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S—APPENDIX.

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# A Word in Conclusion.

The task proposed to themselves by the undersigned in entering, four years ago, upon the preparation of the work which reaches its completion with the present volume, is at length accomplished. The task has been somewhat more protracted and greatly more laborious than was originally anticipated; but both time and labor have been cheerfully spent in the belief that the value of the work has been thereby more than proportionately increased.

In taking leave of the public, the occasion seems to the undersigned to be a fit one for making certain statements in regard to the history of the work which have not hitherto been presented.

The circumstances in which this formidable enterprise had its origin are succinctly narrated in the *Publisher's Announcement* prefixed to the First Volume. The idea entertained by its eminent originator (the late Horace Greeley), as to the form which the work should practically take, is there also given. The plan as he conceived it appears to have been that of a compendium of facts and results of research stripped of all comment and set forth with the smallest possible amount of connecting narrative—a plan by which, for example, history should be substantially reduced to a chronological record; science, to the enunciation of laws and numerical results; and philosophy, to a synopsis of opinions and dogmas. In the execution of such a plan, compilation from standard works already existing was the process which it would be necessary, mainly if not exclusively, to employ; the task not being one likely to interest original investigators or other eminent living authorities so far as to attract and secure their co-operation. It was upon this plan, however, that the work was commenced, and under which it was prosecuted nearly to the close of the First Volume, the editorial superintendence having been in the mean time committed to a gentleman of acknowledged ability, especially qualified for the task by a large previous experience in analogous forms of literary labor. A few of the members of the present Editorial Staff, including the present directing Editor-in-Chief, were at the same time engaged to examine the proofs of the plates as they were successively prepared for publication; so that when, on the retirement of the original Editor, in March, 1873, these incidental collaborators were invited to assume the principal charge, they were fully acquainted with the condition of the work in the form which it had then reached. As this was not such as they would have made it had it been under their control from the beginning, they could not respond to the invitation by consenting to take up the work at this point, and to carry it forward to completion, without an essential modification of the plan pursued in its prosecution, and a thorough revision and reconstruction of the portion which had already been finished. To their judgment it appeared that, in order to secure to the work the high character for fulness and freshness of information, and for logical method and lucidity of statement in the treatment of important subjects, which could only justify its publication, writers specially qualified by past study and experience, and known by reputation to the public to be so, should be engaged to treat each such subject; the plan of compilation being limited to the preparation of those articles of secondary importance which do not require the hand of a master.

The value of eminent names had, it is true, been to a certain extent recognized during the previous management, and some contributions from writers of distinction had been embraced within the pages so far completed; but these were exceptions, the general rule having been the usual one of compilation, and the compilations not having been always made by persons well conversant with the subjects as to which they attempted to summarize the statements which they found in books.

It was a necessary condition, therefore, of the acceptance by the present Editors-in-Chief of the responsibility proposed to them, that the part of the work already prepared should be wholly remodelled and reconstructed; and after a careful consideration of the best means of securing this end, the conclusion was reached that the shortest and simplest, though by no means the cheapest, method of accomplishing the object would be to commence the work *anew* from the beginning. There had been already completed 1106 electrotype plates ready for the press, at a cost of $20,864.67, and at an expense of more than two years of valuable time. It was a large amount, whether estimated in money or in time, to be fruitlessly wasted; but the publisher has never allowed a question of expense to stand in the way of the object which in all his literary adventures he has ever kept steadily in view, and which has been to secure the highest attainable excellence at whatever cost; and he no sooner became satisfied that this sacrifice was necessary than he promptly cancelled all these plates and consigned them to the melting-pot.

In regard to the future conduct of the work, another condition imposed by the new management, and conceded to them, was that the Editorial Staff should be so increased and organized that each important department of the field of human knowledge might be placed in charge of an Associate Editor specially assigned to that department; these several Associates being charged with the duty, first, of exercising a strict censorship over all contributions relating to subjects within their departments; secondly, of taking care, also within their departments, that no subject which ought to receive attention should be neglected; thirdly, of aiding the Editors-in-Chief to secure, in those departments severally, well-qualified special contributors; and finally, of themselves furnishing contributions on such important topics within their proper provinces as should be peculiarly their own. How completely this plan was carried out may be seen in the title-page of the work, in the scheme of the Organization of the Staff, and also in The Departments and Index to Special Articles. About one-half of the titles of the Special Articles which have passed under the personal revision of the several Associate Editors are enumerated in this Index, but not a complete list of those which they have personally contributed; and a glance at the Index is sufficient to show how largely the work has been benefited by the labors of its numerous Associate Editors in their special fields. The departments to which the names of the Editors-in-Chief are attached have been more especially taken in charge by them, because not otherwise provided for. Their supervision, nevertheless, has extended to the whole work.

The reconstruction of Volume I. began with the close of March, 1873. The volume was at that time so far advanced that its publication had been looked for as early as July 1st of the same year; but the great labor involved in the change of plan, and the determination of the Editors to be thorough, conspired to delay its appearance for fully fifteen months, so that the earliest copies were not placed in the hands of subscribers until September, 1874. In the reconstruction, much of the material employed in the work in its original form was of course retained; and thus some of the biographical sketches—which, though entirely accurate, might perhaps without impropriety have been more extended—have been for their brevity subjects of criticism; but these sketches were originally prepared in strict accordance with Mr. Greeley's principle to tell simply and without comment what a man had done, refraining alike from censure and from praise.

The views of Mr. Greeley have in fact been allowed to govern the more recent editorial management, in that part of his scheme at least which exacts the severest brevity of statement consistent with clearness; but in the treatment of all subjects of importance there have been presented, instead of summaries of disjointed facts—which in its literal execution that scheme would have required—memoirs logically and systematically arranged, forming complete and comprehensive monographs. It is accordingly true that the articles in this work are in general at least equal, and in many instances much superior, in respect both to their length and to the fulness of the information they contain, to those on the same topics in other cyclopædias, if we except only those very voluminous publications which, like the *Encyclopædia Britannica*, can have no place on the study-table, but fill whole shelves of libraries.

It may be proper, before concluding, to add one word in regard to the APPENDIX which will be found at the close of the present volume. This, to some extent, is occupied with articles intended to supplement those of the work itself as to which the progress of time has brought additions to knowledge; but it is designed also to make amends for the omission in the regular order of some articles not furnished in season to appear in their proper places; and it includes a number of biographical and geographical titles previously omitted through inadvertence or because they could not be earlier obtained. Many, furthermore, relate to the department of Natural History, which have been added by the accomplished Associate Editor in that department in order to give to this work a completeness as to those subjects not usually aimed at in works of this class.

It remains only for the undersigned to tender to that generous public whose steady encouragement has sustained and cheered them to the close of their labors, their most heartfelt acknowledgments of the unexampled favor with which the previously-issued volumes of this work have been received, and which has been manifested in subscriptions for more than 20,000 copies already received, with a demand daily increasing. The very numerous and warm expressions of approbation, moreover, which have reached them, as well from critics by profession as from intelligent readers in every walk of life, in regard to the manner in which their task has been performed, have been too flattering to permit them to withhold this public expression of their thanks. The thing which is chiefly gratifying, however, about these expressions is not so much the assurances they convey that the undersigned have succeeded in making a good book, as the concurrent testimony they bear to the fact that the book which the undersigned have made is the book they set out to make; and that is, a book of ready reference adapted to the uses of the busy multitude, a treasury of knowledge in which questions upon every subject of interest to man may find a prompt and satisfactory solution.

NEW YORK, April, 1877.

F. A. P. BARNARD,
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It had been the intention to present here a complete list of the special articles contained in all the Four Volumes, alphabetically arranged under the several departments to which they belong, with their writers' names annexed; but after preparing the list it has been found to be too voluminous for insertion in the space which remains at our command. There are given, therefore, but about one hundred titles under each department, which is considerably less than one-half the average. The total number of articles in the entire work bearing their writers' signatures is 8121; of articles by editors of newspapers, relating to local geography and statistics, 1694; and of writers selected for their special knowledge of the subjects treated, 6427. The Editors-in-Chief, besides exercising a general supervision over the whole work, and an immediate supervision over the particular departments to which their names are attached, have personally contributed over 160 special articles. The personal contributions of several of the Associate Editors have been even more numerous.

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Armenian Ch..R. D. Hitchcock.
Arminius.....D. D. Whedon.
Astrology.....M. B. Anderson.
Athanasian Creed..R. D. Hitchcock.
Athanasius.....A. J. Schem.
Atheism.....J. H. Seelye.
Athens.....R. D. Hitchcock.
Augustine.....R. D. Hitchcock.
Augustus Cæsar.....A. Stevens.
Babylon.....R. D. Hitchcock.
Babylonia.....R. D. Hitchcock.
Bell.....R. D. Hitchcock.
Baptists.....M. B. Anderson.
Bible, The.....W. G. Summer.
Boethius.....M. B. Anderson.
Booddha .....J. Thomas.
Brahmanism.....J. Thomas.
Calvin.....J. Thomas.
Capital Punishment.A.Stevens.
Carson, Alex...Thos. Armitage.
Catechism.....R. D. Hitchcock.
Christian Union Churches...L. P. Brockett.
Christmas.....R. D. Hitchcock.
Chronicles.....W. G. Summer.
Church.....J. Thomas.
Codex Alexandrinus..T. Chase.
Codex Bezæ.....T. Chase.
Codex Ephraemi.....T. Chase.
Codex Sinaiticus.....T. Chase.
Codex Vaticanus.....T. Chase.
Confucius.....J. Thomas.
Congregationalism...E. W. Gilman.
Correlation of Forces.....J. H. Seelye.
Criticism of Darwinism...J. H. Seelye.
Crusade.....R. D. Hitchcock.
Cumberland Presbyterian Church, The..Richard Beard.
Cyrus.....R. D. Hitchcock.
Darwinism.....E. L. Youmans.
David.....R. D. Hitchcock.
Dead Sea.....R. D. Hitchcock.
Decalogue.....R. D. Hitchcock.
Desert.....R. D. Hitchcock.
Disciples of Christ..B. A. Hinsdale.
Donatists.....R. D. Hitchcock.
Dualism.....M. B. Anderson.
East Tennessee University...T. O. Summers.
Ecclesiastical History.P.Schaff.
Engraving.....M. B. Anderson.
Ephesians.....R. D. Hitchcock.
Evangelical Alliance..P. Schaff.
Evidences of Christianity..... Charles W. Shields.
Evolution, Hypothesis of.....H. Hartshorne.
Exegesis.....Philip Schaff.
Exodus.....R. D. Hitchcock.
Fakir.....J. H. Seelye.
Familists.....Jas. H. Worman.
Fate.....J. H. Seelye.
Felicissimus...R. D. Hitchcock.
Fetich.....J. H. Seelye.
Fifth-Monarchy Men.....R. D. Hitchcock.
Filioque.....R. D. Hitchcock.
Finley, J. B.....A. Stevens.
First-born.....T. O. Summers.
First-Fruits...R. D. Hitchcock.
Fliedner, Theod..Philip Schaff.
Florence, Council of.....R. D. Hitchcock.
Floy, J.....A. Stevens.
Force, M.....J. H. Worman.
Foss, A. C.....J. H. Worman.
Foster, R. S.....A. Stevens.
Franciscans...R. D. Hitchcock.
Francis of Assisi...C.W.Greene.
Frankfort, Council of.....J. H. Worman.
Free Church of Scotland.....D. Inglis.
Freewill Baptists.....G. H. Ball.
French Prophets.....J. H. Worman.
Friends.....Edward Brown.
Fulco.....J. H. Worman.
Fulgentius.....J. H. Worman.
Fulton, J. D.....J. H. Gilmore.
Furlong, H.....J. H. Worman.
Future State....T. O. Summers.
Galilee..... ....R. D. Hitchcock.
Gallicanism.....C. Petersen.
Gallipoli.....R. D. Hitchcock.
Gardner, H. C.....A. Stevens.
Gath.....R. D. Hitchcock.
Gaza.....R. D. Hitchcock.
General Rules.....A. Stevens.
Gennesaret....R. D. Hitchcock.
George, E.....A. Stevens.
Gerasa.....R. D. Hitchcock.
Gerizim.....R. D. Hitchcock.
German Catholics.....R. D. Hitchcock.
German Theology..I.A.Dorner.
Gethsemane...R. D. Hitchcock.
Gilbert, N.....A. Stevens.
Gilder, W. H.....A. Stevens.
Gilead.....R. D. Hitchcock.
Girgeh.....R. D. Hitchcock.
Gnostics.....R. D. Hitchcock.
Gog and Magog....R. D. Hitchcock.
Gospel and Gospels....P. Schaff.
Greek Church.....P. Schaff.
Habakkuk.....R. D. Hitchcock.
Hades.....R. D. Hitchcock.
Haggai.....R. D. Hitchcock.
Hamath.....R. D. Hitchcock.
Hamath Inscriptions, The...W. Hayes Ward.
Hamilton, W...M. B. Anderson.
Hamilton's Philosophy....M. B. Anderson.
Harmony of the Gospels.....F. Gardiner.
Harris, Howell.....A. Stevens.
Haven, G.....A. Stevens.
Haven, J.....J. H. Seelye.
Hebrew Language.....P. Schaff.
Hebrews, Epistle to...P. Schaff.
Hebron.....R. D. Hitchcock.
Heck, Barbara.....A. Stevens.
Hermeneutics.....P. Schaff.
Hermes, G.....C. G. Leland.
Herod, Great..R. D. Hitchcock.
Heusser, Meta.....P. Schaff.
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Hicks, E.....J. S. Gibbons.
Hilary.....R. D. Hitchcock.
Hodge, A. A...R. D. Hitchcock.
Hodge, C.....R. D. Hitchcock.
HolySepulchre.R.D.Hitchcock.
Homiletics.....William Adams.
Homily.....William Adams.
Hours.....R. D. Hitchcock.
Huguenots.....C. Petersen.
Humphrey, H.....W. S. Tyler.
Hunter, A.....A. Stevens.
Huss, John.....C. Petersen.
Hyksos.....R. D. Hitchcock.
Iconium.....R. D. Hitchcock.
Ignatius, St....R. D. Hitchcock.
Illuminati.....C. G. Leland.
Immaculate Concep...P. Schaff.
Independents.....L. Bacon.
Indra.....R. C. Caldwell.
Infallibilist.....P. Schaff.
Infallibility of Pope..P. Schaff.

Innocent (Popes)..C.W.Greene.
Investiture.....T. M. Post.
Irvingites.....Janet Tuckey.
Isaiah.....J. H. Seelye.
Jacob, or Israel..Porter C. Bliss.
Jacobites.....R. D. Hitchcock.
Jainas.....R. C. Caldwell.
Jansen, C.....Porter C. Bliss.
Jansenism.....T. M. Post.
Jehovah.....C. M. Mead.
Jerusalem.....Howard Crosby.
Jesuits.....Clemens Petersen.
Jesus Christ.....S. J. Andrews.
Jewish Literature..Felix Adler.
Jewish Sects.....Felix Adler.
Jews.....Felix Adler.
John (Popes).....C. W. Greene.
Jordan.....Porter C. Bliss.
Joshua.....Porter C. Bliss.
Judson, A.....M. B. Anderson.
Karaites.....S. Adler.
Kings, Books of.....P. C. Bliss.
Lakshmi.....R. C. Caldwell.
Lee, J.....A. Stevens.
Lee, L. M.....A. Stevens.
Levings, N.....A. Stevens.
Linga.....R. C. Caldwell.
Libanon.....Porter C. Bliss.
Logos.....Philip Schaff.
Local Preachers.....A. Stevens.
Luther.....Clemens Petersen.
McKendree, W.....A. Stevens.
Magdala.....R. D. Hitchcock.
Mahâbhârata.....R. C. Caldwell.
Man.....M. B. Anderson.
Manichæism.....T. M. Post.
Manna.....R. D. Hitchcock.
Marathon.....R. D. Hitchcock.
Martyrology.....Porter C. Bliss.
Mary .....W. F. Brand.
Masorah.....Porter C. Bliss.
Mass.....W. F. Brand.
Massagetæ.....R. D. Hitchcock.
Matthias, St...R. D. Hitchcock.
Memory.....J. H. Seelye.
Mendicant Orders.....W. E. A. Axon.
Meroë.....R. D. Hitchcock.
Merom.....R. D. Hitchcock.
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Methodism.....A. Stevens.
Methodist Episcopal Church, South...T. O. Summers.
Midianites.....R. D. Hitchcock.
Millennium.....T. O. Summers.
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Mnemonics.....J. H. Seelye.
Moabites.....R. D. Hitchcock.
Monachism.....T. M. Post.
Monday.....R. D. Hitchcock.
Money.....J. H. Seelye.
Montanists.....R. D. Hitchcock.
Moral Philosophy....N. Porter.
Moriah.....R. D. Hitchcock.
Moravian Church, The.....E. de Schweinitz.
Morris, T.....A. Stevens.
Mozarabic Lit..R. D. Hitchcock.
Mudge, E.....A. Stevens.
Musgrave, G. W....R. D. Hitchcock.
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Nauplia .....R. D. Hitchcock.
Nazarene.....Porter C. Bliss.
Nazarite.....R. D. Hitchcock.
New Jerusalem Church....Theophilus Parsons.
Nice or Nicæa.R. D. Hitchcock.
Nicomedia.....R. D. Hitchcock.
Nicopolis.....R. D. Hitchcock.
Noëtians.....R. D. Hitchcock.
Nonconformists.....B. R. Betts.
Nova Scotia...R. D. Hitchcock.
Oannes.....R. D. Hitchcock.
Ophir .....R. D. Hitchcock.
Ordination...Clemens Petersen.
Palestine.....R. D. Hitchcock.
Patmos.....R. D. Hitchcock.
Patriarch.....R. D. Hitchcock.
Patrick, St.....R. D. Hitchcock.
Patripassians.R. D. Hitchcock.
Pelagianism...R. D. Hitchcock.
Pelagius I.....R. D. Hitchcock.
Penance.....Clemens Petersen.
Pera .....R. D. Hitchcock.
Peræa.....R. D. Hitchcock.
Petra.....R. D. Hitchcock.
Phrygia.....R. D. Hitchcock.
Piræus.....R. D. Hitchcock.
Pisa, Council..R. D. Hitchcock.
Polycarp.....R. D. Hitchcock.
Pope.....Clemens Petersen.
Priest.....Frederic Gardiner.
Presbyter.....Isaac Riley.
Presbyterian Church.....Z. M. Humphrey.
Procession of the Holy Ghost.. Philip Schaff.
Proverbs.....J. F. McCurdy.
Psalmody.....J. F. McCurdy.
Quadratus.....R. D. Hitchcock.
Rachel.....R. D. Hitchcock.
Ramâyâna.....R. C. Caldwell.
Ramoth Gilead.R.D.Hitchcock.
Raskölniks....W. R. S. Ralston.
Rationalism.....J. F. Hurst.
Ratramnus....R. D. Hitchcock.
Reformation.....Geo. P. Fisher.
Rehoboam.....R. D. Hitchcock.
Rehoboth.....R. D. Hitchcock.
Religion.....H. W. Bellows.
Remigius.....R. D. Hitchcock.
Rephidim .....R. D. Hitchcock.
Rezin.....R. D. Hitchcock.
Roberts, R. R.....A. Stevens.
Roman Catholic Ch....P. Schaff.
Sabbath.....W. W. Atterbury.
Sabbatical Festivals.....R. D. Hitchcock.
Sacrament.....Philip Schaff.
Sacrifices....Frederic Gardiner.
Saint.....Philip Schaff.
Samaria.....R. D. Hitchcock.
Samaritans.....C. A. Briggs.
Samson.....T. C. Murray.
Samuel.....Porter C. Bliss.
Sanhedrin.....T. C. Murray.
San Marino...R. D. Hitchcock.
Schism.....Isaac Riley.
Scio.....R. D. Hitchcock.
Scotland, Reformed Church of. David Inglis.
Scribes.....R. D. Hitchcock.
Scutari.....R. D. Hitchcock.
Scythopolis....R. D. Hitchcock.
Secularism.....R. E. Thompson.
Semiramis.....R. D. Hitchcock.
Septuagint, The.....Ezra Abbot.
Seraph.....Charles A. Briggs.
Seres.....R. D. Hitchcock.
Sheba.....R. D. Hitchcock.
Shechem.....R. D. Hitchcock.
Shias. .....R. D. Hitchcock.
Shittim.....R. D. Hitchcock.
Siloam.....R. D. Hitchcock.
Simon Magus..R. D. Hitchcock.
Sinai.....R. D. Hitchcock.
Socinians.....A. A. Hodge.
Sodom.....Porter C. Bliss.
Solemn League and Covenant.. Philip Schaff.
Solomon.....Isaac Riley.
Stearns, W. A.....J. H. Seelye.
Strauss, D. F.....H. B. Smith.
Sunday.....W. W. Atterbury.
Swedenborg.....T. Parsons.
Syllabus.....Philip Schaff.
Synagogue.....Thos. C. Murray.
Syriac.....Thomas C. Murray.
Tabernacle.....Fred. Gardiner.
Talmage, T. de Witt.....M. H. Bright.
Talmud.....S. Adler.
Tamil.....R. C. Caldwell.
Tertullian.....Isaac Riley.
Theodora.....Clemens Petersen.
Theresa, St.....Porter C. Bliss.
Thirty-nine Articles..P. Schaff.
Timothy.....Porter C. Bliss.
Timothy, Epistles to..P. C. Bliss.
Transposition.....Philip Schaff.
Transubstantiation...P. Schaff.
Trent, Council of.....P. Schaff.
Tridentine Profession of Faith. Philip Schaff.
Tripoli.....R. D. Hitchcock.
Twesten, A. D. C.....P. Schaff.
Urban (Popes).....C. Petersen.
Urim and Thummim.....C. A. Briggs.
Vaishnavas.....R. C. Caldwell.
Vâlei.....R. C. Caldwell.
Vandi.....R. C. Caldwell.
Varuna.....R. C. Caldwell.
Vasishtha .....R. C. Caldwell.
Vatican Council.....P. Schaff.
Vaya.....R. C. Caldwell.
Vestments, Eccles...B. R. Betts.
Vishnu.....R. C. Caldwell.
Viswâmita.....R. C. Caldwell.
Voltaire.....Philip Schaff.
Vulgate, The.....Charles Short.
Waldenses.....R. D. Hitchcock.
Weddah.....R. C. Caldwell.
Wesleys, The....T. O. Summers.
Wôlei.....R. C. Caldwell.
Wordsworth, W...J. H. Seelye.
Worship.....Isaac Riley.
Wycliffe, John de....P. C. Bliss.
Xabatenses....R. D. Hitchcock.
Yarmuk.....R. D. Hitchcock.
Yemen.....R. D. Hitchcock.
Zeboim.....R. D. Hitchcock.
Zebulun.....R. D. Hitchcock.
Zerubbabel....R. D. Hitchcock.
Zoan.....R. D. Hitchcock.
Zoar.....R. D. Hitchcock.
Zwingli.....Philip Schaff.
Zygadenus.....R. D. Hitchcock.


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*Naval Affairs, Naval Construction, Navigation, Biogs., etc.*


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Aëronautics..John G. Barnard.
Amsterdam...John G. Barnard.
Antwerp.....John G. Barnard.
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Arsenals.....P. V. Hagner.
Artillery.....William F. Barry.
Artillery Schools..W. F. Barry.
Assault.....John G. Barnard.
Barracks.....M. C. Meigs.
Base.....John G. Barnard.
Bazaine, F. A.....J. G. Barnard.
Beacon.....J. G. Barnard.
Beaumarchais....J. G. Barnard.
Blasting.....J. G. Foster.
Bombardment...J. G. Barnard.
Breakwater.....J. G. Barnard.
Brick.....Q. A. Gillmore.
Bridge.....J. G. Barnard.
Bull Run Battle..J. G. Barnard.
Burgoyne, J. F...J. G. Barnard.
Burnside, A. E...G. W. Cullum.
Calculus.....J. G. Barnard.
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Cavalry.....Wade Hampton.
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Columbiad.....P. V. Hagner.
Dahlgren, J. A....F. A. Parker.
Davis, C. H.....F. A. Parker.
Dies Ira.....J. G. Barnard.
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Engineer Corps..J. G. Barnard.
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Farragut, D. G....F. A. Parker.
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Fleet.....R. P. Rodger.
Flexure of Beams.W.E.Merrill.
Flying-Machine..J. G.Barnard.
Forage.....M. C. Meigs.
Fortification.....O. H. Ernst.
Fort Monroe....Q. A. Gillmore.
Fort Sumter.....Q. A. Gillmore.
Fossa Mariana..G. C. Simmons.
Fuze.....H. L. Abbot.
Gatling Gun.....Q. A. Gillmore.
Gettysburg, Battle of..J. Watts de Peyster.
Godon, S. W.....F. A. Parker.
Governor's Island.J.G.Barnard.
Great-Circle Sailing.C.H.Davis.
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Gunpowder.....J. G. Benton.
Gyroscope.....J. G. Barnard.
Haarlem Lake...J. G. Barnard.
Halloween.....J. G. Barnard.
Harbors.....J. G. Barnard.
Harbors of American Lakes.... D. C. Houston.
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Harmonic Ratio..J. G. Barnard.
Harris, D. B...Thomas Jordan.
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Hell Gate.....John Newton.
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Hospitals.....J. S. Billings.
Imaginaries.....J. G. Barnard.
Inclined Planes.T. S. Sedgwick.
Infantry.....Robert N. Scott.
Intrenched Camps.....A. Brialmont.
Inundations.....P. Caland.
Invariant.....J. G. Barnard.
Iron Plating for Fortifications. J. G. Barnard.
Irrigation.....G. H. Mendell.
James River.....J. G. Barnard.
Jetty .....J. G. Barnard.
Joinville, De.....J. G. Barnard.
Juarez, B. T....Thomas Jordan.
Kathay.....H. Yule.
Kilns.....Q. A. Gillmore.
Lake Survey....C. B. Comstock.
Lanman, J...Foxhall A. Parker.
Laplace.....J. G. Barnard.
Laughter.....W. A. Hammond.
Legendre.....J. G. Barnard.
Legion.....Robert N. Scott.
Life-Boats.....J. A. Whitney.
Life-Preservers..J. A. Whitney.
Life-Rafts.....J. A. Whitney.
Lighthouse Board of the U. S... J. G. Barnard.
Lighthouse Construction..J. G. Barnard.
Lighthouse Illumination..P. C. Hains.
Longitude.....C. B. Comstock.
Magazine Guns...P. V. Hagner.
Marine Corps.....S. B. Luce.
Masonry.....Q. A. Gillmore.
Metallurgy.....J. A. Church.
Military Academies.....George L. Andrews.
Militia.....Robert N. Scott.
Mines, Military.....O. H. Ernst.
Mitchel, O. McK.....C. Abbe.
Monitor.....G. V. Fox.
Morris Island...Q. A. Gillmore.
Mortars.....P. V. Hagner.
Naval Academies...R. S. Smith.
Naval Adminis.....J. W. Hogg.
Naval Architecture.....T. D. Wilson.
Naval Signals.....S. B. Luce.
Naval Tactics.....S. B. Luce.
Navigation...A. H. McCormick.
Navigation, Inland (Canals).... J. J. R. Croes.
Navigation, Inland (Rivers and Lakes)...W. E. Merrill.
Navigation, Ocean.....W. S. W. Vaux.
Navy.....S. B. Luce.
Nemours, Duke de.J.G.Barnard.
North Holland, Canal of...J. G. Barnard.
North Sea.....J. G. Barnard.
Ordnance.....R. P. Parrott.
Ordnance Survey, British....A. R. Clarke.
Parameter.....J. G. Barnard.
Paris, Comte de..J. G. Barnard.
Periplus.....Foxhall A. Parker.
Pilot.....George W. Blunt.
Plymouth.....J. G. Barnard.
Pole and Polar...J. G. Barnard.
Polo, Marco.....H. Yule.
Pontchartrain Lake....John G. Barnard.
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Projection, Method of.....J. G. Barnard.
Radical Axis.....J. G. Barnard.
Revolvers.....P. V. Hagner.
Rifling of Ordnance.....R. P. Parrott.
Rivers, Hydraulics.H.L. Abbot.
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Rocky Mountains.J. W. Powell.
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Rotation.....J. G. Barnard.
Rotterdam.....J. G. Barnard.
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Sail.....P. F. Harrington.
Sailing.....F. A. Parker.
St. Augustine.....G. C. Simmons.
San Juan Boundary Question.. J. Watson Webb.
Sappers, etc.....O. H. Ernst.
Sergeant.....J. G. Barnard.
Sevastopol.....J. G. Barnard.
Sewer.....Q. A. Gillmore.
Sheffield.....J. G. Barnard.
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Ships' Magnetism...C. A. Scott.
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Sporting Arms...P. V. Hagner.
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Stucco.....Q. A. Gillmore.
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Tehuantepec.....J. G. Barnard.
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Torpedo.....Henry L. Abbot.
Torres Vedras....J. G. Barnard.
Tower of London.J.G. Barnard.
Trajan's Column..J. G.Barnard.
Treves.....J. G. Barnard.

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Truss.....J. G. Barnard.
Variations, Calculus of.....J. G. Barnard.
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Veteran Reserve.....J. B. Fry.
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Waterloo.....J. G. Barnard.
Waterstaat.....P. Caland.
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Beer.....C. F. Chandler.
Bitumen.....Q. A. Gillmore.
Blindness.....Chas. W. Greene.
Blood.....Chas. W. Greene.
Bone.....C. F. Chandler.
Brain.....Henry Hartshorne.
Brandy.....C. F. Chandler.
Bread.....C. F. Chandler.
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Bromine.....C. F. Chandler.
Bronchitis.....Willard Parker.
Butter.....C. F. Chandler.
Caffeine.....C. F. Chandler.
Calculus, or Stone...W. Parker.
Calico-Printing.C. F. Chandler.
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Cancrum Oris.....A. Jacobi.
Carbolic Acid...H. Hartshorne.
Cataract.....Willard Parker.
Catarrh.....Willard Parker.
Cellulose.....C. F. Chandler.
Cements.....Q. A. Gillmore.
Charcoal...Henry Hartshorne.
Chest.....Willard Parker.
Chemical Anal...S. W. Johnson.
Chemistry.....G. F. Barker.
Cholera.....Willard Parker.
Cholera Infantum....A. Jacobi.
Cinchona.....Willard Parker.
Circulation of Blood.....Henry Hartshorne.
Club-Foot.....A. Jacobi.
Collodion.....C. F. Chandler.
Congenital Diseases..A. Jacobi.
Consumption.....C. W. Greene.
Convulsions.....A. Jacobi.
Coxalgia.....Mary C. P. Jacobi.
Cream Tartar...C. F. Chandler.
Deafness.....Willard Parker.
Death.....Willard Parker.
Delirium Tremens..W. Parker.
Dentistry.....C. Newlin Pierce.
Diabetes.....Willard Parker.
Dialysis.....C. F. Chandler.
Diphtheria.....Willard Parker.
Disinfection.....H. Hartshorne.
Dissociation.....Charles A. Joy.
Dropsy.....Willard Parker.
Dyeing.....C. F. Chandler.
Dysentery.....Willard Parker.
Ear.....Henry Hartshorne.
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Embryology.....J. C. Dalton.
Eng and Chang.....A. Jacobi.
Eye.....C. W. Greene.
Facial Nerve.....E. C. Seguin.
Fallopian Tubes.....W. Parker.
Faradization.....E. C. Seguin.
Fats.....B. Silliman.
Fatty Degeneration.W. Parker.
Fermentation...C. F. Chandler.
Fever.....Ernst Krackowizer.
Fibrin.....G. H. Wynkoop.
Fire-Damp.....E. C. H. Day.
Flour.....E. N. Horsford.
Fluorine.....C. F. Chandler.
Fœtus.....G. H. Wynkoop.
Food.....Edward Smith.
Fracture.....Samuel St. John.
Fuel.....B. Silliman.
Fulminates.....W. N. Hill.
Fumigation...Samuel St. John.
Fusel Oil.....C. F. Chandler.
Fusible Metals..C. F. Chandler.
Ganglionic Nervous System..E. C. Seguin.
Gangrene...E. J. Bermingham.
Gas.....J. P. Cooke.
Gas-Lighting...C. F. Chandler.
Gastric Juice...Willard Parker.
Gestation.....E. R. Peaslee.
Guaiacum.....Edward Curtis.
Guano.....W. H. Chandler.
Gum-Resins.....C. F. Chandler.
Gunshot Wounds..W. Detmold.
Gutta Percha...C. F. Chandler.
Hahnemann.....H. D. Paine.
Hare-Lip.....Willard Parker.
Health.....Stephen Smith.
Heart.....Alonzo Clark.
Hemlock.....Edward Curtis.
Hernia...Edw. J. Bermingham.
Herpes.....Willard Parker.
Homœopathy.....H. D. Paine.
Homology.....Henry Wurtz.
Hydrate of Croton-Chloral...E. Curtis.
Hydrates.....C. F. Chandler.
Hydrocarbons..C. F. Chandler.
Hydrocele...E. J. Bermingham.
Hydrocephalus...C. W. Greene.
Hydrogen.....Henry Wurtz.
Hydropathy.....R. T. Trall.
Hydrophobia...Chas. P. Russel.
Hygiene....Henry Hartshorne.
Hypophosphites.....E. Curtis.
Hysteria.....E. J. Bermingham.
Hysterotomy...Willard Parker.
Imbecility.....John Ordronaux.
India Rubber...C. F. Chandler.
Indigestion...E. D. Hudson, Jr.
Indigo.....C. F. Chandler.
Indium.....E. Waller.
Inebriety.....Willard Parker.
Inflammation...Edward J. Bermingham.
Inoculation...Frank P. Foster.
Insanity.....Wm. A. Hammond.
Intermittent Fever..E. Darwin Hudson, Jr.
Intestinal Juice.C. F. Chandler.
Intoxication.....Edward J. Bermingham.
Iodine.....E. Waller.
Iridium.....E. Waller.
Isomerism, etc...Henry Wurtz.
Isomorphism.....Henry Wurtz.
Jaundice.....E. J. Bermingham.
Keratine.....Henry Wurtz.
Ketones.....Henry Wurtz.
Kidney..E. Darwin Hudson, Jr.
Laboratory.....Henry Wurtz.
Lake.....C. F. Chandler.
Larynx.....E. J. Bermingham.
Lead.....Henry Wurtz.
Lead-Plaster.....B. Silliman.
Lead-Poisoning.....W. Parker.
Leather.....C. F. Chandler.
Legumine.....Henry Wurtz.
Leprosy.....E. J. Bermingham.
Levigation.....Henry Wurtz.
Liquids.....Henry Wurtz.
Lithic Acid Diathesis...Edward J. Bermingham.
Lithotomy.....Gurdon Buck.
Liver.....J. W. S. Arnold.
Magnesia.....Henry Wurtz.
Manganese, Chemistry of....H. Wurtz.
Marsh-Gas.....Henry Wurtz.
Measles.....A. Jacobi.
Meat or Flesh Ext....H. Wurtz.
Medical Electricity..A. McLane Hamilton.
Medicine.....E. D. Hudson, Jr.
Medulla Spinalis...E. C. Seguin.
Mercaptans.....Henry Wurtz.
Mercury.....Henry Wurtz.
Metallammoniums...H. Wurtz.
Metamerism.....H. Wurtz.
Metamorphism.....H. Wurtz.
Methyl.....C. F. Chandler.
Milk.....C. F. Chandler.
Mirrors.....C. F. Chandler.
Mordants.....C. F. Chandler.
Mucous Membrane...E. Darwin Hudson, Jr.
Mustard.....Edward Curtis.
Naphtha.....C. F. Chandler.
Narcotics.....Edward Curtis.
Nerves.....E. C. Seguin.
Neuralgia.....E. C. Seguin.
Nitrogen.....Henry Wurtz.
Nitrous Oxide...Edward Curtis.
Nomenclature in Chemistry... Henry Wurtz.
Nosology.....E. D. Hudson, Jr.
Nostrils, Diseases of.....E. Darwin Hudson, Jr.
Notation.....Henry Wurtz.
Nutrition....E. J. Bermingham.
Obesity.....E. J. Bermingham.
Obstetrics.....Paul F. Mundé.
Oils.....B. Silliman.
Olefines.....C. F. Chandler.
Ophthalmia.....C. R. Agnew.
Ophthalmoscope....D. Webster.
Opium.....Edward Curtis.
Organic Analysis.....H. Wurtz.
Organic Chemistry...H. Wurtz.
Osmium.....Henry Wurtz.
Ovaries.....E. D. Hudson, Jr.
Oxalates.....Henry Wurtz.
Oxides.....Henry Wurtz.
Oxygen.....Edward Curtis.
Oxygen.....Henry Wurtz.
Pacinian Corpuscle.....J. W. S. Arnold.
Paint.....C. F. Chandler.
Palate.....J. W. S. Arnold.
Paraffine.....C. F. Chandler.
Paralysis.....E. C. Seguin.
Parchment.....C. F. Chandler.
Paris Green.....Henry Wurtz.
Passive State of Metals.....H. Wurtz.
Pathological Anatomy..F. Delafield.
Pathology.....F. Delafield.
Pearlash.....Henry Wurtz.
Perchlorates.....Henry Wurtz.
Perfumes.....Henry Wurtz.
Peristaltic Motion.....J. W. S. Arnold.
Peritonitis....E. D. Hudson, Jr.
Permanganates..Henry Wurtz.
Petroleum.....C. F. Chandler.
Petroleum Gas..C. F. Chandler.
Pharmacopœia.....E. Darwin Hudson, Jr.
Pharmacy.....E. D. Hudson, Jr.
Pharynx.....E. D. Hudson, Jr.
Phlebitis.....E. D. Hudson, Jr.
Phosphates.....Henry Wurtz.
Phosphorus.....Henry Wurtz.
Physician.....E. D. Hudson, Jr.
Physiology...E. D. Hudson, Jr.
Pleura.....C. V. Riley.
Pleurisy.....E. D. Hudson, Jr.
Pleuro-Pneumonia...E. Darwin Hudson, Jr.
Pneumogastric Nerve.....E. C. Seguin.
Pneumatic Trough...H. Wurtz.
Pneumonia...E. D. Hudson, Jr.
Poison of Serpents...Weir Mitchell.
Polym. Isomorphism.H. Wurtz.
Porcelain.....Henry Wurtz.
Porcelain, Japanese..H. Wurtz.
Potash.....Henry Wurtz.
Potassium.....Henry Wurtz.
Pottery and Porcelain Manufacture...C. F. Chandler.
Preserv. of Timber...H. Wurtz.
Puerperal Fever.....E. Darwin Hudson, Jr.
Pulse.....Alonzo Clark.
Purpurine.....C. F. Chandler.
Putty.....C. F. Chandler.
Pyæmia.....Stephen Smith.
Pyrene.....C. F. Chandler.
Pyrosis.....A. Flint.
Quinine.....Edward Curtis.
Quinsy..E. Darwin Hudson, Jr.
Radicals.....Henry Wurtz.
Rectum, Diseases of..E. Darwin Hudson, Jr.
Remittent Fever.....E. Darwin Hudson, Jr.
Renal Diseases.....F. Zinsser.
Respiration...E. D. Hudson, Jr.
Respiratory Sounds.....E. Darwin Hudson, Jr.
Resuscitation.....B. Howard.
Retention of Urine...E. J. Bermingham.
Rheumatism.E. J. Bermingham.
Rhodium.....Henry Wurtz.
Rhinoplastic Operations.....F. Zinsser.
Ribs.....E. Darwin Hudson, Jr.
Rosin.....C. F. Chandler.
Rubidium.....Henry Wurtz.
Rum.....C. F. Chandler.
Ruthenium.....Henry Wurtz.
Saffron.....C. F. Chandler.
Sago.....Henry Wurtz.
St. Vitus's Dance....A. McLane Hamilton.
Salicylic Acid.....E. Waller.
Salicylol.....Henry Wurtz.
Saliva.....Henry Wurtz.
Salivary Glands.....E. Darwin Hudson, Jr.
Salt-Radicals.....Henry Wurtz.
Salts, Chem. Nature..H. Wurtz.
Sand.....Henry Wurtz.
Santal-Wood.....C. F. Chandler.
Santonine.....Edward Curtis.
Sayre, L. A.....Paul F. Eve.
Scarlatina.....E. D. Hudson, Jr.
Scrofula.....E. D. Hudson, Jr.
Sea-Water.....Henry Wurtz.
Sea-Weeds.....Henry Wurtz.
Secretion.....E. D. Hudson, Jr.
Selenium.....Henry Wurtz.
Series in Chemistry..H. Wurtz.
Serous Membrane....E. Darwin Hudson, Jr.
Sialagogues.....Edward Curtis.
Sight, Defects of...D. Webster.
Sighing.....W. A. Hammond.
Silica.....Henry Wurtz.
Silk, Chemistry of....H. Wurtz.
Silver Compounds....H. Wurtz.
Skeleton.....E. D. Hudson, Jr.
Skin.....Henry Wurtz.
Skin Diseases....C. Heitzmann.
Skull....E. Darwin Hudson, Jr.
Slags.....H. B. Cornwall.
Sleep.....W. A. Hammond.
Small-pox.....Frank P. Foster.
Soap.....B. Silliman.
Soda.....Henry Wurtz.
Soda-Ash.....Henry Wurtz.
Sodium.....Henry Wurtz.
Somatology.....Henry Wurtz.
Somnambulism.....A. McLane Hamilton.
Spasm...E. Darwin Hudson, Jr.
Spavin.....M. C. Weld.
Spermaceti.....B. Silliman.
Spinal Column.....E. Darwin Hudson, Jr.
Spinal Curvatures....E. Darwin Hudson, Jr.
Spleen...E. Darwin Hudson, Jr.
Spontaneous Combustion.....H. B. Cornwall.
Spontaneous Combustion of the Human Body...S. B. St. John.
Stammering..W. A. Hammond.
Starch.....C. F. Chandler.
Starvation....E. D. Hudson, Jr.
Stearic Acid.....B. Silliman.
Steel.....Henry Wurtz.
Sterility.....J. Marion Sims.
Stoichiometry..C. F. Chandler.
Stomach.....E. D. Hudson, Jr.
Stricture.....F. Zinsser.
Stupor...William A. Hammond.
Sublimation.....Henry Wurtz.
Suet.....B. Silliman.
Sugar.....C. F. Chandler.
Suicide.....A. McL. Hamilton.
Sulphides.....Henry Wurtz.
Sulphur.....Edward Curtis.
Sulphur.....Henry Wurtz.
Sulphuric Ether.....H. Wurtz.
Sunstroke.....E. D. Hudson, Jr.
Sweat...E. Darwin Hudson, Jr.
Syphilis.....F. N. Otis.
Syphilization.....F. N. Otis.
Tallow.....B. Silliman.
Tantalum.....Henry Wurtz.
Tartar.....J. P. Battershall.
Tartar Emetic...Edward Curtis.
Tartaric Acid.J. P. Battershall.
Tea.....Edward Curtis.
Tea, Adulteration of..J. P. Battershall.
Tellurium.....Henry Wurtz.
Temperature.....H. Wurtz.
Temperature of the Body.....E. Darwin Hudson, Jr.
Tetanus.....E. C. Seguin.
Tetrads.....J. P. Battershall.
Thermo-Chemistry...H. Wurtz.
Thermometry..J. P. Battershall.
Throat, Diseases of...E. Darwin Hudson, Jr.
Tinctures.....J. P. Battershall.
Titanium.....Henry Wurtz.
Tobacco.....Edward Curtis.
Toluene.....J. P. Battershall.
Tongue..E. Darwin Hudson, Jr.
Tonics.....Edward Curtis.
Touch, Sense of.....E. Darwin Hudson, Jr.
Toxicology.....Edward Curtis.
Tracheotomy..E. D. Hudson, Jr.
Transformation.....H. Wurtz.
Trephining...E. D. Hudson, Jr.
Triads.....J. P. Battershall.
Tubercle.....E. D. Hudson, Jr.
Tungsten.....H. B. Cornwall.
Turpentine.....J. P. Battershall.
Type-Theories...Henry Wurtz.
Typhus.....E. D. Hudson, Jr.
Ultramarine....H. B. Cornwall.
Uranium.....Henry Wurtz.
Urates.....J. P. Battershall.
Urea.....J. P. Battershall.
Urethra.....F. Zinsser.
Urine.....J. P. Battershall.
Uterine Diseases.....E. Darwin Hudson, Jr.
Vaccination...Frank P. Foster.
Vanadium.....Henry Wurtz.

Vapors.....H. Wurtz.
Vapors, Density of....J. P. Battershall.
Vegetative Process...H. Wurtz.
Veins, Anatomy of...E. Darwin Hudson, Jr.
Venereal Ulcer.....F. N. Otis.
Ventriloquism....Wm. A. Hammond.
Veratrum.....Edward Curtis.
Vermifuges...E. D. Hudson, Jr.
Vertebrates.....George A. Otis.
Vesicants.....Edward Curtis.
Veterinary Science..M. C. Weld.
Vinegar.....J. P. Battershall.
Viscosity.....Henry Wurtz.
Vital Statistics.....E. H. Janes.
Vitriols.. .....Henry Wurtz.
Vivisection .....J. C. Dalton.
Voice.....Robert R. Raymond.
Volumenometry.....H. Wurtz.
Volumes, Molecular..H. Wurtz.
Volumetric Analysis..J. P. Battershall.
Vomiting.....E. D. Hudson, Jr.
Water.....C. F. Chandler.
Water-Gas.....Henry Wurtz.
Water-Glass.....Henry Wurtz.
Water of Crystallization and of Constitution...Henry Wurtz.
Wax.....B. Silliman.
Weeping...Wm. A. Hammond.
Weighing, Chemical..J. P. Battershall.
Weights, Atomic.....H. Wurtz.
Wells, Horace...J. Marion Sims.
Whalebone....J. P. Battershall.
Whisky.....J. P. Battershall.
Windpipe.....E. D. Hudson, Jr.
Wine.....Edward Curtis.
Womb...E. Darwin Hudson, Jr.
Women, Medical Education of.. E. Darwin Hudson, Jr.
Wood.....Henry Wurtz.
Wood-Spirits .....Henry Wurtz.
Wounds.....E. D. Hudson, Jr.
Yawning.....W. A. Hammond.
Yellow Fever..E. D. Hudson, Jr.
Zero.....Henry Wurtz.
Zinc.....Henry Wurtz.
Zincography..J. P. Battershall.
Zirconium.....Henry Wurtz.
Zymotic Diseases.....E. Darwin Hudson, Jr.


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Action.....T. W. Dwight.
Administration..T. W. Dwight.
Agent.....T. W. Dwight.
Alien.....T. W. Dwight.
Alimony.....T. W. Dwight.
Allegiance.....T. W. Dwight.
Apprentice.. .....T. W. Dwight.
Assignment .....T. W. Dwight.
Average.....T. W. Dwight.
Bank.....J. S. Gibbons.
Bankrupt.....T. W. Dwight.
Bargain.....T. W. Dwight.
Bastard.....T. W. Dwight.
Beloit College.....A. L. Chapin.
Benefit of Clergy.T. W. Dwight.
Bill of Exchange..T.W.Dwight.
Bill of Lading....T. W. Dwight.
Blockade.....T. D. Woolsey.
Bond.....T. W. Dwight.
Bottomry.....T. W. Dwight.
Broker.....T. W. Dwight.
Burglary.....T. W. Dwight.
Cambridge Univ.T. D. Woolsey.
Capital.....A. L. Chapin.
Carriers .....T. W. Dwight.
Chambers.....T. W. Dwight.
Charter.....T. W. Dwight.
Chattel.....T. W. Dwight.
Citizen.....T. W. Dwight.
Citizen.....T. D. Woolsey.
Clearing-House....W. A. Camp.
Code.....T. W. Dwight.
Commerce.....J. S. Gibbons.
Condition.....T. W. Dwight.
Constitution.....T. W. Dwight.
Contraband.. ....T. W. Dwight.
Contract.....T. W. Dwight.
Co-operation.....Thos. Hughes.
Corporation.....T. W. Dwight.
Courts..... .....George Chase.
Crime.....T. W. Dwight.
Cross-examin....T. W. Dwight.
Currency.....J. S. Gibbons.
Debt, National, U. S..L. Blodget.
Deed.....T. W. Dwight.
Descent.....T. W. Dwight.
Diplomacy.....T. D. Woolsey.
Divorce.....T. W. Dwight.
Dower..... T. W. Dwight.
Drawback.....T. D. Woolsey.
Dred Scott Case..T. W. Dwight.
Election.....T. W. Dwight.
Eminent Domain.T.W.Dwight.
Equity.....T. W. Dwight.
Estate .....T. W. Dwight.
Evidence.....T. W. Dwight.
Exchange.....J. S. Gibbons.
Exchequer .....J. S. Gibbons.
Excise.....J. S. Gibbons.
Exile.....T. D. Woolsey.
Expatriation.....T. W. Dwight.
Extradition.....T. W. Dwight.
Factory.....George T. Dole.
Fair.....Samuel D. Tillman.
Falcidian Law...George Chase.
False Imprisonment..G. Chase.
Family.....A. L. Chapin.
Farmers-General.A. L. Chapin.
Farming Class..George Geddes.
Fauces Terræ.....George Chase.
Federation...Chas. F. McLean.
Fee.....George Chase.
Feræ Naturæ.....George Chase.
Ferries .....George Chase.
Feudal System...T. D. Woolsey.
Fiction.....T. W. Dwight.
Fieri Facias.....George Chase.
Finance..... J. S. Gibbons.
Finding.....George Chase.
Fine.....George Chase.
Fine of Lands...T. W. Dwight.
Fisheries.....T. D. Woolsey.
Fishery, Law of..George Chase.
Forcible Entry and Detainer... George Chase.
Foreign Attachment..G. Chase.
Foreign Judgment....G. Chase.
Foreign Laws....George Chase.
Forest Laws.....George Chase.
Forgery.....George Chase.
Forum.....George Chase.
Franchise.....George Chase.
Franking Privilege.R. B. Lines.
Frank Marriage.George Chase.
Frank Pledge.....George Chase.
Fraud.....George Chase.
Fraud, Statutes of..Geo. Chase.
Fraudulent Conveyance...Geo. Chase.
Free-Trade.....David A. Wells.
Freight.....George Chase.
Full Power.....T. D. Woolsey.
Funds.....J. S. Gibbons.
Future Estate....George Chase.
Game Laws.....George Chase.
Gaming..... .....George Chase.
Garnishment.....George Chase.
General Issue....George Chase.
General Lien.....George Chase.
Ghent Treaty ...T. D. Woolsey.
Gift.....George Chase.
Goods and Chattels.Geo. Chase.
Grand Jury.....George Chase.
Grotius.....T. D. Woolsey.
Guaranty.....T. D. Woolsey.
Guardian.....George Chase.
Guest.....George Chase.
Guizot.....A. L. Chapin.
Habeas Corpus...T. W. Dwight.
Hanseatic League.A.L. Chapin.
Hartford Convention.....T. D. Woolsey.
Heir.....George Chase.
Hereditaments..T. W. Dwight.
Highway.....George Chase.
Hiring.....George Chase.
Homestead Legislation..Emory Washburn.
Homicide.....George Chase.
Hostages. .....T. D. Woolsey.
Household Suffrage.....T. W. Dwight.
Hypothecation...George Chase.
Impeachment...T. W. Dwight.
Incest..... George Chase.
Income Tax.....A. L. Chapin.
Independence of States....T. D. Woolsey.
Infant.....T. W. Dwight.
Infanticide.....George Chase.
Information.....George Chase.
Innkeepers.....J. N. Pomeroy.
Inns of Court....T. W. Dwight.
Insanity.....George Chase.
Insolvency.....George Chase.
Insurance.....J. Wilder May.
Intercourse.....T. D. Woolsey.
Interest.....A. L. Chapin.
Interest, History of..P. C. Bliss.
Interest Law.....George Chase.
Interference.....T. D. Woolsey.
International Law..T. D. Woolsey.
International Law, Introduction to...David Dudley Field.
International Private Law...C. F. McLean.
International Workingmen's Association, The..C. Petersen.
Interpretation...T. W. Dwight.
Issue.....George Chase.
Joinder of Parties..Geo. Chase.
Joint Ownership.George Chase.
Joint-Stock Company.G.Chase.
Joint Tenancy...George Chase.
Jointure.....George Chase.
Judge.....George Chase.
Judgment.....George Chase.
Judiciary .....George Chase.
Judicium Populi.....P. C. Bliss.
Jurisdiction.....T. W. Dwight.
Jurisprudence.....S. Matthews.
Jurisprudence, Medical...John Ordronaux.
Jury, Trial by...J. N. Pomeroy.
Jus Gentium.....T. D. Woolsey.
Justice.....T. D. Woolsey.
Kidnapping.....George Chase.
Kin, Next of.....George Chase.
Labor.....T. E. Cliffe Leslie.
Land Law.....J. N. Pomeroy.
Landlord and Tenant.....T. W. Dwight.
Law.....John Norton Pomeroy.
Law Canon.....J. N. Pomeroy.
Law, The Civil..J. N. Pomeroy.
Leading Questions.Geo. Chase.
Legacy.....George Chase.
Legates.....T. D. Woolsey.
Letters Rogatory....Geo. Chase.
Letters Testamentary.G.Chase.
Libel.....George Chase.
Liberty.....T. D. Woolsey.
License.....George Chase.
License Laws.....T. W. Dwight.
License to Trade...T. D. Woolsey.
Lien....John Norton Pomeroy.
Limitation.....George Chase.
Literary Prop....T. W. Dwight.
Loan.....George Chase.
Magna Charta..J. N. Pomeroy.
Malice..John Norton Pomeroy.
Malicious Prosecution..George Chase.
Malthus, T. R.....A. L. Chapin.
Mandamus..John N. Pomeroy.
Manslaughter....J. N. Pomeroy.
Marque, Letters.T. D. Woolsey.
Marriage.....John N. Pomeroy.
Martial Law.John N. Pomeroy.
Master and Servant..A. L. Chapin.
Master and Servant in Law..T. W. Dwight.
Maxims, Legal..J. N. Pomeroy.
Mayhem.....George Chase.
Measure of Damages.....T. W. Dwight.
Mendicity....Charles L. Brace.
Mercantile Law...John Norton Pomeroy.
Mill, J. S.....A. L. Chapin.
Mississippi Scheme...A. L. Chapin.
Mistake .....George Chase.
Monopoly.....A. L. Chapin.
Monroe Doctrine...T. D. Woolsey.
Mortgage.....T. W. Dwight.
Mortmain .....T. W. Dwight.
Municipal Corporations...T. W. Dwight.
Municipal Law..T. W. Dwight.
Murder.....John N. Pomeroy.
Naturalization...George Chase.
Naturalization...T. D. Woolsey.
Navigation, Freedom of...T. D. Woolsey.
Negligence.....T. W. Dwight.
Negotiable Paper.....T. W. Dwight.
Neutral Trade...T. D. Woolsey.
New Haven.....T. D. Woolsey.
Nonsuit.....George Chase.
Notice.....T. W. Dwight.
Novation.....T. W. Dwight.
Nuisance.....T. W. Dwight.
Nullification.....T. D. Woolsey.
Oath.....T. W. Dwight.
Obligation.....T. W. Dwight.
Obligation of Contracts...J. N. Pomeroy.
Occupancy .....T. W. Dwight.
Occupation.....T. D. Woolsey.
Ordinance of 1787...T. D. Woolsey.
Outlaw.....George Chase.
Ownership.....T. W. Dwight.
Oyer and Terminer...G. Chase.
Pandects, The...J. N. Pomeroy.
Pardon.....T. W. Dwight.
Parent and Child..T.W. Dwight.
Partition.....J. N. Pomeroy.
Partnership.....T. W. Dwight.
Part-Owners.....J. N. Pomeroy.
Party-Wall.....J. N. Pomeroy.
Passport.....T. D. Woolsey.
Patent Laws.....J. A. Whitney.
Patent Laws.....G. Gifford.
Patria Potestas..J. N. Pomeroy.
Pauperism..... .....C. L. Brace.
Pawnbroking...J. N. Pomeroy.
Payment.....J. N. Pomeroy.
Peace.....T. D. Woolsey.
Peace, Breaches.J. N. Pomeroy.
Penalty.....J. N. Pomeroy.
Pensions.....J. N. Pomeroy.
Perjury..... J. N. Pomeroy.
Personal Prop...J. N. Pomeroy.
Petition of Right.J.N.Pomeroy.
Pirate.....T. D. Woolsey.
Plaintiff.....J. N. Pomeroy.
Pleading.....J. N. Pomeroy.
Pledge or Pawn.J. N. Pomeroy.
Police.....J. N. Pomeroy.
Political Economy.A.L.Chapin.
Population.....A. L. Chapin.
Possibility.....J. N. Pomeroy.
Postliminy.....T. D. Woolsey.
Power of Att'y..J. N. Pomeroy.
Precedents.....J. N. Pomeroy.
Pre-emption.....T. D. Woolsey.
Prescription.....J. N. Pomeroy.
Presumption....J. N. Pomeroy.
Privilege.....T. D. Woolsey.
Privileges.....T. W. Dwight.
Prize .....T. D. Woolsey.
Probate.....J. N. Pomeroy.
Procedure.....J. N. Pomeroy.
Process..... J. N. Pomeroy.
Profits.....A. L. Chapin.
Promise.....J. N. Pomeroy.
Property.....J. N. Pomeroy.
Protection.....R. E. Thompson.
Punishment.....J. N. Pomeroy.
Purchase .....J. N. Pomeroy.
Puritans.....A. L. Chapin.
Railroad Laws..J. N. Pomeroy.
Rank of States..T. D. Woolsey.
Ransom.....T. D. Woolsey.
Real Property...J. N. Pomeroy.
Recapture.....T. D. Woolsey.
Receivers.....J. N. Pomeroy.
Record.....J. N. Pomeroy.
Record of Conveyances....J. N. Pomeroy.
Religious Amendment to the Constitution..J. R. W. Sloane.
Religious Amendment to the Constitution..J. N. Pomeroy.
Remainder.....T. W. Dwight.
Rent .....A. L. Chapin.
Rent.....J. N. Pomeroy.
Replevin.....J. N. Pomeroy.
Reports.....T. W. Dwight.
Requisitions.....T. D. Woolsey.
Respondentia....J. N. Pomeroy.
Retrospective Laws.....John N. Pomeroy.
Revenue.....A. L. Chapin.
Ricardo, D.....A. L. Chapin.
Rights.....T. D. Woolsey.
Riot.....J. N. Pomeroy.
Riparian Rights.J. N. Pomeroy.
Road, Law of....J. N. Pomeroy.
Robbery.....J. N. Pomeroy.
Sale in Law.....T. W. Dwight.
Salvage .....J. N. Pomeroy.
Salvage.....T. D. Woolsey.
Satisfaction.....J. N. Pomeroy.
Saving Banks.....E. W. Keyes.
Seal.....J. N. Pomeroy.
Seaman.....P. F. Harrington.
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Fasti.....Henry I. Schmidt.
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Gallus, C. A.....Henry Drisler.
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Genitive.....Clemens Petersen.
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Painting.....Eliza J. Haldeman.
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Palestrina...Caroline C. Marsh.
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Palladium.....A. H. Bullen.
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Halo.....Cleveland Abbe.
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Micrometer.....L. Waldo.
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Missouri River...C. G. Forshey.
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Needle.....Janet Tuckey.
New Orleans.....C. G. Forshey.
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Orrery.....S. Alexander.
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Thermodynamics..W. P. Trowbridge.
Three Bodies, Problem of.....S. Newcomb.
Threshing Machinery.....J. A. Whitney.
Time Signals.....L. Waldo.
Tin.....H. B. Cornwall.
Traverse-Table.....W. G. Peck.
Trigonometry.....W. G. Peck.
T-Square.....W. G. Peck.
Tunnel, Chicago.....E. S. Chesbrough.
Tunnelling.....B. H. Latrobe.
Turbine.....J. P. Frizell.
Vernier.....W. G. Peck.
Ware, N.....C. G. Forshey.
Warfield, C. A....C. G. Forshey.
Watches.....L. P. Brockett.
Water-Meter.....J. P. Frizell.
Water-power.....W. P. Trowbridge.
Watershed of the Gulf of Mexico...C. G. Forshey.
Waterworks.....J. P. Frizell.
Waves.....J. P. Frizell.
Weather.....C. Abbe.
Weighing-Machines...James A. Whitney.
Weight of Observations...W. G. Peck.
Wheelwork..W. P. Trowbridge.
Work.....W. P. Trowbridge.
Whirlwind.....C. Abbe.
Wire and Wire-drawing...J. A. Whitney.
Wool.....L. P. Brockett.
Writing-Machines.....W. S. Paterson.


OCTAVIUS B. FROTHINGHAM, A. M.,
*The Fine Arts, Liberal Christianity, Biographies, etc.*

WILLIAM STAUNTON, S. T. D.,
*Music, Theory of Harmony, Composition, Mus. Terms, etc.*


Angelo, M..O. B. Frothingham.
Apelles.....Clarence Cook.
Arabian Architecture..C. Cook.
Arch.....Clarence Cook.
Architecture.....Clarence Cook.
Architecture of the American Aborigines.....L. H. Morgan.
Bach, J. S..O. B. Frothingham.
Beethoven...O.B.Frothingham.
Bryant, W.C.O.B.Frothingham.
Cesnola, di L. P..Clarence Cook.
Chinese Architecture..C. Cook.
Correggio.....Clarence Cook.
Dance of Death..Clarence Cook.
Donato.....Clarence Cook.
Doré, Gustave...Clarence Cook.
Dürer, A.....Clarence Cook.
Düsseldorf School of Painting. Clarence Cook.
F.....William Staunton.
Fabriano...O. B. Frothingham.
False.....William Staunton.
False Cross Relation...William Staunton.
Fantasia.....William Staunton.
F Clef.....William Staunton.
Fiesole..... O. B. Frothingham.
Fifth.....William Staunton.
Figured Bass....Wm. Staunton.
Fine Arts.....G. F. Comfort.
Flat.....William Staunton.
Florid Style.....Wm. Staunton.
Flotow, von..O.B.Frothingham.
Foot.....William Staunton.
Fortuny, M.....Clarence Cook.
Fourth.....William Staunton.
Free Thinker...O. B. Frothingham.
Fugue.....William Staunton.
Full.....William Staunton.
Gainsborough, Th..O. B. Frothingham.
Gamut.....William Staunton.
Gannett, E. S...O. B. Frothingham.
Garrick.....O. B. Frothingham.
G Clef.....William Staunton.
Genre-Painting.....C. Petersen.
German Sixth...Wm. Staunton.
Gérôme.....O. B. Frothingham.
Ghiberti....O. B. Frothingham.
Ghirlandajo.....O. B. Frothingham.
Gibbons, G...O.B.Frothingham.
Gignoux, F. R..O. B. Frothingham.
Giulio Romano.....O. B. Frothingham.
Glee.....William Staunton.
Gluck.....O. B. Frothingham.
Gottschalk, L. M...O. B. Frothingham.
Gounod, C. F...O. B. Frothingham.
Gregorian Music..W. Staunton.
Grisi, Giulia.....O. B. Frothingham.
Guido Reni..O.B.Frothingham.
Guitar.....O. B. Frothingham.
Halévy.....O. B. Frothingham.
Half Cadence...Wm. Staunton.
Händel, G. F...C. H. Farnham.
Harmonics..William Staunton.
Harmonic Stops..W. Staunton.
Harmony....William Staunton.
Haydn, F. J....C. H. Farnham.
Haydon, B. R...O. B. Frothingham.
Hexacord...William Staunton.
Hidden.....William Staunton.
High.....William Staunton.
Hogarth, W.....O. B. Frothingham.
Holbein, H.....Clarence Cook.
Hosmer, H...O.B.Frothingham.
Houdon, J. H...O. B. Frothingham.
Hummel, J. N..C. H. Farnham.
Hunt, R. M..O.B.Frothingham.
Hunt, W. M..O.B.Frothingham.
Huntington, D..O. B. Frothingham.
Imitations...William Staunton.
Imitative Music..W. Staunton.
Imperfect....William Staunton.
Infinite.....William Staunton.
Ingres.....O. B. Frothingham.
Inman, H...O. B. Frothingham.
Interrupted.....W. Staunton.
Inversion....William Staunton.
Jarves, J. J..O.B.Frothingham.
Jarvis, J. W.....O. B. Frothingham.
Jones, Inigo.....O. B. Frothingham.
Kauffman, Angelica.....O. B. Frothingham.
Kaulbach....Clemens Petersen.
Kean, C. J..O. B. Frothingham.
Kean, E.....O. B. Frothingham.
Kellogg, Clara Louise.....O. B. Frothingham.
Kemble.....O. B. Frothingham.
Kensett, J. F....O. B. Frothingham.
Key.....William Staunton.
Key-board.. William Staunton.
Kit-Kat Club...O. B. Frothingham.
Landscape Gardening.....Frederick Law Olmsted.
Landseer...O. B. Frothingham.
Large.....William Staunton.
Leading-Note.....W. Staunton.

Ledger-Line.....W. Staunton.
Leech, J.....O. B. Frothingham.
Leutze, E...O. B. Frothingham.
License.....William Staunton.
Lind, Jenny.....O. B. Frothingham.
Line..... William Staunton.
Liszt.....O. B. Frothingham.
Lombard Architecture....Clemens Petersen.
Longfellow, S...O. B. Frothingham.
Louvre, Palace of.....C. Cook.
Maclise, D...O. B. Frothingham.
Macready, W. C.....O. B. Frothingham.
Major..... William Staunton.
Masaccio....O. B. Frothingham.
Measure, or Bar...W. Staunton.
Meissonier, J. L. E...O. B. Frothingham.
Melody ..... William Staunton.
Mendelssohn-Bartholdy...C. H. Farnham.
Metronome.....Wm. Staunton.
Meyerbeer...O.B.Frothingham.
Millais, J. E.....O. B. Frothingham.
Millet, J. F...O.B.Frothingham.
Mills, Clark..O.B.Frothingham.
Minor Scale.....W. Staunton.
Mixed Cadence...W. Staunton.
Mixed Modes..... W. Staunton.
Mixture..... William Staunton.
Mode ..... William Staunton.
Mode, Ecclesiastical....William Staunton.
Modulation..William Staunton.
Monochord..William Staunton.
Mordente....William Staunton.
Moscheles, I.....O. B. Frothingham.
Movement...William Staunton.
Mozart.. .....C. H. Farnham.
Murillo.....Clemens Petersen.
Music..... William Staunton.
Natural.....William Staunton.
Notation..... William Staunton.
Notes.....William Staunton.
Opera.....James Sully.
Oratorio....O. B. Frothingham.
Organ.....James Sully.
Organ Point.....W. Staunton.
Ostade, I. van...O. B. Frothingham.
Overbeck...O. B. Frothingham.
Overture.....William Staunton.
Palfrey, J. C.....O. B. Frothingham.
Part.....William Staunton.
Passing Notes.....W. Staunton.
Perugino...O. B. Frothingham.
Phidias.....O. B. Frothingham.
Pitch.....William Staunton.
Plain Song..William Staunton.
Portrait Painting.....C. Cook.
Praxiteles..O. B. Frothingham.
Progression.....Wm. Staunton.
Pugin.....O. B. Frothingham.
Raphael.....Clarence Cook.
Renaissance.....C. Petersen.
Repoussé.....Clarence Cook.
Rhythm.....William Staunton.
Rosa, Salvator...O. B. Frothingham.
Rubens.....Clemens Petersen.
Ruysdael...O. B. Frothingham.
Sarto, A. del.... O. B. Frothingham.
Scale.....William Staunton.
Scheffer, Ary....O. B. Frothingham.
Schubert....O. B. Frothingham.
Schumann..O. B. Frothingham.
Score..... William Staunton.
Sculpture.....Clarence Cook.
Sequence.....William Staunton.
Solmization.William Staunton.
Spohr.....O. B. Frothingham.
Stop.....William Staunton.
Stradella,A...O.B.Frothingham.
Symphony...William Staunton.
Syncopation.....W. Staunton.
Temperament..... W. Staunton.
Thorough-Bass... W. Staunton.
Thorwaldsen....O. B. Frothingham.
Time.....William Staunton.
Tone.....William Staunton.
Turner, J. M. W.....P. C. Bliss.
Unitarianism....Orville Dewey.
Universalism.....Giles Bailey.
Variations...William Staunton.
Velasquez.....Porter C. Bliss.
Vernet, Horace.....C. Petersen.
Vinci, Leonardo da.....C. Cook.
Voluntary...William Staunton.
Wagner, Richard...O. B. Frothingham.
Water-Color Painting.....O. B. Frothingham.
Wren, C.....O. B. Frothingham.


THEODORE GILL, A. M., M. D., PH. D., M. N. A. S.,
*Zoology, Comparative Anatomy, and Animal Physiology.*

ASA GRAY, M. D., LL.D., M. N. A. S.,
*Botany and Vegetable Physiology.*

JOHN S. NEWBERRY, M. D., LL.D., M. N. A. S.,
*Geology and Palæontology.*


America.....J. S. Newberry.
American Antiquities.....J. S. Newberry.
Ammonitidæ....J. S. Newberry.
Amphibia.....J. S. Newberry.
Ant.....J. S. Newberry.
Anthracite.....J. S. Newberry.
Appalachian Mountains...J. S. Newberry.
Bear.....J. S. Newberry.
Beaver..... .....J. S. Newberry.
Beech.....C. W. Greene.
Biology ..... Theodore Gill.
Birds.....J. S. Newberry.
Botany.....Asa Gray.
Camel.....J. S. Newberry.
Carboniferous System...John S. Newberry.
Cave or Cavern..J. S. Newberry.
Cephalization.....J. D. Dana.
Coal.....J. S. Newberry.
Coffee.....C. W. Greene.
Comparative Anatomy.....E. D. Cope.
Conchology....G. W. Tryon, Jr.
Coryphodon..... O. C. Marsh.
Diatomaceæ.....C. W. Greene.
Elasmobranchiates..Theo. Gill.
Elephant.....William Jacobs.
Entomology...Sanborn Tenney.
Eohippus.....O. C. Marsh.
Facial Angle.....Theodore Gill.
Fascination of Serpents.....Edward Hitchcock.
Fault.....E. C. H. Day.
Fauna.....Theodore Gill.
Feldspar.....E. C. H. Day.
Ferns.....Daniel C. Eaton.
Fertilization of Plants....Chas. A. Goessmann.
Fibre.....E. M. Schaeffer.
Ficus.....E. C. H. Day.
Fig.....Asa Gray.
Fingal's Cave.....E. C. H. Day.
Fir.....Asa Gray.
Fire-Brick.....J. S. Newberry.
Fish.....Theodore Gill.
Fish-Culture..... .....L. Stone.
Fisheries.....Theodore Gill.
Flax.....M. C. Weld.
Flexible Sandstone..J. S. Newberry.
Flower.....W. W. Bailey.
Foot, Structure...E. Hitchcock.
Foraminifera...J. S. Newberry.
Formation.....J. S. Newberry.
Fossil.....C. H. Hitchcock.
Fossil Botany...J. S. Newberry.
Fossil Fishes...J. S. Newberry.
Fossil Footprints...C. H. Hitchcock.
Fossil Forests...J. S. Newberry.
Frozen Wells..C. H. Hitchcock.
Fruit-Culture.....F. R. Elliot.
Fuchsia.....W. W. Bailey.
Fungi.....M. C. Cooke.
Galena.....J. S. Newberry.
Gall-Insects.....C. V. Riley.
Galls.....C. V. Riley.
Gault, The.....E. C. H. Day.
Geodesy.....J. E. Hilgard.
Geology.....J. W. Dawson.
Geology, Chemical..T. S. Hunt.
Geranium.....W. W. Bailey.
Germ.....W. W. Bailey.
Germination.....Asa Gray.
Gourd.....W. W. Bailey.
Granite.....J. S. Newberry.
Graphite.....J. S. Newberry.
Grasses.....W. W. Bailey.
Grasshopper.....C. V. Riley.
Gum.....C. W. Greene.
Gypsum.....E. C. H. Day.
Hadrosaurus.....O. C. Marsh.
Hand, Structure..E. Hitchcock.
Hemp.....M. C. Weld.
Hepaticæ.....Coe F. Austin.
Hermaphrodism..C. W. Greene.
Herpetology.....Theodore Gill.
Hesperornis..... O. C. Marsh.
Hominidæ.....Theodore Gill.
Hop-Culture.....M. C. Weld.
Horse..... O. C. Marsh.
Horticulture.....C. W. Greene.
Hybridity.....Theodore Gill.
Hydroidæ.....A. E. Verrill.
Hylæosaurus.....O. C. Marsh.
Hymenoptera.....A. S. Packard, Jr.
Ichthyology.....O. C. Marsh.
Indian Corn.....Porter C. Bliss.
Individuality.....Theodore Gill.
Inflorescence.....G. L. Goodale.
Infusoria.....C. H. Hitchcock.
Insectivora.....Theodore Gill.
Invertebrata.....E. C. H. Day.
Iridaceæ.....Asa Gray.
Iris.....Asa Gray.
Jerusalem Artichoke...A. Gray.
Joint...Edward J. Bermingham.
Jurassic, The.....E. C. H. Day.
Kangaroo.....J. B. Holder.
Kew.....Asa Gray.
Labiata.....Asa Gray.
Labyrinthodon.....O. C. Marsh.
Lead.....J. S. Newberry.
Leaf.....Asa Gray.
Lemon..... .....Asa Gray.
Lepidoptera...A. S. Packard, Jr.
Lias, The.....E. C. H. Day.
Lichens.....H. Willey.
Liliaceæ.....Asa Gray.
Lily.....Asa Gray.
Lime.....J. S. Newberry.
Limestone.....J. S. Newberry.
Locust.....A. S. Packard, Jr.
Locust Tree.....W. W. Bailey.
Lophiodon.....O. C. Marsh.
Loxodonta.....O. C. Marsh.
Machærodus.....O. C. Marsh.
Macraucheniidæ...O. C. Marsh.
Malvaceæ.....W. W. Bailey.
Mammalogy.....Theodore Gill.
Mammals ..... Theodore Gill.
Mammoth.....O. C. Marsh.
Mammoth Cave...N. S. Shaler.
Marble.....J. S. Newberry.
Mastodon.....O. C. Marsh.
Megalosaurus.....O. C. Marsh.
Megatherium.....O. C. Marsh.
Meliphagidæ.....Theodore Gill.
Mica.....H. B. Cornwall.
Micraster.....E. C. H. Day.
Mocha-Stone.....E. C. H. Day.
Monkey.....Theodore Gill.
Moon-Stone.....E. C. H. Day.
Morel.....W. G. Farlow.
Morphology .....Theodore Gill.
Morphology.....Asa Gray.
Mosasauria.....O. C. Marsh.
Mosses.....Coe F. Austin.
Mould.....W. G. Farlow.
Mouse.....Theodore Gill.
Mucorini.....W. G. Farlow.
Mushrooms.. .....W. G. Farlow.
Myoconcha.....E. C. H. Day.
Myriapods....A. S. Packard, Jr.
Myrtaceæ.....Asa Gray.
Narwhal.....E. C. H. Day.
Natrolite .....E. C. H. Day.
Natural History.....Theo. Gill.
Negro..... Theodore Gill.
Nepenthes.....Asa Gray.
Nepheline.....E. C. H. Day.
Nests of Birds....T. M. Brewer.
Neuroptera...A. S. Packard, Jr.
Notornis.....E. C. H. Day.
Oak.....George B. Emerson.
Obsidian.....E. C. H. Day.
Odontology.....Theodore Gill.
Odontopteris...J. S. Newberry.
Odontornithes.....O. C. Marsh.
Oldhamia.....J. S. Newberry.
Old Red Sandstone...J. S. Newberry.
Oleaceæ.....Asa Gray.
Onagraceæ.....Asa Gray.
Onyx.....E. C. H. Day.
Opal.....E. C. H. Day.
Orange.....W. W. Bailey.
Ore.....Thomas Egleston.
Ore Deposits.....R. Pumpelly.
Ornithology.....Theodore Gill.
Orthacanthus...J. S. Newberry.
Orthoclase..... E. C. H. Day.
Oryctology.....E. C. H. Day.
Osteology.....E. D. Cope.
Otter.....Theodore Gill.
Ovule.....W. W. Bailey.
Oxford Clay.....E. C. H. Day.
Oyster.....Theodore Gill.
Palæontology...J. S. Newberry.
Palefits.....E. C. H. Day.
Palladium.....W. P. Blake.
Palm Tree.....W. W. Bailey.
Pampas Grass.....Asa Gray.
Parasites .....Theodore Gill.
Peronosporeæ....W. G. Farlow.
Petroleum, Geology of.....J. S. Newberry.
Phycology.....W. G. Farlow.
Phylloxera.....C. V. Riley.
Pine.....George Engelmann.
Pistil.....W. W. Bailey.
Pitcher-Plant.....Asa Gray.
Placenta.....Theodore Gill.
Polemoniaceæ.....Asa Gray.
Pollen..... .....Asa Gray.
Polygalaceæ.....Asa Gray.
Polygonaceæ.....Asa Gray.
Polyps.....Theodore Gill.
Poplar.....Asa Gray.
Potato..... .....Asa Gray.
Potato-Bug.....C. V. Riley.
Potsdam Sandstone...J. S. Newberry.
Prairie.....J. S. Newberry.
Primates.....Theodore Gill.
Protococcus.....W. G. Farlow.
Protophytes.....Asa Gray.
Pteranodon.....O. C. Marsh.
Pterichthys.....J. S. Newberry.
Pterodactyls.....O. C. Marsh.
Puff-Balls.....B. D. Halsted.
Pyrenomicetes...W. G. Farlow.
Quadrumana .....Theodore Gill.
Quadrumana, Fossil.....O. C. Marsh.
Quarry.....J. S. Newberry.
Radiata.....Theodore Gill.
Reproduction....Theodore Gill.
Reptiles.....Theodore Gill.
Respiration in Plants..A. Gray.
Rhododendron....C. S. Sargent.
Rock.....J. S. Newberry.
Rodentia.....Theodore Gill.
Roots.....G. L. Goodale.
Rosaceæ .....Asa Gray.
Rose.....C. S. Sargent.
Rubiaceæ..... .....Asa Gray.
Sable.....Theodore Gill.
Salamander.....Theodore Gill.
Salmon.....Theodore Gill.
Sandal-Wood.....Asa Gray.
Santalaceæ.....Asa Gray.
Sapotaceæ.....Asa Gray.
Scorpions.....Theodore Gill.
Scrophulariaceæ .....Asa Gray.
Seeds..... .....Asa Gray.
Septarium.....J. S. Newberry.
Serpentine .....J. S. Newberry.
Serpents.....Theodore Gill.
Sequoia.....Asa Gray.
Shad.....Theodore Gill.
Shark.....Theodore Gill.
Sheep.....Theodore Gill.
Silurian System.J.S.Newberry.
Simarubaceæ.....Asa Gray.
Sivatherium.....J. S. Newberry.
Skylark .....Theodore Gill.
Slate.....J. S. Newberry.
Sloth.....Theodore Gill.
Smut.....W. G. Farlow.
Solanaceæ.....Asa Gray.
Sole.....Theodore Gill.
Sparrow.....Theodore Gill.
Spiral Ducts.....G. L. Goodale.
Sponges.....A. Hyatt.
Spring.....J. S. Newberry.
Squirrel.....Theodore Gill.
Stalactite.....J. S. Newberry.
Stamen.....W. W. Bailey.
Stone, Building.J. S. Newberry.
Sturgeon.....Theodore Gill.
Styracaceæ.....Asa Gray.
Sun-Fish.....Theodore Gill.
Swallow.....Theodore Gill.
Tailor-Bird.....Theodore Gill.
Tapeworm.....J. C. Dalton.
Teal.....Theodore Gill.
Tea-Plant.....Asa Gray.
Teeth.....Theodore Gill.
Teratology...G. Jackson Fisher.
Terrapin.....Theodore Gill.
Therology.....Theodore Gill.
Thrush.....Theodore Gill.
Tillodontia..... O. C. Marsh.
Timber and Timber-Trees...Asa Gray.
Tin, Geology of..J. S. Newberry.
Tinoceras.....O. C. Marsh.
Titanotherium.....O. C. Marsh.
Toad.....Theodore Gill.
Tortoises.....Theodore Gill.
Tree.....Asa Gray.
Tree-Frog..... Theodore Gill.
Trichina Spiralis...J. C. Dalton.
Trout.....Theodore Gill.
Tunicates.....Theodore Gill.
Ungulata.....Theodore Gill.
Uredineæ.....W. G. Farlow.
Ustilagineæ.....W. G. Farlow.
Vegetable Histology.....G. L. Goodale.
Vegetable Physiology.....G. L. Goodale.
Vertebrates.....Theodore Gill.
Vine-Culture.....E. W. Hilgard.
Vulture.....Theodore Gill.
Warblers.....Theodore Gill.

Warm-blooded Animals..Theodore Gill.
Wasp.....Theodore Gill.
Weevil.....C. V. Riley.
Whale.....Theodore Gill.
Whip-poor-will..Theodore Gill.
Wireworm.....C. V. Riley.
Wolf.....Theodore Gill.
Yak.....R. C. Caldwell.
Yucca.....Asa Gray.
Zoological Geography...T. Gill.
Zoology.....J. S. Newberry.


## Horace Greeley, LL.D.,

*American History, Statistics, Agriculture, etc.*

## Alexander H. Stephens, LL.D.,

*American History, Southern Geography, Statistics, etc.*


Abolition of Slavery.....Horace Greeley.
Abstinence, Total...H. Greeley.
Adams, John.....J. Thomas.
Adams, John Q.....J. Thomas.
Agricultural Chemistry...S. W. Johnson.
Agriculture....Horace Greeley.
Alabama.....L. P. Brockett.
Alaska.....L. P. Brockett.
Albany.....H. A. Homes.
American Institute...S. D. Tillman.
Anti-Masonry.....H. Greeley.
Anti-Slavery Society, American...Horace Greeley.
Arboriculture.....J. J. Thomas.
Arch, Joseph....Clarence Cook.
Arizona.....L. P. Brockett.
Arkansas.....L. P. Brockett.
Arnold, Benedict.....W. Jacobs.
Atlanta.....A. H. Stephens.
Audubon, John James.....Wm. Jacobs.
Bache, A. D.....J. E. Hilgard.
Baltimore..Henry Stockbridge.
Baltimore, Lord.....Henry Stockbridge.
Bangor.....B. F. Tefft.
Boston.....N. B. Shurtleff.
Bridgeton.....C. E. Sheppard.
Brooklyn.....Alden J. Spooner.
Buffalo.....S. M. Chamberlain.
Burlington.....B. L. Benedict.
Butler, Benjamin F.....James Parton.
Calhoun, John C.....A. H. Stephens.
California.....L. P. Brockett.
Carpet-Bagger.....H. Greeley.
Caucus.....Horace Greeley.
Central Park.....Clarence Cook.
Charleston..W. E. Simmons, Jr.
Chase, S. P...Joseph P. Bradley.
Chicago.....William Bross.
Cincinnati.....G. Brühl.
Clay, Henry...Horace Greeley.
Cleveland.....F. H. Bradner.
Colorado.....L. P. Brockett.
Columbus.....Jacob H. Studer.
Concord.....A. J. Fogg.
Confederate States..H. Greeley.
Connecticut.....L. P. Brockett.
Constitution of U. S.....Alex. H. Stephens.
Cooper, Peter.....J. C. Zachos.
Cotton.....A. T. Longley.
Cruse, C. F...W. A. Muhlenberg.
Dakota.....L. P. Brockett.
Dayton.....W. D. Bickham.
Declaration of Independence... A. H. Stephens.
Delaware.....L. P. Brockett.
Democracy.....Charles O'Conor.
Des Moines.....R. P. Clarkson.
Detroit.....W. E. Quimby.
District of Columbia.....L. P. Brockett.
Domingo, Santo, Projects of Annexation...A. D. White.
Doremus, S. P...J. Marion Sims.
Douglas, Stephen A...A. H. Stephens.
Dubuque.....S. W. Russell.
Duluth.....R. D'Unger.
Emigration.....W. C. Wyckoff.
E Pluribus Unum.....A. H. Stephens.
Erie.....F. A. Crandall.
Everett, E.....R. C. Winthrop.
Florida.....L. P. Brockett.
Frankfort...H.A.M. Henderson.
Freedmen's Bureau.....O. O. Howard.
Fremont, J. C...A. H. Stephens.
Georgia.....L. P. Brockett.
Government.....A. H. Stephens.
Grange.....L. P. Brockett.
Hamilton, A.....C. W. Greene.
Hartford.....S. A. Hubbard.
Hay.....M. C. Weld.
Henry, Patrick...C. W. Greene.
Hilliard, H. W...A. H. Stephens.
Houston, S.....A. H. Stephens.
Idaho.....L. P. Brockett.
Illinois.....L. P. Brockett.
Indiana.....L. P. Brockett.
Indianapolis...Charles N. Todd.
Indian Territory...L. P. Brockett.
Iowa.....L. P. Brockett.
Iredell, J.....A. H. Stephens.
Iredell, J., Jr...A. H. Stephens.
Jackson, Andrew.....P. C. Bliss.
Jay, John.....Porter C. Bliss.
Jefferson, Thomas..Jas. Parton.
Johnson, Andrew.....P. C. Bliss.
Johnson, H. V...A. H. Stephens.
Kansas.....L. P. Brockett.
Kentucky.....L. P. Brockett.
Klamaths.....Porter C. Bliss.
Labrador.....C. W. Greene.
Lamar, L. Q. C...A. H. Stephens.
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## William T. Harris, A. M., LL.D.,

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Zeno the Stoic.....W. T. Harris.

# S.

**S,** a consonant of the sibilant class, frequently interchanged with *z*, and also with the mute sound of *th*—the latter more especially in the lisping speech of children. *S* in English often has the sound of *z*, as in *closes*. S. is the abbreviation for south and saint; SS. for saints; *SS.* for Esses (which see); *Ss.* for *scilicet*, "to wit;" *ss.* for *semis*, "half" (in medical prescriptions). S. in chemistry designates sulphur; S. on medical prescriptions stands for *signa* or *scribe*, "write."

**Saadi.** See Persian Literature, by E. H. Palmer.

**Sa'adia Ben Jo'seph,** b. at Pithom in Egypt in 892; was appointed director of the Jewish academy at Sura, Babylonia, in 928. D. there in 942. He wrote in Arabic a work on the dogmatics and morals of Judaism, which was translated into Hebrew by Judah Ben Tibbon under the title of *Emunoth vedebth*, and into German by Fürst in 1845. He also translated many, if not all, of the books of the Old Testament into Arabic, and wrote commentaries on the Canticle, Daniel, and Job.

**Saa'le,** a river of Germany, rises in the Fichtelgebirge, flows in a northern direction through the Prussian province of Saxony, where it becomes navigable, and falls into the Elbe after a course of about 200 miles.

**Saal'feld,** an old town of Germany, in the duchy of Saxe-Meiningen, on the Saal, has a fine ducal palace with a magnificent church, several good educational institutions, and manufactures of chemicals, vinegar, etc. P. about 5000. On Oct. 10, 1806, the Prussians were defeated here by the French.

**Saar'brücken,** town of Rhenish Prussia, on the left bank of the Saar, connected by a floating bridge with the suburb of St. Johann on the right bank, has about 14,000 inhabitants, and was the theatre of the opening of the Franco-German war of 1870–71. On Aug. 2, 1870, Napoleon III., at the head of a whole army corps and accompanied by his son, attacked the town, which was feebly garrisoned by the Germans, compelled the garrison to retreat, and marched into the town. Next day, however, the French evacuated the place, and on Aug. 6 a violent encounter took place in the vicinity, the 1st German army attacking the French position on the hills of Speichern to the S. W. of the town. In front of the French corps, under Frossard, which held the hills occupied, the 14th German infantry division and the 5th cavalry division crossed the bridge and pushed onward to attack the superior force, though no such order had been given from head-quarters. The crossing took place between 12 and 1 o'clock, and the German troops, commanded by Gen. von Kameke, began immediately to deploy their columns for attack. Kameke made his dispositions for an attack on both flanks of the French position, and reported to the commander-in-chief of the corps, Gen. von Zastrow. On the German right wing the 28th brigade gained possession of the woods between Drathzug and Stiring after three hours' fighting, and kept the terraine with effect. On the left the 27th brigade achieved an extraordinary exploit by climbing the steep slope of the hills under the terrible fire of the enemy; among their dead was their general, Von François. In the centre six batteries maintained a stubborn and only slowly-advancing fight. Meanwhile, new German troops came on, attracted by the din of the battle, and the 14th division, whose position at one time was rather exposed, was reinforced first by the 40th regiment, and next by six battalions under Von Alvensleben, commander-in-chief of the 3d army corps. Nevertheless, the French could not be wholly dislodged, and the fight continued from 5½ to 8½ o'clock. But at that moment the left French wing began to feel the approach of the 13th German division, which had crossed the Saar at Wehrden and directed their advance toward Forbach. When the vanguard began to attack from this dangerous position, the French immediately retreated across Eslingen to Blittersdorf, leaving behind them many prisoners, their camp equipage, pontoons, and provisions. The loss of the Germans in dead and wounded amounted to 223 officers and 4648 men; that of the French was somewhat less.

August Niemann.

**Saardam.** See Zaandam.

**Saar-Lou'is,** town of Rhenish Prussia, on the Saar, was founded by Louis XIV. and its fortifications constructed by Vauban. It was the birthplace of Marshal Ney. It has now more importance as a manufacturing town than as a fortress. P. 7247.

**Saavedra, de** (Angel). See Rivas.

**Saaz,** town of Bohemia, on the Eger, has 7674 inhabitants, who are mostly engaged in the cultivation of hops.

**Sabadell',** town of Spain, province of Barcelona, on the Ripoll, is a prosperous and rapidly increasing manufacturing town, with 80 woollen and 20 cotton spinning and weaving factories. P. 13,945.

**Sabadilla,** or **Cebadilla.** See Asagræa.

**Sabæans.** See Sabaism.

**Sa'baism,** or **Zabism,** the religion of the Sabæans, originally a people of Arabia Felix, supposed to be the Sheba of the Old Testament. Their religion was a system of sun, moon, and star worship, widely prevalent, not only in Arabia, but in Chaldæa, Syria, and Ethiopia. It is probable that it was quite distinct from Magianism. The name Zabism especially designates the Syrian development of the system, which powerfully impressed itself upon ancient philosophy, and upon Judaism and Christianity as well. Neo-Platonism, the Cabbala, and Gnosticism were among its fruits. The Mendaïtes, or Christians of St. John (so-called), are descendants of the old Zabians, and it is probable that other fragments of the old sect remain. In Arabia the Mohammedan, and in Ethiopia the Christian, religion overthrew Sabaism. The derivation of the term is extremely doubtful. The doctrines, especially in Syria, were complicated, obscure, and absurdly fantastical.

**Saba'ra,** town of Brazil, province of Minas Geraes, on the river Velhas, an affluent of the São Francisco, is well built and has some trade and manufactures of leather, saddlery, and cotton fabrics. In the vicinity are rich gold-mines, and rice, maize, sugar, and grapes are produced. P. about 5000.

**Sab'bath** [Heb. שַׁבָּת, "rest," "cessation from labor"], the weekly day of religious rest. The observance of a weekly rest-day is now very widely held to have a natural basis in the constitution of man. The persistency with which such an institution has been maintained for many ages among Jews, Christians, Mohammedans, and even some pagan nations, supports this view. Inquiries instituted by a commission of the English Parliament in 1832, the testimony of 641 medical men of London in a petition to Parliament in 1853, and of a great number of medical societies, physicians, physiologists, political economists, and managers of industrial establishments, go to prove that in the case of men engaged in ordinary bodily or mental labor the rest of the night does not fully restore the waste of energies during the day, and that to maintain a condition of vigor a supplementary rest of about one day in seven is needed. This view is confirmed by the experience of France during the Revolution, when the decade was substituted for the week, and each tenth day devoted to rest—a proportion of time which was found to be insufficient. The need of a weekly respite from daily toil appears also in the social nature and relations of man as a member of the family and of the state. This point has been ably illustrated by Pierre Proudhon, the French radical philosopher, in his essay *La Célébration du Dimanche*. The natural law of a weekly rest-day is conceded by most of the theological writers who deny what is called the Sabbatarian doctrine, and is held by them to underlie the Jewish Sabbath, the Christian Lord's Day, and other forms of weekly religious rest.

The first mention in the Bible of such an institution is in Gen. ii. 2, 3—a passage which forms the close of the earliest of the records of which the Mosaic history, according to the theory of many biblical scholars, is composed. The seventh day is consecrated by the Creator, who, having finished the creative work of six days, blessed and hallowed the seventh day, because he rested therein. The natural meaning of the passage is the establishment of a holy rest-day after every six days of labor for the race just created. The natural law of periodic rest was thus lifted out of the sphere of mere physical necessities into that of intellectual and spiritual privilege and enjoyment, as befitting a creature made in the image of the Creator and capable of holding fellowship with him. Its connection with the Creation shows that, with the family constitution, it was intended to lie at the basis of the development of all human life, inclusive of all human conditions, and not merely for any sect or age. The view is held by some writers that, while

the seventh day was consecrated at the Creation, its promulgation by positive precept did not take place till the time of Moses; like monogamy, which, though also resting on natural law, was left apparently without explicit positive enactment until the time of Christ. Paley and others hold that the hallowing of the seventh day was not historically connected with the Creation, but is mentioned in Genesis out of chronological order and by way of anticipation. As to the observance of the Sabbath in the patriarchal period, the Mosaic narrative, which is very brief and meagre, gives us no knowledge save what may be inferred from the occasional intimations of the division of time by weeks (Gen. xxix. 27; viii. 10, 12; iv. 10, etc.). The week was in very early use among the Semitic nations, and the recently-discovered cuneiform tablets, which give the Babylonian traditions of the Creation, as translated by Fox Talbot, record the institution of a seventh day of holy rest.

The first mention of the Sabbath by name occurs in Ex. xvi. 23 *seq.*, where its observance is not introduced with the formalities with which an institution of such importance would be inaugurated for the first time, but in language which seems to imply that it was not wholly unknown to the people. It next appears among the Ten Commandments, which were distinguished from the rest of the Jewish law by the circumstances of peculiar solemnity under which they were spoken on Mount Sinai and given to Moses engraved on stone tablets by the hand of God (Ex. xx. 8). Its observance was enforced by gratitude for deliverance from bondage (Deut. v. 15), and was constituted a sign of covenant between God and the Jews. Like other of these great commands, the law of the Sabbath reappears in the Jewish municipal and ceremonial code with special prescriptions and penalties, all of which show the importance attached to its observance and the great care taken—as by the prohibition of servile work, gathering of sticks, kindling fires, etc.—that all alike, servants as well as masters, strangers as well as members of the congregation, should enjoy its benefits. A single instance is recorded of the punishment of death being inflicted upon a presumptuous transgressor (Num. xv. 30 *seq.*). Connected with the weekly Sabbath there was ordained in the Jewish municipal and ceremonial law a system of sabbatical years of local and national significance and use (Lev. xxv.). The Sabbath also, in its leisure and opportunity for social intercourse and holy convocation (Lev. xxiii. 3), sustained an important relation to the free republican institutions of the Jews. In later periods of the Jewish history, Isaiah (lviii. 13) and Jeremiah (xvii. 21 *seq.*) enforced its observance with threatenings and promises; Ezekiel (xx. 12 *seq.*) puts its violation foremost among the national sins; Nehemiah (x. 31; xiii. 15) narrates the public efforts at reformation after the return from the Babylonish captivity. Henceforward, the Sabbath was kept with scrupulous care, and gradually to the time of Christ became burdened with self-enforced severities and ridiculous prohibitions.

Christ, while observing the Sabbath, sought by his example and teachings to rescue it from the puerile superstitions by which it had come to be degraded. He performed miracles of healing, and, with his disciples, gathered ears of grain for food as he passed through the fields, on the Sabbath, and justified his conduct by showing that such works of necessity and mercy were not violations of its true law. He also taught that the Sabbath was made for man, for his benefit, and not man for the Sabbath, and that He, the Son of man, the one in whom all humanity is represented in its perfection, was so the Lord of the Sabbath as rightfully to define and prescribe its true obligation and use (Mark ii. 27, 28).

The resurrection of Christ and his subsequent appearances to his disciples till his ascension, and the miraculous descent of the Holy Spirit on the first day of the week, led to that day being set apart for the special religious assemblies of the Christians and for the simple services of their faith. For a time the Jewish converts observed both the seventh day, to which the name Sabbath continued to be given exclusively, and the first day, which came to be called the Lord's Day. Later, the apostle Paul sought to relieve their consciences from the obligation of keeping the Jewish Sabbath (Rom. xiv. 5; Col. ii. 16). The allusion in Gal. iv. 10, 11 is evidently to the superstition of lucky and unlucky days into which these converts from rude paganism were in danger of relapsing. Within a century after the death of the last of the apostles we find the observance of the first day of the week, under the name of the Lord's Day, established as a universal custom of the Church, according to the unanimous testimony of Barnabas, Ignatius, Pliny, Justin Martyr, and Tertullian. It was regarded not as a continuation of the Jewish Sabbath (which was denounced, together with circumcision and other Jewish and anti-Christian practices), but rather as a substitute for it; and naturally its observance was based on the resurrection of Christ rather than on the Creation rest-day or the Sabbath of the Decalogue. Tertullian (about 200), in saying that Sunday was given to joy, and enjoining on it abstinence from secular care and labor, makes it evident that the Lord's Day was regarded as taking the true place of the original seventh-day Sabbath. But the position of the early Church, struggling into existence, exposed to persecution, and with many of its members slaves of heathen masters, would prevent unbroken regularity of worship and a general cessation of labor, until in the time of Constantine (321) the observance of Sunday as the weekly rest-day was protected by law. Later in the history of the Church the connection between the Lord's Day and the original Sabbath became explicitly recognized. The second Council of Macon (585), in forbidding secular work on that day, and enjoining that it be occupied with the hymns and praise of God, says, "For this is the day of perpetual rest; this is shadowed out to us by the seventh day in the Law and the Prophets." At the Reformation, Luther, Zwingle, Calvin, and Bucer at first favored the abolition of all holy days but the Lord's Day. But their antagonism to what they considered the Judaizing legalism of Rome, and their zeal for evangelical freedom, led them at times to deny the scriptural obligation of a weekly rest-day. They were not, however, always consistent with themselves. Luther says of the Sabbath, "Keep it holy for its use's sake both to body and soul, but if anywhere the day is made holy for the mere day's sake, if anywhere any one sets up its observance upon a Jewish foundation, then I order you to work on it, to ride on it, to dance on it, to feast on it, to do anything that shall reprove this encroachment on the Christian spirit and liberty." Elsewhere he represents the observance of Sunday as "good and necessary," and defends the Ten Commandments as still binding on Christians. Upon the Continent, since the Reformation, both among Roman Catholics and Protestants, the observance of Sunday has been based chiefly upon ecclesiastical authority. A different view early obtained in Great Britain, and there and in this country the prevalent doctrine recognizes the weekly rest-day as founded in the nature of man, consecrated by the example of God at the Creation, authoritatively promulgated in the Fourth Commandment, confirmed by Christ, and, while transferred from the seventh to the first day of the week and invested with new significance, perpetuated in the Lord's Day of the Christian Church. (Robt. Cox, *Literature of the Sabbath Question* (1865); Hessey, *Bampton Lectures* (1860); Gilfillan, *The Sabbath, etc.;* Oehler, *Theol. of Old Test.;* Hodge, *Syst. Theol.*, vol. iii.; P. J. Proudhon, *La Célébration du Dimanche;* Philip Schaff, *Hist. of the Apostolic Age* and *Ch. Hist.*, 2d per.; Tayler Lewis, Excursus in his trans. of Lange's *Com. on Genesis*, ch. i.; N. Y. Sabb. Com., *Doc. 26.* See LORD'S DAY, SUNDAY.)

W. W. ATTERBURY.

**Sabbathai Lewi.** See JEWS, by PROF. FÉLIX ADLER, PH. D.

**Sabbat'ical Fes'tivals.** The laws of Moses enjoined the observance of four. These were: (1) the Sabbath day, noticed above. (2) The Sabbath month, which was Tisri, the seventh in the Hebrew year, corresponding with our October. It opened with the Feast of Trumpets, contained the Day of Atonement (10th), and the Feast of Tabernacles (15th to 22d). (3) The Sabbath year, which in *Exodus* (xxiii. 10, 11) has an agricultural aspect (the land is to rest from culture); in *Deuteronomy* (xv. 1, 2) has a commercial aspect (debts were either to be relinquished or held in abeyance); and in *Leviticus* (xxv. 3–7) a religious aspect ("for the Lord"). Every seventh year was thus interdicted to secular and selfish uses. But before the Babylonian captivity the ordinance appears not to have been well observed, as may be gathered from Jer. xxv. 11, 12, compared with 2 Chron. xxxvi. 21. After the Captivity it was different. Alexander, who conquered Syria 332 B. C., remitted the tribute of the Jews every seventh year, "that they might enjoy the laws of their forefathers" (Josephus, *Ant.*, xi. 8, 5). Julius Cæsar afterward did the same (*Ant.*, xiv. 10, 6). According to Jewish reckoning, the last sabbatical year was from Oct., 1874, to Oct., 1875. (4) The Year of Jubilee, which was not, as some say, every forty-ninth, but every fiftieth year, so that there were then two successive years of rest. In that year every Hebrew servant was to regain his freedom, and landed property revert to the representatives of its original proprietors. It has been a question whether this jubilee year was ever observed. Michaelis doubts, Hupfeld denies, but Ewald asserts its observance. (See also FEAST.)

R. D. HITCHCOCK.

**Sabbione'ta,** town of Italy, province of Mantua, about 5 miles S. W. of the city of Mantua, in a district made unhealthy in summer by exhalations from the adjacent

marshes. It is an old walled town, and was placed by Charlemagne under the government of a monastery of Benedictines, but it afterward became for centuries a favorite possession of the great family Gonzaga. In 1806, Bonaparte formed it, together with Guastalla, into a principality for his sister Pauline. The ex-ducal palace is still imposing, though stripped of most of its artistic treasures. The Jews have a remarkably fine synagogue in Sabbioneta, and in 1541 they established a printing-press here which issued several Hebrew works with such neatness and elegance that they are now much sought for by bibliophiles. The industry and trade of Sabbioneta (the latter being chiefly carried on by Jews) have recently revived very much. Silk-reeling occupies a large portion of the population from September till May; very tasteful household furniture is also manufactured here. Besides silk and wine, hemp and rice are abundantly produced in the vicinity. P. 7000.

**Sabellians.** See SABELLIUS.

**Sabel'lius,** a presbyter of the church of Ptolemais in Egypt, excommunicated by Bishop Dionysius of Alexandria in 261 for a heresy which is called after his name. It refers to the doctrine of the Trinity, and is the direct opposite of tritheism. He taught that the Trinity of the Godhead is not a trinity of persons, but of manifestations and periods in the history of revelation. God is strictly one in person, but reveals himself in a threefold aspect as Father, Son, and Holy Spirit in the works of creation, redemption, and sanctification. The same view has been recently revived by Schleiermacher and Bushnell. (See Schaff, *Church History*, vol. ii. p. 292.)

**Sab'etha,** p.-v., Rock Creek tp., Nemaha co., Kan., on St. Joseph and Denver City R. R.

**Sa'bin** (JOSEPH), b. at Braunston, Yorkshire, in 1821; was for some years a bookseller at Oxford, where he published *The XXXIX. Articles of the Church of England, with Scriptural Proofs and References* (1844); came to the U. S. 1848 and settled in New York, where he has become well known as a bibliographer, antiquarian bookseller, and publisher. He has prepared the catalogues of most of the valuable libraries sold at auction in New York since 1850, among which may be mentioned those of Samuel Farmer Jarvis (1851), E. B. Corwin (1856), G. R. Hazewell (1856), W. E. Burton (1861), Edwin Forrest (1863), John Allan (1864), and T. W. Field (1875). He has republished in limited editions on large paper a large number of curious old works on American history; has edited for several years the *American Bibliopolist* (1869 *seq.*), and undertook in 1867 the publication, in parts, of a *Dictionary of Books relating to America, from its Discovery to the Present Time*, still incomplete (1876), but which promises to be a lasting monument of bibliographical industry and enterprise.

**Sabine',** parish of W. Louisiana, on Sabine River and watered by its tributaries, has a level surface and a fertile soil. Staples, Indian corn, cotton, sweet potatoes, cattle, and swine. Cap. Manny. Area, 1300 sq. m. P. 6456.

**Sabine,** county of E. Texas, adjoining Louisiana, from which it is separated by Sabine River, has a broken surface and a fertile soil, and is largely covered with timber. Staples, Indian corn, cotton, sweet potatoes, sorghum-molasses, and wool. Cap. Hemphill. Area, 525 sq. m. P. 3256.

**Sabine** (Sir EDWARD), D. C. L., F. R. S., b. in Dublin, Ireland, in Oct., 1788; educated at the military schools of Marlow and Woolwich; entered the British army as second lieutenant of artillery 1803; became captain 1813; took part in the campaign on the Niagara frontier, commanding the batteries at the siege of Fort Erie, 1814; accompanied the Arctic expedition of Ross and Parry 1818, and that of Parry 1819–20, when he made important researches in terrestrial magnetism, which were communicated to the Royal Society; edited during the latter voyage the *North Georgia Gazette and Winter Chronicle*, a periodical written by the officers on board the Hecla (republished at London 1822); aided in the preparation of the *Natural History* of Parry's first expedition (1824); made a series of voyages, ranging from the equator to the Arctic circle (1821–25), in quest of data concerning the variations of the magnetic needle, the figure of the earth, and other problems in meteorology and terrestrial physics; published *An Account of Experiments to determine the Figure of the Earth* (1825); was secretary of the Royal Society 1827–30; passed several years on garrison duty in Ireland; made valuable reports on magnetic forces to the British Association 1836–38, which led to the establishment of a system of magnetic observatories; published *The Variability of the Intensity of Magnetism upon Many Parts of the Globe* (1838); edited the records of magnetic observations made at Cape Town, Toronto, St. Helena, Hobarton, and other colonial observatories in several large volumes (1843–60), and translations by his wife of Admiral Wrangell's *Narrative* (1840), Humboldt's *Cosmos* (4 vols., 1846–58), *Aspects of Nature* (2 vols., 1849), and Arago's *Meteorological Essays* (1855); contributed numerous memoirs to the British Association, and more than 40 to the Royal Society; was an officer of those corporations for many years, having been president of the former in 1853, and of the latter 1861–71; made a knight of the Bath 1869, and full general 1870, and was chosen corresponding member of the French Academy of Sciences in the section of geography and navigation Apr., 1875.

**Sabine** (LORENZO), b. at Lisbon, N. H., Feb. 28, 1803; was self-educated; became a merchant, and subsequently a bank officer; collector of the board of trade and confidential agent of the treasury department at Boston; resided some years at Eastport, Me., which town he three times represented in the Maine legislature; was collector of the port of Passamaquoddy, and was led by his proximity to New Brunswick to undertake inquiries into the personal histories of the American Tories, who were the chief element in the population of that province and of Nova Scotia. He was a member of Congress from Massachusetts 1851–53, and fishery commissioner on the part of the U. S. for several years. Author of a valuable work, *The American Loyalists, or Biographical Sketches of Adherents to the British Crown in the War of the Revolution* (1847; revised ed., 2 vols., 1864), *Report on the Principal Fisheries of the American Seas* (1853), *Notes on Duels and Duelling* (1855), *An Address before the N. E. Historico-Genealogical Society, etc., Sept. 13, 1859, the Hundredth Anniversary of the Death of Major-General James Wolfe* (1859), *The Life of Preble* in Sparks's *American Biography*, vol. xxii., of four *Annual Reports* of the Boston board of trade, of eleven articles in the *N. A. Review* 1843–59, and of various essays in the *Christian Examiner* and other periodicals. He is an honorary A. M. both of Bowdoin and of Harvard, and a member of the Massachusetts Historical Society.

**Sabine City,** v. (SABINE PASS P. O.), Jefferson co., Tex., on Sabine Bay and Pass. P. 457.

**Sabine Pass,** the mouth of Sabine River and Lake, has a muddy bar, with 6 or 8 feet of water, and a narrow channel. There is a brick lighthouse on Brant Point, the E. side, lat. 29° 43′ 55″ N., lon. 93° 50′ 19″ W., with a flashing dioptric light of the third order.

**Sabine River,** a stream which rises in Hunt co., Tex., flows S. E. to the W. boundary of Louisiana, and then turns southward, forming throughout the rest of its course the boundary beween Texas and Louisiana for 250 miles. It is 500 miles long, is navigable in its lower course, and after traversing Sabine Lake enters the Gulf of Mexico through Sabine Pass, its mouth, which has a maximum depth of 8 feet on the bar. Much timber is shipped from its valley.

**Sabines** [Lat. *Sabini*], a valiant people of ancient Italy, inhabiting the mountain-region N. E. of Rome. The original population of Rome, it would appear, was largely Sabine; and a Sabine king, Numa, was the most eminent of the royal line of old Rome. They were doubtless kindred with the Latins and the Oscans, as is rendered probable by the study of the few Sabine words which have been preserved to us. The Sabine religion, modified by other Italian and Etruscan elements, became in substance that of the Roman state. The Tities, one of the original patrician tribes, were Sabine, as in later times was the Claudia gens. There were numerous wars between the Romans and the later Sabines, who were finally overthrown in 290 B. C. by Manius Curius Dentatus, after the third Samnite war. In 268 B. C. they became full citizens of Rome, and were assigned to the Sergian tribe. The Samnites were of Sabine stock. The Sabines were renowned not only for valor, but for gravity, dignity, and austere virtue.

**Sabi'nus** (AULUS), a contemporary and friend of Ovid, by whom he and his poems are mentioned several times. He was previously considered the author of the *A. Sabini Epistolæ Tres*, found in the first editions of Ovid's *Epistolæ Heroidum*, but it has since been proved that these belong to a certain Angelus Sabinus of the fifteenth century, while the poems of Aulus Sabinus have been lost.

**Sa'ble** [Fr. *zibeline*], a name given to species of the family Mustelidæ and genus *Mustela*. The species in external appearance resemble the familiar little weasel, but their bodies are not so elongated. In summer the color is reddish or brownish yellow, clouded with black, and becoming lighter toward the head; in winter it is dark. The length of the body in well-grown animals does not vary much from seventeen inches from the snout to the tail, while the tail is about seven to ten inches. The Old-World form (*Mustela zibellina*, Linn.) inhabits Northern Europe and Asia. The sable furs are chiefly obtained in Siberia. This Siberian form in winter often has the whole body covered with lustrous blackish-brown or sometimes quite black

hairs, but with these are generally intermingled white ones. The posterior tubercular grinder of the upper jaw is oblong, and nearly twice as long on the inner as on the outer side. The American sable (*Mustela Americana*) is most abundant in British America, and the furs in the markets are chiefly obtained by the Hudson's Bay Company. It is distinguished from the Siberian species by the posterior tubercular grinder of the upper jaw being quadrate, and rather longer on the inner than on the outer side. The furs of both species are held in high esteem. THEODORE GILL.

**Sablé′,** town of France, department of Sarthe, on the Sarthe, which here is crossed by a bridge of black marble, manufactures gloves, serges, beetroot-sugar, and leather, and has large dyeworks and an active trade in corn, cattle, and marble from the rich quarries in the vicinity. P. 5675.

**Sable,** tp., Iosco co., Mich. P. 842.

**Sable Island** [Fr. *sable*, "sand"], an island 90 miles S. E. of Cape Canso, in Nova Scotia. It is a dependency of the above province, and is 25 miles long from E. to W., and from 1¼ to 5 miles in breadth. It is composed of sandhills enclosing a lake 11 miles long with a maximum depth of 12 feet. Grass and wild beach-pea vines grow, and many ponies are bred here. Some of the sandhills reach the height of 80 feet. Lat. of E. point, 43° 59′ N., lon. 59° 47′ W.; lat. of W. point, 43° 57′ N., lon. 60° 14′ W. The island contains a life-saving station, it being surrounded by extensive and very dangerous shoals. It was colonized in 1598 by 40 French convicts, landed there by the marquis de la Roche, but five years later only twelve wretched men survived, and the colony was broken up. The island should not be confounded with Cape Sable Island. (See CAPE SABLE.)

**Sables′,** or **Les Sables d'Olonne,** town of France, department of Vendée, on the Bay of Biscay, was founded by Louis XI., who built its harbor and constructed its fortifications. It is much frequented as a watering-place, and carries on extensive fisheries and a large export-trade in corn, wine, wood, salt, and fish. P. 7000.

**Sa′bre** [Fr., a word of Eastern origin], a long, heavy curved or straight cavalry sword, used for cutting and thrusting, and usually one-edged.

**Sabretache′** [Ger. *Säbeltasche*, "sword-pocket"], a square pocket or pouch attached to the sword-belt of certain mounted officers in some armies. Originally designed for the carrying of despatches, it is now a mere ornament, and is often finely wrought with embroidery in rich ornamental designs.

**Sabrevois,** p.-v., Iberville co., Quebec, Canada, 5 miles S. of St. John's, is the seat of Sabrevois College (Anglican French) and of a Protestant girls' mission school. P. about 175.

**Sabu′la,** p.-v., Jackson co., Ia., on Sabula Ackley and Dakota R. R. and Mississippi River, equidistant from St. Louis and St. Paul, has 2 churches, 2 banks, 1 newspaper, 1 private and 4 public schools, a sash, door, and blind factory, and 2 planing, 1 steam saw, and a grist mill. P. 920. DR. J. F. FAIRBANK, ED. "GAZETTE."

**Sac,** county of W. Iowa, on Indian and Cedar creeks and Boyer River, has a broken surface and a fertile soil. Staples, wheat, Indian corn, oats, and butter. Cap. Sac City. Area, 526 sq. m. P. 1411.

**Sac,** tp., Sac co., Ia. P. 584.

**Sac and Fox Indians,** two associated Algonkin tribes, first known to the French as dwellers in Canada. They were early driven to the Saginaw region, thence to Green Bay, and from that point to Fox River. They afterward occupied a large tract of land on both sides of the Mississippi, including great tracts in Illinois, Wisconsin, Missouri, and Iowa. They were often involved in wars with their neighbors, French, Indian, and English. Their great chief Keokuk was of the Sac (Sauk) tribe. Black Hawk, a later chief of the tribes, was a Pottawattomie by birth. Between 1830 and 1849 they were gradually removed south-westward. In 1872 there were, on a reservation of 483,840 acres in the Indian Territory, 433 Sacs and Foxes, one-half Sacs. They entirely reject civilization, schools, and churches. There are also 88—called Sacs and Foxes of the Missouri—on a reservation in Kansas and Nebraska. They have 16,000 acres of land, and are progressing favorably. They are shortly to be removed to the Indian Territory. There are also 275 Sacs and Foxes in Tama co., Ia., where in 1857 a party of 317 settled and bought lands. Their agency is at Toledo, Ia. They have proved somewhat industrious, but are much given to roving and hunting. They seldom cultivate their own lands, and are mostly employed as hired farm-laborers. (See FOX INDIANS.)

**Sac′apa,** or **Zacapa,** town of Central America, in Guatemala, on a river of the same name, is well built and is in a fertile and well-cultivated district. Its cigars are celebrated. P. about 8000.

**Saccarap′pa,** p.-v., Westbrook tp., Cumberland co., Me., on Portland and Rochester R. R., 6 miles N. W. of Portland. P. about 900.

**Saccas.** See AMMONIUS.

**Saccatoo′,** or **Sokoto,** capital of a kingdom of the same name in the Soodan, Africa, W. of Lake Tchad, from which it is separated by Bornoo. The area of the country is about 117,000 sq. m., and it is well peopled. The inhabitants belong to the Fulbe tribe, and are Mohammedans; a large military force, consisting of 20,000 cavalry, is maintained. The city of Saccatoo is on the Ziermian affluent of the Quorra, in lat. 13° N. and lon. 6° E. It has a weekly market, at which large transactions are made in cloth, raw silk, horses, cattle, glassware, and perfumery. P. about 20,000.

**Saccharim′eter** [Lat. *saccharum*, "sugar," and Gr. *μέτρον*, "measure"], an instrument for determining the percentage of sugar in solutions by the aid of polarized light. (See SUGAR.)

**Sacchi′ni** (ANTONIO MARIA GASPARO), b. at Pozzuoli, near Naples, July 23, 1734; was educated in the conservatory of San Onofrio at Naples, and received instruction in counterpoint from Durante; achieved a great success at Rome in 1762 by his grand opera *Semiramide*, and at Venice in 1768 by his *Alessandro nell' Indie;* went, after composing about 50 operas for various Italian theatres, to Germany in 1771; repaired next year to London, where he was very successful with his operas, but whence he at last was compelled to flee in 1782 on account of debt; found employment in Paris, but only one of his operas, *Œdipe à Colone*, performed after his death, made any great impression. D. at Paris Oct. 7, 1786.

**Sac City,** p.-v., cap. of Sac co., Ia., on Iowa Pacific R. R., 45 miles W. of Fort Dodge, has good schools, 1 newspaper, and the usual county-seat buildings. P. 156.
JAMES N. MILLER, ED. "SAC SUN."

**Saccobran′chia,** or **Saccobranchiata** [Gr. *σάκκος*, "bag," and *βράγχια*, "gills"], an order of tunicates established by Prof. Owen for species whose mantle is united to the tunic at the two orifices, while elsewhere it is generally more or less detached, and whose branchiæ form a dilated solid vascular sac, with, commonly, a tentaculigerous orifice. It includes the larger number of the members of the class, some of which are solitary—*i. e.* each animal complete in itself, such as the Asciidiдæ, etc.—while others are social—*i. e.* with individuals more or less confluent, such as the Botryllidæ, Polyclinidæ, Didemnidæ, Sigillinidæ, Clavellinidæ, and Perophoridæ. THEODORE GILL.

**Saccomy′idæ** [from *Saccomys;* Gr. *σάκκος*, "sack," and *μῦς*, "mouse"], a family of mouse-like rodents peculiar to North America, and distinguished by the hind limbs being much longer than the fore, and hence adapted for leaping; the presence of large external cheek-pouches not connected with the mouth, and lined with fur within; and the development of a long tail. The skull is quite thin, with the interorbital space rather broad; the tympanics inflated and vestibular; the petrosals approximated; the squamosals more or less restricted to the orbit; the mastoids roofing over in part the cerebral cavity; the nasals are produced forward beyond the line of the incisors; the zygomatic arches are very slender; and no special anteorbital foramen is developed. In the dental series the molars are $\frac{4}{4}(\times 2)$. The forms exhibiting these characters in other respects exhibit variations especially in dentition, some (Saccomyinæ) having molars rooted and the upper incisors broad and smooth; others (Perognathinæ) also having rooted molars, but the upper incisor compressed and sulcate; while still others (Dipodomyinæ) have rootless molars, but agree with the second in having compressed and sulcate upper incisors. The species are confined to the western and southern portions of the U. S. and Middle America. They vary in size, some being smaller than the ordinary house-mouse, while others are nearly as large as a rat. They progress chiefly by long leaps, in the fashion of the kangaroo or ordinary jumping mice. In the U. S. there are, according to Dr. Coues (in *Proc. Acad. Nat. Sci.*, Philad., for 1875, pp. 272–327), six species—viz. three *Perognathus*, two *Cricetodipus*, and one *Dipodomys*. THEODORE GILL.

**Saccopharyng′idæ** [Gr. *σάκκος*, "small bag or pouch," and *φάρυγξ*, "pharynx"], a family of fishes of the order Apodes, supposed to be related to the eels, and distinguished by the enormous head and mouth and the whip-like tail. The body is very long, but cannot be called eel-like; the abdominal portion is of moderate length; the caudal portion extremely elongated, band-like, and tapering into an attenuated thread-like extremity; the skin is lax and destitute of scales; the head is very large; the snout

short, pointed, flexible, and like an appendage overlapping the gape; the eye situated far forward; the opercular apparatus apparently imperfect; the nostrils single (?) and in front of the eyes; the mouth is fissured far backward, and the gape consequently is very extensive; the upper and lower jawbones very thin, slender, and arched; the teeth slender, curved, with points directed inward, and in one or two rows; palate unarmed; branchial apertures wide, at some distance from the head, and at the lower part of the sides; "dorsal and anal fins rudimentary, the former more so than the latter, and indicated by a groove bordered by a whitish line on each side, and commencing at a short distance behind the head. Now and then a short ray is visible toward the end of the trunk; anal rays distantly placed, commence behind the vent, and are visible for some distance;" pectoral fins small. The skeleton has thin soft bones, deficient in inorganic matter, and connected by a lax, easily-torn fibrous tissue; the gills are very narrow, free, and exposed; the stomach is distensible in an extraordinary degree, and when full has a bag-like form, which is alluded to in the name. The family has been instituted for the reception of a single species of fish (*Saccopharynx flagellum*) inhabiting the deep portions of the Atlantic Ocean. The only known specimens have been found far off the American coast and off the island of Madeira. The color is black. The last specimen obtained measured nearly three feet in total length, the head to the mandibular joint being two and a half inches, the trunk six inches, and the tail twenty-five inches in length. The affinities of the family are very doubtful, but Günther is probably more correct than his predecessors in referring it to the same great group as the Murænidæ and Anguillidæ. He has also redescribed the species, and to him we are indebted for our better knowledge of it. THEODORE GILL.

**Sachev'erell** (HENRY), D. D., b. at Marlborough, Wiltshire, England, about 1672; educated at and fellow of Magdalen College, Oxford, where he was room-mate with Addison; took orders in the Church of England; was given the living of Cannock, Staffordshire; appointed preacher at St. Saviour's, Southwark, 1705; preached a sermon at Derby assizes Aug. 15, and another before the lord mayor of London at St. Paul's Nov. 5, 1709, in both of which he denounced toleration of dissenters, attacked Low Churchmen, inculcated passive obedience, and declared that the Church was in danger; was impeached for these discourses by the House of Commons Feb. 27, 1710, found guilty of a misdemeanor Mar. 23, and sentenced to three years' suspension from preaching, the offending sermons being burnt by the common hangman. Great excitement prevailed throughout England during this trial, and large numbers of pamphlets were printed on both sides, the Tories favoring the publicity of Sacheverell's sermons, of which at least 40,000 copies were sold, while 30,000 copies of the record of the trial (1710) were circulated. Sacheverell profited by this easy martyrdom; he was invited by the new (Tory) House of Commons to preach before them on the day his sentence expired, and was presented by Queen Anne to the rectory of St. Andrew's, Holborn. D. at London June 5, 1724. The defence he pronounced at the bar of the Lords was an eloquent production, written for him by Atterbury.

**Sachs** (HANS), b. at Nuremberg Nov. 5, 1494; was apprenticed to a shoemaker, his father being a tailor; undertook, after finishing his apprenticeship, the professional wanderings (1510–15) which at that time formed a part of the education of a thorough mechanic; visited many German cities, studying in the guilds his trade and the art of the meistersingers; settled in 1515 in his native city as a shoemaker and a poet. D. there Jan. 20, 1576. He was a man of some knowledge, of good judgment, of wide sympathies, and powerful humor, and he possessed to perfection the skill and taste of his time in the sphere of poetry. Immensely prolific, he became the representative poet of his age, and produced several thousand strophic poems which he published on fly-leaves, and several hundred dramas, dialogues, *Schwänke*, which were performed in the guild-halls or on festive occasions in private houses. The æsthetical merit of these productions, especially of the meistersongs, is very small. A naïve, pious sympathy, a dry but rather coarse-grained humor, a fluent dialogue, and now and then a well-turned verse—that is all. But it must be remembered that the principal aim of this whole literary activity was didactic, a moral and intellectual influence, and in this respect Hans Sachs and his pen were a power in the camp of the Reformers, and his writings contain much precious material for the true understanding of German life and character during the time of the Reformation. Selections of his works are numerous; one of the richest was given in 11 vols. by Götz (Nuremberg, 1824–30). His *Life* has been written by Salomon Ranisch (1764) and by Hofmann (1847). CLEMENS PETERSEN.

**Saci'le,** town of Italy, province of Udine, on the Livenza, 35 miles N. N. E. of Venice. This city—for it has enjoyed that distinction from a remote period—was once very strong, being defended by the Livenza on one side and by a castle and extensive fortifications on the other. It is a well-built town, and some of its churches are of great antiquity, and otherwise of no small interest. In one of the many private palaces, the Palazzo Carli, are good portraits of Dante, Petrarch, and Laura by an old but unknown artist. The immediate neighborhood of Sacile has been the theatre of many important military conflicts, both in mediæval and modern times. P. 5300.

**Sack** [Fr. *sec*, "dry"], a name formerly applied to wines of the class now called "dry"—*i. e.* not saccharine—but especially given to "sherris sack," represented now by the amontillado sherry wines.

**Sack'but,** a wind instrument somewhat resembling the trumpet, having a slide like the modern trombone. It is mentioned in the book of Daniel, but the translation is probably wrong, the English sackbut being a very different instrument, derived from a model excavated at Pompeii.

**Sack'cloth,** coarse hempen or hair cloth, such as was used for making sacks or bags, was worn by the ancients as an emblem of grief, and in later times was much employed as a means of penitential maceration of the body among ascetics.

**Sack'et** (DELOS B.), b. in New York May, 1822; graduated at the U. S. Military Academy, and promoted brevet second lieutenant of dragoons July 1, 1845, when he was ordered to Texas with the army of occupation, and in the war with Mexico was engaged in the battles of Palo Alto, Resaca de la Palma, and Monterey; brevetted first lieutenant. From 1847 to 1861 he served mainly on frontier duty, engaged in numerous expeditions; was assistant instructor of cavalry tactics at West Point 1850–55. In May, 1861, he had risen through successive grades to be lieutenant-colonel of the 2d Cavalry; transferred to the staff in Oct., 1861, as inspector-general, with the rank of colonel, and served in that capacity with the Army of the Potomac throughout the Virginia Peninsular campaign, at the battles of South Mountain, Antietam, and Fredericksburg. Brevet brigadier and major general U. S. A. Mar. 13, 1865, for "gallant and meritorious" and "faithful and meritorious services."

**Sackett,** tp., Sangamon co., Ill. P. 698.

**Sackett's Harbor,** p.-v., Hounsfield tp., Jefferson co., N. Y., on the S. shore of Black River Bay, an inlet of Lake Ontario; lat. 43° 55′ N., lon. 75° 57′ W. A crescent-shaped tongue of land running out from the village forms an admirable inner harbor, with sufficient depth of water for the largest vessels. In the war of 1812–15 it was largely used as a naval station, and it was here that the Oneida was launched in 1809, the first American war vessel ever launched on Lake Ontario. In 1819, Madison Barracks were completed by the U. S. government at this place, since which time it has been occupied as a military post. Although possessing a valuable water-power and adjoining a rich agricultural country, the commerce and population of Sackett's Harbor have steadily diminished. P. in 1870, 713.

**Sack'ville,** p.-v. of Westmoreland co., N. B., at the head of the Bay of Fundy and on Intercolonial Railway, 129 miles N. E. of St. John. It has a good harbor, a brisk trade, 8 churches, 2 weekly newspapers, a large foundry, a steam-tannery, and several mills. It is the seat of Mount Allison College (Wesleyan) and of Wesleyan male and female seminaries. P. about 1500.

**Sackville** (GEORGE **Germain**), VISCOUNT, better known as LORD GEORGE GERMAIN, third son of the first duke of Dorset; b. in England Jan. 26, 1716; educated at Westminster School and at Trinity College, Dublin, his father being lord lieutenant of Ireland; entered the army as LORD GEORGE SACKVILLE; served with credit at the battles of Dettingen (1743) and Fontenoy (1745), and under the duke of Cumberland against the Pretender in Scotland; became a privy councillor; was secretary for Ireland 1751; made lieutenant-general 1758; commanded the allied cavalry at the battle of Minden, Aug. 1, 1759, when he failed to execute the orders of the commander-in-chief, Prince Ferdinand of Brunswick, to charge upon the French infantry; was tried by court-martial and cashiered early in 1760, but was restored to favor at the accession of George III. (Oct., 1760); entered Parliament 1761; was restored to the privy council 1766; fell heir to the estate of Lady Betty Germain, and assumed her surname 1769; fought a duel with Gov. Johnstone of West Florida 1771; entered the cabinet of Lord North as secretary of state for the colonies Oct., 1775; retained that post throughout the war of the American Revolution, distinguishing himself by

his bitterness against the Americans, and resigned Feb., 1782, on which occasion he was created Viscount Sackville. D. Aug. 26, 1785. He is one of the three persons whose claims to the authorship of the *Junius Letters* have been most persistently advocated, but the theory seems now abandoned. Among the works which maintained this view were George Coventry's *Critical Enquiry* (1825), *Junius Unmasked* (Boston, 1828), by Rev. Dr. William Allen; *Reminiscences* (London, 2 vols., 1822–27), by Charles Butler; and *The History of Junius and his Works* (1843), by John Jaques; the two latter writers considering Sir Philip Francis as Sackville's amanuensis.

**Sackville** (Thomas). See Dorset, Earl of.

**Sa'co,** city and tp., York co., Me., situated on Boston and Maine and Portland Saco and Portsmouth R. Rs., 100 miles E. of Boston, and on Saco River, 9 miles from its mouth, the river being open about nine months in the year to vessels drawing 9 feet of water. The various manufacturing industries are well represented, York Manufacturing Co. taking the lead in the manufacture of cotton goods, employing about 1000 operatives. Other articles of manufacture are cotton-machinery, belting, brushes, and carriages. Shipbuilding is carried on to some extent, and 23 vessels are engaged in the coasting-trade. Agriculture and commerce are also well represented. It has 1 weekly newspaper, 6 churches, 4 banks, a city building, 4 large brick school-houses, a high school, a common, 2 steam fire-engines, and a large library. The contiguity of the city to the ocean, and its not very great distance from the White Mountains, make the health-standard remarkably satisfactory; from all points the wind comes laden with health, and the generally hot and suffocating land-breezes of other seaside localities come cool and refreshing from the tempering influences of the snow-capped and ice-filled gorges of the White Mountain range. Old Orchard is a popular and growing watering-place. The Methodist national and district camp-meeting grounds are at the beach. P. 5755.

Wm. S. Noyes, Ed. "York Co. Independent."

**Saco,** a river of Maine, rises in the White Mountains, N. H., and flows S. E. 160 miles to the Atlantic; has several considerable falls, one of which, Great Falls, is 72 feet in height, and furnishes water-power, which is utilized at many places for manufactories.

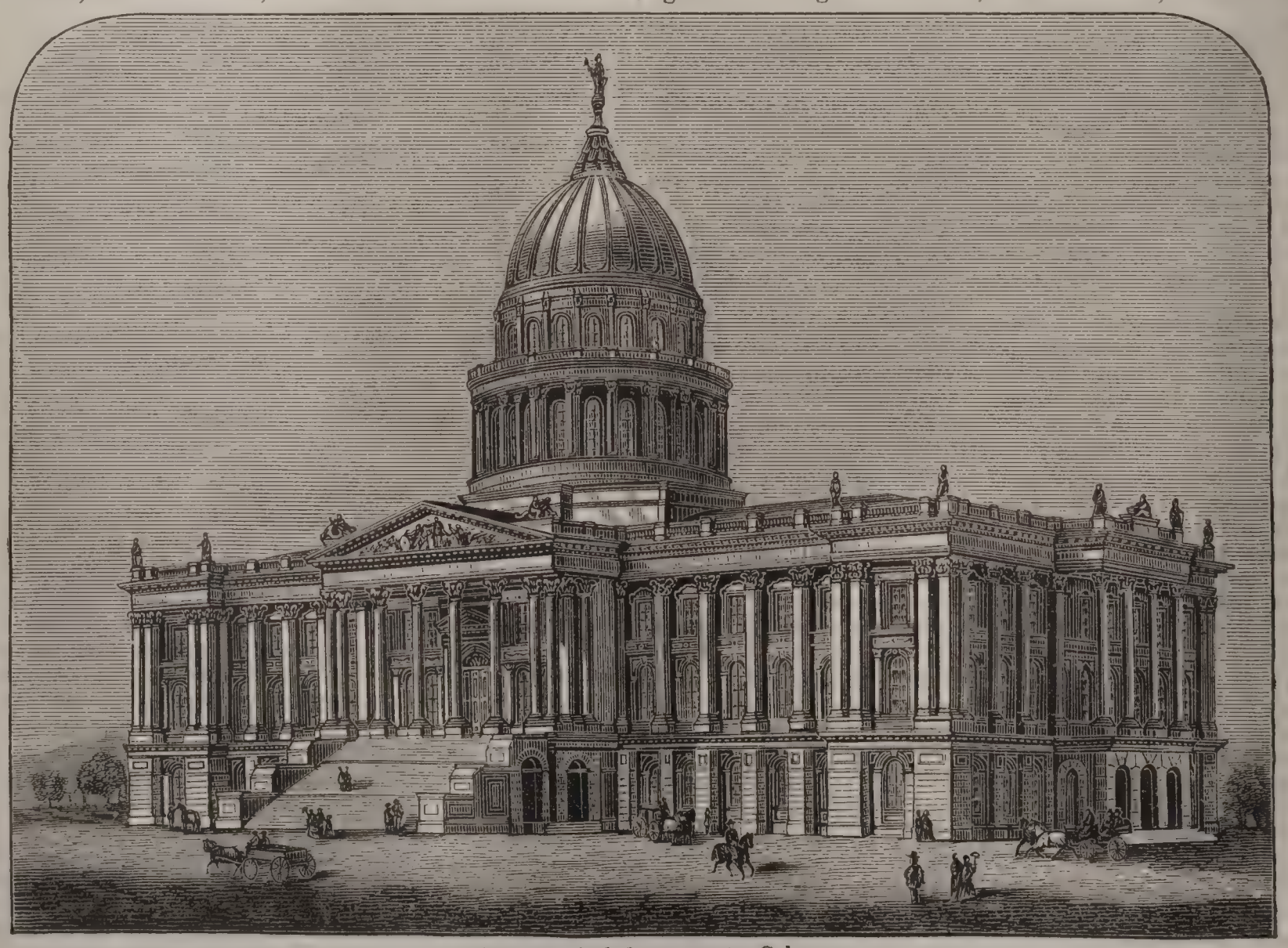
**Sac'rament** [Lat. *sacramentum*, "an oath," especially a military oath, and also a gage in money laid down in court by two contending parties], used in the Church since Tertullian, in a loose sense, of sacred doctrines and ceremonies (like the Gr. *μυστήριον*), and then, more particularly, of Baptism and the Eucharist, and a few other solemn rites connected with Christian worship. St. Augustine defines sacrament in the narrower sense to be the visible sign of an invisible grace (*signum visibile gratiæ invisibilis*). To this was afterward added by Protestants, as a third mark, that it must be instituted by Christ and enjoined upon his followers. Sacraments are also called signs, seals, and means of grace. Their number is by Protestants confined to two—viz. Baptism and the Lord's Supper—because these alone are instituted by Christ and commanded to be observed to the end of time. The Roman Catholic and the Greek churches add to them five others—viz. confirmation, penance, extreme unction, ordination, and matrimony. The Council of Trent anathematizes those who deny that there are seven sacraments (*esse plura vel pauciora quam septem sacramenta*). In the Greek Church they are called "mysteries." As to the efficacy of the sacraments, Protestants require faith as a subjective condition, while the Roman Catholic Church teaches that the sacraments work *ex opere operato—i. e.* by the inherent power of the institution or by the performance of the act, independently of the moral character of the priest and the state of the recipient. There has been much controversy about the sacraments, especially the Lord's Supper, which is sometimes emphatically called *the* sacrament, between Protestants and Roman Catholics, and also between Luther, Zwingli, and Calvin. The Quakers reject the sacraments as external ceremonies, and hold only to internal baptism or regeneration of the Spirit, and internal communion with Christ. (See articles on the several sacraments, especially Eucharist.)

Philip Schaff.

**Sacramentarians.** See Tetrapolitan Confession.

**Sacramen'to,** county of Central California, on Sacramento, American, Calaveras, San Joaquin, Mokelumne, and Cosumne rivers, is mountainous in its eastern parts, is traversed by Central Pacific, California Pacific, and Sacramento Valley and Placerville R. Rs., and is one of the principal seats of gold-mining. The staples are barley, sweet potatoes, hops, hay, wine, butter, cheese, and wool; has very numerous cattle, sheep, swine, and horses, and important manufactories. Cap. Sacramento, which is also the State capital. Area, 1026 sq. m. P. 26,830, of whom 3596 are Chinese.

**Sacramento,** city, cap. of California, and county-seat of Sacramento co., on the left bank of Sacramento River, at its junction with American River, and at the head of navigation for large steamboats; lat. 38° 31′ N., lon. 121° 20′



State Capitol, Sacramento, Cal.

W. It is 135 miles by rail from San Francisco and Pacific Ocean, and is nearly in the centre of the State. P. in 1876, 20,000, estimated from the registered votes. The corporate limits are 2½ miles square. City indebtedness, $2,300,000; cash in the treasury for municipal purposes Mar., 1876, $76,773, and for redemption of bonds $20,594; estimated value of all property in the city, $20,000,000; assessed value of all property for taxable purposes (including prop-

erty of the city, estimated at $500,000), $12,174,526. It has an extensive trade with the mining-districts and with large wheat-raising and agricultural regions, of which it is the centre. Its manufactures are extensive and rapidly increasing, among which are a woollen-mill, with 1440 spindles; carriage manufactories, one of which employs a capital of $100,000; a furniture company, turning out annually goods of the value of $35,000; plough-factories, the largest of which employs a capital of $80,000; a tub, pail, and barrel factory; 2 glue-factories; 2 potteries, each with a capital of $25,000; smelting and refining works for the reduction of silver ores; 4 marble-works, 6 breweries, 4 flouring-mills, ironworks, etc. The city is the railroad centre for the northern part of the State; the Central Pacific R. R. shops and manufactories at this point are very extensive, employing constantly from 1000 to 1500 mechanics. The banks are the National Gold, Sacramento Savings, Capital Savings, Odd Fellows, and Dime Savings, with united capital and deposits of $7,000,000. The city was formerly the western terminus of the overland railroad, which has since been extended to San Francisco. It is also connected with San Francisco by the California Pacific R. R. It has communication with Marysville and the northern part of the State by California and Oregon R. R., with the mining towns of El Dorado and Amador cos. by Sacramento Valley R. R., and with San Joaquin Valley and the southern portion of the State by the connections of Central Pacific with San Joaquin Valley and Southern Pacific R. Rs. A line of steamers and numerous sailing vessels ply on the river between this place and San Francisco. The river is navigable for small steamers for more than 100 miles above the city. The principal buildings are the State capitol, built by the State, in a park of 50 acres, at a cost of $2,500,000; a fine structure erected as a mansion for the governor, but occupied as a State printing-office and armory; Odd Fellows temple, Masonic temple, agricultural hall, C. P. R. R. Co.'s hospital, Turner hall, the stands at Union Park, and many expensive private residences. The principal hotels are the Golden Eagle, Grand, Orleans, and Arcade. There are 14 public-school buildings, 7 of brick, the remainder of wood. The grammar school, a handsome structure of brick erected in 1873, cost $74,000. The total cost to the city for school buildings and lots is $190,500. The school census for 1875 shows 6878 children under 17 years; of these, 150 are Chinese, 100 of whom attend private schools, and 50 who attend no school. The average annual expenses of the public schools is $70,000. The libraries are the City, the Odd Fellows', and the State. The latter contains 25,303 vols. in the general department, and 11,701 in the law department. There are 2 daily papers; also 1 semi-weekly, published in German. Sacramento is well supplied with water from the river by the improved Holly pumps, which were purchased and erected by the city at a cost of $189,993. The streets, which are wide, are laid out at right angles, lighted with gas, and named, those running E. and W. by the letters of the alphabet, and those running N. and S. by numbers. It has a paid fire department, with steam fire-engines, hose carriages, etc. The churches are—1 Roman Catholic, 3 Methodist Episcopal, 3 Baptist, 1 Congregational, 1 Episcopalian, 1 Presbyterian, 1 Methodist Episcopal, South, 1 synagogue, besides other smaller congregations worshipping in halls. Among the charitable institutions are—the Howard Benevolent, which originated at an early day in the history of the city, and relieves distress without regard to Church or party; the Protestant and Roman Catholic orphan asylums, 10 lodges of F. and A. Masons, 13 lodges of Odd Fellows, 1 grove of Druids, 5 tribes I. O. of Red Men, 1 division Sons of Temperance, 1 lodge Knights of Pythias, 5 lodges Good Templars, 1 division Ancient Order of Hibernians, 1 Father Mathew temperance and benevolent association. There are also several Scottish and Jewish benevolent societies. Among other associations are the Sacramento Pioneers, Exempt Firemen's, Turn Verein, Music Union, Turner Harmonie, 2 building and loan associations. Several of these societies own fine halls. The city, built on a plain whose elevation is not more than 30 feet above the level of the ocean, was at one period subject to overflow from floods in Sacramento and American rivers. A flood in the winter of 1861–62 destroyed a large amount of property. During the year 1862 substantial levees surrounding the city were constructed at a cost of $200,000, the principal streets and buildings were raised 8 feet, and since that date it has been exempt from danger from this source. The soil on which the city is built is rich alluvium, and as the climate is semi-tropical, it is noted for its shade trees, beautiful gardens, and pleasantly-situated houses. The mean temperature, from three daily observations kept during seventeen years, is 60.25° F.; mean of heat, 78°; mean of cold, 43°; average yearly fall of rain, 20 inches. It is the boast of its inhabitants that "Sacramento has more pleasant days in the year than any other place yet known." Notwithstanding the rich soil, warm days, and luxuriant vegetation, the nights are always cool, as a breeze from the ocean reaches the city about four o'clock of each day during the summer. The record of mortality kept during eighteen years by the late Dr. T. M. Logan shows but 13 deaths annually in each 1000 inhabitants.

The land on which the city is built was originally a part of the New Helvetia grant, given by the Mexican government to Gen. John A. Sutter, the remains of whose fort are still standing within the corporate limits. It was from this fort Marshall was sent to build a saw-mill on American River, where he made the discovery of gold which caused an immigration to California within one year of more than 100,000 persons. A settlement commenced in the vicinity of Sutter's Fort immediately after this discovery, as it was an important point for the supply of the mines. The population on Apr. 1, 1849, was estimated at 150 persons, keeping stores in tents and canvas houses. In 1853 it had an estimated population of 12,000, living in brick and wooden houses, and was then the great centre of the principal stage lines of the State, as it is now of the railroad lines. The destruction of property by the flood of 1862 and the decline of placer-mining did much to retard its progress, but the people are noted for their energy and enterprise, and soon recovered their losses and accommodated their business to the changes wrought by the wonderful development of California as an agricultural, wool-growing, and wheat-raising State. Many of the most important enterprises of the Pacific coast had their origin among the people of Sacramento. The overland railroad was the scheme of a few of its merchants, who carried it to successful completion, who are still its officers, and who still retain homes among the pleasant shade-trees of Sacramento.

B. B. REDDING.

**Sacramento,** p.-v., McLean co., Ky. P. 195.

**Sacramento River** rises in Lassen co., Cal., and flows first in a westward and then in a southern course. Its upper portion is called Pitt River, the name Sacramento being often given to a comparatively small branch which rises S. of Mount Shasta. The principal branches are Feather, American, and Mokelumne rivers. Its broad and fertile valley is a northward continuation of that of the San Joaquin. The stream is navigable from its embouchure in Suisun Bay, some 50 miles, and by small vessels to Red Bluffs, 320 miles, in good stages of water. Its length is 500 miles.

**Sacred Heart,** tp., Renville co., Minn. P. 316.

**Sacred Heart, Ladies of the,** an order of nuns founded 1800 in France by J. D. Varin, a Jesuit, and Magdalen Sophie Louise Barat; approved by the pope in 1826; first came to the U. S. in 1819, and have now many houses here. There is also a congregation of Sisters of the Sacred Agonizing Heart of Jesus, with a few houses in the U. S.

**Sacred Heart of Jesus, Festival of,** on the Friday after the octave of Corpus Christi. It was first observed by the Blessed Marguerite Marie Alacoque at Paray-le-Monial, Burgundy, about 1670, and was first approved by Pope Clement XII. in 1732.

**Sacred Heart, Regular Clerks of the,** or **Paccanarists,** an association of Roman Catholic priests, founded by Nicolo Paccanari, and recognized in 1800 by the pope, sometimes called **Regular Clerks of the Faith in Jesus,** designed to replace the Jesuits, then forbidden in most countries; in 1814 the order was united with the Jesuits.

**Sacred Hearts of Jesus and Mary, Brothers of,** a Roman Catholic community founded at Le Puy en Velay, France, by M. Coindre, a priest, in 1822. They were first established in the U. S. in 1847. Their work is educational.

**Sacred Music.** See MASS and ORATORIO.

**Sac'rifices** [Lat. *sacrificium*]. The origin of sacrifices has been much debated, but is lost in the dimness of antiquity. The earliest records of our race, whether sacred or profane, show sacrifice as an existing institution, and in the former as receiving the Divine approbation. Their object was everywhere alike—to provide a means whereby man, conscious of his own sinfulness, might approach a holy God. The theory of their efficacy seems, however, to have been very different among the heathen and among the Israelites. In the former sacrifices were looked upon as in some sort a compensation to the gods, and their efficacy, therefore, depended somewhat upon their value, so that in extreme cases even human sacrifices were offered, as among rude nations in modern times; among the chosen people different views prevailed, or at least were distinctly embodied in their law and taught by their prophets. Here the fact was recognized that the

disturbed communion with God could only be restored on the basis of holiness, and the primeval promise that in the long struggle with evil the "Seed of the woman" should obtain the final victory was always the central point of their national existence. Meantime, sacrifices in great variety were provided, but those especially appointed as "sin-offerings" were always of the same character and value. A more valuable sacrifice was indeed required as the sin-offering of the high priest or of the collective congregation, and also one slightly more valuable from a "prince," for obvious reasons; but there was no gradation in the value of the victim in proportion to the aggravation of the offence. Their efficacy was thus made to depend simply upon the Divine appointment.

The chief kinds of Hebrew sacrifices were—the whole burnt-offering, which was wholly consumed upon the altar, and with which an oblation of fine flour and oil, with incense, and a drink-offering of wine, were offered; the sin-offering, of which only the fat and kidneys were burned upon the altar, the flesh being either "burned without the camp" in case the blood had been sprinkled within the sanctuary, or eaten by the priests alone in case the blood had been only sprinkled upon the brazen altar; and the trespass-offering, which is distinguished clearly from the last, although the ground of the distinction is not entirely clear. These were all propitiatory offerings, and with them the priest was required "to make atonement" for the people. Besides these were the peace-offerings, perhaps the most common of all, which might be offered in any number and of any sacrificial animal. Of these, the same parts were burned on the altar, a portion given to the priests to be eaten by them and their families, and the rest of the flesh eaten by the offerer and his friends in a holy feast before the Lord. There were other important sacrifices required. The Passover was a lamb offered in memory of the deliverance from Egypt and as a special type of Christ by each head of a family on the fourteenth of the month Nisan in each year, and eaten in their homes on the following night; the two goats on the great day of atonement in each year, of which one was sacrificed at the altar, the other sent as a "scape-goat" into the wilderness; the red heifer, burned without the camp and its ashes used in purifications; and a great variety of sacrifices for individuals on special occasions. The original comprehensive offering, from which all the others were specialized, appears to have been the burnt-offering.

Under the Levitical law the essential point of the sacrifice was the blood, the treatment of which always formed the culminating point in the sacrificial ritual. A burnt-offering of a lamb for the whole people was regularly offered every morning and evening, with its accompanying oblation or "meat-offering." In regard to the sin-offering, in order to bring it within the reach of all it was provided that for the required animal might be substituted by the poor a pair of doves, or even in case of extreme poverty an offering of flour.

The symbolical character and significance of the sacrifices is set forth at some length in the Epistle to the Hebrews.

*Literature.*—Outram, *De Sacrificiis* (translated by Allen, London, 1817); Spencer, *De Legibus Hebr.;* Maimonides, *De Sacrificiis* and *De Vacca Rufa;* Kalisch, Lev., pt. i.; Faber, *On the Origin of Sacrifice;* Davidson, *Enquiry into the Origin of Sacrifice;* Tholuck, *Diss. II. in Ep. to the Heb.* The authors cited by Keil: *Handbuch der biblischen Archäologie,* p. 47; Bähr, *Symbolik des mosaischen Cultus;* Bramesfeld, *Der alttest. Gottesdienst* (Gütersloh, 1864); Hengstenberg, *Die Opfer der heil. Schrift;* Keil, *Die Opfer des alten Bundes* (Guericke's *Zeitschrift,* 1836–37); Kliefoth, *Die ursprüngliche Gottesdienstordnung der deutschen Kirche;* Kurtz, *Der alttest. Opfercultus;* Neumann, *Die Opfer des alten Bundes;* Oehler, *Der Opfercultus,* in Herzog's *Realencyklopädie;* Sartorius, *Ueber den alt- und neutest. Kultus;* Tholuck, *Das alte Test. im neuen Test.;* Lisko, *Das Ceremonialgesetz des alten Test., seine Erfüllung im neuen Test.;* Wangemann, *Die Opfer der heiligen Schrift nach der Lehre des alten Test.;* Lange, *Com. on Levit.*

FREDERIC GARDINER.

**Sacrobos'co, de** (JOANNES), the Latinized name of JOHN HOLYWOOD, a celebrated English mathematician of the thirteenth century, of whom little is known except that he entered the University of Paris 1221, became professor there, and d. 1256. Author of a treatise *De Sphæra Mundi,* which is little more than a paraphrase of Ptolemy's *Almagest,* which he had employed in Arabic, and having been printed in 1472, passed through more than 20 eds., with commentaries. He also left treatises, *De Computo Ecclesiastico* and *De Algorithmo.*

**Sa'crum** [Lat. *os sacrum,* the "sacred bone;" the rabbins called it *luz,* and said that it never decays, but forms the germ of the new body at the resurrection; the Arabs say that the judgment angel sits upon it and judges the soul of the departed], in the vertebrate skeleton, is situated below or behind the lumbar and above or before the coccygeal vertebræ. In man it is formed of five (rarely four or six) united vertebræ. It is large, roughly triangular, and is penetrated by foramina for the passage of nerves. It is developed from thirty-five centres of ossification.

**Sacs and Foxes.** See SAC AND FOX INDIANS.

**Sacy', de** (ANTOINE ISAAC SILVESTRE), BARON, b. at Paris Sept. 21, 1758; studied jurisprudence and Oriental languages; was appointed professor in 1795 at the newly-founded École des Langues orientales, and in 1808 at the Collége de France; succeeded Rémusat in 1831 as keeper of the manuscripts of the Royal Library. D. at Paris Feb. 21, 1838. His principal works are—*Mémoires sur Diverses Antiquités de la Perse* (1793), *Principes de Grammaire universelle* (1799; translated by David Fosdick, Andover, Mass.), *Crestomathie arabe* (3 vols., 1806), *Grammaire arabe* (2 vols., 1810), *Mémoires sur l'État actuel des Samaritains* (1812), *Exposé de la Réligion des Druses* (2 vols., 1838), besides a great number of minor essays in scientific periodicals, critical editions, translations, etc. But he exercised as great an influence by his teaching as by his authorship. He educated a large number of pupils, not only of France, but also from Germany and the Scandinavian countries, and he supported scientific studies and scientific undertakings of any description with rare enthusiasm and disinterestedness.—His son, SAMUEL USTAZADE SILVESTRE DE SACY, b. at Paris Oct. 17, 1801; studied law; practised as an advocate; became in 1828 a contributor to the *Journal des Débats,* and held for more than twenty-five years a most prominent position in French journalism; was elected a member of the Academy in 1854, though he had published no work besides his articles; was appointed keeper of the Mazarin Library in 1836, its administrator in 1848; member of the council of public education in 1864. He has edited *Lettres de Madame de Sévigné* (11 vols., 1861–64), and given a selection of his literary articles in *Variétés littéraires, morales et historiques* (2 vols., 1858).

**Sad'dle Riv'er,** p.-v. and tp., Bergen co., N. J. P. 1168.

**Sad'dlery,** in its widest sense, includes the draught-harness of horses, mules, etc. In 1870 the U. S. census reported 7607 harness establishments, employing 12 steam-engines of 172 horse-power, and 3 water-wheels of 43 horse-power, giving employment to 23,557 persons, mostly adult males. The capital invested was $13,935,961; wages paid, $7,046,207; materials used, $16,068,310; and the goods produced, $32,709,981. England exports much saddlery, chiefly made at Walsall, Staffordshire.

**Sadducees.** See JEWISH SECTS, by PROF. FÉLIX ADLER, PH. D., and KARAITES, by REV. SAMUEL ADLER, PH. D.

**Sad'ler** (MICHAEL THOMAS), F. R. S., b. at Snelston, Derbyshire, England, Jan., 1780; was for some time a merchant at Leeds; became an accomplished popular orator; took a philanthropic interest in behalf of the agricultural poor and the children in factories, on which subjects he wrote and spoke much; and sat in Parliament from 1829 to his death, which occurred in Ireland July, 1835. Author of *Ireland, its Evils and their Remedies* (1828), and *The Law of Population* (2 vols., 1830), a treatise directed against the Malthusian doctrine, which was severely condemned by Macaulay, to whom Sadler published a rejoinder. In Parliament he was a strong opponent of the Reform bill and of Roman Catholic emancipation.

**Sadler,** or **Sadlier** (Sir RALPH), b. at Hackney, England, in 1507; was in early life a protégé of Thomas Cromwell; was employed by Henry VIII. in effecting the dissolution of the religious houses, and shared in their spoil 1535–37; was ambassador to Scotland in 1537, and again in 1540 and 1541–43; negotiated a treaty for a marriage between Prince Edward and Mary, the infant queen of Scots, July 1, which was, however, declared null by the Scots Dec. 11, 1543; distinguished himself in the ensuing war with Scotland, being made knight-banneret upon the battle-field of Pinkie, Sept. 10, 1547; was made privy councillor by the will of Henry VIII., and master of the wardrobe soon afterward; bore a prominent part in the administration under Edward VI.; lived in retirement during the reign of Mary; was recalled to the privy council on the accession of Elizabeth, and again sent on a mission to Scotland 1558; was one of the commissioners in the conferences at York respecting the charges made against Mary, queen of Scots, Oct. 4, 1568; was her keeper when imprisoned at Tutbury Castle 1562, and was again envoy to Scotland about 1586. D. at Standon Mar. 30, 1587. His interesting *Letters and Negotiations,* first printed in 1720, were edited by Arthur Clifford, with a memoir and notes

by Sir Walter Scott, under the title *State Papers and Letters of Sir R. Sadler* (2 vols., 1809).

**Sadlier'** (Mary Anne **Madden**), b. at Cootehill, Cavan co., Ireland, Dec. 31, 1820; wrote at an early age for London periodicals; settled in Montreal, Canada, where she published *Tales of the Olden Time;* married in 1846 James Sadlier of the publishing house of D. & J. Sadlier & Co., and subsequently removed to New York, where she has translated religious and other works from the French, and written novels for Roman Catholic readers.

**Sa'do,** island of Japan, in lat. 38° 20′ N., lon. 138° 30′ E., a few miles W. of the main island. Area, estimated at 720 sq. m. P. 130,000. It is noted for its rich gold, silver, copper, and lead mines. The chief harbor is Ebisuminato.

**Sadole'to** (Jacopo), b. at Modena July 14, 1477; was ordained priest in Rome in 1502; appointed secretary to Leo X. in 1513; made bishop of Carpentras, in France, in 1517, and cardinal in 1536. D. in Rome Oct. 18, 1547. He made a favorable impression even on the most zealous Reformers by his conciliatory spirit, and he was often employed, and not without success, in the diplomatic negotiations between Charles V., Francis I., and the popes. His writings, *Philosophiæ Consolationes* (1502), *De Liberis recte instituendis* (1533), *Phædrus sive de Laudibus Philosophiæ* (1538), etc., and his *Letters* were published in a collected edition at Verona (4 vols., 1737) and at Rome (5 vols., 1759). (See Joly, *Étude sur Sadolet* (Caen, 1857).)

**Sadow'a,** v. of Bohemia, on the Bistritz, near Königgrätz. The battle fought between the Prussians and Austrians (July 3, 1866) in this vicinity is familiarly known by the names of both these places. The strength of the Prussian army advancing into Austria was but little short of 300,000 men, with about 800 guns, and divided into three armies—the 1st under Prince Frederick Charles, the 2d under the crown prince of Prussia, and the army of the Elbe under Herwath von Bittenfeld. On the 16th of June the Prussians entered Saxony; on the 23d, Bohemia. The boundary-line which divides Austria from Prussia and Saxony is marked by ranges of mountains, which, starting from the neighborhood of Zittau, run in a S. W. direction toward Bavaria and S. E. toward Troppau. These ranges are traversed by four groups of roads fit for the passage of an army. The two lines chosen by the Prussian generals for their advance were—that which comprises the roads of Rumberg, Zittau, and Friedland, and that comprising those of Landshut, Braunau, and Glatz. By the 28th of June the whole army had successfully crossed the mountains, and secured as trophies 15,000 prisoners and 24 guns. The Austrian army, under Feldzeugmeister Benedek, opposed to Prussia had a nominal strength about equal in numbers, the number of effectives of each army being, for the Prussians, about 230,000, with 800 guns, for the Austrians 185,000, including 30,000 Saxons, with 700 or 800 guns—a total number greater than has been brought together in modern times on any battle-field except that of Leipsic, where the forces of three empires and three kingdoms were assembled. On the 29th, the Prussians advancing, the 1st army met the Austrians and defeated them at Lochow, taking 7000 prisoners, and at midnight entered Jicin, thus threatening the right flank of the Austrian army, and compelling Benedek (July 1) to take up a new position behind the Bistritz on a range of hills running parallel to that stream. On the 3d of July the Austrian left rested on Problus and Upper Prim, the centre in front of Lipa and Chlum, the right resting on Horenowes. A cavalry corps was stationed near Trotinka. At 7 A. M. of this day the Prussian 1st army and the army of the Elbe attacked the Austrians. At this hour the Prussians were inferior in numbers, the 2d army under the crown prince being 12 or 15 miles away; but moving forward as rapidly as the roads would permit, his advance reached the field about noon, and became at once engaged, and by 3 P. M. had gained the right and rear of the Austrian army, compelling the Austrian commander to retreat as best he could. Considering the number of men engaged and the duration of fighting, the loss in killed and wounded (about 28,000 on both sides) was remarkably small. The Austrians, however, lost largely in prisoners and guns. On the 5th the Prussians advanced on Vienna, but peace was concluded Aug. 23. Probably there has been no instance in the last two centuries in any campaign, except Jena, where success so rapid was followed by results so important. Within a week of crossing the frontier the Prussians utterly routed the combined forces of their enemy in a pitched battle; within a month they dictated peace to him in sight of his capital, the result being the long-desired supremacy of Northern Germany. The operations of the campaign are said to have been directed by Von Moltke.

**Sads'bury,** tp., Chester co., Pa. P. 2400.

**Sadsbury,** tp., Crawford co., Pa. P. 894.

**Sadsbury,** tp., Lancaster co., Pa. P. 1617.

**Sae'gerstown,** p.-b., Woodcock tp., Crawford co., Pa., on French Creek and Atlantic and Great Western R. R., has good water-power and some manufactures. P. 441.

**Safe-Conduct** and **Safe-Guard** are not essentially different from Passport (which see).

**Safed'** [Heb. *Zephath*], town of Palestine, ancient province of Galilee, at an elevation of nearly 2700 feet, thought by some to be the "city set on a hill" of Matt. v. 14, was almost entirely destroyed by an earthquake in 1837, which killed more than half of its inhabitants. The Jews consider it a sacred city, expecting that the Messiah will make it his capital; its college is one of the principal seats of Hebrew learning. It has some dyeworks and manufactures of cloth. P. about 5000.

**Safes, Fireproof.** See Fireproof Safes.

**Safe'ty Cage,** an apparatus worked by steam-power at the mouth of deep mines to facilitate the descent and ascent, as the simple use of ladders is connected with much loss of time and causes great fatigue. The apparatus consists generally of a square cage or open box in which the miners place themselves, and which travels in guides fixed vertically down the sides of the shaft or pit. The term, however, is more especially given to a contrivance for arresting the cage in case of accident, consisting of a catch which, if the rope or chain should snap, takes fast hold of a toothed guide and prevents the cage from being precipitated to the bottom.

**Safe'ty Lamp,** an illuminating apparatus for mines, so constructed as to obviate the dangers of explosion when artificial light is needed in places where fire-damp exists. In deep coal-mines accumulations of carburetted hydrogen take place; this gas, when mixed with air, is highly explosive, and fearful accidents have resulted from the use of ordinary lamps in such places. The earlier contrivances to effect illumination without danger were clumsy and imperfect. One of these, the steel-mill, produced a succession of sparks by the revolution of steel wheels which struck against bits of flint. In 1813, Dr. W. R. Clanny, and in 1815 George Stephenson and Sir Humphry Davy, each invented, independently, true safety lamps. Of these, Davy's has been most used. All those now most generally in use depend upon two principles for safety—the obstructive action of wire gauze and the protection afforded by a glass cylinder. Davy made a number of experiments upon the nature of the gas escaping from coal-strata, and on the conditions of its union with atmospheric air. Ventilation, perfect enough to sweep away the exhalations, was found to be impracticable, and the problem to be solved was reduced to this: Since flame is incandescent gas, some contrivance was to be devised to prevent the fire-damp becoming heated to the luminous point. Flame, he found, cannot pass through wire gauze of a certain fineness; it loses so much heat as to be incapable of igniting the inflammable gas outside. This is the case even when the gauze is red-hot. One of the greatest dangers in mines arises from the recklessness of the miners, and in the construction of safety lamps precautions have to be taken against this as against more obvious perils. Davy's lamp consists of a closed cylinder of gauze made of wire from $\frac{1}{40}$th to $\frac{1}{60}$th of an inch in diameter, with 28 wires to the inch; over the closed top is fitted a lid like a pill-box cover, fitting closely around, but not closely down over it, and so leaving between the two gauze tops a sort of air-chamber, which protects the upper lid from excessive heat. The cylinder should not exceed $1\frac{1}{2}$ or 2 inches in diameter, or the volume of gas within will be sufficient to induce explosion. Three strong vertical wires extend up the outside of the cylinder and unite above the lid, where a handle is attached; beneath is secured a common lamp. The objections to this lamp are that the light is feeble, and that it is perfectly safe only in still air and when cautiously moved about. Stephenson's lamp has a glass cylinder inside the wire one, and within the upper portion of the glass is a metal chimney perforated with small holes; this forms the double lid. The light is brighter than Davy's, and steadier; the glass, while it intercepts no light, prevents flaring from air-currents; if the glass breaks, it still leaves a wire-gauze lamp, though of rather too large diameter. The Clanny lamp has suspended above its flame an extinguisher; when the flame burns up too high from an excess of fire-damp, the wire which sustains the extinguisher melts; it falls and puts out the dangerous gas-flame, leaving a small and safe oil-flame sufficient to light the miner away from the dangerous spot. The Muessler lamp is much used in continental Europe. The Whitehead lamp is a cylinder of iron with bull's eye and surrounding reflectors and a wire-gauze top. The Mackworth is an improvement upon and modification of Davy's lamp. There are some forms of safety lamp which are considered by

scientific men more perfect than any of those mentioned—the Upton & Roberts, for instance—but which do not find favor with the miners. Other forms have been invented and used, all of which may be safely employed if proper care be taken, but any one of which may occasion an explosion if recklessly used. It seems to be agreed, generally, that the gauze cylinder should be accompanied by one of glass—the gauze to ensure against fracture, and the glass to resist air-currents, and so ensure a clear and steady light. S. B. Herrick.

**Safety-Valve.** See Steam-Engine.

**Saf'fi,** or **Azaffi,** an old and strongly-fortified town of Northern Africa, in Morocco, on the Atlantic, in lat. 32° 20′ N. It is in a naked and barren cleft, surrounded by deserts, but it has a good harbor, and its exports were formerly very extensive. Since the rise of Mogador, however, it has greatly declined. P. 12,000, of whom 3000 are Jews.

**Saf'flower** [from *saffron* and *flower*], or **Carthamus** [Fr. *carthame;* Ger. *Farbendistel*], the flower of *Carthamus tinctorius,* of the thistle tribe, indigenous to Egypt and the Levant, but now cultivated in France, Spain, Germany, Italy, Hungary, the southern Asiatic provinces of Russia, the East Indies, and South America. It was formerly used very extensively for producing pinks, reds, scarlets, and lilacs on cotton, flax, and silk, especially for dyeing "red tape" and for preparing "pink saucers." It is still extensively used in Lancashire for certain shades of pink for the Eastern market, though aniline colors have displaced it in many cases. Safflower contains two coloring-matters—one, yellow, is an acid, bitter, soluble in water, and useless; the other, *carthamine* or *carthamic acid,* red, insoluble in water, but soluble in alcohol and in alkalies, and valuable as a dye. To prepare carthamic acid the safflower is placed in bags and washed to remove the yellow coloring-matter. It is then macerated in water with 15 per cent. of its weight of crystallized carbonate of soda. Into the clear solution cotton yarn is dipped. On acidulating with dilute acid the cotton takes up the carthamic acid. The dyed cotton is washed and digested with a solution of carbonate of soda, which dissolves the carthamic acid, but leaves yellow matter fixed on the cotton. By acidulating the alkaline solution the carthamic acid is precipitated as a brilliant red powder. This may be further purified by solution in alcohol and precipitation with water. Its formula is $C_{14}H_{16}O_7$. With the exception of purification with alcohol, the above process is used in preparing safflower for use in dyeing. In dyeing the solution in carbonate of soda is acidulated, and the yarn or fabric is introduced and properly manipulated. To produce scarlet, the goods are first dyed with annotto. The alkaline solution must be prepared when it is wanted, and not kept any length of time. The safflower colors on fabrics are very fleeting; light destroys the color rapidly, and goods dyed with it must be dried in the shade. Age is nearly as injurious as light, especially when the goods are damp. Sulphuretted hydrogen converts carthamic acid into colorless carthamous acid, hence this gas acts injuriously on goods dyed with safflower. The extract of safflower consists of the carthamic acid in suspension in water. The *rouge* used for the toilet is a mixture of carthamic acid with fine burned talc (French chalk). *Pink saucers* are coated with carthamic acid. (See Safranine.) (See Calvert's *Dyeing and Calico-Printing* (1876); Ure's *Dict.;* Muspratt's *Chem.;* Schützenberger, *Die Färbstoffe.*) C. F. Chandler.



The Safflower.

**Saf'ford** (James Merrill), A. M., Ph. D., M. D., b. Aug. 13, 1822, in Zanesville, O.; graduated in the Ohio University, and afterward entered Yale College, Conn., from which institution he received the degree of doctor of philosophy; before leaving Yale was elected to two professorships—one of mathematics in the Ohio University, the other of chemistry, natural history, and geology in Cumberland University at Lebanon, Tenn.; accepting the latter, he located in Lebanon in 1848; in 1853 resigned from Cumberland University and moved to Nashville; in 1854 was made State geologist of Tennessee, which office he held for many years and still holds. His report on the geology of Tennessee, published in 1869, is one of the best of the State reports. In 1872 received the degree of doctor of medicine from the University of Nashville; in 1873 was elected to the chair of chemistry in the medical department of the University of Nashville, and the following year to the same position in Vanderbilt University; in May of this year (1875) was elected professor of mineralogy, botany, and economic geology in Vanderbilt University, which chair, together with that of chemistry in the medical schools, he now holds. Paul F. Eve.

**Safford** (Truman Henry), b. at Royalton, Vt., Jan. 6, 1836; obtained in early boyhood great celebrity for his wonderful mathematical powers; prepared an almanac at the age of nine years; calculated the elliptic elements of the first comet of 1849; devised an original labor-saving method of calculating the moon's risings and eclipses; graduated at Harvard 1854; was some years engaged in astronomical studies; became in 1863 adjunct observer in the Cambridge Observatory, acting director Feb., 1865, and director of the Chicago Observatory Dec. 28, 1865, a post he still (1876) holds. He determined at Cambridge the right ascension of 1700 stars, the declination of 450, observed 6000 transits, and completed Prof. Bond's report of discoveries in the constellation Orion.

**Safford** (William H.), b. at Parkersburg, Va., in 1821; removed to Chillicothe, O., 1848, and was a member of the Ohio senate 1858–60. Author of a *Life of Harman Blennerhassett* (Philadelphia, 1850; 5th ed. Cincinnati, 1859) and editor of *Blennerhassett Papers* (1864), containing important materials for the history of the Ohio Valley.

**Saf'fron** [Ger. *Saffran*], a yellow substance, consisting of the stigmas, with part of the styles, of the saffron crocus (*Crocus sativus*), a plant indigenous in Greece and Asia Minor, and extensively cultivated in Austria, France, and Spain, and formerly in England. Saffron was formerly imported in two forms—*hay saffron,* consisting of the stigmas of the flowers, and *cake saffron,* an artificial compound of safflower, gum, etc.; the former only occurs in commerce at present. Spanish saffron is the best. It is said 100,000 flowers are necessary to produce one pound of saffron. This dye is often adulterated with safflower, marigold, pomegranate, and other flowers. The stigmas of the true saffron are from 1 inch to 1½ inches long, narrow and roundish where they are attached to the style, but spreading and club-shaped near the extremity, which is truncated. They have an orange or brownish-red color, yellow in the narrower part, an agreeable aromatic, almost intoxicating, odor, and an aromatic bitter taste, and impart a yellow color to the saliva and to water, alcohol, and oils. Strong sulphuric acid colors them blue, then red, and finally brown. Saffron was formerly a favorite dye, but is now rarely used as such. It is employed in medicine for coloring tinctures and for liqueurs, varnishes, confectionery, and especially cakes in the W. of England. The coloring-matter of saffron is a glucoside, to which the names safranine, saffron-yellow, polychroite, and crocine have been given. By treatment with dilute sulphuric acid it is decomposed, yielding crocetine ($C_{20}H_{26}O_{11}$), glucose ($C_6H_{12}O_6$), and a peculiar volatile oil. C. F. Chandler.

**Saffron, Meadow.** See Meadow Saffron.

**Saffron of Mars.** See Iron, Medicinal Uses of.

**Saf'fron Wal'den,** town of England, county of Essex, trades in malt and cattle, and has 5715 inhabitants.

**Saf'ranine** [from *saffron*], **Saffranine, Aniline Pink,** or **New Rose.** This dye, which has to a large extent superseded safflower for dyeing silk and cotton, is obtained by treating heavy anilines with nitrites and arsenic acid: 2 parts of basaniline are heated with 1 part of sodic nitrite and 1 part of arsenic acid, for five or six minutes, to from 176° to 212° F. The colored mass is then treated with boiling water, the solution neutralized with an alkali, filtered, and treated with chloride of sodium, by which the new dye is precipitated. It is filtered and drained, and sent into commerce as a paste. Hofmann and Geyger (*Deut. Chem. Ges. Ber.,* v. 526) have shown that safranine cannot be obtained from pure aniline nor from crystallized toluidine, but that it must be prepared from liquid toluidine ($C_7H_9N$), boiling at 389° F.

$$3C_7H_9N + HNO_2 = C_{21}H_{24}N_4 + 2H_2O.$$
$$C_{21}H_{24}N_4 + O_2 = C_{21}H_{20}N_4 + 2H_2O.$$

When arsenic acid is employed as the oxidizing agent, the safranine is mixed with a large amount of secondary products, the formation of which is to a great extent avoided by using chromic acid. The safranine of commerce is either in the form of a paste or a yellowish red powder, consisting of the hydrochlorate of a base safranine mixed with calcic carbonate and sodic chloride. It may be purified by repeated solution in boiling water and precipitation by hydrochloric acid. By decomposing this salt with oxide of silver, the free base is obtained as a red solution, which yields reddish-brown crystals on evaporation, very soluble in alcohol and in water. Safranine has the composition $C_{21}H_{20}N_4$, and is nearly related to Perkin's mauveine, which appears to be phenylated safranine ($C_{21}H_{19}(C_6H_5)N_4$). In fact, safranine when treated with aniline yields a purple dye, and mauveine and safranine give similar reactions with sulphuric acid. Perkin noticed that a substance resembling safranine occurred as a by-product in the preparation of mauveine. The most characteristic reaction of safranine is that when strong hydrochloric acid—or, better, sulphuric acid—is gradually added to its solutions, the color changes first to a fine violet, and then successively to blue, dark green, and light green. On diluting the solution the same changes of color are observed in reverse order. For dyeing, the safranine is dissolved in boiling water and carefully filtered, and a very little carbonate of soda added before it is added to the dye-beck. To dye wool a rose-pink, proceed exactly as with aniline red. (See ANILINE COLORS.) To dye silk, add the solution of the color to the bath in which some castile soap has been previously dissolved; keep the bath lukewarm. To dye cotton, it is a good plan to first soak in a cold bath containing hyposulphite of soda, ¾ths ounce to the pound of cotton, to destroy the last traces of chloride of lime. For a rose-pink, mordant the cotton in either of the following ways: (1) Soak cotton half an hour in the clear solution of acetate of alumina, obtained by dissolving 2 pounds of alum and 1 pound of acetate of lead in 2 quarts of water; dry; soak half an hour in a cold fat-soap bath; dry; then dye lukewarm in the solution of safranine. (2) Soak the cotton four to six hours in a lukewarm bath to which the extract from ½ pound of nutgalls has been added; wring; soak one hour in a cold bath containing for every pound of cotton ½ to ¾ ounce of perchloride of tin crystals; wash; dye in a lukewarm bath to which the color is added in three or four instalments to secure an even color. For a dark-rose or cherry color use the second method, doubling the quantity of nutgalls and increasing slightly the quantity of perchloride of tin. For ponceau and scarlet, first give the cotton, after treatment with hyposulphite, a bottom of turmeric (hot), then continue by the second method. To darken the shades, let the cotton soak in the gall-bath over night. Tannin may be used in place of nutgalls, ¾ of an ounce to the pound of cotton. Lastly, pass all cotton dyed with safranine through a cold bath slightly acidulated with acetic acid. To print with safranine, thicken the paste with a mixture of "acetate of alumina standard" 1 gallon, clear water 1 gallon, starch 1 pound; boil; when cold add 1 pint of "arsenic standard." After printing steam half an hour. The alumina standard is made by dissolving 5 pounds of alum and 6 pounds of acetate of lead in 2 gallons of water; use clear solution. The arsenic standard is made by boiling 4 pounds of white arsenic ($As_2O_3$) in 1 gallon of glycerine till dissolved, and filtering. C. F. CHANDLER.

**Sagada'hoc,** county of S. Maine, on Atlantic Ocean, bounded W. by Androscoggin, intersected by Kennebec River, and partly consisting of islands at its mouth, traversed by Portland and Kennebec, Bath and Portland, and Androscoggin R. Rs., has extensive interests in shipbuilding, lumbering, and fisheries. Staples, hay, potatoes, wool, and butter. Cap. Bath. Area, 300 sq. m. P. 18,803.

**Sa'gan,** town of Prussia, province of Silesia, on the Baber, has a fine palace with a beautiful park, and extensive manufactures of woollen and cotton cloth. P. 10,433.

**Sagape'num** [Gr. *σαγάπηνον*], or **Gum Seraphic,** one of the fetid gum-resins, milder than asafœtida, but stronger than ammoniac and galbanum. It is brought from the Levant, and is the product of some unknown umbelliferous plant. It has now almost gone out of use.

**Sagas.** See ICELANDIC LANGUAGE AND LITERATURE, by PROF. CLEMENS PETERSEN, A. M.

**Sage** [Fr. *sauge*], the *Salvia officinalis,* a familiar garden-herb of the order Labiatæ. Its leaves are employed in flavoring force-meats and other dishes, and sage-tea, a decoction of its leaves, is a useful domestic remedy, having aromatic, stimulant, and tonic powers.

**Sage, Le** (ALAIN RENÉ). See LE SAGE.

**Sage-Brush,** a popular name for *Artemisia tridentata, A. cana, A. Ludoviciana,* and other Artemisias of the alkaline plains and table-lands of the Far West. The kind called white sage is greedily devoured by cattle and affords much pasturage. The broom sage of the plains is *Linosyris graveolens* (order Compositæ).

**Sage-Cock** (*Centrocercus urophasianus*), a species of grouse (belonging to the family Tetraonidæ and subfamily Tetraoninæ), also called **Cock of the Plains.** It is characterized, among the forms which are feathered to the toes but with the toes themselves bare, by the tail being much elongated and cuneate, and the constituent feathers narrow and attenuated, the nasal fossæ equal to two-thirds of the culmen, and the shafts of the feathers on the lower part of the throat very spinous. The color above is brownish-yellow, with blackish areas on the inner fields of the feathers; the wing has light-colored shafts to the feathers of the coverts; the lower portions of the breast are whitish, the abdomen marked with a broad black area. The male bird has very large, dilatable, naked, and yellow-colored air-sacs on each side of the neck, bordered by stiff, scale-like feathers. The species is the largest American representative of the family, the male having an average length of over thirty inches, and the female about twenty-one or twenty-two; but these dimensions are frequently much exceeded. It is confined to the arid plains of the West, ranging from the Black Hills in the E. to California and Oregon in the W., and in the N. from British America to Arizona in the S. In those plains the sage-brush (*Artemisia*) grows in abundance, and it feeds upon that plant, whereby a bitter flavor is imparted to the flesh; but it is said that if the bird is eviscerated at once after being killed, this taint is not so marked. The species differs from all its congeners in that in place of a gizzard there is, according to Mr. Ridgway, a simple muscular membranous bag, contrasting with the peculiarly-developed gizzard of the ordinary species. THEODORE GILL.

**Sage'town,** p.-v., South Henderson tp., Henderson co., Ill., on Chicago Burlington and Quincy R. R., at junction of Mississippi division of Rockford Rock Island and St. Louis R. R. P. 332.

**Sage'ville,** p.-v., Lake Pleasant tp., cap. of Hamilton co., N. Y., on Round Lake.

**Saghali'en,** or **Sakhalin,** by the natives called **Taraika,** a long and narrow island off the E. coast of Asia, and separated from Asiatic Russia by the Gulf of Tartary. It extends from lat. 45° 54′ to 54° 24′ N., and comprises an area of about 32,000 sq. m. It belongs partly to Russia and partly to Japan. Hunting and fishing are the principal occupations; the reindeer, elk, musk-ox, and seal abound. P. about 16,000.

**Sag Har'bor,** p.-v., Suffolk co., N. Y., on Peconic Bay and the Long Island R. R., has 6 churches, 1 high school and several private schools, an extensive cotton-factory, a steam flouring mill, and 2 cigar-factories. It is the principal market-town for the E. end of Long Island, and is engaged in whaling, fishing, and other maritime pursuits. It is a summer resort for tourists. P. 1723.

JOHN H. HUNT, ED. "SAG HARBOR EXPRESS."

**Sag'inaw,** county of E. Michigan, on Saginaw, Cass, Shiawassee, and Tittabawassee rivers, traversed by Michigan Central, Flint and Père Marquette, Saginaw Valley and St. Louis, and Marquette Houghton and Ontonagon R. Rs., has fine water-power, utilized by a large number of carriage-factories and saw-mills, has abundant salt springs, and a considerable interest in the fisheries. Other staples are hay, wool, and butter. Cap. Saginaw. Area, 900 sq. m. P. 39,097.

**Saginaw,** city and tp., cap. of Saginaw co., Mich., on Saginaw River, navigable for the largest lake craft, 18 miles above its mouth. It is 100 miles N. W. of Detroit, 64 miles N. E. of Lansing, the State capital, and is the eastern terminus of Saginaw Valley and St. Louis R. R., running to St. Louis, Mich., of magnetic springs fame, and to be continued to Lake Michigan; is on Jackson Lansing and Saginaw R. R., a division of Michigan Central; also on the line of Flint and Père Marquette R. R., which extends from Monroe, 40 miles S. of Detroit, to Ludington on Lake Michigan. Saginaw is immediately within the railway system of the country, having close connection with all sections, the benefit of competing roads and lake navigation. It is on an elevated plateau, amply drained, the centre of a rich farming-district; has the lightest indebtedness and levies the lightest taxes of any city in Michigan of equal population. It has 9 steam saw-mills, 8 shingle-mills, 8 saltworks, 3 planing-mills, 1 measure, bale, box, and drum factory, hoop-factory, tannery, boiler-works, foundry, machine-works, axe-factory, grist-mill, boat-factory, 4 carriage-factories, and various small manufactures.

It has union schools with academic course—central building cost $100,000—Holly waterworks, school library 2400 vols., 3 other public libraries, 3 public halls, 8 churches, 1 national and 1 private bank, 3 benevolent societies, 1 weekly and 1 semi-weekly newspaper, Wah-Wah-Sun boat-club, and street railway to East Saginaw. Product in 1875, 60,844,929 feet of lumber, 143,861 barrels of salt, 54,421,560 shingles, and $500,000 in value of other articles. P. of city, 7460; of tp. 1004.

GEO. F. LEWIS, ED. "SAGINAWIAN."

**Saginaw Bay,** in the E. of Michigan, extends 60 miles S. W. from Lake Huron. It is studded with fine islands, and has wonderfully clear and pure water and valuable fisheries. It is 30 miles in breadth.

**Saginaw, East.** See EAST SAGINAW.

**Saginaw River,** in Michigan, is formed by the junction of Flint and Shiawassee rivers. It flows N. 30 miles to Saginaw Bay, and is navigable for 24 miles by steamers of 10-foot draught.

**Sagitta'rius** [Lat., "archer"], the sign of the zodiac into which the sun enters about Nov. 22. There is also a constellation S., corresponding to the sign Capricornus.

**Sa'go** [Malay, *sâgu*], a variety of starch obtained from the medullary matter or pith of the stem of the sago-palm (*Sagus Rumphii*), an East Indian tree which grows in low lands in all the islands of that part of the world. It is a low tree, with a thick trunk, of which the woody part is but an inch or two in thickness, the whole cavity being filled, at a certain stage of its growth, with the farinaceous pith. This is mixed with water, which is passed through sieves, and the starchy matter is allowed to settle. There are several varieties: common sago, which is, like other varieties of starch, insoluble in cold water, but swells to a transparent jelly on boiling; and pearl sago, which has been granulated and subjected to some process, probably involving heat, which causes it to be somewhat soluble, even in cold water. If potato-starch be mixed with sago for purposes of adulteration, the microscope will detect its granules, from their greater size and more regular shape. H. WURTZ.

**Saguache,** county of S. Colorado, forming the N. part of San Luis Park (locally called Homan's Park), bounded N. and E. by the Rocky Mountains and W. by the Saguache range, and watered by Saguache, San Juan, and other rivers, which flow into San Luis Lake, also within the county, which has no outlet, but has a regular ebb and flow. The "park" consists of fertile natural meadows affording a rich pasturage. Staples, wheat, wool, and butter. Cap. Saguache. Area, about 2500 sq. m. P. 304.

**Saguache,** p.-v., cap. of Saguache co., Col., in San Luis Park.

**Sa'gua-la-Gran'de,** town of Cuba, on the northern side of the island, on the river Sagua, 12 miles from its mouth, and connected by railway with its port, Concha, situated on the coast. In 1867 it exported 1,024,358 cwts. of sugar and 390,200 cwts. of molasses, and is steadily growing. P. 9632.

**Saguenay',** county of Quebec, Canada, on the N. shore of the St. Lawrence, and bounded S. W. by Saguenay River. In the census of 1871 the Saguenay district included only the sub-districts of Tadousac and Escoumains, all places N. E. of these being classed as Labrador. P. 1788.

**Saguenay River,** a tributary of the river St. Lawrence, entering it on the N. shore, 120 miles below Quebec; length of course, 357 miles. It drains an area of about 23,716 sq. m., generally high, very rugged and mountainous, in the centre of which is a great oblong basin of comparatively low country, about 100 miles in length by 60 in breadth, in the S. side of the middle of which is Lake St. John, 28 miles long by 20 wide, the reservoir of the Saguenay. At its head it receives the Chomouchuan or main branch, 215 miles long, from the W. N. W., and the Mistassini, 180 miles long, from the N.; on the N. side the Paribonca, 165 miles long, from the N. N. E.; on the S. side the Metabetchuan, 110 miles long, and two smaller rivers from the S. From the S. E. end of the lake the Saguenay issues, discharging a most extraordinary volume of water from its sources being in moist and densely-wooded mountain-regions, where winter snows are occasionally 8 feet deep; but its width seldom exceeds a quarter of a mile, till at the foot of its lowest rapid, 36 miles from the lake, it meets the influence of the tides; 7 miles below which, at Chicoutimi, which is the county-town and a seaport with a considerable export trade in lumber, it becomes navigable by large ships, and receives the river Chicoutimi, 110 miles long, on the W. Ten miles lower it expands to 2 miles in width, and with a great depth, often exceeding 100 fathoms, narrows gradually to 1 mile in width at its mouth, 75 miles below Chicoutimi. The central basin of the Saguenay is bounded on the N. E. by the Ste. Marguerite or Paribonca Mountains, varying from over 4000 to 2000 feet in height; on the S. W., S., and S. E. by the Laurentides, of similar height. It is in traversing this range, for 50 miles of its lower course, through a deep chasm, whose cliffs present precipices occasionally 1500 feet in height, that the stern and grand scenery is to be found for which the Saguenay is famed. A. J. RUSSELL.

**Sagun'tum,** an ancient town of Spain, founded by Greek colonists from Zacynthus (ZANTE, which see), prospered and became very wealthy. In 218 B. C. it was besieged by Hannibal. After a year of energetic resistance, the Saguntines, pressed by famine, set fire to their city, and while all the women and children perished in the flames, the men issued forth to battle and were killed. This conquest by Hannibal occasioned the Second Punic war. The Romans afterward rebuilt the city and called it *Muriveteres* ("the old walls"), whence the name of the city, MURVIEDRO (which see), which now occupies the site. A theatre and a temple of Bacchus are still left of the ancient city, the former in comparatively good condition.

**Sahagun', de** (BERNARDINO), b. at Sahagun, Spain, early in the sixteenth century; was educated at Salamanca, where he became a Franciscan monk; went as a missionary to Mexico 1529; became versed in the languages, history, and antiquities of the Mexican tribes; wrote several religious treatises in Mexican, and left in MS. a number of works illustrating the ancient history of that country. D. at Mexico in 1590. His *Historia Universal de la Nueva España*, first published by Bustamante (Mexico, 1829) and by Lord Kingsborough in his great collection (1830), has been treated by Prescott and most writers as a leading authority upon Aztec customs and religion, but there is reason to believe that its accuracy has been much overrated.

**Sahap'tins, Shahaptans,** or **Saptins,** a family of Indians in Oregon, Idaho, and Washington territories, occupying the region on both sides the Columbia, Lewis, and Snake or Sahaptin rivers from the Dalles of the Columbia to the Bitter Root range of the Rocky Mountains. They are bounded on the N. by the Salish family, and on the S. by the Shoshone or Snake family, and include the Nez Percés or Sahaptins proper, Palus or Palooses, Walla-Wallas, Cayuses or Waiilatpus, Wascos, Yakimas, and Kliketats. They live chiefly on fish and bitter roots, and practise flattening of the head. (See H. H. Bancroft's *Native Races of the Pacific States*, vol. i., 1874.)

**Sahara.** See APPENDIX.

**Saharunpoor',** town of British India, presidency of Agra, in lat. 29° 58′ N., lon. 77° 36′ E., in a fertile plain, at an elevation of about 1000 feet above the sea-level. It is a military station, and has a botanical garden. P. 37,968.

**Sahib, Tippoo.** See TIPPOO SAHIB.

**Sai'da,** town of Syria, on the Mediterranean, in lat. 33° 34′ N. Its harbor was filled up in the seventeenth century, and is accessible now only for small boats; the adjacent country is noted for its fruit; some silk manufactures are carried on; in the neighborhood are the ruins of the ancient SIDON (which see). P. about 9000, of whom 7000 are Mohammedans.

**Saïd Pasha,** viceroy of Egypt. See EGYPT.

**Saigiidæ.** See APPENDIX.

**Saigo,** b. in Satsuma, Japan, in 1825; belonged to the Samurai or "Retainers;" was well educated in Japanese and Chinese; was a strong leader against the tycoon; in 1857 was compelled to leave Yedo, being under arrest, and fled to his home in Satsuma; his friend, the prince of Satsuma, advised him to take an assumed name and go to an islet in the Pacific Ocean; he there spent three years in exile, but returned to his home in 1861, and became active once more in the attempt to restore the supremacy of the mikado. In 1862 he joined the prince of Shimadz and others in the warfare against the tycoon which resulted in the recent revolution in Japan. He was banished a second time to a more distant isle, and endured great privations for three years, but in 1866 was recalled to the service of his country, and was received with extraordinary enthusiasm. He joined the adherents of the mikado, and was made lieutenant-general of the imperial army in 1868; succeeded in negotiating with the civil dignitary, Katz, and the result was the surrender of the tycoon; continued in active service until there was entire submission to the imperial forces in 1869; then retired to Satsuma, but in 1870 was again solicited to return to the public service, and was appointed councillor of state. After the government was fully established he felt that he was no longer needed in state affairs, and retired once more to his home. F. A. P. BARNARD.

**Saigon',** capital of the French possessions in Cochin-China, Farther India, situated in lat. 10° 47′ N., lon. 106° 45′ E., on the Dounai, a branch of the Saigon, 35 miles from its mouth in the China Sea. The Dounai, which here

winds through a district of exuberant fertility, is navigable for the largest vessels, and forms at Saigon one of the finest harbors of the E. coast of Asia, lined with stone quays and surrounded with dockyards, arsenals, and magazines, and various naval establishments. The town itself is well built, and carries on an active trade, exporting annually more than 8000 tons of cotton, rice, sugar, indigo, and dyewoods. P. 120,000, of whom 10,000 are Chinese, engaged in the retail business of the place.

**Saikio,** city of JAPAN (which see).

**Sail** [Ang.-Sax. *segel*], a sheet of canvas or other material used to propel a vessel through the water. The invention or origin of sails has not been determined, but we know of their use at a very remote period. Sails are now made by sewing cloths of canvas together with twine in a double seam, and binding the edges around with a *bolt-rope* to relieve the strain upon the canvas, the whole being so fitted as to present a flat surface to the wind. Bands of canvas are placed wherever additional strength is required or the sail is exposed to chafing, as the *reef-bands, buntline-cloths*, etc. Sails are in shape either quadrilateral or triangular. In all quadrilateral sails the upper edge is called the *head*, the lower edge the *foot*, and the sides *leeches*. When the head and foot are parallel, the upper corners are called the *head-earings*, and the lower ones *clews*. When the head and foot are not parallel, the foremost corner at the head is called the *throat* or *neck*, the after upper corner the *peak*, the forward lower corner the *tack*, and the after lower corner the *clew*. In triangular sails we find the head, tack, and clew. In all sails the foremost edge is called the *luff* or *fore-leech*, and the aftermost the *after-leech*. Sails are classed as *square sails* and *fore-and-aft sails*. The former, all quadrilateral, are those which make a large angle with the direction of the keel, and are spread by yards, as the principal sails of a ship, or by yards and booms, as the *studding sails*. The latter, either quadrilateral or triangular, are those which make but a small angle with the line of the keel. The triangular are spread by a yard, as *lateen* sails; by a stay, as *staysails*; or by a mast, as *shoulder-of-mutton* sails. The quadrilateral are extended by means of gaffs and booms, the head of the sail being attached to the gaff. In all fore-and-aft sails the luff is attached throughout its length to the yard, stay, or mast. The principal sails of a ship are—*courses*, the lowest ones; *topsails*, next above the courses; *topgallant-sails*; *royals*; and, sometimes, *skysails*. These sails are attached by the head to their proper yards, and, excepting the courses, are spread by having their clews drawn out by ropes called *sheets* to sheaves in the ends of the yards below them. The clews of the courses are in like manner drawn to the *chess-trees* and *bumpkins* on deck. Studding-sails are set beyond the leeches of the foresail, fore and main topsails, and fore and main topgallant-sails, the head being extended by a studding-sail yard, and the foot by a boom run out beyond the end of the yard next below. Staysails are hoisted upon the stays between the masts, the foot being stretched out by a rope or whip called the *sheet*. All sails take their names from the mast, yard, or stay to which they are attached. Thus, that upon the main yard is called the main-sail, above which are the main topsail, main topgallant-sail, and main royal. Vessels are named from the number of their masts and the shape and number of their sails. A ship has three masts, with square sails on each mast, while schooners have two or three masts, but fore-and-aft sails only. Boats' sails follow the rules given as to form and class, but have peculiar names. The most common are spritsails, standing lugs, dipping lugs, sliding gunters, etc.; and in many instances boats are known by the names given to their sails.

P. F. HARRINGTON.

**Sail'ing.** Horace in one of his odes wonders at the hardihood of the man who first ventured to sea in a frail bark:

> "Illi robur et æs triplex
> Circa pectus erat, qui fragilem truci
> Commisit pelago ratem
> Primus," etc.,

but fails to inform us to what country he belonged; so that the honor has been claimed by the Chinese, the Egyptians, and the Phœnicians. Certain it is that of all the seamen of remote antiquity, the last named were the most daring and adventurous, and their voyages around the Cape of Storms and to the Cassiterides, considering the age in which they lived, were not less remarkable than the circumnavigation of the globe by the hardy mariners of the sixteenth century. Groping his way feebly at first, without nautical instruments, the mariner ventured a short distance from the shore; but little by little, with the help of a rude compass and a ruder astrolabe, his knowledge of the sea increased, until with the scientific appliances of to-day the ocean is as well known as the land. (See NAVIGATION and GREAT-CIRCLE SAILING.)

FOXHALL A. PARKER.

**Saimiri,** a name derived from the South American Indians, and given to species of New-World monkeys (family Cebidæ) whose tail is hairy to the tip, and scarcely, if at all, prehensile; the lower jaw is moderately dilated behind, and the incisor teeth are vertical. The species have been mostly described under the generic name *Chrysothrix*.

THEODORE GILL.

**Sain'foin** [Lat. *Sanum fœnum*, "sound hay"], a forage-plant, the leguminous *Onobrychis sativa*, very valuable on dry chalky lands, but not much raised in the U. S. It is prized as green forage, as hay, and as a crop to be ploughed under. It is believed to be well fitted for Western Kansas and Dakota. It often stands ten years without re-seeding.

**Sainsbury** (W. NOEL), b. in England about 1820; became a prominent official of the British state paper office and a contributor to the reviews and other periodicals; editor of *Original Unpublished Papers illustrative of the Life of Sir Peter Paul Rubens* (1859), of the valuable *Calendar of State Papers, Colonial Series, 1574–1660* (1861), and of a second volume devoted to the papers upon the East Indies, China, and Japan 1513–1616 (1863). In 1860 he proposed to the government of the U. S. the continuation of the *Calendar*, as far as regards America, from 1668 to 1783, but the proposition was unfortunately declined.

**Saint** [Lat. *sanctus*, "holy;" Gr. ἅγιος, "pure," "clean," "venerable," from ἄζω, to "fear," to "venerate;" Heb. קָדוֹשׁ], in the New Testament a title of all Christians (Rom. i. 7; 1 Cor. i. 2; Eph. i. 1; Phil. i. 1, etc.), in the sense that they are called out of the world, regenerated by the Holy Spirit, and consecrated to God and to holiness. In the Apostles' Creed "the communion of saints" is one of the articles of faith, closely related to the preceding article on "the holy catholic Church," but is not found in the earlier forms of that symbol. The oldest MS. copies of the Gospels bear simply the names of Matthew, Mark, Luke, and John, without "S." attached to them. After the fourth century the term began to be applied to particular persons of special eminence in piety and services to the Church, as the apostles, evangelists, and martyrs. It became the exclusive title of a spiritual nobility or aristocracy. Special honor was paid to their memory, which gradually assumed the character of a limited Christian hero-worship, called by the scholastic divines *doulia* or *veneratio* (as distinct from *latria* or *adoratio*, which is due to God alone, and *hyperdulia*, or a peculiar degree of veneration which is claimed for the Virgin Mary as the mother of our Lord and queen of saints). The Greek and Roman churches, believing in the active intercession of the saints in heaven in behalf of the struggling Christians on earth, consider it proper and useful to pray to them; with this difference, however, that God is to be implored as the giver of all blessings, while the saints are to be implored as the friends of God, that through their advocacy of our cause we may obtain from him all necessaries of life (hence the form *Ora pro nobis*, "Pray for us"). Protestants reject the worship of saints, images, and relics as inconsistent with the First and Second commandments and the exclusive worship of God, and hence they pray directly to God and to Christ.

The question, Who are the saints? was for a long time left to the public sentiment of the Christian people in the particular nation or province or monastic order to which the saint belonged. The voice of the people was regarded as the voice of God. But to prevent the immoderate increase of the number of saints, the popes since Alexander III. (A. D. 1170) monopolized the right of canonization—*i. e.* of deciding and pronouncing a departed Christian to be a *saint*, and authorizing and prescribing his worship within the Roman Catholic Church. The act of canonization is preceded by a regular process of law, in which one acts as the accuser of the candidate, another as his advocate. The necessary qualifications for the honor are, besides the highest sanctity, the power of working miracles either during their lifetime, or after their death through their pictures or relics or the invocation of their aid. An Italian proverb says it requires a miracle to prove a miracle. This is especially true after the lapse of several centuries, which now usually intervene between the death of a saint and his canonization. The last instance occurred at Pentecost, 1862, when Pope Pius IX. solemnly canonized twenty-six Japanese missionaries and converts who died in a persecution in 1597, nearly 300 years ago. (Comp. *Descrizione delle ceremonie che si celebrano nella Basilica Vaticana per le solenni Canonisazioni dei Santi*, Rom., 1862.)

The Roman Church celebrates the memory of each canonized saint on the day of his death (which is regarded as his birthday in heaven). The Roman calendar of saints includes (1) the apostles, evangelists, and most eminent martyrs, fathers, schoolmen, and missionaries down to the

Reformation, who are the general property of Christendom; (2) the specifically Roman saints who lived after the Reformation and zealously opposed Protestant doctrines (as Ignatius Loyola, Charles Borromeo); (3) a few popes. The last canonized pope was Pius V. (1566–72), who excommunicated Queen Elizabeth.

The biography of saints has given rise to an immense body of literature. The most learned and extensive work on the subject is the *Acta Sanctorum* of the Bollandists, begun in 1643, embracing 60 vols. fol., and not yet completed. PHILIP SCHAFF.

**Saint-Affrique′,** town of France, department of Aveyron, on the Sorgne, has large tanneries and trade in wool and cheese made in the neighboring Roquefort. P. 6618.

**Saint Alban's,** town of England, county of Hertford, on the small river Ver, is historically interesting from the two battles fought here during the wars of the Roses in 1455 and 1461, and has some straw-plaiting and silk-spinning industry. P. 8303.

**Saint Alban's,** tp., Hancock co., Ill., on Chicago Burlington and Quincy R. R. P. 1147.

**Saint Alban's,** p.-v. and tp., Somerset co., Me., on Moose Pond. P. 1675.

**Saint Alban's,** tp., Licking co., O. P. 1110.

**Saint Alban's,** city and cap. of Franklin co., Vt., 32 miles N. of Burlington and 63 miles S. of Montreal, borders on Lake Champlain, and is on Vermont and Canada R. R., which is a link in the line of the Central Vermont, of which this is the head-quarters. It is also the southern terminus of Missisquoi R. R. It has 2 national banks and 2 trust companies, extensive railroad-shops, a large rolling-mill for the manufacture of silicon steel-capped rails, 1 considerable iron-foundry, 2 daily and 2 weekly newspapers, 8 churches, a public graded school, a convent, 2 public libraries, waterworks, and gasworks. It is the chief business centre of the county. It has 6 hotels, and is quite a summer resort. Aside from railroading, its chief business is trade and agriculture. Its butter-market is famous throughout the country. P. 7014.

ALBERT CLARKE, ED. "MESSENGER."

**Saint Alban's,** p.-v., Kanawha co., West Va.

**Saint Alban's** (HARRIET **Mellon**), DUCHESS OF, b. in England about 1775, in a low condition of life; became a popular comic actress; married Mr. Coutts, a wealthy London banker; was soon afterward left a widow with one of the largest fortunes in England, and married June 16, 1827, the duke of St. Alban's. D. Aug. 6, 1837, leaving the bulk of her fortune to Miss Angela Georgina Burdett, daughter of Sir Francis Burdett and grand-daughter of her first husband, a lady distinguished for her benevolence, who has been ennobled by Queen Victoria. (See BURDETT-COUTTS, BARONESS.)

**Saint Al′bert,** village of British America, on the Saskatchewan, is the seat of a Roman Catholic bishop, and has an academy and an orphanage under the Sisters of Charity.

**Saint Aldegonde.** See MARNIX.

**Saint Amand′,** town of France, department of Cher, at the influx of the Marmande in the Cher, carries on a considerable trade in iron, cattle, hemp, and chestnuts. P. 8607.

**Saint Amand,** town of France, department of Nord, on the Scarpe, has celebrated sulphur springs, a large trade in flax, and manufactures of lace, linens, and porcelain. P. 10,210.

**Saint An′drew's,** town of Scotland, in Fifeshire, on a bay of the same name, has a university and other good educational institutions, and is much frequented as a watering-place. P. 6316.

**Saint Andrew's,** a port of entry, cap. of Charlotte co., N. B., at the mouth of St. Croix River, on Passamaquoddy Bay, 66 miles by land W. of St. John. It is the S. terminus of a branch of New Brunswick and Canada Railway. It has a good harbor, a weekly newspaper, a marine hospital, a custom-house, a postal savings bank, and various public buildings. It is an attractive place of summer resort. P. of sub-district, 2981.

**Saint Andrew's,** tp., Charleston co., S. C. P. 3277.

**Saint Anne,** p.-v. and tp., Kankakee co., Ill., on Chicago Danville and Vincennes and Cincinnati Lafayette and Chicago R. Rs., has 5 churches, 1 college, 1 weekly newspaper, 3 hotels, and 4 grain-houses. It is noted for its fine farming-lands, adapted to the culture of fruit, grass, and corn; also for stock-raising. P. 1385.

EDWARD PARO, ED. "GRANGER."

**Saint Anselme′,** p.-v., cap. (?) of Dorchester co., Quebec, Canada, 16 miles S. of Quebec. It has a good trade in provisions and produce, and a splendid convent. P. about 700.

**Saint Ans′gar,** p.-v. and tp., Mitchell co., Ia., on Red Cedar River and Iowa division of Illinois Central R. R., has 1 newspaper. P. of v. 360; of tp. 893.

**Saint An′thony,** a former city of Minnesota, now consolidated with MINNEAPOLIS (which see).

**Saint Anthony's Fire,** the popular name of ERYSIPELAS (which see).

**Saint Antonin′,** town of France, department of Tarn-et-Garonne, on the Aveyron, has large tanneries and dye-works, and a trade in prunes. P. 5152.

**Saint Ar′mand,** tp., Essex co., N. Y., on the headwaters of Saranac River, includes a portion of the celebrated Whiteface Mountain. P. 335.

**Saint-Arnaud.** See LEROY DE ST.-ARNAUD.

**Saint Au′bert,** p.-v. and tp., Callaway co., Mo. P. 1139.

**Saint Augus′ta,** p.-v. and tp., Stearns co., Minn. P. 570.

**Saint Au′gustine,** city, cap. of St. John's co., Fla., on the narrow peninsula formed by Matanzas and San Sebastian rivers, and behind the N. end of Anastasia Island, which separates it from Atlantic Ocean. The manufacture of palmetto-straw goods is a considerable industry, and there is a limited coasting-trade. Two lines of sailing vessels also run between this port and New York. It has 5 churches, 2 public schools, a public library, a weekly newspaper, and numerous hotels. As the oldest city in the U. S., St. Augustine rests its claims upon its past history and its antiquities, which, with its almost insular position and equable climate, make it a favorite resort for tourists and secure for it a large population of invalids during the winter. Although as early as 1512, Ponce de Leon landed in this vicinity in search of the fabled "fountain of youth," the first *permanent* settlement was made by Don Pedro Menendez de Aviles, who on Sept. 8, 1565, disembarked with some 1500 followers and took possession of the country in the name of his sovereign, Philip II. of Spain. The point of disembarkation was the site of the present city, to which its name was given in honor of "the greatest of the Fathers," on whose day (Aug. 28) the fleet arrived off the coast. During the two centuries of occupation by the Spanish the town acquired a maximum population of upward of 3000, besides a garrison of 2500, and some 900 houses of masonry were built. The Spanish population, however, very generally abandoned their residence here upon the cession of the provinces to Great Britain in 1763, leaving a poor exhibition of progress for an occupancy of nearly 200 years. Perhaps the only *finished* undertaking was the present Fort Marion, called the castle of St. Mark by the Spaniards, which was upward of 100 years in course of construction. It was mainly built by the enforced labor of Appalachian Indians and Mexican convicts. The work was essentially completed in 1756, under Don Alonzo Fernandez de Herrera, and over the main entrance is a tablet bearing an inscription to this effect, surmounted by the Spanish coat-of-arms. In 1842–43 the U. S. government added a water-battery, excepting which and some repairs the fort is essentially as completed in 1756. As early as 1690 a sea-wall of coquina (shell concrete, or shells cemented by shell lime) was commenced to resist the further encroachments of the sea, traces of which wall are still visible in parts of the city. During the years 1837–43 the U. S. government completed a substantial wall with granite copings at an expense of $100,000; it is a favorite promenade. In the Plaza de la Constitucion, as the public square is called, stands a monument erected in 1812–13 in honor of the adoption of the Spanish constitution of 1812. On its failure the inhabitants of St. Augustine contented themselves with removing the tablets denoting its object, which, however, have since been restored. The old Roman Catholic cathedral, commenced in 1793, has a bell in its tower bearing date 1682. The building now the U. S. barracks was originally a Franciscan convent, but has been so much changed that little except the foundations of the original building now remain. The present custom-house was formerly the residence of the Spanish governors. Like the last-named building, much of its ancient character has been lost by subsequent alterations. Among the early buildings of the Spaniards was a lighthouse on Anastasia Island, with fortified walls, etc., the remains of which yet exist. A new lighthouse has been erected by the U. S. on the N. end of this island and S. side of the entrance to the harbor; lat. 29° 53′ N., lon. 81° 17′ W. Traces also yet exist of the two lines of defences which stretched across the peninsula, consisting of a ditch and embankment. In 1586, Sir Francis Drake made a descent upon and destroyed St. Augustine, and is is also said that the town was burned by

order of Gov. Moore of the Carolinas, who besieged the castle for three months in 1702. During the Revolutionary war it was an important British dépôt, and here Prevost organized his expedition against Savannah in 1779. In 1821 the American flag supplanted the Spanish standard, which 256 years before had been raised by Menendez.



Old Fort St. Mark, St. Augustine.

During the Seminole war (1835–42) St. Augustine acquired some importance. The present population is about 2000, of which perhaps three-fourths are of Spanish origin. It has a mean temperature of 70°; in Apr., 1828, a severe frost occurred; also in Feb., 1835, when ice formed in St. John's River. P. in 1870, 1717. J. G. BARNARD.

**Saint Barthol'omew,** one of the Caribbean Isles, in the West Indies, in lat. 17° 53′ N. and lon. 62° 52′ W., belongs to Sweden. Area, 35 sq. m. P. 2898. On account of the scarcity of fresh water the productiveness of the soil is very small—insufficient to feed the inhabitants, who are mostly engaged in trade. The coast is skirted with coral-reefs and difficult of access, but offers on its W. side a good harbor at Gustavia.

**Saint Bartholomew, Massacre of.** See BARTHOLOMEW, ST., MASSACRE OF.

**Saint Bernard',** parish of S. E. Louisiana, between Mississippi River on the W. and Gulf of Mexico on the E., having Lake Borgne and Mississippi Sound on the N. and Isle au Breton Sound on the S. E., has a very fertile soil, producing large crops of sugar-cane. Rice and cotton are also raised. Cap. St. Bernard. Area, 620 sq. m. P. 3553.

**Saint Bernard,** p.-v., cap. of St. Bernard parish, La..

**Saint Bernard,** THE LITTLE, a celebrated pass across the Graian Alps, on the frontier of Savoy and Piedmont, Italy, S. of Mont Blanc, is 7200 feet high, leads from the valley of the Isère into that of Dora Baltea, and has near the summit a convent for the relief of travellers, believed to have been founded by St. Bernard of Menthon. The pass is comparatively easy, and is supposed to have been the route taken by Hannibal in his invasion of Italy.

**Saint Bernard Pass.** See BERNARD, THE GREAT ST.

**Saint Brieuc',** town of Bretagne, France, cap. of department of Côtes-du-Nord, on Gouet River, near the Bay of St. Brieuc, has a school of hydrography, an ancient cathedral, and a statue of the celebrated constable Bertrand du Guesclin, and is largely engaged in the whale and cod fisheries. P. in 1872, 15,253.

**Saint Cath'arine,** v., Liberty co., Ga. P. 128.

**Saint Catharine,** p.-v., Linn co., Mo., on Hannibal and St. Joseph R. R. P. about 300.

**Saint Catharine's,** town of Ontario, Canada, the capital of Lincoln co., on Great Western and Welland railways, 12 miles N. of Niagara Falls, is celebrated for its mineral artesian wells, which afford strongly saline waters with valuable tonic properties. There are several fine hotels, 2 daily and 4 weekly newspapers, a convent, a marine hospital, and important manufactures. The town is in a picturesque and fertile region. P. 7864.

**Saint Césaire',** v., Rouville co., Quebec, Canada, on Yamaska River, 33 miles E. of Montreal. It has a large trade, a fine water-power, thriving manufactures, an astronomical observatory, a museum of mineralogy and zoology, and is the site of Ste. Croix College, a commercial school, and a Presentation convent. P. 937.

**Saint Chamond',** town of France, department of Loire, at the confluence of the Gier and Ban, has several silk-mills, ironworks, and manufactures of ribbons and lace. The vicinity contains rich coal-mines. P. 11,626.

**Saint Charles,** parish of S. E. Louisiana, bounded N. by Lake Pontchartrain, S. by Lake Washa, W. by Lake des Allemands, intersected by Mississippi River, and traversed by Morgan's Louisiana and Texas and New Orleans Mobile and Texas R. Rs., and produces sugar-cane and rice. Cap. St. Charles. Area, 340 sq. m. P. 4867.

**Saint Charles,** county of E. Missouri, situated between Mississippi and Missouri rivers at their confluence, and traversed by St. Louis Kansas City and Northern R. R., has several ranges of hills, fertile bottom-lands, productive mines of coal, and numerous manufactories of carriages. Staples, wheat, Indian corn, oats, hay, tobacco, wool, and butter. Cattle, sheep, and swine abound. Cap. St. Charles. Area, 480 sq. m. P. 21,304.

**Saint Charles,** p.-v. and tp., Kane co., Ill., on Fox River and Fox River branch of Chicago and Burlington R. R., has fine water-power, several manufactories, and 1 newspaper. P. 2281.

**Saint Charles,** tp., Floyd co., Ia., on Red Cedar River, includes Charles City, the county-seat. P. 3374.

**Saint Charles,** p.-v., cap. of St. Charles parish, La., on Morgan's Louisiana and Texas R. R.

**Saint Charles,** p.-v. and tp., Saginaw co., Mich., at the forks of Bad River, and on Jackson Lansing and Saginaw R. R., has numerous saw-mills. P. 1185.

**Saint Charles,** p.-v. and tp., Winona co., Minn., on Winona and St. Peter R. R., has 1 newspaper. P. of v. 1151; of tp. 1960.

**Saint Charles,** city and tp., cap. of St. Charles co., Mo., upon St. Louis Kansas City and Northern R. R. and Missouri River, 20 miles from its mouth and 19 miles by rail from St. Louis. The business portion of the city is along the river-bank. For health, business, and beauty the site is fine. St. Charles is one of the earliest Spanish and French settlements. Here the first State legislature of Missouri met and the first State governor was inaugurated. The buildings in which these events occurred still stand. A few of the old French residents and their descendants remain. The population is largely German, and is thrifty and prosperous. Society is excellent. There are 13 churches, 1 national and 2 savings banks, a public library, 2 English and 2 German weekly newspapers, with other publications, a fire company, and an insurance corporation. A convent school is conducted by the ladies of the Sacred Heart, and Lindenwood Female Seminary, under the patronage of the Presbyterian Church, is known throughout the West. There are 3 public schools, 3 parish schools, 3 private schools, and 1 college. The St. Charles iron railway bridge over the Missouri cost $2,000,000, and is one of the finest specimens of the art in the world. With its approaches it is 2 miles in length. St. Charles has car-shops, woollen-mills, foundries, pork-houses, breweries, and factories where the finest starch in the world is made from the celebrated St. Charles white corn. Six steam-mills manufacture choice flour, for which St. Charles is noted. The delta between Missouri and Mississippi rivers is of unsurpassed richness. The rest of the county is good wheat and corn land, and is thickly settled by industrious people. Several counties to the N. and W. are also tributary to St. Charles, which has a steady, solid growth. A tornado swept through the chief business street Feb. 27, 1876, doing $100,000 damage. In a week's time the enterprise of the people had left hardly a trace of the visitation. P. of city, 5570; of tp. 3479. P. A. FARLEY, PROP. "NEWS."

**Saint Chris'topher,** or **Saint Kitt's,** one of the Lesser Antilles, in the West Indies, in lat. 17° 17′ N., lon. 60° 42′ W., belongs to Great Britain. It is 20 miles long, 5 miles broad, and traversed by a mountain-range of volcanic origin, whose highest peak, Mount Misery, reaches 3711 feet. From this range the ground slopes gently toward the coast. The soil is very fertile and eminently well adapted for sugar-plantations; it is also well cultivated, and the revenue of the island, which in 1834 amounted only to £3638, rose in 1867 to £26,317, and in 1871 to £31,000. Chief towns, Basseterre and Sandy Point. P. about 25,000.

**Saint Clair,** county of N. E. Alabama, on Coosa River, has a hilly surface covered with oak timber, has beds of bituminous coal, and is traversed by Alabama and Chattanooga R. R. Staples, cotton, Indian corn, and molasses. Cap. Ashville. Area, 700 sq. m. P. 9360.

**Saint Clair,** county of S. W. Illinois, on Mississippi River opposite St. Louis, and on Kaskaskia and Cahokia

rivers, intersected by the numerous railroads leading to St. Louis, has a rolling surface, a fertile soil, several coal-mines, raises large quantities of stock, and has very numerous manufactures, chiefly of carriages, cooperage, agricultural implements, and brick, also many flour-mills and breweries. Staples, wheat, Indian corn, hay, wine, and butter. Cap. Belleville. Area, 630 sq. m. P. 51,068.

**Saint Clair,** county of E. Michigan, on St. Clair River and Lakes Huron and St. Clair, which separate it from Ontario, drained by Bell and Black rivers, has a rolling surface, sandy in the N. W. parts, which are covered with pine timber, is traversed by Port Huron and Lake Michigan and Grand Trunk R. Rs., is well adapted for stock-raising, and has numerous saw-mills and manufactories. Staples, wheat, oats, potatoes, hay, hops, wool, and butter. Cap. Port Huron. Area, 900 sq. m. P. 36,661.

**Saint Clair,** county of W. Missouri, intersected by Osage and Sac rivers and traversed by Sedalia division of Missouri Kansas and Texas R. R. Staples, Indian corn, wheat, oats, hay, tobacco, and wool. Cap. Osceola. Area, 650 sq. m. P. 6742.

**Saint Clair,** tp., Benton co., Ia. P. 811.

**Saint Clair,** p.-v. and tp., St. Clair co., Mich., on Michigan Midland and Canada and Chicago Saginaw and Canada R. Rs., 45 miles N. E. of Detroit, has 5 churches, a union and ward school, 2 banks, 6 steam brickyards, 2 flouring and 2 saw mills, an extensive tannery, a woollen-factory, machine-shops, a carriage establishment, 2 hotels, and 1 newspaper. P. of v. 1790; of tp. 3792.

H. P. Wands, Ed. "Republican."

**Saint Clair,** p.-v., Franklin co., Mo., on Atlantic and Pacific R. R.

**Saint Clair,** tp., Butler co., O., on Great Miami River, includes Hamilton, the county-seat. P. 1187.

**Saint Clair,** p.-v. and tp., Columbiana co., O. P. 1156.

**Saint Clair,** v., South Beaver tp., Beaver co., Pa. P. 232.

**Saint Clair,** tp., Bedford co., Pa. P. 2219.

**Saint Clair,** p.-b., Schuylkill co., Pa., on Philadelphia and Reading R. R., 3 miles E. of Pottsville, has 8 churches, good schools, a public library, 4 public halls, 7 large coal-concerns, on which it largely depends, 1 weekly newspaper, 7 hotels, several factories and furnaces, 1 bank, and gas-works. P. 5726.

J. Warren Lewis, Ed. "Review and Chronicle."

**Saint Clair,** tp., Westmoreland co., Pa. P. 777.

**Saint Clair,** tp., Smyth co., Va. P. 1547.

**Saint Clair** (Arthur), b. at Thurso, Caithness-shire, Scotland, in 1734; was grandson of an earl of Rosslyn; educated at the University of Edinburgh; studied medicine under John Hunter; inherited a large fortune on the death of his mother; entered the British army as an ensign May 13, 1757; came to America 1758; served under Amherst at the taking of Louisburg; became a lieutenant Apr. 11, 1759; was distinguished under Wolfe at Quebec; married at Boston, May 14, 1760, Miss Phœbe Bayard, half-sister of Gov. James Bowdoin; resigned his commission Apr. 16, 1762; settled in Ligonier Valley, Pa., 1764, erecting there a fine residence and several mills; became in 1770 surveyor of the district of Cumberland; was afterward a justice of quarter sessions and of common pleas and member of the proprietary council; was in 1771 a justice, recorder, clerk of the orphans' court, and prothonotary of Bedford co.; held similar offices in the newly-erected county of Westmoreland 1773; became colonel of militia July, 1775; was in the autumn of the same year one of a commission to treat with the Western Indians at Fort Pitt; was appointed colonel of the 2d Pennsylvania regiment Jan. 3, 1776, resigning his lucrative civil offices; accompanied Sullivan in the expedition against Quebec; saved the army from capture by his judicious advice after the defeat at Three Rivers; was appointed brigadier-general Aug. 9, 1776; joined Washington Nov., 1776; was detailed to organize the New Jersey militia; rendered valuable service in connection with the battle of Princeton, Jan. 2, 1777, by his advice and by protecting the fords of Assinpink River; was for a short time adjutant-general; was appointed major-general Feb. 19, 1777; succeeded Gates in command at Philadelphia in March; took command at Ticonderoga Apr. 1; was forced to evacuate that post July 4, thereby incurring unpopularity and retirement from his command, but acted as a volunteer aide at the battle of Brandywine, Sept. 11, 1777; assisted Sullivan in fitting out his expedition against the Six Nations; was acquitted with honor by a court-martial in respect to the surrender of Ticonderoga Sept., 1778; was a commissioner to treat with the British at Amboy Mar., 1780; was appointed to the command of La Fayette's corps of light infantry during the latter's absence Aug. 1; was a member of the court-martial on Major André; commanded at West Point from Oct. 1; took a conspicuous part in the suppression of the mutiny in the Pennsylvania line Jan., 1781; distinguished himself in the Southern campaign which terminated at Yorktown, and subsequently in that under Greene; was a member of the Pennsylvania house of censors 1783, of the Continental Congress 1785–87, being its president during most of the latter year; was president for Pennsylvania of the Society of Cincinnati 1783–89; became first governor of the North-western Territory Feb. 1, 1788; made the treaty of Fort Harmer with the Indian tribes 1789; fixed the seat of the supreme court for the Territory Jan., 1790, at a point which he named Cincinnati after the society of which he was an officer; became commander-in-chief of the U. S. army Mar. 4, 1791; made an expedition against the Indians of the Miami and the Wabash, and suffered a severe defeat near the Miami villages Nov. 4, 1791; was vindicated from all blame by a committee of investigation appointed by Congress; resigned the command of the army May 5, 1792; was removed from the post of governor by Jefferson Nov. 22, 1802, when he settled in a log house on the summit of Chestnut Ridge, near Greensburg, Pa., where he passed his remaining years in poverty and fruitless efforts to effect a settlement of claims against the U. S., but receiving small pensions both from the national and State governments. D. near Greensburg Aug. 31, 1818. He published a *Narrative of the Manner in which the Campaign against the Indians in the year 1791 was conducted* (1812), and a *Memoir* by A. T. Goodman was prepared from his papers.

Porter C. Bliss.

**Saint Clair, Lake,** a body of water lying between Michigan and Canada. Through St. Clair River it receives the waters of Lake Huron, and its own waters are discharged through Detroit River into Lake Erie. It is 30 miles in length and 24 in maximum and 12 in mean breadth. Area, 360 sq. m. Elevation above the sea-level, 573 feet; above Lake Erie, 3 feet. Its mean depth is 20 feet, but the shoals off the mouth or inlet of St. Clair River, known as the St. Clair Flats, formerly obstructed the navigation of its upper part. This impediment has been removed under direction of the U. S. engineer bureau, upon a plan proposed by Brevet Maj.-Gen. T. J. Cram, U. S. engineers, with appropriations of Congress, by the dredging of a channel through the flats. The canal is 300 feet wide, with parallel dikes 5 feet high formed of the earth taken from the canal, the inside being lined with planks. The banks on either side are 40 feet wide, and are sodded and planted with willows. The depth of the canal, for a central width of 200 feet, is 16 feet.

**Saint Clair River,** the outlet of Lake Huron, has a total fall of 7 feet in the 33 miles of its course. It is from 40 to 60 feet deep, and flows through a fertile and picturesque region. It is a part of the boundary between Michigan and the province of Ontario.

**Saint Clairs'ville,** p.-v., Richland tp., cap. of Belmont co., O., on the National Road, in the midst of a fine agricultural region, has 2 newspapers. P. 1056.

**Saint Clairsville,** p.-v., St. Clair tp., Bedford co., Pa. P. 144.

**Saint Claude,** town of France, department of Jura, at the confluence of the Bienne and Tacon, has celebrated paper manufactures and manufactures of fancy articles of horn, bone, ebony, ivory, and tortoise-shell. P. 6316.

**Saint Cloud,** a small town of France, department of Seine-et-Oise, on the Seine, 6 miles S. W. of Paris, derives its name from St. Clodoald, grandson of Clovis, who founded a monastery here in 551. The place was burned by the English in 1358, and again by the Armagnacs in 1411. In the palace of St. Cloud, built in 1572, Henry III. was assassinated in 1589; and here the *coup d'état* of Nov. 10, 1799, which placed Napoleon Bonaparte at the head of the French government, was effected. The capitulation of Paris in 1815 was signed here, and also the famous decrees of Charles X. in 1830, which caused the second revolution. The duke of Orleans, brother to Louis XIV., made extensive repairs and additions to the royal château at great cost. In 1870 the palace was seriously injured by fire, but many of the valuable works of art were preserved. P. about 5500.

**Saint Cloud,** p.-v. and tp., cap. of Stearns co., Minn., on St. Paul and Pacific R. R. and on the W. bank of Mississippi River, 75 miles above St. Paul, contains 6 churches, a public library, the State normal school, graded schools, 4 newspapers (1 German), 2 banks, several saw, planing, and flouring mills, 1 foundry, a wagon-factory, nursery, and sash, door, and blind factories. St. Cloud is the leading commercial and manufacturing town of Northern Minnesota. P. of v. 2161; of tp. 582.

W. B. Mitchell, Ed. "Journal."

**Saint Colomb′,** a suburb of Quebec, Canada, 3 miles up the river, has a large lumber-trade, a convent, an academy, and several schools.

**Saint Croix,** county of N. W. Wisconsin, on St. Croix River, which separates it from Minnesota, drained by Willow, Apple, Rush, and other rivers, has a rolling surface, mostly covered with pine forests, and is traversed by West Wisconsin and North Wisconsin R. Rs. Staples, wheat, oats, hay, hops, and butter. Cap. Hudson. Area, 750 sq. m. P. 11,035.

**Saint Croix Falls,** p.-v. and tp., Polk co., Wis., on St. Croix River. P. of v. 288; of tp. 543.

**Saint Croix River,** a part of the boundary between Maine and New Brunswick, flows from Grand Lake in a general E. S. E. course, and falls into Passamaquoddy Bay. It is navigable to Calais, Me., above which it affords fine water-power. It is 75 miles in length. It is also called the *Schoodic*.

**Saint Croix River** rises in La Pointe co., Wis., flows S. W. to the Minnesota line; from this point southward, for more than 100 miles, it is the boundary between Wisconsin and Minnesota. It is some 150 miles long, and is navigable 54 miles to the Dalles or Falls of the St. Croix. After passing through the beautiful Lake St. Croix it flows into the Mississippi at Prescott, Wis. At its falls it descends 50 feet in 300 yards. Half a mile below there is a picturesque cañon through which the river flows.

**Saint-Cyr,** village of France, in the park of Versailles, is noted for the celebrated establishment which Madame de Maintenon founded here in 1686 for the education of 250 daughters of the French nobility. The building was erected by Mansard. In 1793 it was transformed into a military hospital, and in 1806, Napoleon removed the military academy from Fontainebleau to this place.

**Saint Denis′,** town of France, department of Seine, 6 miles N. of Paris, on the Great Northern Railway, celebrated as the site of the ancient Benedictine abbey, the chosen place of burial of the kings of France. The abbey of St. Denis was founded by Dagobert I. in 613; a church commenced by Pepin, the father of Charlemagne, was completed by the latter and consecrated in 775. This edifice was demolished during the reign of Louis VII., and a more imposing one erected in 1144, the porch and two towers of which yet remain; the rest of the present building was reconstructed by Louis VIII. Up to the Revolution the remains of the kings and princes of France were deposited here. The Convention of 1793 ordered the removal of these bodies, and in 1795 the destruction of the building; the latter decree, however, was not fully carried out. Napoleon I. restored the church, which has been further protected by subsequent governments, and is considered one of the most beautiful specimens of Gothic architecture existing in France. P. 31,993.

**Saint Denis,** the capital of the French island of Bourbon, of the Mascarene group, is on the north-eastern shore, has a royal college and a botanical garden, and carries on a considerable trade. P. 12,000.

**Saint Denis,** p.-v., Baltimore co., Md., on the main line and on Washington branch of Baltimore and Ohio R. R. (Washington Junction).

**Saint Deroin,** p.-v., Nemaha co., Neb., on Missouri River. P. 276.

**Saint Die′,** town of France, department of Vosges, on the Meurthe, has large breweries, cotton and flax-spinning mills, ironworks, tanneries, and dyeworks, and an extensive trade in corn, cattle, and wood. In the vicinity are several rich iron and copper mines, and much fine marble is quarried. P. 9954.

**Saint-Dizier′,** town of France, department of Haute-Marne, on the Marne, has several iron-foundries, active shipbuilding, and a trade in iron and timber. P. 8077.

**Saint Domingo.** See Hayti and San Domingo.

**Sainte Agnès,** v., Charlevoix co., Quebec, Canada, on Murray Bay River, 9 miles N. W. of Murray Bay, a landing on the N. shore of the St. Lawrence, 90 miles below Quebec. P. of sub-district, 1615.

**Sainte Anne,** p.-v., Montmorenci co., Quebec, Canada, on the N. side of the St. Lawrence, 22 miles below Quebec. There is a fine waterfall near by. P. of sub-district, 1154.

**Sainte Anne de la Pérade,** p.-v., Champlain co., Quebec, Canada, on the N. shore of the St. Lawrence, 58 miles above Quebec, and on both sides of the river St. Anne, here crossed by a bridge 1500 feet long. The town has a large church and an active trade. P. about 1000.

**Sainte Anne de la Pocatière,** p.-v., Kamouraska co., Quebec, Canada, on the S. shore of the St. Lawrence, 8 miles below Quebec, and near Grand Trunk Railway. It has a weekly paper, and is the site of St. Ann's College, a Roman Catholic institution. The town is finely situated. P. of sub-district, 3134.

**Sainte Anne du Bout de l'Isle,** v., Jacques Cartier co., Canada, at the upper end of Montreal Island. Here is a railroad bridge, a rapid, and a canal. (See Canals of Canada.) Here Thomas Moore composed his Canadian boat-song. The village is on Grand Trunk Railway, 21 miles above Montreal. P. about 1000.

**Sainte-Beuve** (Charles Augustin), b. at Boulogne Dec. 23, 1804; studied medicine at Paris; entered in 1824 on his literary career as a contributor to the *Globe;* published in 1828 his *Tableau historique et critique de la Poésie française au XVI. Siècle;* removed after 1830 from the *Globe* to the *National* and *Revue des Deux Mondes;* received employment at the Mazarin Library in 1840 after publishing the first volume of his celebrated work, *Port Royal* (5 vols., 1840–60); held various positions under Napoleon III., contributing steadily to the *Moniteur;* was made a senator in 1865. D. at Paris Oct. 13, 1869. The various series of his *Critiques* or *Portraits* or *Galleries* or *Causeries,* comprising over 30 vols., contain some of the finest, most delicate, and most striking delineations of characters from history and literature which have ever been written. Selections have been translated into English: *Portraits of Celebrated Women* (Boston, 1868), *English Portraits* (1875), *Madame des Bordes-Valmore, sa Vie et sa Correspondance* (Boston, 1872). He also wrote 2 vols. of poems and a novel, *Volupté.*

**Sainte Croix,** p.-v., cap. of Lotbinière co., Quebec, Canada, on the S. shore of the St. Lawrence, 33 miles above Quebec. It has a Roman Catholic academy. P. about 750.

**Sainte Croix,** or **Santa Cruz,** an island in the West Indies, one of the Lesser Antilles, belongs to Denmark and comprises an area of 100 sq. m., with 25,600 inhabitants. It is very fertile, and produces much sugar and cotton. Chief town, Christianstad.

**Sainte Foy,** a suburb of Quebec, 5 miles distant, is finely situated and contains many handsome residences. P. of sub-district, 1625.

**Sainte Geneviève′,** p.-v., cap. of Champlain co., Quebec, Canada, 24 miles N. E. of Three Rivers. P. about 350.

**Sainte Genevieve,** county of S. E. Missouri, on Mississippi River, drained by Rivière aux Vases, Isle au Bois, and other creeks, has a broad belt of fertile bottom-land along the river, while the remainder of the county is rugged, but abounds in mines of lead, copper, zinc, and iron, and in marble-quarries. Staples, wheat, Indian corn, oats, tobacco, and wool. Cap. Ste. Genevieve. Area, 400 sq. m. P. 8384.

**Sainte Genevieve,** p.-v. and tp., cap. of Ste. Genevieve co., Mo., on the W. bank of Mississippi River, 65 miles S. of St. Louis, is an important shipping-point for the mineral products of Iron Mountain, glass-sand, fruits, and wine, was one of the earliest French settlements in Missouri, and has 3 weekly newspapers. P. of v. 1521; of tp. 3409.

**Sainte Julienne′,** p.-v., cap. of Montcalm co., Quebec, Canada, 45 miles N. of Montreal. It has a good water-power and large trade. P. about 400.

**Sainte Justine′,** v. (P. O. Langevin) of Dorchester co., Quebec, Canada, 63 miles S. E. of Quebec, has a spacious monastery of Trappist monks. P. about 150.

**Saint Eli′as, Mount,** a volcano on the boundary-line between Alaska and British America (lat. 60° 15′ N., lon. 141° W.), the height of which has usually been estimated at from 16,000 to 18,000 feet, but which the trigonometrical observations of Dall show to be 19,000 feet, or several hundred feet higher than any other summit in North America.

**Saint El′mo,** p.-v., Avena tp., Fayette co., Ill., on St. Louis Vandalia and Terre Haute R. R. P. 273.

**Sainte Marguerite.** See Lérins.

**Sainte Marie′,** p.-v., Beauce co., Quebec, Canada, on the river Chaudière, 30 miles S. of Quebec, in a fertile region, has a fine Roman Catholic college, a spacious convent, a good trade, a large number of mills, and ores of copper and manganese. P. about 1000.

**Sainte-Marie-aux-Mines** [Ger. *Marienkirch*], town of the German empire, province of Alsace, on the Liepvrette, derived formerly its importance from the silver-mines in the vicinity, but these are now nearly exhausted, and the town is mostly engaged in the manufacture of woollen, linen, and cotton fabrics. P. 12,332.

**Sainte Martine′,** p.-v., cap. of Chateaugay co., Quebec, Canada, 24 miles S. W. of Montreal, has a fine water-power. P. about 700.

**Saintes,** town of France, department of Charente-Inférieure, on the Charente, is an old and ill-built place, but it has several interesting Roman remains, numerous breweries, distilleries, tanneries, and potteries, and an active trade in corn, hemp, leather, and wine. P. 11,566.

**Sainte Scholastique′,** p.-v., cap. of Two Mountains co., Quebec, Canada, on La Belle Rivière, 33 miles W. N. W. of Montreal. It has a convent, and is a place of active business. P. 707.

**Sainte Thérèse de Blainville,** p.-v., Terrebonne co., Quebec, Canada, on the N. outlet of Ottawa River, 18 miles N. N. W. of Montreal. It has a large Roman Catholic college and a good trade. P. 914.

**Saint-Étienne′,** town of France, department of Loire, on the Furens, an affluent of the Loire, is situated in the centre of very rich coal-fields, from which 600,000 tons are annually raised, and which have given to the city a most vigorous manufacturing impulse. It arose in an astonishingly short time; it had 49,614 inhabitants in 1851, 92,215 in 1861, and 110,814 in 1871, and now it is one of the most flourishing manufacturing cities of France. Its two principal branches of manufacture are ribbons and firearms; 30,000 looms, employing about 40,000 persons, are in operation, and produce ribbons to the value of over $10,000,000 annually, which are sent all over the world, and are unsurpassed in beauty of design and colors; 7000 persons are employed in the ironworks, and produce, besides large quantities of cutlery, files, nails, etc., 40,000 stand of arms annually, and are able to turn out 300,000. The appearance of the city is that of a great manufacturing place, where coal-smoke makes the sky and coal-dust the rain; yet several portions are spacious and consist of fine edifices. The first railroad of France, the Chemin de fer de St. Etienne à Lyon, was constructed to carry coal to Lyons. (See Railroads.)

**Saint Eusta′tius,** an island of the West Indies, in the Leeward group, 12 miles N. W. of St. Christopher, belongs to the Netherlands, though the language spoken is English. Area, 8 sq. m. P. 2200. At the close of the eighteenth century it was often mentioned as the centre of a contraband trade, and in 1780 its population was estimated at 25,000. It is now of no importance.

**Saint-Évremond.** See Évremond.

**Saint Ferdinand,** tp., St. Louis co., Mo. P. 7214.

**Saint Féréol,** a beautiful village of Montmorenci co., Quebec, Canada, on the N. shore of the St. Lawrence, 30 miles below Quebec. Here are seven or eight waterfalls, whose beauty attracts many summer visitors. P. 991.

**Saint-Flour,** town of France, department of Cantal, on the Auzon, has manufactures of pottery and glue, which enjoy a high reputation. P. 5786.

**Saint Fran′cis,** county of E. Arkansas, on St. Francis and L'Anguille rivers, traversed by Memphis and Little Rock R. R. Staples, Indian corn, cotton, and sweet potatoes. Swine are numerous. Cap. Madison. Area, 625 sq. m. P. 6714.

**Saint Francis,** tp., Saint Francis co., Ark. P. 513.

**Saint Francis,** tp., Greene co., Ark. P. 970.

**Saint Francis,** tp., Phillips co., Ark. P. 5061.

**Saint Francis,** tp., Effingham co., Ill. P. 509.

**Saint Francis,** p.-v. and tp., Anoka co., Minn. P. 166.

**Saint Francis,** tp., Butler co., Mo. P. 246.

**Saint Francis,** tp., Madison co., Mo. P. 386.

**Saint Francis,** a river of Missouri and Arkansas, between which States it partially forms the boundary, rises in the Iron Mountain district of S. W. Missouri, and flows S. W. 450 miles, entering the Mississippi near Helena, Ark., is navigable 150 miles, passes through a continuous swamp after entering Arkansas, and spreads into numerous lakes, one of which, 50 miles long by 20 wide, is supposed to have been produced by a sinking of the soil at the time of the great earthquake of 1811.

**Saint Francis Plantation,** tp., Aroostook co., Me. P. 253.

**Saint Fran′cisville,** p.-v., Denison tp., Lawrence co., Ill., on Wabash River. P. 131.

**Saint Francisville,** p.-v., cap. of W. Feliciana parish, La., near Bayou Sara, on the E. bank of Mississippi River and on Feliciana and Woodville R. R., is a shipping-centre for cotton, and has 1 weekly newspaper.

**Saint Francisville,** p.-v., Clarke co., Mo., on Des Moines River. P. 408.

**Saint François′,** county of S. E. Missouri, on the sources of St. Francis River, has a mountainous surface, including a portion of the Iron Mountain, is traversed by St. Louis and Columbus and St. Louis and Texas divisions of St. Louis and Iron Mountain R. R., has extensive ironworks, and raises large numbers of sheep and swine. Cap. Farmington. Area, 350 sq. m. P. 9742.

**Saint François,** tp., St. François co., Mo. P. 1614.

**Saint François,** tp., Wayne co., Mo. P. 1755.

**Saint François du Lac,** p.-v., cap. of Yamaska co., Quebec, Canada, on the river St. Francis, near its mouth in Lake St. Peter, 60 miles below Montreal. It has a large trade and many barges are built here. P. about 800.

**Saint Gall,** canton of Switzerland, bounded E. by the Rhine and N. by the Lake of Constance. Area, 749 sq. m. Pop. 191,015, of whom 116,060 are Roman Catholics and 74,573 Protestants. The surface exhibits a thoroughly alpine character—mountains covered with forests, pastures, and snow and ice, and valleys studded with vineyards, orchards, and corn-fields. Agriculture, dairy-farming, and wine-cultivation are the principal branches of industry.

**Saint Gall,** town of Switzerland, capital of the canton of St. Gall, on the Steinach, in a valley at an elevation of 2152 feet. It was formerly fortified, but its walls and ramparts have been transformed into promenades. It has a fine cathedral, many good educational institutions, 2 large public libraries, and extensive manufactures of woollen, linen, and cotton fabrics, especially fine muslins and printed calicoes. P. 16,676.

**Saint Gaudens′,** town of France, department of Haute-Garonne, on the Garonne, has manufactures of porcelain, faïence, tiles, leather, and paper, and a trade in agricultural products. P. 5183.

**Saint George,** port of entry of Charlotte co., N. B., on Passamaquoddy Bay, at the mouth of the river Magaguadavic, which affords water-power and brings down abundance of timber. The town has a large lumber-trade, a custom-house, 3 gang saw-mills, 4 churches, beautiful residences, and several public buildings. P. about 600.

**Saint George,** v. and hundred, Newcastle co., Del., on Chesapeake and Delaware Canal. P. of v. 265; of hundred, 5075.

**Saint George,** p.-v. and tp., Pottawattamie co., Kan., on Kansas Pacific R. R. P. of v. 118; of tp. 435.

**Saint George,** p.-v. and tp., Knox co., Me., on Atlantic Ocean, at the mouth of Penobscot Bay. P. 2318.

**Saint George,** tp., Benton co., Minn. P. 317.

**Saint George,** city, cap. of Washington co., Ut., on Utah Southern R. R., 350 miles S. W. of Salt Lake City, contains a handsome tabernacle, a public-hall, 4 schoolhouses, a large establishment for making wine and canning fruit, a court-house, a temple of magnificent structure and proportions, and 1 newspaper. St. George produces many rare and delicious fruits, domestic and exotic. There are ten extinct volcanoes in the neighborhood, and this whole region is rich in mineral deposits. P. 1142.

J. E. Johnson, Ed. "Utah Pomologist."

**Saint George,** p.-v. and tp., Chittenden co., Vt. P. 111.

**Saint George,** p.-v., cap. of Tucker co., West Va., on Cheat River. P. 864.

**Saint George's Channel,** connecting the Irish Sea with the Atlantic and separating Ireland from Wales, is 100 miles long and 65 miles broad.

**Saint George's Parish,** tp., Colleton co., S. C., on South Carolina R. R. P. 3993.

**Saint-Germain-en-Laye,** or simply **Saint-Germain,** town of France, department of Seine-et-Oise, on the left bank of the Seine, on the outskirts of the forest of St.-Germain, which comprises 10,873 acres. The magnificent palace is now used for barracks. P. 22,862.

**Saint Ger′mans** (Edward Granville **Eliot**), LL.D., Earl of, b. in England Aug. 29, 1798; educated at Christ Church, Oxford; served for several years in various European capitals as attaché and secretary of legation; entered Parliament as a Liberal 1823; was a lord of the treasury 1827–30; was envoy to Spain 1834–35; chief secretary for Ireland 1841–45; became privy councillor 1841; succeeded to the earldom on the death of his father Jan. 19, 1845; became postmaster-general 1846; was lord lieutenant of Ireland 1852–55, lord steward of the household 1857–58, and again 1859–65, and attended the prince of Wales in his tour in the U. S. 1860.

**Saint Gervais′,** p.-v., Bellechasse co., Quebec, Canada, 21 miles S. E. of Quebec. It has a convent and a good trade. P. about 850.

**Saint Gilles,** town of France, department of Gard, trades much in wine and brandy. P. 6365.

**Saint Gothard′, Tun′nel of.** From remote ages until a very recent period most of the travel and a very large

proportion of the transport of merchandise between Italy, including her seaports on the one hand, and Switzerland, North-eastern France, Central and Western Germany, and Northern Europe on the other, were conveyed over Alpine passes having their northern terminus in Switzerland. After the construction of the three great carriage-roads—the Simplon in 1806, the Splügen in 1818, and the St. Gothard in 1830—these routes monopolized most of the transit, though the Stelvio, the Brenner, and other less conspicuous passes, and especially that of Mont Cenis, maintained an active competition with the Swiss highways. The completion of the Brenner railway from Innspruck to Verona (1867), and the opening of the Fréjus (or Mont Cenis) tunnel (1870), at once intercepted a great proportion of this important communication; and the construction of a new, direct, and independent railway route across the Alps was felt to be a matter of vital necessity to Northern Italy and Switzerland, as well as of great interest to the Rhine provinces, and indeed to all the western and central German states. A line following substantially the course of the Simplon road was at first the favored project, and, being sustained by French influence, if not by French capital, the construction was put under contract, and the grading nearly finished to the northern foot of the Alps at Brieg, and the southern at Domo d'Ossola. But it was soon seen that the importance of this route was local and not national, and that, as on the Swiss slope it was necessarily confined to the valley of the upper Rhone, and must debouch on the frontier Lake of Geneva, it would, like the Mont Cenis route, be directly tributary to French interests, and serve rather to divert traffic from Central Switzerland and Germany than to conduct it to them; and consequently the works were suspended, and the project, for the time at least, abandoned. The choice now lay between the Splügen and the St. Gothard routes, though the Lukmanier, the Septimer, and some other minor passes had their advocates. It was said that the Splügen route required a tunnel of but 4 miles in length; that the other technical difficulties were much less considerable than upon the St. Gothard line; that at the N. it might communicate directly with the Lake of Constance, and by the basin of the Lake of Wallenstadt with the Lake of Zurich, and thus furnish an eligible channel of transit to North-eastern Switzerland and Germany, while its southern junction with the Italian lines would be not less advantageous than that of the rival route. But an objection corresponding to that which had proved fatal to the Simplon route was urged with decisive effect against the Splügen—the fact, namely, that it must pass down the valley of the upper Rhine, and of course along the Austrian frontier, and accordingly, like the Simplon, be liable to interruption and control by a hostile force in case of European complications which should disturb the neutrality of Switzerland.

The St. Gothard line, on the contrary, would commence on the Lake of Lucerne in the very heart of the confederacy, pass entirely on Swiss soil, far removed from the eastern and western frontiers, to Lago Maggiore and to the Lake of Lugano, and there easily connect with the Italian lines, and especially with the port of Genoa. The only serious objection was the unavoidable necessity of a tunnel more than 9 miles in length, which of course would involve both a great expenditure and a long delay in the completion of the route. This objection was, however, overruled, the St. Gothard route adopted, and Oct. 15, 1869, a treaty was concluded between Italy and Switzerland, by which the principal points relative to route, construction, and connections were determined, and on Oct. 28, 1871, the German empire adhered to the treaty. The convention stipulated that the summit-level of the line—which naturally falls within the tunnel—should not be at a greater height than 1162½ mètres above the sea, and that the tunnel should follow a straight line between Airolo and Göschenen; the shortest radius of the curves was fixed at 300 mètres; the maximum of the grades not to exceed 25:1000 (or 132 feet to the mile), except for a short distance near Biasca, where, in case of necessity, 26:1000 might be allowed. The three contracting powers were to contribute to the enterprise 85,000,000 francs, in the proportion of 45,000,000 by Italy, 20,000,000 by Switzerland, and 20,000,000 by Germany. This convention was adopted as a basis at a conference in which the great Italian and Swiss railways and various Italian and Swiss local jurisdictions were represented, and a company formed in accordance having been incorporated and organized, proposals for construction were at once invited. This company is charged with the construction and operation of the line from the Lake of Lucerne to the Lago Maggiore and the Lake of Lugano only, the connecting lines being otherwise provided for.

On Aug. 7, 1872, a contract was concluded between the company and M. Louis Favre of Geneva for the perforation of the tunnel by him within eight years from the acceptance of the contract by the Swiss government, at fixed rates per mètre lineal measure, amounting altogether to 48,500,000 francs, with a large premium in case of completion of the works in a shorter time, and a heavy penalty in case of delay. The contract-price covers all expenses, whether direct or accessory, including revêtement where necessary, estimated at about half the length of the tunnel, and all risks and contingencies from whatever cause arising. The length of the tunnel is 14,900 mètres, or 16,295 yards, equal to rather more than 9¼ miles. Its cross-section is the same as that of the Fréjus tunnel (see FRÉJUS), and the same technical methods of excavation are followed; but the contractor has the advantage of employing the most improved machinery from the beginning, and of using dynamite and other explosives not known until the work on the Fréjus tunnel was far advanced. Besides this, the slopes of the overlying mountain are not so steep as to prevent the sinking of a considerable number of shafts, if necessary, though it has not been found expedient to resort to them.

The line of the tunnel leaves the St. Gothard carriage-road to the left at Airolo, and running about 5° W. of N. passes under the Kastelhorn, 2977 mètres high, the St. Anna glacier, the village of Andermatt, the river Reuss about at the Devil's Bridge, and comes out at Göschenen, at the level of that village and the carriage-road. At the southern end is a curve of junction 145 mètres in length, but, as in the case of the Fréjus tunnel, a straight gallery is excavated through the mountain from terminus to terminus. The station at Airolo is 1145 mètres above the sea. From this point the grade ascends, at the rate of $\frac{1}{1000}$th, 7400 mètres; then follows the summit-level of 180 mètres at the height of 1152.4 mètres, or 10 mètres lower than the highest limit allowed by the convention; then a descending grade of 5.82 : 1000, 7457 mètres, to the northern terminus at the station of Göschenen, 1109 mètres above the sea.

Yearly, quarterly, and monthly reports are published by the board of direction, furnishing the fullest information upon all points of interest connected with the execution of this great work. The most improved drilling machinery has been employed from the beginning. The work has been frequently impeded by the caving in of the rock and by the irruption of water from fissures in the strata. On Jan. 31, 1876, the heading, including both ends of the tunnel, had been carried 18,238½ feet, but the enlargement of the excavation had not kept pace with the progress of the heading. The St. Gothard Railway will form the shortest line of transit between the valley of the Rhine and the Mediterranean; and when we consider the geographical relations of the countries it serves to connect, and the vast political, military, and commercial interests which will be affected by it, we may safely characterize it as the great artery of European international life and circulation, and as the most important work of material improvement yet projected on that continent.

GEORGE P. MARSH.

**Saint Grégoire′,** p.-v., Nicolet co., Quebec, Canada, on the S. shore of the St. Lawrence, 6 miles above Three Rivers, has a large academy and a good trade. P. about 600.

**Saint Hel′en,** p.-v., cap. of Columbia co., Oregon, on Columbia River.

**Saint Hele′na,** an island of the British empire, in South Atlantic Ocean, lat. 15° 55′ S. and lon. 5° 44° W. It is 10½ miles long and 6½ broad, enclosing an area of 47 sq. m., with a pop. in 1871 of 6241. St. Helena was discovered by Juan de Nova Castella, the Portuguese navigator, on May 21, 1501 (St. Helena's Day), but continued unknown to other nations until 1588, when it was observed by Capt. Cavendish. It remained uninhabited until the Dutch took possession of it. In 1673 it was taken from the Dutch by England, and soon after the East India Company was granted a charter by Charles II. for its possession. It has now reverted to the British crown. The only good inlet is St. James's Bay, on the N. W. of the island, possessing a good harbor, where the chief town (Jamestown) is built. Though 800 miles from the nearest land, Isle of Ascension, and 1400 miles from the nearest point of the African continent, it is one of the best known of all the solitary islands of the world, as being the place of exile and death of Napoleon Bonaparte, and because of its importance as a stopping-place for provisions and water for ships engaged in the European and East India trade.

**Saint Helena,** parish of E. Louisiana, between Tangiparoa and Amite rivers, has a rolling surface and a fertile soil. Staples, Indian corn, cotton, sweet potatoes, and wool. Cap. Greensburg. Area, 450 sq. m. P. 5423.

**Saint Helena,** p.-v., Napa co., Cal., on California Pacific R. R.

**Saint Helena,** p.-v. and tp., cap. of Cedar co., Neb., on Missouri River. P. 665.

**Saint Helena,** tp., Beaufort co., S. C. P. 6152.

**Saint Hel'en's,** town of England, county of Lancaster, on the Mersey, is ill built and filthy, but has extensive manufactures of glass and copper ware, leather, and vinegar. P. 45,240.

**Saint Hel'ier's,** capital of the island of Jersey, on its southern coast, has a good harbor, is fortified and defended by two citadels, and carries on an extensive trade. P. 30,756.

**Saint Hilaire', de** (Auguste), b. at Orleans, France, Oct. 4, 1799; became auditor to the council of state at Paris; accompanied the duke of Luxembourg in his voyage to Brazil; spent there six years in botanical researches, exploring more especially the southern province and the *misiones* on the left bank of the Paraguay, and published on his return several works on the natural history of Brazil, the most important being *Flora Brasiliæ Meridionalis* (3 vols., 1825–32). He became a member of the Institute, and d. at Orleans Sept. 30, 1853.

**Saint-Hilaire', de** (Marco), the pseudonym of Émile Marc Hilaire, b. about 1790; was educated as a page at the court of Napoleon I., but, left without any employment after the Restoration, took up literature merely as a means of living, writing biographies of the duke of Berri and the courtesans of the Palais Royal, and commenced after 1830 to publish his books on Napoleon I., which were actually devoured: *Mémoires d'un Page de la Cour impériale* (2 vols., 1830), *Les Petits Appartements de Tuileries, de Saint-Cloud et de la Malmaison* (2 vols., 1831), *Souvenirs de la Vie privée de Napoléon* (2 vols., 1838), *Souvenirs intimes du Temps de l'Empire* (6 vols., 1838–40), and many more, none of which has any historical value. One of his later works was a *Histoire de Napoléon III.* (1853).

**Saint-Hilaire, Geoffroy.** See Geoffroy St.-Hilaire.

**Saint-Hilaire** (Jules). See Barthélemy St.-Hilaire.

**Saint Hy'acinthe,** county of Quebec, Canada, bounded W. by the river Richelieu, and traversed by Grand Trunk Railway, Quebec division. Cap. St. Hyacinthe. P. 18,310.

**Saint Hyacinthe,** city, cap. of St. Hyacinthe co., Quebec, Canada, on Grand Trunk Railway and the navigable Yamaska and Black rivers, 35 miles E. N. E. of Montreal. It contains a Roman Catholic college and seminary, a hospital, and an academy, 4 large bridges, 3 convents, and numerous manufactories. Among the fine buildings are the college, bishop's palace, city hall, and market. The town has a lively trade by rail and some by steamer. There are 1 tri-weekly and 3 weekly newspapers. There are three municipalities—the city proper, p. 3746; the parish of St. Hyacinthe, p. 2581; and St. Hyacinthe le Confesseur, p. 788.

**Saint Ignace',** tp., Mackinac co., Mich., on the N. side of the Straits of Mackinaw, opposite Mackinaw City, was the seat of an early Jesuit mission, where Father Marquette resided for some years, and which was the rendezvous of many exploring expeditions. P. 405.

**Saintine',** the pseudonym of Joseph Xavier Boniface, b. at Paris July 10, 1798; published a volume of poems in 1823, which was well received; became one of the most prolific writers for the stage, producing, alone or in connection with Scribe, Duvert, Masson, and others, about 200 plays, and published in 1836 his celebrated sketch *Picciola*, which ran through 40 editions, was translated into all European languages, and received the Montyon prize from the Academy. Another of his numerous sketches, a novel, *Seul* (1857), made a great sensation and was translated into English—*The Solitary of Juan Fernandez, or the Real Robinson Crusoe* (Boston, 1861), also his *Queen of the Danube* (1854), and *Myths of the Rhine* (1874) illustrated by Gustave Doré. D. at Paris Jan. 21, 1865.

**Saint In'igoes,** p.-v. and tp., St. Mary's co., Md., forming the peninsula between Potomac River and Chesapeake Bay. P. 1897.

**Saint Ives,** town of England, county of Cornwall, has a good harbor on St. Ives Bay, a large pilchard fishery, and an active trade in copper, tin, and slate. P. 7007.

**Saint James,** parish of S. E. Louisiana, bounded on the N. E. by Lake Maurepas, and on the S. E. by Lake des Allemands, and intersected by Mississippi River, has a level surface and an alluvial fertile soil, and is intersected by New Orleans Mobile and Texas R. R. Staples, sugar, molasses, cotton, and rice. Cap. St. James. Area, 338 sq. m. P. 10,152.

**Saint James,** p.-v., cap. of St. James parish, La., on the W. bank of Mississippi River.

**Saint James,** p.-v., cap. of Manitou co., Mich., on Great Beaver Island in Lake Michigan, was formerly inhabited by a number of Mormons who had seceded from the main body of the sect.

**Saint James,** p.-v. and tp., Watonwan co., Minn., on St. Paul and Sioux City R. R. P. 141.

**Saint James,** tp., Mississippi co., Mo. P. 505.

**Saint James,** p.-v. and tp., Phelps co., Mo., on Atlantic and Pacific R. R. P. 1531.

**Saint James,** p.-v. and tp., Cedar co., Neb. P. 327.

**Saint James,** tp., Charleston co., S. C., on Goose Creek. P. 7795.

**Saint James,** tp., Charleston co., S. C., on Santee River. P. 2657.

**Saint James,** tp., Clarendon co., S. C. P. 640.

**Saint Jean Baptiste',** a thriving suburb of Montreal (which see), Hochelaga co., Quebec, Canada. It is connected by street railway with the city, 1 mile distant. P. 4408.

**Saint-Jean d'Acre.** See Acre.

**Saint Jean d'Angély',** town of France, department of Charente-Inférieure, on the Boutonne, manufactures serge, gunpowder, and brandy, and has 6413 inhabitants.

**Saint Jean Molenbeek',** town of Belgium, province of Brabant, on the Senne, has iron-foundries and manufactures of soap and carpets. P. 22,712.

**Saint Jérôme',** p.-v., cap. of Terrebonne co., Quebec, Canada, 33 miles N. W. of Montreal. It has a fine water-power, a large woollen-mill, and other manufactories. P. 1159.

**Saint John,** county of New Brunswick, consisting of a narrow strip extending along the N. W. shore of the Bay of Fundy. It is generally very fertile and well cultivated, and is traversed by the railways centring at St. John, the capital. P., including the city of St. John, 52,303.

**Saint John,** city and seaport, cap. of St. John co., New Brunswick, Canada, on a harbor of the same name in the Bay of Fundy, at the mouth of St. John River, 54 miles S. E. of Fredericton, picturesquely located on the declivities of a rocky peninsula, is regularly and handsomely laid out, some of the streets being cut through solid rock to a depth of 30 feet; is divided by a projecting rock into an upper and lower town; has several fine public edifices, including the Carleton city hall, the court-house, opera-house, academy of music, city and marine hospitals, provincial lunatic asylum, market-house, post-office, Roman Catholic cathedral, and the Dominion penitentiary, a mile outside the city; is well supplied with water from Little River; has one of the finest harbors on the Atlantic coast, always free from ice; has a fine breakwater and a magnificent lighthouse on Partridge Island, with average annual entrance of above 1100 vessels, having an average of about 400,000 tons, the annual value of imports being about $8,000,000 and of exports $4,000,000; is connected with Fredericton and with Bangor, Me., by European and North American, and with Halifax, N. S., by Intercolonial R. R.; is connected by lines of steamers with Fredericton, Annapolis, N. S., Portland, Me., and other ports on the eastern coast; receives by St. John River, and exports large quantities of lumber to the U. S. and West Indies; has extensive shipyards, where 50 to 60 ships are annually built; has important manufactures, especially of ironware, furniture, carriages, boots and shoes, paper, cotton goods, rope, and hats; has sea-fisheries of considerable value, 9 or 10 banks, public or private, 31 churches, 4 daily and 9 weekly newspapers, 3 orphan asylums, several commodious hotels, an abundance of public and private academies and schools, an historical and a scientific society, an efficient fire department, a municipal government by a mayor, 9 councilmen, and 9 aldermen, representing the same number of wards, and is connected by street cars with the large town of Portland (p. 1871, 12,520), which is practically a suburb, and with Carleton, a portion of the city situated on the W. side of the river, which enters the harbor through a rocky gorge only 160 yards wide, spanned by a magnificent suspension bridge 100 feet high. The river has at this point a fall at low tide of 12 feet, but as the tides in the harbor rise from 17 to 20 feet, the waters of the river and those of the harbor are alternately higher, and are twice each day at the same height for a few minutes, at which time vessels pass the falls with entire ease. Saint John was settled at the close of the American Revolution by loyalists, chiefly from the New England States, and received a city charter 1785. P. in 1861, 28,805; in 1875 (including Portland and other suburbs), about 50,000.

**Saint John,** p.-v., Duquoin tp., Perry co., Ill., on Illinois Central R. R. P. 356.

**Saint John,** p.-v. and tp., Lake co., Ind. P. 1442.

**Saint John,** tp., Harrison co., Ia. P. 1507.

**Saint John,** tp., New Madrid co., Mo. P. 403.

**Saint John,** tp., Hertford co., N. C. P. 2016.

**Saint John** (Bayle), son of James A., b. in London, England, Aug. 9, 1822; educated as an artist; resided or travelled for several years in the East and in Africa; wrote at an early age for London periodicals, and was author of *Adventures in the Libyan Desert* (1849), *Two Years' Residence in a Levantine Family* (1850), *Village Life in Egypt* (1852), *The Turks in Europe* (1853), *The Subalpine Kingdom, or Experiences and Studies in Savoy, Piedmont, and Genoa* (1856), containing some curious documents on Rousseau; *Legends of the Christian East* (1856), *Montaigne the Essayist, a Biography* (1857), and an abridged translation of the *Memoirs of the Duke of Saint Simon* (4 vols., 1857). He wrote for many London periodicals, and was foreign editor of a daily paper at the time of his death, at London Aug. 1, 1859.

**Saint John** (Henry). See Bolingbroke.

**Saint John** (Horace Roscoe), son of James A., b. in Normandy, France, July 6, 1832; was educated under the direction of his father; studied Oriental literature; published a *Life of Columbus* (1850), *History of British Conquests in India* (1852), *History and State of the Indian Archipelago* (2 vols., 1853), and has been for many years a leader-writer and special correspondent for the London daily press. He married a daughter of Thomas Roscoe, a lady who has published *Lives* of Audubon (1856) and of Masaniello (1865), and an essay entitled *Englishwomen and the Age* (1860).

**Saint John** (James Augustus), b. in Caermarthenshire, Wales, Sept. 24, 1801; educated at the village school, and by the aid of a neighboring clergyman acquired a good knowledge of languages, ancient and modern, including Arabic and Persian; was at an early age engaged by Mr. J. S. Buckingham as sub-editor of the *Oriental Herald;* started the *London Weekly Review* 1827; settled in Normandy 1829; travelled in Norway the same year; visited Egypt and Nubia with his family, ascending the Nile to the second cataract in a vessel chartered for the purpose; made several interesting discoveries in physical geography and archæology, including that of the site of the tomb of Osiris on the Sacred Isle; explored Lake Mœris; followed the (supposed) track of the Israelites through the Desert of Sinai; returned to England by way of Malta, Sicily, and Naples; gave an account of this journey in his *Egypt and Mohammed Ali* (1834), *Description of Egypt and Nubia* (1844), and *Isis, an Egyptian Pilgrimage* (1853); wrote at Chantilly, France, an elaborate work, *The Hellenes, or the Manners and Customs of Ancient Greece* (3 vols., 1842), in which he was assisted by his son Bayle; became nearly blind while so occupied, but subsequently partially recovered his sight; published *The Nemesis of Power* (1854), the *History of the Four Conquests of England* (2 vols., 1862), a *Life of Sir Walter Raleigh* (2 vols., 1868); several novels, including *Tales of the Ramadhan* (1835), *Margaret Ravenscroft, or Second Love* (1835), *Sir Cosmo Digby* (1844), *The Ring and the Veil* (1856), and *Weighed in the Balance* (1864); two religious treatises, *Philosophy at the Foot of the Cross* (1854) and *The Preaching of Christ, its Nature and Consequences* (1855); a biography of *Louis Napoleon, Emperor of the French* (1857); a treatise on *The Education of the People* (1858); and has edited Sir Thomas Browne's *Religio Medici* and *Hydriotaphia,* Lady Mary Wortley Montagu's *Letters from the Levant,* Bunyan's *Pilgrim's Progress,* Locke's *Philosophical Works,* Sir Thomas More's *Utopia,* Bacon's *Atlantis,* and the *Prose Works* of Milton (3 vols., 1848), the latter in Bohn's *Standard Library.*

**Saint John** (Oliver), b. at Stanton, Oxfordshire, England, about 1598; studied at Queen's College, Cambridge, and at Lincoln's Inn; was called to the bar 1626; married in 1629 a lady who was nearly related both to Hampden and to Cromwell; was prosecuted by the Star Chamber 1630; was one of the counsel for Hampden in the great ship-money trial, Nov., 1637, and obtained a great reputation by his argument on that occasion; married as his second wife Elizabeth Cromwell, cousin of Oliver, Jan. 21, 1638; was elected to the Short and the Long Parliaments 1640; became solicitor-general Jan. 29, 1641, a commissioner of the great seal Nov., 1643; was one of the Parliamentary commissioners appointed to treat for peace at Uxbridge Jan., 1645; became lord chief-justice of the common pleas Nov. 22, 1648; took no part in the trial of Charles I., which he probably disapproved; was a joint ambassador to the Netherlands Mar., 1651, commissioner for the affairs of Scotland in October, and a member of the council of state in November of the same year; became afterward chancellor of the University of Cambridge; was opposed to the later policy of the Protector, but retained his office under both Oliver and Richard Cromwell; was a member of the Rump Parliament; narrowly escaped proscription at the Restoration, and lived on the Continent for some years under an assumed name. D. Dec. 31, 1673, whether in England or abroad is uncertain. He was the author of the famous "Navigation act," the chief promoter of the drainage of the "Bedford Level," and ancestor of the earls of Bolingbroke.

**Saint John** (Percy Bolingbroke), eldest son of James A., b. at Plymouth, England, Mar. 4, 1821; accompanied his father in his Eastern travels while a boy, and early devoted himself to literature, aiding his father in the preparation of some of his works; made a tour through the U. S., Texas, and Mexico about 1840; wrote sketches of his travels and numerous Indian tales, usually first published in *Chambers's Journal;* lectured on Texas and Mexico; became Paris correspondent of the *North British Daily Mail* 1847; was a witness of the French revolution of Feb., 1848; wrote the *Book of the War* (1853), for which he received the thanks of the Greek Parliament; has written many novels and been a contributor to many magazines and literary periodicals, especially Cassell's *Illustrated Family Paper* and the *London Journal.* Among his best known books are *The Young Naturalist's Book of Birds* (1844), *The Trapper's Bride* (1845), *Three Days of the French Revolution* (1848), *Paul Peabody, Countess Miranda* (1861), *Arctic Crusoe* (1854), *Quadroona* (1861), *The Creole Bride* (1864), *The Snow Ship* (1865), and *Good as Gold* (1870).

**Saint John** (Spenser), son of James A., b. in London Dec. 22, 1826; received a good education; devoted himself to Oriental literature; became proficient in the Malay language; was appointed secretary to Sir James Brooke, rajah of Sarawak (Borneo), in 1848; was secretary to Brooke's mission to Siam 1850; was acting British commissioner and consul-general in Borneo 1851–55; was full consul-general 1855–62; published *Life in the Forests of the Far East, comprising Explorations of the Interior of Borneo, Sarawak, etc., with Illustrations* (2 vols., 1862); went to Hayti as chargé d'affaires 1863, and visited Spain in 1866 with his father, whom he assisted at Simancas in researches preparatory to the publication of the latter's *Life of Sir Walter Raleigh.* He was afterward appointed minister-resident and consul-general in Peru.

**Saint John of Jerusalem, The Order of the Knights Hospitallers of,** also called the **Order of the Knights of Rhodes** or **Malta,** originated at the close of the eleventh century; its first constitution was confirmed by Pope Paschal II. in 1113, its second and final by Pope Calixtus II. in 1120. In 1048 some merchants from Amalfi founded a hospital and hostelry for pilgrims in Jerusalem, and a confraternity of pilgrims took charge of the establishment, which subsequently increased much and was largely endowed. During the siege and capture of Jerusalem by the crusaders in 1099 this confraternity, under the direction of Pierre Gérard, excited general admiration by the heroism with which it administered help to all who suffered. Godfrey of Bouillon gave it a large endowment, and several knights joined it as Hospitallers. The confraternity was then organized as a monastic order with philanthropic purposes, and the members assumed the black Augustinian garment with a white cross. After Gérard's death in 1118, Raymond du Puy succeeded as provost of the order, and he immediately undertook a reorganization of the whole institution on a military basis, adding the defence of Christianity and war against the infidels as the new and the principal purpose of the order. Many celebrated knights now joined it, great endowments were conferred on it from all Christian countries, brilliant exploits were achieved by it, and in a short time it rose to be one of the richest and most famous of the Christian orders. Soon, however, it also began to exhibit the same signs of greed, intrigue, jealousy, and dissipation which characterized the other orders, and its embroilments with the Templars caused much scandal. After the conquest of the Holy Land by the Saracens the knights removed in 1291 to Limisso in Cyprus, and hence in 1309 to Rhodes. Their life here was one perpetual war against the Turks, and in 1479, while D'Aubusson was grand master, they repelled Mohammed II., who besieged them in the city of Rhodes with a force far superior to their own. Nevertheless, in spite of many brilliant exploits, they were compelled to surrender Rhodes to Solyman II. in 1522, and at the same time they lost by the introduction of the Reformation many of their possessions in England, Germany, and the Scandinavian countries. In 1530, Charles V. gave them the

island of Malta, and here Solyman II. attacked them in 1565 with an immense force. Under the grand master Lavalette they offered a most heroic resistance, and, to the astonishment and enthusiasm of all Europe, they finally succeeded in repelling the Turks. Soon after, however, the order began to sink into insignificance—less, perhaps, on account of any faults of its own than because the advancing spirit of the times had no more use for such an institution. During the Revolution the knights lost their large possessions in France. In 1798, on his way to Egypt, Napoleon drove them from Malta, and the English, who conquered the island in 1800, refused to reinstate them. In vain the last grand master, Hompesch, resigned his dignity and transferred it to Paul, emperor of Russia. The pope would not recognize a man belonging to the Greek Church as grand master, and appointed some obscure Italian to the dignity. The exertions which the members made to revive the institution by the aid of the Congress of Vienna were in vain, and since 1798 the order has existed only nominally.

**Saint John River,** of Maine and New Brunswick, rises on the boundary of Somerset co., Me., and Dorchester co., Quebec, near the head of the Penobscot. It is for nearly 40 miles the boundary between the U. S. and Canada. It then traverses for 112 miles the wilds of Northern Maine, and is known as the Walloostook or Main St. John. Some 150 miles below its origin it joins with the St. Francis, and changes its north-easterly to a more easterly course. Below the mouth of the St. Francis it is the N. boundary of Maine for about 75 miles. Below this part of its course it is wholly in Canadian territory; shortly after entering which its Grand Falls occur, 225 miles above its mouth. The river here falls 75 feet perpendicularly. From its mouth at St. John, N. B., it is navigable by large steamers for 80 miles to Fredericton, and at high water to Woodstock, 145 miles, and by small steamboats, at good stages of water, even as high as the Grand Falls, above which it is again navigable some 40 miles. At its mouth a singular phenomenon occurs. The water, here compressed into a narrow channel, falls at low tide some 12 feet in order to reach the harbor, but at high tide the level of the harbor is from five to eight feet the higher. Vessels can consequently pass from the river to the harbor, or from the harbor to the river, only at the turn of the tide. The total length of the river is 550 miles. Its drainage-area is 26,575 sq. m. Its navigation is free to U. S. citizens by the Ashburton Treaty.

**Saint John's,** capital of Newfoundland, on the E. coast of the peninsula of Avalon, about 65 miles N. of Cape Race, and 18 miles S. of Cape St. Francis. It contains a population of 30,000 inhabitants. Its position is lat. 47° 33′ 29″ N., lon. 52° 45′ 10″ W. The entrance to the harbor of St. John's is called the Narrows, which at the sea-surface is 360 fathoms across, and at its narrowest part, between Chain Rock and Pancake Rock, is only 220 yards. On the N. side of the Narrows is a precipitous cliff of sandstone and slate rock 300 feet high, above which is Signal Hill, 510 feet above the sea-level. On the S. side a hill or mountain rises abruptly to the height of 650 feet, having a sort of shoulder near the water, on which is erected a lighthouse called Fort Amherst. Inside the Narrows the harbor expands and trends toward the S. W. It is spacious and secure, has 90 feet of water in the centre, and is accessible for the largest vessels at all periods of the tide. The city is built on the N. side of the harbor, on a moderately steep incline which affords an admirable site. The principal street is Water street, running parallel to the N. side of the harbor, somewhat more than a mile in length, containing well-constructed houses and large and substantial stores; excellent wharves jut into the water, and vessels of large tonnage can at all times safely moor at them. The houses and stores in Water street are built of brick or stone, a law to that effect having been passed after the disastrous fire of 1846, by which the greater part of the city was destroyed. The houses in the other streets are, for the most part, built of wood. The Roman Catholic cathedral stands on the highest point of the declivity which forms the site of the city, this summit being 225 feet above the level of the sea. Opposite the city, at the S. side of the harbor, a lofty ridge of precipitous hills, 700 feet high, rises abruptly from the water's edge, and stretches for some miles into the interior. A small space at the base of these hills has been made available for building, and here the merchants have erected warehouses and large vats for the manufacture and storing of seal oil.

The approach to the harbor is well lit by Cape Spear and Fort Amherst lights, and vessels entering the harbor are guided through the Narrows by the following arrangement: Two red lights are exhibited every night from sunset to sunrise, intended as leading marks for vessels entering the Narrows—the lower light on the roof of the custom-house, the other 400 yards in rear, on a white post 180 feet above the sea. These lights will be readily distinguished from any other lights in the city, and keeping them in a line bearing N. W. $\frac{3}{4}$ W. will lead in the largest vessel clear of all danger. To serve as leading marks also during the day the pediment of the custom-house is painted white; this is to be kept in line with the upper lantern, also painted white. The distance from St. John's to Liverpool, England, is about 2000 miles; to Valentia, Ireland, 1640 miles; to Quebec, 900 miles; to Halifax, Nova Scotia, 540 miles.

The city is well supplied with water from a lake called Twenty-mile Pond, distant 6 miles, and elevated 150 feet above the highest part of St. John's. The waterworks were constructed at a cost of £80,000 sterling, which was raised on a government guaranty of 5 per cent. There are 2 well-organized volunteer fire companies, the Phœnix and Cathedral Fire Brigade. The city is lighted with gas. There are 3 banks. The Commercial bank has a capital of £50,000 and a note circulation of nearly the same amount. The Union bank has a capital of £50,000 and circulates notes to the extent of £104,387. All government business is done through this institution, and the shares are at a high premium. The savings bank is a government institution, the government being responsible for its deposits and having control of its expenditure. Its rate of interest is 3 per cent. per annum. The profits, after payment of interest to depositors, are added to the general revenue. There are 10 churches in the city. The Roman Catholic cathedral is an imposing structure. The Church of England cathedral is also a fine edifice, though as yet incomplete. There are 2 Wesleyan churches, 1 Established Church of Scotland, 1 Free Church of Scotland, and 1 Congregational. Two-thirds of the population are Roman Catholics. The most important public edifices, in addition to the cathedrals and churches, are—Government House, the residence of the governor, a plain but substantial and commodious stone building which cost £60,000; the House of Assembly, in which the legislature holds its sittings and where are the government offices; the Union and Commercial banks; the lunatic asylum, 4 miles distant from the city; the public hospital, market-house, and court-house; Roman Catholic college and convents; Episcopalian, Wesleyan, and General Protestant academies; Roman Catholic and Episcopalian orphan asylums. Nineteen life, fire, and marine insurance companies have agencies in St. John's. The joint-stock companies are—the St. John's Gas-Light Co., General Water Co., Floating Dry Dock Co., Vail's Joint-Stock Co. for ship-biscuit baking, and St. John's Steam-tug Co. The city has 2 saw-mills, 1 gas manufactory, 1 iron-foundry, 1 distillery, 2 breweries, 4 bakeries (by machinery), 1 patent slip, 1 floating dock, 2 tanneries, 1 boot and shoe factory. The chief public societies are the agricultural, floral, and horticultural, and the fishermen's society. The benevolent and charitable societies are numerous, the principal being the Benevolent Irish Society, Church of England asylum for widows and orphans, St. John's Industrial Society, Dorcas Society, St. George's Society, St. Andrew's Society, British Society, Society of St. Vincent de Paul, Mechanics' Society, Shipwrights' Benefit Society, and 4 temperance societies. There are 3 Masonic lodges—2 under the jurisdiction of the Grand Lodge of England, and 1 under the jurisdiction of the Grand Lodge of Scotland. The medical society of St. John's was incorporated in 1867. Of the literary institutes, the St. John's Athenæum has a library containing 5000 vols., and a reading-room well supplied with British and American newspapers and periodicals; the St. Joseph's Catholic Institute has a reading-room and library. The newspapers published in St. John's are the *Morning Chronicle*, daily; the *Express*, *Newfoundlander*, *Public Ledger*, *Advertiser*, *Courier*, and *Times*, twice each week; the *Royal Gazette*, *North Star*, and *Patriot*, weekly; the *Commercial Journal* and the *Temperance Journal*, fortnightly. Of these newspapers, the *Royal Gazette* is the oldest, having been established in 1806.

St. John's is the seat of government, which consists of a governor, executive council, legislative council, consisting of 15 members nominated by the Crown, and a house of assembly, consisting of 31 members elected by the people. The judicial department consists of a supreme court, Sir H. Hoyles being chief-justice, and Hon. B. Robinson and Hon. John Hayward assistant judges; and a circuit court and admiralty court. There is also the district court of St. John's. The Allan line of steamers call at St. John's on their outward and homeward passages, carrying mails and passengers. Every alternate Tuesday a steamer leaves Halifax, N. S., calling at St. John's on her voyage to Liverpool, and every alternate Tuesday a steamer leaves Liverpool, calling at St. John's on her voyage to Halifax. This arrangement holds good for nine months of the year, and during February, March, and April the steamers run

only once a month, instead of fortnightly. Local steamers make fortnightly trips between St. John's and the principal outports N. and S. Excellent roads connect the capital with the neighboring towns and settlements.

There are few manufactures in St. John's, the population being chiefly engaged in business connected with the fisheries, which are the staple industry of the colony. The large mercantile establishments in St. John's issue supplies on a large scale for the prosecution of the seal and cod fisheries, and collect and export fish and oil. The codfish are chiefly sent to Great Britain, Spain, Portugal, Italy, the West Indies, and Brazil. The seal oil and seal skins are mainly exported to Britain. The great bulk of the imports of the colony arrives at the port of St. John's. In addition to the large mercantile establishments, there are in St. John's a large number of handsome retail shops in which a cash trade is carried on. St. John's is a place of extensive business, and much wealth is accumulated by the capitalists, who, unfortunately, are mostly non-resident and are represented by their agents. The average number of vessels entering the port of St. John's annually is 1200, having a burden of 250,000 tons. The number of sailing vessels clearing from St. John's for the seal fisheries each year was once very great, but of late years these have been largely superseded by steamers. Eighteen powerful steamers now leave St. John's each year for the seal fishery soon after Mar. 10. The great bulk of the seal oil taken is manufactured in St. John's; Harbor Grace, the second town in the colony, being the only other place where oil is manufactured.

St. John's is a place of growing importance, and will probably occupy an influential position one day. It is proposed to build a railway across the island from St. John's to St. George's Bay, on the western coast, and a steam-ferry would carry passengers and mails thence to Shippegan or Louisburg, C. B. This would constitute the shortest and safest travel-route between America and Europe, as swift steamers could make the distance between St. John's and Valentia, Ireland, in a little over four days. The distance between London and New York by this route would be traversed in seven days. M. HARVEY.

**Saint John's,** county of Quebec, Canada, bounded E. by the river Richelieu, and S. by the State of New York. It contains some very fertile land, and is traversed by the railways leading to St. John's, the county-seat. P. 12,122.

**Saint John's,** town, cap. of St. John's co., Quebec, Canada, on the W. bank of the river Richelieu, at the head of Chambly Canal, and on Central Vermont R. R., 23 miles N. of Rouse's Point. It is also the terminus of a branch of Grand Trunk and of Stanstead Shefford and Chambly railways. It is connected with Iberville by two bridges. It is the seat of the provincial lunatic asylum, and possesses fine buildings, churches, and manufactories, an active trade, commodious barracks for troops, an academy, and 2 weekly newspapers. P. 3022.

**Saint John's,** the capital of Antigua, West Indies, and the seat of several military and civil authorities, is beautifully situated and has a good and fortified harbor, which, however, is not accessible for large vessels. It is generally well built, though somewhat dirty, and it sometimes suffers greatly from lack of water. P. 9021.

**Saint John's,** county of N. E. Florida, lying between St. John's River and the Atlantic, consisting chiefly of marshes, is covered with timber, including some live-oak. Staples, sugar, molasses, and sweet potatoes. Cap. St. Augustine. Area, 540 sq. m. P. 2618.

**Saint John's,** p.-v., cap. of Clinton co., Mich., on Detroit and Milwaukee R. R., 100 miles W. of Detroit, has 7 churches, 2 school-houses, 2 newspapers, a large furniture manufactory, foundry, wooden-bowl factory, 1 saw and 2 grist mills, and carriage and repair shops. P. about 2500. CORBIT & ESTES, EDS. "CLINTON INDEPENDENT."

**Saint John's,** v., Marion tp., Mercer co., O. P. 105.

**Saint John's,** a lake of Quebec, Canada, forming the source of Saguenay River, is nearly circular in form, being 30 miles long and 25 broad, and lies on a high plateau sheltered N. E. by lofty mountains. Its principal tributaries are Assuapmoussoin, Mistasini, and Curious rivers.

**Saint John's, Berkley,** tp., Charleston co., S. C. P. 7868.

**Saint Johns'bury,** p.-v., cap. of Caledonia co., Vt., at the junction of Connecticut and Passumpsic and Portland and Ogdensburg R. Rs., 50 miles S. of the Canada line. It has 5 churches, a public library and reading-rooms, an academy and 6 school-houses, 2 banks, 2 weekly newspapers, the largest scale manufactory in the world, 2 foundries and machine-shops, mills of various kinds, and 2 hotels. P. 4665. WM. H. WHEELER, ED. "VERMONT FARMER."

**Saint John's College,** Stearns co., Minn., was founded in 1869 by the Very Rev. Demetrius Maragna, who was its first president, and d. in 1869. Its present president is Rev. Alexius Edelbrock, b. in 1843 at Dülmer, Westphalia, but educated in this country.

**Saint John's, Colleton,** tp., Charleston co., S. C. P. 8604.

**Saint John's Plantation,** tp., Aroostook co., Me. P. 127.

**Saint John's River,** in Florida, rises in the swamps of Brevard co., and after a course of nearly 400 miles reaches the Atlantic. It is regularly navigated by steamboats to Enterprise, 330 miles from its mouth, and small steamers have ascended some 60 miles above that point. It is a beautiful stream, having but a slight fall and a very gentle current. Its banks are clad in rich half-tropical verdure, and for nearly two-thirds of its course it is nowhere less than a mile in breadth, and often expands into spacious lakes. The general direction of the river from its mouth, in lat. 30° 20½′ N., to Jacksonville is E. and W. Above Jacksonville, as far as Pilatka, it lies nearly N. and S., being parallel with the main coast and about 20 miles from it. "For nearly 100 miles from its mouth it forms a wide, sluggish sheet of water, more resembling a lagoon than a river," the distance from shore to shore in some places being fully 5 miles. The currents in the river are apparently but slightly influenced by freshets, even during the rainy season, and where most active near the mouth are without doubt mainly due to the tidal wave. After passing the bar a depth of 14 to 15 feet may be carried to Jacksonville, 10 feet to Pilatka, and 8 feet to Lake George, while small steamers ply much higher up. A minimum depth of 7 feet of water at mean low tide at present exists on the bar, with an average rise and fall of 5.4 feet.

**Saint Johns'ville,** p.-v. and tp., Montgomery co., N. Y., on Mohawk River and New York Central R. R., has fine scenery and important manufactures. P. of v. 1376; of tp. 2189.

**Saint John the Bap'tist,** parish of S. E. Louisiana, having on the N. Lake Maurepas, on the N. E. Lake Pontchartrain, on the S. Lake des Allemands, intersected by Mississippi River, and traversed by New Orleans St. Louis and Chicago R. R., has a level surface and a soil highly productive of rice and sugar-cane. Cap. Bonnet Carré. Area, 250 sq. m. P. 6762.

**Saint Jo'seph,** p.-v., Westmoreland co., N. B., 3 miles from Memracook. It has a Roman Catholic college and a handsome stone church. P. about 400.

**Saint Joseph,** county of N. Indiana, adjoining Michigan, on St. Joseph and Kankakee rivers, traversed by Lake Shore and Michigan Southern, Michigan Central, and Chicago and Lake Huron R. Rs., has a nearly level surface divided between oak-openings, prairie, and forest, has numerous manufactures and raises considerable quantities of stock. Staples, wheat, hay, Indian corn, maple-sugar, wool, and butter. Cap. South Bend. Area, 470 sq. m. P. 25,322.

**Saint Joseph,** county of S. W. Michigan, adjoining Indiana, drained by St. Joseph River and its tributaries, intersected by Lake Shore and Michigan Southern, Michigan Central, and Grand Rapids and Indiana R. Rs., has a rolling surface, numerous saw-mills, several manufactories, and raises considerable numbers of sheep and swine. Staples, wheat, Indian corn, potatoes, hay, sorghum-molasses, wool, and butter. Cap. Centreville. Area, 550 sq. m. P. 26,275.

**Saint Joseph,** p.-v. and tp., Champaign co., Ill., on Indianapolis Bloomington and Western R. R. P. 1222.

**Saint Joseph,** tp., Allen co., Ind. P. 1373.

**Saint Joseph,** p.-v., cap. of Tensas parish, La., on Mississippi River, 350 miles above New Orleans and 60 S. of Vicksburg, has 2 religious societies, good schools, courthouse, jail, and clerk's office, a Masonic lodge, 1 newspaper, and a tin and blacksmith shop. P. about 350.
P. CHEW, ED. "NORTH LOUISIANA JOURNAL."

**Saint Joseph,** p.-v. and tp., Berrien co., Mich., on Lake Michigan, at the mouth of St. Joseph's River, on Chicago and Michigan Lake Shore R. R., is the centre of the principal peach-region of the N. W., has 2 weekly newspapers and a flourishing trade in lumber and in fruit sent to Chicago, and a handsome bridge across the river. P. 2994.

**Saint Joseph,** p.-v. and tp., Stearns co., Minn. P. 868.

**Saint Joseph,** city, cap. of Buchanan co., Mo., and the second city of commercial importance in the State, is beautifully situated on the right bank of Missouri River, on the western boundary of the State. It is one of the oldest cities in the U. S. between Mississippi River and the Pacific coast. It was founded by Joseph Robidoux, a French Roman Catholic, who was born in St. Louis in 1784, and who was one of the most noted pioneers of the West. As early as when the general government incorporated the

Territory of Louisiana, Robidoux left St. Louis for the then wild country of the West to trade with the Indians. Selecting a beautiful spot among the hills on the river-bank, he built a hut and commenced trafficking with the red men. The country was thickly inhabited by the Indians, and was in their possession. The steamboats from St. Louis brought him his wares and carried the valuable peltries and metals he received from the Indians to market. He was beloved by the Indians, whom he treated fairly. In 1840 the rich country surrounding the trading-point, known as the "Platte Purchase," was opened to settlement by treaty with the Indians. The fertile land was rapidly taken up, and the settlement immediately became the principal frontier-town W. of the Mississippi. In June, 1843, the original town was laid out by Mr. Robidoux, and named St. Joseph. In 1846, with 600 inhabitants, it became the county-seat; in 1849 it became the great outfitting-point for emigrants and gold-seekers leaving the States for California, it lying directly on the great highway across the Plains; in Feb., 1851, with a population of 4000, it became a city. The original charter is still in force, having been amended twenty-two times. In Feb., 1859, Hannibal and St. Joseph R. R., the first road to penetrate so far W., was completed to the city. From this the city made rapid strides in growth and population. In the following year the famous "pony express," to quickly transmit a limited mail from the States to San Francisco, was started from the city. In 1861, at the breaking out of the war of the rebellion, the city became the scene of factious disturbances on the part of the secessionists, and the war-period was a gloomy one. The government occupied and fortified the city, and it became a point for the centralization and distribution of troops. The population, which was 10,000 in 1861, had dwindled to 7000 in 1865. The return of peace brought prosperity again, an immense trade flowed in, and the city grew rapidly. In 1870 the census showed a population of 19,565 and an assessed property valuation of $11,283,435. The population is now estimated at 30,000, and the assessment shows a property valuation of at least $25,000,000. The country surrounding St. Joseph is one of the richest in the U. S. Since its founding the city has been the largest wholesaling point in the Central U. S. W. of St. Louis and Chicago, which supremacy it still maintains. It has 9 distinct lines of railway centring at its location, with a formidable network of connections, giving it direct communication with the great Pacific and Atlantic seaboard cities and the cities of the lakes and the Gulf, and is closely united with all the smaller cities and towns under its shadow. In 1875 its wholesale trade exceeded $20,000,000. May 31, 1873, it celebrated the completion of a magnificent iron railway bridge across Missouri River, costing $1,500,000. The city's public schools stand next to those of St. Louis in the State, and vie with those of Cleveland and Boston. The city has 32 schools and colleges, 24 churches, 4 daily and 5 weekly newspapers, 5 public libraries, 63 societies, an industrial exposition association, State asylum for the insane, the finest opera-house W. of New York City, and one of the largest court-houses in the U. S.

ISAAC C. PHIFER, ED. "HERALD."

**Saint Joseph,** tp., Williams co., O. P. 1844.

**Saint Joseph,** tp., St. Croix co., Wis. P. 265.

**Saint Joseph de Beauce,** p.-v., cap. of Beauce co., Quebec, Canada, 42 miles S. S. E. of Quebec. It has a large stone court-house and copper-mines. P. about 450.

**Saint Joseph, Sisters of,** founded at Puy, in France, in 1650 by J. P. Medaille, a priest; have many houses in the U. S.

**Saint Joseph's River** rises in Hillsdale co., Mich., and after a tortuous course of 250 miles enters Lake Michigan at St. Joseph. Its mouth affords a good harbor, and the stream is navigated throughout half its length by small steamers to Constantine, Mich.—Another stream of the same name rises in Hillsdale co., Mich., flows S. W. into Ohio and Indiana, and near Fort Wayne joins St. Mary's River to form the Maumee.

**Saint Junien',** town of France, department of Haute-Vienne, at the confluence of the Glane and Vienne, has 6795 inhabitants, mostly engaged in the rearing of horses, bees, and mules.

**Saint-Just, de** (ANTOINE LOUIS LÉON), b. at Decize, department of Nièvre, France, in 1768 or 1769; studied literature; published in 1789 a large poem, *Organt*, in 20 songs; embraced the ideas of the Revolution with enthusiasm; wrote in 1791 *Esprit de la Révolution;* entered the Convention in 1792 as a member for Aisne; advocated the most extreme measures; became a member of the Committee of Public Safety; was one of the most conspicuous leaders during the Reign of Terror; became president of the Convention in Feb., 1794; brought Danton to the guillotine; attempted on the 9th Thermidor to defend Robespierre, but was arrested, and executed the next day, July 28, 1794. His *Œuvres politiques* were collected and published in 1834. His *Life* was written by Fleury in 1852 and Hamel in 1859.

**Saint Lam'bert,** or **South Montreal,** v., Chambly co., opposite Montreal, Canada, on the river St. Lawrence, at the terminus of the Victoria bridge and at the junction of the St. John's branch with Grand Trunk Railway. A steam-ferry connects it with the city, 2 miles distant. P. about 400.

**Saint Lambert, de** (CHARLES FRANÇOIS), MARQUIS, b. at Nancy, Lorraine, France, Dec. 16, 1716; served in the army; obtained a post at the court of Stanislaus, king of Poland, where he made the acquaintance of Voltaire; obtained some note as a poet, and still more by his successful rivalry with Voltaire and Rousseau for the favor of their respective mistresses. He became a member of the Academy. D. at Paris Feb. 9, 1803.

**Saint Lan'dry,** parish of Central Louisiana, bounded E. by Atchafalaya River, W. by Bayou Nezpeque, watered by their numerous tributaries, has an undulating surface, well adapted to agriculture and stock-raising. Staples, Indian corn, cotton, sweet potatoes, tobacco, rice, sugar, molasses, and wool. Cap. Opelousas. Area, 2200 sq. m. P. 25,553.

**Saint Law'rence,** county of N. New York, on St. Lawrence River, bordering on Canada, watered by St. Regis, Racket, Grass, Oswegatchie, and Indian rivers and their numerous tributaries, which afford abundant water-power, and traversed by Ogdensburg and Lake Champlain division of Vermont Central and Rome Watertown and Ogdensburg R. Rs., is thinly settled, and mountainous in its S. E. portions, which are broken by a series of parallel ridges forming part of the Adirondack region, and are covered with almost unbroken forests; is rich in minerals, especially iron ore, and well adapted to dairying, which with lumbering and manufactures of many kinds forms the chief industry, more than 30 cheese-factories existing in the county. Staples, wheat, oats, potatoes, hay, hops, flax, maple-sugar, butter, cheese, and wool, the production of the four latter articles being probably greater than in any other county in the U. S. Cap. Canton. Area, 2900 sq. m. P. 84,826.

**Saint Lawrence,** p.-v. and tp., Scott co., Minn., on St. Paul and Sioux City R. R. P. 315.

**Saint Lawrence,** tp., Waupaca co., Wis. P. 759.

**Saint Lawrence River and Gulf.** The river St. Lawrence, from its mouth in the Gulf to the W. end of Lake Superior, is about 2000 miles long, or to its farthest source, that of the river St. Louis, 2150 miles long from E. to W., by 745 in greatest breadth, from the sources of the Nipigon, lat. 50° 33′ N., to those of the S. branch of the Maumee, lat. 40° 13′ N. Its approximate area, as reduced by the most recent surveys, is about 510,000 sq. m.—187,440 in the U. S. and 322,560 in Canada. The tortuous watershed (5400 miles) that bounds it traverses regions very different in character and climate. On the S. side, from the Gulf westward, it interlaces the Notre Dame Mountains, 4000 to 1200 feet high, till remotely opposite Quebec it passes, by the highlands at the sources of the St. John, the Kennebec, and the Penobscot, to those of the Connecticut, and down through the picturesque hills and valleys of the Green Mountains round the S. end of Lake George to and through the lofty Adirondacks, whose highest summit rises over 6000 feet. There, at 1000 miles, it descends to the fertile regions of Western New York, encircles the sources of the Oswego and Genesee, skirts Lake Erie and the sources of the Maumee, and the S. W. shore of Lake Michigan, where its elevation is scarcely perceptible, passes northward, W. of the feeders of Green Bay, then westward, reaching the head of Lake Superior at 3000 miles—the first 1000 highly picturesque and interesting, physically and historically, the last 2000 chiefly through the finest wheat-country of this continent, with the climate of the peach and grapevine. From the sources of the St. Louis the line of watershed throughout its winding course round the northern tributaries of Lakes Superior and Huron, the Ottawa, St. Maurice, Saguenay, and other rivers, is, on the contrary, monotonously unvaried, uninhabited, little known, and repulsively uninteresting, save for its many lakes and copper-bearing character. For though the Laurentian formation, that covers the northern half of the basin of the St. Lawrence, rises on Lake Superior to 1800 feet, to 2800 below Quebec, and to 4000 in the interior, it is along the watershed a generally sterile plateau, 1300 to 1500 feet above the sea (except at lon. 79° 23′ W., where it is 947), with occasional low hills. It has generally a poor sandy soil, and a climate fit only for growing barley.

The infant St. Lawrence, entering the W. end of Lake Superior as the river St. Louis, meets the accumulated waters of many tributaries, including the Pigeon River, important only from being the international boundary, and the Kaministiquia, with its great falls of 120 feet, before receiving its greatest, the Nipigon, with its mountain-guarded entrance and island-studded lake, 50 miles by 30 in extent, draining an area of 9800 sq. m. Lake Superior is 400 miles long by 160 wide, 598 feet above the sea, and 900 in mean depth. Its picturesque and rugged shores are generally unfit for agriculture, but have very rich mines of silver and copper, the latter worked by pre-historic races. The St. Lawrence leaves it a great river, 1 mile to ½ mile wide, with the surplus waters of an area of 84,700 sq. m.—including that of the lake, 32,330. Descending 23 feet, chiefly at Sault Ste. Marie, it enters Lake Huron, 240 miles long by 170 wide. Rugged and mountainous on the N. and N. E., its southern shores skirt the fertile peninsulas of Michigan and South-western Ontario. The area of its basin is 74,190 sq. m., the lake covering 21,070. Its chief Canadian tributary is the French River, from Lake Nippissing, draining over 7000 sq. m. In Lake Huron the St. Lawrence receives the waters of Lake Michigan, 345 miles long by 84 at its widest, 576 above the sea, and 1800 in mean depth. Its basin is 70,040 sq. m. in area, of which the lake occupies 22,120; five of its feeders are from 135 to 245 miles in length, mostly traversing magnificent timber forests. The St. Lawrence leaves Lake Huron as the river St. Clair, only ½ to ¼ of a mile wide; at 33 miles crosses Lake St. Clair, 25 miles long, receiving the Thames from Ontario; and at 18 more, with a descent of 11 feet, enters Lake Erie. Compared with the St. Mary, the river St. Clair seems small for what should be the greatly-augmented discharge of Lake Huron; but the proportional evaporation of Lakes Huron and Michigan must be greater than that of Lake Superior, whose low surface temperature (40° F.) should rather cause precipitation in warm weather; and the volume of the St. Clair is hidden by its great depth and velocity of 6 miles an hour. Lake Erie is 244 miles long by 60 at its widest, and 90 feet in mean depth. Its area is 9600 sq. m., including which its basin embraces 39,680, of which the river Maumee drains 7000, the Grand River of Ontario 2430.

From Lake Erie the St. Lawrence flows rapidly, ¾ of a mile wide, 20 to 40 feet deep. Expanding around Grand Island and many lesser ones, at 22 miles it descends the Falls of Niagara with its enormous mass of 389,000 cubic feet of water in each second of time. Then narrowing to ¼ of a mile, it surges down its deep precipitous ravine, through its fierce Whirlpool, and at 35 miles, with a total descent of 330 feet, overcome by the Welland Canal, enters the S. side of Lake Ontario, 190 miles long by 60 at its widest, and 412 feet in mean depth. Passing 170 miles through it, it receives on the S. the Genesee, draining 3000 miles, and the Oswego, with its eight lakes and branches, 5600 miles, and on the N. the Trent, of the same area. Leaving Lake Ontario augmented by the waters of its basin of 29,760 sq. m., including the lake-surface of 6300 miles, passing through the romantic Lake of the Thousand Isles, then gradually narrowing to ¾ of a mile at 66½ miles, the St. Lawrence enters on the series of alternate rapids, overcome by the Canadian canals and slackwater reaches, by which it descends 176 feet in 96 miles to Lake St. Louis, with a volume of 510,000 cubic feet per second, by the Canadian canal commissioners' report. The depth of water is so great that many large vessels, including passenger steamers, run down through the rapids to Montreal, using the canals only in going up.

We have now traced the St. Lawrence first for 600 miles through the rugged and solitary Laurentian and Huronian land of its origin; then for over 900 miles of its middle course, where its vast sea-like waters, after expanding through the great fertile and generally Silurian plain countries of the rapidly-improving lake States and province of Ontario, with their many prosperous cities and shipping-ports, here descend to the great plain of Lower Canada, 350 miles in length by 60 at its widest, bounded by the Laurentian mountain-range on the N. and a continuation of the Green Mountains on the S., till they converge in the St. Lawrence below Quebec, the site of the dense old settlements of the French race, rich in historical associations of events and usages linked to mediæval times. Traversing Lake St. Louis, 15 miles, to Sault St. Louis, the St. Lawrence descends 44½ feet, and at 8½ miles enters the harbor of Montreal, the commercial metropolis of Canada, frequented by Atlantic steamers and large sea-going vessels. Partly in Lake St. Louis and partly below the island of Montreal it receives the Ottawa, draining over 60,000 sq. m., whose volume of 85,000 cubic feet per second where measured is increased by lower tributaries to over 90,000, swelling that of the St. Lawrence to over 600,000. Their waters continue long visibly distinguished in color. Those of the Ottawa, amber-tinted, are much purer than the clear pale-blue waters of the St. Lawrence, which by analysis have three times as much solid matter, calcareous salts, in solution. Above this the St. Lawrence varies, it is said, not more than one-twentieth in volume by drought or flood, though rising sometimes very slowly 3 feet. Here it becomes subject to the floods of the Ottawa (an unusually high one has at present raised the St. Lawrence 2 feet over the wharves at Montreal, where the width is 1¾ miles, with strong current). Fifty miles lower, above Lake St. Peter, 30 miles long, it receives the Richelieu from Lake Champlain, draining about 9200 sq. m. In Lake St. Peter it receives the Yamaska, with 2000 sq. m., and the St. Francis from the Eastern Townships, 3500 sq. m. of area. At Three Rivers, 86 miles, it meets the tide, and receives from the N. the St. Maurice, draining about 16,000 sq. m., but discharging a most unaccountably great volume of water, even considering that the discharge of the eastern tributaries of the St. Lawrence is, for their areas, nearly double that of the western feeders. From Montreal to Quebec its average width is about 1¾ miles. Narrowing to ¾ of a mile at Quebec, under Cape Diamond, but 150 feet deep, it expands below the city, and passing the island of Orleans, at 35 miles it flows 11 miles wide of fresh water, soon becomes brackish, and gradually salt. At 120 miles below Quebec it is 16 miles wide, receiving from the N. the Saguenay, draining 23,716 sq. m., through its vast gloomy chasm in the Laurentides. Fed by the frequent rains and winter snows (6 to 8 feet deep) of mountainous and elevated northern regions, it is of extraordinary volume, as also are the large rivers Bersiamis, Outard, and Manicougan, and other tributaries eastward. Widening to 36 miles at Metis, the St. Lawrence expands to 90 at its mouth, at the W. end of the island of Anticosti, where the volume it pours into the Gulf is probably about 1,000,000 cu. ft. of water each second of time. For the last 200 miles on the S. side, and 300 on the N., its shores are but sparsely settled at favorable points for fisheries or the manufacture and shipment of lumber, and in the interior not at all, except in the basin of the upper Saguenay.

The St. Lawrence presents the extraordinary characteristic of being navigable for large ships from the head of Lake Superior, almost its source, to the sea, a distance of about 2000 miles, its obstacles being overcome by 71¾ miles of canals passable for ships of 700 tons, and with improvements now in progress it soon may be so for vessels of 1300 tons, being equalled in that respect only by the Amazon, which it exceeds in the greater sea-room for sail navigation afforded by its great lakes, but subject to the drawback of its canals being closed for four months, and its lower course for five months, in winter.

The commerce of the St. Lawrence and its lakes is very great. The total tonnage of vessels cleared outward and inward, between the U. S. and the province of Ontario, in the year ending June 30, 1875, was 3,822,247 tons, of which 2,038,293 was U. S. tonnage. In 1874 the downward tonnage to Montreal was 777,016, besides the grain and flour, 1,400,834 tons, shipped at Oswego and Buffalo for the Erie Canal route. There cleared from Montreal seaward that year 441 vessels, tonnage 315,502, and from Quebec 1041 vessels, 840,065 tons, chiefly timber-laden, and 35 from Three Rivers and Rimouski, with 21,621 tons, of sawed lumber chiefly.

The *Gulf of St. Lawrence* lies between lat. 45° 6′ and 51° 17′ N., and lon. 55° 23′ and 65° W. It is 490 miles long north-eastward and 275 wide, and includes an area of about 64,000 sq. m. It is bounded on the N. W. from the mouth of the river St. Lawrence, at the W. end of Anticosti, to the Straits of Belle Isle, 356 miles, by the rugged Laurentian coast of Inner or Canadian Labrador, hilly but rarely mountainous, with occasional fertile spots suited only for hardy vegetables and hay-crops. It has many harbors for fishing-boats and vessels, and is sheltered by clusters of small islands. Its fisheries are very rich. On the S. E. side the gulf is bounded for 300 miles of its extent by the hilly W. coast of Newfoundland, of Calciferous and Carboniferous formation, which has much good land and timber, and a climate in the S. parts suitable for agriculture, but is uninhabited generally, being frequented exclusively by French fishermen. Then, crossing the main outlet of the gulf, 75 miles wide, the W. coast of Cape Breton Island for 115 miles completes the S. E. boundary to the Gut of Canso. On the S. it is bounded for 140 miles by Nova Scotia, and on the W. for 245 miles by the coasts of New Brunswick and Gaspé, to the mouth of the St. Lawrence. This southern and western circuit of the gulf coast, from Cape Breton to Gaspé, inclusively, contrasts strongly with the more northerly portion of it. Being of generally favorable soil, surface, and climate for agriculture, and of varied and favorable geological formation, with numerous and excel-

lent ship-harbors, it is well studded with important towns and settlements, whose numerous and intelligent populations are prosperously engaged in agriculture, shipbuilding, coal-mining, lumbering, and general commerce, in addition to the fisheries. In the latter several thousand inhabitants of the small sandbar-like Magdalen Islands, out in the gulf, are exclusively occupied. The populous little province of Prince Edward's Island, 2134 sq. m. in area, in the S. end of the gulf, is pre-eminent in agriculture. The island of Anticosti, 3000 sq. m. in area, of Silurian formation, and richer soil though inferior climate, is almost entirely uninhabited, owing to want of harbors and to far-reaching shoals of stratified limestone.

The chief bays of the gulf are the Baie des Chaleurs, between Gaspé and New Brunswick, 90 miles long and 20 in general width, into which falls the large river Restigouche, with 18 miles of further ship-navigation and rich salmon fisheries, as are four other strong rivers falling into the bay. The equally large river Miramichi of New Brunswick enters a smaller bay. The most important on the W. coast of Newfoundland is St. George's Bay, off which there are at times dangerous currents. The gulf has three outlets—the main one mentioned, the Gut of Canso, 15 miles long and 2 in average width, and the Straits of Belle Isle, 60 miles long and 11 to 24 miles wide, the most direct to Europe. By it a strong current sets in, bringing with it icebergs in early summer. The value of the fisheries of the gulf is very great. What was taken in 1875 by the Canadian fishermen resident on its shores amounted to about $3,666,000 in value; to which is to be added the value of the products of the very extensive U. S. gulf fisheries, and that of the French on the whole of the W. coast of Newfoundland. Their amount is not officially ascertained, but may be estimated as over $3,000,000 more. A. J. Russell.

**Saint Leg'er** (Barry), b. in England about 1730; entered the British army as ensign 1756; served as captain at Louisburg 1758, and at Quebec under Wolfe 1759; became lieutenant-colonel May, 1772; was sent to Canada 1775; commanded the unsuccessful expedition against Fort Schuyler Aug., 1777, with the local rank of brigadier, and became colonel Nov., 1780. D. in England in 1789.

**Saint Leon'ard Mid'dleton,** town of England, in Lancashire, 5 miles N. N. E. of Manchester, has extensive manufactories of cotton and silk, numerous good schools, a fine market-house, and other public buildings. P. 9876.

**Saint Leonards** (Edward Burtenshaw **Sugden**), D. C. L., Baron, b. in London, England, Feb. 12, 1781, son of a hair-dresser; studied law at Lincoln's Inn; became a leader of the chancery bar and a bencher of Lincoln's Inn; was made king's counsel 1822; entered Parliament for Weymouth as a Tory 1828; was knighted and appointed solicitor-general 1829; was a strenuous opponent of the Reform bill; was lord chancellor of Ireland 1835, and again 1841–46, and lord chancellor of England 1852, when he was raised to the peerage; was a privy councillor, high steward of Kingston-on-Thames, and deputy lieutenant of Sussex. D. at Thames-Ditton Jan. 29, 1875. He was generally recognized as the highest English authority on property law, a subject which he treated in several useful manuals, from the *Concise and Practical Treatise of the Law of Vendors and Purchasers*, published as early as 1805, to the *Handy Book on Property Law*, issued in 1858 and revised in 1869. In his later years he was a cautious advocate of local reforms. Lord St. Leonards, who had written much in reproof of carelessness in the execution of wills, gave an interesting practical illustration of the necsssity of placing them where they might be secure and accessible. His will, which he was known to have drawn up with great care, could not be found after his death, and it was at last (1876) admitted to probate as repeated verbally from memory by his daughter, Miss Charlotte Sugden, who had been for many years his secretary and amanuensis.

**Saint Liboire',** p.-v., cap. of Bagot co., Quebec, Canada, on Grand Trunk Railway, 38 miles E. of Montreal. P. about 150.

**Saint Lin,** p.-v., L'Assomption co., Quebec, Canada, 32 miles N. of Montreal. It has fine red, black, and gray building limestones, a convent, and extensive manufactures of lumber. P. about 900.

**Saint Lo,** town of France, capital of the department of Manche, on the Vire, 158 miles W. by N. from Paris, has manufactures of druggets, flannels, serges, calicoes, and laces, 6 large printing establishments, and an active trade in cattle, horses, poultry, honey, wax, and butter. The church of St. Croix, built in 805, is one of the completest, best preserved, and most interesting specimens of Saxon architecture. P. 9810.

**Saint Louis',** capital of the French possessions in Senegambia, West Africa, on an island at the mouth of the river Senegal, is fortified, has a good harbor, and carries on an important trade; in 1864 it exported 20 cwts. of ivory and 32,000 cwts. of gum. P. 17,600.

**Saint Lou'is,** county of N. E. Minnesota, bounded N. by Rainy Lake and River, S. by Lake Superior, watered by St. Louis, Vermilion, Embarras, and many other rivers, and including Vermilion Lake, a body of water of considerable extent; is mostly covered with timber, settlements being as yet confined to the shore of Lake Superior. Northern Pacific and Lake Superior and Mississippi R. Rs. have their common terminus at Duluth, the county-seat. Area, 6500 sq. m. P. 4561.

**Saint Louis,** county of E. Missouri, occupying the peninsula between Missouri and Mississippi rivers, S. of their confluence, and drained by the Maramec, has a low and level surface along the rivers, but broken in the interior; embraces extensive deposits of coal and marble, and is traversed by the numerous railroads centring at St. Louis. Manufactures form a very extensive industry, representing an annual value of $158,761,013. Staples, wheat, Indian corn, potatoes, hay, wine, wool, butter, and cheese. Cap. St. Louis. Area, 550 sq. m. Pop. 351,189.

**Saint Louis,** p.-v., Gratiot co., Mich., on Saginaw Valley and St. Louis R. R., 33 miles W. of Saginaw, has excellent water-privileges, good schools, a public hall, 2 banks, 1 newspaper, extensive saw-mills, and several hotels. The Michigan Magnetic Springs are located here. P. 888. J. B. Graham, Ed. "Herald."

**Saint Louis,** city, St. Louis co., Mo., situated in N. lat. 38° 37′ 37.5″ and lon. 6° 0′ 45.29″ W. from Washington. It is on the W. bank of the Mississippi River, 20 miles below the mouth of the Missouri, and has a commanding site, with beautiful suburbs and fine harbor. The city is built on a limestone formation, undulating back and rising to quite an elevation. The climate is temperate, the water good, fuel cheap and abundant. A natural drainage has greatly facilitated the construction of sewerage, and as a consequence the rate of mortality is lower than that of any other large city on the continent. It was founded Feb. 15, 1764, by Pierre Laclede Lingueste, and was designed at first as a mere trading-post, and named in honor of Louis XV. of France. Next year, however, the arrival of St. Ange de Bellerive and his command from Fort Chartres, which had been surrendered to the English, gave additional importance to its establishment, and constituted it thenceforth the capital of Upper Louisiana. Although subject to the authority of Spain by the treaty concluded at Paris in 1763, St. Louis was practically under French control, and remained so until formal possession was taken by Don Pedro Piernas Nov. 29, 1770. In 1800 the territory of Louisiana was retroceded to France, and on Apr. 30, 1803, was purchased by the U. S. The transfer of this vast domain took place in St. Louis Mar. 9, 1804. There is not much of historic importance attached to the early annals of the village. Its interests were interwoven with the romance of frontier-life; its events were those occurrences of special moment to its safety; its chronicles were the expressive designations of a simple people. The attack by Indians in 1780 was known thereafter as *L'année du grand coup*, or "The year of the great blow;" the extermination of some river-pirates in 1788 became memorable as *L'année des dix batteau;* the flood of 1785 was designated *L'année des grandes eaux*, or "The year of the great waters;" and subsequent events were similarly noted as "the year of the hard winter," "the year of the galleys," "the year of the small-pox." The population was hardy, mirthful, adventurous; the French element largely predominated; trade pushed its voyageurs up all tributary streams; quite a commerce in peltries was established abroad; and at the date of its acquisition by the U. S. St. Louis is said to have contained 150 houses. with 1500 inhabitants, making yearly shipment of $200,000 in furs. The town was incorporated Nov. 9, 1809. Its distance from Louisville was then a twenty-five days' journey. A two-month voyage from New Orleans was held a good trip; tangled tow-paths were the main reliance for speed; the batteau the navigator's sole defence against the waters. It was not until Aug. 2, 1817, that the first steamboat landed at its wharf—the Pike, Capt. Reed, low-pressure, built on the Ohio. This constituted an era in the history of the city, and an American population soon began to flow into the place. John Jacob Astor located the Western department of his company there in 1819. Previously, Lewis and Clarke had made it the starting-point of their celebrated expedition, and from there also Gen. Ashley subsequently set forth to explore the passes of the Rocky Mountains. By this time, however, great change had taken place. Various industries had been organized, capital was

abundant, enterprise buoyant. A cathedral decorated with original paintings by Rubens and Raphael replaced the humbler house of worship. A university was established, complete in its appointments and containing a library of 8000 vols. imported from Europe. Ten subordinate schools were put in operation. Three newspapers were published; a bank was organized; a museum of curiosities founded, and every aspect attested it as a centre of rare prosperous fortune in the then wilderness of the West. As a striking illustration of the adventurous spirit which characterized the early population of St. Louis, the journey of Russel Farnum may be worthy of historical preservation. He had been employed for some time in the trade of Mr. Astor, and was sent with orders to the stations around Astoria. Having delivered his despatches, and being possessed of a desire to explore unknown parts, he started forth again northward along the Pacific coast, visited the Hudson Bay settlements, reached Behring Strait, passed over on the ice in the winter of 1813–14, entered Siberia, and proceeded alone and on foot across its vast expanse to St. Petersburg. He introduced himself to the American minister, was sent forward by the czar to Paris, and finally returned to St. Louis, where he died of cholera in 1832.

The Territorial organization of Louisiana which had been enacted by Congress in 1812 was not adapted to the wants of the communities W. of the Mississippi, and the demand for a State government being more and more imperative each year, St. Louis, as the centre of population, became naturally the focus of political agitation. It was at this time the slavery question first obtruded upon our national arena, taking shape in the so-called "Missouri restriction." The Compromise of 1820 which followed was supplemented by the calling of a convention to frame the State constitution, and its discussions, connected necessarily with exciting themes, brought into political prominence many of those citizens of St. Louis whose reputations afterward became national. Benton and Bates, Barton, Lucas, O'Fallon, Geyer, and Gamble, are names that will live in the history of the country not less than in that of the city. A new charter was given to St. Louis Dec. 9, 1822, William Carr Lane being the first mayor elect. This was amended from time to time, and occasionally an entirely novel charter was furnished by the legislature, and nearly always with injurious effect upon some of the great property interests designed to be protected. At last the evil became so serious as to demand constitutional intervention, and the city charter has finally been placed under the ægis of the fundamental law of the commonwealth. For five-and-twenty succeeding years unprecedented growth and prosperity attended upon St. Louis. Within that period many of its largest public improvements were inaugurated, and the foundations laid of that great commerce which now extends to every part of the world. A period of depression, however, was in store to try its energies to the uttermost. The financial reverses beginning in 1837 and extending through the next decade were serious inflictions upon a young metropolis; but the great flood of 1844, desolating all the fertile valleys and surpassing even that of 1785, followed by the fearful ravages of the cholera, beginning in 1848 and sweeping off a sixth of the entire population, and succeeded in turn by the great fire of 1849, which destroyed one-third of the city and almost obliterated its marine, gave it a great shock that to almost any other community would have proved irreparable. Confidence, however, revived with the new year, and the inauguration of railway enterprise gave a stirring and attractive impulse to the business connections of St. Louis. The Pacific R. R. was commenced in 1851, the Ohio and Mississippi in 1852, the Chicago and Alton in 1853, and the Iron Mountain and Southern R. R. in 1854, thus attesting the zeal with which these new commercial agencies were developed. The city subscribed largely to most of the railroad enterprises, incurring thereby the greater portion of its existing public debt.

The growth of St. Louis, again for some years exceedingly rapid, was brought to a stand by the breaking out of the civil war. One of the earliest collisions of the war occurred in its streets, and the first Federal victory of any moment was achieved in the capture of a hostile camp of State militia located in its suburbs. This secured to the government the arsenal, a great store of arms, eventual possession of the State, and a consolidation of the whole North-west in its support. Proximity to the theatre of hostilities suspended all business other than the supplying of armies, and at the close of the war St. Louis found itself with no trade, a worthless shipping, and a legacy of bad debts. One great benefit had resulted, however, which was the abolition of slavery. The prejudice in Northern sections of the country against this institution had already begun to operate unfavorably against its business interests prior to the war, and to favor a concentration for exchange at some point on free soil; but rid of this incubus, and stimulated by large expenditures of the government, and encouraged by an immense Eastern immigration which poured into the city, everything soon assumed a new aspect. The trade of the South was swiftly regained, that of the North was eagerly contended for, and that of the West was immensely developed. Unprecedented activity prevailed likewise in extending railroad connections. Direct routes were built to unite more closely with the great central lines of New York, Pennsylvania, and Maryland; the Kansas Pacific and the Atlantic and Pacific were pushed forward to completion; and all-rail routes were established to Texas and the Gulf of Mexico. Thus, the next decade enabled it to become the third city in magnitude in the U. S. The subjoined table of population well illustrates its history and progress:

| | | | |
|---|---|---|---|
| 1799 | 925 | 1852 | 94,000 |
| 1810 | 1,400 | 1856 | 125,200 |
| 1820 | 4,928 | 1860 | 185,587 |
| 1830 | 5,862 | 1866 | 204,327 |
| 1840 | 16,469 | 1870 | 310,864 |
| 1844 | 34,140 | 1873 | 428,126 |
| 1850 | 74,439 | 1876 | 498,182 |

The government of St. Louis consists of a mayor elected for two years, a council consisting of two members from each of the twelve wards, and various commissions having in charge the waterworks, the health, police, fire, and other departments. Changes are in preparation, however, under the provisions of the new State constitution, which will materially modify this distribution of powers, and perhaps involve a very large extension of the area of the city.

The bonded debt of St. Louis is $16,270,000, with a floating debt, the larger part of which is litigated, of $1,027,000. Its assets in the shape of property, including a sinking fund, are valued at $13,045,363. The real and personal estate within the corporation limits amounts to $166,999,660. The rate of assessment for municipal purposes, exclusive of a tax to pay interest on bonded debt, is limited to 1 per cent. The credit of the city is good, and its renewals negotiate in London at a premium. Statistics of the engineer department show the length of wharf or river front to be $11\frac{3}{10}$ths miles, of which about 3 miles are paved. Of macadamized streets there are 225 miles; of Nicolson pavements 10 miles, chiefly confined to the business sections; and of paved alleys and courts 41 miles. The system of sewerage is admirable, embracing in mains, branches, and district sewers 168 miles, besides 51 miles of private drainage. The mains have a diameter of 20 feet, the territory finished comprises 3334 acres, and the whole cost is estimated at $6,241,600. The waterworks constitute an important feature in the internal economy of the city. The supply is drawn from the Mississippi River some miles above, is received in four immense settling-basins, thence pumped up into distributing reservoirs, and pressure maintained by an elevated water-tower. The average consumption of water is 20,722,293 gallons daily; the largest quantity ever used in any one day was 29,580,343, as gauged at the basins. The receipts from water-rates in 1875 were $564,860, as against an expenditure of $579,391. The extent of pipe laid down is 165 miles. The city is in litigation for possession of the gasworks, held as the property of two private corporations. The total of lamps erected is 6189. The price of gas is $3.25 per M. feet; the regulation standard 13 candle-power. There are 275 miles of fire-alarm and 50 miles of police telegraph in operation. A paid fire department has added much to the security of property. Its equipment consists of 18 steam fire-engines, 3 hook and ladder companies, and 1 chemical engine; the staff consists of 1 chief, 5 assistants, 1 secretary, and 90 men. The total running expenses for the year $256,315. Total loss by fire, $335,322, on which the insurance was $286,137. A salvage company, supported by the underwriters, has been found of great service, and yearly saves many thousands of dollars. A well-appointed and well-disciplined police force has long been a source both of pride and protection to St. Louis. Recent extensions of territory, however, render an increase of its numbers desirable, as in that respect it is inferior to most well-organized cities. It consists of 1 chief, 6 captains, 43 sergeants, 12 detectives, and 350 men. The pay-rolls amount to $390,000, besides a contingent expense of $110,000, making a total of $500,000 annually for the support of the establishment. The number of buildings erected in 1875 was 1774, of improvements, 198; valued in all at $5,622,930.

The public parks present one of the most attractive features of St. Louis. With wise prevision a great many spacious squares were early reserved for pleasure-grounds, and time and taste have so added to their adornment that they now offer delightful retreats in the midst of the busy life of the city. More conspicuous still, however, are the greater parks, which almost connect in a semicircle from the river on the N. to the river on the S. The first of these is

O'Fallon Place, containing 180 acres, strikingly picturesque in scenery, with a commanding view of the Mississippi, and covered with a forest of native growth. The Fair Grounds, which come next, although embracing only some 83 acres in extent, have many interesting features other than the annual display which has attained such renown. Its amphitheatre of 540 feet diameter, with a greater seating capacity than any other in the world, its art-halls, its galleries of mechanism, its ample course for trials of speed, its zoological gardens, designed to embrace the largest collection of animals on the continent,—all combine to render it a favorite resort for the multitude. The Forest Park succeeds with its immense area of 1374 acres, threaded with rivulets and roadways, and forming a continuity of beautiful landscape. The Missouri Botanical Garden, of 50 acres in the highest state of cultivation, then intervenes, with its immense carpet of flowers, its arboretum embracing every tree known to the temperate climate, and its cabinet of curiosities enriched by innumerable rare and interesting studies. Tower Grove Park, which adjoins, is 350 acres in extent, planted with great care and taste, and handsomely cared for under an appropriation of $25,000 a year. Its improvement is very thorough, its roadbeds costing $60,000 a mile, and the expenditure upon it has already exceeded by threefold the original estimates. It is the munificent gift of a private gentleman to the city of St. Louis. Carondelet Park stretches away to the S., and completes the environment. It is not so well adorned as some of the others, but has many features which in time will give it great beauty. In the extension of the city limits to take in all the parks for police and other purposes, as provided by law, it is designed to connect them all by a boulevard sweeping from one extreme to the other, and constructed in a manner that will endure for ages. Access from the city proper is had by various steam roads that intersect the several parks, as also by extensions of the different tramways penetrating the leading avenues of the city. These latter are numerous and well equipped, covering more than 75 miles of streets, transporting daily 100,000 passengers, and representing an outlay of $3,000,000.

In outward look St. Louis shows many marks of its origin, and has but little of that newness so common with American cities. It presents a solid and substantial, rather than a costly, aspect. There are, however, many fine buildings, whilst the character of private residences is rapidly taking luxurious and ornate shapes. Thus, the new custom-house in course of erection on Seventh street is designed to be one of the largest and handsomest public edifices in the U. S. It is estimated to cost $4,000,000, but will probably reach twice that sum if finished according to the present design. The adaptation is very perfect. The material is red and gray granite, supplied in large part from quarries in the State of Missouri. The Merchants' Exchange, on Third street, is another imposing structure. It is just completed at a cost of near $2,000,000. The front is 233 feet, the depth 187 feet, the material sandstone, the order Renaissance. The grand hall is 222 feet by 93 feet, with an elevation of 60 feet, and unobstructed by columns throughout. The Four Courts is a very conspicuous building, combining the attributes of a prison and a place of justice, and furnishing likewise appropriate quarters for the police. All the criminal business of the city is transacted here. The court-house, erected on ground donated in 1823, was half a century in constructing, and has involved an outlay of $1,250,000. It is built in the form of a Greek cross, with porticoes and columns on either front, and an iron dome of rather excessive proportion in the centre. The various civil courts are congregated there, as also the revenue service, the law library, and the records of land titles. The insane asylum, built upon the most improved hygienic plans, occupies an elevated site in the suburbs, and presents a most imposing architectural display. In the attempt to secure pure water for the institution an artesian well was sunk to the depth of 3852 feet, but stopped in granite without the desired success. The building cost $900,000, and has a capacity for 300 patients. The Mercantile Library Building is interesting rather from the treasures of art and literature which it contains than from any striking appearance. Like the Polytechnic, it has well served the purposes of an earlier time, and the foundation laid in each for extensive and useful libraries gives great future promise. Plans for enlarged fireproof structures are being canvassed, and it cannot be long before they will be carried into effect. They together contain about 90,000 volumes. The Emigrants' Home and the Widows' and Infants' Asylum, two noble charities that are faithfully administered, were endowed by private legacies. They form conspicuous objects of interest to visitors, and will long endure as witnesses to the worth that established them. The institution for the blind, under the management of the State, is an extensive building, on Morgan street, that has recently been much improved and furnished with extensive workshops, designed to give trades to the inmates. It has a capacity for receiving about 200 pupils. Another smaller institution for the deaf and dumb, where great success is attained in teaching them to converse intelligently by articulation, is situated on Bremen Avenue. Hotels are numerous and capacious, comprising several splendid edifices, most prominent of which are the Laclede, Southern, and Lindell. Others on still more extensive scales are projected. A tunnel under one of the principal thoroughfares and a union dépôt at a central point have added largely to the facilities of the travelling public. The most noted structure of St. Louis, however, is the bridge across the Mississippi, which from the boldness of its engineering and the magnificence of its proportion has attained a world-wide celebrity. The entire length is 2225 feet; it contains 5600 tons of steel and iron, whilst its cost has exceeded $10,000,000. The superstructure consists of three arches supported by abutments on either shore, and two massive granite piers, built up from the rock foundations 110 feet below the level of the river. Two of the spans are 500 feet each, and the central one 520 feet, being the longest span ever erected. These are framed of steel tubes, sustaining truss-ribbed arches, fastened by braces of charcoal iron. Built without the erection of false works, regardless of inclement seasons, with few fatalities attending the work, it will remain an enduring monument to the genius and energy of its architect, Mr. James B. Eads. Many fine churches adorn St. Louis and attest the liberality of its citizens. Of these there are enumerated in the directory 13 Presbyterian, 2 Unitarian, 28 Roman Catholic, 18 Methodist, 9 Baptist, 3 Christian, 4 Congregational, 10 Episcopal, 16 German Evangelical, 4 Hebrew, and 4 missions. Of the different hospitals, that of the quarantine is situated some distance below on the river, that of the city in the southern portion, and that of the Sisters in the northern suburbs. There are also under denominational charge the Alexian Brothers, Good Samaritan, Marine, Female, St. Louis, and two lying-in charities. Somewhat kindred institutions are presented in the Woman's Christian Home, Girls' Industrial Home, Widows' Home, Little Sisters of the Poor, and various orphan and half-orphan establishments. Organized societies for the relief of the indigent are connected with most of the Church associations. Provision is also made at public expense for gratuitous furnishing of medicines and medical advice from a city dispensary.

In educational progress St. Louis has in no wise disappointed the promise given in its early day. Colleges of great excellence, many academies of repute, and private schools without number have grown up with the growth of the city. Of sectarian institutions there are not less than 36 Roman Catholic, 12 Lutheran, and 15 of other denominations, of which the most prominent are the St. Louis University, the Academy of Loretto, the Sacred Heart, the Visitation, and the Ursuline. Of those non-sectarian, the Washington University, Mary Institute, and Bonham School are the more important. But the fame of St. Louis has gone forth even amongst European educators for the excellence of its public-school system rather than its private establishments. This is admirably organized and largely endowed. In 1812, Congress donated certain vacant lands and common lots within the district of St. Louis to the support of public schools. In 1831 the grant was made effective by additional legislation, and in 1833 the first school board was elected under the new charter and entrusted with custody of the property so acquired. The first building was erected and first school opened in 1846. It was not until 1849 that a permanent city tax of 1 mill, afterward in 1865 increased to 5 mills, was voted for school purposes. In addition, the public-school system derives its proportionate share of the general school fund, which is 25 per cent. of the gross revenue of the State. An enhancement of the values of real estate, increased general revenue, and high assessments by the city have enabled the school board to organize with ample means at its command. As one consequence, no charge is made for tuition; as another, only the best talent is employed, and that well remunerated. The property schedule of the board for 1875 exhibits the following: real estate used for school purposes, $2,386,620; held for future uses, $1,289,991; receipts are, from rents, $52,855; from State school moneys, $91,083; from city taxes, $645,176; from other sources, $60,398; making a total of $849,513. Results show a most efficient application of these large resources. A conclusion has been reached which seems to combine the maximum of effect with the minimum of expenditure. Thus, there are now 56 commodious school buildings completed, and 5 temporarily rented, containing a total of 32,070 seats. The number of registered pupils is 43,852; average belonging, 29,309, and average attending, 27,100. The average number of teachers is 769, with

salaries aggregating $522,350. The average of attendance is practically 94 per cent.; average cost of tuition per scholar, $19.21; average of incidentals, $2.53. There are 44 schools, with 74 teachers, having German and English classes, embracing 11,527 German-American and 5670 Anglo-American scholars. Drawing has been introduced systematically throughout all the grades of advancement. Admission is had at six years of age. Corporal punishment is discountenanced. The classification is that of a normal school, high schools, district schools, and recently there has been attached the Kindergarten for very young children. Evening schools, introduced some years since, have met with marked success. The course of study and method of instruction arrived at cannot be analyzed in any brief space, but it can be said that it stands second to none in the success attained. The present system is the product of careful, persistent, enlightened work, in which the practice of other cities and the labored research of other nations have been freely laid under contribution. It has thus been a creation rather than a growth, and the high educational standards wrought out confer distinguished honor upon its superintendent, Mr. William T. Harris, who has devoted years of scholarly toil to its perfecting.

The financial system of St. Louis consists of 7 national, 31 State, and 19 private banks not in the clearing-house, with a combined capital of $19,559,542. The savings and time deposits are $16,144,337; demand deposits, $24,562,084; cash and exchange, $11,778,495; loans, discounts, and bonds, $45,928,085. The circulation of the national banks is only $706,690, and the aggregate bank-clearings for the year, $1,151,372,654. The ordinary rate of discount is from 8 to 10 per cent. Total taxation on real estate, including State, county, city, and schools, for 1876 was 3.48½ per cent. The insurance business has been very successfully prosecuted in St. Louis. Of home companies there are organized under the laws of the State 12 stock and 14 mutual, all having their head-offices here. There are also 10 European companies, and of the 139 companies of other States carried on the books of the insurance department almost all have offices in the city, with a cash capital of $35,280,000, assets $84,505,000, liabilities $33,164,000, and surplus $16,060,000. The business of the stock companies is of gross assets $4,301,352, liabilities $890,288, income $1,951,586, expenditure $1,645,971; of the mutuals, premium notes $4,619,000, liabilities $104, income $370,000, and expenditure $323,000.

As a manufacturing city St. Louis, according to the last census, ranked fourth in the U. S., and since then a comparison made with great care, showing the capital employed and the production of 40 leading manufacturing interests, demonstrates an increase of 36 per cent. The total amount is now estimated at $200,000,000. The great resources of the State in minerals, timber, earths, and other materials has been one cause of this rapid growth, which may be well illustrated by an announcement made on the completion of the new exchange that the granite in its foundations, the sandstone of its walls, the framework of iron, and the finishing of wood, the lead, and the zinc, the glass, and the paints for its frescoes, all came from Missouri. The vast coal-fields which lie underneath its very site, and which intersect the bluffs across the river, extending for many miles, supply cheap and inexhaustible fuel, and the process of desulphurizing, recently applied with such success, must give increased activity to many of its large manufacturing enterprises, especially those of steel and iron. In fact, this branch of its business is as yet in its infancy, although numerous furnaces are congregated along the river, and one of the largest rolling-mills in the world for the manufacture of steel rails has just been completed. The Board of Trade report for 1876 presents an elaborate summary of the leading industries of the city well worth being consulted. Probably no better evidence could be adduced of the extent to which the manufactures of St. Louis command the markets of the world than the facts that its brands of flour rank highest in England; it supplies machinery to the mines of old Mexico; it sends railway iron to Brazil; and has recently shipped a large order of steamer engines to the Sea of Okhotsk. The ores of the State are sent from its wharves to all the large furnaces of every country, its manufactures of hollow-ware have large sales even in Germany, and its meats are on the market in the cities of remotest India.

The commerce of St. Louis, which depended for a long time upon river navigation, received great impulse from the railroad connections as they were made, and its increase was commensurate with their extension. Latterly, a demand for cheap freights, modifications in constructing steamers, the introduction of a system of barges and tows, are bringing the great water-ways into prominence again. Deepening of the channel of the Mississippi at its mouth, so as to admit sea-going vessels of the largest size, and confining its waters along the whole length by levees, promise to give to St. Louis more importance still as a dépôt where the grain of the North-west will collect for shipment to Europe. There are now 14 trunk-lines of railroad entering the city, with an estimated arrival and departure of 200 trains daily. The receipt of freights by them aggregated 3,232,770 tons for the year. The total arrival of steamers was 2201, of barges 743, and freights 663,525 tons.

Custom-house exhibits for 1875 show collections $1,186,202, foreign value warehoused $1,635,793. Great attention has been devoted latterly by the merchants of St. Louis to the removal of barriers between consumer and producer, and to facilitating in every way the interchange of commodities. A bureau of freights has been organized at the exchange, custom-house regulations that impeded direct importation have been abolished, and extensive European connections established which give promise of large results hereafter. In fact, the commercial advantages of St. Louis are in many respects unequalled. It commands more than 6000 miles of direct river navigation, made accessible to steamers and barges for a large part of the year. Situated, too, at a point where the open flow to the South breaks away from the frozen streams of the North, where deeper channels give opportunity for more commodious vessels, and where the growths of the far West meet the manufactures of the East, immense transfers of freights will necessarily be involved, and the foundations thereby laid of a city which in time to come may rival the ancient queens of commerce. B. Gratz Brown.

**Saint Lou'isville,** p.-v., Newton tp., Licking co., O., on Lake Erie division of Baltimore and Ohio R. R. P. 166.

**Saint Luce,** p.-v., cap. of Brevard co., Fla.

**Saint Luci'a,** an English island of the Windward group, West Indies (lat. 14° N., lon. 61° W.), 24 miles S. E. of Martinique and 21 N. E. of St. Vincent; is 26 miles in length by 11 in breadth; has a circumference of 150 miles, an area of 250 sq. m., and a p. in 1871 of 31,811, of which number only 910 were white. The surface is mountainous and covered with valuable timber and dyewoods, and an extinct volcano supplies an inexhaustible quantity of sulphur. The climate is warm and unhealthy, and destructive hurricanes are not infrequent. Staple productions, sugar and cacao. The government is in the hands of an administrator, an executive and a legislative council, resident at Castries, and subject to the governor-in-chief of the Windward Islands. Settled by the English in 1609, the colony has several times been held by the French, and was finally recaptured 1803.

**Saint Malo',** town of France, department of Ille-et-Vilaine, near the mouth of the Rance, on a small island in the English Channel, connected with the mainland by a causeway 650 feet long. The harbor, which is perfectly dry at ebb-tide, has from 40 to 50 feet of water at flood-tide, is large and safe, and defended by fortifications both on the mainland and on the island. Cod and herring fishing in the Channel and for seals and whales in the Arctic Ocean, trading along the coast and to foreign ports, shipbuilding, and the manufacture of sailcloth, ropes, and every kind of naval fittings are vigorously carried on. P. 12,316.

**Saint-Marc Girardin.** See Girardin (Saint-Marc).

**Saint Marie',** p.-v. and tp., Jasper co., Ill., on Embarras River. P. 1452.

**Saint Marie,** tp., Green Lake co., Wis. P. 705.

**Saint Mark's,** tp., Clarendon co., S. C. P. 480.

**Saint Mar'tin,** one of the Lesser Antilles, in the West Indies. Area, 30 sq. m. The northern part belongs to France, and has 3450 inhabitants; the southern to the Netherlands, and has 3157. From its extensive salt marshes more than 300,000 vats of salt are made annually.

**Saint Martin,** parish of S. Louisiana, bounded E. by Atchafalaya River, S. by Lake Chetimaches, and drained by Bayou Teche, has a level surface and a fertile soil. Staples, cotton, sugar, and molasses. Cap. St. Martinsville. Area, 500 sq. m. P. 9370.

**Saint Martin,** tp., Stearns co., Minn. P. 556.

**Saint Martin** (Alexis). See Beaumont (William).

**Saint Martin'** (Antoine Jean), b. at Paris, France, Jan. 17, 1791, was the son of a tailor; studied Oriental literature under Sylvestre de Sacy, and took part in politics under the Bourbons. D. at Paris July 20, 1832. Author, among other works, of *Mémoires historiques et géographiques sur l'Arménie* (2 vols., 1818–22) and of treatises on the chronology of the Ptolemies and on the zodiac at Dendera.

**Saint-Martin, de** (Louis Claude), Marquis, generally known under the name of Le Philosophe inconnu, b. at Amboise, department of Indre-et-Loire, France, Jan. 18, 1743; served for some time in the army, but lived subsequently in retirement, devoting himself to the study of theology and philosophy, especially the mystics Martinez Pasqualis, Swedenborg, Jakob Böhme. D. at Paris Oct. 13, 1803. His writings, *Des Erreurs et de la Vérité, par un Philosophe inconnu* (1775), *Tableau naturel des Rapports, qui existent entre Dieu, l'Homme et l'Univers* (1782), *Ecce Homo* (1796), *De l'Esprit des Choses* (1800), *L'Homme de Désir* (1790), etc., are all against sensualism and materialism. In France they made no great impression, but most of them were translated into German. (See Matter, *St.-Martin, le Philosophe inconnu*, 1862.)

**Saint Martin's,** p.-v. and tp., Worcester co., Md., on Isle of Wight Bay. P. 1133.

**Saint Martin's Island,** Delta co., Mich., in Lake Michigan, at mouth of Green Bay. P. 101.

**Saint Martins'ville,** p.-v., cap. of St. Martin parish, La., on Bayou Teche, has 2 newspapers. P. 1190.

**Saint Ma'ry,** parish of S. Louisiana, bounded N. E. by Lake Chetimaches, S. E. by Atchafalaya River, and S. by Atchafalaya and Côte Blanche bays, has a marshy but productive soil. Staples, sugar, molasses, rice, and Indian corn. Cap. Franklin. Area, 860 sq. m. P. 13,860.

**Saint Mary,** tp., Waseca co., Minn. P. 737.

**Saint Mary's,** port of entry of the district of Placentia and St. Mary's, Newfoundland. The fisheries and agriculture are carried on. The harbor is excellent. The town is 65 miles by land S. W. of St. John's. P. 650.

**Saint Mary's,** p.-v., Perth co., Ont., Canada, on the N. W. branch of the river Thames, at the junction of the London branch with Grand Trunk Railway, 22 miles N. of London. It is a prosperous and well-built town, has a large trade in grain, quarries of fine limestone, 2 splendid railway viaducts, important manufactures, and 2 weekly newspapers. P. 3120.

**Saint Mary's,** county of S. Maryland, lying between Patuxent River on the N. E., Chesapeake Bay on the E., and Potomac River on the S. W., watered by numerous small bays and creeks. Staples, tobacco, wheat, and Indian corn. Cap. Leonardtown. Area, 250 sq. m. P. 14,944.

**Saint Mary's,** p.-v. and tp., cap. of Camden co., Ga., on St. Mary's River. P. 702.

**Saint Mary's,** tp., Hancock co., Ill. P. 1650.

**Saint Mary's,** tp., Adams co., Ind. P. 925.

**Saint Mary's,** tp., Mills co., Ia. P. 279.

**Saint Mary's,** tp., Pottawattamie co., Kan. P. 1205.

**Saint Mary's,** p.-v., Marion co., Ky., on Louisville and Nashville and Great Southern R. Rs. P. 113.

**Saint Mary's,** tp., Perry co., Mo. P. 1940.

**Saint Mary's,** p.-v. and tp., Ste. Genevieve co., Mo., on Mississippi River. P. 397.

**Saint Mary's,** tp., Wake co., N. C. P. 2124.

**Saint Mary's,** p.-v. and tp., Auglaize co., O., on Miami Canal, has 1 weekly newspaper. P. of v. 1370; of tp. 2420.

**Saint Mary's,** p.-b., Elk co., Pa., on Philadelphia and Erie R. R., has 3 churches, a convent, and seminary, 1 bank, 1 newspaper, 2 foundries, 2 flouring and 2 planing mills, and several wagon and carriage manufactories. Principal business, lumbering and mining coal. P. 1084.

G. C. Brandon, Ed. "Gazette."

**Saint Mary's,** p.-v., cap. of Pleasants co., West Va., on Ohio River.

**Saint Mary's Hall,** an Episcopal school for girls, situated at Faribault, Minn., 56 miles from St. Paul, was founded in 1866 by the Rt. Rev. H. B. Whipple, bishop of Minnesota. In 1872 the school came under the control of a board of trustees. The bishop is president of the board and rector of the school. It has accommodations for 70 resident pupils. Its curriculum embraces a preparatory department, followed by a four years' course in history, English literature, Latin, modern languages, mathematics, and natural sciences. Music, drawing, and painting also receive special attention. It has a corps of 10 teachers, including the principal, Miss S. P. Darlington. It has property amounting to $35,000, including a valuable telescope, philosophical and chemical apparatus, a museum, and library.

R. W. Lourie.

**Saint Mary's Mission,** p.-v., St. Mary's tp., Pottawattamie co., Kan., on Kansas Pacific R. R., and on the Pottawattamie reserve, 23 miles from Topeka, has 1 weekly newspaper.

**Saint Mary's River,** the outlet of Lake Superior, after a course of 75 miles, and a total fall of 20½ feet, 18 of which, in the distance of a half mile, constitute the rapids or Sault Ste. Marie. Ste. Mary's Falls Canal was built to enable vessels to pass around these rapids. In 1850 a grant of 750,000 acres of land was made to the State of Michigan, by act of Congress, to defray the cost of building the canal. Work was commenced in 1853 by a company under contract with the State, and on June 18, 1855, the canal was opened to navigation. It is supposed that it cost the company about $1,000,000. As originally built, the canal was 5400 feet in length, had a width of 100 feet at the water-line, with paved slopes of 1½ to 1, and a depth of 12 feet at mean stage. The locks, located near the foot of the canal, were two in number, combined, each 350 feet long, 70 feet wide, lift 9 feet. There was a guard-gate near the upper end of the canal. The capacity of the canal and locks was soon found to be inadequate to the rapidly-developing navigation to and from Lake Superior. To ameliorate these evils the improvement of the canal was taken in hand by the U. S., and work commenced in 1870. When completed, the improvements will consist of a new lock parallel to and at a clear distance of 100 feet from the old locks; an enlargement of the old canal so as to uncover the approaches to the new lock; deepening the canal to a depth of 16 feet; removing the old slope-walls, and substituting for them a timber revêtment with a vertical face; the lock-chamber will be 515 feet long, 80 feet wide, with a lift of 18 feet and a depth of 17 feet of water on the sills. To facilitate repairs, a pair of guard-gates will be placed both above and below the lock-chamber. The estimated cost of the improvement is $1,800,000. The great cost of both the original work and the improvement is due to the difficult character of the excavation in sandstone overlaid with a compact bed of gravel and boulders, to the remoteness of the work from sources of supply, and to the severity of the winters, during which season a large part of the work has been done.

G. Weitzel.

**Saint Mary's River,** of Georgia and Florida, rises in Okeefenokee Swamp, and throughout a large part of its course of 100 miles is the boundary between the two States. Its bar has 13 feet of water at low tide, and 18 or 20 feet at high tide. Large vessels ascend 9 miles to St. Mary's, and small steamers can go up many miles farther.

**Saint Mat'thew's,** tp., Wake co., N. C. P. 2192.

**Saint Maur, Congregation of,** a body of reformed French Benedictines, organized 1618, had at one time 124 houses, but was suppressed by the French revolution. The members of this congregation distinguished themselves by their collective editions of the Greek and Latin Fathers, especially those of Montfaucon, Mabillon, and Ruinart. The congregation was restored on a small scale in 1833 at Solesme, near Le Mans.

**Saint Maurice',** county of Quebec, Canada, extending N. W. from the St. Lawrence, and reaching far into the northern wilderness. Its S. E. portion is fertile. Iron ore is found. The lumber-trade is important. There are large manufacturing interests in the vicinity of Three Rivers, the capital. P. 19,558.

**Saint Maurice For'ges,** p.-v., St. Maurice co., Quebec, Canada, on the navigable St. Maurice River, 7½ miles from Three Rivers. Here bog-iron ore is extensively collected, smelted, and cast for stoves. Six miles E. is the beautiful St. Maurice Village, Champlain co., where bog-ore, moulding-sand, limestone, fireproof stone, etc. abound. P. of the Forges, about 300; of St. Maurice Village, about 250.

**Saint Maurice River,** a northern tributary of the St. Lawrence, which it enters at the city of Three Rivers, 9 miles below Lake St. Peter, in the province of Quebec. From its source, 216 miles N. N. W. from the city of Montreal, it flows N. E. 66 miles, then 167 miles S. E., then 130 miles southerly to its mouth; total length of course, 363 miles; extreme length of valley, 223 miles, width 140 miles; area, about 16,000 sq. m. Its chief tributaries are the Mattawin, 120 miles long; the Bostonnais, 75 miles long; the Croche, 85 miles long; the Vermilion, 115 miles long; and the Mannowan, 90 miles long. The St. Maurice is navigable for steamboats from the Grand Pilles, 34 miles above its mouth, to La Tuque Rapids, 66 miles farther up. The climate is generally too cold for the growth of wheat, though suitable for it in the lower two-thirds of its valley. Its forests contain much valuable timber, that with its iron, which is abundant and of an excellent quality, constitutes its chief wealth and its principal export. About 500,000 saw-logs of pine and spruce are cut annually on the St. Maurice. The wild scenery of the river is highly interesting. Apart from Niagara, the Falls of Shawenegan, 22 miles above the mouth of the St. Mau-

rice, 160 feet in height, are incomparably the greatest and most sternly impressive of the waterfalls of old Canada. The ordinary discharge under the two bridges of 1400 and 600 feet in length, that span its channels near its mouth, is about 40,000 cubic feet per second. A. J. Russell.

**Saint Mi'chael,** the largest of the Azores (which see), in lat. 37° 44′ N., lon. 25° 30′ W., comprises an area of 340 sq. m., with about 81,000 inhabitants. It is the most fertile and best cultivated of the Azores, and exports annually to England alone 100,000 boxes of oranges, valued at £60,300. Grain is exported to Portugal, coarse linen and pottery to Brazil. Chief towns, Ponta Delgada and Ribeira Grande.

**Saint Michael's,** p.-v. and tp., Talbot co., Md., on St. Michael's estuary, has 1 weekly newspaper, several shipyards, and a considerable trade in oysters. P. of v. 1095; of tp. 3448.

**Saint Michael's,** tp., Madison co., Mo. P. 1325.

**Saint Michel' de Bellechasse',** p.-v., cap. of Bellechasse co., Quebec, Canada, on the S. shore of the St. Lawrence and on Grand Trunk Railway, 15 miles below Quebec. It has a convent, a commercial college, a lumber-trade, and 2 steamers plying to Quebec. P. about 700.

**Saint Mihiel',** town of France, department of Meuse, on the Meuse, has manufactures of yarn, stockings, hosiery, cotton cloth, and leather. P. 5467.

**Saint Nazaire',** town of France, department of Loire-Inférieure, at the mouth of the Loire, has a large and commodious harbor, recently constructed. As the navigation of the Loire becomes more difficult every year on account of the amount of sand which it carries with it, St. Nazaire seems most likely to become the chief entrepôt of the great traffic of this river. It had 2391 inhabitants in 1851, 6500 in 1861, over 15,000 in 1871.

**Saint Nich'olas,** p.-v., Mahonoy tp., Schuylkill co., Pa., on East Mahanoy branch of Philadelphia and Reading R. R.

**Saint Nic'olas,** town of Belgium, province of East Flanders, has the largest flax-market in the world, and extensive manufactures of linen, woollen, cotton, and silk fabrics, hosiery, hats, soap, leather, salt, and tobacco. It is situated in one of the most fertile and most densely-peopled districts of Belgium, and besides the exportation of its manufactured goods its home trade is very important. P. 23,388.

**Saint Nicolas,** v., Levis co., Quebec, Canada, on the S. shore of the St. Lawrence, 15 miles above Quebec, with which it is connected by steamer. It has a large lumber-trade and many manufactories. P. about 600.

**Saint Olof,** p.-v. and tp., Otter Tail co., Minn. P. 408.

**Saint Omer',** town of France, department of Pas-de-Calais, on the Aa, is fortified and well built, and has extensive manufactures of salt, beetroot-sugar, soap, brandy, and clay pipes. P. 22,381.

**Saint Ours,** p.-v., Richelieu co., Quebec, Canada, on the E. bank of Richelieu River, 12 miles from its mouth, has a good trade, manufactures of shipping and of bricks, a mineral spring, and a convent. P. 701.

**Saint Par'is,** p.-v., Champaign co., O., on Pittsburg Cincinnati and St. Louis R. R., has 5 churches, a public school, 3 warehouses, 1 newspaper, 1 bank, 2 carriage-factories, 1 flouring and 2 planing mills, and 2 saw-mills. Large quantities of grain, flour, stock, and lumber are exported. P. about 1200.

W. H. Gribble, Ed. "New Era."

**Saint Paul,** town of the French island of Bourbon, on the western side of the island, has a good harbor and considerable trade. P. 16,262.

**Saint Paul,** p.-v., Adams tp., Decatur co., Ind., on Indianapolis Cincinnati and Lafayette R. R. P. about 500.

**Saint Paul,** capital and largest city of Minnesota, county-seat of Ramsey co., on Mississippi River, 2082 miles from its mouth, in lat. 44° 52′ 46″ N. and lon. 93° 4′ 54″ W. It is built mainly on the E. bank, but by a recent extension of its corporate limits now includes a considerable area on the W. side of the river, the two sections being connected by a free bridge. It is built on three tables of land, the lowest being the "river-bottom;" the second, a plateau on which the main portion of the city is built, which is surrounded by an amphitheatre of hills on which are some elegant residences. A considerable portion of the second plateau is underlaid by a bed of limestone of great value for building purposes. The first house was built in 1838, and the city derives its name from a Roman Catholic mission chapel erected in 1841; incorporated as a town in 1849, and as a city in 1854. Its pop. in 1850 was 1083; in 1860, 10,401; and in 1870, 20,030. The present area of the city is 13,583 acres. Its educational system is very complete, having 13 school buildings, valued at $189,000, with 4941 scholars enrolled, 84 teachers, a fine high school, etc., all costing annually $81,000. There are also 2 female seminaries of high order and several private schools, while the Roman Catholics have parochial schools with over 2000 scholars. There are 38 churches, some of them very large and costly, and 2 theatre buildings. There are 3 public libraries, ranging from 7000 to 10,000 vols. each, and an academy of natural sciences. Two daily, 1 tri-weekly, and 9 weekly papers are published in five languages. The city owns a park of



City Hall, St. Paul.

260 acres, costing $100,000, besides several public squares and 2 fine cemeteries. There is a horse railroad with a track and branch line of 4 miles extent. The city is supplied with water from a large and beautiful lake on the high land back of its site, affording a natural pressure. It is lit with gas, and has an admirable system of sewerage. It has a well-managed police force, an efficient paid fire department, and an electric fire-alarm telegraph. There are 3 national, 1 savings, and 3 private banking-houses; total capital, $2,000,000. There are 2 orphan asylums, 3 hospitals, a home for the friendless, 2 Magdalen reformatories, and the State reform school is located on the edge of the city. The U. S. has a granite custom-house and post-office building costing $350,000, in which the U. S. courts are held. The State capitol, built in 1853 and subsequently enlarged, is small and plain. There are 8 railroads terminating in the city, and one or more steamboat lines. There are 2 extensive grain-elevators, a number of wholesale houses, many fine business-blocks, hotels, etc. The principal manufacturing is agricultural implements, machinery, furniture, boots and shoes, etc. The assessed valuation of property is $27,000,000. J. F. WILLIAMS.

**Saint Paul,** p.-v. and tp., cap. of Howard co., Neb., on Loup fork of Platte River.

**Saint Paul,** p.-v. and tp., Robeson co., N. C. P. 1052.

**Saint Paul de Loan′da,** capital of the Portuguese dominions in Lower Guinea, Africa, at the mouth of the Bengo, in lat. 8° 48′ S., lon. 13° 13′ E. Its harbor is excellent and strongly fortified; some parts of it are well built of brick, with roofs of tiles; it exports beeswax and ivory. P. 5600, of whom 1600 are white.

**Saint Pau′lin,** p.-v. of Maskinongé co., Quebec, Canada, 33 miles N. W. of Three Rivers. Here is a splendid cataract, and great quantities of lumber are sawn in the vicinity. P. about 200.

**Saint Paul's,** tp., Clarendon co., S. C. P. 960.

**Saint Paul's Bay,** p.-v., cap. of Charlevoix co., Quebec, Canada, on the N. shore of the St. Lawrence, 60 miles below Quebec. It has a good trade, a court-house, a convent, iron and plumbago mines, saline and sulphur springs, and limestone and garnet rocks. Steamers ply to Quebec. P. of sub-district, 3623.

**Saint Paul's Parish,** tp., Colleton co., S. C. P. 4656.

**Saint Pe′ter,** p.-v., cap. of Nicollet co., Minn., on Minnesota River, at the junction of Winona and St. Peter and St. Paul and Sioux City R. Rs., has 9 churches, schools, 1 bank, 5 hotels, 2 newspapers, a furniture establishment, foundry and machine-shops, and 2 flouring-mills. The Minnesota hospital for the insane is located here. P. 2124. J. K. MOORE, ED. "ST. PETER TRIBUNE."

**Saint Peter's,** seaport of Richmond co., Cape Breton Island, on St. Peter's Bay. A canal half a mile long and 13 feet deep leads hence to the Bras d'Or. P. about 250.

**Saint Peter's,** port of entry of Gloucester co., N. B., at the mouth of Big Nepisiquit River, opposite Bathurst, with which it is connected by a handsome bridge. It has an academy and a large lumber-trade, and shipbuilding is carried on. P. about 600.

**Saint Peter's,** tp., New Kent co., Va. P. 1122.

**Saint Pe′tersburg,** government of European Russia, bordering N. on the Gulf of Finland and Lake Ladoga, comprises an area of 17,260 sq. m., with 621,808 inhabitants, exclusive of the capital. The ground is low and level, the climate damp and cold, the soil thin and little productive. Marshes and forests cover two-thirds of the surface; hemp, flax, and rye are the common crops; market-gardening is extensively carried on around the capital.

**Saint Petersburg,** capital of Russia, the residence of the czar, and the seat of the government, in lat. 59° 56′ 30″ N., lon. 30° 19′ E., on the delta of the Neva, about 20 miles E. of its port, Cronstadt. Its location is not very favorable. The climate is severe, the Neva is covered with ice for five months, and with a mean winter temperature of 18° the thermometer is known to have fallen to −51°. A bar across the mouth of the river prevents vessels drawing more than 9 feet of water from reaching the city, and the elevation of the site above the river is so small that, although both the river arms and the canals are lined with high stone quays, destructive inundations have taken place now and then; as, for instance, in 1824. Nor is the ground itself salubrious; it is marshy and oozy, and in spite of extensive and costly draining typhoid fevers are frequent. To form a sufficiently solid foundation for the Nikolaievski bridges three sets of piles had to be driven into the ground, one on the top of the other; and the foundation of the church of St. Isaac is said to have cost $4,000,000. Nevertheless, Peter the Great, who founded the city in 1703, and declared it his capital in 1712, and Catharine II., who was very solicitous for its growth and prosperity, succeeded in building up here one of the most brilliant capitals of Europe, and forming a commercial and industrial centre of great importance. The city consists of two parts—the Great Side (*Bolshaya Storona*), situated on the main land, on the southern side of the Great Neva; and the Petersburg Side, situated on the numerous islands formed by the arms of the Neva, Vasili Ostrov, Volni, Petrovski, Citadel Island, Aptekarski, Krestovski, Kamennoi, and Velaginski. Only one permanent bridge leads across the Great Neva—namely, the Nikolaievski, from the English quay in front of the admiralty building on the southern branch to the Vasili Ostrov shore. It is a magnificent structure of granite, 1200 feet long, resting on seven elegant arches, and completed in 1850. The other bridges across the Great Neva are all temporary, supported on boats and removed each autumn when the frost comes. The Annitchkoff bridge, across the Fontanka Canal, is also a splendid structure, 110 feet long, and decorated with four groups of wild horses. About 150 bridges connect the islands with each other. The Great Side is the most elegant part of the city, containing a great number of palaces, churches, government buildings, etc., all of which are of immense dimensions, generally gorgeously decorated, and often of a fine architectural effect. The Nevski Prospekt, leading in a south-eastern direction from Admiralty Square, is one of the finest streets in Europe, 130 feet broad, 4 miles long, lined with palaces, and planted with trees. The Petersburg Side is principally the seat of the commercial and industrial interests; some of the islands are occupied by villas and gardens. The most remarkable of the public buildings is the church of St. Isaac, 330 feet long, 290 feet broad, 310 feet high, built in the form of a Greek cross, entered from each side through a magnificent peristyle composed of twelve or sixteen monolithic columns of polished granite 60 feet high and 7 feet in diameter at the base, and surmounted by a dome rising 120 feet above the peristyles, resting on 30 columns, covered with copper, and richly gilded. In the church of St. Peter and St. Paul, whose elegant gilt spire rises 208 feet, and can be seen from all parts of the city, the Russian czars have been buried since the time of Peter the Great. In the church of St. Alexander Nevskoi the body of this saint is preserved in a sarcophagus of solid silver. The Winter Palace, one of the largest palaces in the world, forms a square 455 feet long, 350 feet broad, contains immense wealth in its decorations and furniture, and is inhabited, when occupied by the czar, by 6000 persons; it was burnt down in 1837 and rebuilt in 1839. The Hermitage, built by Catharine II., and connected with the Winter Palace, contains one of the most valuable picture-galleries in the world, rich especially in works of the Spanish school, collections of statuary, gems, vases, arms, a library of 120,000 vols., a theatre, etc. The Annitchkoff Palace was the residence of Nicholas I. Of the public squares, Admiralty Square is the largest. The Palace Square contains the Alexander column, 150 feet high, whose shaft is a monolith 80 feet high, of red granite. In Peter's Square stands a fine equestrian statue of Peter the Great. The educational and benevolent institutions are numerous and good. The imperial library contains over 1,000,000 vols. and 35,000 MSS. The Academy of Sciences, founded by Peter the Great, has a library of 120,000 vols., an excellent ethnographic museum, large numismatic and anatomical collections, etc., and a botanical garden with the largest palm-house in Europe. The university, founded in 1819, was attended by 1413 students in 1872. The mining school has the best collection of minerals in the world. Many special schools and female gymnasia are established, and a number of compulsory elementary schools were opened in 1873. A celebrated institution is the foundling hospital. The manufactories, imperial and private, comprise glass, porcelain, and malachite ware, Gobelins tapestry and embroidery, arms, surgical and optical instruments, linen, woollen, cotton, and silk goods, paper, soap, tobacco, etc. About 3000 vessels enter the harbor annually, and railways connect the city with Moscow, Warsaw, and Berlin. P. 667,026, of which about 40,000 are Germans. CLEMENS PETERSEN.

**Saint Petersburg,** p.-v., Clarion co., Pa., 90 miles N. of Pittsburg, has 3 churches, an opera-house, excellent graded schools, 1 bank, a driving-park, 1 carriage-factory, 2 hotels, a fire department, waterworks, 1 newspaper, and head-quarters for 2 important pipe-lines. Annual exportation of crude petroleum, 2,000,000 barrels. P. about 1800. F. H. BARCLAY, ED. "PROGRESS."

**Saint Peter's Port,** capital of Guernsey, on its eastern coast, has a good harbor and contains many fine villas and cottages. P. 16,388.

**Saint Pie de Déguire,** v., Yamaska co., Quebec, Canada, on the river La Vache, in a forest-region, 25 miles

E. S. E. of Sorel. It has iron-mines, furnaces, foundries, charcoal-works, and a good water-power. (P. O. RIVER DAVID.) P. about 225.

**Saint Pierre′,** town of the French island of Bourbon, in the Indian Ocean, on the southern shore of the island, has a good harbor and a rapidly increasing trade. P. 14,135.

**Saint Pierre,** town of the French island of Martinique, in the West Indies, on the western coast, is elegantly built, has a good harbor, and carries on a very lively trade. It has many educational and benevolent institutions, several fine churches, and a handsome theatre. P. about 30,000.

**Saint Pierre and Miquelon,** a group of three small islets at the mouth of the Gulf of St. Lawrence, near the S. coast of Newfoundland, constituting a French colony, valuable only as a rendezvous for the vessels engaged in the cod fisheries, of which some 1500 annually enter the port. Area, 81 sq. m. P. 4750. St. Pierre, the capital, has a p. of 800.

**Saint-Pierre, de** (CHARLES IRÉNÉE CASTEL), ABBÉ, b. near Harfleur, department of Seine-Inférieure, France, Feb. 18, 1658; was educated by the Jesuits at Caen; entered the order; became chaplain to the bishop of Orleans in 1702, subsequently almoner to the duchess of Orleans; accompanied Cardinal Polignac to the Congress of Utrecht; published here in 1713 his *Projet de Paix perpétuelle*, and in 1718 *Discours sur la Polysynodie*. In this latter work he censured the government of Louis XIV. very freely, and was immediately expelled from the Academy, of which he had been a member since 1695. He continued, however, to write on moral and political subjects, and even repeated his criticisms of Louis XIV. in a much sharper form in his *Annales politiques*. His *Ouvrages de Politique et de Morale* appeared in 16 vols. at Rotterdam (1735–41). D. at Paris Apr. 29, 1743. His *Life* has been written by Goumy and by Molinaro, both in 1861.

**Saint-Pierre, de** (JACQUES HENRI BERNARDIN), b. at Havre Jan. 19, 1737; commenced his education for an ecclesiastical career at Caen; went in 1750 to Martinique as a sailor, returned a few years after; attended the school of engineering at Rouen, but lost in 1760 his position in the army on account of insubordination; went to Malta to become engineer to the knights, but was not appointed; gave lessons in mathematics in Paris; worked as an editor at Amsterdam; went to St. Petersburg, and was appointed a captain in the engineering corps of Finland, but failed to interest Catharine II. in his schemes of a model republic; left the country in 1766; fought against the Russians in Poland, inspired by a Polish princess; then again in Saxony against the Poles, to avenge himself on his former inspiration; returned to France and received a position as an engineer in the Isle de France; returned in 1771 to Paris and determined to devote himself to literature; associated much with Rousseau, who exercised a considerable influence both on his style and his ideas; published in 1773 *Voyage à l'Isle de France*, etc. (2 vols.), which was well received; in 1784, *Etudes de la Nature* (5 vols.), which gave him rank among the best French prose-writers; in 1788, *Paul et Virginie*, which became one of the most celebrated books of the age and was translated into all European languages; in 1790, *La Chaumière indienne* and *Le Café de Surate*, etc.; was made director of the botanical garden in 1792, professor in morals at the normal school in 1794; received a pension under the Empire. D. at his estate, Eragny-sur-Oise, Jan. 21, 1814. Aimé Martin, who married his widow, gave a collected edition of his works in 12 vols. in 1818–20; his posthumous works, letters, and a biography in 4 vols. in 1833.

**Saint Pierre-les-Calais′,** town of France, department of Pas-de-Calais, manufactures leather, beetroot-sugar, files, linens, and tulles, for which latter product it is celebrated. P. 15,008.

**Saint Pol de Léon′,** town of France, department of Finisterre, near the English Channel, has manufactures of linen and a trade in flax, hemp, wax, honey, horses, and cattle. P. 6704.

**Saint Pöl′ten,** town of Austria, province of Lower Austria, on the Trassen, is surrounded by walls, is the see of a bishop, and has a fine cathedral, several good educational institutions, and manufactures of glass, paper, and earthenware. P. 5800.

**Saint Quentin′,** town of France, department of Aisne, on the Somme, has extensive manufactures of cotton yarn which employ over 5000 hands; of linen, tablecloths, lace, muslin, and gauze, in the production of which latter article 500 weavers are employed; besides large distilleries and soapworks. It contains a celebrated Gothic church, and is surrounded by beautiful promenades occupying the site of its old fortifications. P. 34,811. A battle took place here on Aug. 10, 1557, between the army of Philip II. of Spain and the French, in which the latter were defeated; and on Jan. 18, 1871, the French army of the North met here with the 1st German army. The former, under the command of Gen. Faidherbe, pushed forward from the northern fortresses toward Paris, in order to attack the besieging German army; the latter, under the command of Gen. von Göben, was sent against it to prevent the attack. Faidherbe had 40,000 men and 70 pieces, and occupied the hills to the S. of the city, on both sides of the canal of Crozal. Gen. von Göben had 39 battalions of infantry, 53 squadrons of cavalry, and 162 pieces, with which he attacked the French position early in the morning of Jan. 19. At four o'clock in the afternoon the French army began to retreat, and at seven o'clock it was in full flight toward Cambrai and Guise. It lost 9000 prisoners, 3000 wounded, and 6 pieces; the German loss was 94 officers and 3369 men. In the evening St. Quentin was occupied by the Germans.

**Saint Re′gis,** p.-v., situated partly in Bombay tp., Franklin co., N. Y., and partly in St. Regis tp., Huntingdon co., Quebec, Canada, on St. Lawrence River, opposite Cornwall, with which it is connected by ferry. It is inhabited by the St. Regis Indians, an Iroquois tribe speaking the Mohawk dialect. They are mostly Roman Catholics, but a few are Methodists. They are divided into two parties, the British and the American, and owe their allegiance not according to residence, but according to descent in the female line. Their reservation in the U. S. is 14,000 acres, and that in Canada rather larger. Their ancestors settled here in 1760. The American party numbered 683 souls in 1872, and the British about 800. (P. O., ST. REGIS, Huntingdon co., Quebec, Canada, or HOGANSBURG, N. Y.)

**Saint Remy′,** town of France, department of Bouches-du-Rhône, contains interesting remains of the ancient *Glanum*, among which is a triumphal arch in honor of Drusus. Large manufactures of silk are in operation. P. 6348.

**Saint Romuald,** or **New Liverpool,** p.-v., Levis co., Quebec, Canada, on the S. side of the St. Lawrence, 5 miles above Quebec, to which steamers ply daily. It has a large lumber-business. P. about 700.

**Saints' Days,** in the calendar of the Church are days set apart for the special commemoration of any saint. In the Roman Catholic Church the number of saints is very great, and a considerable number of saints are commemorated on each day of the year; but it is the custom to assign to particular countries, districts, or dioceses a certain number of saints for special commemoration. These saints' days constitute the calendar for that district. Any day not a saint's day in the local calendar, and not a festival nor a Sunday, is called a *feria;* other days are either holy days of obligation, doubles, semi-doubles, or simples, according to the solemnity of the occasion and of the service for the day. These points, with other information with regard to the festivals, are set forth in a yearly publication called the *Ordo*.

**Saint Sebast′ian,** town of Spain, capital of the province of Guipuscoa, on a peninsula in the Bay of Biscay, is surrounded with strong walls and defended by a citadel. Its streets are broad and straight and lined with elegant houses; its harbor, though not safe, is frequented by large vessels. A large import-trade in French and English goods is carried on, and during the summer the town is much resorted to as a watering-place. P. about 14,000.

**Saint Servan′,** town of France, department of Ille-et-Vilaine, at the mouth of the Rance, opposite St. Malo. It has two good harbors and an active commerce. It is fortified, and much frequented as a watering-place. P. 12,704.

**Saint-Simon′, de** (CLAUDE ANNE), MARQUIS, b. at the castle of La Faye, France, in 1743; studied in the military school at Strasbourg; served in Flanders and in Poland; became brigadier 1770; sailed for Martinique 1779 with the regiment of Poitiers, and had during the voyage three engagements with Admiral Rodney; entered the Spanish service as field-marshal Mar. 1, 1780; commanded the French contingent of 2000 men in the Yorktown campaign, during which he received several wounds; was a deputy to the States General 1789; soon afterward again entered the Spanish service; defended Madrid against the French 1808, for which he was condemned to death, but reprieved at the solicitation of his daughter, and became captain-general and a grandee of Spain on the return of Fernando VII. in 1814. D. in Spain Jan. 3, 1819.

**Saint-Simon, de** (CLAUDE HENRI), COUNT, b. at Paris Oct. 17, 1760; received a military education and enjoyed the instruction of D'Alembert in mathematics; entered the army in 1777; went to America in 1779, and distinguished himself at Yorktown in 1781, but was captured by the English when attempting to return to France, and brought to Jamaica, where he was held till peace was concluded in

1783. Meanwhile, other and larger plans had arisen in his mind. He laid before the viceroy of Mexico a plan of connecting the Pacific and the Atlantic by a canal, of which, however, no notice was taken; and on his return to France he gave up the military career and went in 1785 to Holland, where he proposed to organize a Dutch-French expedition against the British East Indies; and in 1786 to Spain, where he proposed to connect Madrid with the sea by a canal, both of which plans failed to attract any attention. The Revolution he received with enthusiasm, but not finding in the general confusion a place which exactly fitted his talents and his aspirations, he formed in 1790 a partnership with a certain Count de Redern and began to speculate in the confiscated real estate of the émigrés. During the Reign of Terror he was imprisoned for eleven months; by his partner he was cheated, it is said; nevertheless, he succeeded in retiring in 1797 from the toils and perils of this period of his life with a fortune of 150,000 francs. He now began to study the sciences and form immense plans for a fundamental reconstruction of human society; kept an elegant *salon*, where many scientific men gathered; married in 1801, and lived in splendor and luxury for about one year. In 1802 the fortune was spent. But a brilliant idea presented itself to his mind. Baron von Staël-Holstein had just died. St.-Simon divorced his wife, repaired to Coppet, and proposed to Madame de Staël, confident that she would be immediately carried away by his world-reforming plans, compared with which the Revolution itself would be an every-day event. The lady declined, and under very straitened circumstances he now began his literary activity by his *Lettres d'un Habitant de Genève à ses Contemporains* (Geneva, 1803), which fell flat to the ground. A short time after, he received a small clerkship in the office of the Mont de Piété at Paris, and lived in obscurity till Diard, a former friend of his, took him into his house, and furnished him with means for the publication of his *Introduction aux Travaux scientifiques du 19me Siècle* (Paris, 2 vols., 1808), which also remained almost unnoticed. In 1810, Diard died, and St.-Simon now often suffered from actual want; there are letters from him to Cuvier, Degérando, Cambacérès, and others in which he begs for something to eat. Nevertheless, he continued to pursue his literary plans. In 1814 appeared *Réorganisation de la Société européenne;* in 1817–18, *L'Industrie, ou Discussions politiques, morales, et philosophiques;* and in the mean time the striking criticisms which his works often contained, the fertile hints which he threw out now and then, and the mental vigor which characterized even his confusion, attracted to him young men of great talents, such as Augustin Thierry, Auguste Comte, and others, who helped him both with money and with ideas. In 1820 he commenced a social journal, *L'Observateur*, and was indicted for saying in the first number that the death of 1000 workingmen was a greater loss to a community than the death of 1000 office-holders or the whole royal family; the jury acquitted him. This attracted some attention, and in 1821 *Le Système industriel* was published with some effect. Yet the success, the triumph, would not come; he fell into despair, and Mar. 9, 1823, attempted to commit suicide. He only lost one eye. He lived two years longer, and in a more collected state of mind wrote his two best works—*Catéchisme industriel* (1824) and *Nouveau Christianisme* (1825). D. at Paris May 19, 1825. *Œuvres choisies* (3 vols., 1859), *Œuvres complètes*, in connection with those of Enfantin (20 vols., 1865–69). (See SOCIALISM.) CLEMENS PETERSEN.

**Saint-Simon, de** (LOUIS DE ROUVROI), DUKE, b. Jan. 16, 1675; received a very careful education; entered the army in 1693; distinguished himself at Fleurus and Neerwinden, but left the army in 1702 for the court, where he acquired considerable influence, both under Louis XIV. and the regent, and developed a great activity, partly in futile intrigues, partly in important diplomatic negotiations. At the death of the regent, in 1723, he retired to his family estate. D. Mar. 2, 1755. This long term of leisure he employed to prepare his *Mémoires*, which were intended to be published by his grandchildren. But at his death the government seized them, and a multitude of unauthentic extracts came into circulation and considerable curiosity was excited. At last, Charles X. returned the manuscript to the family of the author, and two authentic and complete editions have appeared—in 21 vols. (1829–30) and in 20 vols. (1856–58). The work proved to be a document of great historical value and still greater literary interest.

**Saint-Simonianism.** See SOCIALISM.

**Saint Ste'phen,** port of entry of Charlotte co., N. B., pleasantly situated on the E. bank of St. Croix River, opposite Calais, Me., with which it is connected by a bridge. It is the terminus of a branch of New Brunswick and Canada Railway, is lighted by gas, does a heavy business in manufacturing and shipping lumber; has 5 churches, 2 weekly newspapers, a custom-house, a bank, and many fine residences. P. 6515.

**Saint Stephen's,** p.-v., cap. of Washington co., Ala., on Tombigbee River. P. 1214.

**Saint Stephen's,** tp., Richardson co., Neb. P. 601.

**Saint Stephen's,** tp., Charleston co., S. C. P. 3094.

**Saint Stephen's College,** at Annandale on the Hudson, was established in 1860 to provide special instruction for persons who at mature age had devoted themselves to the ministry. It was soon found necessary to enlarge its sphere, that young boys might be encouraged to devote themselves to the same work. Mr. John Bard of Annandale gave a number of acres of land, and also built a chapel at an expense of $34,000. He has also been an annual subscriber to defray its expenses. In 1860 a charter was obtained. Rev. George F. Seymour, M. A., was appointed its first head with the title of warden. He was succeeded in 1861 by Rev. Thomas Richey, D. D. Dr. Richey resigned in 1863. Rev. Robert B. Fairbairn, D. D., was appointed the third warden. The powers of the college have been enlarged, and the authority to confer degrees has been granted. It has been brought under the visitation of the board of regents of the University of the State of New York. The professorships of Latin, of Greek and Hebrew, of mathematics and natural philosophy, of history and of English language and literature, of moral philosophy, and of logic and metaphysics have been created and filled. Besides the chapel, the college has received the gift from Elizabeth Ludlow and her sister, Cornelia Ann Willink, of a spacious hall.

**Saint Tam'many,** parish of S. E. Louisiana, bounded E. by Pearl River, S. by Lake Pontchartrain, drained by Bogue Chitto and many other small streams, and crossed in its S. E. corner by New Orleans Mobile and Texas R. R., has a sandy surface, several brick manufactories, and shipyards. Staples, rice and molasses. Cap. Covington. Area, 1200 sq. m. P. 5586.

**Saint Thom'as,** an island off the western coast of Africa, in the Gulf of Guinea, in lat. 0° 27′ N., lon. 6° 3′ E., belongs to Portugal. Area about 140 sq. m. Pop. about 20,000, of whom very few are white. The island is high, of volcanic origin, exceedingly fertile, but extremely unhealthy. Sugar was formerly the principal product; coffee is now more extensively cultivated. Forests abound, yielding excellent timber and the finest varieties of wood. Chief town, St. Thomas.

**Saint Thomas,** p.-v., cap. of Elgin co., Ont., Canada, on London and Port Stanley and Canada Air-line railways, 9 miles N. of Port Stanley, on Kettle Creek. It has a large grain-trade and 2 weekly newspapers. P. 2197.

**Saint Thomas,** v. (P. O. MONTMAGNY), cap. of Montmagny co., Quebec, Canada, on the S. shore of the St. Lawrence, 48 miles below Quebec, and on Grand Trunk Railway. It has a college and a convent. P. about 1650.

**Saint Thomas,** v. (P. O. PIERREVILLE), Yamaska co., Quebec, Canada, partly inhabited by Abnaki Indians. It is on St. Francis's River, opposite St. François du Lac, 60 miles by steamer below Montreal. Barges are built and firewood, grain, lumber, and buck and moose skin goods are largely exported. There are large steam-mills in the vicinity. P. about 1200.

**Saint Thomas,** one of the Virgin Islands, in the West Indies, in lat. 18° 20′ N., lon. 64° 55′ W., belongs to Denmark. Area, 45 sq. m. P. 15,500. Since the forests have been cut down the rivers and brooks have dried up, and the light, sandy soil, exposed to the scorching sun, has become almost totally unproductive on account of lack of water. The island is important only on account of its excellent harbor, Charlotte Amalie.

**Saint Thomas,** p.-v. and tp., Franklin co., Pa. P. of v. 389; of tp. 1902.

**Saint Thomas and Saint Dennis,** tp., Charleston co., S. C. P. 2119.

**Saint Trond,** town of Belgium, province of Limburg, has large breweries and distilleries and manufactures of lace and beetroot-sugar. P. 11,573.

**Saint Valery-en-Caux,** town of France, department of Seine-Inférieure, on the English Channel, carries on extensive herring and mackerel fisheries, besides an active coasting-trade. P. 5377.

**Saint Valier', de** (JEAN BAPTISTE DE **Lacroix**), CHEVRIÈRE, b. at Grenoble, France, Nov. 14, 1653; became chaplain to Louis XIV.; was appointed vicar-general of Quebec by Bishop Laval 1684; arrived in Canada July 30, 1685; returned to France Nov., 1687; was consecrated bishop of Quebec Jan. 25, 1688; arrived in Canada in August of the same year; founded the general hospital at Quebec; was captured by the English at sea while return-

ing from a visit to France July, 1704, and remained a prisoner until 1709. D. at Quebec Dec. 26, 1727. Author of *État présent de l'Eglise et de la Colonie française dans la Nouvelle France* (1688).

**Saint Viateur', Congregation of,** a congregation of Roman Catholic priests first established at Vourles, France, by J. L. J. Querbes; received papal approbation in 1833 and 1838; introduced into North America in 1847; devoted to the work of religious and other instruction.

**Saint Vin'cent,** one of the Lesser Antilles, in the West Indies, in lat. 13° 13′ N., lon. 61° 15′ W., belongs to Great Britain. Area, 131 sq. m. P. 35,688. The surface is high, volcanic, and mountainous, the highest peak, La Soufrière, rising 3000 feet above the level of the sea. The climate is hot and very moist, though not unhealthy. The soil is very fertile, and sugar, rum, and molasses are exported annually to the value of nearly £300,000. Chief town, Kingston.

**Saint Vincent, Cape.** See CAPE ST. VINCENT.

**Saint Vin'cent de Paul,** p.-v., Laval co., Quebec, Canada, on Isle Jésus, 11 miles from Montreal, is the site of the provincial reformatory prison, a well-managed institution, having a fine building. P. about 1000.

**Saint Vincent,** EARL OF. See JERVIS (Sir JOHN).

**Saint Vi'tus's Dance.** The form of disease that received this name was a species of chorea which broke out at Strasbourg in the year 1814, following the plague. The same disease appeared in Aix-la-Chapelle as an epidemic in the fourteenth century, and was then known as "St. John's Dance." Almost simultaneously a malady originated in Italy, there called *tarantism*, and identical with the dances of St. John and St. Vitus. These several conditions presented common symptoms, consisting of jumping, fantastic dancing, and involuntary cries; with these strange symptoms there was catalepsy, when the victim would have visions of either St. Vitus or St. John. These seizures would last until the sufferer was entirely exhausted. On the feast-day of St. John the disorder made its appearance. The people in the course of their dissipation would kindle large fires through which men and women leaped, believing that the attacks would be aborted by this procedure. The excitement attendant upon this undoubtedly brought on the disease. The dance of St. Vitus received its name from the fact that the sufferers went when afflicted to the chapel of St. Vitus, assured that this holy person would listen to their prayers and those of the priests, who also sang masses and interceded for them. All persons of this class who before had St. John's dance now had the dance of St. Vitus.

This name is applied to the disease even at the present day as a common term. In the seventeenth century the disease changed its character somewhat, hysteria being a prominent symptom, and there was a disappearance of a great many of the maniacal outbursts. The condition known as tarantism was supposed to be due to the bite of the tarantula, but in reality it was caused by actual morbid fear of the consequences of a bite. The patients were dull and moody until they heard certain kinds of music. They would then leap into the air in a state of frantic excitement, and dance in an extravagant manner; some would be impelled to cast themselves into the sea, and others would commit disgraceful sexual excesses. They usually danced until utterly worn out, and then fell to the ground. Wind instruments and drums produced the music which seemed to influence them the most quickly. There are numerous cases of chorea recorded in late years that closely simulate the tarantism of several hundred years ago. Dr. Kinder Wood of England had a patient who suffered from this form of chorea; the roll of a drum would stop the attacks. A species of dancing disease very closely allied to St. Vitus's dance appears in certain parts of Africa, particularly in Abyssinia. The disease is known as *tigritier*. The malady begins in an acute form, and runs at first the course of an ordinary continued fever. The priest is appealed to, who arranges the programme and conducts the ceremonies. He leads the patient out into the market-place; when music is played by a band of his dusky friends he begins to dance, and continues all day; he then stops, turns irresolutely, and starts off on a run, and goes a great distance, not stopping till utterly fatigued, when some one of the tribe strikes him on the back with the flat part of the blade of a large knife, and asks him his name. If the disease has disappeared and the mind cleared up, of course he will be able to tell it. Full particulars of this interesting condition are given by many of the English travellers.

It seems as if these same superstitious diseases were not confined to the Middle Ages or to barbarous people. Frequent illustrations of a modern form are shown at the present day among the many fanatical sects affected by kindred conditions. Dancing Shakers, dancing dervishes, and the members of religious societies in France known as *Convulsionnaires* have these peculiar choreiform attacks as a part of their religious ceremonies. Our own camp-meetings abound in examples. Attacks of the disease last frequently for months, and young women often become the victims of a peculiar morbid emotional state which frequently renders their incarceration in an asylum a matter of necessity. These attacks result from a depressed condition of the system, as a sequence of a long-continued state of emotional excitement, of fasting, and, to a certain extent, contact with other individuals affected like themselves. Schele de Vere relates in his *Modern Magic* that in the consecration of a magnificent church at Liege a great many people affected with St. Vitus's dance gave themselves up to shameless dances, and falling exhausted, after spasms and convulsions, requested friends to press violently upon their chests, and thus a seizure was stopped.

The violent forms of chorea of modern times differ from the ancient St. Vitus's dance so far as the mental condition is concerned. The victims of the disease now rarely believe themselves to be possessed. The superstition and ignorance of the Middle Ages did much to foster a general belief in possession by the devil. This is evident from the manner in which cures were effected, by the laying on of hands and exorcising by the priests. Of course the power of advanced religious knowledge and increased ability for reasoning, improved morals, and increase of Christian faith have entirely changed the barbaric character of the disease. ALLAN MCLANE HAMILTON.

**Saint Wen'dell,** p.-v. and tp., Stearns co., Minn. P. 356.

**Saint Yrieix',** town of France, department of Haute-Vienne, has large manufactures of porcelain, earthenware, glass, linen, and leather, and a trade in agricultural products. P. 7613.

**Sai'vas,** the members of one of the three great modern groups of sects of the Hindoo religion, designating those who pay exclusive or pre-eminent adoration to Siva in his various incarnations, especially under the form of the linga. (See HINDU RELIGION, by PROF. JOHN DOWSON.)

**Sakhalin Ula Hotun,** or **Aigun,** town of Mantchooria, on the right bank of the Amoor, in lat. 50° 15′ N., lon. 127° 40′ E., in fertile surroundings. It is a military station, is well built, and has some trade. P. estimated at 15,000.

**Sa'ki,** the rice-beer of Japan, is usually heated before drinking. It has an unpleasant taste and a very heady quality. Its use in Japan is very extensive.

**Sak'tas** [Sansk. *sákti*, "power" or "energy"], the members of one of the three great modern groups of sects of the Hindoo religion, designating the votaries of the female consorts of the gods of the Triad. (See HINDU RELIGION, by PROF. JOHN DOWSON.)

**Sakti.** See SAKTAS.

**Sakunta'la,** the heroine of a considerable cycle of ancient Sanskrit mythology, commemorated in the *Vedas*, the *Mahabharata*, the *Puranas*, and especially in the celebrated drama of *Kalidasa*, which was the first work translated into English by Sir William Jones (1789). Editions of the Sanskrit original are numerous, as also translations in many languages.

**Sakya-Muni** [Sansk. *Saint Sakya*], one of the most usual designations of the founder of the Booddhist religion. (See BOODDHA.)

**Sa'la,** town of Italy, province of Principato Citeriore, is beautifully situated. P. 6994.

**Sala** (GEORGE AUGUSTUS HENRY), b. in London, England, of Italian parentage, in 1828; educated as an artist, but at an early age devoted himself to literature as a constant contributor to Dickens's *Household Words* and other periodicals, especially the *Illustrated London News* and the *Cornhill Magazine;* visited the U. S. 1863–64 as correspondent of the *Daily Telegraph;* represented the same paper in Algeria 1864, and again 1875, at the Paris Exposition 1867, on the Continent during the Franco-German war 1870–71, and in Spain, Morocco, and Venice 1875. Author of several novels and works of travel, and founder and editor of the *Temple Bar* magazine.

**Salaam'** [Arab. *selam*, "peace"], the Oriental salutation, of which there are various forms, mostly accompanied by the words "Peace be with you!" and sometimes by an inclination of the body. Strict Mohammedans never give the salaam to an unbeliever.

**Salaam Convulsions,** a rare and remarkable disease of children, accompanied by rapid bowing of the head. It sometimes occurs periodically. It is a clonic spasm of the sterno-mastoid muscles. Its cause, nature, and treatment are very obscure. Iron, zinc, and nux vomica have been recommended. The disease may possibly pass away

with the completion of the teething process, but epilepsy or idiocy sometimes follows.

**Salaberry'** (Charles **Michel**), **D'Iraberry, Seigneur de Chambly et de Beulac,** b. at Beauport Manor, Canada, Nov. 19, 1778, son of a member of the legislative council, and descended from a noble family in Navarre; entered the British army at an early age; served eleven years in the West Indies; was engaged in the Walcheren expedition July, 1809; returned soon after to Canada; organized and commanded the regiment of voltigeurs; repulsed Gen. Dearborn at Lacolle 1812, and with Gen. Prevost defeated Gen. Wade Hampton at Chateaugay Oct. 26, 1813, for which services he received a gold medal, the order of the Bath, and the thanks of the Canadian legislature; was subsequently a senator and a member of the legislative council. D. at Chambly Feb. 26, 1829.

**Sa'la Consili'na,** town of Southern Italy, province of Salerno, about 10 miles S. W. of Potenza, is believed to occupy the site of the ancient *Marcellana,* destroyed by Totila. It is in a healthy position, is tolerably well built, contains five churches, and the episcopal palace is a handsome edifice. The neighboring country is very rich in pasturage, and the hills are beautifully wooded. P. 7700.

**Sal'ad** [It. *salato,* "salted"], a preparation of uncooked herbs with condiments, as salt, oil, sugar, vinegar, and pepper, often mixed with boiled eggs, deviled lobster, or other animal matter. The principal salad-herbs are lettuce, cresses, samphire, celery, chicory, chives, onion-tops, endive, etc. The use of salads is regarded as very salutary.

**Sal'adin** (Salah-ed-Din Yussuf), a son of Ayub, the founder of the dynasty of the Ayubides, b. at Tekrit on the Tigris in 1137, a Kurd by descent and a subject of Noureddin, sultan of Syria; accompanied in 1163 his uncle, Shirkuh, to Egypt, where he soon gained celebrity for his military talents. Shirkuh was sent to Egypt by Noureddin to reinstate the emir Shawer, who had been expelled; but when Shawer discovered that Noureddin aimed at the subjugation of Egypt, he allied himself with the crusaders and a desperate struggle ensued, which ended with the rout of the Franks and the decapitation of Shawer. Shirkuh now governed Egypt as Noureddin's emir, and after his death Saladin, who showed still greater talents as a civil governor than as a military leader. The country prospered, and after the death of Noureddin in 1173 it became an independent empire under the rule of Saladin. He also interfered in the controversies in Syria between the heirs of Noureddin, and in 1184 made himself complete master of this country too, and was confirmed by the caliph of Bagdad as sultan of Egypt and Syria. In 1186 he attacked Palestine. The Christian knights, especially those belonging to the various orders—the Templars, the Hospitallers, etc.—lived here as they did in Europe, chiefly by robbery. In spite of treaties agreed upon and sworn to, they repeatedly fell upon the Mohammedan caravans of pilgrims journeying to Mecca and plundered them. To put an end to these outrages, Saladin invaded Palestine with an army of 80,000 men, routed the Christians completely at Tiberias (July 4, 1187), and conquered Jerusalem Oct. 2. The king and the poor people he treated with courtesy and magnanimity; the Templars and Hospitallers he put to death. When these tidings came to Europe the third crusade was preached, and Frederick Barbarossa of Germany, Philippe Augustus of France, and Richard Cœur de Lion of England took the cross and led great armies toward the Holy Land in 1189. Frederick died soon, and after the conquest of Acre, Philippe Augustus returned, but between Richard Cœur de Lion and Saladin a long tournament took place, in which the most brilliant exploits of valor and chivalry were performed by both parties. Sept. 2, 1192, a truce of three years was concluded, by which the coast of Palestine from Tyre to Jaffa was ceded to the Christians. Shortly after, Richard Cœur de Lion returned to Europe, and Saladin died at Damascus Mar. 4, 1193. His fame was very great. He was considered a model of chivalry, and his fantastic gallantry sprang from real magnanimity and a strong feeling of justice. He was a great conqueror, though he suffered several heavy reverses in his wars, and he brought his vast empire, comprising Egypt, Syria, Palestine, Arabia, and Mesopotamia, into a flourishing condition.

**Sala'do,** a river of the Argentine Republic, South America, has its source in an outlying spur of the Andes, flows S. S. E. 600 miles, and enters the Paraná near Santa Fé. It is navigable for vessels of light draught through most of its course, and forms the southern limit of the Gran Chaco.

**Salado,** p.-v., Bell co., Tex., on Salado Creek.

**Sal Aëra'tus** [Lat., "aërated salt"]. The commercial product known by this name, formerly a very large article of domestic consumption, has during the present generation been chiefly displaced by the cheaper and in every way preferable compound, bicarbonate of soda, known as "cooking soda," sometimes "soda salaëratus." *Sal aëratus* is a somewhat impure and imperfectly carbonated bicarbonate of potash, made by exposing a concentrated solution of neutral potassic carbonate to an atmosphere of carbonic acid gas proceeding from fermentation or other source; hence the name. The finely granular form of the commercial article is probably a result of agitation during the absorption of the carbonic acid. Medicinally, a purer *crystalline* bicarbonate of potash is used, which is, or should be, fully charged with 2 equivalents of carbonic acid for 1 of potash. The true constitution of these so-called bicarbonates is, with reasonable probability, that of a compound of neutral potassic carbonate with carbonic monohydrate, which latter hydrate is not yet known in separate form; thus: $K_2O.CO_2 + H_2O.CO_2$. Consistently with the views of the hydroxyl school of chemists, however (see Salt-Radicals), this must be viewed as composed of the three radicals, *hydroxyl, potassoxyl,* and *carbonyl;* thus: $H_2K_2C_2O_6 = 2(HO.KO.CO)$. Henry Wurtz.

**Sal Alem'broth,** or **Salt of Wisdom,** a compound of corrosive sublimate and sal ammoniac, once used in medicine, but now discarded.

**Salaman'ca,** town of Spain, capital of the province of the same name, on the right bank of the Tormes, which is here crossed by a magnificent bridge of twenty-seven arches. It is surrounded with old walls, but several portions within the walls have been in ruins since the occupation of the city by the French in 1812. The streets are mostly steep, the town being built on three hills, narrow, crooked, and dark, but they are often lined with lofty edifices most interesting in architectural respects. The university was founded in 1200, and in the fifteenth century it was attended by 12,000 students. It is still the first institution of its kind in Spain, and enjoys a high reputation all over Europe. P. 17,700.

**Salamanca,** tp., Cherokee co., Kan., includes the village of Columbus, the county-seat. P. 708.

**Salamanca,** p.-v., Cattaraugus co., N. Y., at the junction of Atlantic and Great Western with Erie R. R., about midway from New York and Cincinnati, has good schools, railroad repair-shops, an extensive saw-mill, and 1 newspaper. Lumbering is extensively carried on. P. 1881.
Ferrin & Weber, Eds. "Republican."

**Sal'amander** [anglicized from the Latin *salamandra*], an English name, vaguely applied to numerous forms of the order Gradientia, but more especially restricted to species of Salamandridæ (which see). Theodore Gill.

**Salaman'dridæ** [*Salamandra,* the ancient Latin name of the species], a family of amphibians of the order Gradientia (which see), including the typical salamanders and newts of the Old World. The skull has no anterior axial bone; the palatines emit separate posterior processes extending over the parasphenoid, and which have teeth on the inner margins; no dentigerous plates on the parasphenoids; prefrontals and pterygoids are developed; the parietals are separated from the prefrontals by the broad frontals; the orbitosphenoids are confluent with the proötic; there is no postfrontal; the occipital condyle sessile; the vertebræ are opisthocœlian—*i. e.* concave behind; the carpus and tarsus are ossified. The family, thus limited by Cope, includes two genera—*Salamandra* and *Triton*—both of which are represented in Europe and temperate Asia. Theodore Gill.

**Sal'amis,** the modern *Kolouri,* an island of Greece, in the Gulf of Ægina, comprising an area of 36 sq. m., with about 5000 inhabitants. It is mountainous, well wooded, and produces cotton, olives, and wine. In the narrow strait, barely a mile in width, between Salamis and Attica, was fought the famous naval battle in which the Greeks under Themistocles defeated and almost destroyed the Persian fleet (480 B. C.). The village of *Ambelakia* now occupies the site of the ancient city of Salamis.

**Sal Ammo'niac** [Ger. *Salmiak;* synonyms, *Muriate of Ammonia, Hydrochlorate of Ammonia, Chloride of Ammonium*]. Pliny and Dioscorides speak of ἅλς ἀμμωνιακός, "Libyan salt," a Greek name for Libya being Ἀμμωνιάς or Ἀμμωνίς. Beckmann's view is, however, generally adopted, that this was a rock-salt. Sal ammoniac was first made, however, in Egypt or Libya from the urine of camels; hence the name, and our important modern word, *ammonia, ammoniac, ammoniaque.* This solid compound results from the bringing together of the two permanent gases ammonia and hydrochloric acid. The reaction, which in its nature is one of the most remarkable known to chemists, consists in the passing over of the hydrogen of the hydrochloric acid to the ammonia to form a compound

radical or elementoid substance, *ammonium* ($NH_4$), which has the same relations and performs the same functions as *potassium* and *thallium*. This radical unites with the chlorine to form chloride of ammonium: $HCl + NH_3 = NH_4.Cl$. This view, involving the *ammonium theory* of Berzelius, derives its strongest support from a ground hitherto unnoticed by chemists in general, the study of molecular volumes. (See VOLUMES, MOLECULAR.) Indeed, the lowest recorded densities (that is, those of the lightest allotrope) of ammonium chloride (about 1.45) yield a molecular volume identical *at zero* with that from the highest recorded densities of chloride of potassium (about 2.0); while the molecule of thallous chloride (7.0—Willm) has the same volume at zero as *ordinary* sal ammoniac. These are observations of the present writer. Sal ammoniac of commerce is obtained by subliming together crude sulphate of ammonia—which has been prepared from the ammoniacal liquor of the gasworks or of bone-distilleries—with common salt, sulphate of soda remaining as a residual product. Compact cakes of sal ammoniac are thus obtained, which are free from any impurity except a little ferrous chloride. The best way to obtain *chemically pure* sal ammoniac from this is to dissolve in hot water; pass into the saturated hot solution a few bubbles of *chlorine*, which will convert the ferrous into ferric chloride; then add a little ammonia, and filter hot from the ferric hydrate which precipitates; then, on cooling, snow-white chemically pure crystals of chloride of ammonium separate. Commercial sal ammoniac, as obtained by sublimation, is in hard, compact loaves, transparent or translucent, splitting with a sub-columnar or almost fibrous fracture in a direction normal or perpendicular to the planes of original condensation. The fibres thus obtained have a characteristic toughness and flexibility, bending somewhat, without loss of transparency, before they break, though quite destitute of elasticity. Sal ammoniac has a taste at once saline, pungent, and cooling. It is one of the salts which absorb heat during solution, and is therefore often used in FREEZING MIXTURES (which see). Sal ammoniac is often found native about volcanoes, subliming and condensing in fissures, both the muriatic acid and the ammonia constituting it being presumably derived from the chloride of sodium and animal matter in ocean-water which has found its way through the oceanic floor to the volcanic focus. It has also been observed in guano.

HENRY WURTZ.

**Salamonie′,** tp., Huntington co., Ind. P. 1485.

**Salang′idæ** [*Salanx*, a proper name], a family of fishes of the order Teleocephali, and related to the salmon and smelt families, as well as to the Paralepididæ. It has, however, some quite peculiar characters. The body is elongated and naked, or provided with very fine and deciduous scales; the lateral line is indistinct; the head is very much elongated and depressed, and ends in a long, flat, and pointed snout; the mouth is deeply cleft backward; the upper jaw formed above by the intermaxillaries, and at the sides by the supramaxillaries; conical pointed teeth are developed on the palate as well as jaws, of which some on the intermaxillaries and mandibles are enlarged; the branchial apertures are continuous below; the branchiostegal rays few (3–4); the rayed dorsal is small and situated far behind the ventrals, but more or less in advance of the anal; a small adipose is developed; the anal is low and oblong; the caudal forked; the pectorals pointed; the ventrals abdominal. "The entire alimentary canal straight, without bend; pyloric appendages none; ova small." But two species are known, one of which (*Salanx Chinensis*) is found on the coast of China, and the other (*Salangichthys microdon*) in the "rivers of Yedo." They seem to be rather marine than fresh-water forms.

THEODORE GILL.

**Saldan′ha** (JOÃO CARLOS **Oliveira e Daun**), DUKE OF, grandson of the marquis of Pombal, b. at Lisbon, Portugal, Nov. 17, 1791; educated at the College of Nobles at Lisbon and at the University of Coimbra; became at an early age a member of the council of administration for the colonies; was sent a prisoner to England by the English forces 1810; was soon permitted to join the Portuguese court at Rio de Janeiro, where he served in the army; was sent to Europe in a diplomatic capacity; was made minister of foreign affairs 1825; became governor of Oporto and minister of war 1826; resigned and went to England June, 1827; afterward took part in the war against Dom Miguel at the head of the insurgents at Oporto, but was defeated, and took refuge in England; resided for a time in Paris; returned to Portugal with Dom Pedro 1832; took Oporto 1833; became generalissimo and chief councillor of Dom Pedro; directed the successful campaign in the Algarves; took Lisbon; received the capitulation of Dom Miguel at Evora 1834; was appointed marshal and commander-in-chief, but soon placed himself at the head of the opposition party; became minister of war and president of the council May 31, 1835; resigned in November of the same year; took part in the unsuccessful conservative revolution of 1836, after which he lived in exile in England and France until recalled by the queen in consequence of the rebellion of 1836; was placed at the head of the ministry after the intervention of the quadruple alliance 1847; was replaced by the second dictatorship of Costa Cabral 1849; overthrew that administration by force of arms 1851; conducted the government until the accession of Pedro V. (1856), when he became again the head of the opposition; was minister at Rome 1862–64, and again 1866–69; went to Paris as minister Mar., 1869; instigated a revolution in the palace May 19, 1870, in consequence of which he again became prime minister, but resigned in August, and was sent as minister to London, where he d. Nov. 21, 1876.

**Sale,** in law. See APPENDIX.

**Sale′,** town of Italy, province of Alessandria, on the right bank of the Po. The French army under Bonaparte and the Russian under Suwarof halted here, respectively, for two days during the campaign of 1799. P. 5850.

**Sale′,** or **Sla,** town of Morocco, at the mouth of the Buregreb, is surrounded by beautiful gardens, and has a strongly fortified harbor and manufactures of elegant carpets. It was formerly the chief stronghold of the pirates on the Mediterranean. P. 25,000.

**Sale** (GEORGE), b. probably in Kent, England, about 1680 (some authorities say fifteen years later); educated at King's College, Canterbury; became a lawyer and a ripe Oriental scholar; was associated with Archibald Bower, George Psalmanazar, John Swinton, Capt. George Shelvocke, and Dr. George Campbell in writing the *Universal History*, to which he contributed the cosmogony and portions of the Oriental history; wrote the Oriental biography and criticism for Dr. Thomas Birch's translation of Bayle, entitled *A General Dictionary, Historical and Critical* (10 vols. fol., Lond., 1734–41), and executed a translation of the *Koran* (1734), to which he prefixed a scholarly *Preliminary Discourse* upon Arabian history, manners, customs, and religion before Mohammed; which still keeps its place as the best and most accessible English summary of data upon Mohammedanism. The liberal manner in which Sale spoke of Mohammed fastened upon him the reputation of heresy. D. in London Nov. 14, 1736. He is said by the elder Disraeli to have passed his later years in indigence, and often to have lacked food, but there is reason to doubt this assertion. He left a valuable collection of Oriental MSS., now in the Radcliffe Library, Oxford.

**Sale** (Sir ROBERT HENRY), K. C. B., known as the "hero of Jellalabad," b. in England in 1782, son of Col. Sale of the East India Company's service; entered the army at the age of thirteen; was engaged in the storming of Seringapatam 1799, at the storming of the Travancore lines 1809, at the capture of Mauritius 1816, and the occupation of Rangoon 1824; was appointed in 1838 to the command of the first Bengal brigade in the army on the Indus, which constituted the advance-guard of the expedition against Afghanistan; commanded the storming-party at Ghuznee July 23, 1839, on which occasion he was severely wounded; was knighted and promoted to the local rank of major-general the same year; subdued the Kohistan country Sept., 1840; captured several fortresses; defeated Dost Mohammed Khan at Purwan, obliging him to surrender; stormed the Khoord, Cabool, and Jugdollock passes and other strongholds 1841, but was compelled to retreat upon Jellalabad, where he was besieged by Akbar Khan from Nov. 12, 1841, to Apr. 9, 1842, when he attacked and utterly routed the Afghans, capturing guns, ammunition, and camp—a feat which procured him the thanks of Parliament and the highest military reputation; took part in the general action of Teezen and the recapture of Cabool; and in the Punjaub campaign of 1845 as quartermaster-general, but was mortally wounded at the battle of Moodkee, Dec. 18, 1845, and d. Feb. 28, 1846.—His wife, LADY FLORENTIA WYNCH SALE, b. in England about 1790, married in 1809; was a witness of much of her husband's gallant career in India, having been with him in Jellalabad, and wrote a narrative of thrilling interest—*A Journal of the Disasters in Afghanistan in 1841–42* (1843). She also furnished descriptions of the plates to a folio volume entitled *Sale's Defence of Jellalabad* (1846), and supplied materials to Rev. G. R. Gleig for his book, *Sale's Brigade in Afghanistan* (1846). D. at Cape Town, South Africa, in 1853.

**Sa′lem,** town of British India, capital of a district of the same name in the presidency of Madras, on the Toiromanni, at an elevation of 1070 feet above the level of the sea. The town is well built, and has about 25,000 inhabitants, mostly engaged in cotton and silk manufactures.

**Salem,** v., Nichol tp., Wellington co., Ont., Canada, on the river Irvine, 1 mile from Elora Station (Wellington

Grey and Bruce Railway), has thriving and varied manufactures. Pop. about 800.

**Salem,** county of S. W. New Jersey, on Delaware River, traversed by West Jersey R. R. and its branches, has a soil consisting of a sandy loam, with abundant beds of marl and some iron ore. Staples, wheat, Indian corn, potatoes, sweet potatoes, hay, grass-seed, and butter. Cap. Salem. Area, 540 sq. m. P. 23,940.

**Salem,** p.-v., Lee co., Ala., on Columbus branch of Western R. R. P. 2963.

**Salem,** tp., Drew co., Ark. P. 677.

**Salem,** p.-v., cap. of Fulton co., Ark.

**Salem,** tp., Greene co., Ark. P. 676.

**Salem,** p.-v. and tp., New London co., Conn. P. 717.

**Salem,** tp., Carroll co., Ill. P. 839.

**Salem,** tp., Edwards co., Ill. P. 1582.

**Salem,** tp., Knox co., Ill., includes Yates City. P. 1906.

**Salem,** p.-v. and tp., cap. of Marion co., Ill., has 2 weekly newspapers. P. of v. 1182; of tp. 3132.

**Salem,** tp., Delaware co., Ind. P. 1413.

**Salem,** tp., Pulaski co., Ind. P. 567.

**Salem,** tp., Steuben co., Ind. P. 1385.

**Salem,** p.-v., cap. of Washington co., Ind., on Louisville New Albany and Chicago R. R., 40 miles from Louisville, has 5 churches, a public library, a fine graded school, 1 bank, 1 weekly newspaper, foundry and machine-shop, 1 large woollen mill, an axe and plough factory, 3 flouring-mills, 2 carriage shops, 1 jewelry establishment, and 2 hotels. P. 1294. W. W. Stevens, Ed. "Democrat."

**Salem,** p.-v. and tp., Henry co., Ia., on Big Cedar River, has 1 newspaper and considerable trade. P. 1882.

**Salem,** tp., Allen co., Kan. P. 271.

**Salem,** p.-v., Livingston co., Ky. P. 50.

**Salem,** p.-v. and tp., Franklin co., Mc. P. 307.

**Salem,** p.-v., cap. of Essex co., Mass., situated on Maine Central R. R., was for a long series of years the most populous town and city in the county of Essex. It was the first permanent settlement of the old Massachusetts Colony, Roger Conant having come here in 1626, followed by John Endicott two years later, and by Mr. Higginson one year after that. Salem has at different periods in its history given to the world a long array of eminent men. Science has always found encouragement and support, the Essex Institute, the Peabody Academy of Science, and one of the State normal schools being located here. It has many interesting old houses, and the general appearance of the city is attractive. For a great many years Salem was one of the leading commercial cities of America, carrying on more trade with the East Indies at one period than all other American ports combined. Though its harbor is safe and convenient, it is not of sufficient depth for vessels of the largest class, and this first led to the withdrawal of its commerce to Boston and New York. It has now very little foreign commerce, but a large coasting-trade, and it is a point of shipment for large quantities of coal landed here in vessels and sent to the interior by rail. The leading industry is the manufacture of leather, but in addition there are a successful cotton company, 2 lead-mills, 1 or 2 jute-factories, 2 semi-weekly, 3 weekly, and 2 monthly newspapers, and a large number of machine-shops and small industries. It is an important centre of retail trade. Salem was the scene of the witchcraft delusion of 1692, though much of what transpired was in what is now Danvers. It was in Salem that the house of representatives of the province of Massachusetts resolved themselves into a sovereign political power Oct. 7, 1774, with John Hancock as chairman, and then adjourned to Concord. It was also at the North Bridge in Salem that (Feb. 26, 1775) the British commander, Col. Leslie, was impeded in his expedition in search of cannon, and compelled to return to Boston. P. 24,117.

Foote & Horton, Eds. "Salem Gazette."

**Salem,** tp., Allegan co., Mich. P. 1143.

**Salem,** p.-v. and tp., Washtenaw co., Mich., on Detroit Lansing and Lake Michigan R. R. P. 1216.

**Salem,** tp., Douglas co., Minn. P. 208.

**Salem,** tp., Olmsted co., Minn. P. 996.

**Salem,** tp., Daviess co., Mo. P. 986.

**Salem,** p.-v., cap. of Dent co., Mo., on St. Louis Salem and Little Rock R. R., 130 miles S. W. of St. Louis, has 2 churches, an academy, 2 newspapers, 1 steam flouring-mill, 2 iron-ore banks, and 1 steam planing-mill. P. 280.

J. E. Organ, Ed. "Salem Monitor."

**Salem,** tp., Dunklin co., Mo. P. 470.

**Salem,** p.-v. and tp., Richardson co., Neb., on Atchison and Nebraska R. R., and near Big Nemaha River, has 1 newspaper. P. of v. 304; of tp. 681.

**Salem,** p.-v. and tp., Rockingham co., N. H., on Manchester and Lawrence R. R. P. 1603.

**Salem,** p.-v., cap. of Salem co., N. J., on Salem R. R. and River, 34 miles S. W. of Philadelphia, with which it has water-communication, has 11 churches, collegiate and musical institutes, good schools, 1 bank, 2 newspapers, 4 hotels, foundries and machine-shops, mills, a canning establishment, and manufactories of glass, hollow-ware, and oil-cloth. P. 4555. R. Gwynne, Ed. "Sunbeam."

**Salem,** p.-v. and tp., cap. of Washington co., N. Y., on Rutland and Washington division of Delaware and Hudson R. R., 46 miles N. of Albany, has 8 churches, an academy established in 1791, 1 bank, 1 newspaper, railroad repair-shops, a fine court-house, county jail, 4 hotels, 2 slate-quarries, a cheese-factory, several mills, and marble-works. Principal business, farming and dairying. P. of v. 1239; of tp. 3556. James Gibson, Jr., Ed. "Press."

**Salem,** p.-v., Forsyth co., N. C., terminus of Salem R. R., 112 miles W. of Raleigh, contains the Salem Female Academy (1804), 1 bank, cotton and woollen manufactories, and 1 newspaper. P. about 2000.

L. V. and E. T. Blum, Eds. "People's Press."

**Salem,** tp., Pasquotank co., N. C. P. 1314.

**Salem,** tp., Auglaize co., O. P. 877.

**Salem,** tp., Champaign co., O. P. 1854.

**Salem,** tp., Columbiana co., O. P. 3199.

**Salem,** p.-v., Perry tp., Columbiana co., O., on Pittsburg Fort Wayne and Chicago R. R., 70 miles W. of Pittsburg, contains 8 churches, water and gas works, excellent schools, 2 national and 2 private banks, 2 weekly newspapers, 3 extensive machine-shops, 3 stove-foundries, the largest galvanized iron-cornice works in the U. S., and several furniture and shirt manufactories. The residents are mainly Quakers. P. of v. 3700.

J. K. Rukenbrod, Ed. "Republican."

**Salem,** v., Liberty tp., Guernsey co., O. P. 93.

**Salem,** tp., Highland co., O. P. 1029.

**Salem,** tp., Jefferson co., O. P. 1708.

**Salem,** tp., Meigs co., O. P. 1718.

**Salem,** tp., Monroe co., O. P. 2106.

**Salem,** v., Randolph tp., Montgomery co., O., on Dayton and Western R. R. P. 312.

**Salem,** tp., Muskingum co., O. P. 941.

**Salem,** tp., Ottawa co., O. P. 1687.

**Salem,** tp., Shelby co., O. P. 1428.

**Salem,** tp., Tuscarawas co., O. P. 1725.

**Salem,** tp., Warren co., O. P. 2102.

**Salem,** v. (Lower Salem P. O.) and tp., Washington co., O., on Marietta Pittsburg and Cleveland R. R. P. of v. 187; of tp. 1610.

**Salem,** tp., Wyandot co., O. P. 1103.

**Salem,** city, cap. of Marion co., Or., and also of the State, on the E. bank of Willamette River and on Oregon and California R. R., 50 miles S. of Portland, with which city it is connected by steamer for nine months in the year, is surrounded by fertile prairies, has good water-power from the falls of Mill Creek, which is utilized by several flouring-mills, tanneries, machine-shops, and manufactories; has 2 banks, 8 churches, 1 daily and 3 weekly newspapers, the State penitentiary, deaf-mute school, and institute for the blind, and is the seat of Willamette University. P. 1139; estimated at 6000 in 1875.

**Salem,** tp., Clarion co., Pa. P. 949.

**Salem,** tp., Luzerne co., Pa. P. 1525.

**Salem,** tp., Mercer co., Pa. P. 686.

**Salem,** tp., Wayne co., Pa. P. 2607.

**Salem,** b. (Delmont P. O.) and tp., Westmoreland co., Pa., on Loyalhanna River. P. of v. 448; of tp. 2124.

**Salem,** tp., Orleans co., Vt. P. 693.

**Salem,** tp., Culpeper co., Va. P. 2178.

**Salem,** v. (Salem Fauquier P. O.), Fauquier co., Va., on Manassas division of Washington City Virginia Midland and Great Southern R. R.

**Salem,** p.-v. and tp., cap. of Roanoke co., Va., on Atlantic Mississippi and Ohio and Valley R. Rs., 180 miles W. of Richmond, has 4 churches, is the seat of Roanoke College (a flourishing institution of twenty years' standing, containing a library of 10,000 volumes, and the finest mineral cabinet in the State), 1 bank, 2 weekly newspapers, a monthly journal, 2 hotels, a large town-hall, and a fine

graded school. Fine water-power exists. P. of v. 1355; of tp. 3652. EDW. A. MCCAULEY, ED. "ROANOKE TIMES."

**Salem,** p.-v. and tp., Kenosha co., Wis. P. 1386.

**Salem,** tp., Pierce co., Wis. P. 241.

**Salem Chapel,** p.-v., Forsyth co., N. C. P. 848.

**Sale'mi,** town of Sicily, province of Trapani, in an extremely fertile and healthful district, 38 miles N. E. of Palermo. Its name is of Arabic origin, and signifies "place of delight." The castle is of Arabo-Byzantine architecture, and in two windows of the round tower there are Greco-Latin inscriptions curiously interlaced. The Normans, after driving out the Saracens, made Salemi a royal city. The churches still contain some noteworthy pictures and other artistic objects, but the inhabitants, though vigorous and active, are sadly deficient in instruction. P. 14,096.

**Sal'ep** [Arab. *sahleb*], a substance of a mucilaginous nature, made by drying the bulbs of the male orchis (*Orchis mascula*), a plant of the Mediterranean region. Its properties are very similar to those of gum-tragacanth. The dried bulbs are very hard and horny, translucent, and swell up slowly in cold water like tragacanth, forming a mucilage. Certain medicinal virtues ascribed to salep in the East are wholly imaginary. HENRY WURTZ.

**Saleratus.** See SAL AËRATUS.

**Saler'no,** city of Southern Italy, chief town of the Principato Citeriore, now the province of Salerno. It is situated about 30 miles S. E. of Naples, on the Gulf of Salerno, with an adjacent country of the greatest fertility, and is very striking as seen from the sea. The harbor, once of some size, is now nearly filled up, though some efforts are making to improve it. The chief object of interest in the town itself is the old Norman cathedral (1084), injuriously restored in 1768, but still the most imposing specimen of Norman architecture in Southern Italy, and containing, besides rich marbles and mosaics, twenty-eight magnificent granite and porphyry columns from the temples of Pæstum. Pope Gregory VII. (Hildebrand) was buried in this cathedral, and tradition asserts that the body of St. Matthew was brought from the East in 930 and deposited in the crypt where it now lies. Several other churches here contain fine works of ancient and mediæval art. Salerno was probably settled by the Greeks at a very early period, was colonized by the Romans not far from 200 B. C., and was a place of importance during the best Roman period. Its history under Lombard, Norman, Swabian, and Angevine rulers abounds in romance, but the great and just boast of mediæval Salerno was its celebrated medical school, which, according to Prof. de Renzi, was neither a foundation of Charlemagne nor of the Saracens, but of pure native growth, and dating from a very early period. Its great reputation drew hither, during many centuries, invalids and pupils of all classes and nations. The *Schola Salernitana*, a set of hygienic rules drawn up in Latin at this school in the twelfth century, and dedicated to the king of England, was translated into many European languages, and published in very numerous editions soon after the invention of printing. The *Erbario*, a still earlier medical work, also emanated from Salerno, and was widely circulated throughout Europe. P. in 1874, 28,000.

**Sales, de** (FRANCIS). See FRANCIS DE SALES.

**Sales** (FRANCIS), b. in Roussillon, France, in 1771; was instructor in French and Spanish in Harvard College from 1816 to 1839, and of Spanish alone from that time till his death at Cambridge Feb. 16, 1854. Author of a *Spanish Grammar* (1816; 16th ed. 1860); editor of the *Don Quixote* of Cervantes (2 vols., 1836), and of several volumes of select works of Iriarte Moratin, Lope de Vega, Calderon de la Barca, La Fontaine, and other Spanish and French classics.

**Sales'ville,** p.-v., Milwood tp., Guernsey co., O., on Central Ohio division of Baltimore and Ohio R. R. P. 172.

**Saley'er Islands, The,** a group of about 30 small islands situated to the S. of the island of Celebes in the East Indies, and inhabited by between 40,000 and 50,000 Mohammedan Malays, who are ruled by native chiefs, but subject to the Netherlands. Cotton, coffee, sugar, pepper, and mustard are cultivated; also maize and *botta* (a kind of millet), but not rice, on account of certain superstitious ideas of the natives. Fine timber, both sandal and teak, abounds.

**Salford.** See MANCHESTER, England.

**Salians.** See FRANKS, by PROF. J. W. BURGESS, LL.B.

**Salica'ceæ,** or **Salicin'eæ** [Lat. *salix*, "willow"], a natural order of apetalous dicotyledonous plants, consisting of the willows (160 species) and poplars (about 20 species), trees and shrubs of the northern hemisphere, well marked by the diœcious flowers, both sexes in catkins, follicular fruit, and cottony-comose seeds. The wood is soft and light; the young shoots of various willows (osiers) are largely employed for wickerwork; and the bark of many or all the species yields salicine or populine, bitter principles used as febrifuges. ASA GRAY.

**Sal'icine** [Lat. *salix*, the "willow tree"]. All the willow tribe, of which there are said to be 130 species known, with some poplars, contain in their bark a bitter crystalline principle known by this name. Its composition is $C_{13}H_{18}O_7$. It has no alkaloid properties, like quinine, strychnine, and some other crystalline bitter principles, but is a *glucoside*. By the action of hot dilute acids or of the ferment *emulsine* or SYNAPTASE (which see), it breaks up into glucose and another compound called *saligenine:*

$$\underset{}{C_{13}H_{18}O_7} + H_2O = \overset{\text{Glucose.}}{C_6H_{12}O_6} + \overset{\text{Saligenine.}}{C_7H_8O_2}.$$

Salicine has conceded to it valuable medicinal virtues in the treatment of intermittents, though much less efficient than quinine. Its main interest at present, however, is in its being one source of SALICYLIC ACID (which see), which is, nevertheless, now much more readily and cheaply obtainable from another source. To obtain salicine from willow bark, Merck boils the concentrated aqueous decoction with litharge, which precipitates tannic acid, gum, and coloring-matters. Some lead that passes into solution is then precipitated from the liquid by sulphuric acid, and finally by sulphide of barium. Evaporation of the filtered liquid now yields crystals of salicine, which must be purified by repeated recrystallizations. There are other methods, for which the textbooks must be consulted. H. WURTZ.

**Sal'ic Law** [Lat. *Lex Salica*] was written in the fifth century in corrupted Latin, and contains the code of the Salian Franks, who shortly before had invaded Gaul, and shortly after established there a Frankish kingdom. The code exists in numerous manuscripts. The oldest contains 65 *pactus*, but new laws were subsequently added; the third oldest contains 99 *pactus*. The oldest editions are by Pardessus (Paris, 1843) and Merkel (Berlin, 1850). One of the most remarkable points of this code is the law which prevents women from inheriting any landed estate which is not an acquired but inherited possession in the family. This law prevailed in France with respect to the inheritance of the crown; and in Spain, where previously the Visigothic law prevailed recognizing the succession of women, it was introduced by the Bourbon, Philip V., in 1713, but abolished by Ferdinand VII. in 1830 in favor of his daughter Isabella.

**Salicyl'ic (Hyperspinoylic, Spinoylic, or Meta-oxybenzoic) Acid** (formula $C_7H_6O_3$; *oxy-* and *paraoxybenzoic* acids have the same formula), an organic acid existing in the flowers of *Spiræa ulmaria*, and in combination as acid methylsalicylate, forming the essential oil of wintergreen (*Gaultheria procumbens*).

*History.*—It was discovered by Piria in 1838, who formed it by oxidizing salicylol (essential oil of *Spiræa ulmaria*) with chromic acid; in 1844, Cahours obtained it from oil of wintergreen; and in 1860, Kolbe and Lautermann discovered the mode of making it from phenol (carbolic acid). In 1874, Kolbe modified and improved his original process for the manufacture from phenol, and thereby cheapened the article so much that it could be brought into use in medicine and as an antiseptic. Some few chemists—Fleck, Feser, and Friedberger—have made experiments with it, in which they call in question the claims made for it as an antiseptic. (*Arch. f. Wissensch. u. prakt. Thierheilkunde*, 1875, Heft. 2, 3, and 4.)

*Formation.*—Salicylic acid may be obtained in several ways—as (1) by treatment of salicylol with an oxidizing agent, as chromic acid; (2) by fusing salicylol with caustic potassa; (3) by treating oil of wintergreen with strong potassa ley, or (4) with gaseous hydriodic acid; (5) by heating a mixture of indigo and caustic potassa to 300°; (6) by treating phenol (carbolic acid) with sodium and carbonic acid gas, (7) with sodium and ethylchlorocarbonate, (8) with acid potassium carbonate, or (9) with caustic soda, the mixture being heated and carbonic acid gas passed into it. Some five other methods of obtaining this acid might be enumerated, but they have no practical importance.

*Preparation.*—For use, salicylic acid is made from oil of wintergreen or from phenol. In making it from the former the oil is simply heated with strong potassa ley until methyl alcohol ceases to be evolved. The resulting product is potassium salicylate, from which hydrochloric acid precipitates salicylic acid. This is filtered off, washed, and purified by dissolving and recrystallizing from alcohol. To prepare it from phenol, the phenol is dissolved in caustic soda, the exact equivalence of each being used (an excess of one or the other having a considerable effect on the yield obtainable), and the solution is evaporated to dryness, care being taken to drive off all the water. The mass is then

placed in a retort and heated gradually, a current of carbonic acid gas being passed through it; when the temperature reaches that of boiling water, the heat is further raised. At 180° C. phenol begins to distill over, and the operation is continued until no more phenol distills over, the heat being kept between 220° and 230° C. The mass left in the retort consists of sodium salicylate, which is dissolved in water and precipitated by hydrochloric acid. It is usually brownish, on account of a resinous impurity, which may be more or less perfectly removed by resolution and recrystallization or passing the solution through bone-black. In 1875, Rauter invented a process of purifying it by distillation in a current of superheated steam (at 170° C.), which affords a very pure article. In this process disodium phenol and phenol first form, which, under the action of the carbonic acid gas, is changed to disodium salicylate. Caustic potassa, baryta, or lime may be used instead of the soda, but their use is not so advantageous.

*Properties and Uses.*—Salicylic acid when pure crystallizes in white four-sided prisms, which fuse at 130° C. and sublime at some temperature above 200° C. It has a sweetish-sour taste, reddens litmus strongly, and has no action on polarized light. It is slightly soluble in cold water (in proportion of 1 part to 1000 of water), more so in hot, still more so in alcohol, ether, and oil of turpentine. By heating with strong hydriodic or hydrochloric acid or with dilute sulphuric acid it decomposes into phenol and carbonic acid. It is a dibasic acid, forming acid and neutral salts. By treatment with chlorine, bromine, iodine, nitric acid it forms chloro-, bromo-, iodo-, and nitro-salicylic acids. In very small quantities it acts as an antiseptic, and experiments have shown its efficiency in preserving wines, beer, milk, eggs, and other articles of food from the changes which unfit them for use. Its action as a disinfectant is not so powerful as that of carbolic acid. When acting as an antiseptic it appears to undergo no chemical change. Its salts have no disinfecting or antiseptic properties. On account of its being odorless and less irritating than carbolic acid, and not poisonous, it has been used with advantage in surgical treatment, where it can be used for every purpose for which carbolic acid is used, except for the cleansing of instruments. In that case it causes the instruments to rust. In medicine, salicylic acid is used as an antipyretic, and as an internal factor as antiseptic in cases of diphtheria. The dose is from 7 to 45 grains. It is frequently dispensed in solutions of alkaline phosphates, in which it is more soluble than in pure water. It is used also in preserving wine, beer, cider, meat, and other articles of food, and its use has been proposed in the manufacture of glue, leather, etc., of perfumery, and as a dye in connection with iron salts, with which it gives a fine purple color. The production is as yet extremely limited. Von Heyden of Dresden is at present the largest manufacturer, producing 50 kilos (about 100 pounds) daily.

*Literature.*—Piria, *Ann. de Chem. et de Phys.*, lxix. 298; Cahours, *Ibid.* (3), x. p. 329; Kolbe and Lautermann, *Ann. Chem. u. Pharm.*, cxiii. p. 125, and cxv. 201; Fleck, *Benzoësäure, Carbolsäure, Zuimbesäure* (Munich, 1875). (For further references to the literature on the subject, see H. Endermann, *Am. Chem.*, vi. pp. 46, 121, 161, and Feb., 1876.)

E. Waller.

**Salicylol,** also called (incorrectly) **Salicylic Aldehyde.** (Older names are *Salicylous acid, hydruret of salicyle.*) Its composition is $C_7H_6O_2$, and it differs, therefore, from Salicylic Acid (which see) by containing one equivalent less of oxygen. Salicylol occurs naturally in the essential oil of *Spiræa ulmaria* or *meadow-sweet*, in admixture with a terpene compound. It may be obtained artificially by the action of oxidizing agents, as chromic acid on Salicine (which see). It is a fragrant ethereal liquid, smelling like bitter almonds, generally reddish in color from exposure to the air, of density 1.173, somewhat soluble in water, and reacting like salicylic acid, with a violet color, on ferric salts. It forms salts with bases, indicating an acidic nature. This compound has present interest in connection with salicylic acid.

Henry Wurtz.

**Salien'tia** [from the Lat. *salio*, to "leap"], one of the names of the order of batrachians, embracing the frogs, toads, and tree-frogs, and of which another equally expressive name, and one more generally used, is *Anura* (ἀ privative, and οὐρά, "tail"). The frogs are the typical representatives of the order. Referring for information respecting the class to the articles Amphibia and Batrachia, our present inquiries will be confined to the order.

The order comprises all (and only) those species which have, in the mature stage, a short, stumpy body destitute of a tail, and great inequality between the fore and hind legs, the former being quite short, and the latter much enlarged and adapted for leaping; the skeleton is well ossified; most of the cranial bones are present, but the post-orbital and supra-temporal, and, generally, the nasal bones are wanting; the frontal and parietal are coalesced, and compose a pair of fronto-parietal bones; the ethmoid forms a kind of ring surrounding the cerebral lobes; the coccyx is represented by an elongate style, resulting from ossification around the primitive notochord; the inferior elements of the pelvis are applied together, and form a single vertical mass, and the ilia are very much elongated, and are attached to the sacral vertebræ in such manner as to allow of an independent motion of the pelvis. In addition to these more important characters, the skin is naked (destitute of scales or plates), and in the typical frogs is smooth, but in the toads is warty. With few exceptions, a regular metamorphosis takes place, the young coming out from the egg in a form entirely different from that which it assumes in future life, it being at first fish-like and furnished with a long fail, without legs, and with gills exserted on each side of the neck. Soon, however, the hinder legs grow out, and subsequently the fore ones (thus reversing the sequence exhibited in the salamanders), the gills disappear, and lastly the tail is absorbed and completely atrophied, and the frog-like form is attained. These characters are applicable to the true frogs, the toads, and the forms variously called tree-frogs or tree-toads.

The order is a very homogeneous one, the likeness between all its species being very evident, and one which would be recognized by all. Nevertheless, there are considerable variations, although of minor importance, in details of structure: for example, the sternum and bones connected with it exhibit considerable differences, and on such differences the primary divisions of the order have been based by Prof. Cope. The sacral vertebræ are also variable, in some being dilated, and in others nearly cylindrical; the tongue, although almost always present, is in two families wanting; some forms are provided with teeth on the jaws, while others are at all times destitute of them; the ear may be perfect or defective in its superficial parts; and the tongue is variable in its insertions. There are still other variations which are more worthy of extended remark. It has been already indicated that in almost all the species of the order complete metamorphosis takes place, but the period during which the species remain in the tadpole state is in some very short, and in certain terrestrial and tree frogs the tadpole stage is entirely suppressed: these differences in mode of development are not, however, coincident with any structural modifications; and that they do not have the significance that would at first appear probable is evident from the fact that common frogs and toads may be even reproduced directly from the egg in their adult form and without having undergone a regular metamorphosis. These adaptations in development are indeed frequent in the animal kingdom, and in forms which are peculiar in their mode of life and in their relations to their surroundings considerable deviations from the normal type may occur, as among the fluviatile and terrestrial decapod crustaceans, the fluviatile and terrestrial gasteropods, and others: again, it is a fact well known to physiologists that the tadpole condition may be indefinitely prolonged by the deprivation of the animal from proper light and heat.

Another notable character is found in modifications for arboreal life, almost all those species which live among the trees being provided with peculiar disc-like dilatations at the end of the toes. It was formerly supposed that this character was of great importance, and that all the forms in which it was developed were closely related; and they were therefore united in a single family under the name Hylidæ: recent studies of the organization of all such forms have, however, shown that the species confounded under that group exhibit great differences among themselves, while, on the other hand, they are severally very similar in other respects to frogs that have no such dilatations. It thus now seems that the dilatations are adaptive modifications common to all arboreal forms, and which fit those various forms for life among the trees, and that species of any family may be so modified.

There are peculiarities of still another kind in their structure and habits which are worthy of special mention. If a common frog is examined, it will be found to have a bend behind the middle of the back, so that, with the different segments of the hind legs, there will appear to be four flexures: this appearance is the result of the great elongation of the iliac bones of the pelvis and the mode of their connection with the sacral vertebræ. Although most apparent in the frogs, the same feature exists throughout the series, and this mechanism greatly increases the ability to jump. Further, to provide for its long leaps, the frog has very large muscles, especially on the thigh, and this segment of the leg is entirely free—that is, not included within the abdominal integument—as in man; it is this

feature which confers the edible quality on the hind legs of the frog, and in this case quality and quantity are to some extent interchangeable terms.

The various sounds emitted by different kinds of frogs are familiar to residents in the country, especially in the vicinity of marshes and ponds. These noises are produced by a peculiar mechanism in the throat. According to Dr. Bishop, the arytenoid cartilages are triangular, and their apices being upward form the superior lateral boundaries of the larynx. The vocal cords pass from end to end of the bases of the triangle. Above and below the vocal cords there are sacs lined with mucous membrane and bounded by the arytenoid cartilages. In the true frogs and tree-frogs, at least, the males are provided with two sacs, which open by a straight canal into the larynx. These sacs are situated on each side of the lower jaw, and are capable of considerable distension when filled with air during the cry of the animal. These sacs doubtless exert a powerful influence on the quality of the sounds which frogs utter, analogous to the influence of similar sacs which exist in many of the higher animals. The tone of the voice is modified by the character of the vocal cords.

Although there is considerable diversity of opinion among zoologists respecting the systematic value of the variations among the anurous batrachians, and consequently respecting the natural groups into which the order may be divided, all agree in distinguishing two primary groups or series within the order: one of these (Phaneroglossa), embracing almost all the species, is distinguished by the presence of a tongue whose posterior margin is more or less free. The other group (Aglossa) is peculiar in the absence of a tongue; and, in addition, the species agree in having a completely ossified cavum tympani; in the union of the Eustachian tubes, and their outlet by a single oral opening; in the absence of vocal cords; and in the dilatation of the transverse processes of the sacral vertebræ. This second group embraces only two families—Pipidæ, which is represented by a single species (the Surinam toad), and Dactylethridæ, also represented by a single genus, confined to Africa.

The order includes a large number of species which are extensively distributed under one form or another throughout the warm and temperate regions of the earth. While they are chiefly aquatic, and developed from eggs deposited in the water, a number are terrestrial or arboreal in their habits; the waters in which they are found are always fresh, or at most brackish, none being inhabitants of the sea or of salt-water. The cis-tropical hemisphere is the home of numerous species of frogs and tree-frogs, and of a few toads, and in that hemisphere they are most numerous in the U. S. The typical toads are developed especially in the tropical American, African, and tropical Asiatic regions; the true tree-frogs and related forms are most abundant in Australia and tropical America; and the typical frogs are most numerous in tropical Asia and Africa, while they are entirely excluded from Australia.

In brief, if we divide the earth's surface into regions distinguished by combinations of the anurous batrachians, we should have (1) the cis-tropical hemisphere, (2) tropical Asia, (3) Africa S. of the desert, (4) tropical and southernmost America, and (5) Australia; and it is especially to be noted that the last two countries have much in common.

The chronological distribution of this order is very imperfectly known, no species having been found in deposits older than the Miocene Tertiary, during which epoch they were represented by several peculiar types, whose remains have been preserved in the "brown coal" of Germany, and which indicate several forms, one of which appears to have been most closely related to the family Dactylethridæ, which is now confined to Africa. THEODORE GILL.

**Salie'ri** (ANTONIO), b. at Legnano, Northern Italy, Aug. 19, 1750; studied music, first at Venice, then under Gassmann at Vienna; composed his first opera, *Le Donne Letterate*, in 1770; was appointed director of the Italian opera at Vienna in 1774, and chapel-master to the court in 1788; retired into private life in 1824. D. at Vienna May 7, 1825. Of his numerous operas, now all forgotten, the *Danaïdes* was brought out in Paris in 1784 under the name of Gluck, and made a great success; *Tarare* was also received with much applause at Paris in 1784. Beaumarchais wrote the libretto. He also composed some church music, among which was the oratorio *La Passione di Gesú Cristo* (1775).

**Salies,** town of France, department of Basses-Pyrénées, has some remarkable salt springs, which are used both for bathing and for the manufacture of salt. P. 5298.

**Saligenine.** See SALICINE.

**Sali'na,** p.-v. and tp., Kankakee co., Ill. P. 865.

**Salina,** p.-v., cap. of Saline co., Kansas, on Kansas Pacific R. R., in Smoky Hill Valley, 185 miles W. of Kansas City, Mo., has 7 churches, an excellent school system, 2 weekly newspapers and 1 monthly journal, 2 water-power flouring-mills, and 1 grain-elevator. P. 918.
B. J. F. HANNA, ED. "HERALD."

**Salina,** tp., Onondaga co., N. Y. P. 2688.

**Salinas,** tp., San Luis Obispo co., Cal. P. 679.

**Salinas City,** p.-v., cap. of Monterey co., Cal., in the heart of Salinas Valley, on Southern Pacific R. R., has 8 churches, a city hall, 2 large public-school buildings, 1 bank, water and gas works, a well-organized fire department, 1 daily and 2 weekly newspapers, 2 flouring-mills, a foundry, 2 hotels, and a saw-mill. P. in 1870, 599; in 1876, 3100. ROBERT S. FORBES, ED. "DAILY RECORDER."

**Saline',** a river of Arkansas, rises in Saline co., flows in various directions 200 miles, and falls into Washita River. It is navigable some 80 miles from its mouth.

**Saline,** county of Central Arkansas, on Saline River, traversed by Cairo and Fulton R. R., has numerous marble-quarries. Staples, Indian corn, tobacco, honey, wool, and butter. Cap. Benton. Area, 800 sq. m. P. 3911.

**Saline,** county of S. E. Illinois, on Saline River, traversed by Cairo and Vincennes and by Shawnee division of St. Louis and South-eastern R. R., is level and well timbered, with a fertile soil, and is well adapted for stock-raising. Staples, Indian corn, tobacco, wheat, hay, sorghum-molasses, wool, and butter. Cap. Harrisburg. Area, 370 sq. m. P. 12,714.

**Saline,** county of Central Kansas, on Saline River and Solomon and Smoky Hill forks of Kansas River, and traversed by Kansas Pacific R. R., has a level surface, a soil fertile and well timbered along the streams, and several salt springs. Staples, Indian corn, wheat, hay, and butter. Cap. Salina. Area, 720 sq. m. P. 4246.

**Saline,** county of Central Missouri, bounded N. and E. by Missouri River, watered by Black and Salt forks of La Mine River, consists chiefly of prairie, has several salt springs, and some deposits of bituminous coal and lead. Cattle and swine abound. Staples, Indian corn, wheat, oats, hay, tobacco, honey, wool, and butter. Cap. Marshall. Area, 750 sq. m. P. 21,672.

**Saline,** county of S. E. Nebraska, on Big Blue River, intersected by Burlington and Missouri River R. R., and by its Beatrice branch, has a rolling surface and a fertile soil. Staples, Indian corn, hay, and butter. Cap. Pleasant Hill. Area, 576 sq. m. P. 3106.

**Saline,** tp., Dallas co., Ark. P. 488.

**Saline,** tp., Hempstead co., Ark. P. 1265.

**Saline,** tp., Hot Springs co., Ark. P. 444.

**Saline,** tp., Saline co., Ark. P. 1194.

**Saline,** tp., Sevier co., Ark. P. 353.

**Saline,** tp., Johnson co., Ill. P. 1282.

**Saline,** tp., Ellis co., Kan. P. 43.

**Saline,** tp., Trego co., Kan. P. 35.

**Saline,** p.-v., Washtenaw co., Mich., on Detroit Hillsdale and Indiana R. R., 10 miles W. of Ypsilanti, has 4 churches, a union school, 1 newspaper, 3 flouring-mills, 1 tannery. P. 1955. D. B. SHERWOOD, ED. "REVIEW."

**Saline,** tp., Cooper co., Mo. P. 1836.

**Saline,** tp., Miller co., Mo. P. 1720.

**Saline,** tp., Perry co., Mo. P. 1409.

**Saline,** tp., Ralls co., Mo. P. 1634.

**Saline,** tp., Sainte Genevieve co., Mo. P. 980.

**Saline,** tp., Jefferson co., O. P. 1922.

**Saline'ville,** p.-v., Washington tp., Columbiana co., O., on Cleveland and Pittsburg R. R. P. 1429.

**Saling,** tp., Audrain co., Mo. P. 991.

**Salins',** town of France, department of Jura, on the Furieuse, has rich salt springs in its vicinity, from which 40,000 cwts. of salt are annually produced. Gypsum, paper, and leather are manufactured. P. 7361.

**Salis'bury** (saulz'berry), town of England, capital of Wiltshire, on the Avon, has a magnificent cathedral, which perhaps is the purest and richest specimen of the Early English style. It was built 1220–58 in the form of a double cross, with a spire 400 feet high. It is 449 feet long and 81 feet high in the interior; the length of the great transept is 203 feet. The trade and manufactures of Salisbury are insignificant. P. 12,903.

**Salisbury,** p.-v., Litchfield co., Conn., in the northwestern part of the State, is located on Connecticut Western R. R., 63 miles from Hartford. It derives its prosperity chiefly from its mining and manufacture of iron. Salisbury iron is acknowledged the world over as unsurpassed for the manufacture of railway car-wheels. There are in the town 7 ore-mines, some of which have been worked

more than 100 years; 2 blast furnaces, 2 foundries, 1 car-wheel foundry, 1 machine-shop and hardware manufactory, locomotive and car works of the Housatonic R. R. Co., 1 cutlery manufactory, 1 woollen-mill, 1 institute for imbeciles, 2 academies, 1 newspaper, 5 churches, 4 flouring-mills, and 5 hotels. Its five large lakes and mountain-scenery entitle it to the appellation of "The Switzerland of America." P. 3303. J. L. PEASE, ED. "CONN. WESTERN NEWS."

**Salisbury,** p.-v., Duck Creek hundred, Kent co., Del. P. 97.

**Salisbury,** p.-v. and tp., cap. of Wicomico co., Md., on Eastern Shore and Wicomico and Pocomoke R. Rs., at the head of Wicomico River, 140 miles S. E. of Baltimore, has 9 churches and 3 chapels, 1 high, 2 grammar, and 4 primary schools, 3 newspapers, 2 large flouring-mills, 1 wool-carding establishment, 2 hotels, and several saw and planing mills. The town, largely engaged in the coasting and inland trade, owns a number of schooners whose tonnage exceeds 10,000. Lumber and grain are the staple articles of export, but small fruits are also shipped to the North. The Wicomico River is navigable for small boats, and the government is at present engaged in deepening the harbor for the entrance of larger vessels. P. of v. 2064; of tp. 3312.
LEMUEL MALONE, ED. "ADVERTISER."

**Salisbury,** p.-v. and tp., Essex co., Mass., on Atlantic Ocean, extending from the New Hampshire line to the N. bank of Merrimack River, is on the Salisbury branch of Eastern R. R., has large interests in manufactures of cotton and woollen, 7 churches, 2 banks, and 1 weekly newspaper. P. 3776.

**Salisbury,** p.-v. and tp., Chariton co., Mo., on St. Louis Kansas City and Northern and Keokuk and Kansas City R. Rs., has good schools, 1 newspaper, and rich deposits of coal. P. of v. 626; of tp. 1497.
J. M. GALLEMORE, ED. "PRESS."

**Salisbury,** p.-v. and tp., Merrimack co., N. H., on Black River, includes part of Mount Kearsarge. P. 897.

**Salisbury,** p.-v. and tp., Herkimer co., N. Y., on Canada Creek. P. 1933.

**Salisbury,** p.-v. and tp., cap. of Rowan co., N. C., at the junction of Western North Carolina and North Carolina R. Rs., 5 miles W. of Yadkin River, contains 6 churches, excellent schools, 1 bank, 2 newspapers, 2 foundries, several mills, gasworks, and the usual county-seat buildings. P. of v. 168; of tp. 3327.
J. J. STEWART, ED. "CAROLINA WATCHMAN."

**Salisbury,** tp., Meigs co., O. P. 4902.

**Salisbury,** p.-v. and tp., Lancaster co., Pa., on Pequea Creek. P. 3710.

**Salisbury,** tp., Lehigh co., Pa. P. 2860.

**Salisbury,** b., Lick tp., Somerset co., Pa., on Pittsburg Washington and Baltimore R. R. P. 291.

**Salisbury,** p.-v. and tp., Addison co., Vt., on Otter Creek and on Rutland division of Central Vermont R. R. P. 902.

**Salisbury** (EDWARD E.), professor of Arabic and Sanskrit in Yale College 1841–54, and of Arabic alone for several years later; was one of the founders of the American Oriental Society, editor of and leading contributor to its *Journal*, and endowed the professorship of Sanskrit in Yale College, now held by Prof. W. D. Whitney.

**Salisbury,** MARQUISES OF, EARLS OF, VISCOUNTS CRANBORNE (1604), and BARONS CECIL (1603), a prominent family of the British nobility. The earldom of Salisbury was first held by William Longespée, a Norman noble (d. 1226), afterward by the Montacute family, of which Thomas, the fourth and last earl, was distinguished in the wars against France (d. 1428). The title was conferred anew upon Sir Richard Neville on his marriage to Alice Montacute, daughter of Thomas (1442). This nobleman was a prominent Yorkist leader, gained the victory of Bloreheath 1459, and was beheaded at Pontefract Jan. 1, 1461, by order of Queen Margaret, the day after the battle of Wakefield, in which he was taken prisoner. Subsequently, the title was borne by Margaret Plantagenet, mother of Cardinal Pole, who was beheaded as a pretender to the crown 1541. ROBERT CECIL (b. June 1, 1563, d. May 24, 1612), the famous secretary of state to Queen Elizabeth, noted as the enemy of Essex and of Raleigh, was made earl of Salisbury May 4, 1605, and the title still remains in his family, the dignity of marquis having been added in 1787.

**Salisbury** (ROBERT ARTHUR TALBOT **Gascoyne-Cecil**), MARQUIS OF, b. at Hatfield Feb. 10, 1830; educated at Eton; graduated at Christ Church, Oxford, where he became a fellow of All Souls' College; sat in Parliament for Stamford, first under the name of LORD ROBERT CECIL, and afterward under the courtesy title of VISCOUNT CRANBORNE, from Aug., 1853, until his accession to the marquisate by the death of his father, Apr. 12, 1868; became secretary of state for India in Earl Derby's third administration July, 1866; resigned Mar. 2, 1867, in consequence of unwillingness to support the Reform bill, and accepted the same post in Disraeli's second administration Feb., 1874, which he still retains (1876), being regarded as the Conservative leader in the House of Lords. He was elected chancellor of the University of Oxford in succession to the late Earl Derby Nov. 12, 1869; is a member of the privy council; has taken an active part in politics in support of the Church of England and its institutions, and has contributed largely to the *Quarterly Review* and other periodicals.

**Salish,** or **Selish,** a family of Indians of the Columbian group, in Washington, Idaho, and Montana Territories, occupying the region between the Shushwap family of British Columbia on the N. and the Sahaptin family of Snake River on the S., includes the Flatheads, or Salish proper, formerly living on Bitter Root River, but since 1871 on the Jocko Valley Reservation, Mont.; the Kalispels, or Pend d'Oreilles, living in three bands, one in each of the three Territories; the Skitsuish, or Cœurs d'Alêne, on the lake of the same name; the Colvilles, or Indians near the Kettle Falls of Columbia River; the Spokanes, on Spokane River; and the Pisquouses, on the W. bank of the Columbia, between Okanagan River and Priest Rapids. They do not apparently differ much in languages or customs from the Okanagans, Atnahs, and Kootenais of the Shushwap family, which might with propriety be united with the Salish family. The Flatheads are erroneously designated by that name, as they do not practise the custom in question, which is peculiar to the Chinook Indians of the Pacific coast. Most of the tribes of this family have been wholly or in part converted to Roman Catholicism by Jesuit missionaries. (See *The Native Races of the Pacific States*, by H. H. Bancroft, vol. i., 1874.)

**Sali'va** [Lat.], the liquid secretion of the mouth. It comes from several glands secreting different liquids. Though numerous interesting facts are known about it, its chemistry cannot be regarded as completely studied. It has an alkaline reaction, and contains an albuminoid ferment called *ptyaline*, which has the power of converting starch into sugar, thus assisting in its digestion. For this reason it is claimed that young infants, whose lack of teeth renders mastication impossible, and who swallow their food without admixture with saliva, should not be fed upon starchy food, such as arrowroot, which to them proves indigestible. On the other hand, it is asserted that ptyaline acts only in alkaline liquids, and that in the acid liquid of the stomach it is therefore inert. Saliva, very curiously, contains *sulphocyanide of potassium* in minute proportion, but readily detectable by a ferric salt. It contains about 1 per cent. of dry solid matter, of which as much as one-fifth in some cases is made up of saline substances.
H. WURTZ.

**Sal'ivary** [Lat. *saliva*] **Glands,** essentially three in number: (1) the parotid (Gr. παρά, "near to," and οὖς, ὠτός, "the ear"), the largest, situated beneath the integument and immediately below the ear; (2) the sub-maxillary, beneath the lower jaw; (3) the sub-lingual, under the tongue. These glands are composed of a number of sections or lobes of polygonal shape and flattened sides, the result of coaptation and pressure. Their structure is termed *racemose*, or resembling a bunch of grapes. (See HISTOLOGY.) The tree or stem-like framework upon which the glandular lobes are set is a system of excretory tubules, which take up the saliva secreted by the gland, and the trunk is a common duct conveying it through the deep tissues to the surface of the mouth. The names of eminent anatomists are commemorated in the designation of these ducts, which they discovered. The parotid has one large duct, the duct of Steno; the sub-maxillary, the duct of Wharton; the sub-lingual—from eight to twenty minute ducts opening independently beneath the tongue—the ducts of Rivinius; and a few uniting to form a single duct, the duct of Bartholine, which joins that of Wharton. These ducts, their branches, and the interior of the glands are lined with epithelial cells. The process of secretion, more or less constant, is most active during the mastication of food; then saliva is abundantly formed and poured into the mouth. The saliva serves a double purpose—to aid mastication and to partially digest starchy elements of the food. The salivary glands are the seat of disease—mumps or parotiditis, a specific inflammation and catarrhal engorgement (see MUMPS) of the parotid; inflammation and abscess of the parotid in low fevers; deposits of diphtheritic infiltration in some cases of that disease; not infrequently concretions of chalky matter form in the glands, or ducto-salivary calculi. *Ranula* sometimes is due to

occlusion of the sub-maxillary duct and formation of a cystic tumor.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Saliva'tion** [Lat. *saliva*], a specific irritation of the salivary glands, mouth, and throat by mercury. In former years, mercury, in heroic doses, ranked as a remedy second only to bloodletting. Salivation was a frequent occurrence—intentionally produced in many cases, in others the accidental result of large doses and individual susceptibility. Children will endure large doses of mercurials without salivation; adults are relatively susceptible. An open and active state of the skin, kidneys, and bowels favors immunity from salivation, even when the mercurial taken is considerable; reversely, if opium or any remedy which checks the glandular activity and functional excretion of kidneys or bowels be taken before or at the same time, even small doses of mercury, thus detained in the system, may salivate. Mercury to-day is chiefly employed in laxative and cathartic doses, eliminating itself as it performs its intended action; also in small repeated doses for alterative effects in some intestinal disorders of children and in certain specific diseases of adults. Hence, salivation is rare to-day. Salivation is manifested by a coppery or metallic taste, by soreness of the gums, tenderness of the jaws and teeth when pressed together or closed with force, excessive secretion and flow of saliva, even dribbling from the mouth; swollen, red, ulcerated gums; swollen, coated, salvy tongue, taking the imprint of the teeth; and a foul "mercurial" breath. In grave cases, spongy, bleeding, sloughing gums, loosened teeth, swelling of the face and neck, and even gangrene of the mouth, may result. There is accompanying constitutional depression, slight irritative fever, pain, sleeplessness, and sense of choking. The condition requires prompt saline cathartics, very astringent gargles for the mouth, rich liquid food, and tonics.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Salle, de la** (Jean Baptiste). See La Salle, de (Jean Baptiste).

**Sallet', von** (Friedrich), b. at Neisse, Silesia, Apr. 20, 1812; received a military education, and entered the Prussian army as a lieutenant in 1829; was sentenced to ten years' imprisonment in 1830 for a satirical novel he wrote on military life, but the sentence was commuted to two months; retired in 1838 from military service in order to devote himself exclusively to literary pursuits. D. at Reichau, Silesia, Feb. 21, 1843. His *Gedichte* appeared in 1835; his beautiful tale, *Schön Irla*, in 1838; his chief work, *Laienevangelium*, against the current views of religion and morals, in 1839; his collected works (in 5 vols.) in 1845.

**Sal'lust** (Caius Sallustius Crispus), b. in 86 B. C. at Amiternum, in the country of the Sabines, of a wealthy plebeian family; was elected *tribunus plebis* in 52; expelled from the senate in 50 by the censors on account of the dissipated and scandalous life he led; reinstated in the senatorial dignity in 47 by being elected prætor, probably by the aid of Cæsar, to whose party he belonged, and whom he accompanied to Africa in 46; was appointed proconsul of Numidia, and returned to Rome loaded with riches; formed the magnificent *Horti Sallustiani* on the Quirinalis, and lived in luxurious retirement, devoting himself to the study of history. D. at Rome 34 B. C. Of his *Historiarum Libri Quinque* only fragments are extant, but his *Bellum Catilinarium* and *Bellum Jugurthinum* have been preserved, and are much appreciated. Editions by Gerlach (3 vols., Bâle, 1823–31), Dietsch (2 vols., Leipsic, 1842–46), Kritz (3 vols., 1828–53); English translations by Sir H. Steuart (1806), by Watson (1852), and by J. R. Mongan (1864).

**Salma'sius** (Claudius), (Claude de Saumaise), b. at Semur-en-Auxois, department of Côte-d'Or, France, Apr. 15, 1588; studied at Paris and Heidelberg; embraced Protestantism; was appointed professor at the University of Leyden in 1632, and acquired an immense celebrity by his critical editions, *Scriptores Historiæ Augustæ*, etc., learned commentaries, *Plinianæ Exercitationes in Solinum*, etc., and independent essays, *De Usuris*, *De Re Militari Romanorum*, etc. At the instigation of Charles II., living in Holland as a refugee, he wrote (in 1649) *Defensio Regia pro Carolo I.*, which called forth the famous reply by Milton, and caused so much scandal among his republican friends in Leyden that he determined to accept an invitation from Queen Christina of Sweden. The climate did not agree with him, and the inhabitants of Leyden urged him to return, because "their academy could as little be without him as the world without the sun." In 1651 he left Stockholm, but d. Sept. 3, 1653, at Spa. His *Epistolæ* (Leyden, 1656) are very interesting.

**Salm'on** [Lat. *salmo*], a name given to several species of the genus *Salmo*, characterized by anadromous habits (that is, by their ascending from the sea into fresh waters to breed), as well as to the species of the genus *Oncorhynchus*. The species belonging to the genus *Salmo* have only about eleven rays to the anal fin, while those of the genus *Oncorhynchus* have fourteen to eighteen. All of these agree essentially in habits. Their natural home is the salt water, for there they obtain their food and rapidly increase in size; toward the fall, however, they are impelled by a breeding instinct to ascend the rivers, and this they do as near to the source as they can. During their sojourn in fresh water they almost entirely abstain from food and alter considerably in appearance; this divergence from the normal form is most apparent in the male, and is only approached in a slight degree by the female. The snout becomes attenuated and more or less hooked, and the lower jaw is modified in a similar manner; the body becomes emaciated, and the skin decked with glowing hectic colors. In the salmon of Europe and Eastern America this is temporary, and the males in considerable proportion descend to the sea, revive, and assume their pristine vigor and form. Some of the species of the genus *Oncorhynchus* of the Pacific coast, however, become so abnormally developed that after spawning they die, and their carcasses are left by myriads in the waters they have traversed. The most celebrated species of salmon, and those most interesting for Americans, are the *Salmo salar* of the Eastern coast, and the *Salmon* or *Oncorhynchus quinnat* of the Western slope.

The *Salmo solar*, as is well known, is common to the European as well as American streams. It is only found in cold waters; in the U. S. it is nowhere abundant except in some rivers of Maine, although in British America there are a number of streams in which it is found in large numbers. It is generally believed that in former times, and when the country was discovered by Europeans, the species was found farther S., and Hendrik Hudson, in the journal of his ascent of the river which bears his name, records "great stores of salmon in the river." It is tolerably certain, however, that the fish called by him *salmon* was the weakfish (*Cynoscion regalis*), a fish of the family Sciænidæ, having no relation to the Salmonidæ. The salmon-rivers of Canada are now taken charge of by the government and let to parties for private use.

The *Salmo* (or *Oncorhynchus*) *quinnat* is the common salmon of California, and is abundant also farther N.; it is a much deeper fish than the Eastern species, and is further at once distinguishable by the greater number of anal rays —fifteen or sixteen generally—which has caused it to be separated generically from *S. salar*. This species will live and flourish in much warmer waters than the Eastern species, and attempts have been lately made by the U. S. commissioner of fish and fisheries, in connection with the commissioners of several States, to introduce it into Eastern streams, but with what success remains to be ascertained. It has also been attempted, on a small scale, to introduce the Eastern species into Western waters. An extensive business has been developed of late years in the canning of salmon, and this is conducted on a large scale on Columbia River, Or. The species of the genus vary considerably at different ages. The extreme young is banded, and in this state was long known under the name of *parr*, and supposed to represent a distinct species of the family; it then has also red spots. Other names given to it in this condition are samlet, salmon fry, and pink. When about a year old, and when the spots have disappeared and it becomes of a bright silvery color before going to the sea, it is called a *smolt;* after its return from the sea into fresh water it is designated as a *grilse;* and when, finally, it has gone back to the sea and returned from thence a second time, it is known thenceforth ever after as a *salmon*. The species attain very considerable dimensions, *Salmon salar* occasionally attaining a weight of over eighty pounds, and the *Salmo quinnat* even exceeding this weight. (See also Salmonidæ, in Appendix.) Theodore Gill.

**Salm'on,** tp., Klamath co., Cal. P. 136.

**Salmon City,** p.-v., cap. of Lemhi co., Id., on Salmon River.

**Salmo'nes** [plu. of *Salmo*, a generic name], a group of the family Salmonidæ, which, on account of the great importance of its members, deserves special notice. The body is nearly alike in all, being elongated and fusiform; the scales very small; the head shapely and conic, except during the breeding season, when, in certain species, the jaws become deformed and hooked; the mouth has a deep cleft, and the supramaxillaries extend under or beyond the eye; the teeth are acute and well developed (generally large), and situated on the intermaxillaries, mandibles, roof of the mouth, and tongue. The skull is distinguished by the extension of the supra-occipital bone forward between the parietals, which are consequently widely separated. Such are the most obvious common characters of numerous species of fishes known under the names of salmon, salmon-

trout, trout, and charr. The characters which they have in common with other members of the family are to be found in article SALMONIDÆ, in APPENDIX. As to the rest, they are fishes of moderate or large size, few or none of them failing to reach occasionally at least a foot in length, and some of them attaining several habitually. The flesh in most is of a more or less reddish color, or of that peculiar tint which has derived its name—salmon color—from one of the species of the group. The eggs are in all the species of the genera *Salmo* and *Oncorhynchus* of quite large size—sometimes about as large as buckshot, or not very much less—and only in one form (*Brachymystax*) are the eggs what would be called small. Almost all the species of the group begin to spawn in the fall or early winter months, and in this respect they differ from almost all other fresh-water fishes with the exception of the cusk (*Lota*) and the white-fishes (*Coregoni*). There is, however, a notable exception to this rule in the eggs of the *Salmo hucho* (or *Hucho germanorum*) of the Danube, which spawns in the spring, about April, as does also the grayling (*Thymallus*), the representative of another group (*Thymalli*) of the family.

The relations of the members of the group to each other are not yet by any means definitely determined, and the views of systematists have differed, and still differ, as to their arrangement. No reference need be made to old authors (*e. g.* Linnæus), by whom the genus *Salmo* was extended to embrace not only everything that would now be referred to the family Salmonidæ, but to others representing quite different families. The members of the present group, so far as the European species at least are concerned, were separated on the characters of the dentition of the roof of the mouth into two quasi sub-generic groups under *Salmo* by Nilsson. By Prince Charles Bonaparte the same forms were grouped into three divisions: (*a*) *Salmones* (*migratores*), including the anadromous salmons; (*b*) *Truttæ*, embracing the trouts; and (*c*) *Salvelini* (Nilsson), including the charrs.

Valenciennes in 1848 (*Hist. Nat. des Poissons*, vol. xxi. p. 163) recognized three full genera—viz. (1) *Salmo*, in which the vomer has no teeth on the body, but carries them on the chevron or front; (2) *Fario*, characterized by a single row of teeth on the body of the vomer, and also some on the chevron; and (3) *Salar*, distinguished by the position on the vomer of a double row of teeth. To the first belong, *e. g.*, the salmons, charrs, etc., as well as the common trout of this country; to the second, *Salmo argenteus* and *Salmo lemanus* of Europe, and the *Salmo erythrogaster* and *Salmo Rossii* of America; and to the third the common trout of Europe (*Salmo Fario*) and the *Salmo namaycush* of America. This classification is a very unnatural one, especially as no consideration was paid to the fact that the body or shaft of the vomer may have had teeth in early life, and lost them afterward, while the development of one or two rows may be due to a more or less close conformity to, or deviation from, a median line due to approximation, etc. of the teeth. Siebold (*Die Süsswasserfische von Mitteleuropa*, Leipsic, 1863) modified this arrangement, and adopted two genera: (1) *Salmo*, characterized by the shortness of the shaft or body of the vomer, and the development of teeth only on the chevron or fore part; and (2) *Trutta*, distinguished by the elongation and extension of the shaft of the vomer, and the development of teeth thereon, which, however, are sometimes lost in the old; the chevron is sometimes provided with, and sometimes destitute of, teeth. *Salmo*, thus limited, only embraces the charrs—*e. g. Salmo Salvelinus* and the *hucho* (*Salmo hucho*) of Europe, while *Trutta* includes all the others—*e. g. Salmo salar*, *Salmo fario*, etc.

Günther in 1856 (*Cat. Fishes Brit. Museum*, vol. vi., p. 2) admitted three genera—viz. (1) *Salmo*, in which the scales are small, the dentition strong and complete, the maxillary long, cæca pylorica numerous, and the anal rays fourteen or less; (2) *Oncorhynchus*, whereof the scales are small, the dentition strong and complete, the maxillary long, and the cæca pylorica numerous, as in *Salmo*, but with the anal rays more than fourteen in number; and (3) *Brachymystax*, in which the scales are small, the teeth rather feeble, the maxillary short and broad, and the anal short (*i. e.* with twelve or thirteen rays). The first includes all the most common species of the fresh waters of America and Europe, as well as the Atlantic salmons; the second, eight determined and five doubtful species of salmon of the Pacific slopes of America and Asia; the third is only represented by one species, found in the Siberian rivers. The genus *Salmo*, it should be noted, is further subdivided into two sub-generic groups, corresponding essentially with Siebold's genera, *Salmo* and *Trutta*, but differently named; the "first sub-generic group, *Salmones*," of Günther corresponding with the genus *Trutta* of Siebold, and the "second sub-generic group, *Salvelini*," answering to the genus *Salmo* of the older author. It is tolerably certain that these groups do not represent the correct affinities of the species in question, but the present article is no place to discuss such questions.

Great difference of opinion has also prevailed at different times, and among different naturalists during the same time even, as to the number and limits of species belonging to this group. Dr. Günther, who has published the latest complete revision of the family Salmonidæ, has admitted 91 well-determined species and 12 doubtful or unidentifiable ones in the three genera here included under the group *Salmones;* of these, *Salmo* has 82 (+ 7 doubtful) species, of which 52 (+ 2 doubtful) belong to Günther's group *Salmones*, and 30 (+ 5 doubtful) belong to the *Salvelini; Oncorhynchus* has 8 (+ 5 doubtful) species, and *Brachymystax* 1 species. These groups, according to geographical range, are represented as follows: Of the genus *Salmo*, group *Salmones*, three are anadromous, and of these one (*S. salar*) is found on both sides of the Atlantic, while the other two (*S. trutta* and *S. cambricus*) are confined to Northern Europe; the other species are much more limited in range, and especially do not extend so far northward. According to Günther, as far as known, 1 (*S. macrostigma*) is found in Algeria; 3 are peculiar to Italy; 5 to the alpine region of Central Europe; 1 to Hungary; 2 to France; 7 to Great Britain and Ireland; 4 to the Scandinavian peninsula and Finland; 5 to Russia and Tartary; 15 (+ 1) to Northern Asia and North-western America; 4 (+ 1) to the rivers of the eastern slope of the Rocky Mountains; and 1 to Greenland and Labrador. Of the group *Salvelini*, 13 are found in Europe, 6 (+ 5) in Asia, 2 (*S. Lordii* and *S. Campbelli*) in the western parts of North America, and 9 (*S. Hearnii, S. alipes, S. nitidus, S. Hoodii, S. fontinalis, S. hudsonicus, S. sebago, S. Gloveri*, and *S. oquassa*) in the northern and eastern parts of North America. Of the genus *Oncorhynchus*, 8 (+ 5 doubtful) species are attributed to the Pacific slopes of Asia and America, and of the genus *Brachymystax* a single one (*B. coregonoides*) is confined to certain Siberian rivers, tributaries of the Obi, Irtis, and Jenisey. Besides these, the *Salmones* are represented in the Pyrenean peninsula, Asia Minor, Lake Goukcha, the Hindoo Kush, and Japan, but they have not yet been specifically well determined.

An older writer on the American species (Dr. George Suckley), but whose work has only lately been published in a monograph *On the North American Species of Salmon and Trout*, recognized 43 species as inhabitants of American waters, and to these several others have been since added. With a few corrections, but without assuming any responsibility for the validity of views of the author or relationships of the species, we give the results of Dr. Suckley's studies in brief, as they will be doubtless interesting to many persons: Of the sub-genus *Oncorhynchus* there are 6 species, to which must be added 4 species—*Salmo quinnat, S. confluentus, S. argyreus*, and *S. paucideus*—retained under the name *Salmo*. Of the revised sub-genus *Salmo*, of species without red spots and not feeding in fresh water, Suckley admits 8 species—*S. salar* and *S. immaculatus* from the Eastern waters, and *S. aurora, S. tsuppitch, S. Clarkii, S. Gairdneri, S. truncatus*, and *S. Richardi* from the North-western slope, especially Columbia River. Species with red spots, feeding freely in fresh water, are grouped in three categories: (1) Anadromous species, such as *S. hudsonicus* of Hudson's Bay, Labrador, and Newfoundland, and the *S. Campbelli, S. Rossii, S. Hearnii, S. alipes*, and *S. nitidus* of still more remote parts; (2) species not anadromous found in flowing fresh water, of which the only one mentioned is the common trout (*Salmo fontinalis*) of the Eastern States; and (3) species not anadromous, from the sea, but found in deep rivers or lakes, and ascending streams to spawn, including the *S. oquassa* of the Rangeley Lake, Maine, and the *S. Bairdii* and *S. Parkii* of the Western slope; of the species spotted with black, some are found in flowing fresh-water streams—viz. *S. iridea, S. Masoni, S. virginalis, S. Lewisi, S. brevicauda*, and *S. Bairdii*, and others in deeper rivers or lakes, ascending the shallow streams to spawn—viz. *S. sebago* of Maine and the *S. Gibbsii* and *S. Warreni* of Fraser's River, etc. Under the name "lake-trout," passing their lives in deep fresh-water lakes, approaching the shores annually to spawn in shallow water, never entering running brooks or repairing to the sea, six are enumerated—viz. *S. namaycush* and *S. siscowet* of the great lakes, *S. confinis* of the lakes of New York, *S. symmetrica* of Winnipiseogee Lake, and *S. Hoodii* of the lakes of the Atlantic slope N. of Canada, and *S. Newberryi* of Klamath River. Besides all these, there is a peculiar species (*S. Kennerlyi*), for which the generic name *Hypsifario* has been proposed, found in Chiloweyuck Lake and Fraser's River. (See further SALMON, TROUT, etc.)

THEODORE GILL.

**Salmon Falls,** p.-v and tp., El Dorado co., Cal. P. 428.

**Salmon Falls,** p.-v., Rollinsford tp., Strafford co., N. H., on Salmon River and Boston and Maine and Portsmouth Great Falls and Conway R. Rs.

**Salmon Fisheries.** See APPENDIX.

**Salmonidæ.** See APPENDIX.

**Salmon-Trout.** See TROUT.

**Salm-Salm** (FELIX), PRINCE, b. in Austria Dec. 28, 1828; served in the U. S. army during the civil war; was at one time in command of a regiment, and afterward post-commander at Atlanta, Ga., with the rank of brigadier; went to Mexico at the close of the war; became aide-de-camp and chief of the household to the archduke Maximilian, with whom he was captured at Querétaro; was released soon after the execution of the latter; entered the Prussian service as major of the 4th regiment of grenadiers of the royal guard, and was killed at the battle of Gravelotte, France, Aug. 18, 1870.—His wife, to whom he was married in 1862, MLLE. LE CLERCQ, of New York, accompanied him in Mexico, played a prominent part at the court of the archduke, and acquired celebrity by her heroic efforts to procure the pardon of Maximilian or to effect his escape. She accompanied her husband during the Franco-German campaign up to his death. She published portions of her own and of her husband's diaries in Mexico; and issued in 1875 an interesting volume, *Ten Years of My Life.*

**Salnave** (SYLVAIN), b. at Cape Haytien, Hayti, in 1832; entered the army as a common soldier; had attained the rank of captain in 1858, when he took a leading part with Geffrard in the overthrow of the emperor Soulouque; rendered gallant service a few years later in repelling the Spanish invasion; was engaged in an unsuccessful rebellion, and had to flee to St. Thomas 1865; but succeeded in 1867 in overthrowing Geffrard, and was chosen president; but, having been in turn defeated after a three years' administration, he was captured by Nissage Saget, and executed at Port-au-Prince Jan. 15, 1870.

**Saloma,** p.-v., Taylor co., Ky. P. 73.

**Sal'omon** (FREDERICK), b. near Halberstadt, Prussia, Apr. 7, 1826; educated at the gymnasium of that place; became a government surveyor; served in the Prussian artillery; was in 1848 a pupil in the royal academy of architecture at Berlin; came soon after to the U. S.; became a land-surveyor at Manitowoc, Wis.; was four years county register of deeds; chief engineer on Manitowoc and Wisconsin R. R. 1857–59; entered the Union service in the spring of 1861 as captain in the 5th Missouri Vols.; was with Sigel at Wilson's Creek; became colonel of the 9th Wisconsin Vols. Aug., 1861; brigadier-general July 16, 1862; and commanded a brigade in Kansas.—His brother WILLIAM came with him to the U. S., and became governor of Wisconsin 1862–63.

**Salomon Islands.** See SOLOMON ISLANDS.

**Salomons** (Sir DAVID), BART., b. of Jewish parentage at London, England, in 1797; became a merchant and banker; was elected sheriff for the city of London and county of Middlesex 1835; filled that office by virtue of a special enabling act passed by Parliament; was high sheriff of Kent 1839–40; was chosen alderman 1835 and 1844, but could not take his seat in consequence of refusal to take the oaths "on the faith of a Christian;" was called to the bar at the Middle Temple 1849; was lord mayor of London 1855–56; chosen to Parliament for Greenwich 1851, and four times re-elected, but did not obtain a seat until 1859, when, under the law as modified the previous year, he took the oath in the form provided for Jews; was the first Jew who became an English magistrate, having served as deputy lieutenant for Kent, Sussex, and Middlesex; was created a baronet of the United Kingdom 1869, and published several pamphlets on currency, corn laws, oaths, religious disabilities, and persecution of Jews in the East. D. at London July 18, 1873.

**Salo'na,** village of Austria, was the ancient capital of the Roman province of Dalmatia, and a city of great importance both in commercial and military respects. The emperor Diocletian was born here, and close by he built in 303 A. D. the famous palace, covering 8 acres, to which he retired after his abdication. The city and the palace were destroyed in 641 by the Avars, but on the site of the palace and out of its ruins arose the modern town of Spalato—*Salonæ Palatium.* Since 1818 comprehensive excavations have been undertaken by the Austrian government, and the baths, an amphitheatre, etc. have been brought to light.

**Saloni'ca** [Turk. *Selanik;* the ancient *Therma,* afterward called *Thessalonica*], the capital of the Turkish eyalet of the same name, which corresponds to the ancient Macedonia, comprises an area of 51,649 sq. kiloms., with 1,028,141 inhabitants; traversed by the Vardar, and is rich in corn, tobacco, wine, fruit, and cotton. The city is on the north-eastern shore of a spacious gulf of the Ægean Sea, named after it; rises amphitheatrically on the steep slope of the mountain of Kortiasch, and presents from the sea a beautiful view, owing to its palaces and mosques. In the interior, however, it is narrow and irregular, but as it was of importance even in antiquity, and has gone through various vicissitudes, it contains many interesting architectural monuments. In the Greek quarter are found a hippodrome of great antiquity and ruins of a colonnade built under Nero. Most of the mosques have formerly been Christian churches. The old mosque, inlaid with porphyry and jasper, was the celebrated church of St. Demetrius. The church of St. Sophia was the prototype of the church of the same name in Constantinople, and another mosque is the former Rotunda, built after the model of the Roman Pantheon. Ancient mosaics, coins, bas-reliefs, etc. are still discovered in the old streets and in the remains of old buildings in the modern quarters. The city is fortified, has a citadel and several forts, is the seat of the governor-general of the province, a Greek metropolitan, a Jewish grand chakam, and contains numerous churches and schools of different denominations. Its commercial importance it derives from its geographical position, it being located at the termination of the road which, 70 miles long, crosses the peninsula of the Balkan from Belgrade on the lower Danube, thus connecting by land and water roads the valley of the Danube with Smyrna and the coasts of Asia Minor. This position has made it the second commercial port of the country. Numerous vessels from all nations anchor in its safe and spacious harbor, which in 1873 was visited by 3634 sailing vessels of 112,569 tons burden, and 329 steamers of 201,315 tons burden. The total commercial business of the city represented a sum of 19,788,113 thalers, which shows an increase of 3,991,655 above that of 1872, and was made up in the following manner: France, 9,192,788; Austria, 3,259,160; Italy, 2,537,858; England, 2,533,044; Greece, 783,112; Switzerland, 566,100; Germany, 464,450; Belgium, 222,026; U. S., 218,000; Malta, 115,575. The value of the imports, consisting chiefly of sugar, coffee, petroleum, silk, iron, machinery, nails, and textile fabrics, amounted to 10,327,850; that of the exports, chiefly consisting of silk and silkworms, corn, cotton, wool, hides, and tobacco, to 9,460,263. P. about 80,000, of which 10,000 are Greeks and 30,000 Jews. AUGUST NIEMANN.

**Salop.** See SHROPSHIRE.

**Sal'pa** [Gr. *σάλπη,* a kind of fish], an interesting genus of tunicaries, the type of the family Salpidæ. Salpians are in the adult or perfect form separate organisms, produced by true generation from the individuals of a salpa-chain, as the aggregate of compound salpians is called. Each single salpian in turn gives birth, by gemmation, to a chain of salpians, each of which is an hermaphrodite. The chains swing together in water by a serpentine movement, and single salpæ move by ejecting water from the mantle. The individuals are from half an inch to ten inches long, and are found in many seas. All are marine.

**Sal Pol'ychrest** [Gr. *πολύχρηστος,* "good for many things"], the *potassæ sulphas cum sulphure,* a compound closely resembling sulphate of potash, but of somewhat uncertain composition. It was invented in the seventeenth century by Christoph Glaeser, and was once much used in medicine, but is now seldom employed.

**Salset'te,** an island of British India (area, about 150 sq. m.; p. about 50,000), connected with the island of Bombay by a causeway and a stone bridge, and famous for the immense rock-cut cave-temples found at Kenery in the centre of the island and at several other places.

**Sal'sify** [Fr. *salsifis*], or **Vegetable Oyster,** the *Tragopogon porrifolius* and *T. pratensis,* European plants of the order Compositæ. They are cultivated for the roots, which are long, tapering, and have, when properly cooked, a taste somewhat like that of the oyster. The root is highly nutritious.

**Sal Soda.** See SODA, COMPOUNDS OF.

**Salsomaggio're,** town of Italy, province of Parma, known for its mineral springs, which are extensively used both for drinking and bathing. P. 5882.

**Salt,** in chemistry. See SALT-RADICALS and SALTS, CHEMICAL NATURE AND DEFINITION OF, by H. WURTZ, A. M.

**Salt** [Lat. *sal*]. The salt of commerce is chloride of sodium, more or less contaminated with various saline admixtures. These foreign substances may differ in quality and quantity. The differences in the kind of foreign admixtures are due to the peculiarities of the source used for the manufacture. The difference in the quantity of the impurities—so far as the same kind of saline compounds is concerned—is determined not only by the condition of the source, but also by the mode of manufacture. Natural solutions of pure salt are unknown; crystals of pure salt

may be obtained by separating carefully individual crystals from a well-developed rock-salt. The discovery of common salt belongs within the earliest stages of the human family. Wherever we find it mentioned upon the first pages of history it is spoken of as something known. Its presence in the water of the ocean, of various lakes and springs, it appears, was not less recognized than its occurrence as an exudation of the soil in particular localities. Saline exudations, so frequently found in the Orient in common with the residues of accidental evaporation of some of those natural saline solutions previously alluded to, have furnished in all probability its first supply. The manufacture of salt for commercial purposes by artificial heat applied to iron pans, similar to our present mode of working, has been credited to the ancient Romans. Grecian and Roman writers centuries before the Christian era begin already to treat of it from a scientific point of view, although sometimes under a different name. Dioscorides, at the end of the first century, speaks of its peculiar cleavage, and describes some of the differences between the salt resulting from the evaporation of sea-water and of rock-salt. The famous alchemist, Geber, who lived within the eighth century, was engaged in experiments to refine the commercial common salt for chemical purposes. The idea regarding the chemical constitution of *pure salt* has changed quite naturally during the progress of chemistry. Our present view concerning its composition was for the first time experimentally demonstrated by Sir Humphry Davy in 1810; he produced pure salt by burning sodium in chlorine gas; hence its present scientific name, chloride of sodium or sodium-chloride. Chemically pure salt is usually produced by neutralizing pure carbonate of soda with pure hydrochloric acid, evaporating the solution to dryness, and fusing the residue. The salt of commerce is obtained from three sources—namely, sea-water, brines, and rock-salt.

*Sea-Water.*—The water of the ocean is a weak and, comparatively speaking, impure brine. It contains from 3½ to 4 per cent. of saline matter, of which about three-fourths is chloride of sodium, or salt, and about one-fourth impurities. Its chief impurities consist of chloride of magnesium and the sulphates of lime, magnesia, soda, and potassa. Sea-water varies but little in composition and concentration, except in localities where either a limited body of water is prevented from an unrestricted communication with the ocean or where a large influx of fresh water causes its dilution. It represents the main source of supply for the manufacture of salt in France, Portugal, Spain, Italy, the West Indies, and Central and South America; it is also largely used for the production of salt in Holland, Belgium, and England, being frequently employed for the solution of rock-salt of an inferior color. In the U. S. it has been turned to advantage but to a very limited extent. From 300,000 to 350,000 bushels cover, in all probability, our present home-production of salt from sea-water.

*Rock-Salt.*—Whenever, during the various geological epochs, a larger or a smaller body of salt water was cut off from the main ocean, either in consequence of a receding of the ocean, or infiltration into natural basins, or of changes in the level of the strata, and was subsequently placed under favorable climatic conditions for its evaporation and the subsequent preservation, either in whole or in part, of its saline residue, then a salt deposit was produced. Such saline residues, commonly known as rock-salt, have been found in almost every geological horizon from the Silurian upward, and in many localities they are still forming at the present time. Sometimes several independent deposits occur one above the other, interstratified with the rocks of the same geological basin. In consequence of the many casualties to which these saline accumulations have been exposed in the course of time, but a few entire and well-preserved marine saline deposits have been found. Quite worthy of special notice in this connection is the celebrated salt-deposit at Strassfurt in Germany, on account of the large quantities of potash-compounds within its surface layers. The various saline constituents of the ocean are arranged in this deposit in an order which corresponds quite closely with the degree of their solubility in water; yet even in this one instance there are facts noticeable which leave but little doubt that portions of the deposit have been exposed to peculiar disturbing influences of a later date. The majority of salt deposits consist only of part of the constituents of the ocean which served for their production. The rock-salt occurs either in densely aggregated masses of distinctly cubical crystals, or in compact masses having a conchoidal fracture. It is in some instances colorless and transparent, yet more frequently either red, yellow, or blue—rarely green. Its most common admixtures are either sulphate of lime and the chlorides of calcium and magnesium, or the sulphates of lime, magnesia, and soda and the chloride of magnesium. Rock-salt deposits consist usually of alternating layers of salt and gypsum, or sulphate of lime, and sometimes also of clay. These various layers may differ in thickness from a few inches to many feet. They are due to successive periods of evaporation. Colorless and dry rock-salt deposits, when easy of access, are directly mined with advantage, and the salt obtained by that process is subsequently brought into a desirable form for domestic application. Colored salt deposits, or those which suffer from an access of water, or which contain a large percentage of the above-mentioned foreign admixtures or clay, or, finally, those which are located at great depths, if otherwise practicable, are usually dissolved whilst in the mine, and their solutions treated like brines for the manufacture of salt. Only in exceptional cases is the rock-salt removed from the mine and subsequently treated with water or weak brines for the preparation of strong brines. Rock-salt deposits have been noticed quite frequently in every part of the globe. The northern part of our continent contains a number of rock-salt deposits worthy of notice. Among those quite recently discovered are those upon Petite Anse Island, Vermilion Bay, La., and of Goderich, province of Ontario, Canada. The former is covered merely by a drift mass from 16 to 18 feet in thickness. The latter is buried from 700 to 800 feet beneath the surface. At present there is but little rock-salt, as such, used within the U. S.

*Brines.*—Brines are either artificial or natural; that is, they are prepared either by dissolving rock-salt in one of the ways previously described, or they are the natural or chance solutions of saline deposits by means of subterranean currents of water. Natural solutions of rock-salt furnish us with the brines at Saltville, N. W. Va., of Goderich in Canada, and, as is good reason to assume, of Onondaga, N. Y. In cases of natural brines we are still quite frequently ignorant of the exact location and the extent and the general character of the salt deposit from which they originate. Chemically pure natural solutions of rock-salt are unknown; both kinds of brines, artificial and natural, contain the impurities of the rock-salt mass from which they are produced. All known brines may therefore be divided, like the rock-salt, into two classes—namely, those which contain besides salt the chlorides of calcium and magnesium and sulphate of lime, and those which contain only the chloride of magnesium and the sulphates of lime, magnesia, and soda. All our prominent brines E. of the Mississippi River, including those of Goderich, belong to the first class of brines; while the second class occurs in Nebraska, and, most likely, in other localities W. of that river. Sea-water also belongs in that class of brines. The value of a brine for the manufacture of salt does not entirely depend on either concentration or relative proportion of pure salt and of foreign saline admixtures, but on the kind of the impurities; for instance, sulphate of lime and soda, within proper limits, are far less objectionable than a corresponding amount of the deliquescent and bitter-tasting chlorides of calcium and magnesium. The brines of Goderich, Onondaga, and Saltville contain less of the latter than those of Michigan, Ohio, Pennsylvania, etc. All our home-manufactured salt, coarse, fine, and dairy salt, with the exception of from 300,000 to 400,000 bushels obtained from sea-water, is still produced from natural brines.

The general character and the value of the various brines depend, as previously mentioned, to a large degree, on the relative proportion and the kind of the foreign saline substances present. The same is true, to some extent at least, in regard to the salt. A mere analytical statement giving the percentages of impurity, without specifying its kind and nature, gives no reliable standard from which to pronounce upon their commercial value, since the various impurities which the salt has retained are objectionable in a different degree; thus, a sample of salt which contains from 1 to 1½ per cent. of foreign saline admixtures, consisting almost exclusively of sulphate of lime, may claim to be a very fair article of common salt; whilst if it contains but one-half of that amount of the chlorides of calcium and magnesium, or of the sulphates of soda and magnesia together with the chloride of magnesium, or of the carbonates of lime and magnesia, it would be considered quite objectionable, at least for table and dairy purposes. As the peculiar fitness of any kind of salt for the different domestic applications—for instance, meat-packing, dairy or table use—depends not only on a fair chemical composition, but also, in some degree, on its suitable physical or mechanical condition, it is quite obvious that the selection of the mode of manufacturing salt has to be made with reference to both—namely, the quality and the general character of the brine on hand, and the kind of salt desired. The process of saltmaking is quite naturally an operation which aims at the separation of the salt or chloride of sodium from its accompanying foreign saline admixtures. The general rules which apply to a proper management of a successful

crystallization find their application here, as far as circumstances will permit.

So far as the form is concerned, there are two kinds of salt in commerce—(1) *coarse salt*, including salt made by *solar* heat and rock-salt crushed to suitable size, and (2) *common fine salt* or *boiled salt*, obtained by *artificial* heat, and thus by a more rapid evaporation. Both kinds have their special commercial value.

*Coarse Salt.*—The coarse qualities of salt are manufactured, as has been stated, from sea-water and from brines. In France, Spain, Portugal, Italy, the West Indies, and along the shores of both the Atlantic and Pacific oceans on our continent, nearly all the coarse salt made from sea-water is produced in basins along the sea-shores. These basins are either natural or artificial; several of them are, in either case, connected in such a manner as to admit of a systematic working of the saline solutions in their different stages of concentration. In Ohio, Virginia, Michigan, New York, Nebraska, and Kansas, where the natural brines for the manufacture of coarse salt are used, wooden vats, protected by wooden covers, are preferred; for the frequency of rain-showers throughout the more favorable portion of the year, and the low temperature at night during the spring and fall, interfere seriously with a successful evaporation, and thus economical manufacture in open basins; wooden vats with suitable movable covers secure also a cleaner article. The rules adopted in the construction and systematic arrangement of these vats or basins are prescribed by the composition of the brines or saline solutions turned to account for manufacturing purposes. A short description of our most extensive coarse-salt works—those of Onondaga, N. Y.—on account of their rational system of management, may serve as an illustration. The brines of Onondaga are of a good quality; they contain a considerable quantity of sulphate of lime (gypsum), a very small quantity of chloride of calcium and chloride of magnesium, besides traces of chloride of potassium, bromide and iodide of magnesium, and some carbonate of protoxide of iron, with free carbonic acid. The main object, under these circumstances, is to remove the entire amount of iron, more than one-half of the sulphate of lime, and as much as possible of the very objectionable deliquescent compounds, chloride of calcium and chloride of magnesium. To obtain these results the following mode of working is pursued: The brine, being in its fresh state colorless and highly charged with carbonic acid, is filled into shallow vats, and kept there until most of the carbonic acid has escaped and the protoxide of iron has been fully oxidized and settled as brown hydrate of sesquioxide of iron. The saline liquid is then drawn off to a lower set of vats, where it is left for evaporation until crystals of salt appear; during this period the excess of sulphate of lime is separated. The brine being now completely saturated with salt, is called salt-pickle; it is ready for saltmaking, and consequently removed from the separated impurities to another lower set of vats, where, by mere solar heat, the separation and accumulation of a coarsely-crystallized salt takes place. The salt is from time to time gathered, whilst the remaining mother-liquor will be discharged as soon as it reaches a concentration from 28°–30° Baumé. The less attention paid to the separation of the iron and the excess of sulphate of lime, the more concentrated the mother-liquor from which the salt has been gathered; the less the salt-crystals themselves have been washed with new pickle before their removal into perforated tops for drainage, and the less chance they have enjoyed in rendering that last process efficient, the more inferior the quality of the coarse salt produced. A good coarse or solar salt must be of a neutral reaction, hard, large-sized, white or colorless, and produce a clear solution in water. Its use is mainly confined to the packing of pork and beef for the general market.

*Common Fine Salt, or Boiled Salt.*—The finer granulated qualities of salt are obtained by direct or indirect application of artificial heat to iron pans, iron kettles, or wooden vats. In Europe almost all the fine salt is manufactured in a system of large shallow iron pans. These pans are usually from 15 to 17 inches deep, and vary in size from 20 feet long and 16 feet wide to 60 feet long and 35 feet wide. In most of our home saltworks hemispherical cast-iron kettles of from 120 to 150 gallons' capacity are used. The kettle system is almost exclusively used at the Onondaga works, N. Y.; in the Saginaw Valley, in Michigan, besides the kettles, large wooden vats heated by steam are employed; in Ohio and S. W. Virginia, for weak brines, the so-called furnace system is in operation, which may be considered a combination of direct heat and steam heat for evaporation. The steam heat, being applied at the more advanced stage of evaporation, produces a large-sized salt. The best brines of Virginia—for instance, at Saltville—are successfully worked in cast-iron kettles. Inferior brines—particularly those which contain larger percentages of the chlorides of calcium and magnesium—as a general rule give the best results by a slow process of evaporation; for the salt-crystals are produced in that case at a slower rate, more perfectly developed, and less liable to enclose much of the inferior mother-liquors. Brines which contain a considerable percentage of sulphate of lime or of soda or of magnesia, or several of them, produce always smaller salt-crystals than those which contain less or none. The livelier the boiling of the saline solutions, the smaller are the crystals of one and the same brine. The European system of manufacturing common fine salt, and our own modes of producing it in wooden vats by means of steam heat and the furnace system of Ohio, differ in one essential point from the kettle system; they aim at the removal of certain impurities in a separate vessel, and the making of the salt in another; whilst in the kettle system the entire operation is carried out in one and the same vessel. The manufacture of salt in cast-iron hemispherical vessels is peculiar to our country; its success, as far as the quality of the salt obtained by its application is concerned, is due more to the good quality of our brines and the skill of the workmen charged with the manufacture than to the fact that this mode of making salt is based on the safest principle. In the European system the saturation of the brine is at first carried on at a quite moderate heat in an open pan, commonly called the fore-heater. As soon as the salt begins to appear, or at least the iron and a part of the sulphate of lime are removed, the clear salt-pickle is drawn into a lower pan for the manufacture of salt. The temperature applied controls the size of the salt-crystals; the slower the boiling the larger the crystals. Each operation may thus produce a uniform quality, provided the mother-liquor is at certain periods removed. In case cast-iron kettles are used for the manufacture of boiled salt—as at Syracuse, N. Y.—the following arrangement is adopted: From fifty to sixty kettles, of from 120 to 150 gallons' capacity, are placed in a double row along flues with two independent fireplaces and one common chimney. The kettles near the fireplaces are protected by suitable interrupted arches against excessive heat, while high chimneys, frequently supported by blowers, aid in conveying the heat along the row of kettles. Store-rooms for the salt are located along both sides of the boiling-works; the boiling vessels are separated from the furnace by a pathway from four to five feet wide. The entire construction is covered by one roof. The brine before being turned into the kettles has been kept in large wooden tanks for settling. For the purpose of collecting the impurities which separate from the brine during the process of concentration, an iron pan with an upright handle, covering the central bottom part of the kettles, is inserted in each one of the latter until the salt itself begins to form, when the pans are carefully withdrawn. On the skilful handling of the pan depends largely the color and, to some extent, the general quality of the article. Whenever, subsequently, a large amount of salt has been formed, it is well stirred by means of a long-handled iron ladle, and thereby washed in the remaining pickle before it is removed into baskets, which rest for efficient drainage upon sticks over one part of the kettles. After a few hours' keeping the baskets are emptied into the store-rooms; some weeks' storing suffices to render the salt dry enough for the general market.

The chemical composition of the fine salt depends largely, like that of the coarse varieties, on the quality of the pickle or mother-liquor from which it has been gathered and the degree of drainage it has enjoyed. The general physical condition, as size, hardness, etc., depends in part on the character of the brine which served for its production, and on the rate of boiling during its manufacture; the lower the temperature and the less motion of the pickle, the larger the crystals. The normal size of the salt from any brine is readily reduced by adding either quicklime, glue, fat, rosin, or soap in quite small quantities to the boiling salt water. As a general practice, it deserves but little commendation, for it necessitates a superior precaution regarding an entire removal of these substances, particularly in case of those articles of salt which serve for dairy use. A good common fine salt ought to be of neutral reaction, of a clear white color, of a pure agreeable saline taste, and of a gritty feeling between the fingers; it ought to dissolve without any particular residue in 5 to 6 parts of water, and its moisture ought not to exceed from 4 to 5 per cent. The common fine salt, being of an advantageous mechanical condition and readily dissolved in water, finds a general application for family requirements. The best qualities, if well ground and dried, are usually used as table salt or in the dairy industry. The peculiar nature of the dairy products, as well as the unusual risks involved in their successful manufacture, renders it quite necessary that none but a first-class article of salt should be applied for dairy purposes. The fitness of any

of the various kinds of salt in our markets for dairy purposes is not restricted to those from any particular source, but depends entirely on a good chemical composition and a suitable mechanical condition. A good dairy salt ought to be of a neutral reaction and a pure saline taste, free from any offensive odor and without any stain in color—of properly-reduced size to favor a speedy solution, and, what is of scarcely less importance, free from colored specks. To produce such an article requires an extra exertion on the part of the manufacturer, and thus necessitates additional expenses as compared with the average quality of "common fine" and ordinary "coarse or solar" salt, neither of which, as a general rule, answers to the previous description. English manufacturers reserve frequently the first portion of the salt from a good and fresh salt-pickle for dairy use, and work the remaining saline solutions into common salts used for the manufacture of soda-ash. Some of our dealers in sea-salt select the better grades of these articles and grind them into a fine material for dairy products. The American Dairy-Salt Company of Onondaga prepare their dairy salt by subjecting a good quality of boiled and of solar salt to an additional washing process, worked out in its details by the writer, before sending either one of them into the market with that brand.

The consumption of salt for the promotion of animal life far exceeds that for the cultivation of plants; the amount of salt used for meat-packing and for the dairy business is, however, much larger than either. In the industrial arts we can scarcely claim that any of our home resources have been turned to account; England turns more than one-half of its entire production of salt—from 17,000,000 to 18,000,000 bushels (56 pounds each)—into soda-ash. Our present demand for salt, which is still almost exclusively confined to its uses for domestic purposes and in agricultural industry, exceeds our home production—a fact which is not so much due to a real want of suitable home resources as to their disadvantageous local distribution. The production of salt within the U. S. amounts at present to from 18,000,000 to 20,000,000 bushels; our consumption is stated to be from 36,000,000 to 40,000,000 bushels, which represents about one bushel of salt for every head of the population of the country. This large consumption is mainly due to our extensive dairy and meat-packing business. CHARLES A. GOESSMANN.

**Salt, Agricultural Uses of.** In agriculture salt has, strictly speaking, two uses—that of a necessary article in the food of farm-stock and that of a fertilizer of the soil; and these must of course be considered separately. Common salt taken into the stomach is the source from which the hydrochloric acid of the gastric juice and the soda of the bile are derived; hence, under all conditions animals require a greater or less supply of this substance. In the ordinary processes of digestion a given portion of salt is used over and over again in the animal system. The salt yielding up its chlorine, the latter combines with hydrogen and forms hydrochloric acid for the gastric juice. The sodium set free combines with oxygen and forms soda, which passes to the bile and pancreatic juice. When the gastric juice and the bile, having served their respective functions, come together in the lower intestines, the hydrochloric acid and soda are mutually decomposed, and thereby reproduce the chloride of sodium or common salt. This is taken up by the absorbents and returned back to the system, to again undergo decomposition, the acid again passing to the gastric juice and the soda to the bile and the secretions of the pancreas. In this way, assuming the animal to be in a condition of comparative rest, only a small proportion of salt is necessary for its health, the salt in the system being used repeatedly. If, however, we place the animal under such circumstances as involve the excretion of salt, an additional supply is continually needed. For example, in a horse or ox hard driven a large quantity of salt is exuded by perspiration. In like manner, with milch cows a considerable quantity will be daily drawn off to provide the soda in the milk. The want of appreciation of these facts has led to the differences of opinion among theorists as to the actual necessity of salt for animals. In practice, however, farmers have learned by experience, and, without knowing the reason why, have in this respect been careful to meet the requirements of nature in the care of their farm-stock. The writer was once familiar with an instance in which, through neglect, no salt was given to a milch cow for a period of eight or ten weeks; as a result, the milk became greatly diminished in quantity, strongly tainted with a putrescent flavor and odor, and the cream required four or five times the usual amount of churning to "bring" the butter; the latter article being, moreover, practically worthless. In this case, undoubtedly, the quantity of soda in the system was scarcely equal to its demands, apart from affording any supply to the milk. The utility of salt in preventing a bad flavor to the milk when cows are fed on turnips is well known. Salt and ashes in equal quantities, given a handful once a week, are recommended by old farmers as a preventive of the bots in horses; they are, however, most effective when alternated with from four to six quarts of raw potatoes, also given weekly. Inasmuch as soda-salts, as hereinafter further explained, have the property of passing into the circulation of plants, grasses grown in places adjacent to the sea frequently contain sufficient salt for the cattle pastured on them. But in all inland regions salt should be given regularly to all kinds of stock; care must be taken, however, either to keep the supply within bounds or to gradually habituate the animals to a constant supply, as animals long deprived of salt are liable to eat it in quantities sufficient to act as an irritant poison. Many farmers follow the practice of placing a board in some sheltered corner of the pasture on which salt is spread all the time, the cattle eating as much (and no more) as they may require. An example of the results to animals deprived of salt under conditions that involved its elimination from the system is shown in the experience of Lieut. Herndon of the U. S. navy in crossing the continent of South America a number of years ago. When near the centre of the continent (where grass was the most luxuriant) the cattle and horses "were afflicted with weakness, would stagger and lie down, and could not get up again. They would drag themselves along and eat up everything within their reach, until they could drag themselves no farther, and would die of weakness and starvation, the appetite holding good to the last." The party were unable to supply the animals with salt, and the region was so far inland that the sea-breezes could not reach it. A proper supply of salt appears to afford exceptional benefits in the rearing of sheep. The fine wool of the Spanish flocks is attributed in a great measure to the abundant supply of salt given them. In England salt is supposed to be an antidote to the flukeworm, and a ton of salt is said to be the proper quantity for 1000 sheep per year. A writer of sixty years since asserts that at that time 1,000,000 tons were annually given to animals in England.

The use of salt as a manure dates back to remote periods. In China and Hindostan the fertility of the rice-fields has been dependent from time immemorial on the treatment of the soil with sea-water; and in Poland the use of salt as a fertilizer has been common for generations. There is, however, no manurial substance of less reliability, for the reason that its effects depend not only on the kind of crops raised upon the land, but on the character of the land itself, and in a no less degree on the other fertilizers with which it may be used. On sandy soils, devoted to the growth of mangold wurtzel, the results are often little less than marvellous, and under these conditions its use is common and profitable in England. Experience has shown that on stiff clay soils it is almost worthless, and in the growth of cereals—wheat, rye, barley, etc.—the chances of benefit are hardly sufficient to warrant the expense of trial. The chemical reactions that follow the decomposition of common salt in the soil are so complex that it is difficult to follow them, and hence the most unexpected results are sometimes obtained; for example, in a soil containing inert phosphate, the liberation of the soda might render the phosphate soluble, and hence increase the weight and yield of grains, for which, on ordinary soils, salt is considered inapplicable; used in connection, however, with nitrate of soda, it has been known to produce the most advantageous results, even with the small grains.

A given quantity of nitrate of soda has been found to give a far inferior result to that of the same weight mixed with twice as much of common salt. It should be applied as a top-dressing. In the absence of nitrate of soda, night-soil, mingled with five times its weight, and this incorporated with from 3 to 5 per cent. of common salt, should form a good drop-dressing for grass, provided the application be upon a sandy or light loam. Salt alone might prove advantageous in soils rich in organic matter. But this application, even with highly ammoniated manures, on stiff clay soils should be deprecated. Voelcker's experiments are of much interest in this connection. On a sandy soil, with only moderate quantities of soda and potash, and a deficiency of lime, from a given area there was obtained, without salt, 12 tons 2 cwt. and 76 pounds of mangolds; at the rate of 200 pounds of salt per acre, 18 tons 19 cwt. 93 pounds—showing an increase from the use of salt of 58 tons 14 cwt. 20 pounds per acre; 300 pounds of salt per acre gave 18 tons 4 cwt. 72 pounds—an increase of a little more than 5 tons. On increasing the amount of salt to 800 pounds per acre, the yield was 21 tons 18 cwt. 84 pounds, or an increase of 8 tons 14 cwt. as compared with that unmanured with salt: 400 pounds, however, is as

much as is commonly recommended by English authorities. Swedish turnips have given increased yield from the application of salt to the land, but only in a minor degree. An instance, however, of the manner in which a difference in the soil may upset preconceived ideas by the action of salt on manure is shown by another English experimenter, Mr. Hooker of Oaklands, Walton-upon-Thames, something more than twenty years ago. In this case the soil was somewhat stiff clay, resting on a sandy subsoil, and was treated with 400 pounds of salt to the acre, applied in portions as successive top-dressings during the season. This produced an increase in the yield of wheat of about 40 per cent. An analysis of the ash of the straw raised on salted land showed that it had 83 per cent. of silica, while that of the unsalted land yielded an ash having but 28 per cent. of silica. In this case the land was doubtless deficient in soluble silica necessary to the full development of the straw, and this being supplied by the solvent action of the soda of the salt upon the silica of the soil, the plants were able to reach a development otherwise impossible.

To a certain extent, for some unknown reason, salt tends to lengthen the period of development of full maturity of cereals and grasses; its action in this respect being just the reverse of that of highly ammoniated or stimulating manures. The effect of this is most apparent when salt is applied to grass-lands rich in ammonia; in such case the rank growth of the grass is checked; the yield in weight will be less, but the quality of the grass and its succulence will be greatly increased. It has been found that by lightly top-dressing pasture-lands with salt—say, from 100 to 200 pounds to the acre—the herbage will be much preferred by cattle and sheep, and pasturage of the coarse grasses may by this means be much ameliorated.

Salt has been often named as a specific for cabbage, but it is said by practical farmers to be a failure. Like other compounds of soda found in the soil, salt is capable of being taken up into the circulation of plants without being assimilated in their structure. It has even been found effloresced upon the surface of cabbage. It is taken up in the same manner in the structure of the mangold wurtzel, and probably other crops. Hence, when cattle are fed on mangolds raised on salted lands a supply of salt is not needed. This absorption of salt by crops makes the use of salt as a manure for sugar-beets especially objectionable, the beets being rendered useless for sugar manufacture. A very noticeable example of the manner in which soda compounds are mechanically absorbed in the structure of root-crops is afforded by sugar-beets raised in the alkali lands of the great West. The first two or three crops are worthless for sugar-making, because of the quantity of the alkali contained in them; but after a while, the alkali being thus abstracted from the soil, the absorption ceases and the saccharine matter of the beet is perfectly fit for use.

JAMES A. WHITNEY.

**Salt, Industrial Uses of.** Salt is the source from which the soda of commerce is derived; the soda is manufactured by what is known, from the inventor, as Leblanc's process, described in all standard works on applied chemistry. Salt is therefore the real foundation of the manufacture of soaps and glass throughout the world. The manufacture of the soda from the salt also produces hydrochloric or muriatic acid, which has manifold uses in the arts. From salt, also, by processes fully set forth in ordinary textbooks, is obtained the chlorine of the bleacheries. Hence, modern textile manufacture depends in a great measure on this product of common salt. In practice, the chlorine is used in combination with lime, as the so-called chloride of lime. It is also employed for its disinfectant powers in hospitals, etc. Soda by itself is used in some of the operations of bleaching.

The preceding paragraph indicates in brief the more general industrial uses of common salt. Lack of space forbids a detailed description commensurate with their importance. One of the most common industrial uses of salt is in the preservation of animal substances used for food, as cod, mackerel, whitefish, etc., pork, and beef; to the two latter articles it is common to add a small portion of saltpetre, which has a preservative action by withdrawing a portion of the moisture from the substances to be preserved, its action in this respect being, as it were, analogous to that of alcohol. Saltpetre, however, when added to brine in which beef is immersed, combines with substances in the meat which give an unusually red color to the latter. The preservative action of salt is also increased by the addition of sugar. This is especially advantageous in the curing of hams. The preservation of butter is also due to salt, and the quality of the article depends in a great measure upon the quality of the salt, its proportion, and the thoroughness with which it is incorporated. Turk's Island and Ashton salt are always preferred for this purpose. After the butter has been salted and worked, it should be packed in well-soaked wooden tubs or firkins. Salt is sprinkled in the bottom, and the butter packed in a solid mass upon it. When the firkin is filled within half an inch of the top, a cloth is laid over the butter, and over this a layer of salt; water is then poured in, and the butter is thus covered with a saturated brine. The firkin should be placed in a cool, dry cellar, and kept several inches from the ground. It has often been proposed to employ the antiseptic properties of salt in the preservation of timber. This appears to have been first suggested by the great durability of vessels employed in the transport of salt by sea, and in the fishing trade, where large quantities of salt and fish are carried. But timber saturated with salt continually contracts moisture; its weight is increased, and the writer is not aware that the process has ever been approved to any considerable extent. Frequently, however, the joints and intersections of ship-timbers have been filled in with salt, with apparently good results. That timber to be placed in damp and wet situations, or subjected to alternations of wet and dryness, would be much more durable if seasoned by immersion in strong brine, there can be no doubt; on a small scale this could be practised by farmers in the treatment of fence-posts, hop-poles, and the like. The cheapness of salt recommends it as a preservative agent where the objections just mentioned would be of no account. Its antiseptic power is, however, inferior to that of many other substances, being stated at less than one-fourth that of saltpetre, one-twelfth that of borax (which latter has been applied to timber for the double purpose of fire-proofing and preserving), and one-thirtieth that of alum. Salt is used in most effective refrigerating mixtures. Industrially, however, these have thus far only a minor application (see REFRIGERATORS), but under all conditions where a temperature below 25° F. is desired, mixtures of salt with other substances are cheapest and practically the most efficacious. Salt 1 part and 2 parts dry snow or pounded ice will secure a reduction of temperature to −5°; 1 part of chloride of ammonium, 2 of salt, and 5 of snow will reduce it to −12°; 1 part of nitrate of ammonia and 1 of salt, combined with 2½ parts of snow or pounded ice, will reduce it to −25°. A cold even more intense may be obtained by special manipulation of the materials, not necessary to mention in detail here. Freezing mixtures of salt and ice were first discovered in Italy more than 200 years ago, and suggested the modern art of making ice-cream.

JAMES A. WHITNEY.

**Salt** (HENRY), b. at Lichfield, England, about 1780; accompanied Lord Valentia in 1802–06, in an artistic capacity, upon his travels in Egypt, India, and the East, and made a first visit to Abyssinia 1805, of which an account appeared in Lord Valentia's travels; was sent to Abyssinia in a diplomatic capacity to negotiate an alliance Jan., 1809; returned Jan., 1811; was appointed consul-general in Egypt 1815, and made fine collections of Egyptian antiquities, employing Belzoni as his agent. D. at a village between Cairo and Alexandria Oct. 30, 1827. He published a sumptuous volume of engravings of scenes in India, Abyssinia, and Egypt (1809), a *Voyage to Abyssinia, with 36 plates* (4to, 1814), *Egypta, a Descriptive Poem* (1824), and an *Essay on Dr. Young's and Champollion's Phonetic System of Hieroglyphics* (1825). His *Correspondence* was issued in 1834, with a *Biography* by J. J. Halls.

**Salt** (Sir TITUS), BART., b. at Morley, England, in 1803; educated at Wakefield; was for some years associated in business with his father, who was a wealthy wool-dealer; commenced business in a small way as a woollen manufacturer at Bradford 1834; rapidly acquired a fortune, and in 1853 began near Shipley, on the banks of the Aire (since called Saltaire—*i. e.* Salt-Aire), the erection of a model manufacturing village on a colossal scale, which has been truly called a "palace of industry." The factory-works now (1876) embrace more than 20 acres, and the village consists of nearly 1000 houses, built expressly for the work-people with all the appliances of comfort which the builders' art has introduced in modern times. Sir Titus was for many years a magistrate and deputy lieutenant of the West Riding of Yorkshire; served as mayor of Bradford and president of the chamber of commerce; sat in Parliament for Bradford as an advanced Liberal 1859–61, and was made a baronet Oct., 1869. He was the head of the great house of Titus Salt, Sons & Co., known as among the largest employers of labor in Yorkshire; was a liberal benefactor to orphan and lunatic asylums, hospitals, and other benevolent institutions, as well as to public parks, schools, and libraries; and, as a memorial of the esteem of the people of Bradford, was honored by the erection, in the centre of the city, of a fine marble statue, unveiled by the duke of Devonshire Aug. 1, 1874. D. Dec. 29, 1876.

**Sal'ta,** town of the Argentine Republic, South America, capital of the state of the same name, in lat. 24° 15′ S., lon.

64° 50′ W., on an elevated plain, on the small river Arias. It is well built, and carries on a considerable trade, especially with Bolivia, but its immediate vicinity is somewhat barren, and its climate is not healthful on account of the neglected state of the surrounding water-courses. P. 11,716.

**Salt Creek,** tp., Mason co., Ill. P. 1102.

**Salt Creek,** tp., Decatur co., Ind. P. 1687.

**Salt Creek,** tp., Franklin co., Ind. P. 1223.

**Salt Creek,** tp., Jackson co., Ind. P. 1963.

**Salt Creek,** tp., Monroe co., Ind. P. 636.

**Salt Creek,** tp., Davis co., Ia. P. 889.

**Salt Creek,** tp., Tama co., Ia. P. 1113.

**Salt Creek,** tp., Mitchell co., Kan. P. 40.

**Salt Creek,** tp., Cass co., Neb. P. 478.

**Salt Creek,** tp., Hocking co., O. P. 1179.

**Salt Creek,** tp., Holmes co., O. P. 1259.

**Salt Creek,** tp., Muskingum co., O. P. 1131.

**Salt Creek,** tp., Pickaway co., O. P. 1750.

**Salt Creek,** tp., Wayne co., O. P. 1593.

**Salt Creek,** p.-v., cap. of Juab co., Ut.

**Sal'ter** (Richard), D. D., b. at Boston, Mass, in 1723; graduated at Harvard 1739; studied both medicine and theology, and was minister of Mansfield, Conn., from June 27, 1744, to his death, Apr. 14, 1787. He gave a farm worth $2000 to Yale College to promote the study of Hebrew and Oriental languages.

**Salter** (William D.), b. in New York City in 1794; entered the U. S. navy as a midshipman 1809; served on board the Constitution during her action with the Guerriere 1812; became captain 1839; retired after forty-six years' active service 1855; was in command at the Brooklyn navy-yard 1856–59; became commodore on the retired list July 16, 1862, and was a commissioner to examine vessels for the war department 1863–66. D. Elizabeth, N. J., Jan. 5, 1869.

**Salti'llo,** town of the Mexican confederation, capital of the state of Coahuila, on the Tigre, is regularly built, and had in 1831, 31,000 inhabitants, but has greatly declined during the wars, and has now about 15,000 inhabitants. It was founded in 1586, and incorporated under the name of Leone Vicario in 1827. Seven miles from this place was fought the battle of Buena Vista (which see).

**Saltillo,** p.-v., Lee co., Miss., on Mobile and Ohio R. R. P. 148.

**Saltillo,** v., Harrison tp., Perry co., O., on Cincinnati and Muskingum Valley R. R. P. 83.

**Salt Lake.** See Great Salt Lake, and Lakes.

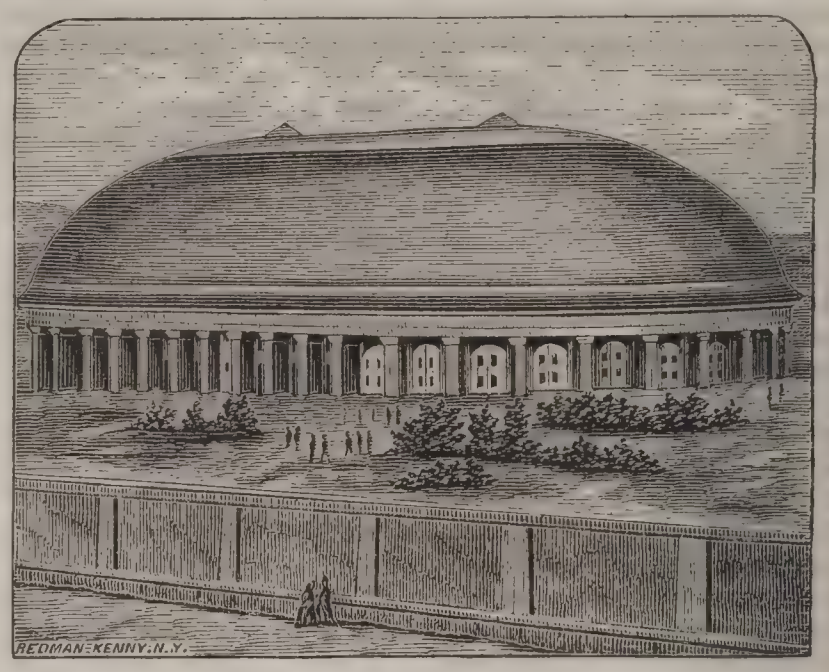
**Salt Lake,** county of N. Utah, lying S. E. of Great Salt Lake, intersected by Jordan River and traversed in E. part by the Wahsatch Mountains; has a soil along the base of the mountains which is naturally sterile, but has been made productive by irrigation; is crossed by several railroads; has important mines of gold and numerous manufactories. Staples, wheat, potatoes, hay, wool, and butter. Cap. Salt Lake City. Area, 1200 sq. m. P. 18,337.

**Salt Lake City,** city, and cap. of Salt Lake co. and of Utah Territory, 11 miles from Great Salt Lake, at the



City Hall, Salt Lake City.

base of the Wahsatch Mountains, near the intersection of the 41st parallel with the 112th meridian, with other mountains 20 miles W. and S., giving it a picturesque situation. It is in every sense the metropolis of Utah and of the Mormons, who founded it in 1847, and have since extended their settlements 150 miles N. and 350 S. The census of 1870 gave it 12,854 inhabitants, and the population has increased to 20,000 since. The streets are 137 feet wide, and the blocks are 40 rods square. Water is conveyed along the streets for irrigation and other uses, and the shade and fruit trees render the city a conspicuous contrast with the country at large. The site covers more than 9000 acres, not more than one-fourth of which is as yet occupied. Utah Central R. R. connects the city with Union and Central Pacific R. Rs. at Ogden, 36 miles N. This and Utah North-



Tabernacle, Salt Lake City.

ern R. R. give it rail communication to Franklin, Id., 120 miles N., to be extended to Soda Springs and the Northern Pacific ultimately, with a branch down Snake River through Idaho to the mouth of the Columbia. Utah Southern R. R. is completed to Nephi, about 100 miles S., along the base of the Wahsatch Range. From this branch off narrow-gauge roads into the mining cañons. The stem-road is the common gauge, and is to be extended as rapidly as possible to St. George and the Southern Pacific. The Utah Western is but just begun. It is designed to reach South-western Utah and South-eastern Nevada. All the Utah railroads but the Utah Central and the Utah Southern are 3-feet gauge. The city is lighted by gas, and has 6 miles of street railroad. It has several graded schools, inclusive of the University of Deseret, a Territorial, a city, and a Masonic library, a museum of the productions and curiosities of the region, 3 daily and weekly newspapers, a weekly in the Scandinavian tongue, and some minor periodicals. The city hall cost $70,000, but the most remarkable building is the Tabernacle, the Mormon place of assembly for worship. It contains an organ second in size only to the big organ of Boston, cost $500,000, and will seat 7000 to 8000 people. There are Masons' and Odd Fellows' halls, Congregational, Presbyterian, Episcopal, Methodist, and Roman Catholic churches, and many relief and benevolent societies. From its founding until recently the city suffered from the exclusive policy of the Mormons, but with the advent of railroads other influences began to be felt, and the city, after a long and feeble infancy, is about entering on the race of growth and progress common to other cities centrally located with respect to large areas of country. O. J. Hollister.

**Salt Lick,** tp., Perry co., O. P. 1349.

**Salt Lick,** tp., Fayette co., Pa. P. 1209.

**Salt-Mines of Louisiana.** An extraordinary deposit of salt was discovered in 1861 in sinking a well on the estate of Judge Daniel Avery on Petit Anse Island, on the sea-coast of Louisiana, lat. 29° 50′ N., lon. 91° 55′ W. The discovery served the Confederacy with a supply of salt during the latter years of the war. Petit Anse is an island of some 5000 acres, rising 160 feet out of the sea-marsh that lies along the coast 30 miles in width. It was covered with a forest, and has been long inhabited and cultivated. The mine was an amorphous mass of rock-salt, its crest about 20 feet underground, and some 50 feet below the summit of the island. The salt was a pure muriate of soda, and was mined without dirt or other foreign matter. Its solidity was complete, without seams or cleavage, or any evidence of crystalline structure. Blocks of crystal were, however, found upon the surface of the mass. A shaft was sunk some 50 feet into the salt, and thence a 10-foot tunnel was run to the westward 100 yards, and another some distance in the opposite direction, and yet no indication appeared of coming to the margin of the deposit. Tunnelling was very difficult, because it was not aided by cleavage. Blasting marred the purity of the product. An amount of about

2000 tons was mined, and carried to the surface by an elevator. It was designed to push the tunnel to the steep portion of the island, where it would emerge above the level of the marsh, and where a bayou, navigable for schooners, would bear the freight 2 miles to Côte Blanche Bay and to the Gulf. The facilities for getting to New Orleans and the markets of the world were all that could be desired. A contract upon royalty was made in 1868, but the works were not completed when the contractor died, and the work was suspended. It has not been resumed. So vast an amount of rock-salt, so convenient to market, has not elsewhere been found on this continent. The geographical position of this mine is in the parish of Iberia, La., about 10 miles S. of Iberia, the parish-seat, upon the river or Bayou Teche. A dike and plank-road reaches the island across the marsh, about 3 miles. The alluvion of the Mississippi extends to the mouth of Vermilion River in the bay of the same name. This embraces Belle Isle, Côte Blanche, and Petit Anse, diluvial islands within the marsh that extends from the Gulf to the Teche, and onward some 30 miles in width to the westward. Several similar islands lie along the sea-coast beyond, and the phenomena invite further exploration. The sulphur-mine near Lake Charles is in evidence.

*Geological Position.*—Fossil remains of the Quaternary period are found thickly strewn upon and beneath the surface of the island. In sinking the shaft of the mine the remains of pottery were found in great quantities, and human bones, with darts and stone axes of various kinds, and with and above them the bones of mammoths, mastodons, elk, and deer, that seem to have frequented the salt-licks, as cattle and horses do now. From the vast amount of human remains and rude weapons, it would appear that men had been attracted thither by the great amount of game that frequented the spot. All seem to have been whelmed in one catastrophe, and the dispositions since made by nature have not borne them far from their original sepulture. The waters of the Quaternary seas overtook them suddenly, and left them very near where they perished. The depression in the Gulf-level has permitted the Mississippi River and other tributaries of the Gulf to denude the entire Gulf-coast, from an elevation of about 180 feet down to the sea-marsh level, and left this salt-block an anomaly, projecting as a peak from the Cretaceous seas in which it was probably formed.

The salt-springs of Louisiana were somewhat noted as early as the war of 1812. Salt was at that time made in the vicinity of Natchitoches, and carried to Sicily Island, Natchez, Opelousas, and even to New Orleans. The springs are 20 and 30 miles E., along the valley of the Saline Creek, nearly at the level of the Red River alluvion. They are copious, and were again worked during the civil war. They have not since been worked on account both of their distance from market and the weakness of the saline water. A series of less copious springs is traceable from far in the Cretaceous formations of the Arkansas, down past these, which issue in the Eocene Tertiary, and emerge again on the Castor, 40 and 60 miles S., and appear to pass beneath the alluvion of the Washita and the Red River. At several points in the great alluvion they make their appearance down to the coast, their connection obscured by their depth. The Cretaceous seems to underlie Western Louisiana, and to be charged with salt. Possibly the salt-mine of Petit Anse has an identical origin. C. G. Forshey.

**Sal'tonstall** (Gurdon), son of Col. Nathan and great-grandson of Sir Richard, b. at Haverhill, Mass., Mar. 27, 1666; graduated at Harvard 1684; was ordained minister of New London, Conn., Nov. 25, 1691; was distinguished as an orator, and took so active a part in politics that he was made governor of Connecticut 1707, and held that post until his death, Oct. 1, 1724. He bequeathed £1000 to Harvard College to educate students for the ministry.—His son, Gurdon, b. Dec. 22, 1708, graduated at Yale College 1725; became brigadier-general of Connecticut forces 1776; was cashiered for misconduct in the Penobscot expedition 1779, and d. at Norwich Sept. 19, 1785.—Dudley, son of Gen. Saltonstall, b. Sept. 8, 1738, became a commodore in the Continental navy, and d. in the West Indies in 1796.

**Saltonstall** (Leverett), LL.D., son of Dr. Nathaniel (1746–1815) and grandson of Richard (1703–56), b. at Haverhill, Mass., June 13, 1783; studied at Phillips Academy, Exeter, N. H.; graduated at Harvard 1802; commenced the practice of law at Salem 1805; attained eminence in his profession; was a member of several learned societies, including the Massachusetts Historical Society, to whose *Collections* (2d series, vol. iv.) he contributed an *Historical Sketch of Haverhill;* served frequently in the general court; was a State senator 1831; chosen Presidential elector 1836; was mayor of Salem 1836–38, and member of Congress 1838–43. D. at Salem May 8, 1845. By his will he gave a large portion of his library to Phillips (Exeter) Academy and a sum of money to the library of Harvard University.

**Saltonstall** (Sir Richard), b. at Halifax, England, in 1586, son of Sir Richard, who became lord mayor of London 1597; came to Massachusetts as assistant governor to Winthrop 1630; was associated with Mr. Phillips in the foundation of Watertown 1630, but went back to England the following year, and never returned to Massachusetts, though he continued through life an influential friend of the colony and was a patentee of Connecticut. In 1651 he wrote a letter to the Massachusetts ministers Cotton and Wilson remonstrating against the persecution of men for their religious opinions. D. in England about 1658. Through his sons, who settled in Massachusetts, he was ancestor of all who have borne the name in New England.—Richard, b. at Woodsome, Yorkshire, England, in 1610, was an early settler of Ipswich, was assistant governor 1637, befriended the regicides Goffe and Whalley, and protested against the introduction of negro slavery into the colony. D. at Hulme, England, Apr. 29, 1694.

**Saltonstall** (Richard), b. at Haverhill, Mass., June 14, 1703; graduated at Harvard 1722; was frequently a member of the general court and of the executive council; was a scientific and practical farmer, and also learned in the law; was chairman of the commission for settling the boundary-line between Massachusetts and New Hampshire 1737, and was judge of the superior court nearly twenty years (1736–55). D. Oct. 20, 1756.

**Saltpetre.** See Nitre, Nitrates, and Nitric Acid, by Henry Wurtz.

**Salt Point,** tp., Sonoma co., Cal. P. 1088.

**Salt Pond,** tp., Saline co., Mo. P. 2895.

**Salt-Rad'icals,** in chemistry, a term used in a certain system of chemical theory, much in vogue during the middle of the present century, and not even yet wholly abandoned by all, though the present prevailing school of theorists substitute chiefly another system of radicals, of which *hydroxyl* (HO) is the main cornerstone. The necessity, or assumed necessity, of *some* radical theory arises from an inherent attribute of the human mind. Whether from the effect of irresistible analogies, or from the profounder working of an implanted instinct, the mind of man expects to find universal harmonies extending throughout the scheme of nature. When these are not recognizable upon the surface, the mind seeks to discover them by the invention of hypotheses; and when one such hypothesis is found to reconcile and explain extended series of diversified facts, and to assist us in our belief in the harmony of nature, we call it a *generalization*, and, by those who deem it thoroughly well established, a *theory*. The vast multitude of substances known to chemists range themselves, in general, into *at least seven* natural groups, which may be thus designated (readopting two good terms used by Berzelius which have fallen into unmerited disuse): *metallic* elements, *halogen* elements, *amphigen* elements, *acids*, *bases*, *hydrates*, and *salts*. Under the latter term is included an enormous group of compounds which result largely from the bringing together of an acid with a base, another result being the simultaneous disappearance of positive acidic and basic qualities, and the appearance, in the resulting compound salt, of the negative quality called *neutrality*. It is undeniable, however, that large and important families of neutral salts—*common salt*, from which the name of the class comes, being itself an example—might be formed without the intervention of either acid or base; that is, by the interaction or combination of a metal with a halogen element, either *chlorine*, *bromine*, or *iodine*. One object of the older salt-radical theory was to generalize *all salts* under one law of formation and structure; and this was accomplished by the invention of a great number of supposititious radicals (see Radicals), there being one corresponding with every known oxygen acid. The process of nature in the formation of salts of oxygen acids, in order to conform with her supposed uniform law, involved the leaping over of the oxygen of the base to the acid, and its coalescence with the latter into a compound radical. Some examples are as follows:

Anhydrous sulphuric acid and water ($SO_3$ and $H_2O$) were supposed, when combining, to form the compound $H_2.SO_4$, $SO_4$ being the compound radical formed. So, likewise, if any other basic oxide be used instead of water, we must have, according to the atomicity of the metal—

| | | | |
|---|---|---|---|
| In the case of monadic metals..... | $M_2O$ | $+SO_3$ | $=M_2.SO_4$. |
| In the case of dyadic metals..... | $MO$ | $+SO_3$ | $=M.SO_4$. |
| With tetradic and dioxides..... | $MO_2$ | $+2SO_3$ | $=M.2SO_4$. |
| hexadic metals, sesquioxides, | $M_2O_3$ | $+3SO_3$ | $=M_2.3SO_4$. |

The radical $SO_4$ was called both "*sulphatoxygen*" and "*oxysulphion*." In the case of nitrates, another radical

($N_2O_6$), called "*nitratoxygen*" or "*oxynitrion*," was believed to be formed by similar transformations, $M_2O$ and $N_2O_5$ giving a compound $M_2.N_2O_6$. In our present prevailing fashion of notation for the nitrates, however, these salts, on the salt-radical theory, should contain a radical $NO_3$, being formed as follows:

$$M_2O + N_2O_5 = 2(M.NO_3).$$
$$MO + N_2O_5 = M.2NO_3.$$
$$M_2O_3 + 3N_2O_5 = 2(M.3NO_3).$$
$$MO_2 + 2N_2O_5 = M.4NO_3.$$

The arguments presented for the salt-radical theory, or the great collocation of hypotheses which passed under that name, are as follows: (1) It brings under the same *binary* type the different families of neutral salts, oxygen or *amphide* salts, halogen or haloid salts, and others, such as sulphur salts, all of which are believed, with reason, to constitute one natural family, and therefore necessarily to have *some* natural link or bond of relationship. The supposed salt-radicals must be similar in their functions to the halogen elements, and to that known and admitted compound salt-radical *cyanogen*, CN. Some even went so far as to claim that this makes hydrated acids to be "salts of hydrogen," as it was expressed, thus virtually abolishing acid hydrates as a distinct family. (2) It explains the fact that neutral or so-called "normal" monobasic salts contain in general as many equivalents of acid as there are oxygen equivalents in the base, as illustrated in the above equations. (3) It has been thought to put in a simpler light the relations of metals to hydrated acids, both in simple solution-processes upon metals and in electrolysis of metallic salts. In a solution of a metal in sulphuric hydrate, for example, the reaction will be as follows: $H_2.SO_4 + M_2 = M_2.SO_4 + H_2$, parallel to that in the case of hydrochloric acid, $H.Cl + M = M.Cl + H$.

In electrolysis of a metallic sulphate in solution, the first stage is the simple decomposition of $M_2.SO_4$ into $M_2$ and $SO_4$, the metal appearing as such at the cathode, while at the anode, if this be of the same metal, the sulphat-oxygen simply takes it up again to form sulphatoxide, or otherwise sulphate; the whole being precisely parallel to the electrolysis of a metallic chloride in solution.

The arguments *against* the salt-radicals are as follows, one or two of these being probably presented here for the first time: (1) The necessity of an indefinite number of distinct hypotheses, one for each known oxygen acid. (2) The failure, thus far, to isolate any of the salt-radicals, with the property of performing directly the functions of a true electro-negative radical, like cyanogen or chlorine. As an example we may cite the case of the compound $SO_3$, which should be the salt-radical of the *sulphites*. We might therefore reasonably expect that at least some metals would directly combine with $SO_3$ to form sulphites. Nevertheless, no such case is yet on record. With mercury this compound forms *sulphate*, not sulphite, with simultaneous evolution of sulphurous anhydride. On iron, zinc, and copper at the ordinary temperature $SO_3$ has no action at all. (3) In case of polybasic acids—like phosphoric acid, for example—each class of salts formed requires a different "*oxyphosphion*" salt-radical. In our present notation this involves real complexity, it being indeed impossible to formulate the bibasic salts or pyrophosphates in reasonable conformity with the others. Thus, while the orthophosphate and metaphosphate of soda may be $Na_3.PO_4$ and $Na.PO_3$, the pyrophosphate must have the cumbrous expression $Na_4.P_2O_7$. (4) The salt-radicals, if admitted, seem to carry us *too far*. In the abolition of the class of acid hydrates is really involved, *by the same arguments*, the abolition of *all* hydrates whatever containing replaceable water or hydrogen, including *alkaline hydrates;* for if the solution of zinc, with evolution of hydrogen, by sulphuric hydrate argues the formation of such a molecule as $Zn.(SO_4)$ from $H_2.(SO_4)$, why does not the solution of the same metal by potassic hydrate, with the evolution of hydrogen, argue the formation of the molecule $Zn.(K_2O_2)$ from $H_2.(K_2O_2)$? Indeed, the prevailing school of chemical theorists—which may be called the hydroxyl school—admit the radical $K_2O_2$ (or rather KO) as "potassoxyl." Hence, the tendency of these speculations is to the generalization, or classification into one natural group, of all kinds of *salts*, together with all the *hydrates*, both of acids and of bases.

Of late years the aim of the leading school, indeed, with reference to acids and bases, both anhydrous and hydrated, has been to attempt what they deem a still wider generalization, which substitutes for the original salt-radicals another class of radicals, equally hypothetical, of which hydroxyl is one type, while others are known as *sulphuryl*, *phosphoryl*, *nitryl*, and so on. Thus, sulphuric, nitric, orthophosphoric, and metaphosphoric hydrates are assumed by them as $2HO.SO_2$, $HO.NO_2$, $HO.PO_2$, and $3HO.PO$. In these cases, apparent simplicity, at least of *notation*, is attained, at the expense, however, of an indefinite multiplication of subsidiary hypotheses. To get pyrophosphoric hydrate into this system they suppose it to be a compound of ortho- and metaphosphoric hydrates; thus, $4HO.PO.PO_2$. These modern improvements, therefore, upon the salt-radical theory would give for the corresponding sodium salts, containing *natroxyl* (NaO), as they are formed by the simple substitution of Na for H in the above hydroxyl formulæ, the following expressions:

| | |
|---|---|
| Sodium sulphate | $2(NaO).SO_2$. |
| Sodium nitrate | $NaO.NO_2$. |
| Sodium orthophosphate | $NaO.PO_2$. |
| Sodium pyrophosphate | $4NaO.PO_2.PO$. |
| Sodium metaphosphate | $3NaO.PO$. |

It will be observed here that the original idea of the older salt-radicalists, of obtaining a parallelism of constitution between the haloid and amphide families of salts, is entirely lost sight of. (For the nature and constitution of salts and acids see SALTS, CHEMICAL NATURE OF, and VOLUMES, MOLECULAR.) HENRY WURTZ.

**Salt Range,** or **Kalabagh Mountains,** a mountain-group of the Punjaub, India, extends from the northeastern boundary of Afghanistan to the Jhylum, a distance of about 200 miles. It is only 2500 feet high, but its bold peaks and steep, wild precipices, consisting of granite, gypsum, and layers of almost perfectly pure rock-salt, are completely without vegetation, and present a barren and forbidding aspect.

**Salt River,** tp., Adair co., Mo. P. 1164.
**Salt River,** tp., Audrain co., Mo. P. 5602.
**Salt River,** tp., Knox co., Mo. P. 2120.
**Salt River,** tp., Pike co., Mo. P. 379.
**Salt River,** tp., Ralls co., Mo. P. 1337.
**Salt River,** tp., Randolph co., Mo. P. 782.
**Salt River,** tp., Schuyler co., Mo. P. 1115.
**Salt River,** tp., Shelby co., Mo. P. 1986.
**Salt Rock,** tp., Marion co., O. P. 351.
**Salts'burg,** p.-b., Conemaugh tp., Indiana co., Pa., on Conemaugh River and on Western division of Pennsylvania R. R. P. 659.

**Salts, Chemical Nature and Definition of.** (See further under SALT-RADICALS.) The importance of *salts* as a class is greater than that of any other group of chemical compounds, inasmuch as they must almost indefinitely outnumber all other groups put together. Each acid, and each simple and compound electro-negative or acidic radical, forms independently as many salts as there are basic oxides or other basic bodies that can combine with the acids, and as there are metals or basic radicals that can combine with the acidic radicals. Polybasic salts and double salts, and variations in crystal-water, combine to swell the *possible* salts to a number which is next to illimitable, and practically quite incalculable. The *classification* of such a huge number of substances is of the most essential importance to science, and until we shall have discovered those laws of molecular constitution and structure which alone can furnish a real and enduring system of classification, and a nomenclature founded on fact and not on hypothesis, some will wisely continue to prefer such provisional and imperfect groupings as present themselves upon the surface of things; some of which indeed, for all we know, may yet be found to furnish indexes to the real system of nature, as yet inscrutable to our merely superficial knowledge or masked by our prevailing artificial hypothetical views.

The best general and comprehensive *definition* of salts as a natural class that can be given is as follows: Bodies formed by the interaction of an electro-negative or acidic element, radical or compound, with an electro-positive or basylic element, radical or compound, in which *neutrality* is engendered, with mutual neutralization and disappearance of pre-existent acidity and basicity.

If we try to make a classification of salts based upon the present classification of the elements into groups according to their *atomicity*, so called—a grouping which would appear to have a certain foundation in nature—we meet soon with obstacles of a baffling character, there being many unmistakably natural groups or series of salts which present no parallelism with these atomicity-groups. To mention a few examples among the many striking ones that present themselves: Among the *basylic monads* we have silver and thallium, than which scarce any metals present less natural parallelism or relationship, either as elements or in salts, to the *alkali metals* or to *hydrogen*, among which they fall according to the accepted atomicity-groupings. Among the *basylic dyads* we have mercury and copper, classed with the natural group of the earthy metals. Among the *tetrad metals* tin, platinum, and lead fall together. Among the

*acidic* or *negative monads* fluorine is placed with chlorine, bromine, and iodine, which is at least dubious, its relationship to oxygen being much closer. Oxygen itself falls with the *dyad negatives*, sulphur, selenium, and tellurium, with very few satisfactory natural analogies to support the arrangement, and numerous irreconcilable differences against it. Boron is also widely separated, as a *triad*, from its natural relatives, carbon, silicon, and titanium, which are undeniably *dyadic-tetradic* elements, and is put with the phosphorus-group, with which we also find gold.

The rude provisional classification of salts, which must apparently even yet be reverted to if we wish to escape hypothetical or speculative views founded upon radical systems (such as are commented on under the head of SALT-RADICALS, which see), is that of Berzelius, this being now just half a century old, having been enounced by him upon his discovery of the group of the sulphur-salts in 1825–26. Berzelius made two general grand divisions of most salts, the *haloid* salts (ἅλς, "sea-salt") and the *amphide* salts (ἄμφω, "both," referring to the assumed existence of the acidic or negative element in *both* constituents of the salt). The haloids include those apparently simplest in constitution, consisting, like common salt, merely of two elements or radicals—one positive and the other negative—united into a compound more or less neutral. Whether this greater simplicity is real—that is, whether, as some have conjectured, the haloids may not possibly contain in their molecules *as many atoms* as the amphides—remains to be ascertained, as one result, probably, of successful studies (such as have not yet appeared at this present writing) into the subject of molecular volumes. (See VOLUMES, MOLECULAR.) A few examples of haloid salts are NaCl, $NH_4Cl$, KI, KCN, $NH_4.CN$, $Fe_2Cl_3$, $Al_2Cl_6$, $BaCl_2$, $AuCl_3$, $SnCl_4$, $SbCl_5$, $WCl_6$, by which it appears clearly enough that this classification is far from being a natural one, for even in this simplest class a very great variation exists both in types of composition and in natural relations. The haloids are further divided into acid, basic, and neutral or normal salts, these divisions being, however, largely arbitrary, and susceptible of no consistent and systematic application.

The *amphide* salts, according to Berzelius, include an enormously greater range of varieties. His group of amphigen elements, like the more modern group of dyadic negatives, contained oxygen, with sulphur, selenium, and tellurium; and he was led by his discovery of the sulpho-salts, or double sulphides, to endeavor to correlate these with oxygen-salts under the general designation of *amphides*. This generalization has even been extended to the contemplation of double chlorides, double fluorides, etc., as belonging to similar types, these being called *chloro-salts*, *fluo-salts*, and so on. These latter views, however, and even the term "amphide" itself, have fallen (probably justly) into disuse of late years, though the other term, "haloid," still holds its ground to some extent by reason of a certain convenience of application it possesses. By far the most numerous and important of the so-called amphide groups of Berzelius belong now to what we term *oxygen-salts*, composed of an acidic oxide combined with a basylic oxide. Of these there is a great variety, one important occasion of this being variations in *basicity* on the part of the acid, by virtue of which variable numbers of equivalents of hydrogen or a basylic metal are required to satisfy the combining power, or "basicity," of the acidic oxide. (See PHOSPHORIC ACIDS.)

An illustration or two may be given of the vague understanding and imperfect generalization of this subject yet possessed by us; which makes it impossible, without hypothetical assumptions (such as that of "hydroxyl"), to classify salts rationally. Thus, by the view of the illustrious Graham, that *hydrogen is a metal*—which accords with its replaceability by, and interchangeability with, metals—we are inevitably forced to ignore the marked natural distinction between salts and acids, the latter becoming merely *salts of hydrogen*. Another similar but much more striking consideration arises from the fact (altogether undeniable, yet generally ignored in the school-books) that there is no essential difference in the mode of action of several highly basylic metals *on both acids and alkalies*. The so-called "hydrates" of the alkalies contain hydrogen in the same state, and replaceable by a basylic metal (zinc, aluminum, etc.) exactly in the same way as in acids, this hydrogen being expelled in a free state, with formation of compounds *of two basic oxides;* which compounds cannot consistently be called salts, and have as yet, indeed, no distinct place in any system.

An entirely consistent and comprehensive theory of acids, bases, and salts remains yet to be generalized as a consequence of further discoveries of laws and relations yet undeveloped, but which time will bring forward. H. WURTZ.

**Salt Spring,** tp., Randolph co., Mo. P. 3526.

**Salt'ville,** p.-v. and tp., Washington co., Va., on the N. fork of Holston River, is connected by a branch railroad with Glade Springs. P. 2471.

**Salt'works,** v., Young co., Tex. P. 20.

**Salu'brity,** p.-v., Pickens co., S. C. P. 1367.

**Salu'da,** p.-v. and tp., Jefferson co., Ind. P. 1682.

**Saluda,** tp., Greenville co., S. C. P. 1761.

**Saluda,** tp., Lexington co., S. C. P. 792.

**Saluda,** p.-v. and tp., cap. of Middlesex co., Va. P. 1715.

**Salute'** [Lat. *salus, salutis,* "health"] originally signified the expression of a wish for the health of another. It now denotes a complimentary notice of an officer or a ship-of-war by the military or naval authorities. Salutes are offered by the presenting of arms, the dipping of colors, the rolling of drums, the firing of guns, the manning of yards, etc. The U. S. national salute is one gun for each State. The President is saluted with 21 guns; the Vice-President with 17; governors, cabinet officers, and generals commanding with 15; U. S. or foreign envoys, ministers and major-generals, 13; brigadier-generals, 11; and foreign ships receive gun for gun for all they fire in salute.

**Saluz'zo,** town of Italy, province of Cuneo, about 33 miles S. S. W. of Turin, near the opening of the mountain-valley of the Po upon the plain of Piedmont. The town itself stands mostly upon the plain, while from the charming hills near and behind it the villas of the Piedmontese nobility command views of great beauty and grandeur, the giant Monte Viso forming a most striking feature. The cathedral, semi-Gothic and of the fifteenth century, the church of St. Martin and St. Bernard, of St. Domenico, etc., all contain objects of more or less interest. In one of the public squares there is a fine monument erected to Silvio Pellico, who was born here. The ancient castle of the marquises of Saluzzo is now used as a prison. Though the numerous antiquities found in the vicinity prove that it was once occupied by a dense Roman population, yet this town does not appear in history until the eighth century, and only assumes importance in the twelfth. After this time as a marquisate, sometimes of greater, sometimes of less extent, it played a conspicuous part in the mediæval history of Northern Italy, the lords of Saluzzo being always dreaded as enemies and courted as allies. War and pestilence, however, at last (1630) reduced the pop. of 30,000 to 6000. At present, industry and commerce are reviving, and the agriculture of the district is prosperous. P. 15,500.

**Salvador'** (JOSEPH), b. at Montpellier in 1796, of Jewish descent; studied medicine and took his degree in 1816; settled at Paris, and devoted himself chiefly to the study of history; wrote in 1822 *Loi de Moïse;* in 1828, *Histoire des Institutions de Moïse* (3 vols.); in 1838, *Jésus Christ et sa Doctrine* (2 vols.); in 1846, *Histoire de la Domination romaine en Judée* (2 vols.); in 1859, *Paris, Rome, Jérusalem, ou la Question religieuse au 19e Siècle* (2 vols.).

**Sal'vage** [Lat. *salvare,* "to save"], the reward paid for saving a vessel and the property on board, whether saved in war from an enemy by recapture or saved from the perils of the sea. The recapture in the first case may be from a pirate, or from a captor who is an enemy, or from one with a commission who is not an enemy. In the first case, the law of Great Britain and that of France give one-third of the value to the captor as salvage. In the second case, the usage and law of nations vary, both as to the restoration of the vessel or property—which depends on the length of time that it has been in the enemy's hand or on the condemnation by a prize court—and as to the amount of salvage in case of restoration. The law of the U. S. adopts the principle of reciprocity in regard to the restitution of the property of friendly nations when recaptured from the enemy, and to the salvage in such cases to be paid. In regard to the third case, we refer to Wheaton's *Elements* (ed. 8, §§ 360–384), which considers the whole subject carefully. T. D. WOOLSEY.

**Salvage,** the term used in the maritime and admiralty law to describe the special compensation which is allowed, according to the doctrines of that law, to those persons who have voluntarily saved, or assisted in saving, property, ship, cargo, and the like, from some impending peril of the sea, or have recovered it when wrecked, or when abandoned and derelict, or when captured by some hostile force. It essentially differs from the ordinary hire for services rendered, which can be recovered by the common law, in the fact that no request, express or implied, from the person benefited, and consequently no promise on his part to pay for the labor when performed, are necessary to constitute a valid claim for this species of compensation, although such a request and subsequent promise may of course form parts of

the transaction. Salvage was provided for in the most ancient codes of sea-laws, and from them has been incorporated into the maritime law of all civilized countries. The questions concerning it, and the judicial proceedings to determine its amount, to compel its payment by the parties benefited, or to enforce the lien upon the rescued property itself which arises in favor of the salvors, generally fall within the jurisdiction of the admiralty courts, and form a distinct head of admiralty jurisprudence. In the U. S. the service may be performed either on the high seas, or on tide-water, or on the great inland lakes and rivers where foreign or inter-State commerce is conducted. In order that a person should be entitled to salvage he must be under no legal obligation to render the assistance. In the language of an eminent American judge, "The relief of property from an impending peril of the sea by the voluntary exertions of those who are under no legal obligation to render assistance, and the consequent ultimate safety of the property, constitute a case of salvage." Upon this principle, the crew, while their relation as crew exists, can never become entitled to salvage for rescuing their own ship or its cargo from the most extreme peril. But if the legal connection of the seamen with the vessel has been wholly and in good faith dissolved, and their contract with the owners thereby ended, for any proper service subsequently done by them their claim to be compensated is valid and complete. Such a dissolution would result from a capture of the ship, or from her voluntary and total or final abandonment done by order of the master. A passenger is not entitled to salvage for any ordinary acts in aid of the vessel when in danger; but by his extraordinary services when safety is wholly or partially the result of his assistance he becomes a salvor, and as such must be remunerated. When the service is performed by the whole or a portion of a crew acting under the direction of their superior officer, the owners of the vessel to which they belong are regarded as among the salvors, and are awarded a considerable share of the entire compensation, since they represent the ship without which no help could have been given, and the remaining part is distributed in varying amounts among the master and crew, since the service was actually performed by them, and all of them in some manner participated in it. It has been recently decided that corporations may become entitled to salvage, and companies have been formed for the purpose of rescuing vessels and their cargoes when stranded or wrecked upon certain exposed coasts of the U. S. To constitute a case for salvage there must be an actual, present, impending peril—something more than the common risks of navigation, from which a vessel can ordinarily escape without help. It may arise from any of the causes by which ships and cargoes are exposed to loss—from storms, rocks, shoals, breaking of machinery, disabled condition of the vessel, fire, public enemies, pirates, and the like; or the property may be found entirely abandoned for any cause, and derelict. Whatever be the nature of the danger, the ship, cargo, or other article must be actually rescued therefrom and brought to some port or place of safety, so that the owner can obtain possession of it; and this result must be wholly or partially produced by the persons claiming the salvage or through their instrumentality. In some countries the amount of the compensation is fixed by law. In the U. S. and in Great Britain the amount is determined by the court, not arbitrarily, but in accordance with some settled principles of apportionment, and depends largely upon the circumstances of each case. It is always more than a mere pecuniary compensation for the labor performed. The risk of person, life, and property by the salvors, the time during which they were employed, and the exertions required from them, the extent and character of the peril to which the saved property was exposed, and its value, are the principal elements which enter into the computation by which the salvage in any particular case is fixed. Its distribution among the salvors is determined by similar considerations. The master's share exceeds that of the mate, and his is larger than that of each seaman. Unless the salvage is settled and paid by voluntary agreement, it is enforced by an admiralty proceeding *in rem* against the property saved, which is sold under a decree of the court, and out of the proceeds the awards are paid to the salvors. JOHN NORTON POMEROY.

**Salvagno'li** (VINCENZO), b. at Caniola, near Empoli, in 1802; practised law from 1826 to 1848; took a lively part in the political movements of Tuscany in 1849, and in 1859 became an active collaborator in the journal *La Patria*, afterward in *La Nazione;* he was an influential friend and adviser of Baron Bettino Ricasoli; was minister of grace and justice in the Tuscan cabinet, and was regarded as one of the most eloquent orators in the Tuscan assembly; he was a highly talented scholar, as well as a distinguished jurist, and a short time before his death was appointed senator of the kingdom of Italy. D. at Pisa in 1861.

**Salvandy, de** (NARCISSE ACHILLE), COUNT, b. at Condom, department of Gers, France, June 11, 1796; entered the army in 1813; was made master of requests in 1819, but dismissed in 1821 on account of his liberal views; travelled in Spain; devoted himself to literature, and wrote, besides a number of political articles and pamphlets, *Don Alonzo, ou l'Espagne* (4 vols., 1824), *Islaor* (1824), *Histoire de Pologne avant et sous le Roi Jean Sobieski* (1827). After the revolution of 1830 he sided with the Doctrinaires; was made a count, ambassador to Madrid and Turin, and minister of public instruction 1837–39 and 1845–48. After the revolution of 1848 he retired to his estate, Graveron, department of Eure, where he d. Dec. 15, 1856.

**Salvator Rosa.** See ROSA.

**Salvia.** See SAGE.

**Salvi'ni** (TOMMASO), b. in Milan in 1829. His father was a professor of literature, and gave him an excellent education. A precocious talent took him at the age of fourteen to the stage, under the administration of Gustave Modena; was connected with the royal theatre at Naples, and afterward for six years played with success at different Italian theatres, several times with Ristori; in 1874 came to America and visited Havana, playing his chief parts, Othello, Hamlet, Saul, and Orosmanes. Salvini has extraordinary talent as a comedian, but his reputation is in tragedy, where he ranks with the greatest artists of his time. He is a man of culture and scholarship, as well as of professional accomplishment. O. B. FROTHINGHAM.

**Salvi'sa,** p.-v., Mercer co., Ky. P. 153.

**Sal'yersville,** p.-v., cap. of Magoffin co., Ky. P. 106.

**Salz'brunn,** town of Prussia, province of Silesia, on the Salzbach, consists of three small villages—Ober-, Nieder-, and Neu-Salzbrunn—and contains 8 rich salt springs, from which 2,500,000 bottles of water are annually exported.

**Salz'burg,** town of Austria, capital of the duchy of Salzburg, is most picturesquely situated at the foot of the Noric Alps, on both sides of the Salza, which here rushes forth from a narrow defile and winds through the city toward the Inn, surrounded by beautiful forest-clad hills crowned with magnificent castles and monasteries. The city is old, with crooked and narrow streets, but it contains many elegant monuments and edifices built of white marble. It is surrounded with walls pierced by twenty gates, of which the most remarkable is the Sigismund Thor, 425 feet long, hewn through the Mönchsberg. It is the see of an archbishop, has a fine cathedral, two good public libraries, a botanical garden, a college, an ecclesiastical seminary, a medical school, and many other educational and benevolent institutions. It has manufactures of paper-hangings, musical instruments, lead-pencils, mirrors, and type, several oil-mills and cotton-spinning and weaving factories, and carries on a very lively trade with Vienna and Bavaria. P. 20,336.

**Salzkam'mergut,** district of the Austrian province of Upper Austria, between Salzburg and Styria, and remarkable both for the beauty of its scenery and for its saltworks. It does not form a political division; it is simply an imperial domain, comprising an area of between 200 and 300 sq. m., with about 18,000 inhabitants. On account of the alpine character of the district, agriculture is almost impracticable; the inhabitants are mostly engaged in cattle-rearing and dairy-farming and in the manufacture of salt from the salt springs. About 40,000 tons are annually produced. The most striking features of the scenery are the lakes, which, enclosed by lofty mountains clad with forests and covered with pastures, lift their heads into the region of perpetual snow. The highest peak, Grosse Priel, reaches an elevation of 7931 feet. The most celebrated of the lakes is that of Traun, formed by the river Traun. The richest saltworks are those of Ischl and Hallstadt.

**Salz'wedel,** town of Prussia, province of Saxony, on the Jeetze, has manufactures of oil, needles, gloves, tobacco, liqueurs, and woollen and linen fabrics. Hops are extensively cultivated in its vicinity. P. 7201.

**Samakov',** town of European Turkey, in Bulgaria, has large ironworks and about 5000 inhabitants.

**Samar',** one of the Philippine Islands, East Indies, comprises an area of 13,020 sq. m., with 110,103 inhabitants, most of whom are mestizoes. The mountains of this island are higher and wilder than those of the other islands. The chief town is Catbalogan, on the W. coast. The principal articles in which trade is carried on are wax, cabinet woods, palm oil, and mat-work.

**Samara',** government of European Russia, bounded E. by the Kirgheez steppes and W. by the Volga, comprises an area of 61,210 sq. m., with 1,837,081 inhabitants. It is very fertile and well adapted to agriculture, but as yet only thinly peopled.

**Samara,** town of European Russia, capital of the government of Samara, on the Volga, has an extensive trade in grain, fish, caviare, tallow, and hides. P. 34,494.

**Samarang′,** town of Java, East Indies, the capital of the Dutch residency of the same name, on the northern coast of the island, at the mouth of the river Samarang. It is tolerably well built, and carries on an important trade, though its climate is unhealthy and its harbor shallow, and in the wet season even unsafe. Sugar, rice, and pepper are extensively cultivated in its vicinity, and it is the entrepôt for the products of the central part of the island. P. 30,000.

**Samarcand′,** or **Samarkand,** capital of a province of the same name, comprising the southern part of Russian Toorkistan, is situated at an elevation of 2154 feet above the level of the sea, 8 miles S. of the river Serafshan. By the Arabian poets of the Middle Ages it is described as a paradise on account of its beautiful surroundings, and under the dynasty of the Sassanides (833–1000 A. D.) it flourished as a home for learning and all the arts of peace. It lost much by the occupation of Genghis Khan in 1219, but it rose again toward the close of the fourteenth century, when Timur made it the capital of his immense empire, and adorned it with architectural monuments of all kinds —the tomb of Kasim-bin-Abbas, the mosque of Timur, the citadel, Timur's tomb, the Medresse, etc. By the Mohammedans of Central Asia the city is still considered the principal seat of Mohammedan learning, and its 86 mosques and 23 colleges attract numerous pilgrims and students. In 1868 it was seized by Russia, together with the whole district of the Serafshan. P. about 30,000.

E. SCHLAGINTWEIT.

**Sama′ria** [Heb. שֹׁמְרוֹן, *Shomerôn,* "watch-height"]. (1) An ancient city of Central Palestine, some 6 miles N. W. of Shechem, and about halfway between the Mediterranean and the Jordan. It was founded 923 B. C. by Omri, the sixth of the nineteen kings of the northern kingdom of Israel, who made it his capital, and called it after the name of the man (Shemer) of whom he bought the hill on which the city was built (1 Kings xvi. 24). This hill, oblong and flattened, swells up to the height of some 300 feet out of a basin about 5 miles in diameter, surrounded on every side by mountains still higher. The Mediterranean is in full view from the top of the hill. "It would be difficult," says Dr. Robinson, "to find in all Palestine a situation of equal strength, fertility, and beauty combined. In all these particulars it has very greatly the advantage of Jerusalem." The city shared in the stormy fortunes of the upper kingdom. Twice it escaped capture when besieged by the Syrians. In 722 B. C., after a siege of two years, commenced by Shalmaneser of Assyria, it was taken by his successor, Sargon, who put an end to the kingdom of the ten tribes. Repeopled by Esarhaddon, it was next captured by Alexander the Great (332 B. C.), and again by John Hyrcanus (109 B. C.). It was splendidly rebuilt by Herod (40–4 B. C.), who named it *Sebaste,* in honor of his patron, the emperor Augustus. The modern Arabic *Sebustieh* is simply a corruption of the Greek name. Nearly 100 limestone columns still standing in their places, some 60 of them in a single colonnade, attest the magnificence of the Herodian city. The partially-ruined church of St. John, now a mosque, dates probably from the twelfth century. In the fourth century it was claimed that John the Baptist had been buried there, as well as the prophets Elisha and Obadiah. The modern village, on the S. E. shoulder of the hill, contains about 60 houses, with a pop. of 400 to 500. The people are noted for their rudeness and insolence to travellers. (2) The name also of one of the three provinces into which Western Palestine was divided by the Romans. Its boundaries are given by Josephus (*J. W.,* iii. 3, 4).

R. D. HITCHCOCK.

**Samar′itans.** After the destruction of the kingdom of Israel, and the removal of its inhabitants into captivity in 722 B. C., in the first year of Sargon, king of Assyria (2 Kings xvii. 6; xviii. 11; Rawlinson, *Com. in loco;* Smith's *Assyrian Canon,* p. 125; Schrader, *Keilinschrift. u. d. A. T.,* p. 160), Central Palestine was left desolate and uninhabited except by a remnant of the poorer classes and fugitives (2 Chron. xxxiv. 6, 9; Jer. xli. 5), until the removal thither by Sargon in 722, and again in 715 B. C. (2 Kings xvii. 24; Smith, p. 128; Schrader, p. 162), and Esarhaddon in 680 (?) (Ezra iv. 2–10; Rawlinson, *in loco;* Smith, p. 138; Schrader, p. 244), of colonists from Babylon, Syria, Arabia, and other Eastern lands. Hence the people (called Samaritans from Samaria, the capital) became an exceedingly mixed race, the main body, however, being of the Aramaic stock. They at first worshipped every tribe its own god, but being plagued by the wild beasts, they united in the worship of the God of the land, being instructed thereto by a priest sent to them from the exiles by the king of Assyria, who restored the worship at Bethel (2 Kings xvii. 24–41). When the Jews returned to Jerusalem (536 B. C.), the Samaritans desired to unite with them in their work, but were rejected by Zerubbabel, owing to their corrupt religion and their mixed or heathen origin (Ezra iv. 3). Henceforth, the Jews and Samaritans entertained the most bitter hatred of each other. This was intensified by the secession of one of the sons of Joiada, the son of Eliashib, the high priest (Neh. xiii. 28), son-in-law of Sanballat, the Samaritan governor (called by Josephus, *Ant.,* xi. 7, 2, Manasseh, the brother of Jaddua, the high priest). Under the leadership of this priest and others of the Jews, who with him were expelled on account of their refusal to separate themselves from their heathen wives, the worship was reorganized (409 B. C.) on the basis of a copy of the Pentateuch that Manasseh carried with him. Gerizim was made the centre of worship, in accordance with the tenth commandment added by the Samaritans to Ex. xx. and Deut. v., and a temple was erected there, probably in the time of Alexander the Great, which continued until it was destroyed by John Hyrcanus (129 B. C.; Josephus, *Ant.,* xiii. 9, 1). The Samaritans shared the fortunes of Palestine during the constant wars between Egypt and Syria, and also under the Roman dominion. They were severely chastised by Pilate for their rebellious spirit, then again by Vespasian and others, until finally, in the reigns of Zeno and Justinian, on account of outrages committed against Christians, they were almost totally destroyed. A remnant, however, clung to their holy place, dwelling in Nablus, the successor of the ancient Shechem, or dispersed in Alexandria, Cairo, Damascus, Aleppo, etc., where they retained the religion of their fathers. And thus they continued during the Mohammedan rule, dwindling until at present they are limited to a community of from 100 to 200 souls at Nablus. They were lost sight of by the learned world until the sixteenth century, when Joseph Scaliger opened a correspondence with them. They then gained an interest that they have since retained, owing to their ancient copy of the Pentateuch, and their religious rites and doctrines, as well as their language and literature. Their religion is based on

*The Samaritan Pentateuch.*—The original MS. is in the synagogue at Nablus. This they claim to have received by tradition from Abisha, the great-grandson of Aaron, whose name is inscribed upon it. It is mentioned by Cyril of Alexandria, Eusebius, Jerome, Procopius of Gaza, etc. among the Fathers, but was lost sight of subsequently until 1616, when Pietro della Valle procured a copy of it at Damascus, which was then published in the Paris Polyglot of 1645, and subsequently in Walton's Polyglot of 1657. At once a hot dispute arose as to its value, which continued for two centuries—Morinus, Houbigant, Poncet, and Hassencamp exalting it above the Masoretic text; Hottinger, Ravius, J. D. Michaelis, and Tychsen advocating the superiority of the latter. Gesenius, in his work *De Pent. Sam. Origine* (1815), was the first to thoroughly compare the two texts. His results have been generally accepted by modern scholars—that whilst the text is an independent one in its origin, it has yet been improved by the Samaritans in order to avoid obscurities and in the interest of their own religion, at times betraying an ignorance of Hebrew grammar and exegesis. It has many features of resemblance to the LXX. (Gesenius calculates them at more than 1000), which have attracted the attention of scholars, so that on the one side Hottinger, Hassencamp, Eichhorn, and Kohn have contended that the LXX. had been translated from the Samaritan, and on the other side Grotius, Usher, etc., that the Samaritan was made from the LXX. But these views are impossible, and have been abandoned by most recent scholars, who give the text an independent authority. It was, then, either with the LXX. derived from a common older MS. of Jerusalem, as Gesenius, Nutt, and others, or, as the differences between them are quite numerous, they are based on independent original MSS., the original of the Samaritan text having been brought from Jerusalem by Manasseh. The text has been published since Walton by Blayney (Oxford, 1790) in Hebrew square characters, and the variations from the Masoretic text have been noted in the appendix to Petermann's *Versuch einer hebräischen Formenlehre nach der Aussprache der heutigen Samaritaner* (Leipsic, 1868; also *Deutsch. Morg. Gesells.,* v. 1). The text has been discussed in Smith's *Bib. Dict.* by Deutsch, and in Kitto's *Cyclop.* (3d ed.) by Samuel Davidson, as well as by those mentioned above.

*The Samaritan religion* is based on the Pentateuch, and differs from that of the Jews in the rejection of the rest of the Old Testament, and in their regarding as the tenth commandment the obligation to worship God on Mount Gerizim. Their religion is monotheistic, the name יהוה being lost, and *Shéma* ("the name") substituted for it. They

believe in the existence of good and evil spirits, עזאזל (Lev. xvi. 10) being interpreted as a "devil," and the נְפִילִים of Gen. vi. 4 as "evil spirits." They believe in the Messiah (John iv. 25), on the basis of Deut. xviii. 15, as a prophet, who is like Moses, but not greater than Moses, who remains for all time the greatest. The Shiloh passage, Gen. xlix. 4, they refer to Solomon, in whose time the sceptre departed from Judah. The Messiah will appear 6000 years after the creation, and enter into judgment of the world on Mount Gerizim. Here they find all the sacred places of the past and future. Here Adam was created; here the ark rested; here Adam and Noah erected their altars, Abraham offered Isaac, and the heavenly ladder appeared to Jacob, etc. They do not offer sacrifices, on account of the destruction of the temple, but keep the feasts of the Pentateuch, circumcise their boys on the eighth day, and observe the Sabbath in their synagogues like the Jews. The Samaritans had their sects after the analogy of the Jewish sects, called Essenes, Sebuæans, Gorthenians, and Dositheans, mentioned by Epiphanius, *Adv. Hæres.* i. 11, fourth century. (For these, and a full description of their present customs in the keeping of the feasts, see Petermann, art. "Samaria," Herzog's *Realencyklop.*; Stanley's *Jewish Church;* and Nutt's *Samaritan History, Dogma, and Literature* (London, 1874).)

The *Samaritan language* is a mixture of the Aramaic and Hebrew, in many cases having side by side the two forms; *e. g.* the article of the Hebrew and emphatic state of the Aramaic; the relatives אשר and ד; the Niphal and Ithpe'el, Aphel and Hiphil; the plurals in ים and ין, ות—and ־ן—. The letters are 22 in number, their order being the same as in Hebrew, but their *form* is like the ancient Hebrew and Phœnician, and not like the square character adopted by the Jews subsequent to the Exile. In pronunciation they are the same as Hebrew, except the gutturals, which are all quiescent and interchange readily with one another, being exceedingly weak. The vocabulary is essentially the same as the Hebrew and Chaldee, although many words have been introduced from Arabic, Latin, and Greek. (Cf. Uhlemann, *Inst. ling. Samarit.* (Leipsic, 1837); Nicholls, *Grammar of the Samaritan Lang.* (London, 1858); Petermann, *Brevis Ling. Samarit. Gr.* (Berlin, 1873).)

*The Samaritan literature* is quite limited in extent. (1) The *Samaritan Targum* is ascribed by tradition to Nathanael the high priest, who d. 20 B. C. There is no reason to doubt that it was composed about the same time as the Targum of Onkelos, with which it has many points of agreement, although certainly an entirely independent version. The translation is exceedingly literal and close, even where the sense was not clear to the translator. (Cf. Winer, *De Versionis Pent. Samaritanæ indole* (Leipsic, 1817); Petermann, *Pent. Samarit.*, Fasc. I. Genesis (Berlin, 1872); Brüll, *Samarit. Targum zum Pent.* (Frankfort, 1875), in Hebrew square characters. Cf. also *Fragments of a Samaritan Targum,* with an introduction by Nutt (London, 1874), and *Krit. Studien über manuscript. Frag. des Sam. Targ.*, von Brüll (Frankfort, 1875).) This Targum is also printed in the great Paris and Walton Polyglots. The Samaritans had also a Greek version, mentioned by some of the Fathers as τὸ Σαμαρειτικόν, which has been lost; also an Arabic version, which they still possess. (2) *Chronicles.*—First in importance is the Samaritan Chronicle, or book of Joshua, composed probably in the thirteenth century, taking some of its material from the Hebrew book of Joshua, but adding thereto much of a legendary character, showing that the Jews were from the time of Eli apostates and their oppressors, continuing the narrative until about 350 A. D., where it concludes abruptly. It was published by Juynboll (Leyden, 1848), with Latin translation and commentary. There is also the chronicle *El Tholodoth* ("The Generations"), professedly by Eleazar ben Amram (1142 A. D.), and then continued by many others until 1859, giving the calculation of sacred times, the age of patriarchs, list of high priests until the present. It was published by Neubauer in *Journal asiatique* (1869). Then comes the Chronicle of Abulfath, in the middle of the fourteenth century, a digest of the two previous works, with fresh legendary material, published by Vilmar (Gotha, 1865). Other minor works, corresponding with the Jewish Hagada literature, are found. (3) *Liturgies and Hymns.*—Nutt (p. 143) says that there are nineteen volumes of these in the British Museum, besides those known in the *Carmina Samarit.* of Gesenius (Lips. 1824) and *Karme Shomeron* of Kirchheim (Frankfort, 1851). Petermann publishes specimens in his *Gram.* and *Chrest.* The present Samaritans have two collections, called *Durrân* ("String of Pearls") and *Defter* ("Book"). These hymns and prayers belong to widely different periods. The earliest are ascribed to the angels. Heidenheim has published many of them in his *Vierteljahrsschrift.* (4) There are also commentaries, theological tracts, and a few quite recent grammatical works, written in Arabic. (Cf. art. "Samaria" in Herzog's *Realencyk.*, by Petermann; Smith's *Dict.*, by Deutsch; Kitto, *Cyclop.* (3d ed.), by Davidson; and Nutt, *Samaritan Hist., Dogma, and Literature* (London, 1874).)

C. A. Briggs.

**Samar'rah,** town of Asiatic Turkey, 65 miles N. W. of Bagdad, on the left bank of the Tigris, is surrounded with substantial walls, and contains two temples, which enjoy a high reputation among the Mohammedans of the Sheeah sect, and annually attract about 10,000 pilgrims. Close by are the ruins of the ancient Opis and the Median wall, which extend for several miles along the Tigris.

**Sambas',** town of the island of Borneo, East Indies, the capital of a state of the same name which occupies the western part of the island and is subsidiary to the Netherlands, on the river Sambas, 30 miles from its mouth, in lat. 1° 15′ N., lon. 109° 20′ E. Its situation is very low; the houses, or rather the huts—for they consist only of boards and palm-leaves—are raised on piles, and all communication is by boats. The best part of the city is that inhabited by the Chinese, who are largely represented here, and are mostly engaged in gold-washing. P. about 10,000.

**Sambia'se,** town of Southern Italy, province of Catanzaro, very near Nicastro. This town suffered severely from the earthquake of 1783. P. 7887.

**Sam'bor,** town of Austria, in Galicia, on the left bank of the Dniester, in a beautiful and fertile plain, is well built, and has some linen manufactures and a lively trade. P. 10,507.

**Sam'bre,** a small river of Europe, rises in the department of Aisne, France, flows in a N. E. direction, and joins the Meuse at Namur in Belgium after a course of about 100 miles. It is navigable for a great part of its course, and forms an important part of the system of canals in Northern France and Belgium.

**Sambu'ca Za'but,** town of Sicily, province of Girgenti, in a very fertile vine and olive bearing district. P. 8673.

**Sam Mil'ler,** tp., Albemarle co., Va. P. 4959.

**Sam'my Swamp,** tp., Clarendon co., S. C. P. 960.

**Sam'nites** [Lat. *Samnites,* plu. of *Samnis*], the people of ancient Samnium, a region of Central Italy. They finally became masters of Campania, Lucania, and a large part of Southern Italy. They were of Sabine stock, and were of several tribes, of which the Pentri and Hirpini were the chief, and the Caudini, Caraceni, and perhaps the Frentani, were less important. The Samnites were a brave, frugal, and religious people, who were often at war. The first Samnite war with Rome (343–341 B. C.) resulted in favor of the Romans and secured a Samnite alliance during the Latin war (340–338 B. C.). The Second Samnite war (326–304 B. C.) was a terrible contest, in which the Romans (321 B. C.) were shamefully defeated at the Caudine Forks, but were finally successful. The Third Samnite war (298–290 B. C.) saw the overthrow of the Samnites and Gauls by Fabius at Sentinum. The Samnites took the part of Pyrrhus, of Hannibal, of the Socii, and of Marius; and at last Sulla undertook their complete extirpation, and for more than a century after his time their land was a scene of desolation, and the Samnite name is thenceforth unknown as having a separate existence. Though nearly allied in blood to the Romans, the Samnites were ever their bitterest enemies, "the eternal enemies of the Roman name." They appear to have been a rude pastoral people, devoted to the preservation of that liberty which Rome sought successfully to destroy.

**Samnium.** See Samnites.

**Samoan Islands.** See Navigator's Islands.

**Sa'mos,** an island of the Ægean Sea, near the coast of Asia Minor, from which it is separated by a narrow channel, called by the Turks *Little Boghaz,* at the foot of *Mount Mycale,* where in 479 B. C. the fleet of Xerxes was defeated and dispersed on the same day that his army was beaten and nearly destroyed at Platææ. Samos, whose area is estimated at about 165 sq. m., with a population of about 50,000, is one of the finest islands in the Ægean Sea. It is mountainous, but its high, picturesque mountains are rich in marble, silver, lead, and copper, covered with forests of oak and pine, and enclosing beautiful valleys, where wheat, olives, grapes, and fruits are produced in abundance and of superior quality. In olden times it was one of the most flourishing of all the Greek islands, and its inhabitants were famous as sailors. In the Greek war of independence the Samiots excelled by their valor; and although they were not allowed to unite with their countrymen, they enjoy a somewhat independent position, only paying a tribute to the sultan. Chief town, Khoran.

**Samothra′ki** [anc. *Samothrace*], an island in the Ægean Sea, belongs to Turkey, and comprises an area of 30 sq. m., with 1500 inhabitants. It is mountainous, with steep, harborless coasts and peaks rising to the height of over 5000 feet. In ancient times it was very famous as the seat of a mysterious religious worship.

**Samoyedes′,** a people of Northern Russia, both in Europe and Asia. They appear to be allied to the Lapps and Finns, but are more degraded than either. They are mostly heathens or nominal Christians, small, filthy, indolent, and much addicted to intoxication, but peaceable and harmless. The herding of reindeer and the collection of fish and furs afford them subsistence. They are stated to number 20,000, of whom one-fourth are European. They speak several dialects. Their country is one of the coldest and most desolate of inhabited lands. They call themselves *Khasovo* or *Nenetch,* signifying "men."

**Sam′phire** [a corruption of *St. Pierre*], the *Crithmum maritinum,* an umbelliferous plant growing on cliffs near the sea in Europe. It is a choice salad-herb and makes a very fine pickle. It is extensively raised in English market-gardens. The golden samphire is *Inula crithmoïdes,* a composite sea-coast plant resembling the above, growing in the same situations and having the same uses. Marsh samphire is *Salicornia herbacea,* a chenopodiaceous salt-marsh plant of Europe and North America. It is marketed for pickling.

**Sam′pit,** tp., Georgetown co., S. C. P. 960.

**Samp′son,** county of S. E. North Carolina, on South and Black rivers, has a rolling surface, covered with vast forests of pitch-pine. Staples, wheat, cotton, sweet potatoes, rice, honey, wool, and butter. Sheep and swine are numerous. Cap. Clinton. Area, 940 sq. m. P. 16,436.

**Sampson,** v., Neave tp., Darke co., O. P. 346.

**Sampson** (Deborah), b. at Plympton, Mass., Dec. 17, 1760; adopted male attire; enlisted under the name of Robert Shurtleff in the 4th Massachusetts regiment during the war of the Revolution; was wounded in a skirmish near Tarrytown, N. Y., and served through the campaign of Yorktown, her sex having never been discovered. She married Benjamin Garnett, a farmer of Sharon, Mass., received a pension, and d. there Apr. 29, 1827. Her account of her military experiences appeared in a volume entitled *The Female Review* (Dedham, 1797), of which a new edition, with introduction and notes by Rev. John A. Vinton, was issued in 1866.

**Sampson** (Ezra), b. at Middleborough, Mass., Feb. 12, 1749; graduated at Yale College 1773; became pastor of the Congregational church at Plympton, Mass., Feb., 1775; was chaplain in the army at Cambridge 1775–76; was settled at Hudson, N. Y., 1796; was there associated with Harry Croswell in the editorship of *The Balance,* one of the first literary journals established in the U. S., 1801–04; contributed essays for many years to the *Connecticut Courant,* which he edited 1804, and became judge of Columbia county 1814. D. in New York City Dec. 12, 1823. Author of *Beauties of the Bible* (1802), *The Sham Patriot Unmasked* (1803), *The Historical Dictionary* (1804), which passed through several editions, and *The Brief Remarker on the Ways of Man* (1817; new ed. 1855).

**Sampson** (Francis S.), D. D., b. in Goochland co., Va., in 1814; graduated at the University of Virginia 1836; studied theology at the Union Theological Seminary of Virginia, in which he became professor of Oriental languages and literature 1848, having been ordained to the Presbyterian ministry 1841. D. in 1854. After his death a *Critical Commentary on the Epistle to the Hebrews* (N. Y., 1856) was edited from his MS. notes by Dr. R. S. Dabney.

**Sam′söe,** an island of Denmark, in the Cattegat. Area, 40 sq. m. P. 5500. It is low, with an undulating surface and very fertile soil.

**Sam′son** [שִׁמְשׁוֹן, "sunny," "sunlike" (Nöldeke, *Z. D. M. G.,* xv. 806). The other etymologies are forced attempts to place in the word the *ἰσχυρός* of Jos., *Ant.,* v. 8. 4. (See Fürst, *Heb. Lex.,* Maurer, Bertheau, Keil, *in loc.;* LXX. Σαμψών, a trace of a pronunciation different from that of the Masorah; comp. Arab. شَمْس)], one of the Hebrew judges, whose history is related Jud. xiii. 2—xvi. 31.

*Time.*—1116–1096 B. C. He judged Israel twenty years (xv. 20; xvi. 31), falling within the forty years (xiii. 1) of Philistine dominion, terminated by Samuel's victory at Eben-Ezer (1 Sam. vii. 11–13), and commencing shortly before the capture of the Ark (1 Sam. iv. 11; comp. vi. 1; vii. 12).

*History.*—Son of the Danite Manoah of Çorah (xiii. 2), living in Mahaneh-Dan (xiii. 25; xvi. 31; comp. xviii. 11–12). To his mother, long barren, the birth of a son is announced by an angel (comp. Luke i. 7, 13). He is a Nazarite from the womb (comp. 1 Sam. i. 11), the first of whom mention is made in the Old Testament (Ewald, *Gesch. Is.,* ii. 517). He is first inspired in his own home to the performance of some deed now lost to us (xiii. 25). His subsequent recorded history may be arranged in three periods: (1) His connection with the Philistine maiden of Timnath, and the consequent complications with the Philistines (xiii. 15). (2) His visit to Gaza (xvi. 13). (3) His connection with the harlot (דְּלִילָה; comp. Arab. دَلُّوْءَة, "bawd"); her treachery and his loss of strength, imprisonment, and death (xvi. 4–31).

*Character.*—He differs from all the other judges in the personal and individual character of his work. He does not appear as delivering the people from the oppression of the enemy, so much as avenging on the Philistines his personal wrongs. His working was entirely confined to the narrow limits of the hill-country along the border between Judah and Dan; only twice do we find any mention of him away from here. We have no proof of his general recognition as judge, and in one instance we find him rejected by the tribe of Judah (xv. 10). Shut out by his Nazarite vow from the use of wine, his passions find another outlet, and his weakness toward women furnishes the key to his wasted life and strength. Throughout all his actions and words runs a fine vein of humor (Herder, *Geist der heb. Poesie,* ii. 204) and reckless carelessness of his God-bestowed strength. The moral standard of his age and position, living on an enemy's border, must be taken into consideration before his life can be explained or understood.

*Literature.*—Very meagre; most valuable are the various commentaries on Judges, especially Cassel in the Lange series (Am. ed.), and by Bachmann (1869).

T. C. Murray.

**Samson** (George Whitefield), D. D., b. at Harvard, Mass., Sept. 29, 1819; graduated at Brown University 1839, at Newton Theological Institute 1843; was for many years pastor of a Baptist church at Washington, D. C., and president of Columbian College, D. C., 1859–71, when he became president of Rutgers Female College, New York City. He travelled in Europe and the East 1848, publishing a series of letters and essays on Italy, Egypt, Palestine, and Sinai; has written several theological pamphlets and critical essays on art, and is author of *To Daimonion, or the Spiritual Medium* (1852), reissued in an enlarged form under the title *Spiritualism Tested* (1860), *Outlines of the History of Ethics* (1860), *Elements of Art Criticism* (1867), and *Physical Media in Spiritual Manifestations* (1869), and is understood to be engaged (1876) upon an important work which will present novel views upon the history and development of the ancient Oriental and classical philosophies, religions, and mysteries.

**Samson** (Joseph Isidore), b. at St. Denis, France, July 2, 1793, in humble circumstances; acted for several years in the provinces, subsequently in Paris, and became in 1832 a member of the Théâtre Français; retired in 1863. D. at Paris in 1871. His representations both of ludicrous and grave characters, numbering about 250, were distinguished by an individuality and elegance which hardly any other actor of his time attained. He was also highly appreciated as a teacher; Rachel and the two Brohans received instructions from him.

**Sam′uel** [Heb. *Shemuel,* "heard of God"], a Hebrew judge, lawgiver, and prophet, whose history is recorded in the first of the two biblical books of Samuel, b. at Ramathaim Zophim in Mount Ephraim, probably in the twelfth century B. C.; was consecrated by his mother, Hannah, to the service of Jehovah as a Nazarite before his birth; brought up in the household of the chief priest, Eli, at Shiloh; received in childhood a divine message foreboding the downfall of the family of Eli; assumed the judgeship of Israel about twenty years after the death of Eli, at which time he headed a successful expedition against the Philistines; resided at Ramah (probably the same as Ramathaim Zophim); visited annually the three principal sanctuaries, Bethel, Gilgal, and Mizpeh, and made his sons deputy judges, but in consequence of their misconduct was commissioned by Jehovah to accede to the popular clamor for a king; to which end he anointed Saul as first monarch of Israel, and on his disobedience to a divine command anointed the youthful shepherd, David, in his place. He d. shortly before the close of the reign of Saul, and his spirit was successfully invoked by the "witch of Endor" to announce to Saul the fatal result of the battle in which he lost his life. Samuel is regarded as the founder of the "schools of the prophets," and by the Talmudists as the writer of the first of the books which bear his name. This opinion, however, is rejected by nearly all modern critics; but another school of commentators, of which Bishop Colenso is the most prominent English representative, con-

siders that large portions of the Pentateuch and the books of Joshua and Judges were compiled by him, or under his direction by the scribes of the prophetical schools. The chronology of the life of Samuel is obscure, and great differences of opinion exist, some regarding him as the immediate successor of Eli in the judgeship, others maintaining that the exploits of Samson fell within the interval between the two judges. The resemblances of the incidents attending the births of Samuel and of Samson are obvious; both of them, moreover, having been Nazarites by parental vow, and both have been taken as archetypes in this respect of Christ, the song of thanksgiving uttered by Hannah, the mother of Samuel, presenting a marked parallelism to that of Mary, the mother of Jesus. (Comp. 1 Sam. ii. 1–10 and Luke i. 46–55.) The traditional tomb of Samuel is still shown at Nebi Samwil, a short distance N. W. of Jerusalem, on an eminence overlooking that city—a spot which is identified by some with Ramah, by others with Mizpeh. PORTER C. BLISS.

**Sam'uel, The Books of,** in the Old Testament, are two in number in the modern editions of the Hebrew text, but this arrangement only dates from the edition of Bomberg in the sixteenth century. The books are said in the Talmud to have been written by Samuel, but the work begins with his time and ends at a point many years after his death. Its real authorship and date are quite unknown, but it appears to have been based upon more ancient annals, from which source, perhaps, were derived the famous passages parallel with others in the books of Chronicles. The LXX. and Vulgate call the two books of Samuel the "First" and "Second" Book of Kings, while the First and Second of Kings in the common English version are in the LXX. and Vulgate named the Third and Fourth Books of Kings.

**Sanaa',** city of Yemen, Arabia, in an elevated valley nearly 4000 feet above the sea, surrounded with beautiful orchards and gardens enclosed by walls. It is well built, though parts of it are in ruins, and sufficiently provided with water, though rain never falls except in July, and sometimes not for several years; the climate is so dry that meat may be kept in open air for eight days without spoiling. The bazaars are well stocked with silks and satins, spices, fruits, coffee, sugar, dates, and tobacco, and an extensive trade in coffee is carried on. P. about 20,000. It is described by Pliny as a large commercial centre and splendidly built. In 930 it became the capital of Yemen, and in 1872 it was taken by the Turks.

**San Andre'as,** p.-v. and cap. of Calaveras co., Cal., has 2 churches, good schools, 2 newspapers, 1 hotel, court-house and jail, and express, post, and telegraph offices. Principal business, mining, farming, and stock-raising. P. about 800. WM. O. SWENSON, ED. "CALAVERAS CITIZEN."

**San Ang'el,** v., Bexar district, Tex. P. 41.

**San Anto'nio,** tp., Marin co., Cal. P. 451.

**San Antonio,** p.-v., Monterey co., Cal. P. 761.

**San Anto'nio,** city, cap. of Bexar co., Tex., on San Antonio and San Pedro rivers, on the routes of the International, the Gulf, Western Texas and Pacific, and the Galveston Harrisburg and San Antonio R. Rs., all of which are now (1876) expected to be soon completed to this point. San Antonio was the capital of Texas under the Spanish and Mexican governments, and one of the oldest settlements in the State, having been founded in 1714 as the fortress of San Fernando, and in 1718 as the mission of the Alamo, both originally on the right bank of San Pedro River, on the site of the present suburb known as Chihuahua, formerly called San Antonio de Valero. The chief settlement, with the fort and the mission, was soon removed to the left bank of the San Pedro, to what is now the "old town" of San Antonio de Bexar (often called simply Bexar), situated between the two rivers. This is still the business centre, containing the plaza, Roman Catholic churches, the public buildings, and many fine stores, but the most elegant residences are at Alamo, the suburb E. of San Antonio River, where the German element prevails, as does the native Mexican element at Chihuahua. The city stands in the midst of a level and fertile plain, bounded on one side at a distance of a mile by a range of limestone hills, affording the materials from which it has been built. It has 10 churches, 5 banks, 2 daily, 1 tri-weekly, and 3 weekly newspapers, a college, a convent, a hospital, and a female orphan asylum, all under Roman Catholic control; a good fire department, 3 flouring-mills, 3 breweries, a soap and candle factory, a meat-extract factory, 2 ice-factories, several free public schools, English and German, and an extensive public park embracing the sources of San Pedro River. The fortress of the Alamo, celebrated in Texan history, is situated within the plaza and the suburb, which both bear the same name. The city is divided into four wards, is governed by a mayor and aldermen, having been incorporated as a city in 1873, and is provisionally connected with the present railway termini at Kingsbury and Cuero by daily lines of stages. P. 12,256, about equally divided between persons of Mexican, German, and American descent.

**San Antonio River** rises in Bexar co., Tex., flows S. E. 200 miles, and falls into the Gulf of Mexico at Espiritu Santo Bay. The city of San Antonio and village of Goliad are upon its banks.

**San Augustine',** county of E. Texas, on Angelina River. Staples, cotton and Indian corn. Cap. San Augustine. Area, 650 sq. m. P. 4196.

**San Augustine,** p.-v., cap. of San Augustine co., Tex. P. 250.

**San Benedet'to del Tron'to,** town of Italy, province of Ascoli-Piceno, not far from Fermo. The town is on the crest of a hill near the Adriatic, and commands magnificent inland and sea views, but the streets are narrow, crooked, and steep. The suburb below, however, which is built around the small harbor, contains comfortable houses, and the place is much resorted to in summer for sea-bathing. P. in 1874, 6112.

**San Benedetto Po** (also called **Polirone**), town of Italy, province of Mantua, on the right bank of the Po and on the left of the Lirone, about 12 miles from the city of Mantua. It has a fine church belonging to the Benedictines, but the vast monastery founded in 1004, and celebrated as the abbey of San Benedetto di Po, is now employed for secular uses. The town is subject to malarious fevers. P. 10,319.

**San Beni'to,** county of W. California, lying at the W. base of the Coast Range, and consisting chiefly of the valley of the San Benito or upper Salinas River, and crossed by Southern Pacific R. R. Agriculture and stock-raising are the leading industries. The county was formed in 1874 from the E. portion of Monterey co. Cap. San Benito.

**San Benito,** p.-v. and tp., Monterey co., Cal., on Salinas River and Southern Pacific R. R. P. 529.

**San Bernardi'no,** county of S. E. California, bounded N. E. by Nevada and E. by Arizona, from which it is separated by Colorado River, crossed by Amargosa, Mohave, and Santa Ana rivers, and traversed by the Coast Range and some spurs of the Sierra Nevada, consists in greater part of dry, dismal deserts and volcanic mountains, dotted with a scanty growth of cacti and yuccas, and interspersed with hot springs and salt marshes abounding in sulphur and soda, forming "sinks," in which the streams are lost. The "Death Valley" in the N. E. between the Amargosa and Panamint ranges, in which Amargosa River disappears, is 100 miles long and from 100 to 250 feet below the level of the sea, and is uninhabitable from extreme heat. Only the S. W. corner is settled, comprising the beautiful San Bernardino Valley, lying between the San Bernardino and Temescal ranges and watered by many tributaries of Santa Ana River. Gold and silver are found in the Sierra Nevada, and tin, copper, marble, and alabaster in the Temescal region. Willows and sycamores abound along the streams, and pine, cedar, hemlock, and maple on the mountains of the Coast Range. Agriculture and stock-raising are the chief industries, the staples being barley, hay, fruits, wine, wool, and butter. Mount San Bernardino is the loftiest peak of the Coast Range. Cap. San Bernardino. Area, about 16,000 sq. m., or nearly twice the size of the State of Massachusetts. P. 3988.

**San Bernardino,** p.-v., cap. of San Bernardino co., Cal., on Southern Pacific R. R., 80 miles from the coast, has 6 churches, excellent schools, 2 banks, 2 daily and 3 weekly newspapers, 2 good hotels, several rich-yielding mines, and good water. The climate is beneficial for consumptives and persons troubled with throat affections. It is one of the most energetic towns on the Pacific slope. P. 3064. W. H. GOULD, ED. "DAILY ARGUS."

**San Bonifa'cio,** town of Italy, province of Verona, near the left bank of the Adelgo, an affluent of the Adige, and about 14 miles E. of the city of Verona. The neighboring valley of Roncà is remarkable for its minerals. P. 5653.

**San'bornton,** p.-v. and tp., Belknap co., N. H., on Great Bay. P. 1236.

**San Bru'no,** tp., San Mateo co., Cal., on Southern Pacific R. R., 14 miles S. of San Francisco. P. 1269.

**San Buenaventu'ra,** p.-v., cap. of Ventura co., Cal., on the coast, 30 miles S. E. from Santa Barbara, has an excellent harbor, 4 churches, a high-school building, 1 bank, 1 newspaper, court-house, waterworks supplying the town with water for irrigation and manufacturing purposes, a planing-mill, and a library and reading-room.

It is a favorite place of resort for tourists and invalids, owing to its climate and the presence of hot springs. P. 2491. W. E. SHEPHERD, ED. "SIGNAL."

**San Car'los,** town of Venezuela, South America, in a beautiful valley surrounded with plantations of coffee, sugar, and cotton. P. 8000.

**San Cascia'no de' Ba'gni,** small town of Italy, province of Siena, situated in a picturesque country full of mineral springs. The baths here have been celebrated from a very remote period, and they are still much frequented for rheumatic affections. P. 3585.

**San Cascia'no in Val'di Pe'sa,** town of Italy, province of Florence, celebrated for its baths. The principal village of the commune is a place of considerable traffic, and was formerly surrounded by walls and well fortified. P. of commune, 12,388.

**San Catal'do,** town of Sicily, province of Caltanissetta, in a very healthy and fertile district, abounding in grain and every variety of fruit grown in the island. The sulphur-mines here are also highly productive. P. 12,700.

**Sanchoni'athon** [Gr. Σαγχουνιάθων], a Phœnician historian or theologian and cosmologist, said by Philo of Byblus to have been a native of Berytus (Athenæus and Suidas make him a Tyrian). He is supposed by Father Martin to have flourished as early as the fourteenth century before Christ; by others, as Creuzer, 1250 B. C. (Suidas makes him contemporary with Semiramis). He is said to have been chief hierophant among the Phœnicians —to have been secretary to Adonilabnas, the reigning king of Byblus. Three works are attributed to him: one, on the physical system of Hermes (Thoth or Taaut); a second, on Egyptian theology; a third, upon the history of Phœnicia. Philo of Byblus is the reputed translator of the original into Greek in the second century A. D. His translation was in nine books, and is believed to have included the three works mentioned. Porphyry, writing against Christianity, appeals to the authority of Sanchoniathon against Moses. Eusebius, replying to Porphyry in his *De Præparatione Evangelica* (i. ch. 10), has preserved the only fragments which have come down to us from Philo's translation. These contain the outlines of a cosmogony and theogony. In the learned work of Cumberland (London, 1770) these are rendered into English. The world is represented as originating from a "dark and windy air and a turbulent evening chaos;" these things at first were without form and void, but "the wind fell in love with its own principle, and a mixture called Desire or Cupid arose;" creation began, and Môt—mud, or a putrefaction of watery mixture—was begotten, and thence came the seeds of the universe; zophesemin or egg-shaped overseers of heaven were born; light shining through the air produced the clouds and rains; thunder and lightning produced intelligent animals, awaking them from unconscious matter by fright. The theogony introduces us to the Greek gods, and represents them as historical personages of Phœnicia, some of them being especially distinguished as inventors and founders—*e. g.* of houses and clothing, of fire, navigation, worship, metallurgy, fishing, magic, dog-training, civil society, medicine, the art of writing, etc. Thus appear Uranus and Gæa, Cronus, Rhea, Astarte, Poseidon, Vulcan, Artemis, Eros, Athena, Persephone, Dione, Hercules, Nereus, Hermes, and others. In fact, the work seems to be an attempt to give—after the manner of Lucretius and the atomistic Epicurean school to which he belonged—first, a materialistic theory of the origin of nature and man; and secondly, a naturalistic explanation of the Greek theogony as found in Hesiod and Orpheus, by making the gods and goddesses to have been historical personages resident about the eastern shore of the Mediterranean. If any Phœnician work was the basis of Philo's work, it must have been almost entirely obscured by his conjectural interpretations and his identification of Phœnician and Greek mythology. Some have thought that Porphyry forged the work from which he pretended to quote. In 1836–37, Wagenfeld published a work which purported to be a German translation of the complete work of Philo from a manuscript discovered in 1835 at a convent in Portugal. This was pronounced by scholars, after careful examination, to be a forgery. J. C. Orelli (Leipsic, 1826) published the best edition of the fragments of Sanchoniathon. WILLIAM T. HARRIS.

**San Colomba'no,** town of Italy, province of Milan, near the right bank of the Lambro, about 10 miles from Lodi. The old castle of San Colombano is one of the most ancient, vast, and best preserved in Lombardy. It is now converted into a charming villa, the property of the family Belgiojoso. This town, which was not without its share in the mediæval history of Lombardy, is now an active and thriving place. P. 7000.

**San Cristo'bal** [formerly *Ciudad Real*], city of Mexico, cap. of the state of Chiapas, 450 miles S. E. of Mexico, in a fertile valley at the E. base of the Cordillera. Mines of iron and lead are found in the vicinity. The manufacture of earthenware and the weaving by hand of woollen and cotton cloths are industries of some importance, though the chief wealth of the city consists in cattle-raising and beef-packing. Founded in 1528, it was the seat of a bishopric, first filled by Las Casas, whence the city is often called San Cristobal las Casas. A monument in his honor has been erected here. P. about 12,000.

**San'croft** (WILLIAM), D. D., b. at Fresingfield, Suffolk, England, in 1616; educated at Bury School and at Emmanuel College, Cambridge, where he became fellow 1642; was deprived of his fellowship by the Long Parliament 1649; became chaplain to the bishop of Durham 1660, in which year he assisted, privately, in the revision of the Prayer Book; obtained from that prelate the rectory of Houghton-le-Spring and a prebend in Durham cathedral; was elected master of Emmanuel College, Cambridge, 1662; was promoted successively to the deaneries of York 1663, and of St. Paul's, London, 1664; spent large sums on the repair of St. Paul's cathedral; was presented by Charles II. to the archdeaconry of Canterbury 1668, and to the archbishopric of Canterbury 1677. He attended Charles II. on his deathbed, and temporized with James II. in regard to the acts of that monarch's illegal ecclesiastical commission, but had sufficient courage to draw up the famous petition against the Declaration of Indulgence, signed by himself and seven other prelates, for which they were committed to the Tower June, 1688; tried for misdemeanor before the king's bench, and acquitted June 29, 1688. Notwithstanding his grievances, he did not take part in the conspiracies against James; refused to take the oath of allegiance to William and Mary; was deprived of his see Feb., 1691; refused to recognize his deposition; retired to his native place, and attempted, with the aid of the numerous nonjuring clergy, to maintain an episcopal succession. D. at Fresingfield Nov. 24, 1693. Author of several volumes of sermons, letters, and political essays. Many of his unedited MSS. are in the Bodleian Library, Oxford.

**Sanctifica'tion.** I. MEANING OF THE WORD (Lat. *sanctum facere;* Gr. ἁγιάζειν).—1. To make sacred, to consecrate or devote, applied to times, places, things, or persons (Matt. xxiii. 17, etc.); (2) to render morally pure, to cleanse from sin, to render holy (John xvii. 17; 1 Thess. v. 23). This moral purification is to be considered in two distinct stages: (*a*) Its commencement, called regeneration, or new birth; (*b*) its progressive accomplishment unto ultimate perfection, which progress is called sanctification. In the language of Protestant theology, justification is a forensic term, and indicates a change of relation effected by a divine sentence declaring that the law is satisfied with respect to the believer in consideration of what Christ has done, and that he is endowed with the rights secured by Christ's merits. Regeneration and sanctification, on the other hand, mark the beginning and progress of the real moral change wrought in the soul by the Holy Ghost.

II. REGENERATION, or the commencement of moral purification, is expressed in Scripture as a "creating anew" (Eph. iv. 24), "begetting" (James i. 18), "quickening" (John v. 21), "calling out of darkness into marvellous light" (1 Pet. ii. 9). The subjects of it are said to be "alive from the dead" (Rom. vi. 13), to be "new creatures" (2 Cor. v. 17), to be "born again" (John iii. 3–7), to be "God's workmanship" (Eph. ii. 10). It is variously conceived by different schools according to their various views of the nature of the soul and its relation to God, of original or habitual sin, and of divine grace.

1. *Pelagians* hold (1) that free-will, in the sense of an absolute power of choice at any moment between good and evil, is essential to moral character and responsibility; (2) that there are no permanent moral habits in man preserving and transmitting identity of character and controlling action, and consequently there is no original or habitual sin, since moral character can be predicated only of acts, not of states; (3) that responsibility is always limited by ability—that is, by natural power. Hence, regeneration is a self-determined change in the general moral course of man's life, an act of the man himself, without any gracious assistance other than that involved in instruction and favorable providential conditions. This was taught by Pelagius in the early part of the fifth century, has been adopted by no historical Church, but has been reproduced in various combinations by Rationalists and Socinians.

2. The *Semi-Pelagian* doctrine taught by John Cassian (d. 440) always contested the palm of orthodoxy in the Roman Catholic Church with Augustinianism, and is now supreme

through the triumph of the Jesuits. This admits that divine grace (*assistentia*) is necessary to enable a sinner to return unto God and live. Yet it follows from the nature of the human will that man must first spontaneously, of himself, desire and attempt to choose and obey God. They deny *prevenient* and admit *co-operative* grace.

3. The *Arminian* view of regeneration admits total depravity, and consequent moral impotency. Nevertheless, man is not really responsible until there is redemptively bestowed upon him for Christ's sake *sufficient* grace to re-endow him with ability (gracious substituted for natural) to do right, which grace becomes *efficient* when the sinner co-operates with it, and thus effects the end intended.

4. The *Synergistic* view, virtually the same as the former, was held by a party among the Lutherans who departed from the traditions of their Church. At the Leipsic Conference (1548) Melanchthon said, "There concur three causes of a good action—the word of God, the Holy Spirit, and the human will assenting, not resisting the word of God." (*Loc. Com.*, p. 90.)

5. The *Lutheran* standard, the *Formula Concordiæ*, teaches: (1) human nature is spiritually dead; (2) the Holy Ghost is the sole efficient agent who quickens the dead soul to life, without the least co-operation of the will of the subject. But the non-regeneration of the unbeliever they refer not to the absence nor to any deficiency of grace, but to the positive resistance of the man himself. (*Formula Concordiæ*, pp. 662, 666, 582, 677.)

6. The *Reformed* doctrine: (1) As to the *nature* of regeneration, (*a*) there are in the soul, besides its several faculties, habits or dispositions, innate or acquired, which lay the foundation for the soul's exercising its faculties in a particular way. (*b*) These dispositions (moral) are anterior to moral action, and determine its character as good or evil. (*c*) In creation God made the dispositions of Adam's heart holy. (*d*) In regeneration God recreates the governing dispositions of the regenerated man's heart holy. It is therefore essentially the communication of a new spiritual life, and is properly called a "new birth." (2) As to its *efficient cause*, it is effected by divine power acting supernaturally and immediately upon the soul, quickening it to spiritual life, and implanting gracious principles of action. (3) Conversion (*conversio actualis*) instantly follows as the change of action consequent upon the change of character, and consists in repentance, faith, holy obedience, etc. (*Thirty-nine Articles*, art. 10; *Can. of Synod of Dort*, ch. iii. art. 3; *West. Conf.*, ch. x.)

7. The *Mediæval and Papal* doctrine admits original sin and necessity of grace. The efficacy of grace in a given case is made to depend (1) by the Augustinian party (Jansenists) on the purpose of God and the specific power of the grace itself. (2) The Council of Trent places it in the co-operation, or at least non-resistance, of the subject. (Sess. 6, can. 4, chs. 5 and 6, and sess. 7, cans. 6 and 8.) But all agree that it is exercised only through the instrumentality of baptism, which acts as an *opus operatum, ex vi actionis ipsius*, effecting regeneration and the entire removal of sin, and consequently of guilt, from every infant, and from every adult who does not wilfully resist (*non ponentibus obicem*). (*Counc. Trent*, sess. 7, can. 6; Bellarmin, *De Sacramentis*, 2. 1.)

8. *Baptismal Regeneration* is held by members of the Church of England and others in various senses. (1) Some hold that the Holy Spirit through the instrumentality of baptism implants a germ of spiritual life in the soul, which may long remain latent, and may be subsequently developed (in conversion) or blasted. (2) Others hold that there are two regenerations—one a change of *state* or *relation*, and the other a change of *nature;* the first is baptismal and the second moral, though both are spiritual, since both are wrought by the Holy Ghost.

III. Sanctification is the progressive completion of the spiritual change of character commenced in regeneration.

1. *Pelagian and Rationalistic View.* See above.

2. *Mediæval and Roman.*—(1) They refuse to distinguish between justification and sanctification. (2) Their definition makes justification to be sanctification—that is, the cleansing from sin, and the infusion of gracious habits by the Holy Ghost for Christ's sake by the instrument of baptism, upon which subjective change the removal of guilt and divine favor is conditioned. (*Counc. Trent*, sess. 6, can. 7.) (3) It is therefore progressive, and is advanced (*a*) by good works, which possess real merit, and deserve and secure increase of grace (*Counc. Trent*, sess. 6, can. 32); (*b*) by penances, prayers, fastings, etc., which satisfy God's justice and purify the soul (*Counc. Trent*, sess. 14, ch. 8; sess. 6, cans. 29 and 30); (*c*) it is possible, even before death, for a believer to perfectly conform to all the demands of God's law as graciously adjusted to this life (*Counc. Trent*, sess. 6, ch. 16, can. 25); (*d*) it is even possible, out of love, to perform supererogatory service by obedience to the councils of Christ, which are advisory, but not obligatory until voluntarily undertaken: these are voluntary poverty, celibacy, and obedience to monastic rule, and merit more than the mere salvation of the person, and contribute to the "treasury of merits" at the disposal of the Church, which is imputable at the discretion of those holding the jurisdiction to believers on earth or in purgatory not yet fully justified (Bellarmin, *De Monachiis*, chs. 6 and 7); (*e*) if the believer dies before the process of deliverance from sin is perfected, he must complete it in purgatory, the pains of which are expiatory and purifying: and there he may be assisted by the prayers and masses and dispensing power of the Church on earth. (Bellarmin, *Purgator.*, ii. 9.)

3. The *Mystical* view of sanctification, though never embodied in any Church creed, has existed as a doctrine and as a tendency in all ages and among all Christian denominations. A Mystic (from Μυέω) is one to whom secret things have been revealed. Christian mysticism more or less depreciates the dependence of the soul for light upon the objective revelation of the word of God, and the necessity of the means of grace and human effort, and emphasizes spiritual intuition, the regulative value of religious feeling, the physical communion of the soul with the substance of God, conditioned on quiet and passivity of mind, etc. Such views gained great currency in the Church after about A. D. 523, when the *Celestial*, and *Terrestrial Hierarchy*, and *Mystical Theology*, falsely attributed to Dionysius the Areopagite, were published and translated into all languages. They qualified the works of the eminent evangelical Schoolmen and writers—Bernard of Clairvaux, Hugo and Richard of St. Victor, and subsequently Thomas à Kempis. They were taught with great influence by Schwenkfeld (1490–1561), Paracelsus (1493–1541), Weigel (1533–88), and Jacob Böhme (1575–1620), after the Reformation, among the Protestants; and by St. Francis of Sales (1567–1622), Molinos (1640–97), Madame Guyon (1648–1717), and Archbp. Fénelon (1651–1715), among the Roman Catholics. The original Quakers held similar views, as is seen in the writings of George Fox (d. 1691), William Penn (d. 1718), and Robert Barclay (1648–90). (See Barclay's *Theologiæ veræ Christianæ Apologia*); Vaughan's *Hours with the Mystics;* Ullmann's *Reformers before the Reformation;* Dorner's *Hist. Person of Christ* and *Hist. Protest. Theol.*)

4. *The Doctrine of Sanctification common to* Lutheran *and* Reformed *Churches, and styled* Evangelical.—(1) The soul after regeneration (*a*) continues dependent upon the constant gracious operations of the Holy Spirit, (*b*) but is, through grace, able to co-operate with them. (2) The operations of the Spirit are (*a*) supernatural, (*b*) yet effected in connection with and through the instrumentality of means. (3) The Spirit gradually completes the work of moral purification commenced in regeneration: this includes (*a*) the cleansing of the soul from sin and emancipation from its power, and (*b*) the development of the implanted principle of spiritual life and infused habits of grace, until the subject comes to the stature of perfect manhood in Christ. (4) It spiritually and morally transforms the whole man, intellect, affections, and will, soul and body. (5) This work proceeds with various degrees of thoroughness during life, but is never consummated in absolute moral perfection until the subject passes into glory. (6) The *means* of sanctification are (*a*) *internal*, as faith and the co-operation of the regenerated will with grace, and (*b*) *external*, as the word of God, sacraments, prayer, Christian fellowship, and the providential discipline of our heavenly Father.

IV. The doctrine of Perfect Sanctification in this life is held in four forms:

1. *Pelagian.*—According to the principles of Pelagianism, stated above, a man is perfect who obeys the law of God to the measure of his present natural ability, since the moral law is a sliding scale, adjusting its demands to the varying ability of its subject.

2. *Mystical* perfectionism consists in absorption in the Divine essence.

3. *Roman* or *Ritualistic* perfectionism consists in perfect conformity to the law of God, graciously for Christ's sake adjusted to the capacities of the regenerated man in this life, and even in the rendering of supererogatory service in the way of extra-legal self-denial from a principle of evangelical love; and this perfection is attained by means of meritorious works and penances, prayers, fasts, acts of voluntary self-denial, and ecclesiastical obedience.

4. *Evangelical Perfection*, as taught by the followers of Wesley, includes the following principles: (1) The satisfaction and merit of Christ has made it consistent with divine justice to offer salvation to men on easier terms than the old Adamic law of absolute perfection. "The gospel, which is the law of love, the 'law of liberty,' offers salva-

tion upon other terms, and yet provides for the vindication of the broken law. The condition of justification at first is *faith alone*, and the condition of continued acceptance is *faith working by love*. . . . Perfect faith and perfect love is Christian perfection. Christian character is estimated by the conditions of the gospel; Christian perfection implies the perfect performance of these conditions, and nothing more." (Wesley's tract on *Christian Perfection; Methodist Doctrinal Tracts;* Dr. George Peck's *Christ. Doc. of Perfection;* Owen on the *Holy Spirit and His Work;* Marshall on *Sanctification;* Rev. Wm. E. Boardman, D. D., *Higher Christian Life;* Upham's *Life of Faith* and *Interior Life;* Hagenbach's *Hist. of Christ. Doctrines;* Hase, *Libri Symbolici Eccles. Evangelicæ* (Lutheran); Niemeyer, *Collectio Confessionum* (Reformed); *Canons and Decrees of the Counc. of Trent.*) A. A. Hodge.

**Sanctuary.** See Asylum.

**Sand** [Ang.-Sax. *sand;* Ger. *Sand;* Dutch, *zand*], a term which is applied, both in common parlance and often even in scientific literature, in a broad and vague sense to include any granulated mineral material destitute of coherence when dry. Thus, in this broad sense any known mineral may form a sand, and we have silicious sand, calcareous sand, magnetic iron sand, coral sand, and other varieties highly diverse in nature and origin. This unfortunate vagueness extends to *sandstones*, which always go by this name when made up by the conglomeration or concretion of such previously-granulated material, whatever its mineralogical nature may be. A familiar example in America is the brown "sandstone" from the Connecticut Valley and from New Jersey, so extensively used for building purposes, which the present writer some years since discovered to be mainly made up of angular grains of *feldspar*, often containing scarce a grain of silicious sand in its substance. In the lithological nomenclature of Brongniart, Naumann, and Cotta it is a feldspathic *psammite*, and not a sandstone. Rocks are converted into sands by the forces of moving water, moving ice, the winds, the freezing of water in crevices, the disintegrating action of vegetation, decomposition by chemical action, and other agencies, for which see Dana's *Manual of Geology*, p. 758. (Further upon silicious sand see Silica.) H. Wurtz.

**Sand** (George), the pseudonym under which Amantine Lucile Aurore Dupin (Madame Dudevant) published her celebrated novels and dramas. She was b. at Paris in 1804, and educated first at the Château de Nohant, department of Indre, by her grandmother, Madame Dupin, a natural daughter of Marshal Saxe, and afterward (1817–20) in an Augustinian convent in Paris. In 1822 she married Baron Dudevant, formerly an officer in the army of Napoleon, to whom she bore two children, but in 1831 separated from him, determined to support herself by literary work; removed to Paris with her daughter, and assumed male dress in order to move about with greater freedom. In connection with Jules Sandeau she wrote *Rose et Blanche* (5 vols.), which was published in 1831 under the pseudonym of "Jules Sand," and the reception it found offered her an opportunity of publishing immediately after a novel written by her alone, *Indiana* (2 vols.), under the pseudonym of "George Sand," which she afterward retained. In 1832, *Valentine* (2 vols.) made her name celebrated, and in 1833 her celebrity rose to sensation with *Lélia* (2 vols.). The book touched in a somewhat peculiar manner the very delicate question of love and conjugal fidelity. In company with Alfred de Musset she then made a journey to Italy, but at Venice they parted, and in 1836 he published *Confessions d'un Enfant du Siècle*, to which she answered in 1859 with *Elle et Lui*, which produced an immense sensation. The violent movement into which her mind was thrown by her relation to Musset is very apparent in her *Letters d'un Voyageur* (2 vols.) and *Jacques* (2 vols., 1834), and is still more visible in *André* and *Léone Leoni* (1835). But by degrees it subsided. In 1836 she was divorced from Baron Dudevant, and both her children came to live with her. About the same time began her intimate friendship with Chopin, which lasted until 1847, and to which are due those many beautiful passages on music which are found in her later books. To this period of her life (1835–41) belongs a series mostly consisting of minor novels—*Le Sécrétaire intime* (2 vols.), *Lavinia*, *Métella*, *Mattéa*, *La Marquise*, *Mauprat* (2 vols.), *La Dernière Aldini*, *L'Uscoque*, *Pauline*, etc.—in which her wonderful talent of artistic representation appears perfectly developed and in its full ripeness. They were published in the *Revue des Deux Mondes*, but in 1841 she fell out with the editor, and *Horace* was rejected. She in the mean time had made the acquaintance of Lamennais, Michel the republican, Pierre Leroux the Socialist; and, truly feminine in her innermost nature, accepting fearlessly any influence which seemed to correspond with her own impressions, and always transforming to the watchword of an enthusiastic crusade the idea which is in the minority and in opposition, she now burst upon the world as the spokesman of very singular and very advanced social and political, moral and religious views: *Lettres à Marcie* (1837), *Spiridion* (1838), *Les Sept Cords de la Lyre* (1840), and especially *Horace* and *Consuelo* (8 vols., 1842), *La Comtesse de Rudolstadt* (4 vols., 1843), *Le Meûnier d'Angibault* (1845), *Le Péché de Monsieur Antoine* (1846), etc. With *Jeanne* (8 vols., 1844) she again returned to the purely artistic novel without any tendency, and now followed (1844–48) some of her most beautiful productions —*La Petite Fadette* (2 vols.), *La Mare au Diable* (2 vols.), *François le Champi* (2 vols.), etc.—but in 1848 she plunged with all her passionate enthusiasm into the very midst of the Revolution—wrote proclamations, founded newspapers, etc., and was about losing herself in the confusion. After the Revolution she wrote during a long period chiefly for the theatres, and some of her plays were very successful. They are, nevertheless, nothing but dramatized novels, without any genuine dramatic effect. Her talent is the novel, more especially the descriptive and reflective novel, and in this genre even her latest books, *Mlle. la Quintinie* (1863), *La Confession d'un Jeune Fille* (1865), *Cadio* (1868), *Journal d'un Voyageur pendant la Guerre* (1871), *Impressions et Souvenirs* (1873), are brilliant and powerful productions. Her *Histoire de ma Vie* (1854) disappointed people, but perhaps the fault was not hers. D. June 8, 1876.

Clemens Petersen.

**Sand** (Karl Ludwig), b. at Wunsiedel, Franconia, Oct. 5, 1795; received a good education; studied theology at Tübingen, Erlangen, and Jena, and was much liked both by his professors and fellow-students, though he was reticent, melancholy, dreamy, and given to solitude. Mar. 9, 1819, he repaired to Mannheim, called at Kotzebue's house at 11 o'clock A. M., and was requested to call again between 4 and 5 P. M. He came, was received by Kotzebue in his study, stabbed him two or three times in the heart with a dagger, and walked away. Arrived in the street, he spoke as if in a trance to the gathering crowd of what he had done, and then attempted to stab himself. He failed, was brought to a hospital, cured, tried, sentenced to death May 5, 1820, and executed May 20. During the whole trial he showed perfect confidence in the righteousness of what he had done, and died calm and collected.

**San'dal-Wood** [Sans. *chandana*, whence *sandalum* in the earliest European accounts and the *Santalum* of botanists], the agreeably aromatic and precious wood of several species of *Santalum* and of one or two other trees. The original sandal-wood of India is yielded by *Santalum album*. Three kinds or hues were known in Europe as early as the eleventh century—white, yellow, and red, the latter of which may have been confounded with the inodorous wood of red sanders or Santal-Wood (which see). After the discovery of the Sandwich Islands a large part of the supply of the sandal-wood of commerce came from two or three species of *Santalum* peculiar to those islands, and later from *S. Yasi* of the Feejee Islands and from *S. Austro-Caledonicum* of New Caledonia; also from *Fusanus spicatus*, a tree of Western Australia of the same natural order. The high price which this wood brings has caused the reckless extirpation of the tree from the more accessible stations, but in India the original sandal-wood tree is now protected by government. It is employed as a perfume and for the fabrication of small articles—glove-boxes, caskets, etc. Much is consumed in India in the celebration of sepulchral rites and for medicinal purposes, where the powder, made into a paste with water, is used for making the caste-mark. But the principal market is China, where it is most largely used for incense in temples, etc. The Malabar sandal-wood there brings three or four times the price of that of the South Sea islands. The wood yields 1 per cent. of a peculiar essential oil, on which the characteristic fragrance depends. This oil, largely extracted in some parts of India from the fresh wood, has been used in medicine as a substitute for copaiba. The famous and richly-carved gates of the temple of Somnauth, supposed to be 1000 years old, are of sandal-wood. Asa Gray.

**San Damia'no d'As'ti,** town of Italy, province of Alessandria, about 9 miles from Asti. This town, once of considerable military importance, is now largely engaged in producing the favorite wine known as vino d'Asti. P. 8427.

**San'darach** [Gr. σανδαράκη], a gum-resin from the *Thuja articulata*, a small coniferous tree which grows in Barbary. It occurs in pale-yellow oblong grains or tears, covered with a fine dust, is transparent and brittle, with a vitreous lustre on the fracture. According to Unverdorben and Johnston (see *J. pr. Ch.*, xvii. 157), it consists of three resinous acids. The α-resin forms a white or yellow powder, slightly soluble in alcohol and not easily fusible, and is

present in but small quantities. The β-resin forms about three-fourths of the whole, is light yellow, softens at 212° F., and is readily soluble in cold alcohol. The γ-resin is a light-yellow powder, soluble in boiling alcohol, and melts with difficulty, decomposing at the same time. Sandarach was formerly given internally, and entered into the composition of various ointments and plasters. It is now chiefly used as an incense and in varnishes. Its powder is rubbed on writing-paper after erasures have been made to prevent the spreading of ink. C. F. CHANDLER.

**Sand Bar Plantation,** tp., Somerset co., Me. P. 15.

**Sand Beach,** p.-v. and tp., Huron co., Mich. P. 666.

**Sand-Blast.** The term "sand-blast process" is applied to a method devised by Gen. Benjamin C. Tilghman of Philadelphia for cutting, boring, grinding, dressing, pulverizing, and engraving stone, metal, glass, wood, and other hard or solid substances by means of a stream of sand or grains of quartz, or of other suitable material, artificially driven as projectiles rapidly against them by any suitable method of propulsion. The abrading power of sand is well known. It is seen frequently on a grand scale in nature, and man has successfully utilized it in the arts. When carried by running water, sand has played an important part in the erosion of rocks, and when driven by the wind it depolishes the glass in the windows of the fisherman's hut upon the seashore and destroys the transparency of the glass in the lanterns of sea-coast lighthouses. One of the best examples of the abrading power of sand carried by the wind is given by Prof. W. P. Blake in his *Report of a Geological Reconnaissance in California in 1858.* The pass of San Bernardino is an opening through the ridge of the Southern Sierra Nevada, leading from the valley of San Bernardino to the Colorado desert. This pass is 2 or 3 miles wide, and is bounded on the one side by the snow-capped Bernardino Mountains, and on the other by the sharp imposing peak of San Gorgoño. The latter, which is 7000 feet high, is mainly composed of granite, which stands out in projecting spurs on the side of the mountain. The whole surface of this granite over considerable areas is deeply grooved and polished by the attrition of the sand carried by the constantly-blowing westerly wind; in proof of which there are large banks or drifts of sand on the lee or eastern side of the ridge. Since the constituent minerals of the granite are differently worn by the action of the drifting sand, the surface is very irregular, those minerals projecting most which are the hardest. In some places garnets are supported upon long pedestals of feldspar, which they have protected from the erosion, and thus they stand, pointing out, like jeweled fingers, the direction of the prevailing wind.

It was a general idea of the cutting power of sand when driven by water or air against hard substances that led Gen. Tilghman to make his first experiments. A simple form of air-blast, producing a few ounces of pressure only, was fitted up, and by means of an extemporized concentric jet of glass this air was made to drive the sand against the object to be cut. In this way holes were bored through ordinary window-glass in a few seconds. It was but a step now to improve the apparatus so as to get increased efficiency; and the preliminary trials having demonstrated the great practical utility of the process, a patent from the U. S. was applied for and granted on Oct. 18, 1870. This patent is numbered 108,408; its claims are as follows: (1) The cutting, boring, grinding, dressing, engraving, and pulverizing of stone, metal, glass, pottery, wood, and other hard or solid substances by sand used as a projectile, when the requisite velocity has been artificially given to it by any suitable means. (2) The artificial combination of a jet or current of steam, air, water, or other suitable gaseous or liquid medium, with a stream of sand, as a means of giving velocity to the sand when the sand is used as a projectile as a means of cutting, boring, grinding, dressing, engraving, and pulverizing stone, metal, glass, pottery, wood, and other hard or solid substances. (3) The combination of a rotary fan, centrifugal machines, and other machines capable of giving direct mechanical impulse with a stream of sand, as a means of giving velocity thereto when the sand is used as a projectile as a means of cutting, boring, grinding, dressing, engraving, and pulverizing stone, metal, glass, pottery, wood, and other hard or solid substances. (4) As a new manufacture, articles of stone, metal, glass, pottery, wood, and other hard or solid substances which have been cut, bored, ground, dressed, engraved, or pulverized by sand used as a projectile, when the requisite velocity has been artificially given to the sand by any suitable means. (5) As a new manufacture, articles of stone, metal, glass, pottery, wood, and other hard or solid substances which have been cut, bored, ground, dressed, engraved, or pulverized by sand used as a projectile, to which the requisite velocity has been artificially given by a jet or current of steam, air, water, or other suitable gaseous or liquid medium. (6) As a new manufacture, articles of stone, metal, glass, pottery, wood, and other hard or solid substances which have been cut, bored, ground, dressed, engraved, or pulverized by sand used as a projectile, to which the requisite velocity has been given by a rotary fan, centrifugal machine, or other machine capable of giving direct mechanical impulse. (7) When a jet or current of steam, air, water, or any other suitable gaseous or liquid medium is employed to give velocity to sand used as a projectile, as a means of cutting, boring, grinding, dressing, engraving, or pulverizing stone, metal, glass, pottery, wood, and other hard or solid substances, the use of the following devices for introducing the sand into the jet of steam, air, water, etc.: First, the suction produced by the jet of steam, air, water, etc.; second, a strong, close vessel or sand-box, into which the pressure of the steam, air, water, etc. is introduced, and through which, when desired, a current of it may be made to pass.

In actual practice, two kinds of work are performed by the sand-blast, which may be called, respectively, heavy and light work. For the former a high pressure and a correspondingly great velocity are required; for the latter the pressure is light and the velocity low. The simplest form of apparatus which can be used for this latter purpose is that in which the requisite velocity is given by the force of gravity. The sand is simply fed into the top of a high vertical tube and allowed to fall. Its velocity increases as the air within the tube is set in motion, until finally the point is reached at which it will readily depolish glass. In some experiments made by the writer glass was depolished in half a minute by No. 20 emery falling through a tube ten feet in height. Ordinarily, however, the necessary velocity is given to the sand by means of an air-blast produced either by a rotary fan or positive blower, or by the pressure of the atmosphere acting toward a vacuum maintained by a fan or a steam-jet. For simply depolishing glass or making the so-called ground glass, the current of air is conducted into a rectangular trough of any desired length, narrowed at the bottom to an opening an inch wide, and having its top perforated by small tubes for the admission of the sand. For each square inch of cross-section of the lower opening the amount of sand required is 20 cubic inches. The glass is carried slowly across the opening of this huge jet, and about an inch below it, by means of a travelling apron. The grain which the surface receives from the sand depends both on the fineness of this sand and on the pressure of the blast. The sand used varies from that which will pass through a sieve of fifty wires to the inch down to the finest powder. The pressure employed varies from one to ten inches of water. With sand of average fineness and a pressure of four inches of water ordinary glass can be depolished perfectly in ten seconds. Air is preferred to steam for light work, since with steam the sand becomes damp and clogs the surfaces. Of course, this depolishing action is not confined to glass. A fine stippled surface may in this way be given to rolled zinc, the grain of which may be made coarse or fine at pleasure. This surface is of use in zincographic printing. The remarkably bold and brilliant frosting which has recently appeared upon silver tableware is also the work of the sand-blast.

If the surface of the glass or metal, instead of being plain, is to be ornamented (or engraved, as it is commonly termed), it is obvious that this may be perfectly accomplished simply by protecting from the action of the blast those portions of the surface which it is desired to leave in their polished condition. This may be done by covering these portions with the desired pattern cut out of some suitable resistant medium, the chief requisite of which seems to be pliability and toughness in distinction from brittleness. A fresh fern-leaf, for instance, attached to a sheet of glass by gum-water, will perfectly protect the surface beneath it from erosion, while the unprotected portions are completely depolished. If the action of the blast be continued, the softer parts of the leaf are first removed, and thus the venation of the frond is faithfully reproduced on the glass. A signature written upon any hard surface with a pen dipped in liquid glue protects this surface, so that after the action of the sand-blast the removal of the glue leaves the autograph indelibly traced in transparent lines. The thin and delicate lace-paper which is used in ornamental confectionery, bobinet lace both plain and figured, and other similar tissues, may be used to cover the glass, and so to transfer their respective designs to its surface. By means of the blocks used in printing wall-papers or oil-carpets designs in oil-paint may be stamped upon the glass. These when dry protect the surface from being depolished, and the pattern is left unground. In actual practice, however, it is necessary that the patterns to be transferred should be capable of being prepared and attached to the

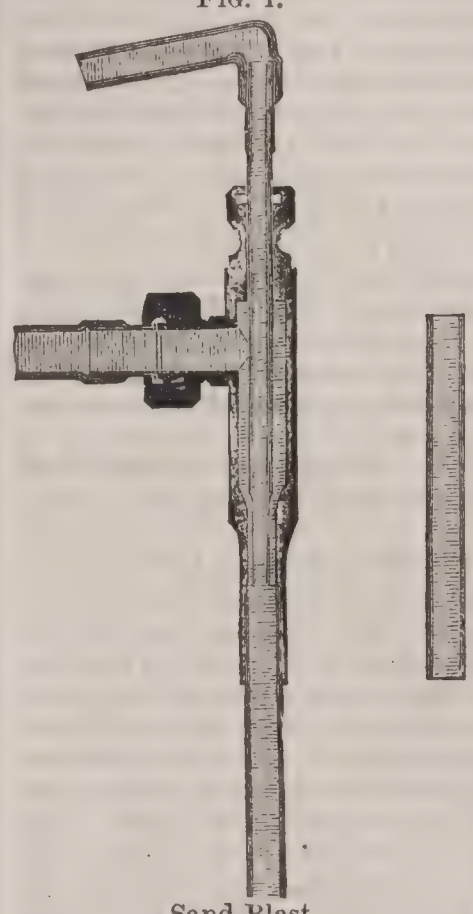
glass by unskilled labor. Several methods of doing this have been employed. In one of these stencils of the required design are prepared in sheet copper or brass. These are held by the operator, usually a boy, firmly upon the glass, and a brush dipped in melted beeswax is drawn over the whole. Upon raising the stencil its pattern is left in exposed glass, and may be fixed there by the blast. Or a piece of tin or lead-foil is fixed to the glass by a little gum-water, the stencil is laid upon it, and its outline drawn through the foil by a sharp point. The foil which is now removed is either the superfluous portions around the pattern—in which case, after brushing with beeswax and again removing foil, the pattern itself is left clear as before, or the pattern itself is removed; when, on covering with beeswax and taking off the rest of the foil, the pattern is reproduced on the glass in wax, and after depolishing appears as a clear design upon a ground surface. A modification of this process has been extensively used, which consists in the employment of a mixture of beeswax and gutta-percha rolled into sheets. This is laid on the glass, the stencil placed upon it, and the design traced through as before. On removing the portions which it is desired to have depolished, and pressing the remaining coating firmly down, the glass is ready for the blast. Still another method, which has been found practically successful, is one in which, by means of the stencil-plates already referred to, the designs are either cut or punched out of lead-foil by the hundred. Girls are employed to attach these to the glass with gum-water, and the operation is proceeded with as before. Sometimes certain portions of the foil are allowed to remain until after the action of the blast. On again covering with beeswax, and stripping off this remaining foil, a new pattern is developed, which may be etched by hydrofluoric acid in the ordinary way, thus producing three entirely different surfaces upon the glass, and giving contrasts of great beauty. Some exquisite designs have been executed in this way upon plate-glass for interior decorations. The lead-foil method now described is extensively used for ornamenting glass gas-globes. Two girls, one to put on the patterns, the other to tend the automatic depolishing-machine, can easily do 300 globes per diem, the most elaborate ornamentation costing scarcely more than the most simple. In the same way table-glass may be ornamented, either with the initials or monogram of the owner or with fancy designs. Chemical glass and glass used in business may also be marked in this way easily and cheaply.

Ornamenting glass in color is another feature of sand-blast work. Most of the colored glass in use is, as is well known, simply plain window-glass, on one side of which is flashed a thin layer of colored glass. By protecting the surface of this layer by a resistant design, it is possible to remove by the sand-blast all the colored layer in the exposed parts, leaving them white and depolished. On removing the protecting material, the design appears in color upon a white ground. Whether the device shall be in color on a white ground, or white upon a colored ground, depends simply on the question which shall be left exposed by the pattern.

But the most beautiful results of the operation of the light-pressure sand-blast are obtained with the aid of the gelatine process in photography. As is well known, this process, in brief, consists in covering a plate of glass with a warm solution of gelatine to which has been added a suitable quantity of potassium dichromate. This operation must be performed in the dark. If this plate, when cold, be placed beneath an ordinary photographic negative and exposed to light, the portions of the gelatine film unprotected by the negative will be acted on by the light, and by an oxidation of the gelatine caused by the dichromate will be rendered insoluble in warm water. If, therefore, the plate, after exposure, be placed in warm water, the parts which were protected by the negative—corresponding to the lights of the original picture—are dissolved away, leaving the glass clear, while the unprotected parts having been rendered insoluble by the action of the light, are not affected and remain on the glass, forming a resistant layer. On drying the plate and submitting it to the action of the sand-blast the glass is depolished in the lights of the picture, while it is left clear in the shades. On removing mechanically the insoluble gelatine, the picture appears, the amount of light coming to the eye being less in the transparent portions, which thus constitute the shadows. Most accurate and beautiful reproductions of line engravings have been in this way transferred to glass with marvellous fidelity even to the minutest detail; and this at a cost which is merely nominal. It is probable, moreover, that the sand-blast process will not long be limited to line engravings. Experiments which have been made to test the matter show that gradations of tone may be secured by its use. Where, for example, there are half tones in the photographic negative, the light which passes through is too faint to render the gelatine beneath entirely insoluble. On washing it, therefore, it is partially removed, and on exposing the film to the action of the blast, these thinner portions are cut away by the blast just before the operation is finished. In this way a more or less imperfectly depolished surface is produced, which corresponds to the half tones. Another application of the gelatine process is to the production of raised surfaces. By using a suitable material on which to work, and by suitably proportioning the character of the blast, any desired pattern may be obtained in relief. This, then, may be used as a block, and by any of the ordinary printing processes the design thus prepared may be printed directly on paper. If a photographed device be thus engraved on a surface—such as that of pitch, for example—either in relief or in intaglio, it may be used as a mould from which to obtain a cast in wax, and this by the electrotype process may be reproduced as a letter-press cut.

The second class of work which the sand-blast is called upon to perform is that which requires a high velocity for the sand. This velocity is generally given to it by a jet of steam or air issuing at a high pressure, though a jet of water or of any other liquid or gas, or even a direct mechanical action, such as the blows of a revolving fan or the centrifugal force of a revolving tube, may also be employed to produce it. Steam is most readily obtained, and, as it cuts twice as fast as air under the same pressure, is generally preferred. It has been employed under all pressures up to 400 pounds to the square inch, and it has been proved that its efficiency increases rapidly with the pressure. It should be dry and entirely free from condensed water. If used at a distance from the boiler, the pipes should be well wrapped, and a purger should be employed to separate the water. The steam is used in a jet, technically called the "blast-pipe" or "gun." As shown in the accompanying sectional drawing (Fig. 1), it consists of a

FIG. 1.



Sand-Blast.

hollow bronze cylinder of about 1½ inches external diameter, having a lateral opening near its upper end (by which the steam enters), and tapering somewhat at its lower. Through the top of this cylinder an iron tube passes, secured by a stuffing-box. This is called the "sand tube;" its exterior diameter is somewhat less than that of the opening through the cylinder, and it tapers with it at its lower end, though somewhat less rapidly, thus leaving a narrow concentric aperture for the passage of the steam. The adjustment of this part of the apparatus is most important. The exterior cylinder is prolonged beyond this concentric opening to form a socket for a supplementary or directing tube called the "nozzle-tube" (seen separately on the right). This tube, being the only portion of the blast-pipe which is exposed to wear, is made of sheet steel, or sometimes of chilled iron. It is easily replaceable when worn through by use. From this description it will be seen that the steam enters the gun laterally, surrounds the sand-tube, issues through the annular space below into the nozzle-tube, and creates a partial vacuum in the sand-tube which draws the sand into the blast. Hence it is evident that the effectiveness of the blast depends upon the accurate adjustment of the tubes and apertures to each other for any given pressure of steam. The sand used for this purpose should be sifted so as to be of uniform size, and should be clean, hard, sharp, and dry. Experiment has shown that sand which will pass through a sieve of 40 holes to the inch, and not through one of 48 wires, will cut faster than a sand which will pass through one of 20 and not one of 30 holes. The action of the gun is as follows: As soon as the steam is let on, it issues with great velocity from the annular opening in the jet, producing a partial vacuum in the sand-tube which it encloses, and consequently in the rubber tube which connects it with the sand-box above. On opening a sliding valve in the bottom of this sand-box a stream of sand—in amount about one or two pints per minute—is drawn through the tube into the jet of steam, and is forced by it through the nozzle-tube, striking at a high velocity

the stone to be cut, which is placed about an inch distant from it. The waste steam, together with the fragments of the stone and sand, escapes laterally, and if the gun be at rest a conical hole is gradually cut into the material. The angle which the sides of this cone make with each other varies, increasing with the hardness of the stone and diminishing with an increase of pressure in the blast. If it is desired to have the sides of the cut parallel, the gun is slightly inclined and slowly revolved about a vertical axis. The angle of inclination varies of course with the hardness of the stone and with the pressure of the steam employed. In cutting granite, for example, with a steam-jet of 300 pounds pressure per square inch, an inclination of 1 in 9 has been found to give a parallel cut. A rather soft-burned brick, however, gave a straight cut under the same circumstances without inclining the jet at all. It is important that free escape should be afforded for the waste steam and sand. Hence, if a deep hole is to be drilled, its diameter must be sufficient to allow this free escape around the gun. In boring holes with the sand-blast there is a decided advantage in having the blast-pipe bent at its lower third to an angle of about 1 in 9, and to have the nozzle-tube only two inches long. By rotating such a jet about its main axis, a hole of almost any shape can be cut through stone, which shall have parallel sides; or, if required, the sides may even be undercut, as is sometimes necessary in making pockets for purposes of blasting.

In order to cut long narrow grooves in stone for the purpose of quarrying it, the gun is somewhat modified by attaching to it, on opposite sides of the opening of the nozzle-tube, two parallel guide-plates of steel. The object of having these plates is to prevent the divergence of the blast laterally, and thus to make the edges of the groove more regular. The gun is carried on a railway, and is automatically moved so as to traverse the stone to be cut along the line of the required division at a suitable rate. It is inclined at an angle such as has been found by experiment to give a vertical cut on one side of the groove. After one cut is made to a depth of two or three inches, a second groove is cut about three inches from the first and parallel to it, the gun being so inclined that the two parallel surfaces face each other. When this is completed, the intermediate prism of stone, whose cross-section is the shape of an inverted V, is split out by a blunt chisel. Two other grooves are then cut to the same depth, and the operation above given is repeated, until finally a cut three inches wide, three feet or more in depth, and of any desired length, is made in the rock. The mass may then easily be detached by known methods. By mounting the blast-pipe on the end of a radial arm moving around a horizontal axis, a circular groove of the above depth may be cut as the circumference of a tunnel. Then a single charge of nitro-glycerine, exploded at the centre, would bring away the entire mass.

The chief uses of the heavy sand-blast, however, are found in dressing and ornamenting stone after it has been quarried. By experiments made for the purpose, it has been ascertained that in dressing stone under a pressure of 50 pounds of steam the blast will cut away five cubic inches of American marble, and three cubic inches of Italian marble or of granite, per minute. The amount of material removed, however, varies very much with the conditions of the experiment, being much greater, for example, when the blast-pipe is moved over the surface than when it is still. Oblique incidence too (from 30° to 45°) increases the rapidity of the cutting effect, probably because the issuing particles of sand are not met and their force deadened by the rebounding ones. So, too, and probably from the same cause, the material is more rapidly cut away when the jet is held four or five inches distant from the stone than when but one inch. If, however, it be desired to limit the action strictly to the region to be cut, as when a narrow groove is to be made, it is best to direct the gun squarely at the face of the stone, and as near it as possible. Moreover, the rapidity of the action is also affected by the quantity of sand used. For hard rocks, in which the action is to be limited to a small area, the amount of sand above specified—one or two pints per minute—gives the best result. But when the stone is soft, and the cutting is to be done over a large surface, two or three times this quantity of sand may be used to advantage. In dressing stone the first operation is to produce a flat surface. This is best effected by cutting first a narrow groove about half an inch deep along one edge of the surface to be dressed, then breaking or splitting off the overhanging edge, and so on, repeating the operation across the entire face. Since most varieties of stone vary in hardness in different portions of the same mass, careful watching is necessary on the part of the workman when using the sand-blast. He must continue the action a little longer upon those parts which are harder, and shorten it on those which are softer than the average. Used in this way and with sufficient care, the sand-blast has been found an efficient means of cleaning and refreshing discolored wrought-stone surfaces of buildings and monuments.

For purposes of ornamentation in stone the sand-blast process has no rival. The method employed is simply to protect those portions of the stone which are not to be cut away with a suitable mat or template of rubber or other more or less elastic material. The gun is mounted on a traverse having a to-and-fro motion adjustable for distance, which carries it forward and backward over the length of the stone. At the same time the frame has a motion at right angles to this, given to it by a ratchet-wheel and pawl working the pinion of a rack, and so adjusted that at the end of every passage of the jet to and fro the pawl pushes the ratchet-wheel forward one or more teeth. In this way the gun is made to pass each time over a fresh portion of the stone, the operation being continued until the required depth is attained. In general, the design which is to be engraved on the stone is cut out of sheet rubber one-sixteenth of an inch, or thereabouts, in thickness. The mat or stencil thus made is cemented on the stone with a solution of rubber in benzol. When the cement is dry the stone is placed immediately under the blast, and at one or two inches' distance from it. The wear which this rubber stencil undergoes is very trifling. In a single case one had been used with the steam-blast under a pressure of 50 pounds and at 2 feet distance to cut 50 slabs of marble each to the depth of a quarter of an inch. This is equivalent to 12½ inches of solid marble, and—as the rubber was one-sixteenth of an inch thick—to 200 times the thickness of the rubber itself. Yet no wear was perceptible on the surface of the stencil. In much of the easier kinds of ornamentation, such as that of marble and glass, patterns of metal are used, generally of iron. When letters are to be cut, for example, alphabets are prepared either of the letters themselves or of their stencils, and by selecting those which are desired and cementing them to the stone, they may be rapidly engraved. Ornamental designs may thus be cut deep into glass, the surface being beautifully frosted. The wear of the iron is very slight. By these various methods the most elaborate ornamentation of stone can be secured at a cost which is comparatively insignificant, since the complication of the pattern is entirely without influence. The stonework of the new Academy of the Fine Arts in Philadelphia was all ornamented by the sand-blast. Exquisite tracery-work has been cut by it out of thin white marble by cutting the pattern half through the slab, then reversing and cutting from the other side completely through. The bevelled edges of the design meet in the centre of the slab, and the open tracery thus made, when placed before a background of colored marble, produces a most excellent effect.

Experiments have also been made with the high-pressure sand-blast for the purpose of turning blocks of granite and other rocks into fancy forms in the lathe. A block of granite, for instance, having been given a roughly-cylindrical shape by the hammer, is placed in the lathe and accurately centred. The axis of the gun is of course perpendicular to that of the block, and is so placed that the blast strikes the block tangentially. If the block be slowly revolved, and at the same time the blast-pipe be carried along parallel to the axis by a motion like that of a slide-rest, a true cylinder of granite will in this way be turned out. But if, instead of moving in a straight line, the gun be made to follow any outline by means of a device similar to any of those employed in turning irregular forms, almost any desired form can be reproduced in the granite. Balcony pilasters which require fourteen days to cut by hand can be finished in half a day by the sand-blast. Another ingenious application of the sand-blast which has proved entirely successful is its use for cleaning castings of brass, iron, etc. from the sand and slag upon them as they come from the moulds. A moderate jet of steam working a blast of sand cleans them perfectly. In the case of iron castings, however, an advantage of the method has arisen which was not foreseen. In the old method of cleaning the castings were pickled, or placed in dilute sulphuric acid, for a short time. But it has been ascertained that the nascent hydrogen evolved by the action of the acid upon the iron is absorbed or occluded by the metal, thus diminishing greatly its strength, confirming fully the general opinion of iron-founders that the castings were weakened by pickling. Hence the sand-blast, by furnishing a new mode of cleaning these castings, prevents the weakening of the iron which results from the occlusion of hydrogen during pickling.

Upon wood the sand-blast acts slowly. The large block type which are used in printing posters may be cut out by the sand-blast, however, very rapidly and cheaply, simply

by cementing the stencils on the ends of the blocks and placing them all together under the moving jet for a few minutes. The letters are clear and sharp, and they work well in the press.

Many other applications of the sand-blast have been suggested. Millstones have been dressed by its means; metals have been cut, cleaned, stippled, and engraved; and all hard materials have been worn away by it. Alterations in the form of jet have been made, and in some cases the sand has been enclosed in a strong box and forced from the jet by the pressure of the steam admitted to the reservoir. But all these are obvious modifications and extensions of one leading principle.

The theory of this extraordinary action of a jet of sand is very simple. The material acted on is worn, not by an abrading action, but by actual pulverization by impact, each grain of sand acting by its own velocity and momentum, like a bullet or projectile, pulverizing, cutting, or indenting the object it strikes. That the impact even of sand-grains must be considerable at these high velocities is quite obvious; moreover, a dull red light may be observed where the sand impinges on the stone or glass. The evidence which may be adduced to prove the correctness of this theory of impact may be arranged under two distinct heads. In the first place, the rapidity with which a substance is cut away seems to have no particular relation to its hardness or softness as such, but is in the exact ratio of its brittleness. While the steam-blast at 50 pounds pressure scarcely affects india-rubber, wood is cut by it with moderate rapidity, marble and granite are attacked energetically, and glass is cut most rapidly of all. With a supply of steam equal to that which would be required in an engine to yield 1½ horse-power, at a pressure of 100 pounds to the square inch, quartz-sand being used in the blast, the cutting effect produced was equal to the removal per minute of 10 cubic inches of sandstone, 4 cubic inches of American marble, and 1½ cubic inches of granite. In sawing with sand, where the effect is unquestionably due to abrasion, marble cuts twelve times faster than granite. An air-blast at 80 pounds will perforate glass a quarter of an inch thick in four or five seconds, and a steam-jet at the same pressure will cut a hole through glass an inch thick in twenty seconds. Moreover, the effect of high velocity is apparent from the fact that when steam is used directly at high pressures—say at 50 pounds to the inch—it cuts fifty times as fast as if the same steam were employed to drive a fan producing one-sixth of a pound pressure of air. Again, abrasion, as is well known, takes place most rapidly at oblique incidences, and not at all at perpendicular incidences. Now, the sand-blast produces its maximum effect at perpendicular incidences, provided only that free space be allowed for the escape of the sand. Hence, a plate of copper, though one of the softest metals, resists the action of the sand-blast at a perpendicular incidence quite as well as a plate of hardened steel. But at oblique incidences, owing to the abrasive action, the copper is far more rapidly worn.

In the second place, the most satisfactory proof that this action is of the nature of pulverization by blows is the fact that the sand which is employed will rapidly cut substances which are much harder than itself—a fact impossible on the abrasion theory. Thus, for example, common quartz-sand, driven by steam at 50 pounds pressure, has cut a slot through a hardened steel file three-sixteenths of an inch thick in four minutes, and through a crystal of *corundum* three-quarters of an inch thick in ten minutes. When it is remembered that corundum is the hardest substance in nature except the diamond, the significance of this action appears. But even these results, marvellous as they are, have been exceeded. In a series of experiments made in New York by Prof. Egleston, in which quartz-sand was used, driven by an air-pressure of 70 pounds, one crystal of topaz lost 94 per cent. of its weight in one minute, and another had a hole drilled nearly through it in the same time, losing 22 per cent. of its weight. Under these circumstances even the diamond itself was attacked by the blast, a fragment of the black variety, weighing 1.2607 grammes, losing 0.0869 grammes in weight in eight minutes. Moreover, it has been proved experimentally that no advantage is obtained by using emery in the blast in place of quartz-sand; for, although it is much harder, it is also much heavier, and hence for a given pressure does not acquire so high a velocity in the blast as the lighter quartz. Now, since the force of impact increases as the square of the velocity, but only as the first power of the mass, it is obvious why a high velocity is so advantageous. In further proof of this second position is the very remarkable fact that a plate of quartz has been drilled by fine lead shot driven by an air-blast, as well as by an iron sand composed of fine particles of cast iron. Glass, too, has been depolished by a blast of marble-powder or chalk. Moreover, the new hardened glass of M. de la Bastie, which the diamond only scratches, but does not cut, is readily depolished by a blast of sand. But the peculiar condition of tension of this glass, due to its rapid cooling, renders it impossible to remove any but the thinnest layer from its surface without causing it to fly into a thousand pieces.

From its novelty and effectiveness, the sand-blast process has attracted much attention both here and in Europe. Patents in several foreign countries have been secured, and the process is already in successful operation in a number of them. G. F. Barker.

**Sand'crack,** a crack in the hoof of a horse. It constitutes an unsoundness, since it springs from a constitutional brittleness of the hoof and leads to serious lameness. It is made worse by overdriving and bad shoeing. It may be treated by paring, firing, and blistering the coronet. The horse should be well fed or turned out to pasture.

**Sand Creek,** tp., Bartholomew co., Ind. P. 1149.

**Sand Creek,** tp., Decatur co., Ind. P. 2029.

**Sand Creek,** tp., Jennings co., Ind. P. 930.

**Sand Creek,** tp., Union co., Ia. P. 328.

**Sand Creek,** tp., Scott co., Minn. P. 1520.

**Sandeau'** (Léonard Sylvain Jules), b. at Aubusson, department of Creuse, France, Feb. 19, 1811; studied law at Paris, but devoted himself subsequently to literature; wrote his first novel, *Rose et Blanche,* in connection with Madame Dudevant (George Sand), and published it under the pseudonym of "Jules Sand." In 1853 he was appointed keeper at the Mazarin Library, and in 1858 was elected a member of the Academy. His most successful novel was *Mlle. de la Seglière* (2 vols., 1848; as a drama 1851). His best comedy is *Le Gendre de M. Poirier,* written in connection with Émil Augier (1854). Also the novel *La Maison de Penarvan* (1858) has been transformed into a drama (1863).

**Sand-Eel,** or **Sand-Lance,** a name given to fishes of the family Amodytidæ and genus *Amodytes.* They are elongated, nearly rectilinear species, with an elongated, pointed snout, forked caudal, and silvery body; they burrow in the sand, and are of little or no use except as bait for other fishes, for which they are sometimes extensively employed. Species are found on the northern shores of all countries. The common American species is *Amodytes Americanus.* Theodore Gill.

**Sandeman** (Robert), b. at Perth, Scotland, in 1718; studied at Edinburgh; became a linen-draper; married a daughter of Rev. John Glas (or Glass), the founder of a sect called the Glasites; became an elder in the congregation; established in 1762 a congregation of the new sect at London, where the adherents became known under the title of Sandemanians; came to America and established a society 1764, and settled in the following year at Danbury, Conn., where he d. Apr. 2, 1771. Glas, the real founder of the sect, was b. at Dundee, Scotland, Sept. 21, 1698; was educated at St. Andrew's; became minister of a country parish; published *The Testimony of the King of Martyrs* (1727), directed against the alliance of Church and State; was thereupon deposed from his ministry by the Scottish General Assembly, and formed his adherents into a separate society. D. at Dundee in 1773. His numerous scattered writings were collected into 4 vols. (Edinburgh, 1762; Perth, 5 vols., 1782).—Sandeman wrote a number of theological and controversial treatises. The Sandemanian Church still maintains a feeble existence, chiefly at Dundee, Edinburgh, and Danbury, Conn., the total membership not exceeding 2000 persons. Among their leading peculiarities, besides several ascetic practices, are the weekly love-feast, eaten on Sunday, and the "kiss of brotherhood;" the washing of feet, formerly one of their practices, has been discontinued.

**Sandemanians.** See Sandeman.

**Sand'erling,** a name given to species of *Calidris,* a genus of the family Scolopacidæ, and closely related to *Tringa,* from which it in fact differs chiefly by the absence of the hind toe. The bill is straight, rather longer than the head, and widened toward the end; the color above is light ashy, interspersed with elongated spots of brownish-black on the head, back, scapulars, and shorter quills; that on the rump and upper tail coverts is black, in fine transverse lines; beneath it is white. The total length is about eight inches—the bill one, tail two. The species is widely distributed, and occurs more or less in the temperate regions of the entire northern hemisphere, and also extends in winter into South America. Theodore Gill.

**Sanders.** See Sandal-Wood and Santal-Wood.

**Sanders** (Charles W.), b. in Herkimer co., N. Y., in 1805; author of two series of *School Readers,* the first commenced in 1838, the second issued in 1860, and of several music-books for the young. More than 15,000,000

copies of his books have been used in American schools.—His brother, Joshua C., aided him in the preparation of the revised series, and was the author of an *Analytical Definer and Higher Speller* (1860).

**Sanders** (Daniel Clarke), D. D., b. at Sturbridge, Mass., May 3, 1768; graduated at Harvard 1788; taught the Cambridge grammar school while studying theology; was licensed to preach 1790; was Unitarian minister at Vergennes, Vt., from June 12, 1794, to 1799, when he removed to Burlington; was the first president of the University of Vermont from Oct. 17, 1801, to Mar. 24, 1814, and pastor of the Unitarian church at Medfield, Mass., from May 24, 1815, to May 17, 1829, and was a member of the Massachusetts constitutional convention of 1820. D. at Medfield Oct. 18, 1850. Author of *A History of the Indian Wars with the First Settlers of the U. S., particularly in New England*, printed at Montpelier, Vt., in 1812, and of more than 30 published sermons.

**Sanders** (George Nicholas), b. at Lexington, Ky., Feb. 21, 1812, grandson of Col. George Nicholas, the proposer of the "Kentucky resolutions" of 1798; became at an early age an efficient Democratic orator and politician; was appointed by Pres. Pierce U. S. consul at Liverpool, and by Pres. Buchanan navy agent at New York; was a prominent supporter of Douglas in the campaign of 1860; resided in Europe during the civil war as a commissioner of the Confederate States, associated with Mason and Slidell; took part with Messrs. C. C. Clay and James P. Holcomb in the peace conference with Horace Greeley at Niagara Falls, July, 1864, and after the war settled at New York, where he d. Aug. 12, 1873.

**Sanders** (John), b. in Kentucky in 1810; graduated from the U. S. Military Academy, and appointed brevet second lieutenant of engineers July 1, 1834, captain 1838; was engaged for many years upon the improvement of Ohio River and the construction and repair of the defences of New York harbor. In the war with Mexico he participated in the battle of Monterey and the siege of Vera Cruz, gaining the brevet of major for gallantry at Monterey. With a brief interval he was subsequently engaged in improving Delaware River and Bay and in the construction of Fort Delaware, till his death, which occurred at that fort July 29, 1858. Author of *Memoirs on the Resources of the Valley of the Ohio*, etc., and of a translation of M. Poncelet's *Memoir on Stability of Revetments and their Foundations*.

**Sanders** (Nicholas), D. D., b. at Charlewood, Surrey, England, about 1527; educated at Winchester School and at Oxford, where he became fellow of New College 1548 and regius professor of canon law 1557; left England on account of the religious innovations of Elizabeth; was ordained priest at Rome 1560; accompanied Cardinal Stanislaus Hosius to the Council of Trent, where he gained great renown by his skill in disputation; went to Poland with Hosius; resided thirteen years at Louvain, Holland (1666–79), as assistant to Sir Francis Englefield, who was the almoner of the aid granted by Philip II. of Spain for the relief of English Roman Catholic churchmen; was sent by Pope Gregory XIII. as nuncio to Ireland; accompanied the Spanish soldiery thither 1579, and is alleged to have there perished miserably while wandering in the woods and bogs to escape from falling into the hands of the English, but whether in 1581, 1582, or 1583 authorities differ, and some discredit the account altogether. Sanders was styled by Anthony à Wood "the most noted defender of the Roman Catholic cause in his time." Author of *The Supper of our Lord* (Louvain, 4to, 1565), a work in defence of the "real presence," in reply to Jewell's *Apology* and Nowell's *Challenge*, and in turn answered by the latter in his *Confutation; The Rocke of the Churche* (Louvain, 1566), *A Treatise of the Images of Christ* (1567), directed against Jewell, and of several other polemical works, of which the best known was a Latin treatise against the English Reformation—*De Origine ac Progressu Schismatis Anglicani* (Cologne, 1585), which was several times reprinted and translated into French, but never into English.

**Sanders** (William P.), b. in Kentucky in 1833; graduated at the U. S. Military Academy in 1856, when he was appointed brevet second lieutenant of dragoons; served in California and Kansas 1856–57, and on the Utah expedition 1857–61. In May, 1861, he was appointed captain in the 6th U. S. Cavalry, and served with his company in the defences of Washington until the opening of the Virginia Peninsular campaign of 1862, when he was engaged before Yorktown, in the battles of Williamsburg, Mechanicsville, etc., and in the Maryland campaign of that year. In Mar., 1863, he accepted the colonelcy of the 5th Kentucky Cavalry, which he led in the pursuit of Morgan on the latter's raid through Indiana and Ohio. In September he was appointed chief of cavalry, department of the Ohio, but the following month was promoted to be brigadier-general of volunteers, and assigned to the 23d corps. He participated in the engagements of Blue Lick Springs, Lenoir, and Campbell's Station, and was mortally wounded in action before Knoxville, Tenn., Nov. 17. D. Nov. 19, 1863.

**San'derson,** p.-v., cap. of Baker co., Fla.

**Sanderson** (John), b. near Carlisle, Pa., in 1783; studied law at Philadelphia; became a teacher in, and subsequently one of the proprietors of, Clermont Seminary; wrote in early life in Dennie's *Portfolio* and the *Aurora* newspaper; prepared with the aid of his brother, James M., the first 2 vols. of the *Biography of the Signers of the Declaration of Independence* (1820), which was completed in 7 vols. by Robert Waln, Jr., and others (1820–27; new illustrated 4to ed. by William Brotherhead, 1865); successfully opposed in a pamphlet the plan to exclude the classical languages from Girard College (1826); resided in Paris 1845–46; wrote an amusing and instructive work, *Sketches of Paris, in Familiar Letters to his Friends* (1838), which was republished in London under the title *The American in Paris* (1838), and translated by Jules Janin into French (1843); commenced a similar work, *The American in London*, of which portions were published in the *Knickerbocker Magazine*, and on his return to the U. S. became professor of Latin and Greek in the Philadelphia High School. D. at Philadelphia Apr. 5, 1844. He was a gentleman of ripe classical culture and of eminent social virtues. (See notice in Griswold's *Prose Writers of America*.)

**Sanderson** (John P.), b. Feb. 13, 1818, in Lebanon co., Pa.; admitted to the bar in 1839; elected to the lower house of the legislature of Pennsylvania in 1845, and to the State senate in 1847; editor of the *Daily News* of Philadelphia from 1848 to 1856; appointed chief clerk of the war department Mar. 4, 1861, which he resigned to accept the position of lieutenant-colonel 15th U. S. Infantry; appointed colonel 13th U. S. Infantry July 4, 1863; in Feb., 1864, was assigned to duty as provost-marshal-general department of the Missouri. D. at St. Louis, Mo., Oct. 14 of the same year. His important service to his country during the war was the very full exposition made by him of the secret political organization in the Northern and Western States known as the "Knights of the Golden Circle" or "Order of American Knights," causing the disruption of the order.

**Sanderson** (John Scott Burdon), M. D., F. R. S., b. at Newcastle-on-Tyne, England, Dec., 1828; educated at the University of Edinburgh; was medical officer of health for Paddington 1855–56; became physician to the Middlesex Hospital; was employed by the royal commissioners to make investigations respecting the cattle-plague 1865–66, the epidemic of cerebro-spinal meningitis in North Germany 1865, and the sanitary condition of the Cornwall mines 1869, on all which subjects he published elaborate *Reports;* introduced the sphygmograph into England; wrote the *Handbook of the Sphygmograph*, and became professor of physiology in University College, London, 1874.

**Sanderson** (Robert), D. D., b. at Rotherham, Yorkshire, England, Sept. 19, 1587; educated at Lincoln College, Oxford, where he became fellow 1606 and reader in logic in 1608; published lectures upon that subject, *Logicæ Artis Compendium* (1615), which passed through several editions; took orders in the Church of England 1611; became in 1619 rector of Boothby Pennell, Lincolnshire, which post he retained more than forty years; became prebend of Lincoln 1629 and rector of Muston 1633; was indebted to his great reputation as a casuist for the appointment of chaplain to Charles I. 1631, by whom he was made D. D. 1636, regius professor of divinity at Oxford and canon of Christ Church 1642; was named by Parliament one of the "Assembly of Divines" convoked at Westminster 1643, but refused to sign the Covenant, and had his living sequestered; attended the king as ecclesiastical councillor at Oxford, at Hampton Court, and in the Isle of Wight; was ejected from his professorship 1648, but restored 1660, and shortly after made bishop of Lincoln, and took part in the Savoy Conference 1661. D. at Lincoln Jan. 29, 1663. Author of several Latin treatises on cases of conscience, the obligation of an oath, etc., written for the guidance of Charles I., and other tracts, collected in his *Works* (Oxford, 6 vols.), edited by Bishop Jacobson. His *Life* was written by Walton. His sermons are masterpieces.

**Sanderson** (Robert), b. at Eggleston Hall, Durham, England, July 27, 1660; educated at St. John's College, Cambridge; became a lawyer in London, clerk of the rolls, usher of the court of chancery, and a distinguished antiquary. D. Dec. 25, 1741. He wrote a *History of Henry V.* (unpublished) and other works, but is chiefly remembered as the assistant of Thomas Rymer in the preparation of his *Fœdera*, and completed that great work after the death of the latter by the publication of vols. xvi.–xx. (1717–35).

**Sanders's,** tp., Jackson co., Ala. P. 158.

**San'dersville,** city, cap. of Washington co., Ga., on the ridge between Oconee and Ogeechee rivers, 135 miles N. W. of Savannah, has 3 churches, an academy, 2 weekly newspapers, 2 carriage-factories, court-house and jail, Masonic and "United Friends of Temperance" lodges, and a grange of "Patrons of Husbandry." The city government consists of a mayor and five aldermen. P. about 1500.

ROBERT L. RODGERS, ED. "HERALD AND GEORGIAN."

**Sand'ford** (Sir DANIEL KEYTE), D.C.L., son of Daniel Sandford, D. D., bishop of Edinburgh (1766–1830), b. at Edinburgh, Scotland, Feb. 3, 1798; educated at Christ Church, Oxford; became at the age of twenty-one professor of Greek at the University of Glasgow; was an accomplished and enthusiastic classical instructor, and an eloquent advocate in Parliament of the Reform bill and other liberal measures, and was knighted 1830. D. at Glasgow Feb. 4, 1838. He was one of the editors (along with Dr. Thomas Thomson and Allan Cunningham) of the *Popular Encyclopædia*, to which he contributed valuable articles. Author of several textbooks for Greek, of many articles on classical subjects in the reviews, of a work *On the Rise and Progress of Literature*, and of a *Sketch of the Literature of Greece*.—His brother, JOHN, b. at Edinburgh Mar. 22, 1802; graduated at Baliol College, Oxford; became archdeacon of Coventry, Bampton lecturer at Oxford 1861, and a royal commissioner for revising the forms of clerical subscription 1864, and author, besides theological treatises, of a biography of his father, Bishop Sandford, accompanying the *Remains* of that prelate. D. Mar. 22, 1873.—The wife of Archdeacon Sandford was author of *Woman in her Social and Domestic Character* (1832) and *Lives of English Female Worthies*.—CHARLES WALDEGRAVE, son of Archdeacon Sandford, b. 1828, was educated at Oxford, and became bishop of Gibraltar 1874.

**Sand'ford** (EDWARD), brother of Lewis H., b. at Ovid, N. Y., in 1809; received an academic education; became a teacher and lecturer in the Rensselaer Institute at Troy; studied law at Albany; began a successful career at the bar in New York City 1833; became a judge of the criminal court in that city 1842; was a member of the State senate 1843; contributed to the *Knickerbocker* and other periodicals, and was lost in the steamship Arctic, Sept. 27, 1854.

**Sandford** (LEWIS H.), b. in Onondaga co., N. Y., about 1805; studied law at Syracuse; settled in New York City 1833; became assistant vice-chancellor of the first circuit Mar., 1843, vice-chancellor 1846, and associate justice of the superior court 1847, retaining that post until his death, at Toledo, O., in 1852. Author of *New York Chancery Reports* from Apr., 1843, to June, 1847 (4 vols., 1846–50), and *New York Superior Court Reports* (5 vols., 1849–52).

**Sand'gate,** p.-v. and tp., Bennington co., Vt. P. 705.

**Sand-Grouse,** a name given to the species of the family PTEROCLIDIDÆ (which see).

**Sand Hill,** p.-v. and tp., Scotland co., Mo. P. 784.

**Sand Hill,** tp., Lenoir co., N. C. P. 400.

**Sand Hill,** tp., Moore co., N. C. P. 268.

**Sand Hill,** tp., Marshall co., West Va. P. 951.

**Sandhill Crane** (*Grus Canadensis*), a rather large bird, characterized by the plumbeous plumage of the adult; the development on the head of a warty space on a line with and above the eyes, which is bifurcated behind by the extension forward in an angle of occipital feathers; the bill longer than the middle toe; and the color of the primaries, which are brown with white shafts; the length is about forty-eight inches; the tarsi nearly ten. The species is quite common, and found to a greater or less extent throughout all of the Mississippi Valley and western portions of the U. S., as well as Florida. THEODORE GILL.

**Sand'hopper,** or **Beach Flea,** names given in the U. S. to *Talitrus quadrifidus* and *Orchestia longicornis*, and in Great Britain to *T. locusta* and *saltator*, small amphipod crustaceans found under sea-weeds and stones at low tide. They have marvellous powers of leaping, and of burrowing in wet sand. Another European sandhopper is *Orchestia littorea*.



The Sandhopper, magnified.

**Sand'hurst,** town of Australia, colony of Victoria, 82 miles N. W. of Melbourne, is the centre of a rich gold-mining district, and has about 25,000 inhabitants.

**Sandhurst,** Berks co., England, the seat of the royal military college of that name, which comprises both a staff school and a junior department for educating pupils (received between the ages of thirteen and fifteen) for the infantry and cavalry. P. 3211.

**Sandhurst** (Right Hon. WILLIAM ROSE MANSFIELD), BARON, b. in 1819; educated at the Royal Military College, and entered into the army as ensign in 1835; served with the 53d regiment in the Sutlej campaign of 1846 as captain; major in 1847, and in command of the regiment in the Punjaub campaign 1849; lieutenant-colonel in 1851, and engaged in operations on the Pewasher frontier 1851–52; attached to the British embassy at Constantinople with the rank of brigadier-general, and as such proceeded to the Crimea; consul-general at Warsaw at the close of the war, but on the outbreak of the mutiny in India was nominated chief of staff, with the local rank of major-general, participating in all the operations of that campaign, and wounded at the battle of Cawnpore; received the thanks of Parliament; in 1863 sent to India as commander-in-chief; lieutenant-general in 1864; transferred to Ireland as commander-in-chief in 1870; created a peer in 1871 with the title of Lord Sandhurst. The order of knight of the Star of India was bestowed upon him in 1866; in 1862 obtained the colonelcy of the 38th regiment. D. June 23, 1876.

**San Die'go,** county of S. California, bounded E. by Arizona, from which it is separated by Colorado River, S. by Lower California, and W. by Pacific Ocean, traversed from N. W. to S. E. by two branches of the Coast Range, which separate into three sections, differing widely in general features. The E. section is a part of the Colorado desert, some of which is below the level of the sea, is without vegetation, extremely hot, and has a lake of boiling mud half a mile long. The central or mountainous section has a delightful climate, mines of gold and silver, good farming-lands in the valleys, where the vine, the orange, and wheat grow to perfection, and forests of valuable timber. The western section, sloping with gentle undulations from the Coast Range down to the ocean, is well watered, has a semi-tropical climate, with good farming lands, and is well adapted to pasturage. The county will soon be traversed by Southern Pacific and Texas Pacific R. Rs., having a common terminus at San Diego. Cattle and sheep are numerous. Staples, wheat, barley, hay, and wool. Cap. San Diego. Area, 13,500 sq. m. P. 4951.

**San Diego,** city, seaport, and port of entry of S. California: lat. 32° 41′ N., lon. 117° 13′ W.; 480 miles S. E. of San Francisco. The harbor is fully described in the *Pacific Coast Pilot* of the U. S. Coast Survey, which says: "Next to that of San Francisco, no harbor on the Pacific coast of the U. S. approximates in excellence the Bay of San Diego." It was discovered by Cabrillo Sept., 1542. The first settlement was made in May, 1769, by Father Junipero Serra, who then established the mission of San Diego, the earliest of the California missions. The growth of the present city dates from 1867, when the new town was begun on the water-front of the bay. Present pop. 4500, of county (assessor's census), 13,500; total pop. of county in 1867, 2100, in 1870 (U. S. census), 4951; net gain 1875 (*Chamber of Commerce Report*), 2513. There are 4 wharves, 3 warehouses, custom-house, fine county buildings and grounds, city hall, public hall, 5 churches, 2 academies, 5 public-school buildings, county hospital, lodges of all the secret orders, public reading-room, 2 banks, chamber of commerce, benevolent association, etc.; waterworks, public park reservation of 1400 acres; iron-foundry and machine-works, tannery, steam flouring-mills, several steam planing-mills, large saltworks, several carriage and wagon factories, and many other minor industries. There are 2 daily newspapers: *The Union*, daily and weekly, was established in 1868. By act of Congress, San Diego is made the Pacific terminus of the Transcontinental R. R. on the 32d parallel, or Southern Pacific R. R. The principal products of the county are wheat, wool, honey, cattle and horses, sheep and hogs. There are gold-mines 50 miles N. of the city, where five or six quartz-mills are employed. Fruit-raising is becoming an important, and will soon be a leading, industry: it has only been begun since 1869, when there were (assessor's returns) less than 600 fruit trees of all kinds in the county: there are now 160,000, the orange, lemon, almond, and olive being largely cultivated. San Diego is the principal honey-producing county in California; the yield in 1875 was 550,000 pounds, the estimated yield in 1876 exceeds 1,250,000 pounds. A railroad is at present (1876) projected to run directly northward to the town of San Bernardino, 100 miles, to connect with a road building southward from Salt Lake, which connection will give the Union Pacific R. R. a Pacific outlet at San Diego. With the completion of this and the Southern Pacific road, San Diego will become the second city in commercial importance on the Pacific coast of the

U. S. The climate of San Diego is shown, by the recorded observations of the U. S. Signal Service station established here, to be the mildest and most equable of which any knowledge exists. The city is a popular resort for invalids from all parts of the U. S.

DOUGLAS GUNN, ED. "THE UNION."

**San'disfield,** p.-v. and tp., Berkshire co., Mass., on Farmington River, has some manufactures, and is noted for its maple-sugar. P. 1482.

**Sand Lake,** p.-v., Kent co., Mich., on Grand Rapids and Indiana R. R., 25 miles N. of Grand Rapids, has good schools, 1 newspaper, a foundry, a stave-factory, 3 hotels, and 1 planing, 4 lumber, and 4 shingle mills. Principal business, lumbering. J. L. TAYLOR, ED. "SENTINEL."

**Sand Lake,** p.-v. and tp., Rensselaer co., N. Y. P. of v. 503; of tp. 2633.

**Sand-Lance.** See SAND-EEL.

**Sand Lick,** tp., Buchanan co., Va. P. 1580.

**San Domingo.** See SANTO DOMINGO.

**San Do'na,** town of Italy, province of Venice, on the left bank of the Piave, about 30 miles N. E. of the city of Venice, occupying a site near that of the ancient *Altinus*. P. 7829.

**San'doval,** p.-v. and tp., Marion co., Ill. P. 958.

**Sandoval, de** (PRUDENCIO), b. in Spain about 1560; became a Benedictine monk at Naxera, where he devoted himself to the study of the civil and ecclesiastical antiquities of Spain; was made an abbot at Valladolid and historiographer to Philip III., and published in that capacity several works, the most important being *Historia de la Vida y Hechos del Emperador Carlos V.* (1604), and *Historia de los Reyes de Castilla y de Leon* (1615). The former work is a leading authority for the period of which it treats, and appeared in English in two abridged translations—*The Civil Wars of Spain* (1652), by James Wadsworth, and *History of Charles V.* (1703), by Capt. John Stevens. Sandoval became bishop of Tuy 1608, and of Pamplona 1612. D. at Pamplona Mar. 17, 1621.

**San'down,** p.-v. and tp., Rockingham co., N. H., on Nashua and Rochester R. R. P. 496.

**Sand'-paper,** paper one side of which is covered with wet glue, upon which sharp sand or powdered glass is evenly sifted.

**Sand'piper,** a name given to many species of snipe-like birds belonging to the family Scolopacidæ. They have little in common, except as members of the same family, but a short and straight bill and a comparatively small size. They associate together in flocks, especially on the beaches of the ocean and lakes. The name is applied in the U. S., according to Baird and Coues, to the following species: *Micropalama himantopus*, the stilt sandpiper; *Ereunetes pusillos*, the semi-palmated sandpiper; *Tringa minutilla*, the least sandpiper; *Tringa Bairdii*, Baird's sandpiper; *Tringa maculata*, pectoral sandpiper; *Tringa fuscicollis*, the white-rumped sandpiper; *Tringa maritima*, the purple sandpiper; *Tringa alpina*, the black-bellied or red-breasted sandpiper; *Tringa canutus*, the red-breasted sandpiper; *Tringoides macularius*, the spotted sandpiper; *Actiturus Bartramius*, the Bartramian sandpiper; *Tringites rufescens*, buff-breasted sandpiper. Allied species are, however, known by other names, and therefore the word *sandpiper* is not strictly synonymous with any scientific designation. THEODORE GILL.

**Sand Point,** v., McNab tp., Renfrew co., Ont., Canada, on the river Ottawa and on Brockville and Ottawa Railway, 45 miles above Ottawa. It is an important shipping-point.

**Sand Prai'rie,** tp., Tazewell co., Ill. P. 1046.

**Sands** (BENJAMIN FRANKLIN), U. S. N., b. Feb. 11, 1812, in Maryland; entered the navy as a midshipman Apr. 1, 1828; became a lieutenant in 1840, a commander in 1855, a captain in 1862, a commodore in 1866, a rear-admiral in 1871; retired in 1874; served on the W. coast of Mexico during our war with that country, and commanded the Fort Jackson in both the Fort Fisher fights; recommended for promotion by Rear-Admiral Porter in his official despatch of Jan. 28, 1865. F. A. PARKER.

**Sands** (ROBERT CHARLES), b. at Flatbush, L. I., May 11, 1799; graduated at Columbia College 1815; studied law in the office of David B. Ogden, and was admitted to the bar 1820, but devoted himself chiefly to literature; wrote many essays and poems while at college and while studying law, some of them being in literary partnership with James Wallis Eastburn (d. 1819), especially the poem *Yamoyden* (1820); wrote for the *Literary Review* 1822–23 and the *St. Tammany Magazine* 1823–24; edited the *Atlantic Magazine* 1824, and (with W. C. Bryant) the *New York Review* 1825–27; was assistant editor of the *Commercial Advertiser* 1827–32, and wrote with Bryant and Verplanck the *Talisman* annual (3 vols., 1827–30). D. at Hoboken, N. J., Dec. 17, 1832. His collected *Works* were edited, with a *Memoir*, by G. C. Verplanck (2 vols., 1834).

**Sand Spring,** p.-v., South Fork tp., Delaware co., Ia., on Dubuque South-western R. R.

**Sand Springs,** tp., Limestone co., Ala. P. 588.

**Sand Star,** a name sometimes given to species of star-fishes, of the orders Asterioidea and Ophiurioidea.

**Sandstone.** See GEOLOGY, by PROF J. W. DAWSON; and STONE, BUILDING, by PROF. J. S. NEWBERRY.

**Sand'stone,** p.-v. and tp., Jackson co., Mich. P. 1598.

**Sand'tuck,** p.-v. and tp., Elmore co., Ala. P. 1421.

**Sandus'ky,** county of N. Ohio, on Sandusky Bay in Lake Erie, intersected by Sandusky and Portage rivers, and traversed by several railroads, has a low surface, partly marsh and reclaimed swamp-lands, which are highly productive. Staples, wheat, Indian corn, oats, hay, apples, cheese, and wool. Sheep and swine are numerous. Cap. Fremont. Area, 425 sq. m. P. 25,503.

**Sandusky,** tp., Crawford co., O. P. 665.

**Sandusky,** city and port on Lake Erie, cap. of Erie co., O., at the mouth of Sandusky River, on a bay 15 miles long and 4 wide, one of the best harbors on the lake. It is the Lake Erie terminus of Baltimore and Ohio and Cincinnati Sandusky and Cleveland R. Rs., and is on the northern division of Lake Shore and Michigan Southern R. R., 61 miles W. of Cleveland. Lines of steamers run to Detroit, Toledo, Cleveland, and the islands of Lake Erie. It has 30 churches, the best of public-school buildings, its high-school building being the most costly in the State. It is the largest fresh-fish market in the world. Its trade is fish, lumber, limestone, manufactured woodwork, grapes, and native wine, steelworks, engine and boiler and threshing-machine works. It is now completing waterworks. It is out of debt save waterworks bonds. It has a paid fire department, 3 national banks, and 1 private banker. Its receipts from the country are largely wool and grain. Its coal-business is large over Baltimore and Ohio R. R., and thence by lake to Detroit and the N. Its receipts by water are chiefly iron ore, lumber, and fish. It has 3 newspapers. Its chief manufacturers are the Sandusky Wheel Company, Woolworth's Handle-Factory, the Sandusky Coal Company, the Converse Machine-works, Klotz & Kramer Engine-works, the Nes Silicon Steelworks. Its fisheries employ over 1000 hands; its grape-and-wine business still more. P. in 1870, 13,000; in 1876, 18,000.

I. F. AND J. T. MACK, EDS. "REGISTER."

**Sandusky,** tp., Richland co., O. P. 682.

**Sandusky,** tp., Sandusky co., O. P. 1570.

**Sand-Wasp.** See HYMENOPTERA and SPHEGIDÆ.

**Sand'wich,** municipal borough of Kent, England, on the coast of the North Sea, at the mouth of the Stour, 4 miles N. of Deal, on the South-eastern Railway, is one of the Cinque Ports, is surrounded by ancient fortifications, is irregularly built, but has several notable mediæval edifices, and was once the principal seaport of London. Near at hand the walls of the Roman city of *Rhutupium* (or Richborough) are still standing. The principal imports are coals; and exports, agricultural products. It forms with Deal a parliamentary borough. P. 3096.

**Sandwich,** county-seat of Essex co., Ont., Canada, on Detroit River, nearly opposite Detroit, has 2 weekly newspapers, a convent and Roman Catholic college, and mineral springs which make it a favorite place of resort. P. 1160.

**Sandwich,** city of De Kalb co., Ill., on Chicago Burlington and Quincy R. R., 58 miles S. W. of Chicago, contains 7 churches, 2 graded schools, 1 bank, and 2 weekly newspapers. Incorporated as a city in 1873. P. 1844.

H. F. BLOODGOOD, ED. "FREE PRESS."

**Sandwich,** p.-v., Barnstable co., Mass., on Old Colony R. R., 60 miles S. of Boston, contains 1 library, 10 churches, excellent schools, 1 bank, 1 newspaper, a foundry at North Sandwich, 5 hotels, a jewelry-box factory, marble-works, a railroad-car manufactory at West Sandwich, and another at Pocasset. There are Masonic and Good Templar Lodges. It is a famous summer resort for tourists. P. 3694. J. H. STEVENS, ED. "SEASIDE PRESS."

**Sandwich,** p.-v. and tp., Carroll co., N. H., on Squam Lake. P. 1854.

**Sandwich Islands,** the name given by Capt. Cook, after Lord Sandwich (fourth earl), to the group whose proper name is HAWAIIAN ISLANDS (which see).

**Sandy,** tp., Winston co., Ala. P. 302.

**Sandy,** tp., Stark co., O. P. 1116.

**Sandy,** tp., Tuscarawas co., O. P. 1163.

**Sandy Creek,** p.-v. and tp., Oswego co., N. Y., on Rome Watertown and Ogdensburg R. R., 44 miles N. of

Syracuse, has 4 churches, 2 excellent schools, 1 newspaper, 2 banks, 2 tanneries, 2 foundries, 3 grist, 2 planing, and 5 saw mills, 4 hotels, and a machine-shop. P. of v. 986; of tp. 2629. H. SOULE & SON, EDS. "NEWS."

**Sandy Creek,** tp., Franklin co., N. C. P. 1453.

**Sandy Creek,** tp., Warren co., N. C. P. 2753.

**Sandy Creek,** tp., Mercer co., Pa. P. 734.

**Sandy Creek,** tp., Venango co., Pa. P. 1391.

**Sandy Grove,** tp., Clarendon co., S. C. P. 317.

**Sandy Hill,** p.-v. and tp., Worcester co., Md., on Chincoteague Sound. P. of v. 146; of tp. 2176.

**Sandy Hill,** p.-v., cap. of Washington co., N. Y., on Glens Falls branch of Rensselaer and Saratoga R. R., has 7 churches, a fine union school, 4 paper-mills, 1 bank, a court-house, 1 newspaper, several furnaces and machine-shops, stone-quarries, and 6 saw-mills. Lumbering is extensively carried on. P. 2347.

JOHN DWYER, ED. "HERALD."

**Sandy Hook,** p.-v., cap. of Elliott co., Ky.

**Sandy Hook,** tp., Washington co., Md., on Potomac River, opposite Harper's Ferry, and on Baltimore and Ohio R. R. P. 1316.

**Sandy Hook,** a low sandy peninsula somewhat famous in connection with the lower bay and entrance to New York harbor, as all Transatlantic navigation to or from New York passes near its northern extremity. The great beacons by which approaching vessels make the entrance—the Navesink lights—stand on highlands of that name at the very origin of Sandy Hook, whence, continuing the sandy beach-line, it projects northward 5 miles, with a width varying from a few hundred feet to ¾ of a mile. A growth of cedars covers the wider areas of the Hook. At its northern extremity is a large bastioned fort (commenced 1858) in an unfinished condition. The Sandy Hook light (lat. 40° 27′ 40″, lon. 74° W.) is ¾ of a mile S. from the northern end, at which very extreme there is a beacon-light. New Jersey Southern R. R., to Long Branch, Camden, etc., has its terminus on the bay side of Sandy Hook, about midway of its length.

**Sandy Lake,** p.-b. and tp., Mercer co., Pa., on Franklin division of Lake Shore and Michigan Southern R. R. P. of v. 428; of tp. 1028.

**Sandy Marsh,** p.-v. and tp., Buncombe co., N. C. P. 894.

**Sandy Mush,** tp., Madison co., N. C. P. 458.

**Sandy Ridge,** tp., Lowndes co., Ala. P. 2180.

**Sandy Ridge,** tp., Union co., N. C. P. 1690.

**Sandy River,** tp., McDowell co., West Va. P. 848.

**Sandy River Plantation,** tp., Franklin co., Me. P. 111.

**Sandy Run,** tp., Cleveland co., N. C. P. 1191.

**Sandy Run,** tp. Lexington co., S. C. P. 643.

**Sandys** (EDWIN), D. D., b. at Hawkshead, Lancashire, England, in 1519; graduated from St. John's College, Cambridge, 1539; took orders in the Church of England; embraced the principles of the Reformation; became vicar of Haversham and master of St. Catharine's College 1547, prebendary of Peterboro' 1549 and of Carlisle 1552; vice-chancellor of Cambridge University 1553; preached a sermon in favor of the royal claims of Lady Jane Grey; was consequently deprived of the vice-chancellorship in July of the same year; was imprisoned in the Tower and the Marshalsea for refusing to proclaim Queen Mary; was liberated and allowed to proceed to the Continent May, 1554; returned at the coronation of Elizabeth 1558; was made bishop of Worcester Dec. 21, 1559, and of London 1570, and archbishop of York 1576; was one of the translators of the "Bishops' Bible" 1565, and came near being the victim of a malicious plot to charge him with infamous conduct 1582, but its author, Sir Robert Stapleton, was detected and punished. D. at the archiepiscopal palace of Southwell July 10, 1588. A volume of his *Sermons* was published 1585, was repeatedly reprinted, and was edited for the Parker Society, with a *Biography,* by Rev. John Ayre (1841).

**Sandys** (Sir EDWIN), son of Archbishop Sandys, b. at Worcester, England, about 1561; studied at Christ Church, Oxford, under Richard Hooker; obtained a fellowship 1579, and a prebend in York minster 1581, though never ordained; travelled extensively over Europe; was a supporter of the dynastic claims of King James I., by whom he was knighted 1603 and employed in several important commissions; was associated with Bacon in drawing up the "Remonstrance" of 1604; was a leading member of the second Virginia Company, of which he became treasurer 1619; was instrumental in securing a charter for the Pilgrims of the Mayflower and in planting representative government in the colony of Virginia, thereby becoming obnoxious to the "Spanish party" at court, and was imprisoned, along with Selden, 1621, for having opposed the royal projects in Parliament. D. at Northborne, Kent, in Oct., 1629. He founded a lectureship on metaphysics at Oxford, and wrote at Paris, in 1599, *Europæ Speculum, or a View on Survey of the State of Religion in the Western Part of the World,* which was surreptitiously printed 1605, translated into French and Italian, and passed through many editions. A volume of *Sacred Hymns* (1615), containing translations of 50 select Psalms, is attributed to him.

**Sandys** (GEORGE), son of Archbishop Edwin, b. at the palace of Bishopsthorpe, York, in 1577; educated at St. Mary's Hall and Corpus Christi College, Oxford; travelled through various parts of the Turkish empire, including Greece, Asia Minor, Palestine, and Egypt, 1610–12; published a *Relation* of his journey (1615), with illustrations, often reprinted, and considered of great value by Orientalists; went to Virginia as colonial treasurer 1621; completed at Jamestown a translation of Ovid's *Metamorphoses* (1626), of which the first five books had previously appeared; built the first water-mill, the first ironworks, and the first ship in Virginia; returned to England 1624; printed poetical paraphrases of the Psalms (1636), Job, Ecclesiastes, Lamentations, etc. (1638), and the Song of Solomon (1641), some of the pieces being adapted to music by Henry and William Lawes; and translated from the Latin of Grotius the tragedy of *Christ's Passion* (1640); was for some years gentleman of the privy chamber to the king, and passed his later years at Bexley Abbey, Kent, where he d. in Mar., 1644. A *Life* was published by Rev. H. J. Todd, prefixed to a *Selection from Sandys's Metrical Paraphrases* (1839), and a complete edition of his poetical works, with introduction and notes, was given to the world in 1872 by Rev. R. Hooper.

**Sandy Spring,** p.-v., Montgomery co., Md.

**San'dyston,** tp., Sussex co., N. J., between the Blue Ridge and Delaware River. P. 1230.

**San'dyville,** p.-v., Sandy tp., Tuscarawas co., O., on Tuscarawas River and Tuscarawas branch of Cleveland and Pittsburg R. R. P. 227.

**San'dywoods,** tp., Scott co., Mo. P. 777.

**Sanel,** p.-v., Mendocino co., Cal. P. 371.

**San Elizario,** p.-v., El Paso co., Tex., on the Rio Grande. P. 1120.

**San Fe'le,** town of Southern Italy, province of Potenza, about 3 miles from Melfi, in a hilly but not unproductive country. In its ancient castle, still standing, Henry of Sicily was strangled by order of Conrad. This town was much injured by the earthquake of 1851. P. of commune, 10,536.

**San Feli'ce** [anc. *Circeii* or *Circæum*], town of Italy, province of Velletri, standing on a promontory near the sea, about 12 miles W. of Terracina. The modern town occupies a higher position than did the ancient *Circæum,* and the views from it are very beautiful. It is, however, chiefly interesting for the very choice antiquities found in its immediate vicinity—rare marbles, mosaics, coins, inscriptions, etc.—from the luxurious Roman palaces which once stood here.

**San Felice à Cancello,** town of Southern Italy, province of Caserta, in a fertile region, and considerably frequented for its mineral waters. P. 7375.

**San Felice sul Panaro,** town of Italy, province of Modena, about 9 miles from Mirandola. It is a walled town, and its remarkable tower, dating from the tenth century, sustained desperate sieges during the fourteenth century. The town was generally in the possession of the house of Este throughout the period of its greatness. P. of commune, 9034.

**San Felieu de Guixols,** town of Spain, province of Gerona, has a good harbor and 6515 inhabitants.

**San Feli'pe,** town of Venezuela, South America, was founded in the middle of the last century by emigrants from the Canary Islands, who are extensively engaged in the cultivation of coffee, sugar, cacao, and indigo. P. 7000.

**San Felipe,** p.-v., Austin co., Tex., on Brazos River. P. 238.

**San Felipe,** tp., Kinney co., Tex. P. 161.

**San Feli'pe de Aconca'gua,** town of Chili, in an elevated valley watered by the river Aconcagua and well cultivated. It has copper-mines in its vicinity, but lacks good drinking-water. P. 12,000.

**San Feli'pe de Ja'tiva,** town of Spain, province of Valentia, at the confluence of the Albayda and Guadamar, contains many Roman and Moorish remains, is regularly

built, and has extensive quarries of rock-salt in the vicinity. It is the birthplace of Ribera. P. 15,631.

**San Fernan'do,** city of Spain, on the Isla de Leon, 7 miles S. E. of Cadiz, is connected with the mainland by a substantial Roman bridge. It has manufactures of salt (extracted from vast marshes along the shore), soap, leather, and liquors. P. 18,000.

**San Fernan'do de Apu're,** town of Venezuela, South America, on the Apure, is finely situated, but has suffered severely several times from conflagrations. The climate is extremely hot, but not unhealthy. P. about 6000.

**San Filip'po d'Argi'ro,** town of Sicily, province of Catania, near the Salso, is the birthplace of Diodorus Siculus, and has large marble-quarries in its vicinity. P. 11,204.

**San'ford,** county of N. W. Alabama, bordering on Mississippi, watered by affluents of Tombigbee River, has a rolling surface and a fertile soil. Staples, Indian corn, cotton, sweet potatoes, and butter. Cap. Vernon. Area, 600 sq. m. P. 8893.

**Sanford,** p.-v., Orange co., Fla., on St. John's River, at the head of large steamer navigation, 200 miles S. of Jacksonville, has 3 churches, a good school, a money-order post-office, and 1 newspaper. P. about 400.

FRED. L. ROBERTSON, ED. "SOUTH FLORIDA JOURNAL."

**Sanford,** p.-v. and tp., York co., Me., on Portland and Rochester R. R. P. 2397.

**Sanford,** p.-v. and tp., Broome co., N. Y., on Delaware River and Erie R. R., includes v. of Deposit. P. 3249.

**Sanford,** p.-v., Moore co., N. C.

**Sanford** (EDWARD), son of Chancellor Nathan, b. in New York City in 1805; graduated at Union College 1824; studied law; was editor of a newspaper in Brooklyn, afterward of the New York *Standard*, of the *Times* (1836–37), and associate editor of the Washington *Globe*, organ of the Van Buren administration; returned to New York 1838; became assistant naval officer at that port; was elected in 1843 to the New York senate, in which he exercised great influence as a Democratic leader, and was a frequent contributor of poems and essays to the New York *Mirror*, *Spirit of the Times*, and *Knickerbocker Magazine*. Specimens of his graceful and humorous verse may be found in the collections of Hoffman, Griswold, Duyckinck, and Bryant.

**Sanford** (NATHAN), b. at Bridgehampton, Long Island, N. Y., Nov. 5, 1779; studied law, and began practice in New York City 1799; was appointed by Jefferson U. S. district attorney for New York 1803, a position which he held twelve years; was elected to the New York assembly 1811; became Speaker of that body, and afterward State senator; was a member of the State constitutional convention 1821; served two terms in the U. S. Senate (1815–21 and 1825–31), and was the successor of Kent in the chancellorship of New York, holding that office from 1823 to 1825, when he resigned on account of ill-health. D. at Flushing, N. Y., Oct. 17, 1838.

**San Francis'co,** county of W. California, consists exclusively of the city of SAN FRANCISCO (which see).

**San Francisco,** the chief city of North America on the western coast, and cap. of San Francisco co., Cal., in lat. 37° 48′ 26.6″ N. and lon. 122° 24′ 39.6″ W., on the end of a peninsula there 6 miles wide and 20 miles long, separating the S. arm of the bay of the same name from the Pacific Ocean. In law it is designated as "the city and county of San Francisco," the functions of city and county government, usually separated elsewhere in the U. S., being consolidated. Its area is 42 sq. m., including, besides the entire end of the peninsula across to the ocean, Goat Island, with 141 acres, 2 miles E. of the peninsula; Alcatraz Island, with 30 acres, 1 mile N. of the peninsula; and the Farallones, six rocky islets 24 miles off shore in the ocean. Nearly half the area is a high rocky hill, rising in several points to 800 feet above the sea, and about 4 sq. m. in the N. W. are sand-dunes. The site now shows a large area of level land, but much of this has been supplied by art, the original inequalities of the surface having been graded away. Not less than 300 acres of the bay have been filled in, and the total expense of grading has been $30,000,000 or more. The business part of the city covers a district about a mile square in the N. E. corner of the peninsula, and the residences extend several miles farther to the W. and S. The harbor is part of a bay 50 miles long and 5 miles wide, has an entrance 35 feet deep at low tide and 1 mile wide, and on the anchorage along the city front there is abundant room, with excellent holding ground and a depth of 40 feet, which increases to 400 feet in the narrowest part of the Golden Gate, as the outlet of the bay is styled. The conformation of the country W. of the Rocky Mountains is favorable to the maintenance of a great city on the Bay of San Francisco, the converging point of the most convenient channels of trade in the interior of the continent, possessing the only large, deep harbor easy of entrance between Mazatlan and the Strait of Fuca, a distance of 2000 miles, with a rich country in the vicinity and navigable streams and good routes leading inland. The coast is peculiarly poor in good harbors, and this poverty contributes to give San Francisco its great relative pre-eminence, monopolizing, with trifling exceptions, the exports and imports on a coast as long as that from Florida to Maine, and having one-fourth of the entire population of the western slope of the U. S., while New York has not one-twentieth on the Atlantic side.

The city is supplied with water from Pilarcitos Valley, 20 miles to the S., where the rain-water is caught in a large reservoir, and artesian water is found at depths varying from 120 to 160 feet, though from many wells the water must be raised by pumping. Some hotels and mills are supplied in this way. The climate, a description of which may be found in the article on CALIFORNIA, is salubrious, the city being protected by the almost unbroken coolness of its temperature and the strength of its breezes, blowing fresh from the ocean every day through the Golden Gate, against many of the influences that elsewhere foster disease. The yearly number of deaths for each 1000 inhabitants is 20, a proportion exceeded in all other seaport cities of equal size. The heavy fogs in summer are pernicious to asthmatics, and consumptives find better climates in other parts of the State. In the year ending June 30, 1875, there were 210 coroners' inquests, including 68 accidental deaths, 58 suicides, and 29 murders.

*Wealth, etc.*—The assessed value of the land within the city limits is $126,000,000, of the buildings $42,000,000, and of the personal property $68,000,000, but the real total value of the city property—though the assessor's report, excluding mortgages, shows only $236,000,000—is not less than $400,000,000; and the residents and business-men of the city own $200,000,000 elsewhere; so that the wealth of San Francisco may be set down at $600,000,000. There are 21 commercial banks, with $40,000,000 banking capital and deposits, and there are 14 savings banks, with 71,000 depositors and $60,000,000 deposits. The dividends paid in 1875 by companies incorporated in the city amounted to $26,000,000, including $15,500,000 by mining companies, $6,000,000 by banks, $2,100,000 by Central Pacific R. R. Co., $1,500,000 by the gas and water companies, $900,000 by miscellaneous companies. More than two-thirds of these dividends are derived from property situated outside of the city; and the companies which paid the $26,000,000 dividends do not own one-twentieth part of the property in the city. The sales of city real estate amounted to $35,000,000, and of mining stocks in the stock boards to $260,000,000 in 1875. The speculation in mining stocks is a prominent and peculiar feature in the business of San Francisco. When the silver-lodes in Nevada were discovered the capitalists of San Francisco were required to supply money to open the mines and to build mills, and having incorporated the companies and kept among themselves the books in which the ownership of the shares is regis-istered, they thus anchored the chief market for the sale of the stock. Though the aggregate of the transactions is far less than in the stock boards of New York, London, Paris, or Berlin, yet the fluctuations are more rapid and greater in percentage, and the influence is more keenly felt in general business. It was a wonderful piece of good luck for a comparatively small city to get complete control of such wealth as the Comstock Mines, but their ownership has two sides to it; for while one set of mines had paid out $70,000,000 in dividends, another set had collected $40,000,000 in assessments before the end of 1875. Three companies had collected each more than $2,000,000 in assessments; five others, each more than $1,500,000; three others, each $1,000,000 or more; and ten others, each more than $500,000; and most of these assessments were levied to work mines that never paid a dividend, and never succeeded even in finding any considerable body of ore; while many of the most productive mines had to spend large sums before the rich deposits were reached. The annual tax paid in the city for State and municipal purposes is $5,500,000, in addition to $9,400,000 for Federal purposes ($8,000,000 as duties on foreign imports, and $1,400,000 as internal revenue), making a total of $14,900,000 paid as taxes in San Francisco in one year. The funded debt, after deducting money in the sinking funds, is about $3,500,000 in gold, and the rate of interest is 6 or 7 per cent.

*Commerce, etc.*—Business is wonderfully active. Most of the people, having come to California as adventurers, are energetic; wages, rents, rates of interest, and the value of land are high; and the statistics show that in proportion

to the tributary population no city on the shore of the Atlantic has commercial or financial transactions so extensive. Land is sold by the foot of frontage on the street, the depth being usually from 70 to 130 feet, and the price without buildings on the most thronged portion of California street is $4000 a foot, while on parts of Montgomery, Market, and Kearny streets it is half as much or more. The imports direct from foreign countries (considerable quantities of imported merchandise are brought by rail, steamer, and sail from New York) were in 1875 worth $33,000,000, including 6000 tons of coffee, 9500 tons of tea (of this 6500 tons were sent by rail to New York), 25,000 tons of sugar, 540,000 tons of coal, and $5,200,000 of treasure. The total receipts of treasure from domestic and foreign sources were $48,600,000; the exports of treasure were $42,900,000, and of merchandise $31,000,000, making a total of $73,000,000 of exports. The leading articles of merchandise exports were wheat, flour, canned and salted salmon, quicksilver, wool, hides, leather, lumber, silver ore, and borax. The commercial statistics of CALIFORNIA, as given under that heading, belong almost exclusively to San Francisco. The lumber received in 1875 was 300,000,000 feet, board measure. The number of passengers who arrived by sea was 32,200, and by rail from the Eastern States 74,900; of those departed by sea, 12,600, and by rail 30,400, leaving a net gain to the population of the Pacific States and Territories of 64,000. The sea-going vessels that arrived in San Francisco numbered 4350, measuring 1,590,000 tons, including 3626, measuring 858,000 tons, from domestic Pacific ports, leaving 624, of 732,000 tons, from foreign and domestic Atlantic ports. Forty-three ocean steamers run from San Francisco, including 8 to China, 6 to Panama, 3 to Australia, 17 to domestic ports on the southern coast, and 9 to domestic ports on the northern coast; and 30 steamboats built for inland navigation run to points on the bays and rivers tributary to the Golden Gate. By reason of the deep strait on the N. and the bay on the E., the only railroad entering the city comes from the S.; but Oakland, Vallejo, Donahue, San Quentin, and Saucelito, where the other roads of the State terminate, send a steamboat after the arrival of every regular passenger-train to San Francisco, which is thus made practically the main terminus of the entire railroad system of California, traversing all its main valleys, reaching to the end of the Sacramento Valley in the N., to the Colorado desert in the S., and connecting in the E. with the network of the Atlantic States. In 1875 there were 553 manufacturing establishments, employing 18,000 men, and producing articles worth $40,000,000 a year. In making cigars 4000 persons were employed; in boots, shoes, and slippers, 2300; in iron foundries, 1240; in bedstead and furniture factories, 1200; in pickling establishments, 950; in woollen mills, 900; in shirtmaking, 750; and in sash and door factories, 500. Among the articles manufactured are billiard-tables, boxes, brooms, brushes, candles, carriages, cordage, flour, glass, furs, gloves, belting, fire hose, jewelry, shot, lead pipes, lasts, macaroni, matches, dynamite, rolled iron, saws, silk thread, silk ribbons, shirts, soap, leather, type, windmills, and willow-ware.

*Architecture, etc.*—Among the notable features in the appearance of San Francisco are the large proportion of wooden houses, the elegance of their external ornamentation, the abundance of bay windows, the extensive use of asphaltum for sidewalks, the number and magnificence of the hotels, and the lack of shade trees. Of the 25,000 houses, 20,000 are built of wood, which is preferred because it is less liable to injury by earthquakes, it does not soak up moisture as readily as does brick (the only other common building material), and it is cheaper. Many of the wooden houses are three, four, five, and some even six stories high. The wood renders ornamentation cheap, and is usually painted on the outside with a light color. The bay windows are liked, and shade trees disliked, because the average temperature, even in midsummer, is too cool for comfort in idleness, and the people want to catch all the sunshine within reach. The general condition of the roadways in the streets is bad. Cubical blocks of trap and granite and cobble-stones are used for paving, and many of the streets where the land is cheap are covered with fir planks 4 inches thick; most of the sidewalks are made with planks 2 inches thick. The Palace Hotel, reputed to be the largest and most commodious building of the kind in the world, is 350 by 275 feet on the ground and 7 stories high, with accommodations for 1200 guests. The site cost $1,000,000; the building, $1,750,000; the furniture, $500,000; making a total investment of $3,250,000. The Baldwin Hotel, erected at a cost of more than $1,000,000, has a front of 186 feet on Market and 275 on Powell street, a height of 6 stories, and 480 rooms, with accommodations for 600 guests. The Palace was finished in 1875 and the Baldwin in 1876, and before their erection the hotels of San Francisco were considered unsurpassed in excellence. The Occidental and Cosmopolitan hotels can each accommodate 400 guests, the Lick House 350, and the Grand Hotel 300, so that there are now accommodations for 3250 guests in first-class hotels in San Francisco. There are 5 theatres used for dramatic representations of high character. Wade's Opera-house has seats for 2500 persons, the California Theatre for 1800, Baldwin's Opera-house for 1700, Maguire's Theatre for 1600, and Maguire's Opera-house for 1200, or 8800 seats in all, exclusive of concert-halls, lecture-rooms, Chinese theatres, and places of low grade. Among the notable public buildings are the Mint, Custom-house, and Appraisers' Store; an unfinished city hall, that is to cost when complete $4,000,000 or more; the Merchants' Exchange; the banks of California and Nevada; the Pioneer Hall; the Mercantile Library House; the Safe Deposit Building, which has 4600 safes or steel boxes let out to the general public; the Federal Marine Hospital; the City Hospital, with room for 384 patients; the Almshouse, with capacity to accommodate 500 persons; the Industrial School; the House of Correction; and hotels, theatres, churches, and many magnificent private buildings used for business and residence. There is a stone dry dock capable of receiving a vessel of 6000 tons. Formidable fortifications defend the entrance of the harbor. A public park of 1050 acres, 3 miles long and half a mile wide, offers a beautiful drive to the ocean-beach, where a strong surf rolls perpetually, and from its more elevated points the park commands extensive views of the ocean, bay, Golden Gate, and city, and mountain ranges and peaks to the N., E., and S. There are besides 11 public squares, and a pleasure-garden open to the public, with a rich variety of botanical, zoological, and artistic attractions. The accumulation of wealth, the activity of business, the excitement of speculation in the stock-market, the excellence of the hotels, the elegance of the private dwellings, the luxurious mode of living, the variety, the multitude, and the merit of the institutions of amusement and instruction, and the throng of visitors from all parts of the world, have made San Francisco a favorite pleasure resort; and there most of the Americans who make fortunes in the interior W. of the Rocky Mountains hope to enjoy their money.

*Education, etc.*—The city has an academy of sciences, a microscopical society, an art school, and a mechanics' institute, which last holds industrial fairs on a large scale nearly every year. Besides these, James Lick has given $540,000 for a school of the mechanic arts, and valuable property (estimated to be worth at least $1,000,000, and perhaps twice as much, the residue of a great estate devoted to philanthropic objects) to be equally divided between the Academy of Sciences and the society of California Pioneers, the latter association being formed, as its constitution declares, for "moral, benevolent, literary, and scientific" purposes. There are 18 public libraries, with 140,000 volumes, the largest being the Mercantile, the Mechanics', and the Odd Fellows', with 100,000 volumes. There are 3 literary colleges and 1 medical college. The free schools number 69, with 510 teachers, and an average daily attendance of 21,000 pupils, maintained at an annual expense of $800,000, and 10,000 children attend private and sectarian schools. Of periodicals there are 84, including 13 daily and 34 weekly newspapers, and 6 semi-monthly and 29 monthly publications. The benevolent associations, exclusive of the secret orders, number 30, including one for each of the leading nationalities represented in the local population. There are 3 government and 5 private hospitals, 4 asylums for foundlings and orphan children, and 4 for destitute or friendless women; and James Lick has given $150,000 for a free bath-house and $100,000 for an old women's home, not yet erected. There are 30 lodges or associations of the Masonic order, 25 of Odd Fellows, 16 each of Druids and Improved Red Men, 12 of Knights of Pythias, 9 each of Hibernians and Independent Red Men, 7 each of the B'nai B'rith and Kesher Shel Barzel, 5 of the American Protestant Association, 4 of Knights of the Red Branch, and 1 each of the Foresters, Seals, White Men, Knights of St. Patrick, and Grand Army of the Republic, making 145 lodges or societies with jurisdiction not extending beyond the city; and in addition to these there are about a dozen grand lodges of these same secret orders with more extensive jurisdiction. The city has 85 religious congregations or churches, of which 5 are Jewish, 14 Roman Catholic, and 66 Protestant, the last representing 18 different sects. Six European languages besides English are used in regular Christian worship, and in half a dozen buildings occupied by Chinese there are rooms set apart for Booddhistic worship. An Episcopal bishop and a Roman Catholic archbishop have their residences in San Francisco.

*History.*—The first white settlement was made in Oct., 1776, by the establishment of a Spanish military post and

a mission of Franciscan friars to convert the Indians. The latter was maintained till 1835. The next year a town called *Yerba Buena* was laid out, and the first house in it was built by an American. The name was changed to *San Francisco* in 1847, when it had 450 inhabitants; in June of the next year it lost most of its male residents on account of the attraction of the gold-diggings, and in 1849 it had become a world-famous seaport city. The harbor was filled with ships deserted by their crews, a large part of the population lived in tents, and the prices of many of the comforts of life were enormous. Within fourteen months after Dec. 20, 1849, the town was devastated by five great fires, which swept away every building in the business district and destroyed property worth $16,000,000 in the aggregate. Every fire was immediately followed by the erection of much better buildings, but for years the merchants stored many of their goods in ships anchored beyond the reach of any extensive conflagration. The increase of $10,000,000 annually in the gold production for the first five years after the mines were opened led the people to suppose that the same ratio would continue; but in 1854 the gold yield began to decline, wages fell, the importations decreased, and many dwellings and business-houses were left vacant. After the lapse of five years more the development of the agricultural resources of the State, the discovery of the Comstock Lode, and various other favorable circumstances brought in new elements of prosperity, upon the flood-tide of which the city rode till 1869, when land speculation, overcalculating the benefits to be derived from the completion of the Transcontinental R. R., led to a panic, the pernicious effects of which were felt for several years. Notwithstanding seasons of depression in certain occupations, general business has always been active and wages high. In 1851 and 1856 vigilant committees, or extra-constitutional organizations of the people, took control of the city to purge it of scoundrels, and most of their proceedings were governed by prudence and justice. During the greater part of the time from 1856 to 1876 the city government was in the hands of independent political parties, which excluded the national political parties, as far as possible, from influence over the nominations for office, and the administration was exceptionally good. The city has been visited by many earthquakes, most of them so slight that inquiry was necessary to determine whether the shaking was not imaginary or due to some other cause. No wooden building and no brick house well built on a solid foundation has ever been seriously injured, nor has any person been hurt in a house, though on Oct. 21, 1868, five persons were killed in the street by loose bricks falling from the tops of houses or chimneys. Tall brick houses are now tied by iron rods as security against such shocks. The population, according to the Federal census, was 34,000 in 1850, 56,000 in 1860, and 149,473 in 1870, in the last-named year including 12,000 Chinese and 48,000 persons of European birth. The estimated population in 1875 was 230,000. (For additional information see *The Annals of San Francisco*, by Frank Soulé; *The Colonial History of San Francisco*, by J. W. Dwinelle; *The History of California*, by F. Tuthill; *The Resources of California*, by J. S. Hittell; and the *City Directories*, by H. G. Langley.) JOHN S. HITTELL.

**San Francisco,** tp., Carver co., Minn. P. 754.

**San Francisco Bay.** See SAN FRANCISCO and CALIFORNIA.

**San Fratel'lo,** town of Sicily, province of Messina, on a hill about 4 miles from the Tyrrhene Sea, and commanding fine inland and marine views. The fruits and wines of the vicinity are of the best quality, and game is most abundant. P. 7489.

**San Ga'briel,** p.-v. and tp., Los Angeles co., Cal., on San Gabriel River, is an ancient Jesuit mission, celebrated for beauty and fertility, and especially for its fruits. P. 436.

**San'gamon,** county of Central Illinois, intersected by Sangamon River and numerous tributaries, and traversed by Springfield and South-eastern, Gilman Clinton and Springfield, Springfield and North-western, Chicago and Alton, and Toledo Wabash and Western R. Rs., consists of level prairies dotted with timber, and has some deposits of bituminous coal; has numerous manufactories of carriages and saddlery, as well as flouring and saw mills. Staples, Indian corn, wheat, oats, hay, potatoes, honey, wool, and butter. Cattle, sheep, and swine are numerous. Cap. Springfield, which is also the State capital. Area, 936 sq. m. P. 46,352.

**Sangamon,** tp., Piatt co., Ill. P. 1380.

**San'gerfield,** p.-v. and tp., Oneida co., N. Y., on Utica division of Delaware Lackawanna and Western R. R., includes v. of Waterville. P. 2513.

**Sang'erhausen,** town of Prussia, province of Saxony, on the Grenau, at the foot of the Harz Mountains, has copper-works and manufactures of vitriol, saltpetre, and linens. P. 7571.

**San German',** town of Porto Rico, West Indies, is about 10 miles from the sea, and has 9000 inhabitants.

**San'gerville,** p.-v. and tp., Piscataquis co., Me. P. 1140.

**San Gil,** or **Saint Giles,** town of New Granada, South America, in lat. 6° 25′ N., lon. 73° 40′ W., has about 10,000 inhabitants, mostly engaged in the cultivation of sugar and tobacco.

**San Gimignano,** Italy. See APPENDIX.

**San Ginesio,** Italy. See APPENDIX.

**San Giorgio Morgeto,** Italy. See APPENDIX.

**San Giovanni a Teduccio,** Italy. See APPENDIX.

**San Giovanni in Fiore,** Italy. See APPENDIX.

**San Giovanni in Persiceto,** Italy. See APPENDIX.

**San Giovanni Rotondo,** Italy. See APPENDIX.

**Sangir' Islands,** a group of 50 islands, most of which are inhabited, between Celebes and Mindanao, in lat. 3° 28′ N., lon. 125° 44′ E. They are high, volcanic, and produce maize, rice, sago, cocoa, sugar, tobacco, and timber. They are inhabited by about 30,000 Christian Malays, who live in different kingdoms subject to the Netherlands.

**San Giuseppe Jato,** Sicily. See APPENDIX.

**Sangkoi, Songca,** or **Tonquin,** river of Farther India, rises in Yunnan, a province of China, and falls, after a course of about 600 miles, into the Gulf of Tonquin, in lat. 20° N. and lon. 106° E.

**Sangor,** town of British India, presidency of Agra, near the Nerbudda, in lat. 23° 50′ N., lon. 78° 29′ E., at an elevation of 1458 feet above the level of the sea. It is a military station, and a large, lively, but somewhat unhealthy place. P. estimated at 50,000.

**San'greal** (*i. e.* the *Holy Grail*, or "cup," or, according to others, the *Sang Réal*, the "real blood" of Christ), according to mediæval legends, the cup of emerald which held the wine at the first celebration of the Lord's Supper. St. Joseph of Arimathea, it is related, received some of the blood of the Lord in this cup at the crucifixion. Finally, when the Holy Grail was carried away and hidden by the angels, a quest for it was instituted, it being revealed that no one who was not perfectly pure in thought, word, and act could ever find it. King Arthur's knights of the Round Table were prominent participants in the quest.

**Sanguinaria.** See BLOOD-ROOT.

**San'hedrim,** correctly **Sanhedrin** (סַנְהֶדְרִין), a corruption of Greek *συνέδριον*, "assembly;" also called בֵּית דִּין, "court." There are two classes to be distinguished.

A. *The Great Sanhedrim.*—The Jewish tradition traces its origin to the seventy councillors appointed by Moses (Num. xi. 16–25; comp. Ex. xviii. 13–26), and asserts its existence at all periods of the nation's history until after the destruction of Jerusalem by the Romans. But the council appointed by Moses was merely temporary in character, and there is not the slightest evidence of the existence of any such body during the times of the judges and kings. Most probably it was formed at some period subsequent to the Captivity, on the model of the old council of Moses. Strongly confirmatory of this is the Greek name, which points to the period of the Seleucidæ. The earliest reliable trace of its existence is under the Maccabees (2 Macc. i. 10; iv. 44; xi. 27; 1 Macc. xii. 6). It was in full activity at the time of Herod (Joseph., *Ant.*, xiv. 9–4). And we find constant mention of it in the New Testament (Matt. xxvi. 59; Mark xiv. 5, xv. 1; Luke xxii. 66; John xi. 47; Acts iv. 15, v. 21, 27, 34, vi. 12, 15, xxii. 30, xxiii. 1, 6, 15, 20, 28).

*Jurisdiction.*—It was the supreme "privy council" of the Jews; not only their court of final appeal and last resort, but also an executive and legislative assembly, shaping the general polity of the nation. Its power in matters civil and religious was practically unlimited. It decided all cases brought upon appeal from the lower courts; it had authority over kings and high priests; in it was vested the trial of heresy, idolatry, false prophets (hence the active part they took against our Lord); and it alone had power to pronounce sentence of death. Its active jurisdiction was confined to Judæa, but the Jews in all parts of the world seem in some degree to have recognized its authority. Owing to the inability to check the constant disorders during the last years of the Jewish commonwealth, its power was greatly curtailed by the Romans, and three years before the death of Christ the right of executing sentence of death was denied, save when confirmed by the Roman authorities (John xviii. 34). In the unsettled condition of

affairs attending the fall of Jerusalem it found itself unable to execute civil authority, and from that time until its extinction in the third century its power was merely nominal.

*Constitution.*—It had seventy-one members (some say seventy or seventy-two), chosen from those who were distinguished in birth, learning, or position. In the New Testament are mentioned—(1) Priests (ἀρχιερεῖς), chiefs of different orders of priests; (2) elders (πρεσβύτεροι), those venerable from age or position; (3) scribes (γραμματεῖς), those learned in the law and tradition. Its officers were—president (נָשִׂיא, "chief"); first vice-president (אַב בֵּית דִּין, "father of the court"); second vice (חָכָם, "judge"); besides a force of secretaries and court officers (Luke xxii. 52).

*Place of meeting*, in Jerusalem, in a room immediately adjoining the temple, called לִשְׁכַּת הַגָּזִית ("hall of squares"). Their meeting in the house of the high priest for the trial of our Lord does not seem to have been legal. After the fall of Jerusalem they removed to Tabneh, and finally to Tiberias, where the Sanhedrim became extinct A. D. 425.

B. *The Lesser Sanhedrim.*—A court of twenty-three members appointed by the Great Sanhedrim, sitting in all towns of over 120 inhabitants, with jurisdiction over local civil and criminal matters. (See Matt. v. 22, x. 17; Mark xiii. 9.)

*Literature.*—Selden, *De Synedriis et Præfecturis Juridicis Veterum Ebræorum* (1650), a mine of learning and the great source from which all knowledge of this subject is drawn, but containing a mass of irrelevant matter; Ugolini, *Thesaurus*, vol. xxv.; Lightfoot gives much valuable information, derived from the Talmud and Mishna (see *Works*); Ginsburg, in Kitto's *Bible Lexicon*, and Leyrer in Herzog's *Encyklopädie* (art. *Synedrium*), give valuable résumés of the subject, with lists of literature. T. C. MURRAY.

**San'ilac,** county of E. Michigan, bordering on Lake Huron, watered by Black and Cass rivers, has a rolling surface well covered with timber. Staples, wheat, oats, potatoes, hay, maple-sugar, wool, and butter. Cap. Lexington. Area, 920 sq. m. P. 16,292.

**Sanilac,** tp., Sanilac co., Mich. P. 1988.

**San'itary Commis'sion, The U. S.** On Apr. 15, 1861, the day on which the President's call appeared for 75,000 men, then deemed sufficient to quell the rebellion, the women of Bridgeport, Conn., organized a society with the somewhat vague idea of affording relief and comfort to the volunteers. In Charlestown, Mass., on the same day, and at Lowell a few days after, the women of those cities formed similar societies. On Apr. 19 the ladies of Cleveland, O., organized an association for the care of the families of volunteers. On Apr. 29 a public meeting, called at the Cooper Union, New York, by 91 of the best-known ladies of New York, and attended by influential women from the city and its neighborhood, formed an association known as the Women's Central Relief Association of New York, in which the principles and ideas that afterward flowered into the U. S. Sanitary Commission were first promulgated. The objects of this association were to systematize the impulsive, disorderly, and uninformed sympathies and efforts of the women of the country, so as to make effective, with the least waste of time, labor, and money, the generous and restless desires to help the young army just gathering with such supplies and protection as it was feared the government could not afford it. It is not perhaps peculiar to this country that the women are as much agitated and engrossed by the dangers and exposures incident to war as the men who are called to face them directly. But under no system of government but our own could women feel so deep a responsibility or see so ample an opportunity for supplementing the defects of the governmental care. Besides, it was felt from the first in our late war that the very life of the country was at stake, and that the homes, the hopes, the honor of the American nation were desperately threatened. This feeling sooner or later drew 2,500,000 different men into the field from all classes and ranks in life, and of these one-eighth of all were in their 19th year, about three-tenths under 21, one-half under 23½, and three-quarters under 29½ years of age. Perhaps the first draft of 75,000 had in it as many or more youth under 20 years as any later drafts. It is easy to understand how anxious and tender were the home-feelings that accompanied these striplings into the field. The Women's Central sent a committee* to Washington to confer with the medical bureau and the war department in order to learn more definitely in what way, with least embarrassment to the government and most help to the army, the women could serve the volunteers. This committee soon discovered, what might have been anticipated, that the regular medical machinery of the government, which had been quite adequate to deal in time of peace or small Indian and other wars with a little standing army, was rusty, valetudinarian, infested with routine prejudices, imperfectly awake to the situation, and very jealous of its powers, without appreciating the difficulties that were soon to overwhelm it. It became plain to the committee that no mere organization of the humane sympathies and helpful hands of the women, or even all the people that stayed at home, could meet the case; that the government, the medical bureau, the army, and the country needed to be aroused to the fact that gunshots and cannon, wounds and death from battle, were not the enemies most to be feared in the war, but the diseases of the camp, arising from private ignorance, inexperienced officers, neglected or unknown sanitary police, the recklessness of raw soldiers, and the influences of exposure, unaccustomed food, and bad cookery. It was known to the committee that the British government had saved what remained of the frightfully decimated army of the Crimea by overriding the regular medical department with a civil commission with nearly absolute powers, which rapidly restored health and the power to achieve a successful campaign. Could a similar commission be established at the very outset of the war in advance of the necessity anticipated with too well-proven fears, instead of after the event of fearful losses by camp-fevers, the committee felt that it would be a great triumph of reason and prudence. They accordingly presented their plan to the government, based very much on the sanitary commission of Great Britain, asking for the appointment of a scientific board, to be commissioned with ample powers for visiting all camps and hospitals, advising, recommending, and, if need be, enforcing, the best-known and most approved sanitary regulations in the army.

The government not unnaturally dreaded the possible collision of such a body with the medical and military authorities, and, although feeling the force of the representations, required that the consent of the medical bureau should be obtained before such a commission was appointed. Conferences fully proved that no such consent could be gained, but that a sanitary commission of inquiry and advice, *without authority* of any kind, might be endured, though it would not be welcomed, as an act of deference toward a respectable body of supposed fanatics or philanthropists, backed by a large class of anxious and sympathetic women. And in fact, after great difficulties, this was all the committee gained—the appointment of a doubtful semi-official commission, with the privilege of advising with the medical bureau, of visiting the army in the field, and of recommending to the war department such sanitary regulations and reforms as it might deem useful. The commission, as compared with the British, might be said to have been born paralytic—to have promised nothing but a paper existence, and a speedy death after ignominious failure to fulfil any of its hopes. If it had depended on the government or the medical bureau, as it proposed to do—not for pecuniary support, but for hearty sympathy and co-operation—it would have died in its infancy. But, happily, although it did not realize it at the time, and was nearly discouraged and hopeless of the usefulness it had dared to plan out, there is a dependence in a country accustomed to self-government on public opinion and the better instincts and sympathies of the nation which in times of danger and war may be trusted, and which the U. S. Sanitary Commission soon found more than an offset to the loss of official encouragement and official powers which they had reckoned on. Without powers, without pecuniary support, without any immediate sympathy even from the people in their main object, which was scientific and preventive, they flung themselves upon the merits of their cause, and upon the secondary purpose, which was intelligible and popular, the relief of suffering and want, and went to work in faith that somehow they should effect at least a moderate amount of good, if not what they could have hoped had they been armed with governmental powers to enforce sanitary laws.

A few things became soon obvious, and guided their course:

1. The great object of the Commission must be to develop, strengthen, and support the regular medical and military authorities and methods—to stimulate the departments having the supply of food, transportation, camp equipage, drainage, and incite them by kind and wholesome criticism and counsel, and by the force of public opinion, to do their utmost for the prevention of pestilence and the spread of scurvy, and the lessening of needless exposures of every kind. Any plan for taking the place of the regular authorities, or supplanting instead of

* The committee consisted of Dr. W. T. Van Buren, Dr. Harsen, Dr. Harris, and the writer.

supplementing their efforts, would have been as injurious to the prospects of the soldiers as offensive to the military and medical officers. The government had money, transportation, stores, and final responsibility. It was the soldier's richest, ablest, and most constant friend. To make the government feel this to the utmost, and the soldiers to recognize and lean upon it, was the true policy of the Commission—never lost sight of from the beginning to the end of the war. But this was the last thing the people at home would believe. They appreciated neither the importance of strict military discipline, the indispensable value of what is so foolishly stigmatized as *red tape*—meaning order and method—nor the utter folly of any outside or philanthropic association attempting to step in between the army and the government to meet the daily and ordinary wants of a million of men. The service the Sanitary Commission—which early understood all this—rendered the country was by standing between the army, as cared for by the government, and the country, which expected impossibilities, and proposed to take care of the army by countless State, county, and town committees, and, while defending military discipline and strictly conforming to it, pacifying the fears and representing the solicitudes of home by doing all that could be done to supplement governmental shortcomings, while prompting, sustaining, and leading, if needs be, such reforms in the medical and sanitary care of the army as would make the governmental administration efficient.

2. The Sanitary Commission became very early in its history thoroughly convinced that to *prevent* evils to the health of the army was greatly more important and serviceable than to attempt to cure them after they appeared. It accordingly gave its attention chiefly, from first to last, to *prevention*, by a system of camp inspection and the promulgation of counsels touching the choice of camp sites, the importance of drainage and police, and the character and cooking of food. By the appointment of skilled medical inspectors it established at once an advisory and tolerably friendly relation with the surgeons of all the regiments in the field, and by supplying them with short medical and sanitary essays, and engaging them by direct personal appeal and co-inspection in the practical enforcement of hygienic and sanitary regulations, it aroused and maintained, or else supported and elevated, a general zeal in this all-important principle and plan of prevention. The surgeons of the volunteers were not seldom among the best practical physicians of the country, but they were generally of a less valuable and accomplished class of doctors. But they were usually found willing to learn, and were persistently urged and warned of the duty to prevent sickness by the medical inspectors of the Sanitary Commission, until the intelligence and experience of the medical bureau had acquired the power of maintaining its own authority and enforcing its own enlightened policy. It is not too much to say that coaxing, instructing, and urging the regimental surgeons were for a long time more efficient in promoting the preventive service than any orders from head-quarters. But as it was the rule for the Sanitary Commission to seek admission into every department, corps, camp, or regiment from the officers in command, and to do nothing without their consent and approval, it ought to be added that by deference, patience, modesty, and tact its agents gradually overcame to a large degree the natural jealousy and distrust of the generals and officers, both military and medical, and had in most cases, if not their personal support and sympathy, their forbearing sufferance and official furtherance. There never was, there never could be, a wholly cordial relationship between a body of unofficial meddlers, who were charged with representing the sentimental feelings of the women at home, and the officers of the army, particularly the under officers. And probably it was just as well that they did not wholly coalesce. Had the military and medical officers been without jealousy or dislike of the Sanitary Commission and its agents, they might have been less active and willing to notice the defects in the service. They would have been friends, and not critics. The coldness and caution with which the government from first to last treated the Commission, from the cabinet and the medical bureau to the generals and surgeons in the field, was a salutary restraint upon what might easily have become an ill-judged, unmilitary, and intermeddling exercise of merely domestic and popular wishes and sympathies, enervating, demoralizing, and worse than useless. It was in this attitude of suspicion, jealousy, and check that the Commission began, continued, and ended. It acquired its caution, its knowledge of war, and how to deal with army wants, its etiquette and subordination, its painstaking foresight and watchfulness of legitimate opportunities, in this chilling atmosphere, which hardened its own muscles and cooled its brain, while perhaps it only made its heart beat with a deeper and warmer pulse.

Among the *preventive* policies of the Sanitary Commission was the prevention of incompetency, inefficiency, and contracted ideas in the medical bureau. It soon took a sufficiently modest view of its own usefulness to discover that all it could render in the way of actual comforts and supplies was a miserable offset to what the army must be steadily losing by any needless ignorance, incompetency, or want of energy in the medical bureau. Doubtless in due time the government, which earlier discovered the necessity of setting aside the rule of regular succession in all the other bureaus in favor of qualifications and vigor, would have seen the necessity of putting younger blood and firmer hands and more inventive minds in charge of the medical bureau. But from its technical nature the medical department would be the last the government would either understand or criticise. The Sanitary Commission soon concluded that the greatest service it could render the army would be to direct the attention of the government and of Congress to the necessity of reforming the *personnel* and the spirit of the medical bureau, and it had the satisfaction, at the risk of its own existence, of accomplishing this vital object.

Another *preventive* measure which it inaugurated was the suggestion, and finally the erection, of pavilion hospitals from its own models, designed to make contagion and pestilence less easy and fatal. Its plans, improved upon and enlarged, became the type of the great general hospitals which were erected at the base of our armies, and became such wonderful sources of relief to our sick and wounded men.

Among the earliest services of the Commission was the establishment of soldiers' homes at the chief places where new regiments were concentrating, to take care of the sick and supply the defects in the expanding but unperfected arrangements of the quartermaster's bureau for receiving them. Thousands of men arrived at Washington and Louisville hungry, sleepless, half sick, who had to wait perhaps twelve hours after leaving the cars before their quarters in camp were ready or their officers knew how to draw their rations. Temporary homes, where the sick could be sheltered and nursed, and from which whole regiments could be supplied with coffee and food, were extemporized by the Commission at or near the railroad dépôts, and later developed into a complete system of soldiers' homes, in which the estrays, the men passing from the hospitals to their regiments, the convalescents, and men who had lost their papers were, through the whole war, received and tenderly cared for—to an extent which averaged about 2000 soldiers daily for the whole four years of the war.

As soon as the capture of Fort Donelson the Commission, finding the government transportation of the sick to hospitals very rude, inadequate, and cruel, began to organize a system of hospital steamers. The several States were already doing something in the way of transporting more carefully in steamers supplied by themselves, each its own wounded men. But this discrimination was felt to be not only impolitic, but dangerous to the Federal feeling, which forbade the soldiers from bearing any less patriotic title than the common name of "national." The Commission therefore set its face against State distinctions, either in the distribution of supplies or the care of the sick and wounded. Its hospital transports were the earliest form in which it came into collision with State and local partialities, but it had a long and painful controversy with this natural but unwise and injurious prejudice through the whole war; and it always considered that one of its chief objects was to discountenance and abolish the treatment and aid of any soldiers otherwise considered than as national soldiers, each and all possessing equal claims on the care of the country and the Commission. The hospital steamers of the Commission, supplied with every comfort, with surgeons and nurses, plied between the ports nearest to the seats of war and the nearest general hospitals, and transported in comparative comfort tens of thousands of sick and wounded men to the places where their cure was to be attempted or their sufferings made tolerable to the end.

But it was not all or most of the wounded who could enjoy the privilege of water-carriage. The cars in which the largest portion were transported were places of torture to wounded men, who were jolted over the rough roads, sitting up in their faintness or lying about the floor of freight cars. The Commission devised a sort of hospital car, in which the common stretcher upon which the wounded man was carried from the field could be converted into a hanging bed in the car. The car was so hung on gutta-percha springs as to obviate all jolting. Food, medicine, hot drinks, and surgical attendance were provided in each car, and trains of these cars were regularly run by the Commission until the system was adopted by the medical bureau and the duty transferred to the government. Dr. Elisha Harris was the inventor of the hospital car.

*Supplemental Hospital Supplies.*—It was a popular error through the war, and remains such since, that the main object and chief service of the Sanitary Commission was to supply the army with food, dainties, flannels, stockings, and handkerchiefs over and above what the government could or would supply. Doubtless this was the original impulse in the early days when all the women of the country were excited about the "lint and bandage question;" and certainly it was the desire to meet these supposed wants that induced the framers of the Commission to go to Washington and study the question. But the very name the committee chose for the new Commission proves that they had put the *preventive* service before the relief service in their plan, and designed to keep the supply of food and clothing and comforts quite secondary to the object of preventing sickness and suffering by teaching, urging, and enforcing, so far as their influence went, sanitary regulations. The people at home could, however, know little of, and do nothing for, the preventive service except give their money to support it; and this they could never have been induced to do directly. The relief of actual suffering from want of food, clothing, niceties, medicine, stimulants, anybody could appreciate. Accordingly, the Commission in its home field had to organize a system of supplies, which at length became so vast and so nearly universal that the collection and distribution of these supplies stood for the whole work of the Commission in the popular judgment. The wants of the hospitals and camps very early in 1861 had exhausted 60,000 articles which the spontaneous sympathy of the homes of the country had forwarded to the Commission. By September of that year it became plain that a demand for extra food and extra clothing was going to exceed anything that the unorganized and intermittent beneficence of the people would furnish. The Commission was reluctantly forced to acknowledge that the government could not provide for the humane treatment of all its sick soldiers in a measure likely to satisfy the homes of the land. And it was felt that the furnishing of extra supplies, if left to the impulse of different neighborhoods by different agents of their own, would become so annoying to the government and so subversive of discipline that a terrible conflict of ill-feeling would grow up, in case of a long war, between the government and the homes of the country out of the inevitable necessity the government would feel to preserve order and exclude a rabble of well-meaning camp-followers, and the equally inevitable necessity the homes of the land would feel to make sure that no avoidable wants or suffering were allowed to fall upon the husbands, sons, and brothers who were fighting the country's battles. Moreover, the Commission saw in the lively sympathy and desire for co-operative work among the women of the country not only an opportunity for securing all the supplies required, but a means of relieving the distress, impatience, and suspense which in a long war rends the hearts of the people at home, and tends to make them unjust critics of the policy of the war or hasty in their wishes to bring it to a premature and barren end. The success the Commission had in organizing over 7000 aid societies, which offered opportunities to millions of American women to take some active share in the war, to do something personally for the comfort of the men in the field, and to feel themselves part and parcel of the national struggle, was one of its best services. It united the women in a common array, helped to federalize and nationalize public sentiment, made the war popular at home, beguiled the impatience of mothers, wives, and sisters to recall their husbands and brothers and sons, and filled up the weary years and months with active duty instead of idle tears—with vigorous helpfulness instead of futile murmurs and longings.

The waste, the loss, the misdirection of a vast quantity of supplies for special regiments or individuals, which were entrusted to public channels of conveyance and to the care of regimental officers that could not be found, gradually made the homes of the land willing to look favorably upon a general agency like the Commission, which received no supplies having any particular designation, but held all for the general use of the national soldier. When the system of the Commission was fully explained and its pretensions and plans verified by many witnesses sent forward by local fears and jealousies to examine its work, the various aid societies began to fall in with its plan. Women's councils were convened at Washington from time to time, composed of representative women from the various centres of supplies, to agree upon plans for collecting, and to explain and make acceptable plans for distributing, supplies. A large body of associate members, selected men of weight and influence, was added to the Commission from the home fields to give the women the aid of their counsel, to collect money for the purchase of materials for hospital clothing, etc., and to explain and support the policy of the Commission. These associates were afterward not only the chief instigators of money contributions, but the inaugurators of the great fairs which so generously and magnificently fed the treasury of the Commission.

On Sept. 5, 1861, dépôts of supplies were established at New York, Boston, Philadelphia, Washington, Cincinnati, and Wheeling. Already central aid associations existed at Boston for New England, at New York for the State and part of New Jersey, at Philadelphia for Pennsylvania, Delaware, and Western New Jersey; in Cincinnati, Columbus, Cleveland, in Chicago, in Iowa, and Wisconsin, for the great Western States, which throughout the war were animated by the greatest zeal and liberality.* These and other centres had each hundreds of town and village tributaries steadily pouring into their dépôts supplies of food and clothing. They arrived at the central dépôts in boxes containing often a most promiscuous assortment of old clothes and new, stockings, handkerchiefs, dried fruits, jams and jellies, cordials and wines, carpet slippers, books, combs and brushes, the combined gifts of the richer and poorer homes, the work of women's hands or the purchase of their difficult and ill-spared savings. Often they contained every blanket in a poor home which the immediate wants of the family could spare. They were most touching collections to open and behold, and often drew tears from eyes long accustomed to read the secrets of sacrifice and love which every one of them more or less vividly betrayed. These boxes were all emptied, sorted on a system, each article marked, their sorted contents repacked, and held subject to orders from Washington. They were shipped to any point where supplies were needed or likely to be needed, to the care of agencies established at all commanding points along the lines of active war. Agents appointed by the Commission moved about the country encouraging and forming aid societies; the *Sanitary Reporter* in the West, the *Sanitary Bulletin* in the East, kept the people freshly informed of the wants of the army and the disposition made of the stores and supplies the aid societies gave. Circulars, now from Washington to the central auxiliaries, and then from the auxiliaries to their supporting aid societies, kept each village society on the alert. The immense result of this admirably-organized system secured a steady, persistent, and copious flow of supplies all through the war, which redounded to the praise of the women, who soon became as business-like, orderly, and systematic in their administration of their own societies as the best shopkeepers. At Washington in the East, and at Louisville, Ky., in the West, were seated the great distributing offices, Washington being the office from which the administrative orders and regulations proceeded. But these offices were so remote that the Louisville office had to assume great responsibilities, and often to act without any other orders than those of its own energetic chief, Dr. John S. Newberry. Vast dépôts existed in both these cities of received supplies, kept against the wants of great battle-fields, besides those which daily went forward to the order of regimental and general hospitals or to the supply of the homes, rests, and field agencies that accompanied the various corps of the army in the field. At the call of its circulars immense quantities of potatoes, onions, and other antiscorbutics were poured into the transports and dépôts of the Commission from time to time as the army was threatened with scurvy, and frequently the Commission was able to stamp out the seeds of pestilence by its supplies of fresh vegetables. It established vast kitchen-gardens at several points, and raised by the aid of volunteer labor thousands of bushels of vegetables after the supplies of the farmers had given out and the government could obtain no potatoes or onions.

It remains to show how these supplies were distributed. The word "relief," as used by the Sanitary Commission, was a technical term and embraced several distinct modes. Thus, the work of relief was *general* and *special*. *General* relief concerned the wants of the inmates of general, field, and regimental hospitals, and of men in the camp and on the march; *special* relief, the care of sick and needy soldiers in or near military dépôts, discharged men, paroled prisoners, and that vast class of sufferers known as "soldiers in irregular circumstances"—*i. e.* having no legal claim upon the ordinary provisions of the government. Another distinct form of relief was *battle-field relief*. In administering this relief the Commission was studious not to weaken the efficiency of the regular sources of relief by any gratuitous superfluity. First, the need must be plain; second, some satisfactory explanation must be given of the cause of the

*Among the numerous devoted women who labored in the forming and directing of these auxiliaries it may be allowed without invidiousness to name Miss May and Miss Stevenson at Boston, Miss Collins and Miss Schuyler at New York, Mrs. Grier and Mrs. Moore at Philadelphia, Mrs. Rouse and Miss Brayton at Cleveland, Miss Campbell at Detroit, and Mrs. Hoge and Mrs. Livermore at Chicago.

need; and third, a voucher from the surgeon showing that he had called for aid. These rules seem strict, but any looser ones would have made the Commission a curse to the army and not a blessing, as it proved.

The principles of distribution being settled, the machinery by which the gifts of the people reached the soldier, and the means adopted for estimating his needs, may be described. To each army sent on a distant expedition, and generally to each column of the main armies operating in Virginia and in the South-west, was assigned an inspector with a competent staff known as relief agents. This corps was permanently attached to, and accompanied, the army as an integral part of its organization. It had its own dépôt of supplies. The Commission owned wagons and horses, and had steamboats under its orders; and one or the other accompanied each corps loaded with supplies. The inspector, always a medical man, had it for his business to visit constantly the hospitals within his field of duty, to notice and advise with the surgeon in charge touching all wants, dangers, and defects in the government service, and to furnish such supplies as the surgeons were willing to ask in due form. The Commission, thanks to the generosity of the country, was never wanting in the means of meeting these demands. Whether it were hospital clothing and diet for the Army of the Potomac, or antiscorbutics for Gen. Rosecrans's army before Chattanooga, or Gen. Grant's before Vicksburg, or Gen. Gillmore's army on Morris Island requiring 400 tons of ice to make its unwholesome water drinkable, the Commission did not fail to meet the occasion. Relief on this vast scale in all departments of the army was the regular daily business of the Commission, and it was reduced to such a system, and the machinery so perfected, that it became at last as easy to deal with troops in Texas as with those in Northern Virginia. Of course, it was easier to deal with hospitals at the base of military operations than with the wants of remote field and regimental hospitals; but with six relief agents in the Army of the Potomac alone, with wagons and horses and men to carry out their orders and purposes, with a base of supplies to meet their calls central to their several posts, and with a great dépôt at Washington with means of communication of its own with the field-base, the system worked with wonderful success.

Of course, the character of the agents was of primary importance. The Commission would not receive any agents who would not pledge themselves for a lengthened, definite period of service, nor put any one in a responsible place until disciplined and prepared by a subordinate service. The agents were all instructed and drilled in the principles and requirements of the Commission, and were brought as nearly under military discipline as this special service would allow. They were promoted or degraded as they won or lost the confidence of their superiors. After trying the volunteer plan for a brief season, the Commission found it dearer than the plan of wages, and it was fortunate in possessing the means of hiring a choice body of agents, at a moderate compensation each, whom it could command and treat with the discipline to which unpaid agents would not submit. These men had their badges of office, and were known and respected in the army as no masters of their own time and ways could possibly have been. Whenever peculiar circumstances compelled the Commission to accept temporarily the volunteer services of men who worked for love only, they found that after a brief spurt of service under fearful pressure of battles and wounds they could not rely upon any patient continuance in the exhausting, often dreary, routine-work required from their agents. By its system of giving about the pay of army surgeons to its inspectors it secured the best services of the best men. In battle-field emergencies it accepted any volunteer aid that offered, and it was often most effective.

*Battle-field Relief.*—The unexpected circumstances of place, time, and preparation under which great battles take place necessarily expose the wounded to sufferings which no foresight of the regular authorities of the army and government can fully provide against. It was one of the main purposes and constant efforts of the Sanitary Commission, by studying the situation of our armies and the probabilities of their collision with the enemy, to place their own stores and relief corps where in case of change of strategy or accident they might be ready to supply the wants of the wounded or supplement the deficient or baffled preparations of the medical and the quartermaster's bureaus. The medical department, having no independent transportation, often suffered from the inevitable preoccupation of the quartermaster's department with the more urgent duty of forwarding military stores. The Sanitary Commission, as one of its chief means of usefulness, had wagons and horses of its own—often forty 4-horse teams at a time—and this enabled it at periods when transportation of medical stores was most embarrassed to forward medical and sanitary supplies to the seats of immediate battle far in advance of the medical department. After Antietam (Sept. 17, 1862) nearly 10,000 of our own wounded, besides many of the enemy's, were left, an immense proportion of the whole, shelterless in the woods and fields, without any adequate supply of surgeons, and with not a tenth part of needed medical stores, which were locked up in the block of the railroad between Baltimore, the base of supply, and the battle-field. A wagon-train loaded with medical stores had, however, been sent forward from the Sanitary Commission daily for some time to meet this anticipated difficulty. For four days the medical director received no government supplies, and the wounded were mainly dependent meanwhile on the stores of the Commission. Within one week after the battle the Sanitary Commission had distributed by its agents on the field "28,763 pieces of dry goods—shirts, towels, bed-ticks, pillows, etc. —30 barrels of old linen bandages and lint, 3128 pounds of farina, 2620 pounds of condensed milk, 5000 pounds of beef-stock and canned meats, 3000 bottles of wine and cordials, several tons of lemons and other fruit, crackers, tea, sugar, rubber cloth, tin cups, and other conveniences." It had succeeded in transporting from the purveyor's office in New York to the dépôt at Frederick 4000 sets of hospital clothing and 120 bales of blankets. This must serve as a sample. At Perryville, Ky., the same services were rendered; at Gettysburg, on a vastly larger scale. An auxiliary relief corps, supplementary to the field relief corps (always continued), was organized in May, 1864, to look after the wounded left behind in hospitals as the army moved on. It was designed to secure personal ministrations to the wounded by chosen men responsible to a superintendent; to meet the wounded as they were carried in ambulances with proper food and stimulants, and secure them tender carriage; to assist in carrying them to the hospitals, and there look after their comfort; to meet both their physical and moral wants; to write letters home; to provide them with reading and consolation. This corps, sometimes over 150 in number, was composed usually of educated men, and sometimes of refined women, frequently of ministers of religion, and always of humane and self-consecrated persons. This corps established "feeding-stations" to meet the long trains of ambulances, full of famishing wounded, *en route* to hospitals. At Belle Plain and Fredericksburg, after the battles of the Wilderness, they rendered great services to humanity and performed all the duties of skilled nurses. This corps had its martyrs; *e. g.* William Wilson, treacherously shot by guerillas during his efforts to promote this humane service; Charles H. Stanley; Prof. Hadley (of the Union Theological Seminary); Mrs. Barlow, wife of Maj.-Gen. Barlow; and Miss Gibson, perhaps the flower of female heroism and devotion in the whole service.

It may be stated, as an evidence of the sagacity, enterprise, and comprehensiveness of the plans for battle-field relief, that of nearly or about 700 battles or bloody skirmishes in the whole war, it is estimated that the Sanitary Commission was present by its agents and stores at about 600.

*Special Relief Service.*—Besides an elaborate machinery of hospital visitors, field relief corps, and auxiliary relief corps, there was required, as experience revealed, a very large ministration to men, without any fault of their own, in what may be called "irregular circumstances," put beyond the reach of ordinary government or army care. Early in the war new regiments, often under incompetent officers, arrived at Washington and other centres with sick men and exhausted soldiers, compelled to walk many miles to their camps, with no government provision of food for them at the dépôts. The Sanitary Commission at once established near the principal dépôts "soldiers' homes," where weak and sick men could be temporarily received, restored to health, and forwarded to camp. This was the beginning of what became a great and costly service of *special relief*. Its several objects were—(1) to supply the sick men of arriving regiments with medicines, food, and care at periods of confusion and under circumstances when they could not be obtained "regularly;" (2) to furnish lodgings, food, and furtherance to soldiers honorably discharged from service or dismissed from general hospitals or from their regiments, but delayed on their way by inability to procure their papers and pay; (3) to communicate with distant regiments in behalf of discharged men and obtain their corrected papers and pay when too sick or weak to go in person; (4) to act as unpaid attorneys for soldiers too feeble to present their own claims at the paymaster's; (5) to aid discharged men without means, if worthy, to reach their homes; (6) to protect disabled soldiers from swindlers in the shape of ticket-agents and sharpers on their way home, procuring them railroad tickets at reduced rates, etc.; (7) to see that discharged and paid men started

for home before being seduced into squandering their pay; (8) to make reasonably clean and comfortable before leaving for home discharged soldiers reduced by misfortune and sickness to self-neglect; (9) to meet at once with food and other aid the necessities of sick men forwarded in large numbers from battle-fields or distant hospitals; (10) to keep a watchful eye upon all soldiers out of hospital, but not yet in service, and prevent desertion and avoidance of duty. Important soldiers' homes and lodges were established at Boston, Hartford, New York, Philadelphia, Cleveland, Cincinnati, Cairo, Chicago, Louisville, Nashville, Memphis, and New Orleans. Forty homes and lodges, in short, were sustained by the Sanitary Commission in its broad field, reaching from Washington to Brownsville, Tex., and from Louisville, Ky., to Port Royal, S. C. Over 4,500,000 meals and over 1,000,000 nights' lodgings were thus supplied, and $2,500,000 of soldiers' wages were collected by the Sanitary Commission. The care of wounded men *en route* was one of the most valuable services of this special relief department; at one time 8000 men were fed for two days by this department.

Convalescent camps — immense establishments found necessary by government—were one of the chief spheres into which the special relief corps penetrated. 200,000 men passed through the one in the rear of Alexandria. The Commission placed a wonderful *woman*, Miss Amy Bradley, at the head of its volunteer labors in this camp, where for two and a half years she and her assistants rendered incalculable service—(1) in distributing clothing among the needy; (2) procuring dainties for the sick; (3) accompanying discharged soldiers to Washington and assisting them in obtaining their papers and pay; (4) furnishing paper and postage and writing letters home for the sick; (5) forwarding money home by drafts that cost nothing to the soldier; (6) answering letters of inquiry to hospital directors; (7) securing certificates of arrears of pay and getting erroneous charges of desertion removed (the Commission saved several innocent soldiers from being shot as condemned deserters); (8) distributing reading matter; (9) telegraphing the friends of very ill soldiers; (10) furnishing meals to feeble soldiers in barracks who could not eat the regulation food. Miss Bradley assisted 2200 men to secure arrears of pay amounting to $200,000. Prisoners of war, while in prison and when released by general exchange, were largely and promptly relieved and comforted by this department. Rev. Frederick N. Knapp was the leading spirit in this whole special relief service, and organized and controlled it with masterly zeal, humanity, and success.

*The Hospital Directory.*—This was an organized effort to tabulate and keep the run of the names of all private soldiers who passed through the general hospitals, so that the soldier's friends could follow him, know where he lay, if he lived or died, and what became of him when out of hospital. The central office at Washington was opened to the public Nov. 27, 1862; branches were soon established at Philadelphia, Louisville, and New York. Returns were constantly received at the central office from 233 general hospitals, with the names of their shifting occupants and such hints about their condition and changes of place as were most important. The hospital directory contained in its four offices the names of over 600,000 men, with the latest information procurable in regard to the condition of each one of them. Agents of the directory accompanied the supply agents to the battle-field the moment battle had ceased to find out the names of the wounded, and to assure them that information should at once be sent to their friends. The method of the hospital directory was simple but efficient. Applicants for missing men or men not heard from at home communicated the name, rank, and regiment of the person inquired for, and the place he had been last heard from. With this clue he was followed through the book and hospitals by the agents, and 70 per cent. of all such inquiries were successfully answered. This service was unspeakably grateful to the people at home; none received higher praise. An immense row of great ledgers, still preserved in the archives of the Commission, attests the extent of this work.

*Pension Bureau and War-Claim Agency.*—This agency, free of all cost to soldiers, was designed to obviate the ignorance or inefficiency, or want of strength to win their own way or to secure correct papers, among thousands of soliers passing through the homes and lodges of the Commission. Delay and exposure often increased the illness of feeble applicants. The Sanitary Commission established a lodge just opposite the paymaster's office, and spread a table at which 50 invalid soldiers were sometimes seen seated together, comfortably waiting their turn at the paymaster's. After the war closed this bureau expanded into a claim-agency for soldiers, widows, and orphans, by which about 57,000 claims were put in proper shape, missing testimony secured, and $7,500,000 collected at a saving of half a million of cost to the soldiers—claims which could probably never have been carried through the government offices if not thus assisted, or at only too late a period to be serviceable.

*War against Scurvy.*—The first appearance of symptoms of scurvy in the armies of the Tennessee and the Cumberland led the Sanitary Commission to make an urgent call on the farmers of the North-west for a gratuitous supply of vegetables. Within a month 15,000 bushels were gathered without cost from a region where the government had been unable to purchase any, and were sent forward to the army, largely meeting the exigency and driving out the disease. Eight barrels of potatoes a day were furnished by the Sanitary Commission to each field hospital, besides other vegetables, pickles, sauer-kraut, etc. To keep up the supply after the farmers' stores had given out, the Commission established *hospital gardens* at Murfreesboro', Nashville, Chattanooga, Knoxville, and Newberne, from which abundant fresh vegetables were drawn for the sick and convalescent and for many other soldiers. At Vicksburg, where the soldiers were depressed by the long delay, the climate, and the crowded condition of boats and barracks, Dr. Newberry, the distinguished representative of the Commission at Louisville and head of the Western department, pushed constant supplies, by the hearty co-operation of Gen. Grant, into the camp, and furnished a large part of the comforts and luxuries that reached the sick and the desponding. His services, and those of Dr. Warriner, were of the highest value in fighting off the symptoms of scurvy and typhoid by extra supplies of sanitary food and antiscorbutics. After the fall of Vicksburg the Pittsburg, Cleveland, and Cincinnati branches of the Sanitary Commission, Davenport, Ia., Quincy and Alton, Ill., New Albany, Ind., Louisville, Ky., Chicago, all vied with each other in supplying the agents of the Commission with boatloads of stores for the heroes who had achieved so difficult a victory. The following list will show the nature and amount of the articles issued from the Sanitary Commission dépôt at or near Vicksburg to the Army of the Tennessee during the four months ending Sept. 1, 1863: Groceries, 2360 pounds; wines and liquors, 2833 bottles; butter, 5839 pounds; apple-butter, 30 gallons; eggs, 2476 dozen; pickles, 5409 gallons; molasses, 85 gallons; potatoes, 7596 bushels; ale and cider, 3139 gallons; ice, 47,367 pounds; crackers, 26,517 pounds; codfish, 13,593 pounds; corn meal, 2485 pounds; tea, 1589 pounds; relishes, 662 bottles; lemons, 25,200; hospital furniture, 2162 articles; fans, 4700; crutches, 65 pairs; mattresses, 199; spices, 2690 papers; comforts, 2429; pillows, 4357; sheets, 9029; drawers, 13,230 pairs; farina, 2125 pounds; sago, etc., 2125 pounds; bed-sacks, 1121; pillow-cases, 6511; shirts, 7909; dressing-gowns, 746; socks, 4218 pairs; slippers, 1504 pairs; bandages, 50 bands; fruit, 7330 cans; dried fruit, 45,208 pounds; dried beef, 1496 pounds; condensed milk, 11,282 cans. The hospitals at Memphis, Vicksburg, Natchez, Helena, Duval's Bluff, Little Rock, Pine Bluff, Brownsville, and Fort Smith were supplied from the steamer Dunleith in the hands of the Sanitary Commission, which constantly refilled at the storehouse at Cairo, from the stores furnished by the branches in the North-west, distributed its cargo to the naval vessels on the White and Arkansas rivers, and relieved the ports they visited, if not always adequately, yet to a most serviceable degree.

In June, 1863, the Army of the Cumberland set out to take Chattanooga over a barren region, mountainous and ill-inhabited, a poor railroad, held by the enemy, the only communication between Murfreesboro' and Chattanooga except by dangerous wagon-roads. Gen. Rosecrans had about 80,000 effective men, 22,000 artillery horses, 3000 private horses, 36,000 mules, requiring immense supplies of forage. All the food for men and horses had to be brought from Louisville, 300 miles away, and 3000 freight-cars were required to do this business. Of course, the medical supplies had to be greatly limited. Rosecrans's lines of communication with his base were several times interrupted by the enemy's temporary successes. By the course of events the Army of the Cumberland became blockaded at Chattanooga, and it is easy to see how limited its means became of relieving the 10,000 wounded men left on its hands after the battle of Chickamauga. For a month, and until the enemy were driven by Gens. Hooker and W. J. Smith from Lookout Mountain, the whole army lived on the scanty wagon-supply accompanying its march and intended only for a few days' use; 10,000 mules died of starvation; starvation was imminent for the men, and retreat for a time seemed the only safety. The medical department was greatly embarrassed in its service. A portion of the Sanitary train (of which 17 wagon-loads had been intercepted and destroyed by the enemy in the Sequatchie Valley) managed to get through—seven wagons loaded with

condensed milk, beef-stock, rags, bandages, and hospital clothing—and reached Chattanooga with the first army-train which arrived there. Three more wagons afterward got through. These ten wagon-loads constituted almost the whole dependence of the hospitals until the Tuesday and Wednesday succeeding the battle. To provide for the necessities of the wounded in crossing the mountains from Chattanooga to Stevenson, where the dépôt of the Sanitary Commission was, the Commission established a feeding station midway on the route of the ambulances, which administered most needed relief to the many wounded wayfarers. The following winter in this army was one of necessary repose, chiefly from lack of means of transportation. The chief peril of the waiting troops was from scurvy and chronic diarrhœa, due to the character of their food. To combat this enemy the Commission made desperate efforts to improve the diet of the whole army. During the month of Jan., 1864, there were distributed from the single dépôt at Nashville 3423 bushels of potatoes, 157 bushels of onions, 8742 gallons of sauer-kraut, 1969 gallons of pickles, 13,662 pounds of dried fruit, etc.—all antiscorbutics. The hospital gardens established at Chattanooga by the Commission aided materially in the following months in improving the diet of the army. The estimated value of the vegetables thus furnished from Apr. 15 to Nov. 14, 1864, was (at Chattanooga) $66,375.70. The beleaguered forces of Gen. Burnside at Knoxville had the same close attention of the Sanitary Commission.

In the rear of the active campaigners was a large force requiring hardly less attention; and feeding stations and ministrations to the great hospitals, and aid in easing the transportation of the wounded, sometimes for hundreds of miles, from field or regimental hospitals to a general hospital, were the ordinary forms of service. The hospital car on india-rubber springs, which one of the commissioners, Dr. Elisha Harris, had invented and perfected, was multiplied and put to constant use in transporting the wounded long distances, and gave an aggregate of immense relief to the agonies of thousands of wounded men. In the great hospitals at Nashville, where Rev. Mr. Ingraham and Judge Root were the visitors of the Commission (100,000 men in six months passed through them), immense personal services were rendered, material and moral, to the sick and wounded from the store-rooms of the Commission; from supplies of delicacies for the use of the "light-diet kitchens," where ladies cooked and distributed them; from supply-hospital visitors to hospitals and camps, seeking out cases requiring special care; in supplying State agents and agents of the Christian Commission with the means of meeting the calls of their clients; and in supplying soldiers' homes and hospital trains with what they lacked after the government had furnished what it could. This lasted until good and sufficient stores and care from the regular authorities were rendered possible by full communication and a more complete order and system.

The Commission then resolved to throw its energies into preparations for Sherman's army in its campaign for the capture of Atlanta. Before it began, 3000 barrels of vegetables and large supplies of condensed milk, beef, stimulants, under-clothing, and bandages were sent to Chattanooga, and from early in May to the close of July about 100 tons a week of additional stores were forwarded. Our army established over 300 hospitals of a rude kind in the woods on its devious and protracted way. Each one of these hospitals was visited by agents of the Commission, and no less than twenty-four wagon-loads of sanitary stores were distributed close to the line of battle during the ten days before the railroad at Ackworth was reached by the army. At feeding stations in the rear more than 17,000 meals were furnished up to July 14.

Throughout the whole West the affairs of the Sanitary Commission had been managed so prudently that the generals in the field, from Gens. Grant and Sherman down to their lowest subordinates, were on the most friendly and confidential relations with its agents, and did their utmost by army orders and personal labor to aid and advance their humane work. This was seldom as true in the East.

It would be only to repeat the same story, with variations to suit other circumstances, if we went to the Army of the Potomac and followed it to the heights opposite Fredericksburg, and saw the work of the Commission there. This army was much better supplied, it is true. Still, the medical officers welcomed, in the distress caused by an unexpected snowstorm early in December, the supply which could not elsewhere be had of 1800 blankets, 900 quilts, 5270 woollen shirts, 4439 pairs of woollen drawers, and 4270 pairs of woollen stockings. The wounded after the battle of Fredericksburg were swiftly removed by rail to Acquia Creek, where the Sanitary Commissioners at once established at the landing "a feeding and relief station," where on the first night of its existence over 600 men were fed and cared for. After the defeat at Chancellorsville the wounded probably suffered more than on any occasion in the war, as not only the regular medical service, but the supplementary service of the Sanitary Commission, was baffled by the fortunes of war. The Sanitary Commission agents accompanied the army on its forced marches to Gettysburg, its wagons continually replenished from Washington, and its supplies freely given to surgeons' orders during all the skirmishes, fatigues, and privations of that midsummer march. The most extensive preparations were made by the Commission to meet the wants of the impending crisis, the inevitable and perhaps final conflict of two equal armies—100,000 men on either side. Experienced officers were sent to Frederick, Baltimore, Philadelphia, and Harrisburg, and a systematic daily communication kept up between them and the agents with the army, while supplies were accumulated and concealed at different points near to the expected field of battle. In the early conflicts of the two armies, on July 1 and 2, many of our men were wounded, and the surgeons received prompt assistance from two wagon-loads of sanitary supplies which had reached Cemetery Hill the night before. The hospitals of the 1st, 2d, 3d, 5th, 11th, and 12th corps were very materially aided from these stores on this first day of a general engagement. The empty wagons were at once sent back to Fredericksburg and reloaded—one to return *viâ* Westminster, the other by the direct route. Dr. McDonald, in charge, and Rev. Mr. Scandlin, one of the most earnest and effective Sanitary Commission agents, with two laboring-men in the service, were captured by the cavalry of the retreating rebels, marched to Richmond, and confined for months in Libby Prison. At this very hour the Sanitary Commission was taking care of men from the rebel side with just as much tenderness as of its own troops; and this it did always when the enemy's wounded fell into our hands. Before railroad communication between Gettysburg and the North was restored, the first and most pressing wants of the wounded had been materially relieved by the energy with which the Sanitary Commission forced its supplies forward by its independent transportation. When communication by rail was fully established, the Commission poured its stores into Gettysburg in immense amounts. Large quantities of fresh provisions were sent every day from Philadelphia in "refrigerating cars." The following table will give some notion of the relief the people sent to Gettysburg during the ten days succeeding the battle through the hands of the Sanitary Commission. Each morning the supply-wagons of the division and corps hospitals were at the doors of the Sanitary Commission storehouse, and went away laden with what was needed. If the stores asked for were not on hand they were telegraphed for, and by the next train arrived and were delivered. The personal services rendered in the hospitals to sick and dying men, to men waiting amputation, to men forwarded by rail and fed on the way by its agents, were enormous and indispensable.

*Table of Supplies distributed by the Sanitary Commission at Gettysburg in the ten days succeeding the Battle.*

| *Articles of Sustenance.* | |
|---|---|
| Fresh poultry and mutton, pounds | 11,000 |
| Fresh butter, pounds | 6,430 |
| Eggs, dozen | 8,500 |
| Fresh garden vegetables, bushels | 675 |
| Fresh berries, bushels | 48 |
| Fresh bread, loaves | 12,900 |
| Ice, pounds | 20,000 |
| Concentrated beef-soup, pounds | 3,800 |
| Concentrated milk, pounds | 12,500 |
| Prepared farinaceous food, pounds | 7,000 |
| Dried fruit, pounds | 3,500 |
| Jellies and conserves, jars | 2,000 |
| Tamarinds, gallons | 750 |
| Lemons, boxes | 116 |
| Oranges, " | 46 |
| Coffee, pounds | 850 |
| Chocolate, " | 831 |
| Tea, " | 426 |
| White sugar, " | 6,800 |
| Syrups, bottles | 785 |
| Brandy, " | 1,250 |
| Whisky, " | 1,168 |
| Wine, " | 1,148 |
| Ale, gallons | 600 |
| Biscuits, crackers, and rusks, barrels | 134 |
| Preserved meats, pounds | 500 |
| Preserved fish, pounds | 3,600 |
| Pickles, gallons | 400 |
| Tobacco, pounds | 100 |
| Indian meal, " | 1,621 |
| Starch, " | 1,074 |
| Codfish, " | 3,848 |
| Canned fruit, cans | 582 |
| Canned oysters, cans | 72 |
| Brandy peaches, jars | 302 |
| Catsup, jars | 42 |
| *Articles of Sustenance.* | |
| Vinegar, bottles | 24 |
| Jamaica ginger, jars | 43 |
| *Articles of Clothing.* | |
| Drawers (woollen), No. | 5,310 |
| " (cotton), " | 1,833 |
| Shirts (woollen) " | 7,158 |
| " (cotton) " | 3,266 |
| Pillows, " | 2,114 |
| Pillow-cases, " | 264 |
| Bed-sacks, " | 1,630 |
| Blankets, " | 1,007 |
| Sheets, " | 274 |
| Wrappers, " | 508 |
| Handkerchiefs, " | 2,659 |
| Stockings (woollen), pairs | 3,560 |
| " (cotton), " | 2,258 |
| Bed-pans, No. | 728 |
| Towels and napkins, " | 10,000 |
| Sponges, " | 2,300 |
| Combs, " | 1,500 |
| Buckets, " | 200 |
| Soap (castile), pounds | 250 |
| Oil silk, yards | 300 |
| Tin basins and cups, No. | 7,000 |
| Old linen, barrels | 110 |
| Water-tanks, No | 7 |
| Water-coolers, " | 46 |
| Bay rum and cologne, bottles | 225 |
| Fans, No | 3,500 |
| Chloride of lime, barrels | 11 |
| Shoes and slippers, pairs | 4,000 |
| Crutches, pairs | 1,200 |

| | | | |
|---|---|---|---|
| Lanterns, No. | 180 | Paper, quires | 237 |
| Candles, pounds | 350 | Pants, coats, and hats, pieces | 189 |
| Canvas, square yards | 300 | Plaster, rolls | 16 |
| Mosquito-netting, pieces | 648 | | |

Want of space compels us to pass rapidly over the work of the Commission in the battles of the Wilderness, never perhaps so laborious and effective. By two steamboats, two barges, and forty-four 4-horse wagons of its own it conveyed 200 tons of stores to advantageous points, while it employed 200 relief agents in personal services to the wounded. From May 3 to 12 the Union army suffered a loss of 3300 killed and 30,000 wounded, and the Sanitary Commission was busy in aiding the humane and efficient Dr. Cuyler, medical director, in the work of assuaging their sufferings. At Port Royal, White House, and City Point their work went on equally efficiently. The money required by the Sanitary Commission during the months of May and June to supplement the supply for the wants of the army in Virginia alone amounted to $515,000. Morris Island, Olustee, and Newberne, owing to the marshy character of the soil, required and received special attention from the Commission in seeking to drive off the effects of malarious poisons; and Gen. Gillmore would willingly testify to the efficient service of Dr. Marsh and his assistants of the Sanitary Commission in sustaining the health of his troops before Charleston, S. C. At and after the terrible siege of Fort Wagner the Commission rendered immense help by its antiscorbutics, ice, and other comforts, so that its flag was saluted by the grateful regiments as they passed its station. Its agents were specially fortunate in supplying the wants of the troops after the unexpected battle of Olustee in Florida, where a terrible deficiency existed in the medical supplies of the government. Gen. Burnside's army in North Carolina, from the character of the soil and climate there, suffered from scurvy, and was attacked at Newberne and Beaufort with yellow fever. Every one of the Sanitary Commission agents, except Dr. Page, was prostrated with the fever. Dr. Hand, the medical director, showed himself a hero in the danger, but he was most zealously supported by the Sanitary Commission inspector, Dr. Page, and together they conquered the pestilence at the risk of their lives, and principally by means of a reorganization of the board of health, with 300 negroes set to work to purify the town. In the department of the Gulf the work of the Sanitary Commission was admirably administered by Dr. Crane and Dr. G. A. Blake, who continued at New Orleans until the close of the war, doing most efficient service. Dr. Newberry sent down cargo after cargo of vegetable food to Dr. Blake, who distributed it among the garrisons at isolated points on the Gulf, the Red River, and to posts in Texas.

*Special inspection of hospitals* was one of the duties undertaken by the Sanitary Commission. It organized a corps of sixty physicians and surgeons of assured position, under Dr. Henry G. Clark of Boston as inspector-in-chief, who visited all the general hospitals in the country, and reported in a thorough and exhaustive manner (in 2500 folio pages) by the month of May, 1863, to the medical committee of the Sanitary Commission, consisting of Dr. W. H. Van Buren, Dr. C. R. Agnew, and Dr. Wolcott Gibbs, who prepared the instructions under which Dr. Clark and his corps acted. The object was to obtain such information in regard to the practical management of the hospitals as might furnish suggestions to the surgeon-general for improvements in the system. What effective aid the Commission offered it might be invidious to the excellent government administrators of the hospitals to state. But it is certain that our army hospital system attained an excellence never reached in any country before; and it is lamentable that the lessons it learned and taught have been since so generally disregarded in the hospital buildings erected by civilians, which are, almost without exception, discreditable to the medical science and art of the country. It is almost impossible to find now in civil use what is known abroad with honor and admiration as "the American hospital;" and this is a disgrace to our intelligence and humanity.

*Bureau of Vital Statistics.*—The most scientific and permanently valuable part of the work of the Sanitary Commission was its early-begun and persistently-continued effort to collect, tabulate, and turn to account such returns as a system of careful inspection could supply touching the effects of applied or neglected hygiene, of diet, of long marching and heavy equipment, of tent and fixed hospitals; the mortality of young recruits; the influence of climate, age, drill, nationality, of previous occupations, or state of education upon soldiers; the height, weight, strength, and force of the enlisted men. Of camp inspections, 1482 were received, representing about 870 regiments. These, conducted according to very careful forms prepared in the bureau, were, after being filled by the inspectors, all tabulated and grouped in a way to convey very valuable information to the Commission in its effort to correct abuses and soften hardships and dangers. But a vast amount of facts of not immediate practical use, but of great scientific value, were collected by the bureau in matters of profound interest to students of anthropology, to life insurance, and to the whole science of vital statistics; which are either already available in Dr. B. A. Gould's really precious report, or can be examined in the archives of the Commission, arranged for preservation in the Astor Library. Mr. Frederick Olmsted, the fertile, thorough, and accurate first general secretary of the Sanitary Commission, to whom the executive management was for two years so judiciously confided by the board, did few things greater in his term of office than the inauguration of the bureau of vital statistics; his report of the statistics of the battle of Bull Run was the first scientific attempt to generalize the causes of our disaster; it began the work which was enlarged under Mr. E. B. Elliott, Mr. T. J. O'Connell, and finally still more effectively under Dr. Gould, until the bureau of vital statistics became one of the most creditable and one of the most fruitful portions of the work of the Sanitary Commission. Its reports have made it known to the whole scientific world, and probably it has added more new and valuable facts to the science of vital statistics than any one contribution at any time.

*Financial History of the Commission.*—The earliest call for aid published by the Commission was June 21, 1861, in two brief papers—one addressed to the people at large, the other to life insurance companies. It received from all sources up to Sept. 1, $13,630, a sum soon exhausted, and with grave uncertainty whether it could be renewed. Up to Mar. 28, 1862, the commission had received only $53,720, while its expenses were continually increasing, and, if it went on, must evidently increase rapidly and in a greater ratio. In Mar., 1862, it looked as if the Sanitary Commission must disband for want of funds, but its board were resolute to try the experiment to the last gasp of their strength. The services of the Commission in its hospital transport system, which cost it $20,000 per month (although the hire of its steamers was paid by the government), began to tell upon the public, and at the darkest moment money came flowing in, in comparatively small sums, but from a wide number of contributors, almost all convinced by their own observation or experience of the services the Commission was rendering. The financial infancy of the Commission ended in Sept., 1862. Till that time it had lived from hand to mouth, never sure of a month's continued solvency. The treasurer reported at the ninth session of the board that its receipts to Sept. 10, 1862, had been $158,501. Thus far, its receipts had been chiefly from New York, Philadelphia, and Boston, but now they began to come in from all parts of the country; and either in money or valuable supplies they became considerable. But it was the munificence of California, and the Pacific States following her lead, that first made a great impression on the public of the needs and possibilities of the Commission. California, and her sisters, remotest from the war and least able to contribute men, indulged their patriotism and gave relief to their pent-up sympathies with the national cause by pouring out their money like water. And, fortunately for the Commission and the country, they adopted the Sanitary Commission as their almoner. The first glorious contribution from California of $100,000, by telegraph dated San Francisco Sept. 19, 1862, was the making and saving of the Sanitary Commission. Supplies had been coming in out of all proportion to the money necessary to move and distribute them. The more the Commission received of goods to aid the soldier, the more embarrassed it was for money to forward and apply them. But this splendid thing done for the soldiers by distant California, the first in magnitude and in power of surprise, awoke a general enthusiasm. Only fourteen days later California sent another donation of equal amount, and from that date its donations to the Sanitary Commission became systematic, and averaged probably $30,000 per month while the war lasted! From that date, after every great battle, money and supplies came pouring in from other quarters, but with each of them came a still greater drain on the stores and the treasury. About this time (the beginning of 1864) a series of great fairs was inaugurated, either by officers of the Commission or by its friends, in aid of its treasury or of the independent treasuries of its branches. They occurred at Chicago, Cincinnati, Cleveland, Pittsburg, Albany, Baltimore, Boston, Brooklyn, L. I., New York, Philadelphia, and many other towns and cities. The net product reached the enormous sum of $2,736,868.84. The total amount in money received from the people by the Sanitary Commission up to May 1, 1866, was $4,962,014.26. But at least $2,000,000 more were raised in its interest by its branches, which they

expended themselves, and which, though equally serviceable, never came into its treasury. Gratuitous transportation by railroad and express companies and free communication by telegraph lines saved the Commission at least two-thirds of the cost in these necessary departments of its work. The aggregate value of the services rendered by the public to the Commission has been estimated at $25,000,000. No officer or member of the Commission, excepting its secretaries, who left other occupations to devote their whole time to the work, ever received a dollar for his services. But it had at some periods 500 persons, from physicians and surgeons to cooks and teamsters, upon its roster, who were receiving its support at army rates, according to grade of service, and its other expenses were enormous. The finances of the Commission received a punctilious care under the lead of George Templeton Strong, a lawyer and man of the highest character, its only treasurer through the war, who gave the most scrupulous attention to vouchers and accounts, and under the direction of the Commission submitted his books to three auditors, Messrs. A. A. Low, Jonathan Sturgis, J. J. Astor, Jr., who employed an expert to examine them from time to time and report their audit, without finding a single flaw, through the whole life of the Commission. Mr. Strong's great services were held in the strongest respect and gratitude by his fellow-commissioners and the public acquainted with his solid devotion; and his recent death has not diminished the sense of them among his old fellow-workers. The sources of the money contributions, and their amount, will be found in the following table, taken from the official report of the Commission:

*Receipts of the U. S. Sanitary Commission from June 27, 1861, to Jan. 1, 1866.*

| | | | |
|---|---|---|---|
| Maine | $24,938.43 | Italy | $50.00 |
| New Hampshire | 21,926.84 | Turkey | 50.00 |
| Vermont | 3,521.17 | China | 2,989.90 |
| Massachusetts | 15,532.00 | Japan | 5,000.00 |
| Mass. (through Boston branch) | 106,396.60 | U. S. army | 1,738.30 |
| Rhode Island | 11,823.96 | U. S. navy | 199.00 |
| Connecticut | 8,418.55 | Boston and New England Fair | 50,000.00 |
| New Engl'd (States not designated) | 6,683.75 | Yonkers, N. Y. | 12,000.00 |
| New York | 229,328.71 | Flushing, L. I., Fair | 3,934.32 |
| New Jersey | 20,741.25 | Brooklyn and Long Island Fair | 305,513.83 |
| Pennsylvania | 12,736.77 | Schuyler co. (N. Y.) Fair | 1,287.43 |
| Delaware | 775.00 | Albany (N. Y.) Fair | 80,000.00 |
| Maryland | 5,913.95 | Metropolitan (New York) Fair | 1,184,487.72 |
| Dist'ct of Columbia | 12,124.53 | Warwick, Orange co. (N. Y.) Fair | 1,432.73 |
| Virginia | 703.60 | Po'keepsie (N. Y.) Fair | 16,192.27 |
| Ohio | 16,049.50 | Hornellsville (N.Y.) Fair | 800.00 |
| Indiana | 1,264.15 | South Adams (Mass.) Fair | 3,087.04 |
| Illinois | 4,342.50 | Maryland State (Baltimore) Fair | 40,234.54 |
| Michigan | 691.30 | Wheeling (Va.) Fair | 2,500.00 |
| Wisconsin | 916.00 | Great Central Fair, Philadelphia | 1,035,398.96 |
| Iowa | 13.50 | Unknown sources | 3,952.26 |
| Minnesota | 67.85 | Interest on U. S. certificates | 37,771.71 |
| Kentucky | 6,608.05 | Interest on deposits in Nassau Bank, Brooklyn | 1,923.63 |
| Louisiana | 3,177.25 | Interest on deposits in Fourth National Bank, N. Y. | 3,154.15 |
| North Carolina | 8.00 | Receipts from advertisements in *Sanitary Bulletin* | 2,160.00 |
| California | 1,233,977.81 | Receipts from subscriptions for *Sanitary Bulletin* | 191.80 |
| Nevada | 107,642.96 | Contributions to medical fund | 197.00 |
| Oregon | 79,406.94 | Proceeds from sales of furniture, surplus stores, etc | 72,298.07 |
| Wash. Territory | 20,918.92 | Total amount | $4,924,480.99 |
| Idaho Territory | 5,301.31 | | |
| Colorado Territory | 1,025.00 | | |
| Nebraska Territory | 10.50 | | |
| Vancouver's Island | 2,195.61 | | |
| Sandwich Islands | 17,955.51 | | |
| Chili | 5,376.79 | | |
| Peru | 2,002.00 | | |
| Buenos Ayres | 18,412.85 | | |
| Cuba | 23.00 | | |
| Costa Rica | 84.00 | | |
| Canada | 441.48 | | |
| Newfoundland | 150.00 | | |
| England | 11,145.33 | | |
| Scotland | 74.75 | | |
| France | 3,550.00 | | |
| European branch (Paris) | 13,372.72 | | |
| London branch | 36,790.42 | | |
| Belgium | 100.00 | | |
| Germany | 843.22 | | |

NOTES.—(1) For a table of disbursements we must refer to the official *History*, by C. J. Stillé, where an audited account will be found on p. 547, Appendix.—(2) The estimated value of supplies sent the Commission, in various kinds of dry goods, raw material and made up, vegetables, fruits, wines and cordials, and all else, is roughly estimated at $15,000,000.

*Internal Organization.*—The original board, named by the medical bureau and the secretary of war after advising with the originators of the plan, consisted of nine persons—Rev. Dr. H. W. Bellows, Prof. A. D. Bache, Prof. Wolcott Gibbs, Dr. Jeffries Wyman, Dr. W. H. Van Buren, Dr. Samuel G. Howe, R. C. Wood, surgeon U. S. A., G. W. Cullum, U. S. A., A. E. Shiras, U. S. A., with power to add as many more associates as they deemed necessary. The order of the secretary of war creating the Commission is dated June 9, 1861. Immediately after, Elisha Harris, M. D., G. T. Strong, Esq., J. S. Newberry, M. D., F. L. Olmsted, Esq., Bishop T. M. Clark, Horace Binney, Jr., Esq., were added, and later Hon. R. W. Burnett, Hon. Mark Skinner, Hon. Joseph Holt, Rev. J. W. Heywood, Fairman Rogers, Esq., J. Huntington Wolcott, Esq., C. J. Stillé, Esq., Ezra B. McCagg. During the early months of the war the board met in Washington (where excellent quarters were provided by the government) once in every six weeks, but after the first year its sessions were held quarterly. The board had a general supervision of the work, the defining of its policy and measures, which were committed to secretaries, heads of bureaus, and agents for execution. The board held twenty-three sessions, usually four or five days each. To them was presented by the general secretary a sketch of the work founded on the reports of the heads of the various bureaus—of Inspection, Statistics, Special Relief, War-Claim Agency, Hospital Record, the Treasury, and the Branches in the Home-field. The pressure and complexity of the business soon compelled the board to appoint from its members a standing committee charged with all the responsibility of the Commission during the intervals of its sessions. This committee consisted of Rev. Dr. Bellows, Dr. W. H. Van Buren, Prof. Wolcott Gibbs, Mr. E. T. Strong, and Dr. C. R. Agnew, to whom Mr. C. J. Stillé was afterward added. It was necessary that this standing committee should be constituted of gentlemen living near each other, as their meetings were held necessarily daily, and the city of New York thus became their head-quarters. For four years their daily meeting was scarcely intermitted, except on Sundays. The care, anxiety, and labor thrown upon them in explaining, defending, and maintaining the deliberate policy of the Commission, anticipating its wants, arranging and addressing public meetings, planning financial schemes, meeting the exigencies of the field-work by summoning supplies and forwarding them to distant dépôts, settling delicate questions with the government, the army, and its own agents, was something which only the immense excitement of the times, and the growing interest and success of their humane work, could have enabled professional men—every one of them with numerous public duties besides—to bear.

But the burden of the labor fell upon the general secretary at the head of the central office at Washington. Mr. F. L. Olmsted occupied this post for the first two years; and it is not too much to say that he impressed his genius upon the Commission, which had originated with others, in such a way as to make it doubtful whether without his fine power of organization, his influence with subordinates, his experience in great undertakings, and his extraordinary powers of concentrated attention upon what he undertakes, it would have survived its youth. He was succeeded by Dr. J. Foster Jenkins, who was promoted for his prudence, faithfulness, and high medical and general intelligence from a lower office in the Commission to this important post, and labored effectively for two years in it until his health broke down. He was succeeded by Mr. John S. Blatchford, who brought rare power of order, industry, and zeal to the work, and specially distinguished himself by his success in organizing the war-claim and historical bureau, and finally by closing up the long-protracted business of this involved and widely-related enterprise. The office at Washington, with its several bureaus, presented all the extension, activity, order, subordination, and checks and balances of a great commercial house. Dr. John S. Newberry at Louisville, the Western secretary, had a large force of clerks, inspectors, and agents under him admirably managed. The office of the standing committee in New York was the scene of constant hard work under Mr. Benjamin Collins, assisted by Mr. C. G. Lathrop and Mr. S. H. Stebbins, accomplished accountants. Considering the fiduciary nature, the extent and growth of this—probably the largest work of volunteer benevolence ever carried on in the same space of time or under similar circumstances—it is gratifying to remember how generous the trust of the public was in the integrity and wisdom of its administrators, and how little friction of a harmful kind, notwithstanding its constant difficulties, it suffered in its anomalous relations to the government and the army and navy.

This long yet imperfect digest of the work of the U. S. Sanitary Commission is mainly taken (though with the help of a full personal knowledge of the general facts and internal policy here set forth) from the official *History of the Sanitary Commission*, so ably written by one of its members, Mr. Charles J. Stillé, now provost of the University of Pennsylvania, and with his concluding words, we end this article: "However opinions may differ in regard to the policy of the government or the strategy of the generals during the late war, the organized sympathy and care of the American people for those who suffered in their cause stands out alone in its ever-fresh beauty from the dark

background of civil strife, and must always and everywhere call forth the homage and admiration of mankind. It is the true glory of our age and our country, one of the most shining monuments of its civilization. May it ever prove a beacon to warn, to guide, and to encourage those who in future ages and other countries may be afflicted with the dire calamity of war!"

*List of the Members of the U. S. Sanitary Commission and its Officers.*—Henry W. Bellows, D. D., New York, president; Alexander Dallas Bache, LL.D., Washington, D. C., vice-president; George T. Strong, Esq., New York, treasurer; W. H. Van Buren, M. D., New York, C. R. Agnew, M. D., New York, Prof. Wolcott Gibbs, M. D., New York, medical committee; Fred. Law Olmsted, Esq., New York, general secretary; Prof. John S. Newberry, M. D., Louisville, Ky., Western secretary; Elisha Harris, M. D., New York; Charles J. Stillé, Esq., Philadelphia, official historian; S. G. Howe, M. D., Boston; Rt. Rev. T. M. Clark, Providence, R. I.; Horace Binney, Jr., Esq., Philadelphia, Pa.; Rev. J. H. Heywood, Louisville, Ky.; *Hon. R. W. Burnett, Cincinnati, O.; Hon. Mark Skinner, Chicago, Ill.; *Hon. Joseph Holt, Washington, D. C.; J. Huntington Wolcott, Esq., Boston, Mass.; Ezra B. McCagg, Esq., Chicago, Ill.; †Fairman Rogers, Esq., Philadelphia, Pa.; ‡Robert C. Wood, M. D., U. S. A.; ⁂G. W. Cullum, U. S. A.; ‖ Alexander E. Shiras, U. S. A.

HENRY W. BELLOWS.

**Sanitary Science,** a term of recent origin, defined by a high authority, Dr. Mapother, as "an application of the laws of physiology and general pathology to the maintenance of the health and life of communities by means of those agencies which are common and in constant use." It is therefore nearly a synonym of "preventive medicine" and "state medicine," and in many of its practical aspects has been treated under the head of HYGIENE (which see). Recent commentators have shown the probability that many, if not all, the minute directions for daily life contained in the Mosaic code were based upon the views then prevalent in regard to hygiene, and a similar origin may be ascribed to the Spartan code attributed to Lycurgus, while the vast public works for drainage and sewerage in Rome, and the appointment of *archiatri populares* or state physicians, testify that sanitary science was not unknown to the rulers of that empire. During the Middle Ages, however, the widespread contempt of the body and of all material things which was inculcated by the ascetics of the Church of Rome effectually prevented the adoption of any public sanitary measures; and it was not until an advanced period of the nineteenth century that public hygiene was recognized as a science of vast intrinsic importance. To the labors of Dr. Southwood Smith (1788–1861), Edwin Chadwick (b. 1801), Dr. Edwin Lankester (1814–74), Dr. William Farr (b. 1807), Dr. Lyon Playfair (b. 1819), and Dr. Edmund A. Parkes may be chiefly ascribed the beneficent movement in England which has resulted in the establishment of sanitary science upon a firm basis—the appointment of boards of health in all the cities of Great Britain and Ireland, and even in most of the smaller towns, the division of that kingdom into health-districts, and the passage by Parliament of very numerous measures directly inspired by those energetic reformers. To their labors, again, is largely due the somewhat later development in the U. S. of similar administrative reforms, which received an incalculable impetus from the medical department of the military service during the civil war—a school in which nearly all the American sanitary reformers of the present day were trained.

Among the more important antecedents to sanitary science may be mentioned the establishment of quarantines in the fourteenth century, the discovery of vaccination in the eighteenth century, and its enforcement by government, and the appearance of the Asiatic cholera in Europe in 1832, the latter being a phenomenon which in England, France, Germany, and the U. S. had the result of directly leading to searching investigations of the conditions of public health and disease, especially in crowded cities. In England a poor-law was enacted in 1834, embracing a provision for the appointment of a medical commission to supervise its execution, and its first elaborate *Report on the Sanitary Condition of the Laboring Population of Great Britain* (1842) has been characterized as "the true starting-point of modern sanitary legislation." The "health-of-towns commission," the first fruits of the preceding publication, issued valuable *Reports* in 1844 and 1845, which in turn gave rise to the "metropolitan sanitary commission," in both of which the organizing genius was Mr. Edwin Chadwick, while the eminent physicians above named imparted "determinate method and an approach to scientific exactness" to the vast accumulations of data presented in the *Reports* of the years 1847 and 1848. The public health department in the privy council was organized in 1858. At the present day sanitary science in England may truly be said to have sensibly lengthened the average duration of human life, to have contributed in no slight degree to the health and comfort of all classes of the nation, and by the numerous associations which have been formed for its promotion to have become a recognized power of the highest order in the state. Its influence is also highly beneficial in an incidental manner as conducting to the scientific treatment of many economic subjects which have heretofore been abandoned to the crude speculations of political theorists or regulated in accordance with ill-understood class interests.

In the U. S. boards of health have been constituted in all the larger cities, most of them dating from a period subsequent to the close of the civil war (1865). The "metropolitan board of health of the State of New York," instituted in 1866, was in 1870 transformed into the "board of health of the health department of the city of New York," and under both names has published valuable *Annual Reports*. Those of 1866, 1867, and 1868 were from the pen of the sanitary superintendent, Dr. Edward B. Dalton (b. 1834, d. 1872), who also wrote an article on the history and management of the metropolitan board of health in the *North American Review* (Apr., 1868). Under the management of Dr. Moreau Morris, assisted by Prof. Charles F. Chandler, Ph. D., as analytical chemist (the latter in 1873 appointed president of the board, which position he still retains), and by 10 district inspectors, much has been done toward rendering the city of New York habitable, but the field for the labors of that board is so vast, and the discretionary powers confided to it so limited, that further legislation is urgently required; as well as the establishment of sanitary instruction in every public school.

The literature of the subject, though recent, is of considerable bulk, and rapidly increasing; it will here be sufficient to direct attention to Dr. Edmund A. Parkes' *Manual of Practical Hygiene* (1864), Dr. Gairdner's *Public Health in Relation to Air and Water* (1862), Dr. A. P. Stewart's *Medical and Legal Aspects of Sanitary Reform* (1867), Dr. E. D. Mapother's *Lectures on Public Health* (1869). Fuller bibliographical references will be found under the title HYGIENE. (See also the articles FERMENTATION, GERM-THEORY OF DISEASE, DISINFECTION, FOOD, GYMNASTICS, RESPIRATION, SEWER, VENTILATION, and VITAL STATISTICS.)

PORTER C. BLISS.

**San Jacin'to,** new county of S. E. Texas, on Trinity and San Jacinto rivers, has a rolling surface and a fertile soil. Cap. Cold Spring. Area, 500 sq. m.

**San Jacinto,** p.-v. and tp., San Diego co., Cal. P. 92.

**San Jacinto,** v., Harris co., Tex., on Buffalo Bayou. P. 172.

**San Jacinto,** a river of Texas, rises in Walker co., and flows S. E. 120 miles to San Jacinto Bay, an arm of Galveston Bay, is navigable 45 miles, and gives name to the famous battle fought on its banks in 1836. (See SAN JACINTO, BATTLE OF, by C. G. FORSHEY.)

**San Jacinto, Battle of.** This closing battle of the war of Texan independence was fought Apr. 21, 1836, in S. E. Texas, 2 miles S. W. of the junction of San Jacinto River and Buffalo Bayou, near the bay of the same name. Gen. Houston, in command of the Texan forces, had been gradually falling back eastward, toward San Jacinto River and Bay, before the advance of the Mexican army under Gen. Antonio Lopez de Santa Anna from the W. The whole sparse population was fleeing in the same direction. Harrisburg, the seat of government, was abandoned on the 18th, and on the same evening was burnt by the pursuing army. The armies were marching on parallel lines, Houston's object being to reach the river and hold command of the ferry at its mouth; Santa Anna's, to cut off his retreat and capture him. They reached the bay boundary almost simultaneously, and took position within a mile of each other. Houston's better knowledge of the country had enabled him to strike the exact point desired; and here they determined to fight. On the 20th some pretty severe skirmishing took place, with but little result. On the 21st the battle was fought, sudden, desperate, and decisive. With the cry, "Remember the Alamo!" the Texans made their charge, and at the expiration of a single hour Santa Anna had fled, and the whole of his army not slaughtered in the action had surrendered. The force of the Mexicans was 1536: that of the Texans, about 700. Their loss was 8 men killed and 25 wounded; among the latter was Gen. Houston, slightly wounded in the ankle. When Gen. Santa Anna was brought in prisoner, the soldiers, burning for revenge for his atrocities committed on the prisoners of the Alamo and Fannin's command, clamored for his

*These gentlemen never took their seats.
†Resigned 1864. ‡Resigned Dec., 1864.
⁂Resigned Feb., 1864. ‖Resigned Dec. 17, 1864.

life. Milder and more politic measures prevailed, however; and upon his proffer to use his best influence to secure the recognition of Texan independence his parole was accepted by Pres. Burnet. How well it was kept history has recorded. This battle, however, ended the struggle for Texan independence. C. G. FORSHEY.

**Sanjio Saneyoshi,** b. in Kioto (now called Saikio), Japan, about the year 1836, of a high Kûgé family; educated by private instructors with great care, both in Japanese and Chinese literature. Before the late revolution he and six others of similar high rank took a decided stand against the policy of the late tycoon, when they were all suspended from the offices they held and consigned to the care of certain daimios for confinement; after his release, and in 1864, he became a court officer to the tenno, and was noted for his continued opposition to the tycoon and for his zeal in the progressive affairs of the empire; early in 1868, and immediately after the change of government, he was made vice prime minister, and in July, 1871, elevated to the rank of dajio-dai-zin. He is by nature a true conservative, and has ever been popular with the people. F. A. P. BARNARD.

**San Joaquin',** county of Central California, intersected by San Joaquin River, and watered by its tributaries, the Mokelumne, Calaveras, and Stanislaus rivers; lies between some outlying spurs of the Coast Range on the S. W. and the Sierra Nevada on the N. E.; is traversed by Central Pacific, Stockton and Copperopolis, and Stockton and Visalia R. Rs.; has a nearly level surface, well adapted for agriculture, and contains considerable tracts of "tule" or unreclaimed swamp-land. Important manufactures are being rapidly introduced. Wheat and barley are produced in vast quantities; wine, hay, butter, cheese, and wool are important staples, and domestic animals abound. Cap. Stockton. Area, 1452 sq. m. P. 21,050.

**San Joaquin,** tp., Sacramento co., Cal. P. 1073.

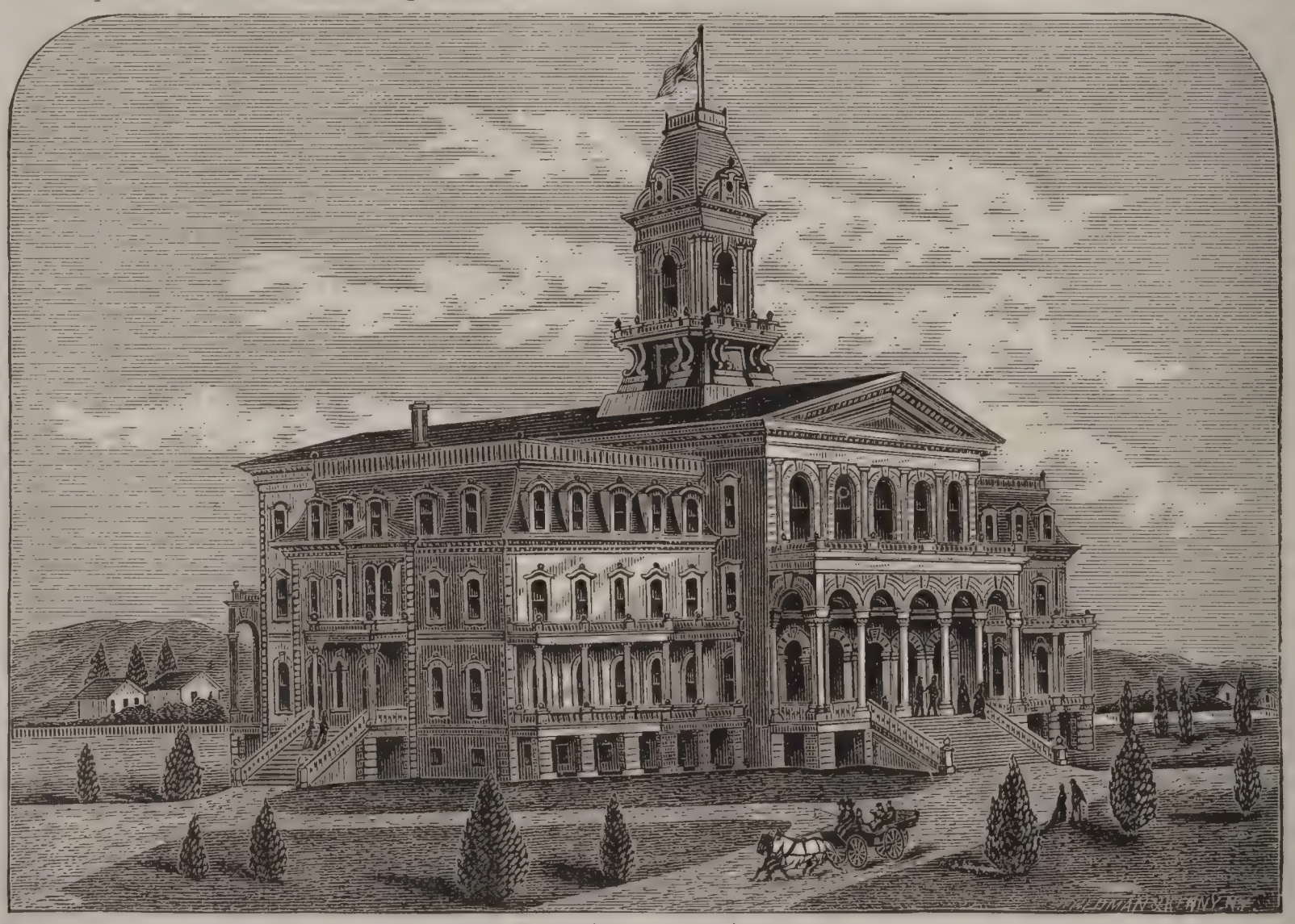
**San Joaquin,** tp., Stanislaus co., Cal. P. 1015.

**San Joaquin River,** rises in Fresno co., Cal., and after a S. W. course to the Tulare Slough it turns N. W., traverses the magnificent valley which bears its name, and at last, joining with the Sacramento, falls into Suisun Bay. At high water the outflow of the Tulare system of lakes is discharged by the San Joaquin, which is navigable to Stockton for large steamers for a good part of the year, and small steamers can ascend 275 miles higher. The river is some 350 miles long.

**San José,** city, cap. of the republic of Costa Rica, in the province of the same name, in lat. 10° 56′ N., lon. 83° 45′ W., about midway between the Pacific and the Caribbean Sea, 15 miles N. W. from Cartago, the ancient capital, with which it is connected by a railway, now in course of construction between Puerto Limon and Punta Arenas, is in a picturesque and fertile valley at the base of the Barba and Cartago volcanoes, 4500 feet above the sea; is regularly laid out, but ill built, having no edifices of architectural merit. It has several educational institutions, including a university, to which are attached a medical department, a museum, and a chemical laboratory; has 2 banks, the National and the Anglo-Costarican; is connected with Punta Arenas, its seaport, by the only tolerable carriage-road in the country, and exports large and increasingly valuable quantities of coffee by way of the steamers of the Panamá and San Francisco lines. P. 26,000.

**San José,** tp., Los Angeles co., Cal. P. 474.

**San José,** p.-v. and tp., cap. of Santa Clara co., Cal., in the heart of the beautiful Santa Clara Valley, 50 miles due S. from San Francisco, and 30 miles from the Pacific Ocean, is connected with San Francisco by railroad on the W. side of the northern arm of San Francisco Bay, and



State Normal School, San José, Cal.

with the overland railroad by a branch road on the E. side of the bay. It is also connected by rail with the southern portion of the State. The city contains a public library, 9 churches, the college of Notre Dame for young ladies, with buildings and grounds valued at $500,000, the San José Institute and Business College, 7 fine public-school buildings, the State normal school, the finest court-house in the State, costing $200,000, a theatre, 3 large public halls, and many other excellent public buildings and elegant private residences. The city owns a beautiful park of 400 acres, 6 miles distant, containing numerous mineral springs, with which it is connected by a magnificent avenue lined with four rows of trees, the avenue alone costing over $30,000. The city is embowered in flowers, trees, and shrubbery, and with a most equable and delightful climate throughout the year is regarded by tourists as one of the most beautiful inland towns on the continent. It has 4 banks, 2 daily and 4 weekly newspapers, and 1 monthly agricultural journal. Staple products of the city and valley, wheat, wine, dried and canned fruits, tobacco, etc. P. of v. 9089; of tp. 3420.

J. J. OWEN, ED. DAILY AND WEEKLY "MERCURY."

**San José,** p.-v., Allen's Grove tp., Mason co., Ill., on Jacksonville division of Chicago and Alton R. R.

**San Juan',** town of the Argentine Republic, province of San Juan de la Frontera, is tolerably well built and in a fertile and well-cultivated district on the river San Juan. P. 8353.

**San Juan,** county of Washington Territory, embracing the islands of San Juan, Orcas, Lopez, Blakely, Decatur, Shaw, Waldron, Henry, Spiedan, Stuart, and Sucia, and several islets, all lying in Puget's Sound between the mainland and Vancouver Island. They were formerly included in Whatcom co., and the possession of several was disputed between Great Britain and the U. S. (see SAN JUAN

Boundary Question); but after the award of the emperor of Germany (Oct., 1872) they were in 1873 erected into a county. The islands of San Juan and Orcas have each an area of about 60 sq. m., Lopez about 30 sq. m., the aggregate of the county being 200 sq. m. The population of San Juan was in 1870, 376, exclusive of an English garrison; that of Orcas, 108, and of Lopez, 48; of the county (including 72 Indians), 554. The islands are mostly mountainous and well wooded, but have some fertile prairie-lands. Deposits of coal and limestone have been found. Cap. Friday Harbor.

**San Juan,** tp., Los Angeles co., Cal. P. 445.

**San Juan,** tp., Monterey co., Cal. P. 2638.

**San Juan,** a river of Central America, 120 miles in length, forming the outlet of Lake Nicaragua into the Caribbean Sea, and in the lower half of its course the boundary between the republics of Nicaragua and Costa Rica. Its depth varies from 2 to 20 feet, and navigation is rendered difficult by five rapids; but small steamers have ascended through its whole course, which forms a part of the contemplated Nicaraguan interoceanic ship-canal, for which purpose extensive improvements in the channel or the construction of lateral canals will be necessary. The mouth of the river has more than once changed, and the best entrance is now in the territory of Costa Rica.

**San Juan Boundary Question.** The island of San Juan, in the Gulf of Georgia, on the Pacific coast of North America, lying midway between lat. 48° and 49° N., and in lon. 128° W., is the largest of the group of islands between the Straits of Fuca and the continent. It is bounded N. by the Gulf of Georgia, E. by the Straits of San Juan, and S. and W. by the Straits of Fuca. This island owes its celebrity to the fact that it was seized and occupied by the British government in 1859, and immediately afterward by an American force under the orders of Gen. Harney, the U. S. claim to the island being deemed indisputable. To prevent a collision between the English and U. S. forces, the late Lieut.-Gen. Scott, then at the head of the army, was sent to San Juan and to the local English authorities at Vancouver, who ultimately arranged for a joint occupancy of the island until its ownership could be settled by diplomacy between the U. S. and Great Britain. From that period until the negotiation of the Treaty of Washington in 1871 the two governments labored in vain to arrange this question, but without success. Six different times the British government proposed arbitration, but in every instance the U. S. rejected the offer, on the ground that our right to the island was as perfect as it is to any part of the N. W. coast S. of lat. 49°; that the treaty of June, 1846, did not give to Great Britain the shadow of a claim to one square foot of land or water S. or W. of the Straits of Fuca and the Canal de Hano; that the U. S. had an indisputable right to continue the line of 49° N. from the Lake of the Woods and the Rocky Mountains due W. to the Pacific Ocean, cutting off the southern portion of the island of Vancouver; and that we only waived that right as an act of grace and comity to a friendly power, and consented that the line of boundary, after reaching the middle of the Gulf of Georgia, should deflect to the southward and pass through the Straits of Fuca, so as to leave untouched the island of Vancouver; *and for no other purposes whatever.*

When (in 1848) the claim of Great Britain, that "the channel which separates the continent from Vancouver's Island," as set forth in the treaty, did not mean the Canal de Hano, but a smaller passage far to the eastward, and which, for the purposes of the claim thus set up, was named *Rosario Straits,* nearly all the parties who were connected with the treaty of 1846 were still living, and of course the impudent claim that under that treaty Great Britain was entitled to nearly all the islands in the Gulf of Georgia S. of lat. 49° was treated almost with contempt. Whenever urged, we refused to listen to it; and finally Great Britain proposed arbitration. This was promptly rejected, on the ground that there was nothing about which to arbitrate, the words of the treaty of 1846, drawn by the English minister of foreign affairs, having definitively fixed and settled the line of boundary; and to each and every subsequent proposal to arbitrate, five in number, the U. S. invariably returned the same reply, until finally, in 1871, when the joint high commission for the settlement of the Alabama claims was in session in Washington, our government, in the interests of peace and to accomplish the settlement of the Alabama question by arbitration; did consent that the "San Juan question," as it was called, should be referred to the king of Prussia, simply to determine whether the words of the treaty of 1846 constituted the "Canal de Hano and the Straits of Fuca" the boundary intended by that treaty, or whether these words were intended to convey to Great Britain all the islands in the Gulf of Georgia S. of 49° N., instead of simply the southern point of the island of Vancouver.

The king of Prussia had no alternative but to decide as he did—viz. that the line of boundary fixed by the treaty with the full knowledge of all those concerned in negotiating it, and which was drawn by Lord Aberdeen and accepted by the U. S. without any alteration whatever, was to pass from the centre of the Gulf of Georgia, on the parallel of 49° N., through "the Canal de Hano and Straits of Fuca" to the Pacific Ocean, and that the divergence from the parallel of 49° was made for no other purpose but to leave to Great Britain *the whole of Vancouver's Island,* instead of giving the southern end of it to the U. S., which would have been the effect of extending the line of 49° N. across the island. This decision, following immediately upon the heels of the Geneva award of £3,000,000 sterling in the settlement of the Alabama question, gave great dissatisfaction in England, where the absurdity of their claim under the treaty of 1846 had never been pointed out, and the merits of the question were not at all understood by the present generation. Under these circumstances Gen. J. Watson Webb, who had been more mixed up with the settlement of the North-western boundary question than any man living, was invited to write and publish a brief history of the treaty of 1846. He did so, and its very general republication by the English press not only satisfied the intelligent people of England that no injustice had been done them, but prevented the threatened arraignment of the English ministry in the House of Commons for having submitted the San Juan question to arbitration. (See *Papers relating to the Treaty of Washington,* vol. v., Washington, 1872.) J. Watson Webb.

**San Juan' de Fu'ca, Strait of,** the entrance to Puget Sound and the Gulf of Georgia, lies S. of Vancouver's Island and N. of Washington Territory. Its entrance is in lat. 48° 23′ 30″ N., lon. 124° 43′ 48″ W.

**San Juan de la Fronte'ra,** town of the Argentine Republic, capital of a province of the same name which forms the westernmost part of the country, on the river San Juan, which rises in the Andes and falls into the salt lake of Guanacache. It is indifferently built, and its 17,000 inhabitants are mostly scattered in straggling suburbs and engaged in the cultivation of wine, fruit, and maize.

**San Juan de los Reme'dios,** town on the northern coast of Cuba, in a low and marshy district, but in 1867 exported 544,426 cwts. of sugar and 187,752 cwts. of molasses. P. 6000.

**San Juan del Ri'o,** town of the Mexican confederation, state of Querétaro, at an elevation of 6300 feet above the sea, on the Rio Paté, and surrounded by orchards and gardens. P. about 5000.

**San Juan de Nicaragua.** See Greytown.

**San Juan de Puer'to Ri'co,** capital of the Spanish island of Porto Rico, West Indies, on a small island off the northern coast of the main island, with which it is connected by a bridge. It has a good harbor, a fine cathedral, a handsome theatre, and is strongly fortified by walls, bastions, and a detached fort. It is generally well built, and is one of the healthiest and pleasantest cities of the West Indies, though it lacks good drinking-water. P. 20,000.

**Sankey** (Ira David), b. at Edinburgh, Lawrence co., Pa., Aug. 28, 1840; in business at New Castle, Pa., 1855–71, when he joined Mr. Moody in evangelistic work in Chicago, Ill. They labored together in Great Britain 1873–75, when they returned to the U. S. to inaugurate a new era of preaching to the masses. Mr. Sankey is the author of several popular sacred tunes, which he sings with remarkable effect. (See Moody, D. L.) R. D. Hitchcock.

**Sankhya,** the name of the chief system of philosophy in India. The word signifies "numerical" or "rational," referring to its twenty-five principles, and not, as some have supposed, to a system of numerical symbolism like that of Pythagoras. Its doctrines are attributed to the venerable sage Kapila, who delivered them in the form of memorial verses (*Káriká*). They owe their preservation to Ishwara Krishna, who reduced them to writing. The *Sankhya Káriká* was translated into English by Colebrooke, and published in 1837, accompanied with the commentary of Gaurapáda (Latin translation by Lassen (Bonn, 1832); German translation by Windischmann (Bonn, 1852); French translations by G. Pauthier (Paris, 1833), by B. St. Hilaire (Paris, 1852).) Besides the *Sankhya Káriká,* there is the *Sankhya Pravachana,* a work of 499 memorial verses (printed at Serampore in 1821). This school of philosophy, which has furnished the underlying thought of all the other Indian systems, seeks to solve the problem of life without recourse to revelation as contained in the *Vedas* and other Hindoo scriptures. It is therefore reactionary in its character, and stands opposed to

religious authority. It may be described as having an atheistical left wing, a theistical centre, and an ethical right wing (the two *Yoga* systems). The atheistical *Sankhya* posits nature (*prakriti*) as the essence of matter and the origin whence all emanates. The theistical *Sankhya* identifies *prakriti* with the Supreme Being. The *Yoga* systems are theistical, but their chief tendency is ethical. The *Yoga* of Patanjali enjoins avoidance of temptation, and tends to renunciation and quietism; while the other, the *Karma Yoga*, enjoins the combating of temptation, and arms its devotees for the active contest with evil. The latter is the doctrine of the *Bhagavad Gita* (translated into English by Charles Wilkins in 1785, and the chief source of the current ideas regarding Indian philosophy). The Indian view makes the world an emanation. Individuality is regarded as having arisen from limitation of the abstract essence or being of the Deity. Hence the individuality of material things, and also of souls, is a negation of true being, and must perish. That which distinguishes one being from another is an addition from without, involves externality, and is a fetter or hinderance preventing the attainment of the divine. Emancipation, "liberation of the soul," is accordingly the great object of the Indian philosophy. The *Sankhya Káriká* begins: "Our inquiry is into the means of avoiding the three sorts of pain; for pain is embarrassment"—*i. e.* external limitation. Its solution is thus stated: "Through the study of (the twenty-five) principles the conclusive, incontrovertible, one only knowledge is attained, that neither I am, nor is aught mine, nor do I exist." This passage is interpreted by some to mean the annihilation of the soul and its absorption into the nothingness of the absolute; by others it is understood as the escape from error and illusion to the clear knowledge of universal truth. One can see in this system a revolt against the irksome and galling limitations of the system of caste. The theoretical mind seeks relief from the rigid distinctions of particularity (tedious ceremonial observances) by a flight to the indefinite, vague, and empty ground and substance of all things, and finds solid satisfaction in contemplating the pure identity wherein neither caste-differences nor the bewildering luxuriance of tropical nature, nor even the prolific creations of its teeming fancy, can any longer find subsistence to vex and weary it.

The *Sankhya* philosophy is supposed to date from a period anterior to the eighth century B. C., and its reaction against Brahmanism became a popular movement in the sixth century in the Booddhistic reformation of Sakyamuni, who taught the *Yoga* system with little change, and named its "deliverance of the soul from pain and illusion" the *Nirvâna*. WILLIAM T. HARRIS.

**San Lazzaro, Island of,** Italy. See APPENDIX.

**San Lean'dro,** p.-v., Alameda co., Cal., on Central Pacific R. R. P. 426.

**San Lu'car de Barrame'da,** town of Spain, province of Cadiz, on the left bank of the Guadalquivir, near its mouth. It is well built, carries on an active trade, and exports large quantities of wine and fruits. P. 18,130.

**San Lu'is,** p.-v., cap. of Costilla co., Col.

**San Lu'is de la Pun'ta,** town of the Argentine Republic, capital of a province of the same name, is beautifully situated, but indifferently built, and has no manufactures and very little trade. Its 5000 inhabitants are mostly engaged in agricultural pursuits.

**San Lu'is Obis'po,** county of S. W. California, extending from the Pacific Ocean to the Coast Range, watered by Guaymas and Salinas rivers, is mountainous, has important mines of gold, silver, and coal; also bituminous and warm sulphur springs. The valleys are exceedingly fertile. Staples, barley, wool, butter, and cheese. Sheep-raising is the chief industry. Cap. San Luis Obispo. Area, 2400 sq. m. P. 4772.

**San Luis Obispo,** p.-v. and tp., cap. of San Luis Obispo co., Cal., 9 miles inland from the bay of the same name, contains 5 churches, a female college and 2 schools, 1 bank, 1 newspaper, and railroad connection with one of the best harbors from San Francisco to San Diego. P. 1579 (1870)—(1871) 3000. O. F. THORNTON, ED. "SAN LUIS OBISPO TRIBUNE."

**San Luis Park** is partly in Colorado and partly in New Mexico. It is the largest of the great Rocky Mountain parks, and has the San Juan Mountains on the W. and the main chain of mountains on the E. It is traversed by the Rio Grande. Gold, silver, iron, and copper abound. The valley is inhabited by people of Mexican descent.

**San Luis Potosi',** state of the Mexican confederation, bounded by New Leon, Tamaulipas, Vera Cruz, Querétaro, Guanajuato, and Zacatecas, and comprising an area of 29,486 sq. m., with 476,500 inhabitants. It is traversed by several mountain-ranges, which to the N. W. enclose large plateaus, while to the S. E. they gradually slope down into low plains. The mountains are rich in precious metals, and are generally covered with beautiful forests of oak, pine, and cedar. The plateaus are treeless, but afford excellent pastures. The soil is everywhere fertile, and the climate is agreeable and healthy, except on the low and marshy coast. Agriculture and the rearing of sheep and cattle are the principal occupations; mining and manufacturing industry have declined.

**San Luis Potosi,** town of the Mexican confederation, capital of the state of the same name, on an elevated plain 6350 feet above the level of the sea, near the sources of the river Tampico. It is well built, contains many fine buildings and handsome public squares, and carries on a lively trade in wines and manufactured goods imported through Tampico, and in the rich products of its own surroundings. P. 33,581.

**San Luis Rey,** p.-v. and tp., San Diego co., Cal., on San Luis Rey River, near the Pacific coast. P. 335.

**San Marcello Pistojese,** Italy. See APPENDIX.

**San Marco in Lamis,** Italy. See APPENDIX.

**San Mar'cos,** p.-v., San Luis Obispo co., Cal.

**San Marcos,** p.-v., cap. of Hays co., Tex., on the great thoroughfare and stage-route from Austin *viâ* San Antonio to Mexico, and on the line of International R. R., 25 miles S. of Austin City, has several churches, excellent schools, and 1 newspaper. A series of boiling springs forming a great natural curiosity and affording fine water-power are located here. P. 742.

ISAAC H. JULIAN, ED. "WEST TEXAS FREE PRESS."

**San Mari'no,** the oldest and smallest republic in the world, is situated in Eastern Central Italy, and is governed by a legislative senate of 60 members elected for life, an executive council of 12, two-thirds of whom go out every year, and two presidents elected for six months. This has been the form of government since 1847, when the constitution was considerably changed. The territory of the republic is 22 sq. m. in extent, and embraces five small villages, with a pop. (in 1874) of 7816. The capital, of the same name, is perched on the crest of a mountain 2635 feet above the sea, and commands a splendid view of the Apennines on one side, and, at sunrise, of the Dalmatian coast, across the Adriatic, on the other. It is said to have been founded early in the fourth century by St. Marinus, a converted stonemason, who fled from Rimini (13 miles N.) during the Diocletian persecution. Borgo, 500 feet lower down, is the residence of the principal inhabitants. The other three villages are Serravalle, Faetano, and Monte Giardino. There is a standing army of 131 officers and 819 men, and it has an annual revenue of about $22,000, the expenditures being a trifle less. The principal products are fruit, silkworms, and wine, and there is some good pasturage. Gunpowder is manufactured. This little republic exists, of course, by the sufferance of its powerful neighbors, but owes much also to the good sense and energy of its citizens, the most distinguished of whom has been Antonio Onofri, a contemporary of the First Napoleon. There is a history of the republic by Melchiorre Delfico, a Neapolitan (1804). (See Augustus J. C. Hare's *Cities of Northern and Central Italy*, 1876.) R. D. HITCHCOCK.

**San Martin, de** (JOSÉ), b. Feb. 25, 1778, at Yapeyú, on Uruguay River, then capital of the province of Misiones, of which his father was governor; educated in the College of Nobles at Madrid; became aide-de-camp to the military governor of Cadiz; distinguished himself against the French at Baylen and subsequent battles, gaining the rank of colonel; returned to the La Plata 1811; entered the military service of the insurgents; was soon made a general and given command of a division; gained several victories in Upper Peru; became governor of the province of Tucuman 1813, and of that of Cuyo (now divided into Mendoza and San Juan) 1815; organized there an expedition for the liberation of Chili from the Spanish yoke; crossed the mountains early in 1817; gained a brilliant victory at Chacabuco Feb. 12 of the same year, and a still more decisive one at Maypú Apr. 5, 1818; organized the government of Chili, which he left in the hands of O'Higgins; sailed for Peru with the squadron commanded by Lord Cochrane Aug. 21, 1820; captured Lima, drove the Spaniards from the coast, and assumed the title of "protector" of Peru, 1821, but resigned that post in a mysterious manner the following year after an interview with Bolivar at Guayaquil, and sailed secretly for Europe, where he passed the remaining twenty-eight years of his life in absolute seclusion near Paris. D. at Boulogne, France, Aug. 17, 1850.

**San Marti'no di Lupa'ri,** town of Italy, province of Padua, with a fine church. P. 5296.

**San Mate'o,** county of W. California, occupying most of the peninsula between the Pacific Ocean and the Bay of

San Francisco, is traversed by Southern Pacific R. R., has several ranges of hills containing deposits of coal, rich plains, and fertile valleys in a high state of cultivation, yielding chiefly fruits, vegetables, butter, and cheese for the San Francisco market. There are mineral springs impregnated with sulphur and iron. Cap. Redwood City. Area, 432 sq. m. P. 6635.

**San Mateo,** p.-v. and tp., San Mateo co., Cal., on Southern Pacific R. R. P. 977.

**San Mau'ro Castelver'de,** town of Sicily, province of Palermo, about 19 miles from Cefalù and 12 miles from the sea. The pasturage of the district is excellent, and it exports cheese and manna. P. 5168.

**San Miguel',** town of San Salvador, Central America, on a navigable river of the same name, 20 miles from its mouth in the Pacific Ocean, in the Bay of Fonseca. Its surroundings, though very fertile, are thinly peopled, as the district is not healthful, yet the annual fair of the city is attended by many people and large sales are made. P. about 12,000.

**San Miguel,** county of E. New Mexico, adjoining Texas, on Rio Pecos and Canadian rivers, is mountainous, and chiefly devoted to sheep-raising. Cap. Las Vegas. Area, 10,800 sq. m. P. 16,058.

**San Miguel, de** (Evaristo), b. at Gijon, Spain, in 1780; served in the Spanish army and in the Cortes during the war of independence; afterward edited a liberal paper which drew on him the persecution of King Ferdinand VII.; took a prominent part, along with Riego, in the constitutional revolution of 1820; wrote the "Hymn of Riego," now the national hymn of Spain; became minister of foreign affairs 1822; was taken prisoner by the French "army of intervention" during the war of 1823–26; resided in England until 1834, after which he was for several years very prominent in the Cortes and in the government of Isabella II. as captain-general of Aragon and of the Basque provinces; took an active part in the revolution of 1854, at which time he was made president of the revolutionary junta and of the Cortes, minister of war and field-marshal, and in 1856 a grandee of the first class. D. at Madrid May 29, 1862. Author of a *History of Philip II.* (1847) and several other historical and political works.

**San Miniato,** Italy. See Appendix.

**Sannaza'ro** (Jacopo), b. at Naples July 28, 1458; educated at the academy of Pontano; travelled much, and began to write poetry to free himself from the overwhelming passion with which Carmosina Bonifacia inspired him; received great favor from King Frederick III. of Naples as a reward for his poems; followed him into exile in 1501, when he was driven from the throne by the Spaniards, and did not return until after his death. D. at Naples Apr. 27, 1530. The most remarkable of his Italian poems, of which a collected edition appeared at Padua in 1723, is *Arcadia*, a series of idyls partly in prose, partly in verse. His Latin poems comprise a long poem, *De Partu Virginis*, of which an edition was given by Becker (Leipsic, 1826), *Eclogæ*, and epigrams, among which is the famous poem in praise of Venice, which the senate rewarded with 600 ducats.

**San Nican'dro Gargani'co,** town of Italy, province of Capitanata, on the Gargano, at the western foot of Monte Origoni, about 4½ miles from the Adriatic. P. 7895.

**San Pab'lo,** p.-v., Contra Costa co., Cal., on San Pablo Creek and San Francisco Bay. P. 1075.

**San Pas'qual,** p.-v., San Diego co., Cal. P. 275.

**San Pasqual Valley,** an Indian reservation in San Diego co., Cal. P. 117.

**San Patri'cio,** county of S. Texas, on the Gulf of Mexico, between Aransas and Nueces rivers, is largely covered with mezquite bushes and other small trees, and is subject to summer droughts. Pasturage is the chief industry. Cap. San Patricio. Area, 550 sq. m. P. 602.

**San Patricio,** p.-v., cap. of San Patricio co., Tex., on Nueces River.

**San Pete,** county of Central Utah, adjoining Colorado, intersected by Green River and the Wahsatch Mountains, watered by Sevier River, has considerable timber, and is well adapted to agriculture. Staples, wheat, potatoes, hay, wool, and butter. Cap. Manti. Area, about 7000 sq. m. P. 6786.

**San Pier d'Arena,** Italy. See Appendix.

**San Pierre',** p.-v. and tp., Starke co., Ind., on Louisville New Albany and Chicago R. R. P. 105.

**San Pie'tro in Casa'le,** town of Italy, province of Bologna, well built and the centre of a very active traffic in agricultural products. P. 8480.

**San Quen'tin,** p.-v., Marin co., Cal., on San Francisco Bay.

**San Ra'fael,** p.-v. and tp., cap. of Marin co., Cal., 15 miles N. of San Francisco by ferry and cars, has 4 churches, 3 academies and 1 public school, a handsome county building, a fire company, 2 carriage manufactories, 2 newspapers, 2 lines of railroad, and 3 of stages. It is a favorite resort for consumptives and asthmatics. P. of v. 841; of tp. 2695. S. F. Barstow, Ed. "Journal."

**San Remo,** Italy. See Appendix.

**San Ro'que,** town of Spain, province of Cadiz, on the Bay of Gibraltar, was built by the Spaniards after the loss of Gibraltar. It is celebrated for the salubrity of its climate, the cheapness of living, and the beauty of its women. It produces great quantities of fruit and vegetables, in which it carries on a considerable trade with Gibraltar. P. 7619.

**San Sa'ba,** county of W. Texas, bounded N. and E. by Colorado and traversed by San Saba River, consists of rolling prairies with a few hills. Staples, wheat, sweet potatoes, molasses, honey, and wool. Cap. San Saba. Area, 700 sq. m. P. 1425.

**San Saba,** p.-v., cap. of San Saba co., Tex. P. 168.

**San Salvador',** or **Banza Congo,** the capital of the territory of Congo, Western Africa, on the river Lelunda, 50 miles from its mouth, was in the sixteenth and the beginning of the seventeenth century a large and flourishing place, but is now only a heap of ruins.

**San Salvador,** city of Brazil. See Bahia.

**San Salvador,** the smallest of the Central American republics, is bounded W. by Guatemala, from which it is separated by the river Paza; N. by Honduras; E. by the Bay of Conchagua or Fonseca; and S. by the Pacific Ocean. Area, 7230 sq. m. P. 600,000, of whom 9000 are white, of Spanish descent, 1000 negroes, 290,000 mestizoes, and 300,000 Indians, who speak Spanish and profess the Christian religion. Between the coast-land, which consists of a belt of low, level ground of an average breadth of 15 miles, and the lofty Cordilleras on the frontier of Honduras, there runs through the whole length of the country, and forming with the Cordilleras a broad inland valley, a range of volcanic mountains, whose highest points are San Vicente and San Salvador, each more than 9000 feet high, and in which sixteen peaks are still active. The valley and the coast-land are exceedingly fertile, well watered by a number of short but copious streams, generally navigable and well adapted to irrigation. Although the climate is hot, the heat seldom becomes oppressive, and only a few districts are unhealthy. Agriculture is the chief occupation. The mineral wealth of the country, which at one time was considered immense, seems to be nearly exhausted. Cattle-rearing and dairy-farming are only pursued to a limited extent, though the country possesses a good breed of cattle; fishing is also of subordinate importance. The whole energy of the population seems to be concentrated on agriculture, and the result is by no means small. The total value of the exports for the year 1870 amounted to $3,810,916—namely, indigo, $2,447,550; coffee, $507,793; and sugar, $250,232. Indigo is the staple crop, being extensively cultivated and of superior quality. The extensive forests yield excellent timber, especially cedar, and yearly from 17,000 to 22,000 pounds of balsam of Peru. The total revenue of the state in 1869 was $830,371; expenses, $802,802. Every village of 50 inhabitants is compelled by law to maintain a school. Cap. San Salvador.

**San Salvador,** capital of the republic of San Salvador, Central America, in an elevated valley 2100 feet above the level of the sea, 5 miles from its port, La Libertad, at the foot of the volcano San Salvador, which rises 7100 feet. On Apr. 16, 1854, the city was entirely destroyed by a fearful earthquake, but it has been rebuilt on the same site, its commerce has revived, and it has nearly as many inhabitants. The climate is healthy, the situation beautiful, and the surroundings very fertile. P. about 16,000.

**San Salvador,** p.-v. and tp., San Bernardino co., Cal. P. 560.

**San Salvador' de Baya'mo,** town of Cuba, on an elevated plain near the Canto. P. 7100.

**San Salvador Island.** See Bahama Islands.

**San Salvato're Monferra'to,** town of Italy, province of Alessandria, 7 miles N. of Alexandria. There are mineral springs here of some reputation for the cure of scrofulous and cutaneous affections. This town belonged for many centuries to the marquisate of Monferrato. P. 7000.

**Sansanding',** town of Central Africa, state of Bambara, on the Joliba, has large markets, and is the entrepôt of an important trade in salt and gold-dust. P. 11,000.

**Sanscrit Language and Literature.** See Appendix.

**Sans Culottes'** [Fr., "without breeches"], a name bestowed early in the first French Revolution by the royalists

upon the lower classes of the populace. The latter for a time accepted the name with much pride, but it was finally dropped.

**San Sebastian.** See SAINT SEBASTIAN.

**San Secondo Parmese,** Italy. See APPENDIX.

**Sansepulero,** Italy. See APPENDIX.

**San Severino Marche,** Italy. See APPENDIX.

**San Severo,** Italy. See APPENDIX.

**Sanson′** (NICOLAS), b. at Abbeville, France, Dec. 20, 1600; was teacher of geography to Louis XIII., afterward royal geographer, and prepared a great number of maps of the Roman empire, etc. D. at Paris in 1667. His two sons succeeded him as royal geographers, and after them followed his grand-nephew, Robert de Vaugondy.

**San′ta An′a,** town of Central America, in the republic of San Salvador, is well built and contains several fine public buildings of the time of the Spaniards. Sugar and coffee are extensively cultivated in the vicinity. P. 10,000.

**Santa Ana,** county of N. W. New Mexico, adjoining Arizona, intersected by Rio Grande, San Juan, and Colorado Chiquito rivers, has a mountainous surface and a wide valley containing good farming-lands, which, however, require irrigation. Cap. Jemez. Area, about 7000 sq. m. P. 2599.

**Santa Ana,** p.-v. and tp., Los Angeles co., Cal. P. 1445.

**Santa Anna,** tp., De Witt co., Ill., on Indianapolis Bloomington and Western and Gilman Clinton and Springfield R. Rs., includes the v. of Farmer City. P. 1276.

**San′ta An′na, de** (ANTONIO LOPEZ), b. at Jalapa, Mexico, Feb. 21, 1798; served as a subaltern in the Spanish ranks against the insurgents during the first war of independence, attaining the rank of colonel; placed himself in 1821 at the head of the movement in Vera Cruz which seconded the "plan of Iguala," proclaimed by Iturbide for the achievement of Mexican independence under a monarch of the house of Bourbon; succeeded in expelling the Spaniards from Vera Cruz; was made a general by Iturbide, whom he recognized as emperor in June, 1822, but, having quarrelled with him, proclaimed the republic at Vera Cruz Dec. 2, 1822, initiating a movement which resulted in May, 1823, in the fall of the short-lived monarchy, the establishment first of a junta, and soon afterward in the election of Guadalupe Victoria to the presidency; lived several years in comparative retirement on his estate near Jalapa until 1828, when, in the bitter struggle between the rival presidential candidates, Gomez Pedraza and Guerrero, he *pronounced* in favor of the latter at the castle of Perote, marched upon Oaxaca, and there sustained a memorable siege, terminated only by the triumph of Guerrero in Mexico (1829); was appointed by the latter to a high command in the army; was sent against the expedition of Gen. Barradas, the last effort of Spain for the reconquest of Mexico, and succeeded in forcing that officer to capitulate with his whole army at Tampico Sept. 11, 1829—an event which obtained for the victor an immense popularity; acquiesced at first in the revolution by which Pres. Guerrero was overthrown by Vice-Pres. Bustamante (Jan., 1830), but in 1832 took up arms against the latter, and after many sanguinary battles negotiated at Puebla terms of peace involving the resignation of Bustamante, the return of the legally-elected president, Gomez Pedraza, from the U. S. to serve out the balance of his unexpired term (Jan. to Apr., 1833), and the holding of a new presidential election. Santa Anna presented himself as the candidate of the liberal party, the first organization of the kind which has existed in Mexico; was elected president for four years, and inaugurated Apr., 1833, but soon retired on plea of ill-health to Jalapa, leaving to the vice-president, the distinguished statesman Dr. Valentin Gomez Farias, the task of attempting the ecclesiastical reforms which had been promised, and which soon led to a revolution headed by the Church party, to which Santa Anna gave in his adhesion, banishing the vice-president and governing thenceforth in the interest of the reactionary spirit of the Church and the army, which found means to establish a practical dictatorship by the overthrow of the constitution of 1824 and the substitution of a clumsy and anomalous system known as the "organic bases" of 1835. The numerous insurrections which attended this change of system afforded a pretext to the Texan colonists to declare their independence, and Santa Anna, having marched against them, won the victory (or massacre) of the Alamo, Mar. 6, but was taken prisoner at the battle of San Jacinto, Apr. 21–22, 1836; negotiated during his imprisonment a treaty recognizing the independence of Texas, which was of course disregarded at the capital and covered his name with obloquy; was set at liberty and sent to the U. S. 1837; ascended the Mississippi and the Ohio; visited Pres. Jackson at Washington; returned to Mexico, and relapsed into obscurity at Jalapa until the French attack upon the fortress of San Juan de Ulloa in Dec., 1838, brought him again into prominence as the heroic defender of Vera Cruz, where he lost a leg, but continued to animate his troops with stirring words; which, combined with the fact that his injuries were for some weeks supposed to be of a mortal character, made him again a popular hero and martyr. In consequence, he was made acting president for some months in 1839, was placed at the head of a successful revolution which in 1841 overthrew the existing system of government, and was dictator until Dec., 1844, when a new uprising of the liberal party against his arbitrary acts made Gen. Herrera president; and, being taken prisoner while attempting to escape from the country, he was tried for treason (Jan., 1845), banished for ten years, and took up his residence at Havana. The war with the U. S. again directed attention to him, and returning secretly to Mexico, he was again made president by a popular movement which restored the liberal constitution of 1824. Defeated by Gen. Taylor at Buena Vista, Feb. 22, and by Gen. Scott in the battles from Vera Cruz to the Valley of Mexico Mar.–Sept., 1847, he was forced to flee from the country (1848), and resided quietly at St. Thomas and at Turbaco, New Granada, until 1853, when a conservative revolution once more placed him at the head of the government as dictator with almost unlimited powers. His despotic instincts now took free range, and he arrogated the title of "serene highness" as president for life, with power to name his successor, and sold the Mesilla Valley to the U. S. for $10,000,000. The impending triumph of the "plan of Ayutla" under Alvarez and Comonfort led to his flight from the country Aug., 1855, when he proceeded to St. Thomas, and was in his absence again tried for treason, and his vast landed property confiscated. During the war of reform he remained quiet, but during the existence of the French intervention he proceeded to Vera Cruz (May, 1864) and offered his services to Gen. Bazaine, but was immediately expelled from the country. Soon afterward he recognized the so-called "empire" of Maximilian, and was created a "grand marshal" by that prince, but was not allowed to return, and consequently began a series of intrigues with the government of the U. S., taking up his residence at Elizabethtown, N. J., whence he corresponded with Secretary Seward and Pres. Juarez to no purpose. After the fall of Maximilian he once more proceeded to Mexico with revolutionary intentions, but was taken prisoner at Sisal, Yucatan, tried at Vera Cruz, and condemned to death, but his sentence was commuted by Pres. Juarez to banishment for eight years. At the beginning of 1874 he took advantage of the amnesty to return to the City of Mexico, where he resided for a time in poverty and obscurity, having been unsuccessful in his appeals to congress and to the executive for the restoration of his confiscated estates. He was destitute of a regular education, but possessed great political shrewdness, and published a vast number of pamphlets and manifestoes. In 1874–75 he was engaged in the preparation of an *Autobiography*. D. at Vera Cruz June 20, 1876. PORTER C. BLISS.

**San′ta Bar′bara,** county of S. W. California, on the Pacific Ocean, bounded N. by Guaymas or Santa Maria River, watered by Santa Inez and other rivers, traversed by the sierras of San Rafael and Santa Inez, is mountainous in the eastern part, has fertile valleys along the coast noted for their luxuriant variety of subtropical fruits and vegetation. Gold, iron, copper, and petroleum are found. Sheep-farming and fruit-raising are the leading industries, grapes, oranges, and almonds being very abundant, and mulberry trees having recently been introduced with success. Cap. Santa Barbara. Area in 1870, 2800 sq. m. P. 7784. Since that time a portion of the county has been formed into a new county named Ventura.

**Santa Barbara,** p.-v., cap. of Santa Barbara co., Cal., about 260 miles S. of San Francisco, with which it is connected by steamboat, stage, and railroad, contains 6 churches, including an old mission cathedral of ancient build, the Santa Barbara and Franciscan colleges, St. Vincent's Institute, and a graded public school, 1 bank, 2 daily and 3 weekly newspapers, a circulating library, Masonic and Odd Fellows' lodges, and temperance and Patrons of Husbandry societies, several vineyards, and 2 excellent hotels. The town has water and gas, and its hot springs are becoming very popular with invalids. P. 4255.

J. A. JOHNSON, ED. "WEEKLY PRESS."

**Santa Caterina Villarmosa,** town of Sicily. See APPENDIX.

**San′ta Cathari′na,** province of Brazil, bounded by the provinces of São Paulo, Paraná, and Rio Grande do Sul, and the Atlantic, comprises an area of 25,000 sq. m., with 140,000 inhabitants. On account of its mild and equable climate, the beauty of its scenery, and the inex-

haustible fertility of its soil this province has received the name of "the paradise of Brazil." Of the many islands which lie along the coast of this province, Santa Catharina, the largest, forms a bay which affords safe anchorage for the largest vessels.

**San'ta Cla'ra,** county of W. California, on San Francisco Bay, watered by Coyote and Guadalupe rivers, and lying between the Monte Diablo and Santa Cruz ranges of mountains, which are heavily wooded with fine timber, is traversed by the Southern Pacific R. R. and by San José branch of Central Pacific R. R., consists largely of a wide valley of surprising fertility, noted for its enormous crops of wheat, while the hillsides are equally favorable to the vine, has mineral and hot springs, and includes the New Almaden and Guadalupe quicksilver-mines, the richest in the world. Manufactures are rapidly being introduced. Cheese, butter, barley, hay, and hops are staples. Cap. San José. Area, 1332 sq. m. P. 26,246.

**Santa Clara,** p.-v., Santa Clara co., Cal., on Southern Pacific R. R., in the centre of the rich agricultural valley from which the town derives its name, 48 miles S. E. of San Francisco, contains 1 college (Santa Clara) and St. Mary's Academy, 1 bank, 1 newspaper, a tannery, a flour-mill, and hotel. P. 3469. EDS. "THE OWL."

**Santa Croce sull' Arno,** Italy. See APPENDIX.

**Santa Cruz,** an island of the West Indies, the largest and southernmost of the Virgin group, in lat. 17° 45′ N., lon. 64° 34′ W., comprises an area of 84 sq. m., with 22,760 inhabitants, and belongs to the Danes. The northern coast is hilly; the rest of the surface is flat. The soil is exceedingly fertile, and the climate not unhealthy, but hurricanes and earthquakes are frequent. Nearly the whole island is under cultivation; sugar and rum, both of excellent quality, are the principal products. The island was discovered by Columbus on his second voyage, and belonged successively to Holland, England, Spain, and France, which latter in 1733 ceded it to Denmark. The language is English. Cap. Christiansted.

**Santa Cruz,** county of W. California, lying between the Pacific Ocean and Monterey Bay, bounded E. by the Santa Cruz Mountains and S. by Pájaro River, consists chiefly of heavily-timbered mountains, is well watered, produces copper, coal, and some gold, and has several fertile valleys yielding fine crops of grain and vegetables. Butter, cheese, and swine are also produced in abundance. There are numerous saw-mills and several manufactories. Cap. Santa Cruz. Area, 432 sq. m. P. 8743.

**Santa Cruz,** p.-v. and tp., cap. of Santa Cruz co., Cal., 75 miles S. of San Francisco, on Monterey Bay, at the mouth of Lorenzo River, has 6 churches, 1 college, and a seminary, 1 savings and loan bank, 2 newspapers, 1 orphan asylum, 3 tanneries, 2 foundries, gasworks, 1 basket manufactory, 1 flour and 2 planing mills, 5 hotels, and repair-shops. P. of v. 2561; of tp. 4436. W. W. BROWNING, ED. "SENTINEL."

**Santa Cruz** (ANDRÉS), b. in Upper Peru (now Bolivia) in 1794; took part in the war of independence, rising to the rank of field-marshal; became Peruvian minister to Chili 1828; was elected president of Bolivia after the overthrow of Gen. Sucre 1829; placed himself at the head of the "Unitarian" movement in Bolivia and Peru, which countries he succeeded, partly by force, in uniting as the "Peru-Bolivian Confederation" (1836), consisting of the three republics of North Peru, South Peru, and Bolivia, each with a separate president and constitution, but subordinate for some purposes to Santa Cruz, who fixed his government at Lima in the double capacity of president of Bolivia and "supreme protector of the Peru-Bolivian Confederation." In 1837–39 he carried on a disastrous war with Chili, probably with the ulterior design of annexing that republic to the confederation, but that anomalous system of government was overthrown in 1839 by the combined efforts of Gens. Velasco and Ballivian, and Santa Cruz took refuge in Europe, never returning to South America. As a safeguard against any attempts at a revolution, he was kept constantly employed by successive administrations, both of Bolivia and of Peru, as minister to the courts of London, Paris, Rome, and Madrid. D. at Saint-Nazaire, France, in Sept., 1865.

**Santa Cruz de la Pal'ma,** town of the Canary Islands, on the E. coast of Palma, at the head of a spacious bay, has some shipbuilding and trade. P. 5600.

**Santa Cruz de Santia'go,** cap. of the Canary Islands, on the N. E. coast of Teneriffe, in a somewhat unfertile and even unhealthy district. But it has an excellent harbor, making the city the chief commercial port of the islands. Wine, brandy, and cochineal are exported. The town and harbor are strongly fortified. P. about 11,000.

**Santa Eufemia d'Aspromonte,** Italy. See APPENDIX.

**Santa Fé,** town of the Argentine Republic, capital of a province of the same name, in a fertile and well-cultivated plain on the river Salado. It is well built, has a college, and carries on some trade. P. 10,670.

**Santa Fé,** county of Central New Mexico, drained by the Rio Grande and Rio Pecos and their affluents, and traversed by the principal chain of the Rocky Mountains, has several fertile valleys producing fruit and wine of superior quality. Sheep-raising is the leading industry. Cap. Santa Fé, which is also the capital of the Territory. Area, about 1800 sq. m. P. 9699.

**Santa Fe,** p.-v. and tp., Alexander co., Ill., on Mississippi River. P. 600.

**Santa Fe,** p.-v., Butler tp., Miami co., Ind. P. 115.

**Santa Fé,** city and capital of the Territory of New Mexico and county-seat of Santa Fé co., the commercial centre, an archiepiscopal see of the Roman Catholic Church, and head-quarters of the military district, is 20 miles E. of the Rio Grande del Norte, on Santa Fé Creek; altitude 7044 feet; lat. 35° 41′ 6″, lon. 105° 46′ 30″. The soil is productive under irrigation for all the fruits and products of the 40th meridian; climate dry and moderate in tem-




Cathedral of Santa Fé.

perature the year round. It is distant per odometer measurement, *viâ* stage-road, 430 miles S. from Denver, 210 miles S. W. of the railroad terminus at Trinidad in Colorado, 598 miles N. E. of Tucson, 280 miles N. of Mesilla, and has mail-coaches daily to railroad, and semi-weekly S. to El Paso and Silver City, and W. to Fort Wingate, and direct telegraphic communication N., E., and S. P. 5000, made up principally of natives of the country, except as represented in the Federal officers, the professions, and commercial classes. It had long been occupied as an Indian pueblo at the discovery and occupation by the Spaniards in the latter part of the sixteenth century; fragments of gold and silver ores are found, among other fragments of slag and pottery, in the edge of the foot-hills, indicating the existence of reduction-works in days gone by, of which neither history nor tradition gives account. Mines of the precious and grosser metals in varying quantities, and extensive quarries of fine marble, gypsum, and limestone, are known in the surrounding mountains. The Pueblo (or Village) Indians, having been subjected to slavery, arose in 1680 and drove the Spaniards out of Santa Fé and the territory; they then erected in the plaza a stone enclosure, into which the public records and fixtures and decorations of the churches were cast and burned, and also filled up and obliterated all traces of mines developed. According to public records in the office of the secretary of the Territory, the Indians held possession of the country for fourteen years to a day, when they were finally reconquered by the Spaniards, who with their descendants continued successively, under the authorities of Spain and Mexico, to occupy and govern the country until the American occupation by Gen. S. W. Kearny, Aug. 18, 1846. On the authority of ex-Gov. Donaciano Vigil we give the following items of history: A custom-house was first established here in 1821; in 1822 the first train of merchandise from the U. S. was brought into Fernandez de Taos by the five Robidoux brothers; two years later the first train of merchandise arrived at Santa Fé from the same source; in 1826 the first American mercantile house was established by Henry Clews & Bro.; there were about 20 American traders and trappers resident when taken possession of by the U. S. army. The Territorial government under the organic act was established in 1851; in 1862 the rebel forces under Gen. Sibley occupied the city for a few days, until

obliged to flee in consequence of defeat by the Union forces under Col. Slough of the Colorado Vols. at the battles of Pigeon's Ranch and Apache Cañon on Mar. 28; a substantial monument of granite and marble stands in the plaza, erected by the Territory in commemoration of the event. Among historical objects of special interest is the adobe palace built prior to 1680, having been the quarters of the civil and military authorities up to 1851, and since occupied by the legislative assemblies and governors of the Territory; the San Miguel church, S. of the river, built, according to tradition, shortly after the Spanish occupation, and hence the oldest church standing, if not the first church erected, in the U. S.; and Fort Marcy, on the foot-hills immediately adjacent to the town, built and occupied by Gen. Kearny in 1846. The city has 6 principal jobbing-houses, whose annual sales reach $2,500,000, 2 national banks, 1 daily and 1 weekly newspaper, an orphan asylum under the Sisters of Charity, 4 Roman Catholic and 2 Protestant churches, and 1 Presbyterian and 2 Roman Catholic academic schools. Archbishop Lamy has in course of erection a very substantial and imposing cathedral of stone, Roman Byzantine in design, cruciform in plan, with 270 feet length of nave and choir, and proportional otherwise, the cornerstone of which was laid in Oct., 1870.

WILLIAM G. RITCH, FOR THE "NEW MEXICAN."

**Santa Fé de Bogotá.** See BOGOTÁ.

**Santa Fiora,** Italy. See APPENDIX.

**Sant' Agata dei Goti,** Italy. See APPENDIX.

**Sant' Agata di Puglia,** Italy. See APPENDIX.

**Sant' Agostino,** Italy. See APPENDIX.

**San'ta Inez',** tp., Santa Barbara co., Cal. P. 1038.

**Santal.** See SANDAL-WOOD and SANTAL-WOOD.

**Santa'laceæ** [from the principal genus, *Santalum*, sandal-wood], a small order of apetalous dicotyledonous plants widely distributed over the world, most nearly related to Loranthaceæ, but incompletely, if at all, parasitic, according with that order in having its ovules and seeds destitute of integuments. The sandal-woods are far the most important representatives of the order. The European are all herbs, as is *Comandra*, the commonest North American representative; but the Alleghanies have two shrubby genera; one of them, *Pynelaria*, oil-nut, has a large kernel abounding with acrid oil. The quandang-nut of Australia, however, is bland and edible. The "Australian cherry" (so called), "with the stone on the outside," is the nut of *Exocarpus*, supported on an apparent succulent red berry, which is formed by an enlargement of the tip of the flower-stalk. ASA GRAY.

**Santaline.** See SANTAL-WOOD.

**Santa Lucia del Mela,** Sicily. See APPENDIX.

**San'tal-Wood, Sanders,** or **Saunders,** etc., from the *Pterocarpus santalinus*, imported from the East Indies, Ceylon, Madagascar, and the coasts of Coromandel and Malabar. It occurs in large billets, compact, hard, and of a dull murky-red color. Its coloring-matter is supposed to be similar to, if not identical with, that of bar and cam wood. It is only developed by age, and, while it is abundant in the trunks, is not found in the young branches. Wiedel (*Zeit. Chem.* [2], vi. 83) isolated two peculiar bodies from santal-wood: (1) *santal* ($2C_8H_6O_3.3H_2O$), colorless crystals, tasteless, odorless, insoluble in water, bisulphide of carbon, benzol, and chloroform, and only slightly soluble in alcohol and ether. Its alkaline solution is yellow, but becomes rapidly red in the air, and gives red precipitates with lime and baryta. Its alcoholic solution assumes a dark-red color with ferric chloride. He obtained 3 parts from 1000 of wood. (2) *Santaline* ($C_{14}H_{12}O_4$), which differs from alizarine by only $H_4$. It has a magnificent scarlet color, with a green metallic iridescence, is insoluble in water, slightly soluble in alcohol and ether, and imparts a reddish-purple color to alkaline solutions. Sandal-wood is used chiefly on the Continent, to give a bottom to woollen cloth to be subsequently dyed with indigo, yielding by this combination a fine blue (*bleu de Nemours*), which is purple-blue by reflected light. It also imparts a dark red to woollen and cotton goods, which assumes a rich brown on passing through a bath of bichromate of potash. With sumac it gives a dark brown—with fustic a light brown. (See also SANDAL-WOOD.) C. F. CHANDLER.

**Santa Margherita di Belice,** Sicily. See APPENDIX.

**Santa Margherita Ligure,** Italy. See APPENDIX.

**Santa Maria.** See PUERTO DE SANTA MARIA.

**Santa Maria Capua Vetere,** Italy. See APPENDIX.

**Santa Maria in Monte,** Italy. See APPENDIX.

**San'ta Mar'ta,** city of Colombia, cap. of the state of Magdalena, on the Bay of Santa Marta, in the Caribbean Sea, near the mouth of Magdalena River, has monthly communication by steamer with New York and the West India ports, and maintains a considerable coasting-trade. The port is commodious, and defended by three fortresses. The Santa Marta mountain-range rises in some peaks to 17,000 feet, and is not connected with the Andes.

**San'ta Mar'tha,** an ill-built and decaying town of Venezuela, South America, on an inlet of the Caribbean Sea, among fertile surroundings. P. about 5000.

**Santa Mau'ra,** or **Leucadia,** one of the Ionian Islands, about a mile off the western coast of Greece, with which it was formerly connected by an isthmus, comprises an area of 180 sq. m., with 20,327 inhabitants. The range of hills which traverses it from N. to S. ends at the southern extremity in some high white cliffs, which are called "Sappho's Leap," and from which the island received its name.

**Santa'na** (PEDRO), b. in Santo Domingo about 1810; headed the revolt of the eastern portion of the island, securing its independence from Hayti, 1844; was president 1844–48; repulsed a new Haytian invasion Apr. 22, 1849, acquiring thereby the title of "liberator;" was again president 1853–56 and 1858–61, but, becoming wearied of the efforts to preserve peace, negotiated in the latter year the reannexation of Santo Domingo to Spain. D. at Santo Domingo June 14, 1864.

**Sant' Anastasia,** Italy. See APPENDIX.

**Santan'der,** town of Spain, capital of the province of the same name, on a promontory in an inlet of the Bay of Biscay, where a spacious and perfectly safe harbor is formed by two moles and provided with convenient quays and docks. The surrounding hills are beautiful, covered with vineyards and forests, and rich in mineral springs and iron and copper ores. The rivers and the sea teem with fine fish. The city has several good manufacturing establishments. Wheat and ores are the principal items of exportation. P. about 35,000.

**Santander',** one of the nine confederate states of the United States of Colombia into which that country was divided by the constitution of 1858, is bounded N. E. by Venezuela, S. E. by Boyaca, and W. by the river Magdalena; includes the cities of Pamplona, Ocaña, and Rosario de Cucuta, the inhabitants of which are industrious and well educated. Area, 16,293 sq. m. P. 425,427. Cap. Socorro, a city of 12,000 inhabitants.

**Santander** (FRANCISCO DE PAULA), b. at Rosario de Cucuta, New Granada, Apr. 2, 1792; educated at the College of Bogota; served under Bolivar in the war of independence as colonel; became provisional vice-president of Cundinamarca; was chiefly instrumental in assembling at his native place, Rosario de Cucuta, in Jan., 1821, the constituent congress of delegates from Venezuela and New Granada, by which the two countries were united as the republic of Colombia, of which Bolivar was chosen president and Santander vice-president (Oct., 1821); was in charge of the executive power from Dec., 1821, to Sept., 1827, while Bolivar was absent in Peru or engaged in campaigns; was re-elected vice-president 1827, but soon came into collision with the "liberator," to whom monarchical projects were attributed, and was soon banished from the country upon a charge of being concerned in a plot for the assassination of the former; resided several years in England, France, and Germany; was recalled after the dissolution of the centralized republic of Colombia, and chosen first constitutional president of the republic of New Granada, which office he filled 1833–37. D. at Cartagena May 6, 1840.

**Sant' Angelo dei Lombardi,** Italy. See APPENDIX.

**Sant' Angelo di Brolo,** Sicily. See APPENDIX.

**Sant' Angelo Lodigiano,** Italy. See APPENDIX.

**Santa Ninfa,** Sicily. See APPENDIX.

**Sant' Antimo,** Italy. See APPENDIX.

**Santaquin',** p.-v., Utah co., Ut.

**Sant' Arcangelo di Romagna,** Italy. See APPENDIX.

**Santarem',** town of Spain, province of Estremadura, on the Tagus, is in a very fertile district. P. 9000.

**Santaro'sa** (SANTORRE), COUNT OF, b. at Savigliano in 1783. While still very young he entered the Piedmontese army; in 1821 was minister of war during the brief revolutionary period. On the complete failure of the new Subalpine government he first retired to Switzerland, and thence to France, where he formed a close friendship with Victor Cousin, who afterward wrote his life; then went to London, and there became attached to Ugo Foscolo, but finally left England for Greece, where he d. in 1825, fighting for her independence. Author of a *History of the French Revolution*.—His son, COUNT PIETRO SANTAROSA, the friend of Silvio Pellico, wrote an admirable history of the Ciompi, and was constitutional minister of the

king of Sardinia. As it was during his ministry that the law Siccardi was passed, abolishing the special ecclesiastical tribunals, the archbishop of Turin, Luigi Fransoni, refused him the last sacraments of the Church.

**San'ta Ro'sa,** county of W. Florida, lying between Alabama and the Gulf of Mexico, bounded S. W. by Pensacola Bay and Escambia River, and traversed by Yellow and Blackwater rivers, has a level surface and a sterile soil. Santa Rosa Island lies off the S. coast. The western extremity of the island, on which is FORT PICKENS (which see), forms the sea-barrier of Pensacola harbor. Staples, rice and molasses. Cap. Milton. Area, 700 sq. m. P. 3312.

**Santa Rosa,** tp., San Luis Obispo co., Cal. P. 1111.

**Santa Rosa,** p.-v., cap. of Sonoma co., Cal., on North Pacific R. R., 60 miles N. W. of San Francisco, has 7 churches, 2 colleges, 1 private, high, and public schools, several flouring-mills, a tannery, 5 hotels, 2 banks, 1 newspaper, and a fine water-supply. The manufacture of wine is extensively carried on, and the largest vineyard under one management in the world is located in this county. P. 2898. THOMAS L. THOMPSON, ED. "SONOMA DEMOCRAT."

**Santee',** tp., Clarendon co., S. C. P. 977.

**Santee,** tp., Georgetown co., S. C. P. 2571.

**Santee Agency,** p.-v. and tp., Knox co., Neb. P. 27.

**Santee River** is formed in South Carolina by the union of Wateree and Congaree rivers. It is navigable throughout for steamboats, and its length is 150 miles. Its lower course is through pine forests and low rice-lands. It reaches the Atlantic through the North and the South Santee.

**Sant' Elia Fiumerapido,** Italy. See APPENDIX.

**Sant' Elpidio a Mare,** Italy. See APPENDIX.

**Santeramo in Calle,** Italy. See APPENDIX.

**Santerre'** (ANTOINE JOSEPH), b. at Paris Mar. 16, 1752; led the mob against the Bastile July 14, 1789; was elected commander of a battalion of the national guard; played a conspicuous part in the riots of the Champ de Mars, the attack on the Tuileries (June 20, 1792), and the insurrection of Aug. 10; was appointed commander-in-chief of the national guard of Paris with the rank of general of division, and governor of the Temple during the imprisonment of the king, whom he escorted to the scaffold; was sent to the Vendée at the head of an army of 20,000 men, but was beaten at Coron Sept. 18, 1793; recalled, arrested as an Orleanist, but liberated after the fall of Robespierre; lost his influence and his fortune. D. Feb. 6, 1809.

**Santhià,** Italy. See APPENDIX.

**Santia'go,** central province of Chili, stretching from the Pacific Ocean to the frontier of the Argentine Republic, consists chiefly of ranges of mountains, embracing some of the highest peaks of the Andes, but with numerous broad, fertile, and picturesque valleys in a high state of cultivation; is traversed by the river Maypú; has productive mines, especially of silver and copper, and affords pasturage to immense herds of cattle. It is subdivided into the departments of Santiago, Melipilla, Rancagua, and Victoria. Area, 7800 sq. m. P. in 1872, 380,419. Cap. Santiago, which is also the capital of the republic.

**Santiago,** city, cap. of the republic of Chili and of the province of the same name, in a beautiful valley on both sides of Mapocho River, which is crossed by several fine bridges, near the W. base of the Andes, at a height of about 1800 feet above the level of the sea, is regularly laid out with wide and well-shaded streets, has several creditable public edifices, including the cathedral, the mint, the treasury and post-office, the archbishop's palace, the hall of congress, and the theatre, considered the finest in South America; is defended by two fortresses, which crown the hill of Santa Lucia in the centre of the city; has a university with 1200 students, a military academy, an academy of science, 2 normal colleges, a large public library, and numerous other educational, religious, and benevolent institutions, public and private, of high rank; has a magnificent *paseo* or drive extending along the banks of the Mapocho for 2 miles, decorated with good statues of San Martin, O'Higgins, Abraham Lincoln, and other patriots; has a considerable internal commerce; maintains 3 banks, 2 insurance companies, and a number of manufactures; is connected by railways with Valparaiso and Talca, and will be placed in communication with Buenos Ayres by the Transandine Railway, now (1876) in course of construction. Santiago was founded in 1541 by Pedro de Valdivia, and has suffered severely from earthquakes and inundations. An international exposition was held here in 1875. P. in 1865, 115,377; estimated in 1876 at 150,000.

**Santiago,** p.-v. and tp., Sherburne co., Minn. P. 156.

**Santia'go de Composte'la,** town of Spain, province of Galicia, at the confluence of the Sar and the Sarela, is the see of an archbishop, and has a magnificent cathedral, a university, and several educational and religious establishments, from which it chiefly derives its importance. The cathedral, said to contain the bones of the patron of Spain, the apostle James, was built in the eleventh century, is in the form of a cross 270 feet long and 204 feet broad, and contains six naves formed by beautiful Gothic pillars. Before the Reformation this church was annually visited by great crowds of pilgrims, but since that time the number of visitors has decreased and the city decayed. Some manufactures of linen, silk, leather, and paper are carried on, and the vicinity is very rich in cereals, vegetables, fruit, and wine. P. about 29,000.

**Santia'go de Cu'ba,** town and formerly capital of the island of Cuba, on the southern coast, near the mouth of the river Santiago. It has a spacious, safe, and strongly-defended harbor, is well built, and contains a fine cathedral and many other handsome public buildings, but its climate is hot and unhealthy. Its commerce is nevertheless very large; in 1867 the total value of its exports amounted to $8,250,000, and 537,994 cwts. of sugar, 4714 cwts. of molasses, 79,728 cwts. of coffee, 6199 tons of copper ore, and 14,470 sacks of cacao were exported, besides large quantities of rum, tobacco, cotton, etc. P. of city and district, 96,000—viz. 27,729 white and 68,271 colored.

**Santiago del Este'ro,** central province of the Argentine Republic, lying S. W. of the Rio Salado, which separates it from the Gran Chaco, is mountainous in the W., but elsewhere level or greatly undulating; has a hot climate and a poor soil covered with stunted vegetation. Agriculture is little practised, stock-raising being the almost exclusive industry. The people are largely of Indian blood, and in a part of the state the Quichua language, introduced by a colony from Peru during the empire of the Incas, is still spoken. Education is little cared for, and there are no public institutions of any importance. Ponchos, lace, and woollen articles of considerable artistic merit are manufactured by hand. Area, about 35,000 sq. m. P. in 1869, 132,763. Cap. Santiago, which has a pop. of 7775.

**Santia'go de los Caballe'ros,** town of Santo Domingo, capital of a province of the same name, on the right bank of Yaqui River, is well built and has about 8000 inhabitants, mostly engaged in agriculture and cattle-breeding, the manufacture of leather and tiles, and commerce. The old city of the same name, founded by the Spaniards in 1504 and destroyed by Dessalines in 1805, stood several miles farther to the N. W., on a less salubrious site.

**Santillana** (IÑIGO **Lopez de Mendoza**), MARQUIS OF, b. at Carrion de los Condes in 1398, son of the grand admiral of Castile, from whom he inherited great wealth; served with distinction in wars against Aragon and against the Moors and in the civil wars of Castile; enjoyed great influence at court, and was an eminent patron of letters, being himself the author of the *Comedieta de Ponza*, of a *Canto Funebre* on the death of Enrique de Villena, of a volume of proverbs in rhyme, *Refranes*, and of various other works. D. at Guadalajara Mar. 26, 1458.

**San'to Domin'go,** or the **Dominican Republic,** comprises the eastern and larger part of the island of Hayti in the West Indies, separated from the republic of Hayti by the river Pedernales, which flows to the S., and the river Daxabon or Massacre, which falls into the Bay of Manzanillo on the northern coast. Its physical geography and its history are given in the articles on HAYTI and DOMINGO, SANTO, PROJECTS OF ANNEXATION TO THE U. S. Its area is estimated at 18,000 sq. m.; its pop. at from 150,000 to 200,000, of which one-tenth are white, Spaniards of unmixed descent, and the rest a mixture of Spaniards, Indians, and negroes, with a small number of pure negroes. The prevailing religion is the Roman Catholic, and the archbishop of Santo Domingo bears the title of primate of the Indies. Other denominations are tolerated, and the Methodists and Baptists have churches and schools, mainly supported by the colony of negroes which emigrated in 1824 from the U. S. and settled in the island. The republic is divided into five provinces—Santo Domingo, Azua de Compostela, Concepcion de la Vega, Santiago de las Caballeros, and Santa Cruz del Seybo. The government consists of a president, who is elected for six years and holds the executive power, and a senate, which has the legislative power and is composed of nine members, elected also for six years. The present president, elected Dec. 20, 1873, is Ignacio Gonzales. The finances are in bad order. In 1870 the receipts were reported to be $772,684, and the expenses $728,605, with a debt of $1,565,831 internal, and $757,700 foreign. The receipts are chiefly derived from customs duties. The rich natural resources of the country are very little developed. The gold and silver mines, which in the sixteenth century yielded an enormous profit, are

not now worked; even their location has in many cases been forgotten. The fine timber and cabinet-woods of the forests are often unavailable on account of the entire lack of roads. The coffee is in many places left to grow wild, and very little care is bestowed on the cultivation of tobacco and the cotton-plant, which latter grows luxuriantly and yields a product of excellent quality. In 1863 the total value of the imports amounted to $1,500,000, of the exports to $2,500,000; but in 1870 the figures had decreased respectively to $560,000 and $700,000. The principal articles of export are tobacco, coffee, cotton, sugar, cacao, ginger, hides, wax, mahogany, and dyewoods. The principal ports are Puerto Plata and Santo Domingo.

**Santo Domingo,** capital of the republic of Santo Domingo, at the mouth of the river Ozama, in lat. 18° 28′ N. and lon. 69° 55′ W., is surrounded with a wall 10 feet high, and has a good harbor. It was founded in 1494 by Bartholomew Columbus, under the name of Nueva Isabella, and was the first city built by white men in the New World. Several of the old buildings, among which is the cathedral, 1512–40, are still standing. The city has a college and some trade in cabinet and dyewoods. P. from 6000 to 10,000.

**San′tonine,** or **Santoninic Acid,** a crystallizable principle obtained from the drug *Santonica* or "Levant wormseed." Santonine occurs in flat, quadrilateral, colorless prisms, is inodorous and nearly tasteless, and practically insoluble in water. It is poisonous in overdose to the animal system, producing convulsive tremblings, dilatation of the pupils, and enfeebling of the functions of the heart and lungs. It also causes the urine to acquire an unnatural yellow color, and, what is very singular and as yet unexplained, it produces *yellow vision*, the field of view appearing as if seen through a yellow-tinted medium. Santonine is exceedingly poisonous to the *Ascaris lumbricoides*, or round-worm, a parasite infesting the intestines in man, and is consequently used in medicine as an anthelmintic or vermifuge. From its poisonous properties it must be given with care. EDWARD CURTIS.

**Santorin.** See THERA.

**San′tos,** town of Brazil, province of São Paulo, on the northern coast of the island of Enguá-Guaçú, in lat. 23′ 55′ S., lon. 46° 19′ W. It has a good harbor and a steadily-increasing trade. P. about 12,000.

**Santo Stefano Quisquena,** Sicily. See APPENDIX.

**Santuck,** p.-v. and tp., Union co., S. C. P. 1879.

**San Vicen′te,** town of Central America, in San Salvador, at the foot of the now extinct volcano of the same name, is regularly built and carries on some trade. The vicinity contains plantations of indigo and tobacco. P. 6000.

**Sanvito al Tagliamento,** Italy. See APPENDIX.

**San Vito dei Normanni,** Italy. See APPENDIX.

**São Francis′co,** or **San Francisco,** river of Brazil, rises in the province of Minas Geraes, in lat. 20° S., lon. 45° W., flows first N., then E., forming the boundary between the provinces of Pernambuco and Bahia, and falls into the Atlantic in lat. 10° 24′ S., after a course of 1652 miles. At 140 miles from its mouth the falls of Paulo Affonzo render it innavigable, but above these falls it becomes navigable once more, and continues so for upward of 900 miles.

**Saône′,** river of France, rises in the department of Vosges at an elevation of 1476 feet above the level of the sea, flows S., and joins the Rhone at Lyons. Its entire length is 316 miles; it is navigable for a distance of 170 miles below the city of Gray, department of Haute-Saône. It receives from the left side the Doubs.

**Saône-et-Loire,** department of France, between the two rivers Saône and Loire, and mostly occupied by the mountains of Côte-d'Or. The mountains are low and rich in coal and iron, and on their gentle slopes is produced the celebrated Macon wine. On the excellent pastures along the rivers large herds of cattle and horses are reared. Area, 3270 sq. m. P. 598,344. Of 72,374 children of school age, 14,487 received no school education in 1857.

**Saône, Haute.** See HAUTE-SAÔNE.

**São Pau′lo,** province of Brazil, bordering on the Atlantic and situated between the provinces of Paraná and Minas Geraes, comprises an area of 131,705 sq. m., with 835,000 inhabitants. The coast-land is mostly low, and separated from the more elevated inland plateau by a chain of mountains which in some places extend to the sea. The province is exceedingly rich. Gold, silver, and sulphur are found, besides a number of gems. All S. European fruits are grown, together with those of the tropics, and forests abound. The climate in the low coast-land is hot, moist, and often unhealthy; in the inland plateau cooler and more healthy. But the natural resources of the province are very little developed.

**São Paulo,** town of Brazil, capital of the province of São Paulo, on a tributary of the Tiete. It has an ecclesiastical seminary, a law-school, a school of medicine, and several other educational institutions. It is rather indifferently built, but beautifully situated, and carries on some trade and manufactures. P. 22,032.

**São Pedro do Rio Grande do Sul.** See RIO GRANDE DO SUL.

**São Salvador,** or **San Salvador,** city of Brazil. See BAHIA.

**Sap** [Lat. *sapa*, "must," or "new wine boiled thick"], the juice of plants. It is probable that the water of the sap and its ash constituents are taken up only by the roots. This dilute solution of inorganic matter is carried to the green tissue of the plant, where it is exposed to the air and concentrated by evaporation. From the atmosphere carbonic acid is taken up. Under the influence of sunlight the dissolved matters are assimilated, and the *crude sap* becomes *elaborated sap*. The prepared sap is fit to be used in growth or any kind of work in the plant, and it is carried to all points where it is needed. The transmission of crude and elaborated sap, and the laws which govern their transfer, will be treated of under VEGETABLE PHYSIOLOGY. Pres. W. S. Clark of the Massachusetts Agricultural College has recently conducted an extensive and valuable series of experiments upon the pressure of sap in our woody plants. (See *Reports of Massachusetts Agricultural College*, 1873 and 1874.)

**Sap′ajou,** a name corrupted from a South American term, and applied to New-World monkeys of the family Cebidæ, having a prehensile tail whose under surface is naked and callous toward the tip; the throat is not dilated. They are better known under the name *Ateles*, and constitute one of the most characteristic forms of American monkeys. THEODORE GILL.

**Sapan′-Wood,** from the *Cæsalpina sappan*, a variety of BRAZIL-WOOD (which see), imported from Siam, Japan, the East Indies, etc.

**Sapelo Island,** one of the "sea-islands" of McIntosh co., Ga., in Atlantic Ocean, famous for its fine quality of cotton. P. 336.

**Sap-Green,** a coloring-matter obtained by boiling down the juice of the berries of the buckthorn (*Rhamnus catharticus*), after adding lime to prevent change by acid fermentation, which would turn the color red. The buckthorn is a native of Europe, but has made its way to the U. S., and grows wild in some parts. It is a shrub six or eight feet high, with branches that terminate with thorns. The berries contain four seeds, are about the size of a pea, black and shining, with green pulp, of disagreeable odor and nauseous bitter taste. They constitute an active purgative medicine, seldom used, as it causes griping pains. Sap-green is used chiefly as a water-color pigment. HENRY WURTZ.

**Sapinda′ceæ** [from *Sapindus*, one of the genera], a large and important natural order of polypetalous exogenous trees and shrubs. As at present constituted, it includes the Staphyleaceæ, or bladder-nuts; the true Sapindaceæ, mostly tropical, but embracing the horse-chestnuts; and the Acerineæ, or maples. Some of the plants are poisonous, others medicinal, and some afford useful fruits.

**Sapodil′la,** the fruit of *Achras sapota*, a West Indian tree of the order Sapotaceæ. It is highly valued as a dessert fruit.

**Saponification.** See SOAP, by PROF. B. SILLIMAN, M. D., M. N. A. S.

**Sap′onine,** also called **Struthiine** [Lat. *sapo*, "soap"], a singular uncrystallizable substance obtained from the plant called soapwort or bouncing bet (*Saponaria officinalis*). It is also contained in *Gypsophila struthium* and many other plants. Bley discovered it; Bussy first obtained it pure; and Bucholz found 34 per cent. in the dry soapwort root, which makes with water a lather like soap. By first extracting the root with water and evaporating, then treating the extract with alcohol, a solution of saponine is obtained nearly pure. On evaporation the saponine appears brown, though white when pure, hard, brittle, sweetish in taste, followed by persistent acrimony. When inhaled in powder it produces violent sneezing. It is said to be poisonous, and, when injected into the cellular tissue of animals, to produce an extraordinary *local* paralysis of the muscles, without acting through the general nervous system. For its composition the following is assigned, but deemed questionable: $C_{12}H_{24}O_8$. H. WURTZ.

**Sapony,** tp., Dinwiddie co., Va. P. 2086.

**Sapor.** See PERSIA, by CLEMENS PETERSEN, A. M.

**Sapota′ceæ** [from *Sapota*, one of the genera], a natural order of gamopetalous exogenous trees and shrubs,

mainly tropical, but the Southern U. S. have a few species, chiefly of the genus *Bumelia*, none industrially important. But the tropical Sapotaceæ include many useful trees. The order is characterized by a tendency to milky juice and to rusty pubescence, especially on the lower face of the simple and alternate entire leaves; small and regular perfect flowers, fertile stamens as many as the lobes of the corolla, and opposite them, their anthers turned outward, alternating with a sterile series or set of petaloid scales, a several-celled ovary and fruit, ovules and seeds solitary in each cell, the latter large and nut-like, having a thick and bony coat. Sapodilla plums (see SAPODILLA), star-apples (from *Chrysophyllum Cainito*), marmalade (*Achras mammosa*), and the bully-tree fruit of Surinam (*Mimuseps*) are among the prized tropical fruits of the order. The butter trees—so called from the bland thick oil they yield—are species of *Bassia*, and the milky juice of several species, notably of *Isonandra gutta*, is the source of gutta-percha. The wood is generally very hard and durable (iron-wood, etc.). ASA GRAY.

**Sap′pers, Miners, and Pontoniers.** Among the great improvements in the attack and defence of fortifications introduced by Vauban, not the least was the establishment of regularly-organized companies of sappers and of miners. The duties of these troops had previously been performed in a desultory manner by soldiers detailed from the artillery and infantry. The first company of sappers was organized about 1690 as a free company, under the command of Vauban himself. It was armed and drilled as infantry, and was instructed in all the works appertaining to sieges. The men were taught to make gabions, fascines, hurdles, etc., to trace lines and trenches, to drive the various kinds of saps (see SIEGE), to descend into and pass the ditch, to destroy the enemy's obstacles, to drain the trenches, to take care of the tools, to put up the various kinds of revetments, to post and superintend working-parties, and were expected also to serve in the mines when required. In the defence they were taught to adjust and sod the slopes, to place the various obstacles, such as palisades, fraises, etc., and to repair the defences when injured by the enemy's artillery. All of these duties are still performed by sappers. Three engineers, Goulon, Esprit, and Mesgrigny, organized in 1679, 1695, and 1705, respectively, each a company of miners, whose duties were the construction and service of mines and countermines. (See MINES, MILITARY.)

By the year 1705 these companies, as well as the sappers, had been attached to the artillery. They naturally belonged to the engineer service, but convenience of transportation and personal influence kept them with the artillery until 1759, when they were placed under the engineers. In the following year, however, they were returned to the artillery, where they remained until 1793, when they were finally attached to the engineers. The duties of pontoniers, or constructing temporary military bridges, had up to this time (1793) been performed by "artillery-workmen." The necessity of a better organization was evident, and companies of pontoniers were organized, continuing, however, to form part of the artillery.

The numbers of these troops were increased from time to time as the necessities of the service demanded; the present force in France is about 8000.

In England the corps of Royal Sappers and Miners was established in 1812. It performed the duties of pontoniers, as well as those indicated by its title. It was composed entirely of enlisted men, the officers being detailed from the Royal Engineers. In 1856 the two corps were consolidated under the name of the corps of Royal Engineers. The present force is about 4500 men.

In Prussia a company of pontoniers was created in 1715, and placed under the orders of the artillery. In 1742, Frederick the Great organized two companies of miners, which were at first attached to a regiment of pioneers, and afterward formed an independent corps. Previously to 1810 there were no regular sappers in the Prussian army, but in that year the pontoniers and miners were placed under the engineers and took the name of pioneers, a part of their duties being those of sappers. The present force is 10,800 men.

In the U. S. a company of "bombardiers, sappers, and miners" was attached to the corps of engineers (see ENGINEERS, CORPS OF) by the act of Congress of Apr. 29, 1812, but was discontinued in the reorganization of 1821. In 1846 a company of "sappers, miners, and pontoniers" was organized as part of the corps of engineers, and was sent to Mexico with the army of invasion. It took part in the siege of Vera Cruz, in the attack at Cerro Gordo, and formed part of the storming-parties at Contreras, Churubusco, and Molino del Rey. At Chapultepec it was engaged in the construction of batteries, occasionally fighting with muskets, and at the Garita San Cosmo it did excellent service as infantry. After the war it was stationed at West Point to assist in the instruction of cadets at the U. S. Military Academy. In 1853 a detachment accompanied Stevens's survey of the Northern Pacific R. R. In 1858 the company formed part of the Utah expedition, returning to West Point in the fall of the same year. In the fall of 1858 a detachment was sent to the Pacific coast, where it was engaged until 1861 in opening and repairing roads, constructing bridges, and in fortifying San Juan Island at the time of the boundary dispute. In 1861 this detachment proceeded to Washington, where it was engaged upon the defences and in the instruction of volunteer troops in the preparation of siege material. The main portion of the company was engaged during the summer of 1861 in the defence of Fort Pickens. In the fall of 1861 it joined the Army of the Potomac. An act of Congress of Aug. 6, 1861, added three companies, of 150 men each, to the engineer troops, and authorized one company of topographical engineers. In 1863 the corps of engineers and of topographical engineers were merged into one, and the strength of the battalion of engineers thus became five companies. One of these was not organized, however, until 1865. From the fall of 1861 until the end of the civil war the battalion formed part of the Army of the Potomac. The limits of this paper will not permit a detailed history of its services during that war. These were simply invaluable. Under Capt. Duane (now lieutenant-colonel of engineers and brevet brigadier-general) the original company had been thoroughly instructed in pontoniering, sapping, and mining. This instruction quickly pervaded the battalion, and it was thus enabled to give lessons to the volunteers which could be obtained from no other source. The battalion bears upon its colors, in addition to the names mentioned above in connection with the war with Mexico, the following: Yorktown, Fair Oaks, Mechanicsville, Gaines's Mill, White Oak Swamp, Malvern Hill, Antietam, Fredericksburg, Chancellorsville, Franklin Crossing, Kelly's Ford, Rappahannock Station, Wilderness, Po River, North Anna, Cold Harbor, Siege of Petersburg.

The following volunteer regiments were organized as engineer troops during the war: The 1st New York Engineers, in service from Sept. 10, 1861, to June 30, 1865, served as sappers in the siege of Fort Wagner and as pioneers and pontoniers with the armies of the Potomac and of the James; the 15th New York, in service from June, 1861, to June, 1863, served as sappers, pioneers, and pontoniers with the Army of the Potomac (another regiment, with the same title, raised between June, 1863, and Jan., 1865, performed similar duties with the armies of the James and of the Ohio); the 50th New York, in service from Sept., 1861, to June, 1865, performed similar duties with the armies of the Potomac and of the James; the 1st Michigan Engineers, in service from Dec., 1861, to Sept., 1865, served in the Army of the Cumberland, repairing and destroying railroads, building fortifications, etc.; the 1st Missouri Engineers, in service from Oct., 1861, to July 22, 1865, served in the Army of the Cumberland, repairing railroads and building bridges, and afterward had charge of the ponton-trains of the Army of the Tennessee during Sherman's march to the sea; the 1st U. S. Veteran Volunteer Engineers, in service from July 8, 1864, to Sept. 6, 1865, served in the department of the Cumberland. In addition to these, many infantry and artillery troops served as engineer soldiers when occasion required, the high character and intelligence of the volunteers rendering it an easy matter to find men capable of being quickly instructed in these duties. For example, the 48th Pennsylvania Infantry, composed largely of Pennsylvania miners, were readily transformed into military miners, and in that capacity executed the Petersburg mine (July, 1864), which as an engineering operation was a perfect success. In the Army of the James a company of the 15th Massachusetts Heavy Artillery, and one of the 9th Maine Infantry, acted as pontoniers. The 58th Indiana Infantry served as pontoniers in the armies of the Cumberland and of Georgia, and accompanied Sherman on his march to the sea. For mining at Vicksburg and Port Hudson practical miners were selected from the different regiments, and temporarily organized as military miners. The sapping at these sieges was done by details from the infantry, as it had been in the seventeenth century, before the time of Vauban. In all cases these troops served under the engineers when on engineer duty.

The most remarkable feats of the war in this branch of the service were, in mining, the Petersburg mine, above referred to; in sapping, the siege of Fort Wagner before Charleston, July to Sept., 1863; and in pontoniering, the bridge across the James River just above Fort Powhatan. The latter was over 2000 feet long in pontons, besides 200 feet of trestle-work. It was built by the regular battalion of engineers, two companies of the 15th New York, and part of a company of the 50th New York, in all about 450 men, in about five hours on the evening of June 15, 1864, the approaches having previously been prepared by the 1st

New York Engineers. The stream was rapid and deep, in some places 85 feet. This was the longest floating bridge ever constructed by an army in the field. (See BRIDGES, MILITARY.) Another long bridge was built by the same troops over the Chickahominy in 1862. That stream was a less difficult one, and a large portion of the bridge was built on trestles and cribwork. (See BRIDGES, MILITARY.) Though not falling strictly within the scope of this article, mention may here be made of the extraordinary feats of bridge-building executed by the construction corps—civilians under the direction of a volunteer engineer—attached to Sherman's army during the Atlanta campaign. The railroad bridge across Etowah River, Ga., which had been burnt by the enemy, was rebuilt by 600 men in six days. It was 625 feet long and 75 feet high. The railroad bridge across the Chattahoochee, near Atlanta, 740 feet long and 90 feet high, was rebuilt in 4½ days.

Upon the reduction of the army in 1870 the number of enlisted men in the battalion of engineers was limited to 354, one company being reduced to a skeleton of 10 sergeants and 10 privates; and in 1875 the number was further reduced to 200. One company of 50 men is stationed at the Military Academy at West Point, engaged in the instruction of cadets in practical military engineering. Small detachments are employed in surveying and exploration in the Western territory. The others are stationed at the engineer school of practice at Willett's Point, New York harbor. They are kept thoroughly drilled as infantry, and are well instructed in field fortification, sapping, mining, pontoniering, field sketching, and the service of torpedoes. The officers of the battalion are temporarily detailed from the corps of engineers, usually serving with it four or five years.

Napoleon I. considered the proper proportion of engineer troops to infantry to be 1 : 40. Since his day the advances in the art of war have somewhat increased this proportion. It should be especially large in a country like the U. S., where the army is rather a magazine of military knowledge than a force capable of resisting a powerful enemy. In France the proportion is 1 : 33; in England, 1 : 34; in Prussia, 1 : 36; and in the U. S., 1 : 60. O. H. ERNST.

**Sap'phire** [Gr. *σάπφειρος*; Lat. *sapphirus*], a gem, among the purest forms of the mineral species CORUNDUM (which see), which is crystallized alumina or sesquioxide of the metal aluminium. These, however, are not usually called sapphires by dealers in gems unless blue in color, the red stones being called *rubies*, the yellow ones often *topaz*, and the green *emeralds*, though the latter two names belong to entirely distinct minerals. (See EMERALD, TOPAZ, and PRECIOUS STONES.) H. WURTZ.

**Sap'pho** [Σαπφώ], b. in the island of Lesbos, at Mytilene or Eresos, a contemporary of Alcæus, Stesichorus, and Pittacus, founded a school of poetesses at Mytilene about 600 B. C., and enjoyed a great reputation herself among her countrymen for her poems. The details of her life and character are uncertain. She is said to have lived for some time in Sicily in exile. The comic dramatists of Athens introduced her often in their plays as a courtesan, but this conception seems to have originated from mere misunderstanding, if it were not simple slander. The story of the leap from the Leucadian rock on account of an unhappy passion for a young man, Phaon, is a fable. Her poems, comprising nine books, were mostly erotic; some, however, were satirical. They were written in the Æolic dialect, and in a great variety of metres, of which one, the Sapphic strophe, is said to have been invented by her. But only one poem, an ode to Aphrodite, has come down to us entire; the rest consist of fragments only. The best editions are by Neue (Berlin, 1827), and in the collections of Schneidewin (Göttingen, 1839) and Bergk (Leipsic, 1866). (For her life and character see Welcker, *Sappho von einem herrschenden Vorurtheil befreit* (Göttingen, 1816), and Schöne, *Untersuchungen über das Leben der Sappho* (Leipsic, 1867).)

**Sar'aband** [Pers. *zerbend*], a slow dance in ¾ time and of a peculiar rhythm. It is now out of fashion. In character it resembled the minuet. It was of Oriental origin.

**Sar'acens,** a name which with classical writers denotes a particular Arabian tribe, though the location of this tribe is not clearly indicated, but which afterward was applied to the followers of Mohammed or to those Mohammedan nations which invaded Europe. The etymology of the word is uncertain. It is sometimes derived from one Arabic root signifying "to plunder;" sometimes from another signifying "to rise," hence meaning *eastern*.

**Saragos'sa,** town of Spain, capital of the province of Saragossa, on the Ebro, was founded by the Phœnicians. Under the Romans it became a flourishing city, rose still higher under the Moors, and reached the culmination of its prosperity when (in 1118) it became the capital of the kingdom of Aragon. After the union of Aragon and Castile, when Madrid became the royal residence, Saragossa lost some of its splendor, and in 1809 it was nearly destroyed by the French, by whom it was twice besieged during the Peninsular war. The place was first invested June 15, 1808; after 49 days' stubborn resistance the siege was raised Aug. 4, but recommenced Dec. 20, and bombarded until Jan. 27, 1809, when the city was entered by general assault. The inhabitants defended the place house by house and street by street, and it was not until Feb. 22 that the place capitulated. By disease and war some 60,000 lives were lost during the siege, mainly by disease. It is still a splendid city, however, well built, containing many excellent edifices and establishments, and situated in a fertile, densely-peopled, and carefully-cultivated district. Of its two cathedrals, the one is an old building in Gothic style, the other a perfectly modern, rather singular, but rich and highly-ornamented edifice of the seventeenth century. Its university was founded in the fifteenth century, and enjoys still a high reputation, being generally attended by more than 1000 students. It has also an ecclesiastical seminary, a school of law, a medical school, 5 hospitals, and many other educational and benevolent institutions. Its former flourishing manufactures have declined, yet linen, cloth, silk, soap, hat, and saltpetre factories are in operation, and quite a lively trade is carried on. P. about 65,000.

**Saragossa, Maid of.** See AGUSTINA.

**Sarahsville,** p.-v., Centre tp., Noble co., O. P. 256.

**Saraisk',** town of Russia, government of Riasan, on the Oster, trades extensively in timber and cattle. P. 6029.

**Saranac,** p.-v., Boston tp., Ionia co., Mich., on Detroit and Milwaukee R. R. P. 724.

**Saranac,** p.-v. and tp., Clinton co., N. Y., on Saranac River, which here has several falls and affords abundant water-power. P. 3802.

**Saransk',** town of Russia, government of Pensa, at the confluence of the Saranka and Insara, manufactures leather, soap, and all kinds of wooden implements. P. 10,109.

**Sarapool',** town of Russia, government of Viatka, on the Kama, has manufactures of leather and a trade in timber. P. 5427.

**Sarato'ga,** county of E. New York, bounded N. E. by Hudson and S. by Mohawk River, intersected by Saconda ga River and other streams, is occupied in its N. W. part by the Adirondack Mountains, which contain deposits of iron ore; has many celebrated mineral springs in its central part, and is traversed by several railroads. Agriculture and stock-raising are the leading industries. Staples, potatoes, hay, Indian corn, oats, buckwheat, hops, honey, wool, butter, and cheese. There are numerous saw and flour mills and manufactories of carriages, saddlery, and machinery. Cap. Ballston Spa. Area, 780 sq. m. P. 51,529.

**Saratoga,** tp., Grundy co., Ill. P. 1233.

**Saratoga,** tp., Marshall co., Ill. P. 1163.

**Saratoga,** p.-v. and tp., Howard co., Ia. P. 104.

**Saratoga,** p.-v. and tp., Winona co., Min. P. 1058.

**Saratoga,** tp., Saratoga co., N. Y., on Hudson River and Saratoga Lake, has several mineral springs. P. 4052.

**Saratoga,** tp., Wilson co., N. C. P. 1108.

**Saratoga,** tp., Wood co., Wis. P. 300.

**Saratoga, Battle of.** The forced abandonment of Fort Ticonderoga by St. Clair in July, 1777, and the attendant disasters, involving the loss of vast quantities of supplies and ammunition, and the retreat of Schuyler from Fort Edward to Saratoga, thence to the mouth of the Mohawk, where he fortified himself, had produced a profound feeling throughout the country. Schuyler was unjustly held responsible, and early in September was superseded in command of the northern department by Gen. Gates. But before the latter's arrival great changes had taken place. Stark had gained a splendid victory at Bennington, Arnold had forced St. Leger to raise the siege of Fort Schuyler, the militia were rapidly assembling, and Morgan with his riflemen, 500 strong, had arrived when Gen. Gates assumed command, and the depression of a few weeks ago was now succeeded by a feeling of confidence and enthusiasm among the troops. Burgoyne, in command of the British forces, pressing on, crossed the Hudson Sept. 13 and 14, and encamped his army on the heights and plains of Saratoga. Gates meantime had moved his army up to Stillwater, and taken possession of Bemis's Heights, to the S. of Saratoga, near the river—a strong position—which he fortified. On Sept. 19, Burgoyne moved out, and was soon engaged with the left wing of the American army under Benedict Arnold, who had with him Morgan's riflemen. The battle, which began about 4 P. M., was continued until dark, each side repeatedly gaining possession of the

disputed ground; but at night the British held the field, having sustained a loss of over 500, that of the Americans falling below 300. Burgoyne now discovered that he had a dangerous foe in his front. He also learned of the capture of his fleet of boats laden with supplies by Lincoln's militia in his rear, and the destruction of his communications with Canada; but, receiving promise of aid from Sir Henry Clinton from below by way of the Hudson, he fortified his position and awaited the latter's coming. Clinton not arriving, and Burgoyne finding himself in danger of being cut off from retreat, and his supplies being nearly exhausted, determined to risk a battle, and on Oct. 7 advanced at the head of 1500 men, with 6 pieces of artillery. His right was at once attacked by a New Hampshire brigade and Morgan's riflemen. Arnold, who had been relieved from command after the battle of Bemis's Heights owing to some misunderstanding with Gen. Gates, and now acting without orders, placed himself at the head of the troops, and with great daring and recklessness led them into action. The British lines were repeatedly broken, and Burgoyne with difficulty regained his camp, but with the loss of his able second, Gen. Frazer. Gen. Arnold was also severely wounded in the leg. Renewing the assault, the Americans gained a lodgment in the camp, when darkness put an end to the conflict. During the night Burgoyne retreated and took possession of the heights in his rear. Fearful of being surrounded, however, he continued his retreat next day to Saratoga. Not receiving aid from Clinton, and every line of retreat being closed to him, it was decided in council to propose a cessation of hostilities while terms of capitulation were being negotiated. Gates at first demanded an unconditional surrender, which Burgoyne refused, and on the 17th terms were agreed upon—the British to march out with the honors of war, and be permitted to embark for England, on condition of not serving against the U. S. again during the war. The number of prisoners surrendered was 5752. Gates's army numbered upward of 10,000. The terms of the surrender were not ratified by Congress, Burgoyne's army being retained as prisoners until the close of the war. Burgoyne and several other officers, however, were permitted to depart: 42 guns, between 4000 and 5000 muskets, and a large supply of ammunition were among the valuable captures.

**Saratoga Springs,** p.-v. and tp., Saratoga co., N. Y., 36 miles N. of Albany and 186 from New York City, on the great trunk-line of railroads from New York to Montreal, is the leading and fashionable watering-place of America, celebrated for its numerous mineral springs, some of which have been bottled and exported to all parts of the world for over fifty years. The principal springs are the Congress, Hathorn, Empire, Geyser, High Rock, Excelsior, Star, Columbian, Washington, and White Sulphur. To accommodate the crowd of travelers who annually visit the place, numerous large hotels have been erected, finished, and furnished in a style equal to the best in the country, with accommodations for from 10,000 to 15,000 persons at one time. Of these, the principal are the United States, Grand Union, Congress Hall, Clarendon, Windsor, Columbian, American, Marion, and Holden House. At the first four named first-class orchestras are sustained in the season, and during the winter of 1875–76, Congress Park was laid out in walks, lakes, etc., with a large orchestra to play during the season. Large sums are spent annually in laying out and keeping up roads for rides and drives, the principal ones leading to Saratoga Lake, a beautiful sheet of water 4 miles from the village, where the college boating-crews held their regattas in 1874 and 1875, the lake affording a straight-away course 3 miles or more in length, where fourteen boats can row side by side. Hotels at the lake accommodate numerous dinner-parties in the season. The great battle-ground, where Burgoyne was beaten by Gates in 1777, is 12 miles E. of the place, on Hudson River, and is accessible by good roads. The Saratoga Racing Association has one of the best mile tracks for running adjacent to the village, and two meetings are held in July and August each year, where the most celebrated thoroughbreds of the country meet. There are 8 churches—2 Presbyterian, 2 Baptist, and 2 Methodist, and 1 Episcopal and 1 Roman Catholic. A town hall costing $110,000 is used for conventions, concerts, and public entertainments. There are 1 daily and 3 weekly newspapers. P. of v. 7516; of tp. 8537. E. J. Huling, Publisher "Sentinel."

**Saratov′,** government of Russia, on both sides of the Volga, comprises an area of 74,730 sq. m., with 1,725,478 inhabitants, among whom are about 100,000 Protestant Germans and 50,000 Mohammedan Tartars, Kalmucks, and Kirgheez. Although a large portion of the government consists of desert steppes, much rye, wheat, and oats is exported, bees and silkworms are extensively reared, and many kinds of manufactures, fisheries, and distilleries are in operation.

**Saratov,** a large and rich city of Russia, capital of the government of Saratov, on the Volga, is for the greater part built of wood, but has many fine public buildings of stone, several hospitals, large bazaars, churches, schools, etc. It manufactures cloth, linen, tobacco, leather, earthenware, rope, etc., has large breweries, distilleries, vinegar-factories, and foundries, and carries on an extensive trade in corn, cattle, and fish. P. 93,218.

**Sarawak′,** kingdom of Borneo, East Indies, on the north-western coast of that island, on both sides of the navigable river Sarawak, is between lat. 0° 30′ and 3° 20′ N., and lon. 109° 40′ and 111° 40′ E., and was granted in 1841 to Sir James Brooke, with the title of rajah, by the sultan of Borneo. The capital, Sarawak, has about 25,000 inhabitants, and carries on a large and steadily increasing trade in timber, teak, sandal, iron, and camphor wood; in edible birds' nests, gutta-percha, sago, antimony ore, and rice, in exchange for which articles it imports European manufactures and tobacco.

**Sar′ber,** new county of Central Arkansas, bounded N. by Arkansas River, and watered by its affluents, has a broken surface, generally well timbered, but with some prairies and fertile river-bottoms. Staples, cotton, hay, Indian corn, and tobacco. Area, 625 sq. m. Name since changed to Logan co.

**Sarcocol′la** [Gr. *σαρκοκόλλα*, "flesh-glue," from its usefulness as a vulnerary], a nauseous gum-resin produced by *Penæa sarcocolla, P. mucronata, Sarcocolla vulgaris*, etc., evergreen shrubs of the order Penæaceæ, ranging from the Euphrates to the Cape of Good Hope. It is now seldom used in civilized regions.

**Sarcolac′tic Acid,** or **Paralactic Acid,** a metamere of Lactic Acid (which see).

**Sarcoph′agus** [Gr. *σαρκοφάγος*, "flesh-eating"], a kind of stone formerly obtained at Assos in Lycia. It was much used for making stone coffins, which were believed to have the property of destroying the corpse within forty days. The powdered stone was also thrown upon dead bodies for the same purpose. In later times, as at present, all stone coffins are called sarcophagi.

**Sar′cosine** [Gr. *σάρξ*, "flesh"], an alkaloid product of the decomposition of Creatine (which see), the crystalline constituent of juice of flesh, discovered by Chevreul. Sarcosine is $C_3H_7NO_2$, and results, together with *urea*, on boiling creatine with baryta-water. Sarcosine forms colorless crystals, soluble in water with ease, but insoluble in ether and with difficulty in alcohol. It is neutral in reaction, though it forms salts with acids, which react acid. Sarcosine is obtainable from other sources than from creatine, as by the action of methylamine on chloracetate of ethyl. H. Wurtz.

**Sarcoxie,** tp., Jefferson co., Kan. P. 1876.

**Sarcoxie,** p.-v. and tp., Jasper co., Mo., on Memphis Carthage and North-western R. R. P. 1983.

**Sard** [Lat. *sarda*; Gr. *σάρδιον*, from *Sardis*, in Lydia], a rich and rare variety of carnelian, deep red, and, when seen by transmitted light, of a fine blood-red. (See Precious Stones.) It commands a high price.

**Sardanapa′lus,** a voluptuous and effeminate king of Assyria, whose name has become a byword, but whose exact place in Assyrian history is still undetermined. According to Ctesias (about 398 B. C.), followed by Diodorus Siculus (about 8 B. C.), he was the last of thirty kings who succeeded Ninus and Semiramis, all of whom were sunk in luxury and sloth. A formidable rebellion, headed by the Median Arbaces and the Chaldean priest Belesys, roused Sardanapalus to prodigies of valor, but he was at last shut up in Nineveh, and, after enduring a two years' siege, made a funeral pile of his richest furniture and burnt himself in his palace, with his concubines and eunuchs. This is not now generally believed to be veritable history. Ninus appears to be a fabricated name, and Semiramis to have been borrowed from Sammuramat, wife of Bin-lik-his III. (857–828 B. C.), later by 500 years than the legendary date of Ninus and Semiramis. Nor would any nation probably survive an unbroken succession of thirty dissolute kings. But most likely there was at some time a Sardanapalus, such as is described by Ctesias. Lenormant, Oppert, and Hincks identify him with the Asshur-lik-hish of the monuments, assigning 800 B. C. as the date of his accession, and 789 as the date of his death and of what may be called the first destruction of Nineveh. This first destruction of Nineveh is denied by the Rawlinsons, who identify Sardanapalus with the Asshur-bani-pal of the monuments, who died 626 B. C., after a reign of forty-two years, and was succeeded by his son Saracus, whose name on the monuments is Asshur-emid-ilin. Saracus, perhaps, burned himself in his palace when Nineveh fell (625 B. C.).

R. D. Hitchcock.

**Sar'dine** [Gr. *σαρδίνη*, the "Sardinian fish"], a name applied to a number of fishes belonging to the family Clupeidæ, and especially to those preserved in oils and enclosed in tin boxes. The true sardine of the Mediterranean and contiguous ocean is the *Pomolobus* or *Clupea pilchardus*, and a very near relative of this species (*Pomolobus sagax*) is found on the Californian coast. The sardine of the Mediterranean is dressed, salted, and partly dried, then scalded in hot oil, and finally hermetically sealed in tin boxes with hot salted oil or oil and butter. A few are preserved in red wine. The menhaden (*Brevoortia menhaden*) of the U. S. has within the last few years been extensively put up in the form of sardines, after its bones have first been softened by steam and the body trimmed to a proper size.

**Sardin'ia,** an island in the Mediterranean Sea, nearly midway between Spain and Italy, and between Europe and Africa, just S. of Corsica, from which it is separated by a channel 7 miles wide, called the Strait of Bonifacio. Area, 9205 sq. m. P. 636,660. The surface is mountainous. A range of mountains—whose highest peak, Genargentu, situated nearly in the centre of the island, rises 5276 feet—traverses the island from N. to S., and sends out branches to both sides. These mountains are in some places completely naked and barren, but in others they are covered with forests or with fine pastures, and almost everywhere they contain marble, alabaster, lead, copper, iron, rock-crystal, etc., though mines and quarries are not very much worked. Between the offshoots of the central range lie large table-lands or slightly-sloping valleys, in which sandy and stony districts, perfectly sterile and unproductive, alternate with large tracts of very fertile soil. Along the coasts, which are in most places steep and rugged, are found extensive salt marshes and lagoons, to which the remarkable insalubrity of these places is generally ascribed. To inhale the gases with which in autumn the atmosphere is impregnated during night is death; the inhabitants move away or try to shut themselves up hermetically in their huts before sunset, and they never come forth until after sunrise. Agriculture is the main occupation of the inhabitants, though it is still in a backward state. Wheat, maize, and beans, wine, olives, figs, and oranges, tobacco, linseed, cotton, and madder, are raised in larger quantities than demanded by home consumption, and the production could easily be doubled by better implements and better methods. The fisheries along the coasts, especially of tunny, anchovies, and sardines, are very valuable, but are mostly in the hands of foreigners. Salt and gunpowder are the only manufactures of any importance, and both of them are monopolies of the government. The island has been in the possession of the house of Savoy since 1720, but until recently it has been shamefully neglected, old baronial and ecclesiastical forms of society being allowed to keep nine-tenths of the population in ignorance and indolence.

**Sardinia,** p.-v. and tp., Erie co., N. Y. P. 1704.

**Sardinia,** p.-v., Washington tp., Brown co., O. P. 164.

**Sardinia, Kingdom of,** was formed Aug. 24, 1720, by a treaty between Austria and Victor Amadeus II., duke of Savoy. The house of Savoy began to make itself felt in the history of Europe as early as the eleventh century, partly by the fidelity and vigor with which its members supported the emperors against the popes, partly by the shrewdness with which they steered through and profited by the wars between Germany and France, in which they could not help being implicated. In 1111, Amadeus III. was created count of Savoy by the emperor Henry V., and in 1416, Amadeus VIII. was created duke of Savoy by the emperor Sigismund. In the war of the Spanish succession (1700–13) Duke Victor Amadeus II. (1675–1730) was a claimant for the Spanish throne, and by the treaty of peace at Utrecht (1713) he received the island of Sicily and the title of king. Sicily he was compelled to yield to Austria in 1720, but as a compensation he received the island of Sardinia, from which he took his title of king, and thus was formed the kingdom of Sardinia, consisting of Savoy, Piedmont, and Sardinia, and comprising an area of 28,769 sq. m., with 5,167,542 inhabitants (1857). In 1831 the elder line of the house of Savoy failed, and the younger line ascended the throne with Charles Albert (1831–49). In his foreign policy Charles Albert was rather unsuccessful, but his interior administration was prudent and vigorous. The material resources of the country were developed with great sagacity, and the state was brought to a most prosperous condition. In 1848 he gave a free constitution, and the whole of Italy looked naturally to Sardinia and Charles Albert as the leaders in a war for liberty and independence. Charles Albert tried, and declared war against Austria, but on Mar. 13, 1849, was thoroughly defeated at Novara, and compelled to resign the crown to his son, Victor Emmanuel II., who succeeded in fulfilling the task of uniting the scattered Italian nation into one free state, for a history which see the article on ITALY.

**Sar'dis, or Sardes,** an ancient city of Asia Minor, the capital of Lydia, was at the foot of Mount Tmolus, on the river Pactolus, near its influx in the Hermus. Under Crœsus it was one of the wealthiest, most magnificent, and most luxurious cities of the East. Under the Romans it declined, and in the time of Tiberius it was entirely destroyed by an earthquake. It was rebuilt, but it never acquired its former splendor and importance. Now only a few ruins of its theatre and of a temple of Cybele are left in the vicinity of the village *Sarti*.

**Sardis,** tp., Bullock co., Ala. P. 1218.

**Sardis,** p.-v., Mason co., Ky. P. 149.

**Sardis,** p.-v., cap. of Panola co., Miss., on Mississippi and Tennessee R. R., 50 miles S. of Memphis, has 7 churches, an academy for males and females, 1 newspaper, 1 hotel, and a handsome court-house. P. about 1300.

L. C. BALCH, ED. "PANOLA STAR."

**Sardis,** p.-v., Lee tp., Monroe co., O., on Ohio River. P. 170.

**Sardis,** p.-v. and tp., Harrison co., West Va. P. 1599.

**Sardou'** (VICTORIEN), b. at Paris Sept. 7, 1831; studied medicine, afterward history; gained his livelihood as a teacher and by writing for papers, magazines, cyclopædias, etc.; tried his fortune as a dramatist in 1854 with the *Taverne des Étudiants*, which failed; tried again in 1860 with *Candide* and *Monsieur Garat*, which succeeded; and burst then upon the public with a productiveness almost unparalleled: *Les Pattes de Mouche*, *Piccolino*, *Les Femmes fortes*, and *Nos Intimes* in 1861; *Les Ganaches*, *La Papillonne*, and *Les Premières Armes de Figaro*, in 1862: *Bataille d'Amour* and *Les Diables noirs* in 1863; *Don Quichotte* and *Les Pommes du Voisin* in 1864; *Les Vieux Garçons*, *La Famille Benoiton*, *Nos Bons Villageois*, and *Maison neuve* in 1865, etc. Most of these plays made a great and decided success, and none failed, and about this time the author took rank by general consent as the first dramatist of his age, ruling the stage wherever there is one. The most prominent of his later works are *Séraphine* (1868), *La Patrie* (1869), and *Fernande* (1870).

**Saree,** town of Persia, province of Mazanderan, on the Tejend, 18 miles from its mouth in the Caspian Sea, is an old place, mentioned by Firdousi, but which long ago has lost its importance. In 1834 cholera destroyed nearly the whole population, and since that time it has been rising very slowly. P. between 20,000 and 30,000.

**Sargas'so Sea,** a name applied to certain great areas in the ocean which are often found almost covered with floating Gulf-weed (*Sargassum vulgare* and *bacciferum*) and other algæ. This principal sargasso sea is to the W. and S. W. of the Azore Islands, reaching to the Bahamas westward. Its area, according to Maury, is equal to that of the Mississippi Valley. The weed impedes the passage of ships and abounds in animal life. Its N. and S. boundaries are 36° and 19° N. lat. In the Pacific there is a sargasso sea some 500 miles E. S. E. of New Zealand, and another about 1000 miles W. of San Francisco; and still others exist. The weed is believed to grow from shallow banks at the sea-bottom, and to become detached.

**Sar'gent,** tp., Douglas co., Ill. P. 1035.

**Sargent** (AARON A.), b. in Newburyport, Mass., Sept. 28, 1827; was in early life a printer and editor; emigrated to California in 1849; studied law; was admitted to the bar 1854; was district attorney of Nevada co. 1855–56; vice-president of the Republican national convention at Chicago 1860; member of Congress 1861–63 and 1869–73, and U. S. Senator for the term 1873–79.

**Sargent** (EPES), b. at Gloucester, Mass., Sept. 27, 1812; spent several months with his father at St. Petersburg, Russia, in childhood; wrote some sketches of European travel for the *Literary Journal*, a paper conducted by himself and several other boys of the Boston Latin School, where he was educated; was two or three years a student at Harvard, and wrote for his brother's paper, the *Collegian*, but did not graduate; was for a short time on the editorial staff of the *Daily Advertiser*; assisted Samuel G. Goodrich ("Peter Parley") in several of his publications; wrote for Miss Josephine Clifton *The Bride of Genoa*, a five-act play successfully produced at the Tremont Theatre (1836), and for Miss Ellen Tree a tragedy, *Velasco*, brought out with equal success at Boston, New York, and Washington, and elsewhere throughout the country (1837), and some years later (1850–51) at Marylebone Theatre, London; became one of the editors of the Boston *Atlas* (1837), and was for some time its Washington correspondent; re-

moved to New York 1839, where he assisted Gen. Morris in conducting the *Mirror;* was afterward one of the editors of the *New Monthly Magazine* (1843); wrote a comedy, *Change makes Change*, produced at Niblo's Theatre; two juvenile tales, *Wealth and Worth* (1840) and *What's to be Done? or The Will and the Way* (1841), both of which passed through many editions; a *Life of Henry Clay* (1842), preferred by Mr. Clay to his numerous other biographies; a novel, *Fleetwood, or Stain of Birth* (1845), *The Mariner's Library*, and *American Adventure by Land and Sea;* and commenced editing the series of the *Modern Standard Drama* (7 vols., 1846–56); settled at Roxbury, near Boston, about 1847, in which year he published *Songs of the Sea and other Poems;* edited for several years the Boston *Transcript;* prepared a successful *Standard Speaker* (1852), which was followed by several other works on elocution and a series of readers (1855); edited the *Select Works of Benjamin Franklin, with Memoir and Notes* (1852); wrote brief biographies of Campbell, Rogers, Collins, Gray, Hood, and Horace and James Smith, prefixed to editions of their poems (1854–57); produced a tragedy, *The Priestess* (Mar., 1855), at the new Boston Theatre; wrote *Arctic Adventure by Sea and Land* (1857), a new volume of Poems (1858), *Original Dialogues* (1861), *Peculiar, a Tale of the Great Transition* (1863), *Planchette, or the Despair of Science, an Account of Modern Spiritualism* (1869), *The Woman who Dared, a Poem* (1869), *School Manual of English Etymology* (1873); has published several novels and other books anonymously; contributed largely to the *Knickerbocker*, the *Atlantic*, and other magazines; has been a favorite lecturer before lyceums, and is now (1876) preparing an elaborate work upon Spiritualism. Among his poems, several have been set to music and become popular favorites, especially the well-known song, *A Life on the Ocean Wave.* PORTER C. BLISS.

**Sargent** (HENRY), brother of Lucius M., b. at Gloucester, Mass., Nov. 25, 1770; studied art for several years at London under Benjamin West; became a distinguished painter at Boston; was adjutant-general of Massachusetts 1814, and afterward aide to Govs. Brooks and Strong, and invented an elevated railway. D. at Boston Feb. 21, 1845. His best-known painting is *The Landing of the Pilgrims*, which he gave to the Pilgrim Society, and is widely known through engravings.

**Sargent** (JOHN OSBORNE), brother of Epes, b. at Gloucester, Mass., in 1810; educated at the Boston Latin School and at Harvard College, where he established a literary periodical, *The Collegian*, in which he was aided by his brother Epes, O. W. Holmes, and other students; graduated 1830; aided S. G. Goodrich in the preparation of his *Pictorial Geography of the World* (1831) and series of school histories (1832–33); studied law with William Sullivan; practised several years at Boston; sat in the Massachusetts legislature 1835–36; was an editorial writer for the Boston *Atlas* 1834–37; assisted Col. J. Watson Webb in the editorship of the New York *Courier and Enquirer*, contributing also as an efficient public speaker to the success of Gen. Harrison in 1840; practised law in New York 1840–48; took part in the political contest of 1848 by conducting the *Battery*, a Whig campaign paper; established with Alexander C. Bullitt, at Washington (1849), the *Republic*, a successful Whig newspaper; translated several books from the German; author of several legal and political pamphlets; published in 1844 an essay on modern *Improvements in Steam Navigation and the Arts of Naval Warfare*, with a biographical sketch of John Ericsson.

**Sargent** (LUCIUS MANLIUS), b. at Boston, Mass., June 25, 1786; entered Harvard College 1804, but did not graduate; studied law, but never practised; translated some minor Latin poems; published *Hubert and Ellen, with other Poems* (1813); took an active part in many philanthropic organizations, and particularly in the temperance cause, frequently appearing as a lecturer and writing a series of twenty-one *Temperance Tales* (1833 *seq.*), which were translated into many languages; was for many years a contributor ("Sigma") to the Boston *Transcript*, in which paper he published *Dealings with the Dead, by a Sexton of the Old School* (republished in a volume 1856), *Reminiscences of Samuel Dexter* (1858), and *The Irrepressible Conflict* (1861), a review of Congressional discussions on slavery. He wrote a number of poems, never collected into a volume. D. at West Roxbury June 2, 1867.—By his first wife, Mary, sister of Hon. Horace Binney of Philadelphia, he had three children, one of whom, HORACE BINNEY, b. June 30, 1821, graduated at Harvard 1843, became a distinguished cavalry officer during the war of the rebellion, and was brevetted brigadier-general Mar. 21, 1864. (See *Reminiscences of L. M. Sargent*, by J. H. Sheppard.)

**Sargent** (LUCIUS MANLIUS, JR.), M. D., son of Lucius M., b. at Boston, Mass., Sept. 15, 1826; graduated at Harvard 1848; studied medicine; became house surgeon and dispensary physician at the Massachusetts General Hospital; was commissioned surgeon to the 2d Massachusetts Volunteers May 28, 1861, but soon exchanged that post for active service in the 1st Massachusetts Cavalry, rising to be lieutenant-colonel Sept. 30, 1864, and was killed in an engagement on Meherrin River, near Bellefield, Va., Dec. 9, 1864, while in command of his regiment.

**Sargent** (NATHAN), b. at Putney, Vt., May 5, 1794; received a good education; studied law; settled at Cahawba, Ala., 1816, where he became county and probate judge; resided at Buffalo, N. Y., 1826–30; established a Whig newspaper at Philadelphia 1830; was afterward Washington correspondent of the *United States Gazette*, becoming widely known under his *nom de plume* of "Oliver Oldschool;" was sergeant-at-arms of the U. S. House of Representatives 1849–51; register of the treasury 1851–53; commissioner of customs 1861–71; and was for some years president of the Washington Reform School. D. at Washington, D. C., Feb. 2, 1875. Author of a *Life of Henry Clay* (1844) and *Public Men and Events* (2 vols., 1875), issued but a few days before his death. It contains many interesting reminiscences of the days of Jackson, Clay, and Calhoun.

**Sargent** (PAUL DUDLEY), b. at Gloucester, Mass., in 1745; was wounded at Bunker Hill; commanded a regiment at the siege of Boston 1775–76, and a brigade in the summer of 1776; took part in the battles of Harlem, White Plains, Trenton, and Princeton; removed to Maine after the war, and was for many years judge of the court of common pleas in Hancock co. D. at Sullivan, Me., Sept. 15, 1828.

**Sargent** (WINTHROP), b. at Gloucester, Mass., May 1, 1753; graduated at Harvard 1771; became captain of one of his father's ships 1775; became navy agent at Gloucester Jan. 1, 1776; served at the siege of Boston as captain of artillery, and subsequently in the Long Island, New Jersey, and Pennsylvania campaigns, attaining the rank of major; was connected with Gen. Rufus Putnam's Ohio Company; was made by Congress surveyor-general of the North-west Territory 1786; became its secretary 1787; was adjutant-general of St. Clair's expedition against the Miami Indians 1791, and in Wayne's expedition 1794–95, being wounded in the former; was a member of the American Academy of Arts and Sciences and of the Philosophical Society, and an original member of the Society of Cincinnati as delegate from Massachusetts; aided Dr. B. S. Smith in preparing his *Papers Relative to certain American Antiquities* (1796); wrote some poems; was governor of Mississippi Territory 1790, and again 1801. D. on a voyage from Natchez to Philadelphia June 3, 1820.

**Sargent** (WINTHROP), grandson of Major Winthrop, b. at Philadelphia, Pa., Sept. 23, 1825; graduated at the University of Pennsylvania 1845, and at Cambridge Law School 1849; practised his profession at Philadelphia, and subsequently at New York; edited from original MSS., with a valuable introductory memoir, *The History of Braddock's Expedition against Fort Duquesne* (1855); edited *The Loyalist Poetry of the Revolution* (1857) and several reprints of curious Revolutionary tracts, and was author of *The Life and Career of Major John André, Adjutant-General of the British Army in America* (Boston, 75 copies only, 1861), a work of extraordinary research. He wrote largely for the *North American Review* and other magazines; was an accomplished bibliographer; was for many years engaged in preparing a *catalogue raisonné* of books relating to America (unfinished). D. at Paris, France, May 18, 1870.

**Sargon.** See ASSYRIA, by W. JACOBS, A. M.

**Sarlat',** town of France, department of Dordogne, on the Sarlat, trades in walnut oil, liqueurs, wine, truffles, and cattle. P. 6586.

**Sarma'tia,** the ancient name for the vast region extending from the Baltic to the Black Sea, and from the Vistula to the Volga. The Romans, however, knew very little about this country.

**Sarmien'to** (DOMINGO FAUSTINO), b. at San Juan de la Frontera in the viceroyalty of Buenos Ayres Feb. 15, 1811; received a liberal education; became a teacher at San Luis; took part in politics as an opponent of Rosas; was consequently exiled to Chili in 1831; returned to San Juan in 1836; established there a ladies' seminary and edited a literary journal, but the province having fallen under the power of Rosas, he again went to Chili in 1840 and devoted himself to the cause of popular education, publishing a number of textbooks, editing several periodicals, and establishing many schools of different grades, including a normal college at Santiago. In 1845 the Chilian government sent him on an educational tour of inspection to Europe and the U. S., where he made the

acquaintance of Horace Mann and carefully studied his methods of instruction. In 1851 he returned to the La Plata; served as colonel and military secretary to Urquiza in the campaign against Rosas, after whose fall he aided in framing the constitution of 1853; held several important ministries in the government of Buenos Ayres; became superintendent of public instruction, governor of the province of San Juan, and minister to the U. S. 1864–68. While holding the latter position he was chosen president of the Argentine Republic, a post which he filled with eminent ability and success from Oct. 12, 1868, to Oct. 12, 1874, when, being ineligible for re-election, he was succeeded by a distinguished member of his cabinet, Dr. Avellaneda. During his term of office the Paraguayan war was successfully terminated, two formidable insurrections were quelled, and an imminent danger of rupture with Brazil was more than once averted without any sacrifice of the national honor. Educational institutions of various kinds were founded in all the provinces, some of them being placed in the hands of American teachers; an astronomical observatory was created at Córdova under the management of Dr. Benjamin A. Gould; railroads and telegraphs were built with great rapidity; a vast European immigration was fostered; commerce was rapidly multiplied, lawlessness was sternly repressed, justice effectively administered, and the national finances managed with strict integrity. Pres. Sarmiento is recognized as one of the most enlightened of modern rulers. He has written largely for the press, being, like many other South Americans, at once a poet, a novelist, an essayist, an historian, and a political writer; but his chief laurels have been won as an educator. The best known of his books are *Viages por Europa, Africa y America, Civilizacion y Barbarie,* and *Vida de Lincoln.* PORTER C. BLISS.

**Sar'nia,** a port of entry, capital of Lambton co., Ont., Canada, at the head of Lake St. Clair. Here the Sarnia branch of Great Western Railway terminates, while at Point Edward, a northern suburb of the town, is the W. terminus of Grand Trunk Railway. Sarnia is connected with Port Huron, Mich., by a steam-ferry which plies throughout the year, while from Point Edward to Fort Gratiot, Mich., are ferry-boats by which railroad cars are carried across. Sarnia has 2 weekly newspapers, a large trade, a custom-house, thriving manufactures, and extensive commerce by rail and steamers. P. of town, 2929; of tp. 3438.

**Sarno,** Italy. See APPENDIX.

**Saronno,** Italy. See APPENDIX.

**Sar'pi** (PIETRO), commonly known under his monastic name, FRA PAOLO, b. at Venice Aug. 14, 1552; entered the order of the Servites in 1565, and became provincial in 1579 and procurator-general in 1585. As such he resided at Rome, and enjoyed at first great favor at the papal court, but his studies of mathematics, physics, astronomy, and medicine, in which he acquired great learning, and is said to have made, or at least anticipated, several great discoveries—as, for instance, that of the circulation of the blood—and his liberal and independent views, made him soon suspected. In 1589 he returned to Venice, the republic having chosen him her councillor and theologian in the controversies with Pope Paul V. concerning the relation between Church and State. Sarpi opposed the papal claims with great energy, and exercised considerable influence on the attitude which the Venetian republic assumed toward the pope. He was consequently excommunicated as a heretic, and, as this had no effect, pursued by assassins, on account of which he was compelled to spend the later years of his life in his cell in the monastery, where he d. Jan. 14, 1623. In 1619 he published at London, under the pseudonym "Pietro Soave Polano," his *Istoria del Concilio Tridentino,* which was soon after translated into several other languages—into English in 1629 and 1676—and now forms the foundation of his fame. A collected edition of his works, among which his letters especially have great interest, appeared at Venice in 6 vols. in 1677. His *Life* was written by Bianchigovini in 1836, and by A. G. Campbell in 1875. (See also T. Adolphus Trollope, *Paul the Pope and Paul the Friar,* London, 1860.)

**Sar'py,** county of E. Nebraska, lying between Missouri River on the E. and the Platte on the S. W., is traversed by Union Pacific and Omaha and South-western R. Rs., has an undulating surface and a very fertile soil. Staples, Indian corn, wheat, hay, and butter. Cap. Bellevue. Area, 235 sq. m. P. 2913.

**Sarpy Centre,** p.-v., Sarpy co., Neb., 16 miles S. W. of Omaha, has 2 churches, a free seminary, a public park, 1 newspaper, and 1 wagon and agricultural implement manufactory. The soil is very fertile, and gold-bearing quartz has been found, assaying 20 ounces to the ton. P. including co., 3800. ALLEN GERRISH, ED. "SENTINEL."

**Sarrace'nia** [named in honor of Dr. Sarrazin of Quebec], a remarkable genus of E. North American herbs of the natural order Sarraceniaceæ, remarkable for the expanded petal-like style, and especially for the hollow pitcher-shaped leaves, usually half full of water, and containing many drowned insects. Of the six species, *S. purpurea* is the commonest. Its roots, and those of *S. variolaris,* recently had a great but transient reputation as a remedy in smallpox.

**Sarracenia'ceæ,** the natural order of pitcher-plants, of which the above is the principal genus and the type. (See PITCHER-PLANTS.)

**Sarreguemines',** town of the German empire, province of Alsace, on the Sarre, has celebrated manufactures of pottery, hemp, silk, satin, velvet, leather, paper, gloves, etc. P. 6075.

**Sarsaparil'la,** the roots of certain species of smilax, indigenous in the northern part of South America and in Central America. Exactly what are the species that afford the sarsaparillas used in medicine is not yet definitely known, although the history of the drug dates back to the sixteenth century; but *S. officinalis* and *S. medica* are doubtless two genuine sources. The medicinal species of smilax are climbing plants, growing from a large woody root-stock, from which long fleshy roots grow horizontally in all directions. It is these roots that constitute the drug sarsaparilla. They vary in thickness from that of a quill to that of the little finger, and consist of a thick cortical portion covered with a thin epidermis of various colors, a thin ligneous layer, and a central medulla, which often abounds in starch. The roots have scarcely any smell, but when chewed produce a disagreeable acrid impression in the mouth, which persists for some time. Sarsaparilla contains a crystallizable principle called *parilline,* upon which such medicinal virtues as the drug possesses most probably depend. There are various sorts of sarsaparilla, obtained from different localities, which are most easily grouped into the *mealy* and *non-mealy,* according to the proportion of starch they contain. Of the mealy are Honduras, Guatemala, and Brazilian or Lisbon sarsaparilla, and of the non-mealy, Jamaica, Mexican, and Guayaquil. Sarsaparilla was at one time held in high esteem as a medicine, principally as a remedy for syphilis, but it is now accorded but feeble power, and where used is prescribed simply to assist the action of more potent drugs. EDWARD CURTIS.

**Sars'field** (PATRICK), earl of Lucan, b. in Ireland about 1645; served on the Continent in the English life-guards under the duke of Monmouth, and against him at Sedgmoor 1685; was at the Revolution a member of the Irish Parliament and one of the wealthiest and most influential Irish Roman Catholics; adhered to the cause of King James, to whom he offered his services in 1689; fought at the battle of the Boyne, July 1, 1690; surprised the English artillery before Limerick, and compelled William III. to raise the siege Aug., 1690; commanded the Irish reserve at the battle of Aughrim, July 12, 1691; exhibited great gallantry in the second defence of Limerick; obtained honorable conditions of surrender Oct., 1691; retired to France with a corps of Irish volunteers; distinguished himself at Steenkirke, Aug., 1692, and was killed at the battle of Landen, July 19, 1693.

**Sartain'** (JOHN), b. in London, England, in 1808; became an engraver; came to the U. S. 1830; settled in Philadelphia; introduced mezzotint engraving into America; also practised oil-painting; was editor and proprietor of the *Foreign Semi-monthly Magazine;* founder of *Sartain's Union Magazine;* published *Poetical and Prose Illustrations of Celebrated American Painters* (4to, 1852), and was the designer of several meritorious public monuments, among which is that to Washington and Lafayette in Monument Cemetery, Philadelphia.

**Sarthe,** department of France, extending on both sides of the Sarthe, comprises an area of 2371 sq. m., with 446,603 inhabitants. The surface is mostly level, and the soil often light and sandy. Wheat and wine are produced, but the rearing of cattle, poultry, and bees is the chief occupation. The manufactures comprise iron, glass, porcelain, and faïence. Of 51,584 children of school age, 12,556 received no school education in 1857. Cap. Le Mans.

**Sar'ti** (GIUSEPPE), b. at Faenza, Papal States, Dec. 28, 1729; received his musical education in Bologna; composed his first opera in 1752, *Pompeo in Armenia,* which had success; was director of the opera at Copenhagen 1756–65; visited London in 1769–70; was chapel-master at the cathedral of Milan 1779–84; went in that year to St. Petersburg as director of the opera. D. at Berlin July 28, 1802. He composed over thirty operas, of which

none, however, made any great impression, but of his church music his terzetto, *Amplius Lava Me*, is still remembered. He was the teacher of Cherubini.

**Sar'to, del** (Andrea), (real name, according to the best authority, Andrea Vannuchi; called Del Sarto from his father's trade, that of a tailor), b. in Florence in 1487; was from the beauty of his early works called "the faultless painter." He studied wood and metal engraving, and became a disciple of Pietro di Cosimo, but gained his best instruction from the works of Ghirlandaio, Leonardo da Vinci, Michael Angelo, and Raphael. His genius was of the sweet, gracious type; his works are pervaded by a sentiment of harmonious beauty. Had he himself been entirely free from the evil influences that corrupted his nature and vitiated his art, he would have stood even higher than he did. As it is, his best pieces, the *Madonna del Sacco*, the *Madonna del Trono*, the frescoes of the Nunziata and the Scalzo, have a singular charm of grace and color. But his unfortunate and miserable marriage with a beautiful but unprincipled woman was the cause of his demoralization as a man and artist. He became careless, mannered, and affected, repeated himself, worked for money and feverishly, and lost whatever of sincerity and earnestness he had. D. in Florence in 1530. The easel pictures of Andrea—*Madonnas, Holy Families*, altar-pieces, and such-like—are familiar to the visitors at foreign galleries. But it is only in Florence that he can be fairly judged. The story of his private life is one of the tragedies of biography. O. B. Frothingham.

**Sarto'rius** (Sir George Rose), b. Aug. 9, 1790; entered the navy at an early age; was present at the battle of Trafalgar; commanded a gunboat at the siege of Cadiz; in command of the Portuguese fleet 1830–31; knighted in 1841, and made K. C. B. in 1865. Author of several papers on naval warfare and engineering.

**Sart'well** (Henry Parker), M. D., Ph. D., b. at Pittsfield, Mass., Apr. 18, 1792; began the practice of medicine when nineteen years of age; served as surgeon during the war of 1812–15; settled at Bethel, Ontario co., N. Y., 1821, and at Penn Yan 1832; kept records of the weather for more than forty years, and for the same length of time was known as an enthusiastic and intelligent botanical collector, forming an herbarium of 80,000 species, now possessed by Hamilton College, Clinton, N. Y. About 1846 he devoted his whole time to the study of the genus *Carex*, and brought out *Carices Americanæ Septentrionalis Exsiccatæ* (2 parts, 1848; part iii. unfinished). D. at Penn Yan Nov. 15, 1867.

**Sarzana,** Italy. See Appendix.

**Sarzeau',** town of France, department of Morbihan, on a peninsula in the Atlantic, is much frequented as a watering-place, and has a trade in wine and silk. P. 6788.

**Saskatch'ewan** (or **Nelson**) **River,** one of the chief rivers of North America. The basin it drains is about 482,000 sq. m. in area, and is 1300 miles in extreme length from the most westerly source of the N. branch of the Saskatchewan, about lon. 117° 35′ W. (from Greenwich) and lat. 52° N., in the heart of the Rocky Mountains, to the source of the Winnipeg, lon. 90° W., lat. 48° 45′ N., 60 miles N. from Lake Superior, at the boundary of the province of Ontario, with an extreme width of 790 miles from the most southern source of Red River in Minnesota to the mouth of Nelson River, lat. 57° 06′ N., lon. 93° 35′ W., on Hudson's Bay. Length of the Saskatchewan by S. branch from source to sea, in straight courses of 10 miles, 1545 miles; with the requisite addition for sinuosities, 1732 miles at least by its channel. It slightly exceeds the Ganges and the Yukon of Alaska, similarly measured, in length, and is one-eighth greater in area of basin than the Ganges, but less than either in volume discharged. For 300 miles N. N. W. from lat. 49° N. (the U. S. boundary) the summit watershed of the Rocky Mountains is the western boundary of the valley of the Saskatchewan, which at the base of the mountains has an elevation of about 4000 feet above the sea. Its southern boundary, the watershed between it and the Missouri, declines from that elevation to 1500 and 1700 feet above the sea. The watershed between it and the river Athabasca on the N. W. rises in steps to 2500 feet. That between it and the river Churchhill or Beaver, on the N., is much lower and less continuous, their waters nearly connecting in some parts when high. On the S. E. and N. E. it is bounded by the summit-ridges of the Laurentian ranges that divide it from Lake Superior and from the other rivers falling into Hudson's Bay, varying from 1800 to 1500 feet above the sea. From these elevations it descends gradually, but unevenly, to Lake Winnipeg, which by latest observations is 710 feet above the sea, lying in the axis of greatest depression of surface, the mean elevation of which, from the Lake of the Woods to Great Slave Lake on the river Mackenzie, is under 1000 feet. The vast sloping plateau from this axis of depression to the base of the Rocky Mountains presents occasional eminences and ranges like the Riding Mountains W. of Lake Manitoba, and more westward the Touchwood, Thunder-breeding, Cypress, and Hand Hills, rising from 500 to 1000 feet over the adjoining plains, which are furrowed with deep and generally narrow valleys, in which nearly all the rivers flow. E. of the axis of depression the country is rugged and hilly. The sources of the N. and E. branches of the Saskatchewan are stated by Dr. Hector to be but a few miles apart, in a grand nucleus of lofty summit-glaciers about lat. 51° 40′ N., lon. 117° W., near Mount Hooker, 15,700, and Mount Brown, 1600 feet, in height, where the Rocky Mountains are 200 miles in breadth. Thence diverging 300 miles apart midway, they unite at 550 miles in direct distance eastward, the course of the N. branch being about 836 miles, the S. branch about 903 miles. At 260 miles up the latter it receives Red Deer River, about 445 miles long, on the left. About 177 miles up the N. branch it receives on the right Battle River, nearly 400 miles long. Measured in August, the volume of water passing in the N. branch was 25,264, and in the S. branch 34,285, cubic feet per second, or very little more than the mean of the Rhine. A little below their junction it measured 59,667 cubic feet per second. At 333 miles farther it enters Cedar Lake, 30 miles long; at 20 miles from which it enters Lake Winnipeg, descending 60 feet, 43½ of which is in the Grand Rapid, 2¾ miles long, commencing 5 miles from the mouth. The last 2 miles are swift waters. The Saskatchewan is narrow, varying from 220 to 660 yards in width below the forks. In the N. or lesser branch the navigation is obstructed at low water by shoals and shifting sandbars. There are two steamboats already on it. It is found, by warping up two rapids, that they can easily ascend from the head of the Grand Rapid, 5 miles from the mouth, up to Fort Edmonton on the N. branch, 850 miles, and probably very nearly to Rocky Mountain House, 160 miles higher. The average ascent in the 894 miles is 15 inches per mile. About 446 miles from its entrance to Lake Winnipeg, traversing the N. end of it for 50 miles, and Play Green Lake adjoining, 30 miles, with its volume of water more than doubled by the large tributary of Lake Winnipeg, obstructed in its course by many rapids and falls, with 710 feet of descent, it enters Hudson's Bay at York Factory, lat. 57° 06′ N., lon. 93° 35′ W.

Of the area drained by the Saskatchewan or Nelson River, that part of it E. of the Lake of the Woods and Lake Winnipeg is a rugged country of Laurentian formation, excepting 100 miles of the lower course of the river, which is in the Silurian plain of Hudson's Bay. W. of these lakes a parallel belt of Silurian formation extends to and over Red River, excepting from the mouth of the Assiniboine upward, where a belt of Devonian intervenes, increasing in breadth southward. The Silurian belt extends to about halfway between Lake Winnipeg and Lake Manitoba, above which it sweeps, with increasing breadth, more abruptly westward. A parallel belt of Devonian of irregular but nearly similar width extends westward of the Silurian, sweeping directly W. along the northern watershed. Then all westward to the Crystalline and Laurentian region of the Rocky Mountains, excepting where a belt of Carboniferous formation crops up along their base, is Tertiary, Cretaceous throughout. Of the Laurentian region E. of Lake Winnipeg, one-fourth may perhaps be arable, and of that one-half along the watershed will be found too cold for cultivation, the remainder, say 70,000 sq. m., being valueless except for timber, to which add 15,000, probably, in the Rocky Mountains equally valueless, with 20,000 on the lower course too cold for cultivation, and three-fourths of the arid region on the S. Saskatchewan and Qu' Apelle, say 60,000; making together 165,000 sq. m. of the total area unserviceable, leaving 317,000 sq. m. of the basin of the Saskatchewan as arable land fit for cultivation. Excellent wheat, weighing 68 pounds to the bushel, was raised at Lake Athabasca in 1875, 340 miles N. of the Saskatchewan. A. J. Russell.

**Sas'nett** (William Jeremiah), D. D., b. in Georgia Apr. 29, 1820; graduated at Oglethorpe University in 1839; studied law, but abandoned it for the ministry, in which he speedily rose to eminence; paid great attention to the subject of education; wrote much in favor of the paramount importance of developing and cultivating the sensibilities in female education; filled the chair of English literature in Emory College, Ga., with great ability; also the presidential chair of Lagrange Female College, and also that of the East Alabama Male College at Auburn, Ala.; besides writing largely for periodicals, published two volumes, entitled, respectively, *Progress* and *Discussions in Literature and Religion*. He was a powerful preacher, a great debater, and a devout Christian; belonged to the Montgomery conference of the M. E. Church, South, at the time of his death, Nov. 3, 1865. T. O. Summers.

**Sas'safras** [from the Spanish *salsafras*], the *Sassafras officinale*, a shrub of the order Lauraceæ, becoming a tree in the Southern States. Its leaves are aromatic and highly mucilaginous, and the bark of the root is a powerful stimulant, with a pleasant taste and smell. It has considerable use in medicine, but is employed principally at present for flavoring purposes. Confectioners use it in the same way. The volatile oil is more frequently employed than the bark in substance. The wood is soft and brittle, but is sometimes employed for making boxes and drawers on account of its pleasant smell. Farther India and China produce the *Sassafras parthenoxylon*. The Brazilian sassafras is *Nectandra cymbarum*.

**Sassafras,** p.-v., Millington tp., Kent co., Md., on Sassafras River. P. 281.

**Sassafras Fork,** p.-v. and tp., Granville co., N. C. P. 1859.

**Sassafras, Oil of,** a highly fragrant essential oil, obtained from the root of the sassafras tree, which contains from 1 to 2 per cent. of it. It is heavier than water; boils at 430° F. St. Evre gives as its composition $C_{20}H_{20}O_4$.

**Sassan'idæ,** the name of a celebrated dynasty which reigned in Persia from 226 A. D. to 651. It ascended the throne with Ardshir, a son of Sassan, and was overthrown with Yesdigerd III. (632–651), who was murdered in that year, having previously been defeated at Cadesia (639) and Nahavend (641) by the caliph Omar. The reign of the Sassanidæ was an epoch of great prosperity. The boundaries of the empire were extended, and time after time the Roman legions retired, defeated and humiliated, from the frontiers. They were thoroughly beaten by Sapor I. (240–273) at Edessa, where the emperor Valerian was taken prisoner; again by Narsi (294–303) under Galerius; and most completely by Sapor II. (310–381) under Constantius; and again under Julian, who fell at Ctesiphon in 363. Bahram V. Gour (420–448) compelled the Byzantine emperor to pay a tribute to Persia, and this tribute was still paid to Chosroes II. (591–628). Internally, the state of the country was very flourishing. The reign of the Sassanidæ was the blossom of the Persian nationality in religion and in poetry. Magnificent cities, of which only the names and some ruins are left, were built and flourished, and by the aid of costly and ingenious aqueducts, canals, and other means of irrigation large tracts were covered with fields and orchards which a few years after the invasion of the Arabs were transformed into arid wastes. Thus, it cannot be wondered at that up to this very day the traditions of the family of the Sassanidæ are very vivid and much cherished among the Persians.

**Sassari,** Sardinia. See APPENDIX.

**Sassoferrato,** Italy. See APPENDIX.

**Sassuolo,** Italy. See APPENDIX.

**Sas'sy Bark,** one of the ordeal drugs of Western Africa, is the bark of *Fillæa suaveolens*, a large tree of the order Leguminosæ. Like the Calabar bean, it is a very poisonous narcotic, administered in Africa to supposed witches. Its properties are not well understood.

**Sa'tan** [Heb. שָׂטָן, "the fiend"]. The idea of Satan as the origin of all evil and the ruler of a realm of evil does not occur in those books of the Old Testament which were written before the Exile. It was introduced among the Jews during the Babylonian captivity through their acquaintance with the religion of Zoroaster. The Persian dualism, however, was absolutely irreconcilable with the monotheism of the old Judaism, and in the book of Job Satan is still the servant of God and dependent on him. In the period between the close of the Apocrypha and the appearance of Jesus the idea of Satan developed into a comprehensive demonology, supported by the Pharisees, though rejected by the Sadducees. This demonology passed directly into Christianity, and was still more strengthened and developed during the contest between Christianity and the heathen world. To many of the early Fathers the universe seemed to be divided between God and Satan, and history to consist of a struggle between them for the sole rule. The Middle Ages still clung to this view; and although in modern times it has faded away before the purer and more energetic conception of God as the One, the idea of Satan as the personal representative of evil still forms a part of the creeds of most Christian denominations.

**Satellites.** See ASTRONOMY, EARTH, MOON, JUPITER, SATURN, URANUS, NEPTUNE, and SOLAR SYSTEM.

**Sat'in,** a smooth and lustrous fabric of silk, of Chinese invention. Of the warp threads only one in every five or ten is raised to allow the shuttle to be passed, but each thread is raised in regular succession as the shuttle is thrown. It is woven with the right side uppermost.

**Satin Bower-Bird.** See BOWER-BIRD.

**Satinet',** a coarse fabric, of which the warp is cotton and the weft woollen. It was originally the name of an inferior variety of satin.

**Satin Spar,** a fibrous variety of carbonate of lime, found of snowy whiteness in England, Scotland, and elsewhere, which when polished has a lustre resembling that of satin. A fibrous kind of GYPSUM (which see) is also called satin spar, is softer than the above, and is frequently made into ornaments resembling cat's-eye.

**Satin-Wood,** a name given to several kinds of ornamental wood. The best is from Guiana, and is the wood of *Ferolia Guianensis*. Florida satin-wood is from *Xanthoxylum Floridanum*, a kind of prickly-ash tree. The West India satin-wood is from different trees, some of it of the very best, and others of the poorest quality. The rich and fragrant satin-wood of India is usually of good quality. It comes from *Chloroxylon Swietenia*, a cedrelaceous tree which yields a sort of wood-oil. Satin-wood is used in making workboxes, hair-brushes, and cabinet-work.

**Sat'ire** is the name of a peculiar species of poetry which originated with the Romans, and in this, its Roman form, died out with the Latin literature. The name *satira* was originally written *satura*, which, derived from the root *sat*, "enough," denoted a dish of different kinds of fruit mixed together, then a stew; with the satyr of the Greek mythology and the satyric drama of the Greek theatre it had nothing to do. In its primitive period, when it first arose out of popular life, the artistic form of the *satura* was dramatic, a scenic improvisation in various metres: but afterward, when under the hands of Lucilius the *satira* became a fixed and well-defined literary *genre*, it adopted the epic form, modifying the tone only of the hexameter, not its construction. As developed by Horace, Persius, and Juvenal, the æsthetic character of the *satira* was a blending of epic and lyric elements. Descriptions of men and manners characteristic of the age formed the epic materials which entered into the composition. But these descriptions were not given by the *satira* in the same manner as by the epopee; that is, in pure objectivity, merely for the sake of artistic representation. On the contrary, they had here another function—namely, to convey to the reader the sentiment with which the poet looked at them, the judgment which he passed on them, his indignation, his scorn; and this formed the lyric element of the composition. From the different manner in which these two elements were combined arose the difference between the satire and the didactic poem. The latter gave its propositions, its theses, directly in abstract form, and added the descriptions as illustrations, as persuasive arguments; while the former gave its verdicts only indirectly, seen through the descriptions, revealed in the picture by illuminating it; that is, the *satira* was humorous.

But although, as above mentioned, this species of poetry, this literary *genre*, died out with the Latin literature, it was only the form, the *satira* (properly speaking), which vanished; the substance, that which we call the satirical, or simply satire, and which was by no means invented by the Romans, continued to live. It flourished among the Greeks long before there existed any Roman literature, and two phases of it, parody and irony, the modern persiflage and sarcasm, were powerfully developed by them. But in Greece its form was principally dramatic. Aristophanes' comedies are dramatic satires, not comedies in the common use of the word, and large passages of Plato's dialogues, especially where Socrates is cornering some Sophist in his argument, are of a most brilliant satirical effect. And it continued to flourish in the Christian era in innumerable shades and under innumerable forms, and often burst forth in specimens compared with which the *satiræ* of Horace, Persius, and Juvenal are very insignificant; such as *Reineke Vos*, *Epistolæ Obscurorum Virorum*, *Don Quixote*, *Gulliver's Travels*, etc. In a volume or two of *Kladderadatsch*, *Charivari*, or *Punch* satire may be studied in all its phases and in all its forms. CLEMENS PETERSEN.

**Satisfac'tion** [Lat. *satisfactio*], in law, denotes, when used in a general sense, the acquittance of a legal claim, the legal compensation and settlement for injuries done, or the discharge of a debt or demand, as by the payment of the money due upon any obligation. As a generic term, it thus includes all the particular modes by which a pecuniary liability on the one side and right on the other are ended, so that they entirely cease to exist. In a more special and restricted sense the term is applied to the discharge of an obligation which is a matter of record—a judgment or a mortgage—where the discharge itself is also of record. At the common law an entry was made on the roll by an at-

torney of the judgment creditor which admitted that the judgment had been paid and satisfied. In the U. S. a written instrument, often called a "satisfaction-piece," is executed by the judgment creditor, or in certain contingencies by his attorney, acknowledging that the judgment therein described is satisfied. Upon filing this writing in the office where the judgment is entered and docketed, the clerk records a minute of that fact in the proper book and upon the docket. A similar entry is made by the clerk upon the filing of an execution by which the judgment has been satisfied. Recorded mortgages are discharged in a somewhat similar manner. In many of the States the mortgagee himself is required by statute to write a satisfaction upon the margin of the record, and a refusal on his part renders him liable to an action for damages. In other States the mortgagee executes and acknowledges before a proper officer an instrument in which he recites that the obligation has been paid, and delivers the same to the mortgagor or other party liable for the debt. On filing this writing in the office of the clerk, recorder, or register, it is itself thereupon recorded, and the mortgage is satisfied of record by an appropriate indorsement. The several means above described are intended to convey a public notice that the lien of the judgment or mortgage is destroyed, of the same nature as the original notice that their lien was in existence. JOHN NORTON POMEROY.

**Sa'toralja Ujhely',** town of Hungary, celebrated for its excellent wine and the granite-quarries in its vicinity. P. 6500.

**Sa'trap** [Gr. *σατράπης*; anc. Pers. *khshatrapâvan;* mod. Pers. *sitrab*], the ruler of a satrapy or province of ancient Persia. The old satraps imitated the absolutism and the tyranny of their royal masters, and on the decline of the old kingdom some of the satrapies became independent monarchies.

**Satta'ra,** town of British India, capital of a district of the same name, in lat. 17° 41′ N., lon. 74° 1′ E., has a fort, and is noted as one of the most salubrious and pleasant stations of Deccan, otherwise it is insignificant. The district of Sattara, comprising an area of about 11,000 sq. m., with 1,028,520 inhabitants, was incorporated in the British empire in 1848, the rajah who had reigned under British authority dying without heirs.

**Sat'terthwaite** (THOMAS EDWARD), M. D., b. at Spuyten Duyvel, N. Y., Mar. 26, 1843; graduated at Yale College 1864, at the College of Physicians and Surgeons, N. Y., 1867; served as a commissioned surgeon in the Franco-German war; is surgeon to Demilt Dispensary, microscopist to St. Luke's Hospital, and pathologist to the Presbyterian Hospital, N. Y., and has published a number of professional papers, among which are *Bacteria, their Nature and Relation to Disease* (in New York *Medical Record*, Dec., 1875), and an essay *On the Structure and Development of Connective Substances*, to which was awarded in 1876 the alumni prize of the College of Physicians and Surgeons.

**Satura'tion,** in chemistry [Lat. *saturare*, to "fill," "glut," "cram," "sate," or "cloy"]. The term *saturation* is used by chemists in *five* distinct senses: *First*, in the sense of saturation of *solvent* powers of liquids. There are here two cases—solutions of solids in liquids, and solutions of gases in liquids. (The subject is treated under the head of SOLUTION, SOLVENTS, AND SOLUBILITY, by HENRY WURTZ.) *Second*, in the sense of saturation of *absorbent* powers of solids for gases. The absorption of *liquids* by porous solids is scarcely to be classed among *chemical* phenomena, unless when accompanied by thermic changes indicating formation of chemical compounds, although in common parlance the term "saturation" is applied to this also. *Third*, in the sense of the saturation of *acidity* and *basicity*, and the formation of *neutral* salts, by the combination of acids and bases, or of electro-positive metals or radicals with halogens. (See SALTS, CHEMISTRY AND CLASSIFICATION OF, by HENRY WURTZ; also SALT-RADICALS, by the same.) *Fourth*, in a sense possibly somewhat akin to the last, referring to the limit of chemical combination of water with other compounds to form *hydrates*. This sense is distinct from *solutions in water*, which generally pass much beyond this limit, but it will also be treated under the head of SOLUTION, SOLVENTS, etc. *Fifth*, in the sense of saturation of the *equivalence*, or so-called "atomicity," of an element or radical by other elements or radicals (for which see VOLUMES, MOLECULAR). HENRY WURTZ.

**Sat'urday** [with the Romans *Dies Saturni*, "Saturn's day"], the seventh and last day of the week, is the Jewish Sabbath, and is called *Dies Sabbati* in the Roman Catholic breviary.

**Sat'urn.** The planet Saturn is the sixth in order of distance from the sun, and the third of the superior planets. It travels at a mean distance of 872,137,000 miles from the sun, but the greatest and least distances of Saturn from the sun differ from the mean distance by nearly 49,000,000 miles, being respectively 920,973,000 miles and 823,301,000 miles. The eccentricity of the orbit is 1.055996. The earth's mean distance being about 91,500,000 miles, and the variation of the earth's distance insignificant in comparison with the enormous distance of Saturn, the greatest, mean, and least distances of the planet from us when in opposition may be conveniently taken as 826,500,000, 777,500,000, and 729,000,000 miles respectively. An account being taken (as in the case of MARS, which see) of the varying degree to which the planet is illuminated, it appears that when Saturn is at his nearest, in opposition, he can be more favorably examined than when at his remotest opposition distance in the proportion of about 8 to 5—a noteworthy difference, which has not been sufficiently taken into account in our books of astronomy. Saturn circuits his orbit in a period of 10,759.2198 days, or 29 years 167.2 days. His synodical period, or the interval between successive oppositions, exceeds a year by about $12\frac{3}{4}$ days on the average. His volume exceeds the earth's about 700 times, but his mean density is so small that his mass only exceeds hers about 90 times. In fact, his mean density is less than that of any known member of the solar system (except, of course, the comets), being only 0.13 when the earth's is taken as unity, or, if the density of water be taken as the unit, that of Saturn is about .73, or less than the density of mahogany. His mean diameter is about 70,000 miles, his compression about $\frac{1}{10}$, so that the polar diameter is about 3500 miles less, and the equatorial diameter about 3500 miles greater.—Saturn is distinguished among all the planets by the remarkable complexity of his structure and the number of subordinate bodies over which he bears sway. His gigantic orb is girt about by a mighty system of flat rings, the span of which from outside to outside amounts to 167,000 miles, or more than six times the circumference of the earth. There are two chief bright rings, the outermost nearly 10,000 miles in width, the innermost about 17,500 miles in width, while between them there is a gap about 1500 miles across. Thus, the entire breadth of the system of bright rings amounts to nearly 28,910 miles. It is probable that each bright ring is subdivided into several others. Inside the system of bright rings there is a dark ring (discovered by the elder Bond of Harvard Observatory, Cambridge, U. S.), also probably multiple, which has a breadth of about 8700 miles. Between this ring and the planet intervenes a space more than 10,000 miles in breadth. This wonderful appendage has been the object not only of very careful scrutiny, but of much discussion. After a careful investigation of the difficult problems suggested by its motion and at least relative stability—an investigation in which Laplace, Peirce, Bond, and Clerk Maxwell have taken part—astronomers have been led to the conclusion that the rings are not continuous bodies, but consist of multitudes of small satellites, mixed probably with vaporous matter, travelling in flat flights around the central orb. This is, in fact, the only possible interpretation of the actual existence and continuance of the rings: for no system of continuous rings could continue to travel in dynamical equilibrium around Saturn, or bear the strains to which the tremendous attractive power of Saturn would subject them. The planet is attended by eight satellites, travelling at distances ranging from 3.36 to 64.359 radii of Saturn, so that the actual span of the orbit traversed by the outermost satellite amounts to more than 4,500,000 miles. This is the largest subordinate scheme within the planetary system. The sixth satellite, in order of distance from Saturn, is judged to be about 3000 miles in diameter, so that it is an orb nearly as large as the planet Mercury. The outermost is about as large as the least of Jupiter's satellites; the rest are smaller; and, somewhat singularly, the satellite which travels between the sixth and the outermost is the least of all, and can scarcely be discerned save in the most powerful telescopes. It was discovered by the elder Bond of Harvard; the sixth or largest by Huyghens; the two innermost by Sir W. Herschel; and the rest by J. D. Cassini. The globe of Saturn is marked, like that of Jupiter, by belts, but they are less distinct. The tint of the planet as a whole is yellowish, but the belts show considerable variety of color. An equatorial belt, nearly always seen, has a creamy-white color; the dark belts on either side are commonly cinnamon-colored; while the polar regions show a faint tinge of azure. As in the case of Jupiter, the conclusion to which we are led by the careful study of these belts and of the probable condition of Saturn's globe is, that we do not see a solid or liquid orb, but only the outer parts of a deep and cloud-laden atmosphere. In fact, while the general evidence in Saturn's case is identical with that already considered in dealing with Jupiter, there are some points of detail which are different, and afford even more convincing evidence as to the condition

of these giant planets. The belts of Saturn show a marked curvature when the planet is near those parts of the orbit where the summer or winter of Saturn is in progress (so far as the sun's elevation viewed from Saturn is concerned). Now, this curvature enables the astronomer on earth to determine whether the varying position of the Saturnian sun exercises any influence on the belts, which, if sun-raised, would naturally exhibit the effects of the solar action. But, instead of any change corresponding to varying solar action, the belts, though not altogether unchanging, exhibit one markedly constant feature in the permanence of the great equatorial bright zone. This, if sun-raised, and therefore sun-ruled, would travel northward and southward (as the Saturnian sun passed N. and S. of the celestial equator) through a range of fully 30,000 miles on the globe of the planet. Since, on the contrary, the belt remains persistently equatorial, the conclusion to which we are led is that it is due to some cause inherent in Saturn's globe. Doubtless, the actual cause is the intense heat still pervading that globe. It is worthy of notice that Prof. Peirce, in discussing the condition of the major planets of the solar system, has been led to the conclusion that they must still be intensely heated, deducing this result from the nebular theory of planetary genesis. Saturn, according to the observations of Sir W. Herschel, the Bonds, Airy, Coolidge, and others, exhibits at times strange changes of figure, his globe bulging out in the regions corresponding to our temperate zones, and being depressed at the poles and equator, or sometimes bulging out toward one polar region and being depressed at the other. The shadow of the globe on the rings also shows at times a very marked departure from the figure to be expected if a perfect oblate sphere cast a shadow on a plane ring. These peculiarities, perfectly inexplicable on the ordinary theory of the planet, are easily explained if the globe we see be regarded as bounded by cloud-masses in an exceedingly deep atmosphere, so that the actual figure of the disk may vary according as higher or lower cloud-strata form its boundary. The whole subject of the condition of the giant planets of the solar system is well worth careful study, carried out independently of notions which, though they have long prevailed, have never had any real basis in observation, or even any justification from analogy, since surely it can no more be regarded as reasonable to assume without evidence that Jupiter and Saturn resemble the earth, which they exceed hundreds of times in volume, than it would be to assume without evidence that they resemble the sun, which exceeds them hundreds of times in volume.

R. A. Proctor.

**Sat'urn,** a mythical king of Italy, settled on the Capitoline Hill, which was also called the Saturnian Hill; introduced agriculture and social order among the aboriginal inhabitants, and instituted the Golden Age. After his death he was removed to the abodes of the gods, and a temple was raised for him at the foot of the Capitoline Hill. In the later Roman mythology he was identified with Cronos.

**Saturna'lia** [Lat.], the old Italian festival of the god Saturn, celebrated in ancient Rome with feasting and mirth. Slaves were permitted freedom of speech and act, and all classes threw off care and toil. During the republic it was celebrated on the 19th of December; Augustus made it embrace the 17th, 18th, and 19th; and later it included five or even seven days. Of these seven days, the first two were the true Saturnalia, and the three following were the Opalia in honor of Ops, while the last two were called Sigillaria, from the *sigilla* or clay toys then sold. The festivities of the old Christmas, of Twelfth Night, and of the Carnival seem to have borrowed much from the Roman Saturnalia.

**Saturni'nus** (Lucius Appuleius), one of the most violent and unscrupulous demagogues which ancient Rome produced, was quæstor in 104 B. C., and stationed at Ostia to superintend the provision of Rome with corn, but filled the position so badly that he was superseded by the senate. He immediately joined the party of Marius. In 100 B. C. he was tribune for the second time, but secured his election only by murdering his competitor. In order to ingratiate himself with the masses, he made the most extravagant propositions of distribution of lands in Gaul, of the establishment of colonies, of a fixed price for corn, etc. In the election campaign of the following year new murders and frauds were committed by him and his party, but suddenly the masses themselves turned against him. After a short fight in the Forum and the Capitol he was compelled to surrender, and was stoned to death by a mob, though Marius, who was consul, attempted to save him.

**Sat'yr** [Gr. Σάτυρος], one of a class of imaginary beings in the Greek mythology, rough and rude woodland divinities, much dreaded by the simple rustics. They were bristly and uncouth, and, according to Liddell and Scott, they differed from the fauns by the want of horns. They were lustful and drunken beings, and are stigmatized by Hesiod as "the race of worthless satyrs." The Romans identified them with the fauni and sylvani. Silenus was the leader of the satyrs, themselves often called Sileni.

**Saucelito,** p.-v. and tp., Marin co., Cal., on N. side of entrance to Bay of San Francisco, has 1 newspaper. P. 731.

**Sau'erkraut** [Ger., "sour cabbage"], an article of food prepared by shredding cabbages, adding some salt, pepper-corns, cloves, caraway, etc., and allowing the whole to ferment under pressure. The juice is poured off from time to time, and strong brine is added. It is freshened before it is cooked, and may be boiled, fried, or otherwise prepared for the table.

**Saugatuck',** p.-v. and tp., Allegan co., Mich., at the mouth of Kalamazoo River, on Michigan and Erie ship-canal (proposed), contains several churches, excellent schools, 1 newspaper, and a few manufactories. Is in the centre of the famous Michigan fruit-region. P. of v. 1026; of tp. 2538.

C. M. Winslow, Ed. "Commercial."

**Saugeen,** Canada. See Southampton.

**Sau'gerties,** p.-v. and tp., Ulster co., N. Y., extending from the Catskill Mountains to Hudson River at the mouth of Esopus Creek, has 1 weekly newspaper, 2 national banks, several churches and schools, extensive manufactories of quicklime, cement, and bricks, and a considerable shipping-business for agricultural products. P. of v. 3731; of tp. 10,455.

**Sau'gus,** p.-v. and tp., Essex co., Mass., on Saugus branch of Eastern R. R., has important manufactures, and includes p.-v. of Saugus Centre. P. 2247.

**Sauk,** county of S. W. Wisconsin, on Wisconsin and Baraboo rivers, traversed in the S. W. corner by Chicago and North-western R. R., has a broken surface, well timbered and productive, with several saw-mills and iron-foundries, and rapidly-increasing manufactures. Cattle, horses, sheep, and swine are numerous. Staples, wheat, Indian corn, oats, potatoes, hay, hops, wool, and butter. Cap. Baraboo. Area, 850 sq. m. P. 23,860.

**Sauk Centre,** p.-v., Stearns co., Minn., on Sauk Lake, 45 miles W. of Mississippi River, has 4 churches, a public library, a graded school, 2 flouring-mills, 1 newspaper, and repair-shops. P. 1155. J. H. Simonton, Ed. "Herald."

**Sauk City,** p.-v., Sauk co., Wis., on Wisconsin River, 25 miles W. of Madison, is a German settlement; has 3 churches, 2 hotels, and a German paper, established 1852. Principal business, farming. It is situated in the hop-centre of Wisconsin, and the completion of the Fox and Wisconsin River improvement, which is now in process by the U. S. government, is expected to add largely to the future of Sauk City. A mile farther N. on the river is the village of Prairie du Sac, with about 600 inhabitants. At each of these two places a bridge crosses the Wisconsin; the bridge at Sauk City is 900 feet long. The lumber-trade is very extensive at Sauk City; the lumber comes down the river in rafts from the pineries. P. about 1000.

H. Kleinpell, Ed. "Pioneer-am-Wisconsin."

**Sauk Rapids,** p.-v. and tp., cap. of Benton co., Minn., on St. Paul and Pacific R. R., 75 miles N. W. of St. Paul, contains 1 graded school, 1 newspaper, excellent water-power, 2 hotels, and shops. The finest granite-quarries in the North-west are here, and dairying is extensively carried on. P. of v. 412; of tp. 444.

G. W. Benedict, Ed. "Sentinel."

**Saukville,** p.-v. and tp., Ozaukee co., Wis. P. 1930.

**Saul,** the first king of Israel, a son of Kish, of the tribe of Benjamin; was anointed by Samuel; fought with great success against the Philistines, Moabites, Ammonites, Edomites, and Amalekites, and governed well in the earlier part of his reign, but afterward became possessed of "an evil spirit from the Lord," committed great cruelties, and fell, together with three of his sons, in the battles of Mount Gilboa against the Philistines, about 1055 B. C. One of his sons, Ishbosheth, maintained himself for two years against David as king of all the tribes with the exception of that of Judah. (For further details concerning Saul see the articles on David, Samuel, and the Jews.)

**Saulcy', de** (Louis Félicien Joseph Caignart), b. at Lille, France, Mar. 19, 1807; studied at the École Polytechnique; was appointed professor of mechanics at the military school of Paris in 1838, and shortly after keeper of the museum of artillery; gained celebrity first as a numismatist by his *Essai de Classification des Suites monétaires byzantines*, which received a prize from the Academy in 1836; studied Assyrian and Celtic inscriptions, and wrote *Les Campagnes de Jules César dans les Gaules* (1860) but concentrated himself more especially on Hebrew antiquities; visited the Holy Land in 1850, and wrote *Voyage autour de la Mer morte et dans les Terres bibliques* (2 vols.,

1852–54), *Études sur la Numismatique judaïque* and *Histoire de l'Art judaïque* (1858), *Voyage en Terre-Sainte* (1865), *Les Derniers Jours de Jérusalem* (1866), *Histoire de Hérode* (1867), *Étude chronologique des Livres d'Esdras et de Néhémie* (1868), *Sept Siècles de l'Histoire judaïque* (1874), and *Numismatique de Terre-Sainte* (1874).

**Sauls'bury,** tp., Hardeman co., Tenn., on Memphis and Charleston R. R. P. 400.

**Saulsbury** (Willard), b. in Kent co., Del., June 2, 1820; educated at Delaware and Dickinson colleges; was admitted to the bar 1845; was attorney-general of Delaware 1850–55, and U. S. Senator 1859 to 1871, when he was succeeded by his brother Eli (b. Dec. 29, 1817). Another brother, Gove, was governor of Delaware 1865–71.

**Saulston,** tp., Wayne co., N. C. P. 1119.

**Sault de Sainte Marie,** p.-v. and tp., cap. of Chippewa co., Mich., at the foot of the rapids or falls from which it derives its name, on St. Mary's River, near the outlet of Lake Superior, and on the ship-canal constructed around those rapids to facilitate navigation between Lakes Superior and Huron, has a picturesque location on the site of an early French fort, mission, and trading-post, famous in the seventeenth century as one of the head-quarters of Jesuit explorations; has 3 hotels, 2 churches, and is chiefly inhabited by French Canadians and Chippewa Indians, who are engaged in hunting, trapping, fishing, making maple-sugar, and in trafficking with the summer visitors who make this a place of resort. P. 1213.

**Saulte Sainte Marie,** p.-v., Algoma district, Ont., Canada, directly opposite the town of the same name in Michigan, and at the foot of the rapids of St. Mary's River. The inhabitants are mostly engaged in fur-trading and fishing. (See Saint Mary's River.) P. of v. about 400; of sub-district, 879.

**Saumaise.** See Salmasius.

**Saumur',** town of France, department of Maine-et-Loire, on the Loire, is famous for its rosaries made of cocoanut shells, has manufactures of linens and cambrics, and trades in wine, corn, hemp, and spirits. P. 14,079.

**Saunders.** See Sandal-Wood and Santal-Wood.

**Saun'ders,** county of E. Nebraska, bounded N. E. by the Platte and drained by Cottonwood and other rivers, consists chiefly of fertile rolling prairies, and is traversed in its S. E. corner by Burlington and Missouri River R. R. Staples, wheat, Indian corn, hay, and butter. Cap. Wahoo. Area, 750 sq. m. P. in 1870, 4547; in 1875, 10,382.

**Saunders,** tp., Henry co., Ala. P. 1143.

**Saunders** (Ephraim Dod), D. D., b. in Morris co., N. J., Oct. 31, 1809; graduated at Yale College 1831, in theology at Princeton; was pastor of a Presbyterian church in Goochland co., Va., for sixteen years, and afterward for a short time at Pottstown, Pa; travelled in Europe, and founded at West Philadelphia, Pa., about 1857, the Saunders Institute, a highly efficient classical school for boys. Among the teachers was his only son, Courtland, b. in Virginia in 1841, a young man of extraordinary attainments, author of *A New System of Latin Paradigms, with a Synopsis of Declensions,* published 1860, when not twenty years of age; entered the Union service as captain in the Corn Exchange Regiment, and was killed at Antietam 1862. Dr. Saunders gave in 1870 the large building and extensive grounds of the institute to found the Presbyterian Hospital of Philadelphia as a memorial of his son, and by personal solicitation raised $100,000 for the erection of other buildings. D. at West Philadelphia Sept. 13, 1872. The late John A. Brown, a retired banker of Philadelphia, gave $300,000 for the endowment of the memorial hospital, which was thus enabled to start with about $500,000.

**Saunders** (Prince), b. at Thetford, Vt., about 1775, a negro, who received an excellent education; taught school at Colchester, Conn., and at Boston; went to Hayti 1807; was employed by Christophe as superintendent of education; was the author of the criminal code of Hayti; visited England in an official capacity, and was there received into the society of the most eminent men, partly owing, it is said, to the supposition that his first name, "Prince," implied a member of the reigning family of Hayti. Returning to the U. S., he studied theology, became minister of a colored church in Philadelphia, and published *Documents relative to Hayti* (1816), *A Memoir on Slavery* and *Haytian Papers* (1818). He ultimately went back to Hayti, where he obtained high offices, and was attorney-general at the time of his death, Feb. 12, 1839 (or 1840).

**Saunders** (Romulus M.), b. in Caswell co., N. C., in Mar., 1791; studied at the University of North Carolina, but did not graduate; resided some years in Tennessee, where he was admitted to the bar 1812; returned to North Carolina; was a member of the legislature 1815–20, and Speaker of that body two years; member of Congress 1821–27 and 1841–45; attorney-general of North Carolina 1828; president of the board of commissioners on claims against France 1833; judge of the supreme court of the State 1835; minister to Spain 1846–50; was subsequently again a member of the legislature, and took a leading part in promoting the construction of railways in North Carolina. D. at Raleigh Apr. 21, 1867.

**Saun'derson** (Nicholas), LL.D., F. R. S., b. at Thurleston, Yorkshire, England, in 1682; lost his sight by an attack of smallpox in infancy, but was carefully instructed by his father; learned Latin and Greek at academies; was taught the higher mathematics by private tutors, and displayed such mastery of all the allied sciences, including optics, that in 1707 he lectured upon them with great applause at the University of Cambridge, and on the recommendation of Sir Isaac Newton was in 1711 chosen to succeed Whiston as Lucasian professor of mathematics at Christ's College. D. Apr. 19, 1739. After his death appeared his *Elements of Algebra* (1740), to which was prefixed a biographical sketch by his son John. His *Method of Fluxions* appeared in 1756.

**Saunemin,** tp., Livingston co., Ill. P. 974.

**Saup'pe** (Hermann), b. at Wesenstein, near Dohna, Saxony, Dec. 9, 1809; studied philology at Leipsic, and was appointed professor at the University of Zurich in 1838, director of the gymnasium at Weimar in 1845, and professor at the University of Göttingen in 1856. Together with Haupt, he has edited since 1848 a collection of Greek and Roman authors with German notes, which immediately became very popular.

**Sauquoit,** p.-v., Paris tp., Oneida co., N. Y., on Utica division of Delaware Lackawanna and Western R.R. P. 459.

**Saurians.** See Reptilia.

**Saurin'** (Jacques), b. at Nîmes, France, Jan. 6, 1677; removed to Geneva after the Revocation of the Edict of Nantes; studied theology; was chosen pastor of the Walloon church in London in 1701, and in 1705 of the Walloon church at the Hague, where he d. Dec. 30, 1730. He was a powerful preacher, and several collections of his sermons have been often reprinted and translated into German and English. His *Discours sur les Événements les plus mémorables du Vieux et Nouveaux Testaments* (1720) also became very popular under the name of "Saurin's Bible."

**Saurop'sida** [σαῦρος, a "lizard," and ὄψις, "resemblance"], a group established by Prof. Huxley for the reception of the birds and reptiles in contradistinction to the mammals or Theropsida, on the one hand, and on the other the amphibians, fishes, and inferior types which constitute the type of Ichthyopsida. These agree with the mammals in having an amnion and allantois, the latter being developed at the expense of the enlarged vitellus of the egg, and with the Ichthyopsida, or at least the higher forms of the group, by the development of a quadrate bone or corresponding elements intervening between the lower jaw and the skull. The skeleton is well ossified; the skull has no separate parasphenoid bone, at least in the adult; "the proötic is always ossified, and either remains distinct from the epiotic and opisthotic throughout life, or unites with them only after they have ankylosed with adjacent bones;" the occipital condyle is always single; the heart is either quadrilocular, as in the birds, or trilocular, as in the reptiles. Specialized kidneys are developed, and succeed the Wolffian bodies of the embryo. All the species are either oviparous or viviparous. The gap now existing between the representatives of the contained classes, birds and reptiles, was much less in former types, and many intermediate forms lived in the Mesozoic period. Theo. Gill.

**Saussure', de** (Horace Bénédict), b. at Conches, near Geneva, Feb. 17, 1740; studied under his uncle, Charles Bonnet, and under Haller, and was appointed professor of physics and philosophy at the University of Geneva in 1762. After careful and comprehensive preparations, improving his instruments, especially the hygrometer, and inventing new instruments, such as the cyanometer and diaphanometer, he commenced a series of scientific mountain-excursions, crossing the Alps fourteen times by eight different routes, ascending Mont Blanc in 1787 and Monte Rosa in 1789, encamping for seventeen days on the Col du Géant, and visiting the Jura, Vosges, and Auvergne mountains, Germany, England, Sicily, and Italy. The result of these voyages was a multitude of the most valuable observations, which exercised a great influence on the development of the science of geology when communicated in *Voyages dans les Alpes* (4 vols., 1779–96). The most remarkable of his minor works are—*Sur l'Hygrométrie* (1783) and *De Aqua* (1771). In 1786 he resigned his chair, but after the annexation of Geneva to France was appointed professor of natural history at the central school of the department of Léman. D. at Geneva Jan. 23, 1799.

**Sav'age** (CHARLES C.), b. at Middletown (now Cromwell), Conn., in 1820; engaged in the stereotyping business in New York City; wrote for religious and agricultural papers, and was author of *Illustrated Biography* (1852) and *The World, Geographical, Historical, and Statistical* (1853).

**Savage** (EDWARD), b. at Princeton, Mass., in 1761; was at first a goldsmith; studied painting under West in London; afterward resided some time in Italy; founded a museum in New York; removed it to Boston, where it formed a part of the old New England Museum. He was established as a portrait-painter in New York as early as 1789; made and engraved a group of the Washington family, and executed a profile portrait of Pres. Washington on wood.

**Savage** (JOHN), b. at Dublin, Ireland, Dec. 13, 1828; studied at the art school of the Royal Dublin Society; took part in the revolutionary movements of 1848, editing two journals and placing himself at the head of an armed band of peasants; escaped to New York; became a proof-reader for the New York *Tribune;* was afterward editorially connected with several newspapers at New York, Washington, and New Orleans; was active in organizing Irish volunteers for the suppression of the rebellion of the Confederate States; wrote several popular war-songs, including *The Starry Flag,* and published several volumes of poems, dramas, and biographies.

**Savage** (JAMES), LL.D., b. at Boston, Mass., July 13, 1784, descended from Thomas Savage, an early Massachusetts settler, and also from Rev. William Wheelwright, noted for his religious and political controversies in the seventeenth century; graduated at Harvard 1803; commenced the practice of law 1807; sat in both houses of the Massachusetts legislature, in the executive council, and in the constitutional convention of 1820; filled several municipal posts at Boston; was official orator July 4, 1811; contributed to the *North American Review* and the *New England Magazine;* conducted for five years the *Monthly Anthology;* edited Paley's *Works* (Cambridge, 5 vols., 1828; new ed. 1830), several volumes of *American State Papers* and of the *Collections* of the Massachusetts Historical Society, of which he was for some years the president; issued several genealogical, historical, political, and controversial pamphlets, and published from the original manuscripts Gov. John Winthrop's important *History of New England* (Boston, 2 vols., 1825–26; new ed. 1853), "with notes to illustrate the civil and ecclesiastical concerns, the geography, settlement, and institutions of the country, and the lives and manners of the principal planters;" was influential in procuring the publication of Gov. Hutchinson's *History of Massachusetts,* and compiled, on the basis of Farmer's *Register,* a *Genealogical Dictionary of the First Settlers of New England, showing Three Generations of those who came before May, 1692* (Boston, 4 vols., 1862–64), a work of great value and displaying extraordinary industry and research, but confused in plan, unequal in execution, and disfigured by the exhibition of spleen against many of the parties to the colonial controversies of the seventeenth century, especially against Cotton Mather and the opponents of his ancestor, Wheelwright. Mr. Savage was long connected with the first savings bank at Boston, and a member of the principal historical, literary, and scientific societies. D. at Boston Mar. 8, 1873.

**Savage** (RICHARD), an English poet, claimed to be the illegitimate son of Anne, countess of Macclesfield, by Richard Savage, Earl Rivers, alleging that he was born at London Jan. 10, 1698; was reared in poverty. By the alleged intervention of his grandmother, Lady Mason, he was enabled to obtain a tolerable education in a grammar school at St. Alban's, and was afterward apprenticed to a shoemaker; but having displayed literary tastes, he went to London about 1716, where he obtained the patronage of Steele, and of Wilks and Mrs. Oldfield, the actors, and assumed the name of his father on being informed in a mysterious manner of the circumstances of his birth. In 1717 he translated from the Spanish a play, *Woman's a Riddle,* which had a run of twelve nights; produced in 1723 a successful tragedy, *Sir Thomas Overbury;* in 1726 a volume of *Miscellaneous Poems and Translations;* in 1728 *The Bastard, a Poem,* which speedily ran through five editions; and in 1729 his best work, *The Wanderer, a Moral Poem.* In 1727 he was condemned to death for killing a man in a tavern-brawl, but pardoned in opposition to the wishes of his mother; was then taken into the house of Lord Tyrconnel, a relative of his mother, and allowed a pension of £200, but soon quarrelled with his protector; subsisted thereafter upon money subscribed by Pope and his literary circle; obtained from Queen Caroline an annual stipend of £50 in consequence of some verses he had written on her birthday; resided several years at Bristol, where he was thrown into prison for debt Jan., 1743. D. there Aug. 1, 1743. He is now best remembered by the pathetic *Life* written by his friend Johnson.

**Savan'na** [Sp. *sabana,* a "sheet"], a grassy plain in a tropical region, yielding pasturage in the wet season, and often having a growth of under-shrubs. It corresponds to the *prairie* of more northern latitudes. The word is chiefly used in tropical America.

**Savanna,** p.-v. and tp., Carroll co., Ill., on Mississippi River and on Western Union R. R. P. of v. 971; of tp. 1236.

**Savan'nah,** cap. of Chatham co., Ga., a seaport, the largest and principal city in the State, is on a level plain on the southern bank of Savannah River, 50 feet above the sea and 18 miles from it by the river. Savannah does an immense foreign and domestic export business in cotton, the staple commodity, rice, timber, lumber, and naval stores. The latter articles—*i. e.* rosin and turpentine—have just begun to assume a prominent place, and promise to become vigorous rivals of King Cotton. In receipts Savannah ranks as the second cotton-port in the U. S.; from Sept. 1, 1874, to Dec. 1, 1874, the receipts exceeded those of New Orleans. Below is a condensed table of exports, foreign and domestic, for the year ending Dec. 31, 1873: Foreign—cotton, 377,697 bales, valued at $29,346,264; lumber and timber, valued at $381,993; staves and headings, $75,512; and miscellaneous merchandise. Domestic—cotton, 243,993 bales, valued at $18,373,980; timber and lumber, valued at $1,198,007; naval stores, $81,944.50; rice, 22,294 tierces, valued at $1,035,488; and other merchandise.

*Summary of Value of Exports for the year 1873.*

| | |
|---|---|
| Foreign | $29,850,275.00 |
| Coastwise | 22,793,778.75 |
| Total | $52,644,053.75 |

The depth of water on Savannah bar is 26 feet at mean high water, 19 feet at mean low water; in Tybee Roads anchorage, 38 feet at mean high water, 31 feet at mean low water. The marine railway has 260 feet length of cradle, with improved appliances; length of graving dock, 345 feet; breadth of base, 45 feet; breadth of top, 80 feet; floating capacity, 16½ feet. Three separate lines of steamships ply between Savannah and New York, and one line to each connects with Boston, Philadelphia, Baltimore, and Providence; 3 daily and 2 weekly newspapers are published here, 1 of the latter being German. Of manufactories there are 1 cotton-factory, 1 paper-mill, 6 iron and brass foundries, 5 wagon and carriage factories, 1 flour-mill; also, 5 cotton-presses, 1 express company, 3 telegraph companies, 1 waterworks, 1 gas company, and a park. Three railroads have their *termini* here—the Central, which feeds the interior of the State, the Atlantic and Gulf, feeding the South-west and Florida, and the Savannah and Charleston. Of horse-car lines, 2 flourish here. Lines of steamboats circulate between the coast-towns of Georgia, Florida, South Carolina, and Savannah. Of public buildings the most prominent are the custom-house and post-office, exchange, police barracks, theatre, Oglethorpe Barracks (U. S.), and market; private buildings of rare and beautiful architectural proportions are prominent. Of these are 4 banks, one of which is national; besides, there are 5 private banking institutions. There are a volunteer fire department and electric fire-alarm telegraph, 11 military organizations, 30 churches, 5 loan associations, 16 benevolent societies, 7 Masonic and 7 Odd Fellows lodges, 6 of temperance, 5 of Knights of Pythias, 4 trades unions, a jockey club, Y. M. L. A., Y. M. C. A., a sportsman's club, choral association, regatta association, cotton exchange, 8 school buildings, 1 infirmary, 3 hospitals, and 1 medical society. Savannah has also three noteworthy and attractive monuments—one in memory of Count Pulaski, who fell in the American assault on the British works in that city on Oct. 9, 1779; another in memory of Gen. Nathaniel Greene; and the third in honor of the Confederate dead—erected in the magnificent park on the southern limits of the city. P. 28,235.

J. A. DOYLE, ASSOCIATE ED. "DAILY ADVERTISER."

**Savannah,** p.-v., cap. of Andrew co., Mo., on the Hopkins branch of Kansas City St. Joseph and Council Bluffs R. R., 14 miles N. of St. Joseph, has 6 churches, good schools, 2 banks, 2 newspapers, a large flouring mill, and 2 hotels. Principal business, farming and stock-raising. P. 1257. O. E. PAUL, ED. "ANDREW CO. REPUBLICAN."

**Savannah,** p.-v. and tp., cap. of Butler co., Neb., on Platte River.

**Savannah,** p.-v. and tp., Wayne co., N. Y., on New York Central R. R. P. 1933.

**Savannah,** tp., Jackson co., N. C. P. 515.

**Savannah,** p.-v., Clear Creek tp., Ashland co., O. P. 394.

**Savannah,** tp., Anderson co., S. C. P. 1067.

**Savannah,** p.-v. and tp., cap. of Hardin co., Tenn., on a river of the same name, 200 miles above its mouth, has several churches, 2 colleges, and 1 newspaper. Business, cotton, corn, and lumber dealing. P. of v. 328; of tp. 1336.

W. L. Oury, Ed. "Transcript."

**Savannah River** forms the boundary-line between Georgia and South Carolina. From its source, at the junction of the Tugalo and Keowee rivers, to its mouth on Tybee Roads it has a channel length of 450 miles, while the distance in a direct line is only 250 miles. With its tributaries it drains an area of over 8000 sq. m. The Savannah is a turbid stream, and the current in the upper portion of the river and its tributaries is rapid and carries a great deal of silt, particularly during the season of freshets. Bars are therefore formed in the broader portions of the stream where the current is less rapid, and the stream becomes sluggish. At Savannah the mean rise and fall of tide is 6½ feet. The tidal-wave ordinarily ascends to a point about 28 miles above Savannah city, or 45 miles from Tybee Roads. The river is now navigable to Savannah for vessels drawing 18 feet of water, and by small vessels to Augusta, 231 miles, and even far beyond the latter place for small craft. Under appropriations of Congress improvements in the river and harbor of Savannah are in progress, having in view the securing of a 22-foot channel to Savannah.

**Savary′** (Anne Jean Marie René), duke of Rovigo, b. at Marcq, department of Ardennes, Apr. 26, 1774; entered the army in 1789; fought under Custine and Pichegru on the Rhine, and under Dessaix in Egypt; became aide-de-camp to Napoleon after the battle of Marengo, and was used by him as much in diplomatic as in military affairs, evincing an equally brilliant talent in both directions. In 1802 he was placed at the head of the secret police to watch even Fouché, and the discovery of the conspiracy of Cadoudal was chiefly his work. In 1804 he presided, as commander of the troops of Vincennes, over the execution of the duke of Enghien. His greatest military exploit was the victory at Ostrolenka (Feb. 16, 1807) over the Russians, for which the emperor gave him a great dotation and made him duke of Rovigo. His greatest diplomatic success was the negotiation in 1808 with Charles IV. of Spain, which ended with the king's journey to Bayonne. From 1810 to 1814 he was minister of police. After the fall of Napoleon he wished to accompany him to St. Helena, but was arrested on board the Bellerophon and kept in captivity at Malta. He escaped, went to Smyrna, returned in 1819 to Paris, and was finally reinstated in his titles and honors. In 1823 he again left France, and took up his residence in Rome, having fallen out with the French court on account of his *Sur la Catastrophe de Msgr. le Duc d'Enghien,* in which he made Talleyrand accountable for the execution of the duke. Louis Philippe recalled him, and made him commander-in-chief of Algeria Dec. 1, 1831, where he developed great activity. D. at Paris June 2, 1833. His *Mémoires* (8 vols., 1828) give a history of the First Empire.

**Sa′ve,** a river of Austria, rises in the province of Carniola, flows through Croatia, forms the boundary between Slavonia and Turkey, and joins the Danube at Belgrade after a course of 550 miles; navigable 200 miles from mouth.

**Saverne′,** town of the German empire, province of Alsace, manufactures woollen cloth and hosiery and trades in timber and wood. P. 6407.

**Saverton,** p.-v. and tp., Ralls co., Mo. P. 1599.

**Saviglia′no,** town of Italy, province of Cuneo, on a plain 1050 feet above sea-level, and 20 miles S. of Turin. The district produces wheat, maize, fruits, vegetables, hemp, silk, etc., very abundantly. Sant' Andrea, the principal church, dates as early as the eleventh century, and there are other mediæval churches, convents, etc., of some interest. P. 16,150.

**Savigny′, von** (Karl Friedrich), b. at Frankfort Feb. 21, 1779; studied jurisprudence at Marburg, Göttingen, Leipsic, Halle, and Jena; was appointed professor at Marburg in 1800, at Landshut in 1808, at Berlin in 1810; minister of justice in 1840; retired in 1848. D. at Berlin Oct. 25, 1861. He was the leader of the historical school in jurisprudence, and exercised a great influence, both on the study of law and on legislation in Germany. His lectures on Roman law, its principles, institutions, and historical development, attracted large audiences, although his views of the Roman law-system as the highest standard and most consummate model, and of our time as utterly incapable of developing the idea of right in adequate forms, were generally considered extravagant. His principal writings are—*Treatise on Possession* (1803; translated into English in 1848), *Vom Beruf unserer Zeit für Gesetzgebung und Rechtswissenschaft* (1814), *Geschichte des römischen Rechts im Mittelalter* (6 vols., 1815–31), *System des heutigen römischen Rechts* (8 vols., 1840–49), *Das Obligationenrecht* (2 vols., 1851–53), besides a number of minor essays, mostly of historical contents, collected in his *Vermischte Schriften* (5 vols., 1850). His biography was written by Rudorff (Berlin, 1863).

**Sav′ile** (Sir Henry), b. at Over Bradley, near Halifax, England, Nov. 30, 1549; educated at Brasenose and Merton colleges, Oxford, becoming fellow of the latter and lecturer on mathematics; travelled on the Continent; became Greek and mathematical tutor to Queen Elizabeth 1578, warden of Merton 1585, provost of Eton 1596; was knighted by James I. 1604, and founded at Oxford the Savilian professorships of geometry and astronomy 1619, giving his library for their use. D. Feb. 19, 1622. He translated the *History* and the *Agricola* of Tacitus (1581), edited the *Latin Chronicles* of English history (1596), brought out a magnificent edition of the complete works of Chrysostom (8 vols., 1610–13), and is regarded by Hallam as the most learned Englishman in profane literature in the reign of Elizabeth.

**Saville,** tp., Perry co., Pa. P. 1693.

**Saville** (George). See Halifax, Marquis of.

**Sav′in,** the *Juniperus sabina,* a berry-bearing, almost prostrate shrub of the order Coniferæ, growing on rough lands of Europe and Asia, and found also in Canada, but scarcely so in the U. S. It has a strong, almost fœtid scent, which frequently causes headache. Its leaves abound in an acrid essential oil isomeric with turpentine oil. Savin oil and tops are sometimes used by abortionists, but if effectual, it is only so at the utmost peril of the patient's life. It is sometimes useful in chronic rheumatism, amenorrhœa, and other diseases.

**Sav′ings Banks,** institutions devised by philanthropists for receiving and securely investing the moderate savings of industry, under provisions for their repayment on demand or at short notice, managed by persons having no interest in the profits of the business, which are divided at stated intervals among the depositors. Savings banks were conceived and instituted as a means to an end. Their ultimate purpose in the social economy was to abate the evils of extreme poverty. Devices to this end, in the form of measures for the care and maintenance of the poor, had served little more than to aggravate the evils they were ordained to mitigate. The means provided and expended for the relief of pauperism had proved fruitful in promoting pauperism. Appropriations for the support of the destitute showed in the results as bounties offered to idleness and improvidence. Statesmen were baffled by this ever-recurring problem of human want, whose magnitude increased and whose difficulties multiplied with every attempt at its solution. They could not stop, they dared not go on. To stop was to decree starvation to thousands—to go on was to invite the idle and dissolute to unite with the destitute in crying for bread. In this strait to the aid of statesmanship came philanthropy, with the suggestion, novel at the time, that incentives to industry might be more effective than gratuities to idleness in diminishing the evils and the burdens of pauperism. These incentives philanthropy proposed to supply by offering to the smallest savings of frugal industry what they had never before enjoyed—a place of secure deposit, whence in time of need they could be withdrawn, together with such moderate interest as they had earned meanwhile. In contrast with the vast monetary interests controlled and nearly or remotely affected by savings banks in our day, their humble origin in the abodes of poverty and toil, which it was their mission to brighten with the hope of gain, is difficult to realize. Yet in conditions such as we have outlined, and with the single purpose which we have noted, did savings banks, both in Europe and America, have their inception.

*Origin and Early History.*—Savings banks, as above defined and characterized, had their origin in England about the close of the last century. The monetary institutions in Berne and Hamburg, which are sometimes cited as instances of an earlier origin, received moneys and granted annuities; they did not undertake to return deposits. The earliest exposition of a practicable scheme, embracing the distinctive features of the modern savings bank, was made by the celebrated Jeremy Bentham, who in 1797 proposed a well-devised system of "frugality banks," to constitute a branch of the pauper system of the government. His plan failed to receive favorable consideration from Parliament or pronounced acceptance by the public, though it doubtless helped to give direction and form to the practical efforts soon afterward inaugurated. Malthus in 1803 advocated a system of county banks to facilitate, and thereby to encourage, the saving of small sums. A later and more pronounced movement for the establishment of savings banks was made in Parliament in 1807 by Mr. Samuel Whitbread.

His bill provided for a "fund and assurance office for investing the savings of the poor." This was to be, in fact, a national savings bank, under the direction of government officers, to which small sums of money might be transmitted free through the post-office from any part of the kingdom. These were to be invested in government securities, and repayment by the sale of securities when required was provided for. While Mr. Whitbread is entitled to distinguished merit for the intelligence and zeal displayed by him in the advocacy of this bill, it is due to the "truth of history" to record that the measure was devised and formulated by Patrick Colquhoun, a local police magistrate of London. While his official duties brought him into daily intercourse with the indigent and degraded poor, his philosophical mind was occupied with the study of the causes and conditions of pauperism, and his active sympathy in devising measures for its relief. He became prominently identified with the system of savings banks as finally established, and in letters to his friend, Thomas Eddy of New York, commending these to his favorable consideration, he refers to a more comprehensive plan devised by himself in 1806 as having failed upon its introduction into Parliament, the time not being ripe for it. He was the intimate friend of Bentham, and doubtless his plan of a national savings bank was the subject, if it was not indeed the result, of many conferences between them. In the mean time, and while these discussions were in progress, an active and practical philanthropy had given form to the distinctive savings bank idea—a place of secure deposit and sure return for the scant savings of poverty. As early as 1798 the Rev. Joseph Smith of Wendover proposed to the poor of his parish to receive from them during the summer sums as small as twopence, which he would return to them in the winter season with an addition of one-third as a reward for their providence. Of course this was more benevolence than banking. The scheme of Mrs. Priscilla Wakefield of Tottenham, inaugurated in 1799, embraced the deposit of moneys by women and children only, to whom pensions were to be granted when they reached a certain age. Moneys were allowed to be withdrawn only in exceptional cases. In 1801 the scheme was somewhat expanded, and a savings bank incorporated as a feature. A more practical organization of this effort was effected in 1804. An undertaking was organized at Bath in 1808, under the patronage of Lady Isabella Douglas, for the benefit of domestic servants only, which approached more nearly the ideal of savings banks, as subsequently defined and understood, than those previously considered.

In each of these several schemes of purely local beneficence, as also in others that might be noted, we discern the germ of the savings-bank principle as subsequently wrought out; but neither of them, in its general scope, in its plan of organization or methods of procedure, presented a model after which a system adapted to the needs of the country at large could be constructed. For the suggestion and practical inception of such a plan and of such methods the credit unquestionably belongs to the Rev. Henry Duncan of Ruthwell, Scotland. He thus organized a savings bank in his own parish of Ruthwell in 1810. Its success, as compared with previous efforts, was marked and decisive, and the notoriety given to it through the writings and labors of Dr. Duncan directly promoted the organization of savings banks upon a similar plan in various parts of the kingdom. Dr. Duncan has been called the "father of savings banks;" and as the founder of a plan of organization and procedure without which the idea of savings banks as originally promulgated could have gained no permanent hold upon the country, the title is not misapplied. The Edinburgh savings bank, though claiming an earlier origin, appears to have been established in 1814. It adopted a less complex and more popular form of organization and procedure than that of Dr. Duncan, and this became the model upon which savings banks were organized thereafter.

*Inception and Course of Legislation.*—The period of exclusively voluntary or unincorporated organization in the establishment of savings banks in Great Britain terminated in 1817, when two acts were passed by Parliament designed to encourage, protect, and regulate these institutions in Ireland and England. There was no legislation affecting this interest in Scotland until 1835. These acts were virtually, if not in terms, repealed in 1828 by a new act, which was thereafter recognized as the "governing statute" concerning savings banks. This statute was modified and amended from time to time until 1863, when an entire revision and consolidation of the laws relating to savings banks was effected. The course and character of the legislation affecting this interest may be briefly but sufficiently outlined as follows: Trustees have at all times been prohibited from deriving any profit from the transactions. The moneys received were to be deposited in the Bank of England or of Ireland to the credit of the commissioners for the reduction of the national debt, and by them were to be invested in 3 per cent. bank annuities. The government guarantied to the trustees a specific rate of interest on the moneys deposited by them to the credit of the commissioners. This rate, under the acts of 1817, was £4 11*s.* 3*d.* per cent., but was subsequently reduced to £3 16*s.* ½*d.*, and finally to £3 5*s.* per cent. per annum. The rate of interest to be paid to depositors was at first left to the discretion of the trustees, but was afterward limited at not exceeding £3 0*s.* 10*d.* per cent. The rate paid has varied in different institutions, and still varies from the limit fixed by law to as low as £2 10*s.* per cent. Deposits were limited originally to £100 the first year, and £50 in any year thereafter; this was afterward changed, and the limit fixed at £30 in any year and £150 in all, or £200 including interest. Depositors were also prohibited from keeping an account in more than one savings bank, but might transfer an account from one bank to another. The significance of these restrictive provisions will be seen in the fact that in the fifty-five years from 1817 to 1872 the interest paid by the government to savings banks exceeded that which it had received from investments on their account by the sum of £4,169,427 10*s.* 5*d.* As an incentive to industry and economy, and a check to pauperism, the government could afford to bestow this bounty upon savings banks, but only upon terms that would tend to exclude from any considerable share in it the opulent classes, whom the liberal interest allowed and the security afforded by savings banks would naturally attract. Trustees in England are made liable only for their own personal malfeasance, but in Ireland they are made liable for losses, unless by their rules they limit their liability to a fixed sum, which is not to be less than £100. The government has never conceded its liability to make good the losses sustained by savings banks, though in one instance of exceptional hardship Parliament appropriated £30,000 as a partial restitution to depositors.

*The internal administration* of savings banks in Great Britain in respect to methods of business and the facilities afforded to depositors in their dealings is far from uniform. Out of 638 savings banks doing business in 1861, only 20 were open daily, and some of these allowed moneys to be withdrawn on only two days in the week; others open new accounts only on certain days. More than half the savings banks were open but one day in each week, and many of these but for one hour, while some, with deposits of from £200,000 to nearly £300,000, are open but two days in a week. A leading savings bank in London closes its doors for a week in each year while preparing its annual balance. In nearly all savings banks outside of Scotland notice is invariably required before any part of a deposit can be withdrawn.

*Savings Banks and Poor Relief.*—The following facts, bearing upon the ministry of savings banks in relieving the poor, are pertinent and suggestive: From 1811 to 1821 there was expended in England for poor relief the sum of £68,000,000. From 1821 to 1831 less than £63,000,000 was expended, a reduction during the decade of over £5,000,000, while during the same period the deposits of savings banks in the United Kingdom increased from £4,740,188 to £14,698,635. Again, the sum expended in England for poor relief in 1834 was £5,989,411, while in 1841, seven year later, it was but £4,492,329, a reduction of £1,497,082, or 25 per cent. During the same period the deposits in savings banks increased from £16,386,035 to £24,536,971. The agency of savings banks in contributing to these results very clearly appears from other and more detailed statistics which the limits of this article compel us to omit.

*Statistics of Growth and Progress.*—In the following table we give the number of depositors and the balance to the credit of savings banks, including interest, on the books of the national debt commisioners in quinquennial periods from 1817 to 1872. We also include the year 1861, as marking the highest limit reached by savings banks before their decadence commenced under competition with post-office savings banks, and the return for 1874, showing the number of depositors and the amount due at that time:

| Year ending Nov. 20. | Number of depositors. | Amount to credit of savings banks. | Year ending Nov. 20. | Number of depositors. | Amount to credit of savings banks. |
|---|---|---|---|---|---|
| 1817 | 9,291* | £231,028 | 1852 | 1,209,934 | £31,912,413 |
| 1822 | 204,584* | 6,546,690 | 1857 | 1,366,560 | 35,255,722 |
| 1827 | 395,000* | 14,188,708 | 1861 | 1,609,103 | 41,790,783 |
| 1832 | 440,861 | 14,416,885 | 1862 | 1,558,189 | 40,809,578 |
| 1837 | 636,339 | 19,711,797 | 1867 | 1,385,782 | 36,792,912 |
| 1842 | 875,086 | 25,406,642 | 1872 | 1,425,147 | 40,000,462 |
| 1847 | 1,096,086 | 30,236,632 | 1874 | 1,463,560 | 41,467,171 |

The whole amount credited to the savings banks by the commissioners from 1817 to 1872 was £104,015,502; amount repaid, £64,015,040; balance, £40,000,462, as above. From

*Partly estimated.

statistics which we have not space to introduce it appears that only about 15 per cent. of the moneys deposited in savings banks ever reached the debt commissioners, the 85 per cent. being used in making current payments. Applying this ratio to the foregoing, we have as the whole amount deposited to 1872, £693,436,680; withdrawn, £653,436,218.

*Post-Office Savings Banks.*—The favorable record made by savings banks did not preserve the system from criticism and complaint. These related chiefly to the high rate of government interest, whereby savings banks were made in a measure a public charge; to their insufficiency in numbers; to the indifferent facilities afforded by those in operation; and to their insecurity, as shown by disastrous failures from frauds of officers, for which neither the trustees nor the government could be held responsible. The efforts to reform the system resulted in 1861 in the establishment of a system of post-office savings banks, which, however, was little more than an expansion and adaptation to existing conditions of the scheme of Patrick Colquhoun, made prominent by Mr. Whitbread in 1807. Amongst the distinguished names identified with the effort to establish postal savings banks, that of Charles William Sikes of Huddersfield is deserving of special record. No arbitrary interference with the existing system of savings banks was attempted, but these were left to hold their own in competition with the new system as best they could. The practical operation of the latter may be briefly stated: Certain post-offices throughout the United Kingdom are designated at which sums of not less than one shilling or some multiple thereof will be received for transmission to the central office in London. Not exceeding £30 in one year, or £150 in all, or £200 including interest, is received from any one person. The depositor receives a book in which his deposits are entered, and a receipt for each deposit is also forwarded to him in due course from the central office. The moneys are invested in the public funds, and deposits of not less than £1 or multiples thereof receive interest at the rate of 2½ per cent. per annum. The government is responsible for the repayment of all moneys received, thus affording to depositors perfect security. A depositor may apply at any post-office savings bank in the kingdom for the purpose of withdrawing money, and may direct payment of the same to be made to him at that or at any other post-office savings bank. His order is forwarded to the postmaster-general, by whom a warrant for the designated amount is drawn upon the postmaster where payment is to be made, which is forwarded to the depositor, who presents the same, together with his book, and receives his money.

*Progress of Post-Office Savings Banks.*—On Sept. 16, 1861, the system was inaugurated by opening in England and Wales 301 postal savings banks, which number was increased before the close of the year to 1629. The system was extended in the following year to Ireland and Scotland. In 1866 the number of postal savings banks in the United Kingdom was 3369, or more than five times the highest number under the old system; and Dec. 31, 1874, the number was 5068. They extend to nearly or quite every township, to every large village, and are amply distributed for the convenience of large cities, London being provided with 576. In the ten years from Sept., 1861, to Sept., 1871, there had been deposited, including interest, £44,198,743, withdrawn £28,044,539, leaving due depositors £16,154,204. During the calendar year 1874 there was deposited £8,341,256; interest credited, £524,559; withdrawn, £6,876,095; balance due depositors Dec. 31, £23,157,469. Of the whole amount deposited in postal savings banks up to the last above date, £2,287,872 had been transferred by the old savings banks, of which 179 had closed, while only 474 were in operation against 638 in 1861. Amongst those remaining there appears to have been but little improvement in the facilities extended to the public, only 26 being open daily as late as 1874. At the close of 1874 there had been deposited in postal savings banks £72,042,032; withdrawn, £48,884,563; accounts opened, 4,006,888, closed, 2,388,155; remaining open, 1,618,733.

*Penny savings banks, military savings banks, and savings banks for seamen* have been established as auxiliaries of the general system, for the purpose of meeting the special needs of classes for which the ordinary savings banks did not hold out adequate inducements or facilities. The penny savings banks have quite commonly been tributary to the larger institutions, making them the depositories of their aggregate accumulations. The military and seamen's savings banks have been conducted independently. Their statistics are unimportant, and fail to exhibit any distinctive features concerning the thrift of the classes they represent, for large numbers of these prefer to deposit in the regular institutions.

SAVINGS BANKS IN THE UNITED STATES.—Our statements in the opening of this article concerning the conditions under which savings banks had their inception finds confirmation in the following extract from the message of Gov. De Witt Clinton to the legislature of New York in 1818. He says: "Our statutes relating to the poor are borrowed from the English system, and the experience of that country, as well as our own, shows that pauperism increases with the augmentation of the funds applied to its relief. The evil has proceeded to such an alarming extent in the city of New York that the burdens of heavy taxation which it has imposed menace a diminution of the population of that city and a depreciation of its real property." Very shortly after the successful inauguration of savings banks in Great Britain upon a popular and practical plan these institutions began to attract attention in the U. S., where, through explanatory pamphlets and correspondence upon the subject, their operation became known. The first organization of which we have record was effected in the city of New York Nov. 29, 1816. The first to go into practical operation was in Philadelphia, which as a purely voluntary association commenced receiving deposits Dec. 2, 1816, which would indicate an organization effected prior to that in New York. The first to become incorporated was in Boston Dec. 13, 1816, and it organized and commenced business in the spring of 1817. Thus, the U. S. anticipated Great Britain in giving to this interest the sanction and protection of law. The savings bank of Salem, Mass., was next incorporated Jan., 1818, and commenced business in April following. The savings bank of Baltimore opened as a voluntary association for receiving deposits on Mar. 16, 1818, and was duly incorporated in December of that year. The Philadelphia Saving Fund Society, whose voluntary action we have noticed, was incorporated Feb. 25, 1819, and the Bank for Savings in New York, which never received deposits under its voluntary organization, was incorporated Mar. 26, 1819, and commenced business on the 3d of July following. The following were also incorporated in 1819: Society for Savings, Hartford, Conn.; Savings Bank of Newport, Providence Institution for Savings, Bristol Institution for Savings, all in Rhode Island; and the Savings Bank of Portland, Me. The subject was also considered in the legislature of New Hampshire in this year, but no result was reached until 1823, when the Portsmouth Savings Bank was chartered. The foregoing are all in existence at the present time except the Bristol, which did not organize, and the Portland, which failed in 1838. The solid basis of financial security upon which these institutions were planned, and the ability and fidelity which have characterized their management, will appear from the following statement of their condition on or near Jan. 1, 1876:

| NAME. | Opening. | Open accounts. | Due depositors. | Surplus. |
|---|---|---|---|---|
| Philadelphia Saving Fund Society, Pa. | 1816 | 44,700 | $11,290,127 | $1,079,428 |
| Boston Provident Savings Institution, Mass. | 1817 | 34,883 | 14,761,081 | 797,178 |
| Savings Bank of Baltimore, Md. | 1818 | 32,429 | 12,512,209 | 1,250,000 |
| Salem Savings Bank, Mass. | 1818 | 16,004 | 6,090,583 | 400,000 |
| Bank for Savings, New York, N. Y. | 1819 | 66,429 | 21,695,401 | 1,150,067 |
| Society for Savings, Hartford, Conn. | 1819 | 23,876 | 8,100,097 | 299,820 |
| Savings Bank of Newport, R. I. | 1819 | 5,203 | 4,058,092 | Unknown. |
| Providence Institution for Savings, R. I. | 1819 | 20,405 | 8,508,380 | 170,895 |
| Portsmouth Savings Bank N. H. | 1823 | 7,204 | 2,440,043 | 55,031 |

*The facilities afforded to depositors* are greatly superior to those of English savings banks under the old system. With rare exceptions, savings banks in this country are open four or five hours daily, and very many of them on one or more evenings in each week. When open it is for the transaction of any kind of business. Deposits are practically payable on demand, though the right to require notice is reserved. There is little danger that this right will be too rigidly enforced. The tendency is in the opposite direction, of an over-solicitude to answer the demands of depositors at once, when the interests of all would be best promoted by delay.

*The plan of organization* of savings banks is not altogether uniform. In some States there is a large body of corporators, empowered to enlarge their number indefinitely, who elect from their number annually a board of trustees or directors, to whom the management of the institution is committed. In others the corporators are a defined and limited number, who are themselves the trustees and responsible for the management. These are commonly empowered to fill vacancies that occur, though in some cases this is done by designated authority outside of the board.

In the States outside of New England, New York, and New Jersey savings banks are commonly organized with a capital stock. In Maryland and Pennsylvania both the mutual and stock systems prevail, but the estimates for these States found in the following table embrace only those of the former class. The latter adapt themselves to conditions which savings banks were not originally designed to provide for. In whatever else they have differed, savings banks in the U. S. have been alike in being organized and conducted upon a plan of independent self-support. They have not been the recipients of private nor of government bounty. The interest they have received and disbursed has been earned, not awarded. They have conferred great and lasting benefits, and have neither asked nor received favors in return.

*Development of the Savings-Bank System.*—The following table exhibits the growth of savings banks in the U. S. from 1830, with such an approximation to accuracy as the defective records of their early condition in all of the States, and the absence of all public record concerning them in many of the States, even at the present time, enables us to reach:

| States. | Deposits at close of 1830. | Deposits at close of 1840. | Deposits at close of 1850. | Deposits at close of 1860. | Deposits at close of 1870. | Deposits at close of 1874. |
|---|---|---|---|---|---|---|
| | $ | $ | $ | $ | $ | $ |
| Maine | No data. | 150,000* | 500,000* | 1,539,257 | 16,597,888 | 31,051,963 |
| New Hampshire | 250,000* | 750,000* | 1,776,768 | 5,590,652 | 21,472,120 | 30,214,585 |
| Vermont | None. | None. | 199,376 | 1,111,532 | 2,301,940 | 5,011,831 |
| Massachusetts | 2,500,000* | 5,819,554 | 13,660,024 | 45,054,236 | 135,745,097 | 217,452,120 |
| Connecticut | 350,000* | 1,500,000* | 5,466,444 | 19,377,670 | 55,297,705 | 73,783,802 |
| Rhode Island | 200,000* | 500,000* | 1,495,545 | 9,163,760 | 30,708,501 | 48,771,501 |
| New York | 2,623,304 | 5,431,966 | 20,832,972 | 67,440,397 | 230,749,408 | 303,935,649 |
| New Jersey | None. | None. | 2,000,000* | 4,500,000* | 20,001,951 | 32,044,840 |
| Pennsylvania | 500,000* | 1,200,000* | 5,000,000* | 8,000,000* | 15,000,000* | 20,000,000* |
| Maryland | No data. | No data. | 3,000,000* | 6,000,000* | 12,000,000* | 16,000,000* |
| Indiana | None. | None. | None. | None. | None. | 1,000,000* |
| California | None. | None. | None. | 1,000,000* | 36,555,909 | 69,026,603 |
| Totals | 6,423,304 | 15,351,520 | 53,931,129 | 168,777,504 | 576,430,519 | 848,292,894 |

The number of open accounts in the States enumerated above at the close of 1874 may be stated at 2,390,664, and a fair estimate of the deposits in savings banks not enumerated would increase the amount to a total of $1,000,000,000, and the open accounts would be increased in like manner to nearly or quite 2,850,000. The annual interest or dividends paid by savings banks in the above States exceeds $45,000,000. In the State of New York alone it is over $16,000,000.

*The aggregate work* accomplished by savings banks in the U. S. since their establishment in 1816 can only be approximated. In the State of New York we are able to reach very nearly a correct statement, as follows: accounts opened, 3,492,256; amount of deposits received, including interest credited thereon, $1,969,347,200; interest credited, $154,561,584. With these data as a basis of calculation, applied only to the States named in the above table, we obtain the following as the nearest rational approximation: accounts opened, 7,533,684; amount deposited, including interest, $4,241,464,470; interest credited, $244,497,868.

*Investments.*—While there is much diversity among the several States in their policy concerning investments, the favorite and best-approved securities are the stocks of the U. S. or of States in undoubted credit, the bonded obligations of cities and counties, and mortgages of real estate. As a rule, the management of savings banks has been more conservative in the matter of investments than the law. But it is a rule with unfortunate exceptions.

*Restrictions upon Amount of Deposits.*—Legislation in this country has followed the English precedent of imposing restrictions upon the amount which might be deposited by one person in any savings bank, but the occasion which made such restriction necessary in England has never existed here. To this may be attributed the fact that the effort has never been attended by marked success, savings banks having seldom regarded these restrictions whenever they have deemed it desirable to evade or to defy the law imposing them. The only really effective restriction of this nature is that imposed by those savings banks which, for reasons of their own, have preferred to deal only with small individual accounts, and have refused to accept those above the prescribed limit. But with every savings bank in the country open to any depositor the restrictions of the law, if rigidly enforced, would be the occasion of inconvenience rather than of hardship.

*Interest or Dividends.*—The original theory of savings banks was that their earnings, after paying expenses, were to be ratably divided amongst the depositors. To this was afterward supplemented the idea of reserving a small sum from these earnings for the purpose of meeting any losses which might occur. In this way a surplus is formed, the purpose of which is to promote security. Upon this theory the interest would be regulated exclusively by the earnings. In late years a practice has grown up of agreeing to pay a given rate of interest. This is a departure from true savings-bank principles. The disasters that in late years have fallen upon savings banks are in nearly every instance traceable to the attempt to fulfil promises concerning interest which should never have been made. Subject to such general restraints as the law may impose, each savings bank regulates the dividends or interest allowed according to its own discretion. In the early history of savings banks 4 per cent. was a common rate, with extra dividends once in three or five years; and many of the older institutions still adhere to this rate. The prevailing rate during the last fifteen years has been 6 per cent. on all sums. In some of the New England States even higher rates have obtained, while in California 8 and 9 per cent. is common, and on deposits for a fixed term 10 and even 12 per cent. is allowed.

*Savings-bank failures*, in the U. S., have in but few instances been the result of fraud or embezzlement on the part of officers; in Great Britain they have been caused by nothing else. In this country bad or reckless management, sometimes within the law, sometimes in disregard of the law, is what has commonly wrought the ruin of those which have failed.

*Savings banks in France* had their inception in the philanthropic efforts of M. Benjamin Delessert of Paris, who obtained from London an account of their operations in Great Britain. He with nineteen associates organized the first savings bank in France on May 22, 1818. They are under the close and direct supervision of the government. No account is allowed to exceed 1000 francs, and when by credits of interest any account is about to exceed that sum, a portion is arbitrarily withdrawn and invested for the depositor in *rentes*. The interest on these investments is collected by the bank and credited to the depositor's account. At the close of 1873 the number of savings banks and branches was 1209, the number of accounts 2,020,623, and the amount of deposits about 535,000,000 francs, or nearly $107,000,000. Measures of legislation designed to enlarge the facilities and increase the usefulness of savings banks have recently been under consideration, with what results we are not advised.

*Savings banks in other countries of Europe* have had a varying success. In Switzerland they have attained much prominence. In Germany they are prosperous, but not numerous, and are frequently combined with life insurance offices. In Sweden they have attained a fair degree of success. Even in Italy they have been more successful than the condition of the people would lead us to expect. In Spain, Austria, and Russia there are savings banks, but so few as hardly to constitute a system. In Ghent, Belgium, a system of deposits in the public schools has been in operation for a number of years with gratifying success, and the system is rapidly extending itself to other countries in Europe.

EMERSON W. KEYES.

* Estimated.

**Savoie',** a department of France. (See SAVOY.)

**Savoie, Haute.** See SAVOY.

**Savo'na** [anc. *Sabatium*], town of Italy, province of Genoa, on the sea-shore, connected by rail with Nice and Genoa, has a large inland and maritime trade, extensive manufactures, metallurgic foundries, and shipbuilding. The old majolica of Savona is still prized. Savona is of ancient origin. Its mediæval history is intimately connected with that of Genoa. P., including suburbs, 24,851.

**Savona,** p.-v., Bath tp., Steuben co., N. Y., on Rochester division of Erie R. R.

**Savonaro'la** (GIROLAMO), b. at Ferrara Sept. 21, 1452, son of Niccolò Savonarola and his wife, Elena dei Buonaccorsi of Mantua. He was intended for the medical profession, and his early studies were directed accordingly. Aristotle, St. Thomas Aquinas, and the Bible were the favorite read-

ing of his boyhood, but he also delighted in music and poetry. Before the age of twenty he had become so shocked and saddened by the vices of the brilliant court of Ferrara, and by the degraded state of morals and religion around him, that he resolved to retire to a monastery. But respect for his father's wishes and the tenderest love for his gifted mother delayed his purpose for some years. In 1475, however, he entered the Dominican convent in Bologna, where he passed seven years in the exercise of every virtue possible in a cloister. In 1482 he was sent to preach in Tuscany, where the magnificent Lorenzo de' Medici was then at the height of his power. It was not likely that a conscience too sensitive to endure the immorality of Ferrara would be more tolerant of the state of things then existing in Florence; and the voice of Fra Girolamo was soon heard in strong condemnation of her vices and those of her rulers. His reputation as a popular preacher rose rapidly. Though the unpolished eloquence of the zealous *frate*, whose every utterance breathed the profoundest conviction of the truth of revelation, could have small attraction for an aristocracy distinguished for its classical culture and its cynical incredulity, yet he was soon listened to with admiring respect by many of the greatest men of that great age, such as Michel Angelo Buonarroti, Pico della Mirandola, etc., as well as by the thousands of humbler citizens who thronged the churches where he preached. In 1491 he was elected prior of San Marco, and at the same time he proudly refused the largess sent to his convent by Lorenzo, who had vainly hoped to buy his silence. His unsparing rebukes, hurled alike at the highest and the lowliest wrongdoer, did not fail to rouse a deadly hostility against him. He asserted both the right and the obligation of the Christian teacher to instruct his hearers in their civic as well as other duties, and his bold exercise of this right drew upon him the increased ill-will of Lorenzo. In his last hours, however, the offended prince turned to him for consolation, and in 1492 took place that awful interview between Fra Girolamo and the dying Lorenzo. Nor was the heroic reformer more indulgent to tyranny and vice in the Church than in the State. He launched the most scathing denunciations against the shameful corruption then scarcely less conspicuous in the higher ecclesiastics than in their infamous head, Pope Alexander VI. With the prophet's "Thus saith the Lord," he threatened Church and State with the speedy vengeance of Heaven if they did not repent, and evil princes, temporal and spiritual, out of Italy as well as in it, trembled before the terrible *frate*. His followers in Florence (known as *Piagnoni*) multiplied; he pressed his reforms more vigorously (the "burning of the vanities" took place in 1494); his enemies (the *Arrabbiati*) grew bitterer and fiercer. The pope remonstrated, a cardinal's hat was offered, *on conditions*, but the bold, disinterested prior was not to be moved. In 1495 he was summoned to Rome, but, knowing what awaited him there, evaded the summons. Finally, an order from the Vatican forbade him to preach. He submitted at first, then disobeyed, declaring himself unable to resist the prophetic spirit which compelled him to speak his Master's words. The sentence of excommunication followed. The *Arrabbiati* got possession of Florence. Fra Girolamo's letters to foreign sovereigns, urging them to call a council to dethrone the Borgia and elect a new pope, fell into the hands of his enemies. On Apr. 7, 1498, occurred the famous attempt at a "trial by fire," and on the night of the following day the convent of San Marco was attacked by an infuriated mob. The signoria sent thither officers to demand the surrender of the prior, who, with two of his brethren, was conveyed to the dungeons of the Bargello, and brutally tortured the same night. These barbarities were continued for weeks, suspended only when the life of their victim was in danger. In the delirium of agony he sometimes gave confused answers as to his prophetic gifts, but no confession of guilt could be extorted from him. His destruction, however, was inevitable. He had been the chief instrument of driving the weak and wicked Pietro de' Medici out of Florence, he had braved Alexander VI.; and these were crimes not to be pardoned when they against whom they were committed had the power to punish. The enraged pope threatened Florence with an interdict and with every other form of vengeance if she spared the hated friar. Sentence of death was pronounced on May 22, 1498, and the next day he and his two friends were publicly hanged and burned in the Piazza della Signoria and their ashes thrown into the Arno. The judgment of history has acquitted Savonarola of the charges brought against him in his own day, and the sincerity of his faith, the disinterestedness of his aims, are now as unquestioned as the purity of his life and the power of his intellect. Even the Roman Catholic Church itself, through Popes Paul V. and Benedict XIV., has declared his works irreproachable, and placed him among the servants of God. In the convent of San Marco are preserved various objects of interest once belonging to the martyred prior, such as his Bible filled with annotations by his own hand, etc., and a portrait, probably by his friend Fra Bartolommeo. He was of middle stature, dark complexion, plain in feature, pallid and worn with abstinence; his expression severely noble, but benevolent, and when animated his keen dark eyes glowed like flames. Among the many works of Savonarola, the best known is his *Triumphus Crucis de Veritate Fidei* (Florence, 1497). The reader is referred to a most interesting *Life* of Savonarola by Prof. Pasquale Villari (2 vols. 8vo, Florence, 1860; translated into English by Horner, London, 1863), where he will find full references to authorities and a list of Fra Girolamo's works, both published and unpublished; also to Mr. J. Perrens' *Savonarola, sa Vie, ses Écrits* (3d ed., Paris, 1859). C. C. MARSH.

**Sa'vory,** the name of *Satureja horensis* (summer savory) and of *Satureja montana* (winter savory), labiate garden-herbs of Old-World origin, much employed in domestic cookery in flavoring forcemeats and other dishes.

**Sav'oy,** formerly a political division of the kingdom of Sardinia, and originally the family possession of the dynasty now reigning in Italy. In 1860 it was ceded to France, and is now divided into the two departments of Savoie and Haute-Savoie. Savoy is the loftiest mountain-region of Europe, containing the highest peak, Mont Blanc. Bounded N. by the Lake of Geneva and E. by Piedmont, it is covered by the Graiian Alps, and entirely broken up into mountains and valleys. It contains very little cultivable land, but that which it contains is most carefully cultivated, planted with vines and mulberry trees, and generally produces wheat enough for home consumption. The mineral wealth of Savoy is not great, though coal, lead, iron, etc. are found, and to some extent worked. But the pastures which cover the mountains are very important, and feed large herds of cattle and sheep; dairy-farming is the principal occupation. The area of the two departments is—Savoie, 2282 sq. m., with 267,958 inhabitants; Haute-Savoie, 1319 sq. m., with 273,027 inhabitants. The Savoyards are an honest, industrious, intelligent, and hospitable race, deeply attached to their native country. They emigrate in large numbers to France, Germany, and other places, but when they have amassed sufficient wealth return to live in their fatherland. Cap. of Savoie, Chambéry; of Haute-Savoie, Annecy.

**Savoy,** p.-v. and tp., Berkshire co., Mass. P. 861.

**Savoy, The,** in the Strand, London, is a spot remarkable for its ancient buildings and its historical associations. The Palace of the Savoy, on the side of the river Thames, was built in the year 1245 by Peter, earl of Savoy and Richmond, uncle to Eleanor, queen of Henry III., who on visiting his niece was solemnly knighted in Westminster Abbey, and afterward made this building his place of residence. According to Knighton, it surpassed other English mansions in beauty and magnificence. It came into the possession of the "time-honored" John of Gaunt, duke of Lancaster, and within its walls John, king of France, after the battle of Poitiers (1356), was confined a prisoner. "Thither," says Froissart, "came oftentimes the king and queen of England to see him and make great feast and cheer." John was released in 1360 upon conditions which could not afterward be fulfilled, and therefore the French monarch, with chivalrous honor, returned to his former prison, and there died in 1364. Disturbances arose in London respecting the duke of Lancaster, who took Wycliffe under his protection, and the citizens threatened the palace; but it escaped for a time, only to be burnt in WAT TYLER'S INSURRECTION (which see). It is curious in connection with this outrage that the insurrectionists would not permit the place to be pillaged, and one of them was thrown into the fire "because he minded to have reserved one goodly piece of plate." The building remained a heap of ruins until the close of the reign of Henry VII., who determined to erect on the site a house "to harbor 100 poor people, sick, or lame, or travellers to be furnished with lodging, food, firing, and attendance for a certain time." It was made, in fact, a sort of casual ward, and, as might be expected, it became a refuge for all sorts of vagabonds and vagrants. This circumstance led to the suppression of the establishment in the reign of Edward VI., but it was restored under Queen Mary. "The court-ladies and maids of honor," says Strype's *Stowe*, "in imitation of the queen's charity, contributed their parts and shares toward it by sending sufficient store of beds and bedding and other things necessary for furniture of the rooms where the poor were to be harbored." The chapel of the palace became a church in the reign of Queen Elizabeth, and the district of the Savoy was constituted a distinct parish. The hospital suffered great abuse at that period—first, through the embezzlement of its funds by the master, one Thomas Thurland, and next through its be-

coming again the resort of abandoned characters, who, under pretence of calamity, sought shelter from the consequences of their crimes or irregularities. The hospital, however, continued to exist until the commencement of the reign of Queen Anne, when it was finally dissolved and the offices of master and chaplains extinguished. The buildings, which had been used in the time of Charles II. for the accommodation of disabled soldiers and sailors, were then left to fall into decay, and a view of the remains in 1761 shows them to have been then in a condition of hopeless ruin. Upon the erection of Waterloo bridge, the first stone of which was laid in 1811, the shattered walls of the palatial edifice were swept away, and the chapel remained the only but a very interesting relic of the ancient pile of buildings.

The chapel of the Savoy was burnt down in 1860, and beautifully restored at the cost of Queen Victoria. It consists of a nave without aisles or chancel. As a specimen of the state of society at a former period we may mention one use for which this building was employed in 1754, as appears from a newspaper. The *Public Advertiser* of the 2d of June of that year announced that marriages might be performed there with "the utmost privacy, decency, and regularity." It is added, "The expense not more than one guinea, the five-shilling stamp included. There are five private ways by land to this chapel, and two by water." In the Savoy chapel many distinguished personages are buried. JOHN STOUGHTON.

**Savoy Con'ference, The,** was held soon after the Restoration, and arose out of the state of parties after the dissolution of the Commonwealth. The Episcopalians were determined to restore the Church of England to what it was before the civil war, but the Presbyterians, who mainly had been in possession of church benefices and church power for many years, contended for some modification of the former system. A royal commission was issued on Mar. 25, 1661, appointing certain divines to confer together. The representatives of Presbyterianism were Edward Reynolds, bishop of Norwich; Dr. Tuckney, master of St. John's College, Cambridge; Dr. Conant, reg. prof. div., Oxford; Dr. Spurstow; Dr. Wallis, Sav. prof. geom., Oxford; Dr. Manton, Mr. Calamy, Mr. Baxter, Mr. Jackson, Mr. Case, Mr. Clarke, Mr. Newcomen. *Coadjutors.*—Dr. Horton, Dr. Jacomb, Dr. Bates, Dr. Cooper, Dr. Lightfoot, Dr. Collins, Mr. Woodbridge, Mr. Rawlinson, Mr. Drake. The Episcopal divines were—Accepted Frewen, archbishop of York; Gilbert Sheldon, bishop of London, master of the Savoy; John Cosin, bishop of Durham; John Warner, bishop of Rochester; Henry King, bishop of Chichester; Humphrey Henchman, bishop of Sarum; George Morley, bishop of Worcester; Robert Sanderson, bishop of Lincoln; Benjamin Laney, bishop of Peterborough; Bryan Walton, bishop of Chester; Richard Sterne, bishop of Carlisle; John Gauden, bishop of Exeter; with the following coadjutors: Dr. Earle, dean of Westminster; Dr. Heylyn, Dr. Hacket, Dr. Barwick, Dr. Gunning, Dr. Pearson, Dr. Pierce, Dr. Sparrow, Mr. Thorndike. The commission gave authority to review the Book of Common Prayer, to compare it with ancient liturgies, to consult respecting exceptions made to it, and by agreement to make alterations such as would satisfy tender consciences and restore unity to the Church. The instrument appointed "the master's lodgings in the Savoy" as the place of meeting. Gilbert Sheldon, the master, perhaps procured this arrangement for his own convenience. As the terms of the commission specified advice and consultation as purposes of the meeting, friendly conference seemed necessary; but the Episcopal party manifested no disposition for anything of that kind. They were determined, as men of business, not to speak freely, but sternly to preserve the old restrictions of the Establishment. They required written communications from their opponents, to which Baxter, the most active of the Presbyterians, agreed. At length exceptions to the Liturgy were presented in form, and emendations of different kinds recommended. They may be seen at length in Baxter's *Life and Times*, the chief authority we have for the history of the proceedings. The answers of the bishops were uncourteous and captious, not indicating any disposition to conciliate, but foreclosing the possibility of removing Presbyterian objections. They said: The alterations asked, if allowed, would be a virtual confession that the Liturgy was an intolerable burden, a cause of schism, and would justify past non-conformity. Taking such ground, it mattered not what the objections made might be—none were admissible; and therefore to advise and consult was a thing out of the question. It had been arranged that whilst the rest of the Presbyterian brethren employed themselves in drawing up *exceptions* against the Book of Common Prayer, Baxter should prepare *additions*. In one fortnight he accomplished his task and presented his reformed Liturgy. The author tells us that he compared what he did with the Assembly's Directory, the Book of Common Prayer, and Hammond l'Estrange; but he seems to have borrowed little or nothing from these sources, beyond introducing or allowing the use of the creeds—sometimes the use of the Athanasian Creed—the *Te Deum*, and the Psalms in order for the day. This famous Presbyterian polemic, at the time presenting his reformed formularies, presented with them a petition to the bishops, begging them to yield to such terms of peace and concord as they themselves confessed to be lawful. The contrast between the pacific, conciliatory, and reasonable strain of the petition and the hard, repulsive tone of the prelates' answers to the exceptions is very striking. A rejoinder to the bishops' answers touching exceptions made to the Liturgy followed on the part of the ministers. A preface to it was drawn up by Calamy. The rejoinder itself, composed by Baxter—forming, indeed, a book of 148 pages, and taking up the Episcopal document paragraph by paragraph with a great deal of close reasoning and scholastic subtilty—is too extensive in its range and too minute in its details to admit of any satisfactory synopsis of its contents. All hope of a *pacifying* conference being abandoned, the Presbyterian divines agreed to a debate; many hours being spent in fixing its order. The bishops, according to their policy throughout, maintained that it belonged to those who were acusers to begin; *they* were simply on the defence. No effect was produced by the Presbyterians' rejoinder: "We are the defendants against your impositions; you command us to do certain things under pain of excommunication, imprisonment, and silence. We defend ourselves against this cruelty by asking you to show authority for this." At last it was settled that there should be a formal dispute, to be conducted by three persons on each side. Strangers were allowed to be present, and the room was full of auditors, young Tillotson, the eminent preacher and archbishop of later days, being amongst them. The debate turned upon vague abstractions and upon subtle theological distinctions, occasionally interrupted by outbursts of temper and uncivil personalities. As might be expected, the hall of the Savoy palace became an arena for logical gladiatorship, and the object of the meeting was a strife for victory. Those who are familiar with modern committees, and with what occurs when both parties lose their tempers and the stronger carries the point, can understand how the Savoy Conference terminated. "We are all agreed," says Baxter, "on the ends for the Church's welfare, unity, and peace, and His Majesty's happiness and contentment; but after all our debates were disagreed of the means; and this was the end of that assembly and commission." JOHN STOUGHTON.

**Savoy, Declara'tion, The,** an ecclesiastical document, so called from its having been framed by a number of ministers who met in the Savoy hospital for the purpose. Before the death of Oliver Cromwell a meeting was convened by notice from the clerk of the council of state, addressed to the Congregational elders resident in London. Cromwell, though not favorable to the proceeding, yet permitted it; but the ministers did not meet until after his decease; then they assembled in the Savoy Sept. 29, 1658, to declare the principles of their faith and polity. The business was disliked by people about the court, who feared it might lead to fresh divisions between the Independents and Presbyterians. There might be political intrigues at the background of the movement, for Cromwell said in reference to some of its projectors, who were republican officers, "They must be satisfied, or we shall all run back into blood again." At all events, when the meeting came to be held nothing was done which the Protector would have disapproved. The declaration did not clash with the sentiments of broad charity so dear to his heart. As to doctrine, the declaration is substantially the same as the Westminster Confession. Its specialty consists in its outline of ecclesiastical order. Whereas the *covenants* or mutual agreements into which Congregationalists had entered at the formation of their churches in the time of the civil wars generally contained some references to further light breaking in upon them from God's word, we discover in the Savoy Declaration no language whatever of that kind; and it seems to be assumed in the document that Congregationalism, as to the knowledge of its principles, had by that period attained to something like completeness. The following were fundamental propositions: "A particular church consists of officers and members, the Lord Christ having given to his called ones—united in church order—liberty and power to choose persons fitted by the Holy Ghost to be over them in the Lord. The officers appointed by Christ to be chosen and set apart by the Church are pastors, teachers, elders, and deacons. The way appointed by Christ for the calling of any person unto the office of pastor, teacher, or elder in a church is that he be chosen thereunto by the common suffrage of the church itself, and solemnly set apart by fasting and prayer, with the imposition of hands of the eldership of that

church, if there be any before constituted therein; and of a deacon, that he be chosen by the like suffrage, and set apart by prayer and the like imposition of hands; and those who are so chosen, though not set apart after that manner, are rightly constituted ministers of Jesus. The work of preaching is not so peculiarly confined to pastors and teachers but that others also, gifted and fitted by the Holy Ghost and approved by the people, may publicly, ordinarily, and constantly perform it. Ordination alone, without election or consent of the church, doth not constitute any person a church officer. A church furnished with officers according to the mind of Christ hath full power to administer all his ordinances; and where there is want of any one or more officers, those that are in the church may administer all the ordinances proper to those officers whom they do not possess; but where there are no teaching-officers at all, none may administer the seals, nor can the church authorize any so to do. Whereas, the Lord Jesus Christ hath appointed and instituted, as a means of edification, that those who walk not according to the rules and laws appointed by him be censured in his name and authority, every church hath power in itself to exercise and execute all those censures appointed by him. The censures appointed by Christ are admonition and excommunication; and whereas some offences may be known only to some, those to whom they are so known must first admonish the offender in private; in public offences, and in case of non-amendment upon private admonition, the offence being related to the church, the offender is to be duly admonished, in the name of Christ, by the whole church through the elders: and if this censure prevail not for his repentance, then he is to be cast out by excommunication, with the consent of the members." JOHN STOUGHTON.

**Saw** [Ang.-Sax. *sage*], an instrument for evenly dividing wood or other substances by the action of a row of sharp-pointed metallic teeth. It is usually made of a thin blade of steel, the teeth being more highly tempered than the rest of the plate. The use of this implement, so necessary to many dissimilar arts and handicrafts, is naturally traceable to an early period of civilization, the Egyptians having made it of bronze, and the Oriental nations of various other metals. The process of manufacture is quite complex and delicate. The East Indian saw has the teeth pointed toward the handle, instead of away from it as in Europe and America; and this peculiarity gives the former an obvious advantage in respect to the expenditure of force, as well as in the neat execution of delicate work. The teeth are usually notched at an angle of 60°. Saws are naturally manufactured in modern times of many sizes, shapes, and qualities, varying from the minute surgical or dental tool to the large instrument used in common water and steam saw-mills, and the still larger one manufactured for working into lumber the gigantic trees of the Pacific coast. The earliest saw-mills worked by water-power are supposed to have been constructed in France about the twelfth century; the earliest ones in the U. S. are said to have been established by the Dutch in New York about 1633, and by the English at the falls of the Piscataqua River, near Berwick, Me., in 1634. Their use now constitutes an important branch of industry in the Dominion of Canada and in all the heavily-timbered northern regions of the U. S., as well as of Europe.

**Sawfish.** See PRISTIDÆ and PRISTIOPHORIDÆ.

**Saw-Fly.** See HYMENOPTERA, by PROF. A. S. PACKARD, JR., M. D., M. N. A. S.

**Saw-Mill,** an establishment for the cutting of lumber by means of saws driven by machinery. The saw-mill has almost entirely superseded the saw-pit, in which planks were made by hand. In its most improved forms it is the product of American ingenuity. Saw-mills employ straight up-and-down saws, single or in gangs, or circular saws. Steam and water power are extensively employed in running saw-mills, and in the Netherlands windmills are also used. Special forms of the saw-mill have been invented for sawing shingles, clapboards, laths, etc., and also for cutting out mouldings, furniture-stock, veneers, etc. Jig, scroll, and belt saws are among the kinds employed for work of this class.

**Saw'yer** (FREDERICK A.), b. in Boston, Mass., Dec. 12, 1822; graduated at Harvard 1844; was a professional teacher at Gardner and Wiscasset, Me., 1844–51, afterward in Massachusetts and New Hampshire 1851–59; became principal of the normal school at Charleston, S. C., 1859; returned to New England during the civil war; was appointed collector of internal revenue at Charleston 1865; took an active part in the reconstruction of South Carolina; was U. S. Senator from that State 1867–73, and assistant secretary of the treasury 1873–74.

**Sawyer** (FREDERICK WILLIAM), b. at Saco, Me., Apr. 22, 1810; removed to Boston 1838; commenced there the practice of law 1840; has been a regular contributor to the *Evening Transcript* since 1847, and was the originator and president of the "Pawners' Bank" at Boston. Author of *The Merchant's and Shipmaster's Guide* (1840), *A Plea for Amusements* (1847), and *Hits at American Whims, and Hints for Home Use* (1860).

**Sawyer** (HORACE B.), b. at Burlington, Vt., Feb. 22, 1797; entered the U. S. navy as midshipman in 1812, attaining by regular promotion the rank of captain in 1853. In the war of 1812–15 he rendered valuable service, being on the Constitution at the capture of the Cyane and Levant, and subsequently engaged in the West Indies and Mediterranean in ridding those waters of pirates. His native State presented him with a sword in 1856 for his services in the war with Great Britain. D. at Washington, D. C., Feb. 14, 1860.

**Sawyer** (LEICESTER AMBROSE), b. at Pinckney, N. Y., about 1805; graduated at Hamilton College 1828; studied theology; was ordained as a Presbyterian minister 1831; was for some time president of Central College, O.; became pastor of a Congregational church at Westmoreland, N. Y., 1854; subsequently resided at Whitesboro', Oneida co., N. Y., and was editorially connected with the Utica *Morning Herald*. Author of *Elements of Biblical Interpretation* (New Haven, 1836), *Mental Philosophy* (1839), *Moral Philosophy* (1845), *A Critical Exposition of Baptism* (Cincinnati, 1845), *Organic Christianity, or the Church of God* (1854), and *The Reconstruction of Biblical Theories, or Biblical Science Improved* (1862). In 1838 he began a new translation of the entire Bible, which he completed about 1856. The New Testament was published at Boston Oct., 1858. The prophetical books of the Old Testament were issued Dec., 1860, and the book of Daniel, with the apocryphal additions, was separately issued 1864. The remaining (earlier) portions of the Old Testament were not published.

**Sawyer** (PHILETUS), b. at Whiting, Vt., Sept. 22, 1816; received an ordinary common-school education; went to Wisconsin 1847; engaged in the lumber-business at Oshkosh on an extensive scale; was a member of the legislature 1857 and 1861; mayor of Oshkosh 1863–64; was a delegate to the "Loyalists' convention" 1866, and sat in Congress as a Republican from 1865 to 1875, when he declined a re-election. He served on several important committees connected with the business interests of the Northwest, and reached the position of chairman of the committee on Pacific railroads.

**Sawyer** (THOMAS JEFFERSON), D. D., b. at Reading, Vt., Jan. 9, 1804; graduated at Middlebury College 1829; was pastor of a Universalist church in New York City 1830–45, and again 1852–61, having in the interval been principal of the Liberal Institute at Clinton, Oneida co., N. Y.; taught theology in the same institution; resided on a farm at Clinton 1861–69, after which he became professor of theology in Tufts College, Medford, Mass., an institution which he had been instrumental in founding (1852), as he had also been in the establishment of the theological department of the St. Lawrence University (1856). He has defended the doctrines of Universalism in public discussions with several clergymen of other denominations, and some of these polemics have been published, the most important being that with Rev. Isaac Westcott, entitled *The Doctrine of Eternal Salvation* (New York, 1854). In opposition to the views of H. W. Beecher, he published *Who is our God? the Son or the Father?* (1859).—His wife, CAROLINE M. FISHER, b. at Newton, Mass., Dec. 8, 1812, was married 1832; has written much in prose and verse for periodicals, especially the *Christian Messenger;* published several translations from the French and German, and edited the *Ladies' Repository*, a Universalist monthly magazine. She also published the *Poems* of Mrs. Julia H. Scott (1854), preceded by a *Memoir*.

**Sawyer's Bar,** p.-v., Siskiyou co., Cal., on N. fork of Solomon River. P. 160.

**Saxe** (JOHN GODFREY), LL.D., b. at Highgate, Vt., June 2, 1816; graduated at Middlebury College 1839; was admitted to the bar at St. Alban's 1843; practised law in Franklin co. 1843–50; was editor and proprietor of the Burlington *Sentinel* 1850–56; was State's attorney of Vermont one year, after which he devoted himself chiefly to literature and to popular lecturing; was Democratic candidate for governor 1859 and 1860; was for some years editor of the Albany *Evening Journal*, and subsequently became a resident of Brooklyn, N. Y. Author of several volumes of humorous poems, the longest of which were delivered at college commencements and other anniversary occasions. More than 40 eds. of his collected poems have been issued in the U. S. and in England.

**Saxe** (MAURICE). See MAURICE, count of Saxony.

**Saxe-Al′tenburg,** duchy; area, 1321.5 quad. kiloms.; pop. 142,122 inhabitants; annual budget, 2,223,561 marks; treasury fund, 3,651,279; is situated N. E. of the Thüringian Forest, and consists of two separate parts, called the eastern and the western district. Cap. Altenburg. By the division of 1485 the country fell to the Ernestine line, but in 1547 it was transferred to the Albertine. In 1553, however, it was returned to Duke Friedrich the Magnanimous of the Ernestine line, and was under dukes of its own from 1603 to 1672, when the reigning family became extinct, and it fell to Saxe-Gotha. As this line too became extinct, the country fell, according to the convention of Nov. 15, 1826, to the duke of Saxe-Hildburghausen, who gave up his own country, Hildburghausen, and became duke of Saxe-Altenburg. His descendants are still reigning. A. NIEMANN.

**Saxe-Co′burg-Go′tha,** duchies; area, 1967.75 quad. kiloms.; pop. 174,339, of which 561.99 q. k., with 51,709 inhabitants, belong to Coburg, 1405.75 q. k., with 122,630 inhabitants, to Gotha; separated from each other by the Thüringerwald—Coburg to the S. and Gotha to the N. Caps. Coburg and Gotha. Although standing under one government, the administration is separate. Coburg has a budget of 868,993 marks, with a debt of 2,285,011; Gotha, a budget of 2,298,000, and a debt of 874,380. Since the accession of Duke Ernst II. in 1844, these two small duchies have formed the starting-point for much intellectual progress. The union of the two countries dates from 1826. The house of Saxe-Coburg, founded in 1680, became extinct in 1699. The contest concerning the heritage ended in 1720. The duke of Saxe-Saalfeld received the country. The dukes of Saxe-Saalfeld-Coburg reigned to 1826, when they ceded Saalfeld to Meiningen, and received Gotha, whose own dynasty had died out. AUGUST NIEMANN.

**Saxe-Lauenburg.** See LAUENBURG.

**Saxe-Mei′ningen-Hild′burghausen,** duchy; area, 2468.43 quad. kiloms.; pop. 187,957; budget, receipts, 4,223,640 marks; expenses, 3,793,640; treasury fund, 9,431,000; is situated to the S. of the Thüringerwald. Cap. Meiningen. The reigning line was founded by Bernhard, third son of Ernst the Pious. In 1826, Duke Bernhard acquired the duchy of Hildburghausen, with Saalfeld and other estates, but having sided with Austria in 1866, he was compelled to abdicate, and was succeeded by his son Georg, who still reigns. AUGUST NIEMANN.

**Sax′enburg,** p.-b., Jefferson tp., Butler co., Pa., on Butler extension of Pennsylvania R. R. P. 295.

**Saxeville,** p.-v. and tp., Waushara co., Wis. P. 746.

**Saxe-Wei′mar-Ei′senach,** grand duchy; area, 3635 quad. kiloms.; pop. 286,183; budget, receipts, 6,319,970 marks; expenses, 6,283,180; no debt; consists of three districts—Weimar, Neustadt, and Eisenach—situated along the Rhön and the Thüringerwald. Caps. Weimar and Eisenach; university at Jena. The reigning line descends from William, the third son of Johann III., the ancestor of the whole now living Ernestine line. In 1672 the house was divided into the lines of Weimar, Eisenach, and Jena. That of Jena became extinct in 1690, and the countries were again united in 1741 under Ernst August. The congress of Vienna enlarged the country with 31 geographical sq. m. and 77,000 inhabitants, and made it a grand duchy. Since 1853, Carl Alexander has reigned.
AUGUST NIEMANN.

**Saxifraga′ceæ,** a rather large natural order of exogenous herbs and shrubs, comprising the true saxifrages, hydrangeas, gooseberries, currants, grass of Parnassus, *Philadelphus,* and numerous other plants, many of them ornamental and some useful. Not a few are astringent. The order is moderately represented in the U. S. The true Saxifragaceæ are most nearly related to the Rosaceæ, from which they differ in the definite stamens, albuminous seeds, tendency to consolidation of the carpels, also to have opposite leaves and no genuine stipules.

**Sax′ifrage** [Lat. *saxifraga,* "the stone-breaker," applied to some plants as growing in clefts of rocks; to others as supposed solvents of stone in the bladder], a name popularly applied to a very great number of plants of widely different characters. But the name should now be limited to plants of the genus *Saxifraga* (order Saxifragaceæ). This large genus comprises many alpine and high northern species, some of them highly ornamental in culture. Some of them were once used in medicine, but none have active properties. The U. S. have numerous species, some of the European also. The vernal saxifrage (*S. Virginiana*) is a very common early spring flower. The swamp saxifraga or meadow plantain (*S. Pennsylvanica*) is common in wet grounds, and its radical leaves are gathered and boiled as potherbs in spring.

**Sax′o Grammat′icus,** the earliest Danish historian, was secretary to Bishop Absalon, and afterward provost at the cathedral of Roeskilde, where he d. in 1204. His *Historia Danica* consists of 16 books, and reaches to the year 1186. The latter part, where he relates what he has seen himself or heard from eye-witnesses, is perfectly reliable, and the narrative has often a great charm; but his representation of the heathenish age is much colored by his monkish views, and the materials which he employed for his narrative—Runic inscriptions, old songs, the writings of the Icelanders, etc.—he did not use critically. His surname he received from the correctness and elegance of his Latin, which excited the admiration even of Erasmus. His work was first printed at Paris in 1514. The best edition is that by P. E. Müller (3 vols., Copenhagen, 1839–58). It was translated into Danish by Vedel in 1575, and by Gruntvig in 1818.

**Sax′ons** [Lat. *Saxones;* Celtic *Sassenach, Saisnaig,* perhaps from *Sachs,* a "battle-knife"], a Low-German tribe first mentioned in history in 287 A. D., when they appear in England under Carausius. Their name survives in Saxony, Prussian Saxony, the minor Saxon states, etc. (On the relations of the Saxons to the Angles of Britain see ANGLO-SAXON.) We find them early colonists of Normandy and France. There is at present a large number of so-called Saxons in Transylvania, descendants of the Low-German colonists introduced in 1143 and 1247 by the Hungarian kings. They are one of the dominant races of that region, and preserve the use of the German language, which, however, is considerably corrupted.

**Saxon's,** tp., Randolph co., Ala. P. 827.

**Saxonville,** p.-v., Framingham tp., Middlesex co., Mass., on Saxonville branch of Boston and Albany R. R., has important woollen manufactures.

**Sax′ony,** province of Prussia, between Hanover and Brandenburg, comprises an area of 9729 sq. m., with 2,103,174 inhabitants. The western portions are occupied by the Hartz Mountains; the rest is low and level, sloping northward and watered by the Elbe and its affluents. The soil is very fertile and very well cultivated, and many branches of manufacture are developed with great energy and success. Cap. Magdeburg.

**Saxony, Kingdom of,** a part of the German empire, comprising an area of 14,989.55 quad. kiloms., with 2,556,244 inhabitants, lies hemmed in between Prussia and Austria, a position fraught with great political difficulties and the principal cause of most of the historical vicissitudes of the country. It belongs to the North German mountain region, two-fifths of the surface being mountainous (Erzgebirge S., Lausitzergebirge E., with the Saxon Switzerland), two-fifths hilly, and one-fifth lowland. The principal river is the Elbe with its affluents, the Black and the White Elster, the Mulde, and the Pleisse. The population is very dense, 8900 to 1 geographical sq. m.; 52,000 Wends, nearly all settled in the government of Bautzen, live among the Germans, who belong partly to the Franconian and partly to the Thuringian tribes. In administrative respects the country is divided into 4 governments—Bautzen, with 330,945 inhabitants; Dresden, with 676,584; Leipsic, with 591,215; Zwickau, with 957,500. The principal towns are—Dresden, with 177,089 inhabitants; Leipsic, with 106,925; Chemnitz, with 68,229; Zwickau, with 27,322; Plauen, with 23,355; Glauchan, with 22,036; Freiberg, with 21,673; and Meerane, with 19,187. With respect to creed, there live in the country 2,493,556 Protestants, 53,642 Roman Catholics, 554 Greek Catholics, 4339 belonging to other Christian sects, and 3357 Jews. Agriculture is carried on with a high degree of perfection. Wheat, rye, oats, barley, millet, etc. are cultivated; also flax. The vine is grown along the Elbe. Cattle-breeding is important; sheep especially are very numerous. The arboriculture is excellent; $30\frac{9}{10}$ per cent. of the total area is covered with forest. Mining is an old occupation here, especially in the Erzgebirge, and it is still very flourishing. Silver, iron, gold, lead, sulphur, arsenic, zinc, etc. are produced; 52,000,000 cwts. of coal and about 10,000,000 cwts. of brown coal are annually raised. Manufacturing industry is much developed; Chemnitz, Zwickau, Plauen, Zittau, Bautzen, and Leipsic especially are important. Linen, cotton, and woollen goods, paper, chemicals, metal ware and machinery, straw goods, porcelain, musical and mathematical instruments, are manufactured. Leipsic has large type-foundries and printing establishments. The commerce is also very comprehensive; its principal centre is Leipsic, which is also the seat of the highest commercial court of Germany. The most important money institutions are the Bank of Leipsic, the Saxon Bank in Dresden, and the Agricultural Bank of Bautzen. The country is better provided with railways than any other part of Germany; 1448 kils. were in operation Jan. 1, 1875. Public education stands very high; the numerous educational in-

stitutions comprise a university in Leipsic, a mining academy in Freiberg, an academy of arboriculture at Tharand, a polytechnic school in Dresden, an industrial school at Chemnitz, 5 architectural, 5 commercial, 7 schools for the exact sciences, 12 gymnasiums, more than 2000 evangelical, and 40 Roman Catholic public elementary schools. The government is a constitutional monarchy, established in 1831 and modified in 1849, 1851, 1860, 1861, 1868, and 1874. In all foreign affairs and in many important interior questions the authority of the German empire has wholly superseded that of the particular Saxon government, which, however, is still independent with respect to the interior administration. The reigning king is Albert, who ascended the throne Oct. 29, 1873; the representation of the people is composed of two chambers. The finances are in good order; the principal items of the budget for 1875 were as follows: (1) *Receipts.*—Domains, 8,106,957 thalers; droits réguliers, 19,535,592; capitaux productifs, 6,367,509; impôts et droits, 13,482,861; total, 47,492,919. (2) *Expenses.*—Dotations, including the royal appanages, 21,916,290; ministère, 135,540; justice, 3,033,630; interior, 5,685,876; finance, 1,702,551; worship and public education, 4,190,577; foreign affairs, 165,960; matriculation, 4,440,651; pensions, 2,048,958; public works, 3,751,350; fonds de reserve, 421,556; total, 47,492,919. At the end of 1874 the public debt amounted to 324,393,675. The army forms the 12th corps of the German imperial army. The colors of the country are green and silver.

*History.*—That German tribe which the Romans called Saxones was in ancient time settled between the Eider, Elbe, and Trave. Charlemagne made war upon them 772–803, and subjugated them, and Saxony now became a dukedom, belonging to the Frankish and afterward to the German empire. Under Otto the Magnificent, Thuringia was united to it, and Otto's son, Heinrich, became king of Germany in 919. His successor, the emperor Otto I., gave the dukedom of Saxony to Hermann Billung. Under the house of the Billungs, Saxony made war upon the emperor Henry IV. in 1067, but in 1106 the house became extinct, and under the emperor Lothar, in 1125, the country came into the possession of Duke Henry of Bavaria. His son, Henry the Lion, increased the dukedom, but when he was placed under the imperial ban his dominions were scattered, and, after being reduced to a small piece of land, the dukedom of Saxony was given to Count Bernhard of Ascania. The house of Ascania branched off in 1260 into two lines, of which one, the Wittenberg, became extinct in 1421, while the other, the Lauenberg, reigned until 1680. The title of duke of Saxony followed the Wittenberg branch; it was changed in 1355 to that of elector, and both land and title were bestowed on Friedrich the Valiant, margrave of Meissen, in 1421. Thus, the name of Saxony, which originally designated a tribe, became a princely title, and was transferred to countries with which it had no historical connection. Since 1088 the house of Wettin has reigned in the margraviate of Meissen. In 1485 the grandsons of Friedrich the Valiant, Ernst and Albert, divided the inherited countries, so that Ernst received Thuringia, and Albert, Meissen, and two lines were thus formed, which still flourish, the Ernestine and the Albertine, of which the former now reigns in the four Saxon duchies, Saxe-Weimar-Eisenach, Saxe-Meiningen-Hildburghausen, Saxe-Altenburg, and Saxe-Coburg-Gotha; the latter in the kingdom of Saxony. Many changes, however, took place in the disposition of the property before the present state became settled. After the battle of Muhlberg, by the capitulation of Wittenberg in 1547, the chief of the Ernestine line lost the largest part of his land and the electoral dignity, which were acquired by Duke Moritz of the Albertine line. During the Thirty Years' war this line acquired considerable importance, Johann Georg I. being an ally of Sweden and receiving the two Lausitz from the emperor by the Peace of Prague in 1635. But after the Peace of Westphalia, in 1648, the rise of Brandenburg became an impediment to the further development of the electorate. The elector August embraced Roman Catholicism in 1607, became king of Poland, and involved Saxony in war with Charles XII. of Sweden. His successor, August, sided with Maria Theresa of Austria against Friedrich II. of Prussia, and in the Seven Years' war Saxony lost 90,000 men and 70,000,000 thalers. At the same time the minister of August, Count Brühl, squandered enormous sums. Under Friedrich August III. (1768–1827) the country again began to rise, though it had some very hard years also during this period. As a member of the German empire it took part in the war against France, and concluded an alliance with Prussia in 1806. The defeat at Jena also affected Saxony heavily, but Dec. 11, 1806, it concluded an alliance with Napoleon and entered the Confederation of the Rhine, after which the elector received the title of king. By the Peace of Tilsit the king of Saxony obtained the grand duchy of Warsaw, which had just been established, and portions of Prussia and Austria, but in the battle of Leipsic he was taken prisoner by the allied Russian-Prussian-Austrians, and, May 18, 1815, he was compelled to surrender all his acquisitions, even the two Lausitz. In the long period of peace from this moment, and up to 1866, the country became very prosperous, though a narrow and short-sighted government presented many obstacles to its development. The revolutionary years of 1848–49 brought many great and beneficial reforms to Saxony. Aug. 9, 1854, King Johann ascended the throne, and both he and his minister, Beust, made a most stubborn opposition to the Prussian policy, and showed a decided partiality for Austria as the leader of the small states. But the war of 1866 brought the independence of Saxony in imminent danger, and the king, Johann, saved his crown only by entering the North German confederacy, over which Prussia presided, by paying 10,000,000 thalers in war indemnity, and by dismissing Beust. The liberal party in Saxony hailed this event with enthusiasm, but the party consisting of the court, the nobility, and the army officers continued hostile to Prussia. In 1870–71 the Saxon soldiers fought under the leadership of the crown prince, afterward King Albert, as true allies by the side of the Prussians, and the interior development of the country has not only kept pace with, but in some respects even advanced beyond, that of the rest of Northern Germany.

AUGUST NIEMANN.

**Sax'ton,** p.-b., Liberty tp., Bedford co., Pa., on Raystown branch of Juniata River and on Huntingdon and Broad Top R. R., at its junction with Shoup's Run branch. P. 318.

**Saxton** (JOSEPH), b. in Huntingdon co., Pa., Mar. 22, 1799, where he received a common-school education. His mechanical ingenuity was early shown by improvements in the machinery in his father's nail-factory. At eighteen he went to Philadelphia, and there invented a machine for cutting the teeth of chronometer wheels, an original escapement with a compensating pendulum, and made the clock which still marks the time from the belfry of Independence Hall. He subsequently went to London, where he resided for nine years. Here he formed the acquaintance of Faraday, which ripened into a lasting friendship. His mechanical genius was fully recognized, and he was placed as chief assistant in the Adelaide Gallery, then the great scientific repository, and while there constructed a magneto-electric machine by which the first magnetic spark was produced, and which was permanently placed in the gallery. He also constructed the apparatus used by Mr. Wheatstone in his experiments on the velocity of electricity in its passage through a wire. He next invented a locomotive differential pulley, by means of which high speed may be given to vehicles by horses travelling at a slow rate, and a medal-ruling machine for tracing lines on metal or glass, representing by an engraving the design on the face of the medal. He returned to America to superintend the construction of the machinery and balances for the Philadelphia mint, and subsequently, under the auspices of Prof. Bache, was placed in charge of the construction of the standard weights and measures for the U. S.—a position he filled with marked ability, furnishing the State capitals and the custom-houses with accurate sets of weights and measures. A gold medal was awarded him at the London exhibition of 1851 for a large class balance of extreme precision, and he was at various times the recipient of other medals awarded for his meritorious works. He was one of the original corporators of the National Academy of Sciences. Among his many ingenious devices and inventions, the mirror-comparator for comparing and the tracing-machine for dividing standard measures, his deep-sea thermometer, used in the exploration of the Gulf Stream by the U. S. Coast Survey, his self-registering tide-gauge, and his immersed hydrometer, deserve especial mention. D. at Washington, D. C., of paralysis, Oct. 26, 1873.

G. C. SIMMONS.

**Saxton** (RUFUS), b. in Deerfield, Mass., Oct. 19, 1824; graduated from the U. S. Military Academy July 1, 1849, as brevet second lieutenant of artillery, his first service being in Florida against the hostile Seminoles; from 1855 to 1859 was on Coast-Survey duty, and for a year was assistant instructor of artillery tactics at West Point. On the outbreak of war he was stationed at St. Louis, and participated in dispersing the Confederate force at Camp Jackson, May 10, 1861; appointed assistant quartermaster U. S. army May 13, 1861, he served on the staff of Gen. Lyon as chief quartermaster until transferred in July to the staff of Gen. McClellan in West Virginia. In September he accompanied the expedition to Port Royal, S. C.; appointed brigadier-general U. S. volunteers in Apr., 1862, he commanded at Harper's Ferry when threatened by Jackson; assigned to duty as military governor of the department of the South July, 1862, where he was engaged in

organizing negro laborers and troops, and as commissioner of the Freedmen's Bureau until Jan., 1866, when he was mustered out of the volunteer service; brevet major, lieutenant-colonel, colonel, and brigadier-general. In 1872 he became deputy quartermaster-general U. S. army, with rank of lieutenant-colonel.

**Saxton's River,** p.-v., Rockingham tp., Windham co., Vt., on the river of the same name.

**Say** (Jean Baptiste), b. at Lyons Jan. 5, 1767; was educated for a commercial career, and spent a part of his youth in England; found employment on his return to Paris on Mirabeau's paper, *Courrier de Provence*, and afterward as secretary to Clavière, minister of finance; edited from 1794 to 1800 *La Décade;* became a member of the tribunate in 1799; published his celebrated *Traité d'Économie politique* in 1803, and enjoyed already a great reputation when his thorough disagreement with Napoleon's policy compelled him to retire into private life. He established a large spinning-mill, and published in 1812 *De l'Angleterre*, and in 1815 *Catéchisme d'Économie politique*. After the fall of Napoleon he again took an active part in public life, and was appointed professor at the school of Arts et Métiers in 1819, and at the Collége de France in 1831. D. at Paris Nov. 15, 1832. His lectures, which gathered large and appreciative audiences, were published 1828–30 under the title *Cours complèt d'Économie politique*, and after his death some minor essays, *Mélanges et Correspondances* (1833).

**Say** (Thomas), b. at Philadelphia, Pa., July 27, 1787, son of a druggist and bred to that business, from which he withdrew in consequence of pecuniary losses and devoted himself to natural history; became an intimate friend of William Bartram, the naturalist; was one of the founders of the Philadelphia Academy of Natural Sciences Mar. 21, 1812; was first curator of that body, living for several years in its museum at an average cost for food of not above twelve cents a day; was one of the leading contributors to the *Journal* published by the academy; accompanied Messrs. Maclure, Peale, and Ord in their scientific exploration of the islands and coasts of Georgia and East Florida 1818; was chief zoologist to Major Long's expeditions to the Rocky Mountains 1819–20, and to the sources of St. Peter's River 1823; published *Astronomical and Meteorological Records and Vocabularies of Indian Languages* (Philadelphia, 1822); supplied material for James's and Keating's accounts of Major Long's two expeditions, and wrote the zoology for the latter book (1824); issued his principal work, *American Entomology*, in 3 8vo vols. beautifully illustrated (Philadelphia, 1824–28), describing here and in his other works probably a greater number of new species of insects than were ever discovered by any other single naturalist up to that period; was chosen a member of the Linnæan and Zoological societies of London; contributed numerous articles to the *Transactions* of the Philosophical Society, to the publications of other scientific bodies, and to *Silliman's Journal;* removed with Maclure and Owen to New Harmony, Ind., 1825; remained there after the separation of his associates, acting as agent of the property of that unfortunate socialistic experiment; published at New Harmony 7 numbers of a great work on *American Conchology* (1830–34), with colored plates by Mrs. Say. D. at New Harmony Oct. 10, 1834. His *Complete Writings on the Conchology of the U. S.* were edited by William G. Binney (New York, 8vo, 1858, with 75 colored plates), and his *Complete Writings on the Entomology of the U. S.* were collected and issued by Dr. John L. LeConte (New York, 2 vols. 8vo, 1859, with 54 colored plates), the latter work being preceded by a *Memoir* of the author from the pen of his early associate, George Ord, originally read before the American Philosophical Society Dec. 19, 1834. A *Biographical Sketch of Thomas Say*, delivered before the Academy of Natural Sciences by Dr. Benjamin H. Coates Dec. 16, 1834, was published in Waldie's *Select Circulating Library* (vol. v., 1835), and another memoir may be found in the *National Portrait Gallery*, vol. iv. It was asserted in the obituary notice which appeared in *Silliman's Journal* that Mr. Say had "done more to make known the zoology of his country than any other man." Porter C. Bliss.

**Say'brook,** p.-v. and tp., Middlesex co., Conn., on Long Island Sound, at the mouth of Connecticut River, on the Shore Line division of New York New Haven and Hartford R. R., at its junction with Connecticut Valley R. R., has a fine hotel, is a noted place of summer resort, and celebrated as the original seat of Yale College and for the ecclesiastical council which promulgated the "Saybrook Platform." P. 1267.

**Saybrook,** p.-v., Cheney's Grove tp., McLean co., Ill., on Decatur and State Line R. R. P. 389.

**Saybrook,** p.-v. and tp., Ashtabula co., O., on Lake Shore and Michigan Southern R. R. P. 1421.

**Saylor,** tp., Polk co., Ia. P. 1007.

**Sayre** (Lewis Austen), M. D., b. in Madison, N. J., Feb. 29, 1820; his grandfather was a deacon, and served as quartermaster under Gen. Washington. At the age of ten young Sayre was taken to Lexington, Ky., where he was adopted by an uncle; entered the University of Transylvania; graduated there in 1837; having selected the medical profession, in 1839 he entered the office of Dr. David Green in New York City; in 1842 took the degree of M. D. in the College of Physicians and Surgeons; his first appointment was prosector to Prof. Willard Parker; appointed resident physician in 1859 by the mayor of New York, and soon after was elected professor of orthopedic surgery in the Bellevue Hospital Medical College, which he still holds, the first chair of the kind created in the U. S.; in 1852 first exsected the head of the os femoris and portion of the acetabulum with success—an operation he has now performed oftener than probably the whole profession besides. Dr. Sayre is the author of several monographs on orthopedic surgery, and stands at the head of the treatment of deformity in this country. Paul F. Eve.

**Sayre** (Nathaniel C.), b. and educated in New Jersey; was admitted to the bar; moved to Sparta, Ga., in 1820; was elected solicitor-general of the northern circuit; for a number of years was elected to the legislature, either to the house or senate; was promoted to the bench in his circuit 1845. D. at Sparta in 1854. As a lawyer and legislator he did much in the legislative halls for the improvement of the judiciary system of the State.

Alexander H. Stephens.

**Sayre** (Stephen), b. on Long Island, N. Y., in 1734; graduated at Princeton 1757; became a successful merchant and banker in London, of which city he was chosen sheriff 1774; was intimately connected with Lord Chatham and other friends of the American colonies; was imprisoned in the Tower on a charge of high treason in consequence of unguarded language; was soon released, but had already suffered the ruin of his business interests; was employed by Dr. Franklin and Arthur Lee in their important negotiations with European courts; returned to the U. S. after the peace of 1783, and was an active political opponent of Washington's administration. D. in Virginia Sept. 27, 1818.

**Say'ville,** p.-v., Islip tp., Suffolk co., N. Y. (Long Island), on South Side R. R. P. 1200.

**Scab** [Lat. *scabies*], a disease of sheep much resembling the itch which sometimes afflicts the human species. Like that disease, it is caused by the presence of a minute acarus or spider-like mite. Sulphur ointment, arsenical washes, tobacco-water, and mercurial ointments are all useful, and the disease can generally be cured without difficulty. It may be suspected when the sheep rub themselves much or have bare and scurfy patches upon the skin.

**Scabaritic Disease.** See Scabies.

**Scab'bard-Fish,** a name given to the *Lepidopus argyreus*, a species of the family Trichiuridæ, distinguished by the elongated, ribbon-like body, pointed head, formidably-armed mouth, elongated dorsal and anal, and well-developed and forked caudal fin. The species is an open-sea fish, and rather rare on the coasts of Europe. (See also Trichiuridæ.) Theodore Gill.

**Sca'bies** [Lat.], or **Itch,** is a parasitic disease of the skin. It affects chiefly the hands, more especially the webs of the fingers, their inner surfaces, and the back of the hand. Less frequently it extends to the arms, and rarely the feet, legs, and abdomen are affected. The scalp may be invaded, but the face is exempt. This disorder infests children, who receive the peculiar insect from person to person by contact in school or play, and its lodgment is facilitated by neglect to wash perspiration and dirt from the hands. Persistent and annoying itching is experienced; careful inspection detects small red elevations, points of irritation, papular at first; soon these become vesicular or watery at the tip, white-capped points, and often from scratching are rendered pustular, and later scaly. Closer inspection discloses small red lines connecting these vesicles or branching from them into adjacent healthy skin. These red lines are subcuticular channels, produced by the burrowing of the itch-insect beneath the cuticle or scurf-skin, and the vesicles are the result of inflammation to which its presence and irritation have given rise. The insect will not be found in the fluid or cavity of the vesicle, but by laying open the diverging canals with a fine needle may often be found at its end. This parasitic insect is known as the *Acarus scabiei*, or *Sarcoptes hominis*. It is a minute, whitish insect, from $\frac{1}{100}$th to $\frac{1}{50}$th of an inch long. The male is least often found, being migratory in his habits, and small. His head is provided with two mandibular organs and four palpi or bristles; the adult

male has eight legs. The female is sedentary in habits, and more easily found, especially at the ends of channels, where she lays her eggs. The acarus makes its progress beneath the epidermis by means of suckers or disks upon its legs, and by aid of bristles upon its back, directed backward. Hahnemann ascribed itch to a supposititious cause, a subtle humor, which he termed *psora;* but the microscope has established the parasitic nature of the disease. The treatment of scabies is to kill the parasites. Remedies producing this end are termed parasiticides. Chief among these is sulphur, in ointment, powder, or vapor. Sulphurous acid is a convenient application. Carbolic acid, kerosene, petroleum, strong alkalies, solution of corrosive sublimate are also efficacious. Even when cured as a specific disease, the redness and vesicles may linger, a chronic condition of irritation. Soothing ointments are then indicated. E. Darwin Hudson, Jr. Revised by Willard Parker.

**Scad,** a name given in some parts of England to the *Trachurus trachurus* (otherwise called horse-mackerel), a fish of the family Carangidæ, distinguished by its elongated, fusiform body, completely plated lateral line, and silvery color. When fresh it is scarcely edible, but it takes salt well, and when pickled is very good. Immense quantities are taken in the British seas. The name has been also extended to congeneric species, as well as to species of like form belonging to the genera *Trachurops* and *Decapterus*.

**Scæv'ola,** a cognomen common among the members of the plebeian family of the Mucii in ancient Rome, signifying, according to Varro, an "amulet." The two most prominent members of the family were Quintus Mucius Scævola, the Augur, and Quintus Mucius Scævola, the Pontifex, both celebrated as jurists, and nearly contemporary. The former, the augur, was *tribunus plebis* in 128 B. C., prætor in 121, consul in 117, and d. soon after the outbreak of the war between Marius and Sulla. Cicero, who was born in 106 B. C., states that after putting on the toga virilis he was taken by his father to Scævola to be instructed in law, and that he remained in close attendance upon him until his death. The latter, the pontifex, was *tribunus plebis* in 106 B. C., and consul in 95. He was afterward *pontifex maximus*, and during a riot in Rome in 82 between the parties of Sulla and Marius sought refuge in the temple, but was slain by the Marians before the altar. He did not give direct instruction in law, but allowed young men to be present when he gave his *responsa* to his clients. After the death of the augur, Cicero attached himself as a student to him. —The surname *Scævola* was also given to a legendary hero in the Roman history, Caius Mucius, a patrician, at the close of the sixth century B. C. When Porsenna besieged Rome, Scævola penetrated his camp and killed one of his attendants, whom he mistook for the king. Seized and brought before Porsenna, he confessed that he was one of 300 young Romans who had sworn to free Rome from its dangerous enemy by killing him; and when Porsenna threatened to burn him alive if he did not mention the names of the other conspirators, he thrust his right hand into the fire and held it there till it was consumed. Hence the surname *Scævola*, "the left-handed."

**Scafati,** Italy. See Appendix.

**Scaglio'la** [It. dim. of *scaglia*, a "scale"], an imitation of marble, made by mixing ground gypsum with glue, coloring it, applying it to the surface to be marbleized, and setting into the soft mass, if it be desired, bits of various ornamental stones. When hard the surface is smoothed and polished. It is an admirable imitation of the more costly marbles, but is not durable, especially in damp places.

**Sca'la** [Lat. *Scaligeri*], the name of a celebrated Italian family which reigned in Verona from 1260 to 1387. The name first occurs in the history of Verona in the middle of the eleventh century, and after a long series of internal disturbances, tyranny alternating with anarchy, Mastino della Scala succeeded in 1260 in making himself master of the city. He ruled with firmness and wisdom; the city prospered, and, although he was assassinated in 1279, the power continued in his family for more than a century. Under Cangrande (1311–29) the fortune of the family culminated. He was confirmed in his possessions, to which were added Vicenza, Padua, Treviso, etc. by the emperor Henry VII. At his court lived Dante, and many of the most magnificent architectural monuments of the city were erected during his reign. But most of his successors, Cangrande II., Paolo Alboino, and others, were worthless and infamous tyrants, and in 1387, Galeazzo Visconti of Milan expelled Antonio della Scala. The male line of the family, which flourished in Bavaria under the name of Scaligeri, became extinct in 1598; the female is still flourishing in the families of Dietrichstein and Lamberg.

**Sca'la No'va,** town of Asiatic Turkey, eyalet of Aïdin, on an inlet of the Ægean Sea, has a good harbor and some trade. P. about 10,000.



**Scalars.** See Quaternions, by J. M. Peirce.

**Scald.** See Burns and Scalds.

**Scale** [Lat. *scala*], a mathematical instrument used in plotting and in other branches of applied geometry. It consists of a slip of wood or other material divided into parts in accordance with some mathematical law. The ivory ruler ordinarily furnished by the instrument-maker has a great variety of scales stamped on its faces, of which the *scale of equal parts* and the *scale of chords* are of most frequent use.

*Scale of Equal Parts.*—This consists of a number of inches, or aliquot parts of an inch, laid off along a line. The first part, counting from the left, is subdivided into ten equal parts, the 0 of the scale being at the beginning of the second part. The *principal divisions* are numbered from the 0 toward the right, and the *subdivisions* toward the left. This scale is used, in connection with a pair of dividers, for laying off and measuring the lines of a drawing.

*Scale of Chords.*—This scale is used for laying off and for measuring the angles of a drawing. It is constructed by laying off from the left-hand extremity of a given line the chords of all the arcs from 0° up to 90°, corresponding to some assumed radius. The extremity of each chord is marked by a corresponding number; the origin of the scale and the extremity of the chord of 60°, which is equal to the radius, are marked in a more conspicuous manner than the other divisions. To lay off an angle, the vertex and one side being given, take the chord of 60° as a radius, and from the vertex of the angle as a centre describe an arc cutting the given side; then from the point in which this arc cuts the side as a centre, with a radius equal to the chord of the arc corresponding to the given angle, describe a second arc cutting the first; join this point of intersection with the given vertex; the last line will make the required angle with the given side. The method of measuring an angle by means of the scale is obvious. W. G. Peck.

**Scale,** in music, the name applied to the regular series of sounds, or degrees on the stave, which form the gamut. The scale in its simplest form consists of seven steps or degrees, counted upward in regular order from a root or prime, to which series the eighth is added to complete the octave. By reverse motion the same notes form the descending scale; and by the addition of other notes above or below in a continuous order the scale may be extended to seven, eight, or more octaves. The *diatonic* scale is that which consists of the tones and semitones of the octave in their natural order and relation; as, for example, A, B, C, D, E, F, G, A. (For the origin of this scale see the article Gamut.) Of the diatonic scale, only two varieties are in use in modern music—viz. the *major* scale (or scale of the major mode), commencing on C; and the *minor* scale (or that of the minor mode), commencing on A. The major scale is complete in itself, requiring no modification of any of its intervals by accidentals, either in its ascending or descending form. The minor scale, on the contrary, is less perfect, and for the satisfaction of the ear the sixth and seventh degrees ascending require elevation by accidental sharps (or their equivalents). In the descending minor scale, however, these alterations are not so necessary, as the scale may either resume its natural form or retain the sharp only on the seventh. (See this fully explained in the article Mode.) The chief characteristic interval in both these scales is the *third*, which is one semitone greater in the major than in the minor. In ancient music several other diatonic scales were in use besides those here described, of which notice has already been taken under the head of Modes Ecclesiastical, to which article the reader is referred. As the diatonic scale comprehends within the octave five tones—viz. C–D, D–E, F–G, G–A, and A–B—and also two semitones—viz. E–F and B–C—it is evident that another kind of scale may be formed by dividing the five tones into ten semitones, thus producing the semitonic series which is known as the *chromatic* scale. The intermediate semitones of this scale may be expressed in writing either in sharps or flats, though the former are commonly used for the ascending scale and the latter for the descending. The further subdivision of the scale into quarter tones, forming the *enharmonic* scale, is of little practical importance, though recognized in theory and in certain progressions both in melody and harmony. On the greater number of modern instruments quarter tones cannot be produced; and all musical compositions are therefore written either on the diatonic or the chromatic scale.—The word Scale means also the entire range or compass of sounds producible by any given instrument, as the scale of the violin, flute, organ, or pianoforte. It is also applied by organ-builders to a graduated rule, plan, or scheme showing the lengths and diameters of the various pipes comprised in any "stop." In like manner,

the length and thickness of the strings of a pianoforte are regulated by a carefully-graduated scheme called the *scale;* hence the terms "new" or "improved" scale refer to changes adopted by manufacturers in regard to the length and thickness of the strings. WILLIAM STAUNTON.

**Scale of Numbers,** a conventional expression of the law of relation between units of different orders. There are two kinds of scales—*uniform* and *varying*. In the uniform scale a unit of any order is equal to a unit of the next lower order multiplied by a fixed number, called the *modulus*. In the varying scale the law which connects the successive units varies in passing from order to order. The uniform scale is used in writing abstract numbers, and, subordinately, in writing compound numbers; the varying scale is employed exclusively in writing compound numbers.

*Uniform Scales.*—In every uniform scale the abstract number 1 is assumed as the primary base, and this is called a unit of the first order. The unit of the $n$th order *ascending* is then equal to 1 multiplied by the $(n-1)$th power of the modulus; a unit of the $n$th order *descending* is equal to 1 divided by the $n$th power of the modulus. Furthermore, the order of any unit is indicated by the place which it occupies, the ascending and descending orders being separated by a point, as shown in the scheme below, in which $r$ is the modulus:

| Ascending. | | | | Descending. | | |
|---|---|---|---|---|---|---|
| $n$th order. | 3d order. | 2d order. | 1st order. | 1st order. | 2d order. | $n$th order. |
| $\ldots r^n \ldots,$ | $r^2,$ | $r,$ | $1.$ | $\frac{1}{r},$ | $\frac{1}{r^2},$ | $\ldots \frac{1}{r^n} \ldots$ |

As an illustration, let $r = 10$; the resulting scale is then called the *decimal* scale. In this scale, which is our ordinary uniform scale, the number of units of any order is denoted by one of the Arabic digits, and the order of the unit is expressed by the place which it occupies in the scale. Thus, the number 234.7 is equal to 2 units of the third order, or 200, *plus* 3 units of the second order, or 30, *plus* 4 units of the first order, or 4, *plus* 7 units of the first descending order, or 7 *tenths;* this, in the abbreviated language used in reading numbers, is equivalent to *two hundred and thirty-four* and *seven-tenths*. Other uniform scales have been used for special purposes, but they are of little importance except as matters of curiosity. If the modulus is 2, the corresponding scale is said to be *binary;* if it is 3, the scale is *ternary;* if 4, the scale is *quaternary;* and so on. If the modulus is 12, the scale is *duodenary* or *duodecimal*. The last-named scale in a modified form is used somewhat in computing areas and volumes when the linear unit is one foot. (For the method of using this modified form the reader is referred to Peck's *Complete Arithmetic,* pp. 299–302.)

*Varying Scales.*—In expressing compound numbers the order of any unit is indicated by a proper conventional symbol, and the value of the unit of each order in terms of the unit next higher, or next lower, is written in a table. Thus, the principal units used in expressing British currency are *pounds, shillings, pence,* and *farthings* or *quarters;* these units are denoted respectively by the symbols £, *s.*, *d.*, and *qrs.* Taken in an ascending order, 4 units of the first order make 1 of the second, 12 of the second make one of the third, and 20 of the third make one of the fourth. The numbers, 4, 12, 20, written with intervening commas, constitute the *ascending* scale, and the numbers 20, 12, 4, similarly written, constitute the *descending* scale, of British currency. In like manner, the numbers 16, 25, 4, 20 express the *ascending,* and the numbers 20, 4, 25, 16, the *descending,* scale of avoirdupois weight. It is to be observed that the scales of compound numbers in the *metric system,* now coming into use in many countries, are essentially *decimal.* W. G. PECK.

**Scale of a Series,** a conventional method of indicating the law of formation of the successive terms of a series after a sufficient number of leading terms have been obtained. (An illustrative example, showing the character of such a scale and the method of application, is given under the title RECURRING SERIES.) W. G. PECK.

**Scales.** See BALANCE, by PRES. F. A. P. BARNARD, and WEIGHING AND WEIGHING-MACHINES, by PROF. J. A. WHITNEY.

**Scales,** of fishes. See COMPARATIVE ANATOMY, by PROF. E. D. COPE, A. M., M. N. A. S.

**Scales Mound,** p.-v. and tp., Jo Daviess co., Ill., on Illinois Central R. R. P. 748.

**Scal'iger,** the name of two famous scholars, father and son. (1) JULIUS CÆSAR, b. Apr. 23, 1484, at Padua, the son of Benedetto Bordone, a miniature painter who assumed or received the name DELLA SCALA from the street in which he lived; studied medicine in his native city; lived subsequently for some time at Venice; settled finally at Agen, department of Lot-et-Garonne, France, in 1529, as physician to the bishop of the diocese; married into a noble and wealthy family of the vicinity. D. there Oct. 21, 1558. He attained a great reputation both as a scholar and as a poet, and several of his works are still of interest, such as his commentaries on Hippocrates, *De Insomniis* (1538); Aristotle, *De Plantis* (1556); Theophrastus, *De Causis Plantarum* (1566); and his grammatical work, *De Causis Linguæ Latinæ* (1540). But he was exceedingly vain and irritable. He fabricated a genealogy to prove that he descended from the Della Scalas of Verona, and invented an autobiography corresponding to this dignity. Both Cardanus and Erasmus covered him with ridicule.—(2) JOSEPH JUSTUS, the tenth son of Julius Cæsar, b. at Agen Aug. 4, 1540; received an excellent education; travelled extensively; was appointed professor of belles-lettres at Leyden in 1593. D. there, unmarried, Jan. 21, 1609. His learning was immense. He spoke thirteen languages and read many others with facility; the Greek poets he knew by heart. He more especially devoted himself to the science of chronology, and his *De Emendatione Temporum* (1583) and *Thesaurus Temporum* (1606) have great merits. But he was, if possible, still more arrogant and conceited than his father, and his *Epistolæ* (1627) and the two volumes *Scaligerana* (Gröningen, 1659, and Copenhagen, 1667) give very curious proofs of these faults.

**Scal'lop** [O. Fr. *escalope*], a name given to various species of the family Pectinidæ, all of which agree in having a suborbicular shell, which is more or less equivalve and provided with ear-like expansions from the enlarged hinge, which is itself nearly straight. The species are numerous, and the animals of many are used to a greater or less extent as food. The common scallop of the New York markets is the *Pecten concentricus,* whose shell has about twenty diverging ribs, and which is of a dusky horn-color, with alternating lighter and darker zone-like areas: it generally attains a length and height of between two and three inches. It is quite common along almost the entire coast S. of Cape Cod. Only the large median abductor muscle is used as food. THEODORE GILL.

**Scalp** [Lat. *scalpere*], the outer covering of the top of the human head, consisting of the hairy integument, the flattened tendon of the occipito-frontal muscle, and subcutaneous cellular tissue. Wounds of the scalp are peculiarly liable to take on an untoward kind of inflammation, and their treatment requires great care. The removal of the scalp of a dead (or even a living) enemy as a signal of triumph is one of the customs of many tribes of North American Indians.

**Scaly Ant-Eater.** See ANT-EATER.

**Scaman'der,** a stream in the plain of Troy, of which Homer says that it was called *Xanthus* by the gods, but *Scamander* by men. It is probable, however, that it received the name Xanthus from the yellow or brownish color of its water, which was believed to have the power of dyeing the wool of sheep which drank of it. The discrepancies between the statements of Homer concerning this river and those of later writers, such as Strabo, Pliny, Pomponius Mela, and Ptolemy, are probably due to the great changes in the configuration of the coast which took place on account of the heavy deposits at the mouth of the river. A mistake seems also to have been made between the river itself and a canal which connected its bed with the sea at a point above its junction with the Simois, and which is still navigable for small barges.

**Scam'mony** [Gr. σκαμμωνία], a cathartic drug obtained from *Convolvulus scammonia,* a twining plant of the natural order Convolvulaceæ, indigenous in Greece, Syria, Anatolia, and Southern Russia. The root of this convolvulus contains a milky juice, which, collected from the cut surface of a fresh root, dries into a slate-colored lump, hard and brittle, and constitutes the drug in question. But at the time of collection the juice is much adulterated, so that scammony varies greatly in purity. The purest quality is called *virgin* scammony. The active principle of scammony is a resin, which may be used in medicine instead of the crude drug. Scammony has been known from a remote period. It is a powerful drastic cathartic, and in overdose is capable of exciting dangerous inflammation. Its principal advantage is the fact that an emulsion of the drug is nearly tasteless, but it is very seldom used except in combination with other purgatives. Resin of scammony is an ingredient of the U. S. compound extract of colocynth and compound cathartic pill. EDWARD CURTIS.

**Scan'derbeg,** whose true name was GEORGE CASTRIOT, was b. at Croia about 1410, a son of the Christian prince

John Castriot, who ruled as chief one of the many Albanian districts. George was the youngest of four brothers, who were all delivered up as hostages to Amurath II. in 1423 when he invaded Epirus and made John Castriot a tributary. The three elder brothers died by poison, but the sultan became so fond of George on account of his beauty and brightness that he had him educated in Islamism as his own son, and gave him the name of ISKANDER BEG ("Prince Alexander"). While yet a youth he distinguished himself greatly in the Turkish wars in Asia, but when in 1432, on his father's death, Amurath II. incorporated the principality as a Turkish province, the young man felt deeply offended and began to dream of vengeance. In 1443 he invaded Hungary as second in command of a great Turkish army. The first battle was lost, or rather Scanderbeg gave the victory to Johannes Hunyady, and fled during the confusion of the defeat with a few followers to Croia, having previously procured from the secretary of the sultan, whom he slew immediately after to escape discovery, an order according to which the Turkish commander of Croia was to cede his power to the bearer of the letter. By this stratagem he came into possession of the principal fortress of the country. He now abjured Islamism and called his countrymen to revolt against the Turks. The whole country responded and arose; all the Albanian chiefs declared themselves willing to follow him and pay him tribute; and with an army of 15,000 men he marched out to meet the Turkish army of 40,000 which the sultan had sent against him. He gained a brilliant victory, and other still more brilliant victories followed soon after. Amurath himself, who invaded Albania at the head of an army of 100,000 men, was defeated and repelled, and Mohammed II., who succeeded him in 1450, had no better luck, though several Albanian chiefs, wearied by the continual war, left Scanderbeg, and even joined the Turks. By the truce of 1461 he kept his paternal heritage. In the following year he went to Italy to aid the pope, who had formerly aided him against John of Anjou, and here he gained the great battle of Troja (1462). But the pope persuaded him to break the truce with the Turks, and immediately after his return home the war against Mohammed recommenced. Again the Turks were worsted in several great battles; Scanderbeg defeated them in all twenty-two times. But on Jan. 17, 1467, he d. in Lissa, and, although the Albanians continued the war, the spell was broken, and the country finally subjugated by Mohammed II. Scanderbeg's *Life* was written by his friend, Marinus Barletius (Frankfort, 1537), and by Dr. C. C. Moore (New York, 1850).

**Scandiano,** Italy. See APPENDIX.

**Scandina'via,** known to the ancient Romans under the name of **Scandia** or **Scandinavia,** a name which probably originally belonged to Skone alone, the southernmost part of Sweden, consists, according to purely physical features, of Norway, Sweden, and Finland. An arm of the White Sea, running through to the Gulf of Finland, formerly separated Finland from the plains of Russia, and this epoch is probably not so very distant, as in the peninsula of Finland a process of upheaval is still going on, amounting to about four feet in a century. Political circumstances have connected Finland with Russia, and the name *Scandinavia* now generally means simply that peninsula which, comprising Sweden and Norway, stretches between lon. 5° (entrance of Sognefjord) and 30° 50′ E. (Vardöhns at the entrance of Varangerfjord), and between lat. 55° 20′ (Falsterbo) and 71° 11′ N. (North Cape in Magerö). The isthmus which connects Scandinavia with Finland is 70 geographical miles broad; at all other points the country is surrounded by the sea—N. by the Arctic Ocean, W. by the Atlantic, S. by the North Sea, which communicates with the Baltic through Sagerrak, Kattegat, and the Sound, and E. by the Baltic. The length of the coast-line amounts to 600 geographical miles when considered as a straight line, and in reality to about four times as much. The area amounts to 1500 geographical sq. m., of which 8078 belong to Sweden, 5751 to Norway, and the rest to Russia, which stretches over the isthmus into the peninsula. The coast formation presents great varieties. The northern and western coasts are rocky and steep. The walls of the mountains which traverse the peninsula from the North Cape to Lindenæs rise immediately and nearly perpendicularly out of the sea, which enters the long, narrow, deep, fissure-like valleys (*fjords*), carrying the largest vessels far into the interior of the country. The entrances to these fjords are generally girded by a multitude of larger and minor rock-islands, the so-called *Skärgaard*. Sognefjord and Hardangerfjord are the two largest and most beautiful fjords of the whole coast; the North Cape, a steep wall of rock 1200 feet high, one of the most striking points, and Lofoten, a group of islands, noticeable as the principal scene of the Norwegian fishery. The climate is so mild, on account of the presence of the Gulf Stream, that up to North Cape no harbor freezes. The southern coast, from Stavanger to Christianiafjord, shows a similar formation, but is less rich in fish; on the other side of Christianiafjord the fjord formation ceases, but the steepness and the Skärgaard continue, though on a smaller scale. The eastern coast stretches for 160 geographical miles to the N. nearly in a straight line, and here the harbors are generally situated at the mouths of the rivers. With respect to its surface formation, the peninsula consists of two divisions, of which the one comprises that part of Sweden which stretches to the S. of a line drawn between the lakes of Mälar and Venern. This region contains in its centre a low mountain or hill land, whose middle elevation is indicated by the level of Lake Wetter, 272 feet above the sea. The highest point of this mountain-district is Taberg, 1032 feet high, and rich in iron. The plains which extend to all sides are fertile, though in many places the bottom rock looks through the thin layer of vegetable earth, and numberless erratic boulders, often of enormous dimensions, are scattered all around. Extensive forests and lakes occupy the rest of the surface. In general, this part of Scandinavia bears the character of lowland. The other division, on the contrary, comprises the mightiest mountains of Europe, not equalling the Alps in elevation, but covering nearly double the area. The Scandinavian mountains form a continuous plateau without any chain formation. To the W. this plateau breaks off so abruptly that no large river could be formed, and the watershed is nowhere more than 10 geographical miles distant from the Atlantic; while to the E. it slopes down gradually through a number of terraces to the coast-plains of the Bothnian Gulf, which generally are about 10 geographical miles broad and covered with forests and swamps. This terrace formation is especially apparent in the courses of the rivers, which generally expand into long lakes, and then pass on over the edge of the terraces in falls and rapids. The watershed is everywhere elevated far above the tree-line, and especially around Hardangerfjord and Sognefjord it bears extensive snowfields, from which magnificent glaciers descend, often close to the Atlantic. It consists of vast plateaus (*fjeld, heidi,* or *widder*), which in the northern part are called kjölen; they are covered with meagre pastures or swamps, and here and there single peaks arise, called *hauba, kaabe,* or *tind.* The valleys are narrow and deep, often cut into the plateau like glacier-fissures, and entirely without lateral depressions or passes—a circumstance which makes the interior communication exceedingly difficult. In consequence of this surface formation the population is not gathered into villages, but scattered in single houses throughout the narrow valleys. The average elevation of the Scandinavian mountains ranges in the N. between 1000 and 2000 feet; nor are the peaks so very high, Sulitelma, the highest, reaching only 5796 feet. Farther to the S., however, the elevation increases. In the Dovrefjeld, across which the road leads from Christiania to Trondhjem, the average elevation amounts to 3000 feet; the highest point of the road reaches 3726 feet; the snow-line descends to 5000 feet; and the highest peak, Sneehättan, rises 7099 feet. To the S. W. of Dovrefjeld stretch Jötunfjeld and Hardangerfjeld, with an average elevation of 4000 to 5000 feet, and here the highest peaks rise close to the sea, such as Store Galdhöpiggen, 8017 feet. Farther to the S. the mountains gradually decrease; the average height of Byddefjeld is only 3000 feet. The Scandinavian mountains are rich in useful minerals. There is very little coal, but the iron ore is inexhaustible, and the Scandinavian iron is of excellent quality. Copper is found in Sweden at Falun, and in Norway at Röraas; silver in Sweden at Sala, and in Norway at Kongsberg. The main body of the rock consists of granite, the upper layer often of mica-schist. On the southern coast of Norway zircon-syenite appears in considerable extension, besides various kinds of porphyry. On the north-western and southern coasts of Norway graywacke, lime, clay, and flint-slate are found; Tertiary rocks appear only in Skone, and here alone coals are found. The water-supply of the country is extraordinarily rich; an area of more than 1000 geographical sq. m. is covered with lakes, swamps, and rivers. The south-eastern slope of the mountains sends numerous parallel rivers to the sea. The Torneå-Elv, with the Muonio, communicating with the Kalix; the Luleå, Piteå, Umeå, and Angermann Elv; also the Dal-Elv, the largest river of Sweden, formed by two arms, run in a south-eastern direction to the Baltic. From the southern slope of the mountains comes the Klara-Elv, issuing from the Fœmund Lake, and entering the Venern Lake. After leaving this lake it receives the name of Göta-Elv, and on its way to the Kattegat it forms several falls, of which the Trollhättan is the most remarkable; an immense canal carries vessels by it. The Glommen, which forms the largest river-system of Scandinavia, rises in the vicinity of Röraas, expands at various places into lakes,

and forms near its mouth, at Frederikstadt, the fall of Sarpfoss; its largest affluent is the Longen. Between the Dovrefjeld and the plateaus around Sognefjord is situated the small lake of Lessö, at an elevation of 1930 feet. From it issue to the W. the Rannea, which falls into the Moldefjord, and to the S. E. the Longen, which rushes down into the deep Guldbrand's Valley, expands into the Mjösen, the largest lake of Norway, and assumes the name of Vormen. The rivers of the southern, and especially of the western, coast are insignificant. The largest lakes of Sweden are the Venern (94.78 geographical sq. m.), the Wetter (33.68), and the Mälar (22.23). The climate presents great differences, caused by the extension from N. to S. and by the higher elevation of the surface to the W. On the W. coast the annual rainfall amounts to 80″, in Stockholm to 18′; here the winter is mild and the summer cool, while in the interior the climate has a more continental character. In Bergen, January shows a middle temperature of + 1° 3′ and July of + 12° 6′, while in Christiania, January shows a middle temperature of — 5° 0′, and July of 13° 0′, and in Falun, January — 6° 1′, July + 13° 0′.

The oldest part of the population consists of Lapps and Finns, who came from Finland across the isthmus and penetrated as far as the reindeer led. They confined themselves to the N. and the plateaus of the S.; into the fir forests then covering the valleys and plains the animal did not descend. Later, a Germanic immigration took place, partly through Denmark, partly across the Baltic. Under violent struggles the Lapps and Finns were driven back, and this movement is still going on, somewhat in the same manner as in the North American backwoods. In the rough climate the Germanic tribes developed into audacious warriors and pirates. They were governed by a number of petty kings, who often made war upon each other, but also often united and undertook extensive campaigns to foreign countries. The Norwegian tribes, the Normans, became famous in history by their conquests in the period from the ninth to the eleventh century. The Swedish pirates were called Wäringer or Warägen; they appeared in Constantinople in 1043. Christianity met with great opposition in the country. It was first preached among the Swedes in 829 by a Danish monk, Ansgar. In Norway it began to spread under Harald Haarfagre in the beginning of the tenth century, and it was thoroughly established in the country under Olaf Trygveson and St. Olaf, who died in 1033. Contemporary with the introduction of Christianity the union of the many petty kingdoms began to take place, and two empires, Norway and Sweden, were established. The language of the people was originally one, represented by a most remarkable literature, and still living in Iceland, but it afterward branched off into two, Swedish and Danish.

AUGUST NIEMANN.

**Scandinavia,** p.-v. and tp., Waupaca co., Wis. P. 1065.

**Scandina'vian Mythol'ogy** found its earliest and most authentic representations in the two Eddas, of which the elder consists of weird old songs compiled by Sæmund Sigfusson Frode (1054–1133); the younger, of prose pieces, generally ascribed to Snorre Sturleson (1178–1241). Both of these two sources originated in Iceland. They are consequently of Norwegian descent, and there are traces of a difference between the Norwegian, the Swedish, and the Danish conceptions of that mythology, which in its general features was common to them all. The difference seems, however, to have arisen simply from the circumstance that in certain localities a preponderance was given to certain myths, as we find to be the case in Greece. But a much deeper difference existed between the mythology of the Scandinavian people and that of the kindred race in Germany, though it is impossible to demonstrate this difference in details on account of the entire lack of authentic German sources. The most prominent among modern writers on Scandinavian mythology are A. Munch, *Nordmændenes Gudelære, i Hedenold* (Christiania, 1847); Keyser, *Nordmændenes Religionsforfatning i Hededommen* (Christiania, 1847); N. F. S. Grundtvig, *Nordens Mythologie* (Copenhagen, 1808 and 1832); N. M. Petersen, *Nordisk Mythologi* (Copenhagen, 1849); Jakob Grimm, *Deutsche Mythologie* (Göttingen, 1835).

The cosmogony of the Scandinavian mythology is obscure and vague when compared with that of the Greeks. Its ideas are grotesque when they are grand, and narrow when they are really suggestive and clear. Instead of the Greek Chaos, into which order entered by the separation between heaven and earth, the Scandinavians began from the contracted conceptions of a North and a South, between which an abyss (*ginnunga gap*) expanded. The sparks from Muspelheim, the land of fire, reached the ice-needles which trickled down from Niflheim, the land of frost, and from this contact originated life in the form of an immense giant, Ymer, the father of the evil race of the Jotuns. Another living being was also called into existence by this primitive process of the elements, the cow Audhumbla, who produced Buri by licking the salty ice of Niflheim. From Buri descended the three brothers, Odin, Vili, and Ve, who slew Ymer and built the world from his corpse. Of his blood, in which all the Jotuns were drowned with the exception of one couple, they made the ocean; of his skull the sky, on which sparks from Muspelheim were fixed as stars; of his brains, the clouds; of his bones, the mountains; of his flesh, the earth; of his hairs, the forest, etc. The Jotuns, the evil race, were thrown down to Utgard. Loki was their chief. The Asers (*æsir*), the gods, ascended to Asgard, where they lived in Odin's splendid palace, Walhalla. In the middle Odin built Midgard from the eyebrows of Ymer, and created the first two human beings, Askar and Embla. This whole world-fabric was sustained by the sacred ash tree, Ygdrasil, at whose root sat the three goddesses of destiny, *nornir*, Urd (what is completed and has passed), Verdhandi (what is just now being born), and Skuld (what shall be in time to come).

The ideas which the Scandinavians entertained with respect to that which would take place after death and at the end of the world are much more distinct and impressive. They believed firmly in the immortality of the soul, or rather in a future life; and this belief formed the fundamental rule for their whole moral conduct. He who was brave and fell on the battle-field was led by the Walkyries to Walhalla, where he lived, together with the gods and the heroes, in great enjoyment. But he who was a coward and died on the straw-sack would be thrown down into Helheim, the realm of shadows, where Hel reigned, the daughter of Loki, more blue than flesh-colored, and with vipers crawling around her skull. These ideas bore absolute sway over the life of the ancient Scandinavian people—not so much because they represented moral ideals, arrived at after long observation of life and deep pondering over its meaning, as because they expressed the ruling passions of the race. Life in Walhalla was simply a continuation and glorification of life on earth. But, singularly enough, the ancient Scandinavians did not believe that Walhalla would last for ever. Although there are evident traces of influence from Christianity in the form in which the ideas of the fall of the Asers have come down to us, there must, nevertheless, have been an opening for such an influence in the original system; and it is probable that the old doctrine of the norns at the root of all existence has formed the links of connection or transition.

With Odin (Ang.-Sax. *Wodan*, whence Wednesday) and his wife Frigg (whence Friday) in Asgaard there lived Thor (whence Thursday), the god of the thunder, who had a girdle around his loins which doubled his strength when he tightened it, a hammer in his hand with which he cleft the mountains and crushed the Jotuns, and a carriage which was heard through the whole world when he drove it over the sky; Tyr (whence Tuesday), the god of war, with an artificial hand of iron, having lost the natural one in a wager with Loki; Heimdal, who stood on the rainbow watching the entrance to Asgaard, and who could hear the grass grow and see a thousand miles into the depth of the night; Freya, the goddess of beauty and love, who drove a span of doves and made all plants blossom when she looked at them; Ægir, the god of the sea; Bragi, the god of poetry; Frey, the god of the winds; and others. Loki, the principle of evil, was by descent a Jotun, but on account of some mysterious transactions with Odin at the beginning of time he had access to Walhalla, where he did all the mischief he could; he was the cause of its fall. It was foretold that if Baldur, the son of Odin and Frigg, died, the Asers would perish. Warned by bad dreams, Frigg went around and asked everything to swear that it would do Baldur no harm. The rocks, the sea, the clouds swore; all things, living and lifeless, took the oath. Only the mistletoe was forgotten. Loki knew it, grasped the tree, and made a spear of it. Meanwhile, in Walhalla the gods determined to try the power of the oath. Thor threw his hammer against Baldur, Tyr hit him with his sword, but Baldur was invulnerable. Then Loki asked Hödur, Baldur's blind brother, to thrust a spear after Baldur, and reached him that made of the mistletoe. Hödur threw it, and Baldur fell dead on the floor. Immediately the Jotuns and all the monsters of nature arose against the gods, and a war began between Niflheim and Walhalla. The suns and the stars took fire and burnt up; the earth sank to the bottom of the ocean, and all living beings on it perished; the Asers were killed, and the end of the world had come. But out of the sea a new heaven and a new earth would arise, in which the All-father should reign, and he would pass a new judgment upon men—not according as they were brave or cowardly, but according as they were good or bad.

It can hardly be doubted that this last tale of the fall

of the Asers was formed under influences from Christianity; but, on the other hand, it is also certain that there was in the original Scandinavian paganism not an element of skepticism, such as sprang up very early in the Greek mythology, but a longing beyond Walhalla, an instinctive feeling that the Asers, with all their magnificent splendor of victory and conquest, with all their boundless energy and vigor, with all their stern dignity and justice, were not the highest form of the highest truth. The old Norseman confided more in himself than in his gods. He held festivals in honor of them, and made magnificent sacrifices to them of 99 horses, 99 dogs, 99 cocks, and 99 slaves; but he had no priests, no Eleusinian mysteries, no oracles, no temples or theatres, no processions with songs and dances. In the din of the battle he felt the presence of the gods, and in his rapture he saw the doors of Walhalla flung open to his view. But when he sat at home and the trance was over, a sad and sombre aspect spread over him, and over his gods too. He became restless, cynical, and cruel, and he knew of no other check to his passions than his pride. CLEMENS PETERSEN.

**Scanso'res** [Lat., from *scandere*, "to climb"], an order of birds popularly known as climbers, distinguished by having the toes in pairs, two before and two behind, thus facilitating the habits from which they derive their name. The most important members of this are parrots, toucans, cuckoos, and woodpeckers.

**Scaphiopod'idæ** [from Lat. *scaphiopus;* Gr. *σκάπτειν*, to "dig," and *πούς*, "foot"], a family of amphibians of the order Salientia or Anura, comprising forms somewhat resembling in superficial appearance toads, but quite different anatomically. According to Prof. Cope, they have procœlian vertebræ, "no costal elements or coccygeal diapophyses; diapophyses of the ninth vertebra much dilated, thin, and triangular; coccygeal style without condyloid articulation, its axial portion restricting that of the sacrum and connate with it; external metatarsi bound; distal phalange continuous, simple. Manubrium cartilaginous. Tongue nearly entire." Almost all, too, have the cuneiform bone developed as a shovel-like process, by means of which they are enabled to excavate the earth with considerable facility; in allusion to which the family has been named. They are mostly nocturnal animals, and are very rarely to be seen. In accordance with this nocturnal habit, the pupils of the eyes are vertical. The family is represented chiefly in the U. S., in which are three species of *Scaphiopus* and two of *Spea*. The genera *Didocus*, *Pelobates*, and *Cultripes* of the palæarctic region (Europe, etc.) also belong to the family, and one species of *Spea* is found in Mexico. The only species found in the Eastern U. S. is *Scaphiopus Holbrookii*. THEODORE GILL.

**Scaph'oid** [Gr. *σκάφη*, "boat," and *εἶδος*, "likeness"] or **Navic'ular Bone,** a name applied to one of the bones of the wrist, and another of the foot, named from a fancied likeness to a boat (Lat. *navicula*).

**Scap'ula** [Lat.], the shoulder-blade, a bone of the anterior or upper extremity, forming part of the shoulder. It is regarded as a pleurapophysis of the occipital (fourth cephalic) vertebra. In man and nearly all mammals it is (save in exceptional cases) firmly united to the coracoid bone, which is regarded as a process of the scapula, though representing a hæapophysis of the occipital vertebra. The dorsum of the scapula is marked by a prominent keel or spine. The scapula is developed from seven centres, and is in man not fully ossified till the twenty-fifth year of life.

**Scap'ular** [Lat. *scapularis*], (1) a garment worn by lay brethren and professed monastics of various Roman Catholic orders. It is a long piece of serge, one end of which falls in front and another behind the wearer. Its size, color, and proportions vary. (2) A small concealed emblem worn by many Roman Catholics, who bind themselves to a certain round of religious exercises called the "Devotion of the Scapular." There are several scapulars, as that of the Passion and that of the Seven Sorrows of Mary, but the original one, that of Our Lady of Mount Carmel, was, it is claimed, revealed by the Virgin to the blessed Simon Stock, an English Carmelite and general of that order, who died in 1265.

**Scarabæ'us** [Lat., "beetle"], in ancient art, a figure of a beetle, often worn as a charm or seal. Egyptians, Phœnicians, Etruscans, and Romans reverenced the scarabæus. The Egyptians frequently made scarabæi three or four feet long. They were made of gold, precious gems, granite, porphyry, and many other materials. Beetles are often found embalmed in Egypt. They are of four or five species of the genus *Ateuchus*, all insects which enclose their eggs in a ball of Nile mud. It is supposed that the Egyptians regarded the ball as a symbol of the earth. They also thought that all scarabæi were males. Hence, the scarabæus was the symbol of the paternal principle in nature. Some of the Gnostics also revered the scarabæus. SCARABÆUS is also the name of a genus of beetles, the type of a family (Scarabæidæ) to which the sacred scarabæi belong.

**Scar'borough,** town of England, in Yorkshire, on an inlet of the North Sea, has a good harbor protected by a high promontory. Its mineral springs enjoy a high reputation, and the city is much frequented by fashionable visitors, on account both of these springs and its sea-bathing. A considerable trade in corn, butter, salt fish, and bacon is carried on. P. 24,259.

**Scarborough,** p.-v. and tp., Cumberland co., Me., on Atlantic Ocean and on Boston and Maine R. R. P. 1692.

**Scarborough,** p.-v., Ossining tp., Westchester co., N. Y., on Hudson River and Hudson River R. R.

**Scar'idæ** [from the old Latin and Greek name, *Scarus*, of one of the species], a family of teleocephalous fishes well represented in the tropical seas by forms generally known under the name of parrot-fishes, from some resemblance of their mandibles to the bill of a parrot. The body is oblong and compressed; the scales large and cycloid; the lateral line interrupted behind; the head compressed; the cheeks unprotected; the opercula normal and unarmed; the nostrils double; the mouth terminal and with a short lateral cleft; the jaws well exposed, and with the teeth soldered to them, so that they form a cutting edge, but with imbricated series of older worn teeth; palate smooth; branchial apparatus confluent below; branchiostegal rays five; dorsal single, with a longer anterior spinous part (containing nine spines), and a shorter posterior portion (with ten articulated rays); anal fin corresponding to the posterior half of the dorsal, and provided with two spines and eight soft rays; caudal distinct; pectorals with branched rays; ventrals thoracic, with one spine and five soft rays; the lower pharyngeal bones are ossified together in a solid mass; the superior pharyngeal apparatus is represented only by the third bone of the typical series, and those of the opposite sides are united and are connected by a sliding articulation, with the much-enlarged fourth superior branchihyals; the vertebral column has eleven abdominal and fourteen caudal vertebræ. The family is remarkable for its homogeneous character, and especially for the constancy in the number of the rays of the dorsal and anal fins. About 130 or 140 species are more or less known, and these have been distributed among five genera—viz. *Scarus*, *Scarichthys*, *Callyodon*, *Callyodontichthys*, and *Pseudoscarus;* about 100 of the species belong to the last-named genus, and about 14 to the first one. The species are confined to the tropical regions, and in these latitudes are everywhere to be found on coral-reefs and among the groves of coral. They are reported to browse upon the coral, which they cut by means of their strong trenchant jaws.

A species of the family (*Scarus cretensis*) was one of the most celebrated fishes of the ancients. It was known to the Greeks and Latins under the name *σκάρος* or *scarus*, and was the subject of several fables; it was believed to ruminate its food, and was celebrated for the skill with which it evaded the toils of the fishermen. According to some ancient authors, when one was taken by line the others aided it and cut the line; or, if it was caught in the meshes of a net, its companions endeavored to draw it out by its tail, or one of them presented to the captive its own tail, so that he might pull the latter out. The species, it was believed, was originally not found in the Italian seas, although it was abundant in the Grecian Archipelago and the Sicilian waters; but in the reign of Claudius, according to Pliny, Optatus Elipertius introduced it into the Italian sea between Ostia and Campania, where for five years it was assiduously protected, and afterward became abundant. It was regarded, at least for a time, as being the very first of fishes (Galen says, "*Nunc scaro datur principatus*"), and even its excrements, far from being rejected, were regarded as enhancing its value, and were cooked with it. Although still esteemed, it does not enjoy the same reputation as formerly. What is true of this species must also be, to a great extent, of all the members of the families, as they are very closely related to each other. THEODORE GILL.

**Scarlati'na** [N. Lat.], or **Scarlet Fever,** one of the acute eruptive or exanthematous fevers. Chiefly a disease of childhood, with immunity for adults, increasing as the period beyond puberty lengthens. It is an infectious disease, but propagated often by contagion or close aggregation of children, as in schools, asylums, or at play; therefore occurring sometimes in local epidemics; at other times with a graver type and great mortality, involving whole communities. In different individual cases, as well as different seasons and epidemics, it assumes variable degrees, from a trivial disorder to a malignant and hopeless attack.

However, no case is without danger. While in the well-defined scarlatina sore throat, high fever, and the scarlet eruption or "efflorescence" are present, in the undeveloped and trivial attack the kidneys are perhaps equally liable to be seriously involved. Physicians recognize three marked varieties: (1) *Scarlatina simplex*, simple scarlet fever, in which the "rash" or eruption is fairly developed, the patient comfortable, and complications do not exist; (2) *scarlatina anginosa*, where an unusual soreness of the throat, with formation of pseudo-membrane resembling diphtheria, is present; (3) *scarlatina latens*, a latent form, where the eruption may be absent or doubtful, but grave injury is done by the scarlatinal poison in the blood to the nerve-centres or the kidneys. Like other contagious diseases, scarlatina has its period of "incubation" or development; four to six days usually intervene between exposure and the consequent attack. The fever develops, sometimes a simple and steady rise of temperature, more often with projectile vomiting, nervous excitement, and exhaustion indicative of a powerful impression on the nervous centres. The temperature may rise to 104° or 107° F., higher in fatal cases. The throat is already florid and tender, the tongue studded with sensitive red papillæ. At the end of twenty-four hours of fever the eruption appears—an efflorescence composed at first of minute red points upon a flushed surface, and later of a uniform scarlet hue. It develops upon the body and neck before the face, being especially developed over the upper half of the back. The face and lower extremities are soon involved, and the cuticle, destroyed by the high temperature of the surface, may begin to fall by the fifth day. This process of "desquamation" varies. In mild cases, when sponging or bathing has been employed to allay fever, no flaking or falling of the cuticle is seen. In others it may slowly separate in shreds and patches. Still again, the cuticle covering fingers and toes may exfoliate intact, forming perfect casts or like the finger of a glove. During and following this desquamation danger is greatest of acute inflammation of the kidneys, the "desquamative nephritis" constituting the most serious sequela or complication of scarlet fever. Scarlet fever is a grave disease. The mortality is very variable, from 1 in 5 to 1 in 25, according to class of patients and type of epidemics. The chief causes of death are early convulsions, diphtheritic throat complications, and uræmic poison and dropsy from implication of the kidneys. Scarlatina is chiefly to be distinguished from measles, since these are the two prominent eruptive fevers of childhood. It lacks the early developments of measles—watery eyes, sneezing, cold in the nose, loaded tongue—and presents its peculiar eruption two days earlier than that of measles.

(1) In scarlet fever treatment is chiefly directed to confining the temperature within limits by the use of aconite, diaphoretic drinks, blanketing, frequent sponging, or even the wet pack. (2) To favoring the action of the kidneys by digitalis and emollient alkaline drinks, as flaxseed tea and soda. The inunction of lard, practised by the Germans, and of butter of cacao, protect the skin and guard the kidneys from congestion. (3) To maintain the strength and counteract the poison of the disease. Quinine and tincture of iron are chiefly indicated, in free and frequent doses. Sulphite and sulpho-carbolate of soda and salicylic acid may be administered for their antiseptic effect. Liberal liquid diet throughout, and mild alcoholic stimulus when convalescing. The throat may require cold gargles, cold and disinfecting sprays. Secondary kidney disorder—dropsy and scanty urine—calls for dry cups over the kidneys, the hot-air bath, elaterium as a purge, digitalis, and alkaline diuretics.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Scarlat'ti** (Alessandro), b. at Trapani, Sicily, in 1649; brought his first opera on the stage in 1680 in Rome in the palace of Queen Christina of Sweden; lived afterward alternately in Rome and Naples as chapel-master; composed 118 operas, of which only the titles of 20 are known, 200 masses, 3000 cantatas, and minor pieces. D. in Naples Oct. 24, 1725. He was the inventor of the overture, and the first composer who gave to orchestral accompaniment an air of separate design.—His son, Domenico Scarlatti, b. 1683, d. 1759, was considered the greatest pianist of his time, held positions in Madrid and Lisbon as court-pianist, and composed operas and many pieces for the piano.

**Scarlet Fever.** See Scarlatina.

**Scarlett** (Sir James). See Abinger, Lord.

**Scar'lett** (Sir James Yorke), son of the first Lord Abinger, b. in England Feb. 1, 1799; educated at Eton and at Trinity College, Cambridge; entered the army in 1818; colonel 1851; major-general of cavalry, and distinguished himself at Balaklava; obtained command of the entire cavalry, and was knighted 1855; adjutant-general 1860, lieutenant-general 1862. D. at Burnley Dec. 6, 1871.

**Scar'pa** (Antonio), b. at Castello-Motta, Friuli, June 13, 1747; studied medicine at Padua; travelled extensively; was appointed professor of anatomy at Modena in 1772, and in 1783 at Pavia, where he d. Oct. 31, 1832. He was considered one of the greatest anatomists of his time, and many important questions of the science were settled by his works, *Anatomicæ Disquisitiones de Auditu et Olfactu* (1789), *Tabulæ Neurologicæ ad illustrandam Historiam Cardiacordum Nervorum* (1794), *De Anatomia et Pathologia Ossium* (1827), *Sull' Aneurisma* (1804), *Sull' Ernie* (1807).

**Scar'panto,** an island in the Mediterranean, 32 miles long, 8 miles broad, between Rhodes and Crete, belonging to Turkey. It consists mostly of naked rocks, whose highest peaks rise 4000 feet. Its inhabitants, numbering about 5000, are mostly engaged in carpentering.

**Scarron'** (Paul), b. in Paris in 1610 of a good family; was destined for the Church, but spent his youth in the grossest dissipations, and was in 1637 overtaken by paralysis, which for ever deprived him of the use of his legs. He now took up literature as a means of subsistence, and developed a brilliant talent for burlesque. His comedies and poems are now forgotten, but his *L'Énéide Travestie* (1648), *Mazarinade* (1649), which cost him the pension Anne of Austria had bestowed upon him, and especially his *Roman comique* (1651; translated into English by Oliver Goldsmith, 1775), became literary types, and are still read with interest. In 1652 he married Françoise d'Aubigné, afterward Madame Maintenon, and she, as well as the irresistible humor of her lame husband, made their home a rendezvous for all the Parisian wits, who, however, had to contribute to the maintenance of the establishment, as Scarron always wanted money and was a consummate beggar. D. at Paris in 1660. Complete edition of his works in 10 vols. by Bruzen de la Martinière (1737).

**Scars'dale,** p.-v. and tp., Westchester co., N. Y., on New York and Harlem R. R. P. 517.

**Scau'rus** [signifying a person who has a defect in his ankles or feet], the cognomen of a patrician family in ancient Rome belonging to the Æmilia gens. The family was poor and lived in obscurity, when it was suddenly raised into wealth and notoriety by Marcus Æmilius Scaurus, b. in 163 B. C. His father was a dealer in coal on a small scale, but he himself studied eloquence; served in the army; was *prætor urbanus* in 120, consul in 115, censor in 109, consul again in 107, and left an immense fortune to his son. In 111 he accompanied the consul Bestia to Africa as his legate in the war against Jugurtha. Both received large sums from the Numidian king, to whom the consul granted a peace on very favorable conditions. In Rome, however, indignation grew very hot, and Bestia was arraigned, while Scaurus secured for himself a seat in the committee of investigation. He was always more cautious in concealing his crimes than rash in indulging his vices; that is the principal feature of his character. D. about 89 B. C. With his descendants the family rapidly declined and soon became extinct.—His son, Marcus Æmilius Scaurus II., a stepson of Sulla, committed the same crimes as his father, but he lacked his talent of concealing them. He received a large bribe in Judæa from Aristobulus, committed the most outrageous extortions in Sardinia, perpetrated frauds in the elections, etc. For some time he escaped punishment through his powerful connections and by squandering large portions of his wealth on the entertainment of the people; finally, he was exiled.—His son, Marcus Æmilius Scaurus III., sold Sextus Pompey, his half-brother, to the generals of Mark Antony in 35 B. C.; and his son, Mamercus Æmilius Scaurus, the last Scaurus, committed suicide in 34 A. D., having been accused of high treason, adultery, etc.

**Scelidosauridæ.** See Appendix.

**Sce'nery Hill,** p.-v. and tp., Washington co., Pa.

**Scep'ticism,** in philosophy [σκέπτομαι, "to look about carefully"], is the doctrine which sets up, as its highest principle, doubt or suspense of judgment in view of the contradictory nature of phenomena. It endeavors to establish the subjectivity of all cognitions, and to show their incompatibility with each other; it infers, as a consequence, the impossibility of knowing truth, and takes its stand simply and solely upon its own individuality. Scepticism therefore deepens and intensifies mental independence, and is regarded as a necessary clearing up preparatory to philosophic thinking. At least since the time of Descartes this has been the case, and some writers—as Herbart, for example—insist upon the point that all beginning in philosophy is sceptical, and, on the other hand, that all scepticism is elementary philosophy. It is most important to note that all scepticism is based upon the observation of method, and in this respect is a higher activity of the mind

than the mere dogmatism which it attacks. All modern philosophy is a struggle to found itself upon method, and thus to place its structure above the assaults arising from scepticism. Its arguments emanate neither from the stage of sense-perception nor from that of simple reflection—*i. e.* neither from the first nor second intention of the mind, so-called, but from a *third* intention, a perception not of external objects, nor of species or genera, but a perception of the activity or process of reflection itself. Hence, simple common sense, alike with the deepest speculative insight, may be attacked and undermined by scepticism, but sceptical arguments can have no weight except for those minds that abandon other points of view and give attention to the method of cognition.

The ancient scepticism is directed against sense-perception, and usually counts Pyrrho of Elis as its founder. Gorgias, the Sophist, had reached the doctrine of nihilism: nothing exists; nothing can be known if it does exist. Socrates had asserted that he knew only that he knew nothing. The Megarian Stilpo had shown the contradictions in sense-perception involved in predicating universals of individual objects. The scepticism of the second and third schools of the Middle Academy, founded respectively by Arcesilaus and Carneades, was of a modified type. But Pyrrho, who seems to have learned much from Stilpo, developed scepticism as a system of philosophy, and made universal doubt the highest principle, and ἐποχή (suspension of judgment) and ἀταραξία (tranquillity of mind, imperturbability) the practical objects to be attained. With Pyrrho, Timon the Sillograph and Ænesidemus are reckoned as the representatives of the old sceptics. The last-named collected Pyrrho's arguments in the form of ten tropes, as follows: Knowledge of truth is uncertain, because of the difference (1) in the organization in animals resulting in different modes of knowledge (how can we decide?); (2) in the human constitution in tastes, feelings, desires, capacities, etc.; (3) in the structure of the organs of sensé, the same object being white to the eye, sweet to the taste, rough to the touch, etc.; (4) in the mental and physical conditions at different times; (5) in the position, distances, and intervals of objects; (6) in the appearance of objects by reason of their complication with each other; (7) in the appearance of objects owing to their variation in quantity, size of parts, etc.; (8) in objects on account of the general relativity of things known; (9) in the frequency with which objects are observed; (10) in regard to education, all customs, habits, laws, ideas, faith, and theories being derived from it. The later school of sceptics includes Agrippa, Favorinus, Sextus Empiricus, and others. Agrippa reduced the tropes to five: (1) the discordance of opinions renders all uncertain; (2) every proof rests upon grounds which again need proof, and so *ad infinitum;* (3) all our ideas are relative; (4) all systems rest upon hypotheses; (5) the vicious circle, demonstrating the grounds on which the proof rests by that which is proved by them. Sextus Empiricus has left us a complete account of ancient scepticism, and himself sums up the whole as follows: Nothing is certain in itself, as is proved by the diversity of opinion, and nothing can be made certain by proof, since it derives no certainty from itself, and, if based on other proof, leads us either to the *regressus ad infinitum* or to a vicious circle.

Among famous sceptics of later times are Algazel the Arabian, Duns Scotus the Schoolman, Agrippa of Nettesheim, Glanvill, Nicolaus Cusanus, and Hirnhaym, who reject science in the interest of faith. Montaigne, Charron, Sanchez, and Le Vayer revive the ancient scepticism. Hume is the greatest modern sceptic. He saps all dogmatism by making habit or "invariable sequence" the origin of the idea of causality, and gives rise to the Kantian system and its derived schools, which "criticise the faculty of cognition" and build their structures upon insight into method, and thus eliminate scepticism by making its partial view (of method) a complete one. W. T. Harris.

**Scep'tre** [Gr. σκῆπτρον], a rod or truncheon borne by kings and other magnates as an emblem of authority. It has been employed as one of the regalia of almost all monarchies which have any record. The English sceptre now in use dates from Charles II.'s time; it is cruciform. The sceptre for Scotland dates from the time of James V. There are several smaller sceptres made for queen's-consort.

**Scha'dow** (Johann Gottfried), b. at Berlin May 20, 1764; studied drawing and sculpture in his native city and at Rome 1785–87; was appointed professor at the Academy of Art in Berlin in 1788, and d. there Jan. 28, 1850. His principal works are statues of Ziethen in Berlin, Frederick the Great in Stettin, Leopold of Dessau in Berlin, Luther in Wittenberg, etc.; he has also modelled the quadriga over the Brandenburg gate of Berlin.—His son, Friedrich Wilhelm von Schadow-Godenhaus, b. at Berlin Dec. 6, 1789; d. at Düsseldorf Mar. 19, 1862; studied painting in Rome with Cornelius and Overbeck, and was converted to the Roman Catholic Church; became director of the Academy of Düsseldorf in 1826, and was ennobled in 1843. He was one of the founders of the romantic school, and the principal founder of the school of Düsseldorf. His principal works are *Mignon,* the four evangelists, *Paradise, Purgatory, Hell,* the *Fountain of Life,* etc.

**Schaef'fer** (Charles Frederick), D. D., b. at Germantown, Pa., in 1807; graduated at the University of Pennsylvania 1827; was successively pastor of Lutheran churches at Carlisle and Easton, Pa.; professor of theology in the Lutheran seminary at Columbus, O., of German in Pennsylvania College, Gettysburg, and of theology in the Lutheran seminary at Philadelphia. Author of several theological works in English and German, and translator of Kurtz's *Manual of Sacred History* (1855) and Lechler's *Commentary on Acts* (1866).—His brothers, David Frederick (1787–1837) and Frederick Christian (1792–1831), were also doctors of divinity in the Lutheran Church, and authors of some religious treatises.—Their father, Frederick David Schaeffer, D. D. (1760–1836), was Lutheran pastor successively at Carlisle, Germantown, and Philadelphia.

**Schä'fer** (Heinrich), b. at Schlitz, Hesse, Apr. 25, 1794; studied theology in Giessen; was appointed librarian to the ducal library of Darmstadt in 1819, and professor of history at Giessen in 1833. D. July 2, 1869. His *Geschichte von Portugal* (5 vols., 1836–54) and *Geschichte von Spanien* (3 vols., 1831–67) form parts of Ukert and Heeren's *Geschichte der Europäischen Staaten.*

**Schaff** (Philip), S. T. D., LL.D., b. at Coire, Switzerland, Jan. 1, 1819; studied at Coire, Stuttgart, Tübingen, Halle, and Berlin; took the degree of B. D. and passed the examination for a professorship in Berlin 1841; travelled as tutor of a Prussian nobleman through several countries of Europe; returned to Berlin and lectured in the university on exegesis and church history 1842–44; was called (upon the recommendation of Neander, Tholuck, and others) to a professorship in the theological seminary of the German Reformed Church of the U. S. at Mercersburg, Pa. This position he filled from 1844 till 1863. He removed to New York Dec., 1863; made a second visit to Europe 1865; was secretary of the New York Sabbath committee 1864–69, and delivered courses of lectures on church history in the theological seminaries at Andover, Hartford, and New York. In 1870 he accepted a call to the professorship of sacred literature in the Union Theological Seminary, New York, which place he still (1876) occupies. He received the honorary degree of D. D. from the University of Berlin 1854; was elected member of the Leipsic historical, the Netherland, and other literary societies in Europe and America. He is one of the founders and honorary secretaries of the American branch of the Evangelical Alliance, and was sent three times (1869, 1872, and 1873) as commissioner to Europe to make arrangements for the general conference of the Alliance, which, after a second postponement in consequence of the Franco-German war, was held in New York Oct., 1873. He was also one of the Alliance delegates to the emperor of Russia in 1871, to intercede with him in behalf of the religious liberty of his subjects in the Baltic provinces. He is president of the American Bible revision committee, which he organized in 1871 at the request of the English committee, and he was sent to England in 1875 to negotiate with the British revisers and university presses about the terms of co-operation and publication of the Anglo-American revision.

His books are mostly historical and exegetical. He wrote *History of the Apostolic Church* (New York, 1853; Edinburgh, 1855; Leipsic, 1854, etc.), *History of the Christian Church from A. D. 1–590* (New York and Leipsic, 3 vols., 1867, to be continued to the present time), *History and Collection of the Creeds of Christendom* (New York and London, 1876, in 3 vols.). He is editor of the Anglo-American reproduction and adaptation of Lange's *Critical, Theological, and Homiletical Commentary on the Bible,* begun in 1864, and to be completed in 24 vols. (of which 20 have so far appeared in New York and Edinburgh). Of his minor books we mention—*Sin against the Holy Ghost* (Halle, 1841), *James and the Brethren of our Lord* (Berlin, 1842), *The Principle of Protestantism* (1845), *Life of St. Augustine* (New York, 1853; London, 1854; Berlin, 1854), *Historical Development* (Philadelphia, 1846), *German Universities* (Philadelphia, 1857), *Lectures on the Institutions of America,* delivered in Berlin 1854, and additional lectures on the *Civil War and the Overthrow of Slavery,* delivered and published in the same city (1865; also in English, New York, 1866); *German Hymnbook, with Hymnological Introduction and Notes* (Philadelphia and Berlin, 1859; new ed., with tunes and

appendix, 1874), *Christian Catechism* (1863), *Critical Edition of the Heidelberg Catechism*, with its history to the tercentenary celebration (1863, revised ed. 1866); *Person of Christ, with reply to Strauss and Renan* (1865; translated into several languages), *Christ in Song* (New York, 1868; London, 1869 and 1876), *Bible Revision* (New York, 1873), *The Vatican Council* (New York, 1875). He founded and edited the *Kirchenfreund* (the first German theological monthly in America) 1848–53; *Evangelische Zeugnisse*, 1863–66; edits, with Prof. Henry B. Smith, the *Philosophical and Theological Library* (begun in 1873, and published in New York and London); he wrote several documents for the New York Sabbath Committee and the Evangelical Alliance, and contributed articles to American and foreign reviews, to Herzog's, Smith's, and other encyclopædic works.

**Schaffhau'sen,** the northernmost canton of Switzerland, is bounded N. by the grand duchy of Baden and S. by the Rhine. Area, 116 sq. m., with 37,721 inhabitants. It consists mostly of a number of valleys, which slope toward the Rhine and are very fertile. Wheat and other kinds of grain, fruit and wine of superior quality, hemp and flax are extensively cultivated; the rearing of cattle and the manufacture of steel and silk are important.

**Schaffhausen,** town of Switzerland, capital of the canton of Schaffhausen, on the right bank of the Rhine, 3 miles above the celebrated falls. It is an old, curiously-built town, with some manufactures of ironware and silk goods. P. 10,303.

**Schagh'ticoke,** tp., Rensselaer co., N. Y., on Hoosac River and on Troy and Boston R. R., has important manufactures. P. 3125.

**Scharn'horst, von** (Gerhardt David), b. at Bordenau, in Hanover, Nov. 12, 1756; entered the Hanoverian army in 1776; became a lieutenant of artillery in 1780, and teacher in the school of artillery in Hanover in 1782; attracted much attention by his military writings; was invited to enter the Prussian service, and became in 1801 director of the military academy of Berlin. His lectures here became quite celebrated, but his ideas called forth a strong opposition from the older military men, and in 1803 he was removed to the staff, where he advanced to the rank of general. After the Peace of Tilsit, in 1807, he took charge of the whole administration of military affairs in Prussia until 1810, when he was compelled to retire at the request of Napoleon. He continued, however, to exercise a decided influence, and it was chiefly due to his energy and his ideas that Prussia in 1813 was able to bring a large and effective army into the field. He was wounded at Grossgörschen, and d. at Prague June 28, 1813, on his way to Vienna to persuade Austria to join the allies against Napoleon.

**Schäss'burg,** town of Austria, in Transylvania, on the Great Kökel, has manufactures of woollen and linen fabrics and a large trade in wine and fruits. P. 7996.

**Schauf'fler** (William Gottlieb), D. D., b. at Stuttgart, Germany, Aug. 22, 1798; resided in Russia during his youth; studied theology, and went to Turkey as an independent missionary 1825, but having soon convinced himself that he needed a more thorough training, came to the U. S. in 1827; graduated at Andover 1830; was ordained Nov. 14, 1831; was missionary to the Jews in Constantinople, Turkey, 1831–55, and after that to the Moslems; has translated the entire Bible into Hebrew-Spanish and into Turkish, the New Testament, the Pentateuch, and Isaiah in the latter language having been printed in Germany under his supervision; and published an *Essay on the Right Use of Property* (1832). He is also author of *Meditations on the Last Days of Christ* (1837).

**Schaum'burg-Lip'pe,** a principality and state of the German empire, between Hanover and Westphalia, comprises an area of 207 sq. m., with 32,059 inhabitants. The southern part is hilly and well wooded; the northern is flat, and here is found the large lake, Steinhuder-meer, occupying an area of 22,000 acres. The revenue for 1873 was 139,535 thalers; expenditure, 137,264. Cap. Bückeburg.

**Schee'le** (Karl Wilhelm), b. at Stralsund, Pomerania, at that time a Swedish possession, Dec. 19, 1742; was apprenticed to an apothecary in Gottenburg; studied afterward chemistry in Stockholm and Upsala, and settled in 1777 as apothecary at Köping, near Stockholm, where he d. May 21, 1786. By his comprehensive and minute chemical analyses he discovered tartaric acid, manganese, chlorine, barytes, the pigment called "Scheele's green," and the coloring-matter of prussian blue. In his *Chemical Observations and Experiments on Air and Fire* (1772; translated into English by Kirwan) he described oxygen, unaware of its previous discovery by Priestley.

**Scheele's Green,** also called **Swedish Green.** In this country the common name is **Paris Green,** a name which is now applied in France to a special *aniline-green* product. The correct name above, by which it is known in all chemical books, proceeds from its discovery by the great Swedish chemist Scheele. It is a compound of the poisonous arsenious acid and cupric oxide, which, on account of its extreme brilliancy and beauty of color, has come into use throughout the world, but more especially throughout America, to an extent which has for many years been with chemists a constant subject of protest, often strenuous, but apparently always unavailing. While it is almost as poisonous as arsenious acid itself, it has become so common an article of trade as to be purchasable without any restriction from every dealer in pigments and colors throughout the land. Worse than this: it is commonly used for coloring paper for ornamental use, as for binding books, making lamp-shades, and even for *labels* and *stamps* for legal documents (*gummed*, and applied by *wetting in the mouth*). Schoolbooks bound in such bright-colored paper are placed in the hands of young children, who have been sometimes destroyed, and oftener diseased, by swallowing some of the deadly poison. Such paper is often used for wrapping up articles of food, medicine, and confectionery. Wall-paper stained with Scheele's green is very common, and the dust therefrom, when inhaled, produces serious arsenical disease. H. Wurtz.

**Schef'fer** (Ary), b. at Dordrecht, Holland, 1795; exhibited in the salon at Amsterdam when but twelve years old; was taken to Paris by his mother in 1811; acquired eminence in 1822 by the well-known picture of *Francesca di Rimini*, now in the possession of the duc d'Aumale. This was followed by the *Gaston de Foix* and the *Suliote Women*. D. June 15, 1858, at Argenteuil, near Paris. Scheffer is best known by his *Mignon, Faust and Marguerite, Dante and Beatrice, Christus Consolator, The Temptation, Christus Remunerator, St. Augustine and Monica, The Kiss of Judas, The Holy Women*, all of which have been engraved or photographed. His earliest works were weak and sickly; his last are still sentimental and romantic; but his best, though pale and thin in color, and tinged with a profound melancholy, have a depth of enthusiasm and a mastery of technical treatment which entitle him to a place among the masters. Scheffer's life was embittered through his sympathies. A republican at heart and a faithful Orleanist, the success of the Napoleonic dynasty increased the natural melancholy of his disposition, and added more sombre hues to his art. The pictures of Scheffer number in all about 160. He painted several portraits, one of Queen Marie Amelie, wife of Louis Philippe. O. B. Frothingham.

**Scheldt,** the most important river of Belgium, has its rise in a small lake in the department of Aisne, France, and by a circuitous passage enters Belgium near Tournay; thence moves N. N. W. past Tournay, province of Hainault, and at Hérinnes becomes the boundary of this province and E. Flanders, and at Escamaffles becomes the common boundary between W. and E. Flanders; thence N. N. E., past Oudenarde, to Ghent, where it receives the Lys on the left; thence E. S. E. to Dendermonde and N. N. E. to Antwerp, at which point it becomes a noble stream, with a fine harbor sufficient for largest ships. Leaving Antwerp, its course is N. W. The island of S. Beveland divides it into two arms; the left, or S., known as the Hond or W. Scheldt, and the most important, enters the North Sea near Flushing. The right, or N., called the E. Scheldt arm, is divided again by the island of N. Beveland before it falls into the sea. It has an entire length of 210 miles, and is navigable to Condé, near its source. Among its numerous affluents, the Scarpe, Lys, and Darme from the left, and the Dender and Rupel from the right, are the most important. A system of canals connects this stream with the principal cities of Belgium. The entrance to the river is rendered somewhat difficult for large vessels by sandbanks which form at its mouths. These mouths are almost opposite that of the Thames, thus increasing its commercial and naval importance.

**Schel'ler** (Immanuel Johann Gerhardt), b. at Ihlow, Saxony, Mar. 22, 1735; studied theology and philology at Leipsic, and became rector in 1772 of the gymnasium of Brieg, where he d. July 5, 1803. His Latin-German dictionaries, in 7 vols., in 2, and in 1, published between 1780 and 1792, were often reprinted, and are still used.

**Schel'ling, von** (Friedrich Wilhelm Joseph), b. at Leonberg, a village near Stuttgart, Würtemberg (the birthplace also of the illustrious Kepler), Jan. 27, 1775; d. at the baths of Ragatz, Switzerland, Aug. 20, 1854. His father, distinguished as an Orientalist, was a country clergyman who became prelate at Maulbronn; he directed his son's education. In his sixteenth year young Schelling entered the theological seminary at Tübingen, and studied theology in connection with philosophy and philology. In his seventeenth year (1792) he wrote a thesis

for his degree of master of philosophy, taking as his theme the origin of evil as set forth in Gen. iii. As early as 1793, in his essay on myths, historical sagas, and philosophemes of antiquity, there begins to appear in outline his most important theory, developed in later life. In the spring of 1796 he went to Leipsic, and there remained for two years. He had already published his essay *On the Ego as Principle of Philosophy*, in which he had repudiated the Kantian dualism, and pointed out the common source of the two sides, theoretical and practical, subjective and objective, and set up the theory of a faculty of knowing which could grasp the unconditioned ground of these two sides—a faculty or activity which he called "intellectual intuition." At Leipsic he pursued studies in mathematics and natural science, and paid special attention to medicine. His attitude toward Fichte's system was at first that of an expounder, afterward that of a critic. He put forth his *Ideas on the Philosophy of Nature* (1797) and *Concerning the World-Soul* (1798), indicating his departure from this standpoint. The "Science of Knowledge" (*Fichte*) had made the Ego all in all, and nature a mere subordinate affair. Consciousness being regarded as the essential principle, and the will as the highest, ethical science was the sole outcome, and the natural sciences, as well as all partially unconscious activity of man as displayed in art, religion, poetry, and the mythologies, was ignored. Schelling's function was to call attention to this unconscious evolution of Reason—the side of the absolute Ego which Fichte had slighted, perhaps with justice if a choice was to be made, but certainly not with impunity. Schelling, however, went so far in this new direction as to make Nature a coequal pole of the absolute, with Mind as the other, apparently influenced in this by Spinoza, who had made "thought and extension" the two poles of his "substance." Accordingly, the union of the ideal with the real, of mind with matter, was the ultimate principle with Schelling's system. In æsthetic art this union was to be found. The Beautiful is the highest realization of the Absolute, and that "toward which the whole creation moves." This standpoint was criticised subsequently by Hegel, who restored the supernatural realization of the highest principle in the human soul as above its mere incarnation, which then sinks into a subordinate phase of spiritual life as a mere probationary stage thereof, a step in its progressive development. If the Beautiful be the highest principle, immortal life, a soul divorced from body, becomes a mere abstraction, and with this God, as supernatural, loses consciousness and perfection. Schelling, who remained almost entirely silent from 1812 to 1834, during the period of the activity of Hegel, whose system was that of Schelling, with this essential modification (the substitution of religion for art as the highest activity, and indeed the preference of conscious thought as found in theology or speculative philosophy to all other forms—being in this particular Aristotelian), seems to have felt this defect in his system, and after the death of Hegel (1831) to have developed his system from the amended basis. He calls, therefore, his earlier system, which lays so much emphasis on nature-philosophy and art, his negative system, and his later one, in which he endeavored to make freedom the highest ideal, his positive system. From Leipsic he was called to Jena (1799), partly through the interest of Goethe, who was attracted toward his philosophy of nature. At this time he came into contact with and exercised a powerful influence upon the romantic school, becoming intimate with the Schlegels, Novalis, Gries, and others. Caroline Schlegel, twelve years his senior, wife of A. W. Schlegel, patronized his efforts and readily discerned his promise as the philosopher who should unite the severely ethical systems of Kant and Fichte with the genial æsthetic naturalism of Goethe. Caroline Michaelis, daughter of the distinguished Orientalist, Michaelis (married in 1784 to a physician, Dr. Böhmer, by whom she had three children), had married, eight years after the death of her first husband, A. W. Schlegel, from whom she finally obtained a divorce in 1803, after an unhappy marriage relation of seven years. According to her statement, she had married Schlegel not from love, but out of gratitude for his friendly assistance given to her and to her mother in struggles and perplexities which they encountered. She married Schelling soon after the divorce mentioned, and exercised a great influence upon him by her appreciation and sympathy until her death in 1809. The philosopher not long afterward married Pauline Gotter.

If Fichte may be regarded as building his system chiefly on Kant's *Critique of Practical Reason*, Schelling certainly builds upon the *Critique of Judgment* and the *Metaphysical Principles of Natural Science*. Kant's use of the forces of attraction and repulsion for the construction of matter suggested an entire system of philosophy in his fertile mind. Polarity became the principle of matter and of mind as well. In 1800–01 he edited the *Journal of Speculative Physics*, and set forth the doctrines of this fundamental conception, showing how the giant mind of the world develops from its sleep in nature ("petrified in nature") to consciousness in man. In 1802 appeared his dialogue, *Bruno, or on the Natural and Divine Principle of Things*, in which the theory of Giordano Bruno is given in the style of the Platonic *Timæus*. In the same year he associated himself with Hegel for the publication of the *Critical Journal of Philosophy* (Tübingen, 1802–03), the latter furnishing the greater part of the articles for it. In his *Lectures on the Method of Academical Study*, delivered in 1802 and published the next year, he gives the outlines of his entire system in a popular form. The tendency toward mysticism here makes its appearance, and is quite marked in his works written during the next few years. In his *Philosophy and Religion* (1804) he makes finiteness and materiality to be the result of a lapse from the Absolute, to recover from which lapse is the object and goal of human history. Theosophic doctrines appear in his essays *On the Philosophy of Nature* (1806) and *On the Relation of the Plastic Arts to Nature* (1807). The influence of Franz Baader upon Schelling belongs to this period, and is manifested in the noteworthy treatise, *Philosophical Inquiries into the Nature of Human Freedom* (1809), in which he seems to follow Jacob Böhme in his theological distinctions. In this treatise also, which does not strictly accord with his system of transcendental idealism already given, the stress that he lays upon freedom and personality indicates the first appearance of his latest system, his "positive philosophy." He defended his system against the charges of naturalism, Spinozism, and atheism in a controversial work against Jacobi in 1812. In 1808 he had gone to Munich as secretary of the Academy of Arts and Design. When in 1826 the University of Munich was founded, after the removal of that at Landshut, Schelling became professor, and for a time formed the chief attraction of the university. At Erlangen in 1820 he wrote the *Philosophy of Mythology* and the *Philosophy of Revelation*, mythology, according to his view, being an imperfect revelation. In 1834, upon the occasion of the publication of Hubert Becker's translation of Cousin's estimate of French and German philosophy, Schelling wrote a preface for it, and criticised the Hegelian philosophy as being merely negative, and as substituting logical abstractions for the living and real. The dialectic of Hegel he regarded as a fiction of hypostatization, whereby self-movement is ascribed to the Idea. In his lectures on the history of modern philosophy, delivered at Munich, he unfolded this critical view more fully. Ten years after Hegel's death, Schelling became his successor at the University of Berlin, and in his opening lecture (1841) endeavored to unite his earlier and later systems, pronouncing the system of Identity to be the necessary negative phase of his entire philosophy, and needing only to be supplemented by his philosophy of mythology and revelation, which he regarded as the positive phase. The publication (1842) of the substance of his lectures at Berlin, from notes taken by Paulus and Frauenstädt, showed very clearly that the work on freedom already mentioned lay at the basis of his later views. He distinguished in God, after the fashion of Böhme, (1) a blindly necessary or unpremeditating Being—the primordial "abyss" of the divine nature; (2) the three potencies of the essence of God: (*a*) unconscious will, the *causa materialis* of creation; (*b*) conscious will, the *causa efficiens*; (*c*) *causa finalis*, the union of the two —that by which all things are made that are made; (3) the three Persons, who proceed from the three potencies by overcoming the first or unconscious phase by means of the theogonic process. These Persons are the Father, Son, and Spirit—the possibility, the power, and the completed deed of overcoming that "primordial abyss of unconsciousness." In nature, only potencies are at work; in man, personalities. Both Schelling and Fichte laid great stress on the distinction between Pauline and Johannean Christianity. Schelling makes three periods of Christianity: (*a*) Petrine, or Catholicism; (*b*) Pauline, or Protestantism; (*c*) Johannean, or the Church of the future.

The two sons of Schelling (K. F. A. and Hermann) published a complete collection of his writings (Stuttgart and Augsburg, 1856–61) in 14 vols., of which the first division, in 10 vols., contains the works published during his life, arranged in their chronological order, while the second division, in 4 vols., gives what had remained unpublished, and is chiefly the exposition of his later system. Schelling's works have not been, to any great extent, translated into other languages. His introductions to the *Sketch of a System of Nature-Philosophy* and to the *System of Transcendental Idealism* (1799), however, have been translated and published in the *Journal of Speculative Philosophy* (St. Louis, 1867).

William T. Harris.

**Schells'burg,** p.-b., Napier tp., Bedford co., Pa. P. 342.

**Schem** (Alexander, J. B.), b. at Wiedenbrück, Germany, in 1826; studied at the gymnasium of Paderborn 1839–43; at the universities of Bonn 1843–45, and of Tübingen 1845–46; edited Westphalian newspapers 1849–51; came to the U. S. 1851; was professor of Hebrew and of modern languages at Dickinson College, Carlisle, Pa., 1854–60, after which he devoted himself to literature in New York, chiefly in the departments of geography and statistics; edited ecclesiastical almanacs for 1860 and 1868–69; wrote for religious and political newspapers; aided Rev. George R. Crooks in the preparation of his *Latin-English School Lexicon;* was one of the editors of the *Methodist* and of the *Methodist Quarterly Review;* was a contributor to Appleton's, McClintock & Strong's, and Johnson's *Cyclopædias*, and prepared a revised American edition of the *Conversations-Lexicon* in the German language, in 12 vols. (1869 *seq.*).

**Schem'nitz,** a large mining-town of Northern Hungary, on the Schemnitz, at an elevation of 2300 feet above the sea, has a celebrated mining school, with chemical laboratories and a splendid collection of minerals. The mines, which yield gold, silver, copper, and iron, extend below the city. P. of town and suburbs, 22,000.

**Schenck** (Noah Hunt), D. D., b. at Pennington, N. J., in 1825; graduated at Princeton 1844, and at Gambier Theological Seminary 1853; was ordained in the Protestant Episcopal Church; was for some years rector of Emanuel church, Baltimore, and became in 1867 rector of St. Anne's church, Brooklyn, N. Y. He founded and edited at Chicago the *Western Churchman* 1858–60; was co-editor of the *Protestant Churchman* 1867; and has published many sermons, essays, and treatises.

**Schenck** (Robert Cumming), b. at Franklin, O., Oct. 4, 1809; graduated at Miami University in 1827; studied law and was admitted to the bar, locating at Dayton; member of State legislature 1841 and 1842, and member of Congress 1843–51; U. S. minister to Brazil, and employed on diplomatic missions to Buenos Ayres, Montevideo, and Paraguay, 1851–54; appointed brigadier-general of volunteers in May, 1861, he commanded a brigade at the battle of Bull Run, July 21, subsequently in Western and Northern Virginia; engaged at battle of Cross Keys, Apr., 1862. At the second battle of Bull Run he was severely wounded and incapacitated until December, when, having meanwhile been promoted to be major-general from Aug. 30, he was placed in command of the 8th army corps and Middle department. Resigned from the army Dec., 1863, and resumed his seat in Congress, having been re-elected, serving at the head of the committee on military affairs and that of ways and means; appointed minister to England in 1871; resigned 1876.

**Schenec'tady,** county of E. New York, intersected by Mohawk River and Erie Canal, and traversed by the New York Central, Schenectady and Saratoga, Schenectady and Duanesburg, Schenectady and Troy, and Albany and Susquehanna R. Rs.; is watered by Norman's Kill and other streams; has an uneven surface, which becomes rugged in the southern part, while the valley of the Mohawk is extremely productive, and has important manufactures, chiefly in the city of Schenectady. Staples, Indian corn, broom corn, oats, hay, potatoes, hops, butter, and wool. Cap. Schenectady. Area, 220 sq. m. P. in 1870, 21,347; in 1875, 24,895.

**Schenectady,** city, cap. of Schenectady co., N. Y., on Mohawk River, in the beautiful valley of that name, about 17 miles by railroad and 30 miles by canal or river W. of Albany. It was patented Nov. 4, 1684; created a borough Oct. 23, 1765; incorporated a city Mar., 1798. Erie Canal passes through the city, also New York Central, Troy and Schenectady, Schenectady and Athens, Schenectady and Susquehanna, Schenectady and Saratoga R. Rs. It has 16 churches, and is the seat of Union College, one of the oldest and most successful in the State, incorporated in 1795, noted as having Dr. Nott for president for sixty-two years, from 1804 to 1866; has first-class graded schools with academical department and preparatory school for boys for college. Among its manufacturing establishments are large locomotive-works, the Washington Agricultural Works, forgeworks, 2 foundries, a shawl-factory, hoop-skirt factory, knitting-mills, sash, door, and blind factory, 3 planing-mills, varnish-factory, and 2 carriage-factories. The city is supplied with water by the Holly system, is lighted with gas, has 2 daily and 4 weekly newspapers (1 German), 1 monthly and 1 quarterly magazine, issued by college students, the St. Andrew's Home of the Friendless, and Vale Cemetery. Masons, Sons of Temperance, and I. O. of O. F. have lodges here. There are public halls, 1 park, and a State armory. P. in 1870, 11,026. It is one of the oldest settlements in the State; was burned and nearly all its inhabitants massacred by French and Indians in the winter of 1690. J. J. Marlett, Ed. "Evening Star."

**Schenevus,** p.-v., Maryland tp., Otsego co., N. Y., on Albany and Susquehanna R. R., has 1 newspaper. P. 549.

**Schen'kel** (Daniel), b. at Dögerlin, canton of Zurich, Switzerland, Dec. 21, 1813; studied theology in Bâle under De Wette and Hagenbach, afterward in Göttingen; was appointed pastor at Schaffhausen in 1841; professor of theology at Bâle in 1849, and in 1851 at Heidelberg, where his liberal views exercised considerable influence, but also met with great opposition. He edited *Allgemeine Kirchenzeitung* (1852–59) and *Allgemeine Kirchliche Zeitschrift* (1859–72), and *Bibel-lexicon* (1869–75, 5 vols.); wrote *Das Wesen des Protestantismus* (3 vols., 1846–51), *Christliche Dogmatik* (2 vols., 1858–59), *Das Charakterbild Jesu* (1864; translated into English by W. H. Furness, 1866), besides a number of pamphlets, essays, etc. He is the founder of the German Protestant Union.

**Scherr** (Johannes), b. at Hohenrechberg, Würtemberg, Oct. 3, 1817; studied philosophy and history at Tübingen; resided partly in Stuttgart, partly in Switzerland, and was appointed professor of history at the polytechnic school of Zurich in 1860. He was a very prolific writer; his principal works are *Geschichte der deutschen Literatur, Geschichte der englischen Literatur, Schiller und seine Zeit, Geschichte der deutschen Frauenwelt* (2 vols.), *Blücher, seine Zeit und sein Leben* (3 vols.).

**Scherz'er** (Karl), b. at Vienna May 1, 1821; worked as a printer in Leipsic and Paris; travelled in North and Central America 1852–55; accompanied the Austrian expedition around the world 1856–59; led an expedition in 1869 to Eastern Asia, Siam, China, and Japan, and was appointed Austrian consul at Smyrna in 1872. He has described in German all his travels; in 1875 he published *La Province de Smyrne.*

**Sche'veningen,** village of the Netherlands, province of South Holland, on the North Sea, 2 miles N. E. of the Hague, of which it is almost a suburban watering-place, has valuable fisheries and manufactures of sailcloth and ropes, and is the most celebrated sea-bathing resort in the country. P. 7436.

**Schiedam',** town of the Netherlands, province of South Holland, on the Schie, is a neat and well-built place, and has fine buildings, among which the town hall and exchange are the most remarkable. Its principal industry is gin manufacturing, for which it has 236 distilleries, besides 74 maltworks. Large herds of cattle and swine are fed from the refuse of the distilleries, and an extensive trade is carried on. P. 20,778.

**Schil'ler, von** (Johann Christoph Friedrich), the renowned German poet, who is ranked, by the critical judgment of all lands, as only second in genius and widespread influence to his great contemporary, Goethe, was born in the little village of Marbach, in Würtemberg, on Nov. 10, 1759. His father was a military surgeon, who was made captain in the army for his services in the Netherlands and Bohemia. He was an instance, very rare in those days, of a man who tried, in middle life, to make up for the deficiencies in his early education. His mother, Elizabeth Kodweiss, was a baker's daughter, with some natural taste for music. As a boy, Schiller exhibited signs of a highly imaginative and spiritual nature, and his childish ambition was to become a clergyman. But Duke Karl of Würtemberg insisted, against the wish of the parents, on having the boy educated in a new academy—the Karl's-School—which he had founded according to the most approved plan of military discipline. Theology was not taught in this academy; Schiller, therefore, entering at the age of fourteen, first selected law, but afterward changed to medicine, in which branch he was graduated in his twenty-first year. There can be no doubt that the rigid, soulless discipline to which he was subjected for seven years was one cause of the fierce, reckless, rebellious spirit which breathes through his earliest works. Even before leaving the academy he had written his play of *The Robbers*, and after his graduation and appointment as military surgeon to a regiment in Stuttgart, he published it at his own expense. The impression it made was immediate and universal; the time was ripe for a revolt in literature against the French classicism, which had governed the intellectual tastes of Europe for a century. Baron Dalberg, then director of the theatre at Manheim, announced *The Robbers* for representation on the stage, and Schiller, being refused leave of absence, went to Manheim without it, and witnessed its first successful performance Jan. 13, 1782. On his return to Stuttgart he was arrested and temporarily imprisoned; the duke endeavored to exact a pledge from him that he would write no more poetry, and the probability of sterner measures being taken induced Schiller to take refuge in flight. In September of the same year, under an assumed name, in company with a musician named Streicher, he left Stuttgart, and for nearly

a year afterward remained in concealment on an estate belonging to the noble family of Wolzogen, near Meiningen. During this time he completed his plays of *Fiesco* and *Intrigue and Love*. The first of these, rejected by Dalberg, was finally produced at Manheim, and became so popular that the author was offered the post of dramatic poet to the theatre there with a meagre salary. He accepted the position, undertook also the editing of a new dramatic periodical, *Thalia*, and remained in Manheim until the spring of 1785, when a cordial invitation from Körner (the father of the famous poet, Theodore Körner) drew him to Leipsic. Soon afterward he followed Körner to Dresden, and was supported in the most generous manner by that faithful friend during two years while writing his tragedy of *Don Carlos*, his historical sketch *The Revolt of the Netherlands*, the romantic fragment *The Ghost-Seer*, and a number of lyrical poems. In the summer of 1787, Schiller visited Weimar for the first time, and made the acquaintance of the authors Wieland and Herder. He also met his future wife, Charlotte von Lengefeld, whom he returned to see the following summer, and in the garden of the Lengefeld family at Rudolstadt first met Goethe. The interview has a special interest from the fact that these two poets, destined to be such friends and colaborers, mutually repelled each other at first sight. Nevertheless, it was through Goethe's influence that Schiller early in 1789 was offered the place of professor of history at the University of Jena. He at first hesitated to accept on account of want of preparation, but he was tired of his homeless life, and saw in the appointment the possibility of marriage. His opening lectures were remarkably popular. He married Charlotte von Lengefeld early in 1790, and devoted himself with ardor to a life of study and creative activity. But during the following year he was brought to the verge of the grave by an inflammation of the lungs; the report of his death was circulated, and he was already so well known beyond the boundaries of Germany that two Danish noblemen, the prince of Augustenburg and Count Schimmelmann, sent him the sum of 1000 thalers annually for three years, in order that he might rest and recover his strength. His *History of the Thirty Years' War* was published in 1793, and in the autumn of that year he returned to Würtemberg with his family, and remained until the following spring, his visit being wisely ignored by the duke. Through consultation with the publisher Cotta a literary periodical called *The Hours* was projected, and this led to the most important crisis of his life. Goethe's co-operation was too important to be overlooked: the two poets met again, discovered unexpected points of sympathy, and soon became united in a personal and literary friendship as noble as it is rare in history. Schiller soon freed himself from the influence of Kant, which had seriously interrupted his poetical activity; stimulated by Goethe, he wrote his finest ballads and lyrics, and was greatly encouraged by the success of his periodical, *The Hours*. His plan for a great drama based on the history of Wallenstein was resumed, and the completion of the work as a trilogy or triple drama in the year 1799 placed him at once in the first rank of authors. His ill-health, however, made it more and more difficult for him to discharge the duties of his professorship at Jena; a closer intercourse with Goethe became an intellectual necessity, and in the year 1800, after the grant of a liberal pension by the duke, Karl August, he removed to Weimar. His friendship with Goethe drew upon both the bitter hostility of most of the secondary authors of Germany, and many attempts were made, but in vain, to estrange the two great friends. The splendid rhythm, rhetoric, and artistic completeness of form of Schiller's *Song of the Bell*, *The Diver*, and his classical ballads bore down all narrow criticism, and secured his fame as a poet in the universal judgment of the German people. His *Wallenstein* was a great success upon the stage; not less so his *Marie Stuart*, which appeared in 1800, and *The Maid of Orleans*, in 1801. In the year 1802, Schiller was ennobled by the emperor, Francis II. His next work, *The Bride of Messina* (1803), was an interesting attempt to unite the stately formalism of the antique Greek chorus with the free romantic element of modern dramatic art. Notwithstanding many passages of rare lyrical beauty, the experiment cannot be considered successful, although the play is still occasionally given on the German boards. *William Tell*, which appeared in 1804, although poetically inferior to *Wallenstein*, was Schiller's greatest dramatic success. He visited Leipsic and Berlin when it was produced, and was received with the greatest popular enthusiasm. There was a chance of his obtaining the post of director of the royal theatre in the latter city, but the duke doubled his pension in order to retain him, and he was also unwilling to relinquish his intercourse with Goethe. He began a new play, *Demetrius*, and was well advanced in the work when, in the spring of 1805, his failing vital power reached its limit. A simple cold apparently turned the balance, and on the 9th of May he died, aged forty-five years and six months. A dissection showed that under no circumstances could his life have been prolonged for more than six months more. His remains were exhumed in 1826, placed in a granite sarcophagus, and transferred to the vault of the grand ducal family, where they now repose beside those of Goethe. Schiller had two sons and two daughters, only two of whom left issue; his present (1876) surviving descendants are his grandsons, the baron von Schiller and the baron von Gleichen-Russwurm, the latter of whom is a distinguished landscape-painter. As a poet Schiller has a right to be placed at least among those of the second rank, in the list which includes Virgil, Tasso, and Byron. In him the interest belonging to individual character is associated with his genius, and lends to it the magnetism which accompanies universal popularity. On the hundredth anniversary of his birth, in 1859, a "Schiller-fund," amounting to several hundred thousand dollars, was created in Germany, and the annual income is devoted to the assistance of needy authors, some fifteen or twenty of whom are now wholly or partially supported from this source. All the principal cities of Germany have erected statues in his honor. The unselfish devotion of his life to his art is recognized with a fervor which takes no note of his early irregularities; and without ever having made the slightest profession of democracy he is everywhere celebrated in Germany as the poet of the people. The explanation of this fact must be sought for in the sincerity of his nature, no less than in the persecution of which he was temporarily the object. Carlyle finely says of him: "He was a high ministering servant at truth's altar, and bore him worthily in the office he held." The recognition of his powers has rather increased than diminished since his death.

BAYARD TAYLOR.

**Schil'ling** (JOHANNES), b. at Mittweida, Saxony, June 23, 1828; studied sculpture in Dresden, Berlin, and Rome; settled in 1856 at Dresden, and was appointed professor at the academy in 1868. The first work which attracted attention was *Amor and Psyche*. The most remarkable of his later works are the Schiller monument in Vienna and the four allegorical groups on the Brühl Terrace in Dresden.

**Schim'melfennig** (ALEXANDER), b. in Germany in 1824; was an officer under Kossuth in the Hungarian insurrection, after which he came to the U. S.; published *The War between Russia and Turkey* (1854); became in 1861 colonel of a Pennsylvania regiment; served under Siegel and Pope in Virginia; brigadier-general Nov. 29, 1862; commanded a brigade at Chancellorsville and at Gettysburg; was sent to garrison St. John's Island Feb., 1864. D. at Minersville, Pa., Sept. 7, 1865.

**Schin'kel** (KARL FRIEDRICH), b. at Neu Ruppin, Prussian province of Brandenburg, Mar. 13, 1781; studied architecture in Berlin, Italy, and France, and was appointed professor at the Academy of Berlin in 1820. D. Oct. 9, 1841. He built the guard-house, theatre, museum, Potsdam gate, etc. in Berlin, and other buildings elsewhere; published *Sammlung architektonischer Entwürfe* (1820–37); after his death appeared *Werke der höheren Baukunst* (1845–46).

**Schi'o,** town of Northern Italy, province of Vicenza, on the Leogra, near the borders of the Trentino, has recently risen to importance by the establishment of first-class woollen factories. A railway 20 miles long was opened in 1876, connecting with Vicenza. P. about 16,000.

**Schism** [Gr. σχίζειν, to "split"], a division in the Church on points of worship and discipline. A schismatic is one who separates himself, or improperly cuts off others, from the Church. The New Testament word refers to differences rather than divisions. Some of the chief divisions, either voluntary or forced, are the Ebionite (second and third centuries), Novatian (251 A. D.), Miletian (305), Donatian (311), Arian (first under Damasus, 355; second under Miletian, 361), Nestorian (428), Monophysite (482). The great schism between the East and West (c. 880) arose from hierarchical rivalry, the conflict concerning courts of appeal between Pope Nicholas I. and Photius, patriarch of Constantinople, limits of jurisdiction, doctrines and rites. Their mutual excommunication dates 1054. The papal schisms concerning the election of popes were 963, 1159, 1164, 1168, 1178, and the great schism, with rival courts at Rome and Avignon, 1378–1418. With discussions and corruptions rose new sects, some fanatical, some reforming, but in their separation from the Church differences of doctrine were emphasized, and generally they were called heretics.

ISAAC RILEY.

**Schist** [Gr. σχιστός, "split," "cloven"], a somewhat flaky rock, usually less perfectly laminated and harder than the shales and slates, and most commonly metamorphic.

There are many varieties of schist, and the term is somewhat loosely employed.

**Schla'gintweit** (Hermann), b. May 13, 1826; Adolf, b. Jan. 9, 1829, killed at Kashgar Aug. 26, 1857; Robert, b. Oct. 27, 1833, were sons of an eye-physician of Munich; received a careful education, and distinguished themselves early by their enthusiastic study of physical science, especially geology. Twice they explored the Alps, and communicated the results of their researches in *Untersuchungen über die physikalische Geographie der Alpen* (1850) and *Neue Untersuchungen* (1854), which attracted general attention. From 1854 to 1858 they undertook, supported by the king of Prussia and the British East India Company, comprehensive explorations of the Himalayas, Thibet, Hindostan, and Deccan, the results of which have been communicated in *Results of a Scientific Mission to India and High Asia*, with an atlas of panoramas, views, and maps, of which 5 vols. have appeared, and *Reisen in Indien und Hochasien*, written by Hermann alone, of which 4 vols. have appeared. Robert also travelled extensively on the American continent, and wrote in 1870 *Die Pacific Eisenbahn in Nordamerika*, and in 1871 *Californien, Land und Leute*. —A fourth brother, Emil, b. July 7, 1835, studied first law at Berlin, afterward Oriental languages and history, and published *Buddhism in Tibet* (1863), *Die Gottesurtheile der Indier* (1866), *Die Könige von Tibet* (1866).—A fifth brother, Edouard, b. Mar. 8, 1831, entered the Bavarian army, and fell in the battle of Kissingen, July 10, 1866. He published *Der Spanisch-marokkanische Krieg* (1863).

**Schlat'ter** (Michael), b. at St. Gall, Switzerland, July 14, 1716; educated at his native city; studied divinity; preached for some time in Switzerland; came to Pennsylvania in 1746 as a missionary to the German Reformed immigrants; was pastor of churches in Philadelphia and Germantown 1746–51; visited the German settlers scattered in the colonies of Pennsylvania, New Jersey, Maryland, and Virginia, organizing churches; took the preliminary steps in the formation of the first American synod of the German Reformed Church Sept., 1747; revisited Europe 1751; procured six other ministers for the American churches; became superintendent of the German charity schools in Pennsylvania 1755; accompanied the expedition against Nova Scotia as chaplain of the Royal American regiment 1757, and suffered imprisonment by the British authorities at Philadelphia on account of his Revolutionary services 1777. D. near Philadelphia Oct., 1790.

**Schle'gel, von** (August Wilhelm and Friedrich), two brothers, b. at Hanover—the former in 1767, the latter in 1772; became the founders and leaders of the romantic school in German literature, and acquired great celebrity for poetical and critical talents, comprehensive and generally correct knowledge, and exquisitely refined and generally sound taste. August Wilhelm led a somewhat restless life. He studied theology and philology at Göttingen; acted as a tutor in Amsterdam; lectured in Jena from 1797 to 1802, and in Berlin from 1802 to 1805; travelled for several years with Madame de Staël through France, Switzerland, Italy, Spain, and Austria; accompanied Bernadotte in 1812 as private secretary; travelled once more for several years with Madame de Staël, and settled down at last, in 1818, as professor at the University of Bonn, where he d. in 1845. He was married twice, and both times divorced. He was editor of and contributor to numerous periodicals. He wrote ballads, tragedies, and literary satires, but his most valuable works are his translations of Shakspeare (1797–1810), of Calderon (1803–09), and from Sanskrit (1823–39), and his celebrated *Lectures on Dramatic Art and Literature*, delivered at Vienna in 1808, and published next year in 3 vols.—a book wonderful as a whole, charming in its details, and, although it now needs manifold correction, instructive and full of true information.—Friedrich von Schlegel was less volatile in his manners, as he was less versatile in his talents. He studied philology in Göttingen and Leipsic; lectured in Jena 1800, in Dresden 1802, in Paris 1803; joined, with his wife, the Roman Catholic Church in 1808; and lived after that time mostly in Vienna, writing and lecturing. D. on a lecturing-tour to Dresden in 1829. Like his brother, he wrote poems and tragedies and contributed much to periodicals, but his principal works are his *Philosophy of Life* (1827), *Philosophy of History* (1828), and *Philosophy of Language* (1829), and his famous romance *Lucinde* (1799), a book which is now never placed in a private library on account of its naked indecency. Although there were great differences between these two brothers, and they often followed different lines of conduct, yet the fundamental characteristics of their minds were the same, and they always worked in the same spirit. August Wilhelm was elegant, but a little superficial; Friedrich was deeper, but his depths easily became a little obscure. August Wilhelm was witty, Friedrich was cutting. August Wilhelm's talent was description, Friedrich's was discrimination. But they both lacked conviction and creative power, and, like all people who hunger and hunt after conviction and have no power of attaining it, they made a retrograde movement, and sought refuge in adoration of that which formerly had given rest and blessedness to the mind of mankind. The Middle Ages, with their naïve and passionate ideas of kingdoms and popedom, became their ideal, and through them the ideal of the romantic school. Much confusion and much real harm came from this mental peculiarity of theirs, but both brothers nevertheless had a precious faculty of appreciating a mental phenomenon exhibited in literature or art, in morals or æsthetics, in its pure objectivity, without mixing it up with their own subjective whims and passions; and although they failed in their philosophical explanations of this faculty, which they called *irony*, and which they proclaimed as the highest artistic faculty, yet German civilization learned much from them in this respect.

Clemens Petersen.

**Schlei'cher** (August), b. at Meiningen, in the Saxon duchies, Germany, Feb. 19, 1821; studied theology and comparative philology at Leipsic, Tübingen, and Bonn, and was appointed professor at Prague in 1850, and in 1857 at Jena. D. Dec. 6, 1868. His linguistic knowledge was very extensive, but the Slavo-Lettic languages formed his specialty, and some of his most remarkable writings treat this subject—*Die Formenlehre der kirchenslawischen Sprache* (1853) and *Handbuch der litauischen Sprache* (2 vols., 1856–57). He also wrote *Die Sprachen Europas* (1850), *Compendium der vergleichenden Grammatik der indogermanischen Sprachen* (1862; translated into English by H. Bendall, London, pt. 1, 1874), *Die Darwin'sche Theorie und die Sprachwissenschaft* (1863), *Ueber die Bedeutung der Sprache für die Naturgeschichten der Menschen* (1865).

**Schlei'den** (Matthias Jakob), b. in Hamburg Apr. 5, 1804; first studied law at Heidelberg, then medicine at Göttingen, and finally botany at Jena, where he was appointed professor in 1839. In 1862 he resigned his office, and after a short stay at Dorpat (1863–64) as professor of vegetable chemistry, he settled at Dresden. His principal works are—*Grundzüze der wissenschaftlichen Botanik* (2 vols., 1842–43), which attracted much attention and gave rise to many controversies; it was translated into English by Dr. Lankester (1849); *Die Pflanze und ihr Leben*, translated into English by Prof. Henfrey (1848); *Baum und Wald* (1870), *Die Rose* (1873).

**Schlei'ermacher** (Friedrich Ernst Daniel), b. at Breslau Nov. 21, 1768; d. at Berlin Feb. 12, 1834, was the son of a Reformed clergyman, and was brought up in the community of Moravian Brethren, receiving a profound religious impulse from them. From 1783 to 1787 he attended the pædagogium at Niesky and the seminary of the United Brethren at Barby. He completed his theological course at Halle, and after filling the positions of private tutor, assistant preacher, etc., became in 1796 the chaplain of the Charité-Haus at Berlin; in 1802 court-chaplain at Stolpe, and in 1804 professor (*extraordinarius*) of theology and philosophy at Halle. In 1809 he preached at the Trinity church in Berlin, and the following year received appointment as professor (*ordinarius*) of theology at the new University of Berlin, which position he retained till his death, Feb. 12, 1834. During the ten years previous to going to Berlin he had studied and criticised the Kantian philosophy, and was greatly attracted by Jacobi's exposition of Spinoza. He subsequently studied and translated Plato, and did much by his lectures to encourage the study of the remains of the early Greek philosophy. His activity knew no limits. He labored to effect a union of the Lutheran and Reformed churches on the broad basis that demanded unity in the spirit of Protestantism and allowed diversity as to doctrines and modes of worship. His failure in this led to a misunderstanding with Minister von Altenstein which lasted for some years.

The fundamental point of view of Schleiermacher's system is this: Religion is not a knowing nor a doing, but a feeling—a feeling of the universal life of the Infinite, and of the dependence of the Ego upon it. Hence, with him, religion begins with the feeling of dependence. Reflection upon this feeling gives rise to descriptions of it, and hence the statement of religious principles and dogmas. All religions are historic and positive. Among these Christianity holds a unique place, inasmuch as in it is found the reconciliation with the Infinite, hence the very essence of religion itself. Upon the same framework of antithetic ideas of the universal and particular (infinite and finite, common and special, God and the Ego) he builds his system of ethics. The organizing activity of reason in the realm of the common or universal, securing

identity of common usage, is the first province of ethical action—that of interchange among men. The second is that of organization in the realm of particular individuality, the province of inalienable personality. The third and fourth provinces of ethical action are not those of organization, but of "symbolism," the third being that of symbolism with identity in the realm of thought and language, and the fourth the symbolism with individuality in the realm of feeling. Corresponding to these four provinces are the four institutions: (*a*) state, in which each is for the whole; (*b*) civil society, organized for the benefit of the individual; (*c*) school (college, etc.), for community of culture; (*d*) church, "for individual symbolic activity." The most important of Schleiermacher's writings are—(1) *Discourses on Religion* (Berlin, 1799); (2) *Monologues* (1800); (3) *Confidential Letters on F. Schlegel's Lucinde* (1800); (4–7) *Four Collections of Sermons* (1801–20); (8) *Outlines of a Critique of Previous Systems of Ethics* (1803); (9) *Translation of Plato's Works* (1804–28); (10) *The Christian Faith according to the Principles of the Evangelical Church* (1821–22); (11) *Theological Encyclopædia* (1811). After his death were published (1835) lectures on the history of philosophy, dialectics, psychology, ethics, politics, and pedagogics. The lectures on the life of Jesus, which appeared in 1864, made an epoch when first delivered. According to the authority of Zeller, Schleiermacher is the greatest theologian of the Protestant Church since the period of the Reformation—"a churchman whose liberal ideas will yet prevail in regard to the union of Protestant confessions, the constitution of the Church, and the rights of conscience and individuality in religion"—"a deep-working religious teacher, who formed the heart by the understanding and the understanding by the heart—a philosopher who scattered fruitful seeds, who introduced a new era in the knowledge of Greek philosophy, and who assisted in Germany's political regeneration." He investigated the nature of religion more profoundly than any before him. Physically, he was small of stature, slightly deformed, quick and animated in his movements, his countenance kind and sympathetic. He married in 1809 the widow of his friend Willich. His *Autobiography* (covering only the first twenty-six years of his life) was published in 1851. His *Correspondence with J. C. Gass* appeared the following year in 4 vols. His *Biography* has been written by K. Schwartz, D. Schenkel, W. Dilthey, and others.

WILLIAM T. HARRIS.

**Schleitz.** See REUSS.

**Schle'stadt,** town of the German empire, province of Alsace, on the Ill, has manufactures of calicoes, woollen and cotton hosiery, linens, soap, and oil, and a large trade in corn, wine, and fruits. P. 10,184.

**Schles'wig** [Dan. *Slesvig*], the northern part of the Prussian province of Schleswig-Holstein, comprising an area of 3529 sq. m., with 409,907 inhabitants, and bounded N. by Jutland; S. by Holstein, from which it is separated by the river Eider, E. by the Baltic, and W. by the North Sea, formed a part of Denmark from the establishment of that kingdom in the beginning of the ninth century up to 1866. When in 826, King Gorm the Old had gathered all the small Danish kingdoms under one crown, his wife, Thyra Dannebod, induced the Danes to build a wall (Dannevirke) on the frontier between Denmark and Germany; that is, on the frontier between Schleswig and Holstein. The Danes assembled from all parts of the country; while the men worked on the wall, the women tilled the fields, and when, after the lapse of about thirty years, Dannevirke was finished, it was in some respects a gigantic work. It stretched from the gulf of the Schley or Slienfjord to the river Eider, a distance of about 20 miles, was from 20 to 40 feet high, faced Holstein with a broad ditch, with bastions and towers, and communicated with it only through one narrow gate. But it was built of turf, peat, and wood. Henry the Fowler succeeded in setting fire to it, and broke through it. It had to be rebuilt of clay, cement, and stone, but then it held good for centuries. That this wall was not merely an artificial frontier-line between two countries, but the natural boundary between two different tribes destined to develop into two distinct nationalities, is shown by several facts. Those weapons and utensils of stone which characterize the oldest phase of civilization in Scandinavia are found in great numbers in Schleswig, down to Dannevirke, but none were ever found in Holstein on the other side of the wall. Next, the river Eider is generally called the frontier of the "Holy Roman" empire by all kinds of authors, both in the German and Danish literature, up to the end of the eighteenth century, and people on both sides of the river were very well aware of the fact that the influence of the Roman law stopped before the Eider, while the law of Schleswig was a development of purely Scandinavian origin. Nor was the name of the country at that time Schleswig, but South Jutland, and the wars between the German and Danish kings were by no means waged for the possession of this territory, but merely because the Germans wished to christianize the Danes, while the Danes wished to plunder the Germans.

In 1232, King Waldemar II. divided his dominion between his three sons, in accordance with the tendency then ruling universally in Europe. Erik became king in 1241; Abel received Schleswig as a fief; Christopher, Laaland and Falster. Feuds immediately ensued between the king of Denmark and his vassal, the duke of Schleswig; and when the family of Abel intermarried with that of the counts of Holstein, and thereby procured foreign aid, the feuds grew into wars. In 1375 the family of Abel became extinct, and Schleswig returned to Denmark; but in 1386, Margrethe, who was busy with the establishment of the Scandinavian union, enfiefed Count Gerhardt of Holstein with it, on account of his relationship with the family of Abel, and in order to procure peace on her southern frontier while she was warring on the northern. This Holsatian family, which thus held Holstein as a fief of the German crown and Schleswig as a fief of the Danish, died out in 1459, but the Danish king, Christian I., a German prince and the founder of the house of Oldenburg, instead of incorporating Schleswig and sending Holstein adrift into Germany, chose to use Schleswig as a bait by which to catch Holstein. He promised that Schleswig and Holstein should always be united together under one government, and thereby procured his election by the states as duke of Holstein. His successors on the Danish throne used to provide for their younger sons by giving them estates in Schleswig and Holstein. Thus, several ducal lines sprang up; some of them acquired considerable power, and all of them assumed, from natural jealousy, a hostile attitude toward the Danish dynasty. They were Germans by origin and connections; they sought their allies in Germany, and thus the Germanization of certain parts of Schleswig took place in a natural way, nobody noticing it. In 1721 all these ducal lines were driven out of Schleswig, having committed open treason against the Danish crown during the late war with Sweden, and the incorporation of the country as a Danish province was recognized and guarantied by the European powers. The germanization, however, did not stop. On the contrary, it was even favored by the Danish government—first, because at the court of Copenhagen, German played the same part up to the end of the eighteenth century as French at the court of Berlin during the reign of Friedrich II.; and next, because the government hoped to get a firmer grasp on Holstein by fostering German sympathies in Schleswig. But in the first half of the nineteenth century the idea of nationality began to show itself in politics, and the rapidity and force with which it developed gave very soon the affairs in Schleswig a new aspect. This country, to which Germany never had had, nor ever had made, any claims, had now become partly German, and twice—in 1848, during the general revolutionary excitement in Germany, and in 1864, during the dangerous conflict with Austria concerning the supremacy in Germany, and with the diet concerning the military reorganization—the Prussian government used this circumstance as a safety-valve. The attention of the German nation was artificially drawn away from its own affairs and concentrated on this point, and its natural and honest sympathy was fanned into fanaticism and hatred. In 1848, however, the interference of Russia compelled Prussia to withdraw its troops, and then the insurrection in Holstein was speedily put down; but in 1864, Prussia and Austria conquered Holstein and Schleswig, and by the Treaty of Vienna (Oct. 30, 1864) Denmark was compelled to cede them. According to the convention of Gastein (Aug. 14, 1865), Austria occupied Holstein, Prussia Schleswig, but by the Treaty of Prague (Aug. 23, 1866) Prussia retained them both; and to the article of that treaty stipulating that the northern Danish-speaking part of Schleswig should be given back to Denmark it has paid no regard.

CLEMENS PETERSEN.

**Schleswig,** town of Prussia, province of Schleswig-Holstein, formerly the capital of the duchy of Schleswig, is at the head of the Schley or Slie, a narrow inlet of the Baltic, 20 miles long, and navigable only for small vessels. It is an old town, and was of considerable commercial importance in the Middle Ages. Its cathedral contains many curious monuments, but when its harbor filled up with sand its mercantile enterprise decreased. There are several good educational institutions, and some manufactures of leather, sugar, earthenware, and woollen stuffs. P. 13,850.

**Schleswig,** tp., Manitowoc co., Wis. P. 1718.

**Schleswig-Holstein,** province of Prussia, bounded N. by Denmark, S. by the Elbe, which separates it from Hanover, E. by the Baltic, and W. by the North Sea, com-

prises an area of 6766 sq. m., with 995,873 inhabitants. Several islands—Romö, Sylt, and Föhr in the North Sea, Alsen and Femern in the Baltic—belong to the province. A slightly elevated ridge stretches through the centre of the country, sandy, gravelly, and covered with heath in Schleswig—swampy, marshy, and covered with forests in Holstein. To the E. of this ridge the surface is beautifully diversified by hills, and the coast much indented by long, narrow fiords. The soil affords excellent arable land, and forests of oak and beach are numerous. To the W. the surface is perfectly level, and the ground so low that the country in many places must be protected against the North Sea by high dikes; but the soil is rich and affords excellent pasturage. The chief occupations are agriculture in the eastern part, cattle-breeding in the western. Wheat, hops, and fruit are raised in great quantities, and thousands of fat oxen are annually sold in Hamburg and London. The fisheries in the North Sea are considerable, but the manufacturing industry is insignificant. One-half of the population of Schleswig, about 200,000 people, speak Danish; the Frisian language is spoken in the western districts and on the islands of the North Sea; the rest of the inhabitants speak the Low German dialect. The province is of vital importance to Prussia for the formation of a German fleet, partly on account of the harbor of Kiel, the best, if not the only one available for naval purposes, on the coast of Germany, and partly because of the fitness of the inhabitants for maritime occupations.

**Schleus'ner** (Johann Friedrich), b. in Leipsic Jan. 16, 1756; studied theology and philology in the university of that city; appointed professor of theology in Göttingen 1784, and in 1795 professor of theology and provost of the collegiate church in Wittenberg; devoted himself principally to the lexicography of the Greek Scriptures. After the removal of the University of Wittenberg he was associate director of the theological seminary. His chief productions were—*Lexicon Græco-Lat. in Novum Testamentum* (Leipsic, 1792; last ed. (4th), 1819, 2 vols. in 4 parts), *Thesaurus sive Lexicon in LXX.* (Leipsic, 1821, 5 vols.; both reprinted in Glasgow and London, the former in 2, the latter in 3 vols.). The lexicon to the Septuagint is still the most complete on the subject. Schleusner edited, with Stäudlin, for some years (till 1795), the *Göttingsche Bibliothek der neuesten theologischen Literatur*. D. Feb. 21, 1831. H. Drisler.

**Schley,** county of S. W. Georgia, watered by Cedar, Bear, and Muckalee creeks, has a level surface and a moderately fertile soil. Staples, Indian corn, cotton, and sweet potatoes. Cap. Ellaville. Area, 160 sq. m. P. 5129.

**Schlie'mann** (Heinrich), b. in 1822 at Kalkhorst, Mecklenburg-Schwerin; received a mercantile education at Fürstenberg and Amsterdam; established a business of his own in St. Petersburg in 1847; travelled much, acquired many languages, and retired in 1863 from business. In 1869 he published at Paris *Ithaque, Péloponnèse et Troie*, giving an account of his travels in those regions; in 1874 followed his *Trojanische Alterthümer*, giving an account of the excavations he had undertaken on the plateau of Hissarlik, and accompanied by an *Atlas trojanischer Alterthümer*, consisting of 217 photographic plates. The latter work was translated by Philip Smith into English in 1875.

**Schlos'ser** (Friedrich Christoph), b. at Jever, Oldenburg, Nov. 17, 1776; studied theology and philosophy at Göttingen; spent several years as a private tutor in various families and as librarian to the city of Frankfort, and was appointed in 1817 professor of history at the University of Heidelberg, where he d. Sept. 23, 1861. His principal writings are *Geschichte des 18. Jahrhunderts* (8 vols., 1823–46; often reprinted, and translated into English by Davidson, Lond., 1843–52), *Weltgeschichte in zusammenhängender Erzählung* (9 vols., 1817–24), *Universal historische Uebersicht der Geschichte der alten Welt und ihrer Cultur* (3 vols., 1826–34). His *Weltgeschichte* (19 vols., 1842–54) is mostly a compilation from his other works by Kriegk.

**Schlöz'er, von** (August Ludwig), b. at Gaggstedt, Würtemberg, July 5, 1735; studied theology at Wittenberg and Göttingen; lived from 1755 to 1759 at Stockholm as private tutor, and wrote here, in the Swedish language, a history of commerce; went to Russia in 1761 with the Russian court-historiographer, Müller, and was appointed professor of political science in 1764 at Göttingen, where he d. Sept. 9, 1809. His principal works are his *Allgemeine nordische Geschichte* (2 vols., 1772) and his translation of Nestor's *Russian Chronicles* (5 vols., 1802–09).—His grandson, Kurd von Schlözer, b. at Lubeck Jan. 5, 1822, was German minister to Mexico 1869–71, and subsequently in Washington, and wrote *Choiseul und seine Zeit* (1849), *Geschichte der deutschen Ostseeländer* (3 vols., 1850–53), *Verfall und Untergang der Hansa* (1853), *Friedrich der Grosse und Katharina II.* (1859).

**Schmal'kalden,** town of Prussia, province of Hesse-Nassau, at the confluence of the Schmalkalde and Stille, has saltworks, iron and steel forges, and manufactures of white-lead and paper. The famous league of the German Protestant princes was formed here in 1531. P. 5600.

**Schmid** (Christian Friedrich), son of a clergyman, b. at Bickelsberg, in Würtemberg, in 1794; was professor extraordinary at Tübingen 1821, professor ordinary 1826, and d. Mar. 28, 1852. His *Biblische Theologie des Neuen Testaments* was published posthumously (1853; 2d ed. 1859; Eng. trans. by G. H. Venables, 1870). R. D. Hitchcock.

**Schmid** (Leopold), b. at Zurich June 9, 1808; studied theology at Tübingen and Munich, and was appointed professor of theology in 1839, and afterward of philosophy at Giessen. Although a strict adherent of the Roman Catholic Church, his broader and more liberal views, acquired by an extensive study of philosophy, brought him into collision with the ultramontane party. In 1849 his election as bishop of Mentz was not confirmed by the pope, who, however, dared not place his book, *Der Geist des Katholicismus oder Grundlegung der christlichen Irenik* (2 vols., 1848–50), in the *Index*. His *Ultramontan oder katholisch?* (1867) showed a decided opposition to the exorbitant claims of the pope. D. at Giessen Dec. 20, 1869.

**Schmidt** (Heinrich Julian), b. at Marienwerder, province of Prussia, Mar. 17, 1818; studied philology and history at the University of Königsberg; settled in 1847 at Leipsic as editor, afterward in connection with Gustav Freytag as proprietor of the *Grenzboten*, which supported the Prussian interest in Germany; removed in 1861 to Berlin and edited the *Berliner Allgemeine Zeitung* (1861–63), but retired afterward to private life. His books, *Geschichte der Romantik in Zeitalter der Reformation und Revolution* (2 vols., 1850), *Geschichte der deutschen Literatur seit Lessing's Tod* (3 vols., 1858), *Geschichte des geistigen Lebens in Deutschland von Leibniz bis auf Lessing's Tod* (2 vols., 1860–64), *Bilder aus dem geistigen Leben unserer Zeit* (1870), are both interesting and instructive. The views of the author are decided and lucid, and his style forcible, but sometimes his conceptions look wilful, and his argumentation becomes too subtle to be convincing.

**Schmidt** (Henry I.), S. T. D., b. at Nazareth, Pa., Dec. 21, 1806; educated at the Moravian pædagogium and theological seminary of his native town; was a teacher in the former institution 1826–29; pastor of Lutheran churches in Bergen co., N. J., 1831–33; professor at Hartwick Seminary, Otsego co., N. Y., 1833–36; pastor of a German Lutheran church at Boston, Mass., 1836–38; professor in Pennsylvania College and Theological Seminary at Gettysburg, Pa., 1838–43; pastor of Lutheran churches in Montgomery co., N. Y., 1844; principal of Hartwick Seminary 1845–47; and became professor of the German language and literature in Columbia College, N. Y., 1848, which post he still fills (1876), having also been an occasional instructor in other departments of the same institution. Author of many theological articles in the *Evangelical Review*, of a *History of Education and Plan of Culture and Instruction* (1842) in "Harper's Family Library," clvi., of several published sermons, addresses, and other miscellaneous pamphlets, a treatise on *The Scriptural Character of the Lutheran Doctrine of the Lord's Supper* (1852), and a *Course of Ancient Geography* (1860).

**Schmitz** (Leonhard), Ph. D., LL.D., b. at Eupen, near Aix-la-Chapelle, Germany, Mar. 6, 1807; educated at the University of Bonn, where he studied history and philology under Niebuhr and Welcker; became professor in a gymnasium at Bonn; settled in England 1836; was rector of the high school at Edinburgh 1845–66, and principal of the London International College 1866–74, after which he accepted the post of classical examiner in the University of London. He was classical tutor to the prince of Wales 1859, and to Prince Alfred 1862–63; translated into English the lectures of Niebuhr, and Zumpt's Latin Grammar; edited the *Classical Museum* 1844–50; contributed to Dr. Smith's *Classical Dictionaries* and to cyclopædias; is author of Latin and Greek grammars and of a series of histories for schools and colleges.

**Schmuck'er** (Samuel Mosheim), LL.D., son of Rev. Dr. S. S. Schmucker, b. at Newmarket, Va., Jan. 12, 1823; graduated at Washington College, Pa., 1840; studied theology at Gettysburg; was Lutheran minister at Lewiston, Pa., 1842–45, at Germantown 1845–48, and was admitted to the Philadelphia bar 1850. D. at Philadelphia May 12, 1863. Author of biographies of Catharine II., Nicholas I., J. C. Fremont, Alexander Hamilton, Jefferson, E. K. Kane, Napoleon III., Webster, and Clay, and of various historical compilations.

**Schmucker** (Samuel S.), D. D., b. at Hagerstown, Md., Feb. 28, 1799; studied at Princeton, but did not grad-

uate; was ordained in the Lutheran Church 1818; was pastor of a church at Newmarket, Va., 1820–26; became professor of didactic theology in the Gettysburg Theological Seminary at its foundation, Sept., 1826, and retained that post until Aug., 1864, having acted for many years as president of the institution, and was emeritus professor from 1864 to his death, at Gettysburg July 26, 1873. Author of numerous works of Lutheran theology in English and German, and contributions to reviews.

**Schnaa'se** (KARL), b. at Dantzic Sept. 7, 1798; studied law at Heidelberg and Berlin, and held from 1819 to 1857 various judicial offices at Königsberg, Marienwerder, Düsseldorf, and Berlin, but travelled much at the same time in Italy, France, and the Netherlands, and studied art with great enthusiasm. In 1834 he published his *Niederländische Briefe*, and from 1843 to 1864 his *Geschichte der bildenden Künste* (7 vols.) appeared. In 1858 he commenced the publication of *Das christliche Kunstblatt*, together with Grüneisen and Schnorr. D. at Wiesbaden May 21, 1875.

**Schnee'berg,** town of Saxony, has silver, copper, and iron mines in its vicinity, and manufactures of gold and silver lace. P. 7582.

**Schnei'der** (JOHANN GOTTLOB), b. at Collmen, near Wurzen, Saxony, Jan. 18, 1750; began his philological studies at Schulpforte, which he continued at Leipsic, and at Göttingen under Heyne, who recommended him to Brunck at Strasbourg to aid the latter in his edition of the Greek poets. Here he added to his classical studies that extensive and thorough acquaintance with anatomy, botany, and zoology which gave so great value to his editions of the ancient authors who treat of those subjects. In 1776 he was appointed professor of ancient languages and eloquence in the University of Frankfort-on-the-Oder. When in 1811 the university was removed to Breslau, he accompanied it, holding the same office, which, however, he resigned in 1816 on his appointment as chief librarian. Of the many valuable editions published by him, the most celebrated were—*Xenophontis Opera* (new ed. by Bornemann and Sauppe, 6 vols., 1815–38), *Scriptores Rei Rusticæ* (4 vols., 1794–95), *Vitruvius* (3 vols., 1807–08), *Aristotelis Historia de Animalibus* (4 vols., 1812), *Theophrasti Opera* (5 vols., 1818–21), *Oppiani Cynegetica et Halieutica*, with Brunck (1776; new ed. 1813), *Eclogæ Physicæ* (2 vols., 1801). Besides these he wrote critical remarks on portions of ancient authors and treatises in German on natural history. A very important contribution to Greek studies was made by Schneider in his large *Griechisch-Deutsches Wörterbuch* (2 vols., 1797–98; 3d ed., with supplement, 1819–21), on which Passow based his lexicon. D. Jan. 12, 1822.

H. DRISLER.

**Schneider** (KARL ERNST CHRISTOPH), b. Nov. 16, 1786, at Wiehe in Saxony; studied theology and philology at the University of Leipsic; in 1816 appointed professor of ancient literature in the University of Breslau, where he also was associate director of the philological seminary; published *De Originibus Tragœdiæ* (1818); edited, with a critical commentary, *Platonis Civitas* (3 vols., 1830–33; supplement, 1854); German translation of same (*Plato's Staat*), (2d ed. 1850); translation of Plato's *Timæus* (1847), and an edition of *Procli Commentarius in Platonis Timæum* (1851); Cæsar's *Commentarii de Bello Gallico* (2 vols., 1840–55), with elaborate commentary; edited a portion of the Plato in Didot's *Bibliotheca Græca* (Paris, 1846–53). D. at Breslau May 14, 1856. H. DRISLER.

**Schnei'dewin** (FRIEDRICH WILHELM), b. at Helmstedt June 6, 1810; entered the University of Göttingen 1829, where he studied philology under Mitscherlich, Dissen, and Otfried Müller; appointed in 1833 teacher in the gymnasium at Brunswick; in 1836 instructor in the University of Göttingen, and in 1837 professor (extraordinarius, in 1842 regular professor) in the same, with a share in the direction of the philological seminary, of which he became subsequently associate director. His literary activity was very great. Published *Exercitationes Criticæ in Poetas Græcos Minores* (1836), *Delectus Poeseos Græcæ* (1838–39), *Beiträge zur Kritik der Poetæ Lyrici Græci* (1844), *Martialis Epigrammata*, with critical commentary (2 vols., 1842), *Sophoclis Tragœdiæ* (7 vols., 1849 *seq.*; 2d ed. 1853 *seq.*), *Simonidis Carminum Reliquiæ* (1835), and *Paræmiographi Græci* (2 vols. 8vo, 1839–51, in conjunction with Leutsch), the newly-discovered orations of Hyperides (1853); edited from 1846 *Philologus*, a valuable journal of classical literature. D. Jan. 10, 1856. H. DRISLER.

**Schnetz** (JEAN VICTOR), b. at Versailles May 15, 1787; studied painting under David, Regnault, and Gérard, and in Italy; began to exhibit in 1819; was director of the French Academy in Rome from 1840 to 1866. D. at Paris Mar. 15, 1870. His most celebrated pictures are—*The Gypsy and Sextus V.* (1820), *The Sacking of Rome* (1835), *Christ and the Little Children* (1855), *The Capuchin Physician* (1867).

**Schnorr von Karolsfeld** (JULIUS), b. at Leipsic Mar. 26, 1794; studied painting under his father, who was a painter himself, in Vienna and Italy; was appointed professor at the Academy of Munich in 1827, and director of the picture-gallery of Dresden in 1846. D. there May 24, 1872. His principal works are his frescoes in Munich illustrating the *Nibelungen*, the history of Charlemagne, Barbarossa, and Rudolf of Hapsburg, his *Luther at the Diet of Worms*, and *Bibel in Bildern* (240 plates, with text).

**Schodack',** tp., Rensselaer co., N. Y., on Hudson River and Boston and Albany R. Rs., and on Hudson River. P. 4442.

**Schoel'cher** (VICTOR), b. at Paris July 21, 1804; travelled much in Mexico, the U. S., East and West Indies, Africa, and wrote *De l'Esclavage des Noirs et de la Législation coloniale* (1833), *Abolition de l'Esclavage* (1840), *Les Colonies françaises* (1842), *Les Colonies étrangères et Haïti* (1843), *Égypte en 1845* (1846), *L'Histoire de l'Esclavage pendant les deux dernières Années* (2 vols., 1847). He was a member of the Constituent and Legislative assemblies 1848–51; during the Empire he lived in London, where he published a *Life of Händel* (1857); after the downfall of Napoleon III. he returned to Paris, and represents Martinique in the Legislative Assembly.

**Schoell** (MAXIMILIAN SAMSON FRIEDRICH), b. at Harskirchen, Hesse-Nassau, May 8, 1766; studied at Strasbourg; travelled as tutor with a Livonian family (1788–90) in Italy, France, and Russia; attempted different occupations until in 1814 he received employment in the Prussian diplomatic corps; was employed as secretary at various legations and congresses. D. at Paris Aug. 6, 1833. His literary activity was very comprehensive; the most remarkable of his works are *Cours d'Histoire* (46 vols., 1830–36), *Archives politiques ou diplomatiques* (3 vols., 1818), *Pièces relatives au Congrès de Vienne* (6 vols., 1816), *Pièces officielles destinées à détromper les Français, etc.* (9 vols., 1814), *Hist. de la Litt. grecque* (8 vols., 1823–25), *Hist. de la Litt. romaine* (4 vols., 1815).

**Schöf'fer** (or **Schoiffer**) (PETER), b. at Gernsheim, near Darmstadt, in 1430; became in 1450 assistant in the printing establishment of Gutenberg and Faust in Mentz; formed in 1455 a partnership with Faust, whose daughter he married, and carried on the business alone after the death of Faust in 1466. He introduced many improvements in the art of printing. D. in 1503. A monument was raised in his honor at Gernsheim in 1836.

**Scho'field** (JOHN M.), b. in Chautauqua co., N. Y., Sept. 29, 1831; graduated at the U. S. Military Academy, and promoted brevet second lieutenant of artillery July 1, 1853; captain May 14, 1861. From 1855 to 1860 he was professor of natural and experimental philosophy at West Point, and at the outbreak of civil war was filling the chair of physics in Washington University, St. Louis, Mo. Appointed major 1st Missouri Vols. Apr. 26, he served with Gen. Lyon as chief of staff in the operations in Missouri, participating in the battles of Dug Spring and Wilson's Creek. Commissioned brigadier-general of U. S. volunteers and of Missouri militia Nov., 1861, he commanded the State troops and the district of St. Louis, and in Oct., 1862, was placed in command of the Army of the Frontier; promoted to be major-general U. S. volunteers Nov. 29, 1862, he commanded the district and department of Missouri until Jan., 1864, when appointed to command the Army of the Ohio; was in immediate command of the 23d corps in Sherman's Georgia campaign, participating in the almost constant severe fighting ending with the capture of Atlanta, Sept. 2, 1864. In Nov., 1864, he was placed in command of the forces detached from Gen. Sherman's army to strengthen Gen. Thomas at Nashville, being constantly engaged with Hood's army invading Tennessee, and defeated it at the battle of Franklin, Nov. 30, 1864; joined Gen. Thomas the next day, and commanded the 23d corps at the battle of Nashville and subsequent pursuit of Hood's army. For his services at Franklin he was appointed brigadier-general in the regular army. Transferred with his command to North Carolina and placed in command of that department Feb. 9, 1865, he occupied Wilmington Feb. 22, fought the battle of Kinston Mar. 8–10, and joined Gen. Sherman at Goldsboro' Mar. 22, 1865. Upon the surrender of Gen. Johnston's army (Apr. 26) he was appointed to execute the terms of the convention; in command of the department of North Carolina until June, 1865, and of the first military district of Virginia 1866–67; secretary of war *ad interim* May, 1868–Mar., 1869, when he was promoted to be major-general U. S. A., and assigned to command of department of Missouri. In May, 1870, he assumed command of the division of the Pacific. Became

superintendent of the U. S. Military Academy at West Point July, 1876.

**Schohar'ie,** county of E. New York, intersected by Schoharie, Cobleskill, and Catskill creeks, traversed by Albany and Susquehanna R. R., has the Helderburg Mountains on the E. border and spurs of the Catskill Mountains on the S. and W.; is well adapted for pasturage, and has several manufactories and saw and flouring mills. Staples, hops, oats, buckwheat, potatoes, hay, flax, maple-sugar, honey, wool, butter, and cheese. Iron ore and sulphur springs are found. Cap. Schoharie. Area, 650 sq. m. P. 33,340.

**Schoharie,** p.-v. and tp., cap. of Schoharie co., N. Y., on Schoharie Valley R. R., near the junction of Schoharie and Fox's creeks, 40 miles (by rail) W. from Albany. It has 3 churches, an academy and union school, 1 bank, 2 newspapers, and 2 hotels, with the county buildings. P. of v. 1200; of tp. 3207.

A. A. Hunt, Ed. "Schoharie Republican."

**Scholasticism.** See Schoolmen, by W. T. Harris, A. M., LL.D.

**Scholten'** (Johannes Hendrik), b. at Vleuten, near Utrecht, Netherlands, Aug. 17, 1811; studied theology and philosophy at the University of Utrecht; appointed professor of theology in 1843 at the University of Leyden, and became the founder and leader of a liberal movement in Dutch theology which attracted much attention, not only in the Netherlands, but also in Germany and France. His principal writings, mostly translated into German and French, are *Geschiedenis der Godsdienst en wysbegeerte* (1853), *De leer der hervormde kerk in hare grondbegin selen* (2 vols., 1848–50), *De vrye wil* (1857), *Het evangelie naar Johannes* (1864), *De oudste getuigenissen aangaande de schriften des Nieuwe Testaments* (1866).

**Schom'berg** (Frederick Hermann), Duke of, b. in Heidelberg, Germany, about 1616, was the son of Count Schomberg by a daughter of an English nobleman, Earl Dudley; served in the army of the United Provinces, afterward in the French army, where he acquired a great reputation as a strategist and tactician; visited England 1660; went thence to Portugal, where he exercised important commands in the war of liberation, and compelled Spain to recognize the independence of that country under the dynasty of Braganza (1668), for which he was made a grandee and received a handsome pension; was again in the French service in Catalonia 1675, where he won the grade of marshal; was at Maestricht (1676) and Charleroi (1677); left France on the Revocation of the Edict of Nantes 1685; went again to Portugal, but was compelled by the Inquisition to withdraw; was appointed by William, prince of Orange, his second in command in the expedition to England 1688; was made duke of Schomberg in the English peerage, knight of the Garter, and master of the ordnance 1689; received from Parliament a grant of £100,000; took a leading part in the expedition against Ireland, and was killed at the battle of the Boyne, July 12, 1690. His brother and son succeeded to his honors and estates, but the titles became extinct in 1719.

**Schom'burgk** (Sir Robert Hermann), Ph. D., b. at Freiburg-on-the-Unstrut, Prussia, June 5, 1804; resided, engaged in mercantile pursuits, at Leipsic 1823, afterward in Virginia as partner in a tobacco manufactory, in which business he experienced pecuniary losses; settled in the island of St. Thomas in the West Indies 1829; devoted himself to botany and natural history; made a scientific examination of Anegada, one of the Virgin Islands, 1830, on which he prepared a report which procured him the patronage of the Royal Geographical Society of England; spent four years in the exploration of British Guiana, where he discovered the great water-lily named by him *Victoria regia;* published a *Description of British Guiana, Geographical and Statistical* (1840), a series of *Views in the Interior of Guiana* (1840), *Researches in Guyana* (1840), and several reports to the Geographical Society, for which he received the gold medal of that body 1839, and which were translated into German by his brother Otto, and published at Berlin with a preface by A. Humboldt (1841); was at the head of the commission for surveying the frontier between British Guiana and Brazil 1841–44; published the *Natural History of the Fishes of Guiana* (2 vols., 1841–43); was knighted 1845; published a *History of Barbadoes* (1847) and *The Discovery of the Empire of Guiana by Sir Walter Raleigh* (1848); was British consul and chargé d'affaires in the Dominican republic 1848–57, and consul-general in Siam 1857–64. D. at Schöneberg, near Berlin, Mar. 11, 1865.—His brother, Moritz Richard, took part in the second exploration of Guiana, of which he published an account in German (3 vols., 1847–48); translated some of the works of Sir Robert into German; went to Australia 1849; and has been since 1865 director of the botanical garden at Adelaide.

**Schön'bein** (Christian Friedrich), b. at Metzingen, Würtemberg, Oct. 18, 1799; studied natural science at Tübingen and Erlangen; visited England and France; was appointed professor of chemistry at Bâle in 1828; discovered Ozone (which see) in 1839; invented Gun-Cotton (which see) in 1845. D. at Baden-Baden Aug. 28, 1868. His principal works are—*Das Verhalten des Eisens zum Sauerstoff* (1837), *Beiträge zur physikalischen Chemie* (1844), *Ueber die Erzeugung des Ozons* (1844), *Ueber die langsäure und rasche Verbrennung der Körper in atmosphärischer Luft* (1845). Hagenbach wrote his *Life* (1869).

**Schön'brunn,** an imperial palace situated a few miles from Vienna, on the river Wien, built in 1744 by Maria Theresa, contains 1441 rooms, among which are several magnificent state-rooms, and is surrounded with a large and beautiful park, containing a botanical garden, a menagerie, etc. The palace is generally inhabited by the imperial family during parts of the summer. The Peace of Vienna (Oct. 14, 1809) was signed here.

**Schö'nebeck,** town of Prussia, province of Saxony, on the Elbe, has large saltworks, breweries, and distilleries, and manufactures of powder, chemicals, soap, white lead, and vinegar. P. 8995.

**Schön'linde,** town of Bohemia, has manufactures of yarn and linen and cotton fabrics. P. 5472.

**School Brothers and School Sisters,** the collective name of a large number of educational orders or fraternities in the Roman Catholic Church, including the Ursulines, Piarists, Visitation Nuns, Ladies of the Sacred Heart, Sisters of Charity, Sisters of Mercy, and many others (for which consult their respective names).

**School'craft,** county of the upper peninsula of Michigan, stretching from Lake Superior on the N. to Lake Michigan on the S. E.; drained by Manistique, Sturgeon, Whitefish rivers and other streams; has a broken and densely wooded surface, and embraces the celebrated "Pictured Rocks," a perpendicular stratified wall 250 feet high extending many miles along the lake. Lumbering is the chief industry. There are 2 blast furnaces. Cap. Onota. Area, 1100 sq. m. P. in 1874, 1290.

**Schoolcraft,** tp., Houghton co., Mich. P. 669.

**Schoolcraft,** p.-v. and tp., Kalamazoo co., Mich., on the Chicago and Lake Huron and the Lake Shore and Michigan Southern R. Rs., 12 miles S. of Kalamazoo. It contains 3 churches, a union school, 1 bank, 1 newspaper, a large steam flouring-mill, saw and planing mill, and 1 hotel. Principal business, farming. P. of v. 932; of tp. 2136. V. C. Smith, Ed. "Dispatch and News."

**Schoolcraft** (Henry Rowe), LL.D., b. at Watervliet (now Guilderland), Albany co., N. Y., Mar. 28, 1793; studied at Union and Middlebury colleges, but did not graduate; wrote for several periodicals; made considerable progress in chemistry and mineralogy, and devoted himself to a scientific study of the art of glassmaking, his father being a manager of extensive glassworks; commenced the publication at Utica in 1817 of a work on *Vitreology,* which was left incomplete through lack of patronage; made a journey down Alleghany and Ohio rivers, up the Mississippi to St. Louis, and thence through the mineral regions of Southern Missouri and Arkansas in 1817–18, of which he published an account, *A View of the Lead-mines of Missouri* (New York, 1819); visited Washington with a fine collection of mineralogical specimens from Missouri, and endeavored in vain to induce the U. S. government to promote the working of the mines of that region; obtained from Secretary Calhoun in 1820 an appointment as geologist to an exploring expedition sent under Gen. Cass to the upper Mississippi and Lake Superior copper region, and published a *Journal* (1821) which obtained immediate popularity; went in 1821 to Chicago, by way of the Miami and Wabash valleys, to act as secretary at a conference of Indian chiefs, as subsequently related in his *Travels in the Central Portions of the Mississippi Valley* (1825); was in 1822 appointed by Pres. Monroe Indian agent for the tribes of Lake Superior; resided nearly twenty years in the vicinity of Michilimackinack and Sault Ste. Marie, where in 1823 he married Miss Jane Johnston, an educated lady partially of Indian blood, being daughter of an Irish gentleman and granddaughter of a Chippewa chief; devoted thenceforth much of his time to the investigation of Indian languages, customs, and traditions; was in 1828 and 1832 a member of the Territorial legislature of Michigan; procured the enactment of several beneficent laws upon Indian affairs; was the principal founder of the Michigan Historical Society (1828) and of the Algic Society at Detroit (1831), the latter being an association for the investigation of Indian antiquities; was at the head of a scientific expedition which in 1832 explored for the first time Lake Itasca and

the sources of the Mississippi; negotiated in 1836 a treaty by which the U. S. purchased from the Chippewas a tract of 16,000,000 acres on the upper lakes, after which he became superintendent of Indian affairs for the northern department, and in 1839 chief disbursing agent for the same department; published in that year *Algic Researches* (2 vols.), a collection of Indian tales and legends; removed to New York 1841; issued the prospectus of an *Indian Cyclopædia* (1842), afterward carried into effect in another form; visited Europe 1842; travelled through the Ohio Valley and Canada 1843; was commissioner to take a census of the New York Indians 1845; obtained from Congress the passage of an act (Mar. 3, 1847) authorizing the collection through the Indian bureau of an extensive series of reports upon all the Indian tribes of the U. S., and spent the remaining years of his life at Washington in the direction of this enterprise and the publication of its results, a series of six 4to vols., illustrated with numerous plates (Philadelphia, 1851–57), forming the most extensive existing repository of information upon the American Indians, and comprising many materials of great value, but unsatisfactory as a whole from lack of systematic arrangement. During the latter portion of his life Mr. Schoolcraft was confined to his chair with paralysis, and was unable to write, but his second wife (formerly Miss Mary Howard of Beaufort, S. C.—herself authoress of several works of fiction) with rare devotion acted as his amanuensis, enabling him to realize a considerable portion of his literary projects. D. at Washington, D. C., Dec. 10, 1864. Among his numerous publications were a *Narrative of an Expedition to Itasca Lake, the Actual Source of the Mississippi* (1834; reissued in 1853, along with the account of the earlier exploration of 1820), *Oneota, or Characteristics of the Red Race of America* (New York, 1844), *Notes on the Iroquois* (Albany, 1848), *Personal Memoirs of a Residence of Thirty Years with the Indian Tribes* (Philadelphia, 1851), and *Scenes and Adventures in the Semi-alpine Regions of the Ozark Mountains* (1853). He was a member of numerous literary and scientific societies in Europe and America; received the degree of LL.D. from the University of Geneva 1846; wrote several poems and novelettes on Indian subjects, and many essays, lectures, magazine articles, memoirs, and reports addressed to the government or presented to ethnological associations. PORTER C. BLISS.

**Schoo'ley's Mountain,** p.-v., Morris co., N. J., at the base of mountain of the same name, a noted summer resort, has fine scenery and several hotels.

**School'men,** a name applied to the philosophers of the Middle Ages, whose labors were directed chiefly to adjusting the relations of the Christian religion to philosophy. The teachers of the seven liberal arts (*trivium* and *quadrivium*) in the cloister schools founded by Charlemagne were called *doctores scholastici*, whence the name "scholasticism" as applied to the system of philosophy that arose in those schools and flourished in the universities that were founded subsequently. The grounds of the faith and their reconciliation with human reason were brought under discussion, and the attitude of the Church was readjusted toward the numerous questions which the new intellectual activity of the time brought forth. The first period of scholasticism is characterized by the accommodation of Neo-Platonic principles and the Aristotelian logic to the doctrine of the Church, and it extends from the time of Johannes Scotus Erigena (A. D. 843) to Abelard (d. 1142). The second period extends from Alexander of Hales (d. 1245) to the fourteenth century, and is characterized by the thorough mastery of Aristotle and the ascendency of his authority in matters of philosophy. Aristotle came to be called *præcursor Christi in naturalibus*, just as John the Baptist was called *præcursor Christi in gratuitis*. Johannes Scotus Erigena, at the head of the court school at Paris, was commissioned by Charles the Bald to translate the writings of the pseudo Dionysius Areopagita, which had been received as a present from the emperor of the Eastern empire. Upon the Neo-Platonic basis of those writings he endeavored to render the Christian conception of creation intelligible. The doctrine of emanation was thus substituted for creation. The Platonic theory of ideas—*universalia ante rem*—was adhered to, and the opposite doctrine, that individual things are substances in the fullest sense, was warmly repudiated. The well-known passage in the *Isagoge* of Porphyry, translated by Boëthius, "*Mox de generibus et speciebus illud quidem sive subsistant sive in solis nudis intellectibus posita sint,*" etc., is regarded as the historical occasion of the disputes of nominalism and realism which took up the greater part of the first period of scholasticism, and in a modified form (that of individual reason *versus* a world-soul) was the central theme of the discussions of the second period. It is indeed easy to understand that this question of nominalism and realism (see NOMINALISTS and REALISM) concerned vitally the possibility of Christian theology. If general terms are mere conventional signs, and have no corresponding reality, there can be no spiritual existence, and Roscellinus was right in denying the unity of the Godhead as set forth in the Trinity. Moreover, the doctrines of immortality and free-will could not be sustained. On the other hand, the doctrine of nominalism is closely connected with the rise of independent thinking and the study of nature, although it led to scepticism in spiritual matters. The prominent Schoolmen of the first period were the nominalists Roscellinus and Abelard (who was a moderate nominalist), and the realists Anselm and William of Champeaux. Besides these, there were Eric and Remigius of Auxerre, Gerbert, Fulbert, Berengarius of Tours, and later, Bernard of Clairvaux, Bernard of Chartres, William of Conches, Walter of Mortaigne, Gilbertus Porretanus, Petrus Lombardus (famous author of *Sentences* compiled from the Church Fathers), the St. Victors (Hugo, Richard, and Walter), John of Salisbury, Alanus, Amalrich of Bena, David of Dinant. After the end of the twelfth century scholasticism changed very materially, by reason of the influence of the Arabians, who had cultivated to a high degree the Aristotelian philosophy. The Syrian Christians at Edessa, among whom had existed an Aristotelian school since the fifth century, translated the works of Aristotle into Syriac in the sixth century, and in the ninth century into Arabic. In the tenth century new translations into Arabic, not only of Aristotle, but also of his commentators, Alexander, Themistius, Syrianus Ammonius, and Theophrastus, were widely circulated, and afterward used by Alfarabi, Avicenna, and Averroës. Avempace, Abubacer, and the learned Jews Avicebron and Moses Maimonides elaborated and applied partly Aristotelism and partly Neo-Platonism and the doctrines of the Cabbala. The sluggish intellect of Christendom was thoroughly aroused. The Oriental principle of abstract unity in the Godhead, which had made its appearance in the early history of the Church, and had finally been eliminated by violence after the Council of Nicæa, had made its way through the Ebionitic Christians in Arabia into a new religion, Mohammedanism. A rigid monotheism sprung up, and became a menace to Christianity. Its philosophic thinkers naturally tended to the adoption of the emanation theory, and to the denial of permanence of identity on the part of the individual. The great commentators followed Alexander of Aphrodisias in his interpretation of the *De Anima*, and limited immortality to the world-soul, which should find its particular existence in individual men, capable, it is true, of cognizing universal ideas through participation in this general intelligence, but who could not survive as individuals the death of the body, inasmuch as the faculties of desire, perception, memory, and reflection (*νοῦς παθητικός*) are corporeal. Christian thought was aroused, and it grappled resolutely with the question whether any particular individual can be immortal; that is, whether the individual can be universal and particular at the same time. This added to the zeal with which Realists combated nominalism. Is the universal or generic only a fiction of the mind? If it is really existent, is it immanent in, or separate from, the particular individual? If the latter, then there can be no immortality. The Christian dogmas establishing the Trinity, human responsibility, and immortality had hitherto been accepted on faith, and few thinkers had arisen since the downfall of the Western empire with any inclination to follow the direction of St. Augustine and attempt to gain theoretical insight into the logical necessity of Christian doctrines. Against pagan religions such as Christendom had encountered in the North and West there was no need of a metaphysical justification, for there was no metaphysics to oppose. But with the Moslem came a philosophical system as complete as Aristotelianism, and skilfully interpreted in the interests of pantheism. There arose a series of great minds who made it their work to master Aristotle and to interpret him in the interests of Christianity. Alexander of Hales, Bonaventura, Albertus Magnus, his pupil Thomas Aquinas, Duns Scotus,—these are the great names in the period of the greatest bloom of scholasticism. Of these, Thomas Aquinas is the greatest, and through him Christian theology gained a consistent, systematic form. Each portion of Aristotle's system was interpreted in the light of the whole, and he came to be regarded as the great pillar of the truth. Besides the five greatest names of this period, above given (of whom Bonaventura the Mystic preferred Plato to Aristotle), there is a host of eminent thinkers—William of Auvergne, Robert Greathead, Michael Scotus (translator of Aristotle), Vincentius of Beauvais, Henry of Ghent, Richard of Middletown, Petrus Hispanus, Roger Bacon, Raimond Lully, Petrus Aureolus, Durand de St. Pourçain, John Buridan, Pierre d'Ailly.

William of Occam, a pupil of Duns Scotus, gave the deathblow to scholasticism, which had already begun to decline. The work of Duns Scotus had been chiefly critical, and had done much to undermine the arguments by which the rational grounds of the dogmas had been established. Occam adopted the doctrine of nominalism, and denied altogether the possibility of showing the rationality of the tenets of faith. In his *Centilogium Theologicum* the greater part of his hundred demonstrations attempt to prove that theological dogmas, such as the existence, unity, or infinity of God, the Trinity, creation, incarnation, transubstantiation, etc., involve contradiction of logical principles, and are irreconcilable with reason, and to be accepted only by faith. Scholasticism had done its work. For more than 200 years it had vindicated the dogma before reason. It had erected a vast structure of Christian theology opposed to the pagan systems of thought that had preceded. The Arabian pantheism had been vanquished. Now there arose in the fourteenth century a necessity for more individualism in thinking. The mind must go back to the beginning, and assure itself of its freedom by passing through the twilight of error in order to discover the universality and necessity of truth. Hence, philosophical investigation needed to be divorced from theology, and this was accomplished by the labors of Occam. Religious dogmas became solely matters of faith, and human reason turned its activity to another field for a time.

WILLIAM T. HARRIS.

**Schools.** See COLLEGE, COMMON SCHOOLS, EDUCATION, INFANT SCHOOLS, JUVENILE OFFENDERS, MILITARY ACADEMIES, NORMAL SCHOOL, SCHOOL SYSTEM OF BOSTON, and UNIVERSITY.

**School System of Boston.** The seed out of which the whole public-school system of Boston has sprung is found in an order adopted by the freemen of the town five years after its settlement, in these words: "The 13th of ye 2d month, 1635; Likewise it was then genrally agreed upon yt or brother Philemon Pormont shall be entreated to become schoolmaster for ye teaching and nourtering of children wth vs." This was the beginning of the present Latin school of the city, and for forty-seven years it was the only public school in the town. In 1682 two elementary schools were set up, to which is traced the origin of what are now known as the grammar schools. It was not until 1789 that girls were permitted to attend the public schools, and during nearly forty years thereafter they were allowed to attend only half the year, from April to October. Children were not admitted to the grammar schools until seven years of age. In 1818 primary schools were established for children from four to seven years of age. In 1821 the English High School, resembling a German Realschule, was established, affording to boys who had finished the grammar-school course the advantages of a three years' course in English and French as a preparation for a business career. A normal school to fit female teachers for the public schools was established in 1852, and soon after made a high school for girls as well as a normal school; recently the two departments were separated into distinct schools.

The whole number of children of school age, between five and fifteen years, in the city in 1874 was 56,684; the average number of pupils belonging to day schools of all grades during the same year was 44,942; and the average number belonging to the evening schools was 3601, the total number belonging being 48,543, while the total average attendance at the day schools was 41,613. The primary schools for children from five to eight years of age, with 18,867 pupils belonging, are taught in 87 school-houses, containing 21,645 sittings, by 417 female teachers, with salaries ranging from $600 to $800. The grammar schools for pupils from eight to fourteen years, with 23,863 pupils, classified in six grades, are taught in 49 school-houses by 511 female and 94 male teachers, salaries of principals being $3200. There are 9 high schools, including the normal, which are accommodated in 8 school-houses with 2997 sittings, and are attended by 1019 boys and 1053 girls, and taught by 47 female and 51 male teachers; salaries of principals $4000. Besides these free high schools, there is in the Roxbury district an excellent free Latin school, supported by an endowment and managed by trustees. In addition to the above-named regular schools, the system comprises 20 special schools, in 6 kinds—viz. 11 elementary evening schools, 1 evening high school, 4 evening industrial drawing schools, 1 Kindergarten, 2 schools for licensed minors, and 1 deaf-mute school. The school-houses and lots, exclusive of those in recently-annexed districts, are valued at $6,772,400, which gives $181.19 per pupil belonging. The salaries of the high-school teachers amount to $145,744.86, and the whole amount of salaries is $1,015,572.72; the total expenditures in 1874, for all school purposes, were $1,865,720.29. The schools are supported by a tax on the personal and real property of the city, and the tuition in them all is gratuitous; stationery, drawing-books and writing-books, and text-books for indigent children, are furnished at the public expense. There is no separate school-tax, but the funds for school purposes are appropriated by the city council out of the general tax levy. The school board has authority to determine the salaries of teachers, and the city is liable to pay them without regard to amount appropriated for schools. School-houses are built by the city council on request from the school board, by which the plans must be approved. The schools were managed until 1789 by the selectmen of the town, the clergy being invited to visit the schools on examination-days; from 1789 to 1822, by 12 committeemen, in conjunction with the selectmen; from 1822, the date of the city charter, to 1835, by a board consisting of the mayor, the 8 aldermen, and 1 person chosen from each of the 12 wards; from 1835 to 1855, by a board composed of the mayor and president of the common council and 24 other persons, 2 being elected annually from each ward. Until the latter date the primary schools had been managed by a committee appointed by the "grammar-school" board, one member for each school, and numbering at the time of its abolition 180. By a change in the charter in 1855 all the schools were placed in charge of a board of 72 members, elected for three years, with the mayor and president of the common council. The present system of supervision, which went into operation in Jan., 1876, comprises a school board consisting of the mayor and 24 persons elected at large for three years, a board of 6 supervisors elected by the school board for two years, and a superintendent elected for two years. The office of superintendent was established in 1851, and has had only two incumbents. Vocal music and drawing are thoroughly taught in all grades of the schools, each of these branches being under the general supervision of a chief and several subordinate supervisors. The boys in the high schools are regularly instructed in military drill, the military organization comprising 24 companies. The girls in the lower classes in the grammar schools are taught sewing two hours a week by special teachers. Fourteen truant officers are employed to enforce the laws relating to school attendance; "absentees" and truants are sent to the reformatory on Deer Island. In the tuition-paying private schools of the city there are about 4000 pupils, and about 5000 in free sectarian (Roman Catholic) schools.

JOHN D. PHILBRICK.

**Schoon'er,** a vessel with two or three masts and fore-and-aft rigged; or, if the foremast have a square topsail, the vessel is called a topsail schooner. When sailing by the wind, schooners have an advantage over square-rigged vessels, and they are easily handled by a small crew.

**Scho'penhauer** (ARTHUR), b. in Dantzic Feb. 22, 1788. His father was a banker; his mother, Johanna, a writer of novels and books of travels. In his youth he travelled through France and England; entered the University of Göttingen in 1809; studied philosophy under Schulze the sceptic, and gave especial attention to Kant and Plato; in 1811 heard the lectures of Fichte at Berlin; wrote his famous essay, *On the Fourfold Root of the Principle of Sufficient Reason,* for his degree at Jena in 1813; adopted Goethe's theory of colors, and wrote in 1816 an essay *On Seeing and Color.* His principal work, on *The World as Will and Representation,* was composed in Dresden and published in 1819. After a visit to Italy he settled at Berlin University as *Docent,* and remained there in this capacity until 1831, with the exception of some intervals spent in Italy. Want of success as a lecturer caused his withdrawal from Berlin in 1831 to Frankfort, where he spent the rest of his life in seclusion. D. Sept. 21, 1860. His characteristic doctrine is pessimism. The world is the worst of possible worlds. We can alleviate our lot in it by sympathizing with the suffering, and in a still more effectual way by an asceticism which destroys our will to live. This view of the world he connects with his doctrine of the Will, but not in a very obvious manner. According to him the Will is the only substantial essence in the universe; it is Kant's "thing in itself." The intellect, consciousness, our entire theoretical activity, is simply a result of the Will in its higher forms. The Will constantly energizes toward life, and the stadia of Nature are simply the instrumentalities of the Will created on its way to life. Mere matter, as the product of forces, is the lowest stage, the result of blind Will; in chemism, where there is reciprocal excitement to activity, the Will is manifested on a higher stage; finally, the Will objectifies itself in organisms, which do not depend upon externally-exciting causes for their activity, but work from internal motives, and select likewise their own food, and hence need intelligence to convert blind exciting impulses into motives. The organism thus evolves a brain in which the Will manifests its highest objectivation. With the brain, and intelligence which is its

function, there arises simultaneously, as result, the world as representation with all its forms: subject and object, space and time, causality, etc. The brain with its intelligence is therefore only the tool or instrument of the will to live. And yet Schopenhauer recognizes the archetypal forms of the various stadia of existences in nature as unchangeable genera—as "ideas" in the Platonic sense. These abide while the individuals perish and are merely phenomenal and illusory. He adheres to the Oriental idea of annihilation, and considers the Christian idea of immortality a delusion. Hence "the happiest moment of life is the completest forgetfulness of self in sleep, and the wretchedest is the most wakeful and conscious." The world presents a continual tragedy before us, in which eternal justice becomes visible as the Nemesis which reduces to nullity again the individuals which have arisen like bubbles upon the surface of the Eternal Will. Hence, the highest act of morality is resignation, renunciation. Enjoyment of art is the only permissible pleasure, because that is cognition devoid of Will. The Nirvana of the Booddhists is the ultimate desideratum in the view of Schopenhauer. In this world, which was the worst possible, the worst features in it, to Schopenhauer, were the contemporary philosophers, Fichte, Schelling, Hegel, and their followers, who achieved popularity and success, while he failed. He exhausts his ingenuity in inventing opprobrious epithets for these "professors of philosophy." But the dependence of his own views upon contemporary systems is quite obvious, especially upon those of Fichte and Schelling. Optimism might as well have been the logical consequence of his theory that the energy of the Will develops the intellect as its tool; for the world as representation must be then regarded as the ultimate final product of the Will, and any pessimistic annulment thereof as retrogression to a less complete standpoint. It was therefore illogical to adopt Booddhism as a consequence of his system. Consistent elaboration would have developed a philosophy much resembling the earlier system of SCHELLING (which see). Besides his three works already named, the following are important: *Upon the Will in Nature* (1836), *The Freedom of the Human Will* (1839), *The Basis of Morals* (1841). *The Parerga and Paralipomena* (1850) contains his views in a fragmentary form, and is the most popular of his works. Julius Frauenstädt has edited his works, and done much to make known his doctrines. Edward von Hartmann, in his *Philosophy of the Unconscious*, the most popular philosophical work of modern times, presents in a modified form the philosophy of Schopenhauer.

WILLIAM T. HARRIS.

**Schou'ler** (WILLIAM), b. at Kilbarchan, Renfrewshire, Scotland, Dec. 13, 1814; came to the U. S. in childhood with his father, who established a cloth-printing business on Staten Island, N. Y., and subsequently at West Cambridge, Mass.; was editor of the Lowell *Courier* from 1841 to 1847, when he undertook the management of the Boston *Atlas*, the leading Whig paper of New England 1847–53; represented Boston four years in the legislature; was a member of the constitutional convention of 1853; editorially connected with the Cincinnati *Gazette* 1853–56 and the *Ohio State Journal* 1856–58, after which he returned to the *Atlas* 1858; was appointed adjutant-general of Massachusetts 1860, and in that capacity rendered important service during the war for the Union. D. at Jamaica Plain, Mass., Oct. 24, 1872. Author of a *History of Massachusetts in the Civil War* (1868) and of *Political and Personal Recollections* in the Boston *Journal* (1870).

**Schouw** (JOACHIM FREDERIK), b. at Copenhagen Feb. 7, 1789; studied law first, afterward natural science; travelled much, and undertook comprehensive scientific researches in the Scandinavian and Italian peninsulas; was appointed professor of botany at the University of Copenhagen in 1821, and director of the botanical garden in 1841. D. Apr. 23, 1852. His numerous writings, botanical, climatological, and geographical—*Grundträk til en almindelig Plantegeographie* (1822), *Physisk-geographisk Skildring af Europa* (1832), *Natur-Skildringer* (1839–45), etc.—have been translated into German and French, and his eminent talent as a lecturer contributed much to the diffusion of knowledge among his countrymen and to the awakening of a truly scientific interest. He was also very active in politics, liberal, and as a reformer cautious in his plans and fearless in their execution.

**Schra'der** (JULIUS), b. at Berlin June 16, 1815; studied painting at the academy of his native city, at Düsseldorf 1837–45, and in Rome 1845–51, and was appointed professor at the Academy of Berlin in 1851. His most celebrated pictures are *The Death of Leonardo* (1851), the great fresco in the New Museum of Berlin, *The Consecration of the Church of St. Sophia in Constantinople* (1853), *Esther before Ahasuerus* (1856), and a number of portraits.

**Schreve'lius** (CORNELIUS), b. at Haarlem in 1615; succeeded his father in 1642 as rector of the College of Leyden. D. there Sept. 11, 1664. Besides editions of numerous Greek and Latin authors, he published in 1654 a *Lexicon Græco-Latinum et Latino-Græcum*, which was used for more than a century in the schools of Germany, England, France, Holland, and in the U. S., and reprinted innumerable times.

**Schri'ver** (EDMUND), b. in Pennsylvania in Nov., 1812; graduated at U. S. Military Academy, and promoted brevet second lieutenant of artillery July 1, 1833, captain 1842; resigned July 31, 1846. From 1847 to 1861 he was treasurer of Saratoga and Schenectady and of Rensselaer and Saratoga R. R. Cos., and president of the latter company 1851–61. In Apr., 1861, he accepted an appointment on the staff of Gov. Morgan of New York, with the rank of colonel and A. D. C., and May 14 was appointed lieutenant-colonel of the 11th Infantry U. S. A.; colonel and A. A. D. C. May, 1862, and served as chief of staff to Gens. McDowell and Fremont (1st corps), participating in the battles of Cedar Mountain, second Bull Run, and Chantilly; appointed inspector-general U. S. A. (rank of colonel) Mar., 1863, and assigned to the Army of the Potomac, he was engaged at Chancellorsville and Gettysburg 1863, and in the Richmond campaign of 1864, up to the investment of Petersburg; was inspector of the Military Academy 1867–70. Brevet brigadier and major general U. S. A.

**Schröckh** (JOHANN MATTHIAS), b. at Vienna July 26, 1733; studied at Göttingen; was appointed professor at Wittenberg in 1762, first of belles-lettres, then of history. D. there Aug. 2, 1808. He wrote *Weltgeschichte für Kinder* (6 vols., 1779–84), *Christliche Kirchengeschichte* (35 vols., 1768–1803), *Kirchengeschichte seit der Reformation* (10 vols., 1804–12, the 9th and 10th added by Tzschirner 1810–12), a work of immense learning which later writers have freely used.

**Schrö'der** (FRIEDRICH LUDWIG), b. at Schwerin Nov. 3, 1744; was left and forgotten, while still a boy, by his parents, who were strolling actors, at Königsberg, where he grew up in squalid and degraded circumstances; found his parents again in 1759 in Soleure, where he was trained to become a dancer; joined them finally in Hamburg in 1764, after going through a course of wild dissipation; undertook in 1771 the management of the troop after the death of his step-father, Ackermann; and raised the stage of Hamburg to a literary and artistic influence in Germany, partly by his plays (collected and published in 1831 in 4 vols., with an introduction by Tieck), partly by the rigid sense of social propriety with which he governed the theatre, but more especially by his grand impersonations of some of the principal Shakspearian characters, such as Lear, which he was the first to introduce on the German stage. D. in Hamburg Sept. 3, 1816. His *Life* has been written by F. L. W. Meyer (1810) and Brunier (1864).

**Schröder** (SOPHIE), b. at Paderborn, Westphalia, Feb. 28, 1781; entered upon the stage when twelve years old in St. Petersburg, where the troop to which her parents belonged was playing; married in 1795 Stollmers (whose true name was Smets), the director of another band, in 1804 the singer Schröder, and in 1825 the actor Kunst; acted in all the principal theatres of Germany, but principally at Vienna, and acquired a great fame by her impersonations of Phædra, Medea, Merope, Lady Macbeth, Sappho, etc. In 1840 she retired from the stage with a pension from the Austrian court; lived in Augsburg. D. in Münich Feb. 25, 1868. Her *Life* was written by P. Schmidt (Vienna, 1870).—Her daughter, WILHELMINE SCHRÖDER-DEVRIENT, b. at Hamburg Dec. 6, 1804, made her début as a singer in 1821 in *The Magic Flute;* sang as Donna Anna, Euryanthe, Fidelio, etc., and was soon acknowledged as the first singer of Germany; was received with great enthusiasm in Paris, London, and St. Petersburg; retired from the stage in 1847. D. at Gotha Jan. 26, 1860. She was twice married, the first time to the actor Karl Devrient. Her *Life* was written by Claire von Glümer (1862) and Wollzogen (1863).

**Schröd'ter** (ADOLF), b. at Schwedt, Prussia, June 28, 1805; studied engraving at Berlin, afterward painting at Düsseldorf, and was appointed professor of drawing at the polytechnic school of Carlsruhe in 1859. His most celebrated works are the *Wine-tasters* (1832), *Auerbach's Cellar* (1847), *Falstaff* (1854), *The Two Monks* (1863), and a number of humorous illustrations and engravings.

**Schroe'der** (JOHN FREDERICK), D. D., b. at Baltimore, Md., Apr. 8, 1800; graduated at Princeton 1819; studied at the Episcopal Theological Seminary, New Haven; was ordained 1823; was assistant minister of Trinity church, New York, 1824–38, afterward rector of the church of the Crucifixion, New York, and of St. Thomas's church, Brooklyn; established St. Ann's Hall, a seminary for young ladies, at Flushing, L. I., 1839; obtained popularity as a

preacher and lecturer, and published several miscellaneous works, including a volume of essays on biblical topics and Oriental literature, and *The Maxims of Washington* (1855). D. at Brooklyn Feb. 26, 1857. At the time of his death he was engaged upon a serial work, left incomplete, *The Life and Times of Washington*, of which 2 vols. were published.

**Schroep'pel,** tp., Oswego co., N. Y. P. 3987.

**Schroon,** v. and tp., Essex co., N. Y., a favorite summer resort among the Adirondac Mountains. There are small steamers on the lake, which is drained by Schroon River. P. of v. 300; of tp. 1899.

**Schu'bert** (Franz), b. in Vienna Jan. 31, 1797; d. there Nov. 19, 1828; is best known by his songs, more than 200 in number, 50 or 60 of which are celebrated and will live. He wrote operas that were never published, and symphonies that are little known; the symphony in C is an exception, being a favorite in instrumental concerts. His compositions for the pianoforte, trios, etc. are skilfully wrought and imaginative. His romance, *The Erlking*, is considered as, on the whole, his finest production.

O. B. Frothingham.

**Schubert, von** (Gotthilf Heinrich), b. at Hohenstein, Saxony, Apr. 26, 1780; studied theology at Leipsic, medicine at Jena; practised as a physician two years at Altenburg; studied geology under Werner at Freiberg; held various positions in educational institutions, and was appointed professor of natural science at Erlangen in 1819, and at Munich in 1827. D. at Laufzorn, Upper Bavaria, July 1, 1860. The most remarkable of his writings are—*Ahnungen einer allgemeinen Geschichte des Lebens* (3 vols., 1806–20), *Ansichten von der Nachtseite der Naturwissenschaften* (1808), *Symbolik des Traums* (1814), *Geschichte der Seele* (2 vols., 1830); most of these works are based on the philosophy of Schelling, and have a mystic character. His *Altes und Neues aus dem Gebiete der innern Seelenkunde* (5 vols., 1817–44) is of an ascetic character.

**Schul'te** (Johann Friedrich), b. at Winterberg, Westphalia, Apr. 23, 1827; studied law at Berlin; practised in this city, Arnsberg, and Bonn, and was appointed professor of canon law in 1855 at Prague, and in 1872 at Bonn. He wrote *System des katholischen Kirchenrechts* (1856), *Die Lehre von den Quellen des katholischen Kirchenrechts* (1860), *Lehrbuch des katholischen Kirchenrechts* (1868), *Lehrbuch der deutschen Reichs- und Rechtsgeschichte* (2 vols., 1861–70), *Die Rechtsfrage des Einflusses der Regierung bei den Bischoffswahlen* (1869). His *Die Macht der römischen Päpste* (1871), in which he protested against the dogma of the papal infallibility, made a great sensation, and occasioned his removal to Bonn, where he sided with Döllinger and Reinkens. He is the lay-reader of the Old Catholics, and has presided over their annual congress since 1871. He recently advocated the abolition of celibacy.

**Schultz,** tp., Edgefield co., S. C. P. 848.

**Schultz-Schultzenstein** (Karl Heinrich), b. at Alt-Ruppin, Prussian province of Brandenburg, July 8, 1798; studied medicine at Berlin, and was appointed professor at the university in 1825. D. there Mar. 27, 1871. His comprehensive botanical researches, *Ueber den Kreislauf des Saftes in den Pflanzen* (1824), *Die Natur der lebendigen Pflanze* (2 vols., 1823–28), *Natürliches System des Pflanzenreichs* (1832), *Sur la Circulation et sur les Vaisseaux lacticifères dans les Plantes*, crowned by the French Academy in 1839, *Die Cyklose des Lebenssaftes in den Pflanzen* (1841), led him to new views of the character and conditions of life in the animal kingdom; *Ueber Anaphytose oder Verjüngung der Pflanzen* (1843), *Neues System der Morphologie der Pflanzen* (1847), *Die Verjüngung im Pflanzenreich* (1851), which have not been without practical influence on the cultivation of plants; *Die Entdeckung der wahren Pflanzennahrung mit Aussicht zu einer Agriculturphysiologie* (1844), *Ueber Pflanzenernährung, Bodenerschöpfung und Bodenbereicherung* (1864). Corresponding views he developed on the field of animal physiology—*System der Circulation in seiner Entwickelung durch die Thierreiche und im Menschen* (1836), *Ueber die Verjüngung des menschlichen Lebens und die Mittel und Wege zu ihrer Cultur* (1842), *Die Verjüngung im Thierreich als Schöpfungsplan der Thierformen* (1854), and applied them to medicine—*Allgemeine Krankheitslehre* (2 vols., 1845), *Die Heilwirkung der Arzneien nach den Gesetzen der organischen Verjüngung* (1846), and to psychology—*Die Bildung des menschlichen Geistes durch Cultur der Verjüngung seines Lebens* (1855), *Naturstudium und Cultur oder Wahrheit und Freiheit in ihrem natürlichen Zusammenhange* (1866), *Die Moral als Heilwissenschaft und Culturwissenschaft* (1863). His polemical relation to other scientific standpoints he has explained in his *Physiologie der Verjüngung des Lebens im Unterschiede von den dynamischen und materialistischen Stoffwechseltheorien* (1867).

**Schul'ze-Delitzsch'** (Hermann), b. at Delitzsch, Prussian Saxony, Aug. 29, 1808; studied law at Leipsic and Halle; travelled in Northern Germany and Scandinavia, and published in 1838 his *Wanderbuch;* held various judicial positions, and sat in the National Assembly at Berlin 1848, where he attracted much attention as a member of the committee to investigate the state of the working-classes. Perpetually harassed by the Prussian government on account of his liberal views, he resigned in 1853 his office, settled in his native city, and devoted himself to the improvement of the condition of the working-classes, in which undertaking he was eminently successful. In 1847 he organized an association of the shoemakers in Delitzsch, which bought all the leather the trade of the place demanded, and sold it to the members of the association at the wholesale price. Similar associations for the purchase of raw materials, provisions, etc. were soon established by other trades and in other cities, and exercised, in connection with corresponding loan institutions and savings banks, a most beneficial influence. Also his writings succeeded—*Das Associationsbuch* (1862), *Die arbeitenden Klassen und das Associationswesen* (1863), *Die Vorschuss- und Creditvereine als Volksbanken* (1867), *Kapitel zu einen deutschen Arbeiterkatechismus* (1863), *Neues Kapitel* (1866), in opposition to Lassalle. (See *Jahresberichte über die auf Selbsthülfe gegründeten deutschen Erwerbs- und Wirthschaftsgenossenschaften*, issued regularly since 1859, when a central bureau was formed for all the existing associations.)

**Schu'macher** (Heinrich Christian), b. at Bramstedt, Holstein, Sept. 3, 1780; studied mathematics and astronomy at Kiel, Jena, Copenhagen, and Göttingen, and was appointed professor of astronomy at the University of Copenhagen in 1810, and superintendent of the conservatory in 1815, but removed in 1821 to Altona, where he d. Dec. 28, 1850. In 1821 he founded the *Astronomische Nachrichten*, which is still continued. In 1830 he made the observations of the length of the seconds pendulum which formed the basis of the Danish scale of measure. He also gave very accurate accounts of the distances of Venus, Jupiter, Mars, and Saturn from the moon.

**Schu'mann** (Robert), b. at Zwickau, Saxony, Jan. 8, 1810; composed symphonies, cantatas, sonatas, quartets, quintets, an opera, and songs. The opera *Genoveva* was given at Leipsic, and failed. *Paradise and the Peri*, a cantata, is considered fine even by critics of the opposite school. Schumann founded the *New Musical Journal* at Leipsic. He was learned, ingenious, imaginative, and gifted with much poetic feeling. While living at Düsseldorf he became deranged, and attempted suicide by drowning in the Rhine, but was rescued and taken to an insane asylum. D. at Bonn July 29, 1856. His wife, Clara (Wieck), b. at Leipsic in 1819, an eminent pianist and teacher, introduced to the German public the works of Chopin and Henselt.

O. B. Frothingham.

**Schurmann** (Anna). See Labadie (Jean).

**Schurz** (Carl), b. at Liblar, near Cologne, Rhenish Prussia, Mar. 2, 1829; educated at the gymnasium of Cologne and at the University of Bonn 1846–48; aided Prof. Gottfried Kinkel in the publication of a liberal newspaper, commenced after the revolutionary outbreak of 1848; was engaged in an unsuccessful attempt to excite an insurrection at Bonn in the spring of 1849; fought in the Palatinate, taking part in the defence of Rastadt, with the rank of adjutant; went thence to Switzerland; returned to Germany 1850, and succeeded in effecting the escape of his companion, Kinkel, from imprisonment in the fortress of Spandau; went to Paris as correspondent of German newspapers 1851; gave private lessons in Paris 1851–52; came to the U. S. toward the close of 1852, and lived at Philadelphia until 1855, when he settled at Madison, Wis.; entered with great zeal into national politics; was a leader of the German element of the newly-founded Republican party; was an unsuccessful candidate for lieutenant-governor 1857; made his first speech in English in Illinois during the Senatorial contest between Lincoln and Douglas 1858; settled at Milwaukee as a lawyer 1859; attracted attention by a series of lectures in New England in the winter of 1859–60; was prominent in the Republican national convention at Chicago 1860, and in the ensuing Presidential campaign; was appointed by Pres. Lincoln minister to Spain Mar., 1861; resigned that post in December of the same year; was appointed brigadier-general of volunteers Apr., 1862; became major-general Mar. 14, 1863; commanded a division in the second battle of Bull Run and in the battle of Chancellorsville; was temporarily in charge of the 11th army corps at Gettysburg; took part in the battle of Chattanooga; was Washington correspondent of the New York *Tribune* 1865–66; visited the Southern States as special commissioner appointed by Pres. Johnson 1866; settled at Detroit, Mich., the same year, and

founded there the *Post* newspaper; removed in 1867 to St. Louis, Mo., where he became editor of a German paper, the *Westliche Post;* was an active member of the Chicago convention of 1868; was U. S. Senator from Missouri 1869–75; acquired a high reputation for ability by his speeches on finance and national policy; became involved in antagonism with Pres. Grant's administration; presided over the "Liberal" convention at Cincinnati which nominated Horace Greeley for the Presidency 1872; visited Europe in 1873 and 1875; became on his return a resident of New York City; took part in the political campaign of 1875 in Ohio, advocating the election of Gov. Hayes on a "hard-money" platform, and in Apr., 1876, joined Messrs. Bryant, Woolsey, Bullock, and Horace White in calling the independent conference of May 15 in New York City. A selection of his *Speeches* appeared in a volume in 1865.

**Schuy'ler,** county of W. Illinois, on Illinois River, traversed by a branch of Chicago Burlington and Quincy R. R., has a rolling surface and a productive soil, well adapted to dairying and stock-raising. Staples, wheat, Indian corn, oats, hay, sorghum-molasses, wool, and butter. Cap. Rushville. Area, 416 sq. m. P. 17,419.

**Schuyler,** county of N. E. Missouri, adjoining Iowa, watered by Chariton, Salt, and Fabius rivers, and traversed by Missouri Iowa and Nebraska and St. Louis Kansas City and Northern R. Rs., and has an undulating surface, partly prairie and partly timber-land. Staples, Indian corn, wheat, oats, hay, tobacco, sorghum-molasses, honey, butter, and wool. Sheep and swine are numerous. Cap. Lancaster. Area, 324 sq. m. P. 8820.

**Schuyler,** county of Central New York, embracing several small lakes and the southern portion of Seneca Lake, traversed by Northern Central R. R., has a hilly surface, and includes the Watkins Glen on Seneca Lake, famous for numerous picturesque cascades; has a hilly surface and a fertile soil. Staples, wheat, hay, oats, barley, Indian corn, buckwheat, honey, wool, butter, and cheese. Cattle and sheep are very numerous, and there are several tanneries, saw and flour mills, and carriage manufactories. Cap. Watkins. Area, 352 sq. m. P. 18,989.

**Schuyler,** p.-v. and tp., cap. of Colfax co., Neb., on Platte River and Union Pacific R. R., has 1 newspaper and an extensive trade.

**Schuyler,** tp., Herkimer co., N. Y. P. 1558.

**Schuyler** (Peter), b. about 1650; became mayor of Albany and colonel of New York militia; commanded upon an expedition against the French on Lake Champlain 1691; enjoyed great influence with the Five Nations of New York; took to England, at his own expense, in 1710, five of their chiefs, in order to promote vigorous measures against the French in Canada; often warned the New England colonies of expeditions against them sent by the French and Indians; was many years a member and chairman of the executive council, and in that capacity became acting governor of New York in 1719.

**Schuyler** (Peter), b. at Albany, N. Y., about 1710; settled on the Passaic in New Jersey; commanded the New Jersey regiment in the operations against Canada 1746; attended the congress convoked by Gov. Shirley at New York 1755; was in command at Oswego when that place was taken by the French, Aug. 14, 1756, and for a short time a prisoner in Canada, at which time he purchased from the Indians the freedom of many captives, and was again in command of the New Jersey regiment in Sir Jeffrey Amherst's campaign which resulted in the conquest of Canada 1759. D. at his residence, near Newark, N. J., Nov. 17, 1762.

**Schuy'ler** (Philip), b. at Albany Nov. 20, 1733. His father died when he was but eight years old, leaving him, as the eldest son, all his large real estate, which, however, Philip generously divided with his brothers and sisters. He later inherited the fine estate of his uncle, Col. Philip Schuyler, at Saratoga. In June, 1755, he was appointed captain of New York volunteers, and was engaged in the expedition against the French at Crown Point. At the end of the campaign of 1756 he left the army, but in 1758 accepted the appointment of commissary with the rank of major. After the peace of 1763 he was active in public affairs and a member of the colonial assembly of New York; was associated with Washington in June, 1775, to prepare rules and regulations for the government of the army, and two days after the battle of Bunker Hill, Congress appointed him a major-general, and placed him in command of the northern department. In the expedition against Canada, Schuyler commanded that by way of Lake Champlain, but was compelled, owing to ill-health, to relinquish his command to Montgomery in September, and return to Albany, after having taken possession of Isle au Noix on Sorel River. At Albany, besides continuing to exercise an active supervision of affairs in the northern department, his influence among the Indians during this period was of great value. The failure of the Canada expedition excited much hostility toward Schuyler, who was blamed for the failure, and insinuations were uttered against his loyalty, which became so offensive that in the autumn of 1776 he sent in his resignation to Congress, which that body declined to accept; but the abuse continuing, Schuyler, in Apr., 1777, proceeded to Philadelphia and demanded a court of inquiry, which entirely approved his management of affairs, and he resumed command of the northern department. The forced abandonment of Ticonderoga by St. Clair, and his retreat to Fort Edward, where Schuyler had just arrived with reinforcements, compelled the latter to fall back to Saratoga, after using every means to obstruct the advance of Burgoyne. The losses thus sustained in stores, ammunition, etc. caused a widespread consternation throughout the country, and the clamor against Schuyler was renewed, and this time Congress ordered his supersedure by Gates. At the time of the latter's arrival (September) to assume command Schuyler occupied a fortified position at the mouth of the Mohawk, to which he had fallen back from Saratoga. Gates had, since Schuyler's resumption of command of the northern department, been unfriendly to Schuyler, and it was with feelings of mortification the latter received the order deposing him at a time when the feeling of depression arising from former disasters had been dispelled by recent victories, and when volunteers were from all quarters swelling his army. He, however, obediently turned over his command, and placed his successor in possession of full information of the situation, and, though without command, remained with the army to aid in any capacity, and was present at the surrender of Burgoyne. A court of inquiry again approved of his management in strong terms, but in Apr., 1779, he resigned, though continuing to render valuable service in the military operations in his native State. From 1778 to 1781 he was a member of the Continental Congress, and in 1789 was appointed U. S. Senator from New York, and again in 1797 to succeed Aaron Burr. In the New York Senate he contributed largely to the code of laws adopted by the State, and was an active promoter of the canal system. In public life he is spoken of as being "distinguished by strength of intellect and upright intentions," and in private life as a "dignified, courteous, and pleasing companion." D. at Albany Nov. 18, 1804. (See his *Life and Times*, by B. J. Lossing, 2 vols., 1860–62; new ed. 1872.)

G. C. Simmons.

**Schuyler's Falls,** p.-v. and tp., Clinton co., N. Y. P. 1684.

**Schuy'lerville,** p.-v., Saratoga tp., Saratoga co., N. Y., on Hudson River and Champlain Canal, 30 miles N. of Troy, has 5 churches, a union graded school, 1 bank, 1 newspaper, a paper-mill, 1 foundry, a sash, door, and blind factory, 1 grist and 2 saw mills, and repair-shops. P. 1367.

P. C. Ford, Ed. "Standard."

**Schuyl'kill** [Dutch for "hidden stream," is said to be so called because the first explorers passed its mouth without seeing it], a river which rises in Schuylkill co., Pa., and after a south-easterly course of 125 miles flows into the Delaware at Philadelphia, which city it traverses. Its lower portion affords extensive wharfage and is of much commercial importance. The river was (1816–25) adapted to slack-water navigation for freight-boats to Port Carbon, 3 miles above Pottsville (which see). In 1872, 625 such boats were reported, belonging to Philadelphia and Reading R. R. Co., but the transportation of coal by railroad has greatly reduced its importance as a navigable stream. The river affords, by the Fairmount and other waterworks, the greater part of the water-supply for Philadelphia. It enters the Delaware between *League Island,* on which is the new navy-yard, and *Mud Island,* on which is Fort Mifflin (which see).

**Schuylkill,** county of E. Pennsylvania, on both sides of Schuylkill River, traversed by Broad, Sharp, and Mahanoy ranges of mountains, and bounded S. E. by Kittatinny or Blue Mountain, all abounding in deposits of anthracite coal and iron, the richest in the U. S., and intersected by many railroads; has a sterile soil, mining being the almost exclusive interest. About 4,000,000 tons of coal are annually mined. There are 47 flour and 21 saw mills, 26 tanneries, and more than 30 manufactories of castings, pig, and rolled iron. Cap. Pottsville. Area, 750 sq. m. P. 116,428.

**Schuylkill,** p.-v. and tp., Chester co., Pa., on Schuylkill River and Canal and on Philadelphia and Reading R. R. P. 1593.

**Schuylkill,** tp., Schuylkill co., Pa., on Little Schuylkill River, in the anthracite coal-region, includes p.-b. of

Tamaqua, an important railroad centre. P. (exclusive of borough), 1840.

**Schuylkill Haven,** p.-b., North Manheim tp., Schuylkill co., Pa., on Schuylkill River and Canal, at the junction of the Mine Hill and Schuylkill Haven branch with Philadelphia and Reading R. R. P. 2940.

**Schwab** (Gustav), b. at Stuttgart June 19, 1792; studied theology and philosophy at Tübingen; was appointed professor of ancient literature in the gymnasium of Stuttgart in 1817; pastor at Gomaringen in 1837, and at the St. Leonhard church in Stuttgart in 1842, where he d. Nov. 4, 1850. His poems, distinguished, like those of Uhland and other members of the Schwabian school, by purity and warmth of feeling and simplicity and naïveté of form, consist of romances and ballads, and were originally published in papers and periodicals. The first collected edition of his *Gedichte* appeared in 2 vols. in 1828–29; a second revised edition, *Neue Auswahl* (1838), has been often reprinted. Of his prose works, mostly consisting of sketches from nature and history, the most remarkable are *Schiller's Leben* (1840), *Sagen des classischen Alterthums* (1840), *Deutsche Volksbücher* (1843), and *Wegweiser durch die Literatur der Deutschen* (1846).

**Schwa'bach,** town of Bavaria, has large manufactures of pins, type, gold and silver lace, paper, and tobacco, and eight annual well-attended markets. P. 6600.

**Schwal'bach,** or **Langenschwalbach,** town of the Prussian province of Hesse-Nassau, has 2643 inhabitants, and is celebrated as a watering-place, having very strong gaseous and chalybeate springs. In the middle of the eighteenth century it was one of the most frequented watering-places of Europe, and after the visits in 1866 by the empresses of Russia and France it again became fashionable.

**Schwal'ber** [better known as Chelidonius, the punning Græco-Latin translation of the German *Schwalber*, a "swallow;" Gr. χελιδών], a friend of Albert Dürer, and who wrote the text in Latin verse to his three series of wood-cuts, *The Apocalypse, The Passion of Christ,* and *The Life of the Virgin Mary.* Schwalber was a monk of the abbey of St. Egidius (St. Julian, St. Gilgan, St. Giles), built by Conrad III. in 1140 for a society of Scotch Benedictines. He was nicknamed "Musophilus," from his love of learning, and he had a reputation for considerable knowledge of the classic Latin poetry. While a member of this monastery he wrote the text for Dürer's wood-cuts, besides verses about his monastery, *Versic. de Fund. Cœnob. Egid.*, and about the abbots, *Versic. de Abbat. nonullis ejusdem Cœnob.* In 1515, Schwalber left Nuremberg to become abbot in the Schotten Kloster, near Vienna. D. there Sept. 8, 1521.

Clarence Cook.

**Schwan'thaler** (Ludwig Michael), b. in Munich Aug. 26, 1802, the son of a sculptor; studied in Rome, but wrought in Munich. He was a man of numerous and colossal imaginations and of immense industry. His statues, decorations, models, are seen in the great cities of Germany, but chiefly in Munich. Most of the buildings erected by King Ludwig were designed by him—the frieze of the Barbarossa hall, the colossal statue of Bavaria, the monumental images in the Walhalla. D. Nov. 15, 1848. Schwanthaler was the chief representative of the so-called "romantic" style, and was the founder of the school to which Schaller, Widman, Brugger, and Zumbusch belonged. His influence, however, is local, and is not widening.

O. B. Frothingham.

**Schwartz** (Christian Frederick), b. at Sonnenburg, Prussia, Oct. 26, 1726; studied in the University of Halle 1746–49; was ordained at Copenhagen 1749; embarked at London for India, where he arrived July, 1750; settled at Tranquebar, a Danish mission on the Coromandel coast; transferred his services to the English Society for Promoting Christian Knowledge 1766; when he removed to Trichinopoly, and in 1778 to Tanjore; was sent as ambassador to Hyder Ali at Seringapatam to negotiate a peace, and admitted by him after all other envoys had been refused, and succeeded in relieving the city of Tanjore from imminent danger of famine by his influence with the native farmers, who brought in their cattle on his personal pledge of payment. D. at Tanjore Feb. 13, 1798. He was one of the most celebrated missionaries of modern times. He aided Schultz in translating the Bible into Tamil, and was tutor to the son and heir of the rajah of Tanjore, who erected to his memory in the mission church a magnificent monument by Flaxman, and the East India Company also placed a monument of him by Bacon in St. Mary's church, Madras. (See *Memoirs of his Life and Correspondence,* by Hugh Pearson, D. D. (2 vols., 1833; 3d ed. 1839).)

**Schwarz** (Berthold), whose true name is said to have been Konstantin Ancklitzen; received the name of Berthold on entering a Franciscan monastery at Mentz, Cologne, or Gosslar, and was called Schwarz ("black") on account of his passion for the black arts. According to legend, he invented gunpowder in 1330, and in Freiburg, his reputed birthplace, a monument was raised in his honor in 1853. All the details of his life are uncertain, however, while it is certain that gunpowder was known before 1330, though not used in war or hunting.

**Schwarz'burg-Ru'dolstadt,** principality and state of the German empire, between the Saxon duchies, and comprises an area of 387 sq. m., with 75,523 inhabitants. It is covered with well-wooded spurs of the Thüringerwald, and mining and cattle-rearing are the principal branches of industry. Flax is very extensively grown, and some linen manufactures are carried on. The total revenue for the year 1874 was 878,506 gulden; expenditure 861,431. Cap. Rudolstadt.

**Schwarz'burg-Son'dershausen,** principality and state of the German empire, in the Prussian province of Saxony, and comprises an area of 324 sq. m., with 67,191 inhabitants. It resembles in every respect Schwarzburg-Rudolstadt, only it is a little smaller. Cap. Sondershausen.

**Schwarz'enberg,** a princely family of Germany, descended from Erkinger von Seinsheim, who was ennobled in 1417 by the emperor Sigismund, and in 1420 bought the estate of Schwarzenberg in Franconia, whose name he adopted. In 1670 the head of the family was made a prince of the empire by the emperor Leopold I., and in 1746 this dignity was conferred on all members of the house by the emperor Francis I. The most celebrated names of the family are—(1) Karl Philipp, b. at Vienna Apr. 15, 1771; d. at Leipsic Oct. 15, 1820. He received a military education, and distinguished himself in the battles of Würzburg, Ulm, Hohenlinden, and Wagram. After the peace of Vienna (Oct. 14, 1809) he went to Paris as Austrian ambassador, and negotiated the marriage between Napoleon and Maria Louisa. Napoleon placed great confidence in him, and demanded that he should command the Austrian contingent in the Russian campaign of 1812. The slowness of his movements and the inefficiency of his measures have provoked much criticism from French historians, but Napoleon himself never uttered a doubt of his loyalty, and requested the Austrian emperor to make him a field-marshal. In the next year he commanded the Austrian army of observation in Bohemia, and when Austria joined Russia and Prussia he was made commander-in-chief of the allied army, gained the battle of Leipsic (Oct. 16–18, 1813), and led the army victorious into Paris.—(2) Felix Ludwig Johann Friedrich, a nephew of the preceding, b. at Kruman, Bohemia, Oct. 2, 1800; d. at Vienna Apr. 5, 1852. He entered the Austrian army in 1818, and was made a field-marshal-lieutenant in 1848, shortly before the battle of Custozza, but was mostly employed in diplomatic missions to St. Petersburg, London, Brazil, and Naples; and Nov. 22, 1848, was placed at the head of the Austrian government as chancellor of the empire. He found the state nearly dissolved, Vienna, Prague, Hungary, and the Italian provinces in open insurrection, the treasury on the very verge of bankruptcy, the Austrian influence in Germany almost annihilated, and the German states about to reorganize their union under the leadership of Prussia, etc. But all these difficulties he confronted with a courage and energy which excited admiration, even among those who were very far from approving either his aims or his measures. By the aid of Russia he put down the revolution in Hungary, and in a very short time succeeded in tying together once more the discordant limbs of the Austrian empire by means of a military and bureaucratic government. He was, however, by no means a mere repetition of Metternich. He was not averse to reform when it could be achieved in a regular and settled manner. He raised the credit of the state, and he baffled all the Prussian plans in Germany by drawing the southern and middle states over to the Austrian side.—(3) Friedrich Johann Joseph Celestinus, a brother of the preceding, b. in Vienna Apr. 6, 1809; was made archbishop of Salzburg 1836, cardinal 1842, archbishop of Prague 1849. He opposed the declaration of the dogma of the papal infallibility as inopportune, but accepted it afterward.

**Schwarzwald.** See Black Forest.

**Schwedt,** town of Prussia, province of Brandenburg, on the Oder, has breweries and manufactures of hosiery, soap, and tobacco. P. 9039.

**Schweg'ler** (Albert), b. at Michelbach, Würtemberg, Feb. 10, 1819; studied theology at the University of Tübingen, where he was appointed professor of classical philology in 1848, and afterward of ancient history. D. Jan. 5, 1857. In theology and criticism he belonged to the Tübingen school of Dr. Baur. Besides annotated editions and translations of the Clementine homilies (1847), Aristotle's metaphysics (1847–48), and Eusebius (1852), he published

*Der Montanismus* (1841), *Das Nachapostolische Zeitalter* (2 vols., 1846), *Römische Geschichte* (unfinished; 3 vols., 1853–58). But his best-known work is his *Geschichte der Philosophie* (1848), originally written for *Neue Encyklopädie für Wissenschaften und Künste*, but afterward often reprinted in book-form and translated into most European languages—into English by Prof. J. H. Seelye of Amherst (New York, 1856), and by Stirling in England. After his death appeared his *Geschichte der griechischen Philosophie* (1859).

**Schweid'nitz,** town of Prussian Silesia, on the Weistritz, is well built, contains several interesting public buildings, such as the town-house, the parish church with a tower 327 feet high, etc., and carries on a flourishing manufacturing industry in cloth, paper, leather, chemicals, beet-root-sugar, vinegar, etc. It was formerly a fortress of considerable strength, and played a conspicuous part during the Seven Years' war, but in 1807 the French demolished its outer works, and it has now lost much of its military importance. P. 16,998.

**Schweig'ger** (Johann Salomon Christoph), b. at Erlangen Apr. 8, 1779; studied mathematics and physics at the university of his native city, and was appointed professor of chemistry in 1819 at Halle, where he d. Sept. 6, 1857. After the announcement of Oersted's discovery of electro-magnetism in 1819, he invented the electro-magnetic multiplier.

**Schweig'häuser** (John), b. at Strasbourg June 26, 1742; studied theology and the Oriental languages; went to Paris to perfect his linguistic studies under De Guignes; visited Germany, England, and Holland; was appointed adjunct professor of philosophy at Strasbourg in 1770, and in 1778 professor of the Greek and Oriental languages. After the organization of the university at Strasbourg, he was made professor of Greek literature and dean of the faculty of letters, and was also appointed librarian. His editions are esteemed for the elaborate and learned commentaries annexed; among the most valuable are *Appiani Historiæ* (1782–85, 3 vols.); *Polybii Opera* (1789–95, 8 vols.), the 2d part of 8th vol. containing *Lexicon Polybianum; Epicteteæ Philosophiæ Monumenta* (1799, 5 vols.); *Athenæi Deipnosophistæ* (1801–07, 14 vols.); *Herodoti Historiæ* (1815, 6 vols., in 12 parts), to which was added a *Lexicon Herodoteum* (1824, 2 vols.). D. Jan. 19, 1830.

H. Drisler.

**Schwein'furt,** town of Bavaria, on the Main, is beautifully situated and well built, and has large manufactures of chemicals and pigments, especially ultramarine blue and Schweinfurt green. Large cattle and wool markets are held here. P. 10,325.

**Schweinfurt Green,** also called **Mountain Green** [Ger. *Wienergrün, Mitisgrün, Berggrün*], a compound of *cupric arsenite* and *cupric acetate;* three equivalents of the former to one of the latter, according to Ehrmann. It is prepared by boiling together arsenious acid and acetate of copper, and is but little used in this country. H. Wurtz.

**Schweinfurth** (Georg August), b. at Riga Sept. 29, 1836; studied botany and natural science at Heidelberg, Munich, and Berlin; made three journeys in the valley of the Nile to investigate the flora and fauna of those regions, 1864, 1865–66, and 1868–71, and wrote *Plantæ quædam Niloticæ* (1862), *Beitrag zur Flora Æthiopiens* (1867), *Reliquiæ Kotschyaræ* (1868), *Im Herzen von Afrika* (2 vols., 1874; translated into English as *The Heart of Africa* in 1874).

**Schwei'nitz, von** (Lewis David), Ph. D., b. at the Moravian village of Bethlehem, Pa., Feb. 13, 1780; was educated in Germany, where he resided from 1798 to 1812, when he went as Moravian minister to Salem, N. C.; settled in his native town 1821, and resided there until his death, Feb. 8, 1834. He was an enthusiastic cultivator of science, especially botany, and added by his own researches more than 1400 new species to the catalogues of American flora, the greater part being fungi which had been previously little studied. Author of several botanical monographs, the most important being those upon the genera *Viola* (1821) and *Carex* (1825), catalogues of the fungi of North Carolina (1818), of North America in general (1832), and of the plants collected in the N. W. Territory by Thomas Say (1824).—His son, Edmund Alexander, b. at Bethlehem in 1825; studied theology in the Moravian seminary of his native town and at the University of Berlin; became a clergyman; edited the *Moravian* newspaper for several years; was one of the translators of Herzog's *Real Encyclopædia* (Philadelphia, 1856 *seq.*), and author of *The Moravian Manual, being an Account of the Moravian Church* (1859), *Systematic Beneficence* (1861), *The Moravian Episcopate* (Bethlehem, 1865), and a *Life of Zeisberger, the Western Pioneer and Apostle to the Indians* (2 vols., 1870).

**Schwenk'feld, von** (Kaspar), b. about 1490 in Silesia; employed in the service of the duke of Liegnitz; embraced the Reformation with great enthusiasm, but developed afterward its ideas in a manner which brought him in conflict with the Reformers. It was especially his conception of the deification of the body of Christ and of the Lord's Supper, and his demands for the establishment of a Church to which only the *holies* should be admitted, which gave offence. He was persecuted both by Roman Catholics and by Protestants. D. in Ulm about 1561. In his *Bekanndtnus und Rechenschaft von den Hauptpunkten des christlichen Glaubens* (1547) he gave a representation of his doctrines. A sect, the Schwenkfelders, was organized in Silesia, but most of them emigrated in 1734 to North America and settled in Pennsylvania, where they still number about 1000 members, with their own churches and schools. (See Kadelbach, *Ausführliche Geschichte Kaspar von Schwenkfelds*, 1861.)

**Schwenkfelders.** See Schwenkfeld.

**Schwerin',** town of Germany, capital of the grand duchy of Mecklenburg-Schwerin, on the western side of Lake Schwerin, is connected by railways with Hamburg and Wismar. It is beautifully situated, surrounded with old walls, generally well built, and contains many magnificent buildings, among which the ducal palace is the most remarkable. It has many good educational institutions, museums, galleries, and collections, and numerous manufacturing establishments, though its trade and industry are of little importance. P. 26,804.

**Schwerin,** town of Prussia, province of Posen, at the influx of the Obra into the Wartha, has several tanneries, tobacco manufactories, and large horse-markets. P. 6142.

**Schwerin, von** (Kurt Christoph), Count, b. in Swedish Pomerania Oct. 16, 1684; studied at Leyden, Greifswald, and Rostock; entered the Dutch army in 1700, and fought at Ramillies and Malplaquet; took service with the grand duke of Mecklenburg in 1706, and distinguished himself by repelling the Hanoverians, who invaded the country; removed afterward to Prussia, as that part of Pomerania in which his estates were situated was ceded to that country; enjoyed the confidence of Friedrich Wilhelm I., and in a still higher degree that of Friedrich II.; won the battle of Mollwitz, Apr. 10, 1741, in the first Silesian war, stormed Prague Sept. 16, 1743, in the second, and fell in the battle of Prague, May 6, 1757, in the Seven Years' war.

**Schwytz,** one of the four so-called forest cantons in the middle of Switzerland, borders N. on the Lake of Zurich and S. on the Lake of Lucerne, and comprises an area of 353 sq. m., with 47,705 inhabitants, who speak German and profess the Roman Catholic religion. It is entirely covered with mountains, but only one peak, the Rieselstock, on the eastern frontier, 8890 feet high, reaches the line of everlasting snow. Agriculture can only be pursued to a limited extent, though fruits and wine are cultivated. Cattle-breeding is the principal branch of industry, and cheese, cattle, and timber are largely exported. Manufactures are confined to the demands of home use. The capital is Schwytz, a well-built town, with a good college and 6154 inhabitants.

**Sciac'ca,** town of Sicily, province of Girgenti, on the S. coast of the island, at the foot of Mount Cronium or Monte S. Calogero, occupies a site near the ruins of the ancient *Thermæ Selinuntinæ*, the birthplace of Agathocles (330 B. C.), and the whole district is one of great interest to the antiquary, to the geologist, and to the lover of nature generally. The rocky sides of Monte S. Calogero, itself a smouldering volcano, present innumerable natural caverns, showing more or less traces of the later hand of man, and which were evidently once the homes of the Troglodytes or cave-dwellers. Many of these caverns are now filled with mephitic exhalations, and medicinal springs everywhere abound. Everything indicates the immediate neighborhood of volcanic fires, and in July, 1831, just off this shore there arose a new island from the bed of the sea. The circumference of this island, when measured by Vice-Admiral Hotham, was three-quarters of an English mile, with an elevation of 81 feet above the sea. It was evidently composed of volcanic matter, and not long after it totally disappeared. Humboldt gives an interesting account of this phenomenon. The natural beauty of the scenery is here heightened by the picturesque old castles and other ruins, Greek, Roman, Saracenic, and Norman, some of which occupy striking points, and all of which tell strange tales of human vicissitude. The present town contains some mediæval structures of interest, and the sanctuary of San Calogero is worthy a visit. There is some industry and commerce here, but the exports, grain, oil, soda, honey, sardines, dried and salted

fish, limestone vases, etc., might be greatly increased. P. 19,209.

**Sciæn'idæ** [from the Latin name, *Sciæna*, of a large Mediterranean species], an extensive family of fishes of the order Teleocephali, distinguished by their physiognomy. The body is more or less elongated and compressed; the scales ctenoid and distributed in very oblique rows; the lateral line continuous and extending generally between the median rays of the caudal fin; the head more or less compressed, generally with a convex snout, sometimes with an acute one; the opercula normal and armed; nostrils double; mouth with a lateral cleft; upper jaw scarcely protractile; teeth acute, and in bands on the jaw; palate unarmed; branchial apertures continuous below; branchiostegal rays seven; dorsal fins two, the first short and with the spines generally feeble, the second longer and with branched rays; anal fin comparatively short, generally with two, but sometimes with one or three, spines; pectoral fins with branched rays; ventrals thoracic, each with a spine and five rays; the skeleton has the vertebræ nearly in normal number (*e. g.* 10 + 15, 11 + 14, etc.); the skull is channelled by muciferous cavities, bridged over by osseous bars; the stomach is cæcal, and pyloric appendages are developed in moderate number; the air-bladder has generally a number of slender cæcal appendages. The family is represented by about 130 or 140 species, variously distributed in different parts of the world; most of them are marine and inhabitants of the tropical and sub-tropical regions, but a few are confined to fresh waters. The most characteristic of the latter forms is the American genus, *Haploidonotus*, comprising the sheepshead of the interior lakes and rivers. This genus is most nearly related to the drumfish (*Pogonias chromis*) of the Atlantic seaboard. The family is divisible into several sub-families, distinguished by the relative numbers of the vertebræ, the development of the pharyngeal apparatus, and the form of the head. The principal of these are (1) Sciæninæ, including the croakers (*Micropogon*), king-fishes (*Menticirrus*), red bass (*Sciænops ocellatus*), and silvery perch (*Bairdiella punctata*) of the Atlantic coast; (2) Liostominæ, represented by the Lafayette (*Liostomus xanthurus*); (3) Haploidonotinæ, represented by the drum (*Pogonias chromis*) and the fresh-water sheepshead (*Haploidonotus grunniens*, etc.); and (4) Otolithinæ, represented by the weak-fishes (*Cynoscion*) of the Eastern coast. The most celebrated foreign fish of this family is the famed *Sciæna* of the ancients, *Sciæna aquila* of modern systematists. This grows to a very large size, sometimes attaining a weight of more than sixty pounds. It was much esteemed by the Romans for the delicacy of its flesh, and, on account of its large size, was generally sold in slices. Its head was the most esteemed part, and it was the custom among the fishermen to present it to three of the principal magistrates of the city as a kind of tribute; in connection with this custom an often-repeated story has been preserved by Paolo Giovio respecting the adventures of a gourmand named Tomisio in his endeavor to be at the feast at which an unusually large head was to be the principal attraction. The otoliths or ossicles of the ear are comparatively large in this fish, as in others of the family, and they were esteemed in former times for medicinal purposes as "colic-stones," and were encased in gold and suspended from the neck. THEODORE GILL.

**Scialo'ia** (ANTONIO), b. near Naples in 1817; studied law, and gave himself to its practice, but in 1846 he was called to the University of Turin as professor of political economy; in 1848 was minister of agriculture and commerce at Naples; was arrested and imprisoned in 1849, and after three years of confinement was banished. Upon this he returned to Turin, where he resumed his chair in the university, and in 1859 was elected to Parliament; in 1860 became minister of finance, and two years later was sent to Paris to negotiate a commercial treaty between Italy and France; in 1865 again took the portfolio of finance, and during the war of 1866 he signed the decree for a legal-tender paper currency and for a forced loan. He also warmly advocated the imposition of a tax upon personal property. In 1872–73 he was for some months minister of public instruction, and is now senator of the kingdom of Italy. His best printed works are—*I Principj dell' Economia Sociale* (Naples, 1840), *Sulla Proprietà de' Prodotti d'Ingegno* (Naples, 1843), *Industria e Protezione* (Leghorn, 1843).

**Sciat'ica** [L. Lat.], *neuralgia ischiadica*, a neuralgia of the great sciatic nerve, the sacral plexus, or any of the nerves of the thigh and hip. According to Niemeyer, the cutaneous nerve of the thigh, the superficial branches of the peroneal nerve, and the sural nerve are the principal seats of what is called sciatica. Exposure, rheumatism, gout, tumors near the nerve, fæcal masses, hæmorrhoids, diseased vertebræ, metritis, and perimetritis are reckoned among the causes. It sometimes follows a severe labor in childbed. Laxatives, cupping, the moxa blisters, hot baths, and local or general anodynes are frequently palliative, and sometimes curative. Periodic sciatica may often be relieved by quinine. Iodide of potassium and turpentine are both sometimes extremely useful, and so is the constant electric current. It is, however, a most obstinate and distressing complaint.

**Scic'li,** town of Sicily, province of Syracuse, on a rocky hill overlooking the sea, about 5½ miles from Modica, occupies a healthy position, but has no high roads of communication with the neighboring country, and of course cannot be prosperous. P. 10,887.

**Sci'ence** [Lat. *scientia*, from *scio*, to "know"]. In a general sense, science means knowledge reduced to order; that is, knowledge so classified and arranged as to be easily remembered, readily referred to, and advantageously applied. Strictly speaking, it is a knowledge of laws, principles, and relations. All science is based on the assumption that the laws of nature are immutable. From this point of view science may be regarded as a knowledge of the laws of nature, embracing the processes of observation and deduction by which they are discovered, and the modes of reasoning by which their operation in the production of phenomena are made known. Pure science is based on self-evident truths, and from these, as premises, laws of relation are deduced by a regular course of logical deduction. Of this nature is mathematical science. Natural science is based on experiment and observation; its fundamental laws are deduced by induction. Knowledge of the relations of quantity is *abstract* science; knowledge of causes and effects is *physical* science. W. G. PECK.

**Scientific Schools.** *Nomenclature.*—Under this head reference will be made to some of the institutions of the higher grade founded in this country within the present century for giving instruction in the various branches of mathematical, physical, and natural science, and their applications to the useful arts. Such establishments receive different names in different places, and are not readily separated into classes because of the manifold and varied purposes to which they are devoted. The phrases technical schools, polytechnic schools, technological institutions, industrial universities, scientific schools, schools and colleges of science, etc., are generic terms, under which are included seminaries for instruction in civil, mining, mechanical, military, and naval engineering; agriculture, horticulture, and forest-culture; physics, chemistry, metallurgy, and mineralogy; botany, zoology, and geology; etc. Medical schools might fitly be grouped with schools of science, but custom treats of them as professional schools. Schools of music, drawing, and design, painting and sculpture should be regarded as schools of the fine arts.

*Historical Sketch.*—We begin this survey with a brief historical statement. Soon after the Revolutionary war the need of professional in distinction from collegiate education was felt in the new republic, and efforts were made to establish schools of law, medicine, and theology. The need of training for the officers of the army was also appreciated, and Washington is reported to have said that "an army of asses led by a lion is vastly superior to an army of lions led by an ass." (*Cullum*, I. x.) During Jefferson's administration (Mar. 16, 1802) the U. S. Military Academy at West Point was instituted by Congress, and it has been maintained from that day to this. In consequence of the excellent mathematical instruction thus provided, and the limited opportunities which the country afforded for purely military careers, the graduates of this Academy were for a long time the principal civil as well as military engineers; many of them became renowned as explorers of "the Far West," and many more as teachers of mathematical science in the colleges, East and West. Mansfield, Partridge, Thayer, and other of the early officers of the Academy have thus left their impress upon American education. The history of the Academy has been well presented by Cullum, Boynton, and others. Its roll in June, 1875, included 252 cadets. In 1845, while Polk was President and George Bancroft secretary of the navy, an Academy for the preparation of navy officers was instituted by Congress at Annapolis, Md. The number of cadets in 1875–76 is 322, of whom 48 are cadet-engineers and 274 cadet-midshipmen. Nearly a quarter of a century after the beginning of the U. S. Military Academy the first civil school of science in this country was created at Troy. In 1826 the plans of Stephen Van Rensselaer, which had been gradually developing for some time previous, took form in the incorporation of the Rensselaer Polytechnic Institute, for which he provided a building and funds. Its object was declared to be the application of science to the common purposes of life, and especially the qualification of teachers to instruct in the application

of chemistry, philosophy, and natural history to agriculture, domestic economy, and the arts and manufactures. Under the lead of Amos Eaton the school at once became a success. The graduates were at first, like their chief teacher, inclined to the study of the natural sciences rather than of the mathematics, as the names of James Hall, E. Emmons, A. Fitch, etc. indicate; in later days the graduates have been distinguished for their skill in applied mathematics and the various branches of engineering. Twenty years later, and again by private munificence, an impulse was given to scientific education by the foundation in 1847 of the Lawrence Scientific School as a department of the university at Cambridge, for the purpose of providing instruction "in those branches of science which are more immediately connected with the great industrial interests of the country," such as chemistry, engineering, zoology, geology, etc. The recipient of this gift was Harvard, the oldest classical college in the Union; its donor, Abbott Lawrence; its promoter, Edward Everett; its amount unprecedented, the largest sum "ever given at one time during the lifetime of the donor to any public institution in this country." All these circumstances gave renown to the foundation, and the fame was increased by the appointment of Louis Agassiz, then forty years old, to be one of the professors. The Scientific School of Yale College was projected quite as early as that of Harvard, though it was slower in securing an endowment. The return from Europe of a young agricultural chemist, John P. Norton, led in 1847 to the beginning of a school in which agricultural and technical chemistry were to be taught, and gave shape to certain plans which had previously been projected for a new department of the college to be called "philosophy and the arts." In 1860 the school received a generous endowment from Joseph E. Sheffield, since largely increased, and was named in his honor the Sheffield Scientific School of Yale College. It became a school of mathematical as well as of chemical science, and afterward of natural history and geology. Five years later, in 1852, Dartmouth College received a legacy of $50,000 from Abiel Chandler, by which an institution kindred to those at Harvard and Yale was founded under the name of the Chandler Scientific School.

During the period from 1850 to 1860 the importance of scientific education was discussed in every part of the Union. Many excellent scholars returned from Germany, familiar with European schools of science, and urged their development in this country; full accounts were published of the technical schools of the Continent; the construction of public buildings and public works, the establishment of manufactories, and the development of mines called for scientific experts; while the lectures of Liebig, Johnston, and others, widely distributed among the people, suggested the importance of applying to agriculture also the discoveries of modern science. Organized efforts were put forth in New York, Illinois, and elsewhere for the promotion of agricultural colleges. In 1855 the State of Michigan provided for such a college, which was opened in 1857, and has remained to this day one of the foremost institutions of the purely agricultural class.

Attention was early directed to the possibility of securing from Congress a grant of public lands for the promotion of scientific education. In Dec., 1857, Hon. Justin S. Morrill, then Representative (and now Senator) from Vermont, introduced and advocated a bill bestowing a grant of public lands for this purpose. Public meetings were held in many of the States, petitions were signed and sent to Washington, and essays were printed for the encouragement of the project. The measure passed both houses by a close vote, but failed to receive the signature of the President, James Buchanan. A few years later a similar bill was carried through Congress, again under the lead of Mr. Morrill of Vermont, and having received the approval of the President, Abraham Lincoln, it became a law July 2, 1862. This bill, out of deference to many of those who promoted its passage, or by oversight or compromise, was entitled "An act for the benefit of agricultural colleges," and from this circumstance it is still popularly supposed to be directed exclusively or chiefly to the endowment of agricultural colleges. Its provisions, however, were not so restricted. Under the wise foresight of its chief advocate, Mr. Morrill, those phrases were employed which secured in every State ample encouragement for at least one scientific school, from which literary and classical studies were not excluded, but in which provision must be made especially for those branches of learning which are related to agriculture and the mechanic arts, or, in other words, for the various departments of applied or technical science. Although the national aid was bestowed by this act, every State receiving the grant was left free to determine in what manner the grant should be developed. The amount of land bestowed by this act was a "portion" of 30,000 acres for every Senator and Representative in Congress, or in all, for the 317 members of Congress in 1867, an aggregate area of nearly 10,000,000 acres. The following table, corrected by the U. S. land commissioner in Feb., 1876, exhibits the amount of land bestowed under the provisions of this act:

*Distribution of Land to the Several States for Colleges of Agriculture and the Mechanic Arts.*

| States. | Number of Senators and Representatives. | Acres. | States. | Number of Senators and Representatives. | Acres. |
|---|---|---|---|---|---|
| Alabama..... | 8 | 240,000 scrip. | Missouri..... | 11 | 330,000 land. |
| Arkansas..... | 5 | 150,000 scrip. | Nebraska..... | 3 | 90,000 land. |
| California..... | 5 | 150,000 land. | Nevada ..... | 3 | 90,000 land. |
| Connecticut.... | 6 | 180,000 scrip. | New Hampshire | 5 | 150,000 scrip. |
| Delaware..... | 3 | 90,000 scrip. | New Jersey.... | 7 | 210,000 scrip. |
| Florida..... | 3 | 90,000 scrip. | New York..... | 33 | 990,000 scrip. |
| Georgia..... | 9 | 270,000 scrip. | North Carolina | 9 | 270,000 scrip. |
| Illinois..... | 16 | 480,000 scrip. | Ohio..... | 21 | 630,000 scrip. |
| Indiana..... | 13 | 390,000 scrip. | Oregon ..... | 3 | 90,000 land. |
| Iowa..... | 8 | 240,000 land. | Pennsylvania.. | 26 | 780,000 scrip. |
| Kansas..... | 3 | 90,000 land. | Rhode Island.. | 4 | 120,000 scrip. |
| Kentucky ..... | 11 | 330,000 scrip. | South Carolina | 6 | 180,000 scrip. |
| Louisiana..... | 7 | 210,000 scrip. | Tennessee..... | 10 | 300,000 scrip. |
| Maine..... | 7 | 210,000 scrip. | Texas..... | 6 | 180,000 scrip. |
| Maryland ..... | 7 | 210,000 scrip. | Virginia..... | 10 | 300,000 scrip. |
| Massachusetts.. | 12 | 360,000 scrip. | Vermont..... | 5 | 150,000 scrip. |
| Michigan..... | 8 | 240,000 land. | West Virginia.. | 5 | 150,000 scrip. |
| Minnesota..... | 4 | 120,000 land. | Wisconsin ..... | 8 | 240,000 land. |
| Mississippi..... | 7 | 210,000 scrip. | | | |

From the bestowal of that grant until now the progress of scientific schools in the U. S. has been rapid; private munificence has supplemented the public bounty, excellent buildings have been constructed, apparatus and laboratories have been provided, and thousands of scholars have been taught.

*Schools of Science in the Older Colleges.*—Having reviewed the mode in which scientific schools have grown up in this country, we proceed to speak of their actual condition. The older colleges have now, most of them, established special courses of study, leading to special degrees (Ph.B., Sci. B., C. E., Mech. Eng., etc.). Thus, at Cambridge there is the Lawrence School, the Museum of Comparative Zoology, and the Bussey Institution, and there was the School of Mining; but the modifications of the main college (or "college proper," as it used to be called) have of late been such that the significance of these special schools is lessening, while the scientific advantages of the central college or university are increasing. Pres. Eliot in his report for 1875 favors the abandonment of such independent trusts, while his administration favors the college extension. The number of students in the Lawrence School in 1875–76 is 34; in the college, 776; in the university, 1278. In Yale College the Sheffield School has grown to be a second college, side by side with the original college, under the same trustees, with a different body of professors, who are united with the college professors in one faculty, called the "philosophical." The Sheffield School teaches chiefly the mathematical, physical, and natural sciences, pure and applied, and looks to the preparation of young men for modern scientific vocations, such as chemists, engineers, naturalists, etc. It received in 1863 the Connecticut portion of the national grant, but its chief endowment has come from the benefactor whose name it bears. The popularity of scientific education is illustrated by the number of students resorting here; in 1865–66 it was 93, and 249 in 1874–75. More than 1000 students have been trained in the decade 1865–75, and 75 of the former students are now professors of science in American colleges. Brown University, under Dr. Wayland, early took steps tending toward the modern scientific courses. For want of funds its progress has not been so rapid in this direction as that of some other colleges. Its receipts from the national grant of 1862 have not been adequate to fulfilling the purposes to which it is devoted. Union College claims to have been the first to introduce the system of scientific education by the substitution of modern languages and mathematical and physical science for Greek and Latin. It early established a special school of civil engineering, under W. M. Gillespie, which is still maintained. Wesleyan University at Middletown also claims to have been among the first of American colleges to provide special courses of instruction in science. These courses received a new impulse in 1870, when the institution was provided with a good building for scientific uses by the gift of Orange Judd. Columbia, like Yale, maintains the old classical curriculum, and simultaneously promotes with vigor a scientific department under the name of the School of Mines. This new institution is not restricted, as its name might imply, to mining, but it provides, as a comprehensive school of science, courses in analytical chemistry, engineering, geology, etc. Dartmouth retains the Chandler School, already referred to, and has affiliated with

it the school endowed by the New Hampshire portion of the grant of 1862; and it also has a special endowment for advanced instructions in engineering, given to it by Col. Thayer, formerly superintendent of the U. S. Military Academy. Princeton has received from John C. Green a liberal foundation for the establishment of a school of science which bears his name, and which is akin in scope to those already named. It is provided with an excellent hall adapted to such instructions, which was opened to students in 1873. Lafayette College at Easton, Pa., has received a special gift from Mr. Pardee for the endowment of a scientific school, which was inaugurated in 1873. The building constructed at his expense is spacious and convenient. Rutgers received the national grant of 1862, and with it maintains a scientific school in which agriculture has been given prominence.

These examples, which might be multiplied, show the mode in which instruction in science has developed in the older colleges of this country. The tendency has been to maintain (with such modifications as circumstances permitted) the traditional college course, and, parallel with it, to establish scientific courses. The efforts made to enlist bachelors of arts in the pursuit of graduate courses in science have been attended hitherto with but moderate success. Enough has been said to show that most of the older colleges in this country, inheriting the classical curriculum, have supplemented it, in one form or another, with a school of science. The newer foundations, like those of Ezra Cornell at Ithaca and Johns Hopkins in Baltimore, and especially the State universities, as in Michigan, Wisconsin, Minnesota, Kentucky, California, etc., have not been restricted by traditions, and have generally recognized with equal liberality, so far as their means would allow, the claims of literature and science. It may therefore be said that in American colleges and universities hostility toward science is almost unknown. Those who prefer the classical training, and those who advocate religious education, have favored schools of science, or at least have refrained from all opposition to them.

Many schools of science have been instituted independent of literary and classical colleges. One of the earliest phases of this movement was the foundation of agricultural colleges, upon which large sums of money were expended in New York, Pennsylvania, Maryland, and elsewhere, rarely if ever with results which were equal to the expectations. In Michigan, however, the agricultural college already referred to, established in accordance with a provision of the State constitution, and incorporated in 1855, and aided greatly by the Congressional grant of 1862, has maintained a course of almost uninterrupted vigor. In Massachusetts the State College of Agriculture at Amherst, a more recent foundation, likewise aided by the Congressional grant, has proved a success.

Two other technical schools have rapidly attained to positions of great influence—the Massachusetts Institute of Technology in Boston and the Stevens Institute of Technology, a school of mechanical engineering, in Hoboken, N. J. The first mentioned of these was founded by an association of which Prof. W. B. Rogers was long president. It received a small share of the Congressional grant of 1862, the most of which in Massachusetts was directed to the agricultural colleges, but it has also received State aid and generous contributions from individuals. Degrees are conferred in either of ten departments—civil engineering, mechanical engineering, mining, architecture, chemistry, metallurgy, natural history, physics, science and literature, philosophy. The number of graduates from 1868 to 1875 is 126. The number of students in 1874–75 was 288. The building and collections of this institution are noteworthy. The Stevens Institute has for a specialty mechanical engineering, and by concentrating its funds on this department has been able to accomplish excellent results. Its founder, E. A. Stevens, Esq., of Hoboken, bequeathed a lot of ground and the sum of $650,000 to found an institution of learning, and his executors determined its specific scope. The hall and its equipments, including the physical and mechanical collections, are of great value and well adapted to their purpose.

A third institution deserves mention here—the Thayer School of Civil Engineering, founded, in connection with Dartmouth College, by a gift of $70,000 from Gen. Sylvanus Thayer, U. S. Eng., for the advanced professional training of civil engineers.

There is obvious danger that the multiplication of these schools will tend, like the multiplication of colleges, to mutual injuries. Certainly, foundations enough have been created, and their distribution is wide enough through the country, for all present and probable necessities; and the interests of education require that further gifts and appropriations should be concentrated on the existing institutions rather than directed to new projects.

The scope of most of the schools referred to in this article is liberal; in the Eastern States, and to some extent in the Western States, the plans have been based upon the best European experience, and carefully adapted to our own country, needing only ampler funds for their execution. Sometimes the purely industrial claims are magnified, and manual labor is exalted beyond mental, but such tendencies are lessening every year. The most enlightened persons, whether devoted to business, legislation, or study, concede that the country has much to gain from the prosecution of scientific research, and that scientific vocations afford attractions to many who desire an intellectual calling, but are repelled from classical and professional study. In most schools of science in this country provision is made for the study of German, French, and English, and in some of them the study of Latin is also acquired; so that their graduates receive some degree of literary culture in connection with their scientific training. Many of the institutions provide for graduate as well as undergraduate instruction.

To these general remarks we append three lists which are believed to include the more important institutions of this country for instruction in the various branches of mathematical and physical science, pure and applied. Some unendowed and undeveloped projects are not included in these lists:

I. *Schools of Science aided by the National Grant of 1862, which was bestowed by the several Legislatures on the Institutions named.*

| | Institution. | State. | Location. |
|---|---|---|---|
| 1 | Agric. and Mech. Coll. of Ala. | Alabama | Auburn. |
| 2 | Ark. Industrial University | Arkansas | Fayetteville. |
| 3 | University of California | California | Oakland. |
| 4 | Sheffield Scientific School of Yale College | Conn | New Haven. |
| 5 | Delaware College | Delaware | Newark. |
| 6 | | Florida. | |
| 7 | Ga. State Coll. of Agric. and Mechanic Arts | Georgia | Athens. |
| 8 | N. Ga. Agricultural Coll | Do | Dahlonega. |
| 9 | Ill. Industrial University | Illinois | Urbana. |
| 10 | Purdue University | Indiana | La Fayette. |
| 11 | Iowa State Agricultural Coll. | Iowa | Ames. |
| 12 | Kan. State Agricultural Coll. | Kansas | Manhattan. |
| 13 | Kentucky University | Kentucky | Lexington. |
| 14 | Agric. and Mech. Coll. of La. | Louisiana | New Orleans. |
| 15 | State Coll. of Agric. and the Mech. Arts | Maine | Orono. |
| 16 | Maryland Agricultural Coll. | Maryland | College Station. |
| 17 | Mass. Inst. of Technology | Mass | Boston. |
| 18 | Mass. Agricultural Coll | Do | Amherst. |
| 19 | Mich. Agricultural Coll | Michigan | Lansing. |
| 20 | University of Minnesota | Minnesota | Minneapolis. |
| 21 | University of Mississippi | Mississippi | Oxford. |
| 22 | Alcorn University | Do | Rodney. |
| 23 | Univ. of Mo | Missouri | Columbia. |
| 24 | " " School of Mines. | Do | Rolla. |
| 25 | Agric. Coll. (Univ. of Neb.). | Nebraska | Lincoln. |
| 26 | Coll. of Agric. (Univ. of Nev.) | Nevada | Elko. |
| 27 | N. H. Coll. of Agric. and Mech. Arts. (Dartm. Coll.). | N. H | Hanover. |
| 28 | Rutgers Scientific School (Rutgers College) | New Jersey | New Brunswick. |
| 29 | Cornell University | New York | Ithaca. |
| 30 | University of N. C | N. C | Chapel Hill. |
| 31 | Ohio Agric. and Mech. Coll. | Ohio | Columbus. |
| 32 | Oregon Agricultural Coll | Oregon | Corvallis. |
| 33 | Agricultural Coll. of Pa | Pa | Near Bellefonte. |
| 34 | Brown University | R. I | Providence. |
| 35 | S. C. Agric. Coll. and Mech. Inst. (Claflin Univ.) | S. C | Orangeburg. |
| 36 | East Tennessee University | Tennessee | Knoxville. |
| 37 | Agric. and Mech. Coll. of Texas | Texas | Bryan. |
| 38 | Univ. of Vermont and State Agricultural College | Vermont | Burlington. |
| 39 | Va. Agric. and Mech. Coll | Virginia | Blacksburg. |
| 40 | Hampton Normal and Agric. Institute | Do | Hampton. |
| 41 | West Virginia University | West Va | Morgantown. |
| 42 | University of Wisconsin | Wisconsin | Madison. |

II. *Schools of Science maintained by the National Government.*—(1) U. S. Military Academy, West Point, N. Y. (School of Engineering at Willett's Point, N. Y.). (2) U. S. Naval Academy, Annapolis, Md. (Torpedo School at Newport, R. I.).

III. *Schools of Science unaided by the National Grant of 1862.*—New Hampshire: (1) Thayer School of Civil Engineering in Dartmouth College, Hanover; (2) Chandler Scientific School of Dartmouth College, Hanover; Massachusetts: (3) Lawrence Scientific School of Harvard College, Cambridge; (4) Bussey (Agricultural) Institution of Harvard College; (5) Massachusetts Institute of Technology, Boston; New York: (6) Rensselaer Polytechnic School, Troy; (7) School of Mines of Columbia College, New York; (8) Scientific Department of Union College, Schenectady; New Jersey: (9) Stevens Institute of Tech-

nology, Hoboken; (10) John C. Green School of Science of Princeton College; Pennsylvania: (11) University of Pennsylvania, Scientific Department, Philadelphia; (12) Pardee Scientific Department of Lafayette College, Easton; (13) Lehigh University, South Bethlehem.

The scope of this article is purposely restricted to the scientific schools of this country. Its limits permit but a brief reference to the corresponding schools in Europe. France, Germany, Austria, Switzerland, Belgium, and other continental states have long been distinguished for the excellent provision they have made for the promotion of scientific education, and many English and American writers, during the last twenty years, have diligently observed and carefully described the scope of such institutions. Numerous papers on this subject are scattered through Barnard's *American Journal of Education*, the twenty-first volume of which is devoted to the subject (Hartford, 1870), and a special report of Prof. J. W. Hoyt on the Paris Exhibition of 1867 is included among the *Reports of the U. S. Commissioners*, published by the government (Washington, 1870, 8vo). The need of corresponding schools in England has been urgently presented, and liberal appropriations have been made by the government for the encouragement of special advanced schools of science and art and for the promotion of scientific instruction in popular schools. The diligence of the British government in collecting such data as illustrate the experience in this respect of other nations is remarkable. The latest and fullest information of this character is given in the *Reports of the Royal Commission of Science* (1872–75), eight reports, with evidence, index, etc., published under the secretaryship of J. Norman Lockyer, Esq. D. C. GILMAN.

**Scil'la** [anc. *Scylla*], town of Southern Italy, province of Calabria, on the famous rock mentioned by the ancient poets as so perilous to the mariner who sought to avoid Charybdis: "Incidit in Scyllam cupiens vitare Charybdim." Though there has been great exaggeration, the navigation here is certainly dangerous from the fact that when opposite Cape Pelorus a strong current urges the vessel toward this rocky coast. Scilla was a fortress of no small strength, and has been the scene of severe fighting between the English and the French. It is now a place of some industry and commerce. P. 7448.

**Scil'ly Isl'ands,** a group of islands belonging to Great Britain, situated 30 miles W. of Land's End, the south-western promontory of Cornwall. It consists of 140 isles and rocks, of which only 6 are inhabited—namely, St. Mary, Tresco, St. Agnes, Sampson, Bryher, and St. Helen's. Total area, 5770 acres. P. 2627, of whom about 1500 live on St. Mary, where Hugh Town, the capital, is situated. On St. Agnes is a lighthouse; and on Bishop Rock (see LIGHTHOUSE CONSTRUCTION), 6 miles westward, is one of the finest "rock" lighthouses existing. All the islands are rocky, consisting of granite with a thin layer of light sandy soil. Agriculture and fishing are the principal occupations; good crops of barley, oats, and potatoes are raised. The Romans called the islands *Cassiterides* ("Tin Islands"), but the meaning of this name is as yet unexplained, for the islands contain no tin. The present name is Cornish, and means "cut off." The navigation around these isles is very dangerous. In 1705 the fleet under Admiral Sir Cloudesley Shovel fell upon these rocks, when his ship and several others were lost. The recent loss of the steamship Schiller near Bishop Rock is familiar.

**Scim'itar** [a word probably of Basque origin], a curved sword, of which the convex edge is sharp. It is generally employed in Asia, where it receives an admirable temper, but it is useless for thrusting, though as a cutting instrument no sword surpasses it.

**Scin'cidæ** [Lat. *Scincus;* Gr. σκίγγος or σκίγκος, an ancient name], an extensive family of lizards (order Sauria) of the group Leptoglossa. As limited by Gray, it includes those forms in which the body is subcylindrical or fusiform, and with the tail cylindrical or tapering; the scales generally smooth, but sometimes peeled or striated; the head subquadrangular and regularly shielded, with the rostral plate moderate, and the nostrils lateral, and in a special nasal shield interposed between the frontal and labial shields; the limbs variable in development, typically four, generally more or less weak, sometimes atrophied. According to Prof. Cope, the temporal fossa is roofed, the premaxillary double, the palatine maxillary laminæ dilated, and rarely a xiphisternal fontanelle is developed. The tongue is short, flat, and squamous. The family embraces numerous genera, distributed in almost all parts of the world. There is every gradation in the development of the members, from those forms in which the limbs are quite strong and provided with five digits each, to those in which they are entirely wanting, and the number or development of these parts is of comparatively little systematic value in the group. In the U. S., according to Prof. Cope, there are fourteen species—one belonging to the genus *Oligosoma* (*O. laterale*), and the thirteen others to the genus *Eumeces*. THEODORE GILL.

**Scinde.** See SINDH.

**Scindia,** or **Sindia.** See GWALIOR.

**Scintilla'tion of the Stars** [Lat. *scintillatio*]. The phenomena of scintillation or twinkling are sufficiently known in a general way, but it is only within a few years that sufficient details have been recognized (by the help of the spectroscope) to establish a sure theory. Prof. Respighi of Rome is the astronomer whose observations are most carefully made, and whose theory best explains the facts noticed.

When the spectroscope is properly applied to a star near the horizon, as seen by a telescope of moderate power, its spectrum is seen to be crossed or partially occupied by moving dark and bright bands of various breadth and intensity. If the spectrum be horizontal and the star near the horizon, these bands are transversal to the spectrum, but form an angle with the vertical as the star's altitude increases, which becomes a right angle at an altitude of about 40°; and beyond this the bands are longitudinal, faint, and ill-defined. When the prism is turned into a vertical direction, the bands are transversal, whatever be the star's altitude, if less than 30°, but less well defined; they are less numerous and rapid in their motion for low stars than for high, and their inclination to the vertical is always from the zenith toward the violet end of the spectrum. Their motion is generally from the violet to the red end of the spectrum for a star E. of the meridian, and *vice versâ* for a star W.; but for one on the meridian they are sometimes stationary, and sometimes vibrate backward and forward from one color to another. The bright bands and masses are not so frequent and regular as the dark ones; both kinds are more regular in continued good weather and with an atmosphere nearly at the point of saturation; in these cases even the planets exhibit the scintillation-bands.

The explanation of these phenomena depends upon atmospheric dispersion; the existence of strata of air which have a different index of refraction, owing to variations in density, temperature, or moisture, from the surrounding atmosphere; and lastly, upon the various motions of these strata with respect to the rays which reach the telescope. The atmospheric dispersion is about one-seventieth of the refraction. The red and violet rays which are seen side by side in the image of a star 5° above the horizon are perhaps a rod (5 mètres) apart at the distance of 70 miles from the eye, and three rods apart at a triple distance, so that some rays from the star may pass through a stratum of entirely different refractive power, and be turned aside so as not to reach the telescope; this process will produce dark lines in the spectrum; while other rays not similarly directed may be refracted into the telescope, producing bright spots in other portions. There can be no doubt of the existence of such strata, nor any reasonable hesitation in believing that those which produce scintillation must be very far off, for in this case a slight difference in the indices of refraction would produce a greater effect. If the star be in a direction nearly E. or W., the motion of these strata relatively to the rays is chiefly due to the motion of the earth. In the E. the violet rays from a low star reach the disturbing stratum before the red rays, and the dark band will be seen to pass from the violet to the red end of the spectrum. W. of the meridian this is reversed, and upon the meridian, when the stratum is horizontal, the band will appear stationary; but when not, the varied form, position, and motions of the disturbing strata will produce an unsettled flitting of the spectral bands, as it is observed. The phenomena become more complicated at greater altitudes, and at the same time less definite to observation.

The earlier observations were not sufficiently complete to furnish a consistent theory. Arago's was the earliest of any value; it was chiefly based upon observations made with a vibrating telescope, and is mainly derived from the idea that the light-waves which reach the eye may be at different phases—that is, tend in part to destroy each other's influence, and this intermittently. Montigny, who investigated the subject by the help of a prism, but without a cylindrical lens, supposed that some of the rays were totally reflected by strata of irregular density. Both these older theories may possibly help explain some share of the phenomena, although there are theoretical difficulties, especially with Arago's, which are hard to clear up; Respighi's alone is adequate to account for all the effects so far as yet observed. His papers are to be found under the title *Sulla Scintillazione delle Stelle* in the *Atti dell' Accademia Pontificia de' Nuovi Linui,* anno xxi. xxii.; Arago's,

in his *Œuvres complètes*, edition Barral, vii. 1–96; Montigny's, in the *Mémoires couronnés de l'Académie royale de Belgique*, vol. xxviii. T. H. Safford.

**Sci'o, Chios, or Khio** [Turk. *Sâkîz Adasi*], a rough and rocky but very beautiful and fertile island in the Ægean, in the latitude of Smyrna, separated from the W. extremity of Asia Minor by a strait only 5 miles wide at the narrowest point. It is 32 miles from N. to S., from 18 to 8 from E. to W., 110 miles in circuit, and has an area of about 400 sq. m. There are no perennial streams, but numerous large wells keep up a perpetual verdure and ensure bountiful crops. The principal products are cotton, wool, silk, oil, wine, cheese, figs, lemons, oranges, and especially gum-mastic, which exudes from a species of lentisk, and is much used for chewing by ladies in the Levant, as also in certain varnishes and in distilling a kind of gin. The oldest inhabitants were Ionians. Homer was said to have been born there. The island has been repeatedly ravaged and desolated—by the Persians in 499 B. C., by the Athenians in 412 B. C., and by the Turks, first in the early part of the fourteenth century, and again in 1822. This last was one of the greatest atrocities on record. As the private property of the sultana, the island had long been mildly governed, the people had become wealthy, refined, and unwarlike, and were not at all disposed to join their countrymen in the struggle for Greek independence. Stirred up at last by the Samians to take part in the revolt, the Turks came down upon them in great wrath. Thousands were massacred, other thousands sold into slavery, and the whole island ruthlessly laid waste. In Feb., 1822, there was a pop. of at least 100,000, and in August there remained not more than 30,000; some say not more than 16,000. The island is now flourishing again, with a pop. of 50,000 or 60,000, most of whom are Turks. R. D. Hitchcock.

**Scio,** capital of the island of Scio, has a good harbor, formed by two moles and defended by a citadel, some manufactures of silk and velvet, and a lively trade. P. 14,500.

**Scio,** p.-v. and tp., Washtenaw co., Mich., on Michigan Central R. R. P. 2495.

**Scio,** p.-v. and tp., Allegany co., N. Y., on Genesee River and Erie R. R. P. 1652.

**Scio,** P. O. name of New Market, Harrison co., O., on Pittsburg Cincinnati and St. Louis R. R.

**Scio'ta,** p.-v. and tp., McDonough co., Ill., on Toledo Peoria and Warsaw R. R. P. 1138.

**Sciota,** tp., Shiawassee co., Mich. P. 1270.

**Sciota,** tp., Dakota co., Minn. P. 328.

**Scio'to,** county of S. Ohio, on Ohio River, traversed by Scioto and Little Scioto rivers and their branches, has a broken surface and a fertile soil, and is crossed by the Portsmouth branch of Marietta and Ohio R. R. In the E. part iron ore is abundant, as also some coal, and there are many furnaces, foundries, and manufactories. Agricultural staples, Indian corn, oats, hay, and potatoes. Dairying is carried on to some extent. Cap. Portsmouth. Area, 550 sq. m. P. 29,302.

**Scioto,** tp., Delaware co., O., on Scioto River and Cleveland Columbus Cincinnati and Indianapolis R. R. P. 1542.

**Scioto,** tp., Jackson co., O., on Little Scioto River. P. 1505.

**Scioto,** tp., Pickaway co., O., on Scioto River. P. 1545.

**Scioto,** tp., Pike co., O., on Scioto River. P. 772.

**Scioto,** tp., Ross co., O., on Scioto River, includes the city of Chillicothe. P. 2318.

**Scioto River,** a beautiful stream which rises in Auglaize co., O. Its course to Columbus is S. E., and from that city it flows S. to Portsmouth, where its waters are discharged into the Ohio. It is 200 miles long, and for 130 miles may be navigated in good stages of water. Its valley is extremely productive of grain and live-stock.

**Scio'toville,** p.-v., Harrison tp., Scioto co., O., on Little Scioto River and on Portsmouth branch of Marietta and Cincinnati R. R. P. 480.

**Scip'io,** tp., Allen co., Ind. P. 420.

**Scipio,** tp., Laporte co., Ind. P. 856.

**Scipio,** tp., Hillsdale co., Mich. P. 1107.

**Scipio,** p.-v. and tp., Cayuga co., N. Y. P. 2070.

**Scipio,** tp., Meigs co., O. P. 1761.

**Scipio,** tp., Seneca co., O. P. 1635.

**Scipio,** the name of one of the most illustrious patrician families in ancient Rome, belonging to the Cornelia gens. The first member of the family mentioned in history is Publius Cornelius Scipio, who was *magister equitum* to the dictator Marcus Furius Camillus in 396 B. C.; the last is Publius Cornelius Scipio, who was consul under Nero in 56 A. D. The family tomb, situated on the left of the Via Appia, near the Porta Capena, about 400 paces from the modern Porta S. Sebastiano, was discovered and excavated in 1780, and has been described in full by Visconti, *Monumenti degli Scipioni* (1785). The oldest inscription found in the tomb was that of Lucius Cornelius Scipio Barbatus, who was consul in 298 B. C. His grandson was that Publius Cornelius Scipio who was consul in 218 B. C., and who, after attempting in vain to prevent Hannibal from crossing the Rhone, was defeated at the Ticinus, and shortly after at the Trebia. In 217 B. C. he took the command of the Roman forces in Spain, where he was afterward joined by his brother Cneius. They carried on the war here with some success, but in 212 B. C. they were both killed—Publius in the battle of Anitorgis, Cneius in the battle of Urso. In 211 it was determined in Rome to send a proconsul to Spain and prosecute the war with greater vigor, the proprætor Caius Nero, who succeeded the Scipios, having been unable to achieve anything; but as it was impossible to provide a sufficient armament, and as it was well known that the Carthaginians maintained a great force in the Peninsula and had succeeded in forming alliances with the natives, the fierce Celts and Iberians, there was in the whole of Rome only one man who offered himself for the position—Publius Cornelius Scipio, Africanus Major, a son of the Scipio who fell at Anitorgis. He was very young (b. in 234 B. C.), and although he had fought with distinction at the Ticinus, where he saved his father's life, at Trasimenus, and at Cannæ, he had never before held a superior military command. But he was the only one available, and he was consequently entrusted with the task; perhaps also the irresistible charms of his person contributed something to the result. He believed that the gods had destined him for something great, but this belief he did not hold as a superstition, which makes men overbearing and cruel when they succeed, suspicious and fanatical when they fail. With him it was a lofty self-confidence, which led him to pursue the most audacious plans because they were the shortest way to the goal, but which after the victory made him magnanimous and full of sympathy. Arrived in Spain in 210 B. C., he did not attack any of the three Carthaginian generals—Hasdrubal, Barca's son, Hasdrubal, Gisco's son, and Mago, who were in different parts of the peninsula—but swooped down on Nova Carthago, the capital of the Carthaginian empire in Spain and the emporium of all its treasures, provisions, materials, hostages, etc. In 209 he defeated Hasdrubal, Barca's son, at Bæcula; in 207, Hasdrubal, Gisco's son, and Mago at Silpia; and when in 206 he returned to Rome the Carthaginians had been totally expelled from Spain, and the natives had been so captivated by Scipio that they asked him to remain and become their king. Next year he was elected consul. It was his plan to drive Hannibal out of Italy by invading Africa, but this idea seemed too daring to the old senators; they refused to give him an army. Nevertheless, a sufficient number of volunteers gathered to his standard, and in 204 B. C. he landed in Africa near Utica. Masinissa joined him; Hasdrubal, Gisco's son, and Syphax were defeated; another Carthaginian army was annihilated; Hannibal was recalled, and by the battle of Zama (Oct. 19, 202 B. C.) the power of Carthage was broken and a new goal raised for the policy of Rome—the dominion not of Italy only, but of the whole western basin of the Mediterranean. After this time he mingled only occasionally in public life. His task was done. His belief that he was a god-sent man had proved true, and he assumed an attitude corresponding to this idea, refusing to accept the honors which the people in their enthusiasm offered him, and refusing to obey the laws which the state imposed on him as on other citizens. Conflicts soon arose, and he had no party to support him. He was an aristocrat, but not an oligarch. The jealousies and intrigues of the nobility were as disgusting to him as the foolishness and venality of the people. The old Roman party hated him, and so did the new Roman. He had inaugurated a new epoch in Roman politics, and thereby made the village wisdom of the old fathers an empty sound, and now it seemed as if he were about to inaugurate a new era in Roman civilization and make the austerity and boorishness of the old virtue ridiculous. He was an elegant man, familiar with Greek literature and art; he used silver plate on his dinner-table and studied grammar. Cato was his sworn enemy. On the other hand, he was utterly averse to those ideas of a new disposition of power and property which just then were taking shape in Roman society and in his own family: his daughter Cornelia was the mother of the Gracchi. Nevertheless, although unsupported by any, he made the people and the state bow to his will. When his brother Lucius, whom he accompanied as legate in the war against Antiochus simply

for the purpose of procuring celebrity and influence for him, was accused of having been bribed by Antiochus, proved guilty, and imprisoned, Scipio rescued him from the hands of justice by force, and the tribunal found it advisable to submit to this violence. When he himself was accused of having taken bribes, he said nothing to defend himself, but explained to the assembled people what good and great deeds he had done, and ended by asking them to accompany him to the capitol to thank the gods who had sent him among them; which they did. The day after this event, one of the few fairy-tales in history which are true, he left Rome and retired to his country-seat at Liternum, where he d. about 183 B. C.—His son adopted PUBLIUS CORNELIUS SCIPIO ÆMILIANUS, AFRICANUS MINOR, b. about 185 B. C., a son of Lucius Æmilius Paulus, the conqueror of Macedonia, whose sister was married to Scipio Africanus Major. He did not excite great expectations while a young man. His strongly-marked literary propensities even made people believe that he was unfit to uphold the great traditions of the family by which he had been adopted. Nevertheless, during his first campaign in Spain in 151 B. C. he attracted great attention, not only in the army, but even in Rome, by his personal valor, the integrity of his character, and his talent as a general. In the beginning of the Third Punic war he commanded under Manilius, but soon both soldiers and citizens agreed that he was the only fit commander-in-chief. In 148 B. C. he was made consul, and in 146 B. C. he took Carthage and razed it to the ground. In 134 B. C. he again made a brilliant campaign in Spain, which ended with the capture of Numantia. While here he heard that Tiberius Gracchus, whose sister Sempronia he had married, had been murdered in Rome, and he said openly, and repeated it often afterward, that he considered the murder just. On his return to Rome he employed all his talent and energy to elude and frustrate what Gracchus had begun, but one morning in 129 B. C. he was found dead in his room, and it was generally believed that he had been murdered. He was an intimate friend of Polybius, who accompanied him on all his campaigns, and Cicero has perpetuated the friendship of Scipio and Lælius by his treatise, *Lælius sive de Amicitia;* he was also a great patron of Terence, whose comedies people said he had a part in.—One branch of the family of the Scipios bore during several generations the surname Nasica. From this branch descended QUINTUS CÆCILIUS METELLUS PIUS SCIPIO, who was adopted by Quintus Metellus Pius, and who played a conspicuous part in the struggle between Pompey and Cæsar. True to the traditions of the Scipios, he sided with Pompey, and commanded the army of the optimates in the battle of Thapsus (46 B. C.). He was defeated, and killed himself. CLEMENS PETERSEN.

**Sci're Fa'cias** [Lat.], the technical name of a peculiar common-law writ based upon a record, and ordering the party against whom it is directed to show cause why some act should not be done in relation to such record in favor of the party at whose suit it is issued. Its peculiar name, like that of many other common-law writs, is derived from the operative words addressed to the sheriff, originally in Latin (*"quod scire facias præfato N.,"* etc.), "that you cause said N. to know that he must show cause why," etc. A *scire facias* might be used at the common law in reference to three species of records—judgments, recognizances, and letters patent. When based upon a judgment, its object might be twofold—either (1) to revive such judgment if by lapse of time a legal presumption had arisen that it was paid or released, and to obtain authority to issue execution thereon; or (2) to extend the judgment, and enforce it for or against other parties who were not parties to the original recovery, but who were or had become so connected with such original parties that the same rights or liabilities existed for or against them; as, for example, when in an action against several joint debtors the judgment recovered against some of them, the others not having been served with process, is afterward extended and made to embrace these latter defendants. When based upon a recognizance, the object of a *scire facias* was simply to procure the issuing of an execution by which the obligation might be enforced. (See RECOGNIZANCE.) In these cases the sole design of the writ was to continue the judgment and to keep it in force, and the proceeding upon it was in no respect an action. When based upon letters patent, the *scire facias* was issued on the application of the government, and its object was to procure them to be annulled by the court for some cause affecting their validity. In this case it was the commencement of an action, in which the defendants put in a plea or answer, and the issues of fact thus raised were regularly tried. In New York and many other States the writ of *scire facias* has been abolished, and a simple motion has been substituted, for the purpose of reviving and continuing a judgment or of extending it to other parties. In several of the States a proceeding in the nature of *scire facias* is used to accomplish the same object, as it is under U. S. statutes in the national courts to annul letters patent; while in a few commonwealths the ancient writ is still retained.

JOHN NORTON POMEROY.

**Scit'uate,** p.-v. and tp., Plymouth co., Mass., on the Atlantic, was settled as early as 1628 by Puritans from Kent, England; has been the native place of several eminent men, but has now become a place of little importance, chiefly occupied with fishing, the lumber-trade, and the collection of Irish moss from the rocks on the seashore. There are 4 churches. (See the *History of Scituate,* by Samuel Deane, 1838.) P. 2350.

**Scituate,** tp., Providence co., R. I. P. 3846.

**Sciur'idæ** [Lat. *Sciurus,* a "squirrel"], a family of mammals belonging to the order Rodentia and sub-order Simplicidentati, including the squirrels, marmots, etc. The external form is very variable; the skull is well developed and delicate in organization; the infraorbital foramen is only represented by a small anterior foramen, the zygomatic process of the upper jaw being an imperforate, thin, and oblique plate, which rises from the general level and forms a dead wall in front of the orbit; post-orbital processes are more or less developed; the lower jaw has its descending ramus subquadrate, the upper angle acute and sub-erect, and the lower rounded or subtruncate and bent inward; molar teeth $\frac{4-5}{4} \times 2$, provided with roots, and (except the anterior upper one when present) of nearly equal size, with tubercular crowns; perfect clavicles are developed; the hind limbs moderately large; the fibula and tibia separate from each other. The family is quite an extensive one, at least 150 species being known, and is represented in almost all quarters of the world except Australia. There are all gradations, between the slender and graceful form of the squirrel and the heavy, almost bear-like, form of the woodchuck; and hence these two types, distinct as they at first sight appear, cannot be even differentiated into distinct sub-families. This transition is manifest from the arboreal squirrels (*Sciurus*) through the ground-loving *Tamias* with well-developed tails; the *Spermophilus,* or prairie-squirrels, with shorter tails; *Cynomys,* or the prairie-dogs, with stouter forms; and *Arctomys,* or the woodchucks, with still more robust forms. The latest writer, J. A. Allen, on the American species, recognizes as inhabitants of the U. S. 24 species (*Sciurus,* 5 species; *Tamias,* 3 species; *Spermophilus,* 11 species; *Cynomys,* 2 species; and *Arctomys,* 3 species), besides a number of varieties.

THEODORE GILL.

**Scleroder'ma** [Gr. *σκληρός,* "hard," and *δέρμα,* "skin"], a sub-order of plectognath fishes, in which the bones of the upper jaw are but imperfectly united, the teeth independently developed, and the scapular arch, with the hypocoracoid and hypercoracoid bones, both developed. The form is typically fish-like, in which respect the species differ much from the other members of the order. The dermal armature is developed in the form of small scale-like plates or bristles; the dorsal fin is represented by from one to six spines; the pelvic elements are well developed. To the group thus distinguished belong two well-defined families—Triacanthidæ, including the most fish-like forms, and Balistidæ, comprising the more aberrant species.

THEODORE GILL.

**Scleros'toma** [Gr. *σκληρός,* "hard," and *στόμα,* "mouth"], a genus of parasitic nematoid worms found in the intestine of the horse and some of the ruminant animals. They have a slender, elongated body, a resisting integument, and a complete intestinal canal running in a straight direction from the mouth at the anterior extremity to the anus posteriorly. The sexes are separate. In the male there is a long, filiform, convoluted spermatic tube, with its external orifice at or in the immediate neighborhood of the anus, and provided with external copulatory appendages. In the female the ovarian tubes, in which the eggs are produced, are also very long, and folded in the interior of the body. The external genital orifice, or vulva, is situated at an intermediate point between the mouth and the anus. The characters above described are those common to all the nematoid worms. This genus is distinguished from the remainder principally by the structure of its head, which is of a truncated globular form, with a comparatively large orbicular mouth, and is sustained internally by a capsule of horny consistency; whence the name, *Sclerostoma* ("hard-mouth"), is derived. The worm is of a white color, cylindrical in form, and twenty or thirty times longer than wide. The integument is marked by numerous fine transverse striations. In the male there are two long and slender copulatory spicules, which protrude from the genital orifice, and the orifice is bordered on each side by a membranous expansion, sustained by ribs or ridges of somewhat firmer consistency, in the same manner as the extended web

of a frog's foot is sustained by the toes. The two lateral expansions are united posteriorly by a third, of smaller dimensions; the whole thus forming a copulatory pouch which nearly surrounds the genital orifice at the posterior extremity of the body. In the female, which is considerably larger than the male, the caudal extremity is conical and tapering, and extends for a certain distance beyond the anus. The vulva is situated considerably in advance of the anus, toward the anterior extremity. The most important species of this genus at present known is *Sclerostoma equinum*, so called from its being found in the intestine of the horse. It is of very frequent occurrence, and, according to Dujardin, is sometimes to be found in all the horses examined for that purpose. It is often, also, very numerous; as many as 1000 having been counted in a space of two inches square on the inner surface of the intestine. Notwithstanding, however, its numbers and frequency, it does not appear to cause any serious injury to the animal in whose body it is domiciled. Its usual locality is the large intestine, where it fixes itself to the inner surface of the mucous membrane, but it is sometimes found in the upper part of the small intestine, in the pancreas, and even in the tunic of the testicle. Its specific characters are the following: It is of a reddish-gray or brown color, and from a little over one inch (the male) to an inch and a half or two inches (the female) in length. The edge of the mouth is bordered by one or more ranges of finely-toothed eminences or fringes directed inward, and the body is marked, in addition to the usual transverse striation, with ten or twelve longitudinal lines. A remarkable fact in regard to this worm is that it occurs also in *aneurismal tumors of the mesenteric artery*. Aneurisms of this nature are not found in other cavities of the body, but only in the abdomen, in the arterial branches supplying the intestine; and they have been met with only in the horse, the ass, and the mule. They are never present in the foal when newly born, though they have been found in colts within one or two years after birth. At later periods, on the contrary, they are very frequent, and, according to Davaine, but few old horses are entirely free from them. They are usually of small size, not more than three-fourths of an inch in thickness, and do not appear to produce any marked injurious effect. Each aneurism contains one or more sclerostomata, imbedded partly in the clot occupying the cavity of the artery, partly in the substance of its thickened wall. The aneurism is usually regarded as caused by local irritation due to the presence of the worm. J. C. Dalton.

**Sclo'pis** (Federigo), Count, b. at Turin in 1798; took his legal degree in the university of his native city in 1818, and in 1827 gave his first historical lecture, *I Longobardi in Italia*, before the Turin Academy of Sciences. This was followed by *La Storia dell' Antica Legislazione nel Piemonte* (Turin, 1833), *La Storia della Legislazione Italiana* (4 vols., Turin, 1840–64), *Ricerche Storiche sopra le Relazioni Politiche tra la Dinastia di Savoia ed il Governo Britannico* (Turin, 1853). In 1845 he was elected corresponding member of the Institute of France, and in 1869 foreign member of the same; in 1847 was made president of the superior commission of censorship in Piedmont; in Mar., 1848, accepted the portfolio of grace and justice; in 1849 was named senator, and from 1861 to 1864 was president of the Italian Senate; was also elected president of the Turin Academy of Sciences. In 1868, Victor Emmanuel bestowed upon him the highest order of the kingdom, that of the Annunziata, and in 1871 he was still further honored by being selected as representative of the kingdom of Italy in the congress of arbitration which assembled at Geneva for the settlement of the important Alabama question; was elected president of this congress by his colleagues, and he performed the duties of his office with signal ability and tact.

**Sco'field** (Glenni W.), b. in Chautauqua co., N. Y., Mar. 11, 1817; graduated at Hamilton College 1840; studied law, and was admitted to the bar at Warren, Pa., 1843; was a member of the State assembly 1850–51, and the State senate 1857–59; became president judge of the eighteenth judicial district 1861; sat in Congress 1863–75, being a Representative for the State at large during the latter term, and was for several years chairman of the committee on naval affairs.

**Scolecophid'ia** [Gr. σκώληξ, σκώληκος, an "earthworm," ὄφις, a "serpent," and εἶδος, "form"], a sub-order of serpents, including sluggish, worm-like species. It is chiefly distinguished by anatomical characters. As now understood by Prof. Cope, it includes those forms in which the mastoid forms a part of the cranial wall, the coronoid bone is present, and no ectopterygoid is developed. It was formerly, however, limited to those forms which, in addition to these characters, were distinguished by the absence of the prefrontal, the non-development of alveolar ridges on the maxillary or malar processes, and the development of rudiments of a pelvis without pubis, in contradistinction to the Catodonta, in which the prefrontal is present, the maxillary has an alveolar ridge and a malar process, and a rudiment of a pelvis with pubis is developed. As thus limited, the Scolecophidia are equivalent to the family Typhlopidæ, and the Catodonta to the family Stenostomidæ. Theodore Gill.

**Scolopac'idæ** [Lat. *scolopax*, a "woodcock"], a family of wading birds, including the snipe, woodcock, and related forms. The bill is long and slender, rather soft and flexible, and with the sides compressed and grooved to the tip, which is blunt; the lower mandible has no angle at its lower margin; the nostrils are basal, elongated, and situated in a groove closed by a membrane; the wings are long and pointed, the first or second primary being longest; the tail is usually short and even; the legs elongated; the thighs exserted and naked; the tarsi elongated and slender; the toes moderately long and attenuated, the anterior being connected more or less by a basal membrane, the hinder short or wanting. The family is a very extensive one, and by some (*e. g.* Lilljeborg) has been subdivided into two—Scolopacidæ, in which the orbits are closed below, and Totanidæ, in which they are open below. By many authors (*e. g.* G. R. Gray) it is divided into five subfamilies: (1) Scolopacinæ, including the snipes, woodcocks, etc., with 5 genera and 35 species; (2) Tringinæ, or sandpipers, with 6 genera and 27 species; (3) Totaninæ, or the longshanks, tatlers, and plovers, including 2 genera and 19 species; (4) Recurvirostrinæ, or the avocets, including 3 genera and 13 species; and (5) Limosinæ, or the godwits, with 3 genera and 26 species. All these types are widely distributed, and among them are some of the most cosmopolitan of birds. They differ much in habits. The typical members of the family are wading or shore birds, but some are found in uplands far from water, and others in inland forests. (See Curlew, Sandpiper, Snipe, Woodcock, etc.) Theodore Gill.

**Scomberesoc'idæ** [Lat. *scomber*, a "mackerel," and *esox*, "pike"], a family of fishes comprising some remarkable forms. The body is more or less elongated, and generally rectilinear, but sometimes subfusiform; the scales are cycloid, a lateral peak developed along each side of the belly; the head is more or less subquadrangular and flattened above; the jaws are very variable in development, sometimes very much elongated, and sometimes short and subtruncate; the upper is constituted by the intermaxillaries at the middle and the maxillaries at the sides; the teeth are variable in development; the branchial apertures confluent below; branchiostegals in considerable number; the dorsal fin single and far back, composed mostly of branched rays; anal fin opposite the dorsal; caudal distinct and generally emarginated, and with its lower lobe longest; pectorals with branched rays and variable in development; ventrals abdominal. The air-bladder is generally present, but is shut off from any communication with the intestinal canal; the pseudobranchiæ are hidden and glandular; the stomach is not distinct from the intestine, which is quite straight and without pyloric appendages. As thus defined, the family includes two quite dissimilar types—on the one hand, the Beloninæ, and on the other, the Scomberesocinæ, Hemirhamphinæ, and Exocœtinæ. The first is rather the type of a distinct family; the others, however, are closely related, although presenting very different forms. In the Scomberesocinæ both the upper and lower jaws are attenuated into a snipe-like bill; in the Hemirhamphinæ the lower jaw is alone extended into a long flattened styliform apparatus, while the upper jaw is subtriangular and transverse; and in the Exocœtinæ both jaws are short. In the Scomberesocinæ and Hemirhamphinæ the pectorals, although well developed, are not excessive, but in the Exocœtinæ are extremely large and adapted for flight; and to this group belong the celebrated flying-fishes. The species are mostly inhabitants of the tropical seas, in all of which they are found in greater or less numbers. One species of Scomberesocinæ, two of Hemirhamphinæ, and four of Exocœtinæ, as well as one of Beloninæ, have been obtained along the eastern coast of the U. S. Theodore Gill.

**Scom'bridæ** [from *scomber*, the Latin name of the mackerel], an important family of fishes, including the mackerels, tunnies, and related forms. The body is elongated and fusiform; the scales very small or wanting (generally cycloid, but about the thorax larger and sometimes ctenoid ones are developed, which form the so-called corselet of the tunnies); the lateral line is distinct and frequently sinuous; the head conic and pointed forward; the opercula unarmed and well developed; the mouth with a lateral cleft; upper jaw not at all protractile; teeth present on the jaws, and generally on the palate; branchial apertures large and confluent below; branchiostegal rays generally seven; dorsal fins two, the first composed of

rather slender spinous rays, the second with branched rays, the posterior of which are free and developed as finlets; anal similar to the second dorsal; caudal forked, and well adapted for powerful propulsion; pectorals pointed; ventrals thoracic, each with one spine and five rays; the vertebral column has numerous vertebræ; the stomach is sacciform, and pyloric cæca are developed, generally in large number. In extreme youth the preoperculum is armed at its angle with several radiating spines, which are soon, however, absorbed and lost. The family is divisible into four sub-families—(1) the Scombrinæ, distinguished by the short first dorsal and the wide space between it and the second, and the pectorals high up, including the genus *Scomber*, or common mackerels; (2) the Orcyninæ, in which the spinous dorsal is contiguous to the soft, the pectorals comparatively low, the caudal peduncle with a median adipose carina, and two others (one above and one below) converging backward, and the pyloric cæca very numerous—including *Orcynus*, *Sarda*, *Cybium*, and related forms; (3) Thyrsitinæ, in which the spinous dorsal is also long and pectorals comparatively low, but the caudal peduncle not carinated, and the pyloric cæca in rather small number (7—10)—including the genera *Thyrsites*, *Ruvettus*, etc.; (4) Gempylinæ, distinguished from the others by the very long body (the height being less than a tenth of the length) and the numerous spines of the first dorsal—represented by the genus *Gempylus*. The family includes many forms frequenting the high seas, and among them are some of the best and most powerful swimmers to be found in the class of fishes. The typical forms at least—*i. e.* the Scombrinæ, or mackerels, and Orcyninæ, or tunnies—go in large schools, and some of the species are subjects of great fisheries. The species vary in size from the dimensions of a small mackerel to those of the great tunny, which sometimes attains a weight of over 1000 pounds. Some of these are great wanderers. In the summer of 1871, for example, there appeared suddenly on the coast of Massachusetts large numbers of a small tunny (*Orcynus alliteratus*) which had previously been unknown as an inhabitant of our coast, although familiar as a Mediterranean fish. (See also MACKEREL and TUNNY.)

THEODORE GILL.

**Scoo'ba,** p.-v., Kemper co., Miss., on Mobile and Ohio R. R., has 1 newspaper.

**Sco'pas** [Σκόπας], b. in the island of Paros, flourished between Ols. 97 and 107 (about B. C. 390 to 350). He worked mostly in marble, the product of his native place, and chose his favorite subjects from the myths of Dionysus and Aphrodite. With Praxiteles, he formed the character of the second or later Attic school of sculpture, in contradistinction to the earlier school of Phidias. He was celebrated also as an architect, and constructed the temple of Athena Alea at Tegea, and engaged with Leochares and others in embellishing the mausoleum at Halicarnassus. The statement that he assisted in the erection of the temple of Artemis at Ephesus rests on a doubtful passage of Pliny. Among the most noted works ascribed to Scopas were the group of Niobe and her children and the group of sea-deities escorting Achilles to the island of Leuce. His separate figures are enumerated by Sillig in his *Dictionary of Ancient Artists* (Müller, *Ancient Art and its Remains*, § 125, etc., Sillig, s. v.).

H. DRISLER.

**Scopel'idæ** [from the generic name, *Scopelus*], a family of fishes of the order Teleocephali, related to the Salmonidæ, etc. It has been variously defined, but if we consider it coextensive with the Scopelidæ saurina of Günther, its characters may be summarized as follows: The body is compressed and oval or elongated; the scales present and cycloid or wanting; the lateral line nearly concurrent with the back; the head compressed or depressed; the opercula normally developed; the mouth with an extensive lateral cleft; the upper jaw with margin formed by the intermaxillary only, the supramaxillary being behind; teeth on the jaws as well as palate; branchial apertures very wide; branchiostegal rays in large number; dorsal fin short or of moderate length, and in (or nearly in) the middle of the length of the body; adipose fin developed; anal short and posterior; caudal large and distinct; pectorals with branched rays; ventrals abdominal, but as such rather far forward; the pyloric appendages are generally few, but sometimes (*Harpodon*) numerous; the intestinal canal very short; no air-bladder is developed; the eggs are enclosed in sacs of the ovarium, and excluded by oviducts. The genera thus embraced are *Scopelus* and *Scopelosaurus*, in which the body is scaly and phosphorescent spots are developed; *Odontostomus*, in which the body is naked; and *Synodus* (= *Saurus*, *Trachinocephalus*, *Saurida*, *Harpodon*, *Aulopus*, and *Chlorophthalmus*), in which the body is scaly and no phosphorescent spots exist. The species are mostly inhabitants of warm waters, and the typical species are open-sea forms.

THEODORE GILL.

**Scordi'a,** town of Sicily, province of Catania, in a fertile and healthy district, about 15½ miles S. E. of Catania. P. 6203.

**Score,** in music, the full and complete draught of all the parts of a composition, whether vocal or instrumental, or both in combination. When several parts on their respective staves are thus arranged one over the other, the bar-strokes are frequently extended or "scored" in continuous lines drawn through all the parts; and the derivation of the term "score" is usually traced to this marking or scoring.

WILLIAM STAUNTON.

**Scores'by** (WILLIAM), b. at Cropton, Yorkshire, England, May 3, 1760; became a skilled navigator; made thirty successful whaling-voyages to the arctic seas, and introduced many improvements in apparatus for the whale fishery. D. in 1829.

**Scoresby** (WILLIAM), D. D., F. R. S., son of Capt. William, b. at Cropton, England, Oct. 5, 1790; went to sea in one of his father's ships when ten years old; became chief mate at the age of sixteen; spent the intervals between his annual voyages in scientific studies at Edinburgh under Profs. Jameson and Brewster; reached the highest northern latitude that had then been attained May, 1806; became captain of his father's ship 1811; made important observations on the electrical phenomena of the arctic regions, and by his communications to Sir Joseph Banks, president of the Royal Society, was instrumental in inducing the government to send the first (1817) of the long series of arctic exploring expeditions. After seventeen voyages to the Greenland or Spitzbergen regions, he published his *Account of the Arctic Regions* (2 vols., 1820) and his *Journal of a Voyage* (1823). When above forty years of age Capt. Scoresby passed through a course of literary and theological study, graduating in divinity at Cambridge; filled several pastorates; received the degree of D. D.; was noted for philanthropic labors; visited the U. S. 1847, and made a voyage around the world for magnetic research 1855–56. D. at Torquay Mar. 21, 1857. Author of valuable works on magnetism and several scientific books. He wrote a *Life* of his father (1851), and his own *Life* was written by a nephew (1861).

**Scorpæn'idæ** [from Lat. *Scorpæna*; Gr. σκόρπειος, "scorpion-like"], a family of fishes of the order Teleocephali and sub-order Acanthopteri. The body is more or less oblong and compressed; the scales developed in variable manner, sometimes wanting, but typically ctenoid and imbricated; the lateral line continuous and concurrent with the back; the head compressed, and often inflated laterally, and more or less armed with ridges and spines; the cheeks protected by an enlarged suborbital bone, which articulates with the inner angle of the preoperculum; the mouth with a lateral cleft; the upper jaw moderately protractile; teeth acute and present on the jaws as well as palate; branchial apertures continuous below, but with the branchial membrane often well developed at the middle; branchiostegal rays generally seven; dorsal differentiated into a longer spinous and a shorter rayed portion; anal with its rayed portion smaller than that of the dorsal, and armed generally with three spines; caudal well developed and free; pectorals with at least the inferior rays generally somewhat enlarged and simple, not branched; ventrals thoracic, with a spine and generally five rays; the stomach is sacciform, and pyloric appendages are developed in moderately small number. The family includes many genera, the principal of which are *Scorpæna*, *Sebastes*, *Sebastosomus*, *Pterois*, *Pterodichthys*, *Tæniotus*, and *Apistus*. They are chiefly inhabitants of the tropical or subtropical regions, but *Sebastes* proper is peculiar to the northern seas, and of *Sebastosomus* and *Sebastomus* a number of species are found on the western coast of the U. S., as well as corresponding latitudes of the Asiatic portions of the Pacific. In some (*Apistus* and *Minous*) an independent pectoral filament or ray is developed.

THEODORE GILL.

**Scorpio,** in astronomy. See ZODIAC.

**Scor'pion** [Lat. *scorpio*], also applied in various parts of the U. S. to different species of lizards—viz. (1) in the Southern States to *Eumeces fasciatus*, a representative of the family Scincidæ, a glossy, smooth lizard with reddish head and dark-greenish or olivaceous body; (2) in some regions, with the qualification *brown* ("brown scorpion"), to *Sceloporus undulatus*, a small lizard with rough carinated scales, marked on the back with undulating cross-bands of black, and on the belly with a white median line, on each side of which the color is greenish; and (3) in Arizona to the *Heloderma horridum* or *suspectum*, a large lizard with tubercular scales and marbled with black and red, which labors under the suspicion of being poisonous.

THEODORE GILL.

**Scorpions,** or **Scorpiones,** a group of articulates belonging to the class of Arachnoids, and by some regarded

as an order, and by others as a sub-order within the class. They are provided with eight pulmonary sacs, with which are connected as many spiracles opening on the latero-abdominal surface; the abdomen is not separated by decided constriction from the cephalo-thorax, and the six caudal segments are narrow and elongated, and the last one provided with a poison-sac and terminal hook-like sting; the maxillæ are developed as long forceps, and simulate the anterior legs of crabs; beneath and behind the last pair of legs from the abdomen are developed two laminated or comb-like appendages; the integuments are coriaceous, consisting chiefly of chitine; six or more eyes are developed toward the front on the surface of the cephalo-thorax. The latest writer on the group, Prof. T. Thorell (1874), considers it as an order, and recognizes as belonging to it four families distinguished by the form of the sternum, the pectoral combs, the armature of the fingers of the mandibles, the palpi, and the eyes. These families are—(1) Androctonoidæ (= Scorpionidæ of others), with two sub-families and nine genera; (2) Telegonoidæ, with three genera; (3) Vejovoidæ, with two genera; and (4) Pandinoidæ, with two sub-families and seventeen genera. Representatives of the order are found in all tropical and warm regions, to which they are mostly confined. They frequent dark places, and conceal themselves for the most part under stones, logs, etc., and are wont to frequent ruined houses. They run with considerable rapidity, keeping then the tail elevated. Like crustaceans, they shed their skin. They feed chiefly on insects, which they catch and convey to the mouth by the forceps-like maxillæ, and then suck their blood. They are viviparous, and gestation is said to last for the greater part of the year. They are rather dangerous animals, and their sting is very painful, although rarely fatal. The result of the sting depends much upon the size and irritability of the animal and the temperature of the climate. The most esteemed antidotes are ammonia, administered externally as well as internally, and other caustics and stimulants. Thirteen species have been recognized by Dr. Horatio C. Wood as inhabitants of the south-western portions of the U. S. Of these (using the nomenclature of Wood, but which does not coincide with that of Thorell), *Scorpio Allenii* is found in Lower California; *Buthus carolinianus*, in all the Southern States, from South Carolina to Kansas and Texas; and *Buthus spinigerus*, in Texas; the other species are mostly confined to Southern California. The order came early into existence, and truly typical species are found in the Carboniferous rocks of both Europe and America. (See T. Thorell, *On the Classification of Scorpions*, in *Annals and Magazine of Natural History*, 4th series, vol. xvii. pp. 1–15, Jan., 1876.) THEODORE GILL.

**Scorzone'ra** [Sp. *escorza*, a "snake"], a garden vegetable popular in parts of Europe, but quite unknown in the U. S. *Scorzonera Hispanica, glastifolia, deliciosa*, and *tuberosa* (Compositæ) all furnish edible roots, whose taste is compared to that of asparagus, celery, hazel-nuts, and salsify. The black skin is washed off, the root soaked a while in fresh water, and the roots are then boiled fifteen minutes. Scorzonera is very highly esteemed by many, and is especially praised as food for invalids. It is very hardy and of easy cultivation.

**Scot** (REGINALD), b. in Kent, England, early in the sixteenth century; was educated at Hart Hall, Cambridge, after which he retired to his paternal estate near Smeeth, and there passed a retired life, dying in 1599. Author, among other works, of *The Discoverie of Witchcraft* (1584), one of the first published denials of the reality of witchcraft—a book which was burned by the common hangman and replied to by King James in his *Demonology*.

**Scotch Bush,** p.-v., Florida tp., Montgomery co., N. Y. P. 120.

**Scotch Confession of Faith.** It was drawn up by John Knox and his compeers at the request of the Scotch Parliament, which assembled at Edinburgh in Aug., 1560, after the death of the queen-regent, Mary of Guise (June), and the close of the civil war. It consists of a preface and twenty-five articles on the chief doctrines of religion, which are briefly, tersely, and vigorously stated. It agrees with the other Reformed confessions of the sixteenth century, but is more pronounced in its opposition to the Roman Catholic Church than most of them. It was rather hastily composed in four days, twice read article by article in Parliament, and adopted by the same as being "based upon the infallible word of God." Only three temporal lords voted against it, for the reason that they believed as their forefathers believed; the Roman Catholic bishops were called upon to object and refute, but kept silence. Seven years later (1567), after the abdication of Queen Mary, the confession was readopted, and the Reformed Kirk of Scotland formally acknowledged and established. In 1580 the confession was signed by King James II., and a supplementary confession (sometimes called the *second* Scotch confession) added to it. It continued to be the only doctrinal standard of Scotland recognized by the civil government till the Revolution of 1688, but it was practically superseded by the Westminster Confession, which is more logical and complete, and was adopted by the Covenanters and the General Assembly during the Commonwealth. The Scotch Confession is printed in the acts of the Scotch Parliament for 1560, in Knox's *History of the Scotch Reformation* (ed. Laing, vol. ii.), in Calderwood's *History of the Kirk of Scotland*, in Dunlop's *Collection of Scotch Confessions* (vol. ii.), in Niemeyer's *Collectio Confess. Reform.*, and in Schaff's *History of the Creeds of Christendom*, vol. iii. PHILIP SCHAFF.

**Scotch Grove,** p.-v. and tp., Jones co., Ia. P. 929.

**Scotch-Irish,** tp., Rowan co., N. C. P. 1465.

**Sco'ter,** a name by which are designated species of sea-ducks belonging to the genus *Oidemia* of Fleming. These are distinguished by the bill being much swollen at the base, with the terminal part depressed and broad, and the extension of the feathers of the chin forward as far as the nostrils; the color is, to a great extent, black. The American species are *Oidemia americana* (the common scoter), *O. Trowbridgii* (long-billed scoter), *O. perspicillata* (commonly called surf-duck or sea-coot), and *O. velvetina* (the velvet duck or white-winged coot). THEODORE GILL.

**Sco'tists,** among the SCHOOLMEN (which see), the followers of John Duns Scotus. Their principal adversaries were the Thomists. The Scotists held to freedom of the will and the immaculate conception of the Virgin. The Franciscans were generally Scotists, while the Dominicans were Thomists.

**Scot'land** [Lat. *Scotia*] was originally the name of Ireland, and the inhabitants of that island, a Celtic tribe, were called *Scots*. To the northern part of the island of Great Britain, the present Scotland, the name was not applied until the tenth century, when an invasion from Ireland succeeded in consolidating a Scotch empire here. The country was then, and for several subsequent centuries, designated as *Nova Scotia*. The Romans called it *Caledonia*, and its inhabitants, also a Celtic tribe, *Caledonians* or *Picti*. In the reign of Titus (79–81) Julius Agricola penetrated to the Frith of Tay, and constructed a line of forts from the Forth to the Clyde, but beyond this limit the Romans never extended their dominion. In 120, Hadrian built a continuous wall of turf between the Solway and the Tyne, and twenty years afterward Antoninus Pius connected the detached forts of Agricola by a rampart of earth; but in 208, Alexander Severus abandoned this boundary and constructed a wall of stone from the Solway to the Tyne, a little S. of the wall of Hadrian. In the mean time, the country between the two walls, the province of Valentia (subsequently the kingdom of Strathclyde, the *Regnum Cambrense*), had been thoroughly Romanized; but when, in 420, the Romans entirely abandoned Britannia, the free Picts again swept down over the Lowlands and far into England, ravaging and devastating the country with savage but irresistible valor. The Britons now called the Anglo-Saxons to their aid, and the Picts were once more confined to their Highlands; in 449 a Saxon chieftain, Edwin, founded Edinburgh. In 503 the Scots—that is, the Celts from Ireland—crossed over to Britain and founded, under the leadership of Fergus, a Scotch kingdom along the western coast of Caledonia, from the Firth of Clyde to the present Rosshire. The Celts of Ireland were Christians, having been converted by St. Patrick, and in 563, St. Columba went over from Ireland and settled among the heathen Picts, spending the rest of his life, till 597, in converting them to Christianity. In 836, Kenneth, a lineal descendant of Fergus, became king of the Scots, and in 843 he also became king of the Picts, transferring his residence to Forteviot in Stratherne, the old capital of the Picts. Thus, the Scots and the Picts, two tribes of the Celtic race and speaking two dialects of the Celtic language, coalesced and formed one empire, which soon began to be designated *Scotia, Nova Scotia, Scotland*, though the Celts of Ireland continued for centuries to protest against this application of the name. The southern boundary of this empire was the wall of Antoninus; beyond that line stretched the kingdom of Strathclyde, which at one time reached as far S. as the northern frontier of Wales. Soon, however, the boundary between these two empires began to move. One Cumbrian province after another was incorporated with Scotland, and under Malcolm II. its southern border was advanced to the Tweed. But while thus the Scotch kingdom was externally much extended, the Scotch people underwent an internal change by which the Celtic character almost disappeared. So many Teutonic elements were absorbed that in the course of a couple of centuries a new national type was developed, in which the Celtic element was hardly more than recognizable. Teutonic language,

ideas, and blood poured into Scotland both from the N. and the S. The Norwegians and the Danes held the islands before the time of Kenneth, and afterward, at times, also large tracts of the mainland, and a lively intercourse took place between the Scots and the Scandinavians, both as friends and as foes. The Hebrides and the Isle of Man were not united to Scotland until the reign of Alexander III. (1249–86), who defeated Haco, king of Norway, at Largs, on the coast of Ayr; and the islands of Orkney and Shetland not until the reign of James III. (1460–88), who married Margaret, daughter of King Christian I. of Denmark, and received them as her dowry. Still greater was the Teutonic influence coming from the South—first Anglo-Saxon, then Norman. Various Anglo-Saxon provinces were incorporated with the Scoto-Pictish kingdom—Cumberland in 950, Strathclyde in 970, Lothian in 1018—and Malcolm III., who slew and succeeded Macbeth in 1057, was educated at the English court and married an English princess. Her brother, Edgar Atheling, and many Anglo-Saxon nobles, sought refuge and support with Malcolm during the Norman invasion of England, but in 1072, William the Conqueror penetrated into Scotland and compelled Malcolm to submit and do homage to him. What this homage meant became a question of much contention between the Scotch and English kings, and was not settled until the reign of William the Lion (1165–1214). He was captured by Henry II. of England, and regained his liberty in 1174 only by declaring himself a vassal of the English king; but in 1189, Henry's successor, Richard Cœur de Lion, who wanted money for his campaign to the Holy Land, ceded his right of supremacy for 10,000 marks. Once more, however, the question arose of Scotch allegiance to England. When Margaret, the so-called "Maiden of Norway," daughter of King Eric of Norway, granddaughter of Alexander III., and heiress to the Scotch crown, died on her voyage from Norway to Scotland, several pretenders appeared, and finally John Balliol obtained the crown by the aid of Edward I., to whom he swore allegiance. But another party of the Scotch people arose and made the fiercest resistance to Balliol and the English—first under William Wallace, who fell into the hands of Edward I. and was put to death in London 1305; then under the younger Robert Bruce, who routed the English under Edward II. at Bannockburn June 24, 1314, invaded England twelve times in fourteen years, and ravaged the country so fearfully that Edward III. was glad to buy peace of him by resigning all his claims to supremacy over Scotland. With Robert II. (1371–90) the house of Stuart ascended the throne, and the history of Scotland from this time to the establishment of the union with England is given in the articles on ROBERT II.–III., JAMES I.–VI., MARY STUART, KNOX, etc. Most of the kings of the Stuart dynasty were valiant and energetic men, but most of them ascended the throne as minors and ended their lives by untimely deaths. This circumstance gave the power of the nobility an exorbitant development, and for centuries the history of Scotland became one long contest between the Crown and the nobility, and one confused maze of feuds between the various noble families. In these troubles the kings sought support from the Church; they flattered and enriched it. The Scotch Church was the richest in Christendom. In the sixteenth century it owned one-half of all the real estate in the country. But its members were the most debased set of men within the pale of Romanism, and were able to maintain their social position only by means of the dense ignorance which they spread around them. The nobility were jealous and afraid of the Church, and embraced the Reformation with great eagerness; and the great crisis in Scotch history in the sixteenth century was essentially a contest between Romanism and absolutism on the one side, represented by the Crown, and Protestantism and feudalism on the other, represented by the nobility—a contest in which the final decision was given by a third party, the middle class, the burghers, who, under the leadership of Knox, carried the Reformation through and put certain limits to the power both of the Crown and the nobility. Other elements were mixed up in the contest. The relation between Scotland and England during this period consisted mainly in a continuous border feud, which was carried on almost without intermission, and which now and then grew into actual warfare on a great scale. Nevertheless, by degrees there developed an English party within the Scotch people. During the wars between England and France the Scotch went to France to fight against the English, and this circumstance opened the way for a French influence in Scotland, which became of very great importance when James V. married Mary of Guise. France understood that, in a conflict with England, Scotland could be used as one of the most effective weapons, but in her attempts to form a close alliance with this country Roman Catholic France was compelled to seek her main support from the Roman Catholic clergy in Scotland, and thus she caused, most unwillingly, the nobility and the Protestants to turn their eyes to England. Meanwhile, statesmen arose on both sides of the Border who wished to stop the perpetual hostilities, and who understood that a union between the two countries was the only means of achieving this end. It was a favorite idea with Henry VIII., and after the death of James V., during the regency of the count of Arran, a treaty was made by which Mary, the queen of Scotland, was betrothed to the prince of Wales, the son of Henry VIII., and it was agreed that when ten years of age she should be brought to England, in order to be educated there. But Henry's demand of political supremacy soon brought discord, and before the treaty was half a year old it was broken and war was declared. After the death of Henry VIII. the duke of Somerset tried to re-establish the treaty, but in vain; and after the battle of Pinkie (Sept. 10, 1547), Scotland threw herself into the arms of France. The queen-mother, Mary of Guise, assumed the regency, and the queen was brought to France to be educated, and betrothed to the dauphin. At last, however, by the victory of Protestantism in Scotland, and the extinction of the house of Tudor in England, the union actually took place.

The history of Scotland has been written by William Robertson (2 vols., 1759), P. F. Tytler (9 vols., 1828–43), John Hill Burton (7 vols., 1867–70). See also *Domestic Annals of Scotland*, by R. Chambers (3 vols., 1859–61), and various essays and monographs by Innes, Pinkerton, Chalmers, Hailes, and others. (For the geography and statistics of the country see the article on GREAT BRITAIN. For Scottish language and literature see ENGLISH LANGUAGE AND LITERATURE.) CLEMENS PETERSEN.

**Scotland,** county of N. E. Missouri, adjoining Iowa, watered by Wyaconda and Fabius rivers, consists chiefly of fertile prairies, and is traversed by Missouri Iowa and Nebraska R. R. Staples, Indian corn, oats, hay, sorghum-molasses, tobacco, honey, wool, and butter. Sheep and swine are plentiful. Cap. Memphis. Area, about 400 sq. m. P. 10,670.

**Scotland,** tp., Bullock co., Ala. P. 760.

**Scotland,** p.-v. and tp., Windham co., Conn. P. 643.

**Scotland,** tp., McDonough co., Ill. P. 1162.

**Scotland Neck,** p.-v., Halifax co., N. C.

**Scotland, Reformed Church of.** It is difficult to determine the precise time when Christianity was first introduced into Scotland. In the twilight of traditional history there arises the figure of St. Rule as he landed with the bones of St. Andrew on the rocky shore which has since borne the name of St. Andrew's, and of St. Ninian, who, amid the mud houses of the Scots on the banks of the Solway, erected his wonderful stone church. We get out of this dim and shadowy twilight when we reach the mission of St. Columba, who, founding his monastery on the lone isle of Iona, extended his missionary work all over Scotland, and even into England. This was about 563 A. D., and from this period down to the middle of the tenth century, the Culdees, as they were called, continued to propagate Christianity, though often impeded in their work by the incessant hostilities of the Scots and Picts.* Meanwhile, another stream of Christian influence was poured into Scotland from the South, representing the Roman form of ecclesiasticism; and the Culdee worship with its simpler ritual came into conflict with the Roman observances and modes of worship. We cannot here trace the progress of this conflict, and can only notice that after the Scottish and Pictish monarchies were united in one king during the reign of Malcolm III., and largely through the influence of Margaret, his Saxon queen, many of the Culdees yielded to the powerful influence of the Roman Church. From this time, the middle of the twelfth century, till the dawn of the Reformation, the history of the Church in Scotland is one of constantly-increasing power and wealth, and of growing corruption. Two points bearing directly upon the future history of the Scottish Church may be mentioned here. The first, that not only was a system of diocesan bishops established all over the land, but the parochial system of Scotland owes its establishment to this period. The other is, that the Scottish ecclesiastics maintained a brave and successful struggle for independence against the claims of the primacies of Canterbury and York, who successively sought to assume control over the Scottish bishops.†

During the four centuries preceding the Reformation the Roman Church had not only attained universal supremacy, but one-half of the wealth of the nation had passed into its hands. In the end of the fifteenth century the feudal

* Jamieson's *Hist. Cul.*; Cunningham's *Ch. of Scot.*; Hetherington's *Hist. Ch. of Scot.*

† Jamieson, Cunningham, Hetherington, as above, and Lee's *Lectures.*

power of the greater nobles was greatly weakened, not only by the absorption of the wealth of the country by the Church, but also by the rising up of a middle class of lesser landholders and burghers, who had become the most powerful party in Scotland in intelligence, industry, and resources. In the beginning of the sixteenth century the writings of the continental Protestant divines were introduced into Scotland, and the result was seen in the awakened intelligence and spiritual earnestness of this middle class. Patrick Hamilton, a youth of high mental endowments, returned from Wittenberg in 1527, and immediately began to preach the Reformed doctrines at Edinburgh and other places in Scotland. Steps were soon taken to arrest him, and he was committed as a prisoner to the castle of St. Andrew's. He was tried for heresy, condemned, and burned at the stake (1528). We cannot dwell on the persecutions which followed for the next thirty years, or on the historical circumstances which resulted in the triumph of the Reformation in Scotland.

The peculiar and essential features of the Reformed Church of Scotland, besides the profession of the evangelical faith common to all the churches of the Reformation, were—(1) The government of the Church by that order of men which is indicated in the New Testament by the terms presbyters and bishops or overseers; (2) the subjection of the Church in all things spiritual to Christ as her only Head, and to his word as her only rule. The first General Assembly of the Reformed Church of Scotland was held in 1560, but her history goes back to the year 1557, when the "First Covenant" or "Common Bond" was signed. The subscribers to this document, after declaring their faith in "the Evangel of Christ," promise "before the majesty of God to maintain and defend the whole congregation of Christ, and every member thereof, to the death," and "to renounce and forsake all superstitions, abominations, and idolatries."* The word *congregation* was then used as the distinctive name of all those who held to the doctrines of the Reformed Church, having the same signification as the word *kirk*, which was subsequently introduced, and the leaders of the Reformation in Scotland were known as "the Lords of the Congregation." The various congregations which belonged to "the Congregation" used the liturgy of Edward VI.; and the Apostles' Creed, together with King Edward's Catechism, formed the articles of religion by which they were bound into a doctrinal unity.† At the death of the regent, Mary of Guise, in 1560, the Parliament of Scotland met, and on Aug. 24 an act was passed which is described as "The Confession of Faith and Doctrines believed and professed by the Protestants of Scotland, and authorized by the Estates in Parliament."‡ This confession was in fact "the Order of Geneva," including the confession of faith prepared for the English congregation at Geneva by John Knox. It was presented to Parliament by "the Lords of the Congregation;" but immediately afterward, on Dec. 20, 1560, the first General Assembly of the Kirk of Scotland was held, and from this date the Assembly "took order for God's glory and the weal of his Kirk in the realm of Scotland."§ At this Assembly "the Book of Discipline of the Church was allowed and approved;" this book was afterward submitted to the council, but they refused to sanction it. This marks the point at which the controversy between the ecclesiastical and civil authorities began. The Book of Discipline was rejected by the state, but the Church proceeded at once to carry it into execution. The principles of religious liberty were not understood in that age, and the Scottish Reformers did not hesitate to enact laws which involved the infliction of civil penalties for offences that were purely religious, though, to their credit, it should be stated that these penalties were seldom inflicted; but with these exceptions the great principles both of faith and order which were then agreed to, remain, amid all the changes of confessions, as those held by all the branches of the Reformed Church in Scotland to this day. It is especially worthy of note that in this "first Book of Discipline," while "the duty of nations and their rulers to own the truth of God and to advance the kingdom of his Son," is clearly stated, it is at the same time maintained that the Kirk possesses an independent and exclusive jurisdiction, "which flows directly from God and the Mediator, Jesus Christ, and is spiritual, not having a temporal head on earth, but only Christ, the only King and Governor of his Church."

For seven years, from the death of the regent Mary of Guise (1560) till the abdication of Mary Queen of Scots, the Kirk was without state endowment, and indeed without any recognition by the state of her jurisdiction. At a very early period lay patronage was introduced into Scotland. Laymen who had endowed churches and monasteries reserved for themselves and their heirs the right of presenting incumbents to the benefices thus founded. At a later period these rights of presentation were to a large extent annexed to bishoprics, priories, abbacies, and other religious houses, so that at the time of the Reformation there were only 262 out of the 940 benefices the patronage of which remained in the hands of laymen. The rights of presentation which belonged to the religious houses were after the Reformation a continual subject of contention between the Assembly and the queen. In 1565 the General Assembly drew up six articles for the queen's consideration, with a view to their ratification by Parliament. The second of these articles had reference to the law of patronage, and demanded that the absolute right of the queen or of any lay patron to present a minister without examination be disallowed. To this the queen answered that it seemed to be "no way reasonable that she should defraud herself of so great a part of the patrimony of the Crown as to put the patronage of benefices forth of her own hands."‖ The patronage to these benefices continued to be held by the queen, or was by her distributed among her favorite nobles.

Immediately after the queen's abdication the Parliament met on Dec. 15, 1567, and passed an act in favor of the Reformed Kirk, ratifying the act of 1560 by which the Confession of Faith was sanctioned and adopted, and among other statutes one for the examination and admission of ministers by the Kirk, reserving, however, the right of presentation to the lay patrons. This Parliament also "declared and granted the jurisdiction of the Kirk anent preaching of the true word of God, correction of manners, and administration of the holy sacraments."¶ A similar act was passed in 1592, ratifying and enlarging the rights of the Kirk in regard to her jurisdiction over the appointment or deprivation of ministers. The acts of 1567 and 1592 have always been regarded as the solemn recognition and sanction by the nation of the constitution of the Reformed Church, and the great charters of her Presbyterian government and freedom from the supremacy of the Crown in all causes spiritual and ecclesiastical.

We have next to consider as briefly as possible the history of that period which resulted in the Scottish confession of 1560 being exchanged for that of the Westminster Assembly. In 1603, James ascended the English throne, and this was immediately followed by a tyrannical invasion of the Church's independence by the civil power, and the partial overthrow of the Presbyterian polity and government. The struggle against the attempt of the kings of the Stuart line to subdue the Kirk, and the further development of the doctrines of the independence of the Kirk, form deeply interesting chapters in the history of the Church of Scotland, but we must pass them over here with this brief notice. After a long and bitter struggle, both in England and in Scotland, against the royal encroachments on the civil and religious liberties of the people, an ordinance of the English Lords and Commons in Parliament was passed on June 12, 1643, calling the Westminster Assembly. The General Assembly of the Kirk met in Edinburgh on Aug. 2 in the same year. Commissioners from England were present, and the result of their conferences was that on Aug. 17 "the Solemn League and Covenant" was passed unanimously by the General Assembly; it was then carried to the Convention of Estates and unanimously ratified by them.** Commissioners were also appointed to represent the Kirk of Scotland in the Westminster Assembly. The Confession of Faith of the Westminster divines was finished in 1646, and on Aug. 4, 1647, it was adopted by the Scottish General Assembly, with two modifications; and two years later the Estates of Parliament ratified this decision.†† During the twelve years of Cromwell's government, while Scotland was rent asunder by political intrigue, the Church was left to carry out her discipline and instruction of the people, though the General Assembly was not allowed to meet. Charles II. was restored to the throne in 1660, and in the following year the Scottish Parliament declared the ecclesiastical as well as civil supremacy of the king. An attempt was then made to conform the Scottish Church to that of England by the establishment of the episcopal form of government. For the next twenty-five years the statute-book of Scotland is crowded with inquisitorial and persecuting acts. The struggle of the Reformed Church against this exercise of the royal prerogative was a long and bloody one, and there is much to kindle admiration in the spiritual earnestness and devotion to principle of a high-hearted nation, who fought even to death against what they considered not only as an attack upon their liberties, but

* Knox, Calderwood, Spottiswoode, and Taylor Innes.
† Knox, i. 275, and Innes, 7.
‡ Knox, iii. 206; Keith, i. 311; Innes, 8; Hetherington, 80.
§ *Booke of the Universall Kirke of Scotland;* Knox, iii. 223, and Innes, 22.

‖ *Booke of the Universall Kirke*, 34.
¶ Calderwood, Hetherington, and Innes.
** Baillie, i. 387; Hetherington, 334; Innes, 60.
†† Innes, Cunningham, Calderwood.

still more as a subversion of the rights of Christ's Church. So severe was the persecution that even to be present at a field conventicle was punishable by death and confiscation of goods. Yet the great body of the Scottish people steadfastly resisted the attempt to enforce conformity.* In the year 1688 the event known as the Revolution took place, and soon after William of Orange landed the Estates of Scotland presented to him a claim of rights, declaring that the superiority of any office in the Church above that of presbyters is and hath been a great and intolerable grievance. In Apr., 1689, the Scottish Parliament met and passed an act abolishing prelacy.† In 1690 the Parliament again met and passed acts rescinding the statute of 1669, which had declared the king's supremacy, and ratifying the Confession of Faith and settling Presbyterian church government. The same Parliament passed an act abolishing lay patronage, though the new monarch was known to be strenuously opposed to its abolition.‡ In 1693 the Parliament passed an act for "settling the quiet and peace of the Church," but this act expressly provided for summoning the General Assembly by royal authority. So far from settling the peace and quiet of the Church, the consequence of this act was that a fresh storm of ecclesiastical trouble swept over Scotland. The General Assembly met in May, 1694, prepared to assert the freedom of the Kirk and her intrinsic power to meet in synods and assemblies. The king instructed the royal commissioner that if the act of supremacy was not accepted he should at once dissolve the Assembly; but the members of the Assembly had determined in that case to disregard the royal dissolution and to continue their sessions. At the last moment the breach was avoided, instructions were sent to the commissioner to withdraw the threat of dissolution, and the independence of the Kirk was again confirmed.§

With the beginning of the eighteenth century came the union of the two kingdoms of England and Scotland and the merging of the two legislatures in one Parliament. In the article on the FREE CHURCH (which see) will be found a full statement of the successive legislative acts in reference to the law of patronage and the independence of the Church, and also of the long-continued struggles between the two parties in the Church itself, which resulted in the first secession in 1733, in a second secession in 1752, and ultimately in the formation of the Free Church of Scotland in 1843. During the first part of this period the Moderates, as they were called, in distinction from the Evangelicals, were the ruling party in the Church. They exercised their power for the most part with toleration and forbearance, except in the cases arising out of the exercise of lay patronage. They were confessedly lacking in spiritual insight and practical zeal, but many of them were distinguished for their intellectual and literary influence and for their high personal and social characteristics.

In the beginning of the present century the Church of Scotland established missions in Australia and in the provinces of British North America. These missions were gradually formed into presbyteries and synods. Recently, the different branches of the Scottish Church in Australia dissolved their ecclesiastical connection with the parent churches, and now occupy a separate position as a Church possessing supreme jurisdiction. A similar union has still more recently taken place in Canada. The Church of Scotland during this century has established missions in India, which have been distinguished for their zeal and success in teaching. Missions to the Jews are also sustained at Alexandria, Smyrna, and Salonica.

During the last twenty years there has been a remarkable development of spiritual and intellectual life among the clergy of the Scottish Church and a corresponding growth of religious power in the congregations. The law of patronage has been abolished, so that each parish as it becomes vacant, on the payment of a small sum to the patron, has now the right of electing its own minister, subject to the assent of the presbytery.

There are in the Scottish Church upward of 1000 parishes, with about 200 chapels. There are 84 presbyteries, consisting of from 12 to 24 ministers, with an elder from each kirk session. There are 16 synods, comprehending each from 3 to 7 presbyteries. The General Assembly is the supreme court of the Church, and meets annually in Edinburgh. It consists of representatives from all the presbyteries, and also from the royal burghs and the four universities. The queen is represented in the General Assembly by the lord high commissioner, but he takes no part in the deliberations. The General Assembly decides in all cases that may be brought before it by appeal from the inferior courts, and passes laws for the regulation of the affairs of the Church; but, according to what is called the Barrier act, no law introducing an innovation or change in the established laws can be passed until it has received the approval of the majority of the presbyteries. DAVID INGLIS.

* Innes, Calderwood, Cunningham, Hetherington.
† 1 William and Mary, c. 3.
‡ Crookshank, Hetherington, and Innes.
§ Carstair's *State Paper*, 52; Innes, 79.

**Scott,** county of W. Arkansas, watered by Fourche la Fave, Petit Jean, and other affluents of Arkansas River, has a hilly soil. Staples, Indian corn, tobacco, and butter. Swine are numerous. Cap. Waldron. Area, 850 sq. m. P. 7483.

**Scott,** county of W. Illinois, on Illinois River, has a level surface abounding in coal and limestone, and is traversed by several railroads. Staples, Indian corn, wheat, wool, and butter. Cap. Winchester. Area, 255 sq. m. P. 10,530.

**Scott,** county of S. E. Indiana, watered by tributaries of White River, and traversed by Jeffersonville Madison and Indianapolis and Ohio and Mississippi R. Rs. Staples, Indian corn, tobacco, sorghum-molasses, wool, and butter. Cap. Scottsburg. Area, 180 sq. m. P. 7873.

**Scott,** county of E. Iowa, bounded E. by the Mississippi and N. by Wapsipinicon River, has a high, rolling surface, with some deposits of coal and limestone, and is traversed by Davenport and St. Paul and by Iowa division of Chicago Rock Island and Pacific R. R. Manufactures of carriages, clothing, furniture, and saddlery are numerous; horses, cattle, and swine abound. Staples, Indian corn, wheat, oats, barley, hay, potatoes, wool, and butter. Cap. Davenport. Area, 450 sq. m. P. 38,599.

**Scott,** an unorganized county of W. Kansas, on Smoky Hill River and Walnut Creek, has a rolling surface and a fertile soil. Area, 720 sq. m.

**Scott,** county of N. Kentucky, watered by Little Fork of the Eagle and Elkhorn River, and traversed by Louisville Cincinnati and Lexington R. R., has a hilly but fertile surface. Cap. Georgetown. Area, 240 sq. m. P. 11,607.

**Scott,** county of S. E. Minnesota, bounded N. by Minnesota River, has a rolling prairie surface, with abundance of timber, and is traversed by St. Paul and Sioux City and Hastings and Dakota R. Rs. Staples, wheat, Indian corn, oats, hay, and butter. Cap. Shakopee. Area, 390 sq. m. P. 11,042.

**Scott,** county of Central Mississippi, watered by Young Warrior and other tributaries of Pearl River, has a level surface, a sterile soil, and extensive pine forests, and is crossed by Vicksburg and Meridian R. R. Staples, Indian corn and cotton. Cap. Forest. Area, 540 sq. m. P. 7847.

**Scott,** county of S. E. Missouri, on Mississippi River, has an uneven surface, the river-bottoms being low and swampy, covered with vast forests of cypress, and is traversed by Cairo Arkansas and Texas and St. Louis and Iron Mountain R. Rs. Staples, Indian corn, wheat, tobacco, and sorghum-molasses. Cap. Commerce. Area, about 400 sq. m. P. 7317.

**Scott,** county of N. E. Tennessee, adjoining Kentucky, watered by Big Fork of Cumberland River, has a stony and sterile soil, chiefly occupied by the Cumberland Mountains, which are covered with thick forests and have deposits of coal. Staples, Indian corn, tobacco, butter, and honey. Cap. Huntsville. Area, 315 sq. m. P. 4054.

**Scott,** county of S. W. Virginia, adjoining Tennessee, intersected by N. fork of Holston and by Clinch River, traversed by Clinch Mountain and several parallel ranges, includes the celebrated "Natural Tunnel" made by Clinch River through the mountains of the same name; has deposits of bituminous coal and of iron, and a generally fertile soil, well adapted for pasturage. Staples, Indian corn, wheat, oats, tobacco, maple-sugar, honey, wool, and butter. Sheep and swine are numerous. Cap. Estillville. Area, 450 sq. m. P. 13,036.

**Scott,** tp., Mississippi co., Ark. P. 659.
**Scott,** tp., Poinsett co., Ark. P. 592.
**Scott,** tp., Sharpe co., Ark. P. 680.
**Scott,** tp., Champaign co., Ill. P. 755.
**Scott,** tp., Ogle co., Ill. P. 829.
**Scott,** tp., Harrison co., Ind. P. 996.
**Scott,** tp., Kosciusko co., Ind. P. 700.
**Scott,** tp., Montgomery co., Ind. P. 1111.
**Scott,** tp., Steuben co., Ind. P. 1024.
**Scott,** tp., Vanderburgh co., Ind. P. 1677.
**Scott,** tp., Fayette co., Ia. P. 337.
**Scott,** tp., Floyd co., Ia. P. 196.
**Scott,** tp., Fremont co., Ia. P. 1277.
**Scott,** tp., Hamilton co., Ia. P. 270.
**Scott,** tp., Henry co., Ia. P. 1113.

**Scott,** tp., Johnson co., Ia. P. 964.
**Scott,** tp., Madison co., Ia. P. 1229.
**Scott,** tp., Mahaska co., Ia. P. 1103.
**Scott,** tp., Poweshiek co., Ia. P. 512.
**Scott,** tp., Bourbon co., Kan. P. 1729.
**Scott,** tp., Linn co., Kan. P. 1306.
**Scott,** tp., Taney co., Mo. P. 554.
**Scott,** p.-v. and tp., Cortland co., N. Y. P. 1083.
**Scott,** p.-v. and tp., Adams co., O. P. 1409.
**Scott,** tp., Brown co., O. P. 1070.
**Scott,** tp., Marion co., O. P. 495.
**Scott,** tp., Sandusky co., O. P. 1274.
**Scott,** tp., Allegheny co., Pa. P. 1807.
**Scott,** tp., Columbia co., Pa. P. 1465.
**Scott,** tp., Lawrence co., Pa. P. 902.
**Scott,** p.-v. and tp., Luzerne co., Pa. P. 1132.
**Scott,** tp., Wayne co., Pa. P. 817.
**Scott,** tp., Colleton co., S. C. P. 1361.
**Scott,** tp., Fauquier co., Va. P. 5745.
**Scott,** tp., Boone co., West Va. P. 792.
**Scott,** tp., Putnam co., West Va. P. 1794.
**Scott,** tp., Randolph co., West Va. P. 594.
**Scott,** tp., Brown co., Wis. P. 1385.
**Scott,** tp., Columbia co., Wis. P. 832.
**Scott,** tp., Crawford co., Wis. P. 800.
**Scott,** p.-v. and tp., Sheboygan co., Wis. P. 1448.

**Scott** (Charles), b. in Cumberland co., Va., in 1733; served in Braddock's campaign 1755; raised the first company S. of James River for service in the war of the Revolution; became colonel of the 3d Virginia battalion Aug. 12, 1776; brigadier-general Apr. 2, 1777; distinguished at Trenton, Germantown, Monmouth, and Stony Point; taken prisoner at the surrender of Charleston 1780; settled in Woodford co., Ky., 1785; brigadier-general of Kentucky volunteers in St. Clair's unfortunate expedition against the Miami Indians 1791, but made a successful incursion to the Wabash, defeating the Indians; commanded a portion of Wayne's army at the battle of Fallen Timbers, 1794; was governor of Kentucky 1808–12. D. Oct. 22, 1820. A town and a county in Kentucky bear his name.

**Scott** (David), b. at Edinburgh Oct. 10, 1806, son of a landscape engraver; educated at the High School; showed precocious talent for designing and engraving; visited Italy in 1832. D. Mar. 5, 1849. He was a man of powerful imagination and originality. Among his paintings are *Nimrod, Sarpedon, Wallace, Mary Queen of Scots receiving her Death-Warrant, Jane Shore found dead in the Street, Achilles, Orestes, Paracelsus, Peter the Hermit, Christ in the Garden.* His conceptions were vast, but his smaller pieces were touched with great loveliness. Scott made a wonderful likeness of R. W. Emerson. He was an author too; wrote an able series of papers on art in *Blackwood* (1840); competed, unsuccessfully, for the decoration of the Houses of Parliament, the disappointment whereat is supposed to have hastened his death. O. B. Frothingham.

**Scott** (Dred). See Dred Scott Case.

**Scott** (Sir George Gilbert), R. A., F. S. A., grandson of Thomas Scott, the biblical commentator; b. at Gawcott, Buckinghamshire, England, in 1811; became an architect, and a prominent member of the school which effected the so-called "Gothic revival;" was largely employed in the restorations of the ancient cathedrals of England, including Westminster Abbey, and the building of new churches, colleges, and secular public edifices. Among his recent works are the university buildings at Glasgow, the Indian, foreign, home, and colonial offices, London, and the national memorial to Prince Albert in Kensington Gardens, which procured him the honor of knighthood Aug. 9, 1872. He was the chief promoter of the Architectural Museum at Westminster, is lecturer on architecture at the Royal Academy, and has published several professional treatises.

**Scott** (Gustavus H.), U. S. N., b. June 13, 1812, in Virginia; lieutenant in 1841, commander in 1856, captain in 1863, commodore in 1869, rear-admiral in 1873; retired in 1874. Served afloat during the civil war, and commended for good "service and gallantry." F. A. Parker.

**Scott** (Henry L.), b. in North Carolina Nov., 1814; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of infantry July 1, 1833; captain 1847. From 1842 to 1848 he served as A. D. C. on the staff of his father-in-law, Gen. Winfield Scott, and in the war with Mexico as his chief of staff, gaining the brevets of major and lieutenant-colonel for gallantry; was acting judge-advocate 1848–50; again on the staff of Gen. Scott 1850–61, being advanced to the grade of lieutenant-colonel in 1855. In May, 1861, he was appointed an inspector-general U. S. army; retired from active service Oct., 1861; resigned Oct. 31, 1862. Author of a *Military Dictionary* (1861).

**Scott** (John), b. at Alexandria, Pa., July 14, 1824; was admitted to the bar 1846; was a prosecuting attorney 1846–49; was for ten years solicitor for the Pennsylvania Central R. R. Co.; was elected to the Pennsylvania legislature 1862, and was U. S. Senator 1869–75.

**Scott** (John Morin), b. in New York City in 1730, descended from the baronial family of the Scotts of Ancram; graduated at Yale 1746; became a prominent and wealthy lawyer in New York; was an early and vigorous opponent of the oppressive measures of the British ministry, cooperating with William Livingston, Sears, Lamb, and the "Sons of Liberty," in which organization he was a popular orator; was defeated as a candidate for the Continental Congress of 1774; was perhaps the most influential member of the general committee of New York, appointed in 1775, and of the provincial Congress 1775–76; aided in drawing up the constitution of New York 1776; was chosen by the Continental Congress as one of the first brigadier-generals of New York troops June 9, 1776; served at the battle of Long Island and in Westchester co. until Mar., 1777, when he became secretary of state of New York, which office he filled until 1779; was delegate in the Continental Congress 1780–83, and chosen an honorary member of the Society of Cincinnati 1784. D. in New York Sept. 14, 1784.

**Scott** (Julia H. **Kinney**), b. at Shesequin, Pa., in 1809; was married to David L. Scott in 1825. D. at Towanda, Pa., in 1842. She wrote many fugitive poems, which after her death were published in a volume (1843) by Mrs. S. C. Mayo, and again in 1854 by Mrs. C. M. Sawyer.

**Scott** (Levi), D. D., b. at Cantwill's Bridge (now Odessa, Newcastle co.), Del., Oct. 11, 1802; educated at a neighborhood school, but mainly self-taught; had the degree of A. M. conferred upon him by Wesley University, Middletown, Conn., and D. D. at Delaware College, Newark, Del., both honorary; was principal of Dickinson grammar school, Carlisle, Pa., from 1840 to 1843; also bishop of the Methodist Episcopal Church from 1852 to date.

**Scott** (Michael), b. probably at Balwirie, Fifeshire, Scotland, early in the thirteenth century; was knighted by Alexander III.; travelled in England and France; resided for some years at the court of the emperor Frederick II. of Germany; is said to have written treatises on natural history and the occult sciences, and acquired a vast reputation as a magician, being introduced in that capacity by Dante in his *Inferno.* Supposed to have d. in Scotland in 1293.

**Scott** (Michael), b. in Glasgow, Scotland, in 1789; educated at the high school and university of that city; resided in Jamaica, engaged in agriculture and commerce, 1806–22; published anonymously in *Blackwood's Magazine* two brilliant sea-novels, *Tom Cringle's Log* and *The Cruise of the Midge,* which were ascribed to Chamier or to Marryatt until after his death in 1835.

**Scott** (Robert), D. D., b. in Devonshire, England, in 1811; studied at Shrewsbury school; graduated at Christ Church, Oxford, 1833; became a fellow of Baliol and college tutor; took orders in the Church of England; was rector of Duloe, Cornwall, and of South Luffenham, Rutlandshire; became master of Baliol 1854, professor of exegesis 1861, and dean of Rochester 1870. He translated several works forming part of the Oxford *Library of the Fathers,* and was associated with Dean Liddell in the preparation of a well-known *Greek Lexicon* (1845; 6th ed. 1869).

**Scott** (Robert Kingston), b. in Armstrong co., Pa., July 8, 1826; graduated in medicine at Starling College, O.; settled as a physician in Henry co.; became lieutenant-colonel of Ohio volunteers Oct., 1861, colonel July 5, 1862; was at Fort Donelson, Shiloh, and Corinth; commanded a brigade under Hurlbut in Tennessee, in Mississippi under Logan, and in Georgia under Sherman; made prisoner near Atlanta, but soon exchanged; took part in the "march to the sea;" was assistant commissary Freedmen's Bureau in South Carolina 1865–68, and governor of South Carolina 1868–71.

**Scott** (Robert N.), b. Jan. 21, 1838, at Winchester, Tenn.; appointed second lieutenant of 4th U. S. Infantry Jan. 21, 1857, adjutant July, 1861, and captain Sept., 1861. He served on the Pacific coast until 1861, being in command of the U. S. steamer Massachusetts during the San Juan difficulties in 1859. He was with the Army of the Potomac as acting adjutant-general 1st brigade regular infantry Mar.–June, 1862; was engaged in the siege of Yorktown and battle of Gaines's Mill, where he was wounded and brevetted for gallantry, and as acting adjutant-general of Casey's division Aug., 1862, to June, 1863. From June, 1863, to Sept., 1864, he was senior aide-de-camp to Maj.-Gen. Halleck; assistant adjutant-general of volunteers

(major and lieutenant-colonel) Sept., 1864, to Jan., 1867; at head-quarters of the army and military division of the James to July, 1865, and adjutant-general military division of the Pacific July, 1865, to Dec., 1866; aide-de-camp to Gen. Halleck from Jan., 1867, till 1872, except for a part of 1870, when in command of posts in Mississippi and Kentucky; assigned to 16th Infantry in 1870; transferred to 3d Artillery Jan., 1871; professor of military science at Faribault, Minn., 1872–73, since when has commanded at Fort Ontario, N. Y. Brevet lieutenant-colonel Mar. 13, 1865, "for services in connection with organization of the volunteer armies of the U. S." Author of *Digest of the Military Laws of the U. S.* (1872).

**Scott** (Thomas), D. D., b. at Baytoft, Lancashire, England, Feb. 16, 1747; had limited educational advantages, but by private study qualified himself as a minister of the Church of England; was ordained 1772; became in 1780 curate of Olney, where he was intimate with the poet Cowper; in 1785 chaplain to the Lock Hospital, and in 1801 vicar of Aston Sandford, Buckinghamshire, where he d. Apr. 16, 1821. He wrote several works of a strongly Calvinistic stamp, and published in 1796 a popular *Family Bible, with Notes*, often reprinted in England and the U. S.

**Scott** (Thomas A.), b. at Loudon, Franklin co., Pa., in 1824. After a common-school education he was placed in business in 1834, working in several different positions until 1850, when he entered the employ of the Pennsylvania R. R. Co. as general agent of the eastern division. In 1859 he was elected vice-president of the company, and in 1874 its president. Three years before he had been made president of the Pennsylvania Company. He has also been president of the Texas Pacific R. R. since its organization in 1871, and is controlling director of the Southern Railway Security Co. In 1861 he was assistant secretary of war. J. B. Bishop.

**Scott** (Sir Walter), b. in Edinburgh Aug. 15, 1771, the son of Walter Scott, a writer to the Signet, and Anne Rutherford, daughter of Dr. John Rutherford, professor of medicine in the University of Edinburgh. The first six children of his father and mother died in infancy between the years 1759 and 1766. The children born after this date, five sons and one daughter, survived to maturity. They were, in the order of their birth, Robert, in the navy and subsequently in the East India Company's service; John, a major in the army; Walter; Anne; Thomas, paymaster of the 70th regiment, d. in Canada; and David. Walter was a strong and healthy child until about eighteen months old, when he became incurably lame in his right leg—a weakness which sadly interfered with his love of active sports, but never marred his cheerfulness, good temper, or courage. At the age of eight he was placed in the High School of Edinburgh, where he remained for four years, the first two in the class of Mr. Luke Fraser, and the remaining time under the tuition of the distinguished rector, Dr. Alexander Adam, of whom Scott gives a pleasant account in his fragment of *Autobiography*. Personally popular, and making himself respected by his courage and general ability to take care of himself, he was not regarded as a very bright scholar, although even then giving evidence of his love of knowledge, of a strong memory for whatever pleased him, and of special delight in history, poetry, fairy-tales, and romances. In 1783 he entered the university, and for a year or more attended the classes in Greek, Latin, logic, and ethics, giving some attention also to history and law. In the ancient languages he made but little progress, although more successful in other studies. It is not surprising, then, that in thorough knowledge and discipline he should have found himself at fault. Years afterward, and when he had become famous, he writes in his *Autobiography*: "It is with the deepest regret that I recollect in my manhood the opportunities which I neglected in my youth. Through every part of my literary career I have felt pinched and hampered by my own ignorance; and I would at this moment give half the reputation I have had the good fortune to acquire if by doing so I could rest the remaining part upon a sound foundation of learning and science." His progress in the university was arrested by a severe attack of illness, which seems to have broken up all plans of further study, and in 1785–86 he entered into indentures with his father to serve the usual apprenticeship to a writer to the Signet. In 1792 he was called to the bar. During these and the succeeding years he was crowding his mind with vast accumulations of "ponderous and miscellaneous" knowledge of poetry and archæology, fiction and history, not easy to condense or reduce to system and order. "My memory of events," he says, "was like one of the large old-fashioned stone cannons of the Turks, very difficult to load well and discharge, but making a powerful effect when by good chance any object did come within range of its shot." He had already begun to collect books and articles of antiquarian interest, "the germ of the magnificent library and museum of Abbotsford." His mind was already turning toward letters, and in 1796 he made his first considerable publication, being translations from the German of Bürger. This was followed in 1799 by a translation of Goethe's *Goetz von Berlichingen*, *The House of Aspen*, and several ballads.

In the mean time, in 1797, he was married to Charlotte Margaret Carpenter, a young lady of French birth and parentage, but a resident in England. Two years later, through the influence of his friends, he obtained the appointment of sheriff-depute of Selkirkshire, an office with light duties and which brought the important addition to his resources of £300 a year. In 1802 he published two volumes of the *Minstrelsy of the Scottish Border*, which was completed the next year by a third volume. It was received with great favor, and may be considered as opening the way to his general fame. It brought him also into familiar acquaintance with men of genius and lovers of legendary lore, such as Richard Heber, long member of Parliament for the University of Oxford, and that eccentric genius, John Leyden.

From this time onward to the year 1831, when, at the age of sixty, he gave to the world the fourth series of *Tales of my Landlord*, there was but one year (1807) which was not marked by some independent work in verse or prose, bearing the impress of his genius, giving new impulse to literature and new fame to the land of his birth. There is room to mention only the most important of these. In 1805 was published the *Lay of the Last Minstrel*. It took the world by surprise, and was received with unbounded delight, not only for its chivalric spirit, its "vivid richness of coloring," its pathos, beauty, grace, and airy freshness, but as giving the promise of original poetic fervor and power to which the kingdom had long been a stranger. Edition after edition was called for, and sold as soon as published. "In the history of British poetry," says Mr. Lockhart, "nothing had ever equalled the demand for the *Lay of the Last Minstrel*." This was followed in 1808 by *Marmion*, perhaps the strongest and boldest of his poems, and in 1810 by *The Lady of the Lake*, in some respects more pleasing than any. In these his poetic power culminated. The poems subsequently published—*The Vision of Don Roderick* (1811), *Rokeby* (1812), *The Bridal of Triermain* (1813), *The Lord of the Isles* (1815)—were unequal to the earlier, and in various ways gave evidence of a waning popularity, which Scott was among the first to recognize. Another reason for this perceptible loss of popular favor was the appearance of another brilliant light in the early poetry of Lord Byron.

During these six or eight years Scott had been advancing in fame and in pecuniary resources. In 1806 his friends had procured for him the appointment to one of the clerkships of the court of sessions, worth about £1300 a year, the emoluments of which, however, by an express arrangement, he did not receive until the death of his predecessor in 1812. Still earlier, in 1805, he had become a regular partner in the printing-house of James Ballantyne & Co., although this connection was kept a profound secret from nearly every one of his most intimate friends. This was undoubtedly one of the most important steps of his life. "He continued bound by it," says his son-in-law, "during twenty years, and its influence on his literary exertions and his worldly fortunes was productive of much good, and not a little evil." In 1808 he took a prominent part in establishing the *Quarterly Review* in London, in opposition, politically, to the *Edinburgh Review*, the acknowledged advocate of the Whigs; and in the same year became a secret partner in the publishing-house of John Ballantyne & Co. In 1811 he began to gratify his ambition for territorial aggrandisement by the purchase of 100 acres of land on the banks of the Tweed, near Melrose, for £4000. To this he added estate after estate adjoining, purchasing at high rates, till he had expended nearly or quite £40,000, to which must be added £25,000 more for preparing the grounds and erecting the mansion where for a few years he dispensed a splendid hospitality, and to which his fame drew visitors from every part of the civilized world.

On the decline of his popularity as a poet his fertile mind turned to another form of literature, with which for ten or twelve years he surprised and enchanted the world. In 1814 appeared, anonymously, a novel under the title of *Waverley*. The next year *Guy Mannering* was published; in 1816, *The Antiquary* and the first series of the *Tales of My Landlord*; in 1817, *Rob Roy*; in 1818, *The Heart of Midlothian* (2d series of *Tales of My Landlord*); in 1819, *Tales of My Landlord* (3d series) and *Ivanhoe*. This splendid series of novels, thrown off with an ease and rapidity without parallel, marks the high tide of his genius. Those which follow are on a somewhat lower level, but the

abundance of the production was hardly diminished. *The Monastery* and *The Abbot* followed in 1820; *Kenilworth* and *The Pirate* in 1821; *The Fortunes of Nigel* in 1822; *Peveril of the Peak, Quentin Durward,* and *St. Ronan's Well* in 1823; *Redgauntlet* in 1824; *The Tales of the Crusaders* in 1825; and *Woodstock,* written in the midst of impending troubles, in 1826. *The Chronicles of the Canongate* (1st and 2d series) followed in 1827 and 1828. *Anne of Geierstein* and *The Tales of My Landlord* (4th series) in 1829 and 1831 close the long list.

The secret of the author of *Waverley,* although known to some and confidently conjectured by almost every one, was not acknowledged until after the bankruptcy of Constable and the Ballantynes had rendered even a formal concealment no longer possible. Early in 1826, Constable was obliged to stop payment, and the Ballantynes, including Scott as partner in the house, being closely connected, failed for a very large amount. The humiliation to Scott was indescribable, but he met the trial with remarkable strength and dignity. The most liberal offers of assistance were made to him by friends and admirers, among them one of £30,000 from an anonymous correspondent, but he firmly declined them all. He refused to take any advantage of circumstances which might have freed him from the claims of his creditors, but insisted that they should stand, and pledged the labor of his future life to the payment of these debts. He at once entered upon that course of untiring industry in writing new works and in the republication of the old with notes and prefaces which enabled him within a few years to pay to his creditors £40,000, and to put things in such shape that soon after his death the principal of the whole was paid by his executors. It was a tremendous exertion, and it cost him his life. In 1830 alarming symptoms, which had appeared the preceding year, were followed by a paralytic attack, from which he partially recovered. In Apr., 1831, the shock was renewed, and in September he left Abbotsford for the Continent, a great part of which he had never visited. Wordsworth commemorated this departure, and gave form and expression to the universal feeling of sadness and hope, in one of his most beautiful sonnets:

> "A trouble, not of clouds or weeping rain,
> Nor of the setting sun's pathetic light,
> Engendered, hangs o'er Eildon's triple height:
> Spirits of power assembled there complain
> For kindred power departing from their sight;
> While Tweed, best pleased in chanting a blithe strain,
> Saddens his voice again and yet again.
> Lift up your hearts, ye mourners! for the might
> Of the whole world's good wishes with him goes!
> Blessings and prayers, in nobler retinue
> Than sceptred king or laurelled conqueror knows,
> Follow this wondrous potentate. Be true,
> Ye winds of ocean, and thou midland sea,
> Wafting your charge to soft Parthenope!"

The admiralty furnished him a ship of war, on which he proceeded to the Mediterranean, touching at Malta, and thence going to Naples. Here his mind almost entirely gave way, and he hurried homeward as rapidly as possible, stopping for a few weeks in London, and reaching Abbotsford in July, 1832. He died Sept. 21, and on the 26th was buried in the grounds of Dryburgh Abbey: Mrs. Scott had died in 1826. His four children, two sons and two daughters, survived him, but none are now living. Anne, his younger daughter, died in London, at the house of Mr. Lockhart, May 24, 1833, and Sophia (Mrs. Lockhart), four years later. Walter, the oldest son, major of the 15th Hussars, died childless in India, and Charles, unmarried, died in Persia. Scott's character was in the highest degree manly, open, tolerant, and kindly. "He died," said Mr. Gladstone, "a great man, and, what is more, a good man. He has left us a double treasure—the memory of himself and the possession of his works. Both of them will endure." Nor will one withhold assent from the judgment of Thomas Carlyle: "No sounder piece of British manhood was put together in that eighteenth century of time. . . . Adieu, Sir Walter, pride of all Scotchmen! take our proud and last farewell."

There is no room in a short article like this to attempt a critical estimate of the genius of Scott, or of the worth of his contributions to the literature of his age, or of his influence on the honor and fame of his native land. His works, both in poetry and in prose, notwithstanding some adverse criticism, have taken their place among the classics of the English language—a place which they will not be likely to lose.

Of the standard editions of his works, probably the most complete and discriminating list is to be found in Allibone's *Dictionary of Authors.* Extended memoirs of Scott have been written by David Vedder, William Weir, George Allan, and (in the *Encyc. Britann.*) by William Spalding. But the great work on the author and the man, and one of the best pieces of biography in any language, is the *Life* by his son-in-law, Lockhart.

S. G. Brown.

**Scott** (William Bell), brother of David, b. in Scotland about 1810; became a distinguished painter and archæologist and head-master of the government school of design at Newcastle-on-Tyne; wrote poems at an early age; published *Hades, and other Poems* (1839), *The Year of the World, a Philosophical Poem* (1846), a memoir of his brother David (1850), *Antiquarian Gleanings in the North of England* (in quarto numbers, 1849–51), *Chorea Sancti Viti* (1851), *Poems* (1854), *Half-hour Lectures on the History and Practice of the Fine and Ornamental Arts* (1861), *Albert Dürer, his Life and Works* (1869), and another volume of *Poems* (1875), with beautiful illustrations executed by himself, and aided his brother in his illustrations to Bunyan's *Pilgrim's Progress.* After more than a generation of neglect the poems of William Bell Scott are now (1875–76) recognized by W. M. Rossetti, the London *Athenæum,* and other good authorities as worthy of a high rank in modern literature.

**Scott** (Winfield), b. in Dinwiddie co., near Petersburg, Va., June 13, 1786; educated at William and Mary College; studied law, and was admitted to the bar. In 1808 (May 3) he accepted an appointment as captain of light artillery, and was ordered to New Orleans, where a year later, for disrespectful allusion to the conduct of his superior officer (Gen. Wilkinson), he was suspended by a court-martial for one year, rejoining his command at Baton Rouge in the fall of 1811. Promoted to be lieutenant-colonel June, 1812, he was sent to Philadelphia to organize troops for the field, but on application was ordered to the Niagara frontier, reporting to Gen. Smyth Oct. 4, near Buffalo. The attack on Queenstown occurred Oct. 13; Scott, declining to serve under Col. Van Rensselaer, his junior, did not participate in the carrying of the heights and battery, but Van Rensselaer being wounded, Scott was now ordered across to take command, and the battle was fought by him. After a gallant resistance he was overpowered, and, the militia refusing to cross to his support, he was obliged to surrender with his command. Held a prisoner until Nov. 4, he was exchanged soon after. In Mar., 1813, he was appointed adjutant-general with the rank of colonel, and the same month attained the colonelcy of his regiment. Reporting with his battalion to Gen. Dearborn on the Niagara frontier in May, he led the advance in the assault on Fort George, May 27, where he was severely wounded by the explosion of a powder magazine, but first to enter the work. In June he commanded the rear-guard in the retreat from Stony Creek to Fort George, and in connection with the navy made the descent on Burlington and York in September. In October he joined Gen. Wilkinson's army in Western New York, but the enterprise on Montreal being abandoned, he was ordered to Washington, and in Mar., 1814, promoted to be brigadier-general. Reporting to Gen. Brown at Buffalo, he established a camp of instruction, and entered upon the improvement of the drill and discipline of the troops with great zeal, bringing them to a condition of considerable efficiency when (July 3, 1814) the river was crossed and Fort Erie captured. Pursuing the retreating army, the battle of Chippewa (which see) ensued July 5, in which Scott greatly distinguished himself; the battle of Lundy's Lane (which see) next followed (July 25), where Scott was severely wounded after having had two horses shot under him. He was now (July 26) promoted to be major-general, and Congress voted him a gold medal. He was disabled by his wound until October, when, but partially recovered, he was ordered to Baltimore, then again threatened; thence to Washington, where he was engaged as president of a board on infantry tactics and of a court of inquiry in the case of Gen. Winder. Declining to act as secretary of war, he sailed for Europe in July, 1815, returning the following year, and soon after was married to Miss Maria Mayo of Richmond. In 1818 he commenced the preparation of *General Regulations of the Army,* and in 1826 his *System of Infantry and Rifle Tactics.* Ordered to the North-west in the Black Hawk war, he arrived just after the defeat of the Sac Indians at Bad Axe (Aug. 2), which virtually ended the war. During the nullification troubles (1832–33) Scott was ordered to South Carolina, where, by a conciliatory policy and delicate management, a collision between the "nullifiers" and the U. S. troops was prevented. His next service was in Florida and the Creek Nation against the Indians, but being charged by Gen. Jesup with dilatoriness, he was superseded by that officer, and a court of inquiry ordered, which resulted in a verdict of acquittal and approval of Scott's conduct. The Canada border troubles (1837–38) next demanded his attention, followed in 1838 by the duty of emigrating the Cherokee Indians to the upper Arkansas, and in 1840–41 he was engaged in Maine during the disputed territory controversy, conducting the management of each of these delicate and important duties with great judgment and success. In June, 1841, he succeeded to the command of the army as

general-in-chief. In the war with Mexico he was ordered in Nov., 1846, to take command. Assembling his troops at Lobos Island, from whence he moved in transports in February, a landing was effected (Mar. 9) at Vera Cruz. The place was at once invested on the land side, and surrendered, together with the castle of San Juan d'Ulloa, Mar. 29. (See VERA CRUZ.) The battle of CERRO GORDO (which see) was fought Apr. 18, and Jalapa occupied next day; Worth's division, in advance, occupied Puebla, where it was joined by Scott with the reserve by the end of May. Awaiting reinforcements and supplies, the army was delayed here until August, on the 7th of which month the advance was resumed with 10,738 men. The battles of Contreras, Churubusco, and San Antonio (see CHURUBUSCO) were fought Aug. 19–20, and on the 24th an armistice was concluded and negotiations entered into between commissioners. Failing to agree upon terms, operations were resumed Sept. 7, and on the 8th the battle of MOLINO DEL REY (which see) was fought; the heights of CHAPULTEPEC (which see) were carried Sept. 13, as well as the San Cosme and Belen gates of the City of Mexico, the army entering the next day (Sept. 14). A contribution of $150,000 was levied on the capital, and taxation for revenue imposed to the amount of $70,000. The sum of $118,000 was sent by Scott to Washington to serve as the basis for the establishment of an army asylum. The Guadalupe-Hidalgo treaty of peace, signed by the commissioners Feb. 2, 1848, was ratified by Congress. Declining the proffered presidency of the Mexican republic, Scott, having been superseded by Gen. W. O. Butler, and a court of inquiry ordered in his case, arrived in New York May, 1848. Congress in March had extended to him a vote of thanks and authorized a gold medal. In June he was a candidate for nomination in the Whig convention which nominated Gen. Taylor for the Presidency. In 1852 he received the nomination from the Whig party, but was signally defeated by Franklin Pierce, carrying but four States—Vermont, Massachusetts, Kentucky, and Tennessee—though receiving a large popular vote. In 1855 the rank of lieutenant-general by brevet was conferred upon him. In 1859 he was sent to Puget's Sound to arrange the difficulty caused by the occupation of San Juan Island by Gen. Harney.

Though too infirm to undertake the conduct of the army in the great civil war, Gen. Scott unhesitatingly threw the weight of his influence in favor of his government, and in the exciting events preceding actual hostilities rendered important service. On Nov. 1, 1861, he was retired from active service, but without reduction of pay or allowances. He published his *Autobiography* in 1864. D. at West Point May 29, 1866. G. C. SIMMONS.

**Scot'ticisms** are words and expressions proper to the Teutonic speech of North Britain, with which literary English is often corrupted, particularly in parts of the U. S. occupied by a population derived from Scotland and North Ireland. Sir Walter Scott carefully excluded them from his works as he discovered them, but *suddenty* for "suddenness" remains; and attention was called to them by John Sinclair, M. P., in his *Observations on the Scottish Dialect* (1782). (See also Jamieson, *Dict. of the Scottish Lang.*, revised ed. 1867.) In lecturing, George Combe used *pate* for "head;" a reviewer detects a traveller as Scotch from the expression, "We were not long *of* finishing our breakfast;" and in the U. S. we may trace a Scotch ancestry by expressions like *anunder* ("under"), *backset* ("relapse"), *begrudge* ("grudge"), *bladherskite* ("babbler"), *big-coat* ("great-coat"), *bore-tree* ("elder"), *bowl* ("basin"), *bullirag* (to use abusive language), *chap* or *chappie* ("fellow"), *check* (slight repast), *chuck* ("throw"), *clash* (slanderous talk), draw *cuts* ("lots"), a *cut* of yarn; *fornent* ("opposite"), *glasses* ("spectacles"), *a gone man*, not a *hait* ("whit"), *keel* ("ruddle" or "red chalk"), *killogue* (to "plot"), no *objections* ("objection"), *red* ("comb out") the hair, a *redding* comb; *red up* ("arrange") a room; *Sabbath* (Sunday); *scrunty* ("stunted"); *so* ("as") soon as, used by Hume; *slippy*, *storm-staid*, *summons* (summon), *sundown* ("sunset"), *swap*, *swingle-tree*, *tantrum*, a *tin* ("tin cup"); *what's your will*, *trap* (to get the place of a higher pupil by a correct answer), and many others. Some of these are also Irish, a dialect which seems to have given us *deck* (a pack of cards), *renig* or *renegue* ("revoke" at cards), and perhaps *nīther* ("nēither"), as well as the archaic *nayther*. S. S. HALDEMAN.

**Scottish Language and Literature.** See ENGLISH LANGUAGE AND LITERATURE.

**Scottow** (JOSHUA), b. in England in 1615; came to Boston, Mass., in 1634; became a captain of militia, was confidential agent of La Tour in his negotiations with the colonial government 1654–57. D. at Boston Jan. 20, 1698. Author of *Old Men's Fears, etc.* (1691), and *A Narrative of the Planting of the Massachusetts Colony, etc.* (1694).

**Scott River,** p.-v. and tp., Siskiyou co., Cal. P. 446.

**Scotts'boro,** p.-v. and tp., cap. of Jackson co., Ala., on the Memphis and Charleston R. R., has 2 churches, good schools, 2 newspapers, 1 steam-mill, several cotton-gins, and 3 hotels. P. of v. 357; of tp. 1443.

A. SNODGRASS, ED. "HERALD."

**Scotts'burg,** p.-v., cap. Scott co., Ind., on Jeffersonville Madison and Indianapolis R. R., 79 miles S. of the latter place. It was laid out in 1873, and has 2 churches, good schools, 1 newspaper, 3 hotels, and several large mills and shops. Principal business, manufacturing lumber and barrel-staves. P. about 500.

JOHN H. J. SIERP, ED. "SCOTT CO. DEMOCRAT."

**Scott's Creek,** p.-v., Jackson co., N. C. P. 529.

**Scotts'ville,** p.-v., Bibb co., Ala. P. 955.

**Scottsville,** p.-v., cap. of Allen co., Ky. P. 217.

**Scottsville,** p.-v., Wheatland tp., Monroe co., N. Y. P. 119.

**Scottsville,** p.-v. and tp., Albemarle co., Va., 79 miles W. of Richmond, on James River, has 5 churches, 2 public schools, 1 bank, 1 newspaper, 2 hotels, and 1 large mill. Principal business, farming. P. of v. 388; of tp. 5994.

DAWSON & MAHONEY, EDS. "COURIER."

**Scott Valley,** tp., Siskiyou co., Cal. P. 1259.

**Scott'ville,** p.-v. and tp., Macoupin co., Ill. P. 1440.

**Scotus** (DUNS). See DUNS SCOTUS.

**Scotus** (JOHANNES). See ERIGENA.

**Sco'ville** (JOSEPH A.), b. in New York in 1811; was long engaged in journalism in his native city, where, during the war, he was correspondent of the London *Herald* and *Standard* over the signature "Manhattan," and became clerk of the common council. D. in New York June 25, 1864. Author of *The Adventures of Clarence Bolton, or Life in New York, Marion* (London, 3 vols., 1864), *Vigor* (1864), and of a work of curious and entertaining research and anecdote, *The Old Merchants of New York, by Walter Barrett, Clerk* (4 series, 1861–66).

**Scran'ton,** p.-v., cap. of Jackson co., Miss.

**Scranton,** city, Luzerne co., Pa., in Lackawanna Valley, 150 miles W. of New York. Founded in 1840 by the Scrantons, it is now the third city in size and importance in Pennsylvania. It is the southern terminus of the Delaware and Hudson Canal Co.'s R. R., which extends to Montreal; the northern terminus of the Lehigh and Susquehanna division of Central R. R. of New Jersey and of the Bloomsburg division of Delaware Lackawanna and Western R. R.; the Delaware Lackawanna and Western R. R. passes through it. A street railway diverges to four parts of the city. It derives its thrift from the operations of numerous collieries within its borders, from its immense rolling-mills and steelworks, its furnaces, its ironworks for manufacturing rails, locomotives, and mining machinery unequalled in America. It manufactures brass and iron castings, coal screens and sieves, huge steam-boilers, stoves and hollow-ware, files, coaches and carriages, silk fabrics, sash and blinds, edge tools of every kind, and turns wood, leather, sheet iron, and brass into useful contrivances. It has 2 daily and 6 weekly papers, 12 banks, 15 incorporated companies, 33 churches, 1 nunnery, 1 opera-house, 2 incorporated benevolent institutions, 2 waterworks, 1 gas company, 1 public library, 6 fire companies and 3 steam fire-engines, 1 driving park, and the largest collection of Indian stone relics in the world. P. in 1860, 9223; in 1870, 35,092; in 1876, 50,000. H. HOLLISTER,

AUTHOR OF "HISTORY OF LACKAWANNA VALLEY."

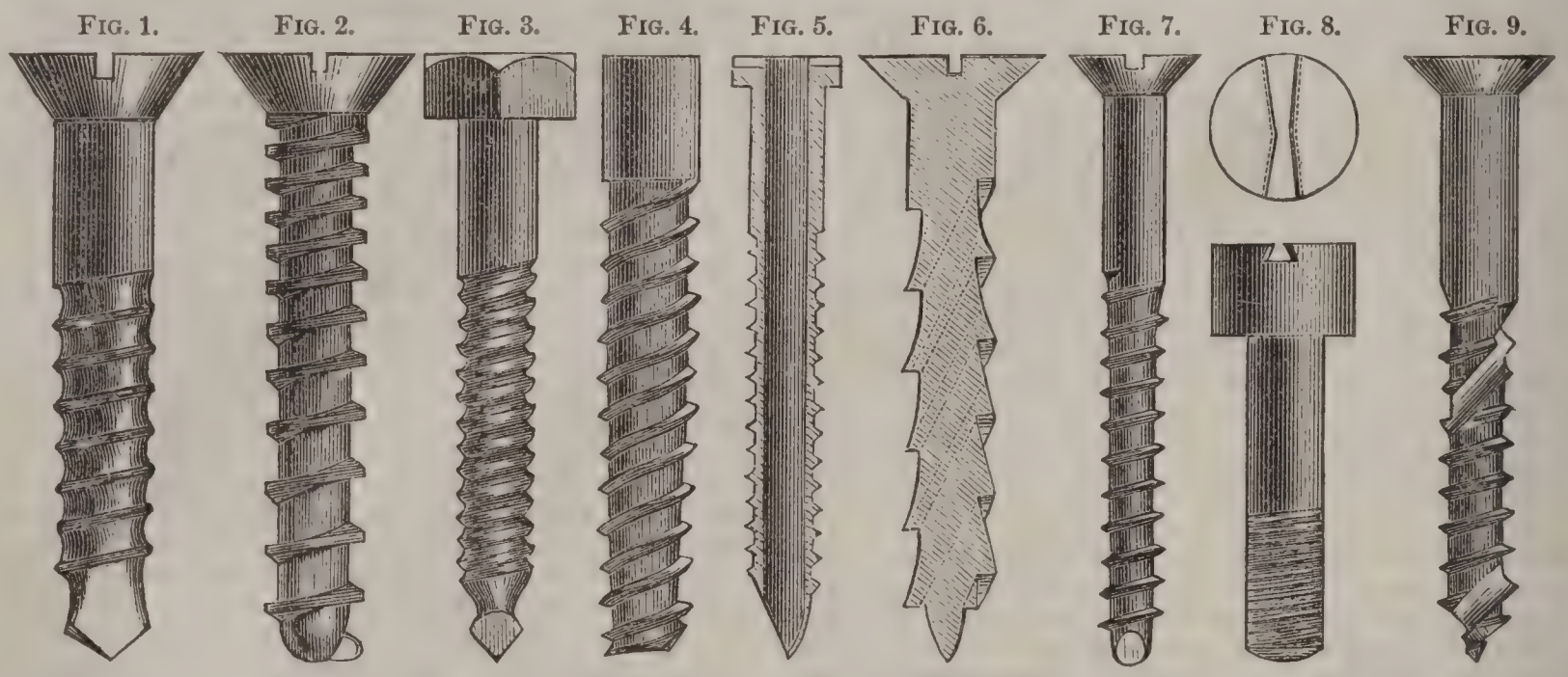
**Scranton** (JOSEPH H.), b. at Madison, Conn., June 27, 1813; was in early life a clerk at New Haven; entered into business at Augusta, Ga.; settled in the coal-region of the Lackawanna Valley 1847, and with the aid of other members of his family built up the vast iron and coal interest which has in thirty years converted a country hamlet of two or three houses into the city of 50,000 souls which bears his name; was successively for twenty years the manager, superintendent, and president of the Lackawanna Iron and Coal Co., and president of railways, manufacturing and banking institutions. D. at Baden-Baden, Germany, June 6, 1872.—His brother, GEORGE W., b. at Madison, Conn., May 23, 1811; removed to Oxford, N. J., when eighteen years of age; engaged in the iron and railroad business; was one of the founders of Scranton, Pa., president of Lackawanna and Western and Cayuga and Susquehanna R. Rs., and member of Congress from 1859 until his death, at Scranton Mar. 24, 1861.

**Scream'er,** a name given to a South American bird representing the family PALAMEDEIDÆ (which see).

**Screw-Pine.** See PANDANACEÆ.

**Screw Propeller.** See STEAM NAVIGATION.

**Screws** [O. Fr. *escrue*], one of the elementary mechanical powers, so called, is composed of an inclined plane wound spirally around an axis in what is commonly termed a screw. The spiral thread or fillet is provided externally upon a core or stem. In a nut or hollow screw the thread or fillet is provided upon the cylindric inner circumference of a square, polygonal, or other suitable-shaped block or piece. The two varieties of screws are always used in connection with each other, that first named passing into or through the other. The modifications of the screw are too many for enumeration in this brief article, and their peculiarities too varied for extended description here. Screws vary from the micrometer screws used for graduating lines, circles, and scales of mathematical and astronomical instruments to the huge wooden screws employed in the ruder kinds of hop, hay, cotton, and cider-presses, for which latter, it may be remarked, the wood of the birch tree is commonly preferred on account of its solid strength and fineness of grain, which give a comparatively smooth surface to the threads. Screws are used for lifting weights, as in the well-known screw-jack; for compressing materials, as in the presses above referred to; for fixing bodies together, as in carpentry, joinery, the making of frames for machinery, and many other operations, and for transmitting motions from one part of a machine to another. The size, proportions, and general construction of the screw must of course vary according to the purpose to which it is to be applied. The same remark applies also to the method by which screws are manufactured. The best example of a screw applied to the transmission of motion is found in the common engine-lathe, in which a screw operates the slide-rest in due ratio with the rotation of the shaft or other article to be turned in the lathe. The fabrication of these screws say, from five to twenty or even more, was formerly a complex, laborious, and imperfect operation, but by the use of the engine-lathe, in which the slide-rest is itself actuated by a screw, screws of this kind and others of similar nature may be made with the utmost exactness and accuracy of finish, and at a small cost compared with former methods. As an example of the state of the art not more than thirty years ago, may be mentioned one of the methods of originating screws, which was simply to wrap a small wire in close coils around a larger wire, and to take an impression thereof between two pieces of hard wood, the hollow or counterpart thread thus indented in the wood serving as a guide in cutting the screw. One of the most common examples of the screw and nut pure and simple is that afforded by the common carriage-bolt. This has a portion of its shank or stem squared, in such manner that when fitted into a hole or socket of corresponding shape it will be kept from rotation, and also has on its squared end a head commonly of circular form; the opposite or cylindric end of the shank is threaded and furnished with a hollow screw or nut; the shank is passed through suitable holes provided in the materials to be clamped between the head and the nut. This simple form of screw has perhaps 100 uses in the arts. Another simple form is the set screw, in the use of which the nut or hollow screw is commonly tapped in the mass; as, for example, the frame of a machine to which something is to be fixed by the set screw. The threads on screws like the carriage-bolt and the set screws are formed by dies worked either by hand or machinery, which are gradually compressed upon the metal until spiral curves are formed with the metal for the threads upset between them. The nuts or hollow screws




are formed by taps, which are devices constructed with spirally-arranged teeth, which by being turned in a hole of suitable diameter displace the metal to form the spiral screws with the thread between them, in a manner analogous to that by which the threads are formed externally upon the screws themselves. In screw-hooks, which are used for suspending pulleys from rafters for hoisting hay with horse-pitchforks and various other purposes, the straight shank of a hook is provided with a deep thread, the front surface of which should be as nearly as possible at right angles to the length of the shank, in order to secure a firmer hold upon the wood, the requisite edge to the thread being secured by sloping the back thereof; the threads of such screws may be cut in a lathe, but greater strength is secured by forging the screws on the metal at an ordinary forging heat, although in some cases the threads have been successfully formed by rolling the cylindric shank between two suitably-grooved surfaces; this plan having also been successfully adopted in the fabrication of that variety of set screws sometimes used for fastening planking and scantling together, the thread in such cases imbedding itself in the surface of a hole of suitable diameter previously bored in the wood for the screw.

Wood-screws—so termed because used successfully in wood work, and which must not be confounded with *wooden* screws—constitute a class by themselves, and there are few articles that illustrate more clearly the gradual growth and development experienced in every branch of manufacture. The blanks for making wood-screws were formerly forged out by nailmakers; the next step was the cutting of the blanks from rolled round iron; the heads were formed on these by pinching them while red hot between dies; and the threads were cut by means of a file. A great number of machines, rude at first, but gradually approaching the comparative perfection of the present time, were devised, until now the blanks are cut and headed from coils of wire, and being transferred to a second machine have the heads turned and nicked and the shanks turned and threaded by automatic mechanism, until the screws drop complete into a receptacle. Until within about thirty years the wood-screws were blunt at the end, so that a gimlet-hole had to be bored for their reception. At the period referred to Thomas J. Sloan, an American inventor, originated the gimlet-pointed screw now in universal use, and devised the machinery still employed in its manufacture. It is true that before him an English inventor had proposed to put the tapering point of a gimlet upon the end of the screw, the pitch of this gimlet-point being different from that of the screw itself. As a consequence, the thread of the point and the thread of the screw acted against each other, and the idea was futile. In the Sloan screw the pitch of the body of the screw was continued down to the point; the depth of the thread and its thickness, but not the pitch, being diminished to the very extremity of the thread; it was this slight difference in shape that produced a revolution in the industry, and affords an example of the immense industrial importance from changes that at first sight appear trivial; not only has the screw itself been made better, as it requires no hole previously formed for its reception, but the machinery for making it has been so improved in comparison with that previously in use that the difference in the first cost of the crude material—*i. e.* iron wire—when bought in large and small quantities, is more than the entire cost of making the screws. A simple device added to the machine to remove the slight bur left by the saw in cutting the nick in the head of the screw saved the Eagle Screw Co. of Providence, R. I., $97,000 in fourteen years—an index alike of the value of small inventions and the magnitude of the screw manufacture.

Many modifications of the wood-screw have been pro-

posed in recent years. Among these may be mentioned Barrett's screw (Fig. 1), patented in 1873, which has a drill-point in place of a gimlet-point. In the same year Biswell & Chisholl patented a screw made of Bessemer or homogeneous steel wire. In the same year Russell patented his wood-screw (Fig. 2), having a thread gradually decreasing from the point throughout the whole of its length. The Burdick screw (Fig. 3), also patented in 1873, was of peculiar form, having ovolo screw-threads and being provided with a harpoon-point. The Matthews screw (Fig. 4) of the previous year was formed with a smooth cylindrical neck, and had no nick, and was driven by a kind of clamp, instead of by a screw-driver. Will's screw (Fig. 5), also patented in 1872, had a spoon-shaped point for tapping the wood as the screw was inserted. Stockton in 1873 patented a hammer-driving screw (Fig. 6), having triple driving-threads slanting rectangular to the core, with a conical point; while Bourn, also in 1873, produced a wood-screw provided with a flattened point having a circular cutting edge (Fig. 7). Armstrong's patent (1872) described a screw provided with a nick widening from the centre toward the circumference (Fig. 8), to allow the edge of the driver to be pressed up and wedged near the centre. Ladd & Corning the same year patented a wood-screw provided with a peculiar cutter and point, in substance a combination of a German twist-bit with the screw (Fig. 9), in such manner as to cause the screw to cut its own hole into the wood, instead of pressing the latter laterally. JAMES A. WHITNEY.

**Scri'ba,** p.-v. and tp., Oswego co., N. Y. P. 3065.

**Scribe** (AUGUSTIN EUGÈNE), b. at Paris Dec. 24, 1791; studied law; wrote in 1811 his first play, *Les Dervis*, which failed; achieved his first success in 1816 with *Une Nuit de la Garde nationale*, written in connection with Delestre Poirson; provided from 1816 to 1820 the Théâtre de Vaudeville and the Théâtre des Variétés with as many vaudevilles and small comedies with songs as they could perform; wrote for the Gymnase between 1820 and 1830 about 150 plays, mostly one-act comedies of a sentimental or satirical character; composed, finally, from 1830 to his death, Feb. 20, 1861, more than 100 plays in three or five acts, historical, satirical, and even tragical, for the Théâtre Française and other houses, besides a similar number of opera librettos for Boieldieu, Adam, Auber, Donizetti, Meyerbeer, Verdi, and other composers, and some novels and romances. Of his dramatic works, numbering about 400 plays, there exist various collections—one in 20 vols. (1833–37), and another in 26 vols. (1855–58); a collected edition in 50 vols. is now publishing. Most of these plays he produced in connection with some other playwriter—Germain Delavigne, Mélesville, Bayard, Dupin, Legouvé, etc.—and at one time, between 1820 and 1830, this artistic copartnership was organized in thorough business style; one made the plot, another sketched the characters, a third wrote the dialogue, etc. After 1830, however, it became necessary to be a little more careful in order to satisfy the public. In general, his success was complete. For nearly forty years he reigned supreme in all the theatres of the world; he was courted and flattered, and he left a large fortune. Nor can it be said that his success was entirely undeserved; his plots have a novelty and originality, their movements an adroitness and rapidity, and the dialogue an eloquence and piquancy, which always will be of value; but his picture of characters is so superficial, and of passions and sentiments so untrue, that generally his plays cannot be enjoyed. The best are his earlier one-act comedies, such as *Les premiers Amours;* the worst are his later historical dramas in five acts, such as *Bertrand et Raton* and *Le Verre d'Eau.* To judge him rightfully, however, he must not be compared with Sardou, who succeeded him, but with Diderot and Kotzebue, whom he succeeded. He then appears as he is—in poetical respects a bungler, in theatrical a master.

**Scribes** [Heb. *shoterim*, "writers"], officers already in existence among the Israelites in Egypt (Ex. v. 6–19) and in the desert (Num. xi. 16), whose business apparently it was to keep the genealogical registers, serve processes, and the like. In Palestine they appear to have been chosen from the Levites (1 Chron. xxiii. 4; 2 Chron. xix. 11; xxxiv. 13). From the time of Ezra (fifth century B. C.) they were expounders of the Law. In the New Testament they are generally named in connection with the Pharisees, and are noted for their hypocrisy, ostentation, and arrogance. R. D. HITCHCOCK.

**Scrib'ner** (CHARLES), b. in New York City in 1821, son of Uriah R. Scribner, a prominent merchant and a member of an old family of New York; was educated at New York University and at Princeton, where he graduated 1840; studied law for three years, and was admitted to the bar, but never practised the legal profession; began the business of book-publishing in the old "Brick Church" in partnership with Isaac D. Baker in 1846, under the style of Baker & Scribner. In 1850, Mr. Baker died, and the business was thenceforth carried on in Mr. Scribner's name. Among the works he successfully brought out may be enumerated those of Donald G. Mitchell, N. P. Willis, Prof. Guyot, Dr. J. G. Holland, G. P. Marsh, Drs. Bushnell, Schaff, Noah Porter, and W. G. T. Shedd. In 1870 *Scribner's Magazine* was established. D. at Lucerne, Switzerland, Aug. 26, 1871.

**Scriptures, Holy.** See BIBLE, THE, by PROF. W. G. SUMNER, A. B.

**Scri'ven,** county of E. Georgia, on Savannah and Ogeechee rivers, has a level sandy surface, largely covered with pine timber, and is traversed by Central R. R. of Georgia. Staples, Indian corn, sweet potatoes, and cotton. Cap. Sylvania. Area, 540 sq. m. P. 9175.

**Scrive'ner** (FREDERICK HENRY AMBROSE), LL.D., b. at Bermondsey, England, Sept. 29, 1813; graduated at Trinity College, Cambridge, 1835; was for many years master of classical schools, especially that at Falmouth, where he was also incumbent of a church 1846–61, since which time he has been rector of Gerrans, Cornwall. He has taken a high rank in the philological criticism of the New Testament; has published valuable editions of the *Greek Testament* (1860) and of the *Codex Bezæ* (1864), a *Full Collation of the Codex Sinaiticus with the Received Text of the New Testament* (1863), and the *Cambridge Paragraph Bible, with the Text Revised and a Critical Introduction prefixed* (1873); is author of a *Plain Introduction to the Criticism of the New Testament* (1861; 2d ed., revised and enlarged, 1874), and other works of kindred character; was appointed one of the company of revision of the authorized version of the New Testament 1870, and was granted a pension from the civil list 1872, "in recognition of his services in connection with biblical criticism."

**Scrive'ner's Pal'sy,** or **Writer's Cramp,** a derangement of the motor nerves of the fingers and thumb of the right hand, caused by over-exercise with the pen, combined with inattention to the mechanism of the arm. It may also attack musicians, milkers, seamstresses, shoemakers, and others who employ to excess the same nerves, but is then generally known by other special names, such as "cobbler's spasm." It is frequently attended with spasmodic and uncontrollable movements of the fingers. It should be treated with tonics, particularly iron, and galvanism has been employed with good effect.

**Scrof'ula** [Lat. *scrofa*, "a breeding sow," swine being affected by a similar disease]; also known as **Struma** (from Lat. *struere*, to "build"), since the lymphatic glands are enlarged in this condition. Persons of the lymphatic temperament are most liable to develop the marked symptoms of struma or scrofula. Scrofula is hereditary in many families. In many other persons it arises *de novo* from bad hygiene and regimen, especially in children when rapidly developing. Disordered digestion, uncleanly skin, deficient clothing, foul air, are its causes. Many symptoms of disordered blood-states formerly grouped as scrofulous are now distinguished as having definite causes. Eczema, though often an exponent of struma, is as often due to other causes—nervous influences, rheumatic taint, gastric and intestinal derangements. The scrofulous person is light-complexioned, the skin is white, the body often full, or even obese, but the muscles soft and flabby. In the child the head is large relative to the body, the eyes full and white, the teeth white, tending to fracture and early decay. The chest often lacks symmetry, the breast-bone prominent, the bones of the arms and legs often are unduly long, with prominent bulbous extremities. Such conditions, more advanced, constitute the "rickets." The chief characteristic of scrofula is the susceptibility of the glandular system. Either persistently or with every slight impairment of health the glands of the neck, groin, abdomen, etc. become indurated and enlarged. Such swellings may be evanescent or leave permanent indurations. The glands of the neck frequently are so engorged with "scrofulous" exudative matter that it becomes "caseated"—a state of fatty degeneration—or actually suppurates, producing scrofulous abscess. Scrofula is not, then, a definite specific disease, but a condition of serious perversions of the nutritive qualities of the blood, and resulting affections of the various tissues and organs of the body. Enlarged glands, moist skin diseases, superficial abscesses, unsymmetrical developments of the teeth, nails, and bones are some of its manifestations. Inherited scrofulous taint may remain latent until developed by depressing sickness. Thus, measles, a harmless disorder in robust children, is hazardous when struma lurks in the system. The bottle-fed infant and the foundling are more often scrofulous than the nursed, home-reared child. The mucous and serous surfaces are very

liable to disease in struma,—subacute and tubercular meningitis, hydrocephalus, chronic bronchial catarrh, diarrhœa and cholera infantum, and marasmus. The relation of scrofula and the pulmonary tuberculosis of adults is disputed. That strumous and scrofulous persons are very liable to develop phthisis is, and has always been, generally conceded. Very prominent pathologists to-day regard scrofula and tuberculosis as separated only in degree. The discovery by the microscope that yellow tubercle is merely "caseous" or fatty metamorphosed matter, and gray tubercle an exudation or deposit rather than a definite structure, supports this view. The disastrous effect of pulmonary tubercle depends largely upon the preceding low blood-state, largely upon the close structure and functional disturbance of the lung invaded. Simon terms scrofula the soil for tubercle; Wilks calls scrofula a primary tubercle, a secondary form of a common disease. A majority of cases of pulmonary consumption are, however, disconnected with scrofula or struma, the result of preceding inflammatory processes in the pleura, bronchial tubes, or lung-tissues. The treatment of scrofula is hygienic and nutritive—warm clothing, bathing, friction to the skin, pure air, correct rich diet, special articles of diet, as the hydrocarbons or fats and preparations of phosphates. Iron, iodine, and arsenical preparations act as alteratives to reduce glandular enlargements.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Scrophularia'ceæ** [from *Scrophularia*, one of the genera], an important natural order of gamopetalous exogenous plants, of nearly 160 genera and 2000 species, mainly herbs, natives of nearly all parts of the world. It is characterized by the bilabiate or more or less irregular corolla, didynamous, or by suppressive diandrous stamens, two-celled ovary, and mostly indefinitely numerous seeds, containing a small and narrow embryo in copious albumen. Bitterish, somewhat acrid, emetic, or narcotic and sedative properties prevail, but the only plant of medicinal importance is foxglove (*Digitalis purpurea*), which is also commonly cultivated for ornament. Other plants of the order largely cultivated for ornament are snapdragon, *Calceolaria, Pentstemon, Mimulus, Veronica*, and one tree—namely, *Paulonia* of Japan.

Asa Gray.

**Scrub'grass,** tp., Venango co., Pa. P. 997.

**Scru'ple** [Lat. *scrupulus*, a "small stone"], in apothecaries' weight, is one-third of a drachm, 20 grains, the $\frac{1}{288}$th part of the pound Troy. The Romans gave the name *scrupulum* to the $\frac{1}{288}$th part of any standard unit of measure.

**Scud'der** (Horace Elisha), b. at Boston, Mass., in 1838; graduated at Williams College 1858; was for several years editor of *The Riverside Magazine* (Cambridge, 1867 *seq.*), and became a resident of New York City 1875, devoting himself to literature. Author of *Seven Little People and their Friends* (1862), *Dream Children* (1863), *Life and Letters of David Coit Scudder* (1864), *Stories from my Attic* (1869), and other works for the young.

**Scudder** (John), M. D., b. at New Brunswick, N. J., Sept. 3, 1793; graduated at Princeton 1811; became a physician in New York, where he was house-surgeon to the city hospital; abandoned an extensive practice to devote himself to missionary work; studied theology; was ordained 1819 in the Dutch Reformed Church; was a missionary physician of the A. B. C. F. M. at Tillipally, Ceylon, 1820–39, after which he was transferred to the Madras mission; spent several years (1842–46) in the U. S., visited the Cape of Good Hope for his health 1854, and d. at Wynberg, South Africa, Jan. 13, 1855. Author of several publications on missionary subjects. His labors in the establishment of hospitals and schools in India were very successful. His ten children, eight sons and two daughters, all became missionaries in India; most of them are also physicians. (See his *Memoir*, by Rev. J. B. Waterbury.)

**Scudéry', or Scudéri, de** (Madeleine), commonly called Mademoiselle Scudéry, b. at Havre June 15, 1607; was educated in Paris; became one of the most conspicuous figures in the literary circle of the Hôtel Rambouillet, and acquired great celebrity by her romances, *Ibrahim* (4 vols., 1641), *Artamène, ou le Grand Cyrus* (10 vols., 1649), *Clélie* (10 vols., 1656), *Almahide* (8 vols., 1660), etc.; formed, after the reunions of the Hôtel Rambouillet had been broken up by the disturbances of the Fronde, a *salon* of her own, frequented by the queen and the princes. D. at Paris June 2, 1701, honored and loved, though her celebrity had gone. In artistic respects she has hardly made anything but blunders, but her work was nevertheless not bad or useless. In a time of confusion and violence, when brutal passions and gross sensuality defied every moral or social rule, she placed before the public a picture of the most watery sentimentalism, the tamest moral correctness, the flattest social elegance. The stronger elements of the French civilization, such as the Port Royalists, Bossuet, Boileau, etc., condemned and ridiculed her, for they saw that what she offered was simply the opposite extreme to the reigning ideal of the age. But people in general were struck by the contrast. They found in her books a help against their own brutality, a refining and elevating enthusiasm. To read one volume of one of these romances or *Conversations* or *Entretiens* is very amusing, and throws a stream of electric light on *Les Précieuses ridicules* and *Les Femmes savantes* by Molière.

**Scu'do** [It. for "shield"], a coin of Italy, now equal to five lire or francs, and nearly equivalent to our dollar. Many different scudi have been struck by the numerous powers which have prevailed in Italy, and their values are extremely various.

**Scuf'fletown,** p.-v., Laurens co., S. C. P. 1797.

**Scull'ing,** rowing with one oar (called a scull) in each hand. The principles of the art of sculling are very similar to those of Rowing (which see). The main difference is in the "finish" of the stroke. Instead of drawing the hands up to the chest at the end of the stroke, they are drawn down past the sides to the waist, thus bringing the sculls gradually out of the water, instead of lifting them out suddenly. Among nautical men, sculling means a peculiar way of propelling a boat by the rotation of a single oar at the stern of a boat. It is only used occasionally and for short distances.

G. L. Rives.

**Scul'pin,** a name having reference to the spines of the skull, and given to various species of acanthopterygian fishes belonging to the family Cottidæ. They are distinguished by the rather stout, club-shaped body and large head, the spines with which the head is armed, and the naked or simply rough body: the mouth is quite large. They are very destructive to other fishes and are a nuisance to the angler. The common sculpins of the Atlantic seaboard are species of the restricted genus *Cottus* (or *Acanthocottus* of Girard). The best known are the *Cottus octodecem-spinosus*, which is the most southerly species, and the *Cottus grœnlandicus*, which is the most common N. of Cape Cod. The name deep-water sculpin, or sea-raven, is applied to the *Hemitripterus acadianus*. On the Pacific coast the name is applied to corresponding species of the same genus. The species are rarely or never used as food except by the Greenlanders and the very poor.

Theodore Gill.

**Sculpt'ure** [Gr. γλάφειν; Lat. *sculptura*; It. *scultura*; Fr. *sculpture*; Ger. *Bildhauerkunst*], the art of carving in stone, marble, or wood, or of casting in metal, figures of men and animals, whether in the round or in relief. The term is much extended, so as to embrace the carving of ornament whether of natural or of conventional forms, the engraving of gems, and even engraving upon metal—the word *sculpsit*, he "carved" or "sculptured it," being continually affixed to the name of the engraver on steel or copper. But within the limits of this article we can only consider sculpture in the higher and more usual application of the term. For the rest, the art of engraving upon metal and wood has already been fully treated in these pages (see Engraving); another branch of the subject is treated under Architecture, while the articles Gem and Cameo will be found to give the gist of all that is known on the subject of engraved stones.

It is now believed that the statues of the sheik Ra-em-ké, of Schafra (or Chephren), and of Ra-hotep and his wife or sister, Nefer-t, discovered by Mariette-Bey at Sakkarah, are the oldest statues in existence. The first of these, and the most remarkable, is of cedar-wood, the second is of diorite, and the other two are of limestone. The statue of the sheik Ra-em-ké is the least ancient of the four. It is ascribed by Mariette to the fifth dynasty (B. C. 3951). Next above it in antiquity is the statue of Chephren (fourth dynasty, B. C. 4235). The oldest are the figures of Ra-hotep and Nefer-t from the pyramid of Maidoum (third dynasty, B. C. 4449). Those who know Egyptian sculpture only by the later examples of the art, when it was subjected to the deadening and formalizing influence of hieratic ideas, can with difficulty believe in the greater antiquity of these statues discovered by M. Mariette, seeing how much more they are pervaded by a sense of life, and how much more closely they are modelled after nature. M. François Lenormant has remarked that art in Egypt appears to have followed a contrary direction in its development from that of any other country whose art is known to us. Other nations began with purely sacerdotal art, and only subsequently and by slow degrees attained to the imitation of nature. The Egyptians are the only people who began with following nature and ended by becoming the slaves of convention. In these Sakkarah statues the bodies have much of the stiffness and immobility familiar to us in Egyptian sculpture, although in even the modelling of the limbs and in a certain warmth of the contours there is much to praise. But it is in the expression of the faces

that we find the most to admire. Life has hardly ever been better rendered than in the face of the sheik, with its pervading benevolence, where the artist has known how to give the effect of a smile without our being able to ascribe it to any one feature of the face. It is a genial radiance, far removed from the grin of the Cypriote and Etruscan faces—far removed, even, from the smile which pursues us in the faces of that later Etruscan, Leonardo da Vinci. There are dignity and breeding, with something of homely simplicity, in the plain face of Nefer-t. She is a human being who has lived and suffered and enjoyed; while in the face of Chephren there is a look of good-natured assurance, and a turn about the shoulders and in the set of his head which agreeably modifies the formalism of his attitude, allowing the spectator to rest in the hieratic symbolism if he will, or to indulge a sympathetic movement toward the monarch as toward a man and a brother. Two points must be noticed even in so brief a review as this. One is, that even in our own day, when so many tricks are played with marble, it would be difficult to conceal and yet show the contours of the body under drapery better than is done in the statue of Nefer-t. Another is, that the statue of Ra-em-ké, made as it is of cedar and mimosa wood, is covered with a thin coating of stucco, on which the flesh-tints were laid, the eyeballs formed of pieces of opaque white quartz, in the centre of which are inserted rounded bits of rock-crystal to represent the pupils. Under each crystal is fixed a shining nail, which indicates the visual point and gives an expression of life. Supposing this statue to have been undoubtedly made at the epoch assigned to it, what a notion it gives of the antiquity of a country where such ingenuity and research had been arrived at at an epoch already long anterior to the oldest recorded dates of man's history! There is nothing childish nor of the plaything order in this statue of the sheik, and those who are disposed to sneer at its pretensions must remember that its processes merely antedate by a few thousand years those which the Greeks were delighting in when, according to our judgment, their art was in its prime. The sculpture of Egypt with which we are more familiar belongs to a much later period than that of the ancient empire or Memphian Egypt. Of this earlier period we have only selected three or four chief examples in illustration, but M. Mariette's discoveries at Sakkarah have been very numerous, and the ancient empire is well represented in its art-remains. After this era was ended there came a long time of confusion, and it was not until the eleventh dynasty (B. C. 3064), the date of the middle empire, or Theban Egypt, that the art of Egypt became purely sacerdotal, and was condemned to formalism and inanition. This was a necessary consequence of the idea that ruled in Egypt, and that imbued the religion, the politics, the laws, and the sciences, no less than the arts—the belief in a law of immutability that made life on this earth one uninterrupted being, without aspiration, without hope, without desire of change, and with no belief in the possibility of change; and the life after death was equally fixed. The statues of the gods and of the kings only reflected this passionless, calm beatitude. After the order of her history settled down into the hieratic rule the art of Egypt may be briefly dismissed as presenting only work interesting to the archæologist and to the historian. There was indeed, after a long period of formalism, a return to the greater naturalness that marked the earliest time, but this was but a flickering flame that soon gave out, and in the time of the Pharaohs had become utterly extinct. The sculpture of the Egyptians is almost entirely unideal, and consists of figures of the gods and in portraitures of kings and heroes. As these were objects of veneration, there was little scope allowed for imaginative treatment, which would have disturbed the attitude of the worshipper and interfered with the stability of the legend. It was the story of Byzantine repression in the history of the art of painting applied to sculpture. The priests dictated everything—not only the subjects, the style, the sentiment, but even the processes—and the result was a despotic uniformity during long periods of time. The Egyptians worked but little in marble, preferring almost any other material, a probable reason being that marble does not belong to the country. Some of their materials were harder to work than marble, and would almost defy the appliances of our own mechanical time. But in Egypt time and labor were all the machinery they had, and they cost nothing in that land of long life, of even climate, and of superabundant food. They cost nothing but human muscle and human tears. The Egyptians had rather more skill in hitting the expression of animal life than in getting human likeness. The cat, the fox, the hawk were well designed by them, though only the heads of these animals are represented as covers to the jars that contain their mummies. This is worth noting, as the Greeks and Romans only in a few instances did anything worth naming in this field.

Next in antiquity to the Egyptian, and more interesting because it had so much greater influence in shaping the art of other nations, is the Assyrian sculpture. Except when introduced into other countries merely as a fashion—as it was into Italy in the later days of the Roman empire—Egyptian sculpture was neither copied nor sought for outside its own country. It had no interest for other people, no attraction. This may have been owing to the isolated position of the country, and to its being out of the beaten track, for it is difficult for us to prefer the Assyrian sculpture, even as art, to that of Egypt. There is a grotesqueness about it, an affectation, a look as if the authors of it wanted to do something great and did not know how, besides a grossness and vulgarity in the type, that repel us from the art of Nineveh and Babylon. But we find Assyrian architecture and sculpture influencing first Cyprus, then Western Asia Minor, then Greece; and in each of these countries the study of its art begins with a time when Assyrian forms are everywhere suggested. It was not until 1842 that the discoveries of M. Botta at Nineveh enabled us to see that the art of Assyria is not derived through the works of other peoples, but as they themselves produced it; and the discovery was one of the most important of our times. The colossal bulls, the bas-reliefs of kings, with all their battles, hunting-scenes, and episodes of court-life, enable us to read their history almost as clearly, though not indeed with such minuteness, as we can that of the old Egyptians on their painted and sculptured walls. But the art of Assyria is rude and unideal, and far behind that of Egypt in real grandeur and refinement of expression. The finest specimen of Assyrian sculpture is the bas-relief of the wounded lioness, transfixed with darts, dragging herself along. Nothing grander in its way than this has ever been produced in the world. But in the portrayal of man the Assyrian failed. His Nimrod is not a hero; he is only a combed and curled Assyrian bull.

Greek sculpture had its rude beginnings in the island of Cyprus, and the light spread thence along the shores of Asia Minor and the islands of the Ægean to the peninsula, where it had its splendid culmination in Athens. In the Metropolitan Museum in New York we may see in the Di Cesnola collection the influences at work that were to join themselves together and produce a new sculpture that should recall none of them in its perfected examples. It took many hundred years, and thousands of workmen laboring in schools or associated in the carrying on of great public works, to produce the mass of work—good, bad, and indifferent—that was to form the public taste, create a public interest in art, and finally make possible the appearance of sculptors who had learned in ways unknown to themselves to distil in their alembics the pure essence of beauty out of a wilderness of roses with all its various loveliness and with all its irregularities, freaks, and abnormal growths. European museums, public and private, are crowded with the evidences of Greek and Asian-Greek skill in sculpture, their delight in form showing itself not only in their sculpture proper, but in their architectural ornament, their coins, their vases. Every city, every town, every district, had its productive centres, and they varied in innumerable ways. As far back as Homer it is evident that the most delicate as well as sumptuous taste prevailed, and was recognized as taste—made a part of the feelings of the common people. It was out of this superabundance that the final perfection came; and it is because we have it no longer that there is no longer perfect sculpture produced anywhere. In Greece, as in Egypt, the oldest statues seem to have been of wood, and Dædalus is the generic name given to all the early workers in this kind. About the years 575 and 525 B. C. we begin to hear of carvers of stone, of modellers in clay, of engraving on metal, and even on gems, and of casting statues in bronze. This points to a growing commerce and intercourse with older people, and from this time down we hear of progress in all directions. Soon the Parian marble began to be worked, and once the discovery made of this most beautiful of all the materials in which the sculptor can work, the progress toward perfection was rapid. But progress was not limited to one material. The Greeks sought perfection in all directions; and this universality of skill, which makes a Greek coin, a Greek vase, a Greek ornament of the best periods almost equal in artistic value, is another reason for the perfection they attained in sculpture. Artistically, the people were developed on every side, and the atmosphere was pervaded with creative talent as well as with the power to enjoy the productions of talent. The statues from the pediment of the temple at Ægina, now in Munich, the later found marbles from Selinus, now in Palermo, with the earlier coins and vases, enable us to trace the progress of the Greek-speaking peoples from the infancy of art to a point where a higher flight was not only possible, but might be looked for with confidence. That higher flight,

in which the last perfection was reached, is found in the sculptures of the Parthenon, in the Venus of Milo, and in a half dozen other pieces which have but one defect—their very perfection. For they stand at the gates of Endeavor with drawn swords, and "Thus far, and no farther," on their lips for the children of men. This is one reason why sculpture lags so far behind painting — that man, having once accomplished in that field the impossible, there is no longer any room for aspiration, and all that has been done since, or nearly all, is the fruit of slavish imitation, or of admiration that unconsciously moulds itself after what it admires. The most famous Greek sculptor of the great era was Phidias, born at Athens about 488 B. C. He made statues in bronze, in ivory, in marble. The most famous of the works ascribed to him—for much of what is commonly asserted with regard to him is clouded with doubts—are the sculptures of the Parthenon, the statues of the pediment, the high relief of the *metopes* and the low relief of the frieze, and a statue of the Olympian Jove at Elis, made of ivory and gold. The greater part of the sculptures of the Parthenon were brought to England by Lord Elgin, and are now in the possession of the English government; they are deposited in the British Museum. Others are owned by the French government, and are in the Louvre. The years immediately following Phidias produced a swarm of sculptors. This was the necessary consequence of the appearance of a man of genius, not the least of whose functions it is to develop the talent that lies about him and give it employment. The temples at Ægina, at Phigaleia, at Selinus, could not have created a revolution; they were merely temples amid a host of temples, and differed from them only by having served as a frame for sculptures whose chief value is that they show us how the Parthenon was prepared for. But Phidias appeared, and immediately every latent talent, every hiding genius, sprang to light. Assyria and Egypt, Cyprus and Rhodes, Chios and Samos, Dædalus and Rhœcus, were as if they had never been. Certain names have come down to us of this golden time, distinguished from the crowd of names that are only empty sounds—Polycletus of Sicyon; Myron of Eleutheræ in Bœotia, famous for his brazen heifer; Scopas of Paros; the Athenian Praxiteles; Lysippus of Sicyon. We have the names of the works executed by these artists, and plentiful details about their influence on their contemporaries and their characteristics, with anecdotes, epigrams, historical data, and, with all, the fewest possible proofs that we possess any of their works except in copies. Still, these copies are in most cases so beautiful that though we are not always sure they represent the statues whose names they bear, yet we cannot conceive of works more perfect; they themselves create the standard by which we must judge them.

The Romans did not, so far as we know, produce a single sculptor of eminence, but they had taste enough and sense enough to know the value of Greek sculpture, and they filled their temples, palaces, private houses, and public squares with statues brought from Greece or wrought in Italy by Greek workmen. Greeee and her colonies were for long years a quarry whence the Roman people drew infinite riches. The Roman soil has in turn been a quarry whence all the states of Italy and of modern Europe have drawn the cloud of Olympian gods and goddesses and statues and busts of famous men that make their galleries places of pilgrimage. And yet it is known that there must still be a multitude of sculptures left in Greek and Asian ground. How easy to believe it when we know that Di Cesnola found 3000 statues heaped in the ruins of a single temple, and when we read of the discoveries in Lycia, at Ephesus, at Olympia, at Carthage, and in the Troad!

After the break-up of the Roman empire, and in the confusion that followed while the barbarians from without and the bourgeois population within were working together to construct a new society, there was no sculpture worth mentioning produced, partly because the times were not favorable to the production of art of any kind, and partly because the supply of sculpture left by the Romans was ample for all needs. The statues of the gods and heroes—such as had not been defaced beyond all recognition by the barbarians in their conquering fury, or by the early Christians in their fanatic zeal (though, thanks to the reverence or the superstition that animated some pagan spirits, many of them had been buried or walled up beyond the reach of either iconoclast)—such of these statues as still remained were utilized in ornamenting the new buildings which were being constructed out of the ruined structures of old Rome; and the same use was made of the ornamental carvings, the capitals, and the friezes. The sarcophaguses in which the old Romans had been buried were employed as altars for the Christian churches or served as receptacles for the bodies of Christian bishops or princes. The sculptures belonging to the early centuries of our era, even so late as the thirteenth century, show only a steady decline from even the debased standard of art that prevailed under the later Roman emperors. But in the first years of the thirteenth century a certain Nicola was born in Pisa who was the first to bring sculpture back to life again. He was inspired by the study of remains of classic art, especially, it is said, by the daily sight of a sarcophagus sculptured by a Greek artist. Trade with the East was now enriching Pisa as well as other Italian seaports, and a new zeal was stimulating there, as everywhere in the Peninsula, the building and adorning of churches, for which trade was willing enough to pay; so that Nicola Pisano, who, if he had been a century earlier, might have starved for occupation, now found his talent in universal demand. He is credited perhaps with a greater number of works than he really accomplished, but the pulpits in the cathedrals of Siena and Pisa and the tomb of St. Dominic at Bologna are sufficient to prove his power to have accomplished all that has been attributed to him. He was followed by a long line of sculptors—by his son Giovanni of Pisa (d. 1320), his pupil Arnolfo di Lapo (1232–1310), by Andrea Pisano, Andrea Orcagna, Lorenzo Ghiberti, Donatello. These notable names, with a cloud of others less distinguished or with only a local celebrity, took their light from Nicola's torch, and kept its flame alive. The sculptors more truly represent the spirit of the Italian people than do the painters who were their contemporaries, excepting only Giotto, who was more in sympathy with the joy-in-life of the classic time as opposed to the ascetic spirit that was attempted to be forced upon his countrymen by the so-called Christian spirit of the time. Giotto and Nicola Pisano, Giovanni Pisano, and Andrea Pisano (what three splendid stars in the little city's crown!) were the real beginners of the renaissance in art, and they wrote the beauty of holiness all over and about the churches of Italy in place of the gloom and terror with which Eastern Christianity would fain have filled them. The influence of these artists continued very late; and when Ghiberti in the year 1402 began his first gate for the Baptistery of Florence, we find him following closely the spirit and the arrangement of the gate which Andrea Pisano had made in 1330 from designs attributed to Giotto. By the time that Ghiberti was ready to begin the second gate, however, there had been such a change produced in the spirit of the time, and classicism had gained such a mastery, that the next period in the history of Italian sculpture takes a new departure, and looks back to Ghiberti and Donatello as its founders. Giotto and the Pisani are old-fashioned, antique, and the new men both in painting and in sculpture turned their backs frankly on the Galilean, and with Plato adored the dwellers on Olympus. The greatest sculptor of the new time was Michael Angelo (1474–1564), who produced but little, but of that little some part was worthy to stand beside the greatest of man's creating. The statues of the chapel of the Medici, the *Captives* of the Louvre, the *David*, the *Moses*, and the *Madonna* of Bruges make an inheritance such as no one other man ever left to the world. Other sculptors of this late time are Andrea Verrocchio (1432–88), Benvenuto Cellini (who, however, was hardly a sculptor in the true sense), Sansovino, and Luca della Robbia. But the works of these men (excepting Verrocchio), who belong to the times immediately preceding Michael Angelo, were the works of a decline that went forward with such rapidity that the art of sculpture in Italy expired at the end of the sixteenth century, along with her sister art of painting. Bernini (1598–1680), Algardi (1583–1654), and Canova (1747–1822) each in his turn attempted to restore life to the dead, but neither of these had skill to accomplish more than a galvanic resuscitation. Bernini is now laughed at by the Italians, who once adored him, and Canova is no more a name to charm by. Bernini was all sound and fury, signifying absolutely nothing. Canova was theatrical, affected, and vapid, but he had at times more refinement and sentiment (though both of an invalid sort) than had been seen for a long time; and he not only took the fancy of the French, Italians, Germans, and English, but had a great influence, and a most unhappy one, on modern sculpture. Thorwaldsen, a man of independent genius, was shorn of much of his strength by his admiration of Canova, and the modern Italians and the Englishmen of the last age are all followers or imitators of the same sculptor. Canova's principal works are the *Boxers*, the *Perseus*, the *Cupid and Psyche*, the *Graces*. Besides forming Thorwaldsen, he also influenced Bartolini, Dupré, Vela, and a number of lesser men, whose productions seem to condemn Italy to a mediocrity in art the more displeasing because her past has been so interesting.

Contemporary with the new birth of art in Italy was the growth of the art of sculpture in the countries N. of the Alps, where, but chiefly in France, the building of cathedrals and churches, many of them among the most important of man's feats in architecture, gave an opportunity

for sculpture such as has never been enjoyed before anywhere out of India. So much of the religion that made its shrines in these cathedrals came from the East, so much of the ornamentation of its architecture, with all its sacred symbolism, had that origin, one may almost be excused for conjecturing that the East, too, gave the notion of covering with statues the front of these mountains of stone and lining the mouths of the cavern doorways that gave admission to them. Certainly, only Egypt and India show the like; and though in the beginning the ideals of the sculptor have been formed on reminiscences of late Roman work, such as has been left by them in the provinces they once ruled, yet soon an independent spirit was manifest, and the so-called Gothic sculpture showed itself a new thing on the face of the earth, the first untaught, unfettered school of workers that had appeared since the old Greek days. The French sculptors of the thirteenth and fourteenth centuries were freer even than the Italians of the same date from classic influence, and succeeded better than they in creating an original school. Besides, their work was far greater in bulk, and, explored and studied as it has been by scholars and lovers, is only as yet known in part. Nor was its merit ever fully analyzed and done justice to until the appearance in 1866 of vol. viii. of Viollet-le-Duc's *Dictionary of Architecture*, where, under the head of "Sculpture," we have an exhaustive treatise on the subject of the mediæval sculptures in France, accompanied by illustrations. The Gothic architecture began, as is now known, in France—where even in its decline it was lovelier than it was anywhere else in its perfection—and from thence it spread westward into England, eastward into Germany, and southward into Spain. In each of these countries—but notably in England—it produced much exquisite sculpture, but the greater part of it has perished in these three countries, and even in France comparatively little remains. In Germany, in the fifteenth century, some interesting works were executed in stone and metal, chiefly by artists of Nuremberg: the tomb of St. Sebald, the masterpiece of Peter Vischer, the *Beautiful Fountain* with its statues by Schönhofer, the *Sacrament-house* of Adam Kraft, are works of a peculiar character, in which the art is more curious than beautiful, and which, in spite of the romantic interest that has gathered about them, as about almost everything connected with Albert Dürer's city, yet must, we fear, be admitted to belong to a period of decline.

If the history of sculpture were being written here, or only a sketch of it even had been attempted, it would have been necessary to follow in detail the list of sculptors in each country from the time of the Renaissance down to our own day. It would have been obligatory on us to show how sculpture, having remained dormant in England for over two centuries, at last, after some feeble effort at revival, did, as it were, smile in her sleep when John Flaxman came. There was hardly power enough in him, however, sweet as his spirit was, to rouse her to full life, and what he could not do was surely not to be done by Banks or Nollekens, or even in our own day by Gibson, by Westmacott, by Foley, or by McDowell. The art of sculpture in England has never mounted so high as Canova or Thorwaldsen, and from end to end of England not one masterpiece of statuary exists created by English hands.

In France things have been better; and indeed France is the only country where the spirit of the Renaissance survived in art. John of Bologna, born at Douai in the fifteenth century, left the greater part of his work in Italy —all the world knows his *Mercury*—but other Frenchmen dowered their own country. Jean Goujon (1530–72), Jean Cousin, and Germain Pilon, his contemporaries, gave an accent to French sculpture which they themselves learned from Italian art, and which Benvenuto Cellini himself had perhaps done much to teach them. These artists and their pupils and followers found employment in the decoration of the châteaux and palaces which in their time were rising all over France, and in the erection of sculptured architectural tombs—a fashion directly borrowed from Italy—over kings, warriors, and princes. They were followed after a long interval by men who made statues only, without reference to where they are to be placed—a practice which has since their day become universal. In the seventeenth century we have Puget, Coysevox, Girardon, the brothers Coustou, whose work is their own, alike in its defects and its excellences, but it never rises to the highest level nor gives any essential reason for being. In fact, it would seem that this age had nothing to say that it thought worth the saying, for all its utterances in art and literature are those of one who talks for talk's sake. Later in the eighteenth century we have the name of Houdon, whose statues of Voltaire and Washington, with his busts of Molière and Rousseau, have given him immortality as a portrayer of character. The *Voltaire* is indisputably one of the finest and most original of modern works. Another famous name is that of Rude, the author of the bas-relief on the Arch of Triumph, *The Departure;* and Barye, the sculptor of animals, just dead, made himself the greatest fame that has yet been achieved in that field. France has shown distinguished activity in the art of sculpture, and a multitude of clever works have been produced by her artists; but sculpture lives only by architecture and by monumental works, and without them dwindles down inevitably into the pretty, the temporary, the merely ornamental.

The history in Germany has been the same as in France, except that Germany never had so much life nor such fulness of life in her artistic world as were in France, and her list of great men, as well as of little-great men, is thin and poor compared with that of her western neighbor. Rauch and Rietschel are distinguished names, but their work has only superior science and skill to mark it as standing at all above that of the hundreds of craftsmen that in Germany, as all over Europe and in America, mould clay, chip marble, and melt bronze in obedience to what may be called the demands of trade.

In America it has been little better, but it is fair to say that outside of France no country has produced more respectable work in sculpture than our own within the short period of her national existence, leaving out of consideration the names of Canova, Thorwaldsen, and Flaxman. These were not men of genius, and America has produced no man of genius in sculpture; but the talent of these three, and their industry, aided by the wealth of their clients and their large employment, climbed higher than that of our best men has been able to climb. It may be doubted whether we shall accomplish much more in sculpture in our next hundred years than we have done in the first, for it is no longer the custom to call upon sculpture to fill out the shortcomings or add to the beauties of architecture, and the spare commissions of governments, with the uncertain employment of private persons, make it difficult for the sculptor to find a field of work. Yet with all these obstacles we have yet at the end of fifty years—for it is about fifty years since the first statue was cut in marble by an American—produced a few names that deserve not to be wholly forgotten. Horatio Greenough, Hiram Powers, Thomas Crawford, Henry Brown, Erastus Palmer, Thomas Ball, Quincy Ward,—these are the names of men who, though they cannot take any very high place among the illustrious artists of the world, yet have labored faithfully to show their love of art, and deserve at least the honor of having made a solid platform on which future artists can build more shining works. CLARENCE COOK.

**Scup.** See PORGY.

**Scuppaug.** See PORGY.

**Scup'pernong,** tp., Tyrrell co., N. C. P. 1121.

**Scur'vy** [Lat. *scorbutus*, a hybrid word from a Scandinavian root, *scorb*, and the Latin termination *-utus*], a diseased blood-state, induced chiefly by prolonged privation of fresh vegetable and animal food. Although not exclusively a sailor's malady, its ravages have been most disastrous at sea, devastating, previous to this century, the navies and merchant marine of all nations. Pizarro's squadron included 2700 men, of whom but 100 survived. Ships were often lost adrift at sea, the crew unable to work and perishing. Anson's English fleet in 1742 in nine months lost 626 out of 961 men. The chief cause of this pest of the marine was the exclusive diet—salt meat and hard, dry bread, with impure and deficient drinking-water—upon which sailors subsisted during prolonged voyages. Exposure to cold or to tropical heat, fatigue, and the unsanitary and foul condition of ships contributed to the development of scurvy. As early as 1617, Wodall recorded the virtues of lemon-juice in curing this disease, and in isolated cases its use and a vegetable diet saved the crews so treated. But not until the latter half of the eighteenth century were improved ship hygiene and vegetable diet at sea enforced. Thus, only thirty years after Anson's fearful loss, Capt. Cook sailed on a three years' voyage around the world, losing but one man by disease. Parry in three polar expeditions of a year and a half and two years' duration lost only 7 men out of 334. To-day, scurvy is almost unknown at sea, but it occurs occasionally on land, in garrisons and prisons, and in communities suffering from starvation. All of the symptoms of scurvy are directly connected with the impoverished, impure state of the blood. The fibrine of the blood is less and its coagulability decreased; the salts of soda are lessened, the red corpuscles are dark, poorly oxygenated, and tend to disintegrate. All parts of the body are correspondingly ill nourished. The face is cachectic and sunken, the body emaciated, the limbs are feeble and seem unduly heavy. The gums become dark, bloody, relaxed, and spongy. There is an early tendency for the vitiated blood to escape from its vessels—an occurrence favored

both by its thinned consistency and by the changed nutrition of the capillary walls. At first, mulberry-colored, purple spots of variable size appear on the legs, later on the body—a mere transudation of serum and blood-pigment in solution beneath the epidermis. Later, larger purple spots or diffused patches appear upon a tough, indurated, leathery base, due to effusion of blood in quantity beneath the true skin or between superficial muscles, infiltrating and coagulating in the minute interspaces of the connective tissue. Such patches are painful to touch; they may become the site of bloody blebs or of ulcers. Bloody serum often transudes into the pleural cavities, embarrassing the respiration; also into the pericardium, peritoneum, and the cavities of the joints. "Bloody flux," or dysentery, is frequent; also vomiting of blood and nose-bleed. Death occurs from exhaustion. Critical cases may rapidly change for the better, and mild cases quickly recover, when put upon supporting and vegetable diet. Onions, cabbage, radishes, horse-radish, "scurvy-grass" or spoon-wort, water-cresses—the entire class of the Cruciferæ—are especially efficacious; all the vegetable acids, lemons, limes, oranges, cherries, currants, apples, are valuable. Sauerkraut is extolled by the Germans, combining vegetable food and acids. Animal broths, tonics, and regimen are essential adjuvants to this treatment. Modern improvements in sailing ships and the use of steam at sea, by shortening voyages, have tended to lessen sickness among sailors. The improved hygiene of ships, the supply of fresh meat and vegetables prescribed by law for sailors, and the modern methods of keeping such articles hermetically sealed for long voyages, have rendered scurvy an unknown disease.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Scur'vy-Grass,** the *Cochlearia officinalis*, a cruciferous plant abundant upon many sea-shores (but not on those of the U. S.), and also found on mountain-ranges, and sometimes cultivated as a salad-plant. It has the pungent qualities of horse-radish, and is of importance as an antiscorbutic. It is often gathered and eaten by mariners, especially during the prevalence of scurvy. The scurvy-grass occasionally cultivated for salad in the U. S. is mostly *Barbarea præcox*, the Belle Isle cress, a European cruciferous plant sparingly naturalized in the U. S.

**Scu'tari.** (1) [Turk. *Iskudar;* Gr. *Chrysopolis*], the largest of the suburbs of Constantinople, with a pop. of more than 60,000, on the Asiatic side of the Bosphorus, opposite the Golden Horn. It is built on seven low hills, has a palace, barracks, military hospital, 8 mosques, a convent of howling dervishes, and immense cemeteries covering more ground than the city itself. Turks dying on the European side of the Bosphorus prefer to be brought over to the Asiatic side for burial. Florence Nightingale had her hospital here during the Crimean war, and some 8000 nameless dead are now lying in the English cemetery, surrounding an ugly granite obelisk by Baron Marochetti. On a plain near by the persecuting emperor Licinius was vanquished by Constantine Sept. 18, 323.—(2) [Turk. *Iskenderieh;* Gr. *Scodra*], in Albania, European Turkey, lat. 43°, near the S. extremity of a lake of the same name 20 miles in length. The city is 17 miles from the Adriatic, has considerable trade, and a pop. of about 30,000, one-third of whom are Latin Christians, and the rest Mohammedans.—(3) (written also *Skutari*), a village in Southern Greece, near Cape Matapan, on a steep hill overlooking the sea, over against the island of Cerigo. R. D. Hitchcock.

**Scutibranchia'ta** [Lat. *scutum*, "shield," and *branchia*, "gill"], an order of gasteropod mollusks, proposed by Cuvier for those forms in which the branchiæ are plumose or pectinated, and with the entire body covered by a shell, which is widely open and shield-like; whence the name. In it were included by Cuvier the genera *Haliotus*, *Fissurella*, *Emarginula*, and *Parmophorus*. By Gray the same name was employed for a so-called order characterized by "gills consisting of two series of lamellæ, forming one or two series over or under the edge of the mantle round the foot. Animal hermaphrodite, self-impregnating (?). Shell spiral or symmetrical conical. Rectum often traversing the heart." As thus extended, it included, in addition to the forms referred to it by Cuvier, the Neritidæ, Trochidæ, and related forms, as well as the Dentaliadæ, Patellidæ and allies, and Chitonidæ; and thus was a most heterogeneous mixture. The name has not been adopted by recent authors, the forms referred to it by Cuvier being, with the Trochidæ and kindred types, combined under the ordinal name Rhipidoglossa. Theodore Gill.

**Scylla.** See Scilla.

**Scylla and Charybdis.** See Scilla and Charybdis.

**Scylli'idæ** [from Lat. *Scyllium;* Gr. σκύλλειν, to "tear"], a family of sharks (order Squali) distinguished by the position of their dorsal fins and their laying eggs like those of the rays. The body is more elongated than in the sharks generally; the scales developed as fine shagreen; the head depressed and oval; the nostrils with large flaps; the mouth inferior and arched; the teeth small (several series being in use at the same time), compressed, and cuspidate; branchial apertures five, the posterior of which are above the pectorals; spiracles behind the eyes well developed; dorsal fins two, the anterior above or behind the ventrals; anal fin present, variable in position; caudal fin extended toward the end of the tail, and with the lower lobe little produced downward at its front margin; pectorals moderately developed and with rounded angles. The family, as thus defined, embraces the genera *Scyllium*, *Pristiurus*, *Stegostoma*, *Parascyllium*, *Chiloscyllium*, and related ones. They are inhabitants entirely of the seas of the Old World and Australia, none being found in American waters. They are among the few sharks which lay eggs invested in parchment-like cases, like those of the rays. Theodore Gill.

**Scym'nidæ** [Lat. *Scymnus*, the generic name of one of the species], a family of the order Squali, including sharks distinguished by the combined characters of absence of the anal fins and unarmed dorsals. The form is that common to most of the sharks; the scales are generally developed in the form of shagreen or fine bristly spines; the head is oval and depressed; the eyes are destitute of nictitating membranes; the nostrils have each a simple anterior tag; the mouth is inferior and a little arched; the teeth have trenchant edges, but otherwise differ in form; branchial apertures five, and all in advance of the pectorals; dorsals two, unarmed, the first in advance of the ventrals, the second far behind; anal wanting; pectorals rather small; ventrals very far behind. The family, as generally understood, embraces the genera *Scymnus*, of the Mediterranean and neighboring Atlantic; *Somniosus*, of the northern seas and Mediterranean; *Euprotomicrus*, of the Indian Ocean; *Isistius*, of the tropical seas; and *Echinorhinus*, of the Mediterranean and eastern coast of the Atlantic. Both *Somniosus* and *Echinorhinus*, however, are by some regarded as the types of distinct families.

Theodore Gill.

**Scyphoph'ori** [Gr. σκύφος a "bowl," and φέρω, to "bear"], an order of fishes established by Prof. Cope, and distinguished by the following characters: The skeleton is completely ossified; the basis cranii simple; the parietals narrow, and distinct from each other as well as the supra-occipital; the pterygoid is very peculiar, being enlarged and funnel-shaped, and excavated by a bowl-like chamber (whence the name), which expands laterally and is covered by a lid-like bone; no symplectic exists; the jaws are well developed, but the intermaxillaries coalesce, at least in the old, into a single bone, and the maxillaries are lateral; opercular apparatus complete, but with the interoperculum and suboperculum reduced in size; scapular arch with the several coracoid elements represented; the brain has over the cerebellum a peculiar plicated organ; the air-bladder is simple, and communicates by a duct with the intestinal canal. The order is related to the more generalized form of Teleocephali, as well as to the Nematognathi. It is represented by but two known families, both of which are peculiar to the rivers of Africa; these are the Mormyridæ (which see) and Gymnarchidæ.

Theodore Gill.

**Scyros.** See Skyros.

**Scythe** [Ang.-Sax. *sîdhe*], a long sharp cutting instrument used in harvesting grass. It is curved, and its concave edge is sharp. It is attached, for use, to a curved handle, called a snath. Shorter and stronger scythes are used for cutting bushes, etc. The introduction of mowing-machines has to a great extent superseded the use of scythes in haymaking, but on grounds where the mowing-machine cannot be employed scythes are still indispensable.

**Scyth'ia,** the ancient name for the vast regions which extend N., E., and S. of the Caspian Sea and the Sea of Aral. It was not so much used as a geographical term, for the boundaries of these regions were entirely undefined; it was rather a general term by which the Romans denoted a swarm of savage tribes living here, but of whom they knew very little.

**Scythop'olis,** the *Beth-shean* of Josh. xvii. 11, the *Beth-shan* of 1 Sam. xxxi. 10, now called *Beisan*, the most important city of the ancient Decapolis, and the only one W. of the Jordan, about 4 miles from the river, and nearly 14 miles S. of the Sea of Galilee. It was nearly as well watered as Damascus, four perennial streams running through it. It was a place of great strength, its acropolis rising 300 feet above the plain. The ruins, which are 3 miles in circuit, surpass all others in Western Palestine. Its classic name, *Scythopolis*, is of disputed derivation. The modern village, of some 50 houses, contains a colony of Egyptians brought here by Ibrahim Pasha in 1848.

R. D. Hitchcock.

**Sea.** See Ocean, by Prof. Arnold Guyot, LL.D.

**Sea and River Defences.** See Breakwater, Dyke, Embankment, Foundation, Haarlem Lake, Harbor, Harbors of American Lakes, Inundations (Maritime), Inundations and Floods of Rivers, Jetty, and Levees.

**Sea-Anemone.** See Actinia and Polyps.

**Sea-Bear.** See Otariidæ.

**Sea'board,** p.-v. and tp., Northampton co., N. C., on Seaboard and Roanoke R. R. P. 1576.

**Seaboard,** tp., Princess Anne co., Va. P. 3053.

**Sea'brook,** p.-v. and tp., Rockingham co., N. H., on Atlantic Ocean and on Eastern R. R. P. 1609.

**Sea'bury** (Samuel), D. D., b. at Groton, Conn., Nov. 30, 1729; graduated at Yale College 1748; studied medicine and theology in Scotland; was ordained in the Church of England at London 1753; was pastor of churches at New Brunswick, N. J., at Jamaica, L. I., 1756–66, and at Westchester 1766–75; was imprisoned at New Haven as the supposed author of some Tory pamphlets, but soon released; resided in New York City during most of the Revolutionary war; was at one time chaplain of a loyalist regiment; went to England 1784; was consecrated bishop of Connecticut by three Scottish prelates at Aberdeen Nov. 14, 1784, being the first American bishop of the Protestant Episcopal Church; took part in revising the Prayer Book and framing a constitution for the American Church 1789; published 2 vols. of sermons (1791) and a number of single sermons; exercised the duties of his episcopal office at New London, Conn., until his death at that place Feb. 25, 1796. A posthumous volume of *Sermons* was published 1798.

**Seabury** (Samuel), D. D., grandson of Bishop Seabury, b. at New London, Conn., June 9, 1801; was ordained in the Protestant Episcopal Church 1826; was for several years a missionary at Huntington, Oyster Bay, and Hallett's Cove (now Astoria), L. I.; was editor of the *Churchman* at New York 1831–49; rector of the church of the Annunciation 1838–68, and professor of biblical learning in the General Theological Seminary from June, 1862, to his death at New York Oct. 10, 1872. Author of *The Continuity of the Church of England in the Sixteenth Century* (1853), *Discourses on the Supremacy and Obligation of Conscience* (1860), *American Slavery Justified* (1861), *Theory and Use of the Church Calendar* (1872), and a posthumous volume of *Discourses on the Holy Spirit* (1874), edited by his son.

**Seabury Divinity School.** This is the property of the Bishop Seabury Mission, and is an institution of the Protestant Episcopal Church, founded in 1860, which contains (1876) 5 professors and 25 students. It has sent forth some 35 clergymen. Its buildings are of stone and very substantial, situated on a beautiful domain of 30 acres in the city of Faribault, Minn., and will with a little outlay accommodate 50 students. In its three years' course of study every department of theological education usual in America is provided for. It has a preparatory department, with a two years' course, to fit for theological study young men not college graduates, served by 2 tutors. The institution is not yet endowed, but is supported by voluntary contributions. Its president is Rt. Rev. H. B. Whipple, D. D. R. W. Lowrie.

**Sea-Cat.** See Chimæra.

**Sea, Collisions at.** See Road, Law of the.

**Sea-Cow.** See Manatee.

**Sea-Cucumber.** See Holothurians.

**Sea-Devil.** See Angler.

**Sea-Duck.** See Scoter.

**Sea-Eagle.** See Erne.

**Sea-Egg,** the sea-urchin. See Echinus.

**Sea-Elephant.** See Elephant Seal and Phocidæ.

**Sea-Fan.** See Gorgonia.

**Sea Fisheries.** See Fisheries, by Pres. T. D. Woolsey, S. T. D., LL.D.; Fisheries, by Prof. T. Gill, A. M., M. D., Ph. D., M. N. A. S.; and Fishery, Law of, by Prof. George Chase.

**Sea'ford,** p.-v. and tp., Sussex co., Del., on Dorchester and Delaware and Delaware R. Rs., 60 miles from Chesapeake Bay, contains 4 churches, 4 schools, 1 bank, a shipyard, 1 newspaper, several planing-mills, 2 hotels, and 10 oyster-houses. Principal business, oyster-packing. P. of v. 1304; of tp. 2699. J. F. Pennington, Ed. "Citizen."

**Sea'forth,** p.-v., Huron tp., Ont., Canada, on Buffalo and Goderich Railway, 21 miles S. E. of Goderich. It ships annually 1,000,000 bushels of grain, and is underlaid with a stratum of pure rock-salt over 100 feet thick at a depth of 1100 feet. It has productive salt wells, active manfactures, and 1 weekly paper. P. 1368.

**Sea-Fox.** See Fox Shark.

**Sea'ham Harbor,** town of England, co. of Durham, on the North Sea, has a good harbor, from which large quantities of coal are exported. P. 6180.

**Sea-Hog.** See Porpoise.

**Sea-Horse.** See Hippocampus.

**Sea-Kale,** the *Crambe maritima*, a perennial cruciferous herb, a native of European sea-coasts, much cultivated in England as a potherb. It requires a generous soil, and its large leaves and sprouts are unfit for eating until blanched.

**Seal** [Lat. *sigillum*], a means of legally executing or authenticating certain written instruments, and consisting of an impression made upon a piece of wax or other tenacious substance, such as a wafer, adhering to the paper or parchment on which the writing is engrossed. The term is also applied to the instrument itself by which such impression is made, and the common-law doctrines in relation to the effect of sealing arose from the ancient practice, once universal, of using private seals with heraldic devices thereon, instead of written signatures, in the execution of deeds. To constitute a valid seal at the common law, as above defined, there must be a tenacious substance adhering to the paper or parchment, and an impression upon it; an impression made in the material of the paper itself would not suffice. This requirement has been so far modified by statute in New York that the seals of public officers and of corporations may be stamped into the paper, but for all transactions between private persons in that State and in the New England States the seal must conform to the ancient rule of the English law. In most if not all the other States a flourish with the pen, often called a scroll, placed after the signature, answers all the purposes of a seal in private documents. The common law attributed a very high but most arbitrary and technical efficacy to the seal upon instruments of a private nature. Its presence was essential to a valid conveyance of a freehold estate in land; it distinguished a most important class of contracts; and it raised a conclusive presumption of a valuable consideration. This latter rule has been generally modified by modern statutes, which permit the presumption to be overcome by proof. The public or great seals of all independent nations, like their flags, are universally recognized by the governments and tribunals of other civilized countries, so that records, statutes, and the like authenticated by their means are everywhere accepted as correct transcripts. The seals of notaries-public are also regarded as proving themselves, especially throughout the European states. The seals of superior courts and of many administrative officers possess the same attributes within the territorial jurisdiction of the countries to which they belong, but the like authority is not extended to them within the limits of other states or nations unless it is conferred by special statute from considerations of convenience or of comity. John N. Pomeroy.

**Seal** [Ang.-Sax. *seol*], a name given to representatives of the order or sub-order Pinnipeds, the species of Phocidæ being distinguished as true or hair seals, and those of Otariidæ as fur seals, sea-lions, etc. (See Otariidæ and Phocidæ.)

**Seal,** tp., Pike co., O. P. 1451.

**Seal Engraving.** See Gem, by C. G. Leland, A. M.

**Seale's Station,** p.-v., cap. of Russell co., Ala., on Mobile and Girard R. R.

**Seal Fisheries.** See Furs and the Fur-Trade, by L. P. Brockett, A. M., M. D.; Fur Seal and Otariidæ, by Prof. T. Gill, A. M., M. D., Ph. D., M. N. A. S.

**Sealing-Wax.** See Lac, by Prof. C. F. Chandler, Ph. D., M. D., LL.D., M. N. A. S.

**Sea-Lion.** See Otariidæ.

**Seal Islands.** See Lobos Islands.

**Sealkote',** town of British India, in the Punjaub, in lat. 32° 29′ N., near the left bank of the Chenaub. It is a military station, and has manufactories of paper. P. 19,249.

**Seals'field** (Charles), the assumed name of Karl Postel, b. at Poppitz, Moravia, Germany, Mar. 3, 1793; became secretary to a religious order at Prague, but escaped from the convent 1822, and came to America under his assumed name, which he preserved through life with such care that his real name and place of birth were not known until after his decease. His first occupation in the U. S. seems to have been that of assistant editor of the *Courrier des Etats-Unis* at New York. In 1828 he was in Mexico; proceeded thence to New Orleans and to Philadelphia, where he published his first known work, a novel in English, entitled *Tokeah, or The White Rose*. About 1830 he was in

London and Paris, connected with journalism, and in 1832 became a resident of Soleure, Switzerland, which was thenceforth his chief home, though he spent a number of years in the U. S., where he became a citizen. D. at Soleure May 26, 1864. Author of *Transatlantic Travelling Sketches* (1833), *The Cabin Book, or Sketches of Life in Texas, Rambleton, North and South, Flirtation in America, Life in the New World, Scenes and Adventures in Central America, Pictures of Life in both Hemispheres, The Viceroy and the Aristocracy* (a novel of Mexican life, considered his best work), and *Morton, or the Grand Tour* (1846). A monument to his memory was erected at Poppitz in 1875.

**Sea'man** [Ang.-Sax. *sæmann*], a sailor. In law, any person whose employment is necessary or whose service is useful in the navigation of a vessel. The U. S. statutes provide for the appointment, by the several circuit courts, of shipping commissioners for ports of entry and of ocean navigation, whose general duties are to facilitate and superintend the engagement and discharge of seamen, and to arbitrate in questions arising between a seaman and the master or owner of a vessel; and at any port for which no commissioner has been appointed the duties of a shipping commissioner are imposed upon the collector of customs. Under pain of the penalties provided, the master of every foreign-bound vessel, other than vessels trading between the U. S. and British North America, the West India islands, or Mexico, or of any vessel of seventy-five tons burden or upward bound from an Atlantic to a Pacific port, or *vice versâ*, must execute before a shipping commissioner an agreement with each seaman of his crew. The articles of agreement must state, as far as practicable, the nature and duration and the port of termination of the voyage, the number and description of crew and their respective employments, the amount of wages each seaman is to receive, the capacity in which he is to serve, and the time he is to begin work on board, a scale of provisions to be furnished, regulations as to conduct and as to fines, short allowance of provisions, or other lawful punishments for misconduct, and any stipulations as to advance or allotment of wages. This provision of law does not apply to masters of vessels where the seamen are by custom or agreement entitled to participate in the profits of the voyage, nor to masters of coastwise or lake-going vessels that touch at foreign ports. Shipping articles for vessels in the coasting-trade of fifty tons burden and upward are more simple in form, and are not executed before a commissioner. In foreign ports the shipping of seamen takes place before a consular officer or commercial agent, who has for this and like purposes the powers of a shipping commissioner.

A seaman's right to wages and provisions accrues at the time he begins work, or on the date specified in the shipping articles for the beginning of work, whichever first happens; but he is not entitled to wages for any period during which he unlawfully refuses or neglects to work when required after the date agreed upon, nor for any period during which he is lawfully imprisoned for any offence. In case of loss of vessel, wages are due only to the date of such loss, but proof that any seaman has not exerted himself to the utmost to save the vessel, cargo, and stores will bar his claim. Wages become a lien upon the ship and freight, and upon the proceeds of them, in the nature of a preferred claim over bonds of bottomry or respondentia; but the right to wages is not dependent upon the earning of freight; and where freight might have been earned seamen have a right of action against the master or owner *in personam*. A proceeding against the ship *in rem* for wages does not abridge the right of action against the owner or master. A seaman cannot forfeit by agreement his lien upon the ship, nor be deprived of any remedy for the recovery of wages, except by agreement for allotment or advance. A stipulation to abandon the right to wages in case of loss of ship, or any right in the nature of salvage, is wholly inoperative; and any assignment other than advance or allotment made prior to the accruing of wages or salvage is equally void. Wages cannot be insured by seamen, nor are they subject to attachment in the courts. Seamen may forfeit their wages, either wholly or in part, by any of the following offences, viz.: desertion, absence without leave, neglecting and refusing without reasonable cause to join the vessel, wilful disobedience or continued wilful neglect of duty, wilfully damaging the vessel, or embezzling or wilfully damaging any of the stores or cargo, and by any act of smuggling whereby loss or damage is occasioned to the master or owner. But upon the commission of an offence for which it is intended to prosecute or enforce a forfeiture, an entry of the offence must be made in the official log-book and signed by the master and by the mate or one of the crew, and the reply of the offender, if still in the vessel, must likewise be entered and signed; which entries must be produced or proved in any subsequent legal proceedings.

The statutes further particularly enjoin the duties and guard the rights and interests of seamen. Provision is made for an examination of a vessel upon complaint of the first mate and a majority of the crew that the vessel is unseaworthy; but if such complaint is without foundation or sufficient cause, the expenses of examination and reasonable damages for detention become a charge against the wages of the complaining seamen. A proper supply of medicines and provisions is made obligatory upon the master or owner; and regulations prescribe the issue of provisions and compensation to the seamen when placed on short allowance without reasonable cause. The master must enter into bond, with security, for the return of the crew to the U. S., and seamen are carefully protected from impressment or detention. It is made the duty of consuls to provide subsistence and a passage to a port in the U. S. for destitute American seamen, and a fund for this purpose is drawn from the extra wages of seamen paid upon their discharge in foreign ports. Marine hospitals are established and maintained by collection from the wages of seamen at the rate of forty cents a month. In case of discharge improperly or prior to the termination of the engagement, except on account of wreck or condemnation of vessel, a payment to the seaman of extra wages is required. Seamen must submit to the usual punishments, lawful and as agreed upon in the shipping articles, but they have a remedy for any cruel or unusual treatment. Flogging is abolished by special enactment of law.

(For a full exposition of the rights and duties of seamen see Parsons's *Maritime Law*, Kent's *Commentaries* (vol. iii.), and the *Revised Statutes of the U. S.*)

P. F. Harrington.

**Sea-Mouse,** a popular name for annelids of the genus *Aphrodite* (family Aphroditidæ), dorsibranchiate and setigerous marine organisms, remarkable for the beautiful and ever-changing prismatic colors produced by the transparent hairs of the animal. Respiration is performed by means of gills concealed beneath the scales of the back, and the water employed in respiration is filtered by means of a felt-like covering.

**Sea-Nettle.** See Acalephæ.

**Sea-Otter.** See Otter.

**Sea-Parrot.** See Auk.

**Sea-Pie.** See Oyster-Catcher.

**Sea'po,** p.-v., Grant tp., Republic co., Kan.

**Sea-Porcupine.** See Diodon and Plectognathi.

**Sea-Raven.** See Sculpin.

**Search.** See International Law, Summary, by Pres. T. D. Woolsey, S. T. D., LL.D.

**Search'-Warrant,** a warrant issued by a duly-authorized magistrate, requiring the officer to whom it is directed to search a particular house or other place therein specified for the purpose of discovering (if possible) certain personal property alleged to have been stolen and to be secreted therein, and, if the same shall be found by such search, to bring the goods, together with the body of the person occupying the place (who must be named in the warrant), before the magistrate issuing it or before some other proper magistrate. The U. S. Constitution declares (Amendment IV.) that "the right of the people to be secure in their persons, houses, papers, and effects against unreasonable searches and seizures shall not be violated; and no warrants shall issue but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched and the persons or things to be seized." A provision either exactly or substantially the same is found very generally in the State constitutions. A practice had existed in England of issuing "general warrants" on behalf of the government in political prosecutions—especially in those for libel or sedition—which were granted on mere suspicion, contained no specifications either of persons, places, or things, and directed the officers to search any house, to break open any receptacle, and to seize and carry away any and all papers and property. These species of warrants were finally pronounced utterly illegal by the higher courts in a series of memorable decisions rendered about the middle of the eighteenth century. The recollection of this judicial controversy between the antagonistic principles of civil liberty and of arbitrary government was fresh in the minds of those who proposed the original amendment to the U. S. Constitution, and the provision quoted above was plainly aimed at all "general warrants," while it permits those which are specific in their nature, and which are often indispensable instruments for the detection of crime and for the due administration of justice. In pursuance of this requirement, contained in the organic law of a State, the complainant who applies for a search-warrant must make a statement, under oath, of the facts which show that a crime has been committed, and that goods have been stolen or

otherwise feloniously taken and carried away, and of the reasons for suspecting that they are concealed in the place which he desires to be searched; and these reasons must be so cogent that they amount to a probable cause for supposing the suspicion to be well founded. The warrant itself must specify and particularly describe all the important features, so that they can be certainly identified—the house or other place to be searched, the person in whose occupancy, possession, or custody it is, and the articles of personal property which are the direct objects of the search; it must be directed to an officer, and not to a private person; and it must command the goods if found, and the person in whose custody they are found, to be brought before the magistrate. If the warrant is thus duly and regularly issued and executed, the complainant who in good faith procured it to be granted is not liable either civilly or criminally, although the property is not in fact secreted in the place directed to be searched, and the suspicion upon which the proceeding was based turns out to be unfounded. The officer who executes such a warrant is also protected by it, although the complainant himself might be liable through want of good faith. JOHN NORTON POMEROY.

**Sear'cy,** county of N. Arkansas, on Buffalo fork of White River, has a hilly surface largely covered with forest. Staples, Indian corn, cotton, tobacco, and swine. Cap. Marshall. Area in 1870, 850 sq. m. P. 5614. Stone co. has since been erected from the E. half.

**Searcy,** tp., Cross co., Ark. P. 1018.

**Searcy,** tp., Phillips co., Ark. P. 1375.

**Searcy,** p.-v., cap. of White co., Ark., on Little Red River, near Cairo and Fulton R. R., is a shipping-point for cotton, has sulphur springs, and 3 weekly newspapers. P. 874.

**Searle** (GEORGE W.), b. at Salem, Mass., Feb. 22, 1826; was admitted to the bar at Boston 1827; became law-critic to the Boston *Post;* wrote treatises on legal topics; contributed to professional and literary reviews, and has devoted much attention to questions of social economy, on which he has frequently lectured.

**Searle** (JAMES), b. in the city of New York in 1730; settled in Philadelphia about 1762, and was one of the signers of the memorable non-importation agreement of Oct. 25, 1765. By this agreement the merchants and other citizens of Philadelphia bound themselves not to order any more goods from Great Britain, and to sell no goods or merchandise on commission, until the Stamp Act should be repealed—one of the most practical and influential movements toward the Declaration of Independence. Aug. 19, 1778, he was elected by Congress a member of the navy board; Nov. 20, 1778, was elected a delegate in Congress from Pennsylvania. The journals of Congress show him to have been an active and prominent member of that body. He was chairman of the commercial committee, and a member of the marine committee and the committee on foreign affairs. In July, 1780, while still a delegate in Congress, he was appointed by the governor and council of Pennsylvania the agent of the State, with the rank of lieutenant-colonel, to negotiate a loan of £200,000 in Europe. He went immediately on his mission, and returned to Pennsylvania in 1782. Mr. Searle possessed a ready pen and a graceful flow of language, and was an ardent and true patriot. He is spoken of as "one of the greatest wits of the time." D. in Philadelphia Aug. 7, 1797, and is buried in St. Peter's churchyard. G. M. CONARROE.

**Sea-Robin.** See GURNARD.

**Sears,** tp., Sierra co., Cal. P. 758.

**Sears** (BARNAS), D. D., LL.D., b. at Sandisfield, Mass., Nov. 19, 1802; graduated at Brown University 1825, and at Newton Theological Seminary 1829; was pastor of a Baptist church at Hartford 1830–32; was afterward professor in the Literary and Theological Institute at Hamilton, N. Y. (now Madison University); studied theology at German universities 1833–36; was professor in Newton Seminary 1836–48, acting as president during the later years; succeeded Horace Mann as secretary of the Massachusetts board of education 1848–55; was president of Brown University 1855–67, and since that time has been general agent of the Peabody Educational Fund. He was several years editor of the Baptist *Christian Review* (1838 *seq.*), a regular contributor to the *Bibliotheca Sacra,* and author (with Edwards and Felton) of *Classical Studies* (1843), *The Ciceronian* (1844), and *The Life of Luther* (1850); edited Nöhden's *German Grammar* (1842), *Select Writings of Luther* (1846), and Roget's *Thesaurus* (1854), and published many addresses, educational reports, and miscellaneous essays.

**Sears** (EDMUND HAMILTON), D. D., b. at Sandisfield, Mass., in 1810; graduated at Union College 1834, and at Harvard Divinity School 1837; was pastor of a Unitarian church at Wayland, Mass., 1839–40, and at Lancaster 1840–47; was several years an editor of the *Monthly Religious Magazine,* and became in 1865 pastor of a church at Weston, Mass., where he d. Jan. 14, 1876. Author of *Regeneration* (1853; 9th ed. 1873), *Pictures of the Olden Time* (1857), *Christian Lyrics* (1860), *Athanasia* (1857), *The Fourth Gospel the Heart of Christ* (1872), and *Sermons and Songs of the Christian Life* (1875).

**Sears** (ISAAC), b. at Norwalk, Conn., in 1729; commanded a privateer which cruised against the French 1758–61; was shipwrecked in the latter year; engaged in the West India trade in New York; was the leader of the Sons of Liberty in New York after the passage of the Stamp Act; was an active patriot during the war of the Revolution; sat in the provincial congress and in the assembly of 1783. D. at Canton, China, Oct. 28, 1786.

**Sears** (ROBERT), b. at St. John, New Brunswick, June 28, 1810; became a publisher in New York City, and compiler of a series of illustrated works, which were among the first of the now well-known class of books sold exclusively by subscription. They reached a sale of above 500,000 copies. Among them were *Illustrations of the Bible, Family Bible, History of China and India, Scenes and Sketches of Continental Europe, Description of Great Britain and Ireland, Information for the People, History of the American Revolution,* and *The Wonders of the World* (2 vols.).

**Sears'borough,** p.-v., Sugar Creek, Poweshiek co., Ia., on Central R. R. of Iowa, has 1 weekly newspaper.

**Sears'burg,** p.-v. and tp., Bennington co., Vt. P. 235.

**Sears'mont,** p.-v. and tp., Waldo co., Me., on St. George River, 10 miles S. W. of Belfast and 30 miles S. E. of Augusta, was settled in 1804, incorporated in 1814, has excellent water power, utilized by a large number of mills, grist-mills, and a tannery, and has several churches and schools. P. 1418.

**Sears'port,** p.-v. and tp., Waldo co., Me., on Belfast Bay at the mouth of Penobscot River. P. 2282.

**Sea'-Serpent,** a marine animal said to have been seen often on the coast of Norway, especially in Moldefjord (Pontoppidan, *Natural History of Norway,* London, 1755; *Naturalist's Library,* vol. viii., Edinburgh, 1841), and also on the coasts of New England (*American Journal of Science,* vols. ii., xi., xii., xxviii.; *Report of the Committee of the Linnæan Society of New England,* Boston, 1817; Sir Charles Lyell, *Second Visit to the U. S.,* London, 1849), but which is nevertheless considered fabulous by most naturalists. In the ancient Scandinavian mythology one of the most conspicuous figures is the *Midgaardsormen,* a huge serpent which, hidden on the bottom of the sea, embraces the earth with its folds; and there can be no doubt that the extravagant descriptions which Norwegian peasants, who profess to have seen the sea-serpent, give of this animal are more or less influenced by the old mythological ideas of Midgaardsormen. That, however, which has contributed most to make naturalists suspicious with respect to the very existence of this marine animal is the circumstance that no remains of it have ever been found, and for a long time naturalists generally considered all reports of the appearance of the sea-serpent as the fabrications of superstition and delusion. But in his *Romance of Natural History* (London, 1860–62) Gosse has shown that the argument against the existence of the sea-serpent taken from the non-existence of any remains of it does not hold good, and naturalists are not disposed to deny the possibility that such an animal may exist, and may prove to be some modified type of the Secondary enaliosaurians or some form intermediate between them and the elongated cetaceans. (Agassiz, *Geological Researches,* 1871; *Proceedings of the Boston Society of Natural History,* vol. xvi., Mar., 1874.)

**Sea'-Sickness,** a nervous affection attended with nausea and convulsive vomiting, produced by the oscillations of a ship at sea. Its origin and nature are still very imperfectly known. It may attack the strong and cautious, while the debilitated and incautious go free. It may attack in calm weather and on smooth waters, while a storm and a rough sea fail to produce it. It may pass away after the lapse of a few hours, or last during a long voyage. Dr. Chapman (*On Sea-sickness, its Nature and Treatment,* London, 1864) explains it as an undue accumulation of blood in the nervous centres along the back, and especially in those segments of the spinal cord related to the stomach and the muscles concerned in vomiting, and recommends as the best remedy against it the application of ice-bags to the spinal column. In some persons its violence is prevented by small doses of opium or by soda-water, or saline draughts in the effervescent state.

**Sea'side Grape,** the *Coccoloba uvifera,* a small polygonaceous tree of Florida and the West Indies, producing the extract called Jamaica kino. (See KINO.) It has clusters

of purple edible fruit, and a beautiful hard wood, which yields a red dye.

**Sea-Slug.** See BÊCHE DE MER.

**Sea-Snipe.** See BELLOWS-FISH and SNIPE-FISH.

**Seasons.** See CLIMATE, by PROF. ARNOLD GUYOT, LL.D.

**Sea-Spider,** or **Spider-Crab.** See CRAB.

**Sea-Squirt.** See ASCIDIA.

**Sea'-Swallow,** a fish. (See GURNARD.)

**Sea'ton** (JOHN **Colborne**), BARON, b. at Lyndhurst, Hampshire, England, in 1779; educated at Christ's Hospital and at Winchester School; entered the British army 1794; served in Holland 1799, in Egypt 1801, afterward in Italy, Sicily, and Portugal; became military secretary to Gen. Fox and to Sir John Moore, whom he accompanied until his death at Corunna 1809, after which he joined the forces of Wellington, receiving command of a brigade, which was nearly annihilated at Albuera; distinguished himself at the assault of Ciudad Rodrigo, where he was wounded Jan. 8, 1812; at Vera, where he stormed the redoubts on the heights of the Pyrenees Oct. 7, 1813; at Nivelle, the Nive, Bidassoa, and Orthes; contributed to the victory at Waterloo 1815; became major-general 1825; was lieutenant-governor of Canada 1828–36; was made governor-general and commander-in-chief 1837; suppressed the "Patriot" rebellion 1837–38; was raised to the peerage and received a handsome pension and the rank of lieutenant-general 1838; was lord high commissioner of the Ionian Islands 1843–49; became general 1854, and field-marshal Apr. 1, 1860. D. at Torquay Apr. 17, 1863. A colossal statue of Lord Colborne was erected at Southampton 1866.

**Seaton** (WILLIAM WINSTON), b. in King William co., Va., Jan. 11, 1785; chiefly educated by private tutors; early acquired a knowledge of printing; edited a paper in Petersburg, Va., and also another in Halifax, N. C.; soon became connected with the *Register* in Raleigh; in 1812 went to Washington City, and joined his brother-in-law, Joseph Gales, in the management of the *National Intelligencer*, with which he was most honorably identified until his death in Washington June 16, 1866. He held a great many local offices in the Federal city; was frequently elected mayor; was a regent of the Smithsonian Institution, and in conjunction with Mr. Gales was one of the public printers for many years, and left a brilliant reputation for his merits as a man and his high character as an editor and statesman. A few years after his death a sketch of his life, with correspondence, was published by one of his daughters, Miss Josephine Seaton, and for a chapter of personal recollections the reader is referred to *Haphazard Personalities* by the present writer. CHARLES LANMAN.

**Seat'tle,** p.-v., cap. of King co., Wash. Ter., on Admiralty Inlet, near the mouth of Dwamish River, is the seat of the Territorial university, has 1 daily and 2 weekly newspapers, and an active trade in coal and lumber. P. 1107.

**Sea-Unicorn.** See NARWHAL.

**Sea-Urchin.** See ECHINUS.

**Sea'-Water, Chemistry of.** The ocean is constantly receiving, through rivers, solutions of substances leached out of the solid matter of the continents. These substances in solution pass into the body of the great ocean, and by oceanic currents must be more or less distributed throughout its mass, to yield up their water again by evaporation, which sends it back continually to the continental surfaces, to be again condensed, to sink, in part, into the rocks and soils again, and dissolve out again more of the soluble constituents of these. It would then seem, at first glance, as if the water of the great ocean should continually become a stronger and stronger solution of all the substances brought down by rivers, until it should reach the point of concentration possessed by such brines as those of the Dead Sea, the Great Salt Lake, and other similar basins. This result, however—which would surely come about upon a lifeless earth—is under the control, more or less, of the zoic influences that have possession of the oceanic depths. Particularly do those animals that secrete *lime* work continually to prevent the accumulation of this substance in the ocean, at the same time fulfilling another most weighty function. *Lime* is indeed a grand factor in a stupendous chemical process which is proceeding imperceptibly upon the surface of this globe, the existence and nature of which were first pointed out by the present writer to the American Association for the Advancement of Science in 1869. The waters which continually distill through the atmosphere from the vast surface of the ocean, and constantly condense upon, bedew, and bedrench the rocks of the continents, condense together with themselves at the same time a portion of the *carbonic acid* of the atmosphere. This decomposes the silicates, and especially the lime-silicates; and all the rivers are thus continually collecting and carrying down into the ocean, as carbonate of lime, the carbonic acid of the atmosphere, that sole feeder of life, the constituent which furnishes sustenance, directly or indirectly, to all living beings—directly to those of the vegetable, and indirectly to those of the animal kingdom. It is in the ocean, however, that the unceasing work is going on of building up masses of solid calcareous matter, such as we find forming continents and mountain-chains, by coral animals and mollusks. This calcareous matter, comprehending carbonic acid derived from the atmosphere, thus *locks up the latter, for all time* at least, if not for eternity. Hence, we arrive at the curious generalization, that by a slow but omnipotent law life upon the earth is surely destroying and absorbing its own essential pabulum, and thus that the race of man cannot hope to perpetuate itself for ever on this globe. The active agent in this chemical process, without which it could not go on, is the lime of the crystalline silicates of the solid rocks of the earth. (See further on sea-water under the head WATER.) HENRY WURTZ.

**Sea-Weeds.** See PHYCOLOGY, by PROF. ASA GRAY, M. D., LL.D., M. N. A. S.

**Sea'-Weeds, Chemistry of.** Many of this class of plants are of value as food and medicine, containing certain peculiar constituents not found in land-plants, and on some coasts they are cast up on the shore in such enormous masses as to be of no trifling consequence to the inhabitants, being used for fuel, as fodder for cattle, and even as a highly-nourishing food for man. The use of their ashes as sources of iodine and alkalies will be found explained under the heads of BARILLA and KELP. The use of sea-weeds as food is due to the prevalence therein of gelatinous and mucilaginous constituents, sometimes constituting more than half their weight. In addition to this, some species, like *Laminaria saccharina* (exceedingly abundant on the Asiatic coasts of the Pacific, where it is a highly valuable article of food), have a very sweet taste, due to the presence of the peculiar sugar called MANNITE (which see). Another celebrated species used for food is known to us as *Ceylon moss*. It contains three-fourths of its weight of gelatinous and starchy matter of a highly nutritious quality. It is known in the East as *âgar-âgar* and *bulung*. Botanists call it *Gigartina lichenoides*, and others *Plocaria candida*. The famous *edible birds' nests* are believed to be constructed of material derived from these latter species. (See BIRDS' NESTS, EDIBLE.) In another species, *Gelidium corneum*, used for confectionery and jellies in China, under the name of *nin-mau*, the French chemist Payen found 27 per cent. of a remarkable substance called by him *gelose*, whose gelatinous character is stated by him to be so intense as to have in this respect *ten times* the value of fish-gelatine or ISINGLASS (which see). This should be looked into further. Other species used as food are *Fucus saccharinus*, called by the Russians "sea-cabbage," and "jambon" by the Japanese, which is boiled and eaten as food; the "Irish" or "Carrageen moss," called by botanists *Chondrus crispus* (see CARRAGEEN), and many others. The compounds of *iodine* contained in these plants are conceived to give them certain virtues as food, particularly for invalids, as consumptives and others. The gelatinous portions of some sea-weeds become exceedingly hard and elastic upon being dried after previous purification, and have been moulded into various forms as substitutes for horn, shell, etc. for making handles for knives, files, and other tools. It is thought by some that the colored sea-weeds, sometimes very brilliant, would yield useful dyes and pigments, but this has not been followed up. In some countries "drift-weed," so-called, is found to be a highly valuable *manure*, especially for the potato-crop, which requires much *potash*, a large mineral constituent of sea-weeds. H. WURTZ.

**Sea-Wolf.** See ANARRHICHAS.

**Sebaceous Glands.** See HISTOLOGY, by COL. J. J. WOODWARD, M. D.

**Sebac'ic Acid** [apparently from Latin *sebum*, an inelegant form of *sevum*, "tallow;" Ger. *Fettsäure*]; also called **Sebic** and **Pyroleic Acid.** This compound, which has the empirical formula $C_{10}H_{18}O_4$, is formed during the destructive distillation of all fatty bodies which contain oleic acid or oleine. Nitric acid forms it also when acting upon fatty bodies, together with oxalic acid and other lower homologues of the same series, or those having the general empirical formula $C_nH_{2n-2}O_4$, a series of which *malonic*, *succinic*, and *suberic* acids are members. Sebacic acid is most readily obtained by fusing together castor oil and caustic potash, 2 parts of oil being slowly mixed with 1 part of potash, fused with a little water, and heated until the mass is faintly yellow. On boiling the mass with water and adding HCl while hot, sebacic acid crystallizes on cooling in needles. It resembles benzoic acid in appearance. It tastes acid, reddens litmus, melts at 127°, and

sublimes above this. Melted, its density = 1.317. But slightly soluble in cold, very soluble in hot water and in alcohol. Its salts, called *sebates*, are bibasic, like oxalates and succinates. Neither sebic acid nor sebates have obtained as yet any practical application. HENRY WURTZ.

**Seba'go,** p.-v. and tp., Cumberland co., Me., on Sebago Lake. P. 803.

**Sebaste.** See SAMARIA.

**Sebast'ian,** county of W. Arkansas, on Arkansas River, adjoining Indian Territory, traversed by the Poteau Hills and other spurs of the Ozark Mountains, has a fertile soil and considerable mineral wealth, especially bituminous coal. Staples, Indian corn, sweet potatoes, cotton, tobacco, and butter. Swine are numerous. Cap. Greenwood. Area, about 650 sq. m. P. 12,940.

**Sebastian,** SAINT, b. at Narbonne in Gaul about 255; educated at Milan; was a captain in the imperial guard when, under Diocletian in 287 or 288, he was seized as a zealous Christian, bound to a tree, and used by the Mauritanian archers as a target. He did not die, however, but having been brought to a Christian home and cured, he was seized a second time, trampled to death, and thrown into a sewer. His body was recognized by the Christians and buried in the Catacombs. Pope Damasus (366–384) built a church over his tomb, relics of him were sent to every corner of Christendom as very powerful against the plague, numerous churches were consecrated to him, and he was generally chosen as patron by associations of archers or riflemen. His feast is celebrated in the Roman Catholic Church Jan. 20, and in the Greek Church Dec. 18. Roman Catholic Church historians ascribe much importance to the *Acta Sancti Sebastiani*.

**Sebastian,** king of Portugal, known as DOM SEBASTIAN, b. in Lisbon Jan. 20, 1554; succeeded his grandfather, John III., June 11, 1557; headed an expedition which captured Tangier, Morocco, in 1574; embarked for Africa with 15,000 soldiers June 24, 1578; landed near Arzila July 29; took part in a civil war supporting the claims of Muley Mohammed to the throne of Morocco against his uncle, Muley Malek; was joined by the forces of the former, with whose assistance he commenced the siege of Alcazar; fought a great battle Aug. 4, in which a great part of the Portuguese nobility perished, as well as both the rival Moorish kings, and was himself probably killed, though his body could not be found. Having no immediate heir, Portugal was soon annexed by Philip II. of Spain, but the masses of the Portuguese people refused to believe in the death of Dom Sebastian, and a series of pretenders appeared at intervals for many years, and received some popular support. One of them made a great sensation at Venice, Florence, and Naples twenty years later, was repeatedly imprisoned, and finally condemned to the galleys, but had to be released on account of popular sympathy, and is said to have died in prison in Castile. The belief in the future return of Dom Sebastian finally took in Portugal the form of a myth, and continued to exist for more than a century, giving rise to a considerable literature of poems and romances.

**Sébastiani'** (FRANÇOIS HORACE BASTIEN), COUNT, b. at La Porta, near Bastia, in Corsica, Nov. 11, 1775; entered the French army in 1789; distinguished himself greatly in Napoleon's Italian campaigns; fulfilled several diplomatic missions to Constantinople, Syria, and Egypt with great success; was made a general of division after the battle of Austerlitz, and held various important commands in Spain and during the campaigns of 1812–14. After the Restoration he lived for some time in retirement; was elected a member of the Chamber of Deputies in 1819; opposed the policy of the cabinet of Polignac with great energy; was appointed minister of foreign affairs 1830, ambassador to Naples in 1834, and to London in 1835; was made a marshal in 1840. D. at Paris July 21, 1851. His only child was the duchesse de Praslin, who was murdered in 1847 by her husband.

**Sebastopol.** See SEVASTOPOL.

**Sebasto'pol,** p.-v., Sonoma co., Cal.

**Sebec',** p.-v. and tp., Piscataquis co., Me., on Sebec Lake, Piscataquis River, and Bangor and Piscataquis R. R. P. 954.

**Sebe'nico,** town of Austria, in Dalmatia, on an inlet of the Adriatic, has a fine cathedral and an active trade in wine and rosoglio. P. 5300.

**Sebes'ten Plum,** the fruit of *Cordia myxa* and *latifolia*, Asiatic trees of the order Cordiaceæ. The fruit is edible, and was once employed in European medicine. The wood is soft, light, and readily takes fire on friction. It was used by the old Egyptians for mummy-cases. The genus is an extensive and interesting one. Florida has one species, the beautiful *Cordia bullata*.

**Sebe'wa,** p.-v. and tp., Ionia co., Mich. P. 1139.

**Sebewa'ing,** p.-v. and tp., Huron co., Mich., on Saginaw Bay. P. 907.

**Se'bringville,** p.-v. of Perth co., Ont., Canada, on Buffalo and Goderich Railway, 4 miles W. of Stratford. It has active manufactures and a large lumber-trade. P. about 500.

**Sec'chi** (PIETRO ANGELO), b. at Reggio, province of Emilia, Italy, July 29, 1818; entered the order of the Jesuits in 1833; studied mathematics, physics, and astronomy; came to the U. S. in 1848, and taught mathematics at the college of Georgetown, D. C.; was appointed director of the observatory of Rome in 1850, and acquired a great celebrity by his researches in every field of astronomical science, especially by his meteorological observations and spectroscopic analyses. Among his writings the most remarkable are *Researches on Electrical Rheometry* (Georgetown, 1852), *Spectrum Observations on the Rotation of the Sun* (1870), *Le Soleil* (1870). On the expulsion of the Jesuits from Italy in 1870, Secchi retained his office.

**Seccomb** (JOHN), b. at Medford, Mass., Apr. 25, 1708; graduated at Harvard 1728; was minister of Harvard, Mass., 1733–57, and of Chester, Nova Scotia, from 1763 to his death at that place, Jan., 1793. Author of a humorous poem, *Father Abbey's Will*, printed in the *Gentleman's Magazine* and also in the *European Magazine* for May, 1732; reprinted by John Langdon Sibley (1854), with historical and biographical notes.

**Seces'sion.** This word, which denotes any withdrawal from a political or religious organization, has acquired lasting notoriety by being used of the right of a State included under the Constitution of the U. S. to withdraw from the Union and set up an independent government. The way was prepared for broaching and exercising this so-called right by the theory of nullification advanced, and for a time acted upon, by SOUTH CAROLINA. (See that article.) The existing tariff law was declared in 1832 by that State to be "null, void, and no law," and duties on imports were forbidden to be paid after a certain day within its jurisdiction. Gen. Jackson, then President, felt that such a power lodged in a State was a deathblow to the Union and altogether unconstitutional. His energetic opposition and the message on nullification in 1833 put a stop to this political heresy for the time, but only scotched the viper. The heresy amounted to this: that every State has a right to interpret the Constitution for itself, whatever be the decision of the Supreme Court on the subject, and, so interpreting, to retire from the Union. Hence, there is no right to force it to return. This is really a plan to make revolution easy, and to couch under the term *nullification* the extreme act which denies that the "Constitution, and the laws of the U. S. which shall be made in pursuance thereof, . . . shall be the supreme law of the land," and that "the judicial power of the U. S. shall extend to controversies to which the U. S. shall be a party," and that the judges in every State are bound thereby. (Art. III. § 2; Art. IV. § 2.) Secession is but another stage in this process of destroying a legal connection between an ordinance of the U. S. and one of the States. It declares the tie dissolved, and the State or States making the secession to be no longer members of the Union. This is revolution under a soft name, intended to throw a disguise over the proceeding. No such doctrine could be admitted by any stable government. (For an inapplicable precedent see HARTFORD CONVENTION.) T. D. WOOLSEY.

**Se-Chuen',** province of the Chinese empire, between lat. 26° and 33° N., and between lon. 101° and 110° E., comprises an area of 166,832 sq. m., with 21,435,678 inhabitants. Principal river, Yang-Tse-Kiang; cap. Ching-Too-Foo. Rhubarb and other drugs, musk, metals, silks, and sugar are produced.

**Seck'endorf,** the name of a family of German nobility which can be traced back to the middle of the thirteenth century, and still flourishes in various branches. Several of its members have become celebrated in German literature and history: (1) VEIT LUDWIG VON SECKENDORF, b. Dec. 20, 1626; studied law and history at the University of Strasbourg; held various important positions in the service of Duke Ernst the Pious of Gotha, Johann Georg II., elector of Saxony, and Friedrich III., elector of Brandenburg. D. Dec. 18, 1692. He was the author of *Deutsche Fürstenstaat* (1655) and *Commentarius historicus et apologeticus de Lutheranismo* (3 vols., 1692), in their time very famous books.—(2) FRIEDRICH HEINRICH, COUNT VON SECKENDORF, a nephew of the preceding, b. July 5, 1673; studied law at Jena, Leipsic, and Leyden; entered the Dutch-English army in 1693; served successively in the Austrian army against the Turks on the Danube and the Spaniards in Sicily, in the Saxon-Polish army against the Swedes,

and in the German army, of which he was commander-in-chief, against the French, whom he defeated at Klausen Oct. 20, 1735, and developed at the same time an astonishing diplomatic activity as Saxon-Polish ambassador to the Hague at the Peace of Utrecht, and as Austrian ambassador to numberless German courts to bring about the Pragmatic Sanction. After the death of Prince Eugene (1736) he was made commander-in-chief of the Austrian army against the Turks, but was defeated, recalled, accused of treason, imprisoned in the fortress of Gratz, and liberated only after much difficulty. He then entered the service of Charles II. of Bavaria, who, after the death of Charles VI., laid claims to parts of the Austrian heritage in spite of the Pragmatic Sanction, and was elected emperor under the name of Charles VII.; commanded his army with success; expelled the Austrians from Bavaria, and succeeded in negotiating a tolerable peace for his son in 1745. After this time he lived quietly on his estate, Meuselwitz, near Altenburg, in the Saxon duchies, with the exception of a little episode in 1758, when Friedrich II. kidnapped him, shut him up in the fortress of Magdeburg, and pressed $10,000 out of him. D. at Meuselwitz Nov. 23, 1763.—In this century several members have acquired a name as poets: (3) Leo (1773–1809); (4) Karl Sigmund (1744–85), translator of Camoens; (5) Christian Adolf (1767–1833); (6) Gustav Anton (1775–1823), known also in the U. S. as a lecturer under the name of Patrik Peale; (7) Alfred (1796), known under the name of Alpin.

**Seck'er** (Thomas), D. D., b. at Sibthorpe, Nottinghamshire, England, in 1693; was educated at Tewkesbury with a view to the dissenting ministry; studied medicine at London, Paris, and Leyden, graduating at the latter school 1721; studied theology at Exeter College, Oxford, 1721–22; took orders in the Church of England 1723; became chaplain to the king 1732, bishop of Bristol 1735, and of Oxford 1737; dean of St. Paul's 1750, and was consecrated archbishop of Canterbury Apr. 21, 1758. D. Aug. 3, 1768. He was noted for his eloquence as a preacher and his sternness as a moralist and disciplinarian. His collected *Works* were issued in 12 vols. (1770).

**Sec'ond** [originally *minuta secunda*, or *scrupulum secundum*, the "second minute," as distinguished from the *prime minute*, or ordinary minute], in the measurement of time and of angles the 60th part of a minute. The term is of Roman origin.

**Second,** in music, the distance from one degree on the diatonic scale to the next adjoining. (See Interval.)

**Second-Adventists.** See Adventists.

**Second Creek,** tp., Monroe co., West Va. P. 1222.

**Secondiglia'no,** town of Italy, province of Naples, in a fertile and healthy position N. of Naples, and dates from the eighth century. P. 6487.

**Second Sight,** according to a superstition formerly very common in the Scottish Highlands, was a gift by which certain persons were enabled to see depicted before their eyes an event which was taking place at some distant place, or which was destined to take place at some future time. It was not considered a supernatural power, but a mysterious sharpness of the natural powers, and the inhabitants of the Western Islands were especially famous for their second sight. Martin first brought this superstition into notice in England by his *Description of the Western Islands*, and 100 years later, in 1775, Dr. Johnson treated it with great gravity in his *Journey to the Hebrides*.

**Se'cor,** p.-v., Palestine tp., Woodford co., Ill., on Toledo Peoria and Warsaw R. R. P. 407.

**Sec'retary-Bird,** a name given to the species of *Serpentarius*, which is so called on account of having feathers upon its head recalling a pen behind the ear of a scribe. It is an inhabitant of Southern Africa.

**Secretary of Legation,** the principal assistant of foreign ministers. Secretaries of legation assist their superiors in their official duties, keep the records of their office, administer oaths, and act as notaries. In the absence of the superior officer the secretary performs his duties, with the title of chargé d'affaires *ad interim*. He is therefore accredited to the government to which he is sent. There are twenty-eight authorized U. S. secretaries of legation, besides assistant secretaries at Paris, London, Berlin, and St. Petersburg.

**Secretary of State,** an officer at the head of one of the executive departments of the U. S. government and a member of the cabinet. His position is considered the most responsible and important one in that cabinet. He has charge of foreign affairs, and is the organ of official communications with foreign ministers and with our ministers and other officers abroad, as well as with State and Territorial governments at home; signs and seals civil commissions; promulgates the laws and resolves of Congress; compiles the *Blue Book;* and makes an annual report to Congress. His salary is $8000. The two assistant secretaries receive each $3500.

**Secretary of the Interior,** an officer of the U. S. executive department and of the cabinet, who has charge of patents, land-offices, Indian affairs, pensions, the census, the departments of agriculture and education, and of many other important details of the government. There are several distinct bureaus under him. His salary is $8000. He has an assistant secretary with a salary of $3500. Both are appointed by the President and confirmed by the Senate.

**Secretary of the Navy,** an officer of the U. S. executive department and member of the cabinet, was first appointed by Pres. Washington in 1798. He executes the orders of the President with regard to naval affairs; renders biennial statements of naval and civil officers of his department for publication in the *Blue Book;* makes annual statements to Congress and to the treasury with regard to naval appropriations and expenditures; supervises the Naval Academy, the naval bureaus, the marine corps, etc. He is appointed by the President, confirmed by the Senate, and has a salary of $8000. There is an assistant secretary of the navy, whose salary is $4000.

**Secretary of the Senate,** an officer of the U. S. Senate, who keeps its two journals, disburses its contingent fund, has charge of all Senate documents, reports annually concerning his disbursements, and, in connection with the clerk of the lower House, makes an annual statement of all new appropriations, new offices, new salaries, and the like. He has a salary of $3600, besides fees for certified extracts from the Senate journals.

**Secretary of the Treasury,** an important member of the cabinet of the President of the U. S., whose duties correspond to those of the ministers of finance in most constitutional governments, including control of all receipts and disbursements, the coinage of money, the printing of currency, the relations with national banks, and the collection of trade statistics. Salary, $8000; of the assistant secretary, $3500. This post has been filled by many eminent statesmen, including Hamilton, Gallatin, Crawford, Rush, R. J. Walker, Corwin, Dix, Chase, Fessenden, and Bristow.

**Secretary of War,** an officer at the head of one of the executive departments of the U. S. government and member of the cabinet, has charge, under the President (who is commander-in-chief), of the affairs of the army and of the Military Academy. He is appointed by the President, confirmed by the Senate, and receives $8000 a year.

**Secret, Discipline of the.** See Arcani Disciplina.

**Secre'tion** [Lat. *secretio*, from *se*, "aside," and *cernere*, to "separate," "divide"], one of the chief physiological processes of the body; the separation of certain elements of the blood, and their elaboration to form special fluids, termed secretions and excretions. Both of these products contribute to the health and nutrition of the body, the secretion performing some positive function, as aiding digestion; the excretion subserving the same purpose negatively by freeing the system of effete matter, the débris of cell and tissue waste, which if detained in the blood develops disease. The function of the perspiratory and sebaceous glands is positive, so far as they preserve the moisture and delicacy of the skin, but is chiefly negative in relation to the nutrition of the body, from which they exhale water and salts; hence is classed as excretion. Bile is variously defined as a secretion, an excretion, and as both, its constituents being effete substances deleterious to health if not promptly excreted, yet performing an important part in the process of intestinal digestion. Secretion is performed in several ways. Certain smooth surfaces, the serous membranes, are lined with glandular epithelial cells capable of developing special homogeneous fluids. The serous shut sacs which invest the lungs, heart, and intestines—the pleuræ, pericardium, and peritoneum—are lubricated by a fluid which they secrete; so also are produced the synovial fluids on the inner smooth surfaces of the joints. A more typical secretory structure is the *tubule*, a cylindrical recess or tube at right angles to the surface, lined with secreting cells; a follicle is a diminutive membranous secreting sac beneath the surface, upon which it has an excretory aperture. Secreting surfaces, as the mucous lining of the bronchial tubes, stomach, and bowels, have many hundreds or thousands of such tubules and follicles to the square inch. An isolated group of tubules ramifying from a single central duct constitutes a simple gland: a number of such groups having a common duct is a compound gland; the larger glands, composed of an extensively-divided tubular system, with corresponding lobules, are termed racemose glands—that is, in structure

resembling a cluster of berries. Such complicated glandular structures serve merely to multiply secreting surface within a limited space; the functional action is the same whether performed on the free surface, in the tubule and follicle, or by the multiple gland. Secretion is the product of cell-activity. The cell derives its material from the blood, its stimulus to action from the nervous system, and it elaborates a peculiar fluid, in each instance predetermined by the inherent function of the gland or organ of which it is an integral part. Secreted fluids are homogeneous, consisting chiefly of water with variable quantities of salts, fatty matter, and in each case a distinguishing component, as pepsine in gastric juice, pancreatine, mucine, synovine, etc. Flint tabulates the secretions as follows: *Secretions Proper*—(1) *Permanent Fluids.*—Serous and synovial fluids, the aqueous and vitreous humors of the eye, fluid of the labyrinth of the ear, the cerebro-spinal fluid; (2) *Transitory Fluids.*—Mucus, sebaceous matter, cerumen or ear-wax, Meibomian fluid of eyelid, tears, milk, saliva, gastric juice, pancreatic juice, intestinal fluids, bile (also excretory). *Excretions.*—Perspiration, urine, bile (also secretion).

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Secret Service,** a bureau of detective officers of the U. S. government, under the solicitor of the treasury, who are employed in looking out for evasions of the revenue laws. During the civil war there was a secret service in connection with the war department. Neither of these services was established by statute. The chief of the present secret service receives a salary of $3000. The chief of the late military secret service had the rank of a brigadier-general of volunteers.

**Sectarianism.** See Schism, by Rev. Isaac Riley.

**Sec′tor** [Lat. *seco*]. A *circular* sector is a part of a circle bounded by an arc and two radii. A *spherical* sector is a part of a sphere that may be generated by a circular sector revolving about a diameter lying exterior to it.

**Sec′ular Clergy,** in the Roman Catholic Church, designates those bishops, priests, and deacons who do not belong to a monastic order and are not subject to the rule of any special order. Those who belong to such an order are called *regular* clergy, since they obey a monastic rule (*regula*). At present parish priests are both regular and secular, but chiefly the latter.

**Secular Games** [Lat. *ludi sæculares*, from *sæculum*, an "age"], a great Roman festival of probable Etruscan origin, originally called *ludi Tarentini*, from *Tarentum*, a place in the Campus Martius. It was customary to celebrate these games in honor of Dis and Proserpina once in a hundred years or thereabout, but, in reality, the celebration took place at long but very irregular intervals, and all the greater gods received a share of the honors. They were celebrated (we are informed) only four times during the republic and four times under the emperors.

**Sec′ularism** [Lat. *secularis*, "worldly"], the belief that the duties of this life, being more clearly ascertainable than those which we call religious, and which depend on a belief in God and in immortality, should have men's first, or even their entire, attention. The Secularists of England are an offshoot of the socialist party founded by Robert Owen. Mr. Owen denounced religion and marriage as evils co-ordinate with property; and because of his theory that a change of man's environment, and not a change in himself, was chiefly necessary to secure his happiness, he stood in an attitude of avowed hostility to the churches and creeds, but was at no time an avowed atheist. Many of his followers went so far, and in 1842 one of them was prosecuted and imprisoned for avowing it. This caused great excitement among his more immediate friends, and led to an active propaganda of atheistic opinions among the working-classes, under the leadership of George Jacob Holyoake. At first this was in connection with the advocacy of socialism, but afterward that topic was abandoned, while on the other side the Owenites, through their Social Congress, labored to sunder socialism from any alliance with theological or anti-theological opinions. Till about 1852, Mr. Holyoake and his friends called themselves sometimes Utilitarians, but more commonly Atheists, as in the title of his most known tract, *The Logic of Death, or Why should an Atheist Fear to Die?* They then adopted the name of Secularists, as expressing the positive side of their opinions and as free from evil associations. Their expectations were for the most part disappointed, in spite of their manifold activity in debates and lectures, in printing books, tracts, and periodicals (*The Reasoner*, and at present *The National Reformer*). They organized Secular societies, held Secular conferences, and erected Secular halls in the leading cities. But several of these halls were sold to pay expenses; their work of publication was carried on at a loss, which was met by a few wealthy patrons, of whom Mr. J. W. Birch, an Oxfordshire magistrate, was the best known. The effort to rally men around a purely negative set of opinions was defeated by the indifference of those who agreed with them. No great and general interest was excited by it, although some of its representatives—notably Mr. Holyoake — were men of extraordinary power as speakers and writers. Once and again it received a temporary stimulus from the unwise prosecution of individual Secularists for blasphemy. Since Mr. Holyoake left the platform their most prominent leader has been Mr. Charles Bradlaugh, the republican agitator. They have several places of meeting in London, and a considerable number of men and women speakers, who frequently hold open-air lectures on Sunday mornings, and sometimes make a tour of the manufacturing districts.

Secularism has many points of likeness to positivism, but with the difference that it is English and democratic, and more dogmatic in its denials. The idiosyncrasies of Robert Owen are still stamped on it, just as the thoughts of Saint-Simon have never been eliminated from the system of his pupil Comte. While Secularists treat the doctrines of theism and immortality as purely speculative and uncertain, they do not exclude from their fellowship those who take an affirmative side in regard to them; and they have a few such persons in their societies. They will co-operate with all who assent to the statements that human morality does not require religious sanctions, and that the duties of the present life are vastly more certain and ascertainable, and therefore, on every principle of prudence, more worthy of men's attention. They further hold that if there be a God to whom men are accountable, he must reflect all that is best and highest in man's moral nature, and therefore he will be better pleased by a life spent in the conscientious pursuit of truth and in the service of our fellow-men than by any dogmatic belief or formal worship. But they, for the most part, profess to see a practical refutation of every sort of theistic belief in the suffering and anguish of the world, in the terrible inflictions of sudden and painful death by the powers of nature, and in the perpetuation of misery, ignorance, superstition, slavery, tyranny, and all those evil conditions in which they find the root of what is evil in man. They distinctly disown those who reject the claims of religion through mere stupid indifference or through a dislike of the restraints it imposes on the passions; they lay emphasis on *duty*, and seek to organize men "for moral work." But, like Owen, they see in man the creature of circumstances, holding that "he owes his actions to the destiny of his organization and position;" and, like Owen, they "labor to find a situation in which it shall be impossible for men to be depraved or poor." But they find the obstacle to this chiefly in men's ignorance of the scientific laws which govern human life, and their distraction from the study and the obedience of those laws by the teachings and the claims of religion. Their skepticism is not that of the rich and prosperous, who find the present world and its visible belongings so comfortable that they have lost all interest in the unseen and the eternal. It is that of men who are utterly dissatisfied with the world and their place in it, and who "regard all tidings respecting the unseen as only fictions that are invented to keep them on their present level."

Whatever be the worth of secularism in itself, it has some value as a criticism upon popular Christianity and its one-sidedness. It shows that the suffering and struggling classes cannot be satisfied with a creed that promises them spiritual rewards in the life to come, but exhibits a stolid indifference to their welfare in the life that now is; or with one that sunders duty to man from duty to God. But it remains to be seen whether a belief that denies any object for the deepest and most universal aspirations of men's spirits, and which sanctions all the indifference to the welfare of mankind which grows out of a materialistic contempt for human nature, can maintain its hold upon those who most need the inspiration of faith in God to help them to face with courage the hardships of their lot.

R. E. Thompson.

**Secularizaʹtion.** This term, in its most general sense, denotes the process of converting objects from a religious or spiritual to a common or secular use, and of removing matters from a purely ecclesiastical control and bringing them under the civil jurisdiction. A strong tendency among all enlightened peoples toward secularization has been shown for a long time in many departments of social activity and of public legislation; the limits of ecclesiastical and civil authority have been more clearly defined; the policy of confining the Church to affairs strictly and essentially spiritual is everywhere accepted as theoretically correct, and in some countries it is already practically triumphant. During the epoch when the Church had attained its highest degree of power its interference with secular matters extended in every direction, but was most distinctly

exhibited in connection with certain special subjects, the control of which it has ever struggled to retain. Vast quantities of lands had gradually accumulated in the hands of the religious houses, and all the most valuable estates of Europe were likely to fall into their ownership. Through the operation of the canon law certain subjects of the utmost consequence to society were brought under the ecclesiastical jurisdiction, the most important of which were marriage, divorce, and the succession of decedents' estates. Education in all its grades and departments was entrusted exclusively to the Church. The progress of secularization has nearly destroyed these spiritual interferences with civil affairs in many countries of Europe and America, and has greatly narrowed their extent in all the others. The first impulse of this grand movement was naturally directed against the threatened monopoly of land. At an early day statutes were passed in England and on the Continent prohibiting the acquisition of land by religious corporations; and this policy has continued to the present day, and has been adopted throughout the U. S. (For a description of these enactments, their design, and effect, see the article MORTMAIN.) In addition to this system of restraint, the accumulated possessions of the ecclesiastics and the spiritual houses have sometimes been seized by the civil authorities and appropriated to secular uses. The most remarkable instances of such enforced changes occurred in England under Henry VIII., in Scotland at the Reformation, and in France during the Revolution. The Italian and the Mexican governments are now pursuing a similar policy to a partial extent. Within the present half century, and almost within the present generation, the law of matrimony has been greatly modified. In England, France, Italy, Prussia, Austria, and several other European states marriage has been made wholly a civil contract and status, divorce is regulated by statute, and both are placed under the jurisdiction of the ordinary tribunals. The same steps had before been taken in reference to successions. So far as education is public or is supported at the public expense, the course of modern legislation in England, France, Italy, and Germany favors a control by the State, and not by the Church. It is in the U. S., however, that the theory of secularization has had the fullest scope, and has been worked out most thoroughly and consistently. The fundamental conception of the State contained in the organic law confines the Church to functions purely spiritual and religious; the Church itself, as a spiritual society, has no legal existence and is not recognized by the law, and all the separate congregations or parishes are in all respects civil and lay corporations. Marriage, divorce, and all other relations domestic or social, successions and all other matters connected with property, are of course under the exclusive dominion of the civil government. A few traces are still left of ecclesiastical influence and privilege, but it is probable that these may ere long disappear. The removal of all distinctively religious instruction from the common schools, with the consequent secularizing of the public educational system, and the repeal of all laws which exempt churches and other ecclesiastical property from taxation, are strongly advocated, and one or both of these measures may soon be accepted as a part of our permanent national policy.

JOHN NORTON POMEROY.

**Secundus** (JOHANNES). See JOHANNES SECUNDUS.

**Sédaine'** (JEAN MICHEL), b. at Paris July 4, 1719; d. there May 17, 1797; wrote a number of comic operas, a *genre* of which he is the real founder, and also some comedies, of which *Le Philosophe sans le Savoir* (1765) is still played. Philidor, Monsigny, and Grètry composed his operas.

**Seda'lia,** city, cap. of Pettis co., Mo., at the intersection of Missouri Pacific, the Lexington branch of Missouri Pacific, and Missouri Kansas and Texas R. Rs.; hence it is a railroad centre. It is 189 miles W. of St. Louis, 100 miles E. of Kansas City, and 40 miles S. of Missouri River. It was founded in 1860 by Gen. George R. Smith. Present pop. 10,000, and rapidly increasing. The location is a high rolling prairie, with a stream and abundant timber to the N., S., and W. within 3 miles. The leading business-houses and finest private residences are of brick. The city has 8 churches, value $30,000; public high-school building, value $40,000; 2 other public-school buildings, value $10,000; average attendance 1000 pupils. The general offices, car manufactory, and machine-shops of Missouri Kansas and Texas R. R., and the machine-shops and car-factories of Missouri Pacific R. R. (middle division), are located here; number of men employed, 500; value of buildings and real estate owned here by the two companies, $175,000; money paid to town annually by them, about $400,000. The city is lighted by coal-gas, and furnished with water by the Holly waterworks system, costing $125,000. The city has 2 daily papers, with weekly editions, 1 weekly and 1 monthly paper; 3 flouring-mills, capacity 100,000 bushels of grain per year; iron-foundry, capacity 5 tons per diem; woollen-mill, capacity 35,000 yards of material per annum; agricultural implement and machine shop, soap-factory; beer-brewery, capacity 30,000 kegs per annum; 5 wagon-shops, broom-factory, grain-elevator, etc. Numerous rich coal-mines, accessible by rail, are within 12, 20, 25, and 50 miles. Mar. 1, 1876, a charter to build a street railroad within one year was granted a company. Sedalia has an opera-house, seating capacity 1000; 2 first-class and 4 second-class hotels; 4 banks, with an aggregate capital of $500,000; a public library, and a gymnasium. The town is surrounded by a "garden spot" of country, and is increasing daily in wealth, population, and prosperity. P. in 1870, 4560.

A. Y. HULL, ED. "DEMOCRAT."

**Sedan',** town of France, department of Ardennes, on the Meuse, is fortified, and contains an arsenal and several magazines. Its manufactures of cloth and other kinds of woollen fabrics are very celebrated. Sept. 2, 1870, Napoleon and his whole army surrendered here to the king of Prussia. P. 15,536.

**Sedan,** p.-v., cap. of Chautauqua co., Kan., located in a charming grove on Cana Creek, and surrounded by one of the finest agricultural districts in Southern Kansas, contains 3 dwelling-houses, 1 newspaper, a blacksmith's shop, a grist-mill, and a cotton-gin.

JOSEPH MOUNT, ED. "WIDE AWAKE."

**Sedan Chair,** a portable vehicle, differing from the litter and the palanquin in that the traveller is carried in a sitting posture. The sedan chair took its name from Sedan in France, where it was invented, but it had long been employed in Eastern countries, notably in Japan. It was first seen in England in 1581, and was long an extremely common and fashionable conveyance. It was carried by two men.

**Sed'atives** [Lat. *sedare*, to "calm"], a term somewhat loosely employed in medical parlance to designate agents which are soothing or actually anæsthetic over the sensory function, or which in relation to various motor functions tend to diminish activity. Aconite is thus called "sedative," because it lessens the force and frequency of the heart's beats; hemlock, because it paralyzes the voluntary muscular system; and chloroform, because it is a general paralyzer of the cerebro-spinal functions. From these examples it is obvious enough that there is no group of allied agents to which the general term "sedative" can apply; and where used in relation to special paralyzing power the latter term is far more accurate and expressive. EDWARD CURTIS.

**Sed'don,** p.-v. and tp., cap. of Bland co., Va., on Big Walker's Creek, 21 miles N. of Wytheville, has 1 church, an academy, an excellent court-house and jail, 2 newspapers, and 2 hotels. P. 828.

WM. HICKS, ED. "HOLSTON ADVOCATE."

**Seddon** (JAMES A.), b. in Virginia about 1815; became a lawyer at Richmond; was a member of Congress 1845–47 and 1849–51, of the Peace Congress and of the Confederate House of Representatives 1861, and became secretary of war on the resignation of George W. Randolph, Nov. 18, 1862.

**Sed'ges,** the grass-like plants of the natural order Cyperaceæ. They often grow in tufts, are always herbaceous, never hollow-stalked, and have frequently triangular stems. The glumes are single, scale-like, and have a flower in the axil. There are some 120 genera and thousands of species. Many of them are coarse marsh-plants. They furnish large quantities of very inferior hay. A few have edible tubers. Several have pleasant odors and are used in perfumery. The papyrus is one of the most interesting of these plants. Mats, baskets, etc. are produced from some of the species. (See CAREX.)

**Sedg'wick,** county of S. Kansas, intersected by Arkansas River and its tributaries, and traversed in its N. part by the south-western branch of Atchison Topeka and Santa Fé R. R., which terminates at the county-seat; has prairie surface, half of which consists of fertile bottom-land. Staples, wheat, Indian corn, oats, potatoes, and wool. Cap. Wichita. Area, about 1000 sq. m. P. in 1870, 1095; in 1874, 7429.

**Sedgwick,** p.-v. and tp., Harvey co., Kan., on a branch of Atchison Topeka and Santa Fé R. R.

**Sedgwick,** p.-v. and tp., Hancock co., Me., on Penobscot Bay. P. 1113.

**Sedgwick** (ADAM), LL.D., F. R. S., b. at Dent, Yorkshire, England, in Jan., 1786; graduated at Trinity College, Cambridge, 1808; became fellow 1810; took orders in the Church of England 1817; was appointed Woodwardian professor of geology at Cambridge 1818; was chosen fellow of the Royal Society 1819, in which year he aided in founding the Cambridge Philosophical Society, of

which he became secretary; contributed largely to the popularization of the study of physical science at Cambridge and to the formation there of a museum of geology; became proctor of the university, and made a geological tour in Scotland 1827; accompanied Murchison in his geological researches in Germany, Austria, and Switzerland 1829; commenced a survey of the Lower Palæozoic strata of England and Wales 1831; was president of the Royal Geological Society 1829–31; became involved in a bitter controversy with Murchison as to the use of the terms Cambrian and Silurian; became prebendary of Norwich 1834; was secretary to Prince Albert when the latter was acting as chancellor of the university; contributed largely to the *Transactions* of the Geological, Philosophical, and other scientific societies; was a formidable opponent of the utilitarian school of morals and of the evolution theories propounded by the *Vestiges of Creation* (1844), by Darwin, and by Spencer; was one of the most active members of the British Association, and received the Copley medal of the Royal Society 1863. D. at Cambridge Jan. 27, 1873, being then senior fellow of Trinity College. His works consist chiefly of reviews, lectures, addresses, and memoirs scattered through the publications of learned societies, the most important separate essays being a *Discourse on the Studies of the University of Cambridge* (1834; enlarged ed. 1850) and a *Synopsis of the Classification of the Palæozoic Rocks* (1855). (See Geikie's *Memoirs of Sir R. Murchison* (1874) and Prof. T. S. Hunt's *Chemical and Geological Essays* (Boston, 1875).)

**Sedgwick** (Catharine Maria), daughter of Judge Theodore, b. at Stockbridge, Mass., Dec. 28, 1789; received an excellent education; undertook after her father's death (in 1813) the management of a private school for the education of young ladies, and continued in that employment fifty years. Published her first work of fiction, *A New England Tale*, in 1822, the success of which decided her to continue the career of authorship; brought out *Redwood* (2 vols., 1824), which was reprinted in England, translated into French, Italian, German, and Swedish, and compared favorably with the novels of Cooper, to whom, indeed, it was attributed in the French version; *The Traveller* (1825), *Hope Leslie, or Early Times in Massachusetts* (2 vols., 1827), reputed her best work; *Clarence, a Tale of our Own Times* (1830), *The Linwoods* (1835), *The Poor Rich Man and the Rich Poor Man* (1836), *Live and Let Live* (1837), *A Love-Token for Children*, and *Means and Ends, or Self-Training* (1838), *Stories for Young Persons* (1840), *Letters from Abroad to Kindred at Home* (1841), a record of a European tour made in 1839; *Historical Sketches of the Old Painters* (1841), *Wilton Harvey and other Tales* (1845), republished from Godey's *Lady's Book; Morals and Manners* (1846), *Facts and Fancies* (1848), *Married or Single?* (1857), and *Letters to My Pupils* (1862). She wrote much for the annuals and magazines; contributed the *Story of Le Bossu* to Sands's *Tales of Glauber Spa* (1832); prepared the biography of Lucretia M. Davidson in Sparks's series (1841); and published several volumes of short stories collected from the magazines. D. near Roxbury, Mass., July 31, 1867. (See her *Memoir*, by Mary E. Dewey, 1871.)

**Sedgwick** (Henry Dwight), second son of Judge Theodore, b. at Sheffield, Mass., in 1785; graduated at Williams College 1804; became an eminent member of the New York bar; published some legal arguments and essays, and contributed to the *North American Review* and to the political and religious journals. D. at Stockbridge, Mass., Dec. 23, 1831.—His brother Robert, b. at Stockbridge in 1787, also graduated at Williams College, and practised law in New York, where he d. in 1841.

**Sedgwick** (John), b. in Cornwall, Conn., Sept. 13, 1813; graduated at the U. S. Military Academy in July, 1837, and appointed second lieutenant of artillery, his first service being against the hostile Seminoles in Florida; subsequently upon the frontier during the Canada border troubles; recruiting and in garrison until 1846; in the war with Mexico he participated in the siege of Vera Cruz, the battles of Cerro Gordo, Churubusco, Molino del Rey, Chapultepec, and the assault and capture of the City of Mexico, winning the brevets of captain and major for gallantry. In 1855 was transferred to the 2d Cavalry with the rank of major, of which regiment he became lieutenant-colonel in Mar., 1861. In April he was appointed colonel of the 1st; transferred to the 4th Cavalry Aug., 1861, and in the same month was commissioned brigadier-general U. S. volunteers. In the Virginia Peninsular campaign of 1862 he commanded a division of Sumner's corps, and engaged in the siege of Yorktown; in the battle of Fair Oaks, where he arrived, after a toilsome march, in time to decide the day, May 31; of Savage Station (June 29) and Glendale (June 30), where he was wounded. Appointed major-general of volunteers, to date from July 4, 1862, he commanded a division at Antietam, where he was severely wounded three times, and disabled until December, when he was placed in command of the 9th corps. Transferred to the command of the 6th corps Feb., 1863, he was ordered by Gen. Hooker, in May, 1863, to carry the heights of Fredericksburg and effect a junction with the main army at Chancellorsville. On the morning of Sunday, May 3, Fredericksburg was occupied without serious difficulty, but the storming of the heights in the rear of the town was attended with severe loss—nearly 5000. Continuing his march toward Chancellorsville in pursuance of his instructions, his further advance was checked at Salem Heights, about 4 P. M., by the force which Gen. Lee was able to detach for this purpose after the repulse of Hooker in the morning; and by Hooker's inactivity Lee was able the next morning to so far strengthen the force sent to oppose Sedgwick that it was only by great skill and hard fighting the latter was able to hold his ground during the day, withdrawing after dark across the Rappahannock. In the Pennsylvania campaign of 1863 the 6th corps formed the right wing of the army following the movements of Lee, and on the evening of June 30 encamped at Manchester, upward of 35 miles from Gettysburg. The events of the 1st of July demanded the hasty concentration of the army, and before 2 P. M. of July 2, Sedgwick reached the field with his corps, having made the march of 35 miles in 20 hours. So sharp and furious was the struggle the corps was at once engaged, as also in the third day's fight, and pursuit of the enemy, July 5. At the battle of Rappahannock Station (Nov. 7) he commanded the right wing of the army, composed of the 5th and 6th corps, as in the "Mine Run move" (Nov. 26–Dec. 3). In the Richmond campaign of 1864, continuing in command of the 6th corps, he was conspicuous in the battles of the Wilderness (May 5–6), as in the battles of Spottsylvania, where, while directing the placing of some artillery in an advanced position, he was killed early in the day by a bullet from a sharpshooter. His loss caused the most profound grief among his command, by whom he was greatly beloved, and indeed throughout the whole army, to whom he had endeared himself by his many noble qualities. A monument wrought of cannon captured by the 6th corps was erected to his memory at West Point in 1868, on which occasion George William Curtis delivered an eloquent oration.

**Sedgwick** (Robert), b. in England about 1590; an early settler at Boston, Mass.; had been a member of the Artillery Company in London; aided in founding the Ancient and Honorable Artillery Company 1638; was its captain 1640; became colonel of the Middlesex regiment 1643, and commander of all the militia of Massachusetts 1652; went to England; was employed by Cromwell to expel the French from Penobscot 1654; took part in the West India expedition 1655; was made major-general. D. in Jamaica May 24, 1656. With John Winthrop, Jr., he established the first ironworks in New England 1643–44.

**Sedgwick** (Theodore), LL.D., b. at West Hartford, Conn., in May, 1746; educated at Yale College, but did not graduate; commenced the study of theology; was admitted to the bar Apr., 1766; began the practice of law at Great Barrington, Mass.; soon removed to Sheffield, which town he represented several years in the Massachusetts legislature; was aide-de-camp to Gen. Thomas in the expedition against Canada 1776; was an active patriot throughout the Revolution; was a member of the Continental Congress 1785–86; took an active part in the suppression of Shay's rebellion 1786–87; settled at Stockbridge 1787; was Speaker of the Massachusetts house of representatives and a member of the State convention for the ratification of the Federal Constitution 1788; member of Congress 1789–96; U. S. Senator 1796–99, serving one term as president *pro tem.*; again member of Congress and its Speaker 1799–1801, and judge of the supreme court of Massachusetts from 1802 to his death, at Boston Jan. 24, 1813. Judge Sedgwick was a laborious and highly-accomplished statesman and jurist, and an enthusiastic Federalist; by his agency was obtained from a court in Massachusetts (1780) a decision in a fugitive-slave case which foreshadowed and led to the abolition of slavery in that State; and subsequently pronounced the decision from the supreme bench that "one man could not have legitimate property in another."

**Sedgwick** (Theodore), eldest son of Judge Theodore, b. at Sheffield, Mass., Dec. 31, 1781; graduated at Yale College 1798; studied law with his father and at Kinderhook; was admitted to the bar 1801; practised his profession with eminent success at Albany, N. Y., 1801–22, and subsequently at Stockbridge, Mass.; sat in the Massachusetts legislature 1824–25, and again 1827, in which year he carried through a bill authorizing the construction of a railroad from Boston to Albany through the Green Mountains; was thrice an unsuccessful candidate for Congress; an effective speaker, a prominent Democratic politician, an

earnest opponent of slavery and advocate of temperance and free trade; was president of the Berkshire agricultural society 1823 and 1830; travelled in Europe 1836–37. D. of apoplexy at Pittsfield, Mass., Nov. 7, 1839. Author of *Hints to my Countrymen* (1826) and *Public and Private Economy* (3 vols., 1836–39; 2d ed. 1856).—His wife, SUSAN RIDLEY, a granddaughter of Gov. William Livingston of New Jersey, b. about 1789, was married 1808; was authoress of several works of fiction for the young, including *The Morals of Pleasure* (1829), *The Young Emigrants* (1830), *Allen Prescott* (2 vols., 1835), *Alida, or Town and Country* (1844), *Louisa and her Cousins*, and *Walter Thornley* (1859).

**Sedgwick** (THEODORE), son of Theodore second, b. at Albany, N. Y., Jan. 27, 1811; graduated at Columbia College 1829; was admitted to the bar May, 1833; was an attaché to the U. S. legation at Paris 1833–34, the minister being Edward Livingston; practised law in New York City 1835–50; was president of the New York Crystal Palace Association 1852, and became U. S. district attorney for the southern district of New York Jan., 1858. D. at Stockbridge, Mass., Dec. 8, 1859. Author of a *Memoir* of his great-grandfather, Gov. William Livingston (1833), a *Treatise on the Measure of Damages, etc.* (1847; 5th ed. 1869), and a *Treatise on the Rules which govern the Interpretation and Application of Common and Statutory Law* (1857); edited the political writings of William Leggett (2 vols., New York, 1840); published several legal, political, and anniversary addresses, and contributed to many reviews and other periodicals, especially the *Evening Post* and Harper's *Magazine* and *Weekly*. He declined the mission to Holland in 1857, and twice declined the post of assistant secretary of state.

**Sed'ley** (Sir CHARLES), b. at Aylesford, Kent, England, in 1639; studied at Wadham College, Oxford, 1655–56, but did not graduate; was one of the wits and poets of the court of Charles II., leading a licentious life; sat in Parliament, and favored the revolution of 1688. D. Aug. 20, 1701. His *Works*, consisting of plays, poems, songs, speeches, and political pieces, were edited by his friend Ayloff (2 vols., 1702).—His daughter, CATHARINE, though extremely ugly in person, was the favorite mistress of James II.; employed her influence in favor of the Protestant party; at the instigation of Rochester refused to leave Whitehall on the accession of James to the throne 1685; was by him made countess of Dorchester 1686, and married the earl of Portmore in Ireland. D. at Bath Oct. 26, 1717.

**Seduc'tion** [Lat. *seductio*]. According to the doctrines of the English common law, based upon the maxim *volenti non fit injuria* ("no legal injury can be done to one consenting"), the female whose chastity has been seduced has no remedy against her seducer, but the father is permitted, under certain circumstances, to maintain an action for damages against the man who debauches his infant daughter. This right of action, however, is not founded upon the paternal relation, nor upon the wrong done to the father's honor, nor upon the destruction of the child's character and position in society; it is rested solely upon the harsh and almost brutal conception that the relation of master and servant has been interfered with, and that by the illness and consequent inability to labor on the part of the daughter, which become the natural results of the defendant's act, the father has been deprived for a time of the service which would otherwise have been rendered to him. For this reason the suit may be brought not only by a father, but also by a guardian, a master, or any one standing *in loco parentis* where service is legally due and is actually performed. The legal relation of master and servant existing between the plaintiff and the female at the time of the seduction must therefore be averred and proved, although the service itself may be purely nominal; and it must appear that she was prevented from discharging her duty by means of some physical disability, such as her sickness, which was a direct consequence of the seduction. If no such result follows the wrong, there can be no recovery, since the remedy is not given for the mere act of debauching. Notwithstanding this unnatural basis of the action, the jury are directed that, in estimating the damages, they must award full compensation for the irreparable wrong inflicted upon the plaintiff in all his parental and social relations, for his wounded honor and affections, his personal grief and public disgrace, as well as for his loss and expenses as a master, and that to this compensatory relief they may add exemplary or punitive damages. The common-law theory as thus described has been adopted in a somewhat modified form in a portion of the American States, but there has been a strong tendency on the part of their courts to break away as much as possible from these absurd and arbitrary restrictions; the English rules which define the relation of master and servant, and require a condition of actual service, have been mitigated, and recoveries are permitted which would be impossible under the common law as administered in England. What the courts have cautiously aimed at in some of the States has been fully accomplished by the legislatures in many of them. The statutory rule, which prevails so widely that it may properly be called the American doctrine, has utterly swept away the ancient notion of master and servant, and has rested both the right and the remedy, where the wrong is inflicted, in the family and parental relations. According to this legislation, the action is brought by a parent as the head of the family; the offence is treated as one against the unity, happiness, and purity of the family, and the right and the remedy are thus made to harmonize. The statutes of a few States have gone even farther, and permit the female who has been seduced to recover compensation for the personal injury done to herself. When the marriage relation is invaded by the seduction of the wife, the husband has an action against the seducer, in which full damages may be awarded for the domestic injury, and which is founded upon the simple fact that the union of the parties has been virtually destroyed. JOHN NORTON POMEROY.

**Sedum.** See CRASSULACEÆ.

**See'bach** (MARIE), b. at Riga Feb. 24, 1835, the daughter of a comic actor of some reputation; was educated at Cologne for the opera; made her début at Nuremberg, where she acted minor parts in the vaudeville and light comedy; achieved a great success in Hamburg by her impersonation of Gretchen in Goethe's *Faust;* was engaged from 1856 to 1865 at the royal theatre of Hanover; removed in 1866 to Berlin with her husband, the tenor singer Niemann, and visited the U. S. in 1870–71. Her representation of Clärchen in Goethe's *Egmont* was another decided success.

**See'bohm** (FREDERICK), b. at Bradford, England, in 1833; was called to the bar at the Middle Temple, London, 1856. Author of *The Facts of the Four Gospels* (1861), *The Oxford Reformers of 1498* (1867), and other historical and biographical works.

**Seed-lac.** See LAC, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D., M. N. A. S.

**Seeds** [Ang.-Sax. *sæd*], the immediate result of sexual propagation in phænogamous plants, being the ovules after fertilization and the consequent formation of the embryo, which is the germ of a new individual. A seed consists of the embryo; of the matured coats of the OVULE (which see), commonly two, of which the outer, and generally the firmer, is technically called the *testa*, the inner, *tegmen;* and often of a stock of nourishing matter accumulated around or accompanying the embryo. The latter was named *albumen*, from a mainly fanciful analogy; the seed being likened to an egg, the albumen was supposed to answer to its white (albumen) and the embryo to its yolk. Seeds, such as those of peas, beans, and almonds, which have no albumen—that is, no stock of nourishment outside of the embryo—have always a strong and well-developed embryo, abundantly supplied with the same or similar matter stored in its own tissues. The general structure of the seed depending upon that of the ovule, the same terms are mostly applicable to it and to its modifications and parts (such as *anatropous, orthotropous, rhaphe, chalaza,* etc.); but the now closed orifice through which impregnation was effected is called the *micropyle;* the scar left by separation from the seed-stalk or placenta is the *hilum;* the accessory and usually partial external covering, which is sometimes developed by a growth from the micropyle or the apex of the seed-stalk, is an *arillus* or *aril*. The mace of nutmeg and the pulpy covering of *Euonymus* seeds are familiar examples. A *caruncle* and a *strophiole* are nearly similar appendages at the base or hilum, not developed into a covering. Other appendages to certain seeds are the *coma*, or tuft of downy hairs at the summit, as in milkweed, or the base, as in willow, also the wing, as in trumpet-creeper; these and various other appendages aid in the dispersion of seeds. The albumen of the seed, when distinctively present, may differ greatly in abundance, consistence, and nature; as from farinaceous or flowery in wheat to cartilaginous or horny as in coffee, or to the texture and appearance of ivory in the "vegetable-ivory" nuts. In many cases, as in those just referred to, it forms much the larger part of the kernel of the seed; in others the embryo is so minute as to be with difficulty discerned antecedent to germination; while sometimes the embryo is the more conspicuous, and the albumen is reduced to a thin layer. When copious, the albumen generally envelops the embryo, but sometimes the latter enfolds the former, as in mallows, or is coiled around it, as in four-o'-clock and chickweeds. The embryo and its parts have been described in other articles. (See BOTANY, EMBRYO, GERM.) Its most important structural characteristic is the number

of cotyledons or seed-leaves—one in monocotyledonous or endogenous plants; a pair in the dicotyledonous or exogenous. What are called polycotyledonous embryos, such as those of pines, with a whorl of few or several subleaves, are considered to be formed of a pair of cotyledons divided, as it were, into leaflets.

As to the duration of vitality in seeds, there are many conflicting accounts. The story of grain found buried with Egyptian mummies having germinated after being exhumed is now generally discredited. All recent attempts under proper observation and due precautions have failed. The appearance of plants new to the station upon soil brought to the surface from excavations can usually be otherwise explained when they appear to involve a high antiquity, although there is no doubt that buried seeds have germinated after a lapse of fifty or more years. The best authenticated case, pointing to a much longer preservation of vitality under such conditions, is that of the growth of raspberry-seeds found in the abdominal portion of a skeleton exhumed from a Roman tomb near Dorchester, England; but it is one not beyond doubt and uncertainty. One or two series of experiments, conducted within the last forty or fifty years by the sowing of seeds of known age, and also by the annual sowing from a stock of a considerable variety of seeds of the same age, indicate a rapid extinction of vitality under ordinary conditions. Out of 338 species, representing 74 natural orders, only 94 kinds grew after 3 years, only 57 after 4 to 8 years, only 16 from 8 to 21 years, 5 from 25 to 27 years, 3 to 43 years. In ordinary cases, leguminous seeds have longest preserved germinating power, in some very well-authenticated instances up to seventy or perhaps one hundred years. Nearly uniform temperature, darkness, and either dryness or burial beyond atmospheric influences, most favor the prolongation of vitality. ASA GRAY.

**See'konk,** p.-v. and tp., Bristol co., Mass., on Pawtucket River and Boston and Providence R. R. P. 1021.

**See'land,** the largest and most important of the Danish islands, between the Cattegat and the Baltic, and between the Sound which separates it from Sweden, and the Great Belt which separates it from the island of Funen. Area, 2840 sq. m. P. 637,711. The ground is low and undulating, dotted with small lakes, and studded with forests of oak and beech. The soil is very fertile, and well cultivated.

**See'ley** (JOHN ROBERT), b. in London, England, about 1834, son of a well-known London publisher; graduated at Christ's College, Cambridge, 1857; obtained a fellowship and lectureship there 1858; became classical teacher at the City of London School 1860; professor of Latin in University College, London, 1863; succeeded Charles Kingsley as professor of modern history at Cambridge Oct. 9, 1869. Author of *Ecce Homo, or The Life and Work of Jesus Christ* (1865), which rapidly passed through many editions and elicited many replies; *Roman Imperialism* (1869), *Lectures and Essays* (1870); and editor of *Livy, with Introduction, Historical Examination, and Notes* (1871).

**Seely,** tp., Faribault co., Minn. P. 266.

**See'lye** (JULIUS HAWLEY), S. T. D., LL.D., b. at Bethel, Conn., Sept. 14, 1824; graduated at Amherst College 1849; studied theology at the Auburn Seminary, and also in Germany; was ordained pastor of the First Reformed Dutch church, Schenectady, N. Y., in 1853, where he remained until 1858, when he accepted the professorship of mental and moral philosophy in Amherst College, which he still holds. In 1872 he visited India, where he spent three months, largely occupied in lecturing to educated and English-speaking Hindoos on the truths of Christianity. Some of these lectures were published in Bombay (1873) by request of their auditors, and also at Boston (1874) under the title *The Way, the Truth, and the Life.* He has also published a volume on *Christian Missions* (New York, 1875), besides various sermons, addresses, and articles in quarterly reviews, and translated Schwegler's *History of Philosophy* (New York, 1856). In 1874 he was elected to the 44th Congress by a spontaneous movement of the people of his district, and without having received a nomination from any political party. In 1876 he was elected president of Amherst College, still retaining his professorship.

**Seelye** (LAURENUS CLARK), D. D., brother of Julius H., b. at Bethel, Conn., Sept. 20, 1837; graduated at Union College 1857; studied at Andover Theological Seminary 1857–59, at Berlin and Heidelberg universities 1860–62; travelled in Europe, Egypt, and Palestine; was ordained pastor of a Congregational church at Springfield, Mass., 1863; was professor of English literature and oratory at Amherst College 1865–74, and became in 1874 president of the new Smith College for Young Women at Northampton, Mass. Author of various contributions to reviews, including articles on collegiate education and on Celtic literature.

**See'mann** (BERTHOLD), PH. D., b. at Hanover, Germany, Feb. 28, 1825; educated at the lyceum of that city and at the University of Göttingen; was naturalist on board H. M. S. Herald on an exploring expedition around the world 1846–47; made three arctic voyages in search of Sir John Franklin; explored the Feejee Islands and parts of North and South America 1860–62; published *A Narrative of the Voyage of the Herald* (1853), *Popular History of Palms* (1855), *The Botany of the Voyage of the Herald* (1857), *Viti, an Account of a Government Mission to the Fiji Islands* (1862), *Popular Nomenclature of the American Flora,* and other scientific works; contributed to literary, political, and geographical periodicals in England; accompanied Capt. Bedford Pim in his travels in Central America, and joined him in writing *Dottings on the Roadside in Panama, Nicaragua, and Mosquito* (1869); engaged in mining enterprises in Nicaragua. D. at the Javali Mine Oct. 10, 1871.

**Seet'zen** (ULRIC JASPER), b. near Jever, Friesland, Holland, Jan. 30, 1797; educated at the University of Göttingen, where he gave special attention to natural science; became a friend of Blumenbach and of Humboldt; undertook, under the patronage of the dukes of Saxe-Gotha, an extensive exploration of Asia and Africa; reached Constantinople 1802; proceeded to Aleppo, where he studied Arabic fifteen months, 1803–04; traversed Syria and Palestine to the borders of Arabia, making valuable scientific collections 1804–05; explored Lebanon and the regions E. of the Dead Sea in the costume of a Turk, discovering the sites of many towns before unknown, 1805–06; was again at Jerusalem Mar., 1807; proceeded thence by way of Sinai to Egypt, where he procured a vast collection of MSS. and other objects for the museum of Gotha; explored Upper Egypt, and in the disguise of a Mohammedan pilgrim visited Mecca and Medina; set out for Mocha Mar., 1810, and reached that city, whence his last letter was written Nov. 17, 1810. Nothing certain was ever known of his subsequent history, but he was believed to have been poisoned in 1811 by the imam of Saná. His diary and maps, recovered in 1815, were published at Berlin (3 vols., 1854–55).

**Seez,** town of France, department of Orne, on the Orne, manufactures gloves and linen. P. 5045.

**Sefton,** tp., Fayette co., Ill. P. 1227.

**Seg'ment** [Lat. *segmentum*]. A segment of a circle is a part of a circle included between two parallel chords; these chords are the bases of the segment. If one chord becomes a tangent, the segment has but one base. A spherical segment is a portion of a sphere included between two parallel planes; the circles cut out by these planes are the bases of the segment. If one of the planes is tangent to the surface of the sphere, the segment has but one base.

**Segner's Wheel.** See BARKER'S MILL.

**Se'gni,** town of Italy, province of Rome, on a hill S. E. of Rome, 40 miles distant by rail. This was one of the oldest Italian cities, being already a place of importance when it was occupied and strengthened by Tarquin the Proud. Most interesting remains of these remote ages may still be seen here, such as fragments of the old cyclopean walls, a fine gate of the same period, etc. During the Middle Ages it was one of the foremost towns of the Campagna, a favorite sojourn of popes and princes. The cathedral is one of the most imposing in the province, and contains some rich chapels. The present inhabitants are a vigorous race, and bring down for market large quantities of wood from the neighboring mountains. P. 5600.

**Se'go,** town of Western Africa, capital of the state of Bambara, on the Joliba, in lat. 13° 5′ N., lon. 5° W. It is well built, contains many mosques and a large palace, and carries on considerable traffic. P. 30,000.

**Sego,** p.-v., Madison tp., Perry co., O. P. 33.

**Segor'be,** town of Spain, province of Castellon, on the Palancia, is beautifully situated, well built, and has large manufactures of brandy, paper, and flour. P. 7232.

**Sego'via,** an old and interesting town of Spain, the capital of the province of the same name, on the Eresma, on a lofty rock, and is surrounded by old walls surmounted by round towers. Its streets are narrow and crooked, but many of its buildings are magnificent. The aqueduct which carries the waters of the Rio Frio into the city is 2921 feet long and rests on 170 arches, some of which are 102 feet high. It is built of granite blocks without cement or mortar, and is the grandest specimen of Roman architecture in Spain. But the famous cloth manufactories which once supplied Europe have entirely disappeared, and the trade of the city has also sunk into insignificance. P. about 12,000.

**Se'guin,** p.-v., cap. of Guadalupe co., Tex., on Guadalupe River, has 1 weekly newspaper. P. 988.

**Seguin'** (EDOUARD), M. D., b. at Clamecy, department of Nièvre, France, Jan. 20, 1812. His ancestors for sev-

eral generations had been eminent as physicians. He was educated at the colleges of Auxerre and St. Louis in Paris, and studied medicine and surgery under Itard, and was subsequently associated with Esquirol. While yet a student he became one of the brilliant coterie of young men who accepted the teachings of Saint-Simon in philosophy and political economy. Ledru Rollin, Pierre Leroux, Michel Chevalier, Louis Blanc, the elder Flourens, and the Pereires were his most intimate friends. At the suggestion of Itard, who had himself attempted without success the training of a wild idiot boy, Dr. Seguin undertook soon after receiving his medical degree the training of a few idiot children. Devoting himself with great assiduity to the study of their psychological condition, he at length comprehended the nature of their infirmity so clearly that he was able to produce most remarkable results by his system of training them. In his first experiments Esquirol was associated with him, and their names appear together on the title-page of his first pamphlet on the subject of idiot training in 1839. Other duties called Esquirol away, but Seguin continued his humane labors, and from the idiot children in the great Hospice des Incurables a number were selected and placed under his care. In 1844 a commission from the Academy of Sciences of Paris, consisting of MM. Serres, Flourens, and Pariset, examined critically Dr. Seguin's method of training and educating idiot children, and in their report to the Academy they gave to it the highest commendation, declaring that up to the time when he commenced his labors (1837) idiots could not be educated or cured by any means previously known or practised, but that he had solved the problem. His work thus approved by the highest scientific authority, Dr. Seguin continued his philanthropic labors in Paris for some years, publishing in 1846 his great treatise, *Traitement moral, Hygiène et Éducation des Idiots et des autres Enfants arrières,* which has continued to be the standard textbook for all interested in the education of idiots to the present time. (See Idiocy, by Dr. H. B. Wilbur.) He devoted his spare moments during this period (1839–48) to literary labor, but with direct reference to his specialty. After the revolution of 1848, Dr. Seguin migrated to the U. S.; visited the school for idiotic children in South Boston and the institution for feeble-minded youth at Barre, Mass., both in large measure the outgrowths of his labors in Paris; went to Albany, where Dr. Wilbur was just organizing the experimental school which has culminated since in the New York State Idiot Asylum at Syracuse, and rendered him invaluable assistance in that organization; returning to France, he came back with his family in 1851, and settled in Portsmouth, O., in the practice of his profession. But he could not be content without toiling still more for the helpless idiot children, and in 1854–57 he was at Syracuse teaching and training idiot children, aiding in the establishment of new institutions in Connecticut, Ohio, and Pennsylvania, and for a time was at the head of the Pennsylvania institution. Revisiting France again in 1858, he returned in 1859, and settled in practice at Mount Vernon, N. Y., from whence he removed to New York City in 1863. In 1866 he published *Idiocy, and its Treatment by the Physiological Method,* a valuable textbook and authority on the subject. Though he has not lost his interest in the subject with which he has been so fully identified, his later writings have been largely occupied with physiological education and professional topics. He was a commissioner from the educational bureau at the Vienna Exposition in 1873. Besides the works mentioned above, Dr. Seguin has published *Conseils à M. O. sur l'Éducation de son Enfant Idiot* (Paris, 1839), *Théorie et Pratique de l'Éducation des Idiots* (2 parts, Paris, 1842), *Hygiène et Éducation des Idiots* (Paris, 1843), *Images graduées à l'Usage des Enfants arrières et Idiots* (Paris, 1846), *F. R. Pereire, premier Instituteur des Sourds et Muets en France* (Paris, 1847), *Historical Notice of the Origin and Progress of the Treatment of Idiots* (translated by J. S. Newberry, M. D., 1852), *Idiocy, its Diagnosis and Treatment by the Physiological Method; An Address before the New York State Medical Society* (1864), *New Facts and Remarks concerning Idiocy* (1869), an edition of Wunderlich's *Medical Thermometry,* with large additions (1871), *Family Thermometry, A Manual of Thermometry* (1873), *Medical Thermometry and Human Temperature* (1876), *Report as Commissioner to the Vienna Exposition to the Secretary of State* (1876). Dr. Seguin is also the inventor of the physiological thermometer, so largely used by physicians. L. P. Brockett.

**Seguin** (Marc), b. Apr. 20, 1786, at Annonay, department of Ardèche, France, nephew of Montgolfier; studied engineering; was engaged in the construction of railways in South-eastern France and in the establishment of steam navigation on the Rhone; wrote *Mémoire sur le Chemin de Fer de Saint-Etienne à Lyon* and *De l'Influence des Chemins de Fer et de l'Art de les tracer et de les construire,* and is said to have arrived in 1839 at the same results in the calculation of the mechanical effects of heat as Mayer in Heilbronn in 1842, and Joule in London in 1843. D. at Annonay in 1875.

**Ségur',** a family of French nobility mentioned in the history of the middle of the ninth century, produced many names of good reputation in war, literature, and politics, and is still flourishing: (1) Louis Philippe, Count de Ségur, b. at Paris Dec. 10, 1753; received a military education, and served in America under Rochambeau; was appointed in 1783 ambassador to St. Petersburg, where he gained the favor of Catharine II., and concluded an important commercial treaty between Russia and France in 1787; retired from the public service after the overthrow of the monarchy; lost his large fortune during the Reign of Terror, and sustained himself and his family by literary work; was recalled to service by Napoleon; made a peer during the Restoration. D. at Paris Aug. 27, 1830. His principal works are *Théâtre de l'Hermitage* (2 vols., 1798), originally written for the private stage of Catharine II.; *Contes, Fables, Chansons et Vers* (1801), *Tableau historique et politique de l'Europe de 1786–96* (3 vols., 1800), *Mémoires, ou Souvenirs et Anecdotes* (3 vols., 1825). His *Œuvres complètes* were published in 33 vols. at Paris (1824–30).—(2) His son, Paul Philippe, b. at Paris Nov. 4, 1780; entered the army in 1799; became a member of the staff in 1802; governor of the imperial pages in 1804; brigadier-general and aide-de-camp to Napoleon during the Russian campaign, but was left without employment by the Restoration; made a peer by Louis Philippe. D. at Paris Feb. 25, 1873. In 1824 he published *Histoire de Napoléon et de la Grande Armée pendant l'Année 1812,* which made a great sensation, and has been often republished. He also wrote *Histoire de Russie* (1829) and *Histoire de Charles VIII.* (2 vols., 1834; translated into English, Philadelphia, 1842).

**Sehome,** p.-v., Whatcom co., Washington Terr., on Bellingham Bay, Georgia Straits.

**Seicentis'ti** [It.], in the history of the Italian literature, is the collective name of the writers of the seventeenth century, but as these stood lower than those of the preceding age, and the whole period denotes the lowest point of a long decline, the name becomes associated with the idea of false taste and artificial expression.

**Seid'litz,** village of Bohemia, near Bilin, is famous for its mineral springs, whose water, containing sulphate of magnesia, sulphate of soda, and carbonic acid, is often used as an aperient.

**Seidlitz Powders.** See Rochelle Salt.

**Seidlitz Water.** See Seidlitz.

**Seifhen'nersdorf,** town of Germany, kingdom of Saxony, on the Mandan, has large dye-houses, bleaching-grounds, and linen-weaving factories. P. 6076.

**Seign'iorage** [Fr. *seigneuriage*], in finance, is the charge levied by government to cover the expense of coinage. In England no fixed seigniorage is levied on gold, while a considerable seigniorage is levied on the silver and copper currencies; any person may have standard gold coined in quantities of not less than £10,000. In France, on the contrary, the seigniorage on gold is heavy; and this absence of uniformity in the monetary systems of Europe is, irrespective of the weights of the several denominations, a serious hinderance and loss in international trade.

**Seine,** a river of France, rises in the department of Côte d'Or at an elevation of 1420 feet above the level of the sea, flows in a north-western direction, passes through Paris, where it is from 300 to 500 feet wide, and enters the English Channel at Havre by an estuary 7 miles wide. Its entire length is 497 miles, of which about 350 below Troyes are navigable by barges, and 40 from Rouen to Havre (to which the term *Seine maritime* is applied) by vessels of 200 to 300 tons. It receives from the left the Yonne, the Essonne, and the Eure, and from the right the Aube, Marne, and Oise. By canals it communicates with the Loire, Saône, Rhine, and Scheldt. "Though surpassed in some respects by the Loire, Saône, and Garonne, yet taken as a whole, with the hills and valleys, forests and meadows, numerous villages and populous towns, and famous cities, which line its banks, it is the finest river in Europe."

**Seine,** the smallest but the most densely peopled and wealthiest department of France, comprises an area of 185 sq. m., with a population of 2,220,060. The ground is undulating and beautifully varied, traversed by the Seine and the Marne. The soil is not naturally fertile, but it has been made very productive by the skill of the farmers and gardeners. Immense quantities of vegetables, mushrooms, melons, peaches, and strawberries are raised for the market of Paris. Beautiful forests, as those of Boulogne, Vincennes, St. Cloud, and Meudon, cover a large part of

the surface between the cities, and rich quarries of building-stone and gypsum are found.

**Seine-et-Marne,** department of France, comprises an area of 2154 sq. m., with 341,490 inhabitants. The ground is slightly undulating and the soil very fertile. Extensive forests, yielding excellent timber, are found, among which is that of Fontainebleau. Large crops of wheat, vegetables, and fruits are raised; the wine of the department is mediocre, though it produces one of the most celebrated kinds of table-grapes, the Chasselas de Fontainebleau. On the pastures and meadows numerous cattle are reared, and immense quantities of cheese, the so-called fromage de Brie, are sent to the Paris markets. Of 45,763 children of school age, 3638 received no school education in 1857. Cap. Melun.

**Seine-et-Oise,** department of France, comprises an area of 2141 sq. m., with 580,180 inhabitants. In the southern part the ground is almost flat; in the northern, hilly and covered with forests. The soil is generally not fertile, but, being well manured and excellently cultivated, yields large crops of fruits and vegetables for the capital. Different branches of manufactures are pursued with great success. Several fine varieties of stone and clay are found, and the porcelain manufactures of Sèvres have acquired a world-wide reputation. Of 35,249 children of school age, 3450 received no school education in 1857. Cap. Versailles.

**Seine-Inférieure′,** department of France, borders on the English Channel, where a range of chalk-cliffs from 200 to 500 feet high faces the sea and forms many good harbors. The ground is generally composed of plains, watered by numerous small streams, and broken only in the south-western part by ranges of low hills. The soil is fertile and well cultivated. Forests abound; large crops of grain, hemp, flax, hops, and fruits are raised, and sheep, cattle, and horses are extensively reared and of good breeds. Manufactures, and especially fisheries and commerce, form important sources of wealth. Area, 2298 sq. m. P. 790,022. Of 87,857 children of school age, 21,359, nearly one-fourth, received no school education in 1857. Cap. Rouen.

**Seis′in** [Fr. *saisine*]. The ancient English law concerning real property did not conceive of a freehold estate in land—that is, an estate for life, or in fee simple, or in fee tail—as complete without the presence of a peculiar element, partly consisting in a physical fact and partly in a mental condition, which was termed seisin. The mere right of ownership was not enough unaccompanied by the seisin, which made that right perfect. Seisin was not the mere possession of the land, although it is very erroneously defined in many textbooks as synonymous with possession; it was the possession accompanied by a claim to a freehold estate in the land so possessed. It was a fundamental dogma of the common law that there could be only one seisin of the same land at the same time, and that the seisin could never be in abeyance; that is, it must be continuously vested in or held by some person. It might be rightful or wrongful It was rightful when the person seized had also a valid title to the estate which he claimed; it was wrongful when the person seized had no such valid title, but held the possession and claimed the estate in hostility to the one in whom the true title was vested. So much importance was attached by the law to this technical conception that a person who obtained the seisin wrongfully was nevertheless, while it lasted, regarded as holding an estate and as having tangible rights against the true owner. The seisin, however, so closely attended the title that it could not be lost by the entry of a stranger on the land while the owner thereof remained in possession; and if the owner made an entry upon his land, he immediately acquired the seisin thereof, and was enabled to maintain all actions for its recovery based upon the fact of his seisin. In a few instances the seisin passed on a change of ownership without an entry upon the land. It passed in this manner to the heir immediately upon the death of his ancestor, if the latter was seized at the time of his death. It was then denominated seisin in law, to distinguish it from the ordinary case, which required a possession. These highly technical, arbitrary, and even absurd conceptions and dogmas of the old common law have been wholly abrogated in the great majority of the American States, and they can only serve to confuse the simple rules of real property which generally prevail in this country. In the jurisprudence of the U. S. seisin means simply ownership, and as an almost universal rule it passes by the execution, delivery, and record of a valid conveyance; no actual entry on the land is requisite for its acquisition or recovery. There is no good reason why the word should be retained in our legal nomenclature; the simplicity and accuracy of the law would be promoted by its complete abandonment. JOHN NORTON POMEROY.

**Seismol′ogy** [Gr. σεισμός, "earthquake," and λόγος, "discourse"], the science of earthquakes. (See EARTHQUAKE, by PROF. ARNOLD GUYOT, LL.D.)

**Seiss** (JOSEPH AUGUSTUS), D. D., b. in 1823 in Maryland; pastor of the Evangelical Lutheran church of the Holy Communion, Philadelphia, and editor of the *Lutheran;* distinguished as a preacher and as the author of a number of books, especially in defence and illustration of Millenarianism. He is also author of the *Baptist System* (3d ed. 1860), *Ecclesia Lutherana* (1867), the *Javelin* (1871), and has been one of the most active and influential laborers in every prominent department of Church activity.

**Seistan′,** province of South-western Afghanistan, Central Asia, between lat. 30° and 32° N. and lon. 61° and 62° E., bordering W. on the Persian province of Yezd. The surface forms a deep valley, or rather an extensive depression, toward which the surrounding table-lands slope gently. The soil consists either of quicksand or of a stiff clay covered with coarse grass and tamarisk bushes, and uncultivable except along the rivers, which from the surrounding highlands gather in the middle of the depression and form the large but shallow lake of Hamoon. The land is mostly a desert. Between 50,000 and 60,000 inhabitants cultivate the river-tracts, but they are exposed both to the robberies of the wild nomadic tribes of the neighboring provinces and to the devastations of the hot, scorching winds, which rise on the Persian deserts, and carrying along with them clouds of dust, sweep down over the land and cover the fields with sand. Horses and cattle will not thrive here, but camels and sheep. Large ruins show, however, that this country once must have been well peopled and wealthy; it was probably ruined by Timoor at the end of the fourteenth century.

**Seizin.** See SEISIN.

**Seja′nus** (ÆLIUS), b. at Vulsinii in Etruria, a son of that Seius Strabo who was commander of the prætorian guard in the latter part of the reign of Augustus; grew up in intimate intercourse with the younger members of the imperial family, and gained by means unknown the full confidence of Tiberius, over whose mind he seems to have borne absolute sway for many years. He was an infamous character in every respect, and, outside of scheming, intriguing, lying, and dissimulating, had no abilities. But he was audacious and energetic. He dared to aim at the imperial power, and he came very near his goal. Having succeeded his father in the command of the prætorian guard, he gathered the whole body of these troops, which had hitherto lived scattered over the whole city and its vicinity, into one intrenched camp at the Porta Viminalis, and thereby both increased their importance immensely and gained their favor for himself. To the senate and populace he considered it unnecessary to pay any regard, but, although in possession of the military power, between him and the crown there still stood the whole imperial family. In 23, however, he persuaded Livilla, who was married to Drusus, the son and heir of Tiberius, to poison her husband, and he divorced his own wife in order to marry her. Soon after, he succeeded in making Agrippina, the widow of Germanicus, suspected in the eyes of Tiberius, and she and her two sons, Nero and Drusus, were banished from Rome. In 26 he induced the emperor himself to retire to the island of Capreæ, and the whole administration was now actually left in his hands. Meanwhile, the suspicion of Tiberius became aroused, by what or by whom is unknown, and (Oct. 18, 31) Sejanus was arrested in his seat in the senate, sentenced to death by that assembly, and executed the next day. His body was dragged through the streets, torn to pieces by the mob, and thrown into the Tiber. His immense fortune was confiscated; his children, most of his relatives, and many of his friends were killed. The sources of his *Life* are Tacitus, Suetonius, Dion Cassius, and Velleius Paterculus, all rich in striking scenes.

**Sekunderabad′** [properly **Sikanderabad,** "Alexander's town"], 3 miles due N. of Hyderabad, the capital of the nizam's dominions in British India, the head-quarters of the Hyderabad subsidiary force, and the largest cantonment of European English troops in India. It is 1830 feet above sea-level; the annual mean temperature is 77.4° F.; the climate may be set down as favorable. Formerly, Sekunderabad had the reputation of being one of the most unhealthy stations in India; now the new European barracks are the most commodious and handsome of the kind in India; they stand on a piece of ground known as Trimulgherry, given to government by the nizam, and enclose a space of 2½ sq. m. The hospital is a very superior building; the prevailing disease is fever. In 1862 the nizam built the "public rooms," consisting of a ball, dining, billiard, and retiring rooms, and presented them as a free gift to the officers of the garrison for the time being; the institution is maintained by the subscrip-

tions of the European residents of the station. In 1790 an agreement was made that the nizam should furnish a contingent of 10,000 men, to be paid by the British government; by the treaty of 1800 some regiments of the East India Company's native troops were added to the subsidiary force, and it was stipulated that this force is to be stationed in perpetuity in the nizam's territories for his own service. To this force European troops were first added in 1803; in 1874 the strength of the troops was 2457 Europeans, 3386 native troops. The troops are annually paraded for inspection by the nizam's military authorities. In Oct., 1874, the railway was opened, which, branching off at Gulbarga from the Bombay-Madras line, ends at Sekunderabad; a very unpleasant march of 140 miles is thus spared to the troops. E. SCHLAGINTWEIT.

**Sela'chians** [Gr. *σέλαχος*, "cartilaginous fishes"], the name of the class of ichthyoid vertebrates containing the sharks, rays, and chimæras. (See ELASMOBRANCHIATES in APPENDIX.)

**Selachos'tomi** [Gr. *σέλαχος*, "cartilaginous fishes," especially rays or sharks, and *στόμα*, "mouth"], a name devised by Cope for an order of fishes belonging to the sub-class Teleostei and super-order Chondroganoidea, the only other order of which is that of the Chondrostei, containing the sturgeons. The order Selachostomi is represented in the present epoch by only two generic types, which are closely related, but peculiar one to North America and the other to Eastern Asia. They were formerly classed in the same order as the sturgeons, but are very decidedly different in many respects. The distinctive characters are as follows: The skeleton is mostly cartilaginous and the *chorda dorsalis* persistent; the cranium cartilaginous, or very imperfectly ossified; the mouth is bounded above by the premaxillary bones, and no supramaxillary ones are developed; of the opercular bones, the operculum alone is developed, the suboperculum and interoperculum, as well as preoperculum, being wanting; the symplectic bone is also wanting; the basihyals and superior ceratohyals remain unossified, as well as the branchihyals; the proscapula, as well as post-temporal and interclavicles, are well developed; the coracoid, or paraglenal, is also well developed and entire; the fins are very finely radiated, and the caudal heterocercal. The order is represented by the single family POLYODONTIDÆ (which see), and as yet no fossil remains certainly attributable to the order have been found, although undoubtedly the living representatives of the class are the last of a long line of more or less similar types. The special characters of form of the mouth, dentition, and leaf-like prolongation of the snout are rather of family than ordinal value. THEODORE GILL.

**Selborne,** BARON. See PALMER (ROUNDELL).

**Sel'by,** town of England, county of York, on the Ouse, has shipbuilding slips and manufactures of sailcloth, rope, leather, and iron goods. P. 5271.

**Selby,** tp., Bureau co., Ill. P. 1497.

**Sel'bysport,** tp., Garrett co., Md., on Youghiogheny River. P. 1419.

**Sel'den** (HENRY), M. D., a son of William B., b. in Norfolk, Va., Nov., 1817; educated at the University of Virginia, and took his degree in medicine from the University of Pennsylvania 1841; was a private pupil of the celebrated Dr. Gerhard, and became resident physician in Blockley Hospital, Philadelphia; subsequently spent three years in Europe. On his return he soon secured a high position as a successful practitioner, but fell a martyr to professional duties in the prevailing epidemic. D. of yellow fever Oct. 2, 1855. PAUL F. EVE.

**Selden** (JOHN), b. at Salvington, near Worthing, Sussex, England, Dec. 16, 1584, being descended on the mother's side from a knightly family; studied at Chichester free grammar school, at Hart Hall, Oxford, 1598–1601, at Clifford's Inn 1601–04, and afterward at the Inner Temple, where he was called to the bar; acquired great fame for his classical, Oriental, and political attainments; became intimately associated with Camden, Usher, Sir Robert Cotton, Sir Henry Spelman, and other eminent scholars; was intimate with Ben Jonson; wrote in 1606, when only twenty-two years of age, his first treatise, the *Analecton Anglo-Britannicon* (not published until 1615; new ed. 1653), giving an account of the civil administration of Great Britain prior to the Norman Conquest; issued his *Jani Anglorum Facies Altera* (1610; English translation 1682); furnished learned notes and illustrations to Drayton's *Poly-Olbion* (1613); published elaborate treatises on *Titles of Honor* (1614), and on Syrian mythology, as illustrative of the Old Testament, *De Diis Syris Syntagmata duo* (1617), a work which supplied Milton with important material for his *Paradise Lost;* was cited before the court of high commission (Dec., 1618) for having denied the divine right of tithes in a *History of Tithes* (1618), and was compelled to sign a withdrawal (not recantation) of the obnoxious doctrine; was imprisoned five weeks in the custody of the sheriff of London (1621) for having advised the House of Commons to resist King James's claim that their privileges were derived from royal grants; was elected member of Parliament for Lancaster 1623; was for some years an earnest and effective champion of the popular party in the long struggle with the Crown; conducted the prosecution of the duke of Buckingham in 1625, and again in 1628; defended Sir Edward Hampden before the court of king's bench for refusing to pay a forced loan 1627; opposed the royal prerogative on the questions of tonnage and ship-money, and aided in drawing up the celebrated "Petition of Right" 1628, for which conduct he was imprisoned in the Tower by order of the king Jan., 1629; was transferred to the king's bench prison in September, and remained there until 1634, when he was allowed to go at large on bail. During his imprisonment he continued his antiquarian and legal studies; published shortly after his release his most celebrated work, *Mare Clausum* (1635), which was dedicated to Charles, and defended the sovereignty of England over the "narrow seas" in reply to the claims of Holland to the right of fishing on the coasts of England, as advocated by Grotius in his *Mare Liberum;* sat in the Long Parliament (1640) for the University of Oxford; favored the exclusion of the bishops from the upper house, and aided in drawing up the articles of impeachment against Laud, but was subsequently considered a moderate supporter of the royal side, though displaying great impartiality in the questions at issue, and condemning the excesses of both parties; was a lay member of the Westminster Assembly of Divines; took the Covenant, and was appointed by Parliament chief keeper of the rolls and records in the Tower 1643; declined the mastership of Trinity Hall, Cambridge; was one of the twelve commoners appointed commissioners of the admiralty 1645; received from Parliament a grant of £5000 in recompense of his losses and as a reward for his services to the state 1646; was one of the university visitors 1647, and influential in Parliament in protecting the endowments of university chairs from the destructive zeal of the fanatics, and in preserving the library of Archbishop Usher from being dispersed; remained in Parliament after the death of the king, though taking little part in its proceedings; declined Cromwell's request to write a reply to the *Eikon Basilike,* and spent his closing years at White Friars, near London, as manager of the estate of Elizabeth, countess-dowager of Kent, to whom he was said to have been secretly married. D. at London Nov. 30, 1654, and was buried in the Temple church. He bequeathed his valuable library to some public institution at the discretion of his executors, among whom was Sir Matthew Hale, and it was given to the University of Oxford. Among his many works were *Marmora Arundeliana* (1628), a description of the marbles brought from Greece by the earl of Arundel; *De Jure Naturali et Gentium, juxta Disciplinam Hebræorum* (1640), *A Discourse concerning the Rights and Privileges of the Subjects* (1642), an edition of Fleta's celebrated *Commentary on English Law* (1647), *De Synedriis et Præfecturis Juridicis veterum Hebræorum* (3 books, 1650–55), and an edition of *Eutychius* (1656). His *Table Talk,* an amusing and valuable miscellany, was published in 1689 by Rev. Richard Milward, who had been his amanuensis, and by Samuel Weller Singer (Lond., 1847; 3d ed. 1860). His *Works* were edited, with a *Memoir,* by David Wilkins (3 vols. folio, 1626). PORTER C. BLISS.

**Selden** (WILLIAM), M. D., b. in Norfolk, Va., Aug. 15, 1808; was two years at the University of Virginia; graduated M. D. at the University of Pennsylvania 1830, and spent two years in London and Paris; has been a practitioner in Norfolk since 1833; served during the late war as surgeon in the Confederate army. Published an account of the origin of yellow fever in his native city in 1815, and reported a case of ligature to the subclavian artery for gunshot wound of the axillary in the *Confederate Medical Journal.* He is now one of the leading physicians of Norfolk. PAUL F. EVE.

**Selden** (WILLIAM BOSWELL), M. D., b. at Hampton, Va., Aug. 31, 1772; studied medicine in the University of Pennsylvania and Edinburgh, Scotland; for half a century was the leading practitioner of Norfolk. His faculty for observation and sound judgment gave him a great reputation. He was probably the first to use calomel in cholera infantum. His only professional publication was an account of yellow fever in Norfolk in 1800. D. July 18, 1849. PAUL F. EVE.

**Selenates.** See SELENIC ACID.

**Sele'ne,** in Grecian mythology, the goddess of the moon (Lat. *Luna*), was a daughter of Hyperion and a sister to Helios and Eos. She was also called Phœbe, as the

sister of Phœbus, and in later times she was identified with Artemis, and the worship of the two became amalgamated. In art, however, they were usually distinguished, Selene being smaller, having a rounder face, and wearing a long robe.

**Selen'ic Acid.** This acid, which is very interesting from its analogies with sulphuric acid and the parallelism of the compounds of the two, has the composition $H_2.O_4.Se$. Mitscherlich discovered it in 1827. The anhydrous oxide, $SeO_3$, is as yet unknown. It is best prepared from Selenious Acid (which see) by the method of Wohlwill, which consists in forming a selenite of copper, converting this into selenate by the action of chlorine, which gives a mixture of cupric chloride and cupric selenate. The former is dissolved out from the latter by alcohol, and the cupric selenate suspended in water and decomposed by sulphuretted hydrogen. The filtered selenic acid is concentrated by evaporation. The most concentrated liquid acid obtainable boils at 280°, and Mitscherlich found for two preparations the densities 2.52 and 2.62. In this state it contains still a little water. It resembles oil of vitriol in many respects, and, like this, dissolves zinc when diluted, with evolution of hydrogen; but it nevertheless has the extraordinary power of oxidizing and decomposing hydrochloric acid when boiled with it, chlorine being evolved and the selenic acid reduced to $SeO_2$. The *selenates* are bibasic, like the sulphates, and have a remarkable analogy with the latter, there being biselenates like the bisulphates, and selenic alums similar to common alums; and the corresponding salts of the two acids resemble each other even in solubility, the lead, barium, and strontium selenates being insoluble, like the sulphates. Nitric acid does not act on them, but with hydrochloric acid they evolve chlorine, forming selenious acid and chlorides. Henry Wurtz.

**Sel'enides,** compounds of selenium with metals and other elements. Many native mineral selenides are mentioned under Selenium (which see). The selenates and selenites, when subjected to reducing agents, yield selenides. They are much less easily dissolved by hot nitric acid than the corresponding sulphides, mercuric selenide (*tiemannite*) being almost unacted on. Henry Wurtz.

**Sele'nious Oxide** and **Acid** ($SeO_2$), the only oxide of selenium known, is a solid white substance obtained by combustion of selenium in oxygen, or by evaporating selenious acid to dryness. It sublimes, without fusing, below redness, condensing in crystals; and is very deliquescent. Its compound with water, selenious acid ($O_3.H_2.Se$), is a strong acid, which decomposes, with heat, the chlorides and nitrates, and forms neutral salts with bases, being exceptional, nevertheless, in being decomposed by heat, as above intimated. The *selenites* are bibasic, and large numbers have been prepared and investigated, but for these the chemical textbooks must be referred to. Henry Wurtz.

**Sel'enite** [Gr. σεληνίτης, "moonlike"], a mineralogical name for Gypsum (which see). Dana believes that the σεληνίτης of Dioscorides was probably really crystallized gypsum, but not the *selenitis* of Pliny. The writer's recent discoveries in molecular structure indicate two distinct varieties of the species selenite or gypsum—allotropic modifications, as they may be called—one having density, when homogeneous, = 2.313 (Mohs found 2.31, and Kenngott, as the mean of 15, found 2.317), and the other = 2.337 (Filhol found 2.331). These two contain the metallic base, the calcium, in *calcite* and *aragonite* molecules respectively. This will be found explained under the head of Volumes, Molecular. Henry Wurtz.

**Sele'nium** [Gr. σελήνη, the "moon"], one of the elements, thus named by Berzelius, who discovered it in 1817, because closely related to *tellurium*, which had been named by Klaproth after *tellus*, the "earth." Sulphur, selenium, tellurium, and oxygen form Berzelius's natural *amphigen* group of elements, which are certainly separated widely from the *halogen* group in many respects, though fluorine apparently forms a connecting link, having many affiliations with both groups. Selenium must be considered one of the *rarer* elements, though several native mineral compounds of it are known. According to some authorities, it occurs native in the elemental form at a Mexican locality, but this must be dubious, as Dana, in his *Mineralogy*, makes no allusion to it. The mineral *clausthalite* is selenide of lead, *zorgite* a double selenide of lead and copper, these being the principal sources of commercial selenium, and somewhat common in the mines of the Hartz Mountains, at Tilkerode, Clausthal, and Zorge, also at Glasbach in Thuringia. *Lehrbachite* is a selenide of lead and mercury from the Hartz; *berzelianite*, a selenide of copper from the same, and from Skrikerum in Småland, Sweden; *eucairite*, a copper and silver selenide, also from Skrikerum, and found in several Chilian localities; *naumannite*, a silver-lead selenide from the Hartz. There is a silver selenide in crystals at Tasco in Mexico (del Rio); *tiemannite*, a mercuric selenide, from the Hartz; and a few others less known. Certain iron pyrites, as at Fahlun in Sweden, contain selenium; and when these are used for making sulphuric acid, a seleniferous deposit forms in the leaden chambers, in which, indeed, the element was first discovered by Berzelius, and from which, at Fahlun, a good deal is now procured. Traces of selenium were found by Dr. Genth in the Virginian and Georgian *tetradymites* (bismuthic tellurides), but this element seems almost absent from the North American continent, so far as known. In obtaining it from the Hartz Mountain selenides, carbonates are first removed by muriatic acid, and the ore then fused with *black flux* to form selenide of potassium, which is soluble in water. The solution, exposed to the air, allows the selenium, through oxidation of the potassium, to precipitate in the elemental form. The leaden-chamber deposit is deflagrated with saltpetre to form selenate of potash, the latter dissolved in muriatic acid, concentrated, and treated hot with sulphurous acid, which reduces the selenium.

Selenium forms a series of allotropes, like sulphur, phosphorus, and indeed most of the other elements. New discoveries of the writer in molecular chemistry (which will be found explained, in part, under the head of Volumes, Molecular) enable him to recognize and define at least four distinct selenium allotropes, with considerable probability, from the facts placed on record by different investigators: (1) *Electro-negative amorphous selenium*, obtained by action of air or of a voltaic current upon HSe in solution. This is amorphous, and soluble in $CS_2$. Its density when pure and homogeneous = 4.241 at 0°. Schaffgotsch found as a minimum 4.245. (2) *Electro-positive amorphous selenium*, obtained from solutions of selenates or selenites by reduction with $SO_2$, or by electrolysis. This appears to be the modification experimented on by Berzelius. It is insoluble or difficultly soluble in $CS_2$. It is called "vitreous selenium." It fuses somewhat above 100°, and on cooling remains soft and *viscous*, so that it may be drawn into threads like sealing-wax for a long time; *viscous* selenium would be a better term. The threads, when slender, are translucent with a deep ruby color. When suddenly cooled it becomes brittle, with vitreous fracture, lustre almost metallic. It is a non-conductor of electricity, and when pure and homogeneous its density at zero should be = 4.322. Berzelius found, as a *maximum*, 4.32. (3) *Lighter crystalline selenium*, obtained by Mitscherlich by crystallization from $CS_2$. Density when homogeneous = 4.495 at 0° (Mitscherlich, 4.46 and 4.509 at 15°). The crystals, once formed, redissolve only to the extent of 1 per cent. in boiling $CS_2$. On heating to 150° it passes to the next modification, but by melting and rapid cooling may be brought to a somewhat soluble condition again, probably to modification No. 2. (4) *Metalloidal* and *Black Selenium*, the *Heavier Crystalline Selenium*.—This modification is formed either on very slow cooling of fused selenium, or on heating the allotrope No. 3 to 150° C. It has, when homogeneous, at zero, the density 4.815 (Hittorf found 4.808 at 15°, and Rathke found, for *black* Se, 4.81). Metalloidal selenium is lead-gray, opaque, with metallic lustre and granular fracture, entirely insoluble in $CS_2$, and conducts electricity. All authorities agree that heat is produced during the condensation of the denser selenium-allotropes from the lighter ones, but the amount of this heat is great according to some, and according to others small. Probably the same allotrope was not always started with.

Selenium does not kindle easily like sulphur, but when heated strongly will burn in the air; and selenides will burn before the blowpipe. A characteristic *odor* accompanies this combustion, compared by some to that of *horseradish*, by which the presence of selenium in a mineral can be detected by those who know the odor.

*Compounds* (see also Selenic Acid, Selenious Acid, Selenite).—*Selenietted hydrogen*, corresponding to *sulphuretted hydrogen*, is one of the most interesting of these. $H_2Se$ is a permanent gas, which may be formed by the action of an acid on selenide of potassium, or by heating selenium in a current of dry hydrogen to its vaporizing-point. At a higher temperature dissociation again occurs. It is very poisonous, producing catarrhal disease when inhaled, and destroying the sense of smell. It does not liquefy at —15° C. Henry Wurtz.

**Seleu'cia,** the name of two ancient cities of Asia, built by Seleucus Nicator (312–280 B. C.). The first, *Seleucia Pieria*, was on the Orontes, near its mouth, and formed the port of Antioch. It had an excellent harbor and was strongly fortified. Under the Romans it lost its importance and fell into decay, but its ruins still bear witness to its splendor. The second, *Seleucia on the Tigris*, rose and became the first city of the empire, surpassing Babylon in splendor and Antioch in importance, and containing 600,000

inhabitants. After the fall of the Seleucidæ, in the wars between the Persians and the Romans, it was sacked several times, and at last entirely destroyed.

**Seleu'cus I., Nica'tor,** founder of the Syrian monarchy and of the dynasty of the Seleucidæ, which ruled over it from 312 to 65 B. C., b. in Macedonia about 358 B. C. His father, Antiochus, was one of the generals of Philip, and he himself accompanied Alexander on his Asiatic campaigns, and is mentioned several times as holding superior commands, in which he distinguished himself. After the death of the great conqueror he followed Perdiccas, and was made commander of the cavalry, but after the disaster at Pelusium on the bank of the Nile in 321 he was one of the foremost of the conspirators who broke into the tent of Perdiccas and assassinated him. By the second division of the empire he received the satrapy of Babylonia through the influence of Antigonus, whom he then supported against Eumenes; but when Antigonus had defeated Eumenes he assumed an authority over all the Asiatic provinces to which Seleucus would not submit, though he was unable to resist it. In 316 B. C. he fled to Egypt, and instigated Ptolemy to join Lysimachus and Cassander against Antigonus. In the war which ensued he commanded the Egyptian fleet, and operated with great success before Tyre and at Cyprus. After the battle of Gaza, in which Demetrius Poliorcetes, the son of Antigonus, was completely routed, Seleucus was able to return to Babylonia, though only with a very small retinue; but his popularity was so great in the province that the inhabitants unanimously rose in his favor, and he was once more established as satrap of those populous and wealthy regions. The date of his return (Oct. 1, 312 B. C.) was afterward fixed as the starting-point of the era of the Seleucidæ, which was used by the Jewish and Arabian historians down to the fifteenth century A. D. In 306 B. C. he assumed the title of king, following the example of the other generals of Alexander, but very little is known of his life during these years, as he principally directed his activity toward the East, where he extended his dominions to the Oxus and Indus. He was a powerful monarch when for the second time he joined the league of Ptolemy, Lysimachus, and Cassander against Antigonus, and he decided the fortunes of the battle of Ipsus (301 B. C.) by his 480 elephants. Of the spoil he received the lion's part, Syria and the southern half of Asia Minor. In 286 B. C. Demetrius Poliorcetes surrendered himself unconditionally to him, and was kept in a sort of mild captivity at Apamea on the Orontes, where he died in 283 B. C.; and in 281 B. C. he completely routed Lysimachus at Corupedion, thus extending his dominion over all the Asiatic countries which had formerly belonged to the empire of Alexander. As Lysimachus had fallen in the battle of Corupedion, the throne of Macedonia was now vacant, and in the following year Seleucus crossed the Hellespont with a magnificent army, but at Lysimachia he was assassinated by Ptolemy Ceraunus (280 B. C.), and thus ended his brilliant career. Philetærus, satrap of Pergamus, redeemed his body and brought it to his son and successor, Antiochus, who buried it in Seleucia on the Orontes and raised a magnificent temple over his tomb. In his internal policy he was a true representative of the ideas of Alexander. He planted Greek colonies everywhere in his Asiatic provinces, and introduced Greek religion and art, Greek laws and customs. He divided his empire into 72 satrapies, and at the head of each he placed a Macedonian or Greek. Of the many cities which he founded, Seleucia on the Tigris and Antiochia in Syria were the most remarkable; both became important and splendid, and flourished through many centuries. (For the vicissitudes of his kingdom see SYRIA; for those of his dynasty, see ANTIOCHUS.)

**Self-Defence'.** This generic term embraces and describes all the rights which the law confers upon the individual to protect by his own acts and agencies his property or his person against some injury unlawfully attempted to be inflicted by another; and the rules of the municipal law in respect to these rights are in close conformity with the principles of natural justice. In ascertaining the extent to which the rights of self-defence may be exercised, the two cases of property and of person should, for greater convenience and clearness, be considered separately. When the invasion of property is in the nature of a private trespass merely, or is an attempt simply to deprive the true owner of its possession, the proprietor may use so much force as may be reasonably necessary to defend, protect, and retain his own possession, short of taking life; the law does not allow the sacrifice of human life in order to preserve a present right of property, which if lost could probably be regained by a judicial proceeding. If, however, the attack is forcible, and is made with the intent by the assailant to commit some great and heinous felony—if, for example, the assailant is attempting a burglary, or arson of a dwelling-house in the night-time, or enters a house with intent to commit murder or robbery and the like—not only the owner, but any occupant, may repel the attack with all the force that is requisite, and may if necessary kill the assailant in order to accomplish that object. An attack upon the person may be either (1) a mere assault and battery, or (2) an attempt to take life or to do some great bodily harm. In the first instance, the right of self-defence permits the use of so much force as may be necessary to repel the assault, and no more; in the second instance, the same principle permits and justifies, under proper circumstances, the destruction of life. If one's own life is threatened, or if some great bodily harm is about to be inflicted, or if an aggravated and forcible crime against the person is attempted—such as robbery, or rape upon a woman—and the circumstances are such, the danger so apparent, as would lead any reasonable man in the same position to the conclusion that the only mode of escape was by slaying the assailant, the law permits and excuses the homicide. The justification in such a case does not depend upon the actual fact of an impending danger, but upon the sufficiency of its appearance to convince a reasonable man in the same situation that it did actually exist. This right to defend one's self extends also under like circumstances to the person of a husband or wife, parent or child, master or servant; and undoubtedly a private citizen may interpose and prevent, by the use of all necessary force, the actual commission of a violent felony upon the person of any individual. JOHN NORTON POMEROY.

**Self'ridge** (THOMAS O.), b. Feb. 6, 1836, in Massachusetts; graduated at the Naval Academy in 1855; became a lieutenant in 1861, a commander in 1870; served with distinguished gallantry on board the Cumberland when sunk by the Merrimack, on the Mississippi River and its tributaries, and in both the Fort Fisher fights, and always commended for "courage and coolness." F. A. PARKER.

**Se'lim,** the name of three Turkish sultans, of whom the first and the last have exercised a great influence on the destiny of the empire: SELIM I., b. in 1467, son of Bajazet II.; revolted and usurped the throne by the aid of the Janizaries Apr. 25, 1512, putting to death his father, brothers, nephews—in short, every one who was able to offer any resistance to his turbulent will; and he continued to show the same ferocious energy in all he did during his whole reign. In 1514 he began war with Persia, defeated Shah Ismael at Calderoon with immense slaughter, and annexed Diabekr and Koordistan to the Ottoman empire. After conquering Armenia he began war in 1516 with Egypt, defeated the Egyptian sultan Kansu-ghori at Margabik, and conquered Syria; and next year Kansu-ghori's successor, Tonman-Bey, at Gaza and Rudania, and subjugated Egypt. The last lineal descendant of the Abbaside califs, then residing at Cairo, transferred the standard of the Prophet and the religious prestige of his own descent to Selim. Thus, the Ottoman sultan became the chief of Islam, the representative of Mohammed, and the chief Arabic tribes and the sacred cities of Mecca and Medina acknowledged his supremacy. D. Sept. 22, 1520.—SELIM II., b. in 1524, a son of Solyman the Magnificent and Roxolana, succeeded his father Sept. 6, 1566, and d. Dec. 12, 1574. While his generals fought in Hungary, Persia, Cyprus, Tunis, and at Lepanto (Oct. 8, 1571) he spent his days in the harem, always intoxicated.—SELIM III., b. Dec. 24, 1761, a son of Mustapha III., succeeded his uncle, Abd-ul Hamid, Apr. 7, 1789, and was the first Turkish sultan who tried to introduce the civilization of Western Europe into his empire. When he ascended the throne he found the state in a most dangerous condition—revolution in Syria and Egypt, a disastrous war with Austria and Russia, insurrection even in the European provinces, Napoleon leading a French army into Egypt, and the diplomatic relations with England becoming more and more complicated. Nevertheless, as soon as he got his hands free he began his reforms in commercial, industrial, administrative, and military affairs. On the last point especially he met with exasperated resistance. He sought support from France, and the French ambassador to Constantinople, Count Sebastiani, exercised great influence. This circumstance awakened the jealousy of England. An English fleet appeared in 1807 before Constantinople, but was repelled. Soon, however, English and Russian agents succeeded in exciting the religious fanaticism of the people against the sultan; his reforms were depicted as infringements on the laws of the Koran. Open revolution broke out, and on May 31, 1807, Selim was deposed by the Janizaries and the muftis, and his cousin, Mustapha IV., was raised to the throne. He was at first imprisoned in the seraglio, but when Bairaktar, pasha of Roostchook, arose in his support and approached Constantinople with a formi-

dable army, Mustapha IV. put Selim to death (July 28, 1808), and his corpse was thrown across the wall into Bairaktar's camp.

**Selim'no,** or **Islamje,** a walled town of European Turkey, at the S. foot of the Balkan Mountains, 65 miles N. N. W. of Adrianople, manufactures coarse woollen cloth, firearms, and attar of rose, and has an important annual fair. P. 15,000.

**Se'linsgrove,** p.-b., Snyder co., Pa., on Pennsylvania and Northern Central R. Rs. and Pennsylvania Canal, 50 miles N. of Harrisburg. It contains 4 churches, a classical and theological institute, 1 bank, a money-order post-office, a building association, a boatyard, 2 newspapers, fine water-power, 3 hotels, and several saw, planing, and sash factories. It is the principal outlet for the produce of the county. P. 1453. FRANKLIN WEIRICK, ED. "TIMES."

**Seli'nus,** a Greek colony founded in the seventh century before Christ from Megara, and situated at the mouth of the Selinus, on the south-western coast of Sicily, received its name from the quantities of wild parsley (σέλινον) which grew in the vicinity. Of its history very little is known, but it must at one time have been a flourishing city. It was destroyed by the Carthaginians in 409 B. C., but again rebuilt. It finally decayed when in 249 B. C. the Carthaginians removed all the inhabitants to Lilybæum. Its site is now desolate, though covered with interesting ruins. The remains of three temples on a hill close to the city are very interesting, and one of them shows the ground-plan of one of the largest buildings of ancient Greek architecture—359 feet long and 162 feet broad, with eight columns in front and seventeen on the sides. The bas-reliefs found here are also very interesting, and belong to the oldest specimens of Greek sculpture. (See Benndorf, *Die Metopen von Selinunt,* Berlin, 1873.)

**Seljooks,** or **Seljuks,** a small Turkish tribe settled in the plains on the north-eastern border of the Caspian Sea, who received their name from Seljook, one of their chiefs, who in the latter part of the tenth century moved in a south-eastern direction, conquered Bokhara, and embraced Mohammedanism, and under whose successors they rapidly grew by absorbing other Turkish-Tartarian tribes, conquered the whole of South-western and Central Asia, and developed a marvellous energy during the course of several centuries. The only source, however, of this energy seems to have been religious fanaticism. At times, when this source became temporarily dried up, the vitality of the nation slackened, and when finally this burning but narrow enthusiasm waned away completely to give room for the steady purpose of broad general interests of humanity, the whole race seemed destined to pass quietly out of history. Seljook's grandson, Togrul Beg, conquered Balkh and Khaurezm in 1041, Irak-Ajemee in 1043, Kerman and Fars in 1047, Bagdad in 1055, Irak-Arabi and Mosul in 1061, thus completing the conquest of the whole of Persia, and assumed the title of sultan. Under his nephew, Alp-Arslan (1063–73), and Alp-Arslan's son, Melek Shah (1073–93), the empire still increased in power and prosperity. The latter conquered Arabia, Syria and Palestine, Asia Minor and Armenia, and ruled from the Mediterranean to the Chinese frontier, and from the Caspian to the Arabian Sea. From the history of Persia we know that the internal administration of this vast empire was regular, firm, just, and not altogether destitute of an interest in science and literature, nor wholly averse to undertakings of public benefit. Melek Shah, who removed the residence from Bagdad to Ispahan, instituted a celebrated law-school in Bagdad, and established an observatory there, the first in Asia. He also encouraged the building of roads, canals, bridges, etc. At his death the Seljook empire was divided between his four sons, and soon a large number of small independent sultanates was formed; which circumstance finally caused the ruin of the Seljook dominion. The sultanate of Iran was at first the central and principal state, and exercised a sort of authority over the others. But in 1194 it was swallowed up by the sultanate of Khaurezm, and this was again overthrown by the Mongols in 1221, Jelal-ed-din being completely routed by Genghis Khan on the western bank of the Indus. The sultanate of Aleppo fell in 1114, that of Damascus in 1155. The sultanate of Iconium (the present Konieh), comprising Asia Minor, and generally called by the Orientals the sultanate of Roum (Romans), lasted until 1299, and became the starting-point for a new departure of the Seljook tribe under the Ottoman dynasty. The sultans of Iconium maintained a perpetual war with the Byzantine empire and the crusaders, but in the thirteenth century they were compelled to pay tribute to the Mongols, though they did not lose their independence. With the overthrow of the Seljook dynasty in 1299, and on the ruins of its dominion, arose the Turkish empire.

**Sel'kirk,** a small, mountainous county of South-eastern Scotland, comprises an area of 263 sq. m., with 14,000 inhabitants. Cattle-rearing and agriculture are the principal occupations. Chief towns, Galashiels and Selkirk.

**Selkirk,** or **Sealchraig** (ALEXANDER), b. at Largo, Fifeshire, Scotland, about 1676; made several voyages to the Pacific; was sailing-master to a privateer called the Cinique Ports Galley, and having quarrelled with the captain, one Stradling, was put ashore, at his own request, Sept., 1704, on the uninhabited island of Juan Fernandez, off the coast of Chili, with some nautical instruments, a few books, a knife, kettle, axe, gun, and a supply of ammunition. Here he remained until Feb. 12, 1709, when he was relieved by Capt. Woodes Rogers of the privateer The Duke. He lived chiefly on the flesh of wild goats, which abounded in the island, and of which he killed above 500. He became mate to Capt. Rogers, whom he accompanied around the world; arrived in England Oct. 1, 1711, when his narrative appeared in an account of the voyage (1712), also in several separate publications. Selkirk returned to his native place; eloped with a girl, whom he married and brought to London; subsequently entered the navy, rose to the rank of lieutenant, and d. on board the man-of-war Weymouth in 1723. As is well known, De Foe's celebrated story of *Robinson Crusoe,* which appeared in 1719, has been generally supposed to be based upon the adventures of Selkirk, by whom the incidents were said to have been communicated to De Foe, but there is little reason for supposing that the latter had more than a general knowledge of the facts of the case. *The Life and Adventures of Alexander Selkirk* (Edinburgh, 1829) by John Howell, is the latest and best source of exact information on the subject.

**Selkirk** (THOMAS **Dundas**), FIFTH EARL OF, b. in Scotland in 1774; spent several of the later years of his life in promoting emigration to the Red River of the North, British America, where the colony now called Manitoba was long known as "the Earl of Selkirk's Settlement." He published several tracts on emigration, and political speeches. D. at Pau, France, in 1820.

**Sel'ler's,** tp., Hardin co., Ill. P. 560.

**Sel'lersville,** p.-v., Rock Hill tp., Bucks co., Pa., on North Pennsylvania R. R.

**Sel'ma,** city and tp., cap. of Dallas co., Ala., at the head of steamboat navigation on Alabama River, on Selma Rome and Dalton, Alabama Central, and Western R. Rs., has 13 churches, 2 daily and 3 weekly newspapers, 2 banks, 3 cotton-warehouses, 3 railroad machine-shops, and several mills and manufactories; was during the civil war an important military centre, having an arsenal, a navy-yard, artillery-foundries, and powder-works, and was captured by the Union forces Apr. 2, 1865, after a sharp engagement. P. 6484; of tp. 1651.

**Selma,** p.-v. and tp., Johnston co., N. C., on Richmond and Danville R. R. P. 1167.

**Sel'ters Nie'der,** v. of the German empire, province of Hesse-Nassau, is famous for its mineral springs, which furnish the so-called seltzer water.

**Selt'zer-Water** [Ger. *Selterswasser*], naturally, the water of a mineral spring at Selters, in the valley of the river Ems, in Nassau, which has been known since the ninth century. Having become the most famous and widely-known, probably, of all mineral waters, it is now very skilfully and successfully imitated and fabricated by chemical means in this country as well as throughout Europe. It is an alkaline water, containing over 6 grains of carbonate of soda to the gallon, with 30 cubic inches of free carbonic acid. There are also minute quantities of *lithia, baryta,* and *strontia,* and of *fluorine,* with other commoner ingredients usually found in mineral springs. H. WURTZ.

**Sel'va,** or **Silva** [Sp. *selva;* Port. *silva,* "forest"], a name applied in South America to great wooded tracts, chiefly in the Amazon Valley. They are mostly very level and densely covered with trees, mixed with underwood and lianas, rendering them very difficult to traverse except by boats, for the streams are often deep and navigable. Much of the Selva is annually overflowed. The area is more than 700,000 sq. m.

**Selvatico** (PIETRO ESTENSE), MARQUIS, b. at Padua in 1803; having studied literature, physical science, painting, and architecture under the best masters, he travelled through Italy and the greater part of Europe; in 1850 was appointed professor of æsthetics and of the history of art in the Academy of Fine Arts at Venice, and in 1855 was named inspector of the schools of design throughout the Venetian provinces. Political considerations induced him to resign these posts in 1858 and retire to private life. He is the architect of several churches in Venetia, and as an art-critic has not his superior in Italy. He has published numerous works, among which the following are especially notewor-

thy: *La Cappellina degli Scrovegni in Padova ed i Freschi di Giotto* (Padua, 1836), *L'Architettura e la Scultura in Venezia* (Milan, 1847), *Storia estetico-critica delle Arte del Disegno* (Venice, 1852–56), *Scritti d'Arte* (Florence, 1859), *L'Arte nella Vita degli Artisti* (Florence, 1870), *Guida di Venezia, Guida di Padova, Il Disegno Elementare e Superiore ad Uso delle Scuole* (Milan, 1874).

**Sel'wyn** (GEORGE AUGUSTUS), D. D., b. at Richmond, Surrey, England, in 1809; educated at Eton and at St. John's, Cambridge; became tutor at Eton and curate of Windsor; was consecrated first bishop of New Zealand 1841; visited many of the groups of islands in the Pacific in a small "missionary ship," provided by Miss Yonge out of the profits of *The Heir of Redclyffe;* was appointed bishop of Lichfield, England, 1867, and made a tour through the U. S. and Canada 1874. Author of several religious treatises.—His brother WILLIAM, b. 1806, became professor of divinity at Cambridge 1855; was one of the revisers of the Old Testament translation; author of several theological works, and a benefactor of the Divinity School at Cambridge, where he d. Apr. 24, 1875.

**Semaphore.** See NAVAL SIGNALS and TELEGRAPH.

**Sem'ele,** in Grecian mythology, a daughter of Cadmus and loved by Zeus; was persuaded by Hera to demand of her lover that he should visit her once in all his royal majesty. Zeus begged her to desist from this demand, but as she would not, and he had sworn to grant her any wish, he came to her with thunder and lightning, and she perished in the flames. She was the mother of Bacchus.

**Semen'dria,** or **Smederewo,** town of the principality of Serbia, on the Danube, is beautifully situated, but poorly built. It is fortified, and has manufactures of firearms, important fisheries on the Danube, and extensive wine-cultivation in the vicinity. P. about 5000.

**Sem'inary,** tp., Fayette co., Ill. P. 920.

**Sem'inole Na'tion County,** the reservation in the Indian Territory occupied by the SEMINOLES (which see).

**Sem'inoles,** a tribe of Indians lately resident in Central Florida, but now, for the most part, settled on a reservation in the Indian Territory, originally formed a part of the Creek or Muskogee nation, from which they separated about 1750, when they absorbed some remnants of other Floridian tribes, especially the Mickasuckees, who are sometimes erroneously considered as the true Seminoles; received from the Creeks their present name, signifying "vagrants" or "wanderers;" were allies of the British forces in their forays upon Georgia, during the war of the Revolution; were associated with the Tallapoosas in a treaty of peace made with the Spaniards at Pensacola May, 1784; were included by the Creeks in the provisions of their treaty of 1790 with the U. S., but disavowed that instrument, and commenced border-forays 1794; were gradually reinforced by fugitive slaves and by negroes whom they carried away from the frontier plantations; received a considerable accession of numbers by a new secession from the Creeks 1808; ravaged the Georgia frontier in 1812, and again in 1817, when they massacred some scores of persons; were punished by Gen. Gaines, and subsequently by Gen. Jackson, who pursued them into Florida (Apr., 1818) and destroyed the Suwanee and Mickasuckee towns, a circumstance which led to the purchase of Florida the following year; disposed of a large portion of their lands and agreed to deliver up fugitive slaves by the treaty of Moultrie Creek, Sept. 18, 1823, and by the so-called treaty of Payne's Landing, 1832; sold their remaining lands for a sum of money and a reservation beyond the Mississippi. The latter instrument was informal, if not fraudulent, and was repudiated by the great body of the tribe. Pres. Jackson, however, acting upon the advice of the Senate, resolved to enforce that treaty, which gave occasion to a long and bloody war, begun Dec. 28, 1835, by the chieftain Osceola, and which in a few years cost the U. S. $10,000,000 and 1500 lives. In 1842 most of the Seminoles had been taken prisoners or had come to terms and been transported beyond the Mississippi; only about 300, under their chief Billy Bowlegs, remaining in the Everglades of Florida. A portion of the emigrants settled on the Rio Grande in Mexico. Treaties were made with the Seminoles in their new home in 1845 and in 1856, granting them lands W. of the Creeks, and a considerable annuity. The Confederate government made a treaty Aug. 1, 1861, with a portion of the tribe, the rest remaining loyal, and a civil conflict ensued in which the loyal Seminoles were defeated with great loss Dec. 25, 1861, and withdrew into Kansas. The two bands were reunited 1865, when they sold their old reservation to the U. S. and purchased a new one of the Creeks. They are now industrious and prosperous agriculturists, having in great part adopted civilization and Christianity through the influence of Presbyterian missions. In 1822 they numbered nearly 4000; in 1858, 2253; in 1865, 2959 (including negroes); and in 1874, 2438, besides about 150 in Florida and an unknown number in Mexico. They have some 8000 acres of land under cultivation, possess personal property valued at about $250,000, have 5 schools, and receive an annuity from the U. S. of $25,000 by virtue of treaties, the last of which bore date Mar. 21, 1866. PORTER C. BLISS.

**Semipalatinsk',** town of W. Siberia, on the Irtish, in a district of the same name, in lat. 50° 24′ N. Its houses are mostly built of wood, and stand single, surrounded with gardens. It is a military station, and carries on an important trade with China, Toorkistan, and the Kirgheez. P. 14,135.

**Semir'amis,** according to Ctesias, the wife of Ninus, the founder of the Assyrian kingdom, a woman of extraordinary beauty, passion, and military prowess, who flourished nearly 2200 years B. C., survived and eclipsed her husband, and after a reign of forty-two years abdicated in favor of her son, Ninyas. All this is now admitted to be mythical. Ninus is merely a personification of the power of Nineveh, and what is related of Semiramis apparently belongs to Beltis, wife of Bel, the second person in the old Chaldean Triad, her name only being historical, but of much later date. Herodotus (*Hist.*, i. 184) mentions a Semiramis who ruled over Babylon five generations before Nitocris. This Semiramis of Herodotus is certainly not to be identified with the Semiramis of Ctesias. The name appears to have been derived from Sammuramat, or Sammuramit, found upon the monuments. Lenormant makes her the queen of Bin-lik-his III. (857–828 B. C.). Rawlinson makes her the queen of Vul-lush (or Iva-lush) III. (810–781 B. C.). R. D. HITCHCOCK.

**Semitic Languages.** See APPENDIX.

**Semitic Races.** See MAN, by M. B. ANDERSON.

**Sem'ler** (JOHANN SALOMO), b. at Saalfeld, duchy of Saxe-Meiningen, Dec. 18, 1725; studied theology at the University of Halle, where he was appointed professor in 1752 and director of the theological seminary in 1757. D. Mar. 14, 1791. He took a prominent part in the starting of the rationalistic movement in the German theology, but he was cautious in forming his views and careful in arguing them; and although his talent as an author was rather small, his works are pervaded by a spirit of genuine historical criticism, which exercised a great influence. His principal works are *Apparatus ad liberalem Veteris Testamenti Interpretationem* (1773), *Abhandlung von der Untersuchung des Kanons* (4 vols., 1771–75), *Versuch einer biblischen Dämonologie* (1776), *Versuch christlicher Jahrbücher* (2 vols., 1783–86), and an *Autobiography* (2 vols., 1781–82).

**Sem'lin,** town of Austria, in the Military Frontier, at the confluence of the Save and the Danube, opposite Belgrade. The city is poorly built, a large portion of it consisting of thatched mud huts, but it carries on a very important transit-trade between Austria and Turkey, and has improved considerably of late. P. 8915, consisting of Slavonians, Germans, Servians, Greeks, Croats, gypsies, and Jews.

**Sem'mering,** or **Söm'mering,** a branch of the Noric Alps, forming the boundary between Lower Austria and Styria, rises 4416 feet above the sea, and contains, at an elevation of 3066 feet, the principal pass leading from Vienna to Trieste. The first carriage-road was built here in 1728 by Charles VI., who placed at the turning-point of the road a memorial column with the inscription, *Aditus ad maris Adriatici litora.* In 1840 a longer but more comfortable road was completed, and in 1854 a railway was opened between Gloggnitz on the Austrian and Mürzzuschlag on the Styrian side, ascending an elevation of 2893 feet, and leading through fifteen tunnels and over fifteen viaducts. The road was constructed by Carlo Chega, and was considered the most audacious and most ingenious engineering work of its kind.

**Semmes** (RAPHAEL), b. in Charles co., Md., Sept. 27, 1809, of Scotch-Irish parentage; became a midshipman in the U. S. navy 1826; was a volunteer aide to Gen. Worth in the Valley of Mexico 1847; became commander 1855; was secretary of the lighthouse board 1859–61; resigned at the beginning of the civil war; obtained a commission in the Confederate navy; obtained great notoriety by his exploits as commander of the Sumter and the Alabama in capturing and burning many scores of American merchant-vessels, and became after the war professor of moral philosophy in the State seminary at Alexandria, La. Author of *Service Afloat and Ashore during the Mexican War* (1851), *Campaign of Gen. Scott in the Valley of Mexico* (1852), *The Cruise of the Alabama* (1864), and *Memoir of Service Afloat during the War between the States* (1869). He was in 1867 editor of the Memphis *Bulletin,* and has frequently appeared as a lecturer.

**Semoli'na** [It.], a finely-cracked wheat, or a very coarse meal made from hard wheat. After grinding it is separated into various grades, according to the size of the particles. A series of sieves is employed for this purpose.

**Sem'pach,** v. of Switzerland, canton of Lucerne, is famous for the battle fought here on July 9, 1386, between the Austrians and the Swiss, in which the Austrian noblemen, in spite of their valor and superior numbers, were butchered like sheep by the Swiss peasants, as they were unable to use their horses, and unable to fight on foot encumbered by their heavy armor. P. 1109.

**Sem'per** (Gottfried), b. at Hamburg in 1804; studied mathematics at Göttingen, architecture in Munich and Paris; travelled much in Italy, Sicily, and Greece; was appointed professor of architecture at Dresden in 1834; fled to London in 1849 on account of his participation in the revolutionary movements, and taught at the Royal Academy in Marlborough House till 1856, when he became professor at the polytechnic institute of Zurich. His principal buildings are the theatre and new museum of Dresden and the Polytechnicum at Zurich. He wrote *Die vier Elemente der Baukunst* (1851), *Ueber Industrie, Wissenschaft und Kunst* (1852), *Der Stil in den technischen und tektonischen Künsten* (2 vols., 1860–65), etc. He set forth with great decisiveness and defended with many ingenious arguments and acute observations the view that the antique architecture and sculpture were polychromic throughout, and he decorated the antique department of the art-museum of Dresden in accordance with this principle of style.—His nephew, Karl Semper, b. at Altona July 6, 1832; explored the Philippine Islands; was appointed professor of zoology at the University of Würzburg in 1868; and published *Reisen im Archipel der Philippinen* (1867–72), *Die Philippinen* (1869), and *Die Palan Inseln im Stillen Ocean* (1873).

**Sempervirens.** See Evergreen.

**Sempervivæ.** See Crassulaceæ.

**Sem'ple** (James), b. in Kentucky in 1799; became a lawyer at Louisville, and subsequently at Edwardsville, Ill., where he settled about 1827; served frequently in the legislature; was Speaker several sessions; became attorney-general and general of militia 1833; was chargé d'affaires to New Granada 1837–41, judge of the supreme court of Illinois 1842, and U. S. Senator 1843–47. D. Dec., 1846.

**Semple** (Robert Baylor), D. D., b. at Rose Mount, Va., Jan. 20, 1769; received a classical education; studied law, and afterward theology; became pastor of a Baptist church 1790; declined the presidency of Transylvania University 1805; became financial agent of Columbian College, Washington, D. C., 1827; published a controversial treatise against Alexander Campbell, a *History of the Baptists in Virginia* (1810), and other works, and was president of the Baptist triennial convention from 1826 to his death, at Fredericksburg, Va., Dec. 25, 1831.

**Sempro'nius,** p.-v. and tp., Cayuga co., N. Y., at the head of Skaneateles Lake. P. 1165.

**Sen** (Keshub Chunder). See Brahmo Somaj.

**Senachwine,** tp., Putnam co., Ill. P. 801.

**Sen'ate.** In many of the early states of the world, especially in city-states, besides the meetings of the people entitled to have a share in public affairs—the *ecclesia*, the *comitia*, etc.—there was a preparatory body, or, it might be, more than one, whose function it was to give advice on such matters as might come before the general assembly of the people. This body had also at a very early date the power of judging, together with the kings or supreme magistrates. It formed to a considerable extent at first a superior order, into which persons of lower birth could not find entrance. As usage and old custom, rather than positive enacted law, ruled in the decisions of those times, old men were preferred to younger ones for the members of such bodies, which received some of their names from this source. Such were γερουσία (from γέρων, "old man"), the senate of Sparta, and *senate* (from *senex*), the corresponding Roman body. In modern times the word senate is retained, although many of the members may be young.

The history of institutions gives us instances of senates selected on principles greatly varying from one another. But *upper houses*, as they may be called, are not necessarily senates according to the idea of the Athenian βουλή or council, or the Spartan γερουσία. Even the Roman senate's consent was not necessary to the confirmation of a law or rogation of the *comitia*. So, in modern times, senates, while their confirmation is always needed, have sometimes limitations on their power which the popular branches have not, especially those of originating and altering money-bills. The exact legislative competence of a senate or *upper house* must be learned from the constitution of each particular country.

T. D. Woolsey.

**Senato'bia,** p.-v., cap. of Tate co., Miss., on Mississippi and Tennessee R. R., 37 miles S. of Memphis, Tenn., contains 3 churches, a Peabody public school, 1 newspaper, and a fine hotel. Ships annually 8000 bales of cotton. P. about 1100.

Ira D. Oglesby, Ed. "Times."

**Sen'eca,** county of W. New York, extending from Cayuga Lake on the E. to Seneca Lake on the W., drained by Seneca and Clyde rivers, traversed by New York Central and Geneva Ithaca and Athens R. Rs., and by Erie and Cayuga and Seneca canals; has a hilly surface, well adapted for grazing, and a productive soil, and has numerous manufactories and flouring and saw mills. Staples, wheat, oats, Indian corn, barley, potatoes, hay, flax, wool, and butter. Caps. Ovid and Waterloo. Area, 330 sq. m. P. 27,823.

**Seneca,** county of N. Ohio, intersected by Sandusky River, traversed by Cincinnati Sandusky and Cleveland, Lake Erie and Louisville, Chicago division of Baltimore and Ohio, Cincinnati Sandusky and Cleveland, and Mansfield Coldwater and Lake Michigan R. Rs., has a level and fertile soil, abundant water-power, numerous flouring and saw mills, and manufactures. Stock-raising is an important industry. Staples, wheat, Indian corn, oats, hay, potatoes, apples, wool, and butter. Cap. Tiffin. Area, 550 sq. m. P. 30,827.

**Seneca,** tp., Plumas co., Cal. P. 400.

**Seneca,** p.-v., Manlius tp., La Salle co., Ill., on Illinois River and Chicago Rock Island and Pacific R. R.

**Seneca,** tp., McHenry co., Ill. P. 1027.

**Seneca,** p.-v., cap. of Nemaha co., Kan., on St. Joseph and Denver City R. R., 77 miles W. of St. Joseph, Mo., has 4 churches, a graded school, 1 newspaper, 2 hotels, 1 bank, a grist-mill, and the usual county-seat buildings. Principal business, stock-raising and farming. P. about 1000.

West E. Wilkinson, Ed. "Weekly Courier."

**Seneca,** p.-v. and tp., Lenawee co., Mich. P. 2396.

**Seneca,** p.-v., Newton co., Mo., on Atlantic and Pacific R. R. P. 285.

**Seneca,** tp., Ontario co., N. Y., at outlet of Seneca Lake, includes the flourishing village of Geneva. P. 9188.

**Seneca,** tp., Monroe co., O. P. 1242.

**Seneca,** tp., Noble co., O. P. 982.

**Seneca,** tp., Seneca co., O. P. 1583.

**Seneca,** p.-v. and tp., Oconee co., S. C. P. 2313.

**Seneca,** p.-v. and tp., Crawford co., Wis. P. 1233.

**Seneca,** tp., Green Lake co., Wis. P. 414.

**Seneca,** tp., Wood co., Wis. P. 293.

**Seneca** (Lucius Annæus), b. at Corduba in Spain about 8 B. C., belonged to a Spanish-Roman family, but was educated in Rome. His father, Marcus Annæus Seneca, the Rhetorician (b. about 61 B. C. at Corduba, d. at Rome about 35 A. D.), was a teacher of rhetoric and a man of literary studies, wealthy and influential. Almost the whole of his *Suasoriarum Liber* and five books of his *Controversiarum Libri Decem* are still extant, edited by Bursian (Leipsic, 1857), and give a striking aspect of the moral degradation and æsthetic futility to which the oratorical art had sunk in Rome at his time. (See Koerber, *Ueber den Rhetor Seneca und die römische Rhetorik seiner Zeit*, 1864.) Young Seneca was trained in his father's art, and although he afterward left rhetoric for philosophy, he never forgot the lessons of his youth. His style, with all its pompous dignity and brilliant pointedness, is characterized throughout by that absolute preponderance of the form over the contents, of the expression over the thought, which rises from a lack of veracity, and results in mannerism and affectedness. Caligula said of his eloquence that it was sand without lime. After travelling in Greece, he began to practise as an orator in Rome, and achieved great forensic triumphs, but in 41 A. D. Messalina had him accused of entertaining an adulterous connection with Julia, the daughter of Germanicus and the wife of Vinicius, and he was banished to Corsica. Here he lived for eight years, and wrote, among other works, *De Consolatione ad Helviam Liber*, a consolatory letter to his mother, and one of the best of his writings, and *De Consolatione ad Polybium Liber*, a similar letter to Polybius, a freedman and one of Claudius's favorites, who had lost his brother; but this letter is one of his most disagreeable productions on account of its flattery. When Claudius married Agrippina, Seneca was recalled by her influence and appointed tutor to her son, Domitius, afterward the emperor Nero; for which position he showed a rather surprising adaptation. The pupil's vices grew as luxuriantly as the tutor's wealth. Most of Seneca's very prolific authorship belongs to this last period of his life. He wrote moral essays, philosophical letters, physical treatises, and

tragedies. The last mentioned, ten in number—of which, however, three are generally considered spurious, *Hercules, Œtæus, Agamemnon,* and *Octavia*—are the best of his productions. The rhetorical character is predominant here also, but the declamations become rarely entirely hollow, and *Hercules Furens, Phædra,* and *Medea* contain traits of genuine creative imagination. Of his prose essays, some of the most celebrated, *De Ira, De Animi Tranquillitate,* etc., are inexhaustible sources of piquant quotations; others, *De Clementia ad Neronem Cæsarem Libri Duo,* are rather curious on account of the personal character which the author has not been able to conceal under the flourishing representation of his ideas; but the largest portion is vague and trivial—*De Constantia Sapientis, De Brevitate Vitæ,* etc. His 124 *Epistolæ ad Lucilium* have more interest, containing moral observations and aphorisms of practical value. His *Apocolocyntosis* is also worth reading. It is a satire on Claudius, of course written after the death of the emperor, and it is very biting: there is, however, no indignation in it; it is merely written to please Nero. Meanwhile, the emperor began to hint at the millions which the philosopher had amassed. Seneca became alarmed, and offered to repay the whole amount and content himself with a small annuity. Nero refused the offer, and Seneca now retired from the court, gave no levées, was never seen in public, and tried his utmost to sink into oblivion. But in vain. Some one mentioned him as an accomplice in the conspiracy of Piso, and Nero sent him an order to commit suicide, which he immediately obeyed. He opened the veins in his feet and arms, and, discoursing with his friends on the brevity of life and the equanimity of the philosopher, he bled to death in a hot bath 65 A. D. From the revival of letters in Europe, and up to the beginning of this century, the works of Seneca, both the philosophical and the poetical, were much read and much admired. Editions were numerous and translations were made into all European languages. There were, however, always some voices which protested against his fame; and when his admirers tried to prove that he was a Christian and a friend of St. Paul, his adversaries undertook, seemingly with more success, to prove that he was an atheist and a mean hypocrite. In the present century much less attention has been paid to him, though there are editions of his works of quite a recent date—of his prose writings by Fickert (3 vols., Leipsic, 1842–45) and by Haase (3 vols., Leipsic, 1852–53), and of his tragedies by Peiper and Richter (Leipsic, 1867). See Farrar's *Seekers after God;* and Lightfoot's "Essay on St. Paul and Seneca," appended to his *Com. on the Ep. to the Philippians* (1868). CLEMENS PETERSEN.

**Seneca Falls,** p.-v. and tp., Seneca co., N. Y., on New York Central R. R. and Cayuga and Seneca Canal, at the outlet of Seneca Lake, has fine water-power and beautiful falls of Seneca River, flourishing manufactures of steam fire-engines, machinery, pumps, woollen goods, etc., 2 banks, 7 churches, an academy, and 1 monthly and 2 weekly newspapers. P. of v. 5890; of tp. 6860.

**Seneca Lake,** in Western New York, bounded by Seneca, Schuyler, Ontario, and Yates counties, is 35 miles long, from 1 to 4 miles broad, with an elevation of 447 feet. Its shores are bold, picturesque, and fertile, and the lake is navigated by steamboats. Its waters reach Lake Ontario by Seneca and Oswego Rivers. Its greatest depth is 630 feet.

**Seneca Oil,** a local name for PETROLEUM (which see).

**Senecas,** one of the tribes of the so-called Iroquois, or Six Nations of Indians of Western New York, the most numerous and warlike of that confederacy. Known in their own language as *Nundawa-ono,* or "People of the Great Hill," from one of their original seats at the head of Canandaigua Lake, near Naples, where, according to legend, their ancestors sprang from the ground, they were called by Champlain *Ontouoronons* (whence the name of Lake Ontario); by the Jesuit missionaries *Tsonnontouans;* and by the Dutch, *Sinnekaas*—a word of unknown etymology, which became corrupted into Senecas. They were the westernmost of the original five tribes composing the famous league of the Hodenosaunee or "Long House," of which they were the "doorkeepers," since their geographical position brought them more immediately into contact with hostile nations. Though they seem at all times to have constituted fully one-half of the fighting force of the confederacy, they had, in the distribution of the 50 hereditary sachemships, the smallest number, only 8, while the comparatively feeble tribe of Cayugas, their immediate neighbors on the E., had 10 sachems. This anomaly can best be explained by reference to the probable origin of that complicated system of tribal, clan, and family relationship which, as one of the most remarkable features of aboriginal politics, has received so much attention from writers, while its real nature has usually been totally misunderstood. There can be little doubt that all the "nations" of the confederacy formed but one tribe at a period distinctly within the range of existing traditions, therefore not more than three or four centuries ago. The only original subdivisions were those still subsisting in all the tribes under the name of "clans," eight in number, ranged in two series—Wolf, Bear, Beaver, and Turtle; Deer, Snipe, Heron, and Hawk. All the members of the same clan are regarded as constituting a single family, tracing their descent from a common ancestry; they can therefore only marry in other clans. The clans, being a social, not a political division, were doubtless pretty evenly distributed throughout the tribe at the time when increasing numbers and the progress of colonization led to the recognition of a *geographical* subdivision—first into three, and afterward into the "Five Nations" now known. The seat of government having been at Onondaga, it was natural that a larger number of the sachems remained in that vicinity; hence, the Onondaga "nation," though numerically weak, retained 14 out of the 50 sachemships, while to each of the two original colonies 18 sachems were assigned. The eastern colony was subsequently divided into 2, the Oneidas and Mohawks, each with 9 sachems, and the western colony also into two, the Cayugas and Senecas, the former retaining the disproportionate number of 10 sachems simply on account of greater proximity to the capital of the league. The present "nations" are usually said to speak distinct languages, but they are in reality only dialects, which might readily be differentiated from a common tongue in three or four centuries, the Onondaga retaining a pre-eminence as a sort of "court-language," and the Cayuga and Seneca tongues bearing a resemblance which indicates the recent date of their separation. When first known to the French explorers, the Senecas occupied the region between Lakes Ontario, Cayuga, Seneca, and Canandaigua, but during the seventeenth century they, with their brother tribes, waged incessant and successful wars against their western neighbors, who were more remotely of their own lineage—the Hurons or Wyandottes of Lake Huron, the Jenesasas (Neutral Nation or *Nation du Chat* of the Jesuits) on the Niagara peninsula, the Kahquas, Erikes, or Eries on the S. shore of Lake Erie, and the Andastes, otherwise known as Susquehannocks, Minquas, Mingoes, or Conestogas, on Susquehanna River. Large numbers of the defeated Hurons, and all the survivors of the Jenesasas, Kahquas, and Andastes, as well as captives from many other hostile tribes, were adopted by the Senecas, who were indebted to this resource for their numerical preponderance. At one time captives of eleven different tribes are mentioned as having been thus adopted. Descendants of the Eries are still pointed out among them. The exploits vaguely ascribed by historians to the "Iroquois," of carrying their arms to the Mississippi and Tennessee rivers, were usually true only of the Senecas, among whom resided the two hereditary war-chiefs of the confederacy. The Senecas bore the brunt of the famous battle where Braddock lost his life, as they had previously done of several French invasions from Canada, and were, as allies of the English, the chief sufferers by Gen. Sullivan's famous campaign of 1779. Having made peace at Fort Stanwix (1784), they sold to the U. S. most of their lands in the Genesee Valley and removed to the shores of Lake Erie and the banks of the Alleghany. They rendered good service as allies of the American forces during the campaign on the Niagara frontier 1812–14, and under the influence of Protestant missions have become during the present century prosperous agriculturists, whose religious and educational *status* differs little from that of their white neighbors. Through the advance of settlement in Western New York the ancient territories of the Senecas were rapidly diminished by successive purchases, until about 1847 they were reduced to the three reservations of Cattaraugus, Alleghany, and Tonawanda—some 66,000 acres. Early estimates of their population were much exaggerated, but there is little reason to believe that they were ever more numerous than at present, while it is certain that they have largely increased since 1812. They numbered in 1870, 3060, besides 206 in the Indian Territory, and about 200 with the Mohawks on the Grand River reservation in Canada. The Quakers founded schools among the Senecas before the close of the eighteenth century, and the American Board of Foreign Missions sent missionaries thither early in the present century. To the teachings of Rev. Asher Wright (1802–75) of the Buffalo (subsequently of the Cattaraugus) reservation, Rev. Asher Bliss* and Rev. William Hall of Cattaraugus and Alleghany reservations, and Rev. Anson Gleason of Cattaraugus, the Senecas owe their religious and educational status. The former gentleman, a scholar of culture, translated portions of the Scriptures and several educational works into Seneca, and prepared a hymn-book. PORTER C. BLISS.

*Father of the writer.

**Sen'ecaville,** p.-v., Richland tp., Guernsey co., O. P. 376.

**Se'nefelder** (Aloys), b. at Prague Nov. 6, 1771; entered on the stage at Munich, his father being an actor; attempted afterward literature, and engaged finally in the printing business, which led to his invention of Lithography (which see). Lack of money and the imperfection of the invention in its primitive state caused him many difficulties and disappointments, and it was not until 1806, when he settled at Munich and received the support of the Bavarian government, that he was able to carry his invention to perfection and make it of really practical importance. D. at Munich Feb. 26, 1834. He wrote a *Lehrbuch der Lithographie* (1819), which was translated into English—*Complete Course of Lithography* (1819).

**Senegal',** a river of Western Africa, rises in lat. 10° 30′ N. and lon. 18° 40′ W., in the Madingo highlands; flows first N. W., then W., and enters the Atlantic in lat. 16° N., after a course of about 1000 miles. It divides into two branches at 35 miles from its mouth, the southernmost of which is deep enough for the largest vessels, but a shifting sandbar at its mouth, having only 10 feet of water, makes its entrance very difficult. Its shores are generally wooded and fertile, but frequent cataracts and shoals obstruct its navigation, and make it of comparatively small commercial importance.

**Senegal,** the collective name of the French colonial settlements on the river Senegal, including the island of St. Louis, at the mouth of the river, and Gorée, off Cape Verd. They were founded in the seventeenth century, controlled successively by the West India, Senegal, and East India companies, and held by the English from 1758 to 1779 and from 1803 to 1814. A system of military colonization similar to that of Algeria is also applied here, though, as it would seem, not with any great success, as several stations have been abandoned of late. The population was estimated in 1874 at 100,000, and the value of exports at 10,800,000 francs; of imports at 6,400,000 francs. Commerce is exclusively in the hands of the French.

**Senegam'bia,** a large division of Western Africa, bounded N. by Sahara, E. by Soodan, S. by Guinea, and W. by the Atlantic, and extending between lat. 8° and 17° N., and between lon. 4° and 17° W. Its area is estimated at 400,000 sq. m.; its pop. at about 9,000,000. It derived its name from the Senegal and Gambia, which together with the Rio Grande are the only streams of any importance. The surface of this country presents a belt from 100 to 200 miles wide, of low, flat coastland, generally of a swampy and marshy, though in some places of an arid and sandy, character. Behind these plains the interior rises in terraces until at last it reaches the Kong Mountains, whose highest peaks do not rise more than 3280 feet. The country is very little known, however, on account of the climate, which is often very trying to the natives, and sure death to the European. Senegambia and Nubia are the hottest places on earth. In the dry season the thermometer stands at 102° at six o'clock in the morning, and at 110° at noon, and in the sandy districts, where the rays of the sun are strongly reflected, such a heat is produced that eggs can be cooked by simply burying them in the sand. In the wet season the heat is not diminished, and the rain, which pours down continuously, with a roaring, thundering sound like that of the discharge of musketry, transforms the atmosphere to a real vapor-bath. In the highlands the climate is, of course, cooler, and the air is free from the death-bringing vegetable miasmas with which it is impregnated in the coastland. The vegetation of such a country must necessarily be exceedingly luxuriant wherever the soil is fertile; and it is so, though travellers describe it as somewhat monotonous. In the forests the gigantic baobab, the African teak, and other timber trees alternate with different kinds of palms, the banana, the bread-fruit tree, and the mangrove. Rice, sugar, indigo, tobacco, coffee, and cotton grow wild and are of good quality. Oranges were introduced by the Portuguese, and are cultivated but not eaten by the natives. The inhabitants of Senegambia consist of a great number of different races and tribes, whose descent and relationships involve many intricate complications. N. of the Senegal live the desert tribes of the Moors; S., the Yolofs. The Yolofs are negroes of the very deepest black, and with thick lips and woolly hair, but they are tall, well proportioned, with noble features, and often remarkably handsome. They are Mohammedans, warlike, energetic, and industrious, and their language, which is entirely different from that of the neighboring tribes, has much resemblance to that of the Kaffirs in its grammatical structure. Farther S. live the Foohahs. They have an olive-brown complexion, long, silky hair, eagle nose, and show an apparent relation to the Caucasian race. They call themselves "white men," and are proud, but open, trustworthy, and kind; they are Mohammedans. In the highlands live the Mandingoes, who have all the characteristics of the negroes—woolly hair, thick lips, flat nose, and black complexion—but they are tall, well-proportioned, simple-minded, cheerful, winning, and industrious; some of them are Mohammedans, others are idolaters. Between these tribes, and especially along the coasts, live many other smaller tribes, which are often utterly debased and barbarous, turbulent, and given to intoxication and robbery. Each tribe forms generally a state of its own, but with the lower tribes one tribe is often broken up into several states, each state consisting only of one family: we are here near the bottom of humanity. Of foreigners, the French, the English, and the Portuguese have made settlements or hold possessions in Senegambia—the French on the river Senegal, the English on the Gambia, and the Portuguese on the Rio Grande.

**Sen'eka,** a drug consisting of the root of an indigenous perennial plant, *Polygala senega,* natural order Polygaleæ. This plant grows throughout most parts of the U. S., frequenting open fields and rocky places. It is a small herb, with small white flowers forming a close spike at the summit of the stem. The roots are of various sizes, tapering, branched, and twisted, with a thick gnarled head from which the several yearly stems arise. The epidermis is dark-colored, corrugated, and is the active part of the root. The dried root has but little smell, but leaves a pungent and acrid impression in the mouth after chewing. Seneka contains a peculiar principle called *polygalic acid,* probably identical with saponine. The drug is an acrid irritant, producing vomiting and purging in overdose. Its first use in medicine was by the Seneca Indians, who employed it as a remedy in cases of rattlesnake-bite, but by physicians it is now used almost exclusively as an ingredient in cough mixtures in the second stage of respiratory catarrhs. Its effects are analogous to those of squill. Seneka is an ingredient of the *compound syrup of squill* of the U. S. Pharmacopœia. Edward Curtis.

**Sen'eschal** [probably from the old Ger. *sene-scalc,* "senior servant"], an officer of mediæval courts, originally of menial character, but in later times powerful magnates sought the office, which in some instances conferred upon its occupant high military and judicial trusts. Not only monarchs, but many nobles, were attended by a seneschal, sometimes called a bailiff or high steward, for the three terms are nearly synonymous.

**Senigallia,** Italy. See Sinigallia.

**Sen'ior** (Nassau William), b. at Uffington, Berkshire, England, Sept. 26, 1790; studied at Eton; graduated at Magdalen College, Oxford, 1811; was admitted to the bar 1818; was professor of political economy at Oxford 1825–30, and again 1847–62; was master in chancery 1835–53, and subsequently examiner in political economy in the University of London. D. at Kensington June 4, 1864. Author of essays upon political economy, philosophy, etc., of narratives of travel in Turkey and Greece (1859) and in France and Italy (1871), and was for forty years a leading contributor to the *Edinburgh Review* and other magazines.

**Senise,** Italy. See Appendix.

**Senlis',** town of France, department of Oise, on the Nonette, is surrounded by old walls, and has a cathedral and an extensive trade in corn, flour, and wool. P. 6085.

**Sen'na** [Arab. *sana*], the leaves of several species of cassia constitute the commercial senna, brought from Southern India and from Alexandria. A senna-plant is indigenous in Egypt and the African deserts, which is called *Cassia acutifolia,* and furnishes most of the Alexandria senna. Great labor has been expended by chemists in endeavoring to isolate the valuable cathartic principle of senna, which has now been known since 1868 to be an acid substance called *cathartic acid,* which was discovered by Dragendorff and Kubly. It is not yet thoroughly well known, but is believed to be a complex compound of the *glucoside* family, and, singularly, contains *sulphur.* Like glucosides generally, it is easily alterable, and hence difficult of isolation and preparation. (For further information reference may be made to Wood and Bache's *U. S. Dispensatory,* under "Senna.") Henry Wurtz.

**Sennaar',** a state of North-eastern Africa and a part of Nubia, lies between the Bahr-el-Azrek and the Bahr-el-Abiad, and extends from lat. 12° to 15° 45′ N.; it is subject to Egypt. The surface presents an elevated plain, consisting of a sandy soil strewn with large boulders, but occasionally broken by the presence of large, isolated rocks, rising to the height of 1200 feet, such as Moia, Mandera, and Legadi in the neighborhood of the city of Sennaar. Along the Bahr-el-Azrek, the proper valley of the Nile, the soil is more productive, the sand being mixed with alluvial deposits or altogether supplanted by a rich, stiff marl; and it is only this tract of land which is in-

habited, the whole valley being studded with villages, while there are very few settlements to the E. of the river, toward the Abyssinian Alps, and none at all along the Bahr-el-Abiad. The climate of Sennaar is, like that of all Nubia, extremely hot, the thermometer often rising during the dry season to 119° in the shade. The soil then looks like a piece of parchment, bare, naked, cracked, and hard-baked. When the rain comes it is transformed into one vast sheet of mire, and then *durra* is sown without any further preparation of soil than what Nature has done herself. Durra is not only the easiest kind of grain to cultivate, but it is also the most remunerative; and although it is inferior to wheat as a breadstuff, it yields an excellent beer and brandy, which the natives enjoy very freely—too freely indeed, intoxication being a feature of their every-day life. The inhabitants are an extremely mixed race, and, like most mixed races, they are indolent and sensual. At one time they were Christians; now they are Mohammedans, but their Islamism does not sit deeper than did their Christianity. They are, however, not without ingenuity. Their houses are often well built, and they possess much skill in gold-smelting, leather-working, and pottery. They have built several cities, of which Sennaar is the capital, in lat. 13° 34′ N., lon. 33° 30′ E. It was a century ago a large and populous city, built of brick and containing several noteworthy edifices, but of late it has declined very much; large portions of it are in ruins, and the number of its inhabitants has decreased from 30,000 to 4000.

**Sennacherib.** See Assyria, by W. Jacobs, A. M., and Nineveh, by George Smith.

**Sen′nett,** p.-v. and tp., Cayuga co., N. Y., on New York Central R. R. P. 1748.

**Senoi′a,** p.-v., Coweta co., Ga., on Savannah Griffin and North Alabama R. R., has 3 churches, 2 academies, 1 newspaper, 2 warehouses, 1 hotel, and planing, merchant, and saw mills. P. about 1000.

J. E. Stallings, Ed. "Senoia Journal."

**Sens,** town of France, department of Yonne, on the right bank of the Yonne, is surrounded by old walls constructed by the Romans, has a fine cathedral, manufactures of leather, serge, druggets, and glue, and an active trade in corn, wine, flax, and hemp. P. 11,514.

**Sensation.** See Psychology, by Pres. J. McCosh, S. T. D., LL.D.

**Sensa′tionalism,** a term in philosophy sometimes used to denote the doctrine that all knowledge is derived originally from the senses. Various other terms are used as its synonyms—viz. "sensism," "sensualism," "sensuism," "empiricism," etc. Hobbes (in 1650) taught that all knowledge grows out of sensations. After sensation there remains behind the memory of it, which may reappear in consciousness. The memory of objects once perceived is aided by words. We therefore connect words to our mental representations of objects. The same word, serving as a sign for numerous similar objects, gives rise to general ideas. Locke held substantially the same views. Condillac (1755) likewise endeavored to explain all mental functions as transformations of sensation (*sensations transformées*). Desire arises from the recollection of a past sensation; the Ego is the totality of sensations. Bonnet (1755), Von Holbach (1770), Buffon (1780), Cabanis (1798), Destutt de Tracy (1815), Laromiguière (1818) held the doctrine of sensationalism. Among recent German writers Czolbe has elaborated a system of psychology that derives all the elements of self-consciousness from sensation. But he has to assume teleological forms—"the sensations and feelings which are hidden in space or the world-soul"—to explain the "fundamental limits of knowledge." His contemporaries, however—Moleschott, Büchner, Vogt—proclaim not only sensationalism, but materialism without reserve. While Cabanis said that thought is a secretion of the brain, Carl Vogt added, "the brain produces thought in the same way that the liver produces bile," etc. John Stuart Mill (1865) defines matter to be "a permanent possibility of sensation," and mind to be "a series of feelings with a background of possibilities of feeling;" thus making sensation the central principle, not only of knowledge, but of being, and apparently reaching the doctrine of Berkeley, *Esse est percipi*. Post-Kantian sensationalism has had to explain away the existence of universal and necessary ideas, such as time, space, causality, etc. Mill holds the geometrical axioms to be "generalizations from observation." Herbert Spencer (1860) holds that knowledge consists in "symbolic conceptions" when it relates to aught else than concrete objects that are not "too great or too multitudinous to be mentally represented." In contrast to this, he holds that "the ultimate truth which transcends experience by underlying it is the persistence of force." Thus, he makes in one instance all general ideas "symbolic," the real being particular things only; and then he makes Force, which corresponds to the most symbolic of our ideas, to be the most real of realities. (See Nominalism and Realism.) William T. Harris.

**Senses,** individual developments of the general sensibility belonging to the living organism. In the individual senses, hearing, sight, etc., the general sensibility of the organism has become immensely intensified by being concentrated and localized in distinct organs, the ear, the eye, etc., and by being specialized so that each organ transfers from the object to consciousness only a distinct part of that total impression which the object is able to make and the consciousness is capable of receiving—the ear only the audible, the eye only the visible, etc. There are five such senses—hearing, sight, smell, taste, and feeling—but they all rise simply as individual developments of the same fundamental faculty of general sensibility; which is evident from the curious connection existing between them. (See Histology.) But their degree of individualization is very different. In sight it is highest. All sensations, whether they come through the hand or the ear, transform themselves into visions, when they become vivid; while an image never suggests anything to the other senses except through associations. It is feeblest in smell and taste. They both disappear very easily in mere feeling, such as smell in sneezing and taste in nausea. It is apparent, however, that the general sensibility of the human organism covers a much larger ground than its five individual senses. There are sensations which enter into consciousness with great vividness without going through the senses, as, for instance, the feelings of hunger, thirst, suffocation, etc., generally designated as the sensations of organic life; or the feelings of pleasure and pain accompanying rest and fatigue, etc., generally designated as muscular sensations. This observation has given rise to a number of delicate researches which have thrown much new light on the whole question of sensation and sensibility, but it has also caused some physiologists and psychologists (Dr. Thomas Brown, Sir Charles Bell, etc.) to push their zeal for putting life into a thorough system so far as to propound a sixth sense, the muscular sense. Thereby, however, nothing is gained but to throw the definition of sense into confusion. Those sensations result directly from the general sensibility in its unindividualized, unspecialized form; that is their place in the system. Clemens Petersen.

**Sen′sitive Plant,** a name applied to *Mimosa pudica*, a low leguminous plant of tropical America, now widely dispersed over the world and commonly cultivated, on account of the rapid movement of the leaves when brushed or jarred, appearing to shrink from the touch. This faculty is shared in a less degree by several other species of *Mimosa* and some related plants, such as the sensitive brier (*Schrankia*) of the Southern U. S. (See Vegetable Physiology.)

**Senso′rium** [Lat.], with earlier philosophers and physiologists, meant the seat of the soul; with Cartesius, the pineal gland; with Boerhaave, the boundary-line between the gray and white substances. It now means the seat of sensation; and as sensation has been proved to take place wherever there exists a ganglionic structure, the term is now coextensive with that of nervous centres.

**Sen′tence** [Lat. *sententia*], in the law, denotes a judgment or determination pronounced by a court after the trial or hearing of a cause, by which the remedy is granted or the sanction is imposed. In the common-law courts the term is confined to criminal cases, their final decision in civil suits being called a "judgment;" while the corresponding act of a court of equity is usually denominated a "decree." In those tribunals whose procedure is based upon the civil law—in the admiralty courts, the English ecclesiastical courts, and sometimes in the American probate or surrogate's courts—the word "sentence" is used, instead of "judgment" or "decree," to designate all judicial determinations. The sentences in civil causes like judgments are either final or interlocutory—final, when they pass upon all the issues material to the decision, determine the rights and duties of the parties, and terminate the pending controversy; interlocutory, when they pass upon some collateral matter or proceeding in the action, or when they establish some right preliminary to the final adjudication. In criminal trials, according to the common-law methods, the sentences are all from their very nature final. It is the exclusive province of the jury to determine the guilt or innocence of the accused. When a verdict of guilty is rendered, the prisoner is thereby convicted, and it then becomes the duty and function of the court to pronounce upon him the judgment or sentence which the law provides as a punishment for his crime. Previous to this final act in all cases of felony the convict is publicly asked by the judge if he has anything to say why the sentence of the law should not be

pronounced upon him. This proceeding, which was originated at an early period of the English law, when the prisoner could not be defended by counsel, in order that he might have an opportunity to suggest any error that had occurred, is now an empty form, and yet the form must be observed or else the judgment would be illegal. No error being shown, the presiding judge declares the sentence, whereby the court orders the prisoner to be capitally executed on a certain day named, or to be imprisoned for a specified period, or to be fined in a designated amount, as the case may be. This sentence is entered by the clerk, and constitutes a most important part of the judicial record. The doctrines and rules of the law in reference to the nature and effects of judgments apply also to sentences. (See JUDGMENT.) JOHN NORTON POMEROY.

**Sen'ter** (ISAAC), M. D., b. in New Hampshire about 1755; settled early in life at Newport, R. I., where he studied medicine; was surgeon in Arnold's expedition against Quebec 1775, during which he kept an interesting *Journal*, published in vol. i. of the *Bulletin* of the Historical Society of Pennsylvania; practised his profession with distinguished success at Pawtucket, and afterward at Newport; contributed to the medical and scientific journals; was an honorary member of the medical societies of London, Edinburgh, and Massachusetts, and for many years president of the Rhode Island branch of the Society of Cincinnati. D. at Newport Dec. 20, 1799.

**Separate Lutherans of Prussia.** When King Frederick William III. of Prussia, by a cabinet order of Sept. 27, 1817, first attempted to introduce, or at least to prepare, a union between the Reformed and the Lutheran churches in Prussia, the attempt was met with much hesitation, not to say aversion, by many earnest Lutherans, who found an eloquent and fearless spokesman in Johann Gottfried Scheibel, professor in theology at the university and minister at the church of St. Elisabeth in Breslau. His two sermons (of Nov. 2, 1817, and Apr. 13, 1821), in which he compared the Reformed administration of the Lord's Supper with the Egyptian Isis-worship, and declared participation in it a deadly sin, set the difficulties of the intended union very forcibly before the eyes of the public, and became the rallying-point of the disaffected. The alterations in the administration of the sacrament, the breaking of the bread, and the introduction of the formula, *Christ, our Lord, says, This is . . .*, he also absolutely refused to adopt, and was suspended; but up to the year 1830 the opposition to the royal plan confined itself mainly to the literary sphere. In this latter year, however, two new cabinet orders, of Apr. 4 and Apr. 30, were issued with the purpose of pushing the cause; and then an open breach took place. Several distinguished men, such as Henry Steffens, Prof. Huschke, and Attorney-general von Haugwitz, many clergymen, and between 200 and 300 families, joined Scheibel. The measures which the government employed were at first rather cautious. Scheibel was driven into exile by chicanery, and died in Nuremberg Mar. 21, 1842; Steffens was removed to Berlin, and negotiations were carried on with Huschke and Haugwitz. The results were not satisfactory, however. The demands became every day louder of entire separation from the state Church and of complete surrender by the state to the congregation of the control of the ecclesiastical government. To suppress the fermentation, first the police and then military force were used. Clergymen were thrown into prison, laymen were fined heavily, assemblies dispersed by dragoons. Many families emigrated to America, but with the martyrdom the enthusiasm rose higher, and the number of the separatists increased. With the accession of Frederick William IV. to the throne in 1840 the situation changed. He restored the imprisoned ministers to liberty, left the congregations undisturbed in their endeavors at organization, and finally recognized the accomplished establishment July 23, 1845. In 1847 a great number of Lutheran congregations joined the separatists, discontented with the continued agitations of the union agenda; and at a synod held at Berlin Oct. 12–14, 1857, one speaker declared all the non-separate Lutheran congregations in Prussia to be the schools of Satan. The zeal of the establishment, however, was soon to be turned against its own bosom. In 1858 the Oberkirchen Collegium of Breslau, the highest administrative authority of the establishment, wanted to be specially mentioned in the official Sunday prayer made by the minister; some objections were made; a discussion of the authority of the Oberkirchen Collegium arose, and it now became apparent that the members of the establishment held very different views concerning church government. In 1861 two parties, a conservative under Huschke, and a radical under Diedrich, were formed, and soon after they entirely ceased to have any intercourse, condemning each other in the harshest expressions. Oct. 28, 1874, a conference was held at Eisenach with the purpose of re-establishing unity.

**Sep'aratists,** a Christian sect which was organized in 1803 in Dublin, Ireland. They aim at a return to primitive Christianity, and object to taking judicial or other oaths. In 1833, Parliament passed an act permitting them to make use of an affirmation in the place of the oath.

**Separatists,** one of the chief sects of the Mohammedans; also called MOTAZILITES (which see).

**Sepia.** See INDIA-INK.

**Sepiadæ.** See CUTTLE-FISH.

**Sepino,** Italy. See APPENDIX.

**Se'poy** [a corruption of the Indian word *sipahi*, "soldier"], a native soldier in the British service in India. Before the great Sepoy rebellion of 1858 these troops numbered 232,224 men, but in 1871 the force of natives in India proper was given as 102,801. The Sepoys consist of Mohammedans, Rajpoots, Brahmans, and men of other castes, besides Sikhs, Ghoorkas, and hill-men of various tribes. The officers are European.

**Sep'sidæ** [Lat. *seps*, from *σήπω*, to "creep"], a family of the order Sauria and group Leptoglossa, including certain small lizards. The body is subcylindrical and elongated, and the tail conical and pointed; the scales smooth; the head conical and regularly shielded, with the rostral plate quite large, and the nostrils in a notch in the hinder edge of the rostral shield; the limbs variable in development, generally all being present, but sometimes (*e. g. Scelotes*) only the posterior two; according to Cope, the temporal fossa is roofed, the premaxillary double, and the palatine maxillary laminæ often dilated. The family is a small one, and is peculiar to the Old World, being chiefly developed in Africa. Two species (*Seps tridactylus* and *Gongylus ocellatus*) occur in Europe. THEODORE GILL.

**Septa'rium** [pl. *septaria;* Lat. *septum*, "partition"], concretions formed by segregations of calcareous matter diffused through clay, not uncommon in shale-beds of all formations. They are lenticular or spheroidal in form, sometimes attaining a diameter of ten feet or more. In many instances these concretions seem to solidify first and most completely at the surface, and subsequently the interior by shrinkage is divided into a great number of ramified cracks; later, these are filled with calc-spar or some other substance deposited from a solution that has penetrated the mass, and then, when broken or weathered, the sparry lines show septa or partitions, from which the name *septarium* comes. They are also sometimes called *turtle-stones*, the flattened concretions, the surfaces of which are divided into polygonal spaces, having somewhat the aspect of the carapace of a turtle. Septaria frequently form about some organic nucleus, as a leaf, shell, bone, etc., and a great number of interesting fossils have been obtained from them, among which may be mentioned the great Devonian fish *Dinichthys*, of which the bones and plates are frequently found in the central portions of the huge concretions which lie in the Huron shale (Devonian) in Central Ohio. The material composing septaria is usually an earthy limestone, which when calcined often produces good hydraulic cement. J. S. NEWBERRY.

**Septem'ber** [Lat., from *septem*, "seven"], the seventh month of the old Roman year, but the ninth of the Gregorian. It is the month of the autumnal equinox. (See EQUINOX.)

**Septima'nia** [so named from its seven cities—Toulouse, Agen, Bordeaux, Poitiers, Saintes, Périgueux, Angoulême], an ancient district in the S. W. of France, was ceded to the Goths in 419. Its name appears in the writings of Sidonius Apollinaris (430–482). It was conquered by the Saracens in 712–719; desolated by Charles Martel in 737; conquered in part by Pepin in 760; became a part of the kingdom of Aquitaine in 778; became a dukedom in 817, a marquisate in 844; and was devastated by the Normans in 859. The Spanish March was set off in 864, and soon after it passed to the house of Toulouse.

**Septimius Severus.** See SEVERUS.

**Septuages'ima** [Lat., "the seventieth day"], in the ecclesiastical calendar the third Sunday before Lent. The first Sunday in Lent is termed Quadragesima, the three preceding ones Septuagesima, Sexagesima, and Quinquagesima.

**Sep'tuagint, The,** or **LXX.** [from the Lat. *Septuaginta*, "the Seventy" (translators)], the name commonly given to the earliest Greek translation of the Old Testament, otherwise called the Alexandrian version. According to the fabulous account of its origin in the letter of the pseudo-Aristeas, repeated by Josephus (*Ant.*, xii. 2) and others, Ptolemy Philadelphus, king of Egypt from 283 (285) to 247 B. C., at the instance of his librarian, Demetrius Phalereus, sent an embassy to Jerusalem to procure from the high priest Eleazar a copy of the Jewish Law, and to make arrangements for a translation of the same into

Greek for the Alexandrian Library. Seventy-two learned men were accordingly selected by the high priest, six from each tribe, and sent to Egypt with a magnificent copy of the Law written on parchment in letters of gold. They retired to the island of Pharos, where they completed the translation in seventy-two days. According to Philo (*Life of Moses*, ii. 5–7), they were divinely inspired. The legend appears with embellishments in Justin Martyr and other Christian Fathers, according to whom the translators were shut up in separate cells and worked independently, and at the end of seventy-two days their several versions, being compared, were found to agree *verbatim*. In this later form of the story the translation is made to include the whole Old Testament. All that can be inferred with certainty from this legend is the high estimation in which the translation was held by the Jews as early as the first century of the Christian era. There is, indeed, no improbability in the supposition that Ptolemy Philadelphus may have taken pains to procure a copy of the books of Moses for his universal library. Jews in his time were numerous in Alexandria. On the other hand, a translation of the Old Testament, or at least of the Law, must have become a necessity at that period to the Hellenistic Jews, to most of whom the Hebrew original, long before the Christian era, was a sealed book; and to this necessity alone it may have owed its origin.

The character of the translation proves it to have been the work of many hands. The Pentateuch is best translated. Anthropomorphisms and offensive expressions are, however, often softened; *e. g.* for "they saw the God of Israel" (Ex. xxiv. 10), we read "they saw the place where the God of Israel stood." The translation of Proverbs has considerable merit, and the book of Job was rendered by a man of genius, who was better acquainted, however, with the Greek poets than with Hebrew, and dealt very freely with his text. The speech of Job's wife (ii. 9) is a curious interpolation. Ecclesiastes is rendered with barbarous literalness, so as to be in some places unintelligible; *e. g.* Eccl. vii. 30. The prophets are for the most part poorly translated, especially Isaiah; and the translation of Daniel was so bad that the version of Theodotion was early substituted for it in Christian use, and but a single manuscript of it is known. In some books, particularly Jeremiah, a recension of the text was followed differing from our present Hebrew; to others, as Esther and Daniel, apocryphal additions were made. The version contains all the books commonly printed in the English Apocrypha of the Old Testament, except the second book of Esdras. Some manuscripts and editions add a third, others a fourth book of Maccabees. As to date, the time assigned by the pseudo-Aristeas for the translation of the Pentateuch has nothing against it; and from a passage in the Prologue to Ecclesiasticus, which alludes to a Greek translation of "the Law and the Prophets and the rest of the books," it seems probable that the collection of books had assumed something like its present form before 130 B. C.

In the controversies between Jews and Christians in the second century it was found that the LXX. could not be relied on as an accurate representation of the Hebrew. Other translations were accordingly made, of which the principal were—(1) that of Aquila, in the first half of the second century, slavishly literal; (2) of Theodotion, based on the LXX., but aiming at greater fidelity; and (3) that of Symmachus, distinguished by greater freedom and elegance. These were presented in parallel columns, together with the Septuagint and the Hebrew text (in Hebrew and Greek characters), in the *Hexapla* of Origen in the first half of the third century; in the Septuagint column words and clauses not in the Hebrew were marked with an obelisk or dagger (to stab them as false), and words in the Hebrew not represented in the translation were added from one of the other versions, generally Theodotion, with an asterisk prefixed. Origen's *Hexapla* as a whole was never copied, but probably perished in the destruction of the library of Pamphilus at Cæsarea in Palestine. Copies were taken, however, of his Hexaplar text of the LXX., parts of which have come down to us in various manuscripts, and also in a Syriac version. The best edition of the remains of the *Hexapla* is that by Field (Cambridge, 1867–75, 2 vols. 4to).

The Septuagint has had a wide influence. It was habitually used by Philo and Josephus, and it is very often quoted by the New Testament writers, even where it differs widely from the Hebrew. Most of the ancient versions of the Old Testament were made from it, as the Old Latin, Memphitic, Thebaic, Ethiopic, Armenian, Slavonic, etc. With all its faults, it has been the only representative of the Old Testament to the Greek or Eastern Church from the beginning, and a knowledge of it is essential to one who would understand the language of the Christian Fathers and the history of theological opinions. From no other source is so much illustration to be derived of the peculiar Greek of the New Testament. It has also considerable value as a help in the criticism of the Hebrew text.

The text of the LXX. became early corrupted, and the Hexaplar edition of Origen increased the corruption, his obelisks and asterisks being often omitted or misplaced by copyists. Our existing manuscripts differ considerably, and the correction of the text is a difficult problem. The primary editions of the LXX. are—(1) that contained in the Complutensian Polyglot (1514–17; published 1522); (2) the Aldine (Venice, 1518); (3) the Roman, Vatican, or Sixtine (Rome, 1587, fol.), founded largely on the Vatican manuscript of the fourth century; and (4) that of Grabe (Oxford, 1707–20), the basis of which was the Alexandrian manuscript. The edition of Bos (Franeq., 1709, 4to) exhibits the Roman text with the variations of the other three editions; and the great edition of Holmes and Parsons (Oxford, 1798–1827, 5 vols. fol.) gives the same text, with the various readings of more than 300 manuscripts collated for it at great expense. The text of nearly all the oldest manuscripts of the LXX. (fourth to ninth century), as the Sinaitic, Vatican, Alexandrian, etc., has since been accurately published, but no critical edition exists in which these rich materials have been properly used. Such an edition has, however, been lately undertaken by an eminent English scholar, Dr. F. H. Scrivener. Meanwhile, the most convenient manual editions are those of Tischendorf (5th ed., Leipsic, 1875), the best; and Bagster's *Septuagint, Greek and English* (London, 1870, 4to), giving the Roman text with Brenton's translation in parallel columns. There is an excellent critical edition of the text of the Apocrypha by O. F. Fritzsche (Leipsic, 1871, 8vo). The best concordance to the Septuagint is that of Trommius (Amst., 1718, 2 vols. fol.); there are lexicons by Biel (Hagæ Com., 1779–80, 3 vols. 8vo) and Schleusner (Leipsic, 1820–21, 5 parts, 8vo, or Glasgow, 1822, 3 vols.). Sophocles's *Greek Lexicon* (Boston, 1870) is also valuable; and for the Apocrypha, Wahl's *Clavis* (1853). Among the most important works on the version are Hody, *De Bibliorum Textibus* (1709, fol.); Thiersch, *De Pent. Vers. Alex.* (1841), excellent in regard to the language; Frankel, *Vorstudien* (1841) and later essays; and Geiger, *Urschrift u. Uebersetzungen d. Bibel* (1857). EZRA ABBOT.

**Sepul'chral Mound,** a tumulus of earth or earth and stones thrown up over the burial-place of the dead. Sepulchral mounds are among the most frequent and interesting monuments of pre-historic ages. Throughout Europe, Asia, and America such tumuli abound; and the name Mound-builders has been applied to the pre-historic race of the present U. S., which left these relics, and a large part of the now remaining mounds are unquestionably sepulchral. The sepulchral mounds of Europe abound in interesting relics of the meagre civilization of early times, and many tumuli long considered Celtic or Scandinavian are of late referred without hesitation to remote ante-historic ages. Some of these are simple barrows of earth; others contain one or more stone chambers or kists.

**Sepul'ga,** tp., Conecuh co., Ala. P. 1600.

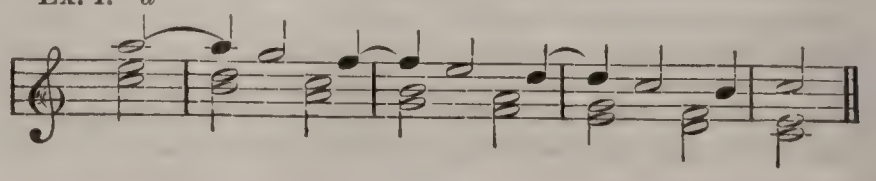
**Sepulture.** See FUNERAL, by S. SEXTON, M. D.

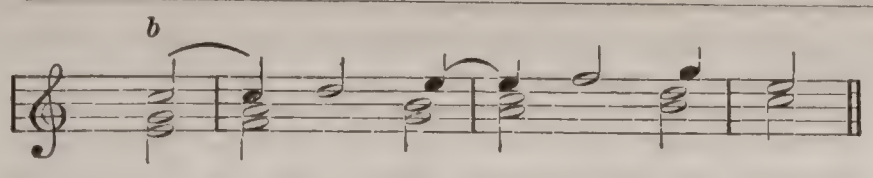
**Sepul'veda, de** (JUAN GINEZ), b. at Pozoblanco, near Cordova, Spain, in 1490; became a priest; resided twenty-two years in Italy; assisted Cardinal Cajetan in the revision of the Greek Testament; became chaplain and historiographer to Charles V. 1536; was tutor to Prince Philip. He wrote a *History of Charles V.*, a *Life of Cardinal Albomas*, and engaged in a polemic with Las Casas upon the subject of Spanish cruelties in America. D. near Cordova, Spain, in 1574. His works were edited by the Spanish Academy (4 vols., 1780).

**Sequat'chie,** county of S. Tennessee, traversed by Sequatchie River and lying between two ranges of the Cumberland Mountains, which have deposits of iron and other minerals. Staples, wheat, Indian corn, oats, tobacco, and wool. Cap. Dunlap. Area, about 300 sq. m. P. 2335.

**Se'quence** [Lat. *sequens*], in music, a peculiar chain-like progression, in which a short musical figure or group of notes is repeated several times on successive steps or degrees of the ascending or descending scale. As a sequence is thus only a group placed one degree higher or lower at each repetition, it can have (in itself) no proper termination, but may be continued indefinitely or through the whole range of the scale. One of the simplest forms of sequence is that made by a chain of thirds and sixths, with each sixth suspended by the seventh, as at *a*, Ex. 1, or with a suspension of the sixth by the fifth, as at *b*:

Ex. 1.—*a*






In sequences the leading trait or figure may lie in the treble, the bass, or one of the middle parts, or in any two or more of the parts together. In Ex. 2 the most forcible expression of the sequential idea is found in the treble at *a*, and in the bass at *b*, while at *c* it appears in the treble and bass combined:

Ex. 2.—*a*




Sequences are of infinite variety, and occupy an important place in fugues, organ-pieces, and instrumental compositions of almost all kinds, furnishing a grateful relief to the ear, and awakening certain emotions which seem peculiar to progressions of this class. Those we have given in the above examples are founded on the diatonic scale, but many of the richest sequences derive their beauty from the peculiarities of the *chromatic* scale, and are sometimes exceedingly elaborate and complex in their structure.

WILLIAM STAUNTON.

**Se′quin** [It. *zecchino, zecca*, a "mint;" Arab. *sikkah*, "a stamp"], a name applied to various Italian and Levantine coins. The original sequin was a Venetian gold ducat of the thirteenth century. At present the gold Italian sequin is worth $2.301, but it is no longer coined.

**Sequoi′a** [for derivation of the name see below], a genus of coniferous trees of the sub-order Cupressineæ, or cypress family, remarkable for the great size which they attain, being the redwoods and big trees of California. They are natives of California only, and of two species—one, *S. sempervirens*, the proper redwood, confined to the Coast Ranges; the other, *S. gigantea*, more particularly called big tree or mammoth tree in that State, restricted to the western face of the Sierra Nevada. The Pacific forest-belt is prolific of large trees, but these surpass in girth, if not absolutely in height, the sugar-pines, Douglas spruces, etc. with which they are associated. They are distinguished at sight from other trees by the trunks alone, invested with a peculiar fibrous bark of a rich cinnamon-brown color, and of thickness somewhat in proportion to that of the wood; but the bark of one associated tree, the incense cedar (*Libocedrus decurrens*), is to a certain extent similar. The nearest relative of the genus among existing trees is the *Taxodium*, or so-called cypress (more properly bald cypress) of the Southern Atlantic U. S. and Mexico; but that has deciduous foliage. Both differ from the cypress tribe proper in having the scales of the cone (which is small and oval) arranged on the axis in a spiral order, after the manner of pines, instead of being in pairs or whorls of three. Each of the wedge-shaped scales usually bears five wing-margined seeds. The leaves also, unlike those of the proper cypress tribe, are spirally arranged on the branch. But those of the two species are remarkably different, considering the essential similarity of the rest of the structure.

In the coast redwood the bright green foliage, spreading in a two-ranked manner, is very similar to that of yew, forming a graceful spray. The wood answers to its name, being of rich brownish-red; it is light, but firm, free and straight-grained, handsome for wainscoting and the like, although the color fades on exposure without protection, while it is fully as durable as red cedar when used for posts and palings. The tree is tenacious of life, the stumps even of the oldest trunks long retaining their vitality at the circumference, and sprouting into a circle of fresh young shoots. This tree adorns, or till recently adorned, the Coast Ranges from Monterey Bay to the Oregon line, but most abounds northward of the Bay of San Francisco up to lat. 40°. Being by far the most valuable lumber-tree of California, and growing near the coast, the available stock is being rapidly consumed. Where this redwood abounds it naturally forms a forest almost by itself. As Profs. Brewer and Whitney remark: "Let one imagine an entire forest, extending as far as the eye can reach, of trees from 8 to 12 feet in diameter and from 200 to 300 feet high, thickly grouped, their trunks marvellously straight, not branching till they reach from 100 to 150 feet above the ground, and thence forming a dense canopy, which shuts out the view of the sky, the contrast of the bright cinnamon-colored trunks with the sombre, deep, yet brilliant green of the foliage,—let one picture to himself a scene like this, and he may perhaps receive a faint impression of the majestic grandeur of the redwood forests of California." As to size, there are well-known trees with trunks from 50 to over 75 feet in circumference and from 200 to 275 feet in height; and credible accounts are given of still larger ones, equalling perhaps any of the giants of the Sierra species. Archibald Menzies, the surgeon of Vancouver's voyage, was the first botanist to collect specimens of the redwood, but only with old and imperfect cones. This was almost eighty years ago. They remained unpublished until the year 1832, when one of these specimens was figured by Lambert, and described under the name of *Taxodium sempervirens;* that is, it was referred to the bald cypress genus. Soon after, the tree was made known to botanists by Douglas. In 1847, Endlicher founded upon it the genus *Sequoia*. Although the derivation of the name was not explained, there is no doubt that Endlicher, who was a philologist as well as botanist, bestowed the name in commemoration of *Sequoyah*, a Cherokee Indian of mixed blood, who also bore the English name of GEORGE GUESS (which see), and who invented an alphabet (of 85 characters, each representing a syllable) and a written language for his tribe.

*S. gigantea*, the "mammoth tree" of the Sierra Nevada, now so famous, is of recent discovery. It appears to have been first seen by white men in the spring of the year 1852, when a hunter named Dowd reached the Calaveras grove, and afterward led a company of miners to the spot. Some account of these wonderful trees soon appeared in the California newspapers, and specimens (branches with cones) reached the Atlantic States and Europe in 1853. The earliest scientific account and name of it appeared in *The Gardener's Chronicle* (London), Dec. 24, 1853, by Lindley, who published it as *Wellingtonia gigantea*, and under this name also a figure appeared early in 1854 in the *Botanical Magazine*, edited by the late Sir William Hooker. The Californian botanists and amateurs, with a pardonable patriotism (which was unscientific if they knew that the tree was named and published already), proposed to call it *Washingtonia Californica*, and under this name it was published in the California *Farmer* some time in the year 1854. Meanwhile, the late Dr. Torrey, having obtained flowers of both sexes, determined that this tree was of the same genus as the common redwood—*i. e. Sequoia*—notwithstanding the remarkable difference in the foliage; and this conclusion was announced by the present writer in the *American Journal of Science* for Sept., 1854, but without appending the proper specific name. Prof. Decaisne in Paris had already taken the same view, and had assigned the name which the tree now bears as early as in June, 1854 (*Bull. Soc. Bot. France*, i. 70; also *Rev. Hort.* Jan., 1855). This conclusion being now fully adopted by botanists, the name could be regarded as settled were it not that Endlicher, misled by a mistake by Hooker and Arnott of a fir for a new redwood, had already applied the name of *Sequoia gigantea* to that. But Endlicher's second species, being founded upon a nonentity, disappears, the name *Sequoia Wellingtonia*, proposed by Seemann in 1855, has no proper reason, and that of *S. gigantea* stands.

Although attaining in general a vaster size than the coast redwood, this giant of the Sierras is not so handsome a tree, either when young or aged. The branches are short, the spray less graceful, the leaves small, awl-shaped, appressed to the branchlets, and paler. But the cones are three or four times larger. The wood is similar, but of a duller reddish hue. This species nowhere forms a forest by itself, but is intermixed with other coniferous trees, mainly sugar-pines of lordly size, and it generally occurs in detached patches or "groves." Its range in latitude is only between two and three degrees; in longitude very little, being confined to a particular part of the western

slope of the Sierra Nevada; in vertical range it is restricted between 4760 feet (at the northernmost locality) and about 7000 feet. The most northern groves known are the two in Calaveras county, one of which was the first discovered, and is still the most visited and most accessible. It contains some of the tallest trees known. This grove still contains four trees which are over 300 feet high; the tallest, called "the Keystone State," reaches the height of 325 feet, and its girth at six feet from the ground is 45 feet. The tree from which the bark was taken for exhibition (and finally consumed in the Sydenham Crystal Palace) is not quite so tall, but its stripped trunk measures 61 feet in circumference. The stump of the tree which was cut down was squared off, and a pavilion erected over it, has a diameter of 23 feet, and in one direction of 24 feet. Its annual rings on the section are 1255, besides a small portion in the centre which is imperfect. Its age cannot have exceeded 1300 years. Between this grove and the Merced River are two or three patches of big trees,

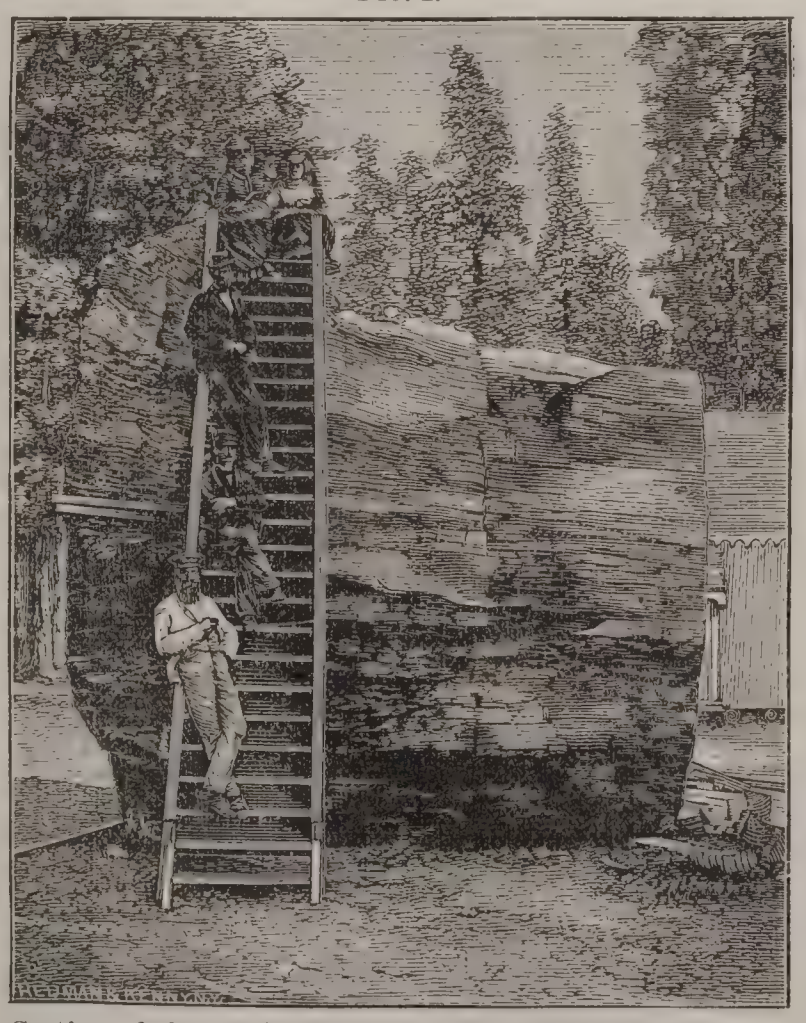
Fig. 1.



The Grizzly Giant.

but none of great note until the Mariposa grove is reached. This is 16 miles S. of the Yosemite Valley, and is

Fig. 2.



Section of the original Big Tree, 92 feet in circumference.

in two patches—the lower one 5500 feet above the sea-level. It contains about 125 trees that are over 40 feet in circumference—one, the Grizzly Giant, which is over 93 feet at the ground and over 64 at eleven feet above—as well as ruins and remains of still larger trees. Many have been sadly injured or destroyed by fire. None equals those of the Calaveras grove in height, the very tallest being only 272 feet. This grove, like the Yosemite Valley, is a government reservation and in charge of trustees. About a dozen miles S. of it is the Fresno grove, which is said to contain about 600 trees, the largest 81 feet in circumference. From this district S. to the Tule River, but at greater elevations, they appear to be more abundant than elsewhere, and more dispersed through the forest. There are probably existing trees of both species of *Sequoia*, and there are doubtless remains of the Sierra species, which have attained the age of over 2000 years; probably there are none which have very much exceeded this. (We learn from Prof. Whitney that a small grove has recently been discovered farther N. than any known before —*i. e.* 50 or 60 miles N. of the Calaveras, in Placer county —and that one of the fallen trees, of no unusual size, gave data indicating an age over 2000 years.)

It appears that neither of these species is adapted for planting in the Atlantic States, although the *S. gigantea* has not rarely survived well for a certain number of years. But it thrives in Europe, especially in England, where it is much planted and grows rapidly. The most full and authentic account of these trees is to be found in Prof. J. D. Whitney's *Yosemite Book*, from which this article is largely abstracted. This genus of trees, now so local and restricted in species, has played a larger part in the forest growth of earlier ages. It can be traced back to the older stage of the Cretaceous period in geology, and was represented by at least seven or eight species in the Tertiary period, during which it occurred all around the Arctic zone—in Europe as far S. as Greece, and in the western part of the North American continent, at least to Oregon. One of the Tertiary fossil species much resembles *S. gigantea;* two or three are very like the coast redwood, or only questionably and provisionally distinguished from it; one is of a type intermediate between the two existing species.

Asa Gray.

**Sequoia Gigantea.** See Sequoia.

**Sequoy′ah,** county of S. W. Kansas, formed since the census of 1870, and still unorganized. It is intersected by Arkansas River, traversed by Atchison Topeka and Santa Fé R. R., and consists of high rolling prairies. Area, 720 sq. m.

**Sequoyah.** See Guess (George).

**Seraglio.** See Constantinople.

**Seraing′,** v. of Belgium, province of Liege, on the Meuse, has large manufactures of steam-machinery, locomotives, iron goods, and mirrors, and rich coal-mines in its vicinity. P. 21,853.

**Serajevo,** or **Sarajevo.** See Bosna-Serai.

**Serampore′,** town of British India, presidency of Bengal, on the Hooghly, in lat. 22° 45′ N., lon. 88° 26′ E., is a neat and well-built city, with large manufactures of paper. It was originally a Danish settlement, and was sold in 1845 to Great Britain. P. 15,000.

**Sera′peum,** a temple dedicated to the god Serapis, of which there were several at Rhacotis, Alexandria, Memphis, and other places of Egypt, Babylon, and elsewhere, 42 temples having been recorded as dedicated to this god. As Serapis was the appellation of the Asar- or Hesar-Api, the Osiris or deceased bull Apis, the term Serapeum was applied to the cemetery of these sacred bulls at Memphis, which lived in the Apeum close by from the seventh century B. C. It was called the Great Serapeum. This subterraneous sepulchre was discovered in 1850 by Mariette-Bey at the western end of a dromos of sphinxes lying N. of the pyramids of Sakkarah, by a series of excavations extending to 7000 feet, and uncovering 141 sphinxes, at the end coming to a semicircle adorned with statues of gods and philosophers, supposed to be the library of the Serapeum. A lateral dromos 360 feet long led to the Apeum or temple of Apis and a naos of the god. This part of the Serapeum was built in the reign of Necht-her-hebi (B. C. 378–360), the mortuary chapel of the bull, however, having been founded by Shaemuas, a son of Rameses II., about B. C. 1300. Another of the shrines was erected during the Ptolemies (about B. C. 300), and the worship continued till the reign of Julian II. (A. D. 360–363). The Serapeum comprised a group of shrines dedicated to Astarte, Anubis, Imouthos, or Æsculapius, and a hospital, and had an organization of different officers, the most remarkable of which were the *didymi* or "twin" priestesses, and those persons who lived as monks (*en katoché*) in the precincts. The mummies of the Apis there buried began with that of a bull which died in the reign of Amenophis III. (about B. C. 1450), and con-

tinued, with some interruption, till the time of Ptolemy Euergetes II. (B. C. 117). They were not all buried with the same honors or in the same manner; those from Amenophis II. to Rameses II. had mortuary chapels, while at a later period they were buried in galleries, the chambers becoming (seventh century B. C.) of considerable size, with magnificent sarcophagi of red granite sixty-four tons in weight, in which portions of the bull were mummied. The tomb of the bulls had attached to outer walls tablets recording the dates of their birth, installation, and death, and the dates of the reigns in which these occurred. Hence, compared with the length of the life of these animals, the inscriptions have thrown great light upon the Egyptian chronology from the nineteenth dynasty downward. About 1200 tablets were discovered, chiefly in hieroglyphic, but a few of the later in demotic characters. Altogether, 7000 different objects were found during the excavations of Mariette-Bey. Besides the worship of the Apis, the sacred cow-mother of the god was also treated with divine honors, and probably buried there; but the place of sepulture of the bulls before the eighteenth dynasty is unknown, and they may have been buried in pyramids. Twenty-four Apis bulls were buried between the reigns of Rameses II. and Psammetichus I.

The other Egyptian Serapeum at Alexandria was erected by the Ptolemies to the god, a modified type or form of Aidoneus or Pluto, brought from Pontus. The building, of magnificent architecture and size, rose 100 feet above the level of the city, and in it was the celebrated Alexandrian library, that burnt by Cæsar having been replaced by the collections of the kings of Pergamus, given by Mark Antony to Cleopatra. The worship of the god was continued after the introduction of Christianity, but the temple and statue of the god of colossal size, made of wood plated with different metals, was destroyed at the instigation of Theophilus, archbishop of Alexandria, about A. D. 390, after the temple had been besieged by the Christians and an edict for the destruction of idols obtained from the emperor Theodosius. The celebrated Alexandrian library was pillaged or destroyed in the tumult, although its loss by fire has been popularly attributed to Amrou, 250 years later—perhaps burnt like the wooden portions of the god in the amphitheatre at the time of Theophilus. The temples of Serapis were supposed to give oracular responses by dreams or visions in which the god appeared, and connected the worship of Greek with Asiatic and Egyptian deities. No representations of the Serapeum have been preserved, but the one at Alexandria was evidently a Greek temple with a quadrangular portico and decorated with statues. One of the shelves of the library which held the works of Dioscorides has been found, but all other portions have been lost or can no longer be recognized. S. BIRCH.

**Ser'aph,** pl. **Seraphim** [occurring but once in the Bible (Isa. vi. 2, 6), derived by Steudel, Gesenius, Schultz, and others from an obsolete Hebrew root like the Arabic *sharufa*, "to be high," "pre-eminent," but by most interpreters from *saraph*, to "burn," "consume"], regarded by Hävernick, Diestel, and others as symbolical creatures; by Ewald, as of the form of a dragon with fiery eyes; by others identified with the cherubim, of which they are supposed to be another manifestation; but by most interpreters considered to be real creatures in human form, with six wings, ever worshipping at the throne of God, and performing the highest sacerdotal functions, like the twenty-four elders of Rev. iv. 4. CHARLES A. BRIGGS.

**Ser'aphim** [Heb.], **Order of the,** in Sweden and Norway, a knightly order founded in 1260 or 1285 by Magnus I., king of Swealand, or, as others say, by Magnus II. in 1334. Charles IX. abolished it about 1610, and Frederick I. restored it Feb. 11, 1748. The bishop of the Seraphim, the prelate of the order, belongs to the national Lutheran Church.

**Sera'pis,** the name of an Egyptian and Græco-Egyptian god. The Egyptian Serapis or Sarapis was the *Asar-Hapi* or Osiris-Apis, the name given to the sacred bull of Memphis, a supposed incarnation or avatar of the god Ptah, and the sepulchral or votive tablets set up in his honor bore that name, the Osor-Apis being supposed to be the son of the god Ptah, and animated by the soul of Osiris. As such he is represented under the type of a man with a bull's head. The Greek Serapis was introduced into Egypt in the reign of Ptolemy Philadelphus (B. C. 284–246), in consequence of a dream of that monarch, and his statue, a form of Hades or Pluto, sent as a present by the people of Sinope. It was placed in the temple on the promontory of Rhacotis, according to one statement, or else transferred from Pontus to Alexandria. As he was not a native deity, great diversity of opinion prevailed as to his significance. He was thought to be Æsculapius, Osiris, Jupiter, or Pluto, but the Greek inscriptions in the temples of Egypt identify him with Zeus or Jupiter and Helios or the Sun. He was also thought to be the ruler of demons and the invisible world. Besides Rhacotis, he had temples at Memphis, Alexandria, and Canopus. His worship was introduced into Rome by Antoninus Pius A. D. 146, and his mysteries celebrated on the 6th of May, but subsequently abolished by the senate. The form of Serapis constantly appears on the Roman coins struck in Egypt as that of a bearded man like Pluto, his hair slightly dishevelled, draped in a full garment, and wearing on his head the cylindrical modius or *polos*. He replaces at this time all the principal deities of Egypt, appearing instead of Osiris in the company of Isis, or else as Chnumis accompanied by Satis and Anucis. The principal site of the worship of Serapis was at Alexandria, and in the Serapeum of that city his type and worship existed till A. D. 379, when, at the instigation of Bishop Theophilus, a colossal figure of the god made of wood, plated with metal, was destroyed and burnt. Several busts and statues of Serapis are known, and small statuettes in bronze of this deity are not uncommon; and he often appears on later and especially Gnostic gems. He was sometimes represented seated with the attributes of Jupiter and Pluto, the eagle and Cerberus, at his side. At other times he is accompanied by the uræus, or even assumes the body of that serpent for his human form. S. BIRCH.

**Seregno,** Italy. See APPENDIX.

**Sere'na,** p.-v. and tp., La Salle co., Ill. P. 1076.

**Serena, La.** See COQUIMBO.

**Se'res** [Chinese, *see*, "silk"], the Greek and Roman name for a people of Eastern Asia, probably the Chinese, who were the first manufacturers of silk. Arnobius of Northern Africa, who flourished about 300 A. D., speaks of them as having been reached by Christian missionaries.
R. D. HITCHCOCK.

**Ser'es,** town of European Turkey, eyalet of Salonica, in a densely-peopled and extremely fertile plain covered with rice-fields and cotton plantations. It is well built, has many mosques and extensive manufactures of cotton, and carries on an active trade. P. 25,000.

**Serf** [Lat. *servus*, a "slave"]. The historical origin and development of serfdom were very different in the different European countries. There are, indeed, hardly any two countries in which this institution exhibits exactly the same character, though in them all it at one time during the Middle Ages formed one of the most prominent elements of the existing social order. In many countries its features varied even from province to province; thus, in Denmark there was a great difference in this respect between Jutland and the islands; and in Germany between Mecklenburg and Saxony. Nevertheless, in spite of the innumerable modifications under which serfdom existed, and which make it one of the most difficult institutions of mediæval society to understand, there are several large features which, with some slight qualifications in certain individual cases, may be put down as its general description. It originated from the slavery of the ancient republics, and was transformed by the concurring influences of Christianity and feudalism. It received its final and legally-defined organization from the absolute monarchy, and disappeared with it under the influence of modern liberalism, more especially through the agency of the French revolution.

The slavery of ancient Rome, on which her whole civilization depended, was not a thing entirely unknown to the barbarians who invaded her territory and finally overthrew her empire. The Germanic nations had their thralls. Wherever they settled they employed the native population—that is, that part of it which was not killed and did not flee—to perform all menial labor for them, treating them nearly as we treat our domestic animals; and when they moved they generally carried along with them a multitude of such helpers, probably at the rate of ten thralls to one freeman. Such was the relation in England between the Anglo-Saxons and the Celts, and in Scandinavia between the Goths and the Finns and Lapps. But in the Roman slavery there was something absolutely unintelligible to the man of Germanic descent. In Rome the poet, the philosopher, the man skilled in science and art, the tutor of the children, and the ornament of the house was often, not to say generally, a slave. In the Germanic nations a man possessed of eminent wisdom or skill could never become a thrall. He might be sold, when captured, to a foreign market as a slave, but the individuals kept as thralls in the household were always inferior to their masters, both in natural capacity and in training; and whenever a thrall gave proofs of eminence in any respect, in some kind of workmanship or in noble courage, he was immediately made free. Furthermore, the Roman law had established a very subtle gradation in civil freedom, from

the slave just bought in the market to the patrician just become independent by the death of his father. But these subtleties the barbarian did not understand; he despised them, evaded them, and judged each single case according to his individual feeling; which, as society around him was far superior to him in refinement and general civilization, led him naturally toward the acknowledgment of freedom rather than toward the establishment of slavery. Thus, although the Germanic nations kept thralls themselves, their conquest of the Roman empire acted as a powerful agent in breaking up and transforming the ancient institution of slavery; and at the same time the Christian Church succeeded in enforcing laws which forbade Christian masters to keep Christian slaves; that is, they forbade slavery. But of course it was only the form which changed; the thing itself, the dependence of one individual on another, could not be abolished. In time of famine—and famines were frequent—the monasteries, or rather the ecclesiastical establishments, the bishops' sees, were the only places where provisions were found stored up, and the inhabitants of large districts were often compelled to buy relief here by selling a part of their independence. In time of war—and wars and feuds were perpetual—the agricultural population of whole provinces or of smaller circuits was often compelled to buy in the same manner protection for their corn-fields, vineyards, cattle-herds, and huts from the commander of an army or the lord of a castle. And still more general causes were at work. It was as impossible in the period between the sixth and the eleventh century to realize any kind of aspirations without belonging to the retinue of some lord or the court of some prince as it would be in the nineteenth century to achieve a success in any line of business without acquiring first the elements of the corresponding education. Thus, ancient slavery arose again in mediæval society, but in a much milder and more alleviated form—as a serfdom only; and it is probable that the mastership which the feudal and ecclesiastical lords exercised over their serfs was for centuries felt as a blessing rather than as a burden; for the feudal system was indeed, up to the tenth century, the main support of social order, the condition of life. In countries in which feudalism did not penetrate, such as Italy, no serfdom was developed: here the peasants, the population of the agricultural districts, entered the armies of the city-republics to which they belonged, and their position as citizens was not very different from that of the burghers.

The serfdom of the early Middle Ages was a very vague organization, and by no means regulated. But after the victory of absolute monarchy over feudalism it was defined by law in all its particulars; and however hard and repulsive it might formerly have been in many cases, on account of the arbitrariness and violence of the lords, it now became a general curse, an organized misery. The serf was not exactly a slave; the lord could not sell him, though it was quite common among noblemen in the seventeenth century, when playing at cards, to stake a certain number of peasants. But he was tied to the soil; he could not move, and if he fled he was hunted like a wild beast. He could hold property, said the law, but the law did not give him any means of protecting his property. The nobleman could arbitrarily increase the rent of the farm, from which the peasant was not allowed to move, and when the rent became due, but was not paid, the lord was his own court and sheriff; and in some countries he could even employ torture to enforce payment. The reasons why absolute monarchy thus delivered up one part of its subjects to the greediness and violence of another were different in different countries, but generally they bore the character of being a sort of compromise; the king had usurped the rights of the nobility, and, as a sort of compensation, he thus surrendered the rights of the peasants. In Russia, Peter the Great introduced feudalism and serfdom together in a very summary manner. His favorites were presented with a certain number of square miles and with all the people living on the land; he was to be lord, and they serfs; which practice was continued up to the time of Alexander I. In England, where absolute monarchy never became a fixed establishment, serfdom gradually disappeared during the fifteenth and sixteenth centuries. It is mentioned for the last time in 1574 by a commission issued by Queen Elizabeth for its abrogation in the counties of Cornwall, Devon, Somerset, and Gloucester. In France, where both Louis IX. and Louis X. had sought support in the serfs against the feudal counts, serfdom was maintained, often in very harsh forms, up to the Revolution. In Denmark it was abolished in 1784 by Frederick VI., at that time heir-apparent only, but actually governing instead of his insane father; in Prussia in 1808 by Von Stein; in Hungary in 1848 by the revolutionary anti-Austrian Diet; and in Russia in 1861 by Alexander II. CLEMENS PETERSEN.

**Serge** [from the Lat. *sericeus*, "silken"], a name applied to various twilled fabrics. Silk serge is a coarse and strong material used for lining coats, making light shoes, etc. Woollen or worsted-and-woollen serges are made for ladies' cloaks and other uses. Some kinds of coarse serge are employed for making the garments of certain ecclesiastics.

**Ser'geant,** a non-commissioned officer (*i. e.* an enlisted soldier holding an appointment from the colonel authorizing him to exert a limited authority over his fellow-soldiers) in the army and marines, of a rank higher than that of corporal. Bardin (*Military Dict.*) derives the word from the Low Latin *servientes*, men discharging a military service, and hence *soldiers;* while *servientes armorum* referred to armed knights, and hence our SERGEANT-AT-ARMS (which see). Each infantry company has a certain number of sergeants, one of which is of higher rank and pay than the rest, and is called first sergeant. Each battalion (or regiment, if as in the U. S. it has but one battalion) has a sergeant-major, who is the highest non-commissioned officer of the battalion. He is the executive officer of the adjutant, and superintends the making out of details and the performance of other camp duties for the adjutant. There are also quartermaster and commissary sergeants to each battalion. In the U. S. service *ordnance sergeants*, whose duty relates to the care of ordnance, arms, ammunition, and military stores at the posts to which they are attached, are provided for by law, to be selected from sergeants of the line who have served eight years, four of which as non-commissioned officers. J. G. BARNARD.

**Sergeant,** tp., McKean co., Pa. P. 119.

**Sergeant** (JOHN), b. at Newark, N. J., in 1710; graduated at Yale College 1729; was tutor there 1731–35; began to preach to the Indians at Housatonnuc, in Western Massachusetts, Oct., 1734, and translated portions of the Bible into their language. D. at Stockbridge July 27, 1749.—His son JOHN, b. at Stockbridge about 1747, was pastor to the same Indians at New Stockbridge, N. Y., from about 1768 until his death, Sept. 8, 1824.

**Sergeant** (JOHN), LL.D., son of J. D. Sergeant, b. at Philadelphia, Pa., Dec. 5, 1779; graduated at Princeton 1795; was admitted to the Philadelphia bar 1799; was appointed a commissioner of bankruptcy 1801; was subsequently deputy attorney-general of Pennsylvania; sat several times in the Pennsylvania legislature; was member of Congress 1815–23, 1827–29, and 1837–42; was the leading representative of the Northern States in advocating the passage of the Missouri Compromise act 1820; was minister to the Panama congress 1826; Whig candidate for the Vice-Presidency on the ticket with Clay 1832, in which year his *Select Speeches* were published; president of the Pennsylvania constitutional convention 1830; declined the mission to England 1841; was appointed by Secretary Marcy arbitrator to determine a controversy of long standing between the U. S. and the State of New Jersey; was president of the Philadelphia House of Refuge and of the Apprentices' Library Company, and for half a century was regarded as one of the leaders of the Pennsylvania bar. D. at Philadelphia Nov. 23, 1852.

**Sergeant** (JONATHAN DICKINSON), b. at Newark, N. J., in 1746; graduated at Princeton 1762; became a lawyer; was a member of the Continental Congress 1776–77, having taken his seat a few days after the Declaration of Independence; was attorney-general of Pennsylvania 1777–80; was afterward an eminent member of the bar of Philadelphia, where, in consequence of his benevolent efforts as a member of the board of health, he caught the yellow fever, and d. in Oct., 1793.

**Sergeant** (THOMAS), son of John, b. at Philadelphia, Pa., Jan. 14, 1782; became a lawyer; sat in the legislature 1812–14; was judge of the district court 1814–17; secretary of state 1817–19; attorney-general 1819–20; postmaster of Philadelphia 1824–32; associate justice of the supreme court of Pennsylvania 1834–46, having been reporter of the decisions of that court 1814–28; was long president of the Historical Society of Pennsylvania; wrote several professional works, and was a frequent contributor of prose and verse to the literary periodicals. He married Sarah Bache, a granddaughter of Benjamin Franklin. D. at Philadelphia May 5, 1860.

**Sergeant-at-Arms,** originally an officer who attends the English lord chancellor and also the House of Lords. He acts as executive officer for the Lords and for the chancery court. The House of Commons has another sergeant-at-arms.

The sergeant-at-arms of the U. S. Senate assists in the preservation of order, serves processes, arrests persons, and holds them in custody when so directed by the Senate, etc. He has $2000 a year, and large fees, in the aggregate,

for the serving of processes. The sergeant-at-arms of the House of Representatives performs duties corresponding to the above, and also keeps the pay and mileage account of the House, and, if required, pays money to the members for the pay-checks prepared by him and endorsed by the Speaker and the member to whom the check is issued. His pay is $4320, without fees.

**Sergi′pe,** province of Brazil, bounded N. by the province of Alagoas, from which it is separated by the river São Francisco, W. and S. by the province of Bahia, and E. by the Atlantic; comprises an area of 31,958 sq. m., with a population estimated at from 250,000 to 300,000. The coastland is mostly sandy and extremely hot; the interior is high, though not mountainous, and in many places very fertile. Agriculture is the principal branch of industry, sugar and cotton the common crops. Coffee, for which the soil is well adapted, is not cultivated. Cattle-rearing is mostly neglected. There is a little shipbuilding.

**Seriation,** in chemistry. See SERIES, IN CHEMISTRY.

**Sericine.** See SILK, CHEMISTRY OF.

**Sericulture.** See SILK.

**Se′ries** [Lat.], an infinite number of terms following one another in regular order, each of which is deduced from one or more of the preceding terms by a fixed law, called the law of the series. A certain number of leading terms being given, and the law of the series being known, the series may be written out to any number of terms. Sometimes the law of the series is given by means of a *general* term, from which any term may be derived by making proper suppositions on the arbitrary constants that enter it. A series is said to be *increasing* when the numerical value of each term is greater than that of the preceding term; it is *decreasing* when each term is less than the one preceding. A series is said to be *converging* when the sum of any number of terms approximates more nearly to a fixed quantity the greater the number of terms that are taken. The fixed quantity is called the *sum of the series*, and the operation of finding this quantity is called summation.

The following are some of the more important series: (1) The *arithmetical series*, in which each term is derived from the preceding one by the addition of a constant quantity; (2) the *geometrical series*, in which each term is equal to the preceding one multiplied by a constant quantity; (3) the *recurring series*, in which each term is the algebraic sum of the products obtained by multiplying two or more preceding terms by certain fixed quantities: these quantities taken in order constitute the scale of the series; (4) the *logarithmic series*, which may be deduced by the development of a logarithmic function; (5) the *exponential series*, which may be deduced by the development of an exponential function; (6) the *trigonometrical series*, which may be deduced by developing a trigonometric function in terms of its arc, or an arc in terms of one of its trigonometric functions; (7) the *series of figurate numbers*, whose terms may be deduced from the general expression

$$\frac{n(n+1)\ldots(n+m)}{1\,.\,2\,.\,3\ldots(m+1)},$$

by assigning to $m$ a particular numerical value, and then making $n$ in succession equal to 1, 2, 3, etc. To these may be added the *series of powers* of natural numbers, the *series of reciprocals of powers*, and many others.

W. G. PECK.

**Series, in Chemistry.** The word *series* is Latin, and means a "succession," a "chain," or a "train" of things *of like derivation.* Its Latin meaning is precisely applicable in chemical and chemi-physical science, in which it is destined to be in the future a most important word. The prevalent notions of the chemical schools of the present day rest mainly upon the assumption of the derivation of all the infinite variety of bodies from a certain small number of so-called *types.* These typical bodies are selected so as to represent the different known degrees of "atomicity" or *equivalence*, and need therefore be only equal in number to these degrees of equivalence. (See TYPE-THEORIES.) They are conceived to represent types of *completed* or "saturated" *molecular structure*, made up of atoms, which atoms, while admitted by some to have probably some sort of *motion* in a way no one has attempted clearly to explain, yet must nevertheless have, according to the hypothesis, in the mean and relatively, *fixed positions.* Every other body is then derived from one or other of this small number of saturated types by the *substitution*, according to the known laws of equivalence, of one or more of these atoms by an equivalent number of atoms of either elements or radicals. The attempts to apply this hypothesis exhaustively, so as to cover the whole field of chemistry —though it seems at first to possess to some degree those elements of beauty and simplicity which we expect to find in nature—have not been very encouraging. Instead of enabling us to rid ourselves of any of the vast cloud of assumptions which overshadowed the science of Berzelius and his contemporaries, it has been found necessary to retain the *alcohol-radicals*, and even some of the *ternary* organic radicals, and to invent, in addition, new classes of these mystical "residues;" as will be found partly explained under the head of SALT-RADICALS. The invention also of *hydroxyl*, *carboxyl*, or *oxatyl*, and their analogues has been found necessary. Even with all this, we must have also "mixed types" and "condensed types" to cover all the facts. Briefly, a survey of the field of theoretical chemistry shows convincingly that we have been following a track which, to say the least, is doubtful, and can be but a by-road or side-track at the best. The inductive philosophy requires that we should "try back," and follow up, in a tentative way at least, other experimental paths of classification and derivation of compounds.

The *serial system* of building up and deriving chemical compounds from each other has heretofore been distinctly recognized only in organic chemistry, as it was first proposed in 1842 by James Schiel, a German chemist who was long a resident of America. His original memoir on what he named "progressive series" in organic compounds is in Liebig and Wöhler's *Annalen der Chemie* (July, 1842). A *résumé* of the subject, by Schiel himself, with a reclamation of priority against Gerhardt, will be found in the *American Journal of Science and Arts* (July, 1861). In this latter paper he claims two kinds of seriation as occurring in organic compounds, one being the homologous seriation—so called by Gerhardt, whose term he adopts—which is based upon successive additions of $H_2C$ to a nuclear group of atoms (see HOMOLOGY), and another based upon successive additions of HC, which he calls "hemilogous series," though he did not indicate any very satisfactory example of a known series of the latter kind.

According to the views of constitution of chemical compounds most in vogue at present, the existence of homologous series—which are generally admitted to run throughout the whole range of organic chemistry, as was claimed by Schiel, their discoverer—is attempted to be explained by calling $H_2C$ a "residue," derived from the *typical* saturated compound $H_4C$, or marsh-gas, by the abstraction of two atoms of hydrogen, and that this residue is therefore unsaturated, having two affinities or units of equivalence unsatisfied. It is therefore regarded as a dyad or diatomic group of atoms, and is compared and virtually classed with the electro-negative dyads, oxygen, sulphur, selenium, and tellurium, the *amphigen* group of Berzelius, which stand alone by themselves in being able to combine in varying proportions with almost if not all the other elements, without regard to atomicity. Oxygen and sulphur are themselves derivable just in the same way from the saturated compounds *water* and *sulphuretted hydrogen*, by the abstraction of two atoms of hydrogen in each case. It is represented—and easily justified by the graphic system of notation—that dyadic atoms or groups, by virtue of their two "bonds of affinity," may be introduced *ad libitum* into saturated groups without disturbing the balance of atomicity. *In fact*, however, it is only dyadic *negatives*, like oxygen and sulphur and the like, that can in reality be thus introduced; and hence, as aforesaid, the group $H_2C$ thus assimilates itself, even according to the type theories, through the analogies of its derivation, and by its relations, with oxygen and sulphur. The present writer has proposed to give this group a name, *Homologen*, and to regard it as having, like *ammonium* and *cyanogen*, a real individual existence, as being a true *compound radical*, and not a mere imaginary "residue," merely representing so much atomicity. In following out this view, the molecular volumic relations of $H_2C$, or homologen, have been investigated by the writer. (See *American Chemist* for March, 1876.) These volumic relations have been found to demonstrate in every way the reality of homologen as a real compound radical, like ammonium.

Homologous series are found, however, to have a quite different basis and mode of derivation from that which is apparently deduced, as above, from the prevailing views; homologen turning out to be, in its analogies and relations, an *electro-positive* radical or group, and to diverge probably as far as possible from oxygen in its combining relations. Certain universal *geometric* principles have been discovered which govern the volumes of chemical equivalents of all the elements and radicals when entering into *liquid* and *solid* combinations; and it is found that electro-positive elements and radicals have the general property of varying in molecular volume within compound molecules that they help to make up, this variation being according to a certain simple geometric law, the volumes varying *in the ratio of even cubes of whole numbers.* In this manner series of *isomeres* are constituted. When to an existing

group a molecule is added, either of an element or a radical which is already present, the new molecule, if negative, always assumes the same volume as that already present; but if positive, is liable to vary to the next even cube above or below that already present. It is this latter mode of derivation that rules in the formation of homologous series, each new molecule of homologen added being either in the same cubical volume or the next cube below the previous one. Hence it is that homologen assimilates itself, *in fact*, with the electro-positive elements and radicals, and not with oxygen.

We have here two modes of derivation *in series*—series of homologues and series of isomeres (the latter pertaining not merely to organic, but to mineral chemistry also)—both now seen to be dependent upon the addition of molecules having certain geometrical relations to *space*, and not merely to weight or centripetal force, the only relation heretofore ascertained. It is also found that in the case of *elementary* bodies similar laws govern, and that the known elemental forms are generally congeries of molecules, one or more of which may vary according to the same geometric law; and thus is formed another kind of series, series of *elemental allotropes*. As several other compound radicals exist besides homologen which have been also newly recognized as forming extensive and varied kinds of series, it has become possible—indeed inevitable—that all known chemical compounds, as regards their *modes of derivation*, the determination of which is the chief end of the science of chemistry, shall fall naturally into *series*, which follow certain simple geometric volumic laws, instead of being derived from the supposed few simple *types*, which, when followed up, evolve complexity instead of simplicity. Hence, there has dawned the reasonable expectation of a *serial system* of chemistry. (Under VOLUMES, MOLECULAR, these new principles will be made clearer.) HENRY WURTZ.

**Serinagur′,** or **Srinagar,** capital of Cashmere, situated in a broad, marvellously beautiful valley at an elevation of 5276 feet, and with a mean temperature of 56.8° F. It is built on both sides of the navigable river Jhylum, from which numerous canals, spanned with light wooden bridges, branch off, the lively traffic by boat reminding one of Venice. The most remarkable building is the palace of the maharaja, a Rajput by descent, but a Hindoo by religion; it is called the Shergarh ("citadel"), and a large, beautiful flight of stairs leads from it down to the river. Close by the city is Lake Dal, which boasts of the far-famed isle Chinars (*Platinus orientalis*). Vegetables are raised here on floating rafts called gardens. About 21 miles N. W. of the city is Wular Lake, which covers 103 sq. m. In 1875 the maharaja was presented by Queen Victoria with a small steamboat, which plies between the two lakes. Europeans, provided with Indo-English passports, are allowed to take up their residence here, and 399 persons, among whom were 63 ladies, spent the summer here in 1873. The village of Sonamarg has become very popular among the English, who have here a club and boarding schools. A police force, organized after the Indo-European fashion, is stationed here. E. SCHLAGINTWEIT.

**Seringapatam′,** city of Southern India and formerly capital of Mysore, on an island in the Cavery, in lat. 12° 25′ N., lon. 76° 48′ E. Under Hyder Ali and Tippoo Sahib its fortifications were strengthened, and although unhealthy it had 300,000 inhabitants. In 1799 it was conquered by the English, and now it has barely 13,000 inhabitants.

**Serino,** Italy. See APPENDIX.

**Sermide,** Italy. See APPENDIX.

**Sermon.** See HOMILETICS and HOMILY, by W. ADAMS.

**Sermone′ta** (MICHELANGELO CAETANI), DUKE OF, belongs to one of the most ancient and illustrious of the patrician families of Rome, that of Pope Boniface VIII. He was b. in 1804, and received an accomplished literary and artistic education; made a profound study of Dante, and his three essays on the eighth and ninth cantos of the *Inferno*, on the Matilda of the *Purgatorio*, and on the image of the eagle in the *Paradiso*, have excited great admiration. His illustrations of the *Divina Commedia* are original in conception and of great excellence in the drawing: *La Materia della Divina Commedia di Dante Allighieri dichiarata in Sei Tavole* (Rome, 1855–72). The marble *Cupid Bound* of the duke of Sermoneta has been many times reproduced, and Castellani, the great Roman jeweller, is indebted to this distinguished man for many a beautiful design. In 1865 the duke had the great misfortune to lose his sight. In 1870 he was chosen president of the Roman commission appointed to convey to the king of Italy the result of the *plébiscite* of the Romans, and on that occasion he was honored with the order of the Annunziata. The daughter of the duke of Sermoneta, the Countess Ersilia Lovatelli, is a learned archæologist, as well as a Latin, Greek, and Sanskrit scholar.

**Se′rous Flu′ids.** The term *serum* designates the homogeneous fluid of the blood deprived of the blood-cells and coagulable fibrine. All the translucent, homogeneous fluids of the body, resembling blood-serum, are called serous fluids. In health the inner walls of the large cavities of the body—the arachnoid which envelops the brain and spinal cord, the pleural cavities, the pericardium and peritoneum, as well as many lesser serous tracts—are bathed with a variable quantity of serous fluid. The presence of an excess of serous fluid in these cavities constitutes disease: such excess is due in some instances to hypersecretion of the surface or the unloading of its nutrient blood-vessels when actively congested or inflamed; in other cases it is a passive, dropsical transudation of the serum of impoverished blood. Thus, serous fluids at the base and within the ventricles of the brain are effused in subacute meningitis; larger quantities in the same locations or within the arachnoid are the result of transudation, constituting the hydrocephalus or "dropsy of the brain" in strumous, ill-nourished children. The pleural cavity may be filled with many pints of serous fluid, either of inflammatory origin, as in pleurisy, or a transudation, "hydrothorax." Pericarditis, with effusion, and hydropericardium, or "dropsy of the heart," are similarly produced. Abdominal dropsy, known technically as "hydroperitoneum" and "ascites," is a collection of serous fluid in the peritoneal cavity consequent upon obstructed portal circulation, and chiefly secondary to disease of the liver. Serous fluid may accumulate in large quantity in cystic tumors, as in ovarian dropsy. Serous fluid may escape from the blood-vessels when the blood is impoverished or perverted, as in Bright's disease, and infiltrate the meshes of the subcutaneous connective tissue, producing a swollen, puffed appearance of the surface, which pits when pressed—a condition styled "œdema." Fluid of serous consistency is often discharged from the mucous lining of the nose, throat, and air-passages, either in recent or chronic inflammation; serous diarrhœa frequently occurs in gastro-enteric disorders; in Asiatic cholera, the copious evacuations of serous fluid ("rice-water" stools) completely drain the blood, leaving it of a pasty, tarry consistency. Serous fluid in all such cases originates from overloaded, congested capillaries. Serous fluid is often discharged from granulating wounds when the healing process is feeble. Bloody serum escaping from the ear is a guide to diagnosis of fracture at the base of the skull.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Serous Membrane,** in the human body the membranous walls of the arachnoid, pleural, pericardial, and peritoneal cavities, and the investing membrane of the testis. Serous membranes in all instances, save the peritoneum in women, are closed sacs, with their opposed walls collapsed in contact, but lubricated by secreted serous fluid, so as to permit of free motion. The serous membrane is therefore a contrivance of nature to ensure the freedom of the large organs of the body in the limited movements incident to their functional activity. The brain is congested by mental action; is anæmic during sleep; it pulsates synchronous with the heart; the arachnoid surfaces permit these movements. The lungs of adults expand and collapse, in health, between eighteen and twenty times per minute, more often in the child, and with greater frequency in certain pulmonary and febrile diseases. The heart of the adult undergoes marked movements between seventy and eighty times per minute; such constant movements of the lungs and heart are rendered easy, with a minimum of friction, by the smoothness of the gliding surfaces of the pleural and pericardial sacs by which they are surrounded. The variable conditions of the intestines as to distension by food, flatulence, or fæces, and the intestinal peristaltic action by which the contents of the bowels are moved onward, are guarantied by the reduplicated structure of the closed peritoneal sac. The serous membrane is composed of a delicate layer of "tessellated" (tile-like) epithelial cells upon a thin basement membrane of dense, impacted, inelastic fibrous tissue. It is often closely adherent to adjacent structures. In the sub-serous tissues, or elastic connective tissue which unites the membrane to contiguous parts, capillary vessels freely ramify, but nerves and lymphatics have not been demonstrated. The diseases of serous membranes are chiefly inflammatory, and often involve the underlying invested organs. Hence, they are usually very grave. Acute meningitis, acute pleuritis when involving the lung also—pleuro-pneumonia—pericarditis, and peritonitis, all are attended with danger, and often are fatal.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Ser′pent,** a musical wind instrument of brass invented by Edme Guillaume of Auxerre in 1590, has a curvilinear form, is composed of a mouthpiece, a neck, and a tail, and has six holes stopped with the fingers, with a compass from B flat below the bass staff to G, the treble clef line.

**Ser′pentine,** a metamorphic rock, essentially a hydrous silicate of magnesia, which takes its name from its mottled colors, chiefly yellow and green, thought to resemble those of the skins of certain serpents. It is so soft as to be readily cut or sawed, is also susceptible of a fine polish, and is frequently manufactured into vases and other ornamental articles. Serpentine rocks occur in a great number of places through New England and down the Alleghany belt; very beautiful varieties are found at Deer Island, Me.; Newburyport, Mass.; Montville, N. J.; Chester co., Pa., etc. Serpentine also is an important constituent of the Coast Mountains, Cal. "Verde antique marble" is composed largely of serpentine (green), mingled with carbonate of lime (white); this is a highly-prized ornamental stone, well adapted to internal decoration, but losing its polish and rapidly decomposing on exposure. One variety of serpentine (chrysotile) is made up of flexible fibres of more than silky fineness and lustre; this is sometimes called amianthus, though that name was originally applied to the finer varieties of asbestos. J. S. Newberry.

**Serpents.** See Appendix.

**Serpents, Poison of.** See Poison of Serpents.

**Serpent-Worshippers.** See Ophites.

**Serpookhov′,** town of Russia, government of Moscow, on the Nara, has a fine cathedral of the fourteenth century, and manufactures of linen fabrics of different descriptions, mostly coarse. It is one of the oldest towns of Russia. P. 12,196.

**Ser′pula,** a genus of annelides, worms with red blood, and inhabiting a tubular shell, which much resembles that of some mollusks. They belong to the family Serpulidæ. There are two beautiful ctenoid gills, which may be protruded from the tube; and, though eyes are wanting, the animal appears to have a sense highly analogous to sight. Each tube is fitted with an exactly-fitting stopper, often of very beautiful color.

**Serracapriola,** town of Southern Italy, province of Foggia, on a rugged height commanding magnificent views of the adjacent country, has suffered often and severely from earthquakes. P. 5300.

**Serradifalco,** town of Sicily, province of Caltanisetta, at the foot of Monte Calvario, N. E. of Girgenti, was long a fief of the family of the same name, and the late duke of Serradifalco has during the present century illustrated the antiquities of Sicily with great taste and learning. P. 6948.

**Serrano y Dominguez** (Francisco), Duke de la Torre, b. at San Fernando, near Cadiz, Spain, Nov. 10, 1810, son of Gen. Serrano y Cuenca, distinguished in the Spanish war of independence; entered the army as a cadet 1825; rose rapidly in military rank during the Carlist wars, attaining through the favor of Queen Christina the grade of general of division before he was thirty years of age; sat in the Cortes as deputy for Malaga and vice-president of the chamber 1843; became minister of war in the "nine days' administration" of Lopez May 11; joined Narvaez in effecting the overthrow of the regent Espartero July 24; was again minister of war for ten days (Nov. 19–29) under Olozaga, but withdrew and successfully intrigued with Narvaez against the government; became lieutenant-general and senator 1845; obtained such influence over the young queen after her marriage (1846) as to give rise to much scandal; was appointed captain-general of Granada 1847; took part in several short-lived ministries and in equally numerous revolutions, figuring ultimately as a "liberal" at the head of the senatorial opposition; was exiled Feb., 1854, for participation in an insurrection at Saragossa; returned to power in July of the same year as an ally of Espartero and O'Donnell; became captain-general of New Castile; espoused the cause of the latter at the rupture of the "Liberal Union," which culminated in the *coup d'état* of July, 1856; went as ambassador to Paris 1857; received the appointment of marshal; was captain-general of Cuba 1860–62, signalizing his administration by the reannexation of Santo Domingo to Spain, which procured his elevation to a dukedom as a grandee of the first class; became captain-general of Madrid June, 1865; was president of the senate 1866, in which year he suffered a brief imprisonment at Alicante for having signed a protest against the illegal prorogation of the Cortes; was exiled to the Canary Islands July, 1868, when he took part with Prim and Topete in effecting the revolution which drove Isabella from the throne, landing with those generals at Cadiz Sept. 19, 1868; became thereupon the ostensible head of the government as president of the council of ministers and commander-in-chief of the army; was elected regent June 16, 1869; negotiated the acceptance of the Spanish crown by Prince Amadeus of Italy, by whom he was made premier Jan., 1871; resigned that post in July of the same year; took the field as commander-in-chief against the Carlists Apr., 1872; concluded with them the convention of Amorevieta in May; returned to office as premier for a few months; fled to France soon after the proclamation of the republic (Apr., 1873), but shortly returned; was made "chief of the executive" after the *coup d'état* of Gen. Pavia Jan., 1874; again took the field against the Carlists with varying success, and privately arranged with Martinez Campos the details of the restoration of the monarchy in the person of Alfonso XII. Jan., 1875. Porter C. Bliss.

**Serra San Bruno,** town of Southern Italy, province of Catanzaro, about 20 miles S. E. of Monteleone, was almost totally destroyed by an earthquake in 1783. P. in 1874, 5050.

**Serrastretta,** town of Southern Italy, province of Catanzaro, on the right bank of the Corace, about 9 miles S. of Nicastro. P. 5380.

**Serravalle Pistojese,** town of Italy, province of Florence, on a hill E. of Lucca and about 4 miles from Pistoja. The old castle and two towers are still standing, and recall the fierce conflicts for the possession of this town between the rival republics of Florence, Lucca, and Pistoja. P. 5574.—Serravalle is the name given, from their geographical position, to several other smaller Italian towns.

**Serravezza,** town of Italy, province of Lucca, about 22 miles W. of the city of Lucca, at the confluence of the two branches of the Serravezza or Versilia. The fine marble of the neighboring mountains, especially that from Monte Altissimo, is here sawed and sent in various directions to market. Though good white marble was quarried from these mountains as early as the time of Michelangelo, yet the superior quality now in such great demand was only discovered at the beginning of the seventeenth century. The town contains an active and industrious pop. of 8900.

**Serto′rius** (Quintus), b. about 121 B. C. at Nursia in the country of the Sabines; distinguished himself highly in the battle of Aquæ Sextiæ (102 B. C.) under Marius, whose fortunes he afterward followed. He fought with Cinna at the Colline gate in 87 B. C. against Pompeius Strabo, but he did not participate in the bloody massacre which Marius instituted after the capture of Rome; on the contrary, he surrounded and put to death a gang of about 4000 slaves whom Marius had let loose on the city, and who had perpetrated the most horrible cruelties. In 82 B. C. he was sent to Spain as proprætor, but in the same year Sulla returned to Rome from Asia, and the power of the democratic party came to a sudden end. Sertorius was outlawed. Nevertheless, although he had only a small army, he took up the contest against the oligarchs in Spain, and carried it on for several years with steadily-increasing success. He gained the favor of the natives, especially the Lusitanians, who became his faithful allies. Fugitives from Rome gathered in his camp; in 77 B. C. Perperna joined him with fifty-three cohorts. In 74 B. C. he formed an alliance with Mithridates. Metellus Pius, whom Sulla first sent against him, was repeatedly defeated, and even Pompey, who came to Spain in 76 B. C., achieved nothing, and was driven back across the Ebro. But intrigues and jealousies arose in Sertorius's camp, and in 72 B. C. he was invited to a banquet by Perperna and treacherously assassinated at the festival. His biography by Plutarch is very interesting, though more full in its description of his personal character than in its narrative of his exploits.

**Sertularia′dea** [pl.], a sub-order of hydroid acalephs which are attached by a peduncle and protected by a horny case, which forms a cup about the head. It includes the sertularians proper and the campanularians. The genus *Sertularia* is a typical one. There are a great many species, some of them extremely beautiful.

**Se′rum** [Lat.], a word applied in two different senses having little real resemblance or analogy, as *serum of milk* and *serum of blood*. Serum of milk is Whey (which see), containing no albuminous matter; whereas serum of blood, the fluid part left after the separation of the *coagulum* from Blood (which see), is a strong solution of albumen in a liquid containing certain salts, neutral and alkaline. The total amount of saline matter in the serum of a healthy man is somewhat over 10 per cent., and there are present carbonates and phosphates of soda, potash, lime, and magnesia, with considerable chloride of sodium, some chloride of potassium, and sulphates of soda and potash. The amount of albumen is in the neighborhood of 7 per cent. Both the saline matter and the albuminous matter prevent the solution of the blood-globules, which are very soluble in water itself, and are attacked at once on addition even of a very little water to blood. In disease, changes of composition of the serum occur, and rapid methods of analysis of blood, applicable to small quantities, appear likely to be hereafter, when perfected, of great value in pathology.

H. Wurtz.

**Ser'val,** an animal of the Felidæ or cat family, having a slender body, small head, long legs, long and shaggy hair, body spotted with dark brown, the general color being ochrey-yellow, and the lower parts white. It is mild and docile, and is about three feet long exclusive of the tail, which is tipped and ringed with black. It is found in the southern part of Africa.

**Servant.** See MASTER AND SERVANT, by PRES. A. L. CHAPIN, S. T. D.

**Serve'do** (MIGUEL), usually known by the Latinized form of his name, SERVETUS, b. at Villanueva, near Saragossa, Spain, in 1509, son of a notary, who sent him at the age of nineteen to study law at the University of Toulouse, France; gave his attention principally to theology, in which he became very proficient; visited Italy, and was present at the coronation of Charles V. at Bologna 1530; travelled in Germany and Switzerland; became acquainted with many of the Reformers, and partially adopted their doctrines; resided some months at Bâle, where he discussed theology with the celebrated Johann Hussgen (Œcolampadius), and broached for the first time his conclusions adverse to the doctrine of the Trinity; proceeded to Strasbourg 1531; acquainted himself with the teachings of the Protestant divines Kuhhorn (Bucer) and Capito; went thence to Hagenau, Alsace, where he published his *De Trinitatis Erroribus* (1531) and *Dialogorum de Trinitate Libri duo: de Justitia Regni Christi Capitula quatuor* (1532), works which embroiled him with both Roman Catholics and Protestants; took up his residence at Lyons under the name of "Michel de Villeneuve" about 1533; studied medicine, and supported himself by working as a corrector of the press; was at the University of Orleans 1534; settled at Paris 1535; studied medicine under Sylvius and Fernel; took the degree of M. D. with high honors 1536; became an eloquent and popular lecturer at the university on medical science and mathematics; published a treatise, *Syruporum Universa Ratio* (1537), attacking opinions of Galen and of the Paris faculty of medicine; had about this time several conferences on theology with Calvin, whom he challenged to a public discussion on the Trinity, which was agreed to, but, distrusting the consequences, left Paris secretly before the appointed day; proceeded to Charlieu, near Lyons, 1538; lived some time at Avignon; published at Lyons editions of Ptolemy's *Geographia* (1541) and of the Bible (1542) with Latin notes, which were condemned as heretical by the Roman Catholic Church; took up his residence in 1543 at Vienne, Dauphiné, living in the palace of the archbishop, Pierre Palmier, a former pupil; carried on with Calvin, then at Geneva, an active theological correspondence, which resulted in a bitter quarrel; published anonymously his chief work, *Christianismi Restitutio* (Vienne, 1553), the authorship of which was discovered by Calvin and made known by him to the Roman Catholic archbishop of Lyons, Cardinal Tournon. Arrested and imprisoned by the Inquisition at Vienne at the instance of that prelate, Servedo would probably have been acquitted for lack of evidence had not Calvin supplied portions of his correspondence as proofs against him. Not being vigilantly guarded, Servedo escaped from prison in disguise Apr. 7, crossed the frontier into Piedmont, and remained in concealment several months. Meanwhile, his trial went on; he was condemned for heresy, and burnt in effigy at Vienne June 17, 1553. He now resolved to go to Naples, but by a strange fatality went first in disguise to Geneva, when, his presence having become known to Calvin, he was arrested, brought to trial (Aug. 14) before the municipal court on charges of heresy, sedition, insult to the Fathers of the Church, and calumny against Calvin and other Protestant divines; was forced to discuss doctrinal points with Calvin, who appeared as prosecutor and drew up the final articles of accusation, thirty-eight in number; was condemned to the stake, and, notwithstanding the desire of Calvin for a milder form of death, was burned alive on a hill near Geneva Oct. 27, 1553. *Lives* of Servedo have been published by Mosheim (1750), Trechsel (1839), W. H. Drummond (London, 1848), and Brunnemann (1865).

PORTER C. BLISS.

**Servetus.** See SERVEDO.

**Ser'via** [Slavonian, *Serbia;* Turk. *Syrp*], principality of Europe, tributary to Turkey, bounded N. by the Austrian empire, from which it is separated by the Save and Danube; E. by Wallachia and Bulgaria; S. by Macedonia, from which it is separated by the Balkan Mountains; and W. by Albania and Bosnia. Area, 16,817 sq. m. Pop. 1,338,505, of which 140,000 are Wallachs, 25,000 gypsies, and 15,000 Turks. The surface is very mountainous, being covered W. by the Dinaric Alps and S. by the Balkan Mountains, which latter meet the Carpathian Mountains on the eastern frontier at Orsava, separated from them by a narrow cleft, called the Iron Gate, through which the Danube rushes along. The average height of these mountains is only from 2000 to 3000 feet, and toward the N. they open into broad valleys sloping toward the Danube and the low, level plains which extend along its shores. The climate, though rigorous in the highlands, is generally mild and healthy. Extensive forests of oak and walnut trees cover the mountains—that is, more than one-half the surface—but the excellent timber which these forests contain is as yet unavailable on account of the total lack of means of transportation. Immense herds of swine are fed in the forests, and millions of hogs are annually exported. In the valleys and in the plains of the Danube rice, maize, and wheat, flax, hemp, and tobacco, wine and fine fruits, grow abundantly, but agriculture is as yet in a backward state. Iron, copper, lead, and coal are found, but no mines are worked; all manufactures are confined to articles for home use. Cap. Belgrade.

In the early Middle Ages, Servia formed an independent kingdom, powerful and flourishing. But in 1385 it was conquered and subjugated by the Turks, and they soon brought it into a miserable state. The first rising of the Servians against their oppressors, in 1806, under Czerny, was successful, but not lasting, and the Turks took bloody revenge when they again came into possession of the country. The second rising, in 1814, under Milosch, proved lasting, and the country is now rapidly progressing as an hereditary monarchy under the Obrenovitch dynasty, paying an annual tribute of 2,300,000 piasters to Turkey, but with a free constitution and an independent government. The strong sympathy which the Servians show for the Russians, their co-religionists, the inveterate antipathy they feel against the Turks, and the constant intermeddling in all Turkish affairs from the Russian side, led finally, in 1876, to a new and bloody war, still pending. The Servians are a Slavonic tribe, and belong to the Greek Church. They are a strong, well-built, and handsome people, enthusiastic but industrious, energetic but benevolent, and deeply devoted to their fatherland, their freedom, and their Church. In the present war, however, they have won no laurels as soldiers. There is no nobility and no proletariat. Each family, the father, the sons with their wives, the children, etc., remains together, forming a community of which the oldest member is the chief. The estate is the property of the family, and cannot be sold. The range of personal property is very limited.

The Servian language, which is spoken by about 7,000,000 people, living partly under Austrian, Russian, and Turkish rule, partly independent, is the richest, softest, and most melodious of all Slavonian languages, and has received considerable literary development, both in Servia proper and in Dalmatia. It contains a great treasure in its ballads, which in translations have traversed Europe, and charmed all with the nobleness of their feelings and the beauty of their imagery, at times simple and distinct, with an almost Greek plasticity, at times dazzling and alluring, with an almost Oriental mysticism. (See W. Denton, *Servia and the Servians* (London, 1862); Elodie Lawton Mijatovics, *History of Modern Servia* (London, 1874); Talvi, *Historical View of the Languages and Literature of the Slavic Nations* (New York, 1850); St. René Taillandier, *La Serbie au XIXe. Siècle, Karah George et Milosch* (Paris, 1875).)

**Service-Berry.** See JUNE-BERRY.

**Serv'ice Tree,** the *Pyrus domestica,* a tree of Europe, Asia, and Africa, of the order Rosaceæ, much resembling the MEDLAR and SORB (which see). Its fruit, when overripened and bletted, is soft and pleasant to eat. It is considerably cultivated. The wood is very hard and valuable, and is used as a substitute for box. In parts of North America the shad tree is called the service, and in others the mountain-ash.

**Servites,** a community of Augustinian friars, called Servants of the Virgin Mary, founded at Florence in 1233. One Monaldi was their first general and one of their founders. They were confirmed in 1255 by the pope, and in 1493 a part received a reformed rule. There is also a congregation of Servite Tertiaries, and there are a few houses of Servite nuns. The Servites are mostly found in Europe.

**Serv'itude** [Lat. *servitus*], the generic name given by the civil law to the class of rights which may be held in the lands or other things of another person, and virtually synonymous with the "easement" of the American and English law. A prædial servitude is a burden imposed upon one piece of land, called the servient estate, in favor of and attached to another tract, called the dominant estate. The right accompanies the latter and the burden follows the former in their transfers from one owner to another, until terminated in some legal manner. Among the most common species are the servitudes of way, of aqueduct, of light, of prospect, of support for walls or beams, of drip from

eaves, and of pasture. Prædial servitudes are divided into rural and urban, depending upon the situation of the lands in the country or in a town. A personal servitude differs from the prædial in not being appurtenant to any dominant estate, but in being attached to and held by a person who exercises the right unconnected with the ownership of any particular land. By some modern text-writers the name is used interchangeably with "easement." (See EASEMENT.) JOHN NORTON POMEROY.

**Ser'vius Tul'lius,** the sixth king of Rome (578–534 B. C.). His history is full of fables and wonderful traditions—his birth by a female slave of the queen's and the god Vulcan; his education in the royal household under the special care of the queen Tanaquil; his marriage with the king's daughter, and his accession to the throne by the stratagem of his mother-in-law; his death in Vicus Sceleratus, thrown down by Tarquin himself from the stone steps of the senate-house, then overtaken and stabbed by Tarquin's servants on his way home, and finally driven over by the chariot of his unnatural daughter, Tullia, the wife of Tarquin. But amidst the many mythical elements which cling to his name there are several facts, well established at least in their general outlines, which show that his reign must have been one of the most important periods in the history of Rome. He gave a new constitution, by which the plebeians became an independent part of the nation equally with the patricians, and part of that political influence which hitherto had been attributed to birth alone was transferred to property. He completed the city by incorporating with it the Quirinal, Viminal, and Esquiline hills, and surrounding the whole with a wall five miles in circumference, which remained the legal boundary of the city up to the time of the emperors. Finally, he formed an alliance with the Latins, by which Rome and the cities of Latium became the members of one great league, which was consecrated by the erection of a temple of Diana on the Aventine, where the Romans and the Latins worshipped in common.

**Ses'ame** [Gr. *σησάμη*; Arab. *simsim*], the **Benne-Plant** of our Southern States (*Sesamum Indicum*), belonging to the order Pedalineæ, sometimes annexed to the Bignoniaceæ. There are several varieties, which have been regarded as species. They are annual Oriental plants, now naturalized in most warm climates. Sesame was probably brought to the U. S. by slaves from Africa. Its rich oily seeds are prized by the negroes, who also make a thick gelatinous drink of the leaves, which is very bland and useful in diarrhœas. The seeds can be made to yield half their weight in oil, which is in some respects better than olive oil. It is locally known as tilseed and oilseed. The oil is called oil of Benne and Gingilie oil. Sesame fully deserves attention as a regular crop in this country. It does well about Philadelphia.

**Sesame-Grass,** the *Tripsacum dactyloides*, a large grass of the Atlantic U. S., from New Jersey southward, with broad leaves and a solid stem, like that of Indian corn or sugar-cane, which it somewhat resembles. It is very coarse, and in the North is not valued, but in parts of the South and in the West Indies and Mexico is used as fodder.

**Ses'amoid Bones** [so called from their supposed resemblance to a sesame-seed], bones developed in the tendons of muscles, and found both in man and the lower animals. The most familiar example is the patella or knee-pan. They do not belong to the vertebral appendages proper, but to the sclero-skeleton.

**Se'sia,** an interesting genus of hawk-moth (Sphingidæ) of a mimetic type, resembling the bees in form. The U. S. have several species, called clear-wings or bee-moths.

**Sesos'tris,** the name of a king of Egypt, according to Manetho the third monarch of the twelfth dynasty. According to popular tradition, all the boys born on the same day as Sesostris were brought up with him, and he grew to the great size of four cubits three palms and two digits, or more than seven and a half feet high. The youths educated with him became afterward his most devoted friends and ministers. On his accession to the throne he divided Egypt into thirty-six nomes, and then departed with a vast army for the conquest of the world, and is said in nine years to have conquered the whole of Asia and Europe as far as Thrace. In the S., Libya, Æthiopia, and Arabia were subdued by his arms. To record his exploits he placed *stelæ* or tablets to mark his power, and on those of the warlike nations were engraved emblems of the male, and on those of effeminate countries of the female sex. Some of these tablets, according to Strabo, existed at the Bab-el-Mandeb, recording his victories over the Ethiopians and Troglodytes. He did not, however, advance so far S. as the so-called Cinnamon Land. After his wars he devoted his attention to the protection and improvement of Egypt, which he intersected with canals to prevent the incursions of cavalry, partitioned the country into fields, and imposed a land-tax on all except those belonging to the temples. He also raised the great wall on the E. of Egypt, along the edge of the desert by Heliopolis, 1500 stadia, or 187 Roman miles. It was built of sun-dried bricks. Sesostris is also said to have had a fleet of 400 sail in the Mediterranean and the Arabian Gulf. The temples of Egypt, 100 in number, he is said to have built, and to have erected obelisks about 180 feet high, and made a boat 280 cubits long to the god of Thebes. His public works were said to have been executed by prisoners of war reduced to slavery for the purpose. His triumphs were signalized by making the captive monarchs drag his car, but his life was embittered by the treason of his brothers, who endeavored to burn him in a house, from the blazing chambers of which he only escaped by the sacrifice of two of his children thrown on the burning embers, and by walking over their bodies. In his old age he became blind, and finally, in disgust of life, put an end to his existence, and was honored by the priests as second only to Osiris. The name of Sesostris is that of no Egyptian monarch hitherto discovered on the monuments, and the exploits attributed to him do not agree with those of any monarch of the twelfth dynasty, the power of which did not extend beyond the peninsula of Sinai. It is, however, evident that the scenes represented on the temples and the exploits of Rameses II. and other monarchs of the eighteenth and nineteenth dynasties had become interwoven into the legendary history of Sesostris, and that the monarch most like him was Rameses II. In some papyri the name of Rameses has been found shortly written as *Sesu*, the root of the name Sesosis or Sesoosis, sometimes given by the Greeks as the equivalent of Sesostris. Rameses II. also boasts on the monuments that he had constructed public works by means of his prisoners of war, and captive chiefs are seen ignominiously tied under his chariot, which files of prisoners appear to drag along. The name of Rameses II. is also found on the great wall of the eastern frontier attributed to Sesostris, and tablets recording his campaigns in Northern Syria are found in the passes of the Nahr-el-Kelb, as mentioned by Herodotus. Even the lion which is said to have accompanied Sesostris in his campaigns is found on the monuments following Rameses II. Although the exploits of this monarch, elevated to the rank of a hero by the Egyptian scribes, did not extend beyond the Orontes, the more extended campaigns of Thothmes III. gave rise to the reported conquest of the whole of Asia, while the monuments found at Nymphi, near Smyrna, and elsewhere, had been attributed by popular report to Sesostris, although they were not of Egyptian origin. The legendary height of the monarch is also said to correspond with the proportions of some of the figures of these slabs, and to have given rise to the traditionary but by no means impossible stature of the Egyptian hero. The conquest of Libya may have been derived from the defeat of the Libyans in the reigns of Meneptah and Rameses III. by these monarchs, and the incorporation of the vanquished people in the Egyptian territory. S. BIRCH.

**Ses'sa Aurun'ca** [anc. *Suessa*], town of Southern Italy, province of Caserta, on the crater of an extinct volcano about 6 miles from the Tyrrhene Sea. Suessa was a conspicuous city of the Auronians or Auruncians as early as 418 B. C., and, judging from the position of important architectural remains of a very remote period, antiquarians and geologists are of opinion that the town was, in part at least, buried by a volcanic eruption. Medals, bronzes, and inscriptions of interest have also been found here. Tradition says that St. Peter laid the foundation of the Christian church here, but there is no certain account of a bishop of Suessa before the beginning of the fifth century. The present town is poorly built, but is furnished with cafés and tolerable inns. The weekly market is very animated. P. 20,708.

**Sester'tius** [Lat. for *semis tertius*, "two and one-half;" it was once worth two and a half *asses;* see As], in ancient Rome, a silver or bronze coin worth one fourth part of a denarius. Originally, it was worth two and a half asses, but in later times four asses made one sestertius, and the coin, originally of silver, was struck in fine bronze. The SESTERTIUM was a money of account equal to 1000 sestertii, but it was never coined. The value of the sestertius, roughly stated, was from one and a half to five cents of our money, for the value declined greatly after the downfall of the republic.

**Ses'to Fiorenti'no,** town of Italy, province of Florence, about 5 miles from the city of Florence. This town is formed of several fractions or parishes, the most con-

siderable containing about 6000 inhabitants. In the parish of Colonnata is the famous manufactory of porcelain known as the Doccia or *Manifattura Ginori*. This establishment was founded by the marquis Carlo Ginori in 1735, and is therefore coeval with the celebrated manufactory of Sèvres. The ceramics produced here are very beautiful. P. of commune, 13,437.

**Ses'to San Giovan'ni,** or **Sesto di Monza,** town of Italy, province of Milan, about halfway between the city of Milan and the town of Monza. It is a favorite site for villas, and the land here sells at very high prices. P. 5050.—Sesto (Lat. *Sexto ab urbe lapide*) is a name common to many other small towns in Italy.

**Ses'tri Levan'te** [anc. *Segesta Tiguliorum*], town of Italy, province of Genoa, on a tongue of land about five miles from Chiavari. The views from this point are almost unrivalled in beauty even on this coast, so famed for its scenery, and the climate is no less charming. The harbor is well protected, and receives about 500 coasting-vessels annually, besides the many employed in fisheries. P. of entire commune, 8800.

**Ses'tri Ponen'te,** town of Italy, province of Genoa, beautifully situated on the seashore about 5 miles W. of Genoa. It enjoys a delicious climate, and is a favorite summer resort of the Genoese aristocracy, many of whom have superb villas here. The inhabitants of Sestri Ponente are extensively engaged in shipbuilding, and are otherwise very industrious. P. of commune, 9600.

**Sestus,** or **Sestos.** See Abydus.

**Set,** or **Typhon.** See Typhon, by S. Birch, LL.D.

**Se'te Lago'as** ["seven lakes," so-called from their number], a collection of lakes in Brazil, situated on the N. top of the Serra da Melgueira, province of Matto Grosso, and the sources of the Paraguay (which see).

**Set-Off,** in law, is a cross-demand existing in favor of a defendant which in certain actions and under certain conditions may be interposed as a defence, and either partly or wholly defeat a recovery by the plaintiff, or even result in a recovery against him. This species of defence was unknown to the common law, and was first authorized by the English statutes 2 Geo. II. ch. 22, § 13, and 8 Geo. II. ch. 24, § 4, which have been substantially re-enacted in the several States of this country. The original statute only permitted a set-off in the case of mutual "debts." The use of this technical word restricts the set-off to actions brought for the recovery of a fixed, certain sum of money due upon a contract, and the demand in favor of the defendant must be of the same nature. There can be no set-off of unliquidated damages resulting from the breach of contracts, but only of those claims the amount of which has been ascertained and settled by the promise itself, whether that promise be express or implied. The debts must also be mutual, and due to the parties in the same right. Under the American statutes a set-off may be interposed in two different cases: (1) Where the cross-demands accrued in favor of the actual parties, the plaintiff and the defendant; and in such an action, if the defendant's claim is the greater of the two, he will not only defeat the plaintiff s recovery, but will recover a judgment for the excess. (2) Where the cross-demands originally accrued in favor of persons who are not both the parties to the action, as, for example, where the plaintiff is an assignee of the demand in suit, and the defendant's claim is against the assignor. Under these circumstances, the set-off can only avail as a partial or total defence; no judgment for any excess can be recovered by the defendant, since the plaintiff is not his debtor. Judgments held in the same right may also be set off, sometimes on motion, in the discretion of the court. Courts of equity, acting upon the analogies of the statute, have created an "equitable set-off" broader and more comprehensive than that administered by the courts of law. The reformed American procedure has greatly expanded and liberalized the doctrine of set-off by the "counter-claim" which it has introduced, and which has also been adopted by the new English procedure. John Norton Pomeroy.

**Se'ton** [Fr. *séton*, from the Lat. *seta*, a "bristle"], in surgery, a twist of silk or a piece of leather, india-rubber, or other material passed through a fold of skin and beneath the subcutaneous tissue for the purpose of exciting suppuration. Its action may be derivative, or it may tend to promote a salutary adhesive inflammation. The use of setons is less common than formerly, but they nevertheless often serve a very useful purpose. They are much employed in veterinary practice.

**Seton** (Elizabeth Ann **Bayley**), b. in New York City Aug. 28, 1774; married William Seton about 1794, and on his death at Pisa 1804, returned to New York; joined the Roman Catholic Church Mar. 14, 1805; conducted a school at Baltimore 1805–08, and with her sisters-in-law, Harriet and Cecilia Seton, took the veil as Sisters of Charity Jan. 1, 1809, at Emmittsburg, Md., being the first members of that order in the U. S. A conventual establishment was opened at Emmittsburg July 30, 1812, with "Mother Seton" as superior-general. The new order took charge of orphan asylums at Philadelphia 1814, and at New York 1817, in which year it was incorporated by the legislature of Maryland. At the death of the foundress, at Emmittsburg Jan. 4, 1821, there were 50 members. In 1869 there were in the U. S. 95 houses and more than 1000 Sisters of Charity.

**Seton** (Samuel Worthington), b. in New York City Jan. 23, 1789; engaged in mercantile life, and was teller of a bank when in 1827 he was chosen agent of the Public School Society, and thenceforward devoted himself to the promotion of popular education. Upon the establishment of the board of education (1853) he was appointed assistant superintendent, and retained that position through life. He was also zealous in the organization and management of Sunday schools. D. in New York Nov. 20, 1869.

**Set'ta,** town of West Africa, dominion of Dahomey, in a very fertile and well-cultivated district, has about 9000 inhabitants.

**Settembri'ni** (Luigi), b. at Naples in 1812; was appointed professor in the lyceum of Catanzaro at the age of twenty-three, but becoming compromised in political affairs, was arrested in 1839 and imprisoned at Naples. Being set at liberty in 1842, he gave private lessons in literature until 1848, publishing in the mean time his bold *Protesta de' Popoli delle Due Sicilie*. In 1848 he held an important post in the ministry of public instruction; May 16, 1849, the reaction having triumphed, was arrested and thrown into the prison of San Stefano, where he occupied himself in translating the works of Lucian into Italian. On his release he devoted himself wholly to literature, and published in 2 vols. his course of *Lezioni di Storia della Letteratura Italiana*, a work very popular in Southern Italy, notwithstanding many defects. In 1873, Settembrini was appointed senator of the kingdom of Italy.

**Set'ter,** a hunting-dog of a breed apparently intermediate between the pointer and the spaniel. This dog was formerly trained to sit or drop when marking down game, but at present it stands at its work like a pointer. There are several distinct strains, as the Irish, the Russian, and the English setters, and of late there are several new stocks which are highly prized. Notable among these are the Macdona and the Laverack setters. The colors vary, but a liver color is a favorite one.

**Setting-Machines for Type.** See Printing, by W. S. Paterson.

**Set'tlement,** in law, the right which an individual acquires to parochial assistance in that parish or district to which he legally belongs, and in which he is said to have the settlement. (See Pauperism.)

**Settlement of Property.** See Marriage, by Prof. J. N. Pomeroy, LL.D.

**Setu'bal,** town of Portugal, province of Estremadura, on the Bay of Setubal, 20 miles S. of Lisbon, has an excellent harbor, lined with broad and convenient quays and defended by five forts. It is an old town, surrounded by walls, but it is well built, airy, and clean. It is the chief seat of the Portuguese salt-trade, and has also a very extensive trade in wine. Considerable pilchard fisheries are carried on. P. about 15,000.

**Sevasto'pol,** or **Sebastopol,** near the S. W. extremity of the Crimean peninsula in the Black Sea, *was* the great naval station of Russia in that sea. The roadstead and the harbor, and the extensive establishments connected with them, formed the most important features of the place. It was a Tartar village (*Akhtiar*) until 1780, when the Russian government commenced the work of establishing here its naval arsenal. The great harbor-fortifications which existed at the period of the siege were planned in 1834, and simultaneously land defences; which latter, however, had not been constructed when (Sept., 1854) the allied armies of England and France established themselves before the place and the memorable siege commenced. Every effort was then made to increase the strength of existing intrenchments, and the process continued *pari passu* with the siege. The "bastions" (of earth) mentioned in accounts of the siege had been previously thrown up. The connecting lines had not the strength of ordinary field fortification, the scarcity of earth preventing the excavation of ditches except about the bastions and other points of support (*e. g.* the "Malakoff," originally a stone tower; the Redan, an earthwork, etc.). To compensate for want of ditches every imaginable and practicable expedient to render access difficult was resorted to.

These defences, based upon a matured plan of permanent

fortification, and having some of its features, combined therewith the characteristics of lines of fieldworks and those of the siegeworks always resorted to by a besieged garrison, but yet differed from all these and from all others previously employed, owing to peculiarities of site and circumstances, to the skill of the engineer, and to the indomitable resolution of the defenders. Though compressed into comparatively small linear space, their real magnitude was enormous, 5000 or 6000 men being at some periods daily engaged on them, and the labor being unintermitted during the eleven months of the siege. The garrison during this period (always in free communication with the external forces by which it was replenished) was usually about 30,000 men; the number of guns mounted at the final assault is said to have been 800, several times that number having been rendered unserviceable in the course of the siege, which lasted eleven months (Oct., 1854–Sept., 1855). The Russian loss in the defence was 84,000 men. (*Todleben.*) The forces *actually engaged* were, during the later months of the siege, about as follows: French, 120,000; English, 27,000; say, 147,000 men. The Sardinians (5000) and Turks are not included, as they were not directly engaged in the siege. The former, however, and a portion of the Turkish force, were indirectly "engaged," inasmuch as they helped to hold the base (Balaklava) and communications of the besiegers. The French loss was 44,500 (*Niel*); hence the total loss of allies must have been about 60,000. The total loss of besieged and besiegers must have been nearly 150,000 men.

The fortifications and naval establishments were, after the capture, destroyed by the allies, and by the Treaty of Paris, which terminated the war, Russia was debarred from maintaining a naval force in the Black Sea beyond a fixed and very limited magnitude. By the stipulations on this point of that treaty Russia in 1870 asserted her intention no longer to be bound. P. before the siege, 40,000; now about 10,000. (See TODLEBEN.) J. G. BARNARD.

**Sevastopol,** p.-v. and tp., Door co., Wis., on Green Bay. P. 326.

**Seven Dolors of the Virgin Mary, Festival of,** the Friday next preceding Palm-Sunday. This celebration was fixed by Benedict XIII. in 1725. The Seven Dolors were—the prophecy of St. Simeon; the journey to Egypt; the losing of Jesus at Jerusalem; the sight of the Lord bearing the cross; the Lord upon the cross; the piercing of his side with the holy lance; and the burial.

**Seven Mile,** p.-v. and tp., Butler co., O., on Cincinnati Richmond and Chicago R. R. P. 229.

**Seven-Mile Creek,** tp., Juneau co., Wis. P. 825.

**Seven Pines, Battle of.** See FAIR OAKS.

**Seven Sages** (or **Wise Men**) **of Greece, The,** according to most authorities, were Bias, Chilon, Cleobulus, Periander, Pittacus, Solon, and Thales, but the names are variously given. In fact, the selection of seven names from among the sages of ancient Greece is a purely arbitrary one. Many aphorisms in prose and verse, chiefly practical observations for the regulation of life, have come down to us as the work of these and other wise men of the antephilosophic period of Greece. These have been collected in Orelli's *Opuscula Græcorum Veterum Sententiosa et Moralia* (vol. i. pp. 138 *seq.*).

**Seven Sleepers, The,** according to an old tradition, were seven Christian brothers of Ephesus who in 251 A. D., during the persecution of Decius, took refuge in a cave, the entrance of which was walled up by the heathens in order to starve the young men. They, however, slept 200 years, or till 447 A. D., when they awoke. They were finally brought to Ephesus, to the great edification of the faithful. The Roman Catholic Church commemorates them on July 10, but the legend is older than the Church itself, and is found in various forms in the folk-lore of the East.

**Seventeen-Year Locust.** See CICADA, and also LOCUST.

**Seventh,** in music, an interval comprising six degrees of the diatonic scale. (See INTERVAL.)

**Seventh-Day Adventists.** See ADVENTISTS.

**Seventh-Day Baptists,** a denomination of Christians formerly called *Sabbatarians.* They hold to the immersion of adult believers, and also to the observance of the seventh day of the week as the Sabbath. Traces of this peculiar practice among some of the early Reformers are not few. The Sabbatarians began to attract attention in England about the time of the Commonwealth. In 1650 they assumed a denominational form in that country. The first Sabbatarian church in America was organized at Newport, R. I., in 1665, under the care of Stephen Mumford. In 1671 they left the Baptist denomination. In 1818 they assumed their present name. In the U. S. they number about 10,000 members, support one university (at Alfred, N. Y.), a number of academies and periodicals, a tract and publication society, and a missionary organization. In England they are at present few in number.—SEVENTH-DAY BAPTISTS (GERMAN), a small sect which in 1728 seceded from the Dunkers of Pennsylvania, and established at first a solitary, and then a conventual, life at Ephrata, Lancaster co., Pa. They hold a part of their property in common, adopt the Capuchin habit and a system of monastic names, and recommend, but do not absolutely require, celibacy. At present their leading establishment is at Snowhill, Franklin co., Pa. They are few in number. Their founder was Conrad Beissel. (See *A General History of the Sabbatarian Churches,* by Mrs. Tamar Davis (1851).)

**Seventy-First,** tp., Cumberland co., N. C. P. 1184.

**Seventy-Six,** tp., Muscatine co., Ia. P. 959.

**Seventy-Six,** tp., Washington co., Ia. P. 449.

**Seven Wonders of the World, The,** are variously given, but more generally as follows: the Colossus of Rhodes, Diana's temple at Ephesus, the Mausoleum at Halicarnassus, the Pyramids, the Pharos at Alexandria, the Hanging Gardens at Babylon, and the Olympian Zeus. Each is noticed under its alphabetical head.

**Seven Years' War** (1756–63). Maria Theresa could not forget the loss of Silesia. It had been taken from her by an insignificant power, to which the house of Austria was not used to pay any regard, and her attempts at rebuking this audacity had failed signally in the first and second Silesian wars. She was fully determined on crushing—or at least humiliating—the house of Brandenburg, and since the Peace of Aix-la-Chapelle (1748) her generals had been busy in reorganizing and increasing the Austrian armies and her diplomats in forming alliances against Prussia. The czarina of Russia, Elizabeth, was willing; she knew that Frederick II. used to make her amorous aberrations the favorite subject of his sarcasms. But with respect to France, the hereditary enemy of Austria and just now at war with England, the former ally of Maria Theresa, the difficulties seemed almost insurmountable. Nevertheless, when George II. concluded an alliance with Prussia Jan. 16, 1756, in order to secure his Hanoverian possessions against a French invasion, and when Maria Theresa stooped to write a letter to Madame de Pompadour, calling her *Ma chère cousine,* Prince Kaunitz succeeded in forming an alliance between France and Austria (May 1, 1756). With other powers also the negotiations were promising and nearly ripe. Sweden, whose possessions in Northern Germany were now confined to Stralsund and the island of Rügen, demanded only money to make a descent upon Pomerania, and France declared herself willing to pay; and in Saxony the elector was found so exasperated at Prussia that he even came forward with a proposal of playing the traitor—of alluring the Prussian king into Bohemia by a feigned neutrality, and then throwing an army into his rear to cut off his lines of retreat and communication. Frederick II. knew of all these plans, and when he saw that war was unavoidable he fell at once, without any declaration of war, upon Saxony with an army of 60,000 men (Aug., 1756), took Dresden Sept. 10, shut up the Saxon army of 18,000 men in its camp between Pirna and Königstein, defeated the Austrian army under Browne, who from Bohemia hastened to the support of Saxony, at Lobositz (Oct. 1), compelled the Saxon army to surrender Oct. 15, and placed the whole country under Prussian control, treating it very severely. The exploit was brilliant on account of its rapidity and completeness, but Frederick II. knew very well that no single exploit, however dazzling, would finish the game this time; and he conquered Saxony, not because he thirsted for a sip of revenge, but because the country formed the necessary basis for his future operations. His situation in the spring of 1757 was almost overwhelming. At the N. 22,000 Swedes gathered in Stralsund ready to cross the Peene; in the E. 100,000 Russians under Apraxin pushed onward to Memel; in the S. E. two Austrian armies approached through Bohemia—the one, of 76,000 men, under Charles of Lorraine, destined for Silesia, the other, of 46,000 men, under Daun, destined for Saxony; in the S. W. two French armies marched toward Prussia—the one, of 100,000 men, under D'Estrées, through Hanover, the other, of 36,000 men, under Soubise, through Hesse-Cassel; in the S. an army was organized from the contingents of the South German states, and was destined to manœuvre in connection with the Western Austrian and Eastern French armies. In the centre of this circle, which drew nearer and nearer every minute, on the Brandenburger heath, where there grows little corn and no iron, stood Frederick II. with an army of about 200,000 men, trim and in good repair like his country, quick and undaunted like himself. But he was alone. England, his only ally, promised and paid him for several years a handsome subsidy, but her representative

at the theatre of war, the duke of Cumberland, commanding an army of 40,000 English-Hanoverian troops in Hanover, was the sorest point in Frederick's position. In Apr., 1757, he broke into Bohemia; attacked the Austrian army under Charles of Lorraine before Prague, May 6; split it in two, of which the one part retired into Prague, and the other retreated to the S. W. to join Daun; invested and besieged Prague; marched with one division of his army against Daun, who came to reinforce the city; met him at Kolin June 18; was completely defeated, and retreated with his whole force into Saxony, slowly followed by Daun, while Charles of Lorraine marched onward to Silesia. In Hanover the duke of Cumberland was totally defeated by D'Estrées at Hastenbeck, July 26, and compelled to conclude the capitulation of Kloster-Seven, Sept. 8, by which his army was dissolved. D'Estrées' successor, the duke of Richelieu, was too much occupied with plundering Hanover to do anything serious, but in the mean time Soubise, with the second French army, had conquered Hesse and penetrated into Saxony. Frederick II. met him at Rossbach Nov. 5, and literally scattered his army to the winds. With incredible rapidity he then turned to Silesia, which had fallen into the hands of the Austrians; routed Charles of Lorraine at Leuthen Dec. 5, and reconquered the whole province with the exception of Schweidnitz. In the N. the Swedes had been driven back into Stralsund, and the Russians, although victorious at Grossjägerndorf, Aug. 30, and still occupying Memel, suspended all hostilities on account of the illness of the czarina, which changed the whole policy of the country. Thus, when winter set in and stopped all military operations, the actual loss which Frederick II. had sustained was not great, and the prestige he had gained was enormous. The capitulation of Kloster-Seven was not ratified by the English Parliament. On the contrary, a new English-Hanoverian army was organized and placed under the command of Duke Ferdinand of Brunswick, and during the subsequent campaigns he succeeded by his vigilance, energy, and shrewd tactics, and by several brilliant victories—at Crefeld June 23, 1758, over Clermont, and at Minden Aug. 1, 1759, over Contades and Broglie—in keeping the French on the other side of the Rhine. In the sea-war between England and France, Spain joined the latter in 1761, but England was so successful in North America, the West Indies, the African coast, and India, and showed herself so superior to France in all their great naval encounters—at Quiberon, 1759, and Belleisle, 1761—that she then laid the foundation of her great maritime empire, while France became utterly exhausted. The attempts of the Swedes in the N. and of the German army in the S. were of no great consequence, but along the eastern and south-eastern frontier, in the provinces of Prussia and Silesia, and in Saxony, the struggle against the Russians and Austrians was at times desperate. In 1758, Frederick II. defeated the Russians under Fermor at Zorndorf Aug. 26, but he was himself defeated at Hochkirch Oct. 14, by the Austrians under Daun. He nevertheless kept both Silesia and Saxony, but in 1759 was so completely routed at Kunnersdorf, Aug. 12, by the Russians under Soltikow and the Austrians under Daun, that the morning after the battle he could hardly gather 5000 men. Dresden and a large part of Saxony fell into the hands of the allies, and although he reconquered it in 1760 by the brilliant victories at Liegnitz, Aug. 15, over Landon, and at Torgau, Nov. 3, over Daun, his ruin seemed, nevertheless, unavoidable. On Oct. 25, 1760, George II. died, and the English subsidies stopped. The Russians under Todtleben took Berlin and plundered it for three days. In large districts, especially of the eastern part of his kingdom, the houses were burnt, the animals driven away, the men killed, and the women and children left on the naked ground to starve. His army, mostly foreigners and young recruits, numbered only 50,000, and with this force he had to face three hostile armies at once, each superior in numbers to his own. But, fortunately, the czarina died Jan. 5, 1762, and her successor, Peter III., was an enthusiastic admirer of Frederick II. Peace was concluded with Russia May 5, and with Sweden May 22, and although the projected Russian-Prussian alliance was frustrated by the assassination of Peter III., Catharine II., his successor, declared herself neutral; Austria felt too weak to carry on the war alone; France also had lost its warlike enthusiasm; all seemed sunk in sheer exhaustion. During the many years of fruitless exertions the angry passions and haughty demands had vanished, and given room for a longing after peace. There was only one man who still seemed wide awake, who did not ask for peace, who would yield nothing; and as the alliance between the three greatest powers of the world, seconded by several minor ones, had not been capable of putting him down, they determined to let him stay. Almost without any preliminary negotiations peace was concluded between Prussia and Austria at Hubertsburg Feb. 15, 1763, by which "all should remain as it had been before the war," with the exception of the million of lives and the millions of property which had been destroyed. (See Frederick II., *Histoire de la Guerre de Sept Ans* (6 vols., 1794–1801); Carlyle, *Frederick the Great;* Ranke, *Ursprung des siebenjährigen Krieges* (1871).) CLEMENS PETERSEN.

**Sev'erance,** p.-v., Wolf River tp., Doniphan co., Kan., on St. Joseph and Denver City R. R.

**Sev'ern,** a river of England, rises in Montgomeryshire at an elevation of 1500 feet above the level of the sea, flows in a southern and south-western direction, and falls into the Bristol Channel after a course of about 200 miles. It is navigable for a distance of 180 miles, and the tide, which in its estuary assumes the character of the *bore* or *eagre,* is perceptible 120 miles from its mouth.

**Severus** (ALEXANDER). See ALEXANDER SEVERUS.

**Seve'rus** (LUCIUS SEPTIMIUS), Roman emperor from 193–211, b. at Leptis Magna, on the northern coast of Africa, Apr. 11, 146 A. D.; studied jurisprudence at Rome; held the highest offices under Marcus Aurelius and Commodus, and commanded the legions in Pannonia when tidings came that the prætorian guard at Rome had murdered Pertinax in 193 and sold the imperial purple to Didius Julianus. The legions immediately proclaimed Severus emperor, and on June 2, 193, he appeared at their head before the walls of Rome. Julianus was deposed, sentenced to death, and executed, and the prætorian guard was dissolved, while a new guard was formed of the legions, which received great dotations. Meanwhile, the Roman legions in Asia had proclaimed their general, Pescennius Niger, emperor. Severus marched against him and defeated him in several battles, finally, at Issus in 194; made successful campaigns against the Parthians, and returned to Rome, where he entertained the people in a most magnificent way, and gave the army new and still larger dotations. Another rival, Clodius Albinus, appeared at this time in Gaul, but in the battle of Lugdunum (197) Severus was victorious, though only after a protracted struggle and a horrible massacre. New campaigns in the East followed, and resulted in the capture and plunder of the Parthian capital, Ctesiphon. Then the emperor spent several years (202–208) at Rome, occupied with reforms of the internal administration of the empire, but in 208 a rebellion broke out in Britain, and Severus again took the field. His campaigns in Britain were difficult, bloody, and without any decisive or lasting result. He was just planning a new campaign against the Caledonians when he d. at Eboracum (York) Feb. 4, 211. His last years were much disturbed by the dissensions and dissipations of his sons, Caracalla and Geta. The discipline of the army was greatly deteriorated by the large dotations he at different times conferred on the soldiers. The surname *Severus* he received from the cruelty with which he treated the families and partisans of Pescennius Niger and Clodius Albinus.

**Severus** (SULPICIUS). See SULPICIUS SEVERUS.

**Severus, Wall of,** a wall of stone erected by the emperor Severus in 208 A. D. to protect Roman Britain from the Caledonians. It extended from the Solway to the Tyne, immediately N. of that of Hadrian, and consequently far S. of that of Antoninus. Considerable portions of the wall still remain.

**Sevier',** county of S. W. Arkansas, on Little River, adjoining Indian Territory. Staples, Indian corn, cotton, sweet potatoes, tobacco, and wool. Cap. Lockesburg. Area, about 850 sq. m. P. 4492.

**Sevier,** county of E. Tennessee, adjoining North Carolina, from which it is separated by the Unaka, Iron or Great Smoky mountains, is watered by French Broad and Little Pigeon rivers, has bottom-lands of extraordinary fertility, and valuable beds of limestone and iron ore. Staples, Indian corn, wheat, oats, tobacco, sorghum-molasses, honey, wool, and butter. Cap. Sevierville. Area, 500 sq. m. P. 11,028.

**Sevier,** county of E. Utah, adjoining Colorado, intersected by Green and Grand and Sevier rivers, and traversed by the Wahsatch Mountains. Cap. Richfield. Area, about 7000 sq. m. Settled since 1870, when the pop. was only 19.

**Sevier** (AMBROSE H.), b. in Middle Tennessee in 1802; received a scanty education; removed to Arkansas Territory when eighteen years of age; studied law; was admitted to the bar two years later; became clerk to the Territorial legislature; was elected to that body 1823 and 1825; delegate in Congress 1827–36; U. S. Senator 1837–48; was many years chairman of the committee on Indian affairs, and afterward of that on foreign relations, and was a commissioner to negotiate peace with Mexico 1848. D. at Little Rock Dec. 21, 1848.

**Sevier** (JOHN), b. on Shenandoah River, Va., in 1740, of French parents originally named XAVIER; emigrated to

the Holston River country, in what was then North Carolina, in 1769, and with an exploring-party built the first fort on Watauga River, which he defended against the Indians, and in 1772 was delegate to a convention at Halifax, N. C. In 1773, Lord Dunmore, then governor of Virginia, commissioned him as captain of an expedition fitting out against the Shawnees and other tribes of Indians; took part in the battle of Point Pleasant, 1774; sat in the North Carolina colonial assembly 1777; procured the erection of the Tennessee region into a district under the laws of North Carolina, and the establishment of courts of justice; was commissioned lieutenant-colonel, and defeated the Indians at the battle of Boyd's Creek 1779. As colonel of a regiment raised by himself in Tennessee, he participated in the signal victory over the British at the battle of King's Mountain, N. C., Oct. 7, 1780, and for his distinguished bravery on that occasion was presented with a sword and a vote of thanks by the legislature of North Carolina. He was foremost in almost all the battles and skirmishes, as well as treaties and negotiations, with the Indians during many years, and was regarded by the settlers as their father, friend, and protector; was chosen in 1785, without opposition, governor of the anomalous State of Frankland, which was formed by the settlers out of a portion of what is now Western North Carolina and Eastern Tennessee. He received from Pres. Washington the commission of brigadier-general of the territory S. of Ohio River. In 1796 the State of Tennessee was erected and admitted into the Union, and Sevier was chosen governor, served for two consecutive terms, and re-elected in 1803; was elected a Representative in the U. S. Congress in 1811, and re-elected in 1813. During the war with Great Britain (1812–15) he served with honor as a member of the military committee, and in 1815, against the advice of friends who regarded his age and impaired health, accepted an important mission to adjust difficulties with the Creek Indians in Alabama Territory. While thus engaged he was taken sick, and d. at an encampment on the E. side of Tallapoosa River, near Fort Decatur, Sept. 24, 1815. A handsome monument to his memory stands in the city cemetery at Nashville, Tenn. JAMES D. PARK.

**Sevier Lake,** a body of salt water lying in Western Utah, 120 miles S. S. W. of Great Salt Lake, N. lat. 39°, lon. W. from Greenwich 113° 10′; altitude above the ocean 4600 feet. Its length N. and S. is 20 miles, its width 10 miles, and its area 140 sq. m. Its surface is not interrupted by an island. It has no outlet, and its sole tributary is Sevier River, which enters the N. end. The valley which contains the lake is an arm of the Sevier desert, and is uninhabitable by reason of the absence of fresh water. It is walled at the W. by the House range of mountains, and at the E. by the Beaver Creek range, and it opens northward to the desert. The shores of the lake are low and treeless, and desolate in the extreme. The soil is saline and pulverulent, and sustains only a scanty growth of low bushes. A few wading-birds haunt the beach, and a flock of gulls hover about the mouth of the river feeding on the fish that stray into the lake and are poisoned by its brine. In the lake are found the forms of life that usually inhabit strong brines—namely, *Artemia* and the larvæ of certain insects. The brine has been found by analysis to contain 62.3 parts in 1000 of chloride of sodium, 13.4 of sulphate of soda, 10.3 of chloride of magnesium, and 0.4 of sulphate of lime. It is needful to note that the facts contained in this description were gathered in the year 1872, for, like all salt lakes, Sevier Lake is subject to fluctuations. Having no outlet, but disposing of its surplus by evaporation, it oscillates with every change of climate. When the weather is unusually dry, the accession of water from the river becomes less and the loss by evaporation greater; the surface falls, the dimensions shrink, and the brine becomes stronger. When the weather grows more moist, the opposite result is produced. All about the lake are abandoned beaches, which record its former extent. At some time in the past the water was expanded over a large portion of the Sevier desert, and discharged northward into Great Salt Lake. The channel through which this discharge took place is still to be seen on the watershed between the Sevier and Salt Lake deserts, 50 miles N. of the present shore of Sevier Lake. It is known as the "Old River bed," and may well excite the wonder of the traveller, for it is the trace of a broad stream where now there is perpetual drought and one must journey 50 miles from spring to spring. At a time still more remote Great Salt and Sevier lakes rose so high that their waters joined, and the combined lake, to which the name "Bonneville" has been given, overflowed to the ocean through Snake and Columbia rivers. The sediments and shore-lines of Lake Bonneville are well preserved, and show that it covered Great Salt Lake, Sevier, and Escalante deserts, and sent arms into Utah, Juab, Rush, Skull, Preuss, Snake, and Cedar valleys. It had an extreme width of 125 miles. Its water-level was about 575 feet above the present level of Sevier Lake (1872), and 968 feet above Great Salt Lake (1873). Its sediments abound in fresh-water shells. In its phenomena is the record of a climate far less arid than that which now prevails in Utah. The epoch of moisture was not, however, of great duration as geologists reckon time, and it was preceded by a long period of dryness. It was probably coincident in time with the Glacial epoch.

G. K. GILBERT.

**Sevier'ville,** p.-v., cap. of Sevier co., Tenn. P. 159.

**Sévigné', de** (MARIE DE RABUTIN CHANTAL), MARQUISE, b. at Paris Feb. 6, 1626; was left an orphan very early, but received an excellent education from her uncle, Abbé de Coulanges, and married in 1644 the marquis Henri de Sévigné (d. 1651), to whom she bore two children, a son and a daughter. Her social position was very elegant; she was rich, spirited, beautiful, one of the most prominent members of the literary circle of the Hôtel Rambouillet, and intimate with all the principal actors in the civil war of the Fronde. In 1669 her daughter, to whom she was passionately attached, was married to the marquis de Grignan, governor of Provence; the consequent separation occasioned a correspondence which, although not intended for publication, appeared after the death of the authoress, and has made her name celebrated, the letters being at once of great historical interest and of the highest literary merit. D. Apr. 18, 1696. The first edition of her *Letters* appeared in 1726; the last and best are those by Silvestre de Sacy (11 vols., 1860–63) and by Regnier (14 vols., 1862–66). (See Walckenaer, *Mémoires touchant la Vie et les Écrits de Madame de Sévigné* (1842); *Madame de Sévigné*, by Countess de Puliga (London, 1872).)

**Sev'ille,** city of Spain, capital of a province of the same name, on the left bank of the Guadalquivir, 70 miles from its mouth. Under the Romans, Goths, and Moors it was the capital of wealthy and powerful empires. The earlier kings of modern Spain also resided here; and although Charles V. removed the royal residence to Valladolid, Seville rose to a still higher degree of splendor and prosperity when America was discovered, as it became the mart of the new colonies. During the French invasion (1810–13), and by the subsequent loss of the Transatlantic possessions, it suffered very much, but recovered rapidly, and is to-day not only a city of great and brilliant remembrances, but also a lively and enterprising modern town. It is surrounded by old Moorish walls, 5 miles in circuit, pierced by fifteen gates, and surmounted by sixty-six towers; as fortifications these walls are of little consequence, but their ramparts afford beautiful public walks. Across the city runs the Alameda, a broad, open street lined with palaces, planted with magnificent elms, and adorned with numerous fountains, which, like the city in general, are provided with water by several great aqueducts, of which that built by the Moors in 1172 is a magnificent structure resting on 410 high arches. The rest of the city, with the exception of the numerous public squares and promenades, consists mostly of narrow streets lined with high, sombre-looking, but substantial houses of Moorish construction, and eminently well adapted to keep the sun out and give a cool, healthy, and comfortable abode. Among its many splendid edifices the cathedral is the most remarkable. It is one of the greatest Gothic structures in the world, 431 feet long, 315 feet wide, and 145 feet high under the transept dome, and it is most magnificently adorned with paintings by Murillo, the Herreras, and other masters of the school of Seville, besides being almost overloaded with the most elegant sculptures. Unique of its kind is the Giralda, a belfry 350 feet high; and most interesting on account both of their elegant architecture and beautiful ornamentation are the Alcazar or royal palace, and the university, founded in 1579. Besides the university, which is generally attended by about 1200 students, and to which several fine scientific establishments are attached, Seville has many other good educational institutions, and several valuable libraries and art-collections. Among its manufactures are a tobacco-factory, in which about 5000 persons are employed, a cannon-foundry, several manufactories of muskets and other firearms, powder, saltpetre, soap, leather, cotton thread, etc. Of its exports, oranges, olive oil, wine, wool, and cork, together with copper, lead, and quicksilver, form the principal items. P. of city proper, 81,546; with suburbs and surroundings, 152,000.

**Seville,** tp., Gratiot co., Mich. P. 575.

**Seville,** p.-v., Medina co., O., on Lake Shore and Tuscarawas Valley R. R., 36 miles S. of Cleveland, has 4 churches, excellent schools, 2 banks, 1 weekly and 1 monthly newspaper, a cheese-factory, 2 flouring-mills, flax

and vinegar factories, a planing-mill, 1 wagon and carriage establishment, and a town-hall. P. 597.

MRS. M. A. COULTER, ED. "SEVILLE TIMES."

**Sèvres,** town of France, department of Seine-et-Oise, on the Seine, is celebrated for its manufactures of porcelain, which are generally acknowledged to be the most elegant ever produced, both in design and painting. P. 7096.

**Sèvres, Deux,** department of Western France, has received its name from two rivers—the Sèvre-Niortaise, which flows into the Bay of Biscay, and the Sèvre-Nantaise, which joins the Loire. Area, 2315 sq. m. P. 331,243. The northern part is hilly, even mountainous; the southern, level, but the soil is everywhere very fertile; it produces more wheat than necessary for home consumption, and affords excellent pastures. Cattle, horses, mules, and asses are extensively reared. Iron, marble, and granite are found, and considerable manufactures are carried on. Of 33,992 children of school age, 11,181 received no school education in 1857. Cap. Niort.

**Sewage.** See SEWER, by GEN. Q. A. GILLMORE.

**Sew'all** (JONATHAN), LL.D., b. at Boston, Mass., Aug. 24, 1728; graduated at Harvard 1748; taught school several years at Salem; began the practice of law at Charlestown about 1758; became attorney-general of Massachusetts 1767; gained a suit by which the slave James recovered his freedom at common law 1770; resided several years in the Vassall House at Cambridge; went to England early in 1775; was included among the sufferers by the penal act of Apr. 30, 1779, against the loyalists or "Tories;" settled at St. John, New Brunswick, 1788, and was judge of the court of vice-admiralty until his death, Sept. 26, 1796. He was long, but incorrectly, reputed the author of the letters signed "Massachusettensis" published in defence of British policy, and replied to by John Adams over the signature of "Novanglus," it being now known that they were written by Daniel Leonard.—His son, JONATHAN SEWALL, LL.D. (1766–1839), was chief-justice of Lower Canada 1808–38.

**Sewall** (JONATHAN MITCHELL), b. at Salem, Mass., in 1745, was adopted and reared by his uncle, Chief-Justice Stephen Sewall; was a distinguished lawyer; became register of probate for Grafton co., N. H., 1774; removed some years later to Portsmouth; was noted as a wit and writer of popular Whig and Federalist lyrics, which were collected into a volume 1801. D. at Portsmouth, N. H., Mar. 29, 1808.

**Sewall** (SAMUEL), b. at Bishopstoke, England, Mar. 28, 1652, grandson of Henry, a pioneer resident at Newbury, Mass.; was brought by his parents to that town 1661; graduated at Harvard 1671; studied theology; preached for a short time; acquired a fortune by his marriage (Feb. 28, 1676) with Hannah, daughter of John Hull, the celebrated master of the mint at Boston; was assistant governor 1684–86 and 1689; visited England 1688–89; was annually chosen a member of the executive council from 1692 to 1725; was judge from 1692 to 1718, when he was made chief-justice, being at the same time judge of probate for Suffolk county; presided at the trial of some of the victims of the witchcraft delusion of 1692, but was soon convinced of his error, for which he publicly asked pardon of God and man in a paper read to the congregation on Fast Day, Jan. 14, 1697, by his pastor, Rev. Samuel Willard; was noted for his charity and philanthropy, having been perhaps the first American writer against slavery, on which theme he published a tract, *The Selling of Joseph* (1700); was secretary and treasurer of the society for the maintenance of Indian missions, and was author of *An Answer to Queries respecting America* (1690), *Accomplishment of Prophecies* (1713), *A Memorial relating to the Kennebec Indians* (1721), and *A Description of the New Heaven* (1727). He resigned his judicial offices 1728, and d. at Boston Jan. 1, 1730. His *Diary* and other papers are in the possession of the Massachusetts Historical Society.—His son, JOSEPH, b. Aug. 15, 1688; graduated at Harvard 1707; studied theology; was ordained colleague pastor of the Old South Church Sept. 16, 1713; declined the presidency of Harvard College 1724; received the degree of D. D. from the University of Glasgow 1731; gave to that institution a fund for the education of indigent students; was a friend of learning and a man of great benevolence and worth. D. at Boston June 27, 1769. Author of *Four Sermons* (1741) and of twenty-three other sermons separately printed.

**Sewall** (SAMUEL), LL.D., grandson of Dr. Joseph, and great-grandson of Chief-Justice Samuel, b. at Boston Dec. 11, 1757; graduated at Harvard 1776; became an eminent lawyer at Marblehead; frequently sat in the legislature; was a member of Congress 1797–1800; judge of the supreme court 1800–13, and chief-justice of Massachusetts from 1813 to his death, at Wiscasset, Me., June 8, 1814.—His son, SAMUEL, b. at Marblehead June 1, 1785; graduated at Harvard 1804; studied theology; was long pastor at Woburn and Burlington, Mass., and d. at the latter place Feb. 18, 1868, leaving a MS. *History of Woburn,* published the same year by his son (?), Rev. Charles Chauncey Sewall, who prefixed a *Memorial Sketch* of the author.

**Sewall** (STEPHEN), b. at Salem, Mass., Dec. 18, 1704; graduated at Harvard 1721; was tutor there 1728–39; was judge of the superior court 1739–52; chief-justice and member of the council from 1752 to his death, Sept. 10, 1760.

**Sewall** (STEPHEN), b. at York, Me., Apr. 4, 1734; graduated at Harvard 1761; taught the grammar school at Cambridge; became Hebrew tutor at Harvard 1762 and Hancock professor of Hebrew 1765–85; published a *Hebrew Grammar* (1763); wrote seven of the Greek and Latin poems in *Pietas et Gratulatio* (1761), and left several MSS., now in the library of Harvard, including a *Chaldee and English Dictionary.* D. July 23, 1804.

**Sewa'nee,** p.-v., Franklin co., Tenn., on Tennessee Coal R. R., is the seat of the University of the South, and has 2 monthly periodicals.

**Sew'ard,** county of S. W. Kansas, adjoining Indian Territory, and watered by tributaries of Cimarron River, consists of rolling prairies, and is still unorganized. Area, about 720 sq. m.

**Seward,** county of S. E. Nebraska, on Big Blue River, traversed by Midland Pacific R. R., has a rolling prairie surface. Staples, wheat, Indian corn, oats, hay, and butter. Cap. Seward. Area, 576 sq. m. P. in 1870, 2953.

**Seward,** tp., Kendall co., Ill. P. 944.

**Seward,** tp., Winnebago co., Ill. P. 997.

**Seward,** Kosciusko co., Ind. P. 1353.

**Seward,** p.-v. and tp., cap. of Seward co., Neb., on Midland Pacific R. R., has fine water-power, a weekly newspaper, and a growing trade. P. 1207.

**Seward,** p.-v. and tp., Schoharie co., N. Y., on Albany and Susquehanna R. R. P. 1765.

**Seward** (ANNA), b. at Eyam, Derbyshire, England, in 1747; obtained some celebrity as a poet, chiefly by her elegies upon her friend Major André (1781), and upon Captain Cook; resided most of her life at Lichfield, where she was intimate with Dr. Erasmus Darwin, of whom she published a *Life* (1804), in which she laid claim to the authorship of the first fifty lines of the *Botanic Garden.* D. at Lichfield Mar. 25, 1809, bequeathing her MSS. to Sir Walter Scott, who published her *Poetical Works and Correspondence* (3 vols., 1810), with a prefatory memoir, but the collection met with little favor.

**Seward** (JAMES L.), b. in Georgia; studied law; was elected to the State legislature in 1836, serving several years; was Representative in Congress 1853–59; resides in Thomasville, Ga. ALEXANDER H. STEPHENS.

**Seward** (WILLIAM HENRY), LL.D., b. May 16, 1801, in the retired town of Florida, Orange co., N. Y., where resided his father, Dr. Samuel S. Seward, at that time a practising physician. With such facilities as the place afforded he was made ready for entrance to Union College, Schenectady, at the age of fifteen, and in regular course took his degree, with signs of promise, in the year 1820. He then addressed himself with diligence to the study of the law under competent masters, who introduced him to practice in the year 1823. He selected his place of abode at Auburn in Cayuga co., and there soon found in the family of Judge Elijah Miller of that place a partner, Miss Frances Adelaide Miller, with whom he appears to have enjoyed a happy home for the whole of their joint career. This union took place in the year 1824, when he was twenty-three years old. He began by practising law, a profession for which he was in some respects tolerably suited, and wherein he might certainly have counted upon distinction had he confined himself to it exclusively. But little time intervened when circumstances presented to him inducements to enter the more tempting field of national politics. The year after his marriage he acceded to the call of his fellow-townsmen to address them on the national anniversary, and then enunciated opinions singularly prophetic of the conflicts of his later days. The year 1828 found him presiding in a convention of young men of New York, having for its purpose the election of Mr. John Quincy Adams as President for a second term, and the year 1830 brought him forward as a prominent leader in the uprising of the population of all Western New York against the audacious and successful conspiracy of certain lodges of Freemasons, which had combined to visit upon the person of William Morgan secret and summary vengeance for his disclosure of their formulas. The consequence to Mr. Seward was his election to a seat in the New

York senate, and from that date he may be said to have been, with few intervals, in one form or another, an effective and prominent leader in the councils which framed the policy both of the State and nation.

The political history of the most populous and powerful State of the Union, considered separately, has already been partly written by a competent hand; but as time moves on, events continually occur which tend more and more to supply materials for philosophical speculation far wider than has ever been attempted yet. For this immediate occasion it will be enough to point out as briefly as possible the precise nature of the influences which had prevailed in that State down to the time of Mr. Seward. The two individuals of prominence who had as statesmen contributed the most to give a tone to politics had been Aaron Burr and Martin Van Buren. Their policy had chiefly been the narrow one of manipulation of measures and men to the main object of securing the control of place. Neither of them can ever rank in the list of great men, but both materially contributed to establish habits and practices the bitter fruits of which will probably be gathered to the latest days of expiring freedom. With these men and their school Mr. Seward was little able to sympathize at any time of his life, for the reason that his mind dwelt far more in a region of abstract generalization, from which he studied to deduce just practical conclusions for the useful development of the public interest. The nature of his philosophy was to lead the public mind through maxims, spreading a useful influence over the welfare of the State. Men to him were mainly instruments to promote the public welfare, and not that of a few leaders. It is this tendency which sets him in a degree apart from the common run of politicians of the century. Hence it appears that in all the high positions which he ultimately occupied his aim was always to move in advance of and not after the public sentiment. His mind was remarkably clear and prompt in action, and the result rarely failed to justify his judgment. Yet he strove to exercise a decisive power, not simply over the adoption of a policy, but likewise upon the selection of the right agents to carry it out. Events not to be foreseen by human ken happened more than once utterly to demolish his best-devised conceptions, but they never impaired the organizing energy which formed his most characteristic feature. The difference between Seward and Burr or Van Buren is the difference between Sir Isaac Newton and a gamester—the clear perception of great results drawn from abstract philosophical deductions, and the sharp calculation of chances applied to the management of dice.

The political action of Mr. Seward was mainly directed through three channels laid open to him pending his career. The first was his election by the people to be governor of New York; the second, his election by the legislature of that State to a seat in the Senate of the Union; the third, his appointment by Pres. Lincoln to the post of secretary of state. His services in these forms absorbed twenty-four years of the best part of his life, during which he was steadily exercising a direct healthy influence over the movement of great events. At times the part which he chose to take needed for success courage of the highest kind, yet qualified by calmness and prudence to make it truly effective. It was his fortune to enter into debate with several of the most distinguished statesmen of the period; and, although not by nature so well gifted to shine in the mere externals of oratory as they, he never failed to maintain himself as quite their equal in the strategy of every conflict. In reviewing the proceedings of that period it is worth while to note at this day the haughty, dictatorial style of discussion habitually used by the exponents of what was then the ruling power in the national legislative bodies, as if their word was equivalent to law, to be obeyed everywhere. And for a long while it must be confessed this style remained potential over the larger number of the elect from the free States, who were content to submit for the sake of the strength derived from combinations with them to hold the central citadel of power. Yet in his various conflicts Mr. Seward studiously preserved all proprieties of deportment toward his antagonists without sacrificing any portion of his convictions. One of their favorite modes of assault was to pick out some one of his most pungent propositions, to which they assiduously labored with some success at the moment to attach popular odium. The later result is that they have invested him with the imperishable mantle of a seer. One strong feature of his character seems not to have been yet fully explained in the various notices taken of his life. This was his promptness and decision in action when required in an emergency. While he remained a member of the so-called Whig party it was chiefly his energy which prompted the success secured to them in the selection both of Gen. Harrison and Gen. Taylor, the only two candidates for the Presidency who ever secured a popular majority to their side. Yet this good fortune in these cases never inured either to his own or their benefit. In each of the three instances in which the party to which he attached himself gained the supremacy it was his fate to witness, by the sudden interposition of a higher law, the blight of his own hopes of personal influence for the public good at the very instant of fruition.

Mr. Seward in 1860 had been himself a candidate for the nomination to the Presidency, with every prospect of success. He lost it by the force of certain bargains which are apt in this country to defeat the just expectations of the majority of the nation. The successful candidate, Mr. Lincoln, however, was not slow to recognize the value of his long public services by immediately placing him in what then was undoubtedly the most difficult position in the cabinet. For the four years following he underwent an extent of labor and care in the maintenance of the country's influence upon foreign nations which it is difficult to describe in adequate language. All the powers of Europe had fixed their attention upon the catastrophe in the U. S., and, with perhaps the exception of Russia, they scarcely disguised their satisfaction at witnessing the temporary check administered to the steadily-expanding power of the great republic. Plenty of traitors had been sent out to do whatever they might to win sympathy for their cause, and most of the then existing envoys, if not secretly co-operating with the enemy, certainly bore small good-will to assist the struggling republic. In other words, the entire organization of the foreign office needed reconstruction, both in spirit and in substance, throughout the world. There have been in this department many statesmen who have merited the reputation which they earned by their effective direction of this branch of service, but there never was before Mr. Seward a case when not one, but every, nation of importance needed to be impressed with the expediency of neutrality as the safest line of policy. Much the larger portion of the labors of Mr. Seward in this field may probably remain for centuries unseen and unread, and yet it may be preserved hereafter to testify to the patriotism, the energy, and the wisdom of him who bore up the honor and safety of his country through five long years of as critical diplomatic intercourse as ever was carried on in any responsible hands.

In the whole career of Mr. Seward one element appears steadily predominant—the firmness of his spirit and his presence of mind in the face of difficulties. Few public men of any note have been subjected to more sudden and desperate reverses, and none ever bore them with more fortitude or set to work more energetically to recover from them. His rivals and opponents often vied with each other in their efforts to deride him—efforts which did not escape his attention, though they seldom were permitted to affect his deportment. He had very little of the peculiarity so common to jealous politicians of damning with faint praise, or yet of insinuating calumny under the phase of sympathy. He was not always prudent in his own speech, nor sensible of the foul uses to which his rather grotesque efforts at humor were sometimes put to injure him. The whole atmosphere of political contention is always fetid with the vile gases exuded from the bad passions of swarms of actors, especially those of inferior grades of character. He passed through it all, catching as little of the stain as possible. His enemies only hated him the more bitterly the less he permitted them to spoil his temper. It is the law of public life that the more of power a great mind applies in action the stronger is the wave of resistance which he is sure to carry before him. For conflicts of this kind Mr. Seward was by temperament peculiarly well fitted. Only in a very few instances did he lose his self-command, and these were very naturally bruited with more industry from the very reason of their rarity.

In Mar., 1865, the great conflict at arms was over, but the labors of the state department continued to involve questions ominous to the peace of the country. Mr. Seward had a just right to expect relief from the strong pressure upon him during the preceding four years, and some return for his long services in the grateful homage of the sovereign people. In point of fact, his fatality in reverses followed him to the end. The second term of Pres. Lincoln found him completely in harmony with his chief, and ready to co-operate with vigor in the arduous task of redintegration of the old and fondly-prized institutions under which the people had prospered as no other had ever done for a continuous period of three-quarters of a century. The imagination of a miserable wretch, inflamed by familiarity with histrionic effects, prompted a conspiracy that in the very hour of triumph laid low the heroic martyr President, and but just failed to involve Mr. Seward in the awful catastrophe. It admits of some question whether, historically considered, it would not have

been more dramatically fortunate for him had the assassin succeeded. The consequence would have been a sanctification of the two martyrs together in the memory of all later generations, and a corresponding execration of the miscreants who perpetrated both crimes. As it is, Mr. Seward survived to continue his labors under a successor to the Presidential chair who, with the best of intentions, possessed none of the conciliatory spirit of his predecessor, and stirred up strife instead of establishing harmony. The consequence was domestic dissension instead of peace, alienation instead of union. The whole policy of restoration, which had been carefully matured for adoption, and was really a wise one, sank under the unpopularity attached to its official source, and Mr. Seward, who would not desert his chief, took his full share of the odium attending the failure. Blows fell thick and fast upon him, more severe than those of the assassin or the loss of public favor. His wife, who had always been to him an angel of mercy, deeply sympathizing in his alternations of fortune, and a highly-cherished daughter in the flower of her age, successively withered under the shadow of the destroyer, and left him to return to his old home at Auburn, so strongly associated with the bright promise of his earlier life, to find himself bereft of all the attractions that had once adorned it. The shattered old man had not, however, the disposition even then to sink without a struggle against all these disasters. The threatening progress of disease, and the obstacles suggested to deter him, only stimulated him the more to persevere at every hazard in fighting for life. Surrounded by his remaining family and multitudes of personal friends, who held to him to the last, he yet calmly determined upon a final measure singularly indicative of his resolute will. Feeble as he seemed to others, and conscious of the progress of the enemy within him, he decided to struggle to the last by undertaking nothing less than a voyage and journey around the world. When finally he got back safely to his own home at Auburn, he even then would not sink into the abyss of indolence. Action was indispensable to him. He directed the preparation of a volume to contain his observations upon all that he had seen in the regions he had so painfully traversed. It was accordingly published under his supervision, and will remain as a final illustration as well of his keen observation to the last as of the unflinching tenacity of his will. He d. at Auburn Oct. 10, 1872, in the seventy-second year of his age. CHARLES FRANCIS ADAMS.

**Sew'ell,** tp., Fayette co., West Va., on Chesapeake and Ohio R. R. P. 1333.

**Sewell** (ELIZABETH MISSING), sister of William, b. in the Isle of Wight in 1815; became well known as the authoress of novels of the so-called "High-Church school of fiction," among which were *Amy Herbert* (1844), *Gertrude* (1845), *Laneton Parsonage* (1846), *Margaret Percival* (1847), which were republished in the U. S. She also wrote works of travels, poems, many volumes of a devotional character, and histories of Greece, Rome, and Egypt for the young. She was associated with Miss C. M. Yonge, another well-known writer of "High-Church fiction," in the preparation of a volume of *Historical Extracts* (1868).

**Sewell** (WILLIAM), b. in the Isle of Wight, England, about 1805; educated at Harrow School; graduated at Merton College, Oxford, 1827; became fellow of Merton, tutor of Exeter College, public examiner at Oxford (1836–41), principal of St. Peter's College, Radley (1852), and incumbent of Carisbrooke. D. at Leachford Hall, near Manchester, Nov. 14, 1874. Author of *Hora Philologica* (1830), *An Introduction to the Dialogues of Plato* (1841), *Popular Evidences of Christianity* (1843), and of many other religious and literary treatises, and translated into verse portions of Æschylus, Virgil, and Horace.—His brother, RICHARD CLARKE, b. 1803, was a graduate and fellow of Magdalen College, Oxford, a distinguished barrister in London, and subsequently at Melbourne, Australia, where he d. Nov. 7, 1864. Author of several legal works.

**Sewellel,** a rodent of the genus *Aplodontia*, which unites some of the characteristics of the beaver with those of the squirrel family and of the prairie dog, is noted for its rootless molars; has a reddish-brown color, with very small eyes and a short tail; is about the size of a muskrat, and has very strong jaws and a plump heavy body. One species only (*A. leporina*) is known to exist. It is found on the Pacific coast in California, Oregon, and Washington Territory, is gregarious, and lives in burrows. Its skin is employed by the Indians as an article of dress.

**Sew'elsville,** p.-v., Kirkwood tp., Belmont co., O. P. 84.

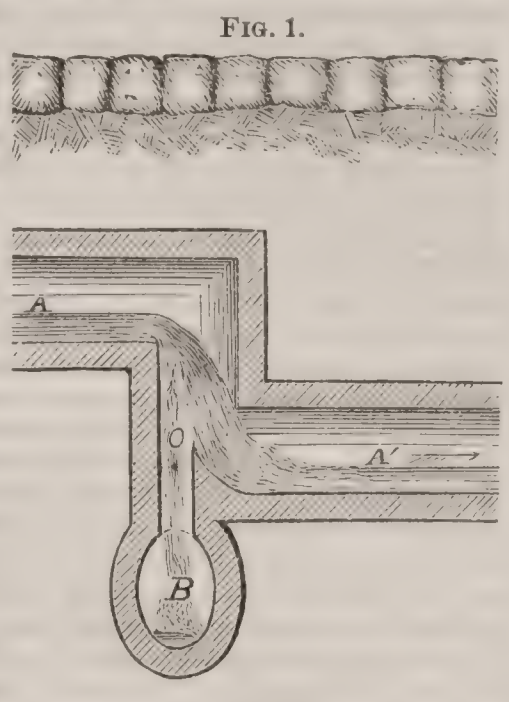
**Sew'er** [O. Fr. *sewiere*], an underground drain or channel for conveying away sewage, such as refuse and filthy liquids and fæcal matter. The construction of sewers and the discharging of water, etc. by sewers, as well as the system or plan of sewers for carrying off the sewage of a locality, are denominated sewerage. Technically speaking, a town or city provided with sewers is said to be sewered.

Sanitary works and regulations for the promotion of the public health have been the accompaniments of civilization in all ages of the world, and most ancient cities had their systems of sewerage and water-supply, and their elaborate public baths or temples of health, the ruins of which, having been less exposed to the action of the elements than those more elegant structures which rose higher above the earth's surface, bear testimony by their magnitude to the liberal views which inspired their construction. The waterworks and sewerage systems of Carthage, Alexandria, Rome, and Jerusalem were both extensive and complete. In Jerusalem the water-supply was so abundant that the gardens were irrigated with the overflow, and it was made to flush the whole temple, and convey away the blood and offal from the numerous sacrifices. The Cloaca of Rome has been continuously performing its present duties for about twenty centuries, and there is other abundant proof that at one time in the history of the human race both art and science had attained, in respect to sewerage, in the East a high state of excellence. This was followed by a period of decline and general neglect of the laws of health among the masses of the people. The present century has witnessed a revival of the spirit of sanitary reform, especially in thickly-populated districts, and some of the ablest minds of the age have been enlisted in its behalf. Carefully-kept statistics show that in England a reduction of the death-rate invariably follows the construction of works of sewerage and water-supply, even in towns having a low death-rate. In twelve towns selected by Mr. Baldwin Latham, from data collected by the medical officers of the privy council, with populations running from 7818 to 68,056, and with average death-rates before the improvements were made varying from $19\frac{1}{10}$ to $33\frac{2}{10}$ per 1000, the average death-rate after the sanitary works were completed ranged from $18\frac{6}{10}$ to $26\frac{2}{10}$ per 1000, with a reduction in the several towns of from 10 to 75 per cent. in typhoid-fever cases, and from 11 to 49 per cent. in phthisis cases. It must be conceded that the amount of value or wealth which a community can produce by its labor, both mental and physical, depends upon the health of the people, and among two or more communities similarly circumstanced and following the same pursuits it will commonly, like the death-rate, vary directly with their sanitary condition. Dr. Lyon Playfair estimates that there are 28 cases of sickness for every unnecessary death. To the loss in wealth-producing power caused by every death there must be added, therefore, not only the expense of burial and the cost of mourning in one or more entire households, and the interruption of industry in many others imposed by custom, but the additional loss arising from the sickness of 28 other members of the community, and the physicians' fees consequent thereon. By following out this line of thought, it will be found that the present or current value of works of water-supply and sewerage can even be estimated in dollars and cents. Moreover, as sickness of long standing may result in diseases transmissible to posterity, this current value is largely increased in the future, in the comparative freedom of the people from inherited diseases. The estimated money-value of sanitary works is therefore capital invested at interest, triply or quadruply compounded.

The requisite sanitary works of a town should provide (1) for a daily supply of pure water at the rate of not less than 20 gallons per capita of the population; (2) for the thorough drainage of the surface and subsoil; and (3) for conveying away all the liquid waste and fæcal refuse produced by the community. Only the second and third of these specified objects come properly within the scope of this article. Some authorities claim that the surface and subsoil drainage should always be kept distinct from the sewers, to the extent of providing for them a separate system of channels; and there doubtless are many cases where they should be so treated. This question, like many others likely to arise, may very properly be regarded as one to be decided upon its merits for each locality. In the general case the considerations which should govern the engineer, in fixing the essential features as well as the details of his project, will depend on (1) whether the subsoil water ordinarily stands so near the surface as to require tapping and draining off to a lower level; (2) whether the surface drainage, loaded with silt and soil not soluble in the water, and too heavy to be carried off by it and deposited in the final outfall, shall be provided with a separate set of channels, or be passed, in whole or in part, directly into the sewers which convey away the fæcal refuse from the habitations; (3) whether the less offensive sullage, arising from the domestic use of the water-supply, shall be conveyed from the houses in the same pipes which carry the animal excreta;

(4) whether the sewers shall be ventilated directly into the streets, and if not, then the best method of securing their ventilation; (5) the most effectual and certain, and therefore the best, method attainable for excluding the sewage-gases from the houses; (6) whether the sewage is needed for manurial purposes, and if so, the best method of adapting the works to that end; and (7) whether, if not required as a fertilizer, the sewage can properly be passed into the natural water-courses. In districts where the sewage is to be used for enriching the land the question of keeping it separate from the rainfall—the surface and subsoil drainage—is an important one, as the expense of handling it will generally be in proportion to its volume. The surface drainage of streets that are closely built up and subjected to heavy traffic is nearly if not quite as impure, in time of moderate and during the first stage of a heavy rainfall, as any sewage; and even if kept separate from the sewage, it might be unwise to allow it to flow into and corrupt the natural water-courses of the neighborhood in localities where it is a matter of grave importance to preserve the purity of these streams. Under these circumstances it seems necessary to deal with the foulest part of the surface drainage as sewage, so that even when the question of the manurial value of the latter is to be considered, it will not always be judicious "to convey the rainfall to the rivers and the sewage to the land," which is advocated by some sanitary writers as an unexceptionable rule. The best arrangement for providing that no portion of the surface drainage except that most heavily charged with street soil shall pass into the sewers, while the rest flows by a separate drain into the natural water-courses, is the method by storm-overflow sewers, by which the rainfall drain, which naturally lies nearer to the street surface than the sewer, is made to cross and discharge into the latter all its contents when the flow from the street is small and the velocity consequently low, while on the other hand the sewer will not intercept any of the water from the surface when the volume in the rainfall drain is great and its velocity proportionally high. This is done where the two channels cross each other by placing an opening in the sole of the drain, directly over a corresponding opening in the crown of the sewer, and by making at that point a vertical fall or step in the drain, of such height that with a high velocity in the drain its contents will overleap the opening in the sewer, and with a low velocity will drop into it. This arrangement is shown in Fig. 1, in which A A′ is the rainfall drain, B the sewer, and O the vertical opening between them. The velocity in a drain or sewer diminishes rapidly with the depth of its contents. The transverse form and the inclination of the drain A A′ being once established, the velocity of its flow, and therefore the horizontal distance to which it will leap in falling from the level A to the level A′, will depend on the depth of its contents; and the difference between these levels, or the height of the fall, can be so arranged at the time of construction, that all the surface drainage for a moderate rainfall, and for the early stages of a heavy one, when the flow is loaded with street filth, will fall through the opening O into the sewer. For a large rainfall there will be a greater depth, and therefore a greater velocity, in the drain A A′, and the stream will leap farther in falling from A to A′. For example, suppose the drain A A′ to be circular and 2 feet in diameter, and laid at an inclination of 1 in 550, and the opening O to be 1 foot wide. With a flow 6 inches deep in the drain the velocity will be 2¼ feet per second, and the stream will require a fall of 3¼ feet to enable it to overleap an opening 1 foot wide. If we suppose this fall to have been fixed at 2 feet in height, all this flow will be intercepted and pass into the sewer. If the drain runs half full, the velocity will be 3 feet per second. The contents will then overleap the opening in a fall of 2 feet, and be passed off by the rainfall drain into the natural water-courses.

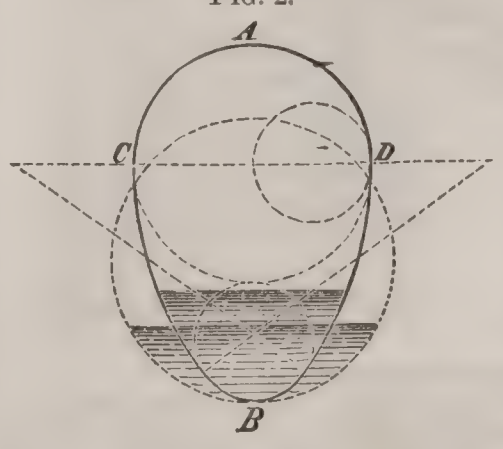
FIG. 1.




With respect to the subsoil drainage, inasmuch as sewers are or should be watertight, as otherwise the contamination of the surrounding soil, and consequently of the atmosphere, by leakage, would be the certain result, they in no sense, when properly constructed, act as drains by lowering the subsoil water-level. In well-paved streets very little of the rainfall is absorbed into the soil, but finds its way into the sewer or other channels provided for it; and were it not for the unpaved areas, including back yards and unimproved lots, the question of draining the soil in built-up streets would not perhaps possess great importance, especially if the soil be of a sandy or gravelly character. It has been shown in Great Britain, from carefully-prepared statistics, that the death-rate from pulmonary diseases was reduced 50 per cent. by sewering certain towns in such manner as to lower the subsoil water by drainage, while in other towns sewered with impervious pipes throughout, with no provision for drainage, there was no decrease in the death-rate from consumption. Some provision for subterranean drainage should therefore be made without using the sewers for that purpose, although the laying of sewers alone, by cutting through the various impervious strata, invariably results in the drainage of the surrounding earth to a greater or less degree. It is easy, when constructing the sewers, to arrange an effective system of subsoil drainage, generally at a moderate cost. There are several ways of doing this, among which are—*First.* The method by perforated inverts, giving, when the invert-blocks are laid, a series of continuous channels in the lower portion of the sewer. The joints between the invert-blocks are left open on the sides and bottom, but are closely filled and pointed with mortar between the sewer and the longitudinal channels, to prevent the escape of sewage into the latter. This manner of securing drainage of the soil is not easy of successful application, and is not therefore recommended for general adoption. *Second.* To make the foundation of the sewer itself serve the purpose of a blind drain, by forming it of well-compacted broken stone of various sizes. Between the broken stone and the earth on either side a vertical layer of straw, hay, or fine brush may be placed, to prevent the choking of the drain with soil. *Third.* To make a blind drain on each side of the sewer, by filling in with broken stone, or a mixture of stone and coarse gravel, instead of ordinary soil. *Fourth.* An ordinary drain of brick, or a tile drain, on each side of the sewer foundation will answer as well as any other, and can easily be laid at less cost than a blind drain of stone. Whatever method be adopted, it should be such as will secure a thorough drainage of the soil to the level of the floor of adjoining cellars. The areas in rear of the houses may be drained by either tile, brick, or blind drains, connected by a single pipe with the house drain, and thence with the sewer.

The transverse form of sewers is a detail of capital importance, more especially if they are required to provide for an intermittent flow, as when the surface drainage passes into them in whole or in part; for in order that they may be self-cleansing the minimum velocity should never fall below 2 feet per second in large sewers, and 3 feet per second in those of 6 to 9 inches diameter, even when the volume of flow is smallest. The greater the sectional area of the stream in proportion to the wetted perimeter of the channel in which it flows, the greater will be the mean hydraulic depth, and therefore the greater the velocity. Sewers should therefore be narrow on the bottom, or invert, in order that the mean hydraulic depth for a small flow may be as great as possible. They should also be broad across the middle and upper portion, to give the requisite capacity for a large flow. A transverse section of the shape of an egg with the smallest end down secures these conditions better than any other form. A good form of such a sewer is shown by the full line in Fig. 2, in which the vertical diameter A B is equal to once and a half the transverse diameter C D, the sides being described with a radius equal to the vertical diameter, and the invert or lower arc with a radius equal to one-fourth the transverse diameter. The circular form is stronger than the egg-shaped, and where the amount of sewage is pretty nearly uniform is generally considered to be the best. Fig. 2 also illustrates the advantage of the egg-shaped over a circular sewer of equal capacity, the latter being indicated by the larger dotted circle. The volume of water flowing, as indicated by horizontal lines, is supposed to be the same in each case, yet the depth, and consequently the velocity, is very much the greatest in the egg-shaped sewer.

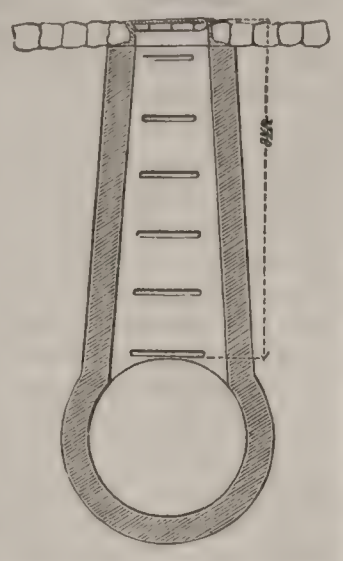
FIG. 2.




In order to afford the requisite facility for inspecting and

repairing a system of sewerage, and keeping it free from obstructions, man-holes are constructed. (See Fig. 3.) These are shafts, usually circular in horizontal section, and placed in a vertical position, constructed with brick, reaching from the street surface through the crown of the sewer. They are large enough for a man to pass through them, and are closed on the top with an iron cover of such strength and so fitted to the opening as to resist the traffic of the street without injury or displacement. They are located at every point where the sewer deviates from a straight line laterally or vertically, so that if a light be displayed in the sewer at any man-hole, a man at the next one on either side can readily see if any stoppage exists between them.

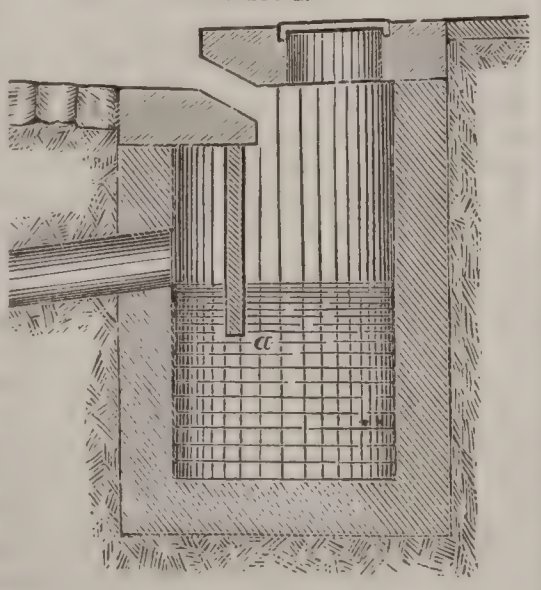
FIG. 3.



When the man-holes are used for purposes of ventilation, the covers are perforated. The practice of placing catch-basins directly underneath the man-holes, which is followed by some engineers, in order to prevent the sewer becoming obstructed by deposits, is a bad one, for they become cesspools for the constant generation of noxious gases, which are discharged into the streets when the man-holes are used for ventilating flues, or find their way in a greater or less degree into the houses. There should be no dead angles and spaces in the sewers, but a constant flow of all the contents until they are discharged at the outlet; and this should take place before putrefactive fermentation can set in. In the summer the time occupied in flowing from the house to the outlet should not exceed ten to twelve hours. In a long stretch of sewer without change in direction or grade man-holes should be placed at intervals of 100 to 150 feet. A small shaft, just large enough to allow a lamp to be lowered through it, may replace some of the man-holes.

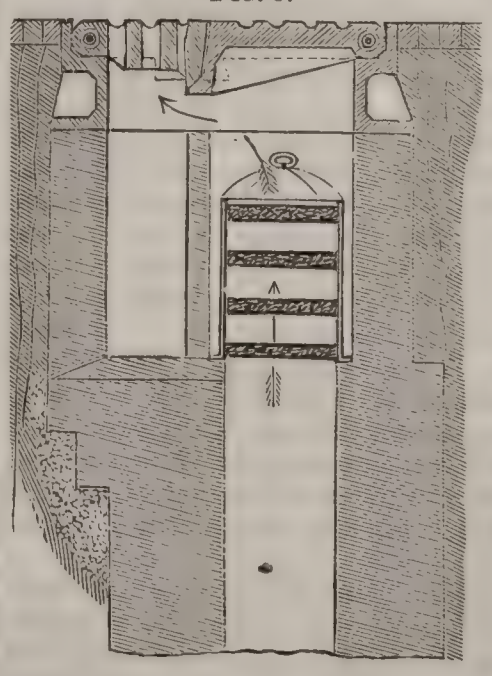
The drainage of the street first flows through openings in the curb or gutter into street-gullies, provided usually with catch-basins which retain the sand, gravel, and heavy detritus, while the water, carrying the lighter street-soil in suspension, flows into a pipe from 8 to 12 inches in diameter, which issues from the catch-basin at a point some feet above the bottom, and leads to the sewer. These catch-basins may be circular or rectangular in plan, and are placed at intervals of 150 to 200 feet apart on each side of the street. They should also be placed in valleys where descending and ascending grades meet. They should be well trapped to guard against the escape of sewer-gases into the street. As often as the basin gets filled with silt up to the mouth of the pipe, it should be removed, and an opening in the covering stone is provided for that purpose. The traps should be so designed that they will not be opened by the leaking of the catch-basin, or by the lowering of the water-level therein when the silt is removed. Many of those in common use in this country are open to these objections. One of them is shown in Fig. 4, in which, whenever the water from any cause gets below the level of the point *a*, a free passage for the gases will be opened from the sewer to the street. As a remedy for this, a siphon-trap may be placed in the gully-drain, so near to the gully that it can be readily cleaned out in the event of its becoming choked. As a security against untrapping by leakage or evaporation, the gullies and traps are sometimes made of cast iron, and frequently of earthenware.

FIG. 4.



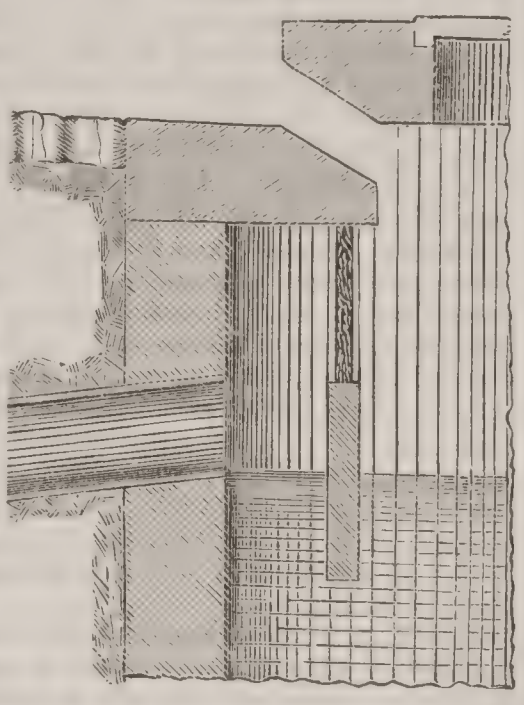

The most perfect system of street sewers will fail in performing its most important function, the protection of the health of the population, unless the sanitary requirements of house-drainage are carefully and skilfully established. House-drains should promptly convey to the sewers all the fæcal matter and liquid refuse produced by the inhabitants, and they should accomplish this in such manner that sewer-gases are effectually excluded from the houses. Glazed stoneware pipe of 5 to 6 inches bore are suitable for house-drains, and they should be laid with tight joints at an inclination that will produce a velocity not less than 3 to 4 feet per second, and provided with a good siphon-trap. Into this drain, which is placed below the level of the cellar floor, and may be carried through to the back-yard to receive its surface and subsoil drainage, all the pipes in the house usually lead, whether from water-closets, bath-tubs, wash-bowls, or kitchen sinks. The soil-pipe may be of lead or iron of $3\frac{1}{2}$ to 4 inch bore; the sink-pipes of lead $1\frac{3}{4}$ to 2 inch bore; and those from bath-tubs and wash-bowls of lead of $\frac{3}{4}$ of an inch to 1 inch bore. All these pipes should be trapped near their opening in the house. The drain-pipe, if leading into the back-yard, should terminate at a catch-basin to hold the silt, and be trapped near it. But all these traps, in the absence of other precautions, cannot be relied upon with confidence to prevent the escape of sewer-gases into the house by blowing through the traps in times of extraordinary compression of the air in the sewers, as when a high wind blows into the main sewers at their outlet, or when an obstruction occurs at any point and the sewage is banked up behind it. Increased pressure in the sewers may also result from an elevation of temperature of the sewage, and consequently of the air and gases in contact with it, produced by the warm refuse-water entering from the kitchens. Sewers discharging into tidal waters between high and low water have their outlets sealed twice a day, during which periods the sewage fills up to a higher level, causing increased and increasing compression of the gases, which continues until the tide falls and the outflow is resumed. There are therefore a variety of causes against which precautions must be taken to prevent the gases when under abnormal compression from forcing the traps and permeating the habitations of the people. In this connection it is well to remember that the sense of smell furnishes no sure evidence of the presence or absence of a dangerous gas, for some of the most pernicious gases are free from odor, while strong-smelling gases may be innocuous. The gases may be rendered harmless either by diluting or by disinfecting them. Dilution naturally ensues when sewers are ventilated through the man-holes into the street; and if we assume that the gases are homogeneously dissipated into the atmosphere, their dilution is in the ratio of the cubes of the distances from the man-hole covers, so that at the distance of 20 feet they are only one-eighth as strong as at the distance of 10 feet. In wide streets, therefore, provided with sewers in which there is a constant current and no deposits, the ventilation secured by simply closing the man-holes with perforated covers will generally suffice. In narrow streets the gas should be deprived of its hurtful properties before it is allowed to mix with the surrounding air; and when this is done by the introduction within the man-holes of an efficacious disinfecting absorbent, like wood-charcoal placed in shallow layers or pans, so arranged that it will remain dry and not choke the draught, while the gas must necessarily pass through it in its passage to the street, the result is an excellent if not, indeed, the best system of sewer ventilation yet devised. The absorbing powers of charcoal are very great. Liebig says the pores contained in a cubic inch of beech-wood charcoal are equivalent to an area of 100 superficial feet. When kept dry, and its pores are not allowed to become choked up by dust, its efficacy does not appear to diminish with continued use. Many methods of using it have been tried, but none of them appear to be entirely free from objections, the difficulties being to so interpose the charcoal as not to obstruct the natural draught too much, to keep it dry, and to prevent the escape of any gas that has not passed through the charcoal. Fig. 5 shows a man-hole fitted up with a charcoal air-filter of very simple design. The pans have perforated bottoms, are each $2\frac{1}{2}$ to 3 inches deep, and will each hold $1\frac{1}{2}$ to 2 pounds of the coal. The man-hole cover should fit so as to be water-tight, the purified air passing up through a catch-basin on one side covered with a grating. Holes left in the bottom of this basin will promptly carry off into the adjacent soil the small amount of water which finds its way into it. The cylinder holding the nest of pans is made of sheet metal, and is entirely open at both ends. It should fit very closely to the ledge on which it rests, so that no gas can escape upward around the outside. For a 20-inch man-hole, 5 to

FIG. 5.



6 pounds of charcoal will be sufficient. It should be renewed about once a month, and may be used again and again by being reburnt a short time at a cherry-red heat in iron retorts from which the atmospheric air is excluded. The cost of maintaining these ventilators, inclusive of labor, new charcoal, and reburning the old, should not exceed $1.50 per man-hole per year. Charcoal ventilators may be introduced into the catch-basins which receive the surface drainage in its passage to the sewer, as shown in Fig. 6.

FIG. 6.

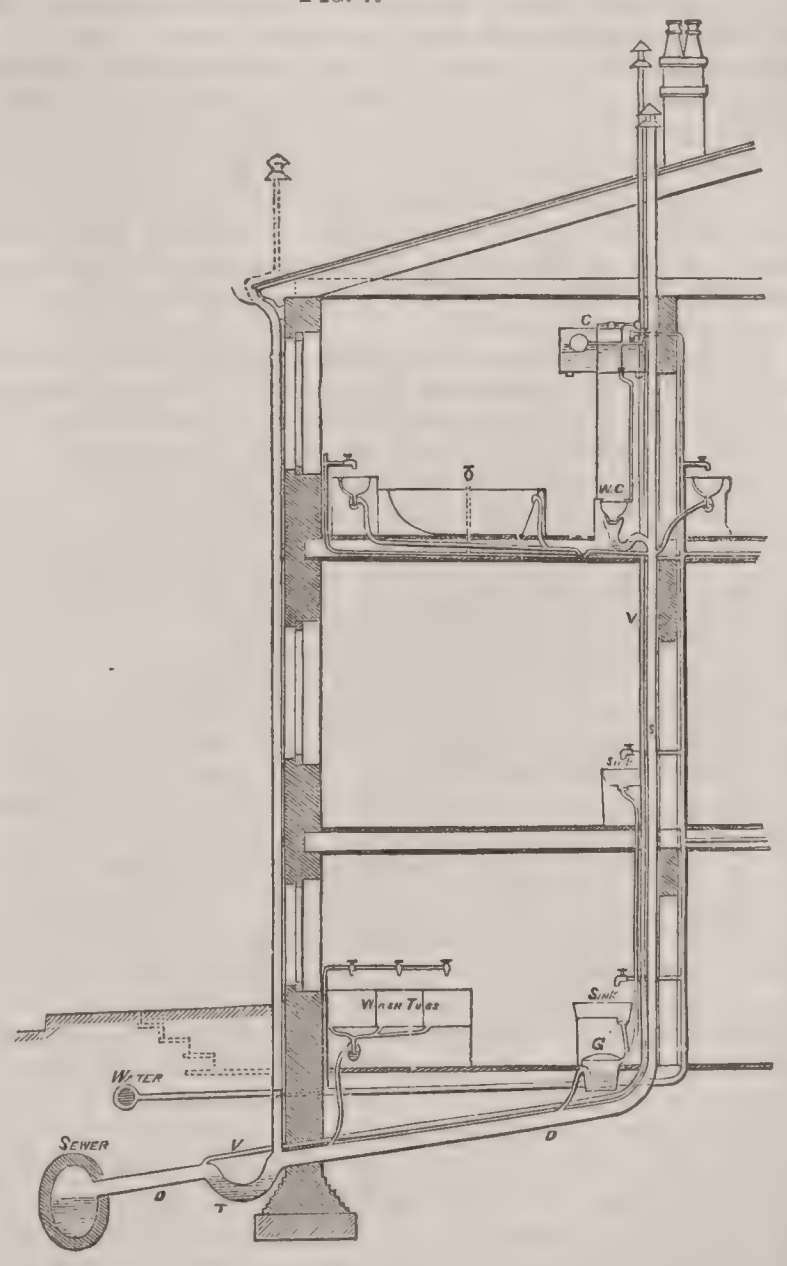


It is now an established rule that all drains and branch sewers should discharge their contents into the mains in the direction of, and with a velocity at least equal to, the current in the mains, in order to avoid a reduction of velocity and the formation of a deposit at the point of junction. Junctions should be formed with curves, and the axis of the branch ought to be approximately tangent to the axis of the main, and the rate of fall in the curve should be increased sufficiently to compensate for the increased friction in the bend. Branch pipes from street catch-basins should join below the average water-level in the sewer. House-drains should join above that level if they are expected to perform any function in sewer ventilation, as they would be effectually sealed if their opening into the sewer be habitually submerged. House-drains, however, cannot, in connection with the rain-water pipes from the roofs, perform effective service in any system of house or sewer ventilation where the public sewers receive the surface drainage; for in time of rainfall. although the drains would or might be sealed at the sewers, the sewer-gases would be compressed, and the water-pipes, already engaged in carrying down the rainfall, might be entirely inadequate to furnish an avenue of escape upward. The consequences might be, first to blow through the drain-trap, and then through all the traps in the house in succession. Moreover, if used for this purpose, the rainfall pipes would, in the ratio of their value as sewer ventilators, discharge the poisonous gases at the eaves, which might be in such dangerous proximity to the windows of sleeping-rooms as to render them unfit for occupancy. Mr. Baldwin Latham states that "at Croydon it was found that the more rigorously the system of ventilation by rain-water pipes was pursued, the more unhealthy the district became." Another danger to be guarded against is the unsealing of the traps in the house by a sudden and rapid rush of water through the pipes in the lower portion of a house, as when a simultaneous discharge into the pipes takes place from bath-tubs, water-closets, wash-bowls, and kitchen-sinks. The tendency then is to create a vacuum in the upper portions of the pipes and suck the water from the siphon-traps, leaving the sewer in free communication with the various rooms until the traps are again filled in the ordinary routine of domestic life. The remedy for this evil is to prevent the formation of the vacuum, by providing for a free ingress of air behind the down-rushing water in the pipes. This may be done by carrying the principal pipe—the soil-pipe—in its full size up through the roof, and leaving it open to the air. It should not terminate near a ventilator nor a chimney-top, nor near any of the windows of adjoining houses. When the circumstances will safely admit the escape of the gases at the eaves, the rain-water pipe may lead directly into the house-drain, between the drain-trap and the house, so that gases after forcing the trap can pass into the upper air through either the rain-pipe or soil-pipe. In every other case the rain-pipe should be disconnected from the house-drain, and discharge into a catch-basin at the ground-level provided with an efficient trap, from which a pipe carries the water to the house-drain. If this trap is forced by the gases, they escape at the catch-basin; and it is therefore a preliminary question whether they had better be set free at the ground or allowed to ascend the rain-pipe and make their exit at the eaves. Where there are necessarily a number of branches leading into a house-drain, the efficient ventilation of the one next the head of the drain will not always afford ventilation to the others. The head of each branch should therefore be carried up and put in direct communication with the open air. They may be drawn together, if thought best, inside the house, so as to show but one top above the roof.

When water is distributed through a house from a cistern located on one of the upper floors, its overflow-pipe, even if trapped in the best manner, should not, in any event, be directly connected with the house-drain, for the reason that as the overflow may be brought into use but seldom, the trap is liable to become unsealed by evaporation, and the cistern thereby placed in open communication with the sewer, or the trap may be forced by the sewer-gases in any of the cases of exceptional pressure already noted. In either event, the danger would be that the water in the cistern would become so tinctured, if not saturated, by the absorption of the poisonous constituents of the gases, as to be entirely unsuitable for domestic use. The overflow-pipe should be treated, with the difference specified below, in all respects like the rain-water pipe when the latter is not used for ventilating the sewers; that is, it should discharge in the open air, generally into a grated catch-basin at the ground-level, from which it flows through a trapped pipe to the house-drain. It may even enter and form a junction with the rain-water pipe at the nearest convenient place. The difference referred to consists in placing a trap at the cistern, intended simply to prevent wind blowing into the house through the overflow-pipe. For this purpose an ordinary siphon-trap within or just below the cistern will suffice.

One of the most difficult kinds of waste material to provide for is kitchen grease, which, so long as it is conveyed along in warm water, is fluid and flows freely. Whenever and wherever it cools, it solidifies and adheres to the object with which it happens to be in contact at that moment. Greasy water should not be allowed to reach the house-drain except through a capacious and well-trapped catch-basin, conveniently located with reference to easy and frequent cleansing. Mr. J. H. Shedd recommends a cast-iron grease-trap of the form shown at G, Fig. 7. The top may

FIG. 7.




be made to fit closely by setting it on a layer of plastic clay every time it is replaced after removal for cleaning out the basin. In houses not provided with the water-closet system all the waste liquids from bath-tubs, wash-basins, kitchen-sinks, etc. can safely be led outside to a ventilated and trapped catch-basin, having an outflow-pipe leading to the sewer. Sewer-gases entering this pipe will escape into the open air as soon as they reach the catch-basin, and the house will not become contaminated by them. The offensive discharges from water-closets cannot, however, be disposed of in this manner, but must be conveyed in a tight house-drain directly to the sewer. It is of vital importance, therefore, to maintain

such control over the poisonous gases which enter this drain that they cannot in any event or under any circumstances permeate the house. It is admitted that under a very slight abnormal pressure they can force their way through the house-drain trap, and reach the various traps at the several openings throughout the building. If these traps remain permanently sealed, and the soil-pipe in full size extends upward to the external air, the gases would doubtless escape in that direction. But the emptying of any one of these traps would ensure its entrance into the house; and there is no doubt that they may and do become emptied from various causes, among which are evaporation of the sealing water during prolonged disuse, and ordinary suction where there is a rush of water in large volume down the soil-pipe. I have no confidence in the efficacy of these traps, nor in any of the usual methods of preventing the escape of sewer-gases into houses, nor indeed in any method hitherto adopted or recommended, so far as I know, for attaining this end. I deem it of vital importance that no sewer-gas whatever should be allowed to enter the soil-pipe. This accomplished, it cannot, as a matter of course, come in contact with any of the inside traps or reach any avenue of escape into the house. This object can be attained by the device shown in Fig. 7, which indicates one method of so arranging the plumbing and draining of a dwelling-house as to render it absolutely secure against infection from poisonous gases. The sewer-gases in their passage up the house-drain will be arrested by the siphon-trap T, and can only force that trap under the existence of two conditions, one of which is a sufficient degree of pressure from behind, and the other the absence of an unobstructed avenue of escape. But such an avenue is purposely furnished by the ventilating pipe V, which issues from the house-drain below the trap, and passes up through the house, terminating above the roof, preferably at some distance from the end of the ventilating shaft of the soil-pipe, in order to avoid all danger that the sewer-gas, after having issued from the pipe V, will be sucked into the main shaft. The pipe V may pass through the roof at some distance from the main shaft. Indeed, it need not enter the house at all, but may discharge through an opening in the sidewalk near the curbstone, provided with a charcoal filter, or it may pass up on the outside of the house and terminate above the eaves, as shown by the dotted lines. There is no doubt that with this arrangement, the sewer-gas, having once ascended the house-drain as far as the trap T, will not exert any serious, or even appreciable, pressure on that trap, but will pass off through the ventilator V.

The proper dimensions of sewers will of course be governed by the proportion of the rainfall they are intended to carry off and the quantity of sewage produced by the population; and this last will depend to some extent on the volume of the water-supply and the methods of its consumption. When no provision except the sewers is made for carrying off the rainfall, the ratio of the total rainfall to the quantity received by the sewers will depend greatly upon the character of the surface-soil, and to some extent on the kinds of pavement used and the area of roof-surface. Very nearly all the water which falls upon the roofs, and upon streets covered with asphalt or other monolithic pavement, finds its way into the sewers within thirty minutes after its fall, while only a small portion of that received upon sandy or gravelly soil, unless the fall be excessive or is repeated at short intervals, will reach the sewers at all. In 1858 a board of distinguished experts in London stated on the subject of Metropolitan drainage that they felt "warranted in concluding as a rule of averages that one-fourth of an inch of rainfall will not contribute more than one-eighth of an inch to the sewers, nor a fall of four-tenths of an inch more than one-fourth of an inch." It was found that of a rainfall of $2\frac{9}{10}$ inches in 26 hours the Savoy street sewer received $64\frac{1}{2}$ per cent., the Ratcliff Highway sewer 52 per cent., and the London Bridge sewer 53 per cent. of the quantity which fell upon their respective drainage-areas. The London Bridge sewer drained an area of 2.250 acres. On another occasion a rainfall of $\frac{24}{100}$ths of an inch in $1\frac{1}{2}$ hours delivered 74 per cent. to the sewers. At Croydon, where the surface-soil is gravel overlying chalk, Mr. Latham found that a rainfall of $\frac{72}{100}$ths of an inch in 12 hours contributed but one-tenth of it to the sewers. Prolonged rainstorms are a greater strain upon the capacity of a sewer than those of shorter duration but of greater hourly amount; for the percentage of the fall which reaches the sewers increases with the degree of saturation of the soil. Mr. Roe found that a rainfall of $\frac{1}{2}$ an inch in 3 hours produced its greatest depth in the sewer half an hour after the fall had ceased; that this greatest depth lasted an hour and a half; and that the effect of the storm had ceased in the sewer at the end of twelve hours from its commencement. On another occasion a rainfall of $1\frac{11}{100}$ inches in 1 hour, followed by another of $\frac{33}{100}$ of an inch in the next 2 hours, produced its maximum effect in the sewer about the time the storm began to slacken, and its effect had ceased in sixteen hours. In a district of Warwickshire, where the surface is an almost impervious red marl formation, Mr. Baldwin Latham made provision for leading off by the sewers a rainfall of 1 inch in 24 hours, together with one-half the maximum quantity of sewage in 6 hours, estimated at 5 cubic feet per head every 24 hours; and he states that the sewers were by no means too large; while in the city of Dantzic, where the surface is flat and sandy, the sewers were proportioned to carry off one-fourth of an inch rainfall in 24 hours, together with 2 cubic feet of sewage per head in eight hours. Rain-water overflows were provided for excessive storms. It is generally considered safe to provide for carrying away one-half the daily sewage production in 6 hours, or two-thirds of it in 8 hours. The sewers of the city of Brooklyn are designed to carry off a rainstorm of 1 inch per hour, upon the assumption that only one-half of it would reach them within the hour. During the excessive rainstorms of the summer of 1872 it was found that the sewers became surcharged in certain localities, and some shallow storm-overflow sewers became necessary. Mr. Shedd states that "the sizes of the sewers in the city of Providence have been based on the supposition that $30\frac{1}{4}$ cubic feet per minute per acre would need to be carried away in the sewers without entirely filling them," which is equivalent to carrying off one-half of a 1-inch rainfall per hour during the time of falling.

The natural drainage-area should always be taken into account in adjusting the sizes of sewers, in order that the question whether the rain which falls upon the higher levels and flows through the district to be sewered shall go into the sewers in whole or in part, or be kept pure in natural or artificial channels, may receive intelligent consideration. It will rarely occur that this outlying rainfall can be passed through the sewers as economically as by separate channels of a more simple and less costly character. If the surface-drainage or rainfall to be passed into the sewers is restricted to that which belongs to the district embraced by them, it will generally suffice to give them such capacity and inclination that they can discharge, without running quite full bore, a rainfall of 1 inch per hour, presuming that only half that volume will reach the sewers within the hour. The ordinary house-sewage is so small a percentage of this discharge that no additional provision need be made for it. In exceptional cases, where manufactories discharge large quantities of water into the sewers, account must of course be taken of it, but ordinarily a capacity adapted to convey away the rainfall will fix the maximum dimensions. For example, take the isolated and simple case of a street 60 feet wide and half a mile long, compactly built up on both sides upon lots 25 feet wide and 100 feet deep, with a sewer in the street to carry off the rainfall and house-sewage of this area of $\frac{1}{2}$ mile $\times$ 260 feet. One-half a rainstorm of 1 inch per hour is 28,600 cubic feet, equal to 477 cubic feet per minute. If the population be estimated at 1000, or 5 persons to each house, and the daily water-supply is 100 gallons per head, one-half of which flows off as sewage in 6 hours, the sewers would receive during the time of greatest flow only 22 cubic feet per minute from this source. As this is only about $4\frac{1}{2}$ per cent. of the rainfall which they should be proportioned to carry off without running quite full bore, they may be safely trusted to carry the sewage in addition. An egg-shaped sewer of $1'\ 8'' \times 2'\ 6''$ at the lower end, running with a velocity of $2\frac{7}{10}$ feet per second, would carry off the water from both sources without running quite full.

Sewers should be laid at such an inclination that the velocity maintained in them when the volume of flow is small will be sufficient to move the heavier materials along, even should they subside to the bottom, in order to prevent obstructing the flow by the formation of deposits. Small sewers should have a greater inclination and a greater velocity than large ones, because they have a greater frictional area in proportion to the volume of flow. It has been found from observation that a velocity of 4 feet per second will prevent deposits in small sewers or drains of 4 inches to 6 inches diameter, while in those of 8 inches to 10 inches diameter a velocity of $3\frac{1}{2}$ feet per second will suffice. For diameters of 1 to 2 feet the velocity should not be less than 3 feet per second; and for larger dimensions not less than $2\frac{1}{2}$ feet. Baldwin Latham suggests 2 feet per second as the lowest admissible velocity for large sewers. Hence, several sewers set to different inclinations may be of such varying sizes that the velocity will be the same in all of them. For example, circular sewers of 1 foot, 3 feet, 6 feet, and 8 feet, diameters, running full or half full, if laid with inclinations respectively of $17\frac{6}{10}$ feet, $5\frac{9}{10}$ feet, $2\frac{9}{10}$ feet, and $2\frac{2}{10}$ feet per mile will

run with the same velocity, the rule being that *for equal velocities the lengths corresponding to a fall of* 1 *foot vary directly as the diameters of the sewers.*

TABLE I.—*Inclinations and Corresponding Velocities for Circular Sewers 1 foot in diameter, running full or half full, $h = v$.*

| Velocity in feet per second. | Inclination. | Velocity in feet per second. | Inclination. |
|---|---|---|---|
| 2 | 1 in 583 | 4½ | 1 in 127 |
| 2½ | " 386 | 5 | " 103 |
| 3 | " 275 | 5½ | " 86 |
| 3½ | " 205 | 6 | " 72 |
| 4 | " 159 | | |

From the foregoing table for 1-foot sewers the inclination of any circular sewer running full or half full can be ascertained by the rule that for equal velocities the lengths corresponding to a descent of 1 foot vary directly as the diameters of the sewers. For example, a 6-inch sewer running full or half full must have a descent of 1 foot in 291½ (583 ÷ 2) in order to run with a velocity of 2 feet per second, while a 4-foot sewer with a descent of 1 foot in 2332 feet (583 × 4) will maintain the same velocity. The inclination and velocity obtained by the foregoing table and rule are applicable to a length of sewer of which $h = v$—that is, in which the total fall in feet is equal to the velocity per second in feet. To find this length, multiply the length for a descent of 1 foot by the total descent—*i. e.* by the velocity. For example, the 6-inch sewer, with a descent of 1 foot in 291½ feet (583 ÷ 2), in order to run with a velocity of 2 feet per second, should have a total length of 583 (291½ × 2). A 4-foot sewer, to run with a velocity of 6 feet per second, should have an inclination of 1 foot in 288 (72 × 4), and should be 1728 feet long (288 × 6). When the total fall in feet of a given length of sewer to be constructed is either less or greater than the velocity in feet per second, a correction in inclination is necessary. This correction can be made by using the following formula, which is applicable to all lengths of sewer, from which may be deduced the value of either one of the four quantities $h$, $l$, $d$, or $v$, when the other three are known:

$$h = \left(1 + e + c\frac{l}{d}\right)\frac{v^2}{2g}, \qquad (1)$$

in which $h$ = head of water or total fall in feet;
$l$ = length of pipe in feet;
$d$ = diameter of pipe in feet;
$v$ = velocity in feet per second;
$c$ = coefficient of friction in pipe;
$e$ = coefficient of resistance for entrance of water into pipe.

The value of $e$ is generally averaged at 0.505, but it may be reduced to 0.08 by rounding off the edges of the inlet. The coefficient of friction $c$ is not quite constant, but varies slightly with $v$. It may be calculated for each velocity by the formula

$$c = .01439 + \frac{.016921}{\sqrt{v}}. \qquad (2)$$

For example, What should be the length of a circular sewer of which the total fall from source to outlet is 10 feet, diameter 4 feet, and velocity per second 2 feet? In this case $c = 0.0263$, and the equation becomes

$$10 = \left(1 + .505 + .0263\,\frac{l}{4}\right)\frac{4}{64.38};$$

from which $l = 24250$. The inclination therefore is 10 in 24250, equal to 1 in 2425. Similarly, by assuming the length, total fall, and velocity, the equation would give the diameter of the sewer.

Although it is the velocity on the bottom which is effective in keeping a sewer clear of deposits, $v$ in the foregoing discussion represents the mean velocity. Prony's formula for mean velocity is

$$v = V\,\frac{V + 7.776}{V + 10.335},$$

in which $v$ = mean velocity, and V = surface velocity. The mean velocity is a mean proportional between the velocity at the surface and the velocity at the bottom. For practical use it may be assumed that the mean velocity is equal to four-fifths the superficial velocity. The sectional area of the stream divided by the wetted perimeter or rubbing surface is called the mean hydraulic depth. The discharge of a sewer in cubic feet per second is equal to the transverse section of the stream in feet multiplied by the velocity in feet per second.

The foregoing discussion applies to circular sewers of any size, running full or half full, with any total fall from source to outlet, and with any velocity. When the velocity does not exceed 6 feet per second, and the total fall in feet equals the velocity, the inclination is calculated directly from Table I. by the rule there given. For greater velocities, and for cases where $v \gtrless h$, recourse can be had to formulas (1) and (2):

TABLE II.—*Inclinations and Corresponding Velocities for Egg-shaped Sewers 1.0′ × 1′ 6″, running full, $h = v$. (The proportions of the Sewer are those shown in Fig. 2.)*

| Velocity in feet per second. | Inclination. | Velocity in feet per second. | Inclination. |
|---|---|---|---|
| 2 | 1 in 676 | 4½ | 1 in 147 |
| 2½ | " 448 | 5 | " 120 |
| 3 | " 318 | 5½ | " 100 |
| 3½ | " 238 | 6 | " 84 |
| 4 | " 185 | | |

From the foregoing table the inclination of any sized egg-shaped sewer, and of the same proportions, running full, may be deduced from the rule that for equal velocities the lengths corresponding to a descent of 1 foot vary directly as the transverse diameters of the sewers. *Example.*—A 2-foot × 3-foot sewer running 3 feet per second should have an inclination of 1 in 636 (318 × 2), and the length of sewer to which this calculation applies is that corresponding to a height of 3 feet ($h = v$). The total length is therefore 3 × 636 = 1908 feet.

TABLE III.—*Inclinations and Corresponding Velocities of Egg-shaped Sewers 1.0′ × 1′ 6″, running two-thirds full, $h = v$.*

| Velocity in feet per second. | Inclination. | Velocity in feet per second. | Inclination. |
|---|---|---|---|
| 2 | 1 in 737 | 4½ | 1 in 160 |
| 2½ | " 488 | 5 | " 131 |
| 3 | " 347 | 5½ | " 108 |
| 3½ | " 259 | 6 | " 91 |
| 4 | " 201 | | |

From the foregoing table the inclination of any sized egg-shaped sewer of the same proportions running two-thirds full may be deduced in the manner already described. Thus, a 4′ × 6′ sewer running 3 feet per second should have an inclination of 1 in 1388 (347 × 4), and the length of sewer to which the calculation is applicable corresponds to a height of 3 feet. This length is therefore 3 × 1388 = 4164 feet.

TABLE IV.—*Inclinations and Corresponding Velocities of Egg-shaped Sewers 1.0′ × 1′ 6″, running one-third full, $h = v$.*

| Velocity in feet per second. | Inclination. | Velocity in feet per second. | Inclination. |
|---|---|---|---|
| 2 | 1 in 482 | 4 | 1 in 132 |
| 2½ | " 319 | 4½ | " 105 |
| 3 | " 227 | 5 | " 85 |
| 3½ | " 170 | 6 | " 60 |

The inclination of any sized egg-shaped sewer of the same proportions, running one-third full, may be deduced from the above table in the manner before described. *Example.*—An egg-shaped sewer 3′0 x 4′6 inches, running with a velocity of 3 feet per second, must have an inclination of 1 in 681 (227 × 3), and this velocity and inclination apply to a length of 2043 feet (681 × 3).

Tables II., III., and IV. afford the means of calculating the inclination of egg-shaped sewers of any size, provided they have the proportions shown in Fig. 2, for velocities up to 6 feet per second, and for lengths in which the fall in feet equals the velocity in feet per second. When the total fall in feet from source to outlet differs from the velocity in feet per second, we may use, as in the case of circular sewers, the equation

$$h = \left(1 + e + c\,\frac{l}{d}\right)\frac{v^2}{2g}, \qquad (1)$$

in which $d$ represents the diameter of a circular sewer having the same inclination, velocity, and mean hydraulic depth as what may be termed the corresponding egg-shaped sewer. The mean hydraulic depth of egg-shaped sewers of the form under discussion (Fig. 2) is found by multiplying the transverse diameter by 0.2897 when running full, by 0.3157 when running two-thirds full, and by 0.2066 when running one-third full. The mean hydraulic depth of a circular sewer when running either full or half full is one-fourth of the diameter. If $t$ = transverse diameter of the egg-shaped sewer, we have for corresponding or equivalent sewers—

when running full, $\frac{d}{4} = t \times 0.2897$;

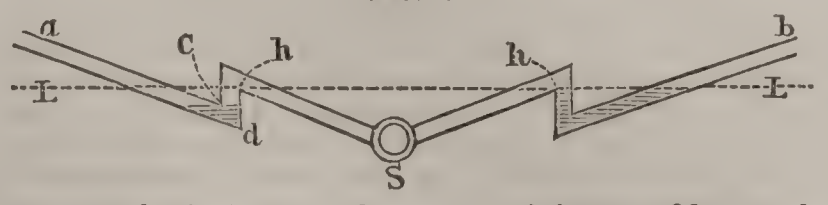
when running two-thirds full, $\frac{d}{4} = t \times 0.3157$; and

when running one-third full, $\frac{d}{4} = t \times 0.2066$.

Hence the diameter of a circular sewer is equal to four times the mean hydraulic depth of the corresponding egg-shaped sewer; and by substituting in Eq. (1) the value of $d$ thus obtained, we shall obtain the value of either one of quantities $h$, $l$, or $v$, knowing the other two. *Example.*—What is the proper inclination of an egg-shaped sewer $3.0 \times 4$ feet 6 inches, running full, with a velocity of 2 feet per second, the total fall being 2 feet? In this case $d = 4 \times 3 \times 0.2897 = 3.4764$ feet, and as $v = h$, we have only to go to the rule under Table I. and multiply the length for a fall of 1 foot by 3.4764, to get the length for the same descent in the given sewer. Answer, $583 \times 3.4764 = 2028$, or 1 in 2028, applicable to a length of 4056 feet ($2028 \times 2$). *Example.*—What is the proper inclination for an egg-shaped sewer 4 feet $\times$ 6 feet, running two-thirds full, with a velocity of 3 feet per second and a total fall from source to outlet of 6 feet? $d = 4 \times 4 \times 0.3157 = 5.0512$, which, substituted in Eq. (1) with $c = 0.0242$, gives the total length, $l = 8640$ feet in a fall of 6 feet, or 1 in 1440. *Example.*—What is the proper inclination of an egg-shaped sewer 2 feet 6 inches $\times$ 3 feet 9 inches, running one-third full, with a velocity of 4 feet per second, and a total fall from source to outlet of 2 feet? $d = 4 \times 2.5 \times 0.2066 = 2.066$, which, put in Eq. (1) with $c = 0.0229$, gives for total length, $l = 589.57$ feet, or 1 in 294.78.

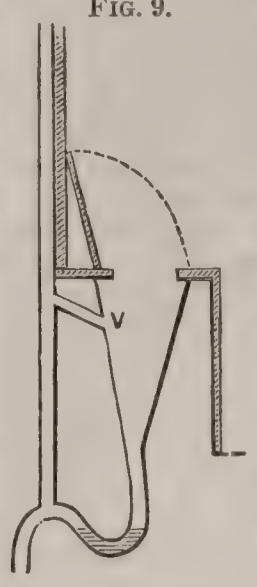
*The Pneumatic System.*—In all the foregoing discussion the fæcal and other waste and refuse matter produced by the inhabitants of a district or town is supposed to be carried away through the agency of the liquid portions thereof, moving under the laws governing the flow of water. This method of carrying off sewage is known as the water-carriage system. In Amsterdam, Leyden, and some other towns in Holland the movement of atmospheric air has been applied to secure the same results, according to a method devised by Capt. Liernur, civil and military engineer, and generally designated the "pneumatic system." Its efficacy has not yet been thoroughly tested, and some of its important and essential details are still confined to the field of experimental research, but its merits have been set forth in such a positive manner, and by advocates of such acknowledged ability and experience, as to entitle it to some notice. In order to understand the principle of this system, suppose that an air-tight iron tank or reservoir occupies some central point of a town or district. From this tank an air-tight main issues, having branches through the several streets to different points in the district. These branches in turn branch off into the several house-drains, and these latter are connected respectively with the soil-pipes of the houses, the latter being open to the external air at their upper end above the highest closet. If the air be pumped out of the central tank, creating a vacuum therein more or less complete, there will ensue a downward rush of air in each and all the houses, and thence through the branches and main into the tank, carrying with it, under a suitable arrangement of the details, all the refuse matter which finds its way into the soil-pipes and house-drains. In this manner the tank may be filled with sewage. It is emptied by a similar process. A pipe with one end inside the tank, and reaching to the bottom, has its other end connected with an air-tight receiver, which may be a portable tank on wheels for carrying the sewage away. When this receiver is exhausted of air by the use of the air-pump, the sewage flows up into and fills it from the main tank. A single stopcock, near the tank, in the main sets the system to work. When this is opened, the pneumatic power of the vacuum in the tank begins to act, and a downward rush of air in the houses, branches, and main sets in with a more or less sudden shock, which puts the sewage in motion. In order to adapt this system to districts where there are differences of level, and therefore different rates of inclination in the branches, and also where the volumes of sewage supplied by the several house-drains vary within wide limits, a water-trap or vertical step is made in each house-drain, something like an ordinary siphon-trap. When this trap is full, all additional sewage entering it will flow off by its gravity. In Fig. 8 let $b$

FIG. 8.




represent the drain from a house containing say fifty people, and $a$ that from a small residence in which only two or three persons live, both in communication through their respective traps with the sewer $s$; also suppose that the drain $b$ carries enough sewage into the trap to fill it up to the level L L in an hour, and that the flow in $a$ requires twenty-four hours to fill its trap to the point of overflow. After the first hour the sewage in $b$ will flow directly into the sewer $s$ and toward the central tank by its own weight, while in $a$ it will remain in the angle $d$ for a whole day. Suppose, after it has risen above the sealing angle $c$, that the pneumatic power is applied by opening the stopcock in the main. The liquid at $d$ will rise up some distance toward the overflow angle $h$ under the effect of atmospheric pressure in the drain $a$, while in $b$ it will begin to flow at once over the ledge and toward the central tank. If the vertical steps in the two drains are of the same height (say one foot), the flow over the ledge in the drain $a$ will not begin until the liquid in $b$ is so much reduced by its flow that were the pressure to be removed by closing the cock it would assume the same height in the two traps. A condition of equality of barometric resistance would then be established, and the two drains will flow simultaneously on a reproduction of the vacuum. It is claimed that by this device of traps or steps the pneumatic power, applied by means of the vacuum in the central tank, operates equally and simultaneously upon all the house-drains in a single district, causing an immediate flow wherever the traps are full, and at a later period in those where the level of the sewage is between the sealing angle and the overflow angle. In the houses the closets on the different floors should, for convenience and economy, be placed as nearly as possible over one another, in order that the fæcal and liquid refuse may reach the house-drain through a single soil-pipe. Each closet-pan is provided below with a siphon-trap, as shown in Fig. 9, and the soil-pipe is carried up through the roof

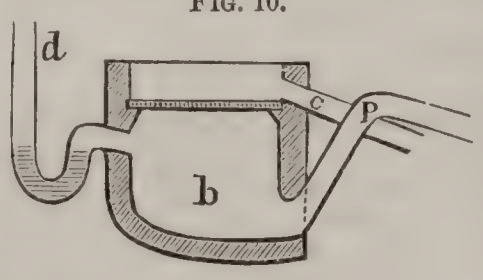
FIG. 9.




from a point outside the siphon of the highest closet. The pan is also ventilated into this main shaft, as seen at V in Fig. 9. The closet room should preferably be next to an exterior wall, and be provided with a window or otherwise ventilated. The soil-pipes, house-drains, and street-sewers in the works constructed under Capt. Liernur's supervision are all of cast iron, 5 inches in diameter, with the joints calked in the manner usually adopted with gas-pipes.

This method of sewerage necessitates a separate system of drains for carrying away the surface and subsoil waters, and into this supplemental system all the refuse waters of the houses flowing from kitchens, bath-tubs, wash-basins, etc. are conveyed. These latter pass through a siphon-trapped pipe into a catch-basin having an overflow near the top for conveying off the liquids to the water-drain pipes, while the more solid matter which has a manurial value sinks to the bottom and is conveyed by another pipe to the pneumatic sewer. This will be understood by a reference to Fig. 10, where the drain $d$ carries the house-sullage through a trap into the basin $b$. The fluid portions pass off through the pipe $c$ to the water-drains, the solid portions being kept back by a screen placed just below the upper outlet-pipe. From the bottom of the basin the pipe $p$ connects with the pneumatic sewer. It has a sudden rise near the basin of, say, one foot, designed to place it under the same barometric resistance with the sewage house-drains. When the vacuum-power is applied, the basin $b$ is emptied of its contents in the same manner as the other parts of the system.

FIG. 10.




During the construction of the works, and before the street-tanks in the several sub-districts are brought into connection with the main reservoirs at the central pumping-station, the tanks are emptied by means of a portable steam-engine and air-pump, accompanied by a portable iron tank or tender. By attaching the pump to the top opening of the street-tank the latter is exhausted of air to about a three-quarter vacuum. The stop-cocks in the mains are then opened, and the sewage of the district flows into the tank, which is then closed. The portable iron tank is next exhausted of its air, and closed, and then connected by its supply-pipe with a pipe reaching to the bottom of the street-tank. Air is then admitted at the top of the street-tank, and the valves of the portable tank opened, when the contents of the former are forced or sucked into the latter, to be transported away. The portable engine and tender-tank are dispensed with as soon as the sub-district or street tanks are placed in communication with the great central reservoir or reservoirs, which, whether one or more in number, are capacious enough to receive the

contents of the tanks in all the surrounding districts. The sewage is transferred from the small tanks to the central reservoir by the same process of pneumatic pressure already explained. It is then treated by a poudrette apparatus, and converted into a fertilizer by a process which it is deemed unnecessary to describe in this article. It generally requires thirty-six hours for the sewage to pass from the houses to the central reservoir, undergo the necessary treatment, inclusive of desiccation, and be packed up and made ready for sale and shipment. Mr. Adam Scott in describing this system says: "The air-pump is set in motion, and maintains during the day a three-quarter vacuum in certain central reservoirs placed below the floor of the building, and at the same time in the central pipes. Workmen perambulate the town, visiting each tank once a day. To drain the houses commanded by one tank, they alternately open the connecting cock of the central pipe and the stopcock of any main pipe; the first to obtain a vacuum in the tank, the second to utilize this by emptying the closet-pipes connected with that particular main. After all the mains of the tank in question have been operated upon, and their contents collected in the tank, the workman turns the discharging cock to send the whole mass to the central building for immediate conversion into poudrette. He then proceeds to the next tank, there to repeat the operation."

There is no doubt that the pneumatic process has a strong prejudice to overcome in communities long accustomed to the visible cleanliness of the water-closet system, but it certainly possesses this advantage, that it prevents the escape of sewer-gases into the houses, for during those intervals when the vacuum-power is not in operation the gases are hermetically enclosed and free from pressure in the mains and branches, and at other times flow away from the houses toward the central reservoir. The total cost of the Amsterdam works, for engineering, plant, machinery, royalties, and the requisite alterations in the houses, is stated to have been a little under £2 10*s.* per inhabitant. Mr. Scott estimates that in an English town with a population of 18,750, covering an area of 250 acres, the cost should for safety be placed at £4 per inhabitant, with a total working expense per annum of £5430, and a yearly credit from the sale of poudrette of £9375, leaving nearly £4000 annually as clear profit after deducting every charge.

The disposal of the sewage of large communities, where it cannot be safely passed into the natural water-courses, is admitted by all who have given any intelligent thought to the subject to be a most serious and vexatious question. In England large sums of money have been expended in more or less fruitless attempts at its solution. All the schemes have attached more or less manurial value to the sewage, upon which their success was predicated. After years of effort the conclusion seems to be that any method by which the sewage of large towns can be harmlessly got rid of is preferable to the best-known devices for utilizing it for fertilizing purposes. In small towns the difficulty is encountered in less unmanageable proportions, and examples are cited where the system of irrigation, as well as that of downward filtration through the soil, has been successfully applied. Artificial purification by chemicals has also been successful in some instances. The limits assigned to this article will not admit of any discussion of this branch of the sewerage question. (For further information see Baldwin Latham's *Sanitary Engineering;* George E. Waring on *The Sanitary Drainage of Houses and Towns;* William Eassie on *Healthy Houses;* J. H. Shedd's *Report on the Sewerage of Providence City.*) Q. A. GILLMORE.

**Sewers and Drains.** See SEWER, by GEN. Q. A. GILLMORE.

**Sew'ickley,** p.-b. and tp., Allegheny co., Pa., on Ohio River and Pittsburg Fort Wayne and Chicago R. R. P. of b. 1472; of tp. 443.

**Sewickley,** tp., Westmoreland co., Pa. P. 2372.

**Sew'ing-Machines.** The sewing-machine is one of the mechanical triumphs of the nineteenth century, and in its practical application to manufacturing and household purposes belongs to the last half of that century. Yet the idea of attempting by a machine to relieve woman from the "drudgery of the needle" had suggested itself to more than one of the inventors and mechanics of the eighteenth century. The first sewing-machine of whose patenting there is any record was intended rather for embroidering than plain sewing. It was patented in 1755, and had a needle with two points, and an eye at mid-length. This form of needle was called for many years a tambour-needle. In 1790, Thomas Saint invented in England a sewing-machine for "quilting, stitching, and sewing, making shoes and other articles by means of tools and machines." This machine was made mostly of wood; it had an overhanging arm, a needle-bar or needle-carrier, into which was fastened by set screws not only a vertically reciprocating straight needle, with a notch at its lower end, but a straight awl also to make the holes through which the thread was to pass. On the top of this needle-bar was a thread-spool, giving out its thread continuously; it had also an intermittent automatic feed between the stitches, and thread-tighteners above and below. It made the chain or tambour stitch—*i. e.* a loop being first made by thrusting the eye-pointed needle, armed with a thread, through the material to be sewed, the second thrust of the needle carried the bight of the thread through this loop, forming in its turn another loop through which the next thrust of the needle carried the bight of the thread to form still another loop, while the first loop was drawn up close by the descending needle. This *tambour stitch* is in use in several machines at the present day. The next machine in the order of time was Duncan's, also English, and patented in 1804. It made the tambour stitch, using for the purpose a number of hooked needles to catch the loop. About this time, and perhaps earlier, several machines were patented making the *running stitch,* usually by crimping or fluted rollers, which crimped or plaited the cloth, and then forced the needle through it horizontally. These used needlefuls of thread, and were not fed from a spool giving out its thread continuously. The next machine was an American invention, and, though not patented, was a decided advance on those which had preceded it. In 1818, Rev. John Adams Dodge of Monkton, Vt., invented and (with the assistance of John Knowles, an ingenious mechanic of the same town) constructed a sewing-machine which made the *back stitch* and sewed a perfect seam. Mr. Dodge was deterred from continuing the manufacture of the machine, and from endeavoring to introduce it to the public or securing letters patent for it, by two causes: first, the exigencies of his professional duties as pastor of two and sometimes three churches, which left him no time for other pursuits; and second, by the bitter opposition of the journeymen tailors, who denounced the machine as an invasion of their rights. There exists, however, ample evidence that it was a machine capable of doing good and practical work. Lye's machine, patented in the U. S. in 1826, exists only in name. The patent-records of that year are burned, and it is not known what were its claims or what stitch it made. The next machine was invented in France, and patented there in 1830, and, after some modifications, in the U. S. in 1850. The inventor was Barthélemy Thimonnier, and his machine is worthy of notice as having been the first, except Saint's, which came into practical use. It made the chain or tambour stitch, but of such strength that it was used near the close of Charles X.'s reign, early in 1830, for manufacturing army clothing. Eighty of these machines, made of wood, were destroyed by a mob, on the plea that they were depriving the journeymen tailors of their daily bread. Thimonnier himself escaped with his life, and again set to work. In a few years he had other machines ready, made of metal, but again they were destroyed by a mob. He died in poverty in 1857. This machine was driven by a treadle and cord. It made the chain stitch, with the successive loops on the upper surface of the cloth. It had the overhang arm, the flat cloth-plate, the vertical post, vertically reciprocated needle, the continuous thread, and a nipple sleeved upon the stem of the needle acted as a presser-foot. Between 1832 and 1834, Walter Hunt, an ingenious and highly-educated mechanic of New York City, invented, manufactured, and sold a number of sewing-machines, which were operated successfully by several persons. These machines had a curved eye-pointed needle at the end of a vibrating arm, used two threads, the lower being on a bobbin and enclosed in a shuttle, and made the *lock stitch—i. e.* a stitch in which the two threads, that from the needle and that from the shuttle, interlock by a single turn or twist as nearly as may be in the centre of the goods or fabric which is being sewn. Like many other inventors, he was improvident, and neglected to patent his inventions. In 1834 a Mr. G. A. Arrowsmith, who had seen these machines working, and who desired to introduce them into the market, purchased of Walter Hunt for a small sum two or three of the machines and the right to procure a patent and manufacture them. While the application for a patent was pending Mr. Arrowsmith became involved in pecuniary disaster, and was unable to perfect his patent. Mr. Hunt, about 1852, repurchased his invention from Arrowsmith, and applied for a patent. The commissioner of patents decided that he had made a good working machine, but held that he had forfeited his right to a patent by his neglect and the sale of his invention. In 1841, Newton & Archbold patented the eye-pointed needle in England, though it had been used certainly for eight, and possibly for more than twenty, years in this country. In 1842, J. J. Greenough patented a sewing-machine intended for leather and other heavy work. This machine had the double-pointed needle, with the eye in the

centre; the needle was preceded by an awl, which made the hole through which the needle passed, and the needle was passed through and through the material, being drawn through by pincers acting automatically on either side. It made at the option of the operator either the *back stitch* or the *shoemaker's stitch*, which went continuously forward. The needle used lengths of thread, and required refilling often. The feed was automatic and regulated by the length of stitch required, and was continuous for the length of the rack-bar of the machine, when it had to be set back. The machine was very little used. The next year (1843) the Corliss machine was invented; its general character was similar to that of Greenough's, but it used two eye-pointed needles, which reciprocated in horizontal paths through holes previously made by awls in the material fastened between clamps and fed in front of the needles. The feed was automatic, the length of the holding-clamps. The motions were derived from peculiarly-shaped cams on a revolving shaft. Except Bean's, and possibly one or two other small machines making the running stitch, there is no other machine on record as patented until 1846, when a patent was issued to Elias Howe, Jr. Howe was but an indifferent mechanic—his inventive genius was far inferior to that of Walter Hunt or Thimonnier, or many other inventors who have done much toward perfecting the sewing-machine—but he possessed great persistence and determination; and though at first the outlook was gloomy in the extreme, yet in the end fortune favored him even beyond his deserts. He first attempted to solve the problem of making a practical sewing-machine in 1843; in 1844 he claimed to have devised the eye-pointed needle and interlocking shuttle, and in May, 1845, had a machine which worked fitfully and intermittently. In Sept., 1846, he obtained his patent. As we have seen, the curved eye-pointed needle, in combination with the shuttle, had been used by Hunt eleven or twelve years before. The eye-pointed needle had been patented in England in 1841.

The original Howe machine is thus described by Dr. E. H. Knight in the *American Mechanical Dictionary*: "It had a curved eye-pointed needle attached to the end of a vibrating lever and carrying the upper thread. The shuttle carrying the lower thread between the needle and the upper thread was driven in its race by means of two strikers carried on the ends of vibrating arms worked by two cams. The cloth was suspended by pins from the edge of a thin steel rib called a baster-plate, which had holes engaged by the teeth of a small intermittingly moving pinion. This was the feed." When the machine was patented it was found to be impossible to sell it. The tailors and seamstresses all opposed it, and the few who were willing to try it found it impossible to make it work satisfactorily. Aside from the defects resulting from imperfect mechanism and badly-adjusted parts, there seems to have been some inherent difficulty in Howe's original plans for a sewing-machine. Several parties who took out licenses from him and attempted to make sewing-machines under his patent and models, though they were greatly his superiors in mechanical ability and genius, found themselves unable to make machines of any practical value. Among other difficulties, two seemed insuperable: the baster-plate did not answer any good purpose as a *feed*, and the vertical suspension of the material was both awkward and objectionable; the *tension* was not regulated, so that the machine would skip stitches, make large loops at some places, and draw the thread too tightly at others. Several eminent machinists undertook in 1848, 1849, and 1850 to produce sewing-machines which might be of more practical value. Messrs. Blodgett & Lerow made a machine which was used to a moderate extent in the manufacture of clothing, but it retained Howe's baster-plate and was otherwise imperfect; Messrs. Morey & Johnson and John Bachelder produced single-thread machines making the loop or *chain stitch*, and having new devices both for feed and tension. Bachelder's feed had a rotating-pin surface moving about a horizontal axis and carrying the material over a horizontal cloth-supporting surface. Johnson's needle-feed possessed considerable merit, and has been lately revived with some modifications. These machines were the first which attempted the *chain* or *loop stitch* in this country. In 1849, Mr. Allen B. Wilson, now the Wilson of the Wheeler & Wilson Manufacturing Co., made, and in 1850 patented, a sewing-machine with a vibrating shuttle, and containing the germ of his two-motioned feed (afterward improved and repatented as the four-motioned feed); this had a considerable sale, and was greatly superior to the Howe machine; but it did not satisfy the inventor, and was eventually abandoned. In Sept., 1850, Isaac M. Singer, an ingenious mechanic of New York City, who had interested himself in the sewing-machine experiments, and was familiar with Blodgett & Lerow's machine, made a contract to invent an improved sewing-machine and have it built for forty dollars. He accomplished this for the specified price within twelve days. His machine was found to be a practical working machine. This machine was the first which had the rigid overhanging arm to hold the vertical needle, in combination with a shuttle, and the double-acting treadle, also Mr. Singer's invention, but which he did not patent, and was the first which had proved satisfactory to manufacturers. A patent was applied for at once, but was not issued until Aug. 12, 1851. The wheel-feed was one of Mr. Singer's improvements in this patent. At about the same time Mr. William O. Grover, afterward of the firm of Grover & Baker, a skilful mechanic of Boston, was attempting the solution of the sewing-machine problem in another direction. On Feb. 11, 1851, Messrs. Grover & Baker patented a sewing-machine making what has since been known as the *double-loop* (or Grover & Baker) stitch by means of a circular under-needle reciprocating with a curved eye-pointed needle above, and doing away with the shuttle entirely. This machine was subsequently improved by a feed device invented by Mr. Grover, substantially similar to Mr. Wilson's (the four-motioned feed), Mr. Grover having at the time no knowledge of Mr. Wilson's invention; the difficulties growing out of this were compromised between the two parties. These machines were very popular, and from 1854 to 1858 took the lead of all others.

We have already spoken of Mr. Wilson's shuttle-machine, and of his dissatisfaction with it. Mr. Wilson, however, possessed what Howe lacked—a high order of inventive genius, as well as the quality of persistence which characterized Howe. He had set himself resolutely to work to produce a machine which would give satisfaction. The result was the invention and patenting (Aug. 12, 1851) of the rotating or revolving hook, which carried within its concavity a double-convex circular bobbin, and a concave ring which held it in place. This hook caught the loop from the descending eye-pointed needle, which was slightly curved, and passed it around the bobbin, thus dispensing with the shuttle. Subsequently, Mr. Wilson perfected the four-motioned feed and various other devices tending to perfect his machine. Thus, these three machines, which for many years led the market (as two of them yet do), started nearly abreast of each other in the race. The Grover & Baker machine was the first patented, but the Singer machine had been most largely manufactured after its patent was applied for, and from 1852 to 1854 made the largest sales. From 1854 to 1858 the Grover & Baker took the lead; from 1858 to 1868, the Wheeler & Wilson; and from 1868 to 1876 the Singer again took the first place in the amount of its sales. For the first five years all of these companies were greatly annoyed and embarrassed by Howe's claims. His patent had been so skilfully drawn as to include the forming of a seam by means of a curved needle and shuttle under a combination of parts and arrangement substantially the same with that described. Under this claim, which arose from the fatal *laches* of Hunt in neglecting to secure a patent for the same combination, he held several points essential to the construction of a successful sewing-machine; and, though he had never constructed one which would work, he demanded from all the manufacturers a royalty of $25 for every machine made. The demand was resisted, but one of the courts having sustained his claim, he enforced it until 1853. After long negotiations an arrangement known as the "Albany agreement" was entered into by Elias Howe, the Singer Manufacturing Co., the Wheeler & Wilson Manufacturing Co., and the Grover & Baker Manufacturing Co., by which the three parties agreed to pay a royalty of $5 to Howe on each machine manufactured by themselves, except those exported, and to exact $15 of those under license from them.* From this royalty a litigation fund of $10,000 was to be accumulated, and the remainder divided between Howe and the three companies, the licensing company receiving the larger share. This arrangement was continued till 1860 (Mr. Howe's patent having been extended for seven years in 1860). Howe applied for a second extension in 1867, although he acknowledged that he had received between $1,000,000 and $2,000,000 for his invention; but his application was denied. Under the extension Howe received but $1 on each machine, and the licensees paid $7, divided as before. For some years but few new machines were invented; the Weed (1854, and subsequently improved in 1868), the Parham (also in 1854), the Finkle & Lyon (the same year), and the Florence (1855), were the principal new-comers. These were all shuttle machines. Mr. Singer, Mr. Wilson, and Mr. Grover were all intensely active during the years 1851–60 experimenting in every direction to perfect their machines. Mr. Singer in particular seems to have gone

* This royalty of $15 included the permission to use specified patents taken out by these companies, such as the feed, form of the needle and of the shuttle, etc., as well as the fee to Mr. Howe.

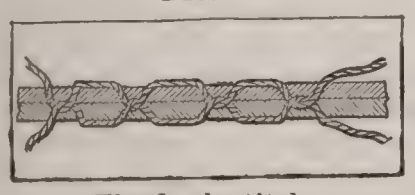
through the entire range of devices which were capable of being applied to the purpose of machine-sewing—reciprocating, vibrating, and rotating shuttles, and various forms of these, latch-takers for chain-stitch machine, feeds of all kinds, tension devices, sewing-machine attachments of all sorts, etc.

In June, 1857, Mr. James E. A. Gibbs of Millpoint, Va., took out his first patent for a machine with a rotating hook, to be used with a single thread, and making the *twisted-loop stitch*, a variety of the chain or tambour stitch which possesses much merit. This, with some additions of other devices by Mr. James Willcox of Philadelphia, and his son, Mr. Charles H. Willcox, became the Willcox & Gibbs sewing-machine, the most popular and approved of the single-thread machines. The Empire (since, we believe, consolidated with the Remington) was put upon the market about 1858, and the Slote or Elliptic, a machine having a hook with elliptic motion, involving the Wheeler & Wilson patent, and subsequently owned by them. The two Howe machines (the Elias Howe and the Amasa B. Howe) came in about the same time, and the American Button-hole and Sewing Machine Co., the Ætna, and the original Domestic under Mack's patents, between 1860 and 1864. The last five were all shuttle machines. The Beckwith machines, driven by hand or by treadle, but without stand, and one making the loop or chain stitch, and the other the double loop or Grover & Baker stitch, were first patented in 1865, and have since been considerably improved. They have a peculiar feed invented by Mr. Beckwith, and combining a smooth plate with a vibrating needle-bar. At the expiration of Howe's patent in 1867 a large number of new machines were put upon the market, but few of them now survive. The Victor (the successor, with considerable improvements, of the Finkle & Lyon machine), the Remington (consolidated with the Empire), and which, as now made, is a popular machine, are the most prominent of the new-comers. The Domestic, with its successive improvements and its easy motion, has also greatly increased its sales. The Davis machine, the Secor, Blees, and J. E. Braunsdorff's (the old Ætna revived) have been the most conspicuous of the minor machines. All of those last named are shuttle machines.

There have been two machines and two attachments for making the *button-hole stitch*—viz. the Union button-hole machine, now owned and greatly improved by the Singer Manufacturing Co., and the House or Wheeler & Wilson button-hole machine; the American button-hole and the Wheeler & Wilson button-hole attachments. As these machines are only used by manufacturers of clothing and leather goods, and from their construction are necessarily costly, the only machine now in use to any extent is the Singer Manufacturing Co.'s, which makes a very perfect and strong button-hole. The attachments are mostly employed on white goods, ladies' dresses, etc., and are in considerable demand. They do not make the circular eye of the button-hole, but have a provision for staying it at the ends, and are also useful in making the button-hole stitch used instead of a binding upon shoes and upon the scalloped edges of cloaks, dresses, etc. In all, about 2000 patents have been issued since 1846 on sewing-machines and their different parts and sewing-machine attachments.

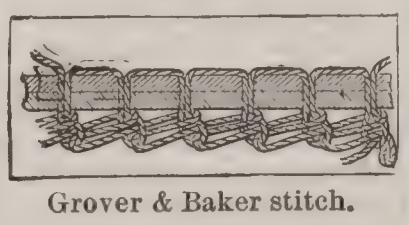
In looking back at this history of the sewing-machine enterprise, it will be seen that the best classification of sewing-machines is by the kind of stitch produced, the only machines now operated making one or other of the following stitches: the *running stitch*, now nearly abandoned; the *lock stitch*, used by not less than four-fifths of all the machines made; the *Grover & Baker or double-loop stitch*; the *twisted-loop or Willcox & Gibbs stitch*, and its congener, the *chain or loop stitch*; and, for a special purpose, the *button-hole stitch*. We give these in their order of development in this country. The *back stitch*, formerly made by the Dodge, the Greenough, and the Corliss machines, is not now made on any machine in operation. The *over-and-over stitch* is only produced on a machine used for sewing carpets by A. T. Stewart & Co. The *running stitch*, or its congener, a stitch made with a spiral eye-pointed needle and holding the thread in a groove of the spiral, is only used in sewing bags by Garland's spiral-needle sewing-machine.

FIG. 1.



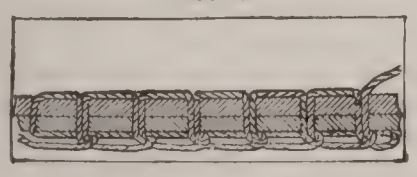
The Lock stitch.

FIG. 2.



Grover & Baker stitch.

FIG. 3.



Twisted Loop stitch.

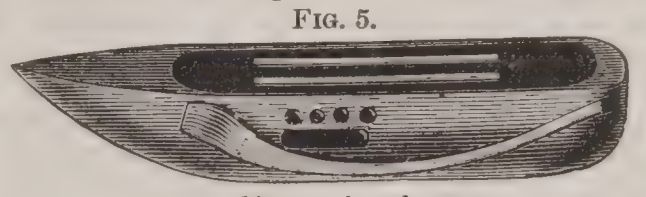
FIG. 4.



Button-hole stitch.

There remain, then (I.), the LOCK-STITCH MACHINES, which are properly divided into two sub-classes—those making the lock stitch by means of a shuttle, and those effecting the same result by a rotating or revolving hook. The first of these sub-classes is a very prolific one; it includes about thirty kinds of sewing-machines, and of the 5,680,000 machines manufactured in the last twenty years, not less than 3,500,000 were shuttle machines. Of course we have not room to describe all of this promising family, but, taking the Singer machine as the type or representative of the whole, we propose to point out in the others their several points of difference. The Singer Manufacturing Co. makes several kinds of sewing-machines, one or two for manufacturing purposes, one for family use, and a button-hole machine. They are made, of course, in all the different styles of cases or stands and of ornamental finish to satisfy different tastes, and have the various attachments which in these days are regarded as indispensable for fancy work. One thing impresses the expert on looking at the working specimens of these, as well as those of the other large sewing-machine manufacturers: there is nothing done for display; the parts are as simple as possible, and as few in number as is consistent with the objects to be accomplished; they are all made on the "assembling principle," every piece, even to the smallest screw or washer, being duplicated thousands of times, and each so exactly alike that the machine is put together by the assembling of these pieces taken at random from their hundred or more drawers or bins. Every part of the machine is and has been for years under the constant scrutiny of the most eminent machinists in the profession, and every modification which tends to make the machines more efficient, to improve their quality of running and their ease of management, has been adopted. These remarks apply not only to the Singer, but to all the machines of the larger companies. But more specifically: the Singer machines produce the lock stitch by the reciprocal action of a straight eye-pointed needle and a long and rather narrow shuttle, opening on its lower face and carrying a fixed bobbin traversing longitudinally a straight race. The machine is operated either through the treadle

FIG. 5.



Singer shuttle.

or other power by means of a horizontal and a vertical shaft, engaged with each other by the action of two bevel-wheels; a pin on the end of the rotating horizontal shaft, entering a heart-shaped groove in a block attached to the needle-bar, communicates motion to the needle-bar, while a crank at the lower end of the vertical shaft connects by a link with the shuttle-driver or carrier. Some of the manufacturing machines for heavy work have the wheel-feed invented by Mr. Singer in 1851; others, and all the family machines, the four-motioned feed of Mr. Wilson. This feed is operated through the horizontal lever actuated from the vertical shaft. The feed is adjusted through a movable fulcrum controlled by a set-screw. A take-up lever controls the thread between the tension device and the eye of the needle. The tension of the under thread is regulated by slots and holes in the shuttle. The upper tension is not professedly automatic, but has as much claim to be considered so as that of some other shuttle machines, the thread passing between two elastic disks of thin steel so arranged that they admit coarse or fine thread without changing the tension. It has its action transmitted mainly by means of cams, though in some instances there is a resort to crank movements. The Singer manufacturing machine cannot be described as noiseless, but the Family machine is as quiet as most of the shuttle machines, and is easy running. The manufacturing machine has always been a great favorite with tailors and the clothing trade. The two Howe machines, now both manufactured by the Howe company, bear a very strong general similarity to the Singer machines, but have an additional cam-movement for bringing the stitch home without a sudden jerk, thus lessening the liability of breaking the thread at that point. The Howe machines are properly manufacturing machines, and in some descriptions of manufacturing, particularly in leather-work, have no superior in the beauty and certainty of their stitching. As family machines they run too heavily and are somewhat noisy, though they do good work. The Weed machines are also of two

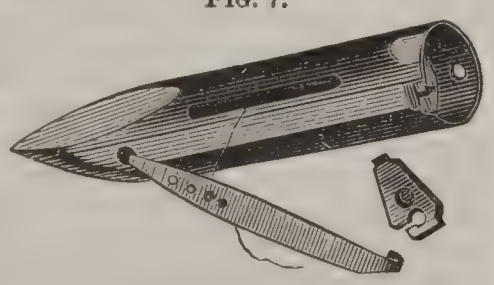
kinds—the General Favorite or manufacturing machine, and the Family Favorite. Both have been greatly improved since 1868 by inventions and changes made by Mr. G. A. Fairfield, their present superintendent. The former machine, usually styled "G. F.," is now, from recent improvements, very popular among the manufacturers of leather goods, not only for its good work, but for its quiet action, its rapidity of motion, and its durability. It has no cams and no long bearings, all the movements being by short cranks and eccentrics so arranged as to have very little wear, and that so uniform that it can be compensated by simply tightening the screws. Their family machine (F. F.) is now receiving some modifications which will doubtless improve it. The shuttle of these machines differs from that of the Singer in opening at the end to receive the bobbin; in having the bobbin loose in the shuttle; in having the lower tension pass through a large slot and under two long steel springs, instead of through holes in the shuttle, thus, it is claimed, diminishing the wear of the thread; and in having the shuttle in a cradle without motion, the only motion being that of the cradle, which reciprocates instead of the shuttle. This, it is claimed, greatly diminishes the clatter of the machine. The Remington machine, remodelled and improved from the old Empire machine, claims to have made several improvements on other shuttle machines. It dispenses with rotary cams except in moving the needle-bar, and claims, from its peculiar construction and the longer amount of revolution of its shaft, to run lighter and with less wear and noise than other shuttle machines. It also claims that its feed is positive, silent, and automatic, and that its tension is so easily and effectually controlled that it can be run at a higher rate of speed than any other shuttle machine. As to quietness of running, there is no appreciable difference between it and the Singer Family or some of the other shuttle machines. The "Domestic" sewing-machine, originally made under Mack's patents of 1863, etc. at Norwalk, O., has been greatly improved since 1870. It has a straight needle, a peculiarly-formed and very simple shuttle, which is supported at the end of a horizontally vibrating shuttle-lever, which is forked at one end to receive the ball-like end of a vertical lever which is itself vibrating from a pivot in the standard of the machine, and which is forked to embrace an eccentric on the horizontal shaft. The shuttle, like that of Weed's G. F., opens at the end, and the bobbin is loose in the shuttle. The thread passes out of the slot through two holes and under a single spring. The bobbin carries 80 to 100 yards of thread. The four-motioned feed is used, but with some adaptations which are claimed to make it more precise and powerful than most others. The upper tension has some claims to be considered as automatic. It is obtained by a spring accommodating itself perfectly to the size of the thread, maintaining a constant, equal, and regular hold, and, when once adjusted, remaining so without the least variation. From several particulars in its construction the Domestic is a light-running and not a noisy machine. The Wilson sewing-machine makes its stitch by a vertically reciprocating straight needle and a longitudinally reciprocating shuttle. The needle is moved by the action of a vibrating arm pivoted to an upright rising from the bed-plate. The lower end of the bent arm is slotted, and receives a pin projecting from a crank or disk on a short cross-shaft located directly under the upright. The shuttle-driver is connected by link with the disk or crank that actuates the needle-arm. In other respects this machine differs very little from other shuttle machines. The "Florence" machine is made under the Langdon patents. It is somewhat complicated in construction; it uses a curved needle carried by a vibrating arm or lever on a shaft which has a backward extension yoke embracing an eccentric on the main shaft. The shuttle-driver is actuated by the shaft by means of a link. The needle and shuttle have constant motion, not having periods of rest, like other machines. By an attachment to the feed-bar when the feed-bar is at a stand the machine can be made to produce a knotted stitch, of no great use. The shuttle has a latch-plate to regulate its tension and distribute the unwinding of the thread from the bobbin. Its reversible feed is regarded as one of its strong points, and its hemming attachment as another. It is said to be more easily handled than some other machines. The "Victor" (the successor of the Finkle & Lyon machine) is manufactured at Middletown, Conn. It also claims an automatic tension, but in its general construction presents few noticeable points of departure from its type, the Singer family machine.

FIG. 6.



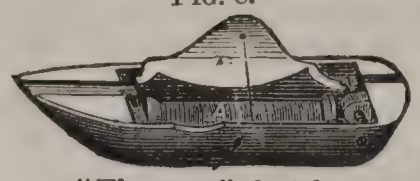
Weed shuttle.

FIG. 7.



"Domestic" shuttle.

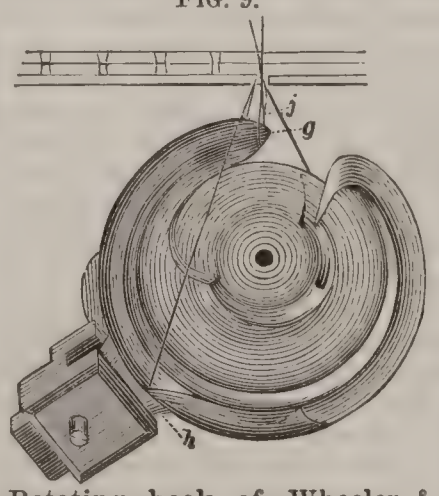
FIG. 8.



"Florence" shuttle.

We come next to the second sub-class of lock-stitch machines—those with a revolving hook instead of a shuttle—of which the Wheeler & Wilson Co.'s machines are now the only representatives. We have already spoken of Mr. Wilson's inventions, and especially of the rotating hook and the four-motioned feed. In Mr. Wheeler, Mr. Wilson found an able and energetic coadjutor, and the two partners and their associates who afterward joined them have conducted their enterprise with great ability and wonderful success. From the first they had a difficult task to perform; the traditions, such as they were, of the sewing-machine interest were all in favor of the shuttle, and have continued so to the present day; and in adhering to the rotating hook, and demonstrating by their work their ability to do all descriptions of sewing, both on heavy and light goods, in every respect equal to that done by the shuttle machines, and with no more expenditure of labor, trouble, or difficulty of working than that of other machines, they have shown what resolute and intelligent manufacturers can accomplish even under adverse influences. They have sold nearly 1,200,000 of their machines—a greater measure of success than has attended any other company except the Singer. Except a single infringement on their patents, they have had no imitators in this country in the use of the rotating hook. They now make four classes of machines: (1) The old Wheeler & Wilson machine, invented by Mr. Wilson, and improved by him at different times, a machine of great capacity for work, and, for very fine work, perhaps the best of their machines; (2) and (3) Nos. 6 and 7 machines, invented by Mr. James A. House, but including some of the devices of the old machine. These are adapted to heavy work, especially in leather and cloth goods. These machines have the straight needle instead of the curved one of the old machines; and (4) the No. 8 machine, intended for family use and light manufacturing, which is also Mr. House's invention, and carries a straight needle. The most characteristic feature of all these machines is the rotating hook and its adaptation to the other parts of the machine. We give below a cut of this hook. Dr. E. H. Knight in his *Mechanical Dictionary* gives the following description of the old machine: "It makes a lock stitch by means of a curved eye-pointed needle carried by a vibrating arm, projecting from a rock-shaft connected by link and eccentric strap with an eccentric on the rotating hook-shaft, this shaft having at its outer end the hook provided with a point adapted to enter the loop of needle-thread. As the hook *g* rotates, it passes into and draws down the loop *i* of needle-thread, which is held by means of a loop-check *h*, while the point of the hook enters a new loop *j*. Then the old loop *i* is cast off, the face of the hook being bevelled for that purpose, and is then drawn upward by the action of the hook upon the loop through which it is then passing. During the rotation of the hook each loop is passed around a disk-bobbin *k* (lying in the concavity of the hook) provided with a second thread, and serving the part of a shuttle. The four-motioned feed (Mr. Wilson's invention) is actuated by means of a cam on the hook-shaft." In the old machine the lock of the stitch is perfected while the point of the needle is in the material; there being some objection to this in some classes of fine leather goods, Mr. House has remedied it in his Nos. 6, 7, and 8 by his "independent take-up," which completes each stitch before another is begun, and while the point of the needle is out of the cloth, dispensing with the loop-check of the old machine. Other changes in the new machines are—the straight needle; the deeper concavity of the hook to allow of a larger and thicker disk-bobbin to hold more thread; the

FIG. 9.




Rotating hook of Wheeler & Wilson.

overlapping tail of the hook, which acts as a guard in keeping off the bobbin-thread while the hook enters the loop of the needle-thread; the eccentric or cam to drive the needle; and the method of giving motion to the rotating hook through the two shafts and their flanges and the differential disk. This differential disk seems to be a new departure in its method of producing a varying velocity without a long crank. The disk revolves freely in a yoke secured rigidly to the frame of the machine, and is revolved by means of two pins in the flanges of the shafts on either side of it, these flanges being set eccentrically to it, and working in slots extending from the circumference of the disk to its axis, in such a way as to give the rotary hook a very quick motion through two-thirds of its revolution, and a slower motion through the other third. There are also minor modifications in the automatic tension of the lower thread and the upper tension. A greater possible rate of speed is claimed for these machines than for the shuttle machines. An improvement in the finishing of the stands and cases by the application of a preparation for filling the pores of the wood without changing the appearance of its grain has been recently patented by Mr. Wheeler. In their preparation of specimens of work for the Centennial Exposition this company have surpassed everything heretofore attempted on the sewing-machine, and are entitled to the credit of having demonstrated its wonderful capacity in directions hitherto deemed only possible to the most skilled of hand-workers.

II. *The Double-loop or Grover & Baker Stitch.*—There are, so far as we can learn, only three machines making this stitch—viz. the Grover & Baker machines, with which it originated; the Gold Medal Machine Co.'s machine in Boston, which produces from 12,000 to 18,000 machines per year, nearly all of which are exported; and the $25 Beckwith machine, which is a hand or treadle machine, but has no stand. The Grover & Baker Co. manufacture also a shuttle machine which comes under a previous head. The Grover & Baker double loop-stitch machine uses a curved eye-pointed needle and a rotary reciprocating curved eye-pointed hook or needle, called a thread-carrying looper, which works horizontally, and thrusts its own loop through that from the descending vertical needle. The next thrust of the vertical needle puts its loop through that from the under needle or looper, thus making a strong yet elastic stitch. The needle is carried at the upper end of a ⊃-shaped arm, slotted at its lower forward end to receive an actuating pin upon a disk connected with the main shaft. The vertical looper-shaft has a spiral portion embraced by a slotted plate at the end of the ⊃-shaped arm, and as the latter vibrates it acts upon the spiral portion of the looper-shaft and imparts to it a reciprocating rotary motion. The feed is the usual four-motioned feed of the Wilson patent. Both the upper and under threads are supplied from the ordinary commercial spools, as there is no necessity for a bobbin. The double loop makes a ridge on the under side, but if the under thread is materially finer than the upper—as, for instance, the upper 60 and the under 120—the ridge is not very noticeable. The machine undoubtedly uses more thread than the lock-stitch machines or the single-loop stitch, but it makes a very strong and elastic stitch, and for some purposes, as in some descriptions of embroidery, it is well adapted. As we have already said, this machine led the others from 1854 to 1858, but of late years its sales have somewhat fallen off. The aggregate sales of the machines making this stitch to Jan., 1876, are probably somewhat more than 600,000 machines. We have been unable to learn the points of difference in construction between the Grover & Baker and the Gold Medal Co.'s machine, which makes the same stitch. The Beckwith double-loop stitch machine uses a sickle-shaped thread-carrying looper and the vibrating needle-bar and smooth plate-feed invented by Mr. Beckwith, which is a material improvement on the Johnson needle-feed. It is claimed for this that it does not injure the finest fabric, and that it avoids the danger of drawing the different folds or thicknesses of the material unequally.

III. *The Twisted Loop and Chain or Single-loop Stitches.*—The twisted-loop stitch is made by only one machine, the Willcox & Gibbs; the chain stitch, tambour, or single loop by several machines past and present. One of these was invented and patented by Mr. Singer in 1854, but is not now made; another is the Beckwith single-thread machine. The Willcox & Gibbs machine, first patented by Mr. Gibbs in 1857, and since improved and perfected by Messrs. James and Charles H. Willcox, is by far the best of the single-thread machines, and is an example of what may be accomplished by resolute and determined men of high mechanical ability when working against popular prejudices. The impressions of the great mass of buyers of sewing-machines in regard to single-thread machines were decidedly adverse to their use. To remove this prejudice, and obtain a foothold of anything like equality with other machines, was a difficult task, and one which other prominent inventors had undertaken and in which they had failed. The Willcox & Gibbs Co. attempted it by making the details of their machine as perfect as possible, producing the most silent and swift-running machine in the market—one easily learned, readily managed, and capable of executing with great facility all descriptions of ordinary work, and from its simplicity of construction not liable to get out of order. Then, availing themselves of the twist in the loop necessarily made by their method of forming the stitch, they set themselves to the task of convincing the public that the chain or twisted-loop stitch, as made by them, was strong, not liable to rip, and at the same time more elastic than other stitches in use. They have not fully succeeded, for the prejudices of men and women are strong and very difficult of removal, but they have made a gallant and protracted fight, have raised up a host of advocates for their stitch, and have sold since 1858 over 270,000 machines. They use a short, straight needle, carried by a reciprocating bar actuated by a vibrating lever, connected by link with an eccentric on the main shaft. At the forward end of the shaft is a hook of peculiar construction, which as it rotates carries the loop of needle-thread, distends and holds it expanded while the feed moves the cloth and until the needle at the next stroke descends through the loop so held. When the needle descends through the first loop, the point of the hook is again in position to catch the second loop, at which time the first loop is cast off and the second loop is drawn through it, the first loop being drawn up against the lower edge of the cloth, forming a chain. An eccentric on the main shaft, back of the rotating hook, actuates the feeding device, and gives it the usual four motions of the Wilson patent. By a succession of improvements made from 1864 to 1872, Mr. Charles H. Willcox has greatly modified this machine, giving it a really self-acting automatic tension, capable of operating without change, and entirely without any interference of the operator, on goods from the thinnest of fabrics to the bulkiest and most difficult, going forward without hesitation, drawing of material, breaking of thread, or defect of stitches. He has connected with this a graduated lever and self-register, which enables the operator to adapt the number of stitches to the inch to the fineness of the thread or silk and the grade of the needle, and fixes it there. The feed surrounds the needle, and by the addition of teeth on the throat-plate causes seams and inequalities to enter and feed through under the presser-foot at regular speed, without assistance. Another of these improvements is the "take-up," which has no moving parts and no joints, the thread itself making all the needed motions, and being kept constantly moving on the staples so as not to wear any part. Other improvements are—that the spool does not revolve, but the thread is drawn off as needed over a disk; that the provision of compensation for wear is perfect and self-adjusting; that the bearings are all globular and smoothly turned, so as to produce the least possible friction; and that while the speed can be increased to 3000 or more stitches per minute, the machine is absolutely silent. The problem of single or double thread and of loop stitch or lock stitch is still unsolved, but it would be difficult to produce a sewing-machine more perfect in all its details than the Willcox & Gibbs. The Beckwith single-loop stitch machine does not differ greatly in its principle from the Willcox & Gibbs. It has a reciprocating instead of a rotating hook or loop-taker, and is generally of very simple construction. Its feed, etc. are similar to those of the $25 machine.

FIG. 10.

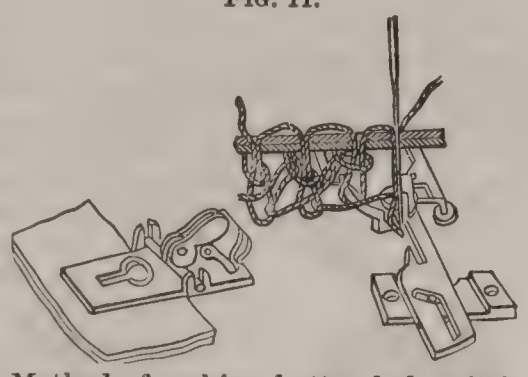


Willcox & Gibbs hook.

IV. *Button-hole Stitch.*—This specialty of sewing-machines is now represented by the Singer button-hole machine, the Wheeler & Wilson machine being nearly or quite withdrawn from the market, by the Wheeler & Wilson button-hole attachment, and the American button-hole and sewing-machine attachment. The Singer button-hole machine, a material improvement on the Union button-hole machine, which it succeeds, is a very complicated machine. For the full comprehension of its construction drawings in detail are needed, but as we have not room for them, we must give a general idea of its action without them. A hole is cut in the cloth or leather for the button-hole, having at one end the nearly circular space which is to form the eye of the button-hole; the machine uses two threads and a cord of gimp or large twist (one spool of thread and the gimp being underneath, and the other spool above). The gimp by an ingenious contrivance is put around the edge of the incipient button-hole to stay or stiffen it after the material has been placed under a dilating clamp which

spreads it; the whole is now moved under the needle, which makes a circuit of the button-hole a short distance from its edge, the needle descending alternately through the material back from the edge and then over the edge; the loop formed by the first descent is interlocked by the loop formed at the second descent, the first loop being by a skilful device brought forward and spread for this loop to enter it; and this second loop is then secured by a thread from the eye-pointed looper, which moves horizontally below. As the needle approaches the eye of the button-hole, where the stitches along the curved edge must be set thicker, a most ingenious combination of cams and slides causes the needle and the looper to turn around it and to increase their speed, the distance traversed by the cam-lever being shorter than in the other part of the button-hole. Its operation is perfect, and the button-hole thus made is much more durable than those made by hand, and the purl edge more beautiful. The button-hole attachments do not attempt to make the eye of the button-hole in this way, and in that of the Wheeler & Wilson Co. the stitching is done first, and the button-hole is cut after the stitching is completed. These attachments also make the button-hole stitch on the edges of garments, shoes, etc., which the button-hole machine cannot do. Its office is to make button-holes, and button-holes only, and this it does well. The button-hole attachments are very ingenious and useful, performing their work with great certainty and beauty, but their office is somewhat different.

FIG. 11.



Method of making button-hole stitch.

There are still other sewing-machines for special purposes—as the cylinder sewing machine, with its cylindrical work-holder, for sewing seams on sleeves, trousers, waterhose, boot-legs, leather buckets, and other tubular forms; the shoe-sewing machine, for stitching the soles of shoes; the carpet-sewing machine, for making up carpets; and the book-sewing machine, for bookbinders—but lack of space forbids our going into details concerning these.

From 1856, at which time the record of sales under license from the parties to the "Albany agreement" was commenced, to 1869, the number of sewing-machines sold was about 1,500,000, divided about as follows: Wheeler & Wilson Co., 450,000; Singer Co., 350,000; Grover & Baker Co., 235,000; Howe Machine Co., 140,000; Willcox & Gibbs S.-M. Co., 105,000; Weed S.-M. Co., 70,000; Florence S.-M. Co., 60,000; all others, 90,000. The aggregate sales to Jan. 1, 1876, are about 5,800,000 machines. The following table shows the sales of such companies as paid royalty to the associated companies during the last seven years. With the expiration of the several patents, only one or two of which are now in force, there is and will be a dropping off of the companies reporting. Some have also withdrawn from business or have been consolidated:

| Sewing-machine companies. | 1869. | 1870. | 1871. | 1872. | 1873. | 1874. | 1875. |
|---|---|---|---|---|---|---|---|
| Singer Manufacturing Company..... | 86,781 | 127,833 | 181,260 | 219,758 | 232,444 | 241,679 | 249,852 |
| Wheeler & Wilson Manufacturing Co.. | 78,866 | 83,208 | 128,526 | 174,088 | 119,190 | 92,827 | 103,740 |
| Howe S.-M. Co..... | 45,000 | 75,156 | 34,010* | est. 145,000 | est. 90,000 | est. 35,000 | est. 25,000 |
| Original Howe S.-M. Co..... | ..... | ..... | 20,051 | | | | |
| Grover & Baker S.-M. Co..... | 35,288 | 57,402 | 50,838 | 52,010 | 36,179 | est. 20,000 | est. 15,000 |
| Weed S.-M. Co..... | 19,687 | 35,002 | 39,655 | 42,444 | 21,769 | 20,495 | 21,993 |
| Willcox & Gibbs S.-M. Co..... | 17,201 | 28,890 | 30,127 | 33,639 | 15,881 | 13,710 | 14,522 |
| Wilson S.-M. Co..... | ..... | 500 | 21,153 | 22,666 | 21,247 | 17,525 | 9,508 |
| Florence S.-M. Co..... | 13,655 | 17,660 | 15,947 | 15,793 | 8,960 | 5,517 | 4,892 |
| B. P. Howe S.-M. Co..... | ..... | ..... | ..... | 14,907 | 13,919 | | |
| Domestic S.-M. Co..... | ..... | ..... | 10.397 | 49,554 | 40,114 | 22,700 | 21,452 |
| Gold Medal S.-M. Co..... | ..... | 8,912 | 13,562 | 18,897 | 16,431 | 15,214 | 14,262 |
| American Button-hole and S.-M. Co.... | 7,792 | 14,573 | 20,121 | 18,930 | 14,182 | 13,529 | 14,406 |
| Victor S.-M. Co..... | ..... | ..... | ..... | 11,901 | 7,446 | 6,292 | 6,103 |
| Finkle & Lyon Manufacturing Co..... | 2,339 | 2,420 | 7,639 | | | | |
| Remington S.-M. Co..... | ..... | ..... | ..... | 4,982 | 9,183 | 17,608 | 25,110 |
| Empire S.-M. Co..... | 8,700 | 3,560 | 2,965 | | | | |
| Davis S.-M. Co..... | ..... | ..... | 11,568 | 11,376 | 8,861 | | |
| Blees S.-M. Co..... | ..... | ..... | 4,557 | 6,053 | 3,458 | | |
| Elliptic S.-M. Co..... | ..... | ..... | 4,555 | | | | |
| J. E. Braunsdorff & Co., Ætna..... | 4,548 | 5,806 | 4,720 | 4,262 | 3,081 | 1,866 | 1,447 |
| Parham S.-M. Co..... | 1,141 | 1,766 | 2,056 | | | | |
| Bartram & Fanton S.-M. Co..... | ..... | 470 | 1,004 | 1,000 | 1,000 | 250 | |
| Bartlett Reversible S.-M. Co..... | ..... | 496 | 614 | 1,000 | | | |
| Secor S.-M. Co..... | ..... | ..... | ..... | 311 | 3,430 | 4,541 | 1,307 |
| Keystone S.-M. Co..... | ..... | ..... | ..... | 2,665 | 217 | 37 | |
| J. G. Folsom..... | ..... | ..... | 280 | | | | |
| McKay S.-M. Association..... | ..... | 129 | 218 | ..... | ..... | 128 | 161 |
| C. F. Thompson..... | ..... | 100 | 147 | | | | |
| Centennial S.-M. Co..... | ..... | ..... | ..... | ..... | 514 | | |
| Leavitt S.-M. Co..... | 771 | | | | | | |
| Union Button-hole Machine Co..... | ..... | ..... | 124 | | | | |
| Total reported..... ..... | 322,769 | 464,254 | 606,094 | 851,236 | 667,506 | 528,918 | 528,755 |

Of the companies not reporting, such as the Beckwith, Williams & Orvis, Home Shuttle, Hamilton, etc., the entire annual production probably ranged from 25,000 to 50,000 machines, not exceeding the higher amount, in any year. The production of the Beckwith in ten years has been a little more than 35,000 machines. A portion of the large annual production shown in the table has gone to foreign markets, the Singer Co. and Howe Co. having manufactories in Europe; and they, as well as the other companies, export many machines to Europe, Mexico, Central and South America, and other countries. L. P. BROCKETT.

**Sexages'ima** [Lat., "sixtieth"], in the calendar the eighth Sunday, nearly sixty days, before Easter.

**Sex'tans,** or **Sex'tant,** in astronomy, one of the constellations formed by Hevelius. It is placed across the equator and on the S. side of the ecliptic.

**Sex'tant** [Lat. *sextans*], a portable astronomical instrument, invented by Newton, and re-invented by T. Godfrey of Philadelphia in 1730, using for the measurement of an angle a graduated arc of the sixth part of a circle, and employing in its construction the following theorem of optics: If a pencil be reflected by each of two plane surfaces, the deviation of the axis of the pencil is double the inclination of the reflecting planes, supposing its course to be in one plane perpendicular to the intersection of the surfaces. To show the application of this theorem to the sextant in Fig. 1, let I be the index-glass, H the horizon-glass, S the star, S I H E the pencil of light from the star S as it suffers the two reflections at the index and horizon glasses. The star will be seen by the eye projected in the horizontal line E S′. Since $SIr = rIH$ by the law of reflection of light,

$$\therefore SIa = HIA;$$
$$\therefore EIA = HIA.$$

In a similar manner $EHA = PHA$,

$$HEI + AIE = AHE + IAH,$$
$$HEI + HIA = PHA + IAH,$$
$$= HIA + 2IAH;$$
$$\therefore HEI = 2IAH.$$

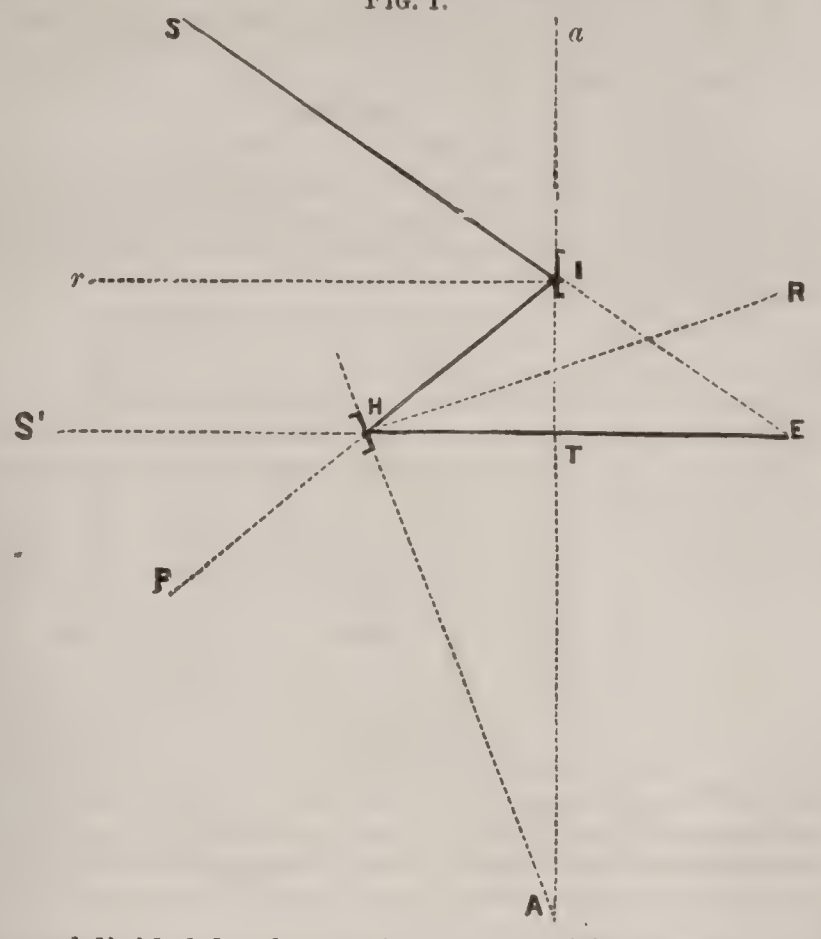
But H E I is the deviation of the pencil produced by the double reflection, and we see this angle is twice the angle of the inclination of the mirrors. So long as the line of sight E S′ is directed to any fixed point the angular distance to any other point may be determined by the revolution of the mirror at I; the angle through which this mirror is moved may be indicated by the revolution of the line *a* A, which carries at some part of it an index sweeping over a graduated arc, which is graduated to twice as many degrees as it measures in its own circumference.

The following description of the instrument is taken from Chauvenet's *Astronomy*, vol. ii. art. 81: Fig. 2 represents the most common form of the sextant constructed upon these principles. The frame is of brass, constructed so as to combine strength with lightness; the graduated arc, in-

* Six months.

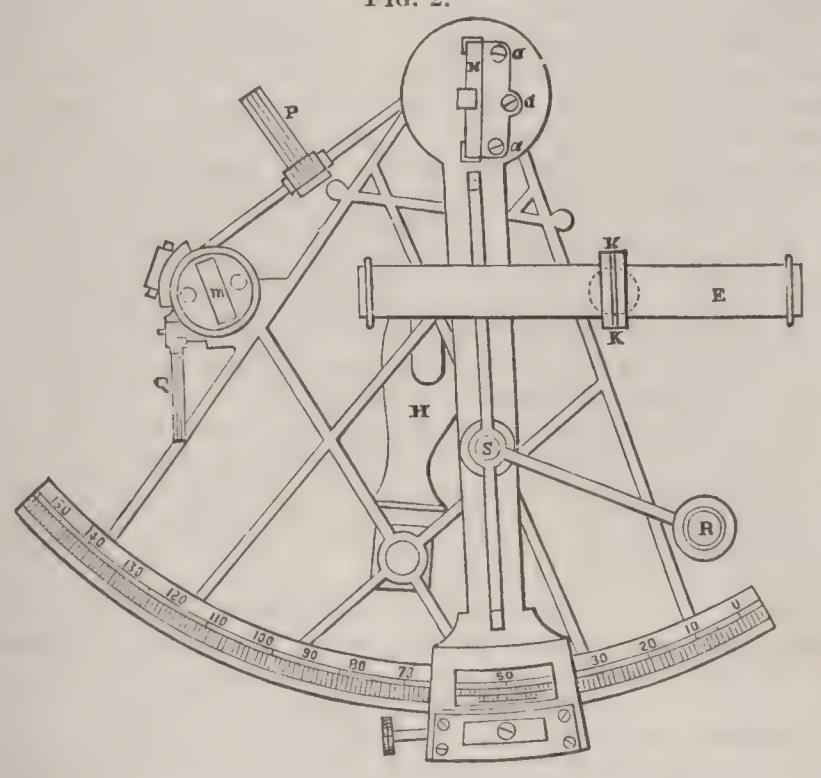
laid in the brass, is usually of silver, sometimes of gold or platinum. The divisions of the arc are usually 10′ each, which

FIG. 1.




are subdivided by the vernier to 10″. The handle H, by which it is held in the hand, is of wood. The mirrors M and *m* are of plate glass, silvered. The upper half of the

FIG. 2.




glass *m* is left without silvering, in order that the direct rays from a distant object may not be intercepted. To give greater distinctness to the images, a small telescope E is placed in the line of sight *m* E. It is supported in a ring K K, which can be moved by means of a screw in a direction at right angles to the plane of the sextant, whereby the axis of the telescope can be directed either toward the silvered or the transparent part of the mirror. This motion changes the plane of reflection, which, however, remains always parallel to the plane of the sextant, the use of the motion being merely to regulate the relative brightness of the direct and reflected images. The vernier is read with the aid of a glass R attached to an arm which turns upon a pivot S, and is carried upon the index-bar. The index-glass M, or central mirror, is secured in a brass frame, which is firmly attached to the head of the index-bar by screws, *a*, *a*, *a*. This glass is generally set perpendicular to the plane of the sextant by the maker, and there are no adjusting screws connected with it. The fixed mirror *m* is usually called the horizon-glass, being that through which the horizon is observed in taking altitudes. It is usually provided with screws, by which its position with respect to the plane of the sextant may be rectified. At P and Q are colored glasses of different shades, which may be used separately or in combination, to defend the eye from the intense light of the sun.

In a theoretically perfect sextant the four faces of the index and horizon glasses are plane and perpendicular to the sextant-plane; the two faces both of the index and of the horizon glass must be parallel to each other. The axis of the telescope must be parallel to the sextant-plane. The arc of the sextant should be accurately centred. The following methods may be used to test and make the above adjustments: (1) To adjust the index-glass, bring the vernier near the centre of the arc. Hold the sextant with its face up and the arc away from you. Look into the index-glass, and the arc to the right of the vernier will be seen reflected, and the arc to the left will be seen direct. If these two arcs are apparently continuous parts of the same circle, the index-glass is in adjustment, but if the reflected arc is lower than the true, turn the small adjusting-screw to the back of the index-glass *inward*; if higher, turn it *outward*. This adjustment is performed by the makers by filing down one of the metallic points against which the glass bears when secured in its frame. (2) To adjust the horizon-glass, screw the telescope into its collar, and observe whether the direct and the reflected image of a star, preferably of about the third magnitude, can be made to coincide by moving the index-arm; if so, the adjustment is made: if not, cause the two images to coincide by altering the proper screws of the horizon-glass. Another method is to observe whether the direct and reflected images of the sea-horizon are continuous when the plane of the sextant is vertical, and then whether they remain so when the sextant-plane is inclined to the horizon. (3) To adjust the telescope axis, make two of the lines in the focus of the eyepiece parallel to the plane of the sextant. Select two objects over 90° apart, and bring their images into contact on the wire nearest the sextant-plane. Move the sextant very slightly, so they may be brought to the other wire. If both images still remain in contact, the adjustment is made; but if they separate, the object-glass end of the telescope is inclined to the sextant-plane. Make the necessary adjustment by means of the two small screws in the collar which carries the telescope.

It is but seldom that the zero of the vernier and the zero of the arc coincide when the horizon and index glasses are parallel to each other. The index and horizon glasses may be so adjusted that this will be the case, but the instability of this adjustment makes it a better plan to determine the reading-arc when these two glasses are parallel, and apply this reading as a correction to an observed angle. We can determine whether the two surfaces of the index-glass are plane and parallel by examining the reflected image of a star when the vernier is set to about 120°. The image of the star will be distorted and indistinct. There are no means of adjusting this error outside of the instrument-shop. We may determine its amount by measuring a large angle after having made the other adjustments very carefully, and then remeasuring the same angle after having turned the index-glass so that the end which was before toward the vernier is now away from it, and carefully re-adjusting the instrument. Half the difference of the two measures will be the error of a single measure at that angle. It may be determined in the same manner for a number of angles, and hence for any particular angle, by interpolation. Should the two surfaces of the horizon-glass be inclined to each other, all angles will be affected alike, the index error included. We may determine whether the instrument is properly centred by measuring a number of known angles with the sextant, and comparing the observed with the true results. These angles may be terrestrial and determined by a theodolite, or the angular distances between two heavenly bodies at any given time computed from their right ascensions and declinations. This error is called the error of eccentricity.

In the following description of the methods of observation we shall assume that the amount of the errors arising from eccentricity, want of parallelism between the surfaces of the index-glass, the inclination of the telescope axis, and the inclinations of the horizon and index glasses respectively to the plane of the sextant, are all either zero, or else have been determined.

*To measure the Altitude of a Heavenly Body.*—When at sea, mariners use the sea-horizon. The telescope is directed toward the horizon, the index is swung forward until the image of the heavenly body, seen by reflection from the horizon-glass, is brought into contact with the horizon, seen directly. The exact instant of time when this contact takes place is noted, and this constitutes a single observation. When the sun is observed, a number of observations are taken, preferably half with the lower limb of the sun brought tangent to the horizon, and the other half with the upper limb of the sun brought tangent to the horizon. If these observations are all comprised within a few minutes of time, it is sufficiently accurate to consider the mean of the observed altitudes as being the observed altitude of the sun's centre at the mean of the times. The index error should be the mean of a number of contacts of the sun's limbs taken first on one side, and then causing the reflected image to move across the direct image, and noting the sextant reading with the contact of the sun's limbs in this po-

sition. For convenience, the graduation of the sextant may be supposed to commence 5° beyond the 0° mark. Thus, what would ordinarily be read as *minus* 1°, can be read as *plus* 4°. This point will be illustrated subsequently. To observe an altitude on land, however, an artificial horizon must be substituted for the sea. Various forms have been suggested to obtain a truly horizontal surface. One artificial horizon consists of a plate of glass, darkened and having its upper surface ground truly plane. It is supported on three delicate screws, and is levelled by a sensitive level placed on the upper surface of the glass. An addition to this form of apparatus consists of a graduated arc by which it may be inclined to an angle with the horizon, and thus larger angles may be observed than with the ordinary sextant and horizon. This form, however, does not seem to meet with much favor among observers. A modification of this method consists in floating the glass plate upon mercury; but by far the best method, and the one almost universally employed, is to use a surface of mercury direct in some such contrivance as shown in Fig. 3, where *f g h i* represents a wooden trough about four inches long and three wide, so constructed that a funnel being screwed into an aperture at *h*, and mercury being admitted, the mercury flows through a narrow channel till it comes to the outlet at *i*, when it rises and overflows the bottom of the shallow basin *k i l*. The object in sending it through the funnel at *h* and the channel *h i* is to get rid of the oxide of mercury, which clouds the surface after standing in an ordinary bottle for some time. This scum is left in the funnel, and the surface is left clean and bright at *k i l*. Owing to its extreme sensitiveness, a slight current of air or tremor of any kind renders observation extremely difficult. Currents of air are guarded against by the cover *a b c d e*, which consists of a frame holding two windows of plane glass at *b c* and *c d*. This form of horizon cannot be used where there is the least tremor; but if, instead of using the wooden trough above described, we form a vessel of flat copper turned up at the edges to about one-eighth of an inch, and then amalgamate the copper vessel by the friction of mercury with water and rotten-stone, and then carefully wash with an abundance of water and dry it by means of a piece of very clean linen, and pour mercury into such a vessel until it overflows, we may skim off all impurities, and have left a brilliant surface which is particularly stable. The quantity of mercury in this case need not be more than a fourth as much as in the ordinary artificial horizon. To an observed altitude of the sun or moon at sea the following corrections must be applied, which will be illustrated in their order: (1) index error, which may be positive or negative; (2) dip of the horizon, which is always negative; (3) refraction, which is also negative; (4) semi-diameter of the body observed, which may be positive or negative; (5) parallax, which is always positive. The *index error* was determined at the time of the observation. Suppose the following observations had been taken by placing the limbs of the sun as shown in the two following figures, where Fig. 4

FIG. 3.

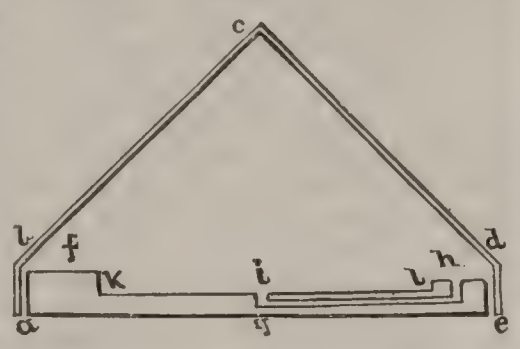
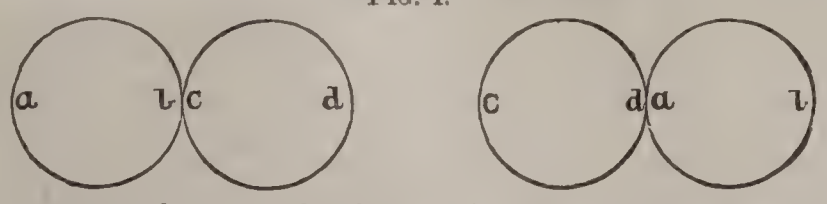



FIG. 4.




represents the two solar images in contact in the first instance, and Fig. 5 represents the same images after the vernier has been moved so as to bring the opposite edges in contact. We thus virtually measure the sun's diameter *on* and *off* the arc, and the mean of the two readings will be the reading of the sextant when the horizon and index glasses are parallel.

Suppose the reading to be in Fig. 4 = 360° 29′ 40″
" " " " " " 5 = 359° 25′ 50″
Mean = 359° 57′ 45″

Consequently the index correction will be + 2′ 15″. The advantage of this method is that it does away with the use of the computed semi-diameter of the sun, and the observations are symmetrical. The index error may be determined by noting the reading of the sextant when the direct and reflected images of any distant, well-defined point are made to coincide in the field of view of the telescope. The correction for dip of the horizon is necessary, because, as the observer at sea is elevated some feet above the surface of the water, the distant horizon is projected to a lower point on the celestial sphere. It may be computed by the following formula, where

$d$ = dip in minutes of arc;
$h$ = height of observer's eye above the level of the sea;

$$d = \sqrt{h} \times 3437.75 \times \sqrt{\frac{2}{20888761.5}},$$

$$= 1.064\sqrt{h}, \text{ very nearly.}$$

Expressed in a convenient rule, the dip in minutes very nearly equals the square root of the height of the eye in feet. The following table gives its amount for various heights in feet:

| Height. | Dip. | Height. | Dip. | Height. | Dip. | Height. | Dip. | Height. | Dip. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0′ 59″ | 10 | 3′ 3″ | 19 | 4′ 13″ | 28 | 5′ 2″ | 65 | 7′ 48″ |
| 2 | 1 22 | 11 | 3 12 | 20 | 4 20 | 29 | 5 13 | 70 | 8 06 |
| 3 | 1 40 | 12 | 3 21 | 21 | 4 26 | 30 | 5 18 | 75 | 8 23 |
| 4 | 1 56 | 13 | 3 29 | 22 | 4 32 | 35 | 5 43 | 80 | 8 39 |
| 5 | 2 10 | 14 | 3 37 | 23 | 4 39 | 40 | 6 07 | 85 | 8 55 |
| 6 | 2 21 | 15 | 3 45 | 24 | 4 45 | 45 | 6 29 | 90 | 9 11 |
| 7 | 2 33 | 16 | 3 52 | 25 | 4 51 | 50 | 6 51 | 95 | 9 26 |
| 8 | 2 43 | 17 | 3 59 | 26 | 4 56 | 55 | 7 11 | 100 | 9 41 |
| 9 | 2 54 | 18 | 4 06 | 27 | 5 02 | 60 | 7 30 | 110 | 10 09 |

The correction for refraction presents too intricate a problem to be followed out in the limits of this article. Usually, the mean refraction is sufficient for the accuracy of sextant-work, and this may be taken directly for any given altitude from some table. The following is an approximate formula for the mean refraction at the sea-level:

$$r = 57.''538 \tan. z;$$

where $z$ = zenith distance of the observed body.

The correction for semi-diameter is the addition of the semi-diameter of the body observed to the observed altitude of its lower limb, or its subtraction from the observed altitude of its upper limb to obtain the altitude of its centre. In the case of the sun it is better to observe a certain number of altitudes of the lower limb and the number of the upper limb. The means will then give the altitudes of the centre of the sun, providing the lower and upper limbs have been observed alternately.

*The Correction for Parallax.*—Since all astronomical observations are referred to the centre of the earth, an altitude observed from its surface will be less than the true altitude until the body reaches the zenith, when its displacement as seen projected on the celestial sphere is zero. This correction becomes insensible in the case of the fixed stars. It may amount to about 9″ in the case of the sun, to about 19″ in the case of Mars, and to about 2″ in the case of Jupiter. In the case of the moon it is a large and varying quantity. The following table shows its amount at various altitudes of the sun:

| Altitude ..... | ° 0 | ° 12 | ° 15 | ° 30 | ° 33 | ° 39 | ° 42 | ° 48 | ° 51 | ° 57 | ° 60 | ° 66 | ° 69 | ° 72 | ° 75 | ° 78 | ° 81 | ° 84 | ° 90 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| Parallax ..... | 9 | 9 | 8 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 4 | 4 | 3 | 3 | 2 | 2 | 1 | 1 | 0 |

Of the above corrections, those for dip of the horizon, semi-diameter, and parallax vanish in the case of a star observed on land and with an artificial horizon. The true altitude of the observed object is obtained by summarizing the above corrections and applying the result to the observed reading of the sextant. It is to be observed that a source of error sometimes exists in the dark glasses used to modify the sun's light. Should such an error exist, it may be eliminated by making half of the observations with the shade-glasses in one position, and the other half with the shade-glasses reversed in their supports. It is, in fact, a common precaution with the best observers to make half the observations with the shade-glasses and artificial horizon-roof in one position, and the remaining half with both reversed.

Mounted on a stand, and all the errors carefully estimated, the sextant gives results much more accurate than is commonly supposed. Thus, Prof. William Harkness from the discussion of 930 observed altitudes of the sun adopts as the probable error of the mean of a set of six altitudes of the sun, ± 3.″00. He also finds that the weights to be given to a series of observations sustain the following relations to the number of observations in each series:

| No. of observations. | Weight. | No. of observations. | Weight. |
|---|---|---|---|
| 1 | 1.00 | 8 | 2.91 |
| 2 | 1.60 | 16 | 3.37 |
| 4 | 2.29 | 100 | 3.88 |

The prismatic sextant by Pistor and Martin by the arrangement of prism is enabled to measure angles up to

180°. Its adjustments are the same as those of the ordinary sextant. The box sextant is merely a miniature one.

For a discussion of the sextant generally see Wm. Chauvenet, *Manual of Practical and Spherical Astronomy* (Philadelphia, 1874); Dr. C. M. Bauernfeind, *Elemente der Vermessungskunde* (Munich, 1872); Merrifield and Evers, *Navigation and Nautical Astronomy* (London, 1868); E. Loomis, *Practical Astronomy* (New York, 1855). For special problems and capacity of the sextant for scientific purposes see *Monthly Notices R. A. S.*, 1853, January; 1873, November; *Washington Astron. Obs.*, 1867, App. ii.; 1869, App. i.; *Pogg. Ann.*, vol. lxxix. p. 136; *Astron. Nach.*, vol. vii. p. 262; vol. xxiii. p. 321. LEONARD WALDO.

**Sex'tus Empir'icus,** a Pyrrhonic or skeptical philosopher, flourished in the first half of the third century A. D. Beyond the facts that he was an African and a physician of the empirical—or, as he preferred to say, the methodical—school, nothing is known of his personal history. He is known chiefly as the author of three works, setting forth, in principle and detail, the skeptical, or, as we should say, critical philosophy: (1) *Institutiones Pyrrhonianæ* (Πυῤῥώνειαι Ὑποτυπώσεις), dealing with the principles of skepticism; (2) a work on philosophy in its three divisions, of which two books, entitled Περὶ Φιλοσοφίας, are devoted to logic, two to physics, and one to ethics; (3) *Against the Mathematicians* (Πρὸς τοὺς ἀπὸ τῶν μαθημάτων Ἀντίῤῥησις), in six books, devoted respectively to grammar, rhetoric, geometry, arithmetic, astronomy, and music. Sextus undertook to prove that there is no criterion of truth either in the subject man, or in his faculties of apprehension, or in his mode of apprehension (κριτήριον ὑφ' οὗ, δι' οὗ, καθ' ὅ). He argued, further, that even if we had a criterion, it would be of no use unless we were sure that there existed truth to which it could be applied. And even if this were admitted, he said, it would be of no use, inasmuch as we should not know whether to look for it in that which appears or in that which is hid. Even if we knew this, by what sign or mark, he asks, should we know the truth? As there is no such sign, there is, of course, no proof and nothing certain. All that men can reach is a certain amount of probability, derivable from the observation of phenomena, and sufficient to enable us to conduct life and attain that calm (ἀταραξία) which the mind naturally craves. Sextus might be called the Hume of ancient philosophy. He differs from Hume, however, in this, that he regards our notions and concepts objectively, not psychologically. He deals with the notions themselves, not with their mode of production. (*Works* edited by Fabricius (Leipsic, 1718; reprinted, 2 vols. 8vo, 1842), by Bekker (Berlin, 1842). Cf. McColl, *The Greek Sceptics* (London and Cambridge, 1869).) THOMAS DAVIDSON.

**Sey'bert** (ADAM), M. D., b. at Philadelphia, Pa., in 1773; went to Europe 1793; studied at London, Edinburgh, Paris, and Göttingen, giving special attention to chemistry and mineralogy; was member of Congress 1809–15 and 1817–19; visited Europe 1819, and again 1824, and d. at Paris May 2, 1825. Author of scientific papers *On Putrefaction of the Blood* (1793) and *Experiments and Observations on Land and Sea Air*, and *On the Atmosphere of Marshes* (in *Philos. Trans.*, iv.) and of *The Statistical Annals of the U. S.* (1818)—a work which gave occasion to the famous article (*Edinburgh Review*, Jan., 1820) in which Sydney Smith asked, "Who reads an American book?"

**Seychelles',** a group of thirty small islands in the Indian Ocean, between lat. 3° 30′ and 5° 45′ S., and between lon. 55° 20′ and 56° 20′ E., belonging to Great Britain. They are rocky and high, but very fertile and covered with a luxuriant vegetation, especially of palms. Cotton is cultivated with some success. The largest is Mahé, 16 miles long and 4 miles broad. The Seychelles Islands were discovered by the Portuguese early in the sixteenth century; they were first settled by the French in 1756, and became an English possession in 1794.

**Seychelles Cocoanut,** the double cocoanut, the fruit of *Lodoicea Seychellarum*, a noble palm tree, now becoming rare in its native islands. The Orientals ascribe great and mysterious virtues to this curious nut, and in mediæval Europe it was sold for fabulous prices. The ancients believed that it grew at the sea-bottom. Practically, it is far less valuable than the true cocoanut.

**Seyf'farth** (GUSTAV), PH. D., D. D., b. at Uebigau, Saxony, July 13, 1796; was educated at Leipsic University, where he was professor of archæology from 1825 to 1855; professor in a Lutheran seminary at St. Louis, Mo., 1855–71, and afterward took up his residence in New York City. Author of numerous works in German and Latin upon theology, Oriental philology, mythology, history, and chronology, chiefly notable for their extreme advocacy of the literal school of biblical interpretation and their entire rejection of the system and results of the Egyptian researches of Champollion and Bunsen.

**Sey'mour,** p.-v., New Haven co., Conn., on Naugatuck River and R. R., 10 miles N. W. of New Haven, has 4 churches, a public library, 1 newspaper, 3 hotels, and paper, rubber, woollen, cutlery, pin, and nail factories, run by water-power from the falls of Naugatuck, Bladen, and Little rivers. P. 2122. W. C. SHARPE, ED. "RECORD."

**Seymour,** p.-v., Jackson co., Ind., at the junction of Ohio and Mississippi and Louisville and Indianapolis R. Rs., 59 miles S. of the latter place, contains 9 churches, good schools, 1 bank, 3 newspapers, spoke and cradle factory, a rolling-mill, 1 woollen-factory, foundry, a carriage-factory, and 3 planing-mills. P. 2372.
A. A. DAVISON, ED. "DEMOCRAT."

**Seymour,** p.-v., Wayne co., Ia., on South-western R. R., has 3 churches, excellent schools, 1 newspaper, 1 bank, 2 hotels, 1 steam-mill, and a coal-shaft. P. about 750.
C. W. BOLSTER, ED "REPORTER."

**Seymour,** tp., La Fayette co., Wis. P. 419.

**Seymour,** p.-v. and tp., Outagamie co., Wis. P. 251.

**Seymour** (EDWARD), duke of Somerset. See SOMERSET, DUKE OF.

**Seymour** (GEORGE FOX), b. in New York City in 1829; graduated at Columbia College in 1850 and from the General Theological Seminary in 1854; had charge of a mission-station at Dobbs Ferry for six years; became first head of St. Stephen's College, Annandale, 1860, and in 1861 rector of St. Mary's church, Manhattanville, N. Y.; in 1863 went to St. John's church, Brooklyn, N. Y., and while there was in 1865 elected professor of ecclesiastical history in the General Theological Seminary. The following year he resigned the rectorship of St. John's; in 1874 was chosen bishop of the diocese of Illinois, but the General Convention refused to confirm him; in 1875 elected dean of the General Theological Seminary. J. B. BISHOP.

**Seymour** (Sir GEORGE HAMILTON), grandson of the first marquis of Hertford, b. in England in 1797; graduated at Merton College, Oxford; entered the diplomatic service 1817; served as secretary of legation at Frankfort, Berlin, and Constantinople; became minister at Florence 1830, envoy at Brussels 1835, at Lisbon 1846, and at St. Petersburg 1851; was approached by the czar Nicholas with proposals to England for the partition of Turkey 1853—a scheme which resulted in the Crimean war; was recalled on the proclamation of that war, Mar., 1854; made envoy to Vienna Dec., 1855, and retired from the service on a pension Mar., 1858.—His cousin, Sir GEORGE FRANCIS (1787–1870), was a distinguished admiral.

**Seymour** (HORATIO), LL.D., b. at Litchfield, Conn., May 31, 1778; graduated at Yale College 1797; studied law under Judge Gould at Litchfield; settled at Middlebury, Vt., 1799; was a member of the executive council of Vermont 1809–17; U. S. Senator 1821–33; was Whig candidate for governor 1836, and became judge of probate 1847. D. at Middlebury Nov. 21, 1857.

**Seymour** (HORATIO), LL.D., nephew of Senator Horatio, b. at Pompey, Onondaga co., N. Y., May 31, 1810; removed in childhood to Utica; studied at Oxford and Geneva academies, N. Y., and at Partridge's Military Institute, Middletown, Conn.; was admitted to the bar at Utica 1832, but soon withdrew from its practice to devote himself to the management of the large estate he inherited by the death of his father; was a member of the staff of Gov. Marcy 1833–39; was elected to the State assembly as a Democrat 1841, and three times re-elected, serving as Speaker in 1845; was chosen mayor of Utica 1842; was an unsuccessful candidate for governor 1850; was governor 1853–55; vetoed a prohibitory liquor law Mar., 1854; was defeated in the election of that year by the prohibitionist candidate, Myron H. Clark; was again elected governor as a War Democrat 1862; aided in suppressing the riots in New York City, and forwarded efficient co-operation to the national government in the war for the Union; was defeated in the election of 1864, in which year he presided over the national Democratic convention at Chicago, as he did again at New York 1868, when he was himself nominated for the Presidency much against his will, and received 80 electoral votes. He resides at Deerfield, near Utica, and is president (1876) of the National Dairymen's Association and of the American Prison Association.

**Seymour** (Lady JANE), third queen of Henry VIII., sister of Protector Somerset, and daughter of Sir John Seymour, b. in England about 1510; became maid of honor to Queen Anne Boleyn; married Henry May 20, 1536, the day after the execution of Anne, and d. shortly after giving birth to a prince (Edward VI.) Oct. 24, 1537. She was chiefly notable for her sympathy with the Protestant Reform.

**Seymour** (Michael Hobart), b. in Ireland in 1802; graduated at Trinity College, Dublin, 1825; took orders in the Church of England; held several curacies in Ireland; distinguished himself in the pulpit and on the platform as a controversialist against Roman Catholicism, and officiated many years as afternoon and evening lecturer at Blackfriars and Southwark, London. D. June 19, 1874. Author of several effective works upon Roman Catholicism, of which the best known was *Mornings among the Jesuits at Rome* (1849).

**Seymour** (Thomas), Baron Seymour of Sudeley, brother of the Protector Somerset, b. in England about 1505; was ennobled and made grand admiral of England Jan., 1547; privately married Catharine Parr, widow of Henry VIII., the same year; was given the custody of the princess Elizabeth and of Lady Jane Grey; projected a marriage with the former 1548; intrigued against his brother, the Protector; was accused of treason; refused to obey a summons to appear before the council; was committed to the Tower Jan. 19, 1549; was shortly after attainted, and beheaded Mar. 20, 1549.

**Seymour** (Thomas Hart), b. at Hartford, Conn., in 1808; educated at Partridge's Military Academy at Middletown; became a lawyer at Hartford, and editor of the *Jeffersonian* (1837), a Democratic newspaper; was some time judge of probate; sat in Congress 1843–45; served in the Mexican war as major of the 9th regiment; became lieutenant-colonel Aug. 12, 1847; commanded the 9th Infantry after the death of Colonel Ransom at Molino del Rey; was brevetted colonel for services at Chapultepec Sept. 13, 1847; was governor of Connecticut 1850–53, and minister to Russia 1853–57. D. at Hartford Sept. 3, 1868.

**Seymour** (Truman), b. at Burlington, Vt., Sept. 24, 1824; graduated at West Point 1846; entered the 1st Artillery; was brevetted lieutenant and captain for gallantry in the Mexican war; was professor at West Point 1850–53; served under Maj. Anderson at Fort Sumter Apr., 1861; became chief of artillery of McCall's division in the Army of the Potomac Mar., 1862; was commissioned brigadier-general of volunteers Apr. 28, 1862; was distinguished in the Virginia and Maryland campaigns; was severely wounded at Fort Wagner July 18, 1863; commanded an expedition to Florida Feb., 1864; was taken prisoner at the Wilderness; commanded a division in the Shenandoah Valley Oct., 1864, and became major-general 1865.

**Seyne, La,** town of France, department of Var, opposite Toulon, has a good harbor and carries on considerable fishing and shipbuilding. P. 11,700.

**Sez'ze** [anc. *Setia*], town of Italy, province of Rome, on a hill overlooking extensive marshes toward the W. The remains of a triple cyclopean wall prove its great antiquity, if they do not confirm the tradition that it was founded by Hercules—a tradition still preserved in the municipal arms in the figure of a lion. The foundations of many ancient temples of great extent may still be seen. The present walls are from the time of the Lower Empire; the mediæval history of the town is closely connected with the fierce feuds of the great Roman houses. The wines of Sezze have always had a good reputation, and the traffic of the place is now confined to this and other agricultural products of the vicinity. Both the costume and the dialect of the inhabitants still retain some striking peculiarities. P. 9367.

**Sforz'a,** the name of an Italian family which ruled Milan as a dukedom in the fifteenth and sixteenth centuries and exercised considerable influence on the politics of Italy by their ambition, which was generally accompanied with violence and faithlessness, and by their talent, which was not always accompanied with education, though several members showed interest for and gave much protection to science, poetry, and art. The founder of the family was (1) Giacomuzzo Attendolo, a peasant-boy from Cotignola in the Romagna, b. 1369. He distinguished himself by his bodily strength, and received the surname *Sforza*, "the forcer;" became chief of a band of condottieri, and entered the service of Queen Joanna II. of Naples, who made him grand constable; served afterward Pope Martin V., who made him a count, and d. in 1424.—(2) His son, Francesco, b. in 1401, was chief of a large troop of mercenaries, and served the highest bidder. He invented a new tactical trick which made his troop very effective in battle; entered the service of Visconti, duke of Milan, and was very successful in his undertakings; received Visconti's daughter, Bianca, in marriage, and Cremona as her dowry; took Ancona from the pope, and began to settle down in fixed purposes. In 1447, Visconti died without any male heirs, and Milan instituted a republican government. But in 1450, Francesco seized the ducal crown, defeated his adversaries both in Milan and among the other states in Northern Italy, reigned well, and d. in 1466, much beloved by his subjects.—(3) His son, Galeazzo Maria, b. in 1444, was a monster of debauchery and ferocity, and was assassinated in 1476.—(4) He was followed by his son, Giovanni Galeazzo, b. in 1468, during whose minority the government was carried on by his mother, Bona of Savoy.—(5) But in 1470, Ludovico the Moor, a brother of Galeazzo Maria, b. in 1451, banished Bona and assumed the regency, and in 1494 he poisoned his nephew and ascended the ducal throne himself. As Galeazzo Maria was married to a Neapolitan princess, Naples remonstrated very seriously against the usurpation, and in order to avert the impending danger Ludovico induced Charles VIII. of France to assert his claims on Naples. But the success of the French alarmed him more than the threats of Naples, and he now formed a league between all the North Italian states against France. To punish him, Louis XII. invaded his country, which he claimed as a grandson of Valentina Visconti, captured him in 1500, and confined him in the castle of Loches in the present department of Indre-et-Loire, where he d. in 1510. —(6) His son, Massimiliano, b. in 1491, was made duke in 1512 by the Holy League, but expelled by the French in 1513; reinstated in the same year by Charles V. after the battle of Novara, but was again driven out by Francis I. after the battle of Marignano, and finally sold his claims to the dukedom to France for a pension.—(7) His brother, Francesco II., b. in 1492, was made duke of Milan by Charles V. in 1522 after the battle of Pavia, and at his death (Oct. 24, 1535), he being the last representative of the main line of the house, the country was incorporated with Austria. Collateral branches of the family, the counts of Santa Fiora and the dukes of Sforza-Cesarini, are still flourishing in Italy.

**'S Gravesan'de, van** (Willem Jakob), b. at Herzogenbusch (Bois-le-Duc), Holland, Sept. 27, 1688; studied first law, then mathematics, physics, and philosophy at Leyden and Leipsic; edited 1714–22 the *Journal Littéraire*, and attracted much attention by both his mathematical and his philosophical essays, and was appointed professor, first of mathematics and astronomy in 1717, then of philosophy in 1734, at the University of Leyden, where he d. Feb. 28, 1742. His principal works are *Physices Elementa Mathematica* (1720), *Philosophiæ Newtonianæ Institutiones* (1723), *Introductio ad Philosophiam* (1736); his *Œuvres philosophiques et mathématiques* were published in 2 vols. in 1774.

**Shabbo'na,** tp., De Kalb co., Ill. P. 1205.

**Shabonier,** p.-v., Kaskaskia tp., Fayette co., Ill., on Illinois Central R. R. P. 143.

**Shackle'ford,** county of N. W. Texas, on Clear fork of Brazos River, has a rolling surface and a productive soil. Cap. Fort Griffin. Area, about 500 sq. m. P. 455.

**Shad** [Ger. *Schade*], a name applied to several species of the family Clupeidæ, agreeing in the possession of an oblong-fusiform and rather high and compressed body, with trenchant and serrated belly, the preoperculum and suborbital higher than long, a deep re-entering notch in the upper jaw, and the roof of the mouth and tongue at least toothless; these are by some naturalists combined in a peculiar genus, *Alosa*, but by others with them are associated species of the groups *Pomolobus*, *Brevoortia*, etc., and by others still they are all regarded as constituents of the enlarged genus *Clupea*, and thus confounded with the salt-water herrings, etc. The shads are all inhabitants of the northern hemisphere, and anodromous, like the salmon, living for the greater portion of the year in the sea, but in the spring ascending the rivers in large schools for the purpose of spawning. The time of ascent is determined by the temperature, and the point is only limited by insurmountable obstacles in the form of dams or falls which cannot be overleaped, although the larger portion spawn at intervals far below this final point. The eggs are moderate in size, the ovaries of a single female having generally, it is said, about 25,000 eggs, although sometimes as many as 100,000 to 150,000. They are discharged near the surface, and slowly sink to the bottom. The time between impregnation and hatching depends on the temperature, and varies from about three to six days; thus, when the temperature is about 75° to 80° F. they hatch in about seventy hours or little more, while at a temperature of 62° to 67° they are delayed to about six days. The shads are the largest and most esteemed, at least in America and China, of the Clupeidæ. The best-known species are four —viz. *Alosa vulgaris* and *Alosa finta* of Western Europe, *Alosa sapidissima* of the Eastern U. S., and *Alosa Reevesii* of China, which last especially ascends the Yang-tse-Kiang River. The European species are held in much less esteem than the American and Asiatic. The last are esteemed among the best, if not the finest, of fishes in their respective countries, and their ovaries are also regarded as special objects of luxury. The capture of these fishes gives rise to

a large industry, and in the early spring months the fishermen are to a large extent engaged in their capture by means of fixed nets as well as seines, and to a small extent by dip-nets. The shads eat little or nothing when in fresh water, but sometimes rise to the fly, although not enough to constitute them generally-recognized game-fishes. In the salt water and estuaries they feed chiefly on small crustaceans, such as species of *Mysis*, etc. Within the last few years attempts have been made by the U. S. commissioner of fish and fisheries to introduce the shad into the waters of California and those emptying into the Gulf of Mexico, in which last they had, however, already been to some extent acclimated. It has also been sought to introduce the American species into German waters, but the shortness of the period of hatching and the tenderness of the young have hitherto rendered futile the attempt. The fish commissioners of several Atlantic States, especially the U. S. commissioner and the commissioners of the States of Connecticut, New York, and Maryland, have for several years past endeavored, by artificial fecundation, to increase the supply of this species, which had been overfished, and, it has been claimed, success has rewarded their exertions. THEODORE GILL.

**Shad'dock** [called **Pompelmoose** in the East Indies], the large fruit of *Citrus decumanus*, a small tree of the orange family (Rutaceæ). It has a watery pulp, cooling, acid, aromatic, and somewhat bitter. It is used for preserves. It was named from one Shaddock, who carried it from India to Jamaica. Risso describes six varieties. The fruit sometimes weighs fifteen pounds.

**Shade,** tp., Somerset co., Pa. P. 1287.

**Shade'ville,** p.-v., Hamilton tp., Franklin co., on Scioto River, O. P. 124.

**Shad'ine,** the *Alosa sadina*, a little spotted shad about a foot long, caught, but not abundantly, off the New York and New Jersey coasts.

**Shad Tree,** or **Bush,** the *Amelanchier Canadensis* of the order Rosaceæ. It is remarkable for its numerous and strongly-marked varieties, some of them very small shrubs and others larger shrubs, and it occasionally grows to be a tree, 50 feet high or more. Its wood is hard, white, and very fine-grained. Its flowers appear in early spring in loose white racemes. The fruit is a juicy and savory berry, abundant in the North-west, where it is called service-berry. It is there collected as food, and is one of the ingredients of the native pemmican.

**Shad'well** (THOMAS), b. at Stanton Hall, Norfolk, England, about 1640; educated at Caius College, Cambridge; studied law at the Temple, London; travelled on the Continent; acquired considerable reputation by his comedy, *The Sullen Lovers*, produced in 1668; devoted himself thenceforth to literature, chiefly dramatic; was author, among many other plays, of *The Virtuoso* (1676), *Lancashire Witches* (1682), *The Squire of Alsatia* (1688), and *Volunteers, or The Stock-Jobbers* (1693); became poet-laureate and royal historiographer 1688, succeeding Dryden in both posts, and thereby incurring a resentment which led to his unjust impalement by that poet as the hero of *Mac Flecknoe* in the character of "monarch of dulness." D. Dec. 6, 1692. His collective *Works* appeared in 4 vols., 1720.

**Shady Spring,** p.-v. and tp., Raleigh co., West Va. P. 1686.

**Shaef'ferstown,** p.-v., Heidelberg tp., Lebanon co., Pa. P. 636.

**Shaftes'bury** (ANTHONY ASHLEY **Cooper**), FIRST EARL OF, b. at Wimborne St. Giles, Dorsetshire, England, July 22, 1621, son of Sir John Cooper of Rockbourne, Hampshire, and grandson on the mother's side of Sir Anthony Ashley, secretary of war to Queen Elizabeth; entered Exeter College, Oxford, 1637, and Lincoln's Inn 1638; was elected for Tewkesbury to the Short Parliament Apr., 1640, though but nineteen years of age; sat in the Long Parliament as a supporter of the king; went over to the popular party Feb., 1644; commanded forces in Dorsetshire; stormed Abbotsbury and relieved Blake at Taunton in the same year; was a member of the "Barebones" Parliament July, 1653, and of Cromwell's council of state Dec., 1653; separated from the cause of the Protector Dec., 1654; was excluded from the Parliament of 1656; took his seat in that of Jan., 1658; was a member of the council of state May, 1659; co-operated in the restoration of Charles II.; was one of the commissioners sent to the new king at Breda Apr., 1660; was made a privy councillor in May, and a commissioner for the trial of the regicides Oct., 1660; was raised to the peerage as Baron Ashley Apr., 1661; became chancellor of the exchequer May, 1661; opposed the Act of Uniformity 1662; supported the Dispensing bill 1663; was one of the grantees of the province of Carolina 1663 and 1665; secured the services of John Locke as private secretary 1666; prepared with Locke the famous aristocratic constitution for the government of the Carolinas; was a joint commissioner of the treasury 1667; a member of the "Cabal" 1670; created earl of Shaftesbury Apr. 23, 1672; was president of the council of trade and plantations from Sept. 27, 1672, to Apr., 1676; was lord chancellor Nov. 17, 1672, to Nov. 9, 1673; refused a bribe offered by the French ambassador Dec., 1673; was dismissed from the privy council May 19, 1674, on account of having gone over to the opposition; was imprisoned by order of Parliament for aiding the king in asserting the prorogation of that body 1677–78; procured the passage of the Test bill 1678; became president of the council Apr., 1679; procured the passage of the Habeas Corpus act 1679; was dismissed from office Oct., 1679; presented the duke of York before the court of king's bench as a "Popish recusant" June 26, 1680; attended the Parliament at Oxford Mar., 1687; was thrown into prison by order of the council on a charge of high treason July 2, but released Dec. 1, 1681, the grand jury having refused to find a true bill; went to Amsterdam Nov., 1682, and d. there Jan. 22, 1683. He was the Achitophel of Dryden's satire, is brilliantly sketched by Macaulay in his *History*, and gave name to Ashley and Cooper rivers in South Carolina. (See his *Life*, by W. D. Christie, 1871; also Fox-Bourne's *Memoir of John Locke*, 1876.)

**Shaftesbury** (ANTHONY ASHLEY **Cooper**), THIRD EARL OF, grandson of the first earl, b. in London Feb. 26, 1671; was educated under the supervision of Locke; entered Parliament 1673; resided in Holland 1698–99; succeeded to the peerage 1699; supported the administration of William III., and retired from public life on the king's death; was noted as a philanthropist and stigmatized as a free-thinker; published a *Letter on Enthusiasm* (1708) in defence of the rights of the "French Prophets," *The Moralist, a Philosophical Rhapsody* (1709), *Sensus Communis* (1710), *A Soliloquy, or Advice to an Author* (1710); spent much of his time on the Continent, and was preparing a work upon the arts of design when he d. at Naples, Feb. 15, 1713. His principal work, *Characteristics of Men, Matters, Opinions, and Times*, was posthumously published (3 vols., 1713–23; often reprinted), and enjoyed great popularity for its elegant and thoughtful style.

**Shaftesbury** (ANTHONY ASHLEY **Cooper**), SEVENTH EARL OF, b. in England Apr. 28, 1801; graduated at Christ Church, Oxford, 1822; entered Parliament 1826; supported the administrations of Liverpool and Canning; was made a commissioner of the board of control by the duke of Wellington; was a lord of the admiralty under Sir Robert Peel 1834–35; succeeded to the peerage 1851; has labored zealously to improve the condition of the working-classes; has been president of the Bible Society, the Pastoral Aid Society, the Protestant Alliance, and other organizations for the propagation of evangelical doctrines, and has been long regarded as the head of the so-called "Exeter Hall" school of Low Churchmen.

**Shafts'bury,** p.-v. and tp., Bennington co., Vt., on Harlem Extension division of Central Vermont R. R. P. 2027.

**Shagreen.** See LEATHER, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Shah** [Pers., "king"], the title of the ruler of Persia and of certain other Asiatic princes. The sons and other male relatives of the Persian shah also assume this title, the full title of the monarch being *shah-in-shah*, "king of kings."

**Shahjehanâbâd.** See DELHI.

**Shahjehanpoor',** town of British India, presidency of Bengal, in lat. 27° 52′ N., lon. 79° 28′ E., on the Gurrah, has 62,875 inhabitants.

**Shairp** (JOHN CAMPBELL), LL.D., b. at Houstoun House, Linlithgowshire, Scotland, about 1830; educated at Edinburgh Academy, Glasgow University, and Baliol College, Oxford; was for some years assistant master of Rugby School; became professor of humanity at the United College, St. Andrew's, 1861, and principal of that institution 1868. Author of *Kilmahoe, a Highland Pastoral* (1864), *Studies in Poetry and Philosophy* (1868), *Lectures on Culture and Religion* (1870), and of numerous contributions to magazine literature.

**Shakerag,** v., Fayette co., Ga. P. 1010.

**Shakerag,** v., Henry co., Ga. P. 428.

**Sha'kers** [so called from certain rhythmical movements of the arms which form a part of their ceremonial], a sect called by themselves the United Society of Believers in Christ's Second Appearing. They claim descent from the French Camisards, and were founded by Mrs. Stanley, better known by her maiden name as Ann Lee. (See LEE, ANN.) She was a member of a society founded in 1747 at

Manchester, England, by Jane Wardlaw, a visionary and professed prophetess, whose followers were named Shaking Quakers. Of these people Mother Ann (as she was called) became in 1770 the acknowledged head. She called herself "Ann, the Word," and professed to be the bride of the Lamb, the queen of Mount Zion, and the second appearing of Christ. In 1774 she emigrated with her leading followers to the U. S. In 1776 they settled at Watervliet, N. Y., but the society did not thrive until after 1780. The Shakers lead a celibate life, hold their property in common, believe that they communicate with the spirits of the departed, that the millennium has come, and teach that for those who are not Shakers marriage, if entered into for the perpetuation of the human race, is not sinful. They hold that the millennium has come, make use of the song and dance in worship, wear a peculiar dress, and devote themselves to agriculture, horticulture, the raising of medicinal herbs, and engage in a few simple manufactures. They are a thrifty, cleanly, and industrious people. They teach a system of doctrine which is founded partly on the Bible and partly on the supposed revelations of Mother Ann Lee and their other inspired leaders. They are opposed to war and the use of pork as food, and believe in the exercise of miraculous gifts. The U. S. census for 1870 reports 18 communities of Shakers, with 8850 sittings, and $86,000 in church property, but their whole common property is worth over $10,000,000. Their establishments are at New Gloucester and Alfred, Me.; Canterbury and Enfield, N. H.; Harvard, Hancock, Shirley, and Tyringham, Mass.; Enfield, Conn.; 2 in Canaan, N. Y., and 1 each in Groveland, Mount Lebanon, and Watervliet, N. Y. (those in Canaan are dependent on that at Mount Lebanon, which is indeed a kind of mother-house to all the others); at North Union, Union Village, Watervliet, and Whitewater, O., and Pleasant Hill and South Union, Ky.

**Shakers,** or **Whitewater Village,** v., Crosby tp., Hamilton co., O. P. 123.

**Sha'kerstown,** v., Van Buren tp., Montgomery co., O. P. 54.

**Shake'speare** (WILLIAM), b. in Stratford-on-Avon, Warwickshire, England, in Apr., 1564—on the 23d of that month, it is supposed. His father, John Shakespeare, was of the yeoman class; his mother, Mary Arden, was of a family of the minor gentry. John Shakespeare seems to have been a man of character and ability. He became a landholder, and rose rapidly through all the grades of office in Stratford until he became chief alderman and *ex-officio* justice of the peace. Misfortune, however, befell him, and he was reduced to comparative poverty, and was even subject to arrest for debt. Of Shakespeare's early life until he married we know nothing; but it is probable that he was educated at the grammar school of Stratford, and that he acquired there a little Latin and some Greek. Passages in his works showing more than ordinary familiarity with law-terms have been regarded as indicating that he was for a time in an attorney's office. The fact that he was the third child and the eldest son of the eight children of a man who suffered heavy losses may give us assurance that he was early set at work of some kind; and we may well believe that it was rather that of an attorney's clerk than that of a helper to his father in the trade of a butcher —a story which has only the flimsiest traditional foundation. Whatever his occupation in Stratford, however, he soon left it, and under very depressing circumstances. While but a lad of seventeen he had become entangled with a woman of twenty-five, Anne Hathaway, the daughter of Richard Hathaway, who lived at Shottery near Stratford. He married this woman, in another parish and by special license, when he was but eighteen, while she was twenty-six years of age, and her first child, as far as our knowledge goes, was born in May, 1583, between four and five months after her marriage. How long he lived with her, and where, we do not know, but it was probably in Stratford, and for not more than three years. She bore him twins, a boy and girl, in Feb., 1584, which were named Hamnet and Judith, her first child having been named Susanna. Shakespeare at twenty-one, with a wife eight years his senior, whom he married under such circumstances, with three children on his hands and his father in distress, was driven to seek some change for the better; and he left Stratford to seek his fortune in London. Tradition says that he himself had led a somewhat wild although not a vicious life, and that, having killed some of the deer of Sir Thomas Lucy of Charlecote, near Stratford, and having written a rhyming lampoon upon him and affixed it to his gate, Sir Thomas made Stratford too hot to hold him. The story of the deer-killing is not well authenticated, but it is very probable, as it also is that the knight's vindictiveness was one of the causes of his leaving his native village. How Shakespeare lived during his first year or two in London we do not know, but it is probable that he sought employment in the office of a cousin who was an attorney in that city. However this may be, ere long we find him engaged as an actor and as a playwright. This became his profession, and he remained in London practising it for almost all his life. There is no evidence that he returned to Stratford more than once or twice, and then on business, until he withdrew from active connection with the theatre. But tradition says that he visited the home of his wife and children once a year. It may as well be here said that to this evidence of his indifference to the former there is to be added that of his will, in which he gave her only his second-best bed, and this as an afterthought and by an interlineation of the bequest, without which her name would not even have appeared in that instrument. In regard to her, it is also important to remark that she met with similar negative evidence of disregard in the will of her father, although her sisters were kindly and considerately remembered therein. Shakespeare was led to adopt the dramatic profession not only by strong native impulse, but by his acquaintance with some young dramatists of his native town who were living in London, and also by his memories of dramatic performances in Stratford during his father's prosperity and under his patronage. It is not improbable that, with his strong poetical and dramatic instincts, he may have made some attempts at play-writing before he went up to London, and still more probable that at that time he had written his first poem, *Venus and Adonis.* However this may be, he went upon the stage as an actor of minor parts, and seems never to have risen higher than a position of what is known as "general utility." We know that he was one of the original performers of Ben Jonson's *Every Man in his Humour;* that he appeared in the same author's *Sejanus* (but we do not know in what part); and there is a tradition that he played the Ghost in his own *Hamlet,* and that his brother Edward saw him play the part of an old man, which was probably that of Adam in his own comedy *As You Like It.* As a dramatist he began his career by rewriting old plays in conjunction with others, his seniors in years and as playwrights. At the time of his leaving Stratford the drama was rising rapidly in favor with all classes in London, where actors were made much of in a certain way, and where there was a constant demand for new plays. Ill-provided younger sons of the gentry, and others who had been bred at the universities and at the inns of court, sought to mend their fortunes by supplying this demand; and it was the custom of the various companies of players to have several playwrights in their pay, who, working together, produced new plays and patched up old ones. These plays were not regarded as literature, but were produced and used only as attractions to the theatres. There is good reason for believing that Shakespeare, in accordance with this practice, wrote at first in conjunction with Marlowe, Greene, Peele, and other playwrights of less note. His superiority to all his contemporaries, however, soon asserted itself, and he began to write alone or with little assistance. His first wholly original play was probably *Love's Labour's Lost;* for in *Titus Andronicus,* a revolting tragedy characteristic of a kind of drama then in vogue, there are but slight traces even of his 'prentice hand. He probably also in his earliest dramatic days wrote, in conjunction with Marlowe, Greene, and Peele, the first and the second parts of *The Contention between the Houses of York and Lancaster,* his own contributions to which he afterward embodied in Part I. and Part II. of his *Henry VI.* His success provoked the jealousy and excited the enmity at least of one of those whom he eclipsed—Robert Greene, a gifted but dissolute man, who died in wretchedness, and who, in a pamphlet written during his last illness, attacked Shakespeare as a pretentious plagiarist. This enmity was probably heightened by the respectability of Shakespeare's character, and the favor in which he seems to have been held by all with whom he was brought into contact. Henry Chettle, who was one of the knot of writers to which both Greene and Shakespeare belonged, speaks, in a pamphlet, of the latter as in his demeanor "no less civil than he was excellent in the quality he professes;" adding that "divers of worship have reported his uprightness of dealing, which argues his honesty, and his facetious grace in writing which approves his art." In the phraseology of that day "facetious" meant, not humorous and whimsical, but skilful and of a delicate fancy, and "of worship" meant of social rank and consideration. Among the friends that Shakespeare won among the latter class was the earl of Southampton, a nobleman of taste and culture, who took great interest in literature and the drama. To him the poet dedicated his first published poem, which was his first purely literary effort: he calls it "the first heir of his invention." Whether this dedication was an acknowledgment of substantial service from the earl, or whether it led to such an exhi-

bition of friendliness, we do not know. But there is a tradition that Southampton gave Shakespeare a large sum of money—£1000, quite equal to $30,000 in this day and country—and the story is probable. Such munificence was not unknown in those days among English noblemen; and when Shakespeare published *Lucrece*, his second poem, he dedicated this also to Southampton, saying, "The love I dedicate to your lordship is without end. . . . What I have is yours; what I have to do is yours; being in part all I have devoted yours." This at least, is evidently the acknowledgment of a great service; and there is therefore good reason to believe that to the nobleman's generosity the poet-dramatist owed his ability to become a very considerable sharer in the Black Friars' Theatre, at which the company with which he was connected was in the habit of performing. Having attained this advantageous position, Shakespeare soon reached the utmost height of success, both as to reputation and profit, possible to one of his profession. The notion long prevalent that he was neglected during his life, and that his plays rose into popularity only a long time after his death, is entirely unfounded. We know from contemporary evidence that he was the most admired of all the dramatists of his day, and that when the productions of the best of his contemporaries—Ben Jonson included—failed to pay the expenses of their representation, his plays filled the house to overflowing. He now entered upon a career of dramatic production which is without a parallel in the history of literature, and which soon placed him—its chief value in his eyes—in independent circumstances. It cannot be too strongly insisted upon, or too constantly remembered in reading his plays, that he produced them only in the way of business. He was a theatrical proprietor and an actor; and his object in writing was not fame, or even literary exertion, but to get money by his professional labor. He rose rapidly, however, both in fame and in fortune. He had money to spend and money to lend; and he used it to place his father in comfort and to acquire landed property and other wealth in his native town. The object of his life appears to have been to return to Stratford—which he had left hardly a man, and almost in disgrace—a man of property, and to take a position as a gentleman of consideration. The Heralds' College made his father a gentleman by coat-armor; and there is reason to believe that this was done at the instance and the request of the successful playwright, who thereby became a "gentleman" by descent both on his father's and his mother's side. He invested a part of his money in the tithes of Stratford, and he bought "New Place," a large house which had been built by the Cloptons, a Warwickshire family of wealth and position. To this house he retired on his withdrawal from the theatre about A. D. 1611, and there he died Apr. 23, 1616, leaving behind him only one child, his daughter Judith, who was married to Thomas Quiney, a vintner. His family, even through her descendants, soon became entirely extinct.

Of Shakespeare's life in London we know very little, almost nothing except the successive production of his plays. Fuller says that he and Ben Jonson used to have many "wit-combats," in which he compares Jonson to a heavy Spanish galleon and Shakespeare to a light English man-of-war. Jonson was his junior, but was one of those who knew him intimately; and jealous, hot-tempered Ben loved him well and honored his memory after his death. He supports Fuller's comparison by saying, with a classical allusion, that Shakespeare was distinguished by great copiousness and facility of thought and language—so great as to be almost oppressive to his hearers. There was a sort of club of which Raleigh, Jonson, Beaumont, Selden, and Donne were members, and which met at the Mermaid Tavern; and it has been assumed that the wit-combats took place at these meetings. It is not improbable that Shakespeare met with this club, but there is not the least evidence of the fact. Tradition says that Jonson owed to Shakespeare's influence the performance of his first comedy, *Every Man in his Humour*, which had been offered and rejected. But we only know that the story agrees with Shakespeare's reported kindliness of nature, and with the gruff and cynical scholar-dramatist's love for him. Traces of Shakespeare's personal character and experience are found rarely in his works, if at all, unless we are to accept his *Sonnets* as an expression of personal feeling. These very remarkable compositions, 154 in number, were published in 1609, and were dedicated to a Mr. W. H. as their "only begetter," but by the publisher, not by the poet, who seems to have had no agency in the publication of any of his works except *Venus and Adonis* and *Lucrece*, the two poems before mentioned. The *Sonnets* remain a literary puzzle to this day. A few of the first in the collection are addressed to a very beautiful young man, and entreat him to marry; two of them are avowedly the expression of Shakespeare's own feeling, and show that his spirit was galled by the nature of his profession and the low estimation in which it was held. But the most of them were written as an expression of the feelings and the experience of a man who loved and suffered deeply. It is almost impossible to believe that Shakespeare, even with all his powers of dramatic simulation, wrote these strong utterances of deep emotion in an assumed character, although it is to be remarked that such performances were rather the fashion in his day, and also that poets were employed to use their art in this way vicariously for others. If, on the contrary, we are to regard these *Sonnets* as the result of Shakespeare's own experience—which seems most probable—we learn from them that he passionately loved and was loved by a beautiful dark-eyed "black"—that is, brunette—woman, who nevertheless tortured him by being false to him with his best friend. This theory agrees with what we know of Shakespeare's character, and with his long residence in London, neglectful, if not entirely forgetful, of his wife. The *Sonnets* are worthy to be the utterance of such an experience by such a man. Although inferior to the plays, they are far superior to the other poems. But who was the Mr. W. H. whom the publisher styles their "only begetter"—whether he was connected in any way with their production, or only with their collection for publication—is only a subject of vague and unsatisfactory conjecture.

Shakespeare's dramas are unlike those of his predecessors, his contemporaries, and his successors, but their unlikeness is not in form or in purpose. He assumed the forms of comedy and tragedy, and of history or historical play, which had been established before he began to write, and he conformed in every external respect to the fashion of his time and the needs of the theatre. His difference from other dramatists consists in his thought and his language, and in his power of dramatic characterization; in all of which he is unapproached by any writer who ever lived. No other writer ever united imagination, fancy, humor, knowledge of human nature, worldly wisdom, psychological insight, and creative power, as all these were united in him. The fertility of his mind appears to have been inexhaustible, the profundity of his thought illimitable. He throws away upon a minor personage and an unimportant situation poetical thoughts and philosophical reflections which other writers, if they could have originated them, would have carefully reserved for elaboration upon great occasions. His dramatic isolation from his creations appears to have been perfect; once evoked from his mind, they exist independently and altogether outside of it, and act and speak altogether according to the laws of their own being, not of his. He may be almost said to have had, as a dramatist, no sympathy either with good or with evil, for he elaborates a human devil and a human angel with an equally loving hand; and he does not hesitate to show us that even both good and bad may, and often do, act from mixed motives, good and evil. It is in this inflexible justice, characteristic of only the very highest quality of intellectual and moral nature, that we find one of the chiefest evidences of his superiority.

Such of his plays as were published during his lifetime seem to have been given to the press entirely without his agency. Indeed, his interest was against their publication. They were written not to be read, but to be performed; and it was to the interest of all concerned in the theatre, whether as proprietors or only as actors, or, like himself, as both, that the theatre should have the entire benefit of whatever favor they enjoyed with the public. But the publishers—or stationers, as they were then called—eagerly sought copies of them for publication, and obtained them surreptitiously; sometimes, it would seem, by corrupting persons connected with the theatre, and sometimes, as the text which they printed shows, by sending short-hand writers to the performance. It is not improbable that in case of great and injurious misrepresentation of the text of a play by the latter method fair copies were furnished by the theatrical people, at the author's request, in self-defence. The first and second editions of *Hamlet* (1603 and 1604) appear to have been the result of such manœuvres on the part of the pirates and the author. However this may be, twenty of Shakespeare's plays were published by various stationers during his lifetime. They are known as "the 4tos" from the form in which they are printed. They are, most of them, full of errors, and, with one or two exceptions, they are all more or less imperfect. Some of them seem to have been put in type from stage-copies, or not improbably from an aggregation of the separate parts which were in the hands of the various actors. But they are nevertheless of great value in the formation of the text, and they have been freely used for that purpose by all the editors except Mr. Charles Knight. For the text of the remaining seventeen of the plays we are entirely dependent upon the folio edition of the whole thirty-six, which (not including *Pericles*) was published by Isaac Jaggard and Edward Blount

in 1623, under the authority—and, in some sort, the editorial supervision—of John Heminge and Henry Condell, who describe themselves as his friends and fellows. This edition, known as the "first folio," although greatly superior, as to the text of almost all the plays, to the quarto copies of the twenty plays before mentioned, is yet marred by so many and so great errors, and even by such important omissions in some of the plays, that it has required the labors of a numerous body of editors and commentators during 150 years to produce the text as it is now accepted, if indeed there is a text which can be regarded as accepted. As Shakespeare had no hand in the publication of his works, and as we know so little of his life, the very interesting question of the order in which the former were produced is left to inference from external evidence and critical opinion upon the evidence in the plays themselves. The *Stationers' Register* (a sort of contemporary record of copyright), the remarks of a critical writer named Francis Meres, whose book, *Palladis Tamia*, appeared in 1598, and one or two diaries written at the time furnish the external evidence upon this question; and the language, the style of thought, and the versification of the poet the internal. All this evidence unites in showing that the poems and plays were produced in the following order, and at about the following dates: *Venus and Adonis*, 1584–85; *The Passionate Pilgrim*, 1584–86; Part I. of *The Contention of the Two Houses of York and Lancaster*, *The True Tragedy*, etc., *The Taming of a Shrew* (in which old plays Shakespeare had a share), 1587–79; *Love's Labour's Lost*, 1588–89; *The Comedy of Errors*, 1589; *Love's Labour's Won* (probably an early form of *All's Well*, etc.), 1589; *The Two Gentlemen of Verona*, 1589–90; *King Henry VI.*, Parts I., II., and III., 1590–91; *Sonnets*, 1590–1605 (?); an early form of *Romeo and Juliet*, 1591–92; *Lucrece* and *Richard III.*, 1593; *A Midsummer Night's Dream* and *The Merchant of Venice*, 1594; *Richard II.*, 1594–95; *Romeo and Juliet*, *King John*, and Part I. of *King Henry IV.*, 1596; Part II. of *King Henry IV.*, 1597; *Much Ado About Nothing*, 1598–99; *Twelfth Night*, *Henry V.*, and *As You Like It*, 1599; *Hamlet*, 1600; *The Taming of the Shrew*, 1601; *Pericles* (Shakespeare's part), 1602; *The Merry Wives of Windsor*, 1603; *Measure for Measure*, 1603–04; *All's Well that Ends Well*, 1604; *A Lover's Complaint*, 1605 (?); *King Lear*, 1605; *Timon of Athens*, 1605–07; *Macbeth*, 1605; *Julius Cæsar*, *Antony and Cleopatra*, and *Troilus and Cressida*, 1606–08; *Cymbeline*, *Coriolanus*, and *Othello*, 1609–11; *The Winter's Tale* and *The Tempest*, 1611; *Henry VIII.*, 1613. To these should be added *The Two Noble Kinsmen*, in the writing of which there is hardly a doubt that he had a part, and which has a better right than *Titus Andronicus* or *Pericles* to a place among his collected works. In this order of production we see evidence that although Shakespeare was a miracle, like the sun and the stars in their daily rising and setting, his mind developed and his power grew like that of any ordinary mortal. His great tragedies, *Hamlet*, *King Lear*, *Macbeth*, and *Othello*, were produced between his thirty-seventh and his forty-seventh year, during which rich and fruitful decade he also produced his most beautiful comedies, with *Antony and Cleopatra*, and his wisest play, *Troilus and Cressida*. After 1611 he ceased to write—probably because he was weary of his profession and had accumulated money enough to live upon handsomely—and retired to Stratford. But he retained his interest in the theatre, and at Stratford he probably wrote his last play, *Henry VIII.*, to supply a pressing need of his company for a show-piece. It bears marks of great maturity of mind, but of great haste in production, and parts of it are plainly not his. They were supplied, according to the custom of the time, by other writers connected with the company. *Cymbeline*, which contains some of his finest thoughts and most beautiful creations, bears also in some scenes the marks of another hand. There are no traces, even in tradition, of any intercourse between Shakespeare and any of the eminent men of his time except Ben Jonson, and, if we may call him eminent, Southampton. Bacon was his contemporary; and it is an impressive and a somewhat saddening fact that these two intellects, probably the two greatest the world has known—certainly two such never existed together at any other time before or since—had, so far as we know, no communication. Shakespeare and Bacon lived at the same time in the same city, then not a large one, passed each other in the street, and yet probably never interchanged one word. The reason was that one was a player and a poet, the other a statesman and a philosopher, and that each was absorbed in his own affairs. The notion that Shakespeare's plays were written by or in conjunction with Bacon—which has found two or three ingenious advocates—is unworthy a moment's consideration by any reasonable creature.

Shakespeare did not long enjoy that for which he had longed so much and worked so hard—the life of a gentleman of substance and leisure in his native place. He died in Apr., 1616, and was buried on the 25th of that month in front of the chancel of Stratford church. There is a stone over his grave on which there is this inscription:

> "Good frend for Iesus sake forbeare
> To digg the dust encloased heare:
> Blest be ye man yt spares thes stones,
> And curst be he yt moves my bones."

These lines, which may embody a wish expressed by Shakespeare, but which are hardly of his writing, have prevented the removal of the remains of the greatest Englishman to Westminster Abbey. Against the wall of Stratford church there is a monument to Shakespeare, with a laudatory inscription in Latin. But of far greater interest is the bust of the poet which forms part of the monument. It is coarse and rude in execution, but there is no reason for doubting that it gives at least a general idea of his personal appearance. According to this, he was at fifty-eight a portly but not at all corpulent man, with a high forehead, a head somewhat bald, a small aquiline nose, and a well-formed mouth and chin. Aubrey, the antiquarian, who lived two generations after him, had heard that he was "a handsome, well-shapt man." An engraved portrait upon the title-page of the first collected edition of his works, which Ben Jonson, in some verses almost as hard and expressionless as the engraving itself, assures us was a good likeness, has a general conformity in the features and the form of the head to the bust. The latter is supposed by some persons to have been modelled from the poet's face after death. But a close examination of it shows this to have been impossible. The bust was originally colored after life, and had hazel eyes and auburn hair and beard. These traits were afterward obliterated by a coat of white paint. The bust and the engraved portrait in the Folio are the only portraits of Shakespeare which are of undoubtable authenticity; but one known as the Chandos portrait has tradition of very respectable antiquity in its favor. There is a very slight and vague tradition that Shakespeare "died a papist," but this is very improbable. His works show very little religious sentiment, and favor no religious form, sect, or dogma. There was also a tradition in Stratford fifty years after his death that he, Drayton, and Ben Jonson had "a merie meeting, and it seems drank too hard, for Shakespeare died of a feavour there contracted." The event is not absolutely impossible, but this tradition has probably as little foundation as the other.

Although Shakespeare was acknowledged as the greatest dramatist of his time, his reputation rather diminished than increased during the century after his death. He had no followers or imitators; he established no school. Dramatic taste and dramatic writing steadily declined after the Elizabethan age (about 1575 to 1625), and by the beginning of the eighteenth century Shakespeare was lightly thought of by the literary critics, and much neglected by the actors. But there had been among the reading public a steady although not a large demand for his plays. The folio of 1623 was succeeded by another folio in 1632, and a third edition was called for and published in 1664. In the last *Pericles*, and six spurious plays which had been published in quarto in Shakespeare's lifetime, with his full name or his initials upon the title-page, were included. A fourth edition, also in folio, appeared in 1685. Upon these four folios, and upon the existing old quarto edition of twenty of the plays, the readers of Shakespeare depended for their supply. They did not meet the demand, and in 1709 the first edited edition of Shakespeare's plays appeared, in 7 vols. 8vo. The editor was Nicholas Rowe, himself a poet and dramatist of considerable merit. Rowe, however, did little for his author more than the correction of the most obvious typographical errors in the old copies, the division of the plays into acts and scenes, the addition of stage directions, and the writing of a biography, for which the materials were mostly collected by Betterton the actor, and to which, after a century and a half spent in investigation, little has been added. Rowe's edition has an engraved frontispiece to each play, and these are of interest as contemporary evidence of stage costume, action, and "business" at the end of the seventeenth and the beginning of the eighteenth century. From the time of the appearance of this edition the fame of Shakespeare steadily grew until about the beginning of this century he was acknowledged to be the first of poets and of dramatists, the most creative mind, the greatest master of imagination and of language, that the world has known. The number of mere impressions of his works, even in the English language, is quite out of all reckoning; and the real editions, those formed by a careful collation and collection of the text, are many. Among the editions of this character the following are the most worthy of note: Alexander Pope's (1725), Louis Theobald's (1733), Sir Thomas Hanmer's

(1744), Bishop Warburton's (1747), Dr. Samuel Johnson's (1765), Edward Capell's (1767), Edmund Malone's (1790), Boydell's illustrated edition, 9 vols. folio (1802), Alexander Chalmers's (1805), Heath's illustrated edition, 6 vols. 4to, Reed's, 21 vols. 8vo, known as the "first variorum" (1813), Rev. William Harness's (1825), S. W. Singer's, known as "the Chiswick" ed. (1826), Charles Knight's "Pictorial" (1838), J. P. Collier's (1841), Gulian C. Verplanck's (1847), Rev. H. N. Hudson's (1852), J. O. Halliwell's, 15 vols. folio, with illustrations (1853), Rev. Alexander Dyce's (1857; 2d ed. 1864; 3d, 1875), Clark and Wright's, known as the "Cambridge" (1863), R. Grant White's (1857–64). In 1852, Mr. John Payne Collier published *Notes and Emendations to the Text of Shakespeare's Plays from early Manuscript Corrections in a copy of the Folio 1632.* The very numerous readings which appeared on the margins of this now notorious copy were at first received with enthusiastic welcome by a large class of the readers of Shakespeare, and even by some critics and editors; and it was for a time supposed that they would be generally accepted, and produce great changes in the received text. But their soundness, and even their genuineness, were soon disputed. A critical controversy arose upon them which is one of the most remarkable in the history of literature. It continued for years, the result being that nearly all of the readings were rejected, with damage to Mr. Collier, not only as a Shakespearian critic, but even to his reputation for literary good faith; for on both internal and external evidence it was shown that the volume was not what it professed to be. See *The Text of Shakespeare*, by R. Grant White, in *Putnam's Magazine* (Oct., 1853); *The Text of Shakespeare Vindicated*, by S. W. Singer (8vo, 1853); *Shakespeare's Scholar*, by R. Grant White (8vo, 1854); *An Inquiry into the Genuineness of the MS. Corrections in Mr. J. Payne Collier's annotated Shakespeare Folio, 1632*, etc. (4to, 1860); *A Complete View of the Shakespeare Controversy*, by C. M. Ingleby (8vo, 1861); and *The Shakespeare Mystery*, by R. Grant White, in the *Atlantic Monthly* (Sept., 1861). The number of Shakespeare's commentators has much exceeded that of his editors. His text was left in such a condition by the printers of the old quartos and folios that, although it may be read even in those impressions with pleasure and with a full comprehension of its general meaning, there is to its perfection need of more critical labor than is required by most old manuscripts; and of such we have none to consult, for of Shakespeare's writing not a line has come down to us—not even a word, except his own signature. The number of those who have rushed to the correction of Shakespeare's text and the explanation of his meaning is so large that it is not surprising that among them there should have been some weak-minded and ignorant persons altogether unfitted for a task the nature of which they did not even understand. And among those better qualified for their work, some have been narrow-minded, over-precise, and captious. But notwithstanding the reproach which such persons have brought upon Shakespearian criticism, it must be admitted that more critical ability and learning has been displayed upon this subject than upon any other in the whole range of literature, the poems of Homer perhaps excepted; the reason for the excess being the remoteness of the age when those poems were produced, the uncertainty of their origin, and the fact that their language is foreign to all their critics—very important circumstances which do not apply to the works of Shakespeare. The works written upon Shakespeare form a library in themselves, and the reader desirous of becoming acquainted with their titles must consult the catalogues of *Shakespeariana*, of which the best is Franz Thimm's (Lond., 1865; 2d ed. 1872). This, however, is imperfect, and sometimes erroneous; while the next best, that in Bohn's ed. of Lowndes's *Bibliographer's Manual*, is not without important errors in names, dates, and titles. Among the foreign students of Shakespeare the Germans have been the most laborious and steadily enthusiastic. There is no department of Shakespearian criticism in which they have not exerted themselves, and to which they have not brought their habits of patient and systematic inquiry. But it may be questioned whether, except for themselves, they have increased pleasure in his writings or made them more thoroughly understood; while as to the text there can be no doubt that their labors have been entirely fruitless. The best German translation of Shakespeare's plays—and it is admirable in every respect—is that of Schlegel and Tieck. The best contemporary discussion of Shakespearian subjects is to be found in the *Jahrbuch* of the German Shakespeare Society, published since 1865 yearly at Berlin.

Shakespeare, like so many other men of great eminence, left little trace of his personality behind him. His only son, Hamnet, died at the age of eleven years. His two daughters were married and left children, but the family, even on the female side, became extinct in the third generation. "New Place," his residence upon his retirement from the theatre, after passing through several hands, was in 1759 razed to the ground by its last owner, the Rev. Francis Gastrell, who was exasperated by a quarrel with the town authorities and by the persecution of prying visitors to the home of the great poet. John Shakespeare's house, which stands in Henley street, and in which it is reasonably supposed that William was born, is still standing. In the poet's time it was a pretty, comfortable dwelling for that age, with gable ends and pargetted walls. After falling into decay, it was a few years since bought by an association and restored, but in so unskilful and tasteless a manner that it gives very little idea of its appearance when he lived in it as a boy who has brought pilgrims to it from all quarters of the earth.

RICHARD GRANT WHITE.

**Shakopee',** city and tp., cap. of Scott co., Minn., on Minnesota River and St. Paul and Sioux City R. R., has 6 churches, 2 academies, and 3 public schools, an orphan asylum, 1 steam flouring-mill, 1 newspaper, 2 wagon manufactories, 1 bank, and the repair-shops of the above railroad. P. of v. 1349; of tp. 1263.

HENRY HINDS, ED. "ARGUS."

**Shale** [Ger. *Schale*, "shell"], a name commonly given to soft laminated argillaceous rock formed by the induration of clay stratified in water. When containing much carbonaceous matter it is called bituminous shale. When hardened by metamorphism, shales are converted into slates. (See PETROLEUM, GEOLOGY OF.)

J. S. NEWBERRY.

**Shale Oil.** See PETROLEUM, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Sha'ler,** tp., Allegheny co., Pa. P. 1473.

**Shaler** (NATHANIEL SOUTHGATE), S. B., b. in Campbell co., Ky., Feb. 20, 1841; graduated at Lawrence Scientific School 1862; became director of the State geological survey of Kentucky, in which capacity he has published various *Reports;* professor of palæontology at Harvard, and assistant at the Museum of Comparative Zoology at Cambridge, and is author of above sixty papers and memoirs on geological and palæontological subjects.

**Sha'lersville,** p.-v. and tp., Portage co., O., on Cuyahoga River. P. 977.

**Shallot',** the *Allium ascalonicum*, an onion-like plant which grows in cloves somewhat like the garlic. The cloves are set in the ground early, and become large enough for market two months before seedling onions are ripe. In the U. S. they are sold as onions by market-gardeners. They much resemble the onion in taste. The tops and bulbs are both eaten.

**Shal'lotte,** p.-v., Brunswick co., N. C. P. 1035.

**Shama'ka,** or **Kooneshur,** town of Asiatic Russia, in Transcaucasia, is a rising place, especially celebrated for its silk manufactures, which are said to equal those of Lyons. P. 25,609.

**Sha'manism** [Per. and Hind. *shaman*, "idolater;" Sans. *sramana*, an "ascetic"], the religion of a large number of primitive North Asiatic tribes, blended in Central Asia with Lamaism. It has no idols, save perhaps some fetiches and charms and rude ancestral images. It is a mixture of pretended sorcery and ceremonies for the propitiation of evil spirits. The priests or shamans offer sacrifices and perform grotesque and tumultuous ceremonies upon all extraordinary occasions. (See E. B. Tylor's *Primitive Culture* (2 vols., 1871).)

**Sham'burg,** p.-v., Oil Creek tp., Venango co., Pa.

**Shamo, Desert of.** See GOBI.

**Shamokin,** p.-b., Coal tp., Northumberland co., Pa., on Shamokin division of Northern Central R. R., and on Shamokin branch of Philadelphia and Reading R. R., in the centre of an important anthracite coal-field, which produces annually 1,250,000 tons; contains 3 foundries and machine-shops, 3 banks, 2 weekly newspapers, 10 churches, 4 large public schools, is well built and lighted, and supplied with water from Shamokin Creek. P. 4320.

**Shamokin,** tp., Northumberland co., Pa. P. 2282.

**Shamong,** p.-v. and tp., Burlington co., N. J., on New Jersey Southern R. R. P. 1149.

**Sham'rock,** the national badge of Ireland, as the thistle is that of Scotland, the rose of England, and the lily of France. The shamrock is a three-leaved or trifoliate plant, which was used by St. Patrick to illustrate the doctrine of the Trinity. There is some dispute as to whether the wood-sorrel (*Oxalis acetosella*), the common white clover, or the black medick or nonesuch (*Medicago lupulina*) is the true and original shamrock.

**Sham'yl** (*Samuel*), b. at Aul Himry, Northern Daghestan, about 1797; became a zealous disciple of the fanatic but sagacious and energetic Mohammedan reformer, Kasi-Mollah, whom he assisted in reconciling the feuds of the various Caucasian tribes and uniting them into a furious hatred of the "heretic" Russians. In 1834 he was unanimously chosen chief of the sect, and for more than twenty years he maintained, often with brilliant success, a continuous war with Russia. The culmination of his power falls between 1844 and 1852, when he succeeded in organizing a considerable number of tribes into a well-ordered state, which he governed from his capital, Dargo. But after this time the religious enthusiasm subsided, the Russian attacks became more comprehensive and energetic, one tribe after the other fell off, and the great opportunity which the Crimean war afforded him he was unable to avail himself of. After the Peace of Paris, Russia resumed the war with redoubled energy, and on Sept. 6, 1859, Shamyl was captured on the plateau of Gounib and carried to St. Petersburg, and the Caucasian tribes were finally pacified. In St. Petersburg, Shamyl was treated with much regard by Alexander II. He received a pension and resided in Kaluga, afterward in Kiev, and finally in Mecca, where he d. in 1871.

**Shanda'ken,** p.-v. and tp., Ulster co., N. Y., on Esopus Creek and on New York Kingston and Syracuse R. R. P. 2751.

**Shane's Crossings,** p.-v., Dublin tp., Mercer co., O. P. 246.

**Shanes'ville,** p.-v., Sugar Creek tp., Tuscarawas co., O. P. 360.

**Shanghai',** or **Shanghae,** city of China, province of Kiang-Su, situated in lat. 31° 10′ N., lon. 121° 30′ E., on the left bank of Wusung River, 12 miles above its junction with the southern portion of the mouth of the Yang-Tse-Kiang. It consists of the city proper and numerous suburbs. The city proper is surrounded with a wall 3 miles in circumference, but it is generally poorly built, though it contains a very fine Chinese temple and several elegant tea and ice houses. Of the suburbs, that inhabited by the foreign merchants is the most remarkable. It sprang up after 1843, when by the treaty between England and China the port was opened to foreign commerce. It is laid out like a European city; was inhabited in 1873 by 80,367 persons, of whom a little more than 2000 were foreigners—English, French, and Americans; and contains many elegant residences, magnificent warehouses, manufacturing establishments, dockyards, etc. The manufactures of Shanghai are flourishing, and comprise silks, glass, paper, and articles of gold, silver, and ivory. But its commerce is still more important, on account of its favorable situation at the mouth of the Yang-Tse-Kiang. Between 7000 and 8000 river and coast junks put it in communication with the interior and other parts of the empire, and the number of vessels engaged in the foreign trade which visited its harbor in 1873 amounted to 2111, with a burden of 1,165,967 tons, of which 940 vessels were English, 741 American, 135 Chinese, 127 German, and 47 French. The total value of its foreign imports amounted to $82,169,694; of native imports, to $61,549,673; of exports of native produce, to $45,504,851; of re-exports of foreign produce, to $50,880,627. The principal articles of exportation are tea, of which the U. S. took in 1874 the value of $13,869,522, silk, oil, porcelain, and straw goods; of importation, opium, treasure, grain, and coal. P. estimated at between 250,000 and 320,000.

**Shanghai',** v., Knox tp., Jefferson co., O. P. 76.

**Shan'non,** a river of Ireland, rises in the county of Cavan at an elevation of 345 feet above the sea, flows first S. to Limerick, then W., and enters the Atlantic through an estuary 10 miles wide after a course of 224 miles. It is navigable throughout nearly its whole course, though at several places it has been necessary, on account of rapids, to transfer the navigation to canals. Vessels of 400 tons burden can ascend to Limerick.

**Shannon,** county of S. E. Missouri, traversed by Current River, has a broken surface, with some deposits of copper and iron, and extensive pine forests. Staples, Indian corn, tobacco, and butter. Cap. Eminence. Area, about 1150 sq. m. P. 2339.

**Shannon,** p.-v. and tp., Carroll co., Ill., on Western Union R. R., 136 miles W. of Chicago, has 5 churches, a public school, 1 bank, 1 newspaper, and a mill. P. of v. 635; tp. 1102. MASTIN & SANFORD, EDS. "GAZETTE."

**Shannon,** tp., Atchison co., Kan. P. 1301.

**Shannon,** tp., Pottawattamie co., Kan. P. 812.

**Shannon,** v., Muskingum tp., Muskingum co., O. P. 44.

**Shannon** (WILSON), b. in Belmont co., O., Feb. 24, 1802; studied at Athens College, O., and at Transylvania University, Ky.; became a lawyer; was prosecuting attorney for the State of Ohio 1835; governor 1838–40, and again 1842–44; minister to Mexico 1844; member of Congress 1853–55; Territorial governor of Kansas 1855–56, and has since practised law at Lawrence, Kan.

**Shan'nonville,** port of entry of Hastings co., Ont., Canada, on Salmon River, 1½ miles from the Bay of Quinté, and on the Grand Trunk Railway, 120 miles E. of Toronto. Its chief trade is in lumber and railroad ties. P. about 700.

**Shan'ny,** a marine spiny-rayed fish of the genus *Pholis*, family Blenniidæ (see BLENNY) and natural order Teleostea, is usually about 5 inches long, is found in shoals on the coasts of England and France, and is remarkable for the habit of creeping, by means of its ventral fins, out of the water into the crevices of the rocks, and there remaining until the return of the tide. It has been known to live thirty hours away from salt water, but soon dies in fresh water. The American radiated shanny (*Pholis sub-bifurcatus*) is found, though rarely, on the coasts of Massachusetts and New York.

**Shanonehaw,** tp., Watauga co., N. C. P. 328.

**Shan-See',** province of China, bordering W. and S. on the Hoang-Ho, and bounded N. by Mongolia or the desert of Shamo, comprises an area of 55,278 sq. m., with 20,166,072 inhabitants. It is mountainous, and yields the purest iron ore in China; also marble, crystal, salt, and building-stone, and the most extensive coal-fields in the world. Wine is extensively cultivated; silk, carpets, iron and steel goods are the principal manufactures. Cap. Tai-Yuan-Foo.

**Shans, The,** occupy the central part of Farther India, N. of Siam and E. of Burmah, and form states which are tributary, partly to Siam and partly to Burmah. Their rulers levy no taxes, but support themselves exclusively from the proceeds of their hereditary estates and from a part of the fines. They are under the supervision of a royal commissioner from Burmah or Siam, who in his turn has left his family as hostages at the royal court.

**Shan-Toong',** province of China, bordering on the Yellow Sea, comprises an area of 65,100 sq. m., with 41,700,621 inhabitants. It is mountainous. Wheat, millet, and indigo are produced; silk, hempen cloths, and felt are manufactured. In Yen-Chow-Foo, a department of this province, Confucius was born. Cap. Tsee-Nan-Foo.

**Shap'leigh,** p.-v. and tp., York co., Me. P. 1087.

**Shapoor'** [anc. *Sapores*], the capital of the Sassanian dynasty, in lat. 29° 50′ N., lon. 51° 40′ E., in the Persian province of Fars. Its ruins, which cover vast fields, contain the finest and most interesting specimens of Persian or Oriental antiquities.

**Shark,** the English name applied to most of the species of the order or sub-order Squali, and to some extent synonymous with it. Inasmuch, however, as the word is used rather vaguely, and a number of species agreeing in structure with the so-called sharks are called by other names—*e. g.* dog-fish (*Squalus* or *Acanthias* sp., *Scyllium* sp.), sea-fox (*Alopias vulpes*), etc.—the forms will be most advantageously considered under the scientific name, SQUALI.

THEODORE GILL.

**Sha'ron,** p.-v. and tp., Litchfield co., Conn., on Housatonic R. R. P. 2441.

**Sharon,** p.-v., Taliaferro co., Ga.

**Sharon,** tp., Fayette co., Ill. P. 1663.

**Sharon,** tp., Appanoose co., Ia. P. 661.

**Sharon,** tp., Clinton co., Ia. P. 1152.

**Sharon,** tp., Johnson co., Ia. P. 1120.

**Sharon,** p.-v. and tp., Norfolk co., Mass., on Boston and Providence R. R. P. 1508.

**Sharon,** tp., Washtenaw co., Mich. P. 1087.

**Sharon,** tp., Le Sueur co., Minn. P. 924.

**Sharon,** tp., Hillsborough co., N. H. P. 182.

**Sharon,** p.-v. and tp., Schoharie co., N. Y., on Cherry Valley branch of Albany and Susquehanna R. R. P. 2648.

**Sharon,** tp., Mecklenburg co., N. C. P. 2197.

**Sharon,** tp., Franklin co., O. P. 1480.

**Sharon,** tp., Medina co., O. P. 1131.

**Sharon,** p.-v. and tp., Noble co., O. P. 1227.

**Sharon,** tp., Richland co., O. P. 2762.

**Sharon,** p.-b., Mercer co., Pa., on Erie and Pittsburg and Cleveland and Mahoning branch of the Atlantic and Great Western R. Rs., 14 miles W. of Mercer, contains 7 churches, 3 large graded schools, 2 banks and 2 banking companies, 2 newspapers, 2 extensive rolling-mills and nail-factories, 5 blast furnaces, 2 foundries and machine-

shops, 4 hotels, and a fire department. Principal business, mining and manufacturing. P. 4221.

RAY & MORRISON, EDS. "HERALD."

**Sharon,** tp., Potter co., Pa. P. 968.

**Sharon,** p.-v. and tp., Windsor co., Vt., on White River and Central Vermont R. R. P. 1013.

**Sharon,** p.-v. and tp., Bland co., Va. P. 939.

**Sharon,** tp., Portage co., Wis. P. 948.

**Sharon,** p.-tp., Walworth co., Wis., on Chicago and North-western R. R., 71 miles from the former place, has 3 churches, an academy, graded and common school, 1 bank, 1 newspaper, 1 steam flouring-mill, cheese-factory, 2 produce-houses, and 2 hotels. Excellent farming lands in the vicinity. P. 1865. J. C. KEENEY, ED. "INQUIRER."

**Sharon** (WILLIAM), b. in Smithfield, O., Jan. 9, ——; studied law, but never practised; engaged in banking; removed to Nevada, where he followed the same business, residing much of the time in San Francisco, where he was a trustee of the Bank of California; acquired enormous wealth by judicious investments in Nevada silver-mines, and took his seat in the U. S. Senate 1875.

**Sharon Springs,** p.-v., Sharon tp., Schoharie co., N. Y., on a branch of Albany and Susquehanna R. R., is a noted place of summer resort, having four mineral springs—chalybeate, magnesia, white sulphur, and blue sulphur—has 10 hotels and numerous boarding-houses, and is annually visited by above 10,000 persons. P. 520.

**Sharp.** See MUSIC, by REV. WILLIAM STAUNTON.

**Sharp** (GRANVILLE), grandson of Archbishop John, and son of Thomas Sharp, D. D., archdeacon of Northumberland, b. at Durham, England, Nov. 10, 1735; was bound apprentice to a London linen-draper 1750; was for some time a law-student, and for several years a clerk in the ordnance office; was the chief patron of the slave Somerset in suing for his freedom (1769), which resulted in the famous decision against the legality of slavery in England, pronounced by the court of king's bench May, 1772; resigned his post in the ordnance office on account of opposition to the American war Apr., 1777; devoted himself thenceforth to philanthropic objects, especially the overthrow of slavery and the slave-trade; was the first chairman of the Association for the Abolition of Negro Slavery May 22, 1787; was the principal promoter of the colony of Sierra Leone; opposed the impressment of seamen; advocated parliamentary reform, and favored the claims of Ireland. D. in London July 6, 1813. Author of sixty-one publications, chiefly pamphlets, in advocacy of the causes to which he devoted his life, philological tracts in favor of trinitarianism, and millenarian interpretations of biblical prophecies. (See his *Memoirs*, by Prince Hoare (1820) and by Charles Stuart (1836).)

**Sharp** (JAMES), D. D., b. in the castle of Banff, Scotland, in May, 1618; educated at the University of Aberdeen, where he figured among the students who declared against the Solemn League and Covenant 1638; took orders in the Scottish Church; became professor of philosophy at St. Leonard's College, St. Andrew's, 1640; was the representative of the Presbyterians sent to Cromwell 1656, to Monk and to Charles II. 1660; was appointed king's chaplain for Scotland and professor of divinity in St. Mary's College, St. Andrew's; consecrated archbishop of St. Andrew's and primate of Scotland upon an Episcopalian foundation Dec., 1661; was regarded as a tool of Charles in the persecution of the Covenanters, and consequently assassinated by "a band of nine enthusiasts" on Magus Muir, near St. Andrew's, May 3, 1679.

**Sharp** (JOHN), D. D., b. at Bradford, Yorkshire, England, Feb. 16, 1644; educated at Christ's College, Cambridge, on leaving which he became chaplain to Sir Heneage Finch, then attorney-general, through whom he obtained the archdeaconry of Berkshire 1672, a prebend at Norwich, 1675, the rectorship of St. Bartholomew, London, 1676, of St. Giles-in-the-Fields 1677, and the deanery of Norwich 1681. He became chaplain to Charles II. and James II., by whom he was deposed from his preferments for preaching against his church policy 1686; became dean of Canterbury 1689 and archbishop of York 1691. D. at Bath Feb. 2, 1714. Seven volumes of his *Sermons* were published 1709.—His son THOMAS, b. 1693, became archdeacon of Northumberland, and was author of various theological, philological, and philosophical works. D. at Durham Mar. 6, 1758.

**Sharp Creek,** p.-v. and tp., McPherson co., Kan. P. 199.

**Sharpe,** county of N. E. Arkansas, adjoining Missouri, intersected by tributaries of Black River, consists of high land broken by several ridges, in which iron, lead, and zinc are found. Cap. Evening Shade. Area, about 650 sq. m. P. 5400.

**Sharpe,** tp., Alexander co., N. C. P. 825.

**Sharpe** (DANIEL), D. D., b. at Huddersfield, England, 1783; emigrated to New York 1805; became pastor of the Baptist church at Newark, N. J., 1809; was from 1812 till his death in 1853 pastor of the Charles street Baptist church, Boston, Mass.; published about twenty sermons, of which the most significant is one on the *Recognition of Friends in Heaven*.

**Sharpe** (DANIEL), F. R. S., nephew of Samuel Rogers the poet, b. in London, England, in 1806; educated at Walthamstow; was interested in natural history and geology from boyhood; became a wine-merchant; made several visits to the wine-growing districts of Portugal; presented to the Geological Society several memoirs on the rocks and fossils of Portugal, and of Wales and England and Scotland, and several other memoirs on special subjects; contributed to the Palæontological Society an important monograph *On the Fossil Remains of the Mollusca found in the Chalk Formation of England;* reduced to system the fragments of the Lycian language preserved in the inscriptions discovered by Sir Charles Fellows; was an eloquent and keen debater in scientific associations; became president of the Royal Geological Society, and was noted for his munificence in private life. D. in London May 31, 1856.

**Sharpe** (SAMUEL), b. in England about 1800; author of a translation of the New Testament from the text of Griesbach (1846), and of a revision of the authorized version of the Old Testament (3 vols., 1865), of a *History of Egypt* (1846; new ed. 1860), of many works on Egyptian chronology and hieroglyphics, embracing editions of the Rosetta Stone and the Decree of Canopus, of *Texts from the Bible explained by Ancient Monuments* (1866), *Chronology of the Bible* (1860), *History of the Hebrew Nation and Literature*, and of a work claiming to decipher the mysterious Sinaitic inscriptions (1876).

**Sharpes'burg,** tp., Iredell co., N. C. P. 947.

**Sharps** (CHRISTIAN), b. in New Jersey in 1811; became a machinist, thoroughly conversant with every branch of his art, and invented the "Sharps rifle," which has proved so serviceable a weapon to the hunters on the Plains. In 1854 he settled at Hartford, Conn., to superintend the manufacture of this rifle, and subsequently invented other fire-arms of great value, and patented many ingenious implements of other kinds. D. at Vernon, Conn., Mar. 13, 1874.

**Sharps'burg,** p.-v., Bath co., Ky. P. 319.

**Sharpsburg,** p.-v. and tp., Washington co., Md., on Potomac River and Washington co. branch of Baltimore and Ohio R. R. P. of v. 1001; of tp. 2478.

**Sharpsburg,** p.-b., Indiana tp., Allegheny co., Pa., on Allegheny River, Allegheny Valley R. R., and Western Pennsylvania division of Pennsylvania R. R. P. 2176.

**Sharps Rifle,** on the breech-block principle, has a calibre of 0.500 inch, rifled, the breech-action being confined to three parts—the lever, the slide, and the extractor. The lever forming the trigger-guard opens the breech. The breech-slide is spheroidal, permitting the use of cartridges with varying thickness of base. The cartridge is rim-fire metallic, and the bullet cylindro-conoidal, with three cannelures, solid base, and flattened point. (See SMALL-ARMS.)

**Sharps'town,** p.-v., Pilesgrove tp., Salem co., N. J. P. 296.

**Sharps'ville,** p.-v., Mercer co., Pa., midway on Erie and Pittsburg R. R., has 5 churches, a large public school building, 1 bank, 1 newspaper, 9 blast furnaces, foundry and machine-shop, 2 carriage-factories, and 1 hotel. Principal business, manufacturing pig iron. P. about 1500.

P. J. BARTLESON, ED. "ADVERTISER."

**Sharp'town,** p.-v. and tp., Wicomico co., Md., on Nanticoke River. P. 695.

**Shars'wood** (GEORGE), LL.D., b. at Philadelphia, Pa., July 7, 1810; graduated at the University of Pennsylvania 1828; was admitted to the Philadelphia bar 1831; became a judge of the district court 1845, president judge 1851–67, judge of the supreme court of Pennsylvania 1867, and for many years professor in the law-school of the University of Pennsylvania. Author of *Professional Ethics* (1854; new ed. 1864), *Popular Lectures on Commercial Law* (1856), *Lectures Introductory to the Study of the Law* (1870), and editor of Blackstone (1859), Starkie, Roscoe, and other English law-writers.

**Shas'ta,** county of N. California, extending from the Sierra Nevada on the E. to the Coast Range on the W., intersected by Sacramento and Pitt Rivers, and traversed by the Oregon division of Central Pacific R. R., has several elevated peaks, is covered in its mountainous portion with forests of pine and redwood, contains several boiling

springs and some mines of gold, silver, and copper, has a soil exceedingly fertile in the bottom-lands, and a climate well adapted to the production of semi-tropical fruits. Staples, wheat, barley, hay, wine, wool, and butter. Cap. Shasta. Area, about 4000 sq. m. P. 4173.

**Shasta,** p.-v., cap. of Shasta co., Cal., on Sacramento River and Oregon division of Central Pacific R. R., has 1 newspaper and flourishing mines.

**Shasta, Mount.** See CALIFORNIA.

**Shas'tra** [Sans. *s'âs*, to "teach"], a name applied to the authoritative books of the Hindoos upon religion and law, civil and religious. The most important works of this class are collectively called *Dharma-s'âstra*, or "Law Shastra."

**Shatsk,** town of Russia, government of Tambov, on the Shat, has some manufactures and 6488 inhabitants.

**Shatt-el-Arab.** See EUPHRATES.

**Shat'tuck** (GEORGE CHEYNE), M. D., LL.D., b. at Templeton, Mass., July 17, 1783; graduated at Dartmouth College 1803; became a highly successful physician at Boston and president of the Massachusetts Medical Society; published several professional works; contributed largely to the library of Dartmouth College, and built an observatory for that institution. D. at Boston Mar. 18, 1854. By his will he left more than $60,000 to charitable objects. (See SHATTUCK SCHOOL.)

**Shattuck** (LEMUEL), b. at Ashby, Mass., Oct. 15, 1793; was for several years a teacher in New Hampshire, New York, and Michigan; a merchant at Concord, Mass., 1823–33; afterward a bookseller and publisher in Boston, where he was a member of the common council 1837–41; was one of the founders of the New England Historic-Genealogical Society 1844, and for five years its vice-president; a member of several other literary and scientific associations, and sat several years in the Massachusetts legislature. D. at Boston Jan. 17, 1859. Author of a *History of Concord, Mass.* (1835), *Vital Statistics of Boston* (1841), *Census of Boston* (1845), *Report on the Sanitary Condition of Massachusetts* (1850), and of a genealogy of the Shattuck family.

**Shattuck School,** Faribault, Minn., is a collegiate boarding school under the auspices of the Protestant Episcopal Church. It was organized under a State charter in 1865. The name is in honor of a liberal patron, George C. Shattuck, M. D., of Boston, Mass. The bishop of Minnesota is president of its trustees. Boys of ten years and upward are fitted for the junior class in college or for business. It has a military organization under the charge of a U. S. officer. The school occupies two fine stone buildings as a home; has a beautiful stone chapel and fireproof library and other buildings, admirably situated on 50 acres of land; the present value (in 1876) is $90,000. It has no endowments. It numbers 100 boarders. The president is Rev. James Dobbin, A. M. R. W. LOWRIE.

**Shaum'burg,** p.-v. and tp., Cook co., Ill. P. 931.

**Shaw** (GEORGE), M. D., F. R. S., b. at Bierton, Buckinghamshire, England, Dec. 10, 1751; graduated at Magdalen Hall, Oxford, 1769; took orders in the Church of England 1774, but relinquished the clerical profession for scientific pursuits; studied medicine at Edinburgh and Oxford, taking the degree of M. D. 1787, after which he settled in London as a scientific lecturer; was one of the original members and the first vice-president of the Linnæan Society; lectured on natural history at the Leverian Museum; became librarian and assistant keeper of natural history at the British Museum 1791, and principal keeper 1807. D. in London July 22, 1813. Author of *The Naturalist's Library* (24 vols., 1790–1813), *Zoology of New Holland* (1794), *General Zoology, or Systematic Natural History* (11 vols., 1800–19), *Zoological Lectures at the Royal Institution* (2 vols., 1809), and of many memoirs in the Philosophical and Linnæan Society's *Transactions*.

**Shaw** (HENRY W.), b. at Lanesborough, Mass., in 1818; resided for twenty-five years in various parts of the Western States, where he was successively farmer and auctioneer; settled at Poughkeepsie, N. Y., in the latter capacity about 1858; began to write humorous sketches for the newspapers over the signature "Josh Billings" 1863; became immediately popular both as a writer and as a lecturer; has published several volumes of comic sketches, and edited an annual *Allminax*, which has had a wide circulation. His *Complete Works* were published in a single volume in 1876.

**Shaw** (JOHN), M. D., b. at Annapolis, Md., May 4, 1778; graduated at St. John's College 1795; studied medicine; was surgeon on the American squadron sent against Algiers 1798, and secretary to Consul Eaton at Tunis; studied medicine at Edinburgh, Scotland, 1801–02; went with the earl of Selkirk to Canada 1803, where that nobleman was engaged in founding a settlement on St. John's Island in Lake St. Clair; returned to Annapolis and began practice 1805; removed to Baltimore 1807; contributed both prose and poetry to Dennie's *Portfolio* and other periodicals. D. at sea while on a voyage from Charleston to the Bahamas Jan. 10, 1809. His collected *Poems* appeared, with a *Memoir*, in 1810.

**Shaw** (LEMUEL), LL.D., b. at Barnstable, Mass., Jan. 9, 1781; graduated at Harvard 1800; became an usher at the Franklin School, and assistant editor of the Boston *Gazette;* studied law with David Everett; was admitted to the bar in New Hampshire Sept., 1804; sat in the legislature 1811–16 and in 1819, and in the State constitutional convention 1820; was State senator 1821–22 and 1828–29, and chief-justice of the Massachusetts supreme court from Aug. 31, 1830, to Aug., 1860. His reported decisions in the collections of Pickering, Metcalf, Cushing, and Gray amount to above 50 vols., and his judicial reputation in Massachusetts was second only to that of Theophilus Parsons. The city charter of Boston was drafted by him in 1822. He was a member of the American Academy, of the Massachusetts Historical Society, and for twenty-seven years one of the corporation of Harvard College. He published a few orations, addresses, and judicial charges, the most important being that upon the trial before him of Prof. John White Webster for the murder of Dr. George Parkman (1850). D. at Boston Mar. 30, 1861.

**Shaw** (ROBERT GOULD), b. at Gouldsborough, Me., June 4, 1776; became a successful merchant at Boston, where he d. May 3, 1853. By his will he bequeathed $110,000 for a "Shaw fund" to be kept at interest until it accumulates to $400,000, when it is to be applied to found an asylum for the children of sailors.

**Shaw** (ROBERT GOULD), grandson of the preceding, b. at Boston, Mass., Oct. 10, 1837; graduated at Harvard 1860; entered the famous 7th regiment of New York as a private Apr., 1861, which he accompanied to Washington; became in the following month lieutenant of the 2d Massachusetts regiment; captain Aug. 10, 1862; colonel 54th Massachusetts Volunteers, Apr. 17, 1863, being the first regiment of colored soldiers from a free State mustered into the U. S. service; killed at the assault of Fort Wagner, July 18, 1863, after having reached the parapet of the work at the head of his regiment, which led the advance.

**Shaw** (SAMUEL), b. at Boston, Mass., Oct. 2, 1754; educated at the Latin School; entered the counting-house of his father, Francis Shaw; was commissioned lieutenant of artillery Jan. 1, 1776; served through the war of the Revolution, being at its close major of artillery and aide-de-camp to Gen. Knox, by whom he was made chief clerk of the war department May, 1785, on his return from a voyage to China; was appointed U. S. consul at Canton, China, Feb., 1786, and made several mercantile voyages between that port and New York. D. at sea while returning to Boston from China May 30, 1794. His *Journals*, with a *Memoir* by Josiah Quincy, were printed in 1847.

**Shaw** (THOMAS), D. D., F. R. S., b. at Kendal, England, about 1692; educated at Queen's College, Oxford, of which he became fellow 1727; was twelve years chaplain to the English factory at Algiers, after which he travelled through Northern Africa to Egypt, Palestine, and Asia Minor; returned to England 1734; published *Travels and Observations relating to Several Parts of Barbary and the Levant* (Oxford, folio, 1738), republished in Pinkerton's *Voyages* (vol. xv.), a *Supplement* (1746), and a *Further Vindication, etc.* (1747), both in reply to Dr. Pococke and other critics who had questioned the accuracy of his observations. The work of Dr. Shaw has maintained its reputation as one of the best of the kind, having been translated into French and Dutch, and new editions having appeared in 1757 and 1808, both of which contain the supplementary publications. In 1740, Dr. Shaw became principal of St. Edmund's Hall, Oxford, and regius professor of Greek, being also collated to the vicarage of Bramley, Hampshire. D. at Oxford Aug. 15, 1751.

**Shaw** (THOMAS BUDD), b. in London, England, in 1813; educated in the free school at Shrewsbury and at St. John's College, Cambridge; became professor of English literature at the Imperial Alexander Lyceum, St. Petersburg, 1842, and at the University of St. Petersburg 1851, and was tutor in English to the imperial family of Russia from 1853 until his death, at St. Petersburg Nov. 14, 1862. Author of *Outlines of English Literature* (1848; new ed. 1864) and *Student's Specimens of English Literature* (1864), both valuable works. The former was edited in the U. S. by H. T. Tuckerman.

**Shawa'no,** county of N. E. Wisconsin, intersected by Oconto, Wolf, and Embarras rivers and their numerous tributaries, having in its centre Lake Shawano; has a gen-

erally level surface and a fertile soil. Staples, wheat, oats, and potatoes. Cap. Shawano. Area, 1260 sq. m. P. 3166.

**Shawano,** p.-v. and tp., cap. of Shawano co., Wis., on Wolf River, has 2 newspapers (1 German). P. 298.

**Shawangunk** (shong'gum), p.-v. and tp., Ulster co., N. Y., on Wallkill Valley branch of Erie R. R. P. 2823.

**Shawl** [Per. *shâl*], a kind of loose garment worn on the shoulders or around the waist, manufactured by the different nations of different materials, as the Cashmere shawl of goat's hair, the Chinese of silk, the barège of wool, etc., and in different patterns, as the palm pattern of India, the plaid pattern of Scotland, etc. The most celebrated kind is the Cashmere shawl, famous over the whole world as early as the sixteenth century. Its manufacture was then under the supervision of the government, and each shawl which issued from the looms received a separate description in the royal registers. The manufacture is still flourishing in CASHMERE (which see), though it is imitated extensively in France, Germany, and England. In Europe shawls are mostly made of wool, of cotton, or of mixed cotton and silk.

**Shawnee',** county of N. E. Kansas, on Kansas River, traversed by Kansas Pacific, Kansas Midland and Atchison Topeka and Santa Fé R. Rs., has an undulating prairie surface, with abundance of coal and limestone, and several flourishing manufactures. Staples, Indian corn, wheat, oats, potatoes, hay, and butter. Cap. Topeka, which is also the State capital. Area, 546 sq. m. P. in 1870, 13,121.

**Shawnee,** tp., Cherokee co., Kan. P. 894.

**Shawnee,** p.-v. and tp., Johnson co., Kan., on Missouri River Fort Scott and Gulf R. R. P. 2451.

**Shawnee,** tp., Wyandotte co., Kan. P. 1243.

**Shawnee,** tp., Fountain co., Md. P. 867.

**Shawnee,** tp., Cape Girardeau co., Mo. P. 1676.

**Shawnee,** tp., Allen co., O. P. 1169.

**Shawnees,** a tribe of American Indians of the Algonkin family, supposed to have been originally identical with the Kickapoos, was first known on the banks of Fox River, in the present State of Wisconsin, in 1648; engaged in war with the Iroquois; was for the most part driven southward to Cumberland River, whence it dispersed, parts of it going to Florida, others to North Carolina, and several bands to Pennsylvania. The latter were parties to Penn's famous treaties of 1682 and 1701, and to those made with the Iroquois at Albany in 1693 and 1722. The Florida bands ultimately settled in the Carolinas, where they were known as Savannahs and Yemassees, lived for a time with the Creeks, and finally joined the northern bands which were driven W. by the Iroquois, and settled on Scioto River. They were usually favorable to the French, whom they aided in the Seven Years' war, took part in the conspiracy of Pontiac, were subdued by Col. Bouquet, were at the head of the confederacy of Western tribes which fought at Point Pleasant Oct., 1774, repulsed Col. Bowman from their towns in Ohio 1779, fought against the expeditions of Harmer, St. Clair, and Wayne, and made peace at the treaty of Greenville 1795. About this time a portion of the tribe settled in Missouri under the protection of the Spanish authorities, and another portion emigrated southward. About 1805 a so-called "prophet" named Elskwatawa, then living on the upper Wabash, and his brother, the celebrated Tecumseh, became the chief leaders of the Shawnees, and attempted to form a confederacy of all the North-western Indians against the whites, visiting for that purpose most of the tribes from the great lakes to the Gulf of Mexico. This project was defeated by Gen. Harrison, who in 1811 marched upon the prophet's town, and routed the gathering forces at Tippecanoe Nov. 7. On the outbreak of the war of 1812, Tecumseh resumed his intrigues, proceeded with a band of Shawnees to Canada, made an alliance with the British, who commissioned him brigadier-general, and fell at the battle of the Thames Oct. 5, 1813. (See TECUMSEH.) The Shawnees on the Scioto remained neutral, sold their lands in 1831, as those in Missouri had done in 1825, and with them settled upon a vast reservation in the Indian Territory, now in Kansas. By the treaty of 1854 the tribal relation was terminated. The Shawnees now number about 1600 souls, some of them living with the Sacs and Foxes, a few with the Quapaws, and others with a band of Senecas. Missions have long been maintained among them by the Methodists, Baptists, and Quakers, and most of them have become civilized.

PORTER C. BLISS.

**Shaw'neetown,** p.-v., cap. of Gallatin co., Ill., on Springfield and Shawneetown branch of Ohio and Mississippi and the Shawneetown branch of St. Louis and Southeastern R. Rs., has 3 churches, 2 banks, 2 newspapers, excellent schools, 1 foundry, 2 large mills, and 1 hotel. Principal business, farming, salt-making, and coal-mining. P. 1309. F. M. PICKETT, ED. "SHAWNEE HERALD."

**Shaw's Creek,** tp., Edgefield co., S. C. P. 1760.

**Shaws'wick,** tp., Lawrence co., Ind. P. 2560.

**Shays** (DANIEL), b. at Hopkinton, Mass., in 1747; attained the rank of captain during the war of independence, after which he resided at Pelham (now Prescott); took part in an insurrectionary movement in Western Massachusetts directed against the State government 1786, and, though not at first a leader, became ultimately so prominent that the movement is generally known as "Shays's rebellion," the pretexts of which were the high salary paid the governor, the aristocratic character of the Senate, the extortions of lawyers, and the pressure of taxation—grievances which were to be met by the removal of the general court from Boston and the issue of paper money. In Dec., 1786, he led a considerable force of insurgents to Worcester, where he prevented the holding of a U. S. court, and with 2000 men marched to Springfield to capture the arsenal (Jan., 1787), but was repulsed by the militia under Gen. William Shepard. After another engagement at Petersham (Feb. 4, 1787), in which his forces were completely dispersed by Gen. Lincoln, Shays fled to New Hampshire; was pardoned the following year by Gov. Bowdoin, and removed to Sparta, Livingston co., N. Y., where he received a pension for his Revolutionary services, and survived until Sept. 29, 1825. (See Minot's *History of the Insurrection* and Holland's *History of Western Massachusetts,* Worcester, 1788.)

**Shea** (JOHN D. GILMARY), LL.D., b. in New York City July 22, 1824; educated at the grammar school of Columbia College; studied law, and was admitted to the bar, but has devoted himself chiefly to literature, and has rendered great service in illustrating the obscure early annals of French colonization and Jesuit missions. He has published *The Discovery and Exploration of the Mississippi Valley* (New York, 1853), *History of the Catholic Missions among the Indian Tribes of the U. S.* (1854), *Perils of the Ocean and Wilderness* (1857), *The Catholic Authors of America* (1858), *The Fallen Brave* (1861), *Early Voyages up and down the Mississippi* (Albany, 1862), *Novum Belgium, an Account of New Netherlands in 1643–44* (New York, 1862), *The Operations of the French Fleet under Count de Grasse* (1864), *The Lincoln Memorial* (1865); has translated, with extensive notes, Charlevoix's *History and General Description of New France* (6 vols. 8vo, 1866–72); edited from the MSS. the "Cramoisy" series of *Memoirs and Relations concerning the French Colonies in North America,* embracing documents on the early history of Canada and Louisiana (24 vols., 1857–68), *Washington's Private Diary* (1861), Colden's *History of the Five Indian Nations* (1866), being a reprint of the edition of 1727, Alsop's *Maryland* (1869), 15 vols. of grammars and dictionaries of Indian languages (1860–74); was joint author and translator into English of Courcy's *Catholic Church in the U. S.* (1856); prepared for several years the *Catholic Almanac;* revised and corrected several very erroneous Catholic Bibles; issued several prayer-books, school histories, and translations of religious treatises; edited the *Historical Magazine* (1859–65); contributed largely to the *Catholic Magazine* and other periodicals, and to the transactions of historical and philological societies; superintended for a considerable period Frank Leslie's illustrated periodicals, and wrote most of the articles on American Indian tribes for Appletons' *Cyclopædia.* Few American scholars enjoy a higher reputation for accuracy in the several departments to which he has devoted himself.

**Shea'fer** (PETER WENRICK), b. in Dauphin co., Pa., Mar. 31, 1819; educated at Oxford Academy, N. Y.; became a surveyor, geologist, and mining engineer; displayed a pronounced taste for literature and science; assisted his father, Henry Sheafer, president of the Lykens Valley R. R. and superintendent of the Lykens Valley Coal Co., in introducing that celebrated fuel in the Susquehanna market as early as 1834; joined Prof. H. D. Rogers in the first geological survey of Pennsylvania 1838; was especially active in tracing the remarkable geological features of the "Second Mountain" range extending from near Pottsville to beyond Shamokin and Tamaqua; settled at Pottsville 1848, has since as a mining engineer been one of the chief promoters of the wonderful development of the anthracite and iron interests of that vicinity, having managed, among many others, the coal-mines of the Philadelphia and Reading Coal and Iron Co. and those bequeathed by Stephen Girard to the city of Philadelphia; has extended his professional engagements to the British provinces and to the Deep River coal-lands of North Carolina; has been often consulted as an expert in complicated questions of mining-property law; has published many maps and statistical reports; delivered lec-

tures on coal at Lafayette College and elsewhere; secured in 1849 the passage of a bill for the completion of the first State survey; was influential in 1873 in securing the appointment of Prof. J. P. Lesley to make a new geological survey, and is a prominent member of many scientific, charitable, and religious organizations. Among his publications, the map of Pennsylvania as it was in 1775, issued 1875 by the Pennsylvania Historical Society, deserves especial notice.

**Sheaffe** (Sir Roger Hale), Bart., b. at Boston, Mass., July 15, 1763; obtained a commission in the British army 1778 through Earl Percy, whose head-quarters had been at his mother's house at Boston three years before; had risen to the rank of major-general in 1811; served in Canada 1812–13; took command of the British forces at the battle of Queenstown, after the death of Gen. Brock, and succeeded in inflicting a serious defeat upon the American invaders, for which service he was made a baronet Jan. 16, 1813; defended York (now Toronto) against the attack of Apr., 1813, and became full general in 1828. D. at Edinburgh, Scotland, July 17, 1851.

**Sheak'leyville,** p.-b., Sandy Creek tp., Mercer co., Pa. P. 273.

**Shears,** or **Sheers,** a form of the crane or derrick used in masting and rigging ships. It is sometimes mounted on land and sometimes on a floating vessel called a shear-hulk. Still other forms of the crane are called by this name.

**Shears** (Rev. Alonzo Groesbeck), M. D., b. in Washington, Dutchess co., N. Y., Feb. 3, 1811; educated at Wesleyan University, he became M. A. at Trinity and Yale colleges, and M. D. of New York Medical College; was ordained by Bishop Whittingham in Trinity church, New York, Mar. 4, 1849; founded the New Haven Suburban Home School, of which he was rector seventeen years; visited Europe and the East; preached in Great Britain, Rome, Naples, Jaffa, Jerusalem, and elsewhere; wrote *Sermon on Brotherly Love* (Toledo, O.), *Laus Deo*, with music (1867), *Letters from Abroad;* editor of New Haven *Musical and Masonic Magazine*, and contributed to various periodicals; has charge of a parish in New Haven.

**Shear'water,** a name bestowed on species of the subfamily Puffininæ and family Procellariidæ, to which belong the petrels or Mother Carey's chickens, etc. The species are of moderate size, the greater shearwater (*Puffinus major*) being about eighteen to twenty inches in length, and the Manx shearwater (*Puffinus anglorum*) about fifteen inches long. They are often met with at sea hundreds of miles from land. Above, they are brown or cinerous, and below white; the tail is rather long and rounded; the feet large; the tarsus shorter than the middle digit; the nasal tubes are short, flat, and obliquely truncated. (See also Procellaridæ.) Theodore Gill.

**Sheath'bill,** the English name of the species of the family Chionididæ and genera *Chionis* and *Chionarchus*. Only two species are known, and both are inhabitants of the southern hemisphere—one, *Chionis alba*, being native to the Falkland Islands, etc., and the other, *Chionis* or *Chionarchus minor*, is peculiar to Kerguelen's Island. Much difference of opinion has prevailed among naturalists respecting the relations of these birds to others in the class, some having regarded them as waders (Grallatores), others as swimmers (Natatores), and others still as gallinaceous forms. The recent researches of Drs. J. H. Kidder and Elliot Coues (*Bulletin of the U. S. National Museum*, No. 3, 1876) have, however, established the fact that they are most nearly connected with the gulls (Laridæ), and that they form a family (Chionididæ) next to the Laridæ, but distinguishable, perhaps, as the representative of a peculiar super-family (Chionidimorphæ). These relationships are expressed especially in the skeleton, and above all in the skull. In their economy and habits they strongly simulate pigeons and fowl; according to Kidder, who studied the species of Kerguelen's Island in life, the "observer is first struck by the strong resemblance which *Chionis* bears to the pigeons in general appearance, gait, and mode of flight. The general shape of the body is of an ordinary columbine character, the head being notably small, as usual in that group, the neck short and full, and the body plump; the tail, moreover, having but twelve rectrices." "The feet, in almost every particular, are thoroughly gallinaceous, even to the character of the marginal fringe of the toes." In color, however, they recall rather the characteristics of the gulls than of either gallinaceous or columbine forms. "On the other hand, the bird's omnivorous diet, habits under confinement, easy domestication, dislike of water, entire inability to swim, and many other points in its habits are strongly gallinaceous characteristics, by so much removing it from the vicinity of either grallatorial or natatorial birds." Nevertheless, the indications furnished by the skeleton outweigh all such superficial correspondences, and conclusively prove that the birds in question are derivatives from gull-like (and therefore primarily natatorial) types, but modified for terrestrial life. They are quite omnivorous in diet, feeding upon vegetable substances (sea-weeds, etc.), mollusks, and eggs. The *Chionis alba* has a total length of about seventeen inches or more, and the *Chionarchus minor* about fourteen or fifteen inches. They are called by whalers "white paddy." Theodore Gill.

**Sheath'ing,** for a ship's bottom, is made of sheet copper, and was first introduced about 1800. It not only serves to protect wooden ships from boring-shrimps, teredoes, and other small destructive animals, but to a great extent it prevents the fouling of the bottom by sea-weeds and barnacles.

**She'ba,** or **Saba,** the name of three persons in the Old Testament: (1) A great-grandson of Ham (Gen. x. 7), who appears to have settled somewhere on or near the shores of the Persian Gulf.—(2) The tenth of the thirteen sons of Joktan (Gen. x. 28), who settled in Southern Arabia, and gave his name to the kingdom whose queen visited Solomon in Jerusalem (1 Kings x. 1–13).—(3) A grandson of Abraham and Keturah (Gen. xxv. 1–3), whose descendants were nomads, in close connection with the descendants of the Hamitic Sheba mentioned above.

R. D. Hitchcock.

**Shebance,** tp., Iroquois co., Ill. P. 2530.

**Sheboy'gan,** county of E. Wisconsin, on Lake Michigan, watered by Sheboygan River and Pigeon Creek, traversed by Milwaukee Lake Shore and Western, Wisconsin Central, and Sheboygan and Fond du Lac R. Rs., has an even surface affording excellent pasturage, a productive soil, and thriving manufactures. Staples, wheat, oats, potatoes, hay, vegetables, hops, maple-sugar, butter, cheese, and wool. Cap. Sheboygan. Area, about 550 sq. m. P. 31,749.

**Sheboygan,** city and tp., cap. of Sheboygan co., Wis., on Lake Michigan, at the mouth of Sheboygan River, on Milwaukee Lake Shore and Western R. R., at E. terminus of Sheboygan and Fond du Lac R. R., has a fine harbor, ships annually 500,000 bushels of wheat, has an extensive trade in lumber, 10 churches, 3 weekly newspapers, 2 banks, a high school, and above 50 manufacturing establishments. P. in 1870, 5310; in 1875, 6828.

**Sheboygan Falls,** p.-v. and tp., Sheboygan co., Wis., on Sheboygan River and Sheboygan and Fond du Lac R. R., has good water-power and flourishing mills and manufactures. P. of v. 1174; of tp. 3223.

**Shech'em** [Heb. *Shekem*, "shoulder," "ridge"], a very ancient city of Palestine, so called because it was on the watershed between the Mediterranean and the Jordan. It is about 35 miles N. of Jerusalem, and was Abraham's first camping-ground in the country. Jacob dug a well, and Joseph was buried there. It was one of the cities of refuge, and the first capital of the northern kingdom of Israel. In the New Testament it is called *Sychar*. During the reign of Vespasian (69–79 A. D.) it was rebuilt and named Neapolis, corrupted by the Arabs into Nablus (which see).

R. D. Hitchcock.

**Shechi'nah** [Heb., "presence"], a name which first appears in the Jerusalem Targum to designate the Divine Presence wherever it exists in a special manner, but more particularly as manifested in the holy of holies within the ancient sanctuary of Israel.

**Shedd** (William Greenough Thayer), D. D., LL.D., son of a clergyman, b. at Acton, Mass., June 21, 1820; graduated at University of Vermont in 1839, and at Andover Theological Seminary in 1843; was pastor of the Congregational church in Brandon, Vt., 1844–45; professor of English literature in the University of Vermont 1845–52; professor of sacred rhetoric and pastoral theology in Auburn Theological Seminary 1852–53; professor of ecclesiastical history and lecturer on pastoral theology in Andover Theological Seminary 1853–62; pastor of the Brick church (Presbyterian), New York City, 1862–63, and professor of biblical literature in Union Theological Seminary, New York City, 1863–74, when he was transferred to the chair of systematic theology in the same institution. Besides editing the *Works* of Coleridge (7 vols., 1853) and the *Confessions* of Augustine (1860), he has published *Outlines of a System of Rhetoric*, from the German of Theremin (1850), *Lectures upon the Philosophy of History* (1856), *Discourses and Essays* (1856), Guericke's *Church History* (2 vols., 1857, 1870), *A History of Christian Doctrine* (2 vols., 1863), *Homiletics and Pastoral Theology* (1867), and *Sermons to the Natural Man* (1871). He has also published occasional addresses and essays.

**Shediac',** p.-v., Westmoreland co., N. B., on European and North American and Intercolonial railways, 106 miles

from St. John, and on Shediac Island and the Gulf of St. Lawrence. It has a fair harbor, some trade, and a weekly newspaper. P. about 500.

**Shee** (Sir MARTIN ARCHER), D. C. L., b. in Dublin, Ireland, Dec. 23, 1770; studied painting at the school of the Royal Dublin Society; was introduced in 1788 by Edmund Burke to Sir Joshua Reynolds, under whose patronage he entered as a pupil in the Royal Academy; became an exhibitor in the following year; was elected an associate of the academy 1798 and a member 1800, and was chosen successor to Lawrence as president of that institution in 1830, on which occasion he was knighted. He took Romney's house in Cavendish Square 1798, obtaining as a portrait-painter the patronage of the latter's distinguished friends; was a formidable rival of Lawrence, and in a long career preserved the lineaments of many illustrious men. He retained the presidency of the academy through life; was an effective orator on public occasions; survived all his original academical associates, and received a pension during his later years. D. at Brighton Aug. 19, 1850. Author of several poems, a tragedy, and a novel. A *Life*, by his son (2 vols., 1860), was published at London.

**Sheeah.** See SHIAS.

**Sheen's,** tp., Sanford co., Ala. P. 567.

**Sheep.** See APPENDIX.

**Sheep'shanks** (JOHN), b. at Leeds, England, in 1787, son of a wealthy cloth-merchant, by whom he was bred to the same business; employed his fortune and his leisure in forming a magnificent collection of pictures by English artists, including many of the best works of Turner, Stanfield, and Chalon, which in 1856 he presented to the nation upon certain conditions, and which is now a prominent feature of the South Kensington Museum. D. at London Oct. 6, 1863.—His brother, RICHARD, b. at Leeds in 1794, graduated at Trinity College, Cambridge, 1816, where he became a fellow 1817; studied law; was called to the bar 1822; became a clergyman about 1824; devoted himself to mathematics and astronomy, being elected to the Royal Astronomical Society 1824, and fellow of the Royal Society 1830; had a fine observatory, first at London and afterward at Reading; conducted a long series of experiments in the rooms of the Astronomical Society at Somerset House; was a boundary commissioner under the Reform bill 1831; completed the restoration (begun by Francis Baily) of the national standards of weights and measures destroyed by the burning of the houses of Parliament 1834, a task which occupied him eleven years; wrote a valuable series of astronomical articles for the *Penny Cyclopædia*, and published a number of scientific memoirs. D. at Reading Aug. 4, 1855.

**Sheeps'head** (the *Archosargus probatocephalus* of recent American authors, the *Sargus ovis* of most ichthyological works), a well-known and esteemed fish of the family Sparidæ, found along the Atlantic coast of the U. S. south of Cape Cod, but most abundant in the warmer waters. The name is given in allusion to a fancied resemblance of the head to that of a sheep, produced by the form and color as well as the cutting teeth of the jaws. The form is compressed oval, the profile very declivous; the dorsal fin has twelve spines and eleven rays, and is preceded by a recumbent spine; the anal fin has three spines and ten rays; the color is distributed in five or six blackish bands; the front or incisor teeth are quite broad, the lateral teeth molars, and in several rows. The species frequently exceeds two feet in length, although averaging less. It is one of the most esteemed fishes found in American waters, and on account of the delicacy of its flesh has been likened to the English turbot. It is also highly regarded as a game-fish, and its great strength and the formidable armature of the mouth render it a redoubtable antagonist for the angler. It feeds chiefly on mollusks and crustaceans, and its molar teeth and stout jaws are eminently adapted for breaking shells. THEODORE GILL.

**Sheep'-Tick,** the *Melophagus ovinus*, a wingless parasitic insect of the order Diptera and family Hippoboscidæ. They are often extremely annoying to sheep. There are various arsenical washes which will destroy them; a solution of carbolic acid is also recommended for the purpose.

**Sheeraz',** or **Schiraz,** town of Persia, capital of the province of Fars, in lat. 29° 36′ N., lon. 52° 44′ E., at an elevation of 4500 feet above the sea. It is in a beautiful and fertile valley, covered with rose-gardens, vineyards, groves of platane and cypress, and orchards in which pears, oranges, cherries, and other fruits ripen to the highest perfection. It was for more than five centuries one of the most splendid cities of Persia, the residence of the ruler, the seat of science and art. Saadi died here 1282, and Hafiz 1388. It was magnificently built, and celebrated both for its delicious climate and for its elegant manufactures. But in 1812 a large portion of it was laid in ruins by a fearful earthquake, and the rest of it was nearly destroyed by the same cause in 1824. It was rebuilt, but in 1853 a new and still more fearful earthquake destroyed it for the second time. It has been rebuilt once more, but not in the same style, and its manufactures and trade have declined considerably. Of its buildings, the large bazaar, the mosques, and the numerous public baths are the most remarkable. Its gardens are still wonderful. P. about 40,000.

**Sheerness',** a seaport and market-town of England, on the right bank of Medway River, at its junction with the Thames. The harbor is safe and commodious, and, being almost at the mouth of the Thames estuary, often crowded with vessels. As a naval establishment it is of inferior importance, being principally used for fitting out, refitting, and repairing ships of war, and in this capacity may be considered auxiliary to the great dockyard of Chatham, 13 miles higher up the Medway. The principal commercial business of the place is due to the fisheries, supplying shipping, the corn-trade, etc. It is also a favorite summer resort. P. 16,880.

**Shef'field,** town of England, West Riding of Yorkshire, at the junction of the Sheaf and the Don, is picturesquely situated at the foot and on the slopes of a range of hills, and is generally well built, though it presents a rather unpleasant aspect on account of the smoke and dust with which its numerous factories envelop it. Noticeable among its public buildings are the parish church, 240 feet long, 130 feet broad, built in the reign of Henry I.; St. Mary's Roman Catholic church; the cutlers' hall; the town hall; the new music hall, etc. Its educational and benevolent institutions are numerous and good. Its school of art enjoys a great reputation; a public park was opened in 1874; in 1872 the places of worship numbered 123, of which 62 belonged to various Methodist denominations, 28 to the Church of England, 13 to the Congregationalists, 4 to the Baptists, and 4 to the Roman Catholics. The river Don is navigable to within 3 miles, and by a canal the city can be reached by vessels of 60 tons burden; its means of communication by rail are perfect. In the time of Chaucer the city was celebrated for its manufacture of cutlery, and it is still the centre in England of the manufacture of knives, files, saws, carriage-springs, and all kinds of agricultural, mechanical, medical, and optical instruments. Silver-plating and britannia metal were both invented here, and have given rise to a very comprehensive manufacturing industry. Of the old Sheffield Castle, in which Mary Queen of Scots was imprisoned for twelve years, nothing is left. P. 261,029.

**Sheffield,** p.-v., Concord tp., Bureau co., Ill., on Chicago Rock Island and Pacific R. R. P. 771.

**Sheffield,** tp., Tippecanoe co., Ind. P. 1599.

**Sheffield,** p.-v. and the southernmost tp. of the Housatonic Valley, Berkshire co., Mass., the State line forming its southern boundary. Westward are the TACONIC MOUNTAINS (which see), of which the "Dome" (improperly named by Prof. Hitchcock in his geological report "Mount Everett") is, excepting "Greylock" (or Saddle Mountain) in Williamstown, the highest summit in Massachusetts, being 2650 feet above tide and 2000 feet above the village. Eastward the Hoosac range, rising to heights of 2000 feet, bound the valley, which, from foot to foot of ranges, here reaches the unusual width of about 4 miles, the otherwise nearly level plain of which is broken by frequent abrupt ridges or monticles of limestone or gneiss, generally wooded. The Housatonic meanders through with tortuous course and gentle current, and furnishes (for this and almost the only part of its course) no water-power. Sheffield, with a small rural population, is almost exclusively agricultural, having, if the usual grist and saw mills and a limited working of its exhaustless marble-quarries (the marble for Girard College, Philadelphia, as also much of that for the new court-house in New York City, came from them) are disregarded, no manufactures. Though the level site of the village has not the beauty of those of some of its neighboring Berkshire rivals, the region possesses a manifold variety of beautiful scenery. The autumnal splendor of its forests and the excursion-routes to the "Dome," "Sage's Ravine," to the "Bash-a-pish" Falls, to the Twin Lakes of Salisbury, etc. are unrivalled. Sportsmen, too, resort here for trout-fishing and shooting the woodcock, which are numerous in the autumn. Near the N. E. boundary, and elevated on the slopes of the Hoosacs, are the "Berkshire Soda Springs," resorted to, principally, for cutaneous diseases. There are Congregational and Methodist churches, and quite recently an Episcopal parish has been organized and a small church built. P. 2535.

J. G. BARNARD.

**Sheffield,** tp., Ashtabula co., O. P. 770.

**Sheffield,** p.-v. and tp., Lorain co., O., on Lake Erie and Black River. P. 973.

**Sheffield,** p.-v. and tp., Warren co., Pa., on Tionesta Creek and on Philadelphia and Erie R. R. P. 660.

**Sheffield,** p.-v. and tp., Caledonia co., Vt. P. 811.

**Sheffield** (John), Duke of Buckinghamshire and Normanby, b. in England in 1649; succeeded his father as earl of Mulgrave 1658; served in the Dutch wars of 1666 and 1672; defended Tangier against the Moors 1680; became privy councillor and lord chamberlain Feb., 1685; favored the revolution of 1688; was made marquis of Normanby May 10, 1694, duke of Normanby Mar. 9, lord privy seal and duke of Buckinghamshire Mar. 23, 1703, and built in St. James's Park the residence now known as Buckingham Palace and belonging to the Crown. He was said to have been an early lover of Queen Anne; was author of some poems which enjoyed fame during his own generation, and was a friend of Dryden, to whose memory he erected a monument in Westminster Abbey. D. Feb. 24, 1721. His poetical works were printed in 1723, and several times afterward. The title became extinct on the death of his son Edmund 1735, but the present marquis of Normanby is a descendant.

**Shef'ford,** one of the "south-eastern counties" of Quebec, Canada. It is traversed by Stanstead Shefford and Chambly Railway, is generally fertile, and possesses valuable ores of copper and iron. Cap. Waterloo. P. 19,077.

**Shehr,** town on the south-eastern coast of Arabia, in lat. 14° 43′ N., lon. 49° 40′ E., has some manufactures of coarse cotton fabrics and a brisk general trade, though it has no harbor, but only an open roadstead. P. 6000.

**Sheik** [Arab., "elder"], among the Arabs, the chief of a Bedouin tribe; a title bestowed also upon learned men, eminent religious dignitaries, and reputed saints. For instance, the grand mufti at Constantinople is called Sheikh-ul-Islam, "the chief of the faith."

**Sheil** (Richard Lalor), b. at Dublin, Ireland, Aug. 17, 1791; educated at the Jesuit college, Stonyhurst, England, and at Trinity College, Dublin; studied law at Lincoln's Inn; was called to the bar at Dublin 1814; wrote several successful dramas; contributed *Sketches of the Irish Bar* to Campbell's *New Monthly Magazine,* republished in the U. S. by R. S. Mackenzie (New York, 2 vols., 1854); became an effective popular orator in the agitation for Roman Catholic emancipation; was chosen by the Catholic Association, in conjunction with O'Connell, to represent that body at the bar of the House of Lords 1825; was active in promoting the election of O'Connell to Parliament 1828; was himself chosen member for Milburne Port shortly after the passage of the Relief act 1829; was returned for the county of Lowth 1831, and for Tipperary 1832; became noted as a brilliant and effective parliamentary orator, and aided O'Connell for several years in his campaign for the repeal of the Union, until 1838, when he accepted the sinecure post of commissioner of Greenwich Hospital. He subsequently became vice-president of the board of trade, member of the privy council 1839, and judge-advocate-general 1841; was master of the mint 1846–50, and was appointed minister to Tuscany 1850. D. at Florence May 23, 1851. His *Memoirs* were written by W. Torrens McCullagh (2 vols., 1855); a collection of his *Speeches* appeared at London 1845.—His younger brother, Sir Justin Sheil, became major-general and minister to Persia, and aided his wife in the preparation of a valuable work, *Glimpses of Life and Manners in Persia* (1856).

**Shek'el** [Heb., "weight"], a standard weight among the ancient Israelites, and also a coin of gold, silver, or copper, originally of a shekel's weight. The shekel corresponded to the Greek stater, and contained 60 *geras* or 2 *bekahs.* There were common, sacred, and royal shekels. The gold shekel was worth about $5.69 of our money; the silver, 53 cents; the copper shekel, a little more than 3 cents.

**Shelbi'na,** p.-v., Shelby co., Mo., on Hannibal and St. Joseph R. R., has 1 newspaper and a considerable trade in tobacco and stock. P. 1145.

**Shel'burn,** p.-v., Curry tp., Sullivan co., Ind., on Evansville and Crawfordsville R. R.

**Shel'burne,** the southernmost county of Nova Scotia. Its coast-line is broken by numerous excellent harbors, and a part of the interior is mountainous. Maritime pursuits are chiefly followed. Cap. Shelburne. P. 12,417.

**Shelburne,** a seaport, cap. of Shelburne co., N. S., has a very fine harbor. Shelburne Lights, on Cape Roseway, are in lat. 43° 38.5′ N., lon. 65° 15.5′ W. The town is 141 miles S. W. of Halifax. There is excellent water-power, afforded by the river Roseway. Fishing, commerce, and shipbuilding are extensively pursued. P. about 1000; of sub-district, 2789.

**Shelburne,** p.-v. and tp., Franklin co., Mass., on Deerfield River and Vermont and Massachusetts and Troy and Greenfield R. Rs. P. 1582.

**Shelburne,** p.-v. and tp., Coos co., N. H., on Androscoggin River and Grand Trunk R. R. P. 259.

**Shelburne,** p.-v. and tp., Chittenden co., Vt., on Lake Champlain, Laplotte River, and Central Vermont R. R., includes Shelburne Pond, a considerable sheet of water. P. 1190.

**Shel'burne** (William **Fitz-Maurice Petty**), Earl of, afterward Marquis of Lansdowne, b. in Dublin, Ireland, May 20, 1737, was a great-grandson of Sir William Petty and son of John Fitzmaurice, who in 1753 was made earl of Shelburne in the peerage of Ireland. He spent his early childhood at Lixnaw, Ireland, under the tutelage of his grandfather, Thomas Fitzmaurice, earl of Kerry, by whom his education was neglected; entered Christ Church, Oxford, 1753; entered the army as an officer of the 20th regiment, commanded by Gen. Wolfe, 1757; served in the expedition against Rochefort; distinguished himself at the battles of Minden (1759) and Kloster Kampen (Oct. 16, 1760); was rewarded with the rank of colonel and the post of aide-de-camp to the king; was instrumental in negotiating the support of Henry Fox to the Bute ministry, and was chosen to Parliament for Chipping Wycombe early in 1761, but before taking his seat succeeded to the earldom, by the death of his father, May 10, 1761; became president of the board of trade and privy councillor in the Grenville ministry Apr., 1763; opposed the policy which led to the enactment of the Stamp Act and other measures oppressive to America; became a personal friend of Benjamin Franklin; was dismissed from office Sept. 8, 1763; separated from Bute and Fox, attaching himself to Pitt; declined entering the Rockingham ministry 1765; became secretary of state for the southern department in Pitt's administration July, 1766; exerted himself without success to moderate the arbitrary colonial policy of Grafton and Townshend, which became dominant during the prolonged illness of Pitt; resigned his post Oct., 1768; became thenceforth a powerful opponent of the Grafton and North administrations, especially in regard to the American questions; was intimately associated with Col. Barré; frequented the society of Johnson, Reynolds, Blackstone, and Hume; laid the foundation of an extensive library and collection of historical MSS.; visited Italy and France, making at Paris the acquaintance of many eminent men, and forming an especial friendship with the Abbé Morellet, by whom he was converted to free-trade views of political economy; became intimate soon afterward with Bentham and Romilly, and with the celebrated Unitarian divines Drs. Price and Priestley; made the latter his librarian at Bowood 1772; became secretary of state in the foreign department in the Rockingham cabinet Mar., 1782, and premier on the death of Rockingham, July, 1783; negotiated the preliminaries of peace with the U. S.; resigned Feb. 21, 1783, giving place to the coalition of Fox and North; was created marquis of Lansdowne 1784, and passed the remainder of his life in political retirement. D. in London May 2, 1805. His valuable collection of historical MSS. was sold to the government, and is now in the British Museum. (See his *Life,* by his grandson, Lord Edmond Fitz-Maurice, London, 1875–76.) Porter C. Bliss.

**Shelburne Falls,** p.-v., Shelburne tp., Franklin co., Mass., on Troy and Greenfield R. R., at the picturesque falls of Greenfield River, 40 feet high, which afford water-power for important manufactories of cutlery, locks, bits, and gimlets; has 3 churches, 2 banks, and an academy. A part of the village is on the S. bank of the river, in Buckland tp.

**Shel'by,** county of Central Alabama, bounded E. by Coosa River, intersected by the Cahawba, traversed by Selma Rome and Dalton and Louisville and Montgomery line of Louisville Nashville and Great Southern R. R., has a broken surface, with deposits of coal and iron ore. Staples, Indian corn, wheat, oats, sweet potatoes, cotton, tobacco, and wool. Cap. Columbiana. Area, about 900 sq. m. P. 12,218.

**Shelby,** county of Central Illinois, on Kaskaskia and Little Wabash rivers, traversed by Springfield division of Ohio and Mississippi, Chicago branch and main line of Illinois Central, and Indianapolis and St. Louis R. Rs., has a nearly level, somewhat marshy surface. Staples, Indian corn, wheat, oats, potatoes, hay, tobacco, sorghum-molasses, butter, and wool. Stock-raising is an important industry. Cap. Shelbyville. Area, 780 sq. m. P. 25,476.

**Shelby,** county of S. E. Indiana, on Big Blue and other tributaries of E. branch of White River, traversed by Columbus branch of Jeffersonville Madison and Indianapolis and by Indianapolis Cincinnati and Lafayette, and Cincinnati Hamilton and Dayton R. Rs., has a generally

level surface and a fertile soil. Staples, wheat, Indian corn, hay, tobacco, sorghum-molasses, butter, and wool. Horses, cattle, sheep, and swine are abundant. Cap. Shelbyville. Area, 400 sq. m. P. 21,892.

**Shelby,** county of W. Iowa, watered by Nishnabatona River and Mosquito Creek and their tributaries, traversed in its S. extremity by Chicago Rock Island and Pacific R. R. Staples, Indian corn, hay, oats, butter, and wool. Cap. Harlan. Area, 550 sq. m. P. 2540.

**Shelby,** county of N. Kentucky, traversed by Shelbyville and Lexington divisions of Louisville Cincinnati and Lexington R. R., has a hilly surface, with extensive forests and a fertile soil. Staples, Indian corn, wheat, oats, tobacco, sorghum-molasses, butter, wool, and swine. Cap. Shelbyville. Area, 460 sq. m. P. 15,733.

**Shelby,** county of N. E. Missouri, intersected by N. Salt and South Fabius rivers, and traversed by Hannibal and St. Joseph R. R., has a broken surface and a productive soil, with frequent deposits of limestone and of bituminous coal. Staples, Indian corn, oats, hay, butter, and wool. Sheep and swine are numerous. Cap. Shelbyville. Area, about 560 sq. m. P. 10,119.

**Shelby,** county of W. Ohio, on Great Miami River and Miami Canal, and traversed by Cleveland Columbus Cincinnati and Indianapolis R. R., and by Cincinnati Dayton Lima and Toledo line of Cincinnati Hamilton and Dayton R. R., has a surface level in its N. part and hilly in the S. Staples, Indian corn, wheat, oats, hay, tobacco, butter, and wool. Horses, cattle, sheep, and swine are abundant. Cap. Sidney. Area, 425 sq. m. P. 20,748.

**Shelby,** county of S. W. Tennessee, adjoining Mississippi, on Mississippi River, drained by Loosahatchie and Wolf rivers, traversed by Louisville and Nashville and Great Southern, Memphis and Charleston, and New Orleans St. Louis and Chicago R. Rs., has a level and fertile surface. Staples, Indian corn, cotton, and sweet potatoes. Cap. Memphis. Area, 720 sq. m. P. 76,378.

**Shelby,** county of E. Texas, adjoining Louisiana, from which it is separated by Sabine River, has a level surface and a rich soil. Staples, Indian corn, cotton, sweet potatoes, and swine. Cap. Centre. Area, 844 sq. m. P. 5732.

**Shelby,** tp., Edwards co., Ill. P. 1469.

**Shelby,** tp., Shelby co., Ill. P. 1058.

**Shelby,** tp., Jefferson co., Ind. P. 1890.

**Shelby,** tp., Ripley co., Ind. P. 2412.

**Shelby,** tp., Tippecanoe co., Ind. P. 1395.

**Shelby,** tp., Macomb co., Mich. P. 1695.

**Shelby,** tp., Oceana co., Mich. P. 557.

**Shelby,** tp., Blue Earth co., Minn. P. 728.

**Shelby,** tp., Orleans co., N. Y. P. 3366.

**Shelbý,** p.-tp., cap. of Cleveland co., N. C., on Carolina Central R. R., 56 miles W. of Charlotte, has 4 churches, 2 excellent schools, 1 bank, 2 newspapers, a Masonic hall, a literary and temperance society, 1 tobacco-factory, a foundry, a steam saw-mill, and an extensive vineyard. P. 1849.

W. C. Durham, Ed. "Banner."

**Shelby,** p.-v., Richland co., O., at the junction of Baltimore and Ohio and Cleveland Columbus Cincinnati and Indianapolis R. Rs., has 6 churches, excellent schools, 1 bank, 1 newspaper, several steam grist-mills, and 3 hotels. P. 1807. S. S. Bloom, Ed. "News."

**Shelby,** p.-v. and tp., La Crosse co., Wis. P. 654.

**Shelby** (Gen. Evan). See Appendix.

**Shelby** (Isaac), b. near Hagerstown, Md., Dec. 11, 1750, son of Gen. Evan Shelby; received a common-school education; became a surveyor in Western Virginia; served as lieutenant in a company under his father's command at the battle of Point Pleasant, 1774; became captain 1776; was commissary of the frontier 1777; major and member of Virginia house of delegates 1779; colonel 1780; rendered distinguished service at King's Mountain, Oct. 7, 1780; served under Marion 1781, and under Greene with 500 mounted volunteers 1781–82, in which years he sat in the North Carolina legislature, from which he received a vote of thanks and a sword; settled in Lincoln co., Ky. (then Virginia), 1788; was a member of the constitutional convention 1791; governor of Kentucky 1792–96 and 1812–16; joined Gen. Harrison in Canada with 4000 Kentuckians raised by proclamation; took part in the victory of the Thames, for which Congress voted him a gold medal; declined the post of secretary of war 1817, and was commissioner with Gen. Jackson in negotiating a treaty with the Chickasaw Indians 1818. D. at Traveller's Rest, Lincoln co., Ky., July 18, 1826. His services are commemorated in the names of counties in nine of the Western and Southern States and in the name of a college at Shelbyville, Ky.—His son, James, b. 1784, served as major in the war of 1812–15, became general of militia, and d. in Sept., 1848.

**Shelby** (John), M. D., b. near Nashville May 24, 1786; was severely wounded and lost an eye while in the campaigns under Gen. Jackson against the Indians; practised his profession more than fifty years with skill and success. The second medical college in Nashville was called Shelby after him. Pres. Taylor appointed him postmaster of the capital of Tennessee. D. in Nashville May 15, 1859.

Paul F. Eve.

**Shelby City,** p.-v., Boyle co., Ky., on Knoxville branch of Louisville and Nashville and Great Southern R. Rs. (Danville Station). P. 223.

**Shel'byville,** p.-v., cap. of Shelby co., Ill., on Indianapolis and St. Louis R. R., 151 miles W. of the former place, contains 7 churches, a handsome public-school building, 3 banks, 3 newspapers, 2 large flouring-mills, 1 foundry, 1 woollen-mill, agricultural implement factory, and 3 hotels. The surrounding country is rich in coal and timber. P. 2051. Martin Bros., Eds. "Union."

**Shelbyville,** city, Noble tp., cap. of Shelby co., Ind., on Big Blue River, and at the junction of a branch of the Jeffersonville Madison and Indianapolis with Indianapolis Cincinnati and La Fayette R. R., is situated in a rich farming region, and has 7 churches, 2 banks, 3 weekly newspapers, 5 hotels, several mills, and a good fire department. P. 2731.

**Shelbyville,** p.-v. and tp., cap. of Shelby co., Ky., at the S. terminus of Shelby branch of Louisville Cincinnati and Lexington R. R., has 2 weekly newspapers and is the seat of Shelby College. P. of v. 2180; of tp. 4822.

**Shelbyville,** p.-v., cap. of Shelby co., Mo., 8 miles N. of Hannibal and St. Joseph R. R., has 4 churches, an academy, a savings bank, 1 newspaper, and 2 hotels. Principal business, stock-raising. P. 530.

W. L. Willard, Ed. "Shelby Co. Herald."

**Shelbyville,** p.-v., cap. of Bedford co., Tenn., on Nashville Chattanooga and St. Louis R. R. and Duck River, contains the Shelbyville Institute and high school, 10 churches, 2 newspapers, 2 flouring-mills, 1 cotton-factory, and 1 carriage and wagon factory. P. 1719.

R. C. Russ, Ed. "Commercial."

**Shelbyville,** p.-v., Shelby co., Tex.

**Shel'don,** p.-v. and tp., Iroquois co., Ill., on Cincinnati Lafayette and Chicago and Toledo Peoria and Warsaw R. Rs. P. of v. 231; of tp. 812.

**Sheldon,** p.-v., O'Brien co., Ia., on Sioux City and St. Paul R. R., has several churches, excellent schools, 1 newspaper, and good hotels. Business, farming and dairying. P. about 500. Frank T. Piper, Ed. "Mail."

**Sheldon,** p.-v. and tp., Houston co., Minn. P. 828.

**Sheldon,** p.-v. and tp., Wyoming co., N. Y. P. 2258.

**Sheldon,** p.-v. and tp., Beaufort co., S. C. P. 2225.

**Sheldon,** p.-v. and tp., Franklin co., Vt., on Missisquoi River and Central Vermont R. R. P. 1697.

**Sheldon,** tp., Monroe co., Wis. P. 615.

**Sheldon** (David Newton), D. D., b. at Suffield, Conn., June 26, 1807; graduated at Williams College 1830; studied at Newton Seminary; was a Baptist missionary in France 1835–39; pastor of a church at Halifax, N. S., 1840–42; became pastor at Waterville, Me., 1842; president of Waterville College 1843–53; pastor at Bath, Me., from 1853 to 1856, when he changed his theological views, and has since been pastor of Unitarian churches at Bath (1857–62) and at Waterville. Author of *Sin and Redemption* (1856) and of essays in the *Christian Review.*

**Sheldon** (Gilbert), D. D., b. at Staunton, Oxfordshire, England, July 19, 1598; graduated at Trinity College, Oxford, 1617; became fellow of All Souls' College 1622; obtained the vicarage of Hackney 1633, and the rectories of Ickford and Newington; was appointed warden of All Souls' and chaplain to Charles I. May, 1635; was ejected from the wardenship and imprisoned for loyalty to the royal cause 1647–48; lived in seclusion until the Restoration; became bishop of London 1660, archbishop of Canterbury 1663, and chancellor of Oxford University 1667, and built for that institution, at a cost of £16,000, the famous Sheldonian Theatre, opened 1669. D. at Lambeth Palace Nov. 9, 1677.

**Sheldon** (John P.), b. in Western New York in 1793; founded the first newspaper printed in English in Michigan Territory, the Detroit *Gazette,* and published it from 1817 to 1830, being official printer for several years. He subsequently emigrated to Wisconsin, and published a newspaper at Madison for about two years. D. at Winfield, Ill., in 1871. W. S. George.

**Shel'drake,** or **Shieldrake,** the common name of two genera of Anatinæ or river-ducks, of which the most common species is *Tadorna vulpanser,* a beautiful water-fowl of rich, brilliant colors, green, white, chestnut-brown, and black, with a vermilion-colored bill. It abounds on all the sea-coasts of Europe, making nests lined with down in abandoned rabbit-burrows, feeding on marine plants and Crustacea, whence probably the name, which in America is given only to the red-breasted merganser.

**Shellac.** See LAC, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Shel'ley** (MARY WOLLSTONECRAFT **Godwin**), daughter of William Godwin, b. in London, England, Aug. 30, 1797; educated in accordance with the peculiar social theories of her parents; married the poet Shelley Dec. 30, 1816, after having lived with him two years previously to the death of his first wife. D. in London Feb. 1, 1851. Author of *Frankenstein, or the Modern Prometheus* (1818), a singular novel displaying great power, of *Valperga, Lodore,* and other less successful romances; contributed to the *Cabinet Cyclopædia* a series of biographies of eminent literary and scientific men of France, Italy, and Spain, and edited the works of her husband, with biographical prefaces and notes (1839–40).

**Shelley** (PERCY BYSSHE), b. at Field Place, near Horsham, Surrey, England, Aug. 4, 1792. His grandfather, Bysshe Shelley, was an American, born at Newark, N. J., 1731, who acquired a large fortune, was made a baronet in 1806, and d. Jan. 6, 1815. His father, Timothy, b. Sept., 1753, married, in 1791, Elizabeth, daughter of Charles Pilfold of Effingham, Surrey. The domestic surroundings of the poet were unfortunate, neither of his parents having given him suitable training or inspired him with affection—a circumstance to which much of the waywardness of his career may be attributed. He received his early education at a school taught by the parish clergyman at Warnham; entered at the age of ten Zion House School, Brentford, where he was noted rather as an insatiable reader than as a successful student; was subject to waking dreams, and suffered from the brutality of the "fagging" system; entered Eton College at the age of fifteen; was addicted to experiments in chemistry; read much upon ghosts and the "occult sciences;" was careless of his tasks, but translated half of Pliny's *Natural History* for his own satisfaction; wrote an incredible amount of fragmentary verses, mostly "poor stuff," as he afterward perceived; composed, with his cousin Medwin, one or more plays and novels, and with another cousin, Miss Grove (with whom he was deeply enamored), a romance entitled *Zastrozzi,* which was printed in 1810, and, strange to relate, brought him £40; printed also a volume of poems, which he quickly withdrew from circulation, and of which no copy is known to be extant, and another romance, *St. Irvyne,* all within the same year (1810) in which he entered University College, Oxford; published anonymously a volume of burlesque poems; was expelled from his college Mar. 25, 1811, for having written a pamphlet entitled *The Necessity of Atheism;* went to London with his friend Hogg, who was also expelled in connection with the same affair; was left without support by his offended father, but received occasional supplies from the savings of his sisters, then at school; eloped to Scotland with Harriet Westbrook, the beautiful daughter of a retired innkeeper, and married her there Sept., 1811; effected a settlement with his father, by which he received a small annuity; travelled with his wife to York and Keswick, where he met Southey and De Quincey; proceeded to Dublin, Ireland, Feb. 24, 1812, where he printed two revolutionary pamphlets, addressed one or more political meetings, and was requested by the police to leave the city; went to the Isle of Man, to North and South Wales, Devonshire, and Caernarvonshire, making but brief residences at any point; returned to Dublin finally; settled in London May, 1812; printed early in 1813 *Queen Mab,* his first poem of real literary merit, a production strongly tinctured with anti-religious fanaticism; was remarried in London Mar. 24, 1814, but soon found his married life uncongenial; separated from his wife, settling upon her nearly all his disposable income, and about this time conceived a passion for Mary Godwin (daughter of William Godwin and Mary Wollstonecraft), which was fully returned. As neither of them had any respect for the marriage bond, they saw no difficulty in consulting their own inclinations, and proceeded to Switzerland, travelling as man and wife; returned to England at the close of 1814; obtained an annuity of £1000 in consequence of the death of his grandfather and his father's succession to the baronetcy (Jan., 1815); studied surgery during the winter of 1815–16, and daily walked a London hospital; wrote in 1815 his second poem of permanent interest, *Alastor, or the Spirit of Solitude;* proceeded to the Lake of Geneva in the spring of 1816; resided there some months in daily intercourse with Byron; returned to London in the autumn; legalized his connection with Mary Godwin by marriage Dec. 30, 1816, Harriet having shortly before (Nov. 10) drowned herself in the Serpentine; conducted an unsuccessful chancery suit against Mr. Westbrook (Harriet's father) for the custody of his two children, decision being given against him by Lord Eldon on the ground of atheism Aug. 23, 1817; settled at Great Marlow, Buckinghamshire, where he played the part of a country gentleman; made about this time the acquaintance of Keats and the brothers James and Horace Smith, and became very intimate with Leigh Hunt; published at the close of 1817 *The Revolt of Islam* (originally called *Laon and Cythna*), a grandly-conceived, sublime, and highly-original poem, but with many inequalities and blemishes; suffered much from pulmonary disease, which led him early in 1818 to leave England for the last time; travelled with his early friend Hogg to Italy, residing successively at Milan, Pisa, Leghorn, and Bagno di Lucca; visited Byron at Venice, remaining there some weeks; completed *Rosalind and Helen* (published 1819), a poem of little value; translated, or rather abridged, the *Symposium* of Plato; wrote at Byron's villa, near Este, *Julian and Maddalo,* one of his poetical masterpieces, not published during his life; proceeded to Rome in November, and to Naples Dec., 1818; spent the winter at the latter and the spring of 1819 at the former city; proceeded to Florence Oct., 1819; made in each of the Italian capitals an assiduous study of their works of art; wrote, chiefly at Florence, during this year, his two greatest works, the tragedy *Prometheus Unbound* and the tragedy *The Cenci,* both of which were published in London in 1820; removed to Pisa Jan., 1820; wrote in this year his *Epipsychidion* and his *Witch of Atlas;* in 1821 *Adonais,* a beautiful monody on the death of Keats, and *Hellas,* a noble drama inspired by the insurrection in Greece; made a long visit to Byron at Ravenna Aug., 1821; was joined by the latter at Pisa during the ensuing winter (1821–22); commenced his unfinished poem, *The Triumph of Life;* took a summer residence Apr., 1822, at Lerici, a village on the Genoese coast; went frequently upon boating excursions with his friends, Capt. Trelawney and Lieut. Williams, and was drowned, along with the latter, in the Bay of Spezia July 8, 1822, while returning from a visit to Leigh Hunt at Leghorn, owing to their boat having capsized in a squall. The bodies were cast upon the shore many days later, and were burned in the presence of Byron and Leigh Hunt, in accordance with the quarantine laws of Tuscany. The ashes were buried by Trelawney in the Protestant burial-ground at Rome, near the tomb of Keats. A son, Sir Percy Florence Shelley, b. 1819, is still living (1876), and a daughter, Ianthe, by Shelley's first wife, was living in 1870, as were also three sisters of the poet. His poetical works were edited by his widow in 1839, and a selection of his letters, prose writings, and translations was issued by her in 1840. The first complete edition of his *Works* was edited by R. H. Shepherd (London, 4 vols., 1875). Fragmentary memoirs and reminiscences were written by Capts. Medwin (1847) and Trelawney (1858) and by Lady Shelley (1859). W. M. Rossetti prefixed a short *Memoir* to an edition of the *Poems* (1870), an unfinished *Life* was written by his college friend, T. J. Hogg (2 vols., 1858), and Denis F. McCarthy issued in 1872 *Shelley's Early Life, from Original Sources.* The *Life of Godwin* (2 vols., 1876), by C. Kegan Paul, contains some valuable elucidations. Many parts of the career of Shelley are involved in deep uncertainty, and concerning others there is an almost hopeless conflict of testimony. The text of his poems is singularly uncertain, they having usually been printed in his absence, and the judgment of the world upon his merits as a man and as a poet is still conflicting. Severely judged by most of his contemporaries in both respects, the current of opinion is now setting strongly in the opposite direction; he is styled "the poet of poets," and by the Swinburne and Rossetti school of critics, now in the ascendant in England, is regarded as the greatest English poet since Shakspeare.

PORTER C. BLISS.

**Shell'-Marl,** a pulverulent calcareous deposit, composed largely or exclusively of shells of fresh-water and land Mollusca, found accumulating at the bottom of a few lakes (such as Milk Pond, Sussex co., N. J.), more commonly beneath peat or muck in marshes. In the latter cases the marl occupies the place of a lake that has been filled up and obliterated, chiefly by the growth of vegetation, and has been formed from successive generations of shells which inhabited the water or the immediate shore. In a few instances marl is sufficiently pure to be used for quicklime; more generally, however, it contains too much earthy matter for this purpose, but is a very valuable fertilizer, as which it is largely used. J. S. NEWBERRY.

**Shell Mound,** v., Marion co., Tenn. (NICOJACK P. O.), on Tennessee River, at the base of Raccoon Mountain, on Nashville Chattanooga and St. Louis R. R., is the site of the celebrated Nicojack (or Nickajack) Cave, said to extend 15 miles S. E. under Raccoon Mountain. During the civil war it was one of the chief sources which supplied saltpetre to the Confederate armies.

**Shell Rock,** p.-v. and tp., Butler co., Ia., on Burlington Cedar Rapids and Minnesota and Iowa Pacific R. Rs., has 2 churches, schools, 1 woollen and 2 flouring mills, and 1 newspaper. P. 1142.

SILAS WHITE, ED "ENTERPRISE."

**Shell Rock,** p.-v. and tp., Freeborn co., Minn. P. 512.

**Shells,** in artillery. See PROJECTILE, by J. G. BUTLER.

**Shells,** in natural history. See CONCHOLOGY, by G. W. TRYON, JR.

**Shells'burg,** p.-v., Canton tp., Benton co., Ia., on Burlington Cedar Rapids and Minnesota R. R., has 1 weekly newspaper.

**Shelly's Case,** a celebrated case at law decided in the 23d year of Elizabeth (1591), and reported in the first part of Lord Coke's *Reports,* which established a technical dogma of the English real-property law, long known as "the rule in Shelly's case." This rule is stated by Mr. Preston, a very eminent legal writer, in nearly the following terms: When a person takes an estate of freehold—that is, for life—under a deed or will, and in the same instrument there is a limitation by way of remainder (either with or without the interposition of another estate) to his heirs or to the heirs of his body as a class of persons, the limitation to the heirs entitles the ancestor to the whole estate; if it be to the heirs of his body, he takes an estate in fee tail; if to his heirs generally, an estate in fee simple. Perhaps no reported decision has been more discussed and commented upon, or more frequently referred to in subsequent adjudications, than this. The rule as above recited has, however, been abolished by statute in New York and in many other American States, and in pursuance of this modern legislation the ancestor would take only a life estate, while his heirs would take the fee by way of remainder, according to the express language of the conveyance.

JOHN NORTON POMEROY.

**Sheloc'ta,** p.-v., Armstrong tp., Indiana co., Pa. P. 113.

**Shel'ter Island,** p.-v. and tp., Suffolk co., N. Y. This island, embracing 8000 acres, is in Gardiner's Bay, near the E. extremity of Long Island; was originally the residence of the Manhassett Indians; was sold by the earl of Stirling to citizens of Connecticut Colony, who made a settlement here as a part of Connecticut in 1652. P. 645.

**Shel'ton** (FREDERICK WILLIAM), LL.D., b. at Jamaica, L. I., in 1814; graduated at Princeton 1834; was ordained in the Protestant Episcopal Church 1847; has been settled over churches at Huntington, L. I., Fishkill-on-the-Hudson, and at Montpelier, Vt., since 1854. He was a frequent contributor to the *Knickerbocker Magazine,* and author of *The Trollopiad, or Travelling Gentleman in America* (1837), *Salander and the Dragon* (1851), *Chrystalline* (1854), *The Rector of St. Bardolph's* (1853), *Up the River* (1853), and *Peeps from the Belfry* (1855).

**Shel'ton** (THOMAS), b. in England about 1580; made the earliest English translation of *Don Quixote* (London, 2 vols. 4to, 1612–20), which was "improved" by Capt. John Stevens (3 vols. 8vo, 1705–06) and has been largely drawn upon by subsequent translators. Shelton was author of *A Century of Similes* (1640) and of a work on *Tachygraphy.* The time and place of his death are unknown.

**Shelton's,** tp., Pickens co., S. C. P. 218.

**Shemakha,** town of Russia, in Transcaucasia, on the Pirsaghut, at an elevation of 2230 feet above the sea. It is fortified, and has large and well-stocked bazaars and manufactures of silk and cotton stuffs. In the vicinity is produced much wine and fruit. P. 20,000.

**Shemitic.** See SEMITIC.

**Shenando'ah,** a famous Confederate war-steamer, built at Glasgow in 1863 by a London company for the China trade, under the name of the Sea King, and transferred to the Confederate government in 1864, when she was converted into a war-vessel, and afterward bore the name of Shenandoah. (For her cruise see WADDELL, JAMES IREDELL, who was her commander.) A. H. STEPHENS.

**Shenandoah,** county of N. Virginia, intersected by N. fork of Shenandoah River, consisting of a portion of the fertile "Valley of Virginia," between ranges of the Blue Ridge and Alleghany mountains, is traversed by Harper's Ferry and Valley branch of Baltimore and Ohio and by Washington City Virginia Midland and Great Southern R. R.; has deposits of iron, lead, copper, and coal, and was the theatre of many important military operations during the civil war. Staples, wheat, Indian corn, oats, hay, butter, and wool. Cap. Woodstock. Area, about 500 sq. m. P. 14,936.

**Shenandoah,** p.-v., Grant tp., Page co., Ia., on Nishnabatona River and on Nebraska City branch of Burlington and Missouri River R. R., has 1 weekly newspaper and a thriving trade.

**Shenandoah,** p.-b., Mahanoy tp., Schuylkill co., Pa., on Mahanoy branch of Lehigh Valley R. R. and Shenandoah branch of Philadelphia and Reading R. R., is an important centre of anthracite coal-mining and trade, and has 1 weekly newspaper. P. 2951.

**Shenandoah Iron-Works,** p.-v. and tp., Page co., Va. P. 2175.

**Shenandoah River** rises in Augusta co., Va., and runs N. E. along the Valley of Virginia, W. of the Blue Ridge. At Front Royal it is joined by its N. fork. It is about 170 miles long, and for 140 miles is navigated by bateaus. It joins the Potomac at Harper's Ferry, W. Va. It flows through a rich and picturesque region, and affords great water-power.

**Shenan'go,** tp., Lawrence co., Pa. P. 1748.

**Shenango,** tp., Mercer co., Pa., includes the large village of Greenville. P. 2616.

**Shen'dy,** town of Nubia, on the Nile, in lat. 16° 38′ 35″ N., was formerly a place of great commercial importance, and, although it has declined, large quantities of corn, cattle, and manufactured goods are sold at its weekly markets. P. 10,000.

**Shen-See',** province of China, bordering E. on the Hoangho, and bounded N. by Mongolia, comprises an area of 67,400 sq. m., with 10,207,256 inhabitants. It is mountainous, and rich in iron, gold, porphyry, jasper, and copper. Wheat, millet, rhubarb, ginseng, and excellent timber are produced. Cap. See-Sang-Foo.

**Shen'stone** (WILLIAM), b. at the Leasowes, near Hales-Owen, Shropshire, England, in Nov., 1714; studied at Pembroke College, Oxford, and passed his life in retirement on his hereditary estate, writing elegies, ballads, odes, and pastorals which had considerable popularity. The poem entitled *The Schoolmistress* (1742) is the only one now remembered, being still found in many volumes of poetical selections. D. at the Leasowes Feb. 11, 1763. His *Works* and *Letters* were posthumously collected in 3 vols. 1764–69. An edition of his *Poems,* edited by Gilfillan, with a memoir, appeared at Edinburgh in 1854, and his *Essays on Men and Manners* were republished at London in 1868.

**Shep'ard,** tp., Crawford co., Ark. P. 335.

**Shepard** (CHARLES UPHAM), M. D., LL.D., b. at Little Compton, R. I., June 29, 1804; graduated at Amherst College 1824; studied botany and mineralogy at Cambridge under Nuttall; taught those branches at Boston; was for two years assistant in the laboratory of Prof. Silliman at New Haven, and for one year lecturer at the Brewster Scientific Institute at New Haven; was employed on a government commission to investigate the methods of sugar-culture and manufacture in the Southern States 1832–33; was lecturer on natural history at Yale College 1830–47; associate of Dr. J. G. Percival in the geological survey of Connecticut 1835; professor of chemistry and natural history at Amherst 1845–52, and in the Medical College at Charleston, S. C., 1854–61; afterward became again professor of natural history at Amherst, a post he still (1876) holds. Prof. Shepard has visited Europe many times, has formed at Amherst the finest American collection of minerals and meteorites, is author of a *Treatise on Mineralogy* (1832; 3d ed., enlarged, 1855), and of a *Report on the Geology of Connecticut* (1837), and has contributed many papers to the *Transactions* of scientific associations.—His son, CHARLES UPHAM SHEPARD, JR., M. D., b. at New Haven Oct. 4, 1842; prepared for college at Phillips Academy, Andover, Mass.; graduated at Yale College 1863, and in medicine at Göttingen, Germany, 1867, and has been professor of chemistry at the Medical College of Charleston, S. C., since Oct., 1867.

**Shepard** (THOMAS), b. at Towcester, England, Nov. 5, 1605; graduated M. A. at Emanuel College, Cambridge, 1627; became a preacher at Earle's-Colne, Essex; was silenced for nonconformity 1630; resided for some time at Buttercrambe, Yorkshire, in the family of Sir Richard Darby, whose daughter he married; was again silenced for preaching at that place and at Heddon, Northumberland; emigrated to Massachusetts, arriving at Boston Oct. 3, 1635; succeeded Hooker as pastor of the church at Cambridge Feb., 1636; was influential in founding Harvard College at that place the same year; published *New England's Lamentation for Old England's Errors* (London, 1645), *The Sound Believer* (1645), *The Clear Sunshine of the Gos-*

*pel breaking forth upon the Indians in New England* (London, 1648; New York, 1865), *Theses Sabbaticæ* (1649), and other theological works; married as his second wife a daughter of his predecessor, Rev. Thomas Hooker, after whose death he was esteemed the most learned and skilful exponent of Puritan theology in New England. D. at Cambridge Aug. 25, 1649. By a third wife he was ancestor of Pres. John Adams. He left numerous works in MS., some of which were published in England, especially *Subjection to Christ* (1652), to which was prefixed a *Life* of Shepard by Samuel Mather and William Greenhill; *The Parable of the Ten Virgins Opened and Applied* (London, folio, 1660; new eds. 1839, Aberdeen, 1838), and various collections of *Sermons*. He left an *Autobiography*, first printed at Cambridge (1832) for the "Shepard Congregational Society." A collective edition of his *Works* appeared at Boston (3 vols., 1853), with a *Memoir* of his life and character by Rev. Dr. Alger of Cambridge. A full memoir by Cotton Mather may be found in the *Magnalia Christi Americana*, and another in the *Lives of the Chief Fathers of New England*.

**Shepard** (William), b. in Massachusetts Dec. 1, 1737; served through the French war as captain under Sir Jeffrey Amherst, and through the Revolutionary war, during which he participated in twenty-two engagements; became a farmer at Westfield, Mass., and was brigadier-general of militia when in 1787 he was entrusted with the defence of the arsenal at Springfield against the insurgents led by Daniel Shays; was a member of the executive council 1788–90; became major-general of militia; was member of Congress 1797–1803, and passed his later years in great poverty. D. at Westfield Nov. 11, 1817.

**Shep'herd,** tp., Jefferson co., West Va. P. 1859.

**Shepherd** (Alexander R.), b. at Washington, D. C., Jan. 31, 1835; was apprenticed to a carpenter at the age of ten years, and to a plumber at the age of seventeen; became a successful business-man in the plumbing business; took an active part in local politics, especially in promoting the erection of the District of Columbia into a Territory; became in 1870 president of the Citizens' Reform Association, and in 1871 vice-president of the board of works, in which capacity he was largely instrumental in the rapid growth and adornment of the city. In 1873 he was appointed governor of the District, and held that office until the form of government was changed.

**Shepherd** (Oliver Lathrop), b. in New York City about 1818; graduated at West Point 1840; served in the Florida war 1841–42, on the Rio Grande frontier 1846, in the Valley of Mexico 1847, being brevetted captain and major of infantry for gallantry at Churubusco and Chapultepec; took part in campaigns against the Indians of New Mexico 1856–57; was engaged with the rank of brigadier-general of volunteers in the campaigns of 1861–62 in Tennessee and Mississippi; was brevetted colonel U. S. A. for gallantry at the siege of Corinth May 17, 1862, and brigadier-general U. S. A. for services at Stone River, Mar. 13, 1865; retired from the army July 15, 1870.

**Shepherd Kings.** See Hyksos.

**Shepherd's Dog,** a name applied to the breeds of domestic dog which are trained to assist in attending the flocks of sheep. Of all strains of shepherd's dog, the Scotch colly is the most celebrated. It is one of the most sagacious and docile of dogs, and becomes attached to a kind master, but is shy, and sometimes fierce to strangers.

**Shep'herdstown,** p.-v., Wheeling tp., Belmont co., O. P. 44.

**Shepherdstown,** p.-v., cap. of Jefferson co., West Va., on Potomac River, 8 miles W. of Harper's Ferry, contains 8 churches, Shepherd's College, good schools, 1 bank, a large paper-board mill, an axe-handle factory, cement and flour mills, 1 newspaper, and 2 hotels. P. 1389.

J. H. Zittle, Ed. "Register."

**Shep'herdsville,** p.-v., cap. of Bullitt co., Ky., on E. fork of Salt River, and on Louisville and Nashville and Great Southern R. R. P. 267.

**Shep'ley** (Ether), LL.D., b. at Groton, Mass., Nov. 2, 1789; graduated at Dartmouth College 1811, in the same class with Amos Kendall, Joel Parker, and Daniel Poor; became a lawyer at Saco, and subsequently at Portland; sat in the Massachusetts legislature 1819, and in the Maine constitutional convention 1820; was U. S. district attorney for Maine 1821–33; U. S. Senator 1833–36; became a justice of the supreme court of the State Sept. 23, 1836; was chief-justice 1848–55; published 26 volumes of *Reports* while on the bench, and was a commissioner to prepare the *Revised Statutes of Maine* (1857).

**Shepley** (George F.), son of the preceding, b. at Saco, Me., Jan. 1, 1819; graduated at Dartmouth College in 1837, and at Dana Law School, Cambridge, 1839; admitted to the bar of the supreme judicial court, Bangor, Me., 1840; in 1844 removed to Portland; was appointed U. S. attorney for Maine district in 1848, and reappointed in 1853 and 1857, subsequently devoting himself exclusively to a very extensive and general practice of his profession, in the course of which he was called upon to argue several cases of great importance in the U. S. Supreme Court, until Sept., 1861, when he was commissioned colonel of the 12th Maine Vols.; commanded a brigade in Gen. Butler's expedition against New Orleans, and on the occupation of that city was appointed military commandant and acting mayor, and assigned to the command of the defences of New Orleans, and charged with the administration of civil affairs in the city. Shortly after he was commissioned brigadier-general of volunteers by Pres. Lincoln, who appointed him military governor of Louisiana June 3, 1862. In 1864 he commanded the military district of Virginia and North Carolina; served with the army of the James 1864–65; entered Richmond with the 25th army corps Apr. 3, 1865, and was appointed military governor of that city. Resuming his profession at the close of the war, he declined the appointment of judge of the supreme court of Maine, but in 1869 accepted that of U. S. circuit judge for the first judicial circuit. His decisions are reported in Shepley's *Circuit Court Reports*.

**Shep'pard** (John H.), b. at Cirencester, England, Mar. 17, 1789; came with his parents to Hallowell, Me., 1793; studied at Harvard; was admitted to the bar in Maine 1810; practised law at Wiscasset; was register of probate for Lincoln county 1817–34; settled at Boston, Mass., 1842; was an early and efficient member of the New England Historic-Genealogical Society, and its librarian 1861–69; contributed largely to the *Register* of that society; published occasional poems, several addresses on Masonic and antiquarian subjects, and a *Life of Commodore Tucker* (1868).

**Sher'bet** [Arab., a "draught"], an Oriental name for various drinks, often cooled by means of snow, usually sweetened, and flavored with lemon-juice and various fruit-syrups.

**Sher'born,** p.-v. and tp., Middlesex co., Mass., on Mansfield and Framingham branch of Boston Clinton and Fitchburg R. R. and Milford branch of Boston and Albany R. R., is noted for the extensive cultivation of apples, cranberries, and the basket willow. There is a good town-history by Abner Morse (Boston, 1856). P. 1062.

**Sher'borne,** town of England, county of Dorset, on the Irel, has some silk-throwing mills. P. 5793.

**Sher'brooke,** county of Quebec, Canada, consisting of the townships of Ascot and Orford, and including the important town of Sherbrooke, the capital. It has extensive water-power, afforded by the river St. Francis. Cap. Sherbrooke. P. 8516.

**Sherbrooke,** p.-v., cap. of Sherbrooke co., Quebec, Canada, on both sides of the river Magog and on Grand Trunk Railway, 100 miles E. of Montreal. It has a splendid water-power, an extensive trade, 3 weekly newspapers, a bank, an industrial college, and manufactures of fine tweeds and many other goods. It is the most important town in South-eastern Canada. P. 4432.

**Sherbrooke,** a seaport of Guysborough co., N. S., at the head of navigation of the beautiful St. Mary's River, 12 miles from its mouth. Shipbuilding, the lumber-trade, gold-mining, and quartz-milling are carried on. P. about 500.

**Sher'burne,** county of Central Minnesota, on the Mississippi, intersected by Elk and Rum rivers, and traversed by a branch of St. Paul and Pacific R. R., is dotted with numerous small lakes, and has a diversified surface and a productive soil. Staples, wheat, Indian corn, oats, potatoes, hay, and butter. Cap. Elk River Station. Area, 445 sq. m. P. 2050.

**Sherburne,** tp., Fleming co., Ky. P. 158.

**Sherburne,** p.-tp., Chenango co., N. Y., on Utica branch of Delaware Lackawanna and Western R. R., 40 miles S. W. of Utica, has 5 churches, an academy, 1 bank, 1 newspaper, a woollen-mill, 1 steam flouring-mill, several butter and cheese factories, 2 hotels, and 1 sash, door, and blind factory. P. 2927.

Thomas Randall, Ed. "Sherburne News."

**Sherburne,** p.-v. and tp., Rutland co., Vt. P. 462.

**Sher'idan,** county of Central Dakota, watered by affluents of Cheyenne and Mouse rivers, contains several lakes. The Plateau du Coteau du Missouri embraces the W. part. It is still unorganized. Area, about 1750 sq. m.

**Sheridan,** county of N. W. Kansas, on Solomon and Saline rivers, consists of rolling prairies well adapted to pasturage; is still unorganized. Area, about 900 sq. m.

**Sheridan,** p.-v., cap. of Grant co., Ark.
**Sheridan,** tp., Logan co., Ill. P. 1002.
**Sheridan,** tp., Carroll co., Ia. P. 472.
**Sheridan,** tp., Poweshiek co., Ia. P. 558.
**Sheridan,** tp., Scott co., Ia. P. 1222.
**Sheridan,** tp., Cherokee co., Kan. P. 1149.
**Sheridan,** tp., Crawford co., Kan. P. 1042.
**Sheridan,** tp., Linn co., Kan. P. 828.
**Sheridan,** tp., Ottawa co., Kan. P. 798.
**Sheridan,** tp., Calhoun co., Mich. P. 1619.
**Sheridan,** tp., Clare co., Mich. P. 87.
**Sheridan,** tp., Huron co., Mich. P. 158.
**Sheridan,** tp., Mecosta co., Mich. P. 134.
**Sheridan,** tp., Newaygo co., Mich. P. 458.
**Sheridan,** tp., Redwood co., Minn. P. 111.
**Sheridan,** tp., Daviess co., Mo. P. 923.
**Sheridan,** tp., Washington co., Neb. P. 260.
**Sheridan,** p.-v. and tp., Chautauqua co., N. Y., on Erie and Lake Shore and Michigan Southern R. Rs. P. 1686.
**Sheridan,** tp., Colleton co., S. C. P. 1121.
**Sheridan,** tp., Calhoun co., West Va. P. 589.
**Sheridan,** tp., Lewis co., West Va. P. 2320.
**Sheridan,** tp., Lincoln co., West Va. P. 949.
**Sheridan,** tp., Dunn co., Wis. P. 117.

**Sheridan** (Frances **Chamberlaine**), b. in Ireland in 1724; wrote at the age of fifteen a romance, *Eugenia and Adelaide*, which was dramatized by her daughter long afterward, and successfully acted at Dublin; made the acquaintance of Sheridan, the theatrical manager, during the controversies in which he was involved, by the publication of a pamphlet in his favor; married him about 1748; wrote two popular novels, *Sidney Biddulph* (3 vols., 1761) and *Nourmahad* (1788), and two comedies, *The Discovery* (1763) and *The Dupe* (1764), and left an unpublished play, *The Trip to Bath*, which was of great use to her son in the preparation of his comedy, *The Rivals*. D. in Blois, France, Sept., 1766.

**Sheridan** (Philip Henry), b. in Somerset, Perry co., O., Mar. 6, 1831; was graduated from the U. S. Military Academy, and assigned to the 1st Infantry as brevet second lieutenant July 1, 1853. After a brief term in barracks he was ordered to Texas; transferred to the Pacific coast in 1855, serving in Washington and Oregon Territories until the fall of 1861, at which date he was captain in the 13th Infantry. Recalled to the "States," he was in December assigned to the army of S. W. Missouri as chief quartermaster. After the battle of Pea Ridge (Mar., 1862) he was relieved, and in the Corinth campaign accompanied Gen. Halleck as quartermaster until May 25. On this date he was appointed colonel of the 2d Michigan Cavalry; three days later was off on a raid to Booneville, and May 30 in pursuit of the enemy retreating from Corinth. On the 1st of July, in command of a cavalry brigade, he defeated a superior cavalry force at Booneville, and was commissioned brigadier-general of volunteers from that date. Transferred to the Army of the Ohio, he commanded a division at the battle of Perryville (Oct. 8), where "he held the key of our position, and used the point to its utmost advantage." At the battle of Murfreesboro' (Dec. 31) (which see) Sheridan's division held the left of the right wing. An attack on his front had been met and the enemy driven back, when by the giving way of the two divisions on his right his flank became exposed to the advancing foe. Hastily forming a new line under cover of a charge, he made a brave resistance for an hour, when he was again compelled to take up a new line, this time connecting with Negley of the centre wing, the two divisions repulsing three desperate assaults by four divisions of the enemy, when, Sheridan's ammunition giving out, he ordered a bayonet charge and withdrew his lines from the field. But by his obstinate resistance priceless time had been gained for Rosecrans to make his new dispositions. In due time Sheridan's commission as major-general of volunteers followed, to date from this battle. With the exception of skirmishes with Forrest and Van Dorn, not much occurred until late in June, 1863, when Rosecrans advanced against Bragg, who fell back into Georgia. The battle of Chickamauga took place Sept. 19–20, where Sheridan fought with great gallantry, rescuing his division from a perilous position. Grant superseded Rosecrans in October, and on Nov. 24–25 was fought the battle of Chattanooga, where, on the 25th, Sheridan, by his fearless assault at the head of his division upon the centre of the enemy's lines on Missionary Ridge, gained additional and merited renown. The march to Knoxville, where Burnside was besieged, next followed. Upon Grant's promotion to be lieutenant-general (Mar., 1864) he applied for the transfer of Sheridan to the East, and appointed him chief of cavalry of the Army of the Potomac. In the campaign of 1864 the cavalry covered the front and flanks of the infantry through the battles of the Wilderness until May 8, when the greater part of it was withdrawn, and next morning Sheridan started on a raid against the enemy's lines of communication with Richmond. On the 25th he rejoined the army, having destroyed the dépôts, trains, and track at Beaver Dam and Ashland stations, liberated 400 of our men, and defeated the enemy's cavalry at Yellow Tavern, where their best cavalry leader, J. E. B. Stuart, was mortally wounded. The outer line of works around Richmond was taken, but the second line was too strong to be carried by assault; and crossing the Chickahominy at Meadow Bridge, James River was reached May 14, thence by White House and Hanover Court-house back to the army. This raid drew off nearly all the enemy's cavalry, making the guarding of Grant's trains an easy matter. Resuming the advance, the battle of Hawes's Shop was fought May 28, and Cold Harbor occupied on the 31st, and held until the arrival of the infantry. On June 7, Sheridan with two divisions started around the left of Lee's army to destroy the Virginia Central R. R. in rear, which accomplished, the Fredericksburg road was struck at Chesterfield, thence again striking the Virginia Central at Trevilian's, where he routed Wade Hampton (June 11), and next day tore up the road nearly to Louisa Court-house, when, advancing toward Gordonsville, an indecisive engagement took place; not hearing from Hunter, who was to meet him here, he withdrew, rejoining the army June 19. On Aug. 7 the Middle department and departments of West Virginia, Washington, and Susquehanna were constituted "the Middle military division," and Sheridan assigned to command of the same. Numerous severe cavalry skirmishes occurred during August and early in September, but no general engagement, although the two armies lay in such position—the enemy under Gen. Early on the W. bank of Opequan Creek, covering Winchester, and Sheridan in front of Berryville—that either could bring on a battle at will. Defeat to Sheridan, however, would expose Maryland and Pennsylvania to invasion. But the imperative necessity of having the unobstructed use of the Baltimore and Ohio R. R. and the Chesapeake and Ohio Canal, among other reasons led Grant to take the initiative; but before giving orders to attack he visited Sheridan (Sept. 16), the latter expressing such confidence of success that Grant gave him but two words of instruction: "Go in!" Three days later he attacked Early at the crossing of the Opequan, and after a vigorous battle routed the enemy and captured 3000 prisoners and 5 guns. Early rallied his army at the strong position of Fisher's Hill, where, on the 22d, he was again defeated, with heavy loss, and pursued to the mountains. Sheridan devastated the Valley on his return, rendering it untenable for an enemy's army. He was now (Sept. 20) appointed a brigadier-general in the regular army. On Oct. 19, Early, after surprising our army in the morning, was disastrously defeated. (See Cedar Creek.) The thanks of Congress were bestowed upon Sheridan and his army, and Nov. 8 he was appointed major-general in the regular army. On Feb. 27, 1865, starting out with 10,000 cavalry, he destroyed the Virginia Central R. R., the James River Canal, and immense quantities of supplies, and defeated Early again at Waynesboro', rejoining Grant before Petersburg Mar. 27. Sheridan had now a force of about 9000, and in subsequent operations was under the immediate orders of Gen. Grant. He commanded at the battle of Five Forks (which see), and displayed great generalship. This decisive battle compelled Lee to evacuate Petersburg. Sheridan, pursuing, struck the flying army at Sailor's Creek, capturing 16 guns and 400 wagons, and detaining him until the 6th corps could come up, when a combined attack resulted in the capture of upward of 6000 prisoners. On the 8th four supply-trains were captured at Appomattox Station, and at Appomattox Court-house the advance of Lee's army was resisted until dark. On the morning of the 9th the enemy endeavored to break through his dismounted command, but abandoned the attempt when Sheridan, moving aside, disclosed the infantry behind. Mounting his men, Sheridan was about to charge when the white flag betokening surrender was displayed in his front. In June, 1865, he was placed in command of the military division of the South-west, of that of the Gulf in July, of the department of the Gulf Aug., 1866, and of the fifth military district (Louisiana and Texas) Mar., 1867. In Sept., 1867, he was transferred to the department of the Missouri, continuing in command until Mar. 4, 1869, when he was promoted to be lieutenant-general, and assigned to command of the division of the Missouri, head-quarters at Chicago. Dur-

ing the political disturbances in Louisiana in 1875, Gen. Sheridan was sent to New Orleans, returning to Chicago on quiet being restored. G. C. SIMMONS.

**Sheridan** (RICHARD BRINSLEY BUTLER), son of Thomas and Frances, b. in Dublin, Ireland, in Sept., 1751; educated at Harrow School, where he made some poetical translations from the Greek; married, in 1773, Miss Linley, a celebrated singer at Bath; undertook the study of law at the Middle Temple, but with little assiduity, and was never called to the bar; produced his comedies of *The Rivals*, adapted from his mother's *Trip to Bath*, with great success at Covent Garden Jan., 1775; *The Duenna*, Nov. 21, the latter having a run of seventy-five nights; became purchaser of Garrick's share in the patent of Drury Lane Theatre June, 1776; brought out *A Trip to Scarborough* Feb. 24, and *The School for Scandal*, his most celebrated comedy, May 8, 1777; produced his farce, *The Critic*, 1779; became a prominent member of the circle of wits which surrounded Charles James Fox, by whose influence he was chosen to Parliament for Stafford 1780; proved by his eloquence a useful auxiliary to the great Whig leader; was under-secretary of state 1782, and secretary of the treasury 1783; won a dazzling reputation as an orator by his two "Begum" speeches against Warren Hastings—one in the House of Commons Feb. 7, 1787, the other in Westminster Hall June, 1788; wrote adaptations of Kotzebue's plays *The Stranger* and *Pizarro* (1798); became treasurer of the navy and privy councillor 1806; lost heavily by the burning of Drury Lane Theatre 1809; fell into habits of dissipation and extravagance, and was constantly molested in his later years by numerous creditors. D. in London July 7, 1816. His *Life* was written by Thomas Moore (1825), and his complete *Works* have passed through many editions.

**Sheridan** (THOMAS), D. D., b. in county Cavan, Ireland, about 1684; educated at Trinity College, Dublin; took orders in the Church of England; opened a classical school at Dublin; was appointed chaplain to the lord lieutenant; became intimate with Dean Swift, through whose influence he obtained an ecclesiastical living in the county of Cork; was subsequently master of the free school at Cavan; was noted for wit and extravagance, being generally in pecuniary distress; published a prose translation of Persius and a metrical one of Sophocles' *Philoctetes*. D. at Dublin Sept. 10, 1738. Many of his letters are included in Swift's *Miscellanies*.

**Sheridan** (THOMAS), son of the preceding, b. in 1721 at Quilca, near Dublin, Ireland (the residence of Dean Swift); educated in his father's school, also at Westminster School and at Trinity College, Dublin; became an actor 1743; played tragedy at Covent Garden Theatre 1744 and at Drury Lane 1745; was by some considered a rival of Garrick; was manager of the Dublin theatre 1746–55; was ruined by a riot which took its origin in his proceedings as manager; withdrew temporarily from the stage; became a successful teacher of elocution at London, Oxford, and Cambridge, and in Scotland and Ireland; returned to the stage 1760; was pensioned by George III.; was manager of Drury Lane 1776–79; published several works on elocution; edited the works of Swift (1784), and wrote his *Life*, and was author of a *General Dictionary of the English Language* (1780), of considerable phonetic value. D. at Margate Aug. 14, 1788.

**Sher'iff.** The sheriff is one of the most ancient and honorable officers known to the English law. Under the earliest Saxon commonwealths each shire (*scyre*) or modern county was presided over by a high dignitary called the *ealdorman*. A portion of his functions were performed by his *gerefa*, or deputy. From the Saxon title *scyre-gerefa*, gradually corrupted into *shire-reeve*, was derived the English "sheriff." In the several States of the U. S. the sheriff is the chief administrative officer of each county, representing and acting for the executive department of the State government—in England representing the Crown—in all matters pertaining to the execution and enforcement of the law, whether civil or criminal. He is *ex-officio* the administrative organ of all the superior courts sitting within his county, charged with the duty of carrying into effect their judgments and orders. He is wholly a State official, and has never been incorporated into the executive branch of the U. S. government.

*How Chosen.*—In England the sheriffs of all the counties, with a very few exceptions, are appointed by the Crown from persons nominated by the lord chancellor and the judges of the superior law-courts. The selection of sheriffs for Middlesex county is vested in the city of London, and in one or two other counties the office is hereditary in particular families. In the great majority of the American States the sheriff is elected by popular vote in each county for a fixed term of office, generally three years, and the same person is often prohibited by statute from holding the office during two successive terms. In a few States the ancient practice of appointment by the governor is still retained. The sheriff himself appoints his under-sheriffs and deputies, who may perform in his name all acts which are purely administrative in their nature, but not those which are judicial. They are in all respects his agents; their acts are his acts; he is responsible for all their defaults done under color of office, even when wilful and intentional trespasses or violations of law. To protect himself he can take from them bonds with sureties for their good behavior.

*His Functions.*—The sheriff is the highest peace-officer of his county. As such he is empowered and bound to restrain all breaches of the peace, to apprehend the offenders, to pursue and arrest all criminals, to put down riots, to defend the jail, which is under his charge, and to do all other similar acts by which the good order of the community shall be maintained. To this end he may if necessary summon to his aid the "power of the county." (See POSSE COMITATUS.) As the executive organ of the courts, he arrests and imprisons persons charged with crime, takes bail when ordered, and carries into effect the sentences when pronounced, either by conducting the convicts to the prison or by capitally executing them, as the case may be. He may also serve all civil process by which actions are commenced, unless he is a party, when the service is to be made by the coroner; he also executes mesne process by levying attachments, seizing and taking into his custody, when necessary, the property attached, and by making arrests of defendants and holding them to bail. Executions upon judgments, either against the debtor's property or his body, are issued to him, and he enforces them by seizing and selling the property or by arresting the person and committing him to the jail. In performing this branch of his duty the sheriff is necessarily exposed to great liabilities. If under an execution against A he levies upon property belonging to B, he is a trespasser; he is not protected by the process, and he is responsible to B in damages for the conversion. To protect himself against such liability, he may in cases of doubt demand from the creditor a bond of indemnity. On the other hand, he is exposed to a similar liability from the opposite direction. If he neglects to collect the execution when there is property of the debtor subject to be seized thereon, an action will lie against him at the suit of the creditor, and a judgment may be recovered therein for the damages sustained through his negligence. In executing criminal process the sheriff may break open the outer door of any dwelling-house or other building, but in executing civil process he cannot force an entrance into a dwelling-house, although when once admitted he may break an interior door; and he may break the outer doors of buildings which are not dwellings. He also summons and returns the juries for all the superior courts within his county. The jail of the county is under his charge, the jailer being officially his deputy; and he becomes liable for the escape of imprisoned debtors who have been enlarged from confinement and placed upon the jail-limits. At the common law the sheriff had extensive judicial powers; these have been taken from him in the U. S., and his judicial functions have been restricted to the assessment of damages, with the aid of a jury, in certain classes of actions, generally for torts, in which the defendants have made default, and which are sent to him for that purpose by the court. The powers of the sheriff, of which the foregoing is an outline, are with a few formal exceptions limited to the territorial jurisdiction of his county. His compensation consists in fees which are regulated by statute. JOHN NORTON POMEROY.

**Sher'lock** (THOMAS), D. D., son of Dean William, b. in London, England, in 1678; educated at Eton; graduated at Catharine Hall, Cambridge, 1697, of which he became master 1714; was master of the Temple forty-nine years (1704–53); was made a prebendary of London 1713, vice-chancellor of Cambridge 1714, dean of Chichester Nov., 1715, prebendary of Norwich 1719, bishop of Bangor Feb. 4, 1728, of Salisbury 1734, and of London 1748, having declined in 1747 the archbishopric of Canterbury. He took an active part in the Bangorian controversy in opposition to Dr. Hoadley (1716), wrote several controversial works on Christian evidences, of which the most celebrated were *The Use and Intent of Prophecy* (1725) and *Tryal of the Witnesses of the Resurrection of Jesus* (1729), and published 4 vols. of his *Discourses at the Temple Church* (1754–58), which gained him a high reputation as a pulpit-orator. D. at London July 18, 1761. His *Works* were edited by T. S. Hughes, D. D. (London, 5 vols., 1830).

**Sherlock** (WILLIAM), D. D., b. in Southwark, London, England, about 1641; educated at Eton; graduated at Peterhouse, Cambridge, 1660; took orders in the Church of England; became rector of St. George's, London, 1669, prebendary of St. Paul's 1681, master of the Temple 1684,

and dean of St. Paul's 1691, in which year he at first refused to take the oaths of allegiance to William and Mary, but subsequently took them; published a pamphlet in justification of his course, *The Case of Allegiance Due to Sovereign Powers Stated* (1691), which caused a great sensation and elicited vast numbers of replies. D. at Hampstead June 19, 1707. Author of above sixty publications, chiefly theological and controversial, of which the *Vindication of the Doctrine of the Trinity* (1690), directed against Dr. South, is the only one now read.

**Sher'man,** county of N. W. Kansas, adjoining Colorado, drained by affluents of Republican River, consists of rolling prairies, and is still unorganized. Area, about 900 sq. m.

**Sherman,** county of Central Nebraska, intersected by Loup fork of Nebraska River, consists chiefly of prairie. Cap. Loup City. Area, 576 sq. m.

**Sherman,** tp., Johnson co., Ark. P. 107.

**Sherman,** p.-v. and tp., Fairfield co., Conn., on Housatonic River. P. 846.

**Sherman,** tp., Calhoun co., Ill. P. 545.

**Sherman,** tp., Mason co., Ill. P. 590.

**Sherman,** tp., Hardin co., Ia. P. 77.

**Sherman,** tp., Jasper co., Ia. P. 1007.

**Sherman,** tp., Monona co., Ia. P. 196.

**Sherman,** tp., Montgomery co., Ia. P. 295.

**Sherman,** tp., Story co., Ia. P. 420.

**Sherman,** tp., Clay co., Kan. P. 952.

**Sherman,** tp., Crawford co., Kan. P. 567.

**Sherman,** tp., Dickinson co., Kan. P. 177.

**Sherman,** tp., Leavenworth co., Kan. P. 834.

**Sherman,** p.-v. and tp., Aroostook co., Me. P. 701.

**Sherman,** tp., Huron co., Mich. P. 385.

**Sherman,** tp., Isabella co., Mich. P. 134.

**Sherman,** tp., Keweenaw co., Mich. P. 929.

**Sherman,** tp., Mason co., Mich. P. 152.

**Sherman,** tp., Newaygo co., Mich. P. 382.

**Sherman,** tp., Osceola co., Mich. P. 116.

**Sherman,** tp., St. Joseph co., Mich. P. 1160.

**Sherman,** p.-v., cap. of Wexford co., Mich., on Manistee River.

**Sherman,** tp., Redwood co., Minn. P. 67.

**Sherman,** tp., Wabashaw co., Minn. P. 740.

**Sherman,** tp., De Kalb co., Mo. P. 1116.

**Sherman,** tp., Putnam co., Mo. P. 987.

**Sherman,** p.-v. and tp., Chautauqua co., N. Y., on French Creek and on Buffalo Corry and Pittsburg R. R. P. of v. 610; of tp. 1470.

**Sherman,** tp., Huron co., O. P. 1260.

**Sherman,** tp., Darlington co., S. C. P. 1385.

**Sherman,** p.-v., cap. of Grayson co., Tex., at intersection of Houston and Texas Central with the N. line of Texas and Pacific R. R., is a trade-centre for a cotton and agricultural district. P. 1439.

**Sherman,** tp., Boone co., West Va. P. 878.

**Sherman,** tp., Calhoun co., West Va. P. 640.

**Sherman,** tp., Hampshire co., West Va. P. 1089.

**Sherman,** tp., Dunn co., Wis. P. 305.

**Sherman,** tp., Sheboygan co., Wis. P. 1664.

**Sherman,** p.-v., Albany co., Wyoming Terr., on Union Pacific R. R., at the highest point on the road.

**Sherman Mills,** p.-v., Aroostook co., Me., has several manufactures.

**Sherman** (Charles R.), b. at Norwalk, Conn., Sept. 26, 1788; settled as a lawyer in Fairfield co., O., 1810; became an eminent member of the Ohio bar; was revenue collector for that county several years, and judge of the supreme court of Ohio from 1825 to his death, at Lebanon June 24, 1829. His three sons became distinguished in military or civil life—John, U. S. Senator from Ohio; Gen. William Tecumseh; and Charles T., U. S. district judge for the northern district of Ohio.

**Sherman** (John), b. in Dedham, England, Dec. 26, 1613; graduated A. M. at the University of Cambridge, England, 1633; emigrated to Connecticut 1634; preached in that colony several years; became a magistrate there 1641, and was minister of Watertown, Mass., from 1647 to his death, Aug. 8, 1685. He was distinguished as a mathematician, lectured at Harvard College, of which institution he was a fellow, and published several almanacs.

**Sherman** (John), grandson of Roger, b. at New Haven, Conn., in 1772; graduated at Yale College 1792; was pastor of the First church at Mansfield, Conn., from Nov., 1797, to Oct., 1805, when he left that post on account of having embraced Unitarian principles; was for a short time pastor of a church at Trenton Falls, N. Y. (1806); built at that picturesque locality a residence, which he called the "Rural Resort," and d. there Aug. 2, 1828. Author of *One God in One Person Only* (1805), the first elaborate defence of Unitarianism that appeared in New England, *Philosophy of Language Illustrated* (1826), and of other doctrinal and controversial publications.

**Sherman** (John), son of Charles R., b. at Lancaster, O., May 10, 1823; received an academic education; was admitted to the bar 1844; was a delegate to the Whig conventions of 1844 and 1848; sat in Congress 1855–61; was Republican candidate for the Speakership 1859, and defeated after a prolonged contest by one or two votes only; became chairman of the House committee of ways and means; was re-elected to Congress 1860, but before taking his seat was chosen U. S. Senator; re-elected 1866 and 1872; was long the chairman of the Senate committees on finance and on agriculture; took a prominent part in debates upon finance and the conduct of the war, and was joint author (with Thaddeus Stevens) of the reconstruction measures adopted 1866–67.

**Sherman** (Roger), b. at Newton, Mass., Apr. 19, 1721; was in childhood apprenticed to a shoemaker, and followed that occupation until 1743, when he settled at New Milford, Conn., and joined an elder brother in keeping a small store; obtained by private study a tolerable education, especially in mathematics; was chosen county surveyor 1745; made for several years from 1748 the astronomical calculations for an almanac issued in New York; studied law; was admitted to the bar 1754; sat several years in the colonial assembly; removed to New Haven 1761; was assistant governor nineteen years (1766–85), judge of common pleas and of the superior court twenty-three years; treasurer of Yale College 1766–76; sat in Congress from 1774 until his death; was one of the five members of the committee to draft the Declaration of Independence 1776; served on many important committees on the board of war and ordnance and on the treasury board; assisted in codifying the laws of Connecticut 1783; was one of the framers of the original "Articles of Confederation" 1777, an active member of the Federal constitutional convention 1787, U. S. Senator 1791–93, and mayor of New Haven from 1784 to his death in that city, July 23, 1793. He was an earnest Christian, renowned for practical good sense, and exercised a great influence upon public affairs. No adequate biography has ever been written.

**Sherman** (Roger Minot), LL.D., nephew of Roger, b. at Woburn, Mass., May 22, 1773; graduated at Yale College 1792; was tutor there 1795; became a lawyer at Fairfield, Conn., 1796; sat in both houses of the legislature; was a delegate to the Hartford Convention 1814, and judge of the superior court and of the supreme court of errors 1840–42. D. at Fairfield Dec. 30, 1844.

**Sherman** (Sidney), b. July 23, 1805, in Marlborough, Mass., the lineal descendant of Roger Sherman; educated in the town of his nativity; removed to New York and engaged in business; in 1831 removed to Cincinnati, O., and thence to Newport, Ky., where he established himself in the manufacture of sheet lead, the first of the kind W. of the Alleghany Mountains; was also one of an association that first manufactured cotton bagging by machinery; in Dec., 1835, answered the call of Texas, then struggling for her independence with Mexico, by raising a small force, equipping it, and fitting out two pieces of artillery. Gen. Houston found him already at Gonzales with his company; under his command Capt. (now elected colonel) Sherman fell back before the Mexican general Santa Anna to San Jacinto. On Apr. 20, Col. Sherman led a daring sortie, and on the 21st, in command of the left wing, he led the attack upon the Mexican lines. Col. Sherman was the first to raise the cry, "Remember Goliad and the Alamo!" The enemy were routed and slaughtered or captured, and their general taken prisoner. Pres. Burnet declined his resignation, and gave him a commission as colonel in the regular service; returned to Kentucky on a mission for the army, in which he was successful; removed to Texas in 1837, and in 1842 was elected to Congress from Harris county; in 1846 obtained the first railroad charter, the Buffalo Bayou Brazos and Colorado R. R.; repaired to Boston and secured capital to build it; on the eighteenth anniversary of the battle of San Jacinto he introduced on a Texas prairie the first locomotive W. of the Mississippi. This enterprise he never gave up till completed to Columbus on the Colorado. During the civil war Gen. Sherman planned the defences of Galveston, whither he had removed on the loss of his home at Harrisburg by fire. In the battle of Galveston, on Jan. 1, 1863, he lost his only son, a lieutenant of artillery.

After the war he resumed the presidency of the railroad. D. Aug. 1, 1873. C. G. FORSHEY.

**Sherman** (THOMAS W.), b. at Newport, R. I., Mar. 26, 1813; graduated at the U. S. Military Academy July, 1836, when assigned to the artillery as second lieutenant, and sent to Florida, where he served against the Indians until 1842; subsequently employed in recruiting and in garrison until 1846. In the war with Mexico he commanded his battery at Buena Vista, and was brevetted major; again in garrison and on frontier duty 1848–61, in April of which latter year he attained a majority in his corps, and was assigned to duty, guarding the Philadelphia and Baltimore R. R. and in restoring communications with Washington. On the 14th of May he was promoted to be lieutenant-colonel, and three days later appointed brigadier-general of volunteers. In the Port Royal expedition (Oct., 1861) he commanded the land forces, which he had organized, continuing in command in South Carolina until the close of Mar., 1862, when assigned to the Army of the Tennessee as division commander, participating in the Corinth campaign (April to June). Transferred to the department of the Gulf, he commanded a division in the vicinity of New Orleans until May, 1863, when he joined the expedition to Port Hudson, and in the investment of that place commanded the 2d division 19th corps, forming the left wing of the besieging army. In the assault of May 27 he lost a leg while leading the assaulting column. Colonel of artillery June 1, 1863. Returning to duty in Feb., 1864, he held various commands in Louisiana until 1866, when mustered out of the volunteer service. Brevetted brigadier and major general for gallantry, and Dec. 31, 1870, was retired from active service with the rank of major-general.

**Sherman** (WILLIAM TECUMSEH), son of Judge Charles R., b. in Lancaster, O., Feb. 18, 1820. From the time of his father's death, in 1829, he was reared in the family of the Hon. Thomas Ewing; in July, 1836, he was appointed a cadet at the U. S. Military Academy, and in July, 1840, was graduated, and appointed a second lieutenant in the 3d Artillery; first lieutenant Nov., 1841. He served in Florida until 1842, and from that date, with a brief interval, in garrison at Fort Moultrie, S. C., until 1846, when ordered to California, serving as acting assistant adjutant-general of the department of California, until Feb., 1849, when transferred to San Francisco on similar duty on the staff of Gen. Persifer F. Smith, commanding the division of the Pacific. Ordered to New York in Jan., 1850, as bearer of despatches, he was married on the 1st of May to Ellen, daughter of Thomas Ewing, then secretary of the interior. In September of that year he was transferred to the commissary department with the rank of captain, and stationed at St. Louis and New Orleans until Mar., 1853, when, after a six months' leave of absence, he resigned from the army Sept. 6, 1853, to engage in the banking business in San Francisco; removed to New York in 1857, in which year the affairs of his firm were closed. In 1858 he removed to Leavenworth, Kan., where he practised law until July, 1859, when he was elected superintendent of the proposed military academy in Louisiana. The institution was opened Jan. 1, 1860, as the Louisiana State Seminary of Learning and Military Academy, and Sherman remained at its head until Jan. 18, 1861, when he addressed a letter to the governor asking to be relieved "the moment the State determined to secede." His request was soon after granted, and in the latter part of February he left for St. Louis, where for a short period he held the presidency of a street railroad. On the 14th of May, 1861, he was appointed colonel of the 13th regular Infantry, and soon after his arrival in Washington was placed in command of a brigade in Tyler's division, which he led at the battle of Bull Run, July 21. On the 3d of August following, his commission of brigadier-general of volunteers was issued to date from May 17, and Aug. 24 he was ordered to duty in the department of the Cumberland under Gen. Anderson, succeeding to the command of that department Oct. 8, 1861, but was relieved in November and sent to Missouri. After a brief service on inspection duty he was (Dec. 23) placed in command of the camp of instruction and post of Benton Barracks, from whence in Feb., 1862, he was transferred to Paducah, Ky., to aid in the operations then in progress on the Tennessee River. Here he organized the division which he subsequently commanded at the battle of Shiloh (Apr. 6–7), where his conduct did much to check disorder and overcome the shock of the unexpected onset. Gen. Halleck reported that Sherman's firmness on the 6th "saved the day;" Grant officially announced, "I am indebted to Gen. Sherman for the success of the battle." The advance upon and siege of Corinth next followed, resulting in the evacuation of that place May 29. In the mean while (May 1) he had been promoted to be major-general of volunteers. In July, having been assigned to command the district of Memphis, he occupied that place on the 21st, where he remained until called upon in December by Gen. Grant to take command of the expedition for the capture of Vicksburg. As this movement was intended to be a surprise, the preparations were hastily executed. Embarking his troops Dec. 21, a landing was effected on the 26th at Johnston's Landing, some 12 miles up the Yazoo, separated, however, from the high and strongly-fortified bluffs opposite by almost impassable swamps and bayous. On the 29th the attempt to carry the position by assault was bravely made, but without success, and, owing to the surrender of Holly Springs, which overthrew Gen. Grant's plan of co-operation, reinforcements were now arriving to the enemy, and Sherman returned to Milliken's Bend, where Gen. McClernand, who had arrived, took command Jan. 4, 1863, Sherman being assigned to the 15th corps, which took a leading part in the assault and capture of Arkansas Post (Fort Hindman) on the 11th inst. In the Vicksburg campaign which succeeded, Sherman bore a prominent part with his command —in the expedition up Steele's Bayou to the Yazoo (March); the feint upon Haines' Bluff (Apr. 29–May 1); movement to Grand Gulf (May 1–6); capture of Jackson (May 14); the occupation of Walnut Hills; and subsequent assaults upon the land-defences of Vicksburg (May 19 and 22), in each attempt the colors of the corps being planted on the enemy's works; and in the siege operations which resulted in the surrender of the city July 4, 1863, when Sherman with a detached command was at once ordered to pursue Johnston, who with a relieving force had been lying E. of the Big Black, but retreating hastily on the news of the surrender. By the 10th he was driven behind the intrenchments of Jackson. Siege operations were actively pressed, but on the night of the 16th Johnston succeeded in escaping. Steele's division pursued to Brandon, and after destroying the railroads in all directions, Sherman fell back to the W. of the Big Black, along which he lay when summoned (Sept. 22) to the relief of Rosecrans's beleaguered army at Chattanooga. Meanwhile, he had been appointed brigadier-general in the regular army, to date from July 4. By the 27th of Sept. the last of his command were embarked at Vicksburg, and by Oct. 4, Memphis was reached, whence he marched eastward, repairing the railroad as he proceeded, until the 27th, when orders reached him at Tuscumbia from Gen. Grant, who had superseded Rosecrans, to abandon all work and hasten on to Chattanooga. By Nov. 15, Sherman himself arrived at that place, and, viewing the situation, hastened back to his command, which by forced marches was up and in position by the 23d, and, by 3 P. M. the next day, had carried the N. end of Missionary Ridge, which position he strongly fortified during the night. At sunrise on the 25th, by orders, Sherman attacked Bragg's right, and a furious battle was maintained all day, compelling Bragg to so weaken his centre to support his right that when Thomas was thrown in on the centre at 3 P. M. the success of the day was ensured, and by midnight Bragg's army was in full retreat. Sherman and Hooker pursued at daylight (26th) the routed army, the former turning back on the 29th to take command of the force for the relief of Burnside, besieged at Knoxville and reported to be unable to hold out later than Dec. 3. Moving rapidly, and making the last 84 miles in three days, Longstreet was compelled to raise the siege and retreat to Virginia, whereupon Sherman returned to Chattanooga and ordered his command into winter quarters. Since Oct. 27, Sherman had commanded the department of the Tennessee, though retaining command of troops in the field. On Feb. 2, 1864, Sherman moved out from Vicksburg with four divisions, and making his way to Meridian, the great railway-centre of the South-west and chief source of supplies for the Confederate army in that region, destroyed the railroads in every direction, bridges, locomotives, etc.; but, owing to the failure of the cavalry division of Smith to perform its part, the expedition was obliged to return (Feb. 26). Gen. Grant having been promoted to be lieutenant-general, he named Sherman as his successor in command of the military division of the Mississippi, composed of the departments of the Ohio, the Cumberland, the Tennessee, and the Arkansas. Assuming this command about the middle of March, Sherman at once entered upon the task of organizing his army and enlarging his communications preparatory to the spring campaign, which was to be directed against Atlanta, Ga., and to commence simultaneously with the opening of the Richmond campaign by Grant. Accordingly, on the 6th of May, Sherman set forth with his army from the winter quarters about Chattanooga. To oppose him was the army of Johnston, lying about Dalton and numbering not far from 50,000. Sherman's strength numbered 98,797 men

of all arms, with 254 guns. Space will permit but a brief mention of the important events of this campaign, which was inaugurated at Dalton May 7, which strong position Johnston was compelled, by Sherman's flank movement, to abandon May 13, and fall back upon Resaca, which in turn he evacuated after a severe battle (May 15), and retreated to Allatoona Pass. Without attempting to force this strong position in front, Sherman, on the 23d, by a circuit to the right, marched on Dallas; Johnston took up a strong position about New Hope Church, where severe fighting occurred May 25–28. On the 1st of June, Allatoona was occupied by Sherman, and made a secondary base of supplies; on the 4th, Johnston retreated to the strong positions of Kenesaw, Pine, and Lost mountains. From June 10 to July 2 almost constant fighting occurred, when, after two unsuccessful assaults on Kenesaw (June 27), Sherman commenced (July 2) another flank movement by the right; that night Kenesaw was abandoned by Johnston, and by July 10 the latter had fallen back across the Chattahoochee and taken up a line covering Atlanta. Here he was superseded in command (July 17) by Hood. On this day Sherman completed his crossing of the Chattahoochee, and on the 19th and 20th the battle of Peachtree Creek was fought, resulting in the withdrawal of the enemy to the intrenchments of Atlanta. On the 22d, Hood by a night march had gained the left of Sherman's line, which he attacked furiously, a fierce battle ensuing; the enemy finally retiring to their defences. A movement to flank Hood out of Atlanta by cutting the railroads in his rear was in progress when (July 28) Hood made a vigorous attack, but was repulsed with great loss. Sherman now determined upon bold measures to gain Atlanta. On the 12th of August he had been made a major-general in the regular army. Sending Kilpatrick out to destroy the railroads in the rear, he swung around to the S. W., and by Aug. 28 his entire army, excepting the 20th corps, was behind Atlanta, busily engaged in destroying the only railroads by which that city was supplied. On the 29th the Macon road was reached near Jonesboro', where Hardee was with his own and Lee's corps, the battles of Aug. 31–Sept. 1 ensuing, leaving Sherman between Jonesboro' and Atlanta. During the night of Sept. 1, Hood evacuated Atlanta, after destroying everything that could be used, and on the 2d, Slocum with the 20th corps entered the city. Sherman's losses from Chattanooga amounted to 31,687; the Confederate loss was near 35,000. Hood had been reinforced from time to time, and had yet an effective force of 40,000. Sherman received in June Blair's 17th corps, numbering 13,000. Hood now drew off to about Lovejoy's, uniting with Hardee, while Sherman gave his army a much-needed rest. On Sept. 28, Hood resumed operations by crossing the Chattahoochee and operating against Sherman's communications, appearing before Allatoona Oct. 5, held by a garrison of 1944 men. The repeated assaults of the enemy were of no avail, and were finally abandoned, but not until 707 of the little band had fallen, while the loss of the enemy was not less. Hood now moved N. W., Sherman following as far as Gaylesville, Ala., when, becoming convinced that Hood's only design was to draw him out of Georgia, he abandoned further pursuit, and detaching the 4th and 23d corps to reinforce Thomas at Nashville, and leaving the latter to defend Tennessee against Hood, he ran back all the surplus property and supplies to Chattanooga, broke up the railroad, destroyed Atlanta, and, cutting the telegraph behind him, Nov. 12, started on the 15th upon his famous "march to the sea." The history of this march is well known. By Dec. 10, Sherman was before Savannah; Fort McAllister was carried on the 13th; and on the night of the 20th Savannah was evacuated, while Sherman was on his way to Hilton Head to arrange for making this very step impossible. Returning to Savannah, he entered the city on the 23d. His loss from Atlanta was but 567, including wounded (245) and missing (159). After resting at Savannah and refitting his army he moved northward Feb. 1. Columbia was occupied on the 17th; Cheraw, Mar. 3; Fayetteville, Mar. 11; the battle of Averysboro' was fought Mar. 16; that of Bentonville, Mar. 19–20; Goldsboro' was occupied Mar. 22; Raleigh, Apr. 13; and Apr. 18th, at Durham Station, Sherman accepted the surrender of Johnston's army on a "basis of agreement" which was rejected by the government, but on the 26th received the surrender on the terms accorded to Lee by Grant. Resuming his march, Washington was reached May 24, 1865, where, after the grand review, his army was dissolved. On the 27th of June, 1865, he was appointed to command the military division of the Mississippi; was promoted to be lieutenant-general July 25, 1866, and Aug. 11 assigned to command the military division of the Missouri. On the accession of Gen. Grant to the Presidency he became general (Mar. 4, 1869). In 1871–72 he made an extended tour in Europe and the East. In Oct., 1874, the head-quarters of the army were removed from Washington to St. Louis, but in Apr., 1876, were re-established at Washington. He published in 1875 *Memoirs of General W. T. Sherman, by himself.*

G. C. Simmons.

**Sher'rill,** p.-v. and tp., Texas co., Mo. P. 1399.

**Sherry Wine.** See Wine.

**Sher'win** (Thomas), LL.D., b. at Westmoreland, N. H., Mar. 26, 1799; served an apprenticeship to a clothier at Groton, Mass.; graduated at Harvard 1825; taught an academy at Lexington, Mass., 1825–26; was mathematical tutor at Harvard 1826–27; was sub-master of the English High School, Boston, 1828–38; was one of the originators of the American Institute of Instruction 1830; president of the Massachusetts Teachers' Association 1845; one of the editors of the *Massachusetts Teacher;* a member of the American Academy; took an active part in procuring the establishment of the Massachusetts Institute of Technology, and was from 1838 through life the principal of the English High School, which was reputed a model of its kind. D. at Dedham, Mass., July 23, 1869. Author of an *Elementary Treatise on Algebra* (1841) and of a *Common School Algebra* (3d ed. 1855).—His son Thomas was lieutenant-colonel of the 22d Massachusetts Vols. during the civil war, and at its close was brevetted brigadier-general.

**Sher'wood,** p.-v. and tp., Branch co., Mich., on Air-line division of Michigan Central R. R. P. 1088.

**Sherwood** (Mary Martha **Butt**), b. at Stanford, Worcestershire, England, July 6, 1775; married Capt. Sherwood of the army 1803, with whom she resided in India 1804–18, and settled on her return at Wickwar, Gloucestershire, where they lived many years. D. at Twickenham Sept. 30, 1851. Authoress of 90 vols. of widely-circulated works, chiefly written with a moral object, and many of them for juvenile readers. The best known are *Little Henry and his Bearer, Henry Milner, Ermina, Roxobel,* and *The Lady of the Manor.* A *Memoir,* including an autobiography, was published in 1854 by her daughter, Mrs. Sophia Kelly.

**Sherwood Forest,** a hilly region in the W. of Nottinghamshire, England, between Nottingham and Worksop, about 25 miles in length by 8 in breadth, was once a royal hunting forest, and known to legend as the scene of Robin Hood's exploits, but now divided into farms, includes the town of Mansfield, several villages, and many parks and gentlemen's country-seats. The soil is gravelly and usually unproductive.

**Shes'hequin,** p.-v. and tp., Bradford co., Pa., on Susquehanna River. P. 1596.

**Shet'land** (or **Zetland**) **Islands,** a group of about 100 islands, of which 23 are inhabited, in the Atlantic Ocean between lat. 59° 50′ and 60° 50′ N., and belonging to Scotland. Area, 5388 sq. m. P. 31,605. The largest island is Mainland, with the town of Lerwick; among the others are Yell, Unst, Barra, and Toula. They are all high and rocky, presenting steep, abrupt, and bold coasts, with fine natural harbors, and a rugged, wild surface in the interior. In the valleys some oats, barley, and potatoes are cultivated. Of trees there are none, but good pastures, as the climate is mild and damp. Many cattle and sheep are reared, but the principal occupation of the inhabitants is fishing, especially cod, of which about 3000 tons, salted and dried, are annually exported, and herrings, of which about 10,000 barrels are annually exported. Eggs form another important article of export.

**Shew** (Joel), M. D., b. at Providence, Saratoga co., N. Y., Nov. 13, 1816; studied medicine; visited the celebrated water-cure establishment of Dr. Priessnitz in Germany; became an advocate of his system, which he introduced into the U. S.; wrote several works on the subject; founded and edited the *Water-cure Journal,* and superintended a large hydropathic institution. D. at Oyster Bay, N. Y., Oct. 6, 1855.

**Shi'as,** or **Shi'ites** [Arab. for "sectaries" or "followers"], called by themselves *Al-Adeliat* (the "party of the just"), the followers of Ali, the husband of Fatima, the daughter of Mohammed. They maintain that Ali was the first legitimate khalif or successor to Mohammed, and consequently reject Abu Bekr, Omar, and Othman as usurpers. They differ amongst themselves—thirty-two of the proverbial seventy-three Mohammedan sects being assigned to the Shias. From the Sunnis they differ very much as Protestants do from Roman Catholics. Since 1499 the Shia faith has been the national religion of Persia. (See Hughes's *Notes on Muhammadanism,* 1875.)

R. D. Hitchcock.

**Shiawas'see,** county of Central Michigan, intersected by Shiawassee River, traversed by Detroit and Milwaukee and by Jackson Lansing and Saginaw division of Michigan

Central R. R.; has a rolling surface, well adapted to pasturage, with abundance of timber and some deposits of bituminous coal. Staples, wheat, Indian corn, oats, potatoes, hay, maple-sugar, butter, and wool. Cap. Corunna. Area, 450 sq. m. P. in 1870, 20,858.

**Shiawassee,** tp., Shiawassee co., Mich. P. 1422.

**Shib'boleth** [Heb. for "ear of corn"], a test or password by which one's rank in society is indicated. It is recorded in Judges xii. that after Jephthah's victory over the Ephraimites, the men of Gilead detected their fugitive enemies by requiring them to pronounce the word *shibboleth*, which the Ephraimites called *sibboleth*, and thus betrayed their origin; whereupon they were put to death.

**Shickshin'ny,** p.-b., Luzerne co., Pa., on Lackawanna and Bloomsburg R. R. and Susquehanna River, 17 miles S. W. of Wilkesbarre, has 3 churches, good schools, 1 bank, 1 newspaper, 3 hotels, 2 extensive coal-works, and several mills. Shickshinny is celebrated for its fine mountain-scenery and waterfalls. P. 1045.

C. A. Boone, Ed. "Mountain Echo."

**Shield** [Ang.-Sax. *scild;* Ger. *Schild*], a buckler, a broad defensive weapon carried upon the left arm in former times to protect the body from blows and missiles. Most savage nations employ shields of some form, and all the nations of antiquity, as in mediæval Europe, down to the general introduction of gunpowder in warfare. The shield is of great importance in heraldry. For practical use, shields were of leather, wood, basketwork, etc. (See Heraldry.)

**Shields.** See Iron-Plating for Fortifications.

**Shields,** the name of two towns of England, opposite to each other on the Tyne, near its entrance into the North Sea—North Shields on the northern bank, in the county of Northumberland; South Shields on the southern, in the county of Durham. The harbor is provided with a large stone pier, and the entrance of the Tyne, which is somewhat difficult, with two lighthouses. Ship building and repairing are extensively carried on; also the manufacture of shipbuilding articles, alum, glass, pottery, etc. Roman remains were discovered at South Shields in 1875. P. of North Shields, 8619; of South Shields, 45,336.

**Shields,** tp., Lake co., Ill. P. 1262.

**Shields,** tp., Dodge co., Wis. P. 1119.

**Shields,** tp., Marquette co., Wis. P. 566.

**Shields** (Charles Woodruff), D. D., b. at New Albany, Ind., Apr. 4, 1825; graduated at Princeton 1844, and at the Theological Seminary at the same place in 1847; was pastor of the First church in Hempstead, L. I., 1849–50, of the Second church in Philadelphia 1850–65, and has been since Dec., 1865, professor of the relations of religion to science at Princeton. Author of a *Funeral Eulogy on Dr. Kane* (1857), *Philosophia Ultima* (1861), *A Manual of Worship* (1862), *The Directory for Public Worship* (1863), and editor of *The Book of Common Prayer, etc., as amended by the Westminster Divines* (1864).

**Shields** (James), b. at Dungannon, county Tyrone, Ireland, in 1810; emigrated to the U. S. about 1826; settled as a lawyer at Kaskaskia, Ill., 1832; was elected member of the legislature 1836, and State auditor 1839; became judge of the supreme court 1843, commissioner of the U. S. land-office 1845, brigadier-general U. S. A. 1847; was dangerously wounded at Cerro Gordo, and brevetted major-general; again severely wounded at Chapultepec; declined the governorship of Oregon Territory 1848; was U. S. Senator from Illinois 1849–55, and from Minnesota 1858–60, after which he settled in California; was appointed brigadier-general of volunteers Aug. 19, 1861; commanded at the battles of Winchester and Port Republic 1862; resigned his commission 1863; settled soon after in Wisconsin, but subsequently became a resident of Missouri.

**Shields'borough,** p.-v., cap. of Hancock co., Miss., on New Orleans and Mobile R. R. and the Bay of St. Louis, has 2 churches, custom-house, good schools, 1 newspaper, 3 hotels, and numerous orange orchards. It is a summer resort for tourists. P. about 1700.

F. Heiderhoff, Ed. "Sea-coast Republican."

**Shields, South.** See Shields (England).

**Shieldsville,** p.-v. and tp., Rice co., Minn. P. of v. 110; of tp. 558.

**Shiites.** See Shias.

**Shikarpoor',** town of British India, presidency of Bombay, in a low, level, regularly inundated, but fertile and not unhealthy plain, in lat. 27° 57′ N., lon. 68° 45′ E., 15 miles W. of the Indus, with which it communicates by a canal. Its extensive bazaars are well stocked with woollen, cotton, and silk goods and metal wares, and a large trade is carried on in horses and grain; but as it is situated on the main route from India to Afghanistan, its principal trade is a transit one, and its chief business banking. Its bankers enjoy a general confidence from Astrakhan to Calcutta, and carry on very large transactions. P. 31,000.

**Shil'laber** (Benjamin P.), b. at Portsmouth, N. H., in 1814; entered a printing-office at Dover 1830; was a compositor at Demerara, Guiana, 1835–37, and in the office of the Boston *Post* 1840–47; was editorially connected with the latter paper 1847–50, acquiring celebrity by his "sayings of Mrs. Partington;" was printer and editor of the *Pathfinder* 1850–52, editor and proprietor of the *Carpet-Bag* 1850–52; returned to the *Post* 1853–56, and was one of the editors of the *Saturday Evening Gazette* 1856–66, since which time he has written for various other periodicals. He published several very successful volumes, among which were *Rhymes with Reason and Without* (1853), *Poems* (1854), *Life and Sayings of Mrs. Partington* (1854), and *Knitting-Work* (1859).

**Shil'ling** [a word of doubtful origin], a coin of Great Britain, Denmark, Sweden, and North Germany. The British shilling is of silver, and worth about 24 cents in U. S. money. The Danish is of copper, worth about half a cent; the Swedish is worth 1 cent U. S. money; the North German shillings were little silver coins, worth about 2 cents.

**Shi'loh,** an ancient town of Palestine, the present *Seilun*, 20 miles N. of Jerusalem, was the seat of the ark of the covenant from the last days of Joshua to the time of Eli, but sank into total insignificance when the ark was carried away by the Philistines. Some insignificant ruins of a Roman town are found on the spot, but none of Jewish origin.

**Shiloh,** p.-v., Marengo co., Ala. P. 1391.

**Shiloh,** tp., Edgar co., Ill. P. 745.

**Shiloh,** p.-v. and tp., St. Clair co., Ill. P. 298.

**Shiloh,** tp., Grundy co., Ia. P. 539.

**Shiloh,** p.-v. and tp., Camden co., N. C. P. 1546.

**Shiloh,** tp., Iredell co., N. C. P. 1541.

**Shiloh,** p.-v., Cass tp., Richland co., O., on Columbus division of Cleveland Columbus Cincinnati and Indianapolis R. R. P. 297.

**Shiloh,** p.-v. and tp., Sumter co., S. C. P. 1518.

**Shiloh,** a locality in Hardin co., Tenn., about 2 miles W. of Pittsburg Landing, on Tennessee River, taking its name from a rude log chapel there known as "Shiloh Church." After the fall of Forts Henry and Donelson, Gen. Grant moved by transports up the Tennessee, and by the middle of Mar., 1862, his army lay stretched out from Shiloh Church to Pittsburg Landing, the latter a mere steamboat landing, as its name implies. The division of Lew. Wallace was stationed at Crump's Landing, some 8 miles lower down and nearly opposite Savannah, at which last-named place Gen. Grant established his head-quarters and dépôt of supplies. Gen. Buell, now on his way from Nashville, was to join with Grant at this point, when a general advance was to be made. Meanwhile, Gen. Beauregard had assembled at Corinth, an important railroad centre, 92 miles E. of Memphis, all the available forces from the Mississippi Valley, when he was joined by the command of Gen. A. S. Johnston from Kentucky and Middle Tennessee, who assumed control of the combined forces Mar. 29. Aware of Buell's approach, it was decided on the 2d to attack Grant before Buell could join him. The attack was arranged for the morning of the 5th, and on the 3d the Confederate army moved out from Corinth. A heavy rain and other causes delayed the attack until the 6th, when at an early hour the blow was struck, taking the Union army by surprise, and their front line driven out of its camps, excepting two of Sherman's brigades, whose position outreached the first line of battle. These brigades resisted stubbornly, and by the personal efforts of Sherman a gallant stand was made, but again compelled to give ground and take position on McClernand's right, which was held until afternoon, when both divisions were forced back. Grant had arrived on the field at 8 A. M., and ordered Lew. Wallace to hasten up with his division, while he set to work to re-form his troops and repair his lines. The divisions of Hurlbut and W. H. L. Wallace next received the enemy's attention, assault after assault being delivered along the whole line, which were each time repulsed, until at 3½ P. M. Hurlbut's exhausted division fell back, thus compelling Wallace to retire half an hour later. At this moment that heroic leader, whose gallant defence had been the admiration of all, received a mortal wound. Lew. Wallace's advance having been obstructed by the enemy, he was compelled to countermarch, and did not reach the field till nightfall. The Union army was now crowded back nearly to the river, with all their

encampments, some 60 guns, and 3000 prisoners in possession of the enemy. During the brief interval, while the enemy halted in attack after the withdrawal of W. H. L. Wallace, the remaining Union artillery was hastily assembled by Gen. Webster, chief of Gen. Grant's staff, advantageously posted on a commanding ridge covering Pittsburg Landing, so that at 6 P. M. a renewal of the attack was successfully resisted, and two gunboats now adding their fire, the enemy withdrew. Buell's advance had reached Savannah on the evening of the 5th, but it was after 6 P. M. of the 6th when Ammen's brigade was crossed—just in time to secure the final repulse of the day. By next morning all of Nelson's, Crittenden's, and McCook's divisions had crossed, and, with Lew. Wallace's, some 25,000 fresh troops were now available. The Confederate leader, Gen. Johnston, had fallen at 2½ P. M. on Sunday, the command devolving upon Beauregard, by whom the plan of operations was prepared and carried out. At daylight on Monday, Grant attacked along the whole line, which was gallantly resisted, a stubborn battle continuing until 4 P. M., when the Union lines of the day before and 30 guns were regained, and the Confederate army was in full retreat for Corinth; but pursuit was not pressed. Beauregard reported a loss of 1728 killed, 8012 wounded, and 959 missing. Grant's loss was 1735 killed, 7882 wounded, and upward of 3000 in prisoners. The armies were about equal in strength on the first day, but on the second the Confederates were largely outnumbered.

**Shiloh,** p.-v. and tp., King George co., Va. P. 1797.

**Shimeall** (RICHARD C.), b. in New York City in 1803; graduated at Columbia College 1821, at the Episcopal General Theological Seminary 1824; was pastor of St. Jude's church ten years, when he joined the Reformed (Dutch) Church; subsequently transferred his ecclesiastical connection to the New York presbytery; was successively pastor of several churches in New York; gave considerable attention to Greek and Hebrew, and wrote several works on sacred chronology and the interpretation of prophecy, in which he belonged to the Millenarian school. D. in New York City Mar. 19, 1874.

**Shimonoseki.** See SIMONOSEKI.

**Shin'dler** (Mrs. MARY S. B. **Palmer**), b. at Beaufort, S. C., Feb. 15, 1810; educated in seminaries at Wethersfield, Conn., Elizabethtown, N. J., and New Haven, Conn.; married to Charles E. Dana of New York 1835, with whom she settled at Bloomington, Ia., 1838; lost her husband 1839; returned to her parents in South Carolina; contributed poems to the *Rosebud*, a paper edited by Mrs. Caroline Gilman at Charleston, S. C.; published several volumes of poems and novels—*The Southern Harp* (1840), *The Northern Harp* (1841), *The Parted Family and other Poems* (1842), *The Temperance Lyre* (1842), *Charles Morton, or The Young Patriot* (1843), *The Young Sailor* (1845), *Forecastle Tom* (1845), and *Letters to Relatives and Friends* (1845), the last work being an account of her conversion from Calvinism to Unitarianism. In 1848 she became an Episcopalian, shortly after her marriage to Rev. Robert D. Shindler, who in 1851 became a professor in Shelby College, Ky., and ultimately settled in Texas. Specimens of Mrs. Shindler's poems appeared in the collections of Mrs. Hale, J. S. Hart, T. B. Read, and Mary Forrest.

**Shin'er,** a name applied in a vague manner to numerous small species of fishes of the family Cyprinidæ inhabiting the fresh waters of the U. S., characterized by a compressed body and shining, silvery color. The most notable of the species so designated is the *Stilbius americanus*, a form quite nearly allied to the breams (*Abramis*) of Europe, but not attaining so large a size, and rarely exceeding a few inches in length. This is one of the most abundant species in the streams of the Eastern and Middle States, and affords much sport to the boyish angler.

THEODORE GILL.

**Shin'gle** [Lat. *scindula*, "splinter"], a thin piece of wood used in covering roofs after the manner of slates. In thickness shingles usually diminish from one end to the other. They are laid in courses upon the roof, in such a way that one course overlaps and covers the joints of another. Long split shingles are called *shakes*. Shingles are split, sawed, or in some instances shaved off from a block of wood by a knife worked by machinery. Split shingles are the best as a general rule. Pine, cedar, chestnut, oak, spruce oak, and other kinds of wood are used in making shingles, but pine is generally the best. In sawing shingles a peculiar machine called the shingle-mill is employed.

**Shingles** (a disease). See HERPES.

**Shin'necock,** v., Southampton tp., Suffolk co., Long Island, N. Y., on Shinnecock Bay, is a settlement of a remnant of the Shinnecock tribe of Indians. P. 97.

**Shiogoon, Tai-Shiogoon,** or **Tycoon,** the title of the hereditary military ruler of Japan, once considered as emperor. The office has been abolished since the revolution in favor of the mikado or "spiritual ruler." The shiogoons held their court at Yedo (now Tokio), and were the highest authorities known to foreigners. The treaties which opened Japan to foreign commerce and residence were negotiated with the shiogoon.

**Shipbuilding.** See NAVAL ARCHITECTURE, by T. D. WILSON.

**Ship-Canals.** See APPENDIX.

**Ship'ley** (JONATHAN), D. D., b. in England in 1714; educated at Christ Church, Oxford; took orders in the Church of England; became incumbent of Silchester and Chin Bolton, prebendary of Winchester 1743, canon of Christ Church 1749, dean of Winchester 1760, bishop successively of Llandaff and of St. Asaph 1769, and chaplain to the duke of Cumberland 1775; was a disinterested friend of America, for which he predicted a brilliant future; defended the American cause in his writings and by personal influence. One of his daughters married Sir William Jones. D. Dec. 9, 1788. His *Works, consisting of Sermons, Charges, and Parliamentary Speeches* (2 vols., 1792), contain judicious discussions of questions of the times.

**Ship'man,** p.-v. and tp., Macoupin co., Ill., on Chicago and Alton R. R.

**Shipp** (ALBERT M.), b. in Stokes co., N. C., Jan. 15, 1819; graduated at the University of North Carolina 1840; became a Methodist preacher 1841, president of Greensboro' Female College 1848, professor of history and English literature in the University of North Carolina 1849, president of Wofford College, S. C., 1859, and professor of exegetical theology in Vanderbilt University, Nashville, Tenn., 1875.

**Ship'pen,** tp., Cameron co., Pa. P. 1824.

**Shippen,** tp., Tioga co., Pa. P. 270.

**Shippen** (EDWARD), LL.D., b. at Philadelphia, Pa., Feb. 16, 1729; studied law at Philadelphia and at the Temple, London, where he was admitted a barrister 1750; became prothonotary of the supreme court of Pennsylvania and judge of admiralty 1753; was afterward member of the council and president of the courts of quarter sessions for the county of Philadelphia; became judge of the supreme court 1791, and was chief-justice of Pennsylvania 1799–1806. D. at Philadelphia Apr. 16, 1806.—His daughter MARGARET married Gen. Benedict Arnold.

**Shippen** (WILLIAM), M. D., b. at Philadelphia, Pa., in 1735; graduated at Princeton 1754, and in medicine at Edinburgh; began at Philadelphia May, 1762, the first course of anatomical lectures ever given in the U. S.; became professor of anatomy and surgery in the Philadelphia Medical School Sept., 1765; served in the medical department of the army of the Revolution, and was its director-general from Apr. 11, 1777, to Jan., 1781. D. at Germantown July 11, 1808.

**Ship'pensburg,** p.-b. and tp., Cumberland co., Pa., on Cumberland Valley R. R. and National Pike, 41 miles W. of Harrisburg, contains 7 churches, 1 bank, normal school and an institution of learning for teachers, 2 newspapers, 2 flouring-mills, 4 hotels, 4 carriage-factories, and 2 machine-shops. Large deposits of iron ore exist in the neighborhood. P. of b. 2065; of tp. 381.

**Shippigan',** p.-v., Gloucester co., N. B., on the Gulf of St. Lawrence, near the N. E. angle of the province, 254 miles N. of St. John. It has 3 large harbors, and important herring, cod, and mackerel fisheries. P. about 500.

**Shipping, Law of.** This department of the law is concerned with the ownership of merchant-ships, their use in commerce, the rights, powers, and duties of ship-owners, owners of cargo, masters, and seamen, the contracts with reference to their employment, and the maritime torts committed by their means or by persons engaged in their navigation. The term "ship," especially in the U. S., includes all vessels of commerce for the transport of goods or passengers, whether propelled by wind or by steam, plying either on the high seas, on other tide-waters, or on the great lakes and rivers over which the national admiralty jurisdiction extends. The general principles of the law relating to shipping were embodied in the various maritime codes of the Middle Ages, and have thence been incorporated into the existing jurisprudence. (For a description of these maritime codes see MERCANTILE LAW.)

I. *Nationality of Ships.*—It was formerly the policy of all maritime countries to foster and protect their domestic ships and ship-owners by conferring special advantages upon them, and by discriminating heavily against those of foreign nations. This policy is still retained in the legislation of the U. S.; extensive privileges are granted to U. S. vessels. To constitute a vessel of the U. S. under the statutes of Congress it must be wholly owned by citizens of the U. S.,

and, with certain exceptions, by resident citizens; its master and officers must also be citizens; it must have been built in the U. S., or bought at a judicial sale when condemned as prize or forfeited for a violation of the laws; but if a foreign vessel should be wrecked in the U. S., and then purchased by citizens, and repaired by them within this country at a cost equalling at least three-fourths of its value when completed, it would thereupon become a national vessel. The statutory system requires that when a ship is built, or becomes the property of citizens in any of the modes above mentioned, it must be either "registered" or "enrolled" as a U. S. vessel before it can be used as such for purposes of trade. If it is designed for foreign commerce, the evidence of its ownership and of all other necessary facts is presented by affidavit to the collector of the district in which it belongs, and he issues the first certificate of registry, which recites the owners, the place or port where it belongs, the tonnage, the name, and all the other particulars necessary to identify the vessel and to establish its national character. If it is designed for the coasting-trade or for fishing, and is of 20 tons burden, or more, it is enrolled in the same manner, and a similar certificate of enrolment is issued, and in addition thereto it must be licensed; while if of less than 20 tons burden, the license is the only requisite. This certificate of registry or of enrolment forms the most important part of the "ship's papers," and is evidence at home and abroad of her character and use. If any change of owners takes place, either total or partial, the old certificate of registry or of enrolment must be surrendered and a new one issued, which shall represent the actual ownership. The statute enacts that in case of a sale or transfer there must be a bill of sale, which shall recite at length the original certificate, or else the vessel cannot be registered anew. The result of this provision is that after a ship is once registered or enrolled as a vessel of the U. S. it cannot be effectively conveyed by a verbal contract; unless transferred in writing it cannot be registered anew, and cannot therefore be used without violating the statute. The special privileges enjoyed by U. S. vessels are as follows: They alone, when properly enrolled and licensed, can engage in the coasting-trade and in the fisheries. A foreign ship bringing an imported cargo into one port may, however, carry the goods to another port if they have not been unladen. This statutory provision has been partially interfered with by the Treaty of Washington, which grants certain rights of trading among the Northern and Western lake and river ports and coasts to the inhabitants of the Canadian Dominion. In regard to foreign commerce the statute provides that "no goods shall be imported into the U. S. except in U. S. vessels, or in foreign vessels wholly belonging to subjects of that country of which the goods are the growth, production, or manufacture, or from which they can only be, or most usually are, first shipped for transportation." This restriction does not apply to nations which do not maintain a similar discrimination against U. S. vessels, nor to those nations with whom there exist treaties of commerce and navigation containing stipulations of a contrary import. The result is, that U. S. ships have a virtual monopoly of the coasting and fishing business, and that they enjoy an absolute freedom—so far as our own laws are concerned—to carry on the export and import trade to and from all parts of the world. The limitation upon imports in foreign bottoms is of little practical account, since the commercial treaties between the U. S. and other maritime countries have generally stipulated for the mutual liberty of their respective national ships to trade in each other's ports.

II. *Property in Ships.*—Ships are chattels, and the rules which govern the property in them, its transfer, and its devolution in case of death, are the same, except when changed by statute, which regulate personal property generally. It has already been stated that the original property in a U. S. vessel can only be acquired either by building, by purchase at judicial sale after a capture or forfeiture, or by purchase and repair of a wreck. After the title is thus first obtained it may be transferred by a bill of sale, by a chattel mortgage, by seizure and sale on execution, by assignment in bankruptcy or insolvency, by a sale in an admiralty suit to enforce a maritime lien, and by succession through intestacy or by will. In order to preserve record evidence of title a statute of Congress enacts that every bill of sale, mortgage, hypothecation, or conveyance of any vessel or part of a vessel of the U. S. must be recorded in the office of the collector where the same is registered or enrolled, or else it shall not be valid against any person other than the grantor or mortgagor, his heirs and devisees, and persons having actual notice thereof; but bottomry bonds given while the ship is on a voyage are not affected by this statutory provision.

III. *Owners of Ships, their Rights and Liabilities.*—A ship may be owned by a single proprietor, by a partnership, or by several part-owners. (See PART-OWNERS.) In either case the owners determine its employment, appoint the master and all other agents, and are entitled to the compensation earned by its use. They often delegate their authority to a special agent—usually selected from among themselves—called the "ship's husband," whose extensive powers are well settled by the law. (See SHIP'S HUSBAND.) They are liable for all expenses and charges incurred, as for repairs, supplies, seamen's wages, and the like, and on all contracts made either by themselves or by their lawful agents; and when the ship is used by themselves for the carriage of goods, they are liable to the shippers for all losses and damages to the cargo unless caused by some one of the excepted perils (see CARRIERS, COMMON), and to the owners of other vessels and cargoes for injuries thereto occasioned through negligence in navigating their own. The extent of their liability has been limited by legislation in the U. S., in Great Britain, and in other maritime countries. The statute of Congress enacts—and the British statute is substantially the same—that a ship-owner shall not be liable to the owner of cargo for loss by fire, "unless such loss is caused by the design or neglect of such owner," so that a responsibility does not attach to him when a fire is occasioned by the fault of the master or seamen. Another clause provides that the owner shall not be liable for certain valuable articles, such as gold, silver, money, etc., unless the shipper notifies him in writing of their true nature and value, and the same is entered in the "bill of lading therefor;" nor is he ever responsible for such articles beyond the amount so notified and entered. Finally, the liability of the owner or owners for any embezzlement, loss, or destruction by the master, officers, seamen, or other person of any goods shipped, or for any loss or injury by collision, or for any act, loss, damage, etc. done or incurred without the knowledge of such owner or owners, "shall in no case exceed the amount or value of the interest of such owner or owners in such ship or vessel and her freight then pending;" if the whole value of the ship and freight is not sufficient to fully compensate all the owners of property destroyed or injured, they shall receive compensation in proportion to their respective losses. In some cases the liability of the owners is purely personal, and can only be enforced by an ordinary pecuniary judgment against them; in other cases it creates a lien on the ship itself, and is enforced by a proceeding *in rem* in a court of admiralty.

IV.—*Persons employed in the Navigation of Ships.*—The master is the agent both of the ship-owners and of the owners of the cargo, and his powers are many and great. He is clothed with a large discretion, and by its exercise, if done in good faith and with reasonable judgment, he may bind all the parties whom he represents. Actions upon shipping contracts may be brought by or against him personally as though he were the ultimate contracting party; and in fact all such contracts are generally executed in his name. He has the supreme command and responsibility in navigating the ship and an absolute supremacy of the officers and crew. As a general proposition, the master may enter into all ordinary contracts relating to the usual employment of the ship, and bind the owners thereby. While the vessel is in her home port, or under the immediate supervision of the ship's husband or other managing agent, his authority is restricted, and he acts in subordination to the owners or to such agent in matters pertaining to her condition and use. When she is in a foreign port, and communication with her owners would be attended by a dangerous delay, the actual necessities of her situation become the foundation and furnish the limit of his authority, provided that his acts are such as would have been done by a reasonably prudent owner under the same circumstances. Thus, if she is injured and disabled, he may, if necessary, borrow money for her repairs, and hypothecate the ship or cargo as security by a bottomry or *respondentia* bond; he may sacrifice portions of the vessel or cargo by jettison; he may in certain emergencies even abandon or sell the vessel or cargo, or charter another ship in order to complete the voyage; in short, he may do any act customary in the transactions of commerce which, to a reasonable man acquainted with the course of such business and placed under the same circumstances, would seem to be for the best interests of all the parties represented—the ship-owners, the cargo-owners, and the insurers. While these doctrines have long been established in the maritime law, it has been recently held by very eminent courts that the introduction of the magnetic telegraph, and its extension to so many distant parts of the world, and the consequent ability of immediate communication with owners at home, have very much lessened these extraordinary powers of the master, and that when within reach of the telegraph he should first obtain, or at least attempt to obtain, instructions before taking the final steps which will create a liability or change the legal relations of his principals.

The statutes of the U. S., as well as of Great Britain and of other maritime countries, prescribe the regulations which govern the hiring, treatment, and conduct of seamen, the form and contents of their agreements with the ship-owners, the measures deemed necessary for their welfare and protection. The provisions of this legislation are so numerous, extensive, and minute that even an abstract of them is wholly impracticable. The claim of seamen for their wages when earned is highly favored by the law; it constitutes the first lien on the vessel, taking precedence of all others without regard to their priority in time; and it may be summarily enforced in admiralty by a proceeding *in rem*. It is a doctrine of the maritime law that the liability for wages on a voyage depends upon the earning of freight. (For a statement of this rule, with its limitations and exceptions, see the article FREIGHT.)

V. *The Employment of Ships in Commerce.*—A ship may be used for purposes of traffic in three distinct modes: (1) It may be entirely let or leased, for a given period at an agreed compensation, to parties who take complete possession and control, appoint the master and crew, and assume for the time being the character of owners. This species of hiring is sometimes, though not with perfect accuracy, termed chartering, and the contract of lease a charter-party. (2) The owners, retaining the possession and management of the vessel, and employing the master and crew, let out, for a given time or for a given voyage, either the entire carrying capacity or some specified portion thereof by a contract called a charter-party. (3) The owners of a ship sailing regularly on a definite and constant route, or of a ship destined for some particular voyage, receive on board and undertake to carry the goods in varying quantities of parties generally who desire to use that mode of conveyance. The agreement in this case between the shipper and the ship-owner is a bill of lading. (The form, nature, and usual provisions of these two principal shipping contracts, the special incidents accompanying their use, and the rights and duties of the respective parties thereto, will be found in the articles CHARTER-PARTY, BILL OF LADING, FREIGHT, and DEMURRAGE.) Among the possible incidents of every voyage are the jettison of goods, masts, etc. in time of peril; the contributory liability of all parties when sacrifice, loss, or extraordinary expense has been incurred by some interests for the benefit of the whole; the salvage liability to those who have rescued the ship or cargo from impending danger; and the special contracts of hypothecation by means of which the master is sometimes enabled to complete the voyage. (For a discussion of these several topics see articles JETTISON, AVERAGE (GENERAL), SALVAGE, BOTTOMRY BOND, and RESPONDENTIA. For the rules of navigation which have been adopted to prevent collision see article ROAD, LAW OF THE.) If a collision is caused solely by stress of weather or overpowering natural forces, without the fault of either party, it is a peril of the sea, and no liability whatever ensues. The rules of admiralty in cases of fault are well settled as follows: If both vessels are in fault, the loss is apportioned equally between them; if one of the colliding vessels is wholly in fault, it not only bears its own injury, but is also responsible for the damage inflicted upon the other and upon its cargo. This liability in such case constitutes a lien upon the offending vessel, and is usually enforced by an admiralty suit *in rem*. (In addition to the topics already referred to, the reader should consult STOPPAGE IN TRANSITU and the various articles relating to INSURANCE (MARINE), which is intimately connected with the entire law of shipping.)

JOHN NORTON POMEROY.

**Ship's Husband,** in the maritime law, is a general agent of the owners for the management of the ship. The place of his employment is usually the home port, or that where the vessel is fitted out and from which she sails on her various voyages. He may be appointed by writing, verbally, or in any manner by which an agency can be constituted. He is often one of the part-owners, and indeed in several of the U. S. statutes he is designated as the "managing owner." The general functions of the ship's husband, belonging to him by virtue of his office, are to see that the ship is in a proper condition to be used for the earning of freight, and to see that she is in fact used for that purpose. In carrying out these duties he possesses the following specific powers: to keep the vessel in complete repair, and to procure a proper outfit of tackle, apparel, and furniture, so that she shall be seaworthy; to employ a competent master, officers, and crew; to purchase the supplies of provisions and other sea-stores necessary for the voyage; to obtain the regular ship's papers, and to transact all needful business with the customs and other public officials; to enter into all the contracts required for the foregoing objects, and to provide for and make the payments therein; to negotiate and execute all contracts for the carriage of goods, either by chartering the vessel or by employing her as a general ship; to agree upon, settle, and receive payment of freight; to adjust liabilities, demands, and averages with the shippers; to preserve the vouchers and other papers; and to keep the ship's books of account. While accomplishing these purposes his acts are within the scope of his employment, and are binding upon the owners whom he represents. On the other hand, the ship's husband, as such, has no power to borrow money for the use of the vessel; he cannot insure it and make the owners liable for the premiums; he cannot purchase a cargo on their account, nor bring actions on their behalf, nor delegate his own authority; and, although he may settle and receive payment of freight, he cannot do so by giving credit therefor to the shippers, and delivering up the cargo to them and surrendering the lien thereon, unless such credit was expressly stipulated for in the contract of affreightment. Of course the power to perform any of these acts may be expressly conferred, and if done without antecedent authority they may be ratified and thus made obligatory. The compensation of the ship's husband is usually a commission upon his receipts and payments, or upon the amount of his purchases, and the liability for it is either a joint obligation of all the owners or an individual and *pro rata* obligation of each. JOHN NORTON POMEROY.

**Ships, Iron-clad,** vessels clad with iron plates to give protection against shot and shell.

(1) A retrospect of naval construction prior to the use of armor is necessary to make the subject clear. Artillery was first mounted in naval vessels during the reign of Edward III., about 1350. For several centuries naval construction did not advance as would be expected from so radical a change in weapons. Only by degrees ships were divested of the unwieldy top-hamper which they had in the hand-to-hand conflicts of the Middle Ages. During this long period the improvements in construction and armament made slow progress, but during the last fifty years—since the Nile and Trafalgar—a revolution in naval warfare has been brought about by entirely new systems. This has been wrought by three agents: (1) the application of steam, strictly the screw-propeller, as the naval motor; (2) horizontal shell-firing from naval artillery; (3) application of iron plates to keep out the shells. The submarine torpedo may be added to this list; already are iron-clads designed in vain, it would seem, to be proof against this weapon. As soon as the peculiar qualities of the screw were established to the satisfaction of admiralty boards, it became certain that steam would be the universal naval motor. This may be dated from the U. S. S. Princeton (1842–43), the first screw war-steamer planned as such: she was designed by Ericsson. Great naval powers are reluctant to begin changes that involve costly reconstruction; this, with the conservatism regarding any new system, was the reason of the otherwise inconceivable reluctance of the English to take up the project of a screw navy. When the French built the screw line-of-battle ship Napoleon (1850), the English took alarm and began reconstruction with vigor, and the renovation of their navy by the application of the screw was well advanced in 1859. This year the French launched the iron-plate frigate La Gloire; then began the decline of the wooden fleets and the beginning of new ones on the new system.

(2) The principal incentive to the application of iron armor was the destruction anticipated from horizontal shell-firing against wooden ships. This mode of using shells, perhaps from the danger attending it, made slow progress in ships of war: it was not until 1854 that naval batteries consisted entirely of shell guns, the magazines being filled with loaded shells, ready fused. Admiral Dahlgren in the U. S. S. frigates of 1854 carried the application of this missile to great perfection. The Merrimack, one of these, visited Europe in 1856, startling naval administrations by the enormous shell-power of her battery. It was the extreme use of shells that brought about resort to armor to keep them out. The French general Paixhans some forty years ago suggested iron as a protection against this deadly missile, with which his name is so much identified. The swift destruction of the Turkish fleet at Sinope by the shells of the Russian ships during the war in the Crimea had much to do with hurrying forward its application; the destruction of the Congress and Cumberland, and the engagement between the Monitor and Merrimack, gave it fresh stimulus.

(3) The first definite proposal for building an iron-clad was made in 1841 by R. L. Stevens; armor, it is stated, was suggested by his father, J. C. Stevens, in 1812. An act approved Apr. 12, 1842, authorized the secretary of the navy to enter into a contract with Stevens for the construction "of a war-steamer for harbor defence, shot and shell proof, to be built principally of iron." The contract was made Feb. 10, 1843; it called for the following dimensions:

"Length, not less than 250 feet; beam, not less than 40 feet; depth amidships, 40 feet; protection against shot, 4½ inches of iron; horse-power, 900." About this time Com. Stockton, U. S. N., was experimenting at Sandy Hook with one of the 12-inch wrought-iron guns planned for the Princeton: a 224-pound shot, with 30-pound charge, was fired from it against a target representing the armor proposed by Stevens; it pierced the target and passed through a sandbank 8 feet thick. This stopped the construction of the iron-clad until by a second contract (Nov. 14, 1844) Stevens increased the dimensions as follows: Length, 415 feet; beam, 48 feet; depth, 33 feet 6 inches; protection, 6¾ inches of iron; horse-power intended, 8624. Work was begun 1854, and when the vessel was about half completed the government refused further appropriations. In the early part of the civil war (1861) the navy department again declined to ask Congress for money, a naval board having made an adverse report.

(4) The first iron-clads used in battle were the French floating-batteries Devastation, Lave, and Tonnante (1855), built for special service in the Crimea. Particulars: length, 171 feet 9 inches; beam, 43 feet 1 inch; draught, 8′ 8″; hulls of wood; armor, 4.33 inches thick; armament, 16 guns of "50," carried 2 feet 11 inches above water-line. They formed part of the fleet, carrying 1500 guns, which destroyed Fort Kinburn, an inferior barbette work. The iron-clads engaged at 700 yards; at that range they were proof against 32-pound shot with 10-pound charges. The English adopted the design, and built five; they were very uncouth, in model like a canal-boat.

(5) La Gloire, completed 1861, was the real beginning of the present era of iron-clads; she was the first attempt at a swift, invulnerable, ocean-going iron-plated vessel; her hull, of wood, was on the model of the line-of-battle ship Napoleon of 91 guns, and at the same draught had equal displacement, but being more heavily laden her draught was greater; her guns, thirty-six 6.3-inch rifles, were carried in broadside, in one tier, 6 feet above the water-line. Her sides were completely covered with armor—at the water-line, 4.72 inches thick, above it, 4.33 inches; this was proof against projectiles from guns then in use. With the development in artillery which immediately began, this soon changed; now (1875) naval artillery can put loaded shells through the strongest armor afloat. La Gloire was, in other points than armor, a wide departure from the conventional and time-honored war-vessel. There was no vestige of ornamentation; the stem, in order to increase the ram-power, inclined somewhat backward; to lessen the labor of bending and fitting the heavy iron plates, the hull at bow and stern is of the plainest form. The rig is very simple; it consists of three masts, with very long mast-heads to give support to topmasts which, with the short bowsprit, can be housed at pleasure; the foremast carries a square sail; all the others are plain fore-and-aft sails, the idea being to have as little rigging as possible to be shot away and foul the screw. The sail-area was 11,840 square feet; an ordinary war-vessel of the same tonnage would have 35,000 square feet in the principal sails. This shows that with the iron-clad came increased dependence on steam, sails becoming an auxiliary that will never be used in action. The speed was reported to be 12.8 knots; the bunkers carry five days' fuel. After La Gloire came two iron-clads of the same dimensions and material. In 1863–64 the Magenta and Solferino were completed; these carried out the emperor's idea of a large number of medium-calibre guns; they were armed with fifty-two 6.3-inch rifles. In 1865 eight floating batteries were built, each carrying sixteen medium guns, protected by 4½ and 5½ inch plates. In 1867 the Alma class of corvettes, seven in number, were commenced; hulls of wood; armament, six 7.48-inch rifles; armor at water-line, 5.91 inches, over the battery, 4.72 inches. About the same time the Provence class, eleven in number, were in progress, all of the same dimensions, but differing in armament and method of mounting it. One of these, the Surveillante, carried eight 9.5-inch rifles, capable of piercing 10-inch armor up to 500 yards. During 1867–69 the Marengo class, four in number, were put afloat; with one exception, the Friedland, the hulls were of wood; they carry eight 10.6-inch rifles, which can pierce 12-inch armor up to 600 yards, and six 7.6-inch guns which are mounted in semicircular iron shields projecting their full semi-diameter from the vessel's sides—an arrangement adopted to give increased horizontal range, and suited to the peculiarities of breech-loading, on which plan all heavy French naval guns are made. The armor is 7.87 inches at the water-line, and over battery 6.3 inches thick. The Colbert, Richelieu, and Redoubtable, the largest so-called ocean-going iron-clads in the French navy, are nearly completed; the two former carry eight 10.63-inch rifles, which use 88-pound charges and 476-pound projectiles, and one 9.5-inch rifle. These vessels, with the exception of the rams Tonnerre and Tempête, have the thickest armor in the French navy; it is 8.66 inches at the water-line and 6.3 inches over the battery. All of these (except rams) are masted broadside iron-clads; most of them carry their guns on one deck. The Cerbère, Bélier, and Boule-dogue are coast-defence rams; they are without rigging, and are intended to be fought head on; they carry two 9.5-inch rifles in fixed turrets. The armor on the sides is 8.66 inches thick. The Taureau, similar to these, but with her upper deck formed like the back of a tortoise, carries one gun of the same calibre. The Tonnerre and Tempête, the latest ram-vessels, have monitor hulls and fixed turrets; they carry two 12.6-inch rifles, which use 136-pound charges with 760-pound projectiles; these are said to be able to pierce 15-inch armor up to 300 yards. Their armor is the heaviest in the French navy, being 11.81 inches thick.

(6) As with the screw-propeller the English showed it was their policy to imitate no novel changes which would cause immense and costly reconstruction in their existing establishment, so with the iron-clad they adhered to the same policy until forced to change. No sooner was it known that their naval rival was seriously at work on a real sea-going iron-clad than they set about to reply to the challenge, and before La Gloire was finished the Warrior (1861) was well advanced. The differences between the rival ships show how tenaciously the naval mind clings to conventional forms and usages. The French ship was plain and uncouth; the Warrior is a splendid-looking frigate, with masts and rigging in the old style, her bow and stern of the same form and ornamented in the same manner as the old ships which were passing away; her lines, to ensure high speed with moderate power, were unusually fine. But there were more essential differences: the French vessel, 263 feet in length by 59′ 9″ beam, 5530 tons displacement, was armored from stem to stern; her English rival, 419 feet in length, 58 feet beam, displacement 8950 tons, had a patch of armor on her sides of 4½-inch tongued and grooved plates covering $\frac{7}{13}$ths of her length (see Diagram No. 1), the rest of the ship being unarmored; behind this armor twenty-six 8-inch smooth-bore guns were carried; at the ends of this protected part armored bulkheads of the same thickness, in order to protect the guns from fore-and-aft fire, were carried across the vessel. This was the plan of Russell, the eminent English engineer; with modifications not affecting the principle, and combined with a belt of armor along the water-line, it is now adopted in all broadside iron-clads. The speed was 14.35 knots, but obtained as it was by large dimensions, fine lines, and small relative carrying capacity, it was a costly achievement, as in efforts to equal it in subsequent constructions thickness of armor and celerity of turning were sacrificed. The Warrior was followed by her duplicates, the Black Prince and Achilles, in all respects alike, except that in the latter was an armored belt around the water-line and a perpendicular ram-bow. Shortly after, the Defence, Resistance, Hector, and Valiant were in progress; these were 100 feet shorter than the Warrior; the two former had a patch of armor on their sides like that vessel; the latter had the addition of an armored belt *above* the water-line. Then came the Minotaur, Agincourt, and Northumberland, longer than the Warrior, their displacement being 10,275 tons, so that they could carry a complete cuirass of armor, 5½ inches thick, from stem to stern. These, with the exception of seven wooden ships converted into iron-clads, were the last attempt to carry complete armor in broadside vessels. So great was the increase in the power of ordnance that diminution in the area to be protected in order to increase the thickness of armor became imperative, and all iron-clads built after these, except rams and monitors, carried armor only over a central casemate and around the water-line. The most powerful iron-clads now in European waters are monitors; their construction seems to have been brought about by the rapid development of armor-piercing ordnance. The names and chief particulars of the principal iron-clads are given in Table A (on the following page).

(7) Enough has been said about the European iron-clads to show the development of the system; this can be followed up from the table. The principal forms and varieties of iron-clads emanated from America, France, and England. Those of the other naval powers, many of them built in England, are summarized in the sections immediately following the table mentioned, with such facts as are necessary for an understanding of their power and capacity.

The following synopsis, together with Table A, comprises a complete list of all the iron-clads of any consequence in the world, except those of the U. S. navy, which are given farther on. It must be remembered that the development of ordnance power (to say nothing of submarine movable and fixed torpedoes) is now making such rapid advances that iron-clad construction is very far from

TABLE A.—*Principal Particulars of English and French Iron-clads.*

| Number built. | Name of vessel. | Date of construction. | Length between perpendiculars. | Breadth. | Draught forward. | Draught aft. | Thickness of armor. | Thickness of iron skin. | Thickness of wood backing. | Piercing figures (P. F.). | Length of casemate. | Height of guns above water-line. | Speed. | Displacement. | Armament, etc. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | |
| | *English.* | | ft. | ft. in. | ft. in. | ft. in. | in. | in. | in. | | ft. | ft. in. | knots. | tons. | | |
| 2 | Warrior | 1860 | 380 | 58 4 | 25 0 | 26 9 | 4.5 | ⅝ | 18 | 53 | 213 | 8 10 | 14.4 | 8,952 | (4) 8-in. R., (22) 7-in. R. | C. |
| 1 | Achilles | 1863 | 380 | 58 4 | 26 3 | 27 4 | 4.5 | ⅝ | 18 | 53 | 213 | 9 0 | 14.3 | 9,681 | (4) 9-in. R., (22) 7-in. R. | C. and W.-L. B. |
| 3 | Minotaur | 1865 | 400 | 59 4 | 26 0 | 27 0 | 5.5 | ⅝ | 9 | 54 | 385 | 9 0 | 14.7 | 10,395 | (16) 9-in. R., " | W. |
| 1 | Royal Oak | 1863 | 273 | 58 6 | 23 10 | 25 5 | 4.5 | .... | 29½ | 43 | 280 | 7 6 | 12.5 | 6,416 | (4) 8-in. R., (20) 7-in. R. | W. |
| 1 | Royal Alfred | 1863 | 273 | 58 5 | 25 2 | 26 7 | 6 | .... | 29½ | 56 | 165 | 7 6 | 11.8 | 6,400 | (10) 9-in. R., (8) 7-in. R. | C. and W.-L. B. |
| 3 | Prince Consort | 1863 | 273 | 58 5 | 23 6 | 26 9 | 4.5 | .... | 29½ | 43 | 280 | 7 6 | 13.1 | 6,430 | (4) 8-in. R., (20) 7-in. R. | W. |
| 2 | Lord Clyde | 1864 | 280 | 58 9 | 24 0 | 26 6 | 4.5–5.5 | 1½ | 31½ | 80, 60 | 280 | 8 0 | 13.4 | 7,675 | (16) 9-in. R., (4) 7-in. R. | W. |
| 1 | Zealous | 1864 | 252 | 58 7 | 24 6 | 26 0 | 4.5 | .... | 30½ | 45 | 103 | ..... | 12.6 | 6,027 | (20) 7-in. R. | C. |
| 2 | Hector | 1864 | 280 | 56 5 | 24 0 | 25 7 | 4.5 | ⅝ | 18 | 53 | 288 | ..... | 12.3 | 6,960 | (2) 8-in. R., (16) 7-in. R. | C. |
| 2 | Resistance | 1861 | 280 | 54 1 | 23 6 | 25 6 | 4.5 | ⅝ | 18 | 53 | 143 | 6 11 | 11.8 | 5,986 | " (14) 7-in. R. | C. |
| 1 | Bellerophon | 1865 | 300 | 56 0 | 21 0 | 26 0 | 6. | 1½ | 10 | 70 | 110 | 7 11 | 14.2 | 7,540 | (10) 9-in. R., (4) 7-in. R. | C. and W.-L. B. |
| 1 | Hercules | 1868 | 325 | 59 0 | 22 0 | 27 0 | 9–8–6 | 1½ | 10 | 130, 102, 70 | .... | 12 2 | 13.0 | 8,700 | (10) 10-in. R., (2) 8-in. R. | C. and W.-L. B. |
| 1 | Penelope | 1868 | 260 | 50 0 | 15 7 | 17 7 | 6–5 | ¾ | 10 | 70, 55 | .... | ..... | 12.7 | 4,394 | (8) 9-in. R., (3) 40-pdr. R. | C. and W.-L. B. |
| 1 | Monarch | 1868 | 330 | 57 6 | 22 6 | 26 0 | 10–7–6 | 1½ | 14–12 | 135, 88, 70 | .... | 16 0 | 14.2 | 8,303 | (4) 10-in. R. | Turret. |
| 1 | Royal Sovereign | 1864 | 241 | 62 2 | 22 0 | 23 9 | 5.5 | .... | 36 | 50 | 246 | ..... | 11.0 | 5,000 | (4) 9-in. R. | 4 turrets. |
| 1 | Prince Albert | 1864 | 240 | 48 0 | 20 0 | 20 0 | 4.5 | ⅝ | 18 | 53 | 245 | ..... | 10.5 | 4,020 | (4) 9-in. R. | Turret. |
| 1 | Pallas | 1865 | 225 | 50 0 | 18 0 | 24 0 | 4.5 | .... | 22 | 43 | 50 | 7 11 | 12.6 | 3,688 | (4) 6-in. R., (2) 68-pdrs. | C. and W.-L. B. |
| 1 | Favorite | 1864 | 224 | 46 9 | 18 11 | 21 10 | 4.5 | .... | 26 | 43 | 66 | 8 6 | 11.8 | 3,116 | (8) 7-in. R., (2) 68-pdrs. | C. and W.-L. B. |
| 1 | Research | 1864 | 195 | 38 6 | 12 9 | 15 3 | 4.5 | .... | 19½ | 43 | 34 | 6 11 | 9.0 | 1,780 | (4) 7-in. R. | C. and W.-L. B. |
| 1 | Enterprise | 1864 | 180 | 36 0 | 13 3 | 15 6 | 4.5 | .... | 19½ | 43 | 34 | 6 11 | 9.8 | 1,370 | (4) 7-in. R. | C. and W.-L. B. |
| 2 | Scorpion | 1863 | 220 | 42 0 | 15 0 | 15 0 | 4.5 | ½ | 9 | 50 | 225 | 4 9 | 11.4 | 2,777 | (4) 9-in. R. | 2 turrets. |
| 2 | Viper | 1865 | 160 | 32 0 | 9 6 | 10 6 | 4.5 | ½ | 10 | 50 | 59 | 5 11 | 10.0 | 1,220 | (4) 9-in. R. | |
| 1 | Water Witch | 1866 | 162 | 32 0 | 11 11 | 11 7 | 4.5 | ½ | 10 | 50 | 60 | 5 0 | 9.2 | 1,278 | | |
| 1 | Captain | 1866 | 320 | 53 9 | 22 6 | 23 6 | 12–8–7 | 1½ | 12 | 160, 102, 85 | .... | 8 2 | .... | 7,823 | (4) 11-in. R., (2) 7-in. R. | 2 turrets. |
| 6 | Audacious | 1869 | 280 | 54 0 | 22 0 | 23 0 | 8–6 | 1¼ | 10 | 110, 70 | .... | 7 8 | 12.8 | 6,103 | (10) 9-in. R., (4) 68-pdr. | C. and W.-L. B. |
| 3 | Cerberus | 1868 | 225 | 45 0 | 15 0 | 15 6 | 10–8 | 1¼ | 10 | 135, 102 | .... | 9 1 | 9.6 | 3,344 | (4) 10-in. R. | Monitor. |
| 1 | Glatton | 1871 | 245 | 54 0 | 19 0 | 19 0 | 14–12 | 1½ | 18–15 | 198, 163 | .... | 10 5 | 12.0 | 4,862 | (2) 12-in. R. | " |
| 2 | Devastation | 1871 | 301 | 62 3 | 26 4 | 26 6 | 14–12–10 | 1½ | 18–14½ | 198,163,135 | .... | 13 0 | 13.8 | 9,046 | (4) 12-in. R. | " |
| 4 | Gorgon | 1871 | 225 | 45 0 | 16 5 | 16 5 | 10–9–8 | 1¼ | 10 | 135,117,102 | .... | 9 0 | 11.1 | 3,430 | (4) 10-in. R. | " |
| 1 | Repulse | 1871 | 252 | 54 0 | 25 6 | 26 6 | 6 | .... | 31 | 56 | .... | ..... | .... | ..... | (10) 9-in. R. | C. and W.-L. B. |
| 1 | Sultan | 1870 | 325 | 59 0 | 24 10 | 27 6 | 9–8–6 | 1½ | 12 | 117,102,70 | .... | 11 7 | 14.1 | 9,293 | (13) 10-in. R. | C. and W.-L. B. |
| 1 | Alexandra | 1875 | 325 | 63 8 | 26 0 | 26 6 | 12–8–6 | 1½ | 10 | 160,102, 70 | 75 | ..... | 14.0 | 9,492 | (2) 12-in. R., (10) 10-in. R. | C. and W.-L. B. |
| 1 | Hotspur | 1870 | 235 | 50 0 | 19 0 | 20 8 | 11–8 | 1¼ | 12 | 146, 102 | .... | 10 6 | 12.6 | 4,010 | (1) 10-in. R. | Ram. |
| 1 | Fury | 1870 | 320 | 63 10 | 26 6 | 27 0 | 14–10 | 1½ | 18–15 | 198, 135 | .... | ..... | 14.0 | 10,886 | (4) 12-in. R. | T. R. |
| 1 | Rupert | 1872 | 250 | 53 0 | 21 6 | 23 6 | 12–11 | 1¼ | 12 | 160, 146 | .... | 10 10 | 13.6 | 5,358 | (4) 12-in. R. | T. R. |
| 1 | Shannon | 1872 | 260 | 54 0 | 22 0 | 22 6 | 9 | 1¼ | 12–10 | 117 | .... | ..... | .... | 5,103 | (9) 9-in. R. | C. and W.-L. B. |
| 1 | Inflexible | 1875 | 320 | 75 0 | 23 0 | 25 0 | 24–18 | 2 | ..... | ..... | .... | ..... | 13.0 | 11,165 | (4) 81-ton R. | Monitor. |
| 1 | Téméraire | St'ks. | 285 | 62 0 | 26 6 | 27 0 | 11 | 1½ | 12 | 146 | .... | ..... | 14.0 | 8,412 | (3) 12-in. R., (5) 10-in. R. | C. and W.-L. B. |
| | *French.* | | | | | | | | | | | | | | | |
| 3 | Gloire | 1859 | 252 | 55 9 | 23 1 | 27 10 | 4.72–4.33 | .... | 26–23 | 45, 40 | .... | 6 2 | 12.8 | 5,530 | (36) 6.3-in. R. | W. |
| 1 | Couronne | 1859 | 262 | 54 9 | 23 0 | 26 11 | 4.7 | ⅝ | 10 | 53 | .... | 6 2 | 13.0 | 5,982 | (20) 6.3-in. R., (10) 55-pdr. | W. |
| 2 | Magenta | 1861 | 284 | 57 0 | 24 1 | 28 0 | 4.72 | .... | 26–23 | 45 | .... | 6 3 | 12.8 | 6,876 | (52) 6.3-in. R. | W. |
| 10 | Provence | 1868 | 258 | 55 11 | 23 6 | 26 10 | 5.9–4.33 | .... | 26–23 | 55, 40 | .... | 7 3 | 13.9 | 5,703 | (8) 9.45-in. R., (4) 7.48-in. R. | W. |
| 4 | Marengo | 1869 | 282 | 57 0 | 24 10 | 29 1 | 7.87–6.3 | .... | 32–24 | 85, 70 | .... | 11 9 | 13.5 | 7,360 | (4) 10.63-in. R.,(4) 7.48-in. R. | C. and W.-L. B. |
| 6 | Alma | 1867 | 230 | 46 0 | 18 10 | 23 9 | 5.91–4.72 | .... | 26 | 55, 45 | .... | 6 3 | 11.8 | 3,678 | (6) 7.48-in. R. | C. and W.-L. B. |
| 1 | Belliquese | 1867 | 230 | 45 0 | 17 6 | 21 0 | 5.9 | .... | 10 | 55 | .... | ..... | 12.5 | 3,347 | (16) 9.45-in. R. | C. and W.-L. B. |
| 1 | Colbert | Stk's. | 314 | 57 0 | 24 7 | 27 10 | 8.66–6.30 | .... | 32–24 | 108, 70 | .... | 13 4 | .... | 8,167 | (8) 10.63-in. R., (1) 9.45-in. R. | C. and W.-L. B. |
| 1 | Richelieu | " | 322 | 57 0 | 24 7 | 27 10 | 8.66–6.30 | .... | 32–24 | 108, 70 | .... | 13 4 | .... | 8,269 | (6) 10.63-in. R., (4) 9.45-in. R. | C. and W.-L. B. |
| 1 | Redoubtable | " | 312 | 64 0 | 22 3 | 24 11 | ..... | .... | ..... | ..... | .... | 13 7 | .... | 8,658 | (4) 10.63-in. R., (2) 12.6-in. R. | C. and W.-L. B. |
| 1 | Rochambeau | " | 352 | 60 0 | 21 0 | 22 2 | 4.72–3.54 | .... | 35 | 50, 35 | .... | 4 8 | 13.0 | 7,758 | (4) 10.63-in. R., (11) 9.45. in. R. | C. |
| 4 | Cerbère | 1868 | 216 | 53 0 | 18 7 | 19 7 | 8.66–7.09 | .... | 31–20 | 108, 88 | .... | 17 5 | 11.3 | 3,703 | (2) 9.45-in. R. | Turret. |
| 4 | Paixhan | 1868 | 156 | 46 0 | 10 9 | 10 9 | 4.5 | .... | 10 | 40 | .... | ..... | 7.0 | 1,539 | (16) 55-pdr. | F. B. |
| 4 | Embuscade | 1865 | 130 | 51 2 | 9 6 | 9 6 | 5.51–4.33 | ½ | 15¾ | 53, 40 | .... | 3 0 | 7.0 | 1,422 | (4) 7.48-in. R. | F. B. |
| 3 | Arrogante | 1864 | 144 | 48 0 | 8 8 | 8 8 | 4.72–4.33 | .... | 15¾ | 45, 40 | .... | 4 9 | 7.0 | 1,339 | (9) 6.3-in. R. | F. B. |
| 1 | Taureau | 1864 | 197 | 47 6 | 16 5 | 16 5 | 5.9 | .... | 10 | 53 | .... | ..... | 12.3 | 2,439 | (1) 9.45-in. R. | R. |
| 1 | Onondaga | 1862 | 228 | 51 0 | 12 3 | 12 7 | 5.51 | 1.18 | 11.8 | 53 | .... | ..... | 9.0 | ..... | | T. |
| 1 | Tonnerre | St'ks. | 241 | 57 0 | 20 8 | 21 4 | 11.81 | 1.18 | 15¾ | 158 | .... | 13 5 | .... | 5,494 | (2) 12.6-in. R. | T. R. |
| 1 | Tempête | " | 241 | 57 0 | 16 9 | 16 9 | 11.81 | 1.18 | 15¾ | 158 | .... | 13 1 | .... | 4,454 | (2) 12.6-in. R. | T. R. |

This table does not give the *names* of all the iron-clads in the English and French navies, but it gives the names of each class, with number (in Column 1), either built or laid down, according to the latest information. A number of them, as Royal Oak, Royal Alfred, Lord Clyde, Zealous, and Royal Sovereign (wooden hulls), have probably already been condemned. The Pallas, Favorite, Research, and Enterprise (wooden hulls), if still to be found in the British naval register, are of but little account as iron-clads. These obsolete iron-clads, as well as the turret-ship Captain (lost at sea), have been included in order that the table may be a synopsis of the iron-clads constructed for the English navy up to the present time.

The principal source of information regarding the French iron-clads has been the tables of M. d'Islere in *Revue maritime et coloniale* (trans. by Commander Meade, U. S. N.). With the exception of the Couronne, Embuscade, one of the Marengo class, two or three of the Provence class, and the last three in the table, all these vessels have wooden hulls. If relative impregnability is taken as a standard, the French vessels are, on the whole, very inferior; and a large number of them as iron-clads are practically worthless, if not already condemned. The Magenta was recently destroyed by fire.

The armament of the English iron-clads is frequently changed, 9-inch rifles being substituted for 8-inch, and so on.

NOTE.—W., sides wholly armored; C., central casemate (see Fig. 1); W.-L. B., water-line armored belt (see Fig. 2); F. B., floating battery; T. R., turreted ram; R., rifle. Figures in parentheses are the number of guns. (For explanation of "Piercing Figures" see Table D and Section 29.)

being in a settled state—so much so that in all probability it will require but a few years to make this information valuable only to the naval antiquarian.

(8) *Russian Iron-clads.*—Two wooden broadside iron-clads, 300 feet long; 21′ 6″ draught forward and 24′ 8″ aft; armed with 16 to 20 ton rifles; 4½″ armor, 9″ backing; piercing figure, 40; speed, 14 knots. Three iron broadside iron-clads, 220 feet long; 14′ 6″ draught; 4½″ armor, 10″ backing; P. F. 47. Two monitors, 248 feet long; 16′ 9″ draught; 3 turrets; 6½″ side armor, 17″ backing. Two of same dimensions with 2 turrets. One casemate and armor-belt broadside, 265 feet long; 18′ 6″ draught. One 3-turret monitor, 289 feet long; 20′ 9″ draught; 7½″ armor, 17″ backing; P. F. side-armor, 93; armament, six 300-pdr. rifles. Nine 1-turret (12″ thick) monitors, 200 feet long, 11′ 6″ draught; 5″ armor, 30″ backing; armament, two 9″ rifles of 15 tons; speed, 8 knots. Three monitors somewhat smaller than last. One monitor of same type as English Devastation. The Russians have lately constructed two circular monitors, the Kiev and Novgorod (called Popoffka after their designer, Admiral Popoff). They were designed "with the exclusive purpose of defending passages already protected by obstructions," and are intended for special service in the Baltic in the neighborhood of St. Petersburg, and in the Black Sea at the Straits of Kertch. The peculiarity is in the shape of the hull, which is *circular*, an upright cylinder about 100 feet in diameter. It is claimed that this form gives a maximum of displacement with a minimum of draught. The tops of decks are about 18″ above the water, and the sides carry 9″ armor, laid on peculiar backing of channel iron, which, it is claimed, makes the armor equal to a solid 11″ plate. The hulls are of iron with double skin, and are sheathed with wood and coppered: the draught is 13′ 2″. They are propelled by six separate engines and screws: it is stated that a speed of between 8 and 9 knots was realized on their trial. The turrets have 9″ armor, and are stationary; they are placed in the centre of vessel; the guns, two 11″ 28-ton rifles, fire over the top of them. Several of the same class, larger than the above, are now building; they will carry side armor 18″, and deck armor 2½″ thick.

(9) *Italian Iron-clads.*—Two wooden broadside iron-clads, 260 feet long; 24′ 9″ draught; 36 medium guns; 4¾ and 4½ inch armor, 10″ backing; P. F. 50 and 53. Three iron broadsides, 252′ 6″ long; 24′ 8″ draught; 26 medium guns; speed, 13 knots; 4¾ inches armor, 10″ backing; P. F. 53. Three wooden broadsides, 246 feet long; 21′ draught forward, 24′ 6″ aft; 22 medium guns: 4½″ armor, 10″ backing; P. F. 50. Two iron broadsides, 203 feet long; moderate draught; speed, 8 knots; 4½″ armor, 10″ backing. Two small wooden broadsides, 183 feet long; medium draught; 12 small guns; 4½″ armor, 10″ backing; P. F. 40. One small battery, 4 guns; 4½″ armor, 10″ backing; P. F. 40. Two iron broadsides, 5780 tons displacement; 26 medium guns. Four small batteries, 642 tons displacement. The Duilio, a two-turreted monitor, and one of the most powerful of iron-clads, has lately been launched for the Italian navy. Chief dimensions, length between perpendiculars, 339.48′; extreme breadth, 64.61′; medium draught, 25.9′; displacement, 10,600 tons; height of the battery above water, 15.74′. The hull, of iron, is constructed on the double-bottom system described in Sec. 20: this bottom is 229.6′ in length; it is divided into many watertight compartments. The two turrets, which are each to carry two 100-ton rifles, throwing 2200-pound projectiles, with corresponding charges of powder, are mounted on the box

or "breastwork" system described in Sec. 45. The centres of the turrets do not coincide with the centre line of the vessel, but are arranged in a manner similar to those of the Inflexible (Sec. 47), these centres being placed 7.67′ on one side of the centre fore-and-aft line; the arrangement enables three of the guns to be discharged simultaneously in a direction parallel with the keel. The armor of turrets is to be 17.68″ thick, fixed on a backing of iron and teak; the armor at the water-line, in wake of turret-box, is to be 21.61″. The description from which this is taken (*Army and Navy Gazette*) does not give the thickness of the armor of the box, nor the length over which the above thickness of side-armor is carried. This vessel is built with an under-water ram, and is also fitted with an apparatus for projecting torpedoes; there will also be carried "at the stern, in a tunnel closed by a grated door, a very rapid torpedo-boat," to be launched against the sides of the enemy as opportunity presents itself. The Duilio has two screws, which will be driven by engines of 7500 horse-power; the speed is expected to be 14 knots; the bunkers will carry 1200 tons of coal, a sufficient quantity, so it is stated, to carry the ship 1000 knots at full speed, and 4000 at a moderate rate. From the above it is seen that the commander of this vessel will have three weapons at his disposal—viz. the gun, the ram, and the torpedo. The opinion is held by some that it is the wisest course, especially for coast and harbor defence, to separate these weapons, as so many combined in one vessel may confuse the commander and defeat that unity of purpose which is essential to success. It may be safely said that the more limited and definite the object for which a naval vessel is planned, the greater will be her success in answering the purposes of her construction.

(10) *Austrian Iron-clads.*—One wooden broadside, 284 feet long, 23′ 1″ draught forward, 27′ 5″ aft; twelve 9″ rifles; 6″ armor, 28″ backing; P. F. 65. Three same, 230 feet long; 20′ draught forward, 23′ 4″ aft; twelve 7″ Armstrong rifles, 4½″ armor, 24″ backing; P. F. 40. Three same, 205 feet long; 19′ 4″ draught forward, 23′ 4″ aft; ten 9″ Armstrong rifles; 5″ and 6″ armor, 28″ oak; P. F. 52 and 65. A powerful broadside iron-clad is now constructing at Trieste for this navy. The following particulars of this vessel, furnished by the chief constructor of the Austrian navy, were lately read by Mr. Reed before the Society of Naval Architects: Length between perpendiculars, 286′ 11¼″; total length, 303′ 1¼″; breadth at water-line, 62′ 9″; extreme breadth outside of the armor, 71′ 1½″; depth of hold, 34′ 9″; draught of water aft, 26′ 7¼″; ditto forward, 23′ 1″; displacement in tons with one-half provisions, 7390; area of midship section immersed, 1301 square feet; area of the load water-line, 14,308 square feet; height of metacentre above the centre of gravity of displacement, 14.623′; height of metacentre above water, 4.770′; distance of centre of gravity of displacement before the midship section, 3.356′; depth of the centre of gravity of displacement below water, 9.853′; coefficient of displacement, 0.582; coefficient of water-line, 0.782; coefficient of midship section, 0.82; displacement of an inch immersion at the load water-line, 34.47 tons; weight of armor and backing, 2160 tons; armament, six 11-inch Krupp rifles; area of sails, 82,165 square feet; cost of hull, estimated, £172,790; ditto engines and boilers, £81,715; number of cylinders, 2; diameter of ditto, 125″; length of stroke, 4′ 3″; diameter of propeller, 23′ 6″; number of blades, 2; pitch, 2; revolutions per minute, 70; number of boilers, 4; area of fire-grate, 850 square feet; heating surface, 25,500 square feet; superheating surface, 1800 square feet; pressure of steam, 30 pounds; number of furnaces, 36; indicated horse-power, estimated, 8000; speed, estimated, 14 knots. A belt of armor extends from the stern to within about 30′ of the foremost perpendicular, where it terminates in a transverse armored bulkhead, and a stout iron deck going forward to the stern at about 7′ below water. The hull above water is made of such a form as to simplify as much as possible bending and fitting the armor-plates. The ship is armored on the central casemate and water-line belt system; the casemate overhangs, the battery projecting from the vessel's sides between 4′ and 5′ at a height of 6′ above the water. The Austrian chief naval constructor says: "The ship Tegethoff is in many respects a novelty, its casemate allowing an all-around fire, avoiding at the same time, by its particular form, the dangerous projection of the muzzles of the midship guns, in consequence of experiences acquired in the battle of Lissa, but which are very little known even in our own navy." Transverse bulkheads are fitted in the casemate similar to the Alexandra (see Sec. 24). This bulkhead inclines forward at a considerable angle to within about 4′ of the middle line, where it becomes transverse; immediately over this foremost portion of the battery is a very strong pilot-tower, standing well up above both the gunwale and the forecastle. This shows that the Austrian officers who have been in action in iron-clads do not consider such towers unnecessary.

(11) *German Iron-clads.*—One iron broadside, central casemate and water-line belt; 9761 tons displacement; 355 feet long; 24′ 6″ draught forward, 26′ 6″ aft; armament, 10″ Krupp rifles; 8″ armor, 20″ backing; P. F. 103. Two same, 286 feet long, 26 feet draught; sixteen 8″ Krupp rifles; 5″ armor, 10″ and 15″ backing. Two turret iron-clads, 200 and 172 feet long; 15′ draught; 4½″ and 4¾″ armor, 9″ backing.

(12) *Turkish Iron-clads.*—Three iron broadsides, 293 feet long; 24′ 9″ draught; eighteen 150-pdrs. and two 300-pdr. Armstrong rifles; 5½ armor, 9″ backing; P. F. 54.

(13) *Spanish Iron-clads.*—One iron broadside, 7420 tons displacement; 288 feet long; 27′ 4″ draught; 5½″ armor, 15″ backing; P. F. 55; speed, 13 knots. One, nearly the same, of wood; 4¾″ armor; P. F. 42. One, same, of iron, 316 feet long; 24′ 8″ draught; 5½″ armor, 9″ backing; P. F. 54. Three, same, of wood, 279 feet long; 26′ draught; 4¾″ armor, 9″ backing; P. F. 42.

(14) *Swedish Iron-clads.*—Three 1-turret (12″ thick) monitors, 200 feet long; 11′ 3″ draught; speed, 8 knots; 5″ armor, 40″ backing; two 20-ton guns. Three small monitors, with one 15″ gun.

(15) *Danish Iron-clads.*—Three floating batteries 190 to 280 feet long: 19′ to 21′ 6″ draught; 4½″ to 5″ armor; speed, 9 to 10 knots; armament of small guns. One monitor, 1246 tons; twin screws; 185′ long; 10′ 4″ draught; 4½″ armor, 9″ backing; armament, four 68-pdr. smooth-bores. Two small gunboats, with 2″ armor.

(16) *Iron-clads of Holland.*—One small gunboat, 4½″ armor; 3′ 3″ (?) draught. One 11″ turret; 4⅝″ armor, 10″ backing. Three monitors, 7′ 11½″ draught forward, 10′ aft; one 11″ turret; 5⅝″ armor, 10″ backing. The Hollanders rely chiefly on torpedoes to close the Scheldt.

(17) Brazil has a miscellaneous collection of some ten inferior broadside iron-clads, with from 4 to 4½ inch armor; one formidable monitor similar to the English Devastation; and eight small monitors for river-service. Peru has seven iron-clads of an inferior description, divided between monitors and broadsides. Chili has two broadside iron-clads, Almirante Cochrane and Valparaiso, which carry along the water-line 8 inches of armor. Greece has one small iron-clad. China and Japan have each started an iron-clad navy; the former has one and the latter two of a very feeble type.

Referring to Table A, the great length of the early English iron-clads, compared with the French, will be noticed. Some of these were nearly 100 feet longer than the finest wooden frigates previously built. The object was to carry great weight of armor with fine lines, and thereby secure high speed with moderate power. This reasoning is no doubt correct in the case of vessels intended to steam long distances at high speed; but in the case of iron-clads, which will never use full power except during short periods, and where handiness is all important, practice has shown (if practice were needed to show it) the system to be a mistake. High speed was attained with small relative engine-power, but at the cost of unhandiness and great deficiency in manœuvring power—qualities of cardinal importance in all war-vessels. The system of partial protection carried out in the early vessels was for a time looked upon in official circles as a mistake; so, to carry complete armor and retain the high speed with the same proportion of engine-power, the Minotaur class were made 20 feet longer; these proved to be so unwieldy, and so vulnerable too, that complete protection, with fine forms and great dead rise, was abandoned, and much fuller models adopted. This change was begun by Mr. Reed, who at that time (1864) became chief constructor of the British navy.

TABLE B.—*Steering-power of Typical Iron-clads.*

| | | Bellerophon. | Achilles. | Marengo. | Warrior. | Lord Clyde. |
|---|---|---|---|---|---|---|
| Length | | 300′ | 380′ | 282′10″ | 380′ | 280′ |
| Breadth | | 56′ | 58′4″ | 56′11½″ | 58′4″ | 58′11″ |
| Draught aft | | 27′1″ | 27′ | 29′1″ | 27′ | |
| " forward | | ..... | 26′ | 24′10″ | 26′ | |
| Speed, 12 knts. | Time of completing circle, starboard, min. and sec | 4.40 | 6.40 | 5.12 | 7.21 | 4.56 |
| | Do. port | 4.55 | 6.40 | ..... | 8.11 | 4.52 |
| | Diam. of circle, yds. star. | 365 | 616 | 366 | 753 | 377 |
| | Diam. of circle, yds. port. | 437 | 620 | ..... | 768 | 379 |
| Speed, 5 knts. | Time of completing circle, starboard, min. and sec | 9.5 | 13.18 | ..... | 10.51 | 9.54 |
| | Do. port | 8.32 | 12.35 | ..... | 12.18 | 9.52 |
| | Diam. of circle, yds. star. | 270 | 618 | ..... | 687 | 392 |
| | Diam. of circle, yds. port. | 420 | 615 | ..... | 532 | 388 |
| Area of rudder, sq. ft. | | 248 | 167 | 250 | 177 | |

Omitting some small vessels, the Bellerophon was the first of the new style; her superiority in point of handiness and increased thickness of armor, obtained by decreasing its area, was such that future broadside iron-clads were built after her general plan. Table B shows better than a description the relative merits in respect of manœuvring of the long and the short vessels. The Bellerophon was the first vessel in the British navy fitted with the balanced rudder—*i. e.* with the axis about one-fourth of the total width from the forward edge. This was taken from our monitors, where it had proved very efficient. To place the old-style rudder of the Minotaur class, with an area of only 198 square feet, at an angle of 23° with the keel, the engines working at full speed, required 18 men at the wheel, and no less than 60 more at the tackles connected with the tiller; while the Bellerophon's rudder, 248 square feet area, could be put at an angle of 37° by 8 men. In large iron-clads steam is now generally applied for this purpose.

(18) Respecting the models of the iron-clads, the following will explain the gain by the change from fine to full water-lines. The shape of hull which will give maximum displacement with given dimensions of length, breadth, and draught is obviously a parallelopipedon. The quantity of this circumscribing solid that is always cut away in forming the model determines the degree of fineness of the water-lines. In the Minotaur, for example (10,395 tons), where much was conceded to fineness of model, the displacement (carrying power) is 54 per cent. of the solid; in the Bellerophon (7450 tons) it is 62 per cent. On a six hours' trial the former made 14.16 knots, the engines exerting 6193 horse-power; on a similar trial, both vessels having been out of dock but a few days, the latter made 14 knots with 6199 horse-power, the Bellerophon thus requiring, practically, the same power as the Minotaur to propel at the same speed 2800 tons less weight. This is due to superior fineness of model of the former. Under ordinary circumstances the use of so great power to give 14 knots to a ship so small, comparatively, as the Bellerophon, would be inadmissible; but in an iron-clad, where so much of the displacement must be used to carry armor and armament, the case is very different. The full water-lines, together with making the transverse sections, in the extreme fore-and-aft bodies, in the shape of ∪, instead of ∨, as is usual, constitute the changes in models adopted by the chief constructor. These principles have been carried out in all iron-clads built after the long, sharp Minotaur system was set aside in 1864. But to keep the high speed of the early ships depended altogether on the ability of the engine-builders to construct machinery of much greater power than had been before required. To their success in accomplishing this the speed of Mr. Reed's models is due.

(19) Respecting the advantages of these changes, it has been held by some that as the armor-piercing power of guns has been brought to so high a point, the armor of the short, bluff iron-clads is of but little if of any more value than the thinner armor of their predecessors, and consequently that the Minotaurs, from the greater number of guns their length enables them to mount, would be the victors in an open-sea fight. If, however, broadside iron-clads can be made to carry armor thick enough to cope with the guns now built (which is doubtful), it will be by following the changes which have increased their flotative power.

(20) A change in the mode of constructing the hull was introduced at the same time with those mentioned—viz. a skilful economizing of material, which added to the proportion of weight—guns, armor, etc.—carried with given dimensions. This is a modification of the cellular or double-bottom system, first carried out on a considerable scale in the Great Eastern. Iron ships are usually built on what is called the transverse system—*i. e.* the plates are riveted to continuous angle-iron frames running from gunwale to gunwale, spaced about 18 inches, and strengthened by deep floor-plates; longitudinal strength is added to by keelsons placed between and over the frames. The cellular system was adopted in the Bellerophon to save weight, simplify construction, and to increase both strength and safety. In this hull (a type of all built on this system) the usual angle-iron ribs, except high up on the side, are dispensed with. Continuous longitudinal frames, thirteen in number, the centre one being over the keel-plate, beginning at the lower edge of the armor, are carried well into the bow and stern: these are from 17 to 49 inches in depth; they add to the longitudinal and local strength of the ship. Between them, at intervals about twice as great as the ribs in the transverse system, bracket-frames of equal depth are fitted. This construction thus forms a cellular framing, on the outside of which the bottom plating is riveted, while on the inside a water-tight inner bottom is similarly fastened, which extends two-thirds of the vessel's length, and transversely well up on the turn of the bilge, where it is joined on each side by the vertical wing-passage bulkheads (common to all English iron-clads with iron hulls), which extend up to, and thus in effect continue to the main deck, the water-tight inner skin. The space between the inner and outer bottoms is thus divided up into cells deep enough for men to enter and paint every part. Most of the iron-clads built on this system have three of the longitudinals made water-tight, also the transverse bracket-frames at distances of about 20 feet. Should the outer plating only be ruptured, the water would be confined to the space between the two bottoms; should both be broken through, the ship would be in the same condition as one with a single skin; she would then depend on the transverse water-tight bulkheads. It is estimated that the cellular system saves some 7 per cent. in weight of iron, while at the same time it adds to the longitudinal strength some 10 per cent.

Mr. Reed and others place great reliance on the numerous water-tight divisions of this system, as adding to the ship's chances of escape from being sunk if struck by torpedoes. There is much in favor of this view if the torpedo is a canister of explosive, to be placed near the enemy's side by fastening it to a spar rigged out from a vessel or carried by a swift launch; but with a heavy torpedo, containing several hundredweight of explosive, fired in contact with the iron-clad's sides below the armor, it is not probable that the double bottom would save the vessel so attacked from destruction. The iron hulls of armored ships are now so skilfully built that it is not probable any further reduction in the weight of material can be made. The iron-clads of the Audacious class (1869) and the Alexandra, just launched, it may be said, have the least weight of hull that is compatible with a due regard to safety. The following example will show what has been done in this direction: The total weight of the Defence (1861–62) is 6073 tons, and of the Audacious (1869) 6103 tons; the hull of the Defence weighs 3474 tons, and the weights carried—viz. armor, guns, etc. etc.—are but 2599; the Audacious' hull weighs only 2667 tons, while the weights carried are 3436 tons.

TABLE C.—*Showing Proportions of Weights in Typical Iron-clads.*

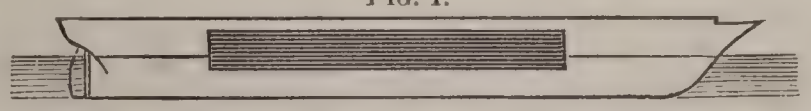
| Name of ship. | Displacement, tons. | Weight of hull, tons. | Ratio to total weight of vessel equipped. | | | | | | | Total weight carried, tons. | Ratio of weight carried to displacement. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Hull. | Armor. | Objects of ordnance. | Machinery and water in boilers. | Coal. | Masts and rigging. | Provisions and miscellaneous. | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| *French.* | | | | | | | | | | | |
| Gloire, wood.....1859 | 5,530 | 2611 | 0.472 | 0.144 | 0.066 | 0.114 | 0.116 | 0.112 | 0.076 | 2919 | 0.528 |
| Magenta, " .....1861 | 6,876 | 3263 | 0.474 | 0.160 | 0.073 | 0.108 | 0.107 | 0.011 | 0.067 | 3613 | 0.525 |
| Marengo, " .....1869 | 7,360 | 3554 | 0.483 | 0.181 | 0.063 | 0.111 | 0.077 | 0.012 | 0.073 | 3806 | 0.517 |
| Richelieu, " .....on stocks | 8,269 | 3936 | 0.476 | 0.195 | 0.068 | 0.095 | 0.085 | 0.030 | 0.051 | 4433 | 0.524 |
| Tonnerre, iron ram.. " | 5,494 | 1965.5 | 0.358 | 0.371 | 0.036 | 0.119 | 0.052 | 0.000 | 0.064 | 3528.5 | 0.642 |
| *English.* | | | | | | | | | | | |
| Ocean, wood.....1863 | 6,920 | 3447 | 0.498 | 0.135 | 0.052 | 0.124 | 0.085 | ..... | 0.106 | 3473 | 0.502 |
| Lord Clyde, " .....1863 | 7,675 | 3696 | 0.482 | ..... | ..... | ..... | ..... | ..... | ..... | 3979 | 0.518 |
| Warrior, iron.....1861 | 8,952 | 4609 | 0.515 | 0.151 | 0.062 | 0.102 | 0.094 | ..... | 0.076 | 4343 | 0.485 |
| Defence, " .....1861 | 6,074 | 3473 | 0.572 | 0.138 | 0.048 | 0.061 | 0.074 | ..... | 0.107 | 2601 | 0.428 |
| Achilles, " .....1863 | 9,681 | 4871 | 0.503 | 0.183 | 0.048 | 0.107 | 0.072 | ..... | 0.087 | 4810 | 0.497 |
| Minotaur, " .....1865 | 10,395 | 5118 | 0.492 | 0.195 | 0.047 | 0.101 | 0.072 | ..... | 0.093 | 5277 | 0.508 |
| Bellerophon, " cellular....1865 | 7,540 | 3636 | 0.482 | 0.171 | 0.054 | 0.118 | 0.085 | ..... | 0.090 | 3904 | 0.518 |
| Monarch, " " ...1868 | 8,303 | 3602 | 0.434 | 0.217 | 0.041 | 0.132 | 0.072 | ..... | 0.104 | 4701 | 0.566 |
| Sultan, " " ...1870 | 9,293 | 3982 | 0.428 | 0.209 | 0.062 | 0.133 | 0.080 | ..... | 0.088 | 5311 | 0.572 |
| Audacious, " " ...1869 | 6,103 | 2662 | 0.436 | 0.222 | 0.055 | 0.117 | 0.085 | ..... | 0.085 | 3441 | 0.564 |
| Glatton, monitor.....1871 | 4,862 | 1570.3 | 0.323 | 0.356 | 0.067 | 0.112 | 0.111 | ..... | 0.031 | 3291.7 | 0.677 |
| Devastation, " .....1871 | 9,046 | 3282 | 0.363 | 0.287 | 0.056 | 0.111 | 0.152 | ..... | 0.031 | 5764 | 0.637 |

(21) Table C shows the proportion of the weight carried to the weight of the hull alone in several typical iron-clads. The ratio that the weight of each of the elements which together make the complete vessel bears to the total displacement is set down in decimals: by multiplying the displacement by these, the actual weight of the elements, guns, armor, fuel, etc., will be ascertained. It is seen that those broadside vessels with full models and cellular bottoms carry larger proportionate loads than the others, while those which stand the highest in this ratio are the rams, as the Tonnerre, and the monitors, as Devastation. This follows from the fact that they are unincumbered with the rigging and other paraphernalia of the broadside ships, as well as from the less height of side exposed above water. Before the time of iron-clads, wooden hulls for large ocean-steamers were about given up, but the use of iron was so successfully opposed for naval purposes that no iron war-ship of any consequence had been built up to that period. This was changed so suddenly that it may well cause surprise. The reasons are obvious: one of the important points in an iron-clad is to secure adequate strength with the least weight; in well-built wooden iron-clads, as the Lord Clyde (see Table C), the hull alone requires one-half the displacement. Wooden hulls, even unarmored, always work and twist more or less; when iron plates are bolted to their sides, this evil is increased; and whether they are wholly or partially armored, they can be set on fire by shells. This is not the case with properly-built iron hulls, which will last a great many years if well cared for, while the wooden ones are sure to rot and need continual repairs. Besides, it is very difficult to fit in them efficient water-tight bulkheads. The English wooden iron-clads are mostly "converted" line-of-battle ships. The French were deficient in iron shipbuilding facilities or experience, and consequently used wood, but their latest constructions are of iron. The rapid fouling of the bottoms of iron ships has been so far overcome by the device of applying a layer of wood and sheathing it with copper that even the most important non-armored naval vessels are now built of iron.

(22) As has been observed, the change in the design of iron-clads from the beginning has been guided by the constant tendency—at no time stronger than at the present—to diminish the number and increase the power of guns. Carry this idea of concentration to extremes, and the monitor principle of 1854 is reached. The early abandonment of complete protection, and the substitution therefor of the central-armored casemate, with its recessed ports and the armored water-line belt; the full models to increase flotative capacity; the efforts made to save weight in hull, the saving to go in increased thickness of armor,—all show the exertions that have been made to make the iron-clads keep pace with the penetrating power of guns, which seem always to be a little in advance. An inspection of Tables A and D shows that by far the largest portion of the iron-clads afloat can be pierced by shells from medium guns—viz. rifles, French, English, and German, of from 7 to 10 inches bore.

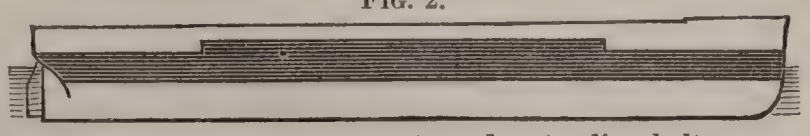
(23) The outline diagrams, drawn to scale, show the varieties in the modes of disposing the armor that have been successively tried from the La Gloire and Warrior up to the present time. Several of these look as though the arrangement was made more to meet the crotchets of current naval opinion than in accordance with any recognized principle. The dark tints show the area of thickest armor, the medium tint that of less thickness, and the light tint the thinnest of all. The chief particulars of all these classes are given in Table A.

FIG. 1.



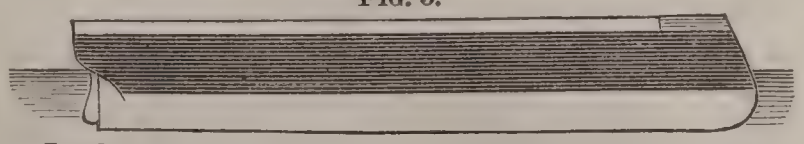
Warrior class, central casemate.

FIG. 2.



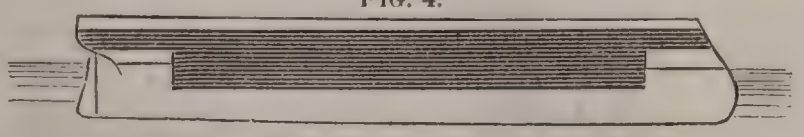
Achilles, central casemate and water-line belt.

FIG. 3.



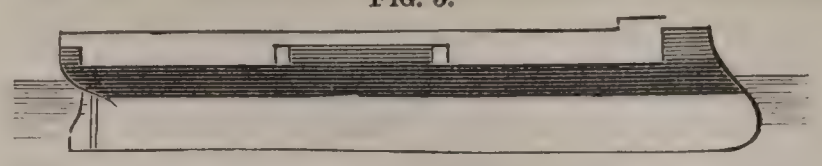
Lord Clyde, wholly armored, as Gloire, Minotaur, etc.

FIG. 4.



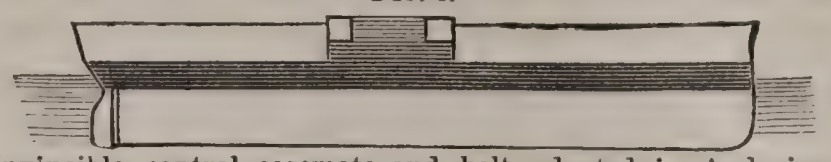
Hector, armor-belt above water-line.

FIG. 5.



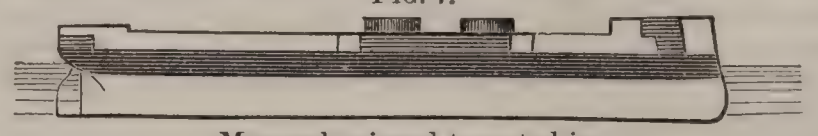
Hercules, central casemate and belt, with end screens.

FIG. 6.



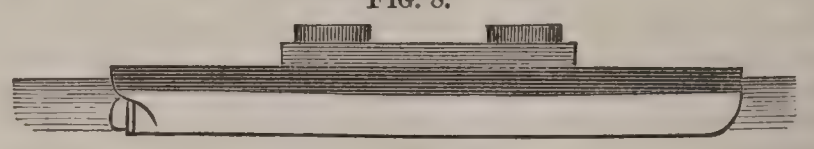
Invincible, central casemate and belt, adopted in Audacious class.

FIG. 7.



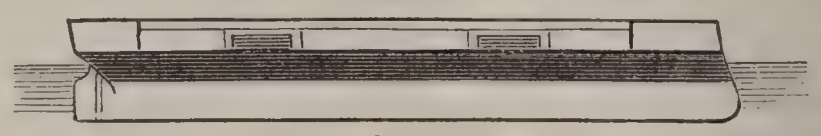
Monarch, rigged turret ship.

FIG. 8.



Cerberus, type of English monitors.

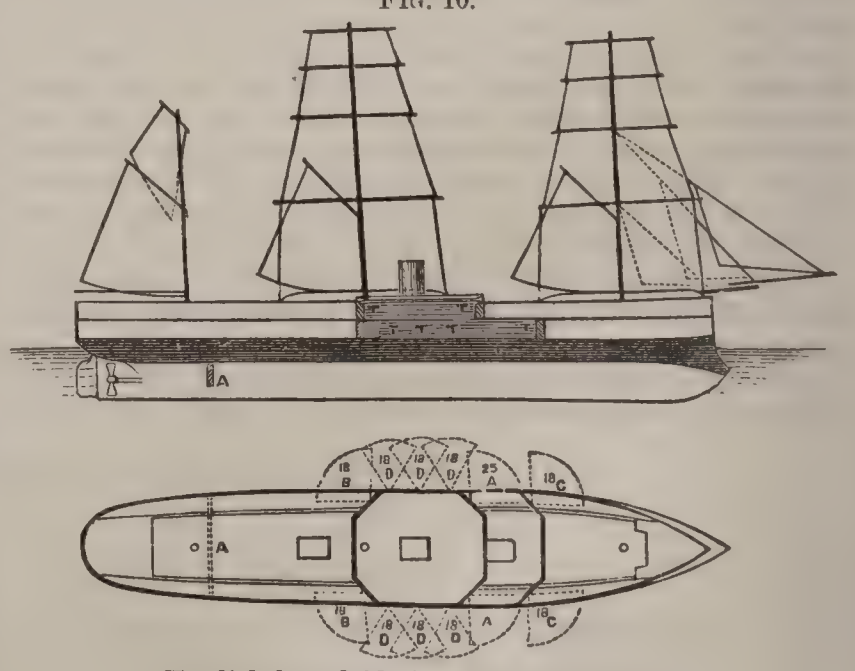
FIG. 9.



Captain, rigged turret vessel, with low freeboard, planned by Coles. (This vessel capsized in a moderate gale.)

(24) By placing in contrast the following ships, a clear idea will be had of the progress during some fifteen years in the construction of broadside iron-clads. Compare La Gloire, 5530 tons (1859–60), sides wholly plated with armor, the piercing figure of which is 45 and 40, armament 36 light guns, with the Redoubtable, now on the stocks, 8658 tons, water-line and central casemate plated with armor, the P. F. of which is 108, and the armament 6 heavy guns. Also, the Warrior, 8950 tons (1861–62), with a patch of armor on her sides, the P. F. of which is 53, and the armament 26 light guns, with the Alexandra, just launched, 9292 tons, two-story central casemate, and water-line belt covered with armor, the P. F. from 70 to 160, and the armament 10 heavy guns. The Alexandra, one of the latest English constructions, is regarded as the most perfect of the broadside type. A cut and description of this ship will therefore be of interest. Her dimensions are given in Table A. She is fitted

FIG. 10.




English broadside iron-clad Alexandra.

with twin screws, driven by engines of 8000 horse-power, and the estimated speed is 14 knots. *Armor.*—The belt shown by deep shading in the cut is 12 inches thick amidships, tapering to a much less thickness at the ends. The first story of the casemate, shown by the middle shading, is plated with 8-inch armor, and the second story, shown by the light tint, with armor 6 inches thick; the teak backing on sides and casemate is 10 inches thick. The 8 and 6 inch armor which shields the armament is a miserable defence against the artillery now carried by the principal navies. The reason of this is, as *London Engineering* (from which the cut and particulars are taken) says, "the ship must before all things be kept above water." In order to localize the effect of a shell exploding between decks, the casemate is divided into two parts by an armored bulkhead; but the effect of a 600 or 700 pound shell, containing, as it does, some five times greater bursting charge than the

heaviest shells so much dreaded in the days of wooden walls, and which made such havoc on the Alabama, bursting inside either compartment of the two-story casemate of the Alexandra, among the guns and gunners, can hardly fail to place them *hors de combat*. The short interval necessary for the explosion of the bursting charge, which is fired by the heat generated by the impact on striking the armor, is about sufficient to allow the passage of the shell through it before it bursts. Thus, the armor is made use of to destroy the guns and gunners it is designed to protect. The armored belt forward is carried down (see figure) over the ram, to strengthen the latter, as well as to guard the vitals of the ship from raking fire from ahead. The magazines, etc. are similarly protected by an armored bulkhead A. A peculiarity of this ship is the method of mounting the guns; in the second story of the casemate, behind the 6-inch armor, two 25-ton rifles and two of 18 tons are mounted; these are shown at A and B, Fig. 2; the 25-ton rifles are arranged to point some 2° across the bow, and about the same distance abaft the beam; the 18-ton rifles are similarly arranged in the after corner of the casemate. In the first story, behind the 8-inch armor, eight 18-ton rifles are carried; six of these, shown at D, Fig. 2, point from the broadside, while the two shown at C in the forward corners are arranged similarly to the two 25-ton guns above them. In order that the guns in the corners of the casemate (A, B, and C guns) may point ahead or astern, the outside skin of the ship forward and aft of casemate, as shown by figure, is set back about 10 feet from the level of the upper edge of the armored water-line belt. The wisdom of spending so much money (some $2,500,000) on a vessel of this character in these days of 700-pounder rifles is questioned by many authorities. *Engineering* says, if so much money was to be spent, it should have been on a monitor, such as an Inflexible, or even upon a Devastation. The Téméraire (see Table A), lately launched, differs from the Alexandra chiefly in the plan of carrying her battery and the reduction of her masts from three to two—a compromise between a mastless monitor and a full-rigged ship. She will have 11″ plates for the protection of the hull, and 2″ horizontal deck-plating. The main battery will carry two 25-ton rifles in its forward part, mounted to fire directly ahead or in broadside; in the after part, which is cut off from the fore part by an armed bulkhead, there are mounted four 18-ton rifles, arranged to fire simply in broadside. This battery, then, can fire three guns in each broadside—one 25-ton rifle and two 18-ton rifles. The upper battery directly over this will mount one 25-ton rifle at the forward, and one 18-ton rifle at the after end. The low turret, over which the gun at the fore is fired, is of 10″ armor, and "will serve the purpose of a lookout house, as well as a partial protection for guns and gunners." The turret for the other gun is armored with 8″ plates. There will be two independent propellers, driven by two sets of engines, separated by a longitudinal bulkhead (as is the case with all the later double-screw iron-clads in the English navy); the total horse-power will be 7000, which, it is expected, will give a speed of 14 knots.

(25) *Rolling.*—When the high broadside iron-clads were introduced, it was thought generally by naval men that on account of their assumed top-heaviness they would be deficient in stability, and consequently that they would roll much more than the old wooden vessels. The trials made in 1863 respecting these qualities (according to M. Xavier Raymond in *Revue des Deux Mondes*) with the French iron-clads Solferino, Magenta, Couronne, Invincible, and Normandie, and the wooden line-of-battle ships Napoléon and Tourville, proved this opinion to be erroneous. The average total roll of the iron-clads was 38.4°, and of the unarmored ships 39°. It was observed on these trials that the ships with the highest centres of gravity—with the least distance between that centre and the metacentre (see NAVAL ARCHITECTURE)—rolled the least. But such rolling will in any case seriously interfere to prevent accurate practice for great guns. The chief point (and the only one that can be noticed here) which influences rolling is the distance that the metacentre is above the centre of gravity of the weight of vessel; when the distance is great, the ship is very "stiff" and will safely carry large area of sails, but this is usually accompanied by very violent rolling. Since these facts, long known to scientific naval constructors, were experimentally confirmed by the French trials, the metacentric height has been lessened gradually in all broadside iron-clads, until, it is believed, the minimum compatible with safety has been nearly reached. This has been attended with less amplitude of roll, and has increased what is technically called dynamic stability. (See NAVAL ARCHITECTURE.) In the most severe recorded tests with the English iron-clads the Bellerophon rolled 29°–16° to starboard and 13° to port, and the Lord Clyde 23° to starboard and 24½° to port. The monitors, as long practice has shown, are remarkably steady; this is not in most cases due to the cause mentioned respecting the high-sided vessels, but it is due to the comparatively short distance they rise above the water-line and the clear decks, without any bulwarks to retain water. The waves cannot rush up their sides and heel them over; the water that reaches their decks quickly flows off again, there being nothing to keep it on. In Assistant Secretary Fox's report of his voyage across the Atlantic in the monitor Miantonomoh, he says: "The extreme lurch observed when lying broadside to a heavy sea and moderate gale was 7° to windward and 4° to leeward." The reports of the experience of officers on other monitors is to the same effect. But this steadiness of the monitor type does not show that they are capable of carrying large sail-power. The angle through which they may be heeled without passing the point (although it takes great force to heel them so far) at which the righting effort becomes zero is much less than in a high-sided ship; hence, low freeboard and great sail-area cannot be safely combined. The English ship Captain, a low-sided turret iron-clad, with high centre of gravity, intended to combine the merits of the turret with full sail-power, designed by a captain in the English navy, capsized and carried with her to the bottom nearly all on board. At an angle of keel of 14° this vessel had a reserve of righting-power represented by 410 foot-tons, while Mr. Reed's high-sided turret-ship Monarch has 6500 at the same angle.

(26) *Armor and Guns.*—When the reconstruction of navies was begun by the application of iron armor (1859–61), the most powerful gun in service was the 8-inch 68-pounder smooth-bore, which with a charge of 16 pounds gave 1600 feet per second initial velocity to the shot. The first iron-clads were proof against this, with considerable margin, but from their time the power of guns has been steadily increasing. France and England were no sooner committed to the innovation of armor than great perplexity arose regarding its inadequacy to withstand the tests to which it was foreseen it would soon be submitted. In 1844, at Sandy Hook, a 12-inch shot had been fired through 4½ inches of laminated iron, and 8 feet of sand besides. The Warrior was hardly through with her trial-trip when the 10½-inch smooth-bore gun put a 150-pound shot through a representative of her armor, and shortly after the same gun penetrated 5½-inch armor and 9 inches backing. Succeeding this, the Horsfall 13-inch smooth-bore sent its 270-pound shot through the same armor, making a hole some 2 feet in diameter; at 800 yards it nearly made a clean breach. Whitworth followed with his hexagonal rifle, and sent a 130-pound 7-inch *shell* through the Minotaur's 5½-inch armor; exploding in the backing, it made a clean breach through. Other experiments of a similar nature might be cited; it is enough to state, however, that these huge ships at this early date were vulnerable to what are now regarded as small guns. The 15-inch smooth-bores afloat in our monitors in 1862 could make a large hole through the armor of any of the European iron-clads built before the end of the civil war. A writer in *Revue des Deux Mondes* states that the guns made for La Gloire had been proved at Gavres to be competent to pierce the Warrior's armor at considerable ranges. It is in evidence before a select committee on ordnance (London, 1862) that the 6½-inch French naval rifle (Aug., 1861) put a 100-pound shot through 4½ inches of iron, 18 inches backing, and 1 inch inner skin at 1089 yards. These early experiments show that as soon as it was established that guns were required for a new purpose they were speedily produced. The progress made in ordnance shows there was good reason for the tendency, early developed, to increase the thickness of armor by concentrating it over a small area; otherwise ships could not float any adequate protection. Ordnance (see ORDNANCE and ARTILLERY) is not in the scope of this article; only enough will be said about it to give an idea of the relations, present and prospective, between the resistance of armor and the power of guns.

(27) The chief advantage of the rifle as compared with smooth-bore artillery for naval warfare and coast defence consists, for the most part, in its greater penetrative power, as well as the increased distance that the elongated rifle projectile will maintain sufficient *vis viva* to pierce armor. For instance, if the 1000-pound ball from our 20-inch smooth-bore was cast into an elongated projectile of the same weight, of say 15 inches in diameter, and discharged from a rifle with the same energy, its penetrative power would exceed the former nearly proportionally to its diminished circumference—about 33 per cent.; while, owing to the lesser resistance the atmosphere would present to its progress, it would retain a far higher ratio of its energy throughout its flight than the spherical shot. Smooth-bores have long ceased to be thought of as weapons to attack armor.

(28) The early experiments with ordnance *vs.* armor were

desultory and unsystematic; the best kind of gun and projectile, and quality of powder best suited to answer the new requirements, were a long time in reaching anything like a settled basis: even now on some of these points opinions differ widely. Subsequently, however, they were very systematically conducted, and from the records which were kept of the work of various kinds of guns, powder, and projectiles on various thicknesses, qualities, and systems of armor, artillerists were able to make close calculation respecting the *work* required of projectiles of different materials and forms to penetrate a given thickness of armor. The velocities of projectiles at various distances, from the muzzle up to several thousand yards, were determined, and, knowing this velocity at different distances (from experiment),. the *work* (energy) is expressed by $\left(\frac{v^2}{2g}\right)$, which gives the height from which the projectile would fall to attain the ascertained velocity; this, multiplied by its weight, gives its energy in foot-pounds or tons (the latter unit being used for convenience—viz. pounds or tons raised 1 foot). From the great number of firings against armor, the resistance it presented to penetration was likewise established; hence, very close predictions could be made as to the strength of any proposed armor and the energy required of the projectile to overcome it.

(29) The energy required to penetrate a given thickness of armor, expressed in foot-tons, for *every inch in the circumference of the projectile*, is called the *piercing figure*.

TABLE D.—*Showing the Penetrating Energy in foot-tons per inch of the Circumference of the Projectile, at various Distances in yards from the Muzzle of the Gun.*

| Guns, Woolwich rifles. | | | | | Distance in yards. | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Projectile. | Charge of powder. | Initial velocity. | Calibre. | Weight of gun. | At muzzle. | 200. | 400. | 600. | 800. | 1000. | 1200. | 1400. | 1600. | 1800. | 2000. | 2200. | 2400. | 2600. | 2800. | 3000. | 3200. | 3400. | 3600. | 3800. | 4000. |
| lbs. | lbs. | feet per sec. | in. | tons. | | | | | Pene | trati | ng e | nerg | y per | inch | of ci | rcum | fere | nce | in | foot- | tons. | | | | |
| 700 | 110 | 1300 | 12 | 35 | 219 | 211 | 204 | 198 | 192 | 186 | 180 | 174 | 169 | 164 | 159 | 155 | 151 | 147 | 143 | 140 | 137 | 134 | 131 | 129 | 127 |
| 600 | 85 | 1300 | 12 | 25 | 188 | 181 | 174 | 167 | 161 | 155 | 149 | 144 | 139 | 135 | 131 | 127 | 123 | 120 | 117 | 114 | 112 | 110 | 108 | 106 | 104 |
| 535 | 85 | 1315 | 11 | 25 | 187 | 180 | 173 | 167 | 161 | 156 | 150 | 145 | 140 | 136 | 132 | 128 | 125 | 122 | 119 | 116 | 113 | 111 | 109 | 107 | 105 |
| 400 | 70 | 1364 | 10 | 18 | 166 | 159 | 152 | 147 | 140 | 134 | 129 | 124 | 120 | 115 | 111 | 107 | 104 | 101 | 98 | 95 | 93 | 91 | 89 | 87 | 86 |
| 250 | 50 | 1420 | 9 | 12 | 125 | 118 | 111 | 105 | 100 | 95 | 90 | 85 | 81 | 77 | 74 | 71 | 68 | 66 | 64 | 62 | 61 | 59 | 58 | 56 | 55 |
| 180 | 35 | 1413 | 8 | 9 | 100 | 94 | 88 | 83 | 78 | 74 | 70 | 66 | 63 | 60 | 58 | 55 | 53 | 51 | 50 | 48 | 47 | 45 | 44 | 43 | 42 |
| 115 | 30 | 1525 | 7 | 6½ | 85 | 79 | 73 | 67 | 63 | 58 | 54 | 51 | 48 | 45 | 43 | 41 | 39 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 |

NOTE.—If the *piercing figure* of any armor is but equal to the *penetrating energy* of any of the projectiles, as given in the table, the distance from the gun, at which penetration will result, will be found in yards over this figure. Thus, the piercing figure of the 6-inch armor of the Bellerophon is 70; by referring to the table, it is seen that the 7-inch rifle will penetrate up to 400 yards, the 8-inch up to 1200 yards, the 9-inch up to 2200 yards, the 10-inch to over 4000 yards, and so on.

Table D shows the energy expressed in *foot-tons*, at various ranges, for each inch of the circumference of the projectiles of the Woolwich wrought-iron rifle, supplied to the British navy. A large number of these figures are the direct result of experiment, as recorded in the English Blue-books; the others are calculated from these according to the data found in the same authority; they are sufficiently accurate for the purpose intended—viz. to show near enough for all practical purposes the distance at which the guns will penetrate iron-clads. To show that this table will also apply with practical accuracy to the German and French naval rifles of nearly corresponding calibre, Table E is given, which compares their power with the Woolwich ordnance:

TABLE E.—*Comparison of French, English, and German Naval Guns.*

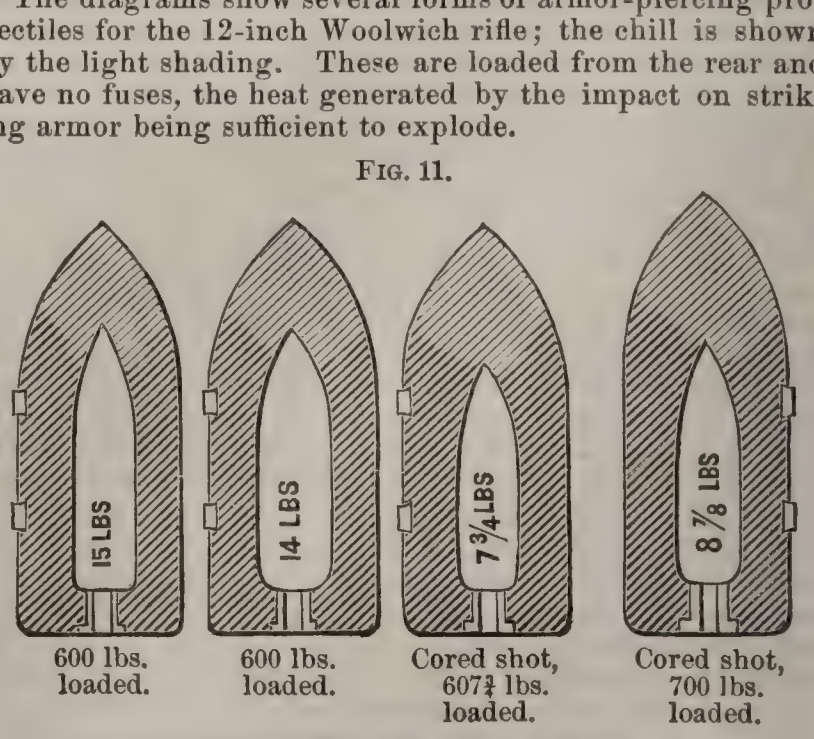
| Guns. | Bore, inch, | Weight of gun, tons. | Weight of projectile, lbs. | Powder-charge, lbs. | Muzzle velocity. | Total energy, foot-tons. | Energy per pound of powder, foot-tons. |
|---|---|---|---|---|---|---|---|
| French.... | 6.48 | ..... | 99.3 | 16.5 | 1312 | 1185 | 71.8 |
| English... | 7. | 6½ | 115 | 30 | 1561 | 1943 | 64.8 |
| German... | 6.79 | ..... | 123 | 25.35 | 1559 | 2073 | 81.7 |
| French.... | 7.63 | 8 | 165.4 | 33.1 | 1486 | 2533 | 76.5 |
| English... | 8. | 9 | 180 | 35 | 1413 | 2492 | 71.2 |
| German... | 8.23 | 9.8 | 217.2 | 37.48 | 1385 | 2889 | 71.1 |
| French.... | 9.49 | 14 | 317.6 | 61.7 | 1427 | 4484 | 72.7 |
| English... | 9. | 12 | 250 | 50 | 1420 | 3496 | 69.9 |
| German... | 9.49 | 15 | 306.4 | 52.91 | 1312 | 3657 | 69.1 |
| French.... | 10.80 | 22 | 476 | 88.2 | 1378 | 6273 | 71.1 |
| English... | 11. | 25 | 535 | 85 | 1315 | 6415 | 75.5 |
| German... | 10.23 | 22 | 414.5 | 70.55 | 1385 | 5514 | 78.2 |
| French.... | 12.6 | 34.5 | 760.5 | 136.69 | 1312 | 9077 | 66.4 |
| English... | 12. | 35 | 700 | 110 | 1300 | 8205 | 74.6 |

The piercing figure of the armor of most important iron-clads is given in Column 11 of Table A; by comparing this figure (the energy per inch of shot's circumference required to penetrate) with the energy per inch of the several projectiles (Table D), the distance in yards at which the various vessels will be penetrated is found.

(30) A wrought iron and steel rifle is now constructing at Woolwich which will weigh 81 tons; diameter of bore, 14 inches; the projectile will weigh about 1200 pounds; and the powder-charge, some 200 pounds, will give an initial velocity to it of about 1300 feet per second. The shot, approximating from the results with other large guns, will have an energy of 320 foot-tons per inch at 2000 yards, and it is expected that at that distance it will penetrate 20 inches of iron.* Krupp has furnished the following particulars to the German government respecting a huge gun he is about to commence: Diameter of bore, 18.22 inches; weight of shell, 2000 pounds; powder-charge, 500 pounds, which will give an energy of about 460 foot-tons per inch at 2000 yards: this will probably pierce the 24-inch armor of the Inflexible now building at Chatham. The Inflexible is to be armed with four of these 81-ton guns. The bursting-charge of the *shells* for these huge pieces will be very large. It must be remembered respecting these huge guns that the difficulties in construction and the danger attending their use increase in a higher ratio than the diameter of the bore, and were it not for the improvements in gunpowder introduced by the late Gen. Rodman their failure would be almost certain. All the experiments and calculations that have been given are based on the shot striking at nearly a right angle, but in the case of most of the iron-clads there is so much margin on the side of the gun that penetration will take place at wide deviation from the normal. Armor-piercing shot and shell are now, for the most part, made of strong cast iron, with the front end chilled in the same manner as the tread of American cast-iron car-wheels: the piercing figures in the tables are for this description of shot.

The diagrams show several forms of armor-piercing projectiles for the 12-inch Woolwich rifle; the chill is shown by the light shading. These are loaded from the rear and have no fuses, the heat generated by the impact on striking armor being sufficient to explode.

FIG. 11.




600 lbs. loaded. | 600 lbs. loaded. | Cored shot, 607¾ lbs. loaded. | Cored shot, 700 lbs. loaded.

Armor-piercing projectiles for 12-inch Woolwich rifle.

(31) At the commencement of the experiments against armor numerous inventions were brought forward, and many tested, which were founded on the notion that combinations of cork, india-rubber, wood, iron, etc., other than great thickness of iron, would have the effect, as one said who proposed to apply steel cones to split and glance the shot, of "robbing the shot of a great portion of its power." Suffice it to say, that experiments have shown that nothing

*Since this was in type this enormous gun has been successfully fired with its original calibre of 14 inches; the calibre was subsequently bored up to 15 inches, and the gun fired with 300 pounds of 1.5 and 2 inch powder, giving the velocity of 1540 feet per second to a projectile of 1466 pounds weight. The force of this shot at the muzzle of the gun is estimated to be about 22,500 foot-tons.

can take the place of good solid plates of iron, backed by a moderate thickness of wood. At first, great tensile strength and hardness were thought to be important elements in armor. In 1861, British steelmakers, in answer to invitations, furnished steel targets for tests; cast, puddled, and Bessemer steel were successively tried. It was quickly seen that the injury to armor bore a close relation to its hardness. It was soon established that armor-plate should be made of very tough, ductile iron, in contradistinction to a metal possessing high tensile strength and brittleness. The usefulness of wood backing was early discovered; its thickness has, however, been decreased; the Warrior (1861) had 18 inches, the Alexandra (1875) had 10 inches. The question of vertical *vs.* inclined armor was soon settled in favor of the former—among other reasons, because with the same total weight the latter gave no more protection, while it introduced constructional difficulties and cramped the interior space. Cole's "cupolas," with their inclined walls, were set aside for the vertical monitor turret before any of them were fairly finished. The manufacture of armor-plates has been brought to great perfection. Cammel's works at Sheffield have successfully rolled plates 21 inches thick. Solid plates of great thickness have been pierced by heavy shot, with scarcely a crack or fissure to be seen; the plate apparently uninjured except where struck by the shot. The fact that other shot striking near the hole previously made experienced about as much resistance as though the plate had not been struck, shows the great results that have been accomplished in this branch of iron manufacture.

(32) Early trials proved that *solid* plates offered much greater resistance than the same aggregate thickness made up of a number of thin plates—the so-called laminated armor. The law of the resistance of solid plates up to $5\frac{1}{2}$ inches has been shown by experiment to vary about as the square of the thickness; this is probably approximately correct for greater thicknesses. But this rule does not hold good in comparison of *solid* with laminated armor; a 6-inch plate, by the law of the squares, would be thirty-six times as strong as a 1-inch plate, yet it would not, as experiment shows, be six times as strong as six 1-inch plates. Experiments by Capt. Noble of the English ordnance against three targets, each 7 inches thick—one 7″ plate, one of two $3\frac{1}{2}$″ plates, one of three $2\frac{1}{3}$″ plates—showed that the resistances to penetration were in the ratio of 61, 57, and 52. He estimated that three 5-inch plates are equal to one 13-inch solid plate. It is probably true that the resistance to punching iron in a punching-machine varies as the circumference of the hole punched out multiplied by the thickness; but this rule, applied to the effects of projectiles on plates, does not hold, and it is of little value in estimating the resistance of armor, which seems to be governed by some law not thoroughly understood. When the laminated armor of 1-inch plates was applied to monitors in 1862, it was with great difficulty that even this thickness could be obtained.

(33) *Rams.*—With the iron-clad, practical shape was given for the first time to the proposition, long talked about by naval men, of reviving the method of attacking the enemy so successful in the hands of the Greeks and Romans at Salamis and Actium—viz. ramming. The bows of La Gloire and Warrior were especially strengthened, so that they could be safely used as rams; all subsequent iron-clads intended to operate at sea have their bows made of a shape to adapt them for ramming; they are strengthened by bulkheads, flats, breasthooks, etc. Three forms of ram-bows have their advocates: (1) the overreaching bow, like the Warrior's, which is claimed to have an advantage in ramming low-decked iron-clads by running over them; (2) a vertical or straight bow inclined somewhat backward, as La Gloire, Minotaur, Defence, etc. It is claimed that these two forms are not so likely to become entangled with the vessel rammed, and to be less liable to twisting and wrenching; but they have both been abandoned in later constructions for (3) the under-water (so-called) spur-bow. This is intended to strike the enemy on his unprotected sides below the armor, which in the heaviest iron-clads does not extend more than 6 feet below the water-line. This form has an important advantage over the others, as a relatively moderate speed will be sufficient to enable it to puncture the plain hull and inflict fatal injury if the cellular divisions and bulkheads do not prevent large quantities of water from entering. This feature, the moderate velocity at which it will inflict serious damage, while the other forms would have to strike at pretty high speed to seriously injure a well-built iron-clad with an iron hull, seems to have been decisive in its favor. It is the form now exclusively adopted; its shape is shown in the diagram of the Hercules and the cuts of the Alexandra and the monitor Inflexible. The French and English have very powerful vessels constructed to be used almost exclusively as rams. (See Table A.)

(34) The following is the projection under water of the ram-bow beyond a perpendicular let fall at the load-water for several of the more important vessels: Magenta, 6′ 6″; Marengo, 1′; Colbert, 7′ 10″; Redoubtable, 11′ 4″; Defence, 4′ 3″; Bellerophon, 18′ 11″; Sultan, 10′ 6″; Hercules, 9′ 10″; Audacious, 4′ 11″; Friedrich Karl, 10′; Devastation (monitor), 10′; Fury (ram-vessel), 10′; Cerbère (turret), 9′ 10″; Tonnerre and Tempête (ram-vessels), 9′ 10″. The ram-vessels have no rigging; none of them, with one exception, have more than two heavy guns, several of them but one; and, as they are intended for firing over the bow, they have quite limited horizontal train. Unquestionably, this is a wise arrangement, because with a vessel built for a special object her commander will not then be tempted to use her in a different way. Admiral Goldsborough has said the use of guns will defeat the unity of purpose (in rams) which is so essential to success; and he has given his opinion that it would be well to have rams without guns. In any case—whether with one or two guns to fire over the bow, which can be fired at the moment of striking, or not so provided—such vessels ought to be fitted with the "deck-scraper" fitted by Ericsson to the monitors. This is a large oblong shell, arranged to be pushed through the deck from below, and by exploding (by a blow on a wafer of fulminate) in a horizontal direction clear the deck of intruders. The Gatling battery is also regarded as an effectual protection against boarders.

(35) The very large dimensions of the heaviest iron-clads seem not to be necessary for a ram-vessel; the dimensions and displacement should not exceed what is required to carry armor thick enough to give a fair degree of invulnerability and speed. The cardinal points that should be kept in view are general handiness, celerity in turning, and engine-power to give high speed. A ram-vessel of 4500 tons weight—little more than half that of the Bellerophon, reported to be a very handy ship—striking at the velocity of 10 knots (16.8 feet per second), will give a blow the energy of which is a trifle less than 20,000 foot-tons; the energy of a 760-pounder rifle shot as it leaves the muzzle is 9077 foot-tons. This mode of comparing the striking force of the ram with that of a projectile has often been used; but reasoning therefrom that the ram ought to be looked upon as a projectile seems to be straining the comparison. The shot rests in the gun until it is pointed at the enemy; a pull on the lock-string, and in a second or two it has reached its mark. A ram weighing say 4500 or 5000 tons, at rest waiting for a fair chance to charge, will, under favorable circumstances respecting skilful management of the engines, require some five minutes to reach the velocity of 10 knots; or if moving slowly, say 4 or 5 knots, it will take some minutes at least to reach the same speed. Any one who has observed the time taken by a large steamer to get well under way, after stopping, for example, to discharge a pilot, will probably admit this. It should not be forgotten that the resistance through the water, as well as the force of the blow on striking, increases as the square of the velocity.

(36) There is another point which should not be omitted in comparing rams with projectiles—viz. the difference in the effect of the impact of bodies moving at very high or very low velocities, though the latter may have much more energy $\left(\frac{v^2}{2g}\right)$ than the former. A ram of 4500 tons striking at, say, 5 knots (8.4 feet per second) has an energy of nearly 10,000 foot-tons, and a 760-pound shell (12.6-inch rifle), moving 1312 feet per second, has an energy of 9077 foot-tons. The heavy ram at 8.4 feet per second, unless it strikes nearly square, will probably either scrape along the side or push the opposing ship around, without inflicting serious injury, while the shell, from its high velocity and the concentration of its impact, will pass through 14 inches of armor. Take the extreme case of a ram heavy enough to strike a blow of 20,000 foot-tons at 1-knot speed; even this great energy, exerted at this low velocity, would do but little more than push along a floating object. It is probably fair to assume that an alert antagonist with plenty of sea-room and good command of steam has it in his power to out-manœuvre the ram—by presenting his bow, for example—so that he cannot be advantageously rammed, or perhaps even struck, without inflicting as much damage as he himself receives. Some writers on ram-manœuvres have constructed diagrams which appear to show that they think a steam-vessel can be turned at a very abrupt angle. Some manœuvre is to be carried into effect, and it is at once executed—in the diagram—precisely as the tactician wishes it. But a steamer in altering her course, even with the rudder hard up, turns by traversing the arc of a large circle; this will be seen by referring to Table B.

(37) A large majority of naval officers are of opinion that the ram will play a very important part in future naval wars. Commodore F. A. Parker, who enjoys a distin-

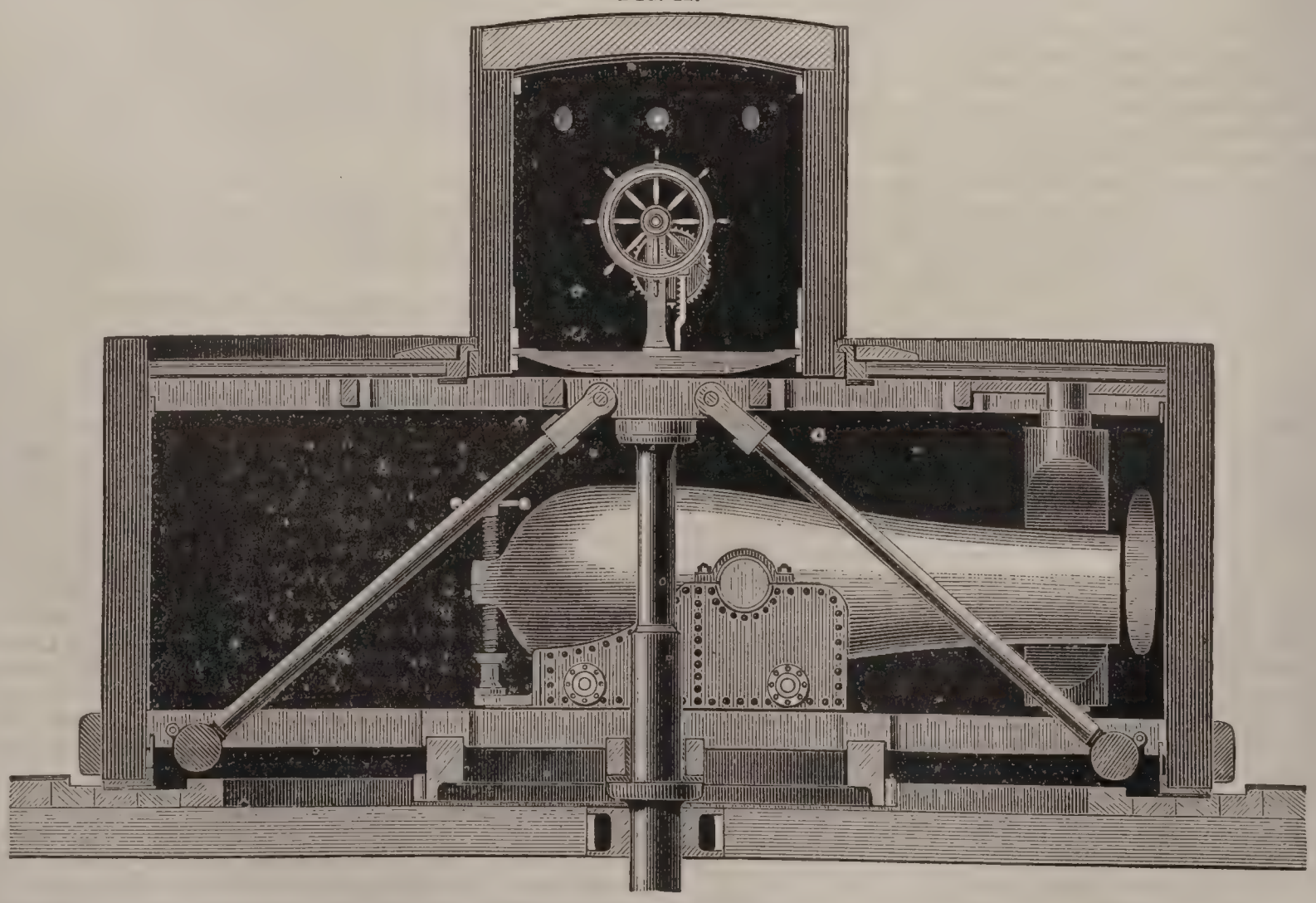
guished reputation as a naval tactician, is of opinion that they are the most efficient vessels for fleet-fighting on the open sea, and that they should "hunt in couples or by threes," so that while the enemy is avoiding one he will be rammed by another. Many hold that so far as our navy is concerned an important field for the use of the ram is as part of the defence of harbors and roadsteads against the unwieldy iron-clads that must be used by a Transatlantic enemy. If the rams are of moderate draught, and possess the celerity of movement mentioned as of cardinal importance, the immense iron-clads of Europe (drawing from 24 to 29 feet) will be taken at such a disadvantage the moment they reach shoal water that it is almost inevitable that they would have their sides punched below their armor, and their screws and rudders—which in these iron-clads are vulnerable to ram-attack—would be pretty sure to be rendered useless.

(38) The qualities that a ram should have for such use are speed, moderate draught, handiness, and no incumbrance whatever by rigging. Celerity of movement would be secured by moderate dimensions, large rudder-power, and twin-screws: the area of the rudder should be considerably greater than is usually applied; the rudder itself and all its attachments should be so strong that by the application of steam-power it could be put hard up in an instant without danger of breakage; and any other practical device that will increase the quickness of turning should be adopted. The steam-power should be ample to secure high speed, and the condensing apparatus should be so arranged that when in action the steam made with clean fires and closed furnace-doors, while the engines are stopped or moving slowly, could be discharged into the condenser instead of escaping into the air with a deafening noise and obscuring the view of the commander. With independent air, circulating, and feed pumps a vacuum would be maintained in the condenser while the engines were at rest, and they would be able to start at full speed at a moment's notice. If the ram is armed at all, it should have one or two of the heaviest guns obtainable, well shielded, and arranged to fire over the bow with small horizontal train, and fixed so that but 1° or 2° of elevation could be given, thus removing the temptation of distant firing.

(39) There is no experience respecting the effect of ramming on a well-built iron-clad with iron hulls and double sides, such as the Hercules, for example.* The most noted instances of the effect of this weapon are the sinking of the Re d'Italia at Lissa, and the Cumberland at Newport News by the ram of the Merrimack. The Re d'Italia had an ordinary wooden hull. She was struck by the Ferdinand Max, a vessel weighing about 5500 tons, fitted with an under-water prow; it is stated she struck her opponent at about 8 knots speed; hence she delivered a blow of 15,950 tons energy. The Cumberland was a sailing frigate, and was sunk while at anchor. The Tennessee, with very strong sides at her water-line, was vigorously rammed by the wooden ships of Farragut's fleet in Mobile Bay without apparently doing her any injury. Rams were used with great effect during the war on the Mississippi and its tributaries, but the vessels bore no comparison in point of strength with those that will be encountered on the ocean.

(40) *Monitor System.*—On the breaking out of the civil war (1861) the navy department knew that iron-clads were wanted for the coming struggle, but much perplexity existed respecting the system that should be adopted, especially for those to be employed on the Atlantic coast. These would certainly be used against the insurgents, with a probability that they might be called on to defend our harbors and roadsteads from a foreign foe. To copy the huge iron-clads building in Europe—two then afloat—was impracticable, for our vessels, if built on this plan, in order to cope with them must have nearly equalled them in dimensions, and some two years would have been required for their construction, while from their great draught they could not approach within gunshot of the coast S. of the Chesapeake. In answer to a call from the government for plans, among others offered, Ericsson presented the design of the Monitor. This invention proved that invulnerability to any ordnance then in service, here or abroad, with peculiar facility for handling guns of any weight attainable, could be had with a small vessel with light draught, and one, too, that could be very quickly built. The work of the Monitor in Hampton Roads (Mar. 9, 1862), when but a few days from the builder's yard, made a profound impression in Europe, which was not lessened by the fact that a fleet of these vessels, superior to the original, was immediately commenced, or by the intelligence which followed a few months later that this monitor fleet was ready for service, mounting 20-ton guns, throwing projectiles some five times heavier than any in foreign navies. The two iron-clads then afloat abroad could not resist these guns, and to send wooden fleets against positions defended by such weapons would be to invite a repetition of the fate of the Turkish ships at Sinope and of the Cumberland and the Congress. The chief constructor of the English navy said in 1869, "It is but five years ago that Parliament was discussing the practicability of carrying 6½-ton guns at sea, especially in broadside iron-clads."

FIG. 12.



Section of monitor turret.

(41) The monitor principle (see MONITOR), stripped of novel minutiæ of detail, is a low hull with pointed ends, the deck flat and free of incumbrances that would prevent the guns, which were mounted in a cylindrical revolving turret, from being pointed over some 340° of horizon. The vessel itself, almost immersed, was impregnable, and gave protection to the engine, propeller, and rudder, as well as to the anchor,

*Since this was written the English iron-clad Vanguard was sunk by being accidentally rammed by her consort, the Iron Duke.

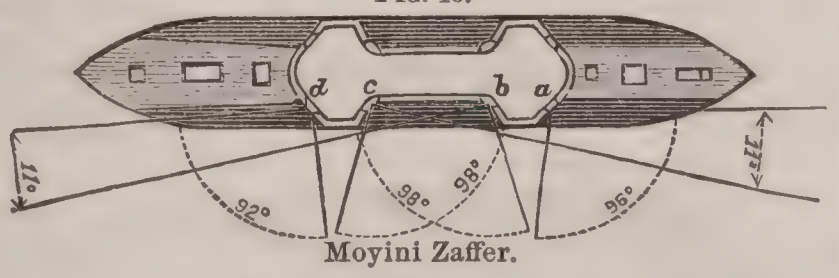
which could be let go and taken up without exposure of the crew while under fire, while the guns and gunners were protected by the turret. This system gives maximum thickness of armor that can be carried with a given displacement, combined with peculiar facility for protecting and pointing the heaviest artillery. Hence, it is especially adapted for coast and harbor defence (which is the chief duty of all iron-clads), because it admits of a higher degree of invulnerability with minimum dimensions and moderate draught. It is the system of *concentration* of armor and guns. Originally proposed in 1854 by Ericsson in a communication to Napoleon, it has nothing in common with the Coles system but the ancient device of rotating the gun platform. Coles proposed to carry a number of *conical cupolas on the deck of a high-sided rigged ship of the usual form;* this is shown in the model of the Royal Sovereign, with five of these cupolas, which was placed by Coles in the great exhibition of 1862. At this time, it appears, he had no idea of the essential principle of the monitor—viz. *concentration.*

TABLE F.—*Iron-clads built during the War for Atlantic Seaboard.*

| Name and number. | Displacement. | Draught. | Thickness of armor. | Backing. | Inner skin. | No. and thickness of turrets. | No. and size of guns. | No. remaining. | When built. |
|---|---|---|---|---|---|---|---|---|---|
| *Monitors.* | tons. | ft. in. | in. | in. | in. | No. in. | No. in. | | |
| Monitor (1) | 1000 | 10 0 | 5 | 36* | $\frac{5}{8}$ | 1 8 | 2 11 | 0 | 1861 |
| Passaic (9) | 1250 | 10 9 | 5 | 36* | $\frac{5}{8}$ | 1 11 | 2 15 | 7 | 1862 |
| Monadnock (4)† | abt. 3000 | 13 0 | 6 | 37 | ... | 2 $10\frac{1}{2}$ | 4 15 | 4 | 1862 |
| Kalamazoo (4)‡ | " 5500 | 18 0 | 14 | 40 | ... | 2 15 | 4 15 or 20 | 4 | 1863 |
| Canonicus (9) | 1750 | 12 2 | $9\frac{1}{2}$ | 28* | $\frac{5}{8}$ | 1 $10\frac{1}{2}$ | 2 15 | 6 | 1862 |
| Puritan | 4851 | 20 0 | $10\frac{1}{2}$ | 48* | 1 | ..... | ..... | 1 | 1862 |
| Dictator | 4383 | 20 6 | $10\frac{1}{2}$ | 48* | 1 | 1 15 | 2 15 | 1 | 1862 |
| *Broadside.* | | | | | | | | | |
| New Ironsides | 3820 | 16 0 | $4\frac{1}{2}$ | 20 | ... | ..... | 14 11 | | |

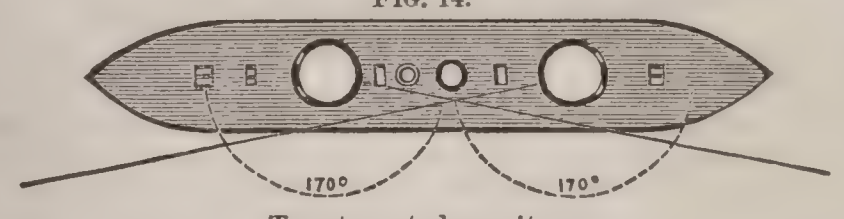
(42) The importance of giving the guns great horizontal range, or "all-around fire," as it is termed, is shown by the devices resorted to in broadside vessels to secure it; as, for example, the recessed ports and two-story casemates of the Alexandra (1875, see figure), also the semicircular casemates projecting from the vessel's side (suited to breech loading) extensively adopted by the French, as in the Marengo and Suffrén and in the Alma and Montcalm classes. The diagrams—one of the Moyini Zaffer, a central-casemate iron-clad, the product of the joint efforts of three distinguished English engineers, Armstrong, Samuda, and Ravenhill, the other of a two-turreted monitor—show the points of superiority, in respect to horizontal range, of the revolving-turret system over the central casemate, or, what is pretty much the same thing, the stationary

FIG. 13.




Moyini Zaffer.

FIG. 14.




Two-turreted monitor.

turret. The Moyini Zaffer is 235 feet in length, with 35 feet 6 inches beam; the armor along the water-line is 6 inches thick, while on the casemate it is 5 inches. The casemate is pierced for 8 guns, but carries four 12-ton rifles, the intention being to transfer them from one side of the battery to the other during action. The complexity attending the form of this casemate shows that the designers were dealing with a difficult subject—viz. to secure great horizontal range with a fixed battery. The monitor is of the same dimensions as the Moyini Zaffer, but she carries on her sides 10 inches of armor against 6 inches, and on her two turrets 15 inches against 5 inches carried by the latter. The turrets each mount two 24-ton guns, which command 340° of the horizon. In order to compare the *broadside* fire of the two iron-clads, the ports of the Moyini Zaffer are denoted by the letters *a, b, c, d;* each gun, beginning with *a*, respectively ranges over a field of 96°, 98°, 98°, and 92°. Referring to plan view of the monitor, each of the four guns sweeps a field of 172°. The 24-ton rifle throws a shot of 600 pounds, and the 12-ton, one of 300 pounds. If the ordnance-power of the two vessels is contrasted by multiplying the degrees of horizontal range by the weight of the projectiles, we have, for the 12-ton gun *a*, $300 \times 96° = 28{,}800$; this, added to similar multiplication for the others, *b, c,* and *d,* gives a total of 115,200. Performing the same operation for the four 24-ton turret-guns, the comparison stands 408 for the monitor against 115 for the fixed casemate. The circumference of this casemate is greater than that of the two turrets in the proportion of 25 to 15; the height from the water-line to the top of the armored belt of the former is several times more than the height of the deck of the latter; hence deeper armor below the water-line must be given to the Moyini Zaffer to afford adequate protection, increased rolling being the result of high sides. This explains how it is that the guns of the monitor are shielded by armor of some nine times greater, and the sides by armor of some three times greater resistance, than the casemate vessel of same displacement, assuming the resistance to be as the squares of the thickness. If the suggestion is made that heavier guns could be mounted on the Moyini Zaffer, it is met by the fact that much heavier guns could more easily be mounted in the turret, the limit of weight being much sooner reached in the casemate.

(43) The advantages of the turret are so obvious that many naval men opposed to the low monitor hull have advocated placing it on high-sided ships with large sail-power, but its best points are destroyed when so placed. The "all-around" fire disappears, as the decks, over which the guns must be pointed to secure it, are encumbered with masts, rigging, and other obstructions, which obscure the sight and diminish the sector of fire. The sides of the high-sided vessel below the level of the armored part of the turret may be penetrated; consequently, there is a great length of side where penetration may destroy the revolving machinery or damage the gun-slides, which, with part of the mechanism of the carriages, are below the armored walls of the turret. The English turret-ship Monarch, 8070 tons displacement, is a case in point. Rigged with two-thirds of the sail-power usual in men of war, she carries two turrets with armor 8″ and 10″, backing 10″, and inner skin $1\frac{1}{2}$″ in thickness; these turrets project above the upper deck. In order to secure even a limited horizontal range, it is part of the plan (so her commander informed the writer) to cast loose the shrouds before going into action. The turret-guns can fire neither astern nor within 20° of ahead; even if they could, the person pointing them could not see the object aimed at, unless it was at a considerable distance. About the water-line the armor is 7 inches thick; above this, and below the level of the armored part of the turrets, where penetration would make them inoperative, the armor is 6 inches thick. This puts it in the power of a single shot, penetrating any part of a large area of 6-inch armor, to stop the use of the guns. When the writer visited the Monarch at Portland, the U. S. monitor Miantonomoh was anchored near by, her proximity suggesting a comparison between the two systems. The Miantonomoh was a wooden vessel, built to meet the exigencies of the war, of about 3000 tons displacement; she carried two turrets 11 inches thick, mounting four 20-ton guns. Her sides, about two feet above the water-line, hardly visible from the Monarch, were plated with armor 6 inches thick. The Monarch, on the other hand, presented a large target to the monitor, which with her "all-around" fire could engage head on, stern on, or in any other position that suited the tactics of her commander. As an example of the great protection that is afforded by a low hull, the writer may mention that he has been in a monitor anchored within easy range of a well-armed fortification; the whistling of shot over the deck and the splashing alongside showed the difficulty of hitting the small height of side exposed above water, even under exceptional circumstances, as in this case, where the range was known to the enemy. It is then

* Besides entire width of main deck. † Wooden hulls.
‡ Wooden hulls so rotten that they will not be completed.

clear that the most appropriate place for a revolving turret is on a low hull with clear decks. In 1867 the controller of the British navy in a report to the admiralty said: "I still hold that for coast defences . . . the turret system of armament, properly designed, in vessels known as the monitor type, is superior to all others, and the most formidable engine of war that can well be conceived; so I still maintain that combining a sea-going vessel with masts, rigging, and sails, and this kind of armament, entails a sacrifice of a large portion of its efficiency."

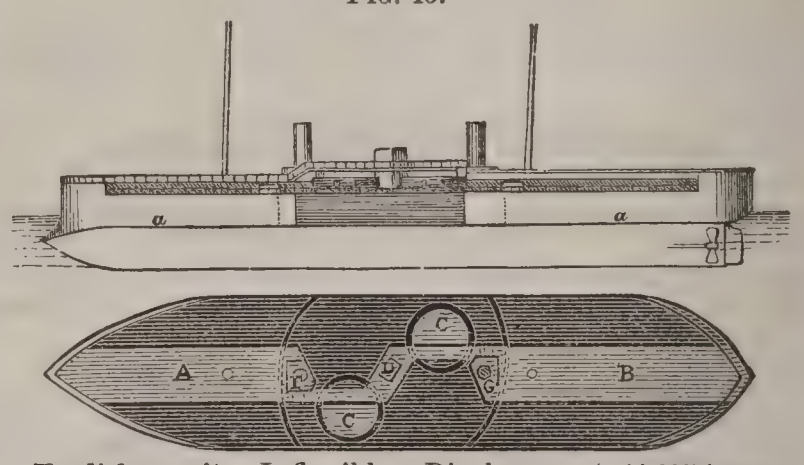
(44) Admiral Dahlgren, in his report to the secretary of the navy, made while in command off Charleston Jan. 28, 1864, speaking of the monitors, says: "The battering received was without precedent. The Montauk had been struck 214 times; the Weehawken 187 times, and almost entirely by 10-inch shot. What vessels have ever been subjected to such a test? Any defects of detail were marked by this searching process," he adds, "and no vital principle was seriously touched." These monitors mounted one 15-inch 20-ton gun, and one 11-inch. Speaking of the rate of fire, the admiral says: "That this was due to the calibre of the gun, and not to its being located in a turret, may be shown by one notable instance: In one engagement the 11-inch fired 25 shells successively in one hour, of which 21 hit the wall of the fort—distance, 1600 yards. This is at the rate of one shell in 2.4 minutes, which is not only rapid, but also exceedingly accurate practice. . . . Each turret contains two guns, and from the peculiar facility which it has for giving direction to the heaviest ordnance, no doubt arises the desire to make them of the heaviest description." With both guns handled with the same rapidity as that above mentioned the turret would deliver a shot in every 1.2 minutes; the improvements shortly after introduced in the gun-carriages enabled this to be done with the heavy calibres. The admiral further says: "I have been in a monitor in all the principal actions, and the recurrence of casualties to fleet-captains near me shows that I was in a situation to judge. . . . I have also watched the behavior of the monitors through all phases of winter weather in this exposed situation. . . . The completeness with which four little monitors (1250 tons) and an iron-clad frigate have closed this harbor is well worth noting." The total hits received by the monitors in these engagements, mostly by 10-inch shot fired with (for those days) heavy charges, was 1030, and the weight of projectiles fired by them was 817,600 pounds. At the present time, fourteen years after the Monitor, by far the most powerful iron-clads in the European navies are on this principle; several of the largest have nearly as great tonnage as our whole fleet, nine in number, which came immediately after the original. The monitors of the Devastation class, 26 feet draught, are 9000 tons displacement; the total displacement of our fleet of sixty-two referred to, was 11,250 tons, yet they carried turrets 11 inches thick against the 14 inches, 10 inch backing, and 1½ inner skin turrets of the Devastation.

(45) A great variety of plans for mounting and working the monitor turrets has been proposed; in fact, nearly every one with an inventive turn who has seen one has had a device to propose. Many of these, no doubt, have merit, but space will not allow any to be mentioned except those that have been adopted. The chief difference between the monitors built by us during the war and those of the English (built many years later), apart from their much greater dimensions, is in the manner of mounting the turrets. Ours revolved on a broad, flat, polished plate, placed slightly lower than the level of the deck, the principal parts of the revolving machinery being below the water-line. In the English monitors a long rectangular box, called a "breastwork," somewhat wider than the diameter of the turret, is fixed upon the deck; the turret rests on rollers, and projects just far enough above this box to allow the guns to be fired over it. This plan has in a less degree the defects spoken of in the Monarch—viz. it gives a large target where penetration will destroy the turret mechanism—rollers, gun-slides, etc.—which is behind it and below the armored part of the turret. If the armor of the box is less than the turrets (as it is in some cases), it is equivalent to making the lower and more important part the most vulnerable. The box should be the target aimed at, as penetration with a heavy shell would be disastrous. To have the same invulnerability with the box-plan, other things being equal, requires more weight, as the area to be armored is greater; this and other things which are not of so much consequence in the 9000 to 11,000 tons displacement, 26-feet draught monitors, that can be used in European waters; but where invulnerability with medium draught and moderate dimensions is the object, as was the case with American iron-clads built during the war—which had a displacement of but about one-eighth that of the English vessels, and with but 11 feet 6 inches draught—the constructor could take no liberties that would add to the weight to be floated. For large, deep-draught monitors, with great fuel capacity, intended to make long voyages, the box-plan of carrying turrets, if skilfully carried out, may be on the whole preferable, as it carries the guns higher above the water-line, and gives access to the hurricane deck without passing through the turrets. The much-talked of danger of the revolving of the turret being impeded by impact of shot is very small in either case; the plan used here during the war was submitted to long and severe tests under the skilful eye of Dahlgren; the turrets were heavily battered in every part of their walls with 10-inch shot; these turrets were built of laminated plates, which are so greatly inferior to the solid armor (which would now be used) that these trials were far more searching than they are generally thought to be.

(46) There is no point connected with monitors that has been more misunderstood than ventilation. Probably of all places human beings have been forced to live in, none are more wanting in ventilation than the between-decks of the old frigates and line-of-battle ships—where from 500 to 700 men swung their hammocks—when the weather made it necessary to close the air-ports and cover the hatches. The accounts current during the war made it generally believed that good ventilation had been the rule, and that its absence came in with the iron-clads. The records of the bureau of medicine and surgery of the navy department show that the "sick-list" of the monitors was less proportionately than the wooden ships; the reason was the ventilation could be controlled at will by modifying the working of the rotary fans.

(47) The Inflexible, now constructing, is intended to be the most formidable iron-clad ever built. She is to carry armor of such thickness that it is expected it will be far in advance of the penetrative power of guns for many years to come. The chief dimensions are in Table A; the following description and diagrams will explain the particulars of her construction:

FIG. 15.

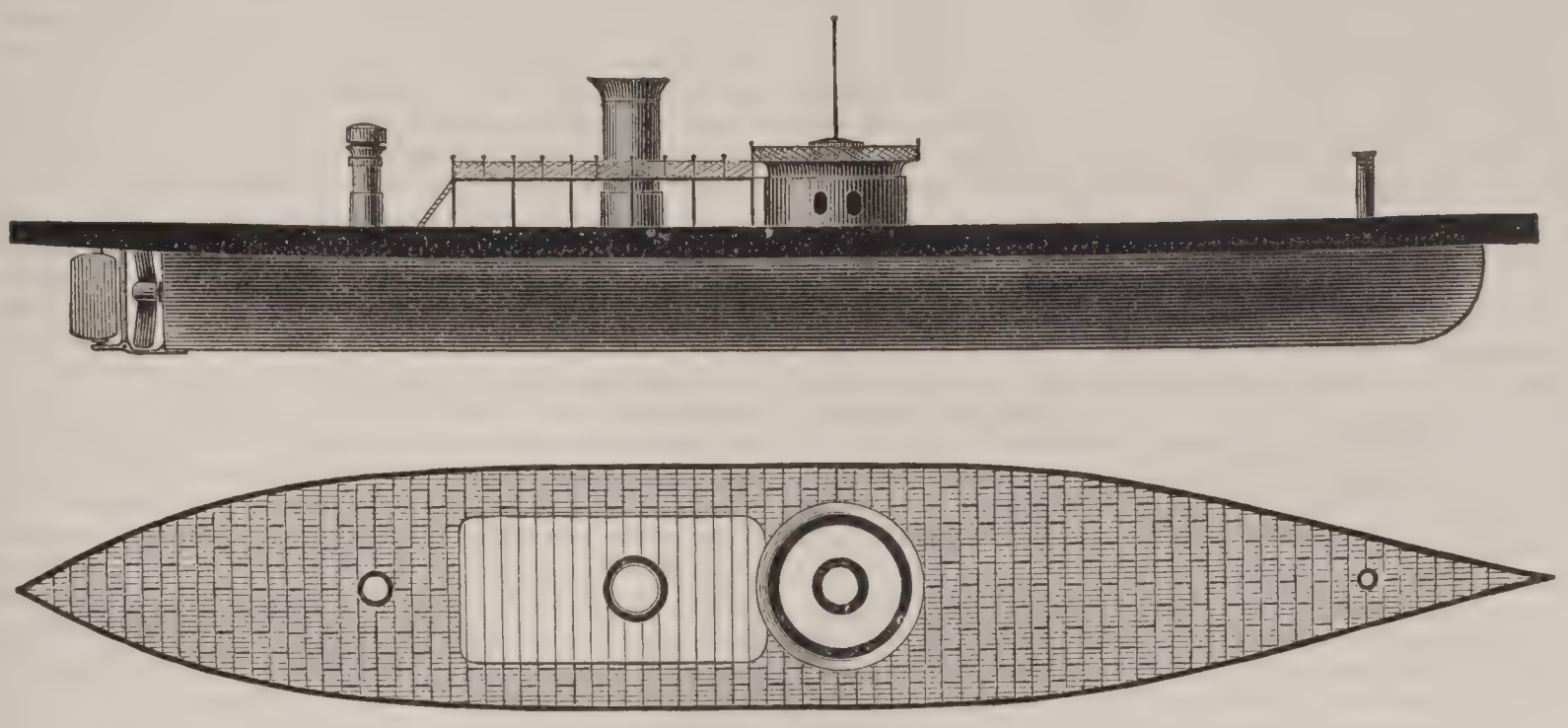



English monitor Inflexible. Displacement, 11,095 tons.

The turret-deck, through which the armored part of the turrets project, is at the top of the dark-shaded area of armor on the sides; it is 10 feet above the water-line from stem to stern. On the top of this there is another deck, 20 feet above the water-line; this deck is shown at A, B. It is set back from the sides to allow the guns to be fired by it. The turrets are carried one on each side, placed zigzag, shown by C, C, Fig. 2; this allows all the guns to be fired ahead or astern. Each turret carries two 81-ton rifles. There is no pilot or "conning" house, as in the American monitors, from which the commander can direct the steering and the firing of the guns; this will be done from the top of one of the turrets; but the ship is so broad, and as the top of the turrets are on a level with the upper deck, it seems that a clear all-around view cannot be had from this place. The central box, shown by dark shading below the turrets, Fig. 1, is 110 feet in length by 75 feet, the full beam of the vessel, in width. It is armored with two plates, each 12 inches thick, separated by a layer of wood; the object of this, it is said, being that a shell may be exploded and destroyed by the outer plate before it reaches the inner plate. The armor of the box, though not of the same thickness, extends 6 feet below the water-line; at this depth a deck (*a a*, Fig. 1), covered with 3-inch plates, extends fore and aft to the ends of the vessel. The sides above this 3-inch deck, 210 feet in length, are unarmored; above this, where penetration would probably allow water to enter in sufficient quantity to "disable or even sink the ship," if it could fill this space, there are numerous compartments in which the main coal-supply and a large part of the stores and provisions are carried, the object being to exclude water to the extent of their bulk; part of this space, not so occupied, is filled with cork and a part left vacant. It is intended to admit a certain quantity of water before going into action, in order to increase the immersion; this is the plan proposed by E. A.

Stevens to the naval board of 1861 for completing the battery which bears his name. It is intimated in the English journals that much of the top-hamper of this vessel has been introduced as a sort of compromise to settle the diverse views of the gunmakers, naval constructors, and sailors. The hull of the Inflexible is constructed avowedly to resist the effect of torpedoes, but it will scarcely be doubted that a charge of some 1000 pounds or 1500 pounds of such explosives as gun-cotton or the nitro-glycerine preparations, exploded in contact with her unarmored sides below water, would cause her destruction. An appliance to handle such heavy charges is now being experimented with, and it is probable it will be in practical shape at an early day.

FIG. 16.



U. S. iron-clad Dictator.

The monitor Dictator (see diagram), built of iron, 4500 tons displacement, planned by Ericsson in 1862, is 320 feet in length over all, 270 feet between perpendiculars, 41 feet 6 inches breadth of hull, and 50 feet breadth over all: the sides are covered from stem to stern with 10-inch armor. She carried one turret, 26 feet inside diameter and 15 inches thick; it contained two 20-ton guns, mounted on carriages which were worked by steam. The armored sides were very massive, the backing being 48 inches thick, which were supported by the entire width of the heavy deck, which was laid on oak beams 14 inches square. This vessel has been severely tried on several occasions in heavy gales, and proved to be an excellent sea-boat. The ventilation in the quarters is excellent, and the crew experienced no inconvenience during the heavy weather encountered. In the case of the English monitor Devastation (1872), which carries her turrets on the central-box system, combined with high deck-houses, the arrangement being almost expressly made to secure comfortable quarters, the crew, according to English accounts, were greatly annoyed by the deficiency of pure air.

(48) *Iron-clads on the Western Rivers.*—At the beginning of the civil war the Confederates were in possession of many important points below Cairo on the Mississippi, where they constructed batteries which almost completely closed the river. The government took immediate steps to build an iron-clad flotilla. The first seven of these, the De Kalb, Carondelet, Cairo, Benton, etc., were built under contract with the war department; they were mostly converted Mississippi steamboats. The armament was mounted in casemates erected on the deck, armored for the most part with 2½-inch plates, which with the heavy backing were placed at an angle of 45°; this was vulnerable to heavy guns, such as the 8- and 10-inch smooth-bores used by the Confederates at several places. The records of the navy show that these vessels, with many others which were facetiously called "tin-clads," did some of the most severe and effective fighting of the war; their officers never hesitated, when the occasion required it, to run by or engage the heaviest fortification on the river. Later, two monitors, 145 feet long, 45 feet beam, draught 4 feet, with one 6-inch turret and two 11-inch guns, sides plated with 2½ inches of iron, were built by J. B. Eads. After these came three monitors, by the same contractor, of the Kickapoo class; they were 236 feet long, 56 feet beam, 6 feet draught, 3-inch armor on the sides; they carried two 8-inch turrets, with two 11-inch guns in each.

(49) *Conclusion.*—The most formidable iron-clads of the European powers, as the foregoing description of their construction shows, are practically without sails or rigging. It seems to be the tendency to abandon these, and to concentrate all the weight possible in armor and guns. This indicates that these vessels are more for defensive than aggressive purposes; more to prevent a naval force from attacking harbors, roadsteads, and other important points than for assailing the enemy in his own strongholds. The weight of professional opinion is in favor of abandoning all incumbrances for heavy fighting vessels, and of constructing monitor-hulled, rotating-turret iron-clads, unhampered with masts. That this is the tendency is shown by such constructions as the English monitors Glatton, Devastation, Inflexible, etc., and the ram-vessels Fury and Hotspur; by the Russian monitor Peter the Great and the so-called circular monitors of Admiral Popoff; by the Tonnerre, Tempête, etc. of the French navy; and by the large turret-vessels building by the Germans. Such naval fighting engines as these are evidently suited for defensive purposes, and they are so greatly superior in guns and armor to the fleets of masted broadside iron-clads, thinly armored, as to place it out of the power of the latter to conquer positions protected by these so-called floating gun-carriages; nor could they safely venture in their neighborhood unless ready at any moment to avail themselves of their speed in retreating. It would seem that with the present appliances for destruction these relations must always be in favor of vessels for defensive purposes, constructed, as they can be, without the great fuel-capacity or incumbrances that are necessary for distant voyages or keeping the sea for long periods. High speed is undoubtedly of importance, but for coast and harbor defence thick armor, powerful guns, handiness, and moderate draught are greater essentials. Such vessels can be made far superior, in these points, to any structure fit to make distant voyages; and that, too, of more moderate dimensions and at less cost; while a small increase in displacement, with corresponding power, would enable them to surpass the offensive vessels of the enemy if that should be deemed important. It seems probable that the signal failure of the vast fleet of Sir Charles Napier before Cronstadt will be recorded as the last purely naval attack seriously attempted against any harbor or roadstead defended with the appliances which the resources of modern engineering have placed at the disposal of the defence, which it has done in a higher degree than it has added to the aggressive power of iron-clad navies.

*Principal Sources of Information used.*—Reports and documents of U. S. navy department; *U. S. Army and Navy Journal; Revue maritime et coloniale* (Paris); *Engineering* (London); *Journal of United Service Institution* (London); *Our Iron-clad Ships* (Reed, London).

ISAAC NEWTON.

**Ships' Mag'netism and Devia'tion of Com'pass.** It is well known that the earth, as a whole, acts like a combination of magnets, and that in consequence the magnetic needle of a ship's compass (see COMPASS), for any given place on the earth's surface, will put itself, if free to move, in the direction of the horizontal component of the magnetic force existing at that point. (See MAGNET and EARTH, VII.) The direction of this force is different in different localities, and moreover varies with the time, though slowly, and when referred to the direction of the meridian produces what is known nautically as the variation of the compass, and scientifically as the magnetic declination. The vertical component of the earth's magnetism likewise enters into our considerations, as well as the intensity of the force. It is also a matter of expe-

rience that the line of force becomes locally affected by the near presence of iron, of steel, and feebly by a few other substances, but more powerfully by magnets. This disturbing effect of the action of iron in the vicinity of the compass on board ship is known as the "deviation of the compass."

So long as ships were chiefly built of wood, it sufficed to avoid the use of iron about the compass within a radius of a few mètres, and, in case metal had to be employed, to substitute copper. With the increased use of iron in the shape of beams, girders, posts, stanchions, guns, large anchors, engines, funnels, wire rigging, and principally with the construction of iron hulls, armor-plates, deck-plates, iron gun and steering-turrets, and when the ship itself could be regarded as a large magnet under the earth's inductive force, the subject of the deviation of the compass at once assumed a vast practical and theoretical importance.

Considered magnetically, iron may be soft, hard, or of an intermediate condition. By soft iron is understood cast iron or malleable iron not subjected to mechanical vibrations when cold, which when presented in the shape of a bar to a suspended magnet will of itself not disturb its equilibrium, but will temporarily act upon it as a magnet under the effect of the earth's induction. It possesses no independent magnetism, but is subject to induced magnetism, which is instantaneously taken up or parted with. Hard iron or steel when once magnetized retains its magnetism for a long time, and is but slightly susceptible of induction. Sub-permanent magnetism may be developed in a rod of iron when struck or subjected to tremor; magnetism thus imparted, though retained for some time, is slowly dissipated. The rate of loss at first is large. Iron of this character is subject to the laws of induction and of permanent magnets, but is variable in its effects. Compared with hard iron, iron of sub-permanent magnetism possesses but feeble coercive force, while soft iron has none at all. The disturbance of the compass is principally due to sub-permanent magnetism of the ship's iron, and is always produced by the transient induced magnetism of masses of soft iron. In wood-built ships there is little of permanent magnetism, and the character of the generally small observed deviation is that of the temporarily induced magnetism. In iron-built ships, on the contrary, the peculiarity of the generally large deviation is dependent on permanent magnetism, and remains indicative of the direction in which the ship was built, its magnetism, as a whole, having then become fixed by the process of hammering and riveting.

Before entering more minutely into the analysis of the deviation of the compass as depending on the location on board, on the character and distribution of the ship's iron, on the heading of the ship, and its geographical position, we may state the following laws of magnetism: (1) Under the influence of terrestrial magnetism the force on a magnet acts as a couple, one end being drawn N., the other S., with equal force; this is the law of duality of powers. (2) One magnet acting upon another, there is attraction between dissimilar ends, and repulsion between similar ends. (3) The magnetism collected in or near each pole of a magnet acts equally in all directions. (4) The attraction or repulsion (as the case may be) between two quantities of magnetism is proportional to the product of their magnetic energies; and, lastly, the attraction or repulsion of magnetic masses is inversely as the square of the distance between them. These statements apply properly to magnetic particles, but, when the mutual total actions of magnetic bodies are considered, require great modification; thus, the mutual effect of two magnets, supposing their distance large in comparison with their length, is more nearly inversely proportional to the third power of the distance; the attraction between the magnetisms—namely, that of the permanent magnetism of a magnet and of the induced magnetism of a mass of soft iron—will be nearly inversely as the fourth power of the distance. It is thus seen that the disturbing effect on a compass by surrounding masses of iron diminishes very rapidly with distance. The inductive effect of the earth's magnetism is greatest in the line of the magnetic dip. Iron-plated ships during construction, and under this inductive influence, have part of their magnetism fixed through molecular vibrations produced by hammering. By means of a small compass the writer was enabled to trace out with chalk on the iron gun-turret (sides 11 inches thick) of one of our iron-clad vessels its magnetic equator, and found its plane inclined to the horizon at an angle of nearly 90° dip; after revolving the turret 180°, the line of no polarity again was traced out, when the plane, passing through the intermediate horizontal position, gradually approached its former place after a lapse of about twelve hours; it probably takes weeks before the fixed position is reached, depending on the coercive power of the iron. Inside such turrets the magnetic intensity is very much weakened, but 12 per cent. was found to be left in the above case. (For the mathematical investigation of the action of one magnet upon another in various positions of the magnets, and for the disturbing force produced on a small compass-needle by a large magnet, and for the inductive effect of masses of soft iron, and the combination of these actions with that of terrestrial magnetism, the reader is referred to Sir George B. Airy's *Treatise on Magnetism* (London, 1870) and to the *Admiralty's Manual for the Deviations of the Compass*, by Capt. F. J. Evans, R. N., and Mr. Archibald Smith (3d ed., London, 1869). This manual is at present the standard work on the subject of the deviation of the compass, and the reader is once for all referred to it for all details, theoretical and practical, needed by the navigator.)

Although we are not in possession of any satisfactory theory, physical or mathematical, of the actions of magnetic bodies upon each other, and of induction produced by terrestrial magnetism, yet the disturbing effect upon a small compass-needle produced by the permanent, sub-permanent (the principal agent), and transient (induced) magnetism of a ship admit, with the assistance of Poisson's theory (*Mémoires de l'Institut de France*, tome v., 1824), of a tolerably direct expression and analysis with regard to magnitude and sign of the disturbance produced by each of these masses of iron. For this purpose the earth's magnetic force has been represented by three component forces, drawing the N. point of the compass-needle to the ship's head, to the starboard side, and to the keel respectively; similarly, we have the components of the combined total magnetic force of earth and ship in these directions; their respective differences or components of their disturbance can be expressed by linear equations possessing each a constant and three coefficients, which are to be determined by experiment for each ship and position of compass, and must be numerically worked out by application of the method of least squares. The mathematical development of Poisson's theory to the special case of application to the disturbance of a compass on board ship is due to Mr. Archibald Smith, and will be found in Appendix No. 1 to the *Admiralty's Manual*, referred to above.

We proceed to the statement of the results of experience, resting upon the examination of a large number of ships of various kinds. The general character of the deviation in wood-built sailing ships, with compass as usual on the quarter-deck and over the middle fore-and-aft line of the ship, is found as follows: No deviation when heading (magnetically) N. or S.; greatest deviation when heading (magnetically) E. or W.; deviation easterly when head in eastern semicircle, and westerly when head in western semicircle. In steam-vessels, with the compass aft, these directions of no and maximum deviation will often be found displaced by several degrees, yet preserving their general symmetrical character. In the southern (magnetic) hemisphere the deviations are reversed, though for steam-vessels they may be only partially changed. In iron-built ships we have to recognize an individual character. The points of no deviation are shifted from the N. and S. points, and lie nearly in the direction (by compass) of the ship's head and keel while building; they may not be opposite to each other, nor be removed exactly at right angles from the point of maximum deviation. In general, the deviation is easterly when the part of the ship which was S. in building is E. of the compass; westerly when W. In the southern (magnetic) hemisphere the deviation may appear reduced or aggravated, depending on the intensity of the fixed magnetism of the hull, and too many other circumstances to be known except by observation. Composite-built ships conform generally in their magnetic character more nearly to that of iron-built ships, especially if fitted with iron ribs. The deviation described above is technically known as the semicircular deviation, and may be expressed by $B \sin\zeta' + C \cos\zeta'$. In the general deviation formula $\delta = A + B \sin\zeta' + C \cos\zeta' + D \sin 2\zeta' + E \cos 2\zeta'$, the angle $\zeta'$ being the azimuth or the compass-bearing of the ship's head reckoned from the disturbed magnetic meridian positive to the eastward; it is a constant, generally small, + if easterly deviation is in excess. + B is approximately the deviation at E., and + C at N.; in the last terms of the harmonic function involving $2\zeta'$, and which are technically known as the quadrantal deviation, + D is the mean deviation approximately at N. E. and S. W.; the coefficient E is generally small or zero; the deviation $\delta$ is reckoned + when the N. end of the needle is drawn to the E.; and the above empirical expression applies, provided the deviation on any course does not much exceed 20°, or about two points, in which latter case the formula becomes somewhat more complicated. The correct magnetic course will be $\zeta = \zeta' + \delta$. The semicircular deviation rarely exceeds 10° in wood-built vessels, but in iron-

built ones may reach double and treble this amount. The quadrantal deviation seldom exceeds 1° or 2° in wood-built ships, but in iron-built ones may reach three or four times this amount. The semicircular deviation is principally due to the effect of permanent or sub-permanent magnetism. The quadrantal deviation, which undergoes no change with a change in the ship's place, is mainly due to the effect of induced magnetism.

The heeling error in wood-built ships is not appreciable, but in iron-built ones it may be serious; generally, the error vanishes with the ship's head at or near E. or W., and attains a maximum value with headings at or near N. or S. The sign of the error changes with a change from the northern (magnetic) to the southern hemisphere. In the northern (magnetic) hemisphere, with the compass above the upper deck, the majority of iron ships have the N. end of their compass-needle drawn to windward, and in the southern hemisphere to the leeward. The heeling error is due to the joint disturbing effect of the vertical components of permanent and of induced magnetism.

The values of the coefficients A B C D E are found directly from observations, the deviation of the compass being observed with the ship heading in a number of equidistant points around the horizon, usually either 32, 16, or 8. If the deviation is observed on four cardinal compass-points, D remains indeterminate; if on four quadrantal compass-points, E remains indeterminate. These observations are made by swinging the ship (or allowing it to swing by the tide), and noting for the several headings the bearing of a *distant* object, or by reciprocal bearings if the locality be confined, or when at sea by azimuths of the sun, the local time and latitude being known. The deviations being determined for a number of points, they may be plotted on what is known as Napier's diagram, and graphically interpolated by drawing a curve with a free hand through the several fixed positions. The deviations for any compass course will then become known. They may also be tabulated. If we deduce numerically the coefficients A B C D E, we can compute directly the values of $\delta$ for plotting or tabulation. In either case, we know the correct magnetic course corresponding to the disturbed or compass course, as well as the reverse of the compass course belonging to any correct magnetic course. An ingenious instrument has recently been invented (first exhibited at the World's Exposition at Vienna in 1873) by Dr. F. Paugger of Triest, Austria. It is described by him under the name of "Dromoskop," or course-indicator. After impressing upon it the known values of the deviation coefficients A, B, C, D, E, it furnishes directly, by means of its mechanism, the deviation of the compass, due to the effect of ship's iron, as represented by the above coefficients, for any course desired.

It has been remarked that inside iron turrets the magnetic intensity is greatly diminished; the same is the case with nearly all iron ships, the directive force of the needle being diminished. The relative horizontal force is found by means of the number of oscillations in a given time of a small needle, and the proportion of the disturbed to the undisturbed horizontal force, usually called $\lambda$, is determined from oscillations in four equidistant azimuths. It is usually less than 1, and is closely connected with the coefficient D, as may be surmised from the fact that $\lambda$ is due to the effect of the horizontal induction of soft iron. D and $\lambda$ are nearly constant. A knowledge of the value of $\lambda$ is of importance; by its assistance the values of B and C may be found without swinging the ship from observations of $\delta$ and $\lambda$ on one course; similarly, observing on two courses, we may determine B C D and $\lambda$. The value of $\lambda$ is further needed in the computation of the heeling error, which is expressed $-\left(\mathrm{D} + \frac{\mu}{\lambda} - 1\right) \tan\theta \cdot i \cdot \cos\zeta'$ for a heel of the vessel of $+i$ degrees to the starboard. Here $\mu$ is the ratio of the disturbed vertical force at the compass to the earth's vertical force; it is found by means of oscillations of the dipping-needle in the plane of the magnetic prime vertical; $\mu$ changes with a change in the geographical position; $\theta$ is the magnetic dip. It is therefore not necessary to actually heel the ship in order to determine the heeling deviation. It should be added to the general deviation table.

Experience has shown that the magnetic character of an iron ship is subject to slow changes from the lapse of time; this is particularly the case within a few months after launching. A more permanent condition, however, is attained in a year or two, especially when the ship has not quitted the hemisphere in which it was built. On account of this more or less unstable magnetic character, the direction tables constantly need verifying or renewing; the same must also be done in case of any change in the distribution or amount of iron in the vicinity of the compass.

The mechanical correction of the deviation of the compass is properly resorted to in case no suitable position for the standard compass can be found where the deviations are comparatively small; in ships built head S. (northern hemisphere), and intended for navigation in northern magnetic dips, the compass should be placed as far forward as practicable. It may also be elevated three or four mètres above deck, as in the case of Ritchie's fluid compass or of a tell-tale compass, read by optical means. The semicircular deviation may be corrected mechanically, either by means of two magnets or by one magnet; the quadrantal deviation may be corrected by a mass of soft iron placed near the level of the compass; the same may be effected by the mutual action of two compasses placed side by side; the heeling deviation may be corrected by the application of a vertical magnet. In mechanically-corrected compasses there is always some danger that, with change of geographical position, loss of magnetism of magnets, and change in the sub-permanent magnetism of the hull, deviations may reappear, though the disturbing force may have been completely neutralized in one place and at one time. It is therefore never to be trusted, and, as a rule, *deviation tables should be formed whether mechanical corrections have been applied or not.*

The investigation of the subject of ships' magnetism, and of its effect in producing the deviation of the compass under the influence of terrestrial magnetism, is of comparatively recent origin; having attracted the attention of practical men and of scientists in the early part of this century, it may be said that by their joint labor the solution of the problem has met with much success. About 1803, Capt. Flinders observed that the disturbance of his compass could be explained by the attraction of magnetic iron in the direction of the ship's head and of dissimilar polarity in the northern and southern hemispheres, and suggested the use of a vertical bar for its correction. Between 1820 and 1833, Profs. Barlow and Christie experimented on the action of induced magnetism, and about 1821, Dr. Scoresby on that of sub-permanent magnetism. In 1824, Poisson communicated to the Academy of Sciences a memoir on the theory of magnetism, and in 1838 published his paper on the deviations of the compass in the *Mémoires de l'Institut de France*. Gen. (now Sir) E. Sabine discussed the compass deviations in Sir James Ross's voyage (1839–43). The first explanation of the disturbance of the compass produced by iron ships was given by Prof. (now Sir) G. B. Airy in 1838 (*Phil. Trans.*, 1839), with whom the methods then introduced, and still in use, for the mechanical correction of the compass originated. Other communications by the present astronomer-royal are contained in Colburn's *U. S. Journal* (1840), in the *Phil. Trans. Roy. Soc.* (1856), in the *Trans. Inst. Nav. Arch.* (1860 and 1862). About 1855 the subject of sub-permanent magnetism, and its connection with the direction of iron ships when building, was investigated by the Liverpool committee of merchants, W. W. Rundell, secretary; the committee's first report appeared in 1855, and others in subsequent years. In 1859, Mr. Frederick J. Evans, R. N., communicated a paper on the magnetism of ships in the *Journal of the United Service Institution*, and a second on the same subject in 1860, in the *Phil. Trans. Roy. Soc.* The *Phil. Trans.* of 1861 contain a paper on compass deviations by Messrs. Smith and Evans; the mathematical formulæ relating to the subject were elaborately discussed and published by Mr. Archibald Smith in 1862, in the *Trans. Inst. Nav. Arch.* The *Phil. Trans.* of 1865 contain a paper by these authors on the character of armor-plated ships. In 1862 appeared the first edition of the *Admiralty Manual for the Deviation of the Compass*, by F. J. Evans, staff-captain R. N., and Archibald Smith, M. A., the standard work already referred to above (3d ed. 1869). Capt. Evans also published in 1870 an *Elementary Manual for the Deviation of the Compass in Iron Ships*. An excellent collection of the most important memoirs noticed above, entitled *A Series of Papers from the Transactions of Foreign Societies by Poisson, G. B. Airy, A. Smith, F. J. Evans, W. W. Rundell*, with other papers and documents, was published by the bureau of navigation, by order of the secretary of the navy, under the direction of Commodore T. A. Jenkins, U. S. N. (edited by Mr. B. F. Green), in 2 vols. (Washington, 1867 and 1869).

C. A. Schott.

**Ship-Worm.** See Teredo.

**Shipwrecks.** See Wrecks.

**Shiras** (Alexander Eakin), b. in Philadelphia Aug. 10, 1812; graduated at the U. S. Military Academy in 1833, and entered the service as brevet second lieutenant of artillery, serving in garrison until 1846, except while at the Military Academy (1839–43) as professor of mathematics. He was in the West in 1846 in charge of subsistence of the volunteers for the Mexican war; was appointed commissary of subsistence, with the rank of captain, Mar., 1847; assistant to the commissary-general in Washington 1847–63, when he was appointed colonel and assistant commis-

sary-general. In 1874 he became commissary-general, with the rank of brigadier-general. He was brevetted brigadier and major general in 1865 for faithful, meritorious, and distinguished services in his department. D. at Washington, D. C., Apr. 14, 1875.

**Shiraz.** See SHEERAZ.

**Shire.** See COUNTY.

**Shiré′,** river of South-eastern Africa, issues from the Lake of Nyassa in lat. 14° 28′ S., and flows through many rapids and cataracts from the elevated plateau of the interior into the flat coastland, where it forms a broad, calm stream, navigable for the largest vessels, and joins the Zambesi at Shupanga.

**Shire′mantown,** p.-v., Lower Allen tp., Cumberland co., Pa., on Cumberland Valley R. R.

**Shir′land,** p.-v. and tp., Winnebago co., Ill., on Western Union R. R. P. 559.

**Shir′ley,** p.-v., Funk's Grove tp., McLean co., Ill., on Chicago and Alton R. R. P. 163.

**Shirley,** tp., Cloud co., Kan. P. 637.

**Shirley,** p.-v. and tp., Piscataquis co., Me. P. 206.

**Shirley,** p.-v. and tp., Middlesex co., Mass., on Nashua River and on Fitchburg R. R., is a thriving manufacturing town, having 4 cotton and 2 paper mills, 4 churches, 9 public schools, and a Shaker village. P. 1451.

**Shirley,** tp., Huntingdon co., Pa. P. 1633.

**Shirley** (JAMES), b. in London about 1594; educated at Merchant Taylors' School, St. John's College, Oxford, and Catharine Hall, Cambridge; took orders in the Church of England, and obtained a curacy in Hertfordshire, but soon vacated it by becoming a Roman Catholic; taught for some time a grammar school at St. Alban's, but, being unsuccessful, became a dramatic writer in London; had produced 33 plays before the Great Rebellion, in which he fought on the royalist side; founded a classical academy at White Friars, and wrote several grammatical treatises. D. in London Oct. 29, 1666, from exposure consequent upon the great fire of that year. His *Dramatic Works and Poems* (6 vols., 1833) were first edited by Gifford and Dyce.

**Shirley** (WALTER WADDINGTON), D. D., b. in England July 24, 1828; was only son of Dr. W. A. Shirley, bishop of Sodor and Man; was educated at Rugby School and at University College, Oxford, graduating with high honors in 1851 from Wadham College, where he had obtained a scholarship, and where he was subsequently fellow and tutor; took orders in the Church of England; was a brilliant and thorough historical scholar and an able preacher and lecturer; edited, with learned prefaces and notes, for the master of the rolls, the *Fasciculi Zizaniorum Magistri Johannis Wyclif* (1858) and *Letters Illustrative of the Reign of Henry III.* (1863), both works of great interest for students of early English history; issued in 1865 a *Catalogue of Wickliffe's Writings*, giving an account of all the numerous MSS. of that Reformer known to exist in public or private collections; became select preacher to the university 1862, and was the successor of his friend, Dean A. P. Stanley, as professor of ecclesiastical history at Oxford (1864), and also as canon of Christ Church. D. at Oxford Nov. 20, 1866.

**Shirley** (WILLIAM), b. at Preston, Sussex, England, in 1693; became a lawyer; settled at Boston, Mass., 1734; was commissioner for fixing the boundary-line between Massachusetts and Rhode Island; was royal governor of Massachusetts 1741–45; planned the successful expedition against Cape Breton 1745; was in England 1745–53; returned to Massachusetts as governor in the latter year; treated with the Eastern Indians 1754; explored Kennebec River, erecting there several forts; was commander-in-chief of the forces in British North America at the outbreak of the French war, 1755; planned the expedition of Prideaux against Niagara, and proceeded himself as far as Oswego; was appointed lieutenant-general 1759; became afterward governor of the Bahama Islands, but returned to Massachusetts, where he built a fine residence at Roxbury. D. there Mar. 4, 1771. Author of *Electra*, a tragedy; *The Birth of Hercules*, a masque; *A Letter to the Duke of Newcastle, with a Journal of the Siege of Louisburg* (1745), and *The Conduct of Gen. William Shirley briefly Stated* (1758). —His son WILLIAM, an officer in the army, was killed at Braddock's defeat, 1755.—His son, Sir THOMAS, became a major-general in the British army, was created a baronet 1786, was governor of the Leeward Islands. D. Mar., 1800.

**Shir′leysburg,** p.-b., Shirley tp., Huntingdon co., Pa. P. 329.

**Shir′wa,** lake of South-eastern Africa, 30 miles S. E. of the Lake of Nyassa, is 60 miles long, from 10 to 23 miles broad, and surrounded with well-wooded mountains 2400 feet high. It swarms with crocodiles and rhinoceroses.

**Shis′dra,** town of Russia, government of Kaluga, on a river of the same name, an affluent of the Oka, has manufactures of cloth, glass, iron goods, and leather. P. 10,083.

**Shi′shak,** the name of several monarchs of the twenty-second Egyptian dynasty, called by the Egyptians *Shashanga*, by the Hebrews *Shishag*, and by the Greeks *Sousakim*, the most remarkable of whom was SHISHAK I. There is great difficulty in tracing the succession of Shishak from some monarch of the twenty-first dynasty, apparently one named *Namrut* or *Nimrod*, a priest, to whom he instituted a priesthood in the temple of Abydos. Certainly of Shemitic origin, and apparently also a chief of the Libyan Maxyes, Shishak united Egypt under one government, but was unable to subdue the Ethiopian rulers established at Napata. Hadad and Jeroboam found an asylum at his court, and five years after the schism of the tribes he overran Judah (B. C. 962), and went up to Jerusalem, from which he took as spoil the treasures of the temple and the palace in the sixth year of Rehoboam. In this expedition Shishak had 1200 chariots and 60,000 horsemen, besides a large army of Libyans and Ethiopians. He is supposed for this siege to have marched in three columns, and to have overrun not only Judæa, but also part of Idumæa and the country of the Philistines. At that part of the temple of Karnak called the Portico of the Bubastites, Shishak has inscribed the names of 130 cities occupied or captured, and amongst them are Rabbith, Thaanach, Sunera, Rehob, Hapharaim, Adoraim, Mahanaim, Gibeon, Bethhoron, Kedemoth, Ajalon, Megiddo, and Jerusalem, called Jehuda Maluk. The highest regnal year of his reign is the twenty-first, the same as that given by Manetho. His conquests in Asia appear to have been quite ephemeral.—SHISHAK II. was an obscure monarch, of whose reign no particulars are known, and was the fourth successor of Shishak I.—SHISHAK III., an equally inglorious monarch, appears, from a tablet found in the Serapeum at Memphis, to have reigned fifty-one years at least; and SHISHAK IV., the last king of the twenty-second or Bubastite dynasty, is only known for an insignificant reign of thirty-seven years. S. BIRCH.

**Shit′tim.** (1) Wood of the shittah tree, repeatedly mentioned in Exodus as the timber principally employed in building the tabernacle. It has been identified with the *Acacia seyal*, which abounds in the Sinaitic peninsula. The wood is light, but close-grained and enduring, of a fine orange-brown color. Its leaves are small, and in spring it is covered with tufts of yellow blossoms. It yields the gum-arabic of commerce. (2) A fertile plain, so called from its acacia-groves, just opposite Jericho, in which the Israelites were encamped before crossing the Jordan.
R. D. HITCHCOCK.

**Shoa.** See ABYSSINIA.

**Shoal,** tp., Clinton co., Mo. P. 2475.

**Shoal Creek,** tp., Johnson co., Ark. P. 1355.

**Shoal Creek,** tp., Barry co., Mo. P. 1686.

**Shoal Creek,** tp., Newton co., Mo. P. 763.

**Shoal Creek,** tp., Cherokee co., N. C. P. 1332.

**Shoal′ford,** tp., Limestone co., Ala. P. 1536.

**Shoals,** p.-v., Martin co., Ind., on Ohio and Mississippi R. R., equidistant from Cincinnati and St. Louis, has 3 churches, an academy, 1 newspaper, a blast furnace, an axe factory, a flouring-mill, 3 hotels, 3 saw-mills, and a pottery. Business, farming and grazing. P. 513.
HENRY A. REED, ED. "MARTIN CO. HERALD."

**Shoals, Isles of.** See ISLES OF SHOALS.

**Shoc′co,** tp., Warren co., N. C. P. 1637.

**Shock** [O. H. Ger. *Scoc*], sudden vital depression, the peculiar effect upon the animal system produced by violent injuries or violent mental emotions. It is especially a surgical term. Following serious accidents, the crushing of a limb by a railroad injury or its removal by a cannon-ball, extensive superficial burns, extensive surgical procedures, as amputations or ovariotomy, and as the result of blows over important organs, concussion of the brain, a kick or sudden blow in the region of the stomach over the solar plexus,—a powerful impression is made on the nerve-centres proportionate to the extent of the superficial or peripheral nerve-irritation. Every sensation conveyed, in the state of health, from the surface to the nerve-centres, and recognized by the brain, whether as sensation of simple touch, of pain, or a special sense, as taste or smell, involves the functional activity and wear of the ganglionic or nerve-cells. A violent impression upon many superficial nerves involves sudden and violent action in the ganglionic centres. When the surface impression is extreme, the functional activity of the brain and other central ganglia is disturbed, or may be temporarily or permanently suspended. The vital phenomena of the body—consciousness, respiration, heart-action, capillary circulation—are depressed in pro-

portion to the shock received by the nerve-centres. The symptoms of shock are extreme pallor and coolness of the face and surface of the body, a small, feeble, slow pulse, infrequent and often irregular respiration; if conscious, the mind feeble; often unconscious, or deep coma with relaxation of the muscles. In special cases, delirium, hiccough, convulsions are present. The circulation and respiration may be so depressed that death is immediate, or speedily ensues unless reaction is artificially hastened. Sensation of pain is annulled: in the gravest injury, as the laceration and removal of a limb by a cannon-ball, there may be no pain and no loss of blood during the period of shock; the period of shock, if survived, is followed by reaction, a resumption of ganglionic or central nerve-power, and revival of the dependent functions; extreme loss of blood is a prominent cause of shock, producing sudden anæmia, inanition, and disturbed action of nerve-centres. The depressing after-effect of the inhalation of chloroform and ether, and of alcoholic excess, is sometimes spoken of as shock, but with doubtful propriety. The influence of great mental excitement or depression in causing shock is undoubted. The sight of blood causes many to faint. Fright, terror, sudden sorrow have caused the hair to turn white in a night—have produced delirium, convulsions, incurable epilepsy, dementia, permanent nervous prostration, and death. No satisfactory lesion or organic change has been found to explain shock, as when autopsies have been performed following sudden death by lightning or blows over the solar plexus. The treatment of shock is to be directed to the immediate development of reaction. The sinking pulse must be rallied by ammonia and alcohol, by stimulating enemata, heat to the extremities and surface. Counter-irritants to the extremities, epigastrium, and occiput aid to equalize capillary circulation. The galvano-electric poles to the region of the medulla and diaphragm may facilitate respiration. In mild cases of shock external warmth, a little diffusible stimulant, and rest are all that is required.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Shod'dy** [originally, the wool that was *shed* or wasted in carding and spinning], in a strict sense, a fibre made by tearing in pieces in a suitable mill rags of worsted or combed-wool goods. The corresponding fibre of carded-wool rags is called mungo. But more frequently both kinds are classed together as shoddy or "devil's dust." Notwithstanding all the hard words which have been used against shoddy goods, there is no doubt that there has been much good accomplished by the shoddy manufacture. Some classes of useful goods cannot be profitably made without shoddy; and if used in reasonable proportion its presence cannot be detected, and the wear of the goods is not much diminished. None but the very best sorts of woollen goods are perfectly free from shoddy.

**Shoe** [Ang.-Sax. *scôh*], in general, any covering to protect the foot (with the exception of hosiery) of which warmth is the special purpose. If the shoe consists mainly of a sole, it is called a sandal or slipper; if it also has a part coming up and covering a portion of the leg, it is called a boot. The earliest form of the shoe was the simple sandal, which was secured to the foot by thongs, and often by a button, coming between the first and second toes. Almost every material has been used for the construction of shoes; the skins of animals, tanned or untanned, more frequently than any other. In some parts of Europe wooden shoes, or *sabots*, are very common among the poorer classes. In Japan sandals of straw are usually worn by the common people; and in South America we find them made of plaited thongs of hemp. There have been great changes in the forms of shoes as worn in different countries and at different periods among civilized nations. The early Greeks usually went barefoot, or confined themselves to simple sandals, which in time came to be highly ornamented. The early shoes of the Romans were buskins, not very dissimilar to the moccasins of the American Indians; thick soles, sometimes of metal, were a later invention. In time they grew into shoes, or even boots, sometimes covering the entire leg. In Europe, during the Middle Ages, shoes often assumed fantastic fashions. At one time they had pointed toes two feet long, which were often brought up and tied to the knee; and not unfrequently a man of fashion would wear them of different colors, as a red one on one foot and a yellow one on the other. In the sixteenth century top-boots, or "trunk-hose," familiar to us on the stage, were the vogue among persons of quality. The tops of these were not unfrequently ornamented with lace. Long after pantaloons had superseded breeches, the boot-legs were worn outside, and consequently were very large. For many years there has been very little change in the general form of the covering for the foot as worn by either sex; the main variations being in the height of the heel and the shape of the toe, whether pointed, round, or square. With us a boot or shoe consists essentially of two parts—the sole, almost universally of thick leather, and the upper, usually of a softer leather, but not unfrequently of cloth of some kind—for females often of satin. These parts are attached to each other in various ways, usually by sewing or pegging. Until quite recently a boot or shoe was made throughout by a single person; at present there are several persons, each performing only a single part of the work, a considerable portion of which is done by ingenious machinery. Indeed, in no single trade is there a more perfect division of labor or a greater adaptation of machinery. Until within a few years pegged boots and shoes were confined to the coarsest and cheapest kinds of articles, but now immense quantities of fine pegged work are produced. This is owing mainly to the pegging-machine, invented about 1851 by A. C. Gallahue, subsequently much improved by E. Townsend and B. F. Sturtevant of Boston, of which there were two or three years since about 1700 in operation in the U. S., each one of which will peg two pairs of women's shoes in a minute, putting in as many rows as may be required. The machine cuts its own pegs as it works, from ribbon-like strips of white birch, which it receives in rolls of 75 to 100 feet. In this country alone 1000 cords of birch are annually fashioned into shoe-pegs. Quite as important is the machine for sewing soles, improved by Gordon McKay. One of these in the hands of a good operator will easily sew on the soles of 800 pairs of women's shoes in ten hours. Of this machine there were in use in 1874 about 1200 in the U. S., 400 in England, and 100 on the continent of Europe. The patentees receive a royalty of from one to three cents a pair, and their income from this source for the years 1870–74 averaged $500,000 a year. This machine sews clear through the outsole, insole, and upper, attaching the sole to the upper. All shoes not so attached are technically known as "turns," the sole being fastened to the upper inside out, which is then turned, and lasted, and finished, partially by hand. There are, however, sole-sewing machines which produce "turns," and even almost perfect imitations of work done wholly by hand. By far the greater part of the boots and shoes used in this country are made in large establishments, much of it, especially the finer kinds, in New York, Philadelphia, Baltimore, and other large cities, but more in several towns in Massachusetts, Maine, and New Hampshire. Lynn, Mass., is the greatest seat of the manufacture, the product in 1874 amounting to 11,000,000 pairs, mostly for women and children, valued at about $14,000,000, and employing 10,000 of its 28,000 inhabitants. Among other large seats of this manufacture are Haverhill, Marblehead, Worcester, Braintree, and Danvers in Massachusetts; Portland, Augusta, and Lewiston in Maine; Dover and Farmington in New Hampshire. Boston is the seat of the principal wholesale shoe-trade, it being estimated that from here 55,000,000 pairs were shipped in 1874, valued at about $62,000,000; the entire production of the shoe-towns of New England being fully $100,000,000 per annum, the consumption being almost wholly confined to the U. S., the value of the exports in 1874 being not quite $450,000. The imports are insignificant, those entering the port of New York in that year being valued at only $41,270.

A. H. Guernsey.

**Shoeburyness.** See Appendix.

**Shoe Heel,** p.-v. and tp., Robeson co., N. C. P. 460.

**Shoeing of Horses.** See Farriery, by M. C. Weld.

**Shoe'makertown,** p.-v., Cheltenham tp., Montgomery co., Pa., on North Pennsylvania R. R.

**Shohola,** p.-v. and tp., Pike co., Pa., on Delaware River and on Erie R. R. P. 729.

**Shoko'kon,** v., Honey Creek tp., Henderson co., Ill., on Mississippi River. P. 79.

**Shomer,** or **Jebel Shomer,** a part of Arabia, bounded N. by the Syrian desert, N. E. by Irak-Arabee, S. by the Wahabee sultanate, and W. by Turkish Arabia, in the beginning of this century was under the authority of the Wahabees, but forms now an independent sultanate. Its population is estimated at about 500,000; the capital is Hayel. Good crops of corn and fruit are raised by means of artificial irrigation. Dates, cotton, horses, mules, and asses are exported. A considerable trade is carried on between Hayel and Medina.

**Shoom'la,** or **Schumla,** town of European Turkey, eyalet of Silistria, on a fertile plain surrounded on the three sides with inaccessible spurs of the Balkan, which, together with its artificial fortifications, make it a fortress of the first rank. It contains large barracks, hospitals, magazines, and military storehouses, and besides its importance as a military point, it has extensive manufactures of silk, leather, tin and copper ware, and ready-made clothing. P. 20,000.

**Shoo'sha,** town of Asiatic Russia, capital of the district of Karabagh, Caucasia, is an almost impregnable

fortress on a commanding height whose three sides are wholly inaccessible. The winters are very cold here, and the summers very hot. The silk cultivation of the place is quite important. P. 15,000.

**Shoos'ter,** or **Schuster,** town of Persia, province of Khoozistan, on the Karoon, in lat. 32° N., lon. 49° E., is fortified, and its streets, though narrow and dirty, are lined with elegant houses, but large parts of the city are in ruins and uninhabited since the plague and the inundation which early in this century successively visited the city. P. about 8000.

**Shooting Creek,** p.-v. and tp., Clay co., N. C. P. 423.

**Shooting Stars.** See METEOR, by PROF. HUBERT A. NEWTON, LL.D.

**Shore** (JANE), b. in London, England, about 1445; married a rich London goldsmith named Matthew or William Shore; became mistress of King Edward IV. about 1470, and of Lord Hastings after the death of the former, 1483, and was accused of witchcraft as an accomplice of Hastings, who was beheaded for that pretended crime, though the real reason for the proceedings against them was their known partiality to the cause of the young princes. Jane Shore was charged by King Richard III. with having withered his arm by her arts of sorcery; was committed to the Tower and her property confiscated; was never brought to trial, but was compelled by the bishop of London to do public penance for impiety and adultery. The king's solicitor, Thomas Lynom, desired to marry her after the death of Hastings, but was prevented by Richard. She survived until after the accession of Henry VIII., and popular legend represented her as having died of hunger in a ditch—a version which long retained currency through the famous drama of Rowe bearing her name; but the legend was probably derived from the name of a London locality still called Shoreditch. Sir Thomas More bears emphatic testimony to her beauty, kindliness, and wit.

**Shore** (Sir JOHN). See TEIGNMOUTH, BARON.

**Shore'ham,** p.-v. and tp., Addison co., Vt., on Lake Champlain and on Central Vermont R. R. P. 1225.

**Short** (CHARLES), LL.D., b. at Haverhill, Mass., 1821; received his early education at Bradford Academy and Phillips Andover Academy; graduated with high honors at Harvard College in 1846; in 1847 was first assistant master in Phillips Academy; master of the Public Classical School in Roxbury, Mass., 1847–53, and of a private classical school in Philadelphia 1853–63; president of Kenyon College, O., and professor of intellectual and moral philosophy 1863–67. On the death of Dr. Anthon, professor of Greek in Columbia College, New York, Dr. Henry Drisler was transferred to the Greek chair, and Dr. Short succeeded Dr. Drisler as professor of Latin in 1868. He has edited, with additions, *Advanced Latin Exercises* in Schmitz and Zumpt's Latin series; revised Mitchell's *New Ancient Geography;* written an elaborate essay on the *Order of Words in Greek,* prefixed to Dr. Drisler's edition of Yonge's *English-Greek Lexicon;* and is now (1876) engaged in a revision of Andrews' Freund's *Latin Dictionary.* He has contributed many articles, mostly critical, to reviews and other periodicals, chiefly to the *Bibliotheca Sacra.* He is a director of the American Oriental Society and a member of other learned bodies, and has been from the outset a member of the American committee co-operating with the British committee in the revision of the English Bible.

**Short** (CHARLES W.), M. D., b. in Kentucky Oct. 6, 1794; graduated in the University of Pennsylvania about 1815; in 1825 was elected professor in Transylvania University, Lexington, Ky., and in 1838 removed to Louisville, and was associated with Drake and Caldwell in the university of that city until 1849, when he retired, and devoted himself to the preservation of plants and flowers; contributed several articles to the medical journals of his day. D. in Louisville Mar. 7, 1863. PAUL F. EVE.

**Short** (WILLIAM), b. at Spring Garden, Va., Sept. 30, 1759; studied at William and Mary College; was at an early age a member of the executive council of Virginia; accompanied Thomas Jefferson on his embassy to France as secretary of legation 1784; was appointed chargé d'affaires to France by Washington 1789 (being the first commission signed by him as President), and was subsequently minister to the Netherlands and to Spain. D. at Philadelphia, Pa., Dec. 5, 1849. Several of his published state papers display great ability, especially those upon the boundaries of the U. S. with Florida and Louisiana.

**Short Creek,** p.-v. and tp., Harrison co., O. P. 1799.

**Shorter** (JOHN GILL), b. in Jasper co., Ga., in 1818; graduated at the University of Georgia in 1837; was admitted to the bar 1838; became a circuit solicitor 1842; served several terms in the State senate; was a circuit judge 1852–61; became a member of the provisional congress of the Confederate States 1861, and was governor of Alabama 1861–63. D. at Eufaula May 29, 1872.

**Shorthand Writing.** See PHONOGRAPHY and STENOGRAPHY.

**Short-horns,** a breed of cattle externally distinguished by the shortness of their horns, of which there are several classes, each designated from the region in which it originated, usually in the British Islands, though some of them are from Holland and other parts of Europe. Bulls and cows of this breed have been largely imported for improving our native stock. Prominent among the short-horns are the Durham breed, characterized by the squareness of the body, which, when the head and legs are removed, presents the form of a rectangle, having no unfilled space, and furnishing much solid meat with little offal; for beef they are unrivalled, and are fair milkers, but for this purpose Mr. Solon Robinson, a good authority, gives the preference to the Devons. The Durhams are red, roan, white, or a mixture of these colors. The Ayrshire short-horns are much smaller than the Durhams, and are celebrated at home and here for their milking qualities. Many good dairy-farmers are of the opinion that these will give a larger return of milk for the quantity of food consumed than any other breed. They are usually spotted or mottled in red and white, although other colors are sometimes found. Smallest of all the short-horns is the Alderney breed, which Mr. Robinson considers "the best of all where only a few are kept, and where butter is the principal object, since their milk is the richest of all for household consumption, and makes the most and the best butter." Of the Devons there are two varieties—the North and the South, the former being preferable for slaughter, the latter for the dairy. (See CATTLE.)

**Short Mountain,** tp., Franklin co., Ark. P. 375.

**Shorts'ville,** p.-v., Manchester tp., Ontario co., N. Y., on Syracuse and Rochester branch of New York Central R. R.

**Sho'shone,** county of N. Idaho, adjoining Montana, from which it is separated by Bitter Root range of the Rocky Mountains, on the N. and S. forks of Clearwater River, has a rugged surface, with abundant timber and many placer-mines of gold. Cap. Pierce City. Area, about 3500 sq. m. P. 722, of whom the greater part were Chinese.

**Shoshones,** or **Snakes,** a family of North American Indians of the Californian group, inhabiting a wide range of territory from Idaho southward into Utah, and from the Sierra Nevada eastward to the Rocky Mountains. They are divided into Shoshones proper and UTES or UTAHS (which see), to which some authorities add, on the evidence of language, the Comanches and Moquis of New Mexico and Arizona, the Netelas and other tribes of California. The Shoshones proper include the Bannacks, who are sometimes classed as a separate tribe, and are subdivided into numerous independent bands, of which the most important are the Koolsatikara or Buffalo-eaters on Wind River, the Tookarika or Mountain-Sheep-eaters on Salmon and Snake rivers, the Shoshocos or White Knives (frequently called Diggers) of Humboldt River and the Great Salt Lake basin, the latter denomination apparently including the Hokandikahs, Yahooskins, and Wohlpapes. These names are destitute of all scientific accuracy, and in the present state of knowledge it is impossible to establish any reliable tribal distinctions. The Shoshones have usually been peaceably inclined, but have several times come into collision with the white settlers and suffered severely, several bands having been nearly exterminated. Treaties were made at Fort Bridger and vicinity in 1863, 1864, and 1865 with six large bands, and in 1867–68 attempts were made to gather them all upon the Bannack reservation at Fort Hall, Id., and the Shoshone reservation in Wyoming. Most of the southern Shoshones live upon roots and small animals, but the northern bands obtain a comfortable subsistence from the fisheries of the Shoshone River and by hunting larger game, some of them being very expert with the bow, and of late years possessing some horses and firearms. They are very fond of barter and of personal adornment, are usually dressed in buffalo or deer skins, live in skin tents, are fond of games of chance, and have borrowed from the whites as a favorite amusement the game of "poker." The property of a dead warrior is buried or burned with him, the favorite wife or horse having formerly been killed over the corpse. Few efforts at their conversion or education have as yet been made, and no critical study of their language. The entire number of the various bands is estimated at about 5000, the greater part being in Utah and Nevada. PORTER C. BLISS.

**Shot.** See PROJECTILE, by J. G. BUTLER.

**Shoulder-joint.** See JOINT.

**Shoveller Duck.** See ANAS.

**Showers of Fishes** are recorded to have fallen from the sky in numerous instances. Investigation shows that they usually take place near large bodies of water, and there can be no doubt that in all well-authenticated cases of the kind whirlwinds and storms have been the means by which they have been lifted. In India, fishes of three pounds weight are reported as having fallen from the sky. Aristotle, Ælian, Cardan, Duméril, and Arago are quoted as authorities for the statement that frogs and toads also sometimes fall from the clouds in the same way.

**Shrapnel.** See PROJECTILE, by J. G. BUTLER.

**Shreve,** p.-v., Wayne co., O., on Pittsburg Fort Wayne and Chicago R. R., 60 miles S. of Cleveland, contains 3 churches, graded public schools, 1 newspaper, 2 flouring and 2 planing mills, several manufactories, and 2 hotels. P. 479.

JAMES N. BRADY, ED. "JOURNAL."

**Shreve** (THOMAS H.), b. at Alexandria, D. C., in 1808; settled at Cincinnati as a merchant 1830; became one of the editors of the *Mirror* 1834, and of the Louisville *Journal* 1842. D. at Louisville, Ky., Dec. 23, 1853. Author of *Drayton, an American Tale* (1851), and of many poems which appeared in periodicals.

**Shreve'port,** city, cap. of Caddo parish, La., situated on the 32d degree of latitude, and on the W. bank of Red River, 500 miles from its mouth, and at the head of low-water navigation. It is now the eastern terminus of Texas and Pacific Railway, and also the terminus of the projected roads from New Orleans and Memphis, Tenn. It has 10,000 inhabitants, and is the second commercial city in the State. It was incorporated in 1839. Situated in the very heart of the finest cotton-growing region in the world, it has become one of the most important cotton-markets in the Southwest, shipping annually from 110,000 to 125,000 bales, dependent upon the cotton crop. Having very few manufactories, its population falls far short of the extent of its trade. A large portion of the cotton is sold to Eastern and European spinners' agents, who ship on through bills to Liverpool or to the Eastern manufacturers. There are 2 fine cotton-compresses in the place. There are 3 miles of street railway, 7 churches (the Presbyterian church and Jewish synagogue being fine buildings), 5 private and 4 public schools (2 of the latter colored), an extensive cotton-seed oil-factory, 2 large steam saw and planing mills, 2 small iron-foundries, 1 daily, 1 semi-weekly, and 2 weekly newspapers, a marine and a charity hospital, a cotton exchange in successful operation; 3 private banks or rather exchanges, of limited capital in comparison with the large amount of money required to move the cotton crop. There is no better opening in the South for the establishment of a national or private bank prepared to discount commercial or other paper. From 3 to 5 per cent. a month is frequently paid on good security. Shreveport also offers a splendid field for the establishment of cotton and other factories and flouring-mills. It is the first port of delivery E. of the Pacific coast on the line of Texas and Pacific Railway, and the country immediately tributary to it embraces large portions of South Arkansas, East Texas, and North Louisiana. P. 4607.

A. D. BATTLE, ED. "SHREVEPORT TIMES."

**Shrew,** or **Shrew-Mouse,** a small, insectivorous, mouse-like mammal of the family Soricidæ, found in nearly all parts of the northern hemisphere, is nocturnal, frequently aquatic, produces its young blind and naked, does not hibernate, is distinguished by an elongated and pointed muzzle, small eyes, plantigrade, six-toed feet, and glands which secrete a musky fluid. There are several sub-families and many species, twelve having been described as natives of the Pacific States of North America, most of them belonging to the genus *Sorex*.

**Shrews'bury,** town of England, capital of the county of Salop, on the Severn, is well built, has important salmon fisheries in the river, and manufactures of linen thread, canvas, and iron wares, and carries on an extensive trade in coal and corn, partly on the Severn and partly on a branch of Grand Junction Canal. P. 23,300.

**Shrewsbury,** p.-v. and tp., Worcester co., Mass., on Quinsigamond Lake. P. 1610.

**Shrewsbury,** p.-v. and tp., Monmouth co., N. J., on Atlantic Ocean and on New Jersey Southern R. R., includes the v. of Red Bank. P. 5440.

**Shrewsbury,** tp., Lycoming co., Pa. P. 442.

**Shrewsbury,** tp., Sullivan co., Pa. P. 209.

**Shrewsbury,** p.-v. and tp., York co., Pa., on Northern Central R. R. P. of v. 600; of tp. 3559.

**Shrewsbury,** p.-v. and tp., Rutland co., Vt., on Central Vermont R. R. P. 1145.

**Shrewsbury,** p.-v., Kanawha co., West Va.

**Shrike** [*Laniidæ*], a family of birds of the tribe Dentirostres and order Passeres, embracing more than thirty species, of which the best known is the butcher-bird (*Lanius excubitor*, Linn.), found in the Atlantic States of North America, and noted for its habit of impaling insects and small birds upon the points of thorns (whence its usual name). It imitates the notes of other birds in distress as an artifice to ensnare them, and in the Southern States is useful to the planter by destroying field-mice and insects. By some the name of *excubitor* is confined to the European variety, which in Russia is trained to catch birds and mice, but the best authorities consider it identical with the great American shrike.

**Shrimp,** a name applied to a vast number of small crustaceans, but proper to the long-tailed Crangonidæ, of which there is a single genus, *Crangon*. In Europe *C. vulgaris* is extensively caught for food. The common shrimp of the U. S., *C. septemspinosus*, is principally used for fish-bait. The red shrimps are Alpheidæ; the sword shrimps, Penæidæ; the opossum shrimps, Mysidæ (Stomatopods). The Squillidæ are also called shrimps. Not a few small amphipod crustaceans are called shrimps. Noteworthy are *Chelula terebrans* and *Limnoria terebrans*, the wood-boring shrimps, so destructive to submarine timber. Some of these creatures inhabit fresh water, but most are marine. Among the more interesting kinds are the brine-shrimps. (See BRINE-SHRIMP.)

**Shrop'shire,** or **Salop,** county of England, on both sides of the Severn, and bounded W. by Wales, comprises an area of 1343 sq. m., with 248,064 inhabitants. The northern part is level and wholly under tillage; the southern is hilly, and here cattle-breeding is the chief occupation. An excellent breed of sheep and an excellent kind of hops are peculiar to this county, which also is very rich in coal, iron, lead, and copper.

**Shrove'-Tuesday,** the day preceding Ash-Wednesday, so called from the old custom of confessing and receiving shrift on that day. It is in general a day of pleasure in most Roman Catholic countries. It is the Carnival of Italians, the *Mardi Gras* of the French, and the Pancake-Tuesday of former days in England. (See NEW ORLEANS.)

**Shu'benacadie,** p.-v., Hants and Colchester cos., N. S., on the navigable Shubenacadie River, 20 miles from its mouth, and on Nova Scotia Railway, 39 miles N. of Halifax. Wooden-ware, shipping, and bricks are manufactured. P. about 350.

**Shu'brick** (WILLIAM BRANFORD), the fourth of six brothers, all of whom served in the army or navy in the war of 1812 with Great Britain, b. in South Carolina Oct. 31, 1790. His grandfather, Thomas, was one of the committee of safety organized at the commencement of difficulties between the mother-country and the American colonies. His father, Thomas, and two brothers, Richard and Jacob, early and persistently espoused the cause of liberty, the first having served as aide to Gens. Lincoln and Green. Two of the admiral's brothers died in the U. S. military service in 1813; his third brother was lost at sea in 1815, while in command of the Epervier; the fifth brother, Edward Rutledge, died in command of the frigate Columbia on her passage to the Mediterranean in 1844; the sixth, Irvine, died a commander in the navy in 1849. The subject of this notice, after attending a grammar-school at Charleston and passing two years of study in New England, became in 1805 a student of Harvard, but was soon after recalled to Charleston for training for the naval service, in which he was appointed midshipman by Jefferson, June 20, 1806; in May, 1807, joined the sloop-of-war Wasp; at the beginning of the war of 1812 was an acting lieutenant on board the Hornet, commanded by Capt. Lawrence, attached to the squadron under Com. Rodgers, which sailed from New York the day after the declaration of war; soon after was transferred to the frigate Constellation, which rendered important services in the defence of Norfolk and the navy-yard at Gosport, where he performed efficient duty on land in defence of the batteries; in 1813 was transferred to the Constitution, at the request of Stewart, her commander, and made two cruises, aiding in the capture of three ships of war, including the Cyane and the Levant. When the Levant surrendered after a bloody action, he was ordered to her command. He returned to the U. S. in May, 1815, second in command of the Constitution, and in consideration of his conspicuous services was awarded a sword by his native State, and a medal by Congress, enjoying a few months' leave of absence after a continuous service of eight years. In Dec., 1815, was made senior lieutenant of the Washington, 74 guns, under Creighton, the first ship of the line which made a full cruise under the U. S. flag, returning to the U. S. in 1818; in 1820 was promoted to the rank of commander, and served second in command at the navy-yard

at Charlestown, Mass., and New York, until Apr. 6, 1826, when he was appointed to the command of the Lexington; in 1829 was appointed commander of the Natchez, and made a cruise in the West Indies; afterward inspector of ordnance, etc.; second in command of the navy-yard at Washington until 1838, when he was ordered to the command of our West India squadron, which he held until 1840, having in 1831 been promoted to the rank of captain; from Oct. 28, 1840, to Oct., 1843, was in command of the navy-yard at Norfolk, Va.; Feb. 3, 1844, appointed chief of the bureau of provisions and clothing for the navy. Asking for sea-service at the beginning of our war with Mexico, he was appointed July 9, 1846, to command the Pacific squadron; sailed from Boston Aug., 1846, returned May, 1849; Sept. 24, 1852, was appointed to the lighthouse board, and in 1853 chairman of the bureau of construction; July 8, 1853, placed in command of the eastern coast squadron for the protection of American fishermen, and in September returned to Washington and resumed his duties as chairman of the lighthouse board; Aug. 3, 1857, appointed president of board to prepare regulations for the navy; Sept. 8, 1858, appointed to command the Brazil squadron and Paraguay expedition, from which, his last sea-service, he returned May 11, 1859, to resume duty as chairman of the lighthouse board; July 17, 1862, was appointed senior member of advisory board, having the day previous been commissioned rear-admiral after a service of fifty-five years, his entire service to the time of his decease, which occurred May 27, 1874, extending to a period of sixty-one years and ten months. The naval history of the country records the details of his long and faithful services, of which only the outline can here be given. JOSEPH C. G. KENNEDY.

**Shubuta,** p.-v., Clark co., Miss., on Chickasawha River and on Mobile and Ohio R. R.

**Shu'feldt** (ROBERT W.), U. S. N., b. Feb. 21, 1822, in New York; entered the navy as a midshipman May 11, 1839; became a lieutenant in 1854, a commander in 1862, a captain in 1869; commanded several vessels on the coast during the civil war, and was actively engaged against the defences of Charleston; commanded the flag-ship of the East Indian fleet during 1865 and 1866, and that of the Mediterranean from 1871 to 1873; in 1875 appointed chief of the bureau of equipment and recruiting. Capt. Shufeldt was for several years in civil life, during which time he held many responsible positions, of which the most conspicuous was that of consul-general to Cuba during the first year of the rebellion—a place of great importance at that trying period, which he filled with admirable tact, judgment, and discretion. FOXHALL A. PARKER.

**Shuf'field,** tp., Moore co., N. C. P. 1270.

**Shujabad',** town of British India, Punjaub, on the right bank of the Chenaub, in lat. 29° 53′ N., is fortified and well built, and has flourishing manufactures of silk and cotton. The adjacent districts are very fertile and well cultivated. P. 10,000.

**Shulls'burg,** p.-v. and tp., Lafayette co., Wis. P. 2702.

**Shul'ze** (JOHN ANDREW), b. in Tulpehocken tp., Berks co., Pa., July 19, 1775; was well educated, and entered the Lutheran ministry; in 1802 became a successful merchant of Myerstown, Dauphin co., Pa.; entered political life in 1806; was clerk of the courts and prothonotary of Lebanon co., 1813–21; governor of Pennsylvania 1823–29, and president of the U. S. electoral college 1840. D. at Lancaster Nov. 18, 1852.

**Shumla.** See SHOOMLA.

**Shunk** (FRANCIS RAWN), b. at the Trappe, Montgomery co., Pa., Aug. 7, 1788, of German ancestry; became at fifteen a teacher; in 1812 a clerk in the surveyor-general's office at Harrisburg, and began the study of law; marched in 1814 as a private to the defence of Baltimore; became clerk of the house of representatives, secretary of the canal commission, secretary of state 1838, and was governor of Pennsylvania 1845–48. D. at Harrisburg July 30, 1848. Gov. Shunk was a man of noble personal character and of fine intellectual culture.

**Shuqualak,** p.-v., Noxubee co., Miss., on Mobile and Ohio R. R.

**Shurt'leff** (NATHANIEL BRADSTREET), M. D., b. at Boston, Mass., June 29, 1810; graduated at Harvard 1831, and at the Medical School 1834; became a physician at Boston; was a zealous and learned scientist, genealogist, and historical student; mayor of Boston 1868–70. He traced his descent to eleven of the Pilgrims of the Mayflower, a number probably exceeding that which any other of his contemporaries could reckon, but, though tolerant of the Puritan opinions of his ancestors, was himself a Roman Catholic. D. at Boston Oct. 17, 1874. Author of *An Epitome of Phrenology* (1835), *A Perpetual Calendar for Old and New Style* (1848), *Passengers of the Mayflower* (1849), *Notice of William Shurtleff of Marshfield* (1850), *Genealogy of the Leverett Family* (1850), and *A Topographical Description of Boston* (1871), besides many minor publications and contributions to the *Genealogical Register*. He was the editor of the valuable series of original *Records of the Governor and Company of Massachusetts Bay 1628–86* (6 vols. 4to, 1853–54), and, with David Pulsifer, of the equally important *Records of the Colony of New Plymouth* (12 vols. in 11, 4to, 1855–61), being chiefly a publication from the MSS. of Secretary Nathaniel Morton.

**Shurtleff College,** an institution of learning at Upper Alton, Madison co., Ill., founded in 1832 as Alton Seminary, chartered in 1835 as Alton College, and took its present name in 1836 in honor of Dr. Benjamin Shurtleff of Boston, who gave it $10,000. It is under the management of the Baptist denomination, and was originally designed chiefly for the training of candidates for the ministry, for which purpose a theological department was organized in 1863. There is a Kendall Institute for young ladies, a preparatory department, and two academic courses, classical and scientific. Both sexes are admitted. The number of instructors in 1875 was 14, of collegiate students 53, of graduates 159. The library contains 7300 volumes.

**Shushan,** p.-v., Salem tp., Washington co., N. Y.

**Shush'waps,** a family of North American Indians of the Columbian group, occupying the valleys of the Fraser, Thompson, and upper Columbia rivers and tributary streams in British Columbia, Montana, Idaho, and Washington Territory. They are subdivided into Shushwaps proper, also known as Atnahs or Flat-bows, the KOOTENAIS and OKANAGANS (which see).

**Shute** (SAMUEL), b. in London, England, in 1653; educated at the University of Leyden, Holland; served in the Dutch army under William, prince of Orange; was afterward lieutenant-colonel under the duke of Marlborough; was royal governor of Massachusetts 1716–23, and had a bitter and protracted controversy with the legislature as to the powers of his office. D. in England Apr. 15, 1742.

**Shutesbury,** p.-v. and tp., Franklin co., Mass. P. 614.

**Shuttle.** See LOOM and SEWING-MACHINES.

**Shyenne',** new county of S. W. Dakota, embracing the extensive and little-known region called the "Bad Lands," on Shyenne and White rivers. A portion of the "Black Hills," which attracted so much attention in 1875–76, falls within the limits of this county.

**Sial'agogues** [Gr. σίαλον, "saliva," and ἀγωγός, "leader"], a term sometimes used in medical parlance to refer to such drugs as cause an increased secretion of saliva. Mercury has this property more than any other substance, but as the increased salivary flow is simply one among many effects of a poisonous dose of the drug, the term "sialagogue" is not a proper definitive appellation. The word is now seldom used. EDWARD CURTIS.

**Siam'** is called by its people *Muang Thai*, "the kingdom of the free"—*i. e.* free from the superstitions of the Brahmans. The appellation which we employ is derived from a Malay word, *Sâyâm*, or "the brown race." This name was hardly known to the natives in ancient times, while the country itself is never so named in the ancient or modern annals of the kingdom. Siam proper occupies the middle portion of the Indo-Chinese peninsula, with all the country surrounding the Gulf of Siam, and stretches between lat. 6° and 20° N. and lon. 98° and 106° E., and measures N. and S. 960 miles, and E. and W. 420 miles in its greatest extent. In the Malayan peninsula, however, the width is only from 60 to 80 miles. It is bounded on the N. by the country of the Laos, E. by Laos and Anam, S. by the Gulf of Siam, along which it has a most beautiful and picturesque coast-line of 1400 miles, and W. by the Indian Ocean and the Tennasserim provinces. Area, 188,000 sq. m. The surface is covered with hills and mountains, especially in the N., while in the centre lies the rich and alluvial plain watered by the beautiful Mèinam. The two mountain-ranges running S. E. from the Himalaya form at the same time the natural boundaries of Siam. The mountains on the E. and W. belong also to the two great chains which stretch S. from the table-land of Yunan, and run on either side of the great valley watered by the Mèinam. A third range, less continuous and direct, rises in the central regions. In this is situated the P'hra Bat, or "mountain of the sacred footprint of the Booddha." Over the footprint is built a beautiful temple, in the centre of which is found a depression in the rock about five feet long by two broad, probably some of the fossil remains that abound in this neighborhood; a grating is usually placed over it, and is only removed on festal occasions. The temple is so dark that it is impossible to discover anything except the five marks of the toes, and yet millions of costly gifts are offered here, and crowds of ardent Booddhists perform long

and painful journeys to press with their lips this holy footprint. The most westerly of the mountain-chains reaches an elevation of 5000 feet; the height of the eastern range is yet unknown. The mountains of the Siamese-Malayan provinces nowhere exceed 3000 feet. The whole region abounds in small rivers, but there are only three great navigable streams—the Saluen, forming a part of the western boundary; the Meikong, or "river of Cambodia;" on the boundary toward Anam, it is 1500 miles long; its entrance was long held by the Cochin-Chinese, and is now in the possession of the French; and the Mèinam. Of these the Mèinam is the most important, being in all respects the Nile of Siam. It has three distinct names. In the ancient annals it is called *Suen Samudra*, "ocean sister;" in the royal archives, *Chow P'hya*, "His or Her Royal Highness;" and by the people simply *Mèinam*, or "mother of waters." It is a noble river. Rising among the southern slopes of the snow-covered mountains of Yunan, it traverses the whole length and breadth of the great valley of Siam, receiving in its course of nearly 900 miles the waters of many other streams, and almost monopolizing the trade and navigation of that portion of the East. It falls into the Gulf of Siam by three different channels, only the eastern one of which is navigable for sea-going vessels. Ancient annals relate that in the fifteenth, and as late as in the seventeenth, century Chinese junks of great size ascended this river as far as Sangkalok, nearly 120 leagues from its mouth; now, owing to the increasing alluvial deposit, it is not navigable more than 15 leagues at most. The only other river worthy of notice is the Bangphakong, about 240 miles long, which enters the gulf at Bangplasoe, 60 miles E. of the Mèinam. All the rivers of Siam are flooded. In the month of June, the mountain-snows begin to melt, the deluging rains of the wet season set in, the strong southerly winds (called the monsoon) dam up the waters of the Mèinam, and it begins to rise—an event most eagerly looked for by the people, and hailed by them as a blessing from heaven; and these annual inundations account for the extreme fertility of the basins watered by the rivers of Siam. In August the inundation is at its height, and the whole vast valley is like an immense sea, in which towns and villages look like islands connected by drawbridges and interspersed with groves and orchards, the tops of which only are seen; while boats, small steamers, and native craft pass to and fro without injury to the rice and other crops starting beneath them. The whole valley is intersected by canals, some of great size and extent, in order to distribute as far as possible the benefits of this grand operation of nature; but the lands situated in the middle of great plains derive the greatest advantage therefrom. When the inundation is supposed to have reached its height, and is about to subside, a deputation of talapoins or priests, sent by the king, descend the river in magnificent state barges, and with chants and incantations and movements of magical wands command the waters to retire. The popular river-festival, which takes place after the waters have subsided, both in origin and character belongs to the Hindoos, rather than to the Booddhists. It is an annual festival held at night, and the scene which is exhibited during its celebration is excedingly beautiful. The banks of the Mèinam are brilliantly lighted up; accompanied and announced by numerous flights of rockets, a number of floating palaces, built on rafts, the grandest of which belongs to the king, come sailing down the stream, preceded by tens of thousands of lamps and lanterns wreathed with chaplets of flowers, which cover with their gay brilliancy the entire surface of the flashing water. The rafts, which are formed of young plaintain trees fastened together, are often of considerable extent, and the structures which they bear are such as Titania herself might delight to inhabit. Towers, gates, arches, and pagodas rise in fantastic array, bright with a thousand colors, and shining in the light of numberless cressets. So the fairy-like spectacle moves on, while admiring crowds of men, women, and children throng the banks of the river, not only to join the brilliant pageant, but to watch their own frail little plaintain tree barque, freighted, perchance, with a single lamp, yet full of life's brightest hopes, as it floats unextinguished down the rapid stream, glimmering on with ruddy flame amidst the shadows of night.

Granite and mountain limestone are supposed to constitute the chief Primary rocks, covered in the lower districts with thick beds of stiff clay and alluvial strata.

The products of Siam, as may be supposed from its range of latitude, its tropical heats, its variety of climate, and the fertility of the valley, annually renewed by the overflow of the Mèinam, are very diversified and almost unlimited in quantity. Vegetation is luxurious and beautiful beyond description. Not more than one-third of the land is under cultivation, but this renders a rich return to the farmers. Its rice, of which there are forty varieties, is excellent; its sugar is esteemed the best in the world. Among the other exports are cotton, tobacco, hemp, cutch, dried fish, cocoanut oil, areca-nut, beeswax, precious gums, spices, dye and other woods, especially teak and ebony. In the abundance and variety of its fruit trees, vegetables, and aromatic herbs and spices Siam is unsurpassed, and is justly termed the garden of the world. The durian (a very delicious but unpleasantly odoriferous fruit), the mango, the mangosteen, the pineapple, and bread-fruit are cultivated in large plantations, trenched, and watered by the daily tide. In the forests they are found in great numbers also, putting forth leaf, bud, flower, and fruit almost simultaneously, and greatly enhancing the stately beauty of the poh, banyan, peipal, and other trees. Here also are found gutta-percha, lac, dammar, catechu, gum-benzoin, and the fragrant agilla, or eagle wood; gamboge, transplanted from Cambodia, is everywhere cultivated. Of medicinal plants there are innumerable varieties, many of which are well known to the native physicians as possessing wonderful curative properties for diseases common to the climate. The butterfly-plant is found in the vicinity of P'hrabat, the leaves of which are very much like butterflies with green wings striped with red. The most remarkable of the woods are the sapan, indigo, fustic, and many other dyes. The lofty silk-cotton abounds; its soft silky gloss is only used for the pillows and mattresses of the rich, as its fibre is found too brittle for the loom. There are many varieties of the palm, of which the attap, areca, and cocoanut are the most valuable; the attap is mostly used for covering houses, while the cocoanut furnishes beams and rafters for habitations; the leaves when plaited make excellent thatch, umbrellas, coarse mats; the finer fibres are woven into beautiful mats, and then painted in a variety of patterns for the houses of the rich; the nuts afford abundance of oil, and when it is expressed the remains feed cattle and poultry, besides making excellent manure; the shells of the nut furnish cups and ladles and other domestic utensils; the husk is manufactured into ropes and cordage of every kind and size, and is more durable than hemp. Many of the trees are not permitted to bear; the embryo bud from which the blossoms and buds would spring is tied up to prevent its expansion, and a small incision is made at the end, and a cool, pleasant liquor called *taree*, the palm wine of the poets, oozes out, which in its turns furnishes arrack, vinegar, and jaggaree, or coarse sugar; from the roots is manufactured a very valuable black paint, as well as other inferior articles for foreign and domestic markets. The rattan and bamboo are of manifold use to the natives; the teak, the monarch of the forest, and more durable than the oak, is very abundant, and with the iron, the red, and white woods is used for house and ship building. Besides these there are the ebony, banyan, and sacred fig tree. Of flowers, the water-lily, the rose, the lotus, and jessamine are the most common, while there are a number of flowers peculiar to this region, and not only not classified, but unknown to the European world. After the rainy season the bamboo forests are curtained to the height of from 60 to 70 feet with wild flowering creepers, and in particular with huge clusters of wild convolvuli of every shade of color.

The animal kingdom is equally varied, singular, and interesting. The most celebrated is the *chang p'hoouk*, or white elephant. According to the Booddhist's philosophy of metempsychosis, each successive Booddha, in passing through a series of transmigrations, must necessarily have occupied in turn the forms of white animals of a certain class, particularly the swan, the stork, the white crow and sparrow, the dove, the monkey, and the elephant; all of which are peculiar to Siam. But there is much obscurity and diversity in the views of their ancient writers on this subject. Only one thing is certain—that the forms of these nobler and purer creatures are reserved for the souls of the good and great, who find in them a kind of redemption from the baser animal life. Thus, almost all white animals are held in the deepest reverence by the Siamese, because they were once superior human beings; and the white elephant in particular is supposed to be animated by the spirit of some king or hero. Having once been a great man, he is thought to be familiar with the dangers that surround the great, and to know what is best and safest for those whose condition in all respects was once his own. He is hence supposed to avert national calamity, and bring prosperity and peace to a people; and from the earliest times the kings of Siam and Burmah have anxiously sought for the white elephant. The titles reserved for the white elephant vary according to the purity of complexion (for these favored creatures are rarely true albinos, salmon or flesh-color being the nearest approach to white in almost all the historic "white elephants" of the courts of Burmah and Siam). The stately occupant of the stable-palace at the court of the late king

was distinguished by the high-sounding appellation of *Mââ P'hya Seri Wongsah Ditsarah Krasâât* ("august and glorious mother-descendant of kings and heroes"). In 1862 a magnificent white—or rather salmon-colored—elephant was "bagged," and preparations on a gorgeous scale were made to receive him. A temporary pavilion of great splendor sprang up, as if by magic, before the eastern gate of the palace, and the whole nation was wild with joy, when suddenly came awful tidings: he had died. It was a terrible affliction to the people, not less than to the king. His body was not burned; only his brains and heart were thought worthy of that last and highest honor. The carcase, shrouded in fine white linen and laid on a bier, was carried down the river, with much wailing and many mournful dirges, to be thrown into the Gulf of Siam. In the stable-palace of the white elephant is kept a white monkey to ward off evil spirits. The national standard is a white elephant on a deep crimson ground. Among the other animals are the rhinoceros, the buffalo, the ox, which with the elephant are used as beasts of burden; the striped tiger, equal in size and ferocity to the Bengal tiger, whose bones and decomposed carcase form a valuable export for the Chinese *materia medica;* the pangolin, an animal covered with scales overlapping each other like tiles, and which when attacked rolls itself into the form of a ball; the anabas, a genus of acanthopterygious fishes, having cells in the pharynx capable of retaining water, which gradually drops into the branchial cavity, so as to moisten the gills, whereby they are enabled to climb trees and wander a mile or two from the water; the flying-fish; the singing-fish or mollusk; the platoo, or sardine-like fish, so abundant as to form the common food of the people, as well as an article of export when dried or compounded into a sort of kapee, a fetid mass; water-snakes of great size; crocodiles from three to twenty-five feet long, some of which are tamed and kept in artificial ponds adjoining the temples, and looked upon as sacred; the flying tree-gecko; the python; the cobra de capello, to which also the natives attach a superstitious reverence as a messenger from the unknown; the viper, most deadly of its kind; in fact, there are a great many varieties of snakes, and many of singularly beautiful coloring. Cats are numerous; a species of wild-cat is much dreaded by the natives; dogs, vultures, and crows are the scavengers of the great plain; they abound in the cemeteries or cremation-grounds at Bangkok. Birds are the most varied, beautiful, and gorgeous in plumage in the world—some of great size, and many of them songsters of wonderful power and sweetness of melody, in which the *sooruk*, or red-and-brown-spotted rice-bird, is unsurpassed, even by the nightingale. The edible swallow's nest is much sought after by epicurean Chinese, Siamese, and even by Parisian gourmands. It is also a valuable article of export. The butterflies are large and of exquisite beauty, both in form and coloring, while the bright mantis and firefly are the most beautiful of an infinitely varied and curious insect-realm.

Tin underlies the whole Malayan peninsula, even down to its extreme S. point; it is found in great abundance in the Siamese territory between lat. 11° and 14°, and the mines in the island of Salang, off the W. coast, are scarcely less productive than those of Banca. Gold is extensively found, especially in the province of Bangtaphan, and in great purity; copper, iron, and lead abound, but, owing to the hardships of the jungle, the fevers and cholera prevailing there, and the extreme jealousy evinced toward foreigners, the precise locality in which they are found is kept secret by the mining population of Siam, and thus their great wealth is as yet comparatively undeveloped. A beginning has at last been made in this respect by the present king. Zinc and antimony, sulphur and arsenic, are also found, and silver in combination; sapphire, ruby, spinel, corundum, amethyst, garnet, black coral, topaz, and other precious stones are found in the hills of Chantaboun, on the E. of the gulf. They are obtained by washing the alluvial soil. The mines yielding them, however, are a monopoly of the king, while those of gold, iron, copper, etc. were kept for a long time under the strict surveillance of the Siamese government, and carried on chiefly by Chinese slaves. But under the late treaties they have been thrown open to foreign enterprise, and are at this moment exciting much interest among European explorers. Salt in large and saltpetre in less quantities are manufactured by solar evaporation.

Siam has two seasons, the hot and the dry, the former beginning in April or May, and the latter in July. The mean temperature at Bangkok is 82° F., with a mean range of 13°. On the whole, the country is salubrious, but in the wet season and in marshy places ague and cholera are very prevalent. In the upper country the climate is more extreme.

The Siamese are mainly of Mongolian type, but there is also as much reason to suppose that they are closely allied to that powerful Indo-European race to which Europe owes its civilization, and whose branches are the Hindoos, Persians, Greeks, Latins, Celts, and the Teutonic and Slavonic tribes. The original site of this race was in Bactria, and the earliest division of the people could not have been later than 3000 or 4000 years before the Christian era. Comparative philology alone enables us to trace the true origin of nations of great antiquity. According to the researches of the late king, who was a very studious and learned man, out of 12,800 Siamese words more than 5000 are found to be Sanskrit, or to have their roots in that language, and the rest in the Indo-European tongues, to which are added a great number of Chinese and Cambodian terms. He says: "The names of temples, cities, and villages in the kingdom of Siam are derived from three sources—namely, Sanskrit, Siamese, and Cambodian. The names which the common people generally use are spoken according to the idiom of the Siamese language, are short or monosyllabic, and are easily pronounced; but the names used in the court-language and in the documents which receive the government seals are almost all of Sanskrit derivation. Some of our cities and temples have two, and even three, names, being the ancient and modern names, as they have been used in the court-language or that of the people." As the words common to the Siamese and the Sanskrit languages must have been used by both peoples before their final separation, we have here a clue to the origin and degree of civilization attained by the former before they emigrated from the parent stock. They are generally of medium stature, the face broad, the forehead low, the eyes black, the cheek-bones prominent, the chin retreating, the mouth large, the lips thick, and the beard scanty. In common with most of the Asiatic races, they are apt to be indolent, improvident, servile, vain, inquisitive, superstitious, and cowardly, but individual variations from the more repulsive types are happily not rare, while among their better qualities may be ranked temperance, toleration, and benevolence. In public they are scrupulously polite and decorous according to their own notions of good manners, respectful to the aged, affectionate to their kindred, and bountiful to their priests, of whom more than 20,000 are supported by voluntary contributions in the city of Bangkok alone. Besides the Siamese, a great variety of races inhabit the territories of Siam, as the Chinese, the Cambodians, the Laos, Kariens, Shans, Burmese, Peguans, and Malays. The population of Siam cannot be ascertained with correctness, owing to the custom of enumerating only the men. In 1867 the native registers gave the number of them as follows: 4,000,000 Siamese, 1,000,000 Laotians, 1,000,000 Malays and Hindoos, 1,500,000 Chinese, 350,000 Cambodians, 50,000 Peguans, and the same number of mountain-tribes; in all nearly 8,000,000. If these figures are even approximately correct (which is very doubtful, if we may judge from recent investigations: it was thought by traditional computation that the native population of Bengal amounted to 43,000,000, but by actual counting we find it to be 66,000,000; here is an error of no less than 23,000,000 = the entire population of England and Wales), and the women and children bear the same proportion to the men as in other countries, the total population of Siam far exceeds the numbers which have hitherto been assigned to it. The whole empire is divided into forty-nine provinces with their respective p'hayas or governors, and these again are subdivided into districts under inferior officers, respecting whose administration but little that is good can be said. The dress consists of a cotton waist-cloth or skirt, to which the females add a bright silk shoulder-scarf, a jacket for the cold, with a crimson or blue mantle thrown over the entire figure; the princes, kings, and nobles on state occasions wear silk and gold brocade with high conical caps. The royal robes of the supreme king are fairly ablaze with diamonds, emeralds, rubies, and other precious stones; the royal headdress is of a tapering spiral form, of pure gold, and studded with the rarest gems. Even the phra batt, or golden slippers, are tapering at the toes and wrought with costly gems. A chatiya, or tapering gold umbrella, is also the accompanying mark of royalty. The Siamese stain their teeth black, black teeth being esteemed a great beauty among them; the head is shaved regularly, but a black bristling tuft, like an inverted brush, is left on the top of the head; that of the females, whose hair is only closely cut, is encircled by a parting, which is effected by uprooting two or three hairs all round the tuft, while on either side of the cheek is left a single lock of hair. The fact is remarkable that though education in its higher degrees is neglected in Siam, there is scarcely a man or woman in the empire who cannot read and write. Though a vain people, they are neither bigoted nor shallow; and the day is not far distant when enlightening influences, accepted through

their willingness not only to receive instruction from Europeans, but even to adopt in a measure their customs and their habits of thought, will raise them to the rank of a superior nation.

The language of the people advances but slowly in the direction of grammatical perfection. Like many other Oriental tongues, it was at first purely monosyllabic, but as the Pali and Sanskrit have been literally engrafted on it, polysyllabic words have been formed. Its pronouns and particles are peculiar, its idioms few and simple, its metaphors very obvious. It is copious to redundancy in terms expressive of royalty, rank, dignity; in fact, a distinct phraseology is required in addressing personages of exalted station. Sententious brevity and simplicity of expression belong to the pure spirit of the language, and when employed impart to it much dignity and beauty; but there is no standard of orthography, nor any grammar, and but few rules of universal application. Every Siamese writer spells to please himself, and the purism of the one is the slang of the other. The Siamese write from left to right in a line unbroken by spaces, points, or capitals. When not written with a reed, using steatite or gamboge on folds of black native paper, the characters are engraved with a style on palm-leaves prepared for the purpose. The language of the court and of all the standard works is filled with entirely different terms, mostly from the Pali and Sanskrit. The more elegant books are composed of tablets of ivory or of palmyra leaves delicately prepared; the characters engraved on these are gilt, the margins and edges adorned with heavy gilding and flowers in bright colors. The sacred and scientific literature in the Pali is mostly very ancient and written on slips of palm; 4000 volumes of which, amid much that is absurd and fanciful, contain also a vast amount of what is true, real, and good in morals, philosophy, and religion. The Siamese have an extravagant fondness for the drama and for poetry of every kind. Their dramatic entertainments are mainly musical, combining rudely the opera with the ballet. Dialogue is often introduced, the favorite subjects being passages from the Hindoo Avatars, the epic *Râmâyana* and the *Mahâbhârata*, or from beautiful legends peculiar to Siam. Throughout their literature mythology is the all-pervading element; history, science, arts, customs, conversation, opinion, and doctrine are alike colored and flavored with it. The greater part of the literature of the Siamese deals principally with religious topics. The *Kamarakya*, or Booddhist ritual—a work for the priesthood only, and therefore, like others of the Vinnâyâ, little known—contains the vital elements of the Booddhist code, and, *per se*, is perfect. On this all writers, whether partial or captious, are of one mind. A sacred and mystic work, the *Parajika*, is read in the temples with closed doors by the priests and devotees exclusively; then there are the *P'hrajana paramita* (or "Transcendental Wisdom"); the *Lalita Vistara*, containing the life of the last Booddha; the *Dhamma Padam*, etc., which are freely taught in the schools attached to the monasteries. It is difficult to comprehend how the human soul, not aided by revelation, could have soared so high and approached so near the truth. Besides the five great commandments—not to kill, not to steal, not to commit adultery, not to lie, not to get drunk—every shade of vice, hypocrisy, anger, pride, suspicion, greed, gossip, cruelty to animals, is guarded against by special precept. Among the virtues commended we find not only reverence for parents, care for children, submission to authority, gratitude, moderation in time of prosperity, resignation and fortitude in time of trial, equanimity at all times, but virtues of the highest system of morality, such as forgiving insults and of rewarding evil with good. All virtues spring from *maitrî*, and this maitrî can only be rendered by charity and love. I may here add the testimony of Barthélemy Saint-Hilaire. "I do not hesitate to add," he writes, "that save the Christ alone there is not among the founders of religion a figure more pure, more touching, than that of the Booddha. His life is without blemish; his constant heroism equals his conviction; and if the theory he extols is false, the personal examples he affords are irreproachable. He is the accomplished model of all the virtues he preaches; his abnegation, his charity, his unalterable sweetness never belie themselves. At the age of twenty-nine he retires from the court of the king, his father, to become the saviour of men. He silently prepares his doctrine by six years of seclusion and meditation. He propagates it by the unaided power of speech and persuasion for more than half a century, and when he dies in the arms of his disciples, it is with the serenity of a sage who has practised goodness all his life, and knows that he has found the truth."

The most remarkable examples of Siamese art in painting are presented in the cartoons to be found on the walls of ancient temples. One that is still to be seen in the Watt Khiem Ma is especially noticeable. The practice of decorating walls and ceiling with paintings may be traced to a remote period of Siamese art, which has degenerated for want of kind fostering patrons. Nevertheless, they still paint with some cleverness on cloth, wood, parchment, ivory, and plastic material, as well as on silver and gold—a sort of enamelling; they also possess fair knowledge of effect in fresco. Their mosaics, executed in colored porcelain, glass, mother-of-pearl, and marble, represent chiefly flowers and sprays on a subdued background. The most remarkable work of this kind is that which is lavished on the temple Watt P'hra Këau, or temple of the Emerald Idol, the walls, pillars, windows, roofs, towers, and gates being everywhere overlaid with mother-of-pearl and profusely gilt. This temple is unquestionably one of the most remarkable and beautiful structures of its class in the Orient; the lofty octagonal pillars, the quaint Gothic doors and windows, the tapering and gilded roofs, are carved in an infinite variety of emblems, the lotus and the palm predominating. The altar is a wonder of dimensions—a pyramid 60 feet high, terminating in a fine spire of gold rising to the height of 100 feet. On every side of the altar are idols, all curious and precious, from the bijou image in sapphire to the colossal statue in plate gold. The floor is paved with diamonds of polished brass, which reflect the light of tall tapers that have burned on for more than 100 years, so closely is the sacred fire watched. The floods of light and depths of shadow about the altar are extreme, and the effect overwhelming. The Emerald Idol is about twelve inches high and eight in width. Into the virgin gold of which its headgear and collar are composed must have been stirred, while the metal was yet molten, crystals, topazes, sapphires, rubies, onyxes, amethysts, and diamonds; the combination is as harmonious as it is splendid. No wonder it is commonly believed that Booddha himself alighted on the spot in the form of a great emerald, and by a flash of lightning conjured the glittering edifice and altar in an instant from the earth, to house and throne him there. The Emerald Idol, however, is a part of the loot from the great temple of Maha Naghkon Watt, already described, and a trophy of the Siamese conquest of Cambodia.

The palaces, temples, and pagodas of the Siamese resemble the ancient Egyptian architecture, both in style and manner of decoration, and are not unworthy of European art. The temple of Watt Poh, where reposes in gigantic state the great sleeping idol, is one of these. Imagine a reclining figure 150 feet long and 40 feet high, overlaid with plate-gold, the soles of its monstrous feet covered with bas-reliefs inlaid with mother-of-pearl and chased with gold, each separate design distinctly representing the many transmigrations of the Booddha whereby he attained Nirvâna. Their structures are solid and endurable. The temples are beautifully situated amid spacious parks and avenues of trees, paved and enclosed by gardens, while their tapering pyramidal roofs, sculptured façades, and lofty *prachaidi* (spires, all painted, gilded, and glazed) are made vocal with tiny air-rung bells at all hours of the night and day, and resplendent beyond description in the sunlight. In the art of sculpture and modelling the Siamese are in advance of their civilization. Their music is agreeable, unwritten, simple, and plaintive. Bands of a variety of instruments, among which the kang-wong and tâkay most nearly resemble the piano, are a part of princely establishments, while the first and second kings possess each a fine band of foreign instruments, performed by natives under the instruction of a French musician.

The government of Siam is theoretically a duarchy, practically a monarchy; royalty seems to have taken such hold on their affections that it usurps the place of a religious sentiment. The person of the king is sacred. He is not only enthroned—he is enshrined. His rule is despotic, but it is tempered by law and not less revered custom. He may name his successor by will, but the royal or secret council, composed of twelve of the highest officers of state, determine whether that will shall be carried into effect. A second king, selected, like the first or supreme king, from the royal family, is also appointed by the secret council. The authority of this second king, however, is dependent on that of the supreme king, with exemption from the customary prostrations before the first king, whom he may salute by simply raising his hands and joining them above his head. But, like any lesser *ducus* of the realm, he must appear twice a year before his lord and renew his oath of allegiance by drinking of the consecrated water in the temple of the Emerald Idol. Somdelch P'hra Paramendr Ramesr Mahiswarer, who died Dec. 29, 1865, was the legitimate son of the supreme king, second of his dynasty, who reigned from 1809 to 1824; his mother was the lawful first queen-consort (as there are not only dual kings, but dual queens, which name is applied to the right- and left-hand wives of the supreme king of Siam). The late su-

preme king, Somdelch P'hra Paramendr Maha Mongkut, was his elder full-brother. On the death of their father (in 1824), and the accession by intrigue of their elder half-brother, Maha Mongkut entered the Booddhist priesthood, but his brother took active service with the reigning king, and was appointed superintendent of the army, artillery and Malayan infantry. In 1821 he became acquainted with English merchants and American missionaries, with whom he studied English. On May 26, 1851, after the coronation of his elder brother, he was appointed second king. On the birth of the second king's first son an American missionary, who was on terms of intimacy with the father, named the child "George Washington;" and that child, the Prince George Washington (Kroma Mun Pawarwijagan), is the present second king of Siam. In his palace, which he had rebuilt after the model of an English nobleman's residence, he led the life of a healthy, practical, and systematic student. The freshest publications of London found their way to his tables, and he heartily enjoyed the creations of Dickens. Of his elder brother, the late supreme king of Siam, it may safely be said that he was the most progressive of all the supreme rulers of Siam, of whom the native historians enumerate not less than forty from the founding of Ayodhya, the ancient capital, in A.D. 1350. He labored with enthusiasm for the diffusion of religion and enlightenment, and above all to promote a higher appreciation of the teachings of Booddha. Before the arrival of the Protestant American missionaries he had acquired some knowledge of Latin and the sciences from Jesuits. But when the Protestants came to Bangkok, he at once placed himself under the tutorship of the Rev. Mr. Caswell, an American missionary, under whose instruction he made extraordinary progress in advanced and liberal ideas of government, commerce, and even religion. Several commercial treaties of the first importance were concluded with foreign powers during his reign. The Siamese government voluntarily reduced the measurement duties on foreign shipping from 1900 to 1000 ticals (a tical is a silver coin of the value of 60 cents) per fathom of ship's beam. This was a brave stride in the direction of a sound commercial policy, and has attracted enterprising traders from all parts of the world, the imports consisting of shirting, prints, fine muslins, piece goods, crockery, machinery, opium, Mexican dollars, etc., from San Francisco and New York. The old silver tical has been replaced by a new coin, with the inscription of the elephant. The rate of interest is 30 per cent. The great inland trade is carried on by boats, which are at one and the same time the shop and home of the trader. The merchant service consists of numberless junks and vessels. Steam service was opened in 1855, and is rapidly increasing. Foreign steamers ply fortnightly with the mails between Bangkok and Singapore. In 1855 a new treaty of commerce was negotiated with the Siamese government by H. B. M.'s plenipotentiary, Sir John Bowring, which proved of great advantage to both parties; in 1856 a new treaty, substantially like that with Great Britain, was procured by Townsend Harris, Esq., representing the United States; and later in the same year still another, in favor of France, through H. I. M.'s envoy, M. Montigny. Before that time Portugal had been the only foreign government having a consul residing at Bangkok.

The name of Siam was first heard in Europe—*i. e.* in Portugal—in 1511, nine years after Alfonso d'Albuquerque, the great viceroy of the Indies, had landed on the coast of Malabar with his soldiers and conquered Goa, which he made the seat of the Portugo-Indian government and the centre of its Asiatic operations; and he made the name of Portugal so feared and respected in the East that many of the potentates in that region, and among them the kings of Siam and Pegu, sent embassies to him and sought his alliance and protection. As early as the fifteenth century the celebrated German traveller Mandelslohe visited Ayodhya, the capital of Siam, and called it "the Venice of the East." The Portuguese explorer Mendez Pinto, who was in Siam in the sixteenth century, gives a very favorable account of the country. In 1632 an English vessel is said to have reached Ayodhya, and to have found it in ruins, the country having been laid waste by the successive incursions of the Burmese. Since the way was opened to admit a resident consul of each of the treaty powers, millions of dollars have flowed into Siam annually by channels through which but a few tens of thousands had been drawn before. A new and superb palace was erected after the model of Windsor Castle, together with numerous royal residences in different parts of the country. In 1862 an English school was established at the court of Siam for the royal family, under the superintendence of an English lady, as well as a private printing-office. The nobility soon began to emulate the activity and munificence of their wise and progressive sovereign. So prosperous did the country become under the benign influence of foreign trade and civilization that treaties with almost every nation under the sun were speedily concluded, and the king found it necessary to accredit Sir John Bowring as plenipotentiary for Siam abroad. Early in this reign the appointment of harbor-master at Bangkok was conferred upon an Englishman; next came a French commander-in-chief of the army, but who since the defeat of the French by the Germans has been replaced by a Prussian. The armies of Siam are raised on the spur of the moment. These recruits are clothed, equipped with arms and ammunition, and "subsisted" with daily rations, but are not otherwise paid. The small standing army consists of infantry, cavalry, elephant-riders, archers, and private body-guards, and is yearly renewed by an annual service of three months paid by every subject in some form or other to the king, save by the Chinese, who are consequently triennially taxed. The king's private body-guard is comprised of picked men, permanent in office, well paid, clothed, and quartered. A custom-house has been established, and a police force composed of trusty Malays and commanded by an Englishman.

In his daily habits the late king, Maha Mongkut, was remarkably industrious and frugal. His devotion to the study of astronomy never abated. The French government having sent a special commission to observe the great solar eclipse of the sun in Siam, the Siamese government expended not less than $100,000 on this expedition. But the extraordinary excitement and exposure to the noxious atmosphere of the jungle, where the observations were made, proved inimical to the constitution of the king. On his return to Bangkok he was seized with a fever. He rapidly grew worse, and died Oct. 1, 1868. That very night, without disorder, the Senabawdee elected his eldest son, Somdetch Chowfa Chullalonkorn, to succeed him, and the prince George Washington as second king. The late king had 81 children, of whom upward of 70 were alive at his death. Polygamy—or, more properly speaking, concubinage—is very common in the country. The number of concubines is limited only by the means of the man. As the king is the source of all the wealth and influence, kings, nobles, and princes vie with each other in bringing their most accomplished and beautiful daughters to the royal harem. But the king may have only two wives of royal blood, whose offspring alone are legitimate. The late king had two queen-consorts, but not in conjunction. His concubines were unlimited in number. Marriage takes place as early as eighteen for males and fourteen for females. The religion is pure Booddhism; nevertheless, the lower classes, and even in some respects the more enlightened, are profoundly superstitious. They have peopled their spiritual worlds with gods, demons, and goblins, and to flatter or propitiate these, especially to enlist their tutelary offices, they commit or connive at enormous crimes. The most honorable disposal of the dead is by burning. White is the badge of mourning. At the cremations of royal persons thousands of dollars are expended; on all festive occasions the coffers of the kings and nobles are freely opened for the merry-making of the people.

Bangkok, the present capital of Siam, is the Venice of the East; a large network of water or water-roads takes the place of streets, intersected with light drawbridges. A large proportion of its inhabitants live in floating houses, which line both banks of the Mèinam. The city is surrounded by a battlemented and turreted wall; the grand palaces and the royal harem are situated on the right hand as you ascend the river, which encloses it on the W., while on the eastern side it is bounded by a deep canal. This spot of ground is encompassed by two walls running parallel to each other. Within the outer of these walls are the magazines, the royal exchange, the mint, the supreme courts of justice, the prisons, temples, and fantastic pleasure-grounds of the palace, with many elegant villas, theatres, and aviaries, some of which are richly gilt and ornamented. Near this, and surrounded by a high wall, which defends it from all entrance from without, is the harem. This is a sort of miniature city, with streets, shops, bazaars, gardens; halls where women-judges administer justice; barracks of the Amazons, who are 500 in number and divided into companies of fifties under commanding officers; gymnasia and theatres, and the quarters of the women of the harem. The southern part is occupied by mechanical slaves of the wives, concubines, and princesses attached to royalty; here they ply their various trades and occupations for the benefit of their mistresses. This woman's city is almost self-supporting, and has its own laws, judges, police-guards, prisons, and executioners, all women. Into this inner city no man is permitted to enter except the king and the priests, who are admitted under guard for alms and other sacred offices to be received or administered. The population is always changing, and

varies from 5000 to 9000 souls. The slave- and trade-women are allowed to go out to visit their husbands or on business for their mistresses, but the great princesses and ladies of the harem hardly ever leave it until they have by age and position attained to a certain degree of freedom. The second king has a similar court and miniature female city, smaller in some respects, attached to his palace, which stands higher up on the same bank of the Mèinam.

Somdetch Chowfa Chullalonkorn was nine years old when he commenced his English studies, and he seemed to overcome the difficulties and obstacles he encountered with a resolution that gained strength as his mind gained ideas. He was handsome in person, modest, affectionate, and eager for knowledge. A prince in Siam, though legitimate heir to the throne, may be rejected by the secret council should they find him morally or physically incapacitated. But on the death of the late king this prince was unanimously elected to the throne, and was crowned Nov. 11, 1868. One of his first acts on coming to the throne was to liberate unconditionally all the state prisoners in his kingdom on the occasion of his father's cremation. Shortly after this he issued a remarkable proclamation giving perfect religious freedom to all his subjects. In 1871 he visited the islands of the Malayan peninsula; on his return to Bangkok he adopted several reforms, permitting those of his subjects who would wear a semi-European dress to stand erect in his presence, thus abolishing the degrading custom of prostration. From time immemorial there has existed in Siam a mixed system of slavery, in part resembling the old system of English feudal service, in part the former serfdom of Russia, and again in part the peonage of Mexico. Three-fourths of the population were either branded with the mark of their owners, or held by their creditors in a form of qualified servitude to work out a debt. On the first opportunity that offered the king urged before his secret council the abolition of slavery. In 1871 he caused a royal proclamation to be made that from Jan. 1, 1872, slavery should cease to be an institution of Siam, and that a general tax, according to the circumstances of each and every man, should be levied on the nation to remunerate the slaveholders for the loss of their slaves; since which date slavery is gradually dying out, and a new era is at hand for this nation and kingdom. To the united influence of an English education and Christian missionary zeal Siam unquestionably owes much, if not all, of her present advancement and prosperity. In this respect the Rev. Messrs. Bradley, Caswell, House, Mattoon, and Dean are entitled to special mention.

The Siamese months are lunar, and each is divided into two parts, the waxing and waning moon. Six of the months have 30, and six 29 days. They have an intercalary month of 30 days every third year, to compensate for the deficiency of 11 days required to make the full solar year, there being still a loss of about 3 days in nineteen years. This is supplied by an arbitrary addition of a day to the seventh month of some favored years. They have two cycles, one within the other; the greater is 12 and the lesser 10 years in duration. Every year in each cycle has its own peculiar name. Their sacred era is reckoned from the death of the Booddha (2415). Their civil era is reckoned from the time of its establishment (1233) by P'hra Rooang, a Siamese king of great celebrity. A. H. Leonowens.

**Siamese Twins.** See Eng and Chang.

**Sibe'ria,** the name of the whole northern part of Asia, belonging to Russia, and bounded N. by the Arctic Ocean, E. by different parts of the Pacific Ocean—namely, the Strait of Behring, the seas of Kamtchatka, Okhotsk, and Japan—and W. by European Russia, from which it is separated by the Ural Mountains and the river Ural. Its southern boundary has varied very much, as it has been thrown farther S. after every war with China and the independent empires of Central Asia. It seems now, however, to have been finally fixed, since the Russian conquests in Central Asia have been formed into a separate political division, and it follows pretty nearly the circle of lat. 50° N. The area, population, and administrative divisions of this immense territory are shown by the following table, whose figures, however, are estimates only, not actual measurements:

| Provinces. | Area in Eng. sq. m. | Population. |
|---|---|---|
| Littoral | 708,253 | 43,320 |
| Amoor | 107,514 | 22,297 |
| Yakootsk | 1,500,141 | 228,363 |
| Transbaikal | 210,799 | 350,843 |
| Governments. | | |
| Irkootsk | 279,963 | 372,833 |
| Yeniseisk | 958,042 | 350,848 |
| Tomsk | 329,783 | 784,268 |
| Tobolsk | 565,920 | 1,105,855 |
| Total | 4,660,415 | 3,327,627 |

There is considerable difference between the eastern and western parts of Siberia, the eastern part being higher, with a more rugged surface and a more rigorous climate. While Western Siberia is one unbroken plain, the southern and eastern districts of Eastern Siberia are mountainous, covered by the Altai Mountains (which form the boundary between Siberia and Mongolia, and send numerous branches N. toward Lake Baikal) and the Stanovoi Mountains (which run N., parallel with the Sea of Okhotsk, which they face with a line of bold and precipitous rocks). These mountains, however, are not high, and in general Siberia may be described as a plain, sloping from S. to N. toward the Arctic Ocean; and a general view of the surface of this plain may be given by dividing it into three longitudinal belts. The northernmost belt, extending along the shore of the Arctic Ocean, consists of swamps frozen several feet below the surface, and for hundreds of miles the ocean is covered with thick ice, so that during winter it is impossible to ascertain where the land ceases and where the sea begins. In summer the ice of the ocean breaks up and floats in huge icebergs, which make navigation dangerous, not to say impossible, and on the mainland the sun succeeds in thawing the ground for a couple of inches, calling forth a thin cover of pale moss. Immense herds of wild reindeer inhabit the northern regions during the long, bleak summer day, when for three months the sun never sets, and turn their course toward the S. when the winter night comes, during which, for three months, no light but the cold streaks of the aurora borealis is to be seen in the sky. The polar bear and the black fox abound; the rivers teem with salmon and sturgeon, and innumerable whales and seals haunt the coast during the summer. The middle belt is one continuous forest of fir, pine, larch, and birch, feeble and stunted when it tries to creep farther N. than lat. 64°, but at lat. 62° generally of a vigorous growth, and swarming with sables, ermines, marmots, martens, squirrels, lynxes, wolves, bears, and beavers; the wild-boar, the wild-sheep, and the Caspian antelope are also found here, and here the human settlements begin. They are of course few, and hunting is the only occupation, but the furs exported from this part of Siberia form an important item in Russian trade. The southern belt is agricultural; in some parts it consists of steppes, best adapted for cattle-breeding; in others all the common European grains and fruits, even the grape, are grown with perfect success.

About three-fourths of the inhabitants of Siberia are Russians, mostly exiles and their descendants. In the seventeenth and eighteenth centuries the inhabitants of whole counties of European Russia were transferred to Siberia because they were dissenters from the Russian Orthodox Church, and settled here as regular colonists, enjoying full social liberty and prospering; meanwhile, their places on the soil of Russia were filled with German Protestants. Since then the Russian government has sent its political dissenters to Siberia, sometimes incorporating them in the Siberian army, but often putting them to work in the mines with the meanest criminals. The Ural, Altai, and Stanovoi mountains are exceedingly rich in minerals, and mines of every description, gold, silver, copper, lead, iron, salt, and coal, are extensively worked. But the greatest sufferings which modern civilization in Europe has heard of are connected with these mines, and at one time it was generally understood in Europe that more noble intellect and more mental vigor were wasted in the subterranean galleries of the Siberian mines than were employed in the governmental palaces of St. Petersburg. The most remarkable of the native tribes are the Ostiaks in the W., the Calmucks in the Altai, the Booriats, of Mongolian origin, the Toongooses, of Tartar origin, and the Tchooktchees, related to the Esquimaux, in the E. and N.; they are mostly pagans, and live by fishing and hunting.

A peculiar feature of Siberian life is its trade, very extensive as far as regards its own products—furs, skins, metals, fish, caviare, cattle, and grain—and still more extensive as a transit-trade by which large quantities of tea, silk, satin, and rhubarb from China are exchanged for metals, furs, cotton goods, and cutlery from Russia. On account of the vast dimensions and the thin population of the country it is necessary to fix times and places where buyers and sellers are sure to meet each other; and from these Siberian fairs, of which that of Kiakhta generally has transactions to the value of $15,000,000, large caravans of camels start for the S., while long trains of sledges, drawn by reindeer or dogs, set out for the N. and N. W. The commercial centre of Siberia is Tobolsk, from which the direct highway across the Ural Mountains leads to Perm, which has water-communication with different parts of the country. Clemens Petersen.

**Sib'ley,** county of S. Minnesota, on Minnesota River, includes Lake Minnetonka, 30 miles in length, has a rolling surface and a productive soil. Staples, wheat, Indian

corn, oats, hay, butter, and wool. Cap. Henderson. Area, about 525 sq. m. P. 6725.

**Sibley,** p.-v., cap. of Osceola co., Ia., on Sioux City and St. Paul R. R., 76 miles N. E. of the former city, has 2 churches, 1 graded school, 2 banks, 1 newspaper, a court-house and county jail, 2 hotels, 1 grain-elevator, 3 grain-warehouses, and a park. P. about 500.

HAWXHURST & REED, EDS. "GAZETTE."

**Sibley,** tp., Cloud co., Kan. P. 309.

**Sibley,** tp., Keweenaw co., Mich. P. 47.

**Sibley,** p.-v. and tp., Sibley co., Minn. P. 272.

**Sibley** (GEORGE CHAMPLAIN), b. at Great Barrington, Mass., in 1782, son of Dr. John, a surgeon in the war of the Revolution, and grandson of Rev. Dr. Samuel Hopkins; spent his youth in North Carolina; was appointed an Indian agent by Pres. Jefferson; explored the Grand Saline and Salt mountains with a band of 100 Osage warriors, and published a report of the expedition; settled in Missouri; became a major in the regular army of the U. S.; was a commissioner to survey a trading-route from Western Missouri to New Mexico; made several treaties with the Indians; was many years a public-spirited resident in St. Charles co., and was a trustee and liberal benefactor of Lindenwood College and an outspoken anti-slavery worker. D. at Elma, Mo., Jan. 31, 1863.

**Sibley** (HENRY H.), son of Judge Solomon, b. at Detroit, Mich., Feb., 1811; was many years an Indian trader in the service of the American Fur Company at Mackinaw and Fort Snelling; was delegate in Congress from Minnesota Territory 1849–53; chosen first governor of the State of Minnesota 1858; became brigadier-general of volunteers Sept. 29, 1862; commanded a successful expedition against the hostile Indians on the W. frontier of Minnesota 1863; was brevetted major-general of volunteers, and was a delegate to the soldiers' and sailors' convention of 1866.

**Sibley** (HENRY H.), b. in Louisiana July, 1816; was graduated from the U. S. Military Academy July 1, 1838, when appointed second lieutenant of 2d Dragoons; first lieutenant 1840, captain 1847, and major 1st Dragoons 1861; served in Florida war 1838–39 and 1840–41; adjutant of his regiment 1841–46. In the war with Mexico he participated in the siege of Vera Cruz, battles of Cerro Gordo, Contreras, Churubusco, Molino del Rey, and final capture of the City of Mexico, gaining the brevet of major for gallantry in the affair at Medelin, near Vera Cruz, Mar. 25, 1847. Subsequently and prior to the civil war he was actively engaged on frontier duty and on numerous expeditions, notably the Utah expedition (1857–58, 1859–60), and that against the Navajoes (1860). The breaking out of civil war in 1861 found him in New Mexico, where he resigned from the U. S. army simultaneously with the arrival of his major's commission (May 13), and entered the Confederate service, in which he was soon a brigadier-general. Having organized a brigade in N. W. Texas, he left Fort Bliss in Jan., 1862, with between 2000 and 2500 men, to effect the conquest of New Mexico, and Feb. 16 appeared before Fort Craig, commanded by Col. E. R. S. Canby. The action of Valverde was fought Feb. 21, closing by the withdrawal of Col. Canby's troops to the fort. Albuquerque and Santa Fé were occupied by Sibley in March, but the following month he was compelled to evacuate the territory and return to Fort Bliss. At the close of the war he entered the service of the khedive in Egypt. He is the inventor of the tent known by his name. (See TENT.)

**Sibley** (HIRAM), b. at North Adams, Mass., Feb. 6, 1807; removed early to W. New York, and engaged in manufacturing machinery. Becoming interested in telegraph-lines, he found that they were operated under four different patents requiring several companies, and generating competition so ruinous that with $7,000,000 invested in the business no profit had accrued. He conceived the idea of consolidating all the companies into one, so as by economy and system to make the business profitable. Associating a few gentlemen with himself, he bought or leased several worthless lines, until finally over twenty corporations were merged into the Western Union Telegraph Co. He thus solved the problem of telegraphing for our country by making the business pay on the investment. Large profits resulted to the stockholders and great benefit to the community. Mr. Sibley subsequently conceived the idea of a line to California, and was mainly instrumental in carrying through Congress, in the face of the most intense skepticism, a bill which secured a line to the Pacific coast. He also completed negotiations with the British and Russian governments for a European line *viâ* Behring Strait, should the Atlantic cable have proved a failure. Few if any have surpassed Mr. Sibley in the successful efforts which first made telegraph-lines profitable and practicable, and by consequence the business and social servants of mankind. Mr. Sibley is using his wealth intelligently for benevolent ends. He has expended $25,000 in erecting a church in his native place, $100,000 in an edifice and endowment for teaching the mechanical arts in Cornell University, and $100,000 on a fireproof library building for the University of Rochester.

**Sibley** (JOHN LANGDON), b. at Union, Me., Dec. 29, 1804; graduated at Harvard 1825; was assistant librarian there 1825–26; ordained as a Unitarian minister at Stow, Mass., May 4, 1829; preached there until Mar., 1833; became in 1837 editor, and afterward proprietor, of the *American Magazine of Useful and Entertaining Knowledge;* was again assistant librarian at Harvard from 1841 to 1856; since which time he has been at the head of that library, the most important in America in many respects; has edited since 1841 the *Triennial Catalogues* of Harvard, and since 1850 the *Annual Catalogues;* has published a *Notice of the Triennial Catalogues of Harvard University, with a Reprint of those of 1674, 1682, and 1700* (1865); is author of a *History of Union, Me.* (1851), considered a model town-history, and has prepared copious biographies of the early graduates of Harvard, of which vol. i. appeared 1873.

**Sibley** (SOLOMON), b. at Sutton, Mass., Oct. 7, 1769; became a lawyer; settled at Marietta, O., 1795, at Cincinnati 1796, and at Detroit 1797; was a member of the first legislature of the North-west Territory 1799, a delegate to Congress from Michigan Territory 1820–23, and judge of the supreme court of Michigan 1824–36. D. at Detroit Apr. 4, 1846.

**Sib'thorp** (JOHN), M. D., F. R. S., b. at Oxford, England, Oct. 28, 1758, son of Dr. Humphrey Sibthorp, professor of botany; graduated at Oxford University about 1778; obtained a Radcliffe travelling fellowship; studied medicine at Oxford, Edinburgh, and on the Continent; made botanical researches in France and Switzerland; became professor of botany at the College of Physicians 1784; made a botanical tour in Southern Italy, Crete, Cyprus, Asia Minor, parts of European Turkey, and Greece Mar. 1786–Sept., 1787; succeeded his father as professor of botany at Oxford; was one of the founders of the Linnæan Society; was given the title of regius professor 1793; made a second and more minute botanical exploration of Greece and the Ionian Islands 1794–95; published the *Flora Oxoniensis* (1794), and d. at Bath Feb. 8, 1796. He bequeathed to the university £1200 per annum for the publication of his great work, *Flora Græca,* which was edited by J. E. Smith and John Lindley (20 vols., royal folio, with 1000 colored plates, 1807 *seq.*).

**Sib'yl** [Gr. *σίβυλλα*] was the common name given by the Greeks, and subsequently by the Romans, to all old women who were believed to be possessed of prophetic gifts, and whose advice and help were consequently eagerly sought by superstitious persons. The most famous of these women was the Cumæan sibyl, so called after Cumæ, in Campania, where she resided. She brought nine books of oracles and prophecies to Tarquinius Priscus, king of Rome, but the price she asked for them was so enormous that the king declined to buy them. She then burned three of the books, but asked the same price for the remaining six. When the king still refused to pay the price, she burned three more books, and he now paid for the last three the sum originally demanded for nine. These books were preserved in the temple of Jupiter Capitolinus, and were held in great respect. But in 83 B. C. they were destroyed by fire, together with the temple. A collection of sibylline oracles was then made in Italy, Greece, Asia Minor, Egypt, and Libya, and having been thoroughly sifted by a committee of knowing men, it was deposited in the new temple of Jupiter Capitolinus, where it was destroyed by Stilicho in the fifth century A. D. Under the title of *Sibylline Oracles* there still exists a collection of Greek verses of Jewish, Christian, or pagan origin, probably made in the second or third century A. D. It was edited with a Latin translation by Alexandre (2 vols., Paris, 1841–53). (See Ewald, *Abhandlung über Entstehung, Inhalt und Werth der sibyllischen Bücher,* 1858.)

**Sicard'** (ROCH AMBROISE CUCURRON), b. at Fousseret, department of Haute-Garonne, France, Sept. 20, 1742; studied theology and took holy orders at Toulouse; was sent by the archbishop of Bordeaux to Paris to study the method of Abbé de l'Epée; became director in 1786 of a school for deaf-mutes at Bordeaux; succeeded De l'Epée in 1789 as director of the school of Paris; was imprisoned as a royalist in 1792, and barely escaped with his life during the September riots; was again suspended by the Directory in 1795 from his position as editor of *Annales catholiques,* but resumed his office in 1799. D. at Paris May 10, 1822. He wrote *Mémoires sur l'Art d'instruire les Sourds de Naissance* (1789), *Catéchisme à l'Usage des Sourds-muets* (1796), *Cours d'Instruction d'un Sourd-muet* (1800),

and *Théorie des Signes pour l'Instruction des Sourds-muets* (1808).

**Sicil'ian Vespers,** the name usually given to the outbreak of the insurrection of the Sicilian people against the French usurper, Charles of Anjou, at Palermo on Easterday, Mar. 30, 1282. Pope Urban IV. had deposed the infant sovereign of the Two Sicilies, and in 1265 bestowed that kingdom upon the bigoted Charles of Anjou, who was as notorious for his vices as his brother, King Louis IX. of France, was conspicuous for his virtues. Charles took forcible possession of the kingdom, suppressed the provincial and municipal jurisdictions in Sicily, superseded the native authorities by French favorites and adventurers, and converted the government into an oppressive and unmitigated despotism. This was long borne without organized resistance, but the brutality of a French soldier toward a young lady in a religious procession to a sanctuary at Monreale, at the hour of sounding the vesper-bells on the festival above mentioned, produced an explosion of popular resentment which began by the instant massacre of the French soldiery present, and ended with the slaughter of most of Charles's foreign and native adherents throughout the island, and the final overthrow of his domination in Sicily. This is the received account, which differs, however, in some respects from the results arrived at by historical research. (See Amari, *La Guerra dei Vespri Siciliani*, Palermo, 1842, 2 vols.; many times reprinted.)

GEORGE P. MARSH.

**Sic'ilies, The Two** [*Reame*, or *Regno Delle Due Sicilie*], the legal designation of a political state popularly called the kingdom of Naples, founded by the Norman dynasty in the Middle Ages, and comprising the S. E. provinces of Italy, Sicily, and some smaller islands near the coast, among which Ischia, Procida, Capri, in the Parthenopæan group, the Lipari or Æolian and the Egadi archipelagoes, and Pantellaria, are the most conspicuous. The mainland provinces composed what were styled the *dominio al di quà del Faro;* Sicily and the adjacent islands were called the *dominio al di là del Faro*, Faro ("lighthouse") being the name commonly given to the Strait of Messina, 2 miles wide at its narrowest point, which divides Calabria from Sicily. The possessions of the state, which had no foreign dependencies, lay between N. lat. 36° 45′ and 42° 52′ and E. lon. 11° 55′ and 18° 32′, and contained about 33,000 sq. m., or not far from two-sevenths of the superficial extent of the present kingdom of Italy. (For the description and special history of the insular portion of the kingdom of the Two Sicilies see SICILY, ISLAND OF.) The continental territory of the Two Sicilies embraced the foot and ankle of the *stivale* (or "boot") to which the form of the Italian peninsula is compared. It was bounded N. W. by the Pontifical States, from which it was separated by the Liri or Garigliano on the Tyrrhenian, by the Tronto on the Adriatic coast; N. E. by the Adriatic; S. E. by the Ionian; and S. W. by the Tyrrhenian Sea. It included a considerable part of the first and fourth, and the whole of the second and third, *regions* into which Augustus Cæsar divided Italy, or the southern portion of Latium, Somnium, and Picenum, and the entire districts of Apulia, Lucania, and Bruttium. (A description of the maritime outline will be found in the article ITALY.) In the long period between the downfall of the Roman and of the Napoleonic empires its various provinces underwent many changes of boundary, designation, and government. At the establishment of the Hohenstaufen dynasty almost the whole soil was absorbed in the duchies of Spoleto and Apulia, and Calabria; under Napoleon I. it became the kingdom of Naples; and at the general pacification of Europe in 1815 it was reunited with Sicily under the ancient style of the kingdom of the Two Sicilies, which it retained until, by the *gran dono* of Garibaldi to Vittorio Emanuele II. in 1860, it was incorporated, with the other possessions of the dynasty of Savoy, into the kingdom of Italy. The old peninsular territory of the Two Sicilies is now divided into 16 provinces grouped in 5 compartments: Abruzzi and Molise, Campania, Apulia, Potenza or Basilicata, and Calabria. (For the names, areas, and population of the provinces in 1861 and 1871 see ITALY.) The territory of these provinces consists chiefly of the main and subordinate chains of the Southern Apennines and their lateral ramifications, with valleys, plateaus, morasses, and lakes interspersed between the mountain-ridges. A considerable part of both the eastern and the western coasts has been shoaled, and the harbors which once indented the sea-shore filled up by mineral and vegetable matter brought down by the numerous torrents, aided by sand washed in by the sea, and the overflowing mountain-streams have often spread out in their lower courses wide expanses of fluviatile deposit rich in the elements of vegetable life, but exhaling pestilential miasmata which render them unfit for the abode of man. (See the official report of Rafaele Pareto, *Sulle Bonificazioni, Risaie e Paludi del Regno d'Italia*, 1865.) There are, however, in the continental territory of the Two Sicilies great plains of a different origin and character. Thus, the ancient Campania, corresponding in part to the modern Terra di Lavoro, though broken by Vesuvius and other eruptive elevations, is in great part level, composed of volcanic soil of exuberant fertility and enjoying a not insalubrious climate. There is also the Tavoliere, or plateau of Apulia, on the N. E. slope of the Apennines, with a comparatively level general surface, and forming a sort of vast common of pasturage. The Tavoliere belongs chiefly to the public domain or to great proprietors, and its administration has been a source of much embarrassment to the successive governments of this part of Italy. The Neapolitan Mountains are higher and generally with broader bases than those of Central and Northern Italy. Monte Corno, or the Gran Sasso d'Italia, near the former pontifical frontier, rises to the elevation of 9312 feet, and is the loftiest peak in the whole chain of the Apennines. Monte Amaro is 9131 feet high, and Monte Velino measures 8180 feet; Monte Meta, 7835, and Monte Pellino, 7070, are also loftier than any of the Apennine summits in Central and Northern Italy. The height of Vesuvius is variable, because the great central cone of eruption sometimes rises 300 feet above the lip of the crater, sometimes sinks 2000 feet below it. The Punta del Palo, a rock on the northern edge of the crater at the height of 3944 feet above the sea, appears to be substantially stable, and when the volcano is at rest is the highest point of the mountain. The eruptive rock from Vesuvius, and from other now inactive volcanoes in the same region of comparatively late geological date, like Vesuvius itself, have given a special character to the surface of a large district, of which Naples is approximately the centre; and though the peninsular territory of the Two Sicilies is very irregular in outline, as well as in hypsometric configuration, it has no very marked great geographical divisions, if we except that between the volcanic district, of recent origin, and the regions of older geological formation.

Although there are extensive forests in various parts of the kingdom, the woods have been generally felled in the easily-accessible regions, and fires, with the pasturage of black cattle and goats, have reduced most of the remainder to a perishing condition. The soil has thus been deprived of its natural protection, and the winter rains have bared much of the mountainous territory of the kingdom not only of herbaceous vegetation, but of the earth which once covered the rocky hills. From the same cause the permanent mountain-springs have been dried up, the pastures have lost their old luxuriance, and the upland plateaus of the interior are without water for irrigation, which, in that climate, is a prime necessity of agriculture.

The most important lake is, or rather was, the Fucino or Lago di Celano, lying 50 miles E. from Rome, at the height of 2200 feet above the sea, and covering some 40,000 acres, lately drained and converted into a vast expanse of most productive soil by the enterprise of Prince Alessandro Torlonia. (See FUCINO.) There are also some large fresh and many salt water lagoons along the coast, especially on the Adriatic shore. (See the report of Pareto, above referred to.)

The width of the Neapolitan territory, measured normally to its length, scarcely anywhere exceeds 100 miles, and the watershed of the Apennines, which, though with many sinuosities, runs in general approximately parallel with the coasts, has few interruptions, and lies everywhere at a considerable elevation. From this configuration of surface the course of the rivers which drain, but can hardly be said to water, the soil is generally short and rapid. Hence, their volume is not considerable except in the rainy season, when they often swell to formidable torrents. The chief rivers, besides the boundary-streams, the Tronto and the Garigliano or Liri, are the Pescara, the Sanaro, and the Ofanto, emptying into the Adriatic; the Bradano, Vasenti, and Agri, which discharge their waters into the Gulf of Taranto; and the Volturno and Sele, tributaries of the Tyrrhenian. The Garigliano is boatable below Pontecorvo, but otherwise none of these rivers are in any way navigable, though the estuaries of some of them form small ports or anchorages; and neither the Garigliano nor the Volturno, the two largest, and which flow for a considerable distance in valleys parallel with the coast, has a total length of more than 100 miles.

The general traits of the geology and mineralogy of Southern Italy are sufficiently well known, but the difficulty of penetrating the inhospitable interior districts has prevented much special examination of the stratigraphy of the inland territory, and the superior attractions of the Vesuvian regions, the great volcanic laboratory of continental Europe, have almost exclusively absorbed the atten-

tion of scientific investigators. In the northern provinces the central mountains are of calcareous and serpentine formation or of arenaceous and conglomerated rock, and with overlying Jurassic strata. Great beds of gypseous rock and much sulphur also occur. On the lower elevations rest extensive Tertiary strata, containing, among their fossils, shells apparently identical with existing species. Further to the S. the mountains are granitic, with Secondary deposits. The volcanic rocks, derived not only from Vesuvius, but from other long extinct craters, belonging to the same system, are extensive, and the frequency of the eruptions of Vesuvius and the accessibility of all the deposits of volcanic origin have offered such facilities for the study of eruptive phenomena as do not exist elsewhere in Europe. The volcanic character of Vesuvius was hardly suspected by the ancients until the destructive eruption of A. D. 79 suddenly revealed its true nature, and there have since occurred long periods of rest during which the external slopes, and even the interior walls of the crater, have been covered with woods and pastures. But for the last two centuries and a half eruptions have been frequent, and several of them, as in 1822 and in 1872, have been of extraordinary violence. The volcanic ashes of ancient eruptions have been spread over a wide extent of plain as arable soil or hardened into tufaceous rock, sometimes by rain and other atmospheric agents on the surface, at others by the action of sea-water into which the eruptive matter fell. In some cases these deposits appear to have been of submarine ejection, in others they have been submerged, and again raised by the alternate subsidence and elevation of the land, which is so strikingly exemplified at Pozzuoli. The fact of the occurrence of sea-shells in these strata is not always conclusive evidence that they were ever covered by the sea; for if we are to believe the reports of Braccini and Father Ignatius, marine shells were thrown out from the crater in the eruption of 1631, having been drawn into the abyss from the sea with the water, the absorption of which into the focus of the volcano is counted by some among the causes of volcanic outbreaks.

Among the phenomena allied to volcanic energy which occur in this territory we may mention mineral springs, very various in composition and temperature of water, gaseous exhalations, and especially the earthquakes, which are more frequent and destructive than is generally known abroad. The earthquake of 1783 is widely celebrated both from its violence, and from the fact that its force was chiefly exerted in easily-accessible and familiarly-known provinces; but that of 1857, which laid waste an inland territory lying mainly in the province of Potenza, was not less violent, and was perhaps equally destructive, though it did not attract the general attention of Europe in so high a degree. Examples of almost all known volcanic products are found among the ejections of Vesuvius or in those of older date, distinguished as belonging to Somma. (On this subject see Phillips, *Vesuvius*, London, 1869, and later editions, and in the article VOLCANOES.) The mineral resources of Southern Italy have not yet been thoroughly explored, and, though very various, they are not relatively of great present economical importance. Ores of iron, copper, lead, and silver occur; petroleum is obtained in Calabria by sinking wells; lignite, manganese, sulphur, salt, marbles, ceramic clays, and aluminiferous rock are abundant, and many of the deposits of these minerals are utilized to an extent not only sufficient to meet the domestic demand, but to furnish considerable contributions to commerce.

There are few animal or vegetable species peculiar to the Neapolitan territory, though strong-winged birds, properly African in *habitat*, are not unfrequently seen in Southern Italy, and the bear and some other of the larger quadrupeds, very rare in the more cultivated regions of the peninsula, still furnish sport for the chase. The markets of Naples and other southern cities are remarkable for abundance and variety of fish. Sardines, anchovies, and the tunny are cured in great quantities. The *Pinna marina* is common on the S. E. coasts, and its silky filaments have a certain value as a beautiful material for knit-work and even woven tissues. The red or precious coral occurs in Neapolitan waters, though most of the coral, as well as turtle-shell, so skilfully wrought by Neapolitan artisans, is from the African coasts. The only European palm, *Chæmerops humilis*, is thought to be indigenous in the southern provinces of the kingdom of Naples.

The elevation of the mountains of the interior of course occasions a great range of climate. Monte Corno is said to be covered with snow nine months in the year, but the cooling influence of this and other high inland peaks and ridges is modified by the sea-breezes to which every portion of the narrow peninsula is more or less accessible, and the climate everywhere partakes of an insular character. There are very few meteorological stations in the interior, and the mean temperature and precipitation are scarcely known except at one or two observatories. From 1866 to 1872, at Catanzaro in Calabria, 10 miles from the Ionian coast, at an elevation of 1000 feet above the sea, the mean temperature was 60½° F., the extremes 26⅓° and 93½°; at Naples the mean was 63½°, the extremes the same as at Catanzaro; the mean precipitation at Naples was 35½ inches. (See ITALY.) Upon the whole, the climate of the Neapolitan territory cannot be said to be more unhealthy than that of other countries in the same latitude, though extensive districts in the southern provinces, anciently salubrious and densely populated, are now malarious and no longer habitable.

The agricultural products of the Neapolitan provinces are those of the peninsula generally, corn, wine, and oil being the most important. Madder and liquorice are largely grown. The almond, important for its oil as well as its kernel, the peach, the fig, and the other fruits of the cooler temperate zone are also abundant. The lemon, orange, citron, and lime, in their hundredfold varieties, grouped by the Italians under the general name of *agrumi*, have far greater prominence in rural industry than in Central and Northern Italy, where, except in some favored localities, these fruits must be treated as exotics. The culinary vegetables, which, though of great moment in domestic economy, figure little in public finance, grow luxuriantly, and Naples supplies *primeurs*, or first fruits, not only to Northern Italy, but to countries far beyond the Alpine frontier. It is an important characteristic of Neapolitan agriculture that the dryness of the summers makes irrigation necessary for almost every cultivated crop.

The clothing, furniture, and ordinary tools and implements of labor of the mass of the population are largely the product of household industry, and the laborer has few wants which his native soil does not supply; while the upper classes derive the necessaries, the comforts, and the elegancies of life in great proportion from the same industrial sources as the rest of civilized Europe. There are, however, at Naples and some other points important foundries, forges, and other mechanical and chemical establishments, which not only render the southern provinces in a certain degree independent of foreign supplies of such products, but furnish important material, among which blue vitriol and sulphuric and other acids deserve special mention, for commerce.

The seaports and the adjacent territories of the Neapolitan provinces were occupied at the earliest period of which we have precise historical knowledge by Greek colonists. The extent of these settlements was such that, though they do not seem ever to have been united in a common political organization, or to have enjoyed full possession of the inland districts, the whole of Southern Italy was regarded as essentially Greek, and was vaguely known by the general designation of Magna Græcia. Many of the cities of Magna Græcia rose to great wealth and high social culture, but internal dissensions and wars with the aboriginal populations and with each other, together with earthquakes, pestilence, and other natural calamities, reduced their power after a comparatively brief period of opulence, luxury, and strength; they became involved in entangling alliances and hostile conflicts with foreign powers, and their participation in the Pyrrhic and the Punic wars, whether as allies or as enemies of Rome, opened the door for the intervention of that powerful people in their political affairs, and finally to their conquest and incorporation into the great Italic republic. From this period they became Roman provinces, and for centuries had no longer a special common history. After the Moors had conquered Sicily, they reduced a considerable part of the southern provinces of the Italian peninsula, and plundered many rich towns, sometimes acting independently, and sometimes as condottieri or mercenary allies of the native princes and barons. The Normans tore Sicily from the Mussulmans and established themselves under different leaders in Lower Italy. In 1059 the Norman Robert Guiscard made himself duke of Apulia and Calabria. In 1130, Roger, of the same family, was crowned at Palermo king of the Two Sicilies, and soon reduced to submission the cities and provinces of Southern Italy, which had still maintained an independent government. The most noteworthy points of historical interest in the chaotic era which preceded the consolidation of the kingdom under Roger are the rise of the rocky nook of Amalfi to the rank of a great commercial state, which it held till the loss of its independence in 1059 and the contemporaneous rivalry of Pisa reduced it to insignificance; the establishment of the great medical school of Salerno, due, in part at least, to the diffusion of Saracenic culture; and the foundation of the celebrated monasteries of Monte Casino and La Cava, the important archives of both of which are now in course of publication. In 1194 the emperor Henry possessed himself of the kingdom, and it remained in the family of the Hohenstaufens till 1266, when

Manfred, the occupant of the throne and uncle of the lawful heir, Conradin, was defeated and slain by Charles of Anjou, upon whom Pope Urban IV. had bestowed the crown. Conradin was taken prisoner, and in 1268 put to death by Charles, bequeathing his kingdom to Pedro III. of Aragon, son-in-law of Manfred. The history of the war waged by Peter for the recovery of the bequest, which resulted in the expulsion of Charles and his adherents from the island of Sicily, is most picturesquely narrated by the Catalan chroniclers Ramon Muntaner and D'Esclot, and in a more philosophical spirit by Amari, in *La Guerra dei Vespri Siciliani*. The Angevine dynasty, restricted to the *dominio al di quà del Faro*, was dispossessed in 1442 by Alfonso V. of Aragon, who bestowed this territory on his natural son Ferdinand. Charles VIII. and Louis XII. of France successively attempted the recovery of the kingdom, with partial success, but in 1504, Sicily was again united with Naples under the Spanish crown, and governed by viceroys until 1713, with the exception of a short interval when a successful revolt under Masaniello temporarily liberated the Neapolitan provinces from foreign rule. The Peace of Utrecht gave Naples to the emperor Charles VI., but it was recovered by Spain in 1734 and given to the Infant Don Carlos under conditions which virtually separated it for ever from the Spanish crown. The long reign of Ferdinand IV., the successor of Don Carlos, was marked by the expulsion of the Jesuits, the conquest of the kingdom, and its erection into the Parthenopæan republic by the French, the restoration of Ferdinand, his second expulsion from his continental states, though retaining Sicily, the successive accessions of Joseph and of Murat, Ferdinand's return to Naples in 1815, and the revolt of 1821, which was suppressed by Austria. The reign of Ferdinand, though useful reforms were adopted at its commencement, was characterized by an unenlightened policy, by tyranny, by political corruption, and by cruelty in the suppression of discontents and the punishment of the instigators of revolt. After the suppression of the insurrection of 1821 the Austrian troops remained as an army of occupation until 1827, and a separate administration was created for the island of Sicily. Ferdinand, who died in 1825, was succeeded by Francis I., and in 1830 the crown passed by inheritance to Ferdinand II., popularly known as "King Bomba," from the bombardment of Messina and other towns on occasion of a revolt in 1837 and the following years. In 1847 a formidable insurrection in the southern provinces and in Sicily led to royal concessions, but which were not satisfactory. In the revolutionary year 1848 Ferdinand granted a liberal constitution to his people, which, however, he soon revoked and resumed his despotic autocracy, which he exercised with unrelenting severity, notwithstanding serious warnings and earnest remonstrances from several European powers. In 1857 a new insurrection broke out, but soon met a bloody repression. Ferdinand died in 1859. His successor, Francis II., continued his father's system of misgovernment and tyranny, but in 1860, Garibaldi, having first overcome opposition in Sicily, crossed over to the mainland, where he met little or no resistance; Francis fled from Naples, and Garibaldi on Sept. 7 entered the city as dictator, unarmed and without a military escort. The battle of the Volturno on Oct. 1 decided the fate of the kingdom, which indeed was before hardly doubtful; Victor Emmanuel II., king of Sardinia, took possession of the capital Nov. 7; the strong places remaining in the hands of Francis were soon reduced; the kingdom of the Two Sicilies ceased to exist; the annexation of its territory to the dominions of King Victor Emmanuel was sanctioned by a popular vote; and it became an integral part of the new kingdom of Italy. No satisfactory general history of the kingdom of the Two Sicilies exists, and in fact, under the former jealous governments of that country, none could be written. The historical authorities oftenest cited are Giannone, *Storia di Napoli*, of which there are numerous editions, and Colletta, *Storia del Reame di Napoli dal 1734 al 1825*, both highly meritorious works. The history of Naples must therefore be studied in the annals of foreign nations having political relations, amicable or hostile, with that state, in general histories of Italy, and in documentary collections. These, indeed, are fragmentary sources of information, and they are too numerous and diversified to be here enumerated.

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**Sic'ily, Island of** [It. *Sicilia;* Lat. *Sicilia, Sicania, Trinacria*], the largest and most important island of the Mediterranean, lying near the centre of that sea, between N. lat. 36° 41′ and 38° 18′, E. lon. 12° 30′ to 15° 40′. Sicily belongs to the kingdom of Italy, from which it is separated by the narrow Faro or Strait of Messina. It forms a nearly isosceles triangle, the shortest side or base fronting the E., and contains about 11,300 sq. m., or an area not far from that of Maryland in the U. S. Besides Ustica, lying 50 miles from the N. coast, and Pantellaria, 80 miles from the S. W. coast, there are two archipelagos belonging to Sicily, of which the Æolian or Lipari, consisting of twelve small islands near the N. E. extremity of the main island, has acquired celebrity from its volcanic character, Stromboli, one of the group, having been constantly in eruption during the whole historic period. The Egadi (*Ægates*), a group of three islands near the westernmost point of Sicily, are important for their fisheries.

For administrative purposes Sicily is divided into seven provinces—Caltanisetta, Catania, Girgenti, Messina, Palermo, Syracuse, and Trapani; but the island has no separate political organization, and is in all respects an integral part of the kingdom of Italy. In 1861 the population was estimated at 2,391,802, which is probably below the truth. According to the census of 1871, it was then 2,584,099.

The coast has a total development of about 700 miles. Though diversified in outline, it has few harbors suitable for vessels of great burden. Commencing at the N. E., the N. coast trends generally S. E. to near Termini, but the regularity is broken by the capes of Milazzo, Calaria, Orlando, and Cefalù. From the Bay of Termini it stretches N. W., rounding the capes of Zaffarana and Mongerbino, to the Capo di Gallo, then S. W. to the Bay of Castellamare, then N. W. to the point of the long promontory of San Vito, then by a winding course S. W. to Capo Bœo at the extremity of the island. The S. W. coast is more regular, and presents no very conspicuous salient or retreating angle. The E. coast is indented with the harbors of Syracuse, Agosta, Catania, and Messina, which latter, and Palermo on the N. coast, are the most important ports of the island, though a large trade is carried on at the small harbors of Trapani and Marsala on the W. and the roadstead of Licata on the S. W. coast. The S. E. point of the island is called Capo Passero—the N. E., Capo del Faro. Near the N. E. point of the island commences a chain of mountains of ancient geological formation, corresponding to those of Calabria. Its general direction is S. S. W. to Taormina, then turns to the W., and runs about parallel with the N. coast, and in general very near it, attaining a height of from 2000 to 3500 feet, to its culmination nearly S. from Cefalù in the Madonia Mountains, the highest summit of which, the Pizzo dell' Antenna or Pizzo di Case, rises to the elevation of 6478 feet, and the Monte San Salvatore is but 200 feet lower. There the chain breaks up, or rather divides, into three ridges, running, with diminishing height, S. W., S., and S. E., toward the southern coast of the island; but these ridges are so often interrupted that they compose rather a series of detached mountains than continuous elevations. The northern scarp of the coast-mountains is abrupt, the S. much more gradual; and in fact the general surface of the island may be considered an irregular plateau, descending from the N. or coast-chain to the S. E. The S. E. portion of the island consists of gypseous and cretaceous mountains and plateaus, nowhere rising above 3000 feet, and generally much lower, and it is in this region that the famous sulphur-mines of Sicily are found.

Mount Etna is an isolated volcanic peak, resting on a base about 30 miles in diameter, and rising to the height of 10,935 feet, but the great cone is subject to change of form by eruptions, and therefore its elevation, like that of Vesuvius, is variable. The slopes are studded with cones of eruption, hundreds in number, and sometimes of considerable dimensions. One of the most remarkable features of the surface of Etna is the Val del Bove, a tremendous chasm 2000 feet deep on the E. flank of the mountain. (See ETNA, and the great monograph of Sartorius von Waltershausen on this mountain.) The Macaluba, or mud volcano, near Girgenti, and various phenomena observed on the southern coast (see SCIACCA) point, as some geologists suppose, to a renewal of volcanic activity in that region.

The minerals of Sicily correspond to the geological formations of which the island is composed. Metallic ores occur, but hardly in such quantities as to be worth elaboration. The marbles, jaspers, and agates are fine. Lignite is found, and a certain quantity of alum is produced. Amber, generally of a transparent yellow, but sometimes blue or green in color, is collected on the eastern coast, but sulphur is economically the most valuable mineral product of Sicily; and since the appearance of the oïdium of the grape, against which sulphur is if not the only at least the most effectual remedy, the demand for this article of export has immensely increased.

The general surface of Sicily is very irregular, and there are no plains of any considerable extent, that of Catania being the largest. There are few lakes or ponds in the island. There is a small lake near Castro Giovanni, the ancient *Enna*, and the Lake of Lentini, though larger, is but an inconsiderable sheet of water. The flanks of Etna, and indeed of all the Sicilian mountains, were rich in

forests, but these have been greatly reduced in modern times. Eruptions—as, for example, that of 1868—have been very destructive to the forests of Etna, but those in other parts of the island, where not protected by inaccessibility of position, have been chiefly destroyed by improvident felling and abuses of the right of pasturage. The southern mountain-slopes are in general bare and arid, and furrowed with channels cut by the heavy winter rains, which give rise to numerous swift torrents, *fiumare* or *ciumare*, but are neither absorbed by the soil nor collected in natural or artificial receptacles for a supply in the dry seasons. The Giarretta, formed by the confluence of the Simeto and the Gurnalunga, the Fiume Salso, the Platani, and the Belici are the principal rivers. The streams of smaller volume are altogether too numerous to be designated, though very many of them are serious obstacles to internal communication from the violence of their currents in winter, and the extreme difficulty of constructing secure bridges over them.

The slope of the surface of Sicily toward the S., and its consequent exposure to the winds from the neighboring continent of Africa, might be expected to create for it a tropical climate, but the evaporation from the surrounding seas mitigates the heat, and its condensation on the mountains of the N. coast-range furnishes a supply of water, which, badly economized as it is, serves in some degree to protect the soil from the effects of the droughts of summer. The temperature is not subject to extremes; it is agreeable except during the prevalence of the depressing sirocco; and in general it is not unhealthy, though many localities are rendered almost uninhabitable by malaria. The soil, whether of volcanic or of sedimentary origin—for alluvial formations can hardly be said to exist—is of exuberant fertility wherever a moderate quantity of water can be secured for irrigation. The agriculture generally is of the rudest and most primitive description, and the great insecurity of life and property is an almost insuperable objection to the investment of capital in rural improvements. Breadstuffs, and especially wheat of excellent quality, and leguminous vegetables are the most important articles of cultivation. The vine thrives almost everywhere, and the varieties of Sicilian wines, some of which are in great demand for exportation, are numerous. Of late years the stronger sorts are largely employed for *coupage*, or mixing with the wines of France, to which they give body and flavor. Hemp is grown in considerable quantities. Saffron and sumach, the latter especially, are of some importance in commerce. The mulberry is cultivated for the silkworm. Much manna is collected from incisions in the bark of a species of ash. The almond is extensively cultivated, as is also the olive, and the figs are good for the table, but as an article of commerce do not rival those of Smyrna. The prickly pear thrives, and its fruit enters into the regular diet of the poorer classes. In favorable situations the *agrumi*, or lemon and orange tribe, are said to be the most profitable objects of cultivation, and as the agave flourishes luxuriantly, there seems to be no reason why it should not be regularly cultivated for the beverage it yields, as in Mexico. The date-palm is grown, but not for profit. The sugar-cane was introduced by the Moors, and much sugar was manufactured from it by that industrious people. In all probability the sugar-cane, as well as a great number of other sub-tropical vegetables, might again be advantageously cultivated, and substituted for tobacco, which is an economically profitable, though certainly not otherwise useful, crop.

The manufactures are not of great importance, but extensive enough and various enough for the supply of most articles of consumption required by the laboring classes. The fisheries are prosecuted with more energy than most branches of Sicilian industry. The tunny is taken and cured at various points along the coast, and sardines and anchovies are shipped to foreign ports in great quantities. The precious coral occurs, but is not abundant, and many small vessels visit the Tunisian Sea in pursuit of it.

Besides a few great highways, most of the roads in Sicily are mere bridle-paths, and many large towns in the interior are not accessible by wheel carriages. A railway from Palermo to Girgenti, by way of Termini, is far advanced; another from Messina to Syracuse is completed; and another from Catania, to connect with the Palermo-Girgenti road, will be opened in the course of a few months. These will but partially supply the wants of the people, and a long time must elapse before the traveller can penetrate the greater part of Sicily without great discomfort and personal risk.

In spite of the devastations of earthquake, volcano, and malaria, few regions of the earth are more favored by nature than this island, but from moral causes these advantages have been turned to little practical account, and the populace is deplorably ignorant, indolent, and vicious. The present government of Italy has done what was practicable for the diffusion of instruction. In the larger towns the facilities for education are respectable, and it may be hoped that from these centres redeeming influences will radiate.

The Sicilian dialect much resembles that of Calabria, and indeed there is a certain family likeness in all the popular speeches of Southern Italy. The points which first strike the ear of a stranger acquainted with Tuscan are the very frequent substitution of *u* for the *o* final; the change of *ll* into *dd*, as *beddu* for *bello;* and the omission of the *u* sound after *q*, as *chistu* for *questo*. The Sicilian dialect is agreeable to the ear, and though it generally agrees with the Tuscan in vocabulary, it has nevertheless many words peculiar to itself, some borrowed from Arabic, and others from unknown sources. It can hardly be said to be a literary language, but it has ancient chronicles in the popular speech, and the modern poems of Meli, not to speak of other works *in dialetto*, are justly admired. It was long maintained that poems alleged to be the work of Sicilian bards of the twelfth and thirteenth centuries—such, for example, as those ascribed to King Enro, to the emperor Frederic, and to Ciullo d'Alcamo—written substantially in the Tuscan dialect, were the earliest existing specimens of the *lingua comune* of Italy; and that the literary tongue originated not in Tuscany, but at the court of Palermo. But we have no contemporaneous copies of these ancient poems, and the better opinion seems to be that, as we possess them, they are, if genuine, later Tuscan *rifacimenti* of Sicilian originals. (On the existing folk-lore of Sicily see Pitrè, *Biblioteca delle Tradizioni popolari Siciliana* (Palermo, 1875, 7 vols. 12mo), a work of much interest and value.)

The classic authors have preserved us many traditional accounts of the earliest inhabitants of Sicily, but the proper history of the island goes no further back than the colonization of the coasts by Greek adventurers, beginning, it is alleged, in the eighth century B. C., and continuing for more than 150 years, and all the civilization and culture of ancient Sicily was doubtless of Greek origin. Bucolic poetry is said to have originated in Sicily. Bion long resided in the island, and his pupil and follower, Moschus, as well as Theocritus, was a Sicilian by birth. Many of Pindar's poems belong, in subject, to Sicily. (On the relations of Sicily to Greek literature, and on the early history of the island, see T. W. Lloyd, *History of Sicily*, London, 1872, 8vo.) The Greek colonists were from many different states, and, like the emigrants of the same race in other countries, inclined little to unite in a common or national organization. The cities and their respective territories were governed by oligarchies or tyrants, and, though often at war with each other, gradually rose to great wealth and power. Near the end of the fifth century B. C. the Carthaginians, who already had trading establishments in Western Sicily, were invited by an expelled despot to interfere in Sicilian affairs, and they sent a great army to lay siege to Himera, but were defeated. In 415 B. C. Athens, which had on a former occasion taken part in the intestine dissensions of Sicily, sent a powerful force to the island, really with a view to its conquest and subjugation, though ostensibly for the protection of its allies in Sicily. The Athenians were totally defeated. The Carthaginians now invaded the island, and soon made themselves masters of a great part of it. Peace and war with the remaining territory alternated for a long time, and about the year 278 B. C. Syracuse invoked the aid of Pyrrhus, then at war with Rome, who was victorious against the Carthaginians. A few years later the Mamertines, who had possessed themselves of Messina and of much of the interior, invited the Romans to protect them against the Carthaginians. The Romans consented, and their interference in B. C. 264 was the occasion of the First Punic war. All Sicily became involved in the struggle, and the Romans soon reduced the whole island, with the exception of the Syracusan territory, which was spared by Rome for a time, but succumbed at last to that power, after a war ending with the memorable siege and capture of Syracuse in 212 B. C., when Archimedes, whose engineering skill had so long delayed the conquest, lost his life.

Sicily shared the fortunes of the other Roman provinces until the downfall of the Empire. It then passed under the dominion of the Goths, from whom it was conquered by Belisarius, and it remained a Byzantine possession till the ninth century, when a new African invasion subjected it to the Saracens. The Mussulmans held the island till it was torn from them by the Norman invasion, commencing under Robert Guiscard in 1061 A. D., and ending thirty years later by the submission of all Sicily to Duke Roger of the same family, whose son, Roger II., conquered a part of Southern Italy, and was crowned king of the Two Sicilies in 1127. On the failure of the Norman line, the

pope bestowed this kingdom on Charles of Anjou, who was expelled by the revolt of the Sicilian Vespers in 1282, and succeeded by Peter III. of Aragon. The Aragonese dynasty reigned until 1576, when Sicily, with its other possessions, was transferred to the Spanish crown. In 1706, Austria obtained possession of Sicily. The Peace of Utrecht in 1713 gave the sovereignty to Victor Amadeus of Savoy, who re-ceded it to Austria in 1717 in exchange for the island of Sardinia. In 1734, Spain obtained possession of Sicily, and in 1736 the island was reunited with Naples under Don Carlos as king of the Two Sicilies, and continued to be ruled by the same dynasty until its liberation in 1860. The possession of the island by the Neapolitan government was maintained during the wars which followed the French revolution by the fleets and armies of England, and British influence secured some improvements in its government. There were many revolutionary movements after this period, and various changes were made in the administration of its government. The revolts of 1847, 1848, and 1849 were suppressed by violence, and till the final overthrow of the Neapolitan dynasty nothing substantial in the way of reform was effected. On May 16, 1860, Garibaldi, at the head of 1000 volunteers, landed at Marsala, on the 27th entered Palermo, and captured Milazzo, after an obstinate defence, on July 20, after which he met with no serious resistance, and he soon after crossed over into Calabria and marched upon Naples. The expedition of Garibaldi was not, at its organization, avowedly a movement in behalf of the king of Sardinia; but if any doubt existed before as to its objects, they were speedily dissipated by a proclamation from the "dictator," and Sicily hastened to annex itself to the dominions of the house of Savoy.

Passing by the few remains of pre-historic constructions, the oldest of the successive Sicilian civilizations has left more abiding and magnificent memorials than any of its successors. The temples of Selinus and of Agrigentum are of a very early style of Greek architecture, and are of great interest in the history of that art. Many ruins of Greek temples are found in other parts of the island. There is little which can be ascribed to Carthaginian architects, and most of the works of Roman art have perished or been so far transformed as to render it difficult to determine their origin. The Saracenic influence is very visible in many constructions at Palermo and elsewhere, and the Normans erected or modified many churches in accordance with their peculiar taste. If, then, we cannot affirm the existence of a special Sicilian style in art, Sicily at least shows a skilful local adaptation of several foreign styles, and many of her religious and other public structures exhibit features of great excellence.

(For the history of Sicily see the authors referred to at close of article SICILIES, THE TWO, and the following, relating more especially to the island: The article "Sicilia," *Dictionary of Geography;* Pietro San Filipo, *Compendio della Storia di Sicilia* (1857); G. E. di Blasi, *Storia del Regne di Sicilia* (3 vols. 8vo); Amari, *Storia dei Musulmani di Sicilia* (Florence, 3 vols. 8vo, 1854–72); La Lumia, *Studi di Storia Siciliana* (2 vols. 12mo, Palermo, 1870); Di Giovanni, *Filologia e Letteratura Siciliana* (2 vols. 12mo, Palermo, 1871); Lo Faso, Duca di Serradifalco, *Antichitá di Sicilia* (5 vols. folio). Of the older Sicilian historical writers, Fazellus, *De Rebus Siculis Decades Duæ*, is important.) GEORGE P. MARSH.

**Sic'kingen, von** (FRANZ), b. Mar. 1, 1481, in his ancestral castle of Sickingen, near Carlsruhe, in the present grand duchy of Baden, was one of the wealthiest and most powerful knights of his time, and was treated with much regard both by Charles V. and by the French king, Francis I. He spent all his time in feuds with his neighbors, and, having come into contact with the new religious ideas through his friend Ulrich von Hutten, he formed a plan of carrying through the Reformation by force. As the despoiling of the Roman Catholic Church of all its property, and the distribution of its estates among the knights, formed the principal points of his plan, he expected support from the nobility, and pamphlets were written and spread among the peasantry in order to arouse them too against their ecclesiastical lords. But the attempt entirely failed. One after another his castles were taken, and at last he was compelled to surrender himself, together with his last castle, Landstuhl, near Kaiserslauten. He d. immediately after, May 7, 1523. There is still one line of the family flourishing, the counts of Sickingen-Hohenburg.

**Sick'le** [from the root of the Lat. *seco*, to "cut"], a reaping-hook; a curved knife, usually with a toothed or serrate edge, used for cutting grain and the like. The sickle has been mostly superseded by the scythe attached to the *cradle*, and the cradle in turn has given place to the reaping-machine and the header, implements drawn by horse-power.

**Sick'les** (DANIEL E.), b. in New York Oct. 20, 1822; was educated at the University of New York, but, without graduating, studied law, and was admitted to the bar in 1843. He soon became identified with politics, and in 1847 was elected to the State legislature as a Democrat. In 1853 he was appointed corporation attorney of New York City, and the same year accompanied Mr. Buchanan to England as secretary of legation. Returning in 1855, he was elected State senator, and the following year was chosen member of Congress from New York City, and re-elected in 1858 and in 1860. On Feb. 27, 1859, he shot and killed Philip Barton Key in Washington for improper intimacy with his wife, and was placed on trial for murder, but acquitted. On the outbreak of civil war he raised the Excelsior Brigade, and in June, 1861, was appointed colonel of one of its regiments, the 70th New York. In Sept., 1861, he was nominated a brigadier-general of volunteers. The appointment was at first negatived by the Senate, but subsequently confirmed to date from original appointment. In the Virginia Peninsular campaign his brigade was attached to Hooker's division of the 3d corps, to the command of which corps he succeeded in Apr., 1863, having been commissioned major-general of volunteers Nov. 29, 1862, and was distinguished at the battle of Chancellorsville, May 3–4. At Gettysburg he lost a leg early in the second day's fight. In 1866–67 he commanded the military district comprising North and South Carolina. On the 28th of July, 1866, he was appointed colonel of the 42d Infantry of the regular army, and in Apr., 1869, was retired from active service upon the rank of major-general. In the latter year he was appointed U. S. minister to Spain, which position he resigned in 1874. He received the brevets of brigadier and major-general U. S. A. for gallantry.

**Sicoliana,** or **Siculiana,** town of Sicily, province of Girgenti, about 8 miles N. W. of Girgenti, in a district fertile in all the usual productions of the island. P. 5665.

**Sic'yon,** an ancient city of Greece, was situated in the northern part of Peloponnesus, near the Corinthian Gulf, on a steep hill surrounded with strong walls. It was originally a Dorian settlement, and sided in the Peloponnesian war with Sparta. Aratus, the famous general of the Achæan league, was born here; also Leucippus and Apelles. The city was celebrated as one of the principal seats of the fine arts in Greece. In the beginning of the Christian era it fell into decay, and very few remains are now left of it.

**Sid'dons** (SARAH), daughter of Roger Kemble, b. in Brecon, South Wales, July 5, 1755. She had traditions of the stage behind her inherited dramatic genius, and was familiar with theatres and theatrical people from infancy; played as a girl in her father's company; married Mr. Siddons, an actor, at the age of eighteen; made her first appearance at Drury Lane, with Garrick, as Portia in *The Merchant of Venice*, in 1775, but made no mark; retired in disappointment, but reappeared in 1782. This time she made a deep impression as Isabella in *The Fatal Marriage*, and began her career of extraordinary success. For thirty years, until her retirement in 1812, she was, in spite of jealousies, intrigues, and controversies, the queen of the English stage. Her favorite and famous characters were Lady Macbeth, Queen Constance, Queen Catharine, Jane Shore, Isabella, Ophelia, Desdemona, Portia, and Imogen—impersonations of tragic pathos and majesty. Comedy she did attempt in parts like Rosalind, but without distinguished success. To her contemporaries she was a prodigy of genius. She seemed to them on the stage a being almost supernatural. Yet in the opinion of judges her ordinary recitation was imperfect. Her effects were produced by presence, mien, attitude, expression of voice and countenance, and by intense concentration of feeling, which lifted and dilated her form, transporting her audience as well as herself. Her stature was not above that of ordinary women. Her form was beautiful, her countenance expressive, her coloring effective from the contrast of her pale complexion with her black hair and dark eyes; and all worked together in her moments of passion. The public readings she gave from Shakspeare after her withdrawal from the stage were interesting, but did not add to her fame. Her last appearance as an actress was in 1818, when she played for Charles Kemble's benefit. Thenceforth she lived in retirement, honored as a woman of stainless reputation, and respected in all the relations of life. D. in London June 8, 1831. Her portrait was painted by Sir Joshua Reynolds; her *Life* was written by Thomas Campbell. O. B. FROTHINGHAM.

**Sidell,** tp., Vermilion co., Ill. P. 1165.

**Sidell** (WILLIAM H.), b. in New York Aug. 21, 1810; was graduated from the U. S. Military Academy, sixth in his class, July, 1833, when assigned to the 1st Artillery as brevet second lieutenant, which position he resigned the

following October, and adopted the profession of civil engineering. For a time he was a city surveyor of New York and an assistant engineer on the Croton aqueduct, Brooklyn dry dock, etc., until 1837, when he became principal assistant to Capt. Talcott in the hydrographic survey of the delta of the Mississippi River, on which duty he continued two years. Subsequently he was extensively engaged in the laying out and construction of railroads in various parts of the U. S., and in 1851–52 was assistant to Major (now Gen.) J. G. Barnard in the exploration and survey of a railway route across the Isthmus of Tehuantepec. This work had been nearly completed when in 1852 the action of the Mexican authorities caused the withdrawal of the surveying party. In 1858, however, the Louisiana Tehuantepec Co. resumed the work, and appointed Sidell chief engineer, in which capacity he completed the location for a railway and constructed a carriage-road 110 miles long from Salina Cruz on the Pacific to Suchil on the Goatzacoalcos River. This route was operated for several months in the transportation of passengers and mails from New Orleans to San Francisco in connection with the Gulf and Pacific steamers. On the outbreak of civil war he relinquished his profession and accepted (May 14, 1861) the commission of major of the 15th U. S. Infantry, but without joining his regiment was at once assigned to duty as mustering officer in the department of the Cumberland. In July, 1862, he was detailed as acting assistant adjutant-general of that department, continuing as such until transferred to Louisville, Mar., 1863, as acting assistant provost-marshal-general of Kentucky, resuming soon after the duties of general superintendent of recruiting and chief mustering officer of the State, which important offices he continued to fill until 1867, when he joined his regiment, the 10th Infantry (to the lieutenant-colonelcy of which he had been promoted in 1864), with which he served in Dakota Territory until 1869, when placed in charge of the dépôt of the general recruiting service at Fort Leavenworth, Kan. While thus engaged he was stricken with paralysis, and Dec. 15, 1870, retired from active service. Returning to New York City, he lingered until July 1, 1873, when his death occurred. For meritorious and faithful services in the war he was brevetted colonel and brigadier-general U. S. army.

**Sidereal System.** See ASTRONOMY, by PROF. S. NEWCOMB; and STARS, by P. A. SECCHI.

**Sidereal Time.** See DAY.

**Sid'erite** [Gr. *σίδηρος*, "iron"], the mineralogical name for spathic iron ore. (See IRON, ORES OF.)

**Si'di-Bel-Abbes,** town of Algeria, province of Oran, has good bazaars and large barracks. The surrounding districts are very fertile. P. 7500, of whom about 3000 are Europeans.

**Sid'i Moham'med,** b. in 1803, the eldest son of Abderrahman, succeeded his father in 1859 on the throne of Morocco, and was immediately involved in a war with Spain on account of the piracies which prevailed along the coasts of his dominions; he was compelled to cede to Spain some territories and pay a very heavy war-indemnity. Another policy was now adopted. He formed alliances with the European powers, concluded commercial treaties, and attempted to introduce reforms among his subjects. But these exertions resulted only in exasperated and very dangerous insurrections. D. Sept. 20, 1873, and was succeeded by his son, Meley Hassan.

**Sid'mouth** (HENRY **Addington**), VISCOUNT, b. at Reading, England, May 30, 1757, son of Dr. Anthony Addington, author of some medical treatises and family physician to the earl of Chatham; educated at Winchester School and at Brasenose College, Oxford; studied law; was admitted to the bar 1784; entered Parliament the same year through the influence of the younger Pitt, who had been his friend and companion from boyhood, and to whom he gave an efficient support during his administration; was Speaker of the House of Commons from 1789 until 1801, when, on the resignation of Pitt as prime minister, he formed a new ministry, accepting the posts of chancellor of the exchequer and first lord of the treasury; directed the negotiation of the Peace of Amiens 1802; supported a war-policy 1803; resigned office 1804; was raised to the peerage and made president of the council Jan. 12. 1805; was lord privy seal in the Grenville and Fox ministry 1806–07; was secretary of state for the home department 1812–22, and a member of the cabinet without a portfolio 1822–24, after which he retired from active public life, and spent his later years at Richmond Park, where he d. Feb. 15, 1844.

**Sid'ney,** p.-v. and tp., Champaign co., Ill., on Toledo Wabash and Western R. R. P. of v. 480; of tp. 1560.

**Sidney,** p.-v. and tp., cap. of Fremont co., Ia. P. of v. 817; of tp. 2521.

**Sidney,** p.-v. and tp., Kennebec co., Me., on Kennebec River. P. 1471.

**Sidney,** p.-v. and tp., Montcalm co., Mich., on Stanton branch of Detroit Lansing and Lake Michigan R. R., includes part of Stanton, the county-seat. P. 611.

**Sidney,** p.-v. and tp., cap. of Cheyenne co., Neb., on Lodge Pole Creek and on Union Pacific R. R., has a round-house, a repair-shop, a hotel, and a small military post. Sheep-farming is a leading industry in this vicinity. P. 369.

**Sidney,** p.-v. and tp., Delaware co., N. Y., on Susquehanna River. P. 2597.

**Sidney,** p.-v., cap. of Shelby co., O., at the junction of Dayton and Michigan and Cleveland Columbus Cincinnati and Indianapolis R. Rs., has 2 banks, several factories, a bell-foundry, flouring-mills, 2 newspapers, machine-shops, and waterworks. P. 2808.

JAS. S. VAN VALKENBURGH, ED. "DEMOCRAT."

**Sidney,** or **Sydney** (ALGERNON), b. about 1622, was a son of the earl of Leicester, his mother being daughter of the earl of Northumberland; in 1632 accompanied his father, who was appointed ambassador to Denmark, and four years later to France. In 1641 he served as captain of a troop of horse in Ireland, of which his father had been made lord lieutenant. When the great rebellion broke out, he and his elder brother set out to join the royal army in England; were arrested at Liverpool by order of Parliament; King Charles I. believed that this was done by their own procurement, and sharply censured them, upon which the brothers joined the Parliamentary army, Algernon being made a captain of horse in the regiment of the earl of Manchester. He was severely wounded at the battle of Marston Moor May, 1644; and in Apr., 1645, was made colonel of a regiment. In 1646 his brother, Lord Lisle, was appointed lieutenant-general of Ireland, and he was made lieutenant-general of horse and governor of Dublin; in that year he was chosen as member of Parliament for Cardiff; in 1647 he received the thanks of the House for his services in Ireland, and was made governor of Dover. In 1648 he was one of the judges at the trial of Charles I., but was not present when sentence was passed, and did not sign the warrant for the execution, though he afterward characterized it as "the justest and bravest action that ever was done in England or anywhere else." Being opposed to the protectorate of Cromwell, he retired from Parliament in 1653, but when the Long Parliament was restored in 1659, he resumed his seat, and was named one of the council of state, and was sent as one of the English commissioners to negotiate a peace between Sweden and Denmark. He was absent from England at the time of the Restoration, and not acceding to this, he lived abroad in exile for nearly eighteen years, and was often in great pecuniary straits. He labored all this time to bring about the establishment of a republic in England. In 1677 he received a pardon from the king, with permission to return to his native country; was an unsuccessful applicant for a seat in Parliament, and was considered as being in league with Monmouth, Essex, William Lord Russell, and other popular leaders. The discovery of the Rye House plot in 1663 gave the court an opportunity of ridding itself of so dangerous an opponent. He and Russell were arrested and committed to the Tower on a charge of high treason. The only witness as to the main facts charged was Lord Howard of Escrick, who by his own confession had been a party to the plot, and was ready to swear away the lives of his associates in order to save his own. The law required two witnesses to prove the alleged crime, and under the decision of the infamous chief-justice, Jeffreys, the other witness was found in a manuscript on government which had been discovered among the papers of Sidney, in which it was maintained that a people had the right to depose an unworthy sovereign. The trial was opened Nov. 7, 1683; sentence was pronounced on the 26th; and on Dec. 7 he was beheaded on Tower Hill, London, the disembowelling and quartering, which were a part of the sentence, being remitted at the last moment. Upon the scaffold he declined to speak to the people, saying that he had made his peace with God, and had nothing to say to man; but he delivered a paper to the sheriff, in which he said that he died a witness for the truth, and for that old cause in which he had been engaged from his youth. The reversal of the act of attainder was one of the earliest acts of the first Parliament of William and Mary. His *Discourses concerning Government* were published in 1698, and a 4th ed., with some miscellaneous writings, in 1772. The *Life* of Algernon Sidney has been written by Meadley (London, 1813) and Van Santvoord (New York, 1851). A. H. GUERNSEY.

**Sidney,** or **Sydney** (Sir PHILIP), b. at Penshurst, in Kent, Nov. 9, 1554, was the son of Sir Henry Sidney, the

favorite of Edward VI., his mother being a daughter of the duke of Northumberland and sister of Robert Dudley, the favorite of Queen Elizabeth. At the age of ten he was placed at school in Shrewsbury, where he became noted for gravity and intelligence beyond his years. He studied at Oxford, and afterward at Cambridge, and in 1572 received a special license from the queen to go beyond the sea in order to perfect himself in foreign tongues. In Paris he was received with great favor by Charles IX., who gave him a court appointment. He came near being involved in the massacre of St. Bartholomew, and was obliged to take shelter with the English ambassador, Sir Francis Walsingham. He then visited Belgium, Germany, Hungary, and Italy, in all of which countries he was noted for his skill in knightly exercises, as well as for his fondness for literature and art. He returned to England in 1572, and, aided by the influence of his uncle, now earl of Leicester, rose to high favor at court. In 1576 he was sent on a mission to Vienna, nominally to console with the emperor Rudolph on the recent death of his father, but really to urge an alliance of all the Protestant states against the overshadowing power of Spain. Upon his return he found Elizabeth meditating a marriage with the French duke of Anjou, and addressed to her a spirited remonstrance against the match; the queen apparently took no offence at this, although many others who had opposed it were severely punished; but it would appear that his favor declined, and not long after the queen sharply rebuked him for having had the presumption to quarrel at tennis with the earl of Oxford, a nobleman, while he was only a simple gentleman. Sidney withdrew from court, retiring for a time to the seat of his brother-in-law, the earl of Pembroke, where he devoted himself mainly to literary pursuits, in which he was joined by his sister, Mary, countess of Pembroke, who aided him in a metrical translation of the Psalter, and after his death wrote an elegy upon him. Here he wrote his pastoral romance *Arcadia*, which, however, was never completed, and his *Defence of Poesie*, upon which his literary fame mainly rests. In the mean time, the queen's favor for him revived, and he took a prominent part in all pageants of the court. He fell deeply in love with Lady Penelope Devereux, whom he celebrated under assumed names in his *Arcadia* and in numerous amatory verses. In 1583 he was knighted, and married the daughter of Sir Francis Walsingham. In 1585 he wished to join Sir Francis Drake in his second expedition against the Spaniards in the West Indies, but the queen forbade this, fearing, as she said, "lest she should lose the jewel of her dominions." It is said, probably without good grounds, that the crown of Poland was offered to him. The war was now raging between Spain and the Netherlands, and Elizabeth made some show of assisting the Dutch. In 1585, Sidney was appointed governor of Flushing, and soon after was made general of horse under his uncle, the earl of Leicester, in which capacity he gave promise of much military ability. On Sept. 22, 1586, he encountered a body of the Spaniards under the walls of the town of Zutphen. Sidney had a horse shot under him, and in the third and decisive charge received a musket-bullet in the thigh, and was borne from the field. Almost fainting from loss of blood, he called for drink; a bottle of wine was brought, but as he was about to drink he saw a wounded soldier eagerly looking at the bottle. Without even tasting of it, he gave it to the soldier, saying, "Thy necessity is yet greater than mine." He was carried to Arnheim, where he d. Oct. 7, a little more than a fortnight after receiving his wound. His body was conveyed to England, where it lay in state for several days, and a general mourning, the first of the kind in English history, was observed. Sir Philip Sidney is perhaps the best English model of knightly virtues, and his character has always been a favorite theme with poets. His writings had great celebrity in their day, but they are marked by the strained and artificial style of the period. His *Arcadia* was first published soon after his death as the production of his sister, the countess of Pembroke. His *Complete Works* appeared in London in 3 vols. in 1725; his *Miscellaneous Works*, with a memoir, were published at Oxford in 1826, reprinted at Boston in 1860; his *Complete Poems*, edited by Rev. A. B. Grosart, were published at London in 1873.

A. H. Guernsey.

**Sidney Plains,** p.-v., Sidney tp., Delaware co., N. Y., on Susquehanna River, at the junction of New York and Oswego Midland with Albany and Susquehanna R. R., has 1 weekly newspaper. P. 405.

**Si'don,** or **Zidon,** an ancient city of Phœnicia, on the coast of the Mediterranean, in lat. 33° 34′ N., near the site of the present *Saida*, attained by its manufactures and commerce very early such a celebrity that its name was transferred to the whole country and to the nation. It had commercial stations in Sicily, Sardinia, Spain, and on the northern coast of Africa; it made expeditions to the British islands and into the Baltic; and the fame of its purple, glass, linen, gold, silver, and ivory ware was of a thousand years' standing. Its most brilliant period seems to have been between 1600 and 1200 B. C. It was afterward superseded by its own daughter-city, Tyre. It still flourished under Persian rule, but after an unsuccessful revolt against Artaxerxes Ochus in 351 B. C. it was nearly destroyed, and although it was rebuilt, it never again reached its former splendor. During the Greek, Syrian, and Roman dominion it sank more and more. During the Crusades it was alternately held by the Christians and the Saracens. In 1291 Malek Ashraf razed it.

**Sidonius Apollinaris.** See Apollinaris Sidonius.

**Sidra, Gulf of.** See Syrtis.

**Sie'bold, von** (Philipp Franz), b. at Würzburg, Bavaria, Feb. 17, 1796; studied medicine and natural science; went in 1822 to Batavia as a physician in the Dutch service; accompanied in 1823 the Dutch embassy to Japan, where he stayed several years, and was enabled by his connections with Japanese officials and scientists to undertake comprehensive researches; returned to Europe in 1830; published *Nippon, Archiv zur Beschreibung von Japan* (20 vols., 1832–57), *Fauna Japonica, Flora Japonica, Bibliotheca Japonica* (6 vols., 1833–41); made a new journey to Japan 1859–62; entered on his return into communications both with the Russian and the French governments concerning their relations with Japan; founded the Japanese museum at Munich. D. Oct. 18, 1866. He also published *Urkundliche Darstellung der Bestrebungen Niederlands und Russlands zur Eröffnung Japans* (1854).—His brother, Karl Theodor Ernst von Siebold, b. at Würzburg Feb. 16, 1804, studied medicine, physiology, and zoology; practised as a physician at Königsberg and Dantzic; was appointed professor in physiology and comparative anatomy at Erlangen in 1840, at Breslau in 1850, and at Munich in 1853; and wrote *Lehrbuch der vergleichenden Anatomie der wirbellosen Thiere* (1848; translated into English in 1854), *Wahre Parthenogenesis bei Schmetterlingen und Bienen* (1856), and *Die Süsswasserfische von Mitteleuropa* (1863). In 1849 he founded, together with Kölliker, *Zeitschrift für wissenschaftliche Zoologie.*

**Siedl'ce,** town of Russia, kingdom of Poland, the capital of the government of the same name, has a fine palace surrounded with beautiful gardens, distilleries, sugar-refineries, and manufactories of agricultural implements. P. 10,013. The government of Siedlce, comprising an area of 5534 sq. m., with 543,392 inhabitants, is situated to the W. of the river Bug, between the governments of Lomza, Warsaw, Radom, Lublin, Volhynia, and Grodno, and occupies nearly the same territory as the old palatinate of Podlachia.

**Siege** [Fr. *siège*]. Modern fortresses are of two general types—single fortresses, consisting of an enceinte and its outworks (see Fortification), and intrenched camps, consisting of the former combined with detached works. (See Intrenched Camps.) The latter may be defended simply by its garrison, or by a large army in addition to the garrison. The methods of attack will vary with these different circumstances, and may be classified as (1) siege of a single fortress; (2) siege of an intrenched camp defended by its garrison simply; and (3) siege of an intrenched camp occupied by an army.

I. The method perfected by Vauban in the latter half of the seventeenth century applied to the first case, and under ordinary circumstances, with the proper force—five or six times the garrison—was almost certain of success. This method has been employed without essential change for 200 years, and it is only within a very brief period that military engineers have found it necessary to introduce some modifications in order to adapt it to modern instruments of war. It consists, in brief, in taking up a strong intrenched position in front of the work, beyond the range of its artillery, and clearing a path thence to the interior. To do the latter it is necessary to subdue the fire of the work, to batter down a portion of the scarp, and to excavate a path by which troops can advance under cover. The occupation of the ground is called the investment. The intrenchments on the side of the work are called lines of countervallation. Sometimes defences are thrown up to guard against attack from the exterior; these are called lines of circumvallation. The covered roads constructed toward the work are called approaches, zigzags, or boyaux. To prevent their being enfiladed, they are run in a zigzag direction, each branch being so placed that its prolongation shall fall outside the salients of the collateral works. Whenever it is practicable several zigzags are pushed forward simultaneously from different points, and converge toward the point of attack. During the earlier

portions of the siege these approaches are constructed by digging a trench and throwing the earth up on the side toward the enemy, thus forming a simple trench. When within easy range of artillery, cover is more quickly obtained by placing a row of gabions and filling them with earth; this is called a flying sap. During the latter portions the excavation is pushed forward by sappers, foot by foot, under the cover of a rolling shield called a sap-roller; it is revetted with gabions, and is called a full sap. As the heads of these approaches offer an easy prey to sorties, they are united from distance to distance by lines of trench running nearly parallel to the front of attack. These are called parallels. They are arranged for infantry defence something like rifle-trenches (see FORTIFICATION), but their terre-pleins are made wider to afford means for the free circulation of troops. Each parallel should be nearer to the preceding one than it is to the work attacked, and must be within easy supporting distance from it. The number of parallels therefore depends upon the distance of the first one from the work, and that depends upon the range of the artillery. In Vauban's time there were usually three; at Sevastopol in 1854–55 there were seven. When the approaches have advanced within easy artillery-range—about the second parallel—batteries are constructed to silence the artillery of the work. When practicable, they are placed on the prolongation of the faces of the work. The artillery fire having been subdued, the approaches are pushed forward toward the crest of the glacis. In the old method, when within a short distance from it, mounds of earth, called trench cavaliers, were thrown up to command the covertway, and served to drive out the defenders. Their construction is now considered impracticable. The occupation of the crest of the covertway is called the crowning of the glacis. Here, in the old method, breaching batteries were constructed to batter down the scarp, and a gallery was excavated (see MINES, MILITARY) to lead into the ditch, the advance through the ditch and breach being continued with the full sap or by assault. In these operations the miner goes hand in hand with the sapper. He searches out and destroys the countermines, creates large craters in which the sapper can make lodgments, and is frequently employed to make the breach.

The driving of a full sap, and the establishment of these breaching batteries, in the later stages of the siege, always difficult, may be said to have become of late years impracticable, assuming always that the defence is vigorous. At Sevastopol the fortifications were not strong, their profile being that of field-works. At the siege of this place, which lasted eleven months, during which the French executed 42 miles and the English 8 miles of trenches, the approaches never reached the ditch. At the final assault the ramparts were intact, and the troops had to advance without cover, at some points more than 200 yards. The assault failed at six points out of seven, and it was the opinion of Gen. Niel, commandant of the French engineers, that the place would have been impregnable if it had been provided with good revetted scarps. This opinion, however, assumes that the scarps remained unbreached, and it is qualified by the statement that the place possessed an armament such as is only found in a great maritime arsenal, and a garrison perpetually replenished by communication kept open with the interior of Russia. Since that date further great improvements have been made in the calibre, range, and accuracy of artillery fire, as well as in small-arms. It has become possible to effect the breach by indirect fire from a distance, while the difficulties of the assault have been proportionately increased. The introduction of the Gatling gun and of the breech-loading musket, by means of which a thin line of troops can keep up a steady sheet of fire, has rendered impracticable the *open* assault of even slight intrenchments if resolutely defended. It has fair chance of success, however, when made from a point close up to the works, and against a garrison worn out with the labors and anxieties of a long siege, or when following closely after the explosion of a mine.

The prompt capture of many of the single fortresses of France during the Franco-German war of 1870–71 has but little bearing on the subject, as many of them were of an ancient pattern, none were in a complete state of preparation, the artillery was inferior to that of the enemy, and the defence was often lukewarm or unintelligent, or both. The method of the Germans was to observe the places by detachments until operations in the field afforded leisure for a serious effort against them, and then to plant powerful batteries at distances varying from 1 to 2 miles, and bombard them until they capitulated. The bombardment of Schlettstadt lasted 5 days; of Neu-Brisach and Fort Mortier, 5 days; of Thionville, which had been blockaded three months, 2 days; of Montmédy, after four weeks' investment, 2 days; of Longwy, which had been invested seven weeks, 9 days; of Mezières, after being observed by detachments three months, and regularly invested ten days, 1½ days; of Rocroi, 7 hours with field artillery; of Toul, after being observed four weeks by a brigade and closely invested by a division eleven days, 8 hours; of Soissons, 4 days; of La Fère, after ten days' investment, 30 hours; of Peronne, after six days' investment, two of them employed in bombardment with field guns, 7 days, etc. These facts do not militate against the value of these fortifications in themselves. Even defended as they were, they caused great annoyance and delay to the invaders, and they enabled the hastily-organized armies of France to make a defence of which otherwise they would not have been capable. Phalsburg required a blockade of over four months for its reduction, and Bitche held out to the end of the war. Verdun resisted a *coup de main* Aug. 24, was observed by detachments until Sept. 23, when it was closely invested, resisted a bombardment of 54 hours from captured French guns Oct. 14–16, but surrendered Nov. 8 without standing a regular siege, after preparations had been made for carrying it on with Prussian artillery. Strasbourg, with a garrison of 17,000 men, resisted for 51 days a besieging army of about 60,000. The attack was by regular approaches, the outworks being breached by distant fire and by mining, and the main rampart by the fire of batteries in the second parallel. These batteries, called demolition batteries, were about 800 yards from the place, and effected their purpose by indirect firing, the masonry not being visible. The crowning of the glacis was successfully accomplished, followed by the descent into the ditch. The ditches, being filled with water, were crossed by dams, or, where the water was deep, by floating bridges of barrels floored over with planks. Everything having been prepared for the assault, the garrison capitulated without waiting to receive it.*

In a vigorous defence of a single fortress the enemy will be kept at a distance as long as possible by the occupation of favorable points on the exterior. His approaches and other works will be harassed or destroyed by a concentrated artillery fire, with occasional sorties in large bodies. Counter-approaches will be run out to obtain favorable positions for enfilading his lines, and sharpshooters will be posted in small pits—called rifle-pits—well to the front, to pick off his gunners. Countermines will be prepared, and sprung at the proper time. Damage to the works suffered during the day will be repaired at night. Débris will be removed from the foot of the breach, and when the latter has become practicable it will be obstructed by crows'-feet, chevaux-de-frise, or other obstacles, and intrenchments will be thrown up to command it. If the garrison has not been overworked, the assault should be repulsed.

II. The siege of an intrenched camp, defended simply by its garrison, may take the form on an enlarged scale of the operations described above, or of a blockade. In the former case one or two of the detached works are selected for attack, and proceeded against until their capture, the difficulties being greatly magnified by the position of the artillery of the place. The siege of Belfort (Nov., 1870, to Feb., 1871) is an illustration. The works planned for the defence of this place were not all completed at the breaking out of the war, and some of the points selected for the detached works were occupied by field fortifications of the semi-permanent type. These were selected by the Germans as the point of attack. The investment was completed Nov. 3, the garrison consisting of 16,000 and the attacking force of 30,000 men, increased about the middle of January to 80,000. A bombardment was opened Dec. 3, and continued night and day until Feb. 13, during which time more than 500,000 projectiles were thrown into the place. In five days nearly every house in the city had been struck. The defence, under Col. Denfert-Rochereau, was gallant and skilful. For many weeks he kept the enemy at a distance by first occupying exterior positions, and then freely using his projectiles at long range. This kept the line of investment so attenuated that the attacking force was inadequate. Moreover, the latter was compelled to throw up lines of circumvallation against the threatening force under Gen. Bourbaki, and to use part of its artillery in defending them. The detached fieldworks were finally evacuated Feb. 3–8, the approaches having reached the ditch. Thus, after 98 days' investment and 68 of bombardment, the attack found itself just where it would have been on the first day of the siege had it not been for these fieldworks.

* European sieges have been selected for illustration in this paper rather than American, for the reason that the former were conducted against permanent fortifications constructed at great cost and intended to resist land-attacks, while the latter were conducted against earthworks or seacoast fortifications. These will be noticed further on (Section IV.).

Further operations were to be pushed against the main works, but the garrison was ordered out of the place by the French government, and turned it over to the Germans Feb. 17 and 18, Paris having capitulated Jan. 28.

III. When the intrenched camp is occupied by an army, the difficulties of forcing an entrance are greatly magnified; and if the army is not very much inferior to the attacking force, they will probably be insuperable. The method of blockade may then be resorted to, with a view to exhausting the supplies of the besieged of ammunition and provisions. Here the attack and defence consist at first of a struggle for the possession of the communications with the place. These being once all secured by the attack, their further operations consist mainly in harassing the garrison by a distant bombardment while vigilantly guarding against the introduction of supplies or reinforcements. The defence consists in keeping up a fire upon the enemy, with occasional sorties in large bodies, the object of which is to make a permanent break in the cordon, with a view to its destruction or to cover the introduction of reinforcements. The sieges of Atlanta and Richmond in the war of secession, and of Metz and Paris in the Franco-German war, are illustrations. In the cases of Atlanta and Richmond the operations were confined to the preliminary struggles for the communications. Having lost these, the defenders withdrew at their last opportunity, preferring the immediate loss of the place to the sacrifice of both place and troops a few weeks later. At Metz, although the army of Bazaine was driven into the fortress and kept there against its will, and weakened the fortress for resistance to blockade, nevertheless it offered an immense obstacle to a forced entrance. The general method of occupying the ground by the Germans was about the same both around Metz and Paris. A first line of outposts was established from half a mile to a mile from the works. These were intrenched, and were strong enough to resist small parties of the enemy, but not a heavy force. Behind these was a carefully-selected position, forming the main line. Its distance from the works depended upon the nature of the ground, and varied from 1 to 3 miles, the normal distance being 2¼ miles, or a little more than the effective range of the guns of the enemy. It was fortified by rifle-trenches and gun-emplacements of the strongest profile, strengthened by abattis or other obstacles, with occasionally an enclosed work capable of offering independent resistance. Farther to the rear central points were selected and fortified, at which the reserves were posted, and upon which the troops were to rally in case of the enemy's success in breaking through the cordon. The length of the line of investment of Metz was 24 miles, and of that at Paris 45 miles. In each case the besieging force was about 200,000 men. The holding of such lines by such numbers would have been utterly impracticable previously to the recent improvements in small-arms and the introduction of the free use of continuous lines of intrenchments. As it is, when the investment is once closed the besieging army has a great advantage over the defenders, since it can accomplish its purpose without leaving its works. The rôles are reversed, and the besieged are compelled to throw themselves against the intrenchments, where they are so sure to meet with destruction. The army in Metz was 173,000 strong, and that in Paris 500,000, many of the latter, however, worthless as soldiers. The former capitulated after 70 days' blockade, and the latter after 129 days'. The operations about these cities, especially Metz, give rise to the curious but essential question, Can one army invest and besiege another of equal magnitude? (See BAZAINE.) The object of the sorties from Metz was to break through the cordon and get away with the active army, leaving the place to be held by its garrison. The fortifications aided such attempts; and if they had been mere field intrenchments which were being evacuated, the beleaguered army would have had still less chance of success. The answer, then, seems to be, Let an army somewhat demoralized by defeat simply lie dormant for a while, and it may be invested by equal numbers and taken by siege.

The blockade may be applied to a single fortress, but its chances of success will then be less favorable, for the reason that the number of mouths in the place being comparatively small, the stock of provisions may be such as to enable it to hold out longer than the requirements of the besieger will permit.

IV. For a long period in the early history of war, when the arms employed were slings and arrows, the high and thick walls of fortresses offered insuperable obstacles to a forced entrance. Sieges then were simple blockades. At a later date mining was resorted to (see MINES, MILITARY); ramps of earth and wood were thrown up, beginning beyond the range of an arrow, and sloping upward to the top of the wall; or the battering-ram was employed to effect a breach. The method of carrying on the operation among the Greeks and Romans was as follows: The place was surrounded by a strong continuous intrenched line. In front of the point of attack a covered gallery was established parallel to the work, composed of vines. A vine was a sort of hut on wheels, about 8 feet wide, 20 feet long, and 7 feet high, with a double-sloped roof strong enough to resist anything the besieged could throw upon it, and covered with raw hides or clay to protect it from fire. It was closed in front with wickerwork (from which its name) provided with loopholes. From this parallel gallery several similar galleries were run forward, the head of each being occupied by a special vine, having an overhanging roof projecting about 10 feet to the front, under cover of which workmen levelled the ground or built up the ramp. Through these galleries the material was carried forward to fill up the ditch. When the wall was reached, the battering-ram was brought up, covered by a long hut of a construction similar to that of the vines. In great sieges these attacks were supported by square wooden towers, which were either moved up to the walls on wheels or put together on the spot; in their lower stories they contained rams; in the middle, drawbridges, which could be lowered upon the walls; and in the upper stories, parapets of hides, wickerwork, or cordage to protect slingers and archers. They were sometimes as much as 150 feet high, and had from ten to twenty stories. Towers of these dimensions, however, could not be moved. The besieged endeavored to retain a commanding position. When the ramp rose, they raised the wall opposite to it; and when the towers were constructed, they increased the height of those on the ramparts. They opposed the enemy's works by mining and inundations and by fire.

The invention of gunpowder rendered the wooden approaches and the towers useless, and the vines were at once replaced by trenches. The change in the character of fortifications (see FORTIFICATION) rendered the defence a more active one. The garrison could sally and easily envelop the head of the approach. If an outwork were taken, it was difficult to hold it, for the reason that the supports were at a distance. (At the siege of Candia an outwork was taken and retaken thirty-six times.) During the youth of Vauban the approaches were generally pushed forward to the glacis when the covered way was assaulted. A covered descent was then made into the ditch, and a breach was made by the miner. This also was assaulted. After the capture of the outworks the main work was breached and assaulted, and then the interior retrenchments. These operations were bloody and precarious. Vauban rendered them sure and comparatively safe. He secured his approaches from being enveloped by the introduction of parallels, and, avoiding assaults, accomplished his purposes by well-directed manual labor, establishing the method sketched at the beginning of this paper.

The principal siege operations during the civil war in America were the following: At Yorktown, Va. (April and May, 1862), a parallel was constructed about a mile from the works, and heavy siege batteries were established, but the enemy evacuated before the latter opened fire. This siege is interesting from the fact that it was the first struggle of earthwork against earthwork in that war. At Vicksburg the investment was closed May 19, 1863, and an assault was made and repulsed in the afternoon of the same day. A vigorous assault on the 22d having failed, it was determined to make gradual approaches. There were no engineer troops in the command, and only four regular engineer officers. Every graduate of the Military Academy below the grade of general was detailed for engineer service; practical miners were selected from the different regiments for mining; and the sapping, fabrication of gabions, fascines, etc. were executed by some pioneer companies and by details from the line. The artillery was simply the field artillery of the army and a heavy battery borrowed from the navy. There being no light mortars, wooden mortars were made by shrinking iron bands upon cylinders of tough wood and boring them out for 6 or 12 pound shells. The broken nature of the ground gave ample protection to the attack up to within 600 yards, and often to within 400 yards of the works. By the 30th of June 220 guns were in position. A line of circumvallation was thrown up to oppose the efforts of Gen. Johnston to relieve the place. On June 25 a heavy mine was sprung under one of the salients. The crater was assaulted and occupied, but the besieged, having been warned, had prepared an inner line, to which they retired. Another mine was at once begun, which was sprung July 1, blowing up an entire redan with its defenders; but the interior line was not destroyed, and no assault was made. The besieged attempted to obstruct the advance by countermines, but obtained only slight success. Occasional sorties were also made, and at one point 90 yards of trench were run out as a counter-approach. By July, the approaches had in many places reached the ditch. Orders were given to prepare the heads of approaches for the easy debouch of troops,

to widen the main approaches so that men could easily move by fours, and to prepare planks and sandbags for crossing the ditches. On July 4 the place capitulated with over 30,000 men. (For operations against MORRIS ISLAND and FORTS SUMTER and WAGNER, see those heads; also BOMBARDMENT.) In the operations against Richmond in 1864 it was found necessary to occupy Petersburg. Desperate assaults were made June 15, 16, 17, and 18, but only an outer line of intrenchments could be taken. A mining gallery was commenced June 25, and a regular siege was determined upon July 9, and work commenced July 11. Gradual approaches were attempted, but the difficulties of pushing them against a long line of strong works, which could not be enveloped and were defended by forces nearly equal to the attack, were found to be so great as to offer small chance of success. The mine was sprung July 30, the main gallery being 510 feet long, and its two branches 37 and 38 feet respectively, and the charge 8000 pounds of powder. It was followed by a badly-managed assault, which failed. Gradual approaches were now abandoned, and steps were taken to prepare the lines of investment to be held by a small force, with a view to moving the main body upon the communications which were still held by the enemy. The latter operations gradually extended the lines until in October their length was 32 miles, comprising thirty-six forts and fifty batteries. The system consisted of enclosed fieldworks placed in commanding positions at intervals of about 600 yards, connected by strong rifle-trenches, well protected by obstacles in front. Many of the enclosed works were provided with bombproofs in addition to the magazines, etc. In some parts small redoubts were placed 300 or 400 yards in advance of the main line, to ensure time for manning the latter in case of assault, the ordinary pickets not being deemed sufficient. The line extended from the Appomattox southerly and westerly, embracing two sides of Petersburg, and thence back as a line of circumvallation to the James River, thus enclosing the Army of the Potomac in a loop. The movements of the forces operating upon the communications finally rendered an assault practicable by drawing a large part of the defenders away from their works. It was given Apr. 2, 1865, and a large part of the works were captured, the defenders evacuating the city during the night which followed. The fall of Petersburg necessitated the evacuation of Richmond. In the pursuit which followed, the whole Confederate army of Northern Virginia was captured. Mention may be made of the sieges of Fort Pulaski, Ga. (see BOMBARDMENT), Apr., 1862; Corinth, Miss., May, 1862; Port Hudson, La., May, 1863; Forts Gaines and Morgan, Mobile, Ala., Aug., 1864; and Fort Blakely and Spanish Fort, Mobile, Ala., Apr., 1865.

O. H. ERNST.

**Sieg'en,** town of Prussia, province of Westphalia, on the Sieg, has extensive manufactures of cloth, leather, paper, tobacco, iron, and steel goods. P. 11,070.

**Sieg'ert** (KARL AUGUST), b. at Neuwied, Rhenish Prussia, in 1820; studied painting at Düsseldorf 1837–46; travelled, and became professor at the academy in 1851. Several of his *genre* pictures—*Dinner Hour, Sunday Morning,* etc.—attracted much attention and became widely known.

**Sie'mens** (ERNST WERNER), b. at Leuthe, near Hanover, Dec. 13, 1816; was educated in the gymnasium of Lubeck and in the school of artillery and engineering at Berlin; entered the Prussian army as an officer of artillery in 1838; studied chemistry and electro-magnetism; took out a patent for electro-plating and gilding in 1841, and laid in 1848 the first submarine mines exploded by electricity; left the army in 1849, and founded, in connection with Halske, a telegraph-building establishment in Berlin, which built the telegraph lines of Russia, Spain, Brazil, Northern Germany, etc. Among the many inventions and improvements which are due to him, and of which he generally gave an account in Poggendorf's *Annalen,* are the method of determining the position of injuries in subterranean and submarine lines, of examining insulated wires, of charging subterranean and submarine conductors in order to lessen the disturbing influences of induced currents in the cables. —His brother, KARL WILHELM SIEMENS, b. at Leuthe Apr. 4, 1823, was educated at Göttingen; settled in 1843 in London as a civil engineer, and founded there in 1853 a branch of the Berlin house, with immense telegraph-building establishments at Woolwich and extensive steelworks at Landore in Wales. He invented the regenerating gas furnace, the bathometer, a pyrometer, etc., and published *On a Regenerative Condenser* (1850), *On the Conversion of Heat into Mechanical Effects* (1853), *On a Regenerative Steam-engine* (1856), and *On the Increase of Electrical Resistance in Conductors, with Rise of Temperature, and its Application to the Measure of Ordinary and Furnace Temperatures* (1871).

**Sie'na** [*Sena*], city of Italy, chief town of the province of the same name, covering a beautiful hill, a spur of the Chianti chain, which divides the valley of the Ombrone from that of the upper Arno. It lies in lat. 43° 22′ N., lon. 11° 11′ E., and is connected with Florence (60 miles N.) by a railway that now extends to Rome. The fine views from Siena (1100 feet above the sea) embrace a very wide and broken tract of hilly country, for the most part either highly cultivated or covered with forest-growth; but the character of the soil is such as to be readily affected by heavy rains or by the flow of torrents, and deep ravines are in this way cut in every direction through the hills, which are themselves not unfrequently washed quite bare. The climate of Siena is colder than that of most Italian towns in the same latitude, the prevailing wind being from the N. E., but it is considered very favorable for persons of strong constitutions, though not well suited to invalids. The walls are about 4 miles in circumference; the citadel occupies the N. W. corner of the town, which is entered by nine gates; and the principal streets radiate in irregular lines from the Piazza Vittorio Emanuele, a fine large open space nearly in the heart of the city. The public buildings of Siena are very remarkable. The Duomo, or Chiesa Metropolitana, one of the wonders of Italy, stands on an elevation not far from the centre of the town, The original plan of this edifice, begun early in the thirteenth century on a stupendous scale, has not been carried out, the present church being only a transept of the first design, but as it now stands it is one of the finest existing specimens of Italian Gothic architecture. Its length is about 300 feet, with a mean width of 120 feet. The western façade, especially, is of great richness; and, indeed, Italian genius has lavished all its resources both on the external and internal decoration of this magnificent temple. The effect of the interior is peculiarly picturesque, partly from the horizontal layers of black and white marble of which not only the walls, but even the columns, are composed, and partly from the roofing, which is a vault of blue studded with stars. The pavement is also a remarkable feature. It is of marble inlaid in various styles, the work of different artists from the fourteenth to the sixteenth century, the most distinguished of these being Beccafumi (1517). He produced figures of surprising grace and beauty by using white marbles for his lights, gray marbles for half-tints, and black for dark shadows. The marble pulpit is adorned with some of the finest reliefs of N. Pisano and his school. The bronze tabernacle, the intarsia of the stalls and about the high altar, the pictures by Duccio (1300), several early works of Michelangelo, the celebrated frescoes of Pinturicchio (1502) representing scenes from the life of Pius II., the fonts, the vases for holy water, the large collection of old choir-books exquisitely adorned with miniatures, may be mentioned from among the countless other objects of the highest interest to the student of art. Nor is the artistic wealth of Siena limited to the Duomo. In the church of S. Agostino and in several others, in the ex-convent of S. Domenico, and in many private palaces there are choice pictures by Spagnoletto, Perugino, Lippo Memmi, Salimbeni, Baltasar Perruzzi, etc., and above all by the celebrated Sodoma or Bazzi, whose works are nowhere so well studied as in Siena. Among the palaces should be noticed the P. Tolomei (1205) and the P. del Governo, one of the grandest in Tuscany. The Academy of Fine Arts is very rich, especially in pictures of the Sienese school; Segna, Duccio, the two Memmi, Lorenzetti, Sano, Signorelli, Beccafumi, Sodoma, Pinturicchio, are all seen here to great advantage. The University of Siena shows its records as far back as 1240, and claims a still earlier origin.

Siena (*Sena*), though settled at a remote period, remained an obscure village until about the time of the emperors, when it was raised to the dignity of a *colonia,* with the name of *Sena Julia.* As early as the reign of Charlemagne it was governed by a count. In the disputes between the papacy and the German emperors Siena at first took the side of the former, and, like its neighbors, Florence and Pisa, developed into an independent commonwealth. Its internal history also exhibits the same struggle on the part of the nobles for power and of the people for liberty, as they understood it, and the same deadly feuds between the aristocratic families themselves. In the beginning of the twelfth century the chief authority was exercised by the bishop in conjunction with one consul; but soon after, the number of consuls was increased, and by degrees the whole power was vested in them. The first of the many wars between Siena and Florence occurred in 1141–45 for the fortress of Marturi (Poggibonsi), and though the Florentines were the victors, Siena still continued to increase rapidly in population and wealth. In 1186, Siena joined the other large Tuscan commonwealths in their resistance to Henry, son of F. Barbarossa, but after some brilliant successes was reconciled to the emperor with large privileges, and thence-

forward it continued, for the most part, steadfastly Ghibelline. Not long after this, a successful democratic movement was made to compel the selection of a certain proportion of the consuls from among the *guilds*, and a powerful party was thus formed against the aristocracy. The prosperity of the city, however, advanced rapidly and steadily. In 1220, Siena contained 11,800 families, and in the course of the two following centuries the population is said to have risen to 200,000 persons. In 1260 took place the famous battle, at Montaperti, between the rival republics of Florence and Siena, where the latter won a victory which the Sienese of to-day talk of with pride. The consuls were succeeded (1233–40) by a governing body called the Twenty-four. These were followed (1285) by the Nine, who after seventy years became odious in their turn, and a magistracy of Twelve was appointed (1355). So detested was the rule of the Nine by the citizens that after their fall the use of the numeral 9 was forbidden, 4 + 5 being substituted for it. In the mean time, quarrels among the nobles themselves were growing more and more bitter, thus adding to the already existing confusion. An awful plague, known as the "black death," broke out in 1348, and continued to reappear until toward the close of the century. During the first year of this frightful malady 80,000 persons are said to have perished in the city and territory of Siena. After various other changes in the names and powers of the chief magistracy, the government of the commonwealth fell into the hands of Pandolfo Petrucci (1480), who continued successfully to direct public affairs until 1512. After his death, his family were not strong enough to contend against the overwhelming power of the Medici, who by the help of the Spaniards annexed Siena to the territory of Florence. From this time its history is almost one with that of the rest of Tuscany. There is at present little activity of any kind in Siena, and its actual population numbers only about 23,000. CAROLINE C. MARSH.

**Sien'na** [It. *terra de Siena*, "earth of Sienna"], an ochreous earth which when ground forms an excellent pigment called raw sienna, and when burnt assumes a still richer orange-red tint. It is brought from Italy.

**Sier'ra,** county of N. E. California, adjoining Nevada, watered by North and Middle forks of Yuba River, consists chiefly of mountains and elevated valleys of the Sierra Nevada, has several peaks above 8000 feet in height, contains vast masses of volcanic scoria and heavy forests of redwood and pine, and important gold-mines, quartz-mills, and a few saw-mills. Agriculture is little practised. Cap. Downieville. Area, 830 sq. m. P. 5615.

**Sierra City,** p.-v., Sierra co., Cal. P. 686.

**Sier'ra Leo'ne,** a British possession and colonial settlement on the western coast of Africa, in lat. 8° N., consists of some islands and a peninsula, bounded N. by Sierra Leone River and S. by the Bay of Yawry. Its boundary toward the interior is somewhat undefined, yet its area is given at 468 sq. m. P. 55,374. The soil is fertile, especially in the low coastland, but the climate is extremely hot and unhealthy, especially in the wet season, when there falls more rain in two days in Freetown, the capital of the colony, than in a whole year in England. All tropical plants and fruits grow luxuriantly, and palm oil, pepper, ginger, gum-copal, groundnuts, etc. are exported. Sugar, coffee, indigo, and cotton have been introduced, and succeed well. The settlement was made in 1787 with a merely philanthropic purpose, the idea being to form a home, or at least a place of refuge, for free negroes, but in spite of its climate, which is very unhealthy for Europeans, the colony is steadily growing. The total value of its exports amounted in 1872 to £328,000, and of its imports to £306,000.

**Sier'ra Ma'dre,** the name of one of the principal mountain-ranges of Mexico, commencing a little N. of the City of Mexico and extending from lat. 19° to 25° N. Between lat. 26° and 32° N. is found an extensive depression, which by some is considered as forming the division between the Sierra Madre and the Rocky Mountains. Yet the range extending in New Mexico between lat. 34° and 38° N. still bears the name of Sierra Madre. As a whole, these ranges are not well explored; in some places they contain very rich silver deposits.

**Sier'ra More'na,** a mountain-range of Spain, separates the basin of the Guadiana from that of the Guadalquivir, and extends between lon. 3° and 4° W. Its aspect is generally rugged and sombre; its highest peak is Aracena, 5500 feet high.

**Sier'ra Neva'da,** a mountain-range of Southern Spain, extends between the basin of the Guadalquivir and the Mediterranean. Its highest peaks are Mulhacen, 11,658 feet, and Veleta, 11,387 feet, and it has received its name from its being covered on many of its peaks with everlasting snow and ice. Its southern slopes are clad with chestnut forests, olive and orange groves, and vineyards.

**Sier'ra Neva'da** [Sp. for "snowy range;" the word *sierra* means "saw," and refers to the notched outline of the mountains as seen against the sky], a range of mountains in California, continuous northward with the Cascade Mountains, and southward of the San Joaquin Valley, uniting near the Tejon Pass with the Coast Range. The Sierra Nevada extends along the E. border of the State. It is not a single range, but an aggregate of ranges, on an average some 70 miles wide. The principal lines of crests are distinguished. Numerous peaks reach an elevation of 10,000 or 15,000 feet. Among these are Lassen's Butte (10,577 feet), Pyramid Peak Mountains, Whitney (15,088), Dana (13,227), Brewer (13,886), Tyndall (14,386), Lyell (13,217), Shasta (14,444), Williams (14,500), and many others. The Sierras are remarkably broken by cañons. Quartz-mining for gold, the cutting of timber, and the pasturage of sheep are important industries in these ranges. The Sierras are crossed by Central Pacific R. R., and are famous for their wonderfully sublime scenery.

**Sieyès'** (EMMANUEL JOSEPH), commonly known as the **Abbé Sieyès,** b. at Fréjus, department of Var, France, May 3, 1748; was educated for the Church at the seminary of St. Sulpice, Paris; took orders and became vicar-general and chancellor to the bishop of Chartres in 1784. He had attained some reputation in the circles to which he belonged as an enlightened mind and an acute thinker when suddenly, in Jan., 1789, he attracted the attention of the French people by his celebrated pamphlet, *Qu'est ce que le Tiers État?* and having been elected a member of the States General by Paris, he became for some time the actual leader of the Assembly and originated some of the first and most decisive steps toward the Revolution. He proposed that the three estates should examine their credentials in common, that the third estate should constitute itself as a national assembly, etc.; and his pamphlet, *Reconnaissance et Exposition des Droits de l'Homme et du Citoyen* (July, 1789), was the precursor and immediate occasion of the declaration of the rights of man. The new administrative division of France into departments and the abolition of the old provincial system, with its many feudal remnants and artificial barriers, were also due to him. Nevertheless, as the Revolution ceased to be a philosophy and became a passion, Abbé Sieyès lost his influence. In the Convention he sat silent, though he voted for the death of Louis XVI. without any appeal to the people, and during the Reign of Terror he entirely disappeared from public life. After the fall of Robespierre he returned, was successfully employed in several diplomatic negotiations, and became a member of the Directory May 16, 1799; and it was he, as much as if not more than Gen. Bonaparte, who prepared and carried through the revolution of Nov. 9, 1799, by which the Directory was overthrown and the consular government instituted. Very soon, however, after the accomplishment of the Revolution he discovered that the military force which he had called to his aid felt and acted as the real victor, and of his elaborate constitution, the work of all his wisdom, the pride of his whole life, very little notice was taken. In order to avoid any further humiliation he retired from his consulship and took part henceforward very little in politics. Napoleon made him rich, a count, a senator, etc., and seemed to have partiality for this *idéologist*. After the Restoration, Sieyès was banished from France as a regicide, and removed to Brussels. After the revolution of 1830, he returned to Paris, and d. there June 20, 1836. Boulay published in 1836 *Théorie constitutionelle de Sieyès*, drawn from his *Mémoires inédits*. There are also *Études Sieyès* by Mignet (1836) and Beauverger (1851).

**Si'gel,** p.-v., Big Spring tp., Shelby co., Ill., on Chicago division of Illinois Central R. R.

**Sigel,** tp., Huron co., Mich. P. 181.

**Sigel,** tp., Brown co., Minn. P. 379.

**Sigel,** tp., Chippewa co., Wis. P. 123.

**Sigel,** tp., Wood co., Wis. P. 219.

**Sigel** (FRANZ), b. at Zinsheim, Bavaria, Nov. 18, 1824; graduated in the military school at Carlsruhe; became an officer in the army of the grand duke of Baden, in which he attained the rank of adjutant 1847; took part in the revolutionary movement of 1848; resigned his rank in the army; was appointed minister of war by the revolutionary authorities June 1, 1848; took part in the unsuccessful campaign against the Prussians; concentrated the demoralized remnants of his forces in the fortress of Rastadt; withdrew into Switzerland on the dissolution of the provisional government July 11, but, being expelled by the Swiss government, embarked for the U. S.; was for some years teacher of mathematics in an academy in New York,

and became major of the 5th regiment of New York militia; settled in St. Louis, Mo., 1858, as professor in a college; was commissioned early in 1861 colonel of the 3d Missouri Vols.; took part in the capture of Camp Jackson; fought the desperate battle of Carthage July 5; was second in command under Lyon at Wilson's Creek, Aug. 10; conducted the retreat from Springfield to Rolla; was thereupon commissioned brigadier-general to date from May 17; commanded a division under Fremont in his campaign in Southern Missouri; took an active part in the battle of Pea Ridge, Mar. 6–8, 1862; tendered his resignation in May, in consequent of unpleasant relations with Gen. Halleck, in command of the district; was summoned to Washington; made major-general, dating from Mar. 21; was placed in command of Harper's Ferry June 2; succeeded to the command of Gen. Fremont's army corps June 26; served under Pope in his Virginia campaign, taking a prominent part in the second battle of Bull Run, Aug. 29–30; was placed in command of the 11th army corps Sept. 14, 1862; became commander of the department of West Virginia Mar., 1864; was defeated by Breckenridge at Newmarket May 15; relieved from command shortly afterward by Gen. Hunter. Since the war he has resided in New York City, where he was chosen register Nov., 1871, and has taken part in the political movements of 1876.

**Sigh'ing.** The act of sighing consists of a full, long, and slow inspiration, which is immediately followed by a more rapid expiration unusually prolonged, and characterized by the presence of the sound of the air as it passes out of the mouth. Although usually a reflex act, excited by a slight and almost imperceptible sensation due to imperfect aëration of the blood, sighing is often voluntarily performed. It ordinarily takes place about once in every six respirations, but when the attention is concentrated upon some subject of great interest, the reflex excitability is diminished for the time being, and then, when the mind becomes disengaged, the act of sighing is so prominent as to attract at once not only the notice of the individual, but of those around him. The object of sighing is therefore to aërate the blood more perfectly than ordinary respiration, and through it the lungs are more effectually filled and emptied than would be the case were the breathing uniformly regular. Sighing is also a means of expressing certain emotions, particularly those of a sorrowful and tender character. In this relation it is to a certain extent under the operation of the will, and may be assumed, like smiles and tears, for purposes of deception. Figuratively, the act of sighing is often associated in our minds with desires, and we are said to sigh for the objects of our wishes. But the connection is in reality not primary. We sigh not because we desire anything, but because during the concentration of the mind upon a subject or object of engrossing interest, we are for the time incapable of appreciating the sensation which prompts us to inspire air until it becomes overwhelming, and then the long-drawn sigh takes place. Sighing is not peculiar to the human species, but is a normal phenomena of respiration in all mammals, and perhaps in other classes of animals.

WILLIAM A. HAMMOND.

**Sight.** See VISION, by PRES. F. A. P. BARNARD, and OPHTHALMOLOGY, by C. R. AGNEW, M. D.

**Sight, Defects in.** See APPENDIX.

**Sigilla'ria** [Lat. *sigillum*, a "seal," referring to the numerous marks left by the leaf-stalks], a genus of fossil trees of the coal-measures of the true Carboniferous era. Trunks have been found 5 feet in diameter and 70 feet long. There is some doubt as to whether it was a cycad, a tree-fern, or a giant club-moss, but the latter opinion prevails at present. The roots called *Stigmaria* belong, at least in some instances, to this genus.

**Sig'ismund,** emperor of Germany 1411–37, the last of the house of Luxemburg, b. Feb. 14, 1362, a son of the emperor Charles IV.; received after his father's death (1378) the margraviate of Brandenburg, while his elder brother, Wenceslas, king of Bohemia, succeeded as emperor. Having been betrothed to Maria, the eldest daughter of Louis the Great, king of Hungary and Poland, he became heir-apparent to these two crowns. But on the death of Louis (1383) the Poles chose his younger daughter, Hedvig, queen, Charles Durazzo seized the regency in Hungary, and Maria was kept in captivity by John Horvath, ban of Croatia. Sigismund succeeded, however, in rescuing and marrying her, and was crowned king of Hungary in 1387. He now undertook a war against the Turks, supported by the German and French chivalry, but was completely routed at Nicopolis (1392) by Bajazet, fled to Greece, and found, when in 1401 he returned to Hungary, his queen dead, his throne occupied by Ladislas of Naples, and his brother deposed in Germany, and vindicating himself only with difficulty in Bohemia. Nevertheless, he succeeded once more in turning his fortune. In 1403 he expelled Ladislas, and again took possession of the throne of Hungary, and in 1410 was even elected emperor of Germany. In 1414 he induced Pope John XXIII. to convoke an œcumenical council at Constance in order to reconcile the Hussite party with the Church. He gave Huss a safe-conduct to the council, but he broke it; Huss was burnt, and the Hussite war commenced, which did not end until shortly before his death (Dec. 9, 1437). His uncontrollable impetuosity and entire lack of consistency spoiled even his good plans, and drove him into senseless and infamous undertakings. He was succeeded by his son-in-law, Albert II. of Hapsburg.

**Sigismund,** the name of three kings of Poland of the Jagellonian dynasty: SIGISMUND I., THE GREAT, b. Jan. 1, 1467, a son of Casimir IV., was chosen duke of Lithuania in 1506, and succeeded in the same year his brother Alexander on the Polish throne. He was very successful in repelling the invasions along the eastern and southern frontiers by the Russians, Tartars, Moldavians, and Wallachians, defeating them severely time after time. No less successful was his internal administration. He understood how to curb the arrogant nobility; was prudent in his expenses, and a patron of literature, which flourished highly under him and his son; and he favored the Reformation, which from Germany spread rapidly among the Poles. After the death of his first wife, Barbara Zapolska, he married Bona Sforza of Milan, an intriguing, avaricious, and licentious creature, who exercised great influence on him, and partly averted the love of his subjects from him. D. Apr. 1, 1548, and was succeeded by his son, SIGISMUND II., AUGUSTUS, b. Aug. 1, 1520, who, although educated purposely by his mother in effeminacy and dissoluteness, turned out much better than was expected, and especially opposed the ambitious schemes of the queen-dowager with great decision. In 1553, Bona left Poland, carrying with her an immense treasure, but was cheated out of her money; thus, Philip II. of Spain borrowed 320,000 ducats of her, which he never repaid; and in 1555 she was poisoned at Bari, Italy, by one of her paramours. At the Diet of Lublin (1569) Sigismund succeeded in uniting Lithuania firmly to Poland, and at the Diet of Warsaw (1572) he granted religious liberty. Volhynia and Podolia were also incorporated, and his reign was, in both external and internal respects, a period of great prosperity. D. July 18, 1572, and with him the male line of the Jagellonian dynasty became extinct. But his sister, Catharine, who was married to John III., king of Sweden, had a son, Sigismund, who with a view to the Polish succession was educated in the Polish language and the Roman Catholic faith. After the death of Stephan Báthori (1587) he also succeeded in being elected king of Poland as SIGISMUND III., and was crowned at Cracow; but the great expectations which the Polish people connected with this the last scion of the Jagellonian house were sorely disappointed. He was proud, dull, sour, and lived in indolence and seclusion, surrounded by Jesuits. His only passion was to unite Sweden and Poland, in order to re-establish Romanism in the former and suppress the Reformation in the latter. In 1592, John III. died, and Sigismund succeeded him as king of Sweden, but in 1604 he was formally deposed by the Swedish estates, and his uncle, Charles IX., raised to the throne. Unwilling to give up his claims, he then began that long series of wars with Sweden which contributed not a little to the final ruin of Poland. His relations to Russia, where he supported the false Demetrius; to the Cossacks, whom he attempted to convert to the Roman Catholic Church; to the Turks, whom, however, he defeated at Choczim in 1621, were equally awkward, and in the interior his fanaticism and violence called forth one dangerous insurrection after another. D. Apr. 30, 1632.

**Sigmaringen.** See HOHENZOLLERN.

**Sign** [Lat. *signum*], in algebra, a symbol indicating a relation subsisting between two quantities or an operation to be performed; of the latter, those most commonly used are: +, denoting addition; −, subtraction; ×, multiplication; ÷, division; $\sqrt{}$, square root; $\sqrt[3]{}$, cube root; $\sqrt[n]{}$, $n$th root, etc. The signs denoting relations are: =, equal to; >, greater than; <, less than, etc. (See ALGEBRA.)

**Sign,** in astronomy, a portion of the ecliptic, containing a twelfth part of the complete circle, or thirty degrees. The first sign commences at the point of the equator through which the sun passes at the time of the vernal equinox; and the signs are counted onward, proceeding from W. to E., according to the annual course of the sun around the circle. The signs and their characters are as follows:

| | | | |
|---|---|---|---|
| ♈, Aries, *Ram.*<br>♉, Taurus, *Bull.*<br>♊, Gemini, *Twins.* | Spring. | ♋, Cancer, *Crab.*<br>♌, Leo, *Lion.*<br>♍, Virgo, *Virgin.* | Summer. |

| | | | |
|---|---|---|---|
| ♎, Libra, *Balance.*<br>♏, Scorpio, *Scorpion.*<br>♐, Sagittarius, *Archer.* | Autumn. | ♑, Capricornus, *Goat.*<br>♒, Aquarius, *Waterman.*<br>♓, Pisces, *Fishes.* | Winter. |

The first character, ♈, indicates the horns of a ram; ♉, the head and horns of a bull; ♊, the ancient statues of Castor and Pollux; ♋, the claws of a crab; ♌, a corruption of the Greek letter Λ, initial of Λέων, "lion;" ♍, corruption of παρ for παρθένος, "virgin;" ♎, scales; ♏, the tail of a scorpion, or the legs and tail; ♐, an arrow; ♑, for τρ, initials of τράχος, "goat;" ♒, running water,; ♓, two fishes joined. (See ZODIAC.)

**Si'gna,** town of Italy, province of Florence, on the Arno, about 11 miles W. of the city of Florence. It was fortified as early as the fourteenth century; the walls and turrets are still standing. P. 7222.

**Signal Service.** The necessity of some means of communication in military service at distances beyond the reach of the human voice led to the organization of signal corps at very early periods. Polybius, about 200 years B. C., refers to the wonderful skill attained by the signal service of his day. At a later period semaphores were adopted for use with armies, and systematized codes of flag-signals for use with fleets. The invention of the electric telegraph greatly developed organizations of this description, and telegraph corps are now attached to almost all armies, and field-signals are widely used as an indispensable auxiliary. Under the system adopted for use in the army and navy of the U. S., devised by Gen. Albert J. Myer, messages written in words or characters in any language or of any description can be sent by signals by day or night as far as one man can be made by any means (by the use of the telescope or by being placed on high towers, etc., erected for the purpose) to see another. The apparatus used in the signal service of the U. S. army is light and portable; it can be carried in the hand, on foot, or on horseback. Signals conveying messages are made by motions of flags by day or by torches by night; heliographs, for signalling by sun-flashes, are used also, or many varieties of apparatus may be employed. Fig. 1 represents a signal soldier equipped ready for work.

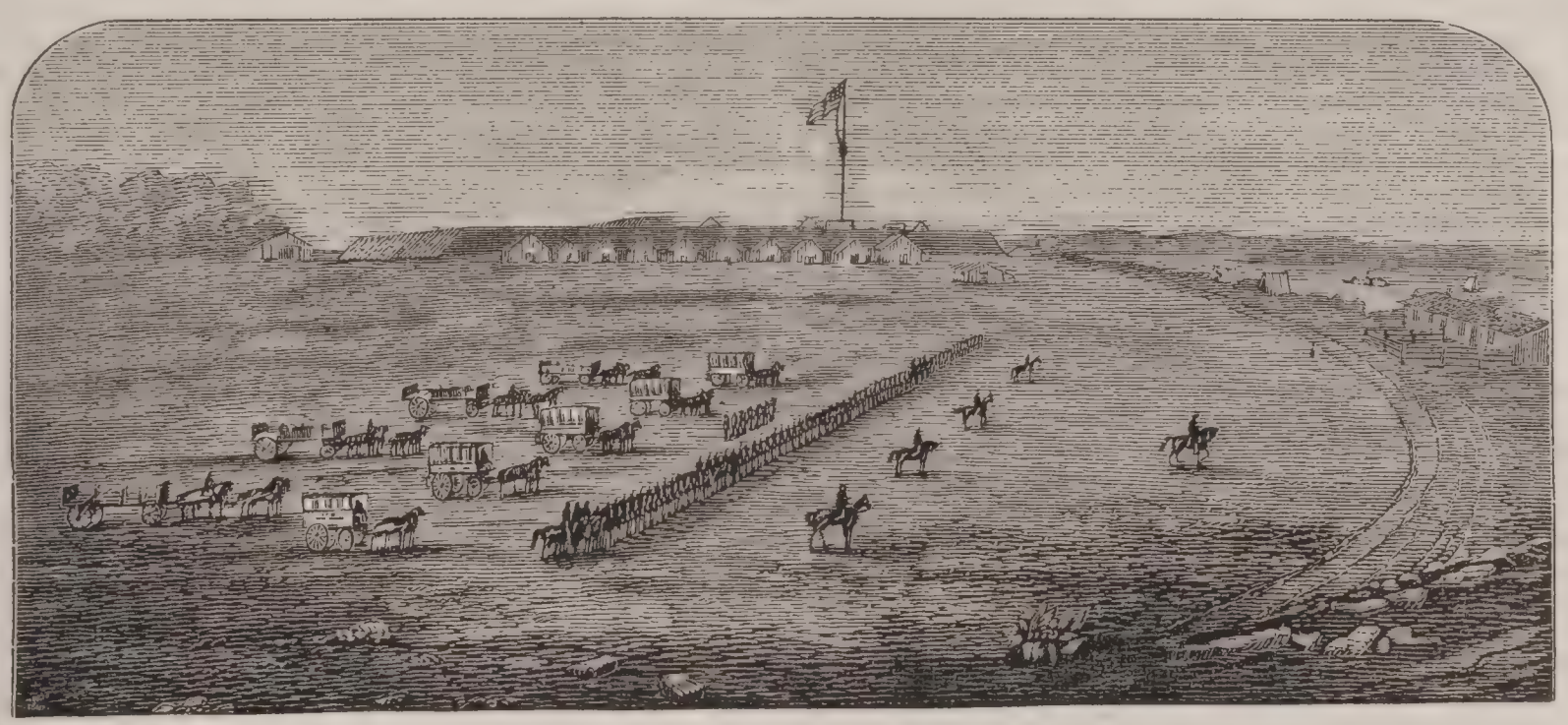
FIG. 1.



To transmit a message of any character by the use of flags or torches a distance of 10 miles would now be considered easy. Ranges of from 16 to 20 miles are often reached, and on the Western prairies messages have been transmitted from 25 to 30 miles by flags. Ranges of 90 miles have been attained in British India by means of the heliograph. In times of war, systems of reports are organized to cover extensive sections of territory. In some instances communication can be had from stations on elevated points over the heads of an enemy.

The general service of a signal corps should be so conducted that it may offer a body of educated and skilful officers, practised in the duties of reconnoissance, the studies that pertain to them, and the habit of making condensed reports; skilled also in the arts of cryptography, telegraphy, and semiology. Signal parties should be armed as cavalry; and as cavalry has been styled the eyes and ears of an army, men of the signal service should aim to make themselves the army's eyes and ears and tongue. The chief signal officer with an army ought to stand in the light of a confidential secretary to the general commanding.

FIG. 2.



In time of war the signal service of the U. S. army is equipped to maintain communication by signals, by telegraph, or by semaphores between different portions of an army or armies, or between armies and fleets. The field-telegraph trains of the signal service are organized for use with armies; they are managed by soldiers, who are drilled to march with, manœuvre, work, and protect them. The train carries light or field telegraph lines, which can be very quickly erected or run out at the rate of 2 or 3 miles per hour; they can be put in use for any distance, and be as rapidly taken down, repacked, and marched off with the detachment to be used elsewhere. Fig. 2 represents a train ready for movement.

In time of peace, the signal service transmits intelligence in reference to storms or approaching weather-changes by the display of signals of warning and by reports posted in the different cities and ports of the U. S. Maps showing the state of the weather over the U. S. are exhibited at board-of-trade rooms, chambers of commerce, and other places of public resort. Bulletins of data for all the stations are also prominently displayed and distributed without expense to the leading newspapers.

Signal stations are also established in connection with the life-saving stations. These stations are connected by telegraph, and, in addition to displaying storm-warning signals and making the usual meteorological reports, make special reports upon the temperature of the water, tempests at sea, the sea-swell, etc. They also summon assistance to vessels in distress from the nearest life-saving stations or from the nearest port. Fig. 3 represents one of these stations.

Stations for river reports, to give notice of the conditions of the rivers affecting navigation and floods, are also established on the principal interior rivers and their tributaries.

The officers and men of the signal service are instructed for the different branches of the service at Fort Whipple, Va., and at the central office in Washington, D. C. They are taught signalling in all its branches, telegraphy, the use of the various meteorological instruments, the modes of observing, and the forms and duties required at stations of observation; the force is also drilled with arms, with the field-telegraph train, the construction of permanent telegraph lines, and in the usual duties of soldiers. For the duties of the observation of storms and for the display of storm-signals all stations communicate directly with the signal-office in Washington over telegraphic circuits arranged with the different telegraph companies, or connecting with the office at fixed hours each day and night. Each station is equipped with the following instruments: barometer, thermometer, maximum thermometer, minimum thermometer, Robinson's anemometer with electrical attachment and self-registering

apparatus, hygrometer, wind-vane, rain-gauge, and at stations located on rivers, lakes, or sea-coasts, thermometers

FIG. 3.



for taking the temperature of water at different depths. The readings of these instruments, made three times a day at fixed hours, are reported to the central office in cipher. These reports from the stations of observation, extending over territory reaching from the Atlantic to the Pacific oceans and from the Capes of Florida into British America, are not unfrequently concentrated at the central office in the space of forty-five minutes. The stations at which cautionary signals are displayed are equipped with flags and apparatus for exhibiting the cautionary day or night signals.

Four graphic charts are prepared at the central office on the receipt of each report, as follows:

I. A chart of barometric pressures, temperatures, and winds, together with the wind-velocities at the different stations, and the precipitation occurring; it exhibits the barometric pressures and the temperatures in their relation to districts and to each other by a system of isobaric and isothermal lines, and the wind-directions by arrows at the different stations.

II. A chart of the cloud-conditions prevailing over the U. S., on which the different varieties and amount of clouds visible at the different stations appear by symbols; on this chart is also indicated the weather as reported at each station, the direction of movement of upper and lower clouds, and each morning the minimum temperature of the preceding night in relation to districts of territory.

III. A chart showing the relative humidities over territorial districts with the temperature at the several stations; this enables studies to be made for territorial sections, the difficulties attending studies of this character being obviated to a very considerable degree by the inter-corrections of the stations among themselves, and by the great extent of the regions over which the readings are simultaneously made.

IV. A chart of barometric pressures, exhibiting, for purposes of reference, by lines of no variation, the districts of territory over which the barometric pressure has increased, and those over which it has diminished in each average period of eight hours in the twenty-four hours, terminating at the hour of the report.

In the study of the charts for the reports the well-known rules and generalizations established by the experience of meteorologists are used. The published office report, based upon each general report of observations, consists of a synopsis of the meteoric conditions prevailing over the territory of the U. S. at the time of the report, and a statement of the changes likely to occur within the next twenty-four hours. For the purposes of convenient study and of condensed description the territory of the U. S. is arbitrarily divided into districts. These districts are described and named as follows, and the italics are those names used in the press reports of the "weather probabilities:"

Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island as the *New England States.*

New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, and Virginia as the *Middle States;* and that part of those States lying E. of the Alleghanies as the *Middle Atlantic States.*

North Carolina, South Carolina, Georgia, and Northern and Eastern Florida as the *South Atlantic States.*

Eastern Mississippi, Alabama, and North-western Florida as the *Eastern Gulf States.*

Western Mississippi, Louisiana, and Eastern Texas as the *Western Gulf States.*

Sometimes the South Atlantic States, Eastern Gulf, that portion of Mississippi not included in the Eastern Gulf States, with Tennessee and Kentucky, are grouped together as the *Southern States.*

*Lower Lakes* means Lakes Erie and Ontario, with adjacent territory.

*Upper Lakes* means Lakes Superior, Huron, and Michigan, with adjacent territory.

The *Lake region* includes the Upper and Lower Lakes.

The *extreme North-west* includes that portion of Dakota lying W. of the Missouri River, and the eastern portion of Wyoming and Montana Territories.

The *North-west* means the country lying between the Mississippi and the Missouri rivers.

The *South-western States* means that portion of the Western Gulf States lying W. of the Mississippi River, and including Arkansas.

*Pacific States* includes California, Oregon, and Washington Territory.

The *Ohio Valley* includes the belt of country about 200 miles broad from Pittsburg to Cairo.

The *Upper Mississippi Valley* includes the belt of country about 200 miles broad from St. Paul to Cairo.

The *Lower Mississippi Valley* includes a belt of country 200 miles broad from Cairo to Vicksburg. Below Vicksburg the character of the country so changes that it is no longer described as a valley.

The *Missouri Valley* includes a belt of country 200 miles broad from Fort Sully to St. Charles, Mo.

The *St. Lawrence Valley* includes a belt of country 200 miles broad from Lake Ontario to the mouth of the St. Lawrence River.

The extensions "from Missouri to Ohio," etc., etc., refer to areas reaching to and including the central portions of the States named. Thus a report, "Westerly winds extending from Iowa to Pennsylvania," would signify that those winds would be felt in the interior of those States, as well as over the territory lying between them of the respective States.

In "*the Coasts, etc.*" is included the land between the coasts and the parallel range of coast-hills or mountains. In Texas, Louisiana, and Northern Florida a belt of land extending 100 miles inward would be included.

The reports are those of readings of the different meteorological instruments, made as nearly simultaneously as possible. The reports from all the stations, received at the central office thrice daily at intervals of about eight hours, are at once entered graphically upon synoptic charts (the weather-maps), and from the study of these charts a deduction is had as to probable weather-changes within the ensuing twenty-four hours. This deduction is furnished to the press, and is telegraphed to twenty-one centres of distribution in bulletin form for the use of farmers, besides being given to the Associated Press for distribution throughout the U. S. The bulletins distributed to the twenty-one centres are displayed at post-offices in numerous villages in the agricultural districts. In the case of serious storms noticed as approaching the lakes or threatening any part of the sea-coast, cautionary signals are ordered at the central office to be displayed at the different lake- and sea-ports and upon the coasts as a warning to mariners. The cautionary signal is a red flag with a black centre by day, and a red light by night. This signal when displayed signifies (1) that from the information had at the central office in Washington a probability of stormy or dangerous weather has been deduced for the port or place at which it is displayed, or in its vicinity; (2) that the danger appears to be so great as to demand precaution on the part of navigators and others interested, such as an examination of vessels or other structures to be endangered by a storm, the inspection of crews, rigging, etc., and general preparation for rough weather; (3) it calls for frequent examination of local barometers and other instruments by ship-captains or others interested, and the study of local signs of the weather, as clouds, etc. etc. By this means those who are expert may often be confirmed as to the need of the precaution to which the cautionary signal calls attention, or may determine that the danger is over-estimated or has passed. The fortunate position of the territory of the U. S., and its great extent, enable a service of this kind to be conducted with especial advantage. The movements of the storms over the continent can be traced upon the chart from report to report, and the direction and rate of their progress, together with their intensity, be noted in time to give warning of their approach.

Floods occurring upon the Western rivers can be traced sometimes from the fall of rain within the respective watersheds and along the course of the different confluent streams until culminating in the dangerous flood of the principal river. In nearly the same manner that storms can be traced upon the charts, approaching changes of temperature and rainfall can be foreseen, and notice is frequently given in time to prevent injury to agricultural and other interests.

In the analyses of the official deductions of the signal office, or the "probabilities," the annual percentage of ver-

ifications is found to have been as follows: 1872, 76.8 per cent.; 1873, 77.6 per cent.; 1874, 84.4 per cent.; 1875, 87.4 per cent. While storms of a limited extent, such as squalls, tornadoes, etc., may spring up suddenly or pass between stations in such a way that their coming or courses cannot be foreseen, extensive and well-defined disturbances can, as a rule, be readily traced in time to forewarn the coasts or districts threatened.

Arrangements have been made with the chiefs of meteorological services in Europe, in accordance with the recommendation of the Vienna conference of meteorologists (1873), providing for the exchange daily of one report taken at the same instant over all the territories of the U. S., nearly all Europe, extending through Russian Asia to the Pacific coast, and in the northern portion of Africa. These exchanges are made every fifteen days by mail, and the reports thus received from 260 foreign stations are published as an *International Bulletin* at the Washington office. Besides the daily bulletins and weather-maps, the signal-office publishes a weekly review of the weather, which is furnished to the press, and a monthly review, accompanied with charts, showing the isobaric and isothermal lines, the prevailing winds, the tracks of low barometer, and a precipitation-chart for the month.* H. W. Howgate.

**Signals, Fog.** See Fog Signals, by J. Henry, LL.D.

**Signals, Naval.** See Naval Signals, by Capt. S. B. Luce, U. S. navy.

**Sig'nature,** in the old system of medicine, was some physical peculiarity of a drug which was supposed to indicate its use. Thus, because the euphrasy or eye-bright has a flower with an eye-like mark, it is good for the vision; the rock-liverwort was thought to be shaped like the liver, hence it is good for diseases of that organ. This belief prevailed not only among herbalists and pretenders, but among the best-trained physicians of the time.

**Signatures.** See Printing, by W. S. Paterson.

**Sig'ourney,** p.-v. and tp., cap. of Keokuk co., Ia., on Chicago Rock Island and Pacific R. R., has 5 churches, 2 newspapers, 1 woollen and 1 planing mill, a cheese-factory, 1 foundry, and a carriage-factory. Deposits of coal exist. P. of v. 992; of tp. 1637.

W. R. Hollingsworth, Ed. "Review."

**Sigourney** (Lydia Howard **Huntley**), b. at Norwich, Conn., Sept. 1, 1791; began to write verses at the age of seven years; established a select school for young ladies at Norwich 1809, and at Hartford 1814; published a volume of *Moral Pieces in Prose and Verse* (1815), which brought her into favorable notice, and obtained for her invitations to write for several periodicals, and was thenceforth through a long life one of the most popular of American female poets. She published 59 volumes of poems, essays, and letters, chiefly on moral or religious themes. In 1819 she married Charles Sigourney, a merchant at Hartford, visited Europe 1840, and d. at Hartford June 10, 1865. Among her works were *Letters to Young Ladies* (1833), *Zinzendorff, and other Poems* (1835), *Pocahontas, and other Poems* (1841), *Pleasant Memories of Foreign Lands* (1842), *Past Meridian* (1854), and a posthumous autobiography, *Letters of Life* (1866). Two volumes of her selected poems appeared in London 1841, and a choice edition, illustrated by Darley, was published at New York 1848.

**Siguen'za y Gongora, de** (Carlos), b. in the City of Mexico in 1645; educated in the university of that city; became chaplain to the archbishop of Mexico; was for twenty years professor of astronomy and mathematics, acquiring so great a reputation for erudition as to be honored with the title of royal cosmographer; wrote several treatises on Mexican history and antiquities; was director of the military school at Mexico; accompanied the expedition of Andrés de Pés against the French establishments in Louisiana and Florida 1693; planned the fortifications of Pensacola; published maps of the Florida coast, a description of the Bay of Galveston, brief histories of Texas and New Mexico, of the city of Queretaro, and of the University of Mexico, a topography of Mexico, and several volumes of poems of a highly ornate character, all in Latin, and left many works in MS., some of which were destroyed by a fire in June, 1692. He entered the order of Jesuits 1693. D. in Mexico Aug. 22, 1700. His name is the most famous one in the literary annals of New Spain during the colonial period, but his works are now rarely to be seen in Mexico, and are rapidly becoming forgotten.

**Sikhs,** the "disciples" (so the name imports) of certain religious teachers in Upper India who have played a notable part in Indian history during the last 100 years.

Modern Hinduism has not universally remained the dead level of idolatry that it is often conceived. All over India, and at various times in the last 800 years, there have been movements towards some sort of spiritual revival, originating generally with brooding individuals of the unlearned classes, who hungered for something better than the popular superstitions. Abandonments of caste and of idol-worship have been frequent, but not universal, characters of these reforms. Most of them have been connected (it is not easy to say why) with what is called *Vaishnava* doctrine. Some of these dissentient bodies have died away, but yet have left a permanent leaven in the shape of innumerable popular verses; some have hardened into mere sectarian idolatries; others have settled into Quietist societies; none have developed into a nation but the Sikhs. The original founder of the Sikh doctrine was Nának, born near Lahore in 1469, of the Khatri caste, warriors once, but then and now oftener traders. He is alleged to have roamed not only over India, but through Persia to Mecca. At last he returned home to resume his place in the household, and passed the rest of his life in preaching fervently, if somewhat vaguely, to Hindu and Mohammedan alike, the worship of one God, virtue, and tolerance. He did not apparently claim a miraculous commission, nor did he attempt to change social usages; he appeared to recognize both Mohammed and the Hindu incarnations as bearing divine missions; he gave no encouragement to asceticism, and he retained ordinary Hindu language as to transmigration and kindred tenets. Nának died in 1539. A line of Gúrús, or chief teachers, succeeded him, and the belief was held, on the traditional deathbed assurance of Nának, that the spirit of the latter became immanent in each of the line successively. Hargovind, the sixth of the Gúrús, was the first to become a man of war and of the chase. His descendant, Tegh Bahádur, the ninth of the line, was executed by the Moghul's government in 1675. When led to death he girt the sword of Hargovind upon his own young son, Govind, the tenth and last and most memorable of the Gúrús. Govind not only deepened the warlike stamp already for some time impressed on the "disciples," but deliberately fixed his aim in the destruction of the hated Mohammedan power, and strove to recast and inspire the Sikh organization as a militant Church and nation devoted to that task. Govind died (1708) by an act of private revenge; his own children had been butchered by the Mohammedans; he named no successor; he declared (the Sikh tradition says) that the fated ten had come, and thenceforward the Gúrú would be present with the community in spirit only.

Neither Nának nor Govind formally abolished caste, but practically their institute, receiving disciples from all classes, wrought in that direction. Govind enjoined that God was to be worshipped without images, but beheld in the body of the *Khálsa* or Congregation of the Faithful. All Sikhs were to be initiated by one rite; they were to be entirely at the disposal of the Faith and of the Gúrú. They were to honor Nának and his successors; to bow in reverence only before the holy *Grant'h* or Book; to bathe in the holy pool of Amritsar; to look to war as their occupation and field of desert. Steel was to be their sacred emblem; sweetened water stirred with steel in the presence of five Sikhs, and then partly sprinkled on the novice, partly drunk by him, formed the initiatory rite. Each initiated Sikh was to assume the title of *Singh* (*Sinha*, "a lion," "a champion"), to keep his locks unshorn, and dress in blue, to abstain from tobacco; and their salutation was to be "Victory to the Gúrú!" The toleration of Nának, at least as regarded Mohammedans, formed no part of Govind's teaching.

We have mentioned the Book. The *Ádi Grant'h*, or First Sacred Book, was compiled by Arjún, the fifth Gúrú, about the year 1600. It is a miscellany of verses, moral and mystical, ascribed in part to Nának and his successors, in part to earlier teachers. A supplementary work, compiled by Govind, known as the *Grant'h* of the tenth king (or pontiff), is a stranger hotch-potch, embracing prayers and hymns, narratives of Govind's own history and exploits, mythological legends, and several series of stories, one of which would seem to be that known in mediæval Europe as the Tale of the Seven Masters.†

*Amritsar*, "the Lake of Ambrosia," was dug by Rám Dás, the fourth Gúrú. Round it has gathered a large and busy city, now holding more than 100,000 souls. In the centre of the pool stands the most sacred edifice of the Sikhs, the Hari-Mandir, enshrining the holy original Grant'h. The building, thickly gilt all over, is joined to the quays by a marble bridge, and the porches and quays are the haunt of the *Akális* or "servants of the Eternal." This order claims its origin from Govind. They are, or were, devotees and fanatics of an active kind, who denied

* This article has been read and approved by Gen. Albert J. Myer.

† An English version of the Sikh sacred books is in preparation by the Rev. E. Trumpp, a German missionary, to be published at the expense of the India office in London.

all earthly masters, and went about with naked swords, the self-constituted and irascible champions and censors of the Khálsa. They alone keep up the blue dress; they carry the holy steel generally in the form of a sharp discus round the peaked turban.

Besides the warlike disciples of Govind and his forerunners, there was a class of Sikhs which at an early period disapproved of the secular turn taken by the majority, and gave themselves more strictly to devotion, claiming Sri Chand, Nának's son, as their teacher. Representatives of these are found in many Indian cities, sometimes gathered in convents and devoting their time to theistic worship and the perusal of the *Adi Grant'h*. The bulk of the Sikh converts was derived from the great Jat race, which forms a large part of the population in N. W. India and of the dry countries near the Indus. The special nurseries of the Sikhs have been (N. of the Sătlej) the districts round Lahore and to the N. of that city; (S. of the Sătlej), the districts of the Patiála state. The former, often called *Mánjha* or Midland, became the seat of greatest Sikh power; the latter, sometimes called *Málwa*,* is the seat of largest Sikh population.

The Sikhs present a striking instance of the effect of moral causes on the outer man. From a sect they have become a nation, not only with a national spirit, but with a strongly characteristic physique and physiognomy. Among all the bronze-tinted races they present probably the finest examples in existence of manly beauty and dignity of aspect, whether as princes or warriors. Three kindred chiefs of the Málwa Sikhs, the rájas of Patiála, Jhínd, and Nába, who were present at a state reception by the governor-general (Lord Canning) in 1860, have left a deep impression on the present writer. All three were tall men, the first two gigantic. Jhínd was advanced in life, but Patiála, in his prime, flashing in steel and gold cloth, was the ideal of a Hindu Phœbus. The moral repute of the Sikhs is not high, but in valor they are not below their looks, as they have often shown in fighting both against and in the British line of battle. The whole body drew extraordinary spirit and life from the pride and union inspired by Govind's *Institutes*.

We revert to history. The Sikhs, after Govind's death, were sorely crushed, and for years little heard of. But the crumbling of the Moghul power, and the repeated invasions of India, first by Nádir Sháh, and then by Ahmed Sháh the Afghan, favored their revival and trained them in war. In 1763 we read of 40,000 Sikhs defeating the Afghan governor of Delhi near Sirhind. Tradition tells how the dispersing victors, as they rode through the land, stripped raiment and accoutrements to cast into the villages, marking them as prize. By 1785 the Sikhs, forming a rude confederacy, with annual diets at Amritsar, were predominant from the Indus to the Ganges, and their armed force was not less than 70,000, all horsemen.

Ranjít Singh, a boy of extraordinary daring and genius, succeeded his father, the Sikh chief of Gujránwála, in 1792. Ranjít was already a personage to be negotiated with when Lake, in hot pursuit of Jeswant Rao Holkar, first showed British colors on the Sătlej in 1805. At the same period was held the last diet of the Sikh commonwealth. The European power barred Ranjít S. of the Sătlej, but beyond that river his dominion extended rapidly. By 1823 he ruled as king the whole Panjáb, including Multán, with Kashmír and the Afghán province of Pesháwar. He had long established a disciplined infantry, for which the Sikhs afforded excellent material, and about 1822 he had been joined by several able officers of the Bonaparte school (Ventura, Allard, Court, Avitabile). In 1838 the English governor-general (Lord Auckland), moved by apprehension of Russian intrigue, took up the ill-fated scheme of displacing the *de facto* rulers in Afghánistán and setting up Sháh Shúja, an ex-king of Ahmed Sháh's family. In this scheme Ranjít was reluctantly associated. He died whilst the expedition was still advancing on Kábul, June 27, 1839, in age fifty-nine years, but older in constitution. He had always been apt to plunge into fits of debauchery, and such habits grew on him in later life. His civil rule preserved a rough order and security, but the energies at his disposal were mainly devoted to war, and instead of the undisciplined horsemen of his youth, he left behind him a trained army of 50,000 disciplined soldiers, besides as many more well-armed irregulars, and 300 field guns. He had always managed to keep peace with England, though suspicion was often rife on both sides.

Under Ranjít the most prominent figures long were three Rájput brothers, who had risen by assiduity and his favor to the rank of rája and the possession of the important fief of Jámú. By their head, the wily Gúláb Singh, the Sikh dominion had been in 1835 extended to Ladák, and even (in 1840, after Ranjít's death) to Bálti, both in the Tibetan region. Gúláb Singh's captain, Zoráwar Singh, then advanced beyond the Indus sources to the holy lakes of Mansarowar, near which his force was surrounded, in midwinter and 12,000 feet above the sea, by Tibeto-Chinese troops from Lhassa, and overpowered. The leader slain, the officers taken, the mass perished; and a few frost-maimed wretches, sole relics of this adventurous band, brought the tale to the British post at Almora, having fled across passes 16,000 feet high. This episode seemed to deserve record, but such adventurers employed few, and the gathered mass of military energy, having no field abroad, spent itself in strife at home. Ranjít's son, Kharak Singh, an imbecile person, succeeded him, but died a year later (Nov. 5, 1840), and the same day saw Kharak's son and successor perish by the fall of a gateway. Sher Singh, a disowned son of Ranjít, was proclaimed by aid of the soldiery, now the real masters. He was murdered in 1843, and succeeded by a child, Dhalíp, ascribed to Ranjít's latter days. A régime of donatives, conspiracies, murders, and all-but anarchy dragged on for two years more. The English government dreaded to precipitate collision by ample preparations, and yet what was actually done in preparation armed and stimulated the Sikh army, which at last (Dec. 11–14, 1845) poured across the frontier river Sătlej. An attack made by the British (Dec. 21–22) on the Sikh camp (at P'hírushahr, more commonly since written Ferozshahr, 10 miles from Ferozpur), partially intrenched and strongly armed, was in the end successful with the capture of 70 guns; but the success was hard to win. The skill of the Sikh artillery and the firmness of the infantry surprised the British officers and shook the Sepoys. After some minor actions the new position which the Sikhs had intrenched at Subraon on the Sătlej, covering a boat-bridge, was stormed (Feb. 10, 1846), and the Sikhs driven into the river with great carnage.

Treaties which followed kept up Sikh rule in the name of Dhalíp Singh, with a British resident in supervision. Two years of this ended in another war, which began with the revolt of the governor of Multán and the murder of two British officers there. After the capture of Multán and several pitched battles the strength of the Sikhs was broken at Gujerat (Feb. 21, 1849), and the whole territory was annexed to British India, except Kashmir, which had been made over to Gúláb Singh in 1846.† The ablest men were selected for the administration of the new province, headed successively by the brothers Henry and John Lawrence, and unusual liberality of expenditure was allowed on works of improvement. These things made due impression, and eight years later (1857), when a day of trial came for the British in India, the stability of this new province became a base for the first steps toward the recovery of power in the Ganges valley. The Sikhs were eminently loyal to their new rulers, and many of them did noble service in the suppression of the revolt. Many since then have served well beyond sea—*e. g.* in China and in Abyssinia.‡

Powerful as the Sikhs became on their native soil, alike from union and from character, they never formed more than a fraction of the population of their own territory. Their present number is about 1,000,000 on both sides of the Sătlej, and these appear to form about one-seventh of the population of those districts which contain Sikhs in any numbers.

Ranjít's reign had already tended to weaken some of the stronger elements in Sikhism, and under the impartial level of English rule its spirit has been still further weakened. The political bond and aspirations that invigorated the Khálsa no longer exist; and as regards religious enthusiasm, the tendency of the educated few is to latitudinarianism, and that of the mass of yeomen to lapse more and more into ordinary Hindu superstitions. The number of initiations at Amritsar has diminished, and though the Sikh landholders are waxing richer, the amount of voluntary offerings at the holy places has greatly declined. Should the British rule continue for two or three generations, it seems probable that the Sikhs will have become practically reabsorbed in Hinduism. Should any calamity to that power (which God forbid!) open a political field before this reabsorption, the Sikhs may still play an important part in Indian history. H. Yule.

**Sik'kim,** a district in the Eastern Himalaya (Bengal presidency, British India), due N. of Calcutta, of 1234 sq. m., with, in 1872, 94,712 inhabitants, among which are 16,709 Booddhists from the Leptsha tribe of Tibetan origin. Chief place, Darjiling, with an elevation of 7168 feet, a mean

* Not to be confounded with proper Málwa, in Central India.

† The young Mahárája Dhalíp Singh was consigned, with a settlement of £20,000 a year, to an English guardian. He spontaneously became a Christian, and has long lived in England.

‡ In 1858 there were nearly 21,000 genuine Sikhs serving under the British colors. There are now about 14,000.

annual temperature of 54.4°, and a rainfall of 130 inches; it is 78 miles from the foot of the hills, and is reached from Calcutta in a journey of from three to four days. Originally a convalescent dépôt for sick soldiers, Darjiling is now a flourishing civil station with numerous European residents, situated on a spur of the gigantic mountains, exceeding 28,000 feet, which cover the northern part of the district. The planting of tea and cinchona proved extremely profitable. In 1841 was made the first trial with the tea-plant; now 58,496 acres are held as tea-gardens, of which 13,305 have been brought under cultivation, and in 1874 the produce was 3,600,000 pounds. The plantation of cinchona had full success; 3,000,000 red-bark trees and 5,000,000 other sorts have been planted, which in 1874 produced 39,405 pounds of dry bark. The district was acquired in 1835 from the native state of Sikkim, and extended in 1849–61 in the treaties with the raja of Sikkim, whose dominions are now reduced to an area of 2544 sq. m., with a population of 7000 souls. Rice, millet, oranges, and some sorts of a common Tibetan cloth are the principal articles of production; the revenue of the raja is supposed to amount to 7000 rupees, exclusive of the heavy transit-duties and tolls to be paid on crossing rivers spanned by bridges. EMIL SCHLAGINTWEIT.

**Sila'nion** [Σιλανίων], b. at Athens, flourished about B. C. 320, a self-taught statuary (Müller from Pliny) of the school founded chiefly by SCOPAS (which see). Among his works may be named a figure of Theseus, a statue of Plato, one of Corinna, one of Sappho, and particularly a *Jocasta at the Point of Death*, where the deathly pallor of the countenance was produced from mixing silver with the bronze of the statue. (O. Müller, *Ancient Art*, § 306, 3; Sillig, *Dict. Artif.*, s. v.) H. DRISLER.

**Sile'nus,** in Grecian mythology, a son of Pan and Gea, or of Hermes, and the chief of the Sileni, a group of satyrs; educated the young Bacchus, and accompanied him afterward on his campaign against the giants, when he slew Enceladus. When he was drunk and asleep, he had the power of prophecy, and a temple was erected for him at Elis. In art he is always represented as an old man, bald, with goat's ears, drunk, riding on an ass or borne by satyrs. In the oldest comic plays in Greek he seems to have played a very prominent part.

**Sile'sia,** province of Prussia, S. of the provinces of Brandenburg and Posen, bounded E. by Poland, S. by Moravia and Bohemia, and W. by Saxony. Area, 15,547 sq. m. P. 3,707,167, of whom 1,760,341 are Protestants, 1,896,136 Roman Catholics, and 46,629 Jews; about two-fifths speak the Polish or other Slavic languages, the rest German. Along the southern and western boundaries the country is mountainous and rugged, but the whole central part is flat, traversed by the Oder and its tributaries. The soil is generally fertile and well cultivated. Grain, flax, hemp, oil-plants, tobacco, beets, and hops are extensively cultivated. An excellent breed of sheep is kept, yielding a very fine wool, and important manufactures of linen and woollen fabrics are carried on. The mineral wealth of the province is considerable, lead, copper, and coal being abundant. Cap. Breslau.

Silesia was from the sixth century inhabited partly by German, partly by Slavic tribes, and formed a fief or—as it was divided between several dukes—several fiefs, first of the Polish, then of the Bohemian crown. In 1537 the duke of Liegnitz and the elector of Brandenburg made an agreement that if either of the two reigning lines became extinct its possessions should fall to the other. In 1675 the ducal family died out, but the German emperor refused to acknowledge the validity of the agreement of 1537, and incorporated Liegnitz and the other ducal possessions as a lapsed fief of Bohemia into the Austrian empire. In 1740, Frederick II. marched, without declaring war, into Silesia, and seized the dominions which according to the agreement of 1537 were his, and after three bloody wars with Austria (1740–42, 1744–45, and 1756–63), kept them. Under the Prussian government the province has developed greatly, and it forms now one of the richest provinces of the kingdom.

**Silesia, Austrian,** province of Austria, between Prussia and Moravia, comprises an area of 1963 sq. m., with 513,352 inhabitants, of whom 434,750 are Roman Catholics and 72,318 Protestants. The northern part is covered by the Sudetes; the rest is flat, though high. The climate is somewhat rigorous, but healthy. Good crops of rye, barley, and oats are raised, cattle, sheep, and bees are extensively reared, and copper, lead, iron, and coal are mined. Cap. Troppau.

**Sil'houette** [named from M. de Silhouette, a parsimonious French statesman of the last century; hence, cheap, plain], a figure in profile cut out of black paper with the scissors. Silhouette-work has of late years been elevated to the rank of meritorious art by the late Paul Konewka and others, figures of a surprising degree of naturalness being produced in solid black. There are also relics of similar work of much merit done by the ancients.

**Sil'ica, or Silicic Acid** [old name, *silex;* Lat. *silex*, "flintstone;" Ger. *Kieselerde, Kieselsäure;* Fr. *silice, acide silicique*], the dioxide of the element *silicon*, which, next to oxygen, is the most abundant of the elements that make up the solid crust of the earth. The abundant mineral *quartz* is pure silica, and the great mass of rocks and soils is made up of different compounds of silica with metallic bases. Among the commonest minerals, the *micas* vary from *biotite* and *phlogopite*, magnesia micas (40 and 41 per cent. of silica), up to *muscovite*, or potash mica (46 per cent.); the *pyroxenes* vary from 50 to 55 per cent.; the *amphiboles* from 50 to 58 per cent.; the *feldspars* from *anorthite*, or lime-feldspar, 43 per cent., and *labradorite*, or lime-soda feldspar, 53 per cent., and *orthoclase*, or potash feldspar, 65 per cent., to the soda-feldspars, *oligoclase* and *albite*, which contain respectively 62 and 69 per cent. Among other common silicates are the *epidotes*, averaging in percentage of silica about 37; the *tourmalines*, 38; the *garnets*, 40; the *serpentines*, 44; the *kaolins*, 46; the *talcs*, 62, etc. The composition of silica is $SiO_2$—

| | |
|---|---|
| Containing silicon | 46.67 |
| And oxygen | 53.33 |
| | 100.00 |

(See SILICON.)

*Quartz*, which occurs in crystalline form in granites and other rocks, also makes up sea-sand (true), sandstones, and a large portion of most soils, gravels, and pebbles. Quartz crystallizes in the rhombohedral or hexagonal system, occurring usually in six-sided prisms, terminated by six-sided pyramids. Its exact density at zero, when pure and homogeneous, is 2.662, as first determined by the writer. (C. Deville gives 2.663; Breithaupt's maximum figures, at normal temperatures, are 2.658 and 2.659; mean, 2.66.) Its hardness is between those of feldspar and topaz. It polarizes light in the manner called *circular* polarization. (See LIGHT.) Quartz presents a good many minor varieties, some of which may possibly be *allotropes* (see *Amorphism*, under ISOMERISM), but it is more probable that the amorphous forms, like *agates, chalcedonies, hornstones, flints*, etc., which are often but slightly soluble in caustic alkalies, and have densities approaching to quartz, are mixtures, or quartz itself in a *crypto-crystalline* condition. *Amethyst*, the common gem, is one of the colored varieties of quartz, the cause of the color of which is not yet settled, some attributing it to manganese, some to titanic acid, and some to iron. *Rock-crystal* includes the transparent, colorless, crystalline varieties, which are sometimes used for making lenses and spectacles, also for prisms, the hardness being a great advantage as a safeguard against injury. Groups of transparent rock-crystals are among the most beautiful objects presented to us by nature, and when large are often valued at large sums. Rock-crystal is often found enveloping, or enclosing within it, other beautifully crystallized minerals, sometimes in slender needles of great length penetrating regular transparent quartz-crystals of great size through and through, proving that they existed before the quartz was concreted around them. We also often find cavities within such crystals containing liquids, sometimes water, sometimes a saline solution, and sometimes hydrocarbon compounds of great volatility which boil below the normal temperature. Some believe they have observed *liquid carbonic acid* in these cavities. All these facts demonstrate the fact of the crystallization of quartz *from solution* in water or other liquid medium, and the existence of enormous compression at the time of the process. *Milky quartz* is a variety exceedingly common as a gangue or vein-stone of metallic sulphides, and therefore generally constituting *gold quartz*, as the gold of this either exists in combination with such metallic sulphides or has been set free by their decomposition and removal. There are other important varieties of this mineral quartz, which will be found described in works on mineralogy. (See, for example, Dana's *System of Mineralogy*, pp. 189–198.)

*Tridymite.*—A species of mineral silica, crystallizing in the same system as quartz, but so far below it in density, this being about 2.3, as to constitute an undoubted allotropic form of silica. It was discovered by Von Rath.

*Asmanite.*—Meteoric quartz; another crystalline silica allotrope, observed by Maskelyne in the meteorite of Breitenbach. Its crystallization is right-rhombic, and its density about 2.25.

*Amorphous Forms of Silica.*—Silica when precipitated from solution, and when fused (to accomplish which requires an intense heat like that of the oxyhydrogen flame), assumes the density 2.225, and in this form is highly soluble in caustic alkalies—to a small extent in many saline solutions, and even in pure water. This is the form in which silica is left in the decomposition of many natural

silicates by alkaline waters, and it is therefore present in most soils. There is another amorphous kind of silica which has a higher density, called by Dana *jeuzschite*.

*Hydrates of Silica* (*Opals, Tripoli, Hyalite, Silicious Sinters*), *etc.*—These are native compounds, whose compositions are not very definitely known. An analysis of a very pure opal by Von Rath gives the formula $3SiO_2.H_2O$, with the density 1.99, corresponding to 9.84 per cent. of water. Some of these hydrates, however, contain as much as 13, 16, and even 21 per cent. of water, and some opals as low as 5 or 6 per cent. only. This indefinite character of opal is probably due sometimes to admixture with quartz or other forms of silica, a variable insoluble residue being generally left on boiling with an alkali. *Tripoli*, or *Infusorial Earth*, which often occurs in quite extensive beds, is made up chiefly of microscopic silicious shells. (See INFUSORIA, where some of these are pictured.) Silica, in the form of hydrates, enters more or less into solution in all river-waters, and is thus continually flowing into the ocean, in the water of which analysis indicates its presence in minute proportion. This proportion is, however, kept from increasing by a constant process of depletion that is going on through the agency of *life*. The superficial waters of the ocean are indeed populated with minute beings, either animal or vegetable—it is not certain which, though most probably the latter—which possess silicious skeletons (similar to the Infusoria above referred to). These continually die and sink to the bottom, so that the floor of the deep ocean is continually accumulating, in this form of organized matter, the silica brought down by rivers from the land. The relations of silica to life upon the land are highly important. Of the animal kingdom it is but a very trifling, and possibly wholly unimportant, constituent, but to many plants silica has just the same relation that *tricalcic phosphate* has to most animals—that is, silica is the main material of the *plant-skeleton*. Of the ashes of plant-stems, particularly, silica is often found to be a large constituent; thus, in ash of rye-straw is found 65 per cent., of potato-stems 36 per cent., and of wheat-straw as much as 73 per cent. Hence the importance of the existence in soils, for growing this class of plants, of silica in such form that it may pass in solution into the roots—namely, in the form of soluble silica, or more probably that of hydrated silica. Many soils are doubtless barren from lack only of silica, their most abundant constituent, in its *soluble* forms.

Silicic hydrates may be obtained artificially by several methods. If solutions of soluble glass (see WATER-GLASS) are treated with acids, hydrate of silica precipitates in gelatinous form. This, if well washed and dried over oil of vitriol, gives, according to Doveri, a product of the composition $3SiO_2.2H_2O$, which was converted at 212° F. into $3SiO_2.H_2O$, the same as Von Rath's native opal, referred to above. Hydrate may also be obtained by the action of the gaseous *fluoride of silicon* (see SILICON, COMPOUNDS OF) on water. Fuchs obtained thus the above trisilicic monohydrate, and another, a tetrasilicic monohydrate ($4SiO_2.H_2O$). Ebelmen also obtained a definite hydrate ($2Si_{03}.3H_2O$) as a transparent solid glass by the action of air upon *silicic ether*. Unfortunately, no record exists of the *densities* of any of these definite hydrates, which would have been of great value in relation to the study of the opals, tripolis, sinters, and other *native* hydrates. The investigations of Graham upon the hydrates and upon solutions in water of silica are of exceeding interest and importance. By DIALYSIS (which see) the great English chemist obtained a solution of 5 per cent. of silica in pure water, which may be boiled rapidly down to 14 per cent. if no gelatinization is allowed on the edges. This solution is tasteless, with a feeble acid reaction. In the course of a few days it passes spontaneously into a transparent jelly. Addition of a little muriatic acid or an alkali tends to preserve it. Carbonic acid coagulates it, also alkaline and earthy carbonates in minute proportion. Added to a solution of *gelatine*, this precipitates, *together with the silica*, about in equal parts. This solution evaporates to a lustrous transparent glass of composition $SiO_2.H_2O$, containing 22 per cent. $H_2O$. Density not stated. (For the relations of silica in soils to organic matter see HUMUS, last paragraph.) H. WURTZ.

**Silicates, Chemistry and Classification of.** The number of mineral silicates is very large, and materials are included therein of the greatest importance to mankind. Their study is therefore equally important. This study includes, of course, as one of its most essential departments, the grouping and classifying of silicates. No promise of success has ever attended, or is ever likely to attend, any system for such classification which is not fundamentally based upon chemical composition, relations, and derivation. This remark applies broadly to all mineral bodies, as well as silicates, and at the present day is not likely to be impugned by any of those qualified to form a judgment in the case. The systems of classification in use, therefore, at the present time are wholly based upon chemical composition by weight—that is, the relations of chemical combining proportions to *centripetal force;* the other great class of quantitative relations—namely, those to *space* or volume—not having been hitherto sufficiently well comprehended to furnish a basis. (See VOLUMES, MOLECULAR.) The chief standard and authoritative work of reference for this subject, as for others in the science of mineralogy, is the *System of Mineralogy* of James D. Dana of New Haven. Dana divides silicates first into *anhydrous* and *hydrous silicates*.

ANHYDROUS SILICATES.—These have three subdivisions: I. *Bisilicates*, containing for 2 equivalents of oxygen in silica—that is, for each equivalent of silica—1 of oxygen in bases, or basic oxygen; II. *Unisilicates*, 2 equivalents of oxygen in silica to 2 in bases; III. *Subsilicates*, 2 equivalents of oxygen in silica to more than 2 in bases—mostly 2 to 3, but also 2 to 4, and other ratios. The oxygen here called basic oxygen may belong to protoxides, sesquioxides, or dioxides, or to all three at once, *the sum of the whole oxygen* being counted; and this oxygen may be distributed among a large number of basic metals without departure from the type, so long as the same total ratio to the oxygen of the silica remains.

I. *Bisilicates.*—Among these there are 3 groups, comprising in all 25 species and sub-species. (1) The *Amphibole Group*, which includes the species *pyroxene, enstatite, hypersthene, diaclasite, wollastonite, rhodonite, spodumene, amphibole, kupferite, anthophyllite, crocidolite*, and others, divided into several sub-groups—all *anisometric*, but belonging to several systems of crystallization. (2) The *Beryl Group*, consisting of *beryl* and *eudialyte*—hexagonal. (3) *Pollucite* or *pollux*, the celebrated cæsium silicate of Breithaupt, which is made a sub-group by itself—regular system.

II. *Unisilicates.*—Of these Dana makes 13 groups, comprising 62 distinct species in all; many of which species, however, contain two or more distinct derivatives, so that there are in all about 90 species and sub-species. (1) *Chrysolites*, under which is *forsterite* (di-magnesium unisilicate), *chrysolite* (magnesium-iron unisilicate), *fayalite* (di-iron unisilicate), *tephroite* (di-manganese unisilicate), *knebelite* (manganese-iron unisilicate), and others more complex in basic constitution—orthorhombic. (2) *Phenacites*, including *phenacite* (di-glucinum unisilicate), *willemite* (di-zinc unisilicate), and *meliphanite*—hexagonal. (3) *Helvites*, containing glucinum—regular. (4) *Garnets*, of which there are 10 varieties, dependent on the variation of the basic constituents, these being *lime, magnesia, ferrous* and *manganous oxides*, as well as sesquioxides, *alumina, ferric*, and (in *ouvarovite*) *chromic oxide*—regular. (5) *Vesuvianites*, including *vesuvianite, zircon*, and *melilite* (or *humboldtilite*)—tetragonal or dimetric. (6) *Epidotes*, including ordinary *epidote*, whose bases are chiefly lime and alumina, with some ferric oxide, *piedmontite, allanite* (in which cerium replaces calcium), these three being monoclinic; also *zoisite* (chiefly lime and alumina), *gadolinite* (yttrium replacing calcium), *mosandrite, ilvaite*, etc.; these latter being orthorhombic. (7) *Axinites*, borosilicates, including *axinite* and *danburite*—triclinic. (8) *Iolite*, magnesia or ferrous oxide, with alumina—orthorhombic. (9) *Micas*, including *phlogopite* (right-rhombic magnesia-mica), *biotite* (hexagonal magnesia-mica), *muscovite* (common mica or right-rhombic potash-mica), *lepidolite* (lithia partly replacing potash, and right-rhombic like muscovite). (10) *Scapolites*, including 8 minerals, some of which vary considerably from the unisilicate ratio. The most important are *meionite* (lime and alumina), *wernerite* (the same, with more silica), *ekebergite* (a wernerite, with some soda replacing lime), *dipyre*, and *marialite*. All the scapolites are dimetric. (11) *Nepheline* (soda and alumina, usually with some potash)—hexagonal. (12) *Leucites*, including the interesting species *leucite, sodalite, lapis-lazuli, haüynite, nosite* (*nosean*)—all in regular system. (13) *Feldspars*. This group includes at least 7 highly-important species, which agree generally in several characters. Their

| Bases. | | | Crystals. | Total oxygen in MO & $M_2O$ | : | $M_2O_3$ | : | $SiO_2$. |
|---|---|---|---|---|---|---|---|---|
| Anorthite | $Al_2O_3$, with | CaO | Triclinic | 1 | : | 3 | : | 4 |
| Labradorite | " " | " and some $Na_2O$ | " | 1 | : | 3 | : | 6 |
| Hyalophane | " " | BaO, " $K_2O$ | Monoclinic | 1 | : | 3 | : | 8 |
| Andesite | " " | CaO, and $Na_2O$ | Triclinic | 1 | : | 3 | : | 8 |
| Oligoclase | " " | $Na_2O$, and some CaO | " | 1 | : | 3 | : | 9 |
| Albite | " " | $Na_2O$, almost solely | " | 1 | : | 3 | : | 12 |
| Orthoclase | " " | $K_2O$, " | Monoclinic | 1 | : | 3 | : | 12 |

densities are below those of most other unisilicates, generally below 2.8; their hardness below quartz; their fusibility easy; the crystallization clinohedral, either monoclinic or triclinic; and they have two cleavages easily obtained, one of which, at least, is brilliant, with a peculiar lustre, and readily recognizable by the practised eye. The preceding table gives an interesting and useful view of the feldspars in condensed form.

III. *Subsilicates.*—Dana makes three divisions of these, according to the oxygen-ratios between bases and silica. In all there are 17 species. A. (Ratio, 4 : 3.) *Chondrodite* and *tourmaline*, which are right rhombic and hexagonal. In chondrodite, Dana considers the fluorine present as *replacing oxygen;* and in tourmaline, the oxygen of the boric oxide as basic oxygen. B. (Ratio, 3 : 2.) This division includes the greater part of the subsilicates, and is separated into five groups: (1) *Gehlenite*—dimetric. (2) *Andalusite Group*, including *andalusite* (macle), *kyanite* (called by Dana *cyanite*), and *fibrolite* (*sillimanite*), these three having essentially the same composition, $Al_2O_3.SiO_2$ (alumina 63.2 per cent. and silica 36.8 per cent.), but each crystallizing in a different system, thus constituting a set of *trimorphs*. (According to computations of the writer, founded upon new discoveries in molecular chemistry (see VOLUMES, MOLECULAR), there should be two normal *andalusites*, having the precise densities at zero 3.079 and 3.146; while normal *fibrolite* should have 3.21; *sillimanite*, 3.276; *rhœtizite* (white kyanite), 3.578; and two normal kyanites, 3.635 and 3.687.) *Topaz* is also placed in the andalusite group, being regarded by Dana as having the above formula, with fluorine substituted for oxygen in the silica. It is orthorhombic, like *andalusite*. (3) *Euclasè Group*, containing *euclase* and *datholite*, the first of which contains glucina as a base, and the second, boric oxide. The 3 : 2 ratio is made out in both these cases only by computing the oxygen of the 5 or 6 per cent. of *water*, which both these minerals contain, as *basic oxygen*. (4) *Guarinite*, a silicate of lime and titanic dioxide, having the same composition as *sphene* or *titanite*, but dimetric in crystallization, while titanite is monoclinic. (5) *Titanite Group*. Titanite itself has the composition $CaO.TiO_2SiO_2$, in which the 3 : 2 ratio is apparent if the oxygen of the titanic dioxide be counted as basic. In this group are also placed *tscheffkinite* and *keilhauite*. C. (Ratio, 2 : 1.) Only two species, *staurolite* and *schorlomite*, are placed here.

HYDROUS SILICATES.—Of these Dana makes three sections, two of which he designates as the *zeolites* and the *margarophyllites*, while to another (which he puts first in order) he gives no distinctive name, calling it the *general section*, or simply the *first section*. Of these three divisions the margarophyllites are much the most numerous, comprising about 75 species; while of the zeolites there are only about 20; and the general section, including all others, numbers about 30 species. In his attempt to subdivide the hydrous silicates upon the same scheme which he has adopted for the anhydrous compounds—according to the relative proportions of oxygen supposed to be associated with the basic and acidic elements—Dana recognizes a great and indeed, in the present state of chemical science, an insuperable obstacle. This consists in the determination, in numbers of cases, whether the water is in the condition of *basic water* or of *water of crystallization* only, or, when it occurs in both forms, in ascertaining how much of it is basic or *constitutional*, and how much is only crystal water. A criterion has been lacking for the determination of this ruling question in the majority of cases. The writer has to say that such a criterion may be expected to arise out of his own discoveries of the geometrical relations of chemical combining proportions to space. (See VOLUMES, MOLECULAR.)

*First, or General Section.*—These are subdivided like the anhydrous silicates. I. *Bisilicates.*—Three groups, *pyroxenoids*, *berylloids*, and *picrosmines*. (1) *Pectolites*, or *Hydric Pyroxenoids*. Three important species, with others, come under this head—*pectolite*, *okenite*, and *laumontite*. Pectolite, which is monoclinic, like the anhydrous bisilicate *wollastonite*, was made to agree in constitution with the latter (by Frankenheim) by regarding all its water as basic, or (which is similar in effect) *all its hydrogen as metalloidal*, or interchangeable with Ca and Na (in accordance with our present views of equivalence, however, $H_2$ replacing one equivalent of the dyadic metals). In the case of *okenite*, which is (probably) orthorhombic, if *half the water* be basic, we get an assumed isomorphism likewise with the orthorhombic anhydrous bisilicate *enstatite* (calcium and hydrogen replacing magnesium, and the other half of the water being crystal-water). *Laumontite*, which is monoclinic, with crystals closely similar to those of the anhydrous bisilicate *pyroxene*, Dana brings into relation with the latter by regarding all its 15–16 per cent. of $H_2O$ as *crystal-water*—a view which receives some support from the facts that about one-fourth of the water escapes over oil of vitriol, and a further quantity, up to about one-half in all, at a heat even below 212° F. Nevertheless, it must be admitted that the other half of the water escapes only on incandescence. As yet, we know too little, in an *experimental* way, about the *precise* behavior of hydrous silicates under the influence of heat to settle these questions with any certainty. To illustrate: there has been no research to determine the questions of the *changes of density*, and therefore of equivalent volume, accompanying the dehydration of such silicates. When these data shall have been procured, we shall at last have some points of departure for computation, inductive generalization, and analogical reasoning. In this connection it may be pointed out that Dana, in adopting the principles above involved in his classification, recognizes the probability of the proposition that additions of crystal-water do not necessarily change molecular types and crystal-systems among silicates. This is in some measure in accordance with views put forth more than twenty years ago by Sterry Hunt, who suggested that the mode of derivation in *progressive series*, discovered by James Schiel (see HOMOLOGY and SERIES IN CHEMISTRY), should be found in mineral as well as in organic chemistry. Though the cases cited by Hunt—the variations in *chabazite* (see below) from $5H_2O$ to $6H_2O$, the hydrous iolites or *fahlunites* and others—may not really be satisfactory cases in point, yet his conception will unquestionably turn out justifiable by facts, in a way which will be found explained under VOLUMES, MOLECULAR. This conception was that $H_2O$ could play a part similar to that of $H_2C$ in homologues, and form *series* belonging to the same molecular family. Hunt conceived also that the *feldspars* (see above) had to each other a relation similar to that of a series of homologues, and that they all contained the same nuclear collocation of oxygen-atoms, associated with varying numbers of equivalents of the more basic elements, the latter playing a part similar to the $H_2C$ (homologen) in homologues. He even demonstrated the sound physical and mathematical origin of the conception in his mind by endeavoring to find evidence of it in the relations of the *equivalent volumes* of the feldspars (*Am. Journal of Science*, Sept., 1854). This view—which was appropriated ten years later by the mineralogist Tschermak, and brought forward without crediting to Hunt—will be found to have a certain justification, in so far as the volumic relations of the *most basylic metals* in the feldspars are concerned—a point which has not yet been specially examined. (2) *Dioptase Group*, or *Hydric Berylloids*. *Dioptase*, a hydrous copper-silicate, with 11–12 per cent. of $H_2O$, has the hexagonal crystallization and the composition of beryl (copper replacing glucinum), if all the water be considered as crystal-water and outside of the (assumed) essential molecular nucleus. This is a case similar to that of *laumontite*, above. *Catapleiite* and *chrysocolla* are placed here with dioptase. (3) *Picrosmine*, a hydrous magnesian silicate, which, if one-fourth of its water or hydrogen is basic, may be a bisilicate. With it is placed *spadaite*.

II. *Unisilicates.*—Six groups: (1) *Calamines*, or *Hydric Chrysolithoids*. Besides *calamine* itself, we have here *prehnite*, *chlorastrolite*, and *villarsite*, all orthorhombic, and nearly isomorphous with *chrysolite*, and made to approximate thereto in constitution by the same process as above, of supposing the water to be outside the essential molecule, as crystal-water, except in the case of *prehnite*, where part of it is made basic. (2) *Thorites*, or *Hydric Helvitoids*. *Thorite*, *cerite*, and *tritomite*, isometric minerals like the anhydrous *helvite* above, containing the rare metals as bases. (3) *Pyrosmalite*, which contains *chlorine*, supposed to replace basic oxygen. (4) *Apophyllite*, a hydrous lime-potash silicate containing a little *fluorine*. (5) *Gismondine* and *edingtonite*. (6) *Carpholite*.

III. *Subsilicates.*—Among these are *allophane* and other amorphous minerals.

*Second, or Zeolite Section.*—This important and interesting class of silicates has been supposed to have some relations in composition and in oxygen-ratios to the feldspars, but Dana prefers to consider them as *unisilicates* and *bisilicates*. By making certain proportions of the water basic, he classes as unisilicates *thomsonite*, *natrolite*, *scolecite*, *mesolite*, and *levynite;* and as bisilicates, *analcime*, *chabazite*, *gmelinite*, *phillipsite*, *harmotome*, *stilbite*, *heulandite*, *brewsterite*, and others. The zeolites are characterized by rarely or never containing magnesia or iron, their bases being earthy and alkaline.

*Third, or Margarophyllite Section.*—This large section has its name from being generally (at least those which crystallize) foliated or micaceous in structure, with the same prismatic angle (120°) as the micas, and usually with a *pearly* lustre. A majority of them are, however, almost always amorphous or massive in structure. Dana again resorts, in classifying them, to the oxygen-ratio, consider-

ing more or less of the water as basic, although he admits that such views are chiefly hypothetical, and without much satisfactory control from other known relations.

I. *Bisilicates.*—There are three groups—*talcs, sepiolites,* and *chloropals.* (1) *Talc Group,* including *talcs* and *pyrophyllites*—both orthorhombic in crystallization. They are hydrous silicates of magnesia. (2) *Sepiolite Group,* including both magnesian and aluminous silicates, which are only known in massive forms, like *meerschaum,* which is a sepiolite. *Smectite,* or "fuller's earth," is another of this group. (3) *Chloropal Group.* These also are massive or earthy. They are characterized by the basic constituent being chiefly iron oxide, either ferric or ferrous. *Glauconite* or greensand, the curious silicate which is found fossilizing small rhizopod shells, is one of this group. *Nontronite* and *pinguite* are varieties of chloropal. The latter contains as much as 25 per cent. of water.

II. *Unisilicates.*—Five groups—*serpentines, kaolins, pinites, margarodites,* and *hisingerites.* (1) *Serpentine Group, serpentine* and its varieties, *deweylite, cerolite, hydrophite, genthite* (nickel-gymnite), and *saponite.* These are all magnesian, *hydrophite* containing about one-third ferrous oxide, and *genthite* about two-thirds niccolous oxide. (2) *Kaolinite* or *Clay Group, pholerite, kaolinite, halloysite,* and *samoite,* hydrous silicates of alumina, samoite containing, by B. Silliman's analyses, over 30 per cent. of water, and giving the formula $2Al_2O_3.3SiO_2.10H_2O$. *Kaolinite,* which forms most clays, kaolins, lithomarges, etc., is $Al_2O_3.2SiO_2.2H_2O$. Dana makes it a unisilicate by supposing half the water to be basic. (3) *Pinite Group.* These are amorphous hydrous silicates, which contain alkalies as bases, together with alumina. Their content of water is generally far less than that of the previous (or clay) group. Dana places the *palagonites,* or basaltic tufas, here. There are many obscure species and varieties, including *gieseckite,* a Greenland pseudomorph after nepheline, found also at Diana, N. Y.; *agalmatolite* and *pagodite* ("figure-stones"), from which the Chinese carve images; *gigantolite* and many others. Jackson's *catlinite,* or Indian pipe-stone, also probably falls among the pinites. (4) *Margarodite Group.* This includes a great number of varieties, products of alteration of various anhydrous silicates. The *fahlunites,* products of hydration chiefly of *iolite,* include many varieties, such as *pyrargillite, aspasiolite, huronite, chlorophyllite,* etc. Also *margarodite* (derived from ordinary *muscovite,* or potash-mica, and therefore retaining the potash in its constitution), in which Dana regards the water as all basic. *Damourite* is another hydrous mica, closely related to margarodite. *Euphyllite* and *Cookeite* (containing lithia) also belong here. (5) *Hisingerite Group.* These are chiefly amorphous hydrous silicates of iron and manganese, some containing a little magnesia.

III. *Subsilicates.*—Three groups—the *chlorites, chloritoids,* and *seybertite.* (1) *Chlorite Group.* These are mostly crystalline micaceous minerals, and comprise very important and interesting species; among them *pyrosclerite,* which includes *vermiculite,* famous for its wonderful exfoliation when heated. This, with *penninite* and *ripidolite* (*clinochlore*), contains as bases chiefly alumina and magnesia, while *chlorite* (now called *prochlorite* by Dana) has but about one-third magnesia with two-thirds ferrous oxide; and *cronstedtite,* another of the group, contains almost wholly ferrous oxide in place of magnesia, and ferric oxide in place of alumina, being rich enough in iron to be regarded as an iron ore (45 to 48 per cent. of metallic iron). (2) *Chloritoid Group,* includes *corundophilite, chloritoid, margarite* (J. L. Smith's *emerylite*), and *thuringite.*

There have been attempts to formulate silicates upon the present prevailing *type-theories,* on the types of several associated molecules of water. Dr. Odling made this attempt first in 1857. For example, Dana's bisilicates, which Odling called *metasilicates,* he derived from two molecules of water, $H_4O_2$, by supposing them to contain a dyadic compound radical or "residue," SiO. *Enstatite* would then be $(Mg.SiO)O_2$, the SiO replacing $H_2$, and the dyad Mg the other $H_2$. *Pyroxene* would be derived in the same way from eight molecules of water $H_8O_4$; thus, $(CaMg.2SiO)O_4$. *Dioptase* he derived from four molecules, as $(Si.Cu.H_2)O_4$, the tetrad Si, and the dyad Cu, with $H_2$, making up the $H_8$. This system is ingenious, like many other type-hypotheses, but will not carry us very far with satisfaction.

HENRY WURTZ.

**Silico-Fluorides.** See FLUOSILICIC ACID, by PROF. CHANDLER.

**Sil'icon,** sometimes called **Silicium** [from Lat. *silex,* "flint-stone"], one of the elements, which, next to oxygen, is the most abundant one in the solid part of the earth's crust. Quartz, sandstones, and other forms of SILICA (see this head) contain over 45 per cent. of their weight of silicon. Granite and gneiss rocks will average 35 per cent. of silicon, slates 30 per cent., and trap-rocks 23 per cent. Silicon is therefore many times more abundant than any other *solid* element; and it is one illustration of the comparatively slight mastery obtained so far by man over nature that for this superabundant element no direct use has been found, it being as yet but a rare curiosity of the laboratory and museum. Silicon was first obtained by Berzelius in 1823 from the silicofluoride of potassium (see FLUOSILICIC ACID) by the action of fused potassium thereon. It appears, when thus obtained, as an amorphous allotrope, a powder of a dull-brown color, which smears the fingers like lampblack. It does not conduct electricity; is not acted on by mineral acids, except hydrofluoric, but dissolved by potash solution. Heated in air or oxygen, it burns brilliantly with a heat sufficient to melt the silica formed. Its density, in this allotropic modification, does not appear to have been determined. Silicon may be obtained in this form also by the action of potassium or sodium on gaseous fluoride or vaporous chloride of silicon; also by the electrolysis of fused silicofluorides, according to Ulik. A second allotrope, or set of allotropes, of silicon is obtained by exposure of the above to strong heat, which causes it to become denser and pass into what is called *graphitoid silicon.* Of this there are at least three distinct modifications, marked by their densities—2.025 and 2.201, as determined by Winkler, and 2.51 by Wöhler and Harmening. The last allotrope has exactly the molecular volume of cast *aluminum.* (See VOLUMES, MOLECULAR.) This allotrope was obtained in hexagonal tabular crystals by Wöhler by fusing silicofluoride of potassium with an excess of metallic aluminum, which reduces the silicon, and dissolving out the aluminum from the metallic button obtained, with acids. Another form is fused silicon, which was obtained by Deville by heating above the melting-point of steel. This is dark steel-gray in color and hexagonal in crystallization; density not stated. Deville and Caron obtained cast ingots weighing near a pound. In this modification it will not burn, even in oxygen gas at a white heat.

*Adamantoid Silicon.*—This is obtained by passing vapor of chloride of silicon over fused aluminum. From the aluminum, when saturated, the silicon begins to crystallize out in large brilliant rhombic (?) prisms of the color, lustre, and iridescent appearance of some kinds of specular iron, and hard enough to cut glass like the diamond. Its density is unknown in this form again. It is also obtained in the diamond modification, more cheaply, by crystallization from melted zinc, substituting for aluminum in the above process an alloy of zinc and sodium.

The silicon-allotropes offer a remarkable parallelism with those of carbon; and, indeed, there are no elements, of such widely different functions in nature, which present so many extraordinary analogies as carbon and silicon, the first being a characteristic element of the organic kingdom, and the last of the inorganic. Silicon is more electro-positive or basylic than carbon, at least at high temperatures, and will even decompose carbonate of potash when fused with it, setting carbon free, with vivid incandescence, silicate of potash being formed. It is therefore a more powerful agent in smelting reduction than carbon, and if it were cheaply procurable would have valuable practical applications in this way. Silicon combines with iron at high temperatures, and pig irons often contain it. Indeed, its practical preparation, when needed, may probably be founded on the power of fused metallic iron to reduce silica at very high temperatures in the absence of air. It will be easy to remove the iron by solvents. One function of the basic slags which are always formed during the smelting of iron ores is to prevent the formation of such compounds of elemental silicon with the iron, these being highly detrimental to the latter. The definite compounds of silicon with iron are as yet unknown.

HENRY WURTZ.

**Silicon, Compounds of.** SILICA (see this head), its compound with oxygen, with the *hydrates* thereof, have been already described; and SILICATES also under that head. Hydrogen forms a curious gaseous compound, sometimes called *silicietted hydrogen,* which has not been yet obtained free from excess of hydrogen. It is *spontaneously combustible* in the air, even when largely diluted with hydrogen. Wöhler and Buff obtained it by the electrolysis of common-salt solutions, when the positive pole was an alloy of silicon and aluminum. There are other methods. Some suppose it to have the composition SiH. *Tetrachloride of silicon* ($SiCl_4$) is a transparent, colorless, volatile liquid, of density at zero 1.5161, boiling at 122° F., decomposed by contact with water into hydrochloric acid and silica, the latter partly in the form of a soluble hydrate which remains in solution. Sodium acts upon the liquid chloride with explosive violence, setting silicon free. It is formed by heating either elemental silicon or a mixture of silica and charcoal in a current of chlorine gas.

*Disulphide of silicon* is a product of the action of the

vapor of disulphide of carbon on a mixture of carbon and silica at a high heat. It is solid, presenting the aspect of asbestos, and volatile in a current of hydrogen gas. Moist air decomposes it into anhydrous silica and sulphuretted hydrogen, but in cold water it dissolves completely, a hydrate of silica being formed in solution; and on spontaneous evaporation sulphuretted hydrogen passes off, and a transparent opal-like mass is left.

The *tetrafluoride of silicon* ($SiF_4$) is one of the most important and interesting of its compounds. The affinity of fluorine for silicon is so great that hydrofluoric acid cannot be kept in glass vessels; and this is the main reason why the element fluorine is almost unknown, as no transparent apparatus can be made to hold or preserve it, through which it can be inspected and its chemical behavior made visible. This compound and its derivatives will be found described by Prof. Chandler under the heads Fluoride of Silicon and Fluosilicic Acid.

Henry Wurtz.

**Silico-Nitrohumic Compounds.** See Humus.

**Silis'tria,** town of European Turkey, eyalet of the same name, on the Danube, is poorly built, mostly consisting of crooked, narrow, and filthy streets lined with houses of wood or huts of mud. Nevertheless, it contains 12 fine mosques, many public baths, a well-stocked bazaar, several manufactories of leather and cloth, and carries on an important trade in timber and grain. Its chief importance, however, is derived from its being a fortress of first rank. It is surrounded by walls of solid masonry and defended by a line of detached forts of immense strength. P. 23,000.

**Silk, and Silk Manufacture.** After wool and linen, silk seems to have been, in the remote East, one of the earliest of textile industries. The Chinese records agree that Hoang-Ti, the third emperor of China, charged his first or principal wife and queen, Si-Ling-Chi, to examine the silkworms and test the practicability of using the thread from the cocoons. In her zeal she collected large numbers of the worms, fed them herself, and discovered not only the means of rearing them, but also the method of reeling the silk and of employing it to make garments. The period when this beneficent discovery was made is left as vague as the rest of the Chinese chronology, and European writers have differed in regard to the date all the way between 2700 B. C. and 1700 B. C. Other particulars in the long and useful reign of Hoang-Ti enable us to fix somewhat more definitely the period in which he flourished, and render it probable that he ruled over China during the greater part, and perhaps the whole, of the century 1800 to 1700 B. C. This would make him a contemporary of the patriarch Joseph. The Chinese say that the empress Si-Ling-Chi was deified for this meritorious act, and that she has ever since received divine honors under the name of "the goddess of silkworms." The wild silkworms—or at least some of the numerous genera and species of the Bombycidæ—were found in great numbers in other countries of Southern or Eastern Asia; they inhabited the jungles of India, Pegu, Siam, and Cochin-China; but for many centuries the only use made of their cocoons was by carding and spinning the silk, very much as spun silk is now produced. Meanwhile, the Chinese kept their methods of rearing the silkworms and reeling the silk a profound secret for nearly 2000 years. During this period the silk-culture had made a little progress westward; some of the nations of Central Asia who were under the sway of the Chinese were rearing silkworms under rather rigid restrictions; and Persia was for nearly 1000 years the common carrier of silk between the Chinese and the Western nations, without knowing, perhaps without caring to know, how or from what silk was made. Aristotle was the first European to learn the true origin of the wrought silk brought to him from Persia on the return of the victorious army of Alexander from that country. He described the silkworm as a horned insect, passing through successive transformations, and producing *bombykia*, the name he gave to the silk. The prevalent theory of the origin of silk among the Greeks and Romans for at least 500 years after this time is given with all seriousness by Ammianus Marcellinus, in the first century after the Christian era, in the passage in which he represents the *Seres*, or silk-growers, as "a sedate and gentle people, passing their happy days in the most perfect tranquillity and delightful leisure, amid shady groves, fanned by gentle breezes; these groves produced fleeces of downy wool which, after being sprinkled with water, is combed off in the finest threads and woven into *sericum*" (the Latin name of *silk*). Virgil also says in reference to silk, "*Vellera ut foliis depectant tenuia Seres*" ("The Seres comb the delicate fleeces from the leaves"). Probably, both writers had confounded the gathering of the silk-cotton from the silk-cotton tree (*Bombax*) of the East with the production of silk. In Aristotle's time Pamphila and her associates in the island of Cos (or possibly Ceos, the modern *Zea* in the Ægean Sea) had imported silk goods, or possibly raw silk, from Persia, and, unravelling it, had woven from the single and delicate threads a silken gauze, which from its transparency received the name of "woven wind." Her example was followed somewhat later by the Roman ladies, who, however, used the silk only for the warp of these delicate tissues, while the weft or filling was of fine threads of linen or cotton. The Phœnicians of Tyre, Sidon, and Berytus also procured raw silk from the Persians, and wove silk goods for Corinth and Rome. The latter city under the emperors indulged freely in the costly luxury of silk attire. It became the favorite dress of both sexes, and sumptuary laws were passed to restrict its use to women, and to the wealthy among these, under the reigns of Tiberius, Vespasian, and Diocletian. Heliogabalus, among his other extravagances, wore garments made wholly of silk, though these were valued at more than their weight in gold. The emperor Aurelian refused to his empress a silken robe, on the ground of its great costliness. Silk in its raw state was still imported through the Persians, and continued to be till the time of Justinian in the sixth century of the Christian era. That emperor, having engaged in war with Persia, found his supply of silk cut off and the manufacturers in great distress. He attempted some very foolish legislation in regard to it, but was saved from the consequences of his folly by the arrival at Byzantium of two Nestorian monks from China, who brought with them the seeds of the mulberry and communicated to him their discovery of the mode of rearing silkworms. The exportation of the eggs of the silkworm or of the unreeled cocoons from China was at this time forbidden under the pain of death; but, stimulated by the persuasions and liberal promises of Justinian, the two monks returned to China, and in 555 came back, by way of Persia and Bokhara, to Byzantium or Constantinople, bringing with them a quantity of silkworm eggs concealed in the hollow of their pilgrims' staves. From this small beginning the culture of silk spread rapidly over Greece and Syria. It was introduced into Spain and Portugal in 711 by the Saracens, into Sicily and Naples in the twelfth century, and probably in the thirteenth into Genoa and Venice. It was not generally extended throughout Italy and Piedmont till the sixteenth century. It did not take root in France till the latter part of the sixteenth and the beginning of the seventeenth century, but during the latter century it made great progress there, as well as in Belgium and Switzerland. The manufacture of silk had begun earlier in France and Germany, and to some extent in England. It is worthy of notice that from the sixth to the seventeenth century the choicest silks, under the names of *samite* (*examitum*, or six-threaded), *cendal*, *siglatoun* or *cyclatoun*, *dyaspres* or *diaper*, *escaraments*, *bauderquin* or *baldaquin*, and cloth of gold, were woven first for the churches and cathedrals and for the hierarchy of the Church, next for kings and emperors, and finally for the higher nobility and the wealthier knights of the age of chivalry. Up to the close of the twelfth century these magnificent silks—some of them with raised woven figures of Oriental patterns, but the best, embroidered by hand with years of labor—were brought first from the East, from Persia and China, and later from Greece, where the art of weaving and embroidering these rich textiles was kept a profound secret; still later from Spain, where the Saracens had introduced these arts; and from about the middle of the twelfth century from Sicily, where the Saracens had at first transported their skill from Spain, but were superseded by Greek silk-weavers whom Roger, king of Sicily, had brought as captives from Corinth, Thebes, and Athens to his own island. Some of these early silks surpass in beauty any of the productions of the manufacturers of modern times. In another hundred years the manufacture of silk had extended to Lucca, and thence, about sixty years later, to Venice, Florence, Milan, Genoa, and Bologna. The manufacture of silk goods was brought from Lucca to Lyons probably as early as the fifteenth century, but it made little progress until silk-culture and the production of the cocoons and raw silk were established at the beginning of the seventeenth century. In England the manufacture had made a little progress in the fifteenth and sixteenth centuries, but all attempts at silk-culture had failed. In Austria, Germany, Switzerland, and the Low Countries there were manufactories of silk, but very little silk was grown.

The first attempts to introduce silk-culture into America were made very early. James I. having been foiled in his efforts to establish the rearing of silkworms in England, and having learned that the climate of Virginia was favorable for silk-culture, sent over, in 1622, silkworm eggs, white mulberry trees, and printed instructions; he also gave special directions to the earl of Southampton to urge the cultivation of silk in the American colonies in preference

to tobacco, to which His Majesty had a strong aversion. Large bounties were offered for the production of the raw silk, and fines were imposed on every planter who failed to plant a certain number of mulberry trees to every 100 acres of land in his possession. At first the enterprise bid fair to prove successful, but it was neglected by the company and thrown upon the planters before it was fully established, and hence failed. Some silk was exported to England for several years, but after a time the attention of the planters was turned wholly to tobacco. At the time when the colonies of Georgia and the Carolinas were founded the effort was made to revive the culture of silk there, and under vigorous protection and encouragement from England it was for a period of perhaps twenty-five or thirty years very successful. The first shipment of silk from Georgia consisted of eight pounds, and was made in 1735. From this small beginning there was a steady increase to 1759 or 1760. A filature, or establishment for reeling the silk from the cocoons, was established about 1750 at Savannah, and in 1755 reeled and exported over 100 pounds of raw silk, worth about $6.50 per pound; in 1758, over 700 pounds; and in 1759, over 10,000 pounds, the export of that year realizing over $75,000. From this time the culture of silk declined, and did not probably yield more than $75,000 to $80,000 in the next twelve years. During the Revolutionary war the production in Georgia was made up into sewing silk and sold at home. After the war there were some efforts made to revive the exportation, and some small parcels were exported as late as 1790. The culture of silk was not attempted in Connecticut till about 1760, but it was carried on there more extensively and persistently than anywhere else in the U. S. For eighty-four years silkworms were reared there in considerable numbers, in Windham, Tolland, Hartford, New Haven, and Fairfield cos. Rev. Dr. Stiles, president of Yale college from 1778 to 1795, was a zealous silk-culturist, and among his manuscript diaries, now in Yale college library, one volume is devoted to the rearing of silkworms. His commencement gown or robe was made of silk grown, reeled, thrown, dyed, and woven in his own family. The silk produced in Connecticut, which for many years amounted to $100,000 or $200,000 per annum, was seldom exported, but was made up into sewing silk and occasionally into woven silk goods in the domestic way, until about 1828 or 1829, when some efforts were made to introduce machinery for its manufacture. Much of it was sold in barter. The rearing of silkworms was also attempted with some success from 1769 to 1775 in Pennsylvania, New Jersey, New York, Rhode Island, and Massachusetts. In most of these States it was given up during and after the Revolutionary war, and was not revived again till about 1825 or 1826, when the large importation of silk goods and the favoring circumstances of the time led to a most determined effort to resuscitate the culture of silk. The venerable and learned Peter S. Duponceau, then president of the American Philosophical Society, took the lead in this movement, and a *protégé* of his, M. J. D'Homergue from Lyons, who was thoroughly conversant with the whole processes of silk culture and production, published a volume of essays on the culture of silk, to which Mr. Duponceau contributed an introduction. Mr. Duponceau next brought the subject before Congress, and a committee was raised who reported in 1826, and directed the secretary of the treasury (Mr. Richard Rush) to have a manual of silk-culture prepared, giving also the statistics of silk-growing in the U. S. This was prepared by Dr. James Mease of Philadelphia; it was a very able and exhaustive document. Mr. Duponceau next memorialized Congress to make a moderate grant for the purpose of establishing a model filature in Philadelphia under M. D'Homergue's instruction, to instruct a large number of young men or young women in the art of reeling the silk from the cocoon. This matter was laid over at two sessions of Congress, and finally failed by a very small majority. Meantime, Mr. Duponceau had established at his own expense a small filature at Philadelphia, and exerted himself in all ways, by his letters, publications, and reviews, to excite public interest in the subject. He was to some extent successful; several of the States offered premiums and bounties for the cultivation of the mulberry and the production of raw silk. Silk societies were established and books on silk-culture multiplied; Dr. F. Pascalis in New York, Hon. Gideon B. Smith in Baltimore, Mr. Jonathan H. Cobb in Massachusetts, Judge F. G. Comstock in Connecticut, and Mr. Vernon in Rhode Island, published volumes of considerable value on the subject. There seemed to be a favorable opportunity to test the question of the practicability of silk-growing in this country, and the manufacturers of silk were all ready to follow. New machinery for reeling, throwing, and weaving silk was invented and put in operation; and as the supply of American-grown raw silk was not sufficient to meet the demand, a moderate quantity was imported. But amid all this excitement the imports of manufactured silks constantly increased, and very soon a new disturbing element was introduced which eventually brought great disaster to the whole movement. The silkworms had hitherto been fed, generally, on the leaves of the white mulberry (*Morus alba;* see SILKWORM), though in a few instances the leaves of our indigenous mulberry (*Morus ruba*), and even lettuce-leaves, had been used in feeding. But subsequently to 1830 a great effort was made to introduce the so-called Chinese mulberry (*Morus multicaulis*) in the place of the white mulberry, on the grounds of its more rapid growth, its yielding two crops of leaves in a season, and these very abundant and succulent. It was objected that it was not hardy, and not relished by the silkworms as well as the *Morus alba*, but all argument seemed to be useless; a sudden infatuation seized the people, and they began to speculate in the *Morus multicaulis*, till the price of the little twigs or cuttings was far beyond the value of all the silk that could be produced from them in twenty years. By the spring of 1839 this infatuation had reached such a height that twigs less than two feet in length and of the size of a pipe-stem were sold at $2, $3, or $5, and many people had given up all other business to buy and sell these twigs; one nurseryman had sent an order to France for 5,000,000 young *multicaulis* plants, his agent taking $80,000 in specie to bind the bargains. In the autumn of 1839 the bubble burst, ruining thousands of persons, and in the spring of 1840 the *multicaulis* trees were offered at two or three cents each, but found no purchasers. In 1844 a severe winter destroyed most of the *Morus multicaulis* trees that remained, and blighted in the Northern States generally the white mulberry; and for the second time in its history the rearing of silkworms was practically abandoned throughout the whole country. Even Mansfield, Conn., and the towns adjacent, which had for eighty-four years hardly known any other industry, gave up their cocooneries and turned their attention to other pursuits. Writers on the subject, like William Kenrick, John Clarke (whose *Treatise on the Mulberry Tree and Silkworm* is to this day the most satisfactory book on the subject), Hon. John S. Skinner, and Rev. I. R. Barbour, and practical silk-growers like the Cheney Brothers, Gideon B. Smith, Edmund Morris, Jonathan H. Cobb, Dr. David Stebbins, and Samuel Whitmarsh, were compelled to admit that they had put too much confidence in the *Morus multicaulis*.

Yet great good resulted, in the end, from this apparent disaster. The men who had devoted so much attention to silk-culture, finding the rearing of silkworms unprofitable, now turned their energies to the manufacture of silk. From the commencement of the century there had been some importation of raw silk, mostly for the fringe and dress-trimming manufacturers, and to some extent also for exportation; in some years it had amounted to $100,000, $200,000, and in one year to $600,000. These new manufacturers now began to import raw silk from China, from Turkey, and from Italy; and though they had to contend with unfavorable tariffs, with the general prejudice in favor of imported goods, and with the difficulties attendant upon the employment of unskilled and incompetent workmen, they persevered. In 1850 the Cheney Brothers at Hartford and South Manchester, Conn., and several manufacturers at Mansfield, at Newton, Groton, Northampton, and other points in Massachusetts, in Philadelphia, Baltimore, and New York, were doing a fair and increasing business in the manufacture of sewing silk and twist. Messrs. Horstmann & Sons, who since 1815 had maintained the even tenor of their way in the manufacture of dress and upholstery trimmings, military goods, etc., partly or wholly of silk, in Philadelphia, now began to enlarge their business. As yet, there was little done save in sewing silks, dress trimmings, and a few styles of ribbons. But in the next decade (1850–60) the demand for sewing-machine silk and twist began to increase, and by this time it was found that the best brands of American sewing silks were superior in quality, evenness, strength, and color to the best Italian; pongees, Japanese silks, and other mixed goods were made of as good quality as the imported; handkerchiefs, ribbons, and a few pieces of broad goods were put upon the markets, and were creating a demand for more; and after years of experiment, on the part of the Brothers Cheney, the spun silks made from silk waste, pierced cocoons, etc. were coming into use, and greatly reducing the cost of those goods of which they could form a part. As yet (in 1860) American silk-manufacturers had received no protection or aid from the government; indeed, they had been hindered rather than helped, since the moderate duties on manufactured silks were more than counterbalanced by the duty on the raw silk, which they needed to have free. But in 1861 the exigencies of the war required the raising of a large

revenue, and a heavy duty (40 per cent., afterward raised to 60 per cent.) was imposed on manufactured silk, while raw silk was admitted duty free. Here was the opportunity for the silk-manufacturers, and they improved it. In every direction their enterprise was manifest. Paterson became to some degree the Lyons of America, and its forty or fifty silk-houses were active and wide awake. In Philadelphia, New York, Boston, and Baltimore, as well as in numberless smaller towns and cities, one form or another of the silk industry was established and profitable work furnished to many thousands of busy workers. The sewing silk and machine twist still continued to be in great demand, and since 1870 has been sold in Europe as well as in other countries; ribbons and scarfs of all kinds are manufactured here, and are crowding out the foreign goods; dress trimmings, from the simplest fringe and the plainest buttons to the richest marabout trimming and bullion fringe, and the costliest of silk buttons are now manufactured here better and cheaper than the imported goods; lace, in all the varieties of which silk is a constituent—scarfs, veils, nets, etc.—is contesting in our markets the palm with the choicest products of the looms of Nottingham and St. Gall. But the greatest advance has been made in what are known as broad goods—dress silks of all colors, fancy and brocaded silks wrought by the improved Jacquard looms, millinery silks, foulards, and spun silks of slight lustre, but of great durability and beauty, and at the same time so moderate in price as to be within the reach of all. In color, quality, and durability, as well as in beauty, the American silks surpass the French silks of the same grade, with two additional advantages—they are not weighted with dyestuffs, as are the same grade of foreign silks, and hence are often more durable and of more enduring colors, and they are lower in price. Much of this success in broad goods and ribbons is due to the enterprise, persistency, and progressive spirit of the Cheney Brothers, who for nearly twenty years struggled almost alone against European competition in these goods. They are now reaping a generous reward, which others have come in to share, but in some descriptions of silks they are still the leaders of the American trade. The intense competition and the present low price of raw silk have brought down the prices, notwithstanding the duties, to such a degree that at no time in the present century, even when there was a merely nominal duty on manufactured silks, has it been possible to buy silks of the better grades so low as they can be purchased to-day. As yet, our manufacturers are doing but little in the very highest grades of dress silks, now generally woven by hand in Lyons, nor are they attempting the production of the heaviest silk velvets, but they will ere long produce both, and weave them on power-looms.

With a few words on the processes employed in the manufacture of silk we pass to the statistics of its production. The cocoons (see SILKWORM) after their completion, generally in six or eight days from the time the worms commence spinning, are ready to be gathered. Those intended for seed—*i. e.* for the hatching out of the butterfly or silk-moth—are first selected with care, and the remainder are subjected to some one of the several processes for destroying the life of the chrysalis, as otherwise the moth would force its way out through the cocoon and spoil it for reeling. Some prefer the heat of the sun at noon, others baking in a moderately hot oven, others the fumes of camphor, etc. etc. The cocoons, which are then called dry cocoons, are next assorted, those as nearly of a size as possible being put together, and the largest by themselves. The small cocoons are much less valuable, and the *dupions* or double cocoons are generally rejected, as there is difficulty in reeling them. All soft or imperfect cocoons are also rejected. When thus assorted they are ready for reeling. The floss or coarse loose silk is taken off, and the cocoons put, eight or ten at once, in a kettle or pan of quite warm but not boiling water, and stirred with a bit of broom or a whisk lightly and gently till the silk fibre is loosened and can be caught up. A fibre from each cocoon is then passed through the holes of the brass plate which covers the pan or kettle, and thence repeatedly crossed and carried forward to the reel. The reeling process requires great skill to keep the thread even, as the amount of silk on each cocoon varies, and it is constantly necessary to be joining new threads. The threads are also of different degrees of fineness on different portions of the same cocoon. The threads thus united on the reel form what is known as *raw* silk. This is imported from China and Japan, from Turkey and Italy, in hanks or large skeins. Much of the Chinese and Japanese silk is not well reeled, and there is a large amount of waste, often from 25 to 30 per cent., in working it. The *raw* silk or *hard* silk, as it is called before it goes into the dyer's hands, is now ready to be thrown (Ang.-Sax. *thrawan*, "to twist"). For this purpose it is re-reeled, doubled, cleaned, doubled again, spun, twisted, and, if to be used for weft or filling, four or six threads are twisted together and finally reeled again into hanks or skeins for the dyer. The dyer on receiving it boils it for two or three hours in soap and water, then rinses in clear water, and, drying it, proceeds to give it the required color. By this boiling good silk loses about 23 or 24 per cent. of its weight, and just here comes in the opportunity for deception or fraud. If the silk receives what is called a pure dye, only a fraction of an ounce in every pound of the loss from the boiling which removed the gum and impurities of the silk is restored, but the silk remains soft, will not crack or fade, is stronger, though somewhat finer, than before it was dyed. If, on the contrary, the dyer is so disposed, he can cause the silk to absorb the dyestuff and swell with it till its weight has been increased one-fourth, one-half, three-fourths, or double, triple, and even quadruple, its original weight. The silk thus treated has a good lustre, but is stiff and brittle; if a dress silk, it is liable to crack and fray, and does very little service; while the silks which are of pure dye are soft, bear any amount of folding or crumpling, will not crock, break, or crack, and are very durable. The silk when dyed is either reeled or spooled, according to the use to which it is to be put. The process of throwing the silk is carried to different degrees, according to the purpose for which it is to be used. If wound, cleaned, and twisted, or thrown, without doubling, it is called *dumb singles*, and is used for making gauze veils, etc.; if doubled once as it comes from the reel, cleaned, and thrown, it is called *thrown singles;* if wound, cleaned, doubled twice or more, and twisted or thrown, it is called *tram*, and is used as the weft or filling of silk goods. Sewing silk goes through the same process, but, except in the case of embroidery and saddlers' silks, is not doubled so many times; when intended for twist, it is twisted or thrown twice (after each doubling), the second reversing the first twist; if wound, cleaned, spun, doubled, and thrown, it is called *organzine*, and is used for the warp or chain of broad silk goods. The weaving may be by hand-looms, power-looms of different kinds, gang-looms for ribbons, or power-looms with the Jacquard attachment where the goods are to have figures wrought in them; for laces there are still other looms; and if the lace is figured, Jacquard attachments to these. (For a description of these different looms see the article LOOM.) Recently, a new loom for weaving silks has been introduced, the Earnshaw needle-loom, improved by Greenleaf. This uses an eye-pointed rod or needle instead of the shuttle, the filling being fed continuously from a large cop at the side of the loom, and the selvedge being made by interlocking the filling on one side with a small shuttle carrying a fine warp thread and running parallel with the warp. It is claimed that this makes a smoother and stronger fabric, that there is no danger of overshot work, and that it accomplishes from one-third to one-half more work per day.

On Jan. 1, 1876, there were in the U. S. 213 silk manufacturing establishments in 15 different States. These establishments employed 18,007 hands, of whom 4733 were men, 8739 women, 2409 boys, and 3126 girls under 16 years of age; they paid, in the year 1875, $6,390,356 wages, reported a capital of $17,913,858 invested in the business,

| COUNTRIES. | Production of raw silk in 1874, pounds. | Production of raw silk in 1874, values. | Export of raw silk in 1874, pounds. | Export of raw silk in 1874, values. | Imports of raw silk in 1874, pounds. | Imports of raw silk in 1874, values. |
|---|---|---|---|---|---|---|
| China | 23,232,000 | $92,928,000 | 8,492,000 | $33,968,000 | | |
| Japan | 4,950,000 | 19,800,000 | 1,533,400 | 6,033,600 | | |
| Italy | 9,875,000 | 79,000,000 | 7,338,980 | 58,711,840 | 1,419,000 | $5,676,000 |
| Switzerland | 381,194 | 3,049,552 | | | | |
| Austria-Hungary | 514,600 | 4,116,800 | ..... | ..... | 350,000 | 2,800,000 |
| Spain and Portugal | 314,000 | 2,198,000 | 297,000 | 2,079,000 | | |
| Turkey in Europe | 1,320,000 | 7,920,000 | 792,000 | 4,752,000 | | |
| Russia, the Caucasus, etc. | 2,420,000 | 14,520,000 | 966,800 | 5,800,800 | 1,518,000 | 5,373,800 |
| Persia, Toorkistan, etc. | 1,100,000 | 6,050,000 | 55,000 | 302,500 | | |
| India | 8,800,000 | 26,400,000 | 1,069,200 | 3,741,200 | | |
| Anam, Cambodia, and Cochin-China | 500,000 | 2,000,000 | 220,000 | 880,000 | | |
| France | 5,207,800 | 41,662,400 | 1,183,920 | 9,461,360 | ..... | 80,800,000 |
| Great Britain | ..... | ..... | ..... | ..... | 3,752,540 | 18,763,000 |
| United States | ..... | ..... | ..... | ..... | 1,159,420 | 4,504,306 |
| Totals | 58,614,594 | $299,646,752 | 21,958,300 | $125,830,300 | 8,198,960 | $117,917,106 |

| COUNTRIES. | Production of manufactured silks in 1874, values. | Exports of manufactured silks in 1874, values. | Imports of manufactured silks in 1874, values. |
|---|---|---|---|
| France | $116,400,000 | $95,400,000 | $12,693,570 |
| Italy, estimated | ..... | 35,000,000 | |
| Great Britain | ..... | 17,730,725 | 49,276,320 |
| Germany | 38,000,000 | 19,300,000 | |
| Switzerland | 16,000,000 | 13,400,000 | |
| Austria | 12,000,000 | 4,712,000 | |
| Russia | 10,600,000 | | |
| Belgium | 15,130,000 | 11,248,095 | |
| Sweden and Norway | 320,000 | | |
| United States | 21,120,428 | 40,878 | 23,996,782 |
| Total exports | ..... | $196,731,698 | |

and produced silk goods to the amount of $27,158,071. These silk goods were thus divided: thrown and spun silks, $5,931,558; sewing silks and machine twist, $6,420,833; broad goods (including dress and fancy silks) and ribbons, $10,261,814; laces, braids, and trimmings, $4,543,866. The gold value of the raw silk imported during the same year was $5,500,970, and of the imported manufactured silk goods, $24,292,757; so that in a year of great depression of business and low prices the value of American manufactured silks was just about equal to the importations, when the gold value is reduced to currency. The American manufacturers of sewing silks have completely driven the foreign article from the markets, and are now exporting sewings and twist to Europe. In ribbons they have sold about four-sevenths of the whole quantity sold, and are selling nearly as many dress and fancy silks as the importers, while the greater part of the foreign dress goods have been sold at a loss. The preceding table, prepared from the most authentic sources, gives the importation, exportation, and production of raw silk in pounds and values, and the production, exportation, and importation of manufactured silk in 1874 by the principal countries of the world. L. P. Brockett.

**Silk Association of America.** On June 12, 1872, a circular was issued by the Silk Industry Association of Paterson, N. J., stating that there was a generally-expressed desire of silk manufacturers to form a national association, and calling on those who would be likely to take an interest in the matter to hold a meeting with reference thereto. The benefits of such union had already been partially demonstrated during the existence of a society called "The National Association of Silk Manufacturers for the Exposition of 1869." Forty-four firms engaged in the business responded to the call of the Silk Industry Association, and held a meeting in New York June 26, 1872. The inception of the undertaking was largely due to the energetic efforts of the late William J. Horstmann of Philadelphia, although he did not live to see the association formed. The result of the meeting was the organization of the Silk Association of America. Its specific objects are to obtain, classify, and publish complete and authentic statistics of the silk trade and manufacture in all their branches, going into detail as to capital and labor employed, conditions and growth of the industry, and amounts of imports; to secure united action in such measures as may be needed to advance the interests of the silk industry in the U. S.; to take steps toward preventing the adulteration of raw silk in China and Japan, and to improve the methods of reeling silk in those countries; and to establish a silk-conditioning house for testing and assaying silk. Mr. John Ryle of Paterson, N. J., was the first president of the association; Mr. B. Richardson acted as secretary *pro tem.* until the selection of a permanent secretary in October following, when Mr. Franklin Allen was appointed. The branches of industry now represented in the association are as follows: importers, dealers and brokers in raw silk, throwsters of and dealers in gum silk, manufacturers of sewing silks and twist, weavers and dyers, manufacturers of fringes, braids, trimmings, etc. The roll of membership Jan. 1, 1876, embraced 81 individuals and firms, whose business, carried on in New York, New Jersey, Pennsylvania, Massachusetts, and Connecticut, employed a capital amounting to $12,350,000. The revenues of the association have been in the first six months ending May, 1873, $3000; in the year ending May, 1874, $5400; in the year ending May, 1875, $7450; in the year ending May, 1876, $6050. It was incorporated Apr. 11, 1876, under the general laws of the State of New York. On Mar. 22, 1876, the association suffered the loss of a trusted leader and wise counsellor by the death of its president, Ward Cheney, who had been for many years among the most prominent of the silk-manufacturers of America, and not less noted for his success in business than for the fatherly care and interest with which he sought the practical welfare of the large force of work-people employed by his firm (Cheney Brothers) at South Manchester, Conn. The officers of the association (elected Apr. 26, 1876) are—president, Frank W. Cheney of Hartford, Conn.; vice-presidents, Thos. N. Dale of Paterson, N. J., A. B. Strange and William Ryle of New York; treasurer, John N. Stearns; and secretary, Franklin Allen of New York. The directors are—F. O. Horstmann, Pa.; William Strange, C. Greppo, I. A. Hopper, and C. Lambert, N. J.; Ira Dimock, William Skinner, and J. W. C. Seavey, Mass.; Frank Cheney and Milo M. Belding, Conn.; B. Richardson, George B. Skinner, A. Soleliac, Seth Low, George H. Burritt, L. Bayard Smith, D. O'Donoghue, A. G. Jennings, Louis Franke, and John T. Walker, N. Y. The office of the association is at 93 Duane street, New York.
Franklin Allen.

**Silk, Chemistry of.** The fibres of silk are mainly composed, together with some albumen, of a substance called *sericine*, coated with a yellowish wax, which must be removed before dyeing the silk. Sericine (from Lat. *serica*) is a name given by Schlossberger to the silk-substance, which had been previously called *fibroine*, and supposed to be identical with the substance of sponges. Spider-webs, according to the same chemist, are also sericine. It is obtained pure by successive boiling with alcohol, water, acetic acid, and water again. The pure sericine is white and lustrous like silk itself, and sinks in water. It is not turned yellow by nitric acid, with formation of *xanthoproteic* acid, like skin and other albuminous tissues of animals. Dilute caustic alkalies do not affect it, but when strong they dissolve it, and on adding water the sericine is again precipitated—according to some authorities unchanged, and even assuming curiously again its former *fibrous* structure! In composition sericine is not very unlike the Albuminoids (which see), though so different in properties. Mulder found carbon 49.11, hydrogen 6.5, oxygen 26.72, and nitrogen 17.67. There is no sulphur, however. For distinguishing silk-fibre from cotton and flax, chemically, two reagents are available, one of which is a concentrated solution of oxide of nickel in ammonia, which forms a brown-yellow solution in the cold; the other is hot basic chloride of zinc, which first gelatinizes, then dissolves the silk (but if *too strong* or *too hot* will also gelatinize the other fibres). Picric acid will also distinguish the silk-fibres in a mixed tissue by dyeing them yellow. Henry Wurtz.

**Silk Cotton,** the cottony down of many sterculiaceous trees of Africa, India, and South America of the genera *Bombax, Eriodendron, Chorisia, Salmalia,* etc. This beautiful cotton grows wild in great quantities, but thus far it has been found not to spin well, and not to wear well. It might perhaps be used for gun-cotton or for paper-stock. The trees are mostly very large, with very soft wood.

**Silk-Printing.** See Appendix.

**Silk Spider** [*Nephila plumipes,* Koch], a geometric spider of the family Speiridæ, discovered by Prof. Burt G. Wilder on the Sea Islands of South Carolina in 1865. It produces two kinds of strong, fine silk—yellow and white—which wind to a length of nearly two miles, and it is claimed that this substance may be made available for the arts. Its hearing and touch are acute, but its sight defective; it prefers the sunlight.

**Silkweed,** also called **Milkweed** [botanically, *Asclepias Syriaca*], the common American silkweed, is an exceedingly abundant wild plant over a great part of the U. S. The silky fibre with which the seed-pods are filled has a very beautiful lustre, but is too brittle and destitute of strength to be of value except for merely ornamental uses. The milky juice—of which large quantities could be procured during the season, particularly if the plant be cultivated, which brings it to a very large size—contains 5 per cent. of the valuable substance *caoutchouc,* which may readily be coagulated in the fresh juice and separated by proper manipulation from the other matters present; and, considering the present high price and increasing scarcity of caoutchouc, this abundant North American source of it ought to receive proper attention. H. Wurtz.

**Silkworm.** See Appendix.

**Silkworm Gut,** used by anglers in attaching the hook to the line, is prepared in Spain and Italy from the silkworm, just as it is ready to begin spinning its cocoon. The material is precisely that which becomes silk if the worm is allowed to spin. The worm is soaked in vinegar for some hours, and the secretion is then removed, stretched, and dried for use.

**Sill** (Joshua W.), b. at Chillicothe, O., Dec. 6, 1831; graduated at the U. S. Military Academy July 1, 1853, when appointed a second lieutenant in the ordnance corps. After a brief service at the Watervliet arsenal, he was recalled to West Point, where he served until 1857 as assistant professor of geography, history, and ethics; subsequently in command of Vancouver ordnance dépôt, Wash. Terr., and Leavenworth dépôt, Kan. In Jan., 1861, he resigned from the army, and accepted the chair of mathematics and civil engineering in the Brooklyn Polytechnic Institute. On the outbreak of civil war he was tendered the colonelcy of a New York regiment, and proceeded to Ohio, where he served as assistant adjutant-general of the State in organizing volunteers, and in the field at the battle of Rich Mountain. In Aug., 1861, he accepted the colonelcy of the 33d Ohio Vols., and was engaged in the occupation of Bowling Green, Ky., and Nashville, Tenn., Feb., 1862, and in Gen. Mitchel's expedition to Huntsville, Ala., and seizure of the railroad from Stevenson to Decatur, thus regaining control of Northern Alabama, most of which time in command of a brigade. In July, 1862, he was commissioned brigadier-general of volunteers, and commanded a division in the Army of the Ohio at the battle

of Perryville, Oct. 8, and subsequent pursuit of the Confederate army. In the battle of Murfreesboro', Dec. 31, 1862, he was killed at the head of his brigade, which led a gallant charge and drove back the enemy's hitherto victorious columns across an open field into their intrenchments beyond.

**Sillagin'idæ** [from *Sillago*, the typical genus], a family of fishes of the order Teleocephali and sub-order Acanthopteri, peculiar to the Asiatic and Polynesian seas. The body is elongated, slightly compressed, and more or less plane below; the scales ctenoid and of moderate size; lateral line continuous to the caudal fin; the head elongate-conical, and excavated by cavities; the opercular bones unarmed, except the operculum, which has a spine; mouth small and terminal; upper jaw little protractile; teeth on the jaws and vomer; branchial apertures continuous below; branchiostegal rays six on each side; dorsal fins two, the first short, the second long; anal with one or two spines; pectorals with branched rays; ventrals thoracic, each with a spine and five rays. The species are rather small, and of no special economical importance. About a dozen species are known. THEODORE GILL.

**Sil'lig** (CHARLES JULIUS), b. at Dresden May 12, 1801; studied philology in the universities of Leipsic and Göttingen; in 1825 was appointed teacher in the Kreuzschule at Dresden, with which institution he remained connected until his death, Jan. 14, 1855, having attained the position of associate rector. Much of his literary labor was bestowed on the explanation of ancient art, and on mythology as illustrated in art. Among his chief productions are—*Epistola Critica de Catulli Carminibus* (1822), followed by an edition of *Catulli Carmina* (1824); *Catalogus Artificum Græc. et Rom.* (1827; translated into English by Rev. H. W. Williams 1837); *Plinii Historia Naturalis*, with critical commentary (8 vols., 1851–58). He also edited Böttiger's *Opuscula et Carmina* (1836), *Kunstmythologie* (1836), and *Kleinere Schriften archæol. u. antiq. Inhalts* of the same scholar (1837–38, 3 vols.). Sillig was a frequent contributor also to the archæological and classical journals.
H. DRISLER.

**Sil'liman** (BENJAMIN), M. D., LL.D., b. at North Stratford (now Trumbull), Conn., Aug. 8, 1779, son of Gold Selleck Silliman (1730–90), a lawyer and colonel of Connecticut cavalry during the Revolution; graduated at Yale College 1796; was a tutor there 1799–1804, studying law in the mean time; was admitted to the bar 1802, and in the same year chosen professor of chemistry in Yale College; spent a part of the years 1802–04 at Philadelphia, preparing for his professorship under the guidance of Dr. James Woodhouse of the University of Pennsylvania; gave his first full course of lectures on chemistry at Yale in the winter of 1804–05; spent fourteen months in England, Scotland, and Holland 1805–06, engaged in the prosecution of his studies; made a geological survey of a part of Connecticut, the first exploration of the kind in America; published a memoir with an analysis of the fragments of the celebrated Weston meteorite of Dec. 14, 1807; aided Dr. Robert Hare in his experiments with the compound blowpipe, with which instrument he demonstrated the fusibility of several bodies never before fused; secured for Yale College the valuable mineralogical and geological cabinet of Col. George Gibbs 1812; founded in 1818 the *American Journal of Science and Arts*, of which he was sole editor until 1838, and senior editor, along with his son, 1838–46; made a series of important observations on the transference of carbon particles from the positive to the negative pole, while experimenting with a voltaic deflagrator 1822; was an eloquent lecturer on scientific topics before popular audiences, having been perhaps the first to give such courses in the principal cities of the U. S.; made a second visit to Europe 1851; resigned his professorship 1853, and was made professor emeritus, but at the request of his colleagues continued to lecture on geology until June, 1855, when he retired from active labors, but spent the closing years of his long life amid the society of colleagues and former pupils, by whom and by the country at large he was honored as the "Nestor of American science." D. at New Haven Nov. 24, 1864. Author of *Journal of Travels in England* (New York, 2 vols., 1810; 2d ed., New Haven, 3 vols., 1820), *Elements of Chemistry* (1830), *A Narrative of a Visit to Europe* (2 vols., 1853), and several minor publications; he also edited Henry's *Chemistry* (1814) and Bakewell's *Introduction to Geology* (1829). An interesting *Life* was prepared from his MS. reminiscences, diaries, and correspondence by Prof. George P. Fisher (New York, 2 vols., 1866). PORTER C. BLISS.

**Silliman** (BENJAMIN), M. D., son of the preceding, b. at New Haven, Conn., Dec. 4, 1816; graduated at Yale College 1837; became associate editor of Silliman's *Journal of Science* 1838, and associate proprietor (with Prof. J. D. Dana) 1846; was an instructor in chemistry, mineralogy, and geology in Yale College 1838–46; became professor of applied chemistry 1846, and successor to his father in the chair of chemistry 1854, which position he still (1876) holds. In 1847, in connection with the late Prof. John P. Norton, he established the Yale Scientific School, which has since grown into the Sheffield Scientific School. He was also professor of medical chemistry and toxicology in the University of Louisville, Ky., 1849–54; visited Europe with his father in 1851; was a director in the departments of chemistry, mineralogy, and geology in the "Crystal Palace" world's fair at New York 1853, and prepared (with C. R. Goodrich) the *Illustrated Record* of that exhibition, and the monograph on the *Progress of Science and Art* published in the same connection; was for many years secretary of the American Association for the Advancement of Science, in which capacity he edited the annual volumes of *Proceedings;* has written *First Principles of Chemistry* (1846 and 1854) and *Principles of Physics* (1858–61); contributed many papers to scientific societies, besides the large number published in his own *Journal;* has been a popular lecturer on scientific subjects; and became State chemist of Connecticut 1869.

**Sil'loth,** a seaport and watering place of England, Cumberland co., on the Solway Frith, 20 miles W. N. W. of Carlisle. It has steam communication with Liverpool, Ireland, and the Isle of Man. P. 5000.

**Sil'loway** (THOMAS WILLIAM), b. at Newburyport, Mass., Aug. 7, 1828; received a good education, especially in the arts of design; devoted himself as a specialty to the preparation of architectural plans for public buildings, in which business he established himself at Boston in 1851, and in the course of twenty years built or repaired more than 200 church edifices, besides many other public buildings, including the new capitol at Montpelier, Vt. (1859), and Buchtel College, Akron, O. (1872). Since 1852 he has occasionally officiated as a Universalist preacher, and was ordained in 1862. He has written or edited several works on architecture, carpentry, warming and ventilation, and church music.

**Silo'am** [Heb. *Siloah*, שִׁלֹחַ "sending" or "sent;" Arab. *Silwan*]. (1) The name of a pool, or rather both a fountain and a pool, in Jerusalem, on the southern edge of Ophel, about 1200 feet S. S. W. of the Fountain of the Virgin, with which it is connected by an underground winding passage. The fountain proper, hewn out of the solid rock, is about 6 feet in breadth. Like the Fountain of the Virgin, it is intermittent. The lower basin is about 50 feet long, 17 broad, and 19 deep, but now holding only 3 or 4 feet of water. It was once arched over. Jewish writers say it furnished the water used in sacrifice on the last great day of the Feast of Tabernacles. This most famous of all the pools in or about Jerusalem is mentioned only three times in the Bible (Isa. viii. 6; Neh. iii. 15; John ix. 7), but frequently by Josephus. A stream still goes "softly" from the pool down into the Kedron.—(2) The name of a little straggling, dirty village occupying an old quarry on the E. side of the Kedron, overlooking the Pool of Siloam.
R. D. HITCHCOCK.

**Sil'phium** [Gr. σίλφιον, a large resin-bearing plant], a genus of perennial plants of the family Compositæ, comprising twenty species, many of which are found in abundance on the prairies of the U. S., in the Southern States, and in other parts of North America. They are very hardy and coarse, bear large flower-heads, and exude a plentiful resin-like juice, whence the commonest species (*S. laciniatum*) has received the name of rosin-weed. The stem sometimes exceeds ten feet in height. Both the resin and the leaves are much employed by farriers for asthma in horses, and a tincture has sometimes been found useful as a tonic and diaphoretic. This species is known by the names of compass-plant, pilot-weed, and polar-plant, from a reputed tendency to point its leaves N. and S. The prairie burdock (*S. terebinthinaceum*) and the singular cup-plant (*S. perfoliatum*) belong to this genus.

**Sils'bee** (NATHANIEL), b. at Salem, Mass., in 1773; became a distinguished and successful shipping-merchant in that city; served frequently in both branches of the State legislature; was a member of Congress 1816–20; president of the State senate 1823–26, and U. S. Senator 1826–35, and was a firm supporter of the administration of Pres. John Quincy Adams. D. at Salem July 1, 1850.

**Silt** [Prov. Eng. *sile*, "sediment"] is the fine mud which is transported by rivers and deposited in lakes and estuaries. The same term is applied to any sediment which accumulates in harbors or river-channels, which, as they are filled, are said to be "silted up." J. S. NEWBERRY.

**Silu'rian System,** the name given by Sir Roderick Murchison to a series of fossiliferous strata which under-

lie the Devonian rocks in portions of England and Wales, anciently inhabited by the Silures. This group is now divided into the Upper and Lower Silurian systems, which are underlaid by the Cambrian rocks of Sedgwick. The line of separation between the Cambrian and the Silurian is not definitely settled, some geologists referring all the oldest unchanged fossiliferous rock to the Silurian, while others, and the larger party, include in the Cambrian all the rocks which contain the "primordial fauna" of Barrande. In the U. S. the base of the Silurian system is the Potsdam sandstone, the Trenton limestone series being the central mass, the Hudson River group the summit. The Upper Silurian series is formed by the Medina sandstone at the base, the Clinton and Niagara limestones in the centre, and the Helderberg group at the top. (See GEOLOGY.) J. S. NEWBERRY.

**Silu'ridæ** [from *Silurus*, the Latin name of the European catfish], an extensive family of fishes of the order Nematognathi, and that comprising the catfishes of Europe and North America. The body is moderately elongated and tapers backward from the shoulders; the skin is naked; the head more or less depressed; the operculum developed; the mouth terminal and transverse; barbels, especially maxillary, well developed; teeth variable; branchial apertures confluent below, the membrane being free at its posterior margin; branchiostegal rays exposed and in moderate or considerable numbers; dorsal fin near the head and belonging to the abdominal region (sometimes atrophied); anal fin of considerable size; pectorals and ventrals normally developed; the anterior vertebræ are co-ossified and much modified; the inferior pharyngeal bones distinct. As thus defined, the family corresponds with the second and fourth sub-families of Siluridæ in Dr. Günther's arrangement —*i. e.* (2) Siluridæ heteroptera, including his Silurina; and (4) Siluridæ proteropteræ, embracing his Bagrina, Prinetodina, Ariina, and Bagarina. It is the richest in number of species and diversities of structure in the order. Most of the species are inhabitants of lakes and rivers, but a number of its representatives are habitual denizens of the salt waters. Species are found in almost all temperate and tropical regions; Europe has the fewest, only one species (*Silurus glanis*) being found in the rivers of Central and Northern Europe; North America is well provided with forms, at least four genera being represented in the fresh waters N. of Mexico—viz. (1) *Amiurus*, including the common chubby catfishes of the Eastern streams; (2) *Ictalurus*, represented by graceful fork-tailed fishes in the great lakes and Western rivers; (3) *Hopladelus*, and (4) *Noturus*. Two salt-water species also visit the Eastern coast—viz. *Ælurichthys marinus* and *Ariopsis Milberti*. The fresh-water species have the anterior and posterior nostrils far apart from each other, and barbels are developed from the edge of the posterior, while in the salt-water forms they are close together and destitute of barbels. The species, so far as known, take care of their young, and peculiar provision is made for the protection of the eggs in the mouth of several genera found in tropical waters. THEODORE GILL.

**Silva.** See SELVA.

**Sil'ver** [Ang.-Sax. *silfor*], one of the precious metals, has been known from remote ages, and much used for ornaments, household vessels, and for money. With the Romans it was known as *argentum*, and among the alchemists as *luna*. Its chemical symbol, Ag, is derived from the Latin name. It is the whitest of the metals, and takes a brilliant mirror-like polish. In hardness it is intermediate between gold and copper, and is very malleable and ductile. It may be beaten into foil or leaves 0.00001 of an inch in thickness. A grain weight of the metal may be drawn out into a wire 400 feet in length. If repeatedly heated it becomes brittle. The specific gravity of silver ranges from 10.1 to 11.1, according to its condition and purity. Karsten found the gravity of fused silver to be 10.4382; G. Rose gives 10.57 for hammered silver, and 10.92 for precipitated silver. The metal fuses readily on charcoal before the blowpipe or in a crucible in a forge or furnace fire. It expands forcibly upon cooling, and thus solid pieces will float in molten silver as ice floats in water. It may be vaporized by the burning lens or by the oxyhydrogen blowpipe or strong electrical currents. The vapors are white. When pure, the molten metal absorbs from twenty to twenty-two times its bulk of oxygen gas, according to various authorities, but the presence of a small percentage of copper or lead greatly diminishes or prevents this absorption. The absorbed gas is, however, given off at the moment of solidification, and with considerable force. If the surface of a globule or bar of silver has cooled while the interior is fluid, the expansion breaks the crust and more or less of the fused metal is projected through the cracks, and forms an arborescent growth generally known as "sprouting," and, when it is projected with violence, as "spitting." This mechanical projection of a portion of a globule of silver cooling upon a cupel is a frequent source of loss in assaying. The absorption of oxygen and the subsequent spitting may be prevented to a great extent by the use of charcoal powder upon the melted metal. Absorption of oxygen is also prevented by fusing it under a layer of salt. The use of nitre in the crucible causes a large absorption of the gas. The vapor of water is decomposed by silver at a white heat, oxygen being absorbed and hydrogen liberated. Silver is a good conductor of heat and of electricity. It is capable of being welded. It alloys freely with gold, copper, and several other metals. It crystallizes in forms of the monometric system, generally in octahedra.

Silver is abundantly distributed in nature, particularly among the metallic minerals. Malaguti and Durocher give a table of 122 substances, chiefly mineral species, in which silver has been found by assay. It exists in sea-water in the ratio of 1 milligramme to 100 kilogrammes. Assuming that there is 1 centigramme of silver per cubic mètre of water, it has been calculated that the oceans of the globe contain not less than 2,000,000 tons of silver. The metal has been found in small quantity also in rock-salt in the mines of the department of the Meurthe, France. All native gold contains from .016 to 16 per cent. of silver, but generally from 5 to 13 per cent.; California gold averages about 12 per cent. of silver. It occurs also nearly pure in masses and irregular grains, but it is not as generally distributed in this form as gold, and is seldom found in placers or alluvial deposits, but is confined rather to the vicinity of the outcrops of veins, and is not water-worn and rounded by attrition. It is usually in irregular, ragged masses, or in thin sheets coating surfaces of the vein-stone, or filiform, as if drawn out into wire; hence the name "wire silver" applied to such specimens, whether the filaments are coarse as a knitting-needle or as fine as hairs. This wire-like form of silver is of frequent occurrence in the cavities of veins. The filaments sometimes reach the length of a foot or more, but are generally much curled up and interwoven or matted together, looking like bunches of hair or wool. At Kongsberg in Norway the metal has been found massive and in large and perfect crystals, which retain their white color without tarnishing in a remarkable degree. One mass taken from these mines and preserved in the Royal Museum at Copenhagen weighs upward of 500 pounds; two other masses weigh, respectively, 238 and 436 pounds. Large amounts of native silver have been obtained in Mexico and South America. One mass in Peru is said to have weighed 800 pounds. Large masses have been reported from the northern portion of the Mexican state of Sonora. It is not uncommon, though not in large masses, in the upper portions of the silver-bearing veins of the Western States and Territories of the U. S. It is found also in a vein upon Silver Islet in Lake Superior, and associated with the native copper of the Keweenaw Point mines. Some of these specimens are remarkable for being completely joined to the copper, without any intermingling of the metals; one-half of a mass may be silver and the other half copper. Jewelry and ornaments are frequently made by local jewellers, one-half being copper and the other half silver, the line of union being sharply defined, while the two metals are perfectly united.

Specimens of silver when taken from mines are usually tarnished a dull-brown color, or even black, this color being caused generally by the presence of sulphurous vapors either from the constituents of the vein or the combustion of powder. Such vapors rapidly tarnish silver. Silver ware and silver plate, it is well known, are rapidly tarnished and turned black by the gases of bilge-water, and also by the tainted atmosphere about drains and vaults, and the sulphurous gases from burning coal. The peculiar whiteness of the Norwegian native specimens is supposed to be due to the presence of a portion of mercury. Native silver is rarely pure. The cupriferous variety sometimes contains 10 per cent. of copper. With gold the proportions are variable. (See GOLD.) The *electrum* of Pliny contains one-fifth of silver. The pale gold of Transylvania contains from 35 to 38 per cent. of silver. The native alloy in the great Comstock Lode of Nevada contains about 43 per cent. of silver, as shown by Attwood, the rest being gold. Native amalgams have been found in Chili, containing from 52 to 64 per cent. of silver. The metal is also found combined with sulphur, antimony, arsenic, tellurium, etc., and with chlorine, bromine, and iodine, giving a great variety of interesting species. The chief ores are the sulphide, containing 86 per cent. of silver; the brittle or antimonial sulphate, with 68.5 per cent. of silver; gray silver ore, with 23 per cent. of silver; dark-red silver ore, with 60 per cent.; and the light-red silver ore, with 64 per cent. This last is generally known as "ruby silver,"

from the brilliant ruby-red color of the crystals by transmitted light. In the upper portions of silver-bearing veins, where air and moisture have had access, a certain amount of decomposition has taken place among the minerals, especially if they consist of the above-mentioned species, and new combinations have been formed, which may be called *secondary ores*. These are generally oxides, chlorides, bromides, and iodides, and are more earthy and highly-colored than those in the deeper parts of the vein, being intermingled with oxides of copper, lead, and iron. They are also softer than the unchanged ores below, and are more easy to work. Such ores are known in Mexico as *colorados*, especially if red, and in Peru as *pacos*. The ores from a greater depth in the mine, which have not been acted upon by the air, are more compact, brilliant, and darker in color, and are called *negros*. The green "bromide ores" are known in Zacatecas, Mexico, as *plata verde*. Chloride of silver is common in the upper portions of rich silver-bearing veins, and usually forms thin dark-colored crusts or films upon the gangue. It is easily identified by its wax-like hardness, and by giving a globule of silver when fused in the flame of a candle.

A large class of the metallic minerals contain silver in varying proportions, especially galena, which is rarely free from a portion of silver. The greater portion of the silver produced in Europe is extracted from argentiferous galena. The galenas of England and of the Hartz Mountains carry from .03 to .05 per cent., and those of Tuscany from .03 to .07 per cent. The galena ores of the U. S., with the exception of those of the Mississippi Valley, nearly all contain silver in larger quantities, the percentage ranging from .10 to 1.85 and 3.0, but the quantity of these rich ores is seldom large in the Eastern States. Sixty ounces to the ton of lead ore is a very fair yield in silver. Formerly lead ores containing less than this could not be profitably worked for silver, but since the discovery by Mr. Pattinson of England in 1829 of the process which bears his name, lead which does not hold over 0.009 per cent. of silver can be profitably worked. By this process an annual saving of over 200,000 ounces of silver, formerly thrown away, is effected, and the cost of separating silver from lead is greatly cheapened. Lead containing only three ounces of silver to the ton can now be worked with profit.

The antiquity of silver coinage is very great. The most ancient coins known were struck in silver by Phidon, king of Ægina, B. C. 869. After the conquest of Egypt by Cambyses, about 540 years before Christ, a great improvement appears to have been made in the purification of silver, for that which was produced under Aryandes was celebrated for its purity and fineness. The alloy in the Greek silver coinage generally appears to have been lead, which had not been removed for want of the requisite skill in refining. The Athenian currency was noted for its purity, and Xenophon mentions the profit with which it could be exported. Silver currency was adopted by the Roman republic about 269 B. C., and its standard was as high as the Greek, but it rapidly fell. Under Vespasian the alloy was one-eighth, under the Antonines one-fourth, under Severus about one-half, after which there does not appear to have been a fixed standard. (*King.*) After the loss of Spain, from which the chief supply of silver was drawn, the silver currency vanished, and was replaced by *billon* denarii, holding only one-fourth part of silver. According to Pliny, Antony alloyed denarii with iron, apparently to harden the coin. The denarii of Justinian and the Italian Goths weigh about 15 grains troy, and are the reputed direct antecedents of the Anglo-Saxon silver penny.

Silver was largely used by the Romans for household plate and table decoration. It was elegantly chased and embossed by Grecian artists in the repoussé style. The wealthy Romans vied with each other in possessing the most massive dishes. Of such dishes, weighing 100 pounds or more, there were 150 in Rome before the first civil war. Pliny cites the existence of one dish weighing 500 pounds, with eight plates to match, weighing together 250 pounds. The old chased plate of the Grecian artists was valued as a curiosity in Pliny's time. The ornamentation of silver, known as *niello*-work, originated in Egypt, and was revived and carried to great perfection by the Florentine silversmiths. Cellini gives a recipe for the fusible argentiferous compound used to fill the engraved design. This art was applied to the decoration of armor as early as the days of Homer. Agamemnon's breastplate was thus inlaid. In mediæval times massive plate was in great favor, and the chief form of investment for the noble-born and wealthy. Its extensive use for ecclesiastical decoration is also to be noted.

In modern times solid silver ware has been to a great extent replaced by nickeliferous alloys and britannia ware, covered with a layer of pure silver by the galvanoplastic method. Silver may, by this method, be deposited to any desired thickness, thus giving all the appearance of solid silver, and its utility for most purposes. The annual consumption of the metal for this purpose alone is very large. Silver thus deposited is pure, but solid silver ware and coin contain a portion of alloy, generally copper. In the U. S. and in France the standard fineness is one-tenth of alloy, or 900 parts of silver and 100 of copper, the mixture being denominated .900 fine. In Great Britain the standard is higher, being 925 of silver and 75 of copper, or .925 fine. This is the fineness of "sterling silver ware."

The value of silver relatively to other objects obviously depends upon two chief conditions—the demand and the supply. The variations in the demand are sufficiently indicated by the preceding references to its use in historic times. The supply, as will be seen by consulting the following article upon SILVER-MINES, is also variable, and at times excessive. The production of silver in the large way, owing to its mode of occurrence and mineralization, is more dependent upon the use of mechanical power (steam or water) than upon the labor of men. There may therefore be a large production of silver in sparsely-populated regions and within a short period of time. With gold the conditions are different: the bulk of the product is derived from *placers*. It is so much more generally distributed in the earth that an unlimited number of men may be engaged together in its production. No expensive preparations or chemical operations requiring large capital and great skill are required to obtain the metal in a merchantable form. Gold is therefore a much better measure of human labor than silver.

The value of silver relatively to gold has greatly changed within historic times, and it has been different in different countries. Commerce has tended to equalize this difference. King justly observes that in the ancient world silver was to the same extent the peculiar production of Europe that gold was of Asia. It follows naturally that the estimation of silver relatively to gold was higher in Asia than in Europe—a condition prevailing until within a recent period. Sir Isaac Newton in 1717 showed that the ratio in weight of equal values of the two metals, silver and gold, in China and Japan was as 9 : 1, while it was as 15 : 1 in Europe. Perhaps the earliest recorded ratio is found inscribed at Karnak, the tribute-lists of Thutmosis (1600 B. C.) giving 13.33 : 1. The same ratio is shown by cuneiform inscriptions on plates found in the foundations of Khorsabad and on ancient Persian coins. It was reported by Xenophon (400 B. C.) as the ratio in Asia. Toward the Christian era gold fell in value relatively to silver. As early as about 189 B. C. the Romans coincided with the Greeks in estimating the value of gold compared with silver as 10 : 1. Upon Cæsar's return to Rome gold became so abundant that the ratio for a time was as $7\frac{1}{2}$ : 1. A century later the ratio was as $12\frac{1}{2}$ : 1, where it remained for 150 years or more. When guineas were first coined in 1663, the value of fine gold compared with that of fine silver was rated in the English mint at about 14 : 1. In 1805 the ratio was nearly as 15 : 1, and in other countries gold was rated higher. In the Middle Ages the ratio varied from 9 : 1 to 12.8 : 1. At the date of the discovery of America the ratio was about 11.30 : 1, since which, up to the discovery of gold in California and Australia, it gradually rose to 15.83 : 1 in the year 1850. In 1874 the ratio became 16.15 : 1. The extraordinary production of silver from the mines of the Comstock Lode, Nev., together with the demonetization of silver in Germany, has had a great effect upon the price of silver in the market. In Jan., 1875, when an act was passed by Congress providing for the resumption of specie payments in Jan., 1879, the price of fine silver in London averaged about 57 pence per ounce. In Mar., 1876, the price had fallen to $52\frac{5}{8}$ pence per ounce. During the year nearly $13,000,000 in silver was purchased by the U. S. mint at an average of 111.4 cents per ounce, the equivalent nearly of $56\frac{1}{2}$ pence per ounce in London. The fineness of standard silver coin, to which all London quotations are referred, is $\frac{111}{120}$. The penny sterling is valued at $2.02771\frac{1}{3}$ cents of the U. S. gold standard, the pound sterling being rated at $4.86656 in U. S. gold dollars. To obtain the value in U. S. (gold) money of a given weight of silver, say 25 grammes of $\frac{9}{10}$ths fineness, the price in pence of the ounce of the British standard should be multiplied by 1.585778, or it may be obtained by dividing the price in pence by 0.6306052. For example, the quotations in London in the early part of the year 1876 vary from $52\frac{1}{2}$ to $53\frac{1}{2}$ pence per ounce, British standard. The value of 25 grammes of silver $\frac{9}{10}$ths fine therefore varies from $52\frac{1}{2} \times 1.585778$ to $53\frac{1}{2} \times 1.585778$ cents U. S. gold; that is, from 83.2545 cents to 84.8403 cents. W. P. BLAKE.

**Silver City,** p.-v., cap. of Owhyhee co., Id., centre of rich silver-mines, has several quartz-mills, and 1 newspaper with daily and weekly editions. P. 599.

**Silver City,** p.-v., Lyon co., Nev., in the vicinity of productive gold and silver mines, has a number of quartz-mills and a tri-weekly newspaper. P. 879.

**Silver Compounds, Chemistry of.** Silver forms a number of compounds of more or less practical importance and scientific and technical interest. We may class them, for convenience and conciseness, into *halogen-*, *oxygen-*, and *amphigen*-compounds.

(1) *Halogen-Compounds of Silver.—Chloride of silver* is an important substance, which is found native as a very valuable silver ore called *horn-silver*, *kerargyrite* (or *cerargyrite*, as Dana prefers to spell it). The latter name is from κέρας, "horn," and ἄργυρος, "silver." This ore is very readily recognizable by those who know its chemical and physical characters. It is usually translucent, sometimes transparent and colorless, of the softness of talc, sectile like wax and similar in lustre, and of very great density, the latter ranging from 5.19 to 5.687 at zero centigrade, there being four allotropic modifications of differing densities. If occurring in particles too small to be certainly recognizable by these characters, the following method is valuable: A piece of sheet zinc is scraped bright, the mineral in coarse powder spread over it and moistened with water. The particles of silver chloride will soon be reduced to metallic silver, and on rubbing the powder between two pieces of glass, or with a knife-blade, the white lustre of the metal will become distinguishable. When crystalline, it is found to belong to the regular system. It contains 75.3 per cent. of silver, the rest being chlorine, and has the formula AgCl. It is totally insoluble in all acids, but soluble in ammonia, from which it is again thrown by an acid as a curd-like precipitate. This may also serve as a ready mode of detecting it in ores. The absolute insolubility of silver-chloride causes its production, by adding a solution of a chloride, to be an excessively delicate test of the presence of silver in a solution. Gay-Lussac's volumetric method of silver-assay, in use in all our mints, depends on the use of a standard solution of common salt to precipitate the silver as chloride. Silver-chloride melts at about 500° F. to a clear liquid. On exposure to light and moisture it undergoes a change the nature of which is not yet well settled, but most probably to be attributed to the formation of a *hemichloride of silver* ($Ag_2Cl$). A darkening of color occurs, and, according to Karsten, an increase of density to 5.567. When any organic matter is present, as when the chloride is applied to *paper*, this action of light is far more powerful. Photographic methods are chiefly founded upon these kinds of changes of the halogen-compounds of silver by light, the dark compound formed under the influence of the light being insoluble in *hyposulphite of soda* and other *fixing* agents, while the unchanged chloride, iodide, or bromide of silver remains soluble, and is therefore easily removed from the paper, leaving the picture, composed of the changed dark-colored compound, attached thereto. *Bromide of silver* (AgBr) constitutes the mineral *bromyrite* or *bromargyrite*, which is regular in crystallization, yellow or amber colored when pure, much harder than the chloride, ranging in this respect between gypsum and calcite, sectile, and heavier than the chloride, when pure weighing at zero from 5.892 (native, Berthier) up to 6.525 (precipitated, Schröder), there being, as with the chloride, *four allotropes* within this range. Bromide of silver contains 57.4 per cent. of the metal. It is found as an ore in Mexican and Chilian localities, and at Huelgoat in Brittany. At some of the Chilian mines, as in Chanarcillo and in Copiapo, another silver mineral is much more abundant than either the chloride or bromide, which is a combination of the two in varying proportions, called *embolite*. *Iodide of silver* (AgI) forms the mineral *iodyrite*, found in Mexico, Chili, Spain, and Arizona. It is sulphur-yellow in color when pure, very soft, sectile, with densities ranging from 5.071 (native, Karsten) to 5.791 (precipitated, Deville), comprising *six allotropes*. It contains 46 per cent. of silver, and is hexagonal in crystallization. Both bromide and iodide of silver, when precipitated, are much more sensitive to light than the chloride, and are hence used in photography, in most cases, instead thereof. They are much less soluble in ammonia than the chloride, but are reducible by zinc to metallic silver when moist, just like the latter. *Fluoride of Silver.*—This differs from the other halogen silver-compounds in being soluble in water. It forms hydrated crystals, obtained by dissolving the oxide of silver in hydrofluoric acid and crystallizing. *Cyanide of silver* belongs properly among its halogen-compounds. It is obtained by precipitating a silver-solution by cyanide of potassium, and much resembles the chloride, but is not blackened by light, and is soluble in hot nitric acid. When heated it is decomposed, leaving metallic silver.

(2) *Oxygen-Compounds of Silver.*—Oxides of silver are three in number—*argentous oxide* ($Ag_4O$), *argentic oxide* ($Ag_2O$), and the *peroxide* ($Ag_2O_2$). The first has not acquired much importance. $Ag_2O$ is the base of the common silver-salts. It is a brown or black substance, of density 7.249 (Boullay) and 8.286 (Karsten), indicating at least two allotropes, slightly soluble in water, according to Bineau (3000 parts), to a solution of alkaline reaction and metallic taste. Heat readily dissociates it into oxygen and metallic silver, some oxygen being given off even at 212° F. Its unstable character is shown by its exploding when rubbed together, even very gently, with many substances, such as red phosphorus, precipitated sulphur, selenium, some metallic sulphides, and tannic acid. Some organic liquids, as *creosote*, are set on fire by dry argentic oxide. Notwithstanding its instability, it is a very powerful base, neutralizing acids completely. On contact with ammonia it forms Berthollet's *fulminating silver*, the nature of which is not yet well understood. $Ag_2O_2$ may be obtained in crystals by electrolysis of a concentrated solution of nitrate of silver, forming on the anode, while metallic silver forms on the cathode. It is a curiously unstable substance, one of its most remarkable properties being that of reacting with peroxide of hydrogen (see HYDROGEN, PEROXIDE OF), so that water and metallic silver are formed, with evolution of oxygen gas. *The oxygen-salts of argentic oxide*, of much practical interest, are only two in number—the nitrate and the sulphate. *Nitrate of silver*, known also by its ancient name of *lunar caustic* (see CAUSTIC), is the most interesting compound. This very beautiful salt is an article of enormous manufacture, owing to its important applications in medicine and in the arts of photography and electro-plating. It crystallizes very easily, and is largely introduced into commerce in crystalline form, though the *lunar caustic* for medicinal use is generally fused and cast into sticks or pencils. The crystals are anhydrous, of composition $Ag_2O.N_2O_5$, and soluble in their own weight of cold water. (See NITRATES.) *Sulphate of Silver.*—This salt is also anhydrous, of quite difficult solubility in cold water, requiring 87 times its weight.

(3) *Amphigen-Compounds of Silver.*—These comprise the *sulphide*, *selenide*, and *telluride*, of which the sulphide only is of practical importance. *Sulphide of silver* ($Ag_2S$), in pure state, constitutes the mineral species *argentite* or *silver-glance*. This is a lead-gray mineral, which has a regular crystallization, but is often crypto-crystalline or amorphous. It varies in density from 7.02 to 7.365, and there is doubtless a series of allotropic modifications. The hardness is about that of gypsum, and one of its most characteristic properties is a high degree of *sectility*, the mineral often cutting almost like metallic lead. It contains, when pure, no less than 87 per cent. of silver, being, in fact, the richest of all silver ores. It is common among the ores of the celebrated Comstock Lode, as well as in many other American localities. Sulphide of silver forms, in combination with other metallic sulphides, a large number and variety of argentiferous minerals and ores. With sulphide of arsenic it forms the mineral *proustite* ($3Ag_2S.As_2S_3$), containing 65.4 per cent. of silver. This is a magnificent carmine-red colored mineral, of adamantine lustre when crystallized, the crystals being rhombohedral. *Pyrargyrite* ($3Ag_2S.Sb_2S_3$), containing 59.8 per cent. of silver, is also a splendid red rhombohedral mineral, of a darker shade of color than proustite, hence sometimes called "dark-red silver ore." "Ruby silver ore" is also a name applied to both the arsenical and the antimonial species. Proust first showed the true difference between them, as implied in the above formulæ, in 1804. Proustite is abundant in Mexican, Peruvian, and Chilian mines, but rare in the Comstock Lode and most North American silver-districts. It was found, however, very fine and in immense masses, with pyrargyrite, in the Poorman Lode in Idaho. *Stephanite* ($5Ag_2S.Sb_2S_3$), containing 68.5 per cent. of silver, is an iron-black ore, right-rhombic in crystallization, found sparingly in the Comstock Lode and in many other North American regions. It is sometimes called "brittle silver ore." *Stromeyerite*, *sternbergite*, *polybasite*, and *freieslebenite* are other double sulphides of silver, for which reference may be made to Dana's *System of Mineralogy*. *Selenide of silver* (see SELENIDES); *Telluride of silver* (see TELLURIDES). HENRY WURTZ.

**Silver Compounds, Medicinal Uses of.** Argentic oxide and nitrate are the only compounds of silver used in medicine. Argentic nitrate is locally irritant and astringent, and, applied in the solid state or concentrated solution, is also superficially caustic, producing upon a mucous membrane or raw surface a white eschar of albuminate of silver. It is extensively used in surgery as a caustic and as a means of promoting absorption, as of exuberant granulations; of inducing healthy action on the part of indolent or morbidly-disposed ulcers or sores; and of controlling or aborting catarrhs of mucous membranes. The oxide, from its insolubility, is quite devoid of the above properties. Internally, in large dose or concentrated form, silver nitrate

is an irritant poison, but in medicinal dose both the nitrate and oxide may improve the tone of the stomach and allay the nausea and pain attending organic diseases of the same. In case of acute poisoning by silver nitrate, the antidote is common salt, which immediately forms the insoluble chloride of the metal. Slowly introduced into the system, silver affects the nervous system, and if too long continued will cause an indelible bluish-black discoloration of the skin and mucous membranes, and may further induce a general poisoning of the blood and tissues. Silver compounds are used internally for their local effects in gastric and intestinal affections, and were at one time vaunted as powerful remedies in epilepsy and other spasmodic nervous disorders, but other drugs have almost wholly superseded them in the latter employment. EDWARD CURTIS.

**Silver Creek,** tp., Stephenson co., Ill. P. 1309.

**Silver Creek,** tp., Clarke co., Ind. P. 1116.

**Silver Creek,** tp., Mills co., Ia. P. 1019.

**Silver Creek,** tp., Pottawattamie co., Ia. P. 231.

**Silver Creek,** tp., Cass co., Mich. P. 3084.

**Silver Creek,** p.-v. and tp., Wright co., Minn. P. 285.

**Silver Creek,** tp., Randolph co., Mo. P. 1831.

**Silver Creek,** tp., Burt co., Neb. P. 271.

**Silver Creek,** p.-v., Hanover tp., Chautauqua co., N. Y., on Lake Erie and on Lake Shore and Michigan Southern R. R., has 2 churches and several manufactories. P. 666.

**Silver Creek,** tp., Burke co., N. C. P. 1314.

**Silver Creek,** tp., Greene co., O. P. 1701.

**Silvered Glass.** See SPECULUM, by H. DRAPER, M. D.

**Silver Hill,** tp., Davidson co., N. C. P. 975.

**Silvering.** See MIRRORS, by PROF. C. F. CHANDLER.

**Silver Lake,** tp., Arkansas co., Ark. P. 702.

**Silver Lake,** p.-v. and tp., Worth co., Ia. P. 354.

**Silver Lake,** p.-v. and tp., Shawnee co., Kan., on Kansas River and Kansas Pacific R. R. P. 159; of tp. 1416.

**Silver Lake,** tp., Martin co., Minn. P. 487.

**Silver Lake,** p.-v. and tp., Susquehanna co., Pa. P. 1079.

**Silver-Mines.** See APPENDIX.

**Silver Mountain,** p.-v., cap. of Alpine co., Cal., in a rich mining-district of the Sierra Nevada.

**Silver-Plating.** See ELECTRO-PLATING.

**Silver Run,** tp., Russell co., Ala. P. 4305.

**Silverside,** or **Silver Fish.** See ATHERINE.

**Silver Spring,** tp., Cumberland co., Pa. P. 2259.

**Silver Stick,** in the English court, a title borne by the lieutenant and the standard-bearer of the corps of gentlemen-at-arms; also by the field officer commanding any of the guard regiments. (See GOLD STICK.)

**Sil'verton,** p.-v., cap. of La Plata co., Col.

**Silverton,** tp., Barnwell co., S. C. P. 1513.

**Silver-Work.** See REPOUSSÉ, in APPENDIX.

**Sil'veyville,** v. and tp., Solano co., Cal. P. of v. 279; of tp. 1583.

**Simaruba.** See QUASSIA and SIMARUBACEÆ.

**Simaruba'ceæ** [name from *Simaruba*, the typical genus], a small natural order of exogenous polypetalous plants, all trees or shrubs, and mainly tropical or subtropical, distinguished from the rutaceous order principally by the dotless leaves, remarkable for the potent bitterness of all the parts, especially of the wood. This property is best represented by QUASSIA (which see), or bitter wood, which is derived from two or three trees of this family. To it belongs the ailanthus, a hardy shade tree. ASA GRAY.

**Simbirsk',** government of European Russia, on the Volga, S. of Kazan, E. of Nizhnee-Novgorod, comprises an area of 18,778 sq. m., with 1,205,881 inhabitants, of whom 76,500 are Mohammedans and 2000 pagans. The surface is level and the soil fertile. Agriculture, breeding of cattle and horses, fisheries, and manufactures of coarse woollen and linen fabrics are the principal branches of industry. Rye, wheat, buckwheat, hemp, flax, and tobacco are the common crops.

**Simbirsk,** town of European Russia, capital of the government of Simbirsk, on the Volga, in lat. 54° 13′ N., manufactures leather, soap, and candles, and has an important annual fair, held in February. In 1851 it had 35,474 inhabitants, but in 1864 and 1865 it was almost destroyed by fires. P. 24,607.

**Sim'coe,** county of Ontario, Canada, bounded on the N. W. by Georgian Bay, Lake Huron, and on the E. partly by Lake Simcoe; traversed by the Northern Railway. Much of the soil is fertile. The lumbering and shipping interests are important. Cap. Barrie. P. 57,389.

**Simcoe,** p.-v., cap. of Norfolk co., Ont., Canada, on the river Lynn, 8 miles W. of Port Dover. It has a fine court-house and jail, 2 weekly newspapers, and some manufacturing interests, and is in a fertile region. P. 1856.

**Simcoe,** a lake of Ontario, Can., situated between Lake Ontario and Georgian Bay, 30 miles long and 18 miles wide, and about 170 feet above Lake Huron, into which it discharges itself through Lake Gougichin, the Severn, and Georgian Bay. The banks are generally clothed to the water's edge with wood, fine white-fish are taken in its waters, and it contains many islands, one of which, Snake Island, is inhabited by Indians.

**Simcoe** (JOHN GRAVES), b. near Exeter, England, Feb. 25, 1752; served in the war of the American Revolution; raised and commanded the battalion of loyalists or Tories known as the "Queen's Rangers," with which he rendered effective service in the Southern campaigns with the rank of lieutenant-colonel; was with Cornwallis at Yorktown; wrote and printed for private distribution a *History of the Operations of a Partisan Corps called the Queen's Rangers* (Exeter, 4to, 1787; reprinted with a memoir of the author at New York, 1844); was governor of Upper Canada 1791–94, where he was accused of promoting Indian hostilities against the U. S. in the Northwestern Territory; was governor of St. Domingo under the brief English domination 1796–97, and became lieutenant-general 1798. D. at Torbay, England, Oct. 26, 1806. A lake of considerable size in Ontario, Canada, bears his name.

**Sim'eon,** the second son of Jacob and Leah. The tribe of Simeon numbered 59,300 at the Exodus, but only 22,200 at the entrance into Canaan. Its territory was scattered, comprising districts wholly within the territory of the tribe of Judah, and tracts in Mount Seir and Gedor. The tribe sank into obscurity.

**Simeon** (CHARLES), b. at Reading, England, Sept. 24, 1759; educated at Eton and at King's College, Cambridge, where he obtained a scholarship 1779 and a fellowship 1782; took holy orders in the latter year; was appointed vicar of Trinity church, Cambridge, Jan., 1783, a post which he retained through life; became distinguished as a leader of the Evangelical party in the Church of England, and exerted a great influence in the training of candidates for the ministry at Cambridge, meeting with great opposition, and even ostracism, from the "High Church" party, and enjoying the sympathy and respect of the great body of dissenters, though he never abandoned any of the distinctive doctrines or practices of the Church of England. He was active in the promotion of missionary enterprise, and organized a successful scheme for the purchase of "advowsons" or presentations to benefices in the Church of England, in order to secure their being conferred upon "evangelical" preachers, the fund established by him still having control of some sixty livings. After a ministry of fifty-four years, having long been senior fellow of his college, he d. at Cambridge Nov. 13, 1836. His *Works* were edited by Rev. T. H. Horne in 21 vols. (1832–33), the best known being several series of "skeleton sermons." His *Life* was written by Rev. William Carus (1846).

**Sim'eon Styli'tes,** b. at Sesan in the northern part of Syria about 390; grew up in solitude as a shepherd in the mountains of Amanus, but received so overwhelming an impression when, in his thirteenth year, he for the first time attended divine service in a Christian church, that he left his herds and entered a monastery at Teleda, where he distinguished himself by the severity of his ascetic practices. Finding the rules of the monastery too lenient, he afterward removed to Telanissa, in the vicinity of Antioch, where he built a hut and determined to live as an anchorite. But soon his fame for holiness attracted swarms of visitors, and in order to escape their intrusion he placed himself on the top of a column, where he spent his days and nights, always standing, never resting, exposed to the severities of the climate, nourished by what was brought to him, and occupied in religious exercises. The first column he occupied was only ten feet high, but the last was sixty feet, with a platform four feet in diameter, and here he is said to have lived for about thirty years. He d. Sept. 2, 459, and was buried in Antioch; and his example, which gained for him much admiration and even power during his lifetime, found many imitators after his death. The so-called pillar-saints, air-martyrs, or stylites were numerous in the Eastern countries, and did not wholly disappear until the twelfth century. Wulfailich, near Treves, on the Moselle, in Rhenish Prussia, about 550, was the only stylite in the West. Simeon's biography was written by his disciple Antonius, contained in the first volume of *Acta Sanctorum*, and by a contemporary admirer, Cosmas, presbyter of Thanir in Cœlesyria, contained in Asseman's *Acta Martyrum*. He is also mentioned with

much praise by Theodoret in his history of the Christian Church, translated into English in Bohn's *Ecclesiastical Library*.

**Simfero'pol,** town of European Russia, in the Crimea, capital of the government of Taurida, is beautifully situated on the Salghir, in a picturesque valley surrounded with gardens and orchards. It consists of a modern part, built by the Russians, and the old Tartar town, with its mosques, Tartar schools, and bazaars. P. 17,797.

**Simi'idæ** [from *Simia*, the old Latin name of the ape, and the family termination *-idæ*], a family of mammals of the order Primates and sub-order Anthropoidea, containing the mammals most closely related to man. The family name has been variously employed, even by recent writers, most extending it to include all the apes and monkeys of the Old World, and others (*e. g.* Huxley, Gill) restricting it to the large apes. In its widest sense the family is distinguished by the following characters, in which it contrasts on the one hand with man (family Hominidæ), and on the other with the monkeys of the New World. The species resemble man in general form and in the freedom of the limbs from the abdominal integument; the fore limbs are, however, employed more or less in progression throughout life, and the body is generally carried prone, and is only exceptionally erect; the skin is protected by a well-developed and dense coat of hair; the feet have the pollex or great toe more or less abbreviated, but thickened and thumb-like, and opposable to the others; the teeth do not form an uninterrupted series, but, on account of the considerable development and projection of the canines, there is a diostema or interval between the canines and the incisors in the upper jaw, and between the canines and premolars in the lower; the molar series, as in man, has five teeth in each jaw on each side—viz. two premolars and three true molars; the nose has a thin and narrow median septum, and the nostrils are correspondingly approximated; a bony external auditory meatus is developed, and at its bottom is the membrana tympani. Such are the diagnostic characters of the group; with these are associated other minor and less universal characters, and certain negative ones contrasting with some exemplified in the New-World monkeys. Thus, the tail, although often long, is never prehensile; callosities are frequently developed on the buttocks; cheek-pouches also exist in many forms. In other respects—in their skeleton, their nervous system, and especially the brain, the muscles, the digestive system, and the generative system—there is an essential agreement between man and the Simiidæ, the differences being only those of degree, and of the same kind as exist between the different members of the family itself. Within the limits above admitted there are two paramount grades of organization, the differences between these indicating the degrees of their relationship to man. To these two grades have been attributed family value by some writers.

The Simiidæ proper, or large apes, are distinguished by a form considerably like that of man, but the anterior limbs are very elongate and the posterior relatively short; the spinal column has a slight sigmoid curve; the lumbar as well as dorsal neural spines are directed more or less backward; the sacrum is large and solid, composed of four or five vertebræ, and tapers gradually backward; they are as entirely destitute of a tail as is man himself; the sternum is broad and short. By all these characters the species are approximated to man. To this group belong two types—one containing large, robust species—*i. e.* the chimpanzee, gorilla, and orang-outang, constituting the sub-family Simiinæ (which see)—and the other comparatively small, slender species—*i. e.* the gibbons, or sub-family Hylobatinæ (which see).

The Cercopithecidæ or Cynopithecidæ—*i. e.* ordinary or tailed monkeys—are characterized by the more quadrupedal form; the anterior limbs are generally shorter than the posterior; the spinal column has typically a simple and not sigmoid curvature; the neural spines of the lumbar as well as last dorsal vertebræ are inclined forward; the sacrum is moderate, composed generally of three vertebræ, and does not taper gradually backward; a tail is more or less developed, although sometimes reduced to a slight rudiment; the sternum is narrow. Such are the distinctive features of the monkeys of the Old World. These are quite numerous, and are naturally divisible into two sub-families: (1) Cercopithecinæ, in which the stomach is a simple sac, as in man, and cheek pouches are developed; and (2) Semnopithecinæ, in which the stomach is complex and sacculated, and the cardial portion dilated, and the pyloric elongated, and no cheek-pouches exist.

As already indicated, the Simiidæ are peculiar to the Old World, all the monkeys of the New World belonging to a quite different group, and, according to most systematists, constituting two families—the Cebidæ and Mididæ—peculiar to America. The Simiidæ are now confined mostly to the tropical countries of Africa and Asia, but one species (*Inuus caudatus*) extends into Spain, and is well known as an inhabitant of the rock of Gibraltar, and two other species, lately discovered (*Rhinopithecus Roxellanæ* and *Macacus Thibetanus*), are found in the district of Moupin, Thibet, where the winter is quite severe.

No representatives of this group have been yet found in rocks older than the Miocene age. In that and the Pliocene epochs species existed in Europe of several genera distinct from any now living. Thus, at St. Gaudens in France the remains of a species supposed to be allied to *Hylobates*, and called *Dryopithecus Fontani* by Lartet, have been exhumed; at Sanson (France) those of another type (*Pliopithecus*), also referred near *Hylobates* (*P. antiquus*, Lartet); and in Zurich those of a congeneric species (*P. platyodon*, Biedermann) have been obtained; the lower jaw of another form, believed to be one of the Simiidæ, has been found at Monte Bamboli in Tuscany, and named by Gervais *Oreopithecus Bambolii*; and, finally, numerous bones of a monkey (*Mesopithecus*), apparently intermediate between the *Macacus* and *Semnopithecus*, have been dug out at Pikermi, Greece. Other fossil remains have been obtained both in Europe and India.

Although the range of structural differences within the limits of the family Simiidæ is not very great, there is a very considerable diversity in outward appearance. Thus, in most forms (*e. g.* Simiinæ and small monkeys) the face is not very much more projecting than in man, but in a few (baboons) it protrudes to such an extent as to resemble a dog's. In most, too, the thumb is quite well developed, but in others it is much reduced (*e. g.* orang-outang) or almost wanting (*e. g.* Semnopithecinæ). Again, the tail is quite long in many forms (*e. g.* Cercopithecus), but in others closely related otherwise (*e. g. Macacus* and *Inuus*) it is quite short or almost wanting. The genera are based on differences of such kind, as well as the number of tubercles on the molar teeth and the development of the ischiatic callosities. These differences, however, are not co-ordinated with others—are of much less importance than the characters already indicated as distinctive of the several sub-families.

Theodore Gill.

**Simi'inæ** [from *Simia*, the generic name of one of the genera, and *-inæ*, the suffix indicating sub-family rank], a sub-family of the family Simiidæ, including the large apes, and contrasting with the sub-family Hylobatinæ, embracing the small apes or gibbons. The form is robust; the ilia broad and alate; the cerebrum projects backward over the entire cerebellum; the molars of the upper jaw have each an oblique ridge running from the front inner angle of the tooth outward and backward to its hinder outer angle; the buttocks are destitute of callosities. In all these characters the apes agree with man, and differ from the gibbons, to which in other respects they most nearly approach. The species are divisible into three genera, which are again combinable into two groups. Two of these genera are peculiar to the forests of tropical Africa, one (*Mimetes* or *Troglodytes*) embracing the chimpanzee, and the other (*Gorilla*) the celebrated gorilla; these have a moderate face, the fore limbs do not reach down to the ankles when the animal is erect, and the thumb and great toe are well developed. The remaining genus (*Simia*) is limited to the orang-outang of Borneo and Sumatra; in this form the face is very deep and projects downward, the fore limbs are very elongated, the hands touching the ground when the animal is erect, and the thumb and great toe are small or imperfectly developed. (See, also, Chimpanzee, Gorilla, Orang-Outang, and Simiidæ.)

Theodore Gill.

**Similitude, Axes of, and Centres of.** See Radical Axis, by Gen. J. G. Barnard, LL.D.

**Sim'la,** principal town in the English Himalaya, in the Pandschab province of British India, was acquired after the Gorkha war (1816) from the raja of Bassahir (Bisser), together with an area of 18 sq. m., and contains as a district 33,995, as a town 7037 souls. The distance from Ambala, on the Delhi-Lahore Railway, is 98 miles. Simla is the permanent abode of numerous European residents, and during the summer the head-quarters of the government of British India. The houses are not massed together, the town being built according to the cottage system; the lowest house stands at 6617, the highest at 8008 feet. The annual mean temperature has been calculated at 57.8°. There are splendid warehouses, good hotels, and 8 schools for European children—excellent institutions which are in a flourishing condition. During the summer Europeans come from all parts of British India. Splendid entertainments and balls are given by the viceroy and high functionaries who pass the summer here. Simla has 4 periodicals, a theatre, a concert-room, Episcopal churches, and one Roman Catholic church. (See

*Times of India; Handbook of Hindostan*, ch. vii., Bombay, 1875.) EMIL SCHLAGINTWEIT.

**Sim'mons** (JAMES F.), b. at Little Compton, R. I., Sept. 10, 1795; was a farmer and manufacturer; served in the general assembly of Rhode Island 1828–41, and was U. S. Senator 1841–47, and again 1857–63. D. at Johnson, R. I., July 14, 1864.

**Simmons** (JOHN), b. at Little Compton, R. I., in Oct., 1796; became a wealthy merchant at Boston, Mass., where he d. Aug. 29, 1870, providing by his will for the founding of the Simmons Female College.

**Simmons** (SENECA G.), b. in Vermont Jan., 1809; was graduated from the U. S. Military Academy, and appointed brevet second lieutenant of infantry July 1, 1834, first lieutenant 1837, captain 1847, major 1861. Prior to 1861 he served mainly on frontier duty and in garrison; in Florida against the Seminoles; and in the war with Mexico. In June, 1861, he was appointed colonel of the 34th Pennsylvania Vols., which he commanded at the battle of Dranesville, and in the Virginia Peninsular campaign of 1862 at the battles of Mechanicsville, Gaines's Mill, and Glendale, where he met his death, June 30, 1862.

**Simmons** (WILLIAM HAYNE), M. D., b. in South Carolina about 1812; studied medicine at Philadelphia, but never practised; published anonymously at Charleston an Indian poem, *Onea*, and was also author of a *History of the Seminoles*. He became a resident of East Florida.—His younger brother, JAMES WRIGHT, was educated at Harvard; travelled in Europe, and settled in one of the Western States. He published at Boston in 1852 a poem, *The Greek Girl*, and has since written a series of metrical tales, *Wood-notes from the West*. Some graceful verses from the pens of both the brothers Simmons may be found in Duyckinck's *Cyclopædia of American Literature*.

**Simms** (WILLIAM GILMORE), LL.D., b. at Charleston, S. C., Apr. 17, 1806; received but a limited education, but acquired a remarkable fund of knowledge by miscellaneous reading; began to write verses at eight years of age; was for several years clerk in a drug-store in Charleston; studied law, and was admitted to the bar 1827, but abandoned that profession for literature and journalism, publishing in the same year two volumes of *Poems;* became in 1828 editor of the Charleston *City Gazette*, a political journal of Union proclivities, which was discontinued during the nullification excitement of 1832, after involving him in pecuniary ruin; resided at Hingham, Mass., 1832–33; wrote there his longest and best poem, *Atalantis, a Story of the Sea* (New York, 1833), and his earliest novel, *Martin Faber, the Story of a Criminal* (New York, 1833); returned soon afterward to South Carolina and settled at Woodlands, near Medway; wrote a successful connected series of romances founded on Revolutionary incidents in South Carolina, *The Partisan* (1835), *Mellichampe* (1836), *The Kinsmen, or the Black Riders of the Congaree* (1841; afterwards republished as *The Scout*, 1854), *Katherine Walton, or the Rebel of Dorchester* (1851), *The Foragers* (1855), and its sequel, *Eutaw* (1856), and *The Sword and the Distaff;* romances of colonial life, *The Yemassee* (1835) and *The Cazique of Kiawah* (1859); a series of border romances, *Guy Rivers* (1834), *Richard Hurdis* (1838), *Border Beagles* (1840), *Confession* (1841), *Beauchampe* (1842), and *Charlemont* (1856); several historical romances on Spanish or other foreign subjects, *The Damsel of Darien* (1839), *Pelayo* (1839), *Count Julian* (1845), *The Lily and the Totem, or the Huguenots in Florida* (1850), and *Vasconcelos* (1853); 11 volumes of novelettes, collected tales, and essays; 2 volumes of *Views and Reviews in American History, Literature, and Fiction* (1845–46), collected from a large number contributed to the leading magazines and periodicals; a *History of South Carolina* (1840), a *Geography of South Carolina* (1843), and *South Carolina in the Revolution* (1854); biographies of Marion (1844), Captain John Smith (1846), *Chevalier Bayard* (1848), and *Gen. Greene* (1849); 12 volumes of poems, none of which were equal in merit to his romances; 2 dramas of considerable merit; several political and controversial pamphlets, and a considerable number of biographies of Southern statesmen in Appletons' *New American Cyclopædia*. He was also editorially connected with the *Southern Literary Gazette*, the *Cosmopolitan*, the *Magnolia*, the *Southern and Western Monthly Magazine and Review*, and the *Southern Quarterly Review;* delivered numerous orations and lectures, and published an edition of the *Seven Dramas* doubtfully attributed to Shakspeare. Mr. Simms was the most voluminous and successful Southern writer, and as a novelist contested the palm with Cooper. He was several years a member of the South Carolina legislature, and filled other political offices. D. at Charleston, S. C., June 11, 1870. His best works of fiction were republished by Redfield, New York, in 19 vols., 1853–59 (new ed., 17 vols., 1865), under the title *Revolutionary and Border Romances of the South*, with illustrations by Darley. A copious selection of his *Poems* appeared in 1864.

PORTER C. BLISS.

**Simoda,** town of Japan, at the southern extremity of Cape Idzu, in lat. 34° 39′ N., was almost entirely destroyed by an earthquake in 1854, but has since been rebuilt. In 1857 its harbor was opened to foreign commerce. P. 7000.

**Si'mon** (JOHN), M. D., b. in England in 1816; became honorary fellow of the Royal College of Surgeons 1844; was afterward professor in King's College; surgeon to King's College Hospital and to St. Thomas's Hospital; was the first appointed medical officer to the general board of health of the privy council, in which capacities his annual reports on sanitary science, dealing with the most vital questions of the day in medicine, have been of extraordinary interest and value. His *Physiological Essay on the Thymus Gland* (1845) gained the Astley Cooper prize of £300. Among his works are *Aims and Philosophic Method of Pathological Research* (1848) and *Lectures on General Pathology* (1850). He has contributed largely to the *Cyclopædia of Anatomy and Physiology* and to scientific and medical periodicals, and edited (with a prefatory memoir) Dr. J. H. Green's *Spiritual Philosophy, founded on the Teachings of the late Samuel Taylor Coleridge* (2 vols., 1865).

**Simon'** (JULES), (JULES FRANÇOIS SUISSE-SIMON), b. at Lorient, department of Morbihan, France, Dec. 31, 1814; succeeded Cousin as professor of philosophy at the Sorbonne in 1839, but was dismissed in 1851 on account of his opposition to the *coup d'état;* lectured in 1855 and subsequently on philosophy in various cities in Belgium; was elected a member of the Legislative Assembly for the department of Loire in 1863; offered a strong opposition to the policy of Napoleon III., the plébiscite of 1870, the declaration of war against Prussia, etc., and was a member of the government for the national defence established on Sept. 4, 1870, and of the government of Thiers, Feb. 19, 1871–May 24, 1873, as minister of public education. During his term of office he carried through a law which makes school attendance compulsory. All his writings are distinguished by clearness and precision both of style and ideas, and some of them are the result of very comprehensive studies. The most remarkable are—*Histoire de l'École d'Alexandrie* (2 vols., 1844), *Le Devoir* (1854), *La Religion naturelle* (1856; translated into English by I. W. Cole, London, 1857), *La Liberté* (2 vols., 1859), *L'Ouvrière* (1863), *Le Travail* (1866), *La Politique radicale* (1868), *Le Libre-échange* (1870), and *Souvenirs du 4 Septembre* (1874).

**Simon** (RICHARD), b. at Dieppe, France, May 13, 1638; entered the congregation of the Oratory in 1659, but left it again in 1678; was for a short time priest at Belleville, but retired in 1682 to his native city; devoted himself exclusively to literary pursuits. D. Apr. 11, 1712. His writings —*Fides Ecclesiæ Orientalis* (1671), *Histoire critique du Vieux Testament* (1678), *Histoire critique de la Créance et des Coutumes des Nations du Levant* (1684), *Histoire critique du Texte du Nouveau Testament* (1689), *Histoire critique des Principaux Commentateurs du Nouveau Testament* (1692), *Nouvelles Observations sur le Texte et les Versions du Nouveau Testament* (1695)—form the first and, both on account of the consistency of the ideas and on account of the learning of the argumentation, one of the most powerful manifestations of that theological standpoint afterward known as rationalism. They were violently attacked by the Port-Royal, Bossuet, and other theologians.

**Simonianism, Saint.** See SOCIALISM.

**Simonians.** See SIMON MAGUS.

**Simon'ides,** b. at Iulis, island of Ceos, about 556 B. C.; lived at the court of the Pisistratidæ in Athens, at that of the Scopads in Thessaly, during the Persian wars alternately in Athens with Themistocles and in Sparta with Pausanias, and went about 476 B. C. to Sicily, where he lived at the court of Hiero in Syracuse, and d. about 467 B. C. A contemporary of Anacreon and Pindar, he was probably the most celebrated lyric poet of his age; his poem on those who fell in the battle of Marathon took the prize in a contest with Æschylus. But he was accused of avarice, and scandalized people by writing for hire. Of his poems only a few fragments are extant; edited by Schneidewin (Brunswick, 1835) and Bergk (Leipsic, 1853).

**Simonides,** generally known as **Simonides of Amorgos,** b. at Samos, but led a colony to Amorgos, one of the Cyclades, where he flourished as a satirical poet in the middle of the seventh century B. C. The existing fragments of his poems were edited by Welcker (Bonn, 1835), *Simonidis Amorgini Iambi quæ supersunt*, and are also contained in Schneidewin's and Bergk's collections.

**Simonin'** (LOUIS LAURENT), b. at Marseilles in 1830; studied at the mining school of St.-Étienne; undertook comprehensive geological explorations in France, Italy,

California, the island of Réunion, and Madagascar; was appointed professor of geology at the central school of architecture in 1865, and wrote, besides numerous travelling sketches in the *Revue des Deux Mondes* and other periodicals, *La Richesse minerale de la France* (1865), *L'Etrurie et les Etrusques* (1866), *La Vie souterraine* (1867), *L'Histoire de la Terre* (1867), *La Toscane et la Mer tyrrhénienne* (1868).

**Si'mon Ma'gus,** a Samaritan of the apostolic age, b., Justin Martyr says (*Apol.*, i. 26), at Gitton, which has been identified with *Kuryet Jît,* a village near Nablus. He is described in Acts viii. 9–24 as a sorcerer, called by the people "the great power of God," who was converted by the preaching of Philip, and sought to purchase with money the power of imparting the Holy Ghost; whence the expression *simony.* Of his subsequent history the ancient accounts are utterly discordant. The Simonians, one of the earliest of the Gnostic sects, lasting for several centuries, took their name from him, and he became a sort of archetype of heresy. R. D. Hitchcock.

**Simonose'ki,** town of Japan, at the south-western extremity of the island of Nipon, in lat. 33° 56′ N., is the entrepôt for European goods coming from Nagasaki and destined for the interior of Japan. It commands the Strait of Simonoseki, which forms the western entrance from the open ocean to the inland sea of Japan. P. 10,000.

During the summer of 1863 three vessels, American, Dutch, and French, were fired upon from batteries on the shore of the Simonoseki Strait; this assault was returned soon after by American and French war-vessels, and in 1864, by agreement of the diplomatic representatives, a combined fleet of U. S., Great Britain, France, and Holland men of war bombarded and destroyed the town. In a subsequent convention the sum of $3,000,000 was demanded by these four powers in compensation for "damages resulting to the interests of treaty powers" and for expenses of the expedition. The final instalments of this indemnity were paid by the Japanese government in 1874.

**Si'monton** (James W.), b. in Columbia co., N. Y., in 1824; educated in the public schools of New York City; became law-reporter for a city newspaper 1845; was shortly afterward sent to Washington as Congressional reporter for the *Courier and Enquirer;* went to California 1850, and was for a time one of the editors of the San Francisco *Courier,* but soon returned to New York; was one of the original staff of assistants to Henry J. Raymond at the establishment of the New York *Times* Sept., 1851, and for seven years was Washington correspondent of that paper; was influential in the exposure of several noted cases of bribery and corruption on the part of members of Congress 1857, at which time he was kept in custody several weeks for declining to give further information on that subject; again went to California, and engaged there in journalism 1859; was a war-correspondent 1861–65, and became manager of the Associated Press 1866.

**Si'mony,** in canon law, denotes the buying or selling of ecclesiastical offices or benefices, and received its name from Simon Magus, who wished to buy of the apostles, for gold, the power of conferring the Holy Ghost (Acts viii. 18–24). By all Christian denominations simony is considered and denounced as a great crime, but in the Roman Catholic Church it was nevertheless, at various periods, an almost universal practice.

**Simoom'** [from the Arabic *samma,* to "hurt," to "poison"], the name of a hot, scorching wind which rises in the sandy deserts when intensely heated by the sun, and blows, loaded with fine sand and dust, over Palestine, Syria, and Arabia. It generally occurs at the time of the equinoxes, and lasts for several hours. It is much dreaded, as it often proves fatal to animal life, partly on account of its heat, which rises to 126°, partly on account of the suffocating dust with which it is filled. Similar winds are the khamsin of Egypt, the samiel of Turkey, the sirocco of Italy, the solano of Spain, the harmattan of Guinea and Senegambia, etc.

**Simplicidenta'ti** [Lat. *simplex,* "simple," and *dentatus,* "tooth"], a sub-order of mammals of the order Rodentia or Glires, contradistinguished from the Duplicidentati (*duplex, duplicis,* "double," and *dentatus,* "toothed"] by the presence of only two incisor teeth in the upper as well as lower jaw. It comprises all the families of rodents except the Leporidæ and Lagomyidæ (which constitute the Duplicidentati), the most prominent of which are the Muridæ, containing the mice, rats, and allied forms, the Sciuridæ or squirrels, marmots, etc., Hystricidæ, or porcupines, and Castoridæ, or beavers. Theodore Gill.

**Simpli'cius,** a Neo-Platonic philosopher, native of Cilicia, flourished in the first half of the sixth century A. D. Nothing is known of his personal history except that he had as teachers Ammonius and Damascius, that he taught at Athens, and that he was one of the philosophers who, after the edict of Justinian (A. D. 529) closing the schools of philosophy at Athens, emigrated, at the invitation of King Khosru Nushirvan, to Persia, where their high hopes were doomed to such disheartening disappointment, and whence they soon returned to Athens, to enjoy liberty of thought indeed, but not liberty to teach. Simplicius is known principally as a scholarly and conscientious commentator on Aristotle. Of his commentaries we still possess those on the *Categories,* the *Physics,* the *De Cœlo* (see *Philological Museum,* vol. ii. pp. 588 *seq.*), and the *De Anima* of Aristotle, and one on the *Enchiridion* of Epictetus. Besides these, he is known to have written one on Aristotle's *Metaphysics.* Like most philosophers of his school, he makes no claim to originality. Adopting unquestioningly the doctrines of Plato, he endeavors to bring those of Aristotle into harmony with them by showing that, however much they may conflict in appearance, they do not do so in reality. He was a great admirer of Chaldæan and Orphic lore. Thomas Davidson.

**Sim'plon** [It. *Sempione;* Ger. *Simpeln*], village and mountain-pass near the boundary between Valais and Piedmont, is famous for the military road which Napoleon I. built here from 1800 to 1806. That much-admired piece of engineering, extending from Brieg to Domo d'Ossola, 42 miles long and 30 feet wide, with several long tunnels, 611 bridges, and 10 houses of refuge, was, after the Brenner Pass, the first carriage-road across the Alps. The culminating point is 6218 feet above the sea. Near by, at the base of the majestic Monte Leone (10,977 feet), a hospice has been erected for the gratuitous accommodation of travellers. The scenery on the southern slope is grand and severe in the extreme. In the village of Simplon, at an altitude of 4340 feet, the winter lasts fully eight months. A. Guyot.

**Simp'son,** county of S. Kentucky, adjoining Tennessee, watered by tributaries of Big Barren and Red rivers, has a generally level surface and a productive soil, and is traversed by Louisville Nashville and Great Southern R. R. Staples, tobacco, Indian corn, wheat, oats, sorghum-molasses, butter, and wool. Swine and sheep are numerous. Cap. Franklin. Area, 375 sq. m. P. 9573.

**Simpson,** county of S. Mississippi, on Pearl and Strong rivers, has a flat sandy surface and extensive pine forests. Staples, Indian corn, cotton, sweet potatoes, rice, butter, and wool. Cap. Westville. Area, 625 sq. m. P. 5718.

**Simpson,** tp., Grant co., Ark. P. 311.

**Simpson,** tp., Johnson co., Ill. P. 916.

**Simpson,** tp., Harrison co., West Va. P. 1474.

**Simpson** (Edward), U. S. N., b. Mar. 3, 1824, in New Jersey; entered the navy as a midshipman Feb. 11, 1840; became a lieutenant in 1855, a commander in 1865, a captain in 1870; actively engaged on the W. coast of Mexico during our war with that country, and in 1857 participated in the capture of the Barrier Forts, China; during the civil war commanded the iron-clad Passaic in all of the engagements with the defences of Charleston harbor from July, 1863, to 1864, and highly commended for "gallantry, skill, and sound judgment." Capt. Simpson has written two valuable works on ordnance, and stands prominently forward among the men who have done good service to the country and the navy. Foxhall A. Parker.

**Simpson** (Sir George), b. at Lochbunn, Ross-shire, Scotland, about 1796; was engaged in commercial pursuits in London 1809–20; accompanied the earl of Selkirk to Canada 1820, and was employed by that nobleman in the establishment of his Red River colony; pushed his settlements northward to Athabasca Lake in rivalry with the Hudson's Bay Company, and after the two companies had coalesced (1821) received the appointment of governor of Rupert's Land and of general superintendent of the affairs of the Hudson's Bay Company. In that capacity he planned the successful expedition under his nephew, Thomas Simpson, 1836–39, which traced the coast of the Arctic Ocean from the mouth of Mackenzie River to Point Barrow, and from the mouth of Coppermine River to the Gulf of Boothia. He made an overland journey around the world 1841–42, of which he published a *Narrative* (1847); was knighted in 1855. D. at La Chine, near Montreal, Canada, Sept. 7, 1860.

**Simpson** (James H.), b. in New Jersey Mar., 1813; was graduated from the U. S. Military Academy July 1, 1832, when appointed brevet second lieutenant of artillery. With the exception of a brief term of service in Florida on the staff of Gen. Eustis, he was mainly in garrison until 1838, when transferred to the topographical engineers with rank of first lieutenant, and was thenceforward engaged on the survey and improvement of lakes and harbors, and on lighthouse and Coast Survey duty until 1858, when ap-

pointed chief topographical engineer of the army of Utah, and while serving in this capacity explored and opened a wagon-route from the valley of Great Salt Lake across the Great Basin of Utah, by which the journey to the Pacific coast was shortened some 200 miles; a report of which he submitted early in 1861. In the early days of the civil war he served as mustering officer in Ohio and chief engineer of department of the Shenandoah. He was appointed colonel of the 4th New Jersey Vols. in Aug., 1861, and in the Virginia Peninsular campaign led his regiment in the action at West Point and in the battle of Gaines's Mill, where taken prisoner and held until Aug. 12. On Aug. 27 he resigned his volunteer commission, and thereafter served as chief engineer of the department of the Ohio and of district of Kentucky (having general charge of the fortifications in Kentucky), and as engineer agent for the Western armies. In Aug., 1865, he was detailed as chief engineer of the department of the interior on proposed change of route of the Union Pacific R. R., W. from Omaha, and served as government commissioner of that road until 1868, since which time he has been engaged in the regular line of duty with his corps, in which he attained the rank of colonel in 1867. For faithful and meritorious services during the rebellion he was brevetted colonel and brigadier-general.

**Simpson** (Sir James Young), Bart., M. D., D. C. L., b. at Bathgate, Scotland, June 7, 1811; educated at the University of Edinburgh and at the medical school of the same institution, taking his degree 1832; lectured there on pathology 1836; became professor of midwifery 1840; introduced the use of chloroform as an anæsthetic 1847; became president of the Royal Society of Physicians at Edinburgh 1849, and of the Medico-Chirurgical Society 1852; foreign associate of the French Academy of Medicine 1853; received the Monthyon prize for his introduction of anæsthesia 1856; was made a knight of a Swedish order about 1854; created a baronet 1867, and enjoyed an enviable reputation not only as a skilful medical practitioner, but as an eminent antiquarian. D. at Edinburgh May 6, 1870. Author of numerous professional works and miscellaneous writings, including *Homœopathy, its Tenets and Tendencies* (3d ed. 1853); *Obstetric Memoirs and Contributions* (2 vols., Edinburgh and Boston, 1855–56), which included several previous tracts on anæsthesia, and *Acupressure, a New Method of arresting Surgical Hæmorrhage and of accelerating the Healing of Wounds* (1864). In 1871 his principal works were collected under the titles *Selected Obstetrical Works, Anæsthesia and Hospitalism*, and *Clinical Lectures on the Diseases of Women;* and his *Archæological Essays* appeared in 1872. A *Memoir*, by J. Duns, D. D., was published in 1873.

**Simpson** (Josiah), b. at New Brunswick, N. J., Feb. 27, 1815; graduated from Princeton College in 1833, and pursued his medical studies at the University of Pennsylvania, graduating in 1836; was appointed assistant surgeon U. S. army July 11, 1837, and promoted to be surgeon 1855; brevet lieutenant-colonel and colonel U. S. A., Mar., 1865. As surgeon of the 6th Infantry he served through the Florida war, being present at the battle of Okeechobee, Dec., 1837. In 1846 he accompanied the regiment by way of San Antonio and Saltillo to Vera Cruz, and thence on to the City of Mexico, serving through the battles of Cerro Gordo, Churubusco, and Chapultepec, and present at the triumphant entry into the City of Mexico; attending surgeon with head-quarters in New York and post surgeon at Bedloe's Island 1848–55; was medical director of the department of the Pacific 1855–58; middle department and department of the Tennessee, 1858–67. Transferred to Baltimore as attending surgeon in 1867, he continued to attend faithfully to his duties, though enfeebled in health, till within a short time of his death, which occurred at Baltimore, Md., Mar. 3, 1874.

**Simpson** (Mathew), D. D., LL.D., b. at Cadiz, Harrison co., O., June 21, 1810; graduated at Madison College 1829; studied medicine and received the degree of M. D. 1833; was licensed the same year in the ministry of the Methodist Episcopal Church; became vice-president and professor of natural science at Allegheny College 1837; president of Indiana Asbury University at Greencastle, Ind., 1839; editor of the *Western Christian Advocate* 1848, and was elected bishop 1852. He has been prominent in educational and missionary labors and organizations; was an intimate friend of Pres. Lincoln, at whose request he devoted much of his time during the civil war to the maintenance of public sentiment in behalf of the Union by his eloquent addresses in many Northern cities, being also employed by the government in several important confidential commissions. In 1863–64 he made an extended tour of inspection of the missions of his Church in Syria and the East generally, and travelled through several countries of Europe upon a similar errand, contributing at the same time to enlighten public sentiment on American affairs. He visited the Mexican missions 1874, and the European mission conferences 1875, and on his return became a resident of Philadelphia. At the inauguration of the Centennial Exhibition, May 10, 1876, Bishop Simpson made the opening prayer. Author of *A Hundred Years of Methodism* (1876).

**Simpson** (Stephen), b. at Philadelphia, Pa., July 24, 1789; wrote against the U. S. Bank in the *Aurora;* was engaged in the battle of New Orleans; became a prominent journalist in Philadelphia, where he was editor and proprietor of the *Portico* and editor of the *Columbian Observer*, a Jacksonian organ. D. at Philadelphia Aug. 17, 1854. Author of *Life of Stephen Girard* (1832), etc.

**Simpson** (Thomas), F. R. S., b. at Market-Bosworth, England, Aug. 20, 1710; was in early life a weaver, but became an accomplished mathematician by private study; was for some years a teacher at Derby and at London; was professor of mathematics in the Royal Military Academy at Woolwich 1743–61, and published many ingenious papers on pure mathematics and physical astronomy. D. at Market-Bosworth May 14, 1761.

**Simpson's Creek,** tp., Horry co., S. C. P. 945.

**Simp'sonville,** p.-v., Shelby co., Ky., on Shelbyville division of Louisville Cincinnati and Lexington R. R. P. 239.

**Simpsonville,** tp., Rockingham co., N. C. P. 1590.

**Sim'rock** (Karl), b. at Bonn Aug. 28, 1802; studied jurisprudence in his native city and in Berlin; entered the Prussian civil service, but was dismissed in 1830 on account of a song he wrote on the revolution of July in Paris; devoted himself to literature, and studied especially the old German language and literature, of which he was appointed professor at Bonn in 1850. He translated the *Nibelungenlied* into modern German (1827), several works of the Minnesingers, the *Edda* (1851), *Beowulf* and *Heliand*, Shakspeare's *Sonnets* (1867), and Tegnér's *Frithiof's Saga* (1863). He also published a *Handbuch der deutschen Mythologie* (1864), *Die Rheinsagen, Deutschen Volksbücher* (1839–67), *Quellen des Shakspeare* (3 vols., 1831), etc.

**Sims,** tp., Grant co., Ind. P. 841.

**Sims** (Edward Dromgoole), b. in Brunswick co., Va., Mar. 24, 1805; graduated at Chapel Hill in the University of North Carolina in 1823, and became a tutor in that institution. He was the principal of an academy at La Grange, Ala., and on the establishment of La Grange College he filled the chair of mathematics and natural philosophy; travelled two years as a minister in the Tennessee conference; then was professor of languages in Randolph-Macon College, Va.; spent two years at the University of Halle, Germany, and another year in an extensive European tour. At the close of 1838 he returned to Virginia, and filled the chair of English literature in Randolph-Macon College, and in Dec., 1841, was elected to the same department in the University of Alabama. His learning was extensive and accurate; he was deeply versed in both ancient and modern languages and literature. He was preparing for publication a work on English grammar, and another on Anglo-Saxon, to which language he had devoted great attention. He was a model professor. As a preacher his sermons were distinguished for profound thought and perspicuous statement, but not for eloquence; though he had mingled in courtly society, he was unpretending in his manners, simple in his tastes, and devout in his spirit. He was greatly beloved for his generous, noble traits of character, to which a beautiful tribute was paid at his funeral by the Rev. Dr. Manly, who was then president of the University of Alabama. D. in Tuscaloosa, Ala., Apr. 12, 1845. His early removal was deplored by all, but especially by his colleagues, one of whom was the editor-in-chief of this Cyclopædia. T. O. Summers.

**Sims** (James Marion), M. D., b. in Lancaster co., S. C., Jan. 25, 1813; graduated from South Carolina College, Columbia, 1832; studied medicine at Charleston and Philadelphia, graduating M. D. at Jefferson Medical College 1835; in 1836 entered upon the practice of his profession at Montgomery, Ala.; in 1845 called attention to his new theory of the nature and origin of *Trismus Nascentium*, publishing a series of articles on this subject 1848 in the *American Journal of Medical Sciences*. In 1845 his attention was also especially directed to the subject of *Vesico-vaginal Fistula*, which previous to this time had been considered incurable. Establishing a private hospital at Montgomery for the treatment of this disease, Dr. Sims commenced a series of experiments, conducting them with intense earnestness during a period of four years (entirely at his own expense), which were crowned with success. His discovery was based on the use of silver sutures, the invention of a speculum which bears his name, and a great

number of new and ingenious instruments by which alone his operation is or can be performed, and are now in general use throughout the world by all surgeons of note. He has since extended the use of metallic sutures to every department of general surgery, their superiority being universally recognized. In 1852 he published a full account of his discovery in the *American Journal of Medical Sciences*. In 1850 his health failed, and he came North, and in 1853 settled permanently in New York. His investigations into the extent and character of diseases peculiar to woman early led him to perceive the importance and necessity of establishing a great permanent woman's hospital in the city of New York for the exclusive treatment of this formidable and very numerous class of affections. To accomplish this purpose he delivered an address (May 18, 1854) in the old Stuyvesant Institute to an immense gathering of the profession. His clearly-defined ideas, practical suggestions, and evident sincerity and earnestness carried conviction to all who heard him. The audience, wholly professional, at once on the close of his address appointed a committee to aid in carrying out his views. A suitable building was secured by Dr. Sims on Madison avenue, the common council appropriated $2500, and a temporary hospital was opened in May, 1855. Dr. Sims was elected attending surgeon, with Drs. Mott, Francis, Stevens, Green, and Delafield as a consulting board. The hospital was immediately filled with patients from all parts of the country. The success attained not only demonstrated the benefits of, but the necessity for, a large and permanent institution. In 1857–58, Dr. Sims obtained from the legislature a charter for the Woman's Hospital of the State of New York; he also obtained a grant of land from the city of New York as a site for the hospital, 200 by 400 feet, near Central Park, opposite Columbia College, consisting of thirty-two lots, now valued at $500,000. The hospital is on the pavilion plan. One pavilion, containing seventy beds, was finished and occupied in 1866. The Woman's Hospital is supported mainly by voluntary contributions. Dr. Sims obtained two appropriations for it from the State, amounting to $60,000, the balance being raised by private subscription. A second pavilion has been erected, and will be open during the present Centennial year, and is of the same capacity as the first. In 1861, Dr. Sims went abroad, and was invited to perform the peculiar operations associated with his name and discoveries by the profession wherever he appeared. He operated in Dublin, in London, in nine different hospitals in Paris, and, by special invitation, at the hospital in Brussels. His success was so decided that he received decorations from the French, Italian, Spanish, Portuguese, and Belgian governments as a public benefactor. As an author Dr. Sims is known by his papers on *Trismus Nascentium*, *Silver Sutures in Surgery*, *The Microscope in the Sterile Condition*, on *Ovariotomy*, on *Intrauterine Fibroid Tumors*, and by his clinical *Notes on Uterine Surgery*. Dr. Sims's European practice became very extensive, especially in France and England, he having many patients from all parts of the world. In 1868 he returned to New York, and resumed his practice during a part of the year, his family remaining in London and Paris, where his children were at school. In 1870, on the breaking out of the Franco-Prussian war, Dr. Sims organized in Paris the "Anglo-American Ambulance Corps," took charge of it as surgeon-in-chief, and went with it to Sedan, arriving there just as the great battle commenced (Aug. 31) which ended in the downfall of the Second Napoleonic empire. He remained at Sedan a month, having charge of a large hospital in the city, and establishing branch ambulances in the suburbs, aiding about 3000 of the wounded of both armies. Soon after this, Dr. Sims returned with his family to their home in New York, where he now resides. To the labors and discoveries of Dr. Sims are mainly due the development and establishment of the science of gynecology as a new department in medicine, recognized by a special professorship in all well-organized medical colleges. Dr. Sims is a corresponding member of many learned societies at home and abroad, notably of London, Edinburgh, Berlin, Christiania, etc., and of the Royal Academy of Medicine of Brussels. He was elected president of the American Medical Association at its meeting at Louisville, Ky., and presided over that learned body at its annual meeting (June 6, 1876) in Philadelphia, and delivered the Centennial annual address. H. L. Stuart.

**Sims** (Richard), b. at Oxford, England, in 1816; educated at New College School, Oxford; became in 1841 an employé in the manuscript department of the British Museum; was appointed transcriber 1859, and subsequently junior and senior assistant in the same department. Author of an *Index to the Heralds' Visitations* (1849), *A Handbook to the Library of the British Museum* (1854), *The Autograph Miscellany* (1855), *A Manual for the Genealogist, Topographer, Antiquary, and Legal Professor* (1856), *The Handbook to Autographs* (1860–61), and *The Autograph Souvenir* (1864–65). He has announced for publication *A Classed Catalogue of Manuscripts relating to British Heraldry and Topography deposited in the Public and many of the Private Libraries of the Kingdom.*

**Sims'bury,** p.-v. and tp., Hartford co., Conn., on New Haven and Northampton and Connecticut Western R. Rs., formerly the seat of the Connecticut State prison. P. 2051.

**Sim'son** (Robert), b. at Kirton Hall, Ayrshire, Scotland, Oct. 14, 1687; educated at the University of Glasgow with a view to the ministry; studied medicine, but never practised; was distinguished for classical and mathematical attainments, and was professor of mathematics at Glasgow University 1711–61. D. at Glasgow Oct. 1, 1768. He restored and edited the *Loci Plani* of Apollonius (1746) and the first six books of Euclid's *Elements* (1756), and Earl Stanhope published after his death his treatises on Porisms, an edition of Pappus, and other mathematical treatises.

**Simulta'neous Equa'tions** [Lat. *simul*]. Two or more equations are *simultaneous* when the value of each of the unknown quantities is the same in all of the equations. A single equation containing more than one unknown quantity is indeterminate; that is, it can be satisfied by an infinite number of sets of values of the unknown quantities that enter it. Any two such equations may be made simultaneous, and by their combination one of the unknown quantities can be eliminated. The act of combining two or more equations implies that they are simultaneous, and the result of the combination will depend on the relative number of equations and of unknown quantities. If the number of equations is equal to that of the unknown quantities, the resulting values of the unknown quantities will be the only ones that will satisfy all the equations of the group. If the number of equations is less than that of the unknown quantities, the result of the combination will be a single equation containing two or more unknown quantities, and consequently indeterminate. If the number of equations is greater than that of the unknown quantities, the unknown quantities may all be eliminated, and there will result one or more equations between the known quantities, which must be satisfied in order that given equations may be simultaneous; these equations are called *equations of condition*. If these are satisfied, some of the given equations must be dependent on some of the others, so that there are in reality no more independent equations in the group than there are unknown quantities.

W. G. Peck.

**Si'nai** [Heb. *Sina*, which means, according to Fürst, "jagged," "full of clefts"]. (1) A triangular peninsula of Arabia Petræa, between the gulfs of Suez and Akabah. The apex of the triangle points southward; its base is 150 miles across from gulf to gulf; its western side 186 miles long, its eastern side 133, and its area about 11,500 sq. m. First comes the wedge-like protrusion of the limestone plateau known as the Desert of the Wandering, then a sandstone belt, and finally the mountain-masses of granite and porphyry, flanked right and left by narrow strips of lowland bordering the gulfs. These mountains may be divided into three groups, the highest peaks of which, respectively, are Serbal (6734), Catharine (8526), and Shomer (8449). The ancient Egyptians called this peninsula "the land of the gods." Its solitary grandeur impresses all travellers alike. Mines of iron, copper, and turquoise were once worked here. It is still the home of about 5000 Bedouin. The curious inscriptions, found mostly on the western side of the peninsula, are still an unsolved problem.—(2) Used in the Old Testament interchangeably with Horeb to designate the Mountain of the Law. Lepsius and some others have tried to identify it with five-peaked Serbal, the most picturesque of all the mountains of the peninsula. But the true Sinai is a gigantic mass, about 2 miles long from N. to S., and about half a mile wide from E. to W. Its S. E. peak, called Jebel Musa, is the traditional scene of the giving of the Law. But there was not open space enough on the S. side of the mountain to accommodate the Hebrew host. Its N. W. peak, called Sufsafeh, overlooks three wadies (Rahah, Deir, and Leja), which might easily have held 3,000,000 or 4,000,000 people; and there is no other such spot anywhere in the whole peninsula. The watershed at the foot of Sinai is 5140 feet above the sea, Jebel Musa 7359, Sufsafeh a little lower. The famous convent of St. Catharine, in whose library Tischendorf discovered the Sinaitic Codex of the Scriptures (in 1844 and 1859), is on the E. side of the mountain. R. D. Hitchcock.

**Sinaloa.** See Cinaloa.

**Sinalun'ga,** or **Asinalunga,** town of Italy, province of Siena, pleasantly situated in a fertile tract on the eastern slope of Monte di Collalto, in the Val di Chiana, about 26 miles S. E. of the city of Siena. The churches contain some

fine pictures by Lodoma and other great Sienese painters. The present name of this town first appears in the twelfth century. P. 8898.

**Sin'apine** [Lat. *sinape* or *sinapi*, "mustard-seed"], a vegetable alkaloid found, in combination with *sulphocyanic acid*, in the seed of *Sinapis alba*, or white mustard. Its composition is $C_{16}H_{23}NO_5$. It has not yet been obtained in solid form in pure state, being decomposed by evaporation of its solution. The latter has the interesting property of precipitating metallic gold from the chloride. The characteristic principle of mustard, *sulphocyanate of sinapine*, may be obtained crystallized in colorless glassy rectangular prisms. It is inodorous, but has the bitter and hot taste of mustard. It dissolves to yellow solutions in water and alcohol, and is soluble also in ether, disulphide of carbon, and essential oils. The smell which mixed mustard (as a condiment) acquires on standing is due to products of decomposition of this very unstable substance. H. Wurtz.

**Sinapis.** See Mustard and Sinapine.

**Sincere Brethren,** a former secret society of Mohammedans, called also **True Friends.** The society sprang up in the Motazilite sect in the latter part of the tenth century. Its great work was philosophical and literary. The brethren produced fifty-one treatises designed as an encyclopædia or statement of all the scientific knowledge of the time. They taught a kind of Pythagorean philosophy, and their real object, we are told, was to reform the corrupt moral tone of the Mohammedan world at that period. They also were bound to befriend each other in all circumstances. They were unpopular in their day, and were charged with being trimmers and compromisers on important moral questions.

**Sin'clair** (Carrie Bell), b. at Milledgeville, Ga., May 22, 1839, is a niece of Robert Fulton the inventor, and daughter of a Methodist minister; spent her childhood at many different places in North Carolina, South Carolina, and Georgia, and finally became a resident of Augusta, Ga., where in 1860 she published a volume of *Poems* containing many graceful verses. During the civil conflict she wrote several war-songs, which were set to music. They have been published, with other pieces, in a volume entitled *Heart-Whispers, or Echoes of Songs.*

**Sinclair** (Catharine), daughter of Sir John, b. at Edinburgh, Scotland, Apr. 17, 1800; acted as amanuensis to her father during his later years, and after his death wrote several novels which enjoyed great popularity both in Great Britain and the U. S. Among them were *Modern Accomplishments* (1835), *Holiday House* (1839), *Modern Flirtations* (1841), *Jane Bouverie* (1845), *Beatrice* (1852), and *Torchester Abbey, or Cross Purposes* (1855). She also wrote books for the young, and took an active interest in philanthropic and educational projects. For some years she was directress of a charitable institution for widows of officers of the army, and equipped at her own expense a volunteer corps of young artisans. D. at Kensington, London, Aug. 6, 1864.

**Sinclair** (George), b. in Scotland about 1625; became professor of philosophy in the University of Glasgow 1654; was a zealous Covenanter, and consequently ejected from his chair after the Restoration 1662; became an engineer; was employed in constructing waterworks and in draining mines; was restored to his university chair 1688, and became also professor of mathematics 1691. D. at Glasgow in 1696. He was a zealous experimenter in natural science, and published works on mathematics, hydrostatics, and astronomy, but is chiefly remembered for his maintenance of the reality of witchcraft in a curious book long popular among the Scottish peasantry, *Satan's Invisible World Discovered, or a Choice Collection of Relations anent Devils, Spirits, Witches, and Apparitions* (1685).

**Sinclair** (Sir John), Bart., LL.D., b. at Thurso Castle, Caithness, Scotland, May 10, 1754; received a careful education at the universities of Edinburgh, Glasgow, and Oxford; became a member of the Faculty of Advocates at Edinburgh 1775; was called to the bar at Lincoln's Inn 1782, in which year he printed tracts on parliamentary reform and on the naval strength of the British empire, as well as a philological treatise entitled *Observations on the Scottish Dialect;* published a learned *History of the Public Revenue of the British Empire* (3 vols., 1785–89); travelled extensively in the north of Europe 1786; was made a baronet the same year; introduced great improvements in agriculture and wool-growing on his immense estate of 100,000 acres; built up the port of Thurso; was influential in reviving the coast fisheries and in the establishment of the Scottish Society of Wool-growers (1791) and board of agriculture (1793), of both which associations he was the first president; maintained an extended correspondence with Gen. Washington, chiefly on agricultural topics (printed in engraved fac-simile, London, 1800; reprinted at Washington, D. C., 1844 and 1847); raised two battalions of fencibles for the national defence; sat in Parliament with brief interruptions from 1780 to 1811; became a member of the privy council 1810; compiled a herculean work which has been called the "Scottish Doomsday Book," *A Statistical Account of Scotland, drawn up from the Communications of the Ministers of the Different Parishes* (Edinburgh, 21 vols. 8vo, 1791–99); printed the alleged Gaelic originals of *Ossian's Poems,* with a preliminary dissertation maintaining their genuineness, and for fifty years issued an incessant stream of publications, 367 in number, covering almost the whole range of literature, being aided therein during his later years by his daughter Catharine, who became eminent as a novelist. D. at Edinburgh Dec. 21, 1835.—His eldest son, Sir George, b. at Edinburgh Oct. 23, 1790, was for some years a member of Parliament, and wrote several works against Roman Catholicism. D. at Edinburgh Oct. 9, 1868.—Another son, John, b. at Edinburgh Aug. 20, 1797, graduated at Pembroke College, Oxford, 1819; took holy orders; became examining chaplain to the bishop of London 1839, vicar of Kensington 1842, and archdeacon of Middlesex 1843; published *Memoirs* of his father (2 vols., 1837), and many theological treatises; was many years an active worker in behalf of education as secretary to the National Society, and visited the U. S. in 1853 in behalf of the Society for the Propagation of the Gospel. D. in London May 22, 1875. Just before his death he published an entertaining book filled with curious reminiscences, *Sketches of Old Times and Distant Places* (1875). Porter C. Bliss.

**Sin'clairville,** p.-v., Charlotte tp., Chautauqua co., N. Y., on Dunkirk Allegheny Valley and Pittsburg R. R., has 4 churches and several mills. P. 575.

**Sinde, Scinde,** or **Sindh,** British province, forming part of the northern division of the presidency of Bombay, in British India, lies between 23° and 28° 32′ N. lat. and 66° 43′ and 71° E. lon. (Greenwich); bounded on the S. by the Runn of Cutch and the Arabian Sea; on the W. by the Hala and Suliman Hills, belonging to Beloochistan (Kelat); on the N. by the British province of the Panjaub; and to the E. by the native states of Rajputâna. Area, exclusive of the native state of Khairpoor, 97,175 sq. m., and (in 1872) a pop. of 2,192,145. The centre of the province, consisting of the valley of the Indus, is rich and, where irrigated, highly cultivated. Toward the W. the valley rises, in parts somewhat abruptly, into barren and rugged uplands, a country of pasture inhabited by wandering tribes of shepherds. On the left bank the plain, unbroken save by natural or artificial canals—among which the Mitsaw Canal, 200 miles in length, for providing a sufficient supply of water to the Fulailee or Gunee river, is the greatest work—stretches toward the Eastern Nara, an offshoot of the Indus, whose course for upward of 100 miles runs nearly parallel to the main stream. Beyond the Nara the country, passing through different stages of fertility, is finally absorbed into the Great Desert, an extensive tract studded with ridges of sand which run parallel to the course of the Nara, varying in height from 80 to 100 feet. In the S. the more recently-formed portions of the Indus delta, consisting of salt-impregnated clay, are a waterlogged, unwholesome, thinly-populated region, nearly devoid of vegetation. The climate shows an extreme of heat. In Upper Sinde the dryness and heat, combined with the aridity of a sandy soil, make up a climate resembling that of the sultry deserts of Africa. The mean maximum height at Hyderabad, in Lower Sinde, during the hottest month of the year, has been given at 98° 5′ in the shade, and the water of the Indus reaches blood heat; but in Upper Sinde it is even hotter, and the thermometer has been known to register 130°. In the low lands lying near the coast the climate is more agreeable, and Kurrachee is one of the best places in India to mass European troops, the mean temperature amounting to 77.7°. The quantity of rain is exceedingly small. The monsoon rains exert no influence. The average of the rainfall varies from 9.25 inches in Upper to 7.35 in Lower Sinde. Geologically, the rocks of Sinde are only partially represented in the Indian peninsula, and must rather be considered as belonging to continental Asia, having been shown to be continuous with the formations found in Persia and Arabia. The province contains in all 32,750,000 acres, of which no less than 25,500,000 are returned unculturable, while of the remainder little more than 2,000,000 are under cultivation. The principal agricultural products are, for the autumn (kharif) crop, rice, millet, panic (*Panicum spicatum*), and cotton, and for the spring (rabi) crop, wheat, barley, oil-seeds, and tobacco; wheat and oil-seeds go to England. Camels are very numerous, horses few, small, but very hardy; bullocks are reared in great numbers and exported to Guzerat. Though

chiefly an agricultural and pastoral country, the pottery, the leatherwork, and the carpets of Sinde are, in design and finish, of superior excellence. The population gives 47.05 persons per sq. m. Islamism is the prevailing religion, 72.4 per cent. being returned as Mussulmans; the Hindoos have adopted Mussulman customs so far as to dress in Mohammedan fashion and to wear the beard. The people are very peaceable and well-disposed, though far less civilized than the generality of Indian populations. Among the Mohammedans there are no castes; among the Hindoos of a notable character are the Amils, who are the best-educated class and the most generally employed in government service. Ethnologically, the population belongs to the great branches of Beloochees who entered the province from Beloochistan, and the Sindhis of Hindoo (Indian) origin. The languages are Sindhî, a dialect of the Aryan family, and not yet very remote from the Sanskrit, and Beloochee, of the Dravidian group, being a mixture of Persian, Sindi, Hindi, and Sanskrit; both languages are written with Persian characters. The literature is poor, chiefly translations from Persian, Sanskrit, and modern Indian dialects; newspapers are not published in any of them. About 35 per cent. of the population are engaged in agriculture; only 16.3 per cent. are returned as proprietors, the others as tenants or laborers; half the entire number of holdings do not exceed 5 acres in area; not more than a quarter exceed 50 acres. Hereditary tenancy is only found in some of the northern districts.

In ancient times the Hindoo nationality ruled the province under Brahman dynasties; successive waves of Mohammedan invasion and conquest passed over Sinde, which under the Mogul dynasties at Delhi became the playground for ambitious Arab governors. Shortly after the beginning of the present century, four brothers of the Talpoor family assumed the government and held the land, with the title of emirs, under a military despotism. The progress of British power in Northern India was accompanied by certain complications with the emirs; but while the questions in dispute were still under negotiation, peace was broken by the emirs' troops. Recourse to arms could no longer be avoided, and after a brief though well-contested campaign the province was, in 1843, conquered by Sir R. Napier and became part of the British empire in India. For administrative purposes the province is divided into the five districts of Upper Sinde frontier in the N., Thar and Parkar in the S. E., and Kurrachee, Hyderabad, and Shikarpoor, which are the three richest, in the centre. These central districts are administered according to the regulation system—viz. the administration of civil justice is entrusted to four grades of courts, whilst the original criminal work is disposed of by the executive officers; in the non-regulated districts these officers hold both civil and criminal functions. The revenue administration is carried on by a staff of collectors and subordinate officers (natives), and yields from 6,000,000 to 7,000,000 rupees. Under the British government the province is making rapid advancement in every direction, not overlooking education; in 1874 there were 227 schools. The principal town is the seaport Kurrachee, terminus of the Indian-European telegraph and of the Sinde Railway, running up to Kotree, opposite to Hyderabad, and under construction to Sakkar, so as to meet the Indus Valley Railway; its pop. is 56,753; its external annual trade amounted in 1873 to 3.7 million rupees, 1874 to 3.9 million rupees. In 1873, 4407 ships entered and cleared the harbor; 31 steamers left for London *viâ* the Suez Canal; the difficulties in entering the harbor are removed. Post and passenger steamers from Aden do not yet run to Kurrachee.

EMIL SCHLAGINTWEIT.

**Sin'dia,** the dynastic name of the most powerful of the present native Mahratta princes of India, having their capital at GWALIOR (which see). The family took its rise in the person of RANOJEE SINDIA, a low-caste retainer of the Mahratta peishwa, who rose to a high rank in the bodyguard, and in 1743 received as a fief half of the province of Malwa.—His son, MADHAJEE SINDIA (d. 1794), joined the Mahratta confederacy; fought against the Afghans at the great battle of Paniput (1761); became a useful ally of the emperor of Delhi; expelled the Sikhs from Central India, and became virtual ruler of the empire; fought against the British 1779–82; was confirmed in his possessions by the treaty of 1782; captured Gwalior 1784; seized on Delhi and Agra; reduced the Rajpoot states, and formed a vast army, well disciplined by French adventurers.—His grandnephew and successor, DOWLUT RAO SINDIA, ruled from 1794 to 1827; waged war with varying success against the rival family of Holkar; was defeated by Wellington at Assaye and by Lord Lake at Laswaree, and submitted to British influence, but retained his capital and a portion of his territories.—The present ruler, BHAGERUT RAO SINDIA, was a loyal and useful ally of the English during the great mutiny of 1857–59.

**Sine** [Lat. *sinus*], in trigonometry, the distance of one extremity of an arc from the diameter through the other extremity.

**Sin-Gan-Foo,** city of China, capital of the province of Shen-Si, and formerly capital of the empire, on the right bank of the principal western tributary of the Hoang-Ho, contains a population variously estimated at from 100,000 to 200,000, is enclosed by strong walls, was long the principal military dépôt for the N. W. of China, and has been for several years the stronghold of the Mohammedan rebels or "Nien-Fei," who have established an imperial government, have overrun several provinces, and now (1876) menace the integrity of the empire. Sin-Gan-Foo is also celebrated for the discovery, a few years since, of a Syriac inscription recording the establishment of Christianity there by the Nestorians in the fourth century A. D., the authenticity of which was formerly much disputed, but has been placed beyond doubt by Col. Yule's careful researches in his 2d ed. of the *Travels of Marco Polo* (1876).

**Singapore',** or **Singapur,** an island on the extremity of the Malayan peninsula, bearing the town of the same name, founded by the Malays 1283, ceded 1819 to the English by the raja of Johor, and rendered a free port in order to strike a blow at the Dutch; became in 1853 the capital of the Straits Settlements. The area of the island is 222 sq. m.; the surface varies from 20 to 30 feet above the sea-level; low hills are numerous, varying from 50 to 200 feet; Bukemata, a hill in the centre of the island, has a height of 517 feet. The climate is agreeable to Europeans; the mean annual temperature is 80.7° F.; during the day the heat is intense; the atmosphere is very moist, there being usually a fall of rain every week. The drainage of the town, formerly as bad as possible, has been considerably improved. The seamen's hospital is an excellent building, well adapted for its purpose and well attended to. From the census of 1871 the population of the islands has been computed to be 97,111. Chinese and Javanese are numerous. The city was once a dreaded lurking-place for pirates, but developed into a great commercial centre of the Malayan Archipelago, doing an annual business in native produce and foreign goods of $70,000,000. But it seems, in this respect, to have reached its point of culmination. Numerous harbors on the Malayan peninsula, especially Pulo-Penang, in Borneo, and Sumatra, in Siam and Cochin China, formerly traded exclusively through Singapore, but have now begun to establish direct connections. About 1330 vessels, among which are 460 steamers, annually enter and clear the port. The value of the exports to the U. S. of America in 1869 was estimated at $2,100,000; that of the imports at $38,380. It is connected by telegraph with Madras, Java, Australia, and Japan.

E. SCHLAGINTWEIT.

**Sing'er** (SAMUEL WELLER), b. in England in 1783; author of one or two original works on antiquarian subjects; was chiefly known as an industrious editor of numerous old English authors, among which were Fairfax's *Tasso* (2 vols., 1817), Spence's *Anecdotes* (1820), Sir Thomas More's *Richard the Third* (1821), Cavendish's *Life of Wolsey* (2 vols., 1825), Herrick's *Poetical Works* (2 vols., 1846), and various works of Clarendon, Roper, Selden, Shakspeare, and Bacon. D. in London Dec. 20, 1858.

**Singers Glen,** p.-v., Rockingham co., Va., on Baltimore and Ohio R. R., 8 miles N. E. of Harrisonburg, has 1 church and 2 large publishing-houses. P. about 100.

ALDINE L. KIEFFER, ED. "MUSICAL MILLION."

**Singha'ra Nut,** the kernel produced by *Trapa bispinosa*, a halagoreaceous water-plant, which, like *T. bicornis* of China and *T. natans* of Europe, is cultivated for its fruit, which is a very useful food, especially important as growing in shallow waters, which would otherwise be unproductive. The Cashmerians obtain a large part of their food from this plant.

**Singh, Runjeet.** See RUNJEET SINGH.

**Sing Sing,** p.-v., Westchester co., N. Y., incorporated in 1813, 33 miles N. of New York City, on New York Central and Hudson River R. R., is spread out over the eastern slope of the Hudson, extending back from the river nearly a mile, being about 2 miles in length from N. to S. Its streets and avenues, rising one above another to the height of from 200 to 300 feet, afford the most delightful views of the lovely scenery of the Hudson from its source to its outlet. The river is wider at this point than at any other; the broad Tappan Zee and Haverstraw Bay are separated by the long peninsula known in Revolutionary times as "Teller's Point" (where the Vulture waited for Arnold and André), and now, as Croton or Underhill's Point, famous for its vineyards. These expansive bays, the mountains on the western border, with Mount Taurn, 640 feet high, Teller's, Verplanck's, and Stony Points, all of his-

toric memory; the villages of Piermont, Nyack, Rockland, and Haverstraw all in view,—combine to make a landscape of surpassing loveliness. Sing Sing is noted for its salubrity as a summer resort, for its far-famed military schools, and for the number and beauty of the private residences in and immediately around it—for the whole town of Ossining, with its 8000 inhabitants, is but a suburb of this its chief village. It has several fine churches—2 Episcopal, 2 Methodist, 1 Presbyterian, 1 Baptist, and 1 Roman Catholic. There are many fine new stores, a handsome marble bank, Masonic and town halls, a large public school with 600 to 700 scholars, 4 military high schools; Mount Pleasant Academy, established over fifty years, with 70 pupils; St. John's School, 78 pupils; Holbrook's Military School, 60; Symond's, 30 to 50; the Ossining Institute for young ladies; Mrs. Clark's, and others. Two newspapers, the *Republican* and the *Democratic Register*, are published weekly. The Croton Aqueduct crosses the Kill by a magnificent stone arch of 88 feet span and nearly 70 feet above the stream; the Kill is also crossed by two large brick and stone arch bridges, and one iron suspension road-bridge. Among the articles manufactured here are Hall's self-feeding cotton-gins, Turner's cotton-gin saws, gas and water pipes, the Monitor and the Empire lawn-mowers, Kipp's steam-engines, files, wrenches, and carriages and sleighs. The 1500 State convicts in Mount Pleasant prison, just outside the corporate limits of the village, and not included in its population, are engaged in making furniture, harness, lime, marble-dust, laundry-work, etc. P. 4696. GEORGE JACKSON FISHER.

**Singular Points.** A singular point of a curve is a point at which the curve possesses some analytical peculiarity not possessed by other points. The most important singular points are *cusps, multiple points, points of inflexion, isolated points,* and *points of abrupt termination,* or, as the French term them, *points d'arrêt.* A *cusp* is a point at which two branches of a curve stop, having a common tangent at that point. A *multiple point* is a point at which two branches of a curve cut each other or are tangent to each other. A *point of inflexion* is a point at which a curve changes the direction of its curvature; the curve cuts the tangent at a point of inflexion. *Isolated points* are points whose co-ordinates satisfy the equation of the curve, but which have no consecutive points. A *point d'arrêt* is a point at which a curve stops.

FIG. 1.

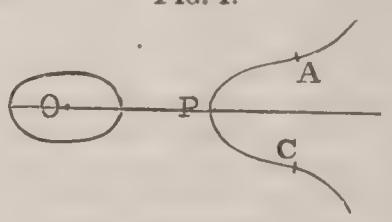
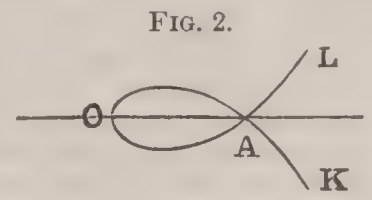
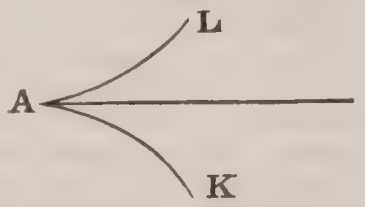



FIG. 2.




A discussion of the curve whose equation is $ay^2 = x^3 - (b-c)x^2 + bcx$ illustrates the relation between some of the more important of the singular points above defined. The general form of this curve is shown in the annexed diagram. It consists of an oval branch O and an infinite bell-shaped branch, C P A, C and A being points of inflexion. If we make $c = 0$, the oval O shrinks to a single point, which is a conjugate point. If we make $b = 0$, the curve reduces the shape K A O A L, A being a multiple point. If we make $b = 0$ and $c = 0$, the curve takes the form K A L, A being a cusp. (For further information the reader is referred to Salmon's *Treatise on the Higher Curves.*) W. G. PECK.

FIG. 3.




**Sinigallia, Senigallia,** or **Sinigaglia,** town of Italy, province of Ancona, near the Adriatic, at the mouth of the Misa, which divides the town into two parts, was formerly very strongly fortified. The streets are broad and well paved, and some of them are flanked by fine buildings constructed with porticoes forming a continuous sheltered promenade. Sinigallia owes its origin to the Sinonian Gauls, but lost its importance by the invasion of the Saracens. The present maritime trade is carried on by means of a short canal, for which the lower arm of the Misa has been made available. From 600 to 800 vessels enter the harbor annually. The manufacturing activity is considerable, chiefly in silk and linen. The annual fair of Sinigallia (beginning July 22) was formerly one of the most famous in Europe, and is still much frequented. P. with suburbs, 22,127.

**Sinim,** another name of the SERES (which see).

**Sinking Fund.** See FUNDS, by J. S. GIBBONS.

**Sinking Springs,** tp., Highland co., O. P. 200.

**Sinoob'** [the ancient *Sinope*], town of Asiatic Turkey, in Asia Minor, eyalet of Kastamooni, on a peninsula jutting out into the Black Sea, is surrounded with walls, has an excellent harbor, an arsenal and shipyard, extensive fortifications, just completed (1876), and a vast castle of the Byzantine period. The ancient *Sinope* was a colony from Miletus, became the capital of the kingdom of Pontus, was the residence of Mithridates, and is celebrated in modern times for the great naval battle, resulting in the destruction of the Turkish fleet by the Russian admiral Nakhimoff, Nov. 30, 1853. Half of its inhabitants are Turks, but the trade which is carried on quite extensively in corn, timber, and fish is entirely in the hands of Greeks. P. 10,000.

**Sinope.** See SINOOB.

**Sin'ters** [Ger.], a general designation for mineral substances deposited as incrustations or porous and cellular masses from the waters of mineral springs. The principal kinds are *silicious* and *calcareous* sinters, but there are also *iron* sinters. Some silicious sinters are classed by Dana with the crypto-crystalline varieties of quartz. (See SILICA.) They proceed from waters containing silica itself in solution, or sometimes, doubtless, soluble silicates of bases which are decomposed by the carbonic acid of the air. The great mass of silicious sinters are composed of hydrates of silica. *Fiorite, michaelite,* and *geyserite* are names that have been given to some of these. *Hyalite,* or glassy silicious hydrate, is also occasionally found about hot springs. *Michaelite,* of J. W. Webster, from St. Michael's in the Azores, is a snow-white capillary substance of pearly lustre, of density 1.866. Its analysis gives exactly the composition $3SiO_2.2H_2O$. Calcareous sinters are also called calcareous tufas. They are similar in nature and origin to the material of STALACTITES (which see). Of the iron sinters the most interesting is the mineral called *scerodite,* which is *tetrahydrated ferric arseniate,* $Fe_2O_3.As_2O_5.4H_2O$, found in several localities in this country. It often occurs crystalline, but sometimes as a sinter. For a complete account of it mineralogical textbooks must be referred to. H. WURTZ.

**Sintus,** or **Sintoos,** in Japan, the adherents of the *Sinsyn* (that is, "the worship of the gods"), the ancient religion of the country, in which the chief deity is the sun-goddess Ten-sio-dai-yin. This divinity is invoked through inferior divinities called Kami. (See JAPAN.)

**Si'nus** [Lat.], a cavity or depression. A term employed in anatomy and surgery. In surgery it is applied to long, narrow tracts connecting with the cavity of an abscess or with dead bone. Sinuses are usually lined with granulation tissue, which often appears as an exuberant, pouting growth at its orifice, and is popularly termed "proud flesh." In anatomy the term *sinus* is applied to two distinct classes of cavities or channels: (1) The larger venous channels of the interior of the skull and spinal column, the sinuses of the dura mater. These venous channels have an outer coat formed by the dura mater, and an inner coat which is a continuation of the serous membrane of the veins. The term is less prominently associated with other vascular pouches or local dilatations, as the sinus of the jugular vein at its base, the sinuses of Valsalva, or aortic and pulmonary sinuses, depressions behind each segment of the tripartite valves at the base of the heart, opening into the aorta and pulmonary artery. (2) Cavernous passages in the bones of the face, connecting with the cavities of the mouth and nose. These are the sinuses of the frontal bone or forehead, of the maxillæ or cheek-bones, and of the ethmoid and sphenoid bones. These remote cribriform cavities of the forehead and base of the skull are involved when the nostrils and throat are the seat of acute or chronic catarrhal inflammation. In influenza and recent colds in the head the catarrhal state of these sensitive surfaces causes a sense of fulness, tension, heat, and pain. They also contribute to the great volume of serum and mucus discharged from the nose during the early period of coryza or acute nasal and bronchial catarrh.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Si'on,** or **Sitten,** town of Switzerland, capital of the canton of Valais, on the Rhone, is surrounded with walls, has several old and interesting churches and castles, and some manufactures of tobacco and silk. P. about 5000.

**Sion, Mount.** See ZION.

**Sioot',** city, cap. of a province of the same name and residence of the governor of Upper Egypt, near the Nile, in lat. 27° 13′ N., on the site of the ancient *Lycopolis,* in an exceedingly fertile district. It has several fine mosques, palaces, baths, bazaars, and the ruins of a Roman amphitheatre, is the residence of several foreign consuls, the seat of a flourishing American mission, and is the chief resort of the caravans from Nubia and Soodan, with which it carries on a considerable trade. The view of the Nile valley from the peaks of the neighboring Libyan hills is reported as one of the finest in Egypt. Its inhabitants, about 25,000, enjoy a good reputation for industry and reliability.

**Sioux,** county of N. W. Iowa, on Big Sioux and Rock rivers, traversed by Sioux City and St. Paul R. R., has a level surface and a fertile soil. Cap. Orange City. Area, 750 sq. m. P. 576, largely increased since 1870.

**Sioux,** tp., Plymouth co., Ia. P. 311.

**Sioux City,** p.-v. and tp., cap. of Woodbury co., Ia., on Sioux City and St. Paul, Iowa division of Illinois Central, Sioux City and Pacific, and Dakota Southern R. Rs., contains several churches, excellent schools, 3 banks, 1 daily and 3 weekly newspapers, foundry and machine-shops, elevator, jobbing-houses, mills, pork-packing houses, an opera-house, water and gas works, and an efficient fire department. P. of v. 3401; of tp. 800.

PERKINS BROS., EDS. "DAILY JOURNAL."

**Sioux Falls,** p.-v., cap. of Minnehaha co., Dakota Ter., 100 miles N. of Sioux City, Ia., has 1 bank, 2 newspapers, U. S. land-office, a brewery, 2 flouring-mills, and 3 hotels. Sioux River falls 110 feet in half a mile, forming a fine water-power. W. F. KITER, ED. "PANTAGRAPH."

**Sioux Indians.** See DAKOTA INDIANS.

**Sioux Rapids,** p.-v., cap. of Buena Vista co., Ia., on Sioux River, has 1 bank, good schools, 1 newspaper, a saw and grist mill, and 2 hotels. Business, farming and stock-raising. P. 61. D. C. & W. R. THOMAS, EDS. "ECHO."

**Si′phon** [Gr. *σίφων*, a "reed"], in hydraulics, a bent tube, one leg of which is longer than the other. If the siphon is filled with liquid, and its shorter leg is plunged into a filled vessel, the liquid will flow out of the vessel through the siphon until the surface of the liquid is brought down to the level of the short leg of the siphon. The principle of the siphon has been employed in aqueducts and in some of the drainage-works of the Bedford Level in England; but the siphon cannot be made to raise water more than thirty-four feet. Its principal use is in the racking of wines and liquors from off their lees.

**Siphonia.** See EUPHORBIACEÆ, and INDIA-RUBBER, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Siphonognath′idæ** [from *Siphonognathus*—Gr. *σίφων*, "tube," and *γνάθος*, "jaw"—the typical genus], a family of fishes of the order Teleocephali and sub-order Acanthopteri, related to the Labridæ. The body is very elongate; the scales cycloid; the lateral line uninterrupted; the head elongate, and the facial bones produced into a tube much longer than the postocular portion; the opercula unarmed; the mouth terminal and cleft laterally, but remote from the eyes; the upper jaw non-protractile; maxillaries weak; teeth absent from the jaws and palate; branchial apertures continuous below; branchiostegal rays four on each side; dorsal fin very elongate, with its spinous portion rather larger than the soft; anal much shorter than the soft portion of the dorsal; caudal distinct; pectorals with branched rays; ventrals wanting. The vertebræ are in large number, there being about 29 or 30 abdominal or costiferous ones alone; the intestinal canal is straight and simple, without a well-defined stomach, and there are no pyloric cæca. The family has been formed for the reception of a peculiar fish (*Siphonognathus argyrophanes*), known only from King George's Sound. It was regarded by its original describer, Sir John Richardson, in 1857, as being a member of the family Aulostomidæ, but by Dr. A. Günther it was afterward referred to the Labridæ; its peculiarities, however, appear to fully entitle it to differentiation as a well-marked family. The specimens obtained measured about sixteen or seventeen inches in length.

THEODORE GILL.

**Sipunculoi′dea,** an order of animal organisms of which *Sipunculus* is the typical genus. It is by some referred to the echinoderms, and by others to the annelides. Its species are worm-like in form, habits, and appearance, but possess decidedly radiate characters; and the whole order may be considered intermediate between the two subkingdoms to which it has been assigned. Some of the species are edible.

**Sir Darya.** See JAXARTES.

**Si′redon** [abridged from *σειρήν*, "siren," and *ὀδούς*, "tooth"], a name given by Wogler to the axolotl of Mexico. At one time it was supposed that this type was a very distinct genus and a true perennibranchiate amphibian. The resemblance to the larvæ of species of *Amblystoma* of the U. S. had, however, been noticed, and it was even suggested by Prof. Baird that it was nothing but a larval form. The fact, nevertheless, that it bred with gills was supposed to contradict this view. But the researches of A. Dumeril on the Mexican form amply demonstrated that the species, under favorable circumstances, develops into a true *Amblystoma*, and analogous observations by Prof. Marsh on a North American species confirmed his observations. (See also AXOLOTL.)

THEODORE GILL.

**Si′ren** [named from the SIRENS (which see) by Linnæus, on account of the incorrect belief that it has a singing voice], a remarkable genus of perennibranchiate tailed batrachians of the Southern U. S. The best-known species is the *Sirens lacertina*, or mud-eel, of the Carolina rice-swamps. It has two weak fore legs, permanent gill-tufts, as well as lungs, is two feet long, and of a black color. It is considered venomous by the negroes. *S. intermedia* and *S. striata* are smaller sirens of the same regions.

**Sirene.** See ACOUSTICS, by PROF. O. N. ROOD, A. M.

**Sire′nia** [from the ancient name *siren*, given in this case because it is supposable that the dugong, one of the representatives of this order, may have suggested the idea of the fabulous siren], an order of mammals containing species adapted for habitual life and progression in the water, but less modified from ordinary mammals than the order of cetaceans. The form is fish-like—*i. e.* elongated—subfusiform, tapering backward, terminating in a fin (which, as in the cetaceans, is horizontal), and destitute of hind limbs; the snout is beset with bristles. The brain essentially resembles that of the hoofed and carnivorous mammals, as well as of the apes and man and the cetaceans, especially in the extension of the corpus callosum and small size of the anterior commissure; but is notable for the compression and elevation of the cerebrum, the upturned bulbous olfactory nerves, and the small size, or rather depression, of the cerebellum, which, however, is only partially covered by the cerebrum. The order contrasts with the cetaceans in the following characters: The skull has the foramen magnum posterior and directed somewhat downward; the supra-occipital is nearly vertical, and extends little forward, the parietals meeting and completely separating it from the frontals; the periotic has its posterior part irregularly rounded, and the tympanic is annuliform; the lower jaw has well-developed ascending rami, and normal transverse condyle and coronoid processes; molar teeth, adapted for the trituration of herbage, are in the sides of both jaws; the neck is moderate, and the second vertebra has a distinct odontoid process; the anterior members are moderately long and flexed at the elbows; the carpal bones are normally developed, and contiguous *inter se* and with the proximal phalanges; the digits are also distinctly developed; the mammæ are pectoral, as in man and monkeys; the heart deeply fissured between the ventricles. The species are all herbivorous, and feed upon the vegetation growing on the banks of estuaries and rivers, as well as sea-weed. In a state of captivity, according to Dr. Chapman, manatees eat "freely of cabbage, spinach, kale, baked apples, celery-tops, etc." When feeding they fan, "as it were, the food into their mouths by means of the bristles situated on their upper and lower lips; these bristles spreading out when in use so as to look very much like small fans." When at rest they remain upraised from the bottom of the water by their tail, but with the head downward, and the back consequently arched; at intervals of about one minute to one minute and a quarter they rise to breathe, and the valves of the nose open and shut as they come to the surface and go downward again. The order is now represented by two families—Trichechidæ, including the manatees, and Halicoridæ, containing the dugongs. Up to within a century a third family (Rhytinidæ) existed in the North Pacific (Behring's Sea), but its only living species was in a short time exterminated by the attacks of man. The earliest extinct representatives of the order yet known are of Eocene age, and then and since several peculiar forms flourished and died out.

THEODORE GILL.

**Siren′idæ** [from *siren*—the name of the ancient enchantresses applied without evident reason—the typical genus], a family of urodele or gradient amphibians confined to the U. S., and constituting the sub-order Trachystomata. (See GRADIENTIA.) The body is very elongate and eel-like; the anus in or near the posterior third of the length; the head elongate, narrowed forward from the cheeks, and truncate in front; branchial tufts three, connected with three branchial apertures; anterior feet only developed, and they very weak and with three or four toes. Such are the external characters by which the species are at once recognizable. As the osteological characters are given under the sub-ordinal head, they need not be repeated here; suffice it to add that the characters generally indicate a low or embryonic type of organization, and such as is exemplified in the young of salamanders or those of inferior grade, so far as they go. Thus, the vertebræ are biconcave, the carpus cartilaginous, etc. They are also notable for the large size of their blood-corpuscles. The species are confined to the Southern States of the Union, and, according to Cope, are reducible to two, which, however, represent as many distinct genera. The *Siren lacertina* is distinguished by the development of four digits to its feet, and

sometimes attains a length of nearly three feet: it extends from North Carolina and Southern Illinois to Florida and Northern Mexico. The *Pseudobranchus striatus* is recognizable by the presence of only three toes to the feet; it rarely attains a length of much more than half a foot, and has hitherto been only found in Georgia. Both species live habitually in the water and in muddy or sandy bottoms. They feed on worms, etc. The *Siren lacertina* is called mud-eel, and is much dreaded, as it is supposed, but without any real cause, to be very venomous. THEO. GILL.

**Sirenoi'dei** [from *Siren*, the generic name of a genus of amphibians, and εἶδος, "like," from the fancied resemblance of its species to that type], an order formerly supposed by some naturalists to belong to the class of amphibians, and most nearly related to the sirens, but now universally conceded to be members of the class of fishes. In this class they are by some considered to be the representatives of a distinct sub-class (Dipnoi), and by others to be aberrant members of the sub-class of ganoids. The superordinal characters are given in the article FISH. The order connects, to some extent, the amphibians and fishes —*i. e.* it has generalized characters which are elsewise peculiar either to the former or latter. It was formerly, in the Palæozoic and Secondary epochs, a predominant type of its class, but is now represented by only three genera, which represent two families. (See LEPIDOSIREN and LEPIDOSIRENIDÆ.) THEODORE GILL.

**Si'rens, The** [Gr. *αἱ Σειρῆνες*], in the Greek mythology, were three, or according to others two, females who were wont to sit upon the seashore and by their delightful song allure to destruction the passing mariners. Their myth is variously told, and their names are variously given. Several places were considered as their abode, commonly the S. W. or western coast of Italy, and at some places they received divine honors. The Sirens are the mermaids of more recent folk-lore.

**Sirikul'.** (1) A lake situated at an elevation of 15,600 feet in the Tameer plateau, whence issues the northern arm of the Amoo Darya. The direct but difficult road to Kashgar leads along its shore, while the crossing from the valley of the Amoo Darya to that of the Tameer takes place along the southern arm of the Amoo Darya by the Tameer or Barkoot Yassin lake, situated at an elevation of 13,300 feet. (2) A district extending along the eastern foot of the Tameer steppes, below the Lake of Sirikul, at an elevation of 11,000 feet. The principal city is Tashkoorgan, the *Lithinum pyrgum* of the ancients, whose merchants passed it on their way through Toorfan, the *Sera* of Ptolemy, to China. The district formed an independent state up to the end of 1868, when the ruler of Kashgar took possession of the country. E. SCHLAGINTWEIT.

**Sir'ius** [Gr. *σείριος*, "scorching"], the dog star, a star of *Canis major*, one of the brightest stars visible in the northern hemisphere. The ancients often speak of its ruddy color, which is no longer perceptible. It was formerly believed to exercise a powerful and, to some extent, a baleful influence upon human affairs.

**Sir John's Run,** p.-v., Morgan co., West Va., on Potomac River and Baltimore and Ohio R. R.

**Siroc'co** [Arab. *shoruk*], a hot, relaxing wind which rises in the Sahara, then blows across the Mediterranean, where it occasionally becomes filled with moisture, and finally over Sicily, Southern Italy, Malta, etc. It generally occurs in spring and autumn, lasts for one or two days, though sometimes for a whole week, and is very pernicious to both vegetable and animal life, causing general exhaustion, great prostration, and depression of all mental energy.

**Sisal' Hemp,** the fibre of various species of AGAVE (which see). Sisal hemp is produced in considerable quantities in Yucatan and at Key West, Fla. It makes excellent cordage, superior to that of true hemp, but it is chiefly made into hammocks of great strength and durability, known as Sisal hammocks.

**Sis'co,** or **Cisco,** a name given to several species of the genus *Argyrosomus* (sub-family Coregoninæ) in the Northern U. S. The principal species are the *A. clupeiformis* (also called "herring") of Lake Ontario, and the *A. Hoyi* of the deep waters of Lake Michigan. They are recognizable by their herring-like form, terminal mouth, with the lower jaw longest, short intermaxillary bones, and the long and narrow suborbital bones. They are small-sized fishes, rarely weighing as much as a pound. The *A. clupeiformis* is found in all the great lakes, and inhabits the shoaler waters. It is in some places excessively abundant. It is but little esteemed for the table, but when cured in a certain manner is very good; this curing is effected by a slight pickling in salt brine, and subsequent exposure to the smoke of a hot fire for a short time; it is thus ready for eating, and will keep for two or three weeks. The *A. Hoyi* is confined, so far as known, to Lake Michigan, and dwells in the deeper waters—*i. e.* depths from 30 to 70 fathoms. It is quite abundant in its favorite localities. It is caught in considerable quantities.

THEODORE GILL.

**Sis'cowet, Siskowit,** or **Siskawitz** [Indian], (*Salmo siscowet*, Agassiz), a species of lake-trout, and an important element in the lake fisheries. It is a stout fish, the height being equal to about a fifth of the length; the head forms a fourth of the length, exclusive of the caudal; the preoperculum is long, of the form of a very opened crescent, placed almost vertically; its posterior margin is attenuate and entire; its lower branch is more extended than the upper; the operculum, of greater height than breadth, is large and notched at the summit, but without prominent processes on the rest of its circumference, which is irregularly circular; the posterior middle part, however, has a tendency to make a projection; the lower margin is denticulate; the suboperculum is one-third smaller than the operculum, irregularly elliptical, pointed at the summit, with an ascending ridge in the form of a fish-hook at its articulation; finally, the operculum has the form of a long square, curved on the posterior side; its height is contained twice in its length (*Agassiz*); B. 13, D. 12, A. 12–14, P. 14, V. 9. "The color varies according to the feeding-ground on which it is caught, and is brighter during the breeding-season, as is generally the case among all species of this family." The species is characteristic of Lake Superior, and was first made known by Prof. Agassiz in 1850. It is an inhabitant of the deep water of the lakes. It never reaches the large dimensions of the great lake-trout or salmon (*Salmo namaycush*), and averages about four and a half pounds in weight, eight pounds being near its maximum; it becomes extremely fat. The flesh is of a very light reddish tint. As a fresh fish it is quite inferior, but "as a salt fish, packed in brine, it is most excellent, and is universally admitted to surpass either whitefish or trout." (*Milner.*) It spawns comparatively early—*i. e.* in the latter part of August and September—and in the deep water, not ascending rivers. THEODORE GILL.

**Sisen'na** (L. CORNELIUS), b. B. C. 119; was prætor B. C. 78; defended Verres in 70, and d. B. C. 67 in Crete, being at the time legate of Pompey in the war with the pirates. Having been an actor in public affairs, he was well fitted to relate the events of his own time (including the Social war and the civil wars of Sulla) in his work entitled *Historiæ*, written in an archaic style. Cicero says of him (in his book on *Laws*) that he surpassed all previous Latin historians, and Sallust highly praises his diligence. Sisenna wrote also commentaries on several comedies of Plautus, and translated into Latin the Milesian tales (Μιλησιακά) of Aristides. Only fragments of the *Historiæ* remain, collected by Krause in *Hist. Roman. Fragmenta*, p. 303–317. (Krause, Teuffel, *Hist. Rom. Lit.*) H. DRISLER.

**Sis'kin** [Dan. *sisgen*], or **Aberderine** (*Chrysomitris spinus*), a bird of the family Fringillidæ, congeneric with the yellow or thistle bird of the U. S. (*Chrysomitris tristis*). The male has a black crown and nape, is olive-green on the neck and back, varied with blackish and yellowish green beneath; its throat is black; its length is about four and a half inches. It is esteemed in Europe as a cage-bird, and is susceptible of considerable training. It is often paired with the canary-bird, and the resulting hybrid is quite a fine songster. THEODORE GILL.

**Sis'kiyou** (sis'e-kew), county of N. California, adjoining Oregon, intersected by Klamath River, and crossed from E. to W. by a transverse range of mountains connecting the Sierra Nevada with the Coast Range. Mount Shasta, its majestic culminating peak, the highest in the State, is an extinct volcano, 14,442 feet in height, covered with perpetual snow. The cultivable lands of the county are chiefly in Scott's Valley, 40 miles long, at the base of Shasta. Staples, wheat, oats, hay, barley, butter, and wool. Cattle and sheep are numerous. Cap. Yreka. Area, about 3000 sq. m. P. 6848.

**Sismon'di, de** (JEAN CHARLES LÉONARD SIMONDE), b. at Geneva May 9, 1773; educated in the college of his native town, and was a clerk in a large counting-house in Lyons; accompanied in 1793 his family, which left Geneva on account of the political disturbances, to England, where he stayed for two years; returned in 1795, but fled again a short time after, and resided for several years at Pescia in Tuscany, where his father bought a farm; settled finally in his native town in 1800; devoted himself to studies and literary work, though at the same time participating very actively in politics; married in 1819 an English lady. D. at Geneva June 25, 1842. His first work was a treatise on political economy, *De la Richesse commerciale* (1803), based on the ideas of Adam Smith, which, however, he afterward

abandoned, and even opposed, in his *Nouveaux Principes d'Économie politique* (2 vols., 1819) and *Études sur les Sciences sociales* (3 vols., 1836). But his acquaintance with Madame de Staël, Benjamin Constant, Guizot, etc., turned his attention from political economy to history, and it was as an historian that he acquired his great celebrity. His *Histoire des Républiques italiennes du Moyen-âge* (16 vols.) appeared at Zurich in 1807–18; *La Littérature du Midi de l'Europe* (4 vols., 1813) was translated into English by Thomas Roscoe in 1823. Of his principal work, *Histoire des Français* (31 vols., 1821–44), he gave an abstract in 1839, *Précis de l'Histoire des Français* (2 vols.). He wrote in English, and contributed in 1832 and 1834 to the *Cabinet Cyclopædia* a *History of the Italian Republics* and *The Fall of the Roman Empire.* (See also *Sismondi, Fragments de son Journal et de sa Correspondance avec Mlle. de Sainte-Aulaire* (1863), and *Lettres inédites à Madame d'Albany* (1864).)

**Sisor'idæ** [from *Sisor*, the generic name of the type], a family of fishes of the order Nematognathi, approximated to the Loricariidæ, or mailed catfishes of South America. The body is elongate and depressed; the skin naked, save on the median line of the back (which has a row of bony plates) and the lateral line (which is rough); the head is depressed and spatulate; the usual opercular bones (except the suboperculum) developed; the nostrils close together; the mouth inferior and small; the intermaxillaries forming a crescent-shaped upper lip; the maxillaries terminating in well-developed barbels; lower lip produced on each angle of the mouth into a long flap, reflected backward; teeth none; branchial apertures restricted to the sides, the branchiostegal membrane being confluent with the skin of the isthmus; branchiostegal rays four (or more?) on each side; dorsal fin short and anterior; anal small; caudal well developed; pectorals normal; ventrals below the dorsal. The typical form is *Sisor rhabdophorus*, an inhabitant of the fresh waters of Northern Bengal. With this have been associated certain other Indian genera—viz. *Erethistes* (= *Hora*), *Pseudecheneis*, and *Exostoma*—but the relations of these types are doubtful. THEODORE GILL.

**Sis'son,** tp., Howell co., Mo. P. 430.

**Sisterhoods.** See SISTERS OF CHARITY and SISTERS OF MERCY.

**Sisters of Charity.** Besides the congregations mentioned under the head CHARITY, SISTERS OF (which see), the following orders may be noticed: (1) *The Gray Nuns of Montreal*, found chiefly in Canada and the U. S.; were founded in 1745 by the widow D'Youville (1701–72); (2) *the Sisters of Charity of Nazareth*, founded in Kentucky in 1812 by Bishop David; have a few houses in the U. S.; (3) *Sisters of Charity of the Blessed Virgin*, founded in Philadelphia by T. C. Donaghoe, a priest; now found mostly in Iowa; (4) *the Sisters of Christian Charity* have a few representatives in the U. S.

**Sisters of Mercy.** See MERCY, SISTERS OF.

**Sisters of the Holy Communion.** See HOLY COMMUNION, SISTERS OF THE.

**Sis'tersville,** p.-v., Lincoln tp., Tyler co., West Va., on Ohio River. P. 364.

**Sisto'va,** town of European Turkey, eyalet of Widdin, on the Danube, has a strong citadel, some manufactures of leather and cotton, and an extensive trade, especially in wine. P. 20,000.

**Sis'yphus,** in Greek mythology, a son of Autolycus, the husband of Merope, reputed father of Odysseus by Anticlea, founder of Corinth and the Isthmian games, was condemned, on account of his crimes against men and gods, to roll up a steep hill a huge boulder, which, on reaching the summit, rolled down again, and thus made his task an endless one.

**Sit'ka,** or **New Archangel,** p.-v., cap. of Alaska Territory, on Baranov Island, near the Pacific coast, has a small but commodious harbor; was founded by the Russians in the eighteenth century, and was long the headquarters of the Russian-American Fur Company, but consisted, when transferred to the U. S. in 1867, of only about 100 log huts. Since that time several commodious edifices have been built, chiefly by San Francisco merchants, and the presence of a detachment of U. S. troops has contributed to the prosperity of the village. P. about 1000.

**Siva.** See HINDU RELIGION, by PROF. JOHN DOWSON.

**Si'vas** [anc. *Sebasteia*], town of Asiatic Turkey, eyalet of Sivas, in a barren, treeless valley on the Kizil-Irmak, the ancient *Halys*, in lat. 39° 28′ N., lon. 37° E. It consists of dirty streets, and is surrounded with ruins; its manufactures, trade, and bazaars are insignificant, and the whole place is decaying. P. about 25,000.

**Sivatheri'idæ** [*Sivatherium*—from *Siva*, an Indian deity, and θηρίον, "wild beast"—the typical genus], an extinct family of mammals of the order Ungulata and group Ruminantia, distinguished by the singular armature of the head. The form was rather heavy—*i. e.* resembling that of an ox more than that of a deer or antelope; the neck moderate; the metacarpals and, to a less extent, the metatarsals shortened; the skull broad behind, contracted in front of the molars forward, with the facial portion produced downward and abbreviated, and with the nasal bones abbreviated and longitudinally arched; molar teeth (M. $\frac{3}{3}$, P. M. $\frac{3}{3}$) broad, with inner crescentic plates of enamel running zigzag in large sinuous flexures; horns in the males in two pairs—*i. e.* frontal and occipital; these are supposed by Murie to have been deciduous, and peculiar to the rutting season, and developed as pseudo-corneous sheaths composed of agglutinated hairs, as in the American Antilocapridæ. The family is represented by a single known species, the *Sivatherium giganteum* of Falconer and Cautley, whose remains have been found in the Miocene rocks of the Siwalik Hills, a branch of the sub-Himalayan Mountains. (See the figure in the article GEOLOGY from a restoration by Murie in the *Geological Magazine* for Oct., 1871.) THEODORE GILL.

**Sivathe'rium** [from *Siva*, the Hindoo god, and θηρίον, a "beast"], an extinct genus of ruminating animals from the Siwalik Hills, India, remarkable for their large size and peculiar horns. *S. giganteum* nearly equalled the elephant in size, and was armed with two pairs of horns, a small pair springing from the anterior part of the head, and a much larger pair from the top of the head. The bony cores of these horns, the only part preserved in the fossil state, show that these animals belonged to the hollow-horned type of ruminants. The front pair were divergent, apparently nearly straight, and simple. The posterior pair were branching, and had at least three points. The American antelope or prong-buck is the only living hollow-horned ruminant with branching horns. It is also the only one known to shed its horns periodically. The posterior horns of *Sivatherium* seem to have closely resembled in structure those of the prong-buck, and may have been, like them, deciduous. The bones of the skeleton of *Sivatherium* were massive, like those of oxen. The neck was strong for the support of the heavy skull. The nose was probably more or less movable, as evinced by the short projecting nasals. Falconer and Cautley supposed the animal to have possessed a true proboscis, but Dr. Murie concludes, from a study of the remains and a comparison with allied forms, that the nose was similar to that of the saiga of Tartary, and he thus figures it in his restoration of the *Sivatherium* in the *Geological Magazine*, Oct., 1871. O. C. MARSH.

**Si'wah** [the ancient *Ammon* or *Ammonium*], an oasis in North-western Egypt, 360 miles W. of Cairo, and 160 miles S. of the Mediterranean. The eastern part of the oasis is very fertile and rich in springs; in the northern part some limestone hills are found. In ancient times the place was celebrated as the seat of the temple of Jupiter Ammon, of which remains are still extant, and of the Fountain of the Sun, whose waters were cold at noon and hot at midnight. The temple was immensely rich and guarded by strong fortifications. Cambyses attempted in vain to capture it. Alexander visited it, and was hailed by the priests as a son of the god. The emperor Justinian built a Christian church here. At present the oasis is inhabited by about 8000 Berbers and negroes, who profess Mohammedanism, speak a peculiar dialect much mixed up with Arabic, and are governed by elders. The town of Siwah is in lat. 29° 12′ N., lon. 25° 30′ E., near the site of the ancient temple.

**Six Mile,** p.-v. and tp., Bibb co., Ala. P. 709.

**Six Mile,** tp., Franklin co., Ark. P. 880.

**Six Nations.** See IROQUOIS.

**Six-Principle Baptists,** a sect of American Christians who take as their creed the six principles laid down in Heb. vi. 1, 2, viz.: (1) repentance, (2) faith, (3) baptisms (of repentance, of fire, and of Christ's sufferings), (4) laying on of hands, (5) the resurrection, (6) the eternal judgment. They especially insist upon the laying on of hands, and refuse to commune with those who do not practise it. They are Arminians, and neither educate nor adequately support their ministry. They are found in Rhode Island, Massachusetts, New York, and Pennsylvania. They were first organized in 1639 in Rhode Island, and have never been numerous. They number some 3000 communicants.

**Six Pound,** tp., Warren co., N. C. P. 930.

**Sixth,** in music, an interval comprising five degrees of the diatonic scale. (See INTERVAL.)

**Six'tus,** the name of five popes—SIXTUS I. (119?–128?), SIXTUS II. (257?–258), SIXTUS III. (432–440), SIXTUS IV.

(1471–84). But most remarkable of all was SIXTUS V. (1585–90), b. at Grotto-a-Mare, near Montalto, Dec. 15, 1521; entered the order of the Franciscans in 1534; became a teacher of canon law at Rimini in 1544 and at Siena in 1546; was ordained a priest in 1548; and acquired great reputation as a preacher at Rome in 1551 and at Venice in 1566; was employed in various diplomatic missions, and became a cardinal in 1570. Arrived at this point, his ambition seemed to go no further. He was not anxious either to exercise influence on the papal government or to procure lucrative positions for his relatives. He lived quietly, and made the impression of being a man easy to lead. After the death of Gregory XIII. (1585) he was unanimously elected pope, but hardly was the result of the election pronounced before he threw aside the stick with which he had been wont to grope along, and stepped forward among the astonished cardinals, no more concealing the power and authority of his character. In all theological controversies he was cautious and tried to remain neutral, but in the discipline of the Church he introduced reforms and prepared a thorough reformation. His great idea was to raise the papal see once more to its former splendor, and although his negotiations with the emperor Rudolph II. of Germany and Stephen Báthori, king of Hungary, led to no permanent result, they show his ambition and his talent. The celebrated aqueduct, *Acqua Felice*, the great dome of St. Peter's church, the obelisk in front of this church, the foundation of the Vatican library, etc., are monuments of his internal government. He d. suddenly at Rome Aug. 24, 1590.

**Sizemore's,** tp., Sanford co., Ala. P. 242.

**Sizes of Books.** See PRINTING, by W. S. PATERSON.

**Skagerrak',** or **Skager-Rack,** an arm of the North Sea, 80 miles broad, extending between Norway and the Danish peninsula of Jutland, and connecting the German Ocean with the Cattegat or Kattegat. The current generally sets E. along the coast of Jutland, where the depth varies between 30 and 40 fathoms, and W. along the Norwegian coast, where the depth generally is 200 fathoms. There is neither haven nor good anchorage on the Jutland, but good harbors abound on the opposite coast.

**Ska'litz,** or **Szakoleza,** town of North-western Hungary, near the Moravian frontier, on the March, has some wool-spinning and weaving factories and a trade in wine and hemp. P. 5882.

**Skama'nia,** county of Washington Territory, N. of Columbia River, bounded E. by the Cascade Mountains, and traversed by spurs of the same range, in one of which is Mount St. Helens, 9750 feet high. Cap. Cascades. Area, 1800 sq. m. P. 133.

**Skaneat'eles,** p.-v. and tp., Onondaga co., N. Y., on New York Central and Hudson River R. Rs., 18 miles S. W. of Syracuse, at the N. end of Skaneateles Lake, has 6 churches, good schools, 2 banks, 2 newspapers, a commodious hotel, 1 flour-mill, and manufactories of carriages, printing paper, woollen goods, hydraulic lime, and merchant iron. Large quantities of the teasel-plant are grown here. It is a favorite summer resort. Pop. of v. 1409; of tp. 4524. H. B. DODGE, ED. "DEMOCRAT."

**Skate,** a name given to species of the family RAIIDÆ (which see).

**Skeat** (WALTER WILLIAM), b. in London, England, Nov. 21, 1835; educated at King's College School and at Sir R. Cholmeley's school, Highgate; graduated at Christ's College, Cambridge, as fourteenth wrangler 1858; became a fellow of that college July, 1860; took orders in the Church of England; obtained the curacy of East Dereham, Norfolk, Dec., 1860, and that of Godalming, Surrey, Dec., 1862; became lecturer on mathematics at Christ's College Oct., 1864, and subsequently English lecturer; is a diligent student of early English literature and philology; a prominent member of the Philological and the Early English Text societies, for which he edited several publications; was in 1873 one of the founders of the English Dialect Society, of which he is director and responsible editor. He has published *The Songs and Ballads of Uhland* (1864), *A Tale of Ludlow Castle,* a poem (1866), *Lancelot of the Laik, a Scotch Metrical Romance* (1865), *Parallel Extracts from 29 MSS. of Piers the Plowman* (1866), *The Romans of Partenay or Lusignan, otherwise known as the Tale of Melusine* (1866), *Pierce the Ploughman's Crede* (1867), *The Vision of William concerning Piers the Plowman* (3 parts, 1867–73), *The Romance of William of Palerne, or William and the Werwolf* (1867), *The Lay of Havelok the Dane* (1868), *The Bruce, by Master John Barbour* (part i. 1870), *Joseph of Aramathie, or the Romance of the Seint Graal* (1871), and Chaucer's *Treatise on the Astrolabe,* the ten latter being publications of the Early English Text Society, for several of which he prepared introductions, notes, and glossarial indexes. For the Philological Society he edited a *Mœso-Gothic Glossary* (1868), for the Oxford University Press 2 vols. of *Specimens of English Literature* and several of Chaucer's *Canterbury Tales,* and is now completing for the Cambridge University Press the *variorum* edition of the *Anglo-Saxon Gospels,* left unfinished by the late John Mitchell Kemble (Mark and Luke, 2 vols., 1875). In a new edition of Chatterton's *Poems* he settled the question of authenticity by showing the precise sources of Chatterton's diction; is author of a *Hand-List of some Cognate Words in English, Latin, and Greek* (1871), *Questions for Examination in English Literature* (1873), and is editing *Shakspeare's Plutarch* (vol., i. 1875).

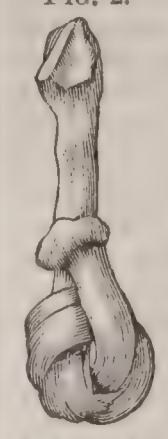
**Skel'eton** [Gr. σκέλλειν, to "dry"], the osseous framework of the body of animals, the articulated bones. The human skeleton commences to develop in early embryonic life by the appearance of points of ossific matter, which soon assume definite forms, the bones of the spinal column, head, extremities, thoracic walls, and pelvis (Fig. 1). At birth all the bones are fully shaped, but many imperfectly ossified, many osseous nuclei appearing between birth and the fourth year, some few later, and the bony union of the shafts of the long bones with their epiphyses or heads occurring as late as the fifteenth, eighteenth, and twentieth years. The skeleton in infancy and childhood is elastic, due in part to cartilaginous structure near the articulations, but chiefly that the organic constituents of bone are largely in excess of the inorganic or mineral constituents. Reversely, with progress in age, the bones and the skeleton as a whole become rigid, unyielding, non-elastic, mineral ossific matter being greatly in excess, so that in old age the bones are brittle and liable to fracture from slight injuries. The organic matter in bones of adults forms about one-third, the inorganic two-thirds. The former is chiefly gelatine (Fig. 2); the latter includes 51 per cent. of phosphate of lime, 11½ per cent. of carbonate of lime, and from 1 to 2 per cent. each of chloride of sodium, phosphate of magnesia, and fluoride of calcium. In minute structure bone is not solid, but constructed to secure the greatest strength with the least possible weight. A microscopic section of bone reveals a methodical arrangement of bone-tissue around minute internal canals and cavities, the Haversian canals, canaliculi, and lacunæ. (See diagrams of bone in article on HISTOLOGY.) The bones are classified according to their shape, into the (1) long bones, (2) short bones, (3) flat bones; the office of each being quite distinct. The long bones, as of the leg and arm, are intended to sustain weight or force as in traction, and to serve as powerful levers, acted upon by the muscles in the performance of locomotion and manual labor. The short bones, as of the wrist and ankle, serve to facilitate motion, unite compactness with strength, and add grace in form and motion. The flat bones, as of the flat bones of the head, the ribs, and pelvic bones, serve primarily to protect the important organs which they enclose—the brain, heart, lungs, bladder, and uterus—and also as fixed points of muscular origin and attachment. Other bones, as the vertebræ and bones at the base of the skull, are to be classed as mixed or irregular bones, and serve chiefly a passive object—to sustain weight and pressure and give form. The entire skeleton of the adult consists of 204 distinct bones; if the teeth and certain accessory bones, termed sesamoid, are included, the number is 246. The bones are covered by a thin, adherent, fibrous sheath, the periosteum, which contains the nutrient vessels; other vessels pass through foramina, or minute apertures, to the interior of the bone, nourishing the interior structure, which varies with the

FIG. 1.



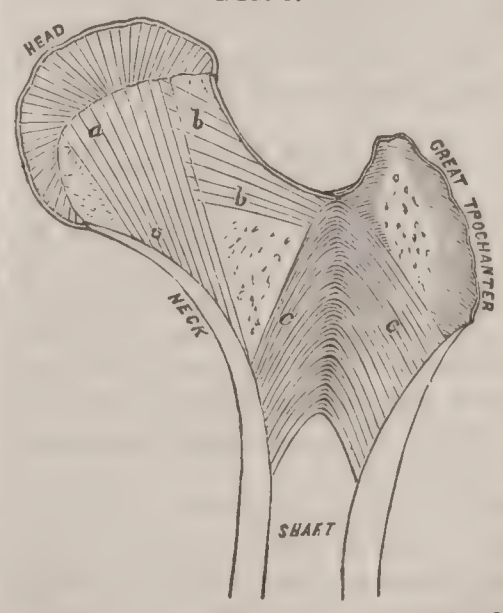
Human embryo at 1 month: points of ossification. (*Dalton.*)

FIG. 2.



A bone deprived of its mineral matter by maceration in dilute acid, and tied in a knot, showing the pliability of the organic matter. (*Dalton.*)

FIG. 3.




Section of head, neck, and part of shaft of thigh-bone (femur).

shape and office of the bone. Thus, the long bones are essentially hollow cylinders, a structure giving greatest strength and elasticity with least material and weight. The bones of the cranium also consist of an outer and inner tablet, with interposed cancellated or spongy bone-structure. The short and flat bones are composed of spongy structure throughout, with a very thin capsule or shell of compact bone. The head of the femur (thigh-bone, Fig. 3) illustrates the distribution and direction of the strata of bone-structure with reference to the forces and offices which are to be sustained. The growth of the bones in childhood, and their healthy condition in the adult, demand a nutritious mixed animal and vegetable diet, rich in phosphates and carbonates, as well as albuminoid matter. The diseases of the bones are many; many due to defective nutrition, as rickets, mollities ossium, fragilitas ossium; others the result of general constitutional disease or local pathological changes in bones—syphilitic, tubercular, and cancerous growths in bone, periostitis, abscess, necrosis, caries, atrophy, mercurial and phosphorous poisoning of bone. (See OSTEOLOGY.)

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Skel'ton,** tp., Warrick co., Ind. P. 1330.

**Skel'ton** (JOHN), b. probably in Norfolk, England, about 1455; graduated at Cambridge about 1482; was laureated at Oxford University about 1490; was ordained deacon 1498 and priest 1499; was tutor to Prince Henry (afterward Henry VIII.); held a nondescript position at court, by some considered equivalent to king's jester, by others to poet-laureate (which latter had not yet become a distinctly-recognized office); became rector of Diss, Norfolk, and curate of Trompington, Cambridge, 1504; subsequently became "royal orator;" was suspended from his benefice by the bishop of Norwich, having concealed the fact of his marriage; incurred the resentment of his former patron, Cardinal Wolsey, by his satirical verses; was obliged to take sanctuary at Westminster, and d. there June 21, 1529. Skelton was one of the earliest English poets whose writings are easily intelligible to modern readers. Most of his verses are coarse, but were highly esteemed by Erasmus and the wits of the day. His best-known poems are *Philip Sparrow* and *Colin Clout;* he also enjoyed fame as a writer of Latin epigrams. The only good edition of his complete *Works* is that of Rev. Alexander Dyce (2 vols., 1843).

**Skene** (PHILIP), b. in Scotland about 1720; entered the British army 1739; served in the taking of Portobello and Cartagena in South America, at the battles of Fontenoy and Culloden, and in the American campaigns against Ticonderoga and Havana; made in 1765 a settlement at Wood Creek and South Bay, at the head of Lake Champlain, N. Y., which was afterward called Skenesborough; was arrested as a loyalist at Philadelphia June, 1775, exchanged Oct., 1776; accompanied Burgoyne in his invasion of Northern New York; was taken prisoner at Saratoga; was attainted by the legislature of New York 1779, his estate being confiscated; resided for the remainder of his life in England. D. near Stoke Goldington, Bucks, Oct. 9, 1810.

**Skene** (WILLIAM FORBES), LL.D., b. at Peverie, Kincardineshire, Scotland, June 7, 1809; educated at the High School and University of Edinburgh, also at that of St. Andrew's, and in Germany; became a lawyer, a distinguished archæologist, and officer of several learned societies. Author of *The Highlanders of Scotland, their Origin, History, and Antiquities* (2 vols., 1837), and editor of *The Dean of Lismore's Book, a Selection of Ancient Gaelic Poetry* (1861), *Chronicles of the Picts and Scots and other Early Memorials of Scottish History* (1868), *The Four Ancient Books of Wales* (2 vols., 1869), *The Coronation Stone* (1869), and *John of Fordice's Chronicles of the Scottish Nation* (2 vols., 1871).

**Skepticism.** See SCEPTICISM, by W. T. HARRIS, LL.D.

**Sker'ryvore,** a rock, or rather reef, in the sea about 30 miles W. of the isles of Iona and Mull and 11 miles S. W. of Tyree Island (W. coast of Scotland); lat. 56° 19′, lon. 7° 7′. Its name is known in connection with its lighthouse. (See LIGHTHOUSE CONSTRUCTION.) The word *skerries* is applied generally in Scotland to isolated seagirt rocks.

**Skim'mer,** an English appellation of the birds of the family Laridæ, sub-family Rhynchopsinæ, and genus *Rhynchops.* (See RHYNCHOPSINÆ.)

**Skin.** See HISTOLOGY, by COL. J. J. WOODWARD, M. D.

**Skin, Chemistry of.** Animal skins consist mainly of elastine or KERATINE (which see), and a tissue which with hot water yields a solution of GELATINE (which see). It is the latter which combines with tannic acid in the conversion of the skin into leather. Skins are not always tanned, but for some uses are dressed in other ways. The aborigines of America are said to use for dressing dried buffalo skins the brains and marrow of the animal. Skins for gloves are treated with alum, and afterward with yelk of egg. Such so-called glove-leather is therefore still readily altered by water, acting upon the gelatine. (See also LEATHER.) H. WURTZ.

**Skin Diseases.** See APPENDIX.

**Skink,** the English name applied to lizards of the family SCINCIDÆ (which see.)

**Skin-Moths,** a name sometimes given to beetles of the family Dermestidæ, which attack skins. They are small insects (about a quarter of an inch or less in length) of dark color, and sometimes commit great ravages in collections of skins and museums. The most notable species are (1) *Dermestes lardarius,* (2) *Dermestes vulpinus,* and (3) *Anthrenus museorum.* (1) The first is for the most part blackish, but the bases of the elytra are ashy or gray buff, relieved by two or three black spots. Both in the imago and larva stages it is very destructive. (2) The second is totally black above, but the sides of the thorax and the under part of the body are covered with white scales. It is less common and generally distributed than the preceding, but almost equally to be dreaded. Some twenty-five or thirty years ago the larvæ committed great ravages in furriers' stores in London, and a large reward was offered for an antidote to their attacks. Both the preceding attain about a quarter of an inch in length. (3) The third species has transverse waved lines. It is often very destructive to museum specimens, and especially to collections of pinned insects. It is only about a tenth of an inch in length. All these species may be killed by applications of benzene; and this remedy is perhaps the most efficacious, although camphor and turpentine are also used. Specimens for museums should be prepared for resistance to the attacks of these pests by applications of arsenic, carbolic acid, corrosive sublimate, and benzene. THEODORE GILL.

**Skin'ner** (CORTLANDT), b. in New Jersey in 1728; received a good education; became a prominent lawyer; was royal attorney-general of New Jersey 1775; was an active loyalist ("Tory"); raised three battalions of New Jersey volunteers for service against his countrymen; went to England at the peace and received compensation from the British government for his losses through his adherence to the royal cause. D. at Bristol, England, in 1799. —His son, PHILIP KEARNEY, b. at Amboy, N. J., served in a loyalist battalion, and was afterward distinguished in the East and West Indies and in Spain, becoming a lieutenant-general. D. at London Apr. 9, 1826.

**Skinner** (EZEKIEL), M. D., b. at Glastenbury, Conn., June 27, 1777; was in youth a blacksmith's apprentice, but became a physician at Granville, Mass., 1801; removed to Lebanon, Conn., 1807; served both as a soldier and as a surgeon in the war of 1812–15; was licensed as a Baptist preacher at Stafford, Conn., 1819, and became pastor of a church at Ashford 1822. His son, Rev. Benjamin Rush Skinner, having gone to Liberia as a missionary in 1830, and died there in 1831, he proceeded to Africa to supply his place in 1834; became medical director of the colony; preached frequently, and acted for a time as governor. Returning to the U. S. 1838, he resumed his pastoral duties and his medical practice. D. at Greenport, L. I., Dec. 25, 1855.

**Skinner** (JOHN), b. at Balfour, Aberdeenshire, Scotland, Oct. 3, 1721; educated at Marischal College, Aberdeen; was minister to an Episcopal church at Longside for sixty-five years; was subjected to many trials from poverty and from his Jacobite sympathies; was an accomplished Hebrew, Greek, and Latin scholar, and author of several learned works on biblical antiquities and interpretation, but is best known as the author of many popular songs, one of which, *Tullochgorum,* is still widely known. D. at Aberdeen June 16, 1807.

**Skinner** (JOHN), b. in New Jersey about 1750; served as a loyalist in the Southern campaigns, attaining the command of a troop in Tarleton's Legion; subdued the revolt of the Maroons in Jamaica 1795; was engaged in the expedition against Surinam 1804; became major-general, and was successively governor of several British islands of the West Indies, having commanded a brigade at the capture of Guadaloupe, 1810. D. in England Oct. 10, 1827.

**Skinner** (JOHN STUART), b. in Maryland Feb. 12, 1788; was admitted to the bar 1809; settled at Baltimore 1813; was postmaster of that city 1822–37; began in 1819 the publication of the *American Farmer,* the first American periodical exclusively devoted to agriculture; afterward edited several other papers of similar character, including the *Turf Register* and *The Plough, Loom, and Anvil;* was the first organizer of agricultural shows and fairs in the Middle and Southern States; wrote several works on farm-

ing and sporting topics, and was third assistant postmaster-general 1841–45. D. at Baltimore Mar. 21, 1851.

**Skinner** (Otis Ainsworth), D. D., b. at Royalton, Vt., July 3, 1807; was for some time a school-teacher; became a Universalist preacher 1826; was settled as a pastor at Baltimore, Md., 1831, at Haverhill 1836, at Boston 1837, at New York 1846, again at Boston 1849, and became in 1857 president of Lombard University at Galesburg, Ill., preaching also at Elgin, and subsequently at Joliet 1858. He edited religious periodicals at Baltimore, Haverhill, and Boston; wrote several religious treatises, and was an active worker in behalf of education, temperance, and reform generally. D. at Napierville, Ill., Sept. 18, 1861. His *Life* was written by T. B. Thayer (1861).

**Skinner** (Richard), LL.D., b. at Litchfield, Conn., May 30, 1778; studied at the Litchfield Law School under Judge Reeve; was admitted to the bar 1801; settled at Manchester, Vt.; became known as the ablest lawyer in that State; was judge of probate for Bennington co. 1806–12; member of Congress 1813–15; associate judge 1815; chief-justice of the supreme court 1816; Speaker of the assembly 1818; governor 1820–23; again chief-justice 1824–29; and was distinguished for benevolence and public spirit. D. at Manchester May 23, 1833.

**Skinner** (Stephen), M. D., b. in London, England, in 1623; graduated at Christ Church, Oxford, 1646; studied philology and medicine on the Continent, especially at Heidelberg; became a physician at Lincoln; was an earnest student of many languages, and devoted his life to the preparation of a vast work on English etymology, which he left incomplete at his death, which occurred at Lincoln Sept. 5, 1667. Fortunately, his MSS. fell into the hands of Thomas Henshaw, who edited them under the title *Etymologicon Linguæ Anglicanæ* (London, folio, 1671), a work of great value to the critical student of the English language.

**Skinner** (Thomas Harvey), D. D., LL.D., b. at Harvey's Neck, N. C., Mar. 7, 1791; graduated at Princeton 1809; studied law, and afterward theology; was co-pastor with Dr. Janeway of the Second Presbyterian (Arch street) church in Philadelphia 1813–16, and pastor of the Fifth Presbyterian church (first in Locust, and after 1823 in Arch street) 1816–32, with the exception of a few months in 1828, when he was over Pine street church in Boston, Mass.; professor of sacred rhetoric at Andover Theological Seminary 1832–35; pastor of Mercer street Presbyterian church, New York, 1835–48, and professor of sacred rhetoric and pastoral theology in Union Theological Seminary, N. Y., from 1848 to his death, Feb. 1, 1871. He published, besides many sermons and essays, *Religion of the Bible* (1839; republished in England 1848–51), *Aids to Preaching and Hearing* (1839; republished in England 1839–40), Vinet's *Pastoral Theology*, trans. (1854), Vinet's *Homiletics*, trans. (1854), *Discussions in Theology* (1868). (See *A Discourse in Memory of Dr. Skinner*, by George L. Prentiss, D. D. (1871).)

**Skin'nersville,** tp., Washington co., N. C. P. 868.

**Skins,** for furs. See Furs and the Fur-Trade, by L. P. Brockett, A. M.

**Skins,** for leather. See Leather, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

**Skip'jack,** a name given in the U. S. to several species of fishes very distinct from each other. (1) It is sometimes used, as in the Boston market, for the *Sarda pelamys*, a fish more generally known under the name Bonito (which see). (2) It is, along the coast of the Carolinas, given to the *Pomatomus saltatrix*, the bluefish of New York and tailor of Maryland and Virginia. (3) It is also sometimes applied to the *Scomberesox scutellatus*. These three fishes have no common characters, and it is impossible to realize how the same name has become perverted to such diverse forms. Theodore Gill.

**Skip'pack,** p.-v., Montgomery co., Pa., 25 miles N. W. of Philadelphia, contains 1 church, a good school system, a public hall and lyceum, 1 newspaper (German), 2 carriage-factories, tin-ware establishment, a washing-machine factory, grist and flouring mills, 2 hotels, rod-iron fence manufactory, and 2 cigar-factories. Principal business, farming, dairying, and live-stock raising. P. about 400.

A. E. Dambly, Ed. "Der Neutralist."

**Skip'per,** a name applied in England to certain animals—viz. (1) to the *Scomberesox saurus*, a long, compressed, mackerel-like fish; and (2) to butterflies of the family Hesperiidæ, small dark-colored butterflies.

**Skip'perville,** p.-v., Dale co., Ala. P. 1720.

**Skip'with's Land'ing,** p.-v., Issaquena co., Miss., on Mississippi River, has 1 weekly newspaper.

**Skir'ret,** the *Sium sisarum*, an umbelliferous parsnip-like plant, a native of Asia, long cultivated in Europe, and rarely in the U. S., for its root, which is very nutritious and palatable. Skirret affords a good percentage of alcohol when distilled, owing to the large amount of sugar present.

**Skittles.** See Nine-Pins.

**Skopin',** town of Russia, government of Riazan, on the Verda, has 9 churches, many educational institutions, and large manufactures of Russian leather. P. 10,578.

**Skowhe'gan,** p.-v., Somerset co., Me., on Portsmouth and Dover branch of Maine Central R. R. and on Kennebec River, 100 miles N. E. of Portland, has 4 churches, good schools, 3 banks, 1 newspaper, a handsome court-house, a woollen-mill, 3 axe-factories, oilcloth-factories, and 2 hotels. P. 3893. W. K. Moody, Ed. "Reporter."

**Skrzynec'ki** (Jan Boncza), b. Feb. 18, 1786, in Galicia; studied at Lemberg; entered the Polish army and fought under Napoleon. When the revolution broke out (Nov. 29, 1830) Skrzynecki was made a brigadier-general; distinguished himself in the battle of Grochow, and was appointed commander-in-chief Feb. 26, 1831. He repeatedly defeated the Russians, at Wawre, Dembe, Iganie, and the Narew, but owing to peculiar political or diplomatic circumstances he failed to pursue his victories. May 26, 1831, he was defeated at Ostrolenka, and compelled to retreat to Warsaw; Aug. 10 he was superseded by Dembinski, and after the capture of Warsaw he fled to Bohemia, where he lived for several years in Prague; in 1839 was appointed commander-in-chief of the Belgian army, but was compelled by the reclamations of Russia, Austria, and Prussia to resign. He afterward lived for twenty years in Brussels, but moved in 1859 to Cracow, where he d. Jan. 12, 1860.

**Skua,** an English name for the species of birds of the family Laridæ and sub-family Lestridinæ (which see).

**Skull** [Ang.-Sax. *scylan*, to "divide"], the collection of bones enclosing the brain and organs of special sense, and forming the osseous frame of the face. The skull includes 22 bones. In the cranium (Gr. κράνος, a "helmet"), the vaulted case which protects the brain, there are 8 bones—the occipital, 2 parietal, frontal, 2 temporal, sphenoid, and ethmoid. The face includes 14 bones—2 nasal, 2 superior maxillary, 2 lachrymal, 2 malar, 2 palate, 2 inferior turbinated, vomer, and the inferior maxillary. In addition to these bones proper of the skull, there are the appended teeth, 32 in number in the adult (see Teeth); the Wormian bones, small bony wedges which develop in variable number and size in the sutures or lines of union of the cranial bones, and the delicate bones of the auditory apparatus, the ossicula auditus, which are lodged within the temporal bone. (See Ear and Acoustics.) The size and shape of the skull and the facial angle vary in the different races of man (see Anthropology), and at different ages from infancy to old age. In the new-born infant the sutures between the cranial bones are open, a condition permitting the bones to overlap during parturition. During the early months of infant life, after union of these sutures, upon the top of the head two noticeable interspaces exist, termed the anterior and posterior fontanelles. As the child grows, the bones firmly unite, their irrregular borders interdigitating and exhibiting a tortuous line of union—the sutures. The fontanelles are covered by the growing cranial bones and the development of the interposed Wormian bones. The lower cranial bones and the facial bones are very irregular and complicated in structure, having numerous bony processes, canals, and foramina for the transmission of nerves of special sense and sensation and nutrient blood-vessels. The great opening at the base of the skull is the foramen magnum, and transmits the aggregated tubules, both motor and sensory, of the spinal cord from the origin and seat of volition and sensation, the brain, to the various parts of the body over which it presides. The two lesser foramina, one in either orbit, transmit the optic nerves. The interior of the cranium is divided into compartments by partial membranous partitions or folds of dense fibrous structure, reflections of the meninges, or membranes lining the interior of the cranial vault; this structure partially separates, supports, and maintains *in situ* the different ganglia and lobes of intercranial nerve-matter, and is a protection from injury by concussion. The bones of the skull are liable to fracture, necrosis, non-development, and periostitis. The maxillary bones are the frequent seat of abscesses consequent upon irritation of the teeth. Death of the maxillary bones is a chief result of phosphorus poisoning, the phosphorus gaining access through necrosed teeth or vacant alveolar cavities.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Skull'cap** [Lat. *Scutellaria*, from *scutella*, a "little dish"], the common name of a genus of perennial herbs found over a wide range of climates in America, especially in Mexico and the sub-tropical regions, though several

species grow in the Northern U. S. and in Europe. They derive their name from an envelope around the fruiting calyx, have little aroma, and enjoy a popular but delusive reputation, especially for the cure of hydrophobia.

**Skull Creek,** p.-v. and tp., Butler co., Neb. P. 238.

**Skunk** [from the Abenaki *seganku*], the common name applied in the U. S. to the species of the family Mustelidæ and sub-family Mephitinæ. The body is moderately elongated and arched backward; the legs comparatively short; the feet sub-plantigrade; the tail rather long and very bushy; the color is particolored, black and white being contrasted. Their distinctive characters, as contrasted with the other members of the family, are chiefly exhibited in the skull and teeth. The skull is compressed backward, produced forward and transversely convex, with the ante-orbital foramen small and opening forward, and the auditory bullæ much inflated and bulging forward; the teeth are M. $\frac{1}{2}$, P. M. $\frac{3}{3}$ or $\frac{2}{3}$, C. $\frac{1}{1}$, I. $\frac{3}{3} \times 2$; the last molar of the upper jaw enlarged, and more or less extended longitudinally. Their anal glands, according to Chatin,* are essentially like those of the badgers and ratels, and are in a single pair and of large dimensions; their outer walls are formed by a thick fleshy tunic formed of two layers of interlaced fibres, capable of sudden strong compression of the receptacles; these are enormous reservoirs, with a dense resisting fibrous coat, always containing a considerable quantity of the follicular product. The glandular substance is not spread all over the central pouch, but is restricted to a particular portion, and contrasts by its dark color with the white ground of the envelope of the pouch. The contents of the receptacles are sufficiently offensive to justify the profound and universal disgust which these animals excite in consequence of their curious and very efficacious means of defence. The voiding of the liquid must be sudden; and it does not suffice that the receptacle is large and powerfully muscular; the offensive liquid must be directed far backward, so as to flow as little as possible upon the rectal muscular membrane; so the opening is large and upon the summit of an umbilicated papilla, around which rests a cutaneous fold which in a measure directs the discharge. It is said that the mephitic fluid is also to some extent diffused by a whisk of the tail, but this is doubtful. The skunks are distributed throughout America, N. as well as S., except the coldest parts, and are found in no other portion of the world. The number of species is not yet entirely certain, but they are much fewer than was formerly supposed. According to Gray, there are three species of *Mephitis* (*M. mephitica* or *varians*, *M. bittata*, and *M. mexicana*), one of *Spilogale* (*S. putorius*), and one of *Conepatus* (*C. mapurito*). Three of these occur in the U. S. The *Mephitis mephitica* is the common large skunk generally distributed over the country; the *Spilogale putorius* is a small species, confined to the Western and South-western States W. of the Mississippi River, and from Iowa southward; the *Conepatus mapurito* is about the size of *Mephitis mephitica*, and confined to the south-western parts of the U. S. (Texas, etc.), into which it extends from Mexico. Although they vary much in color, they can generally be distinguished as follows: the *Mephitis* is black, with the crown white and with two white streaks diverging thence; the *Spilogale* is black, with a spot on the forehead and one on each temple, and a number of white but interrupted longitudinal streaks on the back; the *Conepatus* is black, but with a broad white dorsal median band. The species are all active carnivorous animals, feeding on small quadrupeds and birds as well as reptiles. They burrow in the ground, and in the Northern States remain torpid during the winter. They bring forth from six to nine young at a birth. The mephitic fluid has been employed medicinally to some extent as an antispasmodic in hysteria, asthma, etc. The bite of the animal is in some quarters much dreaded, and is said to induce hydrophobia. THEODORE GILL.

**Skunk'-cabbage** [*Symplocarpus fœtidus*], the popular name of a large marsh-plant of the arum family, common in the U. S. from Maine to South Carolina, distinguished by the unpleasant smell and by the clusters of leaves from which it derives its name, is an endogen, producing early in the spring its four-petaled flowers in a globular cluster upon a short stem within a shell-shaped spathe or hood, of a dark purplish color, or with yellow and purple stripes and spots, variegated with patches of red or green. The fruit is oval and fleshy, enclosing large purple seeds. The roots and leaves have been used as stimulants.

**Skye,** an island of Scotland, the largest of the Inner Hebrides, belongs to the county of Inverness, from the mainland of which it is separated by the channel of Kyle Rhea, half a mile broad. Area, 547 sq. m. Pop. 21,521 in 1851; 18,751 in 1861. The surface is mountainous and rugged; the coast-line especially is steep, abrupt, and wild, but often strikingly picturesque on account of its peculiar basaltic formations, its caves and waterfalls. The soil is not unproductive, but, on account of the extreme dampness of the climate, it is utterly unfit for agriculture. The name of the island, *Skye*, means in the old Scandinavian tongue "cloud," and is very appropriate, for it always rains here; the days during the year on which no rain falls are very few. Turnips and potatoes grow well, however, and sheep-breeding is carried on with some success. Fishing is the principal occupation, and large quantities of salt and dried cod, herring, ling, and saithe are exported. The inhabitants, who are of Gaelic descent, interspersed with Norse settlers, and who still use the Gaelic language, are poor, and their number decreases, as many of them emigrate to the colonies in search of a better home.

**Sky'lark** (*Alauda arvensis*), a European bird, type of the family Alaudidæ, celebrated for its song. It is characterized in its genus by the slight prolongation of the feathers of the occiput, but not enough so to form a crest; the very small size of the first primary, the equality of the second and third (which exceed the fourth), and the margination outside with white of the external tail-feathers; the upper parts are variegated with blackish and reddish gray; the lower parts white on the abdomen, but with the neck, breast, and sides tinged with reddish and spotted with brown. The length is about seven inches, the tail being three. It is found all over Europe as well as Northern Africa and the corresponding zones of Asia. It frequents meadows, and does not perch. It feeds chiefly on the seeds of various plants and larvæ. Its nest is formed on the ground. It lays four or five eggs of a whitish gray color. It is almost equally esteemed for the delicacy of its flesh and the melody of its song. THEODORE GILL.

**Sky'ros** [anc. *Scyros*], an island of Greece, in the Ægean Sea, 24 miles N. E. of Eubœa, comprises an area of 60 sq. m., with 2630 inhabitants. The southern part is very mountainous and rugged, and partly barren, but the northern, more level, is fertile, and produces wine, wheat, oak and pine timber, and goats of a superior breed.

**Slab Fork,** tp., Wyoming co., West Va. P. 480.

**Slade** (WILLIAM), b. at Cornwall, Vt., May 9, 1786; graduated at Middlebury College 1807; began the practice of law 1810; was editor and publisher of the *Columbian Patriot* 1814–15; secretary of state 1815–23; judge of Addison co. 1816–22; clerk in the state department at Washington 1823–29; State attorney for Addison co. 1830–31; member of Congress 1831–43; reporter of the supreme court of Vermont 1844; governor of that State 1844–46, and from 1846 to 1858 secretary of the national board of popular education, in which capacity he rendered eminent service in annually sending to the Western States a considerable number of competent teachers. D. at Middlebury Jan. 18, 1859. Compiler of *Vermont State Papers* (1823), *Statutes of Vermont* (1825), and *Vermont Reports*, vol. xv. (1844), and author of many pamphlets on law, politics, and education.

**Slags** [Dan. *slagg*], the imperfect glassy or vitrifiable compounds which are produced during the reduction of metallic ores by various fluxes. The slags produced in metallurgical operations should have the following properties: They should fuse at the right temperature; be of such fluidity and specific gravity as to allow the metal or matte (*regulus*) produced to sink readily through them; have such a composition that they will not attack the desired product or the furnace-walls, and will not allow undesirable bodies to separate from themselves; must be able to take up foreign substances, and must be in sufficient quantity to protect the desirable products from the hurtful influence of the blast or other agencies. It is seldom the case that all of these conditions can be fulfilled, and therefore the efforts of the smelter must be directed to securing as advantageous a combination as possible. The slags of ordinary occurrence are silicates, combinations of silicic acid with bases already present in the charges or formed during the operation; but they will frequently contain earthy sulphides and fluorides, as well as particles of metal and matte. Sometimes they may be looked upon as single chemical compounds, at other times they appear to consist of mixtures, but in normal slags the amount of silicic acid is always within certain limits.

The following classes of slags have been recognized: *Sub-silicates*, in which the oxygen of the base is to that of the silica as 1 to less than 1; they have sometimes the formula $3RO,SiO_2$, but must frequently be regarded as mixtures of still more basic silicates, while sometimes they approach very near to the uni-silicates. RO is generally represented by FeO (protoxide of iron) and MnO (protoxide of manganese) in these slags, which are produced in pud-

* The writer is indebted to Dr. Coues for the abstract of Chatin's conclusions.

dling and reheating iron. They fuse easily, flow very freely, and solidify quickly to a dark brittle mass of high specific gravity, frequently possessing a metallic lustre; and they are gelatinized by acids. *Uni-silicates* have the oxygen of the bases to that of the silica as 1 to 1; they may therefore have the formula $2RO,SiO_2$, or $2R_2O_3,3SiO_2$, or a combination of protoxide bases with sesquioxide, as $2RO,SiO_2 + 2R_2O_3,3SiO_2$. In these, RO may consist mainly of protoxide of iron, or mainly of lime (CaO) and magnesia (MgO), with $R_2O_3$ represented by alumina ($Al_2O_3$). Uni-silicates of the first class are produced in certain lead-smelting operations and in the early stages of iron-puddling. They closely resemble the foregoing sub-silicates in appearance and properties, and are very prone to form obstructions in the furnace on account of the easy reduction of the oxide of iron contained in them. When the bases are mainly earthy, the uni-silicates are somewhat difficult to fuse, flow quite easily, solidify quickly, and have a light-colored, stony appearance. They are frequently crystalline, and more or less porous, and are sometimes produced intentionally by adding much lime to remove sulphur, as sulphide of calcium, in iron-blast furnaces. *Bi-silicates*, with twice as much oxygen in the silica as in the bases, may have the formulas $RO,SiO_2$; $R_2O_3,3SiO_2$, or $RO,SiO_2 + R_2O_3,3SiO_2$. In general, these are the most desirable slags, as they can be so compounded as to possess most of the qualities of a desirable slag. They do not solidify so quickly as the preceding, can be drawn into threads, are generally vitreous, translucent, and often yield crystals in cooling. They are not completely decomposed by acids until after fusion with alkalies. *Tri-silicates* have three times as much oxygen in the silica as in the bases; $2RO,3SiO_2$; $2R_2O_3,9SiO_2$; or $2RO,3SiO_2 + 2R_2O_3,9SiO_2$. By reason of the large proportion of silicic acid in them, these slags are very apt to take up metallic oxides, and they also fuse at so high a temperature that, in the case of blast furnaces, there is danger of reducing silicon, which would combine with the iron. They are therefore very seldom produced in regular smelting operations.

Although in the preceding formulas combinations of one base with silica have been indicated, this is very seldom the case in practice, partly from the nature of the ores and fluxes, partly from the intentional production of mixed silicates, it being well known that compound silicates are in general much more fusible than those with but a single base. Thus, according to Plattner, silicate of alumina is formed from its constituents at a temperature of 2400° C.; silicate of magnesia, at 2200 to 2250°; silicate of lime, at 2100 to 2150°; while the compound silicate of lime and magnesia forms at 2000°, of lime and alumina at 1950°. Bodeman's bi-silicate slag, regarded as the most fusible combination of ordinarily-occurring slag-forming materials, contains 56 per cent. of silica, 30 per cent. of lime, and 14 per cent. of alumina; any variation from these proportions lessens its fusibility. Most slags obtained in copper and lead smelting will contain metallic oxides, particularly protoxide of iron, in addition to, or in place of, the lime and other earthy bases, thus becoming still more fusible, while the earthy bases alone, even in the case of compound silicates, give slags too infusible for these operations, but well adapted to iron-blast furnaces. Magnesia is not added when any other base can be obtained, even to make a compound silicate, because it gives such an infusible silicate, but sometimes magnesia is purposely added to increase the infusibility of the slag; and it may amount to 25 per cent. Lime is rarely wanting in slags; the alumina should not exceed 15 or 16 per cent.; protoxide of manganese sometimes replaces the lime. A slag once formed will remelt at 300 to 400° C. less than the temperature required to form it, and hence it is better to use native silicates, like hornblende and clay-slates, or old slags, than to add the separate ingredients, whenever it is possible thus to control the acid or basic property of the resulting slag. Frequently, by judicious mixture of ores, the proper slag can be obtained without adding any flux; at other times a basic flux, like limestone, will be absolutely necessary. Occasionally, there will be an excess of alumina, and it is then to be regarded as playing the part of an acid, but aluminates without silicates do not occur as slags. The most infusible silicates, like silicate of zinc or tin, can be made to fuse when combined with other silicates. A slag should not fuse before the desired effect has been produced in the furnace, whether it be the reduction of an oxide, absorption of carbon by iron, sulphurization of metals, etc. Slags are often affected by the manner in which they solidify; rapid cooling producing a glassy, brittle slag, while slow cooling tends to produce a stony, tough slag, provided the chemical constitution is right. For this reason the slags when used for paving or building materials are slowly cooled. Slags have also been used to manufacture cement, alum, for fertilizers, and for ornamental purposes.

The color of slags is very various. Generally, a dark slag will owe its color to metallic oxides, dark green or black indicating iron oxides, and dark brown manganese; light green indicates protoxide of iron; red or reddish-brown, suboxide of copper. Some very dark slags from iron furnaces, however, owe their color probably to sulphur, and contain little iron oxide. The peculiar blue color of some blast-furnace slags has been referred to the presence of ultramarine, vanadium, molybdenum, cobalt, and titanium. While each or all of these, excepting perhaps ultramarine, may be present in blue slags, and may possibly cause the blue color, especially the cobalt oxide, Bontemps has shown that oxide of iron alone can impart all colors to glass; while Fournet refers the blue shades of most of these slags to their physical constitution. The blue color of old zinc retorts has been also referred to the presence of titanium; and Wöhler considered that certain blue slags from blast furnaces owed their color to a compound like ultramarine, but containing sulphide of calcium in place of sulphide of sodium. Among the minerals closely imitated by certain slags in composition and crystalline form may be mentioned amphibole, pyroxene, wollastonite, diopside, gehlenite, and labradorite, all of which have been found in various blast-furnace slags. H. B. Cornwall.

**Slan'der** [Gr. *σκάνδαλον*], in law, is the speaking by one person, in the presence of one or more hearers, of defamatory words concerning another injurious to his reputation and character, by which pecuniary damage is done to him, and for which he is entitled to recover compensation in an action at law. The defamatory words which constitute slander are of two classes: (1) those which are actionable in themselves, because the law conclusively presumes that pecuniary damage results from their utterance; (2) those which become actionable only by alleging and proving that such pecuniary damage was in fact sustained by the person defamed. The first class includes (*a*) words which impute the commission of a crime involving moral turpitude and punishable by the law, or, as it is sometimes expressed, a crime involving an infamous punishment; (*b*) words which charge that a person has an infectious disease, or one which renders him unfit to be associated with, such as small-pox or syphilis; (*c*) words spoken of a person in connection with his office, profession, trade, or business, and which naturally or necessarily tend to injure him therein. All other defamatory words, spoken merely, become actionable only when they actually and directly cause pecuniary loss or injury; and that fact must be averred and proved by the plaintiff. At the common law, words charging incontinence or want of chastity upon a female are not actionable of themselves, and require the additional fact of an injury which the law calls pecuniary; but this serious and barbarous defect has been remedied by statute in many of the States. The gist of the wrong and the foundation of the defendant's liability is his *malice* in uttering the words, and this malice is (except in the single instance of privileged communications) conclusively presumed to exist if the defamatory statement is false. On the other hand, if the charge is true, no matter how injurious it may be, nor how hostile may have been the defendant's motives, the *legal* malice is not present. In an action for slander the defences may be (1) a denial that the words were spoken; (2) a justification, or the assertion that the charge is true; (3) a claim that the words constituted a "privileged communication," and were not malicious; or (4) matters in mitigation of damages, which do not form a complete defence, but tend to reduce the amount of the recovery. At the common law, the rules concerning the defences of justification and of mitigation were exceedingly technical and severe upon the defendant, but they have been much relaxed by modern legislation both in the U. S. and in England. (For several other matters which are common to the actions for slander and for libel, and especially for the rules concerning the defence of "privileged communications," see the article Libel.) John Norton Pomeroy.

**Slang** [a word of doubtful derivation], the use of words which are unauthorized and vulgar, and which usually have a burlesque character. (See Argot.)

**Slate** [O. Eng. *sclate*], indurated metamorphosed shale; a hard tough rock which splits into thin plates, the type being roofing-slate. The lamination of slate is not that of the bedding, but is often at right angles to it. It is produced by lateral pressure, is confined to disturbed and metamorphosed rock (argillite), and from its peculiar character is called slaty cleavage. Slate is now the most highly-esteemed material in use for roofing, and is very largely employed for that purpose. Its excellencies are—its neatness of appearance, its cleanliness, its indestructibility, and its resistance to fire. Slate is found in all countries where there are metamorphic rocks; the great source of supply has, however, been North Wales, where

there are immense quarries located on or near the coast, and from which slate is sent to nearly all parts of the world. The quarries of Penrhyn alone employ nearly 3000 workmen. Excellent roofing-slate is also obtained in many localities in the U. S., as at Brownville, Me.; Poultney, Castleton, etc., Vt.; Granville, Jamesville, and Hampton, N. Y.; Newton, Delaware, Slatington, Pa.; Peachbottom, on the N. line of Maryland, etc. In these different localities there are some hundreds of quarries in active operation, from which the demand for slate in the U. S. is principally supplied. Slate of good quality is also known to exist in North and South Carolina and in the Huron Mountains N. of Marquette, Mich. Although the great consumption of slate is for roofing, it is employed for many other purposes, such as billiard-tables, counters, tiles, blackboards, and writing-slates, and, when enamelled, for mantels, table-tops, etc. In using slate for roofing the larger sizes are attached to battens nailed across the rafters; smaller slates are laid upon a rough board roofing. The slate is attached to its support by nails driven through holes which are made with a sharp-pointed instrument with great facility when skilfully used. The unit of measure usually employed for roofing-slate is a square of 10 feet, or 100 square feet. J. S. NEWBERRY.

**Slate,** tp., Wood co., West Va. P. 878.

**Sla'ter** (SAMUEL), b. at Belper, Derbyshire, England, June 9, 1768; was apprenticed at the age of fourteen to Jedidiah Strutt, partner of Arkwright in the business of cotton-spinning; assisted his master in making some improvements in his machinery, of which he acquired a thorough knowledge; saw in a newspaper in 1789 the law passed by the U. S. Congress in that year for the encouragement of manufactures, and a notice of the bounty offered by the Pennsylvania legislature for the introduction of the Arkwright patents into the U. S., the communication of the models of the new machinery to foreign countries being then forbidden by English law under severe penalties. Believing himself able to construct new machinery from memory, he sailed for New York; arrived there Nov., 1789, and learning that Moses Brown of Rhode Island had attempted the spinning of cotton by machinery, wrote him stating the facts of his knowledge of the Arkwright machinery. By invitation of the latter he proceeded to Providence, entered into a contract with William Almy and Smith Brown to construct and work the new cotton-spinning machinery, and started at Pawtucket Dec. 21, 1790, a mill with three carding-machines and seventy-two spindles, which was the virtual beginning of the cotton manufacture in America. Acquiring a competent fortune by the results of his industry, he erected cotton-mills of his own at Oxford (now Webster), Mass., in 1812, to which he added woollen-mills 1815–16, the nucleus of the prosperous village of Slatersville. He gave due attention to the mental wants of his employés, having established a Sunday-school as early as 1796, and having subsequently maintained schools for the children of his artisans. While engaged in the task of reproducing from memory the models of the Arkwright machinery, he was for a considerable time unable to remember a small but very essential piece of the mechanism, until, having in a dream revisited the English establishment, he examined the piece in question, and was able on waking to make use of the information thus derived. D. at Webster, Mass., Apr. 21, 1835. (See Rev. George S. White's *Memoir of Samuel Slater, the Father of American Manufactures, connected with a History of the Rise and Progress of the Cotton Manufacture in England and America* (Philadelphia, 1836; 2d ed. 1846).) PORTER C. BLISS.

**Slate Range,** tp., Yuba co., Cal. P. 880.

**Slate River,** tp., Buckingham co., Va. P. 2101.

**Sla'tersville,** p.-v., North Smithfield tp., Providence co., R. I., founded by SAMUEL SLATER (which see).

**Sla'tington,** p.-b., Washington tp., Lehigh co., Pa., on Lehigh River and Lehigh Valley R. R., has extensive slate-quarries. P. 1508.

**Slaugh'terville,** p.-v., Webster co., Ky., on St. Louis and South-eastern R. R. P. of v. 130.

**Slave Coast.** See GUINEA.

**Slave Lake** and **River.** See GREAT SLAVE LAKE.

**Slavery.** See APPENDIX.

**Slavery Compromise of 1850.** See SLAVERY.

**Slaves and the Slave-Trade.** See SLAVERY.

**Slavic Races.** See SLAVS.

**Slavo'nia,** formerly a province of Hungary, but forming now, together with Croatia and the Military Frontier, the kingdom of Croatia and Slavonia, a political division of the Austrian empire, comprising an area of 8873 sq. m., with 1,864,034 inhabitants. Slavonia proper is bounded N. by the Drave and S. by the Save, E. by the Danube and W. by Illyria and Styria. A branch of the Carnian Alps enters Slavonia from the W., and traverses it in its whole length, forming the watershed between the Drave and the Save, and terminating somewhat abruptly on the banks of the Danube. These mountains, which nowhere rise above 2700 feet, are rich in copper, iron, lead, and beautiful marble, and their slopes are clothed with fine timber-yielding forests, vineyards which produce a sweet, strong, richly-flavored wine, and orchards in which apples, pears, cherries, and peaches, figs, oranges, and walnuts, ripen to perfection. Along the rivers extend low, rather marshy, but very fertile plains, where large crops of wheat and maize are raised and immense herds of cattle and swine reared. Of manufactures there are almost none; some linen fabrics are made from the excellent flax and hemp which are raised, but only for home use. The inhabitants, who call themselves *Slavonatz* and their country *Slavonska*, are at once warlike and dreamy, fond of music, poetry, and dancing, excelling in all kinds of horsemanship, and preferring the life of the shepherd to that of the tiller of the soil. They are deeply attached to their fatherland and proud of their nationality, and of late political ideas and political passions have begun to play a conspicuous part in their lives. They are mostly Roman Catholics, and speak the Illyrian dialect, which is closely allied to the Servian. Cap. Eszek.

**Slavs.** The present Slavs or Slavonians may be divided into three main branches—Eastern, Western, and Southern. To the first belong the Russians; to the second, the Poles, the Czechs, the Slovaks, and the Lusatian Wends; to the third, the Bulgarians, the Servians and Croatians, and the Slovenes. Among Russians are comprised about 35,000,000 Great Russians, 13,000,000 Little Russians, and 3,000,000 White Russians. The Poles number about 9,000,000, divided between the empires of Russia, Germany, and Austria. Of Czechs there are about 5,000,000 in Bohemia and Moravia. There are about 140,000 Wends in Saxony and Prussia, and about 2,000,000 Slovaks in Hungary. Of South Slavonians there are from 10,000,000 to 12,000,000 in Turkey, Austria, the principality of Servia, etc. The whole population of the Slavonic world is variously estimated, but is supposed to number nearly 80,000,000. No information is given, even by legends, as to the first appearance of the Slavs in Europe. In the fourth century they were found in great numbers in the neighborhood of the Carpathians, and that is supposed to have been one of their earliest haunts. Thither point the legends of many Slavonic peoples, especially the Poles and Czechs, and thence the Slavonic settlers appear to have spread northward to the Baltic and southward to the Adriatic. But the earliest authentic records of the Slavs are given by Procopius, Jornandes, Agathias, the emperor Maurice, and other writers during the second half of the sixth century. These authors all lived in Byzantium or in Italy, and were personally acquainted only with the Southern Slavs, who haunted the Lower Danube and spread through ancient Mœsia and Pannonia. The Northern Slavs they knew by report only. No political unity seems ever to have existed among these early Slavs, but their different bodies consolidated at various periods between the seventh and eleventh centuries into monarchies, of which all but one have virtually disappeared. The Polish, Bohemian, Servian, Moravian, and Bulgarian kingdoms have all lost their independence. Only the Russian has maintained its ground. To the early Slavs, Jornandes and some other writers give the name of Wends, by which name the Slavonic inhabitants of Lusatia are still known to their German neighbors. This designation, under various kindred forms, appears to have been applied to Slavs by foreigners, just as that of Welsh (*Wälsche*) was given by the Teutonic to the Latin-speaking peoples. Of the word *Slav* or *Slavonian* (*Slovenin*) various explanations have been given, some authorities deriving it from *slovo*, "a word," others from *slava*, "glory," but the question is still in abeyance. From it, owing to the state of degradation to which so many Slavs were reduced by their German masters, have sprung the words *slave, esclave, schiavo, sclave*, etc.

Of the ancient Slavs little information can be obtained except from extraneous sources—from the writings of Greeks, Germans, Arabs, and other foreigners. But they appear to have differed but little in the various lands which they occupied, everywhere bearing the character of being a brave and hardy race, but given to agriculture, and therefore of a peaceable nature, except where they were influenced by more martial neighbors. Some modern writers suppose that the Slavs formed into clans, others that the foundation of Slavonic society was the family community. Among the Western Slavs, at least, a cluster of such communities formed a *jupa*, or district, at the head of which was a *jupan*, or chief, and in its centre a *grad*, or town. The mode of life among all the Slavonic tribes was patri-

archal, the father ruling his family with despotic power. Polygamy prevailed among them in heathen times, and also a kind of sutteeism, but women do not seem to have occupied an altogether degraded position. Of Slavonic heathenism not much is known, but its deities appear to have been for the most part personifications of nature-forces. Vague recollections survive of Svarog, the heaven-god, answering to the Greek Ouranos, the Vedic Varuna. He appears to have given place, in some parts, to a solar deity, Dazhbog, together with whom, as the representative of the sun, a Khors is mentioned. Another solar deity was Volos or Veles, the special protector of cattle, surviving in Christian times as St. Blasius or Vlasy. Kupalo and Garilo are supposed to have been representatives of the summer sun, the fertilizer of the earth. Fire is said to have been worshipped under the name of Ogon, answering to the Vedic Agni, and there was a wind-god, Stribog. But the chief deity of the North-eastern Slavs was Perun, the thunder-god, answering to the Teutonic Thor, and supposed to be the European representative of the Vedic Parjayna. Among the Western Slavs other deities were worshipped, such as Radigost and Sviatovit, and the three-headed Triglaf, of whose images detailed accounts are given by old writers. These Western Slavs appear to have had temples and priests, but it is doubtful whether this was the case among their Eastern brethren. Of inferior deities the memory is still preserved in the belief of the common people of all Slavonic lands in Rusalkas, Vilas, and many other supernatural beings supposed to haunt woods, waters, and pastures. The Western Slavs appear to have been the first to accept Christianity, many of the Moravians, for instance, having been converted as early as the seventh century, their religious teachers coming from the West. But the submission of the great body of the Slavs dates from the mission of the Greek monks Cyril and Methodius in the ninth century. After many changes and struggles the Western Slavs mostly submitted to the Latin Church and employed the Latin alphabet, while the Eastern, forming part of the Oriental Church, retained, with some modifications, the alphabet said to have been invented by Cyril, their liturgies keeping to some extent alive at the present day the ancient tongue which seems to have been common to all the Slavonic peoples 1000 years ago.

W. R. S. Ralston.

**Sleeman** (Sir William Henry), K. C. B., b. at Stratton, Cornwall, England, in 1788; became a cadet in the Bengal service of the East India Company 1808; filled many civil and military trusts with great credit, rising to the post of president at Lucknow 1849; became major-general Nov., 1855, and was knighted Jan., 1856. D. at sea, on his return to England, Feb. 10, 1856. While acting as agent in the Sangor and Nerbudda district, Col. Sleeman discovered the existence of the secret order of murderers since widely renowned as "Thugs," and devoted several years to their suppression, which he effected about 1838. Author of *The Thugs or Phansigurs of India* (2 vols., 1839), *Military Discipline in our Indian Army, Rambles and Recollections of an Indian Officer* (2 vols., 1844), *Journey through the Kingdom of Oude* (2 vols., 1858), and other writings on India and on political economy.

**Sleep** [Ang.-Sax. *slâpan*] is that condition of the organism, normal, and occurring generally periodically, in which there is a more or less complete suspension of consciousness and the power of voluntary motion, due to diminished or interrupted cerebral action. The approach of sleep is characterized by a languor which is agreeable when it can be yielded to, but which when circumstances prevent this is far from being pleasant. Many persons are rendered irritable as soon as they become sleepy, and children are especially liable to manifest ill-temper under the uncomfortable feelings they experience when unable to indulge the inclination to sleep. It is somewhat difficult to analyze the various phenomena which go to make up the condition called sleepiness. The most prominent sensations are an impression of weight in the upper eyelids, and of a general relaxation of the muscles of the body; but there is besides an internal feeling of supineness, enervation, and torpor, to describe which is by no means easy. This sluggishness is closely allied in character to, if not altogether identical with, that experienced immediately before an attack of fainting, and is doubtless due to a like cause—a diminution of the quantity of blood in the brain. Along with this languor there is a general obtuseness of all the senses, which increases the separation of the mind from the external world already initiated by the physical condition of the brain. The liveliest scenes cease to engage the attention, and the most exciting conversation no longer interests. For a time, indeed, such circumstances may dissipate the inclination for sleep, but eventually nature obtains the ascendency and consciousness is lost. Before this event there is usually yawning—a phenomenon strongly indicative of a wearied attention—the head nods and droops upon the breast, and the body assumes that position which is most conducive to ease, comfort, and entire muscular inactivity. The order in which the muscles lose their power is in general well marked, and bears a distinct relation, as Cabanis has pointed out, to the importance of their functions. Thus, the muscles which move the arms and legs become relaxed before those which support the head, and the latter before those which maintain the erectness of the back. This, however, is not always the case, for, as we shall presently see, individuals will occasionally walk and keep their position on horseback while in a sound sleep, and persons may be seen slumbering in church, their heads drooping, but yet firmly holding their prayer-books in their hands under pretence of going through the services.

As regards the senses, the sight is of course the first to be lost in ordinary cases, the closure of the eyelids interposing a physical obstruction to the entrance of light. But even where the eyelids have been removed, or from disease cannot be closed, the sight, nevertheless, is the first of the special senses to be abolished. Some animals—as the hare, for example—do not shut the eyes when asleep, but even in them the ability to see disappears before the action of the other senses is suspended. These latter are not entirely abolished during sleep; their acuteness is simply lessened. Taste is the first to fade, and then the smell; hearing follows, and touch yields last of all. To awaken a sleeping person impressions made upon the sense of touch are more effectual than attempts to arouse through any of the other senses; the hearing comes next in order, smell next, then taste, and the sight is last of all in capacity for excitation.

During sleep the respiration is slower, deeper, and usually more regular than during wakefulness. The vigor of the process is lessened, and therefore there is a diminution of the pulmonary exhalations. In all probability also, the ciliated epithelium which lines the air-passages functionates with reduced activity. Owing to this circumstance, and to the general muscular torpor which prevails, mucus accumulates in the bronchial tubes, and requires to be expectorated on awaking. The circulation of the blood is rendered slower. The heart beats with more regularity, but with diminished force and frequency. As a consequence, the blood is not distributed to distant parts of the body so thoroughly and rapidly as during wakefulness, and accordingly the extremities readily lose their heat. Owing to the reduction in the activity of the respiratory and circulatory functions, the temperature of the whole body falls, and coldness of the atmosphere is less easily resisted. The functions of the several organs concerned in digestion indirectly have their activity increased during sleep. The blood which leaves the brain goes, as Durham has shown, to the stomach and other abdominal viscera, and hence the quantities of the digestive juices are augmented, and the absorption of the nutritious elements of the food promoted. The urine is excreted in less quantity during sleep than when the individual is awake and engaged in mental or physical occupation, because the wear and tear of the system is at its minimum. The perspiration is likewise reduced in amount in sleep. In warm weather, however, the effort to go to sleep often causes an increase in the quantity of this excretion, just as would any other mental or bodily exertion. This circumstance has led some writers to a conclusion the reverse of that just expressed. Others, again, have accepted the doctrine of Sanctorius without stopping to inquire into its correctness. This author, with his weighing-chair, established a good many important results, but his observations in regard to sleep were inexact, inasmuch as he determined the loss from the skin and lungs collectively, and as his apparatus was too imperfect to determine a question of such delicacy.

The ganglionic nervous system and the spinal cord continue in action during sleep, though generally with somewhat diminished power and sensibility. The so-called reflex faculty of the latter organ is still maintained, and thus various movements are executed without the consciousness of the brain being awakened. Somnambulism is clearly a condition of exaltation in the functions of the spinal cord, without the controlling influence of the cerebrum being brought into action. But aside from this rather abnormal phenomenon, there are others which are entirely within the range of health, and which show that the spinal cord is awake even though the sleep be most profound. Thus, for instance, if the position of the sleeper becomes irksome, it is changed; if the feet become cold, they are drawn up to a warmer part of the bed; and cases are recorded in which individuals have risen from bed and emptied a distended bladder without awaking, as well as performing many other complicated and apparently volitional acts.

We see, therefore, that though during sleep the operations of the senses are entirely suspended as regards the effects of ordinary impressions, the purely animal functions of the body continue in action. The heart beats, the lungs respire, the stomach, the intestines, and their accessory organs digest, the skin exhales vapor, and the kidneys excrete urine. With the central nervous system, however, the case is very different, for while some parts retain the power of receiving impressions or developing ideas, others have their actions diminished, exalted, perverted, or altogether arrested.

In the first place, there is undoubtedly during sleep a general torpor of the sensorium, which prevents the appreciation of the ordinary excitations made upon the organs of the special senses. So far as the nerves themselves are concerned, there is no loss of their irritability or conducting power, and the impressions made upon them are accordingly perfectly well conveyed to the brain. The suspension of the operation of the senses is not therefore due to any loss of function in the optic nerves, the auditory nerves, the olfactory nerves, the gustatory nerves, or the cranial or spinal nerves concerned in the sense of touch, but solely in the inability of the brain to take cognizance of the impressions conveyed to it. The immediate cause of this torpor will presently engage our attention.

Now, it must not be supposed that, because mild excitations transmitted by the nerves of the special senses are incapable of making themselves felt, therefore the brain is in a state of complete repose throughout all its parts. So far from such a condition existing, there are very decided proofs that several faculties are exercised to an extent almost equalling that reached during wakefulness; and we know that if the irritations made upon the senses be sufficiently strong, the brain does appreciate them, and the sleep is broken. This ability to be readily roused through the senses constitutes one of the main differences between sleep and stupor, to which full attention will be given directly. Relative to the different faculties of the mind as affected by sleep great variations are observed. It has been thought by some authors that several of them are really exalted above the standard attained during wakefulness, but this is probably a wrong view. The predominance which one or two mental qualities apparently assume is not due to any absolute exaggeration of power, but to the suspension of the action of other faculties which, when we are not asleep, exercise a governing or modifying influence. Thus, for instance, as regards the imagination, the faculty of all others which appears to be most increased, we find that, when we carefully study its manifestations in our own persons, although there is often greater brilliancy in its vagaries, uncontrolled as it is by the judgment, the pictures which it paints upon our minds are usually incongruous and silly in the extreme. Even though the train of ideas excited by this faculty when we are asleep be rational and coherent, we are fully conscious on awakening that we are capable of doing much better by intentionally setting the brain in action and governing it by our will and judgment. Owing to the fact that these two faculties of the mind are incapable of acting normally during sleep, the imagination is left absolutely without controlling influence. Indeed, we are often cognizant in those dreams which take place when we are half awake of an inability to direct it. The impressions which it makes upon the mind are therefore intense, but of very little durability. Many stories are told of its power—how problems have been worked out, poetry and music composed, and great undertakings planned; but if we could get at the truth, we should probably find that the imagination of sleep had very little to do with the operations mentioned. Indeed, it is doubtful if the mind of a sleeping person can originate ideas. Those which are formed are, as Locke remarks, almost invariably made up of the waking man's ideas, and are for the most part very oddly put together; and we are all aware how commonly our dreams are composed of ideas or based upon events which have recently occurred to us.

In the previous section to the one just quoted Locke alludes to the exaggeration of ideas which forms so common a feature of our mental actions during sleep. "It is true," he says, "that we have sometimes instances of perception while we are asleep, and retain the memory of those thoughts; but how extravagant and incoherent for the most part they are, how little conformable to the perfection and order of a rational being, those acquainted with dreams need not be told." And yet many remarkable stories are related which tend to show the high degree of activity possessed by the mind during sleep. Thus, it is said of Tartini, a celebrated musician of the eighteenth century, that one night he dreamed he had made a compact with the devil and bound him to his service. In order to ascertain the musical abilities of his servitor, he gave him his violin and commanded him to play a solo. The devil did so, and performed so admirably that Tartini awoke with the excitement produced, and seizing his violin endeavored to repeat the enchanting air. Although he was unable to do this with entire success, his efforts were so far effectual that he composed one of the most admired of his pieces, which in recognition of its source he called "The Devil's Sonata." Coleridge gives the following account of the composition of the fragment *Kubla Khan:* "In the summer of 1797 the author, then in ill-health, had retired to a lonely farm-house, between Perbeck and Linton on the extreme confines of Somerset and Devonshire. In consequence of a slight indisposition an anodyne had been prescribed, from the effects of which he fell asleep in his chair at the moment that he was reading the following sentence, or words of the same substance, in Purchas's *Pilgrimage:* 'Here the Khan Kubla commanded a palace to be built, and a stately garden thereunto. And thus ten miles of fertile ground were enclosed within a wall.' The author continued for about three hours in a profound sleep, at least of the external senses, during which time he had the most vivid confidence that he could have composed not less than from 200 to 300 lines, if that indeed can be called a composition in which all the images rose up before him as *things*, with a parallel production of the corresponding expression, without any sensation or consciousness of effort. On awakening he appeared to himself to have a distinct recollection of the whole, and taking his pen, ink, and paper, instantly and eagerly wrote down the lines that are here preserved. At this moment he was unfortunately called out by a person on business from Perbeck, and detained by him above an hour, and on his return to his room found, to his no small surprise and mortification, that although he still retained some vague and dim recollection of the general purport of the vision, yet with the exception of some eight or ten scattered lines and images all the rest had passed away like the images on the surface of a stream into which a stone has been cast, but, alas! without the future restoration of the latter." Dr. Cromwell, citing the above instance of poetic inspiration during sleep, states that having, like Coleridge, taken an anodyne during a painful illness, he composed the following lines of poetry, which he wrote down within half an hour after awakening. These lines, though displaying considerable imagination, are not remarkable for any other quality:

"*Lines composed in Sleep on the Night of January 9, 1857.*

"*Scene—Windsor Forest.*

"At a vista's end stood the queen one day,
Relieved by a sky of the softest hue;
It happened that a wood-mist risen new
Had made that white which should have been blue.
A sunbeam sought on her form to play;
It found a nook in the bowery nave,
Through which with its golden stem to lave
And kiss the leaves of the stately trees
That fluttered and rustled beneath the breeze;
But it touched not her, to whom 'twas given
To walk in a white light pure as heaven."

In the last two of these instances it is impossible to say whether the individuals were really asleep or not, as the opium or other narcotic taken is a very disturbing factor in both conditions, and doubtless was the exciting cause of the activity in the imagination. No more graphic account of the effects of opium in arousing the imagination to its highest pitch has been written than that given by De Quincey. He says: "At night, when I lay awake in bed, vast processions passed along in mournful pomp—friezes of never-ending stories, that to my feelings were as sad and solemn as if they were stories drawn from times before Œdipus or Priam, before Tyre, before Memphis. And at the same time a corresponding change took place in my dreams; a theatre seemed suddenly opened and lighted up within my brain which presented nightly spectacles of more than earthly splendor." And then, after referring to the various scenes of architectural magnificence and of beautiful women which his imagination conceived, and which forcibly recalls to our minds the poetical effusions of Coleridge and Cromwell, he gives the details of another dream in which he heard music: "A music of preparation, of awakening suspense—a music like the opening of the Coronation Anthem, and which, like *that*, gave the feeling of a vast march, of infinite cavalcades filing off, and the tread of innumerable armies."

In reference to this subject Dr. Forbes Winslow relates the following interesting case: "A feeble, sensitive lady, suffering from a uterine affection, writes to us as follows concerning the influence of three or four sixteenths-of-a-grain doses of hydrochlorate of morphia: 'After taking a few doses of morphia, I felt a sensation of extreme quiet and wish for repose, and in closing my eyes visions, if I may so call them, were constantly before me, and as constantly changing in their aspect—scenes from foreign lands, lovely landscapes, with tall, magnificent trees covered with droop-

ing foliage, which was blown gently against me as I walked along. Then in an instant I was in a besieged city filled with armed men. I was carrying an infant, which was snatched from me by a soldier and killed upon the spot. A Turk was standing by with a scimitar in his hand, which I seized, and attacking the man who had killed the child, I fought most furiously with him and killed him. Then I was surrounded, made prisoner, carried before a judge and accused of the deed; but I pleaded my own cause with such a burst of eloquence (which, by the by, I am quite incapable of when in my right mind) that judge, jury, and hearers acquitted me at once. Again, I was in an Eastern city visiting an Oriental lady, who entertained me most charmingly. We sat together on rich ottomans, and were regaled with supper and confectionery. Then came soft sounds of music at a distance, while fountains were playing and birds singing, and dancing-girls danced before us, every movement being accompanied by the tinkling of silver bells attached to their feet. But all this suddenly changed, and I was entertaining the Oriental lady in my own house, and in order to please her delicate taste I had everything prepared as nearly as possible after the fashion with which she had so enchanted me. She, however, to my no small surprise, asked for wine, and took not one, two, or three glasses, but drank freely, until at last I became terrified that she would have to be carried away intoxicated. While considering what course I had better adopt, several English officers came in, and she at once asked them to drink with her, which so shocked my sense of propriety that the scene changed and I was in darkness. Then I felt that I was formed of granite, and immovable. Suddenly, a change came again over me, and I found that I consisted of delicate and fragile basketwork. Then I became a danseuse, delighting an audience and myself by movements which seemed barely to touch the earth. Presently beautiful sights came before me—treasures from the depth of the sea, gems of the brightest hues, gorgeous shells, coral of the richest colors, sparkling with drops of water and hung with lovely seaweed. My eager glances could not take in half the beautiful objects that passed before me during the incessant changes the visions underwent. Now I was gazing upon antique brooches and rings from buried cities; now upon a series of Egyptian vases; now upon sculptured woodwork blackened by time; and lastly I was buried amid forests of tall trees, such as I had read of, but never seen. The sights that pleased me most I had power to a certain extent to prolong, and those that displeased me I could occasionally set aside; and I awoke myself to full consciousness once or twice while under the influence of the morphia by an angry exclamation that I would not leave it. I did not once lose my personal identity.' The lady almost invariably suffers more or less from hallucinations of the foregoing character if it becomes necessary to administer to her an opiate; and on analyzing her visions she can generally refer the principal portions of them, notwithstanding their confusion and distortion, to works that she has recently read."

Opium in certain doses increases the amount of blood in the brain, and thus induces a condition very different from that of sleep. In this fact we have an explanation of the activity of the imagination as one of its prominent effects. That Coleridge should have composed the *Kubla Khan* under its influence is in nowise remarkable. It is probable, however, that the full influence of his mind was exerted upon it after he awoke to consciousness, and that the wild fancies excited by the opiate, and based upon what he had been previously reading, formed the substructure of his conceptions. In any event, the ideas contained in this fragment are no more fanciful than those which occurred to De Quincey and the lady whose case has been recorded, nor are they more impressively related.

The imagination may therefore be active during sleep, but we have no authentic instance on record that it has, unaided by causes which exercise a powerful influence over the intracranial circulation, led to the production of any ideas which could not be excelled by the individual when awake.

That the imagination may in its flights during sleep strike upon fancies which are subsequently developed by the reason into lucid and valuable ideas, is very probable. It would be strange if, from among the innumerable absurdities and extravagancies to which it attains, something fit to be appropriated by the mind should not occasionally be evolved, and thus there are many instances mentioned of the starting-point of important mental operations having been taken during sleep. Some of these may be based upon fact, but the majority are probably of the class of those just specified, or occurred at an age of the world when a belief in the supernatural exercised a greater power over men's minds than it does at the present day.

As regards the memory in sleep, it is undoubtedly exercised to a considerable extent. In fact, whatever sign of activity the mind may then exhibit is based upon events the recollection of which has been retained. But there is more or less error mingled with a small amount of truth. The unbridled imagination of the sleeper so distorts the simplest circumstances as to render their recognition a matter of no small difficulty, and thus it scarcely if ever happens that events are reproduced during sleep exactly as they would be recalled by the mind of the individual when awake. Frequently, also, recent events which have made a strong impression on our minds are forgotten, as when, for instance, we dream of seeing and conversing with persons not long dead. And yet there are many instances on record of knowledge which had passed out of the mind being reacquired during sleep. Thus, Lord Monboddo states that the countess de Laval, while asleep in the course of a severe illness, spoke in a language which no one around her but an old Breton nurse understood. The countess had in her childhood passed several years in Brittany, but had entirely forgotten the language.

The judgment is frequently exercised when we are asleep, but almost invariably in a perverted manner. In fact, we scarcely ever estimate the events or circumstances which appear to occur in our dreams at their real value, and very rarely form correct conceptions of right and wrong. High-minded and honorable men do not scruple during sleep to sanction the most atrocious acts, or to regard with complaisance ideas which in their waking moments would fill them with horror. Delicate and refined women will coolly enter upon a career of crime, and the minds of hardened villains are filled with the most elevated and noble sentiments. The deeds which we imagine we perform in our sleep are generally inadequate to or in excess of what the apparent occasion requires, and we lose so entirely the ideas of probability and possibility that no preposterous vision appears otherwise than as perfectly natural and correct. Thus, a physician dreamed that he had been transformed into a monolith which stood grandly and alone in the vast desert of Sahara, and had so stood for ages while generation after generation wasted and melted away around him. Although unconscious of having organs of sense, this column of granite saw the mountains growing bald with age, the forests drooping with decay, and the moss and ivy creeping around its crumbling base. But although in this instance there was some conception of time, as shown in the associations of the evidence of decay with the lapse of years, there is in general no correct idea on this subject. The following example, detailed by Lavalette as occurring to him while in prison, is an illustration of this statement: "One night, while I was asleep, the clock of the Palais de Justice struck twelve and awoke me. I heard the gate open to relieve the sentry, but I fell asleep again immediately. In this sleep I dreamed that I was standing in the Rue St. Honoré, a melancholy darkness spread around me; all was still; nevertheless, a slow and uncertain sound soon arose. All of a sudden I perceived at the bottom of the street, and advancing toward me, a troop of cavalry—the men and horses, however, all flayed. The men held torches in their hands, the red of which illuminated faces without skin, and bloody muscles. Their hollow eyes rolled fearfully in their sockets, their mouths opened from ear to ear, and helmets of hanging flesh covered their hideous faces. The horses dragged along their own skins in the kennels, which ran with blood. Pale and dishevelled women appeared and disappeared at the windows in dismal silence; low, inarticulate groans filled the air, and I remained in the street alone, petrified with horror and deprived of strength sufficient to seek my safety in flight. This horrible troop continued passing along rapidly in a gallop, and casting frightful looks upon me. Their march continued, I thought, for five hours, and they were followed by an immense number of artillery wagons full of bleeding corpses, whose limbs still quivered; a disgusting smell of blood and bitumen almost choked me. At length the iron gates of the prison shutting with great force awoke me again. I made my repeater strike; it was no more than midnight; so that the horrible phantasmagoria had lasted no more than two or three minutes—that is to say, the time necessary for relieving the sentry and shutting the gate. The cold was severe and the watchword short. The next day the turnkey confirmed my calculations. I nevertheless do not remember a single event in my life the duration of which I have been able more exactly to calculate, of which the details are more deeply engraven on my memory, and of which I preserve a more perfect consciousness." No instance can more strikingly exemplify aberrations of the faculty of judgment than the above. There was no astonishment felt at the horror experienced, but all the impossible events which appeared to be taking place were ac-

cepted as facts which might have occurred in the regular order of nature.

My opinion, therefore, is, that during sleep the power of bringing the judgment into action is suspended. We do not actually lose the power of arriving at a decision, but we cannot exert the faculty of judgment in accordance with the principles of truth and correct reasoning. An opinion may therefore be formed during sleep, but it is more likely to be wrong than right; and no effort that we can make will enable us to distinguish the false from the true, or to discriminate between the possible and the impossible. That faculty of the mind, the judgment, which when we are awake is pre-eminently our guide, can no longer direct us aright. The stores of experience go for naught, and the mind accepts as truth whatever preposterous idea the imagination presents to it. We are not entirely rendered incapable of judging, as some authors assert, but the power to perceive the logical force of circumstances, to take them at their true value, and to eliminate error from our mental processes, is altogether arrested, and we arrive at absurd conclusions from impossible premises.

But there is no doubt that at times the faculty of judgment is suspended as regards some parts of our mental operations during sleep, and this to such an extent that we are not capable of recognizing our own individuality. Thus, it is related of Dr. Johnson that he had once in a dream a contest of wit with some other person, and that he was very much mortified by imagining that his opponent had the better of him. "Now," said he, "we may mark here the effect of sleep in weakening the power of reflection; for had not my judgment failed me, I should have seen that the wit of this supposed antagonist, by whose superiority I felt myself depressed, was as much furnished by me as that which I thought I had been uttering in my own character." Van Greuz dreamt that he could not answer questions to which his neighbor gave correct responses. An interesting case in which the judgment was still more at fault has recently come to my knowledge. Mrs. C. dreamed that she was Savonarola, and that she was preaching to a vast assembly in Florence. Among the audience was a lady whom she at once recognized to be her own self. As Savonarola she was delighted at this discovery, for she reflected that she was well acquainted with all Mrs. C.'s peculiarities and faults of character, and would therefore be enabled to give special emphasis to them in the sermon. She did this so very effectively that Mrs. C. burst into a torrent of tears, and with the emotion thus excited the lady awoke. It was some time before she was able to disentangle her mixed-up individualities. When she became fully awake, she perceived that the arguments she had employed to bring about the conversion of herself were puerile in the extreme, and were directed against characteristics which formed no part of her mental organization, and against offences which she had not committed.

Why the judgment is not properly exercised during sleep we do not know. Dr. Philip believes that in this condition ideas flow so rapidly that they are not submitted to the full power of the judgment, and that hence the absurdity which characterizes them is not perceived. But this explanation is by no means satisfactory; for a merely swift succession of ideas is no very serious bar to correct judgment, and when the thoughts are as preposterous as those which so often occur in dreams, they present no obstacle at all to a proper estimation of them by the healthy mind. The cause probably resides in some alteration in the circulation of the blood in that part of the brain which presides over the judgment, whereby its power is suspended and the imagination left free to fill the mind with its incongruous and fantastic images.

As regards the will, we find very opposite opinions entertained relative to its activity; but no one, so far as I am aware, appears to have had correct views upon the subject. Without going into a full discussion of the views enunciated, it will be sufficient to refer to the ideas on the point in question which have been expressed by some of the most eminent philosophers and physiologists. In the course of his remarks on sleep, Darwin repeatedly alleges that during this condition the action of the will is entirely suspended, but he falls into the singular error of confounding volition with the power of motion. Thus, he says: "When by one continued posture in sleep some uneasy sensations are produced, we either gradually awake by the exertion of the volition, or the muscles connected by habit with such sensations alter the position of the body; but when the sleep is uncommonly profound and these uneasy sensations great, the disease called incubus or nightmare is produced. Here the desire of moving the body is painfully exerted, but the power of moving it, or volition, is incapable of action until we are awake. In consequence of this misapprehension of the nature of the will it is not easy to arrive at Darwin's ideas on the subject; and the attempt is rendered still more difficult from the fact that though he repeatedly states that volition is entirely suspended during sleep, he yet in the first part of the foregoing quotation makes an individual awake by the gradual exercise of the power of the will, and then in the last part of the same paragraph asserts that volition is incapable of action till sleep is over.

Mr. Dugald Stewart contends that during sleep the power of volition is not suspended, but that those operations of the mind and body which depend on volition cease to be exercised. In his opinion, the will loses its influence over all our powers both of mind and body in consequence of some physical alteration in the system which we shall never probably be able to explain. A very little reflection will suffice to convince the reader that Mr. Stewart has altogether mistaken the nature of sleep. There is no evidence to support his view that the body is not subject to the action of the will during sleep. No change whatever is induced by this condition in the nerves or muscles of the organism. The first are just as capable as ever of conducting the nervous fluid, and the muscles do not lose any of their contractile power. The reason why voluntary movements are not performed during sleep is simply because the will does not act. And Mr. Stewart is again wrong in asserting that volition is not then suspended. We do not will any actions when we are asleep: we *imagine* we do, and that is all. The difficulties which encompass us when we sleep are, it must be recollected, purely imaginary, and the efforts we make to escape from them are likewise the products of the fancy. Herein lies the main error which Mr. Stewart has committed. He appears to accept the dream for a reality, and to regard the seeming volitions which occur in it as actual facts, whereas they are all entirely fictitious. An example will serve to make this point still clearer. Not long since I dreamed that I stood upon a very high perpendicular table-land, at the foot of which flowed a river. I thought I experienced an irresistible desire to approach the brink and to look down. Had I been awake, such a wish would have been the very last to enter my mind, for I have an instinctive dread of standing on a height. I dreamed that I threw myself on my face and crawled to the edge of the cliff. I looked down at the stream, which scarcely appeared to be as wide as my hand, so great was the altitude upon which I was placed. As I looked I felt an overpowering impulse to crawl still farther and to throw myself into the water below. I imagined that I endeavored with all my will to resist this force, which appeared to be acting by means altogether external to my organism. My efforts, however, were all in vain. I could not control my movements, and gradually I was urged farther and farther over the brink, till at last I went down into the abyss below. As I struck the water I awoke with a start. During my imaginary struggles I thought I experienced all the emotions which such an event, if real, would have excited, and I was painfully conscious of my utter inability to escape from the peril of my situation. Here were circumstances such as, according to Mr. Stewart, demonstrate the activity of the volition, but at the same time show its inability to act upon the body. But clearly they show no such thing, for the imaginary volition was to refrain from crawling over a precipice which did not exist, and over which therefore I was not hanging. Such an act of the will, if real, could not, in the very nature of the real conditions of the situation, have been carried out; the volition was just as imaginary as all the other circumstances of the dream.

Again, it is not always the case that the imaginary acts of the will are not executed during sleep; and hence it would follow from Mr. Stewart's argument that the power of the will over the body is not then suspended. Assuming for a moment that the volitions of sleep are real, as Mr. Stewart supposes, if it can be shown that they are satisfactorily performed, it results from his line of reasoning that the will has power over the body during sleep. Every one who has dreamed has at times had his will carried out to his entire satisfaction. He has ridden horses when pursued, and has urged them forward with whip and spur so as to escape from his enemies; or he has executed the most surprising feats both with his mind and body, and has performed voluntary deeds which have excited the admiration of all beholders. Such acts are of course entirely the product of the imagination, and all the volitions which accompany them have no firmer basis than the unbridled fancy; but, according to Mr. Stewart, they would be evidence of the power of the will over the body—a power which in reality does not exist; not, however, as Mr. Stewart supposes, from any impediments in the nerves or muscles, but because it is never exerted.

So far as relates to movements performed during sleep, such as turning in bed and assuming more comfortable positions, they have nothing whatever to do with the will.

They are dependent upon the action of the spinal cord, an organ that is never at rest, and the functions of which were not known as well when Dr. Darwin and Mr. Stewart wrote as they are now. The same is true of more complex and longer-continued actions, such as those already mentioned of individuals riding on horseback, or even walking, during sleep. The theory that the will is in action during sleep is therefore, to my mind, untenable. It has probably had its origin in the idea that confounds it with desire, from which it differs so markedly that it seems strange the distinction should ever fail to be made. Locke points out very clearly the differences between the two faculties. In fact, they may be exerted in directly opposite ways. Desire often precedes volition; but we all at times will acts which are contrary to our desire, and desire to perform others which we are unable to will. That desire is manifested during sleep there can be no doubt; and Mr. Stewart, although insisting as he does on the distinction between this faculty and volition, confounds them in his remarks already referred to. A person suffering from nightmare has a most intense desire to escape from his imaginary troubles. In my own dream, to which reference has been made, my desire to restrain myself from crawling over the precipice was exerted to the utmost, but the will could not be brought into action. Darwin, when he says that in nightmare "the *desire* of moving the body is painfully exerted, but the *power of moving it in volition* is incapable of action till we awake," makes the proper distinction between desire and will, but, as I have already shown, confounds the latter with another very different faculty.

From the foregoing observations it will be seen that during sleep the three great divisions of the mind are differently affected. (1) Feeling, embracing sensation and emotion, is suspended so far as the first is concerned, but is in full action as regards the second. We do not see, hear, smell, taste, or enjoy the sense of touch in sleep, although the brain may be aroused into activity, and we may awake through the excitations conveyed to it by the special senses. The emotions have full play, unrestrained by the will, and governed only by the imagination. (2) The will or volition is entirely suspended. (3) The thought or intellect is variously affected in its different powers. The imagination is active, and the memory may be exercised to a great extent, but the judgment, perception, conception, abstraction, and reason are weakened, and sometimes altogether lost.

In the next place, we have to inquire into the circumstances which make sleep necessary to the system, and which are in force in all organic things, whether plants or vegetables. The state of general repose which accompanies sleep is of especial value to the organism in allowing the nutrition of the nervous tissue to go on at a greater rate than its destructive metamorphosis. The same effect is of course produced upon the other structures of the body, but this is not of so much importance as regards them, for while we are awake they all obtain a not inconsiderable amount of rest. Even those actions which are most continuous, such as respiration and the pulsation of the heart, have distinct periods of suspension. Thus, after the contraction and dilatation of the auricles and ventricles of the heart there is an interval during which the organ is at rest. This amounts to one-fourth of the time requisite to make one pulsation and begin another. During six hours of the twenty-four the heart is therefore in a state of complete repose. If we divide the respiratory act into three equal parts, one will be occupied in inspiration, one in expiration, and the other by a period of quiescence. During eight hours of the day, therefore, the muscles of respiration and the lungs are inactive. And so with several glands, each has its time for rest; and of the voluntary muscles, none, even during our most untiring waking moments, are kept in continued action. But for the brain there is no rest except during sleep, and even this condition is, as we have seen, only one of comparative repose. So long as an individual is awake there is not a single second of his life during which the brain is altogether inactive, and even while he is deprived by sleep of the power of volition nearly every other faculty of the mind is capable of being exercised, and several of them—as the imagination and memory, for instance—are sometimes carried to a state of exaltation not ordinarily reached by direct and voluntary effort. If it were not for the fact that all parts of the brain are not in action at the same time, and that thus some slight measure of repose is afforded, it would probably be impossible for the organ to maintain itself in a state of integrity. During wakefulness, therefore, the brain is continually in action, though this action is not always of such a character as to make us conscious of its performance. A great deal of the power of the brain is expended in the continuance of functional operations necessary to our well-being. During sleep these are altogether arrested as regards some, or else materially retarded in force and frequency so far as others are concerned.

Many instances of what Dr. Carpenter very happily calls "unconscious cerebration" will suggest themselves to the reader. We frequently find suggestions occurring to us suddenly—suggestions which could only have arisen as the result of a train of ideas passing through our minds, but of which we have been unconscious. This function of the brain continues in sleep, but not with so much force as during wakefulness. The movements of the heart, of the respiratory muscles, and of other organs which perform either dynamic or secretory functions are all rendered less active by sleep, and during this condition the nervous system generally obtains the repose which its ceaseless activity during our periods of wakefulness so imperatively demands. Sleep is thus necessary in order that the body, and especially the brain and nervous system, may be renovated by the formation of new tissue to take the place of that which by use has lost its normal characteristics. For the substance of this organ is consumed by every thought, by every action of the will, by every sound that is heard, by every object that is seen, by every odor that is smelled, by every pleasurable or painful sensation; and so each instant of our lives witnesses the decay of some portion of its mass, and the formation of new material to take its place. When we are awake, the expenditure exceeds the income, but when we sleep, the balance is restored. If we do not sleep, we are burning our candle at both ends, and we are in the position of the spendthrift, whose receipts not being sufficient for his extravagances, makes inroads upon his capital. For him financial, for us intellectual bankruptcy, is not far distant.

As to the immediate causes of sleep, it was formerly almost uniformly attributed to an increase in the amount of blood in the brain, but recent investigations instituted by Mr. Durham and myself, independently of each other, have established the fact to the satisfaction of physiologists that sleep is the direct consequence of a diminished amount of blood in the cerebral blood-vessels, and that unless this diminution takes place sleep is impossible. The consideration of these experiments in their entirety, though interesting, would lead us too far into technical grounds.

*Bibliography.*—Macnish, *Philosophy of Sleep* (Edinburgh, 1850); Macario, *Du Sommeil des Rêves et du Somnambulisme* (Paris, 1857); Joffroy, *Du Sommeil* (Paris, 1838); Fosgate, *Sleep psychologically considered, etc.* (New York, 1850); Philip, *An Inquiry into the Nature of Sleep and Death* (London, 1824); Nodier, *De quelques Phénomènes du Sommeil* (Œuvres Complèts, t. v. pp. 170–175); Lemoine, *Du Sommeil au Point de Vue physiologique et psychologique* (Paris, 1855); Durham, *The Physiology of Sleep* (*Guy's Hospital Reports*, 3d series, vol. vi., 1860); Maury, *Le Sommeil et les Rêves* (Paris, 1865); Hammond, *On Wakefulness, with an Introductory Chapter on the Physiology of Sleep* (Philadelphia, 1865); *Sleep and its Derangements* (Philadelphia, 1869.) Also, chapters in many works on metaphysics, philosophy, and physiology.

W. A. Hammond.

**Sleep'er,** a name given to several fishes: (1) At some points in New England (*e. g.* Marblehead, according to Lesueur) it is applied to the *Somniosus microcephalus*, a shark belonging to the family Scymnidæ: this is distinguishable by the absence of an anal fin, the nearly equal length of the dorsals (which have no spines), and the oblique truncate lower teeth: it attains a length sometimes of twenty-five feet or more, and is an inhabitant of the Northern Atlantic, descending on the American side as far southward as Cape Cod. (2) On the coasts of Florida and Jamaica it is bestowed on the *Ginglymostoma cirratum*, also a shark, but belonging to a peculiar family, the Ginglymostomidæ, and distinguished by the position of the first dorsal behind the ventrals, and the teeth, which are in many rows, each tooth having a strong median cusp, and one or two much smaller ones on each side. The species sometimes attains a length of nearly ten feet. (3) In some of the West Indian islands the same name is given to species of the gobivid sub-family Eleatridinæ; these are rather small fishes (rarely much if at all exceeding a foot in length), of an elongated form, and recognizable by the development of two quite widely-separated dorsals, the first of which has six slender spines, and the thoracic ventrals, which have each a spine and five rays, the inner half of which are longest. Theodore Gill.

**Sleep'ing Bear,** tp., Leelenaw co., Mich. P. 340.

**Sleep of Plants,** the diurnal or nocturnal suspension of some of the vegetative functions. It is not to be confounded with the annual rest from functional activity which characterizes most perennial plants. The latter is analogous to hibernation, the former to the true sleep of animals. The sleep of plants is sometimes evinced by the

closure of petals and the drooping or other change of position in the leaves. (The differences in some of the functional activities of plants by day and those occurring by night are noticed in the RESPIRATION IN PLANTS.)

**Sleepy Creek,** tp., Morgan co., West Va. P. 374.

**Sleepy Eye,** p.-v., Brown co., Minn., on Winona and St. Peter R. R., between Minnesota and Cottonwood rivers, has 4 churches, 1 high school, 1 newspaper, wheat-elevator and storehouse with a capacity of 200,000 bushels, and 5 hotels. P. about 500. J. W. TAYLOR, ED. "ARGUS."

**Sleepy Hole,** tp., Nansemond co., Va. P. 2112.

**Sleepy Hollow,** tp., Barnwell co., S. C. P. 1219.

**Slei'dan** (JOHANN), whose true name was PHILIPPSOHN, b. at Schleiden, near Cologne, in 1506; studied jurisprudence at Liege, Cologne, Louvain, Paris, and Orleans; was employed by Francis I. as his representative at the Diet of Regenburg; settled afterward, having embraced the Reformation, as a professor of law at Strasbourg; was appointed historiographer by the princes of the Smalkaldian League; represented the city of Strasbourg at the Council of Trent. D. in Strasbourg Oct. 31, 1556. His *De Statu Religionis et Reipublicæ, Carolo Quinto Cæsare, Commentarii* (Strasbourg, 1555), best ed. by Am. Eude (3 vols., Frankfort, 1785), gives a history of the Reformation from 1517 to 1556, and is distinguished both for the impartiality of its view and for the elegance of its style. It was translated into English by Edmund Bohun in 1689, under the title *General History of the Reformation begun in Germany by Martin Luther.* He also wrote *De quatuor Summis Imperiis* (1556; often reprinted) and *Summa Doctrinæ Platonis de Republica et de Legibus* (1548).

**Slem'mer** (ADAM J.), b. in Montgomery co., Pa., in 1828; was graduated from the U. S. Military Academy July 1, 1850, when appointed brevet second lieutenant in the artillery; first lieutenant 1854. Served a short campaign in Florida against the Seminoles 1850–51; on frontier duty in California 1851–54. Detailed for duty at West Point in 1855, he served as assistant professor of geography and history a year, and of mathematics 1856–59. In the latter year he returned to his company, at Fort Moultrie, S. C., and in 1860 was transferred to Florida, where, in 1861, he commanded the small body of U. S. troops in Pensacola harbor, occupying with them Fort Barrancas and the neighboring feeble Barracks, which, upon intelligence of the surrender of the Pensacola navy-yard reaching him, he transferred (Jan. 10) to Fort Pickens, opposite; which prompt action prevented the seizure of that important work by the seceding States (see FORT BARRANCAS and FORT PICKENS), and which he held until reinforced in April, when superseded in command by Col. Harvey Brown. On May 4 he was appointed major of the 16th Infantry, and ordered to New York harbor; was engaged in recruiting his regiment July–August, then acting inspector-general of the department of the Ohio until November, when compelled by ill-health to take leave of absence. Returning to duty in May, 1862, he was attached to Gen. Buell's army, and participated in the siege of Corinth and in the subsequent movement to Louisville, Ky., and to the relief of Nashville, Tenn. He was commissioned a brigadier-general of volunteers Nov. 29, 1862, and engaged in the battle of Murfreesboro', Dec. 31, where severely wounded and incapacitated from further active service in the field. From July, 1863, to the close of the war he served as president of an examining board. In Aug., 1865, he was mustered out of the volunteer service, and resumed his regular army commission, at that date lieutenant-colonel 4th Infantry. For gallantry at Murfreesboro' he was brevetted lieutenant-colonel, and for gallant and meritorious conduct during the war colonel and brigadier-general. In enfeebled health he served on garrison duty until Oct., 1866, when placed on board duty. D. at Fort Laramie Oct. 7, 1868.

**Sleswick.** See SCHLESWIG.

**Sley'dinge,** town of Belgium, province of East Flanders, manufactures linen, leather, candles, mustard, and vinegar. P. 5797.

**Slick'ensides,** a peculiar polished and striated surface found commonly on the wall-rocks of mineral veins or faults, and where slate, shale, coal, and other fine materials have been crumpled and folded by pressure. Not unfrequently a foreign body, such as a concretion, shell, or nut lying in an argillaceous rock of which the particles have been moved on each other with great force, shows the polished striated surface to which this name has been given. J. S. NEWBERRY.

**Slidell'** (JOHN), b. in New York City about 1793; graduated at Columbia College 1810; settled at New Orleans, where he became a distinguished lawyer; U. S. district attorney 1829–33; member of Congress 1843–45; appointed minister to Mexico 1845, but not received by the Mexican government; was U. S. Senator 1853–61; withdrew in consequence of the secession of his State, which he had done much to promote; sailed for Europe as commissioner of the Confederate government to France; was taken from the Trent with Mason, Nov. 8, 1861, but given up Jan. 1, 1862, and resided in England until his death, at London July 29, 1871.

**Sliding Rule,** an instrument for solving arithmetical, trigonometrical, and other problems with approximate accuracy. Several forms are made, but that invented by the Rev. William Oughtred (1573–1660) is the best known. The rule is chiefly used in gauging, in measuring timber, etc. It consists of two pieces, one of which slides on the other. Each is marked with certain figures; and when a given number on one piece corresponds in position to a given number on the other, their product or other function is seen at once by inspection. The sliding rule may be constructed with various scales, each adapted to some particular use.

**Sli'go,** county of Ireland, province of Connaught, borders N. on the Atlantic, comprises an area of 721 sq. m. The surface is mountainous E. and N. E.; Trushmore rises to the height of 2072 feet. The western part is level, the soil mostly consisting of a light sandy or gravelly loam, interspersed with patches of bog. There are, however, districts with a deep and rich soil well adapted for tillage. Agriculture is the principal occupation, especially cattle-breeding and dairy-farming. Some coarse woollen stuffs are manufactured, and fishing is occasionally carried on. P. 180,809 in 1841, 128,510 in 1851, 124,845 in 1861, 115,493 in 1871. Between 1851 and 1872, 27,608 persons emigrated. Of the present pop., 43,219 are unable to read or write. Principal town, Sligo.

**Sligo,** town of Ireland, capital of the county of Sligo, in the neighborhood of charming scenery, at the head of the Bay of Sligo, has a good harbor. Its manufactures are not important, but it carries on an extensive trade in grain, flour, meal, butter, provisions, and yarn. P. 9340.

**Sling,** a simple contrivance for hurling missiles, consists of a small disk of leather pierced by a hole and suspended by one, two, or three strings, say a yard long. A stone or other missile is placed upon the leathern disk, and then whirled rapidly about for a time, when one of the strings is dropped from the hand at the proper instant, and the missile is sent with great force through the air. The ancient Greek light-armed troops used the sling (*σφενδόνη*; Lat. *funda*), often with a plummet of lead instead of a stone. These bullets are well known to antiquarians. They frequently bear the word ΔΕΞΑΙ, "Take this," or some similar word. The Persians, Achæans, Acarnanians, and especially the Balearians, were famous slingers. The latter used either hand; and we are told that parents obliged their sons to strike their food down with the sling from a pole where it was hung before they were allowed to eat it. Hence their great skill. As late as 1686 British grenadiers were armed with slings.

**Slippery Rock,** p.-v. and tp., Butler co., Pa. P. 879.

**Slippery Rock,** tp., Lawrence co., Pa. P. 1778.

**Sloan** (SAMUEL), b. at Lisburn, near Belfast, Ireland, Dec. 25, 1817; was taken to America in infancy, arriving in New York in 1819; received a common-school education; held several local offices in Kings co., N. Y., and in 1855 was elected president of Hudson River R. R. Co., holding that office for about ten years. Subsequently for two years he acted as commissioner of the "trunk lines" of railroad to the West, as general arbitrator of competitive disputes; in 1863 was elected president of Delaware Lackawanna and Western R. R. Co., which position he now holds. He is also president of Marquette Houghton and Ontonagon R. R. of Michigan and International and Great Northern R. R. of Texas. J. B. BISHOP.

**Sloane** (Sir HANS), BART., F. R. S., b. at Killyleagh, county Down, Ireland, Apr. 16, 1660; became a distinguished physician at London; went to Jamaica in 1687 as physician to the governor, the duke of Albemarle; made there a large collection of plants and other objects of scientific interest; became physician to Christ's Hospital, London, 1694, and retained that post thirty-six years; was influential, as secretary of the Royal Society, in reviving the *Philosophical Transactions* as the organ of that body, and edited it for many years; was made physician-general to the army and a baronet 1716; became president of the College of Physicians 1719, of the Royal Society 1727, and physician to the king in the latter year. D. in Chelsea Jan. 11, 1753. Author of *The Natural History of Jamaica* (2 vols. folio, 1707–25) and various other publications. His magnificent library and collections of botany and natural history were, in accordance with his will, sold to the nation for £20,000, a sum considered to represent not more than a

fourth of their value. The Sloane collections became the nucleus of the British Museum.

**Sloan's,** tp., Moore co., N. C. P. 2206.

**Sloan's Station,** p.-v. and tp., Jefferson co., O., on Ohio River and on River division of Cleveland and Pittsburg R. R. P. 476.

**Sloat** (JOHN DRAKE), b. in New York City in 1780; entered the U. S. navy as a sailing-master 1800; was engaged in the action between the United States and the Macedonian Oct. 25, 1812; served in the expedition against West Indian pirates 1824–25; was commander of the Pacific squadron 1846–52; was next placed in charge of the Norfolk navy-yard; superintended the construction of the Stevens battery at Hoboken; became commodore (retired list) July 16, 1862, and rear-admiral July, 1866. D. at New Brighton, Staten Island, N. Y., Nov. 28, 1867.

**Slobodskoi′,** town of Russia, government of Viatka, on the Viatka, has a large trade in corn. P. 6032.

**Slo′cum,** p.-v. and tp., Luzerne co., Pa. P. 317.

**Slocum** (HENRY WARNER), b. at Pompey, Onondaga co., N. Y., Sept. 24, 1827; was graduated from the U. S. Military Academy July 1, 1852, when appointed second lieutenant of artillery; first lieutenant 1855. After a brief campaign in Florida against the hostile Seminoles, he served in garrison at Fort Moultrie, S. C., until Oct. 31, 1856, when he resigned from the army to enter upon the practice of law at Syracuse, N. Y.; was a member of the New York State legislature in 1859. On the outbreak of civil war he tendered his services, and May 21, 1861, was appointed colonel of the 27th New York Vols., which regiment he led in the battle of Bull Run, July 21, where severely wounded. Early in August he was commissioned brigadier-general of volunteers. Returning to duty in September, he was assigned to command of a brigade in Franklin's division of the Army of the Potomac, and in the Virginia Peninsular campaign of 1862 was engaged in the siege of Yorktown and action of West Point, succeeding to command of the division May 15, on Franklin's assignment to the 6th corps. At the battle of GAINES'S MILL, June 27 (which see), his command was sent to Porter's relief at a critical period, and rendered important service; at the battle of GLENDALE, June 30 (which see), it held the right of the main line, as at Malvern Hill, July 1. He was made a major-general of volunteers July 4, and engaged in the second battle of Bull Run, of South Mountain, and of Antietam. In October he was assigned to the command of the 12th corps, which he led at the battle of Chancellorsville and at Gettysburg, where in command of the right wing of the army. Transferred, with his corps, to the West, he served in the department of the Cumberland until Apr., 1864, when, his corps being consolidated with the 11th, he was assigned to a division, and command of the district of Vicksburg. In Aug., 1864, he succeeded Gen. Hooker in command of the 20th corps, which was the first to occupy Atlanta, Ga., Sept. 2. In Sherman's "march to the sea" and invasion of the Carolinas he commanded the left grand division or wing of that army, participating in all its engagements, from the departure from Atlanta to the surrender of Johnston at Durham Station, N. C., and in its subsequent march to Washington, where disbanded. In Sept., 1865, he resigned, and resumed the practice of his profession at Brooklyn, N. Y., declining in 1866 the appointment of colonel of infantry in the regular army. Was Democratic candidate for secretary of state of New York in 1865, but defeated; was elected to the 41st and to the 42d Congress, and in 1876 was appointed president of board of public works of Brooklyn.

**Sloe,** the fruit of *Prunus spinosa,* a small thorny plum tree of Europe, sparingly naturalized in the Eastern U. S. This black austere fruit is used for preserves, for making a factitious port wine, and for dyeing black. The unripe fruit yields German acacia, a substitute for gum-arabic, and the wood is made into walking-sticks.

**Slo′nim,** town of Russian Poland, government of Grodno, has some manufactures, and 8708 inhabitants.

**Slootsk,** town of Russian Poland, government of Minsk, on the Slootch; is built of wood. P. 5174.

**Sloth** [Ang.-Sax. *slăwdh*], the English name for the species of the family Bradypodidæ, notable for sluggishness. The form is quite characteristic, and somewhat recalls that of the Primates (man and monkeys) in the exclusion of the members from the common abdominal integument, the length of the limbs, and especially of the fore ones, and the atrophy of the tail. The skull is oblong and compressed, with the rostral portion much abbreviated; the intermaxillary bones much reduced; the supramaxillaries widest in front and converging backward; malar bones disconnected from the zygomatic processes of the squamosal bones, and each with a "supratemporal" process; "the mastoid bone with a wide digastric fossa, and a strong, thick styloid process, terminating in a circular concavity for the reception of the stylohyal bone;" the lower jaw has a gutter-like symphysis; molar teeth $\frac{5}{4} \times 2$, simple and rounded; the members are slender and elongated, the anterior especially so; pelvis moderate; posterior limbs shorter than the anterior; toes in reduced numbers, two or three (fully developed) in front and three behind. The species thus agreeing differ considerably in other characters. (1) Some have three fully-developed toes to the front as well as hind feet, and rudimentary lateral (first and fifth) ones; these have also the thorax comparatively short, and expanded toward the middle, and with about fifteen ribs; the neck is rather elongate, and provided with nine vertebræ, and the tail is moderately developed (with about ten vertebræ). Such are the Bradypodinæ. (2) Others have two toes to the front feet, but three to the hind (besides which, however, are lateral ones represented by metacarpals); the thorax is elongated and subcylindrical, and with about twenty-one ribs; the neck is comparatively short, and with six or seven vertebræ; the tail is almost wanting. To this group has been given the name Cholœpodinæ. All the species are confined to South and Central America. Numerous peculiar characters in addition to those mentioned are exhibited by the skeleton, as well as by the nervous, vascular, muscular, and digestive systems. One of the most remarkable features is the number of cervical vertebræ. Almost without other exceptions (the manatees form one) mammals have seven cervical vertebræ, and no more or less; but in the sloths some (the Bradypodinæ) have as many as nine, while one (*Cholœpus Hoffmannii*) has only six, although its near relations (*e. g. Cholœpus didactylus*) have seven. The species are ill-adapted for progression on the ground, the feet being bent inward or "club-footed," but are admirably fitted for life in the trees. Unlike all other mammals, they cling to the branches by their feet with the back downward, and thus they progress, feed, and sleep. They rarely or never voluntarily descend to the ground, but when one tree is denuded of its leaves proceed from it to a contiguous one by means of interlocking or neighboring boughs. The species have not yet been definitely distinguished. By the latest writer on the group (Dr. J. E. Gray) twelve species are admitted—viz. two of *Bradypus* and eight of *Arctopithecus* (both of which genera belong to the sub-family Bradypodinæ), and two of *Cholœpus,* the type of the sub-family Cholœpodinæ. THEODORE GILL.

**Slough,** tp., Limestone co., Ala. P. 1468.

**Slough** (JOHN P.), b. at Cincinnati, O., in 1829; became a lawyer in his native city, and a member of the Ohio legislature, from which he was expelled for striking a fellow-member (1850); settled soon afterward in Kansas, and subsequently (1860) at Denver, Col.; raised a company of volunteers at the outbreak of the war, and became colonel of the 1st Colorado regiment, which formed a part of Gen. Canby's expedition to New Mexico; fought there, against orders, the battle of Pigeon's Ranche, gaining a victory over Gen. Sibley, who was forced to withdraw to Texas; went thereafter to Washington, where he was made brigadier-general and military governor of Alexandria; was appointed chief-justice of New Mexico by Pres. Johnson, and killed in an affray with a senator of the Territorial legislature Dec. 16, 1867.

**Slo′vaks,** a nation belonging to the Slavic family, inhabit the north-western part of Hungary, between the Carpathian Mountains and the Danube, and the adjacent regions of Moravia and Austria. Here they formed an independent empire, the kingdom of Moravia, in the ninth century, and fought with success against the Avars, but in 907, in the battle of Presburg, they were defeated by the Magyars, their kingdom dissolved, and the larger part of the nation incorporated with the Magyars, to whom, however, they never became reconciled. Their number is estimated at about 3,000,000, of which two-thirds are Roman Catholics and the rest Protestants. Their language is closely related to the Bohemian, and as the Reformation was introduced among them from Bohemia, the original Slovak language became so mixed up with Bohemian elements, and was so entirely superseded by the Bohemian as a means of literary communication, that it was on the point of disappearing. Of late, however, much pains has been taken to reinstate it in its natural rights, and books, periodicals, and newspapers are now published in it. Two collections of popular ballads (Pesth, 1823, and Ofen, 1834) have attracted great attention by the peculiar beauty of the songs. The Slovaks are chiefly agriculturists; many of them, however, stroll over all European countries as peddlers. The manufacture of mousetraps and other kinds of wire-work is a branch of industry much cultivated among them.

**Sloventzi, Slovenes, Vinds,** or **Corutans,** a South Slavic race of Carinthia, Carniola, Styria, and Hungary, number 1,260,000, and are mostly Roman Catholics of the Latin rite. The name *Vinds,* long applied to this people, has led to the confounding of them with the WENDS (which see), a distinct but remotely kindred race. The Vindish language is allied to the Servian. It is written in the Roman alphabet, and was, we are told, the first Slavic language to receive literary culture. But the suppression of the Reformation crushed its rising literature. There is, however, considerable recent literature, mostly religious.

**Slow′-Worm,** a name given occasionally to several species of reptiles of the order Sauria—*e. g. Anguis fragilis.*

**Slug,** a name applied to naked terrestrial mollusks, especially those of the families Arionidæ and Limacidæ. Both of these agree in having the body elongated, depressed, and attenuated backward; the mantle moderately developed; four tentacles, of which the posterior are large and support the eyes at their extremities, and the anterior are small; they differ, however, decidedly in several respects. The Arionidæ have the body subtruncated behind, and furnished with a muciferous pore; the lateral teeth of the lingual ribbon are modified on the plane of the median, and mostly more or less bicuspid; and the jaw is ribbed. The Limacidæ have the body pointed behind, and destitute of a pore, the lateral teeth of the tongue are uncine or aculeate, and the jaw is ribless. The name is also loosely applied to other naked mollusks, both of the land and the water. (See LIMACIDÆ, etc.) THEODORE GILL.

**Slug′-Worms,** popularly but incorrectly called **Slugs,** are the larvæ of certain of the saw-flies (Tenthredinidæ), insects usually assigned to the Hymenoptera, but in many respects resembling the Lepidoptera. The larvæ in question are slug-like in form. In the U. S. the pear, rose, vine, raspberry, walnut, linden, and other trees are infested with the larvæ of a peculiar species of *Selandria,* which are often very destructive. Decoctions of tobacco or quassia, whale-oil soap, a weak solution of carbolic acid, and petroleum are among the substances recommended for showering shrubs and trees infested with slug-worms. For small trees and shrubs hand-picking should be resorted to.

**Smack′over,** tp., Ouachita co., Ark. P. 660.

**Smalcald.** See SCHMALKALDEN and THIRTY YEARS' WAR.

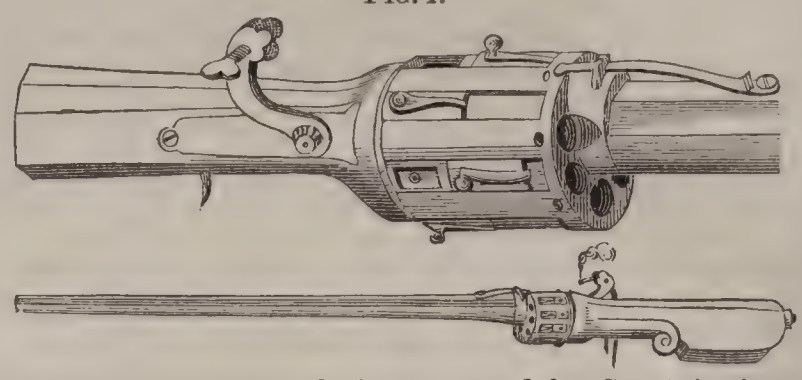
**Small** (JOHN), b. at Strathardle, Scotland, in 1726; served in the Scotch brigade in the Dutch service, in the pursuit of the Jacobites of Scotland 1747, at Ticonderoga 1758, at Montreal 1760, and in the West Indies 1762; was in the battle of Bunker Hill; raised a corps of Highlanders in Nova Scotia, the 84th battalion, known as the "Royal Emigrants," which he commanded as major in the campaigns of New Jersey and Pennsylvania; became lieutenant-colonel 1780, lieutenant-governor of Guernsey 1793, and major-general 1794. D. at Guernsey Mar. 17, 1796.

**Small′-Arms,** portable firearms: known as muskets, musketoons, rifles, carbines, pistols, and sporting arms or fowling-pieces. The chief components of small-arms are known as follows: The *barrel,* as smooth-bores or rifles, muzzle-loaders or breech-loaders; the *lock,* as match-lock, wheel-lock, or flint-lock, prior to the discovery of percussion powder; and as cap-lock, primer-lock, firing-pin lock, or needle-lock, since the introduction of percussion powder; the *stock,* as half-stock or full-stock.

The earliest firearms in use were not portable arms. Cannon, called bombards, were used "*in the attack*" upon towns and ships as early as 1350, but the Burgundians, in the *defence* of Arras in 1414, first successfully employed smaller tubes throwing lead balls. These were movable from place to place on the walls, and in order to check recoil the barrels were made with a hook near the muzzle to catch against the face of the wall; hence they were called *arquebuse,* or "hook-guns." For field use they were placed upon tripods, and in 1471, 300 Flemings, thus armed, accompanied Edward IV. when he landed at Ravenspur. The service of these arms was so difficult, and they were so little efficient compared with the English bow and arrows, that for fifty years thereafter all attempts to introduce firearms into the English army failed, although they were used in other armies. It is stated in the *United Service Journal* for Sept., 1832 (Moritz Meyer, *Technologie des Armes à Feu,* note, anno 1471), as sufficient explanation for this, that "the English archer of that period who did not discharge twelve arrows per minute, of which one only should fail its aim, was dishonored," and "at the distance of 240 yards the arrow could penetrate two or three inches of oak." Smooth-bore small-arms, even in our day, can do no better, either in rapidity of fire, accuracy of aim, or percussive force.

1471. This arquebuse weighed about 30 pounds, threw a ball of 3 ounces, was fired by a match held by the left hand to the vent on the *left* side of the barrel. Three men were assigned to serve each arm.—1494. An arquebuse, firing a ball of 1½ ounces, and having a match-lock, called a *serpentine,* attached on the right side of the barrel, is adopted in France and Spain for part of the infantry.—1480 to 1500. Fig. 1 shows lock of this description upon a revolving

FIG. 1.



Revolver with matchlock (1500), owned by Court-Antiquary Pickert in Nuremberg.

chambered gun, said to be now in a museum at Nuremberg.—1517. The wheel-lock is invented at Nuremberg, and applied to short arms for cavalry use.—1525. The *mousquet* (said to be so called from Mochetto de Villetri, who first attached barrel and ramrod to the present form of stock) was in use in Italy. It weighed 15 pounds, and was fired from a forked rest, which the soldier carried as a cane. (See Fig. 2.) Each mousqueteer wore a broad belt across the breast, to which wood cases containing the proper charge of powder were attached by leather thongs; also a ball-pouch and a priming-flask. Six yards of slow-match for firing was wound about the stock. At the battle of Pavia these mousquets were used with such effect by the Spaniards under Charles V. that the army of Francis I. of France was utterly routed—"*all lost save honor.*" The balls readily penetrated the best armor of the knights, which, it is said, the old arquebuse balls could not do.

FIG. 2.

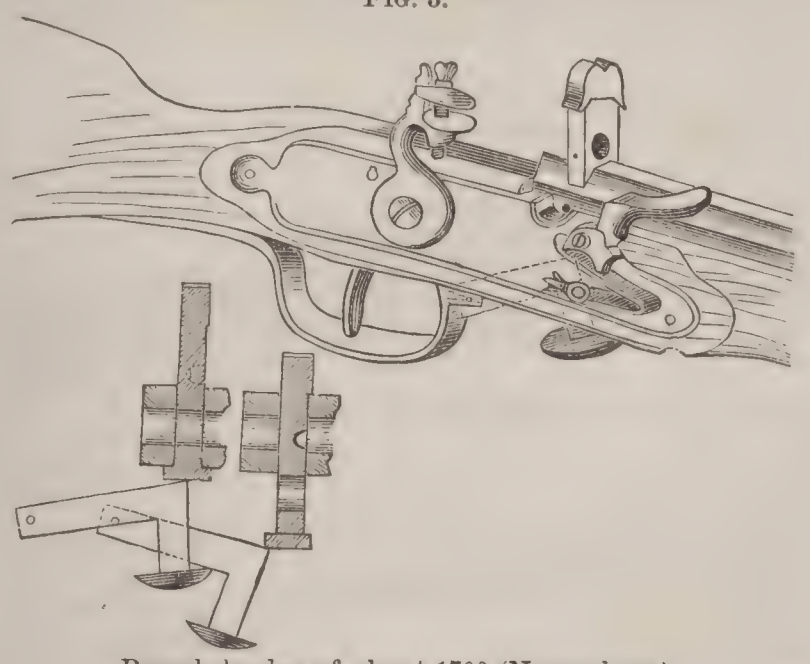


Mousqueteer of 1525.

Improvements in the models of small-arms, and in their ammunition, soon became of the first importance to nations; and notwithstanding the great advances made in field artillery, the possession of the best small-arm is even now justly regarded as the first requisite for success in battle. In view of the general interest of this subject, the dates of introduction of some of the important changes in the models and methods of manufacture of small-arms are here given. (For the greater portion of the earlier dates reference has been made to *La Technologie des Armes à Feu,* par Moritz Meyer.)—1530. The French cavalry have a short arquebuse and pistols, both with wheel-locks. A model of an infantry arm of this date shows a *sight,* a *pan-cover,* and the barrel let into the stock.—1540. An arm of this date (in England) loads at the breech, the charge is placed in a tin case, the barrel opens by a hinge at the breech; the lock is a wheel-lock.—1570. The French, German, and Spanish infantry have mousquets, part with wheel-locks and part with match-locks.—1592. A decree of this date abolishes the use of the bow and arrow by the French army.—1610. Gustavus Adolphus introduces cartridges having the ball and powder in the same paper cylinder; also the cartridge-box to receive the number allowed to each soldier. The Swedish musket calibre is fixed this year at 0.72 inch, and so remains until 1810.—1630. A flint-lock is proposed for small-arms in France, and the rifled carbine adopted. Four carbines are to be issued to each cavalry company.—1640. The bayonet is first proposed in France. It is made with a wooden handle, which enters the muzzle of the gun, and must be removed in order to fire.—1647. The mousqueteers are so harassed by the cavalry charging while they are loading their arms that orders are given to arm one-third of each regiment with pikes.—1671. The French adopt a flint-lock arm,

which they call the "*fusile*" (from the Italian name given to the flint-and-steel box, or to the steel used to strike the flint). It has a hammer (with a notch to catch the trigger) placed on the inside of the lock-plate, and a bayonet, with wooden handle to enter the muzzle. The gun weighs only 9½ pounds, and can be fired from the shoulder without a rest. This arm is soon adopted by the Spaniards, Austrians, and Germans.—1686. The English arm three regiments with the French fusil, the 7th, 21st, and 23d; these are called the *Royal Fusileers*, and retain the name to this day on the army list.—1689. The bayonet is fitted with a socket-handle, fitting around the muzzle; said to have been invented by the English general Mackay. This improvement is soon universally adopted.—1700. Figs. 3 and 4

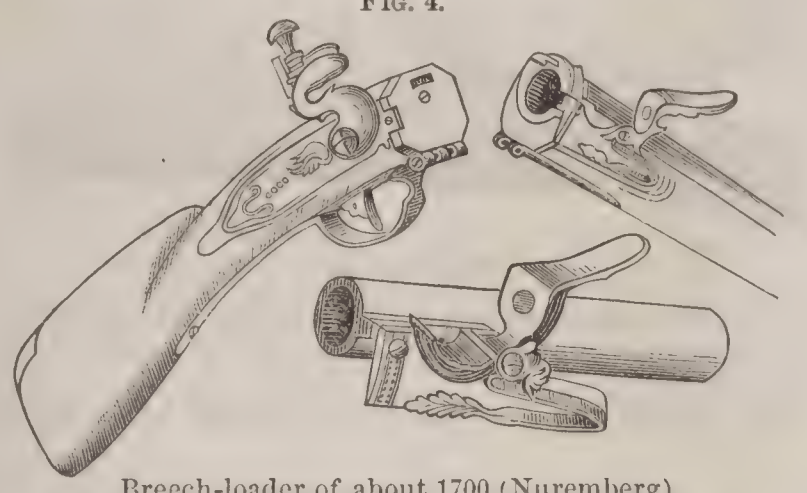
FIG. 3.



Breech-loader of about 1700 (Nuremberg).

show breech-loading arms proposed about this date; models now exist in Nuremberg.—1722. Verifying gauges are

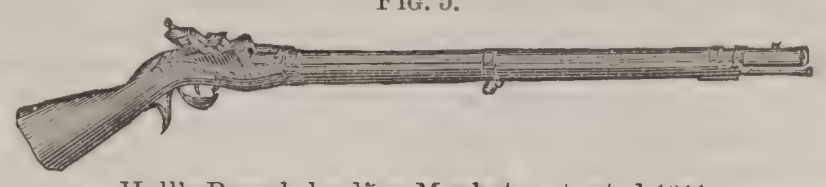
FIG. 4.



Breech-loader of about 1700 (Nuremberg).

adopted for making the new French fusil, called model 1717. It is proposed to make parts of the fusil lock *identical* and *interchangeable*. Trials are commenced at St.-Étienne.—1730. Iron ramrods first introduced. In Russia it is proposed to use the "elliptical ball," having a cavity in the rear, "found to have great percussive force, especially when fired from rifled guns." This is the first suggestion of the present cylindro-ogival ball, with cup in the base. The "*bridle*" of the lock is introduced, also the "*tumbler*," separated from the hammer.—1732. The plan of making lock-work "identical" does not succeed, and is abandoned in France.—1738. The buck-and-ball cartridge is introduced in Sweden. The English call their infantry arm "*musket*." The French apply the word *mousquet* to arms made prior to the flint-lock. The flint-lock arms for infantry are called "fusil."—1740. In France it is proposed to rifle the carbine barrel for a length of only 8 inches nearest the muzzle, leaving the calibre of the rest of the barrel the same as the bottom of the grooves. (This plan has recently been again proposed in England and the U. S. In 1874 it was ordered to be fully tried at the U. S. armory, and proved of no advantage.)—1777. A new system of models for all small-arms ordered in France.—1785. Gribeauval, in France, proposes to try again to make the metal parts of the fusil "identical and interchangeable." After ten years' work the plan is again abandoned. In the opinion of the commission, "swedging in dies injures the strength of the metal;" "is more expensive, because of more numerous rejections," and "from the rapid destruction of the dies the work is less accurate." Gassendi, in 1819 (*Aide Mémoire d'Artillerie*), warmly condemns the plan as impracticable.—1791. In France the fusil lock is simplified—parts reduced from 20 to 12.—1792. A turning-lathe, to finish the conical exterior of the barrel, is introduced at St.-Étienne in France. The *flats* have to be filed after the turning is finished.—1807. Rev. Mr. Forsyth of England first proposes to use a priming of percussion-powder for small-arms, the powder to be chiefly of chlorate of potassa. At the trial one priming sufficed for forty discharges of the gun.—1813. Hall, in the U. S., proposes a breech-loading arm, to be made on the system of "interchangeable" parts, which had been condemned by the French. (Fig. 5.) He

FIG. 5.



Hall's Breech-loading Musket, patented 1811.

receives an order for trial.—1816. Blanchard, at Springfield Armory, introduces his turning-lathes for the *exterior* of the barrel, finishing the flats in the lathe, as well as the conical parts.—1817. Shaw of Bordentown, U. S., first proposes to use percussion-caps to prime small-arms. Hall having finished 100 of his arms, they are tried by a commission, and found, both in the interchange and quality of work, so satisfactory that he is employed to superintend the introduction of this method of manufacture at the U. S. armory, Harper's Ferry.—1818. In Birmingham, England, musket-barrels are successfully welded and drawn to shape and size under rollers; after the first welding the iron need be at a *red* heat only. A hand machine for rifling barrels is invented in France; the barrel is made to turn regularly as the cutting-rod advances from end to end.—1818. At St.-Étienne the principle of proving the straightness of gun-barrels by the reflection within of a straight edge is said to be understood, although the method of straightening by a string continues in use there and elsewhere for many years after this date.—1819. Fulminate of mercury is first proposed in England for percussion-caps, in place of chlorate of potassa.—1820. This year a copper percussion-cap was brought to France by a workman from England (*Catalogue Musée d'Artillerie*, 1862, p. 637); also, this year the discovery is ascribed to Déboubert (Deane's *Manufacture of Firearms*, 1858, p. 90). Hence Shaw's claim (see 1817) is considered prior to both, and has been so recognized by an honorary award from the U. S. Congress.—1820. Blanchard completes his gun-stock machine at Springfield.—1822. A new model musket is adopted. Many parts made upon the interchangeable system.—1825. Breech-loading muskets and rifles of Hall's pattern are made complete this year at Harper's Ferry, the parts interchangeable and accurate.—1827. 100 of Hall's arms, sent to Springfield in 1824, are brought to Harper's Ferry and there compared with 100 arms of current manufacture. All being dismounted, and the parts of each 100 thoroughly intermingled, are remounted, using for each lot of metal parts the stocks previously belonging to the other lot. All the 200 are found to be well fitted. The cost of manufacture of Hall's arms has been reduced nearly one-half by use of identical machines.—1828. Trials by companies at Fort Monroe of Hall's arms prove them to be very satisfactory as compared with muzzle-loading arms.—1832. Changes of form in many parts of the U. S. flint-lock musket are introduced in 1832 and 1840, with a view to facilitate the machine-work—without change of calibre or of ammunition; also, a new model percussion musket is in hand at Springfield in 1840.—1841. The Harper's Ferry rifle, cal. 0.54 inch, made this year, has the percussion lock and cone for cap.—1842. The new model rifle musket, cal. 0.69 inch, is made with percussion lock and cone, and trials in progress to determine the best form of ball.—1844. All flint-lock muskets in store inspected and classified for conversion to percussion, and trials in progress of different plans of alteration.—1847–48. During the war with Mexico the U. S. troops used the following varieties of small-arms: *infantry*, flint-lock and percussion smooth-bore muskets; *cavalry*, percussion B.-L. Hall's carbine, cal. 0.52 inch, North's pattern; *mounted rifles*, Harper's Ferry rifle, cal. 0.54 inch, percussion; *artillery*, musquetoons, smooth-bore, percussion, cal. 0.69 inch; pistols, flint and percussion, both smooth-bore, cal. 0.54 inch. The advantage of the interchangeable system of construction—fully tried in this war—proves to be very great in facilitating repairs in the field. All U. S. arms in Mexico are readily kept serviceable by the ordnance company, using extra parts kept ready for exchange.—1853. The English obtain machinery in the U. S. for introducing the U. S. system of manufacture at Enfield. The Maynard tape-primer is ordered to be adopted as a substitute for the percussion-cap, and experiments made this year to perfect the lock and primer. New models are prepared for musket, rifle, and pistol-carbine; also a plan of converting smooth-bores to rifled percussion cal. 0.69 inch, by attaching a new lock and breech-piece. In doing this work at Frankford arsenal, Philadelphia, rifling-machines are for the first time used which cut three

grooves simultaneously by means of expanding cutters, operated by a central cone in a tubular rod; also, a method of threading breech-screws and tapping barrels by machinery, which for the first time produces identical screws, thus completing the system of interchangeable parts in gun-making. Previously, breech-screws were fitted by hand to each barrel.—1855 and 1856. New models on trial are adopted for all muzzle-loading small-arms to be 0.58 inch cal., and with the primer-lock. Experiments are made testing the best form of elongated ball and weight of cartridge for the different arms.—1860. It is decided to abandon the Maynard primer and use the percussion-cap, without changing lock at present.—1861. War begins in April; Harper's Ferry armory broken up; that at Springfield ordered to be immediately extended.—Mar. 4, 1861. Small-arms in store, as per report of the chief of ordnance:

| | |
|---|---|
| Muskets, smooth-bore | 336,788 |
| Rifles and rifled muskets | 106,397 |
| Smooth-bore pistols | 24,303 |
| Revolvers | 3,928 |
| Breech-loading carbines | 4,076 |
| Total | 475,492 |

To increase the supply of arms promptly—in June, 1861—contracts are made (in the U. S.) to manufacture 0.58-inch cal. rifled muskets, to be interchangeable with each other and the Springfield arm, and to manufacture breech-loading rifles, revolvers, and carbines of various patterns; all small-arms, home-made and imported, are purchased as offered. The following table shows the total number of small-arms provided by the government for the use of its armies from Jan. 1, 1861, to June 30, 1866:

| 1861. | Muskets. | | | Rifles. | | Carbines. | | Revolvers. | | Pistols. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | S.-bore, flint and perc'n. | Rifled, U. S. pattern. | Rifled, foreign. | U. S. muzzle-loading. | Repeating and breech-loading. | M.-L. and musquetoon. | B.-L., U. S. makes. | U. S. pattern. | Foreign patt'n. | S.-bore muzzle-loaders. | |
| On hand Mar. 4, 1861 | 336,788 | 73,544 | ..... | 32,855 | ..... | 2,721 | 1,355 | 3,928 | ..... | 24,303 | 19 varieties of B.-L. carbines, U. S. pattern. |
| Purchased in open market and from contractors | 113,034 | 670,617 | 1,055,862 | 22,793 | 32,048 | 10,838 | 396,896 | 360,034 | 12,789 | 648 | 8 varieties of repeating B.-L. rifles, U. S. pattern. |
| Fabricated U. S. armory | ..... | 805,537 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 13 varieties of revolvers, U. S. pattern; 3 varieties of foreign revolvers. |
| Total | 449,822 | 1,559,698 | 1,055,862 | 55,648 | 32,048 | 13,559 | 398,251 | 363,962 | 12,789 | 24,951 | |

| | |
|---|---|
| Total small-arms provided | 3,966,590 |
| Total on hand, serviceable and unserviceable, June 30, 1866 | 2,649,439 |
| | 1,317,151 |
| Number retained by soldiers and paid for by them, besides sabres | 158,244 |
| Difference, lost and consumed | 1,158,907 |

1866. Report of chief of ordnance, dated Oct., 1866, states that the returns made by regiments of losses, by wear and tear, during the *three consecutive years of active warfare*, show as follows:

Cavalry, carbines, 20 per cent. per annum.
" pistols, 26 " " " "
Infantry, muskets, 13 " " " "

Jan., 1866. A board of officers (Gen. Hancock, president) called by the secretary of war to examine and report what form and calibre should be adopted for breech-loading muskets and carbines, and what form of conversion for muskets from muzzle-loading to breech-loading should be adopted. After testing 22 varieties of breech-loading muskets and 17 varieties of breech-loading carbines, the board reported that their experiments had shown the best calibre for muskets to be 0.45 of an inch, the best charge of powder from 65 to 70 grains, and best weight of ball from 480 to 500 grains; that they could not recommend any of the patterns presented for a new breech-loading musket or carbine, considering all to be capable of further improvement. For altering arms they recommend the reduction of calibre by inserting a tube (as then under trial at Springfield) and using a hinged breech-block.—1869. A board of officers (Gen. Schofield, president) called by orders of the general of the army to meet at St. Louis, Mo., to select the six best patterns of muskets for infantry, and carbines and pistols for cavalry. After examining 34 varieties of breech-loading muskets, 8 varieties of carbines and 8 of pistols, the board recommended the Remington, Springfield, and Sharps's systems of breech-loading as superior to others (in the order named), and alone suitable for adoption by the government without further trial in the hands of troops.—1870. Upon the recommendation of the chief of ordnance, muskets and carbines of each system, and also of the Ward-Burton system of magazine breech-loader, were prepared and placed in the hands of companies of infantry and cavalry for comparative trial in service during a period of not less than twelve months, monthly reports to be made regularly by company commanders, and at the end of the time appointed to be laid before a board of officers appointed to select a suitable breech-loading arm for adoption for the military service.—1872. In compliance with an act of Congress approved June 6, 1872, a board of officers (Gen. A. H. Terry, president) was appointed to meet in New York and Springfield in Sept., 1872, "to recommend a breech-loading system for muskets and carbines to be adopted for the military service; which system, when so adopted, shall be the only one to be used by the ordnance department in the manufacture of muskets and carbines for the military service." After the trial and examination of 99 varieties, besides 9 varieties of breech-loaders in use by foreign nations, the board (May, 1873) recommended that the "*Springfield breech-loading system* be adopted for the military service"

Fig. 6.



Springfield.

(see Fig. 6); which recommendation having been approved, all breech-loaders for the U. S. army are now made upon that system.

Fig. 7 shows the Martini-Henry, adopted by England;

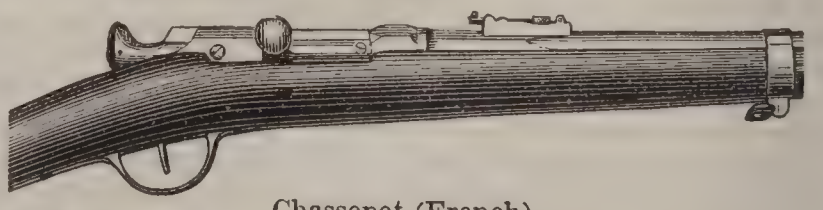
Fig. 7.



Martini-Henry (English).

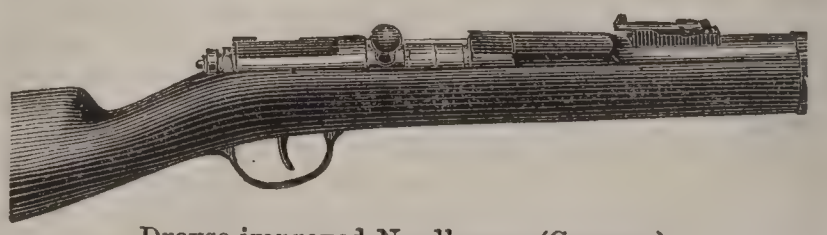
Fig. 8, Chassepot, adopted by France; Fig. 9, needle-gun,

Fig. 8.



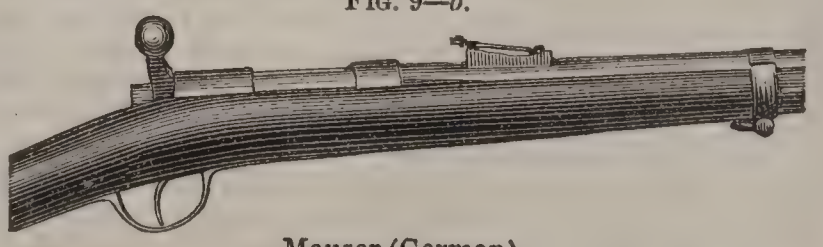
Chassepot (French).

Fig. 9—*a*.



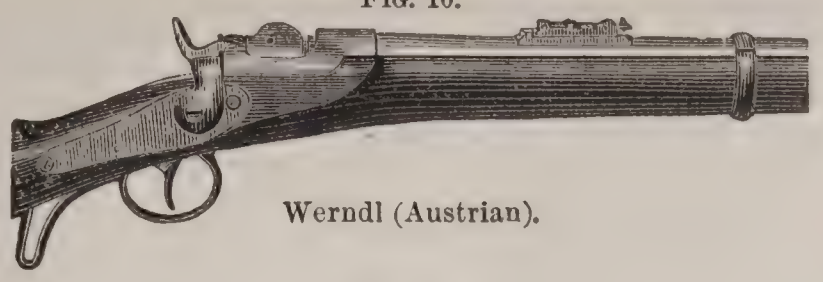
Dreyse improved Needle-gun (German).

Fig. 9—*b*.



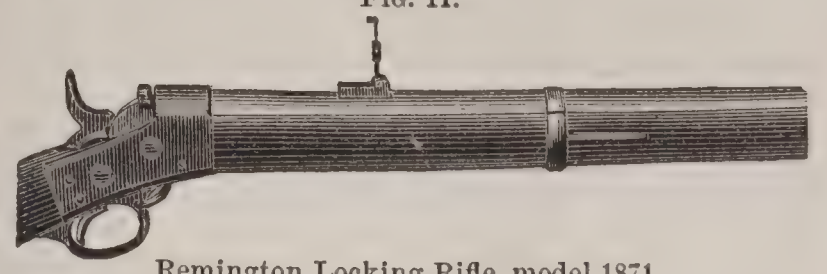
Mauser (German).

FIG. 10.



Werndl (Austrian).

FIG. 11.



Remington Locking Rifle, model 1871.

FIG. 12.



Russian Berdan.

FIG. 13.



Vetterlin (Swiss).

FIG. 14.

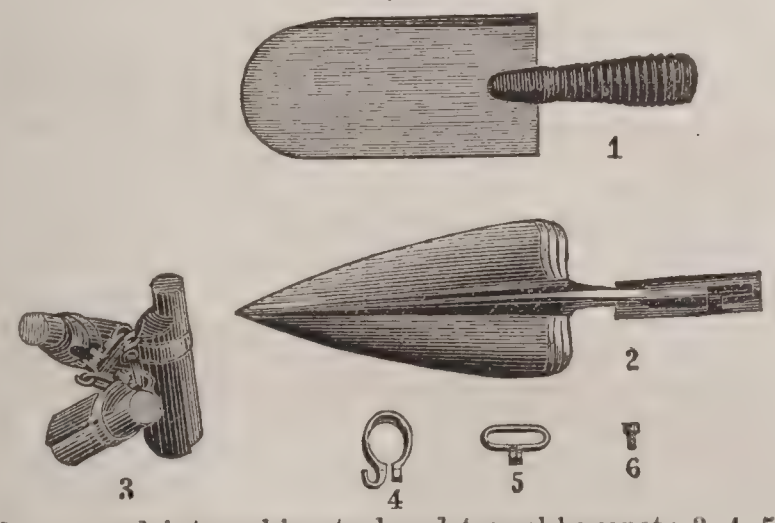


Werder (Bavarian).

adopted by Prussia; Fig. 10, Werndl system, adopted by Austria; Fig. 11, Remington system, adopted by Spain; Fig. 12, Berdan system, adopted by Russia; Fig. 13, Swiss model; Fig. 14, Bavarian model; Turkey uses Martini-Henry's (English), and Denmark and Sweden the Remington's model. France has recently altered the Chassepot to use the metallic cartridge.

*Description of the Springfield Model.*—The *barrel* is of "low steel," cal. 45 inches; rifled with three concentric grooves of equal widths with the lands, and of the uniform depth of .005 of an inch, and uniform twist of one complete turn in 22 inches. The *lock-plate* is 0.175 inch thick, and let in flush. The exterior metal-work (except the bayonet) is browned. An open swivel is attached to the upper band, for stacking arms, instead of locking bayonets, as heretofore; also, a "trowel-bayonet" and "intrenching-tool" proposed. (See Fig. 15.) Length of rifle-barrel, including receiver, 36 inches; of carbine, 25.4 inches. Length of rifle bayonet, 18 inches; crook of stock, 2½ inches, and distance from butt to trigger, 13½ inches. Total length of rifle, without bayonet, 51.9 inches; of carbine, 41.3 inches; weight of rifle, without bayonet, 8.38 pounds; of carbine, 6.87 pounds. Triggers adjusted to pull at 6 to 8 pounds.

FIG. 15.



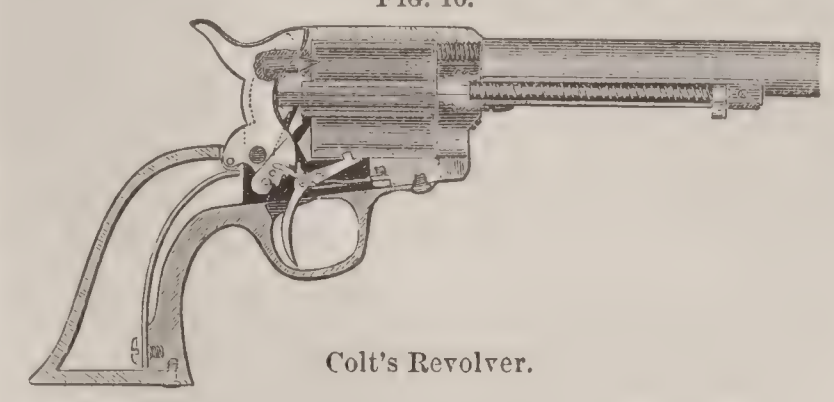

1, 2, proposed intrenching-tool and trowel-bayonet; 3, 4, 5, 6, Merrill Upper Band.

*Details of Practice.—Rapidity of fire,* using service cartridge-box, 12 to 13 times per minute: a very skilful expert has fired 23 times per minute. *Drift,* or deviation, of the projectile to the right, for the rifle at 500 yards, is 25 inches. Initial velocity of rifle-ball, with 70 grains of powder, 1350 feet; of carbine-ball, with 55 grains of powder, 1100 feet. Pressure per square inch, 19,000 pounds. Force of recoil with rifle, with service charge, 174 pounds; of carbine, with service charge, 155 pounds; of carbine, with rifle charge, 182 pounds. Penetration into white pine (1 inch corresponds in force with that producing dangerous wounds upon the body), with the rifle at 100 yards, 17.2 inches; with the carbine, 14.5 inches; with the rifle at 1200 yards, 3.7 inches. The range corresponding with the *maximum continuous dangerous space,* holding the gun 56 inches from the ground, is 262 yards for the rifle, and for the carbine 204 yards (the foot-soldier (height, 68 inches) is covered at all distances between these points and the firer): the like *maximum dangerous space* for cavalry (height, 8 feet) is 291 yards for rifle and 230 yards for the carbine. Hence the best range for military practice-firing is 300 yards, about. (See *Description and Rules,* published at National Armory, 1874.)

*Cadet Rifle,* a special arm made at Springfield for the corps of cadets and for students of colleges and universities receiving military instruction. It has the same calibre, but is shorter and lighter than the infantry rifle-musket, and is sighted to use the carbine cartridge. Dimensions: length of barrel, 29.6 inches; length of arm complete, without bayonet, 48.92 inches, and with bayonet, 65.15 inches. Weight of arm, without bayonet, 8 pounds 3 ounces; weight of bayonet, 10 ounces.

*Revolvers for Cavalry, using the Metallic Cartridge.*—Three systems of construction are now under trial in the U. S. service—the Colt's (Fig. 16), the Schofield, Smith & Wesson's, and the Remington. The principal differences are as follows:

FIG. 16.



Colt's Revolver.

| | Colt's. | S., S. & W. | Remington. |
|---|---|---|---|
| Total length | 12.5 inches. | 12.5 inches. | 13.03 inches. |
| Length of barrel | 7.5 " | 7.5 " | 7.46 " |
| Diameter of bore | 0.45 " | 0.435 " | 0.44 " |
| Number of grooves | 6 | 5 | 5 |
| Twist, 1 turn in | 16 inches. | 20 inches. | 26 inches. |
| Depth of grooves | .005 " | .0075 " | .004 " |
| Total weight | 2.31 pounds. | 2.50 pounds. | 2.60 pounds. |

Weight of charge, the same for all—28 grains of powder and 230 grains of ball. A special holster is made to receive each revolver.

*Private Factories for Small-Arms.*—The system of forging the metal parts of small-arms in swedges and dies, and finishing them by milling-machines, producing identical and interchangeable parts, brought into successful use for the first time in the national armories of the U. S., is now universally followed in the large private factories, and with great advantage both in the cost of production and in quality of work. Iron and steel swedged to shape under the drop must needs be of uniform good quality or the material fails in the working, and the part is lost after labor has been expended upon it. Hence, the manufacturer finds himself enforced, on the score of economy, to use the better kinds of material, as less costly than to return to hand-work. The larger arms-factories of this country, thoroughly equipped with appropriate machinery, are thus enabled to produce so rapidly and of such uniform good quality that they supply a large proportion of the world's demand, at prices not exceeding hand-work of inferior finish.

The following-named private factories are now making small-arms of special patterns for military use in different countries: Colt's Co., Hartford, Conn., making rifles and pistols, revolvers; Sharp's Co., Hartford, Conn., making Sharp's breech-loading rifles and carbines; Winchester Co., New Haven, Conn., making Winchester repeating rifles and carbines; Providence Tool Co., Providence, R. I., making Peabody rifles; Remington Arms Co., Ilion, N. Y., Remington's rifles and revolvers.

The zeal aroused of late years in rifle-shooting has also done much to give notoriety to U. S. arms, as well as to U. S. marksmen. At the International rifle-match at Creed-

moor in 1874, Fulton of the American team, firing 15 shots at each of the three targets, 800, 900, and 1000 yards distant, scored 171 points—higher by 5 points, it is said, than any known score; possible maximum, 180 points. He used the Remington target-rifle, loading it at the muzzle. (See *Report of Executive Committee Amateur Rifle Club*, 1875.) P. V. HAGNER.

**Small-Arms, Cartridges for.** See CARTRIDGE.

**Small Pi'ca,** in typography, type one size smaller than pica. (See PRINTING.)

**Small'-pox,** or **Vari'ola,** is the most important of the group of acute general contagious diseases known as the *exanthematous fevers,* since, when not controlled by vaccination, it is the most fatal of them all. It is said to have prevailed in Eastern countries from the most remote antiquity, but its early history is shrouded in obscurity. Aaron or Ahroon, an Alexandrian priest, who lived in the early part of the seventh century, is said to have first described the disease in an extinct work entitled *Pandects of Medicine.* Some have traced an allusion to it in certain passages of the Old Testament, as, for instance, Moses's record of "the plague of boils and blains." The Greek writers included small-pox and measles under the term λοιμική. The Latin word *variola,* now generally employed by medical writers, is said to have been first used by Constantinus Africanus in the eleventh century. The first appearance of small-pox in Europe is supposed by some to have been the epidemic *cum pusulis et vesicis, quæ multum populum affecerunt morte,* described by Gregory de Tours as having prevailed in France in the reign of King Childebert about the year 520; it is more generally considered, however, that the disease was first brought to Europe by the Saracens about the year 710. Spreading from Spain, it soon overran Europe, but spared for a time certain isolated countries, such as Denmark, where it first appeared in 1527. It was carried to the West Indies in 1517 by the adventurers who hastened to profit by Columbus's discovery of the New World. It reached Mexico in 1520, and Brazil in 1563. Farther north it first appeared in Maryland, having been brought there by an English ship in the early part of the seventeenth century. Thence it rapidly spread through Virginia, the Carolinas, New England, and other portions of the colonies.

Up to the beginning of the present century, when its ravages were decidedly checked by VACCINATION (which see), it continued its course as a deadly pestilence almost always and everywhere present, sparing no age, sex, condition, or nationality, no one being safe from it except by virtue of having already passed through its perils. Its history, like that of the other acute contagious diseases, is that, while always prevailing to a certain extent, especially in large cities, it raged as an epidemic every few years. This periodical recurrence of epidemics is doubtless chiefly due to the fact that each epidemic exhausts nearly all the subjects susceptible to the disease, so that a certain time has to elapse for a sufficient number of others to be born into the world to afford the material for a fresh outbreak. The last great epidemic of small-pox began in 1870, overrunning all Europe and North America, and abated in 1873.

Of the original cause of small-pox we know nothing, but we do know that it now never occurs save as the consequence of infection conveyed from one person to another. The contagion exceeds in virulence that of any other disease. The infectious principle is known to reside in the fluid contents of the pocks and in the crusts resulting from their desiccation, and it is probable that it is also contained in many if not all of the fluids of the body. Moreover, it pervades the emanations from the person, so that actual contact with the sick is not necessary to the conveyance of the disease. To what distance the volatile contagium may extend is uncertain, but it is known to have crossed a river 1500 feet wide. In its fixed condition, attached to articles of clothing, bedding, merchandise, mail-matter, paper money, etc., it is very energetic and persistent. The disease is communicable at all periods of its course, even in the period of incubation, before any symptoms have occurred, and as late as the close of the stage of decrustation; but probably it is most intensely contagious during the vesicular stage of the eruption. Even the dead body is capable of conveying the infection. It may also be carried from one person to another without the person who carries it himself suffering an attack. This is termed "mediate contagion." It is reasonably certain that the prevalence of the disease is more or less influenced by the season of the year, and perhaps by the state of the weather, but the effects of these differ in different countries and in different years, so that the precise part which they play in the production of epidemics can scarcely be stated.

Very few persons (certainly not more than five in every hundred) are naturally and permanently insusceptible to small-pox, and very few are even temporarily insusceptible, except from having already had the disease or from having been vaccinated. Very young infants have been supposed to be rather insusceptible to the infectious diseases, yet it is among children, including very young ones, that small-pox makes its greatest havoc, and it is by no means rare for it to attack the unborn child. One attack of the disease generally exempts the affected person from subsequent attacks, but in exceptional cases second attacks do occur, and even fifth and sixth attacks have been recorded. The immunity conferred by vaccination is almost as complete as that which results from having had the disease.

On contracting the small-pox contagion the individual shows no signs of the disease until after the lapse of a *period of incubation,* which generally lasts thirteen days. It is occasionally a few days shorter, especially in persons who have been vaccinated, and in the case of inoculated small-pox it is remarkably abridged, the local phenomena resulting from the inoculation being observed to begin in two or three days. The *initial stage* is usually ushered in by a violent chill or by repeated slighter chills, followed by high fever, weakness, vomiting, severe headache, and pain in the back. Delirium is frequently observed, and in children convulsions or coma. This stage lasts from two to four (usually three) days, and death may occur before its termination. A preliminary rash—commonly of a roseolous character—is sometimes observed during the initial stage. This is of some value from a prognostic point of view, but must not be confounded with the essential rash which marks the *eruptive stage.* Little red elevations of the skin (somewhat pale at first) appear upon the face and head, and a few hours afterward upon the back, breast, arms, abdomen, legs, and feet. These elevations vary in size from that of a millet-seed to that of a pin-head. They are often more plainly to be felt than seen. They are usually the most numerous on the face. On the second day after their appearance (fifth day of the disease) they have increased in size, constituting distinct papules, and are of a darker hue. On the third day (sixth of the disease) they are more conical, and each papule shows at its summit a minute vesicle containing a clear, lymphy fluid. These vesicles encroach more and more upon the area of the papule from day to day, the remains of the latter being visible as a delicate red line surrounding the vesicle. The vesicle itself is flattened, circular, of a pearly-white color, and very frequently depressed at the centre ("umbilicated"). By the seventh or eighth day (tenth or eleventh of the disease) it has reached the size of a split pea, and, the central depression being effaced, is nearly hemispherical in shape. On the outbreak of the eruption, or soon afterward, the fever disappears or moderates for the time being, according to the severity of the case; but about the sixth day of the eruption (ninth of the disease) the contents of the vesicle, which have gradually been growing opaque, become completely changed into pus. In other words, the vesicle becomes a pustule, the red line or halo surrounding it becomes increased in breadth, and the *stage of suppuration* or *maturation* begins. In mild cases this stage is accompanied by little or no fever, but in severe cases of confluent small-pox the *secondary fever* is generally well marked, being sometimes announced by a chill or chills, and lasting from three to six or eight days, according to the severity of the case. With the renewal of fever there is a return of headache, nervous disturbances, such as delirium, etc., the skin becomes enormously swollen, so that the countenance is frightfully disfigured, and the pustules are exquisitely painful, especially upon the face, the hands, and the feet. At this time the formation of boils is quite common, and numerous complications are apt to occur, such as erysipelas, diffuse inflammation of the cellular tissue, pyæmia, gangrene, affections of the organs of special sense, pleurisy and other inflammatory diseases of the respiratory apparatus, affections of the heart and great vessels, and occasionally abdominal inflammations. About the eleventh or twelfth day of the eruption (fourteenth or fifteenth of the disease) the pustules begin to dry up, which process characterizes the *stage of desiccation.* The general and local symptoms now gradually abate, and the pustules, beginning generally with those on the face, dry into hard, dark-brown crusts. Preceding this occurrence, a yellowish, gum-like exudation frequently takes place upon the surface of the pustules, especially if they have been ruptured, and concretes into a rough, brittle coating overlying the darker and firmer crusts. During the stage of maturation and the earlier portion of that of desiccation the patient's body exhales a peculiar and repulsive odor, which, together with his frightful appearance, makes him an object of horror as well as of pity. The process of incrustation is often accompanied by intolerable itching, and by scratching the course is so interfered with that secondary and tertiary crusts often form;

and this fact, as well as the varying severity of the cutaneous lesions, makes the period of decrustation somewhat variable. After the crusts have fallen off, the sites of their former attachment remain visible for a considerable time in the form of red and somewhat elevated spots, giving the patient a peculiar mottled appearance. In course of time the redness and swelling disappear without leaving any permanent marks, or else (in case the pocks have involved the papillary layer of the skin) the spots become whiter than the surrounding skin, radiated and depressed scars remaining for life. The individual is then said to be pock-marked.

As to the *structure of the pock* (vesicle or pustule), it is not a mere tent-like elevation of the cuticle from distension by a subjacent fluid, but the inflammation begins in the lower layers of the epidermis (the *rete Malpighii*), and soon results in the exudation of fluid *into the substance* of that portion of the skin, separating its cells and forming a multilocular swelling. Hence it is that, on puncturing the vesicle, only a small portion of its contents escapes, the fluid being contained in a number of separate compartments. Along with these changes in the epidermis (and perhaps preceding them, and therefore more essential) the subjacent papillæ of the derma, and even the fibrous corium, become hyperæmic and subsequently infiltrated. In so-called "diphtheritic" pocks the bases of the papillæ are so swollen and gorged with blood that their summits become strangulated, as it were, and die. These dead and bloodless heads of the affected papillæ form a white, pultaceous mass upon the floor of the pock—the "false membrane" of the older writers. Its formation is always followed by pitting. The umbilication of the pock is, as regards the mode of its production, still a matter of dispute. Many have supposed it to be due to a bridle-like action of that portion of the epidermis which dips down to form the lining of a sebaceous or sudoriparous follicle, and they assume that such a follicle constitutes the usual centre of a pock. Others attribute it to the early commencement of desiccation at the centre of the pock while yet the exudation is increasing at the border. In the vesicular stage of the pock the contents consist of a clear, viscid, albuminous fluid (lymph), containing epithelial débris, leucocytes, and very minute globular bodies, about $\frac{1}{30000}$th of an inch in diameter, termed microspheres, microzymes, etc. (also falsely called bacteria). It is probable that these latter bodies are, *par excellence*, the bearers of the contagium. They are supposed to be of a fungous nature, but attempts at their cultivation have resulted in nothing satisfactory. The crust includes the "false membrane" already mentioned, and occasionally a portion of sloughy tissue from the corium, or the subcutaneous layer of cellular tissue, is found attached to it.

Numerous *varieties* of small-pox are spoken of by writers. In the first place, we have the *discrete* and the *confluent* forms. In the former the pocks are separate and distinct from each other, the secondary fever is mild or altogether wanting, and, except for complications, the disease is not specially dangerous. The latter, as its name implies, is characterized by a running together of the pocks, and is always severe and frequently fatal. Semi-confluent eruptions show appearances midway between those of the discrete and the confluent, and betoken a corresponding severity of the disease. In *corymbose* small-pox the pocks are aggregated in clusters or in a single cluster, the eruption being elsewhere discrete. This form is rare and very dangerous. *Malignant* small-pox (black or hæmorrhagic small-pox) is characterized by the early occurrence of blood-poisoning, resulting in effusions of blood into the pocks and into the substance of the organs and tissues of the body, and in hæmorrhages from the mucous surfaces. It may prove fatal before the eruption has had time to appear. Such cases have been called *purpura variolosa*. *Benign* small-pox (*variola verrucosa*, or *cornea*, stone-pock, horn-pock, or wart-pock) is of occasional occurrence. It is exceptionally mild, although the primary fever may be severe. The pocks are abortive, and there is no secondary fever and no pitting. Small-pox *without eruption* (*variola sine exanthemate*, the *febris variolosa* of Sydenham) is of rare occurrence. The whole process consists of the primary fever. *Varioloid* is small-pox mitigated by previous vaccination. The initial fever may be severe, but the eruption is moderate, many of the pocks shrivel early, and there is no secondary fever.

In regard to the *sequelæ* or after-effects of small-pox, it may first be stated that it is capable of rousing into activity any dormant diathesis or morbid tendency, such as the scrofulous, tubercular, syphilitic, etc. Some have supposed that an attack of small-pox had a tendency to improve the general health; but not only is there no foundation for this opinion, the very reverse is the case. Ophthalmia, blindness, chronic ulcers, enlargements of the lymphatic glands, inflammation of the ear, boils or abscesses, cancrum oris, pestilential bubo and carbuncle, laryngitis, salivation, dropsy, necrosis, and many other affections have been known to follow the disease, apparently owing their origin to its occurrence.

The *post-mortem appearances* in small-pox, besides the results of inflammatory complications, consist mainly in degenerative changes in the organs, especially the liver, the kidneys, and the spleen, and hæmorrhagic effusions. On the mucous membranes, particularly near the natural openings of the body, pocks are found essentially like those on the skin. In the trachea they extend down to its bifurcation, and sometimes into the bronchi of the second and third orders. The brain and spinal cord are sometimes congested and œdematous, but generally healthy.

The *diagnosis* of small-pox is easy in cases where the eruption is well advanced, but in the earlier stages, as well as in sporadic cases and modified forms, it is often difficult, and sometimes impossible. It is most apt to be confounded with measles, chicken-pox, pustular syphilides, acne, and lichen among skin affections, and with typhus, relapsing fever, pneumonia, meningitis, and several other acute inflammatory diseases. Too much reliance should not be placed upon the appearance of the eruption, particularly in its earlier stages. The initial fever of small-pox is usually productive of a higher temperature than is that of measles (105° F. or over in the former, and from 102° to 104° F. in the latter); and in measles the catarrhal symptoms occur earlier than in small-pox. In chicken-pox there is little or no premonitory fever, and, if there be any, it lasts only twenty-four hours before the eruption appears, and the latter is more superficially situated and more rapidly developed than that of small-pox. Syphilitic eruptions and acne cause little or no fever, and can only be mistaken for small-pox by a too exclusive attention to the cutaneous appearances. Febrile lichen may for a short time be confounded with small-pox, but the eruption occurs after only one day's illness, appears on various parts of the body indifferently, and does not advance beyond the formation of papules. The preliminary roseola of small-pox often resembles the rash of scarlet fever, but its localization, together with the absence of the marked throat symptoms of the latter disease, will serve to distinguish it. The early diagnosis of small-pox from exanthematic typhus is often very difficult. In the former disease, however, the temperature falls on the appearance of the rash, but does not in the latter. The appearance of the eruption will distinguish variola from the first attack of relapsing fever. The acute inflammations are to be distinguished by a close attention to the local symptoms proper to them, and by the non-occurrence of eruption.

The *mortality* of small-pox varies in different epidemics, ranging in unmodified cases from 15 to 50 per cent. Of 46 hæmorrhagic cases observed by Curschmann, all proved fatal, while 235 cases of unmodified variola (including the 46 hæmorrhagic cases) resulted in 99 deaths—a mortality of over 42 per cent. Marson, of the London Small-pox Hospital, records 1838 cases of confluent small-pox, with 937 deaths (50 per cent.), 614 semi-confluent cases, with 51 deaths (8 per cent.), and 202 discrete cases, with 8 deaths (4 per cent.). Of 4896 cases of small-pox after vaccination (including good, bad, and indifferent vaccination), Marson saw death result from small-pox alone in 316 cases (6.56 per cent.). Confluent small-pox, even if the eruption be confluent only on the face and discrete elsewhere, often proves fatal. Certain abnormal conditions of the pocks—a flat, white, and pasty appearance, with claret-colored areolæ on the limbs—are of ill omen. Young children and aged persons are particularly apt to die if attacked by the disease. Symptoms of blood-poisoning or of a severe implication of the nervous system, as well as affections of the air-passages, are of bad import. Pregnant and lying-in women are in very great peril from small-pox. In the former abortion usually precedes death. Drunkards also are very apt to die. Robust and healthy persons, in good hygienic circumstances, are much more apt to recover than are those of the opposite description. Death may take place at any period of the disease, but is most common during the secondary fever.

The *treatment* of small-pox consists in husbanding the resources of the patient, and in early detecting and combating complications. No sort of medication or regimen exerts any curative effect in the proper sense of the word. Many so-called specifics have been vaunted, but there is no satisfactory proof that they have ever accomplished anything. Vaccination, although of such signal efficacy in *preventing* small-pox, is utterly powerless to cure it; and it has not been shown that vaccination of a person already suffering from small-pox can even ameliorate the disease, whether done in the ordinary way or by the subcutaneous injection of vaccine lymph. No treatment will prevent pitting.

The *prevention* of small-pox may be almost certainly accomplished by thorough VACCINATION (which see). Avoidance of exposure to the contagion will also, of course, prevent the disease, but this is difficult, and often impossible, to manage. Small-pox patients should always be isolated, and the funerals of those who die should be strictly private. All clothing, bedding, etc. which may have become infected should be destroyed by fire, or, if too valuable to be sacrificed, it should be disinfected by heat (as high as 212° F.) or by the fumes of burning brimstone. Every one exposed to the disease should be at once revaccinated. Patients are capable of conveying the infection until all the crusts have fallen off. FRANK P. FOSTER.

**Small'wood,** tp., Jasper co., Ill. P. 993.

**Smallwood** (WILLIAM), b. in Maryland about 1732; raised a battalion of Marylanders 1776, which he commanded as colonel, and half of which perished in the battle of Long Island, at which, however, he was not present; was engaged in the battle of White Plains; was appointed brigadier-general Oct. 23, 1776; accompanied Gen. Sullivan in the Staten Island expedition 1777; raised a new battalion of militiamen from the Western Shore of Maryland, whom he led at the battle of Germantown; was made major-general Sept. 15, 1780; was with Gates in his Southern campaign, but left after the defeat at Camden, refusing to serve under Steuben; was member of Congress 1785, and governor of Maryland 1785–88. D. in Maryland Feb. 14, 1792.

**Smalt.** See COBALT, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Smart** (BENJAMIN HUMPHREY), b. in England about 1785; was for more than fifty years from 1815 a successful teacher of elocution in London; was considered high authority upon English pronunciation, and was a voluminous writer upon grammar, logic, rhetoric, and metaphysics, in which last department he claimed to "assert, correct, and carry onward the philosophy of Locke." Among his works were *A Grammar of English Pronunciation* (1810), *Rudiments of English Grammar elucidated* (1811), *A Grammar of English Sounds* (1813), *Practical Logic* (1829), *An Introduction to Grammar on its True Basis* (1858), *Accidence of Grammar, Principles of Grammar, Manual of Rhetoric and Logic, The Practice of Elocution,* and *Historico-Shakspearian Readings,* the five latter being issued as a complete series in 1858; *Outlines of Sematology* (1831), with a *Sequel* (1837) and an *Appendix* (1839), the three works being issued together as *The Beginnings of a New School of Metaphysics* (1839); *The Way out of Metaphysics* (1844), *The Metaphysicians, a Memoir of Franz Carvel, Brushmaker, and of Harold Fremdling, Esq.* (1857), and *Thought and Language* (1855). Mr. Smart also published in 1836 a *Pronouncing Dictionary,* based upon that of John Walker, issued an epitomized edition of the same in 1840, and an *Appendix* in 1846 (revised editions 1860), which figure among the authorities upon pronunciation most frequently cited in the later editions of Webster's and Worcester's dictionaries.

**Smart** (CHRISTOPHER), b. at Shipbourne, Kent, England, in 1722; educated at Pembroke College, Cambridge, where he became a fellow 1745; settled in London as a writer, becoming intimate with Pope, Johnson, and Garrick; was noted for improvidence and a convivial disposition, which made him successively the inmate of an insane asylum and of the king's bench prison for debtors, within the rules of which he d. in 1771. He translated into Latin verse Pope's *Ode on St. Cecilia's Day* and *Essay on Criticism,* the *Works of Horace* into English prose (2 vols., 1756), and into verse (1767); the *Poems of Phædrus* (1765) and the *Psalms of David* (1765) into English verse; published *The Hilliad, an Epic Poem* (1753), being a satire on Sir John Hill, noted for his quarrels with Fielding and with the Royal Society, and *The Parables of Christ done into Verse* (1765); but his most remarkable production was the *Song to David* (1763), reprinted in full in Chambers's *Cyclopædia of English Literature* (ii. 109), as "possessing passages of considerable power and sublimity," which make it "one of the greatest curiosities in our literature," it having been written on the walls of a mad-house.

**Smart** (Sir GEORGE THOMAS), K. C. B., b. in London, England, in May, 1776; became a chorister in the chapel royal when a boy of eight years; took part in executing the Handel commemorations in Westminster Abbey 1784–91; became an accomplished conductor of musical festivals and of the famous Lent oratorios at Covent Garden and Drury Lane theatres; was one of the founders of the Philharmonic Society 1813; was the instructor of nearly all the great English musicians of the last generation, and the personal friend of Beethoven, Mendelssohn, Rossini, and Weber, the latter of whom died at his house. He was knighted at Dublin 1818, and was in his later years organist to the chapel royal. D. in London Feb. 23, 1867.

**Smart-Weed.** See POLYGONACEÆ.

**Smeaton** (JOHN), b. at Austhorpe, near Leeds, England, May 28, 1724; was noted in childhood for mathematical and mechanical talent; abandoned the study of the law for the business of a mathematical instrument-maker 1750; invented the following year an instrument for measuring a ship's progress; made several valuable inventions in hydraulic machinery, for which he received the Copley medal 1759; was noted as the builder of Eddystone lighthouse (Aug. 5, 1756–Oct. 9, 1759), of Ramsgate harbor (1749–74), of the Forth and Clyde Canal, the Greenwich and Deptford waterworks, and many other important public improvements. D. at Austhorpe Oct. 28, 1792.

**Smectym'nuus,** the title of a celebrated tract written in reply to Bishop Hall's *Divine Right of Episcopacy.* The name is formed from the initials of the names of its five writers—to wit, Stephen Marshall, Edmund Calamy, Thomas Young, Matthew Newcomen, William Spurstowe.

**Smed'ley** (EDWARD), b. in England in 1789; graduated at Trinity College, Cambridge, 1809; became a fellow of Sidney College; took orders in the Church of England; gained the Seatonian prize for English poems on four occasions; contributed articles on French biography, English and Roman literature to the *Penny Cyclopædia;* wrote *Sketches of the Occult Sciences* for the *Cabinet Cyclopædia;* became prebendary of Lincoln 1829, and was for several years editor of the *Encyclopædia Metropolitana* until his death, which occurred in 1836. Author of *Religio Clerici* (1818), *Lux Renata* (1827), *Sketches from Venetian History* (2 vols., 1832), *History of the Reformed Religion in France* (3 vols., 1832; New York, 1834), and of a *History of France from A. D. 843 to 1529* (1836), the latter forming vol. x. of the *Library of Useful Knowledge.* After his death appeared his *Poems and Selected Correspondence* (1837), with a memoir of his life by his widow.

**Smee** (ALFRED), M. D., F. R. S., b. in England in 1818; studied medicine; was admitted a member of the College of Surgeons 1840, and elected a fellow of the Royal Society 1841; was subsequently lecturer at the Aldersgate Street School of Medicine, and surgeon to the Bank of England and senior surgeon to the Royal General Dispensatory; is widely known for his thorough knowledge of electricity in all its branches; is the inventor of the useful "Smee voltaic battery," and of the system now in use for printing the Bank of England notes; is chairman of several important companies, and has taken an active part in Conservative politics. Author of *Elements of Electro-metallurgy* (London, 1841; New York, 1852), *Sources of Physical Science* (1843), *The Potato Plant, its Uses and Properties* (1846), *The Eye in Health and Disease* (1847; 2d ed. 1854), *Elements of Electro-Biology* (1849), *Principles of the Human Mind* (1849), *Instinct and Reason, deduced from Electro-Biology* (1850), *Lectures on Electro-metallurgy, delivered at the Bank of England* (1851), *Process of Thought, adapted to Words and Language* (1851), *On the Stereoscope and Binocular Perspective* (1854), *General Debility and Defective Nutrition* (1859).

**Smell.** See SENSES.

**Smel'lie** (WILLIAM), b. at Edinburgh, Scotland, in 1740; served an apprenticeship as a printer; obtained a good education by private study; became in 1759 editor of *The Scots' Magazine;* commenced business as a publisher 1765, and issued in 1771 (3 vols. 4to) the first edition of the *Encyclopædia Britannica,* much of which was written by himself; edited with Dr. Gilbert Stuart *The Edinburgh Magazine and Review* 1773–76; wrote on many miscellaneous topics; translated Buffon's *Natural History* (18 vols., 1781–93), and was a friend of many distinguished men, including Burns, who has drawn his portrait in the sketch of the "Crochallan Fencibles." D. at Edinburgh June 24, 1795. Among his original works the most popular was *The Philosophy of Natural History* (2 vols., 1790–99), several times reprinted in the U. S.

**Smel'ser,** tp., Grant co., Wis. P. 1291.

**Smelt** (in allusion to the cucumber-like odor of the typical species), the designation of a number of species of fishes distinguished by an elongated, transparent body, greenish back, and silvery sides. (1) In England it is the name of the *Osmerus eperlanus,* a representative of the family Argentinidæ (closely related to the Salmonidæ), characterized by the moderate teeth of the upper jaw, the stronger ones of the lower, and the fang-like ones of the tongue as well as vomer. It averages about eight inches, and rarely attains a foot in length. (2) In the Eastern U. S. the name is given to a species congeneric with the English smelt (*Osmerus mordax* or *viridescens*), and in the District of Columbia, Maryland, etc., to a fresh-water fish

belonging to the family Cyprinidæ (*Hybognathus regius*); the former has teeth like the European species, the latter none. (3) In California the term is bestowed on several species of different families. (1) One is a species of the genus *Osmerus* (*O. thaleichthys*); (2) another is allied, but the type of a peculiar genus (*Hypomesus olidus*); and (3) others are representatives of the genus *Chirostoma* or *Atherinopsis* (*C. californiensis* and *C. affinis*). The first two are Argentinidæ, and distinguished by the first dorsal being rayed, and the second adipose or fatty; the *Osmerus* is armed with large fang-like teeth, while the *Hypomesus* has only small teeth. The others belong to the family Atherinidæ, and are characterized by the development of two distant dorsals, the first of which is provided with slender spines, and the second with branched rays. All the species of smelts are esteemed for the delicacy of their flesh. With the exception of the *Hybognathus* they are normally salt-water fishes, but sometimes inhabit fresh waters for all their life, or ascend the fresh-water rivers. THEO. GILL.

**Smelt'ing.** In its more extended use the term "smelting" applies to the entire process of reducing metals from their ores by fusion; in a more limited sense it applies to those particular metallurgical processes in which an ore or a product of other operations, such as roasting, treatment with acids, etc., is finally reduced to pure metal or some intermediate product. The fusions are conducted in shaft furnaces, reverberatory furnaces, or crucibles. Metals ready for use or sale may be produced from ores by a single smelting operation, as iron; or they may require a series of smeltings, alternated with roastings, as copper when made from sulphuretted ores. The smelting process may be simply reducing, or oxidizing and reducing, or may be designed to volatilize certain bodies, to oxidize others, and to reduce still others. Charcoal, coke, and anthracite are the fuels generally used in shaft furnaces and for heating crucibles, and bituminous coal and wood for reverberatory furnaces; but peat, gas obtained from different materials in special generators and peculiarly constructed fireplaces, and waste gases from furnaces, are used to a limited extent for particular operations in some establishments.

To remove earthy matters and foreign oxides, and to facilitate the collection of the reduced metals, slags are produced, and, according to the nature of the effect to be obtained and the substance to be removed by scorification, the charges are so constituted as to yield more or less acid or basic slags by judicious mixture of the ores treated or by addition of various fluxes, limestone and oxide of iron being generally added in large operations if a base is required, quartz or highly silicious materials if an acid is needed. Fluor-spar is an excellent flux for silicious ores. Sometimes it is desirable to liberate some sulphur to combine with the metals and form a *matte* or *regulus*, and then iron pyrites is added, or sulphate of baryta with quartz and fluor-spar, a reducing action being maintained during the fusion. It is a general rule to form if possible slags which will not fuse until the desired effect, reduction of oxides, separation of sulphides, carbonization of metals, etc., has been produced. The general products of smelting are slag and metal, or slag and *matte*, or sometimes all three at once. The slags may have to be subjected to a reducing smelting to obtain the metal retained in them, the metal to an oxidizing and scorifying smelting to purify it, and the matte to an oxidizing smelting, or, after roasting, to a reducing and scorifying smelting, during which some metals are partly removed by volatilization, as antimony, arsenic, and zinc; others by oxidation and scorification, as iron, zinc, and tin, while the desired metal is obtained in a nearly pure state or as a concentrated matte. Sometimes the result of smelting is mainly a change in the combinations of the elements, as when iron is charged in a furnace with galena, the sulphur combining with the iron and the lead being set free; this is called precipitation, and it may also be effected by employing oxide of iron, which is first converted into metallic iron by a reducing action within the furnace.

Shaft furnaces are mainly employed for reducing fusions with coke, charcoal, and anthracite, although by a proper construction, good management of fluxes, and preparation of the ores, etc. a partial oxidizing action can be produced. The fusion is almost invariably effected by the aid of a blast. Reverberatory furnaces, with wood and bituminous coal, are generally used for oxidation; a very effective reducing action can also be obtained in them by excluding the air and keeping the hearth full of reducing gases. The choice between shaft and reverberatory furnaces, where both are admissible, will generally be determined by the nature and cost of the fuel. In crucibles the results of smelting will depend entirely on the nature of the charge, oxidation and scorification being produced by certain fluxes, as nitre with quartz or borax; reduction by adding carbonaceous matters; scorification alone by using a simple flux like borax; precipitation by adding metallic iron or some substance which will yield iron by reduction; sulphurization by adding metallic sulphides, or alkaline sulphates with a reducing agent and a simple flux.

Iron is reduced from its oxides in high shaft furnaces with a hot or cold blast (*blast furnaces*). The reducing action is produced, as in all shaft furnaces, by the carbonic oxide resulting from the action of the blast on the incandescent fuel. As the descending reduced iron approaches the hottest part of the furnace it takes up some carbon, fuses, and collects in the hearth below, being covered by the liquid slag, which protects it from the blast. The carbon renders it brittle, but malleable iron can be produced from pure, rich ores at one operation, in small open-hearth furnaces, by converting the oxidizing into a reducing action by a proper adjustment of the blast and fuel. Copper is reduced at once to raw copper from its oxides in shaft furnaces; but the sulphurets must first be roasted, then smelted for matte by reducing in shaft or reverberatory furnaces, again roasted, and again smelted, and so on until a matte is produced rich and pure enough to give raw copper after another roasting and final reducing smelting. Lead is smelted directly from very pure galena in one operation by a blast on the Scotch or American hearth, the action being in the latter case chiefly a simple oxidation of the sulphur; or by two operations combined into one—a partial roasting, followed by a reaction between the oxide and sulphate of lead thus produced, and the sulphide still left, the result being sulphurous acid and lead; this is called roasting and reaction. Lead is also sometimes roasted in a reverberatory furnace, then reduced in a shaft furnace, or it may be reduced by "precipitation," as already described, in a shaft or reverberatory furnace. (See BLAST FURNACE, FURNACE, IRON, LEAD, STEEL, ZINC.) H. B. CORNWALL.

**Smer'dis,** the younger son of Cyrus; accompanied his brother Cambyses on his campaign to Egypt, but excited his jealousy by being the only one of all the Persians who could bend the bow sent to the Persian camp by the Ethiopian king, and was consequently ordered back to Susa. Shortly after, having dreamt that he saw his brother seated on the royal throne, Cambyses commanded Prexaspes to go to Susa and put Smerdis to death secretly. Prexaspes did so, and very few heard anything about the murder, but among those who knew the truth was one Patizeithes, a Magian, governor of the palace, whose younger brother bore a striking resemblance to the murdered prince. Afterward, when the tyranny of Cambyses occasioned much discontent among the Persians, Patizeithes represented this brother as the royal prince, and had him proclaimed king; and as Cambyses had just died in Syria from an accidental wound, the false Smerdis was accepted by the people. But some Persian nobles soon became suspicious, and at last one of them, Otanes, discovered the fraud. It was known that Cyrus had ordered the ears of Patizeithes's brother to be cut off on account of some misdemeanor, and Otanes's daughter, who was an inmate of the royal harem, ascertained that the king had no ears. Seven noble Persians then broke into the palace and killed the false Smerdis, who had reigned only seven months, and Darius, the son of Hystaspes, was elected king 521 B. C. Such is the story as related by Herodotus; that by Ctesias differs somewhat in details.

**Smet, de** (PETER JOHN), b. at Termonde, Belgium, Dec. 31, 1801; was trained in the seminary at Mechlin; sailed with six other novices to the U. S. in 1821; assisted in founding the University of St. Louis, Mo.; in 1838 was sent to labor with the Pottawattomies, and in 1840 was transferred to the Flathead mission. Father de Smet acquired a singular power of restraint over nearly all the Indian tribes, from the Sioux westward. He became procurator of the Indian missions, made voyages to Europe, and wrote several works in French and English, among them *Indian Sketches*, *Oregon Missions*, *Western Missions*, and many letters published in the *Annals* of the Roman Propaganda. He was a chaplain in the Utah expedition. D. at St. Louis May 23, 1872.

**Smethport,** p.-v., cap. of McKean co., Pa., on McKean and Buffalo R. R., contains 3 churches, a fine academy, 1 newspaper, and lumber-mills. Principal business, lumbering, mining, farming, and dairying. P. 231.

H. F. BARBOUR, ED. "MCKEAN CO. MINER."

**Smew** (*Mergellus albellus*), a bird belonging to the family Anatidæ, and the only known species of its genus, inhabiting the northern parts of the Old World, and accidental to North America. It is distinguished by the short narrow bill (considerably shorter than the head), whose margins are beset with short approximated lamellæ. In the male the ground color is white (whence one of the popular names, "white nun"); black pervades around and

in front of the eyes, at the occiput under the crest, at the front of the back, on the tail, and on the wings, but the scapulars and middle wing-coverts, as well as secondaries and tertials, are white; in the female the head is of a reddish-brown color; the length is about seventeen inches. Like its relatives, it is an excellent swimmer and diver. It makes a nest near the water, and lays therein from eight to ten eggs. Hybrids have obtained between it and true ducks—*e. g. Bucephala clangula*. The only authority for its occurrence in the U. S. is Audubon, who claims to have found a single female near New Orleans. THEO. GILL.

**Smi'bert,** or **Smybert** (JOHN), b. at Edinburgh, Scotland, about 1684; served his time with a common house-painter; studied painting in Italy; accompanied Dean Berkeley to America 1728; settled at Boston; painted portraits of most of the prominent men of New England and New York of that time, and exercised a considerable influence upon the styles of Copley, Allston, and Trumbull. His most celebrated painting, now in the possession of Yale College, is a group representing Dr. Berkeley, some of his family, and other persons, including himself. D. at Boston, Mass., in 1751 or 1752.

**Smicks'burg,** p.-v. and tp., Indiana co., Pa. P. 143.

**Smi'lax** [Gr. *σμίλαξ*], a large genus of endogenous plants of the order Smilaceæ, by some ranked as exogenous, and by Lindley placed in his proposed class Dictyogens. True sarsaparilla and China root are among the products of the genus. The U. S. have numerous species, none of them important. Several plants of this genus are fine in hot-house and garden culture. Some are herbs, others are shrubs, and many are climbers.

**Smiles** (SAMUEL), M. D., b. at Haddington, Scotland, in 1816; educated for the medical profession; practised some years as a surgeon at Leeds; became editor of the Leeds *Times;* was secretary to the Leeds and Thirsk Railway 1845–52, and to the South-eastern Railway 1852–66, and subsequently of the National Provident Assurance Co. Author of *Physical Education* (1837), *History of Ireland and the Irish People under the Government of England* (1844), *Railway Property, its Conditions and Prospects* (1849), *Life of George Stephenson* (1857), *Self-Help, with Illustrations of Character and Conduct* (1860), *Brief Biographies* (Boston, 1860), *Workmen's Earnings, Strikes, and Savings* (1861), *Lives of the Engineers, with an Account of their Principal Works* (4 vols., 1861–65; new ed., 5 vols., 1875), *Industrial Biography: Iron-Workers and Tool-Makers* (1863), *Lives of Boulton and Watt* (1865), *The Huguenots, their Settlements, Churches, and Industries in England and Ireland* (1867), *The Huguenots in France after the Revocation of the Edict of Nantes* (1874), *Character* (1871), and *Thrift* (1875), the two latter works being companions to *Self-Help*. Most of the works of Mr. Smiles have been republished in the U. S., and have proved of great value in stimulating the young of the working classes to the pursuit of useful knowledge.

**Smillie** (GEORGE D.), b. in New York City Dec. 29, 1840, son of James, a well-known landscape engraver; studied landscape painting under Hart; began to exhibit in 1864, and was speedily chosen a member of the National Academy of Design. He has been particularly successful in reproducing picturesque scenes from the Adirondacs and from the White Mountains.—His brother JAMES D., b. in New York City in 1833, was an engraver until 1862, when he visited Europe and studied painting. He was chosen a member of the National Academy 1865, was treasurer of the Society of Painters in Water Colors, and prepared the plates illustrative of Bryant's poem *Among the Trees*.

**Smirke** (ROBERT), R. A., b. at Wigton, near Carlisle, England, in 1752; was brought up to the business of a painter of coach-panels, from which he passed to higher departments of art, being admitted as a student at the Royal Academy 1771; became distinguished for *genre* pieces, many of which were taken from Cervantes; became an academician 1791, his presentation picture being *Don Quixote and Sancho Panza;* painted many scenes illustrating passages of the Bible, Milton, Thomson, and the *Arabian Nights*, not a few of which have become widely known through engravings in illustrated editions of those works; was one of the contributors to Boydell's *Shakspeare;* made many designs for annuals, and brought out a magnificent edition of his daughter Mary's translation of *Don Quixote*, with 74 engravings (London, 4 vols. royal 8vo, 1818). D. in London Jan. 5, 1845.

**Smirke** (Sir ROBERT), R. A., eldest son of Robert (1752–1845), b. in London, England, in 1780; studied at Apsley School, near Woburn; was carefully educated as an architect both in England and on the Continent; was gold medalist at the Royal Academy 1799; visited Italy, Greece, and Germany; published *Specimens of Continental Architecture* (1806); was architect of the new Covent Garden theatre 1808–09, of the mint 1811, the post-office 1823–29, the Union, United Service, and Carlton clubs, most of them being examples of the so-called "classical school," and built many other important private and public edifices. His fame will rest chiefly upon the British Museum, built by him at intervals from 1823 to 1847. He was knighted 1831, and was thirty years treasurer of the Royal Academy. D. at Cheltenham Apr. 18, 1867.

**Smirke** (SYDNEY), R. A., son of Robert, b. in England about 1800; studied architecture; gained the gold medal of the Royal Academy 1819; practised both the prevailing styles of architecture, but with a decided preference for the Italian school; published *Suggestions on the Architectural Improvements of the West of London* (1834); assisted his brother in designing the Oxford and Cambridge University Club-house in Pall Mall, London, 1835–37; superintended the restoration of the Temple church, of which he published an account (1842); designed Exeter 'Change, the new Carlton Club, the new buildings in the Temple, restorations of Lichfield cathedral, York minster, and Savoy chapel, the custom-houses at Gloucester and Newcastle, and in 1847 succeeded his brother as architect to the British Museum, in which capacity he built the reading-room 1855, the Roman, Assyrian, and other galleries, and was the architect of several other public edifices and of many splendid country-seats. His last achievement was the new Royal Academy in Burlington House, begun 1867 and completed 1874, after which he retired from the practice of his profession. He was chosen R. A. 1860; became professor of architecture at the Academy 1861, and its treasurer 1862; subsequently trustee of that institution and of the Soane Museum; is a gold medalist of the Royal Institute of British Architects. The Elizabethan style of his later edifices presents a singular contrast to the classicism of his brother.

**Smith,** county of N. Kansas, adjoining Nebraska, traversed by N. fork of Solomon River, has a rolling prairie surface and a productive soil. Cap. Smith Centre. Area, 900 sq. m. P. in 1870, 66; in 1875, 3876.

**Smith,** county of Central Mississippi, on Strong River, has a flat surface and an unproductive soil. Staples, cotton, rice, Indian corn, and sweet potatoes. Swine are numerous. Cap. Raleigh. Area, 620 sq. m. P. 7126.

**Smith,** county of N. Tennessee, on Cumberland River and Caney Fork, has a mountainous surface, well adapted for pasturage. Staples, tobacco, Indian corn, wheat, sorghum-molasses, honey, butter, and wool. Swine and sheep are raised in large numbers. Cap. Carthage. Area, 300 sq. m. P. 15,994.

**Smith,** county of N. E. Texas, lying between Sabine River on the N. and Neches River on the W., consists chiefly of fertile prairie, and is traversed by International and Great Northern R. R. Staples, Indian corn, cotton, and butter. Cattle and swine are quite numerous. Cap. Tyler. Area, 850 sq. m. P. 16,532.

**Smith,** tp., Bradley co., Ark. P. 792.

**Smith,** tp., Columbia co., Ark. P. 282.

**Smith,** tp., Cross co., Ark. P. 1515.

**Smith,** tp., Dallas co., Ark. P. 1030.

**Smith,** tp., Drew co., Ark. P. 502.

**Smith,** tp., Greene co., Ind. P. 670.

**Smith,** tp., Posey co., Ind. P. 988.

**Smith,** tp., Whitley co., Ind. P. 1232.

**Smith,** tp., Dade co., Mo. P. 504.

**Smith,** tp., Laclede co., Mo. P. 1146.

**Smith,** tp., Worth co., Mo. P. 889.

**Smith,** tp., Belmont co., O. P. 1777.

**Smith,** tp., Mahoning co., O. P. 1685.

**Smith,** tp., Washington co., Pa. P. 2067.

**Smith** (ADAM), b. at Kirkcaldy, Fifeshire, Scotland, June 5, 1723. His father died before his birth; a faithful mother's devotion carried him safely through a sickly infancy and childhood. Unable to join in the active sports of boys, he early turned to books, and formed habits of close, independent thinking which distinguished his life. His education was carried forward in the grammar school of Kirkcaldy, the University of Glasgow, and Baliol College, Oxford, with a view to his taking orders in the English Church. In Glasgow he gave chief attention to mathematics and natural science, but at Oxford he turned to the study of languages, and took especial pains to master the nice points of the English tongue. Abandoning all thought of the clerical office, he returned to his native place, and in 1748 took up his residence in Edinburgh. There he first

came before the public, delivering lectures on rhetoric and belles-lettres under the patronage of Lord Kames. Dr. Blair acknowledged his indebtedness to Smith for ideas and illustrations on style. In 1751 he was made professor of logic in the University of Glasgow, and the following year became professor of moral philosophy in the same institution. He resolved the science of morals into four parts, and accordingly discussed in his lectures, first, natural theology; second, ethics strictly; third, justice with reference to specific rules and precepts; and fourth, political expediency as affecting the honor, power, and prosperity of the state. His lectures were delivered extemporaneously, and were, for both matter and style, very popular. His first published work was the *Theory of Moral Sentiments*, issued in 1759. It called forth a high encomium from Hume, and brought him at once a wide reputation. Incidentally, this publication led to his being selected, four years afterward, to accompany the young duke of Buccleugh on his travels. He carefully improved the opportunity thus presented to become acquainted with the internal policy of other states, and to confer with distinguished economists on the Continent. He returned to England in 1766, and for ten years lived with his mother in partial retirement at Kirkcaldy. There he devoted himself to the earnest study of subjects which had occupied his attention for nearly twenty years. The result was given to the world in 1776 in his great work entitled *An Inquiry into the Nature and Sources of the Wealth of Nations.* Many principles laid down in that work were no doubt derived from the French economists, but the completeness of their compilation and the clearness with which they are set forth in this treatise fairly entitle Adam Smith to be regarded as the father of modern political economy. His book will continue to be, as it has been hitherto, a standard of reference on almost all branches of the science. Smith's biographer thus defines the main feature of this work: "Its great object is to demonstrate that the most effectual plan for advancing a people to greatness is to maintain that order of things which nature has pointed out, by allowing every man, as long as he observes the rules of justice, to pursue his own interest in his own way, and to bring both his industry and his capital into the freest competition with those of his fellow-citizens." After residing two years in London, he was appointed a commissioner of customs for Scotland, and removed to Edinburgh, where he spent the remainder of his life. In 1787 he was elected lord rector of the University of Glasgow—an honor which gave him great gratification. Mr. Smith was never married. His mother and Miss Douglass, a cousin, superintended his domestic economy until within two years of his death, which happened at Edinburgh July 8, 1790. After his decease, most of his manuscripts were, agreeably to his imperative directions, destroyed. A few that were excepted from that order were published in 1795 under the title *Essays on Philosophical Subjects.* His private character was amiable and irreproachable. His thoughts were generally dictated to an amanuensis slowly and carefully, and subjected to a considerate revision. Abstraction was a life-long habit of his mind, and he was wont, when alone, to be speaking to himself, regardless of everything around him. Often when in company a fit of absence would come on him, and he would fall into the same practice, much to the amusement as well as interest of those present. A. L. CHAPIN.

**Smith** (ALBERT), b. at Chertsey, England, May 24, 1816; became a surgeon; settled at London 1841; contributed to *Bentley's Magazine;* was an early member of the staff of *Punch;* afterward dramatic critic of the *Illustrated London News;* wrote many burlesques, farces, and Christmas pieces, most of the latter being adaptations from the works of Dickens; visited Constantinople 1849; brought out an "entertainment" called *The Overland Mail* May, 1850; ascended Mont Blanc Aug., 1851, and prepared an illustrated "entertainment" descriptive of that feat, which was given by him in London with great success for several years. In 1858–59 he visited China, and afterward lectured upon the incidents of the journey. D. at Fulham, near London, May 23, 1860. Author of *A Month at Constantinople* (1850), *The Story of Mont Blanc* (1853), *To China and Back* (1859), and of posthumous volumes of sketches, *Wild Oats and Dead Leaves* (1860), and *Paris and London* (1867).

**Smith** (ALEXANDER), b. at Kilmarnock, Scotland, Dec. 31, 1830; was pattern designer for a lace-factory at Glasgow; published a volume of poems, *A Life Drama* (1853), which attracted great attention; was appointed secretary of the University of Edinburgh 1854; wrote *Sonnets of the War,* along with Sydney Dobell (1855), *City Poems* (1857), *Edwin of Deira* (1861), *Dreamthorp* (1863), *A Summer in Skye* (1865), *Alfred Hagart's Household* (1866), and *Miss Oona McQuarrie* (1866), of which the last four were prose works. D. at Wardie, near Edinburgh, Jan. 5, 1867. A *Memoir* by P. P. Alexander was published along with a posthumous volume of miscellanies entitled *Last Leaves* (1868).

**Smith** (ANDREW JACKSON), b. in Pennsylvania in 1814; was graduated from the U. S. Military Academy, and appointed in the army a second lieutenant of the 1st Dragoons, of which regiment he became major in May, 1861 (known as the 1st Cavalry since Aug., 1861), and July, 1866, colonel of the 7th Cavalry. Prior to 1861 he served almost continually with his regiment on the frontier, being engaged on several expeditions, and frequently in action with hostile Indians. In Oct., 1861, he was commissioned colonel of the 2d California Cavalry, and Mar. 17, 1862, a brigadier-general of volunteers. As chief of cavalry he served in the departments of the Missouri and the Mississippi, being engaged while in the latter department in the advance upon and siege of Corinth; transferred to the department of the Ohio in September, he was subsequently attached to the Army of the Tennessee, which he accompanied in the Yazoo River expedition, and was engaged in the assault of Chickasaw Bluffs (Dec. 27–29, 1862), and later in the assault and capture of Arkansas Post (Jan. 11, 1863). Assigned to command a division of the 13th army corps, he participated in the active service of that corps preliminary to and during the siege and assaults of Vicksburg and in the subsequent capture of Jackson, Miss. In the Red River campaign he commanded the force (composed of detachments of the 16th and 17th corps) which captured Fort De Russy, and was engaged in the battle of Pleasant Hill, and in almost constant skirmishing while covering the retreat of the army. Next ordered to Missouri, he aided in driving Price from that State, when called to reinforce Gen. Thomas at Nashville, and engaged in the battle of Nashville and pursuit of Hood's army. Recalled to Gen. Canby's command in Feb., 1865, he commanded the 16th corps in the reduction and capture of Mobile, Ala. In Jan., 1866, he was mustered out of the volunteer service, and in May, 1869, resigned his commission in the regular army. The brevets of colonel, brigadier and major general were bestowed on him for gallantry at Pleasant Hill, La., Tupelo, Miss., and Nashville, Tenn.

**Smith** (ASA DODGE), D. D., LL.D., b. at Amherst, Hillsborough co., N. H., Sept. 21, 1804; studied at Kimball Union Academy, Meriden, N. H.; graduated at Dartmouth College 1830 and at Andover Theological Seminary 1834; was principal of Limerick Academy, Me., 1830–31; pastor of the Fourteenth street Presbyterian church, New York, 1834–63; was professor of pastoral theology at the Union Theological Seminary, N. Y., 1843–44, and was inaugurated president of Dartmouth College Nov. 18, 1863, an office he still retains (1876). Author of *Letters to a Young Student* (1832), *Memoir of Mrs. Louisa Adams Leavitt* (1843), of a large number of published addresses and sermons, including twelve *Baccalaureate Discourses,* and of several contributions to theological reviews.

**Smith** (ASHBEL), M. D., b. at Hartford, Conn., in 1806; graduated at Yale College 1824; began the study of law, and afterward graduated in medicine; in 1837 was appointed by Gen. Sam Houston surgeon-general of the Texan army; was joint commissioner with Dr. R. A. Ivion in making the first treaty with the Comanches; was minister of the republic of Texas to the courts of St. James and St. Cloud during the administrations of Presidents Houston and Jones; was recalled and appointed secretary of state by the latter, and afterward served several sessions in the State legislature; in 1846 was in the Mexican campaign; on the secession of Texas went into service and served to the end of the war; represented Harris county in the legislature. In his profession his services were rendered gratuitously, and in every yellow-fever epidemic he repaired to Houston or Galveston to place himself at the disposal of the poor and of his friends; wrote *Account of the Yellow Fever in Galveston, Texas, 1839* (Galveston, 1840), *Account of the Geography of Texas* (in French), and *The Permanent Identity of the Human Race.*

**Smith** (AUGUSTUS WILLIAM), LL.D., b. at Newport, Herkimer co., N. Y., May 12, 1802; graduated at Hamilton College 1825; became a teacher in the Oneida Conference Seminary at Cazenovia, N. Y.; was professor of mathematics and astronomy in Wesleyan University from 1831 to 1857, when he was chosen president of that institution, and was professor of natural philosophy in the U. S. Naval Academy from 1859 to his death, at Annapolis, Md., Mar. 26, 1866. Author of several mathematical text-books.

**Smith** (AZARIAH), M. D., b. at Manlius, N. Y., Feb. 16, 1817; graduated at Yale College 1837; studied medicine as well as theology as a preparation for missionary duties in the Levant; arrived at Smyrna Jan., 1843; travelled extensively through Asia Minor, having been for some time a companion of Layard; rendered great service by attending those attacked with cholera; settled at Aintab 1848,

and d. there June 3, 1851. Author of papers on meteorology and on Syrian antiquities, published in Silliman's *Journal of Science*.

**Smith** (Buckingham), b. on Cumberland Island, Ga., Oct. 31, 1810; spent his childhood in Florida; graduated at the Cambridge Law School 1836; practised his profession in Maine, but soon returned to Florida, where he was elected to the Territorial legislature; was secretary of legation in Mexico from Sept. 9, 1850, to Feb. 2, 1852, having acted as chargé d'affaires *ad interim* from Jan. 26 to Oct. 8, 1851; made a thorough study of Mexican history, antiquities, and of Indian philology, collecting many books and MSS.; was secretary of legation at Madrid from June 5, 1855, to Oct. 10, 1858; made important researches in the Spanish libraries and archives respecting the colonial history of Florida and Louisiana; rendered services to Messrs. Bancroft, Sparks, and Parkman in their respective historical inquiries; settled in Florida on his return, and became a judge and a member of the State senate. D. in New York City Jan. 5, 1871. He edited translations of *The Narrative of Alvar Nuñez Cabeza de Vaca* (1851) and of the *Letter of Hernando de Soto, and Memoir of Hernando de Escalante Fontaneda* (1854), each printed in 100 copies 4to at Washington, D. C., at the expense of George W. Riggs, Esq.; published in Madrid an important volume of Spanish documents on Floridian history, *Coleccion de Varios Documentos para la Historia de la Florida y Tierras adyacentes* (1857); contributed to Mr. J. G. Shea's "Library of American Linguistics" a *Grammatical Sketch of the Hene Language* (1861), and a *Grammar of the Pima, or Névome, a Language of Sonora* (1862), from a MS. of the seventeenth century printed at San Augustine; a *Doctrina Christiana y Confesionario en Lengua Névome, ó sea la Névome* (1862), and a *Rudo Ensayo, tentativa de una prevencional Descripcion geographica de la Provincia de Sonora* (1863); issued at New York *An Inquiry into the Authenticity of Documents concerning a Discovery of North America claimed to have been made by Verrazzano* (1864); prepared for the "Bradford Club" a volume of translations of *Narratives of the Career of Hernando de Soto in the Conquest of Florida, as told by a Knight of Elvas and in a Relation by Luys Hernandez de Biedma, Factor of the Expedition* (1868); furnished interesting biographical and bibliographical data concerning early writers on Florida to the *Supplement* to Duyckincks's *Cyclopædia of American Literature* (1866); and wrote for the *Historical Magazine* and other periodicals. Since his death an improved edition of the *Narrative of Cabeza de Vaca* was issued by Mr. Smith's friends in New York (1873), preceded by a biographical sketch. A portion of his library was secured for the New York Historical Society. Few American scholars have been so conversant with the materials of early American history as Mr. Smith. Porter C. Bliss.

**Smith** (Caleb Blood), b. at Boston, Mass., Apr. 16, 1808; went with his parents to Ohio 1814; educated at Cincinnati and Miami colleges; studied law at Cincinnati and at Connersville, Ind.; was admitted to the bar 1828; founded the *Sentinel* newspaper 1832; was several years a member of the Indiana legislature; member of Congress 1843–49; was on the Mexican claims commission; practised law some years at Cincinnati; settled at Indianapolis 1858; was influential in procuring the nomination of Abraham Lincoln at Chicago 1860, who appointed him secretary of the interior Mar., 1861; became U. S. circuit judge for Indiana Dec., 1862. D. at Indianapolis Jan. 7, 1864.

**Smith** (Charles Ferguson), b. in Pennsylvania in 1805; graduated at the U. S. Military Academy in 1825, entering the army as a lieutenant of artillery. From 1829 to 1842 he served at the Military Academy in various capacities—as instructor of infantry tactics, as adjutant, and as commandant of the corps of cadets. In the Mexican war, as captain of artillery, he served with distinction, received the brevets of major, lieutenant-colonel, and colonel for gallant and distinguished conduct in the battles of Palo Alto, Resaca de la Palma, Monterey, Contreras, and Churubusco. Appointed lieutenant-colonel of the 10th Infantry in 1855, he commanded the Red River expedition in 1856, the Utah expedition 1857–61, and for a time was in command of the department of Utah. At the commencement of disturbances preceding the civil war, he was placed in command of the city and department of Washington (Apr. 10–28, 1861). On Aug. 31, 1861, he was appointed a brigadier-general of volunteers, and ordered to Kentucky. In September he became colonel of the 3d Infantry. In the operations about Forts Henry and Donelson he acquired a high reputation as a skilful and accomplished soldier. In the severe fight for the possession of the latter stronghold he commanded the division which held the left of our investing lines, and which, led in person by Gen. Smith, stormed and captured all the high ground on the Confederate right which commanded Fort Donelson. Gen. Smith was selected to command the new movement up the Tennessee, and, Mar. 21, promoted to be major-general of volunteers, but the exposure to which he had been already subjected aggravated a chronic disease contracted in Mexico, which terminated his life Apr. 25, 1862, at Savannah, Tenn.

**Smith** (Charles Hamilton), F. R. S., b. in West Flanders Dec. 26, 1776; entered the British army in the Netherlands as a volunteer about 1795; served in the West Indies 1797–1809; was deputy quartermaster-general in the Walcheren expedition; took part in the Netherlands campaigns 1813–16; visited the U. S. and Canada on a special mission from the foreign office; retired from the army on half pay, with the rank of lieutenant-colonel, 1820; gave special attention to history, archæology, zoology, and ethnology; wrote the article *War* in the *Encyclopædia Britannica* (8th ed. 1860); was associate author with Sir Samuel R. Meyrick of *The Costume of the Original Inhabitants of the British Islands* (1815); aided that antiquary in other publications; wrote 3 vols. of the *Naturalist's Library* (i., iv., and v., 1843), relating respectively to Mammalia, the dog, and the horse, and published a useful *Natural History of the Human Species* (1848; republished in the U. S. under the editorship of Dr. S. Kneeland, Boston, 1851). During the latter part of his life he resided at Plymouth, where he was first president of the Devon and Cornwall Natural History Society. D. at Plymouth Sept. 21, 1859. He left many volumes of MS. notes which have not been printed.

**Smith** (Charles Henry), b. at Hollis, York co., Me., Nov. 1, 1827; graduated at Waterville College (Colby University) in 1856. As captain in the 1st Maine Cavalry he entered the service in Oct., 1861, rising through successive grades to be colonel of that regiment in June, 1863. His regiment was attached to the Army of the Potomac, and shared in all the operations of that army. For much of the time in the last years of the war Col. Smith was in command of a brigade, and remained in service until Aug., 1865, when mustered out. For gallantry and highly-distinguished services the brevets of brigadier and major general U. S. army were conferred on him. Having studied law prior to the war, he was now examined and admitted to the bar, and in 1866 was chosen State senator from Washington co. In the reorganization of the army in 1866 he was appointed colonel of the 28th regular infantry; transferred to the 19th Infantry in 1869.

**Smith** (Charles Roach), b. at Landguard Manor, Isle of Wight, England, about 1805; was the chief founder of the British Archæological Association, and distinguished for the success of his exhumation of Roman and Saxon antiquities, especially those of Roman London. Author of *Collectanea Antiqua* (6 vols., 1848–66), *Antiquities of Richborough, Reculver, and Lymne* (1850), with *Supplements* on Lymne (1852) and Pevensey (1858), *Notes on the Antiquities of Treves* (1851), *Catalogue of the Museum of London Antiquities collected by and the Property of C. R. Smith* (privately printed 1854); edited the *Inventorium Sepulchrale* of Bryan Faussett (4to, 1856); contributed regularly to the *Gentleman's Magazine* and to the *Archæologia*; gave much attention to pomology and to the cultivation of the vine in the open air, on which subjects he also wrote. In 1870 he issued *The Rural Life of Shakspeare as Illustrated by his Works*, and still later printed a *Catalogue* of the Anglo-Saxon antiquities discovered at Faversham, Kent, bequeathed by Mr. Gibbs to the South Kensington Museum.

**Smith** (Daniel), b. in Fauquier co., Va., about 1740; served in the army during the Revolution; was one of the earliest settlers of Cumberland Valley, Tenn.; was a leading member of the constitutional convention of Tennessee; filled many local offices; was general of militia; U. S. Senator 1798–99, and again 1805–09, and wrote a geography of Tennessee, accompanied by the first map of that State; both were published by Matthew Carey at Philadelphia about 1799. D. in Sumner co., Tenn., June 16, 1818.

**Smith** (Edmund Kirby), b. at St. Augustine, Fla., in 1824; graduated at the U. S. Military Academy in 1845, and entered the army as brevet second lieutenant of infantry. In the war with Mexico he distinguished himself, and was brevetted first lieutenant and captain for gallantry at Cerro Gordo and Contreras. From 1849 to 1852 he was assistant professor of mathematics at West Point. Transferred to the 2d Cavalry in 1855 with the rank of captain, he served on frontier duty, and was severely wounded in a fight with the Camanche Indians in Texas, May 13, 1859. In Jan., 1861, he became major of his regiment, but resigned Apr. 6; was soon after appointed a brigadier-general in the Confederate army, and served under Gen. Joseph Johnston in Virginia. At the battle of Bull Run, July 21, 1861 (which see), he arrived on the field with Elzey's

brigade toward the close of the action, but was soon disabled by a shot, when Elzey assumed command. Made major-general in 1862, he was transferred to East Tennessee, and placed in command of that department. Under Bragg he led the advance in the invasion of Kentucky; he routed the Union forces at Richmond, Ky., Aug. 30, and advanced to Frankfort. Promoted to the grade of lieutenant-general, he was engaged at the battle of Perryville, Oct. 10, and in the battle of Murfreesboro', Dec. 31, 1862–Jan. 3, 1863. He was soon after made general, and in command of the Trans-Mississippi department, opposing Banks in the Red River campaign, and engaged in the battle of Jenkins's Ferry, Apr. 30, 1864. He was the last to surrender the forces under his command, May 26, 1865.

**Smith** (Eli), D. D., b. at Northford, Conn., Sept. 15, 1801; graduated at Yale College 1821, at Andover Seminary 1826; went to Malta as superintendent of a missionary printing establishment 1826; studied Arabic at Beyroot 1827; travelled with Dr. Anderson through Greece 1829, and with Dr. H. G. O. Dwight of Constantinople through Armenia, Georgia, and Persia 1830–31—a tour which resulted in the establishment of the important Armenian and Nestorian missions of the American Board; visited the U. S. and published *Missionary Researches in Armenia* (1832); settled at Beyroot 1833; accompanied Dr. Edward Robinson in his geographical explorations of Palestine, to which he largely contributed, 1838 and 1852; revisited the U. S. 1839 and 1845; introduced an elegant font of Arabic type, cast under his supervision at Leipsic for the mission press, 1839, and was engaged from 1847 upon a new translation of the Bible into Arabic, completed by Dr. C. C. Van Dyke. D. at Beyroot Jan. 11, 1857.

**Smith** (Elias), b. at Lyme, Conn., June 17, 1769; received a scanty education; became a school-teacher; was ordained a Congregational preacher 1792; preached at Lee, Woburn, Portsmouth, and at various other places; wrote several religious treatises, and founded at Exeter, N. H., Sept. 1, 1808, the *Herald of Gospel Liberty*, noted as the first religious newspaper ever published, and continued until Sept. 1, 1817. D. at Lynn, Mass., June 29, 1846.

**Smith** (Elihu Hubbard), M. D., b. at Litchfield, Conn., Sept. 4, 1771; graduated at Yale College 1786; resided two years with Dr. Dwight at Greenfield; studied medicine at Philadelphia; edited the first collection of *American Poems* (Litchfield, 1793); settled at New York 1793; became physician to the New York Hospital 1796; contributed essays and sonnets to the periodicals of the day; joined Drs. Miller and Mitchell in founding the New York *Medical Repository;* published *Edwin and Angelina, an Opera* (1798); edited E. Darwin's *Botanic Garden* (1798), to which he prefixed a poetical *Epistle to the Author;* was the supposed author of *André*, a tragedy printed and performed at New York in the same year, and was the centre of a genial literary circle. He was active in rendering assistance to the victims of yellow fever in New York in the summer of 1798, and fell a victim to that disease Sept. 19, 1798.

**Smith** (Elizabeth Oakes **Prince**), b. at Cumberland (then North Yarmouth), Me., Aug. 12, 1806, descended from Gov. Prince of Plymouth Colony, and from Dr. Urian Oakes, an early president of Harvard; resided from infancy in Portland, Me.; married there in 1823 Seba Smith, the well-known editor and humorist, whom she aided in his journalistic enterprises; obtained a considerable local reputation as a writer of prose and verse, but never appeared publicly as an authoress until after the loss of her husband's fortune in 1839, when she resorted for support to literature, settling in New York City 1842, and soon made her mark by her contributions to the magazines, which have been partially collected in several volumes, of which the best known was *The Sinless Child and Other Poems* (1843); published two tragedies, *The Roman Tribute* and *Jacob Leisler* (1853); *The Western Captive* (1850), a novel (1842), *The Salamander, a Legend for Christmas* (1848), *Woman and her Needs* (1851), *Hints on Dress and Beauty* (1852), *Bertha and Lily* (1854), *The Newsboy* (1855), *The Two Wives* (1870), *Kitty Howard's Journal* (1871), and other books. She has also lectured before lyceums, and been a prominent advocate of "woman's rights." She is now (1876) a resident of Hollywood, Carteret co., N. C.

**Smith** (Ethan), b. probably in New Hampshire about 1763; was Congregational minister at Poultney, Vt., and subsequently at Hopkinton, N. H., where he d. in 1849. Author of two works on prophecy and of *A View of the Hebrews, designed to Prove, among other Things, that the Aborigines of America are descended from the Ten Tribes of Israel*, which was one of the most popular of the numerous books written in support of the same view.

**Smith** (Francis H.), b. in Virginia in 1812; graduated at the U. S. Military Academy in 1833, and entered the army as a brevet second lieutenant of artillery; second lieutenant Nov. 30, 1833. In 1836 he resigned from the army, and in 1837 was appointed professor of mathematics at Hampden-Sidney College, Va. Upon the organization of the Virginia Military Institute (which see) at Lexington, Va., in 1839, Smith was appointed its superintendent and principal professor (of mathematics), the duties of which positions he has since continued to perform. Soon after the outbreak of civil war, the professors and assistants went into the field, and Smith, as colonel of a Virginia regiment, was stationed at Norfolk and in command of the fort on Craney Island. The institute was subsequently reopened. During the campaign against Richmond in 1864, Col. Smith, with his corps of cadets, was called to Richmond to aid in the defence, and thence to Lynchburg to defend the place against the forces of Gen. Hunter. On returning to Lexington, he found most of the buildings of the institute had been burned. Steps were taken for their reconstruction, since which the institute, under the administration of Col. Smith, has maintained its successful career. Author of various educational works.

**Smith** (Sir Francis Pettit), b. at Hythe, England, Feb. 9, 1808; became a farmer in Kent, but amused his leisure with mechanical experiments; constructed in 1834 a model of a steam-vessel to be propelled by a screw driven by a spring; made a larger boat on the same principle, which he successfully tested in the British Channel between Dover and Folkstone 1837; introduced his invention in 1838 to the notice of the lords of the admiralty, by whom he was commissioned to construct for the British navy the screw steamer Archimedes of 237 tons, 90 horse-power (finished 1840), the success of which led to the rapid introduction of screw-vessels into the navy and the mercantile marine. In 1855 the inventor received a pension of £200 a year from the British government; was soon after presented with a service of plate and a purse of £2678 by the leading engineers of the country; was made curator of the patent-office museum, South Kensington, 1860, and was knighted 1871. D. at London Feb. 11, 1874.

**Smith** (George), b. in England about 1825; taught himself the Oriental languages, including that of the cuneiform inscriptions from Nineveh; obtained, by the recommendation of Sir Henry Rawlinson, the post of keeper of antiquities at the British Museum about 1865; soon discovered and deciphered many tablets of great historical importance, especially in relation to Jewish annals; was one of the editors of a volume of *Cuneiform Inscriptions of Western Asia* (1867); published at the expense of Messrs. Fox Talbot and J. W. Bosanquet the Assyrian text and an interlinear translation of an important inscription under the title *The History of Assur-bani-pal* (1871); made known in 1872 his discovery and translation of fragments of a Chaldæan account of the Deluge, which he printed in the *Transactions* of the Society of Biblical Archæology; undertook in 1873, in behalf of the *Daily Telegraph* newspaper, a new examination of the mounds of Nineveh, and found a vast number of new inscriptions from the Assyrian royal library; made another exploration for the British Museum 1874; was unsuccessful in an attempt to renew his researches 1875, but obtained permission from the Turkish government for a more thorough exploration, which he began in the spring of 1876, when, being detained in Syria, he discovered the magnificent ruins of Carchemish, the capital of the ancient Hittite kingdom, and demonstrated that region to have been the original home of the Etruscans; thereby solving a most important ethnological and philological problem. Among his other recent discoveries are tablets containing Chaldæan legends parallel to the earlier chapters of Genesis, including accounts of the Creation and the Fall. Author of *Explorations in Assyria, The Chaldæan Account of Genesis*, and *The Ancient History of Assyria*, besides many separate translations and philological papers. D. Aug. 19, 1876.

**Smith** (Gerrit), b. in Utica, N. Y., Mar. 6, 1797, son of Peter Smith, a proprietor of vast tracts of land in Central and Northern New York, and once a partner of John Jacob Astor in the fur-trade; graduated at Hamilton College 1818; took up his residence at Peterboro', Madison co., N. Y., devoting himself to the management of his great landed estate; became a member of and liberal contributor to the Colonization Society 1825, but withdrew from it 1835, when he connected himself with the American Anti-Slavery Society, of which he was thenceforth one of the leading members; was noted for his philanthropy in every good cause; gave away vast tracts of land in small parcels, distributed to actual settlers; was elected to Congress 1852, but resigned after a single session; was a liberal contributor to the Free Soil campaign in Kansas; gave pecuniary aid to John Brown 1859 when preparing the attack on Harper's Ferry, though, it is believed, without a knowledge of that project; was many times nominated on an anti-slavery ticket for governor of New York and for other

offices for which it was known that he would receive but a small vote; was a liberal contributor to the expenses and charities connected with the war for the Union, but joined Horace Greeley in signing the bail-bond of Jefferson Davis 1867; wrote, printed, and distributed many pamphlets on slavery and other reforms; built a church at Peterboro', in which he sometimes preached, but underwent considerable fluctuations in his religious creed. D. in New York City Dec. 28, 1874. Author of *Speeches in Congress* (1855), *Sermons and Speeches* (1861), *The Theologies* (1866), and *Nature the Base of a Free Theology* (1867).

**Smith** (Goldwin), LL.D., b. at Reading, England, Aug. 13, 1823; educated at Eton; graduated with high honors at Magdalen College, Oxford, 1845; became fellow and tutor of University College; was called to the bar at Lincoln's Inn 1847; was secretary to two university commissions instituted by Parliament, and a member of the education commission 1859–66; became regius professor of modern history at Oxford 1858; was a prominent champion of the American Federal government during the civil war, when he wrote *Does the Bible Sanction Slavery?* (1863), *On the Morality of the Emancipation Proclamation* (1863), and other pamphlets on the same subject; visited the U. S. on a lecturing tour 1864, being received with distinction; published on his return lectures on *England and America* (1865) and *The Civil War in America* (1866); settled in the U. S. 1868 as professor of English history at Cornell University, which post he filled until 1871, when he removed to Toronto, Canada; became a member of the senate of the university of that city; was editor of the *Canadian Monthly* (1872–74), and took the direction of a political newspaper 1875. Author, among other works, of *Lectures on Modern History* (1861), *Rational Religion* (1861), *Irish History and Irish Character* (1861), *On Church Endowments* (1862), *The Empire, a Series of Letters* (1863), *A Plea for the Abolition of Tests in the University of Oxford* (1864), *Speeches and Letters on the Rebellion* (New York, 2 vols., 1865), *Three English Statesmen*, being sketches of Pym, Cromwell, and Pitt (1867), *The Reorganization of the University of Oxford* (1868), and *A Short History of England down to the Reformation* (1869).

**Smith** (Green Clay), son of John Speed Smith, b. at Richmond, Ky., July 2, 1830; served as a volunteer in the Mexican war, gaining the rank of lieutenant of cavalry; graduated at Transylvania University 1849; became a lawyer at Covington; was a member of the Kentucky legislature 1861, and a decided Union man; became colonel of the 4th Kentucky (Union) Cavalry Feb., 1862, and brigadier-general of volunteers June, 1862; was a member of Congress 1863–66; a delegate to the Baltimore convention 1864; governor of Montana Territory 1866, and subsequently a Baptist clergyman. In 1876 he was the candidate of the Prohibitionists for the Presidency.

**Smith** (Gustavus Woodson), b. in Scott co., Ky., Jan. 1, 1822; was graduated from the U. S. Military Academy July 1, 1842, when appointed a brevet second lieutenant in the corps of engineers; second lieutenant 1845; first lieutenant 1853. After serving two years in the construction of fortifications of New London harbor, he was called to West Point as assistant professor of engineering, where he remained until 1846, when, the war with Mexico occurring, he was sent to the field with the engineer company of sappers and miners, which he commanded during the siege of Vera Cruz and during the subsequent operations of the war, receiving the brevets of first lieutenant and captain for gallantry at Cerro Gordo and Contreras. In Nov., 1849, he was recalled to West Point, where he remained as principal assistant professor of engineering until Dec. 18, 1854, when he resigned from the army. He was subsequently employed in the construction of various government buildings and in the iron-works of Cooper & Hewitt at Trenton, N. J. From 1858 to Sept., 1861, he was street commissioner of New York City, though some time previous to the latter date he had departed for the South, and in August had been appointed a major-general in the Confederate army. On May 31, 1862, Gen. Johnston having been severely wounded that day at Fair Oaks, Gen. Smith succeeded to the temporary command of the Army of Northern Virginia, and subsequently commanded at Petersburg, Va. In 1864–65 he was commander of the State forces of Georgia, and was captured at Macon, Ga., Apr. 20, 1865. From 1866 to 1869 he was in charge of the S. W. Iron Co.'s works at Chattanooga, Tenn., and from 1870 to 1875 was insurance commissioner of Kentucky.

**Smith** (Henry), known as "Silver-tongued Smith," b. at Withcock, Leicestershire, England, in 1550; became a fellow-commoner of Queen's College, Cambridge, 1573; afterward studied at Oxford, but did not graduate; took holy orders; became lecturer at St. Clement Danes in the Strand, London, 1587, and soon acquired immense popularity as a preacher, displaying a prodigious memory and excelling in fluency, elegance, and eloquence, and in the practical character of his discourses, but was suspended by Bishop Aylmer in 1588. D. in 1591, and was buried at Husband's Bosworth, Leicestershire. A collective edition of his *Sermons* appeared at London (4to, 1594), and has been many times reprinted, together with a *Memoir* by Dr. Thomas Fuller (1657). Two editions appeared in London in 1866.

**Smith** (Henry Boynton), D. D., LL.D., b. at Portland, Me., Nov. 21, 1815; graduated at Bowdoin College 1834; was a tutor there 1836–37, and again 1840–41, between which periods he studied theology at Andover, Bangor, Halle, and Berlin; was pastor of a Congregational church at West Amesbury, Mass., 1842–47; professor of mental and moral philosophy at Amherst College 1847–50; was professor of church history in Union Theological Seminary, N. Y., 1850–55, and of systematic theology 1855–74; since then professor emeritus; was moderator of the General Assembly of the (New School) Presbyterian Church 1863–64; delivered at the meeting of that body at Dayton, O., an address on *Christian Union and Ecclesiastical Reunion*, which was directed toward that union with the "Old School" Church which was afterward consummated, and for which he prepared an essay on the doctrinal basis, *The Reunion of the Presbyterian Churches* (1867); was appointed delegate in 1867 to the meeting of the Evangelical Alliance in Amsterdam, for which he prepared a report *On the State of Religion in the U. S.;* was the founder and editor of the *American Theological Review* (1859–71), consolidated with the *Presbyterian Review* in 1862, and united with the *Princeton Review* in 1872; aided Prof. R. D. Hitchcock in the *Life, Character, and Writings of Edward Robinson* (1864); wrote a *Memorial of Anson G. Phelps* (1860), and is author, among other works, of addresses on *The Relations of Faith and Philosophy* (1849), *The Problem of the Philosophy of History* (1853), *The Reformed Churches of Europe and America* (1855); of inaugural addresses on *Church History as a Science* (1851), and *The Idea of Christian Theology as a System* (1855). He published in 1859 a *History of the Church of Christ, in Chronological Tables* (folio); was translator in part, and editor, of Gieseler's *Church History* (4 vols., 1859–63; vol. v. in preparation); editor of revised translations of Hagenbach's *History of Christian Doctrine* with large additions (2 vols., 1861–62), and Stier's *Words of the Lord Jesus* (1864–65).

**Smith** (Sir Henry George Wakelyn), Bart., usually known as Sir Harry Smith, b. at Whittlesea, Cambridgeshire, England, in 1788; entered the army as second lieutenant in the rifle brigade 1805; participated in the storming of Montevideo, the unsuccessful assault on Buenos Ayres, and the capture of Copenhagen; was highly distinguished in the Peninsular campaign, being present at every important battle except Talavera; participated as assistant adjutant-general in the capture of Washington, D. C., by Gen. Ross 1814; was military secretary in the campaign against New Orleans to Sir Edward Pakenham, who fell in his arms mortally wounded; returned to England in time to serve as assistant quartermaster-general in the campaign of Waterloo; was employed thereafter for many years in garrison duty at Halifax, N. S., and in the West Indies; went to the Cape of Good Hope 1827; commanded a division in the Kaffir war 1834–35; was appointed adjutant-general to the forces in India 1839; was distinguished at the battles of Gwalior and Maharajpore, being knighted for the latter service 1844; took a prominent part in the war against the Sikhs in the Punjaub, commanding a division at Moodkee and at Ferozepore Dec., 1845; was sent to the relief of Loodianah, and took Aliwal at the point of the bayonet Jan. 28, 1846, capturing 67 guns; reinforced Lord Gough in time to enable him to win the decisive battle of Sobraon, Feb. 10, 1846; received the thanks of Parliament on the proposal of the duke of Wellington, and was made a baronet; became governor of the Cape of Good Hope 1847; conducted the Kaffir war of 1851–52, and was made lieutenant-general 1854. D. in London Oct. 12, 1860.

**Smith** (Henry H.), M. D., b. at Philadelphia, Pa., in 1818; studied surgery at Paris; published several works on that subject; became professor of surgery in the University of Pennsylvania 1855, and surgeon-general of the State 1861.

**Smith** (Horace), brother of James, b. in London, England, Dec. 31, 1779; became a member of the stock exchange, in which business he acquired a fortune; was associated with his brother in writing for several periodicals and in the production of a celebrated volume of poetical parodies entitled *Rejected Addresses* (1812); was author of numerous novels which had but moderate success, and of an anonymous volume of humorous prose sketches, *The*

*Tin Trumpet* (1836). D. at Tunbridge Wells July 12, 1849. A selection from the poetical works of both brothers, including the *Rejected Addresses*, and accompanied by a *Memoir*, was published by Mr. Epes Sargent (New York, 1857).

**Smith** (Horace Wemyss), son of Richard Penn Smith, b. in Philadelphia, Pa., in 1825; has been a frequent contributor of prose and verse to the magazines; edited the *Works* of his father (1865), the *Yorktown Orderly Book* (1865), and reprinted the "Cadwalader Pamphlet" with the "Valley Forge Letters" under the title *Nuts for Future Historians to Crack* (1856).

**Smith** (Isaac), b. in New Jersey in 1736; graduated at Princeton 1755; was a tutor there; studied and practised medicine; commanded a regiment in 1776; was judge of the supreme court of New Jersey eighteen years; member of Congress 1795–97; commissioner to treat with the Seneca Indians 1797; and subsequently president of the Bank of Trenton. D. at Trenton Aug. 29, 1807.

**Smith** (Israel), b. at Suffield, Conn., Apr. 4, 1759; graduated at Yale College 1781; settled as a lawyer at Rupert, Vt.; was boundary commissioner 1789; took an active part in procuring the admission of Vermont into the Union; settled at Rutland; was a member of the convention for the ratification of the Federal Constitution 1791; was chief justice of the supreme court of Vermont 1797; member of Congress 1791–97 and 1800–01; U. S. Senator 1801–02 and 1803–07, and governor of Vermont 1807–08. D. at Rutland Dec. 2, 1810.

**Smith** (James), b. in Ireland about 1720; came to Pennsylvania with his parents and settled on the Susquehanna 1729; was educated at the College of Philadelphia; admitted to the bar; became at first a surveyor near Shippensburg, afterward a lawyer at York; raised in 1774 the first volunteer company in the State for the purpose of resistance to Great Britain; was a member of the convention called to consider the expediency of abstaining from importing English goods, and one of the committee to prepare instructions for the representatives; published an *Essay on the Constitutional Power of Great Britain over the Colonies in America*, which gave a powerful impulse to the Revolution; was a member of the Pennsylvania convention of 1775 and of the provincial conference for framing a new government for Pennsylvania (June 18), in which he seconded Dr. Rush's resolution in favor of independence; was elected to the convention for forming a constitution for Pennsylvania July 15, 1775, and of the Continental Congress 1775–78; signed the Declaration of Independence, and was elected to the general assembly of Pennsylvania 1780. D. at York July 11, 1806. He was a man of great wit, and was accustomed to create a sensation by his odd gestures and drawling utterance.

**Smith** (James), b. in Franklin co., Pa., in 1737; was taken captive by the Indians 1755, and adopted by them, but escaped after four years; was a leader of the "Blackboys" 1763 and 1765; was a lieutenant in Col. Bouquet's expedition to the Ohio region 1764; made an exploring expedition in Kentucky 1766; attained the rank of colonel in the war of the Revolution; settled at Cane Ridge, near Paris, Ky., 1788; was a member of the Danville convention, and afterward represented Bourbon county in the general assembly of Kentucky. D. in Washington co., Ky., in 1812. Author of *Remarkable Occurrences in the Life and Travels of Col. James Smith* (Lexington, Ky., 1799; republished at Philadelphia 1831 and 1834, and edited at Cincinnati by William M. Darlington, 1870), of *A Treatise on the Mode and Manner of Indian War* (Paris, Ky., 1812), and of two controversial pamphlets, *Shakerism Developed* and *Shakerism Detected*.

**Smith** (James), brother of Horace, b. in London, England, Feb. 10, 1775; became a lawyer; was an associate of his brother in the production of *Rejected Addresses* and other literary enterprises; aided Charles Mathews in preparing his *Country Cousins*, *A Trip to France*, and other "entertainments;" was an invalid for several years, and amused himself by writing epigrams and *vers de société*. An early volume of imitations published by the brothers, under the title *Horace in London*, was chiefly written by him. D. at London Dec. 24, 1839. His posthumous *Miscellanies* were edited by his brother (2 vols., 1840).

**Smith** (Sir James Edward), M. D., b. at Norwich, England, Dec. 2, 1759; studied medicine at Edinburgh; practised his profession in London; acquired by purchase a considerable portion of the library and herbarium of Linnæus 1784; was the founder and first president of the "Linnæan Society" 1788; settled at Norwich 1796; lectured on botany at the Royal Institution for many years, and was knighted by George IV. D. at Norwich Mar. 17, 1828. Author of *English Botany* (36 vols., 1792–1807), *English Flora* (3 vols., 1823–25), and other works.

**Smith** (James Milton), b. in Twiggs co., Ga., Oct. 24, 1823; educated at Culloden Academy in Monroe co., Ga.; became a lawyer; in 1861 entered the Confederate service as major of the 13th Georgia regiment; rose to colonel in 1862; was a member of the 2d Confederate Congress until the close of the war; elected a member of the State legislature 1871, and became Speaker of its house of representatives; in 1872 was elected governor of the State to fill the unexpired term of Rufus B. Bullock, and re-elected in Oct., 1872. Alexander H. Stephens.

**Smith** (James Y.), b. at Groton, Conn., Sept. 15, 1809; was for some years a lumber-merchant at Providence; became a cotton-manufacturer at Willimantic, Conn., 1838, and also at Woonsocket, R. I.; was several times a member of the Rhode Island legislature; mayor of Providence 1855–57, and governor of Rhode Island 1863–65.

**Smith** (Jeremiah), LL.D., b. at Peterborough, N. H., Nov. 29, 1759; graduated at Rutgers College 1780; studied law; was distinguished at the New Hampshire bar and as a general scholar, being noted for vast attainments; was a member of Congress 1791–97; was appointed by Pres. Adams in 1801 a judge of the U. S. circuit court, but did not serve; was governor of New Hampshire 1809–10, and several years chief-justice of the State superior court, and an early patron and friend of Daniel Webster. D. at Dover, N. H., Sept. 21, 1842. A *Life* was published by Rev. John H. Morison (Boston, 1845).

**Smith** (Jerome van Crowinshield), M. D., b. at Conway, N. H., July 20, 1800; graduated at Brown University 1818; studied medicine; became professor of anatomy and physiology at the New York Medical College; settled at Boston; edited the *Weekly News-Letter* (1825–26) and the *Medical Intelligencer* for more than twenty years; was port-physician of Boston 1826–49, and mayor 1854; published travels in Egypt, Palestine, and Turkey, and many scientific and miscellaneous works, and has resided (1876) some years in New York City.

**Smith** (John), b. at Willoughby, Lincolnshire, England, in Jan., 1579; spent four years of his early manhood in military service in the Netherlands; was afterward engaged in wars against the Turks in Hungary and Transylvania, having, according to his own account, been taken prisoner, sold as a slave at Constantinople, and sent to the Crimea, whence he escaped, after a remarkable series of adventures, to the Russian frontiers. There is, however, reason to believe that the wonderful adventures of Smith's career in the East are wholly or in part fictitious, as also the pension and patent of nobility which he claimed to have had from Sigismund Bathory, prince of Transylvania. Returning to England, by way of Barbary, he was induced by Capt. Bartholomew Gosnold to take part in the colonization of Virginia (1606), then being carried into effect, and brought to bear with such effect his military renown upon the directory of the "London Company" that his name was placed on the secret list of seven persons appointed members of the council. During the long voyage to Virginia (1607) Smith was placed under arrest on an accusation of sedition, and, though liberated on arrival at Jamestown, Va., where the colony was located, he was excluded from his place in the council. He accompanied Capt. Newport in his voyage of exploration up James River as far as the present site of Richmond; was on their return admitted as a member of the council; took part in the movement which resulted in the removal from office of Wingfield, the president of the colony, against whom he successfully brought a suit for slander; was entrusted with the command of several expeditions into the interior, partly for the purpose of exploration, but chiefly with the object of obtaining food, as the colony was now suffering from famine, and repressed with severity the projects of some of the settlers to return to England; upon which charge he caused Capt. George Kendall to be condemned and executed. Upon one of these expeditions, in Dec., 1607, Smith was taken prisoner, and detained for some time, though kindly treated by the Indian chieftain Wahunsenacawh (afterward incorrectly called by many writers the "emperor" Powhatan). The famous incident of the preservation of his life by the intervention of Pocahontas (or Amonate) was related of this captivity, but documents recently published leave little doubt that the whole adventure is fictitious. On being carried back to Jamestown by the Indian chieftain, Smith was tried by his fellow-councillors for the death of two of his companions, said to have been killed by the Indians through his imprudence, and was condemned to be executed the next day, but his life was saved by the opportune arrival of Capt. Newport with reinforcements and provisions. In the following year Smith made two extended surveys of Chesapeake Bay and its tributary waters, of which he made a map; became president of the council Sept., 1608; had several skirmishes with hostile Indians, who at one time

meditated the destruction of Jamestown. His departure from Virginia, to which he never returned, took place in Sept., 1609, and was attributed by himself to having been burned by an explosion of gunpowder, but another account states that he was sent to England a prisoner. In 1614 he explored with two ships fitted out by some London merchants a large portion of the North American coast, to which he gave the name of New England, and of which he formed a tolerably accurate map, and made a handsome profit by fishing and fur-trading. In 1615 he undertook another voyage to New England for the purpose of founding a colony, but was captured by a French man-of-war and taken to Rochelle. Afterward he claims to have been engaged in "sea-fights for the French against the Spaniards," and to have experienced several remarkable adventures. About 1616 he received the title of "admiral of New England," and was thenceforth much engaged in promoting American colonization by means of a series of publications on America, written either by or for him, in which romantic versions of his career in many lands were put forth; but many of the details are contradicted by conclusive proofs, and his several books and pamphlets are not consistent with each other upon some important points. D. in London June 31, 1631, and was buried in the choir of St. Sepulchre's church. Under the name of "Thomas Watson," Smith sent from Virginia *A True Relation of such Occurrences and Accidents of Note as hath happened in Virginia, etc.* (London, 4to, 1608), which was printed in black letter, accompanied by a map, and is the earliest tract published on the subject. It was reprinted, with an introduction and notes, by Charles Deane (Boston, 1867). He was also author of *A Map of Virginia, with a Description of the Country, the Commodities, the People, Government, and Religion, etc.* (Oxford, 1612); *A Description of New England, or the Observations and Discoveries of Captain John Smith (Admiral of that Country) in the North of America in the Year of our Lord 1614, etc.* (London, 1616; reprinted in the *Collections* (3d Series, vol. vi.) of the Mass. Hist. Soc., and in Force's *Tracts, New England's Trials, etc.* (1620 and 1622); *The Generall Historie of Virginia, New England, and the Summer Isles, with the Names of the Adventurers, Planters, and Governors from their First Beginning Ano. 1584 to this Present, etc.* (1626)—a work including the substance of its predecessors; two treatises on seamanship (1626 and 1627); *The True Travels, Adventures, and Observations of Captain John Smith in Europe, Asia, Africa, and America from 1593 to 1629, etc.* (1630); and *Advertisements for the Unexperienced Planters of New England, etc.* (1631; reprinted at Boston, 1865); and was engaged at the time of his death upon a *History of the Sea*, no part of which has been preserved. The *Generall Historie* and *True Travels* were republished together at Richmond (2 vols., 1829). A *Letter of John Smith to Lord Bacon*, written in 1618 to recommend to the chancellor's attention the fisheries of New England, was first printed in the New York *Historical Magazine* for 1861. There are biographies by George S. Hillard (in Sparks's Series, vol. ii.), W. G. Simms (1846), and George C. Hill (1858). Much light was thrown upon his career by the Hakluyt Society's publication of Strachey's *History of Travails into Virginia Britannia* (1849) from the original MS., and by Mr. Charles Deane's notes to his edition of Wingfield's *Discourse of Virginia* (Boston, 1859), in which publications the falsity of the Pocahontas legend was first exposed. In Bryant and Gay's *Popular History of the U. S.* (vol. i., 1876) judicious use has been made of the materials above mentioned. PORTER C. BLISS.

**Smith** (JOHN), known as "John Smith of Cambridge," b. at Achurch, near Oundle, Northamptonshire, England, in 1618; graduated at Emanuel College, Cambridge, 1640; became fellow of Queen's College 1644; was for several years tutor and mathematical lecturer there; took holy orders, and was esteemed "a man of great abilities, vast learning, and possessing also every grace and virtue which can improve and adorn human nature." According to Allibone, he was "the most eminent divine of both his names." D. at Cambridge Aug. 7, 1652. His *Select Discourses* were edited with a *Memoir* by Dr. Symon Patrick (London, 4to, 1660; frequently reprinted), and acquired great fame. Other *Lives* were subsequently written by John King (1820) and by Lord Hailes (1821). He figures largely in Principal Tulloch's *Rational Theology in England* in the seventeenth century.

**Smith** (JOHN AUGUSTINE), M. D., b. in Westmoreland co., Va., Aug. 29, 1782; graduated at William and Mary College, Va., 1800; studied medicine; settled as a physician at New York 1809; became lecturer on anatomy in the College of Physicians and Surgeons; edited the *Medical and Physiological Journal;* was president of William and Mary College 1814–26, when he resigned and resumed the practice of his profession in New York; was president of the College of Physicians and Surgeons 1831–43, and published numerous addresses, essays, and lectures, chiefly on medical and physical science and moral philosophy. D. in New York Feb. 9, 1865.

**Smith** (JOHN BLAIR), D. D., brother of Dr. Samuel Stanhope Smith, b. at Pequea, Pa., June 12, 1756; graduated at Princeton 1773; studied theology with his brother, then president of Hampden-Sidney College, and succeeded him in that position 1779; became one of the most noted preachers of the Valley of Virginia, and very successful as a revivalist; was pastor of the Third Presbyterian church, Philadelphia, 1791–95; became first president of Union College 1795; returned to his pastoral charge in Philadelphia May, 1799, and d. there of an epidemic Aug. 22, 1799.

**Smith** (JOHN BLAKELY), b. in North Carolina June 11, 1820; was brought up a Presbyterian, but became a preacher of the Methodist Episcopal Church, South; joined in 1847 the Georgia conference, in which he filled responsible positions, and subsequently, after its division, in the South Georgia conference, till his death, in Georgia, Sept. 30, 1872. He was the secretary of the conference, and was a most laborious and successful minister. T. O. SUMMERS.

**Smith** (JOHN COTTON), LL.D., b. at Sharon, Conn., Feb. 12, 1765; graduated at Yale College 1783; was admitted to the Litchfield bar 1786; was several years a member of the legislature, of which he was clerk 1799 and Speaker 1800; member of Congress 1800–06; became a member of the council and judge of the State supreme court 1809; was shortly afterward lieutenant-governor; was governor of Connecticut 1813–18. During the celebrated Congressional debates of 1801 concerning the Federal judiciary he presided as chairman of the committee of the whole; was a man of extensive literary and historical attainments, a distinguished agriculturist and philanthropist, and president of the American Board of Foreign Missions and of the American Bible Society, and contributor to literary and scientific periodicals. D. at Sharon Dec. 7, 1845. His *Correspondence and Miscellanies* was published at New York in 1847 by Rev. W. W. Andrews.

**Smith** (JOHN E.), b. in Pennsylvania; on the outbreak of the civil war was a resident of Illinois, and served on the staff of Gov. Yates; appointed colonel of the 45th Illinois Vols. July 23, 1861, he was engaged in the capture of Forts Henry and Donelson, the battle of Shiloh, and the siege of Corinth; in Dec., 1862, was commissioned a brigadier-general of volunteers, and commanded a division of the 16th army corps in the Yazoo expedition, battles of Port Gibson, Raymond, Champion Hill, and Big Black River; transferred to the 17th corps in June, he commanded the 1st division in the Vicksburg campaign, and with the 15th corps was engaged in the battle of Missionary Ridge, in Sherman's Atlanta campaign and subsequent "march to the sea," and the invasion of the Carolinas. In Apr., 1866, he was mustered out of the volunteer service, and in the reorganization of the regular army (July, 1866) was appointed colonel of the 27th Infantry; transferred to the 15th Infantry Dec. 15, and 14th Infantry Dec. 20, 1870; brevetted brigadier-general for Vicksburg and major-general for capture of Savannah.

**Smith** (JOHN GORDON), b. at Aberdeen, Scotland, about 1788; graduated at Marischal College in his native city, and studied medicine there and at the University of Edinburgh; served in the Peninsular war as surgeon to the 12th Lancers; was subsequently librarian to the duke of Sutherland for four years, and was appointed professor of medical jurisprudence in 1828 at the University of London. He was a man of considerable ability, and his three works on medical jurisprudence are still considered very valuable: *Principles of Forensic Medicine* (London, 1821; several times reprinted), *An Analysis of Medical Evidence* (London, 1825), and *Hints for the Examination of Medical Witnesses* (London, 1829). He also wrote *Santarem, or Sketches of Society and Manners in the Interior of Portugal* (London, 1832), and contributed to the *Military Register*, and to other medical and some miscellaneous periodicals. In the latter part of his life he was much embarrassed, however, by unfortunate pecuniary circumstances, and he d. in the Fleet Prison, London, where he was confined for debt, Sept. 15, 1833. Interesting notices of him will be found in the London *Gentleman's Magazine*, 1833, vol. ii., pp. 278, 543.

**Smith** (JOHN GREGORY), b. at St. Alban's, Vt., July 22, 1818; graduated at the University of Vermont 1838, and at the New Haven Law School; commenced practice 1841 along with his father, John Smith (1789–1858), who was a member of Congress 1839–41, and subsequently chancellor of Vermont; aided him in developing important railway projects; succeeded his father as chancellor 1858; sat in both houses of the State legislature; was Speaker of the lower house 1862; governor of Vermont 1863–65; became president of the Northern Pacific Railway 1866.

**Smith** (John Hyatt), D. D., b. at Saratoga Springs, N. Y., in 1823; became a Baptist minister 1848; was some years pastor of the Eleventh Baptist church, Philadelphia, subsequently of Lee avenue church, Brooklyn, N. Y., where he became widely known as a pulpit-orator and as a leader of the "open-communion" movement.

**Smith** (John Jay), great-grandson of James Logan, b. in Burlington co., N. J., June 16, 1798; was from 1829 to 1851 librarian of the Philadelphia and Loganian libraries; published several volumes on antiquarian and biographical topics; edited several literary periodicals, and superintended the publication of above 100 volumes by other writers. The *Lives* of Franklin, Rittenhouse, Montgomery, Kenton, and Gen. Augustine Washington in the *National Portrait Gallery* were from his pen.

**Smith** (John Lawrence), M. D., M. N. A. S., b. near Charleston, S. C., Dec. 16, 1818; graduated at the University of Virginia, and at the medical school of the University of South Carolina; acted as civil engineer on the Charleston and Cincinnati R. R.; pursued his professional education for three years in France and Germany, devoting himself also to chemistry, mineralogy, and general science; returned to the U. S. 1844; commenced the practice of medicine at Charleston, S. C., where he delivered lectures on toxicology, and soon devoted himself to scientific pursuits; gave attention to agricultural chemistry, and made a thorough examination of the marl-beds near Charleston; was for more than four years (1846–51) mining engineer to the Turkish government; aided in the development of cotton-growing in Asia Minor, where he made extensive mineralogical explorations, and published a report *On the Thermal Waters of Asia Minor* (1849); was afterward instrumental in the discovery of deposits of emery and corundum in the U. S.; invented in 1851 the inverted microscope; was elected in that year professor of chemistry in the University of Virginia; subsequently removed to Louisville, Ky.; became a professor in the Medical University of that city and superintendent of its gasworks; was U. S. commissioner to the Universal Expositions of Paris (1867) and Vienna (1872); was in 1872 president of the American Association for the Advancement of Science; is a member of the National Academy of Science, and of numerous chemical, biological, mineralogical, scientific, and industrial associations; received from the emperor Napoleon III. the cross of the Legion of Honor; is author of an elaborate report to the U. S. government on *The Progress and Condition of Several Departments of Industrial Chemistry* (1867), as seen at the Paris Exposition, and has printed in pamphlets or in periodicals more than 50 scientific papers, most of which were collected into a volume entitled *Mineralogy and Chemistry: Original Researches* (Louisville, 1873).

Paul F. Eve.

**Smith** (John Pye), D. D., LL.D., F. R. S., b. at Sheffield, England, May 25, 1774; studied at the Independent academy at Rotherham; became a dissenting (Independent) minister, and in 1800 resident classical tutor in the theological academy at Homerton; exchanged that post in 1813 for the divinity tutorship, which he filled until 1843; was again classical tutor, and also principal from the latter date until 1850, when New College, St. John's Wood, was formed by the junction of Homerton, Highbury, and Coward colleges, and Dr. Smith retired to private life, aided by a testimonial fund of £3000. For forty-three years he was pastor of the celebrated "Gravel Pits Chapel," Homerton; took great interest in science, and was honored by membership in the Royal and Geological societies. D. at Guildford, Surrey, Feb. 5, 1851. Author of *The Scripture Testimony to the Messiah* (2 vols., 1818–21), *The Mosaic Account of the Creation and Deluge illustrated by the Discoveries of Modern Science* (1837), *Scripture and Geology* (1839), and other works. (See *Memoirs of the Life and Writings of John Pye Smith*, by J. Medway, 1853.)

**Smith** (John Russell), b. at Sevenoaks, Kent, England, in 1810; became a bookseller and publisher in London, and distinguished by the excellence of his bibliographical catalogues, one of which was devoted to the literature relating to the county of Kent (1837), another to the provincial dialects of England (1839), and a third to *English Writers on Angling and Ichthyology* (1856). The most valuable to Americans is the extensive and accurate *Bibliotheca Americana* (1849, 1853, and 1865; *Supplement*, 1865). He has been an assiduous collector of Shakspeariana, and was projector and co-editor of the "Library of Old Authors."

**Smith** (John Speed), b. in Jessamine co., Ky., July 31, 1792; served under Gen. Harrison at Tippecanoe; was his aide at the battle of the Thames 1813; sat several years in the Kentucky legislature, of which he was Speaker 1827; was member of Congress 1821–23; U. S. district attorney for Kentucky under Pres. Jackson, and for a considerable period State superintendent of public works. D. in Madison co., Ky., June 6, 1854.

**Smith** (John William), b. in London, England, in 1809; educated at Trinity College, Dublin; commenced legal practice as a special pleader 1831, and was called to the bar at the Inner Temple 1834. D. in London Dec. 17, 1845. Author of a *Compendium of Mercantile Law* (1834), *An Elementary View of the Proceedings in an Action at Law* (1835), and *A Selection of Leading Cases in Various Branches of the Law* (2 vols., 1837–40), which were received with extraordinary favor, especially the latter, and were reprinted in America. Mr. Smith wrote other legal works, and was a poet of considerable merit. (See *Memoir*, by Samuel Warren, in *Blackwood's Magazine*, Feb., 1847.)

**Smith** (Jonathan Bayard), b. at Philadelphia, Pa., in 1741; graduated at Princeton 1760; became a successful merchant at Philadelphia; commanded a company of militia at the battle of Princeton; was a member of the Continental Congress 1777–78; served many years as a judge of common pleas, and was a trustee of Princeton College and of the University of Pennsylvania. D. at Philadelphia June 16, 1842.

**Smith** (Joseph), D. D., b. in Westmoreland co., Pa., July 15, 1796; graduated at Jefferson College 1815, at Princeton Theological Seminary 1819; preached several years in Virginia; was principal of academies at Staunton, Va., and at Frederick City, Md.; president of Franklin College, O., and of a college at Frederick City; became general agent for the Presbyterian synods of Western Pennsylvania, Northern Virginia, and Eastern Ohio, and was pastor at Round Hill and at Greensburg, Pa., where he d. Dec. 4, 1868. Author of *Old Redstone* and of a *History of Jefferson College*.

**Smith** (Joseph), b. at Sharon, Vt., Dec. 23, 1805; removed while a child, with his parents, to Palmyra, N. Y., where he grew up almost without education, leading an idle and rather disreputable life, and about 1828 began to put forth vague claims as the founder of a new religion, or rather, as the restorer of the original true faith. According to his own account, he began to have visions at the age of fifteen, and on Sept. 21, 1823, the angel Moroni appeared to him, announcing that God had a work for him to perform, and that, buried in the earth in a certain spot a few miles distant, was a record inscribed upon gold plates, giving an account of the early inhabitants of America and of their fate; and with this record would be found a kind of spectacles through which alone the writing could be read. Three years after, the angel placed the plates in his hands, together with the spectacles. Smith described the plates as being about 8 inches long, 7 wide, and connected by rings so as to form a volume about 6 inches thick. The plates were inscribed on both sides with hieroglyphic characters in a language no longer extant, but which he was able to decipher and understand by the use of the miraculous spectacles, which he called the "Urim and Thummim." Smith professes to have dictated in English the contents of these plates to Oliver Cowdery, who acted as his amanuensis, the plates themselves mysteriously disappearing as they were successively transcribed. What purported to be a copy of the original characters on one of these plates was submitted to Prof. Charles Anthon, who says, "The paper was in fact a singular scroll. It consisted of all kinds of crooked characters, disposed in columns, and had evidently been prepared by some person who had before him at the time a book containing various alphabets. Greek and Hebrew letters, crosses and flourishes, Roman letters, inverted or placed sideways, were arranged and placed in perpendicular columns; and the whole ended in a rude delineation of a circle, divided into various compartments, decked with various strange marks, and evidently copied after the manner of the Mexican calendar, given by Humboldt, but copied in such a way as to betray the source whence it was derived." The manuscript as professed to be transcribed by Cowdery from Smith's dictation was printed at Palmyra in 1830 under the title, *The Book of Mormon, an Account written by the Hand of Moroni upon Plates taken from the Plates of Nephi. By Joseph Smith, Jr., Author and Proprietor;* and to it was prefixed a certificate signed by Cowdery and two others to the effect that they had seen and handled the plates. Subsequently, all three of the witnesses fell out with Smith, and declared the whole matter to be a hoax. There can be no doubt that the *Book of Mormon* was a kind of historical romance, written nearly twenty years before by Samuel Spalding, at one time a clergyman, and that he intended to publish it as such under the title *The Manuscript Found;* and that this manuscript fell into the hands of Sidney Rigdon, a printer, who surreptitiously copied it, returning the original to Spalding, who died soon after, but the manuscript was preserved by his widow. Rigdon in the mean while had set up as the foun-

der of a new faith, and fell in with Smith, and they two concocted the plan of making Spalding's romance a kind of Bible of their sect, or at least hoping to make money by its publication. The funds for the printing were advanced by Martin Harris, a neighboring farmer of some property and one of the signers of the attestation; but not being able to get back what he had spent, he disclosed the hoax as to the plates, of which he was probably a victim. The *Book of Mormon* consists of nearly a score of separate books, the first professing to be written by Nephi, who lived in Jerusalem about 600 B. C., and finally, upon the Dispersion, led a colony to America; the work is continued by others until 420 A. D., when Moroni, the last survivor of his race, sealed up the plates and deposited them in the place pointed out to Smith. The entire book bears to Mormonism about the same relation which the Pentateuch and the historical books of the Old Testament do to Christianity. (For the development of Mormonism, and its history, see MORMONS.) Smith and Rigdon soon gained a small body of followers, and in 1831 went to Kirtland, O., where they built a temple, set up a fraudulent bank, and were driven away by the citizens in 1838. Smith had in the mean time fixed upon a place in Missouri as the site of his New Jerusalem, and here his adherents had begun to gather; but becoming obnoxious to the surrounding inhabitants, they abandoned their settlement, and took refuge in Hancock co., Ill, where in 1840 they established themselves in a fine location at a bend of the Mississippi, calling their new home Nauvoo; the town increased so rapidly that in six years the population numbered 15,000. Here Smith soon began to put forth, as occasion demanded, a succession of new revelations, among others one establishing polygamy as an essential feature of the "Church of the Latter-Day Saints," and combining in his own person all civil, military, municipal, and sacerdotal authority. A newspaper was set up to oppose him, which was demolished by Smith and his adherents May 6, 1844. Warrants were issued for his arrest and that of his brother Hyrum and some others; they refused to obey the writs; the State militia were called out; the Mormons armed themselves, and a conflict was imminent. The governor of Illinois at length induced the Smiths to surrender and submit to trial, guarantying their personal safety in the interval. They were committed to jail at Carthage, the county-town, and a guard was placed for their protection. On the evening of May 27 a mob assembled, dispersed the guard, and began firing into the door and window of the jail. Hyrum Smith was shot dead; Joseph returned the fire with a revolver until his charges were exhausted, when he endeavored to make his escape by the window, but was shot in the attempt, and fell dead to the ground. A. H. GUERNSEY.

**Smith** (JOSEPH MATHER), M. D., b. at New Rochelle, N. Y., Mar. 14, 1789; settled as a physician in New York City 1811; was one of the founders of the Medico-Physiological Society; visiting physician to the New York State prison 1820–24; became editor of the New York *Medical and Physical Journal* 1828, and visiting physician to the New York Hospital 1829; was professor of the theory and practice of physic in the New York College of Physicians and Surgeons 1826–55, and afterward professor of materia medica; was president of the American Medical Association 1854, and published several valuable professional books, reports, and memoirs. D. in New York City Apr. 22, 1866.

**Smith** (JOSHUA TOULMIN), b. at Birmingham, England, May 29, 1816; educated in the public schools of Birmingham; published when nineteen years of age an *Introduction to the Latin Language* (1835), and in the following year *A Popular View of the Progress of Philosophy among the Ancients* (1836); devoted himself to the Scandinavian languages and literature, in which he became proficient; resided in the U. S. 1837–42; published at Boston his *Northmen in New England, or America in the Tenth Century* (1839), which was chiefly a translation from the *Antiquitates Americanæ* (1837); devoted himself, on his return to England, to the study of constitutional and Old-Saxon law; was called to the bar 1849; wrote several able legal treatises, especially *The Parish, its Obligations and Powers, its Officers and their Duties* (1854); illustrated in several publications the antiquities of Birmingham, and undertook the preparation for the Early English Text Society of a *History of English Guilds*, a work of immense labor, which, as well as a projected *History of Birmingham*, was left incomplete by his death at Lancing, Sussex, Apr. 28, 1869. The *History of English Guilds* appeared in 1870.

**Smith** (JOSIAH TORREY), b. at Williamstown, Mass., in 1815; graduated at Williams College 1842; studied theology, and was pastor of several churches. Author of two controversial works on the subject of infant baptism, and of *God's Testimony in relation to the Use of Intoxicating Beverages.*

**Smith** (JUNIUS), LL.D., b. at Plymouth, Conn., Oct. 2, 1780; graduated at Yale College 1802; studied law under Judge Reeve at Litchfield, Conn.; was a member of the Connecticut Society of Cincinnati in right of his father, Gen. David Smith of the Revolutionary army; practised law at New Haven; gained an important claim against the British government 1805; engaged in commerce with Great Britain; was the first proposer of a line of steamships across the Atlantic 1832; founded a company for that purpose 1836, and successfully inaugurated the enterprise by the voyage of the Sirius in the spring of 1838, but derived no pecuniary advantage from the efforts of many years; afterward introduced tea-planting into South Carolina, where he purchased an extensive estate; was there assaulted and received a fracture of the skull, from the effects of which he d. at Astoria, N. Y., Jan. 23, 1853.

**Smith** (LLOYD P.), son of John Jay Smith, b. at Philadelphia, Pa., in 1822; educated at Haverford College; succeeded his father in 1851 as librarian of the Philadelphia Library; compiled vol. iii. of the *Catalogue of Books belonging to the Library Company of Philadelphia* (1856); was one of the commission sent to East Tennessee in behalf of the relief association of Philadelphia 1864; published a *Report* of that visit; is author of privately-printed pamphlets upon the character of Napoleon I. and upon the political tendency of the *Life of Cæsar* by Napoleon III., and was editor of *Lippincott's Magazine.*

**Smith** (LYNDON ARNOLD), M. D., b. at Haverhill, N. H., Nov. 11, 1795; graduated at Dartmouth College 1817; studied medicine at Dartmouth and Williams medical schools, graduating in 1823 at the latter institution; began practice at Williamstown 1823; settled at Newark, N. J., 1827; was prominently identified with medical progress as an officer of the State and national associations; was the chief promoter of the establishment of a lunatic asylum in New Jersey, and published numerous professional memoirs in the medical journals. D. at Newark Dec. 15, 1865.

**Smith** (MARCUS), son of Sol F. Smith, b. in New Orleans, La., Jan. 7, 1829, where he made his début as Diggory in *Family Jars.* He appeared for many years in the leading theatres in New York, where he was an established favorite, as well as throughout the U. S. and wherever he appeared in England. D. at London in 1875.

**Smith** (MARTIN LUTHER), b. in New York in 1819; graduated at West Point 1842; became lieutenant of topographical engineers 1843; served in the Mexican war; became captain 1856; resigned Apr. 1, 1861; entered the Confederate army as brigadier-general; became the head of the engineer corps; planned and constructed the defences of Vicksburg, where he was taken prisoner; reached the rank of major-general, and after the war became chief engineer of Selma Rome and Dalton Railway. D. at Rome, Ga., July 29, 1866.

**Smith** (MATTHEW HALE), b. in Connecticut about 1810; was successively a preacher of the Universalist, Presbyterian, Episcopalian, and Baptist churches; published books giving the reasons for some of his ecclesiastical changes; studied and practised law, edited newspapers, took part in politics, and engaged in business, but returned to theology, and was for many years well known by his signature "Burleigh" as correspondent of the *Boston Journal.* Of late years he has resided chiefly in New York City and vicinity.

**Smith** (MELANCTHON), b. May 24, 1810, in New York; entered the navy as a midshipman Mar. 1, 1826; became a lieutenant in 1837, a commander in 1855, a captain in 1862, a commodore in 1866, a rear-admiral in 1870; retired in 1871. Served with great distinction during the civil war at the battle of New Orleans, the passage of Fort Hudson, in the sounds of North Carolina, and in both the Fort Fisher fights, and highly commended for "ability, skill, and daring" by Rear-Admirals Farragut and Porter. From 1866 to 1870 filled the office of chief of the bureau of equipment and recruiting. FOXHALL A. PARKER.

**Smith** (MILES), D. D., b. at Hereford, England, about 1550; educated at Corpus Christi and Brasenose colleges, Oxford; took orders in the Church of England; became deeply versed in patristic literature and in the Oriental languages; was made bishop of Gloucester 1612; was one of the principal translators of King James's version of the Bible, for which he wrote the Preface, and edited Bishop Babington's collected *Works.* D. Nov., 1624. A posthumous volume of his *Sermons* was printed in 1632.

**Smith** (MORGAN L.), b. in Oswego co., N. Y., in 1818; enlisted in youth as a private soldier in the U. S. army; was promoted to sergeant for bravery in the Mexican war, after which he engaged in business for some years in New York City and in the Western States, and at the beginning of the civil war raised and commanded a regiment composed

of men from Illinois and Missouri, who were pledged never to retreat from the field; was distinguished at Fort Donelson, at which time he was made a brigadier-general; took part in the Shiloh, Vicksburg, and Chattanooga campaigns; took part in Sherman's "march to the sea" as major-general in command of a division; became post commander at Vicksburg; served some years after the war as consul at Honolulu, and subsequently became a claim-agent at Washington. D. suddenly at Jersey City, N. J., Dec. 29, 1874.

**Smith** (NATHAN), M. D., b. at Rehoboth, Mass., Sept. 30, 1762; settled in childhood in Vermont; received a limited education; served in the Vermont militia toward the close of the war of the Revolution; studied medicine at Harvard Medical School; practised at Cornish, Vt.; became first professor of the medical school established at Dartmouth College 1798; visited Europe, attending lectures in England and Scotland; was the sole creator of the medical department at Dartmouth; delivered lectures also at the University of Vermont and at Bowdoin College, and became professor in the new medical school of Yale College 1813, retaining, however, his connection with Dartmouth. D. at New Haven, Conn., Jan. 26, 1829. Author of an *Essay on Typhus Fever* (1824) and of posthumous *Medical and Surgical Memoirs* (1831).

**Smith** (NATHAN), b. at Roxbury, Conn., in 1770; studied law under Judge Reeve at Litchfield, and practised at New Haven; was for many years State prosecuting attorney of New Haven co., and U. S. district attorney for Connecticut; was one of the framers of the State constitution; was often elected to the legislature; was a delegate to the Hartford Convention 1814, and U. S. Senator 1832–35. D. at Washington, D. C., Dec. 6, 1835.

**Smith** (NATHANIEL), brother of Nathan Smith, b. at Woodbury, Conn., Jan. 6, 1762; received a limited education; studied law at Litchfield under Judge Reeve; commenced practice at the bar in his native town 1789; served often in the legislature; was a member of Congress 1795–99; State senator 1799–1804, and judge of the State superior court 1806–19. D. at Woodbury Mar. 9, 1822.

**Smith** (NATHAN RYNO), M. D., LL.D., b. at Cornish, N. H., May 21, 1797; graduated at Yale College 1817; took the degree of M. D. at New Haven 1823, and was elected professor of anatomy and surgery in the University of Vermont at Burlington 1825; on the organization of the Jefferson Medical College in Philadelphia, became the professor of anatomy, but in 1827 accepted the chair of surgery in the University of Maryland; invented a sure method of lithotomy, an excellent suspensory apparatus for fractured inferior extremities, and wrote *Surgical Anatomy of the Arteries* (1832) and other medical works; in 1838 became professor of practical medicine in the Transylvania University, Lexington, Ky.; in 1840 returned to the University of Maryland; in 1867 visited Europe, where his reputation secured him a flattering reception. PAUL F. EVE.

**Smith** (OLIVER HAMPTON), b. at Trenton, N. J., Oct. 23, 1794; emigrated to Indiana 1817; studied and practised law; became district attorney 1824, member of Congress 1827–29, and U. S. Senator 1837–43. D. at Indianapolis Mar. 19, 1859. Author of *Recollections of Congressional Life* and of *Early Indiana Trials, Sketches, and Reminiscences* (Philadelphia, 1858).

**Smith** (PERSIFER FRAZER), b. at Philadelphia, Pa., Nov., 1798; graduated at Princeton 1815; studied law; settled at New Orleans; became adjutant-general of Louisiana; was colonel of Louisiana volunteers under Gen. Gaines in the campaigns of 1836 and 1838 in Florida; commanded the brigade of Louisiana volunteers under Gen. Taylor on the Rio Grande May, 1846; was appointed colonel of the mounted rifles May 27, 1846; was brevetted brigadier-general for services at Monterey and major-general for gallantry at Contreras and Churubusco, where he bore the brunt of the battle; was distinguished in the engagement at the Belen gate of the City of Mexico; was a commissioner to treat for an armistice Aug. 22; appointed civil and military governor of the City of Mexico Oct., 1847, and of Vera Cruz May, 1848; subsequently commanded the departments of California and Texas; was appointed brigadier-general U. S. A. Dec. 30, 1856, and was appointed to command the contemplated expedition to Utah a few days before his death, at Fort Leavenworth, Kan., May 17, 1858.

**Smith** (RICHARD), b. in county Wexford, Ireland, Jan. 30, 1823; came to the U. S. 1841, and settled in Cincinnati. After working at the carpenter's trade for nearly three years, he obtained a position as reporter on the *Daily Chronicle;* was appointed superintendent of the Cincinnati chamber of commerce 1849, and became in the same year editor and proprietor of the *Price Current.* In 1854 he bought an interest in the *Cincinnati Gazette,* of which a few years later he became managing editor—a position he still holds (1876). J. B. BISHOP.

**Smith** (RICHARD PENN), son of William Moore Smith, b. at Philadelphia, Pa., Mar., 1799; was admitted to the bar 1821; wrote for the *Union* newspaper; was the successor of Duane as editor of the *Aurora* 1822–27; wrote many poetical pieces for periodicals; published several successful plays, including *Caius Marius,* a tragedy written for Edwin Forrest; was author of a *Life of David Crockett* (1836), and the novels *The Forsaken* (1831) and *The Actress of Padua.* D. near Philadelphia Aug. 12, 1854. His *Miscellaneous Works* (1856) were edited by his son, H. W. Smith, with a biographical sketch by Morton McMichael.

**Smith** (RICHARD SOMERS), b. at Philadelphia Oct. 30, 1813; was graduated from the U. S. Military Academy July 1, 1834, when assigned to the 2d Infantry as brevet second lieutenant, but served on topographical duty until 1836, when he resigned to follow the profession of civil engineering. In 1840 he was reappointed in the army with rank of second lieutenant of infantry, first lieutenant 1846; transferred to the 4th Artillery 1848. For fifteen years (1840–55) he was assistant professor of drawing at the Military Academy, when he again resigned (Jan. 13, 1856) from the army, this time to accept the chair of mathematics and drawing in the Brooklyn Polytechnic Institute, which position he retained until 1859. From 1859 to 1861 he was a director of the Cooper Union; on the 14th of May of the latter year he re-entered the army with rank of major, and was assigned to the 12th Infantry. He served on mustering and disbursing duty until the latter part of 1862, when he rejoined his regiment, and was engaged in the battle of Chancellorsville, May 2–4, 1863. Soon after this (May 30) he relinquished his commission to accept the presidency of Girard College, Philadelphia, which high position he continued to hold until 1868, and from 1868 to 1870 was professor of civil engineering in the Polytechnic College of the State of Pennsylvania; since the latter date he has been at the head of the department of drawing at the U. S. Naval Academy at Annapolis. In 1857, Columbia College conferred the degree of A. M. upon him. Author of *A Manual of Topographical Drawing* and *Manual of Linear Perspective.*

**Smith** (ROBERT), D. D., F. R. S., b. in England in 1689; displayed from childhood great fondness for mathematics and the physical sciences; took orders in the Church of England; became mathematical preceptor to the duke of Cumberland and instructed the king in mechanics; succeeded his cousin and friend, the celebrated Roger Cotes, as professor of astronomy at Cambridge 1716; edited Cotes's *Harmonia Mensurarum* and other writings 1722, and his *Lectures on Hydrostatics and Pneumatics* (1737), both enriched with commentaries; published his chief work, *A Complete System of Optics* (2 vols., 1738), and his *Harmonics, or the Philosophy of Musical Sounds* (1749), and succeeded Bentley as master of Trinity College 1742. D. at Cambridge Aug., 1768. By his will he left £2000 to Trinity College and £2500 to the university for the support of the astronomical professorship and the maintenance of two annual prizes for proficiency in mathematics and natural philosophy.

**Smith** (ROBERT), D. D., b. at Londonderry, Ireland, in 1723; came to Pennsylvania with his parents in childhood, settling at the head-waters of Brandywine Creek, Chester co.; was educated at a school taught by Rev. Samuel Blair, whose sister he married; was settled in 1751 as pastor of a Presbyterian church at Pequea, Lancaster co., Pa., where he established a classical school and theological seminary, in which he trained his sons, Rev. Drs. Samuel Stanhope and John Blair. D. at Rockville, Pa., Apr. 15, 1793.

**Smith** (ROBERT), D. D., b. in the county of Norfolk, England, in 1732; educated at the University of Cambridge, where he became a fellow; took orders in the Church of England 1756; became rector of St. Philip's, Charleston, S. C., 1759; served as a volunteer in the war of the Revolution; preached for a time in Queen Anne co., Md.; presided over Charleston College 1786–98, and was consecrated at Philadelphia as the first Protestant Episcopal bishop of South Carolina Sept. 13, 1795. D. at Charleston Oct. 28, 1801.

**Smith** (ROBERT), brother of Gen. Samuel, b. at Carlisle, Pa., Nov., 1757; served as a volunteer at Brandywine; graduated at Princeton 1781; studied law, which he practised with distinction at Baltimore; was for some years a member of the Maryland legislature; was secretary of the navy in the cabinet of Pres. Jefferson 1802–05, attorney-general Mar.–Dec., 1805, and secretary of state under Pres. Madison 1809–11; was for some years president of the American Bible Society and of the Maryland Agricultural Society, and provost of the University of Maryland. D.

at Baltimore Nov. 26, 1842. Author of an *Address to the People of the U. S.* (1811).

**Smith** (Robert Angus), Ph. D., F. R. S., b. near Glasgow, Scotland, Feb. 15, 1817; educated at the University of Glasgow; studied chemistry under Liebig at Giessen 1839–41; became a professional chemist; labored with zeal and success to improve the sanitary condition of towns and mines, especially in Lancashire; made valuable *Reports* to the board of health and to the British Association on the air and water of towns (1848), a subject to which he returned in the columns of the *Chemical News* 1858, where he demonstrated the considerable difference between city and country air; was employed by the royal mines commission to analyze the air of many mines, and prepared an elaborate *Report;* published an *Inquiry into the Action of Carbonic Acid on the Circulation of the Blood;* was appointed inspector-general of alkali-works 1863; made important researches on the comparative advantages of disinfectants, resulting in favor of the use of carbolic or phenic acid; published a *Memoir of Dr. John Dalton, and History of the Atomic Theory up to his Time* (1857), a volume on *Disinfectants and Disinfection* (1869), and *Air and Rain, the beginnings of Chemical Climatology* (1872). His latest researches have been devoted to a search for solid bodies in the air. He is the author of the memoirs on the arts in Ure and Hunt's *New Dictionary of Arts and Manufactures.*

**Smith** (Robert Payne), D. D., b. in Gloucestershire, England, Nov., 1818; graduated with high honor at Pembroke College, Oxford, 1841; obtained there a Sanskrit and two Hebrew university scholarships; took orders in the Church of England; became under-librarian of the Bodleian; published (in Latin) a *Catalogue* of the Syriac MSS. in that library; edited and translated from the Syriac the *Commentary* of Cyril of Alexandria on Luke (1858); translated from the same language the *Ecclesiastical History* of John of Ephesus (1860); commenced for the delegates of the Clarendon Press a *Syriac Lexicon,* based on that of Castell (parts i. and ii., 1868–70); is author of *The Authenticity and Messianic Interpretation of the Prophecies of Isaiah vindicated in a Course of Sermons preached before the University of Oxford* (1862), *Prophecy a Preparation for Christ* (1865), being the Bampton lectures for that year, and the *Commentary on Jeremiah* (1875) in the series known as the *Speaker's Commentary.* Dr. Smith became regius professor of divinity in the University of Oxford Aug., 1865, and dean of Canterbury Jan., 1871, in succession to Dr. Henry Alford. He visited the U. S. as a delegate to the General Conference of the Evangelical Alliance in Oct., 1873. He is a member of the Old Testament revision company.

**Smith** (Robert Vernon). See Lyveden, Baron.

**Smith** (Samuel), b. at Burlington, N. J., in 1720; was a member of the colonial assembly, treasurer of West Jersey, and author of a *History of New Jersey from its Settlement to 1721* (1755). D. at Burlington in 1776.

**Smith** (Samuel), b. at Carlisle, Pa., July 27, 1752; removed in childhood to Baltimore; was some years in his father's counting-house; made a commercial voyage to Europe; became a captain in Smallwood's Maryland regiment Jan., 1776; participated in the battles of Long Island, Harlem, and White Plains, and in the retreat through New Jersey; became major in Gist's battalion Dec. 10, 1776, and lieutenant-colonel 1777; was at the attack on Staten Island and at the battle of Brandywine; was placed by Washington in command of Fort Mifflin, which he gallantly defended from Sept. 26 to Nov. 11, when he was severely wounded and forced to remove to the Jersey shore; received the thanks of Congress and an elegant sword; was at Valley Forge and at the battle of Monmouth, after which he resigned his commission in the army, but continued to serve as colonel of militia; was a member of the Maryland constitutional convention 1776; member of Congress 1793–1803 and 1816–22; U. S. Senator 1803–15; and again 1822–33, serving much of the time as chairman of the finance committee, and occasionally as president *pro tempore* of the Senate; was major-general of militia at the defence of Baltimore against the British 1814; quelled a formidable mob in 1835, and was thereupon elected mayor. D. at Baltimore Apr. 22, 1839.

**Smith** (Samuel Emerson), b. at Hollis, N. H., Mar. 12, 1788; graduated at Harvard 1808; became an eminent lawyer; settled at Wiscasset 1812; was justice or chief-justice of common pleas for several terms, governor of Maine 1831–34, and commissioner to revise the statutes 1837. D. at Wiscasset Mar. 3, 1860.

**Smith** (Samuel Francis), D. D., b. at Boston, Mass., Oct. 21, 1808; graduated at Harvard 1829; studied theology at Andover Seminary; became a Baptist clergyman 1832; edited the *Baptist Missionary Magazine* at Boston 1832–33; was a prominent contributor to Dr. Lieber's *Encyclopædia Americana;* was pastor of a church at Waterville, Me., and professor of modern languages in Waterville College 1834–42; pastor at Newton, Mass., 1842–54; edited the *Christian Review* 1842–49, and since 1854 has been editor of the publications of the Baptist Missionary Union. He has been a frequent contributor to periodical literature; published (with Rev. Baron Stow) *The Psalmist* (1843); edited a volume of *Lyric Gems* (1844); wrote a *Life of Rev. Joseph Grafton* (1845), and is author of many well-known songs, including "My Country, 'tis of Thee," and "The Morning Light is Breaking."

**Smith** (Samuel Harrison), son of Jonathan Bayard Smith, b. at Philadelphia, Pa., in 1772; graduated at the University of Pennsylvania 1787; edited the *New World* 1796–1800, and on the removal of the seat of government founded at Washington, D. C., Oct. 31, 1800, the well-known newspaper *The National Intelligencer,* which he edited until 1810, and became commissioner of revenue 1813. D. at Washington, D. C., Nov. 1, 1845.

**Smith** (Samuel Stanhope), D. D., LL.D., son of Dr. Robert, b. at Pequea, Pa., Mar. 16, 1750; graduated at Princeton 1769; was educated at, and became a teacher in, his father's classical academy, pursuing meanwhile the study of theology; was tutor at Princeton 1770–73; was ordained to the Presbyterian ministry 1774; labored as a missionary in Western Virginia; was the first president of Hampden-Sidney College 1775–79; became professor of moral philosophy at Princeton 1779, also professor of theology 1783; vice-president of the college 1786, and president 1795; was a member of the committee appointed to draw up a system of government for the Presbyterian Church 1786; was an eloquent and effective pulpit-orator and distinguished for courtly manners; published *An Essay on the Variety of Complexion in the Human Species* (1788), a volume of *Sermons* (1798), *Lectures on the Evidences of the Christian Religion and on Moral Philosophy* (1809), and a *System of Natural and Revealed Religion* (1816); completed the *History of the U. S.,* begun by his brother-in-law, Dr. David Ramsay, and published a number of separate sermons and discourses. He married a daughter of his predecessor, Dr. Witherspoon, and resigned the presidency on account of ill-health 1812. D. at Princeton Aug. 21, 1819. Two volumes of his *Sermons* were published posthumously 1821, preceded by a brief *Memoir.*

**Smith** (Seba), b. at Buckfield, Me., Sept. 14, 1792; graduated at Bowdoin College 1818; became a journalist at Portland; married Miss Elizabeth Oakes Prince 1823; won a wide reputation as a humorist by his *Letters of Major Jack Downing* (1833); lost his property 1839; settled in New York 1842; devoted himself successfully to literature, as did also his wife (see Smith, Elizabeth Oakes Prince); published *Dewdrops of the Nineteenth Century* (1846), *My Thirty Years out of the Senate* (1859), *Powhatan, a Metrical Romance* (1841), *New Elements of Geometry* (1850), and *Way Down East, or Portraitures of Yankee Life* (1855), besides a vast number of uncollected verse and prose essays which appeared in various periodicals. D. at Patchogue, L. I., July 29, 1868.

**Smith** (Solomon Franklin), generally known as Sol Smith, b. at Norwich, Chenango co., N. Y., Apr. 20, 1801; learned the printer's trade; edited at Cincinnati the *Independent Press* 1822–23, and at Mobile the *Mercantile Advertiser* 1837–38; joined a company of strolling players; became a leading comic actor and manager; retained for many years great popularity in the Western and Southern States; became a lawyer at St. Louis, Mo., 1853, and sat in the legislature of 1861 as a Unionist. D. at St. Louis Feb. 14, 1869. Author of *Theatrical Apprenticeship* (1845), *Theatrical Journey-Work* (1854), and an *Autobiography* (1868).

**Smith** (Sydney), b. at Woodford, Essexshire, June 3, 1771; was educated at Oxford, where in 1790 he gained a fellowship of £100 a year; resided a few months in Normandy, where he mastered the French language, and in 1794 became curate of a lonely parish on Salisbury Plain. In 1796 he went to Edinburgh as private tutor to a young gentleman; remained there five years, officiating also in an Episcopal chapel; became intimate with Brougham, Jeffrey, and other brilliant young men, who in 1802 started the *Edinburgh Review,* Smith acting as original editor and contributing seven articles to the first number. Soon after this, he went to London, where he became a popular preacher, and in 1804–06 delivered courses of lectures on moral philosophy, contributing also to the *Edinburgh Review* until 1827. In 1806 he was presented with the living of Foston-le-Clay, in Yorkshire, worth £500 a year, but situated in a desolate region, "twelve miles from a lemon," as he phrased it. In 1809 he went to Heslington, near York,

leaving Foston in charge of a curate, hoping to exchange it for a more desirable benefice. Not succeeding in this, he returned in 1814, built a comfortable rectory, in which he lived until 1828, when the chancellor, Lord Lyndhurst, appointed him canon of Bristol, and gave him the rectory of Combe-Florey. In 1831 he was made resident canon of St. Paul's, upon which he took up his abode in London, where he passed the remainder of his life in the discharge of his official duties, in literary labor, and in the pleasures of society, in which he was a great favorite for his wit and rare conversational powers. In 1843 the death of his brother placed him in possession of a considerable fortune, a portion of which he invested in the public stocks of Pennsylvania; the State failing to make provision for payment of the interest, he sold out his stock for a little more than half its nominal value, and, although his absolute loss is said not to have exceeded £50, he was greatly vexed, and wrote a *Petition to Congress* and *Letters on American Debts* (1844) which were full of humorous invective. Among his most characteristic productions are his *Letters on the Subject of the Catholics, to my brother Abraham, who lives in the Country, by Peter Plymley* (1807–08; published anonymously), which had a large share in bringing about Roman Catholic emancipation. He published at various times several volumes of sermons, many occasional discourses, and political and social essays. Collections of his writings, more or less complete, have been frequently published, both before and after his death, the latest, not including his sermons, having been issued in a single volume in 1869. His early lectures on moral philosophy were edited by Francis Jeffrey, and published under the title *Elementary Sketches of Moral Philosophy* (1849). Several volumes of selections from his various works have appeared, the best of which is *Wit and Wisdom of Rev. Sydney Smith*, accompanied by a biographical sketch and notes, by Evert A. Duyckinck (1856). His memoirs have been written by his daughter, the wife of Sir Henry Holland (1855). D. in London Feb. 22, 1845.

A. H. Guernsey.

**Smith** (Sir Thomas), LL.D., b. at Saffron-Walden, Essex, England, Mar. 28, 1514; educated at Queen's College, Cambridge, where he became fellow 1531; became Greek lecturer 1533, and public orator 1536; visited France and Italy 1539–42, graduating in law at Padua; became regius professor of civil law at Cambridge 1542; aided Sir John Cheke in introducing into England an improved Greek pronunciation; took holy orders; held the rectory of Leverington, Cambridgeshire, and the deanery of Carlisle; was knighted by Edward VI.; made secretary of state 1548, and sent as ambassador to Charles V. at Brussels in July of the same year; was imprisoned in the Tower on the fall of the Protector Somerset; went as ambassador to Henry II. of France Apr., 1551, to negotiate a marriage between Edward VI. and a daughter of the French monarch; lived in retirement during the reign of Mary; was again ambassador to France 1559, 1562, 1567, and 1572; became provost of Eton 1554, privy councillor and assistant secretary of state 1571, chancellor of the order of the Garter 1572, and succeeded Burleigh as secretary of state June, 1572, holding that office until his death, in Essex Aug. 12, 1577. He was highly esteemed for learning and for loyal public service. Author of a treatise on Greek pronunciation, written about 1535, but not printed until 1568, at the same time with a dialogue on English orthography, and left in MS. a learned work, *De Republica Anglorum, the Maner of Government or Policie of the Realme of England* (London, 1583), which reached a 12th ed. 1681. His *Life* was written by Strype (1698), who pronounces him "one of the best scholars of his age, a good Physician and Chymist, an excellent Mathematician, Astronomer, and Arithmetician, a cunning Politician, a great Historian, and a compleat Orator."

**Smith** (Thomas), b. at Boston, Mass., Mar. 10, 1702; graduated at Harvard 1720; studied divinity; went to Falmouth (now Portland), Me., as chaplain 1725; remained there as first minister, and received a colleague, Samuel Deane, 1764. D. at Portland May 23, 1795. His *Journals*, together with those of his colleague Deane, were edited (1849) with biographical notices and a summary history of Portland, by Hon. William Willis, forming valuable historical material.

**Smith** (Thomas Mather), D. D., b. at Stamford, Conn., in 1797; graduated at Yale College 1816, and at Andover Seminary 1820; married a daughter of Rev. Dr. Woods; became pastor of a Congregational church at Portland, Me., 1822; was subsequently settled over churches at Fall River, Mass., Catskill, N. Y., and New Bedford, Mass.; transferred his allegiance to the Protestant Episcopal Church while at the latter place, receiving ordination from the hands of Bishops B. B. Smith and Eastburn 1845; was professor of systematic divinity in the theological school at Gambier, O., 1845–63, and president of Kenyon College at the same place 1859–63. D. at Portland, Me., Sept. 6, 1864.

**Smith** (Thomas Southwood), M. D., b. at Martock, Somersetshire, England, Dec. 21, 1788; graduated in medicine at Edinburgh 1816; settled at London 1820; became physician to the London Fever Hospital; was one of the founders of the *Westminster Review;* was an intimate friend of Jeremy Bentham, who left him his body for dissection; wrote most of the articles on anatomy, medicine, and physiology in the *Penny Cyclopædia;* served on a government commission to inquire into the condition of factory children 1832; presented to the poor-law commission in 1838 a report on the *Physical Causes of Sickness and Mortality which are capable of Removal by Sanitary Regulations*, which led to the appointment of the sanitary committee of the House of Commons 1840, and of the "health of towns commission" 1840; made in 1847 a report on the measures required for the health of London, which procured the establishment in the following year of the metropolitan board of health, and received in his later years a pension of £300 a year. D. at Florence, Italy, Dec. 10, 1861. Author of *Illustrations of the Divine Government* (Glasgow, 1816), *The Use of the Dead to the Living, A Treatise on Fever* (1830), *A Lecture delivered over the Remains of Jeremy Bentham* (1832), *Animal Physiology*, and *The Philosophy of Health* (2 vols., 1835–37). Dr. Southwood Smith is deservedly considered the founder of modern sanitary science.

**Smith** (Truman), b. at Roxbury, Conn., Nov. 27, 1791; graduated at Yale College 1815; was admitted to the bar 1818; sat in the State legislature 1831–32 and 1834; was member of Congress 1839–43 and 1845–49; had a decisive influence in procuring the nomination of Gen. Taylor for the Presidency; was U. S. Senator 1849–54; settled in New York City in the practice of his profession soon afterward; was appointed by Pres. Lincoln judge of the court of arbitration established by the treaty of 1862 with Great Britain, and was subsequently a judge of the court of claims arising from the rebellion. Author of *An Examination of the Question of Anæsthesia* (1859; 2d ed. 1867), in which he supports the claims of Dr. Horace Wells.

**Smith** (William), D. D., b. at Aberdeen, Scotland, in 1726; graduated at the University of Aberdeen 1747; came to America 1750; was tutor in the family of Gov. Martin of New York; accepted the charge of a college at Philadelphia 1751–52; went back to England to be ordained in the Church of England 1753; was inaugurated (May, 1754) first provost of the institution now known as the University of Pennsylvania; was skilled in writing verse, an able and patriotic educator and preacher; pronounced orations, at the request of Congress, on the deaths of Gen. Montgomery and of Dr. Franklin, and many others on public occasions, which were separately published. D. near Philadelphia May 14, 1803. His *Works* were edited by Bishop White (8 vols., 1803). A *Life* is in preparation by his great-grandson, Horace Wemyss Smith.

**Smith** (William), b. in New York City June 25, 1728; graduated at Yale College 1745; studied law; became an eminent member of the New York bar; was appointed a judge of the supreme court 1763, and a member of the council about 1769; was a loyalist during the war of the Revolution; went to England 1783, and was appointed chief-justice of Canada Nov., 1786. D. in Canada Dec. 3, 1793. Author of a *History of the Province of New York from its First Discovery to the Year 1722* (London, 1757; new eds. 1776, 1792, 1814, and 1829–30).—His son William, b. in New York June, 1770, became clerk of the Parliament of Canada, and was author of a *History of Canada from its First Discovery* (Quebec, 2 vols., 1815).

**Smith** (William), LL.D., b. in North Carolina in 1762; educated at Mount Zion College; was admitted to the bar at Charleston, S. C., 1792; was a member of Congress 1797–99, U. S. Senator 1816–23 and 1826–31; was twice president *pro tem.* of the Senate; was a distinguished supporter of the doctrine of "State rights;" sat at various times in the legislature, and acted as a judge of the State supreme court; declined a nomination to the U. S. Supreme bench; received in 1831 the nomination of his own State for the Vice-Presidency; spent his later years in Alabama, and d. at Huntsville June 26, 1840.

**Smith** (William), F. G. S., known as "the father of English geology," b. at Churchill, Oxfordshire, England, Mar. 23, 1769; became in early life a land-surveyor, and in the practice of his profession was led to notice and make maps of the succession of geological strata; afterward visited for that purpose nearly all the counties of England, producing an admirable series of maps, collecting a large museum of fossil remains, and demonstrating the identity of the formation which yielded the same fossils. He published a treatise on *Irrigation* (1806), *Mineral Survey, or*

*Delineations of the Strata of England and Wales* (1815, with 16 colored maps), *Strata identified by Organized Fossils* (1816–19), *Stratigraphical System of Organized Fossils* (1817); issued between 1819 and 1824 no less than twenty-one colored geological maps of English counties; delivered lectures in most of the provincial towns of England; superintended the model farm of Sir John V. B. Johnstone at Hackness, Yorkshire, 1828–34; received in 1831 from the Geological Society the Wollaston medal for his important discoveries; was honored by Trinity College, Dublin, with the degree of LL.D. 1835; selected for the government the dolomitic stone-quarries of Anston, Yorkshire, as supplying the best building material for the new houses of Parliament (1838), and in his later years received a pension of £100 a year. D. at Northampton Aug. 28, 1839. His *Life* has been written by his nephew, Prof. John Phillips (1844).

**Smith** (William), b. in King George co., Va., Sept. 6, 1797; educated at Plainfield Academy, Conn.; was admitted to the bar 1818; became proprietor of a line of post or stage coaches through Virginia, North Carolina, South Carolina, and Georgia, by which he acquired a fortune; was repeatedly elected to the State legislature; was a member of Congress 1841–43, and again 1853–61; governor of Virginia 1846–49; became brigadier-general in the Confederate army, and was wounded at Antietam.

**Smith** (William), LL.D., D. C. L., b. in London, England, in 1813; educated at the University of London, where he gained the first prizes in Latin and Greek; studied law at Gray's Inn, but never practised; was for some years professor of Greek, Latin, and German in the Independent colleges of Highbury and Homerton, and on their consolidation as New College, St. John's Wood, accepted the professorship of the Greek and Latin languages and literature; became classical examiner in the University of London 1853, and editor of the *Quarterly Review* 1867. He is widely known by his excellent series of classical dictionaries, having published those upon *Greek and Roman Antiquities* (1840), *Biography and Mythology* (1843–49), and *Geography* (1852–57), as well as by his *Dictionary of the Bible* (1860–63) and *Dictionary of Christian Antiquities* (vol. i., 1875). He has prepared numerous classical schoolbooks, an *English-Latin Dictionary* (1870), a *Biblical and Classical Atlas* (1875), and a series of *Student's Manuals* of ancient and modern history, etc., in the preparation of which he was assisted by his brother Philip, who is also author of a valuable *Ancient History* (3 vols., 1864–65).

**Smith** (William Andrew), D. D., b. at Fredericksburg, Va., Nov. 29, 1802; became a preacher of the Methodist Episcopal Church, South; in 1846 became president of Randolph-Macon College; in 1866 resigned, and after serving as pastor two years became president of Central College; was a leading member of every General Conference from 1832 to 1866; was appointed at the General Conference of 1866 one of the commissioners on the part of the Southern Church to settle the property question with the Northern Church; wrote *Lectures on the Philosophy and Practice of Slavery* (Richmond, 1860). D. at Richmond, Va., Mar. 1, 1870. T. O. Summers.

**Smith** (William Farrar), b. in St. Alban's, Vt., Feb. 17, 1824; graduated at the U. S. Military Academy July 1, 1845, when appointed brevet second lieutenant of topographical engineers. After a year's service with his corps on lake survey duty, he then passed two years at West Point as assistant professor of mathematics; then engaged on surveys in Texas, on the Mexican boundary commission, and in Florida until 1855, when again at West Point for a year. In 1856 he was placed on lighthouse construction duty, and in 1859 appointed engineer secretary of the lighthouse board. On the outbreak of civil war he was for a month on mustering duty in New York, when attached to the staff of Gen. Butler at Fort Monroe. On the 16th of July he was appointed colonel of the 3d Vermont, and was engaged in the first battle of Bull Run on the staff of Gen. McDowell. Commissioned brigadier-general of volunteers (Aug. 13), he served in the defences of Washington until Mar., 1862, and in the Virginia Peninsular campaign of 1862 commanded a division before Yorktown and in the battles of Williamsburg, Fair Oaks, White Oak Swamp, Savage Station, Glendale, and Malvern Hill; promoted to be major-general of volunteers July 4, 1862, he led his division in the Maryland campaign, at South Mountain and Antietam. In Nov., 1862, he was assigned to the command of the 6th corps, and engaged at Fredericksburg; transferred to 9th corps Feb., 1863. On Mar. 4, 1863, his appointment as major-general, not having been confirmed by the Senate, expired by constitutional limitation, and he resumed his rank of brigadier. In Oct., 1863, he became chief engineer of the department of the Cumberland, and in November of the division of the Mississippi; he directed (Oct. 27) the throwing of a pontoon-bridge across the Tennessee River at Brown's Ferry, below Chattanooga, and capture of heights overlooking it, and participated in the battle of Missionary Ridge. In Mar., 1864, he was confirmed as major-general of volunteers, and in May assigned to the 18th corps, which he commanded in the battles of Cold Harbor, June 1–3, and siege of Petersburg, until July 19, 1864, when relieved and placed on special duty. In Nov., 1865, he resigned his volunteer commission, and in Mar., 1867, his commission as major of engineers in the regular army. For gallantry in battle and gallant and meritorious conduct in the field he was brevetted from lieutenant-colonel to major-general. Since 1864 he has been president of the International Telegraph Co.; appointed police commissioner New York City 1875, and soon after chosen president of the board.

**Smith** (William Loughton), LL.D., b. probably in South Carolina about 1745; was a member of Congress 1789–97; an able supporter of the administration of Washington and Adams, and an active opponent of Jefferson, against whom he published a pamphlet; was minister to Portugal 1797–1800, and to Spain 1800–01. D. in South Carolina in 1812. Author of a volume of *Speeches*, published at London 1794, an *Address* (1794) to his constituents on the difficulties pending with England, a *Comparative View of the Constitutions of the States* (1796), and various other political pamphlets.

**Smith** (William Moore), son of Dr. William (1726–1803), b. at Philadelphia, Pa., June 1, 1759; published a volume of *Poems* (1785); became under Jay's treaty general agent for American claims against England, and visited England in that capacity to close up the business 1803. D. in Philadelphia in 1821.

**Smith** (William Prescott), b. in Baltimore, Md., in 1822; received a common-school education, which he extended by private study; was in youth an ardent Whig politician and a frequent contributor to the press; became in 1850 identified with the management of the Baltimore and Ohio Railway; was for many years master of transportation, afterward general manager, of the Washington branch; was an energetic promoter of many other lines of railway and an officer in several companies; was appointed collector of internal revenue for Maryland 1866, and travelled in Europe 1867. D. at Baltimore Oct. 1, 1872.

**Smith** (William Rudolph), son of William Moore Smith, b. at the Trappe, Pa., Aug. 31, 1787; edited in early life the Huntingdon *Museum;* wrote the life of Wythe for Sanderson's *Signers;* settled in Wisconsin as a lawyer 1837; became attorney-general 1853, and was many years president of the State Historical Society. D. at Quincy, Ill., Aug. 29, 1868. Author of *Observations on Wisconsin Territory* (1838) and of a *History of Wisconsin* (4 vols., 1854 *seq.*).

**Smith** (Gen. William Russell), b. in Alabama about 1813; educated at the University of Alabama; practised law at Greenesboro'; served as a captain of mounted infantry against the Creeks 1836; became an editor at Mobile; founded the Tuscaloosa *Monitor* 1838; was mayor of Tuscaloosa 1839; was a circuit judge 1850–51; a Whig member of Congress 1851–57, when he was chiefly noted for a speech in denunciation of Kossuth; opposed secession, but sat in the Confederate Congress 1861–65; was afterward president of the State university. Author of *The Bridal Eve, College Musings, Alabama Justice* (1841), *Uses of Solitude* (1860), *As It Is, a Novel* (1860), a volume of legal reports (1862), and other volumes of prose and verse.

**Smith** (Sir William Sidney), b. at Westminster, England, in 1764; entered the navy at the age of twelve as midshipman under Lord Rodney; was captain in the Swedish service in the naval war with Russia, and received a Swedish order of knighthood for gallantry in action; served with distinction under Lord Hood at Toulon 1794; was taken prisoner by the French at Havre 1796, and confined two years in the Temple, Paris, whence he escaped 1798; was given command of a squadron in Turkish waters the same year; captured a French flotilla at St. Jean d'Acre Mar. 16, and successfully defended that fortress against Napoleon May, 1799; proceeded to Egypt; negotiated the treaty of El Arish Jan., 1800; was wounded at the battle of Alexandria 1801; was knighted and received a pension 1815; became admiral 1821, and lieutenant-general of marines 1830. D. at Paris May 26, 1840.

**Smith** (William Sooy), b. in Tarlton, Pickaway co., O., July 22, 1830; graduated at the Ohio University in 1849, and at the U. S. Military Academy July 1, 1853, when appointed brevet second lieutenant of artillery; second lieutenant July 9. Resigned June, 1854, to engage in civil engineering; was employed on public works a year, when, in 1855, he became principal of the Buffalo high school. Resuming his profession in 1856, he was employed (1857) by an iron bridge-building company at Trenton, N. J.,

and in 1859 placed in charge of the construction of a bridge over the Savannah River, the foundations of which consisted of pneumatic piles. In the civil war he served as colonel of the 13th Ohio Vols. in West Virginia till Jan., 1862, when transferred to the Army of the Ohio, and engaged at the battle of Shiloh, Apr. 7. Commissioned brigadier-general of volunteers Apr. 15, he participated in the siege of Corinth; commanded a division at the battle of Perryville; was chief of cavalry department of the Tennessee July–Oct., 1863, and division of the Mississippi Oct., 1863–July, 1864, when compelled by ill-health to resign. Has since been extensively engaged in sinking pneumatic foundations for bridges and other structures, and is patentee for various improvements in the process. Member of government board for testing American iron and steel 1875–76.

**Smith** (William Stephens), b. in New York in 1755; graduated at Princeton 1774; served in the war of the Revolution, reaching the rank of lieutenant-colonel; was successively aide to Sullivan, Steuben, and Washington (July, 1781); married the only daughter of John Adams, whom he accompanied on his mission to England as secretary of legation 1785; became surveyor of New York; sat three years in the State assembly; was chosen president of the New York Society of Cincinnati 1804, and was a member of Congress 1813–16. D. at Lebanon, N. Y., June 10, 1816.

**Smith** (Worthington), D. D., b. at Hadley, Mass., in 1795; graduated at Williams College 1816; studied theology at Andover; was licensed to preach 1819; was pastor of the Congregational church at St. Alban's 1823–49, and president of the University of Vermont from 1849 to his death at St. Alban's Feb. 13, 1856. His posthumous *Select Sermons* (1861) were edited by Prof. Joseph Torrey, who prefixed an appreciative *Memoir*.

**Smith Centre,** city, cap. of Smith co., Kan., is surrounded by a fine agricultural region; rich deposits of magnesia, limestone, and coal exist throughout the county. It contains good schools and 1 newspaper.

Will D. Jenkins, Ed. "Smith Co. Pioneer."

**Smithfield,** tp., De Kalb co., Ind. P. 1342.

**Smithfield,** tp., Fayette co., Ia. P. 638.

**Smithfield,** p.-v. and tp., Somerset co., Me. P. 704.

**Smithfield,** tp., Madison co., N. Y., includes the v. of Peterboro'. P. 1227.

**Smithfield,** p.-v. and tp., cap. of Johnston co., N. C., on Neuse River. P. of v. 415; of tp. 2864.

**Smithfield,** p.-v. and tp., Jefferson co., O. P. of v. 515; of tp. 1761.

**Smithfield,** tp., Bradford co., Pa. P. 1790.

**Smithfield,** p.-v., Henry Clay tp., Fayette co., Pa.

**Smithfield,** tp., Monroe co., Pa. P. 1443.

**Smithfield,** tp., Providence co., R. I. P. 2605.

**Smithfield,** p.-v., Newport tp., Isle of Wight co., Va. P. 652.

**Smithfield,** v., Averill tp., Jefferson co., West Va. P. 361.

**Smithfield,** tp., Roane co., West Va. P. 1046.

**Smithland,** p.-v., cap. of Livingston co., Ky., on Ohio River at the mouth of the Cumberland. P. 690.

**Smith's,** tp., Tuscaloosa co., Ala. P. 616.

**Smith's,** tp., Dauphin co., N. C. P. 662.

**Smith's,** tp., Robeson co., N. C. P. 1684.

**Smiths'borough,** p.-v., Tioga tp., Tioga co., N. Y., on Erie R. R. P. 304.

**Smith's Bridge,** tp., Macon co., N. C. P. 708.

**Smiths'burg,** p.-v., Cavetown tp., Washington co., Md., on Western Maryland R. R. P. 459.

**Smith's Creek,** tp., Warren co., N. C. P. 1062.

**Smith's Falls,** p.-v., Lanark co., Ont., Canada, on Rideau Canal and on Brockville and Ottawa Railway, at the junction of the Perth branch. It has a populous suburb called Elgin. The chief industries are the manufacture of stoves and farming implements. P. 1150.

**Smith's Ferry,** p.-v., Ohio tp., Beaver co., Pa., on Ohio River and Cleveland and Pittsburg R. R.

**Smith's Grove,** p.-v., Warren co., Ky.

**Smith's Island,** tp., Somerset co., Md. P. 399.

**Smith's Mills,** p.-v., Hanover tp., Chautauqua co., N. Y. P. 128.

**Smith'son** (James Lewis **Macie**), F. R. S., b. in England about 1765; was a natural son of Hugh Smithson, first duke of Northumberland, by Elizabeth Macie, whom in his will he describes as "heiress of the Hungerfords of Stadley, and niece to Charles, the proud duke of Somerset;" was consequently half-brother to the Earl Percy of Lexington fame; was educated at Oxford, graduating at Pembroke College 1786 under the name of Macie; was chosen a fellow of the Royal Society in the following year; devoted himself to science, especially chemistry; became an associate and friend of Davy, Banks, and Wollaston; published in the *Philosophical Transactions* eight papers, besides several in the *Annals of Philosophy* and other scientific periodicals; took the name of Smithson between 1791 and 1803; was much interested in geology, and was at one time vice-president of the Royal Society. D. at Genoa, Italy, June 27, 1829. For an account of his munificent bequest to the U. S., and its employment in the maintenance of a national scientific institute, see Smithsonian Institution.

**Smithsonian Institution,** located at Washington, D. C., in the centre of one of the largest of the U. S. government reservations, is a scientific establishment founded on the bequest of James Smithson of England for the "increase and diffusion of knowledge among men." The amount first received was $515,169; the "residuary legacy," $26,210.63; total sum derived from the bequest, $541,379.63. In 1867, under act of Congress authorizing the increase of the fund to $1,000,000, $108,620.37, resulting from the savings of income and the increased value of investments, was added to the amount then in the treasury of the U. S., making the entire sum to the credit of Smithson $650,000.



Smithsonian Institution, Washington, D. C.

Besides this, in 1874 a special fund of $1000, known as the bequest of James Hamilton of Carlisle, Pa., the interest on which is to be "appropriated biennially for a contribution, paper, or lecture on a scientific or useful subject," was placed in the treasury of the U. S., making the amount $651,000, which sum bears interest at 6 per cent. in gold. In addition, the institution holds bonds and certificates of the State of Virginia amounting at par to $88,125.20, worth at present (Jan. 1, 1876) about $37,000, the coupons of which are sold annually and the proceeds added to the income of the establishment. All the moneys now or hereafter to be deposited in the treasury of the U. S. to the credit of the Smithson fund constitute a perpetual deposit, of which, by law, only the interest can be drawn. This interest, payable semi-annually, amounting to $39,060, is augmented by conversion into currency. The sum thus obtained, with the proceeds of sales of coupons of State bonds and savings from the previous year's income, constitutes the income for the operations of the year.

The Smithson bequest was accepted by act of Congress approved July 1, 1836, and the first instalment of proceeds from the legacy was brought from England by Hon. Richard Rush, commissioned for the purpose. This money was in English sovereigns, which were transformed into American gold, netting $515,169. To satisfy legal requirements, formal litigation was had in the British courts. Interest was allowed by the U. S. from the date of the receipt of the money into the treasury (Sept. 1, 1838). The remainder of the bequest (residuary legacy) was received in 1867, netting $26,210.63. The Smithsonian Institution was established by act of Congress approved Aug. 10, 1846. By the provisions of this act the establishment is administered by a board of regents composed of the chief-justice of the U. S. Supreme Court, three Senators, appointed by the Vice-President of the U. S., three Representatives, appointed by the Speaker of the House, and six citizens, chosen by joint resolution of Congress; no two regents are allowed from any one State; two of the citizen members must be residents of the District of Columbia. The Representatives serve two years, unless reappointed; the Senators for their respective Senatorial terms; and the citizens for six years. The services of the regents are gratuitous, travelling expenses being allowed them when attending the sessions of the board. The board meets annually in January. The act also authorizes the regents to select one of their number as chancellor or president of the board, and three of the members as an executive or finance committee; further, that the secretary or director of the institution shall also be secretary of the board of regents. The secretary appoints his own assistants, and conducts the active operations of the establishment. Once a year he reports to the board, and by law they in turn report to Congress, as to the operations, expenditures, and condition of the establishment. According to the provisions of the act, the interest on the fund is drawn on the requisition of the executive committee, certified by the chancellor and secretary. This interest, converted into currency, is deposited with the treasurer of the U. S., and can be drawn only by check of the secretary of the institution, who is thus also the disbursing officer. Besides the board of regents, the President and Vice-President of the U. S. and the cabinet officers during the time they hold their respective offices, and such other persons as they may elect honorary members, are by law constituted an "establishment" (or board of visitors) styled the "Smithsonian Institution." By this name they are known and have perpetual succession. The President of the U. S. is the presiding officer of this "establishment." The following is a list of the officers of the institution: *Presiding officer, ex-officio*, U. S. Grant, President of the U. S.; *Chancellor*, Morrison R. Waite, chief-justice of the U. S.; *Secretary or Director of the Institution*, Joseph Henry; *Assistant Secretary*, Spencer F. Baird; *Chief Clerk*, William J. Rhees; *Corresponding Clerk*, D. Leech; *Bookkeeper*, Clarence B. Young.

From the inauguration of the institution to the present time the regents appointed by the two houses of Congress have generally been selected from among the members who had already acquired a national reputation as eminent jurists or upright statesmen, not a few among them being known for great erudition or profound attainments in the science of literature; while those from the citizenship of the several States have usually been chosen on account of probity of character, high social position, and literary or scientific reputation. The present board is composed as follows: Mr. Morrison R. Waite, chief-justice of the U. S., chancellor; Hon. T. W. Ferry, Vice-President of the U. S.; *Senators*, H. Hamlin, J. W. Stevenson, A. A. Sargent; *Representatives*, Hiester Clymer, B. H. Hill, G. W. McCrary; *Citizens*, Rev. Dr. John Maclean, N. J., Hon. Peter Parker, Washington, Hon. George Bancroft, Washington, executive committee; Dr. Asa Gray, Mass.; Prof. J. D. Dana, Conn.; Prof. Henry Coppée, Pa.

The Smithsonian building is one of the most imposing edifices in the U. S. The architecture is the latest variety of the Rounded style of the twelfth century, and is known as the Norman, Lombard, or Romanesque. The semi-circular arch, stilted, is employed throughout in doors, windows, and other openings. It is the first edifice of the twelfth century, and of a non-ecclesiastical character, ever erected in this country. The design, by James Renwick, Jr., of New York, is a main centre building of two stories, with two wings connected by intervening ranges, each having on the principal front a cloister with open-stone screen. The material is a lilac-gray freestone from the new red sandstone formation where it crosses the Potomac, and is called "Seneca," after the name of a creek about 23 miles above Washington, where it is obtained. Comparatively soft when first quarried, it hardens by exposure, ultimately acquiring a toughness and consistency enabling it to withstand atmospheric changes and resist severe mechanical wear and tear. The main building, 205 by 57 feet, and 58 feet to top of corbel course, has in the centre of its N. or principal front two towers, of which the higher is 140 feet. On the S. front is a massive tower 37 feet high. On the N. E. corner is a double campanile tower 17 feet square and 117 in height. There are nine towers in all. The entire length of the Smithsonian building is 447 feet from E. to W.; greatest breadth, 160 feet. The E. wing is 82 by 52 feet, and 42½ feet high to top of battlement. The W. wing, including its projecting apsis, is 84 by 40 feet, and 38 feet high; each of the connecting ranges, including its cloister, is 60 by 49 feet. The first story of the main building consists of one large room, 200 by 50 feet, and 25 feet high, with two rows of pillars to support the ceiling. The upper story is one large room, of the size of that of main building, lower floor; it is unobstructed by any supports. These two halls, together with the large room in the W. wing, contain the collections of the National Museum. The upper story of the E. wing is the dwelling of the director and his family. The operations of the institution proper are confined to part of the lower story of the E. wing and two or three large rooms in the connecting range between the main building and E. wing. The building is substantially erected, and mostly fire-proof. The foundation-walls are 8 feet deep and 12 feet thick at the bottom, diminishing to 5 feet 6 inches at the ground surface; walls of main building to second story, 2½ feet thick; above, 2 feet; wing walls, 2 feet; central towers, 3½, diminishing to 2 feet. Roof of main building, slate on iron frame.

The cornerstone was laid May 1, 1847, with Masonic ceremonies, in presence of Pres. Polk and cabinet; oration by Hon. George M. Dallas.

On Jan. 24, 1865, the Smithsonian building was partially destroyed by fire from a defective flue. The damage was confined to the W. end and upper centre. Among other things consumed was Stanley's gallery of Indian paintings, the property of their author. This loss is almost irreparable in an ethnological as well as an historic point of view; the only remaining collection of a similar character is that of Catlin, now offered for sale to the government by his heirs. The lecture-room, widely known for its favorable acoustic and optical properties, was also destroyed. Active scientific operations, however, were not impeded, and but little abridged, by this calamity, the restoration of the building being gradual and defrayed by small appropriations annually for several years from the income. The building is now wholly reconstructed, and is fireproof.

By law the Smithsonian is the depository of the National Museum, of which the secretary of the institution is the curator. For the last few years this museum has been, and is now, supported entirely by the government; previously, part of its maintenance was from the Smithson funds. It is the only lawful place of deposit of "all objects of art and of foreign and curious research, and all objects of natural history, plants, and geological and mineralogical specimens, belonging, or hereafter to belong, to the U. S., which may be in the city of Washington in whosesoever custody." The nucleus of these collections consists in the specimens brought home by the Wilkes and other early exploring expeditions. Through the agency and influence of the institution these have been greatly augmented, and the museum may now be said to be rich in objects in several of the departments incident to such an establishment, particularly ethnology, ornithology, and ichthyology. Few specimens are purchased, additions being made through gift and by exchange. The collections are accessible to specialists, to whom they are an interesting and exhaustless field for investigations and the basis of contributions to the literature of the natural sciences. Students of natural history, also, to a limited number, are permitted to

study the collections, making return for the privilege by assisting in the classification and arrangement of the specimens. A taxidermist and a modeller are employed, who mount the zoological specimens and make casts of fishes and also of ethnological objects—lent for the purpose—for the public exhibition-halls. Each specimen, after being recorded and classified, is neatly labelled and arranged to the best advantage for display. The museum is visited by thousands of strangers annually.

In the early history of the institution it established a system for the interchange of American and foreign scientific thought. By this system, which has now attained great proportions, societies and individuals are brought into close communion by the interchange of publications, the privilege being accorded at the expense of the institution for ocean transportation. The support of the system costs annually about $6000—an expense only justified by the fact that the enterprise has received world-wide indorsement as among the most efficient means of carrying out the second clause of the will of the benevolent founder of the institution, which enjoins the "*diffusion* of knowledge among men." Having latterly been adopted as the channel of exchange for the publications of the national government, it has now become familiarly known as the "Smithsonian system of international exchanges," or, in other words, the medium of exchange of scientific and literary materials between the U. S. and the other nations of the earth. The effect of this enterprise cannot be too highly estimated. By this means thousands of works embracing the details of the latest inventions and discoveries are brought to America, while in turn a knowledge is disseminated abroad of whatever is doing in the U. S. to advance the welfare of the people. The packages of exchanges of the institution are transmitted by the principal transportation companies of Christendom either without charge or at reduced rates, and passed through all custom-houses free of duty. To attend to the distribution of the packages, as well as to collect and forward returns, the institution has paid agents in several of the principal cities of Europe, while at other points the leading scientific societies cheerfully perform these services. There are now about 2200 foreign societies in correspondence with the institution, exclusive of individuals, all of which freely share the benefits of this arrangement.

The Smithsonian Library was several years ago transferred to the care of the Library of Congress, and now forms the National Science Library. It consists of about 75,000 volumes, embracing the transactions and proceedings of the older scientific establishments of Europe, many of which cannot now be obtained, which have been secured by exchange of Smithsonian publications. The library continues to be enriched by works constantly received by the institution from abroad.

For a number of years the institution conducted an extensive series of meteorological observations made by voluntary observers; but after the successful establishment of the U. S. signal-service bureau, the continuance of this branch of operations was placed in charge of that department of the government. The observations collected by the institution, and extending over a period of more than twenty-five years, have been reduced and discussed, the results forming the basis of memoirs and charts of rainfall, temperature, the winds, etc. These works constitute invaluable data for a projected discussion of the climatology of the U. S. The Smithsonian was also the first to inaugurate a system of daily telegraphic weather-signals, which, however, was interrupted by the war, and never resumed.

The institution issues three series of publications. The first is a quarto entitled *Contributions to Knowledge;* the second, an octavo styled *Miscellaneous Collections;* and the third, an octavo *Annual Report.* The first and second series are printed at the expense of the institution. The memoirs are published separately for presentation to specialists, and for sale to others desiring them at the cost of paper and printing. From time to time these separate memoirs are made up into volumes of uniform size and presented to colleges, public libraries, and other educational and scientific establishments—the first series to those of the *first* class only. The annual reports are printed by Congress, and distributed gratuitously to teachers and others, *applying,* who may be deemed suitable recipients. Of the volumes of the first or quarto class, twenty-one have thus far been issued; of the second, twelve; and of the third, the reports, one each year since 1846, inclusive. The *Contributions to Knowledge* are memoirs pertaining to every branch of physical science, and contain positive additions to knowledge based on original research; they are usually the results of investigations to which the institution has in some way rendered assistance. The miscellaneous collections are monographs designed to facilitate the study of natural history, and to induce individuals to engage therein as a specialty. The annual report is made up of a statement to Congress of the operations, expenditures, and condition of the institution, and an appendix containing translations from works not generally accessible to American students; biographies, original and other, of distinguished scientists; ethnological and meteorological essays; extracts from correspondence; accounts of unusual phenomena, etc. etc. of interest to the general as well as the scientific reader. Papers presented for publication in the first and second series are submitted to competent commissions for examination, with a view—*first,* to their being additions to the existing knowledge of the subjects to which they pertain; and, *second,* as to whether, as such, they are worthy of publication by the institution. When a memoir is accepted, the names of the commission are given on the reverse of its title-page as vouchers for its publication. Apart from the presentation to the author of a few copies of his paper and the payment of the expense of experiments, computations, etc. incurred in its preparation, no remuneration is made for communications, association of the author's name with that of Smithson being considered,—and thus far in all cases accepted—as a sufficient *honorarium.*

By the terms of the will, the bequest of Smithson was to "found at Washington an institution for the increase and diffusion of knowledge among men;" hence, the objects of the institution are, first, to *increase,* and, second, to *diffuse,* knowledge. These two objects are entirely distinct, and should not be confounded. The first is to enlarge the existing stock of knowledge by the addition of new truths, and the second to disseminate knowledge thus enlarged among all mankind. The distinction is everywhere recognized by men of science. Unlike the college or university, the mission of the institution is to add to, rather than merely teach, what is already known. No restriction is made in favor of any particular branch of knowledge. The plan adopted to increase knowledge is that of stimulating men with powers for original investigation to make researches in the different departments of science by offering to publish to the world an account of their discoveries, and by assisting their investigations as far as the means of the institution will allow; that for diffusing the knowledge thus acquired is by means of publications, and their presentation to public institutions on condition that they shall be accessible at all times to any who may desire to consult them, and to specialists.

The institution is not a national, but an individual, establishment, and is to bear and perpetuate the name of its founder. The bequest is for the benefit of *mankind,* and therefore all unnecessary expenditures on local objects is a perversion of the trust. That Smithson did not intend the benefits of his gift for the exclusive enjoyment of any one people is plainly indicated by the terms of the instrument conveying the legacy. Moreover, that such was not his intention is further evident from his own declaration that the "man of science is of no country: the world is his country, and mankind are his countrymen." In accordance with this view, the secretary of the establishment early in its history contended that the support of a library, a museum, or a gallery of art, as prescribed by the act establishing the institution, was foreign to a just conception of the liberal idea of the testator, and a misappropriation of his benevolent measure. With this view, he has from the first strenuously endeavored to so administer the trust as that the greatest good might result to the greatest number, and thus realize to the fullest extent the philanthropic design of the donor. This conception of the intention of Smithson has received the unqualified indorsement of all friends to the advance of civilization, and is enforced by the devotion of the life of the testator to the increase of abstract science, as gathered from a study of his history, as well as from the letter of his will. Impressed with the justice of this view, Congress several years ago authorized the incorporation of the Smithsonian Library with the Library of Congress, the latter providing for it fireproof, roomy quarters, and cataloguing, binding, and otherwise caring for the books. But for this timely legislation a proper maintenance of this single local object would in time have consumed the entire income. The books are still the property of the institution, and can be reclaimed at any time on payment of the cost of their binding. In like manner, the National Museum, which by law is deposited in the Smithsonian building, and which for many years was partially supported from the Smithson fund, has latterly received its entire maintenance from the government. The Gallery of Art has been transferred to the Corcoran Art-Gallery in Washington. Also, in accordance with the policy of the institution to abandon any field of enterprise which can be as well cultivated through other established agencies, its entire system of meteorological operations has been transferred to the meteorological bureau of the general government, while its

herbarium and entomological collections have been deposited with the U. S. department of agriculture, which employs a botanist, approved by the institution, and an entomologist. Thus, by degrees, and after a period of more than a quarter of a century in its history, the institution is, happily, left free to pursue the laudable objects for which it was founded by the generous foreigner who entrusted its management to the care of the U. S.; which objects are the "increase and diffusion of knowledge among men."

DANIEL LEECH. APPROVED BY JOSEPH HENRY.

**Smith'sonite,** mineral *carbonate of zinc* ($ZnO.CO_2$), named after the English chemist Smithson, who was the founder of our Smithsonian Institution. It crystallizes in rhombohedrons of glassy lustre, white when pure, with the hardness of apatite, and density when pure and normal = 4.455 at 0°; Naumann and Levy both give 4.45. Smithsonite occurs in many American localities; abundantly at Lancaster, Pa., near Bethlehem, Pa., and at the Perkiomen lead-mine. H. WURTZ.

**Smith's Ranch,** p.-v., Sonoma co., Cal.

**Smith's River,** tp., Del Norte co., Cal. P. 564.

**Smith's River,** tp., Patrick co., Va. P. 3366.

**Smith'ton,** p.-v., Bowling Green tp., Pettis co., Mo., on Missouri Pacific R. R. P. 309.

**Smith'town,** p.-v. and tp., Suffolk co., N. Y., on Smithtown Bay, Long Island Sound, and on Hicksville and Port Jefferson branch of Long Island R. R. P. 2136.

**Smith'ville,** p.-v., Strawberry tp., Lawrence co., Ark. P. 126.

**Smithville,** p.-v., West Hampden tp., Burlington co., N. J., on Camden and Burlington County R. R., 18 miles N. E. of Philadelphia, has 1 church, good schools, 1 newspaper, the largest wood-working machinery establishment in the world, iron and brass foundries, machine and forge shops, and grist-mills. P. about 1000.

H. B. SMITH, ED. "NEW JERSEY MECHANIC."

**Smithville,** tp., Chenango co., N. Y. P. 1405.

**Smithville,** p.-v. and tp., cap. of Brunswick co., N. C., on Cape Fear River. P. of v. 810; of tp. 1583.

**Smithville,** p.-v., Greene tp., Wayne co., O.

**Smithville,** tp., Abbeville co., S. C. P. 1519.

**Smithville,** tp., Marlboro' co., S. C. P. 1823.

**Smithville,** p.-v., cap. of De Kalb co., Tenn., 65 miles E. of Nashville, has 4 churches, a public library, a good school, 1 hotel, 2 flouring-mills, 1 tannery, and the county jail. P. about 400. M. L. FORD, ED. "WOODBURY PRESS."

**Smithville,** p.-v., cap. of Charlotte co., Va.

**Smoke** [Ang.-Sax. *smoca*], the product of an imperfect combustion. If coal, which is chiefly composed of carbon, hydrogen, nitrogen, and oxygen, be burnt perfectly, the result will be carbonic acid, steam, and nitrogen, which substances will escape through the chimney-top and blend with the atmosphere under the form of invisible and incombustible gases and vapor. But as the combustion of coal in the way in which it is generally burnt is very imperfect, inflammable gases and vapors and large quantities of fine particles of carbon issue together with the above substances, form soot and black and brown smoke, contaminate the air, and cause a considerable loss of fuel. As coal-smoke is a great nuisance, and in large towns and manufacturing districts even a serious evil, much attention has been paid to the matter of burning it. This is attended with great practical difficulties, arising from the necessity of preventing the smoke from cooling, and of supplying the combustible gases and vapors with the necessary amount of oxygen in order to make them burn with flame; but these difficulties are nevertheless not greater than may be generally overcome, as they have been in many single cases.

**Smo'ky,** tp., Ellis co., Kan. P. 18.

**Smoky,** tp., Trego co., Kan. P. 40.

**Smoky Hill,** p.-v. and tp., McPherson co., Kan. P. 348.

**Smolensk,** government of European Russia, bounded E. by the government of Moscow, and traversed by the Dwina, which runs to the Gulf of Livonia, and the Dnieper, which flows to the Black Sea. Area, 21,814 sq. m., consisting generally of extensive plains interspersed with morasses. The climate is cold but healthy; the soil is fertile and well cultivated, yielding large crops of rye, the principal product, and of hemp and flax. Tobacco and hops are also cultivated. On its extensive pastures large numbers of fine cattle are raised, while its vast forests, abounding with game, furnish a large amount of valuable timber. Much attention is paid to the raising of bees, and honey and wax are largely exported. Copper, iron, and salt are found in considerable quantities. Its manufactures are unimportant. P. 1,163,594.

**Smolensk,** an old fortified town of Russia, capital of the government of Smolensk, on the Dnieper, is surrounded with massive walls surmounted by towers. It has a magnificent cathedral, several good educational institutions, manufactures of leather and soap, and a large export-trade in grain. P. 22,977.

**Smol'lett** (TOBIAS GEORGE), b. at Dalquhurn House, Cardross, Scotland, in 1721; lost his father in early childhood; was educated at Dumbarton school by the care of his grandfather, Sir James Smollett of Bonhill, a member of the Scottish Parliament; studied also at Glasgow, where he served an apprenticeship to a surgeon; went to London at the age of nineteen, carrying a tragedy entitled *The Regicide,* which he unsuccessfully offered to the theatrical managers; accepted the position of surgeon's mate in the navy; participated in the unfortunate expedition against Cartagena 1741; resided for some time in Jamaica; returned to England 1746; married in 1747, Miss Anne Lascelles, whom he had known in Jamaica; published in 1748 with great success his first and best novel, *The Adventures of Roderick Random,* in which he made good use of his West Indian experiences; visited Paris 1750; published *The Adventures of Peregrine Pickle* (4 vols., 1751); after endeavoring to obtain medical practice at Bath, settled at Chelsea 1753, in which year he wrote *The Adventures of Ferdinand, Count Fathom;* published a translation of *Don Quixote* (1755); issued *A Compendium of Authentic and Entertaining Travels* (7 vols., 1757), in which he embodied his own experiences at Cartagena; edited for some time a Tory organ, the *Critical Review;* was fined and imprisoned three months for a libel on Admiral Knowles (1759); wrote in fourteen months a *Compleat History of England, deduced from the Descent of Julius Cæsar to the Treaty of Aix-la-Chapelle* (4 vols., 1757–58), to which he subsequently added a *Continuation from 1748 to 1760* (4 vols., 1763), bringing the author £2000, and of which the later volumes have been often reprinted as a supplement to Hume; translated *Gil Blas* (4 vols., 1761); wrote in prison his *Adventures of Sir Launcelot Greaves* (1762); edited the *Briton,* a newspaper in defence of Lord Bute (1762–63); aided Thomas Francklin and other writers in bringing out a translation of the *Works of Voltaire* (37 vols., 1761–70); made a journey through France and Italy 1763–66, which furnished materials for a work of *Travels* (2 vols., 1766); is supposed to have written (between 1759 and 1764) the accounts of France, Italy, and Germany in the *Modern Universal History;* satirized Bute and the elder Pitt in his *Adventures of an Atom* (1769); went for his health to Italy 1769, and wrote on the journey *The Expedition of Humphrey Clinker* (3 vols., 1771), his most amusing book. D. at Monte Nero, near Leghorn, Italy, Oct. 21, 1771. Many complete editions of his novels and poems have been published. Biographies were written by Dr. Robert Anderson (1796), Dr. John Moore (1797), and Thomas Roscoe (1840). PORTER C. BLISS.

**Smolt.** See SALMON.

**Smug'gling** [Dutch, *smokkelen*], the offence either of bringing into the country articles entirely prohibited, or of defrauding the customs revenue by secretly importing goods upon which duties are laid without paying such duties or without paying the full amount required by law. As the whole subject of the customs revenue is the creature of statute, the offences which consist in its evasion or violation are also of a statutory origin, and in this country they belong exclusively to the jurisdiction of the national legislature and judiciary, being included in the power of Congress to regulate all foreign commerce. The existing law is contained in the *U. S. Rev. Stat.,* especially in tit. xxxiv., chap. 10, §§ 3058 to 3094, although some provisions are scattered through other chapters relating to the imposition and collection of duties. The following penalties may be enforced for various acts which are collectively embraced in the general description of smuggling: (1) The guilty person is liable to a fine of not more than $5000 and not less than $50, or to imprisonment for not more than two years, or to both. (2) The goods fraudulently introduced or attempted to be introduced are to be seized, and, if condemned by the court, are to be forfeited and sold. (3) The vessel in which the goods are thus imported may be likewise seized, condemned, and forfeited if the owner or managing agent was consenting to and guilty of the offence. (4) Any vehicle, conveyance, team, beast, etc., by means of which goods are wrongfully brought into the country by land may also be seized and forfeited; but no such conveyances belonging to and used by common carriers, whether persons or corporations, are liable to forfeiture unless the owner, superintendent, or agent in charge is consenting or privy to the illegal importation. (5) Various pecuniary penalties may be visited upon the owners or masters of vessels for certain specific violations of the

law, such as resisting or hindering the revenue officers, and the like; which penalties are made liens upon, and may be summarily enforced against, the vessels themselves. Cases involving any of the foregoing forfeitures or pecuniary fines are reported to the proper U. S. district-attorney, and it is his duty to prosecute the delinquent or to procure a condemnation of the property in the national courts. The customs officers are clothed with very large powers in order to detect and punish any fraudulent importation or concealment, or failure to pay the full duties required by the law. They may board and search all vessels lying in port, and all those bound to the U. S. while not more than four leagues from the coast. They may also search all persons coming into the country, all trunks, boxes, or other baggage, papers, envelopes, all conveyances and means of transport, stores, warehouses, and other buildings—in short, all places or things where the goods themselves or the evidence of their wrongful importation may possibly be concealed. Finally, by means of an order of the court they may obtain an inspection of the books of account and business-papers of merchants and others suspected of or charged with the wrongful non-payment of duties. When the property seized is condemned and sold, the proceeds, after paying the costs and expenses, are distributed, part to the U. S., part to the principal customs officers of the district, and part to the informer if there was any distinct from the officer himself who detected the offence and procured the seizure. JOHN NORTON POMEROY.

**Smut** [Ang.-Sax. *smitta*]. The diseases of grain in which the kernels become converted into masses of black powder are popularly called *smuts*. In England the term *bunt* is often applied to similar diseases. The diseases known as smuts are all caused by fungi belonging to the order Ustilagineæ. The common smut of Europe, also found in this country, is *Ustilago segetum;* it is very common on oats. The most frequent and striking smut, however, which is found in America is *Ustilago mayidis*, which produces the distortions of the ears of Indian corn with which every one is familiar. The smut in wheat is *Tilletia caries*. It is this form which is called frequently bunt. The smut on rye is *Urocystis occulta*. The smuts are by no means, however, confined to grains, but are abundant on other plants, and, although generally confined to the floral organs, in some species are found on the leaves and stalks. (For a further account of smuts see USTILAGINEÆ. For a more systematic account of this group of fungi see UREDINES.) W. G. FARLOW.

**Smybert.** See SMIBERT.

**Smyr'na,** city of Asia Minor, situated at the bottom of the Hermæan Gulf, whose entrance lies opposite the island of Mitylene. The Leleges, a piratical Greek tribe, first built a fort on Mount Pagus and a closed port at its foot about 1500 years before our era. In 1420 (B. C.) Tantalus, king of one of the Lydian tribes, erected the city of Tantalis upon a hill on the N. E. side of the inner bay; the remains of its acropolis and of his own tomb are yet standing, as well as those of its port, the Naulochos, whence sailed the Lydian ancestors of the Tyrrhenians to Italy. Repeated earthquakes having destroyed his father's capital, Pelops removed its inhabitants to Greece and gave his name to its peninsula (B. C. 1362). Fifty years later Theseus built a city farther inland, on the site of the present village of *Boornabat*, and named it Smyrna after his wife, an Amazon. Soon after this occurred the Trojan war, by which the Phrygian power was broken, and the country began to swarm with Greek colonists. In their division of the soil the Hermæan Gulf became the boundary-line between Æolia on the N. and Ionia on the S., and Smyrna was for centuries the bone of contention between the two states. It was first possessed by the Ionians; then the Æolians took and walled it. But it had already changed its site, being erected on the banks of the sacred Meles, a remarkable stream which rushes out of a pond at the foot of the hills and enters the sea but 1500 yards from its source. Here stood the temple of Diana, and many mosaic pavements, columns, and broken statues still attest the veneration of the ancients. Here Homer sang his immortal verse; for, though seven cities dispute the honor of having given him birth, the ancients generally admit the claims of Smyrna. The Ionians had repossessed their city but about 100 years when Alyattes, king of Sardis, took and dismantled it in 628. Thence for four centuries her people dwelt in an unwalled town and in the villages of the neighboring plain (as at the present day), until Alexander the Great, being warned of Jupiter in a dream, ordered a new city to be built on the slopes of Mount Pagus; which was done by his generals Antigonus and Lysimachus (B. C. 320–300), the Lelegian castle being repaired and converted into an acropolis. From this time Smyrna increased in wealth and prosperity, becoming, as it has been ever since, the chief commercial city of Asia Minor. When that country became subject to the Romans, they made it the seat of a *conventus juridicus* (Pliny, v. 31), and it suffered but a temporary injury from the siege there sustained by Trebonius, one of Cæsar's murderers, and its capture by Dolabella; for Strabo at the beginning of our era calls it "the most beautiful city of Ionia." "It was" then, as now, "built on a hill, but the greater part in the plain near the harbor, the Metroum, and the Gymnasium. The divisions of the streets were excellent, and as nearly as possible in straight lines." (Strabo, xiv. 1, 37.) The remains of ancient Smyrna fully attest the high degree of civilization acquired by its inhabitants; columns, statuary, and articles in precious metals and gems have been dug up for centuries, many of which are now adorning the museums and private collections of Europe. Christianity was probably introduced into Smyrna during the first century of our era, and Polycarp, one of its early bishops and a disciple of St. John, suffered martyrdom in 167 A. D., and Pionius, a pious presbyter, in 249. Smyrna sent its bishop, Eutyches, to the œcumenical council held at Nice in 325. The names of only thirty bishops down to the year 1721 have been preserved. Smyrna is one of the seven apocalyptic churches; and it is worthy of note that it alone is commended, with Philadelphia, in the epistles to the seven churches, and that these two cities are still flourishing, while the other five are little better than a mass of ruins. Smyrna has, however, repeatedly suffered from earthquakes, the most notable instance being in 177 A. D., when it was rebuilt by the emperor Marcus Aurelius. In modern times a similar calamity occurred in 1688 and in 1778, and the city was mostly destroyed by fire in 1797 and 1844; many inhabitants were also carried off by the plague in 1812 and 1837. Under the Byzantine empire Smyrna was the capital of a province or thema, and in 900 was erected into an independent archbishopric by Leo the Wise. By this time, however, the Moslems had overrun the peninsula, and their ships were beginning to contend for the mastery of the sea. Tzachas, a Turkish pirate, took possession of the city (1080), but was driven out by a Greek fleet under John Ducas, who greatly damaged the place. It was repaired by John Vataces (1222), and erected into an archbishopric with eight dependent bishoprics. The conquests of the Moslems by land meanwhile brought them nearer the western coast of the peninsula; and though the empire of the Seljookides was falling to pieces, Aïdin, a Turkish prince, carved himself a state out of ancient Ionia and gave his name to its capital, the former *Tralles*, near the Meander. He took Smyrna in 1313; but a fleet of crusaders, surprising the city, built the fort of St. Peter by the sea, and confined the Turks to the castle on Mount Pagus. The Roman Catholic worship was first introduced at this time (1346), and despite many vicissitudes it has been maintained ever since. Soon after (1401), occurred the devastating irruption of Tamerlane, who vanquished Sultan Bayezid in the plains of Angora. He came to Smyrna, and, resolving to take the fort of St. Peter, ordered his soldiers to fill up the port, carried the place by storm, and butchered all who fell into his hands. The Mogul emperor soon after withdrew to his own country, and Smyrna was occupied by Kineït, from whom it was wrested by Sultan Moorad II. (1424). The brave knights of St. John made several vain attempts to obtain possession of a place of such commercial importance, and the Venetians sacked it in 1473, but the Turks finally built the Sanjak Castle at the entrance of the bay and effectually closed the narrow channel (1630). Since that event Smyrna has been in the undisturbed possession of the Osmanli sultans, but its European population has so much increased that the Turks universally call it the city of the Giaours. It early became the chief, almost the only, port in Turkey for foreign commerce until the invention of steam navigation overcame the currents of the Dardanelles and the Bosphorus. Its population has increased from 90,000 in 1631 (Tavernier) or 27,200 in 1702 (Tournefort) to 187,000 in 1868, of whom only 40,000 are Turks; there are no less than 20,000 persons of European birth or descent, who are amenable to Turkish law only in their estates, and are otherwise governed by the codes of the countries to which they respectively belong, administered by their consuls.

Modern Smyrna is built in part upon the slopes of Mount Pagus, but mostly on the low ground at their foot formed in good measure by a torrent from the S., and extending to a tongue of land called "the Point." Its eastern limit is formed by the above-mentioned torrent and the "caravan bridge," beyond which lie the Turkish cemeteries, thickly planted with fine cypresses. The sea-face is 2 miles in extent N. and S., and its irregular line is now being corrected by a long stone wharf. The streets are either parallel or at right angles to the sea, but they are straight only in the Armenian quarter, having been laid out anew by that public-spirited people after the fire of

1844. The houses, usually two stories high, are now generally built of wooden beams encased in stone, to preserve them at once from fire and the earthquake. There are several free hospitals, each nation usually having its own, the Turks and Jews excepted. The Greeks have 3 churches, the Armenians 1, the Roman Catholics 3, the Protestants 4 chapels, and the Jews 1 synagogue. The mosques are mostly ancient churches or *tekkes*. Smyrna is the best supplied with schools of any city in the empire, and has 2 French, 1 Greek, and 1 Armenian weekly paper. Smyrna is the chief mart for European commerce in Asia Minor. Its exports consist of silk, opium, drugs, dyes, and gums, gall-nuts, wool, valonea, dried figs, and raisins, and fresh fruits; and the imports are coffee, sugar, cochineal, indigo, tin, iron, lead, broadcloth, cotton goods, rum, brandy, spices, and machinery. The warehouses are near the sea; lighters are used on account of the shallowness of the water near the shore. There are usually both foreign and Turkish naval ships in port, sometimes an entire fleet, though the preference is usually given by the latter to the Bay of Voorla (*Clazomenæ*), half way out of the gulf. The defences of Smyrna consist of a battery on the shore near the great military barracks, and of the ruinous castle at the entrance of the bay, which contains some old brass cannon large enough for a man to sit within, with stone balls to match. The harbor is secure, but the yearly deposits from the Hermus at its entrance must ere long cut off Smyrna from the sea, as has occurred at Ephesus and Nice. Smyrna possesses the only railways yet built in Asia Minor—the one extending S. to Aïdin, a distance of 83 miles, with Ephesus lying about half way; and the other to Philadelphia, by Magnesia and Cassaba, 113 miles in all. Many steamers, Austrian, French, Russian, English, Greek, Italian, Spanish, Turkish, and Egyptian, place it in direct communication with all the principal ports of the Mediterranean and the Black Sea. Smyrna yet presents some venerable ruins—the castle on the hill, the great theatre beneath it, and the stadium, the scene of Polycarp's martyrdom. The fort of St. Peter is well preserved, and still shows the escutcheon of the old knights. Smyrna is the starting-point for visiting the "seven churches of Asia." The beauty of its neighborhood is justly celebrated, and its country villas are unrivalled in the empire. Magnesia is situated at the foot of Mount Sipylus, and in the plain below Antiochus was vanquished by Scipio. On the same mountain is the bust of Niobe, the oldest Grecian sculpture in existence; and not far away, beyond Nif, may be seen the bas-relief of Sesostris, so called. Ephesus, Aphrodisia, Hierapolis, and Sardis also offer interesting remains. The region is sometimes overrun and made insecure by bands of brigands. The province is governed by a pasha, who resides alternately in Smyrna and Aïdin, the latter being preferred, in spite of its unhealthiness, on account of its large Turkish population. H. J. Van Lennep.

**Smyrna,** p.-v., Kent co., Del., on Delaware R. R., 60 miles S. of Philadelphia, has 4 churches, a library, town-hall, and seminary, 1 bank, 1 newspaper, 3 hotels, 2 iron-foundries, 2 shipyards, and 2 flouring and 1 large ship-lumber and planing mill. Business, fruit-growing and agriculture. P. 2110. J. H. Hoffecker, Ed. "Times."

**Smyrna,** tp., Jefferson co., Ind. P. 1486.

**Smyrna,** tp., Aroostook co., Me. P. 159.

**Smyrna,** p.-v. and tp., Chenango co., N. Y., at junction of New York and Oswego Midland with Utica Chenango and Susquehanna R. R. P. 1668.

**Smyrna,** tp., Carteret co., N. C. P. 905.

**Smyrna,** p.-v., Rutherford co., Tenn., on Nashville and Chattanooga R. R.

**Smyrna Landing,** v., Kent co., Del. P. 158.

**Smyth,** county of S. W. Virginia, on the head-waters of Holston River, consisting chiefly of an elevated, fertile valley, bounded S. E. by Iron Mountain and N. W. by Walker's Mountain, has deposits of limestone, rock-salt, and gypsum; and is traversed by Atlantic Mississippi and Ohio R. R. Staples, Indian corn, wheat, oats, butter, and cheese. Cap. Marion. Area, 500 sq. m. P. 8898.

**Smyth** (Andrew Woods), M. D., b. near Londonderry, Ireland, Feb. 15, 1833; arrived at New Orleans in 1849, where he began the study of medicine; graduated in the medical department of the University of Louisiana 1859. He has been a resident student and house-surgeon of the great charity institution of that city his whole professional life, and in it he performed (May 15, 1864) the operation, the first and only one recorded, of tying successfully the arteria innominata. In some twenty attempts, made by the most eminent surgeons, all had failed; his success was attributed to ligating also, where secondary hæmorrhage had occurred, the vertebral artery, which prevented regurgitant hæmorrhage. Dr. Valentine Mott, who was the first to tie the innominata, said on his deathbed that Dr. Smyth's successful operation had afforded him more consolation than all others of similar character. Paul F. Eve.

**Smyth** (Charles Piazzi), son of Admiral W. H. Smyth, b. about 1820; received a scientific training in his father's private astronomical observatory at Bedford; was employed for some time under Mr. Maclean in the observatory of the Cape of Good Hope; was appointed royal astronomer for Scotland; made a valuable series of observations from the Peak of Teneriffe 1856; published *Teneriffe, an Astronomer's Experiment, or Specialities of a Residence above the Clouds* (1858), being the first work ever illustrated by stereoscopic views; visited Russia, giving an account of his tour and scientific observations in a book, *Three Cities in Russia* (2 vols., 1862), and made a thorough examination of the Great Pyramid of Egypt, which he considers to have been built under divine inspiration as a standard of a system of weights and measures. This theory is set forth and defended in three works—*Our Inheritance in the Great Pyramid* (1864), *Life and Work at the Great Pyramid* (3 vols., 1867), and *Antiquity of Intellectual Man* (1868).

**Smyth** (Egbert Coffin), D. D., b. at Brunswick, Me., in 1829; graduated at Bowdoin College 1848; became a Congregational minister, and was appointed professor of natural and revealed religion at Bowdoin 1856. Author of several published sermons and discourses, etc.

**Smyth** (James Carmichael), M. D., b. in Scotland in 1741; studied medicine at Edinburgh and at Leyden; was employed in the medical department of the British army; had charge of the French prison at Winchester 1780; discovered the means of arresting contagion by the employment of three mineral acids, for which he received a grant from Parliament 1802; became physician-extraordinary to George III., and d. in 1821. Author of several medical treatises, especially on contagion and on hydrocephalus.

**Smyth** (Sir James Carmichael), Bart., son of the above, b. in Scotland about 1775; served in the British army in Canada 1812–15; major-general 1825; baronet 1821, and governor of British Guiana from June, 1833, to his death, Mar. 4, 1838. He prepared for the confidential use of the duke of Wellington *A Précis of the Wars in Canada from 1755 to the Treaty of Ghent in 1814* (London, 1826).

**Smyth, or Smith** (Sir John), cousin through his mother to King Edward VI., b. in England about 1530; was distinguished as a soldier during the continental wars of Elizabeth, and as ambassador to Spain. D. about 1598. Author of *Certain Discourses concerning the Formes and Effects of Divers Sorts of Weapons*, etc. (London, 1590; reprinted in Lilly's *Bibliotheca Anglo-Curiosa*, 1869), and *Instructions, Observations, and Orders Militarie* (1594).

**Smyth** (John), b. in England about 1552; graduated at Christ's College, Cambridge, 1575; became a fellow; took orders in the Church of England; was reproved by the heads of the university 1586 for having advocated a judaic observance of Sunday, but persisted in his teachings; connected himself with the Puritans; was minister at Gainsborough to a congregation with which he emigrated to Amsterdam 1606; was converted to Baptist principles by Dutch theologians; caused a separation among the Puritan refugees in Holland, and maintained controversies with Ainsworth, Robinson, and others. D. at Amsterdam in 1610. Author of *A True Description of the Visible Church* (1589), *The Difference of the Churches of the Separation* (1608), *Parallels, Censures, Observations*, etc. (1609), *The Character of the Beast*, etc. (1609), and a posthumous *Declaration of the Faith of the English People remaining at Amsterdam* (1611), etc.

**Smyth** (Thomas), D. D., b. at Belfast, Ireland, July 14, 1808; was educated at Belfast and at London; came to the U. S. 1830; studied divinity at Princeton, and was pastor of the Second Presbyterian church at Charleston, S. C., from 1832 until his death, Aug. 20, 1873. Author of numerous works, chiefly in illustration and defence of the Presbyterian form of church government; also of *The Unity of the Human Race proved to be the Doctrine of Scripture, Reason, and Science* (1850) and *The True Origin and Source of the Mecklenburg Declaration of Independence.*

**Smyth** (Thomas A.), b. in Ireland; came to the U. S. in childhood; settled at Wilmington, Del.; entered the Union army 1861; made brigadier-general June 3, 1864, for gallant conduct at the battle of Cold Harbor; became commander of the 2d division of the 2d army corps, and was mortally wounded near Farmville Apr. 6, dying at Petersburg Apr. 9, 1865.

**Smyth** (William), b. at Liverpool, England, in 1766; graduated at Peterhouse, Cambridge, 1787; became tutor to a son of R. B. Sheridan, through whose influence he was appointed professor of modern history at Cambridge

1807, retaining that post until his death, at Norwich June 26, 1849. Author of *Lectures on Modern History* (2 vols., 1840), republished in the U. S. with additions by Pres. Jared Sparks (Boston, 2 vols., 1841), and *Lectures on the French Revolution* (3 vols., 1840).

**Smyth** (William), b. at Pittston, Me., in 1797; graduated at Bowdoin College 1822; was for forty years professor of mathematics in that institution, and author of a series of textbooks on algebra and geometry. D. at Brunswick, Me., Apr. 3, 1868.

**Smyth** (William Henry), D. C. L., F. R. S., b. at Westminster, England, Jan. 21, 1788, son of J. B. Palmer Smyth of New Jersey, a loyalist of the American Revolution, who claimed descent from the famous Capt. John Smith; entered the British navy 1805; served at Cadiz 1810; was detailed by the lords of the admiralty to make a hydrographical survey of the coasts of Sicily and the adjacent islands, which resulted in the publication of his *Atlas and Descriptive Memoir on Sicily* (1824); was promoted to commander Sept., 1815; completed a survey of the coasts of the Adriatic 1817; made a final survey of the Mediterranean 1821; published a large number of charts of different portions of that sea; became post-captain 1824, and rear-admiral 1853; resided successively at Bedford and at Cardiff, erecting a private astronomical observatory at each place, and was known for many years as an enthusiastic lover of science; was a member and officer of many societies, and president of the Royal Astronomical Society, and in 1857 became hydrographer to the admiralty. D. near Aylesbury Sept. 9, 1865.

**Snail** [Ang.-Sax. *snægal*, "little snake"], a name given to the terrestrial shell-bearing gasteropod mollusks generally, and frequently extended to the similar forms inhabiting the waters. The terrestrial species were formerly combined by many authors in a single family (called Colimacés by Lamarck), but the incongruity of this assemblage, and the wide differences between the inoperculate and operculate types, were soon recognized; they were then differentiated into the Pulmonifera inoperculata (including slugs and snails) and Pulmonifera operculata. It was subsequently recognized that even such a distribution did not adequately express the fundamental differences between the several types. It is now generally admitted that the terrestrial snails are divisible into three categories—viz. (1) Pulmonata, including the inoperculate forms, as well as allied forms living in the water, and also the slugs; (2) certain operculigerous forms (Cyclostomidæ, Aciculidæ, etc.) which are closely allied to the aquatic Littorinidæ, etc., and consequently Pectinibranchiata, in the extended sense of the word; and (3) other operculigerous types (Helicinidæ, Proserpinidæ, etc.) which are most nearly related to certain other aquatic forms very different in structure from the former — *e. g.* Neritidæ, Trochidæ, etc.—and representative of another order, the Rhipidoglossa. It is thus seen that the form of the shell, and even the presence or absence of a shell, are of very inferior systematic significance, and entirely subordinate to differences in structure of the animal. Those differences are chiefly exhibited by the modifications of the nervous system, the heart, the dentition of the lingual ribbon, and the organs of generation. (See, further, Gasteropods, etc.)

Theodore Gill.

**Snake.** See Serpent.

**Snake-Bird.** See Darter.

**Snake'bite,** tp., Bertie co., N. C. P. 1336.

**Snake'-Eel** (*Ophisurus*), a genus of marine eels, allied to the common eel, but found only in warm latitudes. It is remarkable for the absence of the caudal fin, the end of the tail being much like that of a snake.

**Snake'-Fish,** a name given on some parts of the English coast to the *Cepola rubescens*, otherwise called Band-Fish (which see), and in some of the West Indies and Bermuda to the *Synodus* (or *Saurus*) *lacerta*.

**Snake Indians.** See Shoshones.

**Snake** (or **Lewis**) **River** is the largest tributary of the Columbia. It rises in Shoshone Lake, in the U. S. National Park, within the limits of Wyoming Territory. Its source has an elevation of 7792 feet. It takes a devious course, flowing to the S., N. W., S. W., N. W. again, then northward, forming for a long distance the boundary between Idaho on the E. and Oregon and Washington Territory on the W. Finally, its course is to the W. and S. W. Its mouth is in Washington Territory. Its upper valley is broken, with some fertile areas; lower down, the country is to a great extent open, and in part is fine prairie-land. The stream has numerous rapids, and its great cataract in Idaho rivals Niagara in grandeur and exceeds it in height. The Snake River is over 1000 miles long, and has a large volume of water.

**Snake'-Root,** a popular name for many plants believed to be efficacious in the cure of snake-bites. In the U. S. the name is applied to the following among others: (1) the black snake-root or sanicle (*Sanicula marilandica*), a common umbelliferous plant, with a root of an aromatic taste, of some value as an antispasmodic. (2) The *Eryngium yuccæfolium*, buttonsnake-root, or rattlesnake master, is diaphoretic and expectorant. (3) The Seneca snake-root (see Seneka). (4, 5, 6) *Liatris spicata*, *squarrosa*, and *scariosa*, called also buttonsnake-root, blazing star, rattlesnake master, etc., showy, composite-flowered plants, with stimulant and diuretic properties. (7) The *Eupatorium ageratoides*, common in the Northern States, and a good tonic, is called white snake-root. (8, 9) The *Aristolochia serpentaria*, the well-known Virginia snake-root, which has valuable stimulant and tonic powers and a pleasant fragrance. *A. reticulata* of the South-west produces much of the snake-root of commerce, and is of good quality. (10) The *Cimicifuga racemosa*, or black snake-root, is a valuable sedative and expectorant. (11) *Asarum Canadense*, or wild ginger, is called snake-root and Canada snake-root in New England. It is a fragrant plant, with properties much like those of *Aristolochia serpentaria*, but much more pungent. This list illustrates the vagueness of the popular names of plants and the importance of scientific classification. The list might be considerably extended.

**Snake Spring,** tp., Bedford co., Pa. P. 631.

**Snake'-Stone,** a small piece of stone, bone, or other substance which is placed upon the bite of a poisonous serpent for the purpose of absorbing or charming away the poison. The vulgar in almost all countries have faith in this and other like means of cure, such as the mad-stone, which is applied to the bite of a rabid dog. In India, snake-stones are often used, and there are several apparently well-authenticated instances of their seeming efficacy. It is probable that some of these stones may have a strong absorptive power for the snake-poison, for they are often porous, and the unlimited faith which the bitten persons have in this means used for cure is doubtless a powerful adjuvant.

**Snake'-Weed,** the common name of the Bistort (which see), so called from the root being *twice bent* on itself. This root also contains starch, which renders it nutritive; hence in Siberia it is roasted and eaten.

**Snake'-Wood.** See Letter-wood.

**Snap'dragon,** a popular name for plants of the genus *Antirrhinum*, herbs of the order Scrophulariaceæ. Many fine flowering varieties are cultivated, mostly belonging to *A. majus* and *A. latifolium*, Old-World plants of easy culture.

**Snap'per,** a name applied to a number of different kinds of fishes in the Southern U. S. and West Indian islands. The most noteworthy are the species of *Lutjanus* and *Sebastes*. (1) The *Lutjani* are forms distantly related to, and somewhat resembling, the porgy of the U. S., and are numerous in species. One member of the genus (*Lutjanus caxis*, or gray snapper) is a visitor to the coast of the U. S. as far N. as New Jersey, but only young fishes have been hitherto found. (2) The *Sebastes viviparus* is known about Massachusetts Bay as the *Sebastes*, and may be readily known by its compressed body, 5-lobed preoperculum, large eyes, and reddish body. It belongs to the family Scorpænidæ.

Theodore Gill.

**Snap'ping-Turtle,** the designation in the U. S. of several species of tortoises. (1) The common snapping-turtle of the Northern and most of the Southern U. S. is the *Chelydra serpentina*. This has the head moderately large, and covered with a soft skin, and the marginal scales of the shell are in a single row. It is said sometimes (though very rarely) to attain a length of about four feet and a weight of fifty pounds. It is found from Canada southward, and from the Atlantic seaboard westward to the Plains. (2) A species which in some parts of the Southern States at least replaces the *Chelydra serpentina* is the *Macroclemys Temminckii*. This animal has the head very large and broadly triangular, and it is covered with numerous horny plates; the marginal scales of the shell are in two rows. It reaches a very large size; sometimes it is reported weighing as much as 100 pounds. It is confined to the Southern States, extending from Florida to Western Texas and northward up to Missouri in the West. It is perhaps more generally known as the alligator turtle. Both of these species belong to the family Chelydridæ, and are distinguishable from all the other turtles of the U. S. by the long and imperfectly retractile neck and tail, and the cruciform plastron or lower shell. They owe their name to their habit of snapping at their food or enemies. They are formidable opponents, their bite being severe, and it is difficult to relax their hold. They are by many esteemed for food, and especially for making soup. They have a musky odor, which is rather strong. In the early summer they

lay from twenty to forty eggs in a hole dug by themselves. (3) In some sections of the U. S. the name is also applied to the soft-shell turtles, or Trionychidæ, which also snap abruptly at food or obstacles to their progress. THEO. GILL.

**Sneeds'ville,** p.-v., cap. of Hancock co., Tenn. P. 177.

**Sneek,** town of the Netherlands, province of Friesland, is neatly built, intersected by canals, and surrounded by flat meadow-lands. It carries on a very large trade in cattle, butter, and cheese. P. 9395.

**Sneeze'-Wood,** the beautiful and durable timber of *Pteroxylon utile* (order Sapindaceæ), a tree of South Africa. When sawing or rasping it, joiners are much troubled by the sneezing which its fine dust provokes. Its wood is very inflammable, even when green.

**Sneez'ing,** or **Sternutation,** a convulsive movement by which the lungs and chest-walls are expanded and then suddenly contracted, forcing the breath out violently through the nose. It is produced by reflex action, there being some irritation of the pituitary membrane of the nose which originates the action. The sneezing tends to remove the irritating substance from the nose. There are a large number of irritating substances whose presence in the nostrils will induce sneezing. When it is a symptom of cold, it indicates that catarrhal inflammation has induced a state of things similar to that produced by a foreign substance in the nose.

**Snell** (EBENEZER STRONG), LL.D., b. at North Brookfield, Mass., Oct. 7, 1801; graduated at Amherst College in 1822; was instructor in Amherst Academy 1822–25, and in Amherst College 1825–34, when he became professor of mathematics and natural philosophy—a position which he still occupies. Has published revised editions of Olmsted's textbooks on natural philosophy and astronomy.

**Snell** (THOMAS), D. D., b. at Cummington, Mass., Nov. 21, 1774; graduated at Dartmouth College 1795; taught in the academy at Haverhill one year; was licensed to preach 1797; was ordained pastor of the Second Congregational church at North Brookfield, Mass., June 27, 1798, and filled that post sixty-four years, until his death May 4, 1862. Twenty-four of his sermons and discourses were separately published, several of them being anniversary addresses of interest to the student of local history.

**Snell** (WILLEBRORD), b. at Leyden in 1591; studied mathematics and natural science; succeeded in 1613 his father as professor of mathematics at the University of Leyden. D. there Oct. 31, 1626. He discovered the law of the refraction of light, and laid thereby the foundation of the science of optics. He was also the first to calculate the size of the earth by means of a trigonometrical measurement of an arc of a meridian. The whole method of proceeding which he employed in this undertaking he has described in his *Eratosthenes Batavus, sive de Terræ Ambitus vera Quantitate* (Leyden, 1617). He also wrote *Cyclometricus* (Leyden, 1621), etc.

**Snell'ing,** p.-v., cap. of Merced co., Cal., on Merced River, in a mining and stock-raising region.

**Snelling** (JOSIAH), b. at Boston, Mass., in 1782; entered the U. S. army as lieutenant of infantry 1808; was distinguished at the battles of Tippecanoe (1811) and Brownstown (1812), and subsequent engagements on the Canada frontier; became lieutenant-colonel of rifles and inspector-general 1814; colonel of the 5th Infantry 1819; was a principal witness against Gen. Hull on his trial, and published *Remarks on Gen. Hull's Memoirs* (1825). D. at Washington, D. C., Aug. 20, 1828.

**Snelling** (WILLIAM JOSEPH), son of Col. Josiah, b. at Boston, Mass., Dec. 26, 1804; educated at West Point; became a trapper in Missouri; engaged in developing the lead-mines at Galena, Ill.; began to figure as a writer, both of prose and verse, about 1828; was connected with several newspapers; wrote for the principal magazines; published *Truth, a New Year's Gift for Scribblers* (1832), a spirited metrical satire on several American poets; *Tales of the North-west*, containing accurate sketches of Indian life; *The Polar Regions of the Western Continent Explored* (1831); contributed to the *N. A. Review* and to *The Boston Book;* wrote for William Apes, the Pequod Indian preacher, his little book on *Indian Nullification* (1835), and was for several years editor of the Boston *Herald*. D. at Chelsea, Mass., Dec. 24, 1848.

**Sne'then** (NICHOLAS), b. at Fresh Pond (now Glen Cove), L. I., Nov. 15, 1769; was in early life a farmer; was ordained an itinerant Methodist preacher 1794; labored four years in New England; became private secretary to Bishop Asbury; was chaplain to Congress 1809; emancipated a large number of slaves acquired by marriage 1829; was prominent in the organization of the Methodist Protestant Church 1828; removed to Indiana 1829. D. at Princeton May 30, 1845. Author of several volumes of theological and controversial essays and sermons.

**Snet'ter's,** tp., Darlington co., S. C. P. 771.

**Sniabar,** tp., Jackson co., Mo. P. 2707.

**Sniabar,** tp., Lafayette co., Mo. P. 1550.

**Snia'tyn,** town of Austria, in Galicia, on the Pruth, was formerly fortified; has a fine castle and a trade in cattle and leather. P. 10,663.

**Sni'der Rifle,** so called from its inventor, the essential features of which are that the breech-block revolves around an axis on the right of and parallel to the axis of the bore, and the firing-pin passes obliquely from the nose of the hammer through the breech-block to the centre of the base of the cartridge. This was the first form of breech-loaders adopted by the British government, which in 1866 directed that the old Enfield muzzle-loaders should be altered to breech-loaders upon this system.

**Snipe** [Dutch, *snip*], a name given to many birds of the family Scolopacidæ. The most prominent species in the U. S. are the *Gallinago Wilsoni* (American snipe), *Macrorhamphus griseus* (gray snipe), *Tringa maculata* (jack or grass snipe), *Tringa cornutus* (robin snipe), and *Totanus semipalmatus* (stone snipe). The *Tringæ* are, however, more generally known as sandpipers, and the *Totani* as tattlers. (See SCOLOPACIDÆ.)

**Snipe'-Fish,** a name given to the *Centriscus scolopax*, the type of the family Centriscidæ, on account of the elongated snout, comparable to the bill of a snipe. It is also called trumpet-fish.

**Snohomish,** county of N. W. Washington Territory, extending from the Cascade range on the E. to Puget's Sound on the W., watered by several large streams, is covered in great part with forests, and is noted for its cranberry-marshes along the sound. Staples, lumber, potatoes, and hay. Cap. Snohomish. Area, 1350 sq. m. P. 599.

**Snohomish,** p.-v., cap. of Snohomish co., Washington Territory, on Snohomish River.

**Snor're Stur'leson,** b. in 1178 at Hwamma, on the western coast of Iceland, belonging to one of the most prominent families in the island, descending from the royal family of Norway, and settled at Hwamma since the earliest days of the colonization. He was educated at Oddi by Jon Loptson, the most learned man in Iceland, and a grandson of Sæmund Sigfusson, the author of the *Elder Edda*. In 1204 he married the richest heiress in Iceland, and thus became, by his family connections, his education, and his wealth, the most prominent man in the country—a position which he vindicated by the magnificence and splendor of his life, by his shrewdness and energy as a politician and magistrate, and by his eminent talents as an orator and skald. But many of his passions were mean, and all his ways were crooked. A deadly hatred arose between him and his brother, and bitter feuds with other families made his life a perpetual warfare. He sought support in Norway, where he enjoyed a great reputation; but his egotism, avarice, and passion for intrigue led him into fatal mistakes, and he was murdered at the instigation of the Norwegian king, Hakon, by his two sons-in-law in 1241, at Reikholt, where ruins of his splendid mansion are still to be seen. His life gives a very characteristic and highly interesting picture of the culmination and decline of the Icelandic republic. Of his literary productions, the most important is *Heimskringla*, giving the history of Norway to the death of Magnus Erlingson in 1177. It was translated into Danish by Peder Clausson in 1559, but not published until 1697, by Peringskjold (Stockholm). The best edition is that begun by Schöning and finished by Werlauf (Copenhagen, 1777–1826), with a Latin and Danish translation. There is also an English translation by Samuel Laing (3 vols., London, 1844). The *Younger Edda* also bears Snorre's name, but only parts of it belong to him.

**Snow** [Ang.-Sax. *snâw*]. When vapor condenses at a temperature below 32° F., it freezes or passes into a crystalline form, producing snow. Snow-flakes, though assuming a great variety of forms, usually present the outline of a hexagon or a six-pointed star. In high and middle latitudes the ground is covered with snow each winter, but within the tropical regions no snow falls at or near the level of the sea, for the temperature of the lower atmosphere is always sufficient to melt it, even if it is formed in the upper air. In the northern hemisphere the limit of the fall of snow at the sea-level is an irregular line passing mainly between 25° and 40° N. lat.; in the southern it is more regular, lying in the continents between lats. 37° and 38°. In general, this line is nearest to the equator in the regions most exposed in winter to polar winds, as on the eastern coast of Asia and of North America. As the heat of the air decreases upward, the formation of snow is always

possible upon high mountains, even under the equator. At the summit of the Andes and the Himalayas, for example, the moisture condensed during the rainy season falls in the form of snow, while it rains on the slopes and plains below. Thus, in all latitudes from the equator to the poles the tops of high mountains are covered with a layer of permanent snow, which the summer heat is not sufficient to melt. The lower limit of perpetual snow, called the *snow-line*, is found within the tropics about 3 miles above the level of the sea. In temperate latitudes it descends to a little less than 2 miles; and at the northern limit of the continents it is about half a mile, or even less, above the level of the sea; while on the arctic islands vast fields of snow remain permanently very near the seashore.

*The height of the snow-line*, as observed in different latitudes, is given in the following table:

| Latitude. | New World. | English feet. | Latitude. | Old World. | English feet. |
|---|---|---|---|---|---|
| 75° N. | North Greenland | 2,300 | 75° N. | Bear Island | 600 |
| 54° | Unalashka | 3,500 | 71° | Mageroe, Cape North | 2,300 |
| 48° | Mt. Baker, Or., about | 8,000 | 67° | Sulitelma, Lapland | 3,800 |
| 43° | Rocky Mountains | 12,500 | 61° | Scandinavian Alps | 5,300 |
| 39° | Rocky Mountains | 14,500 | 50° | Altai Mountains | 7,000 |
| 38° | Sierra Nevada | 11,000 | 46° | Alps, N. side | 8,800 |
| 19° | Popocatepetl, Mexico | 14,900 | 46° | Alps, S. side | 9,200 |
| 5° | Tolima, Colombia | 15,300 | 43° | Caucasus | 11,000 |
| 1° S. | Andes of Ecuador | 15,800 | 35° | Hindoo Koosh | 13,000 |
| 17° | Andes of Bolivia, W. side | 18,500 | 31° | Himalaya, S. side | 16,200 |
| 17° | Andes of Bolivia, E. side | 15,700 | 31° | Himalaya, W. side | 17,400 |
| 33° | Andes of Central Chili | 14,700 | 12° | Abyssinian Mountains | 14,000 |
| 42° | Andes of Patagonia | 6,000 | 3° S. | Kilima Njaro | 16,000 |
| 54° | Andes of Sts. of Magellan | 3,700 | 44° | New Zealand Alps | 7,500 |

This table shows that though the height of the snow-line decreases toward the poles, its greatest altitude is not at the equator, but near the tropics, and that it is also subject to great irregularity of elevation.

Two conditions regulate the altitude of the snow-line—the quantity of fallen snow, and the amount of heat to melt it. Thus, in the sub-tropical zones, which have less snow and no less summer heat, the snow-line is higher than at the equator. In similar latitudes the coast-regions, exposed to moist winds, have a lower snow-line than the interior of the continents with their scanty snows, dry atmosphere, and hot summers. The peaks of the Sierra Nevada bear perpetual snow 3500 feet lower than the Rocky Mountains in the same latitude. The S. slope of the Himalayas, which condenses the vapors brought by the warm monsoons, has a snow-limit, on an average, 2000, and in some places 4000, feet lower than the N. slope on the dry and sunny plateau of Thibet. In the Alps the line of snow is somewhat higher on the southern slopes, exposed to the warm summer wind from Italy. In passing from the dry climate of Central Chili to the rainy region farther S., the snow-line descends from 14,700 feet to 6000. A vast amount of snow in the latter region, and a wet, cloudy summer, account for the change. In the Rocky Mountains, in a latitude corresponding to that of the Patagonian Andes, the snow-line has an altitude of 12,500 feet—that is, full 6000 feet higher.

*Glaciers.*—One of the most interesting phenomena connected with the regions of permanent snow, though extending far below their bounds, are the glaciers. Long before reaching the snowy regions the tourist, ascending the Alpine valleys, stumbles with amazement upon vast masses of ice hundreds of feet in thickness, imbedded in green valleys and stately forests, often near flourishing villages and cultivated fields. These prove to be the lower ends of long bodies of ice, whose heads may be traced to the glistening heights in the distance. Seen from above, glaciers look like vast streams of ice, which descend from the lower edge of perpetual snows—like long icicles from a snow-covered roof. They fill the beds of the Alpine valleys, following their windings, and terminate abruptly in a massive wall of ice. From beneath, through a large icy vault, the turbid waters of the melting glacier escape in turbulent torrents, which are the fountain-heads of all the great alpine rivers. Like streams, again, when the slope is gentle their surface is smooth; when precipitous, the mass of ice breaks up in deep crevices, and the glacier assumes the form of a gigantic frozen cataract, but beyond the precipice it becomes even again. In the lower portion, where the air is warmer and the melting more rapid, the shattered mass is sometimes resolved into sharp points of considerable height, called the *needles of the glacier*. The great glaciers of the Alps extend downward, from 3000 to 6000 feet below the snow-line, and are from 10 to 15 miles in length. Along their course, like the great river-systems, they usually receive several tributaries or minor glaciers, which unite in one channel. The several glaciers, though strongly compressed, are united only by their margins, and each preserves its individual structure, often to the end of its journey.

The most astonishing fact in regard to the glaciers, the explanation of which has taxed the ingenuity of many physicists, is that of their motion. Glaciers descend with a steady though imperceptible motion along the valleys they occupy. A rapid slope or a greater mass accelerates, and a gentle slope or a smaller mass retards, the motion. In the same glacier the rate is always greater in summer than in winter. In glaciers of the first order the ordinary progress is from 10 to 20 inches a day, but sometimes, as in the Mer de Glace on Mont Blanc, it reaches 2 feet or more. The bottom and sides are retarded by friction against the rocky walls of the valley, while the top and centre, moving more freely, are more and more in advance. Hence the lower end of the glacier, when free to expand—as that of the Rhone in Switzerland—terminates in a convex semicircle. The *termination* of a glacier, notwithstanding the constant descent, occupies from year to year about the same average position, for the melting in summer is generally sufficient to dissolve the extremity as rapidly as it advances. Heavy snows, however, followed by a cloudy and cool summer, which diminishes the amount of melting, may cause the glacier to extend beyond its usual limit; while a dry winter or an unusually hot and clear summer may reduce both the length and thickness below the average. The glaciers are thus a beautiful provision for relieving the regions of perpetual frost from the excess of snow, which is thus carried down to be melted in the more genial atmosphere below.

Glaciers, like mountain-torrents, transport fragments of rock of all sizes which have gradually crumbled from the peaks and slopes above them. On the surface of all great glaciers are narrow and well-defined bands of rocks and rubbish, called *moraines*, each of which is composed, from beginning to end, of the same kinds of rock. All these rocks falling at the end of the glacier accumulate in a *terminal moraine*, which usually forms a semicircular wall across the valley. The constant friction of these vast masses of ice on the surface of their rocky beds rounds off the projections over which they pass, and smooths and polishes even hard granite and marble. The fine mud, composed of the hardest particles of these crystalline rocks, adhering to the ice, is the polishing powder. Coarser grains cut on the polished surface systems of fine parallel scratches, and larger pebbles form parallel furrows, all indicating the direction of the moving ice. Old moraines, polished and grooved rocks, and other evidences of glacier-action, so different from that of water, show that in a time long past vast glaciers, several thousand feet in thickness, existed in New England and other parts of America, in Switzerland and other parts of Europe, where no permanent snows are now found.

The geographical distribution of glaciers depends upon both climatic conditions and the structure of mountains favoring large accumulations of snow. The mountain-systems in the middle latitudes, with abundant snows and alternate warm and cold seasons, are most favorable to the formation of glaciers. The best known, and probably the most remarkable, glacier region is that of the High Alps, in the heart of which are Mont Blanc, Monte Rosa, and the Bernese Alps. The Pyrenees have only few and small glaciers. Late explorers have found glaciers of large proportions in the Caucasus and Himalayas. In the Scandinavian Alps are many which descend in the deep western fiords nearly to the sea-level. In the New World glaciers are less frequent. They are entirely wanting in the tropical Andes, the constancy of temperature throughout the year, as well as the structure of the snow-covered peaks, being adverse to their formation. In the snowy Patagonian Andes, however, they are numerous and well defined. In the high Sierra Nevada polished and grooved rocks, showing the former presence of great glaciers, are found down to 4000 feet above the sea-level, but no glaciers have been discovered. Farther N., on Shasta Peak and Mount Rainier, genuine glaciers of small dimensions have been noticed. By far the most extensive glaciers are found on the snow-

covered islands of the polar oceans. The gigantic Humboldt Glacier, discovered by Dr. Kane on the shores of Smith Sound, is 60 miles in breadth, rises 300 feet above the water, and extends an unknown distance into the interior. Similar, though perhaps less extensive, glaciers occupy nearly all the valleys of Greenland, Spitzbergen, and other arctic, and also antarctic, islands. Large masses of ice, broken from the ends of these glaciers, form the enormous icebergs or mountains of ice which are so numerous in the polar seas, and are transported by the currents even to middle latitudes. These must not be confounded with the vast ice-floes, such as that on which the nineteen members of the crew of the Polaris floated down during a perilous voyage of nine long months from the Arctic Sea to the lower latitudes. The ice-floes are flat, and often scores of square miles in extent. They are formed by the freezing of the surface of the sea, and subsequently broken up by the action of the winds and tides. A. Guyot.

**Snow** (Caleb Hopkins), M. D., b. at Boston, Mass., Apr. 1, 1796; graduated at Brown University 1813; became an eminent physician in his native city; published a valuable *History of Boston* (1825; 2d ed. 1828), and a *Geography of Boston and Adjacent Towns* (1830). D. at Boston July 6, 1835.

**Snow'ball,** the *Viburnum opulus*, a cultivated shrub of the order Caprifoliaceæ, called also Guelder rose. To this species belongs the high-bush cranberry of the U. S., whose fruit is edible. The species is native to Europe and North America. The snowball is a variety with handsome globular cymes of sterile flowers.

**Snow'-Berry,** the *Symphoricarpus racemosus*, a handsome shrub (order Caprifoliaceæ) common in the U. S. in many parts, and half naturalized in European shrubberies. Its persistent, white, inedible berries are well known and familiar objects. The name is also given to *Chiogenes hispidula* (order Ericaceæ), a creeping woody plant, whose leaves and white edible berries have the taste of the checkerberry (*Gaultheria*). It is common in the Northern U. S. and Canada.

**Snow'-Bird,** a name common to the several species or varieties of the genus *Junco* inhabiting the U. S. These belong to the family Fringillidæ, and have a small conical



The Common Snow-Bird.

bill, the wings rather short, the middle toe shorter than the short tarsus, the outer toe rather longer than the inner, and extending to the claw of the middle one, and the tail nearly as long as the wings, slightly emarginate, and decidedly rounded; the color is blackish or ash above, white on the belly, and not developed in streaks anywhere; the outer tail-feathers are white. The several forms generally rather exceed six inches in length, of which the tail forms a little more than half. They are distributed over different regions of the U. S. Much difference of opinion has prevailed respecting the taxonomic value of the variations, some (*e. g.* Baird in 1853) admitting as many as five distinct species, while others (*e. g.* Ridgway in 1873) combine them as varieties of a single polymorphic species. Of these, the form *hyemalis* is the only Eastern type, while four are found in the West. They are birds of passage in the Eastern and Middle States, those of corresponding temperature going N. to breed while yet snow may be on the ground, and returning in the late fall. They feed on seeds and berries. The nests are built on the ground; they lay about four eggs, about three-quarters of an inch long and of a yellowish-white color dotted with reddish-brown.

Theodore Gill.

**Snow'-Bunting,** or **Snowflake,** the popular name of the *Plectrophanes nivalis*, a species of the family Fringillidæ. In common with the other species of the genus, it has a very long hind claw, which is little curved, the tarsi are longer than the middle toes, and the lateral toes are equal and extend to the base of the claw of the middle one; the distinctive characters of the species are the comparatively small bill and the shortness of the hind toe (it is not longer than the middle one); the general color is white, the middle of the back, inner tail-feathers, and ends of wing-quills black. It somewhat exceeds six inches in length, of which the tail forms less than half. The species ranges over the whole northern hemisphere, and in the U. S. descends southward in winter to about the latitude of 35°. Individuals associate together in flocks of from about a dozen to several hundreds, and are often conspicuous during snowstorms, whence the name of the species. It breeds mostly in the northern regions, and forms a nest on the ground, in which it lays its eggs, which are whitish, generally spotted with brown. Theodore Gill.

**Snow Creek,** tp., Mitchell co., N. C. P. 385.

**Snow Creek,** tp., Stokes co., N. C. P. 1781.

**Snow Creek,** p.-v. and tp., Franklin co., Va. P. 2549.

**Snow'den,** tp., Allegheny co., Pa. P. 1258.

**Snowden** (James Ross), b. at Chester, Pa., in 1840; was Speaker of the Pennsylvania house of representatives 1842–44; State treasurer 1845–47; treasurer U. S. mint 1847–50, and director of the mint 1853–61; wrote the articles on U. S. coinage in the *National Almanac* (1863), also in Bouvier's *Law Dictionary* (1868); published seven annual *Reports* on the mint, and many addresses and pamphlets on coinage, currency, and allied subjects; is author of two beautifully illustrated volumes descriptive of the ancient and modern coins in the U. S. mint (1860) and of the medals and other objects of interest in the same collection (1861); of a volume on *The Mint at Philadelphia* (1861), *The Coins of the Bible and its Money Terms* (1864), and *The Cornplanter Memorial, an Historical Sketch of Gy-ant-wa-chia, "the Cornplanter," and of the Six Nations of Indians* (Harrisburg, 1867), a volume which contains the report of Samuel P. Johnson on the erection of the monument at Jennesadaga (Warren co., Pa.) to the memory of that distinguished Indian chieftain.

**Snow'drop,** the *Galanthus nivalis* (order Amaryllidaceæ), a small herb much cultivated in gardens for its snow-white flower, appearing in earliest spring. A native of the Alps, it is naturalized in Northern Europe, and is becoming so in the U. S.

**Snowdrop Tree,** a popular name for *Halesia tetraptera* and *H. diptera* (order Styracaceæ), small trees or large shrubs native in the Southern U. S. They bear showy white clusters of flowers, which appear in spring somewhat before the leaves. They are very fine in cultivation. A third species is *H. parviflora*, from Florida.

**Snow'flake,** a popular name for the white flowers of *Leucojum vernum*, *æstivum*, and *autumnale*, European herbs of the order Amaryllidaceæ, cultivated also in American gardens. They are hardy bulbous plants. The bulb of the first-mentioned species has long been employed in the Old World as an emetic, and probably all have acro-narcotic powers.

**Snow Hill,** p.-v. and tp., Wilcox co., Ala. P. 4115.

**Snow Hill,** p.-v. and tp., cap. of Worcester co., Md., on Pocomoke River, at the S. E. terminus of Wicomico Pocomoke and Worcester R. R., is an important shipping-point for fruit and oysters, and has 1 weekly newspaper. P. of v. 960; of tp. 2834.

**Snow Hill,** p.-v. and tp., cap. of Greene co., N. C. P. of v. 320; of tp. 2650.

**Snow-Line.** See Snow, by Prof. A. Guyot, LL.D.

**Snow Shoe,** p.-v. and tp., Centre co., Pa., at the N. terminus of Snow Shoe branch of Bald Eagle division of Pennsylvania R. R. P. 1162.

**Snow-Shoes,** a pair of flat rackets or shoes, of which the broad surface prevents the wearer from sinking in the snow. They are either made of wood alone, or consist of a light frame crossed and recrossed by thongs. Snow-shoes of a long, narrow variety are used in Northern Europe, which serve as skates when necessary.

**Snuff.** See Tobacco.

**Snuffer.** See PORPOISE.

**Sny'der,** county of Central Pennsylvania, on Susquehanna River, has a mountainous surface, with abundance of iron and coal, and is traversed by Pennsylvania R. R. and Pennsylvania Canal. Staples, wheat, Indian corn, oats, hay, butter, and wool. Tanneries and flour-mills are numerous. Cap. Middleburg. Area, 260 sq. m. P. 15,606.

**Snyder,** tp., Blair co., Pa. P. 1412.

**Snyder,** tp., Jefferson co., Pa. P. 792.

**Snyder** (SIMON), b. at Lancaster, Pa., Nov. 5, 1759; learned the tanner's trade in youth; became in 1784 a merchant and miller of Selinsgrove, now in Snyder co., Pa.; was in 1789 a member of the State constitutional convention; Speaker of the Pennsylvania house of representatives 1802–08; was several times a candidate for governor, and was elected in 1808, 1811, and 1814, and was a member of the State senate 1818–19. D. at Selinsgrove, Pa., Nov. 9, 1819.

**Snyders** (FRANS), Flemish painter, b. at Antwerp in 1579; was a contemporary of Rubens, with whom he worked in concert, and a friend of Van Dyck, who painted his portrait. D. in 1657. His great power was in painting wild animals in the excitement of combat or the chase. His hunting-pictures are in the grand style. But his kitchen-scenes are equally remarkable in their way for execution of minute details, the color, and the arrangement and relief of culinary vessels. His pieces are common in the European galleries. O. B. FROTHINGHAM.

**Soane** (Sir JOHN), F. R. S., originally called SWAN, b. at Reading, England, Sept. 10, 1753, son of a bricklayer; was taken at an early age as errand-boy into the family of Dance the architect; displayed such intelligence as to be ultimately treated as a pupil; was subsequently a pupil of Holland; was sent to Italy for three years (1777–80) as a travelling student at the cost of the Royal Academy, on the recommendation of Sir W. Chambers; made a diligent study of the remains of Roman architecture; was appointed architect to the Bank of England 1788; executed plans for the country-seats of many of the opulent gentry, especially in Norfolk and Suffolk, a volume of which was printed in 1788; married a wealthy lady; became clerk of the works to St. James's Palace and the Houses of Parliament 1791, architect to the royal woods and forests 1795, surveyor to Chelsea Hospital 1807, and professor of architecture at the Royal Academy 1806; published a volume of his plans of *Public and Private Buildings* (1828) and a *Description* of his own house and museum (1827); was knighted 1831, and d. at Lincoln's Inn Fields Jan. 20, 1837. He bequeathed his house and museum and a sum of £30,000 to the nation for the benefit of students in the arts, but subject to vexatious conditions in regard to admission. His skill as an architect is not rated very high by modern critics.

**Soap** [Fr. *savon;* Ger. *Seife;* Lat. *sapo*]. Soaps are salts of the fat acids with various metallic bases, chiefly soda-base and potassa-base. All the true OILS and FATS (which see) are decomposed by the alkaline hydrates, by certain metallic oxides, and also by acids, high steam, and hot water. Glycerine, the sweet principle of fats, is thus set at liberty, and the fat acids combine with the base, forming soap, or are set at liberty. This process is known as *saponification;* and it is this characteristic which readily distinguishes the fats and oils, properly so called, from oils of the petroleum series, for example, as also from wax, paraffine, etc. By this process potassium and sodium hydrates produce soluble soaps, while calcium, magnesium, zinc, barium, and lead-oxides, and the like bases, produce insoluble soaps. As a rule, soaps formed by sodium-base are *hard soaps*, while those produced from potassium-base are *soft soaps*. Castor oil, however, forms with potassa a hard and brittle soap. A fundamental distinction between the hard and soft soaps is found also in the fact that in the former the glycerine is removed in the mother-liquor or "spent ley," while in the latter it remains mingled with the semi-fluid mass. Moreover, it is not possible to dry the potassium soaps, owing to the very hygroscopic character of the base, while soda soaps may be so completely dried as to admit of grinding to powder. The nature of the fats and oils, as also of glycerine, has been sufficiently explained under each of these heads, and need not be recapitulated here.

Saponification takes place slowly in the cold, much more quickly by aid of heat, and the presence or absence of air is immaterial. The result depends on the nature of the fat or oil, as well as on the base; *e. g.* if the fat is complex—containing, for example, stearine, palmitine, oleine, etc.—then as many new salts are formed as there are fatty acids to combine with the base. The operation is not attended by the production of acetic or carbonic acid; but a small portion of nitrogen is set free in the saponification of hog's lard, due, probably, to impurities in this fat. Hog's lard, 100 parts, digested with 60 parts of potassic hydrate and 400 parts of water for two days at a temperature of 70°–90° (C.), is converted into mother-liquor and soap; the mother-liquor contains free potash, with carbonate and acetate of potash, an odorous principle, and glycerine; the soap contains stearate (margarate), palmitate, and oleate of potassium, a small quantity of acetate of potassium, and a yellow coloring-matter. The carbonic acid and the greater part of the acetic acid in the mother-liquor were previously formed in the potassium hydrate, which had been purified by alcohol; the remaining very minute trace of acetic acid existed ready formed in the lard. To saponify 100 parts of hog's lard requires 18 parts of potassium hydrate, the product consisting of normal stearate, margarate, and oleate of potassium, with excess either of acid or alkali. When 100 parts of lard are boiled for sixty hours with 9 parts of potassium hydrate and a small quantity of water, a homogeneous mass is obtained, almost wholly soluble in boiling alcohol, and forming a solution which does not redden litmus. A large quantity of boiling water, however, decomposes this mass into soluble soap and unaltered neutral fat. Hence, the alkali saponifies exactly the quantity of fat which it can afterward neutralize; and the soap thus produced forms with the excess of fat an emulsion which does not produce grease-spots—a property on which the power of soap to remove grease-spots chiefly depends. (*Chevreul.*) Ammonia and its carbonates act only in a very imperfect way to saponify oils and fats. The potassium bicarbonate and monocarbonate saponify hog's lard with the aid of heat, while borax and biborate of potassium, even with prolonged boiling, saponify only about 2 per cent. of lard. Saponification by calcium hydrate, as described by Chevreul, is a process of great technical importance in the preparation of stearine candles, since it is by this means that the fat-acids are conveniently removed from combination with glycerine. The product of saponification by lead-oxide is familiarly known as lead-plaster or diachylon, lead, like lime, forming insoluble soaps with the fat-acids. Saponification by superheated steam and water, as in the process of Tilghman, Wilson, Fouché, and others, at a regulated heat of not over 400°, has become very important since the demand for pure glycerine has rendered it essential that an adequate supply of this remarkable body should be had at a cheap rate for the production of nitro-glycerine. The decomposition of the fats by hot steam was recognized and used by Gay-Lussac, Chevreul, and others as early as 1825; but at that time, there being little use for glycerine, no care was taken to prevent its destruction by too high a heat, breaking it up into acroleine and a blackened residue. In the form of apparatus now in use, with ample refrigeration and successive compartments, this process of saponification gives the fat-acids separate, for the most part, from the glycerine, which goes over with the vapor of water to the compartments more distant from the still, where the temperature is lower. This process is also especially adapted to the production of stearine candles (see STEARIC ACID), and depends on the fact that the various fatty and oily substances break up completely in an atmosphere of steam, without decomposition of the glycerine, at a temperature which differs but little with the various glycerides. Saponification by acids—*e. g.* by sulphuric acid—is a process which has been extensively used, but the decomposition of fats by steam and hot water has practically superseded all other methods where the object is to obtain glycerine in a state of purity. The glycerine obtained from the lime saponification of fats is never quite pure, and the cost of purification is too great. The glycerides, as has already been remarked under FATS, appear to take up the elements of water during the process of saponification, being probably compound ethers formed by the union of glycerine with the fatty acids, minus a certain number of molecules of water. Thus, by the experiments of Lecanu, 100 parts of stearine yield 8 parts of glycerine and 96.86 parts of stearic acid when both products are obtained as dry as possible, making 104.86—the excess being due to the elements of water taken on. The experiments of Chevreul support this view. Thus he found—

| 100 parts yield— | Glycerine. | Soap acids. | Sum. | Solid at— |
|---|---|---|---|---|
| Stearine from mutton suet | 8.0 | 94.6 | 102.6 | 53° C. |
| " " beef suet.... | 9.8 | 95.1 | 104.9 | 52° |
| " " hog's lard... | 9.0 | 94.65 | 103.65 | 52° |
| Mutton suet..... | 8.0 | 95.0 | 104.5 | 52° |
| Hog's lard ..... | 8.82 | 95.9 | 105.72 | 43° |
| Human fat..... | 9.66 | 96.48 | 105.84 | 31° |
| Oleine from hog's lard ..... | 9.0 | 94.0 | 103.0 | |
| " " human fat..... | 9.8 | 95.0 | 104.8 | |

Gmelin (*Handbook*, vii. 235) has calculated the composi-

tion of stearine on the basis of its being a compound of 1 molecule of glycerine with 2 of stearic acid, minus 8 molecules of water; also for 6 and 4 molecules of water respectively, and finds the two last assumptions giving ratios closely corresponding to the results of saponification—viz.:

| (*b*) | | (*c*) | |
|---|---|---|---|
| 96.55 | and | 94.90 | stearic acid, |
| 8.36 | " | 8.23 | glycerine, |
| 104.91 | and | 103.13 | sum. |

In the production of soap by the action of caustic potash on stearine (glyceritic stearate) the products, as before stated, are glycerine and potassium stearate; thus:

Stearine. 3 molecules pot. hydrate. Glycerine. 3 molecules of potassium stearate.

$$\left.\begin{matrix}(C_{18}H_{35}O)_3\\(C_3H_5)'''\end{matrix}\right\}O_3 + \left.\begin{matrix}K_3\\H_3\end{matrix}\right\}O_3 = \left.\begin{matrix}(C_3H_5)'''\\H_3\end{matrix}\right\}O_3 + \left.\begin{matrix}(C_{18}H_{35}O)_3\\K_3\end{matrix}\right\}O_3$$

While caustic alkalies are required completely to saponify neutral fats, and usually the aid of heat also, the fat-acids, stearic, palmitic, oleic, etc., when once separated from combination with glycerine, are readily saponified by the alkaline carbonates. Thus, the "red oil"—oleic acid chiefly—obtained as a by-product in the manufacture of stearine candles is used largely in the production of soaps.

Formerly in North America and Russia much larger quantities of potash were obtained in clearing up forests than now, and hence potash soaps were produced in proportionate quantity. These were, especially in Germany, converted into hard or soda soaps by utilizing the property of the potash-salts in decomposing common salt or sulphate of sodium, forming chloride or sulphate of potassium and soda soap. Moreover, the enormous production of caustic soda at a cheap rate consequent on the adoption of Leblanc's soda process, stimulated by the great demand for bleaching-powders, from which sodium salts are a by-product, has wellnigh put an end to the use of potash in producing soap, excepting as an element of domestic economy in those regions where potash is still a common product. Thus, in Canada and some of the Northern U. S. "potashes" and "pearlashes" are still articles of considerable importance. Dr. L. C. Beck, in his *Researches on the Commercial Potash of the State of New York* (*Am. Jour. Sci.* [2], xxix. 266, 1836), gives tables of analyses of this commodity which show that it contains from 60 to 70 per cent. of potassium hydrate, with chloride of sodium (added as a falsification), chloride of potassium, sulphate of potassium, and insoluble matter (iron, manganese, silica, etc.) making up the difference. In domestic economy it is the practice in New England and New York to saponify the drippings of the kitchen, chiefly beef and mutton suet, with the crude potash of commerce in the cold. The following empirical receipt has become traditional for domestic soft soap: Fat, 12 pounds; potash, 9 pounds; water, 12 gallons. The fat and alkali are placed together in a cask, and the water is added, three gallons at a time, boiling hot, once in twenty-four hours, until all is used. The process of saponification sets in soon, but is not completed until after many days, and is hastened by frequent stirring with a strong stick. When saponification is complete, all lumps of unaltered fat disappear, the soap has a silky lustre when stirred, and the consistency of a jelly, trailing off in slender threads from a stirrer, and is a powerful detergent for all the coarser purposes of the household, being greatly preferred by the cook for washing crockery and scrubbing floors above the common resinous hard soaps. Such a soap is obviously an impure potash fat soap in caustic ley, and not an actual soap: all the glycerine of the fats is of course present also in this crude product. We will return to soft soap after considering first hard soap and the manufacture of soaps generally.

As a technical art, soap-boiling depends on the use of caustic leys of a suitable strength for the saponification of fats, oils, and resins, with the production of soaps which are hard or soft, as already explained. It is not our purpose to go in any detail into the discussion of the soap-boiler's art, the full consideration of which would require an elaborate treatise. A few general principles must suffice. The "*ley*" of the soap-boiler is a dilute alkaline liquor prepared by the action of slaked lime (calcic hydrate) on a boiling solution of 3 parts of potassium carbonate in 12 parts of water, or the same quantity of sodium carbonate (soda-ash) in half this quantity of water. The carbonic acid of the alkali is transferred to the lime, and when the clear liquor ceases to effervesce with a dilute acid, it is known that the ley is fully caustic: 2 parts of quicklime slaked in 6 parts of hot water suffice for the above quantity of alkaline carbonates. The reason why *dilute* solutions are used is that concentrated alkaline solutions attack calcic carbonate, sending a portion of the alkali back to the condition of carbonate again. By using pure lime and a longer time (both elements of little cost) the soap-boiler saves fuel by acting on his alkali carbonate in the cold, and with equally good results, the ley marking 10° to 12° B. The Baumé hydrometer for alkaline solutions reads 18° B. for a ley of sp. gr. 1.138, which is equivalent to 15 per cent. of potash or 12.8 per cent. of soda, if the liquor is free of impurities. As soda leys are now generally prepared from reasonably pure sodium carbonate, the indications of the hydrometer are more trustworthy than when, as formerly, crude potashes were used, dense with chlorides, sulphates, and other impurities for which the hydrometer offered no correct test. The yet older fashion of a floating egg or bit of hard soap to test the alkaline strength of a ley was really a test only of a certain density, which might or might not be alkaline.

The manufacturer of *hard soap* having provided a stock of alkaline liquors (leys) of various strengths, charges his soap-pan with a quantity of neutral fat or oil, and adds weak liquors of about 1.050° density. Soap-pans are now made of iron plates riveted at the joints, and of various sizes, from 10 to 15 feet in diameter and of proportionate depth, set over fire-chambers, or more frequently heated by steam, either in jackets or injected from numerous small holes pierced in pipes introduced into the liquors. They vary in capacity with size, of course, holding from 20 to 30 tons of soap. As the temperature rises, and the oil and alkali liquor mingle, a uniform milky emulsion is formed, in which neither oily globules nor water are visible on cooling a portion of the fluid. The operator watches for this change, and adds more solution of alkali or water, as the case may require, until the emulsion forms and all alkaline taste has disappeared, using the tongue as a test. Stronger liquors are now added gradually to complete the displacement of the glycerine, which was commenced by the weak liquors, and the boiling continues until a strong alkaline taste is detected. The workman then adds more fat or oils, and repeats the use of stronger leys until gradually the soap-pan is nearly filled, taking care that at the last there shall be no excess of alkali. During this series of operations he often also adds a portion of resin, which by virtue of its constitution undergoes a species of saponification with alkalies, and adds to the product more than its value in weight and volume. Now comes the next important stage of the soap-boiling operation, in which, by the addition of salt, the emulsion of oils and alkali is decomposed, the salt taking the water and causing the precipitation of the newly-formed soap in a curdy or granulated state, floating on the dense "spent leys" in which is found the glycerine and salt, but no alkali. This mother-liquor, after the separation of the soap is complete, is withdrawn and rejected as having no value. The imperfectly-developed soap is now a second time subjected to a like series of operations as at first; it is brought by boiling to a homogeneous state, more oils or fats and strong alkaline liquors are added until the whole has a decided alkaline taste, and more salt is then added to cause the separation of the soap from the alkaline solution, and the whole mass is kept boiling for some time until all the fats, etc., are completely saponified. This completes the chemical part of the operation if the soap contains no rosin; and after allowing time for subsiding of the dregs, the "curd" is transferred by skimmers to the "frames," where it cools and becomes solid preparatory to cutting up for use. If, however, the soap contains rosin, it requires a further treatment before framing—viz. the curds, after removal of the spent liquor and dregs, are melted with more water and boiled by steam or fire, or both. A homogeneous compound results, containing an indefinite quantity of water, which is permitted to rest for two or three days, when it separates into a stratum of a definite compound containing about 65 per cent. of fat acids, 6.5 of soda, and 28.5 of water, and resting on a lower stratum of an indefinite compound containing much more water and the dregs or sediments of the operation. This lower stratum, called "nigre," contains also an excess of alkali, and forms with the addition of fat and salt the staple of another "boil" for more soap. The nigre which accumulates with each "boil" is used as a mottling for clouded soaps, or may otherwise be worked up in subsequent operations. A strong preference at one time existed for mottled soaps, founded on the fact that in such soaps no excess of water could exist; the substances which impart the mottled appearance, being heavier than soap, were held in suspension only in consequence of its thick and pasty condition. To remove entirely the mottled appearance and render the soap white requires the use of more water, so that in the thinner liquid soap the foreign bodies constituting the mottling may sink to the bottom of the pan. This additional quantity of water is not again removed, but is sold with the soap. It is, however, now possible, from the resources of modern art, so completely to simulate the appearance of genuine mottled soap, by

adding mineral and other colors during the process of hardening to soaps containing much more than the normal quantity of water, that this sign has lost its value, and such mottlings are justly regarded now as only evidence of impurity from the introduction of bodies foreign to soap. Good hard white soap contains—

| | | | | |
|---|---|---|---|---|
| Fat acids | 61.0 | or 1 | molecule | = 315 |
| Soda | 6.2 | " 1 | " | = 32 |
| Water | 32.8 | " 17 | " | = 153 |
| Sum | 100.0 | or | molecules | = 500 |

The soaps vary chiefly with the fats or oils from which they are produced, and may be considered as forming two principal classes—viz. soaps made from *vegetable* oils and those from *animal* oils and fats.

A. Vegetable Hard Soaps.—*Marseilles or Castile Soap.*—In Southern Europe soap is largely made of olive oil mixed with about 20 per cent. of rape-seed oil. This soap is noted for its firmness, freedom from the depraved animal odors found too often in tallow soaps, and in general for its excellent qualities. In this country it is commonly sold by the apothecary as "castile" soap. Without the addition of rape-seed oil the soap from olive oil is so hard as to crumble when cut, and is difficult to dissolve in water. This soap has a peculiar mottling—like granite, and not in streaks of color, as in the imitations made from animal fats. The best olive-oil soap is made in Spain and Portugal, also in Provence and Aix (see Olive Oil) from oil hot-pressed from the olives after the virgin and table oils have been extracted: 100 parts of new and good oil produce 175 parts of finished soap when no rape oil is used, by which the product is reduced to 170 parts or less. The richness of olive oil in margarine or palmitine is the reason for the superior quality of the soap it produces. Its manufacture is minutely described by Pelouze and Fremey in their *Traité de Ch.*, v. 951. They state that the consumption of soda is 72 parts for each 100 parts of oils used, and the cost of the manufacture at Marseilles is about 17¼ francs for each 100 kilogrammes of oils employed. The detail of manipulation is essentially that already given. The marbling of the Marseilles soap is due to iron, which is sometimes added as sulphate, and is changed to sulphide by the alkaline sulphide present in the soda. By exposure to the oxidizing influence of air the dark stains of ferric sulphide are changed to a reddish color. Dr. Normandy found the foreign castile (or Marseilles) soap (sp. gr. = 1.0705) to contain fat acids, 76.5; soda, 9; water and coloring-matter, 14.5 = 100. The English imitation (sp. gr. = 0.9669) gave fat acids of pasty consistence, 75.2; soda, 10.5; water with a little coloring-matter, 14.3 = 100.

*Cocoanut-oil Soap—Marine Soap.*—The soap made from the oil of the cocoanut is remarkable for its extreme hardness, and consequently for the very large amount of water it can hold without becoming soft. It has a disagreeable odor, which is with difficulty removed. The oil requires for its saponification a very strong ley, and is aided by the use of potash. This soap is not easily decomposed by weak saline liquors, and is hence used to wash in salt water, whence its name of "marine soap." This quality of carrying a large amount of water has led to the use of cocoanut-oil soap as a means of mottling weak soda soaps from tallow, etc., and is the basis of Blake & Maxwell's patent of 1857 for the use of cocoanut oil in connection with palm oil, tallow, etc. Such soap can be made to hold up manganese oxide, ultramarine, etc., in connection with far more water than can be introduced into a genuine castile soap. Dr. Normandy found a cocoanut-oil soap which contained soda, 4.5; cocoanut lard, 22.0; and water, 73.5 = 100. This remarkable soap was sufficiently solid, but it dissolved in water with great ease.

*Rosin Soap—Common Yellow Soap.*—It has been remarked already that rosin boiled with alkaline liquors, whether caustic or carbonated, is converted into a soapy emulsion. It is not a true soap, but from its plastic, viscid nature it is found to be a good vehicle for diluting true soaps from tallow or other fats. Rosin does not neutralize alkali, and hence it requires the presence of at least an equal quantity of grease to form with it a soap which will not corrode fibres or attack the skin. Indeed, the amount of rosin ought not to exceed a fourth, or at most a third, part the quantity of fats employed. As already stated, the process of manufacture for rosin soap varies from that of soap from oils or fats alone by the omission of the last boiling. By itself, rosin does not form a hard soap, and unless it is thoroughly treated by strong liquors it leaves on the hands or any surface washed with it a resinous varnish and offensive odor of rosin. It forms, when carefully prepared and not in excessive quantity, a very serviceable soap, which quickly forms an excellent lather and is very cheap. Glasgow rosin soap gave Dr. Normandy soda, 6.5; fat and rosin, 70.0; water, 23.5 = 100.

*Castor-oil Soap* and *Palm-oil Soap* are both soda soaps, although the oil of the castor bean forms a hard soap with potash, and is remarkable, like the cocoanut-oil soap, for the large quantity of water which may be combined with it—as much as 70 per cent. The palm oil is saponified like tallow soap; it is used chiefly as an addition to yellow rosin soap, as the unbleached oil has a decided yellow color, and its strong and rather agreeable odor serves to disguise the disagreeable odor of rosin soap, which also acquires in addition a certain transparency, due to the palm oil.

B. Tallow and other Animal-fat Soaps.—We have already anticipated under the heads of Fats and Oils (which see) nearly all that is needful to say of hard soaps from animal fats and oils. The old German hard soap was prepared from crude tallow by ley of ashes or potashes, giving an imperfect soap, which in the subsequent boiling is converted into soda soap by salt, which, being at the same time supplied with an excess of alkali, produces a neutral soda soap, and is then boiled down to "curd" with salt. This art long preceded the knowledge of chemical principles underlying it; was derived, in fact, from very ancient experience, which has been since confirmed and explained by the researches of modern science. The indications of saponification, advancing by all the grades of the process, are so distinct that no thought was entertained at first of working with weighed quantities. All that was required was to add more ley or more fat, according to appearance, until the proper state had been attained. In all respects the teachings of this empiric experience led to the same result which chemical knowledge has since illustrated and confirmed, and an outline of which has already been given. The use of crude tallow has been abandoned in favor of purified grease, and pure caustic soda, supplied now to all the world in unlimited quantity packed in iron casks, renders useless the old methods of leaching ashes for potash ley or of boiling up soda-ash with lime. Thus neatness, cleanliness, and the abatement of nuisances have kept company with economy and the improved methods of modern art. Experiment in the large way shows that 100 pounds of tallow produce 150 to 155 pounds of perfect curd soap, weighed as soon as it is cut; and if some boilers obtain more, it is because water is added in competition with soap of an inferior quality.

*Oleic Soap, or Red Soap.*—This soap, alluded to in the beginning as resulting from the lime-saponification of animal fats in the stearic-acid manufacture, is an important product wherever the manufacture of stearine candles is carried on. As the glycerine has already been removed, the saponification of the oleic acid is readily effected even by alkaline carbonates. It is also mingled with neutral fats, and saponified by soda-ley of 18° B. Campbell Morfitt's patent for a process for producing soap from red oil depends on treating the oleic acid in a steam-heated copper while agitated by a steam twist with carbonate of soda, etc., in equivalent proportion in the state of fine powder, added in successive portions, with or without rosin, according as a coarser soap or a fine toilet-soap is required. The relative proportions of oleic acid, water, and rosin in this soap being adjusted at the beginning, there is no waste ley; the soap is said to come quickly, does not shrink by air-drying, and is in all respects represented as an excellent soap.

*Soft Soap.*—The so-called "soft soap," such as is made in domestic economy, by the recipe already given, or by the soap-boiler's art, is not an actual soap, but a more or less impure solution of a potash soap in caustic ley with free glycerine, forming at common temperatures a smeary jelly, more or less transparent, and of a silky appearance when stirred. If an attempt is made to purify this soap by separation of the glycerine and excess of alkaline ley by solution of salt, it results simply in the production of hard soda soap, on principles already explained. In the manufacture of soft soap by boiling, caustic leys are made from leached ashes or American potashes, exactly as when soda-leys are used, and of graded strength, 9°–11° solutions being first used with gentle heat. The fatty bodies used are kitchen drippings, tallow, fish-oil, linseed, rape-seed, and other drying oils. As soon as the complete combination is effected, and the thick fluid falls in strings from the stirrers with a shining appearance and somewhat turbid, the clarification commences with the gradual addition of a stronger ley at regular intervals until the soap passes from its turbid state to a clear, transparent slime. The boiler judges by empirical rules the state of progress toward completion of the saponification. By the presence and extent of turbidity in a drop cooled on a plate of glass, he judges if combination has been effected, and the cause of failure. If such a drop from the middle of the pan on cooling remains clear, the soap is complete; a gray margin indicates a want of ley in proportion to its breadth; and if this deficiency is great, the specimen is fluid and slimy. If the

proper quantity of ley has been exceeded, the soap is said to be overdone, which is indicated by a gray skin spreading over the whole drop, instead of forming a ring or rim only; the soap is then granular, and when wet easily detached from the glass (*vitreous*). An excess of water is driven off by evaporation with a brisk fire and beating the froth as it rises with stirrers. As the soap thickens, the froth subsides, the soap sinks and becomes darker, white bubbles are borne on the surface overlapping each other, called by the workman *laminations;* and the noise occasioned by this action has led to the saying "the soap talks." The soap is now finished, and all the tests proving satisfactory, the fire is extinguished; and when the soap is sufficiently cool, it is packed for sale. As some kinds of oil, like that of hempseed, impart an esteemed greenish color to soft soap, while other varieties of soap are yellow, the greenish tint is artificially imparted to the yellowish soap by indigo. The detergent power of soft soap is very great, owing largely to its strong alkaline condition, and is hence much esteemed in scouring wool, coarse linens, and for other like uses in the dyehouse. As it normally retains as inseparable from it the excess of alkali, the free glycerine and other impurities, there is no guaranty, as in the case of hard soaps, for its purity, much less any definite molecular constitution which can be established by an analysis. Hence, many methods have been practised for reducing its cost—as, for example, the so-salled *bone-soap*, formed by the addition of the gelatine from ground bones, dissolved or partially decomposed by potash. In another plan hydrochloric acid is used to dissolve out the mineral matter of bones, leaving the gelatine, which, when carefully washed free of acid, is added during saponification to the fat. The soap with bones is called "Liverpool poor-man's soap;" it is an open fraud, since gelatine and phosphate of lime can act only as useless diluents of soap. But this fraud is harmless compared with the use of the intestines of animals, skin, sinews, hoofs, hair, stinking fish, and other animal refuse which are subjects of *patents* for so-called saponification in forming soft soap. Even naphtha, a non-saponifiable oil, and dextrine, are "protected" in a like manner. Soft soap contains, according to quality, fat acids, 50 to 40 parts; potash, 9.5 to 11.5 parts; and water, 38.5 to 50.5 parts in 100.

*Silicated Soaps* contain either soluble silica, or sand and powdered pumice, fuller's earth, and alumina. These substances act only mechanically as detergents, and may be permitted when a proper reduction in price is allowed. Sand soap contains as much as 75 per cent. of its weight of sand, such as is used for scouring floors, and the French *savon-pouce* ("pumice soap") has from 20 to 26 per cent. of ground silica or pumice. These comparatively worthless mechanical mixtures have been replaced by soap in which "soluble glass," or silicate of sodium, is employed with advantage. This feeble alkaline compound has by itself a considerable detergent power, and when mixed with ordinary soap an article is produced of greatly-reduced price and quite useful for many domestic and manufacturing operations. Messrs. Gossage received the award of a prize medal at the Paris International Exhibition of 1862 for this manufacture, which is now carried out on an extensive scale. These silicated soaps are quite strongly alkaline, owing to the nature of the soluble glass; this excessive alkalinity is reduced for some purposes by combining, with the soap, rosin or fatty acids, as in the ordinary process of soap-making. Carbonic and sulphurous acid gases are likewise passed into the liquid for the purpose of partially neutralizing the excess of alkalinity.

*Toilet Soaps* are made from very pure and sweet materials—sweet almond oil, beef's marrow, refined sweet lard, saponified without heat and perfumed with various essential oils. Very pure curd soap is also used for the foundation of toilet soaps, for which purpose the soap is reduced to thin shavings, melted over a water-bath with rose and orange-flower water, and common salt—24 pounds of soap, with 4 pints each of rose and orange-flower water, and about half a pound of salt. When cold next day, it is cut in small bits and dried in the shade, again melted down with the same proportion of orange and rose water, strained, cooled, and dried again. The heavy animal odor is thus removed, when it is powdered and left in a clean place exposed to air for some days. After this, it is ready to receive the desired perfume, and may be colored with aniline tints, ultramarine, etc., and moulded in forms for use. *Shaving cream* is made by beating up lard with once and a half its weight of potash-ley of 17° B., and perfuming and coloring to taste. *Glycerine soap* is prepared by mixing pure glycerine with a toilet soap, or with the transparent soap produced from its solution in alcohol. It mollifies the skin in cold weather.

*Properties of Soap.*—Besides the common properties of soap as a detergent, already familiar, we note that every kind of soap in use contains a variable quantity of water, partly in chemical combination; and its power of absorbing water is also very various, being from 7½ per cent. in hard soda soaps to 162 per cent. in soft potash soaps of oleic acid when previously dried by artificial heat. Soap is perfectly soluble in alcohol, as also in hot water, both solutions becoming of the consistency of a jelly on cooling. In this state, mixed with camphor and oil of rosemary, the alcoholic tincture of soap is familiar as opodeldoc, or *linimentum saponis compositum* of the Pharmacopœia. Tincture of white soap is readily decomposed by salts of calcium and magnesia, and is familiar to the chemist, when made of normal strength, as the most convenient test for the hardness of natural waters ("Clark's test"). Potash soap is more soluble in water than soda soap. The sodium stearate is hardly affected when placed in 10 parts of water, while potassium stearate thus treated forms a stiff jelly. Sodium oleate dissolves in 10 parts of water—postassium oleate in 4 parts, and it forms a jelly even with 2 parts. Cold water partially decomposes the alkaline oleates, palmitates, and stearates (common soap), the neutral salts being resolved into alkali, which dissolves, and an acid salt, which precipitates. This explains why in using soap, even with pure water, its transparency is always disturbed, while the alkaline property, and consequent detergent power, of soapsuds is due to the liberation of a portion of caustic potash or soda, which attacks and removes the grease of foul linen, etc. The insolubility of soap in common salt has been fully explained, and the consequent important use of this property in the soap-boiler's art.

The value of soap depends mainly on the amount of dry soap (the real soap or alkaline salt of the fatty acids) in any given specimen. The loss in weight of a given amount of soap cut in thin shavings, when completely desiccated in a drying oven, at 212° F., is hygroscopic water, which should not for best hard white soap exceed 20 per cent., for mottled soap 25 per cent., and for yellow soap 30 per cent. The fat acids vary from 60 to 70 per cent., and the alkalies from 7 to 9 per cent., according to quality. As before mentioned, soaps made from cocoanut oil contain normally much more water, and in the yellow soaps from 10 to 20 per cent. of the fatty acids are replaced by rosin.

The analysis of soap is not altogether an easy problem, and many methods have been proposed, of which we mention the following: *Bolley's Method.*—One gramme of the soap, cut in thin shavings, is dissolved in a small beaker by ether and acetic acid. The solution quickly divides into two layers, the upper of which is an ethereal solution of the fatty acids, with or without rosin, as the case may be, and the lower is a watery solution of sodium or potassium acetates and of the salts contained in the soap. If there are insoluble matters left behind, these are separated by filtration after removing the ethereal solution by a pipette, and weighed. The fatty acids and resin are left by evaporation on a tared watch-glass and weighed. The saline solution is evaporated to dryness in a platina vessel, ignited, and the alkalies determined as usual. *Gräger's Method.*—One hundred grammes of the soap in thin shavings is dissolved in 30-per-cent. alcohol, and the solution is made up to the volume of a litre with alcohol of the same strength. The insoluble matter left behind contains all the foreign bodies, with some sodium or potassium carbonate; 10 cubic centimètres of this solution, made clear by standing, are diluted with water and precipitated by calcium chloride. This lime-soap of the fatty acids is washed, dried at 212° F., and weighed. Gräger finds 100 parts of this precipitate to correspond to 100.5 parts of anhydrous sodic stearate; if palmitic and oleic acids are also present, the result seems not to be sensibly varied. The methods of decomposition by sulphuric acid, with the use of standard solutions and oil of turpentine, the determination of density by aid of white wax, etc., are less simple, and probably not more exact, than the methods already cited. (For more full details respecting the manufacture of soap, consult Richardson and Watts, *Chemical Technology;* Muspratt's *Chemistry;* Watts, *Dictionary of Chemistry;* and Ad. Wurtz, *Dictionnaire de Chem.*) B. Silliman.

**Soap'-Berry,** the fruit of *Sapindus saponaria* and *inæqualis*, West Indian trees of the order Sapindaceæ. The pulp is a powerful detergent, much stronger than ordinary soap, and the hard shining seed has been exported and used for making buttons, which are very durable. In the Southern U. S. there grows another soap-berry tree, *Sapindus marginatus*, which is sometimes forty feet high. There are various tropical species of which the pulp is edible, but the seed is often poisonous. The name *Sapindus* was invented by Linnæus from *sapo Indicus*, "Indian soap."

**Soap Creek,** tp., Davis co., Ia. P. 817.

**Soapstone.** See Steatite.

**Soap Test.** See Soap.

**Soap'wort,** a name sometimes applied as a general name for the plants of the order SAPINDACEÆ (which see), on account of the soapy quality of the fruits of many species. It is also the name for plants of the genus *Saponaria* (order Caryophyllaceæ) and other plants of the same order, which are sometimes utilized for their detergent powers. There are in many parts of the world vegetables which are excellent substitutes for soap. In some instances this cleansing power depends upon the principle *saponine*, found in plants of widely diverse natural orders.

**Sobieski.** See JOHN III., SOBIESKI.

**Socastee,** tp., Horry co., S. C. P. 725.

**Soc'cage,** or **Socage,** a term of the English law, denoting a species of feudal tenure by which lands are held from a superior lord, and also the services rendered therefor by the tenant to the lord, by means of which this tenure is supported. The nature of feudalism, its system of tenures, and the military character of the services which prevailed during its more flourishing stages are described in the article on the FEUDAL SYSTEM. The distinguishing feature of the tenure by soccage consists in its services, which are not military, but are nevertheless such as may be performed without personal derogation by a freeman, and are fixed and certain both in respect to time and amount, being an annual and definite payment of money, grain, cattle, or other articles of value, products of the soil, in the nature of rent. This tenure existed in the times succeeding the Norman Conquest, when military feuds were almost universal, and was probably a remnant of the Saxon institutions. At that early day the amount of land thus held was small, the holders themselves were insignificant, and their duties were quite servile. In the subsequent generations, as the military spirit died out, and the burden of the military services became unendurable, the advantages of the soccage tenure were gradually, and at last universally, acknowledged. A change went on from one species to the other, until the uncertain military services by which land had formerly been held were almost wholly replaced by the fixed and certain payments of money or of products which characterized the simpler form of tenure. At length, after this great social revolution had been accomplished, Parliament legalized the proceeding; by a statute of 12 Chas. II. all military tenures, with certain formal exceptions, were abolished, the tenure by soccage was substituted in their stead, and nearly all the land in England is now held by its means. While the feudal system was at its most flourishing period this tenure was subject to many of the incidents which belonged to the purely military fiefs—fealty, aids, reliefs, fines for alienation, and escheats—wardship and marriage alone being excepted; but these burdens have long been removed by legislation. The origin of this term is in dispute. One etymology refers it to the Low Latin *soccus* or *socca*, and French *soke*, a "plough," because the original services were of a servile and rustic character. Blackstone and some others derive it from the Saxon *soc*, "free," "a privilege," basing their opinion upon the immunities enjoyed by the holders of this description. The latter theory mingles up two very distinct epochs, and confounds the primitive socmen with the later tenants in soccage. The oldest records speak of *sokemanni* as inferior to the *milites*, and class them with villains and roturiers. They seem to have been in nearly the same social condition as the Roman *coloni*, and perhaps the origin of the feudal socmen may be found among the remnants of the Roman laborers in Britain. At all events, it is not probable that the subject Saxons enjoyed any such special favor from their Norman conquerors that the proud word "free" or "soc" was used to designate their condition.

JOHN NORTON POMEROY.

**Social Circle,** p.-v., Walton co., Ga., on Georgia R. R., has a growing trade. P. 405.

**So'cialism** holds an intermediate position between pure communism and simple co-operation. Unlike communism, it does not advocate the absolute abolition of property, but aims simply at a more just and equitable distribution of it. Every man according to his capacity, and every capacity according to its work, is the great maxim laid down by Saint-Simon; and to carry out in reality this maxim is the great goal of all socialistic movements. On the other hand, it does not confine itself, like co-operation, to a mere regulation of the relation between capital and labor, restricting or even excluding competition, transferring the profit from capital to labor, etc., but attempts a complete reconstruction of society. With the ideas of co-operation for its basis of operation, it approaches communism partly by extending the compass of these ideas, but chiefly by employing them as means to a moral end. Communism is a religious tenet, co-operation an economical scheme, socialism a moral reform. It is the vices of mankind, and the miseries resulting from these vices, to which socialism wishes to put an end, and it seeks its means not in a new religious issue, but in a new social organization; hence its name.

Socialistic tendencies—that is, the employment of political and economical measures for moral purposes—were not entirely unknown in the ancient states; the Gracchian movement in the history of Rome is a striking instance. During the Middle Ages they seem to have been completely forgotten, and their reappearance in the period of the Reformation was short and full of turbulence and confusion. But with the French Revolution socialistic ideas became a principal element of all social science, and were made the subjects not only of passionate discussion, but also of practical experiments. The first to revive these ideas or to bring them into general notice was François Noël Babeuf (1764–97), with his paper, *Le Tribun du Peuple*, founded in 1794. The idea from which Babeuf started was that of equality. The Revolution had established the equality of all French citizens before the law: "Nous la voulons au milieu de nous, sous le toit de nos maisons," said the Babouvists. "There shall be no other differences than those of age and sex. All men have nearly the same faculties and the same needs; they ought, consequently, to have the same education and the same food." Before this principle the idea of personal property disappeared, and it became the duty of the government, its highest function, to regulate the application of labor and the distribution of its fruits. After the death of Babeuf, his system, Babouvism, was for some time entirely forgotten, until in 1834, Buonarotti again attempted its propagation, especially through the papers *Moniteur Républican* and *Homme Libre*. A much greater influence was exercised by Saint-Simon (1760–1825). He developed no system, but the rich and fertile hints which his various writings contain were brought into a rapid growth a few years after his death by a number of gifted disciples. The weekly *Le Producteur* was established by Cerclet and Olinde Rodrigues, and in 1829, Bayard gave a series of public lectures on the system of Saint-Simon—that is, its political and economical side—which attracted great attention. Communism is not taught here, but property is made merely personal—that is, it cannot be inherited. Every man has to make a fresh start, and his success will depend on his capacity and labor. After his death his property falls to the state, which is the great property-holder, and assumes the corresponding duties with respect to the education of its members, etc. In the next year followed a series of lectures by Enfantin on the moral or speculative side of the system, in which Saint-Simon was represented as the restorer of harmony to human nature, as the redeemer from the terrible dualism of nature and spirit which Christianity has sanctioned, if not introduced. The impression of these lectures and of the writings of the school was quite general, and very favorable. A Saint-Simonian family was organized in the Rue Monsigny, and for some time it prospered much. But dissensions broke out between Bayard and Enfantin on some very important questions. Bayard retired, and Enfantin led the enterprise into fantastic extravagances. Finally, the interference of the police and pecuniary difficulties brought the experiment to an end. In strong opposition to the Saint-Simonians, Fourier (1772–1837) developed his system of socialism, based on a more intimate knowledge of human nature. The principal feature of his scheme is the *phalanstery*, a community, or rather a household, of about 1800 persons, in which labor and enjoyment are divided according to the natural inclinations of the individuals. It was Fourier's conviction that if only one phalanstery could be established, other communities, other nations—yea, the whole human race—would soon fall into the same order; but the experiments which have been made at Condé-sur-Vêgres, near Versailles, and in Brazil, have failed.

Several very interesting socialistic experiments have been made in the U. S., and will be found described under their proper heads; but as yet socialism has had its greatest importance as a ferment only. (For its connection with COMMUNISM and CO-OPERATION see those articles; and for further details on the subject see Stein, *Der Socialismus und Communismus des heutigen Frankreichs* (1844) and *Geschichte der socialen Bewegungen in Frankreich* (1849–51); Le Play, *L'Organisation du Travail* (1871) and *La Reforme sociale en France* (1872); Noyes, *History of American Socialism* (1870); Nordhoff, *The Communistic Societies of the United States* (1875); Holyoake, *History of Co-operation* (1875).)

CLEMENS PETERSEN.

**Social Science,** or **Sociology.** These are terms of modern origin, used, as yet, quite indefinitely to comprehend the systematic investigation, in various lines of research, of principles and laws affecting the welfare of mankind in society. In this department they correspond to the vague term "natural science" as applied to the grouping of phenomena and laws pertaining to the mate-

rial creation generally. The distinctive characteristic of social science is that it studies man's social nature and deals with existing social forces, aiming chiefly to find relief for existing evils. In a broad sense it includes political economy. But that branch has been developed by itself more fully than anything else embraced under the common term, and may be regarded almost as a distinct science. Apart from this, social science has mainly to do (*a*) with the laws of *health* and the causes of disease, endemic and epidemic, seeking to devise measures for improving the sanitary condition of communities and to provide curative means through hospitals, dispensaries, etc.; (*b*) with the tendencies to gross and corrupting *vice* which spring from undue indulgence of the sensual appetites, seeking restrictions and remedies especially for prevalent drunkenness and prostitution; (*c*) with *crimes* against human law and government, studying the conditions which favor their multiplication, the counteracting agencies, and particularly the means and institutions for the punishment and reform of criminals; (*d*) with the causes of wretched and degrading *poverty*, and the best modes of administering private and public charity for its relief; (*e*) with the principles on which *society is organized*—to discover, if possible, what radical causes are working to degrade, and what radical changes may serve to elevate and refine, the entire social life and relations of men. The range of the science is immense. The problems have been more or less studied through all history. Aristotle's *Politics* presents the subject in essentially the same phases with those which appear in the discussions of our day. The chief means of advancing this science now are national and international associations, which are enlisting some of the best minds of the age in the practical questions involved, and specific philosophical treatises, like those of Herbert Spencer, which open lines of profound thought on fundamental principles. A. L. Chapin.

**Social Wars** [*i. e.* wars with "allies," *socii*]. (1) The war (B. C. 91–88) between Rome and her Italian allies. After the assassination of M. Livius Drusus (91 B. C.), who desired to grant citizenship to the Italians, the allies, including the Marsi, the Peligni, the Lucanians, the Samnites, and many others, rose in arms and proclaimed a new republic. A bloody war followed, and notwithstanding the great victories of Sulla, Marius, L. Cæsar, and others, the Romans were compelled to make many concessions, and in the end the Italians received substantially all the privileges they called for. Over 300,000 men were slain in this war. (2) In Athens the first social war (357–355 B. C.) was between that city and her allies, Chios, Cos, Byzantium, and Rhodes. The allies sought and gained their independence. (3) The second Athenian social war was between Athens and the Achæan and Ætolian leagues (220–217 B. C.).

**Societies, Literary and Scientific.** The number of associations formed for the promotion of literary or scientific research is one of the distinctive features of the nineteenth century. Though no etymological or other exact line of division can be established between "societies" and "Academies" (which see), it may nevertheless be noted that the associations styling themselves "academies" are usually of earlier origin than the "societies," are frequently under the direct patronage of government, and may be regarded rather as *conservators* than as *promoters* of literature and science; while the "societies" sprung from the modern scientific movement are usually but slightly trammelled by official bonds, and consist of bodies of working investigators, more anxious to extend the domain of knowledge than to celebrate the glories of former discoveries. The title of "royal" conferred upon several English scientific societies must not be construed to imply too much, as the connection between royalty and royal societies is often very remote.

The most ancient among the learned societies of Great Britain are the Royal Society of London (1662), the Antiquarian Society (1707), the Society of Arts (1753), the Royal Academy (1768), the Medical (1773), the Linnæan (1788), and the Royal Institution (1800), besides the royal societies of Dublin (1731) and Edinburgh (1783). In the present century more than 200 similar associations, having more or less a national character, have been incorporated in Great Britain. The more important of these, naming them in the order of time, have been the Geological Society of London (1807, incorporated 1826), the Royal Astronomical (1820), the Royal Asiatic (1823), the Royal Society of Literature (1823), the Zoological Society of London (1826), the Royal Geographical (1830), the Statistical (1834), the Electrical Society of London (1837), the Society for the Diffusion of Useful Knowledge (1838), the Microscopical (1839), the Chemical (1841), the Philological (1842), the Phonetic (1843), the Ethnological (1843), the Archæological Association (1843), the Social Science Association (1857), the Anthropological Society (1863), and the Society of Biblical Archæology (1871). Several of these—viz. the Royal Society, the Astronomical, Geological, Linnæan, and Chemical societies—have formed a species of alliance, having been jointly concerned in the erection of the new Burlington House as a "palace of learning" for the accommodation of their libraries, collections, and reading-rooms, as well as their halls of sessions. The British Association for the Advancement of Science has been noticed under other headings. Scientific societies are much less numerous on the continent of Europe than in Great Britain or the U. S., their freedom of activity being much restrained by the pretensions of the elder "academies." There are, however, flourishing modern geographical societies in Austria, Russia, France, and Germany. In Mexico and Brazil there are several flourishing societies directly connected with the government, the most important being in each case that devoted to geography and statistics. Among the leading societies of comparatively modern growth in the U. S. are the American Association for the Advancement of Science, elsewhere noticed, the Oriental, Geographical, Philological, and the Social Science Association. Pure science finds, however, so few devotees in the U. S. that the larger part of the branches of research, which in England have separate associations, are in the U. S. grouped into a very few and by no means active bodies. Porter C. Bliss.

**Society.** See Academy and Societies, Literary and Scientific.

**Society for Promoting Christian Knowledge,** founded in 1698, is the oldest and one of the greatest religious associations connected with the Church of England. Its objects are—(1) To promote and encourage the erection of charity schools in all parts of England and Wales; (2) to disperse, both at home and abroad, Bibles and religious tracts, and in general to advance the honor of God and the good of mankind by promoting Christian knowledge, both at home and in other parts of the world, by the best methods that should offer. The society is thus at once an educational association, a missionary, Bible, and religious-tract society, but it limits its activity chiefly, though not exclusively, to the British dominions. Its annual revenue is about £100,000.

**Soci'ety Hill,** p.-v., Macon co., Ala. P. 1185.

**Society Islands,** a group of islands in the South Pacific Ocean, between lat. 16° and 18° S., and between lon. 148° and 155° W., consist of one large island, Tahiti or Otaheite, and a number of small isles, comprising altogether an area of 450 sq. m., with 13,847 inhabitants. The islands are mountainous. In the centre some of them rise to the height of 6000 or 8000 feet, but they all have a belt of low land extending between the foot of the mountains and the sea, and they are generally surrounded by coral reefs. The soil is very fertile and the climate delicious. All tropical fruits grow luxuriantly, and European fruits which have been introduced succeed well. The inhabitants are Malays; most of them are Christians. They form an independent state under the French protectorate.

**Socin'ians** and **Socinianism** are the historical designations of the advocates and doctrines of the most thoroughly organized system of anti-Trinitarianism that has ever existed. We propose to present in this article a sketch (*a*) of the history of the sect, and (*b*) of their doctrines.

I. History.—The Trinitarian doctrine, as defined in the Nicene and Athanasian creeds (see article God), has been substantially held as a fundamental element of Christianity by all the great divisions of the ancient churches, Eastern and Western, and by all the churches springing out of the Reformation. It was denied by the early obscure Jewish-Christian sect of the Ebionites and by some sects of Gnostic origin. The negative tendency in a higher form was afterward embodied in the Arian party, which, after threatening to obtain control of the general Church as established by the imperial government during the middle of the fourth century, was finally expelled from the whole empire by Gratian 378, and confined to its Gothic and Burgundian adherents. Afterward, by means of the triumphs of Justinian on the eastward and of the Franks on the westward of the Alps, these nations were converted to Catholic Trinitarian Christianity about the end of the fifth century. At the era of the Reformation the first anti-Trinitarians were certain individuals who appeared at different points, chiefly among the German Anabaptists. Among these were Martin Cellarius (b. in Stuttgart 1499, educated at Wittemberg, at first a disciple and coadjutor of Luther, d. at Bâle 1564), John Denk (d. at Bâle 1528), Lewis Hetzer (at first a fellow-laborer of Zwingli, executed for polygamy at Constance 1529), and John Campanus (studied at Wittemberg, and d. after long imprisonment at Cleves 1574). One of them, named Spiritus, supposed by Dr. Rees to have been Adam Pastor, a Frisian Anabaptist,

first carried Unitarian doctrine to Poland in 1546, which afterward became the seat of the denomination. Michael Servetus (b. in Spain 1509, and educated at the University of Toulouse) was a man of diversified learning, of considerable talent, and of restless spirit. He resided at different times at Bâle, Strasbourg, Lyons, and Vienne. In 1531, at Strasbourg, he published his first work, *De Trinitatis Erroribus*. In 1532, at Haguenau, he published his *Dialogorum de Trinitate, Libri duo*, and at Vienna, in 1553, his *Christianismi Restitutio*. He was then imprisoned by the Roman Catholics for heresy. Escaping, he went to Geneva, where he was burnt in October of the same year as a blasphemer and disturber of the peace.

In Italy, where during the preceding century religious faith had been generally superseded among the educated by a semi-pagan humanism, many prominent persons, affected by the religious excitement of the Reformation, adopted rationalistic views. In the second quarter of the sixteenth century, at Vincenza, a small town in the district of Venice, a society existed consisting of persons denying the divinity of Christ and related doctrine. It was dispersed in 1546, previous to which, it is said, Bernard Ochinus and Lælius Socinus joined it. The latter, born in Siena in 1525, was educated as a lawyer, but devoted his life and great talents to theological speculations. He has been correctly designated "the spiritual father of Socinianism," while his nephew, Faustus Socinus, was "the founder of the sect." He remained ostensibly a member of the Reformed Church at Zurich, although by personal influence, wide correspondence, and extensive journeys disseminating his opinions. He visited Poland in 1551, and again in 1558, and died in Zurich in 1562. His nephew, Faustus Socinus (b. 1539, and d. 1604), was indoctrinated by his uncle, settled first in Bâle, was called into Transylvania to assist Blandrata in his controversy with Francis David, and settled permanently in Poland 1579. After the removal of Spiritus to Poland in 1546, Francis Lismanin, a Corsican monk and confessor of the queen, Bona Sforza, had been converted to Unitarianism in 1551. He was soon reinforced by Peter Conezius and George Blandrata, a native of Piedmont, and through the influence of Lismanin appointed physician to the queen. At this time all the Protestant synods held in Poland embraced promiscuously the ministers of all the Reformed societies, whether Lutheran, Calvinistic, or anti-Trinitarian. In 1566 the latter were expelled from communion, and forced to form an independent ecclesiastical organization. The Unitarian Church thus formed comprised persons of very dissimilar opinions. "They all concurred in maintaining the supremacy of the Father, but with respect to Jesus Christ, some thought him to be a God of inferior nature, derived from the Supreme Deity; others held the doctrine of Arius, conceiving him to have been the first created Spirit, who became incarnate with a view to effecting the salvation of mankind; while a third party believed him to be a human being. These last were divided into two classes—the one believing the miraculous conception of Jesus; the other considering him to have been the son of Joseph as well as Mary." Some also held that although a man only, he was entitled to divine honors since his exaltation at the right hand of God and assumption of the government of the Church, while others denied this.

From the advent of Faustus Socinus these various elements were, through his superior genius, wrought into a homogeneous ecclesiastical organization, and brought into substantial agreement with the theological views of his uncle; and ultimately the denomination and system of theology took their historical designation of "Socinian" from these great leaders, but during their earlier history they were called Pinczovians, from Pinczow, the place of their first settlement, and afterward Racovians, from Racow, a town built for them by a Polish nobleman, and their metropolis of learning and influence. They flourished exceedingly for the greater part of a century, converting to their views many of the Polish nobility; they established colleges which attained great reputation, attracting multitudes of Roman Catholic and Protestant youth, and they produced a number of theological speculators and polemics of great learning and ability, whose works attained a vast circulation. In 1563, Blandrata went into Transylvania to attend the prince, John Sigismund II., as a physician, where he succeeded in bringing over to his own opinions Francis David, at that time superintendent of the Reformed churches. These together secured a large following, but the prosperity of the sect was greatly impaired by the bitter controversy which subsequently arose between Blandrata and David, the former affirming, and the latter denying, that divine honors are to be paid to Christ. David was condemned by the diet held at Weissenburg in 1579, and died in prison in November following. After a long struggle with their opponents the Socinians were suppressed in Poland in 1660. Those who refused to renounce their opinions went into Transylvania, Hungary, and Prussia, and the majority into Holland, where they were merged with the Mennonites and low Arminians. A few churches of their order yet remain in Transylvania.

A first catechism was written by George Schoman (d. 1591). Faustus Socinus (d. 1604) left another incomplete. Valentine Schmalz and Jerome Moscorovius produced the *Racovian Catechism*, the standard of the Socinian churches. It appeared in Polish in 1605, and was published in German 1608, and in Latin 1609. An English edition, produced in Amsterdam 1652, was ordered to be burnt the same year by the English Parliament. It was again translated and published in English in 1818, with a history of the Polish Socinians by Dr. Thomas Rees. After their expulsion from Poland, Andrew Wissowatius and other learned men, finding refuge in Holland, collected their more important writings and published them in 8 vols. folio, comprising the works of Socinus, Crelius, Schlichtingius, and Wolzogenius; to which a 9th vol. has been added, containing the writings of Przipcovius and Andrew Wissowatius, and a 10th vol., containing the works of Brenius. This collection is known by the title of *Bibliotheca Fratrum Polonorum*.

II. Their Doctrine. 1. *The Scriptures.*—They admit that a supernatural revelation is essential as a means to effect the salvation of men. They regard Christianity as a new law, revealed and executed by Jesus Christ. This revelation is contained in the Scriptures of the Old and New Testaments, and especially in the latter. These are authentic, sufficient, and perspicuous. Yet, as they can contain no elements inconsistent with reason, they are to be interpreted in a sense agreeable to reason; which rule of interpretation in their hands led practically to the conclusion that although containing a divine revelation, and virtually infallible, they contain minor errors.

2. *Theology.*—(1) The divine unity is inconsistent with personal distinctions. (2) Free self-determination is more fundamental in the divine nature than either justice or love. (3) By the act of creating the world, God has voluntarily limited his omnipresence as to his essence, and by creating free agents he has voluntarily limited his power and his knowledge, because free-will is self-determined, and future contingent events are not the object of knowledge. (4) "There is no such justice in God as requires absolutely and inexorably that sin be punished. There is, indeed, a perpetual and constant justice in God, but this is nothing but his moral equity and rectitude, by virtue of which there is no depravity or iniquity in any of his works." (Socinus, *Prælect. Theol.*, c. 16.) Hence he can pardon any repentant and reforming sinner without a satisfaction to justice. (5) The Holy Ghost is the impersonal power and efficacy of God.

3. *Anthropology.*—The guilt of Adam's sin is not imputed. Man was created naturally mortal, and since Adam has gradually acquired an hereditary tendency to sin, which of itself does not involve guilt. Responsibility is limited by ability. Man, animated by the promises of God, is able to turn unto God; and when he does so turn and believe, God seals his promises more and more on his heart by the Holy Spirit. (*Rac. Cat.*, sec. 5, ch. 10.)

4. *Christology and Soteriology.*—(1) Christ, as to his essential nature, is a mere man, but one miraculously generated by the power of the Holy Ghost in the womb of the Virgin. Hence he was from birth without sin. At his baptism he was supernaturally sealed with the Holy Ghost, and qualified and endowed with authority for his office as Prophet, Priest, and King. He was also taken up to heaven and admitted to the vision of God, and instructed in divine things. While on earth he revealed the will of God to his disciples with divine authority. After his death, he was raised to the throne of God, endowed with the divine attributes of omniscience, omnipotence, and supreme dominion. He is the rightful object of divine worship and of invocation. He saves his people as Prophet and King, the office of Priest being merged in the other two. He will judge the world at the last day, and raise believers to share in his own glory. (2) As God's justice demands no satisfaction, Christ's death saves us as an exhibition of divine love; it subdues obduracy, confirms hope by sealing God's promises; it was the necessary means to his resurrection, by which he brings life and immortality to light by an ocular demonstration.

5. *The Church and Sacraments.*—The Church they defined as the company of those who believe saving doctrine. As to what this doctrine is, they allowed, within the limit of the recognition of the divine mission of Christ, the largest freedom of opinion. Socinus discarded the term "sacrament," and held that the Supper was the only sacred rite which Christ intended to be permanently observed. The authors of the Racovian Catechism in its final form

teach that baptism and the Lord's Supper are the two Christian rites. These they regard as only memorials and symbols and badges of church membership. They pronounce infant baptism an error, but advise its toleration. (See, as above mentioned, the *Bibliotheca Fratrum Polonorum;* Dr. Toulmin's *Life of Socinus;* Dr. Thomas Rees's *Racovian Catechism, with Hist. of Unitarianism in Poland* (London, 1818); *De Tribus Elohim* of Hieron. Zanchius (1516–91); *Socinianismi Confutatio* (Amst., 1664) of John Hornbeck; *Vindiciæ Evangelicæ* of Dr. John Owen (Oxford, 1655; vol. xii. of Goold's Edin. ed. of Owen's *Works*); *Hist. Person of Christ*, by Dr. J. A. Dorner (div. 2, vol. ii.); Princip. Cunningham's *Hist. Theol.*, vol. ii.)

A. A. Hodge.

**Socinus** (Faustus and Lælius). See Socinians and Unitarianism.

**Sociology.** See Social Science, by A. L. Chapin.

**Socopatoy,** tp., Coosa co., Ala. P. 1267.

**Socor'ro,** town of New Granada, South America, is in a fertile and densely-peopled district, and is well built. P. 15,000.

**Socorro,** county of S. W. New Mexico, adjoining Arizona, intersected by the Rio Grande, drained by the head-waters of Gila River, and traversed by a spur of the Sierra Madre, is chiefly barren, but has some fertile valleys. Some minerals are found. Sheep-raising is almost the only industry, the other staples being wheat, Indian corn, and wine in limited quantities. Cap. Socorro. Area, 11,500 sq. m. P. 6603.

**Socorro,** p.-v., cap. of Socorro co., New Mex., on the Rio Grande. P. 921.

**Socorro,** v., El Paso co., Tex., on the Rio Grande. P. 627.

**Soc'otra,** an island in the Indian Ocean, off the eastern coast of Africa, in lat. 12° 39′ N., lon. 54° 1′ E., belongs to the imamat of Muscat. Area, about 1000 sq. m. P. about 5000, Arabs and negroes. The interior of the island is high, mountainous, and mostly unproductive, but the coast-land, generally from 2 to 4 miles broad, is low, level, and fertile. The island produces good tobacco and dates, and the best aloes known; and has superior sheep and goats.

**Soc'rates,** son of Sophroniscus and Phænarete, b. at Athens in 470 B. C. (or 469, in May or June), drank the cup of poison 399 B. C. (in April or May?). His father was a sculptor, and Socrates in his early years worked at the same occupation. A draped group of Graces which stood at the entrance of the Acropolis at the time of Pausanias is said to have been his work. He alludes to his mother (*Theætetus*) as a midwife, and likens to her art his own skill in drawing out ideas by conversation. He had a brother by his mother's side named Patrocles. In his youth he learned geometry and astronomy and practised gymnastics. He is reported by Plato (*Phædo*) as having studied the work of Anaxagoras on *Nature,* probably under the instruction of Archelaus, the disciple of Anaxagoras; and according to Xenophon (*Mem. I.* and *IV.*), he had a critical knowledge of the writings of the early wise men, as well as of the Ionic school of philosophy. His master, Archelaus, taught not only physical but also moral speculations concerning justice, laws, etc. He probably met Parmenides when about twenty years of age, and mastered the Eleatic view of negative dialectic (which proved its theories by showing up the contradictions of its opponents), and was thoroughly instructed in the docrines of the Sophists—possibly may have received direct instruction from Prodicus. It is said that having early lost the patrimony inherited from his father, the wealthy Crito assisted him in his education, and employed Evenus to instruct him in poetry, Theodorus in geometry, and Damo in music, and that the celebrated Aspasia had a share in his culture. He married, and had three sons. Xantippe, his wife, has come down in history as the typical scold. Socrates is represented as using the violence of her temper as a means of cultivating his patience. He took part in three military campaigns with his fellow-citizens—that of Potidæa (432 B. C.), wherein he saved the life of the young Alcibiades, who was wounded; that of Delium (424 B. C.), in which he saved the life of Xenophon, and himself received assistance against his Bœotian pursuers from Alcibiades in the disastrous retreat which followed, and wherein his own cool bravery was conspicuously manifested; and that of Amphipolis (422 B. C.). He proved himself to have an extraordinary capacity to endure cold, heat, and fatigue. He walked barefoot upon the ice and snow of Thrace in his usual clothing, while others were clad in furs. By this time he had become noted for his peculiar mode of instruction by means of conversations which he held with people of all classes at the public resorts. Aristophanes in the *Clouds* held him up to ridicule as the arch-Sophist, as a dreamer morally worthless and physically incapable, (as Grote remarks) nearly at the time when Socrates was exposing his life for his country on the battle-fields of Delium and Amphipolis. The personal appearance of Socrates was such as to shock the Athenian sense of the beautiful: with a turned-up nose, projecting eyes, bald head, thick lips, round belly, he resembled a satyr or Silenus; he wore a miserable dress, went barefoot, and would frequently stand still in sudden fits of abstraction, rolling his eyes, staring on vacancy. Aristophanes found in him the choicest subject for comedy. Modern historical criticism has justified in large measure the poet, and pointed out his patriotic desire to save his native city from the decline in morals and political ideas which he saw impending from the prevalent tendency to reflection and sentimentalism—the cultivation of independent subjectivity or individualism (the right of private opinion) as contradistinguished from implicit, unreflecting obedience to customs and laws. This he traced, correctly enough, partly to the teachings of the Sophists or private teachers of culture, among whom Socrates was acknowledged to belong by his contemporaries, notwithstanding his radical differences from them in doctrine. In common with Socrates, the Sophists cultivated reflection—to make up the mind on internal personal grounds. Dialectics was the art of the advocate and orator, so much needed before the courts and popular assemblies of Athens—the art to make the worse appear the better reason; an art which could be applied to good purposes or to bad ones, and not in itself a corrupt art. It was the same art that is cultivated in the debating societies and "moot courts" of young lawyers of our own time. Plato and Aristotle were the first to bring the name "Sophist" into odium as a perverted species of philosophizing. Aristophanes condemned equally *all* species of philosophic reflection. Isocrates calls Plato a Sophist, and Aristotle calls Aristippus, the disciple of Socrates, a Sophist. Socrates laid great stress on the fact that the Sophists taught for pay—a distinction of little weight except for purposes of exciting the democracy against them. The Sophists were professional teachers of the higher order of culture current at the time, and only the wealthy and aristocratic could afford to employ them; hence their art was an aristocratic art. Alcibiades and Critias, the former an aristocrat, the latter a tyrant, did not do honor to the teaching of Socrates. They evidently were attracted to him for his unrivalled skill in dialectics, his power to see the end of a long cross-examination, his ironical affectation of ignorance, whereby he humiliated his opponents when they were convicted of their inconsistency and contradiction, by their own admissions. They came to learn the Sophistic culture from him, and not his moral lessons. Socrates was selected as representative of his profession by Aristophanes because of the notoriety of his personal appearance and his missionary habit of practising his art among all classes without price. In *The Clouds* it is portrayed as teaching a vain and profitless semblance of wisdom, corrupting in its influence upon youth, and undermining all true discipline and morality. Thales, Xenophanes, and Pythagoras in the sixth century B. C. had attempted to disenthrall the reflective intellect of their countrymen from the phase of religious personification, which explained everything directly by personal causes—the deities of polytheism. From these there descended three more or less distinct lines of philosophy: (*a*) From Thales the physical philosophers, who attempted to find the elements out of which the totality is composed, as well as the moving principle which arranges it. They explain one appearance by another form of it, and show all from one. These are the Ionics, the Atomists, Empedocles and Anaxagoras. Oceanus, Tethys, Poseidon, and the Styx become simply "water," or Zeus, Hera, Vulcan, Apollo, etc., become air or fire. (*b*) From Xenophanes come the Eleatics, who have recourse to an abstract principle entirely above or behind perception—the One, Pure Being, the All. (*c*) From Pythagoras come the Mystics, who interpret the religious mysteries into other *technique* in part, and in part retain the original forms. From the Eleatics had come dialectics. Zeno taught how to establish the abstract principle of the One or Being by exhibiting the self-contradiction in all opposing doctrines. Dialectic, accordingly, had an aggressive, negative force (against some doctrine), and a positive import only (through the principle of excluded middle) as it established one doctrine by proving its contrary untenable. An acquaintance with dialectic came to be considered a necessary part of a good education. The doctrines of Gorgias the Nihilist present for us the best example of the Sophistic form of it, as derived from Eleatic sources. But the Sophists were equally influenced by Anaxagoras, whose first principle, Reason (νοῦς), justified the wholly subjective tendency of their doctrine. If Reason

or thought is the only substantial thing, then, of course, said Protagoras, "Truth is relative, depending upon the point of view of the individual, and man is the measure of all things—of things that are, that they are; and of things that are not, that they are not." But this principle is ambiguous, and after the first Sophists had sufficiently differentiated this phase of it, so that its consequences could be plainly perceived in the sapping of all fixed principles of ethics, religion, and science, rendering all conviction impossible and the justification of any baseness practicable by argument, then came the reaction through Socrates, who discovered a firm ground in the universal and necessary ideas of Reason which underlie all thought as its logical condition. These ideas are objective as well as subjective, and do not depend upon caprice in any wise, nor can they be disposed of by ratiocination, for all other principles go down in the dialectical process, but these alone remain firm. Hence, the Sophistical stand-point—as negative and partial, confounding what is subjective and relative with what is positive and eternal in the nature of things—is set aside for the more comprehensive insight of Socrates, who announces a constructive basis, once more, from which human institutions, morality, conventionality, law, and religion may be defended against the all-destroying skepticism of the former. Socrates considered physics a useless and unprofitable investigation, and believed that the study of man was the only worthy occupation. But having been a pupil of Anaxagoras or Archelaus, and having the external semblance of the Sophistical profession, Aristophanes made no scruple to place in his mouth the physical doctrines expressly repudiated by him: "Not Zeus, but the clouds rain; you never saw rain without clouds." But, Socrates, who moves the clouds? "Ethereal rotation." "Ah!" rejoins his interlocutor, "rotation? That had escaped me; so Zeus no longer exists, but Rotation reigns in his place!" Aristophanes would not make any nice distinctions in favor of Socrates, for to him all philosophizing was destructive of the old traditions and naïve obedience of ethical custom. Twenty-four years after the appearance of *The Clouds*, Meletus, a poet, seconded by Anytus, an influential demagogue, and Lycon, an orator, hung up an indictment against Socrates accusing him of being "guilty of crime—first, for not worshipping the gods whom the city worships, but introducing new divinities of his own; next, for corrupting the youth. The penalty is death." Lycon is said to have felt aggrieved at what Socrates had said of the orators (see his attack on orators in Plato's *Gorgias*); Meletus, for his treatment of the poets; Anytus, a rich leather-dealer, had been driven from Athens during the rule of the Thirty, and as Socrates was supposed to sympathize with the Tyrants, and especially with Critias, the most detested of them all (having taught him when a young man), his feeling toward the accused may be explained. Moreover, a son of Anytus had become interested in the conversations of Socrates, and the latter had interceded with the father to educate his son for something better than a leather-seller. To produce aspiration for a career above the family vocation was "corrupting the youth." Socrates had cross-examined with his dialectic skill and bitter irony most of the celebrated statesmen, orators, poets, Sophists, and artisans of Athens. None had forgotten their humiliation at his hands; a few had sought help and instruction from him afterward, but most of them avoided his presence and desired revenge. Very many of these were to be found among the 500 (557, according to Diogenes Laertius) judges who sat at his trial. It was remembered that Socrates had opposed the popular will; when president of the Prytanes, he had refused to put to vote the question whether the ten admirals who had neglected the burial of the dead after the battle of Arginusæ should be put to death, as demanded by the angry multitude. He would not sanction what he believed to be unjust and illegal: a violent storm had prevented the recovery of the bodies of the slain. But it was not remembered that he had opposed equally the injustice of the Thirty, having commented severely on their ordinance forbidding "to teach the art of words"—*i. e.* such as he and the Sophists practised—an ordinance for the suppression of the higher class of teachers. Critias and Charicles had peremptorily commanded him to abstain after this from all conversation with youth. Again, he alone of the five who had been ordered by the Thirty to bring back Leon to suffer at their hands, refused to take part in the matter; only their overthrow saved him from death for this. In his defence before his judges he was so bold and free-spoken that he produced a very unfavorable impression, and was accordingly adjudged to be guilty, by a small majority. According to custom, he was allowed to name the punishment he preferred to substitute for the penalty of Meletus; he gave it as his opinion that he deserved to be subsisted in the Prytaneum at public expense for the rest of his life as a benefactor of the state, but upon the solicitation of his friends agreed to ask a fine of thirty *minæ*. This haughtiness so incensed the judges that they voted by a majority of eighty votes for his death. The execution was delayed for thirty days, until the return of the sacred ship from Delos. Socrates refused to avail himself of the means of escape from prison offered him by Crito, thus attesting his law-abiding character. He drank the cup of hemlock with perfect composure after a conversation with his friends upon the immortality of the soul, being assured that he was merely setting out upon a happy journey, and that by his death he attested the steadfastness of his convictions to his disciples, and thereby accomplished far more than by living.

As to the best authority regarding the actual teachings of Socrates, there has been much dispute. He has left behind no writings of his own, and we know him chiefly through his two disciples, Xenophon and Plato. It is supposed that the *Memorabilia* of the former give us a more accurate picture of his method and ethical doctrines, while the *Dialogues* of the latter present us with highly idealized portraitures, and offer us the further-developed doctrines of Plato through the mouth of Socrates. Aristotle testifies that to Socrates belongs the honor of the invention of induction and accurate definition of terms. His dialectic rests on induction. More important even than this was his practical application of the Delphian precept, "Know thyself," as the condition of virtue. Aristotle (*Nich. Eth.*) says that his fundamental idea is the union of theoretical insight and practical virtue. That virtue is a knowing is a very radical statement, and altogether incomprehensible unless one considers its relation to the time in which it was uttered. Relieved of its exaggeration, perhaps it means only that self-consciousness is essential to responsible action. It expresses the transition from the morality of custom and habit, mere conventional use and wont, to morality as conscious right-conduct, resting on reflection and moral principles. In this, therefore, Socrates is the most significant personage in the ethical history of the race. All beyond him lies in the region of unsophisticated use and wont, or prescriptive ethics, like that of the Chinese and other Oriental civilizations; on the hither side the chief interest is the ever-widening influence of the individual consciousness of moral necessity, the long and gradual discipline of mankind into independent, responsible wills, endowed with "rights of conscience." In the ante-Socratic principle the individual takes the impulse of his volition from without—from auspices or auguries, nothing being undertaken without them. Individual conscience and personal decision date from the epoch of Socrates, and their growth from that time is the progress of the world-history. The new principle in its appearance with Socrates is as yet undeveloped, and involved with much that is foreign to it and contradictory of it. His dæmon (δαιμόνιον) or "genius" is a relic of the old, and is akin to those immediate stages of psychical life which we know under the names somnambulism, dreaming, premonition, (what is genuine in) "animal magnetism," and is a return of the conscious mind to its fœtal stage of existence, to instinct—the transplanting, as it were, of the augury from external appearance to internal impression. On the other hand, it was related to the consciousness of principles, and as such formed a factor of what we call conscience. There is no individual responsibility without conscious determination of the will, and even the perverse action of the conscious will is higher than mere unconscious action: a wicked man is a higher order of being and more precious in the sight of God than a good, obedient ox or horse. Socrates seems to have exaggerated this view so far as to make all virtue to be correct knowledge, and all vice to be ignorance, thus ignoring the will altogether. This, however, is not surprising when we consider the novelty and the greatness of his insight into knowledge as a factor of true moral action. Nor, if we consider the ultimate consequences of perfect insight, can we regard him as wrong in holding that ignorance is the occasion of all wickedness, although we insist that moral responsibility implies knowledge of the right, and assert that wickedness is perversity of will in the face of better knowledge.

The panegyrics pronounced upon the character of Socrates are not surpassed. That of Alcibiades in Plato's *Symposium* is perhaps the finest—that of Xenophon more sober and weighty: "Knowing him to be such a man as I have described—so pious toward the gods as never to undertake anything without first consulting them; so just toward men as never to do the slightest injury to any one, while he conferred the greatest benefits on all who came in contact with him; so temperate and chaste as never to prefer pleasure to what was right; so wise as never to err in judging of good and evil, nor needing the aid of others in order properly to discriminate between them; so able to discourse upon and accurately define the subjects we have mentioned; so

skilful in penetrating the hidden characters of men, and seizing the fittest time to reprove the erring and turn them to the paths of virtue,—I cannot but regard him as the most excellent and happy of mankind." The sources of information as to his life are Xenophon's *Memorabilia;* Plato's works, especially the *Apology, Phædo,* and *Symposium;* Aristotle's *Metaphysics* and *Ethics;* Diogenes Laertius (book ii.); and, among others of modern writers, the essays of Schleiermacher, Boeckh, Zeller, Van Heusde, Hegel, Forschhammer, Brandis, Rötscher, and Grote are very satisfactory. WILLIAM T. HARRIS.

**Socratic Philosophy.** See SOCRATES.

**So'da.** (The term is apparently Spanish in origin, *soda* or *sosa* meaning "barilla" in that tongue; Fr. *soude;* Ger. *Soda,* chemically *Natron;* Dutch, *souda.*) This word is quite differently applied in strict chemical language and in common parlance. In the former it signifies at the present day anhydrous oxide of the metal SODIUM (which see), $Na_2O$. What is commercially called soda, however, is the compound formed by the action of water upon the former, generally designated, even by chemists, "hydrate of soda" or "sodic hydrate," though there is the strongest reason for believing that this compound contains no water, as such. (See below.) The *carbonates of soda* also are often called "soda" commercially.

*Anhydrous soda* (in precise nomenclature, *disodium monoxide*).—It is formed when metallic sodium burns in dry air. Karsten prepared it also by mixing and heating together equal equivalents of metallic sodium and "sodic hydrate." It is gray in color, melts at incandescence, and is not susceptible of electrolysis. It is not so volatile as the "hydrate." Karsten found its density = 2.805, its true density at zero, when pure and homogeneous, as deduced from its molecular volume (see VOLUMES, MOLECULAR), being 2.762.

*Sodic Hydrate* ($Na_2H_2O_2$) or *Caustic Soda* (properly *disodium dihydrogen dioxide*).—The hydroxyl school of chemists formulate it as Na.OH, a compound, *hypothetically,* of sodium and hydroxyl; or sometimes as NaO.H, a compound of hydrogen and "natroxyl." According to older views, it was really hydrate of soda—as it is still, without reason, called by all—with the assumed composition $Na_2O.H_2O$. In its formation, however, from soda and water, 18 volumes of liquid water condense, with great heat-evolution, to 15 volumes—a fact in itself conclusive against the presence of water, *as such;* moreover, no water can be expelled by heat from the compound, which, when heated, volatilizes as a whole. Whatever view be taken, therefore, of its constitution, the hydrogen cannot be believed to exist in the molecular condition that it has in water. Caustic soda is prepared commercially from the carbonate by the action of lime. Three parts of crystallized carbonate (*sal-soda*) are dissolved in five times as much boiling water, and one part of quicklime, slaked and mixed to a cream with three parts of water, is gradually added, with continued ebullition. The caustic solution is then decanted after settling, and boiled down rapidly with the access of air. From the residue pure caustic soda may be dissolved out by alcohol, which is then distilled off; but for most commercial, manufacturing, and medical uses the residue is merely melted and cast into sticks, which are preserved in bottles. Much caustic soda is also made by heating or boiling together the Greenland mineral *cryolite* with hydrate of lime. "*Sodic hydrate*" is white, opaque, crystalline, melts below incandescence, has a density at zero of 2.136 (Filhol, 2.13). Caustic soda is used largely, in the form of solution or soda-ley, for making soap. The following table, from Dalton, is a very valuable one:

| Density of soda-ley. | Percentage of $Na_2O$. | Boiling-points, Fahrenheit. |
|---|---|---|
| 2.00 | 77.8 | 600° |
| 1.85 | 63.6 | 472° |
| 1.72 | 53.8 | 300° |
| 1.63 | 46.6 | 280° |
| 1.56 | 41.2 | 265° |
| 1.50 | 36.8 | 255° |
| 1.47 | 34.0 | 248° |
| 1.44 | 31.0 | 242° |
| 1.40 | 29.0 | 235° |
| 1.46 | 26.0 | 228° |
| 1.32 | 23.0 | 224° |
| 1.29 | 19.0 | 220° |
| 1.23 | 16.0 | 217° |
| 1.18 | 13.0 | 214° |
| 1.12 | 9.0 | 213° |
| 1.06 | 4.7 | 212° |

According to Dalton, the *saturated* solution of caustic soda at 60° F. has the density 1.5, boils at 255° F., and contains 36.8 per cent. of anhydrous soda. This corresponds to 47.5 per cent. of caustic soda, or the "hydrate." There is another table of densities of soda-leys which is more detailed than Dalton's, but does not go nearly so high, by Tünnermann. It gives throughout a little less soda for a given density than the figures of Dalton, and will be found in Gmelin's *Handbook of Chemistry;* in Watts's *Dictionary of Chemistry,* v. 339; and in Storer's *Dictionary of Solubilities,* p. 455. Commercial caustic soda, sold for making soap and other uses, should make a clear, colorless solution in water, which should not effervesce with a dilute acid, when neutralized should give no white precipitate with nitrate of silver or chloride of barium, and should have no odor of sulphuretted hydrogen when moistened.

*Salts of Soda.*—The most important salts or compounds of soda are the *acetate, borate, carbonates, hypochlorite, hyposulphite, nitrate, phosphates, silicates, sulphate, sulphite,* and *tungstate. Acetate of Soda.*—This is a commercial article, prepared on a large scale by the manufacturers of wood-vinegar or pyroligneous acid. Its composition is $C_4H_6Na_2O_4.6H_2O$. Its true density at zero is 1.424 (Buignet 1.42). It is a white salt in prismatic crystals, which effloresce in the air, soluble in three parts of cold water. Heat converts it into a mixture of carbon and carbonate. It is used in medicine and as the source of commercial acetic acid by distilling with sulphuric acid. *Borates of Soda.*—Of these the most important is BORAX (which see). The composition of common borax crystals is $Na_2O.2B_2O_3.10H_2O$ (there being a misprint in the previous statement of composition). *Carbonates of Soda.*—Of these there are two of great importance—the neutral or normal carbonate, commercially *sal-soda* or "*washing soda,*" and the bicarbonate, commercially "*cooking soda.*" *Sal-soda* ($Na_2O.CO_2.10H_2O$) crystallizes in splendid large, transparent crystals, which are monoclinic. The densities indicate three modifications, of which the dominant one is 1.467 (Buignet 1.463). This salt effloresces in the air very rapidly, falling down to a white powder, which contains but half as much water as before. It dissolves in twice its weight of cold water. On exposure to a gentle heat it loses all water, and becomes dry anhydrous carbonate. This latter is a product of enormous value in the arts, used chiefly in the glass and soap manufactures. *Cooking Soda* (*disodium dihydrogen dicarbonate,* $Na_2H_2.C_2O_6$).—This is made by exposing the last compound to an atmosphere of carbonic acid gas, which is absorbed, with evolution of heat and separation of water. It is sometimes called *soda salæratus.* Commercial bicarbonate of soda is a white granular powder, which requires thirteen times its weight of water for solution. It is of very large consumption in medicine and in cookery. *Hypochlorite of Soda,* or *Labbaraque's liquor,* used as a disinfectant (see HYPOCHLOROUS ANHYDRIDE); *Hyposulphite of Soda* (see SULPHUR, ACIDS OF); *Nitrate of Soda* (see NITRIC ACID and NITRE); *Phosphates of Soda* (see PHOSPHATES); *Silicates of Soda* (see GLASS and WATER-GLASS).

*Sulphate of Soda,* or *Glauber's Salt* (*sal mirabile,* $Na_2O.SO_3 10H_2O$), forms large transparent monoclinic crystals. The writer has distinguished, from the densities, five distinct modifications, the lightest having at zero 1.358 (Thomson 1.35), and the heaviest 1.528 (Filhol 1.52). This salt occurs native in most mineral springs, and as the mineral species *mirabilite,* there being several abundant American localities. It is manufactured in enormous quantities, in the decomposition by sulphuric acid of common salt, in the process of making soda from the latter. (See SODA-ASH.) Glauber's salt is highly efflorescent, falling to a white powder in the air, and in time losing all its water of crystallization. It dissolves in three times its weight of cold, and in its own weight of boiling, water. It has a remarkable propensity to form *supersaturated solutions.* Glauber's salt is a mild saline cathartic, but is not so much used in medicine at the present day as formerly, its taste being somewhat nauseous. *Sulphite of Soda* (see SULPHUROUS ACID and SULPHITES); *Tungstate of Soda* (see TUNGSTEN).

HENRY WURTZ.

**Soda-Ash.** This is the technical and commercial name given to crude soda, as first produced in the process of manufacture, before having gone through any refining processes. In former times, previous to the invention of the process of Leblanc, which arose out of the French revolution of 1789, the only source of the alkali soda was from the ashes of marine and seashore plants, or KELP (which see). The trade in kelp ceasing during the wars of the Revolution, the committee of public safety called upon French chemists to find some new source of soda, all the *potash* attainable being needed for gunpowder. Hence, Leblanc's method of obtaining it from common salt first arose. This consists in converting the salt first into sulphate by means of sulphuric acid, and then heating this together with charcoal and carbonate of lime, which gives (theoretically) a mixture of carbonate of soda and sulphide of calcium. This process is now carried on, particularly in England, on an enormous scale in many large chemical works, all the soda used for making soap, glass, and a multitude of other products indispensable to civilization being

thus procured. To render the details of the process intelligible would require much space and many cuts of furnaces and other apparatus, and reference must be made for this to the standard works on chemical technology, as, for example, that of Richardson and Watts.

The crude soda-ash, sometimes called "black ash," as it leaves the furnace is a very complex mixture of substances, containing chiefly, however, carbonate of soda, caustic soda (hydrate), carbon, carbonate of lime, and sulphide, or, according to some, *oxysulphide*, of calcium. It is treated with hot water or steam on a furnace-hearth to break it up, and then the carbonate is leached out with hot water in an ingenious apparatus contrived to accomplish much work with little water. The great defect of Leblanc's system is the loss of all the sulphuric acid or of the sulphur used in making it. Hence, other methods of obtaining carbonate of soda from salt have been much sought after. One now being experimented with largely, and said to be in successful operation in Europe, is that due originally to Dyar and Hemming of decomposing concentrated brine with a strong solution of bicarbonate of ammonia, which engenders chloride of ammonium and nearly insoluble bicarbonate of soda. The chloride of ammonium is readily reconvertible into bicarbonate, to be used over again. There seems some probability that this may soon altogether supersede Leblanc's process, but the details of manipulation needed for industrial success have not yet been made public in reliable form.

H. Wurtz.

**Soda-Water.** See Aërated Waters.

**So'dium** [Lat. and Ger. *Natrium*], one of the elements of matter, a very important and remarkable metallic substance of which anhydrous soda is the oxide. Sodium was first obtained in 1807 by H. Davy by the electrolysis of caustic soda ("hydrate"). Its occurrence in nature is chiefly as common salt (chloride of sodium) in the ocean, and as a constituent of soda-silicates, chiefly the feldspars *albite* and *oligoclase*, on the land. A cubic foot of ocean-water contains about 6440 grains, not far from 1 pound avoirdupois, of metallic sodium, and a cubical tank 14 feet on each side filled with sea-water will contain more than 1 ton of this alkali-metal. A cubic foot of rock-salt contains over 52 pounds of sodium, and, according to volumic researches of the writer, very closely half its bulk of that metal. Sodium is a metal probably more abundant in its occurrence than iron, and probably not necessarily much more difficult or expensive to obtain in approximate purity than the latter metal, and yet, by reason of the fewer uses developed for it, the cost of sodium is thirty or forty times that of the purest iron. Sodium is one of the elements most essential to animal life, being a constituent of all blood. It is also found in the vegetable organisms that dwell in the ocean and along its coasts, but plants dwelling on land above the sea-level contain potassium more abundantly than sodium.

*Preparation.*—Davy's original method, by electrolysis, has been regarded, so long as an electric circuit of the old voltaic kind had to be resorted to, as too costly; but undoubtedly, in due course of the rapid improvements now going on in the conversion of heat into dynamic electrolytic energy by means of the magneto-electric machine, Davy's original mode of obtaining sodium from caustic soda will again be found available for the production of this metal on a large scale very readily and economically; and as it is only through sodium that we can now obtain the metals aluminum, magnesium, and calcium, that are destined to be of so great importance, much of the future of human art and industry depends upon the improved production of sodium. Gay-Lussac and Thénard first prepared sodium in quantity by the action of metallic iron at an intense heat on fused caustic soda, but the method now in use is that of Brunner, which consists in distilling a mixture of *charcoal* and *carbonate of soda*, the transformation being essentially as follows:

$$Na_2CO_3 + C_2 = Na + 3CO;$$

a current of carbonic oxide gas resulting, which sweeps along with it the metallic sodium in vapor. The latter is condensed by passing the gases through a thin, flat cast-iron condenser of peculiar form, which becomes, and remains throughout, hot enough to prevent the metal from solidifying within it, and thus clogging it up. It is so contrived also that a sharp-pointed iron rod may be driven in through it into the retort to clear it out when in danger of choking up and thus leading to a dangerous explosion. The sodium trickles out of the condenser in melted form, and is prevented from taking fire and burning in the air by being received in a vessel of melted paraffine. The latter should be double, each part having a close-fitting lid to be applied in case the paraffine should kindle. The temperature required is that at which carbonate of soda volatilizes, so that a very voluminous smoke of carbonate of soda is evolved with the carbonic oxide, which probably contains also some caustic soda, and which it is exceedingly difficult to coerce. Sodium-works must therefore be so located that annoyance will not arise from this, and must be provided with powerful ventilation. This also gives rise, of course, to great waste of material. Another heavy expense of the sodium-process is the rapid destruction of retorts. The writer has found it most advantageous to use horizontal cylindrical retorts made of thin boiler plate, with a lapped joint. These are jacketed with another sheet of boiler plate clamped closely on, which is readily applied, and is largely instrumental in protecting the lower side of the retort, where exposed most to the fire, from being rapidly burned through. This jacket is readily renewed when itself burned through, and by turning round the inner retort so as to bring fresh surfaces next the fire, and by renewing the jacket, retorts may be made to stand several more successive charges than when unprotected. Care must be taken that the carbonate of soda and charcoal are free from *silica* and *phosphates*, which energetically attack the iron of the retort and perforate it from the inside. Deville introduced the admixture of powdered *chalk* with the mass, to prevent its passing into liquid fusion, but this may introduce silicates, and an excess of coarsely-powdered charcoal has been used instead. It is very important also that the fire should be fed in some way which will not check combustion and cool the retort during the distillation of the sodium, which is extremely liable to lead to disaster. *Gaseous fuel* or a *petroleum-vapor* furnace would be eminently adaptable to this art, and would greatly promote economy, of time, labor, and retorts.

Sodium is a brilliant silver-white metal, of the softness of wax within the normal range of temperatures, but becoming somewhat harder at 20° below zero. Its color is stated, when the surface is chemically clean and bright, to have a tinge of *rose-red*, brought out very distinctly by repeated reflections. Its density is variable, the new geometrical law of condensation of the writer (see Volumes, Molecular) indicating three allotropes, having the following true densities at zero:

| | Experiment. | True density at 0°. |
|---|---|---|
| Davy | .9348 | .943 |
| Gay-Lussac and Thénard | .97223 | .9755 |
| Schröder, at 4° C. | .985 | .9922 |

The exact fusing-point of sodium is a little in doubt, Bunsen finding that it *melts* at 204° F., while Regnault found it to *solidify* at 207.5° F. It crystallizes in octahedrons of the dimetric or tetragonal system. Its vapor, unlike that of potassium (which is green), is colorless. When exposed to the air, it rapidly absorbs oxygen, and moisture if present, forming either anhydrous oxide ($Na_2O$) or caustic soda ($Na_2O_2H_2$). When water touches it, there is an intense reaction, with evolution of H gas, and formation of the latter compound, or hydrates thereof. If the quantity of water is small, the heat produced is so high that the metal takes fire, and burns with a very large monochromatic yellow flame and most intense heat, producing more or less peroxide of sodium, with protoxide. In oxygen gas it burns almost entirely to peroxide ($Na_2O_2$).

In the preservation of sodium it must be kept immersed under the surface of some liquid which is free from oxygen, the heavy oils of coal-tar being better for this purpose, apparently, than rectified petroleums, which seem to absorb oxygen slowly and transmit it to the sodium, which thus becomes soon encrusted with a product not yet examined.

Henry Wurtz.

**Sodium Compounds, Medicinal Uses of.** *Caustic soda* produces effects closely resembling caustic potassa, but it is little used. *Sodium carbonate* and *bicarbonate* also resemble the corresponding potassium salts, but are milder in their effects. They are much used as simple alkalies in digestive derangements, or as alkaline washes in skin diseases. *Sodium biborate* (borax), being feebly alkaline in reaction, has something of the same effect as the carbonates. It is mostly used locally, in solution, as a weak alkaline application to the skin or a mouth-wash. A crystal of borax held in the mouth and allowed slowly to dissolve is an excellent means of temporarily relieving huskiness of the voice. *Sodium acetate* may be used for the same purposes as the potassium salt. *Sodium phosphate* is a mild saline purge, and has the advantage of possessing little taste. *Sodium sulphate* (Glauber's salt) is an active cathartic, but on account of its offensive taste has been superseded by magnesium sulphate. *Sodium nitrate* is a neutral salt without striking properties, and is but little used in medicine. The effects of the *sulphite* and *hyposulphite* are spoken of under the heading Hyposulphites (which see). *Sodium and potassium tartrate* is described under Potassium Compounds. *Sodium chloride* (common salt) is used for medicinal purposes, mostly as an emetic, in strong solution in warm water. *Solution of*

*chlorinated soda* is a powerful and valuable antiseptic and disinfectant. EDWARD CURTIS.

**Sodium, Compounds of.** Sodium, like other metals, forms different classes of compounds with oxygen, with sulphur, with the halogens, with mercury to *amalgam*, and with other metals to *alloys*.

*Oxides.*—Of these one, the compound $Na_2O$, has already been described. (See SODA.) Another is the peroxide or dioxide, $Na_2O_2$. This is formed by burning sodium in oxygen, but to obtain it free from $Na_2O$ the mass must be ignited in oxygen until it absorbs no more. The product is white when cold, and yellow when hot. If *slowly* introduced into water, to avoid heating, hydrates may be obtained, which may be crystallized. Its density, and those of its crystalline hydrates, appear to be as yet unknown.

*Sulphides.*—Of these there is a series, the only one of much interest being the lowest one, $Na_2S$. This forms large octahedral crystals of density about 2.5.

*Haloid Salts.*—The most important of these is chloride of sodium, common salt. (See SALT.) The iodide, bromide, fluoride, and cyanide of sodium are of no great practical interest, and for these the chemical textbooks must be consulted.

*Sodium Amalgam.*—Pure quicksilver and sodium, when brought together, unite, with highly explosive violence, to an amalgam, which possesses very extraordinary qualities. This amalgam has assumed much interest within the last twelve years by reason of its introduction into use, by the present writer, in 1864, as an agent in the amalgamation of the precious metals in their ores, and their extraction from the same; the adhesion of the quicksilver to these metals being enormously intensified by the presence of a very minute amount of sodium, and the quicksilver itself being prevented from breaking up into minute globules, which are difficult to recover again in coherent form. Quicksilver, or gold or silver amalgam, which has become already broken up in this way (or "floured," as it is technically termed by the miners and millmen), is also caused to coalesce again instantly into one mass by the addition of a minute proportion of amalgam of sodium. Similar discoveries to these were published also in 1865, in England, by William Crookes, and in some of the metallurgical books are now attributed to that chemist; but it is matter of history that both the American publication and the American practical application anteceded those in England by many months. The preparation of the sodium amalgam successfully on a large scale, without continual and dangerous explosions, is only possible by the method invented by the writer, which is not to be found in the works of reference. This depends upon a very simple device, that of forming first a poorer pasty amalgam by melting up a rich sodium-amalgam with some additional quicksilver, to which the sodium is then added in lumps the size of half an egg. Each lump suddenly melts down upon the surface of the pasty amalgam, combining therewith with a great development of heat, but without any serious explosion or danger of any, and forming a thin broad cake of rich amalgam, which is very hard, and has about the composition $Hg_3Na$. These cakes are immediately removed with tongs, and thrown into a kettle to be melted down under a thin layer of paraffine. As the heat produced raises the remaining pasty amalgam to a point of very liquid fusion, and to a temperature at which combination with sodium would be very explosive, it is necessary to wait a few minutes until the mass has cooled again. It is better, therefore (to save time), to divide the mass of pasty amalgam operated on into a number of portions in as many iron pans. Each can be then successively treated with sodium, and the time occupied in cooling not be lost. By this method one operator, with an assistant, has often made several hundred pounds of hard amalgam of sodium in one day without an explosion. If the amalgam is to be preserved or transported in glass bottles, it should be cast into quite thin sheets before being broken up for bottling, on account of its great weight, and the bottles should be thick and strong. *Moisture* being the great enemy of sodium-amalgam, the bottles should be tied over with sheet caoutchouc or thin rubber-cloth. India-rubber bags have been much and successfully used for containing sodium-amalgam, as being less fragile than glass. They are closed by tying tightly with twine. Sodium-amalgam is largely used in chemical laboratories as a reducing agent. It is so powerful in this way that it will precipitate the earthy metals barium, strontium, and calcium from their solutions. In a large number of cases in which organic compounds are to be deoxidized or subjected to the action of "nascent hydrogen," sodium-amalgam is employed.

*Alloys of Sodium.*—Those with LEAD have been mentioned under that head. The most interesting alloy is the *permanently liquid* one with POTASSIUM (which see).

HENRY WURTZ.

**Sod'om,** a city of ancient Syria, memorable in the earliest records of the Hebrews for its connection with Abraham and Lot, and its miraculous destruction by a storm of brimstone and fire (Gen. xix. 24, 25). The exact situation of Sodom and its allied cities, Gomorrah, Admah, Zeboim, and Bela or Zoar, has been for 2000 years a subject of endless discussion, the usual conclusion having been that the "cities of the plain" occupied the present basin of the Dead Sea, which was accordingly supposed to have been formed at the time of the destruction of those cities. But many modern critics have pointed out that the text of Genesis makes no such statement, the Dead Sea not being mentioned in that connection. Strong geographical evidence has been adduced by Mr. George Grove (in Smith's *Dict. of Bible, s. v.*) to show that the *Kikkar*, or plain of the five cities, was in fact the lower valley of the Jordan, where he would accordingly place the site of Sodom and the allied cities. In support of this view an etymological coincidence may be further alleged, that the plain of *Sodom* will thus be identical with the region elsewhere referred to in the Pentateuch as the "vale of *Siddim*" and the "plain of *Shittim*," both which names offer a strong resemblance to Sodom. De Saulcy identified Sodom with a spot still called *Usdum* to the S. W. of the Dead Sea, but his views have met with little acceptance. Robinson places Sodom near the southern extremity of the Dead Sea. George Warington (in *Journal of Sacred Literature*, Apr., 1866) adduces strong reasons for translating Sodom "hollow," and applying it to the entire crevasse of which the valley of the Jordan and the Dead Sea are but a part; and this view, supported as it is by the etymological resemblances above noted, is perhaps the safest conclusion.

PORTER C. BLISS.

**Sodo'rus,** p.-v. and tp., Champaign co., Ill., on Toledo Wabash and Western R. R. P. of v. 300; of tp. 1458.

**So'dus,** p.-v. and tp., Berrien co., Mich. P. 906.

**Sodus,** p.-v. and tp., Wayne co., N. Y., on Lake Ontario, and on Lake Ontario division of Rome Watertown and Ogdensburg R. R. and on Sodus Point and Southern R. R. P. of v. 516; of tp. 4631.

**Soerabay'a,** or **Surabaya,** town of Java, in the East Indies, capital of a Dutch province of the same name, on the northern coast of the island, opposite Madura, at the mouth of the Kediri. It has a good harbor, is strongly fortified, and contains barracks, magazines, hospitals, and other military establishments. It communicates regularly with Samarang, Batavia, and other places by steamboats, and carries on an important trade, exporting annually rice, coffee, cotton, sugar, tobacco, and cocoanuts to the value of more than $5,000,000, and importing over $3,000,000 worth of manufactured goods. Its shipbuilding is also extensive. P. about 90,000, of whom from 3000 to 4000 are Europeans, the rest Javanese, Arabs, and Chinese.

**Soerakar'ta,** or **Surakarta,** town of Java, in the East Indies, capital of a Dutch residency of the same name, on the left bank of the Solo, is connected with Samarang by railway. It contains a magnificent palace of the native emperor, who lives here as a pensioned rather than as a tributary prince; the Dutch fortress is opposite the emperor's palace. The trade of the city, especially in pepper, vanilla, and cacao, has increased much in the last few years. P. about 50,000.

**Soest,** town of Prussia, province of Westphalia, in the Middle Ages was one of the most flourishing cities of the Hanseatic League, but has since much decreased. It is still a handsome town, however, surrounded with substantial walls, containing a fine cathedral of the fifteenth century, and carrying on trade in corn and cattle. P. 12,404.

**Sofa'la,** a Portuguese settlement on the south-eastern coast of Africa, in lat. 20° 10′ N., sometimes denotes the whole coast-region from the mouth of the Zambesi to Delagoa Bay, comprising several Portuguese settlements, such as Teté, Inhambane, Senna, and others. The city of Sofala is a most miserable place, consisting of 18 mud huts, situated in an utterly unhealthy salt-swamp; but the surrounding territory, though unhealthy to Europeans, is very fertile, and it is only the indolence, cowardice, and treachery of the native inhabitants which have hitherto impeded all progress. The low coast-land swarms with wild elephants, rhinoceroses, and lions.

**Sof'tas, The** [probably from the Arab *soffah*, "bench"], generally, all persons attached to the mosques in any capacity whatever, but more especially applied to the students who are initiated in the upper branches of religious instruction in the mosques, and who, like the fellows of an English university, constitute a corporation long after the completion of their learned pursuits. Some of them supply candidates for the offices of imaums and mollahs, but the larger part of them hang rather loosely on society. In

Mohammed's time they were poor men who slept in the mosques and had a sheltered bench outside; hence they were called "men of the bench." At present they form a large and influential body in Mohammedan society. Their number in Constantinople is estimated at from 10,000 to 20,000, and during the late revolution they entirely controlled the mob, which they excited by appealing to the slumbering religious fanaticism.

**Sogdia'na,** formerly a territory of Central Asia, separated N. from Scythia by the Jaxartes, S. from Bactria by the Oxus, comprised nearly the same regions as the present Toorkistan, the city of Bokhara still bearing the name of *Sogd*. It was conquered by the Persians under Cyrus, and fell after the death of Alexander the Great to Syria; it was subsequently conquered by the Toorkomans. In the time of Alexander the country was remarkable for its forests and game, but the historians of Alexander's campaigns, who speak of the numerous and large cities of the country, seem not to be perfectly reliable.

**Soglia'no al Rubico'ne,** town of Italy, province of Forli, on a high hill near the source of the torrent Fiumicino or Rubicone, about 17 miles from Rimini. This town first appears in history as a rural possession of the family of Sulla. It was a fief of the Malatesta house for many centuries, and is now a more than usually active and thriving town. P. 6239.

**Sohar',** town of Oman, Arabia, on the Sea of Oman, has a good harbor, some manufactures of woollen, cotton, and silks, and considerable trade with Persia, though it has suffered somewhat by the rise of Muscat. It is surrounded by a wall, defended by a castle, and generally well built. P. about 20,000.

**Sohn** (Karl Ferdinand), b. at Berlin Dec. 10, 1805; studied painting under Schadow, whom he accompanied in 1826 to Düsseldorf, in 1830 to Italy; was appointed professor in the Academy of Düsseldorf in 1838. D. at Cologne Nov. 25, 1867. Among his most celebrated pictures are *Rinaldo and Armida* (1827), *Diana and Actæon* (1833), *The Judgment of Paris* and *Romeo and Juliet* (1836), *Tasso and the Two Leonoras* (1838), besides a number of portraits, especially of women.

**Soignies',** town of Belgium, province of Hainaut, on the Senne, has large breweries and distilleries, and important quarries in its vicinity. P. 6769.

**Soils, Chemistry of.** See Agricultural Chemistry, by S. W. Johnson, A. M.

**Soissons',** town of France, department of Aisne, on the Aisne, is an old but well-built city, with manufactures of cloth and hardware, and an important trade in grain. P. 10,404.

**Sokoto.** See Saccatoo.

**Solana'ceæ** [from Solanum, which see], a natural order of gamopetalous exogenous herbs, shrubs, and trees, often containing powerful narcotic principles. Among the poisonous plants of the order are belladonna, henbane, mandrake, stramonium, and tobacco. Some, however, as generally used, are not poisonous; such as the true potato, the egg-plant, and the tomato. The capsicums, chillies, or pod-peppers, moreover, are not poisonous, but very pungent with a volatile acridity. Most of the 1600 species of the order are tropical. In affinity the order is between the Scrophulariaceæ and the Convolvulaceæ, but most nearly related to the former, which might be regarded as an irregular-flowered division of it. It is marked by having the corolla plaited (or rarely imbricated) in the bud; stamens as many as its lobes, and alternate with them, all perfect; numerous seeds, small and mostly terete embryo, with narrow cotyledons, in copious fleshy albumen. The juice is watery and mawkish or nauseous. Asa Gray.

**Solan'der** (Daniel Charles), M. D., LL.D., F. R. S., b. at Nordland, Sweden, Feb. 28, 1736; studied at Upsala under Linnæus; graduated in medicine; made a scientific and botanical tour in Russia; visited the Canary Islands on a Swedish war-vessel; settled in England Oct., 1760; was soon employed at the British Museum in drawing up a catalogue of the collections; was appointed assistant in the natural history department 1763; chosen F. R. S. 1764; prepared a catalogue of the Brander collection of fossils 1766; accompanied Sir Joseph Banks in the first voyage of Capt. Cook around the world 1768–71, and was appointed sub-librarian at the British Museum 1773. D. at London May 16, 1782. Author of botanical papers in the *Philosophical Transactions*, and left to the British Museum numerous unpublished MSS. embracing his botanical researches. It was chiefly through the influence of Dr. Solander that the artificial system of botanical classification proposed by Linnæus was generally adopted by English naturalists, and he rendered important assistance to Ellis in the preparation of his great work, *The Natural History of Zoophites* (1786).

**Solan Goose.** See Gannet.

**Sol'anine** [Lat. *solanum*, "nightshade"], a natural organic alkaloid found in various species of the genus *Solanum*, including the *black nightshade, potato, bittersweet*, and others. It is doubtful, however, whether the alkaloids obtained from these different sources are exactly the same, or only nearly related. Solanine is a solid crystalline substance, readily soluble in alcohol. Its analyses by different chemists have yielded discordant results, the proportion of nitrogen varying, for example, from none at all (*Otto Gmelin*) to 3.6 per cent. (*Moitissier*). The latter makes it to be $C_{21}H_{25}NO_7$. It is very poisonous, producing paralysis of the lower extremities before death. This symptom has been observed in the case of cattle poisoned by eating the green shoots of potatoes, which contain solanine largely. H. Wurtz.

**Solano.** See Simoom.

**Sola'no,** county of W. California, bounded S. E. by Sacramento River, S. by Suisun Bay, and traversed by California Pacific R. R. The surface is variegated with plains, valleys, and high rounded hills, with little timber, and an abundance of marble and limestone; it is one of the best agricultural counties in the State. Staples, wheat, barley, wine, hay, wool, and dairy products. Cap. Suisun City. Area, about 800 sq. m. P. 16,871.

**Sola'num** [Lat.], a genus of herbs and shrubs of the order Solanaceæ, most or all of which contain the poisonous principle *solanine*. The common potato and the egg-plant, however, as ordinarily used, are not poisonous, though there is little doubt that traces of the poisonous principle exist within the plants. The U. S. have several native species, mostly Southern. There are a great many tropical species, some of them of great use in local therapeutics, but none are extensively employed in the medical practice of civilized lands except perhaps the *S. dulcamara*, or bittersweet. Several afford edible fruits, that of the egg-plant (*S. melongena*) being the most important.

**Solar Cycle.** See Cycle, by Pres. F. A. P. Barnard.

**So'lar Sys'tem.** The solar system consists of the sun, together with the planets, comets, and meteors which revolve around it as the centre of their motions. The term "planets" includes bodies of three distinct classes: (1) the major planets, Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune; (2) the minor planets, or asteroids (now numbering 169), revolving between the orbits of Mars and Jupiter; (3) the satellites, or secondary planets, 18 in number, of which the earth has one, Jupiter four, Saturn eight, Uranus four, and Neptune one. The magnitude of Mercury, the smallest of the major planets, is 1000 times greater than that of the largest asteroid. A general view of the planetary elements is presented in the following tables:

| | Mean distance from the sun. | Period in mean solar days. | Longitude of perihelion. | Longitude of asc. node. | Eccentricity. |
|---|---|---|---|---|---|
| Mercury | 35,560,000 | 87.96926 | 75° 7′ 14″ | 46°33′ 9″ | 0.2056048 |
| Venus | 66,449,000 | 224.70079 | 129 27 14 | 75 19 52 | 0.0068433 |
| Earth | 91,875,000 | 365.25637 | 100 21 21 | 00 00 00 | 0.0167711 |
| Mars | 139,988,000 | 686.97965 | 333 17 54 | 48 23 43 | 0.0932611 |
| Jupiter | 478,008,000 | 4332.58482 | 11 54 53 | 98 54 20 | 0.0482388 |
| Saturn | 876,376,000 | 10759.21982 | 90 6 12 | 112 21 44 | 0.0559956 |
| Uranus | 1,762,375,000 | 30686.8208 | 168 16 45 | 73 14 14 | 0.0465775 |
| Neptune | 2,760,103,000 | 60126.72 | 47 14 37 | 130 6 52 | 0.0087195 |

| | Inclination. | Mean longitude at epoch.* | Equatorial diameter in miles. | Volume. | Mass. | Density. | Sid. rotation. |
|---|---|---|---|---|---|---|---|
| | | | | | | | *d.* *h.* *m.* *s.* |
| Sun | ..... | ..... | 853,000 | 1,240,285 | 1 | 0.253 | 25 0 0 0 |
| Mercury | 7° 0′ 8″ | 327°15′20″ | 2,958 | 0.0518 | $\frac{1}{3000000}$ | 2.020 | 24 5 28 |
| Venus | 3 23 31 | 245 33 15 | 7,549 | 0.8686 | $\frac{1}{400000}$ | 0.903 | 23 21 24 |
| Earth | ..... | 100 46 43 | 7,926 | 1.0000 | $\frac{1}{320000}$ | 1.000 | 23 56 4 |
| Mars | 1 51 5 | 83 40 31 | 4,915 | 0.2345 | $\frac{1}{3000000}$ | 0.447 | 24 37 23 |
| Jupiter | 1 18 40 | 160 1 20 | 88,294 | 1303.9 | $\frac{1}{1048}$ | 0.229 | 9 55 26 |
| Saturn | 2 29 28 | 14 50 41 | 71,823 | 667.5 | $\frac{1}{3502}$ | 0.134 | 10 29 17 |
| Uranus | 0 46 30 | 28 26 42 | 33,124 | 73.37 | $\frac{1}{22000}$ | 0.180 | ? |
| Neptune | 1 46 59 | 335 8 59 | 35,910 | 93.47 | $\frac{1}{19760}$ | 0.178 | ? |

*Elements of the Moon.*

| | |
|---|---|
| Mean distance from the earth in miles | 238,800 |
| Mean sidereal revolution in days | 27.321661 |
| Mean synodical revolution in days | 29.530589 |
| Mean inclination of orbit | 5° 8′ 40″ |
| Mean revolution of nodes in days | 6793.391080 |
| Mean revolution of apogee in days | 3232.575343 |
| Mean eccentricity of orbit | 0.054900708 |
| Mass (earth's as 1) | $\frac{1}{81}$ |
| Diameter in miles | 2160 |
| Density (earth's as 1) | 0.556 |

*The epoch is Jan. 0, 1850.

*Elements of Jupiter's Satellites.*

| Number. | Sidereal revolution. | Distance in radii of feet. | Diameter in miles. | Mass, that of Jupiter being 1. |
|---|---|---|---|---|
| | *d.* *h.* *m.* | | | |
| 1 | 1 18 28 | 6.05 | 2352 | 0.000017328 |
| 2 | 3 13 4 | 9.62 | 2099 | 0.000023235 |
| 3 | 7 3 43 | 15.35 | 3436 | 0.000088497 |
| 4 | 16 16 32 | 26.99 | 2929 | 0.000042659 |

*Elements of Saturn's Satellites.*

| Name. | Sidereal revolution. | Distance in radii of Saturn. | Diameter in miles. |
|---|---|---|---|
| | *d.* *h.* *m.* | | |
| Mimas | 0 22 37 | 3.360 | 1000 |
| Enceladus | 1 8 53 | 4.312 | ? |
| Tethys | 1 21 18 | 5.339 | 500 |
| Dione | 2 17 41 | 6.839 | 500 |
| Rhea | 4 12 25 | 9.552 | 1200 |
| Titan | 15 22 41 | 22.145 | 3500 |
| Hyperion | 21 7 7 | 28.000 | ? |
| Iapetus | 79 7 53 | 64.359 | 1800 |

*Elements of Uranus's Satellites.*

| Name. | Sidereal revolution. | Mean distance in radii of Uranus. |
|---|---|---|
| | *d.* *h.* *m.* | |
| Ariel | 2 12 28 | 7.44 |
| Umbriel | 4 3 27 | 10.37 |
| Titania | 8 16 55 | 17.01 |
| Oberon | 13 11 6 | 22.75 |

*Elements of Neptune's Satellite.*

| | |
|---|---|
| Sidereal revolution | 5*d.* 21*h.* 8*m.* |
| Distance in radii of Neptune | 12.00 |
| Maximum elongation | 18″ |

It may afford some idea of the dimensions of our system to remember that a cannon-ball flying outward from the sun with the uniform velocity of 500 miles per hour would not reach the orbit of Neptune in less than 630 years. As to the place occupied by the sun and its attendant orbs among the fixed stars, it is sufficient to remark that *Alpha Centauri*, presumably the nearest of those bodies, is 7000 times more remote than Neptune.

*Solar System, Origin of the.*—It has been inferred from a great variety of facts that the present form and order of our planetary system are the result of a *progressive development* in accordance with the laws of gravitation, cohesion, and chemical affinity. The planets all move in the same direction, and the planes of their orbits are nearly coincident. These phenomena, with various others for which gravitation fails to account, were formerly regarded as ultimate facts. That they are the result, however, of physical causes, and that the latter are a legitimate object of scientific research, is now admitted by all men of science. Laplace suggested a probable explanation in his celebrated nebular hypothesis; and recently Mr. Proctor has proposed a new theory, differing in some essential features from that of the author of the *Mécanique céleste*. In either hypothesis, however, the formation of cosmical masses was a process of gradual accretion. In regard to the *origin* of planetary nuclei, the ring of asteroids between Mars and Jupiter affords undoubtedly some striking indications. The distance of Flora, the innermost of the group, is 2.20; that of Hilda, the most remote, 3.95. The interval between these extremes includes the following distances at which the periods of minor planets would be commensurable with that of Jupiter:

(1) 3.27; where 2 periods would be equal to 1 of Jupiter.
(2) 2.25; " 7 " " " " 2 "
(3) 2.50; " 3 " " " " 1 "
(4) 2.95; " 7 " " " " 3 "
(5) 2.82; " 5 " " " " 2 "
(6) 3.81; " 8 " " " " 5 "

In the case of planetary masses at intermediate distances the perturbations by Jupiter would be distributed around the orbits. In other words, any change produced in a particular direction at one time would be counteracted by a similar disturbance at the opposite part of the orbit at another. The case is different, however, when the periods are commensurable. A planetoid, for instance, at the distance 2.5—between the orbits of Thetis and Hestia—would make precisely three revolutions while Jupiter completes one. It is obvious, therefore, that all its conjunctions with that planet, for an indefinite period, must occur in the same parts of its path. Consequently, its orbit would become more and more eccentric, until, if the nebulous ring had considerable density, the disturbed matter would be brought into contact, either in aphelion or perihelion, with masses having somewhat different velocities. The planetary nucleus formed in this manner would be at some distance from the primitive orbit of the particle disturbed. A gap or chasm in the asteroid zone would thus be produced at the distance 2.5. Similar reasoning will of course apply to any other distance at which the period of an asteroid would have to that of Jupiter a simple relation of commensurability. Let us now inquire whether the actual distribution of the mean distances sustains the conclusions derived from physical considerations.

The mean interval between the consecutive orbits of the 163 known asteroids is 0.0108. The widest chasms are the following:

(1) 3.3210—3.2210 = 0.1000
(2) 2.2661—2.2029 = 0.0632
(3) 2.5265—2.4726 = 0.0539
(4) 2.9779—2.9213 = 0.0566
(5) 2.8140—2.7807 = 0.0333
(6) 3.9505—3.5602 = 0.3903

The least of these gaps is three times greater than the average interval between consecutive orbits. *It will be seen, moreover, that those distances at which the periods of asteroids would be commensurable with that of Jupiter fall, without exception, in those widest chasms.* It is to be expected, indeed, that a few minor planets may yet be found within the zones now apparently vacant; but the irregularity of distribution, which has been increasing from year to year, is now too great to be obliterated by future discoveries. This clustering tendency may be further illustrated as follows: Within a space equal in breadth to the first gap, *and immediately adjacent to it*, seventeen minor planets are known to exist. Between 2.80 and 2.90, the interval containing the distance at which five times the period of a planet would be equal to twice that of Jupiter, only five have been detected; while in the equal space immediately interior—from 2.70 to 2.80—there are twenty-six. Finally, between 2.45 and 2.55, the space in the middle of which an asteroid's period would be one-third that of Jupiter, the number of known minor planets is four; while in the equal space interior and adjacent there are twenty-five, and in that exterior twenty-three. The only physical explanation of which these remarkable facts appear to be susceptible is that derived from some form of the nebular hypothesis.

It has been shown, moreover, that in Saturn's rings the great division is situated where the periods of discrete particles revolving in accordance with Kepler's third law would have simple relations of commensurability with the four inner satellites. The matter, therefore, which originally occupied this part of the annulus would, as the result of perturbations, be brought into contact with either the exterior or interior portions. The existence of the wide and permanent division of the ring is thus explained in the same manner as that of similar gaps in the zone of asteroids.*

The instances of nearly commensurable periods in the Jovian and Saturnian systems, as well as among the primary planets, are well known, and are too numerous and remarkable to be accidental coincidences. The preceding facts in regard to Saturn's rings and the zone of minor planets suggest an obvious cause for the formation of nuclei where their periods would have this observed relation to that of the disturbing body. As these nuclei would receive accretions of matter from portions of space both interior and exterior to their respective orbits, their distances from the central body during their planetary growth would not be liable to great variation.

The rotation-periods of the primary planets were regarded until recently as wholly disconnected. The discovery of an "analogy" between these periods was first announced in 1849 at the Cambridge meeting of the American Association for the Advancement of Science. This law or harmony was derived from the nebular hypothesis. Should it, therefore, be sustained by future discoveries, as it is by known facts, it would constitute a strong confirmation of the cosmogony of Laplace. It may be briefly stated as follows: Let P be the point of equal attraction between any planet and the one next interior; P′ that between the same and the one next exterior. Let also D = the sum of the distances of the points P P′ from the orbit of the planet, which sum we shall call the diameter of the sphere of the planet's attraction; D′ = the diameter of any other planet's sphere of attraction found in like manner; then it will be found that *the* SQUARE *of the number of rotations made by a planet during one revolution around the sun is proportional to the* CUBE *of the diameter of its sphere of attraction.* Some uncertainty still exists in regard to the masses of several planets, as well as to their periods of rotation. The exact truth of the above law cannot therefore be affirmed. It agrees too closely, however, with the known elements of the system to be regarded as wholly an accidental coincidence.

*See *Monthly Notices* of the Roy. Astr. Soc., vol. xxix. p. 100.

The planets exterior to the zone of asteroids may be regarded as forming a system by themselves, their motions being little affected by the comparatively small bodies within Jupiter's orbit. A discussion of the mutual perturbations of these major planets has recently developed the following harmonies: I. *The mean motion of Jupiter's perihelion is exactly equal to the mean motion of the perihelion of Uranus; and the mean longitudes of these perihelia differ by exactly 180°.* II. *The mean motion of Jupiter's node on the invariable plane of the planetary system is exactly equal to that of Saturn; and the mean longitudes of these nodes differ by exactly 180°.* The discoverer of these curious relations, Mr. J. N. Stockwell, remarks, however, that "the perihelion of Jupiter may differ from its mean place to the extent of 24° 10′, and that of Uranus to the extent of 47° 33′; and therefore the longitudes of the perihelia of these two planets can differ from 180° to the extent of 71° 43′. The nearest approach of the perihelia of these two planets is, therefore, 108° 17′. In like manner, the longitudes of the nodes of Jupiter and Saturn, on the invariable plane, can suffer considerable deviations from their mean positions. The actual position of Jupiter's node may differ from its mean place to the extent of 19° 38′, while that of Saturn may deviate from its mean place to the extent of 7° 7′. It therefore follows that their longitudes on the invariable plane can differ from 180° by only 26° 45′. Their nearest possible approach is 153° 15′, while their present distance apart is 166° 27′."

DANIEL KIRKWOOD.

**Solar Time.** See DAY.

**Sol'der** [remotely from the Lat. *solido, solidare*, to "unite," to "consolidate"], an alloy employed to unite pieces of metal together by fusion upon the proposed joint. There are many solders, each designed for some special use. The soft solders are usually of lead and tin, or lead, tin, and bismuth; these melt at a low temperature. (See LEAD.) The hard solders cannot be melted at a low temperature; they are commonly of zinc and copper.

**Sol'dier** [Fr. and Ger. *soldat;* Dutch, *soldaet;* Sp. *soldado;* It. *soldato*]. Webster derives the word from the Lat. *solidus*, a piece of money, the pay of a soldier. Bardin (*Dict. des Armées*, etc.) quotes a variety of forms of the word from mediæval writers, which renders, he says, little surprising the disagreement of etymologists concerning its root. The Ger. *sold* ("pay"), the Latin *sodalis* ("companion"), the Latin *soldurius*, the Low Latin *solidatus* ("who receives a stipend"), are referred to. Cæsar uses the word *soldurius* in reference to a kind of vassals or retainers in Gaul who devoted themselves to the service of some prince, which may have changed into *solidarius* ("a man *paid* or receiving pay"), though the Gauls referred to do not seem to have served for pay.

The etymology which makes the soldier *sodalis* ("companion") would be more congenial to the military profession than that which ignores all but the mercenary in the word by which he is distinguished. "There are," says Rousseau, "callings (*métiers*) so noble that to exercise them for money is to show one's self unworthy of belonging to them; such is that of the soldier" (*homme de guerre*). The word, however, has not, etymologically even, a stigmatic sense, but simply a distinctive one—the recipient of a regular stipend (daily, monthly, or yearly "wages")—as distinguished from those professions which receive *fees* for specific services, or from all occupations which are *not* salaried.

"The military profession is essentially noble; for there is no utility more just and more universal than the protection of the repose and greatness of one's country." (Charron, quoted by Gen. Ambert in his *Soldat.*) "Notwithstanding what moralist-philosophers may say, the profession of arms will always be ranked above all others." (Hallam, *ibid.*) "It is the distinguished profession, because its risks, its successes, its misfortunes even, conduct to greatness." (Montesquieu, *ibid.*) When, says Gen. Ambert, Michael Angelo would personify *Thought*, the garb he chose was that of a *soldier* (referring to the statue of the younger Lorenzo de' Medici in the sacristy of the church of San Lorenzo, Florence, sometimes styled *Il Pensiero*).

The general sense of the word *soldier* as now used is "one who is engaged in military service as officer or private; one who serves in the army; one of an organized body of combatants." (*Webster.*) "Whoever belonging to the military service of the state receives pay is a soldier." (Scott's *Military Dict.*) This latter procrustean application of an etymological sense which barely lurks in the usual acceptation of the word is scarcely tenable, even in a purely technical sense. Washington served the state without pay; La Fayette and the Orleans princes (see also the article on PARIS, DE, COMTE)—true soldiers in every legitimate sense—held commissions and served in our armies without pay. The definition of Webster's is a far better rendering of the primary meaning. In a more general sense we may mean an experienced warrior, or even one whose aptitudes, tastes, and knowledge are eminently military, even though he may never have *served.* In the "Articles of War" and *U. S. Army Regulations* the word is exclusively used in the minor sense of an *enlisted* man—a *private* soldier—as distinguished from *officers* (*commissioned to command* or exert authority)—*e. g.* Art. 2: "It is earnestly recommended to all *officers* and *soldiers* diligently to attend divine service," etc.; and Art. 20: "All *officers* and *soldiers* who have *received pay* or who have been duly *enlisted* in the service of the U. S.," etc. etc.).

It may be remarked that, while the Baptist's injunction, "Be content with your wages," to *soldiers* who came to him (a perennially appropriate admonition), would imply that while even in his day the idea of stipend, salary, or "wages" was associated with the military service, the word used has no such sense. The *miles* of the Vulgate (whence our words *militant, militia, military*, etc.) refers to the legion (tria-*millia*), and the original Greek στρατιώτης (from στρατός, an "encampment," whence we have "strategy," the radical sense being that of extension or spreading out) means one who belongs to an army, the army being thought of as encamped. J. G. BARNARD.

**Soldier,** p.-v. and tp., Monona co., Ia. P. 193.

**Soldier,** tp., Shawnee co., Kan. P. 1430.

**Soldiers' Homes** are institutions of a permanent character founded by government for the benefit of men worn out or disabled in the military service of their country. They should not be classed among charitable institutions, because the beneficiaries have in some way rendered an equivalent for the benefits provided for them, or have contributed to their maintenance, and no others can obtain those benefits. These homes take the place, for the enlisted soldier who has served faithfully, of the provision made by the retired list for commissioned officers.

In the U. S. the founding of a soldiers' home dates from Mar. 3, 1851, when an act of Congress was passed and approved "to found a military asylum for the relief and support of invalid and disabled soldiers of the army of the U. S." For years before this, however, the principal officers of the army, particularly Major-Gen. Winfield Scott, had given the subject attention, and had made special efforts to procure the needed legislation. Feb. 27, 1829, a report was made by the committee on military affairs in Congress upon the subject of establishing an "army asylum fund," and submitting letters from the major-general commanding, and other officers of the U. S. army, containing an expression of their views in relation thereto. In Feb., 1840, Gen. Robert Anderson (then captain and assistant adjutant-general U. S. army) embodied in a letter to Hon. John Reynolds his views upon the benefits and advantages which would follow the establishment of such an institution, and suggested a plan for providing for one. This letter was made the basis of a report dated Jan. 7, 1841, by the military committee, submitting a bill embracing the measures suggested therein, and advising the necessary legislation for an object which commended itself "by every attribute and motive of patriotism, benevolence, national gratitude, and economy." In 1844, Gen. Scott gave the subject special prominence in his annual report, and upon this the military committee again reported as before. Reports were also made Mar. 5, 1846, and Jan. 19, 1848, the former upon a memorial of the officers of the army stationed at Fort Moultrie and the petition of the officers of the 2d U. S. Infantry, and the latter upon a memorial of the officers of the army then in Mexico; and in each case the committee approved the bill reported Jan. 7, 1841. In Feb., 1848, Gen. Scott transmitted to the secretary of war a draft for $100,000 as part of the tribute levied by him on the City of Mexico for the benefit of the army, and he expressed the hope that it might be allowed to go to the credit of an army asylum. Again, in Nov., 1849, in another letter he says, referring to the same matter: "The draft was made payable to me, and in order to place the deposit beyond the control of any individual functionary whatever I endorsed it 'The Bank of America will place the within amount to the credit of the army asylum, subject to the order of Congress.' The funds were at first turned into the public treasury, and subsequently, in the act to found the asylum, were, with a balance of $18,791.19 remaining from the same levy, appropriated for the support of the institution. The act also defines the class of men entitled to the benefits of the asylum—viz. soldiers of twenty years' service, pensioners (who must surrender their pensions), and men disabled by wounds or disease in the service and in the line of duty. It designated as a board of commissioners, *ex-officio*, to administer the affairs

of the asylum, the general-in-chief commanding the army, the generals commanding the Eastern and Western military divisions, the chiefs of the quartermaster's, commissary, pay, and medical departments, and the adjutant-general of the army. It appropriated an unexpended balance ($54,319.23) of a previous appropriation "for the benefit of discharged soldiers disabled by wounds," and provided, for a perpetual revenue, "stoppages and fines adjudged against soldiers by sentence of court-martial," "forfeitures on account of desertion," a certain portion of the hospital and post fund of each station, moneys belonging to estates of deceased soldiers and unclaimed for three years (the latter to be repaid to legal heirs on demand), and also for the deduction of twenty-five cents per month, with the consent of the soldier, from the pay of each enlisted man. By act of Congress approved Mar. 3, 1859, the provisions of the original act were changed to reduce the number of commissioners to three—the commissary-general of subsistence, the surgeon-general, and the adjutant-general of the army; to substitute the name "soldiers' home" for "military asylum;" to reduce the soldier's contribution to twelve and a half cents per month; and to extend the benefits of the "home" to the soldiers of the war of 1812.

Temporary asylums were established in 1851 at New Orleans, La., Greenwood's Island, Miss., and in Washington, D. C. The first named was continued only about one year. In Mississippi the purchase of a tract of about 110 acres having been completed early in 1853, it was occupied till 1855, when the inmates were removed to a branch asylum at Harrodsburg, Ky., where an estate of about 200 acres had been purchased early in 1853. This in turn was discontinued in 1858, under an act of Congress approved Mar. 3, 1857, to abolish that branch and sell the property.

The principal and only permanent home for the regular army was established in the District of Columbia in 1851–52. It is located about 3½ miles due N. from the Capitol in the city of Washington. The original purchase of land was 256 acres. To this was added in subsequent years up to 1869 about 16 acres, and in 1872 the adjoining estate of "Harewood," containing 191 acres, was purchased from W. W. Corcoran, Esq., of Washington. A portion of these spacious grounds is cultivated for farm and garden produce for the benefit of the home inmates, a portion in orchards and flower-gardens, and the remainder is a grand park. The natural topography of the ground favors the construction of numerous extended drives winding through groves of shade and ornamental trees of every native and foreign variety, and over the open ground commanding fine views of the city, the Potomac River, and the surrounding country for miles. The park being open to the public, except on Sunday, the old soldiers derive much amusement from watching the many vehicles constantly passing through their home. The home (building) is of white marble. The original building, commenced in 1852, and completed in 1857, was of Norman design, 151⅓ feet long by 57 feet wide, with a clock-tower, and would accommodate 150 inmates, besides affording rooms for offices, library, mess-room, etc. An additional story and Mansard roof, constructed since, give increased accommodations for about 400 inmates. The whole number of inmates, transient and permanent, admitted up to the year 1876, was about 1800. A neat chapel, built of red stone, was completed in 1871. Religious worship, Protestant and Roman Catholic, is regularly observed. The home is supplied with a library of about 3000 volumes, and with newspapers and magazines, both foreign and domestic. In 1874 a portrait-statue in bronze, ten feet high, of Lieut.-Gen. Winfield Scott, executed by Launt Thompson of New York, was erected upon the most prominent point in the grounds. In 1876 a model hospital was completed, not only for the sick, but as an infirmary for the aged and helpless inmates. The officers of the home are a governor, a deputy governor, and a secretary and treasurer, who, with a medical officer, are detailed from the army. Inmates receive $1 per month pocket-money, and a per diem for any labor they can perform. A small monthly stipend is allowed to some beneficiaries, who, having families, are permitted to live elsewhere than at the home.

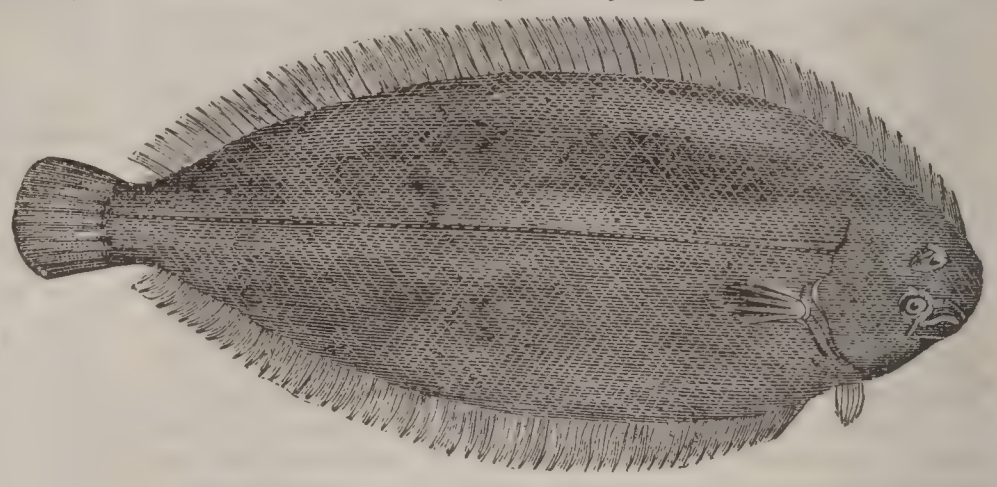
Under an act of Congress approved Mar. 3, 1865, amended by an act approved Mar. 21, 1866, to found "the National Asylum for disabled volunteer soldiers"—which name was changed to "Home" by act approved Jan. 23, 1873—soldiers' homes have been established near Augusta, Me., Hampton, Va., Dayton, O., and Milwaukee, Wis., for the benefit of volunteer soldiers disabled by wounds or disease contracted in the U. S. service during the war of the rebellion (1861–65). The volunteer homes are under the management of a board of twelve commissioners, the President of the U. S., the secretary of war, and the chief-justice of the U. S. being members *ex-officio*, and nine others elected by joint resolution of Congress for a term of six years, who must be citizens of the U. S. and residents of States which furnished troops for the suppression of the rebellion, but no two can be residents of the same State. The revenue for the support of these homes was at first from a source similar to that for the regular home, but is now provided by annual appropriations in Congress.

The principal institutions of a similar character in Europe are Chelsea Hospital, at Chelsea, a suburb of London; Kilmainham Hospital, a sister institution near Dublin, Ireland; the Hôtel des Invalides, in Paris, France, noted as the locality of the tomb of the great Napoleon; and an institution of the same name at Berlin, Prussia.

O. W. Longan.

**Soldin',** town of Prussia, province of Brandenburg, has manufactures of leather, tobacco, earthenware, and tiles. P. 5489.

**Sole** [Lat. *Solea*], the name given to fishes of the order Heterosomata in different English-speaking countries. (1) In England it is distinctive of the *Solea vulgaris*, to which it properly alone belongs. This species is a typical representative of the family Soleidæ, in which the scales are ctenoid, the vertical fins not confluent, the pectorals of both sides developed, and the color dark brown on its upper and white on its lower side, with the pectoral fin blackish at its end; it generally ranges between ten and



The Common Sole of Europe.

twenty inches in length, and between one and ten pounds in weight, although the latter dimensions are rarely attained. It is found along almost the entire coast of Europe, and is one of the most esteemed of fishes; the flesh is white and firm, and is in season in all months of the year except the spawning-time, which takes place toward the end of winter. It is chiefly taken on the English coast by trawling. A recent attempt has been made (1875), at the expense of Mr. Kidder of Boston, under the superintendence of Prof. Baird, U. S. commissioner of fisheries, to introduce it into the Massachusetts waters. (2) The name is extended, with a qualifying adjective, to related species on the British coast; *e. g.* the *Solea* (*Pegusa*) *aurantiaca*, or lemon sole. (3) Occasionally it is used for the *Achirus lineatus* of the Eastern U. S., the nearest American ally of the European species, but this is more popularly known as the hog-choker, coverclip, or calico; it is a worthless fish. (4) In California it is applied to several species of true Pleuronectidæ—*e. g. Parophrys vetula, Lepidopsetta umbrosa, Psettichthys melanostictus,* and *Orthopsetta sordidæ*. These have few characters in common, and belong even to different subfamilies, *Parophrys* and *Lepidopsetta* being Pleuronectinæ, in which the mouth is small; *Psettichthys*, one of the Hippoglossinæ, characterized by a large mouth and the narrow lateral insertion of the ventrals; and *Orthopsetta*, a genus of Rhombinæ, distinguished by the large mouth and the insertion of the ventrals by a long base on the ridge of the abdomen. They are not much esteemed. Theo. Gill.

**Solebury,** tp., Bucks co., Pa. P. 2791.

**Sol'ecism,** a violation of the laws of syntax or of the laws of thought, was derived from Soli (Σόλοι), a city in Cilicia, founded by colonists from Attica, but subsequently notorious for the bad and utterly corrupted manner in which its inhabitants spoke the Greek language.

**Soledad,** tp., Los Angeles co., Cal. P. 265.

**Sole'idæ** [from *Solea*, the Latin name of the typical form], a family of fishes of the order Heterosomata, distinguished by the form of the body, which has been likened to the sole of the foot. The body is oblong or elongated, and nearly equally developed above and below the lateral line; the scales are small (ctenoid or cycloid), or absent; the lateral line mostly straight (sometimes double or triple); the head small, and with a rounded projecting snout, and

more or less hooked upper jaw; the eyes are approximated, and the upper is further forward than the lower; the operecula concealed by the scales; the mouth unsymmetrical, and rather small and curved; teeth generally confined to the blind side of the jaws, and villiform (sometimes wanting); branchial apertures restricted above; branchiostegal rays typically seven; dorsal, anal, and caudal fins typically separate, sometimes confluent; the dorsal commences on the snout, the anal under the pectoral fin; pectorals small or (in some genera) absent; ventrals small and variously developed. The vertebræ are very numerous, but unequally distributed, in the typical forms the abdominal or rib-bearing ones being only eight or nine in number, and the caudal about forty. The family is well distinguished by the physiognomy from the Pleuronectidæ, especially so far as the European and American species are concerned, but some Australian types lessen the distance between them. Species are found in every sea except the extreme polar ones, but are most abundant in the tropics: about 100 have been distinguished. The most notable is the sole (*Solea vulgaris*) of Europe. Two species are found along the eastern American coast—*Achirus lineatus* and *Plagusia plagiusa*—but are of no economical importance. None are known from the Pacific coast, the several species called sole at San Francisco being true Pleuronectidæ. (See SOLE.) THEODORE GILL.

**Solemn League and Covenant.** See COVENANT, NATIONAL, OF SCOTLAND.

**Solemn League and Covenant.** This international politico-religious agreement figures very prominently in the history of Scotland and England during the Puritan revolution. It was drawn up in 1643. It agrees in spirit with the "National Covenant" of 1638, but has a wider scope, extending over the three kingdoms, while the National Covenant was purely Scotch. It aims at a complete uniformity in religion throughout Scotland, England, and Ireland (which was an impossibility, as the result proved), and grew out of the intense religious ardor of an age in which Church and State, ecclesiastical and political interests, were blended. It consists of six articles—pledging the subscribers to preserve the established Presbyterian religion in Scotland, to extend it to England and Ireland, to put down popery, prelacy, superstition, heresy, and immorality, to uphold the rights of Parliament and a constitutional monarchy, and to defend every member of the confederation. The first article is the most important, and reads thus: "We noblemen, barons, knights, gentlemen, citizens, burgesses, ministers of the gospel, and commons of all sorts, in the kingdoms of England, Scotland, and Ireland, . . . with our hands lifted up to the most high God, do swear: That we shall sincerely, really, and constantly, through the grace of God, endeavor, in our several places and callings, the preservation of the Reformed Religion in the Church of Scotland, in doctrine, worship, discipline, and government, against our common enemies; also the Reformation of Religion in the kingdoms of England and Ireland in doctrine, worship, discipline, and government, according to the Word of God and the example of the best Reformed churches; and we shall endeavor to bring the churches of God in the three kingdoms to the nearest conjunction and uniformity in Religion, Confession of faith, form of Church government, Directory of Worship and Catechising, that we and our posterity after us may, as brethren, live in faith and love, and the Lord may delight to dwell in the midst of us."

The immediate occasion of the Solemn League and Covenant was the joint application of the Long Parliament and the Westminster Assembly of Divines to the Scotch Convention of Estates and the General Assembly, then in session at Edinburgh, for effectual aid in the war against the usurpations of Charles I. The English desired a civil league, the Scotch a religious covenant, having been used to the system of covenanting from the days of the Reformation. Both schemes were combined, and the religious feature made prominent. Alexander Henderson, the moderator of the General Assembly, and a man second only to Knox in the esteem of the Scotch people, drew up the document. It was unanimously ratified by the General Assembly and the Convention of States Aug. 17, 1643. The people went into it with the *perfervidum ingenium Scotorum*, and signed it with eagerness all over the country, from city to city, from village to village, from parish to parish. The members of both houses of the Long Parliament and the divines of the Westminster Assembly adopted and solemnly signed the Covenant in St. Margaret's church, under the shadow of Westminster Abbey, Sept. 25, 1643. The adherents of Parliament throughout England followed the example, notwithstanding the king's prohibition. The two countries entered into a treaty Nov. 29, 1643, by which the Scotch promised, on the basis of the Covenant thus ratified, to furnish an army of 18,000 foot, 2000 horse, and 1000 dragoons, for the common war against royal and prelatical tyranny; England to refund the expenses after the conclusion of peace. The united army fought and conquered under the banner of the Covenant. But the positive end was not attained, and was in fact unattainable. No human power could bring England and Scotland under one system of doctrine, government, and worship. Presbyterian uniformity was as impracticable and undesirable as Episcopal uniformity, and could only be conceived of in an age which had no idea of toleration and liberty of conscience. The Covenant was weakened in England by the dissensions between Presbyterians and Independents and the establishment of the Commonwealth under Cromwell. The Scotch still adhered to the monarchy and favored its restoration. With the Restoration the Solemn League lost its significance, and was burnt by a hangman (1662). Charles II. had indeed twice signed it and sworn to it in exile—at Spey June 23, 1650, and at his coronation at Scone Jan. 1, 1651—but he broke his oath as soon as he ascended the throne in 1662, and re-established the royal supremacy and episcopacy, not only in England, but even in Scotland. The Covenanters or Cameronians continued to adhere to the Solemn League, and fought for it with the heroic spirit of martyrdom through all those troubled times,

"Whose memory rings through Scotland to this hour."

(See the relevant chapters in the general histories of Scotland (Burton, etc.) and England; the special histories of Puritanism by Neal, Marsden, etc.; the histories of the Church of Scotland by Cunningham, Stephens, Hetherington, etc.; also Baillie's *Letters and Journals* (ed. by Laing); John Stoughton, *The Church of the Civil Wars*, i. 293, 320; Masson, *Life of John Milton*, iii. 6–15.) PHILIP SCHAFF.

**So'lenhofen Beds,** a famous group of lithographic slates of the Middle Oolite, found at Solenhofen in the Pappenheim district, near Eichstadt in Bavaria. They not only afford the best lithographic stone, but they are singularly rich in well-preserved fossils, including many insects, several saurians, seven species of *Pterodactylus*, and the wonderful bird ARCHÆOPTERYX (which see).

**Solenocon'chæ** [Gr. σωλήν, "channel," and κόγχη, "shell"], mollusks belonging to the class Gasteropoda, subclass Prosopocephala, of which they form the thirteenth order. (See CONCHOLOGY and GASTEROPODS.)

**Solenog'lypha** [from Gr. σωλήν, "tube," and γλυφίς, "notch"], a sub-order of ophidians, including venomous serpents. The superior maxillary bones are excessively abbreviated anteriorly and posteriorly, and thereby assume a vertical aspect, and are thus adapted to support the venom-fangs; they are each united to the anterior frontal at its upper extremity and to the ectopterygoid at the lower extremity of its posterior face by ginglymoid articulations; the fangs (except in *Causus*) are completely tubular, by reason of the obliteration of all external trace of the enfolded canal and the complete enclosure of the poison-channels. Other characters are attributed by Cope, but given as "not universal"—*e. g.* the tympanic bones are much elongated, and thereby entail a great breadth of the head behind, and the contradistinction between it and the neck, so conspicuous in the familiar species; a deep pit; the pupils of the eyes are generally erect and elliptical; the occipital region is scaly. The sub-order includes the most poisonous and dreaded snakes, at least of America, for some equally dangerous in Asia, Australia, and Africa belong to the sub-order Proteroglypha. By Cope four families are recognized—viz. (1) Crotalidæ, including the rattlesnakes and copperheads; (2) Viperidæ, typified by the vipers of Europe and Africa; (3) Causidæ and (4) Atractospidæ, small groups represented by African snakes. THEODORE GILL.

**Solenos'tomi** [from Gr. σωλήν, "tube," and στόμα, "mouth"], a sub-order of the order Lophobranchii, contradistinguished from the Syngnathi by the development of two dorsal fins, the anterior of which has simple and the posterior articulated rays, as well as by the existence of ventral fins. THEODORE GILL.

**Solenostom'idæ** [from *Solenostomus*—σωλήν, "tube," and στόμα, "mouth"—the generic name], a family of fishes of the order Lophobranchii. The body is compressed and has a short tail; the armature is developed as large star-like ossifications covered with a thin skin; the head is produced into an elongated tube forward; the mouth is small, and at the extremity of the tube; the branchial apertures are very narrow; branchiostegal rays four and very fine; dorsal fins two, on elevated bases, the anterior with five inarticulated rays; the posterior with many articulated rays; anal fin elongated, also on an elevated base; caudal fin elongated; pectoral fins well developed; ventral fins arising opposite the anterior dorsal, close together, and

each with seven rays; in the males they are free, but in the females they coalesce by their inner sides with the integuments of the breast, and a large egg-pouch is thereby formed. The vertebral column has about eighteen abdominal and fifteen caudal vertebræ; the intestinal canal is simple, and has a stomachic dilatation, but no pyloric appendages. The family is represented by a single known genus (*Solenostomus*) of three species, all of which are inhabitants of the Asiatic seas, one (*S. cyanopterum*) ranging from Zanzibar to China, while the others (*S. paradoxum* and *S. brachyurum*) are confined to Amboyna. According to Günther, "There is a peculiar provision for the retention of the eggs in the sac, and probably for the attachment of the embryo. The inner walls of the sac are lined with long filaments, arranged in series along the ventral rays, and more numerous and longer at the base of the rays than in the middle of their length, behind which they disappear entirely." These are most developed when eggs are in the sacs, and some are about half an inch long and have mamilliform appendages. THEODORE GILL.

**Solesmes′,** town of France, department of Nord, manufactures calicoes, handkerchiefs, felt hats, and earthenware. P. 6000.

**Soleure′** [Ger. *Solothurn*], canton of North-western Switzerland, comprises an area of 255 sq. m., with 74,713 inhabitants, of whom 62,072 are Roman Catholics and 12,448 Protestants; they all speak German. The surface is covered by offshoots of the Jura Mountains, which here are very rich in iron and marble. The soil is fertile, and produces more corn and wine than demanded for home consumption. Rearing of cattle, sheep, and swine is extensively carried on. Manufactures are confined to iron goods, glassware, and watches.

**Soleure** [Ger. *Solothurn*], an old town of Switzerland, capital of the canton of Soleure, at the foot of the Jura Mountains, on both sides of the Aar. It has a fine cathedral, several interesting museums and collections, and manufactures of linen, tobacco, and watches. P. 5916.

**Solfeggio.** See SOLMIZATION.

**Solferi′no,** village of Northern Italy, province of Brescia, is celebrated for the battle in which the French and Italians utterly defeated the Austrians (June 24, 1859).

**Sol′ger** (KARL WILHELM FERDINAND), b. at Schwedt, Prussian province of Brandenburg, Nov. 28, 1780; studied at Halle and Jena; was appointed professor of philosophy at Berlin in 1811. D. there Oct. 20, 1819. He wrote *Erwin, Vier Gespräche über das Schöne und die Kunst* (2 vols., 1815), and *Philosophische Gespräche* (1817). His posthumous writings and letters were edited by Tieck and Raumer (1826), his *Vorlesungen über Æsthetik* by Heyse (1829). In 1808 he published an excellent translation of Sophocles. His treatises on beauty and art may be considered as representative of the ideas of the romantic school.

**Soli.** See CILICIA.

**Solic′itor** [Lat. *sollicitator*], an officer of the court of chancery, corresponding to the attorney of the common-law courts, whose function is to bring and defend suits therein on behalf of litigant parties. Until very recently the solicitors and the attorneys were distinct branches of the legal profession in England. The statute of 23 and 24 Vict. ch. 127 (1860) provided for the admission of persons as attorneys and solicitors after serving a specified period of clerkship and passing an examination, but no one could practise in the courts of equity until he had been enrolled as a solicitor. The recent consolidation of all the higher courts of England into one "supreme court of judicature" (1875) has produced a corresponding amalgamation or identification of these two professional classes—the attorneys and the solicitors—into one. In the very few States of this country where a separate court of chancery exists—as in New Jersey—the office of solicitor is retained, although each member of the bar may, and usually does, become an attorney of the law-courts, a solicitor in chancery, and a counsellor in both. In the great majority of the States no such division is even nominally kept up, and the lawyer upon his admission acquires at once the functions of the English attorney, solicitor, and barrister.
JOHN NORTON POMEROY.

**Solids** [Lat. *solidus*], in geometry, magnitudes having three dimensions, length, breadth, and thickness, in contradistinction to surfaces, which have only two, length and breadth, lines, which have only one, length, and points, which have none. In physics that state of matter in which the attractive force of the molecules is greater than the repulsive, in contradistinction to that in which the two forces are nearly equal, and which is called *liquid*, and that in which the repulsive is greater than the attractive, and which is called *gaseous*.

**Sol′idus** [Lat. for "solid"], the later Latin name for the Roman gold coin called *aureus*. Originally worth about $5 of our currency, its weight and value gradually declined, while *aurum* seems to have become *cuprum*, until the French *sol* or *sou*, one of its representatives, was worth less than one cent. The *soldi* formerly struck in Italy were also historical representatives of the old *solidus*. (See SOLDIER.)

**So′lingen,** town of Rhenish Prussia, was famous for its manufactures of iron and steel goods, especially sword-blades, in the Middle Ages, and it has maintained its reputation. In the town and circle 8000 men produce 1,000,000 pairs of scissors, 2,000,000 dozen knives, and 500,000 sword-blades annually, which are sent to almost every market in the world. P. 14,040.

**Soli′nus** (CAIUS JULIUS), surnamed GRAMMATICUS, lived in the latter part of the second or the first part of the third century, and wrote a work, still extant, under the title of *Polyhistor*, in which he gives a brief sketch of the world as it was known to him, accompanied with historical notices and remarks on the origin, habits, religious rites, and social condition of the various nations. The whole, however, is derived from the *Natural History* of Pliny, and has no independent value. In the Middle Ages the book was much read. Editions by Salmasius (1689) and by Götz (1777), and an English translation by Golding (1587).

**So′lis, de** (ANTONIO), b. at Alcalá de Henares, Spain, July 18, 1610; was educated for the law at the University of Salamanca; produced at the age of seventeen his successful comedy, *Amor y Obligacion*, which revealed such poetical talent as to introduce him to the notice of Calderon and to determine his vocation for literature; enjoyed the patronage of the count of Oropesa, viceroy of Navarre, who made him his secretary; obtained a lucrative post in the state department 1642; was appointed secretary by Philip IV. about 1655, and historiographer of the Indies 1665; wrote a celebrated *Historia de la Conquista de Mexico* (1682), more valuable as a Spanish classic than as an American history; took holy orders 1666, and thenceforth wrote chiefly on sacred subjects. D. at Madrid Apr. 19, 1686. Among his comedies, *Triumfos de Amor y Fortuna*, *El Alcazar del Secreto*, *La Gitanilla de Madrid*, and *Un Bobo hace Ciento* are esteemed masterpieces. A volume of lyrics, *Varias Poesias*, appeared in 1682, and a posthumous collection of fourteen plays in 1732, and a volume of his letters 1737. There are many editions of his *History*, which has enjoyed great popularity in French and Italian versions, and was translated into English by Thomas Townsend (London, 1724).

**Solis, de** (JUAN **DIAZ**), b. at Lebrija about 1470; became a skilful pilot; accompanied Vicente Gomez Pinzon upon the voyage in which he is supposed to have discovered Yucatan (1506), and again in the exploration of the northern coasts of Brazil 1507–08; was appointed royal pilot on his return to Spain; was sent with Pinzon on a new voyage of exploration in South America, in which they reached lat. 40° S.; was deprived of his post and thrown into prison 1509, in consequence of a quarrel and lawsuit with Pinzon; was appointed chief pilot on the death of Vespucius, and in 1512 was allowed to equip at private expense another squadron, with which he discovered the Rio de la Plate, and returned there three years later, when he was murdered by Indians on the northern bank of that river (then called "Rio de Solis"), near Maldonado, in 1516.

**Solitaire′,** the *Pezophaps solitaria*, a bird formerly inhabiting the island of Rodriguez, near the Mauritius. When the island was settled by the French Huguenots in 1691 it was found abundantly. It was something larger than the turkey, and did not use its wings for flight. It was a slow runner, and defended itself with its wings and beak. Its flesh was good. A rude wood-cut, a description by François le Guat, and a few bones are all that remain of this bird. It is generally supposed to have been of the dodo family, but may have been of the ostrich tribe.

**Solitaire,** a kind of puzzle, consisting of a disk with thirty-three hollows, all but one of which contain a single ball. The game is to jump over and remove each of these balls, going over only one ball and two spaces at a move, and never moving diagonally, until only one ball remains. The game is to be played by a single person, whence the name. There is also a game called solitaire, which is played by a single person with ordinary playing-cards.

**Soller′,** town of Majorca, on the north-western coast of the island, has a good harbor and exports large quantities of oranges and other kinds of fruit. P. 6990.

**Sol′ly** (EDWARD), F. R. S., b. in London, England, Oct. 11, 1819; educated at Berlin; became chemist to the Royal Asiatic Society 1838, lecturer at the Royal Institution 1841, and professor of chemistry in the Military College at Addiscombe 1845; gave especial attention to the applications

of chemistry to agriculture and technology; is author of many scientific memoirs and of *Rural Chemistry* (1843) and *Syllabus of Chemistry* (1849).

**Solly** (SAMUEL), M. D., b. in England in 1805; became a distinguished London surgeon; was lecturer on practical anatomy at St. Thomas's Hospital 1833–39, assistant surgeon of the same institution 1840, and surgeon 1850; member of the council of the Royal College of Surgeons 1856; professor of human anatomy and surgery 1862, and member of the court of examiners and senior vice-president 1867–70. D. in London Sept. 24, 1871. Author of *The Human Brain, its Configuration, Structure, Development, etc.* (1836), and *Surgical Experiences* (1865).

**Solmiza'tion, Solfeggio,** or **Solfaing** [Fr. *solmisation*, from the notes *sol, mi*], in music, the art of giving to each of the seven notes of the scale its proper sound or relative pitch. The acquiring of a true intonation of the scale, first by regular gradation upward and downward, and then by skips from one degree to another, is an object of primary importance in vocal music. To facilitate this, various expedients have been devised, but chiefly the association of the several sounds with articulate utterances, such as the numeral words, *one, two, three,* etc. Many centuries ago certain syllables, void of any special meaning, but containing the several vowel sounds, were selected for this purpose, and have since come into general use. Their origin is referred to Guido, a monk of the tenth century, who derived them from the initial syllables of words in a popular hymn. (See GAMUT.) These syllables, originally six in number, were *ut, re, mi, fa, sol, la,* to which the syllable *si* has since been added for the seventh of the scale. In the course of time objection was made to the syllable *ut,* on the ground of its want of euphony; and in consequence it was rejected by the Italians, who substituted for it the syllable *do.* With these modifications the system of Guido is received in the schools both of Italy and England, whence it has come into use in the U. S. and other parts of America. WILLIAM STAUNTON.

**Solmo'na** [*Sulmo*], town of Italy, province of Aquila degl' Abruzzi, in the plain S. W. of Chieti. It is not an ill-built town, and among other respectable edifices the cathedral and the church of the Annunziata are especially noteworthy. Sulmo was one of the towns which experienced the terrible vengeance of Sulla for having taken part with Marius; it was also several times almost utterly destroyed by the barbarians, but again rose to prosperity under the Normans. The bishop of Solmona is immediately subject to the Holy See. P. 15,019.

**Solo'fra,** town of Italy, province of Avellino, pleasantly situated in a valley in the midst of the Apennines, about 12 miles N. E. of the town of Avellino. Solofra is remarkable for the skill of its goldsmiths, and especially for the delicacy of the gold-leaf produced by them. The leather manufactured here is also of a superior quality. Many other articles are made by the inhabitants, who are exceptionally intelligent and industrious. The ruins of the ancient *Sabatium,* the refugees from which are said to have founded Solofra, are traceable in the neighboring flats of the Ogliara. P. 5771.

**Sol'omon,** tp., Cloud co., Kan. P. 513.

**Solomon,** tp., Saline co., Kan. P. 581.

**Solomon** [*Shĕlômô, Salômôn, Salomo, Suleiman*], probably the last son of David and second child of Bathsheba, b. 1033, called by the father Solomon, "the peaceful one," in token of the peace of the kingdom or his own peace of mind; called by Nathan, in token of David's forgiveness, Jedediah, "the darling of the Lord" (in which to the father's name the name of Jehovah is added). His birth, name, and character had been foretold to David. His mother, once a willing adulteress, was crafty and ambitious. The child was trained by Nathan (Jehiel) the prophet-priest in all Hebrew learning; he afterward studied the learning of other nations. David had solemnly sworn to Bathsheba that Solomon should succeed him, and he openly proclaimed him king when Adonijah tried to seize the throne. He was soon after formally "established" (1015). He reigned thirty-nine years and six months. He at first pardoned Adonijah, but soon after slew him and Joab, banished Abiathar, and severely rebuked his own mother, who were all implicated in new intrigues, and slew Shimei, the last bitter leader of Saul's house. He began his reign humbly and wisely, asking God for wisdom, which was granted. In his fourth year he began his great work, the "house of the Lord." David had planned it after the tabernacle, and had gathered enormous treasures for it. In building, Solomon was helped by Hiram, king of Tyre, with timber and stone from Lebanon, and skilled artisans. It was completed in seven years, and its dedication was the crowning day of Jewish history, and in the service Solomon appears as the supreme head of the nation. He built his own palace from his seventh to his twentieth year. In it were the wonderful and beautiful "house of the forest of Lebanon," the tower of David, around which hung many golden shields, the porch, and the celebrated ivory "throne of the house of David." He peacefully consolidated the empire which his father had conquered, and recaptured, fortified, or built cities or stations for commerce or protection at strategic points—the towers of Lebanon, Hamath, Megiddo, Gaza, Bethhoron, Baalath, and probably Tadmor and Baalbec. He built reservoirs, aqueducts, many wonderful buildings, and laid out "paradises" and gardens. He started the hitherto pastoral or agricultural Hebrews on the new road of commerce, sending ships to "Ophir," India, and Arabia in the East from the new-built port of Ezion-geber on the eastern arm of the Red Sea, and from Jaffa and Tyre westward to "Tarshish," Spain, and England (?). He reorganized and enlarged the civil service of David. Many kings were his tributaries; untold wealth and the wonders and curiosities of many countries flowed into or through the land, so that "silver was nothing accounted of in his day." Everywhere there were signs of great delight and prosperity. Many foreigners were attracted by his splendor and wisdom, notably Balkis (?), the queen of Sheba, with her marvellous retinue. His harem grew to number 1000 inmates, and thus to accord with Oriental ideas of his royal magnificence. Contrary to the law of Moses, he not only multiplied wives, but by his marriages formed alliances with many heathen nations. He married a daughter of Pharaoh (Vaphres, Psusennes?). In his old age his "strange" wives led him to commit or permit gross and vicious idolatry. He allowed the worship in sight of the Lord's house, led thereto by his "liberal" views and motives of state policy. Before his death, Edom and Syria revolted, tribal jealousies arose in Israel, and Jeroboam, formerly a superintendent of building, began to plot the division of the nation, in which he was aided by the alienation of the people coming through the intolerable oppression and taxation that were necessary to meet the enormous expenses of the court. He left one son, Rehoboam, who succeeded him, and from whom ten tribes revolted. Solomon appears as a person of fascinating beauty and grace, impetuous, generous, sympathetic, and at first humble; of fine humor, noble intellect, endowed with the prudence of his father's family and the almost supernatural sagacity of his mother's grandfather, Ahithophel; a man of broad views, a far-sighted statesman, most learned in the science of the day (from his writings the rabbins say Aristotle drew all his philosophy (?), and in the East he has always been regarded as the master of all magic). He was an organizer of splendid executive powers, a great builder and artist, poet, philosopher; and had from the Lord pre-eminently "an understanding heart to judge." In religion he was first devout, then æsthetic, then formal, then indifferent, then idolatrous. He was in later life guilty of great oppression and a growing disregard of human rights. He followed the evil example of David in the matter of polygamy, thereby destroying family sanctity and leading the people to impurity; above all, he forsook Jehovah and followed strange gods. The question of his repentance has been greatly discussed. Against it is urged the silence of the Bible and the mere philosophical results to which he comes in Ecclesiastes. This view has been held by Tertullian, Cyprian, Gregory the Great, Augustine, and the Latin Fathers generally. For it is urged, Neh. xiii. 26; God's covenant in 2 Sam. vii. 14; Ps. lxxxix. 30 +; the final teachings of Ecclesiastes, and the typical relation he bears to the Messiah. This view is favored by Irenæus, Hilary, Cyril, Ambrose, Jerome, and the Greek Church generally. Solomon appears as a voluminous author; his extant writings are Proverbs, Ecclesiastes, and the Song of Songs. ISAAC RILEY.

**Solomon Ben Gabirol,** a Jewish philosopher and poet, b. in Malaga, Spain, about 1020; lived for a time at Saragossa; wrote a Hebrew hymn, *Kether Malkuth* ("Crown of Royalty"), which has been incorporated into the Hebrew liturgy. His philosophical works were written in Arabic, one of them, the *Source of Life,* being cited by several Christian writers of the Middle Ages, the name of the author appearing as Avicebron, Avencebrol, and other corruptions of the Heb. "Ben Gabirol" or the corresponding Arab. "Aben Gebiol." D. at Valencia (or, according to some, at Ocaña) about 1075.

**Solomon Ben Isaac,** surnamed YARKI or IARCHI, and generally known under the name of RASHI, an abbreviation of RABBI SHELOMOH YITZ'HAKI, b. at Troyes, France, about 1040; became rabbi at the synagogue, and d. there July 13, 1105. He wrote commentaries on the Talmud and the Bible which rank very high in Jewish theology. His

commentaries on the Bible have been translated into Latin by Breithaupt (3 vols., Gotha, 1710–14), and parts of them into German—Genesis by Hayman (Bonn, 1833) and the whole Pentateuch by Lucas (Prague, 1833–38).

**Solomon City,** p.-v., Dickinson co., Kan., on the Kansas Pacific R. R. and Solomon River, 100 miles W. of Topeka, has 3 churches, good schools, 1 newspaper, several flouring-mills run by water-power, and 2 hotels. Salt and gypsum manufacturing is carried on.

WILSON & ADMIRE, EDS. "GAZETTE."

**Solomon Islands,** a group of islands in the Pacific Ocean between New Britain and Queen Charlotte's Islands, and between lat. 5° and 12° S. Although they were discovered in 1567 by Mendana, they are as yet very little known. The inhabitants are negrillos, and very savage. They are cannibals.

**Solomon Rapids,** tp., Mitchell co., Kan. P. 65.

**Solomon's Seal,** a popular name for the liliaceous herbs of the genera *Polygonatum*, *Smilacina*, and *Majanthemum*. They are found in both continents, and there are quite a number of species, some common to Europe and North America. The roots are popularly esteemed as a vulnerary, and have some use in domestic medicine. The name properly belongs only to the species of *Polygonatum;* the "seal" is the circular depressed scar left on the root-stock by the death and separation annually of the flowering stem.

**Solomon, Song of.** See CANTICLE.

**Solomon's Temple.** See JERUSALEM, by REV. HOWARD CROSBY, S. T. D., LL.D.

**Solomon, Wisdom of.** See WISDOM, BOOK OF.

**So'lon,** p.-v., Big Grove tp., Johnson co., Ia., on Burlington Cedar Rapids and Minnesota R. R.

**Solon,** p.-v. and tp., Somerset co., Me. P. 1176.

**Solon,** tp., Kent co., Mich. P. 911.

**Solon,** p.-v. and tp., Cortland co., N. Y. P. 872.

**Solon,** p.-v. and tp., Cuyahoga co., O. P. 899.

**So'lon,** the son of Exekestides, filled the office of first archon in Athens (Ol. 46, 3; B. C. 594), and in that capacity established there the constitution framed by him. This is the best-attested circumstance in the life of Solon, for which Plutarch is the principal authority. Plutarch's sources of information were the Alexandrian grammarians, especially Didymos Chalkenteros, the most copious of all compilers, and among the older biographers Hermippos: most important of all are the fragments of Solonic poems which Plutarch has taken up literally into his narrative. The section of Aristotle's *Politica* (ii. 12) which treats of the legislation of Solon is a compilation of later date. Solon is the noblest representative of the many-sidedness which distinguished the Athenian more than all other Hellenes. An Eupatrid by birth, he engaged also in trade and commerce by sea—a combination of activities usual in the Grecian coast-cities, especially Korinth and Athens. By this means it was possible for him, after finishing all exercises, as well in music and poetry as in gymnastics, to become acquainted with the entire coast-world of the Archipelago. It was a time of fermentation in society; Psammetichos had opened the Nile-region to the Greeks (B. C. 666); the first money had been coined in Ægina; navigation took all at once a gigantic stride forward; young adventurers gained in a few years great riches, and those parts of the communities engaged in trade took form as a new middle class, and stood defiantly opposed to the ancient families; property in land was outstripped by movable capital; around Athens on all sides—in Argos, Korinth, Sikyon, Megara—the old system of things had been broken, the ruling families had been overthrown, and through the downfall of the constitutions single tyrants had come to power, who shone by their riches, employed mercenary troops, and pursued a narrow policy of self-aggrandizement. In this revolutionary time, spite of all splendor, the best possessions of the nation were endangered—namely, the free citizen class and the sovereign authority of the law. For this reason Solon deemed it the work of his life to give his native city the benefit of all progress in culture which the times offered, without causing her to break with the past and be exposed to the deplorable evils connected with a revolution. A written criminal code, such as Drakon had issued (B. C. 621), was not able to supply the want; a thorough, peaceful reform of the state was needed, which should reconcile the differences which tore the communities asunder. This was the thought of Solon: like all best reformers, he was, to use Aristotle's expression, one of the "middle citizens" (*μέσοι πολῖται*), who, standing outside of and above parties, are alone in a position to secure the proper adjustment of their differences. For a moral and political renovation of the state was needed more than all else a vigorous self-consciousness. But the Athenians were feeling depressed; Megara held possession of Salamis, and was consequently mistress of the sea; the Athenians were like captives in their own land, and in deep despondency had renounced their own coast-islands. Inflamed by Solon's inspiring poetry, they conquered Salamis (*circa* 604). This was a turning-point for the history of Greece. From that day Megara sank, and Athens rose resistlessly to power. The second step was the summoning of Epimenides from Krete, whose extraordinary personality served to expiate the previous civil dissensions and regulate anew the religion of the city. The reform in the worship of Apollo is probably connected with this event, for in earlier time Apollo was merely the god of the Ionian nobility—a patrician god. It was therefore a real advance toward unity that all citizens now sacrificed to Apollo, and that the religious distinction between Ionians and non-Ionians in Attica was set aside. By this means also Athens was connected anew with Delphi; and after freedom had been established within her own borders, she engaged, under the leadership of Solon and in alliance with Sikyon, in the "holy war" (*circa* 600) to defend the rights of the Delphic god.

Solon was the first man in Athens: he was at liberty to secure for himself absolute power for life, but it was his firm resolve to accomplish his purpose without any violation of law. As recognized mediator between all parties, and solely by the force of his genius, his impressive words, and his pure personality, he carried out the most important reforms, applying them to the evils of society at the very root. The radical evil was that the small land-owners were hopelessly in debt. Owing to a hard debtor-law, they forfeited even their freedom; a wretched proletariat was thus formed, and the land fell more and more into the hands of the great capitalists. Solon caused Athens to alter its standard of coinage (probably after the example of Korinth) by adopting also for silver the Eubœan gold-standard. The result was a lighter drachma, in which debts could be legally paid, so that the poor obtained a relief of 27 per cent. Other measures of alleviation were also introduced: the debtor-laws were made milder, and fixed limits set to the acquisition of large estates; and the surprisingly great success of this legislation (Seisachtheia) in lightening the burdens of the people is most plainly attested by the glorious poem of Solon, in which he calls Mother Earth to witness that she has been happily freed from the burden of many pawn-pillars (which were set up in the ground as tokens of alienated lands). Then followed the great political reform—the conversion of the state, ruled by families, into a timocracy. Here also it is probable that the way had been led by Korinth, the city from which the Romans borrowed their regulation by which the citizens were divided into property-classes. But the measure adopted was not movable capital, but the net proceeds of property in land, by far the greater share of which was in the hands of the noble families. It seemed to them, therefore, only a new guaranty of their privileges that none could hold office as archons except the members of the first class, the Pentakosiomedimni (with a minimum of 500 bushels of barley net income, corresponding to a taxable capital of 6000 drachmæ or one talent), while the citizens of the second class, the knights, with 300, and those of the third (Zeugitæ), with 150 medimni as minimum of each year's income, had access to the council and to the remaining offices. The mass of the people, the Thetes, who did not belong to the three classes, could not become members of the council nor fill any office, but took part in the public assemblies. No one, therefore, was excluded from public life, and even the meanest helped frame the laws which he had to obey. The prerogatives of the first class were also no longer dependent upon birth, but could be forfeited by a careless domestic economy, and won by others through industry. The love for agriculture was encouraged, the worth of landed property was increased, and even commoners could take full share in the management of public affairs if they reached that degree of prosperity which seemed necessary for the attainment of culture and independent leisure. The rating of the citizens was not done with a view to a regular assessment, but merely served as a standard for determining what each could do for his native city in case of need. The council of 400, representing the three classes, and which, changing every year, administered the current business of government, was a political school for the citizens, and made a rupture between government and people impossible. It was the organ of contemporary progress, while the Areopagus, to which the experienced men of affairs were advanced, kept a conservative check on progress. The latter body could at discretion exercise a plenary power in controlling the commonwealth and in interposing to prevent any dangerous departure from custom. In law, the important reform was carried through that the archons could no longer render final decision in

suits, but that appeal to the commonwealth could be made in every case. The statutes by which the sacred, public, and private law was administered were inscribed on three- and four-sided wooden frames, and brought to the notice of all. On private life also the laws took a firm hold: they emancipated the citizen from the family; they gave to the head of every household the free disposal of his acquired property; they allowed the claims of aged parents on their children for maintenance only on the condition that they had given them a careful education; they checked the luxurious adornment of tombs and extravagant display in the dirges for the dead.

In all his reforms Solon's purpose was to purify the public morals, banish all barbarous influences, and bring to perfection whatever was peculiarly Hellenic. He united religion, state, and house in a harmonious whole; every citizen was made responsible for the commonwealth, and on the other hand the prosperity of the state was based upon the stability of the family. The legislation of Solon is the greatest work of art which political wisdom has produced, the clarified expression of the Athenian consciousness—a work based upon the needs of the times, inasmuch as Solon gave a place in his laws to whatever of good had struggled to the light in the time of the tyrants, while he avoided violence and lawlessness like theirs. It is true that Solon's external success was slight, and he himself was to live to see a tyranny in Athens, but his laws remained in force; they protected the city like a palladium, and up to the latest times the Athenians found their better self in Solon's laws.

After the decisive year of office, during which he ruled Athens with dictatorial power, Solon is said to have travelled ten years in foreign countries—a tradition not unworthy of belief, even though the stories of his meeting with Kroisos, Amasis, etc., are apocryphal. People are fond of exemplifying in single persons the distinction between Hellenes and barbarians, which reached its full expression in Solon. Solon lived retired in Athens until his death (*circa* 55, 2; 559), surrounded by a narrow circle, of whom Mnesiphilos, the teacher of Themistokles, was one. Solon is the most attractive and venerable figure which the history of the Hellenes can show. He was a poet of the first order, a sage, a statesman who knew how to realize practically the most ideal aims—a character unstained and virtue-proof.

ERNST CURTIUS.

**Solor',** an island of the Malayan Archipelago, off the eastern extremity of Flores, in lat. 8° 47′ S., lon. 123° 8′ E. Area, 105 sq. m. P. 15,000, who are mostly engaged in fishing and trading. Sulphur and edible birds' nests are the principal articles of exportation. The inhabitants are Malays, partly Mohammedans, partly Christians.

**Solothurn.** See SOLEURE.

**Sol'stice** [Lat. *sol*, "sun," and *sistere*, to "stand" or "cause to stand," in the sense of stopping or arresting motion]. The inclination of the earth's equator to the ecliptic or plane of its annual motion about the sun is the cause that the latter is during one-half the year on the northern polar side of the equator, the other half on the southern, causing the vicissitudes of summer and winter to the respective hemispheres. The distance from the sun N. or S. of the equator (or DECLINATION, which see) is thus constantly varying. The two points at which this apparent northern or southern motion ceases (or at which its progressive increase of declination appears to be *arrested*) are the summer and winter solstices. At these periods the day is the longest or shortest, according as the earth is in the summer (June 21) or winter (Dec. 21) solstice. (See EQUINOX.)

J. G. BARNARD.

**Soluble Glass.** See WATER-GLASS.

**Solu'tion, Solvents,** and **Solubility** [Lat. *solvo*, sup. *solutum*, to "loose" or "release," to "set free," to "melt," to "enfeeble"]. Solution may be defined as the transformation of matter from either the *solid* or the *gaseous* state to the *liquid* state through the mediation of a liquid which is called the *solvent*. Solution may therefore be stated as *combination* of a liquid with either a solid or a gas to form a *homogeneous* liquid. (See LIQUIDS, by HENRY WURTZ.)

An important question in chemistry has always been to define solutions in a chemical sense. The universally-admitted conception of chemical combination involves *definite proportions* of the constituents, any excess of one or the other remaining as a mere mechanical admixture. In solution we have, however, combination to a homogeneous whole in proportions which within certain limits appear indefinite, and subject to no law as yet recognized in our books. While, also, in the formation of recognized chemical compounds there are sudden and enormous leaps or fluctuations of equilibrium between different kinds of matter brought into juxtaposition, following upon changes of temperature and other conditions which involve always definite quantities or weights of matter, in the case of solutions, on the contrary, we apparently have a justification of the dogma of Linnæus, that *Natura non facit saltum*, there being here a *gradual* passage from one condition of equilibrium to another. There are few more difficult subjects than this in all science up to this time; and to account for the phenomena of *true* solutions—cases in which two liquids, or a solid and a liquid, are found to unite to a homogeneous liquid compound without *condensation or expansion of volume*, and without *rise or fall of temperature;* cases which are undoubtedly common—we can only resort to the supposition that these are what may be called uniform molecular mixtures, or a mechanical mingling of the chemical molecules of the two bodies, without acting chemically on each other to form new kinds of molecules—a state of things hard to understand when the two bodies have differing densities.

The writer is one of those who find it impossible to admit that those other cases of solution (so called) in which changes occur of *volume* and of *temperature*—cases which are equally common—can be anything more or less than ordinary combinations between the atoms of the solvent and of the body dissolved to form new chemical molecules. The mere fact that in many cases it has not been found possible to isolate the new compounds in *crystalline* forms, or to identify them in other ways, appears to be wholly immaterial, even as negative evidence, as to their non-existence. It will undoubtedly be found, when the elaborate thermo-chemical researches now in progress by several eminent chemists have reached a sufficiently advanced stage, that the maximum evolution of heat in all such cases will correspond to definite equivalent combinations, thus furnishing positive evidence of the view here taken. This, indeed, has already been found in no unimportant number of cases. In the mean time, this question has been attacked by the writer from a position in some measure distinct from that of thermo-chemistry, though closely related thereto—that of volumic chemistry; and such investigations have satisfactorily proved that those cases of solution involving change of volume conform to the same new geometric law which he has found to govern other chemical combinations.*

(See VOLUMES, MOLECULAR.)

HENRY WURTZ.

**Sol'way Frith,** an inlet of the Irish Sea, 33 miles long, from 2½ to 20 miles broad, and forming the boundary between England and Scotland. It is noted for the swiftness and strength of its ebb and flow, the spring tide rushing in with a wave from 3 to 6 feet high, and with a speed of from 8 to 10 miles an hour. It receives the Esk, the Derwent, and several minor streams.

**So'lyman II., the Magnificent,** sultan of the Ottoman empire 1520–66, b. about 1495, a son of Selim I., whom he succeeded. His reign denotes the culmination of the power and prosperity of the Turkish empire, and he himself was one of the greatest characters the Turkish nation has produced. He possessed eminent military and administrative talents, and was personally a man of many great virtues and some fine attainments. He had a real love of justice, never broke his word, was honest in all his dealings, and worked with zeal, and not without success, for the introduction of justice and honesty in the Turkish administration; his countrymen call him *Kanuni*, the "lawgiver." He was industrious and energetic, and the goal of his gigantic exertions was by no means the mere gratification of his personal ambition; he knew what the organization of a strong people, the establishment of a solid empire, meant. He was temperate in his habits, prudent in his expenses, and well informed. He studied mathematics, and had a real enthusiasm for history. Under him the Turkish language superseded the Persian at the court and in literature. Even his vices—his violence, which came like a hurricane, and his cruelty, which shrunk at no amount of blood and flame—characterized his race and his religion rather than himself personally. During the first part of his reign he was much occupied in the southern and eastern parts of his dominion. He quelled an insurrection by Ghazali Bey in Syria in 1521, another by Ahmed Pasha in Egypt in 1523, and made three campaigns against Persia, of which the second (1534–36) and the third (1548–50) occupied several years and resulted in the conquest of Armenia, Georgia, Irak, and Shirvan. But these undertakings were merely disturbances and diversions; his real ambition and policy were directed toward Western Europe, and more than once European civilization and Christendom

*Our American chemist, Sterry Hunt, in a paper published in the *American Journal of Science* for Mar., 1853, put forth the following remark, far in advance of that day: "Solution is chemical union, as is indicated by the attendant condensation; mechanical mixtures are not accompanied by any change of volume." A highly interesting discussion of the subject of *solution*, with many original suggestions, by another American chemist, Isidor Walz, will be found in the *American Chemist* for Feb., 1875.

were seriously endangered by his victories. Europe had two bulwarks against the Turks—Hungary, inhabited by a chivalric, warlike race, which, although allied to the Turks, hated them as only brothers can hate; and Rhodes, where the Knights of St. John were settled. But in 1522, Solyman expelled the knights from Rhodes, and in 1526 he completely routed the Hungarians at Mohacz. The way to Western Europe stood open to the Turks, both along the Danube to Germany, and across the Mediterranean to Italy and Spain. Solyman tried both roads, but found in both the same hinderance. In 1527 he supported John Zapolya in Hungary against Ferdinand of Austria, took Buda in 1529, and appeared before Vienna with an immense army. But Vienna he could not take; the art of siege he did not understand. Four times he tried in vain. After losing over 100,000 men, he gave up the attempt, and concluded peace, retaining a large part of Hungary as a Turkish province. The war was afterward renewed several times. Solyman conquered Croatia, separated Transylvania from Hungary, and established John Zapolya's son, John Sigismund, as ruler there; won many battles against the Hungarians and Austrians, but the fortress of Vienna he could neither take nor pass. In 1534 he appointed the famous Barbary pirate, Khair-ed-Din (generally called Barbarossa), admiral, and soon his fleet drove the Venetians away from their last possession in the Morea and the Archipelago, and conquered Tunis and Algeria, from which a descent was to be made on Italy and Spain. In 1535 an alliance was formed with France, and in 1542 a French-Turkish fleet pillaged Nice. A reconciliation afterward took place between Francis I. and Charles V., and the latter succeeded in reconquering Tunis, but the Turkish fleet swayed the Mediterranean along the whole northern coast of Africa, and the attitude of Turkey became more and more threatening. Meanwhile, Charles V. had given Malta to the Knights of St. John in 1530, and in 1557 they began to build and fortify the capital of Lavaletta. Solyman could not permit the formation of a strong military station at this point, and in 1565 led an immense armament against the city; but again his attempts in the art of besieging were foiled, and he was repulsed with great loss. In 1566, during a campaign in Hungary, while besieging the fortress of Sziget, commanded by Zrinyi, the difficulties in carrying this point threw him into a fit of rage, and apoplexy killed him Sept. 5, 1566. CLEMENS PETERSEN.

**Somali Land,** a territory of Eastern Africa extending along the Gulf of Aden and the Indian Ocean from Zeilu, in lat. 11° 18′ N., to the mouth of the Jub, in lat. 0° 14′ N. It is mountainous, rich in myrrh and incense, and inhabited by Arabic tribes, mostly nomads and very ill-famed on account of their savage and predatory habits. The principal port is Berbera, in lat. 10° 22′ N. It has an excellent harbor. During the hot season it is a deserted place, but in winter a large and lively city, built of tents and comprising a population of more than 20,000 people, who gather here to exchange the products of their industry.

**Somateria.** See EIDER DUCK.

**Somatol′ogy** [Gr. *σώματα*, "bodies," and *λόγος*, a "discourse"], that part of physical science which treats of the general properties of bodies or masses of matter. Somatology may also be called *molar physics*, but as we now draw most of our explanations of molar phenomena from molecular physics and from chemistry, the dividing line can scarcely be longer preserved. The space assigned for this head admits only of a synoptic catalogue or classification of the divisions of the subject, with a few partial definitions. The classification here adopted is substantially that of Prof. Joseph Henry, secretary of the Smithsonian Institution.

The general properties of bodies so far discovered are:

1, Extension, } necessary to our perception of matter.
2, Impenetrability, }
3, Figure, or form.
4, Divisibility.
5, Porosity.
6, Compressibility.
7, Dilatability.
8, Mobility, }
9, Inertia, } ultimate properties, according to the
10, Attraction, } molecular hypothesis.
11, Repulsion, }
12, Polarity.
13, Elasticity.

Except Nos. 8 to 11 inclusive, these properties are referable to the generally accepted hypothetical constitution of matter, as made up of *chemical molecules*. The above synopsis does not include the *peculiar* properties, not general, but special to these molecules—subjects of the science of *chemistry*, which investigates the properties and composition of *molecules*, or those collocations of ultimate atoms which combine to form chemical compounds.

*Extension.*—Bodies occupy or extend throughout space. Quantity of space is volume. Molecules must also occupy volumes. (See VOLUMES, MOLECULAR, by HENRY WURTZ.)

*Impenetrability* signifies that two bodies cannot occupy the same space simultaneously. In chemistry, the present writer believes that he finds (*American Chemist* for Mar., 1876, p. 342) evidence that impenetrability does not apply to chemical molecules, but that the essence of chemical combination resides in the possibility of two molecules coalescing into one, sometimes with condensation of volume, and therefore necessarily with occupation of the same space. This, however, is dependent upon the atomic hypothesis.

*Form.*—Figure or form is either organic or inorganic. The latter are either crystals or amorphs. (See ISOMERISM.)

*Divisibility.*—Infinite divisibility of *space* does not prove infinite divisibility of matter. Atoms, if existent, must be indivisible by man whatever space they may occupy. If they occupy space only by virtue of their motion or energy, this energy is doubtless indestructible by man. Even the simplest form of *molecule*, containing but atoms of one element, is doubtless indivisible by human power. Chemical facts, however, prove the divisibility of some matter far beyond all power of human perception and conception.

*Porosity and Compressibility.*—These two are to a certain extent joint properties. That all bodies are indefinitely compressible, as formerly assumed, is not in accordance with any facts as yet positively known. The molecules, even in compact solids, however, do not occupy the whole space; and the atoms occupy but an insignificant space, except by virtue of their motion. Most solids, except *perfect* crystals, are liable to have *gross* pores, or actual cavities, which may be seen when magnified. Liquids and gases can have none such. In gases, as now viewed, the very large spaces that would necessarily exist between the molecules are incessantly occupied by them in their incessant motion, so that no porosity, as usually defined, can exist. Indeed, the same should probably be said of *homogeneous* liquids and solids. The energy—that is, the motion of the molecules—must be the agency that causes and preserves the porosity, such as it is, between the molecules.

*Dilatability.*—According to modern molecular views, the dilatation of bodies by increase of temperature, as well as that resulting from removal of pressure, are referable to increased energy of motion; this property is virtually merged into the next one, being due to molecular mobility.

*Mobility.*—Relative or measurable motion is more easily understood than defined. Absolute motion is of course indefinable. It is generally accepted that absolute freedom from motion does not exist in the known universe.

*Inertia.*—This, like motion, is incapable of explanation, or reference to any other cause. It involves the generalization that matter in itself has no volition or inherent power to change. It may really, however, be included in the expression that *Matter is subject to laws.*

*Attraction and Repulsion.*—The laws of *gravitation*, those of *electricity* and *magnetism*, and the related branches, with those of *cohesion*, *adhesion*, and *capillarity*, are referable to these ultimate or unexplainable attributes of matter. But the phenomena called *chemical*, usually also assigned to an assumed attractive force called *affinity* or *elective attraction*, do not seem to the present writer thus referable. This is an action between molecules only, and at *insensible distances* only, and appears justly referable to a distinct property that might be called *molecular penetrability.* HENRY WURTZ.

**Sombrere′te,** town of the Mexican confederation, in the state of Zacatecas, was once a very important place on account of its silver-mines, which contained the richest metallic veins ever discovered; but the mines seem now to be nearly exhausted. P. about 14,000.

**Som′er,** tp., Champaign co., Ill. P. 1120.

**Som′erford,** tp., Madison co., O. P. 935.

**Som′ergem,** town of Belgium, province of East Flanders, manufactures cotton, linen, and woollen stuffs and laces. P. 5927.

**Som′ers,** p.-v. and tp., Tolland co., Conn. P. 1247.

**Somers,** p.-v. and tp., Westchester co., N. Y. P. 1721.

**Somers,** tp., Preble co., O. P. 1862.

**Somers,** p.-v. and tp., Kenosha co., Wis. P. 1359.

**Somers** (JOHN), BARON SOMERS OF EVESHAM, b. at Worcester, England, Mar. 4, 1651; educated in the cathedral school at Worcester, and at Trinity College, Oxford; studied law at the Middle Temple; called to the bar 1676, but remained at Oxford, engaged in classical, historical, and juridical studies; translated from classic authors and wrote pamphlets in vindication of the exclusion of the duke of York from the succession, and in defence of grand juries (1681); began legal practice at London 1682; soon became a leader of the Whigs; one of the counsel for the seven bishops 1688;

sat as member for Worcester in the "Convention Parliament" Jan., 1689; was chairman of the committee which drew up the Declaration of Right; was made solicitor-general May, 1689; was knighted Oct., 1689; became attorney-general May, 1692, lord keeper of the great seal Mar., 1693, one of the lords justices 1695; was appointed lord chancellor Apr. 22, 1697; was raised to the peerage Dec., 1697; was removed from the chancellorship Apr. 17, 1700; was arraigned for trial before the House of Lords with a view to impeachment on fourteen very miscellaneous charges Apr. 1, 1701, but the prosecution was withdrawn June 17, 1701; recovered his influence at court; was chosen president of the Royal Society 1702; drew up the plan for the union of the crowns of England and Scotland 1706; became president of the council Nov., 1708; resigned that post 1710, and spent his remaining years in comparative retirement. D. in London Apr. 26, 1716. Among the charges preferred against him in the House of Commons on his trial, not the least absurd was that of complicity in the so-called piracies of Capt. Kidd. A valuable collection of state papers, known as the *Somers Tracts*, was edited from originals in his library (16 vols. 4to, 1748–52), and a large number of his MSS. was accidentally destroyed by fire at the chambers of his relative, Charles Yorke, in 1752. A new edition of the *Tracts* was issued by (Sir) Walter Scott (London, 13 vols. 4to, 1809–15). A *Life* of this distinguished jurist was published by R. Cooksey (1791), and his career receives considerable attention from Lord Campbell in his *Lives of the Chancellors* (vol. iv.), but an adequate biography remains to be written.

**Som'erset,** county of N. W. Maine, adjoining Canada, watered by and containing the sources of Kennebec, Penobscot, and Walloostook (St. John) rivers, includes a part of Moosehead Lake, abounds in smaller lakes and ponds, has a highly-diversified surface, most of the northern part being still a forest, a favorite resort of hunters and fishermen. The S. part is reached by Maine Central and Somerset R. Rs. Lumbering is the chief industry, the other staples being hay, butter, cheese, and wool. Cattle and sheep abound. The abundant water-power is in the southern part utilized by a considerable number of manufactories, especially of carriages and wagons. Cap. Norridgewock. Area, 3800 sq. m. P. 34,611.

**Somerset,** county of S. E. Maryland, on the E. shore of Tangier Sound, Chesapeake Bay, between Wicomico and Pocomoke rivers, traversed by Eastern Shore R. R., has a generally level surface and fertile soil. Staples, Indian corn, oats, and potatoes. Cap. Princess Anne. Area, 400 sq. m. P. 18,190.

**Somerset,** county of Central New Jersey, bounded N. E. by Passaic River, intersected by Raritan and Millstone rivers, traversed by Delaware and Raritan Canal, by New Jersey Central R. R. and its branches, and by several ranges of hills, has a fertile soil, and abundant water-power, utilized by numerous tanneries, flour-mills, and distilleries. Staples, Indian corn, oats, wheat, hay, butter, and wool. Cap. Somerville. Area, 275 sq. miles. P. 23,510.

**Somerset,** county of S. W. Pennsylvania, adjoining Maryland, watered by Conemaugh and Castleman's rivers, and consisting in great part of the valley between the Alleghany Mountains on the E. and Laurel Ridge on the W., has a fertile soil, with numerous glades, is well adapted to pasturage and dairying, has abundant deposits of bituminous and cannel coal, iron ore, and fire-clay, and is traversed by Pittsburg division of Baltimore and Ohio R. R. Staples, butter, maple-sugar, oats, hay, and wool. Tanneries, woollen and saw mills are numerous. Cap. Somerset. Area, 1050 sq. m. P. 28,226.

**Somerset,** v., Laurel tp., Franklin co., Ind. P. 94.

**Somerset,** p.-v., Waltz tp., Wabash co., Ind., on Missisinewa River. P. 371.

**Somerset,** p.-v., cap. of Pulaski co., Ky., in the midst of an iron and coal mining region. P. 587.

**Somerset,** p.-v. and tp., Bristol co., Mass., on Taunton River, opposite Fall River, and on Dighton and Somerset branch of Old Colony R. R., has some manufactures, and is largely engaged in the coasting-trade and fishery. P. 1776.

**Somerset,** p.-v. and tp., Hillsdale co., Mich., on Detroit Hillsdale and Indiana R. R. P. 1297.

**Somerset,** tp., Steele co., Minn. P. 566.

**Somerset,** tp., Mercer co., Mo. P. 1114.

**Somerset,** p.-v. and tp., Niagara co., N. Y., on Lake Ontario division of Rome Watertown and Ogdensburg R. R. P. 1862.

**Somerset,** v., Somerton tp., Belmont co., O. P. 197.

**Somerset,** v., Knox tp., Jefferson co., O. P. 77.

**Somerset,** p.-v., Perry co., O., on the Straitsville division of Baltimore and Ohio R. R. and the Zanesville and Maysville turnpike, contains 4 churches, good schools, 1 newspaper, an extensive flouring-mill, 1 woollen-factory, 2 carriage-factories, and 1 bank. Rich deposits of coal, iron ore, and potter's clay abound in close proximity to the town. P. 1153. M. G. Mains, Pub. "Press."

**Somerset,** p.-b. and tp., cap. of Somerset co., Pa., at N. terminus of Somerset branch of Pittsburg Washington and Baltimore R. R., has 2 weekly newspapers, and is the centre of an active trade in coal, iron, and lumber. P. of b. 945; of tp. 2836.

**Somerset,** tp., Washington co., Pa. P. 1325.

**Somerset,** p.-v. and tp., Windham co., Vt. P. 80.

**Somerset,** p.-v. and tp., St. Croix co., Wis. P. 491.

**Somerset** (Edward Seymour), Duke of, b. about 1500, was brother of Jane Seymour, third queen of Henry VIII. and mother of Edward VI.; upon his sister becoming queen he was created Viscount Beauchamp and earl of Hertford; distinguished himself in the Scottish and French wars, and was named by Henry in his will as one of the governors of his son during his minority. After the death of Henry, he rose to the head of affairs; was created duke of Somerset and earl-marshal of England, in Feb., 1547, and in March was made lord protector and governor of the realm, and became king in all but name. A powerful party was formed against him, among whom was his own brother, Sir Thomas Seymour, who was apprehended and executed by his orders Mar., 1549. This brought the Protector into great odium, and in Oct., 1549, he was deprived by the young king of his protectorship and thrown into the Tower; but was released with a full pardon in a few months. Among his foremost rivals was the earl of Warwick, afterward duke of Northumberland. Somerset entered into a plot against his life; was again arrested, found guilty of felony and constructive treason, and was beheaded on Tower Hill Jan. 22, 1552.

**Somerset** (Fitzroy J. H.). See Raglan, Baron.

**Somerset** (R. Carr). See Overbury, T.

**Som'ersetshire,** county of South-western England, bordering N. on the Bristol Channel, comprises an area of 1636 sq. m. P. 463,412. The surface is much diversified by ranges of low, rocky hills, the Mendip Hills in the N. and the Quantock Hills in the W., containing iron, lead, zinc, coal, and building-stone; and large tracts of meadow and marshes which afford excellent pasturage. Dairy-farming is one of the principal occupations. Good wheat is raised around Bridgewater. Much cheese and cider is produced; leather, glass, paper, and iron goods are manufactured.

**Somer's Point,** p.-v., Egg Harbor tp., Atlantic co., N. J., on Great Egg Harbor River.

**Somers's Islands.** See Bermuda Islands.

**Som'ersworth,** tp., Strafford co., N. H., on Salmon River, includes v. of Great Falls. P. 4504.

**Som'erton,** tp., Belmont co., O. P. 2042.

**Som'ervile** (William), b. at Edston, Yorkshire, in 1677; entered Westminster School in 1690; became a fellow of Oriel College, Oxford, and in 1704 succeeded to his patrimonial estate, where he lived like a jovial country squire, dividing his time between his hounds, his books, and his bottle. His poems are—*The Two Springs, a Fable* (1725), *Occasional Poems, Translations*, etc. (1727), *The Chace*, his best production (1735), *Hobbinol, or the Rural Games*, a burlesque in blank verse (1740), and *Field Sports* (1742). D. July 19, 1742.

**Som'erville,** county of N. Texas, on Brazos River, formed in 1875 from Hood co., has a rolling surface and a fertile soil. Staples, wheat, Indian corn, and cotton. Cap. Glen Rose. Area, about 300 sq. m.

**Somerville,** p.-v. and tp., cap. of Morgan co., Ala. P. of v. 115; of tp. 1786.

**Somerville,** tp., Lincoln co., Me. P. 505.

**Somerville,** city of Middlesex co., Mass., 3 miles from Boston, on Boston and Albany, Boston and Maine, Eastern, and Fitchburg R. Rs., incorporated as a city 1872, contains 15 churches, excellent schools, several public halls, 1 newspaper, 2 hotels, manufactories of brass tubing, glass bottle-works, a bleaching establishment, a packing-house, flour-mills, an art-foundry, a paid fire department and electric fire-alarm, and 2 lines of street railway. P. 14,685. Bourne & Spooner, Eds. "Journal."

**Somerville,** p.-v., cap. of Somerset co., N. J., on Central Railroad of New Jersey, 37 miles from New York City, has 5 churches, 4 select schools, a public library, and 2 reading-rooms, 3 newspapers, 3 banks, 2 carriage manufactories, and 4 hotels. It is the terminus of the Somerville branch R. R. P. 2236.

Daniel Porter, Ed. "Unionist."

**Somerville,** p.-v., Rossie tp., St. Lawrence co., N. Y., on Rome Watertown and Ogdensburg R. R. P. 113.

**Somerville,** p.-v., Milford tp., Butler co., O., on Cincinnati Richmond and Chicago R. R. P. 389.

**Somerville,** p.-v., cap. of Fayette co., Tenn., on Somerville branch of Memphis and Charleston R. R., has 1 newspaper. P. 954.

**Somerville** (Mary), F. R. A. S., b. at Jedburgh, Scotland, Dec. 26, 1780, daughter of Admiral Sir William Fairfax. She gave no early promise of her wonderful powers except by a thirst for information and indomitable perseverance. Her education was most imperfect; every effort after self-culture was thwarted; and she was not even allowed to read such books as she desired. In 1805 she married Samuel Greig; in 1808 was left a widow with two sons and an independent fortune. For the first time her means and position left her free to follow the natural bent of her mind; she went through a complete mathematical course without aid or sympathy, mastering alone not only pure but applied mathematics. In 1812 she married her cousin, William Somerville, a man of ability and culture, who aided her in her studies, worked with and for her, and introduced her to the highest literary circles of Europe, where her powers were generously acknowledged by its first mathematicians and scientists. She lived to the advanced age of ninety-two, with scarcely waning powers of mind or body, as the dates of her published works attest. In 1830, at the age of fifty, her *Mechanism of the Heavens* was completed and published. The preparation of this work was undertaken by Mrs. Somerville at the earnest solicitation of Lord Brougham, and was published by the Society for the Diffusion of Useful Knowledge. It was an attempt to bring the magnificent *Mécanique céleste* of Laplace within the reach of a larger range of students. Even her clear and simple style failed to bring this work down to anything approaching the popular plane, for Poisson said, four years later, that there were not twenty men in France capable of following its profound mathematical reasoning. In 1834 she published her *Connexion of the Physical Sciences;* in 1849, her *Physical Geography;* in 1869, her *Microscopical and Molecular Science.* She was elected honorary member of the Royal Astronomical Society in 1832, and afterward honorary member, or associate, of the Royal Academy at Dublin, of the Bristol Philosophical Society, of the Société de Physique et d'Histoire naturelle of Geneva, of the College of Resurgenti, of the Imperial and Royal Academy of Science, Literature, and Art at Arezzo, and others. In 1860 she was again left a widow; the later years of her life she passed in Italy, devotedly cared for by her daughters. D. Nov. 29, 1872, at Naples, and rests in the English Campo Santo there.

The wonderful powers of Mrs. Somerville's mind would have placed her abreast of the first mathematicians of Europe if she had received the requisite early training, and had devoted herself exclusively to that branch of study. As it was, she followed with ease and delight the work of others, but was not an original investigator. She recognized too late to remedy it her mistake in abandoning mathematical for physical science. To her great gifts of intellect she united all that is lovely in woman; she had refined and beautiful taste, decided artistic ability both in music and painting, and the executive ability requisite to the management of her home, the education of her children, the fulfilment of her social duties, and her laborious and thorough scientific work. It is her delicate womanliness, her enthusiasm and tenderness which make her chief glory; she was primarily woman, wife, and mother; secondarily, artist, mathematician, and scientist. S. B. Herrick.

**Som'ma Lombar'do,** town of Italy, province of Milan, in a broad plain partially covered with heath and uncultivable for want of water. This plain is the theatre of extensive military manœuvres during the summer, large detachments of the Italian army being sent here for that purpose. In this town there is a remarkable cypress tree, about eight feet in diameter, and the roots of which are said to have been struck, in digging a well, at a depth of 150 feet. Tradition carries this tree back to Roman times, and a drawing of it, taken more than 300 years ago, represents it much as it now is, except that its lofty crown has since been badly shattered by lightning. The old castle of Somma Lombardo dates from a very early period, is one of the best preserved in the province, and is associated with historic events of interest. P. 5653.

**Sommari'va del Bos'co,** town of Italy, province of Cuneo, at the foot of a hill which is crowned by one of the finest old castles in Piedmont. P. 5652.

**Som'ma Vesuvia'na,** town of Italy, province of Naples, on the top of a spur of Mount Vesuvius, about 9 miles N. E. of the city of Naples. This was a favorite retreat of Alphonso I. of Aragon and of Ferdinand I. of Naples, both of whom adorned and strengthened it. In 1794, however, Somma Vesuviana was almost totally destroyed by an eruption of Vesuvius. The fall of ashes and scoriæ, forming a layer to the depth of more than three feet, was followed by torrents of rain, which completed the temporary destruction of the town and adjacent country, and in some places formed a kind of cement so hard as to make further cultivation impracticable, even at the present day. P. 7613.

**Somme,** department of Northern France, bordering on the English Channel, on both sides of the river Somme, comprises an area of 2343 sq. m., with 557,015 inhabitants. The surface is flat, but the soil very fertile, and large crops of corn, hemp, hops, and fruit are raised. Cattle-breeding is extensively carried on, and the manufactures of velvet, silk, cotton goods, soap, chemicals, beetroot-sugar, paper, and linen are very important. Of 56,402 children of school age, 4593 received no education in 1857.

**Somme,** a river of France, rises in the department of Aisne, passes by St. Quentin, Ham, Amiens, and Abbeville, and falls into the English Channel after a course of 120 miles. It is navigable to Amiens, and connected with the Seine, Oise, and Scheldt by canals.

**Söm'mering, von** (Samuel Thomas), b. at Thorn, Prussian province of Posen, Jan. 18, 1755; studied medicine at Göttingen; was appointed professor of anatomy at Cassel in 1778, and at Mentz in 1784; began to practise as a physician in Frankfort in 1790; became physician to the king of Bavaria in 1805; returned to Frankfort in 1820. D. there Mar. 2, 1830. He was a very prolific writer, and his works enjoyed a great reputation, although he held that in man the brain is not absolutely necessary to the maintenance of life—*Abbildung und Beschreibung einiger Misgeburten des ehemaligen anatomischen Theaters zu Kassel* (1791); and also that the soul has its seat in the vapors filling certain cavities of the brain—*Ueber das Organ der Seele* (1796).

**Som'mers** (Charles G.), D. D., b. in London, England, in 1793, came with his family to the U. S. 1802; became confidential clerk and travelling-agent of John Jacob Astor 1811, and made long journeys to Canada and the North-west in his employer's interest for some years, when, in consequence of religious impressions, he devoted himself to the Baptist ministry in New York; labored at the old almshouse in the Park, where he established the first Sunday-school in America; was pastor of churches at Troy and in Nassau street, New York, for fifty years; was prominent in religious societies, having been twenty-three years secretary of the executive committee of the American Tract Society; wrote a *Life of Dr. John Stanford* (1835); edited a volume of hymns and three volumes of the *Baptist Library,* and was author of several tracts and treatises in polemical theology.

**Somnam'bulism** [Lat. *somnus,* "sleep," and *ambulare,* to "walk"], a peculiar perversion of the mental functions during sleep, in which the subject becomes an automaton. The organs of sense remain torpid and the intellectual powers are blunted. During this condition some instinctive excitation may take place, and there may be the production of impulses, in consequence, of different kinds. One individual may walk along the ledge of the roof of a house, and another may jump into a river, or a third may commit a homicide. The condition is not as common a one as is supposed, although imperfect examples are seen in persons who walk at night in sleep. A slight stimulation of the organs of sense is sufficient to restore the person. Of late, numerous diseases have been described where hysteria takes this form, and occasionally the public prints are filled with extraordinary stories of sleeping females. These stories generally have no foundation. Nightmares, which are akin to the somnambulistic state, generally come on while the person is lying on his back, when the blood gravitates toward the cerebellum, which is supposed to be the co-ordinating centre.

Allan McLane Hamilton.

**Somnauth'-** (or **Somnath-**) **Putten,** town of Hindostan, in the Baroda dominions, on the peninsula of Guzerat, in lat. 20° 53′ N., lon. 70° 35′ E., contains a famous temple, now mostly in ruins, but at one time one of the richest and most venerated places of Hindoo worship. Mahmood of Ghuznee sacked the temple in 1024, and carried away its magnificent gates, celebrated as much for their exquisite workmanship as for the costliness of their materials. In 1842 the English carried the gates back from Mahmood's tomb in Afghanistan as trophies, but, fearing to excite jealousy between the two large religious bodies of Hindostan, and not knowing whether the gates were the right ones, the English government did not find it proper to put them in their old place.

**Somonauk′,** p.-v. and tp., De Kalb co., Ill., on Chicago Burlington and Quincy R. R. P. 3359.

**Sona′ta** [It.], when first used in the latter part of the sixteenth century, meant any kind of composition for instruments, in contradistinction to vocal compositions, which were called *cantata*. Subsequently, however, especially after the time of Bach, the name was applied principally to compositions for solo instruments and of a certain form, consisting of several movements—first, three, the *allegro*, *adagio*, and *rondo*—to which afterward a fourth was added by Haydn, the *minuetto* or *scherzo*, which differed from each other in time and sentiment, but were held together by the general character pervading them all. This form of composition was greatly developed by Haydn and Mozart, and culminated in Beethoven.

**Sonci′no,** town of Italy, province of Cremona, on the right bank of the Oglio, was a city of considerable importance, especially as a seat of learning and art, during the mediæval period, and the old castle and other monuments of that time are still standing. The churches contain numerous frescoes of the Campi. P. 7268.

**Son′dershausen,** town of Germany, capital of the principality of Schwarzburg-Sondershausen, is pleasantly situated on the Wipper, and has 5815 inhabitants.

**Son′drio,** town of Northern Italy, province of Sondrio (which embraces the valley known as the Valtellina), is at the southern foot of the Rhætian Alps, on the road which crosses the grand pass of the Stelvio. The torrent Mallero, which runs through this town, and had often before threatened it with destruction, rose on the night of Aug. 27, 1834, more than 20 feet above its ordinary bed, carried away all the bridges, and swept off a considerable part of the village. Heavy rains still continuing, the unfortunate inhabitants were obliged to maintain a desperate struggle with the furious flood during the next fifteen days. Similar catastrophes are always liable to occur. P. 6500.

**Sone,** a river of British India, rises in the Berar highlands, in lat. 22° 41′ N., lon. 82° 7′ E., flows in a northeasterly direction, first through narrow valleys, and then through large alluvial plains, and joins the Ganges, after a course of about 450 miles, 28 miles above Patna. It is 3 miles wide at its junction with the Ganges, but navigable only for a distance of about 60 miles. Above Dandnugur its bed is nearly dry in the hot season. Large works of irrigation are under construction along its banks.

**Song** [Ang.-Sax. *sang*], a short lyric poem adapted to vocal music, and the music itself to which such words are set. The words in general of the better class of songs are expressive of a single dominant feeling or thought, but too often, both in the more elevated and serious and in comic songs, the words are destitute of all thought and feeling, except some threadbare sentimentalism or some stale platitude. The music should always be simple and melodious.

**Song of Birds,** the musical notes uttered by many birds, especially by members of the section Oscines and order Insessores. The music of birds not only differs widely in the different species, but individuals of the same species, especially from localities far remote from each other, are sometimes found to differ surprisingly in their song; and nice observation often shows in individuals of the same neighborhood and species very considerable variations in melody. The song of male birds is almost uniformly by far the best, and especially about the pairing-time do the males of most singing birds put forth their best efforts, as if to win the notice and favor of their mates. As a rule, the gayly-plumaged birds of the tropics are not good songsters, but there are exceptions. The Old World greatly excels the New in the number of species of good singing birds. The vocal organs of all singing birds are very remarkable, but the forms are extremely various. The true larynx, the organ of the voice of man, exists also in birds, but the voice is not produced there. At the lower end of the trachea, just at its bifurcation, we find a "lower larynx," which contains a kind of reed or vibratile plate. The pitch appears to be regulated by variations in the length of the windpipe, and there are various *tympana*, or tense membranous patches, in the air-passages, which appear to intensify the vocal notes of some species. Several birds (notably the mocking-bird) have the power of imitating the song of other birds, and even of learning tunes. The vocal notes of all birds are produced in much the same way, except that the tongue of the parrot and other talking birds is employed in uttering articulate sounds, while a very few birds, such as the stork, have neither voice nor inferior larynx.

**Song of Solomon.** See Canticle.

**Son′neberg,** town of Germany, in Saxe-Meiningen, on the Röthen, forms the centre of a considerable manufacturing industry, comprising articles of wood, papier-mâché, leather, and glass, mostly toys and dolls, which under the name of "Sonneberger ware" are exported to England, France, North and South America, to the value of several million dollars every year. In 1873 the value of the exportations to the U. S. amounted to $938,332, gold. P. 6764.

**Son′net** [Fr., from Lat. *sonus*, "sound"], a form of verse of Italian origin, which, when legitimate, has fourteen heroic lines, comprising a major part, called the octave, and a minor part of six lines, called the sestette. The octave is commonly made up of two quatrains, and the sestette of two tercets. The rhymes should be perfect; the octave should be restricted to two—one for the first, fourth, fifth, and eighth lines; the other for the second, third, sixth, and seventh. The rhymes of the sestette may be two or three, variously distributed, but the last two should not form a couplet—a rule often broken. In getting material for this article several thousand sonnets were examined, containing more than 700 forms of rhyme-variation.

S. S. Haldeman.

**Sonnini′ de Manoncourt′** (Charles Nicolas Sigisbert), b. at Lunéville, France, Feb. 1, 1751; studied marine engineering; resided for several years at Cayenne; joined in 1777 the African expedition under De Tott; visited Egypt and Asia Minor; returned to France in 1780; contributed largely to Buffon's *Histoire naturelle*, the division on fishes; edited *Bibliothèque physico-économique* (1801–12), and *Nouveau Dictionnaire d'Histoire naturelle* (24 vols., 1803). D. at Paris May 29, 1812.

**Sono′ma,** county of N. W. California, between the Coast Range and the Pacific Ocean, watered by Russian, Petaluma, Sonoma, and Santa Rosa rivers, traversed by San Francisco and North Pacific R. R. and by numerous thickly-wooded spurs of mountains, between which are several fertile valleys noted for their orchards, gardens, and vineyards; has some mineral deposits, not hitherto much worked, and contains near its N. E. extremity the celebrated Geysers. Cattle, sheep, and swine are numerous; also saw-mills and manufactures of wooden ware. Staples, wheat, oats, barley, potatoes, wine, butter, cheese, and wool. Cap. Santa Rosa. Area, 1344 sq. m. P. 19,819.

**Sonoma,** p.-v. and tp., Sonoma co., Cal., on Sonoma Creek. P. 1513.

**Sono′ra,** a state of the Mexican confederation, bordering W. on the Gulf of California, and bounded N. by the U. S. Territory of Arizona, comprises an area of 123,466 sq. m., with 147,133 inhabitants. The western and northern part of this state is mostly low and level land, in some places consisting of extensive tracts of sandy, unproductive, and arid soil, but in others very fertile, and yielding two crops annually of wheat, maize, tobacco, rice, sugar, cotton, and all kinds of tropical and semi-tropical fruit. The eastern and southern part is covered by branches of the Sierra Madre, which form elevated plateaus interspersed by deep, sometimes broad, always exceedingly fertile valleys, and of whose mineral wealth travellers give almost fabulous reports. But the natural riches of the state are very little developed. About 100,000 of the population are Indians, and of these many tribes live as nomads and hunters and in fierce contest with the Spaniards. The best part of the population consists of those Indian tribes which have been converted to Christianity, and which have settled down as agriculturists. The descendants of the European immigrants are described as indolent, sensuous, and treacherous.

**Sonora,** p.-v. and tp., cap. of Tuolumne co., Cal., 130 miles E. of San Francisco, equidistant from Yosemite Valley and Calaveras Big Trees, the terminus of the Stockton and Copperopolis R. R., has 4 churches, an academy and schools, Snell Library, 2 weekly newspapers, waterworks, a foundry, and 2 hotels. Sonora is the central point for a large gold-mining area. Principal business, mining, farming, lumbering, and viniculture. P. of v. 1322; of tp. 2489.

Chas. H. Randall, Ed. "Union Democrat."

**Sonora,** p.-v. and tp., Hancock co., Ill., on Mississippi River. P. 1485.

**Sonora,** p.-v., Hardin co., Ky., on Louisville and Nashville and Great Southern R. R. P. 266.

**Sonora,** v., Tarkio tp., Atchison co., Mo. P. 265.

**Sonora,** p.-v., Perry tp., Muskingum co., O., on Central Ohio division of Baltimore and Ohio R. R. P. 97.

**Sonsona′te,** town of Central America, republic of San Salvador, is beautifully situated in a rich district, well built, and carries on a lively trade through Acajutla, its port on the Pacific Ocean. P. about 10,000.

**Son′tag** (Henriette), b. in Coblentz May 13, 1805; was a singer from childhood; was gifted with fine vocal and

dramatic powers, which were highly cultivated; excelled in German and Italian music, and at the age of twenty-five rivalled Malibran, Pasta, and Catalani; married Count Rossi, an Italian noble, in 1830, and retired to private life. Pecuniary misfortunes compelled her at the age of forty-five to resume her professional career; she sang in Europe; came to the U. S. in 1853, and d. in Mexico June 18, 1854, while on a professional tour. Her reception everywhere was enthusiastic, but at this period her musical art was impaired. O. B. Frothingham.

**Soo-Chow-Foo′,** or **Su-Chau,** town of China, province of Kiang-Soo, in a very rich, densely-peopled, and well-cultivated district, is a well-built city, consisting mostly of houses of granite and intersected by a great number of broad canals, on which lives a large floating population. Its manufactures of linen and cotton fabrics, articles of paper, glass, ivory, iron, wood, and horn, and lacquered ware are celebrated and extensively exported. Its trade is very active, and with respect to the gayety and elegance of its life and manners it seems to be a sort of Chinese Paris. Its population is said to exceed that of Nanking, and is estimated at about 2,000,000.

**Soodan′,** or **Sudan,** also called **Nigritia** (the home of the negro race), is a vast territory in Central Africa, with entirely undefined frontiers, but bounded N. by Sahara, W. by Senegambia, E. by Darfoor, and S. by Upper Guinea. It is still very imperfectly known as a whole; our knowledge of it is mostly confined to some single points which have been visited by travellers, such as Darfoor, Bornoo, Saccatoo, etc. (which see).

**Soofees.** See Sufis.

**Sook-el-Shooyookh′,** town of Asiatic Turkey, province of Irak-Arabee, on the Euphrates, was terribly devastated by the plague in 1832, at which time it had about 10,000 inhabitants. It has still a very important horse-market, as the horses of this district are considered the best in all the Turkish dominions.

**Sooloo′** (or **Suluk**) **Islands,** a group of 150 islands in the Indian Ocean, extending from Borneo to Mindanao, between lat. 4° 44′ and 6° 56′ N., and lon. 119° 30′ and 122° 30′ E. All the islands, most of which are very small, are high, well wooded, and exceedingly fertile, yielding sandal-wood and teak timber, and producing sugar, rice, coffee, and spices in abundance, besides being rich in metals and fish. But the inhabitants, who are Malays and governed by an independent sultan, are addicted to piracy, which seems to be their principal occupation.

**Soo′my,** or **Sumy,** town of Russia, government of Kharkow, at the confluence of the Psol and the Suma, has an annual market in November, which is attended by a great number of merchants. P. 10,587.

**Soonga′ria,** or **Songaria,** a vast region in Central Asia belonging to China, extending between lat. 41° and 48° N., and between lon. 75° and 90° E., and bounded W. and N. by Russia, E. by China, and S. by Thibet and Afghanistan. It consists of an elevated plateau surrounded, and in some places intersected, by lofty mountains. The plateau is generally a complete desert, and the numerous streams which rush down from the mountains soon lose themselves in the sand or fall into the large salt lakes which frequently occur. In the valleys or along the lakes and rivers are found good pastures, where the inhabitants, consisting of nomadic tribes, rear their cattle, mostly buffaloes and camels. Originally, the land was inhabited by the Oosuns, a race of blond complexion and blue eyes; these were expelled by the Turks, who in their turn had to give way for the Mongols. In the middle of the eighteenth century the Calmucks, the principal Mongolian tribe, were subdued by the Chinese, and since that time the country has been a Chinese province.

**Soor** [anc. *Tyros*], town of Asiatic Turkey, province of Syria, on an island in the Mediterranean, which Alexander the Great, when besieging Tyre, connected with the mainland by a broad dam. It has suffered very much from earthquakes, and its harbor has become so silted up as to be accessible for small vessels only. P. about 5000.

**Soo′sa,** or **Su′sa,** town of Northern Africa, in Tunis, is surrounded with olive-groves, and has an extensive trade in oil and manufactures of woollen fabrics. P. about 8000.

**Soo′soo,** the *Platanista Gangeticus*, a cetacean of the Ganges, the only living representative of the family Platanistidæ, which is allied to the Iniidæ, or fresh-water dolphins of South America. It is some twelve feet long, and is ordinarily very sluggish, but can move after its prey with much vigor. It has long beaked jaws, 120 teeth, and curious rudimentary eyes.

**Soot** [Sax. *sot*; Dan. *sod*, *sood*], a carbonaceous deposit from smoke, formed in chimneys. That which forms nearest the fire is often shining and varnish-like, consisting chiefly of dried tarry matters mixed with carbon, and giving a brownish-black powder, sometimes used as a pigment under the name of Bistre (which see). That which forms farther up the chimney is more of the character of Lampblack (which see). H. Wurtz.

**Soothsayers.** See Astrology, Divination, Magic, and Oracle.

**Soothsayers,** insects. See Mantis.

**Sophi′a,** town of European Turkey, in Bulgaria, has 23 mosques, several Christian churches, celebrated hot mineral springs, and manufactures of leather, arms, earthenware, and woollen cloths. In its general appearance it is a dirty and miserable place. P. 22,000.

**Sophi′a Dorothe′a,** b. at Celle Sept. 15, 1666, a daughter of Duke George Wilhelm of Brunswick-Lüneburg-Celle, was married Nov. 21, 1682, to George, eldest son of the elector Ernst August of Hanover, and afterward king of England. She bore him two children—George II. and Sophia Dorothea, queen of Prussia and mother to Frederick II.—but the marriage was very unhappy. She asked for a divorce, and when neither her father nor her father-in-law would give their consent, she determined to elope with Count Königsmark to Wolffenbüttel. The intrigue was discovered by the Countess von Platen, whom jealousy made sharp-sighted, and July 2, 1694, when in the night the count came out from the chamber of the princess, he was murdered by four electoral guards. Dec. 28, 1694, the divorce took place, and she lived afterward in retirement till her death, Nov. 13, 1726, at Ahlden, near Celle, whence her popular name, "the princess of Ahlden."

**Soph′ist** [Gr. *σοφιστής*, *σοφισταί*, applied to the seven wise men of Greece; afterward to the teachers at Athens who gave lessons in the arts and sciences for money]. The course of Greek philosophy commences with the establishment of a material first principle—water, air, fire, etc.—and tends toward the recognition of mind as this first principle. Anaxagoras explicitly announced mind (*νοῦς*) as such first principle. The first and most obvious phase of mind as an activity is its capacity to reflect, and hence to discover grounds and reasons. Each ground or reason in some measure communicates its peculiar character to the fact or opinion which it grounds. Hence, from the stand-point of grounds and arguments all truth seems to be an arbitrary affair, depending upon the selection of grounds and reasons which one makes. Truth is supposed to be many-sided, and the point of view taken is supposed to justify one's difference in opinion. The art of presenting grounds or reasons to justify any view is the art of the Sophists. The fact that these many sides or grounds of truth are mutually interdependent, and therefore that each has truth only as seen in view of the rest,—this is the further and deeper insight which it belonged to Socrates and Plato to discover and unfold. The universal or general is the net result, as well as the active principle, of that dialectic process which appears in the genesis and mutual destruction of different opinions—"different points of view." As a necessary elementary stage of human thinking, the province of the Sophists is of permanent importance in the history of philosophy. The Eleatics, who set up the doctrine of pure being, found it necessary to refute the phases of change, finitude, and negativity that appear in the world. Zeno accordingly discovered the dialectic of self-contradiction involved in those phases. This was adopted by the Sophists, of whom the chief were Protagoras the Individualist (b. 490 B. C.), Gorgias the Nihilist (came to Athens 427 B. C.), Hippias the Polymathist, and Prodicus the Moralist (both younger contemporaries of Protagoras). Everything that existed in the Greek consciousness as opinion, faith, custom, religious tradition, even the evidence of the senses, was sapped and rendered uncertain by the ratiocination of these Sophists. Protagoras asserted: Man is the measure of all things. Just as each thing appears to each man, so is it for him. All truth is relative. The existence of the gods is uncertain. Gorgias expressed his nihilism in three propositions: (*a*) Nothing exists; (*b*) if anything existed, it would be unknowable; (*c*) if anything existed, and were knowable, the knowledge of it could nevertheless not be communicated to others. "Common sense," so called, is the stage of naïve faith in one's point of view. The discovery of the equal validity of "many points of view" leads on the one hand to sophistical practices, or on the other to scepticism. Pyrrhonic scepticism in Greece connects through the Megarian school to the dialectic of the Sophists and of Zeno the Eleatic. William T. Harris.

**Soph′ocles,** b. in 495 B. C. at Colonus, a village of Attica, near Athens, led the triumphal choir of Athenian youths celebrating the victory of Salamis; Æschylus fought in the ranks of the soldiers, and Euripides was born on the

day of the battle. His father was a man of means, and devoted his whole life to poetry, and the pæan he sang before the Athenians assembled around the trophies of Salamis was his own composition. His teacher in music was Lamprus, a celebrated name, and in 468 B. C. he brought his first tragedy, probably *Triptolemus*, which now is lost, on the stage. The moment was exciting. There was a turning-point in Athenian politics; the age of Pericles was dawning. People expected a similar movement in literature, and the competition between the old poet Æschylus, who had held the supremacy undisputed for a whole generation, and the new poet Sophocles, caused such an agitation that the archon was at a loss where to find judges of sufficient authority. The festival was about to begin, and no judges of the competing tragedies were as yet appointed, when Cimon and his nine colleagues entered the theatre, just returning from the expedition to Scyros, whence they brought back to Athens the ashes of Theseus; and when they approached the altar to offer up their libations, the archon retained them there, took their oaths, and thus the highest authority of the old time was seated as judge over the first steps of the new. But the prize was given to Sophocles, and Æschylus left Athens and went to Sicily. From this moment, and up to the year 441 B. C., Sophocles reigned in the Athenian theatre—that is, he was the modeller of the religious and æsthetical ideas of the Athenian people, the artistic representative of the spirit of the age; and even Æschylus adopted his innovations, the introduction of the third actor, the reduction of the trilogy from a pragmatical to a merely philosophical unity, etc. But about this time a new turning-point was reached in the history of Greek civilization; the age of the Sophists drew near, and Euripides gained the first prize in 441 B. C. Sophocles was never superseded, however. In the very next year (440 B. C.) he brought the *Antigone* on the stage, and this work, which in its ideal conception, as well as in many of its actual details, is a direct vindication of the political principles of Pericles, produced an unbounded enthusiasm; the Athenians chose him *strategos* immediately afterward. His last victory was won after his death by the performance of his posthumous tragedy, *Œdipus at Colonus*. But he had, nevertheless, now a rival, and elements utterly at variance with the ideas he preached were at work in Athenian life. Finally, his enemies attacked him as they had attacked Pericles: unable to cope with his genius, they assaulted his person. In the last year of his life his son, Iophon, accused him of having fallen into dotage and of being incapable of administering his own estate. But Sophocles went to the court, and read to the judges a song from *Œdipus at Colonus:* the case was then dismissed. D. at Athens in 405 B. C. He is said to have composed 130 plays, besides lyrical poems, but only seven tragedies have come down to us entire—namely, *Antigone, Electra, Trachiniæ, Œdipus Rex, Ajax, Philoctetes,* and *Œdipus Coloneus*. Editions, translations, and historical and critical reviews are numberless. Among the latest editions are those by Wunder (Gotha, 1848 *seq.*, 2d and 3d eds.), Tourneur (Paris, 1873), Schneidewin (Berlin, 1873), Campbell (vol. i., Oxford, 1873), Dindorf (Leipsic, 1866). There are English translations by Dale (1824), Plumptre (1866), Campbell (1874), and others. CLEMENS PETERSEN.

**Sophocles** (EVANGELINUS APOSTOLIDES), LL.D., b. in Greece Mar. 8, 1807; studied at the convent on Mount Sinai; emigrated to the U. S.; entered Amherst College in 1829; was tutor in Harvard College, with a brief intermission, from 1842 to 1859, and in 1860 became professor of ancient, modern, and Byzantine Greek. He has published a *Greek Grammar* (1838), *First Lessons in Greek* (1839), *Greek Exercises* (1841), *Romaic Grammar* (1842), *Greek Lessons for Beginners* (1843), *Catalogue of Greek Verbs* (1844), *History of the Greek Alphabet*, etc. (1848), *Glossary of Later and Byzantine Greek* (1860), revised as *Greek Lexicon of the Roman and Byzantine Periods* (1870).

**Sophonisba.** See MASINISSA.

**So'phron,** flourished at Syracuse in the middle of the fifth century B. C., and was the inventor of the so-called *mime*—that is, he transformed it from a social entertainment into a form of literary composition. The Greeks of Sicily, noted for their broad humor and exuberant talent for merriment, used at the festivals of Dionysus, or perhaps at any kind of social gatherings, to give dramatic representations of events of the life of the wine-god, or of such incidents of every-day life as corresponded in tone to the character of the feast. In these representations gesticulation and musical composition seem to have been the principal elements, but words were also supplied, and by the transition to a form of literary composition they became, of course, of predominating importance. The *mimes*—that is, small comedies—of Sophron enjoyed a great reputation in ancient times; Plato read them again and again, and slept with them under his pillow. But only a few fragments have come down to us, collected by Blomfield in *Museum Criticum* (vol. ii., 1826), and by Ahrens, *De Græc. Dialect.* (vol. ii. p. 464).

**So'quel,** p.-v. and tp., Santa Cruz co., Cal., on Monterey Bay. P. 1193.

**So'ra,** town of Italy, province of Caserta, on the Garigliano, in a plain surrounded by hills, lies about 58 miles N. N. W. of Naples, is a walled town, has some good churches and other public buildings, with a few handsome private palaces, and boasts a fine café and inns for travellers. The paper, woollen, and other manufactories here are on a very considerable scale, and are provided with good modern machinery. Much effort is making for improvement in public instruction, especially in the primary schools. The remains of the old Volscian *Sora*, once so important a city, are very insignificant, and the fact that it was taken by the Romans in the year 411 of their city is almost all that is certainly known of its early history. In the sixth century it suffered severely from the northern invasions; in the ninth it fell into the hands of the Saracens, who were, however, soon driven out. For many centuries afterward the possession of Sora was an almost constant subject of dispute between the Normans, Angevins, popes, etc., who gave it no rest. In 1634 it was wellnigh totally overthrown by an earthquake, but was soon rebuilt. Sora is said to have had a bishop as early as 272, and the canons of the collegiate church of Santa Restituta have the odd privilege of wearing the red velvet cape otherwise worn only by the pope himself. P. 12,074.

**Sorac'te,** the present *Monte di San Oreste,* a mountain of Etruria, an outlying offset of the Apennines, from which it is detached by the valley of the Tiber, rises with its bold and abrupt masses of the peculiar hard Apennine limestone 2420 feet above the surrounding plain, and forms, especially when its top is covered with snow, a conspicuous and very picturesque feature in the views of the Campagna. (Horace, *Carm.*, i. 9.) In ancient times it was dedicated to Apollo, and bore on its top a celebrated temple of this god, to which large and peculiarly solemn processions were made from Rome, situated 26 miles to the S. In 746, Carloman, the brother of Pepin, founded the monastery of San Silvestro on the site of the old pagan temple. Its present name the mountain has received from a village, San Oreste, situated on its slope and notorious for its sour wine.

**Sora'gna,** town of Italy, province of Parma. The old castle contains some fine frescoes. Under Joseph II. Soragna gave its name to a principality. P. 5492.

**Soranjee,** the name given in the East Indies to MORINDINE (which see), a yellow crystalline coloring-matter found in the root of *Morinda citrifolia*. Its chemical composition is $C_{28}H_{30}O_{15}$. When heated it is converted into *morindone*, a beautiful crystalline substance containing $C_{14}H_{10}O_5$.

**Sora'no,** or **Sovana,** town of Italy, province of Grosseto, on a tufa rock about 50 miles E. S. E. of the town of Grosseto. This place, unhealthy like the whole district, was originally a stronghold of the Aldobrandeschi, from whom it passed to the Orsini, who built the upper fortress, then to the city of Siena, and finally to Florence. P. 5589.

**So'rau,** town of Prussia, province of Brandenburg, on the Goldbach, is an old town, with extensive cloth manufactures, print-works, bleaching-fields, etc. P. 11,264.

**Sorb'ite** [Lat. *sorbum*, "sorb tree"], or **Mountain-ash Sugar.** This saccharine substance is formed in the juice of the berries of *Sorbus aucuparia*, the mountain-ash, a European plant, as well as in the related American plant, *Sorbus americana*. These small trees have bunches of brilliant scarlet berries, and are hence grown in gardens for ornament. The sugar, which has the composition $C_6H_{12}O_6$, or an isomere of glucose, is stated to be incapable of fermentation; and when the juice of the berries is allowed to ferment, so that it afterward settles clear, the unchanged sorbite will crystallize out on evaporation in fine transparent crystals, which are trimetric, have density 1.654, are sweet as cane-sugar, and dextro-rotatory to 47°. It is soluble in half its weight of cold water, insoluble in alcohol; forms a cubical compound with NaCl; dissolves lime and baryta like sucrose; and, according to Berthelot, will undergo the lactic and butyric fermentations with cheese, like lactose. H. WURTZ.

**Sorbonne',** the name generally applied to the theological faculty of the ancient University of Paris, was derived from Robert de Sorbon (b. at Sorbon in the Ardennes in 1201, and afterward chaplain to Louis IX.). In 1252 he founded an institution, connected with the University of Paris, in which a number of secular priests were to teach

theology gratuitously to poor students, and in the following year the institution received its charter from Louis IX., which was confirmed in 1268 by Pope Clement IV. The great care which was taken not to admit among the teachers any but men of the highest talents and attainments soon procured for the school a European fame, and in the fourteenth century the entire theological faculty of the university was merged into it. During the Middle Ages, the period of the Reformation, and even after that time, the Sorbonne was generally considered one of the highest authorities of the Christian Church, and its decisions were appealed to not only in theological controversies, but also in the contests between the popes and the secular powers. It was a staunch champion of the freedom of the Gallican Church, and strongly opposed to Ultramontanism. It condemned Jansen and the Jansenists in matters of doctrine, but it sided with them in their fight with the Jesuits. Its culmination was in the time of Cardinal Richelieu, who, himself a graduate of the school, provided it with a magnificent building and enlarged its library. But in its contest with the philosophy of the eighteenth century it was unsuccessful, and it had outlived its fame when, during the Revolution, it was suppressed and bereft of its endowments. At the reconstruction of the university in 1808 by Napoleon I., the building, still called the Sorbonne, was given to the theological faculty in connection with the faculties of science and belles-lettres. (See Duvernet, *Histoire de la Sorbonne* (2 vols., 1790).)

**Sorb Tree,** or **Wild Service,** the *Pyrus terminalis*, a small European tree (order Rosaceæ) whose wood is very hard and valuable. Its fruit, the sorb, when over-ripened, is soft and mellow, and very good eating. Hertfordshire is famous for its sorbs, which are largely marketed in London. (See Service Tree and Medlar.)

**Sorcery.** See Magic.

**Sorel′,** a flourishing town, capital of Richelieu co., Quebec, Canada, on the St. Lawrence, just below the mouth of Sorel (or Richelieu) River, 45 miles below Montreal. It has extensive manufactures, and a large lumber-trade with tropical America. The town is finely laid out, has a large public square, good schools, and 4 weekly, 1 triweekly, and 1 monthly periodical. It is the seat of a convent, hospital, academy, and college of the Roman Catholics. P. 5636.

**Sorel** (Agnes). See Agnes Sorel.

**Sorel's Cements.** These cements owe their name to the inventor, the French chemist Sorel. The principle on which they are founded is the mixing of a concentrated solution of a metallic chloride with the oxide of the same metal to a pasty mass, when, in case of several metals, a solid insoluble oxychloride is rapidly formed, which is sometimes quite crystalline and hard. The most approved compositions of this class are those made with the chlorides of *zinc* and *magnesium*. A solution of MgCl of a density of 20° to 30° of Baumé's hydrometer is mixed with magnesia to a paste, which may be applied and moulded like plaster. It concretes to a very white mass of the hardness of marble. Chloride-of-zinc solution mixed with oxide of zinc, forms a similar cement-composition. H. Wurtz.

**Soresi′na,** town of Italy, province of Cremona, 15 miles N. W. of Cremona. The churches contain frescoes and other artistic objects worthy of notice, and intarsias of great beauty are still wrought here. This town is remarkable for its domestic industries, and it carries on an active traffic in the products of the vicinity. P. 8919.

**Sorex,** the shrew. See Soricidæ.

**Sor′ghum,** a genus of grasses of the tribe Andropogoneæ, closely allied to the sugar-cane, presenting many varieties and having various names. The variety usually known as sorghum (*S. vulgare* or *S. saccharatum*) has been cultivated from time immemorial in Africa and China; in Africa it is called *imphee*. The plant was almost unknown in Europe until 1851, when Count de Montigni, the French consul at Shanghai, sent some seeds to Paris, which were planted, but only one is said to have germinated, and from this has sprung nearly all the seed sown in Europe and America. In 1856 some of this seed was obtained by the U. S. patent-office and distributed, but the introduction of the plant here is mainly owing to Mr. Orange Judd of New York, proprietor of the *American Agriculturist*, who imported 25,000 packages of the seed, which he distributed among the subscribers to his paper in all parts of the country. In 1857, Mr. Wray, an Englishman, brought to New York seeds of several varieties of the African imphee, and they were tested by many agriculturists, but the result was upon the whole unsatisfactory, and the Chinese variety is the one chiefly cultivated here. This attains a height of from eight to eighteen feet, and before the seed-cluster makes its appearance bears a close resemblance to Indian corn. It will grow in any place where maize succeeds, but rarely ripens its seed N. of lat. 41°. It is sown in drills or in hills like Indian corn, and the mode of cultivation is essentially the same. The stalks are cut off at the ground just before the hard frosts set in, stripped of their leaves, and stored away for pressing. Well-ripened stalks yield about half their weight of juice, of which from five to ten gallons are required for a gallon of syrup. The saccharine matter is chiefly in the form of glucose, and produces only a very small percentage of crystallized sugar, so that the plant is cultivated chiefly for the molasses or syrup. A fair average yield is about 150 gallons to the acre. This syrup varies greatly in quality, according to the care and skill bestowed upon its manufacture, from a dark greenish-brown fluid with an unpleasant weedy flavor, to an amber-colored saccharine syrup destitute of any characteristic flavor. The finer qualities are by many preferred to the best cane-molasses. The total production of sorghum-molasses in the U. S. in 1860 was about 6,750,000 gallons; in 1870 it was more than 16,000,000 gallons, of which nearly 10,000,000 were in the States of Indiana, Ohio, Illinois, Kentucky, and Missouri. The seeds are chiefly used as food for cattle, swine, and poultry, although bread has sometimes been made from the flour. Coarse wrapping-paper has been manufactured from the refuse of the stalks after pressing. As fodder for cattle it is not regarded as equal to Indian corn.

**So′ria,** town of Spain, province of the same name, on the right bank of the Duero, is surrounded with thick old walls, has some leather manufactures and dyeing establishments, and carries on trade in wool. P. 5004.

**Soric′idæ** [from *Sorex*, the Latin name of the typical form], a family of mammals of the order Insectivora, which are often designated as shrews or shrew-mice. Externally, they have much resemblance to mice, but are readily distinguishable by the longer and pointed snout, and of course, belonging to a different order as they do, they have no real affinity. In contrast with the Talpidæ, to which they are most nearly related, they present the following characters: The skull (which has a conoid contour) has well-developed posterior ridges; the foramen magnum subcircular and inclined a little forward below; well-developed post-glenoid processes; the tympanic elements annular, and not forming bullæ; the infra-orbital canals long, subcylindrical tunnels covered by broad osseous walls; and the zygomatic arches not developed; the lower jaw has its ascending rami deflected outward, and each has a cavity at the bottom of the coronoid process; the teeth range in number from 26 to 36 (M. $\frac{3}{3}$, P. M. $\frac{1-3}{1-2}$, C. $\frac{1}{1}$, I. $\frac{2-4}{1-2} \times 2$); the true molars of the upper jaw have four primary (but generally reduced to three by coalescence of the median) external, and two primary and more elevated internal cusps, circumscribing V-shaped areas, and a well-developed secondary posterior lower ledge; the molars of the lower jaw have two primary external cusps (anterior and posterior), and four primary internal ones, the antero-external connected with anterior and intero-median internal by ridges, and thus circumscribing a triangular area; the two median inferior incisors are large and proclivous; the vertebræ are also characteristic, the cervical having well-developed hypapophyses, and the dorsal and lumbar distinct hyperapophyses; the sternum has a broad but not keeled manubrium; the anterior members are more slender than the posterior; the carpus is normal, and has no sickle-shaped bone or os intermedium; the scapula is short and broad. The family thus defined is a very homogeneous one, and although it is by far the largest (as regards number of species) in the order to which it belongs, the differences between its constituents are less than in any other of the related polytypic families. Representatives are found in the entire northern hemisphere, and extend southward into India and Eastern Asia in the Old World and into Mexico in the New. By H. Milne-Edwards eight genera are recognized; of these, three (*Sorex*, *Crocidura*, and *Crossopus*) are represented in Europe, and three (*Sorex*, *Blarina*, and *Hydrogale* or *Neosorex*) in North America, while the remaining three (*Anurosorex*, *Diplomesodon*, and *Nectogale*) are Asiatic. Other genera which were referred to the family by the older authors have no affinity with these, but belong to different families. The species are all of small size, and some of them are among the least of mammals. They have certain glands, near the fore limbs, on the sides, and behind at the base of the tail, in which is secreted a musky fluid. They feed not only on insects, worms, etc., but on such young vertebrates (birds, etc.) as they are able to overcome. Theodore Gill.

**Sorites.** See Logic, by Prof. W. D. Wilson, LL.D., L. H. D.

**Soro′sis** [Gr. σώρευσις, "aggregation"], a term in botany applied to a compound fleshy fruit formed by the close

aggregation of many flowers whose floral whorls become succulent, as the pineapple.

In Mar., 1868, the first woman's club of America was organized under the name of *Sorosis*, and has continued to exist under the same style and title; its object being, as stated in its constitution, to bring together representative women in literature, art, science, and kindred pursuits, and by uniting them render them helpful to one another and useful to society. The first annual report of the executive committee of Sorosis, adopted at the annual meeting of the club and published in the *World* of Mar. 23, 1869, states that Mrs. Croly was stimulated to the formation of a woman's club by the refusal of the committee on the Dickens dinner from the Press Club to allow women to participate equally with men on that occasion. She thereupon invited the co-operation of ladies, and a meeting was called at her house in West Fourteenth street to formulate a plan having that object in view. There were present at the first meeting Miss Kate Field, Mad. Botta, Mrs. Henry, Mrs. Field, Mrs. C. B. Wilbour, and Mrs. Croly. A call for a meeting of organization signed by these ladies resulted in the assembling of fourteen well-known women at the same place on the following Monday, twelve of whom organized a woman's club under the name of "Sorosis," which, in the pursuit of a name which should not stand in the way of any object desired, Mrs. Croly found in a botanical dictionary. The officers first elected were—president, Mrs. Fanny Fern Parton; vice-president, Mrs. J. C. Croly; secretary, Miss Kate Field; executive committee, Phebe Cary, Mrs. Ella Clymer, Mad. Demorest, Miss Josephine Pollard, and Mrs. Sara L. Hopper. Subsequently, the officers stood as follows: president, Miss Alice Cary; secretary and treasurer, Mrs. C. B. Wilbour; chairman of executive committee, Mrs. Agnes Noble, Mrs. Parton, Miss Kate Field, and Miss Phebe Cary declining or not being able to serve. At the close of the first year nineteen regular club meetings had been held—fifteen at Delmonico's (the home of the club), four at the houses of members; and the meetings, it is stated, were rendered conspicuously profitable by conversational disquisitions and literary exercises of a high order. The number had increased to 83 members in good and regular standing, 8 of whom were honorary. Among these were 6 artists or workers in art, 22 authors, 6 editors, 1 historian, 11 poets, 9 teachers and lecturers, 8 well-known philanthropists, 2 physicians, 4 writers on science, besides others, contributors to periodicals. At the first January meeting (1869) the committee having in charge the obtaining of an act of incorporation reported that a certificate of incorporation under the general law of the State had been filed in the archives of the secretary of state, a duplicate of which was presented and adopted by the club. The names of the incorporators were Agnes Noble, Jennie C. Croly, Charlotte B. Wilbour, Celia M. Burleigh, E. Louise Demorest, Ella M. Clymer, Josephine Pollard, Sara L. Hopper.

Many women's clubs have since been formed, but Sorosis is the only one whose membership and management consist of and are maintained wholly and solely by women. The scheme of the club is social and educational. It holds two meetings during the month—one on the first, the other on the third Monday—both at Delmonico's, corner of Fourteenth street and Fifth avenue. The first is social, and to it the members are permitted to bring guests; the second is for business purposes, and is confined to members only. This membership is divided up into ten working committees—literature, art, science, education, music, philanthropy, house and home, drama, journalism, and business-women. Two of these committees have the charge of each social meeting, contributing to the useful entertainment of the club reports of facts interesting to women in their special departments, and suggestive papers to lead discussion upon previously-stated questions—the reports being intended to constitute a summary or record of what is being done by or for women in different fields of activity; the papers to stimulate thought and furnish means for arriving at correct conclusions in regard to mooted questions. Lighter exercises, supplied through the efforts of the music committee and members, vary the graver topics. The initiation fee and golden *S*, the badge of the society, are five dollars each; the annual dues are also five dollars. The presidents of Sorosis have been Alice Cary; Mrs. J. C. Croly; Mrs. C. B. Wilbour, re-elected four times; Mrs. J. C. Croly, elected a second time for 1875, re-elected for 1876. Mrs. Ruth O. Delemater treasurer.

**Sor'rel,** a popular name for several sour-leaved plants, especially for those of the diœcious section of the genus *Rumex* (order Polygonaceæ), to which genus the coarse herbs called dock also belong. Plants of the genus *Oxyria* (of the same order) are called mountain-sorrels. The wood-sorrels are of the genus *Oxalis* (order Oxalidaceæ). There are numerous species of the above genera, some of which are occasionally used as salad-herbs and as flavors for sauces. In Europe the sorrels, mountain-sorrels, and wood-sorrels are cultivated for table use in gardens. Of *Oxalis* there are many species, some cultivated for their flowers, and others for their thick starchy roots, used as food in some countries. All the sorrels owe their sourness to the presence of oxalic acid and its salts. (See OXALIS.)

**Sorrel, Salts of.** See OXALIS.

**Sorrel Tree,** or **Sour-Wood,** the *Oxydendrum arboreum*, a handsome tree of the U. S., found in Ohio and Pennsylvania and southward to the Gulf. Its leaves resemble those of the peach. They are sour, and from them a cooling drink is made for the sick. The wood is soft and very difficult to dry. It is sometimes planted as an ornamental tree.

**Sorren'to,** town of Southern Italy, province of Castellamare, on a small rocky peninsula on the S. side of the Bay of Naples. The rocks on which it is built when seen from the sea look like an extensive artificial wall; it is protected from the sirocco by Monte Vico, and from the W. wind by Monte Massa. Sorrento is not a well-built town, but the churches are worthy a visit, especially the Duomo, which contains some fine marbles. The villas, however, are very numerous and extensive, with gardens of almost tropical luxuriance, and the views from the higher points are marvellously beautiful. From the village of Sant' Agata, a mile from the town, the prospect is so enchanting as almost to bewilder the imagination. The high altar of the parish church of Sant' Agata is regarded as one of the finest specimens of intarsia to be seen in Italy; it is of the time of the Medici, and has a curious history. Sorrento was a Greek settlement, was adorned with splendid temples during the Roman period, and after the fall of the Western empire was ruled by its own consuls and dukes. Of the old temples, a few fine marbles, mosaic pavements, etc., alone remain, besides the foundations. The climate of Sorrento, as agreeable as it is salubrious, the luxuriance of the vegetation, and the wonderful variety and beauty of the surrounding scenery, have made Sorrento one of the most frequented resorts in Southern Italy, alike for travellers in search of the picturesque and those in the pursuit of health. There is a small coasting-trade in the rich productions of the vicinity carried on by means of the little harbor. Sorrento has the honor of being the birthplace of Torquato Tasso. P. 7194.

**Sor'so,** town of Sardinia, province of Sassari, about 8 miles from the town of Sassari, is one of the most prosperous towns of its size in the island, and few even of the larger can boast so much private comfort or so much attention to public instruction. The men are laborious, chiefly in agriculture, and the women make large quantities of linen of very tasteful patterns. In the vicinity may be traced many vestiges of a pre-historic population. P. 5533.

**Sortain'** (JOSEPH); graduated at Trinity College, Dublin, and was for many years minister of an Independent church in Brighton, England. He published *Lectures on Romanism and Anglo-Catholicism* (1841), *Memoir of Mrs. George Clayton* (1844), *Life of Lord Bacon* (1851), *Hildebrand and the Excommunicated Emperor* (1851), *Count Arensberg, a Tale of the Days of Luther* (1853), and a sermon on the *Indian Mutiny* (1857). A *Biography* of him by his widow was published soon after his death. D. at Brighton in 1860.

**Sorti'no,** town of Sicily, province of Syracuse, pleasantly situated on the top of Monte Suzio (*Xuthia*) about 19 miles N. W. of the city of Syracuse. The views from this town are extraordinarily fine, especially toward the S., where the rugged mountains offer points of most picturesque wildness. Below may be seen the ruins of old Sortino (*Xuthia*), which was overthrown by an earthquake in 1693. Not more than a mile from the town there are numerous caverns, originally occupied by the rock-dwellers, and subsequently used as tombs by successive populations. One of these caves is 120 feet in length, 75 in width, and 42 in height. The ruins of the once powerful and flourishing *Erbessa* or *Pantalica* are also very near the town. The inhabitants of Sortino are remarkable for their skill in working gold and silver, and are altogether above the average Sicilian standard. P. 8791.

**Sosnit'za,** town of Russia, government of Tschernigov, has extensive manufactures of tobacco. P. 5000.

**Soteriol'ogy** [Gr. σωτηρίας λόγος, "doctrine of salvation"] treats of the redemptive work of Christ. In its wider signification it includes both the atonement which Christ made and its application through faith to individuals. Thus defined, it would comprise not only the doctrine of expiation, but also those of regeneration, justification, and sanctification. It is, however, used in a more re-

stricted signification, to denote only the atonement—the term redemption being applied to the others—and it is in this sense that we shall employ it.

The atonement is the satisfaction of divine justice for the sin of man by the substituted sufferings of the Son of God. Though occupying a large space in revelation, the doctrine received little theoretical investigation in the ancient Church, compared with that bestowed upon the Trinity and original sin. Its first opponents were the Ebionites and Gnostics. From different points of view both alike rejected the two tenets which the Church had derived from Scripture, that the divine justice requires satisfaction for sin, and that this satisfaction was made in behalf of man by Jesus Christ. In combating them, the apostolic Fathers (100–150) confined themselves mostly to the biblical phraseology, and attempted no rationale of the dogma. The evangelical truth was firmly held in the heart and experience, but was not examined in the dry light of the intellect. The relations of the sacrificial death of Christ to the justice of God, on the one hand, and to the conscience of man, upon the other, were left to be investigated by later theologians.

On passing from the apostolic to the primitive Fathers, we find more of the scientific discussion of the doctrine of atonement, though not sufficient to constitute a complete statement. Some of the Fathers, like Irenæus, for example, injure the discussion by attributing to the work of Christ an influence upon Satan, and finding a reference in it to the claims of Satan upon man, his captive. This vitiating element, however, did not enter largely into the patristic soteriology. The principal reference of the death of Christ, according to Irenæus himself, and especially according to Athanasius, the two Gregories, the two Cyrils, and Eusebius of the Greek Church, and Augustine, Leo, and Gregory of the Latin, was to the law and justice of God. The chief defect in the patristic soteriology is, that the distinction between justification and sanctification was not always so carefully drawn as to preserve the doctrine of atonement in its integrity. The holiness of the renewed man is occasionally represented as co-operating with the oblation of Christ in constituting the ground of the remission of sin. This was the beginning of that fatal alteration made in soteriology which finds its completion in the papal theory of justification by sanctification. Augustine himself sometimes employs phraseology which can be construed, and is by papal writers, to mean that man is justified in part by an inherent righteousness. This inward righteousness is indeed regarded as the work of God in the soul, but this fact cannot convert inward holiness or personal excellence into an atonement for past transgression. Because a man has become renewed in his heart and inclination is not a reason why his former sin should be forgiven. Nothing but suffering is expiatory, and holiness is not suffering. The loose use of justification in the sense (favored by the Latin etymology) of making just as well as of pronouncing just, tended to this error.

During the Middle Ages the papal statements had too much influence to allow of an improvement in soteriology. The course of this great doctrine of revelation was downward, in both the theory and the practical experience of the Church. Though holding in a passive and hereditary manner the patristic statements respecting the Trinity and the person of Christ, the Church was holding, more and more, a theory of redemption that was wholly opposed to that form of doctrine which had prevailed during the first four centuries in both the Eastern and the Western Church. The first mind to interrupt this dogmatic decline, and set the Church once more upon the true path of investigation, was Anselm. With him the Protestant theory of the atonement, as distinguished from the papal, may be said to have begun. His tract, *Cur deus homo?* contains the substance of the soteriology of Luther and Calvin. The leading features of his theory are these: (1) Sin is an offence against the divine honor. (2) This offence cannot be waived, but must be satisfied for. (3) Man cannot make this satisfaction except by personal endless suffering. (4) God must therefore make it for him if he is to be saved. (5) God does make it in the incarnation and atonement of the Son of God. Anselm demonstrates, by close reasoning, that the highest form of mercy is the vicarious satisfaction of justice. Whoever puts himself in the criminal's place, and suffers death in his stead, outruns all other forms and degrees of compassion. The soteriology of Anselm exerted but little influence in Roman Catholic Christendom. Anselm's sphere of labor was upon its frontier. The see of Canterbury and the English Church in the eleventh century were too near the Ultima Thule to make themselves felt upon the corrupted Christianity of the Italian popes.

The awakening of the new evangelical life in the sixteenth century was closely connected with the revival of the true doctrine of atonement. Luther's powerful assertion of justification by faith alone, without works, supposed, of course, a biblical theory of expiation. Soteriology now became the centre of dogmatic controversy between Protestant and papist, as anthropology had once been between Augustine and Pelagius, and as Trinitarianism had been between Athanasius and Arius. The consequence was that the symbols of the Reformation, both Lutheran and Calvinistic, exhibit a sharper discrimination than was seen in even the best soteriology of the patristic Church. The principal point of dispute between the Council of Trent and the Protestant theologians related to the place which sanctification occupies. The Roman divine maintained that holiness of heart is necessary to the forgiveness of sin, as a meritorious cause. Pardon, he said, cannot rest solely and wholly upon the atonement of Christ. Man is not justified by faith in Christ's atonement alone, without any works, either internal or external. Though the oblation of Christ is the principal ground of forgiveness, it is not the sole ground. The atonement must be supplemented, to some degree, by charity in the heart and by ecclesiastical penance. The Protestant theologian threw out this subjective and human element altogether. Nothing but Christ's blood is the meritorious cause and ground of forgiveness. Holiness of heart, charity, and all the other Christian graces are indispensably necessary, it is true, but for quite another reason than that assigned by the Tridentine divine. They are no part of the atonement for sin. The Protestant soteriology prevailed in Protestant Christendom, while the papal Church held to the statements now formulated for the first time, with any exactness, in the Tridentine canons.

Within the Protestant Church further discussions were afterward excited, partly by the Socinian opposition, and partly by the Grotian modification. The Socinian denied atonement altogether, taking substantially the position of the ancient Ebionite and Gnostic—namely, that retributive justice is not a real attribute of God, and that benevolence alone regulates the divine method of dealing with sin and sinners. The modification of the doctrine of atonement by Grotius is a much more important chapter in soteriology than its denial by Socinus. Grotius maintained, (1) That the satisfaction of justice is necessary, not intrinsically, but because God so decides. He might decide that it is not necessary should he so please. (2) That the amount and kind of satisfaction required by justice depends upon the will of God. Any sacrifice which God should decide to accept as an equivalent for man's punishment would be an equivalent. This theory is denominated that of *acceptilation*. The substance of it had been held in the Middle Ages by Duns Scotus. The term *acceptilatio* is borrowed from the Roman civil law. As a pecuniary creditor can call a payment of 50 per cent. a full payment if he so pleases, so God can call a satisfaction plenary and complete which in reality is only partial and incomplete. This he has done. The death of Christ in the place of the millions of mankind is not a real and strict equivalent, but it is an accepted equivalent. The object of Christ's death, according to Grotius, is not to make a full satisfaction of all the claims of retributive justice; this would require the death of mankind. But God has the right and power to waive the full demands of justice; he can relax justice if he pleases. This he does when he accepts the sufferings of Christ in the place of those of man. This relaxation of justice could not go to the extent of waiving all the claims of justice without evil consequences to the divine government. A middle course is therefore adopted. There is a partial waiving of claims, and a partial satisfaction of claims. Retributive justice is not satisfied by Christ's vicarious atonement, but public justice, as Grotius denominated it, is. Christ's death exhibits the divine detestation of sin, and thereby counteracts the ill effects of relaxing justice. The public welfare is protected, and in this way public justice is maintained. The Grotian theory finds its refutation in the leading positions taken by Anselm and the Reformers in the construction of their soteriology. The principal arguments against it are—(1) The denial of the Grotian postulate, that justice is of the nature of a positive statute, and may be both made and relaxed by the divine will. Justice is held to be an immanent attribute of God, having a necessary quality, so that its claims cannot be waived or relaxed in the least degree. (2) The satisfaction of justice must be plenary, or none at all. There is no middle ground. Justice must either be fully satisfied or trampled upon. (3) The sufferings of Christ are a true and real equivalent. They are not equivalent because they are accepted, but they are accepted because they are equivalent. The equivalency of Christ's satisfaction to that which mankind would have made by endless suffering is explained by the infinity and deity of his person.

The history of soteriology during the last two centuries presents no elements that may not be found in the preceding history. Churches and theologians have been charac-

terized either by the stricter or the looser theory of satisfaction. Speaking generally, the Calvinist has defended the positions of Anselm and the Reformers, while the Arminian has inclined, though not universally, to those of Grotius.

Among the many treatises may be mentioned Anselm's *Cur Deus Homo?* (translated in *Bibliotheca Sacra*, 1854–55); Calvin's *Institutes*, b. ii. ch. 15–17; b. iii. ch. 1–19; Owen, *On Justification* and *Divine Justice;* Pearson, *On the Creed*, art. iv.; Howe's *Living Temple*, pt. ii. ch. 5–11; Edwards, *On Justification* and *Wisdom in Salvation;* Magee, *On Atonement;* Outram, *On Sacrifice;* Hodge's *Theology*, vol. ii.; Crawford, *On Atonement;* Shedd's *History of Doctrine*, ii. 201–386; Grotius, *De Satisfactione Christi;* Limborch's *Theologia Christiana;* Sykes, *Scripture Doctrine of Redemption;* Socinus, *De Servatore.* W. G. T. Shedd.

**Sotheby** (Samuel Leigh), b. in 1805; was a partner with his father in an extensive book and art auction establishment in London; an accomplished bibliographer, antiquarian, and numismatist. Among his bibliographical works are—*Observations upon the Handwriting of Philip Melanchthon*, etc., with 33 plates (1840); *Collection of Fac-Similes of Types, Wood-Cuts, etc. used by Early Printers*, with 42 plates (1840); *Collection of nearly Five Hundred Water-marks used by the Early Paper-Makers* (1840); *The Typography of the Fifteenth Century*, containing fac-similes from the productions of more than 100 early continental printers (1845); *Principia Typographica*, relating to the block-books issued in Holland, Flanders, and Germany during the fifteenth century, considered in connection with the origin of printing, with several hundred plates and wood-cuts (1858); and *Ramblings in Search of the Autograph of Milton* (1861). He left a MS. collection relating to the works of the early poets to the year 1660, which was continued by his widow. D. in 1861, being accidentally drowned in the river Dart.

**Sothe'by** (William), F. R. S., b. in London, England, Nov. 9, 1757; educated at Harrow and in the military academy at Angers, France; travelled in Germany and Austria; was an officer of dragoons in the British army 1777–80; resided on his handsome estate of Bevis Mount, near Southampton, 1780–91; thenceforth divided his time between residences in London and in Epping Forest; possessed an ample fortune; exercised an elegant hospitality, and did much by his pen to naturalize the modern German classics in England. D. at Fair Mead Cottage, Epping Forest, Dec. 30, 1833. Author of several volumes of poems and of correct metrical translations of Wieland's *Oberon* (1798), Virgil's *Georgics*, with Latin text (8vo, 1800), and Homer's *Iliad* (1831) and *Odyssey* (1834). Printed privately the *Georgics* in six languages (folio, 1827), comprising the Latin text of Heyne, the Italian translation of Soave, the Spanish by Guzman, the German by Voss, the French by Delille, and the English by himself.

**Soth'ern** (Edward Askew), b. in Liverpool, England, Apr. 1, 1830; made his *début* as an actor in Boston, Mass., Sept., 1852, under the stage name of "Douglas Stewart;" created the character of Lord Dundreary in the play of *Our American Cousin* at Laura Keene's theatre, New York, 1858, and has since represented it many hundreds of times with great popularity in the U. S. and in England.

**Sothic** or **Sothiac Period,** and **Sothic** or **Sothiac Year** [from *Sothis*, the Egyptian name for *Sirius*, the dog-star]. From a period of fabulous antiquity, said to date from the reign of Osiris, the Egyptians employed a calendar year of 365 days, embracing 10 months of 30 days each, with 5 epagomenal or supplementary days at the end. But the observation of the heliacal rising of the dog-star (that is, of the earliest appearance before sunrise of this star annually) led them to the discovery that their calendar year was about six hours too short. They did not, however, on this account abandon it, though they perceived it to go backward relatively to the true year by an entire day in every quadrennium. Rather, on the other hand, this circumstance seemed to them to be attended with a compensating advantage; for as their religious festivals were regulated by their calendar, the gradual displacement secured to every season in its turn the benefits supposed to flow from their observance. The year of $365\frac{1}{4}$ days was called the *Sothic* year; that of 365 days, the *vague* [Lat. *vagus*, "wandering," "unsettled"] year, of which the beginning, going backward one day in every four years, completes the circuit of the seasons in $365 \times 4 = 1460$ Sothic years, or 1461 vague years; which duration is called the *Sothic* period.

The epoch of a Sothic period is taken at the coincidence of a vague and a Sothic year. Such a coincidence occurred in the year 136 of our era, when the vague year began July 20, which was also the day of the heliacal rising of Sirius. The period which then began is regarded as the third after the establishment of the cyle; which would place the beginning of the second at B. C. 1325, and that of the first at B. C 2785.

The Egyptians were, however, in error in giving to the Sothic year the length of $365\frac{1}{4}$ days exactly, though that length was also given later to the Julian year. By its definition the Sothic year is a sidereal year (see Year), and it exceeds its assumed length by $9m.\ 5.95s.$—a small amount, but sufficient to affect very sensibly the length of the period. If this period be understood to be the interval between two consecutive coincidences of the vague and Sothic years, its length will be found by computation to be almost exactly equal to 1425 vague years, or 1424 Sothic years. The true beginning of the second Sothic period must, on this supposition, be placed in B. C. 1289, and that of the first in B. C. 2713. In the first of these years, the heliacal rising of Sirius which marked at once the beginning of the vague year, the Sothic year, and the Sothic period, took place on the 11th of July by Julian reckoning extended backward; and in the second, this phenomenon occurred on the 2d of July by the same reckoning. These results make it probable that the epochs of the successive periods were not established by direct observation.

F. A. P. Barnard.

**So'this,** another name of Sirius (which see).

**Soto.** See De Soto.

**Sotteville'-les-Rouen',** town of France, department of Seine-Inférieure, on the Seine, has cotton spinning and weaving factories, and manufactures of soap, ivory-black, and chemicals. P. 8990.

**Sou.** See Solidus.

**Souari-Nut.** See Caryocar.

**Soubise',** the name of an old family of French nobility whose possessions and titles fell to the family of Rohan in 1557 by the marriage of Catharine de Parthenay and René II., Vicomte de Rohan. Their second son, Benjamin de Rohan, b. at La Rochelle in 1583, bore the title of Seigneur de Soubise, and distinguished himself by his zeal in defending the Protestant cause in France. After the fall of La Rochelle he retired to England. D. in London Oct. 9, 1642. The family became extinct with Charles de Rohan, Prince de Soubise, who was b. July 16, 1715. He was a favorite of Louis XV., whom he accompanied as aide-de-camp on his campaigns 1744–48. He also gained the favor of Madame de Pompadour, and was appointed commander-in-chief of one of the two French armies which invaded Germany on the breaking out of the Seven Years' war. But he was ignominiously surprised at Gotha by Seydlitz, and soon after completely routed at Rossbach (Nov. 5, 1757). He was recalled and made minister of war, but in 1758 he again took the highest command in the field, this time, however, with the duke de Broglie at his side. A victory was won at Lützelburg, and Soubise was made a marshal. But the jealousy of the two commanders made any further progress impossible. After the peace in 1763 he lived quietly at the court. D. July 4, 1787.

**Soul** [Gr. ψυχή; Lat. *anima*], a term variously applied to signify either the principle of life in an organic body, or the first and most undeveloped stages of individualized spiritual being, or, finally, all stages of spiritual individuality, incorporeal as well as corporeal. Aristotle, whose treatise *De Anima* (Περὶ ψυχῆς) is the first and still the greatest work on the subject, has himself introduced this confusion by defining the soul in one instance as the self-determining power (ἐντελέχεια) of an organized body, and then afterward attributing to it reason (νοῦς), and making it as reason entirely separable from body. If strictly limited to the phases of relation which the mind has toward its organic conditions, the science of the soul is properly termed anthropology, and treats first of the cosmic, sideric, and telluric influences upon mind—the determining characteristics of race, age, the seasons, the climate, the solar and lunar periods, etc. Next comes the reaction against these determining influences of nature, as manifested in the antithesis of sex, the alternation of waking and sleeping, and in the phenomena of dreams, fœtal life, somnambulism, clairvoyance, catalepsy, St. Vitus's dance, and the various forms of vicarious sense-perception (where seeing, hearing, tasting, etc., are performed by the organ of feeling, the skin, in diseased states of the organism), trance-exaltation, etc. It considers next the questions of arrested development, such as appears in idiocy; the return to the previous stages out of the stage of consciousness, and the mingling of the two (earlier and later) phases in the phenomena of insanity (wherein the Ego is unable to distinguish between the phenomena of sense-perception and those arising from the influence of general external conditions, or those arising from diseased activity of the nervous organism, and is thus confused, now acting upon one set of data and then upon a contrary set of data, and again upon a third set).

Through the stages of feeling and the reduction of external relations to the abstract generalities of habit, and especially in the creation of conventionalities whereby language becomes possible, and with it the formation and expression of general ideas, mind rises into the phase of Consciousness and Reason, knows itself as individual and independent of external natural influences, and accordingly subordinates and eliminates these in manifold ways through institutions—family, civil society, state, church, science, etc.—and learns to recognize conscious immaterial personality as the highest principle of the universe. The much-debated question of the immortality of the soul implies a definition of soul as including not only its phases of corporeal existence, but also the higher ones of thought and will. Hence, if ψυχή (soul) be only the principle of organic life, and νοῦς (reason) be the principle of intelligence elevated above the former and transcending it, the immortality of the former is precluded by definition, for the principle of conscious individuality is placed in the latter. Previous to Aristotle and Plato the theories regarding the soul were mostly crude suggestions. The Pythagoreans taught that the soul is a harmony—that it dwells in the body as in a prison, being confined there for punishment. Many conjectures as to the location of the soul have been made. Alcmæon of Crotona (according to Theophrastus) taught that the soul was located in the brain, "whither all sensations were conducted from the organs of the senses through canals." Like other Pythagoreans he held that the soul was subject to eternal motion, like the stars. Philolaus the Pythagorean held that the soul is united to the body, which is its organ, and at the same time its prison, by number and harmony, all things being known through number as a common principle of the soul and of things—like being known by like. Anaxagoras attributed souls to plants, and affirmed that they sorrow and rejoice. Democritus, who explained everything through the "atom and the void," held soul and fire to possess "round atoms," because they manifested the maximum of mobility. He affirmed that thought arises when the motions of the soul are "symmetrical;" and, further, that "the soul is the noblest part of man; he who loves its goods, loves what is most divine. He who loves the goods of the body, which is the tent of the soul, loves the merely human." Critias the Sophist considered the blood to be the substratum of the soul. Plato (in the *Phædrus*) makes three souls or phases of the soul: (*a*) the appetitive soul, seeking happiness or sensual pleasure, the gratification of desire; (*b*) the irascible or courageous soul, manifesting itself in combative activity, as the former in passive receptivity; (*c*) the rational soul, which alone is immortal. The cognitive or rational soul is the soul in its totality, and the irascible and appetitive souls are merely phases of arrested development occasioned by the confinement of the body. The rational soul dwells in the head (agreeing with Alcmæon), the irascible in the heart, the appetitive in the organs of nourishment and reproduction. Plato defines (*Leg.*, cap. 10) the soul as a self-moving activity (κίνησις ἑαυτὴν κινοῦσα). Transmigration of souls (*Phædo*), a doctrine apparently borrowed from Egypt and the Orient, is consonant with his theory of the pre-existence of the soul, and of the rise of the appetitive and irascible phases of the soul through the descent of the rational soul into a body. Having made the discovery of general and necessary ideas, which could not have originated in sense-perception, he undertook to account for them through reminiscence; the soul had perceived them in a former life. These ideas, *a priori*, were simple and eternal: how could the soul in which they were contemplated be other than simple and eternal? While he condemned the Pythagorean view that the soul was a harmony, Plato employed symbolic expressions quite similar. In the same spirit his successor in the Academy, Speusippus, defined the soul as "extension, shaped harmoniously by number;" hence as, in some higher sense, a unity of the arithmetical and geometrical. So, too, Xenocrates of Chalcedon, the second director of the Academy, taught that the soul is a self-moving number. Aristotle repudiated the use of symbolic language in definitions, to avoid ambiguity. He defined soul (*De An.*, ii. 1) as "the first entelechy [self-actualizing energy] of a physical, potentially living and organic body." The first entelechy is not a fully-realized being, and hence it has been inferred that he intended to exclude the reason (νοῦς) from his definition of the soul, especially, too, as he makes the νοῦς to be independent of the body. But in another place he makes the soul to be "that by which we live, feel or perceive, move, and understand." The νοῦς ποιητικός = the *actus purus*, or pure reason, exists before the body, and enters it from without (θύραθεν) as something divine and immortal (*De Gen. et Corr.*, ii. 3). The νοῦς παθητικός = passive reason, including the nutritive (vegetable), sensitive (animal), and so much of the rational soul as included memory, imagination, sense-perception, and discursive intellect, he regarded (*De An.*, ii. 2) as perishable with the body. Exactly what he meant by this was long in dispute. Alexander of Aphrodisias, the great commentator, held that the active reason is the world-soul, and that individuals are mere incarnations of it which perish with the body. Dicæarchus of Messene, pupil of Aristotle, had held this doctrine. The Stoics had held nearly the same doctrine, acknowledging that the soul outlives the body, but is not eternal. Cleanthes the Stoic asserted that all souls would exist until the general conflagration of the world. But Chrysippus limited this to the souls of the wise, while Panætius denied the future life altogether. The statements of Aristotle, taken together, indicate his belief in the existence of the soul independent of the body; and not merely as a general world-soul, but also as individual souls. In the process of education, culture, or self-development the individual gradually eliminates his lower phases of thought; he depends less upon sense-perception, learning to know a great deal from seeing very little (Cuvier could describe the whole animal from one of its bones; Agassiz, a fish from one of its scales); mechanical memory likewise becomes less important as deduction from principles becomes more prominent; discursive intellect gives place to pure intellect. Thus, the lower faculties die out, and give place to more perfect forms; they become useless in the presence of more adequate forms of cognition. Hence, Aristotle was correct in describing them as transient and perishable like the body; and yet he did not at all deny, by this, future conscious identity to the individual. The active reason could energize as nutritive, locomotive, appetitive, and sensitive, organizing a new body; for organization was only a self-limitation of the active reason, a self-arrested development of it. Hence, when Averroës revived the doctrine of Alexander of Aphrodisias, the great scholastic thinkers devoted themselves to this question until they reconciled Aristotle with himself through this theory of the union of the active and passive reasons—the former as independent and substantial, and the latter as eternally produced through its energy. Albertus Magnus held that the active reason bears within itself the vegetative, sensitive, appetitive, and motive faculties. Thomas Aquinas held, similarly, that as the soul is immaterial, it cannot be destroyed through the removal of its substratum. The form-producing principle of the body, the vital force, the appetitive, sensitive, and motive powers, belong to the thinking substance, and do not inhere in the body; hence are immortal. Pure thought acts without organs; the lower functions of the soul act with organs created for temporary manifestation. This view substantially agrees with that of the Neo-Platonists, except as to the origin of the soul. "The soul is immaterial, and whole or entire in every part of the body;" this statement is constantly repeated by thinkers since Aristotle. Plato's doctrine of pre-existence and reminiscence is endorsed by some of the Platonizing Christian thinkers like Origen, Synesius, and Nemesius, but is generally repudiated, as by Arnobius, Justin Martyr, Gregory of Nyssa, St. Augustine, Æneas of Gaza. With Descartes, thinking substance is so sharply distinguished from matter that only divine intervention will account for their interaction. Geulincx, Malebranche, and Leibnitz presented different solutions of this dualism, but Spinoza boldly denied it altogether, making mind and matter two attributes of one substance. La Mettrie, a pupil of Boerhaave, observing the effect of the increased circulation of the blood upon his thoughts during a fever, concluded that psychical functions are all to be explained by the organization of the body. Diderot held that atoms are endowed with sensation, and that when combined in the animal organism they become conscious, thus reviving the doctrine of Democritus and Epicurus, who made the soul material, and perishable upon the separation of its constituent atoms. Carl Vogt in recent times makes the phenomena of the soul to be functions of the brain and nerves. Moleschott and Büchner have promulgated and popularized the same doctrine. Kant endeavored to show that the metaphysical argument which proved the immortality of the soul from its nature as simple substance is a paralogism, because the Ego which thinks is subject only, and does not appear as object in consciousness. Herbart, however, defends the idea of the soul as a simple, spaceless essence; and his disciple, Beneke, expounds the same doctrine. Trendelenburg returns to the Aristotelian definition: "The soul is a self-realizing, teleological idea; not a result, but a principle." At present there is a very great activity on the part of the physiological school of writers, who are engaged in investigating the physical correlates of psychical action.

WILLIAM T. HARRIS.

**Soulanges,** county of Quebec, Canada, bounded S. by the river St. Lawrence and W. by Glengary co., Ottawa. It is traversed by Grand Trunk Railway. P. 10,808.

**Soulé** (Mrs. Caroline A.), b. in Albany, N. Y., in 1824; has been connected with periodicals as editor or contributor, and has published *Memoir of Rev. H. B. Soulé* (1852), *Home Life* (1854), *The Pet of the Settlement* (1860), and *Wine or Water* (1862).

**Soule** (Joshua), D. D., b. at Bristol, Me., Aug. 1, 1781; was licensed as a Methodist preacher 1798; was presiding elder of the Maine district 1804–13; was author of the plan for a delegated general conference of his Church, adopted at Baltimore 1808; was editor of the *Methodist Magazine* 1816–20; preached in New York and Baltimore; declined a bishopric 1820, but was again elected and accepted 1824; resided some years at Lebanon, O.; was a delegate to the British Wesleyan Conference 1842; adhered to the M. E. Church, South, on the division of the Church 1844; settled at Nashville, Tenn.; visited California on an episcopal tour 1853–54, and continued active in the discharge of the duties of his post until his death at Nashville Mar. 6, 1867, being at that time the senior bishop of the M. E. Church, South.

**Soulé** (Pierre), b. at Castillon, France, in 1801; educated for the Roman Catholic priesthood in the Jesuit college at Toulouse; studied afterward at Bordeaux; there took part in a conspiracy against the government of Louis XVIII., which being discovered he had to flee, and for more than a year followed the occupation of a shepherd; then went to Paris; became a writer for a republican newspaper, *Le Nain;* was imprisoned in Ste. Pélagie for an attack on the ministry; escaped to England; proceeded to Santo Domingo; came thence to the U. S.; resided first a few months at Baltimore; settled at New Orleans 1825; studied law; took a high position at the bar; was U. S. Senator 1847–53, and distinguished for extreme Southern views; was appointed minister to Spain 1853; had a duel with the French ambassador at Madrid; favored the Spanish revolution of Aug., 1854; took part in the Ostend conference of Oct., 1854, intended to facilitate the acquisition of Cuba; returned to the U. S. 1855; visited Mexico soon afterward in the interest of the Tehuantepec canal project; opposed the secession of Louisiana, but ultimately adhered to the movement, and visited Europe as Confederate agent 1861; was imprisoned for disloyalty at Fort Lafayette 1862; was released on condition of proceeding to Europe, where he remained six years; returned to Louisiana 1869. D. at New Orleans Mar. 16, 1870.

**Soulé** (Richard), b. at Duxbury, Mass., in 1812; graduated at Harvard College in 1832; aided in the preparation of Worcester's *Dictionary of the English Language*, and has published *Memorial of the Sprague Family*, a poem, to which the family genealogy and biographical sketches are appended in notes; in conjunction with William A. Wheeler, *A Manual of English Pronunciation and Spelling* (1861) and *First Lessons in Reading* (1866); and *A Dictionary of English Synonyms or Parallel Expressions* (1870).

**Soulié** (Melchior Frédéric), b. at Foix, department of Ariège, France, Dec. 23, 1800; studied law; made his début in literature in 1824 with a volume of poems, *Amours français*, which passed by almost unnoticed, and wrote in 1828 *Roméo et Juliette*, and in 1829 *Christine à Fontainebleau*, which had much effect on the stage. Others of his dramas were also successful—*Clotilde* (1831) and *La Closerie des Genêts* (1846). But it was principally as a novel-writer that he became famous. He wrote about 150 volumes of novels, and although their artistic and poetical merits were very small, some of them became very popular, such as *Le Comte de Toulouse* (1835), *Un Été à Meudon* (1836), and *Mémoires du Diable* (1844). D. at Bièvre, near Paris, Sept. 23, 1847.

**Soulouque′** (Faustin), b. at Petit Goave, in the southern peninsula of Hayti, about 1785; was by birth a slave, but freed by the French decree of 1790; took part in the insurrections of 1803 and 1820, attaining in the latter year the rank of captain; bore a prominent part in the civil war of 1844–45; became commander of a division 1846; was elected to the presidency Mar. 1, 1847; attached himself to the party of the blacks; inaugurated a period of terror and decimation of prominent citizens; attempted without success to conquer the republic of Santo Domingo; proclaimed himself emperor under the title of Faustin I. Aug. 26, 1849; created a nobility, a military, and a civil order of knighthood, and promulgated a constitution, which, however, he reserved the right to abrogate at any time; had himself crowned 1850, and again with great pomp in imitation of Napoleon I. Apr. 18, 1852; invaded Santo Domingo with 10,000 men, but was completely routed by Santana, losing his treasure and throne, and narrowly escaping capture, 1855; was again unsuccessful in another invasion 1856; was overthrown by Geffrard 1858; took refuge in Jamaica Jan., 1859; returned to Hayti on the fall of Geffrard 1867. D. at Petit Goave Aug. 6, 1867.

**Soult** (Nicolas Jean de Dieu), duke of Dalmatia, b. Mar. 29, 1769, at St. Amans-la-Bastide, department of Tarn, France, the son of a farmer; entered the ranks of the army in 1785; became a lieutenant in 1792, captain in 1793, brigadier-general in 1794, general of division in 1799, and marshal of France in 1804. He distinguished himself greatly in the battles of Austerlitz and Jena, and was made duke of Dalmatia after the Peace of Tilsit. With the exception of a short period, during which the fatal battle of Vittoria took place, he held the command in Spain from 1808 to 1814. During his first term he baffled all Wellington's exertions, but during the second, when his army had dwindled down to hardly 20,000 men, he was compelled to retreat into France, and was defeated at Orthez and before Toulouse. Made minister of war during the first restoration, he joined Napoleon during the Hundred Days, and lived in exile at Düsseldorf from 1815 to 1819. Allowed to return in the latter year and reinstated in his dignities in the army, he soon won the favor of Charles X., and was made a peer of France in 1827. Under Louis Philippe, between 1834 and 1847, he was several times minister of war, minister of foreign affairs, and president of the cabinet, but in 1847 retired from public life, having been made a marshal-general of France—a dignity which had been conferred previously only on Turenne and Villars. D. Nov. 26, 1851. The first part of his *Mémoires* was published by his son in 1854, in 3 vols.

**Sound.** See Acoustics, by Prof. O. N. Rood.

**Sounding.** See Deep-Sea Soundings, by Prof. W. P. Trowbridge, A. M.

**Sound, The,** or **Oeresund,** is the narrow strait, 40 miles long and 3 miles broad, between Sweden and the Danish island of Seeland, connecting the Cattegat with the Baltic. As Denmark before 1660 possessed the land on both sides of the Sound, she demanded toll of every vessel passing the Sound, and built the splendid fortress, Kronborg, to enforce her demands; and even after she lost her possessions on the eastern side of the Sound, she continued to impose "Sound duties," as the passage is clearest along the Danish coast. The duty was by itself insignificant, but the delay caused by paying it was often very provoking, and might have serious consequences, as the wind is singularly changeable in the Sound. In 1857 this toll was abolished by a friendly agreement between Denmark and the different nations which use the Sound as a road of traffic, but it is worth notice that the maintenance of these "Sound duties," which in their true character were nothing but robbery, has probably cost Denmark ten times more than the revenue ever brought in, for her wars and most of her enmities arose from this source. (See Hanseatic League.)

**Sound-Waves.** See Acoustics, by Prof. O. N. Rood, and Interference, by Pres. F. A. P. Barnard.

**Souris,** port of entry of King's co., Prince Edward Island, Canada, on both sides of the mouth of the river Souris, which has a bar with only 8½ feet of water at high tide. A breakwater is in process of construction. There are two villages, E. and W. Souris. The town has a U. S. consular agent and a grammar school. Fishing and shipbuilding are carried on. P. about 500.

**Sour′-Sop,** the fruit of *Anona muricata*, a beautiful tree of tropical America. The sour-sop often weighs two or three pounds. Its taste is sour and pleasant. It is very soft and white, and is much eaten in the West Indies.

**Soutane′** [Fr.], or **Cassock** [Lat. *talaris*], the long robe of a Roman Catholic priest. It was formerly, and still is in some places, worn as the every-day garment of priests and clerics of all degrees; and its use is compulsory during public service in all places. The more sacred vestments are worn outside the cassock. Its color for seculars is black; for regulars, such as may be designated in the rules, as white, blue, gray, etc.; for bishops, violet; for cardinals, red; for the pope, white.

**South,** tp., Siskiyou co., Cal. P. 939.

**South,** tp., Madison co., Ia. P. 1040.

**South,** tp., Dade co., Mo. P. 1029.

**South** (Sir James), F. R. S., b. at Southwark, London, England, in 1785, was son of a druggist; educated for the medical profession; practised some years as a surgeon, but abandoned that profession for the pursuit of astronomical studies; was one of the chief founders of the Royal Astronomical Society 1820; aided Herschel in his laborious researches upon nearly 400 double stars; was associated with Herschel in the award of the gold medal of the Astronomical Society Feb. 10, 1826; received the Copley medal of the Royal Society Nov. 30 of the same year; became president of the Astronomical Society 1829; established a private observatory at Campden Hill, Kensington,

London; was knighted by William IV. shortly after his accession, and received a pension of £300; was concerned for many years in the preparation of the *Nautical Almanac;* published papers *On the Atmosphere of Mars* (1831–32), and was a frequent contributor to the *Annals of Philosophy* and to the *Quarterly Journal of Science.* D. at Kensington Oct. 19, 1867.

**South** (JOHN F.), M. D., one of the surgeons of St. Thomas's Hospital, London, and some time president of the Royal College of Surgeons; author of several standard surgical works, among which are *Dissector's Manual* (1825), *Compendium of Anatomy* (1831), *Description of the Bones* (1837), *System of Surgery, from the German of J. M. Chelius* (1847), and *Notes on the Surgery of the War in the Crimea* (1858).

**South** (ROBERT), D. D., b. at Hackney, near London, England, in 1633; studied as a king's scholar at Westminster School under Dr. Busby; graduated at Christ Church, Oxford, 1655; took orders in the Church of England 1658; was university orator 1660; became chaplain to the earl of Clarendon and tutor to his children; was made prebendary of Westminster 1663, canon of Christ Church 1670; accompanied Lawrence Hyde (afterward earl of Rochester) on an embassy to John Sobieski, king of Poland, 1677; became on his return rector of Islip, Oxfordshire, and soon afterward chaplain to King Charles II.; was a vigorous advocate of passive obedience and of the divine right of kings, and a powerful opponent of dissenters, and was esteemed one of the most eloquent preachers of the time. D. in London July 8, 1716. Author of 11 vols. of *Sermons* (1692 and 1744), and of controversial publications against Dr. Sherlock, whom he accused of tritheism.

**South Ab'ington,** p.-v., Abington tp., Plymouth co., Mass., on both Plymouth and Bridgewater branches of Old Colony R. R., has important boot and shoe tack and other manufactories.

**South Ac'ton,** p.-v., Acton tp., Middlesex co., Mass., on main line and on Marlborough branch of Fitchburg R. R., has a woollen-factory, a planing-mill, also pencil and soapstone works.

**South Adams.** See ADAMS, Mass.

**South Am'boy,** p.-v. and tp., Middlesex co., N. J., on Raritan Bay, is the N. terminus of Camden and Amboy R. R., has an academy and some manufactures. P. 4525.

**South America.** See AMERICA.

**Southampton,** county of England. See HAMPSHIRE.

**Southamp'ton,** a seaport-town of England, at the head of Southampton Water, an inlet communicating with the sea-channel which separates the Isle of Wight from the main. The town is a peninsula between the inner entrances of the Itchen and Test (or Anton) rivers, in which Southampton Water terminates. The situation of the port and the auxiliary dock-accommodations have made Southampton one of the most important steam-packet stations in the world. Steamers sail thence for Australia, America, India, China, Spain, Portugal, Gibraltar, and the Mediterranean, for the Channel Islands and for France, and there is an incessant intercourse with the Isle of Wight. As a government emigration-port it is the port from which Australian emigrants depart. A large export and import trade is carried on, the latter in wines and brandies from France and Portugal, of timber from the Baltic, corn and provisions from America, etc. The site of the ancient Roman *Clausentum,* hard by, is still indicated by rampart and ditch. The present town, attributed to the Anglo-Saxons, was called *Hantstone,* from which the present name is derived. J. G. BARNARD.

**Southampton** (P. O. name SAUGEEN), a port of entry of Bruce co., Ont., Canada, at the mouth of Saugeen River, on Lake Huron, 60 miles N. by E. of Goderich, is the N. E. terminus of the Wellington Grey and Bruce division of Great Western Railway. Grain and lumber are the chief exports. P. 858.

**Southampton,** county of S. E. Virginia, adjoining North Carolina, between Blackwater River on the E. and Meherrin on the S. W., intersected by Nottoway River, and traversed by Seaboard and Roanoke and Atlantic Mississippi and Ohio R. Rs., has an undulating surface, variegated by vast forests of pine and cypress. Staples, Indian corn, tar, and turpentine. Cap. Jerusalem. Area, 600 sq. m. P. 12,285.

**Southampton,** p.-v. and tp., Hampshire co., Mass., on New Haven and Northampton R. R. P. 1159.

**Southampton,** tp., Burlington co., N. J. P. 2374.

**Southampton,** p.-v. and tp., Suffolk co., N. Y. (L. I.), on Atlantic Ocean, Shinnecock and Great Peconic bays, and on Sag Harbor branch of Long Island R. R. P. of v. 943; of tp. 6135.

**Southampton,** tp., Bedford co., Pa. P. 1647.

**Southampton,** tp., Bucks co., Pa. P. 1393.

**Southampton,** tp., Cumberland co., Pa. P. 2050.

**Southampton,** tp., Franklin co., Pa. P. 1963.

**Southampton,** tp., Somerset co., Pa. P. 673.

**Southampton,** EARLS OF. THOMAS WRIOTHESLEY, first earl, b. about 1490; was educated at Cambridge; called to the bar; was appointed to an office in the common pleas, and in 1538 was made secretary of state by Henry VIII., and after the fall of Thomas Cromwell was virtually first minister, and in 1543 was raised to the peerage under the title of Baron Wriothesley of Titchfield, with a grant of abbey-lands; in 1544 became lord chancellor, taking the prescribed oath of abjuration of papal authority. He, however, joined in the persecutions of the Protestants under Henry VIII., and in at least the case of Anne Askew personally superintended the torture. He was ordered by Henry to arrest and impeach Queen Catharine Parr upon charge of heresy; but when he came to execute the order, the king had changed his mind, and Wriothesley was roughly sent back; but he soon regained the favor of his sovereign, and was made a knight of the Garter. He was one of the executors of the will of Henry, and was created earl of Southampton by Edward VI., but having opposed the ambitious schemes of the protector Somerset, he was deprived of the seals. D. in London July 30, 1550. —HENRY WRIOTHESLEY, third earl, grandson of the preceding, b. Oct. 6, 1573; was a patron of Shakspeare, who dedicated to him the poems *Venus and Adonis* and *The Rape of Lucrece.* He was a friend of the earl of Essex, whom he accompanied to Cadiz, and in 1599 to Ireland; was accused of complicity in the treasonable designs of Essex; protested his innocence; was convicted, and sentence of death and attainder was pronounced, but Elizabeth remitted the death-penalty, and the attainder was removed by Parliament soon after the accession of James I. He was an assignee of the patents of settlement of Sir Walter Raleigh, and took a prominent part in the early colonization of America, and in the second charter of Virginia his name occupies a leading position, and he became the governor of the Virginia Company. In Parliament he was a firm supporter of liberty; and in 1621 was committed to close custody by the king, but was released through the influence of Buckingham. He soon after went, accompanied by his son, Lord Wriothesley, to the Netherlands, to aid the Dutch in their struggle against Spain, and took command of a regiment. While in winter-quarters he and his son were attacked with fever; the son died, but the father recovered sufficiently to set out to convey the body to England, but died on the way, at Bergen-op-Zoom, Holland, Nov. 10, 1624.—THOMAS WRIOTHESLEY, fourth earl, son of the preceding, b. about 1600; was at first a supporter of the Commons in resisting the encroachments of Charles I., but with Strafford went over to the royal side, and was made a privy councillor; in 1642 was sent by the king to convey to Parliament his proposals for accommodation, and in 1645 was one of the royal commissioners to discuss terms of peace. He was one of the leaders of the moderate party, and lived unmolested in England during the Commonwealth, and sent large sums for the maintenance of Charles II. during his exile; upon the restoration of Charles, in 1660, he was made lord high treasurer. D. in 1667.

**South Ann,** p.-v. and tp., Charlevoix co., Mich. P. 400.

**South Ann'ville,** tp., Lebanon co., Pa. P. 1856.

**South'ard** (HENRY), b. in New York Oct., 1759, his father's name having been SOUTHWORTH, and connected with the Plymouth family of that name; removed to Baskingridge, N. J., in childhood; received an ordinary common-school education, but was a man of great memory and practical talent; worked on a farm, and earned in that way enough money to buy a farm for himself; served in the Revolutionary war; was for nine years a member of the State legislature; sat in Congress 1801–11 and 1815–21, and in the latter year met as a member of a joint committee of the U. S. Senate his distinguished son, SAMUEL LEWIS, with whom he voted on the Missouri Compromise. D. in New Jersey June 2, 1842.

**Southard** (SAMUEL LEWIS), LL.D., son of Henry, b. at Baskingridge, N. J., June 9, 1787; graduated at Princeton 1804; taught school in New Jersey, and was a family tutor in Virginia several years, during which time he studied law and was admitted to the bar; settled at Flemington, N. J., 1811; became law-reporter 1814, associate justice of the supreme court 1815; was U. S. Senator from Jan. 22, 1821, to 1823, serving a considerable time as

president *pro tem.* of that body; was appointed by Pres. Monroe secretary of the navy 1823; was acting secretary of the treasury six months 1825, and for a short time acting secretary of war; was chosen attorney-general of New Jersey 1829, governor 1832; and was again U. S. Senator from 1833 to his death, at Fredericksburg, Va., June 26, 1842. He became a trustee of Princeton College 1822, and soon afterward of the Theological Seminary, and was offered, but declined, the Whig nomination for Vice-President along with Harrison, thereby losing also the post of President, to which he would have succeeded by Harrison's death, on which occasion, however, he was for the second time chosen president *pro tem.* of the Senate.

**Southard** (SAMUEL LEWIS, JR.), b. at Trenton, N. J., in 1819; graduated at Princeton 1836; took orders in the Protestant Episcopal Church, and is author of *The Mystery of Godliness* (1848) and other theological and miscellaneous publications.

**South Ar'lington,** p.-v., Clay tp., Montgomery co., O. P. 124.

**South Austra'lia,** a British colony, founded in 1834 by the South Australian Company, and practically established in 1837, comprises a vast territory estimated at 380,000 sq. m., and extending from lat. 26° S. to the southern coast of the continent, between lon. 132° and 141 E. The climate and physical aspect of so extensive a region vary, of course, considerably, according to locality, but, generally speaking, the interior consists of an elevated plateau, bounded S. and S. E. by ranges of wooded hills, between which fine valleys, running from N. to S., open into large, low plains toward the coast. The interior is only fit for pasturages, but large flocks of sheep and herds of cattle are kept here, and succeed well. In the valleys and on the plains, when sufficiently watered, the soil is very productive; wheat, maize, oats, tobacco, and all the fine fruits of the tropic and temperate zones are raised—oranges, lemons, peaches, grapes, mulberries, etc. But the lack of sufficient water is often severely felt. The whole region, though in many places abounding in small lakes, is deficient in streams. The climate, though healthy, is very hot and dry, and timber and wood are generally scarce. The mineral wealth of the province is very great, but on account of lack of coal the ore must be sent to other places. Gold has been found and mines are worked, though the yield has not been so large that it has attracted any particular attention to the fields. But the copper and lead mines are very rich; the ore of Barra-burra contains 75 per cent. of copper, and in 1868 copper was exported from the colony to the value of £400,691. The principal article of export is wool, which in the same year amounted to £1,346,323. The population of the colony was in 1866, 163,452, and in 1871, 192,387. In 1871 the total value of exports amounted to £3,582,000, and of imports to £2,158,000. Principal town, ADELAIDE (which see).

**South Beaver,** tp., Beaver co., Pa. P. 1206.

**South Bend,** city, cap. of St. Joseph co., Ind., on Lake Shore and Michigan Southern, Michigan Central, and Chicago and Port Huron R. Rs., 85 miles E. of Chicago, contains 12 churches, Notre Dame University, St. Mary's Academy, St. Joseph's Academy, and the Academy of the Assumption, excellent high and ward schools, water and gas works, a fine system of sewerage, 3 banks, 1 daily and 3 weekly newspapers, ample water-power from St. Joseph's River, an extensive wagon and carriage manufactory, South Bend Ironworks, a plough-factory, paper and flouring mills, a sewing-machine establishment, the Indiana Reaper and Iron Co., a fire department, furniture and chair factories, foundries, and the various other industries of a thriving city. P. 7206. A. B. MILLER, ED. "TRIBUNE."

**South Bend,** p.-v. and tp., Blue Earth co., Minn., on St. Paul and Sioux City R. R. P. of v. 301; of tp. 596.

**South Bend,** p.-v. and tp., Cass co., Neb. P. 311.

**South Bend,** tp., Armstrong co., Pa. P. 1127.

**South Berne,** p.-v., Berne tp., Albany co., N. Y. P. 50.

**South Ber'wick,** p.-tp., York co., Me., on Boston and Maine and Eastern R. Rs. and Salmon Falls River, has 6 churches, a library and public hall, an academy (1791), 2 banks, 1 newspaper, 1 cotton and 2 woollen mills, a shoe-factory, carriage and ladder factories, and saw and planing mills. P. 2510. CHAS. E. COOK, ED. "ENTERPRISE."

**South Beth'lehem,** p.-b., Northampton co., Pa., at the foot of Lehigh Mountain. The district in the immediate vicinity is acknowledged to be the richest in needful minerals of any section of the U. S., if not of the world. With 4 railroads to carry raw and manufactured freightage, a canal of good capacity, and a river capable of being converted into the finest, most useful, necessary, and profitable ship-canal in the world, the means of transportation N., S., E., and W. are unsurpassed by any place possessing equal advantages. Surrounding wealth and facilities for manufacturing, and in addition nearness to Atlantic shipping-ports and the markets of New York, Boston, Philadelphia, and Baltimore, make the future of this city most promising. In the immediate vicinity are the richest zinc accumulations in the world. Between here and Mauch Chunk, in Northampton and Lehigh cos., are inexhaustible deposits of iron ore, and near by mountains of coal and slate. There are large quantities of good stone for several purposes, and limestone also. Among the manufacturing establishments are Bethlehem Iron and Steel Rail Works; Lehigh Zinc Works and Mines; Lehigh Shovel Works; Lehigh Brass Works; governor works; iron-foundry and machine-works; Northampton Planing-mill; a brick-yard; Lehigh Mountain Brewery; Lehigh Valley Chain-works, an organ manufactory, a daily and weekly newspaper, slate and coal dépôts, union R. R. dépôt, 4 bakeries, and a bank. Here are Lehigh University (a large endowed institution), a young ladies' seminary, good schools, a water-cure, springs, boarding-houses, St. Luke's Hospital, 6 churches (one of 3000 members), gasworks, 16 hotels, 2 brass bands and 2 string bands, 2 literary societies, free reading-rooms, dramatic associations, beneficial societies, St. Michael's Hall. P. 3556. CUSHING & JACKSON,
PUBS. "NORTHAMPTON CONSERVATIVE."

**South Bloom'field,** tp., Morrow co., O. P. 1115.

**South Bloomfield,** p.-v., Harrison tp., Pickaway co., O., on Scioto River. P. 283.

**South'borough,** p.-tp., Worcester co., Mass., on Boston Clinton and Fitchburg R. R., 28 miles from Boston, including the villages of Centre, Fayville, Cordaville, and Southville, has 4 churches and 6 ecclesiastical societies, a public library, St. Mark's Episcopal school, a seminary, a school for idiots, a handsome town-house, 1 newspaper, 2 shoe, 1 blanket, and 1 mattress manufactory, several mills, a granite-quarry, brickyard, Masonic lodge, and farmers' and reform clubs. P. 2135.
STILLMAN B. PRATT, ED. "PRESS."

**South Bos'ton,** a portion of the city of Boston, Mass., has 18 church edifices; among the public buildings are the house of correction, insane asylum, institution for feeble-minded youth, Massachusetts asylum for the blind, Appleton temporary home for inebriates, branch of the Public Library, excellent schools, 1 savings bank and 1 national bank. Within its limits are many of the largest iron-working establishments in the country, 3 breweries, 3 kerosene-oil refineries, glass-works, several lumber-wharves, 3 sugar-refineries, a chain-factory, American steam safe works, and many factories of other kinds. Its facilities for wharves are very extensive, being a peninsula. The chief historic memory of the place is connected with Dorchester Heights (being formerly a part of Dorchester), by the erection of batteries on which the evacuation of the city by the British was compelled. Three weekly papers are published, and 1 amateur monthly. The streets are laid out with more system and regularity than in the older part of Boston, and when projected improvements are accomplished it will become, doubtless, the business-centre of the metropolis. P. about 45,000. CHARLES L. STORRS,
ED. "SOUTH BOSTON INQUIRER."

**South Boston Dépôt,** p.-v., Halifax co., Va., on Piedmont Air-line R. R.

**South Brain'tree,** p.-v., Braintree tp., Norfolk co., Mass., at junction of Taunton and Plymouth branches with main line of Old Colony R. R., has extensive manufactories, especially of boots and shoes.

**South Branch,** p.-v. and tp., Watonwan co., Minn. P. 146.

**South'bridge,** p.-v. and tp., Worcester co., Mass., on New York and New England R. R., 70 miles S. W. of Boston, has a public library, 1 newspaper, 2 banks, a fire insurance company, 2 hotels, a woollen-factory, Southbridge printworks, American Optical Company, and manufactories of cotton cloth, knives, shuttles, twine, cassimere, reps, etc. P. 5208. GEO. M. WHITAKER, ED. "JOURNAL."

**South Bris'tol,** p.-v. and tp., Ontario co., N. Y., on Canandaigua Lake. P. 1218.

**South Bruns'wick,** tp., Middlesex co., N. J. P. 3779.

**South Buf'falo,** tp., Armstrong co., Pa. P. 1633.

**South Bur'lington,** tp., Chittenden co., Vt. P. 791.

**South'bury,** p.-v. and tp., New Haven co., Conn., on Housatonic River. P. 1318.

**South But'ler,** p.-v., Butler tp., Wayne co., N. Y., has 5 churches and several manufactories.

**South Ca'naan,** tp., Wayne co., Pa. P. 1308.

**South Caroli'na,** one of the Southern Atlantic States, lies between the parallels of 35° 13′ and 32° 04′ N. lat., and between the parallels of 78° 28′ and 83° 18′ W. lon. from Greenwich. It is bounded on the N. and N. E. by North Carolina, on the S. E. by the Atlantic Ocean, on



Seal of South Carolina.

the S. W. and W. by Georgia, the Savannah River and its affluents, the Tugaloo and Chattooga, forming the boundary-line between it and Georgia. The State is triangular or wedge-shaped in form, the coast-line forming the thick end of the wedge, and the North Carolina and Georgia lines meeting at the W. of the State. Its coast-line is about 210 miles, and its extreme length from Little River Inlet to the Chattooga River on the W. about 240 miles. Its area is variously stated, the older authorities making it 29,385 sq. m.; Gov. Seabrook stating it in 1850 at 30,213 sq. m.; and the U. S. census-office in 1860 and 1870 at 34,000 sq. m., or 21,760,000 acres. In the absence of an accurate survey, the census estimate may be presumed to be the nearest approximation to the truth.

*Face of the Country and Topography.*—The coast from 80 to 100 miles from the ocean is alluvial, low, and in some sections covered with swamps and marshes, through which sluggish streams flow and discharge their waters into the sounds and landlocked bays along the coast, which are protected, from Winyaw Bay to the Savannah River, from the violence of the ocean by long stretches of alluvial islands. Much of this low, flat country is covered with pitch-pine forests. Beyond it the land rises into a belt of low sandhills, called the "middle country," which is moderately fertile; next to this comes what is known as "the Ridge," where the land rises abruptly in successive terraces, alternating with beautiful valleys and rounded hills, till it reaches its greatest height in the Blue Ridge in the extreme N. W. of the State. This region averages a height of over 2000 feet above the sea, while Table Mountain in Pickens co., the highest peak of the Blue Ridge in the State, is 4000 feet above the sea, and has a perpendicular cliff with a face of 1100 feet. Cæsar's Head in the same vicinity is of less elevation, as is also King's Mountain, an isolated summit in York co. The State is well watered. The Waccamaw, having its source in North Carolina, winds sluggishly through the low lands in the N. E. portion of the State to Winyaw Bay, interlacing in its course through the swamps with the Great and Little Pedee, two important rivers which with their affluents drain a large region in the N. E. and N. part of the State, and discharge also into Winyaw Bay; Black River, with several affluents, finds its way into the same bay; the Santee, the largest river of the State, with its tributaries, the Wateree, called the Catawba in its upper course, Congaree, Broad, and Saluda rivers, drains the central portion of the State, and forms an extensive delta where it enters the ocean; Cooper and Ashley rivers, after washing the sides of the Charleston peninsula, discharge into the bay and harbor of the city; the Edisto, with its N. and S. forks and its numerous tributaries; the Ashepoo, and the Combahee, formed by the union of the Big and Little Salkehatchie, all discharge their waters into St. Helena Sound; the Coosawhatchie, though itself a minor stream, yet falls into the great estuary known as Port Royal Inlet and Port Royal Sound; and finally the Savannah, having its source, under the names of Tugaloo and Chattooga, in the North Carolina and Georgia mountainous district, flows S. E. between Georgia and South Carolina to its broad delta in lat. 32°. The islands along the South Carolina coast are many of them of considerable size and of great fertility. They are the favorite region for the growth of the long-stapled or sea-island cotton, rice, etc. The principal islands, several of them largely connected with the incidents of the late civil war, are Hilton Head, Port Royal, St. Helena, Phillips' Hunting, Edisto, John, James, and Folly islands, and above Charleston harbor, Long, Dewees, Caper, Bull's, Cape, Cedar, South, and North islands. There are no lakes except those in the swamp region. The sounds and water-courses along the coast of South Carolina, as far N. as Winyaw Bay, form a continuous, though sometimes a circuitous, navigable route, and may become an important portion of the great landlocked canal projected from New Orleans to Charleston.

*Geology and Mineralogy.*—The geological formations of South Carolina are very simple. The whole region of swamps, islands, and natural canals for a distance of 25 or 30 miles inland is Quaternary or Alluvial, the soil a light but wonderfully fertile loam, and with proper drainage the most valuable portion of the State; immediately beyond this is a belt of Tertiary from 60 to 80 miles in width, still flat, sandy, and heavily covered for the most part with pitch-pine and some oak, the soil quite fertile, and, when cultivated, yielding good crops; in this belt, along the valleys of the Great and Little Pedee and Lynch Creek, the chalk-beds crop out; the land begins to rise beyond the Tertiary, and in what is called "the Ridge," or perhaps rather the "middle country," though the primitive or Eozoic rocks crop out at intervals, there is a belt of moderate width of Silurian rocks, with a heavy growth of oak and hickory intermingled with some pine and hemlock. Still farther on, and occupying all the remainder of the State, the primitive or Eozoic rocks appear in all their rugged grandeur. Clay takes the place of sand on the surface here, but the land is moderately fertile and the climate delightful. The State is rich in mineral wealth, though much of it is as yet undeveloped. Gold is found in large quantities in the Abbeville and Edgefield districts, and the Dorn mines before the war turned out, in some years, $200,000 per annum. There are large deposits of excellent iron ores in Union, Spartanburg, Greenville, and Pickens cos. Copper, lead, manganese, and bismuth are found in different portions of the State. Granite of excellent quality abounds in the upper counties, and limestone of suitable quality both for burning and building is plentiful. The finest porcelain clays, sometimes in beds 60 feet thick, are found in Aiken co.; this beautiful mineral, so well adapted for the use of the porcelain manufacturer, is unfortunately very convenient for adulterating sugar, soda, cream of tartar, and other articles, and is largely sold for such uses. In the lower districts of the State, and especially in the region extending from the Santee to the Savannah, valuable phosphate-marls of a peculiar character have been found in great abundance. They are said by the geologists to be coprolites, or the excrementitious remains of fossil animals, who seem to have congregated in great numbers in this region. They are treated with sulphuric acid, and are considered as the best of fertilizers. Large quantities are used in the State, and still larger amounts are sent to Europe and to other States and countries.

*Soil and Vegetation.*—"The soil of the State," said Gov. Seabrook in 1850, "though of every kind, may be said to comprehend six varieties, each the best suited to a certain crop, yet all of them capable of advantageously producing three-fourths of the vegetable products grown in its limits." He proceeds to particularize these different varieties of soil, three of which belong to the low or swamp region and three to the uplands. The swampy soils are—the tide-swamp or rice-lands; the inland swamp, on which rice, cotton, either long or short staple, corn, peas, etc., may be grown; and the salt marsh, like much of the soil of the islands, which is best adapted to the long-staple or sea-island cotton. The upland soils were—the highest on the larger islands and the oak and pine land of the Tertiary formation, which were also adapted moderately well to long-staple cotton, corn, sweet potatoes, etc.; the "middle country," or pine barrens, which were a good region for fruit and vegetables, though much neglected; and the higher lands, where the forests were mainly oak and hickory, but which, especially in the valleys, were well adapted to the growth of short-stapled cotton, corn, and the cereals. The vegetation of the lowlands is sub-tropical. The palmetto, smallest of the American palms, the yucca or bayonet-leaved shrub, the magnolia, the bay laurel, the live-oak, and other evergreens, are abundant, and in the forests streamers of the gray Spanish moss float from pine and cypress trees. In the higher lands pine, oak, hickory, and other trees of the Middle States are the chief forest growths.

*Zoology.*—Bears and wolves are not often seen, though in the mountainous districts the former are not very rare. The raccoon, opossum, ground-hog, rabbit, and several species of squirrel are abundant. Deer (the Virginian deer) are found throughout the forest portions of the State. Wild-turkeys, grouse, and other game-birds are plentiful,

and the variety of aquatic birds along the coast is very large. There are also many birds of prey: the carrion vulture (turkey-buzzard) and two or three other vultures, one or two species of eagle, five or six species of hawk, gulls, etc., are abundant in the lowlands. The State is also distinguished for the number of its birds of fine plumage. Among the reptiles are found the alligator; lizards, in great variety; tortoises and turtles, from the box and snapping turtles to the large marine turtles; fifteen or twenty kinds of serpents, of which, however, only two or three are venomous; and batrachians of many species. Fish of excellent quality abound along the coast and frequent the rivers.

*Climate.*—The climate, from the location, should be very hot, being in the latitude of Morocco and the Barbary States, but it is more like that of the S. of France and Northern Spain. On the coast the sea-breezes, and in the interior the mountains, greatly modify the heat. In the N. W. portion of the State, Indian corn is not as sure a crop as it is in Minnesota, while in the southern and south-eastern districts the orange, the sugar-cane, the pomegranate, the fig, and the banana are largely cultivated. Sudden frosts sometimes cut off these fruits, but in the average of years they do well. The mean annual temperature of Charleston for the past thirty years has been 65.6°—the summer mean about 80°, the winter mean 52°, the spring 66.3°, and the autumn about 65°. The maximum in 1874 was 96°, the minimum 23°, and the annual range 73°. The isothermal line of 64° crosses the State from Little River Inlet (N. E. corner of the State) to Hamburg, opposite Augusta, on the Savannah River. S. of this line, toward the Savannah River and harbor, the mean annual temperature rises to 67°. N. and N. W. of it the annual mean falls to 60°, and in the mountainous district to 56°. The annual rainfall is greatest along the coast; in 1874 it was 67.70 inches at Charleston, but this was exceptional. The range on the lowlands is from 51 to 60 inches; on the middle and ridge lands, 44 to 52 inches; and in the mountainous districts, from 40 to 44 inches.

*Agricultural Productions.*—In 1870 the U. S. marshal for South Carolina reported 12,105,280 acres of land in farms in the State; of these only 3,010,539 were under cultivation, 6,443,851 acres were in woodland, and 2,650,890 acres in other unimproved farming land. The State census of 1875, which in this respect is said to be more accurate than the census of 1870, states the number of acres under cultivation in that year at 2,090,441, but gives no information in regard to other farming lands. The value of farms, according to the census of 1870, was $44,808,763, and of farming implements and machinery $2,282,946. These values are not reported in the State census, but the comptroller reports for 1875 the assessed value of all farming lands and buildings for purposes of taxation at $59,255,589, while the value of farming and mechanical implements is stated at $1,600,224. The value of all farm productions in 1870 was reported to be $41,909,402; of animals slaughtered or sold for slaughter, $2,507,149; of home manufactures, $312,191; of forest products, $167,253; of market-garden products, $127,459; of orchard products, $47,960; and of wages paid during the year to farm hands, $7,404,297. The only items among these reported by the State census in 1875 were—value of slaughtered animals, $1,794,578; of market-garden productions, $399,154; of orchard productions, $114,933. The pitch-pine forests yielded that year 3,421,262 gallons of turpentine and 343,146 barrels of rosin, worth together about $2,490,000. Of particular farm products there were of wheat in 1870, 783,610 bushels, in 1875, 662,912 bushels; of rye in 1870, 36,165 bushels, in 1875, 13,772 bushels; of Indian corn in 1870, 7,614,207 bushels, in 1875, 9,454,341; of oats in 1870, 613,593 bushels, in 1875, 772,590 bushels; of barley in 1870, 4752 bushels, in 1875, 6401 bushels; of cotton in 1870, 224,500 bales of 400 pounds each, in 1875, 349,848.6 bales of short-staple and 4555 bales of long-staple or sea-island cotton; of wool in 1870, 156,314 pounds, in 1875, 185,486 pounds; no flax reported in 1870, but 2586 pounds in 1875; of hay in 1870, 10,665 tons, in 1875, 6975 tons; of rice in 1870, 32,304,825 pounds, in 1875, 35,884,640 pounds; of tobacco in 1870, 34,805 pounds, in 1875, 18,746 pounds; of cane and sorghum sugar in 1870, 1,055,000 pounds, in 1875, 22,816 pounds; of cane and sorghum molasses in 1870, 620,467 gallons, in 1875, 67,170 gallons; of Irish potatoes in 1870, 83,252 bushels; in 1875, 122,461 bushels; of sweet potatoes in 1870, 1,342,165 bushels, in 1875, 1,568,533 bushels; of peas and beans in 1870, 460,378 bushels, in 1875, 466,450 bushels; of beeswax in 1870, 11,404 pounds, in 1875, 15,843 pounds; of honey in 1870, 194,253 pounds, in 1875, 224,577 pounds; of domestic wine in 1870, 13,791 gallons, in 1875, 9506 gallons; of butter in 1870, 1,461,980 pounds, in 1875, 2,223,422 pounds; in 1870, 241,815 gallons of milk were sold, in 1875 there was no report. In live-stock the census of 1870 reported, 44,105 horses, the comptroller in 1875, 68,813; the census of 1870, 41,327 mules and asses, the comptroller in 1875, 56,673; the census of 1870, 98,693 milch cows, the census of 1875, 118,337; the census of 1870, of working oxen and other cattle, 150,610, the comptroller in 1875, 195,212; the census of 1870, 124,594 sheep, the comptroller in 1875, 155,673 sheep and goats; the census of 1870, 395,999 swine, the comptroller in 1875, 392,360 swine. The total value of live-stock in 1870 was reported at $12,443,510; the comptroller in 1875 gives $12,608,973 as its assessed valuation. The increase in the aggregate amount of most of the crops on an acreage nearly one-third less than that of 1870 is due to the free use of the fossil phosphates of the coast-region, of which 76,023 tons were used in 1875.

*Manufactures and Mining Industries.*—South Carolina is not a manufacturing State. She ranks thirty-second in the catalogue of States in this regard, only Arkansas, Florida, Mississippi, Nebraska, and Oregon being below her in 1870, and one if not two of these having since passed her in the race. In 1870 the State had 1584 manufacturing establishments, employing 8141 hands (7099 men, 578 women, 464 children), using a reported capital of $5,400,418, paying wages to the amount of $1,543,715, using $5,855,736 of raw material, and producing $9,858,981 annually. There has been moderate progress since 1870, but it is doubtful if the value of the manufactured products of 1875 would exceed $12,000,000. The most important manufactures of the State were—cotton goods, 12 establishments, employing 1123 hands, having a capital of $1,337,000, and producing goods valued at $1,529,937; lumber, 83 saw-mills, with 859 hands, $400,650 capital, and producing $1,032,194 of lumber; flouring-mill products, 91 mills, 182 hands, $171,150 of capital, and $825,465 of products; tar and turpentine, 54 establishments, 876 hands, $205,425 of capital, and $774,077 of annual products; fertilizers, 2 establishments, 825 hands, $350,000 capital, and $425,000; machinery, 11 establishments, 220 hands, $137,502 capital, $286,550 annual products; printing and publishing, 13 offices, 182 hands, $129,550 capital, $257,155 annual products. The census of 1875 gave no return of manufactures. The mining industry of the State in 1870 was reported as having 5 mines or quarries, employing 148 hands and $137,000 of capital, and yielding an annual product of $19,888. There are no authoritative returns of either manufactures or mines in the State of later date than 1870.

*Railroads.*—In 1875 there were 1481.45 miles of railroad in operation in the State, and nearly 400 miles more projected, but not completed. The roads in operation cost for road, equipment, etc., $39,018,955. The principal lines are the Charlotte Columbia and Augusta, 195 miles; Greenville and Columbia, 197 miles; North-eastern R. R., 102 miles: Savannah and Charleston, 104 miles; South Carolina R. R. and branches, 242 miles; Spartanburg and Union, 68 miles; Cheraw and Darlington, Atlanta and Richmond air-line, Port Royal R. R., Blue Ridge R. R., and Wilmington and Columbia. Several of these are aided by the State.

*Commerce.*—There are three ports of entry and customs districts in South Carolina—viz. Beaufort, Charleston, and Georgetown. The following table gives the commercial statistics of each:

| Ports or customs districts. | Imports from foreign countries for year ending June 30, 1875. | Domestic exports for year ending June 30, 1875. | Foreign goods exported for year ending June 30, 1875. | Entrances of American and foreign vessels, including coastwise trade and fisheries. | | | Clearances of American and foreign vessels, including coastwise trade and fisheries. | | | Vessels owned in each district. | | Vessels registered, licensed, and enrolled in each district. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | American and foreign vessels, number. | Tonnage of Am. and foreign vessels for year ending June 30, 1875. | Crews. | Vessels cleared. | Tonnage of vessels cleared. | Crews. | Vessels. | Tonnage. | Vessels. | Tonnage. |
| Beaufort | $122,318 | $1,047,257 | ..... | 124 | 58,714 | 1,650 | 116 | 59,405 | 1,598 | 8 | 92.53 | 1 | 142.74 |
| Charleston | 680,343 | 19,655,966 | ..... | 745 | 488,829 | 14,507 | 734 | 451,225 | 14,021 | 173 | 6,938.45 | 22 | 3,790.27 |
| Georgetown | ..... | 17,635 | ..... | 56 | 14,530 | 376 | 13 | 3,802 | 97 | 18 | 791.57 | 11 | 288.18 |
| Totals | $802,661 | $20,720,858 | ..... | 925 | 562,073 | 16,533 | 863 | 514,432 | 16,716 | 199 | 7,822.55 | 34 | 4,221.19 |

*Finances.*—The public funded debt of the State on Nov. 1, 1875, was stated by the State treasurer at $7,674,704.75, principal, mostly bearing 6 per cent. interest. Of this amount, $2,616,670.74 was exchanged during the year 1875 for consolidation bonds and stock maturing July 1, 1893. Besides this, there was a floating debt, composed of unpaid appropriations and deficiencies, of about $1,156,000. The receipts from all sources during the year ending Nov. 1, 1875, were $1,558,146.67; the expenditures for the same year were $1,345,465.17, leaving a balance in the treasury of $212,681.50, which was liable to be much more than absorbed by past-due appropriations. The finances of the State for some years after the war were shamefully mismanaged, but there has been a commendable effort to restore its credit and financial standing; and it is believed that its financial affairs are as justly and as economically managed as is possible in its existing condition.

*Banks and Savings Banks.*—In 1875 there were 12 national banks in the State, having an aggregate capital of $3,170,000, $2,010,000 bonds on deposit, and $2,167,420 of circulation outstanding. There were also at that time 5 State banks and trust companies in the State, with an aggregate capital of $1,300,000. One of these, the South Carolina Bank and Trust Co. of Columbia, S. C., failed in July, 1875, involving the State, counties, and education funds in heavy losses. The others were on Oct. 1, 1875, reported to be in good condition. There were also 3 savings banks, estimated to have capital and deposits to the amount of about $600,000, and 16 or 18 private banking-houses.

*Population.*

| Census year.* | Total pop. | Males. | Females. | White. | Free colored. | Slaves. | Natives. | Foreigners. | Density. | Ratio of increase. | Dwellings. | Families. | Of school age, 5 to 20. | Of military age, 18 to 45, males. | Of voting age, 21 years and upward, males. | Citizens. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1790 | 249,073 | 125,082 | 123,991 | 140,178 | 1,801 | 107,094 | ..... | ..... | 7.32 | | | | | | | |
| 1800 | 345,591 | 174,352 | 171,239 | 196,255 | 3,185 | 146,151 | ..... | ..... | 10.16 | 38.75 | | | | | | |
| 1810 | 415,115 | 207,956 | 207,159 | 214,196 | 4,554 | 196,365 | ..... | ..... | 12.21 | 20.12 | | | | | | |
| 1820 | 502,741 | 254,702 | 248,039 | 237,440 | 6,826 | 258,475 | ..... | ..... | 14.90 | 21.11 | | | | | | |
| 1830 | 581,185 | 289,731 | 291,454 | 257,863 | 7,921 | 315,401 | ..... | ..... | 17.09 | 15.06 | | | | | | |
| 1840 | 594,398 | 293,038 | 301,360 | 259,084 | 8,276 | 327,038 | ..... | ..... | 17.49 | 2.27 | | | | | | |
| 1850 | 668,507 | 329,634 | 338,873 | 274,563 | 8,960 | 384,984 | 659,743 | 8707 | 19.66 | 12.47 | 52,642 | 52,937 | 258,708 | 121,053 | 139,573 | 62,150 |
| 1860 | 703,708 | 347,320 | 356,388 | 291,300 | 9,914 | 402,406 | 693,722 | 9986 | 20.70 | 5.27 | 58,220 | 58,642 | 273,843 | 128,480 | 148,327 | 69,170 |
| 1870 | 705,606 | 343,902 | 361,704 | 289,667 | 415,814 | ..... | 697,532 | 8074 | 20.75 | 0.27 | 143,485 | 151,105 | 264,393 | 120,151 | 148,052 | 146,614 |
| 1875 | 925,145 | 450,132 | 475,013 | 350,754 | 574,391 | ..... | ..... | ..... | 27.21 | 31.11 | ..... | ..... | 305,317 | 142,193 | 184,943 | 179,520 |

*Education.*—The school population of the State (between the ages of 6 and 16 years) in 1875 was 239,264, of whom 122,910 were males and 116,354 females; 85,566 were whites and 153,698 colored. There were 428 school districts and 2580 free common schools; the school attendance for the year 1875 was 110,416—57,694 males and 52,722 females; 47,001 whites and 63,415 colored, a little more than $\frac{11}{24}$ths of the whole school population. In 1875 there were 2855 teachers employed in these schools—1773 males and 1082 females; 1876 whites and 979 colored. Only 866 were of the first grade, 1049 of the second grade, and 940 of the third grade. The average monthly wages paid to male teachers throughout the State was $31.64; to female teachers, $29.21. In the city of Charleston the wages of male teachers averaged $121.66 per month, and of female teachers $39.45 per month. The free schools were in session an average of four and a half months during the year; in three counties the average was 7 months in the year, and in one only two months. In the city of Charleston they were in session ten months. Of the whole number of children in the schools, only 2752 were studying anything above the most elementary branches. The number of school-houses in the State was 2347, valued at $313,289.79; only 701 of these were owned by the districts, 1646 were owned by other parties; of these 345 were rented. The number erected in 1875 was 118, and their cost $13,486.35. Of these 2347 school-houses, 1347 were log, 981 frame, 18 brick, 1 stone; 320 had the grounds enclosed. The total amount of school revenue for the year ending Oct. 31, 1875, was $489,542.75; of this, the State school appropriation was $240,000; the net proceeds of the poll-tax, $63,443.42; the local or school-district taxes collected, $130,721.17; eight counties raised no local or school-district taxes. The school expenditures for the school year ending June 30, 1875, were $426,462.99, of which $369,685.21 was paid for teachers' salaries. The public schools in the city of Charleston are generally in very good condition; they were attended in 1875 by 6070 children—2852 males, 3218 females; 3008 white, 3062 colored; 87 teachers were employed—5 males, 82 females; 79 of the whole number were whites and 8 colored; 301 of the pupils were in the higher branches. The expenditure for public schools in the city was $59,932.50. The State superintendent thinks that there has been a fair amount of progress in the schools of the State during the year, but admits that, except in the city of Charleston, they are still in a very low state, which he attributes to four main causes: (1) want of qualified and efficient teachers; (2) inefficiency and unfitness of school officers; (3) lack of sufficient interest of the right kind on the part of the people in general; (4) inadequacy of means. To these might be added the gross mismanagement and frauds which in the past few years have made competent teachers and school officers unwilling to have any connection with the schools. There were 6 teachers' institutes held during the year, and they were the means of some benefit to the schools. There is a small but well-conducted normal school at Columbia, having a principal and one assistant and a matron and steward, with about 40 pupils. Claflin University at Orangeburg, a school under the control of the Methodist Episcopal Church, and which has also the land-scrip of the agricultural college fund, has a department intended as a normal school for colored teachers, which is doing an excellent work. There are 10 or 12 academies and seminaries for the advanced instruction of both sexes; some of these are of a high character, and have been in existence for many years. The following table gives the statistics of the colleges and professional and scientific schools of the State:

| Institutions. | Location. | Date of organization. | Under what control. | No. of professors. | Students. | | Value of buildings, grounds, and apparatus. | Amount of productive funds. | Income from productive funds. | Income from all sources. | Amount of scholarship funds. | Volumes in library. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | In preparatory department. | In collegiate or professional department. | | | | | | |
| *Colleges and Universities.* | | | | | | | $ | $ | $ | $ | $ | |
| Claflin University | Orangeburg | 1870 | Methodist Episcopal | 4 | 156 | .... | 40,000 | ..... | ..... | ..... | ..... | 600 |
| Charleston College | Charleston | 1795 | Non-sectarian | 5 | .... | .... | 50,000 | 200,000 | 12,000 | 13,000 | 33,000 | 10,000 |
| Erskine College | Due West | 1839 | Asso. Ref. Presb. | 5 | 8 | 64 | 30,000 | 45,000 | 3,600 | ..... | ..... | 12,500 |
| Furman University | Greenville | 1851 | Baptist | 5 | .... | 50 | 75,000 | 150,000 | 10,000 | | | |
| Mount Zion College | Winnsboro' | 1785 | Non-sectarian | 1 | 43 | .... | 15,000 | | | | | |
| Newberry College | Walhalla | 1858 | Evang. Lutheran | 6 | 42 | 28 | ..... | ..... | ..... | 350 | 1,400 | 5,500 |
| University of South Carolina | Columbia | 1805 | State | 10 | 117 | 42 | 300,000 | ..... | ..... | 50,000 | ..... | 28,342 |
| Wofford College | Spartanburg C.-H. | 1853 | M. E. South | 7 | 70 | 103 | 100,000 | 50,000 | ..... | 6,103 | ..... | 15,000 |
| *School of Science.* | | | | | | | | | | | | |
| S. C. Agric. and Mech. Institute (Dept. of Claflin College) | Orangeburg | 1874 | State | 2 | .... | 20 | ..... | 180,000 | 12,000 | | | |
| *Schools of Theology.* | | | | | | | | | | | | |
| Baker Theol. Institute (Claflin Univ.) | Orangeburg | 1870 | Methodist Episcopal | .. | .... | 9 | | | | | | |
| Southern Baptist Theological Seminary | Greenville | 1858 | Baptist | 5 | .... | 60 | 30,000 | ..... | 17,000 | ..... | ..... | 5,000 |
| Theol. Sem. Gen. Assembly Presb. Ch. | Columbia | 1828 | Presbyterian | 5 | .... | 57 | ..... | ..... | ..... | ..... | ..... | 18,873 |
| *School of Law.* | | | | | | | | | | | | |
| Law Dept. University of South Carolina | Columbia | 1868 | University S. C. | 4 | .... | 16 | | | | | | |
| *Schools of Medicine.* | | | | | | | | | | | | |
| Medical College of State of South Carolina | Charleston | 1826 | Trustees | 7 | .... | 53 | 20,000 | ..... | ..... | 2,500 | | |
| University of South Carolina Med. Dept. | Columbia | 1868 | University S. C. | 4 | .... | 8 | | | | | | |

* The statistics of population given in the census of 1875, and those of 1870 (U. S. census), are regarded by the State authorities as equally unreliable.

There is an institution for the education of the deaf and dumb and the blind at Cedar Springs, near Spartanburg, founded in 1849, but since 1871 or 1872 instruction has been suspended and the buildings are unoccupied. It is proposed to remove it to Columbia, and reopen it. There is a State orphan asylum, formerly at Charleston, but removed in 1875 to Columbia. It had in Jan., 1876, 84 inmates—35 boys and 49 girls.

*Charitable Institutions.*—The State lunatic asylum is at Columbia, and seems from the governor's message to be well managed, although the best results cannot be looked for in its present crowded condition (it has about 300 patients), and, like all the public institutions of the State, suffering from the need of funds which were three or four years since recklessly squandered by corrupt officials. Its expenditures for the year 1875 were about $70,000, a sum smaller than it should have been, and only made to answer by the most rigid economy.

*Churches.*

| Denominations. | Church organizations, 1870. | Church edifices, 1870. | Church sittings, 1870. | Church property, 1870. | Church organizations, 1875. | Church edifices, 1875. | Ministers, 1875. | Members or communicants, 1875. | Adherent pop., 1875. | Value of church property, 1875. |
|---|---|---|---|---|---|---|---|---|---|---|
| All denominations | 1457 | 1308 | 491,425 | $3,276,982 | 1883 | 1672 | 1111 | 193,708 | 877,850 | $4,065,500 |
| Baptists, regular | 518 | 466 | 190,750 | 688,882 | 790 | 698 | 451 | 95,313 | 400,000 | 890,000 |
| Baptists (other), Anti-mission, etc | 5 | 5 | 800 | 1,600 | 8 | 8 | 12 | 850 | 4,200 | 2,500 |
| Christians, or Disciples | 2 | 2 | 200 | 400 | 2 | 2 | 2 | 150 | 750 | 1,000 |
| Congregationalists | 1 | 1 | 300 | 10,000 | 1 | 1 | 1 | 243 | 1,200 | 12,000 |
| Episcopalians (Protestant) | 83 | 81 | 35,350 | 729,600 | 60 | 58 | 50 | 4,439 | 22,000 | 670,000 |
| Huguenots | 1 | 1 | 400 | 10,000 | 1 | 1 | 1 | 300 | 1,500 | 12,000 |
| Jews | 3 | 3 | 900 | 91,200 | 3 | 3 | 3 | 750 | 1,500 | 100,000 |
| Lutherans | 49 | 44 | 17,900 | 137,450 | 63 | 58 | 37 | 5,271 | 25,000 | 190,000 |
| Methodists | 611 | 532 | 164,050 | 652,100 | 728 | 641 | 412 | 71,480 | 342,000 | 876,000 |
| Presbyterians (regular) | 148 | 136 | 61,450 | 537,900 | 190 | 170 | 112 | 12,180 | 60,000 | 650,000 |
| Presbyterians (other), Associate, etc. | 16 | 17 | 5,650 | 33,500 | 18 | 17 | 13 | 2,232 | 11,200 | 42,000 |
| Reformed (late Dutch) | 2 | 2 | 300 | 4,000 | 2 | 2 | 2 | 250 | 1,000 | 10,000 |
| Roman Catholics | 12 | 13 | 10,775 | 291,500 | 14 | 10 | 12 | ..... | 15,500 | 300,000 |
| Unitarians | 1 | 1 | 750 | 250,000 | 1 | 1 | 1 | 250 | 1,000 | 250,000 |
| Universalists | 3 | 2 | 850 | 58,350 | 2 | 2 | 2 | ..... | 1,000 | 60,000 |

There were also in 1870, 1 Friends' meeting, with one meeting-house, 300 sittings, and $10,000 of society property; and one Union church, with 1 edifice, 700 sittings, and $10,000 of church property.

*Penal Institutions.*—The State penitentiary is at Columbia, and under a new superintendent its management has been much improved. There were 322 prisoners in confinement on Oct. 31, 1875, of whom 318 were males and 4 females. The receipts of the year were $25,000, and the disbursements $19,812.72. Attempts were made to contract for the labor of a part of the prisoners, while a part were employed in making bricks and in agricultural labor. The jails of the State, except that in Charleston, are generally very badly managed, and need reform. There is no reform school in the State. There are several orphan asylums under private control, and one home for destitute ladies.

*Insurance Companies.*—There was in Oct., 1875, but 1 insurance company chartered by the State which reported to the comptroller, the Home Insurance Co. of Charleston. There was, in 1874, a small mutual company also in Charleston, reporting assets amounting to $24,445. There are no life insurance companies chartered by the State, but many of the insurance companies of other States do business here.

*Newspapers.*—In 1870 there were 55 newspapers of all classes, which issued 8,901,400 copies annually, and had an aggregate circulation of 80,900; of these, 5 were dailies, with 16,100 circulation; 4 triweeklies, with 9600 circulation; 42 weeklies, with 44,000 circulation; 3 monthlies, with 10,000 circulation; and 1 quarterly, with 1200 circulation. There have been some changes, but not much increase of circulation, since 1870.

*Constitution, Courts, Representation in Congress.*—The constitution under which the State is now governed was framed by a convention which sat from Jan. to Mar., 1868, and was ratified by the people in April of the same year. By this constitution every male citizen of the U. S. of the age of 21 years and over, who resided in the State at the time of the adoption of the constitution, or who shall hereafter reside in the State for one year and in the county in which he offered to vote for 60 days next preceding an election, is entitled to vote. The legislature is composed of a senate and house of representatives, the two constituting the general assembly of the State of South Carolina. There are 33 senators, one for each county except Charleston co., which has two. The house has 124 members. Both senators and representatives are chosen by ballot every second year in their respective districts. The governor is elected for two years, and the comptroller-general, treasurer, and secretary of state for four years. The judicial power is vested in a supreme court; in two circuit courts—viz. a court of common pleas, having civil jurisdiction, and a court of general sessions, having criminal jurisdiction only; in probate courts and justices of the peace. The supreme court consists of a chief-justice and two associate justices, any two of whom constitute a quorum. It has appellate jurisdiction only in cases of chancery, and constitutes a court for the correction of errors of law. It holds a session annually at the seat of government and at such other places as the general assembly may direct. The State is entitled to five members of Congress under the apportionment of 1872.

*Counties.*—There are 32 counties in the State, as follows:

| Counties. | Total pop., 1875. | Males, 1875. | Females, 1875. | Total pop., 1870. | True valuation, 1870, U. S. census. | Assessed valuation, 1875. |
|---|---|---|---|---|---|---|
| Abbeville | 38,968 | 18,914 | 20,054 | 31,129 | $7,361,095 | $5,549,287 |
| Aiken | 30,304 | 14,779 | 15,525 | ..... | ..... | 3,667,906 |
| Anderson | 29,127 | 14,192 | 14,935 | 24,049 | 5,968,134 | 4,652,444 |
| Barnwell | 37,523 | 18,633 | 18,890 | 35,724 | 9,941,090 | 4,010,600 |
| Beaufort | 43,062 | 21,099 | 21,963 | 34,359 | 11,669,471 | 3,630,442 |
| Charleston | 123,489 | 57,269 | 66,220 | 88,863 | 60,524,654 | 33,308,245 |
| Chester | 24,227 | 11,786 | 12,438 | 18,805 | 5,557,272 | 3,422,824 |
| Chesterfield | 13,826 | 6,645 | 7,181 | 10,584 | 2,500,815 | 1,494,370 |
| Clarendon | 16,243 | 8,049 | 8,194 | 14,038 | 2,559,560 | 1,919,456 |
| Colleton | 33,883 | 16,723 | 17,160 | 25,410 | 5,117,454 | 3,627,813 |
| Darlington | 30,461 | 15,217 | 15,244 | 26,243 | 4,859,282 | 2,993,999 |
| Edgefield | 35,039 | 17,483 | 17,596 | 42,486 | 8,578,424 | 3,890,370 |
| Fairfield | 22,791 | 11,266 | 11,525 | 19,888 | 5,142,542 | 3,750,201 |
| Georgetown | 17,646 | 8,267 | 9,379 | 16,161 | 2,980,338 | 1,819,499 |
| Greenville | 32,706 | 15,804 | 16,902 | 22,262 | 5,362,358 | 4,616,301 |
| Horry | 12,012 | 5,921 | 6,091 | 10,721 | 1,556,500 | 1,116,269 |
| Kershaw | 20,902 | 10,184 | 10,718 | 11,754 | 3,245,161 | 2,358,064 |
| Lancaster | 14,735 | 7,186 | 7,549 | 12,087 | 2,012,810 | 1,711,176 |
| Laurens | 26,405 | 12,854 | 13,551 | 22,536 | 4,504,017 | 3,854,512 |
| Lexington | 16,613 | 8,073 | 8,540 | 12,988 | 3,517,197 | 2,180,238 |
| Marion | 31,654 | 15,527 | 16,127 | 22,160 | 4,682,914 | 3,048,318 |
| Marlboro' | 17,683 | 8,716 | 8,967 | 11,814 | 2,401,298 | 2,181,475 |
| Newberry | 23,326 | 11,433 | 11,893 | 20,775 | 4,984,344 | 4,150,320 |
| Oconee | 14,075 | 6,830 | 7,245 | 10,536 | 2,385,649 | 1,777,120 |
| Orangeburg | 34,070 | 16,998 | 17,072 | 16,865 | 9,039,915 | 4,176,610 |
| Pickens | 11,807 | 5,793 | 6,014 | 10,269 | 1,411,002 | 1,476,056 |
| Richland | 34,245 | 16,992 | 17,253 | 23,025 | 8,127,020 | 6,856,340 |
| Spartanburg | 32,184 | 15,301 | 16,883 | 25,784 | 4,336,940 | 4,312,560 |
| Sumter | 31,480 | 15,509 | 15,971 | 25,268 | 5,337,100 | 3,529,925 |
| Union | 21,965 | 10,703 | 11,262 | 19,248 | 4,287,180 | 3,088,100 |
| Williamsburg | 21,055 | 10,425 | 10,630 | 15,489 | 3,159,638 | 2,204,585 |
| York | 31,639 | 15,601 | 16,038 | 24,286 | 5,035,815 | 4,594,744 |
| Total | 925,145 | 450,132 | 475,013 | 705,606 | $208,146,989 | $134,968,224 |
| Add for railroad property assessed | | | | | | 8,357,911 |
| Grand total | | | | | | $143,326,135 |

*Principal Cities and Towns.*—The capital of the State is Columbia, which in 1875 had 14,449 inhabitants; the largest city and commercial capital is Charleston, which in 1875 had 56,540. (See Charleston.) The other considerable towns are Greenville, which had 1547 inhabitants in 1875; Sumter, 2147; Anderson, 1579; Winnsboro', 1398; Georgetown, Newberry, Beaufort, Pickensville, Spartanburg, and Camden, which had between 1000 and 2000 each.

*History.*—The first attempts at settlement in South Carolina antedate those of all the other Atlantic States except Florida. In May, 1562, John Ribault, the leader of a party of French Huguenots, made a voyage of exploration with two ships to Florida, discovered and named the river St. John in Florida, and after a little delay sailed northward and entered a spacious inlet and harbor, to which he gave the name of Port Royal. On an island in that harbor he built a fort, which he named Carolina in honor of Charles IX. of France. Here he left 26 colonists, and himself returned to France for supplies; but in the course of two or three months the colonists became dissatisfied, mutinied, killed the commandant whom Ribault had placed over them, and, fitting up a clumsy and ill-constructed vessel, sailed for France. They were long at sea and endured great hardships, but were finally picked up by an English vessel and returned to Europe. It was more than 100 years before an attempt was again made to effect a settlement on this coast. In 1670 a party of English colonists settled at

Port Royal, but the same or the following year removed to the W. bank of Ashley River, and in 1680 to the present site of Charleston. There were three shiploads of these immigrants, and they were under the leadership of William Sayle. In 1674, Joseph West was appointed governor of the southern colony, though both North and South Carolina were nominally under one proprietary government. Gov. West remained in office several years. The colonists were made up of several classes and nationalities: there were Cavaliers and the sons of Cavaliers from the English aristocracy and gentry, who had come out to the new country as adventurers or to hold office under the proprietary government; Puritans, who were dissatisfied with the loose morals and the exacting rule of the Stuarts; Irish Presbyterians and Scotch dissenters; French Huguenots of the best blood of France, who fled from the persecution, cruelty, and oppression of Louis XIV.; Hanoverians and other Protestants from Germany; Swiss emigrants from the Protestant cantons; and Moravians and Bohemians from Austria and Bohemia. At first, the Cavaliers were not disposed to grant to these dissenters and refugees the full privileges of citizenship, but eventually they won their way to the complete recognition of their rights. In 1680 there was an Indian war in which the colonists were victorious, and Gov. West having taken a large number of the Indians prisoners, sold them as slaves to the West India planters. This so greatly displeased the proprietors that in 1683 he was removed, and Gov. Morton appointed his successor. Until 1720 both North and South Carolina were nominally governed under the constitution prepared by John Locke, who, with the earl of Shaftesbury and some other associates, had received a grant of the territory. This constitution was very complicated in its provisions, and was never fully enforced. There was a colonial legislature, and its laws were generally observed. The difficulty in enforcing the collection of quit-rents to the proprietors led to frequent *émeutes* and partial insurrections, and in 1687, Gov. Colleton was deposed in consequence of his attempt to compel the payment of these rents. Early in the administration of his successor (probably Gov. Moore) the captain of a Madagascar vessel which entered Charleston harbor sent a bag of seed-rice to the governor, who distributed it among his friends, and thus began the cultivation of that grain. The attempt on the part of Gov. Moore to capture St. Augustine from the Spaniards in 1702, resulted in a defeat and very heavy expenses, which led to the first issue of paper money in the colony. In 1706 a French fleet attacked Charleston, but was promptly repulsed and with heavy loss. The Indians were very troublesome to the colonists, but in 1715 they were expelled after a severe battle, and driven into the swamps of Florida. This Indian war and the previous contests with the French and Spanish had involved the colony in debt, and disturbances grew out of this which led to the expulsion of the governor in 1718 or 1719. The Locke constitution had been practically abrogated since 1693, but after the expulsion of the governor the people of the colony held a convention and proceeded to organize a government independent of the proprietaries. The English Parliament, wiser then than it was afterward, solved the difficulty by purchasing the proprietary rights for about $80,000 (£17,500) and making the colony a direct dependency of the Crown. This was accomplished in 1720. For more than fifty years from this time the career of the colony was prosperous. The colonists were generally loyal, and the colony was a favorite with the British government. Slavery existed, but the proportion of slaves was not so great as it became soon after the Revolution. But when the British government began to pass oppressive laws and lay heavy and unjust taxes, the love of liberty manifested itself in the colonists, and they early took measures to resist the invasion of their rights. A provincial congress was called in 1774, delegates were appointed to the Continental Congress of 1774–75, and when in Sept., 1775, the royal governor fled, the provincial congress assumed all the powers not vested in the Continental Congress. South Carolina suffered much from the invasion of her territory by the enemy during the war of the Revolution. The severe battles of Fort Moultrie, Charleston, Camden, King's Mountain, Cowpens, Eutaw Springs, etc., were fought on her soil. The last-named engagement, fought in Sept., 1781, between Gen. Greene and Col. Stuart, was a drawn battle, but was the last of any considerable moment in the war. On May 28, 1788, the State ratified the Constitution of the U. S. She had previously (July 9, 1787) ceded to the U. S. her claims to the region lying between the Appalachian Mountains and the Mississippi River. On June 3, 1790, her first permanent State constitution was adopted without submission to the people. In 1832 her leading men—and most prominent among them the late John C. Calhoun—attempted to nullify certain acts of Congress imposing a tariff, from the belief that it bore unjustly on the interests of the State. A convention was called by the State legislature, which on Mar. 11, 1833, passed a nullification ordinance. As this was a defiance of the national authority, there seemed a probability of a civil war, but the prompt and decided measures adopted by Pres. Jackson (himself a native of South Carolina) restored order and led to the pacification of the difficulty. From 1820 the number of slaves in South Carolina had exceeded the white population. Her staple agricultural products, sea-island and upland cotton and rice, had led to this great increase of slave-labor, and the State had been for fifty years and more the stoutest advocate of slavery in the Union. The unquestioned intellectual ability of her political leaders and statesmen, and their bold and unflinching advocacy of the slave system in Congress and elsewhere, had given them the foremost position as the leading champions of that system. Whenever, from any cause, the obnoxious and unjust features of slavery came up for discussion or rebuke, for adjustment or appeal, South Carolina, by her legislature and her State and municipal officers, her Senators and Representatives in Congress, was always ready to defend its most odious exactions. This was specially noticeable in their treatment of Hon. Samuel Hoar in 1844, in their advocacy of the Mexican war and of the Kansas and Nebraska bill, and in the violent assault by two of her Representatives in Congress (Messrs. Brooks and Keitt) upon Hon. Charles Sumner in 1856. It is not surprising, then, that deeming the election of a Republican President a menace upon her rights as a slaveholding State, and as threatening the supremacy of the South in the American Congress, South Carolina, as the champion of the South, should have given notice, early in the Presidential campaign of 1860, that if Mr. Lincoln were elected she should secede. On Oct. 25, 1860, a meeting of the prominent political leaders of the State, including its members of Congress, was held at the house of Ex-Gov. Hammond, and it was unanimously resolved that South Carolina should at once secede from the Union in the event of Mr. Lincoln's election. Gov. Gist called the legislature together in extra session by proclamation on Nov. 5, the day of the Presidential election, ostensibly to choose electors, but really, as his message showed, to take measures for immediate secession in case of Mr. Lincoln's election. The legislature ordered an election for a convention on Nov. 22, and appointed Dec. 17, 1860, as the opening day of the convention. It met on that day at Columbia, but adjourned at once to Charleston, and on Dec. 20 passed the ordinance of secession by a unanimous vote of 169 yeas. It also passed a "declaration of causes" by the same vote. Commissioners from South Carolina were sent to the other Southern States to urge their secession and the calling of a convention at Montgomery, Ala., to organize a confederacy. On the night of Dec. 26, 1860, Major Robert Anderson, in command of a battalion of Federal troops in Fort Moultrie, an old and weak fort in Charleston harbor, removed his command, with its munitions of war, provisions, etc., to the new and stronger fort, Sumter, in the same harbor. This act was denounced by the leading South Carolinians, and attempts were made to compel him to return to Fort Moultrie. (See CONFEDERACY, SOUTHERN.) The U. S. arsenal and its arms and munitions were soon after seized by South Carolina volunteers, as were also the custom-house, post-office, etc., and after almost four months of excitement and agitation, on Apr. 12, 1861, South Carolina commenced the civil war by the bombardment of Fort Sumter. After the surrender of this fort, it was at once put in order, for a permanent occupation, by the Confederate authorities, and the work of raising troops and preparing for war went on rapidly in the State. During the war which followed, South Carolina suffered severely. On Nov. 7, 1861, the Federal squadron under Com. Du Pont captured Forts Warren and Beauregard, and entered and took possession of Port Royal harbor and the town of Beaufort, S. C. This port and the adjacent islands were held by Federal troops through the war. Charleston harbor was closely blockaded. Several of the islands were seized and retained; in June, 1862, the severe battle of Secessionville was fought, the heaviest losses falling on the Federal side; in October of the same year, the less important action of Pocotaligo occurred, with a preponderance of loss on the Federal side; the naval attack on Fort Sumter under Com. Du Pont, Apr. 6, 1863, though proving a failure, was not attended with heavy losses on either side. But this was followed in the ensuing summer by that deliberate siege of Charleston and demolition of Fort Sumter under Gen. Gillmore which was one of the most famous events of the war. By this siege Fort Wagner and Battery Gregg were captured, the lower part of Charleston rendered uninhabitable, and the whole coast of the State was at the mercy of the blockading squadron and the Army of the South. South Carolina had made large contributions of men to

the Confederate army, and had suffered, like the other Southern States, from the extensive destruction of her staple crops; but her greatest pecuniary losses were experienced when, in Jan., 1865, Gen. W. T. Sherman commenced his march from Savannah through the Carolinas. His previous march from Atlanta to Savannah had broken the power of the Southern portion of the Confederate forces, and when he entered South Carolina, though his troops and their attendants, the "bummers" or camp-followers, occupied a track fully 50 miles in width and swept everything before them, they encountered very little resistance. What was left of Charleston, Columbia, and all the principal towns of the State, fell into the hands of the Federal troops almost without a struggle, and most of their track was left a desert. Soon after the close of the war, reconstruction was attempted, a convention being called in Sept., 1865, which declared the secession ordinance null and void, repudiated the Confederate State debt, and framed a new constitution for the State. Other conditions being required by Congress for complete reconstruction, were after some delay passed, the thirteenth, fourteenth, and fifteenth amendments to the Constitution of the U. S. ratified, and another and more satisfactory constitution for the State adopted by a large majority, composed almost wholly of colored votes. The State was restored to the Union in June, 1868. As emancipation was a necessary result of the war, and the right of suffrage to the people of color a natural consequence of emancipation, the State, having a majority of its population of African descent, fell into the hands of the negroes and those who had the skill and adroitness to manage them. The legislature was largely composed of negroes, and many of the State officers and some of the members of Congress were of the same race. Had these new legislators and rulers been persons of intelligence, culture, integrity, and political ability, the result would have been different; but they were, with a few honorable exceptions, ignorant of their duties, and controlled by artful and designing men, who through their votes found the means of enriching themselves to the detriment of the State. But the colored people are becoming somewhat more intelligent, and are finding out that these adventurers were not their real friends, and the outlook for the future of the State is much more hopeful than it was in 1870–74.

*Governors of South Carolina.*

| | | | |
|---|---|---|---|
| Charles Pinckney | 1789–92 | George McDuffie | 1834–36 |
| Arnoldus Vanderhorst | 1792–94 | Pierce M. Butler | 1836–38 |
| William Moultrie | 1794–96 | Patrick Noble | 1838–40 |
| Charles Pinckney | 1796–98 | B. K. Hennegan (acting) | 1840–40 |
| Edward Rutledge | 1798–1800 | John P. Richardson | 1840–42 |
| John Drayton (acting) | 1800–02 | James H. Hammond | 1842–44 |
| James B. Richardson | 1802–04 | William Aiken | 1844–46 |
| Paul Hamilton | 1804–06 | David Johnson | 1846–48 |
| Charles Pinckney | 1806–08 | W. B. Seabrook | 1848–50 |
| John Drayton | 1808–10 | John H. Means | 1850–52 |
| Henry Middleton | 1810–12 | John L. Manning | 1852–54 |
| Joseph Alston | 1812–14 | James H. Adams | 1854–56 |
| David R. Williams | 1814–16 | Robert F. W. Alston | 1856–58 |
| Andrew Pickens | 1816–18 | William H. Gist | 1858–60 |
| John Geddes | 1818–20 | Francis W. Pickens | 1860–62 |
| Thomas Bennett | 1820–22 | M. L. Bonham | 1862–64 |
| John L. Wilson | 1822–24 | A. G. Magrath | 1864–65 |
| Richard J. Manning | 1824–26 | Benj. F. Perry (provis.) | 1865–65 |
| John Taylor | 1826–28 | James L. Orr | 1865–68 |
| Stephen D. Miller | 1828–30 | Robert K. Scott | 1868–72 |
| James Hamilton | 1830–32 | Franklin J. Moses, Jr. | 1872–75 |
| Robert Y. Hayne | 1832–34 | Daniel H. Chamberlain | 1875–78 |

*Electoral and Popular Votes for President and Vice-President.*—Until 1868, South Carolina had always chosen her Presidential electors in her State legislature, and had never cast a popular vote for President. Under her present constitution the electors are chosen by the people:

| Elect. year. | Names of candidates for whom the electoral vote was cast. | Elect. vote. | Elect. year. | Names of candidates for whom the electoral vote was cast. | Elect. vote. | Elect. year. | Names of candidates for whom the electoral vote was cast. | Elect. vote. | Pop. vote. |
|---|---|---|---|---|---|---|---|---|---|
| 1788 | George Washington P. | 7 | 1820 | James Monroe P. | 11 | 1848 | Lewis Cass P. | 9 | |
| | John Rutledge V.-P. | 6 | | Daniel D. Tompkins V.-P. | | | William O. Butler V.-P. | | |
| | John Hancock V.-P. | 1 | 1824 | Andrew Jackson P. | 11 | 1852 | Franklin Pierce P. | 8 | |
| 1792 | George Washington P. | 8 | | John C. Calhoun V.-P. | | | William R. King V.-P. | | |
| | John Adams V.-P. | 7 | 1828 | Andrew Jackson P. | 11 | 1856 | James Buchanan P. | 8 | |
| | Aaron Burr V.-P. | 1 | | John C. Calhoun V.-P. | | | J. C. Breckenridge V.-P. | | |
| 1796 | Thomas Jefferson P. | 8 | 1832 | John Floyd P. | 11 | 1860 | John C. Breckenridge P. | 8 | |
| | Thomas Pinckney V.-P. | | | Henry Lee V.-P. | | | Joseph Lane V.-P. | | |
| 1800 | Thomas Jefferson P. | 8 | 1836 | Willie P. Mangum P. | 11 | 1864 | No vote. | | |
| | Aaron Burr V.-P. | | | John Tyler V.-P. | | 1868 | Ulysses S. Grant P. | 6 | 62,301* |
| 1804 | Thomas Jefferson P. | 19 | 1840 | Martin Van Buren P. | 11 | | Schuyler Colfax V.-P. | | |
| | George Clinton V.-P. | | | Littleton W. Tazewell V.-P. | | 1872 | Ulysses S. Grant P. | 7 | 72,290† |
| 1808 | James Madison P. | 10 | 1844 | James K. Polk P. | 9 | | Henry Wilson V.-P. | | |
| | George Clinton V.-P. | | | George M. Dallas V.-P. | | | | | |
| 1812 | James Madison P. | 11 | | | | | | | |
| | Elbridge Gerry V.-P. | | | | | | | | |
| 1816 | James Monroe P. | 11 | | | | | | | |
| | Daniel D. Tompkins V.-P. | | | | | | | | |

(For valuable documents and material for this article the writer is under obligations to His Excellency, Hon. Daniel H. Chamberlain, governor of South Carolina, and Hon. F. L. Cardozo, State treasurer.) L. P. Brockett.

**South Car'rollton,** p.-v., Muhlenburg co., Ky., on Louisville and Nashville and Great Southern R. R. P. 240.

**South Charles'ton,** p.-v. and tp., Clark co., O., on Pittsburg Cincinnati and St. Louis R. R. P. 818.

**South Ches'ter,** p.-b., Delaware co., Pa. P. 1242.

**South Codo'rus,** tp., York co., Pa. P. 2002.

**South Cort'land,** p.-v., Cortland tp., Cortland co., N. Y., on Utica Ithaca and Elmira R. R. P. 54.

**South'cott** (Joanna), b. at Gittisham, Devonshire, England, about 1750; was entirely uneducated, and for many years a domestic servant at Exeter; joined the Methodist Church about 1790, and having become acquainted with a man named Sanderson who laid claim to the gift of prophecy, she in 1792 announced herself as a prophetess, giving forth an extraordinary series of revelations in ungrammatical prose and doggerel verse; challenged the bishop and clergy at Exeter to investigate her claims, and obtained such success that in a few years her believers were numbered by thousands. She established herself at London at the expense of the celebrated engraver, William Sharp, and there published numerous pamphlets setting forth her revelations. She announced herself as the woman spoken of in Rev. xii., sold sealed packets which were warranted to secure the salvation of the purchaser, and at last, when sixty years of age, declared herself pregnant, and that she should give birth to "Shiloh" or "the Prince of Peace" at midnight on Oct. 19, 1814. The event was awaited by large numbers of disciples with eager interest, and a sumptuous cradle provided for the expected infant, but the occasion was marked only by the prophetess falling into a trance. She d. in London Dec. 17, 1814. A *post-mortem* examination showed that she had been suffering from dropsy. Four congregations of believers, comprising 198 persons, were reported in England by the census of 1851, and a community was founded at Wenthorp in 1857.

**Southcottians.** See Southcott (Joanna).

**South Cov'entry,** p.-v., Coventry tp., Tolland co., Conn., on Shetucket River and on New London Northern R. R., has 1 newspaper and several manufactories.

**South Coventry,** tp., Chester co., Pa. P. 649.

**South Creek,** p.-v. and tp., Bradford co., Pa., on Northern Central R. R. P. 1070.

**South Dart'mouth,** p.-v., Dartmouth tp., Bristol co., Mass., at the head of Apponaganset Bay.

**South Deer'field,** p.-v., Deerfield tp., Franklin co., Mass., on Connecticut River R. R., has important manufactures, and is the locality of the famous Bloody Brook massacre in King Philip's war, at which Capt. Thomas Lothrop and 76 men, called the "flower of Essex," lost their lives Sept. 18, 1675 (O. S.). A marble monument, erected in 1838, commemorates this event, and the bi-centennial anniversary was celebrated in 1875.

**South Del'phi,** v., Deer Creek tp., Carroll co., Ind. P. 160.

**South Dix'on,** tp., Lee co., Ill. P. 905.

**South East,** tp., Orange co., Ind. P. 1556.

**Southeast,** tp., Putnam co., N. Y. P. 2975.

**South Eas'ton,** b., Williams tp., Northampton co., Pa., on S. bank of Lehigh River, opposite Easton, on Le-

* Popular vote for Seymour and Blair, 45,239.

† Horace Greeley for President and Benjamin Gratz Brown for Vice-President, received 22,903 votes.

high R. R. and Navigation Canal, has several iron furnaces, foundries, and rolling-mills, and a wire factory. P. 3167.

**Southeast Pella,** v., Lake Prairie tp., Marion co., Ia. P. 147.

**South Eg'remont,** p.-v., Egremont tp., Berkshire co., Mass.

**South Eng'lish,** p.-v., Keokuk co., Ia., on Southwestern R. R. (proposed), 13 miles N. of Sigourney, the county-seat, has good schools, 1 newspaper, and 2 hotels. It is in one of the richest farming sections of the State. P. about 300. BROWN BROS., EDS. "WESTERN HERALD."

**South'ern** (THOMAS), b. at Oxmantown, Ireland, about 1660; studied at Trinity College, Dublin, and at the Middle Temple, London, and was called to the bar, but soon abandoned that profession for dramatic literature; served in the army against Monmouth's rebellion, and afterward enjoyed the friendship of Dryden, Pope, and their circle of wits. D. at Westminster May 26, 1746. Author of ten plays, of which the most popular were *Isabella, or The Fatal Marriage,* and *Oronooko.*

**Southern Confederacy.** See CONFEDERATE STATES.

**Southern Continent.** See ANTARCTIC RESEARCHES.

**Southernwood.** See ARTEMISIA.

**South'ey** (CAROLINE ANNE **Bowles**), second wife of Robert Southey, b. in Hants co., England, Dec. 6, 1787. At an early age she wrote for *Blackwood's Magazine* and other periodicals. In 1820 a collection of her pieces was made, which speedily won for her a place in the world of letters; among those who became her friends were Southey and William Lisle Bowles, who, although bearing the same name, was not her relative. The friendship between her and Southey was of more than twenty years' standing when, two years after the death of his first wife, who had for years been bereft of reason, they were married in 1839. At this time Southey's mental faculties had begun to show signs of decay, and at the moment when she first entered their home as his wife he experienced an attack, which speedily reduced him to a state of absolute dementia, in which the remaining four years of his life were passed. His pension expired with him, and his wife was left absolutely without resources; but a pension of £200 from the civil list was bestowed upon her. Her published works are—*Ellen Fitz-Arthur,* a poem (1820), *The Widow's Tale, and other Poems* (1822), *Solitary Hours,* prose and verse (1826), *Chapters on Churchyards* (1829), *The Birthday,* a poem (1836), *Tales of the Factories,* in verse, and *Robin Hood,* a fragment of a poem commenced jointly by herself and her husband, to which were added other fragments by both of them (1847). D. July 20, 1854.

**Southey** (ROBERT), b. at Bristol, England, Aug. 12, 1774, the son of a linen-draper; early left an orphan, he was cared for by an uncle; received his early education at Westminster School; in 1793 entered Baliol College, Oxford, with the design of taking holy orders, but becoming unsettled in his religious and political views, left Oxford after two years, and entered upon a career of authorship in verse and prose, his first published works being a small volume of poems (1794) and the tragedy of *Joan of Arc* (1795), for which his friend Cottle paid him fifty guineas. In 1795 he married Edith Fricker, whose sister soon after became the wife of Coleridge; set out with his uncle for Portugal; published an account of his six months' residence (1797); published the poem *Thalaba the Destroyer* (1801); was made secretary to the chancellor of the exchequer for Ireland, a sinecure with a salary of £350; resigned the position, and in 1804 settled for life at Keswick. From this time his life is mainly the history of his numerous writings in almost every department of literature. In early manhood he had imbibed strong radical ideas; proposed, in conjunction with Coleridge and Lovel, to set up a socialistic establishment on the banks of the Susquehanna in Pennsylvania, to be called a "pantisocracy," because there all persons were to be equal; and wrote a drama, *Wat Tyler* (printed in 1793, but first published in 1817, without his consent), which was denounced in the House of Commons as seditious. In the course of years he went over to the opposite extreme of conservatism in Church and State, and came to be considered the exponent of high Tory opinions. Although his literary labors were indefatigable, and he was in 1807 made the recipient of a pension of £160, his circumstances were very moderate. He was named poet-laureate in 1813. In 1835 he received from Sir Robert Peel, then prime minister, the offer of a baronetcy, which he declined, mainly for the reason that his income was inadequate; he said that there had never been a time when his earnings were six months in advance of his necessary expenditures. Sir Robert, in acknowledgment of his eminent literary services, at once made an addition of £300 to his pension. His wife, who had for several years been hopelessly insane, died in 1837, and two years afterward he married Caroline Bowles. (See SOUTHEY, C. A. B.) But Southey's own faculties had begun to give way, and on the day when he brought his wife to their home he fell into a state of mental prostration which soon grew into complete imbecility, that continued to his death, which took place Mar. 21, 1843. Southey's principal poems are—*Joan of Arc* (1795), *Thalaba the Destroyer,* an Arabian tale (1801), *Madoc,* founded on legends of early Welsh voyages to America (1805), *The Curse of Kehama,* based upon Hindoo mythology (1810), *Roderick, the Last of the Goths,* founded on Spanish history (1814), *A Vision of Judgment,* an apotheosis of George III. (1821), and *A Tale of Paraguay* (1825). Among his numerous prose works are—*History of Brazil* (1810–19), *Life of Nelson,* one of the best works in English biography (1813), *Life of John Wesley* (1820), *History of the Peninsular War* (1820–32), *Book of the Church* (1824), *Sir Thomas More, or Colloquies on Society* (1829), *Life of John Bunyan* (1830), and *The Doctor* (1834–37). He also contributed largely to the *Quarterly Review* for many years. His poetical works were collected by himself (10 vols., 1837), and have been several times republished in different forms. His *Life and Correspondence,* edited by his son, Rev. C. C. Southey, appeared in 1849, and a selection from his *Commonplace Book,* by his son-in-law, Rev. J. W. Warter, in 1856. A. H. GUERNSEY.

**South Fayette',** tp., Allegheny co., Pa. P. 1927.

**South'field,** p.-v. and tp., Oakland co., Mich. P. 1547.

**Southfield,** tp., Richmond co., N. Y. (Staten Island), includes the v. of Richmond, the county-seat. P. 5082.

**Southfield,** tp., Elizabeth City co., Va. P. 1766.

**South Fork,** tp., Clarke co., Ark. P. 898.

**South Fork,** tp., Fulton co., Ark. P. 518.

**South Fork,** tp., Montgomery co., Ark. P. 624.

**South Fork,** tp., Humboldt co., Cal. P. 273.

**South Fork,** tp., Klamath co., Cal. P. 286.

**South Fork,** tp., Christian co., Ill. P. 1279.

**South Fork,** tp., Delaware co., Ia. P. 1610.

**South Fork,** tp., Jackson co., Ia. P. 1014.

**South Fork,** tp., Wayne co., Ia. P. 774.

**South Fork,** tp., Monroe co., Mo. P. 1463.

**South Fork,** tp., Forsyth co., N. C. P. 1398.

**South Fra'mingham,** p.-v., Middlesex co., Mass., on Boston and Albany R. R., 21 miles W. of Boston. Five railroads centre here, forming one of the most important junctions in the State. It contains 3 churches, excellent schools, 1 newspaper, 3 straw-goods manufactories, 1 grain-elevator, mills, and manufactories of wheels, shoes, and rubber goods. P. 4968. C. M. VINCENT, ED. "GAZETTE."

**South Gard'ner,** p.-v., Gardner tp., Worcester co., Mass., at the intersection of Vermont and Massachusetts with Boston Barré and Gardner R. R., is largely engaged in the manufacture of chairs and settees.

**South'gate** (HORATIO), D. D., b. at Portland, Me., in 1812; graduated at Bowdoin College 1832, and at Andover 1835; took orders in the Protestant Episcopal Church 1836; travelled as a missionary in the East; was chosen missionary bishop of Constantinople 1844; remained there until 1851, in which year he became rector of St. Mark's, Portland, of the church of the Advent, Boston, 1852, and later of Zion church, New York City. Author of *A Tour through Armenia, Kurdistan, Persia, and Mesopotamia* (New York, 2 vols., 1840), *A Visit to the Syrian Church of Mesopotamia* (New York, 1844), *The War in the East* (1855), *Parochial Sermons* (1859), and of printed sermons and pamphlets, and of magazine articles.

**South Glas'tonbury,** p.-v., Glastonbury tp., Hartford co., Conn., on Connecticut River, has several factories.

**South Glen's Falls,** p.-v., Moreau tp., Saratoga co., N. Y., on Hudson River, opposite Glen's Falls. P. 1047.

**South Grove,** p.-v. and tp., De Kalb co., Ill. P. 795.

**South Had'ley,** p.-v. and tp., Hampshire co., Mass., on Connecticut River, which here makes a fall of 40 feet, around which a canal 2 miles in length has been constructed; has 5 churches, 1 cotton, 2 woollen, 4 paper, and 4 saw mills, a high school, lyceum, and farmers' club, and is celebrated for the Mount Holyoke Female Seminary, the earliest collegiate institution for females in the country. P. 2840.

**South Hadley Falls,** p.-v., South Hadley tp., Hampshire co., Mass., takes its name from the noted falls of Connecticut River, which supply, by means of a magnificent dam, an unequalled water-power for flourishing manufac-

tures, both at this point and at the thriving new city of Holyoke on the opposite bank of the river. (See HOLYOKE.)

**South Ham,** p.-v., cap. of Wolfe co., Quebec, Canada, 33 miles N. W. of Sherbrooke, has a court-house. P. about 100.

**South Hamp'ton,** p.-v. and tp., Rockingham co., N. H. P. 448.

**South Han'over,** tp., Dauphin co., Pa. P. 1196.

**South Ha'ven,** p.-v. and tp., Van Buren co., Mich., on Lake Michigan, at the mouth of Black River and at the W. terminus of South Haven division of Michigan Central R. R., has a good harbor, a thriving lake-trade, and 1 weekly newspaper. P. of v. 1576; of tp. 2203.

**South He'ro,** p.-v. and tp., Grand Isle co., Vt., embraces the southern half of Grand Isle in Lake Champlain. P. 586.

**South Hill,** p.-v. and tp., Mecklenburg co., Va. P. 2384.

**South Ho'mer,** tp., Champaign co., Ill. P. 1510.

**South Hun'tington,** tp., Westmoreland co., Pa. P. 2210.

**South'ington,** p.-v. and tp., Hartford co., Conn., on New Haven and Northampton R. R., 20 miles N. of New Haven, contains 7 churches, a well-endowed academy, 1 bank, 1 newspaper, a puddling furnace, 1 hotel, manufactories of tinmen's machines and carriage bolts, general and carriage hardware, pocket cutlery, eyelets, and paper bags. P. 4314. STEPHEN WALKLEY, ED. "REPORTER."

**Southington,** p.-v. and tp., Trumbull co., O. P. 799.

**South Kings'ton,** tp., Washington co., R. I., includes the villages of Kingston, the county-seat, and Narragansett Pier, a thriving watering-place; also the noted headland, Point Judith, at entrance to Narragansett Bay. P. 4493.

**South Lan'caster,** p.-v., Lancaster tp., Worcester co., Mass., on Worcester and Nashua R. R.

**South Leb'anon,** tp., Lebanon co., Pa. P. 1783..

**South Lee,** p.-v., Lee tp., Berkshire co., Mass., on Housatonic River and R. R., has celebrated marble-quarries.

**South Lon'donderry,** p.-v., Londonderry tp., Windham co., Vt.

**South Ma'con,** tp., Macon co., Ill. P. 79.

**South Maho'ning,** tp., Indiana co., Pa. P. 1131.

**South Man'chester,** p.-v., Manchester tp., Hartford co., Conn., noted for the extensive silk-factories of the Cheney Brothers, and the comfortable homes provided for the operatives.

**South Man'heim,** tp., Schuylkill co., Pa. P. 929.

**South Man'itou,** tp., Manitou co., Mich., consists of an island in Lake Michigan. P. 76.

**South Mer'iden,** p.-v., Meriden tp., New Haven co., Conn., on New York New Haven and Hartford R. R.

**South Mid'dleton,** tp., Cumberland co., Pa. P. 3226.

**South Mil'ford,** tp., Cedar Creek hundred, Sussex co., Del., on Junction and Breakwater R. R. P. 800.

**South Mills,** p.-v. and tp., Camden co., N. C. P. 2056.

**South Mountain, Battle of.** See ANTIETAM CREEK.

**South Mud'dy,** tp., Jasper co., Ill. P. 584.

**South Mur'derkill,** hundred, Kent co., Del. P. 4382.

**South Na'tick,** p.-v., Natick tp., Middlesex co., Mass., on Charles River, is noted as the locality of the missionary labors of the "apostle" Eliot, the translator of the Bible into the Indian language, to whose memory a monument has been raised here; has 3 churches, several shoe and other factories, and a society of natural history. There is an Indian burial-place, and a few persons of Indian descent still reside here; none, however, of pure Indian blood, or who speak the language of Eliot's Bible. (See the *History of Natick* (1856), by Oliver N. Bacon.)

**South Newmar'ket,** p.-v. and tp., Rockingham co., N. H., on Squawscot River and on Boston and Maine R. R. P. 808.

**South Nor'ridgewock,** p.-v., Norridgewock tp., Somerset co., Me., on Kennebec River.

**South Nor'walk,** city and seaport, Fairfield co., Conn., on Long Island Sound, 42 miles from New York, on New York New Haven and Hartford and Norwalk and Danbury R. Rs. The principal industries are the manufacturing of hats, shoes, locks, bronzed goods, force-pumps, steam-engines, ship and boat building, marine railway, paper boxes, portable gas-machines, and the cultivation and sale of oysters. It contains 2 banks, an insurance company, 1 newspaper, hotels, opera-house, street railroad, planing-mill, 4 churches, excellent schools, waterworks, fire department, gas, markets, etc. Steam freight-boats run to New York the year round—passenger boats during the summer season. Vessels drawing 12 feet come to the docks. Immediately W., and within the city limits, the land rises to an elevation of 160 feet, affording delightful locations for residences, with extensive views of the Sound N., E., and S., and the harbor on which the city is situated. P. 5000. JAMES GOLDEN, ED. "SENTINEL."

**South Oil City,** p.-v., Venango co., on Allegheny River, opposite Oil City.

**South'old,** p.-v. and tp., Suffolk co., N. Y., on Long Island R. R., is a neck of land between Long Island Sound on the N. and Great and Little Peconic and Gardner's bays on the S., and includes Plum and Fisher's islands in Long Island Sound. The township embraces the incorporated village of Greenport and the post-villages of Southold, Cutchogue, Mattituck, Peconic, East Marion, and Orient. There are 20 churches within the township, and an academy and savings bank at the village. Shipbuilding, manufactures, and commerce are the leading pursuits. Southold was settled in 1640 as a portion of New Haven Colony, became a part of Connecticut Colony 1662, and passed under the jurisdiction of New York 1664. P. of tp. 6715.

**South Ononda'ga,** p.-v., Onondaga tp., Onondaga co., N. Y., adjoining the reservation of the Onondaga Indians. P. 242.

**South Or'ange,** p.-v. and tp., Essex co., N. J., on Morris and Essex R. R., 15 miles W. of New York City, has 4 churches, 1 college and 3 schools, manufactories of hats, gelatine, and paper, 1 weekly newspaper, and a street railway. P. 2963. WILDEY & CO., PROPS. "BULLETIN."

**South Otse'lic,** p.-v., Otselic tp., Chenango co., N. Y.

**South Ot'tawa,** tp., La Salle co., Ill. P. 597.

**South Ottawa,** tp., Franklin co., Kan. P. 44.

**South Pa'ris,** p.-v., Paris tp., Oxford co., Me., on Grand Trunk R. R.

**South Pass City,** p.-v., Sweetwater co., Wyoming Ter., on Sweetwater River, formerly the county-seat. P. 460.

**South Pel'la,** v., Lake Prairie tp., Marion co., Ia. P. 191.

**South Per'ry,** p.-v., Perry tp., Hocking co., O., on Salt Creek. P. 136.

**South Pitts'burg,** formerly a borough of Lower St. Clair tp., Allegheny co., Pa., has been included since 1872 in city of PITTSBURG (which see). P. 3095.

**South Point,** p.-v. and tp., Gaston co., N. C. P. 2414.

**South'port,** town of England, county of Lancaster, at the mouth of the Ribble, on the Irish Sea, contains several large and elegant hotels and beautiful promenades, and is rapidly developing as one of the first sea-bathing places of England. P. 18,085.

**Southport,** p.-v., seaport of Fairfield co., Conn., on Long Island Sound and New York New Haven and Hartford R. R., 50 miles N. of New York City, contains 3 churches, a seminary, high and parochial school, 1 newspaper, 2 banks, a print-establishment, and paper pail-factory. P. 2000. C. M. GILMAN, ED. "CHRONICLE."

**Southport,** p.-v. and tp., Lincoln co., Me., is an island in Sheepscot Bay, on the Atlantic coast. P. 684.

**Southport,** p.-v. and tp., Chemung co., N. Y., on Chemung River, opposite Elmira, and on Erie and Northern Central R. Rs. P. 2185.

**South Quebec',** p.-v. of Levis co., Quebec, Canada, on the St. Lawrence, opposite Quebec, and adjoining the city of Levis. It is on Grand Trunk Railway, has fine docks and a large trade, being the point of departure of the Liverpool steamers. It has an emigrants' home. P. about 3000.

**South River,** tp., Marion co., Mo. P. 728.

**South River,** tp., Augusta co., Va. P. 4481.

**South River,** tp., Rockbridge co., Va. P. 2573.

**South River,** tp., Warren co., Va. P. 2110.

**South Ron'dout,** v., Esopus tp., Ulster co., N. Y., on Rondout Creek, opposite the city of Kingston. P. 405.

**South Roy'alston,** p.-v., Royalston tp., Worcester co., Mass., on Miller's River, and on Vermont and Massachusetts R. R.

**South Royalton,** p.-v., Royalton tp., Windsor co., Vt., on White River, opposite Royalton, and on Vermont Central R. R., has 1 weekly newspaper.

**South Sag'inaw,** p.-v., Spaulding tp., Saginaw co., Mich., on Saginaw River, at the mouth of the Shiawassee. P. 1875.

**South St. George,** v., St. George hundred, Newcastle co., Del. P. 111.

**South St. Louis,** city, St. Louis co., Mo. (annexed to St. Louis in Apr., 1870; enjoys all the privileges of the ward-school system of the latter city), has 1 newspaper, a marine railway and dry-dock, a street railway, an iron shipbuilding yard, a handsome park, Carondelet, water and gas works, the repair-shops of Iron Mountain and Southern R. R., 2 banks, the South St. Louis and Missouri furnaces, producing pig and railroad iron of a superior quality, and the Martindale, Missouri, and Carondelet zinc furnaces, ranking among the first of the country. P. 13,000. R. H. Robbins, Ed. "Carondelet Review."

**South Scit'uate,** p.-v. and tp., Plymouth co., Mass., on North River, has 3 churches, 1 hotel, 1 savings bank, 1 shipyard, 7 saw-mills, 5 box and trunk and 2 tack-factories. There are several large swamps which produce valuable live-oak for shipbuilding, which was formerly an important industry. P. 1661.

**South Sea Bubble,** a financial speculation which arose in England about the same time with Law's Mississippi Scheme in France. The South Sea Company was established by Lord Treasurer Harley in 1711. The public debt was made the stock of the company, under an engagement of the government to pay 6 per cent. interest at the end of five years, and the grant of a monopoly of the trade to the South Sea or the coast of Spanish America. Though the South Sea trade yielded no great profit, the company flourished from other sources, and became so well established as to vie with the Bank of England in controlling the finances of the country. In 1719 the government, with a view to reducing the rate of interest on the public debt and getting rid of certain unredeemable annuities, proposed to extend the privileges of the company and allow it to pay off the annuitants with its own stock. The ministers intended to give the South Sea Company a good bargain, but when the plan was proposed in the House of Commons that body voted to open the scheme for competition to the Bank of England also. The company was thus compelled to offer £7,500,000 for its privilege. Notwithstanding this drawback, under the extravagant expectation of profits from the American trade and the prevalent rage for speculation, the stock of the company was in great demand. It was increased by successive subscriptions, the price of shares rapidly rising till £1000 was paid for a single share of £100. Other bubbles were started, such as schemes for a fishery of wrecks, to make salt water fresh, to make oil from sunflowers, to extract silver from lead, all with promises of enormous profits. Madness ruled the hour. For lack of office-room the streets near "'Change alley" were lined with desks and clerks full of business negotiating the worthless stocks. The action of the South Sea Company itself against some of these bubbles first broke the spell. Attention was turned to its own affairs, and distrust arose, under which the stock rapidly declined. The news of the failure of Law's scheme, and its consequences in Paris, opened all eyes to the delusion, and as the year 1720 closed, the bubble burst, bringing ruin to the company and to thousands of families who had embarked their all on this treacherous sea of speculation. A. L. Chapin.

**South Shenan'go,** tp., Crawford co., Pa. P. 1042.

**South Shet'land,** or **New South Shetland,** a group of islands in the S. Atlantic, between 60° and 70° S. They are destitute of vegetation, and in the interior covered with perpetual snow and ice. They were discovered in 1819, and are visited by whalers, but navigation here is very dangerous on account of the ice.

**South Side,** tp., Wright co., Minn. P. 143.

**Southside,** tp., Appomattox co., Va. P. 2551.

**South Strabane',** p.-v. and tp., Washington co., Pa., includes v. of Washington, the county-seat. P. 1159.

**South Tar River,** tp., Yancy co., N. C. P. 344.

**South Thom'aston,** p.-v. and tp., Knox co., Me., on Penobscot Bay. P. 1693.

**South Tren'ton,** p.-v., Trenton tp., Oneida co., N. Y. P. 206.

**South U'nion,** p.-v., Shocco tp., Logan co., Ky., on Louisville Nashville and Great Southern R. R. P. 263.

**South Union,** tp., Fayette co., Pa. P. 860.

**South Val'ley,** tp., Cattaraugus co., N. Y., on Alleghany River, includes a portion of Alleghany reservation of Seneca Indians, and has numerous saw-mills. P. 743.

**South Versailles',** tp., Allegheny co., Pa. P. 2194.

**South Vine'land,** p.-v., Cumberland co., N. J., on West Jersey R. R., 38 miles S. of Philadelphia, has 3 churches, a graded school, 1 newspaper, and a stoneware and plough factory. Principal business, fruit-raising. P. about 1200. N. P. Potter, Ed. "Good Templar."

**South Wash'ington,** p.-v., cap. of Pender co., N. C., on Wilmington and Weldon R. R.

**South'well,** or **Sotwell** (Nathaniel), b. in the county of Norfolk, England, about 1600; was educated in the English Roman Catholic college at Rome; entered the order of Jesuits 1624; resided in England as a missionary priest 1624–27; returned to Rome; was from 1637 to 1668 secretary-general of the order; completed the *Bibliotheca Scriptorum Societatis Jesu* (Rome, folio, 1676), begun by Peter Ribadaneira (to 1609), and continued by Philip Alegambe (to 1643), and published *A Journal of Meditations for Every Day in the Year* (1669). The *Bibliotheca* was continued by Oudin to the year 1745, and a new edition appeared at Rome 1816. Southwell d. at Rome Dec. 2, 1676.

**Southwell** (Robert), b. at Horsham, St. Faith's, Norfolk, England, in 1560; educated in the Roman Catholic seminary at Douay, France; became a Jesuit at Rome 1578; prefect or rector of the English Jesuits' college at Rome 1585; sent as a missionary to England 1586; chaplain to Anne, countess of Arundel, and secretly administered the rites of his Church to the English Roman Catholics; was thrown into the Tower July, 1592, on an accusation of complicity in a plot against Queen Elizabeth; was ten times subjected to torture, but made no confession beyond that of being a Jesuit and having exercised his priest's office; was condemned to death for constructive treason in refusing to take the oath of supremacy Feb. 20, 1595, and on the following day was hanged, drawn, and quartered at Tyburn, meeting his fate with firmness and composure. Author of several pieces of prose and verse published at London immediately after his death, among which were *St. Peter's Complaint, and other Poems, Mæoniæ, or Certaine Excellent Poems and Spiritual Hymns, The Triumph over Death, Epistles of Comfort to those Catholics who Lie under Restraint,* and *Mary Magdalen's Funeral Teares.* A complete edition of the *Poems* appeared in 1856.

**South West,** tp., Crawford co., Ill. P. 325.

**Southwest,** tp., Warren co., Pa. P. 677.

**Southwest,** tp., Doddridge co., West Va. P. 1251.

**South Wes'terlo,** p.-v., Westerlo tp., Albany co., N. Y. P. 147.

**South West Harbor,** p.-v., Tremont tp., Hancock co. (Mount Desert Island), Me., on the W. side of Soame's Sound, is the site of a French colony established May, 1613, by De Saussaye and the Jesuit Biard, but shortly afterward captured and broken up by Capt. Samuel Argall. (See Francis Parkman's *Pioneers of France in the New World.*)

**South Wey'mouth,** p.-v., Weymouth tp., Norfolk co., Mass., on Plymouth branch of Old Colony R. R., 11 miles S. of Boston, has flourishing manufactures, especially of boots and shoes.

**South Wheel'ing,** v., Ritchie tp., Ohio co., West Va., on Ohio River, adjoining the city of Wheeling. P. 3158.

**South White'hall,** p.-v. and tp., Lehigh co., Pa., on Lehigh River, Canal, and R. R., includes the v. of Allentown, the county-seat. P. 2748.

**South'wick,** p.-v. and tp., Hampden co., Mass., on New Haven and Northampton R. R. P. 1100.

**South Wil'braham,** p.-v., Wilbraham tp., Hampden co., Mass., on Scantic River, which supplies water-power to a paper-mill and to flourishing manufactories, has 3 churches, and a celebrated collegiate institution, the Wesleyan Academy.

**South Wil'liamstown,** p.-v., Williamstown tp., Berkshire co., Mass.

**South Wind'ham,** p.-v., Windham tp., Windham co., Conn., on New London Northern R. R.

**South Windham,** p.-v., Windham tp., Cumberland co., Me., on Portland and Ogdensburg R. R.

**South Wind'sor,** p.-v. and tp., Hartford co., Conn., on Connecticut River. P. 1688.

**South Wood'berry,** tp., Bedford co., Pa. P. 1439.

**South'worth** (Constant), b. at Leyden, Holland, in 1614, son of Edward, a merchant and business-agent of the Leyden Pilgrims (d. 1621); was brought to Plymouth, Mass., in the third vessel that arrived 1621 by his widowed mother, Alice Carpenter Southworth, who became the second wife of Gov. William Bradford, under whose care he was educated; was one of the early colonists of Duxbury; was often a magistrate and representative in the legislature; served as commissioner for the United Colonies; governor of the Kennebec Plantation and assistant governor of Plymouth. D. at Duxbury about 1685. He was supposed to be the author of the *Supplement* to the

*New England's Memorial* of his cousin, Nathaniel Morton. —His brother THOMAS, b. in Leyden in 1616, was also prominent in public affairs. D. 1690.

**Southworth** (EMMA D. E. NEVITT), b. in Washington, D. C., Dec. 26, 1818; was married in 1841, and two years later was thrown wholly upon her own exertions for a livelihood; engaged in teaching, and wrote for the Washington *National Era* a novel entitled *Retribution*, which was published in book-form in 1849, since which time she has put forth in rapid succession a long series of novels. A uniform edition of her works has been published, among which are—*The Family Doom, Prince of Darkness, The Bride's Fate, The Changed Brides, How He Won Her, The Widow's Son, The Bride of Llewellyn, The Fortune-Seeker, The Bridal Eve, The Fatal Marriage, The Deserted Wife, The Lost Heiress, The Discarded Daughter, The Three Beauties, Vivia, The Wife's Victory, The Mother-in-Law, The Haunted Homestead, Lady of the Isle, Retribution, India, or the Pearl of Pearl River, The Curse of Clifton, Cruel as the Grave, Tried for Her Life, A Beautiful Fiend*, and *The Spectre Lover*.

**Southworth** (NATHANIEL), b. at Scituate, Mass., in 1806; early displayed artistic talent; became a celebrated miniature-painter at Boston; visited Europe in 1848, and subsequently practised his profession in New York and Philadelphia. D. at Dorchester, Mass., Apr. 25, 1858.

**Southworth** (TERTIUS DUNNING), b. at Rome, N. Y., in 1800; spent his childhood at Bridgewater; studied at Whitesboro' Academy; graduated at Hamilton College 1827 and at Andover Seminary 1830; became a Congregational minister at Sauquoit, N. Y.; was afterward settled at Claremont, N. H., 1834; succeeded the celebrated Dr. Nathaniel Emmons as pastor of the church at Franklin, Mass., 1838–49; was for several years without pastoral charge on account of ill-health; was settled at Pleasant Prairie, Wis., 1859–68, after which he returned to Bridgewater, N. Y., to spend his declining years, and d. there Aug. 2, 1874. Author of numerous occasional publications, including many sermons and addresses, among which the sermon preached at the funeral of Rev. Dr. Emmons was especially noted for its eloquence.

**South Yar'mouth,** p.-v., Yarmouth tp., Barnstable co., Mass., on Bass River, near Cape Cod R. R., is extensively engaged in fishing and salt manufacture.

**Souval'ki,** town of Russian Poland, cap. of the government of Souvalki, is the seat of several civil and ecclesiastical authorities, and has good educational institutions. P. 16,533.

**Souvarof.** See SUWAROW.

**Souvestre'** (ÉMILE), b. at Morlaix, department of Finistère, France, Apr. 15, 1806; after editing for some time a liberal newspaper at Brest, he settled in 1836 at Paris, where he attracted attention first by his sketches of Brittany, and became soon one of the most popular novelists and dramatists. D. at Paris July 5, 1854. The most remarkable of his novels are *Les Derniers Bretons, L'Homme et l'Argent, Confessions d'un Ouvrière, Un Philosophe sous les Toits* (the last-named receiving in 1851 a prize from the French Academy); and of his dramas, *Henri Hamelin, L'Oncle Baptiste, La Mousse*, etc. All his works have a strongly-marked tendency, representing morality and riches as incompatible. He is sometimes sad, and even bitter, but he often gives most delightful pictures of the innocence of simple surroundings and the cheerfulness of humble circumstances.

**Souzdal',** town of European Russia, government of Vladimir, on the Kamenka, is said to have been founded in 606 B. C. It has 6919 inhabitants, mostly engaged in raising vegetables.

**Sov'ereign,** the British gold coin representing the pound sterling of 20 shillings. It first appeared in 1817, and now weighs $\frac{1}{2567}$th of an ounce troy, and is worth $4.839 in U. S. money. The English coin first called double royal (afterward replaced by the guinea), first struck about 1489, was often called the sovereign. Its value varied from 20 to 30 shillings, but its original value was 22 shillings sterling.

**Sov'ereignty** [It. *sovranità*; Fr. *souveraineté*, from the Latin prep. *super*, through It. *sovrano*, Fr. *souverain*, "high," "supreme"] denotes the possession of the highest power in any given sphere, as in the state or in the universe. A kindred word from the same origin was *suzerainité*, from *suzerain*, the feudal lord-paramount. The debates concerning the supreme power, whether it resides by right in the people—*i. e.* the organized people—ultimately, or in some ruler who received it from God, led to the application of the word to the former as the source from which the right of the particular magistrate or line of kings was derived, and to the latter as invested by the former with his power according to the will of God. In the English usage the king or queen is called sovereign, although possessed of an authority limited on every side by law. Yet as in theory all executive power is derived from that of the monarch, the term sovereign contains no absolute misnomer.

Under our Constitution the question whether the several States or the U. S. are invested with the sovereignty has been made a matter of great contention, and the term has been used to justify the most false and dangerous doctrines. We ask our readers' attention for a word or two upon this subject.

(1) In the provisional articles of peace between the U. S. and Great Britain (1782), and in the definitive treaty of 1783, the king acknowledges the thirteen United States "to be free, sovereign, and independent States," "treats with them as such," and "relinquishes all claims to the government, propriety, and territorial rights of the same, and of every part thereof." The meaning of this is, that he and no one else had any claims of sovereignty over the territory of the U. S., and that by relinquishing those claims he left them in the same condition in which other states, independent of all external powers, were by the nature of their situation placed. The thirteen States were at that time confederated together, but of this confederation he takes no notice.

(2) In the new Constitution, framed in 1787, important limitations were put on the power of the thirteen States, all of them tending to throw power into the hands of the general government. Among these were the powers to declare war, to make peace, to send and receive ambassadors, to raise and support armies, to coin money, to emit bills of credit, to provide for calling forth the militia of the States in order to execute the laws of the Union, to decide in all questions, whether questions of interpretation or of other kinds, arising under the Constitution. And it is added that "the Constitution, and the laws of the U. S. which shall be made in pursuance thereof, and all treaties made or which shall be made under the authority of the U. S., shall be the supreme law of the land; and the judges in every State shall be bound thereby, anything in the constitution or laws of any State to the contrary notwithstanding." (Art. VI. 2.) This section is immediately followed by one to the effect that the Senators and Representatives of the U. S., and all judicial and executive officers, both of the U. S. and of the several States, shall be bound by oath or affirmation to support the Constitution. The President especially is required to declare on oath or affirmation that he will to the best of his ability preserve, protect, and defend the Constitution of the U. S. So far from being sovereigns, then, the States composing the U. S. have not a single attribute of sovereignty belonging, according to international law, to a sovereign and independent state. They can have no other or higher relations to foreign powers than any municipality, private corporation, or individual. If they differ with the general government on the interpretation of laws or treaties, the difference must be drawn before the courts of the Union, and their interpretation must decide the judgments of all State courts thereafter. The Constitution is thus supreme, and as a supreme instrument it *prohibits* the States (Amendments, Art. X.) from exercising certain powers.

(3) The question whether the States were supreme in the interval between the Declaration of Independence and the formation of the present Constitution, or in any part of that interval, as from the peace with Great Britain onward, is of very minor importance. The question of sovereignty is one of fact. Does a community, called a state, possess or not the status of a treaty-making power on a par with other states of the world? Can it interpret the constitution to which it has given its assent, or must some other body interpret for it? Questions like these determine its condition, no matter what its former condition may have been. If it was once sovereign, it can have renounced its sovereignty; if it was not, it never acquired sovereignty by the Constitution. The preamble of this instrument intentionally begins not "We, the States," but "We, the people of the U. S.," "do ordain and establish this Constitution," etc. But we lay no stress on this form of words, except so far as it seems intended to avoid a seeming inconsistency with which "we, the States," might have been chargeable.

All this is better expressed than we can express it in Gen. Jackson's proclamation of Dec., 1832: "The States severally have *not* retained their entire sovereignty. It has been shown that in becoming parts of a nation, not members of a league, they surrendered many of their essential parts of sovereignty. The right to make treaties, declare war, levy taxes, exercise exclusive judicial and legislative powers, were all of them functions of sovereign power. The States, then, for these important purposes, were no longer sovereign. The allegiance of their citizens

was transferred, in the first instance, to the government of the U. S.; they became American citizens, and owed obedience to the Constitution of the U. S., and to laws made in conformity with the powers it vested in Congress. This last position has not been, and cannot be denied. How, then, can that State be said to be sovereign and independent whose citizens owe obedience to laws not made by it, and whose magistrates are sworn to disregard [its own] laws when they come into conflict with laws passed by another? What shows, conclusively, that the States cannot be said to have reserved an undivided sovereignty is, that they expressly ceded the right to punish treason—not treason against their separate power, but treason against the U. S. Treason is an offence against *sovereignty*, and sovereignty must reside with the power [able] to punish it." (Comp. the articles NULLIFICATION and TREASON.) T. D. WOOLSEY.

**Sovicil'le,** town of Italy, province of Siena, is beautifully situated at the foot of Monte Maggio, on the Spino. P. 7115.

**Sow'er** (CHRISTOPHER), b. in Germany toward the close of the seventeenth century; was a bookseller at Hesse-Darmstadt; emigrated to Pennsylvania 1726; settled as a printer and bookseller at Philadelphia; established the first type-foundry and the first manufactory of printer's ink in America; published the first quarterly magazine (1735) and the second Bible (1743), both being in German. D. at Philadelphia Sept., 1758.—His son, CHRISTOPHER, b. at Hesse-Darmstadt Sept. 26, 1721, succeeded to the management of the publishing business 1758; was the introducer of cast-iron stoves into America, and supposed to be their inventor; was noted for philanthropy during the war of the Revolution, when he merited the name of *Das Brod-Vater* ("the bread-father"), but lost his property by confiscation in consequence of his loyalist sentiments. D. at Philadelphia Aug., 1784. A descendant of the family is in the educational-book business in Philadelphia.

**Sow'erby,** an English family, several members of which have attained eminence in connection with natural history and art: JAMES, b. at Lambeth Mar. 21, 1757; was originally a miniature and portrait painter, and later in life took up botany in connection with his art. He published *Botanical Drawing-Book* (1789); *English Botany*, containing colored figures of all the native plants of Great Britain (36 vols., with descriptions by Sir James Edward Smith, M. D., 1792–1807; supplement by his son, James De C. Sowerby, 4 vols., 1815–49; new ed. by J. T. B. Syme, 10 vols., 1863–70); *The Florist's Delight* (1791); *English Fungi or Mushrooms*, with 440 colored figures (3 vols., 1797–1803); *British Miscellany*, comprising animal subjects (1804–06); *Exotic Botany* (1804–05); *British Mineralogy*, with 550 colored plates (5 vols., 1804–17); *Description of Models to explain Crystallography* (1805); *Gleanings of British Algæ; New Elucidation of Colors* (1809); *Exotic Mineralogy*, with 169 colored plates (2 vols., 1811–17); and *Mineral Conchology of Great Britain*, with 600 plates (6 vols.; the last two by his son, J. De C. Sowerby, 1812–30). He was a contributor to the *Annals of Philosophy* and to the *Transactions* of the Linnæan and Geological societies. D. Oct. 25, 1822.—JAMES DE CARLE, eldest son of the preceding, b. at Stoke Newington June 5, 1787; in 1839 was made secretary of the Royal Botanic Society, holding the position until 1870, when he retired with a small pension. He was a skilful artist, made the designs for Loudon's *Encyclopædia of Plants*, and assisted his father in many of his works. D. Aug. 26, 1871.—JOHN EDWARD, son of James, prepared either alone or in conjunction with others *The Ferns of Great Britain* (1855), *Fern Allies* (1856), *British Poisonous Plants* (1856), *The Grasses of Great Britain* (1857), *British Wild Flowers* (1858), *Wild Flowers worth Notice* (1861), *The Useful Plants of Great Britain* (1862), and an *Illustrated Key to British Wild Flowers*.—GEORGE BRETTINGHAM, second son of James, b. at Lambeth Aug. 12, 1788; assisted his father in the entomological portions of his works; purchased for £6000 the collection of shells belonging to the earl of Tankerville, of which he prepared a catalogue, and also purchased several other large collections of shells; was one of the founders of the *Zoological Journal*, and published *Genera of Recent and Fossil Shells*, with 264 colored plates (42 parts, 1822–34); *Species Conchyliorum* (1830; not completed); *Conchological Illustrations* (200 parts, 1832–45); *Thesaurus Conchyliorum*, being figures and descriptions of shells, the later volumes by his son (23 parts, 1842–64). D. July 26, 1854.—GEORGE BRETTINGHAM, JR., son of the preceding, b. Mar. 25, 1812; has published *Manual of Conchology*, with more than 650 figures of shells (1839; 4th revised ed. 1852); *Thesaurus Conchyliorum* (30 parts, 1842–71); *Popular British Conchology* (1854; new ed. 1866); *Popular History of the Aquarium* (1857; new ed. 1865); *Illustrated Companion to Kingsley's Glaucus* (1858); *Illustrated Index of British Shells* (1859); and *Labels for the Recognized Species of British Shells* (1861). He also made the drawings for Reeves's *Elements of Conchology* and *Land and Fresh-Water Mollusks of the British Isles*.—HENRY, a younger brother of the preceding, who subsequently emigrated to Australia, has prepared a *Popular Mineralogy*, comprising a familiar account of minerals and their uses (1850). A. H. GUERNSEY.

**Sowerby Bridge,** town of England, county of York, has malting-houses, dyeworks, and manufactures of iron-ware and cotton goods. P. 6000.

**Sowing and Sowing-Machines.** Sowing, in its widest sense, is the process of depositing seed in the ground for the purpose of producing plants. When the seeds are deposited singly or with only a few in a definite spot, it is usually called *planting*, the term *sowing* being restricted to cases where the seed is thrown broadcast or deposited in rows or "drills." Sowing or planting is usually performed in the spring, but sometimes, and with some kinds of crops, in the autumn, so that the plants may have a fair start when the spring opens. The seeds are usually covered over by harrowing, brushing, or rolling the soil after they have been deposited. As a rule, it may be laid down that when the soil is rather firm and the climate moist, little depth of covering is required; but when the soil is loose and the climate dry, the seeds should be covered to a depth of about twice their thickness. Machines, more or less complex, for performing the operation of sowing or planting in all its forms have been in use from time immemorial. Some scatter the seed broadcast; others dibble it into the ground in rows or drills, and then cover it, the general principle being that the drills should be at such a distance apart that a horse drawing a light plough may pass between the drills without injuring the plants. In the larger machines, often drawn by horse-power, the seed is placed in small cups, from which it passes through tubes so arranged as to suffer them to drop regularly into shallow furrows cut by coulters just in front of the escape-orifice of the tubes, the furrows being closed up by a kind of rake or harrow following immediately after and forming a part of the machine. The term "drill" is commonly applied to sowing-machines of all kinds. By their use the operation of sowing can be performed not only more expeditiously, but also much more uniformly, than by hand, provision being made for regulating the rapidity of the delivery as circumstances render desirable. Sowing-machines form an important adjunct to the reaping and mowing machines elsewhere described. (See REAPING AND MOWING MACHINES.)

**Soy Bean,** the *Soja hispida*, a bean extensively grown in Japan, China, India, and the Spice Islands, where it is much used as food. The sauce called "soy" is, when genuine, made of boiled soy beans, mixed with wheat-meal and fermented. It is then salted and mixed with water, and after daily stirring for a long time the supernatant liquid is poured off and preserved for use. Good soy is a spirited and excellent sauce, and is believed to improve with age.

**Soyer'** (ALEXIS), b. in France about 1800; was cook in the Reform Club in London; became noted for his army cookery during the Crimean war. D. Aug. 5, 1858. He published *Culinary Relaxations* (1845), *Gastronomic Regenerator* (1847), *Modern Housewife* (1849), *Culinary Campaign* (1857).

**Spa,** town of Belgium, province of Liege, in a beautiful valley, is handsomely built, and celebrated for its cold mineral springs, which were resorted to on account of their curing effect even in the fourteenth century. P. 5881.

**Spaccafor'no,** town of Sicily, province of Syracuse, on the side of a hill which rises above the right bank of the Bufaldone. Within the limits of this town is the curious locality known as the Cava Ipsica, a wooded valley, in the rocky sides of which were cut, in some pre-historic age, dwelling-places for a now forgotten population. These artificial caverns are not uncommon in the island, but most of those found in the Cava Ipsica could only have been reached by ladders. P. 8035.

**Space** [Lat. *spatium*] is regarded by Aristotle (*Phys.*, iv. 1–5) "as the first and unmoved limit which bounds body" when taken as finite space or *place;* taken as space in general, it is "the unmoved limit of whatever is moved"—*i. e.* of all bodies. Time, on the other hand, should be, according to him, the number and measure of movement. The existence of pure space is evident, he says, from the fact that things change places; yet in spite of its three dimensions it is not to be confounded with body, for in that case two bodies would coincide; it is not cause; there is no place in which space itself exists; nor does space grow with what grows. Matter and form are in-

separable, but extension and limiting surface are separable; hence matter and form do not explain them, as was thought by Plato in the *Timæus*, where he makes space to be the primitive matter of the universe; it is not form, for space remains when the form is removed. In these distinctions Aristotle lays especial stress on the idea of limit, negation, discreteness in relation to body as essential to the definition of space. In philosophy there is scarcely any subject upon which there is more apparent diversity of opinion or more fruitless attempts at definition. The difference, however, is not really so great as it seems. Space has been made identical with pure extension, but this leaves no definition for time, which likewise involves extension. Leibnitz made it "the order of things coexisting, as time is the order of things successive," so that if the totality of things could be moved, space, being their arrangement, would likewise be moved. It has been defined to be pure nothing, thus omitting its specializing attribute. For while "nothing" may be regarded as the potentiality of all (of events and ideas as well as of bodies), space can be regarded only as the potentiality of bodies. It has been made an accident or attribute or relation inhering in bodies; but this would involve the absurdity that annihilation of bodies destroyed space. As the ultimate logical condition for the co-existence of bodies, space is itself a correlate of time as regards motion and actually existing matter—time by itself being the ultimate logical condition of all succession. As ultimate logical condition it has quite frequently been identified with the infinite, or made to be a divine attribute. Sir Isaac Newton suggested that God by existing constitutes time and space. Samuel Clarke expanded this suggestion into a system of theology, and held a long discussion with Leibnitz on the subject. Akin to this view is that which makes space and time to be forms of mind when it thinks nature. Kant laid great stress on this, making space and time subjective forms of intuition and devoid of objective validity as regards "things in themselves." By this, however, he must not be understood to mean that they are subjective to the mere individual mind, and to be refused validity as regards objects in nature and history; for Kant regards all nature and all history as necessarily conditioned in and through space and time. His doctrine, therefore, does not narrow or belittle space and time, but only magnifies and glorifies mind, which is thus shown to transcend the world and to be of an eternal nature.

Much labor has been expended by sensationalists on the problem of accounting for the origin of the idea of space. Locke thought that he could trace it to the senses of touch and sight; most of his followers have adopted the same doctrine, making it a generalization from experience gained in the perception of bodies. Accordingly, they ignore in some manner the attributes of universality and necessity which are the distinctive characteristics of *a priori* ideas, and make unbroken custom or habit to be the explanation of the inability or impotence of the mind which we call inconceivability. That geometry rests upon the *a priori* cognition of space, as arithmetic and algebra rest upon a similar cognition of time, is not conceded by them. But Kant saw and stated with great clearness the grounds for all transcendental or spiritual philosophy as involved in the question, "Are *a priori* synthetical judgments possible?" *i. e.* Can we enounce the universal and necessary conditions of experience? The answer being affirmative, instancing mathematics, the next question is, "How are they possible?" that is, What does this presuppose in regard to mind? Instead of deriving the idea of space from experience in regard to bodies, he saw that by no possibility could the mind conceive a body in the first instance without already having the idea of space. The mind uses the idea of space as an indispensable instrument in thinking the idea of a body. Moreover, space is not a generalized idea ("discursive"), inasmuch as it is not abstracted from spaces, but is thought as the logical condition of all possible spaces or bodies, and therefore as infinite from the first. Much has been written upon the inconceivability of the infinite, especially by Sir William Hamilton and his followers. We know space to be infinite, because it is its nature to be that in which all limits exist; hence, were it supposed to be finite and limited, it must be necessarily thought to be limited by itself; but self-limitation is continuation, therefore space can be only continued, and this universally. Hegel unites in his view of space the doctrine of the Christian Mystics with that held by such thinkers as Newton and Clarke; the former, making God's thinking and willing to be identical, hold this self-knowledge to be a creation of the world—his making an object of himself to be the creative act. The self-consciousness of God being self-externalization, as well as return out of self-externalization through the act of recognition, nature and man (in whom nature is perpetually sacrificed and subordinated for spirit) come into being. Accordingly, the lowest, most elementary, abstract, and inadequate form of the divine self-knowing is space; time being at once the needed correlate to correct its imperfection, and reflect God's unity with himself, which is essential to destroy his self-alienation. Space and time as abstractions thus unite in matter and movement, which are therefore relatively concrete. Meister Eckhart, Jacob Böhme, Angelus Silesius, Franz Baader, Schelling, and others have explored this abyss of the creative idea, and with substantially the same results. Indeed, the Oriental mysticism which underlies Gnosticism, Neo-Platonism, and the Jewish Cabbala is not essentially different as regards its logical movement, but only in its construction of the "return," and its assertion of the principle of emanation instead of creation. Spinoza's "thought and extension" as the two attributes of God suggest the view which he held of the relation of space to the divine activity.

WILLIAM T. HARRIS.

**Spad'ra,** p.-v. and tp., Johnson co., Ark. P. 1905.

**Spaf'ford,** p.-v. and tp., Onondaga co., N. Y. P. 1595.

**Spagnolet'to,** whose true name was JOSÉ RIBERA, b. at San Felipe de Jativa, province of Valencia, Spain, Jan. 12, 1588; studied painting, first under Francisco Ribalta, afterward in Italy, especially under Caravaggio, and settled about 1612 at Naples, where he achieved a great fame; was made court-painter, and d. probably 1656. His most remarkable pictures are *The Flaying of Saint Bartholomew, Ixion on the Wheel, Jacob's Dream, Adoration of the Shepherds,* etc., besides a great number of portraits. Among his pupils was Salvator Rosa.

**Spa'his** [Pers. *sipâhî*, "soldier"], a name applied to the former irregular Turkish cavalry, abolished in 1826; at present applied to the Franco-Algerine cavalry. There are at present but three regiments of spahis in the French service. The Turkish government has several regiments of regular spahis, besides an irregular force of that name. Tripoli also employs some 1500 spahis at present in her small army.

**Spaight** (RICHARD DOBBS), b. in Ireland about the middle of the eighteenth century; educated at the University of Glasgow; came to America shortly before the Revolution; settled in North Carolina; took part in the Southern campaigns 1778–80; sat in the North Carolina legislature 1781, in Congress 1782–86, in the convention which framed the Federal Constitution 1787; was governor of North Carolina 1782–85; again member of Congress 1798–1801, and killed in a duel by John Stanley Sept. 5, 1802.

**Spaight** (RICHARD DOBBS), JR., b. at Newberne, N. C., in 1796; graduated at the University of North Carolina 1815; studied law; was elected to the State assembly 1819, to the senate 1820–22; was a member of Congress 1823–24; again a State senator 1824–34; member of the State constitutional convention 1835, and governor 1835–37. D. at Newberne in Nov., 1850.

**Spain, Kingdom of,** occupying the largest part of the Pyrenean peninsula, extends from lat. 36° 0′ 40″ to 43° 46′ 40″ N., and from lon. 8° 17′ 42″ to 20° 59′ 56″ E., and comprises an area of 507,036 quadrate kilomètres, inclusive of the two European groups of islands—the Balearic Isles, 4817.4 q. k., and the Canaries, 7272.6 q. k. The surface consists principally of a large plateau walled in N., E., and S. by high mountain-ranges, but sloping W. down to the Atlantic. On the N. rise the Pyrenees and the Cantabro-Asturian Mountains. The Pyrenees are wild and impracticable, almost destitute of longitudinal valleys, and forming a barrier between Spain and France crossed only by two great lines of communication. The average height of the ridge is 7500 feet, that of several single peaks still greater—Maladetta, 10,722 feet; Pic du Midi, 9000 feet; Canigon, 8646 feet; on the Spanish side the descent is very steep. The Cantabro-Asturian Mountains connect with the Pyrenees at the Bay of Biscay, and run parallel with the coast, rising 8800 feet. To the E. the mountains of Catalonia extend along the coast to Tortosa, where the Ebro breaks through them; they are rich in metals, coal, and salt, and have made Catalonia the only truly manufacturing region of Spain. Divided by numerous rivers into insulated groups, which the Spaniards call *muelas*, and without any common name, the mountains continue southward through Valencia and Murcia. The southern wall of the plateau is formed by the Sierra Morena, which rises 5000 feet and runs from E. to W., ending in Cape S. Vicente. The Sierra Morena is not a coast-range, however; to the S. extends the Andalusian lowland, separated from the Mediterranean by the Sierra Nevada, which rises 11,000 feet. The plateau forming the main bulk of the peninsula is divided into two parts by a range running from the N. E. to the S. W. The northern part is the plateau of Leon and Old Castile, with an average height of 2500 feet; the southern, the plateau of New Castile, with an average

height of 2000 feet. The range, collectively called the Castilian Mountains, is called Samosierra to the N. E., Guadarama and Sierra de Gredor to the S. W. The rivers which traverse the country flow mostly in very deep beds, and are thus less available for irrigation. To the Atlantic run the Duero, Tajo, Guadiana, and Guadalquivir, all rising on the eastern wall of the central plateau; to the Mediterranean, the Ebro, which rises between the Cantabrian Mountains and the north-eastern wall of the plateau of Old Castile. Of the minor rivers, the Minho runs to the Atlantic, the Segura, Xucar, and Guadalaviar to the Mediterranean. All the rivers, with the exception of the Guadalquivir, are navigable only for a short distance from the sea, and are consequently of little importance for communication. The most important canals are the Aragonian, the San Carlos, and the Castilian. Noticeable are the immense establishments for irrigation found throughout the country, and generally founded by the Moriscoes; the most remarkable is the canal of Isabella II., which provides Madrid with water. The coast formation of the peninsula is not very favorable. The southern coast is steep and rent by numberless small gulfs from Cape de Gata to Cape Tarifa; then sandy and covered with salt-marshes, *marismas*, to Faro. Only one important maritime place is found here—namely, Cadiz. From Faro to Cape S. Vicente the coast is one steep wall of rock. The coast of Galicia is also steep, but indented by numerous deep bays, *rias*, and rich in small harbors; the northern coast offers good harbors at Santander and Bilbao. Along the eastern coast Barcelona, Tarragona, Valencia, Alicante, and Cartagena are the most important harbors. In general, the climate of Spain, more than that of any other European country, resembles the climate of the tropical regions, all natural forces manifesting themselves with singular power—sudden changes from heat to cold, hurricanes, earthquakes, long droughts, violent rains; nevertheless, the climate is very different in the different regions. The central plateau is dry, destitute of forests, very hot in the summer, very cold in the winter; the Cantabrian and Pyrenean mountain-regions are milder and moister, on account of the sea-breezes; the coast-lands of Valencia and Murcia enjoy a most delicious air, and the lowland of Andalusia has an almost tropical character; it knows only spring and summer. Very unfavorable to the climate and fertility of Spain are the large tracts of waste land and the great lack of forests, both features resulting from false administrative principles and the internal dissensions of the people. A great diversity in the flora and fauna of the country corresponds to the diversity of its climate and surface. In the northern region grow the oak, beech, chestnut, alder, ash, elm, and birch; fruit and nut-bearing trees, wheat, rye, barley, oats, and fodder-plants are cultivated; the wolf, bear, boar, fox, rabbit, stag, roe, etc., are found. The central districts have an alpine flora—heath, thyme, thistle, now and then forests of pine and *Quercus ilex;* in the south-western the olive, orange, fig, almond, vine, laurel, cypress, prickly pear or Indian fig (*Cactus opuntia*), the date and fan-palm, myrtle, etc., abound; in the southern region the plants of Northern Africa, Egypt, and Asia Minor, and sugar, cotton, and sweet potatoes are cultivated; in the south-eastern, oranges, date-palms, melons, and rice are grown; farther to the N., along the Mediterranean, wine and wheat are produced—maize, hemp, flax, vegetables, fruit, especially peaches and apricots, and evergreen oaks abound. A mixture of the European and African fauna inhabits the central, western, and eastern districts. The eagle, falcon, genet, ichneumon, numerous butterflies, the scorpion, etc., are indigenous here, while in the southern districts the African birds and apes and the chameleon are found. The steinbok is frequently met with in the Sierra Nevada.

The population consisted in the oldest times of two entirely different races, the Celts in the W. and the Iberians in the E., much intermixed with each other in the central part of the country. The Basques (*Vascones*) in Navarre, the Cantabrian Mountains, and on both sides of the Western Pyrenees, numbering about 500,000, form a pure and unmixed stock of the Iberians, who probably came from Africa and spread over Southern France as far as the Garonne. To these races many others were added by immigration: first, the Phœnician and Greek colonists; next the Carthaginians, after 236 B. C.; then the Romans, who under Augustus occupied the whole peninsula and divided it into three provinces: *Taraconensis*, the central plateau; *Bætica*, Andalusia; and *Lusitania*, Portugal. In 409 A. D. the Sueves, Alanes, and Vandals invaded the peninsula, and in 711 came the Arabs, who founded a powerful empire. The present race-distribution is the same as was apparent in the political division of the country at the end of the Middle Ages. In Aragon and Catalonia the Limosin dialect is spoken, a branch of the Provençal, down to the frontier of Valencia. The Catalonian is enterprising, courageous, hardy, born a merchant. The Basque is gay and social, patriotic and industrious; his land is carefully cultivated, and good roads are laid out. His language has no relation at all to any other known language. The Castilian, occupying the centre of the country, shows at this very day the same characteristics which formerly the Romans admired. He is proud, grave, valiant, dignified, liable to fall into intolerance and bigotry, and apt to despise everything foreign and new. In Andalusia, Granada, and Murcia the Spaniards are much mixed up with Arabian elements; they are lively, talkative, quick-witted, poetical, and hospitable. But in spite of their many great and good qualities, the Spaniards stand in general civilization far below the other European nations; they are ignorant, and boast most of that which constitutes their very weakness. The reason for this state of affairs lies partly in the soil and climate of the country. The grandeur of all natural phenomena and the violent changes which take place foster superstition and prevent regular labor. But the reason must partly be found in the history of the people, the chief part of which is made up of religious wars; the people have always been under the control of the clergy. According to the census of 1870, the population amounted to 16,835,506, including the Canaries and the Balearic Isles, which together had 573,084 inhabitants. In 1860 the population numbered 15,673,536, and in 1787, when the first census was taken, 10,409,879. The country is divided into the following 47 provinces:

| | Quadrate kilomètres. | Population. | | Quadrate kilomètres. | Population. |
|---|---|---|---|---|---|
| Alava | 3,121.7 | 103,320 | Lerida | 12,365.9 | 330,348 |
| Albacete | 15,465.9 | 220,970 | Logroño | 5,037.5 | 182,941 |
| Alicante | 5,434.3 | 440,470 | Lugo | 9,808.4 | 475,836 |
| Almeria | 8,552.9 | 361,553 | Madrid | 7,762.4 | 487,482 |
| Avila | 7,722.1 | 175,219 | Malaga | 7,312.9 | 505,010 |
| Badajoz | 22,499.8 | 431,922 | Murcia | 11,597.1 | 439,067 |
| Barcelona | 7,731.4 | 762,555 | Navarre | 10,478.0 | 318,687 |
| Biscay | 2,197.9 | 187,926 | Orense | 7,092.8 | 402,796 |
| Burgos | 14,635.1 | 353,560 | Oviedo | 10,595.8 | 610,883 |
| Caceres | 20,754.5 | 302,455 | Palencia | 8,097.2 | 184,668 |
| Cadiz | 7,275.7 | 426,499 | Pontevedra | 4,504.3 | 480,145 |
| Castellon | 6,336.4 | 296,222 | Salamanca | 12,793.7 | 280,870 |
| Ciudad-Real | 20,305.0 | 264,649 | Santander | 5,471.5 | 241,581 |
| Cordova | 13,441.6 | 382,652 | Saragossa | 17,112.0 | 401,894 |
| Corunna | 7,973.2 | 630,504 | Segovia | 7,027.7 | 150,812 |
| Cuença | 17,418.9 | 242,231 | Seville | 13,714.4 | 515,011 |
| Gerona | 5,883.9 | 325,110 | Soria | 9,935.5 | 158,699 |
| Granada | 12,787.5 | 485,346 | Tarragona | 6,348.8 | 350,395 |
| Guadalajara | 12,610.8 | 208,638 | Teruel | 14,229.0 | 252,201 |
| Guipuzcoa | 1,884.8 | 180,743 | Toledo | 14,467.7 | 342,272 |
| Huelva | 10,676.4 | 196,469 | Valencia | 11,271.6 | 665,141 |
| Huesca | 15,224.1 | 274,623 | Valladolid | 7,880.2 | 242,384 |
| Jaen | 13,426.1 | 392,100 | Zamora | 10,710.5 | 250,968 |
| Leon | 15,971.2 | 350,092 | | | |

The old division, however, is much more characteristic both for the land and the people. It comprised (1) the kingdom of New Castile, with the capital, Madrid; pop. 332,024 in 1870; the Escurial palace built by Philip II., and containing the tombs of the kings; Aranjuez on the Tajo, the royal residence during spring; and the towns of Cuença on the Jucar, and Valdepenas and Manzanares on the Andalusian road. (2) The territory of Estremadura, with the fortress of Badajoz and the towns of Merida and Caceres. (3) The kingdom of Leon, the oldest part of the Spanish monarchy, whose inhabitants call themselves *christianos viejos*, with the University of Salamanca, the former fortress of Zamora, and the town of Leon, the capital of Don Pelayo, who began the 700 years' war with the Arabs. (4) The kingdom of Galicia, with the towns of Orense on the Minho, Vigo, La Corunna (pop. 30,132), Ferrol, and the celebrated place of pilgrimage, Santiago de Compostela. (5) The principality of Asturias, the cradle of the Spanish monarchy; here Don Pelayo found refuge in the rock-cave, now an abbey, of Covadonga, and since that time the crown-prince of Spain bears the title of prince of Asturias. Towns, Oviedo and Gijon. (6) The kingdom of Old Castile, with the towns of Santander (pop. 30,202), Reynosa, Palencia; Valladolid (pop. 43,361), built by Philip II., with a university and a harbor on the Castilian Canal; Simancas on the Pisuerga, with the state archives; Avila; Segovia, from the Roman period; San Ildefonso, palace and park; Soria, the centre of the Castilian sheep-breeding; Burgos (pop. 26,000), with a great cathedral and very strong fortifications; Logroño. (7) The Basque provinces, Alava, with the town and fortress of Vittoria; Biscay, with the port of Bilbao; Guipuzcoa, with the town of San Sebastian and the former frontier fortress Fuentarabia on the Bidassoa. (8) The kingdom of Navarre, with the fortress of Pamplona and the town of Tudela on the Ebro. (9) The kingdom of Aragon, with Huesca (pop. 40,000), Saragossa (pop. 67,428), a fortress with a university, and the town of Teruel. (10) The principality of Catalonia, with Lerida, Gerona, Figueras, Barcelona (pop. 189,948), a military and commercial place of first rank, with a university; Tarragona, Reus, and Tor-

tosa. (11) The kingdom of Murcia, with Murcia (pop. 87,803), and Cartagena (pop. 54,315). (12) The territory of Andalusia, composed of the four ancient Moorish kingdoms of Jaen, Granada, Cordova, and Seville, with Almera, Granada (pop. 67,326), containing a university and the palace of the Alhambra; Malaga (pop. 94,732), the second port of the country; Cadiz (pop. 71,521); Xerez de la Frontera (pop. 52,158), Cordova (pop. 41,963), and Seville (pop. 118,298), a fortress, with a university and considerable trade.

The sources of wealth which the country contains are very rich, but generally either undeveloped or abandoned. No other country of Europe is so rich as Spain in metals and useful minerals. Among the rocks which compose the crust, the plutonic and primary sedimentary rocks play a conspicuous part; two-thirds of the south-western part of the peninsula consist of granite, gneiss, and other crystalline rocks, clay-slate and graywacke. In the north-eastern part the more recent formations predominate—the members of the Chalk, Jurassic, and Triassic period. Immense coal-deposits are found, capable not only of supplying the demands of the country, but also of yielding a considerable surplus for exportation if properly worked. Coal-formations are most extensive in Asturias, Leon, and Old Castile, but large coal-seams are also found at Belmez, Fuente-Ovejuna, and Cazalla in the central Sierra Morena, at Villanueva del Rio on the Guadalquivir, and at San Juan de las Abadesas in Catalonia. The Tertiary and Diluvial deposits have an immense extension, covering the largest part of the central plateau and the wide basins of the Ebro, the Guadalquivir, the middle course of the Guadiana, and the lower Tajo. They are rich in salt. Various kinds of porphyry and trachyte are very frequent, especially in the south-western part. From this composition of the crust the wealth of the ground in metals, ores, etc., may be surmised. The cinnabar-veins of Almaden and Almadeneijos, which formerly produced the larger part of all the quicksilver consumed, are celebrated. Veins and whole masses of lead and iron ore are numerous, found partly in the granite, partly in the crystalline and Silurian slates. The copper-mines of Rio Tinto and the silver-veins of the Sierra Almagrera and Hiendelaencina are famous. Tin, zinc, antimony, nickel, cobalt, and graphite abound; salt is inexhaustible; natron, saltpetre, alum, sulphur, asphaltum, and petroleum occur; at Logrosan in Estremadura is an entire mountain of phosphorite. Gold is found in many rivers; precious stones, such as diamonds, rubies, garnets, turquoises, topazes, amethysts, etc., occur in several places; splendid marbles of various colors, jasper, and alabaster; excellent building-stone and chalk abound. The working of the mines and the production of metals are mostly in the hands of foreigners, especially Englishmen, and carried on with foreign capital. In 1874 metals were exported to the value of 252,000,000 reals, and other useful minerals to the value of 165,360,000 reals; and the consumption seems to be increasing of late years.

The fertility of the soil is generally very great, and agriculture is the principal occupation. Nevertheless, in 1875 only 60.6 per cent. of the soil was arable; the rest lay waste; 26–27 per cent. was under tillage, 2–3 in vineyards, 14 in pasturage, and 16.3 in forest. The annual average production of grain in Spain is 90,000,000 hectolitres. Of the cereals, wheat is most generally cultivated; rye principally in the N., rice in Valencia, barley and maize in most parts of the country. The grain production of Spain has increased very much in this century; in 1805 it was insufficient to supply the home demand, while in 1874 grain and flour were exported to the value of 128,344,000 reals. Among the leguminous and fodder-plants, the *Cicer arietinum* and beans are most important, and exported in considerable quantities. Vegetables and other garden-plants are more largely cultivated here than in any other country of Europe. Orchards are numerous and extensive. The olive, orange, fig, and other fruit trees are cultivated with great success. In 1874 the value of the exportation of oil amounted to 74,320,000 reals, of dried fruit to 132,912,000, of fresh fruit to 35,200,000. In the same year the value of the exportation of wine amounted to 561,204,000 reals. Cattle-breeding is an occupation of great importance. In 1865, Spain possessed 680,473 horses, among which were some excellent breeds; horse-breeding, however, is declining, giving room for the breeding of mules and asses, which is highly developed. In the same year the country possessed 2,967,303 horned cattle, 22,468,969 sheep, and 4,531,228 goats. The various breeds of sheep are celebrated, and in goats Spain is richer than any other country of Europe, the herds roaming over immense tracts of land which could be cultivated, but which have lain waste since the expulsion of the Moors. Arboriculture is neglected, and the forests are much impaired; the country is nevertheless still very rich in timber. A peculiar item of exportation is cork, the value of which amounted to 43,023,000 reals in 1874. In general, however, the last Carlist war has injured the productiveness of the country very much, which is evident from a comparison between the exportation of 1874 and that of 1873. In the latter year the value of the exportation of oil amounted to 208,512,000 reals, of cork to 132,800,000, of fruits to 209,260,000, of grain and flour to 386,650,000, and of wine to 736,332,000.

Manufacturing industry is by no means so important as it ought to be in order to correspond to the immense natural resources of the country; in general, however, it is increasing, although in this respect, too, the late Carlist war has done great harm. Paper manufacturing, the spinning and weaving of cotton, the manufacture of leather and metal ware, especially iron goods, are the most prominent branches of Spanish industry, and are principally carried on in the provinces of Gerona, Barcelona, Tarragona, Guipuzcoa, and Vizcaya. The cigar and tobacco manufacture is a government monopoly; other trade limitations were abolished long ago. On account of its geographical position, Spain ought to have an immense commerce, and in the sixteenth and seventeenth centuries she was, indeed, the queen of the sea; but in the eighteenth century her commerce dwindled into insignificance, and a revival was not noticeable until after the end of the first Carlist war, in 1839. The following table shows the commercial movements between 1850 and 1865, computed in reals:

| | Importation. | Exportation. |
|---|---|---|
| 1850 | 671,993,140 | 488,666,682 |
| 1855 | 1,020,331,984 | 1,247,370,998 |
| 1860 | 1,483,313,498 | 1,098,203,445 |
| 1865 | 1,362,000,000 | 1,142,000,000 |

From 1866–70 the average annual value of exportations amounted to 309,700,000 pesetas (a peseta being equal to four reals), and that of importations to 453,200,000 pesetas; in 1871 it arose respectively to 442,400,000 and 569,000,000 pesetas, divided among the various countries in the following manner, reckoned in millions of pesetas:

| | Importations from— | Exportations to— |
|---|---|---|
| England | 206.5 | 177.4 |
| France | 129.2 | 78.3 |
| Portugal | 15.1 | 20.9 |
| Belgium | 10.5 | 2.8 |
| Sweden and Norway | 17.2 | 2.2 |
| Italy | 8.2 | 2.2 |
| Turkey | 7.9 | 1.4 |
| Russia | 4.3 | 3.8 |
| Germany | 2.4 | 6.7 |
| Denmark | 1.4 | 2.0 |
| Rest of Europe | 6.8 | 3.7 |
| Cuba and Porto Rico | 43.5 | 73.5 |
| United States | 66.1 | 23.5 |
| Argentine Republic | 3.2 | 12.4 |
| Brazil | 8.5 | 5.2 |
| Venezuela | 8.4 | 1.3 |
| Uruguay | .6 | 5.8 |
| British colonies | 4.8 | 1.7 |
| Other countries | 12.4 | 3.8 |

The relation between the various items of importation and exportation, reckoned in millions of pesetas, may be seen from the following table: the figures given for 1873 and 1874 do not comprise the territories occupied by the Carlists:

| | Importation. | | | Exportation. | | |
|---|---|---|---|---|---|---|
| | 1871. | 1873. | 1874. | 1871. | 1873. | 1874. |
| Cereals | 19.6 | .4 | 6.4 | 27.0 | 102.4 | 38.7 |
| Fermented liquors | 6.8 | 8.9 | 11.5 | 141.2 | 192.3 | 141.4 |
| Colonial produce | 41.6 | 45.0 | 41.4 | 7.6 | 8.4 | 4.9 |
| Tobacco | 16.8 | ? | ? | | | |
| Seeds and fruits | ... | ... | ... | 51.4 | 55.9 | 45.8 |
| Animal products and living animals | 20.3 | 18.7 | 21.3 | 18.4 | 9.3 | 6.4 |
| Coal | 17.6 | 14.6 | 17.6 | | | |
| Minerals | ... | ... | ... | 30.6 | 34.3 | 43.7 |
| Raw metal | 3.4 | 3.4 | 5.5 | 53.5 | 46.0 | 62.8 |
| Hides and leather | 13.8 | 14.5 | 21.6 | 4.0 | ? | ? |
| Textile fibres | 90.2 | 75.2 | 104.5 | 14.3 | 8.9 | 5.6 |
| Hemp | ... | ... | ... | 7.9 | 6.1 | 10.6 |
| Wood | 14.4 | 14.9 | 23.5 | .5 | .8 | .8 |
| Glass | 1.4 | 1.2 | 1.3 | | | |
| Metal ware | 12.0 | 12.1 | 18.2 | 1.4 | .5 | .2 |
| Machines | 36.2 | 30.8 | 18.7 | | | |
| Shoes | ... | ... | ... | 5.0 | ? | ? |
| Thread and network | 37.2 | 24.7 | 29.3 | | | |
| Woven fabrics and cordage | 38.4 | 19.3 | 23.0 | .9 | | |
| Furniture | 1.8 | 1.4 | 1.4 | | | |
| Cork | ... | ... | ... | 15.0 | 32.1 | 8.2 |
| Paper and playing-cards | 1.8 | 1.8 | 3.6 | 3.6 | 2.9 | 2.4 |
| Drugs, dyestuffs, and chemicals | 9.5 | 16.2 | 17.7 | | | |
| Salt | ... | ... | ... | 8.2 | 8.6 | 9.9 |
| Oils, fats, gums | 11.0 | 10.8 | 15.5 | 16.6 | 55.6 | 21.5 |
| Various | 175.6 | ? | ? | 34.9 | ? | ? |
| Total | 569.0 | 313.8 | 382.0 | 442.2 | 564.2 | 403.0 |

A reform of the tariff, consisting principally in the abolishment of prohibitory or protective duties, was introduced by a law of July 12, 1869, and has proved very beneficial to commerce. The importations amounted in the period from 1865–68 to 8032 millions of reals, and in the period, 1870–73, to 8032 millions, showing an increase of 1198

millions. The exportations amounted in the first period to 4815 millions, in the second to 7493 millions, showing an increase of 2678 millions. The importation of coal comprised in the first period 1,342,333 metrical tons, in the second 1,876,145, showing an increase of 533,812 tons. The increase in the exportation of raw materials during the same period amounted—in steel to 50 per cent., in pig iron to 18 per cent., in cotton to 53 per cent. of the former consumption. The commercial fleet which during the first period consisted of 4362 sailing vessels and 152 steamers, with an aggregate tonnage of 390,700, increased during the period from 1870–74 in tonnage to 551,412; the number of steamers increased to 296, while that of sailing vessels decreased to 3540. The river navigation is much neglected. The Ebro is the only river which can be called navigable; it is accessible to flat-bottomed vessels as far as Saragossa. The Guadalquivir, Guadiana, and Minho can be navigated only near their mouths. Of the navigable canals, the Imperial Canal of Aragon, commenced by Charles V., and the Castilian Canal, are the most remarkable; the Manzanares and San Carlos canals are very little used; 5444 kilomètres of railway were in operation on Jan. 1, 1875. In 1871 the number of post-offices was 2347, of letters, 78,174,400; the length of telegraph lines was 11,754 kilomètres; the number of stations 193, of despatches, 9,916,912, of which 73,357 were received from foreign countries.

The general standard of mental culture is lower in Spain than in any other European country. Although there exist old and celebrated universities and schools, and although a systematic organization of public education and instruction, after the model of foreign countries, was adopted in the eighteenth century, the influence of the clergy has proved stronger than the instinct of progress. The system of public education consists of the *enseñanza superior*, comprising the universities of Barcelona, Granada, Madrid, Oviedo, Salamanca, Santiago, Seville, Valencia, Valladolid, and Saragossa; and the *segunda enseñanza*, comprising the so-called *institutos*, partly *locales*, partly *provinciales*, which latter fall into ten groups, corresponding to the ten universities, and containing each group from three to five schools. In these *institutos* geography, history, mathematics, natural science, and foreign languages are taught, and scientific collections are founded. The *primera enseñanza* was established by law of Sept. 9, 1857, but soon abolished; it was re-established by the revolution of Oct. 14, 1868, but much modified by decree of July 29, 1874. The revolution introduced liberty of teaching, both with respect to method and matter of instruction, but the decree of Feb. 28, 1875, revoked this liberty with respect to the universities and all schools supported by the state, and it hinted at a revocation also with respect to private schools. The primary education is not obligatory. The special schools of agriculture, commerce, art, etc., stand low, and the libraries founded at the universities and the episcopal sees, although in some respects rich and interesting, consist mostly of theological works, and contain very little serviceable to progress and development. The revolution of 1868 made literature and the press free, but many restraining and prohibitory ordinances afterward appeared, and they are applied with great arbitrariness. Some good works on geography and natural science have, however, lately been published, but any great influence from literature and the press cannot be expected, as seven-eighths of the Spanish people are unable to read. Sanitary affairs are not so well regulated as in other European countries. Each province has a sanitary board which is under the sanitary council in Madrid. The large ports have their special sanitary boards. The benevolent institutions are truly grand, as might be expected from the generosity and nobleness of the Spanish character; they have, however, one great drawback: they encourage beggary and idleness. The Spanish beggar is not ashamed to ply his trade; on the contrary, he expects that the rich will compensate with their gifts for the inequality of fortune. About 500,000 paupers are taken care of in the public almshouses, and yet the streets and roads swarm with beggars. There are 7 general, 350 provincial, and about 700 municipal hospitals. The houses of punishment and correction consist of *presidios* for male and *casas de correccion* for female criminals. The treatment in these houses is more humane than in other European countries; the galleys have ceased to exist.

The government is a constitutional monarchy. The constitution dates from June 6, 1869, and places the legislative power in the hands of the Cortes, consisting of a congress elected for three years, and a senate elected for twelve. The principal points of the constitution are—responsibility of the ministers, consent of the Cortes to the budget, foreign alliances and treaties, personal freedom, universal suffrage, the liberty of the press, right of assembly, association, and petition, freedom of exercise of worship for all denominations, etc. But the people understand very imperfectly how to make use of their constitution, and since 1869 the government has cut off some of the most important parts of the constitution without making any great impression on the people. The municipal constitution dates from 1845; each community numbering at least 30 members has its own municipal council, presided over by an alcalde. The administration is carried on by the king and a responsible cabinet comprising the departments of war, foreign affairs, justice, navy, finances, interior, agriculture and commerce, and the colonies. Public instruction and the institute of geography and statistics belong to the ministry of agriculture and commerce.

*Finances.*—The debt of Spain amounted to 40,481,110,882 reals, with an interest of 1,023,122,804, on June 30, 1874, to which on Oct. 1, 1875, a floating debt of 519,000,000 pesetas was added. But on Dec. 31, 1871, the debt amounted only to 29,734,586,152 reals, with an interest of 810,211,213. The budget of the financial year 1874–75 showed the following figures, reckoning in pesetas: *Receipts*—(1) Direct taxes, 151,184,565, among which was the land-tax, 100,768,781. (2) Indirect taxes, 110,826,986, among which were customs duties, 66,892,821; excise, 29,871,685. (3) Stamp-tax and monopolies, 132,710,872, among which tobacco paid 62,865,571, lotteries, 41,145,107. (4) Domains, 57,912,771. (5) Surplus from the Philippines, 2,962,902. (6) War indemnity from Morocco, 1,756,275. (7) Arrears, 23,819,580. (8) Liberation from military service, 63,620,800. (9) Funds from 1873–74, 64,746,390. Total, 609,541,141 pesetas. *Expenses.*—Royal appanage (five months), 2,996,667; presidency of the executive (seven months), 327,592; legislation, 796,704; public debt, 48,898,851; justice, 1,032,920; pensions, 31,503,049; presidency of the cabinet council, 818,318; ministry of state, 3,066,518; ministry of justice and civil administration, 8,059,496; church administration, 14,188,775; ministry of war, 245,731,957; of the navy, 32,811,776; of the interior, 19,291,575; of agriculture and commerce, 36,267,343; of finances, 64,744,401; arrears from 1873–74, 94,589,626. Total, 605,125,569.

The army has undergone numerous changes with respect to its organization during late years. A law of Sept. 27, 1872, made military service a universal duty, and fixed the term to three years in the army and four in the reserve, but on Feb. 17, 1873, this law was abolished, and it was determined to form the army of volunteers. In 1875 the army consisted of 40 regiments of infantry, 20 regiments of cavalry, 4 regiments of foot artillery, 5 regiments of field artillery (mounted), 3 regiments of mountain artillery, and 3 regiments of engineers. The number of soldiers was 91,400 in peace and 216,000 in war. In Cuba were stationed 23 battalions of infantry and 2 regiments of militia (colored), 3 regiments of mounted chasseurs, 1 foot, 1 field, and 1 mountain artillery regiment, and 4 regiments of militia cavalry; in Porto Rico, 4 regiments of infantry, 7 regiments of militia, and 2 squadrons of cavalry; in the Philippines, 7 regiments of infantry. The fleet contained—vessels of the first class, 6 iron-clads, with 105 guns and 3900 horse-power; 10 screw frigates, with 413 guns and 5380 horse-power; 2 wheel-steamers, with 32 guns and 1000 horse-power; of vessels of the second class, 10 wheel-steamers, with 48 guns and 3130 horse-power; 10 screw-steamers, with 47 guns and 1920 horse-power; 2 transport-vessels of 600 horse-power; of vessels of the third class, 16 screw-steamers, with 39 guns and 1660 horse-power; 35 gunboats, with 35 guns and 1400 horse-power; 7 wheel-steamers, with 13 guns and 867 horse-power; 4 screw-steamers, with 530 horse-power; besides 2 steamers, with 4 guns and 310 horse-power, and 19 *fuerzas sutt'les*, with 19 guns and 464 horse-power; total, 113 steamers, with 755 guns and 21,161 horse-power; 20 admirals, 378 officers, 25 cadets, 14,000 marines, and 550 marine infantry.

The colonies of Spain formed in the fifteenth and sixteenth centuries a vast possession, the greater part of which, however, has been lost by bad policy. All European states have endeavored to hold their colonies not through interest, but by force, and have sought to make them as profitable as possible. But Spain has sinned worst in this respect; only under Charles III. were the colonies properly treated. It still holds Cuba, area 118,833 q. k., pop. 1,400,000; Porto Rico, area 9334 q. k., pop. 625,000; the Philippines, area 170,600 q. k., pop. about 6,000,000; the Carolines, area 1384 q. k., pop. 18,800; the Palaos, area 897 q. k., pop. about 10,000; the Marianes, area, 1079 q. k., pop. 5610; Guinea, area 2204 q. k., pop. 35,000; total area 304,311 q. k., pop. 8,094,410. The most important colony is Cuba. In 1873 it exported 714,960 tons of sugar and 189,333 tons of molasses; in 1874, 644,109 tons of sugar and 175,228 tons of molasses. In 1873, Havana exported 1412 tierces (80 gallons each) of honey, 19,574 barrels (125 gallons) of rum, 11,554 arrobas (25 pounds) of wax, 13,387,652 pounds of tobacco, and 224,765,000 cigars; 2104 vessels, of 921,632

tons burden, visited its harbor—944 North American, 731 Spanish, 306 English.

*History.*—The peninsula, so favorably situated for commerce, was inhabited by Celtic and Iberian tribes when in olden times the shrewd and versatile Phœnicians reached it and founded colonies along its coasts. They were followed by the Greeks, and then by the Carthaginians. The latter made the country the principal support of their empire and the basis of their wars with Rome. But the Romans attacked Carthage in Hispania; Hannibal and Publius Cornelius Scipio became the leading names of an important historical epoch; and finally the Romans succeeded in driving their adversaries out of the country in the second century before Christ. At the beginning of our era the peninsula was a Roman province, and one of the most flourishing of the whole empire. The emperors Trajan, Hadrian, Antoninus, Marcus Aurelius, and Theodosius, and the authors Seneca, Lucanus, Martial, Flavius, and Quintilian were born here. Christianity was early introduced. The northern races which finally overthrew the decaying Roman empire invaded also the Peninsula, and caused a thorough revolution in its affairs. First, the Vandals and Sueves conquered the country in the beginning of the fifth century, and confined the Roman dominion to the eastern part. Then, toward the end of the century, the Visigoths, who originally were allies of the Romans, expelled both the Romans and the Germanic tribes, and made themselves masters of the whole country; Toledo was the residence of their kings. The Visigoths, like the Sueves, were Arians, and their religious confession involved them in a war with the orthodox Franks, who considered them heretics. The war for the independence of the state was also a religious war, and this circumstance laid the first foundation of the subsequent power of the clergy. The Visigothic king, Recared, was converted to the Latin orthodox creed in 588, and his successors continued true to their orthodoxy, but the prestige which the Arian clergy had enjoyed was now simply conferred on the orthodox clergy, and in the seventh century the ecclesiastical synods became parliaments, the bishops the chief judicial authorities. In 711 the Arabs invaded the Peninsula from Africa, defeated the Visigoths under King Roderick at Xeres de la Frontera, and conquered the country in three years, with the exception of the northern mountain-regions. In this impracticable terrain, where in recent times the Carlist army formed its strongholds, the Visigoths took a stand, and from hence they commenced the reconquest of the lost country: Don Pelayo was their hero. The Arabs made Spain a province of the caliphate of Bagdad, and crossed the Pyrenees in order to conquer France; but here they were defeated at Poitiers in 732 by Charles Martel. In Spain the Christians still held Asturias, Biscay, Aragon, Navarre, and Galicia, but the rest of the country became a Mohammedan dominion, and Cordova was made the capital of a separate caliphate, founded in 756 by Abderrahman, the last of the Ommyiade dynasty. The war between the Spanish Christians and the Arab Mohammedans lasted for 800 years. It was a war at once for fatherland and for religion. The Arabs founded a flourishing empire, which became the starting-point for all Europe of the arts and sciences. Their schools were frequented by Christians, and they treated the Jews and Christians who lived under their dominion with generosity. On the other hand, the Christians, led by their priests, shut up among wild and arid mountains, deprived of all the luxuries of civilization, poor and ignorant, waged the war with an ineradicable fanaticism. In the middle of the ninth century they reached the line of the Duero; toward the end of the eleventh century, that of the Tajo; in 1085 they reconquered their old capital, Toledo; the Cid was the hero of that century. At the beginning of the twelfth century the Christians occupied one-half of the country—Leon, Castile, Aragon, and Navarre, each of which formed an independent kingdom. Soon, however, Castile and Aragon assumed a prominent position, increasing both by uniting other Christian countries and by conquering Mohammedan territories. Castile acquired Leon in the beginning of the thirteenth century, and conquered Murcia, Estremadura, Cordova, Seville, and Cadiz. Aragon acquired Catalonia and Valencia, and conquered the Balearic Isles, Sardinia, Sicily, and even Naples. At last a union of the two kingdoms took place in 1469 by the marriage between Ferdinand V. the Catholic, king of Aragon (1479–1516), and Isabella, queen of Castile, though each of them continued to rule independently in their respective kingdoms. Meanwhile, the war was carried on with success against the Arabs. After their defeat at Tolosa, in the Sierra Morena, in 1212, they had only Cordova and Granada left, and in 1492 they lost their last possession, Granada, to Ferdinand and Isabella, and became a subjugated race, whose complete extirpation was effected by degrees. The government of Ferdinand and Isabella corresponded with the traditions of their respective houses. Led by their shrewd minister, Cardinal Ximenes, they thought to strengthen the royal power by making the Church the foundation of the throne. They supported the Hermandad and the Inquisition, and they endeavored to curb the nobility. They became grand masters of the three knightly orders instituted at the end of the eleventh century—Alcantara, Santiago de Compostela, and Calatrava—and centralized the judicial authority in the crown. That they, nevertheless, were only tools in the hands of the clergy is apparent from the exclusively religious tendency of their policy; immediately after the conquest of Granada, they began to convert and expel the Moors and the Jews. This policy, which was pursued also by the great successors of Ferdinand and Isabella, made Spain mighty, but only for a moment; then it ruined her. A marked invigoration of the state was the first and immediate consequence of the intimate coalition between kingdom and priesthood. The whole people clung with reverence and enthusiasm to these leaders of its destinies, and in their hands religion became a powerful instrument for the subjugation of other peoples and the propagation of the Roman Catholic Church. But as all scientific research was cut off and all independence of character weighed down, the sources of vitality soon became dried up in the people, and it succumbed the moment weak kings happened to be placed at its head. Even the discovery of America, which added so great a splendor to the name of Spain, so vast an extension to her dominion, such immense treasures of precious metals to her wealth, contributed finally to enfeeble the country through the same false policy. It is true that a similar policy, subservient to the purposes of the Church, was followed generally throughout Europe at that time, and Cardinal Richelieu was really the first statesman who entered on another course; but the theological tendency was much more strongly marked and retained for a much longer time in Spain than in any other country. All the children of Ferdinand and Isabella died early, with the exception of one daughter, Joanna, who married the archduke Philip, a son of Maximilian I., emperor of Germany, and succeeded her mother on the throne of Castile in 1504. Philip died young, and Joanna became insane. The states of Castile then appointed King Ferdinand, Joanna's father, guardian of his grandson Charles, who was declared heir of Aragon and Castile; and he governed both kingdoms till 1516; at his death he appointed his minister, Cardinal Ximenes, regent during the minority of King Charles. The young king, who was born in 1500, assumed the reins himself in 1517, and united to Spain the Netherlands and Franche-Comté, which he had inherited from his father, Philip. At the death of his grandfather Maximilian in 1519, he was also elected emperor of Germany. During his long reign of forty years Spain reached the culmination of its prosperity. Vast conquests were made in America, and in Europe the Spanish armies defeated France, the Protestant princes of Germany, and the Turks. But liberty of any description was not tolerated. An insurrection in Castile, headed by Juan de Padilla, was suppressed with great bloodshed; the Spanish cities were stripped of their old rights; heretics were vehemently persecuted; in the Netherlands alone 100,000 persons lost their lives on account of their creed. In 1556, Philip II. succeeded his father as king of Spain, but the decline of the mighty empire had already begun. Philip wished to rule over all Europe in order to propagate the true faith everywhere; and it was a saying of his that it was better not to rule at all than to rule over heretics. On this point he possessed the full sympathy of the Spanish people, and he actually succeeded in extirpating heresy in Spain, though outside of Spain he suffered several severe defeats. He united Portugal to Spain, but only for a short time; in 1581 he lost the Netherlands, and his contest with England and the Barbary states was unfortunate. From the Spanish possessions in America, which under Philip II. comprised Mexico, Central America, Venezuela, New Granada, Peru, Chili, and the islands of Cuba, Santo Domingo, Jamaica, and others, immense riches flowed into the country. But they were no blessing; they seduced the people into neglect of productive labor. To the ambitious no other career was open than the ecclesiastical or the military. All the great Spanish poets and authors—Cervantes, Calderon, Lope de Vega, Moreto, Montalvan, Sandoval, Argote de Molino, Acuña, Boscan, Hurtado de Mendoza, Pulgar, Solis, Tarega, Miñana, and others—were either priests or soldiers, often both. The literature of that time is pervaded by a glowing enthusiasm for religion and an unconditional reverence for the king. In 1599, Philip II. died, and this sombre, despotic, but energetic man was succeeded by Philip III., a weak and unsettled character. Under him the decline of the kingdom became singularly rapid. The minister, Count Lerma, was the actual ruler, and he en-

tered into a close alliance with the Church in order to secure his own position. The greatest error committed by his government was the cruel expulsion of the Moriscoes in 1609. The measure originated with the clergy. The archbishop of Valencia, Juan de Ribera, the archbishop of Toledo, Bernardo de Roias y Sandoval, and the Dominican monk, Bleda, demanded that all the Moriscoes should be killed. The government contented itself with their expulsion, by which, however, several hundred thousand lost their lives. More than 1,000,000 of the most industrious inhabitants were thus lost to the country, and the sad consequences soon became apparent. The cultivation of rice, cotton, and sugar, the manufacture of silk and paper, were almost entirely in the hands of the Moriscoes, and these branches of industry were thus almost completely destroyed. Large tracts of land became waste, and have remained so since, the lurking-places of gangs of robbers. All scientific research became, of course, stifled in such an atmosphere of fanaticism. But the clergy grew luxuriantly; they actually suppressed the other estates. When Philip III. died, there were 9000 monasteries in Spain, besides nunneries; the Dominican and Franciscan orders alone numbered more than 30,000 members; in the diocese of Seville there were 14,000 chaplains, 18,000 in that of Calahorra; and so all the country through. Laymen were daily plundered in order to enrich clergymen. In 1621, Philip IV. ascended the throne, but he too was incapable. He was entirely under the control of the clergy and his minister, the duke of Olivarez, and the country sank deeper and deeper. Insurrection broke out in Catalonia, Andalusia, and Naples, and long civil wars ensued. Portugal separated from Spain in 1640; by the Peace of Münster (1648) Philip was compelled to acknowledge the independence of the Netherlands, and by the Peace of the Pyrenees (1659) to cede Spanish territory to France; buccaneers deprived Spain of some of her American colonies, Dutchmen and Englishmen of others. His son, Charles II. (1668–1700), was still more miserable, ruined both bodily and mentally. He lost Franche-Comté to France and brought the finances into utter confusion. The decay of the country was nearly complete. From 1668 to 1700 its population decreased from 11,000,000 to 8,000,000; in many cities two-thirds of the houses lay in ruins and whole villages stood deserted. The population of Madrid decreased from 400,000 to 200,000 during this century, and under the reign of Charles II. it was exposed to a severe famine. The army, once so celebrated, was now worth nothing; it had neither able leaders nor reliable soldiers; the arsenals and magazines were empty; the fleets rotted in the docks; the art of building ships was forgotten; of sea-charts there were none, and the Spanish pilots were notorious for their ignorance. The poverty was so great that even the royal servants could not be paid, and sometimes they had nothing to eat. In 1693 the payment of all pensions was suspended, and one-third was deducted from the salaries of all officials, even from those of the ministers of the crown. A change for the better took place when at the death of Charles II., the last king of the house of Hapsburg, the Bourbon dynasty ascended the throne of Spain and opened the way into the country for French intelligence. Charles, who was childless, appointed Philip of Anjou, the grandson of Louis XIV., his successor, and he succeeded him as Philip IV. Louis XIV. said to him, when he left Versailles, that he was never to forget that he was a Frenchman; and, indeed, he remembered it so well that he gave all state affairs into the hands of Frenchmen, disregarded any advice which came from the Spanish side, and received his policy drawn up for him at Versailles. Foreigners now decided all the most important affairs of the country, and although this was certainly very humiliating to Spain, it was nevertheless to her advantage. A few months after the accession of Philip (Apr. 14, 1701), the French financier Orry was called to Spain to bring order out of the confusion of her finances; he also took charge of the ministry of war, and the leadership of the Spanish army was confided to foreigners throughout the whole Succession war, which broke out at the same time. This war was waged by Austria, England, and Holland for the purpose of placing the Austrian archduke Charles on the Spanish throne instead of Philip; the real aim, however, was to check the power of France, and Louis XIV. was compelled to take up the contest. The allied French-Spanish army was repeatedly defeated in 1701 and 1702. In the latter year the king himself took the command in Italy, with the duke de Vendôme as chief of his staff, and at Vittoria (July 26) and Luzzara (Aug. 15, 1702) he fought with success, but at the same time Spain was humiliated at sea. The allied Dutch-English fleet attacked the French-Spanish fleet in the Bay of Vigo, defeated and destroyed it, and captured an immense booty of gold and silver. The war lasted till 1713, and was partly carried on in Spain, as Portugal joined the enemy and Catalonia rose in revolt against Philip. The English and Portuguese conquered Barcelona and Valencia, and even entered Madrid, and the English admiral Rook took Gibraltar. At Almansa the Spanish army, led by the duke of Berwick, an Englishman, defeated the invaders Apr. 25, 1707, and the party of Charles succumbed for a time; but the victories of Marlborough and Eugene over the French again opened the way to Madrid for the enemy. Then the duke of Vendôme was appointed commander-in-chief of the Spanish army, and he succeeded in replacing Philip on the Spanish throne, though by the Peace of Utrecht (1713) Spain was compelled to cede Naples, Sardinia, Milan, and its possessions in the Netherlands to Austria, Sicily to Savoy, and Gibraltar to England; thus the Spanish crown could not even keep its native soil intact. Aided by the Italian Alberoni and the Dutch Ripperda, Philip introduced many reforms after the termination of the war, and encouraged commerce, industry, and art; but he deprived the provinces of their old liberties, and only Biscay and Navarre retained theirs. In 1714 he married a second time, and the new queen, Elizabeth of Parma, was a spirited lady who exercised a good influence on the government. Philip d. in 1746. His son and successor, Ferdinand VI., was a weak-minded person, and could not carry out the reforms begun; on the contrary, many old abuses were revived. He d. in 1759, and was succeeded by his brother, Charles III. With him began an era of progress. The most important men of his government were—Wall, an Irishman, born in France; Grimaldi, a Genoese; and Esquilache, a Sicilian. It was the aim of these truly enlightened men to check the influence of the Church, and especially of the Inquisition; and during the whole reign of Charles III. the Inquisition succeeded in burning only three persons. In 1767 the Jesuits were expelled. Much was done to encourage agriculture, commerce, and industry; foreigners were invited to Spain, and whole colonies were planted in the Sierra Morena; peace was concluded with the African robber-states, and thus a perpetual waste of money and men was stopped, while the Spanish commerce on the Mediterranean rose immensely. However beneficial were the reforms of Charles III., they were, nevertheless, disapproved by the people, and after his death everything retrograded. He had raised Spain from a power of the third to a power of the first rank, but under his son and successor it sank down and became a vassal of France; the reforms did not endure, for they had not sprung from the people. When Charles IV. ascended the throne in 1788, he dismissed his father's councillors, among whom were Aranda and Florida Blanca, and gave himself up to the influence of his favorite, Godoy, duke of Alcudia. He took part in the wars against the French republic, but was compelled to cede to France the colony of Hayti by the Peace of Bâle (July 22, 1795). Godoy, who from the negotiations of this treaty received the title of the "Prince of Peace," now concluded at San Ildefonso (Aug. 19, 1796) an offensive and defensive alliance with France, the principal effect of which was that Napoleon became able to use Spanish soldiers and vessels in his wars. By the Peace of Amiens (1802) Spain lost Trinidad, which was ceded to England; in 1805 her fleet was entirely destroyed by the English at Trafalgar; her troops were sent by Napoleon to Tuscany and Denmark. Spanish Louisiana was ceded to France, and large sums of money were delivered over to the French treasury as tribute. At last the division of Portugal was agreed upon by the convention of Fontainebleau (Oct. 27, 1807), and French troops entered Spain. This called forth the crisis. On Mar. 18, 1808, a revolution broke out which placed on the throne, instead of Charles IV., the prince of Asturias, the leader of the opposition to Godoy, under the name of Ferdinand VII. Both he and Charles asked for help from Napoleon, and the two kings were invited to meet the emperor at Bayonne in April. The result of this meeting was that they both abdicated; Charles was ordered to take up his residence at Compiègne, Ferdinand at Valençay, and on June 5, 1808, Napoleon appointed his brother, Joseph Bonaparte, king of Spain. An assembly of Spanish and American deputies was convoked at Madrid, and opened June 15. On July 7 the new constitution, cut after the French fashion, was ready and published, and on July 20, King Joseph entered Madrid. Provoked by these outrages, the Spanish people rose; *juntas* were formed which declared themselves for Ferdinand VII., and organized an armed resistance to the French and their partisans, first in Asturias, and then in all the other provinces. Gen. Dupont with 6000 men was surrounded at Baylen July 20, and compelled to capitulate; Saragossa was successfully defended; and King Joseph fled in haste from Madrid. Then Napoleon himself went to Spain with a strong army, defeated the Spaniards at Medina del Rio Secco, Gamoral, Espinosa, and Tudela, and carried Joseph back to Madrid (Dec. 1,

1808). But the war did not terminate thus; the Spaniards showed an unexpected stubbornness and valor, and the protracted contest with them proved an important agency in the final overthrow of the Napoleonic power. In regular battles, such as those at Corunna (Jan. 16) and at Medellin (May 28, 1809), the French were victorious; but a perpetual guerilla warfare was going on, and in the mean time the English established an army in Portugal under Wellington, and came to the aid of the Spaniards. The war lasted four years. In 1809, Napoleon went away to take the command in the campaign against Austria, and left it to his marshals to carry on the war in Spain. Wellington conquered at Talavera (July 27 and 28, 1809), but was nevertheless compelled to retreat into Portugal; the French subdued Andalusia, and (Feb. 1, 1810) King Joseph entered Seville, the seat of the central *junta*, which now removed to Cadiz. The siege of Cadiz and Marshal Massena's campaign against Wellington remained without effect; but the French took Valencia. Meanwhile, the central junta deposited its authority in the hands of a regency, which convoked the Cortes to Cadiz for the purpose of forming a new constitution. This constitution was finished Mar. 18, 1812. Soon after (July 22), Wellington defeated Marshal Marmont at Salamanca, and King Joseph fled from Madrid Aug. 11. Once more, however, the French were victorious, and drove Wellington back into Portugal, but the disaster of Napoleon in Russia completely changed the situation. One part of the French army, under Marshal Soult, was recalled, and the rest, under King Joseph, was defeated at Vittoria by Wellington June 11, 1813, and returned to France, across the Pyrenees. Marshal Soult was again sent to Spain, and the contest was continued for several months in the Pyrenees, but the advantage was on the side of the Spaniards and Englishmen, and in Nov., 1813, the French were completely expelled from Spain, while Wellington invaded France. Napoleon now gave up Spain by the Treaty of Valençay (Dec. 11, 1813); Ferdinand VII. was restored to liberty, and invited by the Cortes to take possession of the Spanish throne. He came, but he began his government by overthrowing the liberal constitution of 1812 and persecuting the men who had helped him to the throne; but this infamous conduct was approved by the large mass of the people, who still lived in the darkness of the Middle Ages, and by no means shared the liberal views of their former leaders. Thousands of the best men were driven into exile; the Inquisition was restored, and the most miserable priestcraft, in connection with court intrigues, ruled the country. By the treaty of Feb. 22, 1819, the two Floridas were sold to the U.S. for $5,000,000, while, on the other hand, very expensive but utterly ineffective armaments were sent against the revolting colonies. This last measure called forth a military insurrection. On Jan. 1, 1820, four battalions under Lieut.-Col. Riego proclaimed the constitution of 1812; very soon an insurrectionary army of 10,000 men was formed, and the movement grew so rapidly that Ferdinand became frightened, conceded all demands, and made oath on the constitution Mar. 9, 1820. On July 9 the first general Cortes assembled. But the liberal innovations which Ferdinand now introduced, though against his will—amnesty, the abolition of the Inquisition, the taxation of the clergy, etc.—roused that part of the people which was wholly under the influence of the priests, and an "apostolic junta" was formed with the purpose of re-establishing the absolute monarchy with all its monkish institutions. The nation was split into two parties—the one liberal, which conducted the government and controlled the king; and the other clerical, which intended to liberate the king. The clergy numbered at that time 150,000 men, besides nuns, and possessed property to the value of about 180,750 million reals. In the beginning of 1821 civil war broke out, but in Nov., 1822, the troops of the government gained a decisive victory over the army of the "faithful." Averse to any extension of liberal ideas, France, Austria, Prussia, and Russia then determined to make an armed intervention, and in Apr., 1823, 100,000 Frenchmen, under the command of the duke of Angoulême, invaded Spain, united with the 30,000 soldiers of the faithful, and pushed forward against the army of the government. The generals Ballesteros, Mina, O'Donnell, and Morillo were defeated and compelled to retreat, and on May 24 the French entered Madrid, while the Cortes with the king removed to Seville and attempted to organize a guerilla war. The people, however, were against the government on account of its liberal measures; no guerilla war took place except in Catalonia under Mina, and on June 18 the Cortes was compelled to flee to Cadiz, carrying the king along with them. Cadiz was surrounded by the absolutists and compelled to capitulate; all troops in the field were defeated and dispersed; the king was liberated; the Cortes was dissolved, and when the French occupied Cadiz (Oct. 4, 1823) the king issued a proclamation by which he abolished all laws enacted between Mar. 7, 1820, and Oct. 1, 1823. A horrible reaction set in; the Inquisition was restored; the Jesuits obtained the greatest influence; and the liberals were persecuted in every possible manner. French troops remained in the country for the maintenance of peace and order. But in spite of this terrorism, which even went so far that men were put to death because they were Freemasons, the apostolic junta found the proceedings of the government too lenient, and began intriguing in order to place Don Carlos on the throne, the brother of Ferdinand, whom they considered thoroughly clerical. Thus originated a protracted civil war. Between 1825 and 1828 several scattered risings took place, especially in Catalonia and Aragon, but they were suppressed. Meanwhile, the state of the finances grew worse and worse. In 1828 the public debt amounted to 6000 million reals, and the country was in so miserable a state that the bey of Tunis unpunished plundered its coasts because the tribute due to him was not paid. In 1827 the French left the country. In 1830 the Carlist movement received a new impulse from the alteration of the law of succession. Dec. 10, 1829, Ferdinand VII. married the princess Maria Christina of Naples, and she persuaded him to abolish (Mar. 29, 1830) the Salic law, valid in the house of Bourbon, according to which females were excluded from succession. Sept. 29, 1833, Ferdinand died, and Maria Christina now grasped the reins of the government in the name of her daughter, Queen Isabella (b. Oct. 10, 1830). Don Carlos immediately protested, and laid claims to the throne in accordance with the Salic law, which he declared had been illegally abrogated by Ferdinand. Thus the country became once more divided, this time between Carlists and Christinos, and as the Carlists inscribed absolutism and religion on their colors, Maria Christina was compelled to espouse liberalism. Under able leaders, such as Zumalacarreguy, Javala, and Merino, the Carlist insurrection in the northern provinces soon assumed a dangerous aspect; and in order to gain the support of the liberals the queen was compelled to give the country a new constitution (Apr. 15, 1834). Apr. 22 she formed an alliance with England, France, and Portugal for the defence of constitutionalism against the Carlists. The Inquisition was abolished, the Jesuits were expelled, and when in 1835 the Carlists gained some military success over the Christinos, English, French, and Portuguese troops came to the aid of the queen. Meanwhile, it became more and more apparent that the ideas of the French revolution had penetrated into Spain and spread rapidly. The peasants lived still with the ideas of the Middle Ages, but the educated classes wanted progress, and as soon as Maria Christina was compelled to lean upon the liberals the dam which stemmed the flood of progress was broken through, and many of the larger cities came forward with reform demands far beyond that which the queen was willing to give. At first she resisted, but by degrees she yielded. The cabinet of Mendizabal (Sept., 1835) was a great concession, Mendizabal being an *exaltado;* and when he was replaced by Isturiz, a *moderado* (May, 1836), insurrections broke out in Cadiz, Seville, Xeres, Cordova, and Saragossa, the constitution of 1812 was proclaimed, the troops of San Ildefonso revolted, Sergeant Garcia penetrated into the sleeping-room of the queen (Aug. 12, 1836) and compelled her to issue an order that the army should make oath on the constitution of 1812. The next day Calatrava was placed at the head of the government, and on June 18, 1837, the queen made oath on a new, improved liberal constitution. Meanwhile, the Carlists advanced victoriously, defeated Gen. Cordova, and crossed the Ebro in the spring of 1837. This advance, however, proved fatal. Dissensions broke out in the camp of Don Carlos, and Espartero, commander-in-chief of the army of the Christinos, understood how to avail himself of these dissensions; Aug. 31, 1839, he concluded a convention with Maroto, the Carlist commander-in-chief, according to which most of the Carlists laid down their arms and went home. Don Carlos gave up his cause and fled; and in the summer of 1840 the war was completely ended. Freed from her enemy, the queen-regent now believed that she could give up her liberal policy. The constitution was not abolished, but it existed only on paper, and the reaction gained more and more ground. New insurrections broke out, and the country presented the picture of a perpetual party struggle, without any results. The cabinets changed rapidly, and the Cortes was several times dissolved. In Oct., 1840, the queen-regent abdicated, and the Cortes elected Espartero regent May 8, 1841. His policy was principally directed to the material weal of the country—the building of roads, the improvement of mining, the development of commerce, etc.—but he too found vehement adversaries, and he had to struggle against various military conspiracies formed by the queen-regent, who lived in France. To such a revolt, headed by Concha, he was compelled to yield July 26, 1842:

he went to England. After bloody contests between the *exaltados* and republicans on the one side, and the Christinos on the other, the Cortes declared the young queen, Isabella, of age Nov. 8, 1843. First Olozaga, then Bravo, was placed at the head of the government. The latter recalled Maria Christina, with whom a new epoch of reaction set in, but was afterward replaced by Gen. Narvaez, who introduced a severe military rule. Oct. 10, 1846, the two daughters of Maria Christina were married—Queen Isabella to the infant Francis of Assisi, and her younger sister, Louisa, to the duke of Montpensier. Queen Isabella began immediately after her marriage to emancipate herself from her mother's influence; with her husband she lived in open hostility; her whims and her favorites ruled her policy. One cabinet followed the other—Serrano, Narvaez, Bravo, Murillo, etc. —in rapid succession, each professing an entirely different policy from the others, and the whole political life of the country seemed to dissolve into a struggle between merely personal interests. In 1850 a difficult question arose with respect to Cuba. Several expeditions whose object was to wrest the island from Spain went out from the U. S. in spite of the prohibitory measures of the government. Their commander, Lopez, was garroted at Havana Sept. 1, 1851, but the relations between Spain and the U. S. remained cold for a long time. In June, 1854, the prevailing unsteadiness of the internal affairs of the country developed into open revolt. Gen. O'Donnell, at the head of a number of insurrectionary troops, made a *pronunciamiento*, and demanded the expulsion of Maria Christina and the introduction of the constitution of 1837. The movement assumed great dimensions; Isabella recalled Espartero, and he sent Maria Christina across the frontier with an escort. But the country found no rest—Narvaez, O'Donnell, Serrano, Miraflores, Arrazola, Mon, etc., cabinet after cabinet, *pronunciamiento* after *pronunciamiento*, everybody on the verge of revolt. On July 7, 1868, the duke of Montpensier, Serrano, and other influential men were either banished or imprisoned; Prim had been previously exiled on account of revolt. This led to the overthrow of the royal government. The parties of the liberal union, the progressists and the democrats, united; Admiral Topete received Prim on board his ship in the harbor of Cadiz Sept. 17, 1868, and the colors of revolution were unfurled. The banished generals returned to Spain, advanced with an army upon Madrid, and defeated Gen. Novaliches at Alcolea Sept. 28. On Sept. 30, Isabella left Spain and went to France. In Madrid a provisional government was instituted under Serrano, and the policy of the country was suddenly turned in the direction of the most advanced progress. The order of the Jesuits was dissolved and its property confiscated; the liberty of the press was established, and on Mar. 30, 1869, a draft of a new constitution was laid before the Cortes. It was accepted, and the new constitution, a monarchy with responsible ministers, etc., was proclaimed June 6, 1869; on June 18, Serrano, duke de la Torre, was elected regent. This change was of course received with great discontent by the clergy and its party, and a Carlist insurrection took place, which, however, at first seemed rather feeble; a grandson of Don Carlos, who after the resignation of his father, John, called himself King Carlos, appeared as a pretender to the throne. At the same time the Cuban question arose once more, and in a dangerous manner. The barbarous treatment to which the Spanish government had subjected the island occasioned an insurrection in the autumn of 1868; and as this insurrection found sympathy both in the U. S. and in the South American republics, it developed into a war which demanded a large military force to be sent to the island, and gnawed at the vital power of Spain like a gangrene. At home the most important problem to the leaders of the people seemed to be the election of a king. Finally, on Nov. 16, 1870, after many fruitless negotiations, Prince Amadeus of Savoy was elected king by the Cortes; and on Dec. 30 he arrived in Spain. The same day Gen. Prim, who had prepared the way to the throne for him, died from the wound an assassin had given him three days before. The reign of Amadeus was not successful, and on Feb. 11, 1873, he abdicated and left the country. By his withdrawal all bands of social order were loosened, and the Carlist insurrection, which still raged in the northern mountains, spread to the S. On July 15, 1873, Don Carlos himself arrived and took the command. To suppress this insurrection, which was supported by the deposed Italian princes and by the clerical party in France, Germany, and Austria, was the principal task of Serrano's government, but fortune seemed to declare in favor of the Carlists. At the end of 1874 a change took place, however. On Dec. 29, Gen. Martinez Campos proclaimed Prince Alfonso, son of Isabella, king. On Jan. 9, 1875, he landed at Barcelona and took command of the army. His first movements against the Carlists were not successful; he was defeated at Lacar Mar. 9, 1875. Nevertheless, he gradually succeeded in consolidating his position, in winning over to his side the various parties, and harmonizing the different interests. In the spring of 1876 he was able to attack Don Carlos with a superior force, and the insurrection was finally quelled. AUGUST NIEMANN.

**Spain, Language and Literature of.** See SPANISH LANGUAGE AND LITERATURE, by PROF. SCHELE DE VERE.

**Spain's,** tp., Lauderdale co., Ala. P. 296.

**Spain, Wines of.** See WINE.

**Spalacopod'idæ** [from *Spalacopus* — Gr. *σπάλαξ*, "mole," and *πούς*, "foot"—one of the genera], a family of mammals (order Rodentia, sub-order Simplicidentati) including rat-like and porcupine-like forms, many of which have spiny hairs. They have large anteorbital foramina, through each of which a portion of the masseter muscle, as well as infraorbital nerve, passes; there are four (or three) molar teeth in each jaw on each side, and their crowns have re-entering folds of enamel of varying extent; the alveolar portions of the maxillary lines are normally developed (having no connection with the squamosals); the clavicles are fully developed; the fibula and tibia separate from each other; the claws of the feet curved and moderately acute; the hairs are generally more or less rigid, and in some developed as true spines. This family is distinguished from the Hystricidæ especially by the complete development of the clavicles. It is manifested under a number of generic types, which have been grouped into four sub-families, diagnoscible by the presence or absence of roots to the molar teeth and osteological peculiarities. These are (1) Spalacopodinæ or Octodontinæ, (2) Echimyinæ, (3) Cercolabinæ, and (4) Ctenodactylinæ. Of the 21 recognized generic forms, 17 are peculiar to South America and 4 (Ctenodactylinæ, Petrodromus, and Aulacodes) to Africa. The typical porcupines of America (*Erethizon*, *Cercolabes*, and *Chætomys*) constitute the sub-family Cercolabinæ. THEODORE GILL.

**Spala'to,** or **Spala'tro,** town of Austria, province of Dalmatia, on a peninsula jutting out into the Adriatic, has a good harbor, is defended by a citadel, and carries on an active trade in grain, cattle, horses, swine, fruits, wine, and rosoglio, besides an extensive transit-trade between Italy and Turkey. It is situated near the ancient *Salonæ*, on the site of the famous palace of Diocletian, called *Salonæ Palatium*, or, in an abbreviated form, *S. Palatium*; hence the name of the modern town. Of the magnificent palace, which covered 8 acres of ground and which it took twelve years to build, many interesting and impressive remains are still extant. P. 15,784.

**Spalax.** See MOLE-RAT.

**Spald'ing,** town of England, in Lincolnshire, on the Welland, which is navigable here for vessels of 100 tons burden. It has an active trade in corn, flax, hemp, and wool. P. 9664.

**Spalding,** county of W. Georgia, bounded W. by Flint River, and traversed by Macon and Western and Savannah Griffin and Northern Alabama R. Rs. The surface is undulating, the soil fertile. Staples, cotton, Indian corn, wheat, oats, cattle, and swine. Cap. Griffin. Area, 190 sq. m. P. 10,205.

**Spalding** (BENEDICT JOSEPH), D. D., b. in Marion co., Ky., in 1810; studied at St. Mary's College and at Bardstown, and graduated at the Propaganda in Rome in 1837; was ordained priest; in 1844 became pastor of St. Joseph's church at Bardstown; in 1849 of the cathedral church in Louisville, and vicar-general of the diocese. D. at Louisville Aug. 4, 1868.

**Spalding** (HENRY H.), b. near Prattsburg, N. Y., in 1804; educated at Western Reserve College and Lane Theological Seminary; went in 1836 as a missionary of the American Board to the Nez Percé Indians of Oregon (now Idaho); was there associated with Dr. Whitman, who in Nov., 1847, was murdered with his family at Walla-Walla by the Indians; translated portions of the Bible into the Nez Percé language; and was successful in the conversion of many hundreds of Indians. His later years were employed under the auspices of the Presbyterian Board of Missions. D. at Lapwai, Id., Aug. 3, 1874.

**Spalding** (JOHN FRANKLIN), D. D., b. Aug. 25, 1828, in Belgrade, Kennebec co., Me.; graduated at the North Yarmouth Classical Academy, Me., in 1849, at Bowdoin College, Me., in 1853, and at the General Theological Seminary of the Protestant Episcopal Church, New York, in 1857; minister of St. James's church, Oldtown, Me., 1857–59; was rector of St. George's church, Lee, Mass., till 1860, when he became assistant minister of Grace church, Providence, R. I., for one year; rector of St. Paul's church, Erie, Pa., 1862–74; member of the general board of missions from 1865; dean of the Erie convocation Jan., 1866; member of

the general convention 1868 and 1871; elected Oct. 24, 1873, by the House of Bishops missionary bishop of Colorado, with jurisdiction in Wyoming and New Mexico; consecrated bishop Dec. 31, 1873, and removed to Denver, Col., in Feb., 1874. Published in 1864 *The Threefold Ministry*, and in 1872 *Manual of Prayers*, etc., and author of various articles, sermons, pamphlets, etc. Bishop Spalding has been for many years prominently connected with the movement to promote lay co-operation and women's work in the Church, deaconesses' institutions, and sisterhoods. Residence, Denver, Col.

**Spalding** (Lyman), M. D., b. at Cornish, N. H., June 5, 1775; graduated at Dartmouth College in 1798; studied medicine, and aided in the establishment of the medical school of Dartmouth, where he delivered the first course of lectures on chemistry; began the practice of his profession at Portsmouth in 1799; in 1812 became president of the College of Physicians and Surgeons in Western New York; removed to New York City in 1813; planned the *U. S. Pharmacopœia*, and in 1820 was one of the committee for its publication; was a skilful anatomist, and member of many learned societies in Europe and America. D. at Portsmouth, N. H., Oct. 31, 1821.

**Spalding** (Martin John), D. D., b. in Marion co., Ky., May 23, 1810; graduated at St. Mary's College in 1826, and in 1830 went to Rome to enter the college of the Propaganda; returning to Kentucky, was ordained priest in 1834; appointed pastor of the cathedral church at Bardstown, and established *The Catholic Guardian*, with which he retained his connection until 1858: lectured in favor of Roman Catholicism in the U. S. and Canada, his lectures being published under the title *Evidences of Catholicity* (1847; 4th ed. 1866); in 1848 appointed coadjutor of the Roman Catholic diocese of Louisville; in 1850 became bishop of Louisville, where he erected a cathedral; advocated the establishment of Roman Catholic schools in all parishes; set up a colony of Trappist monks and an institution for the deaf and dumb, and engaged in newspaper controversies. In the Roman Catholic provincial councils held at Cincinnati in 1855, 1858, and 1861 he bore a prominent part. In 1864 he succeeded Dr. Kenrick as archbishop of Baltimore; in 1866, as apostolic delegate, convened the second national council at Baltimore, and drew up the acts of the council (*Concilii Plenarii Baltimorensis II. Acta et Decreta*), which form the manual of American Roman Catholic canon law. He took a prominent part in the Vatican Council of 1870–71, where he urged an immediate decision on the subject of papal infallibility, but wished it to be indirect and implied, rather than positive and affirmative; but he, with the other Roman Catholic bishops from America, yielded in favor of a positive declaration. His principal works are—*Early Catholic Missions of Kentucky* (1844), *History of the Protestant Reformation in Germany and Switzerland*, written in opposition to Merle d'Aubigné (1860), and a translation, with notes and an introduction, of Darras's *General History of the Catholic Church* (1866). D. in Baltimore Feb. 7, 1872.

**Spalding** (Solomon), b. at Ashford, Conn., in 1761; was a soldier in the war of the Revolution; graduated at Dartmouth College 1785; became a Congregational minister in Connecticut 1787; settled in Ohio some years later, and while residing at Salem in that State about 1812 wrote a novel entitled *The Manuscript Found*, suggested by the opening of an Indian mound. It is claimed that this fiction became known to Sidney Rigdon at Pittsburg in 1814, and that it was the origin of the *Book of Mormon*. D. at Amity, Pa., in 1816.

**Spalding** (William), b. at Aberdeen, Scotland, in 1809; educated at Marischal College in that city; was called to the bar at Edinburgh 1833; was professor of rhetoric in the University of Edinburgh 1834–45, and of logic at the University of St. Andrew's from 1845 until his death, Nov. 16, 1859. Author of *Italy and the Italian Islands* (3 vols., 1841); *A History of English Literature* (1852), an admirable work, now (1876) in its 10th edition; and *An Introduction to Logical Science* (1857), being a reprint of the article "Logic" contributed by him to the 8th ed. of the *Encyclopædia Britannica*, for which work he wrote, among others, the important articles on Addison, Bacon, Demosthenes, Tasso, Sir Walter Scott, Rhetoric, and Slavery. He was also a frequent contributor to the *Edinburgh Review*, *Blackwood's Magazine*, and the *Penny Cyclopædia*, and wrote the lives of poets, novelists, and men of letters in Elihu Rich's *Cyclopædia of Biography* (London, 1854).

**Spallanza'ni** (Lazaro), b. at Scandiano, duchy of Modena, Jan. 12, 1729; studied at Reggio and Bologna, and was appointed professor of logic, metaphysics, and Greek at Reggio in 1754, and at Modena in 1761. At the re-establishment of the University of Pavia in 1768 he became professor of natural science; made extensive scientific travels in Italy and Sicily, Switzerland and Germany, Turkey, Asia Minor, Corfu, and Cyprus, and lectured to very large audiences. D. at Pavia Feb. 12, 1799. His numerous writings on geology and zoology, obtained a wide reputation, and were translated into several foreign languages. His polemics against Needham, whose theory of spontaneous generation among the Infusoria he contested, attracted special attention, showing by a series of ingenious experiments that these animals originated from germs existing in the atmosphere. His *Viaggi alle Due Sicilie e in alenne parti degli Apennini* (6 vols., Pavia, 1792) was also much appreciated.

**Span'dau,** town of Prussia, province of Brandenburg, at the confluence of the Havel and the Spree, is fortified, surrounded by walls, and defended by a citadel. The citadel stands on an island in the Havel, and is used by the Prussian government as a prison for military and political criminals. The city, which is very old, but well built, has manufactures of stockings, hosiery, woollen fabrics, gunpowder, and arms, and carries on a large transit-trade between Berlin and Hamburg. P. 19,013.

**Spang'enberg** (August Gottlieb), Ph. D., b. at Klettenberg, Germany, July 15, 1704; graduated at Jena 1726; became a professor at the University of Halle 1731, and assistant superintendent of Francke's orphan-house; was dismissed for too liberal views on church fellowship 1733; joined the Moravians; became assistant to Count Zinzendorf at Herrnhut; visited England 1734; obtained lands from the trustees of Georgia for a Moravian settlement in that colony; landed at Savannah with nine Moravian settlers, the first who located in America, 1735; labored as a missionary among his German countrymen in Georgia and Pennsylvania 1735–39, after which he visited Europe; was instrumental in procuring the establishment of the settlement at Bethlehem, Pa.; founded at London 1741 the first regular Moravian society in England; became "general deacon," and in 1744 bishop, of his church; proceeded to Pennsylvania the same year; repeatedly visited the Oneida Indians; made another visit to Europe 1749–51; organized a Moravian community in Western North Carolina 1752; was elected successor of Count Zinzendorf in the supreme council; returned finally to Europe 1762, and for thirty years was the leading spiritual guide of the Moravians, becoming in 1789 president of the general directory. D. at Berthelsdorf, Saxony, Sept. 18, 1792. Author of a *Life of Zinzendorf* (3 vols., 1772–75) and of *Idea Fidei Fratrum* (1779), the authoritative manual of Moravian theology.

**Span'heim** (Ezechiel), b. at Geneva Dec. 7, 1629; was educated at Leyden under Salmasius and Heinsius, and was appointed professor of belles-lettres at Geneva in 1651, and elected a member of the grand council in the following year. Having been appointed tutor to the son of the elector palatine, whom he accompanied on a tour through Italy, he entered the diplomatic career; represented the elector of Brandenburg for many years at the court of Paris; assisted at the negotiation of the Peace of Ryswick, and was sent in 1702 as Prussian ambassador to London, where he d. Nov. 7, 1710. His *Dissertationes de Usu et Præstantia Numismatum Antiquorum* (Rome, 1664) and *Orbis Romanus* (1704) acquired a great reputation. His editions of *Julianus* and *Callimachus* are still considered valuable.

**Spaniard's Bay,** a large fishing-town on the N. side of Conception Bay, Harbor Grace district, Newfoundland, is surrounded by high hills and has some fine views. The inhabitants are mostly engaged in the Labrador cod fishery. P. 1182.

**Spanish Armada.** See Armada, The Spanish.

**Spanish Fly.** See Cantharis.

**Spanish Grass.** See Esparto.

**Span'ish Language and Literature.** The prevailing opinion as to the oldest known inhabitants of Spain is that they were Iberians, now known as Basques, a race of Ugro-Tartarian origin, and coming from the northern parts of Asia and Europe. They have left few distinct traces of their language in modern Spanish. After a long and bloody war, these Iberians were conquered by invading Celts, who, united with their new subjects, became known as Celt-Iberians, when Spain first appears in the annals of history. The Phœnicians, who came by sea from their powerful colony of Carthage in Africa in search of the mineral resources of Spain, which made it the Eldorado of the ancient world, founded Carthagena, and probably Cadiz, near the Straits of Gibraltar. Before they could obtain, however, possession of the whole country, the Romans, moved by jealousy, interfered with their progress, and by the victories gained in the Second Punic war drove them for ever from Europe. The traces left by the Phœni-

cians in the population and language of Spain are few and of slight importance. The enlightened policy of the new conquerors soon established peace and produced a hearty union between the two races, and the S. of Spain became another Italy. Thus, Latin became the language of the favored province, and the first Roman consul, as well as the first emperor of foreign origin, was a Spaniard by birth. Latin writers of eminence claimed Spain as their native land, and Lucan and Martial, Columella and the two Senecas, with a host of others, bore evidence of the far-famed culture of Spain. The influence and popularity of Latin derived new strength from the use of it by Christianity, which became in the days of Constantine the acknowledged religion of large parts of the country. This Latin was, however, not classic Latin, but the *sermo rusticus*, the speech of the people, sadly corrupted by ignorance and admixture of foreign elements. For in the mean time a new race of northern barbarians had begun to invade Spain after having overrun every part and province of the Roman empire. The first tribes of this German race that rushed over the Pyrenees, the Franks, Vandals, Alani, and Suevi, passed swiftly into Africa, leaving bloody traces behind them. The Goths, who succeeded them, had fortunately been not only converted to Christianity, but more or less civilized in Italy, before they reached Spain, and as Visigoths established a beneficent reign in their new conquest. Their noble code of laws survived their memory, but their language, a barbarous idiom, readily succumbed to the greater power and higher culture of the Latin as far as words were concerned. They played, however, sad havoc with the beautiful though complicated system of Latin inflections, and thoroughly changed the general structure of that language. Of comparatively trifling effect, as far as the language was concerned, was the otherwise formidable invasion of the Arabs, who made their first descent from Africa in 711, and, with their usual marvellous celerity, in three years conquered the whole of Spain, save only the mountainous N. W., where a large body of Christians found a safe asylum. During their long occupancy of Spain they maintained numerous schools and libraries, which were frequented by Spaniards and Arabs, by Mohammedans and Christians, alike. Arabic became the language of the majority of Spaniards; even the Scriptures had to be translated into it, and records and literary works were written in Arabic. Thus, when, after a fierce struggle of nearly eight centuries, the Christian Spaniards recovered possession of their native land, and the Gothicised and corrupted Latin became once more the national language, a considerable infusion of Arabic remained and gave to modern Spanish those Oriental peculiarities which distinguish it most pointedly from the other Romance languages.

As the province of Castile was not only one of the oldest but also the most powerful portion of the newly-restored kingdom, to which it gave its rulers, the new language became generally known as the *Castilian*. The oldest document written in this language which still exists is a confirmation of privileges by Alfonso III. in the year 1155, and from that date Spanish begins its existence as an independent national language. The bulk of words is Latin, to which Arabic, German, and Basque make small contributions, while Gothic constructions abound largely. By order of Alfonso X. (d. 1282) the Bible was translated into it from the Vulgate, and at the same time Spanish was made the language of all law proceedings and legal contracts.

Spanish is spoken now not only in Spain, but also in certain portions of Africa, in Central America, Mexico, and the West Indies, in South America, except Brazil and Guiana, and in the Philippine Islands. It shares with Italian its melodiousness and richness of vowels, but surpasses it in vigor and dignity; as clear and precise as French, it possesses greater elasticity and superior fitness for poetry, and avoids the sibilants and nasal sounds of the Portuguese, without losing its soft and liquid notes. Of former dialects only the Galician (closely related to Portuguese) and the Catalan survive. Lebrija (1492) was the first to treat Spanish grammatically; the dictionary and the grammar of the Spanish Academy are standard works, which Salva's *Gramática Castellana* (Paris and Mexico, 1854) adapts to modern spelling. An historical grammar has not yet been written; the material for such a work is found in Diez (*Romanische Sprachen*). Cabrera wrote (1837) an etymological dictionary, and Hernan Caballero in his *Nomenclatura geografica de España* furnished valuable contributions to Spanish etymology.

The *literature* of Spain, as a national literature, begins only with the twelfth century, when the Limousin and Aragonese dialects had become extinct, and Castilian rose to the dignity of a national language. As in the history of all nations, here also, poetry and, of all its branches, epic poetry, produced first permanent fruit. Amid storm and strife the Christian Spaniards gave utterance to the fierce energy and the matchless heroism which animated them in their long-continued struggle against their national enemies, the Moors. The people of Roman and of Gothic blood alike made common cause against the invader, and in their common language loved to sing the praise and glory of their heroes and heroic deeds. Naturally fond of song, they learned from the Arabs to form riddles and romances, largely tinctured with rich Oriental imagery and passionate eloquence. From their neighbors, the Provençals, they acquired poetic skill through trovadores and yoglares, and thus playful songs and national romances became the representatives of the true national literature of Spain. Adventures of love and achievements in war being the great topics of the day, and most of the poets being warriors themselves, these romances naturally sing mostly of love and war. The form varied, although they were generally written in *redondillas*, consisting of stanzas or couplets, each line containing four trochees. Rhymes occurred only in songs fashioned after Arabic models, and were then employed quite irregularly. Other romances, known as *versos de arte mayor*, consisted of dactylic stanzas of eleven to fourteen syllables. Alexandrine verses and sonnets were mainly used by monks in their poems, and never became popular because they could not so easily be sung. (Authorities: L. I. Velasquez, *Origines de la poesia Castellana* (Malaga, 1754); M. Sarmiento, *Memoria para la historia de la poesia y poetas Españoles;* Martinez de la Rosa, *Sobre la poesia epica Española;* E. de Ochoa, *Tesoro de los poemas Españoles* (Paris, 1840).) The first and by far the most important of these works is *The Poem of the Cid*, composed about the year 1200. Its subject is the life of a great Christian knight, Don Rodrigo Diaz, who bore the Arabic name of *Cid* (*Seid* = "Lord"), bestowed upon him by five Moorish kings whom he had conquered, and was generally known as *El Cid Campeador*, "the lord champion of Spain." His personal adventures form part of the great struggle between the Christian Spaniards and the Mohammedan Moors, and the poem hence has a national character throughout. Although the great hero died as early as 1099 in Valencia, no portion of the poem is older than the twelfth century. It has existed only since 1207, when Per Abbat copied it in its present form. Inartistic in many respects, it is invaluable as a contemporary exhibition of Spanish character; at times it rises to Homeric simplicity, and is always full of life and interest. Every line breathes the true Castilian spirit of loyalty to king and country, as well as to the God of the Christian, and for centuries the poem has held its own as unsurpassed in originality and intrinsic beauty. (Authorities: Sanchez, *Poesias Castellanas* (Madrid, 1729); Southey, *Chronicle of the Cid.*)

For a time the poems of the people remained anonymous, but already in the thirteenth century we meet with a well-known author, Gonzalo de Bercea (1220–60), who has left us a number of rhymed legends. A royal author, Alfonso X., surnamed THE WISE (1221–84), was a true poet and a profound scholar, although a poor king. Of his poems but few survive, but his fame rests mainly on the great code of laws to which his labors gave the general character and finish. He himself called it *El Setenario*, but history records it as *Las Siete Partidas*, from the seven parts of which it consists. This code, the greatest legislative work of its age, has been uniformly respected as the common law of Spain and the basis of all Spanish jurisprudence. Being thus the law of the colonies also, it has not been without influence on American law since the acquisition of Louisiana and Florida. (*Las Siete Partidas*, Academia Española (Madrid, 1807)—*The Laws of the Siete Partidas*, which are still in force in the State of Louisiana (New Orleans, 1820), by M. Lislet and H. Carleton.) Of subsequent poets few rose to distinction. Juan Lorenzo Segura wrote toward the end of the twelfth century a long poem on Alexander the Great, and Juan Ruiz, known as the archpriest of Hita (d. 1351), has left us poems in the style of Petronius, rather free in tone, but full of life and humor. His language is far superior to that of his predecessors, and this and his poetic genius and satirical temper have procured him the name of the Spanish Chaucer.

In the mean time, lyric poetry had brought forth its first fruits under the protection of King John II. of Castile. A courtly school of poets, following the example of the troubadours in the adjoining provinces of France, sprang up under that chivalric monarch and produced a large number of lyric poems. Divided into stanzas (*canciones*), they bore, like every product of the Spanish Muse, the impress of a strongly-marked nationality in form and treatment. Hence, the almost painful uniformity of these poems and the narrow circle of ideas which they display. A collection of such canciones was made by Baena, secretary to John

II., but the *Cancionero General* by Ferrando de Castilla (Valencia, 1511) is far more complete, and an invaluable storehouse of such songs. Cultivated almost exclusively by courtiers and knights, the *canciones* appealed only to certain classes of society; hence the popularity of the far more national ballads and songs, which kept the memory of the ancient glory of Spain alive among the people at large. These romances, written by unknown authors, sang of the great deeds of chivalry performed by the paladins of Charlemagne or the Cid and his followers. Among the older poems a few treat of early myths, while the later compositions are gradually verging into purely lyrical songs. (*Tesoro de los Romanceros y Cancioneros Españoles*, por E. de Ochoa (1818, Paris).) These romances are by far the most attractive works produced by the genius of the Spanish people; they are extremely popular at home and greatly admired abroad.

Unfortunately, Spanish poetry was not allowed long to remain independent of foreign influence. While Spain became under Charles V. the most powerful empire of the world, and its literature kept pace with its political progress, the conquest of Naples (1504) brought it in contact with Italian literature, at that time the most advanced in Europe; and this influence changed the whole aspect of its culture. Italian authors like Dante and Petrarch became the models which Spanish poets tried to imitate, and Italian forms and measures were closely copied. Juan Boscan de Almogaver (d. 1543), who accompanied the duke of Alba to Italy, had there learnt to admire Italian poetry, and after having in his youth written *Coplas Españolas*, now tried his hand at the first sonnets in Castilian. His success, great as it was, was surpassed by that of his friend, Garcilaso de la Vega (d. 1536), whose genius excelled especially in pastoral poems. Their gentleness and winning melancholy are peculiarly striking when contrasted with the life led by the author, a brave but ruthless soldier. The most brilliant among these successful imitators of Italian masters was, however, Diego Hurtado de Mendoza (d. 1595), whose eminent services as a soldier and a statesman left him still leisure to write sonnets and epistles after foreign models, and *redondillas* and *quintillas* in the ancient form of old Castilian verse. His *Cartas*, the first epistles in Spanish, prove him a worthy imitator of Horace. The admiration with which these works were received by the whole nation led to still greater efforts in the same direction, resulting finally in a happy combination of the high art of Italian poets with the attractive peculiarities of Spanish genius. This explains the brilliant success of the two greatest lyric poets that Spain has produced—Fernando de Herrera (d. 1575) and Luis Ponce de Leon (d. 1591). The former earned by his canciones, and especially by his odes—the first classic odes of modern Europe—the title of "the divine;" the latter, as famous in prose as in poetry, gave himself up almost exclusively to mystic meditation, and is hence better known at home than abroad. He deserves special praise, however, for the rare vigor and classical purity with which he uses the old Castilian measures in contrast with the prevailing partiality for Italian forms. So great was the success of this Italian school that even in Portugal, then already an independent kingdom, distinguished poets like Saa de Miranda (d. 1558) and Jorge de Montemayor (d. 1506) wrote idyls and pastoral novels, not in Portuguese, but in Castilian. Nor were imitators and followers wanting in Spain, though their success was but moderate. An Acuña (especially known as a translator) and a Gil Polo became more generally popular among the host of minor poets, while an attempt was made to counteract foreign influence and to bring back the old Spanish simplicity and national feelings. The leader of this party was Castillejo (d. 1580?), whose love-songs are masterpieces. The two brothers Argensola (Bernardo, d. 1565; Bartolomeo, d. 1566) endeavored to imitate Horace directly, without following the example set by Italian writers; while Vicente de Espinel (d. 1634) excelled in canciones and elegies. To assist in restoring the ancient classics to their full authority, Villegas composed his *Eróticas* after the model of Anacreon, and Jaureguy (d. 1640) translated Lucan's *Pharsalia*.

The gradual decline of poetry in the next century was aided by the division of poets into two schools—the Conceptistas, who resorted to metaphors and puns after the manner of Italian *concetti*, and the Cultos or Cultoristos, whose endeavor to show a peculiarly high culture in form and thought led them into exaggeration and pedantry. The illustrious dramatist Lope de Vega wrote some of the best romances and sonnets that were produced during the reign of these two schools, but he also abandoned the good old classic models, and his easy versification led him to commit numerous mistakes. The extreme affectation of Luis Góngora de Argote (d. 1627) makes him the representative poet of the Cultoristos; his style is artificial, full of hyperbole, and affected beyond endurance. The most efficient resistance to this false taste was made by Francisco de Quevedo y Villegas, whose burlesque sonnets and satires fairly entitle him to be called the Spanish Voltaire. In all his works—his *sueños*, clever visions, his *bayles*, songs to accompany dances, and his *jácaras*, gypsy songs—he shows a decided improvement on his predecessors.

The popular desire to preserve the treasures of olden times led to numerous efforts in the sixteenth and seventeenth centuries to collect, complete, and publish the earlier romances. The writers of those days endeavored either to imitate the ancient poems, or, when such efforts proved futile, to regenerate poetry by imitating the works of the classic French writers, who were now in the ascendant. The new dynasty of the Bourbons (1701) favored this tendency, and the brilliant talents of Ignacio de Luzan (1737) succeeded in applying the rules of French critics to Spanish literature. The fact that his own poems, though extremely brilliant, lacked all poetic fire, assisted his opponents, the advocates of a national literature, in counteracting his influence. Their leader, Garcia de la Huerta (d. 1787), received immense applause for his poems written in the old Spanish form, but a number of men who in Salamanca formed a school characterized by moderation, and by endeavoring to unite the merits of older works with the demands of more recent days, soon obtained the supremacy. Although the French and the national party continued to contend for supremacy, the new school obtained great triumphs through men like Moratin (d. 1780), Cadalso (d. 1782), and Iriarte (d. 1791), whose *Fables* are a classic work in Spain; while Melendez Valdez (d. 1807) surpassed all recent poets, and still enjoys universal admiration. A highly-gifted man of genius, he revived the national enthusiasm, and proved that poets might remain true patriots in sentiment and yet profit by the example of the classic models of other nations. For some years Spanish writers followed in his footsteps, trying to learn from the great poets of France, Italy, and England, and their efforts became even more zealous when Spain succeeded in shaking off the yoke of the foreign usurper and once more could think and write as an independent nation. The liberal and patriotic movements of the years following Napoleon's downfall served to revive the national spirit and to give to literature a more patriotic character. These influences infused new life into Spanish poetry, and the number of modern poets is very great, although but few of them have risen to eminence. This comparative failure is especially due to the cruel political persecutions to which almost every man of genius was subjected. Thus, Martinez de la Rosa, Angel de Rivas, Galiano, and Torreno, all men of undoubted genius, were either banished or driven in early youth from literary pursuits. The greater their attachment to their native land, the surer, it seems, was their martyrdom. The younger Moratin (d. 1828), whose ballads were national in tone, though highly finished in form, died an exile in want and poverty (*Obras de L. F. Moratin*, 1830, Madrid); Gallego, Mora, Mauri, Xerica, and Japia, all suffered persecution. Among recent poets of this class, Santos Lopez Pelegrin, known as "Abenamar" (*Poesias*, Madrid, 1841), Campoanor (*Poesias*, Madrid, 1840), and a lady, Gertrudis Gomez de Avellaneda (*Poesias*, Madrid, 1842), may be mentioned as worthy of praise.

Epic poetry, as distinguished from the early romances, can hardly be said to have begun in Spain before the days of Charles V. A nation possessed of such a vast treasure of popular ballads was not likely to encourage individual efforts, and the republication of the old national songs in the romancero made the competition still more difficult. Hence, the small success obtained by poets like Balbuena (d. 1627), whose residence in Mexico and Jamaica led him to publish his *Siglo de Oro* (1608, Madrid), and Cueva (d. 1608) in his *Bética* gives us little more than versified history. The *Cristiada* of Father Hojeda (d. 1611) shows some progress, but the first epic poem of real merit is undoubtedly the *Araucana* by Alonzo de Ercilla y Zuniga (d. 1596). This remarkable work contains a graphic account of a military expedition sent out against the Araucans, a tribe of South American Indians, in which the author took part. Its beautiful descriptions of natural scenery and the eloquent speeches which are plentifully inserted command admiration, and elicited praise even from Voltaire, who first called attention to the strange work. The American continent produced two epic poems of some merit: one on Cortés by Antonio de Saavedra Guzman (Madrid, 1599), and the other on the conquest of Peru by the Pizarros, by Barnuevo (Lima, 1732). The elder Moratin published in 1765 an *Epic Canto* on the destruction of his ships by Cortés, the noblest poem of its class produced in Spain during that century. The *Conquest of Minorca*, by Meras (Madrid, 1797), is a feeble imitation of Moratin's work, and a poem by Melendez, *The Fall of Lucifer* (Mad-

rid, 1785), is a complete failure to copy Milton. The historian Muñoz was equally unsuccessful in his *Méjico Conquistada* (Madrid, 1793), although the work is not without merit; and since that time no effort has been made to revive this branch of poetry in Spain.

Didactic poetry has occasionally been a special favorite with the Spaniards, from the time when Pedro Lopez de Ayala (d. 1407) wrote his famous *Rimado de Palacio* ("Court Rhymes")—a work containing much statesmanship and profound learning—to our own day. The Rabbi Santob (d. 1350) addressed to King Peter the Cruel many wise counsels in a curious poem written in excellent *redondillas*, and breathing a true poetical spirit. Of unknown date and authorship is the *Danza General*, or "Dance of Death," a striking and picturesque poem on the well-known subject of the dance to which all men of all conditions are finally summoned. The age of Charles V. produced, in this branch also, works of considerable merit—Boscan's poem on his own conversion, another by Castilla on *The Virtues*, and one by Mendoza on *A Happy Life* are among the best. They were, however, surpassed by Francisco de Guzman's (d. 1580) larger poems, and especially by Juan de la Cueva (d. 1608) in his *Ejemplar Poetico*, the oldest original effort at an art of poetry written in Spanish. Religious and descriptive poems of this kind abound, but on the whole didactic poetry has not been successfully cultivated by the Spaniards.

Far more brilliant are the annals of the Spanish drama, which seems to have very promptly appeared to take the place of the ancient classical drama, banished by the Arabs. But, although Alfonso X. had already issued edicts against certain abuses connected with farces performed in public, no trace of dramatic writing is found till the latter part of the fifteenth century. At that time the drama appears already under its double aspect—religious, as patronized by the Church and addressing itself to the fervent religious zeal of the people; and humorous, as introduced by the *juglares*, from France, and overflowing with more or less coarse buffoonery. A number of anonymous dramatic works, such as *Mingo Revulgo* (1472) and the *Celestina* (1480), in prose, were followed at last by the first Spanish dramas that were published. They were written by Juan de la Encina (d. 1534), and, although religious in their general character, were acted by secular persons. Thus, in the same year in which America was discovered the foundation was laid of the Spanish secular drama. Gil Vicente (d. 1536) followed Encina's example in Portugal, and endowed that country with the best dramatic works produced in Portuguese literature, though they were written in Spanish. The first *comedias*, so called, bore strongly the marks of Italian influence, having been produced by Naharro (d. 1517), who had long lived in Rome at the court of Leo X. He divided them not into acts, but into *jornadas* ("days"), as is still done in Spain, and he introduced also the *gracioso* ("fool"), who has ever since remained a prominent personage in Spanish comedies. Naharro's verse shows not rarely high artistic finish; the humor of his plays is often broad, but always original, and the interest is well kept up. Hence, his plays were acted both in Italy and in Spain, and soon became highly popular.

The true national drama of Spain begins, however, only with the age of Charles V., after an interval during which the representation of dramas was forbidden by the Inquisition. Only strictly religious plays (*mysteries*) were allowed. Strangely enough, it was a mechanic of Seville, Lope de Rueda (d. 1567), who as a dramatic writer and an actor re-established the popular drama. His plays were performed in a rude structure on public squares, whenever an audience could be collected, but they proved extremely attractive, and evidently had struck the popular vein. His example was promptly followed by others. Thus, Juan de la Cueva (d. 1608) wrote a number of plays, many of which are on national subjects and of great interest. Cristóval de Virues (d. 1609), a friend of the great Lope de Vega, attempted to imitate the ancient Greek masters in form and in spirit, and obtained a fair success. Three tragedies by Lupercio de Argensola (d. 1603) produced a great sensation, but failed to make a permanent impression. By these authors, however, the way was opened to a dramatic literature founded on the national character and manners. Cervantes, unsurpassed in another department of literature, wrote several dramatic works, which, however, were eclipsed by the greater achievements of the two great masters of the Spanish drama—Lope de Vega Carpio (d. 1635) and Calderon de la Barca (d. 1687). The former excelled in fertility, originality of conception, and promptness of execution, 100 dramas having been conceived and written in twenty-four hours. His works comprise all the favorite branches of the Spanish drama—*comedias divinas*, including *vidas de santos* and *autos sacramentales* (lives of saints and glorifications of the sacraments), and *comedias humanas*, which were called *heróicas* when they related to history, and *de capa y espada* ("sword and cloak") when the subject was intrigue. Moreover, almost all his plays (over 2000) have *loas* (prologues), *entremeses* (interludes), or *saynetes* (ballets), interspersed. His rival, Calderon, was fully his equal in the number and value of his works, and his *autos* especially exhibit the imposing grandeur of Spanish religious zeal. These brilliant examples were followed by numerous imitators, and even after the decline of Spanish poetry dramatic writers flourished down to our day. Cándamo (d. 1709), Cañizares (d. 1750), and Zamora (d. 1722) are still favorites, the latter especially, through his *Don Juan*, for which Mozart wrote the music.

Spanish prose began early, Juan Manuel, duke of Peñafiel (d. 1362), having written in his *El Conde Lucanor* the first moral tales. Romantic novels abounded from the beginning, among which the *Amadis de Gaula*, perhaps by a Portuguese, Vasco Lobeira (d. 1403), was most popular, being frequently republished down to the time of Charles V. (*Los 4 libros del muy efforzado Cab. Amadis de Gaula*, Salamanca, 1519). This was followed by a host of imitations, which grew weaker and weaker till works of this kind became a laughing-stock and a grievance. This led Miguel Cervantes de Saavedra (d. 1626), of all Spanish authors best known abroad, to write his immortal *Don Quijote*, a parody, and at the same time the best model of Spanish prose. His *Novelas Ejemplares* ("model novels") showed the remedy, and gave new vigor and great popularity to this branch of literature. Montalvan and Caravajal wrote similar novels (Paris, 1646); Montemayor (1554) added the pastoral novel; and Hurtado de Mendoza (d. 1575), a soldier and a diplomat, invented the *gusto picaresco*, comic novels with heroes taken from low life. His *Lazarillo de Tormes*, the standard work of this kind, was followed by a number of graphic sketches of the lower classes, among which Mateo Aleman's (d. 1609) *Guzman de Alfarache* stands prominent. Quevedo's *Gran Tacaño* and Espinel's *Marcos Obregon* are masterpieces of the kind; the *Limping Devil* of Velez de Guevara (d. 1646) furnished the material for Le Sage's *Diable Boiteux*.

It was much later when historical writings were developed, the Spaniards preferring their romances and ballads to prose-writings. In 1590, however, Perez de Hita published his famous *History of the Civil Wars of Granada*, which still holds its place by the side of Mendoza's *War of Granada*, and by Garcilaso de la Vega's (d. 1620) *History of the Incas of Peru*. In more recent times this branch of literature has become the most fertile, thanks to the tendency of Spaniards to turn from the sadness of their present condition to the glory of former days. Among modern writers, Martinez de la Rosa (1839), Escosura, Serafin Calderon, and a lady, Gertrudis de Avellaneda, stand prominent. Even the social novel gives more or less attention to historical descriptions, and the German lady who writes under the name of "Fernan Caballero" has excelled here, as the German author Hartzenbush excels in the modern drama. The same popular taste has led to the valuable collections of older works published by E. de Ochoa in Paris, and the far superior *Biblioteca de Autores Españoles*, by B. C. Aribau, which was begun in 1846 in Madrid.

The student of Spanish literature will find ample information, among foreign writers, in Bouterwek's German and in Sismondi's French work on the subject, to which Wolf's *History of Spanish National Literature* and Schack's *History of Spanish Dramatic Literature* (both in German) must be added. The most recent work in Spanish is Orihuela's *Spanish and American Poets of the Nineteenth Century* (Paris, 1851), and for reference Ferrer del Rio's *Gallery of Spanish Literature* (Madrid, 1845) is useful. The best work of all is, however, George Ticknor's *History of Spanish Literature* (New York, 1854), which is admitted, even by Spanish authorities, to be still unsurpassed in thoroughness, completeness, and accuracy.

SCHELE DE VERE.

**Spanish Mackerel,** a name given to different kinds of fishes. (1) Along the eastern coast of North America it is applied to the *Cybium maculatum*, a very slender, compressed, fusiform fish, with many-rayed dorsal and anal fins (D. xvii.–xviii. 2.15 + 8–9 finlets; A. ii. 15 + 8–9 finlets), the lateral line slightly deflected under the second dorsal, and thence continued straight to the caudal fin, and the color bluish-green above, satin-like white below, with yellowish spots on the back and sides, and with the first dorsal fin blackish before and along its margin. It attains a length of nearly two feet, and sometimes more. It is a native of the tropical seas, but ranges from Southern Brazil to Cape Cod. It is now frequently caught in spring and summer along the Eastern as well as the Southern coasts. It is one of the most esteemed of salt-water fishes,

and commands a comparatively high price in the markets. (2) In England, along the Cornish coast, the name is conferred on the *Scomber colias*, a species nearly allied to the common mackerel (*Scomber scombrus*), and having, like it, a stout fusiform shape, comparatively few-rayed dorsal and anal fins; the spinous dorsal has seven spines, and there are five or six finlets above and as many below; the lateral line is slightly decurved and then straight, and the color dark-blue on the back, with irregular dark broad lines and grayish spots on the sides. It often reaches fourteen inches or more in length. According to Couch, it is scarce, but some are taken every year, most frequently in drift-nets and in single specimens. (3) The name is employed by Dekay and Storer for the *Scomber colias* or *Dekayi* in their works on the fishes of Massachusetts and New York, and consequently their species must not be confounded with the one now generally so called. At one time the *Scomber colias* was abundant along the American coast.

THEODORE GILL.

**Spanish Main,** a name formerly applied to the southern part of the Caribbean Sea, through which the Spanish treasure-ships passed from Mexico and Central America to Europe.

**Spanish Town,** town of Jamaica, West Indies, on the right bank of the Cobre, is the seat of the English government. It contains some fine public buildings, but is in general ill-built, unhealthy, and of no commercial importance. P. about 7000.

**Spanish War of Succession.** See SUCCESSION WARS.

**Spano** (GIOVANNI), b. at Ploaghe, Sardinia; began his education in his native island; later went to Rome to study the Oriental languages with Sarti and Lanci; afterward to Turin, where he profited by the lessons of Peyron. The following works of Spano are very valuable: *Vocabolario Sardo-Italiano e Italiano-Sardo* (Cagliari, 1851, 2 vols.), *Ortografia Sarda* (Cagliari, 1840, 2 vols.), *Bullettino Archeologico Sardo*, which was continued for eight years, *Canzoni popolari Sarde*, besides numerous learned archæological and linguistic monographs.

**Span-Worm,** another name for the CANKER-WORM (which see).

**Spar.** See BARYTA, CALCAREOUS SPAR, FELDSPAR, FLUOR-SPAR, and ICELAND SPAR.

**Spar'idæ** [from *Sparus*, the ancient Latin name of the typical genus], a family of fishes of the order Teleocephali and sub-order Acanthopteri, comprising the porgy and sheepshead of the U. S. and related forms. The body is compressed and oblong; the scales have obsoletely pectinated margins and striæ diagonally crossing the surfaces, and meeting the sides at acute angles; lateral line continuous to the caudal fin; head compressed; opercular bones unarmed; nostrils double; mouth terminal, with an oblique lateral cleft; upper jaw moderately protractile, and with the supramaxillaries partly sliding under the preorbital bones; teeth in the jaws either developed on the sides as molars, or in front as more or less defined incisors, or of both kinds; palate unarmed; branchial apertures continuous below; branchiostegal rays five to seven; dorsal fin elongated, with its spinous portion rather longer than the soft, and folding in a dorsal groove; anal with three spines; caudal fin with pointed lobes; pectoral fins pointed and with the rays branched; ventrals thoracic, each with a spine and five branched rays, and with pointed axillary scales. The skeleton has about the normal number of vertebræ (*i. e.* D. 10–11 + A. 14–13); pyloric cæca are developed in small number (*e. g.* 5). The family is quite rich in species, and is well represented in all warm and temperate seas. There is a considerable range of variation in dentition and squamation, as well as in osteological characters. Those exhibiting the characters above enumerated have been distributed by Dr. Günther among three sub-families—viz. (1) *Cantharina*, with more or less broad, trenchant teeth in front of the jaws, no molars or vomerine teeth, including mostly vegetable feeders; (2) *Sargina*, with trenchant teeth in front and molar teeth on the sides, mostly carnivorous; and (3) *Pagrina*, with conical teeth in front and molars on the sides, mostly carnivorous. Dr. Günther also confounds in the same family the Haplodactylina, which are at least more nearly related to Cirrhitidæ, and the Pimelepterina, which typify a peculiar family. Considerably over 100 species are known. Four are inhabitants of the Atlantic coast-waters of the U. S.—viz. (1) A small species named *Lagodon rhomboides;* (2) the celebrated sheepshead, *Archosargus probatocephalus;* (3) the common porgy, *Stenatomus* or *gyrops;* and (4) the doubtful *Sparus aculeatus*. No typical sparoids have yet been detected along the Pacific coast of the U. S. (See also PORGY and SHEEPSHEAD.)

THEODORE GILL.

**Spark, Electric and Galvanic.** See ELECTRICITY, by PRES. HENRY MORTON, PH. D.

**Spark'ill,** p.-v., Orangetown tp., Rockland co., N. Y., on Northern New Jersey R. R.

**Sparks** (JARED), LL.D., b. at Willington, Conn., May 10, 1789; graduated at Harvard 1815; was mathematical tutor there 1817–19, studying theology meanwhile; became pastor of a Unitarian church at Baltimore, Md., May, 1819; was chosen chaplain to the U. S. House of Representatives 1821; published two controversial works on the Trinitarian questions then agitated; conducted at Baltimore a periodical, *The Unitarian Miscellany*, 1821–23; retired from the ministry on account of ill-health, and removed to Boston 1823; purchased the *North American Review*, of which he was sole editor until 1830; published a *Collection of Essays and Tracts in Theology from various Authors, with Biographical and Critical Notices* (6 vols., 1823–26); issued a *Life of John Ledyard* (1828); visited Europe 1828; spent considerable time in examining the English and French archives for materials of American history; founded in 1830 *The American Almanac;* edited for the U. S. government *The Diplomatic Correspondence of the American Revolution* (12 vols., 1829–30); published *The Writings of George Washington, with a Life of the Author* (12 vols., 1834–37); *The Life of Gouverneur Morris* (3 vols., 1832); conducted two series of a valuable *Library of American Biography* (1st Series, 10 vols., 1834–38; 2d Series, 15 vols., 1844–48), for which he wrote several of the lives; edited *The Works of Benjamin Franklin, with Notes and a Life of the Author* (10 vols., 1836–40), and *The Correspondence of the American Revolution* (4 vols., 1854); published two or three controversial pamphlets in defence of his editorial conduct in correcting Washington's orthography and grammar, and upon other similar topics. Dr. Sparks was McLean professor of history at Harvard 1839–49, and president of that institution 1849–53. D. at Cambridge Mar. 14, 1866. A *Memoir* by Rev. George E. Ellis, D. D., was published in 1869.

**Spar'land,** p.-v., Whitefield tp., Marshall co., Ill., on Illinois River and on Chicago Rock Island and Pacific R. R., has coal-mines, distilleries, and 1 weekly newspaper. P. 558.

**Spar'row** [Ang.-Sax. *spearwa*], a name applied in English-speaking countries to numerous small birds, chiefly belonging to the family Fringillidæ. (1) The common sparrow of Britain is the *Pyrgita domestica* or *Passer domesticus*. This is a rather strikingly colored bird. The sexes are differently colored: in the male the head is bluish-gray above, with a black band from the base of the bill to the eye, and a longitudinal black streak behind; whitish on the cheeks, and rich rufous brown over the ear and nape of the neck; the back is rufous; the wings also rufous, with the centre of each feather nearly black and with a rather broad transverse whitish band; the chin and throat are black; the breast grayish-brown spotted with white; the belly grayish-white; the length rather exceeds six inches. It is one of the most common and familiarly known of European birds, and is found all through Europe, as well as in Northern Africa and corresponding climatic regions in Asia. It is a sociable, fearless, and rather aggressive species, and seeks the haunts of men, being the most common bird of the cities. The sexes pair early in spring, and are very prolific, having several broods in the course of a year, and five to seven in each brood. They are very careful of their young. The species has been acclimatized in the U. S., and is now common in a number of cities. According to Dr. Brewer, it was introduced into Portland, Me., in 1858, by Mr. Deblois; into New York in 1860 and following years by Mr. E. Schieffelin and (in 1864) the Central Park commissioners; into Boston in 1868 by the city government; into Philadelphia in 1869 by the municipal authorities; and into Washington in 1871 by the Smithsonian Institution. It is now common in all those cities, and has spread into the surrounding country. It is also abundant in St. Louis, Salt Lake City, Havana, etc. (2) Nearly allied to the common sparrow is the tree or mountain sparrow (*Pyrgita montana*). In this the sexes are little differentiated; the head and neck are chestnut, white on each side of the neck, and under the eye and over the ear is a narrow black streak; on the cheeks and sides of the neck a triangular black spot; the back and wings are reddish-brown, streaked with black, and crossed by two narrow transverse whitish bands; the chin and throat are black; the breast and belly brownish-white; the length is about five inches and a half, the male somewhat exceeding, and the female rather less than the mean. The species has not quite as extensive a range as the common sparrow, and is comparatively rare in at least many parts of Britain. It is, on the whole, similar in its habits to its congener, but not so prone to settle in cities. Its popular name, "tree sparrow," is due to the belief that it lives and nests

more in trees than the common species, but it also often builds in company with the latter. It has been introduced into the U. S. to a small extent with the common sparrow, and specimens have been obtained at St. Louis. Both these species belong to a group characterized by a robust swollen bill, the lower mandible of which is narrower than the upper.

All the indigenous American "sparrows" have a more slender conic bill, whose lower mandible is as wide as the upper. The species to which the name is applied are numerous; recent ornithologists (*e. g.* Baird, Brewer, and Ridgway) recognize the name in connection with 3 species of *Passerculus*, 4 of *Zonotrichia*, 3 of *Poospiza*, 5 of *Spizella*, 3 of *Melospiza*, 3 of *Peucæa*, 1 of *Embernagra*, and 2 of *Passerella*. The most familiar of these, at least in the Eastern States, is the *Spizella socialis*, called "chipping sparrow" or "chippy."

A prolonged discussion was carried on recently in several journals as to the relations of the common sparrow (*Pyrgita domestica*) to other birds, some contending that it drove the native species away, while others urged that it did not materially interfere with them. It is claimed that the species has proved of service by destroying the measure-worms which formerly infested shade trees in the parks of the several cities. THEODORE GILL.

**Sparrow-Hawk,** a name given to several forms of the genus *Falco* and sub-genus *Tinnunculus*. They are comparatively small species, whose wings have each two primaries emarginated along their inner webs, the second to third longest, and the first shorter than the fourth; the tarsus longer than the middle claw; and the basal joints of the toes provided with transverse scutellæ; the color of the sexes is very different at all ages, but the old and young of each sex are alike. The common American species is *Falco* (*Tinnunculus*) *sparverius*. Its diagnostic characteristics are the bluish crown (with or without a patch of rufous), whitish front and auriculars, conspicuous "moustache" across the cheeks, the rufous back, the white or whitish abdomen, and the barring of the inner webs of the primaries with white and dusky; in the male the upper part of the head, as well as wings, is ashy-blue or slate-colored, the scapulars, back, rump, and tail rufous; the primaries, secondaries at their basal halves, and broad subterminal band of tail, black; in the female the head is bluish above, but the bluish on other parts is replaced by rufous, which is barred with blackish. Its length is about a foot. The species is an inhabitant of North as well as South America, but is divided by Ridgway into five sub-species or races, limited to various countries; the only U. S. form is the typical *Sparverius*, and this is found from the subpolar regions to the Isthmus of Panama. It preys upon small birds as well as mice and reptiles. It may be frequently seen perched on the top of a tree nearly erect and motionless, surveying the country around. It breeds in the Northern U. S. as well as farther N., and selects for its nest a hollow tree, in which it lays five to seven dark cream-colored, nearly spherical eggs. It often makes incursions upon poultry-yards for chickens. THEODORE GILL.

**Spar'ta.** The Greek name of the city signifies "sown land" (σπαρτή, sc. γῆ), and in truth it is characteristic of the city that it did not stand upon rocky heights, as was the case with nearly all Hellenic towns, but upon a group of knolls, which are seen on the right bank of the Eurotas, an hour's journey E. of Mistra, at the spot where now stands a new Sparta. The first glance at the surroundings makes it clear that the springing up of a city in this place was only accidental; it was the camp of the Dorians, who, coming from the N., gained a firm foothold first on this spot, while the Achaians still held possession of the strongholds and cities of the land. The place was marked by an island which at this point divides the Eurotas into two arms, and thus forms a natural crossing. Four cantons were situated here in the pre-Dorian times—Limnai, Kynosura, Mesoa, Pitane. Limnai and Pitane lay in the low lands by the river, and a very ancient bloody Artemis worship united these districts. The centre of the Dorian city was upon the hill, whose southern slope still shows to view the imposing ruins of a marble theatre. Of all the hills, this alone has a considerable level space at the summit, on which lay the sanctuary of the goddess of the acropolis, Athena Chalkioikos, so called because the walls, according to the oldest style of building, were covered with bronze plates, the work of the architect, sculptor, and poet Gitiadas. The large space of low ground E. of the acropolis was occupied by the market-place, in which centred the traffic of all Laconia. A portion of this space, bearing the name Choros, was designed for the representation of festival dances, and this part must be conceived of as within sight of the theatre. The most beautiful side of the market-place was formed by the Persian porch, the entablature of which was supported by figures of barbarians, among them portrait-statues of Mardonius and Artemisia. The market-place was also the seat of government, where the gerontes had their council-house, and the ephors their place of assemblage and archives. The market-place had three outlets. From the first led the street Aphetais (*i. e.* "race-course," *corso*) toward the southern plain. By the second outlet was the Skias, a large pavilion-shaped rotunda, the work of Theodoros of Samos: this building was arranged for assemblies, and lay near the Karneion, the seat of the worship of Apollo Karneios. A third street led from the market-place past the theatre to the tombs of the Agiadæ. While the principal streets led from the market-place toward the plain which stretched out in the direction of the Taygetos range, a hollow way passed through the group of hills to the Eurotas, where, not far from the acropolis, theatre, and market-place, but at the same time in the rural freedom of the river-bank, extended the quarter of the Pitanatæ, esteemed the most beautiful and desirable portion of the city. Down-stream, where the river-bank widened, stretched the dromos, an enclosed space near the gymnasium and stadium, and constituting the training-school of the young Spartans. Next to it, where the bank became still broader, was the so-called Platanistas, low land overgrown with plane trees and intersected by canals, where the young men, divided into two hostile bodies, executed their unarmed but not bloodless mock fights. To the left of the Eurotas extended the Menelaion, which towers above river and plain in the same manner as does the Janiculum above the Tiber. An ancient bridge, the foundations of which still exist, led from Pitane to the hill-top, where the temple of Menelaos and Helena was seen from far crowning a cliff 700 feet in height. Thither thronged the men and women through the festive street, the former praying to Menelaos for success in war, the latter to Helena for the gift of beauty. (*Herodot.*, vi. 61.) A large number of leaden votive figures have been found in the ruins. The Menelaion was situated in Therapne: Therapne was the acropolis long before in the Achaian times: in its recesses lay the Dioscuri at rest, "changing day and day." (*Pind. Nem.*, x. 55.)

The appearance of Sparta was different from all other Grecian cities. The situation had nothing imposing in it. The small hilly undulations by the Eurotas vanish in face of the enormous rocky walls of Taygetos, which rise steeply from the plain to a height of 7500 feet. No monuments exist which characterize the mistress of Hellas. The whole locality gives only the impression of rural grace, and the prophetic words of Thukydides (i. 10) have been literally fulfilled, that in contrast to Athens, Sparta's ruins would give no sign of the former greatness of the city. And yet the historic character of Sparta is to be plainly seen in all the surroundings. The old city never confined itself within narrow walls; the citizens dwelt beside each other, as it were, in the open country. The canals, whose ditches are seen extending diagonally over the site of the old city, watered the gardens and plantations; there was no distinction between town and country. The laws of Lycurgus forbade the luxury of municipal architecture, even the dwellings of the kings preserved a patriarchal simplicity. The city, as she became powerful, was filled with votive offerings to the gods, especially with tripods, but the sacred centre of the land was not Sparta, but the Amyklaion. In Sparta also, after the Persian wars, a more imposing style of architecture was introduced, as is shown by the Persian porch; but the more Athens took the lead in the arts, so much the more remained Sparta behind, and even Lysander's victories brought the city no new adornments. It only lost more and more its old Doric character; the dwindling numbers of the citizens drew closer together; they themselves were no longer a sufficient protection; ditches and entrenchments were constructed against Demetrius (296), and against Pyrrhus (279), and at last the city was enclosed with a wall whose extent Polybios gives as 48 stadia (ix. 21). As Polybios says that Sparta within this circuit was much larger than Megalopolis within its wall of 50 stadia, we must conclude that the wall had a circular form and the city a dense population. The wall was a symptom of degeneration and loss of freedom (*Livius*, 39, 37); even under the tyrant Nabis it did not enclose the town completely, but only protected the open sides. It was restored after the capture of the city under Philopoimen, and remained under the Romans, under whose sway Sparta was one of the most populous and prosperous cities of the peninsula.

As Sparta was never destroyed in antiquity, and was uninhabited in the Middle Ages, it is reasonable to suppose that many antiquities will be found in the deep soil. Very remarkable reliefs of the old style have come to light in the last few years; especially worthy of mention is the four-sided pedestal with the reliefs, published in the *Annali del*

*Instituto* (1861, tav. d'agg. C), and the relief with Dionysos and Ariadne (1870, p. 272). Since the foundation of the kingdom of Greece the capital city of the Eurotas Valley is no longer Mistra, situated near Taygetos, but has been removed again to the Eurotas, and New Sparta spreads itself out on the hills of the old city. ERNST CURTIUS.

**Sparta,** p.-v. and tp., Conecuh co., Ala., on Mobile and Montgomery R. R. P. 913.

**Sparta,** p.-v., cap. of Hancock co., Ga., on Macon and Augusta R. R., contains 7 churches (3 colored), an academy, a weekly newspaper, 1 cotton-factory, a steam sawmill, and 1 hotel. P. about 1500.

ELAM CHRISTIAN, ED. "TIMES AND PLANTER."

**Sparta,** tp., Knox co., Ill. P. 1950.

**Sparta,** city, Randolph co., Ill., on Cairo and St. Louis R. R., 50 miles S. of St. Louis, Mo., was first settled in 1829 under the name of Columbus, but changed to Sparta in 1840; contains 6 churches, a public library, a high school, 1 bank, 1 newspaper, 3 flouring and 2 woollen mills, 2 large plough-factories, and 4 wagon and carriage factories. P. 1335. S. LOVEJOY TAYLOR, ED. "PLAINDEALER."

**Sparta,** p.-v. and tp., Dearborn co., Ind., on Ohio and Mississippi R. R. P. 1939.

**Sparta,** tp., Noble co., Ind. P. 1381.

**Sparta,** p.-v., cap. of Bienville parish, La., has 1 newspaper and a thriving trade.

**Sparta,** v. and tp., Kent co., Mich., on Grand Rapids Newaygo and Lake Shore R. R. P. 1666.

**Sparta,** tp., Chippewa co., Minn. P. 275.

**Sparta,** p.-v., Chickasaw co., Miss. P. 99.

**Sparta,** p.-v. and tp., Sussex co., N. J., on Sussex R. R. P. 2032.

**Sparta,** v. and tp., Livingston co., N. Y., on Canaseraga Creek. Daniel Shays, the leader of "Shays's rebellion" in Massachusetts, was an early settler, and d. here Sept. 29, 1825. P. 1182.

**Sparta,** p.-v. and tp., Edgecombe co., N. C. P. 1522.

**Sparta,** p.-v., Bloomfield tp., Morrow co., O. P. 197.

**Sparta,** tp., Crawford co., Pa. P. 1131.

**Sparta,** p.-v., cap. of White co., Tenn., has 1 weekly newspaper. P. 414.

**Sparta,** p.-v. and tp., cap. of Monroe co., Wis., in the heart of La Crosse Valley, at the junction of Chicago Milwaukee and St. Paul and Chicago and North-western R. Rs., has 6 churches, excellent schools, 2 banks, 2 newspapers, a public library and reading-room, paper, woollen, and flouring mills, carriage-works, machine-shops, a large pork-packing establishment, several hotels, and medicinal springs. P. of v. 2314; of tp. 3461.

D. W. C. WILSON, ED. "MONROE CO. REPUBLICAN."

**Spar'tacus,** b. in Thrace, and educated as a shepherd; became afterward chief of a gang of robbers, but was captured by the Romans, sold as a slave, and trained as a gladiator in a school at Capua. By showing how much better it would be to die in an attempt at freedom than to be butchered for a Roman holiday in the arena, he succeeded in forming a conspiracy among the pupils of the schools, numbering 200, mostly Gauls and Thracians. But the conspiracy was discovered, and only 70 of the members, among whom were Spartacus and some of the other leaders, escaped. From a cook's shop they snatched some spits and cleavers, fought their way through the streets and gates of Capua, pillaged a train of wagons laden with arms which they met on the road, and took refuge in the crater of Vesuvius. Here they were soon joined by numbers of runaway slaves; an organization was accomplished, Spartacus was chosen leader, Crixus and Œnomaus, two Gauls, his lieutenants, and formidable predatory expeditions were undertaken against the neighboring towns. C. Claudius Pulcher was then sent against them, and blockaded them in the crater with an army of 3000 men. But on ladders twisted of wild vines Spartacus led his troops down through one of the most impracticable, hence the least guarded, fissures of the crater, attacked C. Claudius Pulcher unexpectedly in the rear, and annihilated his army. After this success the insignificant mutiny of a few slaves rapidly grew into a formidable war. The peculiar state of affairs in Southern Italy contributed much to this result. The numerous villages, with their free agricultural population, which formerly flourished in these regions, had entirely disappeared during the wars by which Rome finally subjugated and annexed the country. The bad policy of the Roman statesmen, the insatiable greed of the Roman nobility, and a thirst after vengeance in the Roman people had caused this widespread devastation. The soil was now almost exclusively owned or leased in large allotments by the Roman nobles, who raised immense flocks here or cultivated extensive olive-plantations and vineyards by means of a numerous slave population, which lived in the most abject condition. Spartacus proclaimed the abolition of slavery, and before long he was at the head of an army of 70,000 men. Cities were conquered, armies were routed, and Rome seemed to be on the very verge of ruin. Spartacus, however, had a just idea of the enormous resources which the city could command in an emergency. He never dreamed of conquering it. His plan was simply to force the passes of the Alps, lead his army out of Italy, and then send every man to his home. With a victorious army of about 100,000 men he passed by Rome, and penetrated into the regions of the Po, where he was met by two consular armies. He defeated and routed them both, and at the funeral games which he celebrated in honor of Crixus he compelled the Roman knights among his prisoners to fight as gladiators in the arena, while their former slaves sat in the amphitheatre as spectators and applauded them. These victories, however, which prove that he must have been possessed of considerable military talent, made it difficult for him to command his own army. His soldiers were allured by the prospect of booty, and refused to leave Italy. He returned to Southern Italy, and went into winter quarters in Thurii. Meanwhile, dissensions arose in his camp. The Gauls separated and formed an independent army, which was speedily annihilated by the Roman generals. The discipline in the main army became weakened, and the situation soon became difficult. Spartacus knew very well that by force he could never compel Rome, but he hoped to come to terms with her by carrying the war over to Sicily, the cornfield of Rome, where a recent and very dangerous slave insurrection was not yet wholly extinguished. He hired the fleet of the Cilician pirates to carry him across the strait, but they betrayed him, and delivered up a part of his army to the prætor, Licinius Crassus, who blockaded him at the extreme point of Bruttium. An attempt to cross on rafts and wicker boats failed, and he was nearly lost, when by a violent assault he broke through the intrenchments of Crassus, and once more made Rome tremble. Lucullus was now recalled from the East, Pompey from the West. After new victories, Spartacus turned toward Brundisium with the purpose of seizing the shipping in the harbor and crossing over to Thrace. But Lucullus had just landed here from Epirus. Turning back, he fell in with the army of Crassus, near the source of the river Silarus, and, well aware that the final moment approached, he killed his war-horse in front of his army and plunged himself into the midst of the desperate struggle, in which he was killed. His army was cut to pieces and dispersed. One remnant of it was destroyed a few days afterward by Pompey; 6000 fugitives were crucified along the Via Appia; and thus ended the Servile War, which had lasted only two years (73–71 B. C.), but which was not so soon forgotten. Later Roman authors, among whom are Cicero, Horace, etc., never become tired of vilifying the slave-leader; but their invectives appear inappropriate and time-serving to modern eyes; for his cause was just, his talents admirable, and his character by no means destitute of grandeur and elevation. CLEMENS PETERSEN.

**Spar'tanburg,** county of N. W. South Carolina, bordering on North Carolina, watered by affluents of Broad River, and traversed by Spartanburg and Union and Atlanta and Richmond Air-line R. Rs., has a hilly surface, but productive soil. Cattle, horses, sheep, and swine are numerous, and it has several cotton and flour mills. Staples, Indian corn, wheat, oats, sweet potatoes, cotton, a little tobacco, butter, and wool. Cap. Spartanburg. Area, about 900 sq. m. Pop. 25,784.

**Spartanburg,** p.-v., Green's Fork tp., Randolph co., Ind. P. 192.

**Spartanburg,** p.-v. and tp., cap. of Spartanburg co., S. C., on Piedmont Air-line, Spartanburg and Union, and Spartanburg and Ashville R. Rs., contains Wofford College, a female seminary, orphans' home, 3 newspapers, 2 banks, 2 large hotels, 2 carriage and wagon factories, and excellent water-power. P. of v. 1080; of tp. 2669.

F. M. BROWNE, ED. "SEMI-WEEKLY SENTINEL."

**Spartansburg,** p.-v., Sparta tp., Crawford co., Pa., on Pittsburg Titusville and Buffalo R. R. P. 457.

**Spartianus** (ÆLIUS). See LAMPRIDIUS.

**Spasm** [Gr. σπασμός, from σπᾶν, to "draw or stretch"], sudden and involuntary muscular contraction. The relaxation and tension of muscular tissue are dependent on nerve-force. Spasm of muscle may result from disturbance of the nerve-centres, from peripheral irritation of the affected part, or from irritation of other organs or surfaces, reflected from the nerve-centres. When spasmodic rigidity is persistent for any length of time, it is termed *tonic* spasm. Such is the period of rigidity at the beginning of the epileptic attack and the prolonged rigidity of tetanus and cerebro-spinal meningitis. When spasm is brief and re-

curs rapidly, it is termed *clonic* spasm. Such are the intermitting and repeated muscular contractions following the inception of the true epileptic attack, and constituting the more ordinary epileptiform attacks or "fits" of children, the contractions of chorea and of hysterical seizures. The graver spasmodic diseases are true epilepsy, epileptiform attacks from many causes, as indigestion and worms in children, renal disease in adults, and in the course of severe acute diseases, narcotic poisoning, etc., chorea or "St. Vitus's dance," tetanus, hydrophobia. Many lesser and local states of spasm frequently occur. Sneezing and coughing are spasmodic contractions of the respiratory tracts excited by irritation of the nasal or bronchial mucous membrane. Spasm of the larynx in nervous temperaments causes aphonia. Asthma is spasmodic constriction of many bronchial tubes, producing dyspnœa. Whooping-cough unites extreme hyperæsthesia and spasm of the bronchi with spasmodic constriction at the larynx—a succession of violent expiratory spasms or coughs, followed by a sonorous or whooping inspiratory sound. Spasm of the heart, evidenced by dyspnœa, præcardial distress, and disturbed circulation, by intermitting and irregular heart-beats, has many causes—excess of food, indigestion, narcotic depression. Angina pectoris, or spasm of the heart, with associated spasm of the thoracic walls, is frequently due to disease of the coronary arteries, the nutrient vessels of the heart-wall. Spasm of the diaphragm may be due to indigestion, to taking cold, or to gouty or rheumatic vice. Intestinal colic and cholera morbus are conditions of painful spasmodic constriction of the intestines, due to cold or bad diet. In invalids and persons of sensitive nervous system painful spasms of various internal and external parts may develop suddenly from unknown or trivial exciting causes. The immediate relief of spasm is secured by so-called antispasmodics or nervines, as valerian, musk, camphor; by anæsthetics, narcotics, and sedatives, as bromide of potash, hyoscyamus, belladonna, opium. The permanent cure, when admissible, demands the correction of known causes, as debility, indigestion, and the rheumatic, gouty, and other blood-taints.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Spathe** [Gr. *σπάθη*, a word allied to our *spade*], the single sheathing bract which encloses a cluster of one or more flowers in many species of endogenous plants. Sometimes the enclosed flowers are arranged on a spike of the form called *spadix* (*σπάδιξ*), and in numerous palms the spadix is branching, and besides the principal spathe there are numerous secondary ones on the spadix.

**Spathic Iron Ore.** See Iron, Ores of, by John B. Pearse.

**Spauld'ing,** tp., Prince George's co., Md., on Potomac River, adjoining the District of Columbia. P. 1687.

**Spaulding,** tp., Saginaw co., Mich., includes p.-v. of South Saginaw. P. 2117.

**Spaulding** (Elbridge Gerry), b. at Summer Hill, Cayuga co., N. Y., Feb. 24, 1809; educated at Auburn Academy; taught school; studied law; was admitted to the bar in Genesee co.; removed to Buffalo 1834; became solicitor and councillor in chancery, city clerk, and alderman; was chosen mayor 1847; member of the State assembly 1848; member of Congress 1849–51, and again 1859–63; State treasurer 1854–55; was member of the canal board two years, and for several years president of the Farmers' and Mechanics' Bank of Genesee at Buffalo. He served in Congress on the committees on foreign affairs and on ways and means, and has published a number of speeches and pamphlets on finance and general politics.

**Spaulding** (Levi), b. at Jaffrey, N. H., Aug. 22, 1791; graduated at Dartmouth College 1815 and at Andover 1818; went to Jaffna, Ceylon, as a missionary of the American Board; remained on that island fifty-three years, during which time he made but one visit to the U. S. (1844); superintended a female boarding-school at Oodooville; prepared tracts, hymns, and schoolbooks in the Tamil language, into which he translated several religious works; prepared (with Rev. J. Knight) a *Tamil Dictionary* (Madras, 1844), and issued a revised translation of the Bible. D. in Ceylon June 18, 1873, being then the oldest missionary of the American Board.

**Spav'in** [It. *spavenio*], certain swellings upon the hock-joint of the horse. In the parlance of the stable the name "spavin" is applied to two entirely dissimilar diseases. In "bog spavin" and "blood spavin" the swellings and lameness, if there be lameness, are due to undue secretion of *synovia* (the lubricating fluid of joints and parts subjected to friction) in the hock-joint or in the sacs (*bursæ mucosæ*) which are located upon or near the hock. "Thoroughpin" is identical in character and similarly located, and is distinguished by the fluid occupying two connected cavities, into either of which it may be forced by gentle pressure, and so back and forth. These swellings amount to a deformity, but are seldom, if let alone, a serious inconvenience to the animal, although it may be otherwise in the worst forms of the disease. They are, however, unsightly and difficult of reduction. The lameness which sometimes accompanies them, observable when the horse is first taken out of the stable, is due to the inflammation of the synovial membrane of the joint, which is indeed the cause of the excessive secretion of the fluid. The most successful treatment is entire rest, with frequent bathing of the parts with cold water, and bandaging, accompanied by firm pressure upon the swelling, secured by means of compresses or spring trusses. Blistering is of little or no avail. Bone spavin, or spavin proper, is bony enlargement (exostosis) of the hock-joint, usually commencing at the lower part of the joint on the inside, and involving the heads of the splint and cannon bones, and of the small bones with which they articulate. It causes lameness, observable even in the early stages, and an imperfect action of the joint, gradually growing worse until finally the various bones become to a great extent united and solidified by the mass of fibrous bone which grows over them. The disease is caused by strains, to which the hock is particularly subject in work-horses drawing heavy loads, especially when starting them, and in race-horses and saddle-horses accustomed to leaping. The lameness caused by spavin in its incipiency is most observable when the horse is first taken out from the stable. Even before this is much noticeable, a slight swelling may be detected upon the inside of the hock in front of the middle of the joint. To see this distinctly, both hocks should be examined and compared with care, for the shape of this joint—and of all joints—in different horses varies considerably, but the corresponding processes upon different legs of the same horse will be alike if both are sound. When taken early, rest and counter-irritants will effect a cure; but when a considerable growth of bone has taken place, no absorption sufficient to cause a permanent cure can be expected, although setons, iodine blisters, or firing may cause an absorption of the bony excrescence, or even of the contiguous bone to some extent. The wisest course in an attempt to cure a spavined horse, when the disease is taken early, is to turn the animal out to grass, or otherwise regulate his diet so that his food shall be nutritious yet cooling, and moderately loosening to the bowels. At the same time, the "spavin-place" may be bathed for a week daily with salt and vinegar, and then a blistering salve of biniodide of mercury rubbed in upon the spavin. The salve may be applied once in three or four days, and both the strength and frequency of the application should be graduated according to the amount of excitement produced in the skin, avoiding any considerable blistering, but maintaining irritation upon the surface. After several applications, the spavin may be let alone until all heat and evidence of excitement in the skin have gone down, and the treatment then renewed. When not taken at its earliest stage, entire rest in the stall will promote a solid union (ankylosis) of the bones affected, and cooling lotions, salt and vinegar and iodide of potassium in solution in water, with attention to diet, will reduce the swelling of the contiguous parts, which is often considerable. Thus, after a while the horse will be able to labor with little or no pain, but with more or less stiffness of the joint. Severe blistering and the use of the firing-iron are, as a rule, not advisable, and should never be resorted to except as applied by a veterinary surgeon of education and responsibility—never by a farrier. Though caused by strains and overwork, spavin is peculiarly hereditary, and a spavined horse or mare should never be used as a breeder. M. C. Weld.

**Speak'er,** p.-v. and tp., Sanilac co., Mich. P. 1118.

**Speaker of the House,** the presiding officer of the British Houses of Parliament, of the House of Representatives of the Congress of the U. S., of the lower houses of State legislatures, etc. In the parliamentary bodies of many of the British colonies the name and office of Speaker are also retained. In England the title was first applied to Sir Thomas Hungerford in 1376 (*temp.* Edward III.), Speaker of the Commons, but the office is much more ancient. The lord chancellor is usually the Speaker of the House of Lords. As the representative of the House, the Speaker communicates its resolutions to others and conveys its thanks or censures. He is thus the mouthpiece of the House, whence his title seems to be derived. In the U. S. House of Representatives the Speaker presides over the deliberations of that body, appoints its committees, supervises its journal, certifies to the amount of compensation due its members, signs its bills, resolutions, writs, warrants, subpœnas, etc., and appoints three regents of the Smithsonian Institution. He votes in cases of ballot, and has a casting vote in some other cases. He is chosen

by the House from its own number, and can be removed from office by the House.

**Speak'ing-trumpet,** an instrument usually in the form of a hollow truncated cone, the mouth-piece at the smaller end, and the larger end with a reflected lip. It is used for intensifying the sound of human speech and causing its further propagation in one direction. Its chief uses are on shipboard and in giving commands to firemen during conflagrations. The trumpet is of wood or metal. Its invention is ascribed to Kircher and to Sir Samuel Moreland, but the instrument was well known long before their time; and Alexander the Great, we are told, made use of it in his wars. The theory of the action of this instrument has never been thoroughly explained.

**Spear** (Samuel P.), b. at Boston, Mass., in 1815; entered the U. S. army 1833; served in the 2d Dragoons through the Florida war, and in all the battles of the Mexican war under Gen. Scott, being wounded at Cerro Gordo; was stationed on the frontier 1848–61, taking part in the Utah expedition under Gen. A. S. Johnston; raised and commanded during the civil war the 11th Pennsylvania Cavalry, which did good service in scouting; was wounded twice at Five Forks; was made brigadier-general and brevet major-general; suffered during his last years from a slow disease contracted in the service, and after long illness d. in St. Luke's Hospital, New York City, May 5, 1875.

**Spear** (Samuel Thayer), D. D., b. at Ballston Spa, N. Y., Mar. 14, 1812; graduated as a doctor of medicine Apr. 15, 1833, at the College of Physicians and Surgeons in the city of New York; studied theology under Rev. Dr. Beman of Troy, N. Y.; was ordained and installed over the Second Presbyterian church of Lansingburg, N. Y., 1835; in 1848 accepted a call from the South Presbyterian church in Brooklyn, N. Y., and in 1870 became one of the editors of the *Independent*, which position he now (1876) holds. His publications are *The Family Power, Eighteen Sermons on the Rebellion*, preached during the war, ten essays in various quarterly periodicals, *The Legal-Tender Acts considered in Relation to their Constitutionality and Political Economy*. He has in press a work to be entitled *Religion and the State, or the Bible and the Public Schools*.

R. D. Hitchcock.

**Spearman's,** tp., Shelby co., Ala. P. 500.

**Spear'mint** (*M. viridis*), a species of plant of the genus *Mentha* and order Labiatæ, found abundantly in Europe and the U. S., generally upon moist soil; is frequently cultivated for the sake of its leaves, which are used as the chief ingredient in a popular sauce for roast meats and for imparting a flavor to alcoholic beverages. An oil is also distilled from spearmint, and from this an essence is prepared, both possessing valuable medicinal uses. The common spearmint is a handsome plant, with deep-green, lanceolate, acutely serrate, and nearly sessile leaves, and pale purple flower springing from an erect stem, usually two feet in height.

**Spe'cies** [Lat.], in logic, denotes a group of individuals agreeing in common attributes and designated by a common name, this group of individuals being one of several groups agreeing with it in some of the common attributes, and included with those groups under a common name called the *genus*. Thus, genus and species are relative terms, and the same concept may be a genus when considered in relation to subordinate concepts, which are its species, or a species when considered as subordinate to a more general concept. Thus, *man* is a genus with reference to *negro, Indian, European*, etc., and a species with reference to *animal, biped*, etc. While the *summum genus* can never in turn be species, the *infima species* is the species which can never become *genus*, but can contain only individuals. There can be only one *summum genus*, but there is practically no limit to the number of species, and hence it is next to impossible to ascertain the *infima species*. The species has greater comprehension (*i. e.* more attributes belong to it) and less extension (includes fewer individuals) than the genus.

Species, in perception, is a term used formerly in explaining the process of external perception. It was maintained that external objects send forth *species* or images of themselves, which make impressions on the bodily organs and imprint themselves on the mind. A *sensible species* was the resulting impression upon the senses; an *intelligible species* the concept of the understanding. William of Occam and his followers vigorously combated this theory of vicarious species, as indeed Reid and the Scotch school have done recently. Apart from this theory, however, the question of the reality corresponding to the species was discussed by the Nominalists and Realists (which see), and forms one of the most interesting themes in the history of philosophy.

William T. Harris.

**Specification.** See Patents, Laws relating to, by George Gifford.

**Specific Gravity.** See Gravity, Specific, by Pres. F. A. P. Barnard.

**Specific Heats.** See Heat, by Prof. W. P. Trowbridge, A. M.

**Specif'ic Perform'ance.** This term belongs to the equitable jurisprudence of the U. S. and of England, and denotes the species of remedy conferred by courts of equity, in which a party is compelled to perform the very thing which he has undertaken to perform in behalf of the person to whom the undertaking is given. In its broadest sense the phrase would properly describe all the varieties of equitable relief, which consist in procuring a defendant upon whom an obligation rests to do the very specific acts which such obligation requires him to do; but in its technical and more restricted signification it is confined to cases in which the obligation arises out of a contract entered into by the defendant. The common law knows but one form of remedy for the breach of any and all contracts—a recovery of money either as debt or damages. Whatever be the nature of the agreement, whatever be its subject-matter, whatever acts or omissions it calls for, a pecuniary compensation for its non-performance is the only judgment that can ever be obtained against the defaulting party by means of the common-law courts. It is very plain that in the innumerable variety of relations incident to modern society contracts will necessarily be made for whose breach this mere pecuniary payment would be an utterly inadequate, and often impracticable, relief; and a system of municipal law which provided no other kind would fail in maintaining and dispensing the justice which is the final object of all enlightened jurisprudence. To supply this defect in the common-law methods the courts of equity began long since to decree the specific performance of contracts in certain cases; and the general principles which determine the classes of agreements to which this remedy may be applied are now ascertained and well settled, and constitute a distinct department of equity. The doctrine as thus established will be shown in the simplest and clearest manner by enumerating the instances in which a specific performance will not be decreed, and which are therefore left within the exclusive jurisdiction of the common-law tribunals and to the application of the common-law remedies: (1) The fundamental and most important rule is, that a specific performance will not be ordered when the complaining party can obtain adequate relief by means of a purely legal judgment. If, therefore, the contract vests the plaintiff with property in a chattel, so that he can recover its possession through an action at law, or if by the money recovered he can restore himself to the same position, in contemplation of law, which he would have occupied if the defendant had fulfilled his agreement, he will be left to his legal remedy alone, and courts of equity will not interfere in his behalf. As an illustration: If the contract relates to ordinary goods and chattels, or to any kind of personal property having a marketable value, and contemplates a delivery thereof in any manner or a transfer of title, since a sufficient sum of money paid to the injured party will always enable him to purchase or procure other articles of a like nature, amount, and value to those stipulated for, such a pecuniary compensation is deemed an adequate remedy, and a specific performance will be refused. The example here given, and the fundamental rule which it illustrates, have a very wide application, and they remove at one blow all ordinary agreements concerning personal property, especially those which are mercantile in their character, from the operation of this equitable mode of enforcement. The mere fact, however, that an agreement deals with or relates to personal property does not necessarily withdraw it from the jurisdiction of a court of equity. The subject-matter may be a chattel of some peculiar, intrinsic, but not marketable value, which cannot be elsewhere purchased or reproduced, so that pecuniary damages will not compensate for its loss; and in such cases, although they are exceedingly rare, the specific relief may be obtained. A certain class of covenants, also, wherein the parties promise to execute some further and more formal agreements—as, for example, to execute a marriage or family settlement on wife and children—may be specifically enforced by compelling an execution of the contemplated instrument, although it relates to personal property and not to real estate. These instances, however, are comparatively few, and in the vast majority of contracts concerning personal property or personal services the money-recovery granted by the law-courts is regarded as an adequate relief, and the extraordinary remedy administered by the equity tribunals is denied. In all the subsequent rules it is of course assumed that the agreement, if judged by the principle alone

which has already been stated, is one to which the equitable method of enforcement might be applied. (2) In order that a specific performance may be decreed, such a performance must be reasonably possible by the contracting party. If, therefore, by the original terms of the contract he did not have the power to fulfil, or if from circumstances occurring after its execution the power has been lost, even though this result is produced by his own voluntary act, a court of equity will not go through the empty form of ordering an impossibility to be accomplished, and the plaintiff must be contented with an award of pecuniary damages, which perhaps may be enhanced by reason of the defendant's conduct. For example, if the owner of a farm should, by a valid agreement of sale, bind himself to convey it to the purchaser on a future day named, but before that time had arrived should actually convey it to another *bonâ-fide* grantee, a specific performance of the contract would not be decreed at the suit of the original vendee, because a transfer of the title to him by the vender would then be impossible, and he would be left to his action for damages. As a corollary of this rule, it is requisite that the terms of the contract should be so plain and unambiguous that there can be no reasonable doubt as to the intention of the parties, and that this design may be directly carried into effect by the judgment. (3) Not only must the performance be possible by the party upon whom the obligation rests, but the subject-matter of the agreement, and its stipulations in regard thereto, must be of such a nature that the court, by means of its ordinary administrative instruments and machinery, can compel the specific performance which it decrees. Cases may arise, and are not infrequent, in which the court, after directing a performance according to the provisions of the contract, would have no power to directly enforce its decision without departing from its customary functions or incurring an amount of trouble, care, and responsibility incompatible with the discharge of its regular duties; a specific performance will then be refused, however inadequate might be a mere recovery of damages. Under the operation of this principle the agreement of an actor, a singer, a painter, or other artist to employ his talents in a specified manner cannot be specifically enforced; and the rule applies in general to all stipulations for personal services, notwithstanding the fact that these services may be of such exceptional value that they cannot be procured from any other person but the defendant. For the same reason, it has been decided that the specific performance of a contract to construct a railroad will not be decreed, since such an undertaking is too extensive and burdensome to be carried on under the direction of a court of equity. (4) Finally, in addition to the foregoing requisites, the agreement and the relations of the parties must be such that a decree of specific performance will be reasonable, just, and equitable. It is sometimes said that this remedy is never a claim of right, but is always a matter of discretion. The doctrine as thus stated simply means that in determining whether the relief shall be granted in a given case certain equitable considerations are to be taken into account, and not the mere fact that the agreement is valid in law. The beneficent principle is applied that he who seeks equity must do equity. If, therefore, the contract was procured by overreaching or artifice, although not so tainted with fraud as to be invalid, if it is unfair or oppressive in its terms, if the consideration is grossly inadequate, if its specific enforcement would be unreasonably burdensome to the defendant without any corresponding benefit to the plaintiff, if the plaintiff has been guilty of unnecessary delay in prosecuting the action whereby his opponent has been prejudiced,—in these and in similar cases showing a want of good faith or diligence on one side or serious injury on the other, the equitable considerations become controlling, and lead to a denial of the specific remedy. As the practical result of the foregoing rules, the usual contracts which are enforced by a decree for a specific performance are those directly relating to land as their subject-matter. It is a settled doctrine of the equity courts that money-damages are not an adequate relief for the breach of such agreements. This conclusion is partly based upon the fact that a special value may be attributed to the very premises bargained for which is not susceptible of pecuniary estimate and compensation, but chiefly upon the pre-eminence which the English law has always given to the ownership of land in comparison with every other species of property. A contract for the conveyance of land, or for the creation of an estate therein, if valid by the statute of frauds, and if complying with the conditions above described, will in general be enforced by a decree of specific performance compelling the execution of the proper instruments and the creation or transfer of the proper interests. What contracts are thus valid under the statute, and how far courts of equity have grafted exceptions upon this enactment, substituting certain acts of the parties—such as the vendee's possession, making improvements, and payment of the price—in place of the written evidence required by the legislature, are questions of the highest importance, but do not legitimately belong to the subject-matter of this article. (See FRAUDS, STATUTE OF.)

JOHN NORTON POMEROY.

**Spec'tacles** [Lat. *spectaculum*], a device for the improvement of defective sight, the invention of which is variously ascribed to Alexander da Spina of Florence, or to his contemporary and fellow-townsman, Salvinus Armatus (d. 1317); also to Roger Bacon (d. about 1292). But it is more probable that the knowledge of them in Europe came through the Saracen Alhazen (d. 1038). The Chinese, we are told, have for ages employed spectacles for the relief of defective eyesight. Spectacles are of various kinds. For long-sighted (presbyopic) persons, whose imperfect vision is due to too great flatness of the lens and cornea, either plano-convex lenses or menisci are employed (the latter, called periscopic glasses, were recommended by Wollaston). Both of these magnify objects and render near objects more distinct. Near-sighted spectacles (for the use of myopic persons, those whose cornea and crystalline lens are too convex) are either plano-concave, concavo-concave, or, in the case of the so-called periscopic glasses, the front is slightly convex and the inside deeply concave. Plane glasses, colored blue, green, or smoky, are used by persons with eyes too sensitive to the light. Cataract-glasses have powerful convex lenses, and are employed by persons whose eyes have been operated upon for cataract. Of late, considerable attention has been given to the examination of each eye, and the careful adaptation of each lens to the needs of the eye it is to serve; since it is very common, especially in myopic or near-sighted persons, to find different degrees of abnormality in the two eyes. Periscopic glasses permit the wearer to examine objects with less turning of the head than others. Many spectacles are sold which, as dealers pretend, have their surfaces ground to a parabolic curve, but the construction of such lenses is difficult and expensive, although it is certain that if properly made there would be somewhat less spherical aberration with such lenses. The best optical glass should be used for spectacles. Brazilian pebble (rock-crystal), first recommended by Brewster, has a very low dispersive effect, and if of perfectly uniform refractive power would consequently be better than glass; but it is stated that in practice it is found defective, and that nearly all the so-called pebble spectacles are of a common grade of glass. (See also OPHTHALMOLOGY.)

**Spectator.** See ADDISON (JOSEPH).

**Spectral Illusions, Delusions, and Hallucinations.** See INSANITY, by W. A. HAMMOND, M. D.

**Spectre,** applied to animals. See LEMUR.

**Spec'troscope** [Lat. *spectrum*, "image," and Gr. σκοπεῖν, to "see"]. An instrument, as its name implies, designed for the formation and examination of spectra. Although as yet (1876) the invention is barely sixteen years old, we already owe to it many of the most remarkable discoveries of modern science. By its means the light from a body, at whatever distance, can be made to tell more or less completely the story of its chemical composition, physical conditions, and motion.

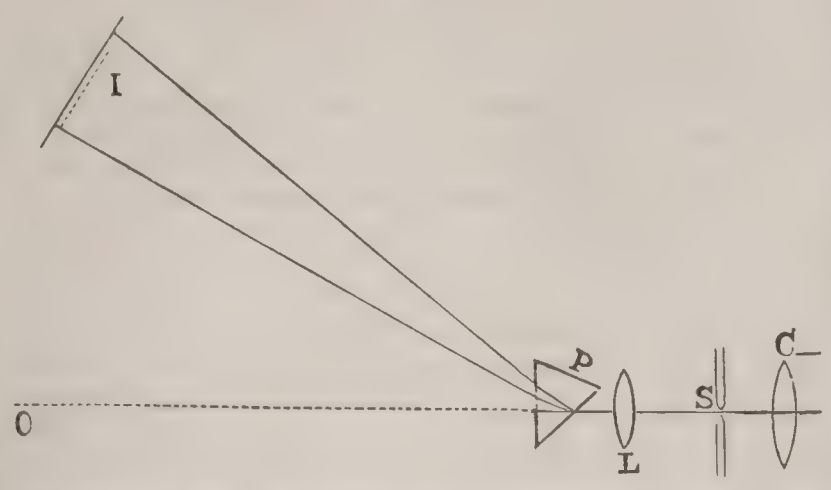
*Newton's Experiment.*—If a beam of sunlight entering a darkened room be made to pass through a triangular prism of glass at the proper angle, the rays will be *refracted* out of their course, the different colors taking slightly divergent paths; if a white screen be now placed so as to receive the refracted beam, there will be formed upon it an elongated band of colored light, red at one extremity and violet at the other, with the remaining hues of the rainbow—orange, yellow, green, blue, and indigo—arranged in order between them. This colored band is called the *solar spectrum*, and the experiment described we owe to Newton, who thus discovered the composition of white light.

*Projection of the Spectrum.*—The spectrum formed in this way is impure, since the different colors overlap each other. But if the light be admitted only through a very narrow slit placed parallel to the edge of the prism, and then, before reaching the prism, be passed through a convex lens so adjusted that if the prism were absent it would form a distinct image of the slit upon the screen, we shall get a pure spectrum, with each tint completely isolated from every other. If sunlight be employed, the spectrum will be marked by numerous faint *dark* lines; if the electric light, it will show *bright* bands and lines. This is the method ordinarily used in exhibiting the phenomena to an audience. The accompanying diagram (Fig. 1) will make the arrangement clear.

*Wollaston's Experiment.*—Another method is simply to look through the prism at a narrow slit from a distance of 20 or 30 feet. It was in this way that, in 1802, Wollaston

first observed a few of the dark lines in the solar spectrum. Some years later, in 1814–15, Fraunhofer, the celebrated op-

FIG. 1.




C, condensing lens, important but not essential; S, slit; L, lens forming image of slit; P, prism; I, spectrum; O, place where image of slit would fall if the prism were removed.

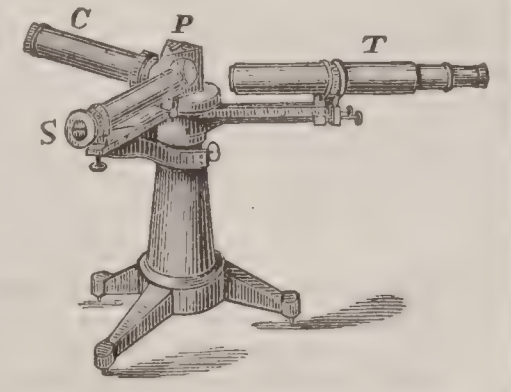
tician of Munich, independently made the same observation, and by substituting for the naked eye a small telescope, greatly increased the power of the apparatus. He made a very careful and accurate map of the spectrum, and to this day its dark lines are known by his name. He also made some observations of a similar nature upon the light of the moon and the stars. He satisfied himself, moreover, that the cause of the lines was not in our atmosphere nor in anything connected with the apparatus.

*The Collimator.*—Either of the arrangements thus far described requires a considerable distance—15 or 20 feet at least—between the slit and the spectrum. Zantedeschi of Milan appears to have been the first to overcome the difficulty in 1846 by the invention of what is called the *collimator* (from the fact that a very similar piece of apparatus is used to determine the collimation of an astronomical instrument). Swan of Edinburgh was an independent inventor of the same contrivance a year later. The collimator is simply a tube closed at one end by a plate of metal perforated with a narrow slit, and at the other by a convex lens whose focal length equals its distance from the slit. The effect is, that rays proceeding from the slit are rendered parallel by passing through the lens, and then behave in all respects as if they came from an infinite distance. *Optically*, the slit is thus transferred to the sky, while mechanically it remains within easy reach of the manipulator.

As ordinarily constructed, the spectroscope consists essentially of three parts—a collimator as above described, a prism or train of prisms, and a small telescope to which the eye is applied in observation: usually, a scale of some kind or a graduated arc is provided for the purpose of determining with accuracy the position of any lines or bands observed in the spectrum.

*The Chemical Spectroscope.*—The annexed figure (Fig. 2) represents the common chemical spectroscope as invented by Kirchhoff in 1859.

FIG. 2.




C is the collimator, carrying at its left-hand extremity the slit, which is usually about $\frac{1}{8}$th of an inch long, and adjustable in width from $\frac{1}{50}$th to $\frac{1}{5000}$th of an inch. The diameter of the collimator is about an inch, and its length from 6 to 8 inches. The prism, generally of flint glass, is at P. It has a refracting angle of about 60°, and plane faces about 1 inch by $1\frac{1}{2}$ inches in surface. It is so placed that the rays entering and emerging may make equal angles with the two surfaces. The telescope T receives the rays after they have passed through the prism. S is a collimator in all respects similar to C, except that instead of a slit it carries at its extremity a small scale photographed on glass. This scale-collimator is so placed that the light coming through it from a candle or gas flame suitably placed is reflected (partially only, of course, but still in sufficient amount) from the anterior face of the prism into the telescope. Thus, the observer sees at the same time the spectrum and immediately above it the scale.

*Formation of the Spectrum—a Congeries of Images of the Slit.*—If the light by which the slit is illuminated be *homogeneous*, the observer looking through the telescope will see simply a single image of the slit, which will widen or narrow to a mere line as the width of the slit is altered by its appropriate adjusting screw. The interposition of the prism between the collimator and telescope in this case merely changes the *direction* in which this image of the slit is seen, making no other difference whatever. If the illumination, instead of being *homogeneous*, contain two or three sorts of light differing in their color, then, instead of one, we shall get two or three separate slit-images or bright lines, the different-colored rays being differently bent by the prism, and thus separated. If the light be white—*i. e.* contain rays of all possible colors in the same proportions as in sunlight—we shall then get a ribbon-like spectrum, formed by an infinity of slit-images placed side by side in contact, thus producing a continuous band. If the light be not white, but either redundant or deficient in any of its component hues, the spectrum will of course be marked by abnormal brightness or darkness in the corresponding region; it will show bands bright or dark.

*Integrating Spectroscope.*—In some cases, and usually in chemical work at least, we wish merely to examine the spectrum of the whole mass of light proceeding from the luminous object, without any special distinction of parts. For this purpose it is only necessary so to direct the collimator that the rays from the central portions of the object shall pass through the slit along the axis of the tube, the object being at such a distance that its angular dimensions as seen from the slit shall not exceed those of the collimator-lens. In this case every portion of the slit, and consequently of the spectrum, receives rays from every portion of the object. An instrument used in this way is called an *integrating spectroscope.*

*Analyzing Spectroscope.*—In many cases it is, on the other hand, important to obtain separately the spectra of the different portions of the luminous body, especially in astronomical investigation. To accomplish this, it is only necessary to place in front of the slit a lens at such a distance as to form upon the plate containing the slit a distinct image of the object. Then each point in the slit is illuminated by rays proceeding from only a single point in the object, and we can get separately the spectra of the top or bottom or centre of the body observed. Used thus, we call the instrument an *analyzing spectroscope.*

*Plücker's Prism of Comparison.*—It is often desirable to compare directly the spectra of two different lights. This is readily done by placing, so as to cover one-half the length of the slit, a small reflecting-prism, which will bring into it light from an object placed on one side. In this case the observer sees before him the two spectra, one immediately above the other.

*Spectroscopes of High Dispersion.*—The form of the instrument of course varies according to the purpose for which it is designed. For many investigations it is necessary to obtain a much higher dispersion than one prism would give. We then use between the collimator and telescope a train of several prisms, sometimes as many as nine. The size of the instrument is also greatly varied. In an enormous spectroscope built by Ladd of London for Lord Lindsay the six prisms had each surfaces 4 inches square, and the collimator and telescope were each 4 inches in diameter and 5 feet long. Browning has also constructed one of fully equal dimensions for Mr. Gassiot, to be presented to the University of Oxford.

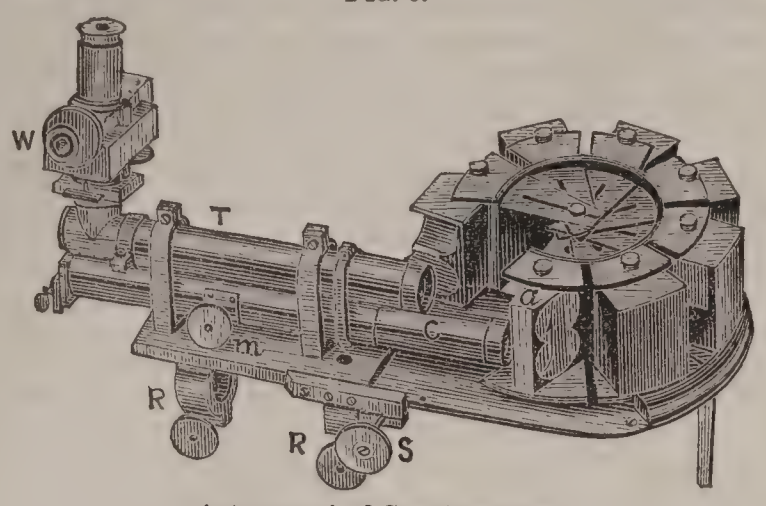
*Adjustment of Prisms for Minimum Deviation.*—To obtain the best definition, it is necessary that the rays in passing through each prism should make equal angles with its surfaces on entering and emerging, and it is therefore important that the prisms should be so adjusted as to fulfil this condition for whatever color of the spectrum may be under examination. In the first large instruments each prism had to be adjusted tentatively and separately, and it was the work of several hours to alter the adjustment from the red end of the spectrum to the violet. In 1863, Littrow of Vienna, and in 1865, Rutherfurd of New York and Cooke of Cambridge, devised different contrivances by which all the prisms are adjusted simultaneously.

*Automatic Spectroscope.*—In 1870, Browning of London, making use of Rutherfurd's plan (of which, however, he seems to have been an independent inventor), contrived a so-called *automatic spectroscope*, in which the adjustment for any portion of the spectrum is completely effected by simply pointing the observing telescope to it by the appropriate tangent screw. Lockyer of London and the writer in this country, as well as Grubb of Dublin, have also devised instruments fulfilling the same condition and admitting the use of still greater dispersive powers. The instruments of the two former, though independently invented, are essentially similar. We give a figure of our own, with which many of our American observatories are supplied. It was designed especially for astronomical work, and in its construction compactness, lightness, and facility of manipulation have been chiefly kept in view.

The light after leaving the collimator C falls perpendicularly upon the face of a *half*-prism *a*, passes around through the train of seven prisms near their bases; at the end of

the train is twice totally reflected by a rectangular prism attached to the last prism of the train (which like the first

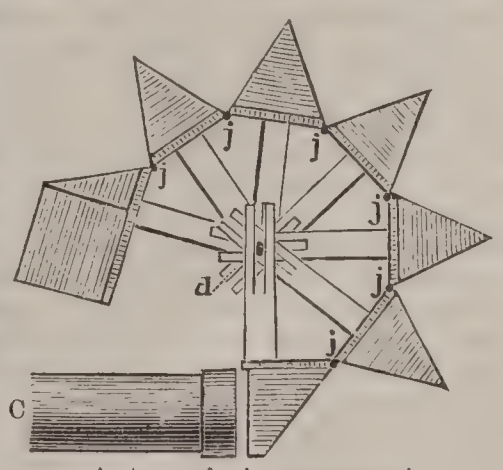
FIG. 3.




Astronomical Spectroscope.

is also a half-prism), is by the double reflection transferred to the upper story of the prism-train, so to speak, and returns to the view-telescope T, which with its diagonal eye-piece is firmly attached to the same mounting as the collimator, and directly above it; both are immovable. The focal length of collimator and telescope is 10 inches, their diameter $\frac{8}{10}$ths of an inch. The different portions of the spectrum are brought to the centre of the field of view by the screw S, which acts upon the last prism of the train. The first prism of the train being firmly fastened, the others are all movable, each being jointed to the preceding, as in the annexed figure, at *j*, *j*:

FIG. 4.



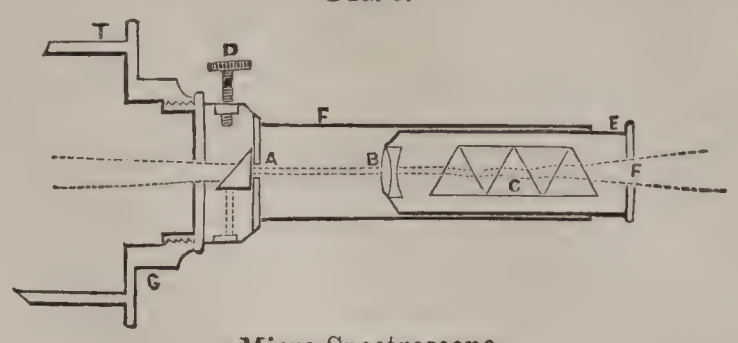

Automatic Arrangement.

To the back of each prism-holder is attached a rigid bar forked at the extremity, and all the forks engage with a movable steel pin or pillar, *d*. It follows, therefore, that whatever motion may be given to the last prism, it and all the others will continue to keep their bases tangent to a common circle whose centre is at *d*, which circle always remains tangent to the axis of the collimator. This is the automatic arrangement, due to Mr. Rutherfurd. The adjustment for focus is by the milled head *m* (Fig. 3 again) upon the tube of the collimator, which carries the object-glasses of both collimator and telescope in and out together. The rings R R furnish the means of attaching the instrument to the eye-end of a large equatorial, and adjusting its distance from the object-glass. The dispersive power of the instrument is that of twelve prisms, but can easily be reduced whenever desired by merely taking out any prism of the train and substituting for it the terminal half-prism with its reflector—an operation not requiring more than a single minute. By adding another tier of prisms, and sending the light back and forth through a third and fourth story, the dispersion could again be doubled with very little expense, except for the additional prisms. The instrument is provided with a comparison-prism at the slit, and the position of any unknown line in the spectrum of a celestial body is referred to the nearest lines in the spectrum of some known gas compared with it by means of a micrometer W in the eyepiece.

*Direct-vision Instruments.*—In the so-called *direct-vision* spectroscopes the ordinary prism or prism-train is replaced by a compound prism made up of from five to eleven prisms of two different kinds of glass, so put together that the *refractions* for the mean rays of the spectrum balance each other, while of course the *dispersions* do not. The advantage gained is, that the awkward angle between the collimator and telescope is avoided, and the instrument becomes in appearance merely a straight tube.

*Pocket Spectroscope.*—The *pocket spectroscope* and *micro-spectroscope* are instruments of this kind. The former consists merely of a small tube some 3 inches long, carrying the slit at one end and a magnifying lens of proper focus at the other, with a direct-vision prism combination in the tube between them. Since, however, the rays from the slit are not rendered parallel before they strike the prisms, the instrument does not give very accurate definition of spectrum lines, though for many purposes it answers pretty well. The annexed figure (Fig. 5) shows the construction of the *micro-spectroscope*, which is designed for use in connection with the microscope, and has proved itself a most valuable auxiliary. The tubular extremity T slips into the end of the microscope-tube in place of the ordinary eye-

FIG. 5.



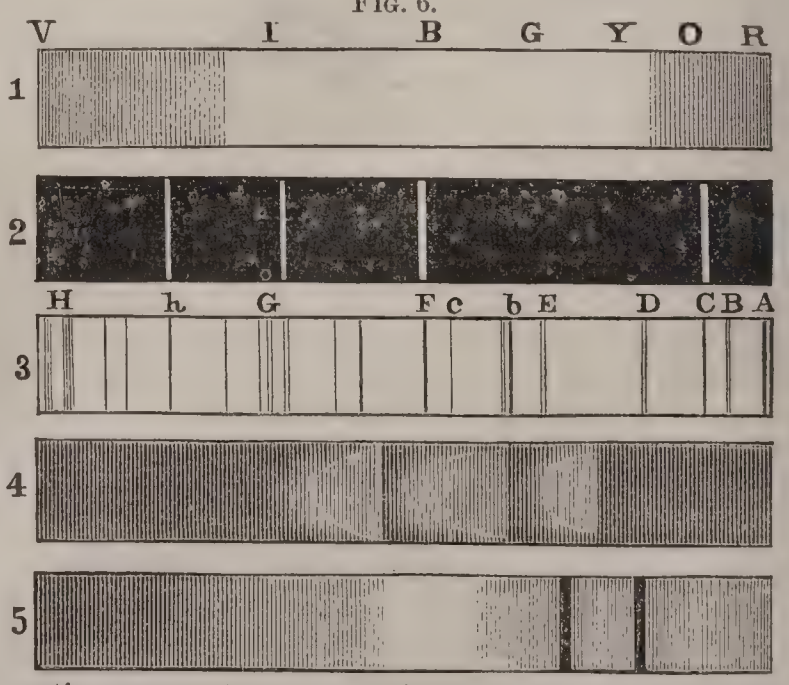

Micro-Spectroscope.

piece. The slit and comparison-prism are at A, the collimating lens (achromatic) at B, the direct-vision combination of prisms at C, and the eye is applied directly at F, the view-telescope being usually dispensed with, though some of the more elaborate instruments retain it, and add numberless accessories—of condensers, illuminating mirrors, object-holders, micrometers, etc.

*Diffraction Spectroscope.*—In the *diffraction spectroscope* the prism is exchanged for a plate of glass or speculum-metal ruled with fine equidistant lines, from 2000 to 20,000 in the inch. The light after passing through the collimator is received upon this grating, as it is called, and thence is transmitted or reflected, as the case may be, to the telescope. With instruments of this sort, furnished with the exquisite gratings which Mr. Rutherfurd has lately been ruling on silvered glass, a dispersive power is easily obtained in the spectra of the higher orders far greater than by any of the spectroscopes described above—equal to what would be furnished by a train of thirty prisms or more. The spectra obtained in this way are less brilliant than those of the prismatic apparatus, so that for some purposes this form of instrument is hardly applicable; for other purposes, however, it has great advantages—as, for instance, in solar observations—and is quite superseding the older forms. The observation of the higher orders of spectra is much facilitated by interposing between the grating and the object-glass of the eye-telescope a prism with its refracting edge perpendicular to the lines of the grating. This separates the spectra of the different orders, which would otherwise overlap. Diffraction spectra present one important advantage—they are strictly comparable with each other, since the relative distances between the lines of a diffraction spectrum depend simply upon the wave-lengths (colors) of the rays concerned. In the prismatic spectrum no such relation holds; every change in the material, angle, or position of the prism alters the relative spacing of the lines, crowding them together in some portions and pulling them apart in others. Hence, more and more the diffraction spectrum is becoming the standard of reference, and the position of a line or band in the spectrum is ordinarily defined by giving its wave-length in millionths of a millimètre, though some still choose to refer to the original map of the solar spectrum published by Kirchhoff in 1862. Thus, for instance, the principal bright line in the spectrum of the sun's corona is described as 1474 Kirchhoff, or wave-length 531.6—sometimes Angström 5316, since Angström in 1868 published a fine map of the solar spectrum as formed by diffraction, giving the wave-lengths in *ten*-millionths, instead of millionths, of a millimètre.

The different spectra observed reduce naturally to five different classes indicated in the annexed figure:

FIG. 6.




1, continuous spectrum—*e. g.* of a common lamp; 2, positive-lined spectrum, the spectrum of hydrogen gas; 3, negative-lined spectrum, the solar spectrum; 4, positive-banded spectrum, the spectrum of Encke's comet; 5, negative-banded spectrum, the spectrum of fresh blood.

We have (1) the *continuous* spectrum; (2) the *positive-lined* spectrum, marked by *bright* lines upon a black or dark background; (3) the *negative-lined* spectrum, characterized by *dark* or *black* lines upon a bright background; (4) the *positive-banded* spectrum, consisting of *bright* bands separated from each other; (5) the *negative-banded* spectrum, consisting of *dark* bands upon a bright background. Not very unfrequently, however, a spectrum presents the characteristics of two or more of these classes combined.

*Continuous Spectrum.*—The continuous spectrum is the least interesting and instructive of all. It simply indicates that the luminous material is comparatively *dense*. An incandescent solid or liquid produces it, and so also does an incandescent gas if sufficiently compressed. From a spectrum of this kind we learn nothing as to the chemical nature of the luminous body, and very little as to its physical condition. It is to be noted, however, that a predominance of the red portion of the spectrum usually indicates a much lower temperature than that which corresponds to a normal development of the blue and violet; in other words, a *red*-hot body is cooler than a *white*-hot one. This, with many other facts of capital importance, seems first to have been brought out clearly by Dr. J. W. Draper, whose early investigations on the chemical and thermal rays of the spectrum, as well as the constant association between spectral lines and certain chemical elements, were very extensive and important, and deserve far more attention and recognition than they ever received. In fact, many of the more recent investigators seem to have been substantially anticipated by him in some of their most important results. There are, however, many cases of brilliant luminosity accompanied by a very trifling evolution of heat. We then usually find the yellow and green portions of the spectrum (which are most energetic in their action upon the organs of vision) quite bright, while the extreme red and violet are alike deficient. This is true of the light of fireflies, glowworms, and the luminous organisms of the sea. But while the continuous spectrum is thus comparatively uninteresting, the other four classes of spectra are full of information.

*Class 2—Positive-lined Spectrum.*—The spectrum of the second class, consisting of a greater or smaller number of sharply-defined bright lines, is produced only by matter in the gaseous condition, of comparatively low density, and, as a general rule, certainly, though possibly not without exception, in an elementary state—*i. e.* not chemically combined with other substances. It is the spectrum of elementary vapor. Every simple substance when sufficiently heated gives its own characteristic spectrum of this sort, as legible to one familiar with the subject as its written name would be. Furthermore, every change in the density, pressure, or temperature alters, so to speak, the style of character in which the name is written; it so affects the relative brilliance of the different lines, their width, distinctness, and general appearance, that from an examination of the spectrum we are not only able to recognize the chemical nature of the material under examination, but also to draw most important conclusions as to the physical conditions to which it is subjected.

*Effects of Temperature and Pressure.*—Speaking generally, when the gas is very greatly rarefied, and not too intensely heated, the lines in its spectrum are comparatively few—not very brilliant, but very thin and fine. As the pressure increases or the temperature rises, new lines make their appearance, and the old ones brighten, but also grow wider and hazy at the edges; at the same time a faint continuous spectrum appears as a background. Pressure and temperature still increasing, the background grows brighter and brighter, while the lines become more numerous, but less sharply defined and relatively less conspicuous, until at last we have a mere continuous spectrum without noticeable markings, precisely like that of a liquid or a solid heated to whiteness. As yet it is not found possible to discriminate with certainty between the effects of temperature and pressure, which in many respects are very similar. Theory, indeed, would lead us to expect this, for, according to the generally-received ideas of the constitution of gaseous matter, simplicity of the spectrum would imply non-interference of the atoms with each other in the vibratory motions which originate the light. But whenever the atoms do come to interfere with each other much and often —which may happen either from crowding them together or increasing the velocity and range of their motions (raising the temperature)—confused and irregular vibrations must result, producing in the spectrum the very effects observed.

*Personal Identity of a Spectrum.*—It is now generally believed that the spectrum of any given element retains its specific identity through all changes of temperature and pressure—*i. e.* that the changes observed are merely in the number, brightness, and sharpness of the lines, and not at all in the *position* they hold in the spectrum; or, to express it differently, after the analogy of sound, the *luminous notes* which characterize the spectrum of a given substance are believed never to change their *pitch* (wave-length). This, however, is not yet perfectly established, and some physicists of high authority still hold, not without apparent reason, that the same chemical element may give under varying circumstances two or more distinct spectra, differing from each other as much as do the spectra of different elements.

*Plücker's Spectra of the First and Second Order.*—Thus, Plücker distinguished a first- and second-order spectrum for nitrogen gas. Some of the latest investigations, however, seem to show that his spectrum of the first order (a banded spectrum) is merely the spectrum of one of the *oxides* of nitrogen, and not of nitrogen itself. Still, the subject imperatively demands further and most careful research.

*Coincidence of Lines in different Spectra.*—In many cases lines in the spectrum of one substance are found to coincide with lines in the spectrum of another. In some instances this coincidence is merely apparent, and a sufficient dispersive power in the instrument employed brings out a slight but real difference in the wave-lengths of the rays concerned. In other cases, the lines probably belong to the spectrum of only one of the substances, and appear in the spectrum of the other simply on account of the impossibility of freeing it entirely from all traces of the first. Thus, iron and titanium and iron and calcium show numerous such coincidences.

*Spectra of the Third Class—Negative-lined Spectra.*—The spectra of the third class (negative-lined spectra) are no less instructive and important than those of the preceding, to which they are complementary, or, to use a common expression, of which they are *reversals*. The two classes differ from each other simply in the interchange of light and darkness, the bright lines and dark background of the one being reversed to black lines and bright background in the other, while in the relative intensity of the lines and their position there is no change. To this class belongs the solar spectrum, and the spectra of most of the stars are similar. Spectra of this kind occur when the light under examination has passed through a vapor or gas which would itself give a bright-line spectrum. Under these circumstances *the gas absorbs out of the transmitted light precisely those rays it would itself emit if luminous*, and thus causes the spectrum to show dark bands and lines at the very points when the spectrum of the gas alone would exhibit bright ones. For example, the spectrum of sodium vapor is characterized by two bright orange-colored lines very near each other. But if we cause the light of an oxyhydrogen lamp to pass through a tube filled with sodium vapor, it will show in its spectrum a pair of dark lines at precisely the same place. It is difficult to say who first discovered this principle. Stokes in England, Angström in Sweden, and Kirchhoff in Germany seem all to have reached it independently. Angström was the first to give it formal publication in 1853, but in the Swedish language, so that it attracted little attention; on the other hand, it was undoubtedly Kirchhoff who in 1859 first appreciated and insisted upon its full significance, and by its application in investigating the chemical composition of the sun, and his other researches in connection with Bunsen, first brought out clearly the enormous power of the spectroscope as an instrument of discovery.

*Changes in appearance of Dark-line Spectrum due to Changes of Pressure, Temperature, and Intensity of Transmitted Light.*—Spectra of this class of course indicate as clearly as those of the first the chemical nature of the absorbing vapor to which the dark lines are due; and changes in the density or temperature of this vapor produce upon the lines effects analogous to those described in connection with the preceding class. Furthermore, when the absorbing vapor is at a temperature high enough to render it self-luminous, then changes in the intensity of the transmitted light will also greatly alter the appearance of the spectrum. If it be brilliant enough, all the lines will be intensely black, provided the absorbing layer is sufficiently thick. As the intensity of the transmitted light decreases, those lines which are brightest in the spectrum of the vapor taken by itself will lose their blackness, vanish, and reappear as bright lines, until at last, when the background light is reduced to zero, we have of course simply a spectrum of the second class, with all its lines bright. Thus, it very frequently happens that in spectra of this sort we find bright as well as dark lines. It is evident, also, that changes in the thickness of the absorbing stratum will greatly modify the spectrum.

*Spectra of the Fourth Class.*—The spectra of the fourth class consist of bright bands of considerable width, sometimes undefined at both edges, and sometimes pretty distinct at one of them, which is usually, but by no means

universally, the lower or less refrangible. They seem to be derived from bodies in which the molecules have less freedom of movement than in elementary vapors, and yet more than in incandescent solids and liquids. Gaseous compounds and fluorescent bodies especially show them; the spectra of comets belong to this class also. They do not admit of such accuracy of measurement as the two preceding classes, nor do they often furnish any such amount of definite and certain information as to the nature and condition of the source of light: still, they are important.

*Spectra of the Fifth Class.*—The fifth and last class of spectra is characterized by broad dark bands crossing a bright background; spectra of this sort are produced by the action of colored absorbing media, usually solid or liquid (though some highly-colored dense vapors act in a similar manner), upon transmitted light. The spectra of blood, chlorophyl, iodine vapor, and many dyestuffs are instances in point. The worker with the micro-spectroscope deals almost exclusively with this class of spectra, and finds in them a mine of most valuable information as to the nature and constitution of the organisms which he studies.

*Chemical Application.*—The applications of the spectroscope are extremely numerous and important. Its earliest use was in chemical analysis; by its means already five new elements have been discovered—the metals thallium, cæsium, rubidium, indium, and gallium. The substance to be examined is introduced into the flame of a so-called Bunsen burner, or used as one of the electrodes, between which a stream of electric sparks is made to pass, or placed between the carbon poles of an electric lamp under the action of a powerful continuous current, or finally, if gaseous, enclosed in a glass tube and illuminated by means of an induction coil. The more volatile metals yield their spectra without difficulty in the gas-flame, but most other substances require the use of electricity.

*Delicacy of the Reaction.*—For some substances this method of analysis is extremely delicate; for instance, $\frac{1}{80000000}$th of a milligramme of thallium is distinctly detectible in the spectrum of the electric spark. At the lower temperature of a Bunsen burner its sensibility is about $\frac{1}{50000}$th of a milligramme. The reaction of strontium is even more delicate, and that of sodium defies estimation. (We give the results of Cappel, as quoted by Schellen.) Indeed, for these and many other substances the method is at present *too* delicate. It is found also, unfortunately, that in a mixture of several substances it frequently happens that only a few of them show their spectra, the others being in some way masked by those which appear. Hence, in examining an unknown material *it is not safe to conclude the absence of any element from its non-appearance in the spectrum.* But for details upon this subject it is necessary to refer to works where it is treated fully.

*Quantitative Analysis.*—In passing, it may be remarked that recently Vierordt has attempted to make the spectroscope give quantitative results, in addition to its merely qualitative indications. He uses an instrument with two slits, one immediately above the other; the one having a fixed and constant width, while the width of the other is adjustable and can be accurately measured by a micrometer screw. The slit of constant width is illuminated by the flame of a substance containing a known percentage of the element tested for; the adjustable slit is illuminated by the flame of the material investigated; and by widening or narrowing this slit it is sought to make the lines of the element in question appear of the same brightness in the two spectra which are seen side by side in the instrument. From the width of the adjustable slit which produces this result a conclusion of more or less accuracy can then be drawn. As yet, however, nothing more than a partial success can be claimed. In a somewhat similar manner, though fundamentally distinct, Mr. Lockyer has utilized the spectroscope in assaying. If by means of a convex lens we form upon the slit of the instrument an image of a metal point from which a stream of electric sparks is flowing, the bright lines characteristic of the metal will of course appear. But under these circumstances they will differ not only in width and brightness, but in *length.* While some reach across the whole width of the spectrum, others will be very short, and some mere points of light on the tip of the electrode. If now a metallic alloy be used for the electrode, the *long* lines of both metals will generally appear; but if one of the metals be present in only minute quantity, even its longest lines will be very short compared with those of the principal metal. Of course two alloys precisely alike will furnish similar spectra; and thus, by comparing the spectrum of a piece of bullion alloyed with a small unknown percentage of silver, with the spectra of a series of test specimens in which the percentage of silver alloy is known, we can determine the composition of the first; and, as experience shows, with great accuracy.

*Physical Applications.*—In other physical sciences the instrument has also important applications, furnishing as it does the means of isolating, for purposes of optical experiment, light of any particular wave-length, and giving valuable indications of the temperature and pressure of gases in many cases otherwise quite unmanageable. In photometry especially it is likely to prove of great value. So long as two lights to be compared are similar in tint, there is no great difficulty in determining the ratio of their brightness within reasonable limits of accuracy by many long-known methods; but when the lights differ in color, these methods fail. Now, by means of a spectroscopic apparatus similar to that of Vierordt, described above, or a more recent and delicate apparatus by Trannin, by means of which two spectra crossed with dark interference-bands are superposed in such a manner that when of equal brightness the bands will disappear, it is possible to compare the lights *in detail*, so to speak; *i. e.* the intensity of the *red* light furnished by the first source can be measured against that of the same color emanating from the second; and in the same way the relative intensity of green and blue in the spectrum of each can be compared. If the lights are such as to furnish discontinuous or bright-lined spectra, the difficulty of the comparison is considerably increased, but can be overcome by an addition to the apparatus which does not complicate it very seriously, though its description would take up too much space to be given here.

*Medical and Forensic Applications.*—The instrument, especially in the form of the micro-spectroscope, has its important medical and forensic applications. It furnishes, according to the investigations of Sorby, a most reliable and delicate method of detecting blood even in the minutest quantity, and distinguishing it from any other coloring-matter of similar tint. Unfortunately, it does not discriminate between blood from different animals, nor does it determine the period which has elapsed since it was drawn from the body. A spectroscopic examination of the contents of the stomach would undoubtedly, in cases of metallic poisoning, show unmistakably the nature of the metal used: arsenic, antimony, thallium, etc., could not escape detection, though as yet we are not aware of any case in which the spectroscope has been thus applied. In the case of poisoning by strychnine, prussic acid, or any similar compound substance, nothing could be expected from the instrument. It is hoped that spectroscopic examination of the urine and other dejecta, and of the liquid contents of cysts and tumors as drawn off by the operation of tapping, may prove of great value in the diagnosis of disease, but as yet the subject has not been thoroughly worked out.

*Technical Applications.*—In several of the arts the instrument has also found important applications. In the Bessemer process of making steel, air is forced by a powerful blast through a vessel (called the converter) containing molten iron, and in its course burns out most of the impurities, and especially the carbon of the crude pig. But it is important to stop the operation at precisely the right moment, when the carbon is all gone; otherwise the air-blast will attack and oxidize the iron itself, spoiling the whole charge. During the process a powerful flame issues from the mouth of the converter, and the spectroscopic examination of this flame gives precisely and sharply the indication needed. At the moment when the blast should be turned off the lines of carbon, which before were bright and clear in the spectrum of the flame, suddenly disappear. It is fair to add, however, that this disappearance of the carbon from the flame produces an alteration in its color sufficiently marked to enable an expert, even without the spectroscope, to determine the critical moment, but the instrument greatly facilitates the operation, and is in constant use for the purpose. The instrument is also very valuable as a detector of adulterations in dyestuffs and liquors. By its help an expert will give the age of port wine within a year or two (up to a dozen years or so), thanks to the investigations of Sorby, and can infallibly detect the "doctoring" to which it and other wines are so liable.

*Application to Astronomy.*—But it is in the domain of astronomical science that the spectroscope has achieved its greatest triumphs, which we can hardly more than enumerate in this connection.

*Chemical Constitution of the Sun.*—Its very first application by its inventor, Kirchhoff, was to the chemical analysis of the sun. In the dark lines of the solar spectrum he read clearly the names of many elements with which we are familiar upon the earth. Iron, titanium, calcium, manganese, nickel, cobalt, chromium, barium, sodium, magnesium, copper, hydrogen, and zinc are plainly indicated, and sulphur, cerium, strontium, aluminium, and iridium are pretty certain. These were the first-fruits.

*Constitution of Stars.*—Applied by Huggins, Secchi, and others to the stars, it has to a certain extent revealed also the chemical constitution of many of them, and has shown

that they resemble the sun, with, however, specific differences, each star presenting its own peculiar spectrum.

*Sun-Spots.*—Applied to the study of the solar spots, it has confirmed the belief that they are cavities, and revealed the nature of the dense clouds of absorbing vapors which fill them, besides throwing clear light upon many curious facts before obscure.

*Nature of the Solar Prominences.*—By its means in 1868 the strange "red protuberances," which had been observed around the disk of the moon during a total eclipse of the sun, were shown to be immense clouds or flames thrown out from the sun and floating in its upper atmosphere—masses composed in the main of hydrogen gas, but also, especially in the lower portions, containing many other vapors carried up from the inferior atmosphere which immediately overlies the incandescent surface.

*Daily Observation of the Chromosphere and Prominences.*—Nor is this all: up to the date we have mentioned these strange phenomena could be observed only during the few moments when the solar disk was hidden in eclipse; but then Janssen and Lockyer independently and simultaneously contrived that beautiful application of our instrument by which the so-called chromosphere of the sun is brought within the range of daily observation, thus opening to astronomy a new, most beautiful and interesting field of research. The reason why we cannot see these prominences at any time with the simple telescope is merely this: The air in the neighborhood of the sun is so intensely illuminated as to mask them, just as the stars are hidden. If we could only devise some means to weaken this air-illumination without much affecting their own luminosity, we could see them well enough; and this is precisely what the spectroscope does. The air-light, being simply reflected sunlight, is dispersed into a long and comparatively faint spectrum by passing through the prisms, while, on the other hand, the light from the gaseous prominences gives a spectrum of a few bright lines, whose brilliance is not affected by the dispersion, which merely separates the lines without making them faint. Hence, with an instrument of sufficient power the continuous spectrum due to the aërial illumination becomes so weak that upon it, as a background, a prominence will form a spectrum of conspicuous bright lines; and on opening the slit, its image in all the detail of form and movement can be clearly made out.

*Nature of the Solar Corona.*—In 1869 the spectroscope gave the first decisive evidence as to the nature of that most wonderfully beautiful of all appearances, the sun's corona, by showing that its spectrum is characterized by a vivid line in the green, at 1474 of Kirchhoff's scale; thus proving it to be constituted, in part at least, of some glowing gas, and therefore of solar and not lunar or terrestrial origin. What this gas is, is yet unknown.

*Nature of the Nebulæ.*—Applied to the study of the nebulæ by Mr. Huggins in 1864, it immediately settled the old dispute as to their nature, showing that some of them, at least, are gaseous masses, and not far-off groups of closely-crowded stars, as the opponents of Laplace's nebular hypothesis had taught.

*Self-luminosity of Comets.*—A little later, in the same skilful hands, it was directed upon the comets, and proved that they shine not merely by reflected sunlight, but with a brightness of their own. Their spectrum is one of bright bands, and seems to indicate that they are constituted either of some slightly-heated, non-elementary gas (Mr. Huggins suggests one of the hydrocarbon compounds, whose spectrum certainly presents a remarkable coincidence), or else some fluorescing dust.

*Atmosphere of Planets.*—Applied to the planets, it reveals to us in the atmospheres of our nearest neighbors, Mars and Venus, the vapor of water, and suggests phenomena and habitudes not unlike those of our own aërial ocean—shows that they may be habitable worlds like ours. On the other hand, it shows certain strange markings in the atmospheric spectra of Jupiter, Saturn, and Uranus, which we cannot yet explain, but which indicate an extremely different air from ours.

*Motions of the Stars.*—Last, and in some respects most wonderful of all, it reveals and measures certain movements of the solar atmosphere and of the stars which would otherwise be wholly beyond our cognizance—motions of approach or recession with reference to the earth. If the source from which the light subjected to the examination of the spectroscope proceeds has a motion either toward or from the instrument, then for any given ray the number of pulsations per second which reach the slit will be altered, and the position of the corresponding line in the spectrum will be changed; if the body be approaching us, all the lines in its spectrum will be displaced toward the blue end of the spectrum, and *vice versâ*. With our present instruments the lowest velocity which can be *perceived* is between 1 and 2 miles per second; a velocity as great as 5 miles can be *measured* with some precision. In studying the spectra of the solar prominences, velocities of from 50 to 150 miles per second are frequently observed, and the observations of Huggins and others upon some thirty or forty of the brightest stars have shown that they are moving, some toward and some from us, with velocities varying from 5 to 60 miles per second.

The best works upon spectroscopy are Roscoe's *Lectures upon Spectrum Analysis* and Schellen's *Spectrum Analysis*, the latter translated from the German by the Misses Lassell, and edited by Mr. Huggins. Mr. Lockyer has also just published a small volume on the same subject. Schellen's work contains in an appendix a very full list of all books and scientific papers in any way bearing upon the subject, complete up to the date of publication (1871–72), and to this we must refer readers desirous of further information.

C. A. Young.

**Spec'trum** [Lat.], in optics, a colored image arising from the dissociation of a ray of light into its constituent tints. There are two modes of obtaining such images: (1) by dispersion, the prismatic spectrum; (2) by diffraction, the grating spectrum.

*The Prismatic or Dispersion Spectrum.*—In a dark room let the temperature of a platinum wire be gradually raised, and the wire be inspected through a prism. When the heat has risen to about 977° F., it will be found that a dim monochromatic red light is emitted. As the temperature increases, the red radiation becomes more intense, and on one side of it there emerges a tint that is orange. The heat still rising, there is added on the side of the orange, yellow, and in like manner successively green, blue, indigo, violet. The appearance of the wire as seen through the prism is now no longer that of a straight line, as at the beginning of the experiment; it is spread out into a ribbon-like colored form, the tints gradually blending into each other. Not only are new colors thus added as the temperature rises, but the brilliancy of the original ones, and indeed of all, steadily increases. It is to be particularly remarked that the colored spaces thus observed are not of equal breadth. Examining them from the violet to the red, they successively become more and more compressed; they are narrower and narrower. This is a necessary effect in the prismatic spectrum.

If instead of examining the wire through the prism, it is directly looked at, the rays that it emits will be found to be of a dazzling whiteness, the brilliancy of which increases until the wire melts. To the parti-colored rectangular figure into which the image of the wire is thus dilated the designation of *the spectrum* is given. A critical examination will prove that this spectrum is continuous—that is to say, it is not crossed by interruptions, dark spaces, or dark lines. It is therefore spoken of as a continuous spectrum. To see it in the most accurate manner the prism should be placed at its angle of minimum deviation.

If instead of an ignited wire a beam of sunlight coming through a narrow slit be in like manner examined with a prism placed as above indicated, it will be found to display the aspect offered by the platinum at its utmost temperature, so far as colors are concerned, and even more brilliantly. Crossing it, however, there will be perceived many black lines. This, the solar spectrum, is spoken of, therefore, as an interrupted or discontinuous spectrum—a spectrum having fixed lines. If an electric spark passing between two pieces of the same metal be inspected, it will be found to be an interrupted one. The lines, however, are not dark, but bright and shining, and of the color of the spaces in which they occur. If the metallic surfaces are of different metals or of alloys, all the lines that belong to each of the metals present will be seen.

Newton was the first to examine the solar spectrum, and to point out the precautions to be taken in order to produce it in a state of purity. He used a slit parallel to the edge of the prism, and also intromitting apertures of triangular, circular, and other forms, employing not only the sun itself, but also these various intromitting apertures as the luminous source, arranging things so as to employ their images. To avoid the optical imperfections of the glass of the prism, its striæ, air-bubbles, etc., he constructed hollow prisms and filled them with a solution of acetate of lead. Under these circumstances it is somewhat surprising that he did not detect the fixed lines. They, however, escaped him. The deductions he made from what he did observe were, however, of the highest importance. He proved the composite nature of white light, and substantiated the theory of the different refrangibilities of its constituent rays by his celebrated experiment of the dark chamber. He considered that the spectrum is divisible into seven differently-colored regions or spaces, which, enumerated in the order of their departure from the direction of the intromitted light, are red, orange,

yellow, green, blue, indigo, violet. Of these, then, the red is the least and the violet the most refrangible ray.

The spectrum thus formed by a prism offers three points for consideration: (1) the distribution of luminous intensity in it; (2) the distribution of heat; (3) the distribution of chemical force.

(1) With regard to the luminous intensity, or the determination of the order of brightness of the rays, various modes of experiment have led to the conclusion that the yellow region of the prismatic spectrum, though it is among the less refrangible, is the most brilliant. From it the effect lessens rapidly toward the red extremity, more gradually toward the violet. Among the methods resorted to for such a determination of the luminous intensity is that of placing a piece of finely-printed paper so as to receive the spectrum, and finding at what distance the letters in the several colored spaces can be distinguished. Other more exact photometric methods have also been employed. All, however, are liable to this criticism—that they merely indicate the relations of the organ of vision, the eye, to the luminiferous radiations, and have nothing whatever to do with their intrinsic force. From other considerations it may be shown that the mechanical intensity of all the radiations is the same.

(2) As regards the distribution of heat in the prismatic spectrum, there has been from time to time much change of opinion. At first it was supposed that the yellow region, being the brightest, must necessarily be the hottest space. This opinion was, however, abandoned on the publication of Sir William Herschel's observations. He had been led to suspect, while using glass screens in telescopic observations on the sun, that a dark red glass is more permeable to heat than one paler and of a different color. He therefore placed a series of small thermometers in the different colored spaces, and found that, commencing with the violet and passing toward the red, they in succession stood higher and higher. Nay, more, in a space altogether beyond the red, and where there was no light, the heat was greatest. Subsequently, it was found by other experimenters that the maximum point varies with the material of which the prism is composed, prisms of water, of alcohol, of crown glass, and of flint glass making it in succession in less refrangible spaces. These experiments were repeated in a more perfect manner by Melloni on the invention of the thermo-multiplier. He showed that when a prism of rock-salt is used, the maximum of heat fell in a much less refrangible space than had ever before been observed. In fact, it was as far below the fixed line B as B is below F. These results have since been repeatedly verified, especially by Tyndall. The observations of such skilful experimenters must of course be correct, but, as will be seen from the description of the diffraction spectrum presently to be given, the conclusions drawn from them must be modified.

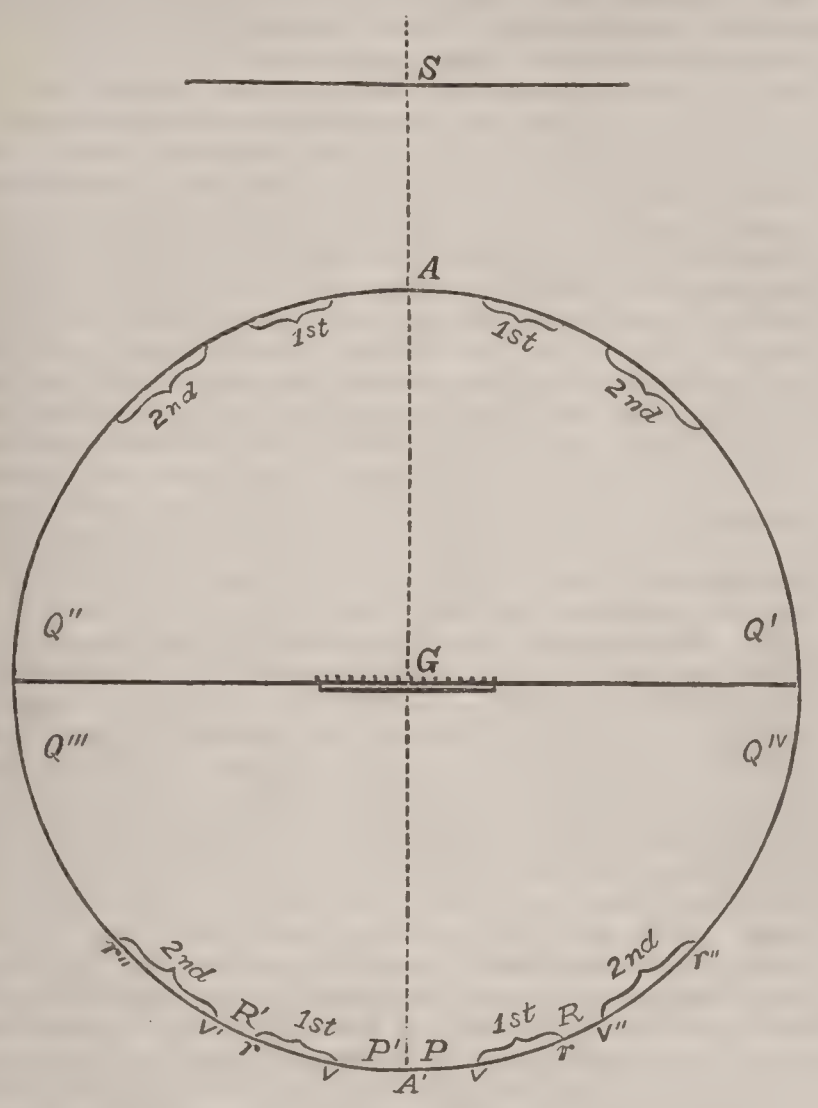
(3) Leaving that topic for the present, we pass in the next place to the consideration of the distribution of chemical force in the prismatic spectrum. The earliest experiments on this point are those of the Swedish chemist Scheele, who received the solar spectrum on a surface painted with white argentic chloride. He found that this substance was not darkened indiscriminately in all the colored spaces, but that the effect took place chiefly in the violet, and not at all in the green, yellow, orange, and red. He also observed that beyond the violet, and in a region where the light had ceased to be perceptible, the darkening continued. Many other experimenters verified these results, and on a comparison of them with the above-mentioned ones in relation to heat, the conclusion seemed to be established that there are three essentially distinct principles in the solar ray: (1) light, (2) heat, (3) chemical force. The last passed successively under various designations, such as chemical rays, deoxidizing rays. Eventually, Sir J. Herschel imposed the inexpressive designation, *actinism*. The view thus held was, therefore, that there are three spectra—one of each of the three essential constituents of light—partially overlapping each other and of different refrangibilities; the heat spectrum being the least refrangible, the light spectrum intermediate, the actinic spectrum most refrangible. Curve-diagrams were drawn, showing the intensity of these principles at different points. This view has been the origin of very many errors—errors that even now have scarcely been eradicated. They have been a serious obstacle to the progress of the science of radiations. They arose from the fact that no account was taken of the physiological peculiarities of the eye. It does not follow, because there are invisible radiations below the red, that what we term heat and light are essentially distinct principles; it is only an illustration that the eye is incapable of perceiving ether-waves that are of slower vibration than the red; and a similar remark applies to what are termed the invisible actinic rays beyond the violet, the vibrations of which are too rapid for the eye.

But there were not wanting those who saw that all these effects could be explained on the principle of one agency —ethereal undulations—giving rise to effects that differed as the surfaces on which they were received were different. On dark ones they produced heat; on the retina, the sensation of light; on others, molecular, and again on others chemical, changes. Among those who advocated this view was Becquerel. Of the results which overthrew actinism as a special principle of high refrangibility there was perhaps none more decisive than that brought forward by Draper—the decomposition of carbonic acid. When we recollect that the whole vegetable world obtains its essential element, carbon, by the decomposition of carbonic acid through the agency of sunlight, we shall perhaps not hesitate to rank this as one of the most imposing natural phemonena, and in the world of organization the most important. It is the starting-point of vegetable and animal life. That it is the sunlight which decomposes carbonic acid, setting free its oxygen and fixing its carbon in plants, had been determined by Priestley and other chemists of the last century. And since this is essentially an effect of deoxidation, it was assumed that it was brought about by the deoxidizing or so-called actinic rays. But Draper, on causing the decomposition to be accomplished in the solar spectrum itself, found that so far from the violet being the active ray, or the actinic space the most energetic, they were altogether without appreciable influence. The effect was at a maximum in the yellow, extending thence on one side into the orange, on the other into the green, and rapidly declining to each end of the spectrum. In the extreme violet and extreme red there was no action whatever. This important observation was soon followed by many others. Thus, it was shown that bitumen, when presented in a thin layer, was acted upon by every ray in the spectrum, from the extreme red to the extreme violet. Argentic iodide, which it had been supposed was influenced by the blue, indigo, and violet rays only, if properly placed was affected by rays far beyond the red. Indeed, it was by this substance that the great cold bands $\alpha$, $\beta$, $\gamma$ were first discovered. Herschel also, in his investigations respecting the coloring principles of flowers, had proved that different colors are affected by different rays, and long previously Grotthus had established the condition under which these actions take place: "The rays effective in the destruction of a given vegetable color are those which by their union produce a tint complementary to that color." In an exhaustive investigation of this subject, Draper proved that "for the production of any molecular or chemical change in any substance it is necessary that some specific radiation should be absorbed," and that "the ray effective in producing chemical or molecular changes in any substance is determined by the absorptive property of that substance." In general terms, it was thus established that all the rays in the spectrum, even the invisible ones at each extremity, are active, and can produce appropriate chemical effects.

Among the mechanical effects accomplished by radiation there is one that can never be witnessed without admiration. It is a matter of common observation that plants tend to grow toward the light. Dr. Gardner was the first to examine the details of this phenomenon in the spectrum. When seeds are made to germinate and grow for a few days in darkness, they develop vertical stems, very slender and some inches in length. These, on being placed so as to receive the spectrum, soon exhibit a bending motion. The stems in other parts of the spectrum turn toward the indigo; those in the indigo bend to salute the approaching ray. Removed into darkness, they recover their upright position. These movements are the most striking of all actinic phenomena. Dr. Gardner's experiments were repeated and confirmed by M. Dutrochet, one of the commissioners appointed by the French Academy to investigate and verify the facts. He, in his report (*Comptes rendus*, No. 26, June, 1844), added a number of other facts respecting the bending of roots *from* the light. This he found to be occasioned by all the colored rays of the spectrum.

The general conclusion which may be arrived at from the foregoing statements, and many confirmatory ones that might be added, is *not* that there exist three or more different principles in the spectrum, but that it is an assemblage of radiations consisting of ether-waves of different lengths and of different times of vibration, the less refrangible being the slower, the more refrangible the quicker. These, when they impinge on surfaces of various kinds, produce varied effects—in some calorific, in others colorific, and still again in others chemical. But this conclusion we shall perhaps see more distinctly when we have considered the diffraction spectrum, to the description of which we now pass.

*The Diffraction Spectrum.*—For the production of this spectrum it is necessary to be provided with a grating, which consists of a thin flat glass on one of the surfaces of which there has been ruled with a diamond a series of straight lines, very close and exactly parallel to each other. Mr. Rutherfurd, by his machine (see RULING-MACHINE), has produced the most perfect gratings that have yet been made. Fraunhofer was the discoverer of the diffraction spectrum, and to him our knowledge of its peculi-




arities is mainly due. Let a beam of light S A pass through a narrow slit, and fall perpendicularly on the ruled grating G, the lines of which are parallel to the sides of the slit. Concentric with the middle line of the grating let there be placed a circular zone or screen Q′ Q″ Q‴ Q⁗ of white paper, through which there is an opening at A to admit the intromitted light. A beam of parallel rays passing along S G will give a bright image of the slit S when it impinges on the screen at A′. This is the image by transmission. It would also give another similar image at A were it not for the opening arranged there. This is the image by reflection. Also from G, as from a central axis, there fall upon the cylindrical paper zone, covering its surface all over, an infinite number of radiations. These effects are seen with much more precision if there be placed behind the grating a double convex lens, and still better if the lens be the object-glass of a small telescope. Now, the eye can only be impressed by special radiations consisting of waves of determinate length. Its vision is limited by those that impart to it a sensation of red on one hand and of violet on the other. To all others it is blind. Then, though the whole paper zone is receiving and reflecting radiations of every kind, the eye selects those only that it can appreciate, and as a result it sees in the four quadrants Q′ Q″ Q‴ Q⁗ those only for which it is fitted. It follows, therefore, that at A′ there is a white image of the slit S, and to the right and left of this there are equal spaces P P′ completely dark. Beyond and symmetrically on each there is a series of spectra *r r*, *r″ r″*, *r‴ r‴*, etc., of which the violet ends are nearest A′ and the red ends most distant. These spectra are designated respectively as being of the first, second, third, etc., order. On each side the first spectrum is separated from the second by an obscure space R R′, which is narrower than the first dark space P P′; and the red end of each second spectrum is overlapped by the violet of the third. In like manner, the third is overlapped by the fourth, etc. If the intromitted ray be of sunlight, and a convex lens or small telescope be used, the dark Fraunhofer lines are seen in these spectra.

Such are the results seen in the quadrants Q‴ Q⁗ from the light transmitted through the grating. In the quadrants Q′ Q″ exactly the same train of phenomena will be discovered—dark spaces and spectra, the latter having their violet ends nearest to A, and the overlapping taking place in the manner above described.

Since the results are thus symmetrical in all the four quadrants, it is sufficient to select one of them for detailed examination. Let it be the quadrant Q⁗. Selecting one of the fixed lines, D, for example, in its successive spectra it will be found that the distances that separate it from the middle of the white image A is in the second double, in the third triple, etc., the distance in the first. These angular distances are designated as the deviations of the ray under examination. Fraunhofer has shown that (*a*) The deviation of the same ray—*e. g.* D—depends on the sum of the width of a groove in the grating and of a transparent interval, being in the inverse ratio of the sum. (*b*) The deviation of one of the colors of the spectrum of the first order, multiplied by the sum of a transparent interval and a groove, gives the length of an undulation of that color. (*c*) The deviations of the same color in the successive spectra increase as the whole numbers 1, 2, 3, 4, etc. (*d*) The deviation of two colors in the same spectra are to each other as the lengths of their undulations. Hence, in all the violet is nearest to A′, and the red most distant.

The undulatory theory gives a rigorous explanation of all these phenomena. It shows that $\lambda$ being the wave-length of any particular light, $\varsigma$ the distance between the rulings from centre to centre, and $\theta$ the angle of deviation in the spectrum of the first order, we should have $\lambda = \varsigma \sin\theta$. In the spectrum of the second order, which corresponds to values of $\theta$ nearly twice as great, $2\lambda = \sin\theta$. In the spectrum of the third order the equation is $3\lambda = \sin\theta$, etc., etc. In practice for the determination of $\theta$ it is customary to measure the angle included between the same ray of the same order of spectrum on each side of A′. This gives, of course, double the angle sought.

We may now examine more closely the spectrum that is nearest to A′, the spectrum of the first order. Being separated completely from all the others, it presents the special facts most distinctly. At the point where the light first becomes visible—the violet or inner end of this spectrum—the wave-length of the incident radiation is, as Angström has proved, about 3930, and the wave-length of the last visible radiation at the outer or red end is about 7600, of the $10^{10}$ of a mètre. Now, it is very important to remark that the distribution of the colored spaces in this spectrum is not the same as in the prismatic. Here the yellow space, which is the most luminous radiation, is in the middle of the spectrum, and is not crowded down or compressed toward the red end as in the prismatic. So the maximum intensity on illuminating power is, as Mosotti first observed, in the centre, the intensity of the light declining symmetrically on each side to the ends.

Recalling, now, the principle that the wave-length of an incident radiation is proportional to its deviation, let us next select on the zone a point where that length will be 7860. It is of course twice as far from A′ as was the violet end of the first spectrum, for the selected deviation is double. If we inquire what interpretation the mind will give of a radiation having such a wave-length, an inspection of the zone shows that not only is it visible, but that it is regarded as being a violet color. This is an important fact. We find that a radiation consisting of waves of a given length which is visible will also be visible when the constituent waves are twice that length. And in like manner it might be shown that the same will hold good when they are three, four, etc., times that length. Moreover, in all these cases the color-impression imparted to the mind will be the same.

Again, let us select upon the paper zone another point where the wave-length is 15,200. It will have double the deviation of the red end of the first spectrum. Now, agreeably to the foregoing remarks, this point should be visible to the eye, and, for anything that has thus far been said, it should be interpreted by the mind as red light, its wave-length being twice that of the red of the first spectrum. But it is obvious that here a new consideration must enter into account. If this radiation has double the wave-length of the first red, it has triple the wave-length of the first yellow. On the principle just laid down the mind may interpret it as red light or as yellow. Which will it do? Examination of the cylindric screen—or, better still, through a telescope—shows that the mind adopts both these interpretations; and, the same principle applying to other wave-lengths, this constitutes what we have spoken of as the overlapping of the second spectrum by the third. At the point here specially considered both red and yellow light are seen.

From what has here been presented it follows that the principle considered as established in optics, that to every color there belongs a determinate wave-length, must be modified, since the same color-impression will be given to the mind by waves that have twice, thrice, etc., that determinate wave-length. But should the wave-lengths under consideration answer to whole multiples of that of some other color, the mind will interpret them as being of that color too.

Moreover, these observations lead us to extend the range of perception of the eye. The prism would lead us to infer that it can only be affected by waves the length of which is between 3930 and 7600. Comparisons have hence been drawn between the organ of vision and the organ of hearing, to the disparagement of the former. The ear, it is said, can embrace a range of several octaves, but the eye is influenced by less than one. The grating, however, leads us to reject this restriction, and to place the eye more nearly on an equality with the ear. The principles here indicated must not be restricted to the luminous radiations; they apply to all others too. Thus, if a photographic sensitive surface be made to receive the first spectrum, it will be impressed by certain of its radiations, chiefly by those above the line G. If it be exposed in the second, third, etc., spectra, it will again be impressed by the corresponding undulations having two, three, etc., times the former length. From this it may therefore be inferred, that a chemical decomposition of a given substance, brought about by undulations of a certain length, will also be accomplished by radiations that are octaves of the first.

We may next consider the dark space intervening between the first spectrum and A′. In 1843, Draper published photographs of the diffraction spectrum. They were copies of the impressions made upon silver daguerreotype tablets in use at that time. These carried the spectrum impressions as far as the wave-length .3800, and therefore encroached considerably on the dark space toward A′. But collodion, introduced since, is a much more sensitive preparation. It has enabled Henry Draper, who has produced superb photographs of the ultra violet rays, to carry the impressions as far as .3400. According to M. Mascart, waves are emitted by incandescent cadmium having a length not exceeding .2200. These stand still further in the dark space P. In these excursions into the dark space the experiments of Prof. Stokes on the long spectrum of electric light become not only interesting, but very important; for as we gradually approach A′ the wave-length of the incident radiation is continually diminishing, and at A′ becomes zero. That point is the supreme limit beyond which no radiant manifestation of any kind is possible. The goal toward which experimental investigation is tending is therefore obvious. We are gradually groping the way across the dark space, and expect one day to reach the bright streak that lies at its terminus. At every step of advance the ether-waves are becoming shorter and shorter, and the vibrations more and more rapid. When the journey is accomplished, a region will have been gained in which the waves are infinitely short and the vibrations infinitely rapid.

At the red or more distant end of the first spectrum there is another dark space, separating the first from the second. In this, though perhaps of less interest than the one we have been considering, some explorations have been made. Draper in 1843, using the sunlight and a prism, discovered three large and very broad bands. They have subsequently been re-detected by M. Lamanski by the aid of a thermo-electric multiplier.

We may now briefly resume the consideration of the distribution of heat in the spectrum, postponed in a preceding paragraph. The diffraction spectrum, as we have seen, differs strikingly from the prismatic in the arrangement of its colored spaces. In the latter the less refrangible parts are compressed more and more in proportion as their refrangibility is less. Now, there is reason to believe that in the former the colored spaces are equally warm, though so feeble is the calorific effect that all attempts at the direct measurement of the heat have proved unsatisfactory. Admitting, however, that equality, it follows that in the prismatic the heat should appear to increase steadily from the more to the less refrangible end, because the compression of the colored spaces is becoming greater and greater. Draper, who first recognized this fact, and also first tried to measure the heat of the diffraction spectrum, attempted to give probability to this view by considering the sodium line D as the optical centre of the spectrum, and collecting all the visible rays below it into one focus, and all the visible rays above it into another focus. The heat of these foci being measured, proved to be equal.

We have now given a description of the two spectra, the prismatic or dispersion, the grating or diffraction, and have considered the distribution of light, heat, and chemical force in them respectively. Under the article SPECTROSCOPE will be found an account of the Fraunhofer or fixed lines, dark and bright, the various forms of spectroscopes, and the uses to which they are applied. We may therefore close with some historical statements in relation to that subject. In 1860, Kirchhoff and Bunsen announced the discovery of two new metals by the use of the prism. Public attention was instantly drawn to what was at once termed "spectrum analysis." The older publications, which really lay at the basis of the subject, were forgotten, and to M. Kirchhoff was awarded the entire honor for what was regarded as a new discovery. The history of science does not offer an instance of grosser injustice. Thirteen years previously, Draper had shown that all solid substances, and probably all liquids, emit light or become incandescent at the same temperature, that temperature being 977° F. The first ray they give forth is red, and other colors in the order of their refrangibility are added as the temperature rises, the spectrum being continuous and containing neither dark nor bright lines. These results, which formed the bases of M. Kirchhoff's fundamental memoir on *The Relation between the Coefficients of Emission and Absorption of Bodies for Light and Heat*, were appropriated without any adequate acknowledgment by M. Kirchhoff under the guise of mathematical deductions, and in a subsequent memoir on the history of this subject he passed them without notice. It may therefore be proper to recall some of the discoveries that had been made previously to 1860. Newton in his treatise on optics laid the foundation of the subject. He showed, as we have already mentioned, the manner in which a pure spectrum is to be prepared, proved the composite nature of white light, and presented the theory of different refrangibilities. He used a slit parallel to the edge of the prism, as well as triangular and circular openings, employing the image not of the sun, but of these slits. Euler, in his theory of light and heat, stated the principle that every substance absorbs light of such a wave-length as coincides with the vibrations of its smallest particles. Wollaston in 1802 discovered the dark lines in the sun's spectrum, but gave little attention to the subject. Fraunhofer invented the spectroscope in 1814; he used it without a collimator—a form by which results of exquisite perfection may be obtained. He mapped 576 of the fixed lines, gave to the more conspicuous ones the names they still bear, and determined that the cause of the lines is outside of the earth's atmosphere. He examined the light of the moon, Venus, and Mars, and saw in it the solar fixed lines. In the rays of the fixed stars Sirius, Procyon, Capella, Pollux, Betelgeux, though the position of the other fixed lines was different, he recognized the double line D. He inferred that the cause of these lines is the absorptive action of the atmosphere of the stars and the sun. He was thus the originator of astronomical spectroscopy. He connected these facts with chemical ones, by showing that the two dark lines D of the solar spectrum are coincident with the two bright lines given by a sodium flame. He found the lines D, E, b, F in Mars, and *b* in Capella. He also studied the bright lines of the electric spark and of colored flames. Brewster in 1822 utilized the yellow sodium flame in his monochromatic lamp. He examined the lines given by the absorption of nitrous acid gas, showing that they were more numerous as the temperature was higher. He also detected that some of the Fraunhofer lines of the sun's spectrum are due to the absorptive action of the earth's atmosphere. J. W. Herschel examined colored flames, and proposed them as a means of detecting the presence of substances. He published many facts in relation to the photographic and thermal properties of the spectra. In some of his investigations in thermal distribution he used paper blackened on one side and moistened with alcohol. Talbot in 1826 again examined the spectra of colored flames, and proposed the prism as a means of qualitative analysis. He used it practically to distinguish lithia from strontia, designating the operation optical analysis. He subsequently studied the bright lines given by various metals, gold, copper, etc., when volatilized by a voltaic current. Draper in 1843 published colored and other engravings of the fixed lines in the prismatic and diffraction spectra. Simultaneously with Becquerel he discovered the ultra-violet fixed lines. He ascertained that the spectra of ignited solids is continuous, showed that the point of ignition is the same for all solids and liquids (977° F.), and that as the temperature rises rays of increasing refrangibility are given off. He made the prismatic analysis of several different gas-flames, using in these experiments a sunlight comparison spectrum. He employed the method of designating the lines by their wave-lengths. This was subsequently used by Ditscheiner, Van der Williger, Mascart, Gibbs, and Angström. Wheatstone in 1836 examined the spectra of electric sparks, and proposed this as a means of distinguishing one metal from another. Miller in 1845 published drawings of the spectra of several colored flames. Zantedeschi modified Fraunhofer's spectroscope by introducing a collimator. This made the instrument more compact, and indeed gave it its modern form. Stokes about 1850, from a consideration of the coincidence of the two dark D lines in the solar spectrum with the two bright lines of the sodium flame, inferred that sodium must exist in the sun. Stewart, from the law of the exchanges of heat, led the way to an explanation of the reversal of the spectrum lines. Angström, in an investigation of the

# STELLAR TYPE SPECTRA

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Fig. 1. *Type* II; *The Sun, Pollux, &c.*

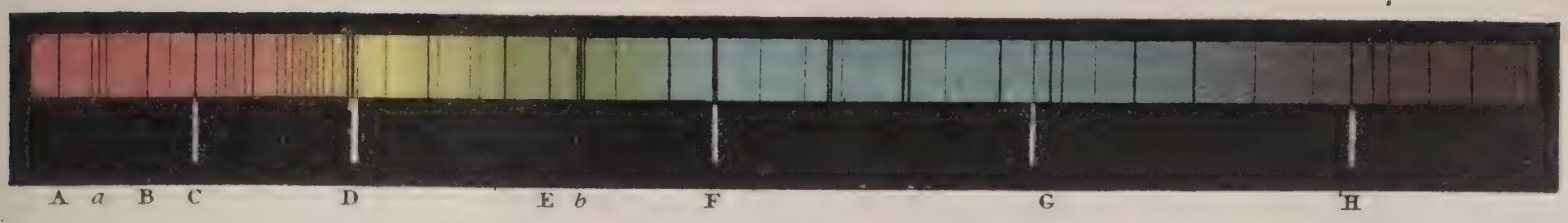



Fig. 2. *Type* I; *Sirius, α Lyrae, &c.*

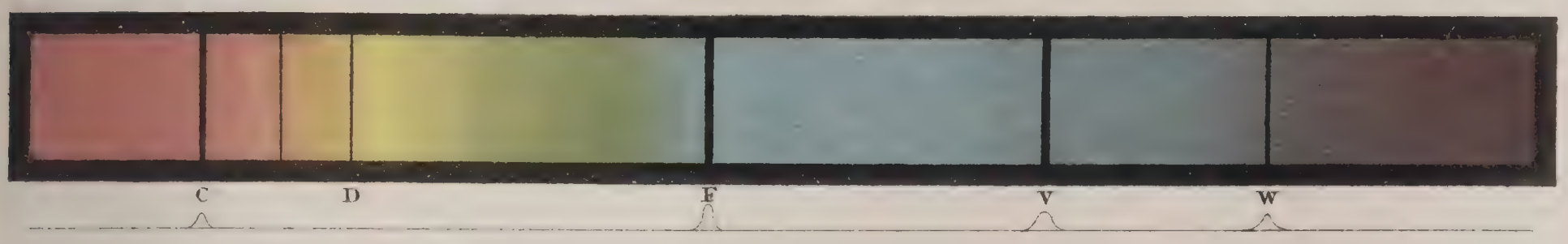



Fig. 3. *Type* III; *α Herculis, β Pegasi, &c.*

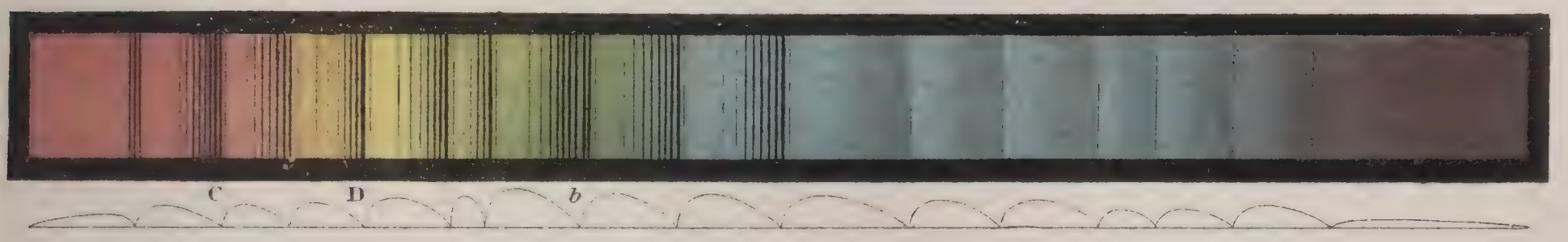



Fig. 4. *Type* III; *α Orionis, Antares, &c.*

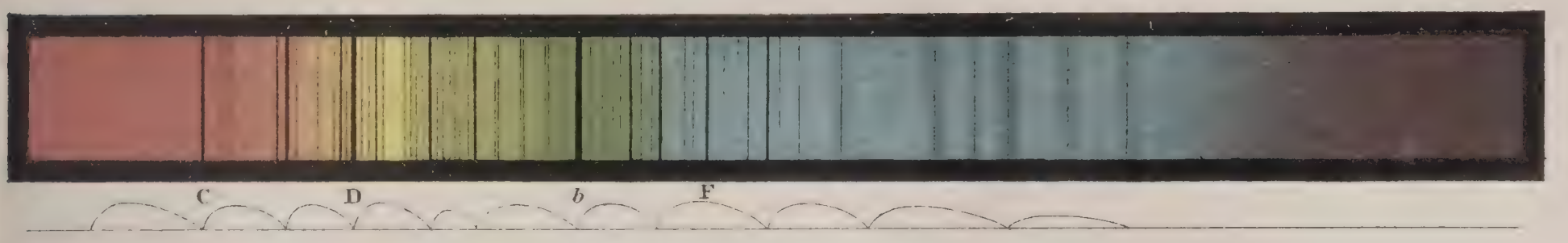



Fig. 5. *Type* IV; *152 Schjellerup.*

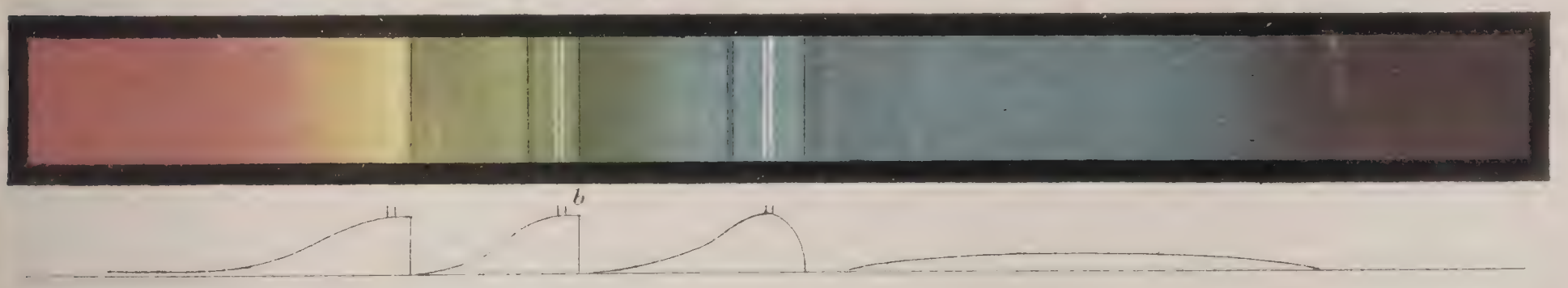



Fig. 6. *Type* IV; *78 Schjellerup.*

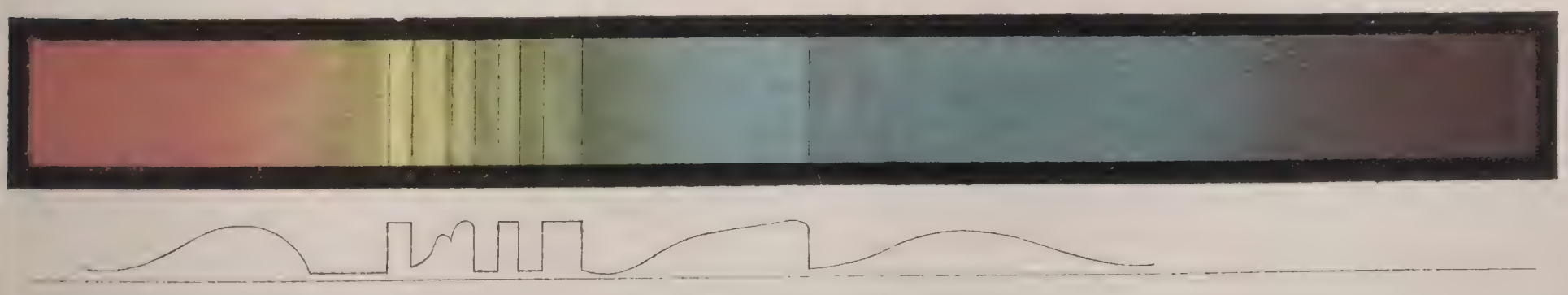
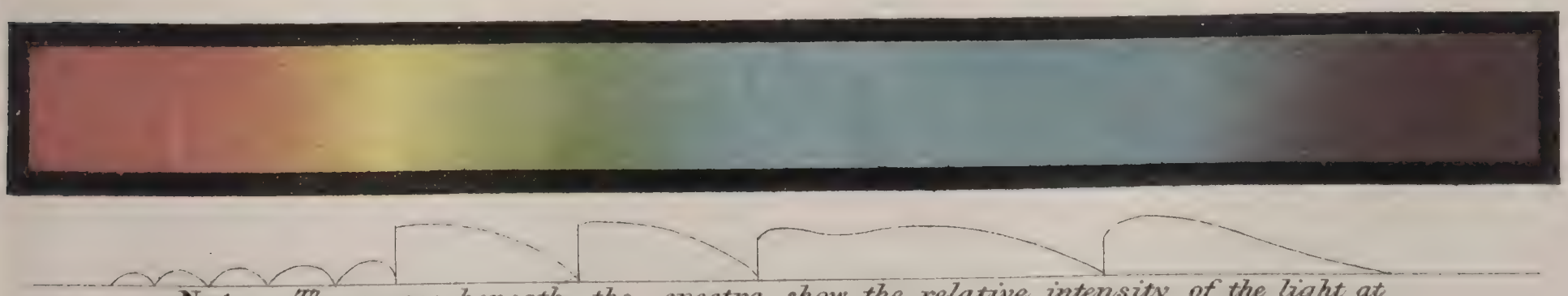


Fig. 7. *Carbon — the Voltaic Arch.*



**Note.**—*The curves beneath the spectra show the relative intensity of the light at different points, which is approximately as the ordinates. Perpendiculars extending beyond the curves indicate sharply defined lines of superior brilliancy.*

electric spark, proved that it yields two spectra—one derived from the metals of the poles, the other from the gas or air through which the spark passes. In 1856 he announced the general law, that a gas when luminous emits rays of light of the same refrangibility as those which it has the power to absorb; or, that the rays which a substance absorbs are precisely those which it emits when self-luminous. The reversal of the fixed lines was thus completely explained. Subsequently he published charts of the fixed lines, arranged according to their wave-lengths, the normal spectrum. Swan in 1857 proved that the two D lines are due exclusively to sodium, and are always a test of great delicacy of its presence.

The foregoing is offered not as a complete history of spectroscopic science previously to 1860, but for the purpose of showing that the generally-received impression of its originating about that time is altogether a misconception. It was the announcement of the fortunate discovery of two new metals, rubidium and cæsium, that instantly and forcibly drew attention to it; its foundations, as this imperfect statement shows, had, however, not only been long previously laid, but the structure carried very far toward completion. Subsequently, the literature of the subject has become immense, the drift of scientific research taking this special direction, and in the hands of the ablest physicists discovery crowding upon discovery to such an extent that it is impossible in the compass of this article to do it justice. What we have endeavored to do is to draw attention to the labors of those earlier experimenters, who in reality established this beautiful and important branch of science.

J. W. Draper.

**Spectrum Analysis.** See Spectroscope and Spectrum.

**Speculative Philosophy.** See Philosophy, by W. T. Harris, A. M., LL.D.

**Spec'ulum** [Lat., "mirror"], **Speculum Metal,** or **Specula of Silvered Glass.** Speculum in optics and astronomy signifies a reflecting surface, usually of metal, though the term has also been frequently applied to unsilvered glass since the introduction of silvered-glass telescopes by Foucault and Steinheil in 1857. As the image formed by a concave speculum is on the same side of the mirror as the object, some arrangement is necessary to prevent the observer's head obstructing the passage of light to the speculum, and hence we have four different forms of reflecting telescope: (1) the Herschelian or Le Mairean, in which the speculum is so tilted as to bring the image to one side of the telescope tube; (2) the Gregorian, in which a secondary concave speculum returns the rays through an aperture in the primary speculum to the eye of the observer; (3) the Cassegrain, in which a convex secondary speculum is used for the same purpose as the concave of the Gregorian; and (4) the Newtonian, in which a plane speculum or right-angled reflecting prism turns the beam of light out to the side of the tube. Each of these forms has its merits and defects. The Herschelian, while it has the brightest image of all with a given aperture, cannot produce the finest definition, because the surface ought to be a paraboloid, with the vertex on the margin of the speculum, and this is almost unrealizable; the Herschels avoided this difficulty in large measure by using nearly spherical surfaces of long focus, their telescopes of 18 inches aperture being 20 feet long, while the Cassegrain of the writer of 28 inches aperture requires a tube less than 10 feet long. The convenience and facility of using a telescope turn almost altogether on its focal length, and in this comparison the advantage of the Cassegrain, allowing for the difference of apertures, is as 3 to 1. The Gregorian form is advantageous where a non-inverted image is desired, and it has been much used for small instruments intended for terrestrial as well as celestial observation. In larger telescopes the increase of length as compared with the Cassegrain, which is equal to twice the focal length of the secondary speculum, is a serious disadvantage. Not only does it require a larger dome to cover a Gregorian of the same aperture, but the flexure of the tube, and the consequent difficulty of preserving the adjustments, are much increased. Moreover, it is commonly stated that the curvature of the secondary speculum being concave, it has a tendency to exaggerate the defects of the primary. But with the modern methods of local correction, to be described further on, this counts for but little.

A defect which is alleged against both the Gregorian and Cassegrain is that the images they give as compared with the Newtonian are too much magnified, and that low powers cannot be used. Under certain circumstances this consideration has some weight, but it is as frequently an advantage. It must always be remembered that with a telescope of large aperture a very low power cannot be employed if the whole objective is to be utilized; for example, with a 28-inch aperture the lowest power should not be less than 140. The pencil emerging from the eyepiece must not be larger than the pupil of the eye at its maximum dilation.

The Newtonian construction may be arranged in two ways—one that used by Newton, to interpose a plane speculum or right-angled reflecting prism in the cone of rays proceeding from the primary speculum at such a distance from the focus as to bring that focus to the side of the telescope, or else as constructed by Foucault, to put a small reflecting prism just inside the focus of the speculum, and adjacent to it the objective of a microscope, the eyepiece of which should be placed on the margin of the telescope tube. This latter construction avoids the serious difficulty of making a large plane surface. The great advantage of the Newtonian is the convenient position the observer may assume; its most serious disadvantage, the necessity of being elevated 40, 50, or even 60 feet from the ground in the case of such instruments as the 4-foot of Mr. Lassell and the 6-foot of Lord Rosse. For the small sizes, like those now so extensively constructed by Messrs. Browning & With of London, this form leaves little to be desired. I have found it convenient to combine both the Newtonian and Cassegrain in my 28-inch.

The relative merits of reflectors and refractors have given rise to much discussion. In truth, each has its separate function: to the reflector belong absolute achromaticity and the maximum of size; to the achromatic, stability of adjustment. The achromatic is therefore suited to measurements of precision—the reflector to physical observation, and especially to certain applications of physics and chemistry to astronomy. The great achromatics of recent years, such as the 26-inch Alvan Clark telescope at Washington, in many respects rival the great reflectors, but they also lose some of the advantages of small refractors. Each is tending to intrude on the special domain of the other, for while Messrs. Lassell, Browning, and Grubb are giving stability to reflectors, Mr. Rutherfurd has made large lenses (13 inches) of great excellence especially suited to astronomical photography.

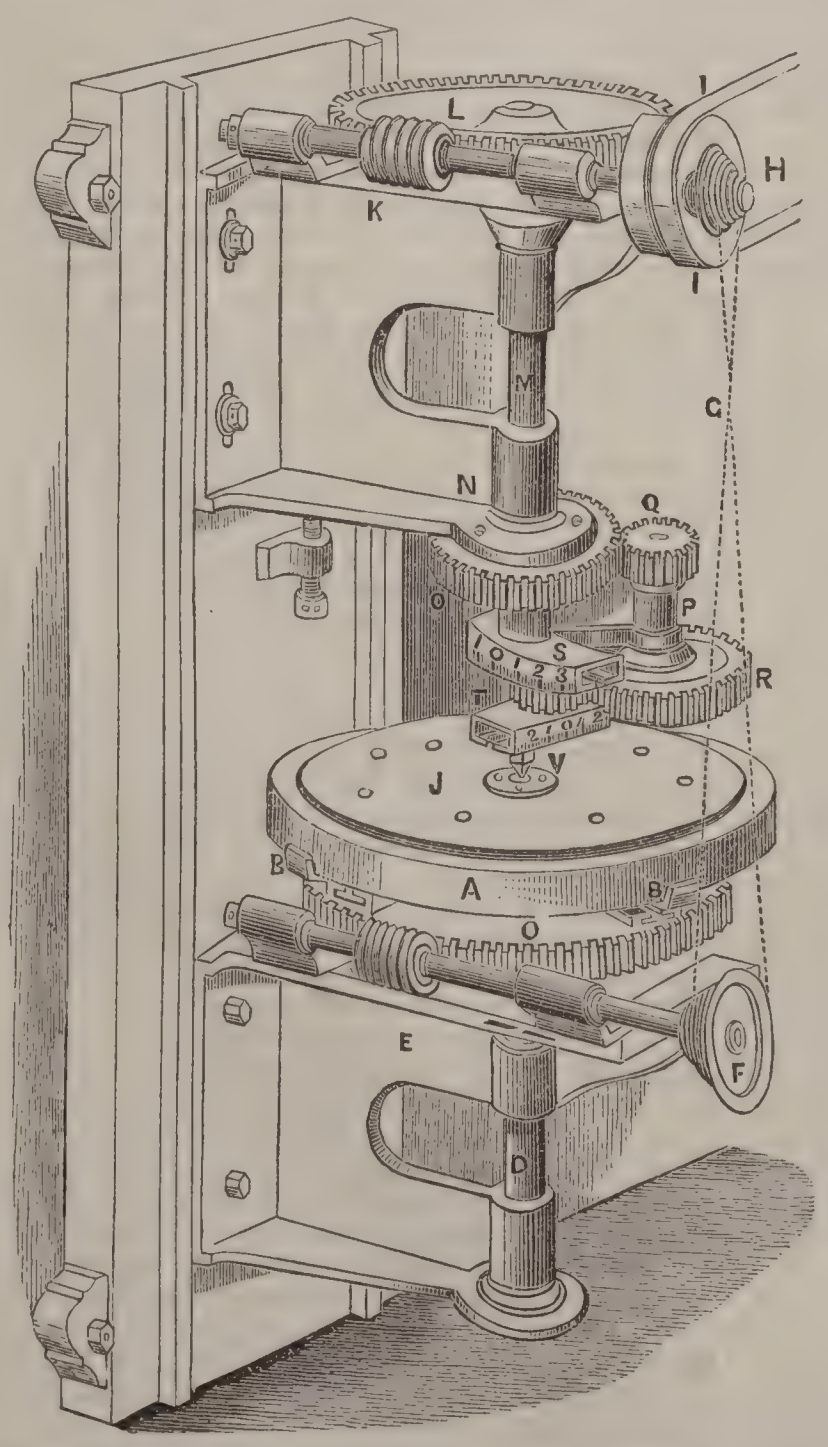
The specula used in reflecting telescopes are of two kinds: (1) Those made of an alloy of copper and tin; (2) those of glass covered with a film of silver, about $\frac{1}{200000}$th of an inch thick on the side turned toward the object. These latter must not be confounded with looking-glass mirrors, which are coated with tin-amalgam on the posterior side. All the great reflectors of Herschel, Rosse, Lassell, De la Rue, and others made previously to 1857, were on the first plan. Silvered-glass telescopes were invented by Steinheil, and reinvented in the same year by Foucault, whose admirable paper in the *Annales de l'Observatoire de Paris* (1859) is a model of what such memoirs should be. It is proper here also to allude to my paper on this subject in the *Smithsonian Contributions to Science* (1864). Ever since the introduction of silvered glass, there has been an animated controversy as to its utility compared with speculum metal, but it seems as if the balance had inclined finally to the former. A silvered speculum is permanent; for even though the silver coating be tarnished, it may readily be repolished, or, if injured by dampness, be replaced without affecting the figure of the glass; it is many times lighter, and therefore demands less weight in the mounting, and is correspondingly more manageable; it is more reflecting, in the proportion of about 92 to 65, and in consequence a smaller aperture will give an equal brilliancy to objects, this being a great advantage in an unsteady atmosphere. Of course, under favorable atmospheric conditions the larger aperture will give greater penetrating power, but nothing prevents the construction of a glass mirror of as large dimensions as any speculum. For these reasons it is not expedient to describe at length the processes for casting speculum metal. It is sufficient to say that it is composed of copper and tin in the proportion of 32 to 14.911; that it must be cast on a chill—that is, a slightly warmed iron surface; and that it must be annealed with the greatest care and for a long time.

*Grinding and Polishing.*—These operations do not differ much in the cases of metal and glass, except that the latter, being more rigid, will not take a permanent set if raised from its bearings, and being lighter can be more easily manipulated. The grinding and polishing of specula may be accomplished either by machinery or by hand. In former times, when Hadley, Mudge, Edwards, Molyneux, Short, and others were making reflecting telescopes, the work was done altogether by hand, the tools being fixed on an optician's post, which allowed free motion all round the surface to be worked. But when the elder Herschel had advanced to the larger telescopes which he constructed, he found it desirable to use machinery. For many years the arrangement of this machinery was kept a profound secret until finally revealed by Sir John Herschel a short time

previous to his death. A full description may be found in vol. xxi. of the 8th ed. of the *Encyclopædia Britannica*. The late earl of Rosse probably, however, did more to bring methods of working reflecting telescopes to perfection than any one else, particularly when we remember that he had an almost unknown field to work in, and that he attained a diameter of speculum never produced before nor since. Only a person who has devoted many years to exploring the difficulties of this pursuit can appreciate what Lord Rosse overcame. At the same time, it should be mentioned that Mr. Lassell has polished unquestionably the finest reflecting surfaces of 2 and 4 feet diameter that have ever been made, and this after many years of persevering and costly endeavor. His polishing-machine is elegant in design and smooth in action. Dr. De la Rue has produced fine results on specula of 13 inches, though he is better known for his extensive photographic use of this instrument on the sun, moon, planets, and stars. Mr. Grubb has also made the 4-foot equatorial now at Melbourne.

As to hand-working of reflectors, that has been confined to glass specula, and science owes the first publication of the processes to the late M. Foucault, who was the independent discoverer not only of this use of silvered glass, but also of the system of "local corrections." Though this method had long before Foucault's time been practised in America by Alvan Clark in the correction of achromatics for spherical aberration, yet the process had not been published. Any one who reads Foucault's memoir, previously referred to, will see good reason for regretting his untimely death. The methods of examining surfaces that he used enable one to detect every defect that a surface has—in the workshop even better than in the telescope—and give the means of obtaining absolute optical perfection.

Without entering into greater detail than is desirable, we may illustrate the subject of machine-polishing by a woodcut of Mr. Lassell's apparatus. After an experience derived from the construction of different kinds of polishing-machine, and extending over eighteen years, I may say that his contrivance with De la Rue's apparatus for controlling the rotation of the polisher will do all that can be accomplished by any machine, though in a recent memoir (*Phil. Trans. Royal Society*, 1874) Lassell states that a new one he there describes of a stronger model is required for 4-foot surfaces. The pitch coating which serves to carry the pol-




ishing rouge adheres very tightly toward the end of the process, and a machine is severely strained.

Lassell's idea was to cause the polisher to describe circular strokes upon the surface to be acted on, and to secure an equable and smooth motion. The machine has two vertical shafts, each driven by a screw, the axes of the worms being connected by a band passing over cone pulleys. The lower shaft carries the mirror and its equilibrated bearings. The upper shaft, passing through a fixed gear, carries at its lower extremity a crank which in revolving causes the secondary shaft at the side to rotate, and this in turn forces the lowest pinion to turn. By means of the two graduated dovetails the extent of the hypocycloids thus produced can be varied, and indeed other curves be originated. Subsequently, Lassell and De la Rue introduced improvements into this mechanism for the purpose of avoiding the irregular rotation of the polisher, and the tendency to the occurrence of rings of unequal action on the speculum.

As, however, it is evident that silvered-glass telescopes will eventually displace speculum metal, the methods by which they are polished claim our notice. An essential difference in the two cases depends on the fact that the glass surface, being once corrected to the paraboloid of revolution, is permanent, being protected by its silver coating. One is therefore prompted to spare no pains to remove even the most trifling defect, and in the case of my 28-inch a good deal of time, extending over two years, was spent in minute retouching. Eventually, a surface was attained that has exhibited the division in the outer ring of Saturn and other similarly difficult objects. The value of the system of local correction depends to a considerable extent on the fact that the disturbances arising from heat produced during polishing are avoided. But a small part of the surface is acted on at once, and the rest being freely exposed to radiation and evaporation, a harmful degree of expansion does not take place. An indispensable part of the process is frequent examination of an illuminated pinhole by a high-power eyepiece, both eyepiece and pinhole being placed near the centre of curvature of the speculum. The unsilvered glass reflects light enough not only to enable one to use this system of investigation, but also to apply the test by screening, in which the image of a pinhole before a flame is gradually cut off by an opaque straight edge. If there are any aberrating rays, they pass by the screen, and entering the eye disclose to it the parts of the reflecting surface that are in error. These can be attacked by a polisher of suitable size and quickly removed. One effect of the local retouching system is, it does not demand that the whole surface should be remade if a small part is in error, but in most cases that part alone is operated on. There is no difficulty about preserving a surface of revolution, and the minute portion constituting the difference between the sphere and parabola is readily rubbed away. In the case of a 4-foot mirror of 40-feet focus the actual depth of the cut on the edge is only $\frac{1}{21.333}$d of an inch to produce parabolicity in a spherical mirror.

*Support.*—But no matter how perfect the optical surface may be, unless it is properly supported it will not officiate even passably. It is almost incredible what a small pressure will totally destroy the goodness of a large reflector. The statement Herschel makes is literally true, that if you lay a speculum on its back on a flat surface, and find it to define well, and then lift it up and put a thread underneath it, it will be so distorted as only to give a pair of images joined by a fuzz of light. When my 28-inch was supported on an air-bag behind, with three fixed points in front just out of contact, by blowing an ounce volume of air into the bag a star could be made triple. Fortunately, in glass as soon as the pressure is removed the fine figure is regained. Foucault suggested for the back support an india-rubber air-bag, and for certain uses this cannot be excelled. But the arrangement is not sufficiently stable for photographic or spectroscopic work, and it is best to employ the equilibrated lever system invented by Grubb and perfected by Rosse and Lassell. This does well as long as the speculum is on its back and the telescope points nearly vertically. But when the tube is depressed toward the horizon, the edge-support assumes more and more importance, and unless a good system is used the image becomes very much confused, either taking the form of a cross or else becoming doubled and fuzzy. In working with a great many glass specula I was for a long time puzzled by the fact that sometimes a surface showed this defect much more than at others, until eventually it turned out that these glass disks have an axis of maximum rigidity, on either end of which they may rest with a minimum of distortion. It seems likely, from reading the difficulties of others, that speculum metal is affected similarly. In surfaces of even quite large size it suffices, having placed the speculum in its best position, to swing it in a flexible hoop, taking care to have some device to keep the proper diameter in a vertical plane, either by revolving the telescope-tube in its cradle or else by turning the

speculum-box on a finely-fitting collar, so as not to disturb the centring. For the very largest specula the best results are undoubtedly attained by Lassell's scheme of a system of levers distributed over the back of the reflector, and taking into holes in it in such a way that the whole weight does not press on the lower edge. The last degree of nicety will be attained by a combination of this latter set of levers with those intended for the support of the speculum when the tube is vertical.

It has been remarked that it is important to avoid heating during grinding and polishing. It is almost certain that the ordinary kinds of glass used for silvered-glass reflectors not only yield to different degrees in different directions by pressure, but also by heat. Hence, by injudicious working or by undue haste a permanent figure may be communicated to glass, which will give only double images in the line of the optical axis. By allowing the beam of light to fall at a small obliquity on the surface, a good image may be produced at one side of the optical axis; and I have in this way made a 15½-inch mirror that was suited to the Herschelian form, the obliquity being about 2½°. There is reason to suppose that speculum metal shows a similar tendency.

*Silvering of Glass.*—A large number of processes have been invented for coating glass with a thin and uniform film of silver. They all depend on reducing metallic silver from a solution of nitrate of silver and ammonia, with perhaps the addition of potash. The reducing agent may be Rochelle salt, milk-sugar, inverted sugar, oil of cloves, aldehyde, etc. The best process is described in the *Monthly Notices* of the Royal Astronomical Society (Dec., 1875) by Martin, who has just completed a 4-foot silvered-glass telescope for the Paris Observatory. The glass must be carefully cleaned with nitric acid, and afterward with potash and alcohol, and then placed face downward on a mixture of equal parts of the following four liquids: (1) a solution of 40 grammes of crystallized nitrate of silver in a litre of distilled water; (2) a solution of 6 grammes of pure nitrate of ammonia in 100 grammes of water; (3) a solution of 10 grammes of caustic potash (quite free from carbonate and chloride) in 100 grammes of water. (4) We dissolve 25 grammes of sugar in 250 grammes of water; we add 3 grammes of tartaric acid, and heat to boiling, which is maintained for about 10 minutes, to produce the inversion of the sugar, and the solution is then allowed to cool. We then add 50 cubic centimètres of alcohol, to hinder any subsequent fermentation, and we dilute with water to make the volume half a litre if the silvering is to be done in winter, or dilute still more if it is to be done in summer. The film of silver, if the potash is pure, may not need any polishing, and should in any case require only a few strokes of a buckskin pad slightly tinged with fine rouge.

*References.—Philosophical Transactions of the Royal Society; Memoirs of the Royal Astronomical Society*, and *Monthly Notices of the Royal Ast. Soc.*, under the headings "Newton," "Herschel," "Rosse," "Lassell," "De la Rue," "Nasmyth," "Robinson," "Grubb;" Smith's *Optics*, vol. ii. p. 301; *Proceedings British Association*, 1850; *Smithsonian Contributions*, 1864; *Annals de l'Observatoire de Paris*, 1859; Holtzapfel's *Mechanical Manipulations*, p. 1292; *Encyclopædia Britannica*, vol. xxi., 8th ed., art. "Telescope." HENRY DRAPER.

**Speech.** See LANGUAGE, by PROF. W. D. WHITNEY, PH. D., LL.D.

**Speed** (JAMES), b. in Jefferson co., Ky., Mar. 11, 1812; graduated at St. Joseph's College; studied law at Transylvania University; began its practice at Louisville 1833; was a member of the legislature in 1847, State senator 1861, U. S. attorney-general Nov., 1864–July, 1866, and in the same year was chosen president of the Philadelphia Loyalists' convention.

**Speed** (JOHN), b. at Farringdon, Cheshire, in 1552 (according to others in 1542); pursued the business of a tailor in London until late in life, but at the same time was amassing an extensive knowledge of English antiquities, and ultimately was enabled by Sir Fulk Greville to publish a costly and valuable series of works. He was also much indebted to the friendship of Sir Henry Spelman for his success as an author. He published anonymously about 1590 a treatise on the *Genealogies of the Scriptures*, afterward prefixed to the 1st ed. of King James's Bible (1611), but his first appearance as an author was in 1608, when he printed a collection of 54 maps of various counties and cities, and engravings of antiquities of England and Wales, which were incorporated into *The Theatre of the Empire of Great Britain* (folio, 1611), with descriptive letter-press—a work in which he was aided by Camden, Christopher Saxton, and John Norden. In the same year he published his *History of Great Britain under the Conquests of the Romans, Saxons, Danes, and Normans*. D. at London July 28, 1629.

**Speed's Mill,** tp., Pickens co., Ala. P. 198.

**Speedsville,** p.-v., Caroline tp., Tompkins co., N. Y. P. 153.

**Speedwell,** tp., St. Clair co., Mo. P. 606.

**Speedwell,** p.-v. and tp., Wythe co., Va. P. 4088.

**Speight's Bridge,** p.-v. and tp., Greene co., N. C. P. 1820.

**Speke** (JOHN HANNING), b. at Jordans, Somerset, England, May 4, 1827; entered the British army 1844; served in India and in the Crimean war; accompanied Capt. Richard F. Burton in the expedition which resulted in the discovery of the great lakes of Central Africa, and afterward was at the head of another expedition (with Capt. Grant), which discovered the connection of the Nile with those lakes. Capt. Speke published a *Journal of the Discovery of the Source of the Nile* (1863), *What Led to the Discovery of the Source of the Nile* (1864); received gold medals from the geographical societies of France (1860) and England (1861), and from the king of Italy, and was engaged after his second expedition in a bitter controversy with Capt. Burton as to the merits of their respective discoveries. He was to have been welcomed by the British Association at Bath, but accidentally shot himself the day previous, Sept. 15, 1864, while engaged in field-sports.

**Spel'man** (Sir HENRY), b. at Congham, Norfolk, England, in 1562; educated at Walsingham School; graduated at Trinity College, Cambridge, about 1580; studied law at Lincoln's Inn, but devoted himself chiefly to archæology; was in 1604 high sheriff of Norfolk; was employed by James I. upon important commissions, especially in determining land-titles in Ireland; was knighted about 1612, in which year he withdrew from public business and settled in London; published his treatise *De Non Temerandis Ecclesiis; of the Rights and Respects due to Churches* (1613), and devoted many years to the study of the Anglo-Saxon language and to the compilation of his chief works, a valuable glossary of terms which occur in records and other ancient writings, and a collection of the councils of the English Church, but published during his life only the first volume of each. D. in London in 1641, and, by special order of Charles I., was buried in Westminster Abbey, near the monument of Camden. Vol. i. of his *Glossarium Archaiologicum*, extending to the letter L, was published 1626: vol. ii., completed by his son, Sir John, and by William Dugdale, appeared in 1664; and the whole work was issued in a single folio volume in 1687. Vol. i. of the *Concilia* was issued in 1639; vol. ii., chiefly by Dugdale, in 1664. Several miscellaneous treatises by Spelman on the laws and antiquities of England were posthumously edited, both separately and in a single volume, entitled *Reliquiæ Spelmannianæ* (Oxford, folio, 1698), with a *Life*, by Bishop Edmund Gibson. They were also included in his *English Works*, republished at London in folio in 1723.—His son, SIR JOHN, was knighted 1641, "in consideration of his father's good services both to Church and State," and was made master of Sutton's Hospital. He edited the *Saxon Psalter* (1641) and a *Life of Alfred the Great*, of which a Latin translation was published in 1678, though the original English was first edited by Thomas Hearne in 1709. D. at Oxford July 25, 1643.—EDWARD SPELMAN, a great-grandson of Sir Henry, published an elegant translation of Xenophon's *Anabasis* (1742) and of the *Roman Antiquities* of Dionysius Halicarnassus (4 vols. 4to, 1758). D. in Norfolk in 1767.

**Spelt,** the *Triticum spelta*, probably the *far* of the ancient Romans and the *zea* of the Greeks, is a grain somewhat resembling wheat, but quite distinct from it. It can be grown on poorer soils than those which are required for wheat. It is much raised in parts of Europe, and crops of it are occasionally seen in the U. S., as in Virginia. In quality it is much inferior to wheat. Spelt is believed to be specifically identical with *Ægilops caudata*, a wild grass of Europe. A sort of spelt, called *Triticum bengalense*, is raised in India. Lesser spelt, or St. Peter's corn (*Triticum monococcum*), called also "one-grained wheat," is raised to some extent on poor soils in Europe.

**Spel'ter,** the commercial name for zinc in pigs or blocks. (See ZINC.)

**Spence** (JOHN), M. D., a well-known practitioner of medicine at Dumfries, Va., and collaborator of the *American Journal of the Medical Sciences* of Philadelphia. He was a native of Scotland; spent five years in the University of Edinburgh in the days of Cullen, Black, and Monro. He took a lively interest in introducing vaccination, being fully satisfied of its protection from variola. Threatened by consumption, a sea-voyage across the Atlantic is sup-

posed to have relieved him, and having acquired distinction in his new home, the faculty of the University of Pennsylvania unanimously conferred on him the honorary degree of M. D. D. May 18, 1829, aged sixty-three.

PAUL F. EVE.

**Spence** (JOSEPH), b. Apr. 25, 1699; educated at Oxford, where he became fellow in 1722; entered into holy orders, was made professor of poetry in his college, and presented to the rectory of Birchanger in Essex. He subsequently travelled on the Continent, and afterward held the living of Great Horwood, and was made a prebend of Durham cathedral and professor of modern history at Oxford. He wrote an essay on Pope's translation of the *Odyssey*, and some minor works. His principal production is *Polymetis*, an attempt to illustrate the agreement between the ancient Roman artists and poets by comparing their works one with the other. He also made a collection of *Anecdotes of Books and Men*, which possesses considerable value. He was accidentally drowned by falling into a fish-pond, Aug. 20, 1768.

**Spence** (WILLIAM), b. 1783; entered upon mercantile business in Hull, where he acquired a taste for natural history; in 1805 presented some specimens of insects to Rev. William Kirby, the famous entomologist, which led to a warm friendship between the two men, who together wrote the *Introduction to Entomology, or Elements of the Natural History of Insects* (1815–26; 7th ed., with considerable modifications and additions, 1858). Before the publication of this work he had written several valuable papers on entomology; was returned to Parliament about 1815, where he earnestly maintained that England might become independent of foreign produce; in 1826 took up his residence in London, and became an active member of several learned associations and president of the Entomological Society. D. in London Jan. 6, 1860.

**Spen'cer,** county of S. W. Indiana, bordering on Ohio River. Surface hilly in the W. and level in the S. part; soil productive, abounding in bituminous coal. Cattle, horses, sheep, and swine are numerous. There are flour and saw mills, and manufactures of carriages and furniture. Staples, tobacco in large quantities, Indian corn, wheat, oats, potatoes, hay, wool, and sorghum-molasses. Cap. Rockport. Area, 390 sq. m. P. 17,998.

**Spencer,** county of N. Kentucky, intersected by Salt River; hilly but fertile. There are many cattle, horses, swine, and sheep. Staples, Indian corn, wheat, rye, oats, and distilled liquors, and a little tobacco. Cap. Taylorsville. Area, 280 sq. m. P. 5956.

**Spencer,** tp., Harrison co., Ind. P. 1310.

**Spencer,** tp., Jennings co., Ind. P. 1927.

**Spencer,** p.-v., cap. of Owen co., Ind., on White River and Indianapolis and Vincennes R. R., 52 miles S. W. of the former city, has 5 churches, 1 bank, excellent graded school employing 6 teachers, 2 weekly newspapers, a woollen and planing mill, 1 stove-factory, a pork-packing establishment, machine-shops, saw and flouring mills, stone-quarries, 4 hotels, and block and cannel coal. P. 971.

JOHN WAYLAND, ED. "OWEN CO. JOURNAL."

**Spencer,** p.-v. and tp., cap. of Clay co., Ia., on Little Sioux River, has 2 churches, a public school, 2 hotels, and 1 newspaper. Principal business, farming and stock-raising. P. 594. SAMUEL GILLESPIE, ED. "CLAY CO. NEWS."

**Spencer,** p.-v. and tp., Worcester co., Mass., on Boston and Albany R. R., 11 miles S. W. of Worcester, has 4 churches, 18 public schools, a town-house, public library and lyceum, 1 bank, Masonic lodge, post of the Grand Army of the Republic, and 1 newspaper. P. 3952.

CHAS. F. MINOR, ED. "SUN."

**Spencer,** tp., Kent co., Mich. P. 580.

**Spencer,** tp., Pike co., Mo. P. 1654.

**Spencer,** tp., Ralls co., Mo. P. 2119.

**Spencer,** p.-v. and tp., Tioga co., N. Y., on Geneva Ithaca and Athens R. R. P. 1863.

**Spencer,** tp., Allen co., O. P. 1153.

**Spencer,** tp., Guernsey co., O. P. 1359.

**Spencer,** tp., Hamilton co., O. P. 2543.

**Spencer,** tp., Lucas co., O. P. 653.

**Spencer,** p.-v. and tp., Medina co., O. P. 929.

**Spencer,** p.-v., cap. of Van Buren co., Tenn. P. 147.

**Spencer,** tp., Powhatan co., Va. P. 2395.

**Spencer,** p.-v. and tp., cap. of Roane co., West Va. P. of v. 143; of tp. 1366.

**Spencer** (AMAN CURTIUS), M. D., b. in Charlotte co., Va., in 1790; graduated in medicine at the University of Pennsylvania; settled in Nottoway co., Va., whence, after practising his profession fifteen years, he went to Europe, prosecuting his studies for some time; on his return settled in Petersburg and devoted himself chiefly to surgery; claimed to have first performed lithotrity in America, May, 1832; was also a successful lithotomist. D. in Petersburg Feb., 1861. PAUL F. EVE.

**Spencer** (AMBROSE), LL.D., b. at Salisbury, Conn., Dec. 13, 1765; graduated at Harvard University in 1783; studied law, and began practice at Hudson, N. Y.; represented Columbia co. in the State legislature 1793; was appointed assistant attorney-general 1796; attorney-general 1802–04; became a justice of the supreme court in 1804, and chief-justice 1819–23; member of the State constitutional convention 1821; was elected member of Congress 1829–31; held the office of mayor of Albany; presided at the Whig national convention at Baltimore in 1844, and was author of a bill mitigating the criminal code and authorizing the erection of a State prison near New York City. D. at Lyons, N. Y., Mar. 13, 1848.

**Spencer** (GEORGE E.), b. in Jefferson co., N. Y., Nov. 1, 1835; educated at the college of Montreal, Canada; was admitted to the bar in Iowa 1856; was secretary of the Iowa senate 1858; entered the Union army as captain 1862; became adjutant-general of volunteers; recruited the 1st Alabama Cavalry 1863; commanded a cavalry brigade under Sherman 1864, and was brevetted brigadier-general for gallantry in the field; became register in bankruptcy in Alabama 1867; was chosen U. S. Senator as a Republican 1868, and re-elected for the term expiring in 1879.—His wife, Mrs. BELLA Z. SPENCER, b. in London, England, about 1840, to whom he was married in 1862, was the authoress of *Ora, the Lost Wife* (1864), *Tried and True, a Story of the Rebellion* (1866), and *Surface and Depth* (1867), the latter published after her death, which occurred at Tuscaloosa, Ala., Aug. 1, 1867.

**Spencer** (GEORGE JOHN), D. C. L., SECOND EARL SPENCER, b. at Wimbledon, England, Sept. 1, 1758; graduated at Cambridge about 1776; entered Parliament under the courtesy title of Lord Althorp 1780; was commissioner of the treasury 1782; succeeded his father in the earldom Oct. 31, 1782; became ambassador to Vienna, lord privy seal, and first lord of the admiralty 1794; resigned the latter office 1802; accepted the secretaryship of state for the home department for a few months in 1806; was the first president of the Roxburghe Club, formed for the reprinting of rare English books 1812, and accumulated one of the rarest and most costly private libraries in Europe. D. at Althorp Park Nov. 10, 1834. Dr. T. F. Dibdin, the celebrated bibliographer, devoted some years to a description of Earl Spencer's library, publishing the *Bibliotheca Spenceriana* (4 vols. super-royal 8vo, 1814–15) and the *Ædes Althorpianæ* (2 vols., 1822).—GEORGE SPENCER, his youngest son, b. in London Dec. 21, 1799, graduated at Cambridge 1819, and took orders in the Church of England, but seceded to the Roman Catholic Church 1830; was ordained priest 1832; took charge of the missions of West Bromley and Dudley; entered the order of Passionists 1846; known as "Father Ignatius." D. at Carstairs, Scotland, Oct. 1, 1864. His *Life* was published in 1866.

**Spencer** (HERBERT), b. in Derby Apr. 27, 1820, and was an only surviving child. His father and grandfather were teachers. Having slender health in boyhood, he was not kept at school, and his father, a gentleman of enlarged views, attended to his studies, but left him much to himself. At thirteen he was sent to study with an uncle, the Rev. Thomas Spencer, rector of Hinton, a liberal clergyman and a cultivated scholar, with whom he remained three years. He had been early attracted to natural history, and under his father's encouragement made collections, practised drawing from objects, made physical and chemical experiments, and indulged a marked taste for manipulation and invention. While at Hinton he devoted himself chiefly to mathematics, and developed a taste and capacity for working out original problems. He was familiar with physical and chemical operations, and the bent of his mind was strongly toward experimental inquiry. Returning to Derby, he was busied for a short time with inventions and miscellaneous study, and in 1837 entered the office of Sir Charles Fox and began work as a civil engineer. After this he was engaged for several years on railroads, but gave his spare time to inventions, scientific experiments, mathematical studies, and to writing for the *Civil Engineer's and Architect's Journal;* in 1842 contributed a series of letters to the *Nonconformist* on *The Proper Sphere of Government;* and in 1848 became sub-editor of the *Economist*. In 1850 he published his first book, *Social Statics*, which was a development in a more scientific form of the ethical ideas contained in his earlier letters on government. The work was a treatise on social science based upon the conception of the evolution of society through the operation of natural laws. He now took up the occupation of a writer, con-

tributing elaborate articles upon various subjects to the leading English reviews. But, although dealing with various themes, his course of thought was systematic, and the masterly series of essays that he published from 1850 to 1860 are mainly devoted to the elaboration and application to various important subjects of the principle of evolution. These papers reappeared in this country in the volumes entitled *Illustrations of Universal Progress; Essays, Moral, Political, and Æsthetic; Education, Intellectual, Moral, and Physical;* and *Recent Discussions.* In 1855, Mr. Spencer published a very able and original work entitled *The Principles of Psychology,* pronounced by Mr. J. S. Mill to be "the finest example we possess of the psychological method in its full power." In this work the doctrine of evolution was applied to the science of mind, and the ground was taken that mental faculties in the whole scale of animal life have been developed by experience, through the intercourse of living organisms with their surroundings, through the principle of heredity and variation, producing slow modifications in vast periods of time. This work was so profound in exposition, and so greatly in advance of the time, that it produced but little public impression. Mr. Spencer had now grasped the conception of evolution in its broad relations, and in 1858 he reached the conclusion that it is a universal process dependent upon the laws of matter and force conformed to by all orders of phenomena and capable of being resolved and formulated. Being a great principle or law of the successive changes of phenomena involving the unfolding and dissolution of things, it seemed to offer the basis of a philosophy of nature from the genetic point of view—understanding by the term "philosophy" the completest unification of positive knowledge by universal principles. Believing that the time had come to attempt a comprehensive scheme of thought from the point of view of modern scientific results, and that although imperfectly executed it might still be valuable, Mr. Spencer resolved to undertake it. Master of logical methods, widely and accurately acquainted with the modern sciences of nature, with rare powers both of analysis and synthesis, peculiarly free from the bias of former systems, and a writer of unrivalled clearness, Mr. Spencer was endowed with unusual qualifications for so difficult an enterprise. To those who think his attempt presumptuous, it may be stated that letters written in 1859, designed to facilitate the execution of Mr. Spencer's project, by Mill, Grote, Huxley, Fraser, Hooker, Tyndall, and Latham, recognized that he was eminently the man to do a great and original work for the advancement of knowledge in this age. This judgment has been abundantly vindicated, high European authorities having subsequently declared that in mental grasp and organizing power Spencer is the strongest man that England has produced since Newton. He began his work by drawing up the prospectus of a *System of Philosophy* involving the full working out of the law of evolution and its application to the phenomena of life, mind, society, and ethics. In this prospectus the logical connection and detailed order of treatment are presented in a scheme designed to embrace eleven volumes, and to require twenty years for its completion. This remarkable analysis of his system was written the same year (1859) that Mr. Darwin made his great contribution to the development-theory in one of its aspects by the publication of the *Origin of Species.* The *Philosophy* was divided into two parts: (1) *The Unknowable;* (2) *The Laws of the Knowable.* The first part was introductory, occupying little more than 100 pages, and was designed to determine the limits of legitimate knowledge, and of any philosophy that is based upon it. It is there argued that in its knowing the human mind cannot transcend phenomena, but that it cannot escape the consciousness of an Unknowable Power, of which all phenomena are the manifestations, and which human thought, from the very nature of intelligence, can never grasp or understand. In this part of his work Mr. Spencer has been much misapprehended. His aim was to clear the field of inquiry of what he held as doubtful and fruitless speculation, so that his proper work might be coextensive with the sphere of science and strictly conform to its methods. Yet for affirming an Unknowable beyond the scope of true philosophy, in a brief preliminary essay, he has been strangely charged with being the author of an "unknowable philosophy." How rigorously his undertaking is confined to the sphere of knowable realities will at once appear. The initial treatise, *First Principles,* was published 1862 in one volume, and aside from its introductory part it is occupied with the foundations of his scheme, in which the law of evolution is broadly worked out and formulated in terms of matter, motion, and force—legitimate conceptions of science. In 1867 he completed the *Principles of Biology* in two volumes, the second division of the system, and devoted to the data and inductions of biological science from the point of view of evolution as expounded in *First Principles.* In 1872 appeared the *Principles of Psychology,* also in two volumes, the third instalment of the *Philosophy,* and based upon the treatise of 1855, with such modifications and extensions as he had been led to by his subsequent studies. It is an exposition of mental science grounded in biology and in accordance with the theory of evolution. The fourth division of his system is the *Principles of Sociology,* outlined to occupy three volumes. But before entering upon it Mr. Spencer issued in 1872 the *Study of Sociology,* a small book, not a part of the regular system, but partially designed as introductory to the sociological division. The *Principles of Sociology* is a very important part of his great work, and is now in progress. Its first volume will be ready this year (1876), and several portions of it have been already printed in numbers. The same plan is here pursued as in the previous divisions, the data of the subject being first treated, to be followed by the inductions or general principles of social science derived from them, and elucidating the conditions and course of social evolution. The closing division of his undertaking will work out the *Principles of Morality,* in two volumes, on the basis of the preceding expositions, and deduce the rules of human conduct from the laws of life, of mind, and of man's social relations. Independent of his "system" proper, but ancillary to the *Principles of Sociology,* he several years ago drew up the plan of a series of publications under the title *Descriptive Sociology.* This is designed to be a comprehensive repertory of facts representing the characters of human societies of all types and grades, existing and historical, savage, barbarous, and civilized. The facts are tabulated upon an original plan, on which the social elements are classified, and the form of presentation is admirably suited for convenient reference, ready comparison, and instructive inference. The civil, military, domestic, industrial, commercial, moral, religious, æsthetic, and intellectual factors which constitute the structure and functions of society are given, so that each table or set of tables maps out, as it were, for inspection, the traits of the communities described. The work involved enormous labor; and having determined its plan and scope, Mr. Spencer employed three cultivated scholars to assist him in carrying it out, assigning to each a separate field of research. In 1873 he published No. I. of this work, the *Descriptive Sociology of English Civilization,* compiled and abstracted by Mr. James Collyer. It is a social history of England in compendious form, giving the classified facts which represent its condition at any epoch, the progress in each element of social activity, the rise of institutions, the differentiation of professions, the growth of industries and arts, and the general *consensus* of English social advancement. Appended to the tables are copious classified extracts sustaining the tabular summaries, and given without comment. This was followed by No. II., devoted to the decayed American civilizations, and was elaborated by Dr. Scheppig. No. III. takes up the Nigretto and Malayo-Polynesian races, and No. IV. delineates the African races. Both were worked up by Prof. Duncan. No. V., devoted to the social history of the Hebrews, and No. VI., to French descriptive sociology, will appear this year. These works are in folio form, as necessitated by the tables. They were at first designed to embrace eighteen issues, so as to form a cyclopædia of the social condition of many representative communities of the world; but the enormous expensiveness of the undertaking, and the very restricted demand for the publication, have compelled Mr. Spencer to limit the printing to nine numbers. His extensive unpublished materials will, however, prove valuable for his own use in dealing with the principles of sociology, the object for which the whole was undertaken. The *Descriptive Sociology* is to be translated and published in Russia, where steps have been taken to reduce Russian social history to the same form of statement. The general works of this author have been translated into nearly all the languages of Europe, and are exerting a powerful influence upon the mind of the age. They are all reprinted in this country.

Mr. Spencer is in imperfect health, which was so broken when he began his great undertaking in 1860 that few believed he would be able to go on with it. But he is a skilful master of the art of taking care of himself, and is in better condition now than when he started. He dictates to an amanuensis about three hours a day, his "copy" as written requiring but little revision for the press. He has followed this practice since 1859, and ascribes his power of going on to the economy of force it allows. Mr. Spencer is full medium in stature, slimly built, long-legged, and a great walker. He is a bachelor, living in a quiet boarding-house in the West End of London. Holding a philosophy that bears closely upon human conduct, and applying it with as much decision and repose as if it had been

accepted by the world for a thousand years, he naturally falls into a critical attitude toward many of the opinions and practices that prevail around him. This leads to controversy, which is serious work with Spencer, as he talks with the same force and perspicuity as he writes. It therefore becomes necessary for him to abstain much from discussion in order to save his strength, and especially in the evening, as it aggravates the sleeplessness that has greatly troubled him for years. His recreations are billiards, concerts, and theatres, with frequent country rambles, which are often prolonged when overdoing has put him "out of order." He is a regular frequenter of the Athenæum Club, where he looks over the periodicals, takes notes in the library, chats with friends, plays billiards, takes his tea in the smoking-room, and sometimes a cigarette. He has been often beset to join scientific societies, and has been offered university honors, but declines, caring only to get along with his work, and setting himself resolutely against everything that would hinder it by diverting his attention, increasing his responsibilities, or wasting his time. His correspondence having accumulated to a burdensome degree, as a measure of self-protection he has recently issued the form of a lithograph letter explaining his inability to answer all who write to him. E. L. Youmans.

**Spencer** (Ichabod Smith), D. D., b. at Rupert, Vt., Feb. 23, 1798; graduated at Union College 1822; taught school at Schenectady, and afterward at Canandaigua, N. Y.; was settled at Northampton, Mass., Sept. 11, 1828, as colleague with Mr. Williams; pastor of the Second church, Brooklyn, N. Y., from 1832 until his death, which occurred at the latter place Nov. 23, 1854. He published *Sermons, with a Memoir* (1855), *Sacramental Discourses* (1861), and *Evidences of Divine Revelation* (1865).

**Spencer** (Jesse Ames), D. D., b. at Hyde Park, N. Y., June 17, 1816; graduated at Columbia College 1837; studied theology at the General Seminary of the Protestant Episcopal Church; was ordained 1840; was rector of St. James's church, Goshen, N. Y., 1840–42; travelled in Europe 1842–43, and again 1848–49, at which time he visited Egypt and Palestine; was professor of Latin and of Oriental languages at Burlington College, N. J., 1849–50; editor and secretary of the Episcopal S. S. Union and Church Book Society 1851–57; declined the vice-presidency of Troy University 1858; was rector of St. Paul's, Flatbush, L. I., 1863–65, and has been professor of Greek in the College of the City of New York since Oct., 1869. Author of a volume of religious *Discourses* (1843), *History of the English Reformation* (1846), *The East, Sketches of Travel in Egypt and the Holy Land* (1850), and of a widely-circulated *History of the United States* (4 vols., 1856–69), first published (in English and German) in semi-monthly parts as a subscription-book, *Greek Praxis* (1870), and *A Course of English Reading* (1873). Dr. Spencer was editor of *The Young Churchman's Miscellany* (1846–68), of 6 vols. of the "Classical Series" of T. K. Arnold (1846–50), of a *New Testament in Greek* (1847), with notes, *Cæsar's Commentaries* (1848), with notes and a lexicon, of Pycroft's *Course of Reading* (1844), of Archbishop Trench's *Poems* (1856), and brought out a new edition of the late Prof. Alpheus Crosby's *Anabasis* (1875). He has been a large contributor to the biographical department of Appletons' *American Cyclopædia*.

**Spencer** (John), D. D., b. at Bocton, Kent, England, in 1630; educated at the King's School, Canterbury; graduated at Corpus Christi College, Cambridge, about 1650; obtained a fellowship there 1652; took orders in the Church of England; became rector of Landbeach, master of Corpus, and archdeacon of Sudbury 1667; prebendary of Ely 1672, and dean of Ely 1677. D. May 27, 1695. Author of *A Discourse concerning Prodigies* (1663; 2d ed. 1665), *Dissertatio de Urim et Thummim* (1669), and *De Legibus Hebræorum Ritualibus et earum Rationibus* (Cambridge, 1685), a work of great learning which excited much controversy. It maintained that the Hebrew ritual was almost entirely borrowed from the Egyptian—a view previously upheld by Maimonides in his *More Nevochim*, and by Sir John Marsham in his *Canon Chronicus Ægyptiacus*, defended by Bishop Warburton and combated by Witsius, Shuckford, Dr. Woodward, and William Jones of Nayland. Editions of Spencer were published at the Hague 1686, and at Leipsic (1705). A new edition, brought out by Dr. Leonard Chappelow (Cambridge, 2 vols., 1727), contained a supplementary book (the fourth) left in MS. by the author, and the whole work, with a memoir and a commentary by Pfaff, was published at Tübingen (2 vols., 1732).

**Spencer** (John Canfield), LL.D., son of Chief-Justice Ambrose, b. at Hudson, N. Y., Jan. 8, 1788; graduated at Union College 1806; was private secretary to Gov. D. D. Tompkins 1807–08; admitted to the bar at Canandaigua 1809; became master in chancery 1811, judge-advocate-general on the northern frontier 1813, postmaster at Canandaigua 1814, assistant attorney-general for Western New York 1815, member of Congress 1817–19, of the State assembly 1819–20, being Speaker the latter year; State senator 1824–28; commissioner to revise the statutes of New York 1829; special attorney-general to prosecute the murderers of William Morgan; was secretary of state and superintendent of common schools 1839–41; secretary of war under Pres. Tyler from Oct., 1841, to Mar., 1843, when he was transferred to the treasury department; resigned the latter post 1844 in consequence of his opposition to the annexation of Texas, and thenceforth devoted himself to the practice of his profession, in which he occupied an eminent position. The organization of the State asylum for idiots and the improvement of the common-school system were largely due to him, and he served on many important State commissions. In 1838 he edited, with a preface and notes, De Tocqueville's *Democracy in America*. D. at Albany May 18, 1855.

**Spencer** (John Charles), third Earl Spencer, better known as Lord Althorp, eldest son of George John, second Earl Spencer, b. May 30, 1782; educated at Harrow and at Trinity College, Cambridge; was elected to Parliament 1804; held office under Fox as junior lord of the treasury from Feb. 11, 1806, to Mar., 1807; sat in Parliament for the county of Northampton from Dec., 1806, till the passage of the Reform bill 1832, during which long period he was one of the leading members of the opposition; was especially prominent in the attacks upon the financial policy of the Tory administrations; was chancellor of the exchequer in the cabinet of Earl Grey Nov., 1830, to Nov., 1834; was ministerial leader of the House of Commons during the memorable debates on the successive Reform bills; succeeded his father as Earl Spencer Nov. 10, 1834, after which he withdrew from active political life; devoted himself to scientific agriculture; was many years president of the Smithfield Cattle Club; was one of the founders and the first president of the Royal Agricultural Society 1838; was an active member of the Roxburghe Club for reprinting rare books; vice-chairman of the Society for the Diffusion of Useful Knowledge, and a liberal promoter of the *Biographical Dictionary* undertaken by that society. D. at Wiseton Hall, Nottinghamshire, Oct. 1, 1845.

**Spencer** (Joseph), b. at East Haddam, Conn., 1714; chosen judge of probate in 1753; was major in the northern army under Col. Whiting 1758; appointed brigadier-general in the Continental army June 22, 1775, major-general Aug. 9, 1776; assisted in the expedition against Rhode Island 1778, also in Sullivan's retreat; resigned his command June 14, 1778, because of an order by Congress inquiring into the reasons for his not executing the plan of an expedition against the British in Rhode Island the year before; was elected to Congress in 1779, and the following year saw him elected into the council, of which he had been a member in 1766; and to this office he was re-elected annually until his death, which occurred at East Haddam Jan. 13, 1789.

**Spencer** (William Robert), son of Lord Charles Spencer and grandson of the second duke of Marlborough, b. in England in 1769; educated at Harrow and at Oxford; was for some years a commissioner of stamps; became involved in pecuniary difficulties, and consequently fixed his residence in Paris, where he d. Oct. 23, 1834. For many years he occupied a prominent position in London social circles as a wit and a writer of *vers de société*, some of which, like *Beth Gelert* and *Too Late I Stayed*, have become widely known through collections of "elegant extracts." Author of *Urania, or the Illuminé, a Comedy* (1802), and *The Year of Sorrow* (1803), a poetical tribute to the memory of several friends who had died in 1802; and translator of Bürger's *Lenore*, published in folio (1796), with designs by his aunt, Lady Diana Beauclerc. After his death a volume of *Poems by the late Hon. W. R. Spencer, to which is prefixed a Biographical Memoir* (1835), was published. Two of Mr. Spencer's sons became bishops: Aubrey George, b. in London Feb. 12, 1795, educated at Oxford, was appointed archdeacon of Bermuda 1825, bishop of Newfoundland 1839, and of Jamaica 1839. D. Feb. 24, 1872.—George Trevor, b. 1801, graduated at University College, Oxford, 1822; was incumbent of Buxton 1824–29, of Leadon-Roding 1829–37; bishop of Madras 1837–49; became chancellor of St. Paul's cathedral 1860, and rector of Walton 1861. D. near Buxton July 16, 1866. Author of 3 vols. of travels in India.

**Spencer Brook,** p.-v. and tp., Isanti co., Minn. P. 403.

**Spen'cerport,** p.-v., Ogden tp., Monroe co., N. Y., on Erie Canal and on Niagara Falls branch of New York Central R. R. P. 591.

**Spencer Rifle,** a breech-loading magazine gun, extensively used as an arm for the Union cavalry during the civil war in the U. S., is characterized by having in the butt of the stock a magazine holding seven cartridges, which are brought one by one into the chamber by a movement of the trigger-guard as a lever, which at the same time throws out the shell of the exploded cartridge. A new magazine can be inserted whenever the cartridges have been exhausted, or the magazine may be shut off and the rifle used as a single breech-loader.

**Spen'cerville,** p.-v., Spencer tp., Allen co., O., on Miami Canal. P. 364.

**Spe'ner** (PHILIPP JAKOB), b. at Rappoltsweiler, Upper Alsace, Jan. 25, 1635; studied theology at Strasbourg, Tübingen, and Bâle; visited several Swiss theological seminaries of the Reformed denomination, though a Lutheran divine, and began to preach at Strasbourg in 1663; was appointed first pastor in 1666 at Frankfort, where he instituted his famous *collegia pietatis* (prayer-meetings), which finally brought him into conflict with the orthodox clergy; became preacher to the electoral court of Dresden in 1686, but lost favor here by calling the elector's attention (privately) to the vices of his own life; was invited in 1695 to Berlin, where he was appointed provost of the church of St. Nicolai. D. Feb. 5, 1705. He was the founder of the so-called *pietism*, but neither in his writings nor in his person was there anything of that mysticism and eccentricity which characterized some of his adherents. In opposition to the orthodox theological system of his time, he conceived Christianity principally as a living duty and comfort, not as a science; and, leaving all subtle definitions to others, he simply recommended his hearers to look at the Bible in the light of their own lives, and then to look at their lives in the light of the Bible. The impression he made was both wide and deep, and after his death his tendency was for a long time represented by the theological faculty of the University of Halle. He wrote *Pia Desideria* (1675), *Das geistliche Priesterthum* (1677), *Des thätigen Christenthums Nothwendigkeit* (1679), *Evangelische Glaubenslehre* (1688). His *Life* was written by Hossbach (2 vols., 1828) and Wildenhahm (1842).

**Spen'ser** (EDMUND), b. at East Smithfield, near the Tower, London, England, in 1552 or 1553. Nothing is known with certainty of his family, but from passages of his poems it may be inferred that he was descended from the Spencers of Hurstwood, Lancashire, and was related to the Spencers of Althorp. He entered as a sizar at Pembroke Hall May 20, 1569, in which month he contributed a number of sonnets and epigrams to a volume printed at London by Dr. John van der Noodt, a Flemish physician; graduated Jan. 16, 1573; visited his relatives in Lancashire, where he fell in love with a lady supposed to have been Rose Daniel (sister of Samuel Daniel the poet), whose charms he celebrated under the name of "Rosalinde" in a pastoral poem, *The Shepheарde's Calendar*, published anonymously in 1579, the dedication of which to Sir Philip Sidney had been preceded by personal acquaintance in London; printed soon afterward *Three Proper and Wittie Familiar Letters lately passed between two Universitie Men* (1580), being a literary correspondence with his college-friend, Gabriel Harvey; obtained in the autumn of 1580, through the influence of Sidney, the post of secretary to Lord Grey of Wilton, lord lieutenant of Ireland; rendered in that capacity services which were rewarded in 1586 by a grant from the crown of an estate forfeited by the earl of Desmond, consisting of 3028 acres of land, including the castle and manor of Kilcolman, near Doneraile, in the county of Cork, and took up his residence at that place, where he began the composition of his *Faerie Queene;* wrote in that year his *Astrophel*, a pastoral elegy on the death of Sir Philip Sidney; was in 1588 appointed clerk of the council of Munster; received in 1599 a memorable visit from Sir Walter Raleigh on his return from the Lisbon expedition; read to Raleigh the first two books of his great poem, which the latter thought "a dish to set before a queen," and accordingly persuaded the poet to accompany him to London. His reception by Queen Elizabeth appears to have been appreciative, for the publication of the first three books of the *Faerie Queene* in 1590 not only placed him in the front rank of poets, but procured him a pension of £50. During this visit to London, Spenser also published a volume of *Complaints, containing Sundrie Small Poems of the World's Vanitie* (1591). His marriage in 1594 to a Miss Nagle inspired his beautiful love-sonnets entitled *Amoretti* and a magnificent *Epithalamium* (1595), which were shortly followed by *Colin Clout's come Home Again.* In 1596 he published *The Second Part of the Faerie Queene, containing the Fourth, Fifth, and Sixth Bookes*, and *Foure Hymnes* addressed to the countess of Cumberland; he also presented the queen a MS. dialogue, *A View of the State of Ireland*, not published until 1633. Spenser was appointed in 1598 sheriff of the county of Cork, thus incurring the enmity of the insurgents of "the earl of Tyrone's rebellion," who toward the close of that year burned his house and plundered his estate, forcing him to fly to England, on which occasion an infant child of the poet is said to have perished in the flames. Reduced to poverty, Spenser passed a few miserable months in London, and d. in King street, Westminster, Jan. 16, 1599. According to Ben Jonson, he "died for lack of bread," after having refused twenty pieces (of gold?) sent him by the earl of Essex, saying "he was sorry he had no time to spend them;" but these details rest upon the memory of Drummond of Hawthornden, and are discredited by most biographers. He was buried in Westminster Abbey, near the tomb of Chaucer, as he had desired, the funeral being at the expense of the earl of Essex; and a monument in his honor was erected in 1620 by Anne Clifford, countess of Dorset, afterward countess of Pembroke. He left two sons, Sylvanus and Peregrine. Hugolin, a son of Peregrine, was outlawed for adhesion to James II., and was living, "very old and unmarried," in 1700. Many editions of Spenser's complete works have appeared, the best being the variorum edition of Henry J. Todd (London, 8 vols., 1805), that of J. Payne Collier (London, 5 vols., 1862), with glossary, notes, and a *Life*, and that of Rev. R. Morris (Globe ed., 1869). These will, however, be superseded by a critical edition announced by Rev. A. B. Grosart as in preparation (1876), with the assistance of leading members of the British Philological Society. G. L. Craik's *Spenser and his Poetry* (3 vols., 1845) is perhaps the most satisfactory critical work. (For a view of his style and poetical rank see ENGLISH LANGUAGE AND LITERATURE.)

PORTER C. BLISS.

**Spe'onk,** p.-v., Southampton tp., Suffolk co., N. Y., on Sag Harbor branch of Long Island R. R. P. 174.

**Speran'sky** (MIKHAIL), COUNT, b. in the government of Vladimeer, Russia, Jan. 1, 1772; educated at the Academy of St. Petersburg, where he principally studied mathematics and physics, in which he became professor in 1797; was appointed secretary to the imperial council in 1801, and charged with the reorganization of the ministry of the interior, the committee on laws, and the imperial council; exercised considerable influence on the government, and carried through several improvements in the method of taxation, the system of public education, etc., but was banished in 1812 to Nizhnee-Novgorod, and afterward to Perm. In 1814 he was allowed to settle on a small estate near St. Petersburg, and in 1816 he re-entered the public service; was made governor of the province of Penza in 1817; governor-general of Siberia in 1819; was recalled to the court in 1821, and made president of the chancery in 1825. D. at St. Petersburg Feb. 23, 1839. His work, written in Russian, but translated into French under the title *Précis des Notions historiques sur la Réformation du Corps des Lois russes*, acquired a great reputation.—His daughter, ELIZABETH BAGREJEW-SPERANSKY, b. at St. Petersburg Sept. 17, 1799, was an authoress of note, and wrote, besides several novels, *Les dernières Heures de l'Empereur Nicolaus* (Leipsic, 1855) and *Les Pèlerins russes à Jérusalem* (2 vols., Brussels, 1854). D. at Vienna Apr. 4, 1859.

**Spermace'ti** [Lat. *sperma*, "sperm," and *cetus*, "whale"], **Spermaceti Fat,** or **Cetine** ($C_{32}H_{64}O_4$). Spermaceti exists ready formed in the cavities of the head of the sperm whale (*Physeter macrocephalus*), and also in that of some other whales and of *Delphinus edentulus*. It crystallizes out of the sperm oil of the head-cavities after the vital heat is lost, forming a magma or mirole, from which in cold weather the sperm oil is expressed by hydraulic pressure ("cold-drawn sperm oil"), the spermaceti being left behind. It is purified by melting it by steam to separate mechanical impurities, and recrystallizing. It then forms a lustrous, pearly, white mass of eminent crystalline texture, feeling soft and soapy to the touch; does not grease paper if quite freed from oil; is brittle; melts at 100°–116° F., and has a density of 0.943 at 60°. The pure spermaceti has a less density = 0.843 at 122°, 0.824 at 178°, and 0.813 at 201° F. (*Saussure.*) If pure, it is without taste or odor, and reacts neutral. The natural product, freed from sperm oil by cold alcohol and repeatedly crystallized from hot alcohol or ether, is the *cetine* of Chevreul, which melts at 120°–128°. Spermaceti was carefully investigated in 1840 by Dr. J. Laurens Smith (*Silliman's Journal*, xliii. 301, and *Scientific Researches*, Louisville, 1873, pp. 229–249), who demonstrated that it is an ether formed from palmitic acid and ethal, with elimination of water, and hence is a palmitate of ethal. It yields by saponification neither oleic or margaric acids nor glycerine, but in addition to palmitic acid small quantities of stearic, myriotic, and tannic acids were found by Heintz, and also, besides ethal, small quan-

tities of stethal, methal, and lethal, which acids and alcohols are present in the form of compounds analogous to palmitate of cetyl. The ethereal nature of spermaceti was distinctly recognized by Chevreul (*Recherches sur les Corps gras*). Spermaceti is decomposed by dry distillation at 600° F. (*Smith*) into a body of lower melting-point, and which may be saponified by potash, but it has an acid reaction, and is no longer spermaceti. It does not yield sebacic acid; whence it follows that cetine contains no oleic acid, and no ethal is found in this decomposition. (*Smith.*) It is also decomposed by steam at 320° F. in the same manner as by potash. No *acroleine* results from the destructive distillation of spermaceti, whence it is inferred no glycerine is present. (*Smith.*) This highly-valued product (isomeric with sperm oil) finds its chief use in the production of sperm candles, which are no longer so common as in the prosperous days of the sperm-whale fisheries, the decline of which dates from the general introduction of refined petroleum and paraffine. Spermaceti burns with a bright, clear flame like wax. The standard sperm candle, which is the common unit of comparison for photometric experiments in Great Britain and America, is taken to burn 120 grains of sperm in an hour, which it rarely does with accuracy. B. SILLIMAN.

**Spermatozo'a** [Gr. *σπέρμα*, "seed," and *ζῶα*, "living creatures"], minute animalcular bodies found in the semen of living creatures, which are the essential agents in producing the fecundation of the ova. Viewed through a microscope, each is seen to consist of a small flattened oval extremity or body, to which is attached a long slender caudal filament; and in the centre of the body a little spot may be detected. They appear to be in constant motion in the seminal fluid, the movements being performed by a lashing or undulatory motion of the tail. The term is also applied by botanists to minute microscopic bodies found in the antheridia of some cryptogamous plants, which are supposed to perform a function analogous to that of the animal spermatozoa. (See HISTOLOGY.)

**Sperm Oil.** See OILS and SPERMACETI.

**Spermophile.** See PRAIRIE SQUIRREL.

**Sperm Whale.** See CACHALOT and PHYSETERIDÆ.

**Sper'ry,** tp., Clayton co., Ia. P. 1141.

**Speusip'pus,** b. at Athens about 380 B. C., a nephew of Plato; received the instruction of his uncle, whom he accompanied to Syracuse, and succeeded as president of the Academy. D. at Athens in 339 B. C. Of his writings nothing is left.

**Spey'er,** or **Speier,** city of Germany, the capital of Rhenish Bavaria, at the influx of the Speyerbach into the Rhine, is surrounded with walls. It has some sugar-refineries and manufactures of vinegar and tobacco, and carries on an active trade in grain, timber, and wine on the Rhine. It is one of the oldest cities of Germany, and in the Middle Ages the German emperors often resided and held their diets here. Nevertheless, it has only one monumental building, the cathedral, erected in the eleventh century, thoroughly restored in 1858, and one of the finest church buildings of Germany. The other great edifices it once possessed have been destroyed by the French, who twice conquered and devastated the unhappy city in the most barbarous manner, blowing up with gunpowder her public buildings and transforming the whole town to a heap of ruins and rubbish. P. 14,806.

**Spezer,** tp., Richardson co., Neb. P. 338.

**Spe'zia,** or **La Spezia,** town of Italy, province of Genoa, beautifully situated on a gulf of the same name in lat. 44° 7′ N., lon. 9° 48′ E. The old walls and gates of Spezia have been mostly demolished in the course of the changes necessitated by the recent rapid growth of the town. This growth has been, in a large measure, consequent upon the construction of a great naval arsenal, begun here in 1861, and carried on with much energy and at an expense of about $9,000,000. The Gulf of Spezia (anciently called the Gulf of Luna) is formed by an offshoot of the Apennines, which, separating from the central chain N. E. of Sestri Levante, runs along the sea to the S. E., until at Spezia it divides into two arms which embrace the waters of this deep and broad gulf, and thus form the finest harbor in Italy. The two extreme points are Portovenere on the W. and Corvo on the E.; the mouth of the gulf opens S. S. E., and the distance from the lighthouse of the Tinotto on one side to that of the Telaro on the other is about 5 miles, while the inland stretch of the gulf as far as the town of Spezia is 6½ miles. The principal entrance is between the above-mentioned points, but there is also a passage from the W. between the promontory and the island of Palmaria, and another between this island and the islet of Tino, on which the pharos of Tinotto stands. This port is entirely safe from every wind except the sirocco, and the many mountain-spurs partially projecting into it and forming, as it were, so many separate little harbors, make it easy to secure complete shelter even from S. E. gales. Besides size and security, the harbor of Spezia is remarkable for its uniform depth (sufficient for the largest vessels), and for a bottom admirably suited for anchorage. With such immense natural advantages it was thought very important for the interests of Italy, as connected with the great highways of Mont Cenis, St. Gothard, and the Splügen, to strengthen and improve this harbor as far as possible, and to make it one of the chief naval stations of the kingdom—a work now wellnigh accomplished. About 1500 trading vessels enter this port annually. P. 24,127.

**Spez'zia,** an island of Greece, lies at the entrance of the Gulf of Nauplia. It comprises an area of 26 sq. m., with 9400 inhabitants, who are mostly engaged in commerce and navigation. The soil is unproductive, but the climate is remarkably salubrious.

**Sphag'num** [Gr. *σφάγνος*], a large and interesting genus of mosses, several species of which grow in the U. S., mainly in bogs, forming deep, spongy masses, almost always damp. They are called peat-moss, being a principal ingredient in pure peat. Peat-moss is the very best material for packing plants for transportation, as it retains moisture and never heats or putrefies.

**Spheg'idæ** [Gr. *σφήξ*, "wasp"], a family of hymenopterous insects, including the well-known sand-wasps, so called because all the females make their nests in the sand. The abdomen is connected by a slender stem with the thorax; the antennæ are filiform, and the feet adapted for digging. The species are numerous, of moderate size, and generally decorated with gay colors, often being banded with yellow. They revel in the sunshine, and are very active and restless. They are armed with a powerful sting; by means of this sting they provide food for their young. The victims (caterpillars, spiders, etc.) are paralyzed by the poison transmitted by the sting, and remain in a torpid condition until the young hatched from the eggs are ready to devour them. *Sphex ichneumonia* is one of the largest and most common in the U. S. This family also contains the mud-wasps. (See DAUBER.) THEODORE GILL.

**Sphenis'cidæ** [from *Spheniscus*—diminutive of Gr. *σφήν*, a "wedge"—the typical genus], a family of birds containing the true penguins, exhibiting some quite peculiar characters, and isolated by Prof. Huxley as a peculiar group (Spheniscomorphæ) of the sub-order Schizognathæ in his system. The form is generally carried erect, the legs being inserted far behind; the bill is moderately long, nearly straight, but with the culmen decurved at the tip, compressed, and longitudinally grooved on the sides; the nostrils are linear, and situated in the grooves of the bill; the wings are quite rudimentary (incapable of flight) and imperfect, and covered with scale-like feathers; the legs arise very far behind; the tibiæ are enclosed within the integuments; the tarsi are short and depressed, covered with small scales, and carried nearly or quite prone; the feet are moderate, with four toes, the three anterior depressed, well-developed, covered with transverse scales, and connected by a membrane, the posterior rudimentary, and united to the side of the tarsus. The skull belongs to the schizognathous type, and the maxillo-palatines are concavo-convex and lamellar; the shaft of the humerus is flattened from side to side, and its distal end presents an obliquely truncated surface, with which the similarly compressed radius and ulna articulate—the former altogether with the fore part, the latter with the hinder part of the humeral articular surface; "there is no free pollex;" "the pelvic bones are less firmly connected with the sacrum than in any other birds;" and "the short tarso-metatarsus is perforated by two very large clefts which lie between the middle and the lateral metatarsals." These osteological characters especially distinguish the group Spheniscomorphæ, according to Huxley. The family is entirely confined to the southern hemisphere, and by the latest systematic reviser (Dr. Elliot Coues) is differentiated into four genera and twelve species—viz. (1) *Aptenodytes*, with two; (2) *Pygoscelis*, with three; (3) *Eudyptes*, with five; and (4) *Spheniscus*, with two species. The *Spheniscus demersus* extends nearly as far N. as the equator—*i. e.* to at least 8° S. on the eastern and 10° S. on the western side of South America—and has by far the most northern range. Most of them inhabit the colder regions of the southern hemisphere, and species have been found in the Antarctic seas as near the pole as travellers have penetrated. The Falkland Islands, according to Coues, appear to be a centre of the family, no less than half of the known species occurring there. But all the continents and great islands of the temperate and cold portions of the southern hemisphere have representatives. All the species live in communities. They are incapable of flight, but are

very powerful swimmers, and their wings are used as fins. They live along the coast, and when at rest sit on their tarsi in an erect posture. In this posture, too, they walk, or rather waddle, till they approach the sea, when they throw themselves in, and are again at ease. According to Dr. Kidder, "no living thing that he ever saw expresses so graphically a state of *hurry* as a penguin when trying to escape. Its neck is stretched out, flippers whirring like the sails of a wind-mill, and body wagging from side to side as its short legs make stumbling and frantic efforts to get over the ground. There is such an expression of anxiety written all over the bird, it picks itself up from every fall, and stumbles again, with such an air of having an armful of bundles, that it escapes capture quite as often by the laughter of the pursuers as by its own really considerable speed." The water is their natural element, and in this they disport themselves with ease and grace. They are expert divers, and by repeated incursions into the depths catch the fishes, crustaceans, and mollusks upon which they feed. The females lay one or two eggs each, according to the species, generally in slight depressions of the ground or in burrows. (See also PENGUIN.) THEODORE GILL.

**Sphenodont'idæ** [from *Sphenodon*—Gr. σφήν, a "wedge," and ὀδούς, "tooth"—the typical and only living genus], a family of reptiles representing, according to some herpetologists, a peculiar order related to the saurians or lizards, and according to others a family of that order. In external form and characters the genus *Sphenodon* is so much like the Agamidæ as to have been originally referred without hesitation to that family. The body is rather robust; the scales on the back are rather small, and on the abdomen larger, quadrangular, and placed in transverse series; the head is quadrangular, covered with small scales; the teeth inserted on the edges of the jaws and on the premaxillary bones enlarged; the tongue papillose and simple; the tail compressed; the legs strong, and each with five toes, all of which are parallel and directed forward. Such are the superficial characteristics. The osteological peculiarities are numerous, and isolate the type from all true lizards. (1) The quadrate bones are perforate, and instead of being simply articulated with the cranial box, are firmly and immovably united with it, as well as with the pterygoid bones, by suture. (2) The rami of the lower jaw are united by ligament, and provided with an elongate articular surface, and their postorbicular processes are very short. (3) The palatine bones are displaced and separated by the pterygoids, and replace a palatal portion of the maxillaries. (4) The dentition is unique—viz. "two large cutting teeth above, formed by the confluence of two pairs of conical 'milk' teeth; alveolar edges of the jaws and palatines cutting and polished (in the adult), only partially armed with teeth (forming a serrature); palatine teeth in close proximity and parallel to maxillary series, both series receiving between them in a groove the similarly-serrated edge of the mandible." (*Günther.*) It need only be further added that the vertebræ are biconcave, and that there are no copulatory organs. Dr. Günther in 1867, in a *Contribution to the Anatomy of Hatteria* (*Rhynchocephalus*, Owen), was the first to recognize the peculiarities and ordinal distinctness of the type. Only one existing species is known—the *Sphenodon punctatum*, Gray (= *Hatteria punctata*, Gray, and *Rhynchocephalus sp.*, Owen). "It is peculiar to the island of New Zealand, and attains a considerable size. It is sluggish in its movements, and lives in holes and often in sandhills near the seashore." It feeds upon young birds (probably mostly nestlings) and insects. Formerly, it was abundant, but its large size rendered it conspicuous, and its sluggishness an easy prey, and now, on account of the combined attacks of man and hogs, it has become very rare. It is so inert that it makes little or no resistance, and may be handled with impunity and without attempting to bite. Nevertheless, fabulous tales of its poisonous qualities were formerly told of it by the natives, who gave it the name "tuatera" or "narara." It owes its interest chiefly to the fact of its being the sole existing representative of the order Rhynchocephalia, which was rich in species in the Mesozoic as well as Later Palæozoic epochs. (See also RHYNCHOCEPHALIA.)

THEODORE GILL.

**Sphenograms, or Cuneiform Characters.** See CUNEIFORM INSCRIPTIONS, by REV. W. H. WARD, S. T. D.

**Sphe'noid Bone** [Gr. σφήν, a "wedge"], a bone of the skull, situated in man at the anterior part of the base. It has been likened in shape to a bat with open wings. It consists of a body, four wings, two greater and two less, and the two pterygoid processes. The body is quadrilateral, and hollowed out into a mere shell. This body is conceived to represent the centrum of the third cephalic vertebra (constituting the posterior portion of the sphenoid), joined to the centrum of the second vertebra (the anterior portion). The two greater wings are the neurapophyses of the third vertebra, and the two lesser wings are neurapophyses of the second vertebra. The sphenoid is exceedingly complicated and irregular in its outlines. It is developed from ten centres. It is usually joined anteriorly in the adult to the two sphenoidal spongy bones (a pair of thin, curved irregular plates). Posteriorly, it becomes continuously united to the occipital bone. It articulates with all the bones of the skull and with five of those of the face.

**Sphere** [Gr. σφαῖρα], a volume bounded by a surface all of whose points are equally distant from a point within called the *centre*. It may be generated by a semicircle revolving about its diameter as an axis. Any line from the centre to a point of the surface is a *radius*, and any line drawn through the centre and limited by the surface is a *diameter;* all radii of the same sphere are equal; also all diameters of the same sphere are equal. Every plane section of a sphere is a circle; if the plane passes through the centre, the section is called a *great circle;* if it does not pass through the centre, the section is called a *small circle;* the radius of a great circle is equal to that of the sphere; the radius of a small circle may have any value from the radius of the sphere to 0, in which case the cutting plane merges into a tangent plane. The surface of a sphere is equal to four great circles, or it is equal to the circumference of a great circle multiplied by its diameter. The surface of a zone is equal to the circumference of a great circle multiplied by the altitude of the zone. The volume of a sphere is equal to its surface multiplied by one-third of its radius. The volume of a spherical sector is equal to the zone which forms its base multiplied by one-third of the radius of the sphere.

In analysis, the surface of a sphere is a surface of the second order, whose equation is of the form

$$(x-\alpha)^2+(y-\beta)^2+(z-\gamma)^2=R^2,$$

in which $\alpha$, $\beta$, and $\gamma$ are the co-ordinates of the centre, and R the radius of the sphere. W. G. PECK.

**Spher'ical Angle,** an angle included between arcs of two great circles intersecting on the surface of a sphere. It is the same as the diedral angle included between planes of the two arcs, and is consequently equal to the angle between two tangents, one to each arc at their common point.

**Spherical Excess,** the excess of the sum of the three angles of a spherical triangle over two right angles, the right angle being taken as a unit.

**Spherical Lune,** a portion of the surface of a sphere included between two great semicircles. The angle between the planes of the semicircles is the angle of the lune.

**Spherical Polygon,** a portion of the surface of a sphere bounded by arcs of three or more great circles, called sides; if the polygon has but three sides, it is a spherical triangle. In a spherical triangle the sum of the three angles is always greater than two right angles, and less than six right angles.

**Spherical Pyramid,** a portion of a sphere bounded by a spherical polygon, called the *base*, and by three or more circular sectors having their centres at the centre of the sphere.

**Spherical Trigonometry,** that branch of trigonometry which explains the method of solving spherical triangles when three parts are given; it also treats of the general relation between the six parts of which a spherical triangle is composed.

**Spherical Zone,** a portion of the surface of a sphere included between two parallel planes. The lines in which these planes cut the surface of the sphere are the bases of the zone, and the distance between the planes is the altitude of the zone.

**Spher'ograph** [Gr. σφαῖρα, "sphere," and γράφειν, to "write"], an instrument for solving by inspection numerous practical questions in spherics, such as arise in navigation, geodesy, etc. Special modifications of the instrument are made for special uses. Among its uses are the finding of the course, distance, etc., in great-circle sailing; the sun's place at noon; his meridian altitude; the time of sunset; the length of the day; right ascensions by night; finding latitudes when the horizon is hidden, etc. It consists of two concentric circular paper disks, the upper one transparent, and capable of being turned around upon the centre as it lies upon the face of the lower disk. Suitable lines and figures are drawn upon each disk, the lines varying according to the special use of the instrument. Readings are obtained by rotating the upper disk upon its centre to a certain point indicated in the data of the problem to be solved. The spherograph is the invention of S. M. Saxby, a British seaman. Its readings are very fairly accurate for mechanical solutions.

**Sphe'roid** [Gr. σφαῖρα and εἶδος], a volume resembling a sphere, and which may be generated by an ellipse revolv-

ing about one of its principal axes. If the ellipse is revolved about its conjugate axis, it generates a flattened volume called an *oblate* spheroid; if it revolves about its transverse axis, it generates an elongated volume called a *prolate* spheroid.

**Spheroid'al Condition,** the globular form assumed by water when dropped upon a heated metallic surface. It was first noticed by Leidenfrost in 1856, and afterward studied by Klaproth, Rumford, Dumas, and others. But to Boutigny we owe the largest amount of information on the subject. When water is gently dropped upon an intensely-heated plate of metal, or, better still, into a red-hot platinum crucible, by means of a pipette, the liquid particles, instead of boiling, coalesce into spheres, which roll and jump about upon the metallic surface; in this way the crucible may be about one-fourth filled with the moving spheres, the water slowly evaporating, but not boiling. When the heat is withdrawn, the water-drops remain for an instant quiet, and then burst into steam and disappear. In 1837, Mr. Tomlinson showed that other liquids—pyroxylic acid, spirits of wine, sulphuric ether, and even mercury—under the proper conditions assume the spheroidal state. Some fluids, those which come into contact with the plate, such as turpentine, olive oil, and sulphuric acid, do not assume this condition. A hot liquid surface may be used instead of a metallic plate; a fixed oil, for instance, may be heated to 450° or 500°, and upon its surface water may be carefully dropped; if this is carelessly done, the water-drop sometimes penetrates beneath the oil, is then transformed into steam, which by its sudden expansion scatters the heated oil in every direction. When water is thus rotating, if a drop of ether be added, the two drops coalesce and rotate as one globule, the ether enveloping the oil and forming its outer layer. Turpentine forms a disk upon a hot oil surface, but pyroxylic acid and bisulphide of carbon form globules; sulphuric ether also forms a globe upon the surface of hot water or hot mercury. A cold platinum plate pierced with holes large enough to permit water to pass freely, will, when maintained at a red heat, retain the water if it be dropped gently on the surface, the spheres being too large to pass through the apertures.

Water when in the spheroidal condition is below the boiling-point; that portion of the spherical drops nearest the plate is continually being converted into steam, whose elastic force holds the globe above the surface. The drop rolls off from the eminence formed by its cushion of steam, and instantly another is formed beneath it, and its rolling motion is thus occasioned. The enormous amount of heat required for the continual conversion of water into steam withdraws a portion of heat from the globule, and the fact that steam is a poor conductor of heat prevents this loss being made good by conduction from the metal plate. If a liquid at boiling-point be introduced into the red-hot crucible, its temperature falls from 5° to 7° as it assumes the spheroidal condition. The lowest temperature of a heated plate necessary to cause the spheroidal condition of water is 340°, of alcohol 273°, of ether 142° F. The temperature of each liquid for its spheroidal condition is supposed to be as fixed as is its boiling-point. Boutigny gives 205.7° for water, 167.9° for alcohol, 93.6° for ether, and 31.1° for sulphurous acid. There is a constant escape of steam from beneath the moving drop, the vapor generally escaping laterally; but when the drops rests upon a flat or concave surface, the lateral escape is difficult, and the vapor then frequently bursts upward through the middle of the drop. At times the escape of the vapor is rhythmic; where it is so, the ordinary oblate spheroid of water becomes beautifully incurved about the border, with a regular sinuous line. Illuminating the drop, and throwing its image, by means of a lens, upon a horizontal screen above it, the form of the drop may be easily seen. By suitable contrivances it is also possible to see with the naked eye the interval between the drop and the heated metal plate.

Many boiler explosions are supposed to be due to the spheroidal condition assumed by the water. "It might happen," says Dumas, "that it [the boiler] ceases to furnish steam, and nevertheless a reduction of temperature would cause an explosion." The water, already in a spheroidal state, coming into direct contact with the heated metal, would suddenly be converted into steam, which from its enormous expansive power would shatter the boiler. The form of the drops is that of a flattened sphere; this is due to the combined action of gravity and the molecular forces controlling the particles of water. When by any means a mass of liquid is removed from the action of gravity, it assumes the spherical form; a mass of oil suspended in a mixture of alcohol and water of precisely its own specific gravity is virtually removed from the attraction of gravity. The molecules of the oil are then free to follow the internal molecular forces, and in obedience to these they form a globe; in the case of a falling stream of water, the attraction of gravitation being satisfied by the motion, the particles are free to yield themselves to the controlling power of the molecular forces; and every mass which separates itself from the jet, or the masses into which the lower part of the jet is broken up, assume a spherical form. In the case of the water-drop supported on its cushion of steam, the downward pull of gravity, though not fully compensated by the upward elastic spring of the steam, and the consequent continual motion of the drop, is partially so, and the spherical form, due to the interaction of the molecular forces, is modified into the oblate spheroid by the attraction of gravity. In consequence of the protective action of vapor, the hand when thoroughly moistened may be passed with impunity through a stream of molten iron, the vapor formed by the heat of the iron protecting the flesh from injury.

Water, and even mercury, may be frozen in a red-hot crucible in consequence of the low temperature at which the intervening mass of frozen carbonic acid and ether assumes the spheroidal state. The carbonic acid snow, which is intensely cold, is placed in a red-hot crucible; a cushion of vapor protects the snow from melting rapidly; water, or mercury, whose freezing-point is 39° below zero, may be placed in the mass of carbonic acid snow within the red-hot crucible, and turned out almost immediately frozen solid.

S. B. Herrick.

**Sphinc'ter** [Gr. *σφιγκτήρ*, "binder"], in anatomy, is a muscle whose fibres, generally circular, surround some passage in the animal organism, closing the passage, in opposition to certain other muscles called dilators. Some of the sphincters are composed of striped fibre, some of unstriped, and some of both combined. The eyes, pupils, mouth, rectum, vagina, bladder, and urethra are the most important passages which are provided with sphincters; but there are numerous other sets of circular fibres which have more or less of the action of sphincter muscles.

**Sphingidæ.** See Hawk-Moths and Lepidoptera.

**Sphinx** [Gr. *σφίγξ*], the combination of the body of a lion with a human or animal head, called in Egyptian *hu* or *akar*. Those with the human head (*androsphinx*) according to the Greek represented the union of intellect and force, or the inundation in the time of the constellations Virgo and Leo; but in reality they symbolized gods or kings, of which their face was the portrait. Several kings of the eighteenth dynasty, and two queens, Mutnetem, mother of the pharaoh Horus, and Batanta, daughter of Rameses II., are depicted under this type. The sphinx also represented the god Har-em-aχu, or Harmachis, one of the forms of the solar Horus. The hawk-headed sphinx, or hieracosphinx, was the type of the god Mentu, another solar form; and the ram, or criosphinx, that of Xnum or Chnoumis, a demiurgic type of Ammon, worshipped at Elephantiné. The most remarkable sphinx is that placed before the second pyramid of Gizeh, sculptured partly out of the solid rock of the Libyan chain of hills, 40 feet high above them, 51 feet from the belly to the top of the head, and 110 feet long. It appears to have been carved before the eighteenth dynasty, and from inscriptions recently discovered, which speak of it as near the temple of Isis and the second pyramid, possibly as old as the fourth dynasty, and contemporaneous with Safra or Chefren, the builder of that monument. In the neighborhood, close to it, was found a shrine lined with aragonite or Egyptian alabaster, containing diorite statues of that king, connecting it with him, while tablets placed between its paws by Thothmes IV. record his worship of the sphinx, which continued during the nineteenth dynasty, and was renewed under the Roman empire. According to Pliny, it was the sepulchre of Amasis. Other sphinxes of smaller size are known; amongst the finest of which are those of Amenophis III., of red granite, at St. Petersburg, found behind the vocal Memnon; one of Menephtah, in the Louvre at Paris; others of black basalt, of Nepherites and Achoris. Sphinxes have occasionally two human arms instead of fore paws, and, although generally represented couchant, on smaller monuments are seen standing and trampling under foot the enemies of Egypt. Those which represent kings have the royal headdress and uræus serpent. Sphinxes are represented in Phœnician, Assyrian, and Etruscan art, and many are introduced at a time, and often are seen as ornaments of thrones and furniture. In Assyrian art they were ministers of the great gods. They appear on some of the oldest monuments of Greek art, but always as females with human heads, lions' bodies, and wings, this last adjunct seldom appearing in Egyptian sphinxes.

The myth of the Sphinx, which first appears in Hesiod, was especially Theban. The Sphinx was supposed to have been brought by the anger of Hera to that part of Greece

from the farthest parts of Ethiopia, or to have been a bacchante changed by Dionysos into that form. Other traditions make her sent by Hades from hell, and to have been the daughter of Typhon and Echidna, or the dog Orthos and the Chimæra. She lays waste the country and destroys many of the inhabitants, whom she devours—amongst others, Hæmon, the son of Creon. This she was supposed to do by proposing a riddle for their explanation in her song called *Alyros*. The riddle asked was, What animal walks on four legs in the morning, two at noon, and three in the evening? This Œdipus explained as man, who crawls on all-fours in the morning of life, walks erect in the meridian of his days, but is compelled to use a stick in his evening or declining years. As a reward for his interpretation, Œdipus received the crown of Thebes and married Jocasta—unfortunately, his own mother. On works of art Œdipus is represented killing the Sphinx with a sword. The esoterical explanations are various; as that it alluded to one of the daughters of Cadmus or Laius, or represented human destiny. It was the type of the coins of Chios, and appears on the helmet of the Minerva of the Parthenon. The sphinx was handed down in Christian art, and has been at all times considered an elegant combination. According to Pliny, a kind of ape so called was found in Ethiopia. The emperor Augustus used the sphinx for the device of his signet. S. Birch.

**Sphinx Caterpillar.** See Hawk-Moths.

**Sphyg'mograph** [Gr. *σφυγμός*, "pulse," and *γράφειν*, to "write"], an instrument for measuring and recording the shape, frequency, and force of the blood-wave in an artery. It consists of a series of delicate levers set in motion by the pulse-beat, and of a moving surface of paper, on which are recorded the results of the measurement. There are two forms of sphygmograph. The first was that of Vierordt, which has been superseded by the more delicate instrument of Marey. Both simply amplify on the record the successive changes in the calibre of the blood-vessel. Considerable skill is requisite in working with the sphygmograph. In diseased conditions of the heart its records have a conceded diagnostic value, which, however, can be fully appreciated only after a careful study of the physics of the blood-wave in a state of health.

**Sphyræn'idæ** [from *Sphyræna*—*σφύραινα*, the Greek name of a species of the family—the typical genus], a family of fishes of the order Teleocephali, distinguished by the pike-like form, combined with two distant dorsal and abdominal ventral fins. The body is elongate and subcylindrical, with parallel dorsal and abdominal outlines; the scales small and cycloid; the lateral line continuous; the head elongate, conic, and compressed; the eyes lateral; the opercular bones normally developed and unarmed; the mouth with a deep lateral and slightly-oblique cleft; the upper jaw scarcely protractile; teeth well developed (large mixed with small) on the jaws as well as palatine bones; branchial apertures continuous below; branchiostegal rays in seven pairs; dorsal fins two, far apart, the first with few (five) spinous rays, the second with a spine and eight to ten articulated rays; anal fin opposite, and resembling the second dorsal; pectoral fins pointed, with branched rays; ventral fins abdominal, and inserted under the first dorsal. The vertebræ are few for the length, there being only about twenty-four—twelve abdominal and twelve caudal. The pyloric appendages are developed in large number. The air-bladder is large and bifurcate in front. The family is chiefly represented in the tropical and subtropical seas all round the world, but species wander both northward and southward, one being found occasionally on the North European as well as North American coasts. One of the largest species is the barracuda of the West Indies (*Sphyræna picuda*), a fish much feared on account of its savage disposition and formidable teeth. Its flesh is often poisonous, though at other times quite savory. This quality depends on a peculiar condition of the fish, and is said to be co-ordinated with a milky sanies which follows the knife on the fish being cut. Theodore Gill.

**Spice** [remotely from the Lat. *species*, "kinds"—*i. e.* kinds of goods, put for the most highly esteemed of goods], a general name for certain aromatic seeds, barks, roots, dried fruits, etc., used in cookery for their flavoring qualities, and in medicine as stimulants and carminatives. Such are cloves, ginger, allspice, nutmeg, pepper, mace, capsicum, cinnamon, cassia, vanilla, etc. Besides the above, which are now extensively imported from tropical countries, and especially from the East, there are others now nearly forgotten, such as cassamuniar, zerumbet, zedoary, culilawan, and the so-called clove-bark. These have nearly disappeared from general commerce—some because they are inferior in quality, and others on account of their limited supply. Most of the spices are natives of the Old World, but a few are American, and nearly all the important ones are now generally naturalized throughout the tropical world.

**Spice Bush.** See Fever Bush.

**Spice Islands.** See Moluccas.

**Spice'land,** p.-v. and tp., Henry co., Ind., 40 miles E. of Indianapolis, contains Spiceland Academy, 2 churches, 1 newspaper, and no saloons. P. of v. 370; of tp. 2014.
Fleming Ratcliff, Ed. "Reporter."

**Spice Valley,** tp., Lawrence co., Ind. P. 1939.

**Spichern,** or **Speichern.** See Saarbrücken.

**Spider.** See Entomology, by Prof. S. Tenney, A. M.

**Spider Crab,** a name given to several short-tailed decapod crustaceans or true crabs. Such are *Maia squinado* (Maiadæ) and *Lithodes maia* (Homolidæ) of Europe, and *Libinia canaliculata* of North American Atlantic waters, and others. (See Crab.)

**Spie'gel** (Friedrich), b. at Kitzingen, near Würzburg, July 11, 1820; studied Oriental languages at Erlangen, Leipsic, and Bonn 1838–42, and at Copenhagen and Oxford 1842–47, and was appointed professor in 1849 of Oriental languages at the University of Erlangen. Besides editions of various Persian works and grammars of the Old Persian and Old Bactrian languages, he published *Einleitung in die traditionellen Schriften der Parsen* (2 vols., 1856–60), *Die Altpersischen Keilinschriften* (1862), *Eran, das Land zwischen Indus und Tigris* (1863), *Eranische Alterthumskunde* (2 vols., 1871–73).

**Spiegeleisen.** See Iron, Ores of, by J. B. Pearse.

**Spie'gle,** tp., Winston co., Ala. P. 493.

**Spiel'hagen** (Friedrich), b. at Magdeburg, Prussian Saxony, Feb. 24, 1829; studied philology and philosophy at Berlin, Bonn, and Greifswald, but devoted himself afterward to literature, and acquired some reputation as a novel-writer. His first books, *Clara Vere* (1857) and *Auf der Düne* (1858), were well received, and his *Problematische Naturen* (4 vols., 1860) gave him a name. Several of his novels have been translated by Prof. Schele de Vere: *Problematic Characters* (1869), *Through Night to Light* (1869), *The Hohensteins* (1870); and by W. H. Browne: *Hammer and Anvil* (1873), *What the Swallow Sang* (1873).

**Spiers** (Alexander), Ph. D., b. at Gosport, England, in 1807; graduated at the universities of Paris and Giessen; settled at Paris 1829; was professor of English successively at the School of Commerce, at the School of Public Works (Ponts et Chaussées), at the Lycée Bonaparte (1833), and at the University of France; became inspector of colleges; received from Napoleon III. in 1869 the cross of the Legion of Honor in acknowledgment of the value of his series of English grammars, and especially of his standard French-English and English-French *Dictionary* (Paris and London, 2 vols., 1846–49), of which two eds. appeared in the U. S.—one edited by G. P. Quackenbos (N. Y., 1852), the other by J. L. Jewett (1856). D. at Passy, near Paris, Aug. 26, 1869.

**Spigelia.** See Pinkroot.

**Spike** [Lat. *spica*], in botany, is a flower-cluster, of the centripetal or indeterminate order, in which sessile flowers are arranged along an axis. The spadix, ament, and cone are varieties of the spike. The ears of wheat and rye are familiar instances of the spike, which in some instances is compound—that is, contains many sessile spikelets. When the flowers are stalked instead of sessile, the spike becomes a raceme.

**Spike'nard,** or **Nard** [Gr. *νάρδος*; Lat. *nardus, spica nardi*; Heb. *nerd*; Sans. *nalada*, "perfume-giver"], (1) in the East the *Nardostachys jatamansi*, a valerianaceous plant of India. Its strong odor is disagreeable to most persons of European and American birth, but it is considered very precious in the East. Its medicinal properties are precisely those of valerian. (2) Valerian roots of various species are exported from Europe to the Levant under the name of Frankish nard, Celtic nard, and mountain nard. Cretan nard is also valerian root. These are much used in the East as substitutes for the true spikenard. (3) In England the fragrant oil of *Andropogon nardus*, an East Indian grass, is called oil of spikenard. It is used in perfumery. (4) In the U. S. the name spikenard is given to *Aralia racemosa*, and the *A. nudicaulis*, or false sarsaparilla, is called small spikenard. They have each a limited use in domestic medicine.

**Spike, Oil of,** the volatile oil of *Lavandula spica*, the broad-leafed lavender of Europe. It has an odor much like that of oil of turpentine. It is used by artists in preparing their varnishes, and by veterinarians as a horse-medicine. Much of the commercial oil of spike is an entirely factitious mixture, of which oil of turpentine is the basis.

**Spin'ach,** or **Spin'age,** the *Spinacia oleracea,* a chenopodiaceous Old-World herb, much cultivated in nearly all parts of the world as a potherb, especially for use in the spring. There are several varieties. Other plants of this and of other genera having similar uses are locally called by this name.

**Spinac'idæ** [from *Spinax,* the name of the typical genus], a family of sharks (order Squali), including species with a spine in front of each dorsal fin, and destitute of an anal fin. The body is rather elongated and subcylindrical; the scales variable in development, in some scale-like, and in others spiniform; the head depressed oval; the eyes with no nictitating membrane; the nostrils inferior, with simple tags at the anterior margin; the mouth inferior, far back, and crescentiform in outline; the teeth variable, but always compressed and with incisorial edges; branchial apertures five, and all in advance of pectorals; spiracle behind the eye large; dorsal fins two, each armed with a spine in front, the first more or less behind the pectorals, the second near the caudal; anal undeveloped; caudal with extended upper and lower lobes; pectorals moderate and produced toward the inner angles; ventral fins far behind. The family includes a number of genera represented in different seas. On our own coast is found the genus *Squalus* (= *Acanthius*), represented by the common piked dog-fish (*S. Americanus*). THEODORE GILL.

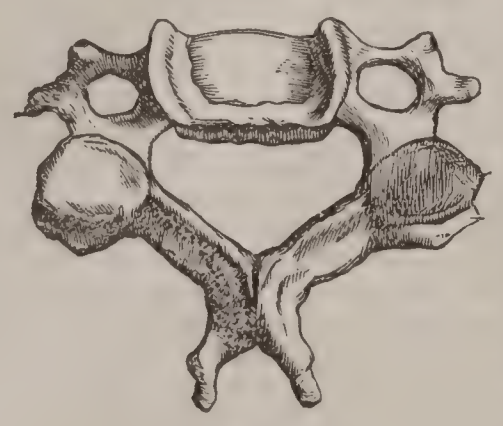
**Spi'nal Col'umn,** the backbone, the composite bony column of the back, which sustains the weight of the head, connects the upper and lower extremities, and affords attachments, direct or indirect, for the ribs and for the numerous groups of voluntary muscles which act upon the surfaces and members of the symmetrically developed lateral halves of the body. It is a flexible column of thirty-three vertebræ united by ligaments, with interposed cartilaginous cushions. The column is from two to two and a half feet in length, and viewed laterally presents marked curves, which add to the grace and free movements

FIG. 1.



Lateral view of spine.

FIG. 2.



A vertebra.

of the trunk. (Fig. 1.) The column is divided into regions—the *cervical, dorsal, lumbar,* and *pelvic*—corresponding to the neck, chest, abdomen, and pelvis. The vertebræ, excepting in the pelvic region, rotate freely and flex both antero-posteriorly and laterally. A single vertebra (Fig. 2) consists of the *body,* which unites it to other vertebræ, and a bony ring which encloses the vertebral foramen or vertebral canal, transmitting and protecting the spinal cord; this ring has articular and spinous processes for attachment of ribs, ligaments, and muscles. The spinal column is liable to fractures, dislocations, curvature (see SPINAL CURVATURES), and the various diseases of bone.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Spinal Cord.** See MEDULLA SPINALIS, by E. C. SEGUIN, JR., M. D.

**Spinal Curvatures,** two kinds—(1) lateral curvature; (2) angular curvature. Lateral curvature is a deviation of the spinal column at one or several points from the position which it occupies in health in the median line of the back. It occurs in children, in young, imperfectly-developed, feeble, and growing adults, more especially women, and less often in men. The spine normally occupies the middle of the back, with a slight convexity to the right in the dorsal region; in this central position it is acted upon by many forces—the weight of the head and trunk, the lateral traction of the arms in all physical efforts, of the thoracic and abdominal muscles in breathing—and beneath has a divided support of the two lower extremities through the intervention of the pelvis. A lateral curvature may develop connected with any one of these forces; when the bones are poorly nourished, the spine may yield to the weight it supports. Habitual use of one arm to the exclusion of the other may cause deviation of the spine, cervico-dorsal, to the stronger side—a common occurrence in weakly children at school, housemaids, and in some confining mechanical vocations. Disease of one lung, as phthisis, chronic pneumonia, pleuritic adhesions, and chest contraction, by limiting respiratory movement on one side, often causes dorsal curvature to the more active side. Shortening of one limb, hip-joint disease, persistent limping from any cause, by tilting the pelvis throw the spine out of centre and develop lumbar curvature. Whenever a curvature is thus primarily established, a secondary curvature develops at another part of the vertebral column, and to the opposite side, and thus the erect position of the body is maintained. The affected spine, viewed anteriorly or posteriorly, presents a double curvature, a tortuous line whose upper and lower ends can be connected by a vertical straight line, representing the component of all the forces, weight, etc. which the spine sustains. The collective vertebræ of the spinal column are so articulated and curved antero-posteriorly (see cut in SPINAL COLUMN), the pressure taken in the "bodies" only, the lateral and posterior processes restrained by attached muscles, that lateral curvature causes rotations of individual vertebræ.

Lateral curvature, if of long standing, may so modify the size and conformation of the lung, so change the nutrition and structure of the intervertebral cartilages, and the muscular volume of the two sides of the body, that cure is impossible or incomplete. More often it is curable by correcting bad habits, as favoring one side in standing, sitting, or sleeping, resort to light gymnastics and special passive movements, and the use of apparatus which removes weight from the spine and applies pressure or traction to counteract the curves. General tonic treatment, cod-liver oil, and phosphates, out-of-door life, warm clothing, stimulating baths, and regulated diet are indicated in all cases.

Angular curvature is of more serious nature. It is termed Potts's disease, and is usually an expression of a tubercular or scrofulous blood-taint. Exceptionally, it may arise in previously vigorous persons, starting from a local injury of the vertebræ, followed by disintegration. More often, when health is reduced and the nutrition of the osseous and cartilaginous structures is defective, the intervertebral bodies atrophy, or are absorbed owing to pressure; the bony vertebræ thus brought in contact form an abrupt joint or antero-posterior angle, which replaces the normal graceful curve, and presents a more or less angular prominence on the back. The approximated vertebræ tend to caries or death and gradual disintegration: in proportion to the extent of this destruction of the vertebral bones and the intermediate cushion of cartilage, the body above sinks forward and downward upon the parts beneath, and the angle is abrupt and acute. Caries of the spine usually develops a local abscess, slow in formation, often with little pain or heat, and tending to disseminate its contained pus beneath adjacent flat muscles of the back; the pus may finally point under the skin of the back or side, or travel around to the front of the abdomen, appearing as a soft tumor in the groin, or even below the flexure of the thigh; in these latter positions erroneously taken for hernia.

Early vertebral disease is indicated by pain in a fixed spot, increased by pressure, by firm tapping, by the sudden concussion of jumping, or by sudden turning; the pain often shoots around the body. The strength wanes, and the weight of the body causes fatigue, which is relieved by reclining, by supporting the shoulders, or by traction on the lower extremities when lying down. Loss of flesh and appetite, elevated temperature, and hectic fever develop as caries is established, and local inspection reveals a change of the normal curves or a perceptible projecting apex. The early arrest of angular curvature is secured in various ways—by rest on the side, with ice-bags to the irritated congested spine, rest with extension and counter-extension; but, when admissible, the plaster-of-Paris bandage may be applied to the body while suspended by axillary supports, the weight of the body counter-extending, and with this immobile apparatus the patient may exercise. Cod-liver oil, phosphates, Peruvian bark, iron, and concentrated diet are to be faithfully administered. When abscess has developed, it may be "aspirated"—subcutaneously removed by needle-tube and pump, incision being injudicious. Where bone is destroyed and angular curvature is fully developed, apparatus is employed to place the body erect, remove the angular protrusion in the back, and permit the spinal column to become "ankylosed," or rigidly united, with as little deformity as possible.

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**Spinal Diseases.** See MENINGITIS and SPINAL CURVATURES.

**Spinaz'zola,** town of Southern Italy, province of Bari delle Puglie, on a hill near the source of the Locone. The site, otherwise attractive, is subject to frequent and great changes of temperature. The town contains six churches, one of them very large and imposing. The streets are of good width and well paved, and there is considerable industry and traffic in the place. Spinazzola was an old Roman military station on the Appian Way, known as *Ad Pinum*, from a celebrated pine tree which stood here, and the modern name is supposed to be derived indirectly from the same source. Spinazzola was the birthplace of Innocent XII. P. 10,078.

**Spind'ler** (KARL), b. at Breslau, in Prussian Silesia, Oct. 16, 1796; was educated at Strasbourg, afterward at Augsburg; entered for some time a company of strolling actors; published in 1824 his first novel, *Eugen von Kronstein* (2 vols.); chose literature for his occupation; lived at Hanau, Stuttgart, Munich, and finally at Baden-Baden, where he d. July 12, 1855. The best of his novels are *Der Bastard* (3 vols., 1826), *Der Jude* (4 vols., 1827), and *Der Jesuit* (3 vols., 1829). Many of his minor novels were published in a periodical, *Vergissmeinnicht*, which he edited after 1831. A collected edition of his works appeared in 102 vols. at Stuttgart from 1831 to 1854.

**Spin'dle-Tree,** a popular name for shrubs of the genus EUONYMUS (which see).

**Spine.** See SPINAL COLUMN.

**Spinel'** [Fr. *spinelle*], a mineral, of which the finest specimens, often very beautiful, are employed as gems. It is an impure anhydrous aluminate of magnesia, sometimes white or black, but commonly of some red tint. The finest are often sold for rubies. The best are from Southern Asia.

**Spinello** (ARETINO). See ARETINO (SPINELLO).

**Spink,** a new county of S. E. Dakota, intersected by James River, has a broken prairie surface and a fertile soil. Area, about 800 sq. m.

**Spin'ner** (FRANCIS ELIAS), b. at German Flats (now Mohawk), Herkimer co., N. Y., Jan. 21, 1802, son of a German clergyman, from whom he received a careful early education, and who insisted on his learning a trade; was successively apprentice to a confectioner in Albany and to a saddle and harness maker at Amsterdam, N. Y.; read all the books in the circulating library at the latter place, giving especial attention to natural science; became in 1824 a merchant at Herkimer; was deputy sheriff of Herkimer co. 1829–34, and sheriff 1835–37; was chosen lieutenant of militia 1825; passed by election through all the intermediate grades up to major-general of the third division of artillery 1834, having meanwhile raised the "La Fayette Guards" and helped to organize the 26th regiment New York Artillery; was appointed in 1838, by Gov. Marcy, commissioner for building the State lunatic asylum at Utica; was removed on political grounds by Gov. Seward in the following year, when he accepted the cashiership to the newly-organized Mohawk Valley Bank at Mohawk; was subsequently president of that institution, and for twenty years was its executive officer; was auditor and deputy naval officer of the port of New York 1845–49, having previously filled by election various town and county offices, such as school commissioner and supervisor; was a Democratic member of the 34th Congress, 1855–57, sitting on the committee on elections, on the special committee to investigate the assault upon Senator Sumner, and on the famous "conference committee" that disagreed on the army appropriation bill; was an original member of the Republican party, and re-elected by it to Congress by 9000 majority in 1856, and again by a similar majority in 1858; was chairman of the committee on accounts 1859–61; was appointed by Pres. Lincoln, on the recommendation of Sec. Chase, to the post of treasurer of the U. S. Mar. 1861, and confirmed by the Senate after an examination of witnesses and a three days' debate in secret session; entered upon his duties Mar. 22, 1861, and held that post until July, 1875. During this period his name was a synonym for official integrity, and his curious signature on the "greenbacks" became more familiar to the American public than the autograph of any other living man. He was defeated in the election of 1875 as Republican candidate for comptroller of the State of New York.

**Spinning,** the art of producing from vegetable or animal fibres an even and compact thread suitable for sewing or weaving, is one of the most ancient of industries, and still practised in many parts of the globe by the spindle and distaff in the same manner that the process is pictured on Egyptian monuments. The distaff, held in the left hand, was a simple stick around which the fibre was loosely coiled; the spindle was a species of top which was set in motion by a twirl of the hand, and by combining its rotary motion with a gradual movement away from the spinner, who equalized the size of the fibre by passing it between the finger and thumb of the right hand until the motion of the spindle was exhausted, when the thread was wound around it, and the process was repeated. The first and most obvious improvement consisted in placing the spindle in a frame and making it revolve by mechanical action of the hand or foot in connection with a wheel and treadle. This constituted the spinning-wheel, which, notwithstanding its simplicity, cannot be traced farther back than 1530. Modern invention has added little to this implement, the chief improvement being a bobbin for winding the yarn by a motion separate from that of the spindle. Up to the invention of the spinning-jenny by Hargreaves in 1764 (see COTTON MANUFACTURE) no contrivance had been devised for spinning more than two threads at a time, but from that date the eight original threads were quickly augmented to eighty, and the number was ultimately dependent entirely upon mechanical convenience. But the spinning-jenny, however developed, could perform but one process, and it was consequently soon supplemented by Arkwright's throstle-machine (1769), and superseded by Crompton's mule-jenny (1779). The former was an ingenious mechanism for passing the rough cotton or woollen fibres through a revolving hollow cylinder furnished on the inside with rows of spikes, by which process they were loosened, freed from lumps and knots, and thus prepared to be moulded by rollers into "laps," or symmetrical compressed layers. The latter are then subjected to the "carding-machine," which consists of a series of cylinders thickly set with steel wires, revolving in opposite directions, so close to each other that the fibres of the "lap" passing between them are rapidly and alternately caught and subjected to such tension by the wire teeth that they come out straightened, side by side in a cobweb-like film. It is then passed through a smooth metal ring and two polished rollers, which form it into a loose, untwisted column an inch thick, called a "sliver," and deposit it in a tin can. The sliver is then, by another process of tension, drawn out into "rovings," not thicker than a quill, slightly twisted to give them consistency, then wound and drawn upon large reels, and subjected to the spinning-jenny. By the operation of Arkwright's throstle-machine the "rovings" were drawn through a succession of pairs of rollers connected together, but each successive pair moving at an accelerated rate of speed, so that the roving when it emerges from the last machine is many times longer than the "sliver." It is then wound upon spools or reels, transferred to the spinning-frame, is brought by similar processes to the thinness deemed desirable, when a rapidly-revolving spindle twists it into thread and winds it ready for the weaver. Modern French manufacturers have carried their spinning processes to such an extreme of tenuity that a pound of cotton has been drawn into a yarn 4770 miles in length. A recent invention patented by Platt & Co. of Oldham, England, combines in a single machine all the operations of carding, roving, and spinning.

**Spinning-Jenny.** See COTTON MANUFACTURE, HARGREAVES, and SPINNING.

**Spi'nola, de** (AMBROSIO), MARQUIS, b. in Genoa, Italy, in 1569, son of a wealthy Levant merchant and of a princess of Salerno; took service at an early age under his brother, an admiral in the Spanish navy; participated in the war against the Dutch and English 1588; raised and equipped at his own expense in Spain a numerous corps of veterans, at whose head he proceeded to the Spanish Netherlands 1602; was instrumental in rescuing the archduke Albert from the superior forces of Prince Maurice of Nassau; became chief commander of the Spanish armies in Flanders 1603; effected the capture of Ostend after a siege of three years, Sept., 1604; conducted the war with great ability, but varying success, until the truce of twelve years (1609), which he favored; commanded in the interval the Spanish forces in Germany; took Aix-la-Chapelle, Wesel, and Jülich 1622; was repulsed from Bergen-op-Zoom 1623; captured Breda after a protracted siege 1625; was subsequently commander of the Spanish army in Italy, and captured the city of Casale, Piedmont, but d. while pressing the siege of the citadel, Sept. 25, 1630.

**Spinoylic Acid.** See SALICYLIC ACID.

**Spi'noza** (BARUCH), (BENEDICT), [Sp. *D'Espinoza*], b. Nov. 24, 1632, at Amsterdam; a member of the Portuguese-Jewish community at that place, then the chief seat of European Judaism. He had two sisters, Rebecca and Miriam, the first remaining unmarried. His parents were traders, and, noticing the extraordinary faculties of the son, allowed him all the advantages of a good education. Accordingly, he entered upon the customary path of a Jewish scholar, passing through all the steps of the ordinary rabbinistic school, from the elements of Hebrew to the

holy writings of the Old Testament, thence to the Talmud, the Jewish commentaries, and the scholastic writers of the Middle Ages. By this he became the pride and hope of the synagogue, though it is evident that at this time already he began to entertain those doubts in regard to his religion which subsequently led him to the elaboration of his peculiar system of philosophy. Thus, Jewish literature led him, through the literature of the scholastics, wherein the Cabbalistic doctrine played so prominent a part, gradually to the portals of the then developing modern views of the school of Descartes. In short, the rabbi Spinoza became a skeptic, even as Descartes, the scholar of the Jesuits, had become a skeptic before him. Descartes, however, was enabled to fall back upon Christianity for salvation from skepticism. This Spinoza could not do. Cut loose from Judaism, unable or perhaps traditionally so opposed to it that he did not feel any way inclined to accept Christianity, he was left without any support or guidance. The Jewish God, as the cause and creator of the universe, he had discarded; the Christian conception of God, as the moral harmony and order of the universe, which Leibnitz so beautifully elaborated, was utterly repugnant to his originally Jewish mind; and thus he had no other recourse left than the so-called "pantheism" of Substantiality. This rupture with Jewish theology brought about a dispute between him and his rabbinistic teachers, which finally led to his expulsion from the synagogue at Amsterdam (July, 1656). Spinoza wrote a protest against the anathema pronounced against him, but otherwise paid little attention to it. He simply changed his name from *Baruch* to *Benedict* Spinoza, by which last name he is now generally known, and when he discovered that he was still persecuted by both the orthodox Jews and orthodox Christians of Amsterdam, he retired to the country-house of a friend in the vicinity of Amsterdam, a member of one of the persecuted sects of Protestants of that time, with whom he lived in deep seclusion from 1656 to 1661. He subsequently accompanied him to Rynsburg, where he remained till 1664, in May of which year he removed to Voorburg, where he remained in the house of the painter Tydenau till 1669. He then, at the entreaty of his friends, removed in 1671 to the Hague, where he remained till his death, on Feb. 21, 1677. In personal appearance Spinoza was of middle height; his features were regular and well formed, complexion dark, hair curly and black, long black eyelashes, and, as Leibnitz remarks, "with somewhat of the Spanish in his face." To earn his livelihood he learned to grind optical glasses, and also the art of painting. His mode of living, however, was throughout extremely frugal and secluded. He never was married, though it is rumored that he was at one period of his life deeply in love.

But all this is of minor importance. The life, character, and personal appearance of the man Spinoza are of no more interest to the student than the life, character, and personal appearance of Kant. The ground of the extraordinary interest taken in Spinoza—whilst Leibnitz, in all respects so infinitely his superior, remains comparatively unnoticed—is to be found in the pantheistic view of the universe which he has carried out in the completest of extant forms in his *Ethics*. Hence, none of the other works of Spinoza claim special notice. Interesting as they may be in connection with the *Ethics*, they have no intrinsic merit of their own. All his few published minor works, as well as his published correspondence, have their central point in the *Ethics*. Students of Spinoza are here referred, first, to the remarks of Goethe concerning Spinoza's philosophical system; secondly, to the remarks of G. E. Lessing; and, in this connection, thirdly, to the essays of Jacobi on Spinoza and Lessing. Fichte's works are also full of references to Spinoza. Spinoza's view of the universe may be very concisely described as follows: Taking hold of the category of substantiality, he altogether abandoned the Jewish conception of a First Cause—a self-conscious Jehovah calling the world into existence by his mere word—and adopted in its place the Oriental notion of an unconscious substance of the universe as a whole, of which all the separate phenomena of that universe—stars, heaven, earth, mankind, animals, plants, and minerals—were but so many attributes. In his scheme there was, therefore, no God, no Freedom, no Immortality. Whenever he uses the word "God," it is to be interpreted as coequal with the word "nature" or "universal substance;" when he uses the word "freedom," it is to be understood as the equivalent of "necessity;" and his conception of the word "immortality" means simply that the human soul, after death of the body, will merge again into the infinite substance, wherein no self-consciousness can possibly exist. His God is therefore no God, in the ordinary acceptance of the term; his freedom, no freedom; his immortality, the very reverse of what men mean when they lay claim to being immortal.

To understand thoroughly the style of the *Ethics*, it must always be kept in mind that Spinoza was a Jew, and that the Jewish tendency of mind betrays itself not only in the subject-matter under discussion, but also and equally in its mode of utterance. The style of all Jewish writers is abrupt, disregarding transition, and loving above everything parallelisms, as every chapter of the Bible shows. This explains, although seemingly in a paradoxical way, why Spinoza chose what he calls the "geometrical or mathematical" method for his chief work. The opening sentences are as disjointed as the opening propositions of Euclid; the first does not involve the second, nor the second the third, etc.; and none are proven, nor is there any attempt in the whole book to prove any of them. Hence, the very fundamental principles of philosophy, about which alone there is any dispute, are at the beginning of the work laid down as axioms; and, what is equally objectionable, at the beginning of each new part of the *Ethics*, of which there are four parts, new axioms are introduced in the same arbitrary, abrupt manner. Besides this grave defect, the *Ethics* are subject to the reproach, already alluded to, that they are full of the most misleading word-quibbles. Take as an instance that opening definition of the *Ethics* wherein *causa sui* is defined as that the essence or nature whereof includes existence. Now, here the word *causa* is either utterly meaningless, or else surreptitiously carries along the conception of cause, which, in the case applied to "God" or "substance," would be the very point in dispute; so also the word "existence" has here either the surreptitiously-appended meaning of "existence in time," or else none at all. Now, a thing—call it "A" if you please—existing in time can, in no meaning of the word, be called its own cause, since it would then have to be thought existing previous to its existence in order to become thinkable as its own effect. The phrase "self-cause" or "cause of itself" is, therefore, utterly meaningless and absurd. In the same way he uses the word freedom as expressive of the very reverse of what the word signifies in ordinary language. That the word freedom had no significance to him in its current meaning is abundantly evident from the following extracts that occur in his letters, wherein he is usually a little more outspoken than in his very guardedly-worded published works. Taking the example of a stone thrown by some hand, and hence impelled by an external cause: "Now conceive, further, that the stone as it proceeds in its motion thinks and knows that it is striving, so far as in it lies, to continue in motion; then, inasmuch as it is conscious only of its endeavor, and in nowise indifferent, it will believe itself to be most free, and to persevere in its motion from no other cause than that it wills to do so. *And this is precisely that human freedom of which all men boast themselves possessed, but which consists of this alone—that men are conscious of their desires, and ignorant of the causes by which these are determined.*" To remove the last objection, that we might be free at least in thinking, Spinoza adds: "Your friend, however, affirms that we can use our reason with perfect freedom. . . . 'Who,' he asks, 'without a contradiction of his proper consciousness, can deny that he is free to think his thoughts, to write what he pleases, or to leave writing alone?' . . . I, for my part, and that I may not contradict my consciousness—that is, that I may not contradict reason and experience, and yield to ignorance and prejudice *—deny that I possess any absolute power of thinking, and that at pleasure I can will, or not will, to do this or that—to write, for example.*"

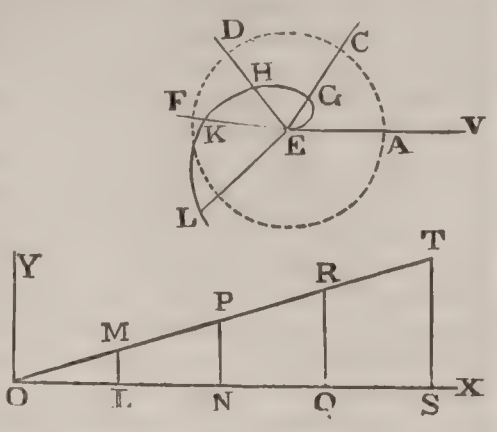
The same criticism applies to his doctrine of immortality. He speaks of it often enough and with sufficient eloquence, but does not mean by it a self-conscious existence of man after death, which is the only proper definition of immortality. It is, on the contrary, complete final annihilation of the individual as such, and submergence into the universal substance, of which it was a mere attribute.—There are numerous Latin and German editions of the *Ethics*, and of most of the other of Spinoza's works. The best English work on the subject is *Benedict de Spinoza, his Life, Correspondence, and Ethics*, by R. Willis, M. D. (London, 1870). It includes all his correspondence, a very valuable feature. In German, Kuno Fischer's *Geschichte der neuern Philosophie, erster Band, zweiter Theil*, is devoted entirely to Spinoza and his antecedents, and is the most satisfactory work extant on the subject.

A. E. Krœger.

**Spinozism.** See Spinoza.

**Spiræ'a** [Gr. σπειραία], a genus of herbs and shrubs of the order Rosaceæ, including numerous species, such as hardhack (*S. tomentosa*), queen of the prairie (*S. lobata*), and several other American, besides numerous Old-World species, many of them very fine in garden-culture. Some species of *Astilbe* (order Saxifragaceæ), having somewhat the aspect of *Spiræa*, are cultivated under this name, incorrectly bestowed.

**Spi'ral** [Lat. *spira*], a curve that may be generated by a point moving along a straight line in accordance with a fixed law, whilst the line revolves uniformly about one of its points, always remaining in the same plane. The portion generated during one revolution of the line is called a *spire;* the moving point is the *generatrix;* the fixed point is the *pole* or *eye;* and the distance from the pole to any point of the curve is the *radius-vector*. If we take any position of the revolving line as the initial radius, and denote the angle through which the line has revolved by $t$, and the corresponding value of the radius-vector by $u$, the equation of any spiral may be written $u = f(t)$. A great variety of spirals have been investigated, of which the following are the most interesting:




(1) *The Spiral of Archimedes.*—In this spiral the generatrix moves uniformly along the revolving line, and the equation of the curve is

$$u = at, \qquad (1)$$

in which $a$ is an arbitrary constant. Starting from the eye of the spiral, the radius-vector is proportional to the arc swept over by any fixed point of the revolving line. The relation between this spiral and a straight line is indicated by the form of its equation. This relation leads to a mode of construction which is applicable to this and also to many other spirals. Let the circumference E A be drawn from E as a centre, with a radius equal to 1, and let E V be taken as the initial line. Again, let O T be an auxiliary straight line whose equation is

$$y = ax. \qquad (2)$$

Lay off equal parts on O X, and at the points of division draw ordinates. Make the arc A C equal to O L, draw E C, and lay off E G equal to L M; make the arc C D equal to L N, draw E D, and lay off E H equal to N P; and so on. Through E, G, H, etc., draw a curve, and it will be the required spiral, as is evident from equations (1) and (2).

(2) *The Parabolic Spiral.*—In this spiral the generatrix moves along the radius-vector so as to satisfy the equation

$$u = at^2. \qquad (3)$$

The spiral bears the same relation to the parabola, whose equation is

$$y = ax^2, \qquad (4)$$

that the straight line does to the spiral of Archimedes, and may be constructed in a similar manner.

(3) *The Hyperbolic Spiral.*—The equation of this curve is

$$ut = a, \qquad (5)$$

and that of the corresponding hyperbola, referred to its rectangular asymptotes, is

$$yx = a. \qquad (6)$$

The curve can be constructed as before.

Every curve having an infinite branch has a corresponding spiral, which may be constructed in the manner indicated. Besides the spirals enumerated, we may name the logarithmic spiral, whose equation is $t = a \ln$, and the lituous spiral, whose equation is $u^2 t = a^2$, each of which has some curious properties. The evolute of the logarithmic spiral is a similar logarithmic spiral. W. G. Peck.

**Spiral Ducts,** or **Spiral Vessels,** of plants, are long cells, or tubes produced by the confluence of cells, on the inner surface of whose walls there are spiral markings. The spirals are secondary deposits of cellulose, and exist as rounded threads or as flattened bands. When cut across, the thread presents under the microscope the appearance of being tubular, but it is solid, although the interior is sometimes less dense than its outer portion. The coils are usually left-handed, but in some plants they are found turning indifferently to the right or the left. The threads are much stronger in most cases than the cell-wall to which they cling; therefore they may be torn out and uncoiled when the duct is pulled asunder. When a succulent shoot or leaf-stalk is broken, these extended threads appear like cobwebs. In some cases they become detached naturally from the cell-wall during growth.

Although spiral ducts constitute only one class of the elongated or confluent cells with peculiar markings, and grade by all possible varieties into *dotted*, *annular*, and *lattice-marked* ducts, they possess special interest from the part they were supposed to play in vegetable life. They were described by the earliest vegetable histologists, who regarded them as tubes for the transfer of air, and looked upon them as analogous to the air-tubes of animals. Subsequent observers have found that the ducts contain, at times, not only air, but sap. They are now understood to share with other forms of vascular tissue in the transmission of liquids as well as gases. (For a more detailed account of their functions see Vegetable Physiology.) When anatomical characters first came to be used in classification, they were deemed of much importance, being regarded as peculiar to flowering plants; but this proves to be not altogether true. G. L. Goodale.

**Spire** [Gr. σπεῖρα], in architecture, an acute pyramid or cone, taller than a turret. It appears chiefly in the Gothic architecture and in styles which have descended from it, and is almost peculiar to ecclesiastical structures, in which it commonly surmounts a tower.

**Spire,** or **Spires.** See Speyer.

**Spirit-Duck.** See Garrot.

**Spirit, Holy.** See Holy Ghost, by Prof. A. A. Hodge, S. T. D.

**Spirit Lake,** tp., Dickinson co., Ia. P. 268.

**Spirit Lake,** p.-v., Centre Grove tp., cap. of Dickinson co., Ia., 90 miles N. of Fort Dodge, has good schools, 1 newspaper, and is surrounded by a rich agricultural region in the midst of the most picturesque scenery in the West. P. 76. Smith & Funk, Eds. "Beacon."

**Spirit-Level.** See Hypsometry, by C. A. Schott.

**Spirit of Salt.** See Hydrochloric Acid.

**Spirit of Wine** and **Spirits.** See Alcohols.

**Spirit Plant.** See Holy-Spirit Plant.

**Spirit-Rapping.** See Spiritualism.

**Spir'itualism** [in French usually *spiritisme*]. The term, in its modern and restricted application, expresses the doctrine of those who believe that communion between this world and the next is, and always has been, a reality more or less frequent at different periods of history. In its present phase, Spiritualism may be said to have had birth about a quarter of a century since, during the same year that witnessed great political convulsions in Europe—to wit, on Mar. 31, 1848. On the evening of that day, in a small village in Western New York, a family of German ancestry (originally named *Voss*, but native-born, and well known now under the name of *Fox*), who had been disturbed for several months with inexplicable noises, discovered, in the knockings that had previously alarmed them, an element of intelligence. They obtained pertinent answers to various questions by raps. It is asserted by those who have made a critical study of the subject that this phenomenon, usually called the spirit-rap, whatever its true explanation, is genuine, and is not referable to any known mundane agency. Spiritualists, however, consider the rap to be one only among many agencies of communication between this world and the next, other modes of communion, according to their view, being through writing by impression, through direct spirit-writing, and through spirit-touches. They believe also in manifestations through outward voices and appearances, through dreams, sometimes of warning, sometimes of prophecy, and through inward spiritual impressions; sharing, in each of these last phases of belief, the opinions of the primitive Quakers. (See Barclay's *Apology*, proposition 2.) They assent, in a modified form, to the faith of the past in regard to what are called apparitions; not, however, as disembodied ghosts or hideous spectres—naked skeletons, with clank of chains and blue lights burning—but as *eidola*, specimens, it may be said, of spiritual sculpture, occasionally though rarely presenting themselves; sometimes to strangers, more frequently to friends or relatives, who recognize the familiar features and dress; these eidola appearing suddenly, and disappearing usually after a brief space, without any known agency heretofore recognized by physical science or by psychology to produce or to dissolve them.

Spiritualists hold that if we admit the probability of another life of which the present is a novitiate, we must also admit the likelihood that means should be afforded us to obtain assurance touching a world for which we have to prepare ourselves. They allege, further, that experimental proof in regard to these matters is needed to arrest the increase of skepticism and the growing indifference to religion of an age which is ceasing to regard ancient historical evidence as sufficient authority for religious doctrine. But aside from mere probabilities, Spiritualists aver that what may be called the epiphanies of Spiritualism are attested by evidence as strong as that which is daily admitted in our courts of justice to decide the life or death of men. The validity of this evidence is at present (Feb., 1872) being tested in London by William Crookes, fellow of the Royal Society, and other eminent scientific men.

Spiritualists do not believe in miracles, asserting that

natural law is universal, invariable, persistent, and that all spiritual epiphanies are natural phenomena. In connection with the principle of invariable and perpetual law, now all but universally acknowledged, they hold that the phenomena of modern Spiritualism are the best proofs of the substantial truth of the gospel narratives, and that these narratives are, in turn, the best proofs of Spiritualism. For, if natural law be invariable, then either the wonderful works ascribed by the evangelists to Christ and his disciples were not performed, or they were not miracles. If they were not performed, then Christ, assuming to perform them, lent himself to deception. But if they were performed under natural law, then, inasmuch as the same laws under which these signs and wonders occurred exist still, we may expect similar phenomena at any time. Again, Spiritualists claim that they have the same evidence for immortality as that upon which was based the faith of the first century. "If the dead rise not, then is not Christ raised; and if Christ be not raised, your faith is vain."

There can, of course, be no unbelievers in another world among Spiritualists, but as regards the person and office of Christ there is, for the present, diversity of opinion. As a general rule, Spiritualists do not regard Christ as one of the Persons of the Godhead, but a large number among them may be called Christian Spiritualists, while others term themselves radical. The former—a majority probably, and said to be on the increase—regard Christ with reverence as the great spiritual and ethical Teacher of mankind; the latter speak of him but as one of the ancient philosophers, with no claims to distinction beyond sages like Confucius, Socrates, or Seneca. This latter element may be chiefly due to this, that Spiritualism has converted millions from materialism, and that some of these converts still retain a portion of their former opinions.

Spiritualists, as a rule, reject the idea of a personal devil. Some believe in the occasional agency and influence of evil spirits, amounting, now and then, to what might be called possession; while others hold that such influences may, in almost all cases, be explained by human agency. Both, however, agree in this—that spiritual communications are by no means infallible, and that great care should be taken to accept nothing, come whence it may, until it has been submitted to the scrutiny of reason and conscience. As happens in all great revolutions of opinion, religious or political, Spiritualism has attracted its waifs and strays possessed by vagrant and fantastic opinions. The best writers on the subject speak of this in warning terms. So also as to seeking wealth or worldly profit through spiritual revealings. This is considered to be pregnant with danger. Money-changers, it is alleged, are out of place in the spiritual temple, and man's destiny is to earn his bread by labor, not by divination.

An examination of the alleged spirit-communications of the day seems to prove (if we admit the origin claimed for them) that, as regards side-issues and non-essentials, there is in the next world the same variety of opinion as in this. There are, however, certain great, leading principles on which it may be said that all intelligent Spiritualists substantially unite. From a recent work we transcribe a summary of these, as follows: (1) This is a world governed by a God of love and mercy, in which all things work together for good to those who reverently conform to his eternal laws. (2) In strictness there is no death. Life continues from the life which now is into that which is to come, even as it continues from one day to another; the sleep which goes by the name of death being but a brief transition-slumber, from which, for the good, the awakening is immeasurably more glorious than in the dawn of earthly morning, even the brightest that ever shone. In all cases in which life is well spent, the change which men are wont to call death is God's last and best gift to his creatures here. (3) The earth-phase of life is an essential preparation for the life which is to come. Its appropriate duties and callings cannot be neglected without injury to human welfare and development, both in this world and in the next. Even its enjoyments, temperately accepted, are fit preludes to the happiness of a higher state. (4) The phase of life which follows the death-change is, in strictest sense, the supplement of that which precedes it. It has the same variety of avocations, duties, enjoyments, corresponding, in a measure, to those of earth, but far more elevated; and its denizens have the same variety of character and of intelligence, existing, too, as men do here, in a state of progress. Released from bodily earth-clog, their periscope is wider, their judgment clearer, their progress more rapid, than ours. Vastly wiser and more dispassionate than we, they are still, however, fallible; and they are governed by the same general laws of being, modified only by corporeal disinthralment, to which they were subjected here. (5) Our state here determines our initial state there. The habitual promptings, the pervading impulses, the life-long yearnings—in a word, the moving spirit, or what Swedenborg calls the "ruling loves" of man—these decide his condition on entering the next world; not the written articles of his creed, nor the incidental errors of his life. (6) We do not, either by faith or works, *earn* heaven, nor are we sentenced, on any day of wrath, to hell. In the next life we simply gravitate to the position for which by life on earth we have fitted ourselves; and we occupy that position *because* we are fitted for it. (7) There is no instantaneous change of character when we pass from the present phase of life. Our virtues, our vices, our intelligence, our ignorance, our aspirations, our grovellings, our habits, propensities, prejudices even,—all pass over with us; modified, doubtless (but to what extent we know not), when the spiritual body emerges divested of its fleshly incumbrance, yet essentially the same as when the death-slumber came over us. (8) The sufferings there, natural sequents of evil-doing and evil-thinking here, are as various in character and in degree as the enjoyments, but they are mental, not bodily. There is no escape from them except only, as on earth, by the door of repentance. There, as here, sorrow for sin committed and desire for an amended life are the indispensable conditions precedent of advancement to a better state of being. (9) In the next world love ranks higher than what we call wisdom, being itself the highest wisdom; there deeds of benevolence far outweigh professions of faith; there simple goodness rates above intellectual power; there the humble are exalted; there the meek find their heritage; there the merciful obtain mercy. The better denizens of that world are charitable to frailty and compassionate to sin far beyond the dwellers in this: they forgive the erring brethren they have left behind them even to seventy times seven. There, is no respect of persons; there, too, self-righteousness is rebuked and pride brought low. (10) A trustful, childlike spirit is the state of mind in which men are most receptive of beneficent spiritual impressions; and such a spirit is the best preparation for entrance into the next world. (11) There have always existed intermundane laws, according to which men can occasionally obtain, under certain conditions, revealings from those who have passed to the next world before them. A certain portion of human beings are more sensitive to spiritual perceptions and influences than their fellows; and it is usually in the presence or through the medium of one or more of these that ultramundane intercourse occurs. (12) When the conditions are favorable, and the sensitive individual through whom the manifestations come is highly gifted, these may supply important materials for thought and valuable rules of conduct. But the spiritual phenomena sometimes do much more than this. In their highest phases they furnish proof, strong as that which Christ's disciples enjoyed—proof addressed to the reason and tangible to the senses—of the reality of another life better and happier than this, and of which our earthly pilgrimage is but the novitiate. They bring immortality to light under a blaze of evidence which outshines, as the sun the stars, all traditional or historical testimonies. For surmise they give us conviction, and assured knowledge for wavering belief. (13) The chief motives which induce spirits to communicate with men seem to be—a benevolent desire to convince us, past doubt or denial, that there *is* a world to come; now and then the attraction of unpleasant memories, such as murder or suicide; sometimes (in the worldly-minded) the earth-binding influence of cumber and trouble; but far more frequently the divine impulse of human affection, seeking the good of the loved ones it has left behind, and at times called forth, perhaps, by their yearning cries. (14) Under unfavorable or imperfect conditions spiritual communications, however honestly reported, often prove vapid and valueless; and this chiefly happens when communications are too assiduously sought or continuously persisted in, brief volunteered messages being the most trustworthy. Imprudence, inexperience, supineness, or the idiosyncrasy of the recipient may occasionally result in arbitrary control by spirits of a low order, as men here sometimes yield to the infatuation exerted by evil associates. Or, again, there may be exerted by the inquirer, especially if dogmatic and self-willed, a dominating influence over the medium, so strong as to produce results that might be readily mistaken for what has been called possession. As a general rule, however, any person of common intelligence and ordinary will can, in either case, cast off such mischievous control; or, if the weak and incautious give way, one who may not improperly be called an exorcist, if possessed of strong magnetic will, moved by benevolence, and, it may be, aided by prayer, can usually rid, or at least assist to rid, the sensitive from such abnormal influence.

While there is very little variance of opinion among the enlightened class of Spiritualists as to the above proposi-

tions, there are local differences as to other matters of speculation, one of which is of a remarkable character. The majority of French Spiritualists seem to have adopted a phase of the old Pythagorean doctrine of transmigration of souls, believing in pre-existence and re-incarnation; while on the other side of the British Channel such a belief scarcely finds a place, nor has it been accepted, except perhaps by an insignificant minority, in the U. S.

As regards the relation of Spiritualism to the mission of Christ, it may be said that, while its votaries usually reject Trinitarianism and dissent from the theology of St. Paul, the better opinion among experienced Spiritualists seems to be that if spiritual communications be sought in an earnest, becoming mood, the views presented will, in the vast majority of cases, be in strict accordance with the teachings of Christ, substantially as these are given by his evangelical biographers. It is held that while such communications touch upon many things which Christ left untouched, the spirit is absolutely identical: they breathe the very essence of his divine philosophy. Thus, enlightened Spiritualists do not set up any theory of ethics deduced from spirit-communion as a substitute for Christ's system: what they find is, as far as it goes, corroboratory evidence for that system. Especially in recent works on Spiritualism is this view set forth. It is also alleged that Christ himself promised (John xiv. 12) that his followers should do the works that he did, and greater works also; and, further, that there is, in point of fact, substantial coincidence between the signs and wonders related in the Gospels and the spiritual epiphanies of the present day.

It is admitted by candid Spiritualists that many of the communications obtained appear to be but a reflection of the opinions or expectations, sometimes of the medium, sometimes of the inquirer; but it is also claimed that in many other cases the replies not only contain information unknown to both, and which is afterward found true, but opinions and assertions utterly opposed to the convictions of all the assistants. In this way, it is held, stubborn facts come to light which unmistakably connect the two worlds, and through which, in the cases referred to, the identity of the alleged communicating spirits is demonstrated.

Spiritualism, its friends declare, is not to be regarded as forming a sect, nor do they ever desire that it should become a separate Church, with prescribed creed and ordained ministers and formal professors. It is spreading, they think, as fast as the world can bear it, and in the manner most desirable; in part through the agency of numerous volunteer lecturers, but chiefly in silence through the agency of daily intercourse, in the privacy of the domestic circle—invading the churches already established, not as an opponent, but as an ally, its tendency being to modify the creed and soften the asperities of Protestant and Romanist, of Presbyterian and Episcopalian, of Baptist and Methodist, of Unitarian and Universalist; and its result being to leaven with invigorating and spiritualizing effect the religious sentiment of the age, increasing its vitality, enlivening its convictions. It is not asserted, however, that such results can be obtained except in proportion as the spiritual mine is wisely worked, its researches judiciously prosecuted, and the millions educated up to the occasion.

Meanwhile, the new faith appears to have overrun every portion of the civilized world. Judge Edmonds, an experienced Spiritualist, formerly of the supreme bench of New York, stated that he had received letters on the subject during the last twenty years from all parts of the U. S., from England, Ireland, Scotland, France, Germany, Russia, Spain, Italy, Greece, the East Indies, Cuba, Jamaica, Brazil, Guatemala, Australia, New Zealand, the Sandwich Islands, the Ionian Islands, Malta, Algiers, and many other places. The author of *Aurelia*, who has spent ten or twelve years travelling all over Europe and in Asia and Africa, says, in a recent work entitled *Scepticism and Spiritualism, or the Experience of a Sceptic*: "There is scarcely a city or a considerable town in continental Europe at the present moment where Spiritualists are not reckoned by hundreds, if not by thousands, where regularly-established communities do not meet for spiritual purposes; and they reckon among them individuals of every class and avocation and intellects of the highest order." It is difficult to estimate, even with approximating accuracy, the number of the believers in Spiritualism. By the author of this article the following statement is made: "The number of those who accept, more or less unreservedly, its phenomena, may be safely assumed to exceed, in the U. S., 7,500,000, and in the rest of Christendom at least as many more. One might have to double this last amount, reaching 30,000,000, to include all in the Christian world whose skepticism in what is called the supernatural—but what *is* the law-governed spiritual—has been, chiefly by this movement, more or less shaken or removed."

The earliest public notice of Spiritualism is contained in a small pamphlet, now very scarce, entitled *Report of the Mysterious Noises at Hydesville, Canandaigua, April, 1848*, from which Mr. Owen (*Footfalls*, pp. 290–297) has copiously extracted. Next came *Spiritualism*, by John W. Edmonds (New York, 1853), causing great excitement and having a large sale; followed by *Modern Spiritualism, its Facts and Fanaticisms*, by E. W. Capron (Boston, 1855), and *Experimental Examination of the Spirit Manifestations*, by Robert Hare, M. D., emeritus professor of chemistry in the University of Pennsylvania (New York, 1856). Judge Edmonds's work has an appendix of 50 pages by Nathaniel P. Tallmadge, U. S. Senator from New York, and afterward governor of Wisconsin. There appeared also, in the earlier days of Spiritualism, *Nature's Divine Revelations* and *The Great Harmonia* (3 vols.), followed by several smaller works, all by A. J. Davis. These works have had a wide circulation, and some of them have been translated into several languages. About the same time were published the *Shekinah*, by S. B. Brittan, and *Spirit Manifestations*, by the Rev. Adin Ballou; while in England appeared *Facts and Fantasies* (London, 1853), by Henry Spicer; and in France, *Arcanes de la Vie future dévoilés* (Paris, 1848), and *Des Esprits et de leurs Manifestations fluidiques*, by the Baron de Mirville (Paris, 1854); also, *Des Tables tournantes, du Surnaturel en général, et des Esprits*, by Count de Gasparin (Paris, 1855). De Mirville's work regards spiritual phenomena, from a Roman Catholic standpoint, as chiefly demoniacal; and a Protestant divine, the Rev. Charles Beecher, in his *Review of Spiritual Manifestations*, though from a different point, takes a similar view. Later works are *Footfalls on the Boundary of Another World* (Philadelphia, 1860), by Robert Dale Owen, formerly member of Congress and American minister to Naples. This work treats of the spontaneous phenomena of Spiritualism, and had in England and the U. S. a circulation of about 20,000 copies. In England were published *History of the Supernatural* (2 vols., London, 1863), by William Howitt, and *From Matter to Spirit*, by Mrs. De Morgan. To this last work was prefixed an introduction by the husband of the authoress, the celebrated mathematician, recently deceased, Prof. De Morgan. From time to time also appeared several additional volumes by A. J. Davis. In 1870 was published a *History of Spiritualism*, by Mrs. Emma Hardinge (now Mrs. Brittan), containing many details connected with the rise and progress of the movement. Finally, about Dec. 1, 1872, there was published, simultaneously in New York and London, the latest work on this subject, entitled *The Debatable Land between this World and the Next*, by Robert Dale Owen. Of this work there have been disposed of, in the two months since it appeared, 5000 copies. Its scope is broad. One-fourth of it is occupied by an "Address to the Protestant Clergy," reviewing the present attitude of the religious world in connection with modern science and with modern ideas touching the reign of law, human infallibility, plenary inspiration, miracles, spiritual gifts. It discusses the effects on morality and on spiritual manifestations of such doctrines as vicarious atonement, original depravity, a personal devil, an eternal hell. More than half the volume consists of narratives, some of them embodying the author's own experience in Spiritualism, others supplying examples of spontaneous spiritual phenomena—all such as would be usually deemed marvellous, or, as a magazine article reviewing the work expressed it, "A most entertaining sheaf of stories, such as human nature has always listened to with terrified delight round the crackling logs of the winter's fire." It called forth a ten-page favorable review by Alfred Wallace, F. R. S., in the (London) *Quarterly Journal of Science*.

There are some eight or ten periodicals in the U. S. devoted to the cause of Spiritualism, the two having the largest circulation being the *Banner of Light*, issued in Boston, and the *Religio-philosophical Journal*, published in Chicago. In London, ten years ago, there was but a single journal, *The Spiritual Magazine;* now there are five, three representing Christian Spiritualism, and two advocating Spiritualism in connection with opinions of a radical tone. In the U. S., it would seem, Spiritualism has spread throughout the whole body of the people, while in England the majority of its adherents are to be found, it is said, among the nobility and gentry. So far, it appears, on the whole, to be steadily on the increase, its phenomena gradually becoming more marked and frequent. Since the above was written there has appeared an elaborate work, *The Identity of Primitive Christianity and Modern Spiritualism* (2 vols.), by Eugene Crowell, M. D.

ROBERT DALE OWEN.

**Spiritualists.** See SPIRITUALISM.

**Spir'ula** [diminutive of the Lat. *spira*, a "coil"], a genus of ten-armed dibranchiate cephalopods, of which

there are three species, found in most warm seas. They constitute a family, Spirulidæ, which has interesting relations to the nautilus and the ammonites. The creature has an extremely delicate, nacreous, chambered shell, especially common on the New Zealand shores, but the animal itself is very rarely seen in a perfect condition.

**Spit'head,** the name by which is known the important roadstead off Portsmouth, England, being the eastern portion of the sea-channel separating the Isle of Wight from the English main. (See PORTSMOUTH and SOUTHAMPTON.) Its security as an anchorage, its contiguity to the great naval establishment at Portsmouth, and its proximity to the coasts of the Continent confer upon it paramount importance in reference to the naval power of England and to the defence of her coast. Its defence has been the subject of profound study (see reports of commissioners on the defences of the United Kingdom) and also of controversy. Besides the works on the Isle of Wight and on the main, there are five iron-plated works (see IRON-PLATING), built from the bottom, which are among the most remarkable specimens of modern iron-plated fortification. (See *Prof. Papers Corps of Engineers U. S. A.*, No. 21.) J. G. BARNARD.

**Spitzberg'en,** a group of three large and several small islands, situated midway between Greenland and Nova Zembla, in lat. 80° 48′ N., lon. 20° 29′ E., and the northernmost known land on the globe. The islands are mountainous, the peaks often rising between 4000 and 5000 feet, and mostly covered with perpetual snow and ice. Only along the shore between the ocean and the mountains are in some places found patches of land, where during the two summer months, when the thermometer rises 5° above the freezing-point, the snow melts and a few herbs appear. The mountains contain granite, marble, and coal. Bears, reindeer, and foxes are found, and innumerable whales, seals, and sea-fowl gather along the shores. The islands were discovered in 1553, and visited in 1596 by the Dutch navigator Barentz, endeavoring to find a north-eastern passage to India. They have since been often visited by whalers, and parts of the coast-land have been explored. The interior highland is entirely unknown, it being impossible to travel over its glaciers.

**Spitz Dog** [Ger. *Spitz*, "pointed"], a small variety of the Pomeranian dog, which is thought to be a cross between some of the Arctic wolf-dogs and the Arctic fox, like the Esquimaux, Siberian, Lapland, and Iceland dogs, to which, though much smaller, it has a marked resemblance. It is characterized by short and erect ears, a pointed muzzle, a curved bushy tail, and long hair, usually pure white, but sometimes cream-color or even deep black. It is brisk in its movements, useful as a watch-dog, somewhat snappish, handsome, quick of apprehension, and has recently become a favorite lapdog in Europe and the U. S.

**Spleen** [Gr. σπλήν], the largest of the ductless or blood-glands of the body. It is situated in the left hypochondriac region, its outer convex surface corresponding with the ninth, tenth, and eleventh ribs, from which it is separated by the descending muscular attachments of the diaphragm; its inner concave surface adjoins the great pouch of the stomach. It also comes near to the pancreas, left kidney, left lobe of the liver, and arch of the colon. It is held in position by a peritoneal reflection from the diaphragm, called the suspensory ligament. It is even more directly related to these adjacent viscera by its blood-supply, the splenic artery being the largest branch of the cœliac axis, the trunk which gives off the nutrient vessels of the stomach, liver, and small intestine—the gastric, hepatic, and gastro-duodenal arteries. The variable size and gross and minute structure of the spleen indicate that it is a great vascular reservoir. In health, it is five inches long, three to four thick, and one to one and a half in breadth, and weighs seven ounces; it is larger immediately after eating, and in malarial and other congestive attacks may weigh fifteen or twenty pounds, and occupy the abdomen down to the pelvic bones. The fibrous capsule of the spleen is very elastic; it is reflected inward on the vessels as they subdivide, thus forming a system of ramifying partitions, the fibrous framework of the spleen. The interspaces of this structure are occupied by the substance of the spleen, a soft, pulpy mass of dark, reddish-brown color, consisting of granular matter, red and white blood-cells in a changed and degenerate state, and the Malpighian corpuscles—sacculated masses of arterial capillaries, which connect with the distensible capillary veins. The relation of the spleen to the blood, which it so freely stores up, is unsettled; by some it is regarded as the origin of white blood-corpuscles, by others as the destroyer of red corpuscles, by others the elaborator of pigment and albuminoid matter. The spleen has been removed in animals and men with no serious or marked result. The function of the spleen is as yet unknown; the object of the other ductless glands—the thymus, thyroid, and the supra-renal capsules—is equally obscure. The spleen is frequently congested, exceptionally inflamed, often permanently enlarged by repeated congestions, infiltration, and hypertrophy of its tissues. There may be supernumerary spleens. The spleen is liable to rupture and fissure from external violence. In typhus fever and many other disorganizing blood-states the spleen is softened and bronzed.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Splint** [Ger.], a bony growth, generally upon the inside of the fore leg of the horse, below the knee. It is usually caused by overworking a young horse. Rest, poulticing, and packing with cold wet compresses are recommended for the early stages. At a later stage, iodine, mercurial ointment, blisters, and the actual cautery may be usefully employed, but not till the inflammation is gone. If the tendons are interfered with, veterinary surgeons sometimes remove the splint.

**Splint,** in surgery, a piece of wood, leather, pasteboard, gutta-percha, metal, or other material employed to prevent displacement of the fractured ends of bones or for other analogous purposes. In many cases surgeons employ bandages stiffened with gypsum, starch, dextrine, or gum-arabic in the place, and a very great number of splints has been devised for special purposes in surgery.

**Splü'gen,** a mountain-pass of the Alps leading from the Swiss canton of the Grisons into Italy over an elevation of 6939 feet, is on the Italian side covered at many places with galleries of solid masonry to protect travellers from avalanches. These galleries were built by the Austrian government, and finished in 1834.

**Spof'ford** (AINSWORTH R.), b. at Gilmanton, N. H., Sept. 12, 1825; received a classical education by private tuition; became principal librarian of Congress 1865, after having been previously employed as assistant; is a member of many historical and philosophical societies; has written much for the press on historical topics, and enjoys a wide fame for the universality of his knowledge, which he renders very serviceable to members of Congress and to students generally. He has published an *Alphabetical Catalogue of the Library of Congress* (1864), several supplementary catalogues, and has prepared a vast analytical catalogue, which, it is hoped, will soon be printed (1876). During his tenure of the responsible office of librarian the national collection has grown from 90,000 to more than 300,000 volumes, and the change in the law of copyright has been effected, by which all copyrights are entered and all facts regarding literary property verified at one central office at the Library of Congress, Washington, D. C., instead of being scattered, as was the case prior to 1870, in the offices of the district clerks throughout the country. The advantage to the American public in thus having secured the complete body of American literature in a national fireproof repository, open to the use and reference of all, is obviously very great; and the chief credit for this benefit is attributable to Mr. Spofford.

**Spofford** (HARRIET ELIZABETH **Prescott**), b. at Calais, Me., Apr. 3, 1835; married in 1865, Richard S. Spofford, a lawyer of Boston, Mass.; is authoress of *Sir Rohan's Ghost* (1859), *The Amber Gods, and other Stories* (1863), *Azarian* (1864), *New England Legends, A Thief in the Night*, and other works of fiction, and has contributed to many literary periodicals.

**Spohr** (LUDWIG), b. at Brunswick Apr. 5, 1784. His father was a physician. He was early noticed by the duke of Brunswick, placed on the civil list, and furnished with means for study and travel. His masters on the violin were Maurer and Eck; visited Russia; in 1804 began his professional career in Germany; was concert conductor under the duke of Saxe-Coburg-Gotha; in 1813 was in Vienna, in 1816 in Italy, in 1817 in Frankfort and London. A residence of some years in Dresden followed, and continued till he was called to the office of chapel-master at Cassel. D. Oct. 22, 1859. Spohr was possessed of fine sensibility and immense activity. Skilful in construction, elaborate in finish, a master of harmony and instrumentation, poetic in sentiment, imaginative, sympathetic, he ranks with the great, if not the greatest, composers. As a violinist he has scarcely been equalled. His book of instruction for the violin is a standard work. He composed in nearly every style—duos, quartettes, quintettes, sonatas, variations, overtures, cantatas, nine symphonies, five or six operas, several oratorios, songs with pianoforte accompaniments. His most famous pieces are the symphony *The Consecration of Tones* and the oratorio *The Last Judgment*, which is rather a collection of musical gems than an evenly-developed structure. A vein of mournful tenderness pervades his compositions, which suggests monotony and mannerism, but is interesting and effective. A critic has said

that "if all the works of Spohr could be destroyed except one specimen in each class of composition, it would be of advantage to his reputation." — His wife, DOROTHEA (SCHINDLER), was an accomplished performer on the harp, and gave concerts with her husband in the principal cities of Europe. O. B. FROTHINGHAM.

**Spole'to** [*Spoletium*], town of Italy, province of Perugia, about 60 miles N. N. E. of Rome, on a slight elevation, the crater of an extinct volcano. It was the foremost of the Umbrian cities, was reduced to a Roman colony in 242 B. C., suffered in the civil wars of Sulla and Marius, was sacked by Totila, rebuilt by Narses; under the Lombards it became a dukedom that increased rapidly in power, but it was plundered by Luitprand. After Charlemagne it was governed by a Frankish family, and Lambert, the second duke of this line, openly resisted the pope, marched to Rome (878), and held the Holy Father prisoner for some time. In the time of Gregory VII. the celebrated countess Matilda took up her residence here. In the twelfth century Spoleto offered an ineffectual resistance to Barbarossa. After the thirteenth century it became a permanent part of the Papal States. The old castle, whose foundations date from the time of Theodoric, stands on a height above the town, from which it is separated by a chasm-like valley spanned by a bridge 670 feet long and 280 feet high, originally Roman, but rebuilt, probably in the tenth century, and now serving as an aqueduct as well as bridge. This is the most striking object to be seen in Spoleto. The old Roman arched gateway, known as the Porta della Fuga, is according to Livy, a monument of Hannibal's time. The grand Palazzo Comunale has a tower of the eleventh century. The number of less important remains of Roman and mediæval architecture is very large. The churches contain many curious old monuments and some interesting pictures. The inhabitants of Spoleto are mostly engaged in agricultural and pastoral pursuits. P. 20,748.

**Spondias.** See HOG PLUM.

**Sponge.** See APPENDIX.

**Spon'sor** [Lat. from *spondere*, to "bind one's self by solemn promise"], in general, one who in any way becomes surety for another; specifically, one who at the baptism of an infant promises in its name that it shall lead a Christian life: a godfather or godmother. The sponsors also bind themselves to see to it that the child shall receive Christian training. Usually, in the churches of England and Rome, there are two sponsors, a male and a female. In the Church of Rome the relation of godfather or godmother and godchild is held to be a real one, precisely as though it were one of consanguinity.

**Spontane'ity** [N. Lat. *spontaneitas*], a term used in philosophy to express self-origination. It is sometimes confounded with freedom. Freedom involves not only spontaneity, but also conformity to law or consistency. Mere spontaneity may contradict each act by its successor, and thus its entire series may reduce to zero, thus preventing its realization by external acts. The existence of spontaneity is denied by strict necessitarians, who think all events under the form of causality, making each effect to flow from an external cause. But an examination of the presuppositions of necessity discovers that the ultimate cause—the "totality of conditions"—must be self-determining or spontaneous. Everything that happens must ultimately flow from a spontaneous activity. This spontaneity—all spontaneity—likewise can be shown to be personal will or else dependent on it. Cousin laid much stress in his philosophy upon the spontaneity of reason as contradistinguished from its reflective activity. While reflection depends on the arbitrary will of the individual, and is subject to error, the spontaneous original activity of reason is above reflection and arbitrariness, and not liable to error. Such a theory of reason was applied to the support of *a priori* ideas upon which the eclectic system was built. Schelling's "intellectual intuition" and Reid's "common sense" were used much in the same way; also, "intuition of the reason," which cognizes *a priori* ideas, according to many contemporary philosophers, corresponds to Cousin's "spontaneity." It is noteworthy that Fichte regarded the philosophic perception of the principles of the true science of knowledge to be a higher order of reflection—as it were, a third intuition of the mind (see PHILOSOPHY), whereas Cousin would make it a first "intention." WILLIAM T. HARRIS.

**Sponta'neous Combus'tion.** Before an ordinary body will unite with oxygen in the energetic manner, attended usually with evolution of both light and heat, which is commonly known as *combustion*, it must be heated to a certain point. Frequently, however, this union begins without any external influence, and it is then called *spontaneous combustion*. Phosphorus will often take fire at the temperature of the hand on account of its affinity for oxygen, and it is this same readiness to combine with oxygen which causes spontaneous combustion in the case of other bodies, so that anything which will increase it will increase the tendency to such combustion. Mechanical division increases it greatly, by affording a larger surface to the action of oxygen, and by lessening the conducting powers of the bodies acted on. If the oxides of nickel, cobalt, or iron are reduced by hydrogen below a red heat, the resulting finely-divided metals take fire when poured into the air; but if heated too highly, they become agglomerated and lose the property, unless some finely-divided powder is present to keep them porous, such as alumina precipitated with the metallic oxides. Freshly-burned charcoal is liable to take fire, owing probably to condensation of oxygen in its pores; on this account it is not ground for making gunpowder until it has been kept for a time. Recently-expressed fixed oils absorb oxygen and give out carbon and hydrogen; the temperature of heaps of rags, tow, sawdust, and similar bodies soaked with oil, grease, turpentine, varnishes, etc., will rise on this account, and the low conducting power of such materials helps the process, until very often the mass takes fire. Serious conflagrations have resulted from this cause. So frequent were the accidents arising in the transportation of silks treated with oil to increase their weight that some European railroad companies refused to receive them. Bituminous coal, especially when containing much pyrites, is liable to spontaneous combustion, and it is said that 4 per cent. of all English vessels sailing with as much as 500 tons of coal from the United Kingdom in 1874 met with casualties from this cause, perhaps through the shipment of coal containing more pyrites than usual, owing to the increased demand and the high price of labor. There are on record one or two cases, apparently well authenticated, of heaps of wood-ashes taking fire long after the addition of any fresh ashes, so that care in this respect is advisable, although the cause seems obscure, as a heap of ashes would scarcely be porous enough to admit the air necessary to support internal combustion, although it might, doubtless, take fire on the surface from finely-divided carbon. Moisture sometimes aids spontaneous combustion, as in the cases where piles of damp hay or freshly-mown grass have taken fire. Barns have probably been burned in this way. It is also well to remember that strong nitric acid will act on straw, hay, and such bodies so as to render them spontaneously combustible. Twice within a year, at one of our scientific schools, concentrated nitric acid leaked from bottles into the straw in which it was packed, and the straw in one case took fire before the box was opened—in the other immediately afterward. Some gases ignite spontaneously, as phosphoretted hydrogen. The illuminating oil distilled from petroleum sometimes gives off gases that inflame spontaneously before it is refined in the "agitator." There are also spontaneously combustible liquids, of which cacodyl is an example. Spontaneously-combustible powders, or *pyrophori*, are made by heating tartrate of lead in a closed glass tube until the lead is reduced to metal, or by heating finely-divided sulphate of potash with half its weight of lampblack in a covered crucible, probably forming a very inflammable sulphide of potassium. The pyrophorus of Homberg is a mixture of dried alum and sugar, carbonized in an open pan, and then heated to redness in a glass flask away from the air. There is not on record an instance of reputed spontaneous combustion of the human body which admits of no other explanation. H. B. CORNWALL.

**Spontaneous Combustion of the Human Body.** There are very grave doubts in the minds of the best scientific authorities whether the human body is, under any conceivable circumstances, liable to inflame spontaneously; so much so, indeed, that one of the best authorities on medical jurisprudence declines to discuss the question under this heading, and substitutes the term "preternatural combustibility of the human body," presupposing that the combustion has in every case been excited by an external source of heat. The analogy between cases of spontaneous combustion in vegetable or mineral materials—which are unquestionable, and explicable in most cases by reference to rapid chemical action in conjunction with highly combustible materials—and cases of so-called spontaneous combustion of the human body fails in several important particulars. Those who believe in its possibility urge that the human body is largely made up of hydrocarbonaceous materials—oils and fats—which are highly inflammable; that under certain circumstances, and as the result of long-continued habits, another highly combustible substance, alcohol, may be largely distributed throughout the tissues, not only increasing the natural combustibility, but forming an inflammable atmosphere around the body by its evaporation from the surface; and that as a result of the varied and rapid chemical processes of life it is quite possible that heat enough may be engendered to inflame the tissues, or that, as the result of these chemical changes, gases may be

evolved or formed which inflame at a very low temperature, or even spontaneously upon coming in contact with the air, or which may be inflamed by some electrical influence.

On the other hand, while admitting the combustibility of the body *when dried*, we must remember that about 70 per cent. of it consists of water, so distributed as to repress combustion in its inception, and that experiments show conclusively that the human body (undried) is a very incombustible substance, even when thoroughly impregnated with alcohol. We must also consider that the chemical processes going on in it, although varied and rapid, cannot be proved to evolve such an amount of heat as to make it probable that the combustion could be spontaneous, even if the material to be consumed were highly inflammable; and, finally, that the production and distribution throughout the tissues of spontaneously inflammable, or even of highly-combustible gases, is a theory resting only upon the fact that the materials out of which these gases might be formed exist in the living body, and not upon a demonstration of their formation.

In reviewing the recorded instances to which the theory appeals for support, we find them to be about thirty in number, the great majority of them females and a large proportion inordinate drunkards. "It does not appear that any one on whose judgment reliance can be placed has ever seen a case of spontaneous combustion of the body or recorded the details from actual observation." (Taylor, *Med. Jurisp.*) The destruction has been in many cases surprisingly complete, mere fragments being left uncharred, and in many cases the bones being calcined. In all well-authenticated cases a candle, lamp, fire, or matches have been in close proximity to the remains. Great stress has been laid by the advocates of spontaneous combustion upon a grimy, greasy soot and an empyreumatic odor which pervade the room, but these are equally the results of the ordinary combustion of human flesh in a confined apartment. The complete destruction of the body in comparison with the damage done to its surroundings, which has been more marked in females, has always been considered as the chief argument in favor of the possibility of such an occurrence. As Taylor pertinently remarks, we must remember that the fuel whose combustion destroys the body is itself consumed, and we have no means of estimating its quantity or quality. In cases where bodies have been set on fire to conceal murder, the clothing of the victims has often been intentionally soaked with some highly inflammable substance, or combustibles, such as pillows, etc., have been piled around the body before applying the light. The latter was the case in an instance which was regarded for some years as an example of spontaneous combustion, but which subsequent developments and the confession of the murderer showed to have been an attempt to conceal crime. The loose dress of females, highly combustible in itself, and containing a large amount of air in its folds, may perhaps partly account for their more complete destruction. It is also manifestly impossible in any case to estimate exactly the duration and intensity of the heat to which the body has been subjected from the combustion of the surrounding objects, particularly when we remember that the combustible parts of the body, liquefied by the heat, will saturate the materials beneath, rendering their combustion more intense and prolonged than is natural; as in one case on record, where the investigator reported that unburned pieces of a thick mat which lay under the body were so saturated with fat that they burned "like a link" upon applying a flame.

While, therefore, some of the instances of so-called spontaneous combustion of the human body are difficult of explanation, there are none whose explanation under conceivable conditions, acting according to natural laws, does so much violence to our reasoning as does the assumption of unproven theories as facts. In the words of one of the best and most recent authorities on this subject, "The hypothesis of such a mode of destruction of the human body is not only unsupported by any credible facts, but is as wholly inconsistent with all that science has revealed as witchcraft itself." Subjoined will be found a few references to the principal articles upon the subject in which may be found in detail the cases upon which the theory rests: *Cyc. Pract. Med.*, art. "Spont. Combustion," four cases; *Transylvania Journ.* (vol. iii. p. 143; vol. vii. p. 128); *Archives générales* (Mar., 1829); *Edinburgh Med. and Surg. Journ.* (vol. xxvi. p. 215; vol. xix. p. 653; vol. xxii. p. 233); *Am. Med. Recorder* (vol. vi. p. 764); *Lond. Med. and Phys. Journ.* (vol. xlv. p. 347); *Lond. Med. Repository* (vol. iii. p. 239); *New York Med. Repository* (vol. xviii. p. 87); *Foderé* (vol. iii. p. 210); *Dict. des Sciences médicales* (vol. vi., art. "Spont. Comb."); *Am. Med. Recorder* (vol. v. p. 489); Beck's *Med. Jurisp.*, art. "Spont. Comb.;" Taylor's *Med. Jurisp.*, art. "Spont. Comb." S. B. St. John.

**Spontaneous Generation.** See Generation, Spontaneous, by Pres. F. A. P. Barnard.

**Sponti'ni** (Luigi Gasparo Pacifico), b. at Majolati, a village in the Papal States, Nov. 14, 1774; entered in 1791 the Conservatory of Music at Naples, and composed in 1796 his first opera, *I Puntigli delle Donne*, which succeeded. His next thirteen operas were also well received in various Italian cities, and he had a name in his native country when in 1803 he went to Paris. Here his first compositions made no impression, but in 1807 his great opera *Vestale* achieved an extraordinary success, as also did *Ferdinand Cortez* in 1809. From 1810 to 1812 he was director of the Italian opera at Paris, but found the position uncongenial to his character, and gave it up in disgust. In 1819 his third great opera, *Olympia*, was received somewhat coldly, and in 1820 he removed to Berlin, where he was director of the opera till 1842. His own compositions from this period—*Nurmahal* (1822), *Alcidor* (1825), etc.—are not very interesting, and he was exposed to much criticism and chicanery from the German musicians. In 1842 he went to Paris, thence to Italy, and d. in his native city Jan. 24, 1851.

**Spoon'bill** [the bill of the European kind is sometimes made into a spoon], a name applied to several birds of the heron family and of the genus *Platalea*, remarkable for the curious shape of the large bill. The windpipe has a singular and unexplained convolution. The roseate spoonbill (*P. ajaja*) of the Southern U. S. and tropical America is a beautiful rose-colored bird some thirty inches long. It lives in communities, and is considered a good bird for the table. The white spoonbill (*P. leucorodia*) is common in marshy regions in nearly all parts of the Old World. A few other species are known.

**Spoon'er** (Alden Jeremiah), b. at Sag Harbor, L. I., Feb. 2, 1810; became a resident of Brooklyn, where he edited the *Evening Star* and the *Long Island Star*; contributed for many years to the *Knickerbocker* and to *Colman's Magazine*, and was editor of Gabriel Furman's *Notes, Geographical and Historical, relating to the Town of Brooklyn* (1865), and Silas Wood's *Sketch of the First Settlement of the Several Towns on Long Island* (1865), contributing to both books memoirs of their authors.

**Spooner** (Lysander), b. at Petersham, Mass., in 1808; author of *The Deist's Reply to the Alleged Supernatural Evidences of Christianity* (Boston, 1836), *The Unconstitutionality of Slavery* (Boston, 1845; part ii. 1847), and of several legal arguments on trial by jury, credit, currency, banking, and the right of maintaining private mails.

**Spooner** (Shearjashub), M. D., b. at Brandon, Vt., in 1809; graduated at Middlebury College 1830, and at New York College of Physicians and Surgeons 1835; was a distinguished dentist in New York City until 1858, when he retired from business. Author of several professional treatises, of *Anecdotes of Painters, Engravers, etc.* (3 vols., 1853), and of a *Biographical and Critical Dictionary of Painters, Engravers, Sculptors, and Architects* (1853; new ed., 2 vols., 1865), containing notices of 12,000 artists. Dr. Spooner purchased and reissued the plates of Boydell's *Shakspeare Gallery*, and purchased for the purpose of reissue the plates of the *Musée française*, but the government refusing to remit the heavy import duty, the plates were returned to France. D. at Plainfield, N. J., in Mar., 1859.

**Spor'ades** [Gr. Σποράδες, "scattered"], the common name of those smaller islands of the Grecian Archipelago which lie scattered around the group of the Cyclades. They belong partly to Turkey and partly to Greece. The Turkish Sporades are Crete, Scarpanto, Rhodes, Cos, Kalimno, Patmos, Nicaria, Samos, Scio, Mytilene, Lemnos, Imbros, Samothrace, and Thasos. The Greek Sporades are Skiatho, Skopelo, Kilidromi, Skyro, Ægina, Salamis, Hydra, and Spezzia.

**Spore** [Gr. σπόρος, "seed"], a small embryo-cell or cell-mass produced by cryptogamous plants, and *functionally* representing the seeds of the higher plants, while *structurally* it more nearly corresponds with the pollen-cell of the higher vegetation. Spores are often so fine as to be quite invisible to the naked eye. The manner of the origin of the young plant from a spore is totally different from the germination of seed. There is indeed considerable difference in the nature of what are called spores. Some plants produce at least two apparently distinct kinds of spores—one large and another small—while the ferns and others have not a true spore, but a *prothallium* produced by gemmation, the prothallium being in fact an alternate generation of the fern, which, when further developed, performs a true act of generation from which originates the young fern. Strictly speaking, then, the spore of the fern must be the product of the action of the sperm-cell upon the germ-cell of the little prothallium, and not the cell-mass from which the prothallium springs; although the

latter functionally represents the spore, and is always called by that name. Familiar examples of spores are the "spawn" of mushrooms, the inflammable dust of *Lycopodium*, and the "smoke" of the common puff-ball.

**Sport.** See DANCING, GAMBLING-HOUSES, GRECIAN GAMES, and HORSE-RACING.

**Sporting Arms.** All small-arms not intended for military service are thus classified, including "double-" and "single-" barrel fowling-pieces and "arms of luxury" for target-firing, and smaller weapons for personal defence. The breech-loading principle has been introduced in sporting arms in great variety, but many experienced sportsmen prefer the muzzle-loader, especially for exact rifle-shooting.

The manufacture of "arms of luxury" is considered one of the highest branches of the mechanical arts, and, from the number of the richer classes who use sporting arms, and the enthusiasm of those devoted to sporting, the sales of favorite patterns are always extensive, and large prices readily given for the most popular. The fowling-pieces made by Joseph Manton of London were in universal demand for many years about forty years since; now Greener, Wesley Richards, and Williams & Powell are of high repute with the English, while Belgium, France, and the U. S. have also celebrated manufactories. Double-barrel guns are made at these factories at prices from $5 to $250 each—all deemed strong and serviceable. Greener states in *Gunnery in 1858* that a first-class double-barrel gun need not cost more, and could not be sold for less, than £35. The U. S. "officer's model rifle" is now made at Springfield of the best material and workmanship for service, but plain in finish, for $36, while the army model made there costs $18.



Springfield Rifle, officer's model, 1875.

Some parts of the arm, not affecting the accuracy of aim or delicacy of the trigger, are common to both models. (See figure.) P. V. HAGNER.

**Sports, Book of,** a proclamation by James I. of Great Britain, issued in 1618, setting forth certain games which might lawfully be indulged in on Sundays after church-service. Among the sports allowed were "dancing, archery, leaping, vaulting, May-games, Whitsun-ales, morris-dances, and the setting up of May-poles." It was designed to prevent unlawful interference by Puritanical magistrates with popular recreations. Bear- and bull-baiting, bowling, and "interludes" were forbidden on Sundays. Charles I. reissued the proclamation in 1633. In 1644 the Long Parliament directed that all copies of the *Book of Sports* be burned by the common hangman. In both instances the publication of the *Book of Sports* gave rise to intense excitement, and aroused the strongest opposition among the Puritans. A fac-simile edition was recently issued in London.

**Sportsman.** See GAME LAWS.

**Spots, Solar.** See SUN, by PROF. C. A. YOUNG, LL.D.

**Spots'wood,** p.-v., East Brunswick tp., Middlesex co., N. J., on Camden and Amboy R. R.

**Spotswood** (ALEXANDER), b. at Tangier, Africa, 1676; was governor of Virginia 1710–23; was deputy quartermaster-general under Marlborough; postmaster in 1730; leader of the expedition intended to operate against Florida 1739; was the pioneer of iron manufacturing in Virginia; was originator of an act improving the staple of tobacco, and making tobacco-notes a medium of common exchange, and lent great aid to William and Mary College. D. at Annapolis, Md., June 7, 1740.

**Spotswood,** or **Spotiswood** (JOHN), b. in Scotland in 1565; was educated at Glasgow, and in 1601 went to France as chaplain to the Scottish ambassador. James VI. having in 1603 acceded to the throne of England, Spotswood accompanied him to London, and in the same year was made archbishop of Glasgow and a member of the privy council for Scotland; in 1615 was made archbishop of St. Andrew's and primate of Scotland. In 1633 he crowned Charles I. at Holyrood, and in 1635 became chancellor of Scotland. He drew great obloquy on himself for the part he took in the prosecution of Lord Balmerino, who was arraigned for the crime of "lease-making" (verbal sedition). Balmerino was convicted, sentenced to death, and only pardoned after a long imprisonment, Spotswood, his personal enemy, taking an active part in the proceedings. In 1637 he endeavored to introduce the new liturgy and book of canons into Scotland, urged on by the king and Laud, and, as is said, contrary to his own wish. Deposed from his bishopric by the assembly convened at Glasgow in Nov., 1638, excommunicated, and declared infamous, he fled to London, where he d. Nov. 26, 1639. He wrote a *History of the Church of Scotland* (published in 1625); it begins as early as 203 A. D., but the greater part is devoted to the history of his own times.

**Spotted Fever.** See FEVER, by E. KRACKOWIZER, M. D.

**Spot'tiswoode** (WILLIAM), LL.D., F. R. S., b. in London, England, Jan. 11, 1825; educated under Dr. Buckland at Laleham School, subsequently at Eton and at Harrow; graduated at Baliol College, Oxford, 1845; gained university mathematical scholarships 1846 and 1847; became manager of the office of the queen's printer; devoted much study to Oriental languages and philosophy, as well as to astronomy, mathematics, art, and the physical sciences; is a fellow of numerous learned societies; a contributor to their *Transactions* and to scientific periodicals, English and foreign; was public examiner in mathematics at Oxford 1857–58, afterward examiner under the civil service commission, for the Society of Arts, and for the middle-class schools, and became treasurer of the Royal Society 1871. Author of *Meditationes Analyticæ; Elementary Theorems relating to Determinants* (1851), *A Tarantasse Journey through Eastern Russia* (1857), and *The Polarization of Light* (1874), a volume of the "Nature" series.

**Spottsylva'nia,** county of E. Virginia, bounded by Rappahannock and North Anna Rivers, drained by the Mattapony, and intersected by Rappahannock Canal and Richmond Fredericksburg and Richmond R. R. The surface is hilly, and the soil generally fertile. There are numerous quarries of granite and freestone. Staples, Indian corn, wheat, oats, tobacco, and wool. Cap. Spottsylvania Court-house. Area, about 450 sq. m. P. 11,728.

**Spottsylvania Court-house,** p.-v., cap. of Spottsylvania co., Va., on Po River.

**Spottsylvania Court-house, Battles at.** See WILDERNESS.

**Sprague,** tp., New London co., Conn. P. 3463.

**Sprague** (CHARLES), b. at Boston, Mass., Oct. 26, 1791; educated at the Franklin School, Boston; became a mercantile clerk at the age of thirteen, partner with his former employer 1816, teller in the State Bank 1820, and cashier of the Globe Bank from 1825 to 1865. He early displayed a talent for poetry; devoted his spare time for many years to the study of old English classics; obtained prizes on five occasions for prologues to be recited at the opening of theatres at New York, Philadelphia, Salem, and Portsmouth; took another prize for a "Shakspeare ode" delivered at the Boston Theatre in 1823 at the exhibition of a pageant; delivered a Phi Beta Kappa poem, *Curiosity*, at Cambridge 1829, and a centennial ode at Boston 1830, on the 200th anniversary of the settlement of that city; was the civic orator at Boston July 4, 1825; wrote various other occasional compositions in prose and verse, which were collected into a single volume at New York in 1841, republished at Boston 1850 and 1855. D. at Boston Jan. 14, 1875. A new edition of his complete writings was issued in Boston in 1876.

**Sprague** (PELEG), LL.D., b. at Duxbury, Mass., Apr. 28, 1793; graduated at Harvard University 1812, and at once entered Litchfield Law School; was admitted to Plymouth county bar Aug., 1815; practised several years in Augusta, Me., and afterward settled in Hallowell; was a member of the Maine legislature 1820–21, Representative in Congress 1825–29, U. S. Senator 1829–35; removed to Boston in 1835; appointed U. S. district judge of Massachusetts 1841–65. He published *Speeches and Addresses* (1858), *Decisions* (1841–61), edited by F. E. Parker (1861); vol. ii. (1854–64) 1868.

**Sprague** (William), b. at Cranston, R. I., 1800; was a member of the assembly and Speaker in 1832, Representative in Congress 1836–38, governor of Rhode Island 1838–39, Senator 1842–45, and subsequently again member of the State assembly. He was largely engaged in cotton manufactures, and was president of a railroad and of two banks. D. at Providence Oct. 19, 1851.

**Sprague** (William), b. at Cranston, R. I., Sept. 12, 1830; engaged in the printworks established by his grandfather, and carried on by his father and uncle. His father was murdered in 1844, and he subsequently became a partner with his uncle; was governor of Rhode Island 1860–63; in 1861 offered a regiment and a battery to the President, with which he took the field, having a commission as brigadier-general; was present at the battle of Bull Run, where his horse was shot under him, and was in several other actions during the Peninsular campaign; in 1862 was chosen U. S. Senator, and was made chairman of the committee on manufactures; and was re-elected in 1868, his term closing in 1875, and served as chairman of the committee on public lands.

**Sprague** (William Buell), D. D., b. at Andover, Conn., Oct. 16, 1795, son of Benjamin Sprague, a farmer, and descended from the Spragues of Duxbury; was fitted for college at Colchester Academy under the care of the venerable John Adams, and also enjoyed in his early education the assistance of Rev. Dr. Abiel Abbot; graduated at Yale 1815; was tutor in the family of Major Lawrence Lewis in Virginia 1815–16; graduated at Princeton Seminary 1819, in which year he was settled at West Springfield, Mass., as colleague pastor with Rev. Dr. Joseph Lathrop over the First Congregational church; became pastor 1821, on the death of Dr. Lathrop; was installed pastor of the Second Presbyterian church at Albany, N. Y., 1829, retaining that post until 1869; visited Europe 1828 and 1836; made the most extensive collection of religious pamphlets and of autographs known in America, the former of which he presented to the New York State library at Albany; was widely known as possessing a most exact biographical knowledge of American celebrities, especially clergymen. In 1869 he settled at Flushing, L. I., where he d. May 7, 1876. Author of more than 100 published sermons, addresses, orations, and essays; of *Letters to a Daughter* (1822), *Lectures to Young People* (1825), *Letters from Europe* (1828), *Life of Edward Dorr Griffin* (1838), *Life of Timothy Dwight* (1845), *Lectures on Revivals of Religion* (1832), *Hints designed to regulate the Intercourse of Christians* (1834), *Lectures illustrating the Contrast between True Christianity and various other Systems* (1837), *Aids to Early Religion* (1847), *Words to a Young Man's Conscience* (1848), *Women of the Bible* (1850), *Letters to Young Men* (2d ed. 1845), *Visits to European Celebrities* (1855), *Memoirs of Rev. John and W. A. McDowell, D. D.* (1864); wrote many introductions to books by other writers, and was a contributor to the biographical department of Appletons' *American Cyclopædia*. The great work to which the labor of a life was given was the *Annals of the American Pulpit* (9 vols., 1857–66).

**Sprain** [O. Fr. *espreindre*], or **Subluxation,** a stretching or wrenching of the non-osseous parts of a joint, without displacement of the bones, and either with or without lesion of ligaments or tendons. Severe sprains are sometimes quite as serious and lasting in their effects as dislocations. Perfect rest, cold or sometimes hot lotions (if the latter be more agreeable to the patient), accompanied by the use of splints for mechanical support and of opiates for the relief of pain, are required in the treatment.

**Sprat,** or **Garvie,** the *Harengulus sprattus*, a little herring of the European seas. Sprats are spiced, salted, dried, and potted in many ways, and are very good fresh, but are generally eaten by the poorer classes. The French preserve great quantities of small sprats and sell them for sardines. Great quantities are also used for fertilizing land. The sprat is seldom over six inches long.

**Sprat** (Thomas), b. in Devonshire in 1636; was educated at Oxford, where he was made D. D.; became chaplain to the duke of Buckingham, and afterward to Charles I.; prebendary of Westminster in 1668, dean in 1683, and bishop of Rochester in 1684. He was a member of the ecclesiastical commission created by James II., and read the famous declaration of indulgence in Westminster Abbey, but soon after resigned his place on the commission in an able letter, which was the cause of the extinction of that tribunal. He took the oath of fealty to William and Mary, and was appointed a member of the new ecclesiastical commission, but soon after withdrew. In 1692 he was arrested and kept in confinement ten days on a false charge of conspiracy against the new government. He was one of the first members of the Royal Society; wrote a *Life of Cowley*, a *History of the Royal Society*, an *Account of the Rye-House Plot*, and poems. D. at Bromley May 30, 1713.

**Spree,** a river of Prussia, rises in the kingdom of Saxony, passes through Berlin, and joins the Havel at Spandau, after a course of 220 miles. At Kosenblatt it becomes navigable for small craft, and considerable traffic is carried on along its whole course.

**Sprem'berg,** town of Prussia, province of Brandenburg, on an island in the Spree, has manufactures of stockings, hosiery, tobacco, and tiles. It has a royal palace and some barracks. P. 5924.

**Spreng'el** (Kurt), b. at Boldekow, a village near Anklam, in the Prussian province of Pomerania, Aug. 3, 1766; studied medicine at Halle; became professor of medicine there in 1789, and in 1797 of botany. D. Mar. 15, 1833. The most noticeable of his numerous writings are *Versuch einer pragmatischen Geschichte der Arzneikunde* (5 vols., 1792–1803), several times reprinted, *Geschichte der Botanik* (1817–18), and *Systema Vegetabilium* (1825–28).

**Sprengel's Air-Pump.** See Pneumatics.

**Spreng'er** (Aloys), b. at Nassereut in the Tyrol Sept. 3, 1813; studied medicine, natural science, and Oriental languages at Vienna; went in 1836 to London, where he assisted the earl of Munster in his work on the *Military Science of the Mohammedan Nations;* entered the service of the East India Company, and exercised during his stay in India (1843–57) a great influence on the introduction and establishment of European civilization among the Hindoo nations as president of the college of Delhi, where he lectured with great success in Hindostani on logic, mathematics, political economy, etc.; by his lithographic press, whence he issued a Hindostani weekly, *Kiran alsadain*, and the *Bibliotheca Indica;* as government interpreter, secretary to the Asiatic Society, assistant resident at Lucknow, director of the Mohammedan college in Calcutta, etc. He returned to Europe through Palestine, Syria, and Egypt in 1857, and was appointed professor of Oriental languages at Bonn. He published *Das Leben und die Lehre des Mohammad* (3 vols., Berlin, 1861–65), in which he brings to light the Mohammedanism which antedates Mohammed.

**Sprigg,** tp., Adams co., O. P. 2086.

**Spring,** one of the four seasons of the year, properly the first, so called because it is the time when vegetation "springs," as it were, to life. In the temperate regions of the northern hemisphere it includes, in a vague and indefinite way, the months of March, April, and May; June, July, and August being the summer; September, October, and November, the autumn; December, January, and February, the winter. In the temperate regions of the southern hemisphere the order is reversed, September, October, and November being the spring, and March, April, and May the autumn. In the tropical regions there is strictly neither spring nor autumn, but only two seasons, the wet and the dry; in the polar regions, only two seasons, summer and winter. Spring may be regarded as occupying the same relative position among the seasons of the year as morning does among the periods of the day, and youth among the stages of human life.

**Spring** [Ang.-Sax.], a fountain or a stream of water flowing out of the earth, and fed by rains on higher lands, frequently quite distant. As the water of springs often flows through subterranean channels which are beyond the reach of changes in surface temperature, it is little affected by the seasons, and is often maintained at about the average annual temperature of the locality. When it emanates from a deeper source, it is sometimes highly heated, producing Thermal Springs (which see). When, as is often the case, the water is impregnated with chemical substances, such springs are called mineral springs. (See Water.) J. S. Newberry.

**Spring,** tp., Jefferson co., Ark. P. 406.

**Spring,** tp., Boone co., Ill. P. 1068.

**Spring,** tp., Cherokee co., Ia. P. 33.

**Spring,** tp., Berks co., Pa. P. 2253.

**Spring,** tp., Centre co., Pa. P. 1608.

**Spring,** p.-v. and tp., Crawford co., Pa., on Erie and Pittsburg R. R. and on Beaver and Erie Canal. P. of v. 323; of tp. 1522.

**Spring,** tp., Perry co., Pa. P. 1492.

**Spring** (Gardiner), D. D., son of Samuel, b. at Newburyport, Mass., Feb. 24, 1785; graduated at Yale in 1805; studied law at New Haven; taught school for nearly two years in Bermuda; was admitted to the bar in 1808; commenced practice, but abandoned law for theology, which he studied at Andover; was licensed to preach in 1809, and in the following year became pastor of the Brick church in New York, then located in Beekman street, near the present site of the post-office, but which was removed in 1856 to Fifth avenue and Thirty-sixth street. Although invited

to the presidency of Hamilton and Dartmouth colleges, he remained in this pastorate until the close of his life, but seldom preached during the later years, the pulpit being usually filled by an assistant pastor. His published works are—*Essays on the Distinguishing Traits of Christian Character* (1813), *Memoirs of Rev. S. J. Mills* (1820), *Fragments from the Study of a Pastor* (1838), *Obligations of the World to the Bible* (1844), *The Attraction of the Cross* (1845), *The Bible not of Man* (1847), *Discourses to Seamen* (1847), *The Power of the Pulpit* (1848), *The Mercy-Seat* (1849), *First Things* (1851), *Contrast between Good and Bad Men* (1855), *Brick Church Memorial* (1861), *Pulpit Ministrations* (1864), *Personal Reminiscences* (1866). D. Aug. 18, 1873.

**Spring** (Samuel), D. D., b. at Northbridge, Mass., Feb. 27, 1746; graduated at Princeton College in 1771; became chaplain in the army, and accompanied Arnold's expedition to Canada in 1775; was ordained pastor of the Congregational church in Newburyport in 1777, and continued there until his death. He was prominent in his denomination, a recognized leader of the Hopkinsian party; aided in founding the theological seminary at Andover, and in the establishment of the American Board of Commissioners for Foreign Missions. He published several controversial essays and about 25 occasional sermons. D. Mar. 4, 1819.

**Spring Arbor,** p.-v. and tp., Jackson co., Mich., on Air-line division of Michigan Central R. R. P. 1117.

**Spring Balance.** See Balance, by Pres. F. A. P. Barnard.

**Spring Bay,** p.-v. and tp., Woodford co., Ill. P. of v. 235; of tp. 475.

**Spring-Boc** [Dutch for "spring-buck," so called from its habit of leaping when alarmed], a very beautiful, active, and graceful antelope of South Africa, the *Antidorcas euchore*. It goes in immense herds upon the plains. Its flesh is in some estimation as food, and the hides are much sought for by tanners. This timid creature, when taken in hand young, becomes very tame, and is sportive and too familiar, sometimes butting at all who come near it, like the goat.

**Springbo'rough,** p.-v., Clear Creek tp., Warren co., O. P. 477.

**Spring Brook,** p.-v. and tp., Luzerne co., Pa. P. 426.

**Spring Brook,** tp., Dunn co., Wis. P. 1061.

**Spring City,** p.-v., Chester co., Pa., 30 miles N. of Philadelphia, on Schuylkill River, has 2 churches, a fine school-house, 1 bank, 1 newspaper, a wood-paper mill, stove-foundry, sash-factory, planing-mill, and a brick-yard. P. about 2000. J. H. Royer, Ed. "Sun."

**Spring City,** p.-v., San Pete co., Ut.

**Spring Creek,** tp., Shelby co., Ala. P. 1183.

**Spring Creek,** tp., Phillips co., Ark. P. 1563.

**Spring Creek,** tp., Yell co., Ark. P. 778.

**Spring Creek,** tp., Pike co., Ill. P. 1009.

**Spring Creek,** tp., Black Hawk co., Ia. P. 707.

**Spring Creek,** p.-v. and tp., Tama co., Ia. P. 573.

**Spring Creek,** tp., Saline co., Kan. P. 726.

**Spring Creek,** tp., Dent co., Mo. P. 1281.

**Spring Creek,** tp., Douglas co., Mo. P. 386.

**Spring Creek,** tp., Howell co., Mo. P. 448.

**Spring Creek,** tp., Maries co., Mo. P. 244.

**Spring Creek,** p.-v. and tp., Phelps co., Mo. P. 1119.

**Spring Creek,** p.-v. and tp., Johnson co., Neb. P. 521.

**Spring Creek,** p.-v. and tp., Madison co., N. C. P. 944.

**Spring Creek,** tp., Miami co., O. P. 1606.

**Spring Creek,** tp., Elk co., Pa. P. 357.

**Spring Creek,** p.-v. and tp., Warren co., Pa., on Philadelphia and Erie division of Pennsylvania R. R. P. 1116.

**Spring Creek,** tp., Wirt co., West Va. P. 490.

**Springdale,** p.-v. and tp., Cedar co., Ia., on Red Cedar River. P. 1539.

**Spring Dale,** p.-v., Springfield tp., Hamilton co., O. P. 382.

**Spring'dale,** p.-v. and tp., Dane co., Wis. P. 1138.

**Spring'er,** a name given by sportsmen to several varieties or sub-varieties of the hunting spaniel, used for starting birds from bushy coverts. The Clumber, Sussex, and Norfolk breeds are the best. The springer should weigh from fourteen to forty pounds, and should have a good coat, a feathery tail, carried low, and an active, graceful style of work. The Clumber is especially liked, because it gives no tongue while at its duty.

**Spring'field,** p.-v. and tp., Green co., Ala. P. 915.

**Springfield,** p.-v., cap. of Bon Homme co., Dak., 30 miles W. of Yankton, has 3 churches, U. S. land-office, good schools, 1 newspaper, a public hall, incorporated library association, and 1 hotel. Principal business, stock-raising and farming. P. about 500.

L. D. F. Poore, Ed. "Times."

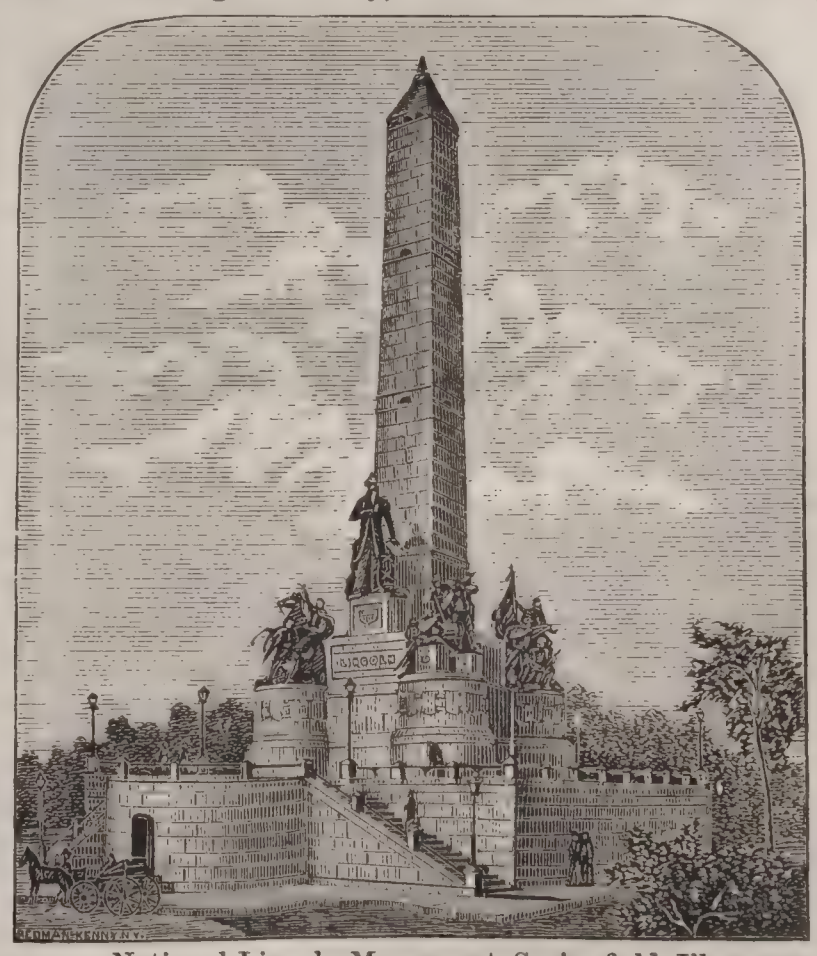
**Springfield,** p.-v., cap. of Effingham co., Ga. P. 32.

**Springfield,** city and tp., capital of the State of Illinois, and also of Sangamon co., is situated on Chicago Alton and St. Louis, Toledo Wabash and Western, Gilman Clinton and Springfield, Springfield and Illinois, South-eastern division of Ohio and Mississippi, and Springfield and North-western R. Rs. P. (1870) of v. 17,364; of tp. 2447. Its population, taken by local authorities recently, is 25,600, making it the fourth city in size in the State, Chicago, Peoria, and Quincy being larger. It was selected as the capital in 1837. Two street horse-railways permeate the city N. and S., E. and W.; 6 coal-shafts are operated on the verge of the city, where superior coal in inexhaustible quantities is mined. Springfield has gas-works, a paid fire department, and adequate waterworks. The principal manufactories are, the Springfield woollen-mills, paper and pulp manufactory, corn-planter and baby-wagon manufactory, Springfield Watch Co., Springfield iron, steel, and rolling mills, machine-shops, spice and hominy mills. Sixteen churches adorn its streets, several of superior architectural beauty. There are 4 ward schools, and a fifth for colored children; also a tasteful high-school building; the Bettie Stuart Institute, Ursuline convent, and St. Joseph's of Notre Dame; the home for the friendless and other charitable institutions; a public library and a law library, the latter belonging to the State. There are two daily, 1 tri-weekly, 4 weekly, and 1 monthly newspaper, and a book and job office. Springfield was the



Lincoln's Home, Springfield, Ill.

home of the late President Lincoln. Adjoining Springfield is Oak Ridge Cemetery, remarkable for natural beauty



National Lincoln Monument, Springfield, Ill.

and æsthetic embellishment. Here repose the remains of the lamented Lincoln, and here is erected the Lincoln national

monument. It was designed by Larkin G. Mead, Jr., of Vermont, and built by William D. Richardson of Springfield, Ill. The former engaged to mould, cast, and deliver the following statuary for the sum of $70,000, the latter to erect the monument for $136,550. The statuary to consist of a statue of Lincoln not less than ten feet high; a group representing infantry, containing three figures, with appropriate accessories, figures 7½ feet in height; group of cavalry, one horse and two horsemen, with accessories, the human figures 7½ feet high, and the horse in proportion; group of artillery, of three figures, same height; marine group of three figures, of same height; and a coat-of-arms of the U. S. The monument proper, excepting the groups, occupies on the ground, fitted with concrete, a space of 119½ feet from N. to S. and 72½ feet from E. to W.; is built with solid masonry of block Massachusetts or Quincy gray granite, 39 feet 4 inches high. The monumental shaft or obelisk from ground-line to apex is 98 feet 4½ inches high. There is a catacomb and memorial hall at its base: the former has five crypts side by side three feet above the vestibule, each 3 feet square and 7 in length. These are reached by stone steps protected by an iron balustrade. The central crypt only is visible through a glass plate; in it is the sarcophagus containing all that was mortal of Abraham Lincoln. From the terrace to the apex of the obelisk is 82 feet 6½ inches; from grade-line to top of the pedestals for groups, 28 feet 4 inches; and to the top of the pedestal occupied by the statue of Lincoln is 35 feet 6 inches. It is understood that several cities of the Union intend to furnish the groups at their individual expense. When these are constructed and placed in position, the monument will be complete. Within Memorial Hall are deposited articles used by Mr. Lincoln or associated with his memory. Here is a stone given to him by Roman patriots during the early part of his second term. It was detached from the wall built by Servius Tullius. The stone bears a Latin inscription, translated as follows: "To Abraham Lincoln, President for the second time of the American republic, citizens of Rome present this stone from the wall of Servius Tullius, by which the memory of each of those brave assertors of human liberty may be associated. Anno 1865." This block is 27½ inches long, 19 inches wide, and 8¾ inches thick. Other objects of interest are deposited in Memorial Hall. Two of the crypts contain the remains of two of the children of Mr. Lincoln—Eddie and Willie.

The new capitol at Springfield was authorized by statute in 1867, under the supervision of a board of commissioners. Its cost is limited to $3,500,000. The cornerstone was laid Oct. 5, 1868, with imposing Masonic ceremonies. The ground-plan forms a great cross; the superstructure is of



State-house, Springfield, Ill.

the style of architecture termed classic. It blends the ancient and modern arts of building, so as to secure the greatest strength and solidity and preserve an exterior light and airy appearance. The grand outlines are—total length from N. to S., 359 feet, exclusive of porticoes, which add 20 feet to each front. From E. to W. it is 286 feet, including the portico on the eastern or principal front. The first floor above the basement is 19 feet high, its floor supported by brick arches, double in the halls, 2 feet below each other, forming viaducts for a supply of fresh air. A layer of concrete covers the area of the arches; upon this, imbedded in cement, is laid marble flooring. This first floor is devoted to private rooms for the judges of the State supreme court, rooms for consultation, for storage of stationery, etc. Here, also, are geological specimens in rooms. Another apartment is occupied by the adjutant-general and the museum. The story is lighted by windows and the glass ceiling in the centre, forming the floor of the rotunda. Next above is the principal story, 22½ feet from floor to ceiling. Here is the main corridor, running the entire length of the building N. and S., 359 feet long and 24 feet wide; the grand corridor crosses it at right angles under the dome from E. to W. The main corridor is finished with marble pilasters. The grand corridor, extending from the eastern portico to the grand stairway in the western wing, is 32 feet wide, with massive marble pillars very elaborately finished. On this floor are the governor's reception and private rooms, offices of the secretary of state, State treasurer, auditor, superintendent of public instruction, a law library, State document library, attorney-general's office, supreme court-room, supreme court clerk's office, four massive stone fireproof vaults, the treasurer's burglar-proof safe, and geologists' store-rooms. Its steps are sixteen feet long, of Tennessee marble. The floors in the halls and corridors are chequered marble in alternate squares of various colors. The prin-

cipal entrance is from the E. by a flight of stone steps 73 feet wide, ascending to the grand portico. The second principal story is 45 feet from floor to ceiling. Upon this floor is the senate chamber and hall of representatives. The former is 75 by 62 feet. Adjoining are rooms for the several officers of the senate. Crossing the corridor is Representative Hall, 100 by 66 feet. Another story above is devoted to galleries, committee-rooms, etc. Mansard roofs, sides lined with copper, top with slate, cover the building. In the centre a stately dome, surmounted by lantern with ball on pinnacle, rises 320 feet from the ground, 43 feet higher than the Capitol at Washington. The lantern is 16 feet wide and 24 feet high; frame of iron, sides of glass. Two sets of elevators from first floor ascend to the upper stories. The rotunda is 76 feet in diameter. From the glass floor, where the grand and main corridors intersect, to the frescoed work beneath the dome, is a view 217 feet without obstruction to sight. Each portico has ten columns, 45 feet high above the plinth-box, 4½ feet in diameter. The eastern or principal portico is 90 feet wide. On each front corner is a turret 132 feet high, surmounted, that of the northern by a statue of Lincoln, that of the southern by one of Douglas. For heating and ventilation, a steam-engine of 40 horse-power occupies a lot 200 feet from the State-house. Hot air in pipes under ground is conveyed, and a fan 12 feet in diameter connects for purposes of ventilation. The State-house is constructed of cut stone, iron, and marble. Its interior arrangement, finish, and the furniture of the rooms and halls are in perfect keeping with the style of the building.

In 1866, during Pres. Johnson's administration, the U. S. government began the erection in this city of the U. S. court-house and post-office building, finishing it in 1868. It is built of Nauvoo stone, is three stories high, cost $300,000 completed, and is a good, substantial building.

E. L. Merritt, Ed. "Register."

**Springfield,** tp., Allen co., Ind. P. 1749.

**Springfield,** p.-v. and tp., Franklin co., Ind. P. 1513.

**Springfield,** tp., La Grange co., Ind. P. 928.

**Springfield,** tp., La Porte co., Ind. P. 1072.

**Springfield,** tp., Cedar co., Ia. P. 1509.

**Springfield,** tp., Winneshiek co., Ia. P. 1260.

**Springfield,** p.-v., cap. of Washington co., Ky., has 1 newspaper. P. 502.

**Springfield,** p.-v., cap. of Livingston parish, La., on Tickfaw River.

**Springfield,** p.-v. and tp., Penobscot co., Me. P. 879.

**Springfield,** city, cap. of Hampden co., Mass., on the E. bank of Connecticut River, 98 miles W. by S. from Boston and 138 miles N. N. E. from New York, in lat. 42° 6′ 10″ N., lon. 72° 35′ 12′ W. The western part of the city is level; the eastern part is on high ground, which rises gradually from the river-valley, commanding an extensive prospect and furnishing many beautiful sites for residences and public buildings. The city is well built; its streets are wide, and are adorned with fine shade-trees. Five railroads centre here—viz. Boston and Albany, New York New Haven and Hartford, Connecticut River, Springfield Athol and North-eastern, Connecticut Valley and Springfield. The three former meet in one spacious and commodious station, and all of them have extensive connections. The city hall is a large building of the Romanesque order, and contains the city offices and an audience-room seating 2300 persons. The city library is one of the finest of the public buildings. It is built of brick, in the modern Gothic style, with facings of stone. It contains, besides a library of 37,000 volumes, a museum of natural history and ethnology. The court-house and the Boston and Albany R. R. block are handsome structures of granite. The high-school building is large and convenient. Six grammar schools are located in various sections of the city in new and substantial buildings of modern design. The entire school system embraces 29 buildings and furnishes employment for 140 teachers and instruction for 6000 pupils. Besides the public schools, there are several private educational institutions. The city contains 27 churches—viz. 7 Congregational, 5 Methodist, 5 Roman Catholic, 3 Baptist, 1 Episcopal, 1 Unitarian, 1 Universalist, 1 Advent, 1 Union Evangelical, 1 Swedenborgian, 1 Free Religion. There are 7 national banks, 3 savings banks, 1 trust banking company, 1 clearing-house, 3 insurance companies. Two daily papers are published here, which also issue weekly editions; there are also 3 weekly papers. The U. S. armory is located here. During the Revolution there was a dépôt for military stores and a place for repairing arms, but the armory was not established for the manufacture of arms until 1794. The arsenal, offices, store-houses, and principal workshops are on the high ground in the eastern part of the city, but the heavier operations required are carried on in the southerly part of the city, on Mill River. The breech-loader, model of 1873, is now manufactured here. About 350 men are employed. During the civil war the armory gave occupation to 3000 men, and 1000 rifles were turned out in a day. The arsenal is a spacious building, 200 feet by 70, and three stories high, and is capable of containing 100,000 stand of arms on each floor. An extensive and beautiful view is obtained from the tower. A pistol manufactory and the Mason Co. Car-works are known throughout the country, and have filled large orders for foreign nations. There are also extensive manufactures of cotton and woollen goods, boilers, blank books, engines, buttons, carriages, confectionery, furniture, cards, corrugated iron, gold and silver plating, trunks and harnesses, paper, paper boxes, paper collars, picture frames, soda fountains, spectacles, tools, envelopes, etc.

The waterworks are under the care of a board of commissioners, and the city is plentifully supplied with water for daily use, while numerous reservoirs and high-service hydrants furnish protection against fire. The fire department consists of a chief and 5 assistant engineers, together with 116 officers and men. There are 6 steam fire-engines and 1 chemical engine, several hose-carts, and about 8000 feet of hose. The leading hotels are the Massasoit House, Cooley's, and Haynes's hotels. The Springfield cemetery contains about 40 acres, and is rendered beautiful by the diversity of its natural scenery and the variety of its shade trees and fountains. Hampden Park, containing about 60 acres, is under the control of the Hampden Park Association, and is used for public recreations and active sports. The street railway corporation was organized in 1869; the tracks connect the extreme sections of the city. Indian Orchard is a busy manufacturing suburb in the eastern part of the city, containing 3 churches and several cotton-mills. Springfield was first settled in 1636 by emigrants from Roxbury, under the leadership of William Pynchon, a gentleman of wealth and education. The town was first called *Agawam*, the Indian name for a portion of the territory occupied. West Springfield, Chicopee, and several of the neighboring towns were then included in its boundaries. In 1637 the first church was organized, with Rev. George Moxon as pastor. In 1640 the name of the settlement was changed to *Springfield* in compliment to Mr. Pynchon, who came from Springfield, Eng. In 1675, during King Philip's war, the town was burned by the Indians. During Shays's rebellion, in 1787, the U. S. arsenal was attacked, but the insurgents were dispersed by the State militia, under the command of Gen. Shepard. Springfield became a city in 1832. P. in 1875, 31,053; in 1870, 26,703.

William Rice.

**Springfield,** p.-v. and tp., Oakland co., Mich. P. 1378.

**Springfield,** city, and county-seat of Greene co., Mo., on the summit of the Ozark Mountains, on Atlantic and Pacific R. R., 241 miles from St. Louis, has 9000 inhabitants, and is the business centre for the whole of S. W. Missouri and Northern Arkansas. The lead and zinc mines developed and in process of development in Christian, Jasper, Newton, Dade, Wright, Webster, Hickory, and other counties in S. W. Missouri are the richest and most extensive in the world. Its climate is very mild and healthful. 5 weekly newspapers are published; 2 large public-school buildings, each under a corps of competent teachers, offer the advantages of education; and Drury College furnishes a complete scientific and classical course. In connection with the college is an incorporated and well-organized musical conservatory. There are 11 church buildings and 3 banks; the leading manufactories are a cotton-mill, woollen-mill, wagon-factory, 3 flouring-mills, 2 planing-mills, 2 iron-foundries, furniture factory, and 4 tobacco-factories; the streets, business-houses, and public buildings are lit with gas. It is the largest town in the South-west, and is growing rapidly, over $200,000 having been expended last year for improvements. P. in 1870, 5555. J. P. Tracy, Ed. "Springfield Advertiser."

**Springfield,** tp., Henry co., Mo. P. 1896.

**Springfield,** p.-v. and tp., Sullivan co., N. H. P. 781.

**Springfield,** tp., Burlington co., N. J. P. 1761.

**Springfield,** p.-v. and tp., Union co., N. J. P. 770.

**Springfield,** p.-v. and tp., Otsego co., N. Y. P. 2022.

**Springfield,** tp., Nash co., N. C. P. 2111.

**Springfield,** city and tp., cap. of Clark co., O., is on Cleveland Columbus Cincinnati and Indianapolis, Cleveland Sandusky and Cincinnati, Columbus Springfield and Cincinnati, Pan Handle, and Atlantic and Great Western R. Rs., 80 miles from Cincinnati, 40 from Columbus, and 164 from Cleveland. Springfield has over 20 churches, and 1 horse railroad. The city has among its literary institutions Wittenberg College, the Springfield Seminary for Young Women, and excellent public schools; has 1 daily, 1

tri-weekly, 5 weekly, and 2 monthly newspapers; it has 70 different factories, employing about 4000 men. In June, 1874, 23,000 Champion reapers and mowers were made and sold. Among the other products are grain-drills, cider-mills, grain-separators, horse-powers, water-wheels, steam-engines, steam-boilers, steam-heaters, woollen goods, carriages, wrapping paper, spring beds, wringers, furniture of all kinds, baking-powder, iron fencing, malleable iron-work, reaper and mower knives, cutter-bars, reaper-guards, galvanized iron-work, house-heaters, lime, dressed limestone, brick, linseed oil, flour, whisky, beer, etc. The city is in close proximity to Mad River. P. (1870) of city, 12,652; of tp. 2888.

C. M. Nichols, Ed. "Daily Republic."

**Springfield,** tp., Gallia co., O. P. 1824.

**Springfield,** tp., Hamilton co., O. P. 6548.

**Springfield,** tp., Jefferson co., O. P. 826.

**Springfield,** tp., Lucas co., O. P. 701.

**Springfield,** tp., Mahoning co., O. P. 2150.

**Springfield,** tp., Muskingum co., O. P. 4022.

**Springfield,** tp., Richland co., O. P. 2046.

**Springfield,** tp., Ross co., O. P. 1238.

**Springfield,** tp., Summit co., O. P. 2085.

**Springfield,** tp., Williams co., O. P. 1981.

**Springfield,** p.-v. and tp., Bradford co., Pa. P. 1455.

**Springfield,** tp., Bucks co., Pa. P. 2551.

**Springfield,** tp., Delaware co., Pa. P. 1267.

**Springfield,** tp., Erie co., Pa. P. 1742.

**Springfield,** tp., Fayette co., Pa. P. 1629.

**Springfield,** tp., Huntingdon co., Pa. P. 738.

**Springfield,** tp., Mercer co., Pa. P. 1318.

**Springfield,** tp., Montgomery co., Pa. P. 1222.

**Springfield,** tp., York co., Pa. P. 1958.

**Springfield,** tp., Edgefield co., S. C. P. 1861.

**Springfield,** p.-v., cap. of Robertson co., Tenn., on St. Louis and South-eastern R. R., 30 miles N. of Nashville, contains 2 churches, 2 academies, 1 bank, 1 newspaper, and 2 large merchant-mills. It is noted for its production of the finest corn whisky in America. P. about 2000.

Archie Thomas, Ed. "Record."

**Springfield,** p.-v., Limestone co., Tex.

**Springfield,** p.-v. and tp., Windsor co., Vt., on Black and Connecticut rivers, and opposite Charlestown, N. H., on Vermont Central R. R., has 2 newspapers. P. of v. 1337; of tp. 2937.

**Springfield,** tp., Page co., Va. P. 1935.

**Springfield,** tp., Hampshire co., West Va. P. 1273.

**Springfield,** tp., Monroe co., West Va. P. 1624.

**Springfield,** tp., Adams co., Wis. P. 386.

**Springfield,** tp., Dane co., Wis. P. 1439.

**Springfield,** tp., Jackson co., Wis. P. 711.

**Springfield,** tp., Marquette co., Wis. P. 261.

**Springfield,** tp., St. Croix co., Wis. P. 372.

**Springfield Centre,** p.-v., Springfield tp., Otsego co., N. Y.

**Spring Garden,** p.-v. and tp., Cherokee co., Ala. P. 161.

**Spring Garden,** p.-v. and tp., Jefferson co., Ill. P. 205.

**Spring Garden,** tp., York co., Pa. P. 3040.

**Spring Green,** p.-v. and tp., Sauk co., Wis., on Wisconsin River and on Prairie du Chien division of Milwaukee and St. Paul R. R. P. of v. 422; of tp. 1156.

**Spring Grove,** p.-v. and tp., Warren co., Ill. P. 1080.

**Spring Grove,** p.-v. and tp., Linn co., Ia. P. 795.

**Spring Grove,** p.-v. and tp., Houston co., Minn. P. 1331.

**Spring Grove,** tp., Edgefield co., S. C. P. 2477.

**Spring Grove,** tp., Green co., Wis. P. 1236.

**Spring Hill,** tp., Drew co., Ala. P. 1128.

**Spring Hill,** tp., Marengo co., Ala. P. 2972.

**Spring Hill,** tp., Pickens co., Ala. P. 942.

**Spring Hill,** p.-v. and tp., Hempstead co., Ark. P. 1240.

**Spring Hill,** p.-v. and tp., Johnson co., Kan., on Missouri River Fort Scott and Gulf R. R. P. 959.

**Spring Hill,** tp., Wilson co., N. C. P. 636.

**Spring Hill,** tp., Fayette co., Pa. P. 1644.

**Spring Hill,** tp., Greene co., Pa. P. 1484.

**Spring Hill,** tp., Lancaster co., S. C. P. 1142.

**Spring Hill,** p.-v., Maury co., Tenn., on Louisville and Memphis line of Louisville Nashville and Great Southern R. R.

**Spring Hill College,** situated about 5 miles from Mobile, Ala., was founded in 1830 by Rev. Michael Portier, first Roman Catholic bishop of Alabama. In 1836 a charter was granted by which the president and faculty were empowered to confer the usual academic degrees; and in Aug., 1840, Pope Gregory XVI. raised the college to the rank of a Roman Catholic university. In 1847 it passed into the hands of the Jesuits, under whose control it still remains. The edifice was burned Feb. 4, 1869, and was rebuilt the same year.

**Spring Hills,** p.-v., Harrison tp., Champaign co., O. P. 172.

**Spring Lake,** tp., Tazewell co., Ill. P. 857.

**Spring Lake,** p.-v. and tp., Ottawa co., Mich., on the E. shore of Lake Michigan, and on Detroit and Milwaukee R. R., in the centre of the "peach belt," contains 5 churches, excellent schools, 1 newspaper, a horticultural hall, 3 hotels, 7 steam saw-mills, a mineral spring, and one of the best harbors on the lake. P. of v. 1156; of tp. 1836.

D. R. Waters, Ed. "Independent."

**Spring Lake,** tp., Scott co., Minn. P. 939.

**Spring Lake,** tp., Pierce co., Wis. P. 386.

**Spring Place,** p.-v., cap. of Murray co., Ga. P. 248.

**Spring Point,** tp., Cumberland co., Ill. P. 833.

**Springport,** p.-v. and tp., Jackson co., Mich. P. 1292.

**Springport,** tp., Cayuga co., N. Y. P. 2175.

**Spring Prairie,** p.-v. and tp., Walworth co., Wis. P. 1209.

**Spring River,** tp., Lawrence co., Ark. P. 729.

**Spring River,** tp., Lawrence co., Mo. P. 1098.

**Spring Rock,** tp., Clinton co., Ia. P. 1694.

**Spring Vale,** v. and tp., Humboldt co., Ia. P. of v. 335; of tp. 533.

**Springvale,** p.-v., York co., Me., on Portland and Rochester R. R.

**Spring Vale,** tp., Isanti co., Minn. P. 93.

**Springvale,** tp., Columbia co., Wis. P. 797.

**Springvale,** tp., Fond du Lac co., Wis. P. 1246.

**Spring Valley,** tp., Colusa co., Cal. P. 850.

**Spring Valley,** tp., Dallas co., Ia. P. 908.

**Spring Valley,** tp., Monona co., Ia. P. 142.

**Spring Valley,** tp., Cherokee co., Kan. P. 1080.

**Spring Valley,** p.-v. and tp., Fillmore co., Minn., on Southern Minnesota R. R., 75 miles W. of La Crosse, Wis., has 4 churches, a high school, 1 bank, 2 public halls, 1 newspaper, a foundry, 1 fanning-mill factory, 2 planing-mills, 3 hotels, and a wagon-factory. It is the business-centre of a large wheat-growing region. P. 1279.

A. M. Hutchinson, Ed. "Western Progress."

**Spring Valley,** tp., Shannon co., Mo. P. 251.

**Spring Valley,** p.-v., Ramapo tp., Rockland co., N. Y., on Piermont branch of Erie R. R.

**Spring Valley,** p.-v. and tp., Greene co., O., on Little Miami R. R. P. of v. 290; of tp. 1555.

**Spring Valley,** tp., Rock co., Wis. P. 1253.

**Spring'ville,** p.-v. and tp., St. Clair co., Ala., on Alabama and Chattanooga R. R. P. 1080.

**Springville,** p.-v., Linn tp., Linn co., Ia., on Dubuque and South-western R. R.

**Springville,** tp., Wexford co., Mich. P. 107.

**Springville,** p.-v., Erie co., N. Y., 30 miles S. of Buffalo, has 6 churches, an endowed academy, 1 newspaper, a banking-house, iron-foundry and machine-shops, a handsome park, and mills. It is the centre of one of the richest dairying sections in the State. P. 1006.

W. W. Blakeley, Ed. "Journal and Herald."

**Springville,** p.-v. and tp., Susquehanna co., Pa. P. 1424.

**Springwater,** p.-v. and tp., Livingston co., N. Y., on Rochester branch of Erie R. R. P. 2174.

**Springwater,** p.-v. and tp., Waushara co., Wis. P. 466.

**Spring Wells,** p.-v. and tp., Wayne co., Mich. P. 3488.

**Sproat** (Ebenezer), b. at Middleborough, Mass., in 1752; served in the Revolutionary army as captain, major, and lieutenant-colonel, commanding 2d Massachusetts regiment; was in Glover's brigade at Trenton, Princeton, and

Monmouth; was made inspector of the brigade by Baron Steuben; settled after the war as a surveyor at Providence, R. I., where he married a daughter of Commodore Whipple; began a survey of Ohio lands 1786; was the leader of the party of emigrants who founded Marietta 1788; was fourteen years sheriff and colonel of militia, and was called by the Indians "the Big Buckeye." D. at Marietta in Feb., 1805.

**Sprot'tau,** town of Prussia, province of Silesia, at the influx of the Sprottau in the Bober, manufactures cloth, linen, and cotton fabrics, tobacco, beer, and tiles, and has 5280 inhabitants.

**Spruce,** a name applied to several trees of the fir genus (*Abies*), and in the U. S. especially to *A. nigra,* black or double spruce, and *A. alba,* white or single spruce. Both of these afford much useful timber, superior to that of hemlock, but inferior to the best pine. There are also several trees called spruce on our Pacific coast. (A full list of these and of the Old-World spruces is given in the article EVERGREEN. See also FIR and PINE.) Much the finest of the foreign evergreens here seen in culture is the Norway spruce (*A. excelsa*), a noble forest tree of the N. of Europe. Our native spruces afford a resinous substance called spruce-gum, much used as a masticatory. The tops are often brewed to make a pleasant drink called spruce beer, which is regarded as antiscorbutic.

**Spruce,** tp., Bates co., Mo. P. 1506.

**Spruce Creek,** p.-v., Morris tp., Huntingdon co., Pa., on Pennsylvania R. R.

**Spruce Head,** an island on the Atlantic coast, constituting a tp. of Hancock co., Me. P. 22.

**Spruce Hill,** p.-v. and tp., Juniata co., Pa. P. 899.

**Spurge.** See EUPHORBIA.

**Spur'geon** (CHARLES HADDON), b. at Kelvedon, Essex, June 19, 1834, the son of an Independent preacher; was educated at Colchester; became usher of a school at Newmarket, but, embracing Baptist views, joined a congregation of that denomination in Cambridge; became a tract distributor and village preacher, and at the age of eighteen minister of a small chapel at Waterbeach, where he soon became noted for his zeal and eloquence. He went to London in 1853, where he at once attracted audiences so numerous that the congregation was compelled to remove first to Exeter Hall, and thence to the still larger Surrey Hall. In 1861 an immense chapel, called "the Tabernacle," was built for him in Newington Butts, London, where he has since preached. Nearly 20,000 persons have been admitted to his church, and thirty-six other chapels have been opened in London, the ministers of which were trained at a college founded and directed by him. His sermons are regularly reported and printed weekly, and from them nearly a score of volumes has been made up. He has also published—*The Saint and his Saviour* (1857), *Gleanings among the Sheaves* (1868), *John Ploughman's Talk, Evening by Evening* and *Readings for the Closet* (1869), *Feathers for Arrows* (1870), *Types and Emblems* and *Lectures to my Students* (1875). In 1867 he laid the foundation of an orphanage established by his congregation, and since 1865 has edited a journal, *The Sword and the Trowel.*

**Spur'rey,** a popular name for plants of the genera *Spergula* and *Spergularia,* belonging to the order Caryophyllaceæ. *Spergula arvensis,* well known to farmers of Europe and North America as a weed, is profitably cultivated in the Low Countries and Germany as a forage-plant, and its seeds yield a valuable oil and oil-cake. *S. pilifera,* a dwarf alpine plant, has been recommended as a lawn-plant in proper climates, handsomer than grass, and requiring much less care.

**Spurz'heim** (KASPAR), b. at Longwich, near Treves, in Rhenish Prussia, Dec. 31, 1776; studied medicine at Treves and Vienna, and became a zealous disciple of Dr. Gall, whom he accompanied on his travels in Germany and France, and assisted in popularizing his phrenological doctrines by lecturing, newspaper articles, etc. In 1813 he separated from Gall, and undertook the introduction of the new doctrines in England, where he resided from 1813 to 1817, and from 1821 to 1828, and gave very popular lectures. In 1832 he came to the U. S., and had just created a great sensation when he d. at Boston Nov. 10, 1832. Among his writings are—*The Physiognomical System of Drs. Gall and Spurzheim* (London, 1815), *Outlines of the Physiognomical System* (1815), *Sur la Folie* (Paris, 1818), *Essai philosophique sur la Nature morale et intellectuelle de l'Homme* (1820), *A View of the Elementary Principles of Education* (1821).

**Spuy'ten Duy'vil,** formerly a p.-v. of Yonkers tp., Westchester co., N. Y., on Hudson River and Spuyten Duyvil Creek, now annexed to city of NEW YORK (which see).

**Spuyten Duyvil Creek** [probably from the Dutch *Spuyt den Duyvil,* "in spite of the devil"], the channel connecting the Hudson River with the Harlem River, and thence with the East River, on Long Island Sound. The creek forms the northern boundary of Manhattan Island. Flaws of wind are apt to burst along the depression through which the creek runs, impeding the navigation by sailing craft, and the name is probably derived from an oath sworn by an old Dutch shipmaster, that he would pass the mouth of the creek "in spite of the devil."

**Spy** [O. Dutch, *spie*]. Under that branch of the laws of nations termed the "laws and usages of war" the term "spy" has a definite and well-understood meaning. A spy is a person who in time of war, whether public or local, surreptitiously and in disguise or by false pretences, seeks military information within or near the lines of one belligerent with an intent to communicate it to the other, or who in disguise or by false pretences seeks to pass through the enemy's lines with despatches. By the customs of war the punishment for the offence is death by hanging on apprehension and conviction.

"Spies," says Vattel, "are generally condemned to capital punishment; and not unjustly, there being scarcely any other way of preventing the mischief which they may do. For this reason a man of honor, who would not expose himself to die by the hand of a common executioner, ever declines serving as a spy. He considers it beneath him, as it seldom can be done without some kind of treachery. The sovereign, therefore, cannot lawfully require such a service of subjects, except, perhaps, in some singular case, and that of the last importance. It remains for him to hold out the temptation of a reward as an inducement for mercenary souls to engage in the business. If those whom he employs make a voluntary tender of their services, or if they be neither subject to, nor in any wise connected with, the enemy, he may unquestionably take advantage of their exertions without any violation of justice or honor." (Vattel, *Droit des Gens,* liv. 3, ch. 10, sec. 179.)

By the customs of war of a century ago a person captured as a spy, with proofs of the fact upon his person, could, by order of the commanding general, be executed without delay. This was illustrated in the case of Capt. Nathan Hale of the Connecticut volunteer infantry, who during the American Revolution was captured by the British in New York City, then militarily occupied by them, and executed (1776) without trial by order of Sir William Howe, the British commander. In the American service the more humane practice has always been adopted of giving the accused a hearing and trial before a general court-martial or military commission; and this practice has now become the rule in modern warfare. This was early illustrated in the case of Major John André, adjutant-general to the British army in America during the same Revolution. He was captured in disguise, under a false name and pass, within the American outposts, and before he had reached the British lines. A full board of thirteen general officers, containing such distinguished military men as Maj.-Gens. Nathaniel Green, Marquis de La Fayette, and Baron de Steuben, unanimously found him guilty on a full hearing. The proceedings were duly approved by Washington, and Major André was accordingly executed as a spy. In this case, on the facts found, Major André could have been convicted of being a spy on one of two grounds: (1) for having landed under a *flag of truce* with sole intent to obtain information, for belligerent purposes, of the character, state, and condition of the garrison and works of the U. S. military post of West Point and its dependencies; (2) for having been subsequently captured in disguise, within the American lines, while seeking to escape with documents concealed on his person containing the desired information.

The commander who employs a spy is not, by the laws of nations, personally responsible for so doing. The offence of being a spy is considered as absolutely condoned after the individual has returned before trial and condemnation to his own lines.

During the American civil war of 1861–65 the U. S. government, in a code which it published for the government of its armies, announced the acknowledged rule that "the spy is punishable with death by hanging by the neck, whether or not he succeed in obtaining the information or in conveying it to the enemy," and that "if it be discovered and fairly proved that a flag of truce has been abused for surreptitiously obtaining military knowledge, the bearer of the flag thus abusing his sacred character is deemed a spy." (*General Orders No. 100,* Apr. 24, 1863.) Under the laws of war any person convicted of the offence will, irrespective of sex, be amenable to the stated penalty. By the *Revised Statutes of the U. S.* (sec. 1343) it is declared that "all persons who in time of war or of rebellion against the supreme authority of the U. S. shall be found lurking or

acting as spies in or about any of the fortifications, posts, quarters, or encampments of any of the armies of the U. S. or elsewhere, shall be triable by a general court-martial or by a military commission, and shall, on conviction thereof, suffer death." ASA BIRD GARDNER.

**Squadron.** See NAVAL TACTICS, by CAPT. S. B. LUCE.

**Squa'li** [*squalus*, "shark"], a group of selachians comprising the sharks, by some considered as an independent order, but by most referred to an order, Plagiostomi, as a sub-order. They mostly have a more or less cylindrical body, but sometimes it is quite depressed forward, and there is a gradual attenuation from the visceral region into the tail; the branchial apertures are lateral, and either entirely in front of the pectoral fins, or, behind, opening over the bases of those fins. The pectoral fins are moderately developed, and distinctly differentiated from the sides. In these respects they differ from the Raiæ, which they otherwise essentially resemble in structure, the two groups constituting the super-order or order Plagiostomi, and thus in combination contrasting with the order Holocephali. The species, as is notorious, are mostly carnivorous, and among the most formidable and most dreaded of the inhabitants of the water; but a few are not so, and are quite harmless to man and the larger animals at least. While the carnivorous species are almost all those with which the name "shark" is connected, the known or supposed herbivorous species, or those at least feeding on small marine animals, are only about four in number—viz. (1) *Cetorhinus maximus*, the great basking shark; (2) *Cetorhinus angiova*, a related Mediterranean species; (3) *Rhinodon typicus*, of the Pacific Ocean; and (4) *Micristodus punctatus*, known only from California. The species, too, are almost all strictly inhabitants of the salt waters, but are not necessarily confined thereto, as they sometimes wander into fresh water, and one species is confined to the Lake of Nicaragua, a purely fresh body of water, entirely shut off from communication with salt water except by a long river. In time they have existed at least from the closing period of the Silurian age (and probably much before) to the present, but under gradually modified forms, the earlier representatives of the family being supposed to have been more nearly related to the heterodontids or cestracionts of the Pacific than to the predominant living species. In space they are found everywhere in salt water, but are most abundant in warm regions. The species of the Arctic regions are few in number, the most northern forms, so far as known, being the *Centroscyllium Fabricii* of Greenland, and *Somniosus microcephalus* of the northern Atlantic generally; those of the tropical seas are numerous; and not a few seek their living in mid-ocean. The jaws are frequent objects of curiosity; they do not correspond exactly with the jaws of true fishes and other animals, but rather partly with the lower jaw and the palatal arch of the higher animals. The teeth are generally movably articulated with the jaws, and developed in several rows which are successively shed and renewed from behind forward, and the outermost row, as a rule, is the only one erect, the rest being recumbent; in some, however (*e. g.* Heterodontidæ and Mustelinæ, or dog-fishes), a pavement-like surface is developed. There is some difference of opinion respecting the natural arrangement of the order, and the relative value and relations of the constituent groups, but the following families have been adopted for the present work, and have received the sanction of some of the most approved authorities: (1) Sub-order Rhinæ, family Squatinidæ. (2) Sub-order Galei: group 1, Heterodontidæ; group 2, Notidanidæ; group 3, Rhinodontidæ, Cetorhinidæ, Lamnidæ, Odontaspididæ, Alopeciidæ, Sphyrnidæ or Zygænidæ, Galeorhinidæ; group 4, Scylliidæ, Ginglymostomidæ, Crossorhinidæ; group 5, Spinacidæ, Scymnidæ, Oxynotidæ, Pristiophoridæ. (See the family names and SELACHIANS.) THEODORE GILL.

**Squamipennes.** See CHÆTODONTIDÆ.

**Square** [Lat. *quadratus*], an equilateral and equiangular quadrilateral. Each of its angles is a right angle, and its diagonals are equal and mutually bisect each other. The square described on the linear unit as a side is taken as the unit of measure for surfaces; hence, the term *square measure* sometimes used in that connection. W. G. PECK.

**Square Number,** a number whose square root is a whole number. The following are some of the properties of square numbers: (1) Every even square number is divisible by 4, and every odd square number, diminished by 1, is divisible by 4. (2) The sum of two odd squares cannot be a square. (3) If an odd square is taken from an even square, the remainder can never be a square. (4) If the sum of two squares is a square, one of the three must be divisible by 25. (5) Square numbers always terminate with one of the digits, 0, 1, 4, 5, 6, 9. (6) In the series of squares of natural numbers—that is $1^2$, $2^2$, $3^2$, etc.—the mean proportional between any two is equal to the less, *plus* its square root multiplied by the difference of the roots of the two squares. (7) The arithmetical mean of any two exceeds their geometrical mean by half the square of the difference of their roots. (8) The difference between any two consecutive terms is equal to twice the root of the less, *plus* 1. (9) In the series of cubes of natural numbers, $1^3$, $2^3$, $3^3$, etc., the sum of any number of terms beginning at the first, is a square number. W. G. PECK.

**Square of the Circle.** See QUADRATURE OF THE CIRCLE.

**Square Root.** The square root of a quantity is a quantity which taken twice as a factor will produce the given quantity. It is one of the two equal factors into which the given quantity may be separated. Sometimes we can find the exact value of these factors, in which case the quantity is said to be a perfect square, and sometimes we can only find their approximate value, in which case the indicated root is called a *surd*. W. G. PECK.

**Squares, Least, Method of.** In all measures, from the ordinary rude weighings and measurings of agriculture and commerce up to the most refined astronomical work, there is a liability to error which cannot be avoided. An ordinary scale, for instance, can be used to measure down to a sixteenth of an inch; that is, if carefully used, its results will be correct to that limit. The level of a transit instrument can make its measures, when used with care, to a ten-thousandth of an inch or even less; but in this case the hundred-thousandths will be uncertain. An ordinary observer notes his time to minutes only, and is liable to state the time incorrectly to the extent of at least half a minute; the man who is trying a fine watch will note its errors to seconds, or even half seconds; the astronomer uses tenths of seconds in his rough data, and hundredths or thousandths in his calculations, but even here there is uncertainty in the fractions of a hundredth or a thousandth of a second.

One of the essential conditions of good observing or measuring is to make these small errors, which we cannot wholly avoid, as much smaller as possible; just as the marksman considers himself to be improving when he comes nearer and nearer the target.

But the best marksman is not he who hits the bull's-eye once only, but that one who comes nearest on the average or in a string of shots. So the average deviation of a series of observations from the truth may, in a rough way, be taken as a measure of the goodness of that series.

Observations or measures of the same thing never agree perfectly—that is, in the minutest fractions: how shall the true result be ascertained from discordant evidence? The ordinary experience of mankind has shown that it is best to "strike an average." When, for instance, two equally good surveyors measure a field a little differently, the half sum of their results is taken. When a boy in school has different marks upon different subjects—in some more, in some less—their average is taken to represent his general merit or demerit as a scholar. The average prices of commodities are taken for their real prices, or at least for a better estimate of their real value than the extreme prices either way as affected by temporary fluctuations. The whole business of insurance rests upon this law of averages.

The "method of least squares" is the application of this law to the results of physical measurements, especially in astronomy and geodesy. The mathematicians whose names are most prominently connected with it are Legendre, Gauss, Bessel, and Encke; Legendre and Gauss seem to have discovered it independently. A short sketch of the history of the method will help in its explanation. Before the method of least squares, as we now have it, was discovered, the method of averages, or of the arithmetical mean, was applied to all physical measures which give a direct result. But especially in astronomy the things to be found out cannot be directly measured, but must be indirectly inferred from measurements of other things. The observations upon the transit of Venus afford an instance. Here the main thing to be found out is the solar parallax; the thing directly observed is the planet's ingress upon or egress from the sun. The time of this depends upon several unknown quantities, of which the solar parallax is one, and also the unknown time of conjunction, and the unknown distance of the planet's and sun's centre at that time, as well as the apparent angular diameters of planet and sun. Each observation, then, gives an *equation of condition* between these five unknown quantities, and at any one place four observations of contacts are made. At thirty stations there would be 120 equations for five unknown quantities; if the best five of these were selected, a good value of the solar parallax might be obtained; but there could many thousand good combinations be made, each of which would give a different result, owing to the errors of the observations. How, then, can such a combination be made as to answer to the average in more direct measures? or, to express it mathematically, How can

the superfluous equations of condition be combined so as to give the best possible result? The mathematical problem here treated is analogous to the combination of ordinarily discordant evidence in a perplexed case in the courts of law: when the result here needed is one capable of numerical expression, as in the assessment of damages, the average is taken; but where not, the evidence is reconciled as well as possible.

Let us go back to the illustration of the marksman. A target which has been a good deal used exhibits bullet-holes at various distances from the centre, but more crowded together in the middle. They are found to be distributed according to a well-defined general law, which can be partially expressed in common language, thus: if a ring be selected to include one-half the shots, and be, say, 12 inches in diameter, then about a sixth will be outside a ring of 24 inches, about a twentieth outside one of 36 inches, while one of 6 inches will include about a quarter of the whole number. This law is expressed by the formula

$$\int_{\Delta_0}^{\Delta_1} e^{-h^2\Delta^2}\, d\Delta,$$

where $\Delta$ is any distance from the centre, and $\Delta_0$ and $\Delta_1$ are two special distances. Experience shows that owing to accidents there are always stray shots on the outside not fully accounted for.

This same law applies to observations and measurements of all kinds. From it Gauss has shown that in simple cases the ordinary law of averages is justified, and that in complex work, like the transit-of-Venus reductions, the following rule is to be used, which is the more general form of the same law: "In treating observations of equal precision the unknown quantities are to be so determined that, after allowing for constant error, the sum of squares of the remaining errors shall be the least possible." This is the "method of least squares." Its practical working is easy after the data are put into proper shape. The equations of condition are first formed, and solved by multiplying both members of each by the coefficient of the first unknown quantity in that equation, and adding together the results, forming one new equation. The members of the equations are now multiplied by the coefficients of the second unknown quantity, and a second equation formed; and so on till as many such equations are obtained as there are unknown quantities; which are then solved in the usual way. The residual errors of observation are squared, their sum taken, and divided by the number of observations less that of unknown quantities. The quotient is the square of the "mean error" of one observation; two-thirds of this plus a ninetieth (nearly) is the probable error; from which may be calculated the relative value of the observations and the uncertainty of the final results.

The difficulties of the method, aside from the mere calculations, are, that it is an extremely nice matter to judge what are observations of equal precision, and make the poorer observations enough less influential than the good ones. The careless witnesses do not wish to see their testimony depreciated. Much, too, has been written about the criteria which distinguish between the worst ordinary observations and those which are affected by some unusual accident, such as a collision between the eyepiece of a telescope and a careless astronomer's head. Prof. Peirce and others have proposed a mathematical formula to decide such cases, but the usual rule is to let each rest on its own merits. It is, above all, difficult to avoid constant errors of observation.

The advantages of this method are so great that it is very largely used. It affords a thorough criticism upon one's own work and that of others, and for this reason is in great favor where the observers are most delicate, keen, and courageous, especially in Russia, Germany, and latterly in America.

The best elementary treatise on this subject is Prof. Chauvenet's, published also as part of his *Spherical and Practical Astronomy*. A classical work upon the subject is Gauss's *Theoria Combinationis Observationum Erroribus Minimis Obnoxiæ*, also translated into French by Bertrand as *Méthode des Moindres Carrés*. T. H. Safford.

**Squares, Magic.** See Magic Squares, by Pres. F. A. P. Barnard.

**Squash** [Mass. Indian, *asq*; pl. *asquash*], called **Edible Gourd** in England, the fruit of *Cucurbita melopepo*, *C. verrucosa*, and other species or races of this genus. Squashes are extremely variable in size, quality, color, etc., the better sorts having great value as food. Squashes were cultivated upon both continents long before the time of Columbus, and it is probable that most of our squashes have had a hybrid origin.

**Squash'-Bug,** the *Coreus tristis*, an hemipterous insect, well known for its destructive ravages upon squash and pumpkin vines. It belongs to the Coreidæ (Corisiæ). It is six-tenths of an inch long, about three-tenths of an inch in breadth, and of a dirty black color. It emits a powerful and offensive odor, supposed to be due to the presence of the formate of amylic ether in its secretions. The striped squash-bug is *Diabrothica vittata*, a coleopterous insect of the family Chrysomelidæ, a much smaller but even more destructive insect, which infests cucurbitaceous vines of almost all kinds in the U. S. The larva of *Melittia cucurbitæ*, the squash-vine borer, is quite destructive in some places. The insect is lepidopterous, and of the family Ægeriadæ. As a rule, the two former insects are most destructive while the plants are young; and the squash-hills should be protected by a frame covered with millinet, or powdered gypsum and shell-lime may be freely sprinkled upon the plants, and will be found to impede the destructive work, particularly that of the striped bug.

**Squaw,** tp., Warren co., Ia. P. 695.

**Squaw Grove,** tp., De Kalb co., Ill. P. 886.

**Squeteague',** or **Weak-Fish,** the *Otolithus regalis*, a marine fish of the family Sciænidæ (which see).

**Squid,** a popular name for many decapod cephalopods, particularly those of the family Teuthidæ (calamaries), but also extended to the Sepiadæ or true cuttle-fishes, and even to the poulpes or Octopodidæ. The squids proper are found in nearly all seas; they form an important part of the food of many fishes and crustaceans, are extensively used as fish-bait, and in many countries are much used as food. Of late, the eating of squid has been introduced into the U. S. Properly cooked, squid is considered a delicacy of the first order. (See Cephalopoda, Conchology, Cuttle-Fish, Flying Squid, Hook Squid, etc.) There are several true squids which are common on our coast.

**Squid, Flying.** See Flying Squid.

**Squi'er** (Ephraim George), b. at Bethlehem, N. Y., June 17, 1821; was brought up on a farm; subsequently taught school, edited several local newspapers, and studied engineering. Removing to Ohio, he undertook, in conjunction with Dr. E. H. Davis, an exploration of the aboriginal monuments in the Valley of the Mississippi, the results of which were issued in 1848 in the *Smithsonian Contributions to Knowledge*, and in the following year appeared his *Aboriginal Monuments of the State of New York*. In 1848 he was appointed chargé d'affaires to the republics of Central America, and in 1853 he went again to that region to examine the proposed line for an interoceanic railway—a project in which he was deeply interested, but which was finally abandoned. For several years he was engaged in literary labor in New York. In 1863 he was appointed U. S. commissioner to Peru, where he remained two years; made extensive journeys to explore the remaining works of the Incas with the design of preparing an exhaustive work on the subject. Returning to New York, he set about this task, which was nearly completed when in 1874 he was attacked by a severe illness which incapacitated him from continuous mental labor, but not before his abundant materials had been arranged and the work was nearly ready for the press, and it is now (July, 1876) on the eve of publication. Besides numerous contributions to periodical literature and to the proceedings of learned societies, translations, and scientific reports, he has published, among others—*Nicaragua, its People, etc.* (1852), *The Serpent Symbol* (1852), *Notes on Central America* (1854), *Waikna, or Adventures on the Mosquito Shore* (1855), *Question Anglo-Américaine* (Paris, 1857), *The States of Central America* (1857), *Report of the Survey of the Honduras Interoceanic Railway* (London, 1859), *Monograph of Authors who have Written on the Aboriginal Languages of Central America* (1861), *Tropical Fibres, and their Economical Extraction* (1861), *Is Cotton King? Sources of Cotton-Supply* (1861), *Honduras, Descriptive, Historical, and Statistical* (1870), and *Peru: Incidents of Travel and Exploration in the Land of the Incas* (1876). Most of his works have been translated into German, French, and Spanish. He has received the gold medal of the French Geographical Society, is a member of many learned associations in Europe and America, and in 1871 was president of the Anthropological Society of New York. A. H. Guernsey.

**Squill** [Gr. σκίλλα], a drug, being the bulb of *Scilla maritima* (sea-onion), a perennial plant of the natural order Liliaceæ, growing on the Mediterranean coast. The bulb is pear-shaped, of the size of a man's fist, or even larger. It is made up of concentric scales, like other tunicated bulbs, of which the outer are dry and dark-colored, but the inner fleshy and juicy, and either colorless or of a pale roseate tint. For use in medicine the bulbs are dried and sliced, and offer the varieties known as white and red squill, according to the tint of the bulb. Squill has but little smell, but an acrid, nauseous, bitter taste. It contains a

good deal of mucilage, but there is still much uncertainty concerning the nature of the active principles. A resin and a bitter principle probably both have to do with the medicinal effects. Squill has been known as a medicine from a very remote period. It is an acrid irritant, affecting the mucous membranes and glands, and in large dose causes vomiting, purging, strangury, and may even prove fatally poisonous. Its medicinal use is from its producing, in small dose, an increased flow of urine, and also modifying in some unknown way the morbid condition of a mucous membrane affected with catarrh, and especially of the bronchiæ. In other words, it is used as a so-called "diuretic" and "expectorant." EDWARD CURTIS.

**Squil'la** [the old Latin name for one of its species], a genus of stomapod crustaceans of the family Squillidæ. They are voracious and active creatures, all marine, and

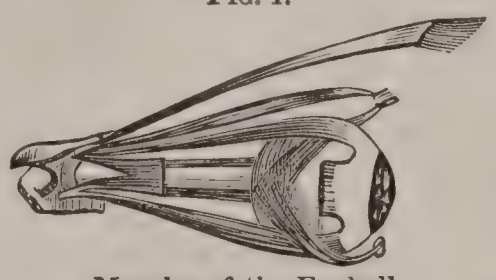


Squilla.

mostly found at a distance from shore. The best known of the numerous species is the mantis shrimp (*S. mantis* of the Mediterranean), so called from its resemblance in form to the insects called MANTIS (which see). *Squilla empusa* is found in our Atlantic waters. *S. chiragra* is the gouty shrimp, a curious inhabitant of the Indian Ocean. The name mantis shrimp is not peculiar to the *S. mantis*, nor to the genus, but is applied to other crustaceans, notably to *Caprella linearis*.

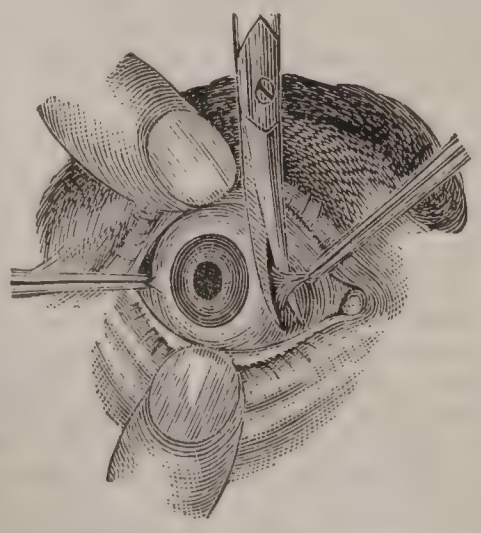
**Squint'ing** [Dutch, *schuinte*], technically termed **Strabis'mus** (from Gr. στραβισμός, "squinting"), obliquity of the axis of one eye; inability to bring both visual lines to bear simultaneously upon one point, one always deviating from the object. If the squinting eye deviates inward, it is termed convergent strabismus; if outward, divergent strabismus; if downward, which is rare, *strabismus deorsum vergens*. The normal position of the eye and correct direction of its visual line depend on the tonicity of the four recti muscles, attached one above, one beneath, and one on each side of the eyeball. If one muscle is relatively weak or paralyzed, the eye is deflected to the opposite by the stronger or intact muscle. Convergent squint is very common in young children of four to six years when learning to spell or read with small letters. It may be periodic, and present only when looking intently and with effort, one eye being converged to facilitate or compensate the "accommodation" or power of the eye to adapt itself for different distances and objects. Such internal squint may be checked by use of larger letters or by checking the bad habit of approximating objects. When the eye is hypermetropic, having a low refractive power, a short antero-posterior diameter, and rays are not focused in the retina, voluntary convergence of the eye and habitual squint are the common result. Children suffering from indigestion, worms, or debility often suffer from convergent squint, in some cases due to spasm of the internal rectus muscle, in others to debility or paralysis of the external rectus muscle. In disease of the brain, convulsions, meningitis, hydrocephalus, etc., squint may occur. Divergent squint is most often present in myopic or near-sighted persons in efforts to see distant objects, the squint disappearing when the object is approximated or by the use of spectacles for distance. It may also occur from paralysis of the internal rectus, or when that muscle has been too freely cut for the cure of convergent squint. In convergent strabismus, unless very marked, in order to determine the squinting eye it may be necessary to place a lighted candle or the finger two or three feet in front of the face in the median line, or, again, closing each eye alternately, to study the extreme lateral movements inward and outward of each. Periodic strabismus may yield to correct use of the eyes, the aid of spectacles, galvanizing the weak muscle, and improving the general health. When marked and persistent, it calls for operation—incision of the ocular conjunctiva or mucous membrane, hooking up the tendon of the muscle close to the cornea and severing it.

FIG. 1.



Muscles of the Eyeball.

FIG. 2.



Operation for Strabismus.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Squire** (SAMUEL), D. D., b. at Warminster, Wiltshire, England, in 1714; educated at St. John's College, Cambridge, where he obtained a fellowship; became chaplain to Dr. Wynn, bishop of Bath and Wells, by whom he was made chancellor of the diocese and canon of Wells 1739, prebendary of Wells and archdeacon of Bath 1743; became rector of Topsfield, Essex, 1748, and of St. Anne's, Westminster, 1750; was shortly afterward made vicar of Greenwich and clerk of the closet to Frederick, prince of Wales; was appointed dean of Bristol 1760 and bishop of St. David's 1761. D. in 1766. Author of *The Ancient History of the Hebrews Vindicated* (1741), *Two Essays: A Defence of the Ancient Greek Chronology, etc.*, and *An Inquiry into the Origin of the Greek Language* (1741), *An Enquiry into the Foundation of the English Constitution* (1745), *An Essay on the Balance of Civil Power in England* (1753); published several sermons and religious treatises; edited Plutarch's *De Iside et Osiride* (Cambridge, 1744), accompanied by an English translation, and left in MS. an *Anglo-Saxon Grammar*.

**Squire's Store,** tp., Tuscaloosa co., Ala. P. 518.

**Squir'rel** [Gr. σκίουρος, from σκιά, "shade," and οὐρά, "tail"], the name given to certain species of the family Sciuridæ, and sometimes employed as the vernacular equivalent of the family name—*i. e.* the squirrel family. It is, however, more properly applicable to the slender arboreal forms constituting the genus *Sciurus* of most naturalists, and in this sense it will be here used. These animals are of moderate or small size, have a rather slender head, no cheek-pouches, rather long ears, no lateral wing-like extension of the skin, a large distichous tail, and the teeth are, as in all the other genera of the family, 24—viz. M.$\frac{5}{4}$, I.$\frac{1}{1}$ $\times$ 2—but the foremost upper molars are often early deciduous, and when present very small; the molars are parallel at least as to their inner walls, the incisors compressed. Such are the most conspicuous and typical characters. The genus, however, grades into others—*e. g. Tamias*, or the chipmunks, and *Spermophilus*, or the ground-squirrels—but is still apparently sufficiently distinct to be entitled to the segregation generally accorded to it. The species are numerous, and representatives are found in almost every region, Australasia and Polynesia, the southern extremity of South America, and the West Indies being the only considerable bodies of land in the temperate or tropical zones destitute of them. Over 100 species have been made known, and these are distributed approximately as follows: North America has about 5 species (10 including sub-species), Europe and Northern Asia 6 or 7, the Indian region over 50, the African about 18, and the South American about 30. In time they existed, according to some authors, as early as the Eocene Tertiary, but the affinities of those early forms are doubtful. In habits the living species are all essentially similar. Most of their life is spent among the trees, and they exhibit great agility in running up the trunks and leaping from branch to branch. Their principal food consists of the nuts of trees, and in nut-bearing forests they are especially to be found; they also eat to some extent the larvæ of insects, and attack the nests of birds for their eggs, and even for their young. Their favorite attitude in eating is to sit on their haunches, with their tail thrown upward on the back, and holding the eatables in their paws. In the colder countries they lay up stores of provisions in holes and nooks in or near the trees in which they live. They are mostly readily tamed, and are generally kept in cages with revolving wheels or treadmills, wherein they exercise. The North American species recognized by the latest monographer of the group, Mr. J. A. Allen, are the following: (1) the great fox or cat squirrel (*S. cinereus*), with the varieties (*a*) *cinereus* of the Northern Atlantic States, (*b*) *niger* of the Southern Atlantic and Gulf States, and (*c*) *ludovicianus* of the Mississippi Valley; (2) the gray squirrel (*S. carolinensis*), with two varieties; (3) the small red or pine squirrel (*S. hudsonius*), with four varieties; and on the Pacific slope of the continent, (4) the California gray squirrel (*S. fossor*) and (5) the tuft-eared squirrel (*S. Aberti*). (See also SCIURIDÆ.) THEODORE GILL.

**Squirrel Corn.** See DICENTRA.

**Squirrel, Flying.** See FLYING SQUIRREL.

**Srinagar.** See SERINAGUR.

**SS, Collar of.** See ESSES, COLLAR OF.

**Staal, de** (MARGUERITE JEANNE CORDIER DE LAUNAY), BARONESS, b. at Paris Aug. 30, 1684, the daughter of a poor painter; was educated in a convent at Rouen; became maid to the duchess of Maine; took part in Cellamare's conspiracy for depriving the duke of Orleans of the regency, and was confined in the Bastile 1718–20; married afterward a Baron de Staal, who held a company in the guard of the duke of Maine, and spent the rest of her life at the ducal court at Sceaux. D. June 15, 1750. Her *Mémoires* were published in 1755, her letters in 1806, her *Œuvres complèts* (2 vols.) in 1821. (See Sainte-Beuve, *Derniers Portraits littéraires*, 1852.)

**Staats'burg,** p.-v., Hyde Park tp., Dutchess co., N. Y., on Hudson River and Hudson River R. R.

**Stabat Mater,** the first words, and hence the name, of a Latin hymn ranked among the seven great hymns of the mediæval Church (*The Celestial Country, Dies Iræ, Stabat Mater, Veni Sancte Spiritus, Veni Creator Spiritus, Vexilla Regis, The Alleluiatic Sequence*). It commences—

Stabat Mater dolorosa, By the cross, sad vigil keeping,
Juxta crucem lacrymosa. Stood the mournful mother weeping.

As the DIES IRÆ (which see) has been pronounced the greatest, so the *Stabat Mater* is deemed the most pathetic of hymns. It is, however, neither so simple nor so grand, nor is it free from sectarian faults. It was written (1268) by a Franciscan friar known as Jacobus de Benedictes, one of the noble Italian house of Benedette. The hymn is still in constant use in the Roman Catholic Church, being sung during the Holy Week and on the festival of the SEVEN DOLORS OF THE VIRGIN MARY (which see), and it is well known in a musical sense to all through the very beautiful and sympathetic music of Rossini. It has been the theme of several of the world's great composers of different eras, of whom, prior to Rossini, Pergolesi perhaps has produced the most famous and masterly, if not the most popular work. J. G. BARNARD.

**Sta'ceyville Plantation,** tp., Penobscot co., Me. P. 138.

**Stack'elberg, de** (ERNEST), COUNT, b. Mar. 21, 1813; was educated in the military academy of St. Petersburg; distinguished himself as an officer of artillery in the campaign in the Caucasus 1852, and was attached to the Russian embassy in Paris as its military member. In 1856 he was sent as minister plenipotentiary to Turin, afterward to Madrid; in 1862 to Florence, in 1864 to Vienna, and in 1868 to Paris, succeeding M. de Budberg.

**Sta'cyville,** tp., Mitchell co., Ia. P. 344.

**Sta'de,** an old fortified town of Prussia, province of Hanover, on the Schwinge, near its influx in the Elbe. The so-called "Stade dues," a toll which Hanover levied on all merchandise carried up the Elbe, but which was abolished in 1864, were paid here. Manufactures woollen, linen, and cotton stuffs, tobacco, and beer. P. 8693.

**Sta'dium** [Lat.; Gr. *στάδιον*], the principal Greek measure of length for journeys, used in later times also for other linear measurements, especially by the Romans. Its length was fixed by that of the foot-race course (*stadium*) at Olympia, and was 600 Greek = 625 Roman = 606¾ English feet, or one-eighth of the Roman mile.—STADIUM was originally the name of the foot-race course in which running and other athletic exercises took place. Stadia existed at many Greek cities, but the most famous was that of Olympia. The stadium was laid out in two parallel oblong areas, connected at one end by a semicircular tract. The whole was surrounded by seats for spectators.

**Stadt'holder** [Dutch *Stadhouder*, "city-holder"], a title given by the United Provinces of Holland to William, prince of Orange, upon beginning their memorable rebellion against Spain. The title was intentionally a modest one, intimating that the revolt was not against the sovereign, but against the tyranny of his viceroy, the duke of Alva. It involved, however, the chief civil and military command, was given to Maurice, son of William, in 1587, and became the hereditary title of the head of the state until the annexation of Holland to the French empire in 1802. On the restoration of the house of Orange in 1814 the title of king was assumed.

**Staël-Holstein, de** (ANNE LOUISE GERMAINE), BARONESS, b. at Paris Apr. 22, 1766, a daughter of Jacques Necker, at that time a clerk in the banking-house of Thélusson, afterward minister of finance to Louis XVI., and the hero of the coming Revolution; was married in 1786 to the Swedish ambassador at Paris, Baron de Staël-Holstein, to whom she bore three children, two sons and a daughter. The marriage was not happy, and she separated from her husband, but when he became old and sick, she returned to him, and stayed with him till he died, at Poligni May 9, 1802. In 1810 she married a French officer, De Rocca, a man much younger than herself, to whom she bore a son, but the marriage was kept secret till after her death. She made her début in literature in 1786 by her *Lettres sur les Écrits et le Caractère de J. J. Rousseau*—a book which owed its success not so much to any powerful originality as to the fresh enthusiasm and peculiar eloquence with which it preached the new revolutionary ideas. It is an interesting book, however, in literary respects. It shows that she stood in a primitive and natural relation to that literary movement called the romantic school which she more than any one else contributed to introduce in France, and which she is often said to have adopted at second hand from the Schlegels. In both respects, literary as well as political, she afterward developed further the ideas of this her first book in her *De la Littérature considerée dans ses Rapports avec les Institutions sociales* (2 vols., 1796), and her *Considérations sur les principaux Événements de la Révolution française*, not published until after her death. In the latter she shows that her political stand-point was the constitutional monarchy, the same as that of her father, whom she almost idolized, and the same as that afterward represented by her most intimate friends, Chateaubriand, Benjamin Constant, Guizot, and her son-in-law, the duke de Broglie. Her first celebrity, however, she owed less to her writings than to the powerful personal impression she made. Firm in her ideas, true to her feelings, impassioned and courageous as a lioness, she was tender-hearted, generous, beautiful, and gifted with an irresistible eloquence. Her salon was the centre around which all the most prominent talents of France gathered, and during the first stage of the Revolution she was a political power. Very active in saving her friends, she barely escaped the guillotine herself. She fled, and sent from London, in 1793, the beautiful pamphlet, *Réflexions sur le Procès de la Reine*. After residing for some time at her paternal estate, Coppet, near Geneva, she returned to Paris during the Directory, and played again a brilliant and influential part in public life. To this period belong *De l'Influence des Passions sur le Bonheur des Individus et des Nations* (1796), one of her most characteristic works, and *Delphine*, a romance in 6 vols. (1802). But she was a decided adversary of Napoleon. An enmity sprang up between these two persons, which cannot be fully explained from the difference of their political views. Napoleon tried to gain her over by offering to pay the two million francs which the treasury owed to her father, but she refused to be reconciled. In 1802 he banished her from Paris, and when, after a journey in Germany, she returned to France and settled in the neighborhood of Paris, she was ordered to remove to Coppet, where she actually lived in a sort of confinement. She kept a court here more brilliant, and for the moment more influential, than that Goethe kept at Weimar. Every great literary man's biography of that period contains some pages on his visit to Coppet, and Frederick Schlegel, the founder and lawgiver of the romantic school in Germany, lived there as her chamberlain. Still, this court was a prison. In 1812 she fled, first to Vienna, then to St. Petersburg, where she was received with enthusiasm; to Stockholm, where she wrote *Dix Années d'Exil* and *Reflexions sur le Suicide;* to London, etc. After the fall of Napoleon, she returned to Paris in 1815. Louis XVIII. showed her the most flattering courtesy, and the Assembly paid the debt to her father. She d. July 14, 1817. Her two most prominent works are *Corinne, ou l'Italie* (1807), the fruit of a journey in Italy, and *De l'Allemagne* (1810), the result of her visit to Germany. The first is an inspiration of a high order, giving, although simply a novel, a picture of Italy, the country, its sky, its mountains, its seas, and of the people, its genius, its history, its life, marvellous both for completeness and for precision and magic impressiveness. It was translated into all European languages, and exercised a great influence; from that day the European painters ceased to copy the old Italian masters, and began to portray the living Italian peasants. The second book is of an inferior order. She did not understand the German language, and the German spirit remained foreign to her; its natural naïveté, simplicity, and purity she mistook for a product of refinement, and its strength she discovered only in its eccentricities. But the book exercised an enormous influence, as from it, for the first time, the French heard that there was something in the world which could be called German civilization. CLEMENS PETERSEN.

**Staff** and **Staff-Schools.** See APPENDIX.

**Staf'fa,** a small island of Scotland, one of the Inner Hebrides, belonging to the county of Argyle, celebrated

for its curious caverns, among which that called Fingal's Cave is the most remarkable, formed by gigantic masses of columnar basalt overlaid with a shapeless stratum of the same material, and presenting a most singular resemblance to an architectural design. The cave of Fingal is 227 feet long and 66 feet high from the sea to the entablature.

**Staf'ford,** town of England, capital of Staffordshire, on the Sow, has manufactures of leather, shoes, cutlery, and general hardware. P. 14,437.

**Stafford,** new county of S. W. Kansas, intersected in the N. W. corner by the Arkansas River, traversed by the Atchison Topeka and Santa Fé R. R., consists mainly of fertile, rolling prairies. Area, 900 sq. m. It is still unorganized.

**Stafford,** county of E. Virginia, bordering on Potomac and Rappahannock rivers, drained by Aquia and other creeks, and intersected by Richmond Fredericksburg and Potomac R. R. The surface is usually hilly, but is fertile along the Potomac. Excellent granite and freestone abound, and gold has been discovered in small quantities. Staples, Indian corn, wheat, oats, and sawed lumber. Cap. Stafford Court-house. Area, 335 sq. m. P. 6420.

**Stafford,** p.-tp., Tolland co., Conn., on New London R. R., 50 miles N. of New Haven, has 4 churches, good schools, 1 newspaper, 3 banks, an insurance company, several mills, a woollen factory, and 1 hotel. It is a summer resort for invalids and pleasure-seekers. P. 3405.

JAMES MCLAUGHLIN, ED. "TOLLAND COUNTY PRESS."

**Stafford,** tp., De Kalb co., Ind. P. 584.

**Stafford,** tp., Greene co., Ind. P. 841.

**Stafford,** tp., Ocean co., N. J. P. 1514.

**Stafford,** p.-v. and tp., Genesee co., N. Y., on New York Central R. R. P. 1847.

**Stafford,** p.-v., Franklin tp., Monroe co., O. P. 150.

**Stafford** (EDWARD), son of Henry, b. in England about 1470; was restored to his titles and estates by Henry VII. 1486; was educated at Cambridge; acquired enormous wealth; commanded the guard at the "battle of the Spurs," 1515; freely asserted his claim to the throne (by descent from Thomas of Woodstock, duke of Gloucester), as next heir to Henry VIII., in case of his death without issue; entered into a correspondence on the subject with Friar Nicholas Hopkins of Henton, Somersetshire, who pretended to the gift of prophecy, and foretold he should be king; excited the hostility of Wolsey by treating him with contempt on account of his humble origin; was accused of treason May, 1521; seized while on his way to court; tried and condemned May 13, and, disdaining to solicit mercy, was beheaded on Tower Hill May 17, 1521. He was attainted by Parliament two years later, and the dukedom thereby became extinct in his family.

**Stafford** (HENRY), duke of Buckingham, son of Humphrey, b. in England about 1440; succeeded to the title 1460; was the most prominent supporter of the duke of Gloucester (Richard III.) when Protector in his plot to obtain the throne 1483; met that prince at Northampton Apr. 29; aided him to effect the arrest and destruction of Earl Rivers and Lord Gray; was appointed chief-justice and constable of the royal castles in Wales May 16; asserted the claims of Richard to the throne in a harangue at Guildhall June 24, and was appointed constable of England July 15, but soon changed his allegiance, conspiring with the Lancastrians; was betrayed to the king in October, attainted, and beheaded at Salisbury Nov. 1, 1483. His name and fame are familiar to modern readers through Shakspeare's tragedy of *King Richard III.*

**Stafford** (HUMPHREY), earl of Stafford, afterward duke of Buckingham, b. in England in 1404; was present at the coronation of Henry VI. as king of France at Paris Dec., 1431; was in command at Calais 1440; married a daughter of Prince Thomas of Woodstock, duke of Gloucester, whose estate he inherited on the death of a brother-in-law; was thereupon created duke of Buckingham Sept. 14, 1444; was declared first peer of the realm; made first constable of Dover and warden of the Cinque Ports about 1449; was wounded at the battle of St. Alban's, 1454, and killed at that of Northampton, July 10, 1460.

**Stafford** (WILLIAM **Howard**), VISCOUNT, second son of Thomas Howard, twentieth earl of Arundel, b. in England Nov. 20, 1612; was brought up a Roman Catholic; was knighted in early life; married, about 1634, Mary, a sister of Henry, thirteenth Baron Stafford. On the death of the latter without issue in 1637, Sir William assumed the title of Baron Stafford in right of his wife, but it was soon discovered that the true heir was a distant relative in obscure life, named Roger Fludd, *alias* Stafford, whose sister was married to a joiner at Newport, Shropshire, and had a son, then following the trade of a cobbler in that town. Roger was induced for a consideration to submit his claim to the arbitration of the king, who decided in favor of Howard, and by royal order Roger executed a deed of surrender of the peerage to his rival Dec. 9, 1639. The king soon afterward (Sept. 12, 1640) created Howard Baron and his wife Baroness Stafford, and in order to settle in his favor a question of precedency among the barons made him a viscount Nov. 11 of the same year. During the civil war Stafford adhered to the royal cause, but after the Restoration often opposed in the House of Peers the measures of the court; was intimate with Shaftesbury, and was, on account of his religion, selected by the infamous Titus Oates as one of his victims. Accused of participation in the "Popish plot" by Oates in his first examination before the House of Commons, Oct. 23, 1678, Stafford surrendered himself the following day; was committed to the Tower with four other accused noblemen Oct. 30; was excluded from Parliament with twenty other Roman Catholic peers by the act approved Nov. 30 of that year; was impeached of high treason Dec. 5, and again, with the other four accused lords, Apr. 7, 1679, when he pleaded not guilty; but the trial, being prevented by a prorogation and a subsequent dissolution of Parliament, did not commence until Nov. 30, 1680, when the impeachment was begun before the House of Lords, Sir Heneage Finch (afterward earl of Nottingham) presiding as lord high steward. Stephen Dugdale and one Turberville, the chief witnesses, swore that Stafford had offered them rewards to participate in a conspiracy against the life of the king, and Bedloe, Dangerfield, and Denis offered confirmatory testimony. Stafford defended himself with spirit, but he was convicted Dec. 7, by 55 votes against 31, four of the Howard family being of the majority. Stafford was executed on Tower Hill Dec. 29, 1680, protesting his innocence in terms which carried great weight with the spectators. His widow was created countess by James, and his eldest son earl of Stafford by James II. (1688), but the title became extinct on the death of the fourth earl in 1762. The attainder was reversed by act of Parliament in 1824, and Sir George William Jerningham, Bart., was recognized as Baron Stafford 1825.

PORTER C. BLISS.

**Stafford Court-house,** p.-v., cap. of Stafford co., Va.

**Staf'fordshire,** an inland county of England, comprises an area of 1138 sq. m., with 857,333 inhabitants. The central part of the county is low and undulating, but both in the N. and the S. the ground rises and the surface becomes hilly. The soil is generally cold, clayey, and little productive. The principal occupations are mining and manufactures. The coal-fields are very rich both in the northern and southern parts of the county; iron, copper, and lead are found, together with marble, freestone, and an excellent potter's clay. With respect to its manufacturing interests this county is the third in rank in England.

**Staf'fordsville,** p.-v. and tp., Giles co., Va. P. 1888.

**Stag,** or **Red Deer,** the largest deer of Europe, the *Cervus elaphus.* The male is called the *hart,* the female the *hind,* and the young the *calf;* the male under three years is called a *brocket;* under four, a *spayad;* under five, a *staggard;* and under six, a *stag;* so that strictly, in sporting parlance, a stag is a red deer five years old. At six years he is a *hart of ten,* and when seven years old he is a *hart crowned,* and is considered fair game. The stag is found in England, but at present only in paddocks, half domesticated; but in Scotland it is still found wild. Its pursuit is the noblest of European sports. The flesh is inferior to that of the fallow deer.

**Stag'-Beetle** and **Horn-Bug** are popular names for *Lucanus dama* of the U. S., *L. cervus* of Europe, and of many other Lucanidæ, large coleopterous insects, remarkable for the great size of the head and for the large horn-like mandibles. The American species named above is a well-known inhabitant of decaying wood, piles of chips, etc., and is capable of inflicting a severe bite.

**Stage-coach.** See CARRIAGES, by L. P. BROCKETT, M. D.

**Stage Road,** p.-v., McIntosh co., Ga. P. 36.

**Stag'gers,** a popular name for some diseases of horses and sheep, is, like many popular names, a very vague one. "Blind staggers" in horses is a sort of epilepsy; "mad staggers," an inflammation of the brain; "grass staggers" is an acute and dangerous gastritis. The treatment of the first is by setons about the head, but the disease is incurable. The second usually receives powerfully revulsive treatment by means of blisters, cathartics, and thorough bleeding. The last-mentioned disease calls for active enemata and good-sized doses of calomel and opium. "Staggers" in sheep is caused by grubs in the nostrils (larvæ of *Œstrus ovis*), which may sometimes be removed by throwing up snuff mixed with whisky.

**Stagg's Creek,** p.-v. and tp., Ashe co., N. C. P. 861.

**Stag'hound,** a dog formerly kept in Europe for the chase of the red deer, is now nearly extinct. This is a large, rough-haired dog, much like the foxhound, but longer in the legs. It is a strong, swift, and fearless creature, and is the rival of the bloodhound in powers of scent.

**Stagi'ra** [Στάγειρα], town of Chalcidice, in Macedonia, was a colony from Andros, but fell into decay during the Peloponnesian war. It was the birthplace of Aristotle, and in honor of his great tutor Alexander restored the city, but its prosperity was merely temporary.

**Stagirite, Aristotle, the.** See ARISTOTLE.

**Stah'el** (JULIUS), b. in Hungary in 1825; entering the Austrian military service, he rose to the rank of first lieutenant; upon the breaking out of the Hungarian revolution joined the patriots, and served on the staffs of Görgei and Guyon. When the revolution was suppressed, he went to Germany, thence to England, and finally to New York, where he engaged in journalism. When the civil war broke out, he was made lieutenant-colonel of the 8th New York Vols., which he commanded at the battle of Bull Run, and of which he soon after became colonel; was promoted to brigadier-general in 1861; in 1862 commanded a division in Sigel's 11th army corps, and was made major-general of volunteers in Mar., 1864.

**Stahl** (FRIEDRICH JULIUS), b. at Munich Jan. 16, 1802, of Jewish parents; embraced Christianity in 1819; studied law at Würzburg, Heidelberg, and Erlangen; was appointed professor of jurisprudence in 1832 at Erlangen, and in 1840 at Berlin. D. at Brückenau, near Kissingen, in Bavaria, Aug. 10, 1861. His specialty was the philosophy of law, and in his system he was a disciple of Schelling. Assuming that human reason is incapable of arriving at a positive conception of truth by itself, he deduces the ideas of state, government, etc., from the doctrines of Christian revelation, and bases the authority of officials and the obedience of citizens on a divine ordinance. As a member of the upper house of the Prussian Diet he became the leader of the feudal and aristocratic party during the period of reaction which followed the abortive revolution of 1848 in Berlin. His principal works are—*Philosophie des Rechts* (3 vols., 1854–56), *Ueber den Christlichen Staat* (1847), *Was ist Revolution?* (1853).

**Stahl** (GEORG ERNST), b. at Ansbach, in Bavaria, Oct. 21, 1660; studied medicine at Jena; was appointed physician to the duke of Weimar in 1687, professor of medicine at the University of Halle in 1694, and physician to the king of Prussia in 1716. D. at Berlin May 14, 1734. He was a great chemist, and had great merit as a systematizer of the science of chemistry; his theory of phlogiston was generally adopted, and considered valid up to the time of Lavoisier. As a physician he also acquired great celebrity. (See A. Lemoine, *Le Vitalisme et l'Animisme de Stahl* (Paris, 1864).) His principal works are—*Experimenta et Observationes Chemicæ* (1731) and *Theoria Medica Vera* (1707).

**Stahr** (ADOLF WILHELM THEODOR), b. at Prenzlau, in the Prussian province of Brandenburg, Oct. 22, 1805; studied classical languages and literature at Halle; was appointed professor at the gymnasium of Oldenburg in 1836; travelled much in France, Switzerland, and Italy, and settled in 1852 at Berlin, where he married the authoress Fanny Lewald in 1855. He is a very prolific writer; his numerous books and articles for periodicals treat subjects of antiquity and modern times, history and art, critically and in a descriptive manner. Some of his works have been translated into English, as, for instance, *Torso, oder Kunst, Künstler, und Kunstwerke der Alten* (2 vols., 1854–55), in the *Crayon* (New York, 1858–59), and *G. E. Lessing, sein Leben und seine Werke* (2 vols., 1859), by Prof. E. P. Evans, of Michigan University (Boston, 1866). He wrote the text to Kaulbach's *Goethe Gallerie* (Abtheilung I., Goethe's *Frauengestalten*). His *Oldenburgische Theaterschau* (2 vols., 1845) drew some attention to the stage of Oldenburg.

**Staigg** (RICHARD M.), b. in England about 1820; coming to America at an early age, he became a mechanic at Newport, R. I., where he took lessons in painting from Washington Allston and Jane Stuart; became eminent as a miniature-painter, a branch of art which he subsequently relinquished for *genre* pictures and coast-scenes. Among his best productions are—*The Crossing-Sweeper, Cat's Cradle, Knitting, The Love-Letter, The Sailor's Grave,* and *News from the War.*

**Stained Glass.** See GLASS, by C. G. LELAND, A. M.

**Stai'ner** (JOHN), MUS. DOC., b. in England in 1840; developed in early childhood a remarkable musical talent; was a chorister at St. Paul's cathedral 1847–56, organist to St. Michael's College, Tenbury, 1856–59, and became in 1859 organist of Magdalen College, and in 1860 of University College, Oxford; received the honorary degree of bachelor of music 1859; embraced the opportunity to pursue the regular course of university studies, as well as to perfect himself in musical theory, graduating as B. A. 1863, Mus. Doc. 1865, and M. A. 1866. In 1872 he was appointed organist of St. Paul's, London. Author of a large number of anthems and church services, as well as songs of a secular character, and of a scientific work on *The Theory of Harmony.*

**Stair** (JAMES **Dalrymple**), SEVENTH BARON and FIRST VISCOUNT, b. at Drummurchie, Ayrshire, Scotland, in May, 1619; graduated M. A. at the University of Glasgow 1637; obtained a commission as captain in the Scottish army, but at the age of twenty-two accepted the professorship of philosophy at Glasgow, which he held six years (1641–47); was admitted an advocate at the Scottish bar Feb., 1648; was secretary to the commissioners sent to treat with Charles I. at Breda 1649–50; became a lord of session July 1, 1657; was knighted by Charles II. 1660, and confirmed as lord of session Feb. 14, 1661; resigned office 1663 from unwillingness to subscribe the declaration against the Covenants of 1638 and 1643 appended to the oath of allegiance, but his resignation was declined, and he was made a baronet June, 1664; became lord president of the court of session Jan., 1671; refused to take the new test oath, and was removed from his offices 1681; published in that year his *Modus Litigandi* and *The Institutions of the Law of Scotland*—a work which has been called the "Scottish Blackstone;" was accused of complicity in the Rye-House plot, and outlawed, but escaped to Holland Oct., 1682; prepared there his *Decisions of the Lords of Council and Sessions 1661–81* (Edinburgh, 2 vols. folio, 1683–87); published at Leyden his Latin treatises *Physiologia Nova Experimentalis* (1686); received a pardon 1686; accompanied the prince of Orange to England 1688; was reinstated in the presidency of the court of session, and made Viscount Stair Apr. 21, 1690; published an *Apology* for his political course (1690) and a *Vindication of the Divine Perfections* (1695). D. Nov. 25, 1695.

**Stair** (JOHN **Dalrymple**), FIRST EARL OF, better known as the "Master of Stair," son of Viscount John, b. in Scotland about 1648; was admitted as advocate in the court of session Feb., 1672; was one of the council for the earl of Argyll on his trial for treason 1681; was twice imprisoned between 1681 and 1685; was received into favor on the accession of James II., by whom he was made lord advocate 1685 and lord of session and lord-justice clerk 1686; supported the Revolution 1688; was a leading Scottish member of the "Convention Parliament" Mar., 1689; was one of the three commissioners sent to London to offer the crown of Scotland to William and Mary, May, 1689; was reappointed lord advocate 1690; became one of the secretaries of state for Scotland 1691; plotted the "massacre of Glencoe," which covered his name with infamy, Jan., 1692, for which act he was dismissed from office 1695 and censured by a parliamentary committee of inquiry, but was never subjected to prosecution; succeeded his father as Viscount Stair Nov. 25, 1695; was sworn of the privy council on the accession of Anne 1702; was created earl of Stair Apr. 8, 1703; was one of the commissioners who negotiated the treaty of union between Scotland and England 1706, and was mainly instrumental in passing that measure through the Scottish Parliament. D. Jan. 8, 1707.

**Stair** (JOHN **Dalrymple**), SECOND EARL OF, second son of the first earl, b. at Edinburgh July 20, 1673; had the misfortune in boyhood to kill his elder brother by the accidental discharge of a pistol; educated at the University of Leyden, where he was distinguished for scholarship; entered the army as a volunteer under the earl of Angus, and commanded the Cameronian regiment at the battle of Steinkirk 1692; was aide-de-camp to the duke of Marlborough at Venloo and Liege 1702; succeeded to the earldom 1707; obtained command of the Scots Greys; was commissioned general; distinguished himself at Ramillies and Oudenarde 1706, and at Malplaquet 1709; withdrew from the army in 1711; became privy councillor and representative peer for Scotland 1714; was appointed commander-in-chief of the forces in Scotland on the accession of George I. (1715); was ambassador to France 1715–20; resided on his estate at New Liston, devoted to scientific agriculture, 1720–40, having been the first person in Scotland to plant turnips and cabbages in the open fields; was made field-marshal commander-in-chief of British forces in Flanders and ambassador extraordinary to the States General of Holland 1741; won the battle of Dettingen, June 26, 1743, and subsequently filled several important public posts under the Walpole administration. D. at Edinburgh May 9, 1747. The *Memoirs of the House of Dalrymple,* published from

family papers (1876), contain important historical data heretofore unknown.

**Stalac'tite** [Gr. σταλάζειν, to "drop"], icicle-like masses of lime, limonite, chalcedony, pyrites, etc., which depend from the roofs of caverns; they are formed from the evaporation of water holding these substances in solution. Stalactites sometimes form columns reaching from floor to roof of high chambers; sometimes they imitate curtains, waterfalls, etc., which constitute notable features in some of the famous caves in the world. The name *stalagmite* (Gr. στάλαγμα, a "drop") is given to the material which composes stalactites, only accumulating on the floor. This sometimes forms continuous sheets over the surface, sometimes rises into columns, which meet and blend with the stalactites above. J. S. Newberry.

**Stalim'ni,** or **Stalimeni,** the ancient *Lemnos*, an island in the Ægean Sea, 40 miles S. E. of Mount Athos, belongs to Turkey, and comprises an area of 160 sq. m., with 8000 inhabitants. The surface is mountainous, containing many extinct craters; the soil is very fertile, and produces corn, oil, wine, and fruits.

**Stambool.** See Constantinople.

**Sta'men** [Lat., from the Gr. στήμων, the warp or its threads in the upright loom of the ancients], the botanical name of the male organ in flowers. (See Botany.) It consists of two parts, viz. a stalk, called the *filament*, which, like the stalk of a leaf, is not essential and may be wanting, and of a terminal body, the only essential portion, called the *anther*. This normally is 2-celled, or is formed of a pair of sacs placed side by side, with, or sometimes without, a prolongation of the filament between them (the *connective*), and filled with *pollen*, a powder, composed of minute grains. This is the fertilizing material, which, acting upon the stigma, develops a tube from each grain, which grows down the style, reaches the ovules or rudimentary seeds, and fertilizes them: that is, causes an embryo to be produced, and so an ovule becomes a fertile seed. The pollen is discharged from the anther through openings, generally by a slit from top to bottom of each cell, sometimes by a hole at the top or elsewhere, rarely by one or more uplifted valves or lids. Morphologically, each stamen answers to a leaf, the anther being conceived to be the blade transformed, and the cells of its parenchyma developed as pollen, the filament answering to the leafstalk. As to position, in a complete flower the stamens stand between the petals and the pistil, in the simpler and normal case borne on the receptacle under the pistil (technically *hypogynous*), but not rarely adnate to or apparently growing out of the calyx (perigynous), or out of the corolla (*epipetalous*), or when all these parts are consolidated with the surface of the ovary, then apparently borne on its summit (*epigynous*), or even consolidated with the style, as in the orchis family (*gynandrous*). Terms relating to the number of the stamens are common, as *monandrous*, with a solitary stamen, *diandrous*, with two, and so on; or to number combined with relative length, as *didynamous*, when of four stamens one pair is shorter, and *tetradynamous*, when of six stamens two are shorter than the four; or to connection, whether by the filaments into one set or brotherhood (*monadelphous*) or into two (*diadelphous*), or by the anthers instead into a ring (*syngenesious*). These and the like terms long ago became familiar, being used by Linnæus to characterize artificial classes. As the petals of a flower, taken collectively, compose the corolla, so the stamens, taken collectively, receive the name of *andrœcium; i. e.* the male members of the household. W. W. Bailey.

**Stam'ford,** town of England, county of Lincoln, on the Welland, which here becomes navigable. P. 7846.

**Stamford,** p.-b. and tp., Fairfield co., Conn., on New York and New Haven R. R., about 32 miles N. E. of New York City, contains 7 churches, public and private schools, 2 military institutes, 4 banks, 1 newspaper, manufacturing establishments, and repair-shops. Stamford is a summer resort, and is the fifth richest town in Connecticut. P. 9714. Wm. Gillespie, Ed. "Stamford Advocate."

**Stamford,** p.-v. and tp., Delaware co., N. Y., at the headwaters of the W. branch of Delaware River, on New York Kingston and Syracuse R. R., has 4 churches, an incorporated seminary with a library, 1 newspaper, 1 furnace and machine-shop, 2 hotels, and several mills. P. 1658. S. B. Champion, Ed. "Mirror."

**Stamford,** tp., Bennington co., Vt. P. 633.

**Stam'mering** [Ang.-Sax. *stamer*], an affection of the faculty of speech characterized by irregular, imperfect, or spasmodic actions of the muscles concerned in articulation. It is in reality a chorea of the muscles concerned, a defective power of co-ordination. It may be manifested under two somewhat different forms. In the one there is a difficulty in beginning the enunciation of words, and this is especially shown in regard to those words which begin with what are called the "explosive consonants" (*b*, *p*), and which require the sudden opening of the lips. In the other form the word is begun, but after the enunciation of a syllable there is a spasmodic, and for a time uncontrollable, reiteration of the same syllable. To this variety the term *stuttering* is sometimes applied. Stammering is one of the mimic diseases, and may be acquired by carelessness in speech or by association with others similarly affected, or even by mocking such persons. In the majority of cases it disappears after the attainment of adult age, probably in consequence of the constant efforts of the subject to improve his habit of speaking. It is always increased by emotional disturbance, especially fright and apprehension, and is much mitigated, and often cured, by the patient acquiring confidence in himself, never attempting to speak in a hurry or when the chest is empty of air, or by reading measured sentences slowly and with deliberation. Stammerers never have any difficulty in singing, for they know that a certain definite manner is to be observed, and this gives them the confidence they require. The affection is sometimes permanently removed in time by the patient performing some trifling muscular action consentaneously with the enunciation of the words over which he stumbles. Thus, if he stammers at the word *baby*, he can prevent the fault by moving a finger at the very instant that he begins to utter the word, and so on.

*Bibliography.*—Voisin, *Du Bégaiement, etc.* (Paris, 1821); Colombat, *Du Bégaiement, et de tous les autres Vices de la Parole, etc.* (Paris, 1831); Becquerel, *Traité du Bégaiement et des Moyens de le guérir, etc.* (Paris, 1843); Hunt, *A Treatise on the Cure of Stammering* (London, 1856); Poett, *A Practical Treatise on Stammering, etc.* (London, 1856); Violette, *Du Bégaiement et de Moyens de le guérir* (Paris, 1858); Klencke, *Die Heilung der Stotterns* (Leipsic, 1860); Rosenthal, *Abhandlung über Theorie und Heilung des Stotterübels* (Wien, *Med. Wochenschrift*, Ni. 35–38, 1861). William A. Hammond.

**Stamp Act,** a law passed by the British Parliament Mar. 22, 1765, "for granting and applying certain stamp duties and other duties in the British colonies and plantations in America," took effect from Nov. 1, 1765, but was the occasion of such excitement, protests, and overt resistance in most of the States that it was repealed Mar. 18, 1766, and a bill of indemnity for those who had incurred penalties was passed June 6 of the same year.

**Stamp'er's Creek,** p.-v. and tp., Orange co., Ind. P. 827.

**Stämpf'li** (Jakob), b. at Schüpfen, canton of Berne, Switzerland, in 1820, in humble circumstances; acquired by the energy of his character a good education; studied law at Berne, and became an advocate in 1843; took part very actively in the politics of the state as leader of the radical party 1845–50 and 1855–65; introduced direct taxation, abolished all feudal burdens, and opposed with great vigor the influence of the Jesuits. In 1872 he was one of the arbitrators at Geneva under the Treaty of Washington.

**Stamp-Mill.** See Grinding and Crushing Machinery, by Prof. R. H. Thurston, C. E.

**Stan'ardsville,** p.-v. and tp., cap. of Greene co., Va. P. 1789.

**Stan'bery** (Henry), b. in New York Feb. 20, 1803; graduated at Washington College, Pa., in 1819; admitted to the bar in Ohio in 1824; became attorney-general of the State in 1846, and attorney-general of the U. S. in 1866, under the administration of Pres. Johnson, for whom he acted as leading counsel in the impeachment trial of 1868.

**Stan'bridge** (John), b. at Heyford, Northamptonshire, England, about 1450; became perpetual fellow of New College, Oxford, 1481; first usher of the free school connected with Magdalen College about 1486, and afterward for many years its head-master. D. about 1525. He was the first author of schoolbooks that were extensively printed and used in England, though now so rare as to have become bibliographical curiosities. Among them were *The Accydence of Mayster Stanbrydge's owne Makynge* (printed before 1500), *Embryon Relimatum, sive Vocabularium* (of which at least 8 eds. were printed by Wynkin de Worde), *Vocabula Magistri Stanbrigi* (1510), and *Parvulorum Institutiones* (1520).

**Stanchio.** See Cos.

**Standard of Values.** See Coinage, by E. B. Elliot.

**Standard of Weights and Measures.** See Weights and Measures, by Pres. F. A. P. Barnard.

**Standards.** See Banner and Flag.

**Standing Stone,** p.-v. and tp., Bradford co., Pa., on Susquehanna River and on Lehigh Valley R. R. P. 905.

**Standing Stones.** See Stones, Standing.

**Stan'dish,** p.-v. and tp., Cumberland co., Me. P. 2089.

**Standish** (MILES), b. in Lancashire, England, about 1584; claimed to be descended from, and the true heir of, the knightly family of Standish of Duxbury Hall; became a soldier in the Netherlands, attaining the rank of captain, and, though not a member of the Leyden church or congregation, accompanied the Pilgrims of the Mayflower to New England 1620; lost his wife, Rose, during the first winter; is said by tradition to have employed his friend John Alden to negotiate his marriage with the fair Priscilla Mullins (see Longfellow's *Courtship of Miles Standish*), with the well-known result that Alden married the maiden; rendered important services to the colonists in preserving them from the open and secret hostilities of the Indians, having with his own hand killed, at Weymouth (1623), Pecksuot, an Indian chief who had planned a massacre; visited England as agent for the colony 1625, returning with supplies 1626; was one of the original proprietors and settlers of Duxbury, having given that name to the town in memory of the seat of his English ancestors; was for the remainder of his life either magistrate or a member of the board of assistants to the governor, and took part in the settlement of Bridgewater 1649. D. at Duxbury Oct. 3, 1656. He was of small stature and choleric temper, possessed great energy and force of will, and was long a terror to hostile Indians, and an object of admiration to the friendly natives, among whom was Hobomok (the hero of Lydia Maria Child's *Hobomok*), who made his home with Standish. By a second wife, Barbara, he left numerous children, more than one of whom married in the family of John Alden. His sword is preserved in the Pilgrim Hall, Plymouth. On the commanding eminence in South Duxbury, formerly called Captain's Hill, from having been the place of his residence, the cornerstone of a monument to his memory was laid Oct. 7, 1872. This structure, still (1876) in process of construction, is to consist of an octagonal base 28 feet in diameter and 25 feet high, surmounted by a circular tower crowned by a statue of "the first commissioned military officer of New England," the whole to be 110 feet in height. A good view of the monument and the beautiful prospect it will command is given in Rev. E. Nason's *Gazetteer of Massachusetts* (1874). The will of Capt. Standish may be read in the *General Register*, vol. v., and many incidents of his career are given, with a partial genealogy of his descendants, in Justin Winsor's *History of Duxbury* (1849). PORTER C. BLISS.

**Stan'field** (CLARKSON), R. A., b. at Sunderland, county of Durham, England, in 1798; began life as a sailor, thus acquiring the practical knowledge of the sea that has given him his fame. Ruskin says: "One work of Stanfield's presents us with as much concentrated knowledge of sea and sky as, diluted, would have lasted any one of the old masters his life." He first exhibited in 1827; was elected an associate in 1832, academician in 1835; made frequent visits to the Continent, and studied in Italy, France, Holland, Venice, Naples, and the Pyrenees; was for many years scenic artist at Drury Lane, theatrical decorator, and painter of landscape. D. in 1867. His masterpiece is conceded to be *The Battle of Trafalgar*, painted for the Senior United Service Club in 1836. This work is characterized by beauty rather than grandeur, by elaboration of detail and carefulness of finish. He has been styled "the English Vandervelde." O. B. FROTHINGHAM.

**Stan'ford,** tp., Clay co., Ill. P. 1349.

**Stanford,** p.-v., Allen tp., McLean co., Ill. P. 274.

**Stanford,** p.-v., cap. of Lincoln co., Ky., on Logan Creek and on Knoxville branch of Louisville Nashville and Great Southern R. R., has 1 newspaper. P. 752.

**Stanford,** tp., Isanti co., Minn. P. 215.

**Stanford,** tp., Dutchess co., N. Y. P. 2116.

**Stanford** (JOHN), D. D., b. in England Oct. 20, 1754; studied medicine; became a teacher, and came to the U. S. in 1786; was pastor of a Baptist church in Providence, R. I., 1787–89; teacher in New York 1789–1813, delivering in the mean time Sunday evening lectures, and acting from 1794 to 1800 as minister of a Baptist church, and subsequently teaching a class of students in theology. In 1811 he became chaplain of the almshouse, and labored in the prisons, hospitals, and charitable institutions. Besides tracts and discourses, he wrote a *History of the First Baptist Church of Providence*, *The Domestic Chaplain* (1806), *Concise Description of the City of New York* (1814), and *The Aged Christian's Companion* (1829; republished, with a memoir, by George Uphold, 1855). D. in New York, Jan. 14, 1834.

**Stanford** (LELAND), b. at Albany, N. Y., Mar. 9, 1824; received a common-school education; studied law, and was admitted to the bar in 1849; soon afterward removed to Port Washington, Wis., where he practised law till 1852, when he went to California and entered into business with three of his brothers. He first appeared in politics as a delegate to the convention at Chicago in 1860 which nominated Abraham Lincoln for the Presidency; was elected governor of California in 1861, and in his inaugural address urged the importance of building the Pacific R. R., and a company for that purpose, with him for president, was formed on July 1 of that year. J. B. BISHOP.

**Stan'fordville,** p.-v., Stanford tp., Dutchess co., N. Y., on Poughkeepsie Hartford and Boston R. R.

**Stan'hope,** p.-v., Byram tp., Sussex co., N. J., on Morris Canal and Morris and Essex R. R.

**Stanhope** (CHARLES MAHON), F. R. S., THIRD EARL STANHOPE and VISCOUNT MAHON, grandson of the first earl, b. in London, England, Aug. 3, 1753; educated at Eton and Geneva; manifested great mechanical talent; obtained while at school a prize from a scientific academy at Stockholm for a memoir on the construction of the pendulum; married Lady Hester Pitt, daughter of the earl of Chatham, 1774; was an unsuccessful candidate for Parliament at Westminster in the same year; was elected for Chipping Wycombe by the influence of the earl of Shelburne 1780; lost his wife, who had borne him three daughters, 1780; married Louisa, daughter of Henry Grenville, 1781; succeeded to the peerage 1786; was noted for his radical opinions; declared himself a republican, laid aside the insignia of nobility, and defended the French revolution; was a frequent speaker in the House of Lords, where he obtained the sobriquet of "the minority of one;" constructed two calculating-machines; suggested improvements in canal-locks; was a close student of electricity; made known in 1779 his theory of the "return stroke" of lightning; invented a monochord for tuning musical instruments, a vessel for sailing against wind and tide, made many improvements in the art of printing, and in 1816 the "Stanhope printing-press." D. in London Dec. 15, 1816. Author of *The Gold Coin* (1774), *Principles of Electricity* (1779), *Observations on Mr. Pitt's Plan for Reducing the National Debt* (1786), *A Letter to Edmund Burke on the French Revolution* (1790), *Rights of Juries Defended* (1792), *Principles of Tuning Instruments* (1806), and of papers *On Securing Buildings against Fire* (1778) and *On Thunderstorms* (1787) in the *Philosophical Transactions*.

**Stanhope** (GEORGE), D. D., b. at Hertishorn, Derbyshire, England, Mar. 5, 1660; studied at Eton; graduated at King's College, Cambridge, about 1680; was successively rector of Tewing, vicar of Lewisham and of Deptford, and dean of Canterbury; was chaplain to William and Mary about 1690, and Boyle lecturer 1701. D. at Bath Mar. 18, 1728. He translated the *Imitation of Christ* (1696), the *Meditations of Marcus Aurelius* (1699) and of St. Augustine (1701), the writings of Epictetus (1700), the *Maxims* of La Rochefoucauld, Bishop Launcelot Andrews's *Private Prayers*, and other works; published many sermons, a course of Boyle lectures (1702), and *Paraphrase on the Epistles and Gospels* (4 vols., 1705–08).

**Stanhope** (Lady HESTER LUCY), daughter of Charles, third Earl Stanhope, b. in London, England, Mar. 12, 1776; was for ten years a member of the family of her uncle, William Pitt, to whom she acted as confidential secretary until his death in 1806; received thereafter a pension of £1200, upon which she resided some years in Wales; proceeded in 1810 to Syria; visited Jerusalem, Damascus, Baalbec, and Palmyra; acquired by her magnificent and singular ways of living the respect and veneration of the Arabs, who treated her almost as a queen; established herself in 1813 in the deserted convent of Mar Elias, 8 miles from Sidon, upon a crag of Lebanon; adopted the dress and style of an emir, having at her command a guard of Albanians, over whom she exercised an absolute authority; became a benefactress to political refugees and to the poor of every kind; exerted considerable political influence; and practised astrology. D. at Mar Elias June 23, 1839. Her *Memoirs* (3 vols., 1845) and *Seven Years' Travels* (3 vols., 1846) were published by her physician, Dr. Meryon.

**Stanhope** (JAMES), FIRST EARL STANHOPE, b. at Paris, France, in 1673; was a nephew of the second earl of Chesterfield; resided in Spain, where his father was minister, during several of his early years (1690–94); entered the army 1694; was wounded at the siege of Namur 1695; served in Flanders until the Peace of Ryswick; was elected to Parliament 1702; took part in the expeditions of 1702 and 1704 in Spain; was a brigadier-general at the siege of Barcelona 1705, major-general 1707; commander-in-chief in Spain, and took Port Mahon, Minorca, 1708; defeated the Spaniards at Almerara and Saragossa (Aug., 1710), but was forced to surrender to the duke of Vendôme at Brihueza Dec. 8, 1710; was appointed secretary of state on the accession of George I., 1714; became first lord of the treas-

ury and chancellor of the exchequer 1717; was created Viscount Stanhope of Mahon July 2, 1717, and Earl Stanhope Apr., 1718; was again secretary of state, and took part in negotiating the Quadruple Alliance 1718. D. in London Feb. 5, 1721.

**Stanhope** (PHILIP DORMER). See CHESTERFIELD.

**Stanhope** (PHILIP HENRY), D. C. L., F. R. S., FIFTH EARL STANHOPE, better known as **Lord Mahon,** b. at Walmer, Kent, England, Jan. 31, 1805, was a grandson of Charles, the third earl; graduated from Christ Church, Oxford, 1827; was elected to Parliament for Wootton-Basset 1830; represented the borough of Hertford 1833–52; was under-secretary of state for foreign affairs (the duke of Wellington being the secretary) in the first Peel ministry 1834; was secretary to the board of control in the last year of the second Peel ministry 1845–46; supported the repeal of the corn laws; introduced and carried the copyright act of 1842; was chosen president of the Society of Antiquaries 1846; was defeated at the parliamentary elections of 1852 in consequence of having voted with the protectionists against the modification of the navigation laws; succeeded to the earldom Mar. 2, 1855; founded the Stanhope prize for the study of modern history at Oxford 1855; was chosen lord rector of the University of Aberdeen 1858, and one of the six foreign members of the Academy of Moral and Political Sciences at Paris May 11, 1872; was instrumental in the establishment of the National Portrait Gallery (1857), of which he became chairman, and in the creation of the Historical Manuscripts Commission. D. at Bournemouth, Hampshire, Dec. 24, 1875. Author of *The Life of Belisarius* (1830), *History of the War of Succession in Spain* (1832), *History of England from the Peace of Utrecht to the Peace of Versailles, 1713–83* (7 vols. 8vo, 1836–53), *Spain under Charles the Second, or Extracts from the Correspondence of the Hon. Alexander Stanhope, British Minister at Madrid 1690–1700* (1839), *Essai sur la Vie du Grand Condé* (privately printed, 1842, which afterward appeared in English as *The Life of Louis, Prince of Condé,* 1845), *Historical Essays, selected from Contributions to the Quarterly Review* (1848), *The Life of the Right Hon. William Pitt, with Extracts from his Unpublished Correspondence and MS. Papers* (4 vols., 1861–62; 4th ed. 1867), *Miscellanies, Collected and Edited* (1863), and a *History of England, comprising the Reign of Anne, until the Peace of Utrecht* (1870). Several fragments of his great work have been separately published, as *The Forty-Five, being a Narrative of the Rebellion in Scotland in 1745* (1851), and *The Rise of Our Indian Empire* (1858). Lord Stanhope edited, with notes, *The Letters of Philip Dormer Stanhope, Earl of Chesterfield* (4 vols., 1845), *The Memoirs of Sir Robert Peel, Bart.* (2 vols., 1856–57), and privately printed two or three volumes of state papers and family documents. The earlier volumes of his *History of England* were edited in the U. S. by Prof. Henry Reed (2 vols., 1849), with elaborate notes.

PORTER C. BLISS.

**Stanislas Augustus,** king of Poland. See PONIATOWSKI.

**Stan'islas Leszczyn'ski,** b. at Lemberg, Galicia, Oct. 20, 1677, of one of the oldest and wealthiest families of the French nobility; held a high position at the Polish court, and was palatine of Posen when the war broke out between Charles XII. of Sweden and Augustus II. of Poland and Saxony. By the diplomatic negotiations which he carried on between Augustus and Charles he won the favor, and even the friendship, of the latter, and when, after the complete defeat of Augustus, Charles declared the Polish throne vacant, Stanislas was by his influence elected king of Poland in 1705. He was a noble character, and not without talent as a ruler, but after the disaster of Charles at Poltava in 1709 he was compelled to flee from Poland, where even his private fortune was confiscated. He joined his friends at Bender, and was in 1714 made governor of the duchy of Zweibrücken, but after the death of Charles in 1718 he was bereft also of this position. He found refuge in France, and settled at Weissenburg in Alsace. In 1725 his daughter, Marie Leszczynski, was married to Louis XV., and at the death of Augustus II. (in 1733) he was re-elected king of Poland by French influence. Russia, however, was opposed to his restoration, and by the intervention of a powerful Russian army Augustus III. was raised to the Polish throne. After a desperate resistance at Dantzic, where he was besieged by the Russians, he fled for the second time from his native country, but by the Peace of Vienna (1735) his family estates were restored to him, he received the duchy of Lorraine as a pension, and retained the title of king of Poland. He subsequently resided at Lunéville or Nancy, where he held a brilliant court, gathered scientific men around him, founded splendid educational institutions, erected magnificent public buildings, and was generally called *Le Bienfaisant.* D. Feb. 23, 1766, by accident, his dress catching fire while he sat reading beside a fire. Among his *Œuvres du Philosophe bienfaisant* (4 vols., 1767) is a little essay, *Voix d'un Citoyen,* in which he predicts the division of Poland.

**Stan'islaus,** county of Central California, bounded in part on the N. by the Stanislaus, and intersected by the San Joaquin and Tuolumne rivers and by a division of Central Pacific R. R. The surface is mostly level, but a strip on the W. border rises in the Coast Range to a height of about 2000 feet. The soil is productive, but timber is scarce; some gold is found in the E. part. There are numerous horses and cattle, and very large flocks of sheep. Staples, wheat, barley, wool, and mill-products. Cap. Modesto. Area, 1350 sq. m. P. 6499.

**Stanisla'wow,** town of Austria, province of Galicia, on the Bristricza, has several good educational institutions and some manufactures and trade. P. 13,047.

**Stan'ley,** county of S. W. North Carolina, bounded by Yadkin and Rocky rivers, and watered by their affluents. The surface is mountainous, the soil usually fertile, and considerable quantities of gold and silver have been found. Staples, Indian corn, wheat, oats, sweet potatoes, and sorghum-molasses. Cap. Albemarle. Area, about 300 sq. m. P. 8315.

**Stanley,** county of S. W. Dakota, recently formed, and not included in the census of 1870; bounded on the N. E. by Missouri River, and intersected by Big Cheyenne and Titon rivers. It has in general a rolling surface.

**Stanley,** tp., Warwick co., Va. P. 548.

**Stanley** (ARTHUR PENRHYN), D. D., LL.D., son of Bishop Edward and nephew of the first Baron Stanley of Alderley, b. at Alderley, Cheshire, Dec. 13, 1815; was a favorite student of Dr. Thomas Arnold at Rugby School 1829–34; gained a scholarship at Baliol College, Oxford, 1834; took the Newdigate prize for his English poem, *The Gypsies,* the Ireland scholarship, and a first class in classics (1837); obtained the Latin prize essay 1839 and the English essay and theological prizes 1840; graduated in 1838 at University College, where he was subsequently fellow tutor for twelve years, and examiner 1841; took orders in the Church of England, affiliating himself with the "Broad Church" party; was select preacher to Oxford University 1845–46, secretary to the University commission 1850–52, canon of Canterbury 1851–58, regius professor of ecclesiastical history at Oxford 1856–64, and canon of Christ Church 1858–64; became chaplain to Prince Albert 1854, to Dr. Tait, bishop of London, 1857, and to Queen Victoria and the prince of Wales 1862; declined the archbishopric of Dublin 1863, was installed dean of Westminster Jan. 9, 1864, and was elected lord rector of the University of St. Andrew's Nov., 1874. He made a tour in the East, visiting Egypt and Palestine, 1852–53, and again as chaplain and *cicerone* to the prince of Wales 1862; was prominent as a defender of free thought in the Church of England in the controversies connected with the celebrated *Essays and Reviews* (1861), Bishop Colenso's work on the *Pentateuch* (1862), and the later series of ecclesiastical prosecutions, having invited dissenters to preach, and Prof. Max Müller to lecture, in Westminster Abbey; has been an active promoter of charitable, missionary, and educational enterprises, and of biblical, antiquarian, and scientific researches, and has been for some years regarded as the best representative of the progressive school of British theology. In Dec., 1862, he married Lady Augusta Bruce, daughter of the late earl of Elgin, and the most intimate friend of the queen—a lady whose death in Feb., 1876, was the occasion of extraordinary manifestations of regard for her memory and of sympathy with Dean Stanley, both in England and in the U. S. Author, among many other publications, of *The Life and Correspondence of Thomas Arnold, D. D.* (2 vols. 1844; 8th ed. 1858; 3d American ed., Boston, 1860), *Sermons and Essays on the Apostolic Age* (1847), *The Epistles of St. Paul to the Corinthians, with Critical Notes and Dissertations* (2 vols., 1855; 4th ed. 1876), *Historical Memorials of Canterbury Cathedral* (1855), *Sinai and Palestine, in connection with their History* (1856; 20th ed. 1874); *Lectures on the History of the Eastern Church* (1861; New York, 1862; new ed. 1870), *Lectures on the History of the Jewish Church* (vol. i. 1862; vol. ii. 1865; vol. iii. 1876), *Sermons preached before the Prince of Wales during his Tour in the East* (1863), *Historical Memorials of Westminster Abbey* (1867; 4th ed. 1874), *Essays on Questions of Church and State from 1850 to 1870* (1870), *The Athanasian Creed* (1871), and *Lectures on the History of the Church of Scotland* (1872). He has been a voluminous contributor to reviews and periodicals; furnished a valuable series of biblical biographies to Dr. William Smith's *Dictionary of the Bible;* and has published many notable sermons, of which that delivered at the funeral of Sir Charles Lyell in Westminster Abbey

Feb. 27, 1875, was remarkable for its hearty recognition of the services of that geologist in having, as he believed, scientifically established the facts in regard to the creation of the earth and of man. He is a member of the new translation company for the revision of the Bible.

PORTER C. BLISS.

**Stanley** (DAVID SLOANE), b. at Chester, Wayne co., O., June 1, 1828; graduated from the U. S. Military Academy July 1, 1852, when appointed brevet second lieutenant in the 2d Dragoons. As a cavalry officer he served almost constantly on frontier duty, being frequently engaged with hostile Indians, and in 1859 was complimented by Gen. Scott in general orders for a successful fight with the Camanches. On the outbreak of the civil war in 1861 he had attained the rank of captain in the 1st Cavalry, then stationed in the Indian territory, and which was successfully withdrawn in May to Fort Leavenworth. Stanley was at once sent to the field of active operations in Missouri, and Sept. 28 was commissioned a brigadier-general of volunteers, and commanded the second division of the army of the Mississippi at the capture of Island No. 10; in the Corinth campaign, including the battle of Farmington and pursuit of the enemy upon the evacuation of Corinth; at the battles of Iuka (Sept. 19) and Corinth (Oct. 3–4). In Nov., 1862, he was appointed chief of cavalry of the army of the Cumberland, and the same month promoted to be major-general of volunteers, and was engaged in the battle of Murfreesboro', the Tullahoma campaign, including the action of Shelbyville and the frequent minor engagements and skirmishes of that army until Sept., 1863, when compelled by sickness to take a short leave. Returning to duty in November, he was assigned to the first division of the 4th army corps, succeeding to command of the corps July, 1864, which he held until the close of the war. In Sherman's invasion of Georgia he bore a conspicuous part in the severe and almost constant fighting from Dalton to Atlanta, being wounded at the battle of Jonesboro' (Sept. 1), the day preceding the occupation of the latter place. During the month of October his command was engaged in pursuit of Hood's army until the 27th, when it was detached from the army of Gen. Sherman to strengthen Gen. Thomas at Nashville, to whom was entrusted the duty of opposing an invasion of Tennessee. With numerous skirmishes the 4th and 23d corps had arrived at Franklin, Tenn., Nov. 30, where, being closely followed by the enemy, a stand was made and a notable victory gained. During the fight Gen. Stanley was severely wounded, and disabled for two months. He was brevetted lieutenant-colonel, colonel, brigadier-general, and major-general for gallantry in battle. On the 1st of Feb., 1866, he was mustered out of the volunteer service, and resumed his commission in the regular army, he having become major of the 5th Cavalry in 1863. In the reorganization of the army in 1866 he was appointed to the colonelcy of the 22d Infantry. In 1872–73 he commanded an expedition upon the Yellowstone River.

**Stanley** (EDWARD), D. D., F. R. S., brother of the first Baron Stanley of Alderley, b. in London, England, Jan. 1, 1779; graduated at St. John's College, Cambridge, 1802; took orders in the Church of England; was rector of Alderley, Cheshire, from 1805 to 1837, when he was made bishop of Norwich, in which post he displayed energy and zeal as a liberal and a reformer. D. in Scotland Sept. 6, 1849. Author of *A Familiar History of Birds, their Nature, Habits, and Instincts* (2 vols., 1835; 8th ed. 1865), and of numerous miscellaneous publications, and contributed to *Blackwood* and the *British Magazine*. After his death appeared *Addresses and Charges* (1851), with a *Memoir* by his son, Rev. (now Dean) Arthur P. Stanley. Bishop Stanley had filled the posts of president of the Linnæan Society and vice-president of the British Association.

**Stanley** (EDWARD), b. at Newberne, N. C., early in the present century; studied at the military academy at Middletown, Conn.; became a lawyer; was a member of the State legislature of North Carolina; a Representative in Congress 1836–42, and again 1849–53, serving on the committee on ways and means, and distinguishing himself as a debater. He went to California in 1853; entered upon the practice of law, and in 1857 was the unsuccessful Republican candidate for governor. In 1862 he was appointed by Pres. Lincoln military governor of North Carolina, in which capacity he acted for several months, when he resigned and returned to California. D. at San Francisco July 26, 1872.

**Stanley** (EDWARD JOHN), SECOND BARON STANLEY OF ALDERLEY, b. at Alderley Park, England, Nov. 13, 1802; studied at Eton; graduated at Christ Church, Oxford, 1823; entered Parliament as a Liberal 1831; was under-secretary of state for the colonies 1833–34; patronage secretary of the treasury 1835–41, paymaster-general of the forces several months in 1841; under-secretary of state for foreign affairs in the Russell administration 1846–51; was raised to the House of Peers as Baron Eddisbury 1848; succeeded to his father's title 1850; held the conjoint offices of paymaster of the forces and vice-president of the board of trade a few weeks in 1852, and again 1853–55; was president of the board of trade 1855–58, and postmaster-general 1860–66. D. in London June 16, 1869.—His son, HENRY EDWARD JOHN, third Baron Stanley of Alderley, b. July 11, 1827, was employed many years in the diplomatic and consular service, and is author of *Rouman Anthology, a Collection of the National Ballads of Moldavia and Wallachia* (Hertford, 1856), *The East and the West, Our Dealings with our Neighbors* (London, 1865), and other works.

**Stanley** (E. H. SMITH). See DERBY, EARLS OF.

**Stanley** (HENRY M.), b. near Denbigh, Wales, in 1840, of humble parentage; he was placed in the poorhouse, where he remained until his thirteenth year, after which he taught in a school, and subsequently shipped as cabin-boy for New Orleans, where he was adopted by a merchant, whose name he assumed instead of his own, which was JOHN ROWLANDS. His adoptive father having died without a will, and the civil war breaking out, he enlisted in the Confederate army; was taken prisoner; volunteered in the U. S. navy, and became acting ensign on an iron-clad. After the close of the war, he went as a newspaper correspondent to Turkey and Asia Minor, and in 1868 accompanied the British expedition to Abyssinia as correspondent of the New York *Herald*, a portion of his correspondence being subsequently embodied in a volume. In Oct., 1869, being then in Spain, he was employed by the *Herald* to head an expedition to learn the fate of Livingstone, the African explorer, from whom only vague intimations had been heard for two years. He reached Zanzibar in Jan., 1871, and toward the end of March set out for the interior, with a company of 192 men. In November he found Livingstone, who was living near LakeTanganyika, whom he furnished with supplies for further explorations. After having explored the N. portion of the lake, Stanley set out on his return journey in Mar., 1872, reaching England in July, where he was received with distinguished honor, the queen sending him a gold snuff-box set with diamonds, and the Royal Geographical Society awarding to him in 1873 its "patron's medal." Under the title *How I Found Livingstone* he published in Nov., 1872, an account of this expedition, which appeared simultaneously in London and New York. Tidings having been received of the death of Livingstone in Central Africa, Stanley was placed at the head of an expedition, the cost of which was jointly undertaken by the New York *Herald* and the London *Telegraph*, to explore the lake-region of Equatorial Africa. He left the coast in Nov., 1874, at the head of 300 men, and after many hardships and some severe contests with the natives, reached Lake Victoria N'yanza Feb. 27, 1875, having in the mean time lost 194 men by death and desertion. He circumnavigated the lake in a boat which he had brought with him in pieces, and found it to be a single large lake, and not, as supposed by Burton and Livingstone, a group of lagoons, thus confirming the opinions of Speke and Grant. Up to this point his despatches to the *Herald* and *Telegraph* detail his proceedings. He started Apr. 17, 1875, to continue his explorations in the direction of Lake Albert N'yanza, since which time, up to June, 1876, only brief and indirect intelligence has been received respecting him.

A. H. GUERNSEY.

**Stanley** (J. M.), b. at Canandaigua, N. Y., in 1814; became a portrait-painter at Detroit in 1835, practising his profession in various places, and occupying much of his time in long journeys and residences among the Indian tribes for the purpose of painting the portraits of their principal chiefs. From 1851 to 1863 he resided at Washington, where his collection of Indian portraits and other pictures was one of the attractions of the Smithsonian Institution; these were destroyed by fire in Jan., 1865, after which he again took up his residence in Detroit.

**Stanley** (JOHN), b. in England in 1713; lost his sight by an accident at the age of two years, but evinced such extraordinary aptitude for music that at the age of eleven he was elected over many competitors organist of All Hallows church, Bread street, London, and two years later of St. Andrew's, Holborn; became organist to the Middle Temple 1734, and master of the king's band 1779; was for many years the conductor of the celebrated Lent oratorios at Drury Lane Theatre, and published many songs, cantatas, and voluntaries which were widely popular. D. in London May 19, 1786.

**Stanley** (JOHN THOMAS), FIRST BARON STANLEY OF ALDERLEY, b. at Alderley, Cheshire, England, in 177–, being the eldest son of Sir John Thomas Stanley, Bart., the representative of an ancient Cheshire family, descended from the earls of Derby; was for many years an active Whig

member of Parliament, rendering services for which he was created Baron Stanley of Alderley in 1839. D. in 1850.

**Stanley** (THOMAS), b. at Comberlow, Hertfordshire, England, in 1625; was carefully educated at home; graduated M. A. at Pembroke Hall, Cambridge, 1641; travelled on the Continent; studied law at the Middle Temple; published in 1647 a volume of *Poems and Translations* (from Anacreon, Bion, Moschus, etc.), frequently reprinted; issued his chief work, *The History of Philosophy, containing the Lives, Opinions, Actions, and Discourses of the Philosophers of every Sect*, in 4 vols., at intervals between 1655 and 1662 (2d ed. folio, 1687; best ed., with *Life* of the author, 4to, 1743), and in 1663 his elaborate edition of *The Tragedies of Æschylus*, with Latin translation, Greek scholia, and commentary, which long maintained its ground among English scholars. D. in London Apr. 12, 1678. A *Memoir* by Sir Egerton Brydges was prefixed to a modern edition of Stanley's *Poems* (1814).

**Stan'nard,** p.-v. and tp., Caledonia co., Vt. P. 228.

**Stannic Acid.** See TIN.

**Stanovoi' Mountains,** a wild and rugged chain of mountains in North-eastern Asia, rising in lat. 50° N., lon. 110° E., forming the boundary between Siberia and the Chinese provinces of Mongolia and Mantchooria, and continuing along the Sea of Okhotsk to Behring Strait. As far N. as lat. 55° they are clad with forests; N. of lat. 65° they are covered with snow. Their eastern part is generally called the Yablonoi Mountains, and is very rich in metals.

**Stans'bury** (HOWARD), b. in New York Feb. 8, 1806; became a civil engineer; was engaged in surveys of Western rivers, and in 1835 was in charge of several public works in Indiana; was appointed first lieutenant of topographical engineers in 1838, captain in 1840, and major in 1861. In 1841 he was employed in the survey of the great lakes; in 1842–45 had charge of the survey of the harbor of Portsmouth, N. H.; in 1847 of the construction of the large iron lighthouse on Carysfort Reef, Fla.; in 1849–51 was a member of the Great Salt Lake expedition, of which he prepared an admirable report; in 1852–53 was employed upon the lake harbors; in 1856 was assigned to the charge of military roads in Minnesota; and subsequently was mustering and disbursing officer at Madison, Wis., where he d. Apr. 17, 1863.

**Stan'sfeld** (JAMES), b. at Halifax, England, in 1820; educated at University College, London; was called to the bar at the Inner Temple 1849; was elected member of Parliament for Halifax as an advanced Liberal Apr., 1859; was appointed a lord of the admiralty Apr., 1863; resigned that position Apr., 1864, in consequence of an official disapproval of his friendship with the patriot Mazzini, whose revolutionary plans in regard to King Victor Emmanuel had just been discovered; was under-secretary of state a few months in 1866; became third lord of the treasury Dec., 1868, one of the joint-secretaries to the treasury Oct., 1869, president of the poor-law board Mar., 1871, and was president of the new "local government board" from Aug., 1871, until the resignation of Gladstone's cabinet, Jan., 1874.

**Stan'stead,** county of Quebec, Canada, bounded S. by Vermont and W. chiefly by Lake Memphremagog. It is generally fertile, and possesses much mineral wealth. Cap. Stanstead Plain. P. 13,138.

**Stanstead,** or **Stanstead Plain,** a port of entry, cap. of Stanstead co., Quebec, Canada, on Massawippi Valley and South-eastern Railway, 5 miles N. of North Derby, Vt., to which a branch railroad runs. It has some fine public buildings, a public library, a branch bank, a weekly newspaper, an insurance company, and a seminary. Mineral paint (a soft talcose slate) and fine granite are found here. P. of Stanstead Plain, 574; of Stanstead sub-district, 4022.

**Stan'ton,** county of S. W. Kansas, not organized or included in the census of 1870. It borders on Colorado River, and is drained by tributaries of the Arkansas. The surface is generally rolling. Area, about 720 sq. m.

**Stanton,** county of N. E. Nebraska, intersected by Elkhorn River. It consists for the greater part of rolling prairies, adapted to the production of wheat, corn, and other grains, and for grazing. Cap. Stanton. Area, 432 sq. m. P. 636.

**Stanton,** tp., Champaign co., Ill. P. 1088.

**Stanton,** tp., Plymouth co., Ia. P. 356.

**Stanton,** tp., Linn co., Kan. P. 528.

**Stanton,** p.-v. and tp., Miami co., Kan. P. 844.

**Stanton,** p.-v., cap. of Powell co., Ky., on Red River. P. 73.

**Stanton,** p.-v., cap. of Montcalm co., Mich., at N. terminus of Stanton branch of Detroit Lansing and Lake Michigan R. R., is chiefly in Day tp., but partly in Douglass, Evergreen, and Sidney tps., and has 1 weekly newspaper. P. 600.

**Stanton,** p.-v. and tp., cap. of Stanton co., Neb., on Elkhorn River, has 1 weekly newspaper.

**Stanton,** p.-v., Haywood co., Tenn., on Memphis division of Louisville Nashville and Great Southern R. R.

**Stanton** (EDWIN MCMASTERS), b. in Steubenville, O., Dec. 19, 1814; admitted to the bar in 1836; reporter of the supreme court of Ohio 1842–45, reporting vols. xi.–xiii. of *Ohio Reports*. In 1845 he successfully and with distinction defended in the criminal court at Washington Caleb J. McNulty, clerk of the House of Representatives, tried for embezzlement. In 1847, Mr. Stanton became the law-partner at Pittsburg, Pa., of Hon. Charles Sharler. He first acquired national reputation as a lawyer in the important case of The State of Pennsylvania *vs.* The Wheeling Bridge Company, involving the question whether control of bridges over navigable rivers of the West flowing between the several States is vested by the Constitution in Congress or the State legislatures. Virginia had authorized the erection across the Ohio at Wheeling of a suspension bridge which would obstruct or retard the passage of first-class river-steamers owned largely at Pittsburg. To avoid irresistible prejudice in Virginia in favor of the bridge, Mr. Stanton conceived the project of making the State of Pennsylvania plaintiff in a suit against the bridge company, on the ground of the State's ownership of canals terminating on the river, the value of which would be injured by obstructing the navigation of the Ohio, and of thus obtaining original jurisdiction in the U. S. Supreme Court. It was decided that Pennsylvania's interest in the controversy gave her standing in that court, and that regulation of bridges over navigable rivers of the West is vested in Congress, exclusive of State control. Successive arguments in the case by Mr. Stanton were so marked by legal learning, logic, and eloquence that at once, and at a comparatively early age, he took place in the front rank of national lawyers. In 1856 he removed to Washington to attend to his practice before the U. S. Supreme Court. Among other important cases at this period, he was counsel for defendant in McCormick *vs.* Manny, a suit for infringement of McCormick's reaper patent, which involved a quarter of a million of dollars, and the question whether by certain improvements in details a monopoly of the entire machine could be appropriated. McCormick's claims were successfully resisted, and in consequence of the declaration of law in this case hundreds of improvers of the reaping-machine immediately entered the field, and the art has since been developed far beyond almost any other kindred to it. In 1858, Mr. Stanton went to California, and remained nearly a year as counsel for the U. S. in certain land cases involving many millions of dollars. Besides carrying to a successful issue those cases to which his employment especially related, Mr. Stanton's services were invaluable in the collection, collation, and translation of Mexican archives. Many of the most important archives were scattered over California in the custody of unauthorized officers, in the possession of private individuals, or in boxes which nobody guarded and which had never been opened. Their value either historically or as evidence in land cases had been almost wholly unknown, but was promptly perceived by Mr. Stanton, who at once took steps for their collection and collation. The archives collected through his efforts furnished conclusive evidence of an organized system of fabricating land-titles carried on for a long time in California. The value of lands claimed under forged grants was estimated at not less than $150,000,000. Large agricultural tracts, some of the richest mines in the world, and the sites of government buildings, of fortifications, and of whole cities, including San Francisco and Sacramento, were claimed under alleged grants from Mexico, forged with consummate skill and boldness, and so well supported by documentary evidence and oral testimony of distinguished officials under the former government that local tribunals of the U. S. in California had acted favorably on many of the claims. Afterward, however, these archives furnished the means of distinguishing valid from forged grants, and enabled a successful defence to be made to every fraudulent claim.

In Dec., 1860, after Mr. Lincoln's election, and before his inauguration, and when active preparations were making for secession, and the indications as to the political future of the country were appalling, Mr. Cass, then secretary of state, suddenly resigned, and Mr. Black, then attorney-general, succeeded him. Mr. Stanton, then in Cincinnati arguing a case before the U. S. circuit court, was appointed attorney-general. Acceptance of the office

involved relinquishment of profitable professional business and assumption of great responsibility, with little prospect of personal distinction. Mr. Stanton had never desired office, nor had he rendered to Mr. Buchanan's administration or party services calling for political preferment. Mr. Buchanan at that time was not so solicitous about conferring political rewards as he was anxious concerning immunity from calamity and disgrace for his administration during its few remaining perilous months. Mr. Stanton's personal and professional qualifications were needed. He accepted the office, and in it his attitude was that of resolute maintenance of national honor and determined opposition to treason, then organizing and arming. Every department then contained traitors and spies; only a handful of U. S. troops was assembled at Washington, and the residents of the capital were mainly in sympathy with secession. To a greater extent probably than any of his associates in the cabinet, Mr. Stanton perceived the danger of an attempt by force and treachery to prevent Mr. Lincoln's inauguration, to seize and hold the capital and insignia of government for the seceding States, and to thus exhibit the latter to the world as a government *de facto*, succeeding to the power and authority of the U. S. Always intense in conviction and earnest in action, he appreciated thoroughly the existence of this peril, and made, and stimulated others to make, preparation against such fatal occurrences. On Mar. 4, 1861, Mr. Stanton retired with the outgoing administration and resumed his profession. After the civil war had existed several months, patriotic citizens and eminent capitalists, without Mr. Stanton's knowledge, urged Pres. Lincoln to place him in charge of the war department. Their motives and arguments were again not political, but proceeded from conviction that Mr. Stanton had the needed nerve, force, judgment, and integrity. On Jan. 20, 1862, he became secretary of war. Excepting a brief meeting in 1857 in Cincinnati, in a lawsuit in which they were both of counsel, there had previously been no intercourse between Mr. Lincoln and Mr. Stanton; but after the latter entered the war department, their mutual friendship and confidence grew with every day. The characteristics of Mr. Stanton's administration were integrity, energy, determination, singleness of purpose, and capacity to comprehend the magnitude of the rebellion and the labor and cost in blood and treasure involved in suppressing it. He believed that the end of the rebellion would come only by exhausting and crushing the forces and resources of the enemy. Exercising indefatigable industry, courage, and self-devotion himself, he visited the slightest indolence, indifference, or cowardice in others with punishment prompt and severe. Honest to the last degree himself, he required the utmost integrity from others.

After Mr. Lincoln's assassination and Mr. Johnson's accession to the Presidency, Mr. Stanton was connected with the latter's administration for three years. He supported many measures which were vetoed by the President and re-enacted by Congress, including those for the establishment of the Freedmen's Bureau, for protection of civil rights, for admission of Colorado as a State, for organization of governments in insurrectionary States, and for conferring suffrage without regard to color in the District of Columbia. These differences of opinion, and the continued adherence of Mr. Stanton to the Republican party, and the President's separation from and aggressive hostility toward it, led the President on Aug. 5, 1867, to notify Mr. Stanton that public considerations of a high character constrained him to request the latter's resignation; to which Mr. Stanton answered that public considerations of a high character, which alone had induced him to remain at the head of the department, constrained him not to resign before the next meeting of Congress. On Aug. 12 the President notified him of his suspension from office. After Congress convened, the Senate refused by a vote of 35 to 6 its concurrence in the suspension. Having received official information of this from the Senate, Mr. Stanton on the next day (Jan. 13, 1868) resumed his office. On Feb. 21, 1868, the President undertook to remove him and to appoint Lorenzo Thomas secretary of war *ad interim*. The Senate, being on the same day officially informed by the President of this action, resolved that under the Constitution and laws the President had no power to remove the secretary of war and designate another officer to perform the duties of that office, and officially communicated this resolution to Mr. Stanton. The House of Representatives immediately decided to impeach the President. In consequence of this action of both houses of Congress, and the general apprehension of revolutionary purposes on the part of the President, Mr. Stanton refused to relinquish control of his department. The President's trial under articles of impeachment followed. A vote was reached on May 26, and 35 Senators voted for conviction, and 19 for acquittal; so that two-thirds not having found the President guilty, he was acquitted. A single vote would have changed the result. Mr. Stanton immediately relinquished his office. The Senate on May 28 again resolved that Mr. Stanton had not been legally removed, and based its confirmation of his successor, Gen. Schofield, upon Mr. Stanton's voluntary retirement. Soon afterward both Houses of Congress passed a vote of thanks to him for his great ability, purity, and fidelity.

With his health shattered by his labors in the war department he resumed his profession and argued several important cases. The last was Whitney *vs.* Mowry, an important patent cause, which, in consequence of Mr. Stanton's feeble health, was heard by Judge Swayne in Mr. Stanton's own library two weeks before the latter's death. The physical pain silently endured during the hearing of this cause exhausted his strength and hastened the progress toward his heart of the dropsy from which he was then suffering. He never again left his chamber. On Dec. 20, 1869, he was nominated by Pres. Grant as an associate justice of the U. S. Supreme Court, and was immediately confirmed by the Senate. But on Dec. 24, and before he had entered upon the duties of a member of that court, he died of the dropsy. The disease was due to the general breaking down of an overworked constitution, and its fatal progress was exceedingly rapid. J. K. Barnes.

**Stanton** (Elizabeth **Cady**), b. at Johnstown, N. Y., Nov. 12, 1815, daughter of Judge Daniel Cady and Margaret Livingston; educated at the Johnstown Academy, where she studied with a class of boys; was fitted for college at the age of fifteen, when she pursued her studies at Mrs. Willard's seminary at Troy; had her attention turned to the disabilities of sex by her own educational experience and through a study of Blackstone, Story, and Kent; married, in 1840, to Henry B. Stanton; accompanied him to the World's Anti-Slavery convention at London; there made the acquaintance of Lucretia Mott; resided at Boston until 1847, when they settled at Seneca Falls, N. Y.; with Lucretia Mott signed the call for the first woman's rights convention, which met at her place of residence July 19–20, 1848, on which occasion the first formal claim of suffrage for women was made; addressed the New York legislature in 1854 on the rights of married women, in 1860 in advocacy of divorce for drunkenness, and in 1867 both the legislature and the constitutional convention, maintaining that during the revision of the constitution the State was resolved into its original elements, and that *all* the citizens had therefore a right to vote for members of that convention. Since 1869 she has frequently addressed Congressional committees and State constitutional conventions. She canvassed Kansas in 1867, and Michigan in 1874, when the question of woman suffrage was submitted in those States; was one of the editors of *The Revolution*. Most of the calls and resolutions for conventions, addresses to women, legislatures, and Congress, have been from her pen. She was president of the national committee 1855–65, of the Woman's Loyal League 1863, and of the National Association until she withdrew in 1873, and elected to do the honors of the association this year. She now (1876) resides in Tenafly, N. J. Susan B. Anthony.

**Stanton** (Henry Brewster), b. at Griswold, Conn., June, 1805; educated at Lane Seminary, O., while Dr. Lyman Beecher was its president; was closely identified with the anti-slavery cause from 1833 till the adoption of the 15th Amendment to the Constitution; was secretary of the World's Anti-Slavery Convention at London 1840, whereof Thomas Clarkson was president; admitted to the bar 1842 at Boston, Mass.; practised there with great success six years, when he removed to Seneca Falls, N. Y.; was elected to the New York senate 1849, and re-elected 1851; deputy collector of New York 1861; practised law twelve years in that city; author of *Reforms and Reformers of Great Britain and Ireland* (New York, 1849; London, 1853); fifteen years a leading editorial contributor to the New York *Tribune* and the New York *Sun;* a large contributor to prominent literary periodicals; an eloquent orator and able writer. On the mother's side he is a lineal descendant of William Brewster, the Pilgrim.

**Stantons'burg,** tp., Wilson co., N. C. P. 1007.

**Stan'wix** (John), b. in England about 1690; entered the British army 1706; served as an officer of grenadiers and marines; became lieutenant-colonel 1745; equerry to Frederick, prince of Wales, 1749; was governor of Carlisle and its representative in Parliament 1750; became deputy quartermaster-general of the forces 1754; was made colonel commanding the first battalion of the 60th regiment (Royal Americans) Jan. 1, 1756; was in command of the southern district of the American colonies, with head-quarters at Carlisle, Pa., 1757; was appointed brigadier-general Dec. 27, 1757; was relieved by Gen. Forbes early in 1758, and

entrusted (1758) with the erection of the important fortress known as Fort Stanwix at the "Oneida carrying-place" (now Rome) on Mohawk River, at an expense of £60,000, as a defence against incursions from the French in Canada; returned to Pennsylvania; was appointed major-general June 19, 1759; repaired and fortified the old fort Du Quesne at Pittsburg, conciliating the good-will of the Ohio Indians; resigned his commission in America to Gen. Monckton May 4, 1760, and returned to England; was appointed lieutenant-general Jan. 19, 1761; was made lieutenant-governor of the Isle of Wight and colonel of the 8th Foot, and was elected member of Parliament for Appleby. He was lost at sea in Dec., 1765, while crossing the Irish Channel from Dublin to Holyhead.

**Stan'wood,** p.-v., Fremont tp., Cedar co., Ia., on Iowa division of Chicago and North-western R. R. P. 257.

**Stan'yhurst** (Richard), b. in Dublin about 1545; educated at University College, Oxford; studied law; returned to Ireland; married, became a Roman Catholic, and went to the Continent. On the death of his wife became a priest, and was appointed chaplain to Archduke Albert, governor of the Spanish Netherlands. D. at Brussels in 1618. He translated into English heroic verse *The First Foure Bookes of Virgils Æneis* (1583); furnished a *Description of Ireland* to Holinshed's *Chronicles;* wrote historical treatises (in Latin) on Ireland, and English and Latin theological works.

**Stapelia.** See Carrion Flowers.

**Staphylea.** See Bladder-Nut.

**Staphylinidæ.** See Rove Beetles.

**Sta'ples** (William Read), LL.D., b. at Providence, R. I., Oct. 10, 1798; graduated at Brown University in 1817; was admitted to the bar in 1819; was associate judge of the supreme court of the State 1835–54, and chief-justice 1854–56. He was one of the founders of the Rhode Island Historical Society; for many years its secretary and librarian, and a vice-president at his death, also editing the 20 vols. of its *Collections,* to the 5th vol. contributing the *Annals of Providence.* Besides historical monographs, he published the *Rhode Island Book of Forms* (1859), and left unfinished a *History of the Criminal Law in Rhode Island, Rhode Island in the Continental Congress,* and a *History of the State Convention of 1790,* since published. D. at Providence Oct. 19, 1868.

**Sta'pleton,** p.-v. and tp., Chickasaw co., Ia. P. 800.

**Stapleton,** p.-v., Richmond co., N. Y., in lat. 40° 39′ N., lon. 74° 04′ W., 8 miles S. of New York City, on Staten Island, contains 10 churches, a circulating library, 2 public schools, 1 private institute, water and gas works, paved streets, an infirmary, the Seamen's Retreat, Old Ladies' Home of the Mariner's Industrial Society, 1 savings bank, Keutgen Observatory, 6 large breweries, an efficient police force, several manufactories, a shot-tower, 3 newspapers, and the health officer's station. The heights are occupied by elegant mansions, and a horse railway passes through the principal streets. P. about 10,000.

W. C. Anderson, Ed. "Richmond Co. Gazette."

**Stapleton** (Sir Robert), LL.D., b. at Carleton, Yorkshire, England, about 1615; was educated in the Roman Catholic college at Douay, France, but became a Protestant on his return to England; became gentleman usher to the prince of Wales, afterward Charles II.; fought at Edgehill under Charles I., by whom he was knighted; accompanied Charles II. on his entry into London 1660, and was munificently rewarded for previous sufferings on account of his loyalty to the Stuarts. D. July 11, 1669. He translated *Musæus* (1645), *Juvenal* (1647), Strada's *Belgic War* (1650), and Pliny's *Panegyric* (1664), and wrote comedies and poems.

**Stapleton** (Thomas), D. D., b. at Henfield, Sussex, England, in 1535; educated at Canterbury and Winchester schools and at New College, Oxford, where he was admitted perpetual fellow 1554; took orders in the Church, turned Roman Catholic; was appointed by Queen Mary prebendary of Chichester; retired on the accession of Elizabeth to Louvain, where he acquired publicity by writing as a Roman Catholic against Jewel, Horne, Whitaker, and other Protestant divines; became regius professor of divinity at the University of Douay and canon of the church of St. Armoure; was for a short time a Jesuit; returned to Louvain, where he was appointed divinity professor, canon of St. Peter's, and dean of Hilverbec, near Bois-le-Duc. D. at Louvain Oct. 12, 1598. Among his works were an English translation of Bede's *History of the Church of England* (Antwerp, 1565), *Propugnaculum Fidei Primitivæ Anglorum* (1565), *Principiorum Fidei Doctrinalium* (Paris, 1579), *Tres Thomæ,* etc. (1588), being "parallel lives" of Thomas the apostle, Thomas à Becket, and Sir Thomas More, *Promptuarium morale* (Antwerp, 4 vols., 1593), and *Promptuarium Catholicum* (1622). A complete edition of his *Works* appeared at Paris (4 vols. folio, 1620).

**Star.** See Stars, by P. A. Secchi.

**Star Anise.** See Anise.

**Star'-Apple,** the large, handsome, and agreeable fruit of *Chrysophyllum cainito,* a West Indian shrub of the order Sapotaceæ.

**Staray'a Rus'sa,** town of European Russia, government of Novgorod, on the Polista, has an imperial palace and rich salt springs. P. 8700.

**Starch, Fecula, Amidon, Amylum,** or **Stärke** ($C_6H_{10}O_5$ or $C_{12}H_{20}O_{10}$), a substance widely diffused in the vegetable kingdom, being found in almost every plant, at least at some period of its development. It is especially abundant in some families of plants, and often occurs in large quantities in the seeds, pith, stalks, bark, bulbs, tubers, roots, etc. The following table, by Dr. Dragendorff, taken from S. W. Johnson's *How Crops Grow,* shows the proportion of starch in a few vegetable products. The quantities are, however, somewhat variable. Since the figures below mostly refer to air-dry substances, the proportions of hygroscopic water are also given, the quantity of which, being changeable, must be taken into account in making any strict comparisons:

*Amount of Starch in Plants.*

| | Water, per cent. | Starch, per cent. |
|---|---|---|
| Wheat | 13.2 | 59.5 |
| Wheat flour | 15.8 | 68.7 |
| Rye | 11.0 | 59.7 |
| Oats | 11.9 | 46.6 |
| Barley | 11.5 | 57.5 |
| Timothy-seed | 12.6 | 45.0 |
| Rice (hulled) | 13.3 | 61.7 |
| Peas | 5.0 | 37.3 |
| Beans (white) | 16.7 | 33.0 |
| Clover-seed | 10.8 | 10.8 |
| Flaxseed | 7.6 | 23.4 |
| Mustard-seed | 8.5 | 9.9 |
| Colza-seed | 5.8 | 8.6 |
| Teltow turnips | dry substance. | 9.8 |
| Potatoes | dry substance. | 62.5 |

There are two other substances found in plants which resemble starch in many respects—the inuline which occurs in the dahlia, elecampane, dandelion, chicory, mustard-seed, etc., and the lichen starch which is found in Iceland moss, carrageen moss, and several of the lichen and fucus tribes of plants. (See Inuline and Lichenine.) A substance supposed to be starch has been observed in certain parts of the animal body. Granules, which after being moistened with oil of vitriol turn blue on the addition of iodine, occur in the brain, spleen, liver, kidneys, and mucous membranes. This is, however, not true starch; it contains nitrogen, and does not yield sugar when heated with dilute acids. A substance exhibiting the physical and chemical characters of starch has been found in the yolk of hen's eggs and in the testicles. Glycogen (which see), the sugar-forming substance of the liver, has the composition and many of the properties of starch.

*Preparation.*—Starch is extracted from a great variety of plants, chiefly from wheat, Indian corn, rice, potatoes, the root of manioc or cassava, *Jatropha manihot* (tapioca), the root of several species of the *Maranta* (arrowroot), and the pith of a great variety of palms (sago). (For an elaborate article on the edible starches of commerce by P. L. Simmonds see *Am. Chemist,* iv., Sept., 1873, p. 93.)

*Wheat Starch.*—Wheat flour contains from 50 to 80 per cent. of starch. Polson gives the following as the composition of samples of the entire wheat:

| | Old American. | New Scotch. |
|---|---|---|
| Water | 10.8 | 14.8 |
| Starch | 62.3 | 56.9 |
| Fat | 1.2 | 1.2 |
| Cellulose | 8.3 | 12.4 |
| Gum and sugar | 3.8 | 5.3 |
| Gluten, albumen, etc | 10.9 | 7.0 |
| Ash | 1.6 | 1.5 |
| | 98.9 | 99.1 |

The starch is extracted from the whole wheat by "softening" in cold water and pressing under millstones or rollers, or in bags under water, as long as milky water runs off from it. This liquid, when left to itself, deposits starch containing gluten; the latter, however, dissolves for the most part in the supernatant liquid, which gradually turns sour; and on decanting this acid liquid, repeatedly stirring up the starch with fresh water, and leaving it to settle, it is at length obtained pure, and may be dried in suitable desiccating chambers. Or wheat flour is mixed with 4 to 5 volumes of water, and $\frac{1}{8}$ to $\frac{1}{10}$ volume sour water obtained from former operations: this sets up a fermentation, which lasts from two to four weeks, according to the temperature,

and is interrupted as soon as the nitrogenized substances are decomposed and dissolved. The sediment of starch, which remains at the end of a fermentation, is repeatedly washed with water, sifted, and dried in desiccating chambers. Starch may be freed from gluten by means of cold dilute potash-ley (*Kirchhoff*) or distilled vinegar (*Saussure*); from pieces of fat and other matter by prolonged treatment with cold water, alcohol, or ether. (Watts's *Dict.*)

*Corn Starch* is extensively manufactured in the U. S. by soaking in water containing caustic soda or hydrochloric acid to dissolve the gluten, grinding, washing on sieves, etc. The manufacture of starch from Indian corn was established in the U. S. by Thomas Kingsford in 1842, while he was superintending the wheat-starch factory of W. Colgate & Co. in New Jersey. In 1848 a factory was built for him at Oswego, N. Y., by a stock company, which by repeated enlargement has reached enormous dimensions. The works occupy about 10 acres, and have a capacity for treating 950,000 bushels of corn per annum. The yield of starch is about 25 pounds per bushel, or nearly 50 per cent. This amounts to a yearly production of 10,300 tons, or 20,600,000 pounds of starch. To pack this starch 300,000 pounds of wrapping-paper are required, and 5,000,000 feet of lumber for boxes. Over 600 operatives are employed in the establishment. The factory is about 615 feet front, partly seven stories high, and contains 12 acres of flooring. There are over 600 cisterns and vats, with a capacity of 2,500,000 gallons, for cleansing and washing the starch; 41 force-pumps are capable of raising 530,000 gallons of water per hour. There are more than 3 miles of gutters for distributing the starch. For grinding the corn 20 pairs of burr-stones and 6 pairs of large heavy iron rollers are used. There are 3 miles of shafting, 20 miles of steam-pipe for drying, 12 turbine water-wheels of 50 horse-power each, with steam-engines sufficient to increase the entire motive-power to 1400 horse-power. The starch is sent to market in three forms: (1) pulverized corn starch, called in England "prepared corn," for culinary use and as food for infants and invalids; (2) refined starch for the laundry; (3) manufacturers' starch for print-works, etc. There is a similar factory at Glen Cove, Long Island, which was established by the Messrs. Duryea in 1858, which is of very nearly the same capacity. The cheapness and excellence of this starch has put an end to the importation of starch from foreign countries, and large quantities are now exported.

*Rice Starch* is largely manufactured in England, France, and Belgium. The rice is first soaked in a weak ley, then ground, and washed on a sieve.

*Potato Starch* is largely manufactured in Europe and in the U. S. Potatoes contain—

| | Fresh. | Dried at 212° F. |
|---|---|---|
| Water | 75.1 | |
| Starch | 21. | 83.8 |
| Albumen, etc | 2.3 | 9.6 |
| Fat | 0.2 | 0.8 |
| Cellulose | 0.4 | 1.7 |
| Salts | 1.0 | 4.1 |
| | 100. | 100. |

"The washed and rasped potatoes are drenched in a sieve with a continuous stream of cold water, and the milky liquid which runs through is set aside for a few minutes till the heavier impurities have settled down, and then left to stand for three or four hours in another pan. The starch which collects at the bottom of the clear liquid is stirred up with water, poured through hair sieves, then left to settle, repeatedly washed with cold water, and dried, first on plates of gypsum, afterward in desiccating chambers." (Watts's *Dict.*) At Stowe, Vt., and Watertown, Mass., there are several factories. A single factory often consumes 20,000 bushels of potatoes annually, averaging 8 pounds of starch per bushel. The land often produces 500 bushels per acre.

*Horse-chestnut Starch* is made in France. A solution of sodic carbonate is used to remove the bitter principle. The yield is about 20 per cent.

(For ARROW-ROOT, SAGO, and TAPIOCA STARCH, see under respective heads.)

*Composition of Commercial Starch.*—The following analyses are given by Wolff:

| | 1. | 2. | 3. | 4. | 5. | 6. |
|---|---|---|---|---|---|---|
| Water | 17.83 | 15.38 | 14.52 | 17.44 | 14.20 | 17.49 |
| Gum | ..... | ..... | 0.10 | traces. | 1.84 | 4.96 |
| Fibre | 0.48 | 0.50 | 1.44 | 1.20 | 3.77 | 2.47 |
| Ash | 0.21 | 0.53 | 0.03 | 0.40 | 0.55 | 1.29 |
| Starch | 81.48 | 83.59 | 83.91 | 81.32 | 79.63 | 73.79 |
| | 100. | 100. | 100. | 100. | 100. | 100. |

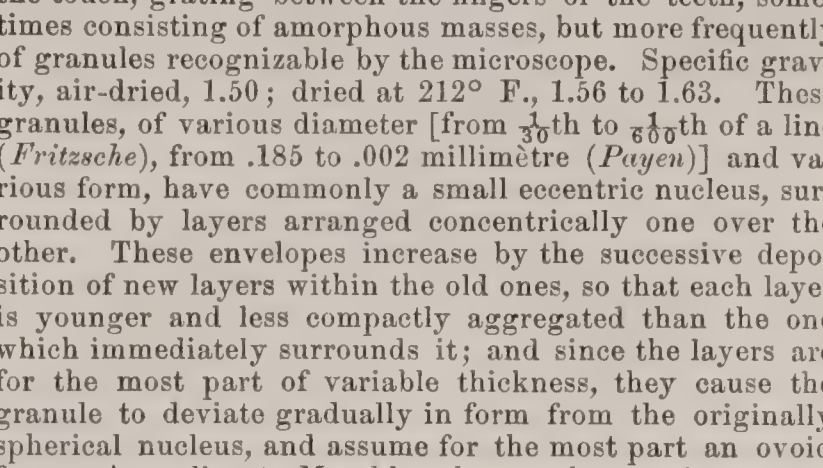
1, the finest white patent starch in stalks, of a bright and crystalline appearance, made from pure potato starch; 2, the finest blue patent starch, potato starch colored with ultramarine; 3, pure wheat powder; 4, fine wheat starch in pieces; 5, medium fine wheat starch in yellowish-white pieces; 6, ordinary wheat starch in grayish-yellow coarse pieces, that upon microscopic examination appear as a mixture of potato and wheat starch. (Wagner's *Tech.*) The following analyses were made by John Dean, Ph. D. (*Proc. Am. Acad. Arts and Sci.*, Apr., 1854):

| | Dried at 212°. Starch, etc. | Gluten, etc. | Ash. | Water. | Loss at 212° Water. |
|---|---|---|---|---|---|
| Corn starch, powder | 94.16 | 0.69 | 0.32 | 4.83 | 16.01 |
| Corn starch, lumps | 92.88 | 2.38 | .42 | 4.32 | 11.88 |
| Tapioca | 95.49 | .61 | .11 | 3.79 | 13.32 |
| Arrow-root | 95.44 | .88 | .21 | 3.47 | 16.51 |
| Sago | 96.65 | .83 | .19 | 2.03 | 12.83 |
| Wheat starch | 94.71 | 1.12 | .51 | 3.66 | 11.28 |
| Rice flour | 88.65 | 8.24 | .49 | 2.62 | 14.01 |
| Macaroni | 86.99 | 9.56 | .95 | 2.50 | 9.90 |
| Prepared potato | 82.77 | 11.09 | 3.99 | 2.15 | 10.07 |
| Farina | 81.23 | 13.52 | .51 | 4.74 | 10.30 |

*Properties.*—"Starch is a white shining powder, soft to the touch, grating between the fingers or the teeth, sometimes consisting of amorphous masses, but more frequently of granules recognizable by the microscope. Specific gravity, air-dried, 1.50; dried at 212° F., 1.56 to 1.63. These granules, of various diameter [from $\frac{1}{30}$th to $\frac{1}{600}$th of a line (*Fritzsche*), from .185 to .002 millimètre (*Payen*)] and various form, have commonly a small eccentric nucleus, surrounded by layers arranged concentrically one over the other. These envelopes increase by the successive deposition of new layers within the old ones, so that each layer is younger and less compactly aggregated than the one which immediately surrounds it; and since the layers are for the most part of variable thickness, they cause the granule to deviate gradually in form from the originally spherical nucleus, and assume for the most part an ovoid form. According to Maschke, the starch-granules appear like bundles of three to six concentric bladders, with light and dark rings, the light rings being formed of insoluble, the dark of soluble starch, and enclosing the central cavity of the innermost bladder, which is either empty, or filled with liquid amylone." (Watts's *Dict.*) Payen gives the greatest diameter of several kinds of starch-grains; the following are a few of his measurements:

| Starch from— | Millimètre. | Inch. |
|---|---|---|
| Large Rohan potatoes | 0.185 | $\frac{1}{137}$ |
| *Canna gigantea* | 0.175 | $\frac{1}{145}$ |
| *Maranta arundinacea* (arrow-root) | 0.140 | $\frac{1}{181}$ |
| Sago | .070 | $\frac{1}{362}$ |
| Wheat | .050 | $\frac{1}{510}$ |
| Maize (Indian corn) | .030 | $\frac{1}{847}$ |
| Beetroot | .004 | $\frac{1}{6369}$ |

S. W. Johnson (*How Crops Grow*) gives the following account of the forms of starch-granules: "In potato starch they are egg or kidney shaped, and are distinctly marked with curved lines or ridges, which surround a point or eye; *a* of figure. Wheat starch consists of grains shaped like a




Starch-granules.

thick burning-glass or spectacle-lens, having a cavity in the centre, *b*. Oat starch is made up of compound grains, which are easily crushed into smaller granules, *c*. In maize and rice the grains are usually so densely packed in the cells as to present an angular (six-sided) outline, as in *d*. The starch of the bean and the pea has the appearance of *e*. The minute starch-grains of the parsnip are represented at *f*, and those of the beet at *g*." The unaltered and the gelatinous starch in a dry state have the same empirical formula, $C_6H_{10}O_5$ or $C_{12}H_{20}O_{10}$. Heated to 160° C., starch is converted into DEXTRINE (which see), first passing through the condition of soluble starch, which is rendered blue by iodine. "Starch, so long as it retains its natural state of aggregation, is insoluble in *water, alcohol,* and *ether;* but when it is placed in contact with *hot water,* the water penetrates between the different layers of which the granules are composed, swelling them up, and forming a gelatinous mass known as *starch-paste,* and used for stiffening linen, etc. If this paste be largely diluted with water, the swollen starch-granules slowly subside, whilst a certain quantity of amylaceous matter remains in solution. When water into which one or two hundredths of starch have been introduced is heated to boiling, the grains swell, and disintegrate till they appear to be dissolved in the water; but

on exposing the liquid to a temperature below zero, the water freezes, and the starch, recovering a certain degree of aggregation, separates from the liquid in the form of small pellicles. When starch is boiled under pressure at about 150°, with from five to fifteen times its weight of water, a thin solution is obtained, which may be filtered from the insoluble portion; this liquid, as it cools, deposits minute spherical granules, which, when dried, have the whiteness of starch without its glistening aspect. These granules are slightly soluble in cold water, but are readily dissolved when the water is heated to 70° or upward. This soluble starch, which is distinguished from dextrine by being turned blue by iodine, and by possessing a greater dextro-rotary power (= 211° according to Béchamp, whereas that of dextrine is 176°), is likewise produced from common starch by the action of *diastase* at ordinary temperatures; by heating it for a certain time with *dilute sulphuric acid;* by heating with *glacial acetic acid* in a sealed tube, or with strong *nitric acid* till red vapors begin to pass off; by boiling with *chloride of zinc;* and by trituration for a short time in the cold with *strong sulphuric acid*. If, however, the action of the diastase takes place at a temperature of 65°–80° (it is completely interrupted by boiling), or if the heating with dilute acids be continued beyond a certain time, the starch is converted into dextrine, and ultimately into dextro-glucose." (Watts's *Dict.*) Starch is converted into dextrine and glucose by the diastase of malt (see DIASTASE and BEER), yeast by saliva, pancreatic juice, gelatine, mucous membrane, urine, bile, spermatic fluid, blood-serum, animal tissue, and by watery infusions of the heart, brain, lungs, liver, kidneys, spleen, and muscles, and by boiling with dilute acids.

"It is generally supposed that in the action of acids or of diastase upon starch the starch is first converted into dextrine by a mere alteration of physical structure, and that the dextrine is then converted into glucose by taking up the elements of water, the second stage of the process occupying a much longer time than the first; but from the experiments of Musculus (*Compt. rend.*, l. 785; liv. 194; *Ann. Ch. Phys.* [3], lx. 208) it appears that both dextrine and glucose are produced at the very commencement of the reaction, and always in the proportion of 1 mol. glucose to 2 mol. dextrine, whence it may be inferred that the molecule of starch contains $C_{18}H_{30}O_{15}$, and that it is resolved into glucose and dextrine by taking up 1 mol. water:

Starch. Glucose. Dextrine.

$$C_{18}H_{30}O_{15} + H_2O = C_6H_{12}O_6 + 2C_6H_{10}O_5.$$

When the conversion is effected by a dilute acid, the dextrine is, after several hours' boiling, completely converted into glucose; but when diastase is used as the converting agent, the production of glucose goes on only so long as there is any unaltered starch still present, the dextrine undergoing no further alteration. These views have been contested by Payen (*Compt. rend.*, liii. 1217; *Ann. Ch. Phys.* [4], iv. 286; *Jahresb.*, 1861, p. 717; 1865, p. 597), who finds that diastase really possesses the power of converting dextrine into sugar, but that the conversion ceases as soon as a certain quantity of sugar has been produced; if, however, the sugar be removed as fast as it is formed, as in alcoholic fermentation, the transformation of the dextrine into sugar recommences, and goes on nearly to completion. Under favorable circumstances of the action of diastase on dextrine a product may be obtained containing more than 50 per cent. of sugar. Musculus, on the other hand (*Ann. Ch. Phys.* [4], vi. 177), adheres to his view of the unalterability of pure dextrine by diastase, and endeavors to show that the formation of sugar observed by Payen was due to the presence of amylaceous substance in the dextrine submitted to experiment. According to O. Philipp (*Bull. Soc. Chim.* [2], viii. 363), dextrine and glucose are not formed in constant proportions in the action of dilute sulphuric acid upon starch, as asserted by Musculus, but the proportion of glucose increases under otherwise equal circumstances with the quantity of acid employed. This, however, is quite in accordance with the known fact—not denied by Musculus—that dextrine is gradually converted into glucose by the action of dilute acids." (Watts's *Dict., Suppl.*)

Heated with glycerine, starch is gradually dissolved; alcohol precipitates it in the form of soluble starch. "With *nitric acid*, starch yields various products, according to the strength of the acid, the temperature, and the duration of the action: (*a*) Cold concentrated nitric acid (specific gravity = 1.52) dissolves starch without evolution of gas; water added to the solution precipitates xyloïdine or nitramidine, $C_6H_9(NO_2)O_5$, as a white powder. (*Braconnot, Pelouze.*) If water is added immediately, nothing remains dissolved; but if the solution is allowed to stand, it gives with water less and less xyloïdine, and at last none, while a substance resembling saccharic acid remains in solution. (Pelouze, *Compt. rend.*, vii. 713.) (*b*) If starch is mixed with its own weight of concentrated nitric acid and twice its weight of ordinary nitric acid ($2NHO_3.3H_2O$), and allowed to stand for twenty-four or thirty hours at the mean temperature, or if it is mixed with enough common nitric acid to form a thick mud, and heated in the water-bath until red fumes are evolved, unorganized insoluble starch is at first produced, then starch soluble in hot water, and lastly starch soluble in cold water. (*Béchamp.*) Starch that has been moistened with $\frac{2}{10}$ per cent. nitric acid and water, and then allowed to dry spontaneously, yields dextrine when heated. (*Payen.*) A mixture of starch with 2 per cent. nitric acid and 4 per cent. water, dried at first in the air, afterward in a water-bath, gives, with 5 parts of warm water, a solution which solidifies to a jelly like lichenine on cooling, and gives sugar when boiled with acids. (Mitscherlich, *Pogg. Ann.*, lv. 121.) (*c*) Hot nitric acid, either concentrated or dilute, employed in excess, evolves nitrous gas and forms oxalic acid, together with malic and acetic acids.—*Nitric peroxide* acting on starch neither evolves gas nor produces oxalic acid. (Bouijs-Ballot, *J. pr. Chem.*, xxxi. 211.) A mixture of strong *nitric* and *sulphuric acids* converts starch into an explosive compound, analogous to or identical with gun-cotton (De Vrij, *Compt. rend.*, xii. 120). According to Béchamp (*Ann. Ch. Phys.* [3], lxiv. 322), the product consists of nitroxyloïdine or dinitramidine, $C_6H_8(NO_2)_2O_5$." (Watts's *Dict.*)

Chlorine has little effect on starch; bromine forms an orange-yellow compound; iodine forms a blue compound. Fresh starch paste is colored blue by a solution of iodine, or by adding an alkaline iodide and then liberating the iodine by a little chlorine-water, nitrous acid, etc. This reaction furnishes a very delicate test for both starch and iodine. The blue color disappears on heating the liquid, and returns on cooling; it is destroyed by alcohol, alkaline hydrates, sulphydric acid, cyanides, sulphocyanides, and, in fact, by all reagents which take up iodine. The reaction loses its delicacy in the presence of much dextrine, glucose, tannic, gallic, and pyrogallic acids, in urine, blood-serum, etc. Infusion of nut-galls (tannic acid) produces a yellowish precipitate, which redissolves on heating.

*Estimation and Separation of Starch.*—(1) In seeds, tubers, etc., the starch is separated by mechanical means. A weighed quantity of the material (about 20 grammes) is grated to pulp (potatoes) or softened in water and crushed in a mortar; the pulp is then washed on a fine sieve until the water runs off clear; the starch is allowed to settle, is washed, dried, and weighed. Flour may be made into dough with a little water, and then placed in a piece of muslin and kneaded in a stream of water till it yields no more starch. This method is only approximate. (2) By converting the starch into glucose, and estimating this with an alkaline solution of copper; 1 gramme of material is added to 50 c. c. of water and 2 grammes oil of vitriol. The mixture is heated on a water-bath for two hours, filtered, the filtrate diluted to 100 c. c., 8 grammes of oil of vitriol added, and the whole heated over a water-bath for seven or eight hours, the evaporating water being replaced from time to time. The solution is finally made up to 100 c. c., and the glucose is determined with an alkaline copper solution, as in testing raw sugar. (See article SUGAR.) This method is not accurate. (See *Wagner's Jahresb.*, 1868, 462.) (3) Dragendorff (*Jahresb. der Ch.*, 1862, 631) gives the following process: "Two or three grains of the substance dried at 100°, and pulverized, are mixed with 25 to 30 grains of a solution of 5 to 6 parts of potassic hydrate in 94 to 96 parts of absolute alcohol, and digested at 100° C. for eighteen to thirty hours in a sealed tube (or a flask which can be closed air-tight); and the contents are thrown, while still hot, on a weighed filter and thoroughly washed, first with hot absolute alcohol, then with cold spirit of ordinary strength, and finally with distilled water mixed (in the case of gummy substances) with a small quantity of alcohol. The filter, with its contents, is dried, first at 50°, then at 100°, and weighed. The difference between the weight thus obtained and that of the original substance gives the quantity of proteine substances, fat, sugar, and part of the salts present. The residue, together with the filter cut in pieces, is next heated with water containing 5 per cent. of hydrochloric acid, till a sample is no longer turned blue by solution of iodine; and the residue, separated from the acid liquid, is washed, dried at 100°, and weighed. The loss of weight thus found gives very nearly the quantity of starch in the substance under examination. Any mineral substances insoluble in potash, alcohol, and water, but soluble in hydrochloric acid, that would introduce an error, may be estimated by evaporating the acid liquid to dryness, and incinerating the residue at as low a temperature as possible. This error may also be avoided by extracting the starch with concentrated extract of malt at 56°, instead of acidulated water. In the case of substances which contain a large quantity of mucus it is

best to perform the extraction with a concentrated solution of common salt slightly acidulated with hydrochloric acid, and wash the insoluble residue with weak spirit. The residue left after the extraction of the starch contains cellulose, mucus, lignine, cuticula, and cork-substance, the last four of which may be separated from the cellulose by digestion with chlorate of potassium and dilute nitric acid." (Watts's *Dict.*) (4) "Starch immersed in a saturated solution of *bromide* or *iodide of potassium* swells up to a pasty mass of twenty to thirty times its original volume, which dissolves in water, leaving only a very small quantity of membrane; and on adding iodine-water to the solution the blue compound of starch and iodine is precipitated in flocks. As cellulose is not affected by bromide or iodide of potassium, these salts may be employed for detecting and separating starch in vegetable tissues. Dilute solutions act less strongly." (*Ibid.*)

*Applications of Starch.*—Starch is used for stiffening cotton and linen cloth, paper, etc. Wiesner says corn starch possesses the highest, wheat the next, and potato starch the most inferior stiffening qualities. It is used for food in the form of arrow-root, tapioca, sago, etc., for making paste, for powdering the hair, for the manufacture of dextrine, glucose ("corn syrup"), etc.

*Literature.*—Muspratt's *Dict. of Chem.*, especially last Ger. ed.; Watts's *Dict. of Chem.* and *Supplements;* Ure's *Dict.;* Wagner's *Technology;* Gmelin's *Handbook of Chem.;* Payen's *Chem. indust.;* Nägeli, *Beiträge zur näheren Kentniss der Stärkegruppe* (Leipsic, 1874). C. F. CHANDLER.

**Star'-Chamber Court** [*Curia Cameræ Stellatæ;* probably so called from the starred ceiling of the hall in Westminster Palace in which at one time it sat], in English history, is mentioned as early as Edward III.'s time, when it was composed of the members of the privy council. It was remodelled—or, as some will have it, first really constituted a court—in 1486, under Henry VII. In 1529 (21 Hen. VIII.) it was again modified. It had important criminal and equity jurisdiction, and was to some extent free from the application of the ordinary forms of procedure in courts; and hence arose great abuses, such as the infliction of torture and mutilation, and the sentencing of accused persons without a hearing. Odious to the Commons and the people, it was abolished by statute in 1640 (16 Chas. I. c. 10).

**Star City,** p.-v., cap. of Lincoln co., Ark.

**Star City,** p.-v., Van Buren tp., Pulaski co., Ind., on Pittsburg Cincinnati and St. Louis R. R. P. 115.

**Sta're Deci'sis** [Lat.]. This phrase, *stare decisis et quieta non movere*—"to abide by decided cases, and not to disturb matters once put to rest"—contains the fundamental principle upon which the law has been built up by the courts. In the decision of particular cases the courts have been and are controlled by precedents. Precedents are simply former decisions of competent tribunals preserved in some manner, usually in the volumes of official reports. As these decisions were made after argument and upon careful consideration, the presumption is that they are right, and therefore the general rule is *stare decisis,* which is a rule of sound justice and equity, as well as of expediency. Unless it were obeyed, there could be no certainty in the law as judicially administered, and no security as to individual rights and duties. But this doctrine is not absolutely inflexible. On further examination made in a subsequent case, the court may be satisfied that the former decision was wrong, and that if followed it would produce results widely injurious. Under such circumstances the prior adjudication may be rejected as a precedent. That the courts possess this power and exercise it freely is shown by the multitudes of overruled cases found in the reports; which, it may be remarked, are relatively much more numerous in the U. S. than in England. Instead of expressly overruling the faulty decision, the judges may limit its effect, may distinguish it from the one under consideration, and thus avoid its controlling authority. An acknowledged incorrect precedent will not always, however, be thus abrogated or avoided. A practical rule of expediency is often controlling in this matter. If the prior case established a rule of property, and on the strength of it rights have been acquired and obligations created which would be infringed or destroyed by abolishing the precedent, the doctrine of *stare decisis* is applied; certainty and fixedness are sometimes the most important elements of a legal rule. Nevertheless, the mode of dealing with decisions conceded to have been mistaken depends upon the sound discretion of the courts, and not upon any absolute dogmas. A plainly unjust and inequitable precedent would probably be overruled at the present day, although property rights might thereby be somewhat affected.

JOHN NORTON POMEROY.

**Star'-Fishes,** radiates of the class Echinodermata and order Asterioidea, organisms more or less star-shaped, and having a disk which gradually merges into the rays, and locomotive suckers along the whole length of the rays. The skeleton is calcareous and made of movable pieces. In some the arms are merged into one. Some are of graceful and others of clumsy form. There are many genera and species, found on most sea-coasts. The term "star-fishes" is equally applicable to the ophiuroids of the family Ophiuridæ (order Ophiuroidea), which have a small central circular disk, having arms which start off abruptly from the centrum. (For illustration see Fig. 20 in COMPARATIVE ANATOMY.)

**Star'gard,** town of Prussia, province of Pomerania, on the Ihna, manufactures linen and woollen goods and trades much in corn, cattle, horses, and peat. P. 17,280.

**Star'gazer,** a popular name for the marine fishes of the genus *Uranoscopus* and family Uranoscopidæ, acanthopterous fishes of the group Trachinoidea. The best-known species is *U. scaber* of the Mediterranean; *U. anoplos* has been caught on our S. Atlantic coast, but most of the species are East Indian. They are ugly and spiny fishes, having the eyes on top of the head, whence the name.

STARGAZER is also a popular name for the cyprinodont fishes of the genus *Anableps,* found in Guiana, and popularly named "four-eyes," each eye having a double pupil. Of the three known species, *A. tetrophthalmus* is the best known, called four-eyed loach. (See ANABLEPS.)

**Stark,** county of N. W. Illinois, intersected by Spoon River, and traversed by Peoria and Rock Island and a branch of Chicago Burlington and Quincy R. Rs. It is generally fertile, consisting in part of prairie-land. Cattle, horses, sheep, and swine are numerous, and there are wagon-factories and woollen and flour mills. Staples, Indian corn, wheat, rye, oats, hay, and dairy products. Cap. Toulon. Area, 325 sq. m. P. 10,751.

**Stark,** county of N. E. Ohio, watered by Tuscarawas River and its affluents, and traversed by Ohio Canal and several railroads. The surface is undulating and the soil productive. Coal, iron, and limestone are abundant. Besides abundance of live-stock, there are manufactories of agricultural implements, carriages, furniture, iron, leather, and woollen goods, and saw-mills, flour-mills, and breweries. Cap. Canton. Area, 570 sq. m. P. 52,508.

**Stark,** tp., Brown co., Minn. P. 447.

**Stark,** tp., Hickory co., Mo. P. 1130.

**Stark,** p.-v. and tp., Coos co., N. H. P. 464.

**Stark,** tp., Herkimer co., N. Y. P. 1541.

**Stark,** tp., Vernon co., Wis. P. 756.

**Starke** (JOHN), b. at Londonderry, N. H., Aug. 28, 1728; became a farmer, and in 1752 was taken prisoner by the St. Francis Indians, but after six weeks was ransomed, having in the mean time gained so much favor with his captors that he was subsequently adopted into their tribe. In 1755 he was appointed a lieutenant in Rogers's Rangers, and in Jan., 1757, distinguished himself in an engagement with the French and Indians near Ticonderoga; took part in Abercrombie's campaign in 1758, and in Amherst's reduction of Crown Point and Ticonderoga in 1759; early in 1775 was chosen a member of the New Hampshire committee of safety; hurried to Cambridge on learning of the battle of Lexington, and as colonel of the New Hampshire troops took part in the battle of Bunker Hill; accompanied Montgomery's expedition to Canada 1775–76; joined Washington at Newton, N. J., Dec., 1776, and took part in the battle of Trenton. Being aggrieved at the action of Congress in regard to promotions, he resigned his commission in Apr., 1777. Upon the advance of Burgoyne from Canada in the spring of 1778, the authorities of New Hampshire commissioned him to raise a force for the defence of the State, which was then held to include Vermont. He attacked the Hessian colonel Baum near Bennington Aug. 16, 1777, routed him, and later in the day defeated a force under Col. Breymann. For this he received from Congress a commission as brigadier-general; served under Gates in the Saratoga campaign; was with Gates in Rhode Island in 1778–79, and in 1780 joined Washington at Morristown; was a member of the court-martial for the trial of Major André, and in 1781 was placed in command of the northern department. After the close of the war he retired to his farm. D. at Manchester, N. H., May 8, 1822. His *Biography* has been written by Edward Everett, and his *Memoirs and Official Correspondence,* edited by his grandson, were published in 1860.

**Starke,** county of N. W. Indiana, drained by Yellow and Kankakee rivers, and crossed by several railroads. The surface is generally level, often marshy, with a fertile soil. Staples, Indian corn, wheat, rye, and wool. Cap. Knox. Area, 432 sq. m. P. 3888.

**Star'key,** p.-v. and tp., Yates co., N. Y., on Seneca Lake and on Northern Central R. R. P. 2370.

**Star'kie** (THOMAS), b. at Blakeburn, England, in 1782; graduated at St. John's College, Cambridge, where he was senior wrangler and Smith's prizeman, 1803; was called to the bar at Lincoln's Inn 1810; was for many years a leading counsellor in London; became Downing professor of law 1823, and a judge at Clerkenwell 1847. D. in London Apr. 15, 1849. Author of several well-known legal text-books, all of which have repeatedly been reprinted in the U. S.: *A Practical Treatise on the Law of Slander, Libel, and, incidentally, of Malicious Prosecutions* (1812), *A Treatise on Criminal Pleading* (2 vols., 1814), *Reports at Nisi Prius, King's Bench, and Common Pleas* (3 vols., 1817–23), and *A Practical Treatise on the Law of Evidence and Digest of Proofs in Civil and Criminal Proceedings* (3 vols., 1824), of which the 8th American ed. (Philadelphia, 1860) contains *Notes and References to American Cases,* by (Judge) George Sharswood, together with the notes to former American eds. by Theron Metcalf, Edward D. Ingraham, and Benjamin Gerhard.

**Starks,** tp., Somerset co., Me. P. 1083.

**Starks'borough,** p.-v. and tp., Addison co., Vt. P. 1361.

**Stark'ville,** p.-v., Lee co., Ga.

**Starkville,** p.-v., cap. of Oktibbeha co., Miss., has 2 weekly newspapers. P. 475.

**Starkville,** p.-v., Stark tp., Herkimer co., N. Y. P. 174.

**Star'ling,** the *Sturnus vulgaris,* a common European song-bird of the family Sturnidæ, now partly naturalized in the U. S. It is a great favorite, especially with the Germans, who often have it caged, and teach it to whistle tunes and even speak words very plainly.

**Star Mines,** v., Van Buren tp., Clay co., Ind. P. 199.

**Starodoob',** town of European Russia, government of Tchernigov, on the Bobonez, has 13,652 inhabitants.

**Star of Beth'lehem,** the *Ornithogalum umbellatum,* a common spring garden-flower of the order Liliaceæ. The genus includes many bulbous-rooted plants of the Old World and of S. Africa. The above-mentioned species (the white star of Bethlehem) is a native of Europe, and is sparingly naturalized in the U. S.

**Star of India, Order of,** was instituted by Queen Victoria in 1861, and reorganized in 1866. There are three classes of knights: 1, knights grand commanders (G. C. S. I.); 2, knights commanders (K. C. S. I.); and 3, companions (C. S. I.), the latter not regarded as of the full rank of knights. The membership is about equally divided between native East Indians and Europeans, most of whom have distinguished themselves in the British-Indian service, military or civil.

**Staroi'-Oskol',** town of European Russia, government of Koorsk, on the Oskol, has 7176 inhabitants. Much fine fruit is produced in its vicinity.

**Staroverski.** See PHILIPPINS.

**Star Prairie,** p.-v. and tp., St. Croix co., Wis. P. 773.

**Starr,** county of S. Texas, separated from Mexico by the Rio Grande. It is for the most part deficient in water, and only adapted for the raising of stock, which forms the principal occupation of the inhabitants, although there is a considerable area of land along the Rio Grande. There are large herds of cattle, horses, and sheep. Cap. Rio Grande City. Area, about 2100 sq. m. P. 4154.

**Starr,** p.-v. and tp., Hocking co., O. P. 1551.

**Starrs** (WILLIAM), D. D., b. at Drumquin, county Tyrone, Ireland; received a classical education; studied theology at Maynooth College; came to the U. S. 1828; completed his theological course at the Sulpician seminary at Baltimore; ordained priest Sept., 1834, at St. Patrick's cathedral, New York, of which he was curate ten years; pastor of St. Mary's from 1844 until 1853, when he was appointed by Archbishop Hughes rector of St. Patrick's and vicar-general of the diocese of New York; administrator of the diocese from the death of Archbishop Hughes until the consecration of Archbishop McCloskey (1864); twenty years president of the board of trustees of St. Vincent's Hospital, and theologian to Archbishop McCloskey in the plenary council at Baltimore 1866. D. in New York Feb. 6, 1873.

**Stars** [Gr. ἀστήρ]. The stars, those innumerable and endlessly-varied glittering points which gem the sky on a clear night, which transport and enchant the gazer by their differing splendors, by the continual twinkling of their light, by their capricious distribution, by the constancy of the figures they compose, are a subject rather of contemplation than of study. Fancy loses herself in the search after a trace of law in those infinite mazes which unite them together; the eye is wearied in the effort to count them; the mind finds itself before an immeasurable, inconceivable abyss; it is not a mere surface, a superficies, but it is a boundless width and depth whose mystery is to be fathomed. Science, however, does not shrink before the difficulty of the problem, and, laying aside her delighted admiration of the beauty of the subject, addresses herself to the investigation of its secrets, and by patient and scrutinizing research, and armed with the most powerful instruments which art has been able to construct, she has already made no small rent in that thick veil which seemed impenetrable by the human intellect. Let us, then, also venture into this immense ocean of wonders, certain that if we may not discover its shores, we shall at least be able to gather, without danger of shipwreck, treasures which should satisfy to the full the most ardent imagination.

Stellar astronomy as a science, in so far as relates to its geometrical aspect, may be said to be the work of little more than a century, and researches into its physics are even of a still more recent date; nevertheless, thanks to the activity of our age, it has already made such progress that its labors fill many volumes. We shall endeavor to compress the results into a few pages, and to bring together what may suffice to give an idea of the variety and the immensity of the subject. We shall first consider the apparent phenomena presented by the surface of the sky, and from these we shall endeavor to deduce the relations which exist between the bodies with which it is peopled. We shall especially make it a point to treat with sufficient fulness those numerous questions of celestial physics so much studied in these last years.

### § 1. *The Constellations.*

From the necessity of distinguishing the different parts of the heavens, the stars have, in all ages, been distributed into groups called "constellations." They correspond to the geographical divisions which constitute the states and nations of the terrestrial globe. The most ancient and famous stellar groups are those through which the sun passes in his annual course over the celestial vault, and which constitute the *zodiacal zone,* through the midst of which passes the apparent orbit of the sun, the *ecliptic.* They are familiarly known to all under the names of Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, Pisces. The extent of these groups is very unequal, and their forms have no analogy with the objects whose names they bear. The origin of these names is lost in the night of time, and at most seems to allude to the agricultural labors of the *season* in which the sun in ancient ages remained in the several constellations; but even this correspondence has in a great measure disappeared, because, with the precession of the equinoxes, the phases of the tropical year, with which agricultural operations are associated, no longer coincide with the entrance of the sun into the same constellations as before. Thus, the period of the spring equinox, which was once in Aries, is now in the constellation Pisces, and so all the other constellations are displaced to the extent of one sign. The present nomenclature of these starry groups is not much older than the epoch of Greek mythology, and dates not far from the time of the reform in ancient astronomy made by Hipparchus. In fact, in that reformation the spring equinox is considered as corresponding to Aries, and that of the autumn to Libra, which is the symbol of the equality of day and night; while it is certain from more ancient astronomical monuments that at historically known epochs it was in Taurus near the Pleiades; and if the names of the constellations had been bestowed upon them then, the series would certainly have commenced with Taurus. The traditions of the most ancient nations have preserved nothing to explain the origin of these names; the zodiacs found in the Egyptian temples of Esneh and Denderah decide nothing, for it is now demonstrated that these sculptures are of the Roman imperial era. Besides, from the fact that these series of constellations begin with Leo, and not with Aries, it cannot be concluded that the equinox was then in that sign. This arrangement is derived from astrological considerations, or from the order of the Egyptian festivals. The division of the zodiac into twelve parts is also found among the Chinese; and this is very natural, from the close relation which exists between the revolution of the sun and that of the moon; but the names given to the constellations in ancient Chinese astronomy, before the arrival of missionaries in that country, are altogether different—so unlike that even lexicographers do not know their precise signification. The modern Chinese names are a mere translation made by the missionaries of those used in Europe.*

*See John Williams, *Observations of Comets in China* (1871), p. xxiii. *et seq.*); also Gaubil et Biot, *Études d'Astronomie indienne et chinoise* (Paris, 1862).

The zone of the zodiac divides the sky into two hemispheres, the northern and the southern. The principal northern constellations are the following: Pegasus, Andromeda, Cassiopeia, Ursa Minor, Cepheus, Perseus, Triangulum Boreale, Auriga, Ursa Major, Draco, Coma Berenices, Boötes, Mons Menalus, Corona Borealis, Hercules, Ophiuchus or Serpentarius, Serpens, Lyra, Aquila, Antinous, Cygnus, Sagitta, Delphinus, Equuleus; and to these the moderns have added The Reindeer, Messor or Reaper, Giraffe, Harp, Lynx, Herschel's Telescope, Little Lion, Greyhounds, Mural Quadrant, Bull of Poniatowski, Shield of Sobieski, Little Fox, Goose, Fly, Trophy of Frederick, Cerberus, Sextant. The ancient southern constellations are—Cetus, Eridanus, Lepus, Orion, Canis Major, Canis Minor, Argo Navis, Hydra, Crater, Corvus, Centaurus, Lupus, Ara, Corona Australis, Piscis Australis. The modern are—The Lamp, Sextant, Solitary, Sculptor or Sculptor's Workshop, Phœnix, Electric Machine, Air-pump, Chemical Furnace, Pendulum, Sceptre of Brandenburg, Engraving Tools, Easel, Square, Compass, Telescope, Microscope, Balloon, Crane, Regulus, Toucan, Little Cloud, Water-snake, Musk, Clock, Reticulum, Great Cloud, Table Mountain, Flying Fish, Chameleon, Charles's Oak, Cross, Bee, Level, Bird of Paradise, Octant, Peacock, Indian, Cat, Dorado, etc.

The definition of these groups is so arbitrary and so intricate that it has been seriously considered by astronomers whether it would not be worth while to abolish them altogether, and make a new division of the heavens. But, considering that the effect of this might be only to increase the confusion, since all would not accede to this novel reform, it has been thought better rather to return to the old system, and to remove from the constellations the excrescences introduced by the moderns, especially in the northern hemisphere. This has been done by the very laborious Heis. As to the southern hemisphere, the difficulty is irremediable, these groups still retaining the names originally given them by Lacaille and the early navigators. Besides, a division of the sky—one might almost say into provinces—has no serious interest for astronomers, inasmuch as the position of each star, when precision is required, is always indicated by the co-ordinates in right ascension and declination, by which means all ambiguity is removed; and the names of the constellations serve only to abbreviate the indications and to assist the memory. Many stars have proper names which are very ancient, as Sirius, Regulus, Capella, etc.; others have names of Arabic origin, as Betelgeux, Rigel, etc. Most of these names are derived from portions of the body of the animal by which the constellation was represented; for the ancients indicated the various stars of the same constellation by the part of the body of the animal within which they fell. Thus, Sirius was called "that which is in the mouth of the dog;" another, as Rigel, "the foot of Orion;" Aldebaran, "the eye of the bull," etc. This made the determination of the star a slow process, but it was not without convenience. However, the means of indicating the stars lying outside of the principal figure, and which they included under the general name *informes*, were wanting, and it has been precisely of these that the moderns have formed their additional secondary constellations.

A German astronomer, Bayer, began to note the principal stars by the letters of the Greek alphabet, and, when these were not sufficient, he employed those of the Latin. Practically, it would seem his intention to indicate by these letters the order of magnitude, but, whether through inadvertence or because the magnitudes have really changed with time, this order is not now found to be fully preserved. The moderns, however, have scrupulously retained these letters for the sake of brevity and facility, and in order not to be obliged to give every moment the numerical co-ordinates, which are more difficult to remember.

The division of the groups of stars in Chinese astronomical maps differs wholly from ours—a fact which shows that these groups were formed independently of European astronomy. The Chinese, besides the division of the zodiacal zone into twelve parts, have divided the whole heavens into twenty-eight regions, which extend far to the N. and to the S. of the ecliptic, and which are called *sieoux*, and are distinguished by twenty-eight stars. These divisions seem to have first originated in the method of observing the sky by means of the passage of the meridian, as we do; and, as they could not trust their timekeepers, which were water-clocks or clepsydræ, they fixed upon several stars by means of which to rectify the computation of time, precisely as is now done. At first, the spaces between the determining stars of these celestial divisions were nearly equal. But now they are most unequal, and, according to the investigations of the very accurate Biot, a great part of this inequality is only an effect of the precession of the equinoxes, which, by changing the positions of the poles of the sphere in relation to the stars, has changed the differences of the ancient right ascensions and declinations of the principal stars to such an extent as to obliterate, and even to reverse, the order of their passage. It was precisely from these studies that this celebrated astronomer concluded that Chinese astronomy had its origin at a very remote epoch, when the equinox nearly corresponded with the Pleiades; that is, at the period of the construction of the pyramid of Cheops in Egypt, in which are found certain galleries and corridors whose axes would point precisely to the altitude of the passage of that group to the S., while to the N. another is directed to the pole-star of that period, and to Alpha of Draco in its passage below the pole. The Indians availed themselves of the Chinese *sieoux* division of the heavens into twenty-eight parts to compose their *nakshatras* or mansions, applying them to the lunar course; but the inequality of the spaces rendered this system useless, and they long since abandoned it, retaining only the division of the ecliptic into twenty-eight, and afterward into twenty-seven, parts; thus showing that their astronomy originated in China, and was transformed by them in order to adapt it to astrological purposes.

At various periods there have been attempts to combine the figures of the constellations, and form out of them a kind of celestial epopœia. The Greeks filled the whole with their fables, and so perpetuated the memory of the heroes of the Golden Fleece or Argonauts—a new proof of the recent date of this nomenclature. The Gnostics, according to the pseudo-Origen, fancied in the constellations visible in summer-time a supernatural drama, derived, perhaps, from the Egyptians. For them the constellation of Hercules, which the ancients represented by a kneeling person, was the figure of Humanity bowing the knee before the emblem of the Great Spirit (Draco), and imploring immortality, which was symbolized by the Crown. This, however, was snatched from it by the envious Serpent, which, in its turn, was strangled by the redeemer, Serpentarius, who crushed the great monster, the Scorpion, of which the Serpent was a continuation. But these fancies are not less ridiculous than the fables of the Greeks.

The best modern works for the description of the heavens are—the *Atlas* of J. E. Bode, a magnificent volume in large folio, with illustrations of great artistic merit, but in which the very perfection of the shaded figures somewhat diminishes the distinctness of the smaller stars; and for the northern hemisphere, and for all that is visible in Europe, the *Uranometria* of Argelander and the *Atlas* of Heis. In these last two the stars visible to the naked eye are carefully classified according to their magnitude, and they form a true *uranometry*—that is, a precise measure of the stellar magnitudes. As to the limits of the constellations, not a few errors and confusions existing in the ancient maps have been corrected. The device of Argelander and of Heis of printing the outlines of the figures in red and the stars themselves in black, is particularly excellent, on account of its great distinctness, especially by night. Particularly valuable, however, for general study are the great celestial maps of Dien, which represent the sky in two hemispheres, having the poles in the centre and the equator at the circumference, and, beneath, a separate zone which gives the equatorial constellations as far as 45° of N. and S. declination, thus sufficiently well exhibiting those parts which in the circular projection are crowded and divided. In these maps the ancient figures are suppressed, and their places are supplied by geometrical figures which unite together the most beautiful stars, sometimes of different constellations. Though this may be useful to beginners, it is a thing not to be commended, since it cannot be denied that the various parts of the ancient figures greatly assist the memory in distinguishing the stars.

The use of good celestial maps is very important for the *falling stars;* Prof. Dorna of Turin has made an atlas which, projected upon the horizon of the middle N. latitudes, is very convenient. In other charts intended for this purpose the gnomonic projection is introduced, because thus every great circle is represented by a straight line, by means of which every trajectory of the meteors is a straight line. It is to be wished that these maps may be more largely extended. For the most scientific and fully-detailed maps, including the telescopic stars, we would notice the Berlin charts, which extend from +10° of declination to −10, and comprehend all the fixed stars of the tenth magnitude; also the ecliptic maps of Bishop, those of Chacornac, the *Atlas* of Harding, and the large *Atlas* of Argelander, which contains all the stars, down to the tenth magnitude, from the N. pole to 10° of S. declination. The subjoined Table A gives the names of the constellations and the stars contained in them, according to the computation of Heis:

TABLE A.—*Distribution of Stars according to their Constellations and Magnitudes. (Stars visible to the naked eye in the mean latitudes of Europe.)*

| | Constellations. | Magnitude. 1. | Magnitude. 2. | Magnitude. 3. | Magnitude. 4. | Magnitude. 5. | Magnitude. 6. | Var. | Cu. | Neb. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A. *Northern Constellations.* | | | | | | | | | | |
| 1 | Ursa Minor | .. | 2 | 1 | 3 | 9 | 66 | .. | .. | .. | 81 |
| 2 | Draco | .. | 1 | 9 | 8 | 39 | 253 | .. | .. | .. | 310 |
| 3 | Cepheus | .. | .. | 5 | 4 | 21 | 198 | 2 | .. | .. | 230 |
| 4 | Cassiopeia | .. | 2 | 2 | 6 | 21 | 151 | 2 | .. | .. | 184 |
| 5 | Perseus | .. | 1 | 4 | 13 | 23 | 145 | 2 | 3 | .. | 191 |
| 6 | Camelopardus | .. | .. | .. | 2 | 25 | 164 | .. | 1 | .. | 192 |
| 7 | Lacerta | .. | .. | .. | 1 | 12 | 52 | .. | .. | .. | 65 |
| 8 | Lynx | .. | .. | 1 | 1 | 12 | 118 | .. | .. | .. | 132 |
| 9 | Ursa Major | .. | 6 | 9 | 5 | 40 | 252 | 2 | .. | .. | 314 |
| 10 | Canes Venatici | .. | .. | 1 | 1 | 18 | 97 | .. | 3 | 2 | 122 |
| | B. *Mean Constellations.* | | | | | | | | | | |
| 11 | Andromeda | .. | 3 | 1 | 13 | 14 | 161 | 1 | .. | 1 | 194 |
| 12 | Equuleus | .. | .. | .. | 1 | 4 | 14 | .. | .. | .. | 19 |
| 13 | Pegasus | .. | 2 | 4 | 8 | 22 | 210 | 1 | .. | 1 | 248 |
| 14 | Pisces | .. | .. | 1 | 10 | 21 | 149 | .. | .. | .. | 181 |
| 15 | Triangulum | .. | .. | 1 | 2 | 4 | 36 | .. | .. | 2 | 45 |
| 16 | Aries | .. | 1 | 1 | 4 | 11 | 93 | .. | .. | .. | 110 |
| 17 | Auriga | 1 | 1 | 2 | 4 | 18 | 188 | 2 | 2 | .. | 218 |
| 18 | Taurus | 1 | 1 | 2 | 15 | 28 | 207 | 1 | .. | .. | 255 |
| 19 | Gemini | 1 | 2 | 5 | 5 | 13 | 131 | 1 | 1 | .. | 159 |
| 20 | Canis Minor | 1 | .. | 1 | .. | 5 | 52 | .. | .. | .. | 59 |
| 21 | Cancer | .. | .. | .. | 5 | 5 | 122 | 1 | 1 | 2 | 136 |
| 22 | Leo | 1 | 2 | 5 | 8 | 20 | 209 | 1 | .. | .. | 246 |
| 23 | Leo Minor | .. | .. | .. | 3 | 6 | 49 | 1 | .. | .. | 59 |
| 24 | Coma Berenices | .. | .. | .. | 2 | 17 | 85 | .. | .. | .. | 104 |
| 25 | Boötes | 1 | 1 | 5 | 10 | 23 | 155 | .. | .. | .. | 195 |
| 26 | Corona Borealis | .. | 1 | .. | 6 | 7 | 19 | 2 | .. | .. | 35 |
| 27 | Hercules | .. | 1 | 9 | 12 | 28 | 244 | 3 | .. | 2 | 299 |
| 28 | Lyra | 1 | .. | 1 | 5 | 9 | 72 | 2 | .. | .. | 90 |
| 29 | Cygnus | .. | 2 | 4 | 15 | 34 | 189 | 3 | 1 | .. | 248 |
| 30 | Vulpecula | .. | .. | .. | 1 | 15 | 71 | .. | .. | .. | 87 |
| 31 | Sagitta | .. | .. | .. | 4 | 2 | 14 | .. | .. | .. | 20 |
| 32 | Delphinus | .. | .. | 1 | 4 | 2 | 35 | .. | .. | .. | 42 |
| | C. *Southern Constellations.* | | | | | | | | | | |
| 33 | Cetus | .. | 2 | 6 | 7 | 24 | 186 | 1 | .. | .. | 226 |
| 34 | Eridanus | .. | .. | 7 | 17 | 24 | 153 | .. | .. | .. | 201 |
| 35 | Orion | 1 | 3 | 4 | 6 | 25 | 116 | 2 | .. | .. | 157 |
| 36 | Monoceros | .. | .. | .. | 4 | 15 | 136 | 1 | 2 | .. | 158 |
| 37 | Lepus | .. | .. | 2 | 6 | 10 | 48 | 1 | .. | .. | 67 |
| 38 | Columba Noachi | .. | 1 | 1 | 3 | 1 | 4 | .. | .. | .. | 10 |
| 39 | Canis Major | 1 | 2 | 4 | 5 | 13 | 75 | .. | 1 | .. | 101 |
| 40 | Argo Navis | .. | .. | 1 | 4 | 13 | 81 | .. | 1 | .. | 100 |
| 41 | Hydra | .. | 1 | 4 | 10 | 20 | 195 | 1 | .. | .. | 231 |
| 42 | Sextans Uraniæ | .. | .. | .. | 1 | 5 | 73 | .. | .. | .. | 79 |
| 43 | Virgo | 1 | .. | 6 | 9 | 19 | 224 | 2 | .. | .. | 261 |
| 44 | Crater | .. | .. | 1 | 4 | 2 | 49 | .. | .. | .. | 56 |
| 45 | Corvus | .. | 5 | 1 | 1 | 5 | 27 | .. | .. | .. | 37 |
| 46 | Centaurus | .. | .. | 2 | 3 | 2 | 10 | .. | .. | .. | 17 |
| 47 | Serpens | .. | 1 | 5 | 5 | 10 | 89 | 1 | 2 | .. | 113 |
| 48 | Ophiuchus | .. | 2 | 7 | 7 | 24 | 111 | .. | 2 | .. | 153 |
| 49 | Scutum Sobieskii | .. | .. | .. | 1 | 5 | 4 | 1 | .. | .. | 11 |
| 50 | Aquila et Antinous | 1 | .. | 5 | 4 | 17 | 136 | 1 | .. | .. | 164 |
| 51 | Libra | .. | 2 | .. | 1 | 8 | 66 | 1 | .. | .. | 78 |
| 52 | Lupus | .. | .. | .. | .. | 6 | ... | .. | .. | .. | 6 |
| 53 | Scorpio | 1 | 1 | 7 | 5 | 11 | 26 | .. | .. | .. | 51 |
| 54 | Sagittarius | .. | 1 | 6 | 8 | 24 | 84 | 2 | 1 | .. | 126 |
| 55 | Capricornus | .. | .. | 3 | 8 | 12 | 58 | .. | .. | .. | 81 |
| 56 | Aquarius | .. | .. | 5 | 11 | 31 | 147 | .. | 1 | .. | 195 |
| 57 | Piscis Australis | 1 | .. | .. | 3 | 13 | 8 | .. | .. | .. | 25 |
| | Northern | 10 | .. | 12 | 32 | 44 | 220 | 1496 | 8 | 7 | 2 | 1821 |
| | Mean | 22 | 7 | 17 | 43 | 137 | 308 | 2505 | 19 | 5 | 8 | 3049 |
| | Southern | 25 | 6 | 19 | 77 | 133 | 339 | 2106 | 14 | 10 | .. | 2704 |
| | Total | 57 | 13 | 48 | 152 | 314 | 867 | 6107 | 41 | 22 | 10 | 7574 |

## § 2. *Magnitudes of the Stars, and Principles of Uranometry.*

With the division of the stars into groups, remounts to the remotest antiquity their distribution into various orders of magnitude. The most beautiful and brilliant were classed as of the first magnitude, those next to these in brilliancy as of the second, and so on to the number of six visible grades. Here the naked eye fails; instruments must do the rest. The limits by which these grades of brightness are defined are not fixed and distinct, but are arbitrary and conventional only. Thus, of those visible in our hemisphere the first magnitude embraces sixteen or seventeen of the most vivid in brightness, which are—1, Sirius, in Canis Major; 2, Vega, in Lyra; 3, Procyon, in Canis Minor; 4, Pollux, in Gemini (some include also Castor); 5, Capella, in Auriga; 6, Arcturus, in Boötes; 7, Rigel, and 8, Betelgeuse, in Orion; 9, Aldebaran, in Taurus; 10, Regulus, in Leo; 11, Spica, in Virgo; 12, Antares, in Scorpio; and 13, Markab, in Pegasus. To these, in the southern hemisphere we add—14, Canopus, in Navis; 15, Fomalhaut, in Piscis Australis; and 16, Alpha, in the Centaur. Some assign the same rank to certain stars of the Southern Cross, but these do not much surpass those of Ursa Major, and belong more properly to the second order. This second order embraces the six most beautiful of those forming Charles's Wain; the pole-star in Ursa Minor; the four larger stars of Cassiopeia; the three of Orion's Belt; the four of the Square of Pegasus, including Alpha Andromedæ, etc. The brightest in Aquarius belong to the third magnitude. But here let me repeat that this entire classification is purely arbitrary, and must be so, because in the first place there has been no rule antecedently established for measuring the intensity of stellar light; and, secondly, no precise limit separates one class from the next, nor can it be said at what point one series commences and another ends. A general idea of the distribution may be obtained from Table A, above, in which is given a summary from the *Atlas Cœlestis Novus* of Heis, showing the stars which enter into the several constellations visible in Middle Europe, arranged according to their magnitudes. From this table it appears that, to an acute eye like that of Heis, though unaided, stars are perceptible which by common usage would be referred to the seventh order. The total number down to this limit would be 5421 in the heavens as visible at Münster—that is to say, in eight-tenths of the entire sphere—whence, supposing the distribution in the remaining part to be in similar proportion, the grand total would amount to 6800.

It being impossible to divest this matter of its arbitrary element, or to fix new conventions without introducing serious confusion, astronomers have reversed the problem, and sought to determine in what ratio the brilliancy of the stars increases according to the various actual orders of conventional magnitude. Diverse methods have been employed for this purpose, and the instruments in use in the investigations are called stellar photometers or astrometers. The science which occupies itself with the inquiry is called *uranometry*.

The first plan proposed was that of Bouguer, who suggested the use of a telescope with two equal objectives, to be directed severally to two unequal stars. The aperture of the one, directed toward the brighter, was then to be reduced until its image should become equal in brightness to the other, when the inverse ratio of the two apertures would be that of the brilliancies. But this method assumes that the absorption of the lenses is in proportion to the intensity of the light, while it is rather a constant quantity. The necessary correction, however, is easily determinable. Sir William Herschel, and later, Johnson of Oxford, made use of this method, the last observer employing for the purpose a magnificent heliometer. Others have used different kinds of photometers. That employed by ourselves is a rapidly-rotating disk with fissures of variable breadth. The light of the brighter star seen through these fissures is diminished until it becomes equal to that of the lesser. Thus we have determined the relative values of the light of various stars, given further on. Among the most important of stellar photometric labors are those of Sir John Herschel, who has arranged all the stars in sequences or successive series, comparing the light of each with that of a neighboring one, either natural or artificial, or with the image of the moon formed by a small lens.

The following are the results to which these inquiries have led. From the labors of Sir William Herschel upon the greater stars, it is inferrible that the ordinary magnitudes are related to each other in respect to splendor according to the following law, viz.:

| Magnitudes, | 1 | 2 | 3 | 4 | 5 to 6 |
|---|---|---|---|---|---|
| Splendors, | 1 | $\frac{1}{4}$ | $\frac{1}{9}$ | $\frac{1}{16}$ | $\frac{1}{64}$ |

It results from this, that a star of the first magnitude, at a distance double, triple, or quadruple, would appear of the second, third, or fourth; but the law fails of precision for the fifth and sixth.

From the study of the sequences of Sir John Herschel, and of those of Heis, it follows that the ordinary scale corresponds to the photometric, provided the ordinary magnitudes are increased by the constant quantity 0.414, which would make them 1.414, 2.414, 3.414, etc., respectively. These results are true of the several classes only with respect to their mean brightness; between individual stars the differences are very great. Thus we have found the following proportions of magnitude among the stars here named:

| Stars. | Relative photometric values. | | Stars. | Rel. phot. values. | |
|---|---|---|---|---|---|
| Sirius | = 75.5 | 1st magnitude. | γ Orionis | = 2.9 | 2d magn. |
| Rigel | = 13.0 | | ζ Orionis | = 2.7 | |
| Procyon | = 9.9 | | χ Orionis | = 1.0 | 3d magn. |
| α Orionis | = 7.3 | | | | |

From the labors of various astronomers it may be concluded that the ratio of brightness from magnitude to magnitude is not rigorously constant, but decreases as in the following series: 1st to 2d, 3.75; 2d to 3d, 2.25; 3d to 4th, 2.20; 4th to 5th, 1.95; where it is seen that the ratio goes on diminishing with the magnitude, in conformity with the fact of observation that, between two lights, it is more easy to estimate the ratio, in proportion as the lights themselves are fainter.

These results, however, relate only to the stars visible to the naked eye. For telescopic stars the case is notably different. We remark, in the beginning, that the scale of these also is arbitrary and of traditional convention; and hence for these also the problem presents itself, What is the ratio of brightness between two stars of different magnitudes seen in the telescope? Johnson of Oxford, by the method indicated above, arrived at the conclusion that the ratio of the successive magnitudes is 0.424; and hence, if $n$ be the number which expresses the magnitude of a given star, its intensity of light as referred to one of the first magnitude would be expressed by $(0.424)^{n-1}$. Comparing, then, his own observations with those of Struve,

Argelander, Groombridge, and Sir John Herschel, he concluded from the whole a mean progression from the minor to the major as 0.412 : 1, or in the inverse order as 2.43 : 1. Pogson has found 2.42; Steinheil, 2.83; Stampfer, 2.51. But we cannot take the mean of these determinations, because they are severally based on stars differing in number and in magnitude. Struve, after an examination of the magnitudes employed by Bessel, Lalande, and others, assigned the following proportions:

| Magnitudes. | Number of stars which make one of the 1st magn. | Ratios of splendors. | |
|---|---|---|---|
| 1 | 1.00 | | |
| 2 | 3.25 | 3.28 | Visible to the eye. |
| 3 | 7.64 | 2.35 | |
| 4 | 15.26 | 2.00 | |
| 5 | 29.75 | 1.95 | |
| 6 | 86.10 | 2.83 | |
| 7 | 249.10 | | |
| 8 | 269.60 | 2.29 | Telescopic. |
| 9 | 1116.90 | 1.96 | |

Whence we might conclude, in a matter so vague, to take a middle course, and say that, generally, the intensity of the light of a star of the second magnitude is about one-fourth as great as that of one of the first, and that the brightness goes on diminishing in a ratio which beyond the second may be taken as constant, and for the telescopic may be assumed at 2.412—a proposition inapplicable, however, beyond the 9th magnitude, on account of the differences of classification employed by different authorities, the subdivisions of Sir William Herschel extending to the 20th magnitude, while Struve has limited his to twelve. The difference arises partly from the individual habits of observers, and partly from the estimate made by each of the penetrating power of his instrument.

It is a matter of importance in this inquiry to know what will be the limiting magnitude of the stars visible in a given telescope. The following proportions of magnitudes with given apertures were established by Johnson:

| Apertures in English inches. | 1. | 2. | 3. | 4. | 8. | 9. | 10. |
|---|---|---|---|---|---|---|---|
| Magnitudes visible..... | 8.1 | 9.9 | 10.6 | 11.3 | 12.9 | 13.2 | 13.4 |

But experience shows that it is possible to push much beyond the visibility expressed by these numbers. From researches apposite to the question made with our own refractor, equal to that at Dorpat (of 9.6 English inches), and which we have found to possess a penetrating power little different from that of Herschel's 18-inch speculum, it results that it is possible with this to reach the magnitude 15.2—two orders beyond the limit assigned by Johnson. It is generally agreed that the extreme magnitudes of Herschel are exaggerated, and that the lower extremity of his scale is not in harmony with the upper.

The break between the telescopic magnitudes and those fixed by direct observation with the unaided eye, arises from this, that the telescope, rendering the image on the retina more definite than that of natural vision, greatly promotes the visibility of objects—a thing so true that even a telescope with an aperture no larger than the opening of the pupil, shows many stars which the naked eye fails to discover, precisely because of the superior sharpness of the image.

Though this matter is of little interest to astronomers in general, as not constituting a study of precision, yet, for many questions of celestial physics which we have presently to treat, it is of the highest importance; and on this account we have ventured to consider it somewhat at length. Since the sun is a star, the investigation of the ratio of its brightness to that of other stars will assist us in determining the intensity of the stellar lights generally. Herschel, comparing Alpha Centauri with the moon at full, assigned the ratio at 27,408 : 1. Now, according to Wollaston, the intensity of the lunar light compared with that of the sun, is as 1 : 801,071; whence the light of the sun to that of α Centauri, should be as 21,955,000,000 : 1; and inasmuch as the distance of α Centauri is known, it is inferred by computation that in absolute intensity its light must exceed that of our sun 2.32 times. Alpha Centauri differs little from Arcturus or from α Lyræ, and is estimated at one-quarter the brightness of Sirius. And the light of this last star, as it reaches us, is, according to Wollaston, only one twenty-millionth as intense as that of the sun.

The general light of the starry heavens is not so feeble as at first sight it may seem. Upon a lofty mountain-top, in a pure atmosphere, and in the long-continued absence of artificial light, one can at length read by its aid large printed characters. Mariners dislike artificial lights by night, because they are confusing, and prefer rather to depend on the light of the stars alone. I am not aware that any precise measures have been made as to this matter. But the general light of the heavens includes, along with that of the stars, the light proceeding from the Milky Way and from the zodiacal brightness, and is frequently strengthened by feeble auroras; which disturbing causes render it difficult to distinguish what belongs to the stars alone. I am able, however, to affirm that a steady electric light from a pile of fifty elements of large dimensions, at the distance of 400 mètres (a quarter of a mile), hardly equals the brightness of Sirius. From certain calculations it is concluded that this star must have an intrinsic light sixty-three and a half times greater than that of the sun. We shall presently see that other modes of reasoning confirm in great part this curious conclusion.

### § 3. *Colors of the Stars.*

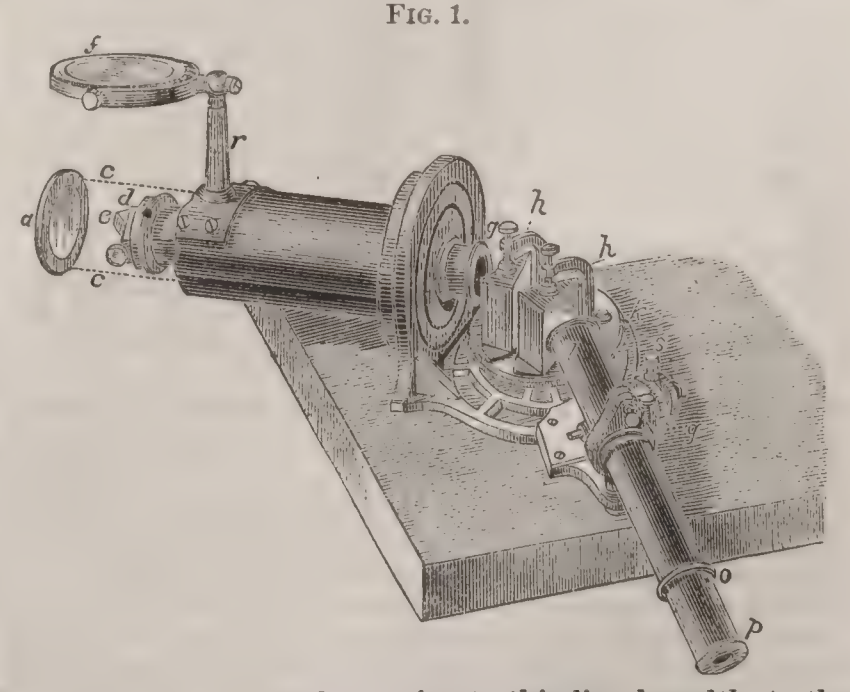
If every star differs from every other in magnitude, the differences in color are not less. The stars are commonly called white, but to the most inattentive eye many appear diversely colored; some are yellow, some are orange, and not a few are decidedly red. The tints of the stars called white are for the most part blue; from this color there is a passage by insensible degrees to true white, then to yellow, to orange-red, and finally to blood-red. Sirius, Lyra, Castor, Regulus, are azure; Procyon, α Aquilæ, white; Capella, Pollux, α Ceti, yellow; Aldebaran, Arcturus, Betelgeuse (α Orionis), orange; Antares, α Herculis, red; the blood-red stars are all small. The shade of color in the yellow and the orange is different at different epochs, as in Betelgeuse, Antares, Aldebaran, Arcturus, etc. In the double stars occurs frequently the curious phenomenon of two different colors, very often complementary—a fact suggestive of illusion, but shown by accurate study to be real. (For examples of this see Table K.)

In certain constellations certain special colors predominate; as in the Pleiades, blue; in Orion, greenish; in Eridanus, the yellows. The azure stars are rare, though we may say generally that a tint of azure prevails in most. Sirius has certainly changed in color. Seneca (*Nat. questionum*, lib. i. c. 1, No. 6, p. 72, ed. Pomba) says that Sirius was redder than Mars ("acrior sit Caniculæ rubor, Martis remissior, Jovis nullus"), while now it is notoriously azure-white. In spite of the philologic doubts which have been raised upon this passage by some who would confound scintillation with color, the fact is confirmed by Ptolemy, who calls it reddish,* and says it is the most splendid of the class; which in truth is not impossible. Beta Geminorum (Pollux), now a yellow star, is also called reddish.

But until very recent times these colors were only vaguely estimated. In endeavoring to classify them by means of the electric spark drawn from different elementary substances, we have been not a little surprised to find that the nebulæ and the comets are green. But the spectroscope has recently taught us how to define their tints with greater precision. Observations of stellar spectra are, however, quite difficult, because of the feebleness of their light. Spectroscopes with fissure, unless of colossal dimensions, can hardly be used even upon stars of the first magnitude. The spectral lines of the stars were discovered by Fraunhofer. Lamont returned to them later, but afterward abandoned the study. Donati was the first recently to resume it, and we have ourselves sought to give it the largest practicable extension. It will not be useless here to say something as to the manner of conducting these observations.

The spectrum obtained directly from a star, by making the focal image of a large telescope fall upon the fissure of the collimator, is a colored line, as its image is a white

FIG. 1.

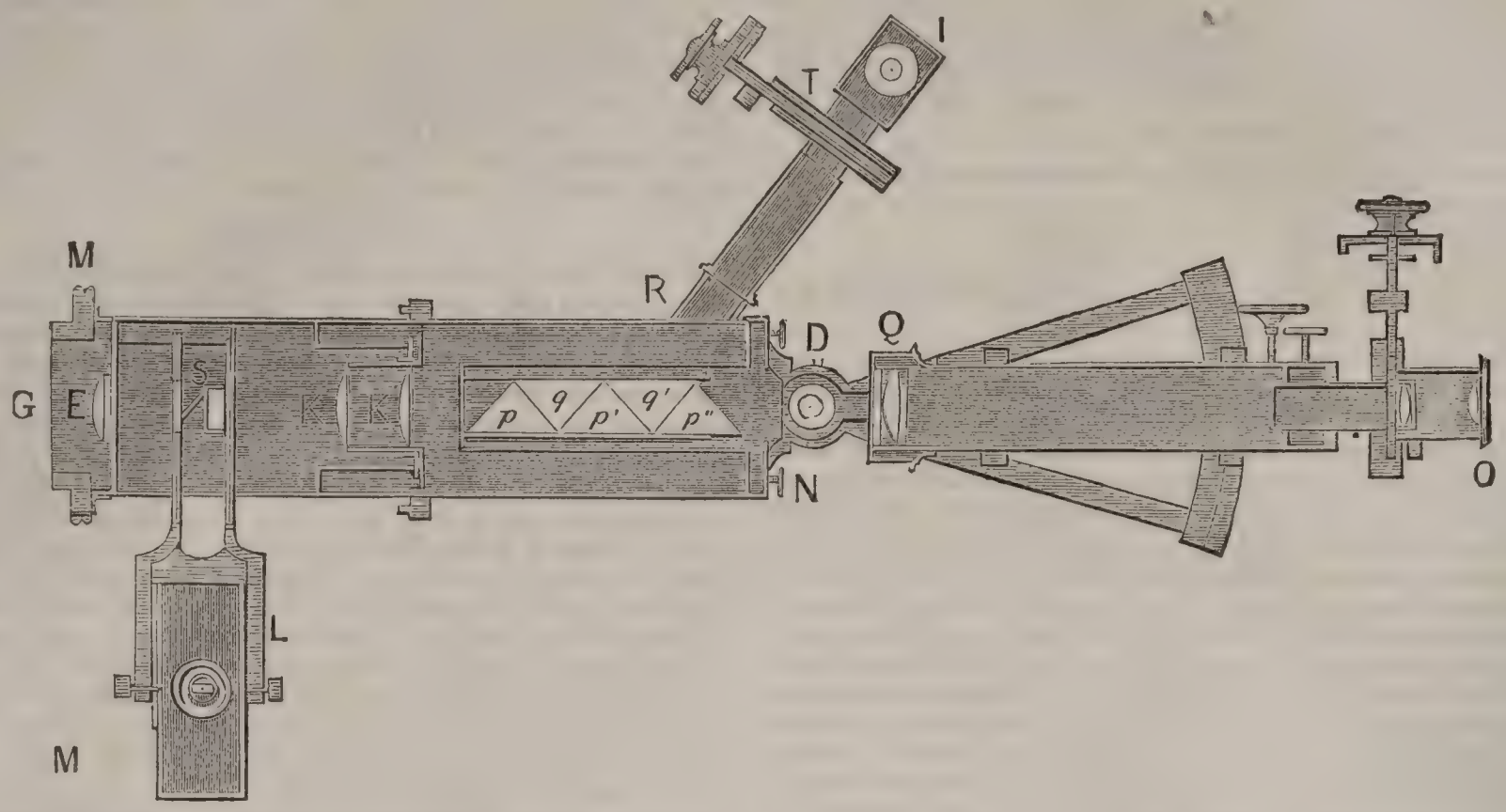



point; our aim must be to give to this line breadth, to the end that we may see and distinguish the transverse lines

* Ptol. *Almag.*, lib. viii., description of the star Sirius in the catalogue p. 73 of the edition of Halma—ὑποκίρρος, *subrufa*.

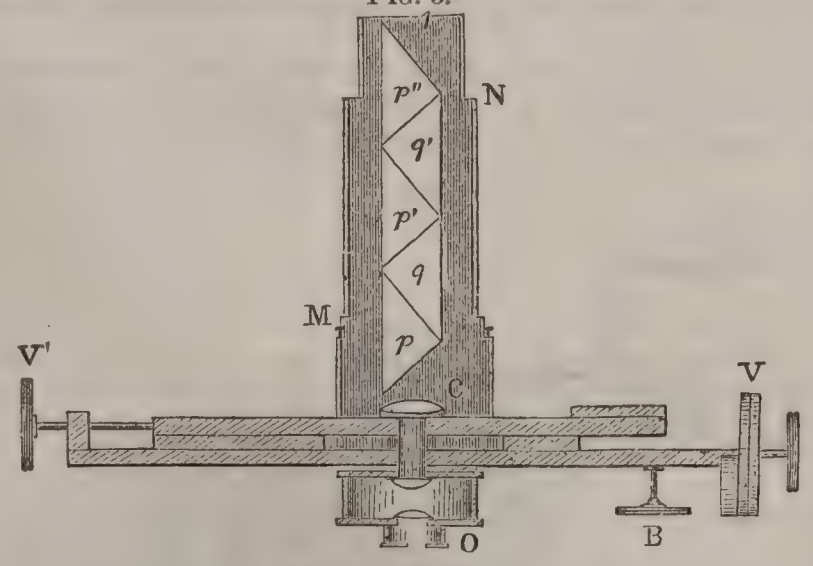
of Fraunhofer. In the common fissure-spectroscope this is accomplished by placing before the fissure of the collimator a cylindrical lens, which dilates in one direction the

Fig. 2.




stars with those of the chemical elements, the fissure is indispensable; but when these are known in a few stars, the labor can be pursued with others by means of simple differential measures, and then we can admit much light. But if we mean to identify the chemical lines and those of the stars with exactness, it will not do to employ a reflecting mirror before the fissure; it is necessary to place the chemical or electric light at the centre of the objective, or at least in the middle of the tube, well adjusting it in the axis of the instrument. For differential observations the best spectroscope is the simplest, employed already by Fraunhofer—viz. a prism placed in front of the object-glass. If the refracting angle is large, the image is naturally dilated, although without the cylindric lens. But ordinary prisms are too small to give light enough. We have caused to be constructed by Merz of Munich a prism six inches wide, with a refracting angle of 13°, which, applied to a refractor of six and a half inches diameter and seven feet focal length, gives superb spectra, requiring, however, to be dilated by a cylindrical lens placed before the ocular, or by the direct use of an ocular constructed with a cylindrical lens. Applied to the great refractor of Merz, this prism gives a magnificent spectrum, even too much dilated, so as to enfeeble the light. For long telescopes, an angle of five or six degrees is sufficient. This instrument, indeed, is rather costly, but we have contrived another more simple and economical by half, and have succeeded in producing a spectroscope which collects the en-

Fig. 3.




tire light of the star so completely as to enable us to recognize spectra of stars down to the 9th magnitude. (Fig. 3.)

* This instrument may be thus briefly described: G M is the screw of attachment to the great telescope, of which the instrument replaces the objective; E is a cylindric lens designed to dilate the light of the star so that it may form a linear image at the fissure S; K K′ are two collimating objectives; $p, q, p', q', p''$ form the compound direct-vision prism; R T is a micrometric screw which moves a plate with an exceedingly narrow fissure, of which the purpose is to measure the position of the spectroscopic lines: this is lighted by a little lamp I; D is a hinge supporting the sector and the analyzing telescope Q O; L is a lamp illuminating the primary fissure of the spectroscope, and introducing, by means of the little plane mirror S′, the light of comparison.

focal image of the great telescope. Fig. 1 shows the prism spectroscope of Mr. Huggins; Fig. 2, the direct-vision spectroscope.* If we desire to identify the spectral lines of the

This consists simply in a direct-vision prism, behind which is a cylindrical lens C, with its axis parallel to the Fraunhofer lines, placed at a little distance from the ocular (four or five centimètres)—that is, at the point where the most distinct vision is obtained; and the spectra are seen in the field of the ocular with almost the sharpness and vividness of the star itself. V B V′ is the micrometer with double screw and double plate, carrying pointers in the field of the ocular O. With an instrument of this kind we have made the analysis of many hundreds of stars, and have been conducted to some consequences of the highest importance, which are the following:

All stellar spectra can be distinguished into four categories or types. The first is that of the white or azure-tinted stars, like Sirius, Lyra, etc., $\beta, \gamma, \delta, \epsilon, \zeta, \eta$ of the Great Bear, etc. The spectra of these are almost continuous, only that they are furrowed by four strong black lines, which are absorption-lines of hydrogen. All the four can be seen in the most brilliant, as Sirius, Lyra, etc.; in the feeblest only the Hβ, or the F of the sun, is ordinarily visible; but in general this is broad and dilated, and frequently hazy at the edges, especially in Sirius. This is an indication of a very high temperature, and of great density in the hydrogen atmosphere of the stars of this order. There are also seen traces of other lines, as of magnesium, sodium, and some of iron; but these are extremely feeble, and require an atmosphere of exquisite purity. (See colored plate, Type I.) Many stars appear of uniform light, without lines, which studied with care are found to belong to this type.

The second type is that of the yellow stars. They have very fine lines, and their spectra are perfectly similar in character to that of the sun. (See plate, Type II.) Capella, Pollux, and many others feebly yellow have such a character. The fineness of the lines requires that in these researches the atmosphere should be very clear and quiet. Sodium, hydrogen, and iron are very conspicuous in them. Arcturus and Aldebaran, in their periods of lively yellow light, approach this type, and in the periods of red light the following. It is curious that α Ursæ Majoris is of this type, while all the others of that constellation belong to the first.

The third type is that which is exhibited by the orange and red stars. It is formed of lines and zones or cloudy bands. A specially striking example is α Orionis, the prototype of this class (see plate, Type III.), to which belong also α Scorpionis, ο Ceti, β Pegasi, α Herculis, and many other beautiful examples, of which we will presently give a brief catalogue. This spectrum ought to be considered as really composed of two spectra superposed—one formed of broad zones of gradually-deepening cloudiness, producing the effect of lights and shadows in a fluted column; the other formed of black absorption-lines of the metals. This, for the structure of the broad zones, has for type α Herculis, where the principal channellings are seven in number, but upon these channellings, in the periods of lively red color, the black lines can be perceived. In some variable red stars, in the period of feebleness, is seen a spectrum of a few lively bright lines; as, for example, in ο Ceti. The black reversion-lines of hydrogen are quite

feeble, and sometimes not present at all in these spectra; while instead of them the sodium, iron, and magnesium lines are very strong; hydrogen is truly there, but is difficult of detection, because the lines are not perfectly reversed.

The fourth type embraces some quite curious stars, for the most part of a blood-red color. They have only three bands (see plate, Type IV.), coinciding in limits with those of the third type, but having twice the breadth; and they are quite bright notwithstanding the minuteness of the stars. There are lucid lines in some of them, but in general these are feeble and few. They have the bright and well-defined side of their channellings turned toward the violet, while those of the third type turn it toward the red. They appear to give a spectrum similar to that of carbon as it is seen in the central part of the voltaic arch projected between two carbon points; except that, in the stars, the shading off is in the opposite direction—that is, the maximum light is turned toward the violet, while in the carbon arch it is turned toward the red. Many of these stars exhibit only a few luminous lines, and are without the channelled and cloudy spaces. All the stars of this type are of a deep-red color, and among them are found the most beautiful spectra. (See the list in Table B.)

TABLE B.—*The more Remarkable Stars of the Fourth Type.*

| No. in catalogue. | Right ascension. | Declination. | Magnitude. |
|---|---|---|---|
| 41 | 4*h.* 36.2*m.* | +67° 54′ | 6. Fine. |
| 43 | 4 42.8 | +28 16 | 8 |
| 51 | 4 58.1 | + 0 59 | 6 |
| 78 | 6 26.9 | +38 33 | 6.5. Fine. |
| 89 | 7 11.5 | —11 43 | 7.5 |
| 124 | 9 44.6 | —22 22 | 6.5 |
| 128 | 10 5.8 | —34 38 | 7 |
| 132 | 10 30.7 | —12 39 | 6. Fine. |
| 136 | 10 44.8 | —20 30 | 6.5 |
| 152 | 12 38.5 | +46 13 | 6. Very fine. |
| 159 | 13 19.3 | —11 59 | 7.5 |
| 163 | 13 47.3 | +41 2 | 7 |
| 229 | 19 26.5 | +76 17 | 6.5 |
| 238 | 20 8.6 | —21 45 | 6 |
| 249 | 21 25.8 | +50 58 | 9 |
| 252 | 21 38.6 | +37 13 | 8.5 |
| 273 | 23 39.2 | + 2 42 | 6. Fine. |

Other stars there are which are not embraced under these types, as they have only simple lines variously situated. Such are those discovered in the Swan by Wolf, whose spectra are composed of only a few bright lines. Such also is the star $\gamma$ Cassiopeiæ, which presents the spectral lines of hydrogen direct and not reversed—a curiosity up to this time unique in the whole heavens. Only the star $\beta$ Lyræ, besides, has occasionally, but only occasionally, shown it.

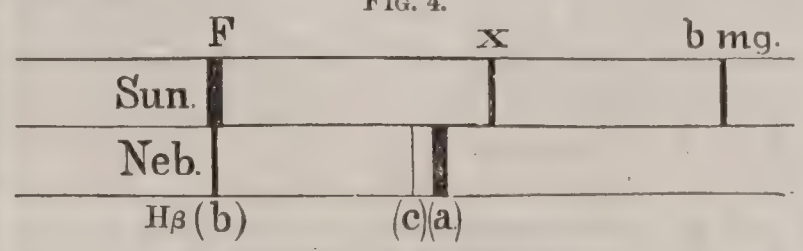
A most momentous occurrence took place in May, 1866. The star T in the Crown burst into flame. While it was of the second magnitude, it gave the direct lines of hydrogen, G and F, quite brightly, together with many other vivid lines undetermined. This was therefore a real conflagration, which in the brief time of its continuance passed through all the phases of incandescence, till from the second magnitude it sank to the eighth.

The study of this subject is hardly begun. D'Arrest has extended our catalogue, finding many stars of various types, but adopting our classification. This list may be found in the *Astr. Nachrichten.*

From the spectral study of the fixed stars we learn many important truths. First, we are assured that the physical nature of matter is everywhere the same, and that the infinitely numerous worlds of space are formed of chemical elements the same as those which compose our system. More than that, the channelled spectra of the third type being analogous to the spectrum found in the middle of the nuclei of the solar spots, it is demonstrated that these stars are enveloped in atmospheres densely vaporous and of inferior temperature. The cloudy zones indicate the presence of metallic oxides. In fact, from recent chemical studies it would seem that channelled spectra are due to metallic oxides which, by reason of the low intensity of the heat, remain undecomposed. We are therefore justified in believing that the stars which present these zones are less intensely hot than those which give only the lines of the metals. Beyond a doubt, broad hydrogen-lines of the first order show a dense hydrogenic atmosphere and powerful incandescence. The spectrum of the fourth type is evidence of carbon, and this substance is possibly also present in the third. Nor ought it to excite surprise that this element should occur quite abundantly in celestial bodies, since it is found abundantly in certain aërolites, and since comets have shown the direct spectrum of this substance, both as pure and as combined with oxygen and with hydrogen. A true difficulty, nevertheless, is found in the fact that carbon gives a spectrum so proteiform for the minutest intermixture with any other substance, as to render it difficult to establish the condition in which it is present there. Fig. 3, colored plate, shows the spectrum of the polar (electric) arch, and Fig. 4 that of the star 152 of the catalogue of Schjellerup (A. R. 12*h.* 38.3*m.*, Decl. 46° 13′ 6″) in the constellation of Ursa Major.

Quite different from the spectra of the stars are those of the nebulæ. The planetary nebulæ, the nebula of Orion, etc., are found to give spectra of very few lines, three at most, one of which (*b*) belongs to hydrogen, and the others to substances unknown, perhaps azote. In Fig. 4, following, is seen the disposition of these lines. This analytic

FIG. 4.




Spectrum of the Nebulæ.

response has cleared up for ever the question whether the nebulæ might not be groups of stars. They are nothing but masses of gas. Some nebulous stars, as that in A. R. 19*h.* 40*m.*, Decl. 50° 6′, give the double stellar spectrum and the lines of the nebulæ; but the stellar groups, as also the Milky Way in its white portions, give the stellar spectrum only. Yet there are nebulæ, like that in Andromeda and others, which give only a continuous spectrum, being in this respect analogous to some stars, in whose spectra the lines, on account of their delicacy or for some other cause, are indiscernible.

The spectroscope informs us that stars of the same type are frequently accumulated in the same quarter of the heavens. Thus, we have already seen that the Pleiades and the stars of Ursa Major, except $\alpha$, have a spectrum of the first type; in Eridanus, Hydra, etc., the yellows prevail; in Orion the first type is general, but with lines of extreme fineness, and very few red, which appear as if seen through a green veil. Certainly, this fact is of great importance, and may indicate the manner in which stars are associated in natural groups or in vast systems, of which we can form no idea. It is confirmatory of this opinion that, in certain groups, the stars of the same type have the same direction of proper motion; as, for example, the five stars of Ursa Major already mentioned—viz. $\beta$, $\gamma$, $\delta$, $\epsilon$, $\zeta$, and Alcor, its companion, as Proctor has discovered, and as we shall presently see more fully. (See Table C.)

### § 4. *Variability of the Stars.*

The stars do not all of them preserve invariably the same magnitude, but many change in brilliancy with time. Perhaps not even a single star is perfectly constant; but the attention of astronomers has been especially fixed upon some which are extremely singular, and which for this reason have received the name *variable.* One of the most famous of these is Omicron Ceti, which in a period of 331 days 8 hours dwindles from the 2d magnitude down to the 12th. After decreasing for about three months, it remains for five almost totally invisible, and then in turn increases for three more. Argelander believes that with the short period is associated a longer of 88 years, in which the maxima vary, their duration being about 25 days. The variability of this star was discovered by Fabricius in 1596, and studied carefully by Argelander. Its color is yellow, but when small becomes reddish. The spectroscope has shown that the spectrum of this star is of the third type, lined, and that in the fading of its light it preserves all the principal bright lines reduced to threads of the extremest delicacy. Its period is explained by some by admitting a rotation of the body on its axis, supposing that on one side it may be covered with spots like those of our sun. This is a plausible hypothesis, but has not been directly proved.

The stars whose colors are orange-yellow or red can be said generally to be all variable. Such are $\alpha$ Orionis, which changes irregularly by about one magnitude, and $\alpha$ Tauri, which also varies to the same extent. Arcturus even is not constant. A well-ascertained fact connected with this variability is the corresponding variation of the spectrum. When the stars are at their maximum brightness, their black spectral lines are fine, and the spectra approach the second order; but when they are at their minimum, these spectral lines become broad, with specially large dilatation of those of sodium, magnesium, and iron, and even pass into true zones. The periods of these larger stars are not yet well known. Alpha Herculis is another variable which passes from the 3d to the 4th magnitude. Its spectrum in the period of minimum is more profoundly furrowed than at maximum. Its period is of about 88 days. Upsilon Hydræ passes from the 4th to the 10th magnitude in 449 days; $\eta$ Aquilæ, from $3\frac{1}{2}$ to $4\frac{1}{2}$ in seven days. From the

TABLE C.—*Prodromus of a Catalogue of the Colored Stars, with their Spectra.*

| No. | No. in Chambers's. | Stars. | Right ascension, 1870. | Decl., 1870. | Magnitude. | Remarks. |
|---|---|---|---|---|---|---|
| | | | *h. m. s.* | ° ′ | | |
| 1 | 1 | —Cassiopeiæ | 0 2 37 | +63 13.8 | 8.5 | Ruby-colored. |
| 2 | 2 | —Piscium | 0 6 36 | + 0 24.6 | 9.5 | Garnet-red. |
| 3 | 3 | —Andromedæ | 0 13 2 | +43 59.3 | 8.2 | Intensely red; Sp. 3d type, zones faint. |
| 4 | ..... | 101 B. A. C. | 0 21 16 | +17 10.4 | 6 | Orange-yellow; Sp. 3d t., beautiful, intervals broad and dark. |
| 5 | ..... | δ Andromedæ | 0 32 22 | +30 8.9 | 3 | Yellow; Sp. 3d t., zones faint, but certain. |
| 6 | ..... | 211 B. A. C. | 0 39 45 | +14 45.0 | 6 | Yellowish; Sp. 3d t., magnificent; intervals as in β Pegasi. |
| 7 | ..... | ζ Andromedæ | 0 40 27 | +23 53.6 | 4 | Yellow; Sp. 3d t., traces of faint zones. |
| 8 | 4 | —Cassiopeiæ | 0 49 44 | +66 59.3 | 9 | Dark orange-yellow. |
| 9 | ..... | η Andromedæ | 0 50 16 | +22 42.9 | 5 | Sp. apparently zoned. |
| 10 | 5 | —Ceti | 0 52 11 | — 6 34.9 | 8 | Red. |
| 11 | 6 | —Cassiopeiæ | 0 58 13 | +52 44.5 | 10 | Beautiful garnet-red. |
| 12 | ..... | Anonymous | 1 7 27 | +34 55.8 | var. | Golden-yellow; groups of fine lines sometimes forming zones. |
| 13 | 7 | —Piscium | 1 9 0 | +25 4.8 | 8 | Red. |
| 14 | 8 | —Andromedæ | 1 10 17 | +47 0.7 | 7.5 | Very red. |
| 15 | 9 | S Piscium | 1 10 46 | + 8 13.7 | var. | Inclining to red. |
| 16 | 10 | —Piscium | 1 14 31 | + 6 17.4 | 9 | Red. |
| 17 | 11 | —Sculptoris | 1 21 0 | —33 13.5 | 6 | Orange-red, very beautiful; Sp. 3d t., beautiful. |
| 18 | 12 | R Piscium | 1 23 56 | + 2 12.6 | var. | Fire-red; Sp. diffuse. |
| 19 | 13 | —Cassiopeiæ | 1 24 53 | +59 59.9 | 10 | Red. |
| 20 | 14 | —Cassiopeiæ | 1 46 11 | +69 33.8 | 8 | Very red. |
| 21 | ..... | LL. 3317 | 1 53 59 | — 9 9.2 | 6 | Red; Sp. 3d t., with well-marked bands, like μ Geminorum. |
| 22 | 15 | Persei | 1 54 27 | +54 35.9 | 8.5 | Nearly ruby-red, with fine lines forming zones more decidedly than β Andromedæ. |
| 23 | ..... | Anonymous | 1 55 55 | +41 42.3 | (?) | |
| 24 | 16 | —Ceti | 2 0 6 | + 0 49.4 | 7 | Very red; Sp. uncertain, variable? |
| 25 | ..... | Anonymous | 2 2 0 | —10 52.0 | (?) | Yellow; Sp. 3d t., with strongly-marked zones. |
| 26 | ..... | 665 B. A. C. | 2 3 25 | +18 53.2 | 6 | Almost white; Sp. 3d t., with magnificent channellings throughout. |
| 27 | 17 | R Arietis | 2 8 44 | +24 27.1 | var. | Orange. |
| 28 | 18 | —Andromedæ | 2 9 52 | +44 36.3 | 9 | Almost ruby-red; Sp. diffuse. |
| 29 | 19 | o Ceti | 2 12 47 | — 3 34.1 | var. | Blood-red; Sp. 3d t. (See text.) |
| 30 | 20 | —Persei | 2 13 14 | +56 32.3 | 10 | Ruby-red, in group 521 H. |
| 31 | 21 | —Ceti | 2 16 8 | + 0 22.3 | 12 | Orange. |
| 32 | ..... | 786 B. A. C. | 2 27 54 | +34 7.1 | 6 var. | Yellowish-red; Sp. 3d t., *par excellence*, like α Ceti. Arr. |
| 33 | 22 | —Andromedæ | 2 29 0 | +56 30.3 | 9 | Beautiful ruby-red. |
| 34 | 23 | 855 Weisse, Trianguli | 2 35 25 | +31 52.3 | 7.5 | Red; Sp. 3d t., faint. |
| 35 | ..... | τ Eridani, 856 B. A. C. | 2 39 2 | —19 7.9 | 4.5 | Yellow; Sp. 3d t., zones very distinct. |
| 36 | ..... | α Ceti | 2 55 29 | 3 24.5 | 2 | Yellow; Sp. 3d t., strongly-marked zones, like β Pegasi. |
| 37 | ..... | ρ Persei | 2 56 51 | +38 15.0 | 7 | Bright-red; Sp. 3d t., beautiful; strong black lines. |
| 38 | 24 | 509 Arg. Ceti | 2 58 23 | + 0 12.9 | 9.3 | Red. |
| 39 | 25 | 1014 B. A. C., Horologii | 3 9 16 | —57 48.6 | 7.5 | Orange-red. |
| 40 | 26 | —Ceti | 3 9 56 | — 6 12.5 | 7 | Yellowish-red; color variable. |
| 41 | 27 | —Tauri | 3 27 27 | +19 22.5 | 9 | Reddish. |
| 42 | 28 | —Tauri | 3 34 55 | +14 22.4 | 9 | Beautiful and almost ruby-red. |
| 43 | 29 | —Persei | 3 36 13 | +53 29.6 | 9 | Fiery red, almost scarlet. |
| 44 | 30 | —Eridani | 3 37 30 | —10 1.1 | 8 | Red. |
| 45 | ..... | 1144 B. A. C. | 3 37 38 | +65 16.8 | 5 | Yellow; Sp. 3d t., well-defined intense zones in yellow and red; feeble in the green. |
| 46 | 31 | 1204 B. A. C., Camelopardi | 3 46 3 | +60 43.5 | 5.5 | Red. |
| 47 | 32 | —Eridani | 3 48 59 | —15 17.4 | 8 | Yellowish-red. |
| 48 | ..... | γ Eridani, 1234 B. A. C. | 3 51 58 | —13 52.8 | 2.5 | Orange; Sp. 3d t.; magnificent zones, but certainly variable. |
| 49 | 33 | —Eridani | 4 14 15 | — 6 33.4 | 7.7 | Yellowish-red; Sp. 3d t. (?). |
| 50 | 34 | 1342 B. A. C., Tauri | 4 14 44 | +20 30.4 | 6.5 | Pale red; Sp. beautifully lined. |
| 51 | 35 | —Eridani | 4 16 37 | + 0 12.3 | 10 | Red. |
| 52 | 36 | R Tauri | 4 21 10 | + 9 52.2 | var. | Red; Sp. 3d t., zoned. |
| 53 | 37 | S Tauri | 4 22 5 | + 9 39.4 | var. | Reddish. |
| 54 | 38 | —Eridani | 4 27 13 | —11 3.8 | 6.7 | Yellowish-red; Sp. 3d t., lined. |
| 55 | ..... | 1419 B. A. C. | 4 27 54 | — 8 30.3 | 6.7 | Red; Sp. 3d t., excellent dark zones in the red. |
| 56 | 39 | α Tauri | 4 28 27 | +16 14.8 | 1 | Pale red; Sp. 2d to 3d t., variable. |
| 57 | ..... | 1451 B. A. C. | 4 34 46 | +19 55.3 | 5 | Yellow; Sp. 3d t., with perfectly distinct and very dark intervals. |
| 58 | 40 | —Aurigæ | 4 36 50 | +32 40.6 | 8.5 | Beautiful ruby-red. |
| 59 | 41 | 1457 B. A. C., Camelopardi | 4 37 47 | +67 56.0 | 6.5 | Bright red; Sp. 4th t., fine zones. |
| 60 | ..... | B. A. C. 1470 | 4 39 55 | +63 16.8 | 5.5 | Yellow; Sp. 3d t., regular with sharply-defined lines. Arr. |
| 61 | 42 | 1317 Rad., Aurigæ | 4 40 49 | +51 59.9 | 9.5 | Fire red. |
| 62 | 43 | —Aurigæ | 4 43 23 | +28 18.0 | 8 | Intense red; Sp. 4th t., zoned, variable. |
| 63 | 44 | O′ Orionis | 4 45 11 | +14 2.0 | 5 | Deep red; Sp. 3d t., magnificently channelled. |
| 64 | 45 | 5 Orionis | 4 46 36 | + 2 16.7 | 5.5 | Pale dark-red; Sp. 3d t., zoned. |
| 65 | 46 | —Orionis | 4 48 46 | + 7 34.0 | 7 | Red; Sp. 3d t. |
| 66 | 47 | —Orionis | 4 48 57 | + 0 13.5 | 10 | Ruby. |
| 67 | 48 | R Orionis | 4 51 58 | + 7 55.9 | var. | Reddish; Sp. uniform (?). |
| 68 | ..... | ζ Aurigæ, 1541 B. A. C. | 4 53 24 | + 4 52.2 | 4 | Yellow; zones faint and cloudy. |
| 69 | 49 | R Leporis | 4 53 41 | —15 0.2 | var. | Hind's crimson star; Sp. uniform. |
| 70 | 50 | —Orionis | 4 55 9 | + 0 31.8 | 6 | Yellowish-red; Sp. uniform. |
| 71 | 51 | —Orionis | 4 58 41 | + 0 59.8 | 6.5 | Beautiful red; Sp. 4th t., zoned. |
| 72 | 52 | —Orionis | 4 59 56 | + 0 22.3 | 9 | Ruby. |
| 73 | 53 | —Orionis | 5 3 26 | — 0 43.7 | 7 | Yellowish-red. |
| 74 | ..... | LL. 9785 | 5 5 18 | —12 0.7 | 6.7 | Orange-yellow; Sp. 3d t., well marked. |
| 75 | ..... | Anonymous | 5 7 59 | — 0 42.7 | 8.8 | White; Sp. 3d t., channelled, faint. Arr. |
| 76 | ..... | Groomb. 953 | 5 8 59 | +42 38.9 | 7 | Yellowish; Sp. 3d t., luminous columns between dark and light zones. |
| 77 | 54 | —Aurigæ | 5 11 7 | +39 12.2 | 7 var. | Red; near neb. 1067 H.; Sp. 4th t., variable. |
| 78 | 55 | —Aurigæ | 5 12 15 | +34 7.8 | 8 | Remarkably red. |
| 79 | 56 | —Orionis | 5 12 45 | + 0 13.8 | 10 | Reddish. |
| 80 | 57 | —Orionis | 5 17 5 | — 9 27.1 | 8 | Very red. |
| 81 | ..... | β Leporis | 5 22 41 | —20 51.8 | 4 | Yellow, with fine lines on the borders of zones. |
| 82 | 58 | 31 Orionis | 5 23 8 | — 1 11.8 | 5 | Yellowish-red, variable; Sp. 4th t. |
| 83 | 59 | 119 Tauri, B. A. C. 1726 | 5 24 36 | +18 29.7 | 5.5 | Red; magnificent Sp. 3d t.; columns; dark broad lines, like π Aurigæ. |
| 84 | 60 | —Orionis | 5 25 51 | +10 57.1 | 7.5 | Red; Sp. faint 4th t., imperfect. |
| 85 | 61 | —Tauri | 5 30 33 | +24 55.2 | 9.5 | Red. |
| 86 | 62 | —Orionis | 5 34 30 | — 3 54.8 | 8 | Red. |
| 87 | 63 | —Orionis | 5 35 31 | + 2 18.0 | 7.7 | Red; Sp. continuous, faint, variable. |
| 88 | 64 | —Tauri | 5 37 17 | +24 21.7 | 8 | Very red. |
| 89 | 65 | —Pictoris | 5 39 36 | —46 31.1 | 8 | Like a drop of blood; superb. |
| 90 | ..... | 1844 B. A. C. | 5 42 10 | +37 15.9 | 5.5 | Yellow; 3d t. like ρ Persei; lines somewhat broad. Arr. |
| 91 | 66 | α Orionis | 5 48 9 | + 7 22.8 | var. | Orange; Sp. superb 3d fundamental t., fluted. (See text.) |

| No. | No. in Chambers's. | Stars. | Right ascension, 1870. | Decl., 1870. | Magnitude. | Remarks. |
|---|---|---|---|---|---|---|
| | | | *h. m. s.* | ° ′ | | |
| 92 | 67 | π Aurigæ | 5 50 17 | +45 55.3 | 6 | Red; superb 3d t., zones variable in magnitude, color, |
| 93 | 68 | — Orionis | 5 54 10 | + 0 12.2 | 10 | Reddish. [and spectrum. |
| 94 | 69 | — Orionis | 5 54 31 | + 0 15.7 | 10 | Red. |
| 95 | 70 | — Orionis | 5 55 45 | — 5 8.4 | 7.7 | Yellowish-red. |
| 96 | 71 | — Orionis | 5 55 51 | + 0 14.6 | 10 | Red. |
| 97 | 72 | — Geminorum | 6 2 49 | +26 2.5 | 8 | Deep crimson. |
| 98 | 73 | — Geminorum | 6 5 24 | +27 11.9 | 8.5 | Ruby; Sp. 4th t., superb, brighter than others of its class; broad bright bands, with dark intervals. Arr. |
| 99 | 74 | — Pictoris | 6 5 30 | —52 29.5 | 9 | Reddish. |
| 100 | ..... | 1992 B. A. C. | 6 5 55 | +61 33.8 | 6 | White; Sp. 3d t., magnificently channelled; broad striæ in the red. Arr. |
| 101 | ..... | 2029 B. A. C. | 6 11 29 | +23 19.5 | 7 | Deep red; Sp. 4th t., normal, magnificent. |
| 102 | 75 | — Geminorum, LL. 12245 | 6 18 3 | +14 47.4 | 8 | Vivid red; Sp. 4th t., quite irregular; points in the yellow. |
| 103 | 76 | — Canis Majoris | 6 18 28 | —26 59.0 | 8 | Intense ruby. |
| 104 | 77 | — Monocerotis | 6 23 40 | + 0 2.5 | 9 | Reddish. |
| 105 | 78 | — Monocerotis | 6 23 56 | — 2 56.2 | 7.7 | Red. |
| 106 | 79 | 2139 B. A. C., Aurigæ | 6 27 36 | +38 32.8 | 6.5 | Superb orange-red; Lalande, 12561; Sp. 4th t., with diverse interruptions. (See memoir.) |
| 107 | 80 | — Monocerotis | 6 28 13 | + 0 7.2 | 9.5 | Red. |
| 108 | 81 | 2169 B. A. C., Argûs | 6 35 30 | —52 49.0 | 6 | Red. |
| 109 | ..... | 2157 B. A. C. | 6 38 48 | +87 14.6 | 5 | Yellow; Sp. 3d t., very decided; dark lines in red and yellow. |
| 110 | 82 | — Canis Majoris | 6 41 26 | —20 36.6 | 8 | Red; the principal star of group 41 M. |
| 111 | 83 | — Canis Majoris | 6 44 13 | + 0 4.5 | 10 | Fine red. |
| 112 | 84 | 1854 Rad., Camelopardi | 6 51 7 | +70 54.9 | 6 | Yellowish-red; Sp. 2d t., uniform. |
| 113 | 85 | 2289 B. A. C., Argûs | 6 52 48 | —48 32.4 | 5.5 | Red. |
| 114 | ..... | LL. 13627 | 6 55 34 | — 5 32.2 | 6.7 | Fluted spectrum, but requiring clear atmosphere. |
| 115 | 86 | 22 Canis Major | 6 56 32 | —27 45.0 | 3.5 | Reddish; Sp. 2d t., golden yellow fine lines. |
| 116 | 87 | — Monocerotis | 6 56 42 | — 8 9.6 | 8.5 | Red; South of 50 M. |
| 117 | 88 | R Geminorum | 6 59 32 | +22 54.1 | var. | Red; Sp. direct, variable (see text); there is a yellow star near. |
| 118 | 89 | — Monocerotis | 7 0 38 | — 7 21.6 | 8 | Red. |
| 119 | ..... | 1027 Redhill | 7 0 49 | +82 39.4 | 5.6 | Reddish; Sp. 3d t., with superb zones, various columns, strong dark lines. |
| 120 | 90 | — Monocerotis | 7 1 59 | —11 43.5 | 7.5 | Red; Sp. 4th t., singular. |
| 121 | 91 | — Camelopardi | 7 2 30 | +82 39.6 | 5.4 | Reddish. |
| 122 | ..... | 1272 Groombr | 7 3 15 | +51 38.7 | 6 | Yellow; Sp. 3d t., with magnificent striæ in all the zones. |
| 122 | *bis.* | Anon | 7 5 54 | +16 22.7 | 5.6 | Very bright yellow; Sp. 3d t., with dark zones exceptionally broad. |
| 123 | 92 | 44 Camelopardi | 7 7 22 | +59 8.7 | 7 | Red to yellow; Sp. 2d t., uniform. |
| 124 | 93 | — Geminorum | 7 7 47 | +22 11.6 | 7.3 | Vivid red; Sp. uniform. |
| 125 | 94 | — Monocerotis | 7 14 49 | —10 8.7 | 5 | Red, preceding H 1517; Sp. uniform, 2d t. (?). |
| 126 | 95 | — Monocerotis | 7 15 47 | — 2 41.3 | 9 | Blood-red. |
| 127 | 96 | — Canis Majoris | 7 17 39 | —25 30.8 | 7 | Intense fiery red. |
| 128 | ..... | η Canis Majoris | 7 18 57 | —19 3.4 | 2.5 | Yellow; Sp. 3d t., like α Orionis. |
| 129 | 97 | S Canis Majoris | 7 25 39 | + 8 35.6 | var. | Strongly red. |
| 130 | ..... | 2537 B. A. C. | 7 34 35 | +13 46.9 | 7 | Orange; Sp. 3d t., resembling LL. 14961. |
| 131 | ..... | LL. 14961 | 7 34 43 | +14 30.9 | 7 | Yellow; Sp. 3d t., intervals marked, broad and dark in the red. |
| 132 | 98 | σ Geminorum | 7 35 11 | +29 12.0 | 5 | Reddish. |
| 133 | 99 | S Geminorum | 7 35 14 | +23 45.2 | var. | Deep-orange. |
| 134 | 100 | — Argûs | 7 35 49 | —31 21.1 | 9 | Red. |
| 135 | 101 | β Geminorum | 7 37 22 | +28 20.2 | 1.5 | Orange; Sp. 2d t., solar, fine lines. |
| 136 | ..... | W. VII. 1093 | 7 38 36 | +35 16.8 | 8 | Light red; Sp. zoned, but faint. |
| 137 | 102 | — Argûs | 7 40 40 | —37 39.7 | 4.5 | Orange. |
| 138 | 103 | T Geminorum | 7 41 30 | +24 3.3 | var. | Ruddy. |
| 139 | 104 | — Argûs | 7 41 34 | —31 48.6 | 9 | Fine ruby. |
| 140 | 105 | — Camelopardi | 7 44 23 | +79 49.7 | ..... | Red. |
| 141 | 106 | — Argûs | 7 47 5 | —26 3.5 | 8 | Red; in middle of 1589 H. |
| 142 | 107 | — Argûs | 7 53 33 | —49 38.3 | 8 | Brick-red. |
| 143 | 108 | — Argûs | 7 56 11 | —60 30.8 | 8 | Orange. |
| 144 | ..... | 2700 B. A. C. | 7 58 36 | +23 0.3 | 7 | White; Sp. 3d t., difficult, but recognizable. |
| 145 | 109 | — Monocerotis | 8 7 12 | — 0 1.5 | 9.5 | Red. |
| 146 | 110 | R Cancri | 8 9 24 | +12 7.4 | var. | Bright-orange. |
| 147 | 111 | — Hydræ | 8 15 25 | + 0 15.1 | 8 | Red. |
| 148 | 112 | 2820 B. A. C., Argûs | 8 18 29 | —37 52.1 | 6 | Red; Sp. uniform (zoned?). |
| 149 | ..... | 2826 B. A. C. | 8 19 32 | +13 4.9 | 6.7 | Light-yellow; Sp. 3d t., zones broad, and also dark in the green and blue. |
| 150 | 113 | — Hydræ | 8 24 47 | + 0 10.8 | 11.5 | Reddish. |
| 151 | 114 | — Hydræ | 8 25 0 | + 0 15.2 | 10 | Orange. |
| 152 | 115 | U Cancri | 8 28 19 | +19 20.5 | var. | Reddish. |
| 153 | 116 | — Argûs | 8 40 1 | —27 43.7 | 8.5 | Fiery-red. |
| 154 | 117 | — Hydræ | 8 40 7 | + 0 7.2 | 8 | Orange. |
| 155 | 118 | — Argûs | 8 45 35 | —47 53.8 | 9 | Ruby-color. |
| 156 | 119 | — Cancri | 8 45 55 | +19 48.7 | 9 | Reddish. |
| 157 | 120 | — Cancri | 8 48 3 | +17 43.4 | 8.5 | Fine red. |
| 158 | 121 | — Hydræ | 8 49 3 | —10 52.6 | 8 | Red. |
| 159 | 122 | T Cancri | 8 49 14 | +20 26.7 | var. | Very red; Sp. small and insignificant. |
| 160 | ..... | LL. 17803.5 | 8 55 29 | +39 15.5 | 7.5 | White; Sp. 3d t., broad zones, chiefly in green and blue. |
| 161 | 123 | — Argûs | 8 59 53 | —53 33.0 | 9 | Ruby-red. |
| 162 | ..... | LL. 17988 | 9 0 17 | + 1 59.8 | 7 | White; Sp. 3d t., pure, entirely discontinuous. |
| 163 | 124 | 3121 B. A. C., Argûs | 9 2 20 | —25 20.1 | 4.5 | Red; Sp. zoned, 3d t. (?). |
| 164 | 125 | — Cancri, LL. 18044 | 9 2 50 | +31 29.7 | 6 var. | Yellowish-red, admirable; Sp. 3d t., sharp black lines, broad obscure places. |
| 165 | ..... | W. IX. 268 | 9 14 16 | + 0 43.9 | 7 | Vivid orange; Sp. 3d t., fine example, black lines broad. |
| 166 | ..... | Anonymous | 9 17 ... | —21 42.0 | 8 | Fine yellow; new Sp. 3d t., fine. |
| 167 | ..... | α Hydræ | 9 21 12 | — 8 5.8 | 3 | Yellow; Sp. 3d t., red, strongly striated, and apparently truncated. |
| 168 | 126 | — Argûs | 9 28 57 | —62 13.3 | 8 | Intense blood-red. |
| 169 | ..... | 3321 B. A. C. | 9 36 39 | +14 36.9 | 6 | Yellow; Sp. 3d t., normal; zoned also besides in the green. |
| 170 | 127 | R Leonis Minoris | 9 37 46 | +35 6.5 | var. | Yellowish-red. |
| 171 | 128 | R Leonis, B. A. C. 3345 | 9 40 34 | +12 1.8 | var. | Deep-red; Sp. zoned and faint; variable; D'Arrest found strong dark zones. |
| 172 | 129 | — Hydræ | 9 45 4 | —22 24.6 | 6.5 | Red; Sp. 4th t., brightness almost solely in the green. |
| 173 | 130 | — Argûs | 9 50 9 | —40 58.4 | 7.5 | Scarlet. |
| 174 | ..... | 3415 B. A. C. | 9 53 21 | + 8 40.1 | 4.5 | Yellow; columns distinct in the red. |
| 175 | 131 | — Argûs | 9 55 47 | —59 36.1 | 8.5 | Scarlet. |
| 176 | ..... | η Leonis, 3453 B. A. C. | 10 0 15 | +17 23.8 | 3.5 | Yellow, with faint zones. |
| 177 | 132 | 18 Sextantis | 10 4 29 | — 7 46.6 | 6 var. | Red, variable, small-zoned spectrum. |
| 178 | 133 | — Antliæ pneumaticæ | 10 6 12 | —34 40.9 | 7 | Scarlet; zoned Sp. 4th t. (?). |
| 179 | ..... | 3510 B. A. C. | 10 9 42 | +14 22.5 | 6 | Yellow; Sp. 3d t., with columns very strongly marked in the red. |

| No. | No. in Chambers's. | Stars. | Right ascension, 1870. | Decl., 1870. | Magnitude. | Remarks. |
|---|---|---|---|---|---|---|
| | | | *h.* *m.* *s.* | ° ′ | | |
| 180 | 134 | — Argûs | 10 9 59 | −60 2.4 | 9 | Ruby. |
| 181 | ..... | 3561 B. A. C. | 10 18 24 | + 9 26.6 | 6.7 | Vivid yellow; 3d t., columned; intervals narrow. |
| 182 | 135 | 3630 B. A. C., Antliæ pneumaticæ | 10 29 28 | −38 53.7 | 6.5 | Orange. |
| 183 | 136 | *r* Carenæ Argûs | 10 30 36 | −56 53.1 | 5.5 | Red. |
| 184 | 137 | 3637 B. A. C., Hydræ | 10 31 9 | −12 42.6 | 6.5 | Red; Sp. 4th t., fine strong yellow. |
| 185 | 138 | — Sextantis | 10 34 24 | + 0 6.0 | 8.5 | Pale red. |
| 186 | 139 | R Ursæ Majoris | 10 35 25 | +69 27.4 | var. | Pale red. |
| 187 | 140 | — Argûs | 10 39 15 | −57 23.3 | 9 | Ruby. |
| 188 | 141 | — Hydræ | 10 45 18 | −20 33.7 | 6.5 | Vivid red; Sp. 4th t., blue wanting. |
| 189 | ..... | 3750 B. A. C. | 10 49 16 | + 6 52.7 | 7 | Almost white; Sp. 3d t., with zones in all the colors. |
| 190 | 142 | — Crateris | 10 53 6 | −15 39.4 | 6 | Red; Sp. 3d t., faint; the yellow bright. |
| 191 | 143 | 11046 O. A., Crateris | 10 54 9 | −17 37.9 | 8 | Intense scarlet; Sp. zoned. |
| 192 | ..... | 3775 B. A. C. | 10 55 12 | − 1 47.3 | 5.5 | White; Sp. 3d t., zones very distinct, especially in the red. |
| 193 | 144 | — Leonis | 10 59 3 | + 0 6.4 | 9.5 | Red. |
| 194 | ..... | 3811 B. A. C. | 11 2 10 | +37 0.9 | 6.7 | Yellowish; Sp. 3d t., normal; columns striking throughout the spectrum. |
| 195 | 145 | — Chamæleontis | 11 5 10 | −81 5.1 | 8 | Ruby. |
| 196 | ..... | 3842 B. A. C. | 11 8 17 | +23 48.2 | 4.5 | Bright orange; Sp. 3d t., with broad dark intervals; normal, fine. |
| 197 | 146 | — Argûs | 11 9 32 | −60 31.8 | 10 | Red. |
| 198 | ..... | 3850 B. A. C. | 11 10 36 | + 2 43.6 | 5.6 | White; 3d t., striæ dark and easily made out. |
| 199 | 147 | *v* Ursæ Majoris | 11 11 28 | +33 48.3 | 4.8 | Red; Sp. 2d t., with delicate striæ, fine. |
| 200 | ..... | 3954 B. A. C. | 11 31 45 | + 8 51.2 | 6 | Yellow; Sp. 3d t., brilliant; intervals dark throughout. |
| 201 | 148 | — Muscæ | 11 33 42 | −71 50.9 | 8.5 | Fine ruby. |
| 202 | 149 | — Leonis | 11 34 27 | +25 31.6 | 8 | Red; Sp. continuous. |
| 203 | ..... | 3982 B. A. C. | 11 39 11 | + 7 15.5 | 5 | Light yellow; Sp. 3d t., fine; zones magnificent. Arr. |
| 204 | 150 | — Centauri | 11 43 54 | −56 27.4 | 8 | Orange. |
| 205 | ..... | Anonymous | 11 48 32 | +37 29.0 | 7 | Light yellow; Sp. 3d t., all the columns well separated. |
| 206 | ..... | 1784 Redhill | 11 53 31 | +81 34.6 | ... | Orange; Sp. with separate lines, and zones very distinct on one side. |
| 207 | ..... | 4148 B. A. C. | 12 13 25 | +49 42.3 | 6 | Yellow; Sp. 3d t., very long zones in the red, narrower in the violet. |
| 208 | 151 | — Chamæleontis | 12 15 44 | −74 47.3 | 8.5 | Dark red. |
| 209 | 152 | — Virginis | 12 18 35 | + 1 29.4 | 7.5 | Red. |
| 210 | ..... | W. XII. 277 | 12 18 39 | + 1 36.1 | 8 | Deep red; Sp. 4th t., lines in the red, narrower in the violet. |
| 211 | 153 | — Comæ Berenices | 12 22 40 | +29 0.8 | 9 | Rich ruby-purple. [few. |
| 212 | ..... | W. XII. 378 | 12 23 44 | + 5 8.2 | 8 | Bright red; Sp. 3d t., marked, singular; interruptions |
| 213 | 154 | *γ* Crucis | 12 23 54 | −56 22.7 | 2 | Red. |
| 214 | 155 | — Virginis | 12 25 35 | + 5 23.5 | 9.5 | Scarlet. |
| 215 | ..... | 4254 B. A. C. | 12 31 45 | + 2 34.2 | 7 | White; Sp. 3d t., fine dividing lines, as in *π* Leonis. |
| 216 | 156 | R Virginis | 12 31 55 | + 7 42.2 | var. | Pale yellowish-red; Sp. diffuse. |
| 217 | 157 | — Hydræ | 12 32 37 | −26 2.1 | 12 | Red (in group 68 M.). |
| 218 | 158 | S Ursæ Majoris | 12 38 15 | +61 48.3 | var. | Red or violet. |
| 219 | 159 | 4287 B. A. C., Canum Venaticorum | 12 39 1 | +46 9.0 | 5.5 | Red; Sp. 4th t., magnificent (the superb). |
| 220 | 160 | — Crucis | 12 39 50 | −58 59.0 | 8.5 | Intense blood-red. |
| 221 | 161 | — Virginis | 12 44 4 | − 0 2.7 | 9 | Red. |
| 222 | 162 | — Comæ Berenices | 12 45 54 | +17 48.8 | 8 | Brownish-red. |
| 223 | 163 | *κ* Crucis | 12 45 57 | −59 38.6 | ... | Extremely red. |
| 224 | 164 | — Crucis | 12 46 16 | −59 39.8 | 9 | Red. |
| 225 | ..... | LL. 24034 | 12 47 33 | −10 56.7 | 6.7 var. | Sp. 3d t., brilliant, marked with dark zones. |
| 226 | ..... | 4330 B. A. C. | 12 47 36 | − 8 49.9 | 6.6 | Bright yellow; Sp. 3d t., fine, like *δ* Virginis; lines dark. |
| 227 | ..... | *δ* Virginis | 12 49 4 | + 4 6.2 | 3 | Yellow; Sp. 3d t., cloudy zones. |
| 228 | ..... | Oeltzen 13158 | 12 51 19 | +66 41.8 | 7 | Dark red; Sp. 4th t., vivid bright zones separated by intensely dark zones (requires further study). |
| 229 | 165 | — Comæ Berenices | 12 51 41 | +18 28.2 | 8 | Red. |
| 230 | ..... | 4351 B. A. C. | 12 52 30 | +18 6.8 | 5 | Light orange; Sp. columned, but not so much as 40 Comæ. |
| 231 | 166 | — Centauri | 12 56 59 | −60 44.0 | 9.5 | Fine orange. |
| 232 | ..... | 4388 B. A. C. | 13 0 3 | +23 19.0 | 6 | Yellow; Sp. 3d t., broad black lines, very obscure, normal throughout the spectrum. |
| 233 | 167 | *γ* Hydræ | 13 11 50 | −22 29.0 | 3 var. | Yellowish-red (?); Sp. 2d t., lines in the zones. |
| 234 | ..... | Oeltzen 13583 | 13 17 34 | +47 41.1 | 7 | White; Sp. 3d t., extremely well marked, though not differing in color from its neighbors. |
| 235 | ..... | 4479 B. A. C. | 13 18 0 | +37 42.8 | 6 | Dull red; Sp. 3d t., dark zones in all the colors. |
| 236 | 168 | *i* Virginis | 13 19 52 | −12 1.8 | 5.5 var. | Red; Sp. 4th t., yellow-red. |
| 237 | 169 | R Hydræ | 13 22 37 | −22 36.4 | var. | Red; Sp. 3d t., vivid lines, and superb example; variable. |
| 238 | ..... | Oeltzen 13681 | 13 23 40 | +60 31.1 | 6 | Orange; Sp. 3d t., columned, but with narrow zones. |
| 239 | ..... | 4516 B. A. C. | 13 25 33 | − 5 35.1 | 6 | Yellowish; Sp. 3d t., as *ψ* Virginis. |
| 240 | 170 | S Virginis | 13 26 13 | − 6 31.4 | var. | Bright red; Sp. diffuse and faint. |
| 241 | ..... | W. XIII. 596 | 13 30 53 | +25 16.6 | 6.7 | Bright orange; Sp. 3d t., columned, fine. |
| 242 | ..... | Anonymous | 13 34 48 | − 8 2.8 | 6.7 | Yellowish; Sp. 3d t., columned, zones strong and easily visible. |
| 243 | ..... | 4568 B. A. C. = 83 Ursæ Majoris. | 13 35 48 | +55 20.4 | 5 | White; Sp. 3d t., remarkable case of a colorless star with such a spectrum. |
| 244 | 171 | *v* Boötis, 4615 B. A. C. | 13 43 13 | +16 26.6 | 4 | Red; Sp. 3d t., black zones in the green; Sp. uncertain, partly 3d and partly 4th; gaps in the green. |
| 245 | 172 | 3105 Rad., Canum Venaticorum | 13 47 39 | +40 58.8 | 7 | Brownish-red. |
| 246 | 173 | — Virginis | 13 58 11 | + 0 9.9 | 8 | Reddish. |
| 247 | 174 | — Centauri | 13 59 55 | −59 6.4 | 8 | Double, both brick-red. |
| 248 | ..... | Groombr. 2078 | 14 2 44 | +44 28.3 | 5.6 | Yellowish; Sp. 3d t., of the finest kind. |
| 249 | ..... | 4700 B. A. C. | 14 3 45 | −15 41.2 | 5.6 | Vivid red; 3d t., of the finest. |
| 250 | 175 | — Centauri | 14 7 35 | −59 18.4 | 7.5 | Ruby. |
| 251 | ..... | Groombr. 2091 | 14 9 38 | +70 2.6 | 5 | Reddish-yellow; Sp. 3d t., zones very distinct as far as the blue. |
| 252 | 176 | *α* Boötis | 14 9 44 | +19 52.0 | 1 var. | Yellow; Sp. 2d and 3d t., sometimes zoned. |
| 253 | 177 | 4775 B. A. C., Boötis | 14 17 55 | + 8 40.8 | 6 | Yellowish; Sp. 2d t., with traces of zones. |
| 254 | 178 | — Boötis, LL. 26342 | 14 18 20 | +26 17.8 | 7.5 | Vivid red; Sp. 3d t., various zones; difficult. Arr. |
| 255 | 179 | — Virginis | 14 22 53 | − 5 21.1 | 8 | Reddish. |
| 256 | 180 | *ρ* Boötis | 14 26 14 | +30 56.6 | 4 | Red; Sp. zoned (error 1° in Schjellerup and Chambers). |
| 257 | 181 | — Centauri | 14 27 32 | −42 48.0 | 9 | Ruby. |
| 258 | 182 | 4825 B. A. C., Boötis | 14 29 20 | +37 11.9 | 6 | Red; Sp. faintly zoned. |
| 259 | ..... | 4864 B. A. C. | 14 37 43 | +27 4.9 | 6 var. | Yellowish-red; 3d t., columns well marked, especially in the red. |
| 260 | ..... | LL. 26918 | 14 39 59 | +15 40.7 | 6 | Light yellow; Sp. 3d t., magnificent, fluted, zones broad and dark, sharp on one side. |
| 261 | ..... | Groombr. 2177 | 14 55 31 | +66 27.0 | 5 | Dull yellow; Sp. 3d t., like *β* Pegasi. |
| 262 | 183 | 4976 B. A. C., Trianguli Australis | 15 1 54 | −69 35.2 | 6 | Almost scarlet. |
| 263 | ..... | W. XV. 106, 107, 108 | 15 6 9 | +19 28.2 | 5.6 | Almost white; Sp. 3d t., fine as *α* Herculis; superb. |
| 264 | 184 | $\delta^2$ Lupi | 15 9 55 | −29 40.1 | 4.7 var. | Bright yellowish-red; Sp. 2d t., dark zones in the green |
| 265 | 185 | — Avis Indicæ | 15 11 46 | −75 27.4 | 7 | Ruby. |
| 266 | 186 | S Serpentis | 15 15 34 | +14 47.0 | var. | Red. |
| 267 | 187 | $\tau^4$ Serpentis | 15 30 27 | +15 32.0 | 7.5 | Red, variable; Sp. 3d t., channelled; zones in the green. |
| 268 | ..... | *α* Serpentis | 15 37 50 | + 6 50.3 | 2.5 | Yellowish; 3d t., fine dark zones. |

| No. | No. in Chambers's. | Stars. | Right ascension, 1870. | Decl., 1870. | Magnitude. | Remarks. |
|---|---|---|---|---|---|---|
| | | | *h. m. s.* | ° ′ | | |
| 269 | ..... | 5234 B. A. C. | 15 42 54 | +18 32.7 | 4.5 | Yellow; Sp. 3d t., fine bright lines; broad dark zones. |
| 270 | 188 | R Coronæ Borealis | 15 43 13 | +28 33.5 | var. | Reddish; Sp. diffuse. |
| 271 | ..... | δ Coronæ | 15 44 10 | 26 28.1 | 4.5 | Yellow; Sp. fine lines with zones. |
| 272 | 189 | R Serpentis | 15 44 44 | +15 31.8 | var. | Red. |
| 273 | 190 | — Coronæ Borealis | 15 44 54 | +39 58.2 | 9.5 | Fine deep-ruby. |
| 274 | 191 | — Avis Indicæ | 15 45 24 | −74 6.6 | 9 | Deep-red. |
| 275 | ..... | 5287 B. A. C. = 2 Herculis | 15 50 18 | +43 31.1 | 6 | Yellow; Sp. 3d t., zones like β Pegasi, wanting in the violet. |
| 276 | 192 | — Coronæ Borealis | 15 54 19 | +36 23.8 | 10 | Ruby-red. |
| 277 | 193 | R Herculis | 16 0 23 | +18 43.4 | var. | Red. |
| 278 | 194 | — Herculis | 16 1 45 | +22 10.4 | 7.5 | Yellowish-red; Sp. striated in the green. |
| 279 | ..... | 5366 B. A. C. | 16 2 12 | + 8 52.9 | 6 | Yellowish; Sp. 3d t., normal, brilliant. |
| 280 | ..... | 5369 B. A. C. | 16 2 21 | + 8 57.7 | 7 | Yellow; Sp. 3d t., dark zones moderately broad. |
| 281 | 195 | — Serpentis | 16 3 5 | + 1 10.0 | 8 | Reddish. |
| 282 | ..... | δ Ophiuchi | 16 7 30 | − 3 21.3 | 3 | Yellowish-white; Sp. finely lined with traces of zones. |
| 283 | 196 | — Normæ | 16 8 41 | −45 28.8 | 8.5 | Ruby. |
| 284 | ..... | 5459 B. A. C. | 16 15 5 | +60 5.2 | 6.3 | Yellow; Sp. 3d t., magnificent; zones broad and dark, well marked. |
| 285 | ..... | 5479 B. A. C., $\nu^1$ Coronæ Borealis | 16 17 28 | +34 6.4 | 5 | Light-orange; Sp. 3d t., zones well marked. |
| 286 | ..... | 2480 B. A. C., $\nu^2$ Coronæ Borealis | 16 17 36 | +34 0.4 | 5 | Light-orange; Sp. 3d t., zones well marked ($\nu^1$ and $\nu^2$ Coronæ are alike). |
| 287 | 197 | — Ophiuchi | 16 17 45 | + 0 6.3 | 10 | Garnet-red. |
| 288 | 198 | — Ophiuchi | 16 19 30 | −12 7.3 | 8 | Dull brick-red. |
| 289 | 199 | U Herculis | 16 20 3 | +19 11.4 | var. | Red. |
| 290 | ..... | 5494 B. A. C. | 16 20 42 | − 7 17.7 | 6 | Yellow; Sp. 3d t., finely fluted; zones broad, dark, normal. |
| 291 | 200 | α Scorpionis | 16 21 27 | −26 8.5 | 1.5 | Perfect red; Sp. 3d t., very fine, variable. |
| 292 | ..... | 5523 B. A. C. | 16 24 22 | +42 10.2 | 5 var. | Sp. 3d t., bright normal like β Pegasi; zones broad and deep in the blue. |
| 293 | 201 | — Scorpionis | 16 32 17 | −32 7.1 | 8 | Deep-red. |
| 294 | ..... | 5596 B. A. C. = 42 Herculis | 16 35 13 | +49 10.9 | 6 | Bright-yellow; Sp. 3d t., channelled; the neighboring star has a continuous spectrum. |
| 295 | ..... | LL. 30500 | 16 38 25 | +36 45.3 | 7.8 var. | Red, in the large group of Herculis; Sp. 3d t., finely channelled. Arr. |
| 296 | 202 | — Ophiuchi | 16 42 42 | + 0 9.2 | 9 | Reddish. |
| 297 | ..... | W. XVI. 1347 | 16 43 10 | +42 28.3 | 7 | Red; Sp. 3d t., easy; others similar in the vicinity, but more difficult. Arr. |
| 298 | 203 | — Ophiuchi | 16 44 29 | − 5 57.1 | 8 | Red. |
| 299 | 204 | S Herculis | 16 45 59 | +15 9.7 | var. | Red. |
| 300 | 205 | — Scorpionis | 16 46 45 | −39 17.3 | 9 | Red. |
| 301 | 206 | — Ophiuchi | 16 49 30 | + 1 37.9 | 8.5 | Red. |
| 302 | 207 | — Aræ | 16 51 54 | −54 52.5 | 9 | Intense ruby-red. |
| 303 | 208 | — Ophiuchi | 16 52 58 | − 4 1.4 | 8 | Yellowish-red. |
| 304 | ..... | 5749 B. A. C. | 16 57 11 | +14 16.8 | 5.6 | Almost white; Sp. 3d t., channelled, with strong dark zones; normal. |
| 305 | ..... | 5763 B. A. C. | 16 58 51 | +35 35.9 | 7.7 | Faint yellowish-red; Sp. 3d t., fine; lines well separated. |
| 306 | 209 | α Herculis | 17 8 43 | +14 32.5 | var. | Yellowish-red; Sp. 3d t., superb; a physical standard. |
| 307 | ..... | W. XVII. 209 | 17 13 13 | + 2 17.8 | 7.8 | Bright-red; Sp. 3d t., brilliant; numerously striated throughout. |
| 308 | 210 | 43 Ophiuchi | 17 15 11 | −28 0.9 | 6 | Rosy-red; Sp. zoned in the green. |
| 309 | ..... | 5871 B. A. C. = 74 Herculis | 17 16 40 | +46 23.3 | 6 | Yellow; Sp. 3d t., but with narrow zones; case of gradation. Arr. |
| 310 | 211 | — Scorpionis | 17 21 29 | −35 31.9 | 9 | Very deep red. |
| 311 | 212 | — Ophiuchi | 17 22 3 | −19 21.9 | 8.5 | Ruby. |
| 312 | 213 | — Scorpionis | 17 31 14 | −41 32.7 | 8 | Fine ruby. |
| 313 | 214 | — Aræ | 17 32 9 | −57 39.4 | 8 | Fine orange. |
| 314 | ..... | LL. 32300 | 17 35 3 | +31 16.3 | 6 | Light-red; Sp. finely zoned in a good atmosphere. |
| 315 | 215 | — Serpentis | 17 37 18 | −18 35.8 | 8 | Fine red. |
| 316 | 216 | — Ophiuchi | 17 47 37 | + 1 47.7 | 9 | Ruby, quite curious. |
| 317 | 217 | — Ophiuchi | 17 51 32 | + 2 44.2 | 7.5 | Fine orange; Sp. 3d t., zoned. |
| 318 | 218 | — Ophiuchi | 17 59 36 | + 7 5.3 | 8 | Red. |
| 319 | ..... | 6134 B. A. C. | 18 0 34 | +22 12.6 | 5.5 | Yellow; Sp. faint, striæ broad, with colored zones. |
| 320 | 219 | — Sagittarii | 18 2 15 | −15 18.1 | 8 | Red. |
| 321 | ..... | 6178 B. A. C. | 18 7 1 | +31 22 5 | 5 | Yellowish-red; Sp. 3d t., lines neatly separated as in R Lyræ. |
| 322 | 220 | — Serpentis | 18 12 49 | + 0 47.5 | 8 | Very red. |
| 323 | ..... | New | 18 14 40± | +25 2± | 6.7 | Very fine red; Sp. 3d t., channelled. |
| 324 | 221 | — Serpentis | 18 15 30 | + 0 5.9 | 7.5 | Red; Sp. exceedingly faint. |
| 325 | 222 | T Serpentis | 18 22 28 | + 6 13.0 | var. | Yellowish-red. |
| 326 | 223 | 6306 B. A. C., Sagittarii | 18 25 18 | −14 57.2 | 6.5 | Red; Sp. 2d and 3d t., lines strong as in Arcturus. |
| 327 | 224 | — Aquilæ | 18 26 12 | − 5 15.3 | 7.5 | Red, variable; Sp. 2d t., cloudy. |
| 328 | 225 | — Sagittarii | 18 28 28 | −24 0.8 | 12 | Red. |
| 329 | ..... | New | 18 28 ... | +36 54. | 8.5 | Intense red (discovered by Bermingham); spectrum faintly zoned. |
| 330 | 226 | — Aquilæ | 18 29 7 | − 6 51.0 | 8 | Red. |
| 331 | 227 | — Aquilæ | 18 31 32 | −13 53.4 | 8 | Red. |
| 332 | 228 | — Serpentis | 18 31 45 | +11 20.5 | 9 | Red. |
| 333 | 229 | — Serpentis | 18 32 41 | + 9 1.9 | 10 | Red. |
| 334 | ..... | W. XVIII. 1018 | 18 33 48 | +39 33.2 | 7 | Sp. 3d t., of surprising beauty, like α Herculis. |
| 335 | 230 | — Aquilæ | 18 35 39 | + 0 2.0 | 8 | Red. |
| 336 | 231 | — Serpentis | 18 39 29 | + 8 36.9 | 9 | Plum-color, or dusky purple. |
| 337 | 232 | — Aquilæ | 18 42 46 | − 8 3.1 | 9 | Very remarkably dark red. |
| 338 | ..... | β Lyræ | 18 45 15 | +32 12.8 | 3 | White; Sp. singular, with bright lines like γ Cassiopeiæ. |
| 339 | 233 | — Sagittarii | 18 46 24 | −22 4.4 | 7.5 | Variably red; Sp. very faint. |
| 340 | ..... | $\delta^2$ Lyræ | 18 50 8 | +36 44.2 | 6 | Sp. 3d t., zones very distinct in the usual places. |
| 341 | 234 | — Aquilæ | 18 50 56 | + 0 17.1 | 9.5 | Garnet. |
| 342 | 235 | — Aquilæ | 18 52 37 | +14 11.0 | 8 | Red; Sp. very faint. |
| 343 | ..... | LL. 35507 | 18 54 29 | +22 37.9 | 7 | Yellowish-red; Sp. 3d t., superb, well marked. Arr. |
| 344 | ..... | Near γ Lyræ | 18 54 ± | +32 ± | (?) | Yellow; Sp. 3d t., like α Herculis. |
| 345 | ..... | See Astr. N. n. 1862, p. 220 | 18 57 27 | − 5 52.5 | 7.5 | Not yet studied. |
| 346 | 236 | — Aquilæ | 18 57 58 | + 0 19.6 | 9.5 | Reddish. |
| 347 | ..... | τ Sagittarii | 18 58 50 | −27 51.3 | 4 | Yellow; various zones. |
| 348 | ..... | W. XVIII. 1861 | 18 59 58 | +30 32.3 | 7 | Sp. 3d t., channels very bright. |
| 349 | 237 | R Aquilæ | 19 0 7 | + 8 2.1 | var. | Red; Sp. very faint. |
| 350 | 238 | — Vulpeculæ | 19 3 12 | +23 58.5 | 7 var. | Red; Sp. with variable zones. |
| 351 | 239 | R Sagittarii | 19 9 4 | −19 32.0 | var. | Red. |
| 352 | ..... | 6674 B. A. C. | 19 23 18 | +24 24.0 | 5 | Yellow; Sp. 3d t., dark zones precisely at the typical places. |
| 353 | 240 | 36 Aquilæ | 19 23 51 | − 3 3.5 | 7 | Red; Sp. 2d and 3d t., like Arcturus; bright. |
| 354 | 241 | 6702 B. A. C., Draconis | 19 26 10 | +76 18.1 | 6.5 | Very red; Sp. 4th t., bright greenish-yellow zones. |
| 355 | 242 | — Sagittarii | 19 26 51 | +16 39.2 | 7 | Remarkably red; Sp. with bright green zones; 4th t. (?). |
| 356 | ..... | LL. 37019 | 19 27 21 | + 5 11.3 | 7.4 | Almost white; Sp. 3d t., superb; deep zones throughout. |
| 357 | ..... | μ Aquilæ | 19 27 44 | + 7 6.4 | 4.5 | Sp. 3d t., very distinct. |
| 358 | ..... | κ Aquilæ | 19 29 53 | − 7 18.9 | 4 | Sp. 3d t., very distinct, like ι Aquilæ. |

| No. | No. in Chambers's. | Stars. | Right ascension, 1870. | Decl., 1870. | Magnitude. | Remarks. |
|---|---|---|---|---|---|---|
| | | | *h.* *m.* *s.* | ° ′ | | |
| 359 | ..... | ι Aquilæ | 19 29 58 | — 1 34.2 | 5 | Sp. 3d t., very distinct. |
| 360 | ..... | 6717 B. A. C | 19 30 7 | +48 58.7 | 7 | White; Sp. 3d t., normal; zones broad in the more refrangible colors. |
| 361 | 243 | — Aquilæ | 19 38 5 | + 4 39.2 | 8 | Red; Sp. excellent, but faint. |
| 362 | ..... | δ Sagittæ, B. A. C. 1726 | 19 41 36 | +18 12.9 | 4 | Sp. 3d t., zones magnificent (Arr.), but yet variable (see Vogel, 2000). |
| 363 | 244 | — Aquilæ | 19 42 35 | + 0 22.6 | 9.5 | Red. |
| 364 | ..... | γ Aquilæ | 19 44 24 | + 8 31.7 | 3 | Yellow; 3d t., zones very distinct. |
| 365 | 245 | χ Cygni | 19 45 34 | +32 35.3 | var. | Red; Sp. 3d t., weak zones. |
| 366 | ..... | Cygni, LL. 37858 | 19 45 57 | +38 23.1 | 5.5 | Red; Sp. 3d t., zones very distinct. |
| 367 | ..... | LL. 37866, Cygni | 19 46 6 | +37 29.6 | 6.5 | Sp. 3d t., feebly but very decidedly channelled. |
| 368 | 246 | — Aquilæ | 19 49 56 | + 0 17.3 | 10 | Reddish. |
| 369 | ..... | 6868 B. A. C | 19 54 11 | +17 9.7 | 6 | Sp. 3d t., magnificent, with zones like δ Sagittæ. |
| 370 | 247 | — Sagittarii | 19 58 58 | —27 35.7 | 7.5 | Fine ruby; Sp. 3d t., superbly channelled. |
| 371 | 248 | — Pavonis | 19 59 56 | —60 18.6 | 8.5 | Vivid red. |
| 372 | ..... | W. XX. 3 | 20 1 45 | +34 32.3 | 6.8 | Yellowish-red; Sp. 3d t., zones sharp in spite of their smallness. |
| 373 | 249 | R Capricorni | 20 4 1 | —14 39.2 | var. | Reddish. |
| 374 | ..... | A star of Wolf | 20 4 49 | +35 45.0 | 8.5 | Rosy (see text). |
| 375 | 250 | — Cygni | 20 5 9 | +41 6.9 | 10 | Fine dark red. |
| 376 | ..... | A star of Wolf | 20 6 17 | 35 46.0 | 8 | Rosy (see text). |
| 377 | ..... | A star of Wolf | 20 9 6 | 36 13.0 | 8 | Rosy (see text). |
| 378 | 251 | — Capricorni | 20 9 30 | —21 42.9 | 6 var. | The finest of the ruby stars; Sp. 4th t., with two bright zones. |
| 379 | 252 | — Aquilæ | 20 12 20 | + 0 11.6 | 9.5 | Orange. |
| 380 | ..... | β Capricorni | 20 13 42 | —15 11.4 | 3.5 | Yellow; Sp. with traces of zones. |
| 381 | ..... | New | 20 16 0 | +47 31.0 | 8 | Deep red (Bermingham); Sp. zones doubtful. |
| 382 | 253 | — Aquilæ | 20 18 10 | + 0 8.0 | 10 | Red. |
| 383 | 254 | — Delphini | 20 19 29 | + 9 38.2 | 8.5 | Red. |
| 384 | ..... | 7037 B. A. C | 20 19 30 | +68 27.8 | 6.7 | White; Sp. 3d t., superb; intervals broad and easy. |
| 385 | 255 | — Capricorni | 20 20 0 | —28 41.2 | 8 | Fine ruby; Sp. continuous (?). |
| 386 | ..... | ω′ Cygni | 20 23 4 | +48 57.2 | 5.5 | Dull yellow; Sp. 3d t., zones very decided. |
| 387 | 256 | — Aquilæ | 20 24 46 | + 0 22.0 | 10 | Red. |
| 388 | ..... | Groombr. 3210 | 20 27 18 | +48 23.2 | 6.7 | Yellowish; Sp. 3d t., zones most visible in the red and orange. [Arr. |
| 389 | ..... | LL. 40182 | 20 42 36 | — 1 2.6 | 7 | Sp. with dark zones, especially in the green and blue. |
| 390 | ..... | LL. 40347 | 20 45 32 | +49 38.6 | 7.3 | White; Sp. certainly channelled in spite of the faintness. |
| 391 | 257 | — Delphini | 20 51 8 | +15 45.2 | 8 | Red. |
| 392 | ..... | — Delphini, LL. 40682 | 20 54 31 | +18 49.6 | 7 | Yellow; Sp. 3d t., channelled, difficult. Arr. |
| 393 | ..... | ξ Cygni, 7333 B. A. C | 21 0 12 | +43 24.6 | 4 | Sp. 3d t., zones very distinct. |
| 394 | 258 | — Aquarii | 21 7 15 | + 0 12.7 | 9.5 | Orange red. |
| 395 | ..... | δ Equulei, 7372 B. A. C | 21 8 10 | + 9 28.9 | 4.5 | Yellow; traces of faint zones. |
| 396 | 259 | — Aquarii | 21 8 51 | — 3 4.9 | 8.5 | Red. |
| 397 | 260 | — Cephei | 21 9 31 | +59 34.7 | 8 | Red; Sp. faint; many red stars near. |
| 398 | 261 | — Pavonis | 21 12 27 | —70 16.7 | 6 | Ruby. |
| 399 | ..... | β Equulei | 21 16 26 | 6 15.26 | 5.5 | Yellow; Sp. with traces of zones. |
| 400 | ..... | LL. 41800 | 21 23 3 | +21 36.8 | 7 | Almost white; Sp. 3d t., magnificent; zones dark and intense. |
| 401 | ..... | 7474 B. A. C | 21 24 4 | +23 4.2 | 6 | Light orange; Sp. with superb dark intervals (to be re-observed). Arr. |
| 402 | 262 | — Cygni | 21 26 3 | +51 0.7 | 11 | Reddish. |
| 403 | ..... | Anonymous | 21 30 2 | +58 8.0 | 6 | Red; Sp. 3d t., channelled. |
| 404 | ..... | LL. 42153 | 21 31 6 | +44 48.6 | 6.5 | Yellowish; 3d t., of the finest kind; fluted; zones broad in the blue. |
| 405 | ..... | Cygni, LL. 42342 | 21 36 32 | +34 55.1 | 6.7 | Deep red; Sp. 4th t., extraordinary; some narrow zones in the red; broad ones in the more refrangible colors. |
| 406 | 263 | S Cephei | 21 36 47 | +78 2.3 | var. | Red. |
| 407 | ..... | Anonymous | 21 37 46 | + 9 16.8 | ..... | Sp. with fine lines bordering the zones. |
| 408 | 264 | — Cygni | 21 37 54 | +37 25.3 | 8 | Red. |
| 409 | 265 | — Cygni | 21 38 59 | +37 16.1 | 8.5 | Extremely intense ruby. |
| 410 | 266 | μ Cephei, 7585 B. A. C | 21 39 31 | +58 11.1 | var. | Fine deep garnet; Sp. perfect example of 3d t., according to D'Arrest, but found by me to be only linear. |
| 411 | 267 | — Cephei | 21 39 39 | +53 7.0 | 9.2 | Red, in group 4701 H. |
| 412 | 268 | — Aquarii | 21 39 48 | — 2 48.8 | 6.5 | Red; Sp. 3d t., fine. |
| 413 | 269 | — Aquarii | 21 43 28 | + 0 21.6 | 10 | Red. |
| 414 | 270 | — Cygni | 21 50 22 | +49 53.7 | 9 | Fiery red. |
| 415 | 271 | — Pegasi | 21 58 5 | +27 43.3 | 8 | Deep orange. |
| 416 | 272 | — Cephei | 22 7 56 | +56 37.7 | 10 | Ruby; in neb. 4772 H. |
| 417 | 273 | 7765 B. A. C., Lacertæ | 22 8 18 | +39 4.2 | 4.5 var. | Reddish; Sp. 2d to 3d t., fine lines variable. |
| 418 | 274 | — Pegasi | 22 10 56 | + 4 29.8 | 6.8 | Red; Sp. with faint zones. |
| 419 | 275 | — Cephei | 22 18 15 | +55 18.4 | 5 | Fine red, variable; Sp. not ascertained. |
| 420 | ..... | ξ Pegasi | 22 40 12 | +11 30.6 | 5 | Sp. with traces of zones strongest in the green. |
| 421 | ..... | λ Pegasi | 22 40 16 | +22 52.9 | 4.5 | Yellow; traces of faint zones. |
| 422 | ..... | ι Cephei, 7967 B. A. C | 22 45 4 | +65 31.1 | 4 | Yellow; Sp. 3d t., zones very decided. |
| 423 | 276 | — Aquarii | 22 53 3 | —25 51.4 | 6 | Red; Sp. 4th t., certainly changeable. |
| 424 | 277 | — Piscium | 22 54 38 | + 0 23.2 | 9 | Red. [composable. |
| 425 | ..... | β Pegasi | 22 57 28 | +27 22.7 | 3 var. | Orange-yellow; Sp. the fundamental 3d t; zones de- |
| 426 | 278 | R Pegasi | 23 0 7 | + 9 50.6 | var. | Red. [variable. |
| 427 | 279 | — Pegasi | 23 0 27 | + 8 42.4 | 5.5 | Red, changing to yellow; Sp. 2d t., lines fine and |
| 428 | 280 | 8 Andromedæ | 23 11 44 | +48 18.3 | 5.5 | Red; Sp. 3d t., fine. |
| 429 | 281 | — Pegasi | 23 13 46 | +22 22.8 | 8.5 | Red; Sp. very faint. |
| 430 | 282 | — Cassiopeiæ | 23 18 29 | +60 53.0 | 9 | Reddish in group 52 M. |
| 431 | 283 | — Piscium | 23 22 52 | + 0 22.6 | 10.5 | Red. |
| 432 | 284 | — Piscium | 23 24 2 | + 0 9.7 | 8 | Red; Sp. very faint. |
| 433 | 285 | — Pegasi | 23 26 0 | +23 7.7 | 8 | Red; Sp. with very faint zones; three others near. |
| 434 | ..... | — Pegasi, LL. 46146 | 23 26 57 | +21 46.9 | 6 | Red; Sp. 3d t., zoned; very fine; numerous obscure zones. [yellow. |
| 435 | ..... | 8250 B. A. C | 23 36 46 | + 9 36.6 | 5.5 | Yellow; Sp. with very sharp striæ in the red and |
| 436 | 286 | — Piscium | 23 39 45 | + 2 45.9 | 6 | Reddish; Sp. 4th t., but certainly variable. |
| 437 | 287 | — Andromedæ | 23 42 31 | +44 27.7 | 10 | Ruby. |
| 438 | 288 | — Piscium | 23 45 53 | + 0 20.4 | 10 | Red. |
| 439 | 289 | — Cephei | 23 46 5 | +74 48.4 | 6.5 | Orange, variable; Sp. 3d t., zones feeble. |
| 440 | ..... | LL. 46859 | 23 48 8 | — 0 57.8 | 6.7 | Almost white; Sp. 3d t., with dark striæ well separated; a rare example. Arr. |
| 441 | 290 | — Ceti | 23 50 26 | —27 20.9 | 5.5 | Yellowish-red; Sp. 2d t., variable. |
| 442 | 291 | R Cassiopeiæ | 23 51 49 | +50 39.9 | var. | Red. |
| 443 | 292 | — Piscium | 23 53 55 | + 0 20.5 | 10 | Rosy. |
| 444 | 293 | — 6259 Rad., Cassiopeiæ | 23 54 39 | +59 37.9 | 6 var. | Red; Sp. a bright-green zone. |
| 445 | ..... | γ Cassiopeiæ | 0 48 52 | +60 0.8 | 3 | White; Sp. reversed of the 1st order; lines H bright. |

NOTE.—*Rad.* signifies Radcliffe's catalogue; *Argel.*, that of Argelander; B. A. C., that of the British Association; LL., that of Lalande; *Neb. H.*, Sir John Herschel's catalogue of nebulæ and groups; *Group M.*, group in Messier's catalogue; *Arg. Oelz.*, catalogue of Oelzen in Argelander's works; *Arr.* signifies D'Arrest; *Sp.* denotes spectrum.

fact that the spectra of these stars change in this manner there can be no doubt that the variation depends on the occurrence of eruptions of metallic vapors, as in the spots of our sun.

Beta Lyræ, a star of the first type, and a famous variable, has a double period—that is to say, a period formed of two maxima separated by two minima, unequal in quantity, but approximately equal in time. The general period is 12*d*. 21*h*. 53*m*. At its maximum it is of the order 3.4; at the first minimum, 4.3; and at the second 4.5; the period moreover of this seems to be variable in duration. This star, at its maximum brightness, presented to us sometimes formerly the bright lines of hydrogen, but in repeated subsequent searches we have never been able to see them again. Delta Cephei is another variable, whose period is 5*d*. 8*h*. 7*m*., and the extent of its variation from the 3d to the 5th magnitude. The interval between the maximum and minimum is 3*d*. 19*h*., and that from the minimum to the maximum 1*d*. 14*h*. It was discovered by Goodricke in 1784.

Algol, or β Persei, in the head of Medusa, is quite an important star. Being ordinarily of the second magnitude, it remains at its maximum splendor for 2*d*. 13*h*., and then begins to decline slowly to such a degree that, in three hours and thirty minutes, it is reduced to a minimum of hardly the fourth magnitude. In this condition it remains but for a very short time—say, seven or eight minutes at most—and, in another three hours and thirty minutes, it resumes its former state. The total duration of the complete period is 2*d*. 20*h*. 48*m*. 55*s*. The variability of this star was discovered by Montanari in 1669. The spectroscopic study of it, made many times, has not shown any variation of type in its various phases. It is of the first type, which it has always preserved constant, even at its minimum. This fact, combined with that of a change of rate in its period, shows that, in this case, the origin of the variations is not an emanation of vapors, but a dark body which, during a certain time, partially occults the star. An accurate study of the period has proved that it is not constant, and that it is apparently at the present time shorter than formerly; but as the rate of change is not itself constant, perhaps the disturbances are periodic, and due to the motion of the principal star, or to perturbations occasioned by other obscure satellites. Up to this time Algol is the only star of which it can be affirmed, with any certainty, that it has dark satellites circulating round it.

A star quite important for its variations of brightness is η Argus in the southern hemisphere. Halley in 1667 placed it in his catalogue as of the fourth magnitude. In 1751, La Caille made it of the second. In 1814 it was again, according to Burchell, of the fourth. From 1822 to 1826, according to Brisbane, it was of the second. In 1827 it was of the first, according to Burchell; in 1834 between the first and second, according to Herschel. It afterward increased to the first, and from 1837 to 1850 became equal to α Centauri; in 1875 it was once more of the fourth. It is difficult to form an idea of the cause of such phenomena. The spectrum, as I am assured by one who has examined it, is banded.

Variable stars, when they have no other proper letter, are indicated in catalogues by capitals; as, for example, J Coronæ, B Herculis, etc.

To the category of the variables belong the temporary stars. A famous object of this kind, which appeared in Cassiopeia in the time of Hipparchus (125 B. C.), determined that astronomer to construct his catalogue, in order that he might leave to posterity a record, which should enable them to judge whether even the stars called fixed are not liable to change their places or to disappear. Another presented itself in 1572, in the time of Tycho, in the same constellation, and excited unbounded admiration. Resplendent as Venus for seventeen months, it afterward passed from white to yellow, and then to red, and finally disappeared altogether, or left at least but a doubtful trace. Argelander, having discussed the observations of Tycho, gave for the position of this star A. R. 0*h*. 17*m*. 52.6*s*., Decl. N. 63° 27′ 18″. In this precise point of the heavens no star exists, but, at less than a minute of distance from the spot, there is a little one which is also variable, and this may be the same. There remains also a record of stars similarly seen in Cassiopeia in the years 945 and 1264—facts which have given ground for a suspicion that all these may have been the same star from time to time reappearing. The ancient Chinese speak of many stars appearing and afterward vanishing. Many of these are comets, but of some there can be no doubt that they were stars. The uncertainty of their positions, however, prevents any comparison.

In the time of Kepler, in 1604, also, a star of this class, which appeared in the foot of Serpentarius, lasted fifteen months with the brilliancy of Venus, and after passing from white to yellow, and then to red, finally vanished. It was situated in A. R. 17*h*. 23*m*. 8.9*s*., Decl. S. 21° 22′ 16″, in which place there is no star now, though there is a small one at less than 2½′ distance.

In 1670, in the constellation of the Swan, a temporary star appeared, which lasted two years and reached the 3d magnitude. In 1848, Hind saw one in Ophiuchus, which sprang suddenly to the 4th magnitude, and is now of the 11th. Finally, in 1866, as mentioned in the preceding section, a new star made its appearance in the constellation of the Crown, which, from the 8th, grew to be of the 2d magnitude. Its spectrum was studied almost solely by Mr. Huggins, because no notice of it reached the public until after it had greatly dwindled. We were able to verify the lines of this spectrum; and we have found also another variable in the Gemini, which, on a small scale, presented the same phenomena. As we have said before, this spectrum had the direct lines of hydrogen, and there was every indication of an enormous conflagration. Perhaps also such is the origin of the other temporary stars. As Sir John Herschel justly remarks, the mind is lost in the endeavor to conceive such a phenomenon. How immense must be a conflagration vast enough to be visible at the distance of millions of millions of miles! But for us such occurrences are still more surprising, in consequence of the revelation they bring, that infinite space is probably strewed with innumerable obscure bodies, which we never see, except on the occasional occurrence in them of catastrophes of this frightful character.

Many of the stars set down in the catalogues of the ancients are now lost; it is impossible to believe all these to have been errors of observation. Some certainly were planets, and some have made themselves known as really Uranus or Neptune, since, by subsequent discovery, the elements of the orbits of these planets have been ascertained; but of divers others it is manifest that they have really disappeared. Annihilated they certainly have not been; there accordingly remains only the conclusion that they have become extinct—that is to say, reduced to the condition of dark bodies like the planets. (See Tables D and E.)

TABLE D.—*Stars possibly Variable.*

| No. | Name. | R. A. 1870 | | | Decl. 1870 | | Magnitude. | Authority. |
|---|---|---|---|---|---|---|---|---|
| | | *h.* | *m.* | *s.* | ° | ′ | | |
| 1 | —Orionis | 5 | 23 | 33 | — 1 | 8.0 | 9 | Argelander. |
| 2 | —Cancri | 5 | 27 | 6 | +21 | 51.2 | 8.9—11.12 | Schmidt, 1864. |
| 3 | *a* Argûs | 6 | 21 | 4 | —52 | 37.5 | 1 | |
| 4 | *a* Ursæ Majoris | 10 | 55 | 42 | +62 | 27.2 | 1.5—2 | Lalande, 1786. |
| 5 | 21 Virginis | 12 | 27 | 4 | — 8 | 44.1 | 5.5 | |
| 6 | W Virginis | 13 | 23 | 39 | — 8 | 56.1 | 8.5 | Hind. |
| 7 | η Ursæ Majoris | 13 | 42 | 24 | +49 | 57.8 | 1.5—2 | Lalande, 1786. |
| 8 | X Virginis | 13 | 47 | 39 | +11 | 42.5 | 8.5 | Hind. |
| 9 | β Ursæ Minoris | 14 | 51 | 7 | +74 | 41.2 | 2—2.5 | Struve, 1838. |
| 10 | κ Coron. Austr. | 18 | 24 | 24 | —38 | 48.9 | 3—6 | Halley, 1676. |
| 11 | S Capricorni | 20 | 34 | 9 | —19 | 30.8 | 9—11 | Hind, 1854. |
| 12 | λ¹ Cygni | 20 | 41 | 58 | +33 | 53.7 | 5.5 | Schmidt, 1864. |
| 13 | —Aquarii (1) | 22 | 22 | 31 | —10 | 36.0 | 7.8—0 | Rümker, 1848. |
| 14 | —Aquarii (2) | 22 | 29 | 4 | — 8 | 16.7 | 9—0 | Hind. |
| 15 | T Cephei | 23 | 14 | 44 | +55 | 24.1 | 8.2—8.8 | Argeland. 1863. |

Even the sun itself is a variable star. The undecennial variations of its spots, and of the protuberances or eruptions, prove that it has not a constant activity, and that on this account it must vary; but the direct proof of this variability and of its limits is, we may say, next to impossible. Light is not measurable with precision, and the greater abundance of spots does not prove that the sun's light is less during their prevalence, because the greater intensity of light in the luminous parts may compensate for that which fails in the obscure—a thing which is also very probable, considering the greater energy of action then evident. Again, as all our observations are necessarily made through the atmosphere, the excessive instability of this medium prevents the exact measurement of the solar radiation and temperature. A proof of variation in these has been sought in the variations of the mean annual climatological temperature, but such variations do not in all places accord with the solar period above mentioned. Such proof has also been sought by Meldrum in the frequency of the equatorial cyclonic storms, but this also is insufficiently trustworthy. A variability of the sun is therefore certain, but the direct demonstration of it is difficult. The very intensity of solar light and heat is an obstacle. Wollaston estimated this intensity at twenty million times that of Sirius, but others put it at sixty thousand millions; whence it is obvious how far we may be from the truth. Spectral research only, by enabling us better to understand the tendency of these variations, can perhaps yet give us some such direct demonstration and measure.

### § 5. *Number of the Stars.*

The stars pass for innumerable, and are a most emphatic emblem of whatever exceeds in number the power of human computation. Nothing could more forcibly impress this idea. To the ancients, judging by the naked eye, it appeared nothing less than miraculous that Hipparchus

TABLE E.—*Variable Stars.*

| Number. | Star. | R. A. 1870. | Decl. 1870. | Period. | Change of magnitude. | Authority. |
|---|---|---|---|---|---|---|
| | | *h. m. s.* | ° ′ | *Days.* | *From to* | |
| 1 | R Andromedæ | 0 17 12 | +37 51.3 | ..... | 6 | Argelander, 1860. |
| 2 | B Cassiopeiæ | 0 17 36 | +63 25.5 | ..... | ..... | Tycho, 1572. |
| 3 | T Piscium | 0 25 16 | +13 52.9 | 143 ± | 9.5 11 | R. Luther, 1855. |
| 4 | α Cassiopeiæ | 0 33 9 | +55 49.4 | 79.1 | 2 2.5 | Birt, 1831. |
| 5 | U Piscium | 0 37 35 | + 6 35.3 | ..... | 9 12 < | Hind. |
| 6 | S Cassiopeiæ | 1 10 8 | +71 55.6 | ..... | 13 < | Argelander. |
| 7 | S Piscium | 1 10 46 | + 8 13.7 | 13 m. ± | 9 13 < | Hind, 1851. |
| 8 | R Piscium | 1 23 56 | + 2 12.6 | 346 | 7 9.5 | Hind, 1850. |
| 9 | V Piscium | 1 47 30 | + 8 8.5 | ..... | 6 9 | Argelander, 1863. |
| 10 | S Arietis | 1 57 40 | +11 54.1 | ..... | 9 13 < | C. H. Peters, 1865. |
| 11 | R Arietis | 2 8 44 | +24 27.1 | 186 | 8 12 < | Argelander, 1855. |
| 12 | o Ceti | 2 12 47 | — 3 34.1 | 331.336 | 2 12 < | D. Fabricius, 1596. |
| 13 | ρ Persei | 2 56 51 | +38 20.1 | 33 | 4 | Schmidt. |
| 14 | β Persei | 2 59 43 | +40 27.2 | 2.86727 | 2.5 4 | Montanari, 1669. |
| 15 | R Persei | 3 21 47 | +35 13.2 | 419 | 8.6 13 < | Schönfeld, 1861. |
| 16 | λ Tauri | 3 53 29 | +12 7.3 | 3.952 | 4 4.5 | Baxendell, 1848. |
| 17 | U Tauri | 4 14 15 | +19 30.2 | ..... | 9 10.4 | Baxendell, 1862. |
| 18 | T Tauri | 4 14 25 | +19 13.5 | ..... | 9.7 13.5 < | Hind. |
| 19 | R Tauri | 4 21 10 | + 9 52.2 | 327 | 8 13.5 < | Hind, 1849. |
| 20 | S Tauri | 4 22 5 | + 9 39.4 | 375 | 10 13 < | Oudemans. |
| 21 | R Orionis | 4 51 55 | + 7 55.7 | 378 | 9 12.5 < | Hind, 1848. |
| 22 | ε Aurigæ | 4 52 38 | +43 37.7 | 250 | 3.5 4.5 | Heis, 1846. |
| 23 | R Leporis | 4 53 41 | —15 0.2 | 411 | 7 | Schmidt, 1855. |
| 24 | μ Doradûs | 5 5 47 | —61 58.4 | Long. | 5 9 | Moesta, 1865. |
| 25 | R Aurigæ | 5 6 48 | +53 26.2 | ..... | ..... | Argelander. |
| 26 | α Orionis | 5 48 8 | + 7 22.8 | 196 ± | 1 1.5 | J. Herschel, 1836. |
| 27 | R Monocerotis | 6 32 4 | + 8 50.9 | ..... | 10 13 | Schmidt. |
| 28 | ζ Geminorum | 6 56 24 | +20 45.5 | 10.16 | 3.8 4.5 | Schmidt, 1847. |
| 29 | R Geminorum | 6 59 32 | +22 54.1 | 370 | 7.3 11 | Hind, 1848. |
| 30 | R Canis Minoris | 7 1 32 | +10 13.6 | 329 | 8 10 | Argelander, 1854. |
| 31 | S Canis Minoris | 7 25 39 | + 8 35.6 | 335 | 7.5 13 < | Hind, 1856. |
| 32 | S Geminorum | 7 35 14 | +23 45.2 | 294.07 | 9.2 13.5 < | Hind, 1848. |
| 33 | T Geminorum | 7 41 30 | +24 3.3 | 288.64 | 9.5 13.5 < | Hind, 1848. |
| 34 | U Geminorum | 7 47 23 | +22 20.5 | 97 | 9 13.5 < | Hind, 1848. |
| 35 | R Cancri | 8 9 24 | +12 7.4 | 359 | 6 10 < | Schwerd, 1829. |
| 36 | U Cancri | 8 28 19 | +19 20.5 | 306 | 9 13.5 < | Chacornac. |
| 37 | S Cancri | 8 36 30 | +19 30.0 | 9.48 | 8 10.5 | Hind, 1848. |
| 38 | S Hydræ | 8 46 47 | + 3 33.5 | 256 | 8.5 13.5 | Hind, 1848. |
| 39 | T Cancri | 8 49 14 | +20 20.7 | 455 ± | 9.5 12 | Hind, 1850. |
| 40 | T Hydræ | 8 49 20 | — 8 38.7 | 291 or 326 ± | 6.5 10.5 | Hind, 1851. |
| 41 | α Hydræ | 9 21 12 | — 8 5.9 | 55 | 2.5 3 | J. Herschel, 1837. |
| 42 | R Leonis Minoris | 9 37 46 | +35 6.5 | 1 year ± | 7 11 | Schönfeld, 1863. |
| 43 | R Leonis | 9 40 34 | +12 1.8 | 331 | 5 11.5 | Koch, 1782. |
| 44 | R Ursæ Majoris | 10 35 25 | +69 27.4 | 301.90 | 7 13 | Pogson, 1853. |
| 45 | η Argûs | 10 40 2 | —59 0.1 | 46 years. | 1 4 | Burchell, 1827. |
| 46 | S Leonis | 11 4 7 | + 6 10.1 | 192 | 9 13 | Chacornac. |
| 47 | U Leonis | 11 31 47 | + 4 5.5 | ..... | 10 14 < | C. H. Peters, 1865. |
| 48 | R Comæ Berenicis | 11 57 55 | +19 30.3 | 1 year ± | 8 13 < | Schönfeld, 1856. |
| 49 | T Virginis | 12 7 56 | — 5 18.7 | 337 | 8 13 < | Boguslawski. |
| 50 | T Ursæ Majoris | 12 30 28 | +60 12.2 | 257 | 6.7 13 < | Argelander. |
| 51 | R Virginis | 12 31 54 | + 7 42.2 | 146 | 6.5 11 < | Harding, 1809. |
| 52 | S Ursæ Majoris | 12 38 15 | +61 48.3 | 222.6 | 7.5 12 < | Pogson, 1853. |
| 53 | U Virginis | 12 44 30 | + 6 15.7 | 212 | 7.5 12 < | Harding. |
| 54 | Y Virginis | 13 19 18 | — 2 42.1 | ..... | 8.5 10 | Schönfeld, 1866. |
| 55 | V Virginis | 13 21 6 | — 2 29.7 | 252 | 7 | Goldschmidt, 1857. |
| 56 | R (υ) Hydræ | 13 22 37 | —22 36.4 | 447.8 | 4 10 < | T. P. Maraldi, 1704. |
| 57 | S Virginis | 13 26 13 | — 6 31.4 | 380.11 | 6 11 | Hind, 1852. |
| 58 | Z Virginis | 13 27 45 | —12 32.7 | ..... | 5 8 | Schmidt, 1866. |
| 59 | T Boötis | 14 8 0 | +19 40.5 | ..... | 9.7 14 < | Baxendell, 1860. |
| 60 | S Boötis | 14 18 32 | +54 24.2 | ..... | 8 12 | Argelander, 1860. |
| 61 | R Camelopardi | 14 27 35 | +84 25.2 | 265 | 7 13 | Winnecke. |
| 62 | R Boötis | 14 31 27 | +27 18.1 | 296 | 8 12 | Argelander. |
| 63 | U Boötis | 14 34 48 | +28 1.4 | ..... | 9.5 13 | Baxendell, 1864. |
| 64 | δ Libræ | 14 54 2 | — 8 0.1 | 6.98 | ..... | Schmidt. |
| 65 | S Serpentis | 15 15 34 | +14 47.0 | 359 | 8 10 < | Harding, 1828. |
| 66 | S Coronæ | 15 16 6 | +31 50.2 | ..... | 6.5 | Hencke, 1860. |
| 67 | R Coronæ | 15 43 13 | +28 33.5 | 350 | 6.2 13 < | Pigott, 1795. |
| 68 | R Serpentis | 15 44 42 | +15 31.8 | 352 | 6.5 10 < | Harding, 1826. |
| 69 | R Libræ | 15 46 15 | —15 50.8 | 722 | 9 13.5 | Pogson, 1858. |
| 70 | T Coronæ | 15 54 4 | +26 17.5 | ..... | 2.5 9.8 | Bermingham, 1866. |
| 71 | R Herculis | 16 0 23 | +18 43.4 | 310 | 8.5 13.5 | Argelander. |
| 72 | T Scorpii | 16 9 18 | —22 39.0 | ..... | 7 13 < | Auwers, 1860. |
| 73 | R Scorpii | 16 9 54 | —22 37.3 | 648 | 9 14 < | Chacornac, 1853. |
| 74 | S Scorpii | 16 9 56 | —22 34.3 | 364 | 9 13 < | Chacornac, 1854. |
| 75 | U Scorpii | 16 14 59 | —17 34.5 | ..... | 9.5 13.5 | Pogson, 1863. |
| 76 | U Herculis | 16 20 3 | +19 11.4 | ..... | 7 13 | Hencke, 1860. |
| 77 | 30 Herculis | 16 24 22 | +42 10.1 | 106 | 5 6 | Baxendell, 1857. |
| 78 | T Ophiuchi | 16 26 18 | —15 51.2 | ..... | 10.5 13 < | Pogson, 1860. |
| 79 | S Ophiuchi | 16 26 47 | —16 53.1 | 229.3 | 9.3 13.5 < | Pogson, 1854. |
| 80 | S Herculis | 16 45 59 | +15 9.7 | 305 | 7.7 12.5 | Schönfeld, 1856. |
| 81 | — Ophiuchi | 16 52 13 | —12 41.4 | ..... | 4.5 13.5 < | Hind, 1848. |
| 82 | R Ophiuchi | 17 0 18 | —15 55.6 | 304.6 | 8 13.5 < | Pogson, 1853. |
| 83 | α Herculis | 17 8 43 | +14 32.4 | ..... | 3.1 3.9 | W. Herschel, 1795. |
| 84 | — Ophiuchi | 17 22 51 | —21 22.1 | ..... | ..... | D. Fabricius, 1604. |
| 85 | T Herculis | 18 4 11 | +31 0.0 | 164.7 | 7.9 13 < | Argelander. |
| 86 | T Serpentis | 18 22 28 | + 6 13.0 | 310 | 10.5 14 < | Baxendell, 1860. |
| 87 | U Sagittarii | 18 24 14 | —19 12.8 | 6.8 | 7.5 9 | Schmidt, 1866. |
| 88 | R Clypei Sobieski | 18 40 33 | — 5 50.5 | 89 | 5 9 | Pigott, 1795. |
| 89 | β Lyræ | 18 45 17 | +33 12.7 | 12.906 | 3.5 4.5 | Goodricke, 1784. |
| 90 | 13 Lyræ | 18 51 23 | +43 46.6 | 46 | 4.2 4.6 | Baxendell, 1855. |
| 91 | R Aquilæ | 19 0 7 | + 8 2.1 | 351.5 | 6.5 | Argelander, 1855. |
| 92 | T Sagittarii | 19 8 43 | —17 11.0 | ..... | 8.5 12 < | Pogson, 1863. |
| 93 | R Sagittarii | 19 9 4 | —19 32.0 | 465 | 8 13 < | Pogson, 1858. |
| 94 | S Sagittarii | 19 11 49 | —19 15.6 | ..... | 10.5 | Pogson, 1860. |
| 95 | R Cygni | 19 33 20 | +49 54.5 | 416.72 | 8 14 | Pogson, 1852. |
| 96 | 11 Vulpeculæ | 19 42 14 | +26 59.8 | ..... | ..... | Anthelm, 1670. |
| 97 | S Vulpeculæ | 19 43 4 | +26 57.9 | 67.9 | 8.8 9.8 | Rogerson, 1873. |
| 98 | $\chi^2$ Cygni | 19 45 34 | +32 35.2 | 409.2 | 5 13 < | G. Kirch, 1686. |
| 99 | η Aquilæ | 19 45 51 | + 0 40.4 | 7.1763 | 3.6 4.4 | Pigott, 1784. |
| 100 | S Cygni | 20 2 47 | +57 36.7 | 324 | 9 13 < | Argelander, 1860. |
| 101 | R Capricorni | 20 4 1 | —14 39.2 | ..... | 9.5 13.5 | Hind, 1848. |
| 102 | T Aquilæ | 20 5 39 | +15 14.3 | 124 ± | 8.9 11.3 | Baxendell, 1863. |
| 103 | R Sagittarii | 20 8 8 | +16 20.0 | 70.88 | 8.3 10.3 | Baxendell, 1859. |
| 104 | S Aquilæ | 20 8 39 | + 8 41.4 | ..... | 9 12 < | Hencke, 1815. |
| 105 | 34 Cygni | 20 13 0 | +37 37.8 | 18 years ± | 3 6 < | Jansen, 1600. |

| Number. | Star. | R. A. 1870. | Decl. 1870. | Period. | Change of magnitude. | Authority. |
|---|---|---|---|---|---|---|
| | | *h. m. s.* | ° ′ | *Days.* | *From to* | |
| 106 | R (24) Cephei | 20 23 41 | −15 42.6 | 73 years ± | 5 11 | Pogson, 1856. |
| 107 | R Delphini | 20 37 5 | +78 2.3 | 248 | 8 13.5 | Baxendell, 1860. |
| 108 | S Delphini | 20 39 20 | +58 11.1 | ..... | 8.6 12 | Baxendell, 1863. |
| 109 | U Capricorni | 20 40 54 | +11 54.2 | 420 | 11 13.5 < | Pogson, 1857. |
| 110 | T Aquarii | 20 4 36 | +57 45.0 | 197 | 7.8 0 | Goldschmidt, 1861. |
| 111 | R Vulpeculæ | 20 58 36 | −21 2.1 | 138.6 | 8 13.5 | Argelander. |
| 112 | T Capricorni | 21 14 50 | +27 22.7 | 274 | 9 14 < | Hind, 1854. |
| 113 | S Cephei | 21 36 47 | +9 50.6 | 470 | 8.9 11.12 | Winnecke. |
| 114 | μ Cephei | 21 39 31 | −16 0.3 | 5 or 6 years. | 4 6 | W. Herschel, 1782. |
| 115 | T Pegasi | 22 2 33 | +50 39.9 | ..... | 10 13 < | Hind, 1863. |
| 116 | δ Cephei | 22 24 21 | +88 44.0 | 5.3664 | 3.7 4.8 | Goodricke, 1784. |
| 117 | S Aquarii | 22 50 8 | +16 37.4 | 279.3 | 8 11 < | Argelander, 1853. |
| 118 | β Pegasi | 22 57 28 | +15 55.7 | 31.5 or 43.4 | 2 2.5 | Schmidt, 1848. |
| 119 | R Pegasi | 23 0 7 | −15 15.6 | 578 | 8.5 13.5 | Hind, 1848. |
| 120 | R Aquarii | 23 37 5 | −5 37.6 | 354 or 388.5 | 7 10 < | Harding, 1810. |
| 121 | R Cassiopeiæ | 23 51 49 | +23 18.4 | 434.81 | 6 14 < | Pogson, 1853. |

should have made a catalogue of only a little over a thousand of them. But this work, worthy of the gods as Pliny called it, contained something more than a simple enumeration; it contained a precise determination of positions—a thing much more difficult. Really, however, also the simple counting of the stars is by no means easy; the sight becomes confused, and when we attempt to fix precisely the number of those we see, we find it quite small, and are at the same time convinced that all have certainly not been counted. The very diligent Heis avers that, for an observer in Middle Europe, it is not possible, with the naked eye alone, to count more than four or five thousand. Possessing an extremely acute vision himself, and using special precautions—such, for example, as removing all artificial light, limiting by means of a large tube the extent of sky under observation, and making his charts black and the stars white—this acute observer was able, at Münster, to see 5421; and since, from this station, eight-tenths of the total superficies of the heavens are visible, he argued that, supposing the remainder of the southern hemisphere to be furnished with equal abundance, the entire number barely reaches 6800.* But these certainly are not all the stars of the heavens. The naked eye sees really more than it is possible to count, because in fixing one in the centre of the retina, others seen on the surrounding portions, or, as the common saying is, "out of the corner of the eye," seem to vanish.

Instruments sublimely undeceive us in this matter. How many times have we made proof of this for the pleasure it affords! With the equatorial of Merz directed to whatever point of the Milky Way, and looking through the finder, which has an aperture of sixty millimètres and a field of half a degree, it is common to see within that narrow limit quite as many stars as the motionless naked eye can take in, in any single direct view.† Passing from the finder to the great telescope of 9.6 inches aperture, with a moderate magnifying power and field of 15′ for the greatest power employed, it is easy to see as many stars as before in the finder; that is to say, as many as were seen before in a space four times as large. Increasing the power, and reducing the field to five minutes, it is still true that the number of stars visible is not in the least diminished, the penetrating power of the enlargement enabling us to discern very minute stars which were before invisible. It therefore results that, in some places in the heavens, in a field of hardly five minutes diameter, there are seen as many stars as with the naked eye in the entire natural field of direct vision. But it is manifest that, in such places, a larger telescope—for example, one of 12 or 14 inches—would make visible a still larger number; and, in fine, the most gigantic of all, the large refractor of Lord Rosse, would increase the number in a proportion corresponding to its extraordinary power. Not all the heavens, however, are thus rich; in many places, even with the most powerful instruments, and in a field of 15′, are hardly found so many as five or six stragglers; whence it follows that, from the examination of a few particular localities, it could not be possible to infer at all the total number of the stars.

The telescopic enumeration of the stars was attempted by both the Herschels—Sir William in the northern hemisphere, and Sir John in the southern. It was one of the most colossal labors ever instituted in astronomy, though incomplete, for the reason that it could not be otherwise; the lifetime of one man being insufficient for the accomplishment of so great a task.

The method employed by the elder Herschel was only indirect. He used for the purpose his 20-foot reflector with 18 inches aperture, directing it successively to various points of the heavens disposed in a certain regular order, of which he recorded the right ascension and declination. These points were so distributed as, in the end, to cover the heavens with a kind of network, sensibly uniform in every direction. The field of the telescope was of 15′ 4″ diameter, and the magnifying power 120. He counted in each field the number of stars visible, and, where this was impossible because of their multitude, or where to count the whole would have occupied too much time, he counted a part, and made a proportionate estimate for the rest. These enumerations he called "star-gauges," or soundings of the heavens. Having united several of these gauges in a determinate part of the sky, he divided the sum by the number of gauges, and took the quotient to represent the density of the stars in the neighboring region. This method, the only one practically available, is in many respects imperfect, but, applied on a large scale, gives valuable results. It may sometimes happen that a spot greatly abounding in stars may occur in the neighborhood of another almost desert, and in such a case the telescope would give an error of excess; but this would be balanced by an error of deficiency similarly occurring elsewhere; and thus, in the long run, there would be a general compensation.

We have said that this enumeration of the stars, though incomplete, forms one of the greatest labors of astronomy. To conceive it, it suffices to reflect that, in his 3400 gauges (of which many were repetitions, the whole number of distinct areas examined having been only 683), Herschel studied no more than the $\frac{1}{250}$th part of the celestial vault; to have embraced the whole would have required not less than 83 years. In fact, as the field of the telescope, 15′ 4″ in diameter, was only equivalent to $\frac{1}{332979}$th of the starry sphere, we may find by computation that, at the rate of 100 gauges per night, and 100 favorable nights (the largest number which can be counted on) per annum, this great length of time would be consumed in completing the work. The results of this immense labor are published by Sir William Herschel in the *Philosophical Transactions* (vol. lxxv.) for 1785, and, for the southern hemisphere, by Sir John Herschel, in his work on the observations made at the Cape of Good Hope. The character of the results obtained in gauges taken at different points of the sky, is immensely various. In some spots, so excessive is the number of stars, that not fewer than 588 are found in a single field; and with a constant density as great as this, they continue to pass for many minutes. In one locality, at about A. R. 19*h*. 27*m*., Polar Dist. 72° 54′, fully 116,000 stars passed in a single quarter of an hour, while in other points, the field embraced but one or two. The law of distribution of these objects will be a subject of inquiry elsewhere; we remark only here, that the number visible in the telescope of Herschel is computed to amount to 20,374,304. In the southern hemisphere, the phenomena are found to present a perfect similarity with those of the northern. But it is beyond a doubt that, while the stars visible in great instruments may be stated at between 20 and 30 millions, the number really existing is immensely greater. The Via Lactea alone, in certain portions, is absolutely white, without giving, like the nebulæ, a gaseous spectrum, and is thus proved to be composed of innumerable stars.

We have already given a numerical list of the stars according to their relative magnitudes as assigned by Heis, from which it is apparent that the numbers go on increasing as the magnitudes diminish. But for the smaller and telescopic stars all precise data are wanting. It is only from the prodigious labors expended upon catalogues designed to fix their positions, that we can derive any idea of them. Such has been the object of many enumerations made by zones, which serve to give an idea of the countless number, but make it clear that we shall never succeed in gathering up the whole. Lalande, by the method of

* Heis, *Atlas Cœlestis Novus*, p. xiii.

† It is necessary to distinguish what we call a direct view of the heavens, from that which is meant by a general view. In a glance, the field of vision embraces hardly more than 13° or 14°; by turning the eye, it is clear that we may sweep over the whole heavens.

zones, fixed the position of more than 50,000 stars, keeping within the limit of the 9th magnitude, and neglecting all the inferior in the immediate vicinity of the more brilliant. The zones of Bessel give a contingent of 52,199 not below the 9th magnitude, within the limits of 15° of N. and 15° of S. declination. Those of Argelander give the astounding number of 324,198 in the northern hemisphere almost wholly, but including 2° of S. declination, all being catalogued down to the 9th magnitude, and some between the 9th and 10th. We still await the results of the extended examination of the southern heavens (celestial survey), made by the Americans at Santiago de Chili, and of that undertaken by Harvard College with the great equatorial of 15 inches. These partial labors only show how far from exaggeration was the result reached by Herschel, when we consider the manner in which it was attained; since, putting the most moderate estimate upon the penetrating power of his telescope, the speculum being in good condition of polish, it assured the visibility of stars of at least the 15th magnitude.

A catalogue of stars is a list in which the stars are entered by their names and magnitudes, together with their co-ordinates of position. The ancients referred these co-ordinates to the ecliptic, in order to facilitate reductions of place from one epoch to another. The moderns, on the contrary, prefer the equatorial co-ordinates of right ascension and declination. The most celebrated catalogues are the following: The catalogue of Hipparchus, made at Rhodes B. C. 128, preserved by Ptolemy, and reduced with an erroneous precession to the year 137 of the common era, containing 1025 stars; that of Ulugh Beigh, made at Samarcand in 1437, containing 1019; that of Tycho Brahe, made at Uranibourg in 1602, and afterward republished by Kepler, containing 1005; that of Halley, embracing 341 southern stars, observed at St. Helena during the year 1677; that of Hevelius, made at Dantzic in 1690, containing 1564, which was the last of these labors conducted without telescopes—that is, by observations made with the naked eye, aided only by instruments with pinnules or plane sights.

From this time forward, labors of this character succeed each other in numbers too great for enumeration here. We limit ourselves to a mention of the principal, and refer for the rest to Chambers's *Descriptive Astronomy*, p. 593 *et seq.* The catalogue of Flamsteed, constructed in 1725, reduced to 1690, contains 3310 stars; the catalogues of Lacaille—viz. 1, that of 1750, containing 398 stars; 2, that of the zodiacal stars, containing 515; 3, that of 1924 southern stars observed at the Cape of Good Hope; the catalogue of Bradley, made at Greenwich and reduced to 1760—a work regarded as surpassing in precision all the preceding, on account both of the exquisite perfection of the instruments employed and of the accuracy of the observer. This was discussed anew by Bessel in 1818, in the *Fundamenta Astronomiæ*, and contains 389 stars; Bessel, from the same observations, augmented it to 3222. The catalogue of Lalande, taken from his *Histoire celeste*, contains 47,390 stars, and has been reduced to 1800 by a member of the British Association. That of Piazzi, made at Palermo, reduced to 1801, contains 6748. This was the work which immortalized its celebrated author, being unrivalled in richness, and most accurately reduced to his time; a second edition, which he prepared in 1814, contained 7646 stars. The catalogue of the Astronomical Society of London, published in 1826, contains 2881 stars; that of Pond, made at Greenwich, contains 1112; that of Argelander, prepared at Åbo—a work which has served to fix with precision the proper motions of the stars—embraces 560; that of Rümker, 1836, contains 11,978, observed at Hamburg; that of the British Astronomical Society contains 8377 stars, and was compiled from various sources, chiefly by the labors of Bailey; besides the positions of the stars it gives also the coefficients of reduction. This classic work, reduced to 1850, deserves to be brought down to the actual state of science, by taking advantage of the labors of the quarter of a century since passed. The catalogue of Airy, of 1849, deduced from the observations of twelve years at Greenwich, and containing 2156 stars, is a work of great precision. Soon after its publication it was followed by other catalogues, embracing the very meritorious results of seven years' and of three years' subsequent labors. The catalogue of Argelander, published at intervals in three parts, embraces stars between the 2d degree of S. declination and the North Pole to the number of 324,188. The catalogue of Weisse, constructed on the zones of Bessel between 15° S. and 45° N., published in two parts at different dates, contains 62,530 stars, observed at Königsberg. The catalogue of circumpolar stars by Groombridge, published 1838, reduced by Airy to 1810, embraces 4243. The Oxford catalogue of Johnson, a work of exactness, contains 6317. That of Carrington, made at Redhill, reduced to 1855 and published by the British government in 1857, contains 3735.

Many other large collections most worthy of mention we omit, but the foregoing will suffice to convey an idea of the perseverance and precision with which stellar astronomy is cultivated in our day. It need only be added that no fewer than 52 catalogues, containing in the mean from 6000 to 8000 stars each, may be counted among the labors, so far, of the present century (from 1800 to 1876), and that many similar works are now in course of publication. Our age will leave to others yet to come a splendid heritage, equally admirable for the abundance and for the precision of the labors which have created it.

### § 6. *Proper Motions of the Stars.*

From the earliest times, the luminous bodies which adorn the firmament have been divided into the classes "fixed" and "wandering." The fixed were called stars—the others, planets or comets. In the infancy of science, when the celestial sphere was conceived to be a solid dome, the stars were believed not only to be fixed in place, but permanently and mechanically affixed to the dome itself. Nor could this be otherwise, since, even after the human mind had made the grand stride to the conception of the earth as suspended in space, it could not yet account for the stability of the body, except by supposing it to occupy the centre of the universe. It was only after a gigantic measure of advancement in science, that it became possible to grasp the conception of an earth stable in mass, and at the same time revolving round the sun, assumed in its turn as the centre. But after the mind had once entered upon this order of ideas, and had succeeded in comprehending that the stability of things upon the surface of a celestial body is entirely compatible with the translation of the body in space, the suggestion naturally occurred that the sun himself might be in motion, and with him all the stars; since already the solid firmament had vanished for ever, and the stars could no longer be regarded otherwise than as so many suns independent of ours, and situated at distances from us so immense as to transcend our conceptions. The mobility of the stars was thus a corollary of the prevalent theory of the *cosmos*, and it remained only to verify it by observation. In this, as in so many things, the genius of Halley displayed its superiority. Comparing the actual positions of Sirius, Arcturus, Aldebaran, and other stars with those given in the primitive catalogues, he saw that, after taking account of all the progressive variations, of precession, and of the annual periodic motions, there remained differences of 37′, 42′, and 33′—quantities entirely too great to be ascribed to errors of copyists. As to Aldebaran, the reality of the change was confirmed by an occultation observed on the 11th of March, A. D. 509, at Athens—an occurrence which, according to the lunar theory, could not possibly have taken place, if the star had at that time occupied its present position. In view of these facts, the conjecture became a certainty; but the rude observations of the earlier astronomers, and the minuteness of the movements themselves, furnished no safe ground for inferences of practical value. It was reserved to modern times to give to observation a precision adequate to form a firm foundation on which to establish laws and deduce consequences, even when the intervals between the observations are by no means great. The difficulty of the subject will be understood by simply reflecting that, for most of the stars, the motions in question do not amount to so much as a single second of space per annum; and that the largest—which, moreover, occur in only a very few exceptional cases—do not exceed six or seven seconds. So long, therefore, as observations were not such as to be relied on within some seconds, the stellar motions were liable to be confounded for many years with errors of observation. That an observation may be good, it is not sufficient that the astronomer should be himself able; there is demanded also a high degree of perfection in his instruments; and this was not secured until the time of Flamsteed and of Bradley, when, a century ago, Bird and Graham carried to such perfection the division of the circle, and the construction of transit instruments and clocks. Then the foundations of success in exploring this maze began first to be laid. More modern observers, profiting by these earlier-gathered data, have been able to determine the movements in question with great precision, and will continue, with the progress of time, to fix them more and more exactly. Thus, Argelander, comparing his observations with those of Bradley and others after him, was successful in directing science to the exact solution of this great problem. The following table, taken from the catalogue of Struve entitled *Stellarum fixarum duplicium positiones mediæ*, etc. (St. Petersburg, 1852), contains a list of the brighter of the stars which have a proper motion of more than ten seconds in seventy years:

TABLE F.—*Table of the Principal Stars whose Proper Motions are not less than Ten Seconds in Seventy Years.*

| Name of Star. | Place of star, 1790.0. A. R. | Place of star, 1790.0. Decl. | Reciprocal of distance. λ. | Observed proper motion. In A. R. P. | Observed proper motion. In Decl. P′. | Observed proper motion. In great circle. Π. | Reduced proper motion. In A. R. q. | Reduced proper motion. In Decl. q′. | Reduced proper motion. Great cir. σ. | Reduced proper motion. Great cir. minim. τ. |
|---|---|---|---|---|---|---|---|---|---|---|
| | *h.* *m.* | ° | | ″ | ″ | ″ | ″ | ″ | ″ | ″ |
| β Cassiopeiæ | 23 58 | 58.0 | 0.488 | + 39.5 | — 13.8 | 41.8 | + 29.6 | — 11.1 | 31.6 | 3.1 |
| η Cassiopeiæ | 0 37 | 56.7 | 0.256 | + 79.7 | — 36.2 | 85.5 | + 74.8 | — 34.0 | 82.2 | 0.7 |
| β Andromedæ | 58 | 34.5 | 0.488 | + 13.7 | — 4.4 | 14.4 | + 4.7 | — 0.1 | 4.7 | 1.8 |
| ζ Piscium | 1 3 | 6.5 | 0.240 | + 10.6 | — 3.8 | 11.3 | + 6.2 | — 2.5 | 6.7 | 0.8 |
| δ Cassiopeiæ | 12 | 59.1 | 0.362 | + 23.2 | — 3.6 | 23.5 | + 16.7 | + 0.4 | 16.7 | 8.8 |
| α Arietis | 55 | 22.5 | 0.555 | + 13.9 | — 9.7 | 16.9 | + 5.2 | — 4.6 | 6.9 | 1.5 |
| ο (Mira) Ceti | 2 9 | — 3.9 | 0.256 | + 0.8 | — 13.9 | 13.9 | — 3.0 | — 13.0 | 13.3 | 13.2 |
| θ Persei | 30 | 48.3 | 0.240 | + 25.0 | — 7.8 | 26.2 | + 21.7 | — 4.3 | 22.1 | 12.7 |
| γ Ceti | 32 | 2.3 | 0.362 | — 9.4 | — 10.0 | 13.7 | — 14.2 | — 8.1 | 16.3 | 13.7 |
| 40 Eridani | 4 5 | — 8.0 | 0.256 | — 162.6 | — 256.7 | 303.9 | — 164.2 | — 256.2 | 304.3 | 304.3 |
| α Tauri | 24 | 16.1 | 0.940 | + 4.4 | — 11.0 | 11.8 | — 0.0 | — 1.5 | 1.5 | 0.4 |
| ω Tauri | 45 | 37.6 | 0.256 | + 8.1 | — 7.0 | 10.7 | + 7.4 | — 2.9 | 7.9 | 6.9 |
| Capella | 5 1 | 45.8 | 1.250 | + 6.2 | — 30.4 | 31.0 | + 4.6 | — 8.0 | 9.2 | 4.1 |
| β Tauri | 13 | 28.4 | 0.555 | + 4.2 | — 14.0 | 14.6 | + 3.9 | — 6.3 | 7.4 | 3.9 |
| Sirius | 6 36 | 16.5 | 2.000 | — 38.6 | — 90.3 | 98.2 | — 24.8 | — 92.5 | 95.8 | 95.2 |
| Castor | 7 21 | 32.3 | 0.770 | — 15.2 | — 3.5 | 15.6 | — 7.1 | + 6.8 | 9.8 | 9.6 |
| Procyon | 28 | 5.7 | 1.030 | — 51.4 | — 77.1 | 92.7 | — 40.0 | — 70.6 | 81.1 | 41.5 |
| Pollux | 32 | 28.5 | 0.830 | — 48.3 | — 3.4 | 48.4 | — 38.8 | + 6.6 | 39.3 | 32.7 |
| ζ Cancri | 8 0 | 18.3 | 0.217 | + 7.3 | — 8.8 | 11.4 | + 10.1 | — 6.8 | 12.2 | 11.5 |
| 1 Ursæ Majoris | 13 | 61.4 | 0.326 | — 9.4 | — 9.1 | 13.1 | — 4.8 | — 4.2 | 6.4 | 0.7 |
| ε Hydræ | 36 | 7.2 | 0.274 | — 14.2 | + 0.5 | 14.2 | — 9.9 | + 2.2 | 10.1 | 5.7 |
| ι Ursæ Majoris | 45 | 48.9 | 0.362 | — 35.0 | — 20.3 | 40.5 | — 29.1 | — 15.8 | 33.1 | 5.2 |
| θ Ursæ Majoris | 9 19 | 52.6 | 0.362 | — 73.7 | — 41.7 | 84.7 | — 67.3 | — 37.8 | 77.2 | 2.9 |
| υ Ursæ Majoris | 36 | 60 0 | 0.284 | — 19.7 | — 120.0 | 23.1 | — 14.4 | — 9.2 | 17.1 | 1.2 |
| Regulus | 57 | 13.0 | 0.840 | — 20.5 | + 2.5 | 20.7 | — 4.4 | + 7.6 | 8.8 | 8.7 |
| λ Ursæ Majoris | 10 4 | 44.0 | 0.326 | — 13.0 | — 3.6 | 13.5 | — 6.6 | — 1.0 | 6.7 | 1.9 |
| γ Leonis | 8 | 20.9 | 0.588 | + 20.8 | — 9.4 | 22.8 | + 32.3 | — 5.6 | 32.8 | 23.1 |
| α Ursæ Majoris | 51 | 62.9 | 0.555 | — 9.0 | — 6.4 | 11.0 | + 2.2 | — 4.1 | 4.7 | 4.2 |
| ξ Ursæ Majoris | 11 7 | 32.7 | 0.284 | — 33.6 | — 43.8 | 55.2 | — 27.8 | — 42.5 | 50.8 | 35.2 |
| ι Leonis | 11 13 | 11.7 | 0.265 | + 10.0 | — 2.1 | 10.2 | + 15.4 | — 0.8 | 15.4 | 10.7 |
| β Leonis | 38 | 15.7 | 0.555 | — 38.7 | — 5.9 | 39.1 | — 27.4 | — 3.7 | 27.6 | 1.8 |
| β Virginis | 40 | 2.9 | 0.326 | + 55.1 | — 18.7 | 58.2 | + 61.7 | — 17.2 | 64.1 | 58.6 |
| δ Ursæ Majoris | 12 5 | 58.2 | 0.326 | + 9.5 | — 3.2 | 10.0 | + 16.0 | — 3.6 | 16.4 | 10.1 |
| γ Virginis | 31 | 0.3 | 0.448 | — 40.8 | + 1.9 | 40.8 | — 32.0 | + 4.0 | 32.2 | 11.5 |
| 12 Canis | 46 | 39.5 | 0.338 | — 18.5 | + 5.6 | 19.3 | — 12.1 | + 5.2 | 13.2 | 4.7 |
| ζ Ursæ Majoris | 13 15 | 56.0 | 0.531 | + 10.5 | — 1.4 | 10.6 | + 20.0 | — 4.5 | 20.5 | 10.9 |
| Arcturus | 14 6 | 20.3 | 1.320 | — 84.1 | — 146.1 | 168.6 | — 64.1 | — 146.5 | 159.9 | 147.3 |
| θ Boötis | 18 | 52.8 | 0.284 | — 19.7 | — 29.2 | 35.2 | — 15.6 | — 31.7 | 35.3 | 34.8 |
| γ Boötis | 24 | 39.2 | 0.411 | — 0.4 | + 13.2 | 13.2 | + 5.3 | + 10.8 | 12.0 | 12.0 |
| μ Boötis | 15 17 | 38.1 | 0.256 | — 11.2 | + 9.1 | 14.4 | — 8.6 | + 7.2 | 11.2 | 1.3 |
| γ Coronæ | 34 | 27.0 | 0.265 | — 7.3 | + 8.0 | 10.8 | — 5.0 | + 6.9 | 8.5 | 4.5 |
| α Serpentis | 34 | 7.1 | 0.488 | + 12.7 | + 6.9 | 14.5 | + 17.0 | + 8.0 | 18.8 | 15.0 |
| ζ Herculis | 16 33 | 32.0 | 0.378 | — 32.1 | + 34.5 | 47.0 | — 30.7 | + 32.0 | 44.3 | 10.6 |
| δ Herculis | 17 6 | 25.1 | 0.362 | — 7.4 | — 8.8 | 11.5 | — 7.1 | — 10.4 | 12.6 | 11.1 |
| α Ophiuchi | 25 | 12.7 | 0.555 | + 6.2 | — 12.9 | 14.3 | + 5.8 | — 12.8 | 14.0 | 10.8 |
| μ Herculis | 38 | 27.9 | 0.274 | — 27.7 | — 53.1 | 59.9 | — 28.2 | — 54.6 | 61.3 | 59.7 |
| ψ Draconis | 46 | 72.2 | 0.256 | — 2.3 | — 18.7 | 18.9 | — 3.2 | — 23.3 | 23.5 | 18.8 |
| 70 p Ophiuchi | 55 | 2.6 | 0.256 | + 15.8 | — 81.3 | 82.8 | + 14.9 | — 80.3 | 81.7 | 42.3 |
| χ Draconis | 18 25 | 72.6 | 0.284 | + 37.9 | — 26.9 | 46.5 | + 36.2 | — 31.7 | 48.1 | 46.8 |
| α Lyræ | 30 | 38.6 | 1.300 | + 15.2 | + 22.4 | 27.1 | + 6.8 | + 11.5 | 13.4 | 1.0 |
| δ Draconis | 19 12 | 67.3 | 0.362 | + 8.7 | + 5.2 | 10.1 | + 5.1 | — 0.2 | 5.1 | 4.8 |
| α Aquilæ | 41 | 8.3 | 0.840 | + 40.5 | + 30.7 | 50.8 | + 30.4 | + 32.5 | 44.5 | 37.2 |
| β Aquilæ | 45 | 5.9 | 0.256 | + 4.9 | — 33.2 | 33.6 | + 1.8 | — 32.4 | 32.4 | 31.0 |
| γ Delphini | 20 37 | 15.4 | 0.284 | — 3.3 | — 12.5 | 12.9 | — 7.7 | — 12.2 | 14.4 | 13.0 |
| ε Cygni | 38 | 33.2 | 0.411 | + 26.7 | + 26.5 | 37.6 | + 20.2 | + 25.2 | 32.3 | 20.3 |
| η Cephei | 41 | 61.0 | 0.284 | + 5.9 | + 60.7 | 61.0 | + 1.4 | + 58.2 | 58.2 | 49.8 |
| 61 Cygni | 58 | 37.8 | 1.690 | + 304.9 | + 236.0 | 385.6 | + 276.4 | + 230.2 | 359.7 | 168.8 |
| δ Herculis | 21 4 | 9.2 | 0.248 | + 5.7 | — 20.7 | 21.5 | + 1.4 | — 20.0 | 20.0 | 19.7 |
| ι Pegasi | 12 | 18.9 | 0.217 | + 10.2 | + 8.1 | 13.0 | + 6.4 | + 8.3 | 10.5 | 8.5 |
| α Cephei | 14 | 61.7 | 0.411 | + 11.0 | + 0.2 | 11.0 | + 3.8 | — 2.7 | 4.7 | 4.3 |
| μ Cygni | 35 | 27.8 | 0.274 | + 15.1 | — 16.9 | 22.7 | + 10.0 | — 16.9 | 19.6 | 17.0 |
| 3 Cygni | 22 15 | 51.2 | 0.232 | — 2.7 | — 13.5 | 13.8 | — 7.3 | — 13.8 | 15.6 | 14.0 |
| ζ Aquarii | 18 | — 1.5 | 0.294 | + 11.4 | + 3.6 | 12.0 | + 5.6 | + 5.0 | 7.5 | 6.0 |
| ι Cephei | 42 | 65.1 | 0.284 | — 6.8 | — 10.2 | 12.3 | — 12.6 | — 10.4 | 16.3 | 12.3 |
| ψ′ Aquarii | 23 5 | —10.2 | 0.217 | + 28.3 | + 0.8 | 28.3 | + 23.9 | + 1.8 | 24.0 | 6.9 |
| λ Andromedæ | 27 | 45.3 | 0.256 | + 11.4 | — 29.6 | 31.7 | + 6.2 | — 28.6 | 29.3 | 27.1 |
| γ Cephei | 31 | 76.5 | 0.326 | — 4.9 | + 12.2 | 13.1 | — 11.6 | + 13.0 | 17.4 | 12.8 |
| α Andromedæ | 58 | 27.9 | 0.718 | + 8.5 | — 9.5 | 12.7 | — 5.8 | — 5.4 | 7.9 | 6.9 |

NOTE.—Col. 1st gives name of star; 2d and 3d, position; 4th, reciprocal of probable distance, deduced by Struve's method; 5th, 6th, and 7th, proper motion observed; 8th, 9th, and 10th, same corrected for parallactic effect (dependent on λ) of sun's motion; 11th, minimum proper motion, deducting possible error which may proceed from uncertain value of λ.

The minuteness of the motions is here made evident. A more attentive examination reveals other important peculiarities.

(1) It is impossible not to recognize in this list a law of signs. In right ascension, the signs are in the first six hours nearly all positive, and in the following six negative; they are again positive between 12*h.* and 18*h.*, and finally in the last six the negative sign once more prevails.

(2) Mr. Proctor has in several tables graphically represented the principal proper motions of many stars, and has deduced the important conclusion that the directions of these motions are identical in many of the individuals of certain natural groups. Thus, in the group of the seven principal stars of Ursa Major, the five, β, γ, δ, ε, ζ, and some companions of these, tend all in the same direction, while the other two are moving in the direction opposite. This shows that the first five form a common system, to which the other two do not belong. In the Pleiades, one half move in one direction, and the other half in the other. In Gemini, very many groups have the same direction, which differs for the different groups. From this systematic distribution of signs, it follows that there ought to be some common cause which gives them such laws, and which could not *a priori* be supposed to control the proper motions of the individual stars severally, since these should naturally be distributed impartially throughout all directions. It is true that these motions may be either real or apparent, or both at the same time. In the first case, a definite law could not be perceptible unless the visible stars should form an integral system distinct from, and perfectly penetrable by us, subject also to certain laws of common motion—a thing very difficult to admit; but the motions may also be apparent, and due to the motion of the observer in space—that is, to the motion of the sun which transports our whole system; or, finally, they may be both real and apparent. It must therefore be our endeavor to study thoroughly the peculiarities of these movements; and on this account the importance of these facts is very great, but it will appear greater when we shall have studied these motions in relation to other peculiar characteristics of the stars.

(3) The first thing we have to study is the relation between the proper motions and the magnitudes of the stars. But here we may observe that, in this inquiry, it is necessary to take the result derived from a great number of stars united, since, when we come to particular cases, the irregularity is too great. In fact, a glance at the table just given, suffices to show that, in general, the larger stars have certainly the greater proper motions; but there are also

minor ones—such, for example, as 61 Cygni, 1830 of Groombridge, 40 Eridani, etc., etc.—which are quite small, and yet have very large proper motions. W. Struve, from a discussion of the proper motions of Bradley's brightest stars to the number of 180, deduced the following conclusions:

| | | | |
|---|---|---|---|
| *1st Category.* Stars of medium brilliancy—mag. 2.5..... | Motion in A. R..... | 11.60″ | 180 stars in 75 years. |
| | " " Decl..... | 11.46″ | |
| | " " great circle.. | 17.67″ | |
| *2d Category.* Stars of feeble brilliancy—mag. 5.5..... | Motion in A. R..... | 4.68″ | 206 stars in 75 years. |
| | " " Decl..... | 3.53″ | |
| | " " great circle.... | 6.71″ | |
| All the foregoing, taken without distinction, in mean... | Motion in A. R..... | 7.94″ | 386 stars in 75 years. |
| | " " Decl..... | 7.29″ | |
| | " " great circle.. | 11.87″ | |

Considering next the smaller stars not comprised in the observations of Bradley, but observed by Lalande, Groombridge, and Piazzi, it is found that 30 years give a proper motion in A. R. of 1.117″, and in Decl. of 0.821″; and recapitulating, and reducing the whole to the interval of 30 years, we have—

| Categories. | Magnitudes. | Motion in A. R. | Motion in Decl. |
|---|---|---|---|
| Class I., 180 large..... | 2.75 | 4.64″ | 4.58 |
| " II., 206 small.... | 5.65 | 1.87″ | 1.41 |
| " III., 1276 minute. | 10.34 | 1.12″ | 0.82 |

Whence it follows that the proper motions are proportioned to the magnitudes. But if we separate the stars into single and double, we obtain the result that the double stars have, in general, a larger proper motion than the single; the mean for the single being 9.28″, and that for the double 15.01″, with a ratio of 1.618.

From this discussion it results (1st) that the largest stars have the largest proper motion; (2d) that, magnitudes being equal, the double stars move faster than the single. The last conclusion was to have been expected, considering that the division of a cosmical mass into two parts might be originally facilitated by a primitive impulse of superior energy and more eccentric application. We shall soon see the importance of the first of these consequences.

Whether, therefore, the observed motions are truly the motions of the stars themselves, or whether they are merely apparent and dependent on the motion of the observer, upon the principles of probability it follows, from this sole consideration, that the larger stars must be our nearest neighbors, and the smaller more distant; since the linear space passed over by any body whatever ought to appear so much the larger as the body is nearer. But in order to decide whether the motion is due to the one or the other of these causes, it is necessary to study the problem more intimately and by a different method; and to inquire (1st) what other criterion we may possess for ascertaining the distances of the stars; (2d) what apparent systematic movements the motion of the observer himself ought to introduce. Observations of proper motion with the usual astronomical instruments give only the component of movement perpendicular to the visual ray, and furnish no indication of the motion which may take place in the longitudinal direction of the same ray. Spectral discoveries have provided, however, a very delicate means of learning the motion in this direction. See briefly in what manner.

As early as 1842, Döppler suggested that, if a star should have a proper motion of any kind, it ought to change in color. It is known, in fact, that vibratory movements are propagated with uniform velocity in a space filled with a homogeneous and elastic medium; consequently, if the vibrating body should be fixed, and the duration of its vibrations constant, the medium agitated by it is divided into so many zones of equal length, called waves; and we may define a wave to be "the space passed over by the undulatory movement in the time of one molecular vibration." But if the vibrating molecule should be in motion toward the observer, the wave would be shortened relatively to a wave generated by the same molecule at rest; since there must be subtracted, from its primitive length, the space passed over by the molecule during the vibration. On the other hand, if the molecule is receding, the wave will be lengthened by the same amount. Hence, in the case of sound, the pitch will rise in the first case, and fall in the second. The same thing will happen if the observer himself travels toward the origin of the vibratory movement or in the opposite direction; since the waves will seem shorter to him in the first instance, and longer in the second. These variations were demonstrated in regard to sound by Fizeau, and any one can verify them for himself by attending to the whistle of a locomotive passing before him, of which the note will be perceived to be quite different in pitch as it approaches and recedes. This principle being established, Döppler argued that similar consequences ought to result from the motion of the stars; and therefore that, if in any case the effect of such motion should be to shorten the wave, the star would lose its red, which would, for example, be transformed into orange or yellow; while, in the opposite case, the lengthening of the wave would convert the violet into blue or green. Hence a general change in the color of the star. But in 1863* I showed that this consequence would not follow, for the reason that, as there are invisible rays beyond the red and the violet, these rays, with change of wave-length, would assume tints corresponding to the red and the violet respectively, so that the general color would not be altered. I added, however, in the same place, that such a motion might be revealed by the aid of the spectroscope. If, for instance, the yellow, in consequence of such motion, should become green, the change of color could not affect the dark lines of Fraunhofer, nor supply the light wanting in the lines D, since, in the shortening of all the waves, those of D would be shortened likewise. Their refrangibility would accordingly be changed, and they would no longer be seen in the place where we find the lines of the sodium known to our globe, but would be displaced relatively to those, in one direction or the other. Should the star be approaching us, the displacement would be toward the violet; should it be receding, toward the red. And what would be true of the sodium-lines, would be true also of those of hydrogen and of every other chemical element which we might compare with the star. I not only indicated this possible phenomenon, but even endeavored to verify it experimentally, but my instrumental means were too deficient in delicacy for this. To convey an idea of the difficulty of the experimental test, I demonstrated that, in order to shorten the wave 40.63 millionth parts of a millimètre, so as to cause the line E to pass to the place of F, it would be necessary that the star should have a velocity of 32,000 kilomètres (nearly 20,000 miles) per second—a thing very unlikely to be true. But the spectroscopes in actual use were capable of indicating displacements much less than this, and a velocity of only 304 kilomètres per second would suffice to effect a displacement equal to the space which separates $D_1$ and $D_2$ in the spectrum of sodium. The tenth part of such a displacement would be obtained by a velocity no greater than that of our earth around the sun. It was not till 1868 that I was able to institute new experimental examinations. I found then that, while the line F coincided with Hβ in Lyra, the same was not the case in E Ursæ Majoris, and in other stars; but the imperfection of my instrumental resources left the amount, and often even the direction, of the displacement, doubtful; whereupon I abandoned the task, but resumed it again to a small extent in 1869, for some of the more brilliant stars. As a result of these observations, it appeared that Sirius has a rapid motion toward the observer, since the hydrogen-line falls quite on the side of the red in the bright part of the spectrum of that star, at the place of the cloudy band due to this gas. In Lyra, no sensible motion could be detected.

Meanwhile, Mr. Huggins, furnished with better instruments than mine, took up the investigation where I left it, and he has obtained results in which he professes great confidence. The Royal Society of London has provided for his use a parallactic refractor of 15 inches aperture, with the necessary auxiliary apparatus and accessories, all of the most exquisite delicacy. According to him, Sirius should have an absolute motion, or a motion corrected for the motion of the earth, of 27 kilomètres per second, receding. Some of his observations, repeated at Greenwich, give for Lyra — 19 kilomètres; for Sirius and various other stars, negative or receding motions, likewise, in every instance; for α Aquilæ, a doubtful result; and for α Pegasi, — 20 km. The stars β, γ, δ, ε, and ζ of Ursa Major are said to be receding at the rate of 20 miles per second, and α and η, approaching. It is worth noting here that the spectra of these five stars are of the first order, while those of α and η are of the second; and we have already seen that, according to Proctor, the proper motions of the same five are opposed to those of the other two. We do not pretend to set our own observations above those of others, but, so various and so uncertain have been the results hitherto obtained, that there seems to be just ground for suspecting some systematic error. If these results, however, shall be confirmed and cleared of the many objections which may possibly be raised in regard to the method of experimenting, the proper motion of the star in the direction of the visual ray will be thenceforth ascertained; and, by compounding this with meridian observations, it will be possible to determine the complex resultant (the absolute velocity and direction of motion in space) at least approximately. For the present, however, considering the minuteness of the deviations, and the difficulty of the observations,†

* See *Bolletino Meteorologico del Collegio Romano*, July, 1863.

† To show that this difficulty is not exaggerated, it is worth mentioning that, while the spectroscope assigned to the comet of Coggia a velocity of approach toward the earth of 46 miles per second, its real velocity of approach was only 24; this, too, according to the observations of Mr. Huggins himself.

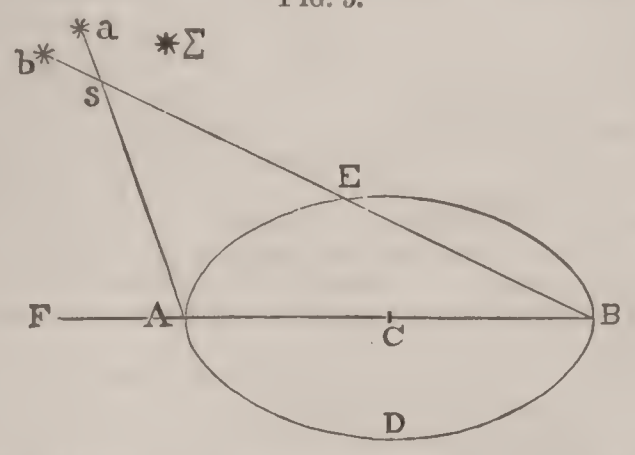
the spectroscopic method fails to inspire us with the same confidence as the other.

### § 7. *Distances of the Stars.*

The vastness of the creation is one of those ideas which overwhelm the limited human intelligence. When it was for the first time announced that no material barrier exists to shut in the ethereal expanse, and that the stars are so many suns, the immensity of the universe and the infinite multitude of the bodies composing it, thus presented as logical inferences, were conceptions which left the mind stupefied with amazement. It endeavored to escape from these consequences by intrenching itself behind ill-interpreted passages of Sacred Writ. Nor should we wonder at these errors of the past, when, even in our own day, we see renewed, over the question of extension in time, the same conflict which then arose in regard to the vastness of space. Notwithstanding that we can touch with our very hands geological formations which have required myriads of ages for their deposition, it is with the utmost difficulty that we bring ourselves to admit the belief, that such an antiquity can belong to our globe. But one of these ideas will help us to comprehend the other, convinced as we must be that the work of the Creator, if not in absolute infinity and eternity, at least in immensity of space and illimitable duration of time, is commensurable with him alone, and that we shall always be incapable of conceiving it in its completeness.

The distances of celestial objects in general are computed by means of their parallaxes; but, for the stars, it was perceived, even by the early astronomers, that the diurnal parallax must necessarily be excessively minute, and hence they sought to find an annual parallax. Galileo made it evident that the altitude of a star above the plane of the ecliptic (its celestial latitude) must be different, as observed from the opposite extremities of the diameter of the earth's orbit round the sun which lies in the plane of the circle of

FIG. 5.




latitude. For if A D B E be this orbit, C its centre, S the star, S A B the plane perpendicular to A D B E passing through S and C, and A B the diameter in which this plane intersects the orbit, then, from the station A, the star will appear in the direction A S, and from the station B, in the direction B S; and the latitude at station A will be F A S, and at station B, F B S. The difference between these latitudes will be = A S B, and half this difference will be the parallax of the star. Even supposing the star at a measurable distance, the direct and absolute determination of this angle might still be difficult on account of its minuteness. Galileo proposed, therefore, that differential measures should be attempted; and, to this end, that a very minute star *a* should be chosen in the near vicinity of a very large one Σ, and that measurements should be made of the distances Σ *a* and Σ *b* at opposite seasons of the year. The variation observed would be the indication of parallax sought for. He assures us that he had tried this method without success. The fact is, that his telescope was far from being capable of resolving this question. But having tested the method in the case of many stars, and found the angles observed as above described apparently in the most positive sense constant, he concluded that the stars are so immensely distant as to reduce the entire great orbit of the earth to absolute evanescence in comparison. His contemporaries were startled by this conclusion, which nevertheless was the only legitimate one, and which magnified a million-fold the Creator's work.

The astronomers who followed Galileo all of them attempted the determination of stellar parallaxes, being stimulated by the hope of thus demonstrating the motion of the earth; and after Flamsteed, Roemer, and Picard had detected that annual fluctuation of star-position which found a later explanation in the aberration of light, Horrebow imagined that the parallax had here been certainly ascertained, and wrote accordingly his *Copernicus Triumphans*. He failed to notice that the displacement then discovered took place in a plane perpendicular to that of the parallax—that is, in the plane of the tangent to the earth's orbit—whereas the parallax should occur in the plane of the radius vector. And it is a marvellous fact, as Bradley afterward made evident, that the sought-for proof of the motion of the earth was really obtained, though not understood for a long time after. The proof was even more certain and grand than the parallax itself could have given, but it was not of a nature to determine the distance of the stars. Long afterward, Sir William Herschel, confident in the power, previously unexampled, of his new instruments, attempted the problem again, but vainly. He found, nevertheless, a compensation for his disappointment, in the discovery of double stars; that is to say, of pairs, in which one star revolves around another in a proper period of many years' duration. Thus, the search for the stellar parallax led to two grand cosmical discoveries, itself remaining still unresolved. It was reserved for the perfection of modern instruments to give to this problem a decisive answer. Bessel, on studying with his heliometer the star 61 Cygni, and comparing this with others neighboring, detected an annual difference of position of seven-tenths of a second, and fixed the parallax at 0.35″. The distance of this star is hence concluded to be equal to 589,043 mean radii of the earth's orbit, and the time required for its light to reach us is no less than twelve years. The longest line, therefore, which astronomers are able to command as a base, observed from this star, would subtend hardly more than one-third of a second. Thus, the distance of the stars becomes so great, that the unit which serves as a scale for the dimensions of the whole solar system is too small for its measurement; on which account it is more common to state it in terms of the time occupied by light in passing over these immeasurable spaces. Since the velocity of light is about 299,000 kilomètres, or 192,000 English miles, per second, it reaches us from the sun in 493.3*s.*, or is 8*m.* 13.3*s.* in passing over the ordinary unit of measure of celestial distances.* Since, then, a parallax of an entire second supposes a distance from us of 206,265 times that unit, there would be required 3.224 years (or 3¼ nearly) for light to come from a star with such a parallax to us. This dimension, equivalent to about 1,000,000,000 radii of the terrestrial globe, is therefore taken for unity in the calculation of stellar distances. But no star has as yet been ascertained to have a parallax so great as one second, and hence all the stars are far beyond even this prodigious distance.

Astronomers were encouraged, by the success of Bessel, to make similar trials upon other stars, especially upon those of the superior magnitudes and those which exhibit the greater proper motions, naturally supposing these to be the least distant; but their success has been inconsiderable. The only one which seems to have yielded a certain response is *a* Centauri, which appears to have a parallax of nine-tenths of a second; but this has been determined only by means of meridian observations, and requires confirmation by the method of differential measurements. In the list following, we give the probable parallaxes of several of the stars; but we warn the reader at the same time that authorities by no means without weight regard the values here given with serious distrust. The successor of Bessel, Dr. Whichmann, confesses to me candidly that he looks upon no stellar parallax whatever as certainly determined, not even excepting that of 61 Cygni; because too many elements enter into the problem which may falsify the observations, made as they must be from necessity in opposite seasons, during which the instruments undergo considerable variations. Without being so sweeping as this, however, we will say, that a parallax not exceeding a quarter of a second, is a thing which the science of the present day can hardly guaranty as certain:

*Parallaxes attributed to Certain Stars.*

| Star. | Parallax. | Authority. | Star. | Parallax. | Authority. |
|---|---|---|---|---|---|
| *a* Centauri | 0.913″, | Henderson. | 1870 Groombridge..... | 0.226″, | Peters. |
| 61 Cygni... | 0.348, | Bessel. | 1 Ursæ Maj.. | 0.133, | Peters. |
| *a* Lyræ..... | 0.261. | | Arcturus ..... | 0.127, | Peters. |
| Sirius ..... | 0.230, | Henderson. | | | |

The pole-star and Capella, having less than the tenth of a second of parallax, are not included in the list. It follows, nevertheless, that, since the stars in general have no perceptible parallax at all, their distances cannot be less than ten parallactic units, or 2,062,650 times the distance of the sun; and that the time occupied by light in coming from them to us cannot be less than 32 years. This is the conclusion in regard to absolute measures, deduced from the facts up to the present time ascertained. But if we seek only relative measures, and are content to know in what proportion the stars of various magnitudes are distant from us, the case is different, and although even this problem is not without its difficulties, something more is discoverable.

* The more recent experiments made in Paris have given 300,005 kilomètres; former ones gave 298,000; we are of opinion that the number assumed in the text, which is near the mean, is preferable to either.

If the stars were all of the same absolute magnitude, their relative distances could be promptly inferred from the ratio of their observed brilliancies, since these ought to diminish in the ratio of the squares of the distances. But, as a real uniformity of magnitude is not presumable in fact, it is not reasonable to assume it. Yet, though this is quite true for a limited number of stars, for a very great number, and for the average of multitudes all equal in apparent magnitude, the case is different, and the rules of probability conduct us to the conclusion that the larger stars must be the nearer, and the smaller the more distant. This conjecture is corroborated by the fact, that the stars of the various orders of magnitude succeed each other according to a similar photometric law, so that the mean splendor of a given order is the same as would be that of a star of the superior order removed to a double distance. Upon this rule of probability has been founded a scale of relative stellar distances for all the magnitudes from the first to the most minute, which is given in the table below, and of which we have already in § 2 explained the principles.

An additional aid in judging of the relative distances of the stars is derived from their proper motions. Here, again, it is evident that, if the actual proper motions of the stars in space were all equal, and all perpendicular to the observer's line of vision, the more distant would give the smaller apparent motions. But this supposition involves a twofold improbability, because, in the first place, the real velocities may be infinitely diverse; and because, secondly, the direction of movement may be such as to mask its magnitude, since when reduced to its components parallel and perpendicular to the visual ray, the last-mentioned component is only perceptible. In spite of this, however, there comes in here also the aid of the rule of probability; and, when we consider a very large number of stars, their partial movements may be mutually compensatory to such a degree that the definite resultants remaining may be esteemed to exhibit the mean proper motions—motions which will appear smaller for the more distant stars. Upon the basis of these principles, and availing himself of the numerous labors of modern astronomers upon this subject, Struve has computed a table of the stellar distances arranged in the order of their magnitudes, resting on the results already explained in § 6; which table we present below in comparison with that deduced from photometry:

TABLE G.—*Table of Stellar Distances, deduced from Photometry and from Proper Motions.*

| Magnitudes. | Photometric distances. | From proper motions. | |
|---|---|---|---|
| | | Simple stars. | Double stars. |
| 1 | 1.00 | 1.0 | 1.0 |
| 2 | 1.55 | 1.3 | 1.4 |
| 3 | 2.42 | 2.1 | 2.0 |
| 4 | 3.76 | 3.6 | 3.2 |
| 5 | 5.86 | 6.1 | 5.9 |
| 6 | 9.11 | 8.5 | 8.2 |
| 7 | 14.07 | 12.0 | 11.6 |
| 8 | 22.01 | 17.9 | 17.8 |
| 9 | 34.30 | 33.3 | 31.8 |
| 10 | 53.36 | | |
| 11 | 83.00 | | |
| 12 | 129.12 | | |
| 13 | 200.90 | | |
| 14 | 312.50 | | |
| 15 | 486.10 | | |
| 16 | 756.20 | | |

Though the two series are to some extent sensibly discordant, still it is impossible not to discover a close relationship between them; and inasmuch as they are severally deduced from elements wholly diverse, depending in the one case simply on the distance, and in the other on the square of the distance, it is out of the question to suppose the coincidence to be accidental, and we are compelled to accept it as a fact founded in nature; observing always to limit the proposition to the stars in general, and by no means pretending that it will be found true in a given particular case.

As a final result, we may state that, if we give to the stars of the 1st magnitude the parallax of one-tenth of a second, we shall have for them the time of light-travel to reach us = 32 years; for stars of the 9th magnitude, 1024 years; and for those of the 16th, the minutest visible in the Herschelian telescope, 24,192 years. All the stars, therefore, might be annihilated to-day, and nearly all of them would continue to be seen by the inhabitants of the earth, very much as they appear now, for several generations.

Since we know nothing certain of the real distances of the stars, it follows that their magnitude in respect to volume remains wholly unknown to us; and more than that, that it is not possible to compute it even for those which have parallax, since one and all are absolutely without measurable diameter. It is true that, in good instruments, the stars in general exhibit an apparent disk by which the ancient observers were deceived; but this appearance is simply an optical illusion occasioned by diffraction, and it may, in fact, be easily increased, by simply placing before the objective a diaphragm of smaller aperture. If our sun were removed to the distance of the parallactic stellar unit, it would hardly subtend a diameter of 0.0093″; that is, its apparent magnitude would be less than $\frac{1}{100}$th of a second, and would be wholly unmeasurable. The intensity of its light also would be reduced to that of a star of the sixth magnitude. As, therefore, it is impossible to know the distances of the stars in absolute measure, so likewise it is similarly impossible to know their material dimensions.

### § 8. *Proper Motion of the Sun.*

If the stars have motions of translation in space proper to them, it is quite natural to suppose that the sun has a similar motion, and that consequently his entire attendant system is in movement with him. But though this conclusion on the part of astronomers was inevitable, the verification of the motion and the determination of its magnitude are problems demanding an inheritance of observations of a much higher degree of precision than have belonged to any which they possessed. Sir William Herschel made, nevertheless, a bold attempt to resolve it, and was successful not only in marking out the method, but even in applying it with satisfactory results. In order to understand this, it is necessary to premise that, inasmuch as all the stars are not equally distant—in other words, fixed upon the surface of a single geometrical sphere (an absurd hypothesis)—if our sun is really in motion, it must follow from that very fact that all of them will be apparently so, precisely as, to a person passing through a wood or an open country anywhere, all the trees and other objects differently distant, though actually fixed, seem to him to be moving. It might thus happen that a great part of the stellar movements of which we have spoken might be due to the translation of our sun in space, and therefore be only apparent, or, in the language of astronomy, parallactic. But, if this is the cause of some, it certainly is not of all; and, by the complication of apparent with real motions, the difficulty of the problem is considerably increased. In order to attain success in its resolution, therefore, we must analyze the conditions separately, beginning with the supposition that all the stars are motionless, though differently distant, and considering what must be the consequences resulting, on this hypothesis, from the solar movement only.

(1) In the first place, then, the apparent stellar movements will always take place in the plane passing through the star and through the line traversed by the sun, or (what, according to the known mechanical principles of relative motion, is the same thing) will be always in the plane of that great circle passing through the sun and the star which is determined in direction by the apparent movement.

(2) For any other star (the absence of real motion being still supposed) the same thing will be true; so that the two planes will intersect in the line of the sun's path, and the circumferences of the two great circles which they trace out on the celestial sphere will cut each other in a point constituting what is called the vertex of translation.

(3) If a third star be taken, regarded also as motionless, its plane must in like manner intersect the others in a line common to all; and, by thus proceeding from star to star through the whole heavens, we shall find that all will have a common intersection and a single apex or vertex of convergency, marking the point on the celestial vault toward which the sun's movement is directed.

In the second place, the apparent motions will be subject to an extremely simple law: all the stars will seem to diverge on the side toward which the sun is moving, and to converge in the opposite region, as happens to a person walking in an avenue bordered by parallel rows of trees, to whom those before him seem to separate, and those behind to approach each other. This is what ought to happen, on the assumption that the stars are all fixed, and their motions all apparent.

But if the stars are themselves in motion, the problem is complicated by the effect of their several proper velocities, and the real velocity in a particular case may be so compounded with the apparent as to mask it entirely, or even to reverse it. As this is the case with which we have practically to deal, we must resort for its solution to another principle, which is this—that, according to all the probabilities, the individual stars will have movements severally directed toward every possible point of space, and, being very numerous, will compensate and extinguish each other, leaving instead a resultant, which will bring into full evidence the single motion due to the translation of the sun.

Such is the principle by which the theoretic discussion of these movements is guided. The compounded movements which observation gives must be accurately determined, and their absolute resultant ascertained; and this may then be regarded as the definitive expression of the solar motion, the other movements being treated as accidental, and being reciprocally destructive. Modern mathematical analysis furnishes precise rules for fixing this resultant, but for the development of these we cannot here afford space.

Such a method of precision was not, however, that employed by Herschel. He simply traced in the celestial sphere the great circles apparently described by various stars having large proper motions, and saw that the intersections of their planes of movement, when taken two and two, tended to converge toward the constellation Hercules, and that the most nearly central point in the area of convergence, assumed as the vertex of the solar translation, had for co-ordinates the values A. R. = 245° 52′, Decl. N. = 49° 58′; confessing this, nevertheless, to be but a rough approximation.

The astronomer who, next after Herschel, occupied himself seriously with this problem, was Argelander. Comparing his own observations with those of Bradley, he deduced the proper motions of many stars, and from them inferred the co-ordinates of the vertex of translation to be A. R. = 257° 49′, Decl. N. = 28° 50′. And, from very elaborate investigations, Otto Struve found the values A. R. = 261° 23′, Decl. N. = 37° 35′. Connected with these labors are the later ones of W. Struve, who assigned for these co-ordinates A. R. = 259° 9′, Decl. N. = 12° 51′; making, however, corrections of quantities introduced which are not always justifiable, and showing that a very great difference in declination might be produced by slightly varying the latitude of the observatory at Greenwich. All these labors were founded on observations made in the northern hemisphere. Galloway chose to discuss those of the southern, and, comparing the observations of Lacaille with others more recent, determined for the vertex of translation the co-ordinates A. R. = 259° 46′, Decl. N = 32° 29′; of which the latter is about the mean of previous determinations, which would give 32° 16′, and the former is substantially identical with those found before. It can accordingly admit of no doubt that this result is pretty near the truth. And it is manifest, besides, that, in order to discover the direction of this movement, there is no need of knowing the distance of the stars, since the deduction is drawn from their apparent displacement only. If, however, we would assign an absolute value to the motion in space, the knowledge of this distance is necessary. Otto Struve, on the principles of stellar distances already explained in the preceding portions of this article, found that the proper motion of the sun, as observed from a star of the 5th magnitude, would amount in 70 years to 3.508″ in right ascension, to 0.800″ in declination, and to 4.597″ in a great circle of the sphere. Considering this motion as a motion in space, and founding the computation upon the hypothetic stellar distances above referred to, it would follow that it must amount to a little more than one and a half radii of the earth's orbit (1.623) per annum, or 154,000,000 of miles—a value, however, extremely uncertain, because of our ignorance of the absolute distances of the stars. Naturally, such a motion cannot be rectilinear, and its direction must vary with time; but these are points in regard to which the answers must be left to be supplied by distant posterity. Where may be the centre of this movement, or whether, indeed, there is a material centre at all, and whether the curve is not determined by the resultant action of many centres, is wholly unknown, and any attempt to define it must be regarded as at present premature.

When once the motion of the sun is established in amount, if, resuming the consideration of the stellar movements, we subtract from them what is due to parallax, the remainder will be the movement which belongs to the individual star. The motions thus found form a class of residual phenomena of observation which, after an enormous succession of ages, may possibly be reduced to law; for the present they are seemingly accidental. We may observe, nevertheless, that, as Struve and Proctor have shown, the direction of solar motion very slightly affects the apparent motions of particular stars—a fact which appears from the inspection of Table F, where the columns 8, 9, and 10 give the individual motions after the parallactic motions due to translation have been eliminated. The existence of such a multitude of movements among the stars will be less a matter of surprise, when we proceed, as we now propose to do, to show that, in those regions where we imagine rest and eternal silence to reign, there exists an almost inconceivable activity, with centres of motion and orbital velocities very much more considerable than any of which our planetary system affords examples.

### § 9. *Double Stars.*

Many stars which to the naked eye appear simple are found, when observed with instruments, to be composed of two, and occasionally of three or more, extremely close together, of magnitudes sometimes equal and sometimes very different. These are called double or multiple stars. The close approximation of the bodies in these instances may either be a simple effect of perspective, in virtue of which two stars widely distant from each other are projected upon very nearly the same point of vision, or, in the second place, may be owing to a physical connection existing between them, the consequence of some sort of force binding them together, as is true of the planets and the sun. In the first case, the objects are called optically double; in the second, physically so. To determine whether, in a particular instance, such a bond of union exists, is a work exacting delicate observation and laborious calculation. Let us take a hasty glance at the results of these studies.

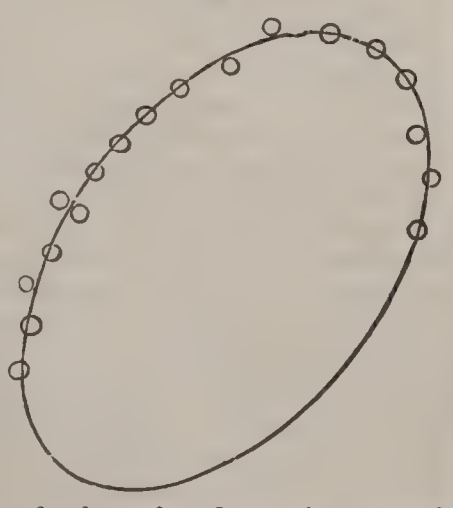
Already, more than a century ago (in 1767), Mitchell had suspected a connection of the kind here suggested, from a study of the question, how great would be the probability of the occurrence of accidental combinations involving only a few seconds of distance between the members, on the supposition that the stars had been strewn at random through space. He found that, for the case of two stars of the 2d magnitude, the chances were 500,000 to 1 against such an occurrence. Now, of such combinations, we have several examples, as α Centauri, α Geminorum, etc. But this probability does not suffice to establish the fact. A more substantial argument is derived from a consideration of the proper motions. If the stars are accidentally companions, their proper motions, whether apparent or real, ought, since the objects are usually of different magnitudes, to be different; and hence these objects, in the progress of time, should separate. Now, it happens, in point of fact, that various stars of this class, though endowed with considerable proper motions, preserve sensibly the same relative distance for very long periods of time. Such are the two companions of α Centauri, the two of Castor, γ Virginis, and ξ Ursæ Majoris, all of which are unequal, and a great multitude of others. Alpha Centauri, hardly separable in the time of Lacaille, has so great a proper motion that, were not this common to both members of the pair, they ought now to be 6 minutes apart. Even this, however, is not a criterion wholly infallible, for it is a possibility that proper motions, in spite of diversities of real amount, may so manifest themselves as to exhibit very minute differences. But the characteristic which rigorously decides the question, is the positive fact that, in many instances, one star of a pair revolves around the other in a closed curve, described according to the laws of central forces. The grand discovery of this fact is due to Sir William Herschel. When that astronomer had so perfected his instruments as to enable him to penetrate farther into the depths of space than all who had gone before him, he proposed to himself, proceeding on the principle of Galileo (§ 7), to resolve the problem of the parallax. Having selected for this purpose a number of the more brilliant stars, each of them accompanied by minute and very near neighbors separated from them only by a few seconds, he measured their distances as exactly as possible, and, by means of a micrometer of his own invention, determined the angle between the arc passing through the pair and the horary circle—an angle which is called the angle of position. If there were any annual parallax whatever, it ought to be brought to light by the variation either of the distance or of this angle. But after many and accurate measurements in all the different seasons of the year, he failed to detect anything certain, and accordingly for the time abandoned the pursuit. Having, however, in the mean time, further perfected his instruments, he returned once more to the labor with the hope of a happier result. What was his surprise to discover that some of the stars which had before appeared to him double were so no longer, and that others had notably changed both in position and in distance! If every hope of the annual parallax had thus vanished, there was nevertheless presented here an indication of a parallax of a higher order, due either to the general motion of the system, or to the motions of the individual stars. To encourage the observer in pursuing these researches, the theory of Mitchell of a bond of connection between the stars was certainly not without its relevancy; and it happened, in fact, that after several years of assiduous investigation, he was enabled, in 1802, to announce to the scientific world, that some of the stars have really luminous satellites revolving round them in periods comparatively brief; as, for example, ζ Herculis in 36 years; η Coronæ Borealis in 44 years; ζ Cancri, a triple star, of which the lesser revolves in 59 years; ξ Ursæ Majoris in 63 years; and so on. It was naturally the case that the first determinations

of these motions were reductions from simple fractions of a revolution, but they were sufficient then to establish with certainty the curvilinear character of the apparent orbits; and these with lapse of time have gone on developing, till at length, in some instances, the bodies have completed more than one revolution. The number of pairs discovered to be physically connected, small in Herschel's first list, has gone on continually increasing, as well in consequence of the increasing number of newly-discovered binaries by proximity—an increase which has kept pace with the improvement of instruments—as through the extensive arcs of revolution described by the smaller members of the pairs round the greater. Since the time of Sir William Herschel this investigation has been prosecuted by his son, Sir John, and also by South, Dawes, and many others, but especially by Struve, who, with the superb refractor of Dorpat, early constructed an exceedingly rich catalogue, embracing no fewer than 3112 double stars—a number which has continued to grow with time, and at present amounts to more than 6000, one-tenth part of which at least are in motion.

But not all the very close stars are physically connected, though such, as we shall presently see, is the case with most of them. In a re-examination and re-measurement which we have made of the stars in Struve's catalogue to the number of 1082, we have found that 181 have noticeably moved with a motion presumably orbital, that in 291 other instances the variation is doubtful, and that in 606 it has not been sensible, or has not exceeded the probable errors of observation. It is to be remarked that simple displacements in angular position or in distance may possibly be the effect of proper motion, and not of central forces; on which account, whenever the successive positions of the star do not present a sensible curve, the case is doubtful; and such a case seems to be that of 61 Cygni, since the recent labors of Flammarion upon this object.

It is of the first interest, therefore, to ascertain the nature of the apparent curve described by a satellite about its primary, in order to establish the reality of any physical connection whatever. This settled, we may afterward recognize the real curve described by the satellite in space, and then, by applying the principles of mechanics, demonstrate the nature of the force. Observation has shown that the curve is usually an oval, approaching nearly to an ellipse, and in most cases perfectly elliptical. But the determination of this curve with precision is by no means easy. The distances to be measured are so minute, that an error of a fraction of a second is, in the outset, an enormous quantity—much greater for the case in hand than were the errors of the old astronomers before Kepler's time, in their rude observations of solar and planetary movements. It is indispensable, therefore, to guard against such errors, not only by multiplying observations, but also by employing a proper and cautious reduction. Not only are there differences, and even systematic differences, among the various observers in regard to these measures, but the same observer, at different times and in different positions of the star, differs from himself. Hence the investigation of the apparent orbit only is, to begin with, a matter of no slight difficulty. The most convenient method of finding it is to construct graphically, upon an arbitrary scale, the positions in angle and in distance assigned to the body by observation, and through the points thus laid down, to draw with a free hand, the curve which best represents them all, and passes among them so as to make the differences a minimum. A glance will show whether the curve has a closed or open contour—whether it is elliptic, hyperbolic, or rectilinear. In the case of a closed curve, most frequently occurring, it will be seen whether the theoretic general equation of lines of the second order, viz.,

FIG. 6.

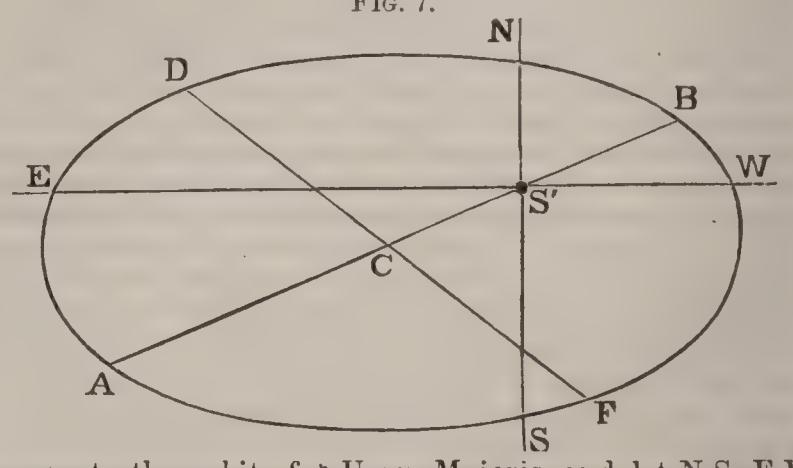


$$ax^2 + by^2 + cxy + dx + ey + 1 = 0,$$

satisfies the perimeter; and, when this happens, the curve is an ellipse. Inasmuch as the constants which define such a curve are five in number, in strict theory five ascertained points upon its contour suffice to determine it completely; but, in practice, as many points are taken as possible, and, by the method of least squares, or other modes of interpolation, the most probable values are ascertained.

The apparent curve having thus been fixed, we have next to seek the real curve; and as this part of the problem is partly indeterminate, we must introduce into it some theoretic element. The apparent orbit which we see, being only the projection of the true orbit upon the celestial sphere, it might, if elliptic, be the projection of any one of a variety of curves suitably placed in space to produce this effect by perspective. It might, for instance, be the projection of a circle, of an ellipse, or even of a curve of double curvature. But this last possibility may be dismissed if, on comparing the various sectors of the apparent orbit, we find their areas proportional to the times of describing them; since we know that, whenever this proportion is true in any projection whatever of an orbit upon a plane, the orbit must be described under the influence of a central force, and must necessarily itself be plane. Whenever, therefore, calculation from the observations assures us that this proportionality of areas to times actually exists, we may be certain that the orbit is plane. But this does not wholly remove from the problem its character of indeterminateness. The ellipse of projection may be produced by more than one species of force: (1) from a force directed toward the centre, and varying directly as the distance; (2) from a force directed toward a focus, and varying, as in the case of the planets, inversely as the square of the distance; (3) from a force directed toward any point in the interior of the ellipse, supposing it to vary jointly as the inverse square of the distance and as a function of the angle made by the radius vector with a fixed direction. In practice, however, this indeterminateness is easily settled. It suffices, indeed, to consider that the apparent orbit is the base of a cylinder, of which the observer's eye is in the axis, and which is intersected normally by the surface of the celestial sphere, which is there practically coincident with its tangent plane; the true orbit being another section of this same cylinder made by a plane otherwise inclined to the axis. But in these two sections, the axis of the cylinder determines a centre common to both ellipses; so that, if the principal star is in the centre of the true orbit, it must also be in the centre of the apparent orbit; and if the primary is out of the centre, the force cannot be of the first kind, but must be of the second. Now, in practice, this is the case usually met with; that is, the star is eccentric in the apparent orbit. Let us take, for example, Fig. 7, which

FIG. 7.




represents the orbit of ξ Ursæ Majoris, and let N S, E W be two co-ordinate axes drawn through the principal star, N S being coincident with the hour-circle and E W perpendicular to it. Only the second and the third hypotheses of force remain to be considered. In favor of the second, is the analogy of the planets; of the third we have no example in celestial mechanics, but only in certain phenomena of electric currents. We have, therefore, only to try whether the second will represent the movements. This premised, let us consider the apparent orbit (Fig. 7). From the calculation of the constants of the general equation we easily determine the co-ordinates of the centre of the apparent ellipse, which, as just observed, is also that of the real ellipse.* Then, as the principal star must occupy the focus of the true ellipse, by drawing the line C S′ and producing it to the perimeter, we obtain A B, the major axis of this same true ellipse. Now, by the theory of the ellipse, it is known that the axes of an ellipse projected on a plane oblique to it will be projected into conjugate diameters of the ellipse of projection; whence, the position of A B and its conjugate being ascertained, we determine, by means of familiar formulæ, the position of the axes of the original or projected ellipse, and also its eccentricity and its inclination to the plane of projection.

Thus, therefore, the geometric elements of the curve become known; that is to say, its dimensions and its position in space. The mechanical elements are the periodic time and the time of perihelion passage, which are calculated without difficulty from the epochs of the observations. The general idea here given of the solution of this problem will suffice for our present purpose. The results are exhibited in the following table, in which are embraced

*This calculation is explained in treatises by various authors on lines of the second order; as, for instance, by Boucharlat. It is applied in his method of computing the orbits of double stars as given by Sir John Herschel. (See *Mem. Royal Astr. Soc.*)

some of the stellar orbits most to be relied on, mostly from Chambers, but with additions from other astronomers:

TABLE H.—*Catalogue of certain Stars physically Double, with the Elements of their Orbits.*

| Star. | Period. | Perihelion passage. | Semi-axis major. | Eccentricity. | Authority. |
|---|---|---|---|---|---|
| | Years. | | | | |
| ζ Herculis | 36.3 | 1830.4 | 1.25 | 0.44 | Villarceau. |
| η Coronæ Borealis | 43.6 | 1850.3 | 0.95 | 0.28 | Winnecke. |
| ζ Cancri | 58.9 | 1853.4 | 1.29 | 0.23 | Mädler. |
| ξ Ursæ Majoris | 63.1 | 1816.3 | 2.45 | 0.39 | J. Breen. |
| α Centauri | 75.3 | 1858. | 30. | 0.96 | E. B. Powell. |
| ω Leonis | 82.5 | 1849.7 | 0.85 | 0.64 | Mädler. |
| 70 Ophiuchi | 92.8 | 1812.7 | 4.19 | 0.44 | Mädler. |
| 3062 Σ | 94.7 | 1837.4 | 1.25 | 0.44 | Mädler. |
| γ Coronæ Australis | 55.6 | 1882.8 | 2.40 | 0.70 | Schiaparelli. |
| ξ Boötis | 117.1 | 1779.8 | 12.56 | 0.59 | J. Herschel. |
| δ Cygni | 178.7 | 1862.8 | 1.18 | 0.60 | Hind. |
| η Cassiopeiæ | 181. | 1715.0 | 10.33 | 0.77 | E. B. Powell. |
| γ Virginis | 182.1 | 1836.4 | 3.58 | 0.87 | J. Herschel. |
| σ Coronæ Borealis | 195.1 | 1831.1 | 2.71 | 0.30 | Jacob. |
| Castor | 252.6 | 1855.8 | 8.08 | 0.75 | J. Herschel. |
| $\mu^2$ Boötis | 649.7 | 1852.5 | 3.21 | 0.84 | Hind. |
| γ Leonis | 1200. | | | | |
| 42 Comæ | 25 | | | | |
| 3121 Σ | 40 | | | | |
| Procyon | 40 | | | | |
| ξ Libræ | 49 | | | | |
| Sirius | 49 | | | | |

TABLE K.—*Table of some Double Stars having different Colors in their Components.*

| Name. | R. A. 1870. | | | Declin. 1870. | | Mag. of components. | | Color of A. | Color of B. |
|---|---|---|---|---|---|---|---|---|---|
| | *h.* | *m.* | *s* | ° | ′ | | | | |
| η Cassiopeiæ | 0 | 41 | 15 | + 57 | 7.8 | 4 | 7½ | Yellow | Purple. |
| α Piscium | 1 | 55 | 18 | + 2 | 8.1 | 5 | 6 | Pale green | Blue. |
| γ Andromedæ | 1 | 55 | 55 | + 41 | 42.4 | 3½ | 5½ | Orange | Sea-green. |
| ι Cancri | 8 | 38 | 49 | + 29 | 14.0 | 5½ | 8 | Orange | Blue. |
| ϵ Boötis | 14 | 39 | 18 | + 27 | 37.4 | 3 | 7 | Pale orange. | Sea-green. |
| ζ Coronæ | 15 | 34 | 29 | + 37 | 3.6 | 5 | 6 | White | Light purple. |
| α Herculis | 17 | 8 | 43 | + 14 | 32.2 | 3½ | 5½ | Orange | Emerald-green. |
| β Cygni | 19 | 25 | 28 | + 27 | 41.3 | 3 | 7 | Yellow | Sapphire-blue. |
| σ Cassiopeiæ | 23 | 52 | 26 | + 55 | 1.8 | 6 | 8 | Greenish | Bright blue. |

One case occurs, however, which cannot be treated in the way above described; it is the case in which the true orbit lies in the plane passing through the observer's eye, and is consequently projected into a straight line. In this case other expedients must be resorted to; and it is necessary to wait until the star, with a gradually slackening movement, reaches the limit of its course and returns in the opposite direction. Such cases as yet are rare.

But the determination of the relative orbit leaves still the question of real dimensions unsolved. To settle this we must suppose the distance of the star—that is to say, its parallax—to be known; that given, it is manifest that from the apparent diameter of the orbit in seconds, and from its inclination, the real magnitude of the true orbit can be determined, and consequently also, by means of the commonly-accepted constant for the attraction of matter, the mass of the system, and the mean motion or periodic time. But here, unfortunately, science fails. The parallaxes are so small and uncertain that none of them can be definitely stated. The star 61 Cygni, which was believed to be physically double, and which has a sensible parallax, might have given an important result, but, inasmuch as recent scrutiny of this object seems to prove that it is only double optically, we learn from it nothing certain. Up to the present time, α Centauri is the only star which gives us any indication available for this purpose. Its parallax may amount to 0.98″; and, if this is to be depended on, as the semi-diameter of its orbit amounts to 20.89″, and its period to 77 years, it follows that its real orbit must be about twenty times greater than that of the earth, and that, in mass, it must be three-quarters as great as the sun. The orbit in reality, therefore, must be about equal to that of the comet of Halley,* though with an eccentricity of only 0.086. The semi-axis of the comet's orbit equals seventeen semi-diameters of the earth's, and its eccentricity is 0.96. Since, furthermore, the principal star has a proper motion of 3.6″, it follows that its linear velocity of translation in space is 371,000,000 miles per annum.

These proper motions may possibly complicate sensibly the phenomena of the real movements. Since the propagation of light from the stars to us occupies an appreciable time, it follows that, if they are approaching or receding, the phases of apparent movement will no longer correspond to those of the true movement, but will be accelerated or retarded according to the direction which the star is taking; occasioning thus a phenomenon analogous to that of the aberration of the light of the planets in our own system. To this we must add the perturbations to which visible satellites may be subject from the influence of others dark and invisible, or which, in triple and multiple stars, visible satellites may produce on each other, as is, for example, the case in the triple ζ Cancri (see Struve, *Comptes Rendus*), in which, in the more distant star, a perturbation due to the nearer seems to exist in fact.

We have said elsewhere that some stars seem to be surrounded by a retinue of dark stars—a case illustrated in Algol. From the calculation of proper motions it has been made evident that other stars experience perturbations from the influence of such invisible bodies. Irregular movements manifesting themselves in Sirius and Procyon gave rise to the belief that they were thus disturbed; and this conjecture has been fully verified of both of them, since it has been discovered that each has really a satellite, difficult indeed of observation, because immersed in the rays of the principal, but brought to light and measured by the powerful refractors of modern times.

If we consider for a moment the physical consequences of these luminous systems and their obscure attendants, we cannot but experience a profound astonishment. In so eccentric a system as that of α Centauri, the planets of these primaries must at one time receive the heat of two suns, both very near, and at another, of one near and another extremely distant. Who can calculate the vicissitudes of life subject to such a periodicity? Only the wisdom of Him who with the fewest instrumentalities is able to accomplish results infinite in variety. Add to this that, in the double stars, the members of the system are often of different and complementary colors, and even the poet's fancy is powerless to paint the varying beauty of days illumined by a rosy sun and nights lighted up by a green one, or of days which two differently-colored suns combine to vivify, preceded by a golden twilight and an azure dawn.

The double stars of which the periods have been calculated are not very numerous, and out of these not a few are uncertain. Time only can enrich the catalogue by adding new systems, as the orbits as yet hardly sketched in rough are fully developed. Struve, however, as if in anticipation of this, has endeavored to measure the probable ratio between the total number of the apparently double stars and those which are physically double, employing a method founded on their proper motions already indicated by Mitchell. He found that, if the number of visibly double stars of his first three orders be represented by the number 693, of these, there will be 48 optically, and the rest, physically double. This proportion for the physically double has been increased by recent discovery. In these three orders we can pronounce, from our own measures only, that motions of revolution are certain in 149 stars, even without any reference to proper motions. As regards the argument from proper motion, we have this remarkable result: the probability that two close stars having the same proper motion are not physically united, is less than the probability that the sun will not rise to-morrow, in the face of all the historical experience we have of that daily-recurring phenomenon. Hence, it is an admitted postulate, that any two stars which have a common proper motion are connected together by a physical bond.

In order to perceive the weight of this argument, one reflection should be premised. It is a fact already proved (§ 6) that the larger stars have greater proper motions than the smaller; whence, while it would not be difficult to find two equal stars (as in 61 Cygni) with equal or nearly equal motions, it is extremely improbable that the motion of a small star and of a large star should be the same. It follows that, for all unequal double stars, an equality of proper motion is a probability in favor of their physical connection. Observation has confirmed this higher probability. In the actual examination of the proper motions of double stars less than 4″ apart, not a single one has been found optically double. Among the higher orders, from 4″ to 16″ of distance, 60 out of 66 have been found physically, and only 6, optically double. The apparently double are found most frequently among the stars of very unequal magnitude, as is natural, since the small are so much more numerous than the large.

In the second place, it is found that orbital motions have been most frequently detected in the closest stars, and that the number diminishes with increase of separation; also, that the proper motions of the doubles of the first orders (the closest) are likewise greatest. If we distribute these stars into two categories—one of the greater proper motions (from 45″ to 10″ in 25 years); the other, of motions below 10″ in the same time—we have the following results:

* Powell, *Mem. Astr. Soc.*, No. xvi. p. 170.

| No. of stars. | Mean proper motions. | Double. | | Ratio. |
|---|---|---|---|---|
| | | Optically. | Physically. | |
| 86 | 0″–10″ | 13 | 73 | 0.177 |
| 103 | 10″–45″ | 15 | 88 | 0.184 |

From this table it results, that the ratio between the physically and the optically double stars remains substantially the same for the two classes of movement, which is as much as to say that this ratio is independent of distance, the proper motions being supposed, as usual, to be inversely as the distance.

We shall conclude this article by presenting some conclusions of Struve as to the number of stars physically double, in proportion to the total number visible in the celestial arch.

(1) Of 72,500 stars of the magnitudes 1 to 8½ inclusive, and distant 16″, 1973, or 1 to 36.7, were found by him to be double. Of these, 1702 are physically and 271 optically double, or 1 optical to 6 physical. This was true of his time, but recent measures have considerably increased the number of the physically doubles.

(2) For the stars from the 1st to the 4th magnitude, inclusive, the total number being 353, there are only 75 physically connected, or 1 to 4.71.

(3) The existence of a physical bond is not limited to stars of minimum distance, but there are cases where the distance is considerable, as is inferrible from the identity of proper motions, sometimes occurring even when the distance is very great. Examples of this sort are found in the minute companions of Castor, and of 40 Eridanus, in Alcor (the companion of ζ Ursæ Majoris), and along with it in all the group of β, γ, δ, ζ of this constellation; from which we conclude that *at least one-third part of the stars visible in the heavens are connected with one another by physical bonds;* and perhaps it would not be an exaggeration to say a half.*

We have to regret that the necessary limitations of this article will not permit a fuller discussion of a subject of so great importance, sufficient of itself not only to enlarge the boundaries of creation, but also to prove that in the depths of space there reign the same laws of force which regulate phenomena in our own immediate neighborhood; and, while establishing identity of laws, to add infinitely to the variety of results, showing that innumerable bodies remain still unknown to us, and that all our solar system, with its numerous cortege of planets, satellites, asteroids, and comets, is only a point in limitless space, associated with myriads of similar systems, which are all animated by the same physical principle, and are ruled by the same laws, and which, like the great First Cause which from nothingness called them into being, constitute one entire and complete unity.

The spectroscope has proved to us the unity of matter; the double stars demonstrate the unity of force; geology teaches how vast a series of ages must have rolled round in order to the accomplishment of the actual state of things; and of this we shall be even more fully persuaded when we study the entire stellar mass, to the consideration of which we now proceed.

### § 10. *Of the Apparent Distribution of the Stars in the Celestial Sphere.*

There is nothing more capricious, to appearance, than the distribution of the stars in the celestial vault. It disconcerts every hypothesis, and even every conceit of the fancy. Yet there must be some kind of order in the arrangement. And just as the observer, who, from the momentary aspects of the satellites of Jupiter or Saturn observed in a single evening, should, in ignorance of their cycles, pronounce their positions to be capricious, so would he err who should imagine that the stars have no other disposition but that which we see. Their appearance is dependent on the orbits which they describe in the mighty void, in periods incalculable in length as compared with our brief generations; but to search out the intricacies of that vast system will perhaps never be conceded to the inhabitants of our little planet. There are, nevertheless, certain general forms which science has detected, and which may give us an idea of a determinate order governing the distribution of these vast masses in space. Even to the most careless glance, the enormous agglomeration of stars in certain regions, and their sparseness in others, cannot fail to be manifest. If, therefore, abandoning any pretension to unravel the intricacies of systems, we are content to investigate their general distribution, we shall gather from the study many and important results. But, in the first place, in order to arrive at any theoretic conception whatever of the real distribution, it is necessary to examine with care the apparent distribution. In spite of the impossibility of penetrating the mysterious constitution of the cosmos, we have, nevertheless, in the labors hitherto executed upon a grand scale by the astronomers, much material suited to illumine our ignorance, at least to some degree. And in this inquiry we should always keep before our eyes the admirable caution of Herschel, to avoid with equal care either of two extremes—the first, that of framing worlds according to our own fancy, by which means we shall fail for ever to understand nature, and shall waste our time vainly; the second, that of hesitating, through too great timidity, to indulge in conjecture, and of thus losing the fruit of observation, the very object of which is to arrive at the structural composition of the universe.†

That in discussing this vast subject we may proceed with method, we shall speak (1) of the apparent distribution of the greater stars; (2) of that of the minor, in treating of which we shall analyze the most important researches made recently in regard to these, not yet as well known as they deserve to be; (3) of the real distribution in space which may be conjectured to exist, comparing the results obtained from various suppositions with that which it is possible to deduce from modern investigations of a different kind.

It is commonly said that the stars of the larger magnitudes are scattered over the celestial vault so irregularly as to suggest no certain principle of arrangement. Yet it has been long since noticed that the brightest of them occupy a broad zone which embraces Taurus, Orion, and the Southern Cross. This obscure indication we have endeavored to examine a little more particularly, with the following results: If a celestial globe be so adjusted that the bright star of the Southern Fish, called Fomalhaut, be in the zenith, the horizon of the globe will mark a great circle, such that a quite narrow zone above and below its plane will embrace the larger number of the conspicuously bright stars. The course of this circle is as follows: Passing through the Hyades, it takes in α Tauri, or Aldebaran, crosses the constellation Orion in a line nearly parallel to his belt, passes between Sirius and Procyon, divides the Southern Cross, and passes between the bright stars of the Centaur and through the body of the Scorpion. Then crossing the ecliptic into the northern hemisphere, it separates the bright stars of Ophiuchus, traverses the constellation of the Lyre, nearly touching Vega, crosses Cassiopeia, and passing through α Persei, leaves at a little distance the beautiful star Capella. The southern pole of this circle, as remarked already, is near the star Fomalhaut; that is, in A. R. 10*h*. 45*m*., and Decl. S. 30°. The northern is in 22*h*. 45*m*., Decl. N. 30°, near ξ Ursæ Majoris. The circle cuts the equator in A. R. 4*h*. 45*m*. and A. R. 16*h*. 45*m*., and cuts the ecliptic in the constellation of the Bull near Aldebaran, and in that of the Scorpion near Antares, having an inclination to this circle of about 70°. From a mere inspection of the globe, it is manifest that most of the stars of the magnitudes from 1st to 4th, are found in this zone. Nevertheless, to give to this statement more of precision, the angular distance from the great circle above described has been determined for all the stars down to the 4th and 5th magnitudes for which the distances do not exceed thirty degrees. The manner of making this determination is obvious enough, consisting only in taking, upon a good celestial globe, the positions of the stars relatively to the horizon, after having first placed Fomalhaut in the zenith, and afterward in the nadir. The numbers thus obtained are certainly not very precise, but they are more than sufficiently so for the present purpose, any greater delicacy being here in fact useless. This list will be seen to embrace not only the principal stars which form the group of Orion and the Greater Dog, but even some which at first view seem to have no relation to it, as Lyra, Perseus, and Cassiopeia. It is immediately obvious that this zone is not coincident with the Milky Way, but yet is not far distant from it, and even follows for quite a stretch the preceding branch of that Way, which, after the division in Aquila, takes the direction of the Scorpion's head. The Milky Way appears commonly not to have on the side of Orion a subdivision corresponding to that in Sagittarius; but our discovery, made in 1855, that the nebula of θ′ Orionis may be traced to very remote limits—even to more than six degrees in declination and four in right ascension — demonstrates a symmetry in this celestial conformation in the two opposite hemispheres, too remarkable to be disregarded. The isolated nebulæ of Andromeda and of the Triangle may possibly belong to this system, but they are situated on the opposite side of the circle. The "sack of charcoal," or the space near the Swan in which every trace of white stellar

* See Struve, *Stellarum Duplicium, etc.*, St. Petersburg, 1852.

† Herschel, *Phil. Trans.*, 1785, p. 213—"On the Construction of the Heavens."

light is absent, does not terminate where in ordinary evenings it seems to do so; but in nights of unusual clearness its continuation may be traced, in the form of an elongated *m*, nearly to the Pole. Now, such a bifurcation corresponds exactly to that which is produced by prolonging, in the other region spoken of above, the great circle which traverses the anterior part of the Scorpion and of Orion. There are many nebulæ in this zone, and numerous groups scattered through Hercules, the Dragon, Ophiuchus, the Lyre, the Bull, the Twins, which, occurring so near to this circle, must certainly belong to the same formation. This is important, as indicating that these groups have in the process of development taken the place of a single great star. We may remark, finally, that the bright star-zone constitutes a well-defined partial system, intersecting the zone of the Milky Way under a pretty acute angle, at points from which, for long distances, the two are confounded. The few bright stars outside of this zone are those of the Lion, the Lesser Dog, and the Twins, which form a third zone, still quite distinct, passing through these constellations not far from the Great Bear in one direction, and extending to the brilliants of the Crane and the Peacock, not far from the Southern Fish, in the opposite. This new circle has its north pole not far from α Cephei, and meets the great circle before described almost at right angles, cutting also the equator near the Belt of Orion.

It would be interesting to seek the relations of these circles to that of the sun's proper motion in space. I limit myself here to the remark that the apex of translation of the solar system is in the principal circle of bright stars; or, more precisely, is near the point in Hercules where that circle intersects the third, or circle of secondary stars, passing through the Lion and the Twins. This coincidence is too singular to be accidental, and points to the existence of some great law of stellar distribution. Hence, probably, the circle first above mentioned should be regarded as the fundamental plane of the stellar system to which our sun belongs.

The distribution of the minor stars is also well marked, so long as we are careful to regard only mean results without descending to particular cases. The larger number of minute stars is evidently in the Milky Way. The course of this zone, with all its cloudlets, has been diligently traced by Heis through the northern hemisphere, in his *Novus Atlas Cœlestis*, and for the southern, by Sir John Herschel in his observations at the Cape. We also have made of it a careful study. The figures given by these authorities, and, better still, a glance at the heavens themselves, the great book open to all, are worth more than any description. The Milky Way is not properly a continuous zone, but is rather a series of luminous patches formed of stars more or less condensed. These masses are not disposed along a regular great circle running through the midst of them, nor is the Way equally broad throughout, or everywhere simple. Broadest in the Swan, it is subdivided, as is well known, in the Eagle, and its principal branch passes through Antinous, Sobieski's Shield, and Sagittarius (H. XVII.), while the other goes on to the Scorpion. Near the Scorpion the globular structure is more apparent than anywhere else. These branches recover their union in the southern hemisphere, where, in the Southern Triangle (H. XV. and XIV.), the zone is brightest, passing thence to the Southern Cross (H. XIII.). But in this constellation it presents a curious phenomenon —viz. an oval empty space called the *Coal-Sack*, beyond which it contracts greatly, becoming only three degrees in breadth, and afterward expands anew, and terminates in a fan of three principal branches (H. IX.). The important gap which the zone here presents, is in the constellation Argo, near λ and γ. Beyond this occurs a vacant interval of about 10°, on the opposite side of which the bright zone reappears, with an extremity similarly split up into the form of another fan of three branches (H. VIII.). Thence it passes over the Great Dog to the Unicorn, where it crosses the equator, and after being considerably dilated and enfeebled in intensity, it reaches our hemisphere, to become diffused over the broad space between the Bull and the Twins, and afterward contracting again, to be anew dilated in Perseus and Cassiopeia, returns finally to the Swan.

This most irregular zone presents no constant density even to the telescope; but while on the side of the Eagle and the Archer, under the most powerful instruments, there still remains a sky of impenetrable whiteness, on that of the Bull, where the breadth is greatest, it is completely resolved into stars. The middle line drawn through this labyrinth is not rigorously a great circle, but rather a small circle distant about 5° from the great circle nearest. It cuts the celestial equator by its principal branch at 108° and 288°, and by the secondary at 268°, being inclined in the mean, on the preceding side, at an angle of about 60°. The Magellanic Clouds may be regarded as detached portions of the Milky Way, isolated in the firmament.

From the slight and very imperfect sketch here given of this immense celestial formation, it is an obvious impossibility, without conveying a false conception, to reduce it to a simple geometrical representation. Nevertheless, in order to resolve certain problems, it is necessary to study its principal characteristics, contenting ourselves in doing so with such mean results as observation gives, and which, if they change the character of the phenomenon, as considered from one point of view, are yet in other respects useful and unexceptionable. Premising this with a view to forestall inopportune exceptions, we proceed with our subject.

The soundings of the stars, instituted by Herschel for the purpose of learning the apparent distribution of those bodies, have already been described. The data thus obtained were discussed by their author, and afterward by Struve, and have led to the following results: (1) The stars are more abundant the nearer we approach the Milky Way, where their density is maximum. (2) The minimum density is found at the pole of the same zone. Employing the numbers of Herschel, W. Struve* has investigated the laws of stellar condensation as referred to the Galaxy, and has obtained these results: Taking separately the soundings made in the middle of the Milky Way at the point where it crosses the equator, there are found for each field—

On the side of the 6th hour (Taurus) 49 different soundings with 4042 stars give for the mean field ..... 82.5 stars.
On the side of the 18th hour (Aquila) 73 soundings in the principal branch, with 10,612 stars, and 29 in the secondary branch, with ..... 5,862 "
Give for the total at the 18th hour 102 soundings and....:16,474 stars, or in mean 161.5 "

The difference is here considerable, and shows a greater accumulation of stars on the side of the 18th hour than on the opposite side. At the 6th, the maximum number found in one field was 204, and at the 17th, 557, which indicates that the Milky Way is more uniform on the side of the 6th hour than on the other. If we limit ourselves, however, to general conclusions, it is allowable to take the mean of these numbers. But on the side of the 18th hour the Milky Way is double, and this introduces another irregularity. Still, even in the space between the branches, it is quite rich, and at the point in the Eagle where it divides, it has a mean of 60 stars per field. Taking, therefore, the average of the numbers given above, we find that, in the plane of the Galaxy itself, the mean number of stars per field is 122. (3) In order to find the mean density at 15° distance from the galactic plane, the celebrated author cited has taken the sum of the Herschelian soundings falling between 10° and 20° of distance S. as well as N. of the Milky Way, as laid down in Lubbock's maps, and has found—

On the side of the 6th hour 33 soundings, with a mean density of ..... 25.56 stars.
On that of the 18th, 23 soundings, with a mean density of ..... 35.06 "
From which the mean density for the distance of 15° is inferred to be ..... 30.30 "

(4) Proceeding in the same way for the distances between 25° and 35°, there is obtained from 35 soundings the density of 17.68 stars; and by similar successive operations is formed the following table:

| Distance from plane of Galaxy. | Star-density. | No. of soundings effected. |
|---|---|---|
| 0° | 122.00 | 151 |
| 15° | 30.30 | 56 |
| 30° | 17.68 | 34 |
| 45° | 10.36 | 48 |
| 60° | 6.32 | 18 |
| 75° | 4.78 | few. |

The two points following, noticed by Struve, are worthy of observation: (1) A *saltus*, or noticeably sudden diminution of density, beyond two degrees of breadth, which explains why the Milky Way appears so narrow—that is, not more than 4° wide—a conclusion to which the law of continuity also leads even in telescopic observations, particular cases only excepted in which stellar groups are so sharply defined that half the field is within and half without the Galaxy; but these cases are rare. (2) The great disproportion between the two extremes, so that in the plane of the Milky Way, even taking means, the stars are thirty times more numerous than at the pole; it being understood that the disproportion between the actual numbers largely varies with the localities. Yet in no locality, not even in

* *Études d'Astronomie Stellaire.*

the openings or "coal-sacks," is the poverty ever so great as at the poles.

It may now be inquired whether a similar distribution of stars occurs in the southern hemisphere; and further, whether stars of the different magnitudes are equally condensed toward the Milky Way, or whether the minuter stars are proportionally more compact. Answers to these questions have been furnished by the labors of the younger Herschel and of Struve. Sir William Herschel, in his soundings, took no account of the magnitudes of the stars, but his son, in pursuing a similar labor for the southern hemisphere at the Cape of Good Hope, divided the stars into classes, and arrived at results similar to those above indicated, with particulars better suited to the purposes of our inquiry. Taking the soundings in a zone of 3° in breadth—that is, of 1½° in each direction from the Galaxy—he found a mean of 75.5 stars per field, and this without following the tortuous course of the Galaxy, on which account, since many of the fields fell outside of it, the number is diminished; so that, when this circumstance is taken into account, the number of stars per field is at least 90, even when those fields are omitted from the reckoning in which there are aggregations so dense as to give more than 200 each. Starting, then, from this number, which does not differ much from the 122 found by his father in the northern hemisphere, he found, for the zones at different distances from the Galaxy, the results following:

| Distance from plane. | Middle of zone. | No. of soundings. | Total No. of stars. | Proportion. |
|---|---|---|---|---|
| 1½° N. to 1½° S. | 0° | 84 | 6,258 | 74.50 to 90 |
| 0° to 15° S. | 7½° | 321 | 16,461 | 51.28 |
| 15° S. to 30° S. | 22½° | 195 | 4,576 | 23.47 |
| 30° S. to 45° S. | 37½° | 68 | 982 | 14.46 |
| 45° S. to 60° S. | 52½° | 21 | 161 | 7.41 |

The rate of decrease is the same as in the preceding table, though the absolute values are somewhat different, referring as they do to different mean limits; and hence the conclusion is drawn that the total number of stars visible in the southern hemisphere is about 2,665,786, and the total number in the entire heavens about 5,331,572, or five and a quarter millions at least. It follows that the southern hemisphere is less richly provided than the northern. In the following table are contained the estimated numbers of stars scattered through the zones parallel to the Galaxy, arranged according to magnitudes:

| Distance from S. pole of the Galaxy. | Number of stars per 100 telescopic fields. | | | | | |
|---|---|---|---|---|---|---|
| | Larger than 8th mag. | From 8th to 9th. | From 9th to 10th. | From 10th to 11th. | From 11th to 12th. | 12th and beyond. |
| 0° to 15° | 5 | ... | 7 | 47 | 72 | 474 |
| 15 36 | 5 | 6 | 22 | 38 | 56 | 535 |
| 36 45 | 5 | 7 | 17 | 39 | 76 | 764 |
| 45 60 | 3 | 6 | 18 | 42 | 109 | 1171 |
| 60 75 | 3 | 7 | 23 | 57 | 161 | 2378 |
| 75 90 | 6 | 11 | 38 | 88 | 248 | 5515 |
| 90 105 | 4 | 9 | 28 | 70 | 215 | 4802 |
| 105 120 | 6 | 8 | 21 | 46 | 121 | 2145 |
| 120 135 | 3 | 1 | 21 | 51 | 130 | 1240 |
| 135 150 | ... | 5 | 5 | 24 | 81 | 656 |

It is here easily apparent that the larger stars are pretty uniformly distributed, but that the smaller are more and more condensed, till near the Galaxy they are twelve or thirteen times more numerous than at the pole of that zone; and if figures be constructed in accordance with these numbers, they will visibly illustrate the closeness and the multitude of the stars. We shall presently see what conclusions may be drawn from this distribution.

Besides the laborious enumerations of Herschel, there are other similar monuments of industry which may possibly suggest the laws of stellar distribution in space. Some of these we shall briefly notice. The zones of Bessel, catalogued by Weisse for the limiting parallels of 15° N. and 15° S. declination, and discussed by Struve, lead to the following distribution, arranged according to right ascensions, the heavens being divided into regions of four hours each. The letters A and B indicate the magnitudes according to Argelander and Bessel respectively:

*Distribution of Stars in Right Ascension.*

| Region. | Hour. | | 1st to 5th magn. (A). | 6 (A). | Magnitudes, 7 (B), | 8 (B). | 9 (B). | 1st to 6th (A). | Total. |
|---|---|---|---|---|---|---|---|---|---|
| | *h.* | *h.* | | | | | | | |
| 1 | 1 to | 4 | 61 | 120 | 392 | 1,452 | 4,793 | 181 | 6,818 |
| 2 | 5 | 8 | 76 | 148 | 598 | 2,549 | 10,227 | 224 | 13,598 |
| 3 | 9 | 12 | 49 | 78 | 393 | 1,356 | 5,129 | 127 | 7,005 |
| 4 | 13 | 16 | 50 | 87 | 475 | 1,396 | 4,848 | 137 | 6,856 |
| 5 | 17 | 20 | 68 | 106 | 674 | 2,432 | 7,377 | 174 | 10,657 |
| 6 | 21 | 0 | 58 | 113 | 362 | 1,273 | 5,365 | 171 | 7,171 |
| I. to VI. | 0 | 23 | 362 | 652 | 2894 | 10,458 | 37,739 | 1014 | 52,105 |

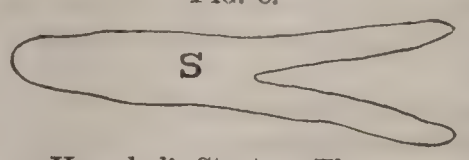
Here is seen at a glance the preponderating abundance of stars in the regions of the second and the fifth hours, where, more largely than elsewhere, the zone is traversed by the Milky Way. The numbers are sensibly larger in these regions for all the stars, but for the small ones in greater proportion. Still, the distribution in these zones has the effect to understate largely the density in the galactic region, and to increase it near the pole of that belt, because the stars of the 9th magnitude, though the most abundant, cannot in the galactic belt be all recorded by the observer, while in the poor regions they are pretty completely gathered up. Moreover, the Galaxy where it intersects the equator does not spread over the four hours of the region to which it belongs, which therefore includes a large celestial space poor in stars. The poorer portions, moreover, being more than 30° distant from the galactic pole, it is evident that the real condition of things cannot be inferred from this enumeration. The conclusions which it suggests are nevertheless sufficiently in harmony with those of Herschel. The zone observations of De Vico, of the American Bond, and others, conduct to the same results, which are these: (1) That stars are more numerous near the plane of the Milky Way than in other quarters of the heavens; (2) that the proportional increase in numbers toward this plane is greater for the small stars than for the large. These general results are incontrovertible, but are hardly an adequate compensation for the severe toil which this discussion has necessitated. The laws of apparent density, however, having been thus reduced, at least approximately, to formal numerical expression, the problem henceforth loses something of its vagueness; and upon the basis of these laws we are enabled to proceed more securely to the discussion of some of the questions which relate to the real distribution of the stars in space.

### § 11. *Real Distribution of the Stars in Space.*

To pass, then, to these questions, the first inquiry which presents itself is this: Is the apparently greater density of the stars in certain regions purely an effect of perspective, or is it owing to the fact that the number of stars in a given space is really greater in those regions than elsewhere? In other words, Does the visual ray in a given direction encounter more stars because its line of transit through them is longer, while they are in fact uniformly distributed through space, or do they appear more crowded because they really are so? This question, in respect to certain particular regions of the heavens—as, for instance, the Magellanic Clouds and certain large spots of the Milky Way, apparently globular agglomerations of enormous bulk—is easily resolved. For in these cases, if we choose to assume that the component stars are, as in other regions, equally distant from each other, we are compelled to regard the agglomerations as cylindrical masses with their axes pointing directly toward the observer—a condition of which the improbability is plain enough to any one. Moreover, some of these masses are composed of stars of nearly equal magnitude, and clustered together with a density increasing toward the centre; so that it is impossible not to recognize them as special systems. Such are the numerous clusters which we find isolated in the heavens, and very many others occurring in the Galaxy. Of these particular cases it is not our purpose here to speak. Our present inquiry relates to the visible stellar mass in general, especially as seen in the Milky Way, and our aim is to settle which of the two hypotheses above mentioned is to be preferred.

Sir William Herschel, in the beginning of his stellar researches, accepted the idea of Huyghens that the stars are uniformly distributed through space; and he consequently regarded the number of these which in his soundings he found on the line of the visual ray, as a measure of the depth of the stratum. He was thus conducted to his famous conception of the galactic system as forming a vast stratum of relatively small thickness, bifurcated on the side of Sagittarius, and presenting in section the appearance shown in the annexed figure. But this fancy was abandoned by himself in his later years, though many quote it still as his finally-settled opinion. If it is admitted that the stellar density is at the same time apparent and real, and that the stars appear crowded not only by the effect of perspective, but because of their actually greater mutual proximity; and if on this hypothesis the relative density of the Herschelian stratum in various planes parallel to the principal plane of the stratum be a subject of inquiry, the following table, calculated by Struve upon the soundings of Herschel, will furnish replies:

FIG. 8.




Herschel's Stratum Theory.
S, sun's place.

| Distance from plane of Galaxy. | Stellar density. | Interstellar distances. |
|---|---|---|
| 0.00 | 1.000 | 1.00 |
| 0.05 | 0.480 | 1.27 |
| 0.10 | 0.330 | 1.45 |
| 0.20 | 0.239 | 1.61 |
| 0.30 | 0.180 | 1.77 |
| 0.40 | 0.086 | 1.97 |
| 0.50 | 0.014 | 2.26 |
| 0.80 | 0.005 | 4.14 |
| 0.86 | ..... | 5.73 |

From this it is apparent how rapidly the stellar distances must increase in proceeding toward the pole of the Galaxy, and how large is the excess of density in its own plane. Thus, at the distance 0.86, which corresponds to 60° of elevation above the galactic plane, the density is hardly 0.0005 of that within the plane itself; and the interstellar distances are something like six times greater near the pole than in that plane. Though such a distribution cannot be called impossible, it is supported by no argument strong enough to give it preference to the other, which supposes the stars equidistant, but arranged in longer lines. In deciding this point the following reflections may be serviceable:

If the stars are more dense only—as Herschel's original supposition presumes—because the visual lines are longer, the proportion of stars of different magnitudes will not be the same throughout the heavens, but, in the directions of the longer visual rays, the number of small stars will predominate; and this for the reason that, to the number of those which are really small, must be added such as, being actually great, are reduced in magnitude in consequence of their distance. On the other hand, if the stars are really closer where they appear to be so, then, assuming that the different magnitudes are impartially distributed through space (for there is no reason to think otherwise), the ratio of the numbers expressing the various orders of magnitude must, within a sphere of visibility of any given radius, be the same as that which is deduced from other elements as related to their distance; as, for instance, from photometry and proper motion.

It is, however, to be remarked that the two hypotheses are not absolutely mutually exclusive, since it may happen that, in certain directions, the stars are at the same time more thickly strown and arranged on longer lines. Really, therefore, we are without any certain criterion, and it is necessary here also to resort to the criterion of probability. We know, indeed, that one of the stars nearest to us, 61 Cygni, is among the smaller. With a view to the resolution of this problem, W. Struve has calculated what should be the radius of a sphere capable of containing the stars of each order of magnitude, on the supposition, first, of a uniform distribution, and secondly, of inequalities of density. Let it be understood that we are not here discussing absolute distances, but proportional distances only, and that, in speaking of uniform distribution, we do not intend a geometrical uniformity, which in space is impossible, but merely an approximate uniformity. Resuming, then, the enumeration of the stars given in the foregoing sections, we have the following table, in which the first column gives the magnitudes, and the second the numbers of the stars according to Argelander; the third, the successive sums of the first and second, the first, second, and third, etc.; the fourth, the radius of the sphere capable of containing the stars of the several magnitudes respectively, supposing them mutually equidistant; the fifth, the results of a similar calculation according to the enumeration made by Struve upon the stars of Bessel in Weisse's catalogue; and the sixth and last, the differences between the two calculations:

| Magnitudes. | Number of stars, according to Argelander. | Successive sums. | Radius of sphere to embrace these sums. | Similar computation from Bessel's numbers. | Diff. |
|---|---|---|---|---|---|
| 1 | 20 | 20 | 1.00 | 1.00 | |
| 2 | 65 | 85 | 1.62 | 1.46 | + .16 |
| 3 | 190 | 275 | 2.39 | 2.13 | + .26 |
| 4 | 425 | 700 | 3.27 | 2.91 | + .36 |
| 5 | 1,100 | 1,800 | 4.48 | 3.97 | + .51 |
| 6 | 3,200 | 5,000 | 6.30 | 4.48 | + 1.82 |
| 7 | 13,000 | 18,000 | 9.65 | 8.58 | + 1.07 |
| 8 | 40,000 | 58,000 | 13.20 | 13.44 | − .24 |
| 9 | 142,000 | 200,000 | 21.55 | 20.38 | − .17 |
| 14 H. | ..... | ..... | 98.00 | | |

The differences of the last column, though sensible, do not exceed the irregularity admissible in this matter. The greatest anomaly appears between the stars of the 6th and 7th magnitudes—that is, at the point of transition from the telescopic stars to those visible to the naked eye—a *saltus* in the scale already noticed by Struve. The total number of stars visible to the naked eye in all the heavens, down to the 6th magnitude, amounts, according to Heis, to 6800, which gives for the radius of the including sphere, 6.610; and from the Pulkova catalogue the number of stars to the 7th magnitude amounts to 26,800, which gives, for the similar radius, 11.021. These two numbers exceed those of the table above, but Heis confesses that his own sight extends to many stars below the 6th magnitude; and it is equally admitted on the part of Struve that many stars half a magnitude below the 7th are included in the Pulkova catalogue—a fact which he attributes to an uncertainty necessarily arising out of the nature of the case, but which I believe to be no less due to our natural tendency to fancy a star larger than it is whenever, without any kind of instrumental aid, we form our estimates by the eye alone.

Let us now see what must be the radii of the spheres capable of containing the same classes of stars, on supposition that their apparent density is also real. From the law of apparent density, deduced by Struve from the labors of Herschel, are computed the following distances:

| Magnitudes. | Radii. Nos. and densities compounded. |
|---|---|
| 1 | 1.00 |
| 2 | 1.80 |
| 3 | 2.76 |
| 4 | 3.90 |
| 5 | 5.45 |
| 6 | 9.28 |
| 7 | 15.78 |
| 8 | 23.86 |
| 9 | 33.40 |
| 14 H. | 180.40 |

It now remains to be seen which of these two series most nearly represents the actual facts in the celestial expanse. To decide the question directly is impossible; but indirectly we may do it by comparing the radii of these tables with the mean distances inferred from photometry and from proper motions. For the purposes of such a comparison a *résumé* of all these values is presented in the following table:

| Magnitudes. | Distances inferred. | | | |
|---|---|---|---|---|
| | From number, distribution supposed uniform. | From number, density supposed variable. | From photometry. | From proper motions of the single stars in A. R. |
| 1 | 1.00 | 1.00 | 1.00 | 1.0 |
| 2 | 1.46 | 1.80 | 1.55 | 1.8 |
| 3 | 2.13 | 2.76 | 2.42 | 2.8 |
| 4 | 2.91 | 3.90 | 3.76 | 3.9 |
| 5 | 3.98 | 5.45 | 5.86 | 5.6 |
| 6 | 5.47 | 9.28 | 9.11 | 9.0 |
| 7 | 8.58 | 15.78 | 14.17 | 16.0 |
| 8 | 13.44 | 23.36 | 22.04 | 18.0 |
| 9 | 20.38 | 33.40 | 34.30 | 33.0 |
| 14 H. | 98.00 | 180.40 | 312.00 | ..... |

Here it is obvious that the photometric scale more nearly accords with the hypothesis of condensation than with the other, especially for the smaller stars; and the same thing is true in regard to the proper motions. We are led, therefore, to the conclusion that, not only in appearance but in fact, the stars are more dense near the Galaxy.

This, which may be called the theory of the real distribution of the stars in space, is the only result which, among the numerous speculations hitherto made as to the structure of the Milky Way considered as the principal body of the universe, deserves any confidence. Kepler, first among these speculators, regarded the Milky Way as a confused ring composed of stars, within which he conceived our sun to be eccentrically placed toward one side, and out of the mean plane. Huyghens supposed the stars to be distributed uniformly—an idea which we have seen to be untenable. Wright, Kant, and Lambert discoursed largely upon the nature of the systems which make up this immense aggregation; but all their conceptions are modelled on the type of the solar and planetary system as it was known in their time. Hence, in their speculations, we have always the inevitable great central primaries, and after these the secondaries and other attendants, of the 3d, the 4th, and even the 5th order. But as, in our day, the solar system itself has been so greatly modified, and since it presents so large an ascertained variety, it would be idle to follow in the footsteps of these. In fact, they could never escape from the conception of a sun surrounded by planets forming systems of the first order, and these surrounded by satellites forming systems of the second order, all the orbits being eccentric and only slightly inclined to the equator

of the primary. They admitted also comets with orbits largely eccentric—numerous, but without law. Now, besides these principal classes, composed of masses of great magnitude, we recognize between Mars and Jupiter a zone of little bodies whose entire mass, although their number already reaches 169 (Jan. 1, 1877), scarcely equals that of the earth; while there is no ground to suppose that they have been all discovered, but rather, from the rapidity with which discovery has followed discovery, we may reasonably infer the contrary. Their orbits are considerably inclined to the ecliptic, and some of them are very eccentric—so much so, indeed, as, in view of their mutual proximity and the intricacy with which they are interwoven, while the whole are distributed over a zone no broader than the mean distance of the earth from the sun, to make their stability doubtful, and even to lend plausibility to the conjecture that the bodies themselves may sometimes come into collision. We recognize, moreover, many periodic comets, and others not periodic, some of which make part of the long parabolic currents of minute cosmical bodies—that is to say, meteorites—forming sometimes arcs of very great and sometimes of limited extent, which follow the tracks of some of the comets. These bodies, moreover, are not all solid, but in part gaseous, and on this account present so strange phenomena in their approach to the sun. In like manner, with the discovery of gaseous nebulæ—a discovery, however, already predicted by Sir William Herschel toward the close of his career—all the fancied resemblances between the nebulæ and the Milky Way fall to the ground.

In view of these discoveries in our own system, it is no longer improbable that groups of very minute stars may take the place of vast isolated bodies, and that every system may not, as Lambert would have it, possess a great preponderating centre to give it an indefinite stability. From the general vicinity of the nebulæ to the Milky Way, and considering that they are not always formed of separate stars, as used to be believed, it is impossible to say that these objects may not be parts of that great formation. Besides, the necessity of a great central mass is not absolute; it being possible to secure regularity of motion by means of an annular system, or other combination, without a central body—arrangements of which examples exist among the nebulæ, where are also spiral systems destined to other ends than perpetual circulation in orbits perfectly closed.*

From this survey must not be excluded the stellar systems, now well proved to exist, of double, triple, and multiple stars, nor the various groups found in the Milky Way, which without being globular seem to suggest the idea of partial systems, since they exhibit coronæ approximately circular, furnished with fringes or linear streams systematically diverging, analogous to the temporary positions of our planets projected around the sun. Nor should it be omitted that the central bodies of such groups may escape observation in consequence of their inferior luminosity. Some systems of this kind may be seen, especially in certain of the nebulæ of Sagittarius, and precisely in A. R. 18*h.* 10*m.* and in Decl. S. 18° 53′. The idea, moreover, of Mr. Proctor, who considers the openings in the Milky Way near the Southern Cross, and in the Swan, as evidences that the thickness of the sidereal stratum is limited, and that we see beyond the limit of its thickness, seems to be just. In fact, as a spherical aggregation, in instances like those of the Magellanic Clouds, is inferred to exist from the form alone, inasmuch as it cannot be supposed to be an indefinite cylinder with its axis directed toward the observer, so these apertures show that the bordering masses have a thickness in the direction of the visual ray bearing some proportion to their breadth; and we are not permitted to conceive them as tubular perforations of indefinite length with their axes turned precisely in our direction. The inference is therefore unavoidable that the Milky Way must be a finite system of stars, of which the depth in the visual direction cannot differ much from its breadth; at least, that this must be true on certain lines, though in others it may be impossible to say where it ends.

The earliest speculators on this subject had much to say about a ring; others talked of a disk split into two laminæ; but neither of these forms can explain, even approximately, the observed convolutions. Mr. Proctor has recently suggested the similitude of a serpent, coiled upon itself yet without closing the circle, there being in one place an interval which is seen in the constellation of the Southern Cross.† But none of these forms suffice to give even a rough idea of this great stellar mass in its entirety, and its real structure defies our every conjecture. All we can say is that it is composed principally of aggregations of unbounded magnitude, with intervening spaces where the stars are scattered with less density and more uniformity; that the series of these aggregations is longest, in respect to us, in the direction of Sagittarius; and that, diametrically opposite to this, in Perseus and Cassiopeia, it has also a great profundity; while to the right and the left of this diametrical line, where it is both narrower and nearer to us, the depth is much less; that our sun, with the neighboring stars of the group to which it belongs, is certainly not situated in the centre of the stratum, but sensibly eccentrically, as is evident from the enormous difference of stellar density between the 6th hour of right ascension and the 18th; moreover, laterally from these, the Milky Way is very singularly bifurcated, and while it is everywhere bright and in many points irresolvable, it is suddenly interrupted, terminating, as remarked above, in two large fans situated in A. R. 9*h.*, nearly in front of the constellation Argo.

The sun, moreover, is a little out of the plane of the Galaxy, since this zone does not form a great circle, but a parallel to a great circle, and distant from it about 5°. More than this it is useless to conjecture. The component masses seem to be scattered groups, independent and countless in number, rather than a unit-system; and in consequence of the complication, their aspects throw no light upon the structure of this immense aggregation.

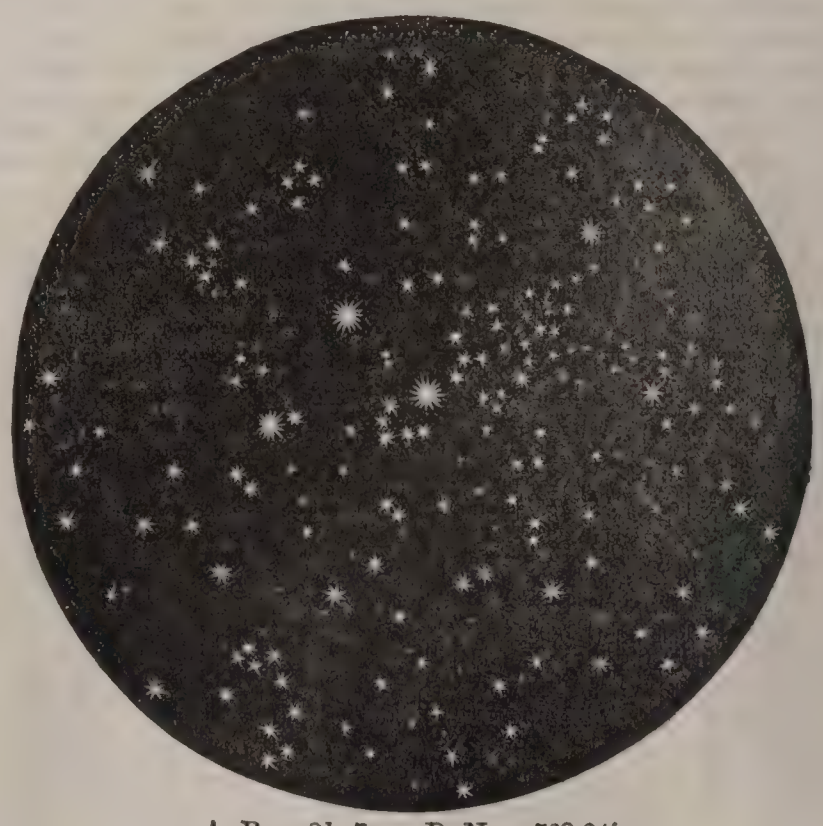
Though resolvability into stars distinguishes in general the Via Lactea from the nebulæ, yet many bits of this, examined with the spectroscope, have given indications of bright isolated spectral lines, so that it is not certain that in these points there may be nothing but stars, as we shall soon learn.

But all the visible stars do not form parts of the galactic system alone. Many groups seem independent of it—as, for instance, the Magellanic Clouds; and the same is likewise true of numerous aggregations of stars mingled with nebulæ, such as Coma Berenices and its surroundings, and other clusters of less dimensions than these. Above all, the nebulæ seem to form a system of their own, and to these we shall now turn our attention.

### § 12. *The Nebulæ.*‡

Not only in the magnificent celestial girdle of the Via Lactea, but also outside of it, there are in the heavens many spots which, even to the naked eye, seem luminous clouds, such as the Pleiades, the Beehive in Cancer, the hilt of Orion's sword, and the Hair of Berenice. These spots, from the earliest antiquity, have been called "nebulæ;" but since the time of Galileo it has been proved, by the aid even of imperfect instruments, that they are in most instances formed of aggregations of minute stars so close together that, though easily separated by instruments, the naked eye fails to distinguish them individually. The Pleiades and Præsepe produce little effect in telescopes, their component stars being so far apart; but the central portion of the group in Perseus, shown in Fig. 9, is magnificent. The little nubecula in the Milky Way near the star $\mu$ in Sagittarius is a surprising entanglement of curves, arches, and circles, defying all description. Its right as-

FIG. 9.



A. R. = 2*h.* 7*m.*; D. N. = 56° 24′.
Portion of the Group in Perseus.

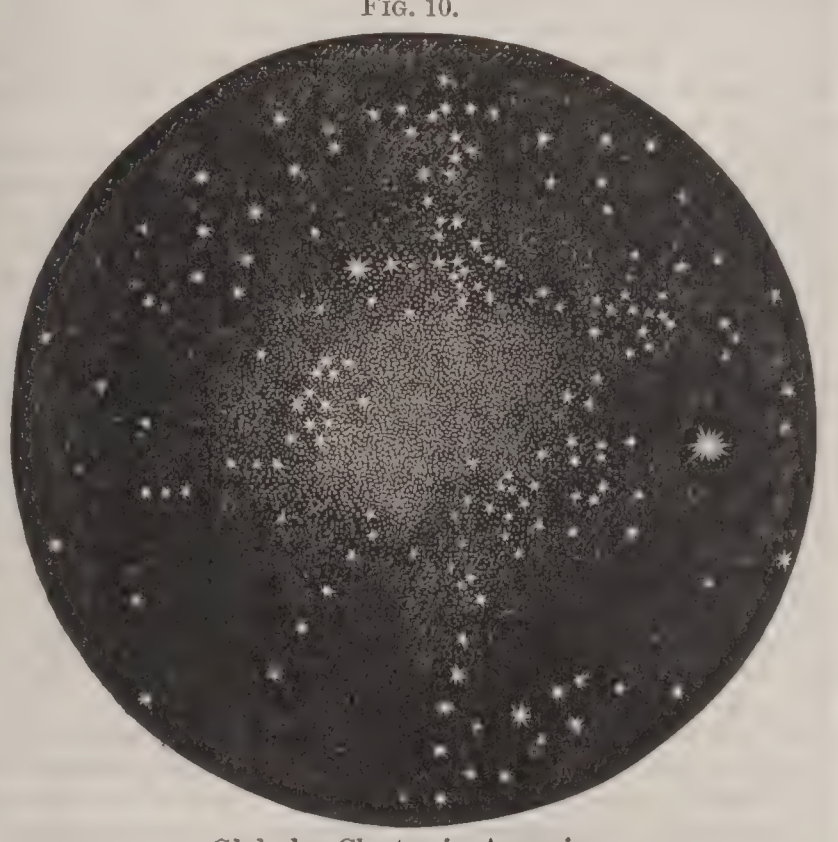
* It is no objection to this hypothesis to say that such systems could not be stable, since it is possibly true that the bodies composing them are destined by their collisions for the renovation of systems and the generation of scenes of new life.

† *Monthly Notices R. Astr. Soc.*, Dec., 1870, and *Astr. Essays*, p. 331.

‡ An article on the NEBULÆ will be found in Vol. III., but this covers only to a slight extent the ground of that, while that contains much not embraced in this. The two are mutually supplementary.

cension is 18*h*. 9*m*., and its declination 18° 50′ S. (See *Memoirs of the Observatory of the Collegio Romano*, 1852.) There is a neighboring group in A. R. 18*h*. 9*m*., Decl. 19° 6′ S., and one also in 18*h*. 10*m*. 46*s*., Decl. 19° 2′ S., where a magnificent red star, surrounded by an indescribable mesh, suggests irresistibly the idea of a system. The improvement of telescopes opened up a much more extensive field of objects of this kind, though of smaller dimensions. Messier and Lacaille in their time detected an admirable list, some separable in their instruments into stars, and others not. It was reserved for the elder Herschel to study exhaustively this branch of astronomy also, and to gather from it marvels without end. As a first result, many of the objects believed by his cotemporaries to be irresolvable, were perfectly resolved by his powerful instruments. Many also show rich aggregations of variously-colored stars—as, for example, the one near κ of the Southern Cross, which resembles a heap of gems—and many form a special category of objects called clusters, and by us groups or globular masses, made up of immense multitudes of exceedingly minute stars arranged in globular form, and so closely condensed in the centre as to present there a uniform white light. Figs. 10 and 11 give an idea of these objects. The

FIG. 10.



Globular Cluster in Aquarius.

most beautiful in our hemisphere is that of Hercules, in A. R. 16*h*. 37*m*., Decl. + 36° 42′, which is noticeable on ac-

FIG. 11.



Globular Cluster in Canes Venatici.

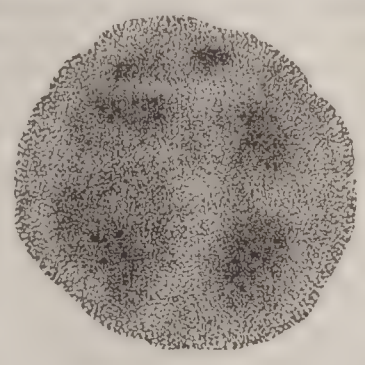
count of its curvilinear rays exterior to the arches of the spiral: it fills a field of 8′; that of Libra is not more beautiful, more extensive, or more resolvable than this. In the southern hemisphere are two others not less surprising —viz. the nebula of Toucan and that of ω Centauri, in which stars are present in thousands. The last occupies at least 20′ of space entirely covered with stars of the 12th and 13th magnitudes. The following is a list of the most beautiful objects of this kind. To give a description of them no number of figures or of pages would suffice. The only mode of acquiring any conception of these objects at all is, with an instrument of adequate power, to examine the objects themselves:

*Principal Globular Groups of Stars.*

| Group. | Right ascension. | Declination. |
|---|---|---|
| M. 5 in Libra | 15*h*. 10*m*. | + 2° 41′ |
| M. 13 " Hercules | 16 37 | + 36 43 |
| M. 92 " " | 17 13 | + 43 15 |
| M. 10 " Ophiuchus | 16 50 | − 3 53 |
| M. 9 " " | 17 12 | − 18 23 |
| M. 14 " " | 17 29 | − 3 02 |
| M. 2 " Aquarius | 21 25 | − 1 34 |
| M. 3 " Canes Venatici | 13 36 | + 29 11 |
| —— " Crux Australis | 12 44 | − 59 26 |
| H. 2322 in Toucan | 0 17 | − 73 2 |
| H. 3504 " ω Centauri | 13 17 | − 46 35 |
| —— " Antinous | 18 44 | − 6 25 |
| M. 13 in Pegasus | 22 22 | + 11 27 |
| —— " Delphinus | 20 26 | + 6 51 |

But the power of Herschel's instruments was not sufficient to resolve into stars all the objects characterized as nebulosities, and the name of nebula is now restricted to the unresolved. Of these nebulæ there are three categories: (1st) the planetary nebulæ; (2d) the elliptic nebulæ; (3d) the irregular nebulæ. The first receive their name from the fact that, in the field of the telescope, they appear as disks more or less well defined, and with a light like that of a planet, nearly uniform. Their color is greenish-blue. A beautiful series of these objects is represented in Figs. 12, 13, 14, 15, 16, 17, 18. The uniformity of light in

FIG. 12.



A. R. = 19*h*. 34*m*.;
D. = − 14° 32′.

FIG. 13.



A. R. = 23*h*. 18*m*.;
D. = + 41° 36′.

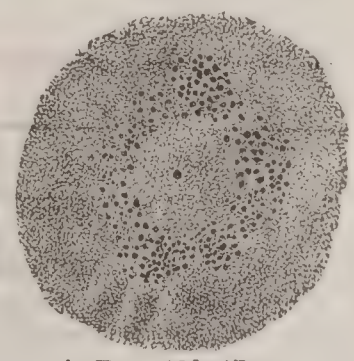
some of these is singular, as in Fig. 12. But in these also are seen spots of greater brightness, which seem to scintil-

FIG. 14.



A. R. = 20*h*. 55*m*.;
D. = − 12° 2′

FIG. 15.



A. R. = 10*h*. 17*m*.;
D. = − 17° 47′.

late, and are arranged apparently in curves. These lucid masses are sometimes disposed in ring shape (Figs. 13, 17),

FIG. 16.



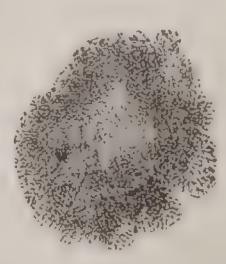
A. R. = 18*h*. 4*m*.;
D. = + 6° 50′.

FIG. 17.



A. R. = 7*h*. 34*m*.;
D. = − 14° 20′.

FIG. 18.

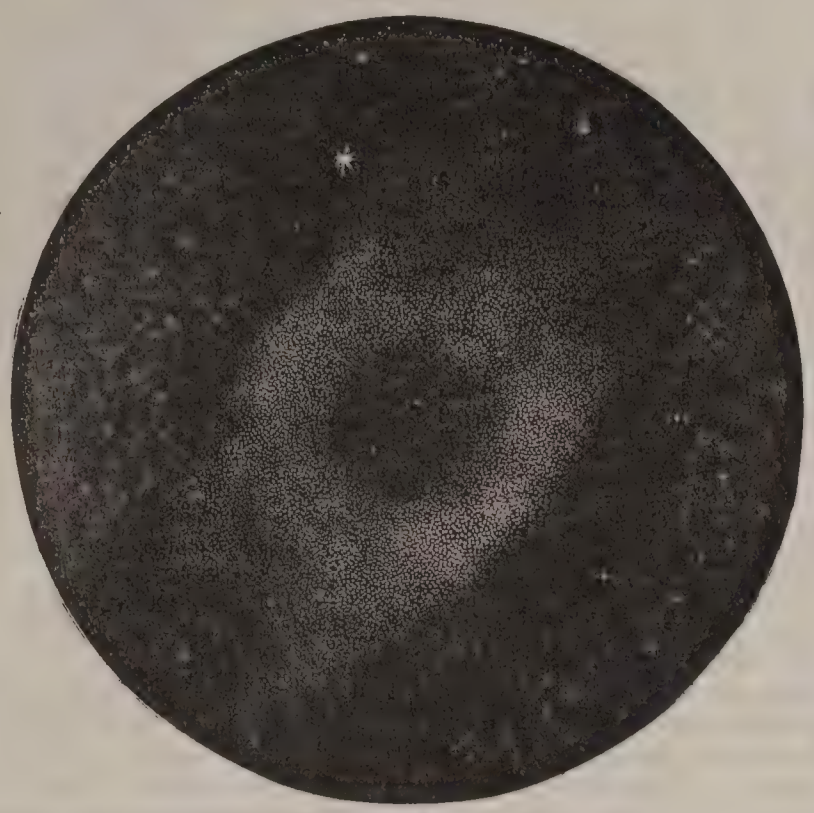


A. R. = 5*h*. 33*m*.
D. = + 9° 0′.

sometimes in ear-shape (Fig. 15). The figures speak more forcibly than many words. Others, again, are cloudy on the edges, while they also present a neatly-defined central part, as in Fig. 16. These at first sight resemble somewhat Saturn with his ring—that is to say, a globe surrounded by an oval—but on closer examination exhibit the characters shown in Figs. 13, 14, and 15. Some have decidedly the aspect of a true ring, the interior being wholly vacant. Unique among these is the nebula of Lyra, A. R. 18*h*.

48*m*. 12*s*., Decl. N. 32° 52′, which presents an elliptic ring, having in the centre the merest scintillation of light, which is an exceedingly minute star. (Fig. 19.)

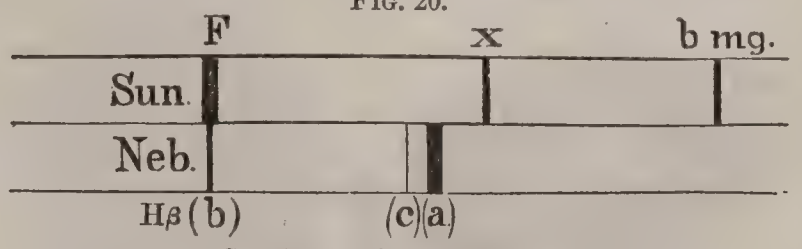
FIG. 19.



Annular Nebula in Lyra.—Diam. 73′.

Though absolutely irresolvable, still, with very powerful instruments, it is possible to discover in these objects a certain scintillation, which favors the belief that they are composed of stars. This conclusion is apparently confirmed by Bond's researches with the great Cambridge refractor, and by those of Lord Rosse with the most colossal reflector ever constructed; but the spectroscope has come in here to undeceive us, by revealing the quite unexpected fact that all these objects are only masses of gas, confirming thus the vague sentiment which always favored the belief that they cannot be all resolvable. Sir William Herschel, indeed, had early abandoned all hope of resolving certain of the nebulosities, and, in the latest years of his career, he insisted on the existence of matter diffused through space, out of which the nebulæ are probably formed. Mr. Huggins, by applying the spectroscope, has found that the spectra of these objects are composed of three lines only—one in the blue and two in the green.

FIG. 20.



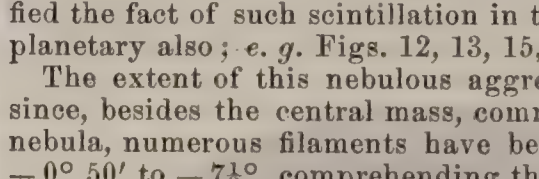

Spectrum of the Nebulæ.*

At the first aspect, it excites surprise, that objects of so feeble luminosity should give a sensible spectrum at all; but surprise will cease when it is considered that their light is not intrinsically weak, and that, in the spectrum, this light is not spread out, as in those of the stars, over a wide continuous space, but is all concentrated in the few lines above named. Thus, preserving all its intensity, it comes out with a force comparatively much greater than that of stars of only equal brightness. From the nature of this spectrum, we are able to infer the nature of the gases which produce it. One of these is certainly hydrogen, since, besides the coincidence of the line above mentioned with the solar F, the line G in the red has also been successfully identified in the brighter of the nebular spectra. As to the others, one is very near to the double line of azote, found in the spectrum of the second order of this gas; but as it is not perfectly coincident with either one of the pair, the substance producing it is unknown. Among the artificial lights which approach nearest to this, there is a line of lead, but the identity is hardly probable. The third and finer line is quite unknown.

(2) The oval nebulæ are elliptic masses, mostly faint and extremely diffuse at the borders. A remarkable example of this class is in the girdle of Andromeda, discernible to the naked eye, and resembling in appearance a light seen through a thin plate of horn; it was so described by its discoverer, Fabricius. Its extent is very remarkable, being in length a degree and a half, and in breadth a quarter of a degree. It was profoundly studied by Bond of Cambridge, who found that it is far from being continuously luminous, but has, as it were, two narrow dark stripes or channels.† Yet its spectrum is found to be continuous, whence the nature of its composition remains unknown. Still, this does not prove that it may not be gaseous, it being possible for gases at low temperature to give a continuous spectrum.

A great number of small nebulæ, of the type shown in Fig. 21, are found chiefly in the region of Coma Berenices and in the wings of the Virgin. These are in general much condensed at the centre and extremely diffuse at the borders. They pass step by step through all the possible grades of density, from the faintest cloud to such as have quite a bright central lustre. It is a remarkable fact that the elliptic nebulæ were generally characterized by Herschel as irresolvable. It is also noteworthy that while, in the globular groups, the borders are entirely formed of brilliant stars, in these, the margin is more diffuse and less bright than the centre.

FIG. 21.



Small Elliptic Nebula—type form.

The irregular nebulæ are not less numerous or celebrated than those already mentioned. The most remarkable among those visible in our hemisphere is that in the hilt of Orion's Sword, involving the multiple star *θ′*. The portion of the heavens which surrounds this star seems to be formed of loosely-heaped locks of cotton.‡

The form of this nebula varies greatly in details according to the power of the telescope with which it is observed; and great refractors, like those of Rosse, Lassell, and Ellery, give to its masses an aspect of sharper definition than smaller instruments; on which account the designs we have of it are in their minor features discordant among themselves. This nebula, in its brighter parts, under strong enlargements and in favorable atmosphere, appears to scintillate and to give signs of resolution into stars. (*Bond, Secchi.*) But analyzed with the spectroscope, it presents, like the planetary, a linear spectrum, and therefore must be regarded as gaseous. This condition of matter does not exclude the possibility of such agglomeration as may produce masses dense enough and bright enough to take on the appearance of small stars. Hence the discovery of Bond ought not to be considered an illusion; and we ourselves can bear witness to having many times verified the fact of such scintillation in this nebula and in the planetary also; *e. g.* Figs. 12, 13, 15, 16.

The extent of this nebulous aggregation is very great, since, besides the central mass, commonly regarded as the nebula, numerous filaments have been traced by us from $-0°\ 50'$ to $-7\frac{1}{2}°$, comprehending the triangular area limited by the stars $\zeta$, 49, and $\upsilon$ in decl., and in A. R. extending from 79° to near 84°; ⁂ that is, through $6\frac{1}{2}°$ in declination and 5° in right ascension. Thus, all this region of the heavens appears to be occupied by a nebulous stratum, and the stars of Orion seen through it exhibit an exceptional tint of green with a faint shade of red—an appearance which may be what is called accidental, or may be owing to the transmission of their light through this mass of decidedly green color. It is an interesting question whether the singular narrowness of the line F in these stars may not perhaps be owing to the superposition upon it of an equal bright line belonging to the nebulous substance. This seems extremely probable.

It is said that around the star *θ′*, which is composed of four beautiful small stars forming the famous Trapezium, and two others exceedingly minute in the neighborhood, the nebulosity does not exist. The exactness of this statement may be doubted. There is certainly a cloudiness there, but, on account of the vivid light of the stars themselves, it is exceedingly faint. The idea that the nebula fails here because of having been condensed into stars has not a sufficiently solid foundation. A brilliant star, by eclipsing the nebula, makes it often disappear, as actually happened to the nebula in Argo when the star $\eta$ was of the 1st magnitude, but now that the star has dwindled to the 9th, the nebula is well marked. It is also said that the nebula in Orion is subject to sudden changes; but as all such opinions have hitherto been founded on observations made with the imperfect instruments of other times, we can regard nothing of this as certain. Inasmuch, on the other hand, as the more recent and more powerful in-

* In order to fix the position of these lines, the following method (given in our memoir) is employed: The position of the micrometer having been fixed in the night, with the micrometer thread on the line (*b*) of the nebula, it is left untouched till morning, when it is found that, on the solar spectrum, (*b*) corresponds to F; the principal line (*a*) falls near a strong dark line near the middle of the interval between B and F; but the line of the nebula is a little to the left, toward F, and does not coincide with this; it is apparently a line of azote. The fine line (*c*) is at about one-fifth of the interval between (*a*) and (*b*) of the nebula.

† See Fig. 4, art. NEBULÆ, for this object.
‡ See Fig. 1, art. NEBULÆ, for this object.
⁂ See *Mem. Osserv. Coll. Rom.*, 1852–53.

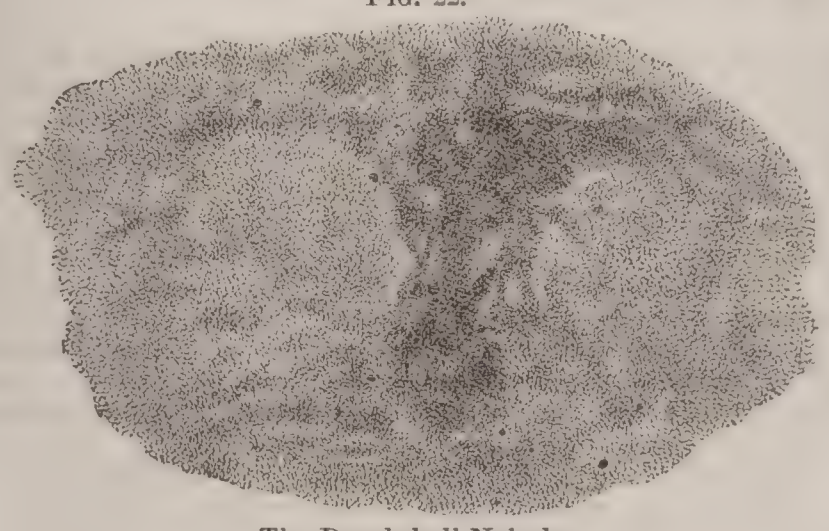
struments render visible divers features which escaped the feebler, there is in this fact a sufficient explanation of all the suspected changes. Even now the designs of Lord Rosse and of Struve very little resemble our own or that of Herschel.

Among the irregular nebulæ visible in middle northern latitude should be ranked the nebula in Sagittarius (3722 C. B. S.) in A. R. 17*h*. 54*m*., Decl. $-24°$ 21′; this also gives the bright lines of the nebular spectrum. The same is true of many other nebulæ drawn by Herschel during his observations at the Cape; as, for instance, that in A. R. 18*h*. 11*m*., Decl. $-16°$ 15′. Finally, many regions of the Milky Way, in Sagittarius, give all the lines of the brighter nebulæ in the same quarter.

Another nebula of not less importance is that which surrounds $\eta$ Argûs in the southern hemisphere, in A. R. 10*h*. 39*m*., Decl. $-56°$ 47′. It is very singular, having a large vacant space in form of a lemniscate, of which it is very difficult to form a theory. A change has been suspected in this nebula also, but the varying appearances supposed to have been hitherto observed, may probably have been due to the varieties of instruments employed, and, as just remarked, to the variations of the stars immersed in the nebula.

There are several other irregular nebulæ in the heavens which were designed by Herschel. One of the most important is that of Vulpecula (Fig. 22), called by the Eng-

Fig. 22.



The Dumb-bell Nebula.
A. R. = 10*h*. 52*m*.; D. = $+2°$ 17′.

lish the Dumb-bell Nebula, and another is that of Canes Venatici (Fig. 23). In this last is manifested a spiral

Fig. 23.



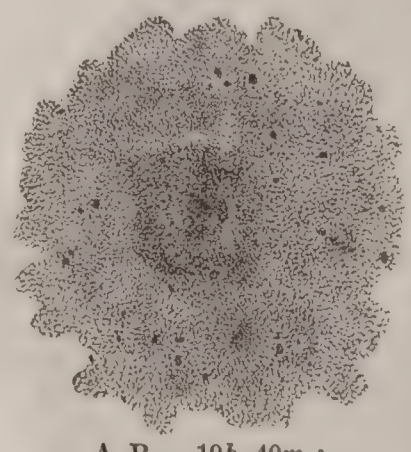
The Spiral Nebula 51 M Canum Venaticorum (*Earl of Rosse*).

structure; and a similar configuration has been found, under the scrutiny of the powerful instruments of Lord Rosse, to be repeated in other nebulæ also.

This structure calls to mind the power of the central force which may tend to unite in one single stellar centre the diffused masses of gas, and may suggest ideas of cosmology analogous to those thrown out by Kant, Herschel, and Laplace, who suppose the stars to have been formed by the condensation of nebular matter. The nebula just mentioned does not show in our instruments the spectral lines of the gases. If this is not the fault of the instruments (a point which deserves verification), it would prove that the mass is at quite a low temperature.

The idea of a progressive condensation receives support from the nebulous stars. This is the name given to the stars which are clothed with a nebulous atmosphere. Such is the object in A. R. 19*h*. 40*m*., Decl. $+50°$ 6′ (Fig. 24), which gives, in addition to a spectrum consisting of a zone sensibly continuous, the bright lines proper to the nebular spectrum; the star is still surrounded by a part of the vapor of which it was formed. Another of the kind is in A. R. 7*h*. 19*m*., Decl. $+21°$ 15′ (Fig. 25), and another still in A. R. 10*h*. 0*m*., Decl. $-39°$ 36′ (Fig. 26). There are also double and triple nebulæ, as in Figs. 27 and 28, but it is extremely difficult to make exact measures of them.

Fig. 24.



A. R. = 19*h*. 40*m*.;
D. = $+50°$ 6′.

Fig. 25.



A. R. = 7*h*. 19*m*.;
D. = $+21°$ 15′.

Fig. 26.



A. R. = 10*h*. 0*m*.;
D. = $-39°$ 36′.

Fig. 27.



A. R. = 7*h*. 35*m*.;
D. = $-17°$ 49′.

Fig. 28.



A. R. = 7*h*. 15*m*.;
D. = $-29°$ 49′.

One of the matters of greatest importance connected with this subject is the study of the distribution of the nebulæ. Herschel II., in his observations at the Cape, gave a statistical statement of the number of these objects in different parts of the heavens. From the study made by him of this distribution, he found that, in the northern hemisphere the richest region is in the Virgin, in Coma Berenices, and in Pisces. This region has its largest density near the pole of the Galaxy—so much so that, putting this zone at the horizon of the celestial globe, the swarm of nebulæ spreads out like a pavilion, having its summit in the pole and its base in the galactic circle. In the southern hemisphere, the distribution is less graphically marked, but it also continues there, and the zone of greatest abundance approaches the northern nebular region of the Fishes. In this distribution there is no trace of a decided band as in the Milky Way, but we recognize only centres of superior density. The chart below (Fig. 29), reduced from the work of Proctor, presents it to the eye.

It is singular that, while the elliptic nebulæ are disposed by preference around the pole of the Milky Way, the irregular nebulæ, on the other hand, are found on the border of that zone or very near it. We may also say that many regions of the Milky Way itself are positively nebulous. From this it is obvious that the elliptic nebulæ form a class independent of the Milky Way.

We cannot, nevertheless, place in this category the Magellanic Clouds, in which immensely vast masses are resolved into stars and into extremely minute nebulæ, forming a gigantic and marvellous group entirely isolated, and having an extent which defies our utmost conception.

It is a thing worthy of observation that, in the elliptic nebulæ, the eccentricity of the strata goes on diminishing, till nuclei are at length reached very nearly spherical. This fact is certainly connected with an important principle of theoretic mechanics wholly different from that which rules in globular systems, and makes, moreover, a contrast with the annular systems, still more striking.

It was for a long time said that the Via Lactea is only one of the nebulæ, but the gaseous nature of these and the stellar structure of the former will no longer admit so sweeping or rigorous a parallel. Still, as in many of the bright regions of this zone, analyzed by the spectroscope, we have found traces of bright lines, there are possibly here vast masses of uncondensed nebulous matter yet existing. But for studies of this difficulty an instrument such as ours is perhaps too feeble. Let us hope that these researches will be continued, as they deserve to be, with sufficient means, by others; this being the criterion so much desired by Sir John Herschel for distinguishing with certainty the gaseous nebulæ from those possibly stellar or composed of condensed matter, such as are our clouds in relation to watery vapor. The globular clusters, not exhibiting any trace of bright spectral lines, remain in the

FIG. 29.




Distribution of the Nebulæ.—The Northern and Southern Nebulæ.

category of stars; an exception may perhaps be made of the planetary nebula of the Dolphin, in which are seen a lucid point, and a diffuse brightness which present a rudimental appearance of a monochromatic zone.

It is still a great question, as we have already intimated, whether the nebulæ have varied in aspect. The solution of this doubt is difficult. Between two observers, making sketches of the same object upon the same night, and with the same instrument, there are still very great differences. It is no marvel, therefore, that designs should fail to agree, when time and place and person and instrument all differ. Many variations may be due to variations of neighboring stars. Thus, for example, while $\eta$ Argûs was most brilliant and of the first magnitude, it appeared free from nebulosity. (*J. Herschel, Cape Obs.*, pp. 36–37.) It is now, having dwindled to the 9th magnitude, seen without difficulty to be involved in such a nebulosity. (*Monthly Notices R. A. S.*, 1876.) We have seen that the Trapezium of Orion was supposed to be without a nebulous surrounding, but that the spectroscope has proved this nebula to be even brighter there than elsewhere. The unchangeability of the nebulæ shows upon what a scale in time we must measure the formations of creation, in respect to which, as to duration, geological periods are truly but days.

The distance of none of these masses is yet known, no parallax having been determined of any one of them; and hence it is impossible to assign their magnitude. It is certain that the space filled by some must be immeasurably great, embracing not merely limited localities, but vast regions in the heavens, since those of Orion, of Argo, and of Andromeda occupy several entire degrees of visible extension; but even limiting ourselves to the smallest and best defined, like the planetary nebulæ above mentioned, which, measuring but a few seconds, are better comparable with our usual scale, the magnitude is beyond conception great. A nebula of this description, though only 26″ in diameter, like that of Sagittarius, or 33″, like that in Hydra, if we allow it a parallax of one second in arc, is comparable only to the orbit of Neptune, which is thirty times greater in diameter than the orbit of the earth. But since so large a parallax as this is not probable, since, on the other hand, it is reasonable to presume that the real parallax is a very great deal smaller, we have dimensions in which our imaginations are utterly lost.

The number of the nebulæ is countless. Herschel discussed 3812 in his statistics, and in the great catalogue published by him in 1864 were included 5079. Since this epoch, not a few others have been discovered at Rome, and several hundred at Marseilles, with the great reflector of ninety centimètres diameter of that observatory. Probably the number will increase with the increasing dimensions of instruments, but all the later discoveries are of objects too faint to promise to future speculators matter of important interest.

This immense labor, due chiefly to the Herschel family, has been completed in a little less than a century.* But to the name of Herschel must be added those of Lacaille and Messier among earlier observers, and among the recent, those of Rosse, Lassell, De la Rue, Bond, D'Arrest, Huggins, and perhaps others. And from the list of these famous observers, some of whom were themselves splendid artisans, ought not to be omitted the hardly less famous names of the artisans proper, such as those of Merz, Cook, Secretan, Cauchoix, Clark, Grubb, and others similarly honorable. The work of this century remains a testimony to the activity of the generations of the present, and an incitement to the emulation of those which are to follow; for whom it is reserved to fathom all those difficult problems, which, being functions of the time, no assiduity and no skill on the part of observers, but the lapse of ages only, can suffice to resolve.

Furling now our sails after the course by no means brief which we have run through the celestial spaces, we may here sum up in conclusion the principal results. (The conclusion here referred to will be found under the title UNIVERSE later in this volume.) P. A. SECCHI.

*Translated by F. A. P. Barnard.*

*Messier published a catalogue of 45 nebulæ in 1771; his second and third, published in the *Connaissance des Temps* for 1783 and 1784, contained 103.

**Star'stone,** a variety of sapphire, the *asteria* of Pliny and the ancients, is found in Ceylon, and presents, when cut *en cabochon*, or in a hemispherical form, and viewed in a direction perpendicular to the axis, a peculiar reflection of light in the form of a star.

**Starüi-Büchow,** town of Russia, government of Vilna, on the Dnieper, has six churches, several good educational and benevolent institutions, and extensive manufactures. P. 6901.

**Starüi-Asskol,** town of Russia, government of Koorsk, on the Asskol, has a normal school and a theological seminary. The vicinity is famous for its rich orchards. P. 7029.

**Starvation.** See APPENDIX.

**Stass'furt,** town of the Prussian province of Saxony, on the Bode, is noted for the immense layer of rock-salt in its vicinity, which was discovered in 1837 at a depth of 826 feet, and with a thickness of about 1000 feet. A shaft was finally opened, and steam-engines applied to operate the mine in 1852. The produce amounted in 1856 to 15,480 cwts.; in 1860, to 666,480; in 1864, to 2,071,880; and the mine is now one of the largest in the world. The town had 4785 inhabitants in 1864, and 10,327 in 1871. (See the descriptions by Bischof (Halle, 1864) and by Rheinwart (Dresden, 1871).)

**Staszow,** town of Russian Poland, government of Radom, on the Czarna, has manufactures of paper, iron goods, and copper ware. P. about 5000, of which many are Jews.

**State,** by PRES. T. D. WOOLSEY. See APPENDIX.

**State'burg,** p.-v. and tp., Sumter co., S. C., on Camden branch of Wilmington Columbia and Augusta R. R. P. 2095.

**State Centre,** p.-v. and tp., Marshall co., Ia., on Iowa division of Chicago and North-western R. R., in an agricultural and stock-raising region, has 1 weekly newspaper. P. of v. 559; of tp. 1076.

**State Line,** p.-v., Mound tp., Warren co., Ind., on Toledo Wabash and Western R. R.

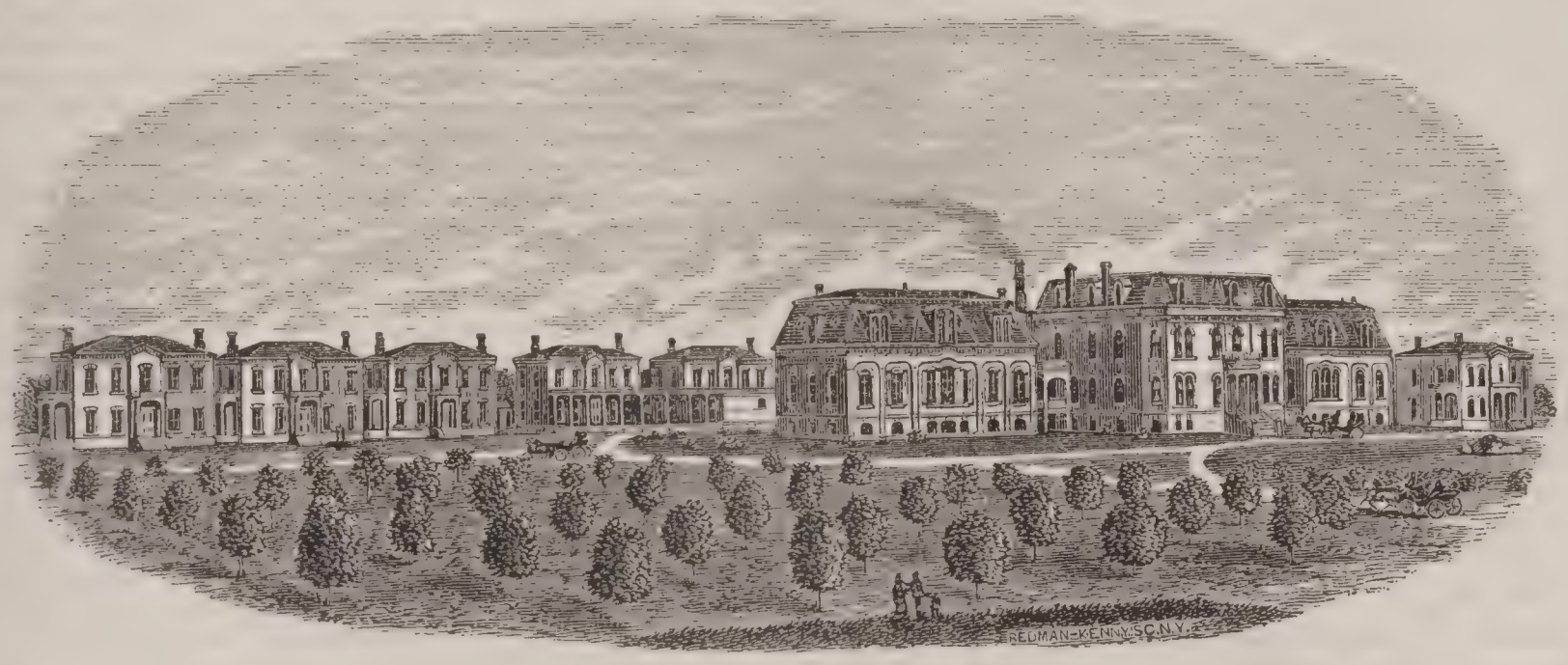
**State Medicine.** See SANITARY SCIENCE, by PORTER C. BLISS, A. M.

**Stat'en Isl'and** [named by the Dutch in honor of the States General], the island which constitutes nearly all of Richmond co., N. Y., is bounded on the E. by New York harbor, New York Bay, and the Narrows, N. by the Kill van Kull, W. by Staten Island Sound, and S. S. E. by Raritan Bay and the Lower Bay of New York. It is 14 miles long, and greatest breadth 8 miles. Area, 58½ sq. m. The island abounds in pleasant scenery, and has many fine residences. It is traversed by Staten Island R. R., and is connected with New York by lines of ferry-boats. (See RICHMOND co., N. Y.)

**Stat'enville,** p.-v., cap. of Echols co., Ga., on Atlantic and Gulf R. R. P. 61.

**State Public School for Dependent Children, of Michigan** was organized by an act (of which the writer was in the senate the author) of the legislature at its session in 1871. It is a part of the common-school system of that State, for which Michigan is so well and favorably known. It is maintained by the State. It is not a penal or reformatory institution, an orphan asylum, or an almshouse; but only for children of sound mind and body, between four and sixteen years of age, that are dependent on the public for support. It is the only one of the kind existing under any government. Others, in some respects similar, receive criminal children from the courts, thus tainting all alike with crime. This has a twofold character, uniting the humanities and economies. First, it is a home and school for the children of the poor, and poverty alone is the price of admission. Second, it is a merciful agency, by which the State becomes the guardian of its dependent children, and restores them to society and a permanent home under parental influences. Heretofore, these children, as they now are in other States, were maintained in the county poorhouses, which places were unfit for innocent children by reason of the necessary association with the adult diseased, idiotic, insane, and immoral inmates of a very low mental, physical, and moral type. There were in these poorhouses no means of classification of inmates or separation in apartments, no educational influences, and hence all the surroundings injuriously affected the impressible child, and it very early learned its first lessons in crime. This course tended to make the child, as the adults around it, also a pauper, and then a criminal, thus propagating, increasing, and perpetuating those classes. The merit of the Michigan system, aside from its humanity, lies largely in its preventive effects. Heretofore, this State had (as other governments yet do) delayed action until these children became criminal, and then erected for them extensive reformatories, workhouses, prisons disguised by the name of industrials, and in them began the always difficult and questionable work of reformation, when early preventive work would have been uniformly successful and far less expensive. All the arguments that have been given to the world as to the education of children might be repeated here, with even more forcible application in reference to these young dependents of society and wards of the State.

This institution is located just outside of the beautiful city of Coldwater, on an eminence overlooking the surrounding country. The buildings are on the cottage plan, the central being used for the superintendent's residence, employés' dormitories, offices, for school-rooms, for cooking,




State Public School, Coldwater, Mich.

dining, sewing, and other industrial purposes. The cottages are for the homes of the children, there being 8 at present, with about 30 inmates each, making the capacity of the school 240. This can be increased to 400 or 500 by adding other cottages only. Over each of these homes presides a lady cottage-manager, whose duties are very similar to those of a mother with a smaller family, except that the cooking, dining, washing, etc., are done as in other large public institutions. The children attend school in the school-rooms in the wings of the main building, where they are taught the common English branches. Those of proper age are taught how to work—the boys on the farm (of 41 acres) and in the garden, to make shoes, caps, and their own clothing, etc.; the girls to make their clothing, do housework, etc. The proficiency of these children in the schools, in their work, and in their general conduct and appearance after they have been there a few months will bear very favorable comparison with that of those who attend our common schools. Their moral culture has proper attention, as required by law, and religious services are held Sunday forenoons and afternoons, conducted by the superintendent, assisted by ladies and gentlemen of the city from different denominations. The children are sent to the institution by superintendents of the poor of the several counties (a board of three members in each), who take the child claimed to be dependent to the judge of probate of the proper county, who hears the testimony, and in case he decides the child to be dependent, it is sent here with a copy of such evidence and decision, which forms the basis of the history of the child, kept on record at the school. The second prominent characteristic is that of providing homes. It is made the special duty of the board to find homes as fast as practicable, giving room in this way for others. The board has authority to appoint an agent to attend to this work. Also, there is an agent in each principal county, appointed by the governor, charged with the duty of finding homes and afterward supervising their condition. All indentures have a clause reserving the right to take back a child when in the opinion of the board it is for the interest of the child to do so. No child can be placed in any home unless the State agent certifies it to be a proper one. The whole career of the child is carefully watched over during its minority, and all of its interests jealously protected by its guardian, the State.

This new charity is in charge of a board of control of three members appointed by the governor and confirmed by the senate for a term of six years each. This board has quite full and discretionary powers. It establishes a system of government, employs all officers, managers, teachers, etc., and fixes their salaries by approval of the governor. The administration of the ordinary affairs is in the hands of the resident superintendent, who is delegated large discretionary authority by the board, and in whom is principally the responsibility of success. Most of the employés reside in the institution.

This school for the children of the poor was opened in May, 1873. It has now about 250 inmates. It has already placed over 100 dependent children in excellent homes under contracts ensuring them "good treatment as a member of the family," and three months each year in the district school, and to be taught the occupation of the guardian. So far the execution of the scheme has been satisfactorily successful in the opinion of the legislature and the people, with whom it appears to be one of our most popular State institutions; and of it our present popular governor, John J. Bagley, says in one of his messages, "This institution will in its results accomplish much, if not more real good than any other yet founded by the State."

C. D. RANDALL.

**State Rights.** See SOVEREIGNTY, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

**States'borough,** p.-v., cap. of Bullock co., Ga. P. 33.

**State's Evidence.** This phrase is not a technical term of the law, but is popularly used to describe the evi-

dence of an accomplice, generally given under an arrangement made with the officer representing the state that the witness so testifying shall not himself be prosecuted for the crime of which he confesses himself to be guilty while he is disclosing the guilt of the party on trial. Hence comes the very common but very inaccurate expression as applied to a person, "to turn state's evidence," or "he turned state's evidence." One who is *particeps criminis* with another in the commission of a crime, either as a principal or as an accessory, is an accomplice, although this designation is usually given to such a confederate when he is permitted to appear and testify on behalf of the state against his associates. It is often necessary, in order that the ends of justice may not be defeated, that one of several criminals, whether indicted jointly with the others, or indicted separately, or perhaps not indicted at all, should be procured or suffered by the prosecution to become a witness for the state, and to testify on the trial of his fellows, although his evidence may show himself to be guilty of the same offence or of some other one. When this is done, there is generally a tacit understanding or an express agreement with the prosecuting officer that the person whose disclosures are thus used on behalf of the public shall not be brought to trial and conviction. When and with whom such an arrangement shall be made rests on the sound discretion of the officer who represents the people, and largely depends upon the exigencies of each particular case. The evidence given under such circumstances is of course very suspicious, and it has even been said that as a matter of law no conviction can be had upon the uncorroborated testimony of an accomplice. The better doctrine, however, is, that this is a rule not of the law, but of practice and of expediency. A jury has the power to convict upon such evidence, and their verdict could not be set aside as illegal. The judge should always instruct the jury that the testimony of an accomplice is to be most carefully scrutinized, and that, unless confirmed in material points by other and reliable evidence, a conviction upon it is inexpedient—that the corroboration should extend not merely to the circumstances of the crime itself, but also to the participation therein by the accused who is on trial. Still, such instructions are rather in the nature of advice than of direction or command, and they may therefore be disregarded. JOHN NORTON POMEROY.

**States General.** See ESTATES, THE THREE.

**States of the Church.** See PAPAL STATES.

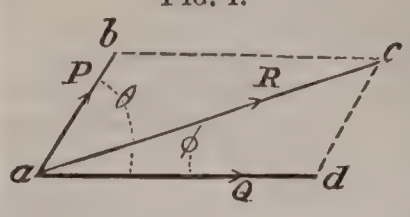
**States'ville,** p.-v. and tp., cap. of Iredell co., N. C., on Western North Carolina R. R., at N. terminus of Atlantic Tennessee and Ohio R. R., has an active trade and 2 weekly newspapers. P. of v. 644; of tp. 1656.

**Statice.** See MARSH ROSEMARY.

**Statics** [Gr. *στατική*] is that branch of mechanics which treats of the properties and relations of forces in equilibrium; and by equilibrium it is meant that the forces are in perfect balance, so that the body upon which they act is in a state of rest. According to the classification presented in most textbooks on the subject, and which, in fact, is now employed by many English writers, the word "statics" is used in opposition to "dynamics," the former being the science of equilibrium or rest, the latter of motion, and both together constituting mechanics. The influence of French literature has, however, produced among recent writers a tendency to a stricter and better use of these words. In this new classification the word "mechanics" is used in a more extended sense, as expressing not only the theory of force and motion, but its applications to the arts; the portion of this which may be regarded as pure science is then divided into kinematics and dynamics, the former being the pure geometrical theory of motion independent of notions of force and matter, and the latter the theory of forces as acting upon and producing either the rest or motion of bodies. The word "dynamics" is thus employed nearly in its etymological sense, as expressing the science which treats of the laws of force or power (corresponding closely to the old use of the word "mechanics"), and it is divided into statics and kinetics, the one being the science which treats of forces considered as producing rest, and the other as producing motion.

In statics, forces are measured by the pressures that they will produce, and for convenience the unit of pressure is a certain effect of the force of gravitation as indicated by a spring balance (not by a steelyard or scales) acted upon at London or some other assigned place by a definite quantity of matter. Thus, the unit may be the pressure called an ounce, a pound, or a kilogram, as may be agreed upon beforehand. In the discussions of statics it is convenient to represent forces by lines, the lengths of the lines being proportional to the intensities of the forces, their directions parallel to the directions of the forces, and their ends denoting the points of application of the forces. By such a representation we form a geometrical figure, and by reasoning upon the properties of its lines we arrive at the properties and relations of the forces themselves. The resultant of two or more forces is a single force, which produces the same effect as the several forces acting together.

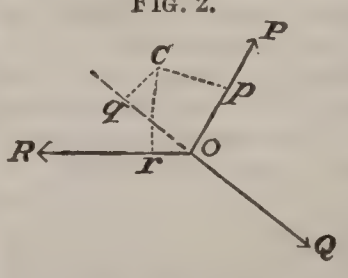
FIG. 1.




The components of a single force are forces whose united action produces the same effect as the single one. The process of combining forces into a resultant is called composition, and that of separating a single force into components is called resolution. These processes are effected by means of the principle of the parallelogram of forces, which is thus stated: If two forces P and Q acting upon the material point $a$ are represented in intensity and direction by the lines $a\ b$ and $a\ d$, their resultant R will be represented in intensity and direction by the diagonal $a\ c$ of the parallelogram $a\ b\ c\ d$ constructed upon the two given sides. Since the relations between the forces P, Q, and R are the same as between the corresponding lines in the parallelogram, we have the equations $R^2 = P^2 + Q^2 + 2PQ\cos\theta$ and $\cos\phi = \frac{R^2 + Q^2 - P^2}{2\,P\,Q}$; the first of which determines the intensity of R when P, Q, and the angle $\theta$ included between them are given, and the second of which determines the direction of R, or the angle $\phi$ which it makes with the given force Q. These two equations contain five quantities, and hence if three of them are given, the other two may be found. The two forces P and Q acting at a given angle $\theta$ may thus be compounded into their resultant, and the single force R may be resolved into any two components whose directions are given. If the resultant R act as represented in the figure from $a$ toward $c$, it will replace the two forces P and Q; if it be taken as acting from $c$ toward $a$, it will hold them in equilibrium.

Another fundamental law of the greatest importance, and upon which, indeed, the whole science may be based, is the principle of moments. By the moment of a force with reference to a point is meant the product of the intensity of the force by the perpendicular distance from the point to the direction of the force; which distance is usually called the lever-arm of the force. The moment of a force, or the product of the force and its lever-arm, is thus a measure of the tendency of the force to cause rotation around the given point or centre of moments. Now, the principle of moments is, that if any number of forces are in equilibrium, the algebraic sum of the moments of all the forces with reference to *any* point must be equal to zero. Thus, if three forces P, Q, and R acting at the point O be in equilibrium or balance, and if from any point $c$ the perpendiculars $p$, $q$, and $r$ be drawn to the lines of direction of P, Q, and R, we must have $P_p + Q_q + R_r = 0$, which is merely the expression of the condition implied in the word equilibrium—viz. that the three forces have no tendency to cause rotation about the point $c$. It must here be understood that a moment may be positive or negative according as its force tends to turn the system in a right- or left-handed direction around the chosen centre.

FIG. 2.




Bearing in mind the meaning of the word "resultant," it follows that the moment of a resultant is equal to the sum of the moments of its components. The principle of moments furnishes, then, also a means for the composition and resolution of forces and the discussion of statical problems.

The conditions of equilibrium of any number of forces acting upon a body are now evident. If the body is at rest, and the forces in perfect balance, there will be no tendency to a motion of translation or to one of rotation. The condition necessary for the first is that the resultant of all the forces shall be zero, and for the second that the algebraic sum of the moments of all the forces about any point shall be zero. These, together, are the necessary and sufficient conditions of equilibrium; the first alone is not sufficient, for a couple may result; and the second alone is not sufficient, for the centre of moments may be chosen on the line of direction of the resultant.

The whole science of statics is but little more than the development and exemplification of the consequences of the above principles. The common textbooks on the subject, after having established and illustrated these fundamental principles, proceed to the consideration of parallel forces and to the determination of centres of gravity and moments of inertia of bodies, after which the equilibrium of forces acting through the cord, lever, pulley, inclined plane, and screw, of which all machines are compounded, is discussed, both in its simplest theoretic conception and as

modified by the forces of friction and cohesion. The laws of the equilibrium of gases (aërostatics) and of liquids (hydrostatics), with their applications to the barometer, pump, and hydrostatic press, are then developed and illustrated. The treatment of these questions in the elementary textbooks exhibits, however, only the first principles, and forms merely the introduction to the science, whose complete development in its several departments must be sought for in special and technical treatises. Among these, where experiment lends its aid to theory by determining the necessary constants for the full discussion and application of the laws of friction, elasticity, and tension, we may mention the theory of the equilibrium of arches and bridges, the theory of the flexure of elastic bodies, the theory of the strength of materials subject to forces of tension, compression, shearing, or torsion, the theory of the tension of fluids and the statics of molecules, each of which may indeed be considered as a science in itself. Within the limits of such an article as this a specific account of even one of the least extended departments of statics would be in fact impossible.

The forces which come under consideration in statical investigations are all the forces of nature which can be measured by pressures. As to their origin, they may be forces of gravitation, of molecular attraction and repulsion, of friction, or of muscular strength. If the equilibrium of a system of forces is disturbed, motion ensues, and statics passes into kinetics. The very disturbance of equilibrium calls, however, into action the resistance of inertia. And we take occasion here to remark that by the consideration of this resistance as a force the laws of statics become applicable, even though the body be not at rest. For by the principle of D'Alembert (which is nothing more than a particular case of Newton's third law of motion) the resistance of the inertia of a body at any instant of its motion is equal and opposite to the resultant of all the exterior forces acting upon it. Hence, regarding inertia as a force, all the forces acting upon a moving body at any instant are in equilibrium, and the principles of statics suffice for their discussion. It thus appears that statics is but a special case of kinetics, and that the law of D'Alembert furnishes the means of passing from one to the other.

With reference to the mode of reasoning and the character of the processes involved, we may distinguish analytical statics and synthetical statics, belonging to the latter of which is graphical statics, a young and growing science of particular value to the civil engineering profession.

*Analytical Statics* is the method of treating the subject by analytical or deductive reasoning, in which the mind seeks to refer complicated phenomena to their fundamental laws, and then from those general laws and conditions to deduce special properties and results. This kind of reasoning is usually best pursued by the use of algebraic symbols and processes, although it must be distinctly borne in mind that these do not form an indispensable part of the method itself. The following example, taken from the theory of flexure, will serve to illustrate the analytical mode of reasoning: Let a straight plank or beam of uniform thickness throughout be laid upon three supports in the same horizontal plane, one of them being at its centre and the others at its ends. What portion of its weight is borne by each support? The weight borne by each support must, from the fundamental conditions of equilibrium, be opposed by the equal and opposite reactions of the supports; and of these the two end ones are equal, and the centre one equal to the difference between their sum and the total load. The solution of the problem begins by the consideration of the consequences of the fundamental conditions of statical equilibrium. Regarding one of the end supports, those conditions affirm that the upward reaction is equal and opposite to the molecular shearing force in a section directly over that support. And, generally, at any section the algebraic sum of the vertical forces must vanish. Hence, taking the end support as an origin, we have for any section, distant $x$ from it, $dS = w dx$, S being the shearing force at the section, and $w$ the weight of the beam per linear unit. To apply this to our problem, we seek the value of S, which we determine in terms of the moment M at the same section, or $S dx = dM$. Again, we have to find M; and this we do by considering the curve of deflection formed by the bent beam, which depends upon its form or moment of inertia I, and the properties of its material as expressed by the coefficient of elasticity E. Upon the hypothesis that the deflection is slight, the curvature at any point whose co-ordinates are $x$ and $y$ is $\frac{d^2y}{dx^2}$, and we find $EI\frac{d^2y}{dx^2} = M$. Substituting this in the previous expressions, there result the following equations:

$$EI\frac{d^4y}{dx^4} = w = \text{uniform load per linear unit};$$

$$EI\frac{d^3y}{dx^3} = S = \text{shearing force at section } x.$$

We have not given the details of the reasoning leading to these results, as we wish not to give an exposition of the theory of flexure, but to exhibit the general character of analytical processes. Starting from the fundamental conditions of equilibrium, we found first $dS = w dx$ for the particular case of beams uniformly loaded, but as this included an unknown element S, we had to determine it also; and this led to the differential equation expressing the dependence of the moment upon the curvature of the beam, its form, and its material. We have thus arrived at the general laws given above, which are applicable to all beams uniformly loaded, whatever be the number of supports. Integrating the first expression four times successively, we obtain

$$EIy = \frac{wx^4}{24} + \frac{Cx^3}{6} + \frac{C'x^2}{2} + C''x + C''',$$

in which C, C′, C″, and C‴ are the constants of integration which determine the curve of deflection for any particular case. For the beam under consideration these are found by the conditions that for $x = 0$, $\frac{d^2y}{dx^2} = 0$; and that for $x = l$ ($l$ being the distance between the supports) $\frac{dy}{dx} = 0$, which gives $C = -\frac{3}{8}wl$ $C' = 0$, $C'' = \frac{wl^3}{48}$, and $C''' = 0$. Accordingly, for the shearing force at any section $x$—

$$S = EI\frac{d^3y}{dx^3} = wx + C = wx - \tfrac{3}{8}wl;$$

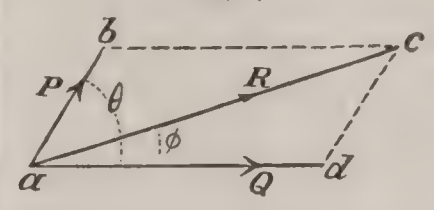
and when $x = 0$, this becomes $S = -\frac{3}{8}wl$, which is equal and opposite to the reaction at the end support. Hence, the three reactions are $\frac{3}{8}wl$, $\frac{10}{8}wl$, and $\frac{3}{8}wl$, whose sum is $2wl$, the total weight of the beam. Thus, having referred our special problem back to the general laws of flexure, we have by a discussion of those laws arrived at its solution. It is well, however, to remark that by this method of discussion we have deduced not only a general law of shearing force applicable to all beams of the class considered, but have incidentally determined a variety of other laws concerning such beams, such as the equation of the curve of deflection, its inclination to the line joining the two supports, its curvature, and the moment of flexure at any point.

Even with questions involving merely numerical data the analytical mode of reasoning is usually followed in a general form. The particular question in hand is solved; and not only this, but the fundamental laws governing all problems of the same class are discovered. It is in the generality of its conclusions, rather than in the generality of its methods, that the power of analysis lies.

*Graphical Statics.*—The synthetical mode of reasoning is that in which the mind starts from the simplest of admitted truths, and from these ascends by comparison and composition to complex relations and properties. Graphical statics, which uses mainly this kind of reasoning for the establishment of its processes, is a method of solving statical problems by means of simple geometric constructions. The forces are represented by lines drawn to scale, and by operating upon them the draftsman deduces other lines which furnish the solution of the particular problem before him.

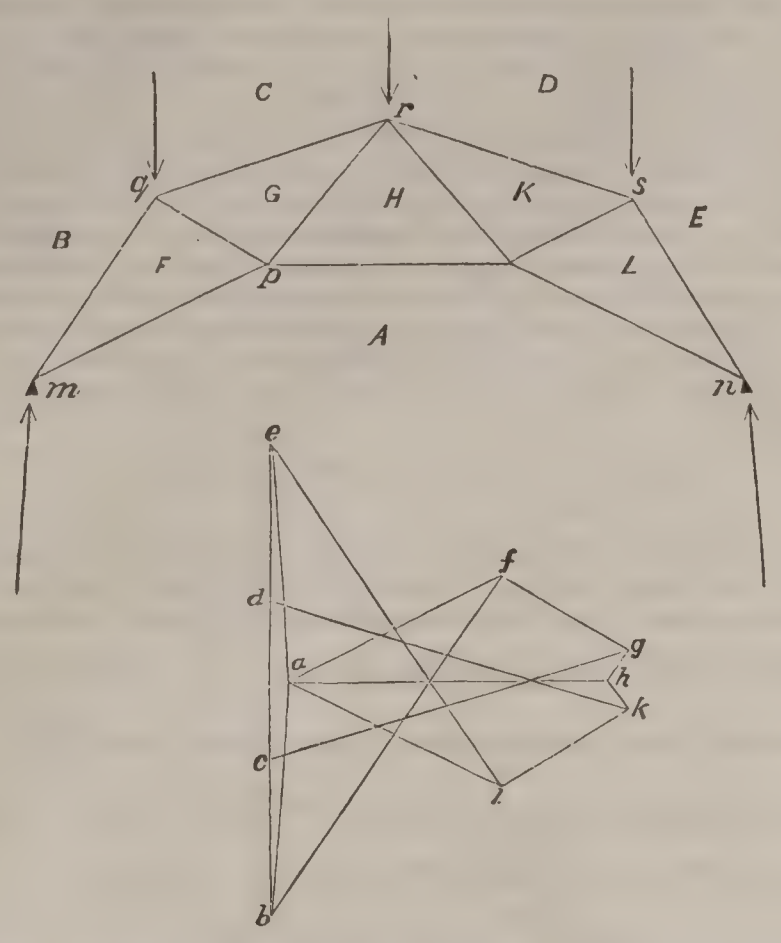
The principle of the parallelogram of forces forms the starting-point of the science. The resultant R of the forces P and Q being represented in direction and intensity by the diagonal $a\,c$ of the parallelogram $a\,b\,c\,d$, it is evident that the directions and intensities of the three forces are shown by the sides of the triangle $a\,b\,c$, $a\,b$ being equal and parallel to P, $b\,c$ to Q, and $a\,c$ to R; and if we follow around that triangle in the direction from $a$ to $b$, $b$ to $c$, and $c$ to $a$, the direction of each force thus obtained is that necessary for equilibrium. Hence arises the principle of the triangle of forces, which is readily extended to include any number under the name of the polygon of forces, and which may be thus stated: If any number of forces are in equilibrium, a closed polygon may be formed whose sides are parallel and equal to the several forces; and if, starting with any force, we follow around this polygon, the direction thus obtained for each of the others will be the direction required for equilibrium. By this principle we may readily perform the graphical resolution and composition of forces, and

FIG. 3.



solve a great variety of practical statical problems. For example, in the annexed sketch there is given a framed roof-truss, held at rest by five external forces—viz. three

FIG. 4.




equal weights acting downward at the points *q*, *r*, and *s*, and two equal reactions acting upward at the supports *m* and *n*. These forces, being in equilibrium, can only preserve that equilibrium by means of other forces or strains transmitted along the various pieces of the truss. It is required to determine these strains. The weight acting at *q* we designate by B C, that at *r* by C D, the reaction at *m* by A B, and so on, each force receiving a name corresponding to the two letters placed on opposite sides of it; in the same way, the pieces of the truss are named, B F being that joining the points *m* and *q*, F G that from *q* to *p*, and so on. We first proceed to form the force polygon for the weights and reactions by drawing *b a* equal and parallel to B A, *a e* to A E, *e d* to E D, *d c* to D C, and *c b* to C B, thus obtaining the closed figure *a e d c b a* to represent the equilibrium of the given exterior forces. The process for finding the strains is then as follows: Beginning at the point *m*, we have three forces in equilibrium, the reaction *a b* and the unknown strains in A F and B F, whose directions, however, are given; and these, being in equilibrium, will be represented by the sides of a triangle formed by drawing *a f* parallel to A F and *b f* parallel to B F, which with *a b* constitute the force triangle *a b f*. Measuring, then, *a f* and *b f* by the same scale with which *a b* was laid off, we have the intensities of the two forces in A F and B F; and following around the triangle in the direction indicated by the given reaction, we find the first to be tension and the second compression. Passing next to the point *q*, we have there acting four forces, of which B F and B C are known and represented in the strain diagram by *b f* and *b c;* hence, drawing from *c* and *f* lines parallel to C G and F G, we form the force polygon *c b f g c* for the forces meeting at *q*, and thus determine the strains *c g* and *f g*. Again passing to *q*, we find two known forces *a f* and *f g*, and by drawing parallels to A H and G H, we determine the polygon *a f g h a*, in which *a h* and *g h* are the two unknown forces or strains. Then passing to *r*, we construct in like manner the force polygon *d c g h k d* for that point, and thus continuing produce a diagram in which every line is parallel to its corresponding one in the truss. The two figures are, as will be noticed, reciprocal ones, the strains represented by the lines meeting at any point, as *k*, being those which exist in the pieces surrounding the space K. The relations of the various forces are thus clearly shown to the eye, the strains are readily found by measurement, their character determined by following around the polygons as noticed above, while the symmetry of the figure furnishes checks upon the accuracy of the work.

The system of diagramming thus briefly indicated for a roof-truss is entirely general, and may be applied to all framed structures acted upon by known exterior forces. It furnishes a system or routine by which the designer may readily, with drawing-board and tools, determine the strains arising in any particular case. Another principle of great importance is that of the equilibrium polygon, which is the polygon or curve that a cord will assume when solicited by forces acting at various angles, a particular case of which is the catenary curve of a suspension cable. The properties of this polygon furnish numerous elegant graphical methods for the determination of centres of gravity and moments of inertia of bodies, as also the discussion of the stability of arches, beams, and bridges. For these it furnishes general methods applicable alike to all problems of the same class, however great be the variation in size or shape of the bodies or in magnitude and direction of the forces.

By analytical methods we not only deduce general laws and relations concerning the objects of our investigation, but also arrive at general solutions—solutions which formulate laws concerning all problems of the same class. Graphical methods, on the other hand, furnish no general laws or solutions, but for the investigation of a certain class of problems afford general processes or systems. Thus, the above question concerning the reactions of the continuous beam whose length is $2l$, and load per linear unit $w$, cannot be graphically investigated unless there be assigned to $l$ and $w$ numerical values. These being given, they may be laid off to scale upon paper, and the numerical values of the reactions be found by established graphical routines; but these routines do not deduce a single one of the general laws or relations which the analytical process has developed. While the processes of analysis are special, the results derived are general; while the graphical method furnishes general processes, they can only be applied for the deduction of special numerical results. The two methods have, then, but little in common; and the fact that a particular problem, or even that a particular class of problems, may be more easily treated and solved by one than by the other, justifies no attempt to weigh their relative merits. Each is indeed a supplement to the other, and he who is acquainted with both will use the one or the other, or a combination of the two, as the requirements of the special problem in hand, as to generality, accuracy, or quickness, may demand.

The history of the science of statics would in itself require a volume, while our space allows only a brief and imperfect sketch. The first general principle which we find recorded is that of the equilibrium of weights on a lever, which is a special case of the principle of moments. This was discovered by Archimedes (B. C. 287–212), as also its application to the determination of the centres of gravity of plane figures; in his writings also appear the first investigations concerning the equilibrium of bodies floating or immersed in liquids. For 1800 years after his time there was no further advance. The next step was made by Stevinus (1548–1603), who represented the intensity and direction of forces by straight lines, deduced the principle of the resolution of forces in rectangular directions, and investigated the equilibrium of a body resting upon an inclined plane. Next followed the principle of the parallelogram of forces, which, partially implied by the methods of Stevinus, was only completely established by the labors of Galileo (1564–1642), Varignon (1654–1722), and Newton (1642–1727). To Varignon is also due the development of the simpler properties of the force and equilibrium polygons. About the same time the statics of fluids began to receive attention, the first true explanation of their equilibrium being due to Torricelli (1608–47), the inventor of the barometer. The application of these principles has since those days occupied the attention of a host of writers, and in the present century the science has grown to such a vast extent that a mere enumeration of the titles of meritorious works would in itself occupy many pages. The new branch of graphical statics may be said to have been entirely developed since the year 1866, and is due mostly to the labors of Culmann. (For detailed information concerning the early history of the subject the reader may consult the section on mechanics in Whewell's *History of the Inductive Sciences* (London, 1847, and New York, 1859).)

MANSFIELD MERRIMAN.

**Stations of the Cross,** a series of figures or pictures, usually fifteen in number, representing the various stages of the *Via Calvaria,* or of our Lord's Passion on the way to Calvary. They abound in Italy and other Roman Catholic countries, and are arranged along the line of approach to a calvary or central shrine. They are visited in succession for the performance of devotional exercises. This devotion was at first a substitute for the pilgrimage to the Holy Sepulchre.

**Statistical Congress, International,** a conference of eminent statists representing the statistical departments of most of the European governments, the U. S., Egypt, and various statistical and learned associations, was held at Brussels in 1853. The main purpose of this conference was to effect a uniformity and harmony in the statistical work of nations, so that the results obtained by separate and independent workers in this field might

be easily comparable, and thus made to serve a wider sphere of usefulness. In addition to this, the benefits to be derived from the personal intercourse and exchange of views among the most eminent statists of all countries was not overlooked. The importance of the object to be attained was too apparent not to have been suggested to many minds, but the practical initiation of the movement and its successful accomplishment are undoubtedly due to a few leading statists. The U. S. may justly claim a share of the credit attached to this important work. In May, 1851, Mr. J. C. G. Kennedy, then superintendent of the census, received from the interior department, at his own suggestion, approved by the President and cabinet, a commission to visit the principal governments of Europe for the purpose of recommending to the constituted authorities in charge of statistical work the propriety of adopting, in common with each other and with the U. S., such a system of inquiry and publication as would enable each government to institute comparisons with the others readily and accurately. During the summer of 1851, Mr. Kennedy presented his views to the statistical departments of England, France, Belgium, and Prussia, and sought their co-operation in the work. At the London International Exhibition of that year the need of such harmonizing effort was forcibly illustrated. Some of the leading statists there present, including Quetelet and Visschers of Belgium, Farr, Porter, and Fletcher of England, and Kennedy of the U. S., strongly impressed with the possibility of international co-operation, held numerous conferences in London and Brussels upon the subject. In Sept., 1851, Mr. Adolph Quetelet announced by letter to Mr. Kennedy that they had decided positively on holding a statistical congress after a consideration of his (Kennedy's) ideas and the concurring opinions of the principal statists of different countries. It was to have been held at Brussels in the autumn of 1852, but was postponed to 1853. The intention was to hold these congresses at intervals of two years. They have been held less frequently, principally on account of political disturbances in Europe. To M. Quetelet is due preeminently the credit of executing the project and successfully organizing these congresses. Being a man of liberal views, a scientist as well as statist, occupying the official position of director of the royal observatory and president of the central statistical commission for Belgium, he was enabled to obtain the support and co-operation of the Belgian government, which assumed the initiative and invited other nations to send delegates to the congress. Eight congresses have been held, respectively in Brussels, Paris, Vienna, London, Berlin, Florence, the Hague, and St. Petersburg; the ninth to meet in 1876 at Buda-Pesth, Hungary. Much has been done to systematize and harmonize the statistical work of different nations, and valuable contributions have been made to the general fund of administrative and scientific statistics. The proceedings of each congress, including the discussions of the delegates, the results arrived at, and the papers read, have been published by the respective governments where these congresses have been held. The principal publications are comprised in large quarto volumes of the proceedings, containing from 260 to 800 pages each. Those of the St. Petersburg congress fill three immense volumes. They are usually published in two languages. Besides the regular volumes of proceedings, a volume has been published entitled *International Statistics* (*Population*), 4to, 406 pp. (Brussels, 1865); also a volume containing the principal transactions of the first four congresses, 4to, 273 pp. (Berlin, 1863, French), and a similar volume of the first five congresses, 4to, 325 pp. (Florence, 1866, French). The U. S. have been represented in each of these congresses except the third and sixth, and official delegates have been accredited by the government to the fourth, fifth, seventh, and eighth. Judge Longstreet represented the government at the fourth congress, and Mr. Samuel B. Ruggles at the fifth and seventh. Mr. Ruggles's report for the seventh is published in *Ex. Doc. No. 7, Senate, 1871.* In the eighth congress the government was represented by Dr. Edward Young of the treasury department, William Barnes, and Edwin M. Snow, M. D. Their report was published at the government printing-office (1875). Besides the contributions from the official delegates, valuable papers have been furnished by Americans representing scientific and statistical associations, notably those of Mr. E. B. Elliot on "Military Statistics," contained in the Berlin proceedings, of Dr. Jarvis on "Vital Statistics," contained in the London proceedings, and of Mr. Kennedy on the "U. S. Census," in the Paris proceedings.

*1st Congress.—Compte-rendu des Travaux du Congrès général de Statistique, réuni à Bruxelles 1853* (4to, Bruxelles, 1853, 260 pp.). *2d Congress.—Compte-rendu de la Deuxième Session du Congrès international de Statistique réuni à Paris 1855* (4to, Paris, 1856, 542 pp.). *3d Congress.—Rechenschafts-bericht über die dritte Versammlung des Internationalen Congresses für Statistique abgehalten zu Wien 1857* (4to, Wien, 1858, 576 pp.); also, an edition published in French (4to, Vienne, 1858, 556 pp.). *4th Congress.—Report of the Proceedings of the Fourth Session of the International Statistical Congress held in London 1860* (in English, with French syllabus, 4to, London, 1861, 548 pp.). *5th Congress.—Rechenschafts-bericht über die fünfte Sitzungsperiod des Internationalen Congresses für Statistik abgehalten zu Berlin 1863*, and *Statistischen Congresses in Berlin* (2 vols. 4to, Berlin, 1865, 250 and 800 pp.). *6th Congress.—Programme* (Florence, 1867, 121 pp.); *Compte-rendu des Travaux de la VI^e Session du Congrès international de Statistique réuni à Florence 1867* (4to, Florence, 1868, 650 pp.). *7th Congress.—Projet du Programme* (small 4to, 18 pp.). *8th Congress.—Compte-rendu des Travaux de la VIII^e Session du Congrès international de Statistique réuni à St. Petersbourg 1872* (3 vols., St. Petersburg, 1874, 600, 470, and 603 pp.).—*Compte-rendu général des Travaux du Congrès international de Statistique dans les Séances tenues à Bruxelles 1853, Paris 1855, Vienne 1857, et Londres 1860* (4to, Berlin, 1863, 273 pp.); *Compte-rendu général des Travaux du Congrès international de Statistique dans les Séances tenues à Bruxelles 1853, Paris 1855, Vienne 1857, Londres 1860, et Berlin 1863* (4to, Florence, 1866, 325 pp.); *Statistique internationale* (*Population*), (4to, Brussels, 1865, 406 pp.).

ALBERT W. PAINE.

**Statis'tics,** a branch of political science having for its object the collection and classification of facts illustrative of the social, moral, and industrial condition of a people. As a basis for the operations of government, attempts more or less rude to obtain such information have been made in every civilized country from time immemorial, the censuses of the Egyptians, Jews, Greeks, and Romans having been rudimentary efforts in this direction. It is, however, only in comparatively modern times that the great importance of the subject has been appreciated, it having first been recognized as a science by Gottfried Achenwall (1719–72), professor of philosophy at Göttingen, who lectured upon the subject and proposed the name. The fundamental principle enunciated by him was that the laws which govern nature, and especially those affecting the moral and physical condition of mankind, are constant, and may be discovered by the collection and comparison of large masses of data, the accidental diversities neutralizing each other. This principle was still more fully grasped and developed by Von Schlözer at the close of the eighteenth century. The rise of political economy supplied a motive for increased interest in statistics, and from the close of the wars of the French revolution all the leading countries of Europe began to organize statistical bureaus, departments, or commissions. It was from the first correctly recognized that it is the province of government to supply the data for the new science, they being for the most part of such a character as to be inaccessible to private research. The province of the statistician, therefore, consists in deducing from known data their more important results. In England the vigorous growth of the science may be reckoned from the passage of the Reform bill, which was immediately followed by the creation of the statistical department of the board of trade (1832), the formation of a statistical section in the British Association (1833), and of the London Statistical Society (1834). The little kingdom of Belgium, formed in 1830, was fortunate in numbering among its citizens the most distinguished statistician of the century, Lambert Quetelet (1796–1874), who from this time devoted himself almost exclusively to this subject, and the Belgian statistical department, organized in 1841, has ever since been the model for similar offices in other countries. Parliamentary reports embodying vast masses of statistics are now annually published in England, and monthly reports are issued in the U. S. by the bureau of statistics of the treasury department. Societies devoted either wholly or in part to statistics now exist in all the chief European capitals, in New York, Mexico, and Rio de Janeiro; international congresses of statisticians have been held biennially or triennially since the first congress, formed at Brussels in 1853; several periodicals are devoted exclusively to this subject; a statistical seminary was established in Berlin in 1862, and a professorship of statistics founded in the University of Berlin 1874. The most important branch of the subject, VITAL STATISTICS, will be treated in a separate article. The remarkable results deduced from statistics by some non-professional writers, such as the late H. T. Buckle, are well known, but must be received with considerable qualification as to the correctness of the data, which is the weak point in all inquiries in this science. (See STATISTICAL CONGRESS.)

**Statius** (CÆCILIUS). See CÆCILIUS STATIUS.

**Sta'tius** (PUBLIUS PAPINIUS), b. about 61 A. D., seems to have acquired early and rapidly a great fame by his

victories in the Alban contests, and then to have lost it again as rapidly after his defeat in the quinquennial contest; but very little is known of his personal life. He lived at one time in Rome and enjoyed the favor of Domitian, but d. about 96 A. D., in retirement at Naples. Juvenal is the only contemporary author who mentions him. For the story that Domitian stabbed him in a fit of anger there is no foundation. Of his works are still extant *Silvarum Libri V.*, a collection of miscellaneous poems; *Thebaidos Libri XII.*, translated into English, the first book by Pope, the first five books by Thomas Stephens (1648), the whole poem by W. L. Lewis (1767); *Achilleidos Libri II.*, unfinished, translated into English by Howard (1660); best editions by Amar and Lemaire (Paris, 4 vols.) and by O. Müller (1870).

**Statuary.** See SCULPTURE, by CLARENCE COOK. See also ROMAN ARCHÆOLOGY.

**Sta'tus** [Lat.], a term of the Roman law, borrowed thence by the jurisprudence of continental Europe, denoting the legal condition of a person, or the sum of his capacities and incapacities to hold legal rights or to be subjected to legal duties. The word does not belong to the technical nomenclature of the American and English law, although it is used by some modern text-writers in the same general sense in which it was employed by the Roman jurists. In the Roman law there were three grades of status or legal condition, the lower and more general of which might exist without the others, while the higher and more special always presupposed the lesser. The first and most general was that of liberty (*status libertatis*), by virtue of which a person was either a freeman (*liberus*) or a slave (*servus*). The second was that of citizenship (*status civitatis*), by virtue of which a person was either a citizen (*civis*) or a stranger (*peregrinus*). The highest was that of the family (*status familiæ*), by virtue of which a person might be the head of a household (*paterfamilias*) and his own master (*sui juris*), or under the control of another (*alieni juris*), as a son, daughter, wife, ward, and the like. An individual might be a freeman without being a citizen or the head of a household, but he could not be the head of a household without being at the same time a freeman and a citizen. It was possible that a person might lose a higher status, and yet remain in a lower condition; he might cease to be *sui juris*, and still be a citizen; he might forfeit his citizenship, and yet remain free; finally, in the earlier periods of Roman history at least, he might sink from freedom into slavery. Although we have not in our law the technical term *status*, it is plain that to a certain extent we have the facts denoted by it. It is true that at birth a person becomes clothed with the great mass of rights conferred by the law of the U. S., but he may be subjected to certain special capacities or incapacities depending upon the existence of particular circumstances. Among these incapacities are those resulting from infancy, lunacy, marriage in case of the wife, conviction or imprisonment for crime, public pauperism, and the like. Among the special capacities the most important are those pertaining to citizenship and to the electoral franchise. In the U. S. the differences of legal condition or status belonging to class, rank, profession, or trade have no existence, for every person—at least every sane person—is clothed with the same *capacity* in respect to these subjects.

JOHN NORTON POMEROY.

**Statute of Frauds.** See FRAUDS, STATUTE OF, by PROF. GEORGE CHASE.

**Stat'utes** [Lat. *statutus*]. A statute is a law in a written form enacted by the supreme legislative authority of a nation or commonwealth, as contradistinguished from the law established by judicial decision. In its generic sense the term includes all legislative as opposed to judicial creations of the law, whatever be the nature and organization of the body—persons or person—which exercises the creative function.

*Their Sources.*—The sources from which statutes have emanated or may emanate, according to the varying political constitutions of different states, are the general or partial assemblies of the citizens, the emperors, kings, or other single heads of despotic governments, and the representative assemblies, either hereditary or elective. The *leges* and *plebiscita* of the Roman citizens during the Republic were produced by the first class of legislators; the "constitutions" of the Roman emperors by the second; while the parliaments of Great Britain and of many other European nations, the U. S. Congress, and the State legislatures are the modern forms of the third. The extent of the powers held by these bodies is determined by the organic law of each country. The British Parliament is said to be omnipotent; which simply means that the restrictions under which it ordinarily acts are self-imposed. In the U. S. the most remarkable feature of the political organization is the express, positive, and extensive limitation of the legislative function contained in all the written constitutions, which are themselves fundamental statutes adopted by the people in their sovereign capacity. With every new revision of the State constitutions this limitation in reference to the forms and modes of legislation, as well as its subject-matter, is made more far-reaching, minute, and prohibitory.

*Their Kinds.*—Statutes may be classified according to their external form and according to their subject-matter and effects. With respect to form three classes exist: (1) The first class comprises those single, separate enactments which are passed from time to time as occasion demands relating to one subject or class of subjects, and therefore comparatively short. Nearly all the acts of the British Parliament, of the U. S. Congress, and of the State legislatures until a period quite recent belong to this division. Where this form exclusively prevails, the legislation of a country is made up of almost innumerable fragments collected into the statute-books without system or order, and the resulting confusion necessarily affects the entire law with uncertainty. Of these enactments, some are intended to be permanent, and remain unaltered until, through a change in governmental policy, they are modified or repealed. Others, like the supply and appropriation bills, are renewed annually or at other short intervals. (2) The second division embraces those statutes which are digested and arranged into the form of complete national codes. The most remarkable instances of this class in ancient times were the XII. Tables (B. C. 451), with which the authentic history of the Roman law began, and the Digests of Justinian (A. D. 529–534), with which the spontaneous growth of that jurisprudence was closed. At the present time the private law has been fully codified in France, Austria, Prussia, and several other European countries, in British East India, and in the States of Louisiana and California. Among modern theoretical jurists and scientific legislators the tendency in favor of this form is very strong and nearly universal. (3) The third class consists in the revisions of the most important and general statutes which have been made by almost all the American States, and recently by the national Congress, and which are, in fact, partial codes, differing from those referred to in the preceding division only in their extent and completeness. With regard to their subject-matter, the classes into which the American and English statutes have been separated are numerous. The following are the most important of these subdivisions. Statutes are *public* and *general* when they affect all persons within the commonwealth, relate to matters of common interest, and apply to all parts of the territory—*private* or *local*, when they affect some particular class of persons, relate solely to matters of a local interest, or are confined in their operation to a specified portion of the territory; they are *declaratory* when they simply re-enact a rule of law already existing—*innovating*, when they introduce a new rule; they are *mandatory* when their command is enforced by some sanction—*directory*, when they are merely permissive, so that obedience is voluntary; they are *remedial* when they supply defects in the existing law, either by abrogating old or by enacting new rules; they are *penal* when they prescribe or forbid certain acts and impose a penalty or forfeiture in case of a violation; and *criminal* if the act prohibited is made a crime and the penalty a punishment; they are *prospective* when their operation is confined to matters occurring after their passage; *retrospective*, when they relate back and affect relations and acts which existed or took place prior to their passage; they are *repealing* when they annul other statutory provisions. It is plain from these definitions that the same enactment may belong to several of the foregoing classes; it may, for example, be at once public, mandatory, remedial, criminal, and prospective.

*Their Parts.*—The common form of English and American statutes may, and sometimes does, comprise the following distinct parts: the title, the commencement, the preamble, and the purview. The "title" is a brief preliminary description—*e. g.* "An act for the amendment of the law." It has become of great importance in the law of this country, since most of the State constitutions prescribe in substance that every statute shall contain but one subject, and that this shall be properly expressed in the title, although in two or three States this requirement is confined to private and local laws. By the "commencement" is meant the formal enacting clause—namely, "Be it enacted by the Senate and House of Representatives of the U. S. of America, in Congress assembled," and, "Be it enacted by the queen's most excellent majesty, by and with the advice and consent of the Lords spiritual and temporal and Commons in this present Parliament assembled, and by the authority of the same." The "preamble" is a preface setting forth the reasons and motives for the act. Once very

common, it is now generally omitted. The "purview" is the main body, the effective portion of the statute, which contains a statement of the legislative will, and declares its object and purpose. Among the special clauses or subdivisions which may be found in it are the "interpretation clause," the "saving clause," the "repealing clause," the "provisoes," the "exceptions," and the "schedules," the objects of which are sufficiently indicated by their names. In codes, whether complete or partial, a more orderly and scientific arrangement of parts is always made, and a division, according to some general plan, into books, titles, chapters, sections, and the like is universal.

*Their Passage.*—The practice which prevails in the U. S. Congress and in the State legislatures is the same in all its substantial features, and differs widely from that which is pursued in the Parliament of Great Britain or in the legislative assemblies of other European nations. A bill may be prepared and offered by a committee, or it may be first presented by any private member, in which case it is referred to the appropriate committee for examination and report. In its course through the house it is read three times, but the first two of these readings are merely formal, and the controversy, if any, is connected with the third reading. After passing both houses, it is engrossed with its amendments, is then signed by the presiding officer of each body, and transmitted to the President or governor for his approval. Upon receiving the assent of the executive it becomes an "act," and is filed in the office of the secretary of state. Many State constitutions contain minute regulations concerning the necessary number of votes, the manner in which they shall be given, and their record in the minutes. No provision, however, is made for any official preparation of proposed measures, nor for ensuring the use of language which shall accurately express the legislative intent. In this respect our methods are in striking contrast with those pursued in certain continental states of Europe, where the most careful attention is paid in the preliminary stages of legislation to the proper drafting of the statutes and to the statement of the reasons and motives upon which they are based. The time when statutes take effect is fixed in most of the American States either by a constitutional provision or by a general law. In some they become operative at the expiration of a specified number of days after the close of the session, in others at a specified period after the day of their passage; but the legislature may in the body of a statute prescribe a different time, as, for example, that it shall take effect immediately. The common law made an act operative from the first day of the session at which it was passed, but this absurd doctrine was abolished in the thirty-third year of George III., and all laws were declared to be binding from the time when they received the royal assent. The repeal of a statute may be either express or by implication. It is express when effected by a clause inserted for that specific purpose in a subsequent act; it is by implication when the provisions of a later enactment are wholly and irreconcilably inconsistent with those contained in an earlier one. Repeal by implication is not favored. If the two statutes concerning the same subject-matter can possibly be harmonized, both will stand; if the contradiction is absolute, the prior one gives way. There remain two most important topics connected with the general theory of statutes—the rules which govern their interpretation and construction, and the peculiarly American doctrine of their validity as affected by the national and State constitutions. The discussion of these topics will be found in the articles on INTERPRETATION and CONSTITUTION. (See also CODE and RETROSPECTIVE LAWS.) JOHN NORTON POMEROY.

**Statutes of Limitation.** See LIMITATION, STATUTES OF, by PROF. GEORGE CHASE.

**Staub'bach** ["dust-stream"], a celebrated waterfall of Switzerland, in the canton of Berne, has a descent of between 800 and 900 feet, but long before the water reaches the bottom it is dissolved into spray and carried away by the wind, which gives the phenomenon a singularly beautiful resemblance to a lace curtain floating in the air.

**Stäud'lin** (KARL FRIEDRICH), b. at Stuttgart July 25, 1764; studied theology at Tübingen 1779–84; travelled in Switzerland, France, and England, and was appointed in 1790 professor of theology at Göttingen, where he d. July 3, 1826. His numerous writings relate mostly to church history, such as *Universalgeschichte der christlichen Kirche* (1806; often reprinted), *Kirchliche Geographie und Statistik* (2 vols., 1804), *Allgemeine Kirchengeschichte von Grossbritannien* (1819), or to the history of special theological disciplines, such as *Geschichte der Sittenlehre Jesu* (2 vols., 1799–1823), *Geschichte der christlichen Moral seit dem Wiederaufleben der Wissenschaften* (1808), *Geschichte der Moral philosophie* (1822), etc. His first work, strongly impregnated by the reigning rationalism, was *Geschichte und Geist des Skepticismus* (2 vols., 1794).

**Staugh'ton** (WILLIAM), D. D., b. in Coventry, England, Jan. 4, 1770; emigrated to America 1793, and became pastor of a Baptist church in Georgetown, S. C.; preached subsequently in Philadelphia (1805–23), teaching at the same time, and acting as secretary of the Baptist Board of Foreign Missions; from 1823 to 1827 president of Columbian College. D. Dec. 12, 1829.

**Staun'ton,** p.-v., Macoupin co., Ill., on St. Louis division of Toledo Wabash and Western R. R.

**Staunton,** p.-v., Posey tp., Clay co., Ind., on Terre Haute and Indianapolis R. R. P. 589.

**Staunton,** tp., Miami co., O. P. 1317.

**Staunton,** p.-v., cap. of Augusta co., Va., at the junction of Great Valley and Chesapeake and Ohio R. Rs., 136 miles from Richmond, has 12 churches, 4 female seminaries, a graded free school, State institutions for the insane and the deaf, dumb, and blind, 3 newspapers, 3 banks, and 2 iron-foundries and machine-shops. It has fine facilities for transportation. P. 5120.

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**Staunton,** tp., Bedford co., Va. P. 3251.

**Staunton,** tp., Halifax co., Va. P. 3915.

**Staunton,** tp., Pittsylvania co., Va. P. 3270.

**Staunton,** a river of Southern Virginia, rising in the Alleghany Mountains in Montgomery co., flowing E. and S. E. through a pass in the Blue Mountains, and uniting with the Dan at Clarksville, Mecklenburg co., forms the Roanoke. In the first 20 miles of its course it descends 1000 feet; its entire length is about 200 miles.

**Staunton** (Sir GEORGE LEONARD), BART., D. C. L., b. at Cargin, Galway, Ireland, Apr. 19, 1737; educated at Dublin and at Montpellier, France, where he graduated in medicine; returned to England 1760; wrote for London periodicals, acquiring the friendship of Dr. Johnson and other eminent men of letters; settled in 1762 as a physician in the island of Grenada in the West Indies, where he held several official positions, including that of attorney-general, for which he had qualified himself by legal study, and acquired a considerable fortune, which he invested in landed estates; formed in 1774 an intimate friendship with Lord Macartney, the new governor of the island, with whom he was sent prisoner to France on the capture of Grenada in 1779, and whom he accompanied as secretary during his governorship in Madras (1781–84) and his celebrated embassy to China (1792), of which he published in 1797 an interesting narrative. D. in London Jan. 14, 1801. He was made a baronet 1784 in reward for his success in negotiating a treaty with Tippoo Sahib.—His son, SIR GEORGE THOMAS, b. at Milford, England, May 26, 1781, accompanied his father to China 1792; learned the Chinese language; was many years in the service of the East India Company in China, rising to the highest posts; was a member of the Amherst embassy 1816; returned to England 1817, and was a member of Parliament with short intervals from 1818 to 1852. D. Aug. 10, 1859. He wrote a *Memoir* of his father (1823), an autobiography (1856), and published various works, original and translated, upon China.

**Staunton** (HOWARD), b. in England in 1810; educated at Oxford; travelled extensively; settled in London; became noted as one of the most skilful of chess-players and as an eminent Shakspearian scholar; edited for many years the *Chess-Player's Chronicle* and the chess column of the *Illustrated London News;* published several manuals of the game of chess, including the *Handbook* (1847), the *Companion* (1849), the *Chess Tournament* (1851), and *Chess Praxis* (1860). He published an edition of Shakspeare's *Plays and Poems* (3 vols., 1857–60, and library ed., 4 vols., 1863) preceded by a *Life,* a photo-lithographic facsimile of the celebrated "first folio" of 1623 (1865); *Memorials of Shakspeare, his Will, Indentures of Conveyance, etc.,* photographed (Apr., 1864), and projected a new edition of Shakspeare, which he did not live to execute, though a portion of its materials were published in an interesting series of articles in the *Athenæum* for 1874, entitled *Unsuspected Corruptions of Shakspeare's Text.* He was extremely familiar with the dramatic literature of the Elizabethan age, and sometimes appeared upon the stage, chiefly in Shakspearian dramas. D. in London June 22, 1874. Author of *The Great Schools of England* (1865; 2d ed. 1869).

**Staunton** (WILLIAM), D. D., b. at Chester, England, Apr. 20, 1803; came to the U. S. at the age of fifteen years; acquired a good education, chiefly by private study; was ordained deacon in the Protestant Episcopal Church June 9, 1833, and priest Sept. 7, 1834; was a missionary preacher at Palmyra and Lyons, N. Y., 1834–35; rector of St. James's

church, Roxbury, Mass., 1835–40, of St. Peter's church, Morristown, N. J., 1840–47; founded and became first rector of St. Peter's church, Brooklyn, N. Y., 1848; was subsequently for seven years rector of Trinity church, Potsdam, N. Y., and has since been a resident of the city of New York. Author of *A Dictionary of the Church* (New York, 12mo, 1844), republished, much enlarged, as *An Ecclesiastical Dictionary* (New York, 8vo, 1861), *The Book of Chants, Songs, and Prayers for the Family Altar* (1860), *The Book of Common Praise* (1866), *Voluntaries for the Organ*, a prize *Te Deum*, and of articles in this CYCLOPÆDIA.

**Stau'pitz, von** (JOHANN), descended from a noble family in Meissen, but his parentage and birth-date are unknown; studied theology at Tübingen, but turned entirely from the barren method of the Schoolmen, and found in the writings of Augustine and the mediæval mystics his spiritual models; took a very active part in the foundation of the University of Wittenberg, and was appointed its first professor of theology; became, as vicar-general of the Augustine order in Germany, acquainted with the young Luther, for whom he conceived a warm friendship, and on whom he exercised considerable influence; procured his appointment as professor in Wittenberg, approved fully of his theses against the sale of indulgences, and gave him, during the first stage of his contest with the Roman Catholic Church, his valuable and effective support. Subsequently, however, when the controversy became too violent, and an open breach with the Church took place, he retired from Wittenberg, and lived after 1519 at Salzburg as court-preacher to the archbishop and abbey of a Benedictine monastery. D. here Dec. 28, 1524. But his friendship for Luther remained unabated to his death; all the Reformer's writings were found in his library, and his own works, *De Amore Dei* and *De Fide Christiana*, show the spiritual sympathy he felt for the Reformation. Roman Catholic writers have not disdained to explain the support he gave Luther as an act of jealousy, because the sale of indulgences was given to the Dominican and not to the Augustine order.

**Stavang'er,** an old town of Norway, at the head of Bukkefjörd, about 100 miles S. of Bergen. It exports timber and salt herrings. P. 17,058.

**Stave,** or **Staff,** in music, the lines and spaces on which the notes are placed. (See NOTATION.)

**Stavro'pol,** government of Russia, bordering on the Caspian Sea, comprises an area of 28,800 sq. m. with 437,118 inhabitants. It is mostly low and flat. In the south-western part agriculture is the principal occupation; wheat, millet, wine, and mulberries are cultivated. In the north-eastern part the inhabitants are nomads, and immense herds of cattle, horses, and sheep are reared.

**Stavropol,** town of Russia, capital of the government of Stavropol, trades in cattle, horses, sheep, skins, wool, jars, and honey, and has 20,927 inhabitants.

**Stay'ner,** p.-v., Nottawasaga tp., Simcoe co., Ontario, Can., on Northern R. R., 86 miles from Toronto, has several hotels, flour, saw, and woollen mills, and factories. P. about 1000.

**Stead'y Run,** tp., Keokuk co., Ia. P. 1038.

**Steam** [Ang.-Sax. *stêm*]. The substance which in the solid condition is known as ice, and in the liquid condition as water, assumes under certain circumstances of heat and pressure the vaporous condition known as *steam*. Water exposed continuously to a temperature below 32° F., or 0° Centigrade, becomes converted into ice. At temperatures above 32° F., or freezing-point, and between this temperature—called the melting-point—and 212° F., and under a pressure of one atmosphere, the liquid state is exhibited. If the temperature be increased to 212° F. under a pressure of one atmosphere, the liquid rapidly disappears, and is dissipated in the form of steam or vapor. This transformation, which is rapid at the temperature of 212° F., takes place *slowly* at all temperatures above the freezing-point when the liquid is freely exposed to the atmosphere, the change being more rapid as the temperature rises, until the limiting temperature, 212°, is reached, above which, under a pressure of one atmosphere, the substance can no longer retain its liquid form. The ordinary "boiling-point" of water, 212° F., is thus a limiting temperature, above which it assumes the vaporous condition under a pressure of one atmosphere.

This formation of vapor at lower temperatures in the atmosphere is a phenomenon of great importance in the economy of nature, the slow evaporation from the surface of the sea, from lakes, and from rivers forming a part of the cycle of changes by which rainfall and dew supply moisture to the dry land. The laws of this natural *evaporation* are not well known, the quantity of water converted into vapor in a given time from a given surface of a lake or river being an almost indeterminate quantity, depending as it does on the removal of the vapor already formed by winds, the temperature of the water, the pressure of the atmosphere, and the quantity of vapor already existing in the air brought from other regions. When water is confined in a close vessel, however, a part of the enclosed space being left free or vacant, the effects of heat may be more definitely determined. If under these circumstances the water be heated to 212°, the space above the water will become filled with steam or vapor with an elastic force of one atmosphere, or 14.7 pounds per square inch. If more heat be applied to the mixture of water and steam, the volume of the vessel remaining constant, an additional quantity of steam will be formed, the quantity of liquid water being correspondingly diminished, an increase of elastic force or pressure will be observed, and these new relations will remain fixed and permanent for any given higher temperature as long as that temperature is constant. If the vessel be then cooled, reverse phenomena will occur; a certain portion of the steam will be condensed to a liquid form, and the elastic force will be diminished. If the steam-space be enlarged, the temperature remaining constant, an additional quantity of vapor will be formed, and the elastic force will remain constant. If the space be contracted, the temperature remaining constant, condensation of vapor will occur, the pressure still remaining constant.

It is thus observed that for every temperature there is a corresponding elastic force or tension, which cannot be changed without causing either evaporation or condensation. Steam in this condition is said to be saturated. If the quantity of water in the vessel be small relatively to the size of the vessel, and heat be continuously applied, the last element of liquid will finally be converted into vapor. At this instant the vessel will contain saturated steam only, unmixed with liquid water. If, now, additional heat be applied, or if the space be enlarged, the temperature remaining constant, the steam will assume what is termed the *superheated* condition. If the volume of the vessel be increased, the temperature remaining constant, the pressure will diminish, but it will no longer be solely proportional to the temperature, as in the case of saturation; it will depend also upon the volume, and the vapor begins to partake of the properties of the permanent gases. Superheated vapor has thus always an elastic force inferior to that which belongs to saturated vapor of the same temperature; and if a quantity of saturated steam and another quantity of superheated steam exist under the *same pressure*, the temperature of the superheated steam will be the greatest.

Steam unmixed with particles of water is transparent and colorless, its ordinary cloudy appearance as it issues from vessels containing it arising from suspended particles of water. Its uses as a medium for the transfer of heat in heating buildings or heating other bodies, and also as a medium for the transformation of heat into useful work in the steam-engine, have become almost universal, and render it one of the most important agents in modern civilization. Its properties have accordingly been carefully studied. In its superheated condition it obeys the general laws of the permanent gases; but saturated steam, as well as the saturated vapors of other liquids, possesses peculiar properties which have been determined mainly by experimental investigations.

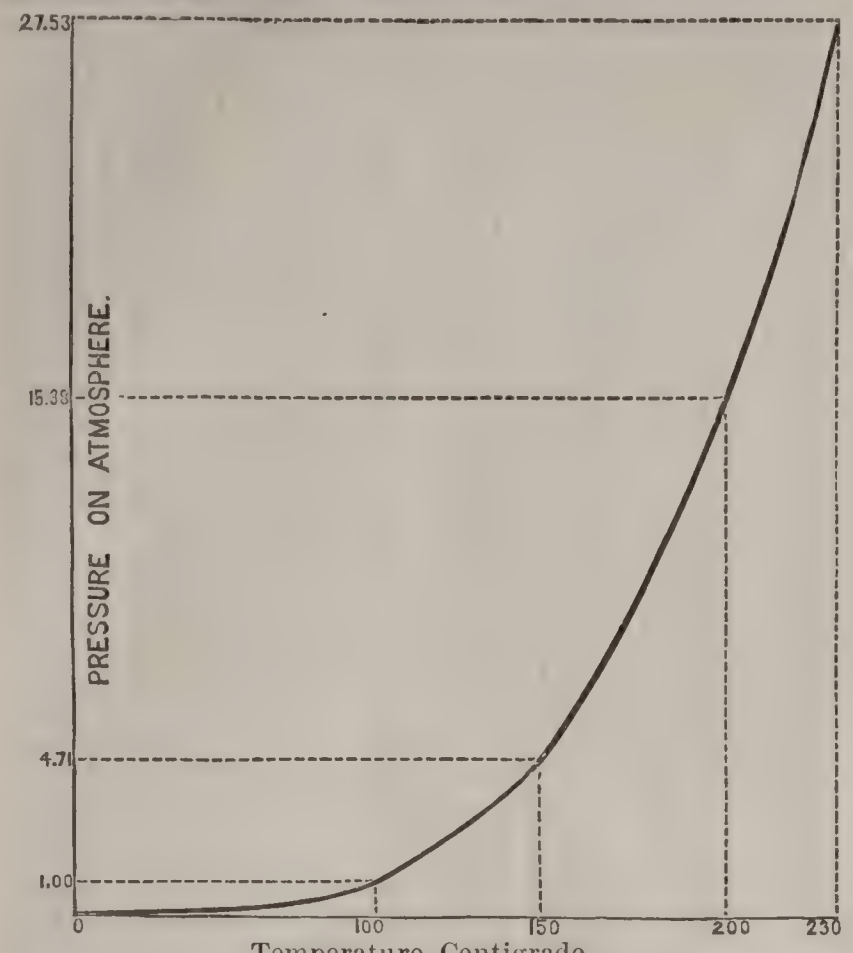
The condition of any body in regard to heat being determined by the pressure, volume, and temperature, the first subject of investigation is to ascertain the relation between these quantities, without reference to the quantities of heat involved in a change of state or condition, the pressure or elastic force being expressed in pounds per square inch, the volume being expressed in cubic feet, and the temperature in degrees Fahr. The first question is to determine the relation between these quantities. For the ordinary permanent gases this relation takes the form $pv = RT$, in which equation $p$ represents the pressure, $v$ the volume of unit of weight, T the *absolute* temperature, and R a constant quantity having a special value for each particular gas. This expression shows that for perfect gases the product of the pressure by the volume is proportional to the temperature. For saturated vapors a law still more simple holds true—viz. that the pressure or elastic force depends only on the temperature, and not on the volume of the mixture of liquid and vapor, the pressure of saturated vapors being independent of the proportion of these two elements.

No *theoretical* mode of ascertaining the relation between the pressure and temperature in the case of saturated vapors is at present known, but for some of the most common, and especially for steam, the celebrated experiments of Regnault furnish the most reliable means of calculating by *empirical* formulas this relation for a wide range of pressures. The diagram below exhibits graphically the law of

*Table of Pressures of the Saturated Vapor of Water, from 32° to 446° F., from the Experiments of Regnault.*

| Temp. Fahr. | Pressures in atmospheres. | Pressures in lbs. per sq. in. | Differences. | Temp. Fahr. | Pressures in atmospheres. | Pressures in lbs. per sq. in. | Differences. | Temp. Fahr. | Pressures in atmospheres. | Pressures in lbs. per sq. in. | Differences. | Temp. Fahr. | Pressures in atmospheres. | Pressures in lbs. per sq. in. | Differences. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 0.006 | 0.09 | 0.00 | 136 | 0.175 | 2.57 | 0.09 | 240 | 1.700 | 24.99 | 0.45 | 344 | 8.500 | 124.95 | 1.65 |
| 33 | 0.006 | 0.09 | 0.00 | 137 | 0.181 | 2.66 | 0.03 | 241 | 1.731 | 25.45 | 0.45 | 345 | 8.612 | 126.60 | 1.64 |
| 34 | 0.006 | 0.09 | 0.01 | 138 | 0.183 | 2.69 | 0.12 | 242 | 1.762 | 25.90 | 0.47 | 346 | 8.724 | 128.24 | 1.68 |
| 35 | 0.007 | 0.10 | 0.00 | 139 | 0.191 | 2.81 | 0.07 | 243 | 1.794 | 26.37 | 0.47 | 347 | 8.838 | 129.92 | 1.69 |
| 36 | 0.007 | 0.10 | 0.01 | 140 | 0.196 | 2.88 | 0.06 | 244 | 1.826 | 26.84 | 0.49 | 348 | 8.953 | 131.61 | 1.72 |
| 37 | 0.007 | 0.11 | 0.01 | 141 | 0.200 | 2.94 | 0.07 | 245 | 1.859 | 27.33 | 0.50 | 349 | 9.070 | 133.33 | 1.75 |
| 38 | 0.008 | 0.12 | 0.00 | 142 | 0.205 | 3.01 | 0.08 | 246 | 1.893 | 27.83 | 0.51 | 350 | 9.189 | 135.08 | 1.78 |
| 39 | 0.008 | 0.12 | 0.01 | 143 | 0.210 | 3.09 | 0.10 | 247 | 1.928 | 28.34 | 0.50 | 351 | 9.310 | 136.86 | 1.81 |
| 40 | 0.009 | 0.13 | 0.00 | 144 | 0.217 | 3.19 | 0.04 | 248 | 1.962 | 28.84 | 0.52 | 352 | 9.433 | 138.67 | 1.80 |
| 41 | 0.009 | 0.13 | 0.01 | 145 | 0.220 | 3.23 | 0.09 | 249 | 1.997 | 29.36 | 0.51 | 353 | 9.556 | 140.47 | 1.83 |
| 42 | 0.009 | 0.14 | 0.00 | 146 | 0.226 | 3.32 | 0.08 | 250 | 2.032 | 29.87 | 0.53 | 354 | 9.680 | 142.30 | 1.82 |
| 43 | 0.009 | 0.14 | 0.01 | 147 | 0.231 | 3.40 | 0.10 | 251 | 2.068 | 30.40 | 0.53 | 355 | 9.804 | 144.12 | 1.84 |
| 44 | 0.010 | 0.15 | 0.00 | 148 | 0.238 | 3.50 | 0.10 | 252 | 2.104 | 30.93 | 0.54 | 356 | 9.929 | 145.96 | 1.85 |
| 45 | 0.010 | 0.15 | 0.01 | 149 | 0.245 | 3.60 | 0.09 | 253 | 2.141 | 31.47 | 0.56 | 357 | 10.055 | 147.81 | 1.87 |
| 46 | 0.011 | 0.16 | 0.00 | 150 | 0.251 | 3.69 | 0.12 | 254 | 2.179 | 32.03 | 0.57 | 358 | 10.182 | 149.68 | 1.89 |
| 47 | 0.011 | 0.16 | 0.01 | 151 | 0.259 | 3.81 | 0.09 | 255 | 2.217 | 32.60 | 0.56 | 359 | 10.311 | 151.57 | 1.93 |
| 48 | 0.011 | 0.17 | 0.00 | 152 | 0.265 | 3.90 | 0.08 | 256 | 2.256 | 33.16 | 0.56 | 360 | 10.442 | 153.50 | 1.95 |
| 49 | 0.011 | 0.17 | 0.01 | 153 | 0.271 | 3.98 | 0.11 | 257 | 2.294 | 33.72 | 0.59 | 361 | 10.575 | 155.45 | 1.99 |
| 50 | 0.012 | 0.18 | 0.00 | 154 | 0.278 | 4.09 | 0.10 | 258 | 2.334 | 34.31 | 0.59 | 362 | 10.710 | 157.44 | 2.01 |
| 51 | 0.012 | 0.18 | 0.01 | 155 | 0.285 | 4.19 | 0.06 | 259 | 2.374 | 34.90 | 0.60 | 363 | 10.847 | 159.45 | 2.03 |
| 52 | 0.013 | 0.19 | 0.01 | 156 | 0.289 | 4.25 | 0.16 | 260 | 2.415 | 35.50 | 0.60 | 364 | 10.985 | 161.48 | 2.03 |
| 53 | 0.013 | 0.20 | 0.01 | 157 | 0.300 | 4.41 | 0.09 | 261 | 2.456 | 36.10 | 0.62 | 365 | 11.123 | 163.51 | 2.04 |
| 54 | 0.014 | 0.21 | 0.00 | 158 | 0.306 | 4.50 | 0.03 | 262 | 2.498 | 36.72 | 0.63 | 366 | 11.262 | 165.55 | 2.04 |
| 55 | 0.014 | 0.21 | 0.01 | 159 | 0.308 | 4.53 | 0.14 | 263 | 2.541 | 37.35 | 0.63 | 367 | 11.401 | 167.59 | 2.08 |
| 56 | 0.015 | 0.22 | 0.02 | 160 | 0.318 | 4.67 | 0.11 | 264 | 2.584 | 37.98 | 0.64 | 368 | 11.542 | 169.67 | 2.08 |
| 57 | 0.016 | 0.24 | 0.00 | 161 | 0.325 | 4.78 | 0.19 | 265 | 2.627 | 38.62 | 0.64 | 369 | 11.684 | 171.75 | 2.14 |
| 58 | 0.016 | 0.24 | 0.01 | 162 | 0.338 | 4.97 | 0.10 | 266 | 2.671 | 39.26 | 0.67 | 370 | 11.829 | 173.89 | 2.16 |
| 59 | 0.017 | 0.25 | 0.01 | 163 | 0.345 | 5.07 | 0.12 | 267 | 2.716 | 39.93 | 0.66 | 371 | 11.976 | 176.05 | 2.19 |
| 60 | 0.018 | 0.26 | 0.00 | 164 | 0.353 | 5.19 | 0.12 | 268 | 2.761 | 40.59 | 0.67 | 372 | 12.125 | 178.24 | 2.19 |
| 61 | 0.018 | 0.26 | 0.00 | 165 | 0.361 | 5.31 | 0.14 | 269 | 2.807 | 41.26 | 0.69 | 373 | 12.274 | 180.43 | 2.22 |
| 62 | 0.018 | 0.26 | 0.02 | 166 | 0.371 | 5.45 | 0.12 | 270 | 2.854 | 41.95 | 0.69 | 374 | 12.425 | 182.65 | 2.22 |
| 63 | 0.019 | 0.28 | 0.01 | 167 | 0.379 | 5.57 | 0.12 | 271 | 2.901 | 42.64 | 0.71 | 375 | 12.576 | 184.87 | 2.23 |
| 64 | 0.020 | 0.29 | 0.00 | 168 | 0.387 | 5.69 | 0.13 | 272 | 2.949 | 43.35 | 0.71 | 376 | 12.728 | 187.10 | 2.25 |
| 65 | 0.020 | 0.29 | 0.02 | 169 | 0.396 | 5.82 | 0.13 | 273 | 2.997 | 44.06 | 0.72 | 377 | 12.881 | 189.35 | 2.26 |
| 66 | 0.021 | 0.31 | 0.01 | 170 | 0.405 | 5.95 | 0.15 | 274 | 3.046 | 44.78 | 0.75 | 378 | 13.035 | 191.61 | 2.28 |
| 67 | 0.022 | 0.32 | 0.02 | 171 | 0.415 | 6.10 | 0.15 | 275 | 3.097 | 45.53 | 0.73 | 379 | 13.190 | 193.89 | 2.31 |
| 68 | 0.023 | 0.34 | 0.00 | 172 | 0.425 | 6.25 | 0.16 | 276 | 3.147 | 46.26 | 0.75 | 380 | 13.347 | 196.20 | 2.35 |
| 69 | 0.023 | 0.34 | 0.01 | 173 | 0.436 | 6.41 | 0.13 | 277 | 3.198 | 47.01 | 0.77 | 381 | 13.507 | 198.55 | 2.40 |
| 70 | 0.024 | 0.35 | 0.00 | 174 | 0.445 | 6.54 | 0.15 | 278 | 3.250 | 47.78 | 0.77 | 382 | 13.670 | 200.95 | 2.44 |
| 71 | 0.024 | 0.35 | 0.02 | 175 | 0.455 | 6.69 | 0.16 | 279 | 3.303 | 48.55 | 0.80 | 383 | 13.836 | 203.39 | 2.45 |
| 72 | 0.025 | 0.37 | 0.01 | 176 | 0.466 | 6.85 | 0.15 | 280 | 3.357 | 49.35 | 0.79 | 384 | 14.003 | 205.84 | 2.47 |
| 73 | 0.026 | 0.38 | 0.02 | 177 | 0.476 | 7.00 | 0.15 | 281 | 3.411 | 50.14 | 0.81 | 385 | 14.171 | 208.31 | 2.49 |
| 74 | 0.027 | 0.40 | 0.01 | 178 | 0.488 | 7.15 | 0.21 | 282 | 3.466 | 50.95 | 0.81 | 386 | 14.340 | 210.80 | 2.50 |
| 75 | 0.028 | 0.41 | 0.02 | 179 | 0.501 | 7.36 | 0.18 | 283 | 3.521 | 51.76 | 0.81 | 387 | 14.510 | 213.30 | 2.51 |
| 76 | 0.029 | 0.43 | 0.03 | 180 | 0.513 | 7.54 | 0.12 | 284 | 3.576 | 52.57 | 0.82 | 388 | 14.681 | 215.81 | 2.54 |
| 77 | 0.031 | 0.46 | 0.00 | 181 | 0.521 | 7.66 | 0.15 | 285 | 3.632 | 53.39 | 0.84 | 389 | 14.854 | 218.35 | 2.58 |
| 78 | 0.031 | 0.46 | 0.01 | 182 | 0.531 | 7.81 | 0.17 | 286 | 3.689 | 54.23 | 0.85 | 390 | 15.029 | 220.93 | 2.60 |
| 79 | 0.032 | 0.47 | 0.00 | 183 | 0.543 | 7.98 | 0.19 | 287 | 3.747 | 55.08 | 0.87 | 391 | 15.206 | 223.53 | 2.56 |
| 80 | 0.032 | 0.47 | 0.02 | 184 | 0.556 | 8.17 | 0.19 | 288 | 3.806 | 55.95 | 0.88 | 392 | 15.380 | 226.09 | 1.13 |
| 81 | 0.033 | 0.49 | 0.01 | 185 | 0.569 | 8.36 | 0.18 | 289 | 3.866 | 56.83 | 0.88 | 393 | 15.457 | 227.22 | 2.64 |
| 82 | 0.034 | 0.50 | 0.03 | 186 | 0.581 | 8.54 | 0.18 | 290 | 3.926 | 57.71 | 0.90 | 394 | 15.637 | 229.86 | 2.69 |
| 83 | 0.036 | 0.53 | 0.01 | 187 | 0.593 | 8.72 | 0.17 | 291 | 3.987 | 58.61 | 0.91 | 395 | 15.820 | 232.55 | 2.65 |
| 84 | 0.037 | 0.54 | 0.03 | 188 | 0.605 | 8.89 | 0.19 | 292 | 4.049 | 59.52 | 0.93 | 396 | 16.000 | 235.20 | 2.79 |
| 85 | 0.039 | 0.57 | 0.03 | 189 | 0.618 | 9.08 | 0.21 | 293 | 4.112 | 60.45 | 0.92 | 397 | 16.190 | 237.99 | 2.87 |
| 86 | 0.041 | 0.60 | 0.02 | 190 | 0.632 | 9.29 | 0.21 | 294 | 4.175 | 61.37 | 0.94 | 398 | 16.385 | 240.86 | 2.90 |
| 87 | 0.042 | 0.62 | 0.01 | 191 | 0.646 | 9.50 | 0.22 | 295 | 4.239 | 62.31 | 0.96 | 399 | 16.582 | 243.76 | 2.94 |
| 88 | 0.043 | 0.63 | 0.02 | 192 | 0.661 | 9.72 | 0.22 | 296 | 4.304 | 63.27 | 0.97 | 400 | 16.782 | 246.70 | 3.04 |
| 89 | 0.044 | 0.65 | 0.03 | 193 | 0.676 | 9.94 | 0.22 | 297 | 4.370 | 64.24 | 0.98 | 401 | 16.989 | 249.74 | 3.47 |
| 90 | 0.046 | 0.68 | 0.03 | 194 | 0.691 | 10.16 | 0.20 | 298 | 4.437 | 65.22 | 1.00 | 402 | 17.225 | 253.21 | 3.03 |
| 91 | 0.048 | 0.71 | 0.01 | 195 | 0.705 | 10.36 | 0.21 | 299 | 4.505 | 66.22 | 1.02 | 403 | 17.431 | 256.24 | 3.04 |
| 92 | 0.049 | 0.72 | 0.02 | 196 | 0.719 | 10.57 | 0.22 | 300 | 4.574 | 67.24 | 1.01 | 404 | 17.638 | 259.28 | 3.07 |
| 93 | 0.050 | 0.74 | 0.02 | 197 | 0.734 | 10.79 | 0.22 | 301 | 4.643 | 68.25 | 1.02 | 405 | 17.847 | 262.35 | 3.04 |
| 94 | 0.052 | 0.76 | 0.05 | 198 | 0.749 | 11.01 | 0.22 | 302 | 4.712 | 69.27 | 1.03 | 406 | 18.054 | 265.39 | 3.05 |
| 95 | 0.055 | 0.81 | 0.03 | 199 | 0.764 | 11.23 | 0.22 | 303 | 4.782 | 70.30 | 1.04 | 407 | 18.261 | 268.44 | 3.04 |
| 96 | 0.057 | 0.84 | 0.01 | 200 | 0.770 | 11.45 | 0.12 | 304 | 4.853 | 71.34 | 1.06 | 408 | 18.468 | 271.48 | 3.04 |
| 97 | 0.058 | 0.85 | 0.05 | 201 | 0.787 | 11.57 | 0.25 | 305 | 4.925 | 72.40 | 1.07 | 409 | 18.675 | 274.52 | 2.55 |
| 98 | 0.061 | 0.90 | 0.00 | 202 | 0.804 | 11.82 | 0.43 | 306 | 4.998 | 73.47 | 1.09 | 410 | 18.848 | 277.07 | 3.16 |
| 99 | 0.061 | 0.90 | 0.03 | 203 | 0.833 | 12.25 | 0.25 | 307 | 5.072 | 74.56 | 1.10 | 411 | 19.063 | 280.23 | 3.19 |
| 100 | 0.063 | 0.93 | 0.04 | 204 | 0.850 | 12.50 | 0.24 | 308 | 5.147 | 75.66 | 1.12 | 412 | 19.280 | 283.42 | 3.19 |
| 101 | 0.066 | 0.97 | 0.01 | 205 | 0.867 | 12.74 | 0.27 | 309 | 5.223 | 76.78 | 1.13 | 413 | 19.497 | 286.61 | 3.19 |
| 102 | 0.067 | 0.98 | 0.03 | 206 | 0.885 | 13.01 | 0.28 | 310 | 5.300 | 77.91 | 1.16 | 414 | 19.714 | 289.80 | 3.19 |
| 103 | 0.069 | 1.01 | 0.05 | 207 | 0.904 | 13.29 | 0.28 | 311 | 5.379 | 79.07 | 1.16 | 415 | 19.931 | 292.99 | 3.19 |
| 104 | 0.072 | 1.06 | 0.03 | 208 | 0.923 | 13.57 | 0.28 | 312 | 5.458 | 80.23 | 1.18 | 416 | 20.148 | 296.18 | 3.19 |
| 105 | 0.074 | 1.09 | 0.06 | 209 | 0.942 | 13.85 | 0.28 | 313 | 5.538 | 81.41 | 1.19 | 417 | 20.365 | 299.37 | 3.19 |
| 106 | 0.078 | 1.15 | 0.01 | 210 | 0.961 | 14.13 | 0.29 | 314 | 5.619 | 82.60 | 1.20 | 418 | 20.582 | 302.56 | 3.07 |
| 107 | 0.079 | 1.16 | 0.02 | 211 | 0.981 | 14.42 | 0.28 | 315 | 5.701 | 83.80 | 1.22 | 419 | 20.791 | 305.63 | 3.38 |
| 108 | 0.080 | 1.18 | 0.04 | 212 | 1.000 | 14.07 | 0.30 | 316 | 5.784 | 85.02 | 1.22 | 420 | 21.021 | 309.01 | 3.38 |
| 109 | 0.083 | 1.22 | 0.04 | 213 | 1.020 | 15.00 | 0.29 | 317 | 5.867 | 86.24 | 1.24 | 421 | 21.251 | 312.39 | 3.38 |
| 110 | 0.086 | 1.26 | 0.03 | 214 | 1.040 | 15.29 | 0.31 | 318 | 5.951 | 87.48 | 1.23 | 422 | 21.481 | 315.77 | 3.38 |
| 111 | 0.088 | 1.29 | 0.05 | 215 | 1.061 | 15.60 | 0.32 | 319 | 6.035 | 88.71 | 1.27 | 423 | 21.711 | 319.15 | 3.44 |
| 112 | 0.091 | 1.34 | 0.03 | 216 | 1.083 | 15.92 | 0.31 | 320 | 6.121 | 89.98 | 1.28 | 424 | 21.945 | 322.59 | 3.32 |
| 113 | 0.093 | 1.37 | 0.03 | 217 | 1.104 | 16.23 | 0.31 | 321 | 6.208 | 91.26 | 1.29 | 425 | 22.171 | 325.91 | 3.38 |
| 114 | 0.095 | 1.40 | 0.07 | 218 | 1.125 | 16.54 | 0.32 | 322 | 6.296 | 92.55 | 1.31 | 426 | 22.401 | 329.29 | 3.39 |
| 115 | 0.100 | 1.47 | 0.03 | 219 | 1.147 | 16.86 | 0.32 | 323 | 6.385 | 93.86 | 1.32 | 427 | 22.631 | 332.68 | 3.83 |
| 116 | 0.102 | 1.50 | 0.04 | 220 | 1.169 | 17.18 | 0.33 | 324 | 6.475 | 95.18 | 1.34 | 428 | 22.892 | 336.51 | 3.53 |
| 117 | 0.105 | 1.54 | 0.03 | 221 | 1.191 | 17.51 | 0.35 | 325 | 6.566 | 96.52 | 1.35 | 429 | 23.132 | 340.04 | 3.53 |
| 118 | 0.107 | 1.57 | 0.08 | 222 | 1.215 | 17.86 | 0.34 | 326 | 6.658 | 97.87 | 1.37 | 430 | 23.372 | 343.57 | 3.53 |
| 119 | 0.112 | 1.65 | 0.03 | 223 | 1.238 | 18.20 | 0.34 | 327 | 6.751 | 99.24 | 1.40 | 431 | 23.612 | 347.10 | 3.52 |
| 120 | 0.114 | 1.68 | 0.04 | 224 | 1.261 | 18.54 | 0.35 | 328 | 6.846 | 100.64 | 1.45 | 432 | 23.852 | 350.62 | 3.68 |
| 121 | 0.117 | 1.72 | 0.06 | 225 | 1.285 | 18.89 | 0.35 | 329 | 6.945 | 102.09 | 1.44 | 433 | 24.102 | 354.30 | 3.67 |
| 122 | 0.121 | 1.78 | 0.04 | 226 | 1.309 | 19.24 | 0.37 | 330 | 7.043 | 103.53 | 1.44 | 434 | 24.352 | 357.97 | 3.68 |
| 123 | 0.124 | 1.82 | 0.05 | 227 | 1.334 | 19.61 | 0.37 | 331 | 7.141 | 104.97 | 1.44 | 435 | 24.602 | 361.65 | 3.67 |
| 124 | 0.127 | 1.87 | 0.04 | 228 | 1.359 | 19.98 | 0.38 | 332 | 7.239 | 106.41 | 1.46 | 436 | 24.852 | 365.32 | 3.91 |
| 125 | 0.130 | 1.91 | 0.09 | 229 | 1.385 | 20.36 | 0.44 | 333 | 7.338 | 107.87 | 1.45 | 437 | 25.118 | 369.23 | 3.83 |
| 126 | 0.136 | 2.00 | 0.04 | 230 | 1.415 | 20.80 | 0.40 | 334 | 7.437 | 109.32 | 1.46 | 438 | 25.378 | 373.06 | 3.82 |
| 127 | 0.139 | 2.04 | 0.05 | 231 | 1.442 | 21.20 | 0.39 | 335 | 7.536 | 110.78 | 1.50 | 439 | 25.638 | 376.88 | 3.82 |
| 128 | 0.142 | 2.09 | 0.06 | 232 | 1.469 | 21.59 | 0.42 | 336 | 7.638 | 112.28 | 1.51 | 440 | 25.898 | 380.70 | 3.90 |
| 129 | 0.146 | 2.15 | 0.05 | 233 | 1.497 | 22.01 | 0.41 | 337 | 7.741 | 113.79 | 1.55 | 441 | 26.163 | 384.60 | 3.97 |
| 130 | 0.150 | 2.20 | 0.06 | 234 | 1.525 | 22.42 | 0.41 | 338 | 7.846 | 115.34 | 1.55 | 442 | 26.433 | 388.57 | 4.11 |
| 131 | 0.154 | 2.26 | 0.06 | 235 | 1.553 | 22.83 | 0.43 | 339 | 7.952 | 116.89 | 1.59 | 443 | 26.713 | 392.68 | 4.12 |
| 132 | 0.158 | 2.32 | 0.06 | 236 | 1.582 | 23.26 | 0.44 | 340 | 8.060 | 118.48 | 1.60 | 444 | 26.993 | 396.80 | 4.11 |
| 133 | 0.162 | 2.38 | 0.06 | 237 | 1.612 | 23.70 | 0.42 | 341 | 8.169 | 120.08 | 1.62 | 445 | 27.273 | 400.91 | 4.12 |
| 134 | 0.166 | 2.44 | 0.09 | 238 | 1.641 | 24.12 | 0.43 | 342 | 8.279 | 121.70 | 1.62 | 446 | 27.553 | 405.03 | |
| 135 | 0.172 | 2.53 | 0.04 | 239 | 1.670 | 24.55 | 0.44 | 343 | 8.389 | 123.32 | 1.63 | | | | |

pressures and temperatures as determined by Regnault for saturated steam, from 0° to 230° C.:




The above curve is a representation of that drawn by Regnault to exhibit the results of his experiments. The law of the curve was expressed *analytically* by him by the empirical formula—

$$\text{Log}p = a + b\alpha^{\tau} + c\beta^{\tau},$$

in which $\tau = t - t_0$, $t$ being the temperature of the experiment, and $t_0$ a lower temperature arbitrarily chosen; the quantities $a$, $b$, $c$, $\alpha$, $\beta$ are constants which were experimentally determined. From this formula, which gave results in correspondence with the experimental curve, a table was constructed which, reduced to English units and temperatures Fahrenheit, is given on p. 468.

The experiments of Regnault were subsequently verified by Magnus, and form the only reliable basis at the present day for the applications of the dynamic theory of heat to steam and the steam-engine. Regnault's experiments comprised also various other vapors, for reference to which see the article HEAT.

In the preceding table the first column gives the temperature Fahrenheit; the second the pressure or tension of the vapor in atmospheres; and the third the same pressure in pounds per square inch. The fourth column gives the differences in the pressures for one degree. An inspection of this column of differences will show at once one of the most remarkable features of the results—viz. the increase of the variation of pressure for one degree of temperature as the temperature rises.

The second important question to be considered is in reference to the *quantity of heat* which must be communicated to a given quantity of water at any temperature to convert it into saturated steam at any other temperature. Another series of experiments by Regnault furnishes the basis for the determination of these quantities of heat under given conditions. In the process of evaporation water must first be heated from a given initial temperature to the temperature of evaporation, or the "boiling-point due to the pressure." The quantity of heat required for this purpose depends on the specific heat of water; and as the specific heat is variable with the temperature, if we designate the specific heat by $c$, the quantity of heat required for an elevation of temperature $dt$ will be given by the expression $dq = c\,dt$, $q$ representing the quantity of heat required for a given finite change of temperature. Expressed analytically, its value is $q = \int_0^t c.dt$. Regnault deduces from his experiments the empirical formula $q = t + 0.0000t^2 + 0.000000t^3$, which gave the quantity of heat $q$ in calories required to heat water from 0° to any temperature ($t$) C. In this determination it is supposed that the volume of the *liquid* subjected to the active heat remains constant. For water the expansion of the liquid by heat is so small that the variations due to external pressure from this cause are regarded as insignificant.

In another series of experiments Regnault deduced the quantity of heat necessary for the *evaporation* of the liquid. The results were obtained by observing the quantity of heat by a suitable calorimeter, which becomes free when the vapor is liquefied under constant pressure, this quantity of heat being the same as that which must be applied to the liquid to convert it into vapor at the same constant pressure. The pressure being constant during the liquefaction or vaporization, the temperature also remains constant. This quantity of heat is usually called the *latent heat of vaporization*, or *heat of vaporization*, while the quantity $q$ is called the *heat of the liquid*. Calling the heat of vaporization $r$, the total heat required to raise water from 0° to the temperature $t$, and evaporate it at that temperature, will be $L = q + r$. From this equation the value of $r$ is $r = L - q$. Regnault found from his experiments that the value of L in calories may be represented by the formula $L = 606.50 + 0.305t$, the temperature being expresed in centigrade degrees. Subtracting from this the value of $q$ found above, and there results $r = 606.50 - 0.695t - 0.0000t^2 - 0.000000t^3$ for the latent heat of vaporization of water in calories. The equivalent formula in English units of heat and temperature Fahrenheit is, neglecting the last two terms, which are small, $L = 1091.7 - 0.695.(t - 32°)$, or for technical applications, $L = 1092. - 0.7\,(t - 32°)$ approximately, or $L = 966. - 0.7\,(t - 212°)$. The latent heat of evaporation of one pound of water, according to this last formula, at atmospheric pressure, is found by substituting for $t$, 212°, and amounts to 966 units of heat, approximately.

The value of $q$ in the formula $q = \int_0^t c.dt$, when $c$, the specific heat of water, is taken as unity (which for technical applications is often admissible), is $q = t$; and thus the number of units of heat necessary to heat one pound of water from the melting-point of ice to any temperature is often estimated by the number of degrees of temperature. By this approximate method the quantity of heat necessary to raise a pound of water from any temperature $t$ to 212°, and evaporate it at that temperature, is $q = (212° - t) + 966$, $t$ being the lower initial temperature. The total heat of evaporation, or the heat L required to raise one unit of weight of water from the melting-point of ice to any temperature $t$, and evaporate it at that temperature, being for French units and centigrade degrees, $L = 606.50 + 0.305t$, and for English units and Fahrenheit degrees, $L = 1091.7 + 0.305.(t - 32°)$, if the heat required to raise one unit of weight of water from the melting-point of ice to any temperature $t_1$, such as the temperature of the feed-water of a boiler, be subtracted from this quantity, and the specific heat of water be taken as unity, the following formula, for English units and Fahrenheit degrees, will give approximately the total heat required to raise water from such temperature (feed-water temperature) to the temperature of evaporation, and evaporate it at that temperature: $q = 1091.7 + 0.305\,(t - 32°) - (t_1 - 32°)$.

The heat of evaporation $r$ is composed of two parts, one of which is the heat required to overcome the work of the molecular attractions, and the other the external work exerted by the vapor in expanding against the constant pressure $p$ from the volume of the water to the volume of the water and vapor which it produces under the given pressure. Calling the first quantity of heat $\rho$, and the increase of volume of the water in expanding to the vaporous form $u$, the external work will be in English units of heat $\frac{1}{772} \times p\,u$, or $A\,p\,u$, A being put for $\frac{1}{772}$. The value of $r$ will then be $r = \rho + A\,p\,u$. The value of $A\,p\,u$ may be calculated by the aid of the dynamic theory of heat, employing also the quantities derived from the experiments of Regnault, already referred to, on the elastic force of vapors.

Having found the value of $A\,p\,u$ for various pressures or temperatures, and knowing $r$, the value of $\rho$ may be found. Prof. Zeuner gives in his work on the mechanical theory of heat empirical formulas, established in this manner for the value of $\rho$ and $A\,p\,u$, which serve for the calculation of tables of their values for different pressures or temperatures. From the values of $A\,p\,u$, calculated as above indicated, the value of $u$ for any pressure $p$ may be calculated. The value of $u$ being found for steam, the volume of unit of weight of steam may be ascertained from the formula $v = u + s$, $s$ being the volume of unit of weight of the liquid, and $v$ the volume of unit of weight of the vapor. The value of $s$ is generally so small compared with $u$ for vapors under ordinary temperatures that it may often be neglected, and the value of $u$ in the table taken as the volume of unit of weight of the vapor.

The density of the vapor of water is found from the formula $D = \frac{1}{v} = \frac{1}{u + s}$. The last column of the table gives the densities of saturated steam—*i. e.* the weight of one cubic foot for the pressures given. The value of $u$, or the volume of unit of weight, being found, the density or weight of unit of volume may be determined by the formula $D = \frac{1}{u}$. Values of the density are given in the last column of the table.

*Giving the Heat of the Liquid, the Internal Latent Heat, the External Latent Heat, the Specific Volume, and Specific Weight of 1 pound of Saturated Steam at different pressures.*

| Pressure in atmospheres. | Pressure in pounds per sq. in. | Temp. in degrees Fahr. | Heat of liquids in units of heat. $q$. | Latent internal heat of vapor in units of heat. $\rho$ | External latent heat in units of heat. $Apu$. | Values of cubic feet. | Specific weight in pounds. D. |
|---|---|---|---|---|---|---|---|
| 0.1 | 1.47 | 115.0 | 83.308 | 969.926 | 63.835 | 233.0879 | .0043 |
| 0.2 | 2.94 | 141.0 | 109.060 | 949.651 | 66.175 | 120.8162 | .0083 |
| 0.3 | 4.41 | 157.0 | 125.437 | 936.779 | 67.633 | 82.3180 | .0121 |
| 0.4 | 5.88 | 169.4 | 137.698 | 927.155 | 68.708 | 62.7204 | .0159 |
| 0.5 | 7.35 | 178.9 | 147.631 | 919.381 | 69.547 | 50.7880 | .0197 |
| 0.6 | 8.82 | 187.6 | 155.992 | 912.818 | 70.281 | 42.7705 | .0234 |
| 0.7 | 10.29 | 194.6 | 163.267 | 907.123 | 70.897 | 36.9812 | .0270 |
| 0.8 | 11.76 | 201.8 | 169.747 | 902.054 | 71.438 | 32.6065 | .0307 |
| 0.9 | 13.23 | 206.8 | 175.577 | 897.498 | 71.923 | 29.1800 | .0343 |
| 1.0 | 14.70 | 212.0 | 180.900 | 893.340 | 72.360 | 26.4216 | .0378 |
| 1.1 | 16.17 | 216.8 | 185.789 | 889.524 | 72.758 | 24.1517 | .0414 |
| 1.2 | 17.64 | 221.4 | 190.332 | 885.978 | 73.127 | 22.2519 | .0449 |
| 1.3 | 19.11 | 225.6 | 194.587 | 882.661 | 73.469 | 20.6356 | .0484 |
| 1.4 | 20.58 | 229.5 | 198.569 | 879.557 | 73.787 | 19.2451 | .0519 |
| 1.5 | 22.05 | 233.1 | 202.334 | 876.625 | 74.086 | 18.0341 | .0554 |
| 1.6 | 23.52 | 236.6 | 205.900 | 873.848 | 74.367 | 16.9720 | .0589 |
| 1.7 | 24.99 | 240.0 | 209.284 | 871.214 | 74.633 | 16.0301 | .0623 |
| 1.8 | 26.46 | 243.2 | 212.506 | 868.709 | 74.884 | 15.1907 | .0658 |
| 1.9 | 27.93 | 246.2 | 215.602 | 866.302 | 75.121 | 14.4362 | .0692 |
| 2.0 | 29.40 | 249.1 | 218.551 | 864.009 | 75.350 | 13.7570 | .0726 |
| 2.1 | 30.87 | 251.9 | 221.391 | 861.802 | 75.566 | 13.1387 | .0760 |
| 2.2 | 32.34 | 254.5 | 224.123 | 859.682 | 75.773 | 12.5764 | .0794 |
| 2.3 | 33.81 | 257.1 | 226.746 | 857.646 | 75.973 | 12.0606 | .0828 |
| 2.4 | 35.28 | 259.6 | 229.295 | 855.666 | 76.165 | 11.5881 | .0862 |
| 2.5 | 36.75 | 262.0 | 231.755 | 853.758 | 76.349 | 11.1508 | .0896 |
| 2.6 | 38.22 | 264.4 | 234.142 | 851.908 | 76.527 | 10.7471 | .0929 |
| 2.7 | 39.69 | 266.6 | 236.437 | 850.127 | 76.698 | 10.3722 | .0963 |
| 2.8 | 41.16 | 268.8 | 238.678 | 848.390 | 76.864 | 10.0230 | .0996 |
| 2.9 | 42.63 | 271.0 | 240.865 | 846.697 | 77.024 | 9.6978 | .1029 |
| 3.0 | 44.10 | 273.1 | 242.980 | 845.052 | 77.177 | 9.3935 | .1063 |
| 3.1 | 45.57 | 275.0 | 245.039 | 843.464 | 77.328 | 9.1084 | .1096 |
| 3.2 | 47.04 | 277.0 | 247.045 | 841.912 | 77.472 | 8.8392 | .1129 |
| 3.3 | 48.51 | 278.9 | 249.014 | 840.389 | 77.614 | 8.5877 | .1162 |
| 3.4 | 49.98 | 280.8 | 250.927 | 838.908 | 77.753 | 8.3507 | .1195 |
| 3.5 | 51.45 | 282.6 | 252.788 | 837.470 | 77.884 | 8.1248 | .1228 |
| 3.6 | 52.92 | 284.4 | 254.610 | 836.060 | 78.016 | 7.9133 | .1261 |
| 3.7 | 54.39 | 286.2 | 256.415 | 834.665 | 78.143 | 7.7115 | .1294 |
| 3.8 | 55.86 | 287.9 | 258.149 | 833.326 | 78.264 | 7.5209 | .1327 |
| 3.9 | 57.33 | 289.6 | 259.862 | 832.003 | 78.386 | 7.3383 | .1360 |
| 4.0 | 58.80 | 291.2 | 261.558 | 830.693 | 78.505 | 7.1669 | .1392 |
| 4.1 | 60.27 | 292.8 | 263.200 | 829.426 | 78.619 | 7.0019 | .1425 |
| 4.2 | 61.74 | 294.4 | 264.805 | 828.187 | 78.730 | 6.8449 | .1458 |
| 4.3 | 63.21 | 295.9 | 266.373 | 826.976 | 78.838 | 6.6943 | .1490 |
| 4.4 | 64.68 | 297.4 | 267.943 | 825.766 | 78.946 | 6.5517 | .1523 |
| 4.5 | 66.15 | 298.9 | 269.474 | 824.583 | 79.052 | 6.4140 | .1555 |
| 4.6 | 67.62 | 300.4 | 270.970 | 823.432 | 79.155 | 6.2826 | .1587 |
| 4.7 | 69.09 | 301.8 | 272.448 | 822.292 | 79.254 | 6.1577 | .1620 |
| 4.8 | 70.56 | 303.2 | 273.908 | 821.167 | 79.353 | 6.0359 | .1652 |
| 4.9 | 72.03 | 304.6 | 275.330 | 820.071 | 79.450 | 5.9206 | .1685 |
| 5.0 | 73.50 | 306.0 | 276.734 | 818.989 | 79.546 | 5.8085 | .1717 |
| 5.1 | 74.97 | 307.4 | 278.122 | 817.922 | 79.637 | 5.7011 | .1749 |
| 5.2 | 76.44 | 308.7 | 279.472 | 816.881 | 79.727 | 5.8986 | .1781 |
| 5.3 | 77.91 | 310.0 | 280.822 | 815.843 | 79.817 | 5.4993 | .1813 |
| 5.4 | 79.38 | 311.3 | 282.134 | 814.831 | 79.905 | 5.4032 | .1845 |
| 5.5 | 80.85 | 312.5 | 283.448 | 813.821 | 79.994 | 5.3103 | .1877 |
| 5.6 | 82.32 | 313.8 | 234.726 | 812.839 | 80.077 | 5.1725 | .1909 |
| 5.7 | 83.79 | 315.0 | 285.984 | 811.870 | 80.159 | 5.1341 | .1941 |
| 5.8 | 85.26 | 316.2 | 287.242 | 810.902 | 80.242 | 5.0508 | .1973 |
| 5.9 | 86.73 | 317.4 | 288.466 | 809.962 | 80.321 | 4.9707 | .2005 |
| 6.0 | 88.20 | 318.6 | 289.688 | 809.023 | 80.401 | 4.8922 | .2037 |
| 6.1 | 89.67 | 319.8 | 290.893 | 808.997 | 80.478 | 4.8169 | .2069 |
| 6.2 | 91.14 | 320.9 | 292.059 | 807.199 | 80.555 | 4.7448 | .2101 |
| 6.3 | 92.61 | 322.0 | 293.247 | 806.288 | 80.629 | 4.6727 | .2133 |
| 6.4 | 94.08 | 323.2 | 294.395 | 805.406 | 80.705 | 4.6038 | .2164 |
| 6.5 | 95.55 | 324.3 | 295.526 | 804.537 | 80.777 | 4.5382 | .2196 |
| 6.6 | 97.02 | 325.4 | 296.658 | 803.669 | 80.849 | 4.4725 | .2228 |
| 6.7 | 98.49 | 326.4 | 297.770 | 802.814 | 80.921 | 4.4100 | .2259 |
| 6.8 | 99.96 | 327.5 | 298.885 | 801.961 | 80.989 | 4.3491 | .2291 |
| 6.9 | 101.43 | 328.5 | 299.961 | 801.135 | 81.058 | 4.2899 | .2323 |
| 7.0 | 102.90 | 329.6 | 301.037 | 800.309 | 81.126 | 4.2322 | .2354 |
| 7.25 | 106.575 | 332.1 | 303.692 | 798.273 | 81.292 | 4.0944 | .2433 |
| 7.50 | 110.250 | 334.6 | 306.256 | 796.307 | 81.450 | 3.9647 | .2512 |
| 7.75 | 113.925 | 337.1 | 308.763 | 794.385 | 81.607 | 3.8445 | .2590 |
| 8.00 | 117.600 | 339.4 | 311.198 | 792.520 | 81.756 | 3.7308 | .2668 |
| 8.25 | 121.275 | 341.7 | 313.598 | 790.684 | 81.902 | 3.6251 | .2747 |
| 8.50 | 124.950 | 344.0 | 315.925 | 788.904 | 82.040 | 3.5242 | .2825 |
| 8.75 | 128.625 | 346.2 | 318.195 | 787.167 | 82.177 | 3.4296 | .2903 |
| 9.00 | 132.300 | 348.4 | 320.431 | 785.459 | 82.309 | 3.3399 | .2980 |
| 9.25 | 135.975 | 350.5 | 322.610 | 783.792 | 82.436 | 3.2534 | .3058 |
| 9.50 | 139.650 | 352.5 | 324.734 | 782.170 | 82.562 | 3.1733 | .3135 |
| 9.75 | 143.325 | 354.6 | 326.842 | 780.561 | 82.683 | 3.0965 | .3213 |
| 10.00 | 147.000 | 356.6 | 328.894 | 778.995 | 82.802 | 3.0228 | .3290 |
| 10.25 | 150.675 | 358.5 | 330.890 | 777.470 | 82.915 | 2.9539 | .3367 |
| 10.50 | 154.350 | 360.4 | 332.869 | 775.962 | 83.029 | 2.8866 | .3444 |
| 10.75 | 158.025 | 362.3 | 334.809 | 774.481 | 83.140 | 2.8241 | .3521 |
| 11.00 | 161.700 | 364.1 | 336.717 | 773.028 | 83.245 | 2.7633 | .3598 |
| 11.25 | 165.375 | 365.9 | 338.603 | 771.590 | 83.351 | 2.7056 | .3675 |
| 11.50 | 169.050 | 367.7 | 340.436 | 770.195 | 83.452 | 2.6495 | .3751 |
| 11.75 | 172.725 | 369.4 | 342.250 | 768.814 | 83.551 | 2.5967 | .3828 |
| 12.00 | 176.400 | 371.2 | 344.027 | 767.462 | 83.648 | 2.5454 | .3904 |
| 12.25 | 180.075 | 372.8 | 345.787 | 766.123 | 83.743 | 2.4957 | .3981 |
| 12.50 | 183.750 | 374.5 | 347.508 | 764.813 | 83.837 | 2.4493 | .4057 |
| 12.75 | 187.425 | 376.1 | 349.213 | 763.555 | 83.927 | 2.4028 | .4133 |
| 13.00 | 191.100 | 377.8 | 350.899 | 762.237 | 84.017 | 2.3596 | .4209 |
| 13.25 | 194.775 | 379.4 | 352.548 | 760.984 | 84.103 | 2.3179 | .4285 |
| 13.50 | 198.450 | 380.9 | 354.179 | 759.744 | 84.190 | 2.2763 | .4361 |
| 13.75 | 202.125 | 382.5 | 355.792 | 758.520 | 84.272 | 2.2378 | .4437 |
| 14.00 | 205.800 | 484.0 | 357.367 | 757.325 | 84.355 | 2.1994 | .4512 |

In the foregoing table the quantities refer to one pound of saturated steam, English units of heat, and Fahrenheit degrees of temperature. The first column gives the pressure in atmospheres; the second in pounds per square inch; the third the corresponding temperatures; the fourth the value of $q$, or heat required to raise one pound of water from 32° to the temperature given; the fifth column gives the value of $\rho$, the heat required to overcome the molecular attractions in the evaporation; the sixth column, the value of A $p$ $u$, the external latent heat, or external work in units of heat required to expand the vapor against the pressure $p$ given in the first column from the volume of one pound of water to the volume of one pound of the mixture of steam and water produced; the seventh column gives the values of $u$ at the given pressure; and the eighth column the weight of one pound of steam at the given pressure, or specific weight. The total heat of evaporation—*i. e.* the heat required to raise one pound of water from 32° to the temperature of evaporation, and evaporate it at that temperature—may be found for any temperature and pressure by adding together the quantities opposite that temperature in columns 4, 5, and 6. Thus, to find the total heat of evaporation of one pound of water from 32° at 212°, the table gives—

$q =$ 180.900
$\rho =$ 893.340
A $p$ $u =$ 72.360
Total = 1146.600

The corresponding quantities for 356.6°, or 10 atmospheres, are—

328.894
778.995
82.802
1190.691
1146.600
Difference, 44.091

showing that it requires 44.091 more units of heat in the second case. If from the first quantity, 1146.600, we subtract 180, the approximate number of units of heat required to heat water from 32° to 212°, we obtain 966.6, the latent heat of evaporation of one pound of water at 212°. The weight of a cubic foot of water being 62.5 pounds, the volume of one pound will be $\frac{1}{62.5}$ cubic feet = 0.016 cubic feet. This quantity added to any value of $u$ given in the table will give the specific volume of steam at the corresponding temperature, or the volume of *one pound* of steam at that temperature. This constant quantity to be added is so small that it is evident that for approximate estimates the quantities $u$ in the table may be taken directly as the volumes of one pound of steam. At eight atmospheres, for instance, the value of $u$ is 3.7308 cubic feet; adding 0.016, the exact specific volume is 3.747 cubic feet; the difference being in all cases $\frac{16}{1000}$ths of a cubic foot.

W. P. Trowbridge.

**Steamboat.** See Steam Vessels.

**Steam'boat Rock,** p.-v., Clay tp., Hardin co., Ia., on Central Iowa R. R.

**Steam'burg,** p.-v., Cold Spring tp., Cattaraugus co., N. Y., on Atlantic and Great Western R. R., near Alleghany River.

**Steam-Carriage.** See Locomotive, by P. Barnes, and Railroads, by Col. J. W. Adams, C. E.

**Steam'-Engine.** The steam-engine may be defined to be a prime mover or motor in which the force of heat is caused to perform useful work through the medium of steam. The most simple form of the apparatus possible embraces at least two distinct organs—one for the production and supply of the steam, called the *boiler*, and the other for the utilization of the steam, called the *engine*. These two organs are in one sense inseparable: there can be no steam-engine without a boiler of some form, and any mechanical device by which steam is made to perform work continuously must be connected with the source of supply, the boiler. These two organs are nevertheless so different in their functions that in a theoretical or scientific point of view they are constructed on quite different principles, and, practically, the only necessary physical or material connection between them consists of a pipe or conduit for the supply of the steam to the engine. The boiler and engine may each have different forms independently of the other, and they may be set up or established separately on different foundations, or they may be combined in one structure. They may therefore be described separately. It is only when the action of the heat of the steam is to be investigated, from the moment that water is injected into the boiler until it has passed through its various transformations, that it is necessary to consider the two as forming one apparatus.

The engine consists of two essential, and to some extent independent, combinations of mechanism—the *cylinder*, with its *piston* and *piston-rod*, its *connecting-rod* and *crank*, by means of which the elastic force of the steam is caused to produce a motion against the useful resistances to be overcome; and the *valve-gearing*, by which the proper distribution of the steam is made to and from the cylinder at certain periods of the motion of the piston. A third organ is often attached to the engine or connected with it by a pipe, called the *condenser*, which performs a special and important office when it is employed, its introduction giving rise to a general classification of engines into *non-condensing* and *condensing* engines, the distinction in the action of the engines as far as the steam is concerned being that in non-condensing engines the steam after having performed its work in the cylinder is ejected from the cylinder into the atmosphere, and is there dissipated; while in condensing engines the steam is exhausted into the condenser, where the condensation is effected by cold water supplied to the condenser, and the condensed steam may be resupplied to the boiler. In such an arrangement, where the condenser is of the kind called a surface condenser, the cooling water does not become mixed with the condensed steam, and the latter may be pumped directly back to the boiler. In such cases the same mass of water may be employed continuously without the introduction of water from an external source. The steam-engine as a whole will then consist of the following parts: the *boiler*, with its *attachments;* the *cylinder*, with its *valve-gear;* the *condenser*, and the necessary *feed* and *circulating pumps*. There are also often combined with the apparatus certain regulators of the motion, such as fly-wheels in stationary engines for regulating the momentary resistances against which the elastic force acts; and governors, for controlling the flow of steam to the cylinder, and thus regulating the average pressure of the steam on the piston. The fly-wheel in such cases is often made in the form of a band-pulley for transmitting the power of the engine to other machines. These various parts may be considered separately, and afterward in various combinations; and finally there will remain to be considered the application of the theory of heat to the steam as it passes through the engine, and the mode of estimating the power.

*The Boiler.*—To whatever use heat is to be applied through the medium of steam, the apparatus for generating and retaining the steam is constructed on the same general principles for all purposes, and is popularly termed a *boiler*. It may be described in general terms as a closed metallic vessel, kept partly filled with water, with arrangements for imparting heat to the water by means of the combustion of fuel. The steam generated is confined in the vessel above the water until it is required for use, when it is drawn off through pipes. This metallic vessel, with its compartments and openings, takes the name of "boiler" in the shops where it is manufactured. But in many classes or forms of boilers the steam-generating apparatus is not complete until the boiler is set up in brickwork, with an external furnace constructed for the combustion of the fuel, and external flues made for conducting the heated gases to the chimney along the sides of the boiler. In others the boiler is ready for use as it comes from the manufacturer, having within its external shell all these necessary arrangements for combustion and draught. In all cases certain adjuncts and appurtenances are necessary, such as the feed-pump or other means of supplying water, with the necessary pipes and attachments, the safety-valve, the steam and water-gauges, and grate-bars for the furnace. So that a complete steam-generating apparatus requires something more than the simple vessel which constitutes its principal and important feature. For the mere exhibition of the principal phenomena connected with the generation of steam such a vessel of the most simple form and construction might be sufficient.

But connected with its uses as an instrument of industrial economy it has become an object deserving and requiring the most thorough and critical study. The primary conditions which steam-generators should fulfil are—(1) strength to sustain the internal pressures to which they will be subjected; (2) durability; (3) economy or efficiency in evaporating qualities; (4) economy of construction in materials and workmanship; (5) adaptation to the particular circumstances of their use. (6) To these conditions must be added safety, which depends on form, construction, strength, and qualities of materials, as well as upon management.

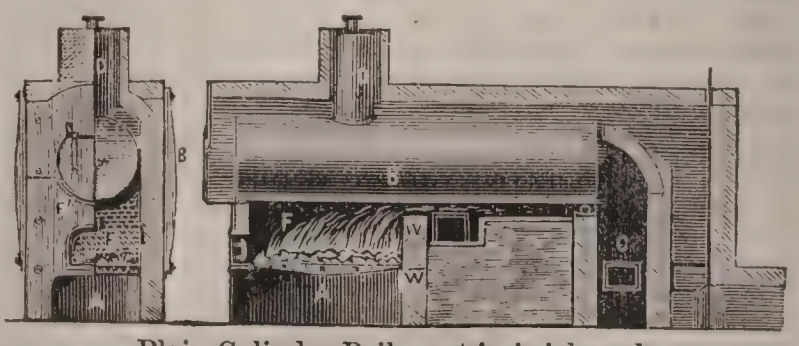
The first condition—strength to sustain the internal pressures—requires the consideration of the materials to be employed, the statical pressures or strains to which these materials will be subjected, and the proper forms and devices to resist those strains. The condition of durability involves the action of these materials, and their preservation under the varying influences of heat, pressure, and the chemical reactions to which they will be subjected in use. Economy in evaporative qualities calls for such arrangements for the combustion of fuel and the transfer of heat as shall utilize the greatest possible proportion of the heat which is evolved by the combustion of the fuel. Economy in materials and construction requires the employment of the least amount of costly materials, and the least labor in the construction, that shall be consistent with the other conditions. Adaptation to various uses gives rise to various forms, in which the special use controls or modifies to some extent some of the other conditions; while safety of life and property demands that strength of parts, quality of materials, excellence of workmanship, and skilful management shall not only meet the requirements of economy, durability, and adaptation, but shall place beyond contingencies, as far as possible, the occurrence of explosions. As far as they relate to construction alone, the conditions of *economy* and *safety* stand, to a certain extent, in constant antagonism, the least amount of material that will bear the internal pressures being the extreme limit of economy of construction, while a near approach to this limit is always attended by excessive risk. But as true economy includes permanence and durability under continuous use, it may be said that all the essential conditions are involved in *strength, economy of construction and use, durability,* and *adaptation*.

In regard to forms and adaptation to various uses, boilers may be classified under a few types, which serve to illustrate not only general principles of construction, but the adaptability of the various forms to particular circumstances of use. Considered merely in reference to strength and internal capacity, combined with the least weight of material, the spherical form is that which fulfils the theoretical requirements of strength and safety. A vessel of this form possesses the advantage, in regard to strength, that every point of the shell or external envelope is exposed to a strain of extension. No cross-strain is produced in any part of the material, and no distortion can occur from the internal pressures. The spherical form is not, however, the best adapted for the application of heat externally, nor is it the form of cheapest construction. Those conditions are obtained by modifying this form and extending it to the cylindrical shape, which gives the same advantages in transforming all the strains into tangential strains, while it permits of the most extensive variety of arrangements for the application of heat. The cylinder, whether it be used for the exterior shell of the boiler, in which it is subjected to internal pressures, or for the flues or tubes required for the flow of the gases to the chimney, or for the liquid circulation, is the form best adapted for cheapness of construction, strength, permanence of shape under both internal and external pressures, and for the flow of fluids; and it thus forms a basis for nearly all constructions, modifications or departures from this form being adopted only in exceptional cases, such as the boilers of steam-vessels, where the figure of the external shell is often adapted to the position and space available.

The most common types of steam-generators may be arranged under the following designations: (1) The plain cylinder boiler; (2) the cylinder-flue boiler; (3) the cylinder-tubular boiler; (4) the return-flue boiler; (5) the return-tubular boiler; (6) the water-tube boiler; (7) the locomotive boiler; (8) the sectional boiler. Each of these types appears under various forms, and the modifications often present such peculiar and distinct characteristics that they would scarcely be classed with either of the above-named types. But for a general discussion these forms comprehend the largest proportion of boilers at present in use, or which have been in use during the last quarter of a century.

The plain cylinder boiler (B, Fig. 1), as it comes from the manufacturer's hands, is a plain cylinder, formed of

FIG. 1.



Plain Cylinder Boiler set in brickwork.

wrought-iron plates of $\frac{3}{16}$ to $\frac{1}{2}$ inch thickness, according to the size of the boiler, the ends of the cylinder being closed by cast-iron heads or by wrought-iron plates hammered into the form of a segment of a sphere. The plates forming the body of the cylinder are shaped to a cylindrical form in a

cold state by rollers, the sections thus formed being riveted together longitudinally, and afterward joined end to end. The cylinder is surmounted at some point by a cylindrical chamber, called the *steam-dome* or steam-drum, which is closed at the top by a cast- or wrought-iron head, on which the castings for attaching the steam-pipes and the safety-valve are usually fitted. This cylindrical structure is called in the shops a boiler, but the complete apparatus to which this term appropriately belongs requires other parts, which, for this class of boilers, is usually supplied by the brick-work setting in which it is mounted. Fig. 1 represents a cylinder boiler set in brickwork. The front end of the cylinder rests upon a cast-iron frame, called the *front*, shown in section and partly in the end elevation of the figure. The rear end of the cylinder rests upon a brick wall, a roller being placed under this end to permit a slight movement when the cylinder expands or contracts, the object being to prevent the shattering or breaking of the walls by the expansions and contractions when the boiler is alternately heated and cooled.

The setting of a boiler of this character consists usually of a chamber formed by the iron *boiler-front*, two side walls, and a rear closing wall of brick. The side walls are built up parallel to each other, as shown in the longitudinal section and end view, at a distance from each other a little greater than the diameter of the shell of the boiler. These walls are held together by clamps, connected at the top and bottom by long bolts, as shown at B in the end view. The space underneath the boiler-shell is divided into two portions by a wall called the *bridge-wall* W. The chamber in front of the bridge-wall is devoted to the combustion of the fuel, and is called the *furnace-chamber*. This chamber is divided by the grate into two chambers, the upper being the *furnace* and the lower the *ash-pit*. The upper part of the bridge-wall extends nearly to the shell of the boiler, the top being finished in a cylindrical form, as shown at F in the end view. This upper portion is called the *bridge*. It is usually made of fire-bricks, and its office is twofold—to furnish a rear wall to the furnace, and to contract the entrance to the flue to the area proper or suitable for the most efficient draught. The chamber in rear of the bridge-wall is contracted into a flue by solid filling up nearly to the surface of the cylinder. The furnace F extends from the front back to the bridge-wall. In this class of boilers the width of the furnace is generally equal to the distance between the side walls, and the depth or distance from the front to the bridge is determined by the conveniences of firing, being usually from 4 to 7 feet. The main flue underneath the boiler terminates in a chamber C, which is connected with the bottom of the chimney. This chamber takes the general name of connection, or smoke-connection. The chimney may be connected with the smoke-connection or chamber directly, or it may be isolated and connected through another flue or conduit. The chimney is a vertical flue, the object of which is usually twofold—viz. (1) to cause a draught or supply of air through the furnace, in which its functions are those of a machine operated by the heat of the gases; and (2) to carry off the products of combustion beyond hurtful or disagreeable proximity.

The principal parts of the plain cylinder boiler, which are also represented wholly or in part in nearly all boilers under the same names, are: (1) The *shell*, or external envelope. (2) The *furnace*, F, the chamber in which combustion takes place. (3) The *flue* or flues, the passages for the heated gases to the chimney. (4) The *bridge*, or rear wall of the furnace, which forms, with the shell of the boiler above it, the boundary of the *draught-area*. (5) The *ash-pit*, the bottom part of the furnace-chamber, which serves as a receptacle for the ashes and cinders, and also as an entrance for air underneath the grate. (6) The *grate*, which is composed of *grate-bars* or *fire-bars*, forming the bottom of the furnace on which the fuel is laid. (7) The *furnace door*. (8) The *ash-pit door*. (9) The *combustion-chamber*. This is an enlargement of the main flue in rear of the bridge, formed by dropping the bottom of this flue a few inches. This part of the main flue is often called the *combustion*-chamber, under the assumption that the combustion of the volatile portions of the fuel is not completed in the furnace, and that an enlargement of this flue into a sort of chamber favors a more thorough mixing of the air and the volatile or combustible gases, and thus produces complete combustion. This is perhaps true where air is admitted by a special arrangement behind the bridge or through holes in the furnace door. When bituminous coal, or fuel containing a large quantity of volatile matter, is used, some such arrangement for burning the volatile matters should be made. (10) The *smoke-box* or smoke-connection is more important in some other classes of boilers than in the plain cylinder boiler, as will appear in the description of those boilers. (11) The *steam-dome* is a vertical chamber set upon the upper surface of the shell, and communicating with it freely through holes in the shell or through a single large aperture, the object of which is to furnish a chamber for the steam above the steam-space, in which the steam, being removed as far as possible from the liquid water in the boiler, and being in a quiescent state, any particles of water which are carried up with the steam may be separated by precipitation. In some boilers, especially those for marine purposes, this dome takes the form of an annular space, which is traversed by the smoke-stack or chimney, and is then called the *steam-chimney*. (12) *Water-room* and *steam-room*. The interior of the shell of the boiler is divided by the surface of the water into two spaces, called the *water-room* and *steam-room*, or water-space and steam-space; all the space occupied by water below the water-level being water-space, and the space or spaces above the water-level, including the *steam-dome*, being steam-room. The water-room of a plain cylinder boiler occupies about three-fourths of the whole space, and generally in other boilers about three-fourths of the internal capacity of the shell when the water is at its mean level. (13) *Man-holes, hand-holes*. It is important in the management of boilers to examine all accessible parts frequently, and accessibility to every part is a fundamental principle of construction, not only for cleaning, but for facilitating repairs. *Man-holes* are apertures left in the shell, and closed by strong plates which can be removed at will, the opening being large enough to admit a man. *Hand-holes* are smaller openings, generally near the bottom, which answer the purpose of cleaning by means of tools. (14) *Heating-surface*. In all boilers portions of the iron plates which form the shell, flues, or tubes are exposed on one side to the heat of the furnace, or the heat of the gases in their course to the chimney, and on the other side to the contact of the water or steam, the transfer of heat being from the furnace and flues to the water through these portions of the iron structure. A heating-surface in a steam-generator may therefore be defined to be any surface which acts as a medium for the transfer of heat from the furnace or gases to the water or steam within the boiler. The *efficiency* of such a surface depends on the difference between the temperatures of the furnace or gases and the water, and the thorough and rapid circulation of the fluids and gases in contact with the surfaces.

Several adjuncts or appurtenances are needed to give efficiency and safety to the boiler—viz.:

(15) The *feed apparatus*, which is composed of a pump, an injector or other device, with the necessary pipes for supplying water to the boiler. (16) The *safety-valve*, a valve opening outward, and so adjusted and arranged that it will be opened by the internal pressure of the steam when that pressure exceeds a given amount per square inch. (17) The *steam-gauge*, an instrument which exhibits at all times to the eye of the engineer or stoker the pressure of the steam in the boiler. (18) *Water-gauges* and *gauge-cocks*, which are intended to show at any instant the level of the water within the boiler. (19) The *low-water detector*, an instrument attached to many boilers, by means of which an alarm is given if the water falls below a given point. To these "fittings," as they are sometimes called, may be added also the necessary stoker's tools for feeding and managing the furnace, cleaning the flues and tubes, and removing ashes and clinker.

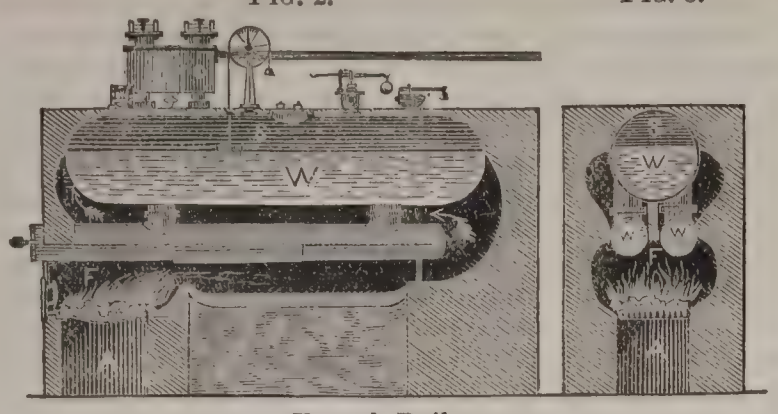
These descriptions of the various parts are applicable to all steam-generators, and, though variously modified, perform the same offices in all. A repetition of the descriptions will therefore be unnecessary in referring to other kinds of boilers, a reference to the plates being sufficient to show the special combinations in each case.

The plain cylinder boiler which has been described is the most simple in construction of all boilers, and for this reason it is often employed where economy of first cost is desirable, and where economy of fuel is a secondary matter. The furnaces and flues are external to the shell. The heating-surface comprises all of the lower part of the cylindrical shell which is exposed to the heat of the furnaces and gases. Its advantages are cheapness of construction, facility of access for repairs, and general simplicity.

*The French Boiler* (Figs. 2 and 3).—A modification of the plain cylinder boiler, called in England the *French boiler*, and also the *elephant boiler*, and in France the *chaudière à bouilleurs*, is much used on the continent of Europe and also to some extent in England. It is seldom seen in this country, although a boiler involving the same principal features is often constructed here for shipment to the West India sugar-plantations. Fig. 2 represents a longitudinal and Fig. 3 a cross-section of this boiler.

*Cylinder-flue Boiler.*—This modification of the cylinder boiler is characterized by an arrangement of one or more internal flues of large diameter running longitudinally within the shell in such a manner that the heated gases pass once through these flues, and once through one or more

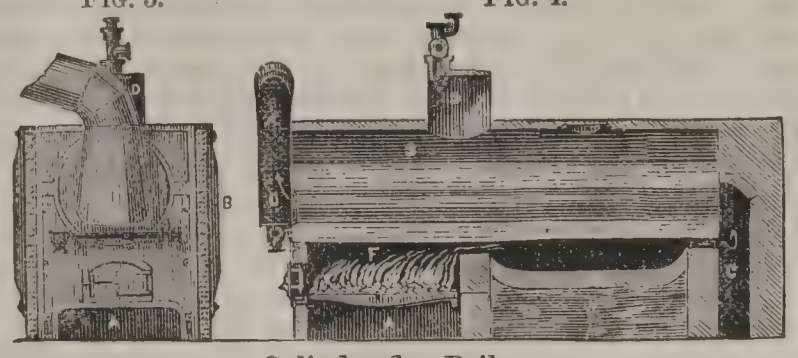
FIG. 2. FIG. 3.



French Boiler.

flues external to the shell. Figs. 4 and 5 give a longitudinal section and an end elevation of a single cylinder-flue boiler, mounted in brickwork.

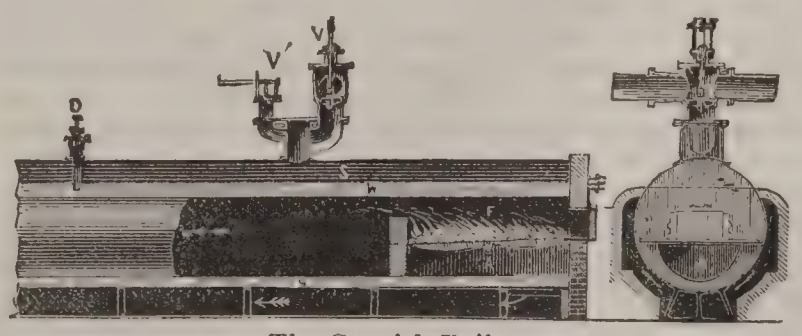
FIG. 5. FIG. 4.



Cylinder-flue Boiler.

*The Cornish Boiler.*—This is a variety of the cylinder-flue boiler which has been long in use in England for stationary engines. It differs from the American boiler of the same class in having an *internal furnace*. The furnace or furnaces are placed within the front end of a large flue,

FIG. 6. FIG. 7.

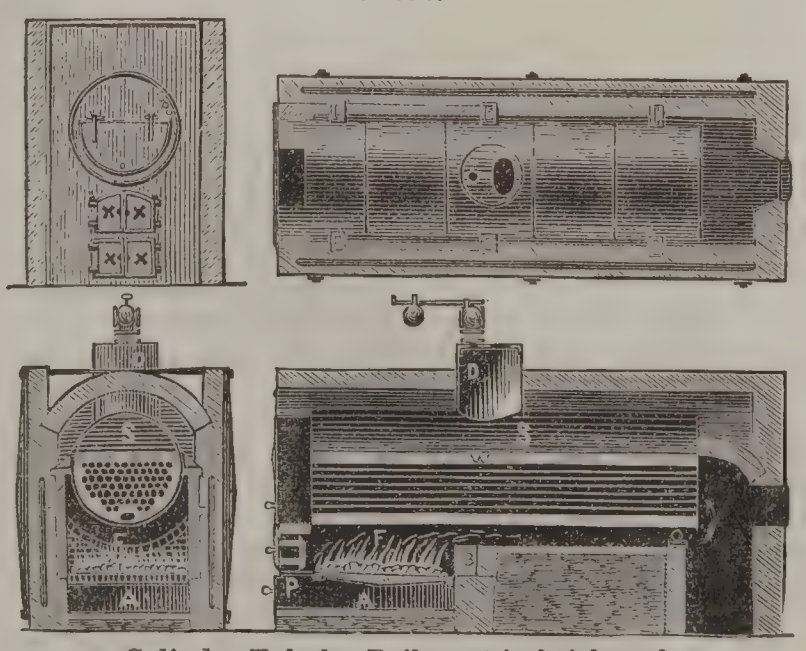


The Cornish Boiler.

which extends through the boiler from the front to the rear end. Figs. 6 and 7 represent a longitudinal section and sectional elevation of the Cornish boiler.

*Cylinder-tubular Boiler.*—Boilers of this class differ so little from the common cylinder-flue boiler described above that they might with propriety be classed with them. They form, however, the basis of a variety of modified forms, and in practice there is a difference between flues and tubes, not only in mechanical construction, but also in the modes of connecting the flues and tubes with the end-plates of the boilers, of which they form parts. Flues differ from tubes in being generally of larger dimensions. They are usually constructed of metallic plates rolled into the cylindrical form and then riveted together, as in the construction of the shell of the plain cylinder boiler. Tubes, on the other hand, are usually constructed by lapping and *welding* the

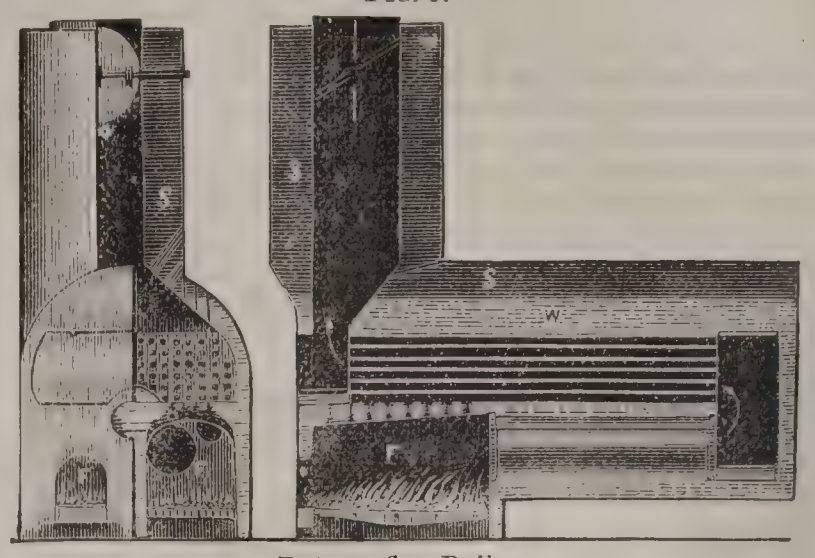
FIG. 8.



Cylinder Tubular Boiler set in brickwork.

edges, instead of riveting them, special machines being used for this purpose. Tubes thus constructed are now made from the smallest form of *pipes* to a diameter of 6 and 8 inches. This form of boiler, with its various modifications, is probably in more universal use at the present day than any other form of cylinder boiler. It constitutes the basis of all *marine tubular* boilers, even where the shell is not cylindrical, and for stationary engines is very extensively used. Fig. 8 represents one of these boilers set in brickwork. Fig. 9 represents varieties of a class of boilers

FIG. 9.

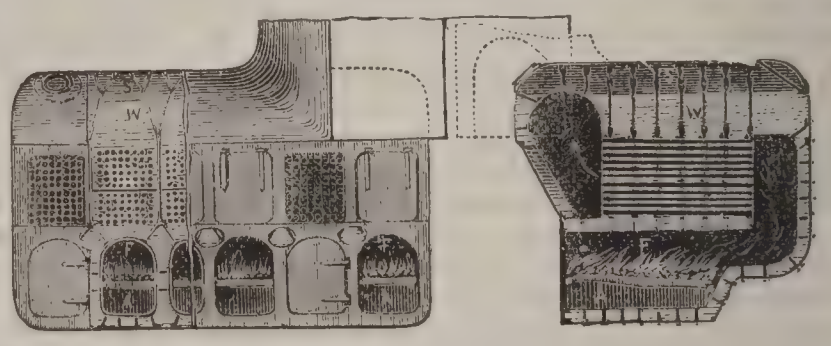


Return-flue Boiler.

which are known as *return-flue boilers*. They were at one time in very general use in steamboats and steamships in this country, and are still employed to some extent. They are characterized by having internal furnaces and internal flues, no external furnaces or brickwork being attached to the boilers. Constructed in this manner, they are ready for use as they come from the hands of the manufacturer. The shell in these boilers is made sufficiently large to receive within it the direct flues from the furnace, from front to rear, and also the return flues, the arrangements being as exhibited in the plate. These boilers having large diameters, it is necessary to strengthen the various parts by stays, as shown in Fig. 11. Around the furnaces the plates are stayed and kept in position by *sockets* and bolts, the sockets acting as struts and the bolts as stays.

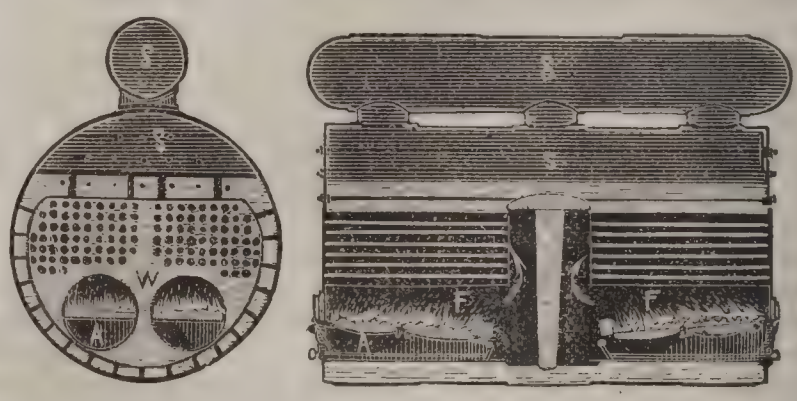
*Marine Tubular Boiler.*—Fig. 10 represents a modifica-

FIG. 10.



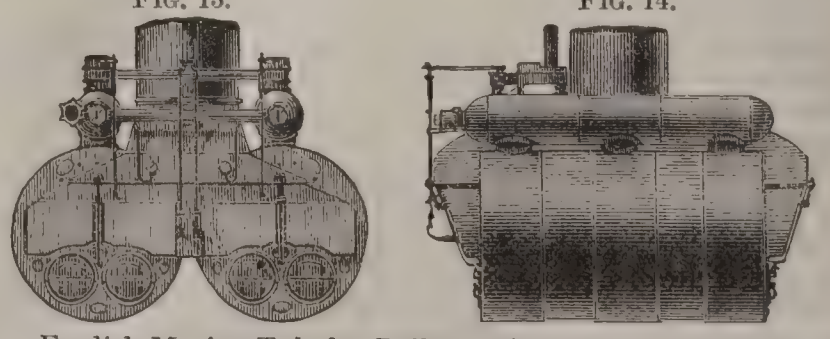
tion of the return-tubular boiler suited to marine purposes. The limitation of space in the hold of a ship renders it necessary to contract the boiler-space as much as possible, and the form of boiler adopted generally is that illustrated in this figure. The arrangement of the furnaces, flues,

FIG. 11. FIG. 12.



tubes, and smoke-connections is as shown in the figure. In boilers of this character each boiler contains several

FIG. 13. FIG. 14.



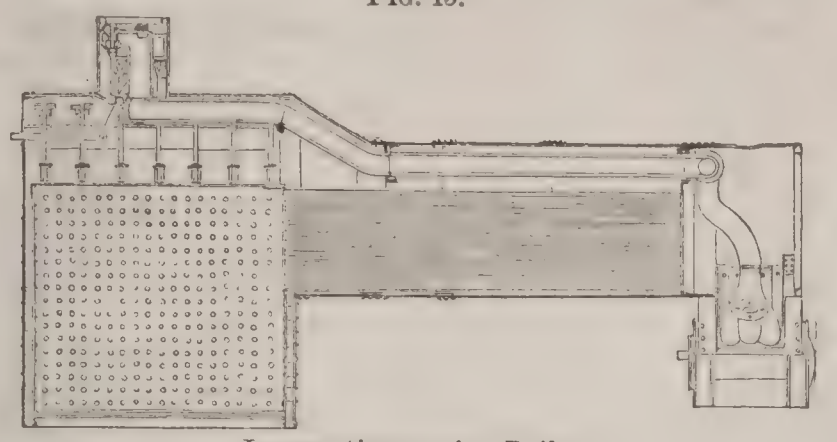
English Marine Tubular Boilers, with cylindrical shells.

furnaces, and two or more boilers are usually set together on opposite sides of the hold of the vessel, in such a man-

ner as to have a common chimney. The peculiar form of the shell is adapted to the space allotted to the boiler along the side of the ship's hold, as is usual in such cases. This form not being cylindrical, it is necessary to brace all flat surfaces which receive pressure. The manner in which this is accomplished is exhibited in the drawing. Figs. 11, 12, 13, and 14 represent a pair of boilers made by English manufacturers for a large steamship furnished with compound engines, the shells being 11 feet in diameter, and the iron of the shell $\frac{7}{8}$ths of an inch thick. These are becoming common in marine constructions, having the advantage of the greatest strength combined with the least material.

*The Locomotive Boiler.*—The railroad locomotive boiler (Fig. 15) presents features peculiar to its adaptation to a

FIG. 15.

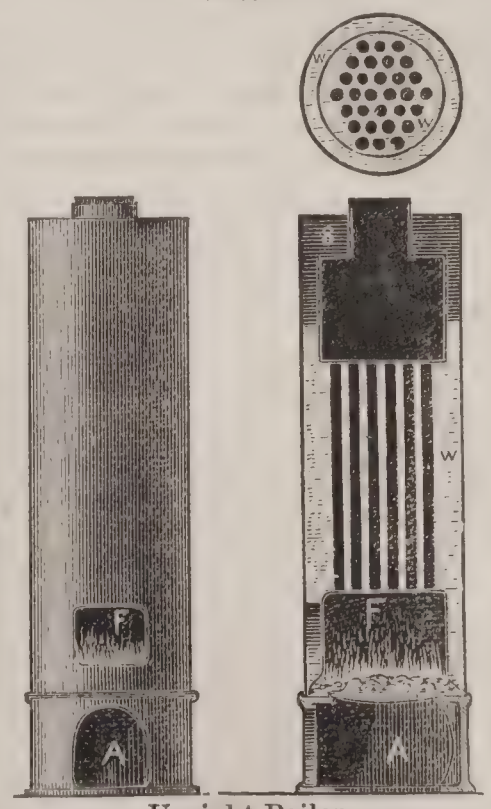


Locomotive-engine Boiler.

particular purpose, but the essential parts of all such boilers are exhibited in the plate. The fire-box is rectangular in cross-section, and the tubes pass directly from the fire-box to the smoke-connection or smoke-box. It will be seen from the construction that the fire-box is an isolated chamber, separated entirely from the sides of the boiler and surrounded by water. The sides and top being flat, and being subjected to external pressure, require to be strongly stayed to the shell. The crown-plate is stayed to the upper part of the shell, and the side-plates and shell are connected by sockets and bolts, the stays acting as struts as well as ties. The shell, dome, and tubes are constructed on the same principles as are applicable to the cylinder-tubular boiler. The heating-surface comprises the interior surface of the fire-box and the interior surfaces of the tubes. The locomotive boiler is the type of a large class of boilers, the distinctive feature of which is that the tubes pass directly from the furnace or fire-box. For railroad engines various modifications are used, each establishment usually having a special form of construction.

A modification of the locomotive boiler, much used for portable and stationary engines, is known as the *upright boiler*, an illustration of which is given in Fig. 16. The simplicity of construction, convenience of access, and small space occupied by these boilers, combined with their evaporative qualities and strength, and combining, as they do, the chimney with natural draught with the upright shell, render them peculiarly adaptable for some conditions of use.

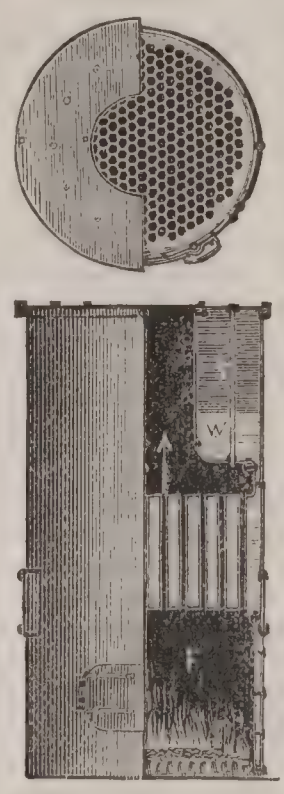
FIG. 16.




Upright Boiler.

A form of this boiler which demands special interest and attention is found in the *fire-engine boiler* represented in Fig. 17. This is essentially an upright boiler of the locomotive type, but its peculiarity consists in the great number of tubes and the great extent of heating-surface, compared with the cubic dimensions and the water-space. To facilitate the sudden and quick raising of steam, the tubes are comparatively thin (usually made of brass or copper). This permits not only the introduction of a larger number in a given space, but the thinness of the tubes lessens the time for the first development of steam. The cut exhibited (Fig. 17) is from a drawing furnished by the Amoskeag Manufacturing Co. of Manchester, N. H. The dimensions of the boiler are as follows: Total height, 5 feet 4 inches; outside diameter, $31\frac{3}{4}$ inches; number of brass tubes, 301; diameter of tubes, $1\frac{1}{4}$ inches; length of tubes, 16 inches; distance from centre to centre of tubes, $1\frac{17}{32}$ inches; heating surface, 157 square feet.

FIG. 17.

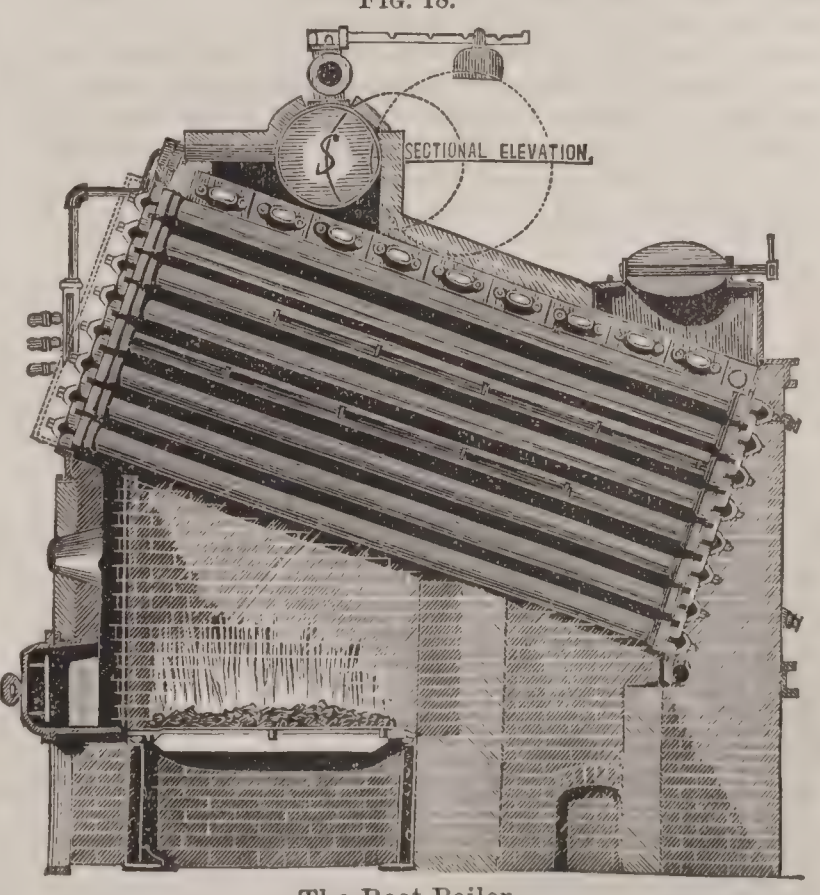



Fire-engine Boiler.

*Sectional Boilers.*—In all types of boilers thus far considered the water- and steam-space is either a single chamber, as in the plain cylinder boiler, or a chamber traversed by tubes, through which, in some cases, the heated gases find their way to the chimney, and in others the circulating water finds its way from one part of the water-space to another, the heated gases passing around the outside of the tubes. The volume of the water is large in proportion to the heating-surface, and the circulation of the water is not confined to prescribed channels. Moreover, an external shell is necessary, which must contain the water and steam, and generally also the system of tubes, this shell being subjected to the whole effect of the steam-pressure.

A system of construction which has come largely into use of late years, and which is becoming more and more advanced toward perfection in its mechanical details, is known in this country by the name of *sectional boilers*, and in France boilers with *rapid circulation* or *water-circulating boilers*. This system may be said to have originated with Mr. Jacob Perkins, who in 1831 obtained a patent in England for improvements in generating steam, in which he insisted on the advantages to be gained by causing the water to circulate rapidly over the heating-surfaces exposed to the direct action of the fire. In 1839, Perkins obtained a patent for a more complete apparatus involving this idea, under the title "apparatus for transmitting heat by circulating water." Steam-generators constructed with special reference to this idea were extensively tried, but were finally abandoned for the reason that, owing to practical difficulties in their construction, the high pressures employed, and the difficulty of keeping them in repair, they soon became unfit for use, and it is only from a comparatively recent date that they have again come into use under more favorable auspices. The *sectional boiler* consists essentially of a system of tubes so arranged that a continuous circulation of the water is maintained through the tubes from the mechanical action arising from some portions of the tubes being maintained at a higher temperature than others, the heated and lighter water ascending and the cooler and heavier water descending. The shell is dispensed with, and the heat applied directly by both radiation and contact to the exterior surfaces of the tubes. The steam-space is usually a large tube or a system of tubes with which the various *sections* of tubes are connected, and the various devices which are found in practical use for connecting and arranging the tubes, so that

FIG. 18.




The Root Boiler.

they shall form a compact arrangement with all the necessary conditions for applying heat, for accessibility, and for

promoting circulation, constitute the *sectional boilers* of the present day, which usually take their names from the inventors or manufacturers. An illustration of one of these boilers, the Root boiler, is given in Fig. 18.

Whatever may be the type of steam-generator selected for a special purpose, the following fundamental considerations are involved in its design and construction: I. Proportion of parts; II. Actual dimensions; III. Kind, quality, and strength of the materials employed, and the mechanical conditions of the structure.

The proper proportions of the parts determine the economy or efficiency of the apparatus; on the actual dimensions depends the capacity for producing steam, or, as it is sometimes expressed, the *power* of the boiler; and on the kind, quality, and strength of the materials employed, and the mechanical perfection of the structure, depend not only the first cost, but also the strength of the structure and its durability. The parts of which the relative proportions require special consideration are those which determine the *combustion of the fuel* and the *transfer of heat*. It is obvious that the first object to be attained is the thorough and complete combustion of the fuel. If any combustible gases or any portion of the fuel in the form of smoke escape from the chimney, a direct loss occurs, which should be prevented if possible. The combustion depends on the means of supplying the draught, and the quantity and disposal of the fuel with which the air comes in contact.

*Chimneys.*—The chimney, in all cases in which the draught is produced by a simple "chimney-draught," performs the functions of a machine, and its dimensions (its height and cross-section), taken in connection with the area of the grate and the surface of contact of the fuel exposed to the action of the air, are the principal elements on which not only complete or perfect combustion, but the quantity of fuel burned in a given time, depend. In boilers provided with any other means of draught, such as the steam-jet or the blower, the dimensions of the chimney are not so important. In almost all stationary, and in nearly all marine boilers, the draught is produced solely by a chimney, which forms an indispensable and important part of the apparatus. The determination of the proper proportions between the heating-surface and the grate-surface depends on the initial temperature of the gases; and as the initial temperature varies with the rate of combustion or the height of the chimney, the height of the chimney indirectly enters into the consideration of this proportion. It is well known that the draught of a chimney is caused by a difference of pressure at the base of the chimney acting in an upward direction, due to the difference between the weight of the heated gases in the chimney and a column of equal height and cross-section of the external air. This difference of pressure is easily found. If we take a unit of area of the cross-section—one square foot, for instance—the weight of the column of external air will be the height of the chimney multiplied by the density of the external air, and the weight of the column of heated gases of equal height will be equal to the height of the chimney multiplied by the density of the *heated gases*. If H be the height of the chimney, D the density of the external air, and D′ the density of the heated gases, the difference of pressure referred to will therefore be, in algebraic symbols, $p = \mathrm{H\,D} - \mathrm{H\,D'} = \mathrm{H(D - D')}$. This unbalanced pressure acts as a motive force to drive the heated gases through the chimney and out at the top. In order to find what height of column of the external air would produce this pressure, acting simply by its weight, we have to divide the pressure by the density of the external air, and will have—

$$\frac{p}{\mathrm{D}} = \mathrm{H}\left(\frac{\mathrm{D} - \mathrm{D'}}{\mathrm{D}}\right).$$

It is a well-known law of dynamics that the theoretical velocity with which the air would enter the chimney if there were no resistance would be found by the equation

$$\mathrm{H}\left(\frac{\mathrm{D} - \mathrm{D'}}{\mathrm{D}}\right) = \frac{v^2}{2g},$$

from which the theoretical velocity of access of external air would be

$$v = \sqrt{2g\,\mathrm{H} \times \left(\frac{\mathrm{D} - \mathrm{D'}}{\mathrm{D}}\right)}.$$

The values of D and D′ may be readily found. If $\mathrm{D_0}$ represent the density or weight of a cubic foot of air at 32° and at atmospheric pressure, the weight at any other temperature will be $\mathrm{D} = \mathrm{D_0} \times \frac{\mathrm{T_0}}{\mathrm{T_1}}$, $\mathrm{T_1}$ being the absolute temperature of the external air generally higher than $\mathrm{T_0}$, the absolute temperature of melting ice. For the weight of a column of the heated gases of the chimney having a base of one square foot, a similar process is to be followed. The results of experiments indicate that the weight of one cubic foot of the chimney gases—composed principally of carbonic acid, nitrogen, and oxygen—is at 32° F. and one atmosphere, 0.08424 pounds. Then $\mathrm{D'} = 0.08424 \times \frac{\mathrm{T_0}}{\mathrm{T_2}}$, $\mathrm{T_0}$ being the absolute temperature of melting ice, and $\mathrm{T_2}$ that of the chimney gases.

The velocity $v$ determined from this formula is not, however, that with which the external air will enter the chimney. Resistance is offered to the passage of air through the grate, through the bed of fuel, and through the flues and chimney. These resistances do not admit of theoretical determination, and can only be found by direct experiment. They are proportional to the square of the actual velocity, and depend on the diameter and length of the flues and chimney, the thickness of the bed of fuel, and the state of division of the fuel. The experiments of Peclèt led him to propose the formula for the actual velocity essentially as given below:

$$v' = \sqrt{2g\,h\left(\frac{\mathrm{D} - \mathrm{D'}}{\mathrm{D}}\right)} \cdot \sqrt{\frac{1}{1 + \mathrm{A} + \frac{\mathrm{K\,L}}{d}\left(\frac{\mathrm{T_2}}{\mathrm{T_1}}\right)^2}}.$$

In Peclèt's formula K represents a coefficient of friction, L and $d$ the length and diameter of the chimney and flues, and A a coefficient of resistance of the grate.

The values of the velocity of access of air found by Peclèt for heights of 10, 20, and 30 mètres, or 32.8 feet, 65.6 feet, and 98.4 feet, were 5.1 feet, 8 feet, and 9.18 feet per second, or 18,360, 28,800, and 32,948 feet per hour. These velocities, divided by the number of cubic feet of air required to burn one pound of fuel, will give the quantity of fuel burned per hour for each square foot of section of the chimney, the section of the chimney being supposed equal to the free surface of the grate. In the ordinary process of combustion in a grate it is apparent that some of the air which enters must escape contact with the fuel and enter the chimney as air. The quantity which thus escapes has been usually assumed equal to the quantity which is required for combustion; or, in other words, the quantity which enters the furnace has been estimated to be double the quantity required for combustion. An ordinary estimate is, however, 250 cubic feet of air for the combustion of one pound of fuel. The consumption of fuel per square foot of section of the chimney will then be, for the heights above given—

| | | | |
|---|---|---|---|
| Heights | 32.8 | 65.6 | 98.4 |
| Pounds | 73.4 | 115.1 | 137.8 |

If it be assumed that each square foot of section of the chimney corresponds to 8 square feet of grate-surface, the above figures will give for the rate of combustion on each square foot of grate surface—

| | | | |
|---|---|---|---|
| Pounds | 9.2 | 14.8 | 17.2 |

These results seem to be the nearest that can be attained by combining theoretical considerations with experimental deductions. The conditions which exist in different chimneys and furnaces in regard to the resistances are so complex and various that no *theoretical* formula will give results which can be considered even approximately correct.

*Showing Heights of Chimneys for producing certain Rates of Combustion per square foot of area of section of the Chimney.*

| Heights in feet. | Pounds of coal burned per hour per square foot of section of chimney. | Pounds of coal burned per hour per square foot of grate, the ratio of grate to section of chimney being 8 to 1. |
|---|---|---|
| 20 | 60 | 7.5 |
| 25 | 68 | 8.5 |
| 30 | 76 | 9.5 |
| 35 | 84 | 10.5 |
| 40 | 93 | 11.6 |
| 45 | 99 | 12.4 |
| 50 | 105 | 13.1 |
| 55 | 111 | 13.8 |
| 60 | 116 | 14.5 |
| 65 | 121 | 15.1 |
| 70 | 126 | 15.8 |
| 75 | 131 | 16.4 |
| 80 | 135 | 16.9 |
| 85 | 139 | 17.4 |
| 90 | 144 | 18.0 |
| 95 | 148 | 18.5 |
| 100 | 152 | 19.0 |
| 105 | 156 | 19.5 |
| 110 | 160 | 20.0 |

A comparison of the results obtained by the partly empirical formula of Peclèt, applied to ordinary conditions of practice, with numerous examples in which the quantity of fuel burned and the dimensions of the chimneys are

given, has led the writer of this article to the suggestion of the preceding practical table of heights and quantities of fuel burned per square foot of section of the chimney per hour. This table is intended only to give approximate quantities; and although instances are given which differ from the table considerably, it is to be borne in mind that in constructing a chimney an excess of height should be chosen, since the draught may be afterward regulated by a damper, and no serious error in choice is likely to occur. It appears from the table that a difference of height of 6 to 8 feet corresponds to a difference in rate of combustion of about one pound per square foot of grate-surface, the ratio of the grate to the chimney section being 8 to 1. The quantities given in the table refer to the average conditions of chimneys of steam-generators.

*Grate-Surface.*—The height of the chimney, taken in connection with the temperature of the heated gases, determines the rate of combustion.

*Heating-Surfaces.*—The heating-surfaces of a boiler have already been defined to be all those surfaces or *plates* of the boiler which serve to transmit heat from the furnace or heated gases to the water or steam within the boiler. From the laws of transfer of heat it appears that the quantity of heat transmitted by any surface depends on the extent of the surface and the difference of temperature between the source of heat and the absorbent; or, in the case of steam-generators, the difference in temperature of the incandescent fuel or heated gases and the water in the boiler. The extent or amount of heating-surface is fixed with reference to the initial temperatures of the furnace and gases; or, since these temperatures are proportional to the rate of combustion, the extent of heating-surface will depend on the *rate of combustion* to be employed. The extent of heating-surface must evidently also be in proportion to the absolute quantity of fuel burned in a given time; or, what is the same thing, it must have a direct relation to the grate-surface.

The following results are taken from the published records of experiments made for the U. S. navy under the direction of Mr. B. F. Isherwood. The first horizontal line represents the quantities of anthracite coal, in pounds, burned on each square foot of grate-surface in a marine tubular boiler, the heating-surface remaining constant and having a ratio of 25 to 1 to the grate-surface. The second horizontal line represents the pounds of water evaporated under atmospheric pressure from 212° F. by one pound of coal:

Pounds of coal burned per hour.

| 6, | 8, | 10, | 12, | 14, | 16, | 18, | 20, | 22, | 24. |
|---|---|---|---|---|---|---|---|---|---|
| 10.5, | 10.4, | 10.1, | 9.5, | 8.9, | 8.2, | 7.7, | 7.3, | 7.0, | 6.8. |

Pounds of water evaporated.

A second series of experiments is furnished by Mr. D. K. Clark in his excellent work on *Railway Machinery*, in which he gives the amounts of evaporation for different *boilers* with varying rates of combustion and varying proportions of heating-surface. The following results are extracted from his work: The first horizontal line of figures gives the quantities of coke burned per hour on each square foot of grate-surface. The second gives the quantities of heating-surface in square feet required to preserve the evaporation constant for each pound of coke, and equal to 9 pounds of water for each pound of coke burned:

Pounds of coke burned on each square foot of grate.

| 14, | 19, | 25, | 31, | 38, | 47, | 56, | 65, | 76, | 87, | 98, | 110, | 125, | 139, | 153. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30, | 35, | 40, | 45, | 50, | 55, | 60, | 65, | 70, | 75, | 80, | 85, | 90, | 95, | 100. |

Heating-surface for each square foot of grate.

These two sets of experimental results serve to show how, in the first place, the economic evaporation varies with the rate of combustion, the heating-surface remaining the same; and in the second, how the heating-surface must vary if the rate of evaporation remains constant.

Inasmuch, however, as it is impossible to vary the heating-surface at will, after a steam-generator is constructed, it is customary to fix the extent of this surface according to average conditions of use, taking into account average rates of combustion. The following proportions represent as near as can be ascertained the usual rules of practice. The grate-surface being 1, the heating-surfaces are for—

| | | |
|---|---|---|
| Plain cylinder boilers | 10 to 15, | average 12. |
| Cornish boilers | 30 to 40, | " 35. |
| French cylinder boilers | 25 to 40, | " 33. |
| Cylinder-flue boilers | 17 to 25, | " 21. |
| Cylinder-tubular boilers (chimney draught) | 25 to 30, | " 28. |
| Traction-engine boilers | | " 32. |
| Marine tubular and flue boilers—French, English, and American practice | | " 25. |
| Locomotive boilers | 40 to 100, | " 75. |

The rates of combustion per hour and per square foot of grate, in ordinary practice, are, according to Rankine—

| | |
|---|---|
| Slowest rate in Cornish boilers | 4 lbs. per hour. |
| Ordinary rate | 10 " " |
| Ordinary rate in factory boilers | 12 to 16 lbs. per hour. |
| Ordinary rate in marine boilers | 16 to 24 " " |
| Locomotive boilers | 40 to 120 " " |

The amount of heating-surface required to evaporate one cubic foot of water per hour at 212° is for—

| | |
|---|---|
| Plain cylinder boilers | 8.8 square feet. |
| Galloway multitubular boiler (water-tube boiler) | 8.5 " |
| Marine tubular boiler | 14 " |
| Double-flue Cornish | 11.7 " |

For these the rate of combustion is such that the total heating-surfaces are sufficient to evaporate 9 pounds of water for 1 pound of coal.

The following conclusions are deduced from Mr. Isherwood's experiments. The boilers of various steamships on which experiments were made, with the results, are indicated by the names of the vessels:

| | | | |
|---|---|---|---|
| Jacob Bell | marine tubular | 19 | 12 | 11 |
| Mt. Vernon | " | 19 | 10.5 | 10.5 |
| Valley City | " | 16 | 11.2 | 9.16 |
| Crusader | " | 16.8 | 11.8 | 9.3 |
| Wyandotte | vert. water-tubes | 20 | 12.4 | 10 |
| Underwriter | hor. flue boilers | 15.6 | 11.2 | 9.9 |
| Young America | " " " | 15 | 10.4 | 9.3 |
| Boston, of N. Y., | marine tubular | 18 | 11.1 | 11.5 |
| | | | | 82.1 |
| | | | | 10.2 |

1st column, Heating-surface required per indicated H. P.; 2d column, water evaporated per hour per pound of combustible; 3d column, combustible in pounds burned per hour per square foot of grate.

The practice of the navy department is to allow 8 pounds of anthracite coal per hour to evaporate 1 cubic foot of water at 212°, under a pressure of 30 pounds per square inch, which requires two-thirds square foot of grate and 16⅔ square feet of heating-surface.

The quantity of water evaporated per pound of coal for the plain cylinder boiler, the cylinder-flue boiler, and the cylinder-tubular boiler, in the order given, is, under the most favorable circumstances, 7, 8, and 9 pounds of water for each pound of coal burned. The railroad locomotive is the only boiler in which the rates of combustion are frequently and greatly varied while in use; and in these boilers it is necessary to provide for very high rates of combustion by giving an extreme amount of heating-surface. The locomotive boiler, with ordinary rates of combustion, corresponds, in evaporative efficiency, to the ordinary marine tubular boiler.

*Causes which affect the Efficiency of Evaporation.*—These are, 1st, those which influence the *rate of combustion*; and, 2d, those which influence the *rate of transfer of heat.* Among the causes which influence the rate of combustion may be mentioned the temperature of the external air, the temperature of the chimney gases, the presence of moisture in the air, the management of the fires, the quality of the fuel, and defective combustion. The principal causes which affect the transfer of heat are the rate of combustion, which determines the initial temperatures in the boiler; the temperature of the water in the boiler; the accumulations of incrustations and dust in the tubes; and generally all those circumstances which impair the qualities of the heating-surfaces. The management of the fires and the quality of coal are most important influences on the rate of combustion and economy of fuel.

*Horse-power of Boilers.*—The term *horse-power* can hardly be applied with propriety to steam-generators, inasmuch as it implies a *rate of work*, and a boiler ordinarily does no work, but merely supplies the means of work to a machine. The amount or rate of work is thus dependent on the utilization of the steam, and must vary with the variations of the machine which utilizes it. Moreover, the application of this term to boilers is especially inappropriate when it is determined solely by the dimensions of the boiler, as is usually the case; a boiler of certain dimensions being spoken of as a boiler of 10-horse power, another of larger dimensions as one of 20-horse power, etc. In reality, a boiler called a 10-horse-power boiler may, according to any rational rule which can be adopted, be made a 20-horse-power boiler by simply increasing the rate of combustion or the pressure of the steam, or both combined. This becomes a matter of some importance when boilers are bought and sold according to their *horse-power*, because in case of dispute it is impossible to attach definite ideas to the terms employed, unless it be at the same time specified what is to be the rate of combustion and the pressure. The rate of combustion is subject to such variable conditions that it is difficult to establish it precisely, and the custom of describing the capacity of boilers by the term *horse-power* is therefore liable to lead to difficulty. In regard to the use of the term, it must be admitted, however, that it is a convenient mode of designating the capacity of land boilers, where *average*

*conditions* of pressure and rate of evaporation are understood. There is, however, a want of uniformity among manufacturers in regard to what amount of heating-surface shall constitute a horse-power with chimney-draughts, the amounts varying from 12 to 18 square feet.

*Kind and Quality of Materials.*—The materials employed in the construction of boilers consist of plates rolled or shaped into the forms necessary for the shell, tube-sheets, and flues; tubes or flues formed by drawing or by lap-welding; rivets for the joints; rods acting as stays; plates or castings for the fronts and doors; and bars for the grates. Where boilers are set in brickwork, it is to be understood that the external work is to be of a character such as will resist the action of heat, as well as prevent its dissipation through radiation and conduction. The materials now universally used for the shell are wrought iron and steel. Cast iron is sometimes employed for the heads of small cylinder boilers and for steam-domes or steam-chambers, but owing to its rapid deterioration under the action of heat it is not a suitable material for heating-surfaces. It is, however, employed largely in the fronts, grate-bars, for attachments for valves and pipes, and for man-hole and hand-hole plates.

*Theory of Stress in Boilers.*—By the term "stress" in applied mechanics is meant the force which acts directly upon the particles of any material to separate them. In boiler construction the adoption of the cylindrical form for the shell and flues or tubes causes this stress to be always a tensile stress on the shell, on flues subjected to internal pressure, and on the stays. The stress is a compressive one on flues or tubes subjected to external pressure, and a shearing stress on rivets. Bending moments are carefully avoided in all parts of the structure. The tensile stress upon the material of a cylindrical shell tending to rupture it longitudinally is found as follows: Let $p$ denote the elastic force of the steam in pounds per square inch, $d$ the diameter of the cylinder, $t$ the thickness of the shell. If we consider unity of length of the cylinder, the total force tending to produce rupture will be $p\,d$, $d$ being expressed in inches. The total resistance of the material will be $2t \times f$, $f$ being the resistance to tension of the material; and the conditions of equilibrium require that

$$pd = 2tf,$$

from which the thickness of the shell is obtained—

$$t = \frac{pd}{2f}.$$

For the same internal pressure and the same material the thickness for different diameters will be proportional to the diameter. For the stress in the direction of the axis of the cylinder, the total pressure in this direction will be $p \times \frac{1}{4}\pi d^2$, and the resistance of the material in the cross-section will be $f \times \pi dt$. Placing these quantities equal to each other, we have—

$$p \times \tfrac{1}{4}\pi d_2 = f\pi dt;$$

or,

$$p\tfrac{1}{4}d = ft,$$

$$t = \frac{p}{4}\frac{d}{f}.$$

This result shows that the area of resistance to rupture in the direction of the axis, *relatively to the total area of pressure*, is double that in the first case; or, in other words, the stress *per square inch* of material in the direction of the axis is only half that which tends to rupture the boiler along a longitudinal plane through the axis. The tenacity $f$ may be taken for the *bursting tension*, the *proof tension*, or the *working tension*. Mr. Fairbairn gives the values of $f$ for wrought iron: bursting tension, 34,000; proof tension, 17,000; working tension, 4250 pounds per square inch. This is equivalent to making the factor of safety 8, which, however, is greater than that usually adopted in practice. It is assumed that the working pressure, multiplied by the factor of safety, will produce rupture. If the working pressure be 60 pounds per square inch, for example, a pressure of 480 pounds per square inch will produce rupture. Ordinary boilers constructed for a working pressure of 60 pounds will hardly bear, before rupture, 480 pounds. Proof-tests of double the working pressure are allowed, although these tests are generally limited to one and a half times the working pressure.

In the construction of boilers the junction of the plates requires special care and attention, inasmuch as the resistance of the joints determines the total resistance. Riveted joints are made in several different modes, the principal of which are the *lap-joint single riveted*, the *lap-joint double riveted*, the *butt-joint single riveted*, and the *butt-joint double riveted*. The stress upon the rivets is a shearing stress. The butt-joint is formed by adjusting the edges of two plates and covering the joint on both sides by covering-plates, riveted with either one or two rows of rivets on each side of the joint.

The order of strength of these joints, in terms of the strength of the original plate, according to Clark, are for plates $\frac{3}{8}$-inch thick and less—

| | | Working strength. |
|---|---|---|
| Original strength of plate* | 100 | 11,000 lbs. per square inch. |
| Single-riveted lap-joint | 60 | 6,700 " " " " |
| Double-riveted lap-joint | 72 | 8,000 " " " " |
| Double-riveted butt-joint | 80 | 9,000 " " " " |

The above figures are given for the best English Yorkshire plates. Fairbairn estimates the strength of joints to be, in terms of the strength of the plate—

| | | | |
|---|---|---|---|
| Strength of plate | 100 | Bursting tension | 34,000 lbs. |
| Double-riveted joint | 70 | Proof tension | 17,000 " |
| Single-riveted joint | 56 | Working tension | 4,250 " |

the working tension being one-eighth of the bursting tension. For cast-iron pipes the working tension may be estimated at one-sixth the bursting tension, and the values of the tenacity in practice may be estimated at

16,500 lbs. per square inch for bursting tension.
5,500 " " " " " proof tension.
2,750 " " " " " working tension.

Welded joints for boilers have been found to possess the same strength as the original plate, but practical difficulties prevent the adoption of this process for ordinary work. The thickness of boiler-plates is practically limited in both directions. Very thin plates cannot be caulked, and very thick plates cannot be riveted. The limits are practically about one-fourth of an inch for the lower limit and three-fourths of an inch for the higher limit. The riveting-machine is essential for very thick plates, a thickness of half an inch being near the limit of hand-riveting. The usual thicknesses for boilers are $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$, $\frac{1}{2}$.

The ordinary feed-pump of boilers needs no special description, as it is constructed on the principle of the force-pump described under the article PUMP.

The Giffard injector, used also for this purpose, requires a special notice. It is represented in Figs. 19 and 20,

FIG. 19.

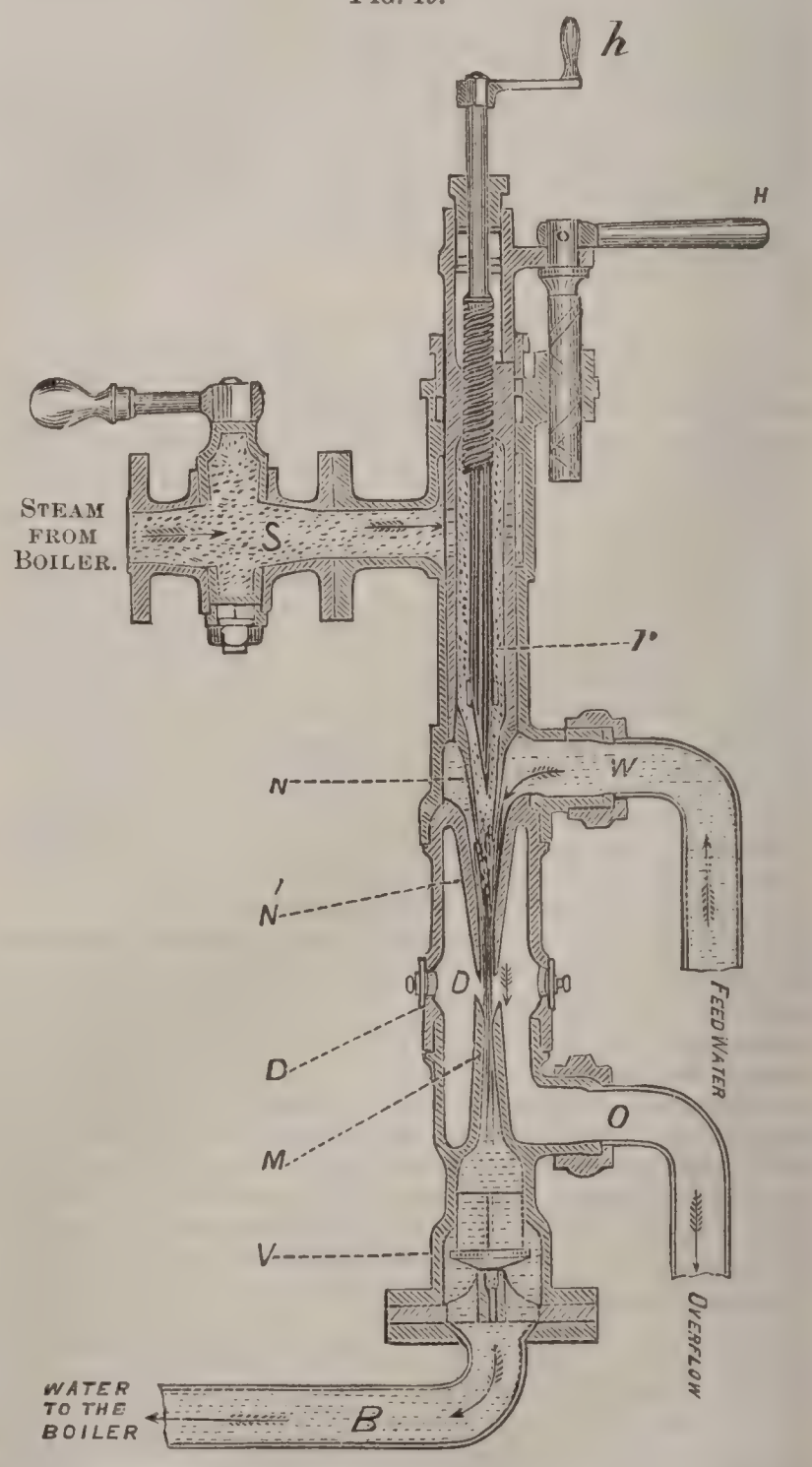
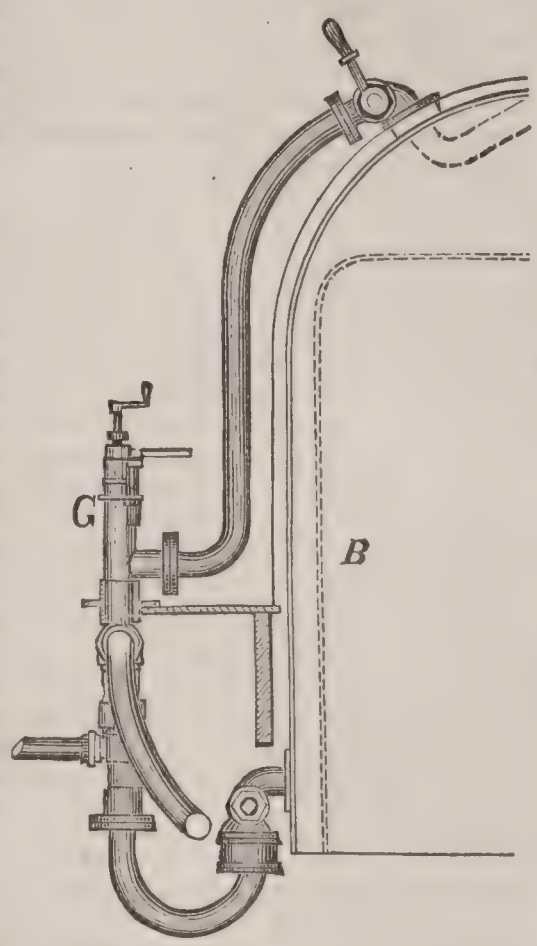



Fig. 19 representing a section longitudinally, showing the internal structure, and Fig. 20 exhibiting the injector in place attached to a boiler. In Fig. 19, S represents a cock through which steam is let into the injector from the boiler: the steam flows down through the hollow casing of the instrument to a conical nozzle N. This nozzle is sur-

*Holley.

rounded, when the instrument is in action, by the feed-water, which enters through the pipe W. The nozzle N is adjustable longitudinally by the screw and handle H, so that it may be set more or less within or toward the fixed cone N′, and thus act as a regulator of the water-supply. A spindle *r*, adjustable by a screw with a handle *h*, regulates the steam-supply as it is set more or less into the cone N. M is an inverted fixed cone or nozzle below N′, the two fixed nozzles N and N′ standing opposite each other, but not meeting. A pipe B, fitted with a check-valve V, leads from the nozzle M back to the boiler. The action of the injector is as follows: Steam from the boiler is let on by the cock S; it flows with great velocity through the cone N and through the fixed cone N′. In its motion it draws water along with it from the feed-pipe W, partly by contact and partly by a condensation which causes a partial vacuum in the space at the mouth of the nozzle N. The result is a stream of hot or warm water issuing from the fixed nozzle D with a high velocity; the stream crosses the short space at D, and impinges upon the mouth of the inverted cone M, which is soon filled, and then the steam exerts a pressure equal to its *momentum* upon the water in this space, and forces open the check-valve V; the current of warm water then continues in an uninterrupted stream into the boiler through the pipe B. It will be observed that all parts of this apparatus are fixed except the cock S, the valve V, and the adjusting parts attached to the handles H and *h*, the first of which regulates the supply of water, and the second the supply of steam. O is an overflow by which any surplus of water entering the space D is carried back to the feed-tank. This overflow practically ceases as soon as the adjustments of the feed of steam and water are made.

FIG. 20.




In regard to this instrument, it has been determined theoretically that it is quite as economical, as far as expenditure of heat is concerned, as the force-pump, and has the advantage over the force-pump in having no moving parts when in action, and hence the work lost by friction of mechanism is nothing. The quantity of heat expended depends only on the quantity of water which is introduced into the boiler, and not on the quantity of steam which the injector uses, nor the temperature at which the feed-water is introduced into the boiler. Water may by this instrument be introduced into a boiler at high pressure by steam from a boiler at low pressure, but the injector ceases to act when the *feed-water* has a high temperature, because the vacuum formed at the outlet of the nozzle N is impaired, and water ceases to flow with sufficient rapidity from the feed-pipe W. The principle on which the injector works is the same as that which determines the action of the steam-jet pump, the difference between the two being that in a jet-pump, which forces water into the atmosphere, all the heat which is imparted to the feed-water is lost, while in the injector this heat goes back into the boiler; the jet-pump for ordinary pumping purposes is therefore excessively wasteful of heat, while the injector employs no more heat, practically, than that which is equivalent to the work of the common feed-pump.

It has been found by experiments made in England that for pressures of 10, 20, 30, 40, 50, and 100 pounds per square inch in the boiler, the temperature of the feed-water should not exceed 148°, 138°, 130°, 124°, 120°, 110°, respectively, the quantity of water forced into a boiler per hour by the same injector increasing with the pressure of steam.

*Supply of Feed-Water.*—The supply of water to a boiler is of course indispensable to its performance. It is usually accomplished by an independent apparatus, a pump or an injector being employed. The capacity of the feeding apparatus should be such as to supply sufficient water not only for the highest rate of evaporation likely to be attained, but to supply all losses from priming, leakage, blowing off, etc. Care should be taken that the feed-water does not impinge on the plates or flues, as the sudden cooling at one point is liable to fracture the plates. Such fractures cannot always be discovered when the boilers are inspected, and are always a source of danger. For land engines a capacity of two and a half times the net feed-water required by the engine is the rule given by Rankine. Proper arrangements for regulating the supply to the boiler are required. Where steam is used for heating purposes, the condensed steam is returned to the boiler by the action of gravity, the waste being supplied from time to time by the attendant through a cock operated by hand.

*Feed-water heaters* are devices by which the exhaust-steam from engines is caused to pass through pipes, through which the feed-water also flows in contact with these pipes. A part of the waste heat of the engine is thus utilized in raising the temperature of the feed-water before it reaches the boiler. The saving effected, in units of heat, is the quantity of heat, nearly, required to raise the temperature of the feed-water from its natural temperature to the temperature at which it is supplied to the boiler.

The risk of life and property which attends the use of the steam-boiler has always been a source of constant anxiety to the engineer and to the public. Explosions continually take place under circumstances of the utmost apparent security: as they occur without warning and occupy but an instant of time, it is generally impossible, except in rare instances, to ascertain with certainty their true cause, and there is seldom a unanimous opinion on the part of experts who examine into the causes after the event. The loss of life and damage to property often produce great public excitement and private distress, and are sometimes followed by suits for damages or indictments for manslaughter. It becomes, then, a matter of serious importance not only to ascertain how far explosions may be prevented, but also the degree of individual responsibility to be attached to them.

It has been remarked that the conditions of safety and economy in the case of steam generators, as in nearly all other structures, are in direct antagonism—economy of construction demanding the least amount of costly materials, and safety requiring such an excess of strength as shall place accidents beyond all contingencies of use and management. In the forms of boilers which are most exposed to explosions it is customary to provide theoretically for a factor of safety of 6 to 8; that is, an internal pressure of six or eight times the working pressure is supposed to be sufficient to produce rupture. This theoretical factor is, however, seldom realized. It is doubtful whether boilers of the common forms are ever manufactured so strong that four times the working pressure, if applied, would not cause permanent injury or rupture, and proof-tests of three times the working pressure would be objected to by any manufacturer, on the ground that it would permanently injure the structure.

There are evidently numerous possible causes of explosion, some of which may be subjected to exact analysis, and means of preventing such causes may be provided; while there are supposed to be other causes not yet fully understood. In a great majority of cases it is safe to say, however, that explosions arise from defects or other causes simple enough in themselves, but which, at the moment, are either hidden from observation or are unavoidable accidents. Excellence in material and workmanship, and intelligence and watchfulness on the part of the attendant, are the surest guaranties of safety. Where such narrow limits exist, although it may not be possible to state positively all the causes of explosions, yet some of the more evident sources of danger may be pointed out. It may be asserted, for instance, as a self-evident truth, that the real or remote causes of all explosions may be reduced to two proximate causes. *First*, insufficient strength of the structure to resist the ordinary working pressure. Such a deficiency in strength may arise from an original defect in the materials or workmanship at the time of construction, or it may be due to deterioration from use, from ordinary wear and tear, or from injuries occurring from mismanagement, want of attention and repairs, etc. Manufacturers and engineers are supposed to comprehend fully these causes of danger, and it is the object of good engineering and good management to avoid them. The *second* cause of danger arises from an accumulation of pressure within the boiler to a dangerous degree above that which the structure is designed to resist. When the limits of safe *working pressure* are exceeded, the danger begins, and beyond a safe *proof-tension* it becomes imminent. The accumulation of pressure may be *gradual*, and due simply to the increase which accompanies a continued evaporation when there is not sufficient outlet for the steam constantly formed, or it

may, according to prevailing ideas, arise from a *sudden* evolution of steam in amounts too great for any ordinary means of efflux, extraordinary stresses being brought to bear from the expansive forces thus generated.

First, in regard to *gradually-increasing pressure*, to what extent may the engineer or stoker be held responsible, or what degree of watchfulness is necessary on his part? One question to be solved is, At *what rate in time* will the pressure in any given boiler increase if there is a constant rate of ordinary evaporation, and no outlet for the steam? and another, To what extent can the engineer trust the ordinary safety-valve to prevent this gradual increase or to furnish an outlet for the steam?

The rate of increase of pressure may be found theoretically by means of a formula given by Prof. Zeuner in his work on the *Mechanical Theory of Heat*. Let T be the time, in minutes, which must elapse from the instant that all efflux of steam is prevented in a boiler to the instant when a dangerous or bursting pressure must follow; let W represent the weight of water in the boiler; $t_1$ the temperature of the water due to a dangerous pressure; $t$ the temperature due to the working pressure; Q the quantity of heat, in British units, transferred to the water per minute; then

$$T = \frac{W(t_1 - t)}{Q}$$

will give, with a sufficient degree of approximation, the time in minutes, the mean specific heat of water being taken as unity. This formula shows that the time will be proportional *directly* to the *amount of water* in the boiler, to the *difference of temperatures* $t_1$ and $t$, and *inversely* proportional to the quantity Q. The fluctuations of pressure will be less rapid in boilers which contain large quantities of water and have at the same time a low rate of evaporation. Such conditions are found especially in marine boilers, while the reverse is true for boilers containing small quantities of water and having rapid rates of evaporation, such as locomotive and fire-engine boilers. The fluctuations will also evidently be more rapid at high pressures than at low pressures, since at high pressures a greater change of pressure occurs with an equal difference of temperatures than at low pressures. The following example will exhibit the applications of the formula:

*Example 1.*—A marine tubular boiler of the largest size W = 79,000 pounds of water. Suppose the working pressure to be $2\frac{1}{2}$ atmospheres, and the dangerous pressure to be 4 atmospheres. The boiler contains 5000 square feet of heating-surface; and supposing the evaporation to be 3 pounds of water per hour for each square foot of heating-surface, we shall have, taking as a sufficient approximation in round numbers, 1000 units of heat as the thermal equivalent of the evaporation of 1 pound of water.

$$t_1 - t = 29^\circ \text{ F.}$$

$$Q = \frac{5000 \times 3 \times 1000}{60},$$

$$T = \frac{79000 \times 29}{\frac{5000 \times 3 \times 1000}{60}} = 9.1 \text{ minutes.}$$

*Example 2.—The Steam Fire-Engine.*—Taking an actual case: The boiler contains 338 pounds of water and has 157 square feet of heating-surface. Supposing each square foot of heating-surface to generate only one pound of steam in one hour, the pressure will rise from 100 to 200 pounds in T = 7 minutes.

*Safety-Valves.*—It is supposed that the gradual increase of pressure above discussed can never take place if the safety-valve is in good working order and if it have proper proportions. It should be observed, however, that engineers do not, in practice, place their trust in the safety-valve alone, and that to their watchfulness and attention the public are more indebted for safety than to the apparatus which is designed to regulate the pressure.

The theoretical area of orifice O′ for the efflux of a given quantity of steam from a boiler into the atmosphere, supposing this orifice to be a circular area, may be determined by first ascertaining the theoretical velocity of efflux, and multiplying this by a coefficient ascertained by experiments. It has been customary to fix the cross-section of the efflux-pipe or the area of the conical safety-valve by empirical formulas, resulting from actual experience. The experiments made by Mr. R. D. Napier on the efflux of steam at different pressures and with different orifices have not only furnished the means of determining the coefficients of efflux, but for determining empirical formulas for the area required for the discharge of a given weight of steam per second. An approximate formula given by Rankine is as follows: When the pressure in the boiler is equal to or greater than five-thirds the external pressure, the weight of steam discharged from an orifice of unit of area in one second is $W = \frac{p_2}{70}$, $p_2$ being the boiler-pressure in unit of weight on unit of surface. The number of pounds of steam discharged per square inch of area per second, the boiler-pressure being $p_2$ pounds per square inch, will be $W = \frac{p_2}{70}$, and for an orifice O it will be

$$O\,W = \frac{p_2}{70} \times O = W, \text{ then } O = \frac{70\,W}{p_2}.$$

*Example.*—Suppose a boiler to evaporate 1800 pounds of water per hour, what area of orifice (supposed to have the form of a cone of the shape of the contracted vein) will be sufficient for the discharge of all the steam, the pressure in the boiler being 4 atmospheres, or 58.8 pounds per square inch? We shall have

$$A = \frac{70}{58.8} \times \frac{1800}{3600} = \frac{70}{58.8} \times 0.5 = 0.60 \text{ square inches.}$$

It is thus seen how small an area of orifice is sufficient to discharge all the steam in the example given.

The ordinary safety-valve is a disk with a bevelled edge, resting on a corresponding seat. The disk is kept down against the boiler-pressure by external pressure variously applied, either by a weight acting with a leverage or by a spring. The opening for the efflux of steam, created by the rise of the valve, is thus an annular opening, the area of which may be approximately found by multiplying the mean circumference of the disk by the rise of the valve measured perpendicularly to the bevelled edge. Representing the orifice by O, the height of rise by $l$, and the mean circumference by $c$, the opening or *orifice* will be approximately $O = l \times c$. In the above example we should have O = 0.60 square inch $= l \times c$. If the diameter of the disk of the valve is 6 inches, the circumference will be, approximately, 18 inches, and $l = \frac{0.60}{18} = \frac{1}{30}$; the rise of the valve will be $\frac{1}{30}$th of an inch. As the rise $l$ is a result of forces the magnitudes of which are not easily determined, there is a difficulty in applying theoretical rules to the subject. One English empirical rule is that the safety-valve *area* shall have half a square inch for each square foot of fire-grate, or .025 of a square inch for each square foot of heating-surface. Others, quoted by Rankine, are as follows: Let A be the area of the piston, V its velocity in feet per minute, P the excess of pressure in the boiler above that of the atmosphere in pounds on the square inch; then the area will be

$$a = A\,\frac{V}{300\,P}, \text{ nearly.}$$

Another quoted by the same author is: "$a$ = area in square inches = from $\frac{1}{25}$th to $\frac{1}{30}$th of the number of pounds of coal burned per hour, or $a$ the area in square inches = $\frac{1}{150}$th to $\frac{1}{180}$th of the water evaporated per hour."

The French rule for the diameter of the valve, as given by Peclèt, is—

$$D = 2.6\sqrt{\frac{S}{n - 0.412}},$$

or,

$$S' = 5.30\,\frac{S}{n - 0.412}.$$

(In these formulas D, the diameter of the disk, is given in centimètres; S is the heating-surface in square mètres; S′, the area of the disk in square centimètres; and $n$ the pressure in atmospheres.) In Germany the laws require that the area of the *disk* of the valve shall be determined by a rule which may be stated as follows: P being the absolute internal pressure, the area of the disk in square inches *for each square foot of heating-surface* is to be determined by the formula

$$A = \frac{1.2}{P + 15}.$$

In all cases it is not only a matter of observation, but a theoretical law, that as soon as efflux begins there is a considerable diminution of pressure underneath the valve; and numerous devices have been proposed by which the opening of the valve shall not be influenced by the pressure in the orifice, but by the action of the pressure at a point remote from the orifice. The equilibrium between the full internal pressure of the boiler and the external forces acting upon the valve is then not disturbed by the actual pressure in the orifice. This seems to be the only principle that can render the safety-valve a perfect regulator of pressure.

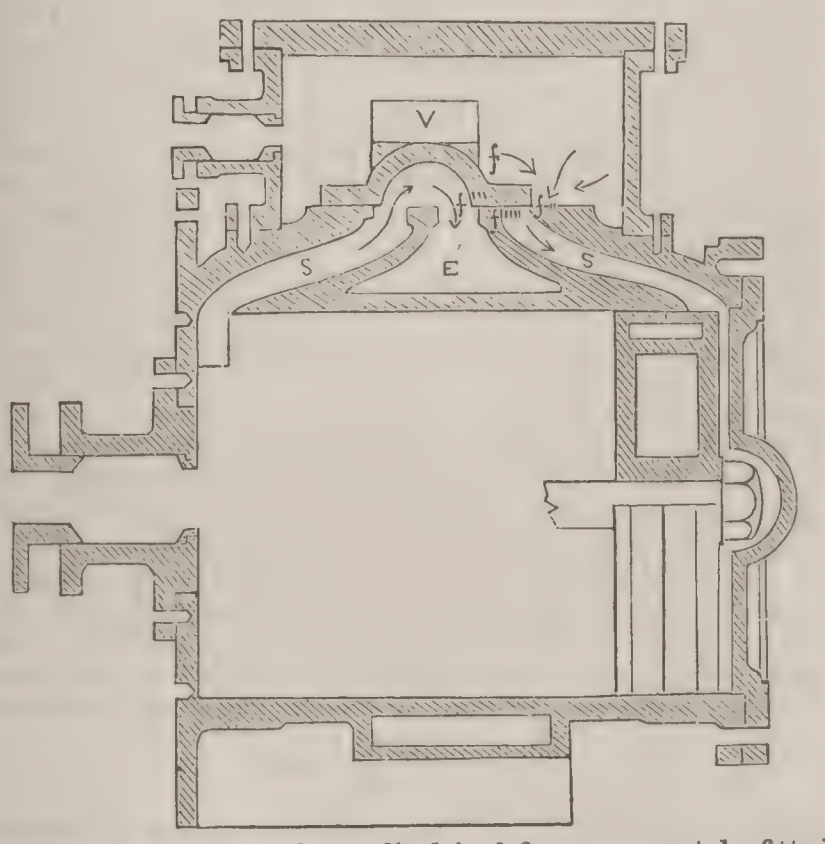
There are supposed to be, under some circumstances, sudden evolutions of steam in such quantities that no relief is *possible* through the medium of safety-valves, however perfect they may be in their action, and under circumstances in which no warning occurs. In regard to such

causes there is much diversity of opinion, but they are supposed to be connected with a deficiency of water in the boiler, and it is considered of vital importance to keep up the supply under all circumstances.

As long as it is necessary to construct steam-boilers with large shells, put together in pieces, fastened by seams, the factor of safety being only 4 or 5, it must happen that of the large number in daily use some must yield to the heavy internal pressures, and explode. The sectional boiler is gaining popularity continually, not so much from its evaporative powers, as from the fact that it has a very large factor of safety, probably as high as 20. Mr. Perkins of London, grandson of the inventor Jacob Perkins, uses steam in several small boats at pressures of 250 and 500 pounds per square inch, the boilers being of the class called sectional boilers. The actual risk with these boilers at this high pressure is probably not as great as that with ordinary shell boilers carrying 80 to 100 pounds pressure.

The cylinder, as applied to the steam-engine, comprises all forms of the chamber or working space in which the steam, by acting upon a movable surface, produces motion against a resistance. This working chamber is almost universally cylindrical, and the movable surface is usually

FIG. 21.




the end of a piston of a cylindrical form accurately fitted to the interior of the cylinder, and moving in the direction of the axis of the cylinder. This most common form of a cylinder is shown in Fig. 21, which represents a longitudinal section of a cylinder, with its piston and piston-rod. Fig. 22 represents a section of the cylinder of the Corliss engine. It shows a different arrangement of openings for the entrance and exhaust of steam. Fig. 23 represents the piston with its packing-rings; these rings serve to prevent the escape of steam past the piston. Figs. 24 and 25 are sketches illustrating the rotary forms of engine as invented by Watt and Bramah respectively. In these engines the cylinders are truly cylindrical, but the pistons revolve about the axes of the cylinders. The action of the steam in each of these may be seen by inspection. Of

FIG. 22.

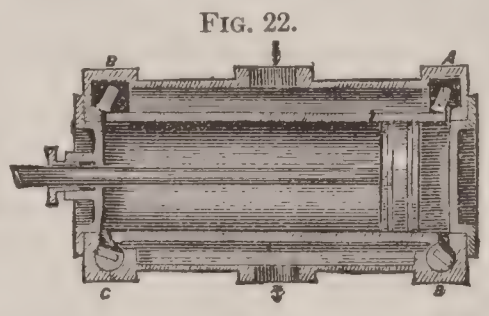



FIG. 23.

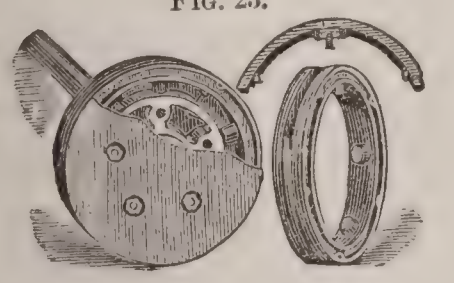
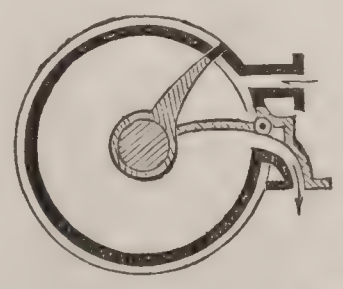


FIG. 24.



many hundreds of devices of rotary engines these are the principal types. In the compound engine the steam performs its work in two or three cylinders successively. These devices need not be here described in detail, as they are introduced merely to exhibit a few of the various forms of cylinders or working chambers which have been employed.

The following cut (Fig. 26) exhibits the mechanism of the ordinary non-condensing stationary steam-engine, by which the reciprocating rectilineal motion of the piston and piston-rod is converted into continuous rotary motion. In this cut, C represents the cylinder, C′ the cross-head moving in guides, C″ the crank, C‴ the connecting-rod, F the fly or band-wheel, *s* the steam-pipe. Fig. 27 represents generally the corresponding features of the Corliss engine, and Fig. 28 the mechanism of the American beam engine, as designed for large steamships and river boats. In this sketch C represents the cylinder, C″ the condenser, B the working- (or "walking-") beam, C‴ the connecting-rod, C⁗ the crank, A the air-pump, V valve-gearing.

FIG. 25.

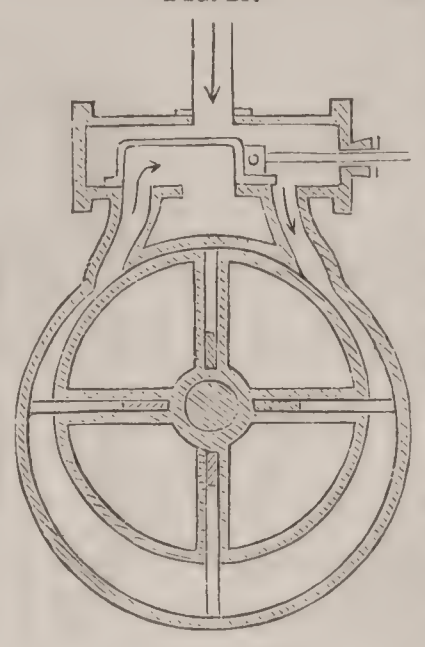
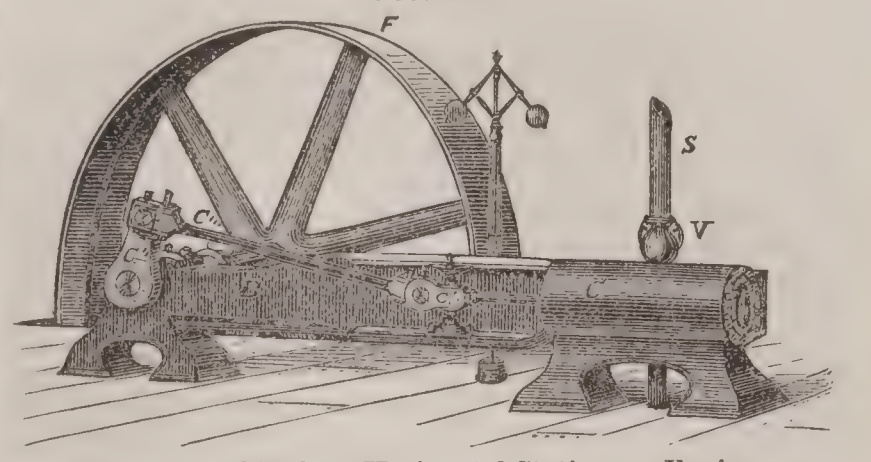


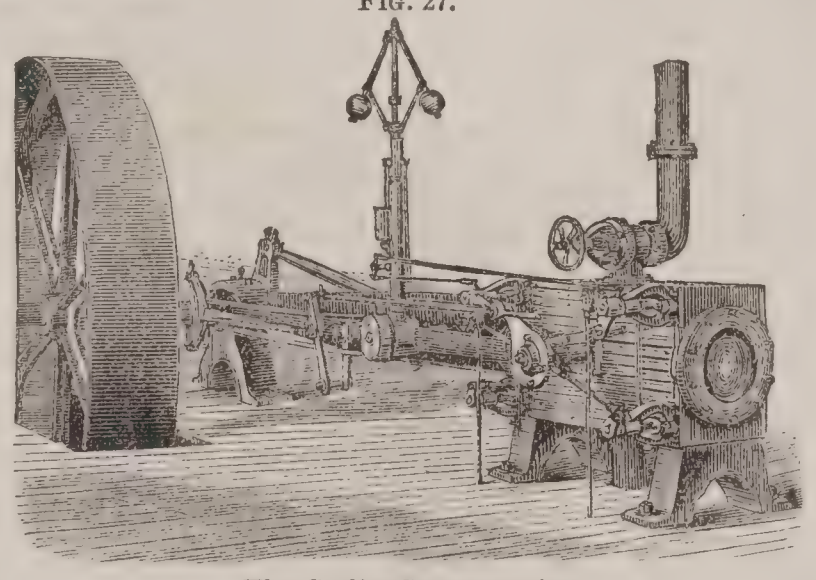
FIG. 26.




Babcock and Wilcox Horizontal Stationary Engine.

Fig. 29 exhibits an arrangement of mechanism of a compound engine for a propeller.

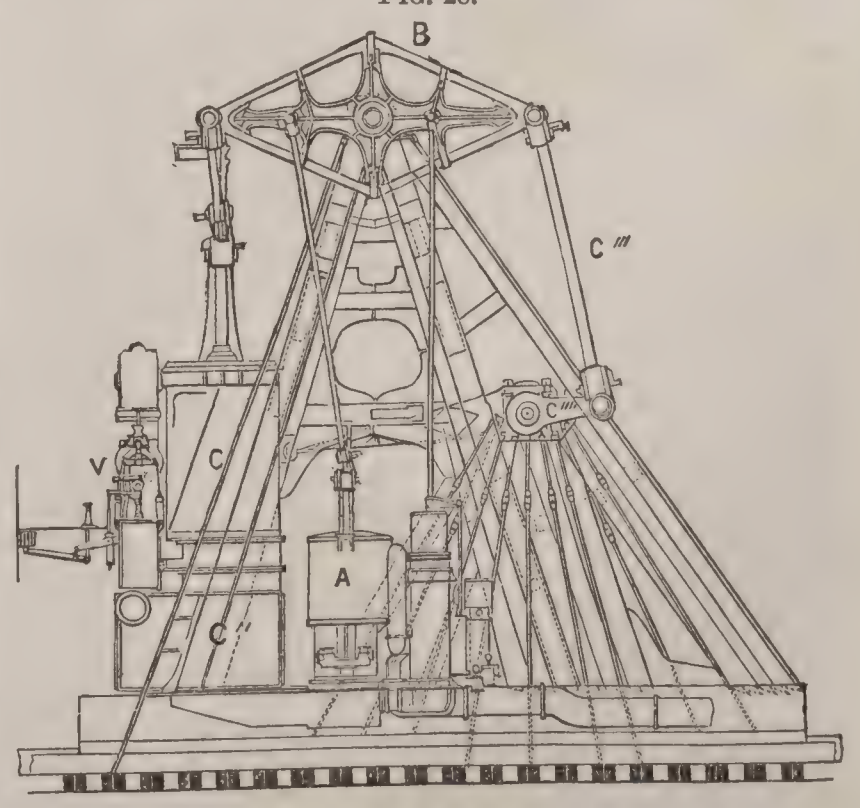
FIG. 27.



The Corliss Steam-engine.

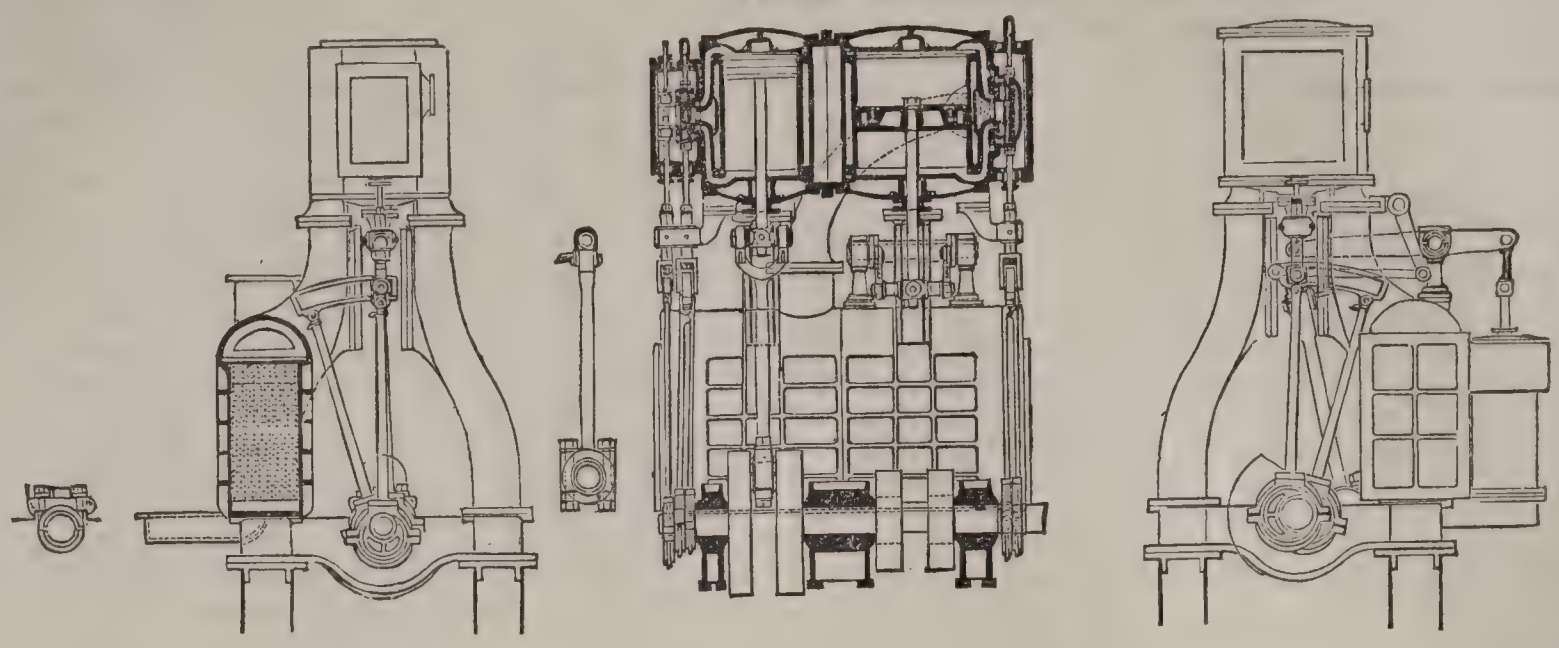
These illustrations exhibit a few of the forms of combination which the mechanism of the engine takes under

FIG. 28.



different circumstances, but it is impossible in a brief sketch to describe minutely even these general forms, much less to mention all the various combinations which the mechanism assumes. A few general classifications only can be given. A *single-acting* engine (*e. g.* the Cornish pumping engine) is one in which the steam acts upon one

FIG. 29.



side of the piston only, the opposite end of the cylinder being open. A *double-acting* engine is one in which the steam acts on both sides of the piston alternately. A *direct-acting* engine is one in which the connecting-rod extends beyond the cross-head, away from the cylinder, and a *back-acting* engine one in which the connecting-rod is brought from the cross-head back toward the cylinder or beyond it. Engines are also classed as *vertical* or *horizontal*, according as the cylinder is vertical or horizontal. An *oscillating* engine is one in which the cylinder is mounted on trunnions, the steam being received and discharged through the trunnions. Such engines have no connecting-rod, the piston-rod being directly connected with the crank.

Nearly all marine engines, except the beam engine, have two cylinders, connecting with cranks at right angles to each other (see Fig. 29), in order to equalize the action of the power.

Another mode of descriptive designation of engines relates to the general nature of the machine and kind of work which it performs; for example, *marine engine, stationary engine, portable engine, locomotive engine, hoisting engine, pumping engine,* etc., each of these varieties having its characteristic mechanism and connections. In the rotary engine the motion of the piston or its equivalent is circular and continuous in one direction, and what is the crank-shaft in other engines is in this the shaft on which the piston revolves. No piston-rod, connecting-rod, or crank is required; and thus, as far as these parts are concerned, the mechanism is the most simple and compact of all engines. The difficulty of providing a perfectly steam-tight working-space for the steam in this class of engines, with freedom from excessive friction, and the existence of other defects which no inventor has yet remedied, render this form very inefficient, notwithstanding its compactness.

The *cylinder* and *common piston*, with the *piston-rod*, *connecting-rod*, and *crank*, may therefore be regarded as the elements of the mechanism in universal use, whatever may be the other parts of any particular combination. To this form we shall refer in discussing the subject of *valve-gearing*. The term *valve-gearing* comprises all the special mechanism attached to the cylinder, which, deriving its motion indirectly from the motion of the piston, acts in such a manner as to open and close, at proper times, the passages by which the steam enters and is discharged from the cylinder. Those pieces of this mechanism which act directly to close the passages are called valves. The mechanism by which they are moved is properly the *valve-gearing*. A full description of the common slide-valve, with the principles of mechanism involved in its use, will illustrate the subject; other kinds of valves and their special mechanisms will then need only a passing notice.

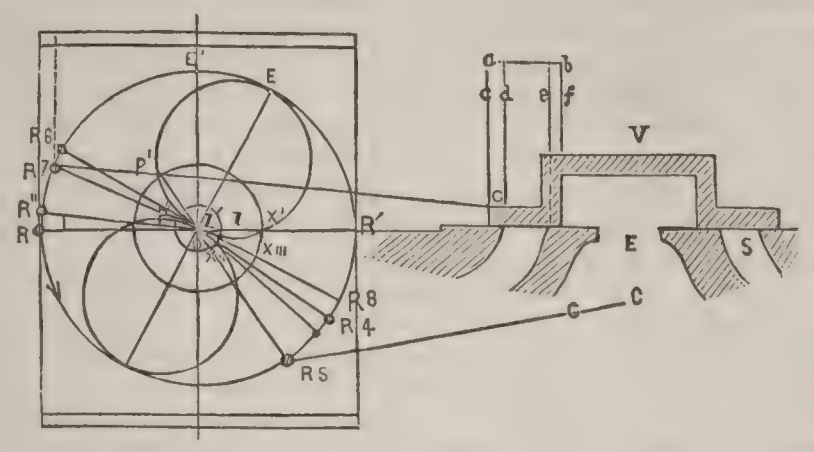
Fig. 21, already given, shows a section of a cylinder by which the action of the common D slide-valve (so called from the shape of its section) may be explained. In this section V represents the valve, situated in a rectangular box or casing, which is in full communication with the boiler when the engine is running. This box, called the *steam-chest*, situated on the side of the cylinder and forming part of it, is constantly full of steam at nearly the boiler-pressure when the engine is in motion. S S are passages called steam-passages leading from this chest to the ends of the cylinder; E, a passage called the exhaust-port leading to the open air or to the condenser. The *ports* are long rectangular openings in a plane surface on the side of the cylinder. The valve V has such form and dimensions that it covers all these ports when in its neutral or middle position, and is caused to slide back and forth just enough to uncover alternately the steam-ports S S, the amount of this sliding, even in the largest engines, in which the valve may have a superficial area of several square feet, being only 3 or 4 inches. In small engines the extent of sliding in one direction may be only a fraction of an inch. This movement of the valve to the right and left is produced by means of an eccentric or small crank and a special connected rod attached to the valve, by which its motions are made to correspond in point of time with the motions of the piston; but the eccentric and main crank being keyed to the shaft in different positions, these motions, although taking place in the same times, will not at each moment correspond in direction or velocity.

It will be seen from the figure that the piston is at the end of its stroke, and its return to the opposite end depends on its receiving the impulse of steam admitted from the steam-chest just at this moment to drive it back. It will be observed, also, that the valve has been moved from its central position, covering all the ports, already sufficiently far to open the steam-port on the right a small amount, and steam is already admitted and fills the narrow space to the right of the piston. Thus, the full boiler-pressure, or nearly so, is already acting on the right of the piston to drive it back. The condition of things on the left of the piston at this moment is quite different. The steam which has been confined in that part of the cylinder to the left, and which by its expansive action has driven the piston toward the right, is now free to pass from this space into the atmosphere back through the steam-port S through which it came, but not into the steam-chest—the port S now leading through the hollow of the valve to the *exhaust*-port; and this opening is by the movement of the valve already larger than the opening for admission on the right. The phenomena which now take place while the piston moves from the right to the left are as follows: The valve completes its excursion to the left, and returns, so as to shut off the supply of steam on the right of the cylinder, while the piston is still in motion to the left. After the supply is cut off, the confined steam continues to act by its expansion alone, no more being admitted. The point at which this occurs is called the point of *cut-off*. The fraction of the stroke at which this occurs depends on the dimensions of the valve and the arrangement of the mechanism by which it is moved. It may happen, also, that by the same movement of the valve on its return to the right, and while the piston is still moving to the left, the exhaust-passage is closed so as to confine a portion of the steam in the left-hand part of the chamber, to act as a sort of cushion. This will occur at the moment the inner edge of the hollow part of the valve on the left reaches the inner edge of the steam-port. These phenomena may be illustrated by a larger sketch of the valve and the ports.

Fig. 30 represents on a larger scale a section of a simple slide-valve and the cylinder ports, the valve being in its middle or neutral position, covering all the ports. It will be observed that the outer edges of the valve project beyond the edges of the steam-ports, so that in this position of the valve the ports are more than covered by the valve. This projection beyond the edges of the port is called the *outside lap*. It exercises an important influence on the distribution of the steam. The inside edges of the hollow part of the valve also project over the inner edges of the steam-ports. This projection is called the *inside lap;* it is always relatively small, and often does not exist to an appreciable amount. Now, suppose the valve to begin to

move to the right. The first phenomenon that occurs will be the opening of the communication on the right between

FIG. 30.

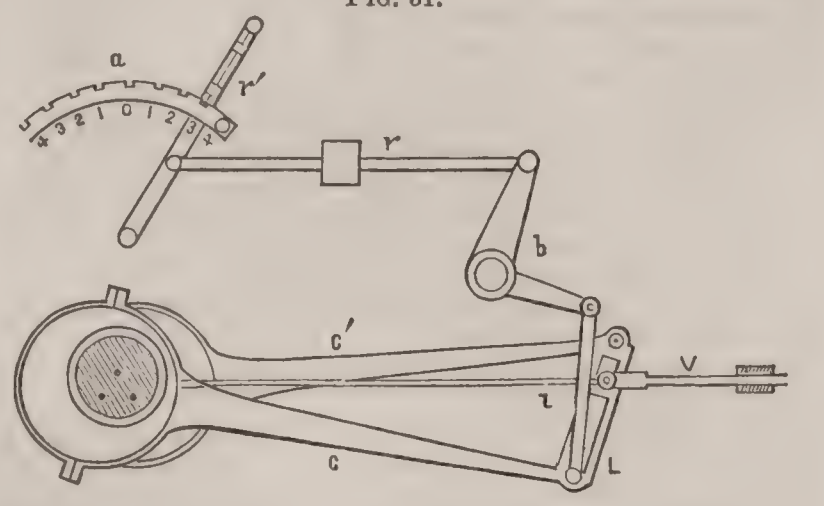



the steam-port S and the exhaust E. This movement is generally only a fraction of an inch. The piston is now on its way to the left, and near the end of its stroke; and, as the sketch shows, the corresponding communication on the left with the exhaust is already closed; the piston is already acting against a cushion of partially-exhausted steam on its left. As the valve continues to move to the right, the outer edge of the valve C on the left approaches the edge of the steam-port, and at a certain instant opens that port, letting new or "live" steam from the boiler into this end of the cylinder, which mingles with the exhaust steam already confined there as a cushion. This phenomenon usually takes place but an instant before the piston reaches the end of its stroke, in order that it may meet not only a cushion of exhausted steam, but of steam at full pressure from the boiler. The action of the inside lap is of some importance, as far as the cushioning is concerned, and it also acts to prolong the expansion to a limited extent, as may be made evident if the motion of the closing and opening of the left-hand steam-port is considered for a moment.

Fig. 30 represents not only the slide-valve and the openings in the cylinder, but also, by the circular diagram on the left, a graphical method of determining the phenomena of the distribution of steam, and of adjusting the parts of the valve-gearing. In this diagram O represents the centre of the crank-shaft; O E the eccentric radius or crank-arm of the eccentric which drives the valve; E' O E the *angle of advance*—*i. e.* the angle which the eccentric crank makes with the perpendicular to line of motion of the end of the eccentric rod. A circle described on O E as a diameter is called the *valve-circle;* it furnishes a scale of distances travelled by the *valve* in its movement to the right and back to its central position. In this diagram, which may be enlarged in scale for distinctness, O E represents the eccentricity; *a b*, the throw of the valve; O *l* represents *c d*, the outside lap, and O *l'* represents *e f*, the inside lap. The two small circles drawn about the centre O are called lap-circles. The circle drawn with O R as a radius represents the crank-pin circle of the engine. It should be drawn to a larger scale. For want of space in this diagram it is taken the same as that described by the eccentric radius. If we suppose the crank of the engine to be on its dead-point at R, and to move in the direction of the arrow, the property of the valve-circle O *p'* E is this—that for any position of the crank, such as $R^5$, if a line be drawn through O and prolonged to meet the valve-circle, the distance O *p'* will give the true distance of the valve to the right of its middle or neutral position. In the position of the valve shown in the sketch the crank is at $R^6$, and the valve is ready to begin its movement to the right. When the crank arrives at R, the dead-point, the valve has moved a distance O X', which is a little greater than the outside lap O *l* or *c d*, and hence steam is already admitted to the piston. The point of admission is found by taking the intersection X''' of the valve-circle with the outside lap-circle, and drawing through O the line O R''. This gives the *angle of lead*, and the distance *l x'* is the *lead* of the valve. The point of cut-off is found by taking the second intersection *p'* of the valve-circle with the outside lap-circle; this shows the angle R O $R^5$ through which the crank has revolved to the time when the valve has completed its movement to the right, and has come back to the point at which its outer edge C closes the steam-port again, cutting off the steam. The intersections of the inside lap-circle will determine the points of release or exhaust and compression. In this diagram four quantities are represented: the eccentricity, O E = *v;* the angle of advance, E' O E = *d;* the outside lap, = *l;* and the inside lap, = *l'*. The adjustment of these quantities, which can be graphically made, will determine the degree of expansion, the lead, the point of release, and the compression, and the proper arrangement of the mechanism for any degree of expansion. This mode of determining these quantities is due to Dr. Zeuner. With a crank-pin circle and cylinder drawn to the same scale, the position of the piston for any portion of the crank may be determined by taking the length of the connecting-rod as a radius, and laying off this length from the position of the crank to the central line of motion of the cross-head.

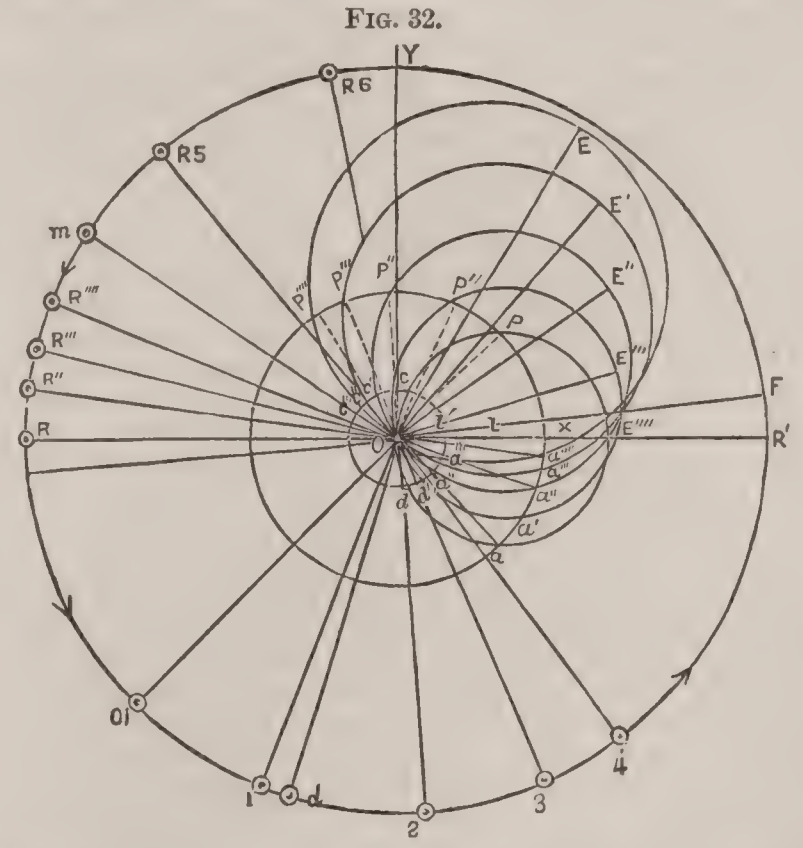
The adjustment of the single slide-valve with a single eccentric, when once made, cannot be easily changed while the engine is running. Where this is desirable in order to change the degree of expansion, and by that means the power of the engine, the link-motion is generally used.

FIG. 31.




This is a device shown in Fig. 31, by means of which the angle of advance and the eccentricity are simultaneously altered; and it is accomplished by means of two eccentrics C C' and a link L, the effect of the two, with the link, being to make one *virtual* eccentric. The arrangement shown in Fig. 31 is that commonly used in locomotives, and is known as Stephenson's link-motion. It is arranged with a reversing lever *r'*, by which either the eccentrics C and C' can be caused to move the valve quite independently of each other, but one giving a forward motion and the other a backward motion to the engine. At positions of the link intermediate between these the virtual eccentric, which is the resultant of the two, controls the movements of the valve, and varies the degree of expansion. The notches in the arc (*a*) determine certain positions of the link with

FIG. 32.



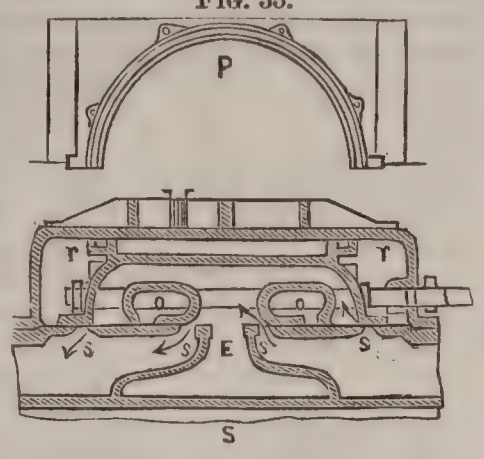

reference to the valve-stem V. Applying Zeuner's valve-circle diagram to the Stephenson link with open rods, as in Fig. 32, O E is the eccentric and Y O E angle of advance for full forward gear (Notch 4). For the 3d notch, O E' gives the corresponding eccentric and angle of advance, and so on to mid gear (Notch 0), in which the eccentricity is O E'''' and the angle of advance 90°. The points of admission *a*, *a'*, *a''*, *a'''* on the left, from mid-gear to full-gear, the corresponding angles of lead, the points of cut-off, *p*, *p'*, *p''*, *p'''*, *p''''*, the points of release, *d*, *d'*, *d''*, *d'''*, on the right of the piston, and the points of compression, *c*, *c'*, *c''*, *c'''*, on the right, are all shown for the different grades of expansion; and the study of the diagram will also show the variations of lead, *l x*, for these different grades.

It is not practicable to enter here into a discussion of this valve-gear, nor to describe the various other link-motions which have been proposed, but simply to illustrate

the most common device for altering the degree of expansion and for reversing by the double eccentric and link. The subject is fully discussed in Zeuner's work on valve-gearing.

The extent of sliding movement of the valve is a consideration of importance, since the hurtful work of its friction depends directly on the extent of its motion. When slide-valves are very large, this useless work becomes an important item of expense. There are two means of reducing it: first, by reducing the travel or space passed over at each stroke; and, second, by relieving the back of the valve from a portion of the pressure of the steam in the valve-chest. Fig. 33 represents a valve in which both these methods are used. P is a plan of one-half the valve, and S a section. There are two steam-ports *s s* on each side of the exhaust-port. When the valve moves from left to right, for instance, both ports *s s* on the left are uncovered simultaneously; steam enters the *outer* port directly from the steam-chest, and the *inner* port indirectly through the arched opening in the valve O, the exhaust taking place on the opposite side, into the hollow of the valve and into the exhaust-port E. A partial vacuum is maintained on the back of the valve by means of a packing-ring *r r*, which slides against the lower surface of the steam-chest cover, the space enclosed between this and the valve being connected with the condenser. This kind of valve is called an equilibrium double-ported slide-valve. The valve of which this is a representation had a total length of over 5 feet and a width of over 4 feet, the diameter of the packing-ring being about 4 feet; the extreme travel of the valve in one direction being only 5 inches, the outside laps less than 3 inches, and the inside laps only $\frac{1}{32}$d of an inch. It formed a part of the mechanism of a large marine engine.

Fig. 33.



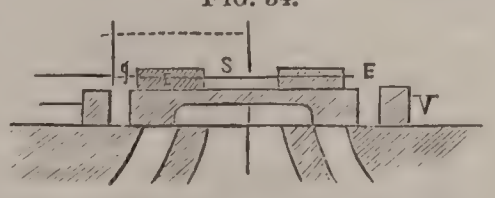

Double-ported Equilibrium Slide-valve.

To avoid long steam-passages, which are disadvantageous, two slide-valves are often connected by a bar and attached to the same valve-stem within the chest, these separate valves being then placed near the ends of the cylinder and having a common exhaust.

*Expansion-Valves* and *Cut-Offs* designate special combinations of valve-mechanism by means of which the steam may be suddenly cut off at any point of the stroke independently of any other phenomena of the distribution of steam. The simple slide-valve, moved by a single eccentric, cannot be arranged to cut off the steam at less than one-half the stroke advantageously, because, as will be evident from the inspection of the valve-diagrams for the link-motion, where the higher grades of expansion are used, the compression and *release* begin so much earlier that the power of the engine exerted in each stroke is diminished, and the efficiency—*i. e.* the economy—of the power is also diminished. To preserve the efficiency of the steam undiminished, and to place in the hands of the engine-driver the means of adapting the power of the engine to the work to be performed, two systems of construction are employed—one in which the variation in the expansion may be adjusted or controlled by the engine-driver by hand; for instance, when for a considerable period of time the engine is not required to perform its full amount of work, and a single adjustment for the given time is all that is required; and second, when a momentary variation of power may be advisable, so that the speed of the engine may remain invariable. The first system is an arrangement of *expansion-valves*, operated as required by the engine-driver; and the second system the "cut-off" system, in which the degree of expansion or the supply of steam at each stroke is regulated by the governor.

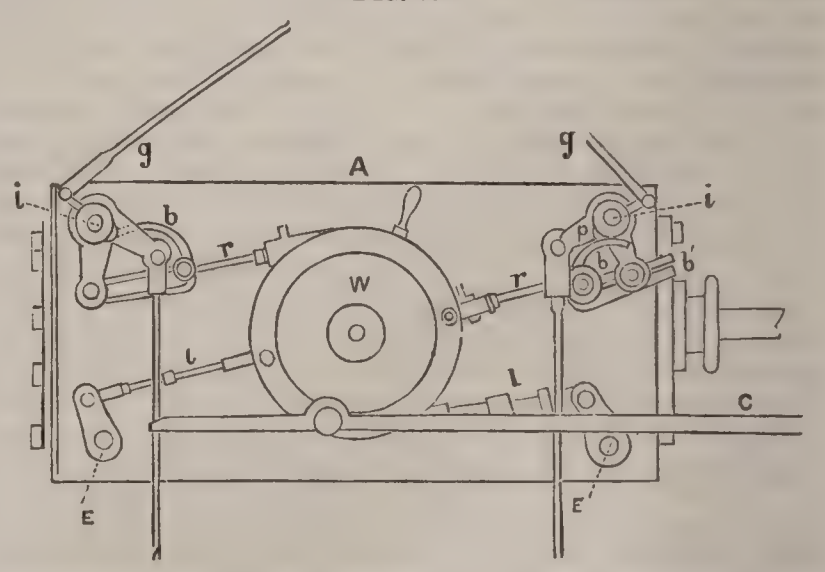
A great variety of expansion-valves, as well as variable cut-offs, are employed in practice, and we will give such examples only as will illustrate the systems. The most common, and perhaps the most simple and perfect, expansion-valve is exhibited in Fig. 34. In this figure the upper surface of the D-valve is made plane, and it is extended some distance beyond the outside laps, a mortise or rectangular aperture, nearly equal in area to the steam-port, being made in the ends. The valve is in other respects precisely like all other D slide-valves, and is moved by an eccentric, sometimes by two eccentrics, with a link for reversing the engine. The expansion-valve consists of two plates E sliding on the top of the D-valve (which is called in this combination the *distribution-valve*). These two plates are on the same valve-stem S, which passes through both, and is supplied with screw-threads, right and left hand, so that when the stem is turned on its axis the two plates will approach or recede from each other. On *their distance apart* depends the period of cut-off, and a device may be attached to the valve-stem outside of the steam-chest by means of which this distance can be made greater or less by turning a hand-wheel even while the engine is running. The degree of expansion is thus controllable by hand. The expansion-valve is moved by a separate eccentric.

Fig. 34.




*Governor Cut-Offs.*—Devices for cut-offs adjustable by the governor are very numerous, and it is impracticable to describe even a few of the best in detail; all that can here be attempted is to illustrate the principles of their action by reference to one or two examples. The old combination of the governor and throttle-valve is not a cut-off. Its action is to diminish or increase the pressure in the cylinder as the speed of the engine is increased or lessened, and thus diminish or increase the work per stroke; but a diminution of the initial pressure in the cylinder and the pressure throughout the stroke entails waste of heat and power, and is therefore only admissible where these considerations are not regarded as important. In stationary engines employed for many purposes it is not only important in point of economy that this waste should be avoided, but the character of the work may be such that variations of speed, to any considerable degree, are to be avoided. The action of the governor in causing a complete cut-off of the steam at any point of the stroke depends primarily upon the speed of the engine by which it is moved (see Governor), and secondarily upon its connection with the valves which close the steam-ports. The power of the governor is not sufficient, generally, to move these valves directly, and hence its action consists in nearly all cases in throwing into or out of gear mechanism driven by the engine itself; by which the requisite movement of the valve is produced. One mode consists in a sudden disconnection of the mechanism which moves the valve, which is then driven back so as to cover the steam-port by means of a weight or spring. The closing of the valve is thus almost instantaneous—a matter of importance both in the opening and closing of the valves. The Corliss engine furnishes an instance of this kind of cut-off. Fig. 35 represents a section of the cylinder of a Corliss engine, with its four valves—the exhaust-valves and the steam induction-valves. The cut-off mechanism is exhibited in this figure, in which A represents a side elevation of the cylinder. The steam-valves move about axes projecting at *i i*, the exhaust-valves about axes at *e e*. W is a plate mounted on an axis projecting from the side of the cylinder. It performs the part of a "rocker" simply, being moved backward and forward by the eccentric-rod *c*. The lever-arms of the lower or exhaust valves are connected with this "wrist-plate" by two links *l l*, which are permanently adjusted, so as to cause the exhaust to take place at the proper moment. The upper corresponding lever-arms for the induction-valves have the form of bell-cranks, to one arm of which a weight is attached by a long vertical rod, shown in the drawing. The links *r r* attached to the wrist-plate are not permanently jointed to the bell-cranks, but the ends of these links or bars slide along the ends of the bell-crank; a notch in the sliding end catches the arm on the return motion and draws it back, opening the valve. The disengagement of this notch is effected by a bent piece, shown at *b*, which, as the link *r* is drawn back, strikes a small protuberance *p*. The position of this small protuberance depends only on the governor. The governor-rods *g g* are attached to the ends of levers which move

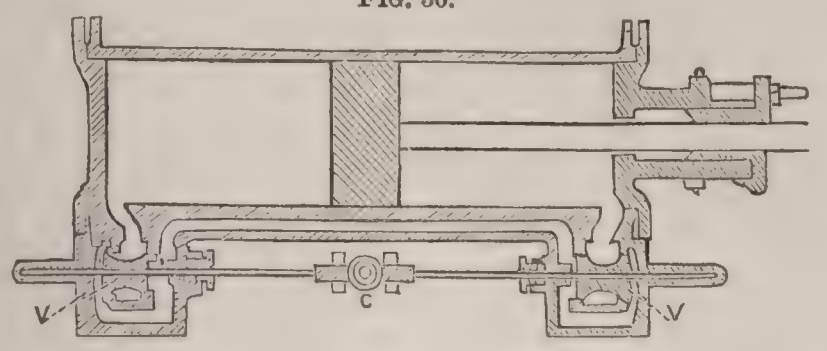
Fig. 35.



plates or rings embracing the axes *i i*, and on these plates the protuberances are made. When the hook or bent piece strikes the protuberance, the notch is disengaged, and the weight, acting on the valve, closes it. The cutting off of the steam is thus instantaneously effected.

Another example, the Wright engine, may be given to illustrate the use of a cam-motion controlled by the governor. Fig. 36 represents a section of the cylinder of the Wright engine; V V the valves, which are balanced *poppet-*

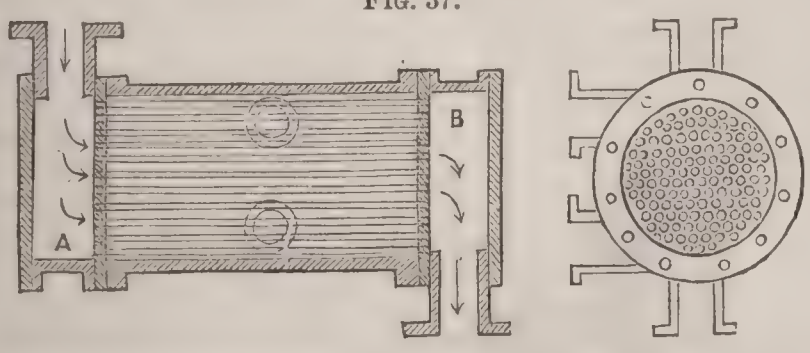
FIG. 36.




*valves*. These valves are double—that is, they have two conical seats—and when they are closed, the steam-pressure acting on both sides of the valve, it is nearly balanced. The stems of these valves extend to a position near the middle of the cylinder, and are there actuated by a cam C, being alternately opened by the cam. When the cam in its revolution releases either valve, it is carried back promptly by a spring. The cam slides vertically on a rod, the vertical motion bringing a new arc of the cam into action. This vertical motion is controlled by the governor. Other efficient devices might be mentioned which are deservedly popular, but these are sufficient to illustrate the principle. The Stevens cut-off, so common on our river-steamers, has poppet-valves, the vertical valve-stems having strong toes or projections attached to them which are lifted by corresponding toes or arms attached to the rock-shaft. This cut-off is not controlled by the governor, but is adjustable by the engine-driver. The Ryder cut-off is one in which by an ingenious device the governor performs the work of moving the expansion-valve, unassisted by the engine.

*Condensers*.—The condenser in steam-engines is an organ which characterizes a certain class of engines called condensing engines. It consists of a chamber of any convenient form, and placed in any convenient position with reference to the cylinder, into which the exhaust steam is carried at each stroke of the engine. In this chamber the steam is condensed, either by actual contact with particles of cold water thrown into the chamber by an injection-pump, or by contact with the surfaces of tubes, the opposite surfaces of which are kept cooled by contact with cold running water, the circulation of the water being produced by a circulating pump. The first form is called the *jet condenser*, and the second the *surface condenser*. In the jet condenser cold water is injected by a force-pump into a chamber into which the exhaust steam is discharged. The condensing water and the condensed steam thus become mingled, and, together with the air disengaged, are removed by the air-pump. A portion of this hot water is conveyed to the boiler, and the surplus discharged as waste. The surface condenser usually takes the form of a cham-

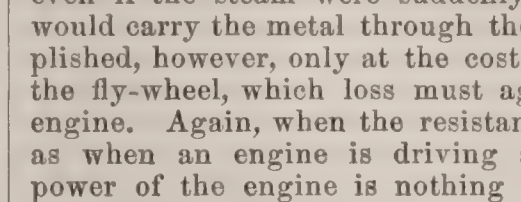
FIG. 37.




ber traversed by hollow tubes through which cold water is kept circulating, while the steam is admitted to the chamber around the exterior surfaces of the tubes. Fig. 37 represents a surface condenser of a cylindrical form. The condensing water enters the tubes at one end, as shown by the arrows, and is discharged at the other, while the steam is admitted around the tubes. A mode of packing the ends of the tubes by ferules of compressed pine wood is shown in Fig. 38. This device, the invention of Mr. Horatio Allen, has contributed, at least in this country, more than anything else to render the surface condenser perfect in its operations.

The chief difference between the surface and jet condensers consists in this—that in the surface condenser the condensed steam does not become mixed with the condensing water, and hence the *same mass* of water may be kept continually circulating from the condenser to the boiler and cylinder, and back to the condenser; the boiler is thus supplied with distilled water, and is much more durable under these circumstances; while indirectly the

FIG. 38.



surface condenser is economically more advantageous than the jet condenser. The employment of either, especially at low pressures, results in a saving of fuel as compared with the non-condensing engine. The disadvantages are the increased cost and the necessity for a large amount of cold water for condensation, which for stationary, locomotive, and many other engines cannot be obtained or practically applied.

*Fly-Wheel*.—The fly-wheel is an important and essential appendage to the steam-engine under many conditions of use.

A stationary engine with a single cylinder requires a moving mass between the piston and the working point, which by its alternate accelerations and retardations will store up and give out energy in such a manner as to keep the power, reduced to or at the working point, nearly constant. As an example, the rolling-mill is perhaps the most striking. The useful work to be performed is in this case the driving of a heavy plastic bar or plate of iron or other metal between rolls—an operation not continuous, but occurring only at intervals. With a single-cylinder engine of the ordinary type the pressure of the steam on the piston at any instant is not usually sufficient to overcome the great resistance offered; by the interposition of a heavy fly-wheel, however, the action of the engine produces gradually a high velocity of revolution in the fly-wheel, causing an accumulation of living force. When the metal enters the rolls, this accumulated energy is given out; and even if the steam were suddenly shut off, the fly-wheel would carry the metal through the rolls. This is accomplished, however, only at the cost of a loss of velocity in the fly-wheel, which loss must again be restored by the engine. Again, when the resistance is sensibly constant, as when an engine is driving a shop or factory, the power of the engine is nothing at the dead-points, and is a maximum at nearly mid-stroke. If there were no moving mass to store up and give out power, the engine must cease working at the first dead-point; for at that point the piston, which is the working point, comes to a stop and begins to return on its course. When, in addition to the above considerations, the action of the steam on the piston is not constant, but diminishes gradually from the time it is cut off, the necessity for the fly-wheel to keep up a uniform or nearly uniform motion in the shaft is still greater; or, rather, the conditions on which its dimensions depend become more complicated. In cases where the living force of the fly-wheel is required for a short period of time to perform nearly the whole useful work, as in the case of a rolling-mill, its dimensions cannot be theoretically estimated with certainty, owing to the fact that it is in such cases impossible to ascertain theoretically the amount of the useful work to be performed during the period. Precedents and experience must then be the chief guides to the engineer. The dimensions suitable for a given engine, in which the resistances are supposed constant, may, however, be determined from theoretical considerations, at least with the aid of experiments made to determine certain constants which enter the formulas.

It is impossible to establish a perfect uniformity of motion in the crank-shaft of an engine, because the mass, which by alternately gaining and losing living force preserves a uniform velocity during certain *periods* of motion, can only act by itself gaining or losing velocity momentarily at intervals of those periods. But under given conditions the variations of velocity may be made as small as is desirable. The moment of inertia of the rim of the fly-wheel is represented approximately by $W r^2$, W being the weight of the rim, and $r$ its mean radius. The dimensions for any engine are determined by the formula

$$W r^2 = \frac{m g E}{v^2},$$

in which $m$ is a number such that $\frac{1}{m}$ is the desired limit of fluctuation of speed, usually $\frac{1}{50}$th to $\frac{1}{60}$th for fine machinery, and $\frac{1}{30}$th for ordinary work; $g$ representing the acceleration due to gravity 32.2; E representing the energy stored up and given out at each revolution—a quantity to be determined experimentally, and depending on the fluctuations of velocity of the driving point or piston, and the variations of pressure of the steam at each stroke. Experiments made by Gen. Morin and others furnish values of E for different non-condensing and condensing engines. The variations in the velocity of the piston at different points of the stroke when the motion of the crank is uniform depend on the

length of the connecting-rod. The fluctuations of energy E, depending as they do on this variable velocity, are quantities which must be established for certain lengths of connecting-rods and certain points of cut-off. The experiments made by Gen. Morin place the average value of E at about $\frac{2}{10}$ths of the whole energy exerted by the steam on the piston in one revolution, so that, having found this quantity in foot-pounds, the value of E may be approximately ascertained by consulting the results of experiments. Two-tenths of this value will give a near approximation; the value of $\frac{1}{m}$ being $\frac{1}{30}$th for common engines, and $\frac{1}{50}$th to $\frac{1}{60}$th for engines driving fine machinery, the value of $W r^2$ becomes known. The radius $r$ is chosen, so that the tangential velocity $v$ of the rim of the wheel shall be what is required. If the wheel acts as a band-wheel, this velocity will depend on the necessary velocity of the countershaft to perform the work required. If the velocity may be arbitrarily chosen, it is taken at 20 to 40 feet a second.

*Theory of the Action of the Steam in the Steam-Engine.*— In designing a steam-engine to accomplish a particular quantity of work in a given time, or of a determinate *horse-power*, although in practice very simple formulas are employed, yet the constructor is supposed to have a knowledge of the principles on which such formulas are based. It has been found especially necessary, at least in the efforts which have been made to improve the economic working of steam-engines, to ascertain the theoretical principles which are applicable to the problem. This will at once be appreciated when it is considered that the *moving force* of the steam must first be produced or generated at the cost of the fuel burned. In the cycle of changes which water undergoes from the boiler to the condenser, and back again to the boiler, it passes through a series of transformations, each of which has its equivalent in a certain quantity of heat required to produce the change; and it is necessary to ascertain those influences which are effective and those which are inefficient in order to introduce conditions to render the first most effective, and to reduce the losses to the least possible amount. This is accomplished mainly by the disposition of the mechanism and the arrangement of the details of the apparatus.

It is first necessary to investigate the action of the fluid in its passage through the cycle of transformations. The water is first evaporated in the boiler at a temperature and corresponding tension which are decided upon as convenient or desirable. The quantity of heat required for this purpose is determined as described in the article STEAM, and the efficacy of the steam-generator as described in that part of this article relating to the boiler.

A certain quantity of steam enters the cylinder at each stroke of the piston, depending on the cut-off or degree of expansion. During this period the piston is actuated by the full pressure of the steam in the cylinder, generally a little less than that in the boiler, and performs a quantity of work represented in foot-pounds by the product of the pressure multiplied by the volume traversed during the period of full pressure, or $p_1 V_1$. After the steam is cut off, it continues to act on the piston by its expansive force, but with a constantly-diminishing pressure, to the end of the stroke. It is usually assumed in practice that the diminution of pressure takes place during this part of the stroke, according to the law, that the pressure is inversely proportional to the volume; and on this supposition the mean pressure throughout the whole stroke is determined by the formula—

$$p_m = p_1 \frac{(1 + \text{hyp. log. } r)}{r},$$

$p_m$ being the *mean* pressure, $r$ the ratio of expansion; the logarithms being taken in the Napierian system. As the piston returns, a certain back or negative pressure is unavoidable, due to the resistance offered by the steam that is being expelled from the cylinder. That pressure cannot be determined from theoretical considerations, but it is approximately known from experience. Calling this back-pressure $p_2$, the negative work of this pressure during the return of the piston may be determined. The work of the steam on one side of the piston during *one revolution* will then be represented by

$$A \times S \times (p_m - p_2),$$

A being the area of the piston and S the length of stroke in feet. This must be doubled in cases where the engine is double-acting, the usual case. If, now, the engine makes $n$ revolutions per minute, the total work in foot-pounds per minute will be

$$n \times 2A.S\ (p_m - p_2).$$

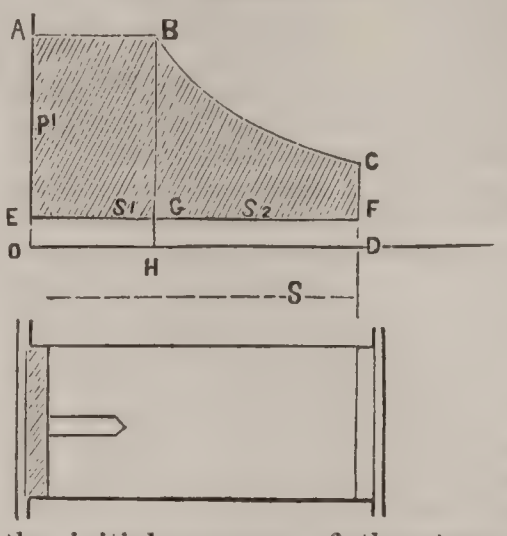
If A is expressed in square feet, $p_m$ and $p_2$ must be given in pounds per square foot. This expression divided by 33,000, the number of foot-pounds per minute in a horse-power, the power of the engine will be

$$\text{H.P.} = \frac{n.2.A.S.\ (p_m - p_2)}{33{,}000}.$$

In this expression the mean pressure $p_m$ depends on the degree of expansion; and hence the power is given by the above formula for one grade of expansion.

In engines in which the grade of expansion may be varied at will, the power of the engine will correspondingly vary. The engine making $n$ revolutions per minute, the distance passed over by the piston per minute will be $n$.2.S., which varies in practice from 200 to 800 feet. The formula is evidently a purely mechanical one—*i. e.* the force of the steam is treated as though it were any other force subjected to like variations, and acting upon the area of the piston. Questions of the quantities of heat do not enter. The action of this force is usually illustrated by a diagram as follows (Fig. 39): Let O D = S represent the length of stroke of the piston; A B = $S_1$ the distance passed over by the piston before the steam is cut off. The ratio of expansion will be $\frac{S}{S_1} = r$, and that will be equal to the ratio of the volumes $\frac{V}{V_1}$ of the steam at point of cut-off and at the end of the stroke. Let O A = $p_1$ represent the initial pressure of the steam in pounds per square inch; then $p_1$ A × 144 will represent the total force on the piston = P. The work performed during the travel from O to H or A to B will be represented by P $S_1$ or A × $p_1$ $S_1$ × 144. The area of the rectangle O A B H will then represent this work. The work performed during the travel from H to D will in the same manner be represented by the area H B C D, on the assumption that the curve B C is an equilateral hyperbola. This area will be equivalent to P $S_1$ hyp. log. $r$, and the sum of these two areas representing the whole work of the steam during one stroke,

FIG. 39.

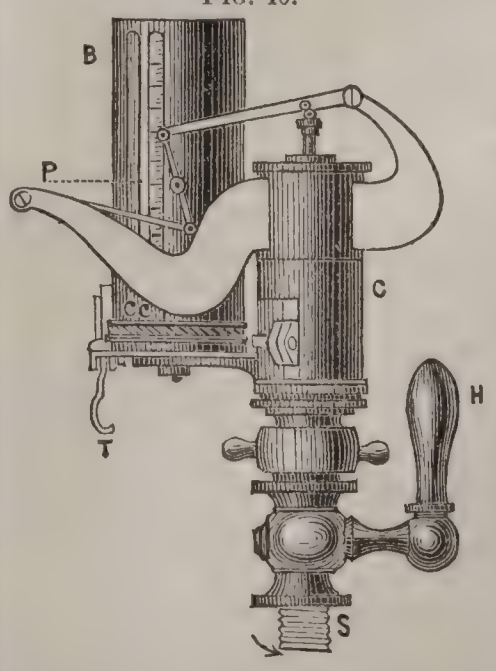



$$P S_1(1 + \text{hyp. log. } r).$$

It is assumed, further, that on the return of the piston the steam that filled the cylinder is discharged at a constant pressure, and that the fall of pressure at the end of the stroke, as well as the rise of pressure on the entrance of the steam, takes place suddenly while the piston is at rest. The area of the rectangle O E D F, subtracted from the sum of the areas given above, will then give an area E A B C F, which represents the work performed. The area E O F D is represented by $p_2 V_2$, the value of $p_2$ being assumed.

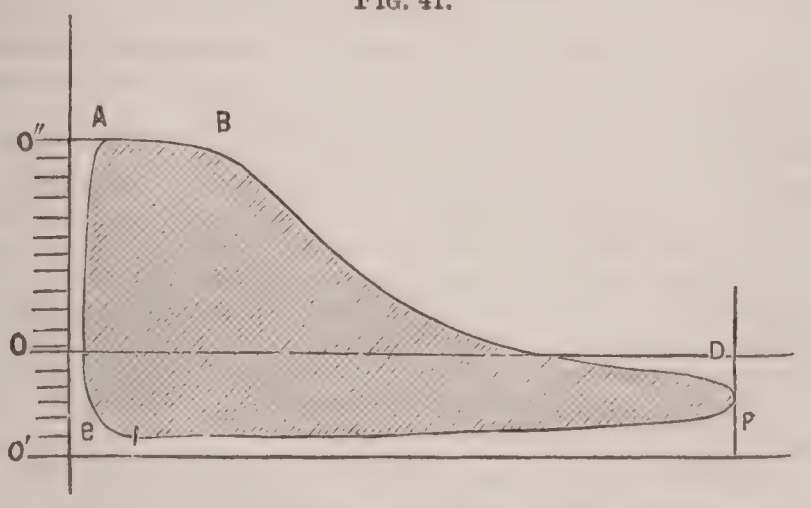
The only way practicable to ascertain how nearly the lines of the above diagram represent truly the actual phenomena that take place in the cylinder of an engine is by employing the *indicator*. The steam-engine indicator is an instrument originally invented by Watt, but improved in modern times, the object of which is to show the actual pressure of the steam on the cylinder at each point of the stroke. The instrument as improved by Richards is exhibited in Fig. 40. In this figure C represents a small cylinder fitted with a piston working without sensible friction; S is a pipe fitted with a screw, by means of which the cylinder can be put in communication with the steam-space of the cylinder, the steam being turned on or off by the cock H. The motion of the piston is resisted by a spring, of which the elastic force is known by careful experiments. B is a barrel mounted on a vertical axis, which can be turned around by pulling

FIG. 40.



on the spring T, a spring carrying the barrel back when the pulling force is withdrawn. Paper is wrapped around the barrel, and a pencil P attached to a parallel motion is caused to move up and down with the piston on the cylinder, the motion of the pencil being magnified by the lever-arm of the parallel-motion bar to which the piston is attached. The pencil will thus rise and fall as the pressure in the cylinder is increased or diminished. The spring T is attached to some moving part of the engine in such a manner that the parts of a revolution forward and back of the barrel H shall correspond truly with the corresponding motions of the piston in the cylinder of the engine. Before steam is turned on the indicator, if the barrel be revolved the pencil will describe a line which, when the paper is unwrapped, is a straight line. This is the line of no pressure, or base line from which pressures are laid off, the piston of the indicator being then subjected to the pressure of the atmosphere above and below. If now the steam be turned on by the cock H, the pencil will make a quick movement up and down, corresponding to the full pressure, expansion, and exhaust in the engine-cylinder; and the barrel having made at the same time nearly a whole rotation forward and back, when the paper is unwrapped it will be found that the pencil has described a closed curve on the paper, corresponding to Fig. 41. This diagram is from a condensing engine, and the atmospheric line

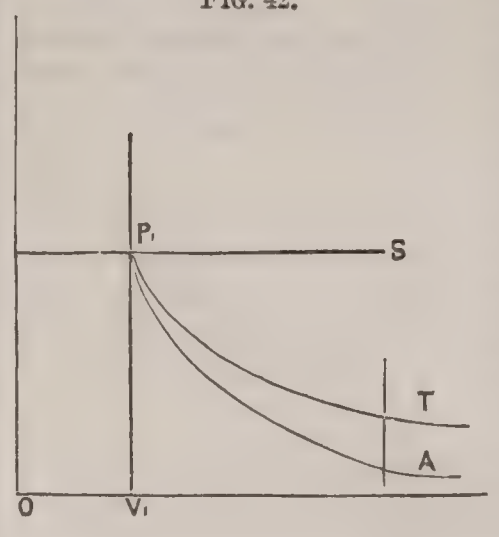
FIG. 41.




is marked O, the lower base line O′, corresponding to a perfect vacuum in the condenser; the distance O O′ will then usually represent about 15 pounds in the vertical scale of pressures. It will be seen that the diagram differs from the theoretical diagram. If the pressure O O″ is measured on the scale, it will be found that this pressure is always less than the boiler-pressure; the line A B is not usually a straight line; the angle at B is rounded; the end of the diagram at D is not the same as in the assumed diagram. The same is true in regard to the curve at E, and the line E A may be a curved line. In truth, real diagrams sometimes differ so much from the assumed theoretical diagram that they would scarcely be recognized as relating to the same phenomena, the upper curve representing the expansion curve, and the lower the back pressures on the return of the piston. In all cases these lines give a true indication of the pressures in the cylinder at different points of the stroke; and by measurements of the pressures on vertical scales, drawn at equal intervals, the mean forward and mean backward pressures $p_m$ and $p_2$ may be determined.

The "efficiency" of a machine is a term used to designate the ratio of the disposable or theoretical work to the useful work. This is the usual mode of estimating the loss of effect in employing any machine. If the disposable work is estimated in the cylinder of the steam-engine in the theoretical manner above indicated, calling W the disposable work and W′ the real work, the efficiency will be $\frac{W'}{W}$, a fraction always less than unity, because, on account of friction, there is always in any machine a certain amount of useless or ineffective work. There are generally also other causes of loss, so that the efficiency of a machine becomes still less. The efficiency of machines can be determined, therefore, only when the disposable work W can be properly determined, and when also the useful work W′ can be determined. The theoretical diagram which has been given does not truly give the disposable work of a given engine for two reasons: First, the expansion curve may not be—and is not usually—a part of an equilateral hyperbola. The equilateral hyperbola is a curve which represents the expansion of a perfect gas under *constant temperature*. The equation $PV = RT$ for perfect gases (and approximately for the permanent gases) becomes, when the temperature is constant during expansion, $PV = \text{const.}$; that is, the product of the pressure and volume during expansion is constant, and the pressure is inversely proportional to the volume—a law which, when the pressures and volumes represent the ordinate and abscissa of a curve, gives the equilateral hyperbola. When steam in contact with water expands at constant temperature, the *pressures are constant*, and such an expansion curve is a straight line parallel to the line of abscissas. When air, for instance, expands without accessory heat, it no longer follows the simple law of Mariotte, but the relation between the pressures and volumes is $PV^{1.41} = \text{const.}$, giving a curve different from the isothermal curve. The two curves for permanent gases represented by the equations $PV = P_1V_1$ and $PV^k = P_1V_1^k$ ($k$ being the exponent of V for the adiabatic curve) have the relation shown above at Fig. 42. Starting from the same initial point $p_1$, the isothermal curve $p_1$T lies always above the adiabatic curve $p_1$A. The pressures diminishing more rapidly for the latter, the *isothermal* curve for steam in contact with liquid water would be the straight line $p_1 s$.

FIG. 42.




The *adiabatic curve* for saturated steam—that is, the curve of expansion when no heat is furnished to or abstracted from the steam during the expansion—differs from both of these, but approaches the isothermal for permanent gases in form. The probable equation of the curve has the same form as that for the permanent gases, but with a different exponent $k$. This exponent, first determined by Rankine empirically, is shown by Dr. Zeuner to depend on the quantity of water mixed with the steam at the beginning of the expansion. For dry saturated steam Dr. Zeuner's determinations gave $k = 1.135$. When the steam is mixed with 20 per cent. of water—that is, when in one pound of the mixture, divided into 100 parts, 20 are water and 80 steam—then $k = 1.115$, and the relation between the pressures and volumes becomes

$$P\,V^{1.115} = P_1V_1^{1.115} = \text{constant.}$$

When the quantity of steam is 30 and the quantity of water 70—a condition never allowed in engines—the adiabatic curve for steam becomes almost coincident with the equilateral hyperbola, or $k$ becomes equal to 1, nearly.

The formula for determining the mean pressure on the supposition that steam expands by the adiabatic curve, the exponent $k$ being 1.111, or $\frac{10}{9}$, as assumed by Rankine, is, $p_m = p_1\left(10.\frac{1}{r} - \frac{9}{r^{1.111}}\right)$, $r$ being the ratio of expansion. This formula may be used for calculating the mean pressure in cases in which the steam receives no heat during expansion; *i. e.* in which the cylinders are unprovided with steam or hot-air jackets.

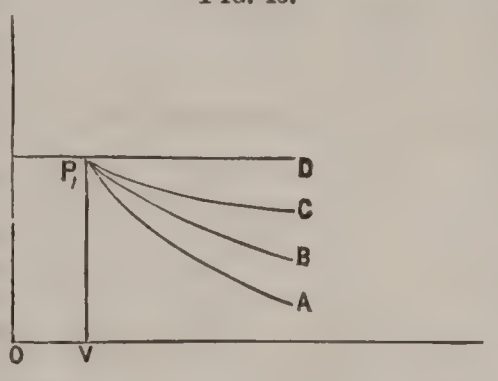
The characteristics of the adiabatic curve of expansion for steam, and the action of the fluid in regard to heat, are—that if the steam is originally dry saturated steam, there will be a condensation of vapor during expansion and a superheating during compression. Taking the other extreme case, in which there is no vapor, but only liquid water under a high pressure, the liquid will be vaporized during the expansion according to the adiabatic curve. Between these extremes there is a point at which for the same initial and final pressures the quantity of vapor will be the same at the *end* of the expansion as at the *beginning*, though not constant during the expansion. Liquid is first vaporized, and afterward vapor is partially condensed. This occurs when the weight of the liquid and vapor at the beginning of the expansion are about equal.

There are two other forms of curve of expansion which may be examined theoretically for steam, and which may be partially realized in practice. If we suppose the steam to receive heat during expansion from some external source, such as a steam jacket or a hot-air jacket around the cylinder, the adiabatic curve no longer represents the law of expansion, that curve being, conditionally, that in which no heat is received or abstracted during expansion and compression. In one case it is supposed that just enough heat is imparted to the steam to prevent liquefaction or condensation when the steam is originally *dry* and *saturated*, or just enough to preserve the quantity of vapor constant if the steam is mixed with water at the beginning of the expansion. This curve of expansion, starting from the same initial point, will lie above the adiabatic curve. The form of the curve of expansion in this case is similar to that of the adiabatic curve. Another is that in which the *interior work* of the vapor and water remains constant—*i. e.* there is neither evaporation nor condensa-

tion, and the *temperature* remains constant. This curve of expansion for the same initial point lies above both the adiabatic curve and the curve of quantity of vapor constant.

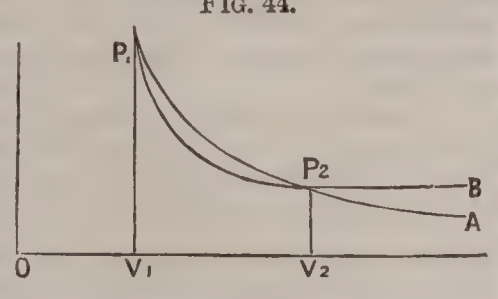
Starting from the same initial point with the same relative volumes of vapor and liquid, the relative position of these curves is shown in Fig. 43. A is the adiabatic curve, B the curve of quantity of vapor constant, C the isodynamic curve, and D the isothermal curve. The straight line D represents the expansion or *compression* of steam at constant temperature when it is in contact always with its liquid.

FIG. 43.




The second curve C is possible as an *expansion* curve only when liquid water is present during expansion, because expansion by this curve is always accompanied by vaporization, and compression by condensation. Curves A and B are possible expansion curves for either dry saturated steam or for mixed water and steam, and hence they are the curves of most interest in connection with the steam-engine. When there is at the beginning of the expansion as much water by weight as vapor, the two curves coincide at two points. In the curve B the quantity of vapor is constant, and in the adiabatic curve there is first an evaporation and then a condensation until the specific volumes become equal; if the expansion is continued, the adiabatic curve (Fig. 44) falls below the curve B.

FIG. 44.




In estimating theoretically the power of an engine furnished with a steam-jacket, it is impossible to assume with certainty the actual conditions of the problem. It is not known, for instance, precisely what quantity of heat will be furnished by the steam-jacket, nor what relative quantities of vapor and water will be found in the cylinder at the beginning of the expansion. It is usually assumed that enough heat enters the cylinder from the jacket during the expansion to prevent the condensation which would occur if no heat were added—*i. e.* if there were no steam-jacket; that the curve of expansion is the curve of quantity of vapor constant, and that the steam is saturated and dry at the beginning of the expansion. The curve of expansion is then represented by Rankine by the formula

$$P V^{1.06} = P_1 V_1^{1.06} \text{ or } P = C_1 \frac{1}{V^{1.06}} = C \frac{1}{V^{\frac{17}{16}}},$$

and the mean forward pressure is given by the formula

$$p_m = p_1 \left( 17 \frac{1}{r} - 16 \frac{1}{r^{\frac{17}{16}}} \right),$$

$r$ being the ratio of expansion. The mean effective pressure ($p_m - p_2$) is then known when $p_2$ is assumed.

It will be seen by the preceding discussion that the equilateral hyperbola is not a *theoretical curve* of expansion for steam except under one particular and (for steam-engines) an almost unsupposable case—viz. when the relative quantities of vapor and of water are to each other in the proportion of 3 to 7, the water being in excess, and the expansion taking place according to the adiabatic curve, no steam-jacket being employed, but that the curve last described given by the equation $P = c.\frac{1}{V^{1.06}}$, $c$ being a constant (heat being supplied by hot steam from the boiler circulating in a jacket around the cylinder), gives a close approximation. Under these conditions the exact curve is in all cases dependent on the relative quantities of steam and water present at the beginning of the expansion. The steam-engine indicator traces, however, a curve which takes very nearly the form of the equilateral hyperbola, and the latter is almost universally applied to indicator "cards" as a test or basis for estimating the action of the steam during expansion. In calculating the dimensions of an engine to be constructed with a given grade of expansion, the equilateral hyperbola may be assumed as the expansion curve.

The application of purely theoretical rules to the expansion is complicated by an important secondary phenomenon which cannot well be submitted to analytical investigation. The cylinders of ordinary engines are made of cast iron, which takes up and gives out heat as a sponge takes up and gives out water. The expansion line of actual engines, on this account, differs from *any* theoretical line that can be drawn, so much that it is only from experiments with the indicator that the effect of this interchange of temperature between the iron cylinder and the mixed steam and water can be determined.

The adiabatic expansion curve for superheated steam is a curve of which, according to the best authorities, the equation is $PV^k = \text{const.}$, $k$ being equal to $\frac{4}{3}$, or, 1.333. Superheated steam in expanding acts, then, like the permanent gases, the exponent $k$ only being different. The isodynamic curve for superheated steam, or the curve for which the interior work (temperature and state of aggregation) is constant, is an equilateral hyperbola. The theoretical work during the expansion by the adiabatic curve for gas, saturated steam, or superheated steam is found by either of the following expressions:

$$L = \frac{p_1 V_1}{k-1}\left[1 - \left(\frac{V_1}{V_2}\right)^{k-1}\right];$$

$$L = \frac{p_1 V_1}{k-1}\left[1 - \left(\frac{p_2}{p_1}\right)^{\frac{k-1}{1}}\right].$$

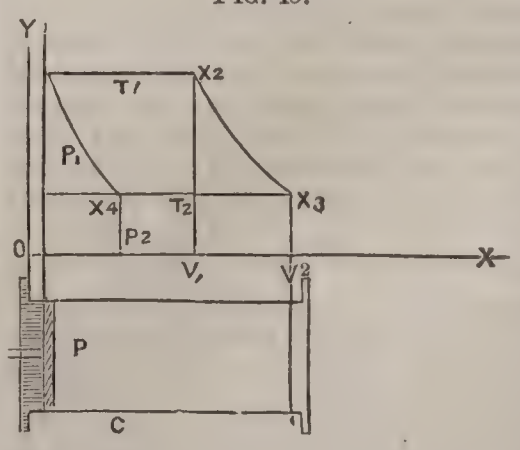
$p_1$ and $V_1$ are the initial pressure and volume, $k$ the exponent of V in the equation of the curve, $V_2$ and $p_2$ the final volume and pressure. $V_1$ may be taken to represent the volume of one pound, and then $p$ will represent the exterior work of expansion of one pound of the gas or vapor.

The use of the steam-jacket, or annular casing enveloping the cylinder with hot steam from the boiler, is an economizer of heat, not because condensation during expansion by the adiabatic curve is in itself a loss of heat, but the presence of liquid water in the form of cloud, or in any other form, in the cylinder, facilitates and renders more rapid the interchanges of heat with the metal of the cylinder and the hot entering steam from the boiler, lowering the initial pressure and increasing the final pressure in a way that cannot be estimated theoretically. As nearly all engines work expansively, it is therefore generally impracticable to ascertain *theoretically*, except as a mere approximation, the quantity of work which an actual engine under given conditions is actually exerting. The only true resource is the *indicator*.

Notwithstanding the difficulties of estimating theoretically the action of a real engine—difficulties which arise not only from the causes which have been mentioned, but from various others also—it is important to ascertain the disposable work of a theoretically-perfect engine in order to ascertain not only the relation which the actual work of the engine bears to that which is placed at our disposal, but to find out where the imperfections of real engines lie, with a view to their correction as far as the nature of the machine will allow.

The first question, then, is, What is the work put at our disposal when a given weight of water at the ordinary temperature of the atmosphere is heated to any temperature, evaporated, and then recondensed to the state of water at the lowest temperature? This is the cycle through which water passes in the boiler and engine, and we have only to seek the conditions in which during this cycle the maximum amount of external work will be performed. We may suppose, in illustrating the problem, that there is no boiler really, but that a certain quantity of water rests in the bottom of a cylinder (see Fig. 45), the weight of the water being W and the temperature $t_1$. To prevent the formation of vapor it will be necessary that a pressure $p_1$ on unit of area should be applied to the piston. If we now suppose heat to be applied to the water, the constant pressure $p_1$ remaining on the piston, vapor will be formed under constant pressure and temperature. After the piston has passed over a given volume $V_1$, the quantity of vapor formed will be $Wx_1$, $x_1$ being the proportion by weight of vapor. (See THERMODYNAMICS.) Let, now, the introduction of heat be interrupted, the mixture of vapor and liquid continuing to expand according to the adiabatic curve until the volume becomes $V_2$ and the quantity of the vapor $Wx_2$, the pressure on the piston diminishing in accordance with the adiabatic curve at the end of the expansion to the volume $V_2$, the pressure having been reduced to $p_2$, let the vapor be compressed at the constant pressure $p_2$. It will be necessary to abstract heat from the water and vapor during this compression. Finally, suppose the abstraction of heat to be arrested, and the compression to be

FIG. 45.



continued without the introduction or abstraction of heat until the water is again reduced to the liquid state, the cycle of operations being such as are represented in Fig. 45. The quantity of heat furnished to the water during the expansion at constant pressure $p_1$ will be given by the formula $Q = Wr_1x_1$, $r_1$ being the latent heat of evaporation at the temperature $t_1$, and the external work performed during the cycle will be

$$L = \frac{Wr_1x_1}{A}\left(\frac{T_1 - T_2}{T_1}\right),$$

$T_1$ and $T_2$ being the highest and lowest absolute temperatures which the water has attained during the cycle, and A the reciprocal of the dynamical equivalent of heat. (See THERMODYNAMICS.) The work L is the maximum work which the vapor can perform between the absolute temperatures $T_1$ and $T_2$. This work L may be reduced to horse-power per hour for a perfect engine of this character by finding the quantity of vapor produced in an hour ($Wx_1$ being supposed that produced in one second), and dividing the quantity L by the number of units of work in a horse-power.

The temperatures $T_1$ and $T_2$ available for actual engines may be readily assumed. The higher temperature $T_1$ will depend on the initial pressure, and the lower, for non-condensing engines, will be the temperature corresponding to $p_2 = 1$ atmosphere, and for condensing engines corresponding to $p_2 = \frac{1}{10}$ of atmosphere nearly.

The following table gives the quantity of vapor required per horse-power per hour for such a perfect engine:

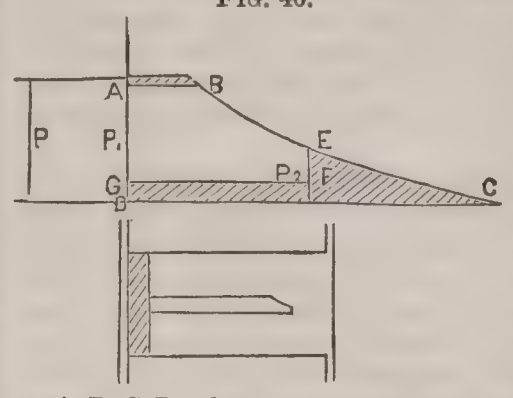
| Pressure in atmospheres. | Pounds of water or vapor per horse-power per hour. | |
|---|---|---|
| | Non-condensing engines. | Condensing engines. |
| $1\frac{1}{2}$ | 73.9 | 15.6 |
| 3 | 33.3 | 12.9 |
| 4 | 26.7 | 12.0 |
| 5 | 23.2 | 11.5 |
| 6 | 21.0 | 11.0 |
| 8 | 18.3 | 10.4 |
| 10 | 16.7 | 10.0 |

The efficiency of a steam-engine in actual use may be ascertained by comparing the quantity of steam *actually used* to give one horse-power per hour with the quantity given by the above table for the same initial and terminal pressures of the steam. For instance, a non-condensing engine may give a horse-power per hour with a consumption of 35 pounds of water or steam at a pressure of 6 atmospheres—a common performance. The theoretical quantity required in a *perfect* engine, according to the preceding table, for the same initial pressure, is 21 pounds. The efficiency of the engine under these circumstances, measured by the standard of steam required, is $\frac{21}{35} = 0.6$. Ordinary boilers of the best type may evaporate 9 pounds of water for 1 pound of coal burned, the maximum of evaporation of the boiler being about 13.5 pounds of water per pound of coal. The efficiency of the boiler is then $\frac{9}{13.5} = 0.6$. Multiplying these efficiencies together, we have the efficiency of the boiler and engine equal to $.0.6. \times 0.6. = 0.36$.

The efficiency of the apparatus, measured by the ratio of the work in foot-pounds accomplished to the number of foot-pounds of work, which are equivalent to the heat evolved in the combustion of fuel, gives quite a different result. A non-condensing engine that requires 35 pounds of water per horse-power per hour will require a consumption of about 4 pounds of coal per horse-power per hour, of which only about six-tenths are available, the other four-tenths being waste heat of the boiler, heat required to produce the draught, etc. One horse-power per hour is equivalent to 1,980,000 foot-pounds per hour of actual work. The *available* heat of combustion of 1 pound of coal is about six-tenths of 10,000,000 foot-pounds, or 6,000,000 foot-pounds; and the available heat of combustion of 4 pounds of coal is about 24,000,000 foot-pounds. The efficiency of the whole apparatus on the basis of the heat which is imparted to the water by the combustion of the fuel will be $\frac{1,980,000}{24,000,000} = .08$, approximately. In condensing engines a corresponding calculation will give a higher efficiency, amounting to .17, a horse-power per hour being produced by 2 pounds of coal in some instances. The efficiency of the non-condensing and condensing engines approach each other as the initial pressure increases.

Some of the inherent deficiencies of the steam-engine, which can in no way be wholly avoided, may be illustrated by the following diagram. If we suppose steam to enter the cylinder with a pressure $p_1$ above an absolute vacuum, and to follow the piston at this full pressure through a part of its course as A B (Fig. 46), then to expand by the adiabatic curve B *e*, and to be discharged with a constant pressure $p_2$, the ordinate of the line *f g*, the diagram A B *e f g* will represent theoretically that of an actual engine. In this it will be observed that the initial pressure $p_1$ is less than *the boiler pressure p;* the expansion is *not complete*, and the back pressure is not zero. Those parts of the diagram covered by shaded lines represent such losses; and it may be added that even with a perfect diagram, as represented at A B C D, the *cycle* is not a complete one, such as has been given in Fig. 45. If to these defects are added others, such as arise from wire-drawing of the steam at the cut-off, hurtful or dead space at the end of the stroke, the causes of losses of efficiency in actual engines become apparent. If to these losses of efficiency the friction of the engine be added—a quantity dependent on the useful work performed—the total losses of efficiency of the machine may be estimated.

FIG. 46.




It may be remarked that the *engine itself*, with all modern improvements, approaches the turbine-wheel in efficiency. The efficiency of the latter may be estimated at eight-tenths, while the best engines will approach an efficiency of six-tenths to seven-tenths. The cost of the power is another question. In the turbine-wheel nature performs the important part of elevating the water to a higher level without cost. In the steam-engine the elevation of the heat of the water to the higher degree from which it must fall to produce work is accomplished only at the cost of labor, beginning with that of the miner who excavates the coal. If the efficiency is estimated by the number of foot-pounds of energy evolved in the combustion of the coal, we have seen that it is a very small fraction.

It is impossible to enter into the details of constructions which have been proposed and executed, having for their object improvement in the efficiency of the steam-engine. The use of the condenser and the steam-jacket has been alluded to. It only remains to notice briefly the *compound engine*. This is an engine in which there are two (or more) cylinders (see Fig. 38), each with its own piston and piston-rod, but all acting upon the same shaft. One of the cylinders is called the high-pressure cylinder, and the other the low-pressure cylinder. Steam is admitted to the high-pressure cylinder, and is cut off before accomplishing the full stroke, but the expansion in the cylinder is not carried to a high degree. The steam is exhausted on the return stroke, not into the condenser directly, but into the second and larger cylinder. In this cylinder the steam continues to expand until the limit of expansion is reached, and it is then exhausted into the condenser. This style of engine has become almost universal for ocean steamships, a substantial proof of its value. The arrangement of the cylinders, whether superposed or side by side or separated from each other, and whether the pistons act on the same crank and move simultaneously in the same direction, or on different cranks having an angle with each other, does not alter the general principles of action, but constitute details which are adapted to different circumstances according to the judgment of the engineer. If the cylinders of steam-engines could be made of a material which would not absorb and give out heat, there would not be theoretically any economic gain in the expansion of the steam in several cylinders as compared with expansion in one, and the only gain which could arise would be the equalization of pressure on the crank-pin during its revolution. But the action of the metal of the cylinders in absorbing and giving out heat modifies, as has already been explained, in a remarkable degree, the action of the engine upon the steam. The less the *change of temperature* in a cylinder from this cause, the more nearly will the action of the steam correspond to that which is indicated by the mechanical theory of heat, uninfluenced by the cylinder. The effect of two cylinders is to diminish the range of temperature in each, and hence the injurious effect of these secondary causes is diminished.

It has been shown by the estimated quantity of steam required per horse-power per hour in a perfect engine that an increase of pressure is accompanied by an increase in economy. Experiments have invariably confirmed this result. In the compound engine, as now employed so generally for marine purposes, there has been with their introduction an advance in practice also in using steam at high pressures. This would in itself account largely for the increased economy in such engines; and it is contended by

many practical engineers that this is the chief, if not the sole, cause of such economy—that the use of a single cylinder with a steam-jacket may be made to exhibit a corresponding degree of economy. Nevertheless, the widely-extended use of the system shows that it has important advantages. An instance is given of an engine with two cylinders on the Woolf system in Normandy, which has been in continual use for fifty years; and this is quoted as an evidence of durability of the mechanism where this system is applied.

It may be stated, as general conclusions, that the use of a steam-jacket with a single cylinder under ordinary circumstances results in an important saving of fuel, especially for high degrees of expansion; that in the compound engine, with the larger cylinder jacketed, there is a saving in economy over a single cylinder jacketed, even with the same steam-pressures and degree of expansion in both. This last conclusion, although derived from what appear to be conclusive and satisfactory experiments, is perhaps not universally accepted by engineers, the subject being one about which there is still considerable discussion. Large cylinders are more economical in expenditure of fuel for a unit of power than small ones, and slow-speed engines generally less economical than high-speed engines. An engine using steam at high pressures, other things being equal, is more economical than one using steam at low pressure. In regard to the *degree of expansion* to be allowed in designing an engine, it is to be observed that the point of cut-off with a given pressure determines the mean pressure in the cylinder from which the requisite power is to be obtained; and if the speed of the piston per minute be fixed, the size of the cylinder is determined.

There is still a want of precise and definite rules for ascertaining the most economical degree of expansion in every given case; and hence it is apparent that a theoretical calculation of the dimensions of the cylinder of an engine to be constructed is a problem which involves some degree of indetermination as far as regards maximum economy. In a paper presented to the American Society of Civil Engineers by Mr. C. E. Emery, M. E., in 1874, giving an account of experiments made by him for the U. S. navy department, the following empirical formula is given, based on the experimental data for the most economical ratio of expansion:

$$r = \frac{p + 37}{22},$$

in which $r$ is the ratio of expansion, $p$ the initial pressure above the atmosphere. For example, taking $p$ equal to 5, 10, 25, 40, 60, 80, 100, the values of $r$ will be 1.9, 2.1, 2.8, 3.5, 4.4, 5.3, 6.2, respectively. Mr. Emery states that these ratios are "nearly correct for single engines of large size, with details of good design, too small for single engines of ordinary construction, and too small for the better class of compound engines." The final performance of an engine can only be satisfactorily tested by the use of the indicator.

The adaptation of the steam-engine to special purposes, such as the locomotive, the marine engine, the stationary engine, the steam-pump, the pumping-engine, the traction-engine, etc., gives rise to details of mechanism which may be found described in works specially devoted to these subjects.

W. P. TROWBRIDGE.

**Steam Fire-Engine.** See FIRE-ENGINE, by PROF. J. A. WHITNEY.

**Steam'-Hammer.** This name has been given to hammers which are raised by the direct action of steam on a piston in a steam-cylinder, and is not understood as applying to hammers which are raised by other mechanical means receiving their power from a steam-engine through the intervention of belts and pulleys or gearing. The direct-acting steam-hammer has been said to have contributed more than any other modern mechanical invention in developing the resources of the iron trade. It is certainly the outgrowth of the needs of the trade in its advancement, and has very considerably aided that advance.

Long before steam-hammers were thought of, iron forgings of considerable size were wrought under heavy hammers operated indirectly by steam or water. These primitive forge-hammers were either known as trip-hammers or tilt-hammers. The latter, and probably the most familiar form, has been much improved, and still continues in use for light forgings. This style of hammer consists of a metal hammer-head mounted on the end of a heavy timber, answering in purpose to the handle of a hand-hammer. This timber is, at some distance from the hammer-head, provided with trunnions, and a prolongation of timber back of the trunnions is operated upon by tappets on a revolving wheel. The tappets, striking the end of the beam or helve, depress it, and thus raise the hammer-head in an arc of a circle, the trunnions being the centre of the circle. The trip-hammer is the same, so far as the hammer-helve and trunnions are concerned, but the tappet-wheel is placed in front of the hammer-head, and lifts the head, acting from beneath upward. The trip-hammer in the forge and rolling-mill is used for rudely forging the puddled balls of iron into blooms. Both of these hammers deliver their blows in an arc of a circle, and are limited in their capacity of regulation as to force and intensity of the blow. The tilt-hammer, when arranged with a spring above the hammer-head or a spring below the tail end of the helve where it is driven down by the tappets, is capable of being operated at a much higher speed than when its blow is the result of gravity alone, for the hammer, recoiling from the action of the spring against which it has been driven in ascending, has a more rapid descent, and can be run at a very high rate of speed. The tilt-hammer, or helve-hammer as it is sometimes called, maintains its place in the workshop, and is largely used for light forgings for cutlery and the like.

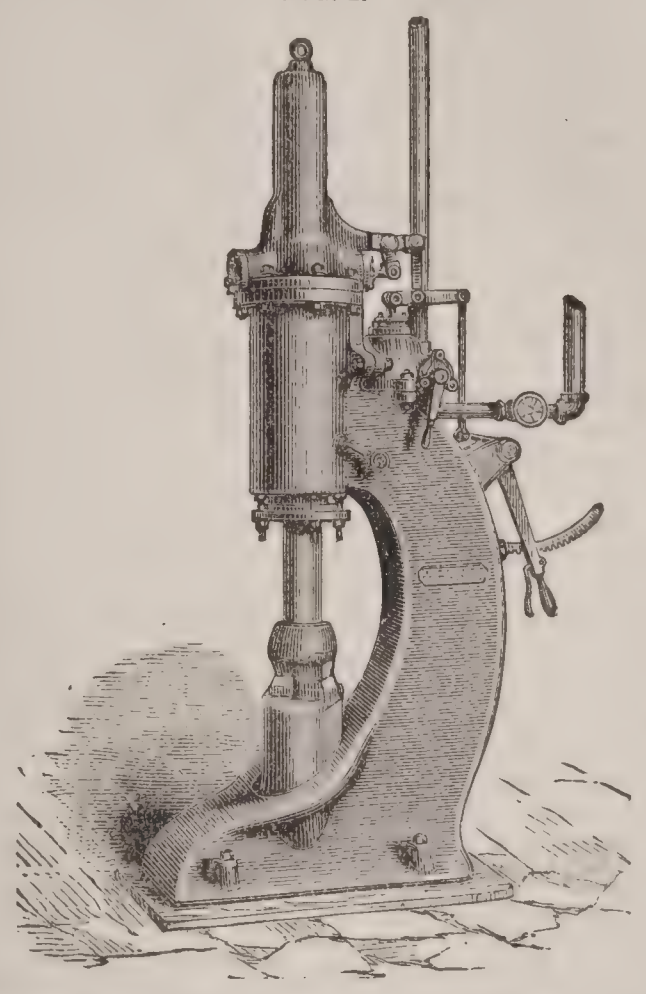
To Mr. James Nasmyth of the Bridgewater Foundry, Patricroft, near Manchester, England, is due the honor of the invention and practical construction of the first steam-hammer. Mr. James Watt in 1784 patented a steam-hammer; one William Deverell also took out a patent for one in 1806, but there is no reason to believe that these patents were ever worked. Mr. Nasmyth proposed the steam-hammer to the engineer of the Great Western Steamship Co. in 1837 as of advantage in forging the paddle-wheel shafts of the Great Britain steamship, then building, but no hammer of this kind was constructed until the years 1842 and 1843. Mr. Nasmyth's steam-hammer was constructed with parts common to all steam-hammers made afterward—viz. a heavy mass of iron which constitutes the hammer, or "tup" as it is called. This "tup" slides freely in guides or ways in the frame or upright of the hammer. On top of this frame is placed a cylinder fitted with piston, piston-rod, and valve, after the manner of a steam-engine. The piston-rod, extending downward through a stuffing-box in the brass cylinder-head, terminates in its attachment to the tup or hammer. Steam admitted under the piston raises it, and thus lifts the hammer; upon the opening of the exhaust, and consequent escape of the steam, the hammer falls with a force due to its weight and the distance fallen through, less the friction of the piston, piston-rod, and escaping steam. This form of hammer was at first made single-acting only, and its essential features are the same as nearly all the steam-hammers made by various makers since then. All direct-acting steam-hammers are, properly speaking, Nasmyth's hammers, but his name has been almost lost in the rival claims of those who have introduced distinguishing improvements on his invention. His hammer, single-acting only, was worked by hand, and no very good valve-motion was added to it to render its action automatic until his engineering manager, Mr. Robert Wilson, hit upon a plan of operating the valve automatically; and he also, it is believed, first applied the balance principle of valve to the steam-hammer. This latter improvement was of great importance, inasmuch as it permitted large valves to be readily raised by hand. The use of this valve has continued, but the cumbersome but ingenious valve-motion of Mr. Wilson has been replaced by more simple if not more efficient devices. During the continuance of Mr. Nasmyth's patent, engineers had but little chance to improve the original invention. Some radical changes were proposed which did not meet with much success, the most radical having been proposed by Mr. Conde. His invention, which bore his name, consisted in suspending the piston by its rod from the top of the hammer-frame, and making the steam-cylinder the hammer proper. Steam to this cylinder passed through the piston-rod, which was hollow. Then the steam-cylinder was made to rise and fall, and a die or hammer-face at its lower end struck the metal to be forged.

Steam-hammers have more cause to deteriorate in use than almost any other machine tool, inasmuch as the severe shocks to which they are submitted while in use tend to destroy their parts. This can be readily understood when it is considered that a mass of metal, perhaps weighing many tons, is lifted by the steam-piston and piston-rod, and either allowed to fall or is driven down by steam-pressure acting above the piston, and the motion of this heavy mass is suddenly arrested when it strikes the metal being forged. If the point of contact in striking be out of plumb with the centre of gravity of the falling mass, a side vibration is given to the mass, resulting in a severe side-strain in the guides or ways. The piston-rod, arrested in its downward motion at the end of the stroke, becomes itself a hammer, acting upon the mass of the hammer proper, or "tup," as on an anvil. This in time destroys the piston-rod. The destruction of the piston-rod from this cause was considered so serious a matter in the early

hammers as to induce Mr. Nasmyth to resort to many ingenious devices to provide an elastic cushion between the piston-rod and the "tup."

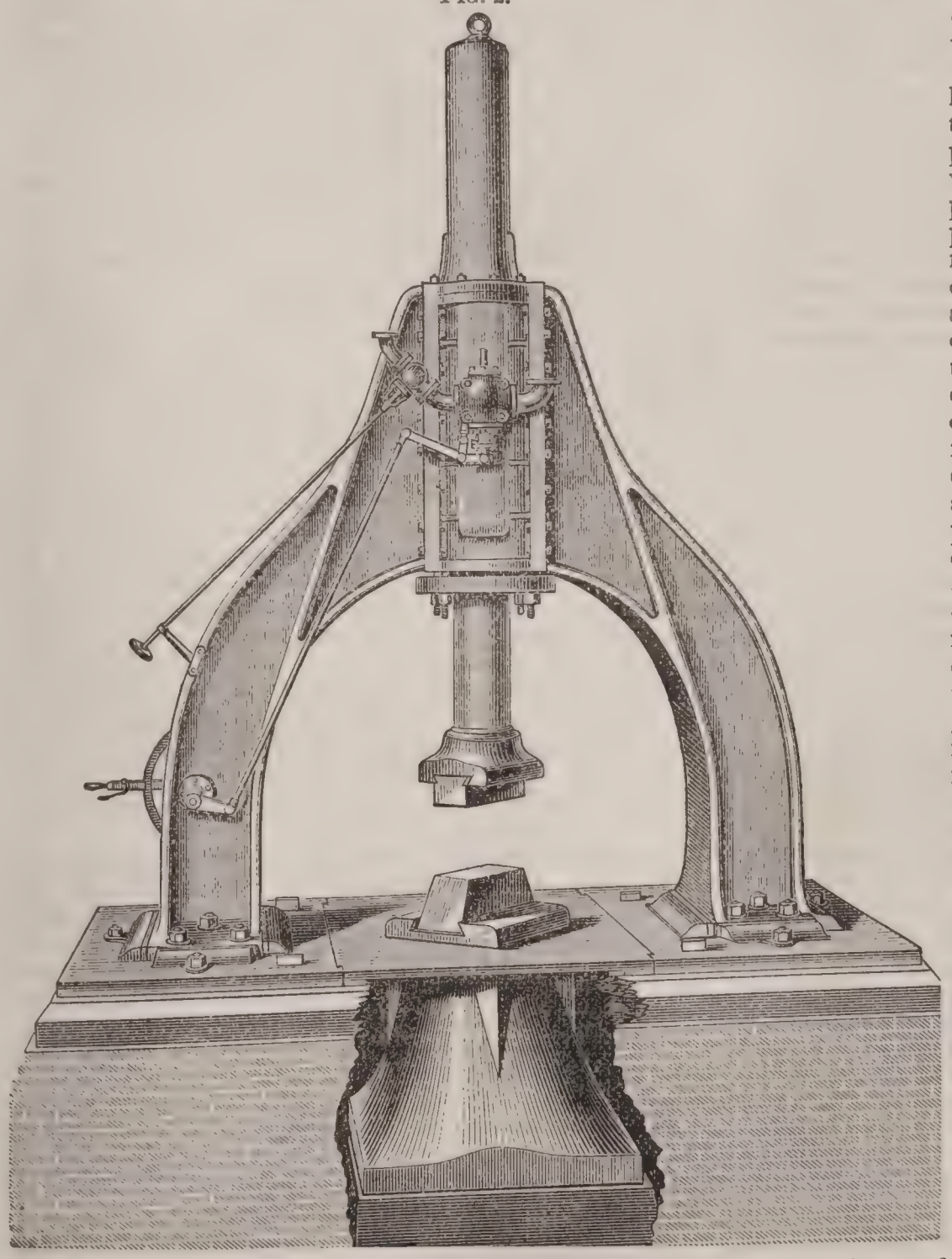
Mr. Robert Morrison of Newcastle-on-the-Tyne in the year 1853, patented a steam-hammer in which the piston-rod was the hammer, and the blow was imparted by the end of

FIG. 1.



the piston-rod properly protected by a shoe or hammer-face. He of necessity made the piston-rod very large and of wrought iron, welding the piston to the middle of this

FIG. 2.



long rod, and guiding it by stuffing-boxes in the upper and lower cylinder-heads. In other words, he extended the rod through both heads of the cylinder, and made it sufficiently large to weigh the number of pounds required. Thus, as an example, a rod weighing 5 tons he made 13 inches in diameter; its piston-head, 31 inches in diameter, working in a cylinder long enough to allow a stroke of 6 feet. His idea was to do away with the many parts which in the Nasmyth steam-hammer tend to beat themselves to pieces, one on the other, and substitute for them one single bar of wrought iron, striking endways on the forging in the manner of a battering-ram. To prevent the bar from turning, he cut a flat on the rod above the piston-head, and guided it by a corresponding shape in the top cylinder-head. This form of steam-hammer proved to be very efficient, but in time developed a weakness where the piston-rod was enlarged at its lower end to receive the hammer-die. Repeated blows caused a fracture immediately above this enlargement. In 1872, Mr. William Sellers of Philadelphia improved the Morrison hammer by enlarging the rod below the piston-head, and continuing the enlarged size down to the hammer-face, then attaching the hammer-face by means of a loose collar surrounding the lower end of the bar, this collar being held in place by means of a tapered wedge-ring driven down between the bar and collar, the collar being provided with proper dove-tails to receive the hammer-face. This arrangement brought the greatest part of the weight nearer to the hammer-face, strengthened that part, and did away entirely with the weak point in the hammer-bar of Mr. Morrison. His improvement obviated all trouble from breakage of the hammer-bar, and rendered it practically indestructible. It was found advantageous to increase the weight of the hammer-bars in hammers of any given length of stroke, so that the lower part of the hammer-bar being increased, the 5-ton hammer of Mr. Morrison's bar came to weigh 7 tons. Hammers for heavy forgings are constructed with double uprights, large-sized hammers, with a long stroke, having a wide spread of base between the legs of the upright to give room for the workmen to handle the iron being forged. The anvil-face is usually set at 18 inches above the floor-level. Fig. 2 shows a double upright hammer of the Morrison type. These large hammers are not made self-acting, it having been found advantageous to work them by hand only. In light work, such as tilting or drawing out bars of steel, an automatic valve-motion is of the utmost importance. Fig. 1 shows the form of a single upright hammer as used for light forging or for tilting steel. A hammer weighing 300 pounds—*i. e.* the hammer-bar, or part which strikes the blow, weighing 300 pounds—should make at least 300 blows per minute to work economically in light forging. An important improvement recently introduced in these rapid-running steam-hammers is the separation of the exhaust-passages in the slide-valve, so that the exhaust from the space below the piston escapes through a passage which does not communicate with the exhaust-passage from the space above the piston. In the exhaust-passage from below the piston, is arranged a throttle-valve, which when partially closed chokes the exhaust escape, and thus, suspending the escape of steam as the hammer descends, materially diminishes the force of the blow, and yet, inasmuch as the upper exhaust-passage is open, the hammer rises as quickly as when working with full exhaust. This is of great advantage in working steel, as the force of the blow can be lessened without materially slowing the speed or rapidity of blows. If steel is hammered with too heavy and too rapid blows, the metal becomes overheated; in fact, cold steel so hardened will become intensely heated. As the steel in tilting is brought near to size, it is of importance that it should be worked cooler to give the requisite finish and to improve the quality of the steel. This requirement is admirably accomplished by the devices above alluded to.

In setting steam-hammers it is of the utmost importance that the foundations should be of the most substantial character. It is usual—and in fact is considered the best practice—to make the anvil-block entirely separate from the hammer—to place it too on a separate foundation, and to underlay it with some thicknesses of wood, say with two layers of closely-fitted timbers at least 24″ in thickness. This gives a degree of elasticity to the

anvil and preserves the foundation. It is customary also to place wooden beams between the foundation-stones and the bed-plate of the hammer itself; the slight elasticity of the timbers relieves the frame from strains incident to the jar of the repeated blows. The anvil for iron-forging hammers should not be less than five times the weight of the hammer. Thus, a 2-ton hammer should have not less than 10 tons of iron put into its anvil-block. This is not enough for hammers used in forging steel, for eight to ten times the weight of the hammer should be put in their anvils. A 10-ton hammer forging steel ingots ought to have from 90 to 100 tons weight of anvil. These very large blocks cannot readily be made in one mass, but are advantageously built up in sections, one resting on another. Such sectional blocks can be more readily handled when put in place, and can also be conveniently raised to pack under when repeated blows have caused the anvil to settle. In setting anvil-blocks they should be placed a half-inch or more, according to their size, above their proper height, to allow for settling, which is sure to occur, no matter how well the foundation may have been put in.

Mr. Ramsbottom of England has devised a form of steam-hammer which in his hands at the works at Crew has given satisfaction. His steam-hammer is duplicated, and the blows are given horizontally, on opposite sides of the forging. The iron being forged rests on a bed-plate, which need not be very massive, the duplex principle doing away with the anvil-block entirely. Mr. Ramsbottom's two hammers are operated through a system of levers by one steam-cylinder, the blows from either side being simultaneous.

The steam-cylinder has been added to helve-hammers operating with a short stroke near the fulcrum, and some ingenious contrivances have been introduced to so operate a light helve-hammer as to make it take the place of a "striker" for a blacksmith, the blow being adjustable in direction as well as in force. The introduction of hydraulic machines for forging has taken some work from the steam-hammer and widened the possible use of wrought iron in engineering works. The steam-hammer forges the metal into the required shape with repeated blows and well-directed skill on the part of the workman. In hydraulic forging the red-hot metal is made to flow in a solid state into metal moulds, and driven into them by plungers operated by hydraulic presses. This method of forging is yet in its infancy; its ultimate extension in use depends on the introduction of improvements in the machinery used—in machinery containing great strength with ready adaptability to the uses it has to perform, and, above all, in the utmost possible durability in constant use. The first cost of the hydraulic machinery and the constant expense of dies will for a time limit the uses to which hydraulic forging may be applied, and yet necessitate the improvement in the modes of working steam-hammers to compete with it. Die-forging under steam-hammers is a step in this direction capable of extension. COLEMAN SELLERS.

**Steam Navigation.** See NAVIGATION, OCEAN STEAM, by W. S. W. VAUX, A. M., F. R. S.

**Steam-Presses.** See PRINTING, by W. S. PATERSON.

**Steam-Pumps.** See PUMPING-ENGINES, by J. P. FRIZELL.

**Steam Type-founding.** See PRINTING, by W. S. PATERSON.

**Steam Vessels.** The idea of the possible adaptation of steam for the propulsion of vessels was suggested at a very early period; it seems to have occurred to Roger Bacon, who lived in the thirteenth century. It has been generally stated that Blasco de Garay of Spain, in 1543, propelled a vessel by steam. As a fact, La Fuente, the Spanish historian, visited the archives of Simancas, and, examining the documents relating thereto, found that Blasco de Garay made (1540–43) several trials with paddles on ships furnished by the emperor Charles V.; but in every case these paddles were moved by companies of men. Suggestions as to the use of steam, none of which were attempted to be carried out practically, were made by Salomon de Caus (*Les Raisons des Forces mouvantes, avec diverses Machines tant utiles que plaisantes*, Paris, 1615) and the marquis of Worcester (*Century of Inventions*, London, 1663). But the earliest practical effort appears to be that of Papin, who in 1707 applied his steam-engine to the propulsion of a model vessel on the Fulda River at Cassel. Newcomen had in the mean time brought the steam-engine itself to a working condition; and in 1736, Jonathan Hulls patented a marine steam-engine which he proposed to employ in a vessel to be used as a tugboat. About 1763, William Henry of Pennsylvania built a small model steamboat, which he tried with flattering success on the Conestoga River; this experiment is specially notable as having furnished the hint to the successful efforts made forty years later by Robert Fulton. During the last quarter of the eighteenth century the problem of steam navigation had begun to engage many minds in Europe and America. In France we find the count d'Auxiron and M. Perier making experiments in 1774 and 1775, and the marquis de Jouffroy, upon a larger scale and with better success, in 1776–83. In America, James Rumsey of Maryland was engaged in similar experiments, and as early as 1786 built a boat which was propelled upon the Potomac by steam at the rate of 4 miles an hour by means of a jet of water forced out at the stern; a society was formed to aid him in his project, of which Dr. Franklin was a member, and he went to London, where he built a boat with which a successful experiment was made on the Thames in 1792; but he died before any thorough success was attained. In the mean while, John Fitch had been also trying experiments in steam navigation upon the Delaware River. His first boat, built in 1786, was propelled by paddles moved by a steam-engine; at first a speed of only 3 miles an hour was attained, but improvements were shortly added by which 8 miles were gained. After an unsuccessful visit to Europe to introduce his invention, he returned to America, and resumed his experiments with a small vessel upon the "Collect," a pond which occupied the spot where now stands the "Tombs" prison. It is noticeable that in this boat he employed side wheels, with a screw-propeller at the stern. (See FITCH, JOHN.) Simultaneous experiments were also carried on in Great Britain. In 1788, Miller, Taylor, and Symington built a boat which consisted of two connected hulls driven by a single paddle-wheel between them, which obtained a speed of 5 miles an hour on Dalswinton Loch. Next year they built a larger vessel, with a steam-engine of 12 horse-power, which attained a speed of 7 miles an hour. In 1801, Symington built a boat for towing on a canal, which drew vessels of 140 tons at the rate of 3½ miles an hour, but was soon abandoned, as the swell raised injured the banks of the canal. About 1790, Robert Fulton left America for England to study his profession of a painter, but he soon turned his attention to mechanics, and especially to steam navigation. He made some experiments in France, which were only partially successful, but he secured the confidence and aid of Robert R. Livingston, the American ambassador, and in 1806 returned to New York, bringing with him a powerful Boulton & Watt steam-engine, for which a hull was built. The vessel, named the Clermont, after Livingston's manor on the Hudson, made a successful trial-trip to Albany, Aug. 7–9, 1807, returning on the two following days, her average running speed being 5 miles an hour. The Clermont was 130 feet long, 18 feet beam, 7 feet deep, with a burden of 160 tons. She soon commenced making regular trips between New York and Albany, and for all practical purposes must be considered the first steamboat adapted for the conveyance of passengers and freight, all previous ones having been experimental models, or at most only designed as tugs. Fulton and Livingston obtained from the State of New York the monopoly for using steam vessels in the waters of the State. (See FULTON, ROBERT.) John Stevens of New York was even earlier than Fulton as an experimenter in steam navigation, and narrowly missed anticipating him in practical success. As early as 1789 he had perfected his plans for a steam vessel, and in 1804 and 1805 built small vessels which evinced that his plans were sound. The Phœnix, his first steamboat, properly so called, was completed in 1807, following hard upon Fulton's Clermont. Prevented by the monopoly of Fulton and Livingston from navigating the Hudson, he sent his boat by sea to the Delaware, upon which she was afterward employed, and in this voyage incidentally demonstrated the problem of the possibility of the use of steam vessels upon the ocean, no one as yet having, apparently, imagined that they could be used except in smooth water. (See STEVENS, JOHN.) Steam vessels in America were now an assured success. Fulton and his coadjutors soon placed a fleet of them upon the Hudson River and Long Island Sound, while Stevens and his sons placed their steamers upon the Delaware and the Connecticut, and upon the Hudson after Fulton's monopoly had expired. The first steamboat in Great Britain was the Comet, 40 feet long, built in 1812 for the navigation of the Clyde; but before this time Fulton and Livingston had begun to build steamers at Pittsburg, Pa. Upon all navigable rivers and smooth waters of the civilized world steamboats were rapidly introduced, but their use upon the ocean was long held practically impossible, although as early as 1819 a little steamer, the Savannah, made the voyage from Savannah, Ga., to England, and thence to Russia. (For the further progress and present condition of this branch of the subject see NAVIGATION, OCEAN STEAM.)

A. H. GUERNSEY.

**Stear'ic Acid** [Fr. *acide stéarique*; Ger. *Talgsäure*], $C_{18}H_{36}O_2$. Stearic acid, discovered by Chevreul in 1811 (*Ann. de Chim. et de Phys.* (2), t. ii. 354, and xxiii. 19;

*Recherches sur les Corps gras*), is the most abundant of the solid fat-acids, and is obtained in the saponification of all the fats containing stearine, and especially of beef's tallow, mutton suet, hog's lard, etc. All the hard fats contain two solid fat-acids, which it is extremely difficult to separate completely from each other. Hence, many fat-acids described under other names are probably only stearic acid imperfectly purified; *e. g.* bassic acid, from oil of bassia; anthropic acid, from human fat (*Heintz*); palmitonic acid, from palm oil (*Schwarz*), etc. Many vegetal fats contain stearic acid, as shea-butter of Mungo Park, cacao-butter, olive oil, oil of black mustard, oil of ben, oil of madia, Chinese wax, and the oil of *Bassia latifolia*, just named (illupei tree of the Himalayan Mountains), which afforded Hardwick the purest stearic acid (his bassic acid).

The so-called stearic acid (or stearine) of commerce, which is found in "star candles," is a mixture of stearic, palmitic, and margaric (and often also oleic) acids. This commercial stearic acid is produced by the saponification of neutral fats by methods already mentioned under Soap. But this acid is never pure, and consists of a mixture of several acids, from which it is obtained in a state of purity by one of the following methods: (1) The commercial stearic acid is dissolved in hot alcohol, which on cooling deposits the greater part of the acid; the excess of alcohol is poured off; the acid is dried by blotting-paper; and this process is repeated until the melting-point of the stearic acid is steady at 160° F. (2) The acid also may be obtained pure by fractional precipitation. For this purpose the soap obtained by the saponification of the fat by an alkali is decomposed by hydrochloric acid; the fat-acids thrown down are dissolved in a great excess of alcohol, and the boiling alcohol solution is, *in part only*, precipitated by a concentrated solution of acetate of barium, lead, or manganese; the alcoholic liquor deposits, after a time, the metallic stearate, which is then decomposed by weak hydrochloric acid; the stearic acid is then crystallized; and this process is repeated, again and again, on the product of these partial precipitations until the acid has a constant melting-point. This last method of Heintz is a modification, with much saving of time, of the original process of Chevreul. But with every possible care it is difficult to obtain stearic acid quite free from all admixture. Mutton suet saponified with one-fourth to one-third its weight of potash most readily furnishes pure stearic acid.

Pure stearic acid is colorless, and without odor or taste, and insoluble in water. It reddens blue litmus when warm and in its cold alcoholic solution, but water, which precipitates the acid, also restores the blue color. It melts at 157°–159°, and solidifies at 150° F.; Chevreul says it melts at 167°, and solidifies at 158° F. By cooling it crystallizes in brilliant needles, greasy to the touch, and after fusion it is very friable. It is insoluble in water, but dissolves in boiling alcohol in all proportions, the cooling solution depositing nacreous crystals. It is very soluble in ether. It burns with a clear and white flame. Stearic acid is the least soluble in different solvents of all the fatty acids. H. Kopp has shown that stearic acid in the act of fusion undergoes an increase of 11 per cent. in volume. The volume at 32° being 1, becomes 1.0169 at 68°, 1.0278 at 104°, 1.0539 at 140°, 1.0793 at 158°, and 1.1980 at complete fluidity. Melted stearic acid has a density of 0.854; at 39.2° its density is 1.01, and between 48° and 50° it has the same density as water. The formula $C_{18}H_{36}O_2$ is deduced from the analyses of Chevreul, Hardwick, and others, and requires C76.06, H12.68, O11.26 = 100, to which the analyses very closely correspond. It boils and distils in a vacuum and in small quantities apparently without change, and at even 572° F. in a sealed tube when heated for several hours, it neither gives off gas or water, nor alters its melting-point or appearance (*Berthelot*).

*Decomposition.*—When larger quantities of stearic acid are subjected to dry distillation, not *in vacuo*, the greater part passes over unchanged, while a small portion is resolved into carbon-dioxide, water, and Stearone (which see). The distillate contains also acetic and butyric acids, and an acid of lower melting-point than stearic acid; also hydrocarbons of the formula $C_nH_n$, and ketones richer in carbon than stearone, resulting probably from the further decomposition of the stearone. The black-brown residue in the retort still contains stearone, but scarcely any fatty acids (*Heintz*). If sebacic acid is found in the empyreumatic residue, it is regarded as evidence of the presence of oleic acid in the stearic acid—*i. e.* of the impurity of the latter (*Redtenbacher*, *Smith*). Chevreul obtained 96 per cent. of this acid unaltered in the distillate from stearic acid. Chlorine and bromine both attack melted stearic acid, replacing hydrogen and producing chlorinated and brominated species, substitution-products; they are mono- and di-brominated stearine $C_{18}H_{35}BrO_{28}$, $C_{18}H_{34}Br_2O_2$, and $C_{18}H_{35}ClO_2$. Concentrated sulphuric acid at a gentle heat dissolves in stearic acid without coloration; the addition of water throws down the fatty acid in white flocks. When the sulphuric acid solution is heated, sulphurous oxide is evolved, and a new fatty acid is formed, resembling elaïdic acid = $C_{18}H_{34}O_2$, and fusible at 111° F. Iodine forms no compound with stearic acid. Boiling nitric acid attacks stearic acid, and transforms it successively into suberic, pimetic, adipic, succinic, capric, and œnanthic acids (*Bromeis*). Cold nitric acid changes stearic acid after some days into margaric acid, and if crude stearic acid is used, suberic and succinic acids are produced. With phosphoric oxide (anhydrous phosphoric acid) stearic acid yields the elements of water, and is transformed to a yellowish brittle mass, which melts between 130° and 140° F. With platinum-black, stearic acid, in an atmosphere of oxygen, at a temperature of 212° F., evolves carbon-dioxide, and at 392° F. is converted entirely into water and carbon-dioxide. Permanganate of potassium converts stearic acid completely into stearate and carbonate of potassium. Distilled with aniline, stearic acid yields phenyl stearamid = stearanilide (*Pebal*). With methylic, ethylic, and homologous alcohols, with carbohydrates, with glycerine, meconine, and cholesterine, stearic acid yields with heat ethereal compounds, formed from the acid and the other body, with elimination of water. Stearate of lime subjected to dry distillation gives off marsh-gas, olefiant gas, or other olefines, and the distillate contains abundance of stearone and other ketones in smaller quantity, calcic carbonate being the residuum.

*Stearates.*—Stearic acid combines with many metallic bases, forming bodies of the consistence of hard soaps and plasters which are mostly insoluble in water, the alkaline salts alone being soluble. The stearates are mostly decomposed by other acids, the stearic acid floating as an oil on the surface of the warm liquid. Stearic acid displaces carbon-dioxide from a mono-carbonate of sodium or potassium only at 212°, and it dissolves in a cold solution of alkaline carbonate, forming bicarbonate. The neutral stearates of the alkalies dissolve without dregs in 10 to 12 parts of warm water, but are decomposed by a large quantity of water, with separation of an acid salt, and the liquid becomes alkaline. This peculiarity was mentioned under Soap as the cause of the detergent power and opaline appearance of soap-suds. The alkaline stearates are soluble in alcohol, better if warm. Ether does not dissolve the stearates, but extracts the excess of acid from the bi-stearates and transforms them into neutral salts. Saline waters dissolve only a trifling quantity of alkaline stearates—a property utilized in the manufacture of soap, as already described. The neutral salts of other metallic oxides decompose the alkaline stearates, forming insoluble stearates of the other metals. Dilute mineral acids also decompose the alkaline stearates, with separation of stearic acid.

There are three stearates of potassium—mono-, bi-, and tri-acid salts, and a mono- and bi-acid stearate of sodium, all more or less soluble salts. (See Soap.) A soluble neutral salt of ammonia with stearic acid also exists. The history of these salts may be found in the larger treatises, as in Gmelin, xvii. 107 *seq.* The stearates of baryta, strontia, lime, magnesia, lead (bi-plumbic and mono-plumbic), copper, mercury (mercurous and mercuric stearates), and silver are all insoluble salts, generally amorphous fusible powders, the stearates of the heavy metals alone being colored, the metals replacing one or more atoms of hydrogen in the constitution of the acid. The lead-salt is familiar in surgery as *diachylon*, while the lime-salt is one of the products of the lime-saponification of fats in the stearic-acid candle industry. The mixture of stearic acid with lauric, myristic, palmitic, and margaric acid gives bodies varying in their melting-points and other relations, as has been already referred to under Oleic Acid (which see), and carefully studied by Heintz (Gmelin, xvii. 113, and xvi. 214).

*Stearic Ethers.*—Methylic, ethylic, amylic, oetylic, and cetylic stearates have been produced as conjugate compounds of the primary nucleus $C_{18}H_{36}$, *plus* the corresponding alcohol radicals. Ethylic stearate ($C_{18}H_{35}O_2,C_2H_5$) is obtained by saturating an alcoholic solution of stearic acid by hydrochloric acid gas, heating the mixture, and agitating with water. Or it may also be obtained by boiling together for half an hour a mixture of stearic acid, alcohol, and concentrated sulphuric acid. This ether forms also instantly if an ethereal solution of stearine is shaken up with an alcoholic solution of potassa insufficient for complete saponification. (*Bouis.*) Ethylic stearate is a transparent, odorless solid; melts at 88° to 93°; distills at 435° F., with decomposition. It crystallizes from the alcoholic solution in white silken needles. Its ethereal solution gives no crystals. It is partially decomposed by boiling water, and completely by chlorhydric acid and alcoholic potassa, but not by watery solution of potassa. It is not necessary to follow the history of the other stearic ethers or of the corresponding mannite compounds, or the derivatives of glu-

cose, which have been so well investigated by Berthelot (*Ann. de Chim. et Phys.* (3), xlvi. 70, and xlvii. 297, 324). (For the relations of stearic, palmitic, and oleic acids see OLEIC ACID and under.)

STEARIC-ACID INDUSTRY.—*Star Candles, Bougies.*—Chevreul, by his well-known researches on the constitution of the fats, commenced in 1811, opened the way for the industrial use of the fatty acids, but it was not until Jan., 1825, that Messrs. Gay-Lussac and Chevreul applied for a patent for utilizing these acids as illuminants. In this patent they proposed to use potassa or soda to saponify the fats, preferably with pressure, and alcohol for the separation of the acids from glycerine. This process was impracticable on an industrial scale, and was never put into use. Moses Poole in June, 1825, took out another patent for Gay-Lussac in England, in which it was contemplated to distill the fatty acids after an alkaline saponification, and to separate the liquid acids after distillation by pressure. This was a step in the right direction, but this patent appears to have been no more fruitful of results than its predecessor of the same year. At that time, also, the use of properly-prepared wicks was unknown, and the common wicks produced very imperfect combustion of the fatty acids. The patents of Cambacérès in 1825 and 1826 were mainly directed to the preparation of wicks, and to the use of pressure while exposing the products to various degrees of temperature. The candles produced by this inventor were greasy to the touch, yellow in color, offensive in odor, and gave a smoky flame; they were unsalable, and the undertaking was quickly abandoned. But the plaited wicks which Cambacérès first introduced have remained in testimony of his useful labors, without substantial change to this day. The method of producing stearic and palmitic acids on a manufacturing scale yet remained to be discovered, and the industry slumbered until 1831, when it was developed by the researches of two young medical students, Messrs. de Milly and Motard, who had taken up the study of illumination by the fatty acids in 1829, and after numerous experiments discovered a method of saponification of the fats by *lime*—a thing which had never before been accomplished on a working scale. The stearic-acid industry dates, in fact, from the year 1831, when the first manufactory by lime-saponification was opened in Paris near the Barrière de l'Étoile; hence the name, now accepted the world over, of *bougies de l'Étoile*, or *star candles*. From that date the development of this important industry was very rapid and assumed great importance—not in France alone, but all over Europe and in the U. S. In 1873, in France alone, official returns show a production of over 30,000,000 kilogrammes (more than 30,000 gross tons) of stearic acid, and a proportionate quantity of glycerine and oleic acid (*red oil*) for soap. This product was furnished by 156 manufactories, employing nearly 3000 workmen and 1200 horse-power. The money-value of the product, taking the price of the quintal (220.46 pounds) at 173.05 francs, was, in gross, 52,326,685 francs. Of this production, which extends over 43 departments in France, one-fourth part was the product of the department of the Seine alone; and the export of stearic products from France in 1873 was a little more than one-seventh of her total product (7,067,291 francs), showing the very extended use of star candles in that country. For the remainder of Europe, including Great Britain, the annual product of stearine in 1873 was stated as not under 100,000,000 kilos, or, in round numbers, about 100,000 gross tons. In the U. S. this industry has also attained great importance, especially in the interior cities of the continent, where the product of hog's fat furnishes the raw material on a great scale. Cincinnati, it is said, produces over one-half of the total make of stearine candles for the U. S., but we are without exact data for the total product, which has fallen off somewhat since petroleum has become so abundant and cheap a source of illumination. The silver and gold mines of Nevada, etc., consume very large quantities of star candles, oil being inadmissible in view of the mischief it works in the amalgamation process.

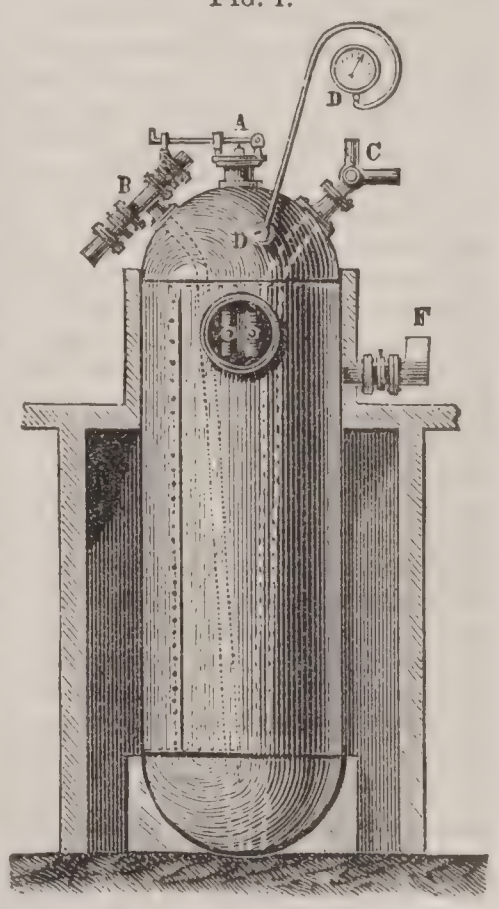
The stearic-acid industry is naturally divided into two quite distinct sections—(1) the *chemical*, and (2) the *mechanical*. The chemical part commences with the saponification of the fats by one of several methods which have already been or will be mentioned, and the separation of the fatty acids from the insoluble lime-soap produced in that mode of saponification; the mechanical processes apply to the non-chemical methods of separating the liquid from the solid acids, their clarification, and the transformation, by moulding and other means, of the solid acids into finished candles. We repeat here what has elsewhere been stated, that in commercial and manufacturing use the term *stearine* means the impure stearic acid, the product of saponification of the fats, containing always more or less palmitic acid, with traces of oleic acid, etc. (See STEARINE.) The transformation of the neutral fats into fatty acids and glycerine, although spoken of in general terms as saponification, and correctly within proper limitations, means in a broader sense the dissociation of glycerine from its associated acids, whether this result is accomplished by alkalies, by acids, by hot water, by superheated steam, or by a combination of these agencies. The production of a soap in the so-called saponification of the fats for obtaining stearic acid is by no means essential, or even general, since the original lime-saponification of De Milly and Motard has been essentially modified by the later improvements of De Milly, presently to be described, while by the method of Tilghman and of Wright and Fouché superheated steam or hot water, alone or with the presence of a very small dose of lime, is the agent of decomposition, and sulphuric acid under several modifications is very extensively employed to effect the separation of the fatty acids from glycerine. We shall therefore consider the subject in the order named, commencing with—

1. THE CHEMICAL PROCESSES.—*Lime-saponification* was first proposed by Messrs. de Milly and Motard, under atmospheric pressure and in open vessels. As this process is now used chiefly by small manufacturers or in isolated situations where skilled labor and good apparatus are of difficult procurement, its interest is chiefly historical as the starting-point of the successful application of the principles discovered so long previously by Chevreul respecting the true constitution of the fats. The fat is melted in wooden tanks provided with steam-pipes perforated with holes and coiled on the bottom of the tank. Water, about equal to the weight of the fat, is added before the steam is turned on. When the fat is melted, milk of lime is turned in, equal in weight of quicklime to about 15 per cent. of the fat employed. The lime is previously slaked, and the cream passed through a sieve to separate foreign matters. The chemical action of the calcic hydrate is slow and gradual under the continued action of the steam heat, and with only the common atmospheric pressure. The mass is constantly stirred, either by hand with a rabble, a rake of wood, or by an agitator turned by machinery. In about eight or ten hours the transformation is complete, with the production of a pasty, granulated soap, which when cold is a hard, white, solid cake, breaking with a brilliant fracture and floating on a yellowish watery solution of glycerine. The impure glycerine solution is drawn off from the cold lime-soap by a cock at the bottom of the tank, and the product is washed with water to remove the last traces of glycerine. No use is made by this process of the glycerine, thousands of tons of which were discharged into the Ohio River and its affluents in former years, before the demand for nitro-glycerine led to the adoption of better methods. The lumps and masses of insoluble lime-soap are then broken up by hand or crushed by wooden rolls to a coarse powder; or more usually the acid-water is brought in immediate contact with the lumps in a tank lined with lead, and cut by the blade of a spade. The sulphuric acid used is reduced to mark on the Baumé hydrometer 20°–25°. Theoretically, 86 parts of lime require 98 of real acid of 1.840 sp. gr. for complete neutralization, or 175 parts of acid to 100 of lime. But in practice a slight excess of acid is used, making the acid double the weight of the lime to be neutralized. The acid-water is then heated by steam in contact with the lime-soap, with continued agitation and at a temperature somewhat below 212°, to avoid charring the oleic acid and stearine, etc. The gypsum, or calcic sulphate, as it forms by the action of the sulphuric acid on the lime of the soap, granulates and falls to the bottom, while the liberated fatty acids float to the top as soon as the flow of steam is arrested after the decomposition is complete. The fatty acids are then drawn off at successive heights into a wash-tank lined with lead, when the first washing is performed with fresh acid-water of about 20° B. and at a temperature of about 175° F., to avoid injury to the color. A second and third washing are made with water alone heated to boiling, by which means the last traces of sulphuric acid are removed, with some sulphate of lime and more or less fatty acids, which rise after standing some days to the surface of the wash-water, and are preserved, but not without loss in spite of all precaution. The acid liquors are preserved to dilute fresh acid for successive operations. The crude stearine and oleic acids are now ready for the press and the successive steps of mechanical treatment for making candles, which are briefly treated beyond.

Theoretically, only 9½ per cent. of lime is required to saponify 100 parts of fat; consequently, the use of 15 to 17 per cent. of lime, which in practice is found necessary for complete lime-saponification in open vessels, involves a proportionate loss of sulphuric acid for the neutralization of 6 or 7 per cent. of free lime. Messrs. de Milly and Motard in 1834 attempted to avoid this loss by saponifying under

pressure in a digester, but using at first a temperature of only about 277° F., the process was not successful, and the attempt was abandoned. In 1852, M. J. Bouis repeated the experiment with a Papin's digester at the Conservatoire des Arts et Métiers at Paris, and had partial success in resolving the neutral fats into their factors by the use of water alone at a high temperature. This was two years before Tilghman's patent of 1854. De Milly then suggested to M. Bouis the use of a certain quantity of lime in the digester, less than that required by theory. During two years many experiments were made to perfect this process, and in 1855, De Milly published the method now in general use, by which saponification was complete in a digester, called by him an *autoclave*, with only 4 to 5 per cent. of lime; and with a pressure of eight atmospheres this proportion was reduced to 2 or 3 per cent. *De Milly's Digester* (or autoclave), for lime-saponification at high temperatures, is seen in Fig. 1. It is a copper cylindrical boiler with hemispherical heads, about 16½ feet high (5 mètres) and nearly 40 inches in diameter (1 mètre). The metal is 15 to 16 m. m. thick (0.6 to 0.7 inch). This apparatus is planted two-thirds its length below the surface, and is encased in a surrounding structure of bricks, which also rise to the level of the upper cap. Its lower end rests in a step of masonry. The void space about the digester is sufficient to permit access for repairs. On its head are seen F, the charging-tube, provided with a stopcock admitting water, fat, and milk of lime; C, the pipe of discharge, drawing from near the bottom; B, the steam-pipe, having an interior diameter of 1.2 inch (= 0.030 m.), and reaching within 2 inches (= 0.05 m.) of the bottom of the digester. The steam is delivered upon a copper plate, forming a shield, to distribute it and save action on the boiler. Exteriorly, this inlet-pipe has two branches furnished with steam-cocks, one connected with the low-pressure boilers, and the other with the high-pressure system. A is a safety-valve; D, a manometer. The man-hole is seen at front. In use, this digester is charged with 2000 kilos (= 2 gross tons, nearly) of melted fat, and 1000 litres (= 1 gross ton, nearly) of water charged with 60 kilos (= 3 per cent. of the fat to be treated) of lime. Steam from the low-pressure boilers is then turned on until the manometer indicates nearly four atmospheres (290° F.); the high-pressure steam is then turned on from a boiler situated at some distance from the digester, safe for ten to twelve atmospheres, and actually used to about nine atmospheres, or so that the manometer on the digester shall mark eight atmospheres (= 340° F.) for four hours. If the pressure on the generator falls, it is needful to cut off the communicating cocks to avoid the recoil of the fat into the steam-boiler. The generator is cut off from all access to fire, to avoid danger from combustion. During the entire tour of eight hours a small opening in the stopcock permits the constant escape of a little jet of steam.

FIG. 1.




The process being complete, and the temperature fallen to about 266° F., the 3-way cock C is opened to permit the discharge of the glycerine and water into a tank until the arrival of the fatty acids commences, when the 3-way cock is turned to the other branch of C, communicating with another tank lined with lead, into which the pasty mass of saponified fat is driven to be treated with diluted sulphuric acid for the saturation of the lime. This very acid lime-soap may be regarded as composed of a small portion of neutral lime-soap diffused in a mass of fat-acids; consequently, the mass reaches the decomposing tank in a state of very fine division, and the decomposition by sulphuric acid is almost instantaneous. M. Bouis enumerates the following advantages of this process over the older lime-saponification: (1) there is no need to pulverize the lime-soap; (2) the proportion of sulphuric acid used is considerably less; (3) the quantity of gypsum produced is small, and the loss of fat-acids retained in it therefore less; (4) the glycerine is obtained easily and without loss; (5) a single workman can look after many digesters at the same time, having only to manage the valves or stopcocks; (6) the whole process is complete in less time.

Many explanations of this process have been offered. For example, considering the neutral fats or tri-stearine as subject to the action of a quantity of lime not sufficient for complete saponification, it might be supposed that stearate of lime should be formed, with the production of mono- or di-stearine, without the separation of glycerine. M. Bouis says this cannot be the case, since in numerous experiments they have always found glycerine free at every stage of the process, and tri-stearine unmodified. The saponification is therefore complete, and to this end the water intervenes at the same time as the fixed base, and forms stearate of lime and free stearic acid. So true is this, that if the water is replaced by alcohol—or, in other words, if stearine is saponified by a quantity of alcoholic potassa insufficient to saturate the stearic acid—stearate of potassium and stearate of ethyl are formed simultaneously, with separation of glycerine; this action is instantaneous. Thus, when acting on stearine by 1 molecule of potassic alcohol, stearate of potassium is formed, and 2 molecules of stearic ether. (*Compt. rend. de l'Acad. des Sci.*, xlv.) We may suppose that when tri-stearine is saponified simultaneously by such a base as lime and by water, the fixed base, reacting first, forms the corresponding stearate and glyceride; then water in excess, acting on the stearate of lime, sets at liberty the stearic acid and regenerates the basic hydrate, which can then attack a new quantity of tri-stearine; and this circle of reactions continues until the saponification of the tri-stearine is complete. This view is sustained by an analogous statement of Stas and Pelouze, who admit that the saponification begins by the formation of a soap in the first stage of the process—that water decomposes this neutral soap, as fast and in proportion as it is formed, into an acid soap and a basic soap, which act on the neutral fat remaining unchanged as the lime itself had acted. Finally, they suppose water alone to be capable of producing saponification—that lime accelerates the process by weakening the affinity which manifests itself between the free fatty acids and glycerine, with a tendency to reproduce neutral fats. This view is sustained by the fact that hot water alone under pressure suffices to hydrate the glyceride and set free the fatty acids, as is seen in the processes of Tilghman and Fouché, mentioned more particularly beyond. The saponification with a diminished quantity of lime requires a corresponding increase in the temperature of the digester; thus, for 5 to 6 per cent. of lime a pressure of six atmospheres suffices, but if only 2 or 3 per cent. of lime is used, a pressure of eight atmospheres is required and a temperature of about 340° F.

*Saponification of fats by water alone*, at a high temperature, was patented by R. A. Tilghman of Philadelphia, Jan. 9, 1854, and about the same time (Apr., 1854) by Berthelot, who announced that he had resolved the neutral fats with water in closed vessels at a temperature of 428° F. Tilghman specified the preferred temperature of melting lead, 625° F., but names also the melting of bismuth, 518° F., and to promote the reaction caused the mixture of water and fat to traverse small tubes of wrought iron heated in a fire to a pressure of 90 or 100 atmospheres. Tilghman's process, as originally set forth in his patent, was never introduced in practice. The very high temperature employed destroyed the glycerine and contaminated the stearic acid. As subsequently modified, it has been used with success, but, as the courts have decided, not within the limits of the patent. Melsens of Brussels almost at the same time with Tilghman took out in Belgium a patent for the use of water slightly acidified by sulphuric acid to act on fats under pressure at a temperature of 356°–392° F. The presence of a small quantity of sulphuric acid—1 to 10 per cent. of the fat used—favors in a remarkable degree the evolution of the fatty acids. Melsens' method was put into successful operation at Antwerp almost immediately, using a peculiar form of digester, lined with lead, holding a ton of tallow, to which was added 50 per cent. of water, and in six hours the decomposition was complete at a temperature of 356° F. (ten atmospheres), and the fatty acids obtained were very satisfactory.

The possibility of decomposing the fats by water under high pressure was distinctly recognized by Chevreul, who pointed out the perfect analogy between the fats and the compound ethers, which are decomposed when heated in close vessels in contact with water. Faraday in 1823 records in the English *Quarterly Journal of Science* (vol. xvi. p. 172) an observation of his on the action of Perkins's steam-engine, by which he shows that fat is changed by hot water under pressure into Chevreul's fat-acids; but this observation, so suggestive of fruitful results, seems to have remained without practical results for more than thirty years.

George Wilson in 1852 revived the method of decomposing

fats at a high temperature, and subsequently distilling off the acids and glycerine separately by a current of superheated steam, originally conceived by Chevreul and attempted by Messrs. Bussy and Le Canu in July, 1825, and more successfully by Dubrunfaut in 1841. In 1855, Wilson exhibited to the jury of the Paris Exposition of that year the results of his method on palm oil by means of water and heat alone, distilling off both glycerine and fatty acids in a way to obtain all the products in a state of chemical purity. To this end the oil is heated in a still to the temperature of 550°–600° F., and then a stream of subdivided, superheated steam passes through it of a temperature of 600° F. Below 550° F. the saponification and distillation of the products is slight; at about 600° F. the distillation is more rapid, but is then accompanied with the production of acroleines. It is by this process that the famous "Price's glycerine" is produced. This process works well only on palm oil, and is in fact only a slight modification of the previous process of Dubrunfaut. The complete success of the hot-water process was achieved only in 1857 by Messrs. Wright and Fouché—French patent of 1857, American in 1859. This requires particular mention.

*Wright and Fouché's apparatus by hot water alone* produces complete decomposition of fats into fat-acids and glycerine by a continuous and automatic commingling of water and steam with the fat at a pressure and temperature of ten to twenty atmospheres for a period of twelve to twenty hours. No lime is used; water at the temperature named is the sole chemical agent; and the glycerine produced is of excellent quality; the stearic and palmitic acids (after expressing the oleic acid) are white, fine-grained, hard, and free of odor. I have examined this apparatus in the factory of R. G. Mitchell in New York, who has used it continuously since 1860 with uniformly excellent results. These inventors "do not claim the application of superheated water for decomposing fatty bodies, nor the form of apparatus described, which may vary somewhat according to conditions and circumstances; but they claim producing a continuous automatic circulation of highly-heated water, in a very finely divided state, through the bodies under treatment," etc. This process is of the more interest since it has been the subject of a protracted legal controversy, in which Mr. R. A. Tilghman sought to establish the priority of his method, patented in 1854, and already alluded to. The case was finally carried up to the Supreme Court of the U. S. by appeal from the decision of the lower courts, and in this upper tribunal it was decided adversely to the plaintiff. In the course of this investigation, and of a like controversy in Cincinnati in which Michael Work was defendant, conducted also by Mr. Tilghman, the literature of the whole subject received a careful scrutiny, and it clearly appeared that, from the date of Chevreul's experiments in 1817 to this day, the action of water as a base to decompose the fats and hydrate the products has been recognized and recorded both when acting alone at moderate and high temperatures or when aided by the presence of metallic oxides, with and without heat. The earliest record of an invention of this sort is found in the London patent of 1826 (No. 5345) issued to N. H. Manicler, who treated 400 pounds of tallow or fat with ten or fifteen gallons of water in a digester or strong boiler provided with a safety-valve, with active ebullition for about six hours, at a pressure of two atmospheres. His method was imperfect, but he obtained fat-acids by the use of hot water and pressure alone, without alkalies or acids.

FIG. 2.

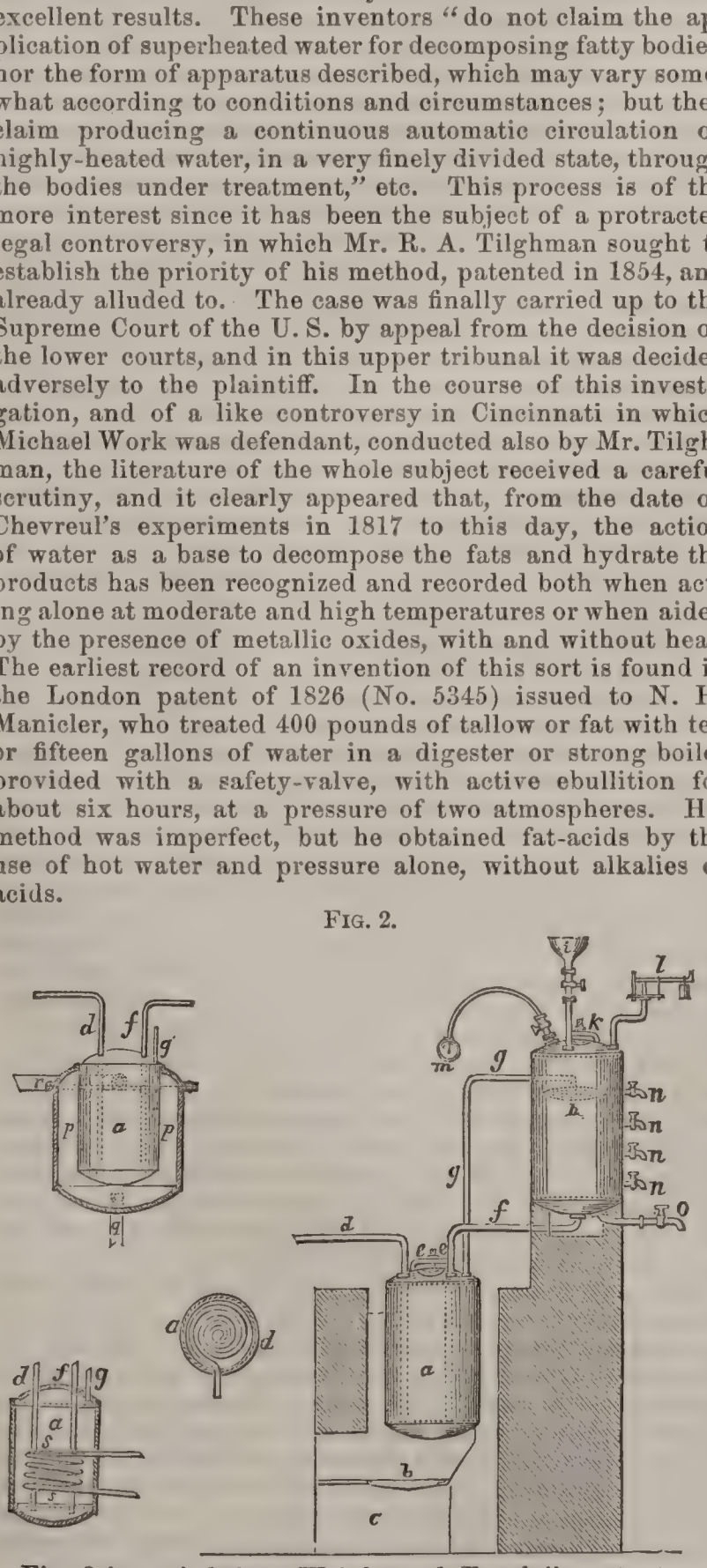



Fig. 2 is copied from Wright and Fouché's patent, and is substantially the apparatus yet in use, the chief difference being that the upper boiler *h* is now made about double the height of the lower one. The boilers *a* and *h* are of copper ⅜ inch thick; the heads are 1 inch thick, and very strongly riveted. The lower boiler *a* is 6 feet high by 2 feet diameter, set in a furnace where it is protected by a brick chamber from the direct action of air and of sulphur from the coal (an arrangement not seen in the drawing). A tube *f* connects the bottom of *a* with the bottom of the cylinder *h*; the ascending tube *g* conducts the superheated water from the boiler *a* to the upper part of the cylinder *h*, where it terminates in a rose-jet, or distributor, pierced with holes to distribute the water uniformly in the cylinder *h*, and to ensure a molecular or finely-subdivided contact between the superheated water and the substance submitted to the operation. The cylinder *h* receives the substances to be treated, which may be introduced by the funnel *i*, or in actual routine by a pipe leading to each cylinder from the reservoirs of melted fat in an upper story, controlled by a cock. A safety-valve *l*, and manometer *m*, serve to regulate and measure the pressure, which at Mr. Mitchell's is kept at eleven atmospheres for fifteen hours. To decompose fatty substances into fat-acids and glycerine, the boiler *a* is completely filled with water; the cylinder *h* is filled to one-third its height with water, and then it is filled to the level of the upper cock *n* with fat; and then the lower boiler is gradually heated until a pressure of about eleven atmospheres is indicated on the gauge (varying with the nature of the substances treated up to twenty atmospheres). It will be readily seen, from the arrangement of this apparatus, that the difference of temperature between *a* and *h* compels and maintains a continuous circulation, the superheated water being driven out of and through the rose on pipe *g* into the fatty bodies, descending again by the tube *f* to the bottom of the lower boiler, to be again heated and sent on its way in a continuous and automatic circulation. The inventors say: "We are aware that the decomposition of fatty bodies by water under the influence of heat and pressure is a well-known scientific fact; . . . that as this chemical action takes place under the influence of a weak affinity, it is necessary, in addition to the physical and chemical conditions named, to ensure a perfect molecular agitation of the whole mass; and that we claim as our invention all apparatus wherein the water and the fatty matters are heated separately in two different boilers; the first boiler heated by the source of heat, and the second boiler heated by the first. . . . The characteristics of our apparatus are that it produces agitation by a continuous and automatic circulation by the pressure of water, and the apparatus effects its chemical action in a continuous manner, without the aid of any manual or other" (external) "assistance."

The capacity of a battery of six of these double autoclaves, each 2 feet in diameter and respectively 6 and 12 feet high, is about 7000 pounds of tallow daily, producing in round numbers 8 to 9 per cent. of glycerine, 33 per cent. of *red oil* (oleic acid), and about 46 to 50 per cent. of stearic, palmitic, etc. acids; feculence, foreign bodies, and loss 8 per cent. more. The glycerine has a density of about 3½° B. as it comes from the autoclave milky with diffused stearic acid. It is evaporated by steam to a density of about 25° B., in which state it is sold to manufacturers of chemically pure glycerine. No lime or acid being used in this process, the glycerine is of a very superior quality to that produced from processes where even a very small dose of lime is used. At the temperature of eleven atmospheres (= 364.2° F.) the glycerine suffers no change, and no acroleine or empyreumatic products are formed. Even at twenty atmospheres, the highest pressure contemplated by this invention, the temperature is only 415.4° F., or 100° under the melting-point of bismuth, the lowest temperature named in Tilghman's patent.

*Sulphuric-Acid Saponification.*—Chevreul, in his original researches on the fatty bodies, discovered the fact that neutral fats were resolved by sulphuric acid into their factors, and he specifies this as one mode of saponification in his patent of 1825, and speaks of distilling off the products. The earlier researches of H. Braconnot (*Ann. de Ch.*, xciii. 250, 1815) first made known the peculiar action of sulphuric acid on the fats; and the coupled acids, sulpho-glyceric, sulpho-stearic, etc., were studied in 1836 by Frémy (*Ann. de Ch. et de Ph.*, 1837, lxv. 113–149), who showed that by the action of water, especially if boiling, these coupled acids were resolved into fatty acids, glycerine, and sulphuric acid, the fatty acids swimming on the surface of a watery solution of glycerine and sulphuric acid. This research first completely explained the real nature of the so-called *sulphuric-acid saponification*.

Incipient decomposition precedes and attends the action of sulphuric acid on the fats, evolving sulphurous oxide, carbon di-oxide, and free carbon, which blackens the mass, producing also a certain proportion of a pitch-like tar,

which remains behind after the distillation. The process was first successfully applied in England by Messrs. Wilson, Gwynne, and Jones in the establishment of Price & Co. in London in 1842. This process is especially available for palm oil, cocoanut oil, the fat of bones, and kitchen-drippings. It is, however, applicable in one form or another to any kind of fat. Numerous forms of apparatus have been devised for the practical use of this process, and various modifications of the process itself, the full history of which would transcend our present limits. For example, the apparatus of Messrs. Masse & Tribouillet at Neuilly, near Paris, is seen in Fig. 3. The action of sulphuric acid on the fats occurs in the lead-lined boiler A, heated by steam introduced by the pipe I into the jacket C. A lead-lined metallic chamber B surmounts the boiler, provided with windows F, and a discharge-pipe G G to carry the heavy offensive vapors evolved to the space H beneath the boilers. The water of condensation escapes by the outlet E, and the contents of the boiler are constantly stirred by the crank J K. After mingling the fat with acid, the contents of the boiler rested for twenty-four hours, the quantity of acid now being from 35 per cent. down, finally, to 10 or 12 per cent. according to the character of the fat. The temperatures ranged from 195° to 212° or 240° F. But this, with many other modified forms of apparatus, has given place to a combination of the sulphuric saponification with distillation by a current of superheated steam under the ordinary atmospheric pressure. This process is conducted in an apparatus shown in Fig. 4, which

Fig. 3.

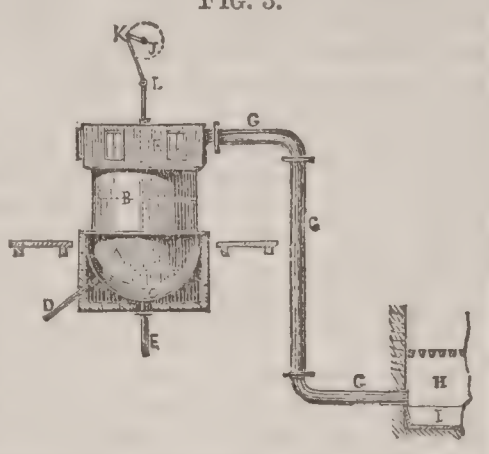
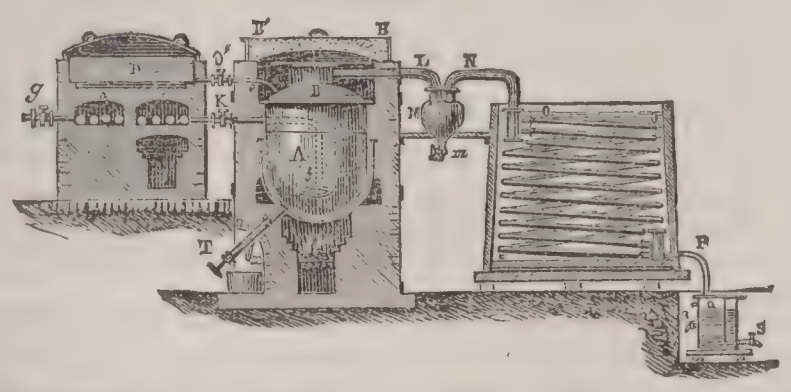


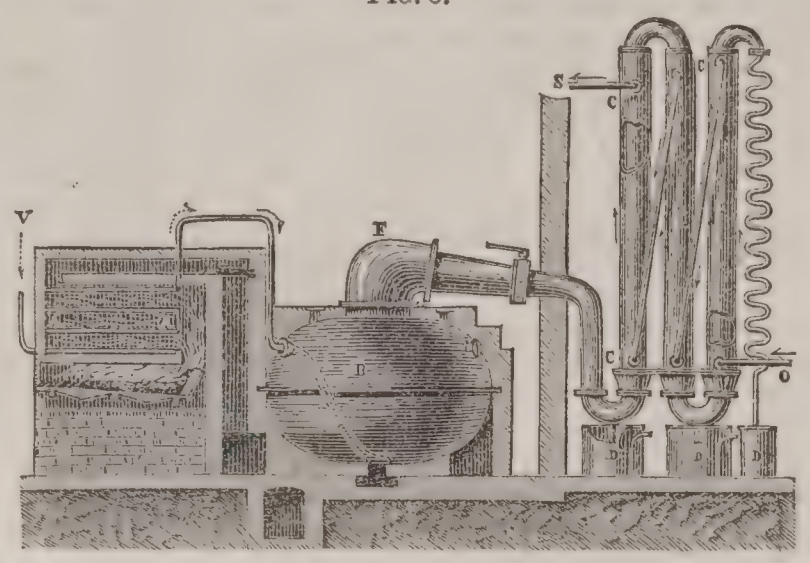

Fig. 4.




Apparatus for the distillation of fatty acids by superheated steam.

combines the results of the scientific researches of Chevreul, Frémy, and Dubrunfaut on sulphuric saponification with those of the inventive genius of Messrs. Jones, Wilson, and Gwynne in the distillation of the fatty acids and glycerine. This process, known as the *dry way*, consists in distilling off by superheated steam the fatty acids obtained from the decomposition of neutral fats by sulphuric acid. Its important advantage is in the facility it affords of obtaining excellent products from almost any kind of refuse fat, as well as from good stock. Gwynne and Wilson, in their patent of 1843, proposed to treat the fats for this process with 5 to 9 per cent. of concentrated sulphuric acid in place of 25 per cent., as formerly employed. This mixture was heated at 212° F. for two hours, and then successively for one hour each at 248°, 280°, 309°, and 350° F. This is substantially the process now in use in nearly all stearine-factories which use the sulphuric-acid saponification, and it is applicable to all kinds of fat. The black mass of fat-acids thus obtained is washed with successive doses of hot water for the removal of the sulphuric acid and glycerine, dried and fused by steam or waste heat, and placed in a boiler, where it can be distilled by a current of superheated steam. In Fig. 4, D is a flat boiler where the fat-acids are dried and melted by the waste heat from the furnace *j*, in the arches of which (*h t*) is a steam-coil, of which *g* is the inlet-cock, and *k* controls the delivery of the superheated steam upon the charge of fat-acids in the still A, the rose *f* effecting the distribution evenly. The cover B′ B is filled with ashes to keep in the heat, which may be enforced by an auxiliary fire below. The delivery-pipe L R is provided with a trap M to catch matters mechanically carried forward in the condensation-water, etc. The double worm O O communicates by the outlet Q with a florentine receiver, where the fatty acids are separated from the water. The tarry residues are drawn off by the outlet-cock T *x*. This apparatus is seen in a more recently modified form in Fig. 5, where a large elliptical or globular boiler of cast iron B is heated by the escape heat from the superheated furnace A A. The vapors of water and fat-acids discharged by the dome F are carried through vertical condensers of copper cooled by water-jackets C C, through which a stream of water passes from O to S in the course of the arrows. The

Fig. 5.




condensed products reach the receptacles D D D. The temperature of the escaping water for condensation should be about 122° F., to avoid the freezing of the condensed stearine, and the velocity of the current of water must be regulated accordingly. This apparatus may be used continuously or otherwise, as may be desired. In the former case, the still is made of a size to hold from 5 to 6 gross tons of crude acids; in the latter case, charges of about 2500 to 3000 pounds of acids are employed at a temperature of about 390° F., with superheated steam, the operation lasting about twelve hours. A second charge is then introduced, and so on several times before draining off the residual tar. As the sulphuric-acid saponification is seldom complete, it happens that rarely over four-fifths of the charge in the still can be distilled; the residue has then to be put aside to be treated afresh with sulphuric acid and redistilled. The heavy irritating vapors of acroleine are always perceived in the still-room where the sulphuric saponification is employed, mingled with gaseous hydrocarbons. The condensed liquid hydrocarbons which gather at the end of the condenser are called "blue liquors," and are found to contain solid bodies analogous to paraffine. From these by-products by treatment with sodic carbonate many amylic hydrates of the American petroleum series may be obtained—*e. g.* hexyl, heptyl, octyl, nonyl, etc.—in a state of purity. These bodies have been studied by Cahours and Demarçay.

One or two matters of interest remain to be mentioned which have been gleaned from the practical experience of those with whom the writer has consulted on this art. Mr. Florence Verdin, who was long in charge of the digesters of Wright and Fouché at R. G. Mitchell's factory in New York, insisted that after a certain time the decomposition of fats by hot water into glycerine and fat-acids not only ceased, but that if the conditions of temperature and pressure were continued, these factors again reunited, forming fats anew. This shrewd observation is in harmony with independent researches in synthetic chemistry.

Mr. S. F. Pease of Buffalo, N. Y., a well-known manufacturer of oils and candles, whose products have been rewarded by numerous medals and testimonials at home and abroad, has given me samples of stearine made by him from hog's lard in 1840, which after more than thirty-six years remain colorless, perfectly hard, and free from greasy odor, with broad brilliant crystalline laminæ. Mr. Pease asserts that no stearine has such large crystalline planes as that from hog's lard. I find the melting-point of this old stearine to be 132° F. It is curious to note that Mr. Pease's process for the production of stearine from hog's lard closely resembles the original process of Chevreul and Gay-Lussac of 1825. After expressing about 50 per cent. of lard oil (summer pressing) by hydrostatic press, he saponifies by caustic soda-ley; by salt removes the curd, which he decomposes by dilute sulphuric acid, and then removes the red oil by two pressings—first, at a pressure of 150 tons, which expels about three-fifths of the red oil, and then by a higher pressure of 700 to 800 tons for the remaining two-fifths. The candles made from this stearine are quite white, and remain so, requiring no bleaching. He exhibited to me very hard and white candles made by this method forty years ago. A portion of alcohol is added to the melted stock just before pouring into the moulds—about one quart to a box of candles—to improve the burning of the candle. The economical results of this process are—lard oil, 50 parts; red oil, 25 parts; stearine, 25 parts. No use is made of the glycerine, which involves a loss of about 4 per cent. on the origi-

nal quantity of lard, about the same quantity remaining with the lard oil. As compared with the lime-saponification, this is not an economical process, but it is claimed that the candles produced are superior in hardness and brilliancy of illumination. In winter the lard yields only 10 to 20 per cent. of lard oil; in summer it gives 50 per cent. The stearine obtained from tallow by the hot-water process is from 40 to 50 per cent. of the crude tallow.

2. Mechanical Processes.—The manufacture of candles from stearic acid, however produced, requires (1) the casting of the acids into convenient forms for pressing; (2) pressing out the oleic acid, cold and hot; (3) the preparation of the wicks; (4) the moulding; (5) the bleaching, washing, trimming, polishing, etc. A very brief notice of these mechanical processes must suffice.

*The casting of the mixed acids* into a convenient form for pressing out the "red oil" or crude oleic acid is performed in a simple way by setting the metallic pans (which are rectangular, with sloping sides, and about three inches deep, usually of copper, sometimes of tin plate or iron) on a terraced framework, one series over another, in such a manner that the melted acids, running first into the upper tiers, fill the successive terraces by overflow in progressive order until all are full.

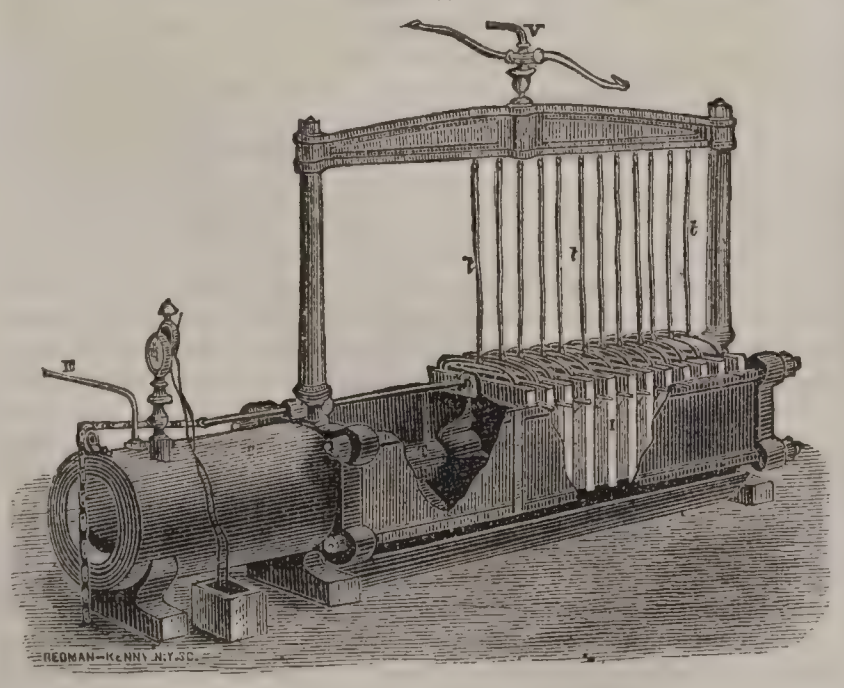
*Pressing out the Oleic Acid.*—After cooling to the point of crystallization—the time varies with the season, from ten to twenty hours—these cakes of crude acid are pressed in strong sacks in a vertical hydrostatic press (Fig. 6) for the removal of the red oil. This process demands care and experience to avoid the loss of more or less stearic acid dissolved in the liquid oleic acid. To this end, the mass is hardened by the addition in the pans of the waste trimmings from the hot press or from the calcareous saponification process. The red oil runs away into vats prepared for its reception on a lower story. The shrinkage of the sacks from the escape of the red oil permits the addition of relays of fresh sacks by reversing the motions of the press. The mass is kept in position by plates of sheet iron or zinc, which also carry the oleic acid to the gutters which lead it to the reservoirs below. The pressure is gradually carried to its full measure of about 400 tons, by which the cakes are reduced from 2 or 2½ inches to about one-half their original thickness, with the removal of about 45 per cent. of the oleic acid contained in the mixed mass. About 10 per cent. of oleic acid is retained in the cold cake, which requires for its removal the hot press. The limit of atmospheric temperature at which the cold pressure can be advantageously carried on is set at about 60° F., so that in this country the summer is a season of rest for this industry unless artificial refrigeration is resorted to.

Fig. 6.



The residual oleic acid remaining from the cold press discolors the stearic acid and renders it soft. For its complete removal a horizontal hydraulic press is employed, in which the cakes of stearic acid are again pressed in haircloth held between heated iron plates at a well-regulated

Fig. 7.




temperature. As this could not be obtained with uniformity by the method first used of heating the iron plates in a bath of steam, and successively packing them, a better method was devised, which is seen in Fig. 7. This apparatus provides a series of twelve or more flat cells of iron, seen in section at I, and supplied with steam from the valve V and by the rubber tubes *t t t*. When the temperature has fallen to about 100° F., the interspaces are rapidly packed with the hair-cloth and stearic-acid cakes, and a pressure of about 500 tons is applied for about an hour. This is a difficult operation, and requires care and experience for its proper management. At best, a considerable quantity of stearine is carried off by the oleic acid, from which it is, in part, recrystallized in the vats provided for that purpose. As its separation from the oleic acid is difficult, it is found in practice a good plan to pump off the supernatant oleic acid, and to use the residue containing the stearine to hasten the crystallization of the fatty acids in the pans prior to the cold pressing.

The thin cakes of stearic acid, on removal from between the crinolines of hair-cloth, are trimmed at the edges to remove the margin colored yellowish by oleic acid. These parings are used in charging a second hot press. The prepared cakes of stearine are still more or less contaminated by stains of iron, copper, etc. from the press, and by the entanglement of filaments of crinoline, etc., and by lime, if the acid is the product of lime-saponification. To free it from these accidental impurities it is again melted in a bath of water slightly acidulated with sulphuric acid (about 3° B.), and heated by steam. The metallic oxides, lime, etc., are thus removed, and on standing the foreign substances subside after a brief time, and the last traces of sulphuric acid are washed out in another tank containing pure water. Sometimes the white of eggs is used to clarify the melted stearine, and the lime is then precipitated by a little oxalic acid. The stearine is thus obtained perfectly colorless and limpid, floating above the water-bath, and may be then cast in blocks for sale or turned into the candle-moulds.

*Melting-Point of Stearine.*—Stearine from tallow melts at about 130°–132°; Price's candles from palm oil fuse at 122° to 124°; while those made from Chinese tallow (product of *Stillingia sebifera*), by Wilson and Gwynne's patent of 1845, fuse at 136° F. Mitchell's stearine, from the Wright and Fouché hot-water process, by my determination, fuses at 132° F., and Pierce's, from hog's lard by soda-saponification, at 131° F. Pure stearic acid fuses at 158° F., and palmitic acid at 140° F. The mixture of the two acids, therefore, in stearine fuses at a lower degree than either factor—a fact supported by other examples of like mixtures.

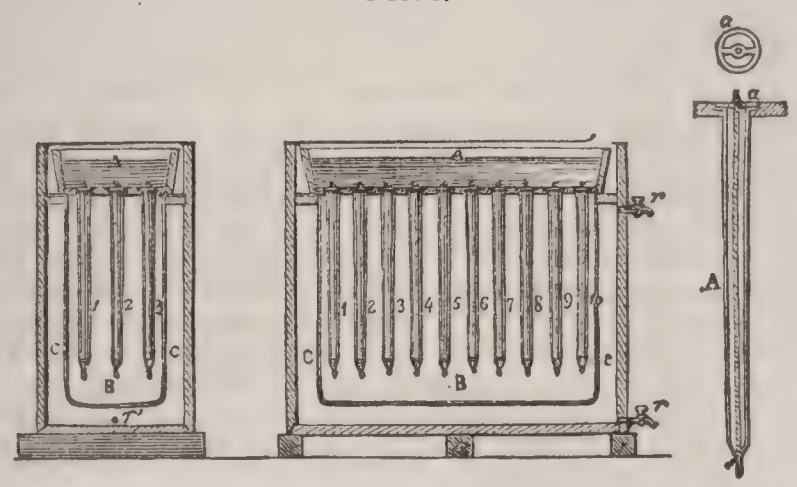
*Wicks.*—Candle-wicks are made of plaited cotton woven by a machine which lays up the 80 or 90 strands in such a manner as to secure the proper deflection of the free end of the burning wick, bringing it in contact with the air, so that it is consumed without a cinder falling into the cup of the candle. This end was not reached without much study and invention. Cambacérès, as already mentioned, in 1825 devised the system of twisted and plaited wicks which is still in use. But it was not until 1836 that De Milly discovered that by impregnating the wick with a weak solution of boracic acid the formation of a "thief," or mushroom of carbon on the wick, could be prevented. "Snuffers," which were an indispensable article of domestic economy in the days of our grandmothers, are now unknown except in the cabinets of *bric-à-brac*, thanks to De Milly's invention; which was, as Stas has remarked in the report of the Exposition of 1855, the finishing touch of the stearic-acid industry. The wicks are prepared by soaking them for two or three hours in a bath holding in solution 1½ per cent. of boracic acid and ½ per cent. of ammonic sulphate. The excess of solution is drained off, and the wicking dried in a hydro-extractor or by the heat of an oven. The use of phosphate of ammonia, ammonic chloride, and bismuth nitrate has also been proposed, as was dilute sulphuric acid, also earlier by Cambacérès. The latter destroyed the wick, and nothing has been found so valuable as De Milly's treatment by boric acid. After treatment the wicks should be singed by a gas-flame to remove the little filaments of cotton, which might impair the perfect combustion of the candle. There is a nice point to determine the proper size of wick for a given weight of candle, that the reservoir of molten acid in the cup be not too rapidly or too slowly drawn up by the capillary action of the wick. The candle burns most satisfactorily when in a pure still atmosphere the melted acid is drawn up at such a rate that the cup preserves its symmetry. If it is too full because the wick is too small, the delicate edge breaks down and the candle "gutters." If the wick is too large, the draught on the reservoir of melted acid exhausts the supply, the flame droops, and an irregular illumination, with a too rapid consumption of the candle, results.

*The moulding of candles* is in theory an extremely sim-

ple operation; practically, it is attended with some difficulties which require skilful manipulation to avoid. Especially was the crystallization of the stearine for a long time a source of trouble, and many expedients were devised before the very simple one was hit on which proves quite sufficient. This is to permit the melted stearine to become almost pasty before pouring into the moulds, which are also gently warmed beforehand. In this way the tendency to crystallize is arrested and a fine granulation results. Wax (of bees) and paraffine, added in small quantity, also prevent the crystallization. Arsenic (arsenious acid) was at one time used with success for this purpose, but was speedily abandoned because of the risks to public health it involved. It was De Milly again who hit upon the very simple expedient of pouring the candles with stearine in the milky state which precedes solidification, and thus solved a difficulty which was wellnigh proving fatal to the stearic industry.

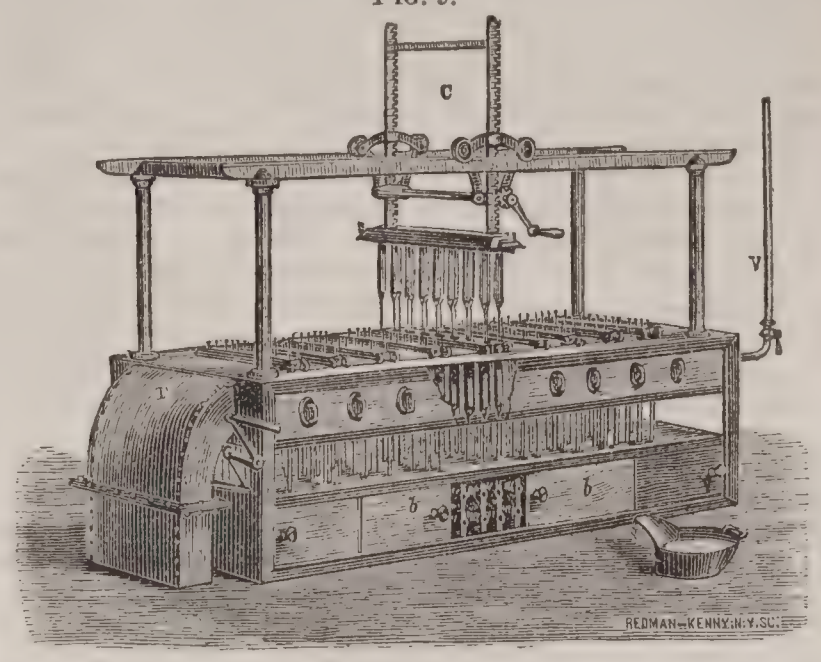
The candle-moulds are slightly tapering tubes cast of an alloy of lead 2 parts and tin 1 part, the size and length varying of course with the denomination of the candle. For convenience, the moulds are arranged in groups of ten, twenty, thirty, or more in a basin or tank, which acts as a reservoir for holding the fluid acids when the moulds are filled, and for furnishing the needful reserve to supply the shrinkage, as the candles contract in cooling. This reservoir or feeder also furnishes a firm support for the withdrawal of the candles from the moulds, for which purpose a suitable handle or grapple of tin is plunged in the feeder while the acids are yet fluid. The wicks, prepared as already described, are introduced by a long and slender crochet-needle while the moulds are laid horizontally. The

Fig. 8.



wick is made central by attachment to an eye seen in the single figure *a* (Fig. 8), and is drawn through the other end, where a plug of wood holds it tight and tense. The figure shows the arrangement of 30 candles in three rows of ten each, prepared for casting. For this purpose it is essential that the temperature of the moulds should be 122° to 130° F., near the melting-point of the acids. This object is attained by placing the moulds in an oven, heated preferably by steam, to the proper temperature, or, as in the figure, by a steam-jacket C C surrounding the chamber B, in which the moulds hang, while the air escapes by *r*, and the water of condensation by *r'*. When the moulds have the proper temperature, the melted stearine is turned in at a temperature when the mass in the vat is milky with the newly-forming crystals. The grapple for removing the mass when cold is put in place, and the whole left to cool, after which the plugs are removed below and the whole mass is withdrawn, the candles are broken from the feeder, and the latter is thrown into the melting-vat to be again used in moulding more candles. This process involves much hand-labor, and is too slow for the demands of a large establishment. It is, in fact, now used chiefly by those who buy the stearine in blocks, while the manufacturers of stearine, who produce candles on a large scale, employ a continuous-acting apparatus of American origin, in which the wicking is automatic, and the moulds are both heated and cooled by a continuous system. Fig. 9 shows in elevation a recent form of this apparatus, as now made by Morane of Paris, having ten sections of twenty moulds, heated in place by steam, and cooled by a current of air from a blower. It is divided into two sections, the lower one *b* holding the bobbins of prepared wicks for continuous threading of the moulds. The upper compartment is a box of plate iron containing the moulds, and heated by steam from the pipe V. The figure shows a section of the moulds with its reservoir, raised by the winch and supported on the carriage C, which traverses the length of the ways to take up each section in turn. The wicks are held firm by a screw at top, which gives them the requisite tension, while the free ends are cut off beneath the tips of the elevated moulds. By this machine all the hand-labor of "cottoning" or wicking is avoided, and by the use of alternate heat and cold, either as steam and air, or otherwise by warm and cold water-baths alternately, the moulds are warmed and

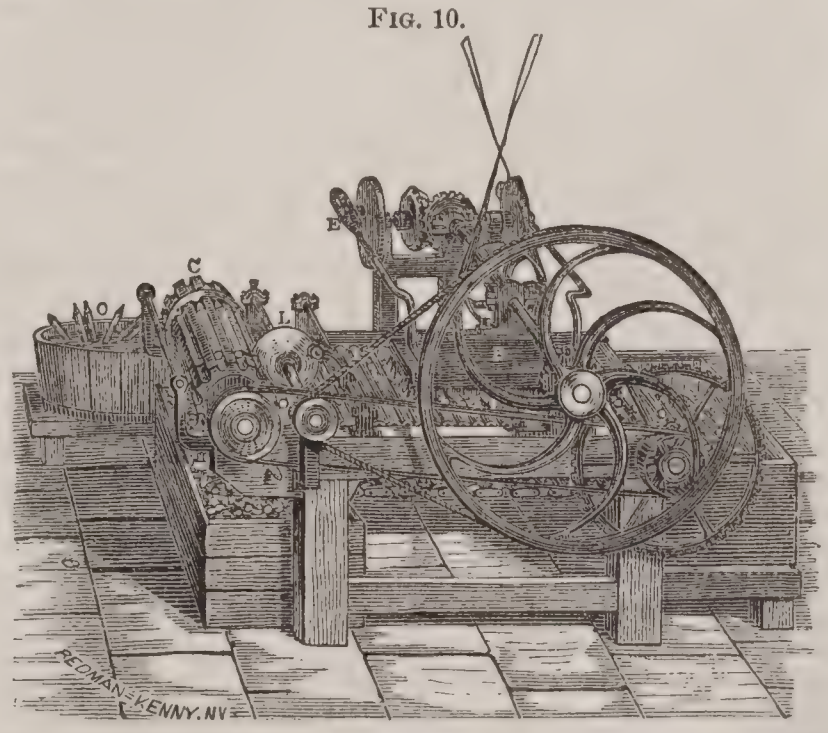
Fig. 9.




chilled with certainty and little loss of time. In very large establishments this system is carried still further by arranging twelve similar machines on a circular tramway, at the centre of which are two elevated tanks, one of hot and one of cold water, which flow successively into each machine as it arrives in due order of rotation opposite the spigots. In this apparatus the necessity of a reservoir or basin of melted stearine over the moulds is avoided by the use of a mechanism which forces up the stearine by a piston from below, with the advantage of filling the moulds completely under pressure, and of making the candle of any desired length or diameter. A fuller description of this apparatus by Morane is beyond our present limits.

*The bleaching, washing, drying, trimming, and polishing* of the candles complete the mechanical operations of this industry. The slightly-yellowish color which the star candle usually has when it leaves the mould is removed by an exposure to sunlight for some days, or perhaps two weeks, in a place provided with a glass roof and suitable shelving for this purpose. No chemical agent other than light has been found practicable. As the candles are more or less soiled by handling and by dust, they are washed off in a dilute solution of sodium carbonate, and dried on an endless apron of cloth, upon which mechanism they roll in contact with each other. As the lower ends are more or less uneven, these are cut off by a circular saw, and the surface of the candles is at the same time polished by the friction of brushes moving lengthwise over them. These last operations of trimming and polishing are combined in

Fig. 10.




the machine shown in Fig. 10. The candles O are placed in grooves of the revolving cylinder C, which brings them under the rapidly-moving circular saw L, which cuts them neatly to even lengths, whence they are carried forward by a grooved apron of wood beneath the brushes B, which are rapidly moved back and forth by the crank E, and thus receive the final finish before packing in boxes.

*Paraffine Candles.*—Since paraffine has become an article of commerce, it has been much used to "break the grain" of stearine candles in place of beeswax, and with decided advantage, producing a candle of superior beauty. By itself, paraffine produces a candle of much beauty, but liable to droop with warm weather, while its extreme fluidity renders it undesirable for a movable light. The moulding of pure paraffine candles is also attended with peculiar

difficulties. It is therefore seldom used alone, but when from 5 to 20 per cent. of stearine is added, candles are obtained having the appearance of wax. But the same lowering of the fusion-point of the mixture already noticed for stearic and palmitic acids occurs with stearine and paraffine. Thus, if equal weights of paraffine, melting at 122° F., and palmitic acid, of 132° melting-point, are mingled, the result is a body fusing at 113° F.

*Colored Candles.*—Stearine, paraffine, and wax candles are made of almost any desired color now by the use of aniline colors of the desired tint. Formerly, metallic oxides and some vegetable colors were chiefly used, which as a rule caused the candles to burn badly, and sometimes to emit poisonous fumes. Stearine may be colored black by heating for a short time in contact with the bruised nuts of *Anacardium orientale.*

*Wax Candles.*—See WAX.

For many recent details in this article the writer is indebted to M. J. Bouis's *Stearique* (*Acide*) in Ad. Wurtz's *Dict. de Chimie*, as also to private communications from R. G. Mitchell, E. S. Wayne, and E. S. Pease. For the literature of the subject the reader may consult: *Reports of the Juries* (London, 1851, 619–624); Chevreul, *Recherches chimiques* (1819); Richardson and Watts (London, vol. i.); Muspratt's *Chemistry*, art. "Candles" (ed. of 1876); Watts's *Dict. of Chemistry;* Morfit's *Chemistry* (Philadelphia, 1847), "Soap and Candles;" Payen, Pelouze and Frémy, Regnault, Berzelius, and Dumas's *Chim.*; Roret's *Encyc.*, "Fat-Acids;" testimony of J. Lawrence Smith, *Record Supreme Court of the U. S.* in case of Mitchell *v.* Tilghman (669); also in same record testimony of Edward S. Wayne, J. C. Booth, R. E. Rogers, F. A. Genth, B. C. Tilghman, and others; *Annales de Ch. et Phys.* (Paris, 1854 [3], t. xli., 246–316); Gehler's *Physikalisches Wörterbuch* (Leipsic, vol. ii., p. 544); *Stearic-Acid Industry*, by J. L. Smith; *Reports of the U. S. Commissioners to the Paris Exposition of 1867* (ii., 118, Washington, 1870). B. SILLIMAN.

**Ste'arine** ($C_{57}H_{110}O_6 = (C_3H_5)_{111}(C_{18}H_{35}O_2)_3$). Stearine is a glyceride or ether of glycerine, as shown by the formula *tristearine.* The constitution of the glycerides has already been explained under FATS and OILS. In commercial parlance, *stearine* is a term applied to the impure stearic acid obtained by the saponification of fats in the preparation of star candles. (See STEARIC ACID INDUSTRY.) Tristearine is the natural form of stearine in the hard fats of both kingdoms. From the seeds of *Brindonia indica* stearine of absolute unity can be obtained, as shown by Bouis and Pimentel (*Compt. rend.*, xliv. 1355). Pure stearine from this source is perfectly white, and crystallizes in mammillary radiations of a nacreous lustre, ending in very delicate needles. This stearine, when fused, is much more transparent than that from animal fats, which obstinately retain traces of oleine and other fat acids. It is very brittle. By saponification it yields directly stearic acid, melting at 158° F., and its analysis affords stearic acid 95.72 per cent., while calculation calls for 95.73 per cent. B. SILLIMAN.

**Stearns,** county of Central Minnesota, lying W. of the Mississippi, drained by Sauk River, and containing Sauk Lake, with many other streams and ponds. It is traversed by St. Paul and Pacific R. R. The W. part is hilly, the remainder prairie-land. There are breweries, saw-mills, flour-mills, and manufactories of wagons, furniture, and agricultural implements. Staples, wheat, oats, Indian corn, potatoes, hay, wool, and butter. Cap. St. Cloud. Area, 1379 sq. m. P. 14,206.

**Stearns** (ASAHEL), LL.D., b. at Lunenberg, Mass., June 17, 1774; graduated at Harvard 1797; practised law at Chelmsford many years; was county attorney for Middlesex; member of Congress 1815–17; professor of law at Harvard Law School 1817–29; and subsequently commissioner (with Lemuel Shaw) for revising the statutes of Massachusetts. D. at Cambridge Feb. 5, 1839. Author of a valuable *Summary of the Law and Practice of Real Actions, with an Appendix of Practical Forms* (Hallowell, 1824).

**Stearns** (GEORGE LUTHER), b. at Medford, Mass., Jan. 8, 1809; became a wealthy merchant at Boston, and a prominent member of anti-slavery organizations; founded the *Commonwealth* and *Right Way* newspapers; aided to equip John Brown for his Free-State campaigns in Kansas; was conspicuous as his friend during the later crisis at Harper's Ferry; was instrumental during the civil war in recruiting in Massachusetts three regiments of colored men, and rendered similar services in Pennsylvania, Maryland, and Tennessee, receiving from Secretary Stanton a commission as major. D. at Medford, Mass., Apr. 9. 1867.

**Stearns** (SAMUEL), b. at Epping, N. H., in 1770, son of Rev. Josiah Stearns (1732–88); graduated at Harvard 1794; was ordained minister of a congregation at Bedford, Mass., 1795, and filled that post until his death, Dec. 26, 1834. Author of seven published sermons and addresses.

**Stearns** (Rev. WILLIAM AUGUSTUS), D. D., LL.D., fourth president of Amherst College, b. at Bedford, Mass., Mar. 17, 1805, the son and grandson of Congregational clergymen; graduated at Harvard College 1827; studied theology at Andover, and after teaching a short time at Duxbury was ordained to the gospel ministry, and installed pastor of the church at Cambridgeport Dec. 14, 1831. In 1854 he accepted the presidency of Amherst College, which he held till the time of his death, June 8, 1876. Besides valuable addresses given during his connection with the college, he published several sermons, with papers in the *Bibliotheca Sacra*, *Biblical Repository*, and *New Englander*, a work on *Infant Church Membership*, and *Life and Select Discourses of Samuel H. Stearns.* J. H. SEELYE.

**Ste'arone.** This body was derived by Bussy (*Ann. Chem. Phys.*, liii. 410) from the decomposition of stearic acid by quicklime, a fourth part of the latter being distilled with one of the former, producing liquid hydrocarbons and a solid body which he named *stearone.* The liquid hydrocarbons were removed by pressure, and the solid residue, treated by ether, yielded a solution which on standing deposited colorless crystalline pellets of a pearly lustre. Stearone is insoluble in water, soluble in boiling alcohol, in fat-acids, and in concentrated acetic acid. It burns with a very brilliant flame and becomes highly electric by friction. Alkalies do not attack it. Hot sulphuric acid burns it with evolution of sulphurous acid. Hot nitric acid does not attack it, but hot nitro-sulphuric acid decomposes it, with the formation of an acid volatile oil (*Rowney*). The *margarone* of Rowney is esteemed identical with stearone. It melts at 86°–88° F. if made from pure stearic acid, but if from impure, its melting-point may be as low as 76°. B. SILLIMAN.

**Ste'atite** [Gr. στέαρ, στέατος, "fat"], or **Soapstone,** a kind of stone which receives both its names from its unctuous quality. It is a compact form of talc, and is an impure hydrated silicate of magnesia. It has some use in the porcelain manufacture. A soft white sort is the French chalk of the toilette and of the tailors' shops. Powdered steatite is employed as a lubricant, and is an ingredient in several kinds of steam-packing. Steatite is easily cut into figures, which are then hardened by fire and colored to imitate more costly stones. Steatite is employed in making stoves and foot-stoves for use in cold weather, since it retains heat for a long time. It is abundant in many parts of the U. S. and other countries.

**Steb'bing** (HENRY), D. D., b. in England about 1800; graduated at St. John's College, Cambridge, 1823; became perpetual curate of St. James's, Hampstead road, London, 1836; chaplain to University College Hospital 1837, and rector of St. Mary, Somerset, London, 1857. Author of a *History of Chivalry and the Crusades* (2 vols., 1830), *Lives of the Italian Poets* (3 vols., 1831), *History of the Christian Church from its Foundation to A. D. 1492* (2 vols., 1833–34), *History of the Reformation* (2 vols., 1836), *History of the Church of Christ from 1530 to the Eighteenth Century* (3 vols., 1838–42), of several volumes of poems, and numerous other religious and historical works, including a *Continuation of Hume and Smollett's History of England* (6 vols., 1837); was in 1828, with J. S. Buckingham, one of the original editors of the *Athenæum*, and afterward edited the *Cabinet Library of Divinity* (15 vols., 1836) and select works of Bishops Tomlinson and Beveridge, and of De Foe, Baxter, and Jeremy Taylor.

**Ste'dingk, von** (CURT BOGISLAUS LOUIS CHRISTOPHER), COUNT, b. at Pinnau, Pomerania (then belonging to Sweden), Oct. 26, 1746; graduated at the University of Upsala 1768; entered the army in youth; took part in a war against Prussia; rose to the rank of lieutenant-colonel in the royal regiment of Swedes in the French army; was an intimate friend of Count Fersen, and, like him, volunteered his services in the cause of the American Revolution; sailed with D'Estaing's fleet for the West Indies 1778; commanded a brigade of infantry in the attack upon Grenada, and led one of the two principal assaults upon Savannah, Oct. 9, 1779, where he lost half his brigade of 900 men and was himself severely wounded; was honored with membership in the order of Cincinnati; held high command in the war against Russia 1787; became ambassador to St. Petersburg 1790, and was Swedish plenipotentiary in the peace conferences at Paris 1814. D. at Stockholm.

**Sted'man** (CHARLES), b. in England about 1745; was an officer under Lord Percy at the battle of Lexington 1775; served under Lord Howe in Pennsylvania and New Jersey, and under Cornwallis in his Southern campaign, and published *The History of the Origin, Progress, and Termination of the American War* (2 vols. 4to, London,

1792; 8vo, Dublin, 1794), said by the bibliographer Lowndes to have been written by William Thomson, LL.D.—a work valuable for its military maps and surveys. Stedman was during his later years a deputy comptroller of the stamp-office. D. at London June 26, 1812.

**Stedman** (Edmund Clarence), b. at Hartford, Conn., Oct. 8, 1833, son by a former husband of Mrs. E. C. Kinney, the poetess; studied at Yale College; became in 1852 editor of the Norwich *Tribune*, in 1853 of the Winsted *Herald;* settled in New York in 1855; became in 1859 a poetical contributor to the New York *Tribune;* was war-correspondent of the New York *World* 1861–63; contributed to the *Atlantic* and other magazines; studied law; was in 1863 private secretary to Attorney-General Bates at Washington, and has been since 1865 a stockbroker in New York. Author of *Poems Lyric and Idyllic* (1860), *Alice of Monmouth, and other Poems* (1864), *The Blameless Prince, and other Poems* (1869), and of a volume of critical essays on *The Victorian Poets* (1875). His scattered *Poems* were collected in a single volume in 1873. He delivered his narrative poem, *Gettysburg*, in 1872 at a meeting of the Army of the Potomac, and his verses for commencement at Dartmouth College 1873. He has prepared a series of *Hebrew Pastorals*, of which some specimens have been printed, and has made a careful study of Theocritus and the Sicilian-Greek school of idyllic poets. (See biographical notice in *Scribner's Monthly*, Nov., 1873.)

**Steed'man** (Charles), U. S. N., b. Sept. 24, 1811, in South Carolina; entered the navy as a midshipman Apr. 1, 1828; became a lieutenant in 1841, a commander in 1855, a captain in 1862, a commodore in 1866, a rear-admiral in 1871; retired in 1873. Served in the naval battery at Vera Cruz during our war with Mexico, and commanded the Bienville at the battle of Port Royal, and the Ticonderoga in both the Fort Fisher fights. Highly commended by Rear-Admirals Du Pont and Porter.

Foxhall A. Parker.

**Steedman** (James Barrett), b. in Northumberland co., Pa., July 30, 1818; went to Ohio in 1837, and in 1843 was elected to the State legislature; was among the earliest in 1849 to try gold-mining in California; in 1851 was made a member of the Ohio board of public works, and subsequently was chosen printer to Congress. At the outbreak of the civil war he was appointed colonel of an Ohio volunteer regiment; served with credit in West Virginia and Kentucky; was made brigadier-general in July, 1863, and for services at Chickamauga was made major-general in Apr., 1864. He was actively engaged in Sherman's Atlanta campaign; afterward was with Thomas in Tennessee, and took part in the battle of Nashville. Resigned his commission in July, 1866, and was appointed by Pres. Johnson collector of the port of New Orleans.

**Steel.** *Definition.*—It is necessary to define the term "steel" at some length, since the old classification very inadequately describes the modern cast, malleable compounds of iron, carbon and metalloids used for structural purposes, and constituting at least three-fourths of the metal now made by steel processes. The old term "steel" referred to the cast malleable product of iron and so much carbon (from $\frac{3}{4}$ to $1\frac{1}{4}$ per cent.) that the metal would harden when heated to redness and quenched in water; it is used almost exclusively for cutting tools. The homogeneity of this metal is, however, an equally distinguishing quality, and is due to its having been poured into a mould while in a fluid state, so that the slag might separate by gravity, and the metal might become solid and crystalline. Wrought iron, on the contrary, while having similar chemical properties, and often as much carbon, consists of pasty masses from which the slag is rarely quite expelled by the pressure that sticks them together; it is therefore laminated in structure. As the soft compounds and those largely varying in chemical constituents came gradually to be produced by casting processes, it was natural and convenient to enlarge the term *steel* to cover them; and the use of the term was at the same time rendered legitimate and scientific by basing the classification on one of the grand characteristics—structure due to casting—rather than on ingredients, as heretofore, especially since structural qualities were constantly increasing in importance. It is found practically convenient to distinguish between all the cast malleable compounds, whether hard or soft, by affixing the name of the metalloid chiefly incorporated, such as "chrome steel," "manganese steel," and the like, or the percentage of carbon, or both. It is important to know the amount of carbon in structural steels, and this may be readily determined. To call the soft steels "wrought iron" would involve not only the sub-classifications mentioned, but another to distinguish structural variety. The general usage of commerce, as well as of works, is rapidly fixing this enlarged definition; it is, however, criticised on the ground of new use for an old name, while some objectors propose a classification based on arbitrary degrees of resilience, or of strength, or of hardening capacity, or of several combined qualities. They would call all compounds on one side of the arbitrary line "steel," and all on the other side "iron." Now, exact definitions must be based on differences which always exist in every form and phase of the materials defined, and not on differences which, however great they may be in certain forms and phases of the materials, run together at one point, and there cease to be differences. If we divide steel from wrought iron by an arbitrary line of percentage of any ingredient, or of modification, such as hardening, due to any ingredient, there must be some point at which the difference between steel and wrought iron is infinitely small. If, however, we define steel as a compound made homogeneous by fusion, while wrought iron, although the same in composition, is heterogeneous from welding, there is always and at every grade of the materials a large and radical difference. Casting fluid steel and welding pasty iron are always distinct in their characters and results; they do not at any point shade into each other. It is hardly possible in this paper to give an outline of the controversy, but, as this article is intended to refer to those compounds of iron which are generally known and sold as steel, such as Bessemer rails and Martin boiler-plate, as well as tool steel and spring steel, the definition must for these purposes be as follows: *Steel is a compound of iron which has been cast from a fluid state into a malleable mass.* The term "cast" prefixed to steel thus becomes unnecessary. Puddled iron combined more or less highly with carbon, without any change in structure by melting, under the names of "puddled steel," "blister steel," etc., is not true steel, according to current nomenclature, nor according to that adopted after the old high tool-steels were first made. The terms "pot" or "crucible" steel, "Martin steel," and "Bessemer steel" are convenient for distinguishing processes of manufacture, but they do not necessarily distinguish between steels which differ either chemically or mechanically.

*Nature and Composition of Steel.*—From the preceding definition it will be observed that the grand structural characteristic of steel, to which it largely owes its value for all uses, is homogeneity due to fusion; also, that its chemical constituents and the characters due to them are very various. The important chemical qualities of tool-steel are: (1) the tempering quality, which is due, first, to the presence of say $\frac{3}{4}$ to $1\frac{1}{4}$ per cent. of carbon; second, to the mechanical mixture of this carbon with the metal by means of slow cooling from a red heat, which makes the metal comparatively soft, so that it can be cut with the ordinary tools; third, the extreme hardening of the metal, when, by means of sudden cooling, the carbon is chemically dissolved in the iron. (2) An important condition of tool-steel is its freedom from ingredients, such as phosphorus and silicon, which induce brittleness. Excepting some modern tool-steels, in the manufacture of which chromium, titanium, and some other metalloids are employed, the best tool-steels have but a few hundredths of 1 per cent. of any ingredient except carbon and iron. The precise effects of the metalloids are not well determined, and are little understood.

The more important qualities of structural steels vary with their precise uses. In general, great resistance to statical strains, or to those gradually applied, is accompanied by comparative brittleness and unfitness to resist strains suddenly applied. High resistance, resilience, hardness, and brittleness increase, up to certain limits, with the amount of impurities, chiefly carbon, contained in the metal. Low resistance, softness, ductility, and toughness become more marked, within certain limits, as the impurities become less. But too little as well as too much impurity makes steel weak and unsuitable for structural purposes. It requires what is called "body" to give it resistance to either statical or sudden strains. This "body" is imparted by carbon, manganese, silicon, phosphorus, and by other ingredients; but too much of either of them, or of certain compounds of them, weakens the metal. While we know, generally, that the substances mentioned may to a certain extent replace one another as body-giving elements, and that some of them appear to neutralize others (for instance, that manganese restores the ductility of steel made brittle by phosphorus), we are but yet on the outskirts of definite and formulated knowledge regarding the mechanical effects of chemical mixture in iron and steel. Great progress is making, however, by means of combined chemical and mechanical tests, and there is no doubt that not only steel, but other constructive metals, will by these means be compounded to more perfectly meet the present and a vastly increased range of uses.

The considerable variation in the composition of steels fit for the same purposes is shown by Table I. Sulphur and copper do not materially affect structural qualities; they

TABLE I.—*Good Steels.*

| | 1. Martin boiler-plate, very soft. | 2. Martin boiler-plate. | 3. Martin boiler-plate. | 4. Martin boiler-plate, very tough. | 5. Martin "phosphorus-steel" rail. | 6. Bessemer rail. | 7. Bessemer rail. | 8. Bessemer rail, hard. | 9. Bessemer machinery steel. | 10. Bessemer machinery steel. | 11. Bessemer machinery steel. | 12. Bessemer machinery steel. | 13. Bessemer boiler-plate. | 14. Crucible (Krupp) machinery. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon | 0.150 | 0.170 | 0.210 | 0.250 | 0.120 | 0.280 | 0.300 | 0.560 | 0.165 | 0.390 | 0.537 | 0.490 | 0.210 | 0.480 |
| Silicon | 0.025 | 0.020 | trace | trace | 0.030 | 0.050 | 0.100 | 0.350 | 0.100 | 0.027 | 0.042 | 0.009 | 0.029 | 0.220 |
| Phosphorus | 0.040 | 0.070 | 0.050 | 0.030 | 0.286 | 0.101 | 0.120 | 0.118 | 0.070 | 0.122 | 0.058 | 0.036 | 0.054 | 0.039 |
| Manganese | 0.160 | 0.550 | 0.540 | 0.750 | 0.750 | 0.350 | 0.480 | 0.800 | 1.000 | 0.778 | 0.432 | 0.576 | 0.350 | 1.000 |
| Copper | ..... | ..... | ..... | ..... | ..... | ..... | 0.280 | 0.050 | ..... | 0.373 | 0.040 | 0.025 | | |
| Sulphur | trace | 0.001 | 0.050 | ..... | 0.130 | 0.028 | ..... | 0.080 | 0.160 | 0.123 | 0.031 | 0.030 | ..... | 0.049 |

tend to make the metal "red-short" or unmalleable at ordinary working heats. Manganese, up to 1 per cent., promotes toughness, and, as in No. 5, Table I., appears to neutralize the hardening action of phosphorus. Carbon, silicon, and phosphorus must be low in boiler-plates and in parts which are subjected at the same time to tension and vibration. They may all be high in suitably-shaped compression members of structures.

Table II. shows steels (Nos. 1 and 2) red-short from want of manganese, although a similar composition in No. 1, Table I., was not red-short. The former, however, were made by the Bessemer process, and needed more manganese to remove the oxide of iron formed in the conversion. This will be further referred to. No. 5, Table II., is both red-short and brittle from excess of phosphorus. No. 3 is a little brittle from carbon; removing two thirds of its phosphorus would leave it tough. Nos. 6 and 7 are, on the contrary, weak for the want of carbon.

TABLE II.—*Miscellaneous Analyses.*

| | 1. Bessemer, red-short. | 2. Bessemer, red-short. | 3. Bessemer, rather brittle. | 4. Bessemer, very brittle. | 5. Bessemer, rotten hot and cold. | 6. Bessemer, low tensile strength. | 7. Bessemer, rails yielded to impact. | 8. Good, hard wrought iron. |
|---|---|---|---|---|---|---|---|---|
| Carbon | 0.292 | 0.180 | 0.744 | 0.150 | 0.480 | 0.060 | 0.142 | 0.036 |
| Silicon | 0.011 | 0.057 | 0.040 | 0.029 | 0.046 | 0.035 | 0.062 | 0.179 |
| Phosphorus | 0.061 | 0.080 | 0.089 | 0.240 | 0.589 | 0.098 | 0.085 | 0.088 |
| Manganese | 0.144 | 0.140 | 0.450 | 0.240 | trace | 0.305 | 0.472 | 0.029 |
| Copper | 0.016 | ..... | ..... | 0.030 | ..... | 0.018 | 0.065 | 0.007 |
| Sulphur | 0.012 | 0.115 | 0.030 | 0.040 | 0.053 | 0.070 | ..... | 0.028 |

Table III. shows the strength and ductility of three kinds of steel, due to carbon.

TABLE III.—*Mechanical Qualities due to Carbon.*

| Fagersta (Sweden). | | | Neuburg (Austria). | | | Cockerill (Seraing). | | |
|---|---|---|---|---|---|---|---|---|
| Quantity of carbon. | Average breaking load. | Percentage of stretching. | Carbon. | Breaking load. | Percentage of stretching. | Carbon. | Breaking load. | Percentage of stretching. |
| | Lbs. per sq. inch. | | | Lbs. per sq. inch. | | | | |
| 1.00 p. c. | 126,486 to 146,383 | 2 to 6 p. c. | 0.88 to 1.12 | 126,486 to 149,226 | 5 p. c. | 0.65 and more. | 98,063 to 156,332 | 5 to 10 p. c. |
| 0.70 p. c. | 100,905 to 130,750 | 4 to 6 p. c. | 0.62 to 0.88 | 103,747 to 126,486 | 5 to 10 p. c. | 0.55 to 0.65 | | |
| 0.45 p. c. | 99,404 to 103,747 | 9 to 10 p. c. | 0.38 to 0.62 | 80,298 to 103,747 | 10 to 20 p. c. | 0.45 to 0.55 | 79,587 to 98,063 | 10 to 20 p. c. |
| 0.35 p. c. | 68,217 to 69,638 | 12 p. c. | 0.15 to 0.38 | 68,217 to 80,298 | 20 to 25 p. c. | 0.35 to 0.45 | | |
| 0.30 p. c. | 59,690 to 62,533 | 11 to 22 p. c. | 0.05 to 0.15 | 56,848 to 68,217 | 25 to 30 p. c. | 0.25 to 0.35 | 68,217 to 79,587 | 20 to 25 p. c. |

As already mentioned, while there is a general rule for the compounding of steel, by means of which a variety of materials and processes may be utilized, the exact effect of the ingredients upon each other and upon the general result can only be formulated when many thousands of chemical and physical tests are made and compared. Carbon appears to be the most important modifying element, whether as a condition of tempering, or in too small quantity to be materially affected by being quenched in water. Its amount may be easily regulated in all steel processes; and its proper regulation is the chief feature of the steel manufacture at present. There is as yet little attempt to combine, control, and utilize the other ingredients mentioned (excepting perhaps manganese), but only to avoid, as far as possible, the raw materials which would introduce them into steel.

*The Manufacture of Steel.*—(1) *The Pot-Steel Process.*—This is the oldest and simplest. It at first consisted in melting wrought iron with carbon in clay crucibles. Thus Indian "wootz" is made, containing as much as 1½ per cent. of carbon, so that it requires decarburization before it can be forged. In the present manufacture other ingredients besides carbon, chiefly manganese, are added. Sometimes substances intended to combine with and remove the impurities in the wrought iron are introduced, but generally these impurities remain in the steel. The finest steel must therefore be made from wrought iron which has been purified by reworking with pure fuel, and which was originally made from pure ores. The melting-point of wrought iron is so high that it has been usual to carburize it by cementation (see FURNACE) in order to fuse it at a convenient temperature in crucibles. This cemented or blistered bar was the steel of commerce until Huntsman melted it in a crucible in 1770, producing a true cast steel. Steel for boiler-plates and some other uses would be too highly carburized if made of melted cemented steel, so that wrought iron, a very little charcoal, and some manganese are now fused together to make the softer pot steels. The use of the Siemens furnace (see FURNACE) and the modern improvement of crucibles render the melting of wrought iron practicable and cheap. Pot steel has been experimentally made from spongy iron produced by deoxidizing iron ore without fusing it. (Sponge steel will be further referred to.) The cheaper grades of pot steel are largely made from Bessemer and Martin steel rail-ends and other scrap. This material, being made directly from cast iron, without that purification from silicon and phosphorus to which wrought iron could have been subjected in puddling, produces an inferior steel to that made from the purest wrought iron for purposes, like tool-steel, requiring both hardness and toughness. By melting wrought iron and a little cast iron together, especially cast iron containing manganese, the cheaper grades of steel are produced. The impurities of the cast iron remain in the steel. Although pot steel has been cheapened by using the materials mentioned, and by means of the gas-furnace, the less refined grades of steel are made at so much less cost and with so much greater uniformity by the Martin process, and within certain limits by the Bessemer process, that the pot-process is becoming gradually confined to the finer grades of tool-steel: and here it must probably long retain its superiority, chiefly because it can begin with a highly-refined iron, from which especially phosphorus, silicon, and sulphur have been more or less completely eliminated. Pot steel is also the more suitable for castings to be used without further working, as it remains for some time "dead melted" in the pots, and so parts with the gases which give porousness to ingots made by more rapid processes. Manganese, however, promotes sound casting in all processes.

The apparatus for making pot steel is comparatively

simple. The gas pot-furnace is shown in article FURNACE, and the operation of the regenerative gas-furnace is fully described in the same article. The coke pot-furnace is a smaller "melting-hole" or fireplace, in which from two to four pots are set in a bed of coke, the combustion of which is urged by a powerful draught. The top of the series—sometimes hundreds—of melting-holes is level with the shop-floor. A series of ash-pits open to a tunnel underneath the floor. Boilers to furnish steam to hammers and roll-trains are usually driven by the waste heat from the pot-furnaces. The pots hold from 40 to 75 pounds of metal each, and melt three charges in twelve hours. They are usually made of fire-clay in England and of plumbago in this country, depending on the quality of the refractory material at hand. The pots are generally charged when cold with all the materials to be fused, set in the furnace, covered with tight lids, and withdrawn for pouring by means of tongs. They endure from two to six rounds. The consumption of coke in the ordinary furnace is 3 to 3½ tons per ton of steel; in the regenerative gas-furnace it is from 1¼ to 1½ tons of a cheap coal per ton of steel.

The soundness of ingots largely depends on the skill with which the pots are emptied into the ingot-moulds. The stream must pour uniformly into the centre of the mould, and must not strike or spatter against the sides. For large castings several hundred pots are sometimes poured, one after another, into a small ladle standing over the ingot-mould, but the stream from the bottom of the ladle into the mould must be unbroken. Steel low in carbon chills very rapidly, so that casting operations must be performed with celerity. Ingot-moulds are made of cast iron, sometimes in two sections held together by hoops, and separated to take out the ingot. Large moulds are usually solid, and tapered, so that the ingot will slip out endwise when it contracts by cooling. Ingots are heated and worked by the various means described in the articles FURNACE and ROLLING-MILL. (See especially FURNACE, *Description of Furnace*, regarding the working of small pot-steel ingots.)

(2) *The Siemens-Martin (or open-hearth) Process.*—The melting of the ingredients of cast steel in large quantities and cheaply on the open hearth of a reverberatory furnace, rather than in small quantities and expensively in pots, having been often unsuccessfully attempted, was patented in a more scientific form by the eminent metallurgist Heath in 1845, and was then experimentally carried out with limited success. The Siemens regenerative gas-furnace, by means of the intensity and uniformity of its heat, first furnished practical conditions to the open-hearth process about 1862. It was also demonstrated by Messrs. Martin that the addition of manganese at a certain stage was necessary to the production of sound and practically malleable steel. (The action of manganese will be further referred to.) By common consent, the process has been called, for the above reasons, the Siemens-Martin process. (The Siemens open-hearth steel furnace and its operation are fully exhibited and described under FURNACE.) The hearth or bed of the furnace consists of a shallow iron tank, ventilated below to prevent the concentrated heat of the hearth and the regenerators from endangering the structure, and lined with a very refractory material, generally silica, nearly pure, and just fusible enough to set into a solid mass. The red-hot air and gas entering and burning at, say, the right-hand end of the furnace, play upon the materials placed on the hearth, and pass down into the regenerators at the left end, where they give off their heat to a checkerwork of fire-bricks. The current being reversed after some thirty minutes, the air and gas enter at the left end through the newly-heated regenerators and pass out at the right end.

The materials employed are various, and consequently the process varies, although the decarburization of pig iron is always a part of it. In order to obtain a sufficiently intense combustion there must be a slight excess of air; the flame is therefore oxidizing, and would seriously waste wrought iron or the ingredients usually melted in pots. A bath of cast iron, which on account of its carbon can be melted without serious loss, is first necessary; in this are immersed and protected the more readily oxidizable materials for the production of steel. The amount of cast iron varies from 10 to 33 per cent. of the total charge. For fine steels it should be as small as possible, so as to introduce the least amount of phosphorus, silicon, etc.

The more common process is known as the scrap process, and this again is divided into (1) the fusion of pig and scrap wrought iron or steel charged together, the former melting while the latter is heated preparatory to melting; (2) the dissolving of either hot or cold scrap in a bath of pig previously melted; (3) the dissolving of wrought-iron sponge in a cast-iron bath. The operation in all these cases is chiefly the melting of the decarburized iron forming the bulk of the charge, and the oxidation of the greater part of the carbon and silicon in the crude cast iron, and also, to a certain extent, of the phosphorus and other impurities. A portion of the iron is also oxidized, and this oxide of iron makes the product unmalleable or red-short. To remove the oxygen something must be added which has a greater affinity for it than the iron has. Manganese is such a thing, and it is easily and cheaply introduced in the form of pig iron called spiegeleisen, which contains 10 to 15 per cent. of manganese, or of an artificial ferro-manganese containing as high as 60 per cent. By this means an excess of manganese can be introduced, so that any desired proportion of it shall remain in the steel. If the decarburization of the cast iron and the dilution of the carburized and uncarburized portions of the charge are carried only to such an extent that a highly carburized product remains, less manganese is needed to make it malleable, and this may be supplied by melting a manganiferous pig iron with the charge. Dissolving scrap in the bath is the more common process; the scrap is fed in a little at a time, so as not to chill the charge and cause it to set on the bottom of the furnace, and also to maintain uniformity in the temperature and working of the furnace. In order to save part of the stress on the steel furnace, an auxiliary furnace is employed in many works to heat the scrap and spiegeleisen before charging them into the bath. Wrought-iron sponge is charged like scrap, either cold or hot, although it is difficult to prevent it from rapidly oxidizing when hot until it is protected by the bath. Wrought-iron sponge is simply iron ore heated in the presence of carbon to such a degree that the carbon will remove the oxygen from the iron ore, but not from the silica or other metalliferous ores present. When sponge is melted in the bath, the silica and the phosphorus (if it is combined with lime instead of iron) and some other impurities, being lighter than iron, float off with the slag. The blast furnace, on the contrary, smelts more or less of the metalloids, and incorporates them with the pig iron, from which they are imperfectly removed by subsequent processes. The manufacture of sponge-steel is not fully developed nor largely practised, but it offers many theoretical advantages.

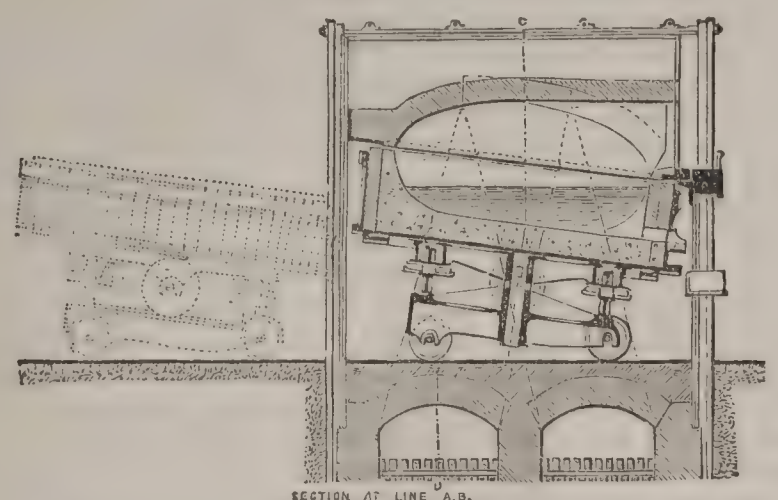
In the production of boiler-plate and of steels to be subjected to blows and vibration while in tension, for which the open-hearth process is largely used and well adapted, about 20 per cent. of the best "Bessemer" pig, containing less than 0.10 per cent. of phosphorus, and preferably not over 1 per cent. of silicon, is employed, the remainder of the charge being charcoal blooms made from "Bessemer" ores, or puddle-bar made by the boiling process, so as to free it as much as possible from phosphorus. For cheap steels, especially those in which hardness without great resistance to impact are required, a less pure pig and any wrought-iron scrap, such as old rails, may be employed. The phosphorus imparted by the latter may be rendered harmless by employing a rich ferro-manganese at the close of the process, thus adding a large amount (¾ to 1 per cent.) of manganese and only 0.10 to 0.15 per cent. of carbon. (See Analysis No. 5, Table I.)

To ascertain when the charge is so far completed as to be ready for the manganese, samples are dipped out of the bath and tested from time to time. The decarburization is accurately denoted by the toughness of the sample and by the appearance of its fracture. As soon as the manganese is thoroughly diffused through the bath, the charge is tapped out and cast in a manner to be further referred to. The open-hearth furnace is made to hold from 3 to 10 tons, the more usual capacity being 5 to 6 tons. The time of the operation is from eight to eleven hours.

The pig-and-ore process, as developed by Mr. Siemens, consists in decarburizing a bath of pig iron by iron ore, and then adding ferro-manganese in the usual manner. The ordinary proportions are 5½ tons of pig and more or less ore in proportion to its richness, usually about 30 cwt. The iron in the ore is added to the bath, and a little limestone is thrown in to facilitate its separation. The theory is to use ore enough to make good the waste of the iron by oxidation. Although pig and ore may be employed alone with success, there is usually 10 or 15 per cent. of scrap made in rolling and forging, and this scrap is returned to the steel furnace. Sometimes 25 per cent. of scrap is added. The process thus partially takes the character of the pig-and-scrap process, although the use of ore as a rapid decarburizer of the large amount of pig employed gives it a distinctive character. The pig and scrap are first melted, the time being four or five hours. During this period an inch or more of slag forms over the bath. Then the ore, in lumps up to 3 or 4 inches in diameter, is charged a little at a time, until the bath is nearly ready for the manganese, when it is allowed to stand, so that the iron may work out of the ore and slag. The usual amount of ferro-manganese finally added is 7 per cent. of a metal containing 12 to 15 per cent. of manganese. After the charging of the ore begins, there are two distinct periods:

first, the rising of the slag; this increases in weight, but much more in volume, and is covered with large and heavily-moving blotches or bubbles; second, the boiling of the metal, when the slag settles and becomes thinner, and the whole surface of the bath is covered with a lively spouting of the metal and slag, sometimes of the metal through the slag. These periods represent the following operations: (1) The silicon in the pig, having at this temperature a higher affinity for oxygen than the carbon has, is burned out first, partly by the flame, which is somewhat oxidizing, and partly by the oxygen in the ore. Thus, slag is rapidly

FIG. 1.



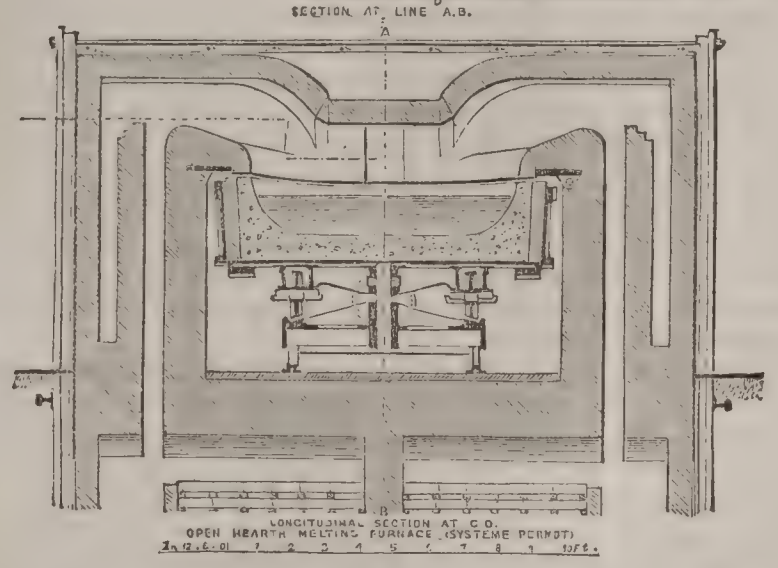




FIG. 2.

formed and also thickened by the release of the silica and other impurities in the ore. (2) When the silicon of the pig is nearly consumed, its carbon begins to burn freely and to throw off carbonic oxide, which makes the now hotter and thinner slag boil violently.

The Pernot revolving-hearth furnace is shown by Figs. 1 and 2. The regenerators may be exactly like those shown under FURNACE, and before referred to. The hearth is inclined at an angle of 5° or 6° to the vertical, and is rotated by an engine and gearing (not shown in the engraving) at the rate of about two revolutions per minute. The effects are—first, that the melted bath is constantly agitated; second, that the solid scrap, such as rail-ends, are alternately dipped into the bath and brought up into the flame; third, that a portion of the side-slope of the hearth is constantly exposed to the flame. In the stationary hearth the heat can only penetrate the bath through the blanket of slag, while in this the bath is heated partly by the side-slopes. Both the decarburization of the cast iron and the dissolving of the scrap must of course be facilitated by these mechanical means. As a result, the Pernot furnace makes four heats in the twenty-four hours, instead of two, or at most three, as made in the stationary hearth. Again, the whole hearth is mounted on wheels, and may be removed to the position shown by the dotted lines in Fig. 1, thus giving ready access to both the hearth and the roof and ports for repairs, and facilitating the cooling of the furnace, so that workmen may get at it. The general arrangement of an improved open-hearth steel plant is shown by Fig. 3 in plan and Fig. 4 in cross-section. The Pernot furnace being employed, which must be charged on the tapping side, a wide platform, 13 feet above the ground floor, is arranged on this side. On the other side provision is made for drawing out and repairing the movable furnace-hearths. The furnace-valves are placed under this platform, also the engines for rotating the hearth. The arrangement of plant for stationary furnaces would be similar, except that the 13-foot platform might be omitted, the ladle A might swing closer to the furnace, and the furnace might consequently be lower; its height is regulated by the convenient height of the ladle for casting the metal in moulds which stand in the ingot-pit. The operation of casting will be referred to under *The Bessemer Process*. The materials are raised by the hydraulic hoist J. When the scrap process is employed, that material is heated in the auxiliary furnace, being charged on the back side and pulled out on a car on the front side; from the car it is pushed into the steel furnace. When the ore process is employed, the pig, which forms the bulk of the charge, is raised by the lift J to the cupola E, where it is rapidly melted and run into the ladle F. The ladle is raised by a hydraulic lift, and tapped out into either steel furnace. A slag-car under the tapping-spout is arranged to catch and carry away the voluminous slag which follows the steel out of the furnace. The hydraulic cranes B B swing over the casting-pit to set the moulds and remove the ingots. Two ovens are provided to dry the flasks for casting ingots in groups from the bottom—a process which will be further referred to. Another plant like this may be added to the end of this, and so on indefinitely, the gas-producer system and the material-yard being extended on the one side, and the railway system for transporting ingots on the other.

FIG. 3.

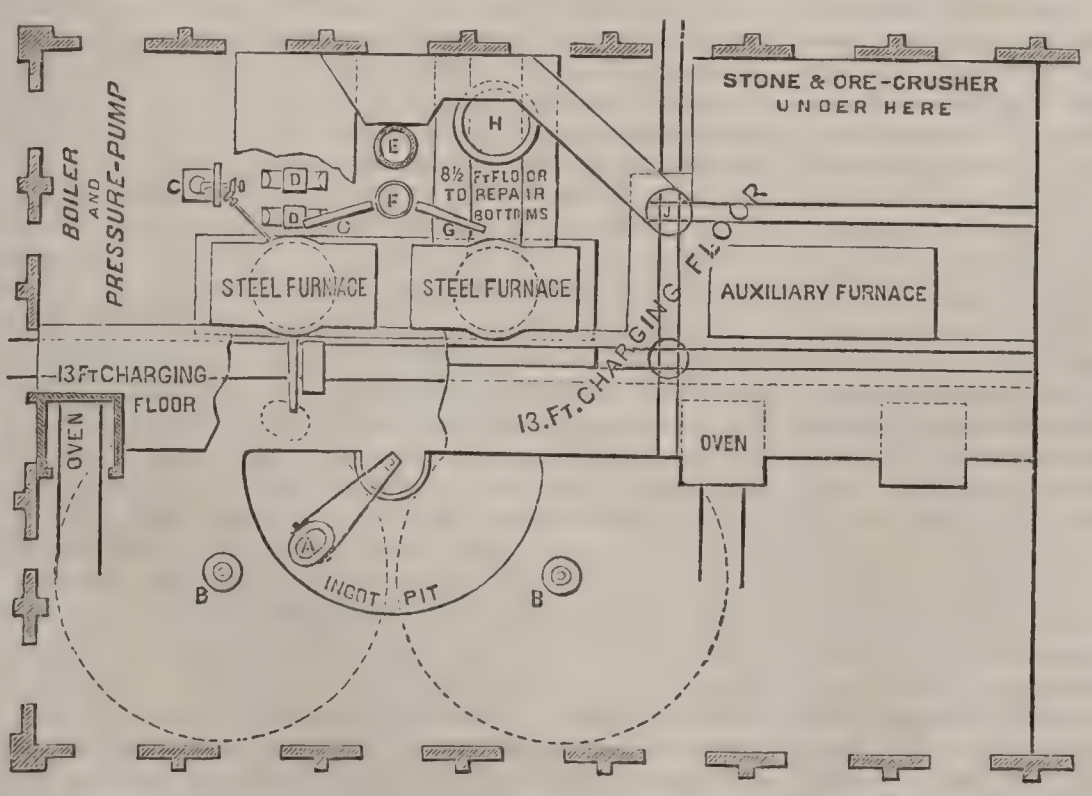
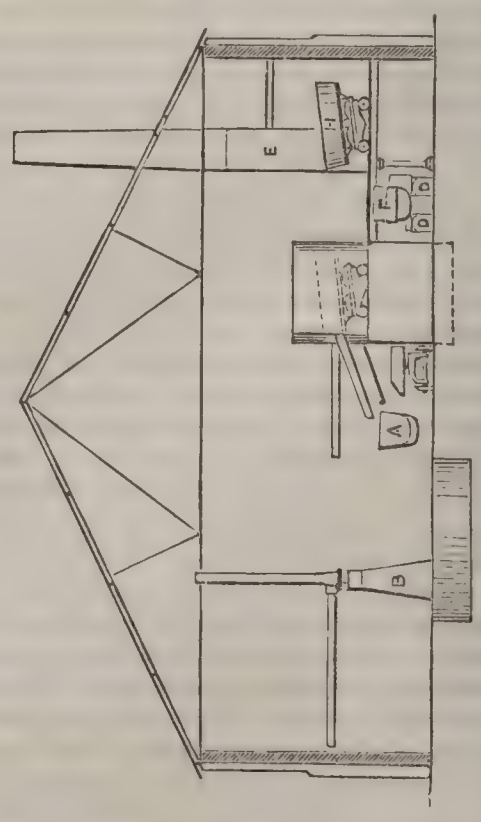



FIG. 4.



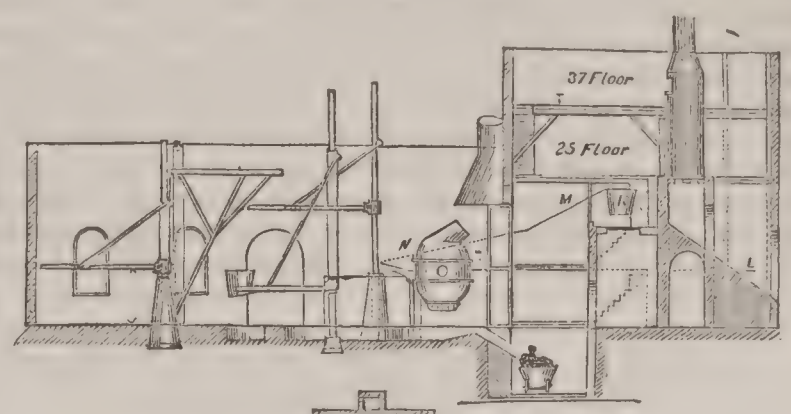
*The Bessemer Process.*—The chemical part of the Bessemer process may be generally stated as the oxidation of the carbon and silicon in melted crude cast iron, so as to make it malleable, by means of air-blasts. This definition, to some extent, describes puddling and the earlier processes of making malleable iron. In all these processes the air oxidizes a portion of the iron, and the oxide of iron thus formed undoubtedly oxidizes a part of the carbon and silicon. In puddling, however, the mixing of the oxidizing agent, so that it may come in contact with all parts of the iron successively, is promoted by stirring the melted mass by manual power; but so slow is the process, and so small are the masses that can be treated by a workman, that not even the heat of the combustion thus promoted, nor even the additional heat of the burning coal, can keep the iron *fluid* when deprived of its carbon. The purified iron is withdrawn in a plastic condition, mixed with slag. It requires compression, piling, heating, and recompression to reduce it to a solid bar. The radical and essential differ-

ence between this process and the Bessemer process is a *mechanical* difference, and it consists in the *intense and violent stirring* of the Bessemerized iron. To this alone is due the production and maintenance of a temperature, without any other fuel than the carbon and silicon contained, that *keeps the metal fluid*, so that it can be cast into homogeneous, malleable ingots. In puddling, the iron is agitated by the power of one man; in Bessemerizing, it is torn into spray by a 500-horse engine. In the one case it is stirred by a single iron bar; in the other it is pierced by innumerable bars of iron, squeezed solid, like rods of glass, penetrating every part, and enveloping every atom of iron in an atmosphere of oxidizing material. The combustion thus takes place not in successive sections of the mass, but throughout the whole of it, at the same time, and in the shortest possible time; and the heat arising from *such* combustion has not time to escape from the mass until purification is completed. The quantity of iron that can be treated, in comparison with the mass of heat-conducting surroundings, is also an important feature. The individual reactions are, as far as we can judge, as rapid and complete in one case as in the other; the fluid condition of Bessemer metal is due simply to the vastly greater number of these reactions that are compelled to occur in a given space of time by the mechanical force and distribution of air-blasts.

The Bessemer process as first performed, and as still practised to a very limited extent abroad with irons rich in manganese, consists in applying the blast until all but one-fourth to one-half of 1 per cent. of the carbon is burned out, and then casting the product. Stopping the blast at this point, however, is very uncertain; hardly any irons contain the right amount of manganese for this treatment, and the process has certain mechanical objections. Hence, the nearly universal practice is to blow the iron until *all* the carbon is exhausted—a point readily determined. But the product now, as in the open-hearth process before described, contains so much oxide of iron that it is red-short and crumbles in working. To reduce this oxide of iron, manganese, which has a stronger affinity for the oxygen than the iron has, is added by running into the converter 8 to 10 per cent. of melted spiegeleisen, which is a pig iron containing 10 to 15 per cent. of manganese, or by otherwise adding ferro-manganese to the charge. Any desired amounts of carbon and manganese are also thus added to the product. No phosphorus is removed from the iron in the Bessemer process. Only the carbon and the greater part of the silicon are oxidized. It is therefore important to start with pig irons having a little less phosphorus, sulphur, and copper than the steel may safely contain. But it is not usually practicable to use irons low in silicon, for the oxidation of this element produces the high temperature necessary to keep the mass fluid. Manganese is to a certain extent a substitute for silicon in this respect, and always a valuable ingredient, but the greater part of the irons of the world do not contain it in important quantities. Usually, a pig containing from 2 to 2½ per cent. of silicon is required. This will heat the charge to such a degree that 10 to 15 per cent. of scrap may be worked with the pig-iron charge. If there is more silicon than this, too much of it is likely to be left in the steel. One reason why silicon has greater heating power than carbon (it is stated by Akerman to have nine times as much) is because the product of its combustion, slag, remains in the converter, while the product of the combustion of carbon goes out in gaseous form, and carries much heat with it.

A standard American Bessemer plant consists (1) of a *melting department*. The furnace and working-floor are shown in plan by Fig. 5; sections of these floors and the furnaces are shown by Fig. 6. There are hoists at *a* for coal, etc., and at *b* for iron; four cupola furnaces and their platforms and blowing machinery; two ladles, K, standing on scales, for weighing the melted iron; and spouts M, N, Fig. 6, for conducting it to the vessels or converters; two reverberatory furnaces for spiegeleisen, and their spouts. (2) The *converting department*, shown in ground-plan by Fig. 5 and in cross-section by Fig. 6. It contains two 5-ton to 7-ton vessels N, in which the melted iron is treated by air-blasts. The vessels will presently be illustrated. Also, a ladle and a hydraulic ladle-crane at E, Fig. 5, by means of which the steel is received from the vessels and poured into the ingot-moulds, which stand upon a depressed part of the floor called the "pit." Three other hydraulic cranes swing over the pit to set the ingot-moulds and remove and load the ingots. Two of them swing over the vessels to assist in their daily repairs. The water- and air-pressure reservoirs are surmounted by a platform *d*, Fig. 5, standing upon which boys, by turning valves, admit water to the cranes and air to the vessels by means of underground pipes. All the constant operations of hoisting, lowering, and blowing are conducted from this platform, which overlooks the entire converting department. The details of

Fig. 6.



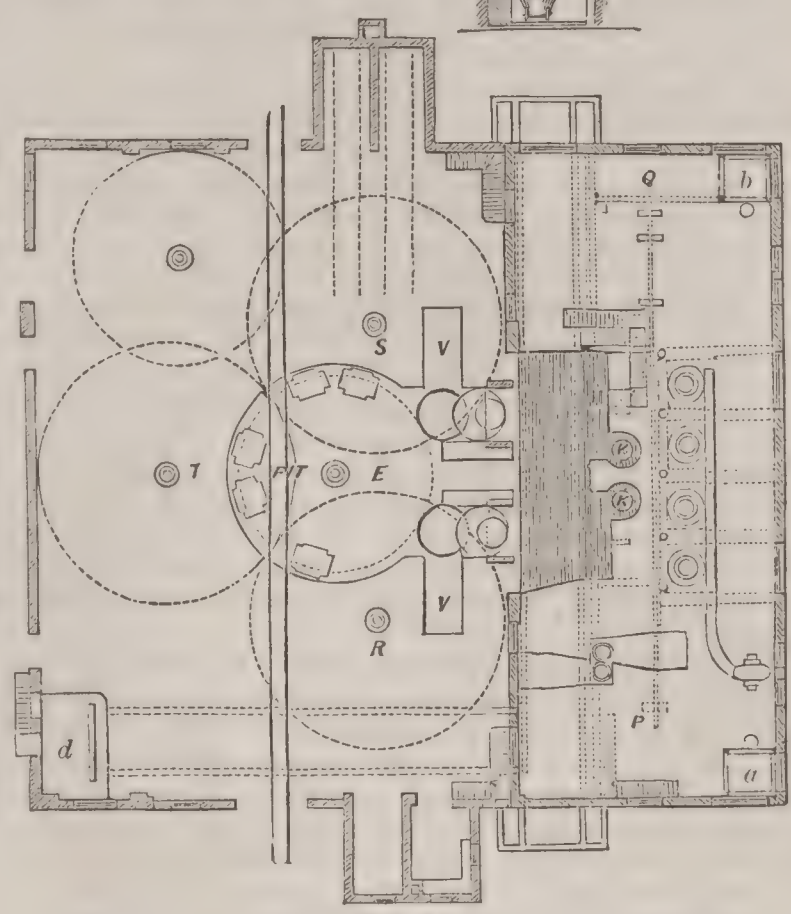



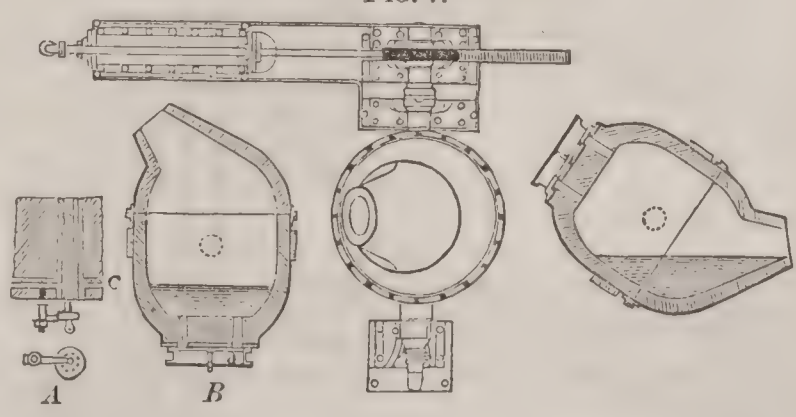

Fig. 5.

these and other parts will be further described. (3) *The Engine Department.*—This is not shown in the engravings. It contains a blowing-engine, usually a double engine, capable at normal speed of receiving 8000 to 11,000 cubic feet of air per minute, and delivering it at 25 pounds pressure per square inch. The water-pressure machinery for actuating the hydraulic machinery consists of a pair of Worthington duplex pumps, each having two 25-inch steam-cylinders, and two 9-inch water-cylinders, 24-inch stroke. The boilers should be capable of 800 horse-power.

The pig-iron, having been hoisted to the charging platform, is put, with, say, 10 per cent. of coal, into one of the cupolas and melted. When some 15,000 to 16,000 pounds (whatever charge is determined on) have run into one of the ladles K, the latter is turned over by means of a worm-wheel, thus pouring the iron into the spout, which leads it to one of the vessels.

Before following the iron through the converting process, let us glance at the construction of the vessel, the simplest

Fig. 7.

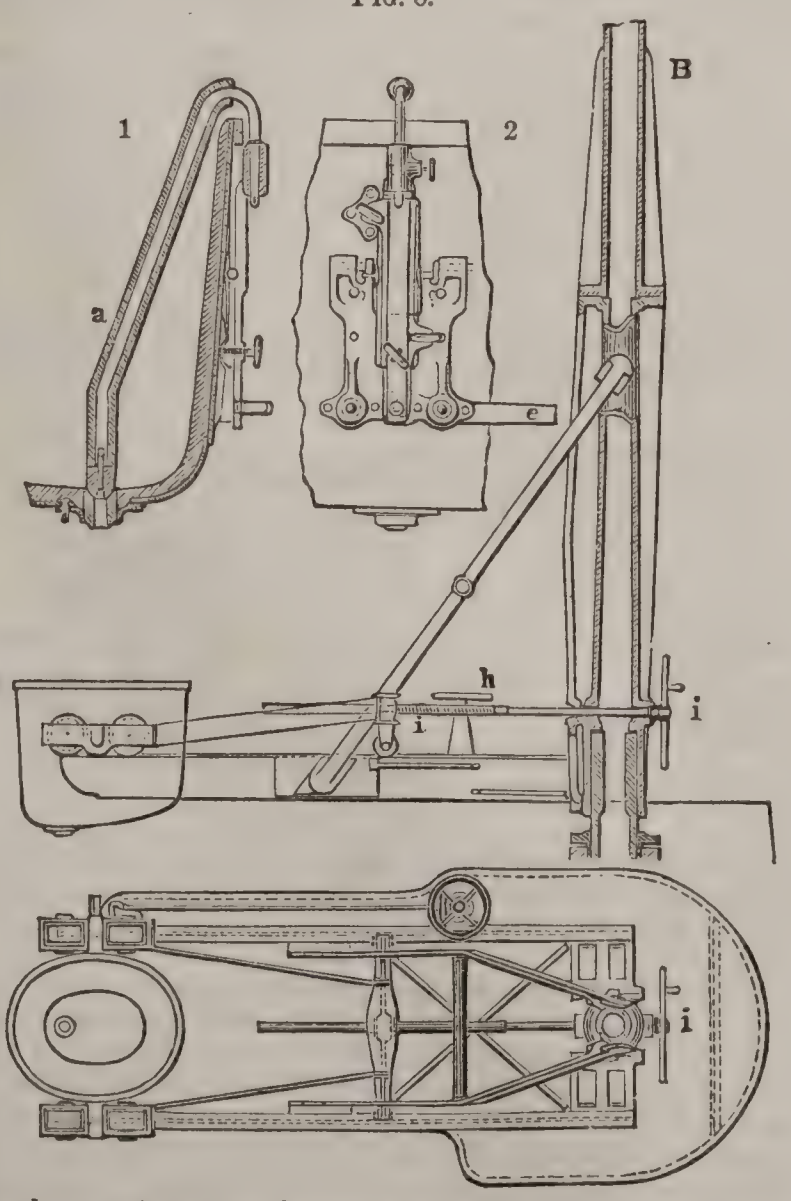



form of which is shown at Fig. 7. A vessel that will convert a 6-ton charge is 8½ feet in external diameter and 15 feet high. It is made chiefly of ½-inch to ¾-inch iron plates, and lined nearly a foot thick with refractory material. At one end it has an 18-inch opening, called the nose; at the other a tuyere-box, communicating with the blowing-engine. From the tuyere-box 12 fire-brick tuyeres, each perforated with twelve ⅜-inch holes, project through and are imbedded in the lining. A tuyere is shown in section by A. These tuyeres last but ten or fifteen heats, and are arranged, as we shall see farther on, to be rapidly renewed. The vessel is mounted on trunnions, and turned by a hydraulic cylinder by means of a rack and pinion. When the charge enters,

the tuyeres are turned up as at C, so that the iron will not run into them. The blast is then admitted, and the tuyeres turned down so that the metal will flow over them, and be pierced by the entering columns of air. The cubical contents of the vessel is eight to twelve times that of the charge of iron, in order to give room for ebullition. The vessel lining is heated red hot and the fuel discharged before the iron is turned in. The iron is now subjected to 144 streams of air, three-eighths of an inch in diameter, at 15 to 25 pounds pressure, for about 20 minutes. Most of the silicon is first burned out, the result being slag, and a comparatively dull flame at the converter-mouth. When the carbon begins to burn freely, the volume and brilliancy of the flame increase; and as the surging mass grows hotter, and boils over in splashes of fluid slag, the discharge is a thick, white, roaring blaze, and the massive vessel and its iron foundations tremble under the violent ebullition. Toward the close of the operation the flame becomes thinner, and when decarburization is complete, it suddenly contracts and loses illuminating power. The determination of this period is the critical point of the process. Ten seconds too much or too little blowing injures or spoils the product. At the proper instant, as determined best by the spectroscope or by colored glasses, but usually by the naked eye, the foreman turns down the vessel and shuts off the blast. The charge of spiegeleisen is then run in, when another flaming reaction occurs. The vessel being still farther depressed, the steel runs into the ladle, pure, white, and shining, from under its coating of red-hot slag. A blanket of slag, most useful in preserving its temperature, follows it into the ladle. The metal is now let into the ingot-moulds by means which will be further illustrated. After the exterior surface of the steel has crystallized, the mould is removed, and the ingot is ready for reheating and rolling.

In working out the Bessemer process the most novel and difficult problem, obviously, was, how to hold and handle fluid iron while it was being treated with violent blasts of air, and how to do this with such celerity that the metal would *remain* fluid. To this end the first *radical* feature of the Bessemer apparatus was imbedding the tuyeres in the lining of the vessel; or, in other words, the perforation of the bottom part of the vessel-lining. The bottoms of the tuyeres (Fig. 7) are luted with plastic clay inserted in openings in the tuyere-box, grooved to hold the luting, so that no air can leak by, and held in place by a dog (A). Semi-plastic refractory material, chiefly ground silicious stone, is then rammed between and around the tuyeres, thus forming the continuous lining of the vessel. The second radical feature is the rotating vessel. The very limited use of a stationary vessel having similar tuyeres

FIG. 8.




has been referred to; but, as recarburization cannot be performed in such a vessel, and as it is otherwise impracticable for a maximum production, we may properly omit its consideration. We have already observed the value of the rotating vessel in placing the tuyeres under the metal to blow, in removing them to stop blowing, in receiving the iron from the cupolas, and in pouring the steel into the casting-ladle. If a tuyere fails while blowing, as is often the case, at the first indication the perforated bottom is turned up out of the metal, where it can be reached and repaired.

The ladle-crane (Fig. 8) is another radical departure from the nearest kindred practice. The ladle, instead of swinging from a crane-chain, as in a foundry, is rigidly held in a fixed orbit. This feature was original with Bessemer, and to it he added the old ladle with a pouring-nozzle in its bottom, regulated by a movable stopper (1 and 2). This consists of a loam-coated rod *a*, armed at its lower end with a round-ended fire-brick or plumbago stopper fitted to the concave top of a fire-brick nozzle. The stopper is raised and lowered by a lever *o* in the hand of the workman. Thus, the heavy steel is discharged pure, while the lighter slag and impurities are left at the top. Pouring steel into moulds over the rim of a ladle, as in foundries, would make excessive scrap from spilling and chilling, and is wholly impracticable. The vertical motion of the crane is necessary in pouring from the vessel, to keep the ladle close under the nose, thus preventing too great a fall of the stream, and consequent slopping. The ladle is also tipped by a worm and worm-wheel *h*, to regulate the position of the nozzle over the moulds and to turn over the ladle for heating and repairs. The hydraulic crane generally used in American works is also illustrated by Fig. 8, and consists of a cylinder open at the top only, and requiring chiefly vertical support from the solid pier on which it rests. The ram passes through an upper stuffing-box and through a top support in the roof of the building. The jib is placed between these supports, so that the lateral strain on the ram is comparatively small. The ram is stepped upon a column of water which is substantially frictionless. The amount of hydraulic pressure employed has been regulated chiefly by the proportions of the crane; that is to say, it was found that for an 8-ton crane, having a 10-foot lift and 22-foot jib, a 13-inch ram was well proportioned for strength. Adding frictions and fluctuations of pressure, it was found that 300 pounds per inch on this 13-inch ram was abundant for all emergencies; and the working pressure has been fixed at about this point, instead of being carried to 1500 pounds or more, as is so usual in other hydraulic machinery. The water is pumped into an accumulator, consisting of a cylinder and weighted ram like those of a crane. When the cylinder is full, the ram, by means of suitable gearing, nearly shuts off the steam from the pump by means of a lever and throttle-valve. This arrangement saves some steam, and prevents the pump from running too fast when several cranes happen to be started at once.

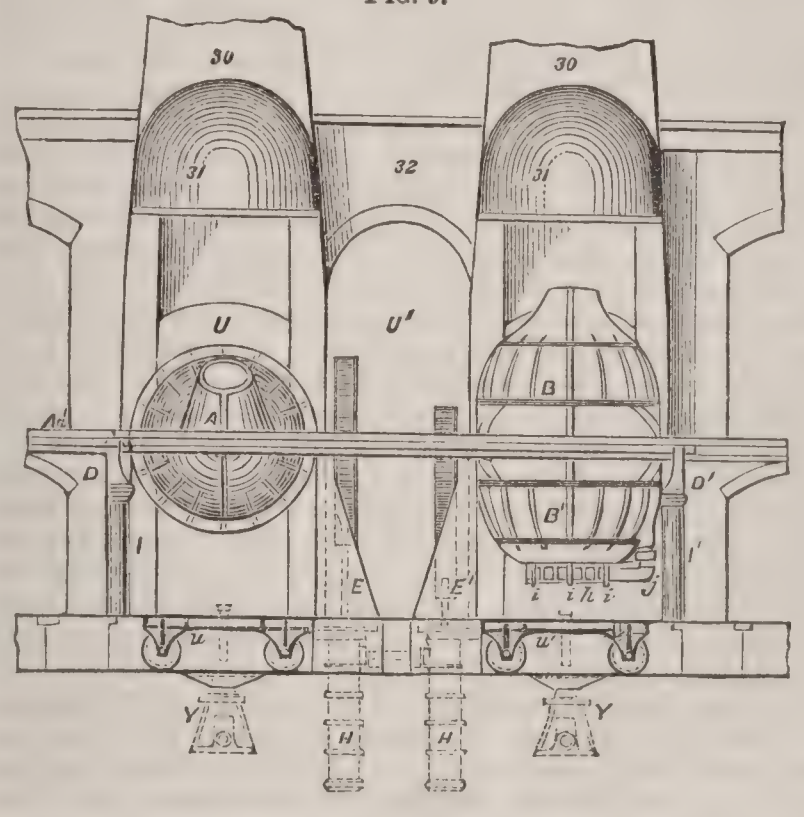
The English vessel-lining is a hard sandstone called "ganister." It contains about 93 per cent. of silica, 4 per cent. of alumina, 1 or 2 per cent. of oxide of iron, and often a little soda, lime, potash, etc. It is a true quartzite. This is ground into sand and dust, and mixed sometimes, but not always, with a little fire-clay while being ground. It is then wetted to a semi-plastic consistency, and rammed into a solid wall between an iron mould temporarily inserted and the shell of the vessel. The hardness and uniformity of the ramming is of special importance. The lining is at first slowly dried, and then glazed by filling the vessel half full of coal and blowing for four to five hours at two or three pounds pressure. The vessel is then ready for use. In this country no stone exactly like ganister has yet been found. We use any hard, dense sandstone, or any quartz, mixed with 10 or 12 per cent. of ground fire-clay. The chemical composition of many of these stones is similar to that of ganister, except that they contain less alumina. The *natural mixture* of the small amount of alumina in ganister appears to give the mass a degree of density and cohesion, both wet and dry, that can hardly be obtained with three or four times the amount artificially mixed. Too much alumina is *chemically* eaten away; this is why tuyeres fail so soon. A fire-brick vessel lining, though hard enough to stand the abrasion of the surging mass, would be chemically destroyed in a very few heats. Silica, on the contrary, although refractory enough, is soon washed away, because it will not fuse into a dense mass. The mechanical structure of quartzite has an important bearing on its endurance when rammed into the vessel. The heat of successive charges compacts and hardens it.

Interposing ladles between the cupolas and vessels is important in many respects: (1) The cupola cannot be so economically and regularly worked if its hearth has to fill up with the whole vessel-charge of iron every thirty or forty minutes. (2) The weight of the charges should be some-

what uniform, to promote uniformity and accuracy of blowing, and to recarburize with a fixed percentage of spiegeleisen. This can only be accomplished by weighing the charge between the cupola and the vessel, and the ladles are placed on scales for this purpose. (3) Several charges are often run into the ladles when the converting department is not ready for them; otherwise the cupola would have to be dumped and part of a day's work lost.

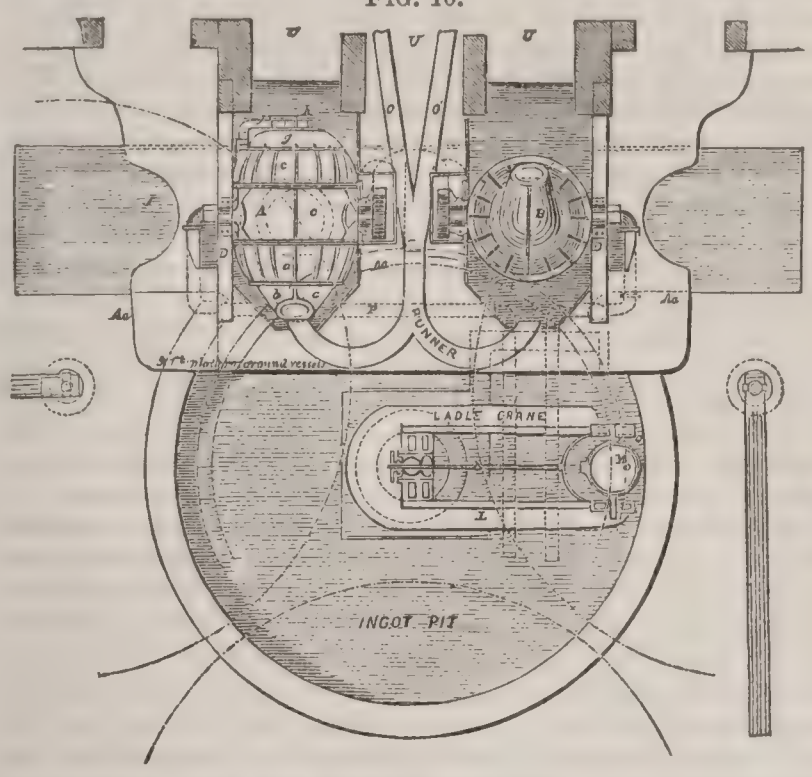
We come, finally, to the general arrangement of plant. The standard English plant, worked out by Bessemer, is still adhered to in England and on the Continent, excepting only in a very few of the later works. The standard American plant is illustrated by Figs. 5 and 6 and by Figs. 9 and 10, which show a plan and elevation of the vessels and their immediate surroundings. The most conspicuous

FIG. 9.




feature is the arrangement of the vessels, especially their height above the general floor, and the consequent shallow-

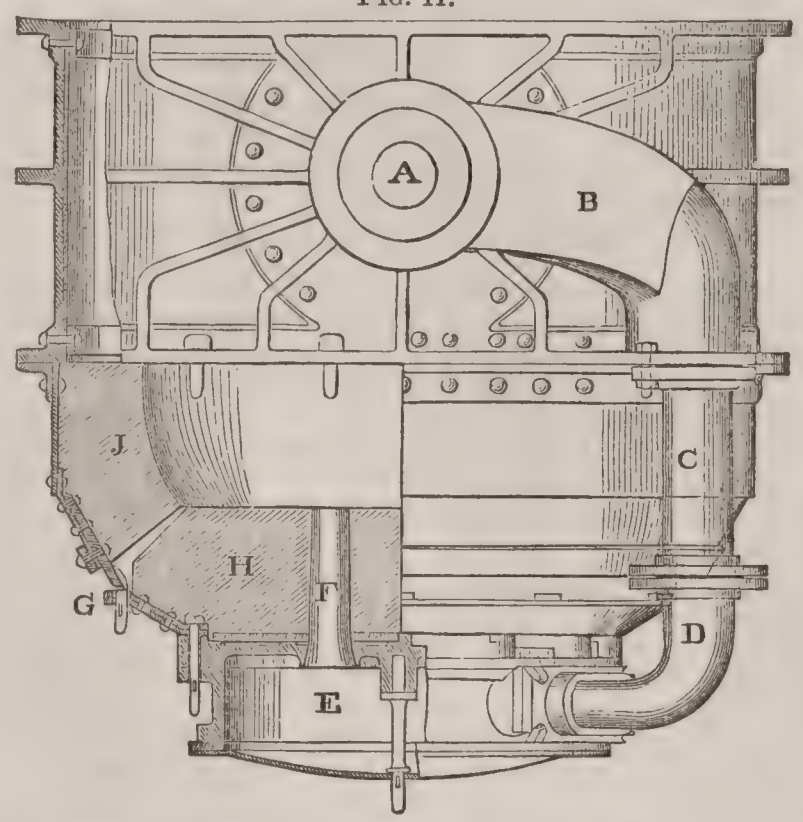
FIG. 10.




ness of the casting-pit. The English vessel-centres stand only three or four feet above the general floor, and the bottom of the casting-pit must hence be eight or nine feet below it. In this confined, unventilated, and comparatively inaccessible gulf the longest-continued and the hottest manual work is performed. Here the steel is poured and the red-hot ingots and moulds are handled. In the American plant the vessel-centres are nine feet above the general floor, and the pit is but three feet deep—just deep enough for convenient casting. All the operations of casting are performed, all the ingots and moulds are handled, by men standing on the general working floor of the building. Convenient access, free ventilation, and a short lift of moulds and ingots are thus secured. The high vessel also allows the removal of the vessel-bottoms on the general floor; and there is a second story of working room by means of the platforms around the vessels at the level of their centres. The runners are accessible for repairs, and the vessel-noses for the insertion of scrap, from this platform. When highly-siliconized or hot irons are used, some steel scrap is put into the vessel cold, and melted as well as reconverted with the iron charge. In the American plant the rear of the vessels is open to a floor in the cupola building, from which they may be conveniently fired, and where the tuyere-boxes may be opened, the tuyeres repaired, and the vessel-bottoms set. The converting-house floor under the cranes is thus clear for ladle repairs—twelve to fifteen casting-ladles are required—for storing ingot-moulds, or for other purposes requiring crane-power. The vessel-bottoms are removed and replaced by means of a hydraulic lift and a car under each vessel. The exterior trunnion of the vessel is supported by a beam instead of a pier, so that the vessel-bottom or a whole section of the vessel can be removed laterally for repairs after it has been let down upon the car by the lift.

The lower part of a modern vessel is shown by Fig. 11. Air enters the trunnion A, and passes down the pipes B, C, and D, the latter of which comes off with the remov-

FIG. 11.




able vessel-bottom H. When one bottom and its tuyeres are worn out, it is, together with its tuyere-box E, pulled out of the vessel. A new bottom is then inserted, keyed to the pins G, and the joint between the bottom H and the vessel-lining J is made good by ramming plastic refractory material into it from the outside of the vessel. Thus, the bottom can be changed in an hour, although more time is generally allowed, while by old methods of construction the joint was made from inside the vessel, and it was necessary to wait half a day for it to cool.

When the steel is intended for rails—and 90 per cent. of that made in this country is so used—the charges are so regulated as to cast either five or six ingots, and a little over as a margin for chilling and spilling. Each ingot makes either three or four rails; it is usually 14 inches square at the bottom, tapering to 13 inches at the top, so as to slip out of the cast-iron ingot-mould, and 4 to 5 feet long, weighing a ton or more. The ingots are removed hot, each charge together on a car, to the blooming-mill, and if any heating-furnace is ready, they are charged into it directly, thus saving much heat. They must be allowed to crystallize, however, before rolling. If the interior of an ingot is still pasty from the heat of conversion, it will go to pieces in the rolls. Ingots for three or four rails each are used, instead of ingots for single rails—first, to save a repetition of manipulations in working. This must be done by machinery to be done cheaply, and a *machine* can handle a big ingot as quickly as a little one. Second, the extreme top of an ingot is unsound, and must be cut off and reconverted; a double ingot yields but one scrap-end for two rails. Third, a single rail might be rolled from a 7-inch or 8-inch ingot, but the steel would be too little condensed; a 4-inch ingot receives three or four times as much work in the rolls, and the density and uniformity of the bar are improved in proportion. The practice is growing in the direction of large ingots and large reductions for all purposes; and the counterpart to this—to cheapen cost—is handling by steam and reducing rapidly by heavier rolls and hammers.

Casting ingots in groups from the bottom is an improvement now in nearly general use, upon which there has been much experimenting. The most cheap and convenient apparatus is illustrated by Figs. 12 to 17. Fig. 13 shows the "flask," an iron platform having pockets L and channels K, as seen in cross-section at N, Fig. 14. These pockets and channels having been filled with suitable moulding material (chiefly sand or old fire-bricks pulverized, and fire-clay), the iron patterns (Fig. 17) are driven into the

channels, thus moulding "runners," as seen at J, Fig. 13, and in section at M, Fig. 14. These runners are partly covered with fire-bricks E E, Fig. 12. The whole apparatus is then thoroughly dried in an oven. A centre-sprue and funnel (A, Fig. 16) is set over F, Fig. 12, whence all the runners radiate, and the ingot-moulds (B B, Fig. 16) are set over the pockets through which the sprues have openings between the covering bricks. Steel poured into the funnel A, runs into the bottoms of all the ingot-moulds at once and rises quietly and evenly within them. Steel poured into the top of an ingot-mould, splashes and sometimes spatters against the sides of the mould, thus making an unsound ingot. Bottom-casting is also a rapid operation, while top-casting requires a small stream and the opening and closing of the stopper at each mould; and in case of soft and quickly-setting steel these interruptions often lead to the chilling of the nozzle and the production of much scrap. Bottom-cast ingots, especially when the steel tends to be red-short, are much more solid and malleable than those poured from the top.

Fig. 12.

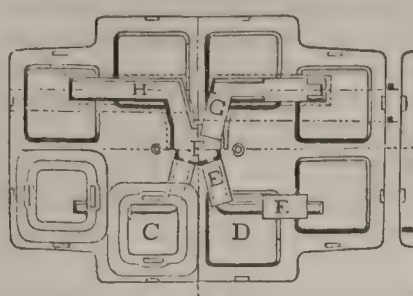
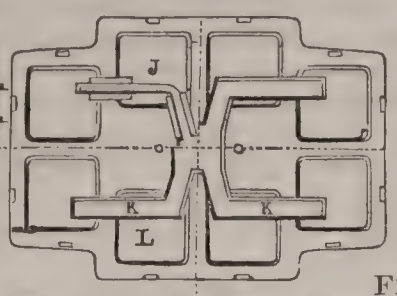



Fig. 13.




Figs. 14. 15.



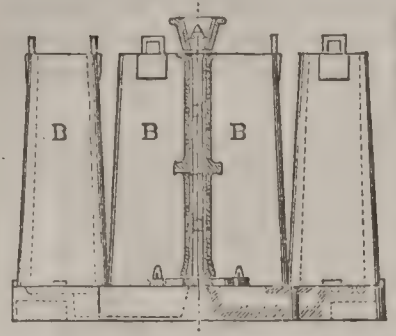




Fig. 16.

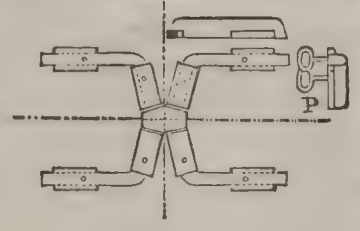



Fig. 17.

The average product of the standard American Bessemer plant is about 1200 tons of ingots per week per pair of vessels of six feet internal diameter, usually rated as 6-ton vessels. As much as 1600 tons per week have been produced. The annual aggregate capacity of American steelworks is as follows: pot steel, 45,000 tons per year; open-hearth steel, 40,000 tons; Bessemer steel, 500,000 tons. A. L. Holley.

**Steel, Chemical Nature,** etc. See Appendix.

**Steele,** county of S. E. Minnesota, drained by Lester River and affluents of Cannon River, and containing several lakes. The soil is fertile, and diversified by forest and prairie. It is intersected by Chicago Milwaukee and St. Paul and Chicago and North-western R. Rs., which pass through its capital. Staples, wheat, oats, Indian corn, wool, and hay. Cap. Owatonna. Area, 432 sq. m. P. 8271.

**Steele,** tp., Daviess co., Ind. P. 738.

**Steele,** tp., Wood co., West Va. P. 1562.

**Steele** (Anne), b. at Broughton, Hampshire, England, in 1717; wrote many poetical pieces, chiefly devotional, of which two volumes were published in 1760 under the name of "Theodosia." D. in 1778. Her collected *Poems and Hymns* (1780; Boston, 1808) were edited by Caleb Evans, D. D., and a new edition in 1863 by John Sheppard.

**Steele** (Ashbel), b. at Waterbury, Conn., Jan. 31, 1796; became pastor of a Presbyterian church at Washington, D. C., and was a writer for several religious and political newspapers. Author of *Chief of the Pilgrims, or the Life and Times of William Brewster* (1857).

**Steele** (Frederick), b. at Delhi, N. Y., 1819; graduated at the U. S. Military Academy July 1, 1843; served in the war with Mexico, gaining the brevets of first lieutenant and captain for Contreras and Chapultepec; was ordered to California 1849–55, and in 1855 to the Western frontier until the outbreak of the civil war, when, as major of the 11th Infantry, he was engaged in Missouri; in Sept., 1861, appointed colonel 8th Iowa Vols., and at the battles of Dug Spring and Wilson's Creek in command of a brigade; for the latter battle was commissioned brigadier-general of volunteers Jan. 29, 1862, and commanded a division in the army of the South-west until November, when promoted to be major-general of volunteers and assigned to the 13th army corps, which he led in the Yazoo expedition and capture of Arkansas Post (Dec., 1862–Jan., 1863); transferred to the 15th corps, he was engaged in the Vicksburg campaign, when his division was sent to Helena, Ark., and captured Little Rock Sept. 10; in 1864 commanded the department of Arkansas, and on Nov. 29, 1864, went to the aid of Gen. Canby in the reduction of Mobile; after commanding various districts in the South-west, was assigned (Oct., 1865) to the command of the department of Columbia, and retained in the volunteer service until Mar., 1867, when mustered out. For the capture of Little Rock he was brevetted brigadier-general, and for meritorious services major-general U. S. A. In July, 1866, he was assigned to the colonelcy of the 20th Infantry, which he held at the time of his death, at San Mateo, Cal., Jan. 12, 1868.

**Steele** (J. Dorman), Ph. D., b. at Lima, N. Y., in 1836; graduated at Genesee College 1858; became a successful teacher of natural science in several schools; served as a volunteer under Gen. McClellan in the Peninsular campaign 1862; has been since 1866 principal of Elmira Free Academy, and has prepared some successful manuals for "fourteen-week courses" of *Chemistry* (1868), *Descriptive Astronomy* (1868), *Natural Philosophy* (1869), *Geology* (1870), and *Physiology* (1871).

**Steele** (Sir Richard), b. in Dublin in 1671, the son of an English barrister, secretary to the duke of Ormond; was educated at the Charter-house and at Oxford, where, failing to take a degree, he enlisted as a private in the horse-guards; rose to be ensign; wrote the *Christian Hero* (1701), which he dedicated to Lord Cutts, colonel of fusileers, who procured for him a captaincy in his regiment, shortly after which he started as a dramatist, his first comedy being *The Funeral, or Grief à la Mode* (1702), followed by *The Tender Husband* (1703) and *The Lying Lover* (1704). Through the influence of Addison, who had been his schoolfellow at the Charter-house, he was appointed court-gazetteer and usher to Prince George of Denmark, the husband of Queen Anne. So loose and extravagant were his habits that he was always in pecuniary difficulties; but such was his amiability of disposition that he always found friends to assist him, and was successively appointed to lucrative offices, among which were commissioner of the stamp-office, surveyor of the royal stables, governor of the royal comedians, justice of the peace for Middlesex, and commissioner of forfeited estates in Scotland. In 1713 he was returned to Parliament for Stockbridge, but was expelled in the following year on account of political articles written by him, but was knighted by the king, and returned to Parliament for Boroughbridge in 1715. In 1720 his patent as governor of the royal comedians was revoked, by which, according to his own statement, he suffered a loss of £10,000, and in the following year he brought out his successful comedy of *The Conscious Lovers*, which was dedicated to the king, who sent him a present of £500. His first wife, who died soon after their marriage, brought him a plantation in the West Indies, and his second wife was a Welsh heiress, but he squandered his large income in dissipation and unprofitable speculations, and being attacked with a paralytic stroke, which disabled him from literary work, he retired to his estate at Llangunnor in Wales, where he d. Sept. 1, 1729, and was, at his own request, privately buried. Several of Steele's political essays and pamphlets had a high reputation in their day, and his comedies were well received upon the stage. But his chief fame rests upon his connection with the *Tatler* and the *Spectator*, almost the earliest of that long series of periodical works which occupy so prominent a place in English literature, although in these his part was much inferior to that of Addison. The *Tatler* (1709–11) contained 271 numbers; 164 were by Steele, and only 42 by Addison, who only began to write for it near its close. This was succeeded by the *Spectator* (1711–14), containing 635 numbers, of which 240 were by Steele and 274 by Addison. After the discontinuance of the *Spectator*, Steele, with the co-operation of Addison, started the *Guardian*, but Addison soon withdrew, and the work was brought to a close with the 176th number, of which 82 were by Steele. His *Poetical Miscellanies*, original and translated (1714), some of them being furnished by others, possess little merit. Thackeray, in his *English Humorists*, speaks very genially of the character and writings of Steele, while Macaulay in his essay upon the *Life and Works of Addison* rather disparages them. The best life of Steele is *Memoirs of the Life and Writings of Sir Richard Steele, Soldier, Dramatist, Essayist, and Patriot*, by H. R. Montgomery (London, 1865). A. H. Guernsey.

**Steele Creek,** p.-v. and tp., Mecklenburg co., N. C. P. 1951.

**Steel Engraving.** See Engraving.

**Steele's,** tp., Richmond co., N. C. P. 1656.

**Steell** (John), b. at Aberdeen, Scotland, in 1804; studied art at Edinburgh and sculpture at Rome; successfully competed for the execution of the sitting statue of Sir Walter Scott which forms part of the monument to that

novelist in Edinburgh; produced the colossal statue of Queen Victoria placed above the Royal Institution, Edinburgh, and the bronze equestrian statue of the duke of Wellington erected in 1850 in front of the Register House, Edinburgh. Others of his statues are of Admiral Saumarez, of Lords Melville and Jeffrey, of Marquis Dalhousie, and Hon. James Wilson at Calcutta, of Prof. John Wilson erected at Edinburgh 1865, the Scottish National Memorial to Prince Albert, colossal bronze statues of Sir Walter Scott and of Burns for Central Park, New York, colossal statues of Allan Ramsay and Dr. Chalmers for Edinburgh, and much-admired monuments to the 42d and 93d Highlanders in the cathedrals at Dunkeld and Glasgow.

**Steel Pens.** See PEN.

**Steelville,** p.-v., Meramec tp., cap. of Crawford co., Mo., near Meramec River, in an iron- and coal-producing region, has 1 weekly newspaper. P. 232.

**Steel'yard,** or **Roman Balance** [Ger. *Schnellwage*], a form of the balance in which the object to be weighed is counterpoised by a smaller weight which may be moved upon the longer arm of a suspended lever. Another form, rarely seen, has the fulcrum movable and the weight fixed at the end of the long arm. The weight is indicated by readings at the place on the lever where the movable weight or movable fulcrum is when equilibrium is produced.

**Steen,** tp., Knox co., Ind. P. 1285.

**Steen** (JAN), b. in 1636 at Leyden; studied the art of painting under Brouwer, and afterward under Von Goyen, whose daughter he married. As he worked slowly, received small prices for his pictures, and liked to spend much money, he established a beer-brewery in Delft, but failed, and lost himself in coarse dissipations, leaving his large family almost destitute. D. in 1689. His pictures are mostly genre pieces, scenes of low life, such as the *Festival of St. Nicholas*, the *Oyster Feast*, the *Bowling-Alley*, etc. Some of his pictures, such as the celebrated *Representation of Human Life*, are in the gallery at the Hague. (See Van Westrheenen, *Jan Steen, Étude sur l'Art en Hollande* (the Hague, 1856).)

**Stee'ple-Chase.** See HORSE-RACING.

**Steering and Sailing Rules.** See ROAD, LAW OF THE, by J. N. POMEROY, LL.D. See also GREAT-CIRCLE SAILING and SAILING.

**Steer'ing Apparatus.** Besides the rudder there are other important appliances which have a limited use in the steering of ships. Such are the use of two screws in steamers, one on either side of the rudder. If these be worked in contrary directions, the vessel will be turned around in a very much shorter course than if the rudder be used alone. So on the Mississippi River and its tributaries the side-wheel steamers have paddle-wheels which act independently of each other; and if one wheel be turned forward and the other reversed, the vessel can be turned upon its centre as a pivot. Steering is in part effected by changing the rate of revolution of each wheel.

**Steer'pen,** tp., Chesterfield co., S. C. P. 545.

**Stee'vens** (GEORGE), b. at Stepney May 10, 1736; was educated at King's College, Cambridge; devoted himself to Shakspearian studies, and in 1766 published in 4 vols. 8vo, *Twenty of the Plays of Shakespeare, being the whole number printed in Quarto during his Lifetime*, etc., which led to his association with Dr. Johnson in an annotated edition published in 1773 under their joint names. Afterward, in conjunction with Isaac Reed, he prepared two new editions (1785 and 1793), in which he left out superfluous syllables and supplied such as had been omitted through the ignorance or carelessness of the early printers. His editions remained the standard for the text for almost fifty years. He also assisted in the preparation of the *Biographia Dramatica*, and furnished contributions to Nichols's *Biographical Anecdotes of Hogarth*. D. at Hampstead Jan. 22, 1800.

**Stef'fens** (HENRICH), b. at Stavanger, Norway, May 2, 1773; was educated in Denmark 1779–94, and studied theology and natural science, especially mineralogy, at the University of Copenhagen; went in 1794 to Germany, and became, through the study of Schelling's writings and through personal intercourse with the author, a zealous adept of the new sensational science, the so-called "philosophy of nature" (*Recension von Schellings naturphilosophischen Schriften* (1800), *Grundzüge der philosophischen Naturwissenschaft* (1806), *Anthropologie* (2 vols., 1822), and *Polemische Blätter zur Beförderung der speculativen Physik* (1829–35)); continued his study of mineralogy and geology at Freiberg under Werner (*Geognostisch-geologische Aufsätze* (1810) and *Handbuch der Oryktognosie* (3 vols., 1811–19)); was appointed professor of natural science in 1804 at Halle, in 1811 at Breslau, and in 1831 at Berlin. D. at Berlin Feb. 13, 1845. In religion he first turned from the stiff orthodoxy in which he was educated to the pietism of Spener, which he found at Halle; then he became an ardent preacher among the Old Lutherans at Breslau; and finally, at Berlin, he settled down in Schleiermacher's elegant religion of the feeling (*Von der falschen Theologie und dem wahren Glauben* (1824), *Wie ich wieder Lutheraner wurde und was mir das Lutherthum ist* (1831)); in politics he made the campaigns of 1814–15, and without being put in Spandau, was very loud in his enthusiasm for Jahn's Turner institutions and for the political commotions among the students at the Prussian universities. His autobiography, *Was ich erlebte* (10 vols., 1840–45), was translated into English by W. L. Gage under the title *The Story of my Career as Student at Freiberg and Jena* (Boston, 1863), and republished under the title *German University Life* (Philadelphia, 1874).

**Stegoceph'ala** [Gr. στέγος, a "cover," and κεφαλή, "head"], a name applied to a group of extinct amphibians by Prof. E. D. Cope, and employed as an ordinal designation for a compound of the Labyrinthodontia, Ganocephala, Microsaura, and Xenorhachia. The so-called order is characterized by the usual cranial elements being distinct, including frontals and pterygoids, and adding "postorbitals" and "supertemporals;" the orbitosphenoids normal; the teeth having ankylosed bases or lodged in shallow alveoli; and the inferior pelvic elements distinct. The four groups above designated are considered as suborders, although by some naturalists the first two, at least (Labyrinthodontia and Ganocephala), are ranked as orders. The group was best represented during the Carboniferous period. THEODORE GILL.

**Steilacoom' City,** p.-v., cap. of Pierce co., Washington Ter., on Puget Sound and on Pacific division of Northern Pacific R. R., has 1 weekly newspaper. P. 314.

**Stein, von** (CHARLOTTE ALBERTINE ERNESTINE), b. at Weimar Dec. 25, 1742, a daughter of Court-marshal von Schardt; was married in 1764 to Baron Friedrich von Stein, chamberlain of the stables, to whom she bore seven children in the first eight years of their marriage. Immediately after Goethe's arrival at Weimar, in 1775, that most remarkable friendship sprang up between him and her which lasted uninterruptedly to his first Italian journey in 1788 and his connection with Christiane Vulpius, afterward his wife, and which never was broken, though it lost its passionate character. She d. at Weimar Jan. 6, 1827. Her letters to Goethe she burned, but his to her have been edited by A. Schöll (3 vols., Weimar, 1848). Several letters by her to other persons—as, for instance, to Charlotte von Schiller—have been published; also a tragedy in prose, *Dido*, which interests by its allusions to actual circumstances.

**Stein, von** (HEINRICH FRIEDRICH KARL), BARON, b. at Nassau-on-the-Lahn Oct. 26, 1757; studied jurisprudence at Göttingen 1773–77; travelled; entered the civil service of the Prussian government in 1780, and was made chief of the department of commerce, manufactures, and indirect taxation in 1804. Strongly opposed to the policy adopted by the president of the cabinet, Count Haugwitz, and by the king himself, he was dismissed Jan. 4, 1807, but recalled immediately after the Peace of Tilsit (July 20, 1807), and made president of the cabinet. In this position he developed an astonishing energy. His internal reforms were a complete reorganization of the Prussian state. Serfdom was abolished, and universal obligation of military service introduced; the manorial estates of the nobility were taxed, all citizens made equal before the law, a liberal municipal system established, etc. His final aim was to elevate the peasant class and to create a powerful and intelligent middle class, and thus, on this basis, to renew the contest with Napoleon. He had also a clear idea of what a united Germany meant, and was averse to that division of the country into petty states which had given the history of the nation such a chaotic and anarchical aspect. But his career was suddenly stopped. An incautious letter, in which he criticised the policy of Napoleon and spoke of his own hopes and plans, fell into the hands of the French police, and was published in the *Moniteur* Sept. 8, 1808. On Nov. 24, Stein was compelled to resign, and on Dec. 16, Napoleon sent a decree from Madrid which outlawed him and confiscated his property. He went to Austria, thence to Russia, but once again he was at the head of the political affairs of Germany during the period between Napoleon's disaster in Russia and the Peace of Paris, when he actually was the leader of the diplomatic coalition against France. After peace had been concluded, his influence soon became comparatively small. The German princes hated him for his ideas of a German unity; the absolutists hated him for his ideas of a representative form of government; and he himself was unwilling or un-

able to associate with those violent but vague aspirations which fermented in the German people. He retired to his estates, where he d. June 29, 1831. Monuments have been erected to him in Nassau and in Berlin. His biography has been written several times, among others by Pertz. Collections of his letters have been published, and are of great importance for the history of that time.

**Stein** (LORENZ), b. at Eckernförde, Sleswick, Nov. 15, 1815, in humble circumstances; studied, through the support of the Danish government, jurisprudence at the University of Kiel; published in 1841 *Geschichte des dänischen Civilprocesses*, and received a stipend from Copenhagen; went to Berlin and Paris, and published in 1844 *Der Socialismus und Communismus des heutigen Frankreich;* was appointed professor of political economy at Kiel in 1846, but was dismissed in 1852 on account of his participation in the rebellion of 1848; published his *System der Staatswissenschaften* (2 vols., 1852–56); removed in 1855 to Vienna, and entered the Austrian civil service. Among his later works are *Lehrbuch der Volkswirthschaft* (1858), *Lehrbuch der Finanzwissenschaft* (1860), *Die Verwaltungslehre* (1865–68), etc.

**Stein'bok** (*i. e.* "stone-buck"), a name applied to different species of the family Bovidæ. (1) The German designation *Steinbock* (and hence the Dutch *steinbok*) was originally conferred on the ibex or bouquetin of the mountains of Southern Europe, a species of goat, and to that animal it properly belongs. (See BOUQUETIN and IBEX.) (2) The Dutch settlers of Southern Africa applied the name to a species of antelope not uncommon in that region, and it is now incorporated in the English vocabulary of animals in connection with it. The species is the *Nanatragus tragulus* (*Pediotragus campestris* of Gray). It is an animal of graceful and symmetrical form, with the head well proportioned, having a bovine nose and large muffle; the horns, developed only in the males and over the orbit, erect, elongate, and subulate; the legs long and slender; the feet destitute of side-hooflets; and the tail very short. The color is a fulvous ash above and on the sides, and white beneath. The length is generally rather less than three feet and a half, and the height at the shoulder somewhat more than a foot and a half. The species is peculiar to Southern Africa, and most abundant on the stony plains and valleys thereof, and especially the open flats, where large stones and clumps of trees are found here and there. It is very swift, and progresses by great bounds. It is also very timid, and readily alarmed. It is much esteemed for its flesh. THEODORE GILL.

**Stein'er** (HENRY H.), M. D., b. in Frederick, Md., Jan. 8, 1816; graduated in the medical department of the University of Pennsylvania Mar., 1838; entered the U. S. army as surgeon June, 1839, and as such served in the Florida and Mexican wars. From 1843 to 1845 he was stationed at Augusta, Ga., to which place, on resigning his position in the army, Jan., 1852, he returned, and made it his home. During the late war he was a Confederate brigade surgeon. He still (Mar., 1876) resides in Augusta. ALEXANDER H. STEPHENS.

**Steiner** (LEWIS HENRY), M. D., b. at Frederick City, Md., in 1827; graduated at Marshall College, Mercersburg, Pa., 1846, and in medicine at the University of Pennsylvania 1849; became a physician at Baltimore; was connected with the Sanitary Commission during the civil war; has been for several years professor of chemistry in the Maryland College of Pharmacy at Baltimore, one of the editors of the *American Medical Monthly*, and a contributor to literary reviews. Has published addresses, reports, and essays upon scientific and medical topics.

**Stein'ersville,** p.-v., York tp., Belmont co., O. P. 73.

**Stein'le** (JOHANN EDUARD), b. at Vienna in 1810; studied painting at the academy of design in Vienna, under Cornelius at Munich, and under Overbeck at Rome, and was appointed professor at the Städel Institute in Frankfort in 1850. His principal works are the frescoes in the choir of the cathedral of Cologne, angels on gold ground; *Solomon's Judgment*, in the Kaisersaal of Frankfort; the four frescoes in the museum of Cologne, etc.; published a number of illustrations to Shakspeare's dramas, Brentano's tales, etc.

**Stein'metz, von** (KARL FRIEDRICH), b. at Eisenach, grand duchy of Saxe-Weimar, Dec. 27, 1796; entered the Prussian army in 1813 as a lieutenant; fought against the French; became a captain in the regiment of Kaiser Franz in 1835; fought at the head of two battalions of the 2d infantry regiment in Mar., 1848, in the streets of Berlin; was subsequently made governor of the academy of cadets at Berlin, and made his name illustrious as commander-in-chief of the 5th army corps in the campaign against Austria in 1866. On June 27, 28, and 29, 1866, he made a stand at Nachod, Skalitz, and Schweinschädel with his corps and one brigade against three corps of the enemy, defeated them, drove them back, and took 11 guns and 6000 prisoners. By this victory he made it possible for the second army to debouch, on which manœuvre the success of the Prussian battle-plan depended. He received immediately the highest order, that of the Black Eagle, and the Diet voted him a national dotation. In the war against France in 1870 he was appointed commander-in-chief of the 1st army, consisting of the 1st, 7th, and 8th army corps, but he held this position only for a short time, as he came in conflict with the supreme command—in what manner is not exactly known, but it seems as if the advance of the 1st army on Aug. 6, and the measures taken by the general during the advance toward and around Metz on Aug. 14, 15, and 16, did not agree with the plans of Von Moltke. In reality, the general now lost his independent command, his army being united to that of Prince Friedrich Charles, and the supreme command given to the prince. Nominally, however, Steinmetz remained a commander, subject only to the orders of the king, and thereby, as well as from the stubbornness of his character, arose disagreements between him and the prince. The result was, that in Sept., 1870, Steinmetz was appointed governor-general of Posen and Silesia, and removed from the theatre of war. He handed in his resignation, which, however, the king did not receive. He was made a general-field-marshal and placed *à la suite.* AUGUST NIEMANN.

**Stein'thal** (HEYMANN), b. at Anhalt, Germany, May 16, 1823; studied philology and philosophy at Berlin, afterward (1852–55) in Paris, where he especially devoted himself to the Chinese language and literature, and was appointed professor at the University of Berlin in 1863. He was a disciple of Wilhelm von Humboldt, and represented the philosophical treatment of philological science. His principal works are—*Ursprung der Sprache* (1851), *Charakteristik der hauptsächlichsten Typen des Sprachbaues* (1860), *Die Mande-Negersprachen* (1867), *Abriss der Sprachwissenschaft* (1871), *Die Sprachwissenschaft W. von Humboldt's und die Hegel'sche Philosophie* (1848), *Gedächtnissrede auf W. von Humboldt* (1867), besides a number of minor essays in scientific periodicals.

**Stein'wehr, von** (ADOLPH WILHELM FRIEDRICH), BARON, b. at Blankenberg, Brunswick, Germany, Sept. 25, 1822; educated in the military academy at Brunswick; became a lieutenant 1841; resigned his commission 1847; came to the U. S. in that year, and unsuccessfully offered his services to the government in the Mexican war; married at Mobile, and went back to Germany; returned to the U. S. 1854; bought a farm and settled at Wallingford, Conn.; raised the 29th New York Regiment 1861, and commanded it in the first battle of Bull Run; became brigadier-general of volunteers Oct. 12, 1861; was commander of the 2d division of the 11th corps in the campaign on the Rapidan and the Rappahannock, and took part in the battles of Chancellorsville and Gettysburg. Author of an "Eclectic Series" of school geographies, of a *Topographical Map of the U. S.*, and of the *Centennial Gazetteer of the U. S.* (Philadelphia, 1873).

**Stellar System.** See STARS, by P. A. SECCHI.

**Stel'lio,** a genus of lizards of the family Agamidæ. The best-known species is *S. Cordylina* of the Levant. Strict Mohammedans kill it, because they conceive that by the frequent bowing of the head it intends to offer insult to their religion, mocking their own gestures at prayer. The Turks use its flesh and excrement in preparing a cosmetic.

**Stem.** See BOTANY, by PROF. ASA GRAY, M. D., LL.D.

**Stem'bel** (R. N.), b. Dec. 27, 1810, in Maryland; entered the navy as a midshipman Mar. 27, 1832; became a lieutenant in 1843, a commander in 1861, a captain in 1866, a commodore in 1870; retired in 1872, and made a rear-admiral on the retired list in 1875. Served with gallantry on the Western waters during the civil war, and was wounded May 10, 1862, while commanding the gunboat Cincinnati in an engagement with Confederate rams. Highly commended for "gallantry and skill." FOXHALL A. PARKER.

**Sten'dal,** town of Prussia, province of Saxony, on the Uchte, manufactures leather, tobacco, woollen, linen, and cotton stuffs, and trades in corn and cattle. P. 7603.

**Stendhal.** See BEYLE (M. H.).

**Sten'house** (JOHN), LL.D., F. R. S., b. at Glasgow, Scotland, Oct. 21, 1809; educated at Glasgow grammar school, at the Andersonian University of Glasgow, and at the University of Giessen, having enjoyed the instructions in chemistry of Prof. Graham, Dr. Thomas Thomson, and Baron Liebig; was lecturer on chemistry at the medical school of St. Bartholomew Hospital, London, 1851–57, and assayer to the royal mint 1865–70; has published above 80 papers on chemical subjects and on sanitary science, and

was awarded a royal medal of the Royal Society Nov. 30, 1871, "for long-continued chemical researches, which have proved of great value in the arts and manufactures."

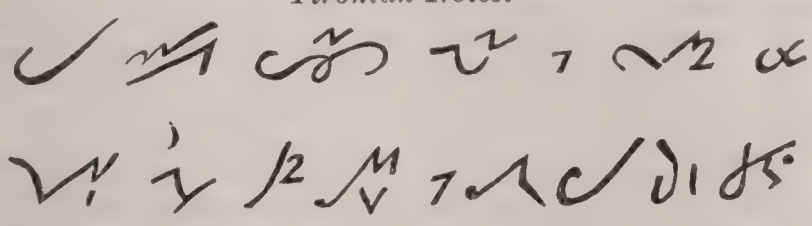
**Ste'no** (NICOLAUS), b. at Copenhagen in 1638; studied medicine, especially anatomy, in his native city, in Paris, and Bologna, and was appointed professor at the University of Copenhagen, but embraced in 1667 the Roman Catholic creed; removed to Florence; became physician to the grand duke of Tuscany; took holy orders in 1676, and d. on a missionary tour at Schwerin in 1687. Discovered the duct of the parotid gland, called "Steno's duct;" among his numerous writings in Latin, Italian, and French are *Elementa Myologiæ* (1667) and *Discours sur l'Anatomie du Cerveau* (1669). Leonardo da Vinci, Palissy, and Steno were the only scientists before the last part of the eighteenth century who understood what fossils meant.

**Stenog'raphy** [Gr. στενός, "narrow," "close," and γράφειν, to "write"]. This is a generic term, which, like "short-hand," embraces every system which seeks the rapid representation, by means of written characters, whether upon alphabetic, phonetic, or hieroglyphic principles, of the words of speech. To those systems which are based upon the phonetic principle is given the name *phonography*, which therefore indicates a *species* of stenography. Some of the various names under which new stenographic systems have been introduced are—*tachygraphy* ("swift writing"), *brachygraphy* ("short writing"), *semigraphy* ("sign writing"—that is, "writing with signs"), *cryptography* ("secret writing"), *bodiography*, *zeiglography*, *polygraphy* ("writing for all"—that is, "universal writing"), *radiography* ("easy writing"), *thoögraphy* ("swift writing"), *stenography* ("close writing"), and *phonography* ("sound writing").

THE EARLY HISTORY OF STENOGRAPHY.—*Stenography among the Greeks.*—The great value and need of some method of representing in legible characters spoken words as fast as uttered was appreciated in the earliest times, and traces of short-hand writing may be found among the Greeks not very many centuries later than the introduction and diffusion of the art of writing. The conclusion has been arrived at that among the Greeks, Xenophon was the inventor of stenography, some method of which he employed in recording the *Memorabilia* of Socrates. Many references show that some style of writing briefer than that in common use was known at this time, though it is not clear that use was made of characters not found in the common alphabet. It has been suggested that certain references in the Bible to "ready writers" (Ps. xlv. 1) show that some system of brief writing was known to the Hebrews, but the passages relied upon to establish the proposition have only suggestive force.

*Stenography among the Romans.*—Among the Romans it is probable that the first efforts at brief writing were reflected in the representation of certain frequently-recurring words by contractions in the ordinary spelling, as by their initial letters; thus: R. P. for *Res Publicæ*, P. R. for *Populus Romanus*, S. P. Q. R. for *Senatus Populusque Romanus*. The next step was the representation of certain frequently-recurring terminations of words by arbitrary contractions or signs; and the next, the representation by arbitrary characters of words and phrases. Ennius the poet is said to have invented and used (239–169 B. C.) a series of 1100 arbitrary characters for the ready representation of words. The first attempt at any *system* of stenographic writing is variously attributed to Cicero and to his freedman Tiro. Certain it is that Tiro, by the use of a system which he had mastered if not invented (and which is said to have been improved by Mæcenas), took down and thus secured the preservation of Cato's great oration against the proceedings of Cæsar respecting the Catilinarian conspiracy, as well as Cicero's own orations respecting the same. Julius Cæsar, Augustus, and Titus Vespasian are said to have been proficient in the art of short-hand writing; and this is clearly shown by many references in Horace, Ovid, and other writers. We give an illustration of the Tironian system.

*Tironian Notes.*



*Translation.*

Cum petitionibus sacerdotum justis & rationabilibus
divini cultus amore favemus, & eas cum Dei adjutorio

*Stenography among the French.*—There are said to be still extant, in the characters of the Tironian system, an inventory and fifty-four charters of Louis the Pious, successor of Charlemagne, copies of which were republished at Paris in 1747. But, whatever use was made of stenography during the Middle Ages, few traces are found of it previous to the end of the eighteenth century. The first work of importance to herald the revival of the art was an adaptation of Taylor's (English) system (1792) by Theodore Pierre Bertin. The system of Fayet, *Nouvelle Écriture et Stenographie* (1832), is said to be the most meritorious and popular now in use in France.

*Stenography among the Germans.*—The credit of the first introduction of short-hand into Germany (1666) is given to one Marshof. His system was rapidly followed by others. The systems at present generally in use are those of Gabelsberger and Stolze, which have the merit of preserving to a great degree the lineality of the writing and of avoiding sharp angles and the distinction between light and shaded characters.

*Stenography in Great Britain.*—Probably in no other nation have so many systems of short-hand been put forth as in England. The earliest of any prominence was that of Timothy Bright (London, 1588)—*Characterie, an Art of Short, Swift, and Secret Writing by Character.* Two years later appeared the system of Peter Bales, under the curious title, *The Writing Schoolmaster, in three parts.* The author says, "Brachygraphy, or the art of writing as fast as a man speaketh *treatably*, may seem difficult, but it is in effect very easy, containing a many commodities under a few principles: the shortness whereof is attained by memory, the swiftness by practice, the sweetness by industry." The more prominent of the succeeding systems have been those of Willis (1602–23), Rich (1654–69), Mason (1672–1707; republished with improvements by Gurney in 1763 and by Byrom in 1767), Taylor (1786), Lewis (1815), Harding (1823–28), and Pitman (1837), with many new editions to date. Pitman's system, by reason of its phonetic principle, its simplicity and legibility, and the copyright protection afforded it, soon outstripped all others in popular estimation, and is now practically the only system used in Great Britain, though Taylor's and Gurney's are still used by a few of the older writers.

*Stenography in the U. S.*—But few stenographic systems have ever received even temporary encouragement in the U. S.; and this is due to the striking superiority of such as have found favor, as well as to their comparative earliness in the field. The first system introduced here was that of Keyes A. Bayley (New York, 1831). This was followed by several American editions of Isaac Pitman's (English) system, by Andrews and Boyle, Booth, Paterson, and Benn Pitman (1847–54). Lindsey's tachygraphy (which is slow, and has the feature of writing in the vowels, and the merit of lineality) was introduced 1864–69. Graham's system was introduced in 1858, and rapidly found favor all over the country. Munson's system (introduced in 1866) is very similar to Graham's, both being founded on that of Isaac Pitman, and has received a considerable degree of support.

The more prominent systems at present in use in Germany, France, Great Britain, and the U. S. have proved equal, in the hands of experts, to the task of keeping pace with the most fervid oratory; but it must be acknowledged that the requirements of the art are so arduous that only those who have devoted years to the practice, and are, withal, specially adapted for the work, can ever hope to make themselves equal to the highest exactions of the reportorial profession. It is to be hoped, and not without confident expectation, that the vast strides in the perfection of the art will speedily be duplicated, and the possibilities of verbatim reporting be made to approximate at least the common orthography in its universal availability. But whether this is to be done by the invention of new stenographic material, by new uses of old material, or by discarding the pen and pencil and introducing *writing-machines*, or machines for recording vocal sound, remains yet to be seen.

The reliability of the art once established, it rapidly grew into favor, and is now very extensively employed in correspondence and in facilitating the composition of authors and editors. Thousands of short-hand amanuenses are now employed in the U. S. alone. In 1860 the legislature of the State of New York passed a law authorizing the employment of stenographers in the courts of New York county when the consent of counsel could be obtained. The innovation proved so beneficial that the law was soon made applicable to the entire State and the official stenographer constituted an officer of the court. California made a similar provision in 1860, Maine in 1867, and other States, East and West, in rapid succession. The proceedings of Parliament were first reported (surreptitiously) by the aid of stenography nearly two centuries ago. This, like many another useful innovation, has had to fight its way against bitter and unreasonable

opposition. But now the legislative proceedings both in Great Britain and the U. S. are regularly reported with considerable liberty of a full and faithful portrayal. (See also PHONOGRAPHY and WRITING-MACHINES.)

JOHN FRANCIS MEYER.

**Stenostom'idæ** [from *Stenostoma*—στενός, "narrow," and στόμα, "mouth"—the typical genus], a family of reptiles of the order Ophidia and sub-order Scolecophidia, distinguished by the development of teeth only on the lower jaw, and hence named Catodontiens by Duméril and Bibron. The form is worm-like, being cylindrical and as large behind as before; the scales are smooth, and disposed in longitudinal rows alike all round; the head is short, with a high projecting rounded snout, and with a row of smaller median and larger lateral scales above a narrow rostral and broader lateral shields, and a row of enlarged upper labial plates; the eyes are very small; the nostrils between the postrostral and labial plates; the mouth a little cleft, and transversely arched; teeth only in the lower jaw; anus near the posterior end. The skull exhibits, in contrast with related families, distinctive characters in the want of ectopterygoid bones, the presence of prefrontal, the development of alveolar ridges and malar processes to the maxillary bones, and the existence of a pelvis with a pubis. The family is represented by small species in South America and Africa. (See SCOLECOPHIDIA and TYPLOPIDÆ.)

THEODORE GILL.

**Stephan** (HEINRICH), b. Jan. 7, 1831, at Stolp, Pomerania, the son of a mechanic; received a good education, and entered in 1848 the postal service, where he made a rapid and brilliant career by his great talents and unwearied industry; in the beginning of 1876 was made postmaster-general of the German empire. He is the reformer of postal affairs in Germany. Possessed of an extraordinary talent for organization, energetic and consistent, he negotiated the transfer of the post from the princely house of Thurn and Taxis to the North German confederacy Jan. 28, 1867, and brought uniformity and order into the postal department of the newly-created empire. In the postal systems of other countries he also introduced reforms through the numerous postal treaties which he concluded with foreign countries, and which exclusively aim at the facilitation of intercommunication and traffic. In spite of this almost overwhelming business, Stephan found time to acquire comprehensive linguistic knowledge, to study classical antiquities, philosophy, and political economy, and to develop his views by travel. He also wrote *Geschichte der preussischen Post* (1859) and a good book on Egypt, *Das heutige Ægypten* (1872).

**Ste'phen,** the name of three saints of the Roman Catholic Church: (1) STEPHEN THE DEACON, generally called the PROTOMARTYR, because he was the first of all Christian martyrs. His history, as given in chapters vi. and vii. of the Acts of the Apostles, is well known. His festival is held on Dec. 26, both in the Eastern and Western churches.—(2) STEPHEN THE POPE, whose reign (253–257) is most memorable for his controversy with Cyprian, which shows that at that time the bishop of Rome did not dream of exercising any supremacy in Christendom. His festival is celebrated Aug. 2.—(3) STEPHEN THE KING. (See HUNGARY, *History.*) In Hungary and Southern Germany he is a very popular saint, and a great number of churches are dedicated to him.

**Stephen,** the name of ten popes. There is, however, some confusion in the order of their succession, caused by the circumstance that Stephen II. died three days after his election, Mar. 27, 752, before he had been consecrated, for which reason he is not reckoned at all by some historians. The most remarkable of these popes is STEPHEN III. (752–757). After asking in vain for help against the Lombards from the Byzantine emperor, Constantine Copronymus, he went in person to Pepin le Bref, chief of the Franks, whom he crowned king on the condition that he should expel Astolphus, the Lombard king, from the exarchate of Ravenna and the Pentapolis and bestow these territories on the see of St. Peter. Pepin made two campaigns in Italy, but succeeded at last in forcing the Lombards to retreat from the above territories, which he then gave to the papal see, in spite of the protest of the Byzantine emperor, thereby laying the foundation of the temporal power of the pope.—STEPHEN VII. (896–897) is most noticeable for the curious but weighty argument against the infallibility of the pope which his reign presents. Belonging to another political party than his predecessor, Formosus, he had the corpse of the latter exhumed, stripped of the papal insignia, mutilated, and thrown into the Tiber, at the same time annulling all his ordinances, and even his consecrations.—STEPHEN VIII. (929–931) was simply the infamous tool of Theodora and Marozia.—STEPHEN X. (1057–58) was a son of Duke Gotelon of Lower Lorraine, and was elected pope through the influence of Cardinal Hildebrand, who was the real master of the Church.

**Stephen,** king of England, b. in Normandy about 1100, son of Stephen, count of Blois, by Adela, daughter of William the Conqueror. William, the only son of Henry I., was drowned in 1120, and the heir-presumptive to the crown was his daughter Matilda, who was married to Henry V., emperor of Germany; but before the death of her father the emperor died, and she married Geoffrey Plantagenet, earl of Anjou, without the royal sanction, which was held to invalidate her right to the succession. Upon the death of Henry I. (in 1135), Stephen claimed the succession, although he was not next in the line, even if Matilda was set aside, for he had an elder brother, Theobald, count of Blois; he was, however, chosen by a party of the prelates and nobles, and his election was sanctioned by the pope. The cause of Matilda was taken up by another party in England, headed by her natural brother, Robert, earl of Gloucester, and after a contest of several years Stephen was defeated and made prisoner at Lincoln Feb. 2, 1141. The rule of the empress was so unpopular that a revolt broke out, and her brother, the earl of Gloucester, was in turn defeated, and captured at the battle of Wilton, Sept. 1143, but was exchanged for Stephen. The civil war now raged with varying fortunes for ten years. In 1153, Prince Henry Plantagenet, son of Matilda, arrived in England at the head of a considerable force; but before a decisive action took place, the barons on both sides entered upon an armistice, and finally concluded an agreement by which Stephen should retain the crown during his life, and that after his death Henry should succeed him. Stephen survived this treaty only a few months, and with him ended the line of Anglo-Norman kings of England. D. Oct. 25, 1154.

**Stephen** (Sir GEORGE), b. in 1794; studied medicine with a view to an army appointment; afterward entered Magdalen College, Cambridge, but did not remain; entered the office of a London solicitor; was called to the bar, and practised many years as an attorney; was appointed by the government to collect evidence against Queen Caroline, and subsequently was active in the cause of police and parochial reform, for which he was knighted by Queen Victoria at her first levée in 1837. In 1849 he took up his residence in Liverpool, but in 1855 emigrated to Australia. He was an earnest advocate of the abolition of slavery in the British colonies, and published, among other works, *Adventures of a Gentleman in Search of a Horse* (1835), *Adventures of an Attorney in Search of Practice* (1839), *The Niger Trade and the African Blockade* (1849), *The Principles of Commercial Law* (1853), *Anti-Slavery Recollections,* in a series of letters to Mrs. Harriet Beecher Stowe (1854), and a *Life of Christ,* intended for the use of schools. He was a brother of Sir James Stephen. D. ———.

**Stephen** (HENRY JOHN), cousin of Sir James and Sir George, b. in England in 1787; was called to the bar at the Inner Temple 1815; became commissioner of bankruptcy; was a distinguished practitioner at the London bar, and became sergeant-at-law 1827. D. at Clifton Nov. 28, 1864. Author of a *Treatise on the Principles of Pleading in Civil Actions* (1824; 8th American ed. Philadelphia, 1859), of a *Summary of the Criminal Law in its Present State* (1834), and of *New Commentaries on the Laws of England* (London, 4 vols., 1841–45; New York, 1843–46). In the preparation of three subsequent editions of this great work the author enjoyed the assistance of his son, JAMES STEPHEN, LL.D., b. in England in 1820, who was called to the bar at the Middle Temple 1846; became professor of English law at King's College, London, recorder of Poole, registrar of bankruptcy at Leeds, and circuit judge at Lincoln. He issued two revised editions of his father's *Commentaries* (1863 and 1868), also *Questions* for both editions, and is author of treatises on *Bar Etiquette* (1851), *The Common-Law Procedure Act* (1860), and *A Digest of the Law of Evidence* (1876).

**Stephen** (JAMES), b. at Poole, Dorsetshire, Eng., in 1759; was educated at Winchester; became a barrister, and subsequently a parliamentary reporter; received an appointment in the prize court at the island of St. Christopher's, where he acquired an intimate knowledge of colonial law; returning to England with an ample fortune, he obtained a large practice as advocate in prize cases before the privy council; published a pamphlet, *War in Disguise, or the Frauds of Neutral Flags* (1806); was returned to Parliament for Tralee; appointed under-secretary for the colonies, and was made a master in chancery for his services in drawing up the system of continental blockade against Napoleon. He was connected by marriage with Wilberforce, sharing in his religious and anti-slavery principles. Besides a number of political essays, he published *History of Toussaint l'Ouverture* (1814) and *Slavery of the British West Indies* (2 vols., 1824–30). He was the father of Sir

James and Sir George Stephen. D. at Bath Oct. 10, 1832.

**Stephen** (Sir James), son of James Stephen, b. in London Jan. 3, 1789; graduated as bachelor of laws at Cambridge in 1812; practised as a barrister in chancery until 1823, when he became counsel to the colonial department, and afterward also to the board of trade; in 1834 was made under-secretary of state for the colonies, retiring from office in 1847, when he was knighted, and in 1849 became regius professor of modern history in the University of Cambridge. He was for many years a contributor to the *Edinburgh Review*, for which he furnished many brilliant articles, a portion of which have been collected under the title *Essays in Ecclesiastical Biography* (1849; 4th ed., with a biographical notice by his son, 1860). He published *Lectures on the History of France* (1851). D. at Coblentz Sept. 15, 1859.

**Stephen** (James Fitzjames), son of Sir J. Stephen, b. in Mar., 1829; was educated at Trinity College, Cambridge, where he took his degree in 1852; was called to the bar in 1854; became recorder of Newark-on-Trent, and in 1869 was appointed legal member of the council of the governor-general of India, remaining there until 1872, during which period he endeavored to consolidate and simplify Indian law. He has published *Essays by a Barrister* (1862), *General View of the Criminal Law of England* (1863), and *Liberty, Equality, and Fraternity* (1873).

**Stephen** (Leslie), nephew of Sir James, b. in England about 1835; graduated at Trinity College, Cambridge, where he became fellow and tutor; took orders in the Church of England; has contributed largely to the literature of Alpine travel; is editor of the *Cornhill Magazine*, and author, among other works, of *Hours in a Library* (2 vols., 1874–76), a collection of acute literary criticisms.

**Stephen Bathori,** descended from a celebrated Hungarian family; was woiwode of Transylvania when, on account of his marriage with Anna Jagellon, a daughter of Sigismund Augustus, he was elected king of Poland in 1575, after the flight of Henry of Anjou. He reigned until 1587, and was much loved by his subjects. Although a zealous Roman Catholic, he was tolerant and just. He put the Jesuits at the head of the new university which he founded at Wilna, and gave them many other preferments, but their exertions in order to induce him to put down by force the Reformation in Poland were in vain. In military respects he was successful, and humiliated the Russians several times. With his son, Gabor Bathori, who was woiwode of Transylvania 1608–13, but not king of Poland, the male line of the family became extinct.

**Ste′phens,** county of N. W. Texas, the name having been changed from Buchanan in 1862. The surface is diversified with hills and valleys, and is generally well watered. Stock-raising is the principal industry. The county was unorganized in 1870. Area, about 900 sq. m. P. 330.

**Stephens,** or **Stephanus** [Fr. *Estienne* or *Étienne*], a family of French printers, several of whom were also noted as scholars. Henry Stephens, the founder of the house (b. about 1460; d. in 1520), established himself in 1502 as a printer in Paris, where his works became famous for the accuracy and beauty of their typography. He was aided, and afterward succeeded in business, by his three sons, the most distinguished of whom was Robert (b. 1503; d. Sept. 7, 1559), who was eminent as a scholar, and in 1531 began the publication of his great *Dictionarium, seu Thesaurus Linguæ Latinæ*, of which he put forth three editions, the last in 1545, and which has been several times republished. He also published editions of the Bible, with notes which were censured by the Sorbonne; but Stephens was protected by Francis I., who had made him royal printer. After the death of the king, the Sorbonne prohibited the sale of his Bibles, and he was obliged to take refuge in Geneva, where he died. He published nearly a dozen complete editions of the Bible in Hebrew, Greek, Latin, and French, and numerous separate editions of the New Testament in various languages, besides many other very important works. The present division of the New Testament into verses was made by him.—After he had taken refuge in Geneva, the business in Paris was conducted by his younger brother, Charles (b. 1504; d. 1564), who was appointed printer to Henry II., and put forth numerous classical and scientific works.—Henry, son of Robert (b. 1528; d. Mar., 1598), was especially eminent as a Greek scholar, and carried on his business at first in Paris, and afterward in Geneva. He ruined himself, financially, by the publication of his immense *Thesaurus Linguæ Græcæ* (1572, 5 vols. fol., reprinted with additions London (by Valpy) 1815–28, and again Paris (by Didot), 9 vols. fol., 1831–65), for at that time Greek students were too few in number to afford purchasers for an edition. He subsequently travelled from place to place, visiting all the principal libraries, for the purpose of collecting materials for various works, which he procured to be printed by others. Among these works is his *La Précellence du Langage françois* (1579).—Paul, the son of Henry (b. 1566; d. 1627), carried on for many years the printing-business at Geneva.—Anthony, the son of Paul (b. 1592; d. 1674), removed from Geneva to Paris, where for nearly half a century he conducted a printing-house, but with ultimate ill-success, and died at the Hôtel Dieu in Paris in utter destitution, and with him was extinguished the line of famous scholars and printers which had lasted almost two centuries and through five successive generations.

**Stephens** (Alexander Hamilton), LL.D., b. near Crawfordville, Ga., Feb. 11, 1812; was graduated at the University of Georgia in 1832; came to the bar in 1834; entered upon political life in 1836 as member for Taliaferro of the State house of representatives; was successively re-elected to the same office until 1840; declined an election in 1841; the next year was chosen State senator by the same constituency. The Western and Atlantic R. R., which links Atlanta with Chattanooga, owes its construction chiefly to him. In 1843 he was elected member of the House of Representatives of the U. S. That office he occupied for sixteen consecutive years, until 1859, when he voluntarily retired to private life. The Compromise measures passed by the Congress of 1850, which for a time gave peace to the sections, had no bolder, abler, or more eloquent champion than Mr. Stephens. He was chosen a delegate to the State convention of that year—the convention which established the celebrated "Georgia platform." In 1855 he united with the Democrats to defeat the Know-Nothing party. In the Presidential campaign of 1860 he was placed at the head of the Douglas-Johnson electoral ticket. He was a delegate to the State convention of 1861 which passed the ordinance of secession. That measure he earnestly opposed by speech and vote, but, whilst he advised against the *policy* of secession for existing grievances, he maintained the *right* of a State to peaceably secede from the Federal Union for sufficient cause. When a majority of the convention passed the ordinance of secession, he readily acquiesced in their decision. He was a member of the Confederate provisional congress; was chosen Vice-President of the provisional government of the Confederate States; was appointed commissioner to the convention between their government and the State of Virginia; was elected by the people, without opposition, to the Vice-Presidency of the Confederacy under the permanent constitution, as it was styled; and, when in Feb., 1865, the fortunes of the Confederacy were desperate beyond the reach of hope, he was placed at the head of the commission on the part of the Confederate States government in the famous Hampton Roads conference. After the collapse of the Confederacy, he was arrested and confined a prisoner of state in Fort Warren for five months; he was released on his own parole in Oct., 1865. In Feb., 1866, the general assembly elected him, by a large majority, against his wishes, freely expressed, to the office of U. S. Senator, but Congress ignored the restoration of Georgia to the Union under the Presidential proclamation of Andrew Johnson; so Mr. Stephens was not allowed to take his seat in the Senate. He was elected a member of the 43d Congress, and also of the 44th, in each case without more than nominal opposition. Mr. Stephens belongs to what is known as the Jeffersonian school of American politics, and of course among the cardinal articles of his political creed are State rights, State sovereignty, local self-government: he has always advocated the largest liberty of the citizen compatible with the attainment of the two prime objects of government—viz. protection to property and preservation of order. He is the author of a *Constitutional View of the War between the States* and of a *Compendium of the History of the United States.*

J. D. Waddell.

**Stephens** (Ann Sophia **Winterbotham**), b. at Derby, Conn., in 1813; in 1831 became the wife of Mr. Edward Stephens; soon after, they went to Portland, Me., where in 1835–37 she edited the *Portland Magazine*, and in 1836 compiled the *Portland Sketch-Book*, a volume composed of the writings of natives or residents of that city. In 1837 they removed to New York, her husband subsequently receiving an appointment in the custom-house. She has edited and contributed to various periodicals, and has written many tales and novels, and some fugitive poems. A uniform edition of her works, now numbering about 20 vols., has been issued. Among her most successful novels are—*Fashion and Famine* (1854), *The Old Homestead* (1855), *Mary Derwent* (1860), *The Rejected Wife* (1863), *Silent Struggles* (1865), *Mabel's Mistake* (1868), *Wives and Widows* (1869), *Married in Haste* (1870), *The Reigning Belle* (1872), *Bellehood and Bondage* (1873), and *Phemie's Experience* (1874).

**Stephens** (Edward Bell), b. at Dublin, Ireland, in 1797; was for some years assistant professor of chemistry at Dublin; afterward devoted himself to literature at London, writing for several magazines, and was one of the earliest of the "special correspondents," having spent several years in Spain in the service of the *Times* newspaper during and after the Carlist war. D. at Madrid Oct. 10, 1844. Author of a work on *The Basque Provinces* (2 vols., 1837).

**Stephens** (Edward Bowring), b. at Exeter, England, about 1810; studied sculpture under E. H. Baily; gained in 1843 the gold medal of the Royal Academy for an alto-rilievo of *The Battle of the Centaurs and Lapithæ;* spent three years at Rome, where he produced *Satan tempting Eve* and *Satan vanquished,* both of which figured in the great London Exhibition of 1851; and executed, among other admired works, *Eve contemplating Death* (1853), *Euphrosyne and Cupid* (1856), *The Angel of the Resurrection* (1861), and a colossal portrait-statue of Sir Thomas D. Acland (1862). D. May 2, 1857.

**Stephens** (Henry), b. at Keerpoy, Bengal, British India, in 1795; studied agriculture at the University of Edinburgh, and in 1815 commenced practical farming, undertaking researches which were published in his standard works, *The Book of the Farm* (3 vols., 1842–44), *Manual of Practical Draining* (1846), *Catechism of Practical Agriculture* (1855), and *Book of Farm-Buildings* (1861). He was editor of the Scottish *Journal of Agriculture* 1832–54, and was awarded at the great Exposition of Paris 1855 a gold medal for his very useful writings.

**Stephens** (James Francis), b. at Shoreham, Sussex, England, Sept. 16, 1792: was for many years a clerk in the admiralty office; president of the British Entomological Society, and an enthusiastic writer and collector upon his favorite branch of natural history. His collection of British insects was by far the most complete in existence. D. at Kennington, near London, Dec. 22, 1853. Author of *Illustrations of British Entomology, or a Synopsis of British Insects* (London, 86 parts, 12 vols., 1828–46), *A Systematic Catalogue of British Insects* (1829), *Nomenclature of British Insects* (1829), *Manual of British Coleoptera* (1839), of various *Catalogues of British Lepidoptera in the British Museum,* and contributed largely to periodicals devoted to natural history.

**Stephens** (John Lloyd), b. at Shrewsbury, N. J., Nov. 28, 1805; graduated at Columbia College 1822; studied law at Judge Gould's law-school at Litchfield, Conn.; practised his profession eight years in New York City; made a tour through Italy, Greece, Turkey, Russia, Poland, and Germany, and a second tour to Egypt and Palestine; contributed to Hoffman's *American Monthly Magazine* a series of letters describing his travels, which were so well received as to induce the publication of fuller narratives in his *Incidents of Travel in Egypt, Arabia Petræa, and the Holy Land* (New York, 2 vols., 1837) and *Incidents of Travel in Greece, Turkey, Russia, and Poland* (2 vols., 1838); was appointed in 1839 by Pres. Van Buren a special commissioner to Central America for the purpose of negotiating a treaty with that republic, which he found distracted by the civil war which soon put an end to the confederation, and was unable to effect his object; proceeded to Costa Rica; journeyed northward by land through Nicaragua, Honduras, and San Salvador to Guatemala, visiting all the principal cities, and giving special attention to the wonderful remains of ancient cities, especially those of Copan, of which accurate daguerreotypes and drawings were made by his companion, Mr. F. Catherwood; proceeded through Northern Guatemala to Chiapas, Tabasco, and Yucatan, examining the vast ruins of Palenque, Uxmal, and other ancient cities, which he was the first to make known with any approach to accuracy by his celebrated work, *Incidents of Travel in Central America, Chiapas, and Yucatan* (New York, 2 vols., 1841); returned to Yucatan, and in 1841, with Mr. Catherwood, equipped for a more careful archæological survey, the important results of which were embodied in his *Incidents of Travel in Yucatan* (2 vols., 1843). In 1846, Mr. Stephens was a delegate to the convention for revising the constitution of New York; became in 1847 an active organizer and officer of the first Ocean Steam Navigation Co.; made the voyage to Bremen in the first steamship (the Washington) of the new line; took part in the enterprise projected after the discovery of gold in California for the construction of a railroad across the Isthmus of Panama, becoming successively vice-president and president of the company; travelled over the isthmus inspecting the route; visited Bogotá, and negotiated with the government of New Granada the contract for that work 1849, and personally superintended its construction during two successive winters, 1850–52, thereby contracting the disease of which he d. in New York Oct. 10, 1852. A monument has been placed at the highest point traversed by the Panama R. R. to his memory.

**Stephens** (Linton), b. near Crawfordville, Ga., July 1, 1823, a brother of A. H. Stephens; was graduated at the State University 1843; his professional studies in the law were prosecuted at the universities of Virginia and Harvard. He represented for a series of years the counties of Taliaferro and Hancock in the house of representatives or in the senate of Georgia. At the age of thirty-five he was appointed by the governor of the State to fill a vacancy on the supreme court bench. His decisions, running through three volumes of the *Georgia Reports,* are distinguished for precision, perspicuity, and power of logic. He was a delegate to the convention of 1861 which passed the ordinance of secession. He voted against that measure, but when it was carried by a decided majority, he elected to share the fortunes of the people of Georgia. At the time of his death (July, 14, 1872) he stood at the head of the Georgia bar. J. D. Waddell.

**Stephens** (William), b. on the Isle of Wight, England, Jan. 28, 1671, son of Sir William, lieutenant-governor of that island; graduated at King's College, Cambridge; studied law at the Middle Temple; sat in Parliament 1696–1722; settled at Charleston, S. C., about 1730; was appointed secretary of the colony of Georgia 1737; became "president" of the county of Savannah 1741, and governor of Georgia 1743–50. D. in Georgia in Aug., 1753. Author of *A Journal of the Proceedings in Georgia* (London, 3 vols., 1742). His biography was written by a son under the title of *The Castle-Builder, or the History of William Stephens of the Isle of Wight* (London, 1759).

**Ste'phenson,** county of N. W. Illinois, bordering on Wisconsin, watered by Pecatonica River, and intersected by several railroads. It has an undulating surface and fertile soil. Cattle, horses, sheep, and swine are raised, and carriages, saddlery, woollen goods, and iron castings manufactured. Staples, Indian corn, wheat, oats, barley, potatoes, and dairy products. Cap. Freeport. Area, 550 sq. m. P. 30,608.

**Stephenson** (George), b. at Wylam, Northumberland, England, June 19, 1781, the son of a poor colliery laborer. He was in childhood an engine-boy; was gradually promoted to be a fireman, and in time was placed in charge of an engine, which he studied until he had mastered its construction so as to be able to take it apart and put it together again. He married at the age of eighteen, and was taught to read by his wife. He had a great aptitude for mechanics; mended shoes, cut out garments, and repaired clocks at odd hours. Accident gave him an opportunity of putting in motion a steam-engine which had been disabled, and in 1812 he was made engine-wright at Killingworth Colliery, with a salary of £100 a year, upon which he declared that his fortune was made. The problem of constructing a locomotive steam-engine was then engaging many minds, and he was in 1814 the first to construct one which would move upon a common road. While engaged in devising improvements upon this, he observed the increased draught in the furnace produced by letting the waste steam escape up the chimney; hence originated the steam-blast, which was introduced into his second locomotive, built in 1815, in which year he devised a miner's safety-lamp, for which a large prize had been offered by colliery-owners; but Sir Humphry Davy having simultaneously invented his safety-lamp, this prize, valued at £2000, was awarded to him, £100 being awarded to Stephenson by the committee; a separate subscription of £1000 was raised in 1817, which was presented to Stephenson, and his lamp is still in use in some English collieries. Stephenson now turned his attention to improvements in railways as well as engines. The first railway built by him, opened in 1822, 8 miles long, was so successful that in the next year he was appointed engineer of the railway recently authorized to be constructed between Stockton and Darlington, and in 1825 of the Liverpool and Manchester line, which was commenced in 1826. He had in the mean time set up an establishment at Newcastle-upon-Tyne for the manufacture of locomotives. At this time the best engineers held that the use of locomotives was practically impossible, and that safety and speed could be attained only by stationary engines placed at short intervals along the line. Stephenson persuaded the directors of the railway company to offer a reward of £500 for the best locomotive which should be adapted for their use, and set himself at work, with the aid of his son, to devise such a one. The public trial took place Oct. 6, 1829, and the prize was adjudged to have been gained by his engine, the Rocket (see Railroad), which attained an average speed of 14 miles an hour, and for a short distance was driven at the rate of 29 miles. For the next fifteen years he was actively engaged

as a railway engineer and contractor in England and on the Continent, still carrying on his great locomotive-factory at Newcastle, and also engaging largely and profitably in coal-mining and limeworks. He passed the closing years of his life at his magnificent seat of Tapton Park in Derbyshire. D. Aug. 12, 1848, leaving behind him a memory in every respect noble. He retained during all his life, in speech and manners, much of the rustic simplicity belonging to his early life, and declined the honor of knighthood, which was urged upon his acceptance; but by common consent he has received the title of "the father of railways," and in 1862 a colossal bronze statue was erected in honor of him at Newcastle-upon-Tyne. (See Smiles, *Life of George Stephenson* (1857; enlarged in 1864, and again in 1868).)

**Stephenson** (Robert), son of the preceding, b. at Willington, near Newcastle-upon-Tyne, Oct. 16, 1803. His early years were marked by few advantages, but as his father's circumstances improved he gave his son the best education within his means, and in 1822 sent him to the University of Edinburgh, where he remained a year studying chemistry, mathematics, and geology, after which, for another year, he assisted his father in railway surveying and in the locomotive-works at Newcastle. In 1824 he accepted an engagement to go to South America, where for three years he superintended the working of the Colombian Mining Association. He then returned to England, where he aided his father, partly in laying down the line of the Liverpool and Manchester Railway, but more especially in the locomotive-works; and to him more particularly than even to George Stephenson belongs the honor of the practical development of the locomotive railway-engine. He was appointed engineer of the London and Birmingham Railway, which, built wholly under his direction, was opened in 1838, and from this time he was employed in similar undertakings at home and abroad. His attention was in the end turned especially to the subject of iron bridges for railways, and of these he constructed several of the most stupendous in the world, notable among which are the high-level bridge crossing the Tyne at Newcastle, the viaduct over the valley of the Tweed at Berwick, the Conway tubular bridge, the Britannia tubular bridge crossing the Menai Straits, the Victoria tubular bridge over the St. Lawrence in Canada, and those crossing the Nile at Benah and Kaffre Azzayat in Egypt. In 1847 he was returned to Parliament for Whitby, retaining his seat until his death. He was a prominent member of several scientific associations, received the great gold medal of honor from the French Industrial Exposition of 1855, and was president of the Institute of Civil Engineers from 1855 to 1858. He published a *Description of the Locomotive Steam-Engine* (1838), *Report on the Atmospheric Railway System* (1844), and *The Great Exhibition, its Palace and Contents* (1851). D. Oct. 12, 1859. He was buried in Westminster Abbey, where a memorial window of stained glass has been placed to his memory. (See Smiles's *Life of George Stephenson* (enlarged editions of 1864 and 1868), and *Life of Robert Stephenson*, by J. C. Jeaffreson and W. Pole (1864).)

**Ste'phensport,** p.-v., Breckenridge co., Ky., on Ohio River. P. 160.

**Ste'phensville,** p.-v., cap. of Erath co., Tex., on Bosque River. P. 162.

**Ste'phentown,** p.-v. and tp., Rensselaer co., N. Y., on Harlem Extension R. R. P. 2133.

**Step'ney,** p.-v., Monroe tp., Fairfield co., Conn., on Housatonic R. R.

**Steppe,** the name given by the Tartars to the plains of Central Asia. They are usually covered with grass, and correspond in their aspects and relations to the prairies of the U. S. and the llanos and pampas of South America. (See Prairie.) J. S. Newberry.

**Steppe Murrain.** See Rinderpest.

**Step'toe** (Edward Jenner), b. in Virginia in 1816; graduated at West Point 1837; was distinguished in the Florida war 1838–42; was assistant instructor of infantry tactics at West Point 1842–43; commanded a battery of light artillery in the Valley of Mexico 1847; was brevetted for gallantry at Cerro Gordo and at Chapultepec; declined the governorship of Utah Territory 1854; became major of the 9th Infantry 1855; was in command of an expedition against the Indians of Washington Territory Apr., 1856; was made lieutenant-colonel of 10th Infantry 1856, and resigned Nov. 1, 1861. D. near Lynchburg, Va., Apr. 1, 1865.

**Sterculia'ceæ** [from *Sterculia*, one of the genera], a natural order of exogenous trees, shrubs, and herbs, mostly tropical. Many of the trees are of prodigious size, such as the baobabs, and those of the genera *Bombax* and *Ceiba*. Many of them produce abundantly a substance called silk-cotton, which resembles true cotton, but will not spin well. The wood is often very light and soft. The order contains medicinal plants, and produces some excellent fruits, some gums, a few valuable bark-fibres, and a number of useful timber-trees. But its most important product is chocolate, from the oily seeds of *Theobroma cacao*. It is usual to divide the order into three sub-orders—Bombaceæ, Helictereæ, and Sterculieæ—but some make six or more sub-orders, and assign Bombaceæ to Malvaceæ.

**Stere.** See Weights and Measures, by Pres. F. A. P. Barnard.

**Sterelmin'tha** [Gr. στερεός, "solid," and ἕλμινς, "worm"], a name applied by Prof. Owen to those intestinal worms which are destitute of an intestinal cavity, the "Vers Intestinaux Parenchymateux" of Cuvier. The group so named was regarded as a "class" of Entozoa, and characterized by "the nutrient canals or cavities excavated in the parenchyma of the body;" and to it were referred the "orders" Tænioidea, Trematoda (containing the turbellarians as well as true trematods), and Acanthocephala. The class is an artificial one, not adopted by modern naturalists. (See Tænioidea, Trematoda, and Turbellaria.) Theodore Gill.

**Ste'reoscope** [Gr. στερεός, "solid," and σκοπεῖν, to "view"], a modern optical instrument by means of which two plane representations of a natural object, taken from different points of view, may be so united as to form a single impression of the object in relief. Binocular vision, or the dissimilarity of the two pictures as seen by each eye separately, has been known for more than 2000 years. Euclid (300 or more B. C.), Galen (131 A. D.), Leonardo da Vinci (1584), Baptista Porta (1593), Aguilonius (1613), Gassendi (1658), Harris, Smith, Porterfield, and others of later date have either distinctly alluded to or fully described the phenomenon. In 1823 the attention of Mr. Elliot was called to the subject of binocular vision in connection with the estimation, by the eye, of distance. About 1834 he conceived the idea of constructing an instrument which, by combining two dissimilar plane representations of an object, would produce the effect of relief. This idea he did not carry into execution till 1839. In the mean time, Wheatstone made a communication to the British Association in 1838, on the physiology of vision, and exhibited a reflecting stereoscope of his own construction. The difficulty of procuring pictures which should differ from each other only as the two impressions upon the eyes of a single spectator differ, proved almost insuperable before the discovery and application to stereoscopic purposes of photography. In monocular vision, or vision with one eye, the effect of relief is produced, as in the most perfect plane pictures, by shadow and the delicate gradation of tints. In binocular vision the effect is produced by the superposition of the image formed by an object on one retina upon that formed on the other. In viewing solid objects each eye sees an image slightly differing from that seen by the other. A thin book held edgewise eight or ten inches in front of the nose will look differently to the two eyes of a spectator; the right eye will see the back and part of the right cover, while the left eye will see the back and part of the left cover. Both eyes at once will see the back and a portion of both covers; seeing at the same time somewhat round the sides, the object is manifestly solid. The binocular camera takes two such impressions as would simultaneously form themselves upon the two eyes of a spectator. These two images are then united either by a muscular effort of the eye itself or by means of reflectors or refractors, and a single image, standing out in relief, is the result. The earliest form of stereoscope, Wheatstone's reflecting stereoscope, is cumbrous and expensive; many other forms have since been used, but all are constructed upon the same principle. The two impressions are displaced by means of mirrors, lenses, prisms, or the muscular effort of the eyes themselves, so that the one is superimposed upon the other. It is found that a single lens cut into halves or quarters is better than two whole lenses, the curvature being more accurately alike, and only the inner half of the lens being essential to the proper displacement of the pictures. The stereoscopic effect of relief, however, is not produced by the superposition of the two pictures merely; for if the two are united in the most perfect way by means of a camera, the resultant picture is, to monocular vision, blurred and imperfect. This same picture, however, when viewed binocularly, is seen distinct and in perfect relief. Distance is estimated principally by the convergence of the optic axes of both eyes upon an object. The eyes look upon a solid by converging upon some one point their optic axes, and estimating the distance of that point by the angle of convergence; this point is perfectly distinct, though the remainder of the solid is indistinct. Running quickly from point to point over the surface of the solid, each point has its distance from the eyes separately estimated, and the object is seen

in relief. It is the same in the case of stereoscopic vision; the two pictures superimposed differ from each other, but at a certain focal distance all corresponding points in the two are made to unite. The distance of the point of union is estimated by the eye, and so in turn each point has its distance from the spectator estimated, and the stereoscopic image stands out in as clear relief as the solid from which the two impressions were derived. The constant change in the muscles of the eye to effect the union of the two impressions is difficult to some people, or even impossible; in some cases the two eyes of the spectator have different focal distances, or other discrepancies of vision, which make it difficult to see stereoscopic images in relief and single.

The earliest refracting stereoscope was made by Andrew Ross for Sir David Brewster, and was exhibited at Birmingham in 1849, but no attention was given to it by the English opticians. In 1850 the inventor carried it to France, and submitted the instrument to the Abbé Moigno, and to M. Soleil and M. Duboscq, the eminent Parisian opticians. M. Duboscq began at once constructing lenticular stereoscopes, and executed many beautiful slides, which soon attracted thousands of spectators. In the great Exhibition of 1851, M. Duboscq exhibited a fine stereoscope, which for the first time attracted attention in England. The demand soon became immense, and opticians of all kinds devoted themselves to their construction. A long, bitter, and fruitless controversy arose between Sir David Brewster on his own behalf and that of Elliot, and Wheatstone on his own behalf, in regard to the priority of the invention of lenticular stereoscopes.

The lenticular stereoscope, which is the most common form, generally consists of a pyramidal wooden box, blackened on the inside and having a lid to admit the light from above if the pictures are opaque. The bottom of the box is made of fine ground glass for transparent pictures; in the top of the box are fitted two lenses (or half or quarter lenses, as the case may be). The bottom, holding the "slide," and the top, with the lenses, may be made to approach or recede from each other to suit different eyes. Among the various forms of the instrument may be mentioned the reflecting stereoscope of Wheatstone; the single reflecting stereoscope, where the direct impression from the picture on one eye is superimposed upon a reflected impression upon the other eye; the double reflecting stereoscope, where both impressions are reflected; the total reflection stereoscope, where a single prism is used, and one image is refracted, totally reflected, and refracted again, while the other impression is direct. Of refracting stereoscopes there are, among others, the single prism, the opera-glass, the eye-glass, the reading-glass, the camera, the chromatic, and the microscope stereoscopes. Among the best is Smith & Beck's achromatic stereoscope. S. B. Herrick.

**Stereotyping.** See Printing, by W. S. Paterson.

**Sterility.** See Appendix.

**Ster'let** (*Acipenser ruthenus*), a small species of sturgeon found in various Russian rivers and the Caspian and Black seas, into which they empty, and esteemed for its flesh. It is characterized by a narrow, pointed snout, which is more or less produced (being half the length of the head or thereabouts), and the slightly fringed barbels; the dorsal shields, 11 to 17, are moderately developed, the lateral ones, 60 to 70, small, and the abdominal, 13 to 15, moderate; the skin is densely covered with minute denticulated ossifications of subequal size. It rarely or never attains a length of three feet, and a common size is two feet in length and three pounds in weight. It leaves the sea in May and June, and ascends the rivers, sometimes very high up, for the purpose of spawning. It has not only a superior reputation as a table-fish, but from its roes is made the best caviare, which constitutes a noteworthy article of trade in Russia. Its introduction into rivers of the U. S. has been strongly recommended, and it has been claimed that the Mississippi and Ohio rivers would be especially suitable for it. The Russian government has introduced it into waters about St. Petersburg, and "in 1870 a considerable number of the young fry were transported from Russia and introduced into the waters of Sutherlandshire, Scotland, in apparently good condition." Their embryonic life is so short that it is difficult to transport the eggs with success, but such was done in the case just cited. Specimens obtained for the Brighton aquarium were imported in the wells of a fishing boat from the Volga River to St. Petersburg, and thence by steamer to London. Theodore Gill.

**Sterling.** See Pound Sterling.

**Ster'ling,** p.-v. and tp., Windham co., Conn. P. 1022.

**Sterling,** city and tp., Whitesides co., Ill., on Chicago and North-western and Rockford Rock Island and St. Louis R. Rs., 110 miles W. of Chicago, has 12 churches, 2 academies, and 3 high schools, 2 banks, fine water-power, manufactories of school furniture, flour, and wood and iron work. P. of v. 3998; of tp., exclusive of city, 712.
W. F. Eastman, Ed. "Gazette."

**Sterling,** tp., Crawford co., Ind. P. 1327.

**Sterling,** p.-v. and tp., Worcester co., Mass., on Fitchburg and Worcester division of Boston Clinton and Fitchburg and on Worcester and Nashua R. Rs., has flourishing manufactures, beautiful scenery, a celebrated camp-meeting ground, 12 public schools, a good town-hall and library, and 3 churches. P. 1670.

**Sterling,** tp., Macomb co., Mich. P. 1549.

**Sterling,** tp., Blue Earth co., Minn. P. 661.

**Sterling,** p.-v. and tp., Johnson co., Neb. P. 480.

**Sterling,** p.-v. and tp., Cayuga co., N. Y., on Lake Ontario and on Lake Ontario division of Rome Watertown and Ogdensburg R. R., includes the v. of Fairhaven, the N. terminus of Southern Central R. R. P. of v. 237; of tp. 2840.

**Sterling,** tp., Brown co., O. P. 1394.

**Sterling,** p.-v. and tp., Wayne co., Pa., on Delaware Lackawanna and Western R. R. P. 1454.

**Sterling,** tp., Polk co., Wis. P. 250.

**Sterling,** tp., Vernon co., Wis. P. 1060.

**Sterling** (John), b. at Kames Castle, Isle of Bute, July 20, 1806, son of Edward Sterling, editor of the London *Times;* was educated at Glasgow and Cambridge; went to London in 1827; was a short time on the editorial staff of the *Athenæum,* and during a part of 1830–31 resided for his health in the West Indies. Returning to England, he took deacons' orders in 1834; was for a short time a curate, but soon gave himself wholly to literary studies and pursuits. Among his works are—*Arthur Coningsby,* a novel (1833), *The Onyx Ring* (originally in *Blackwood's Magazine;* republished 1856), *Minor Poems* (1839), *The Election,* a poem (1841), and *Strafford,* a drama (1843). Two volumes of his *Essays and Tales* were edited, with a *Memoir,* by Julius C. Hare (1848), and Thomas Carlyle has written *The Life of John Sterling* (1851). D. at Ventnor, Isle of Wight, Sept. 18, 1844.

**Sterling Run,** p.-v., Lumber tp., Cameron co., Pa., on Sinnemahoning River, and on Philadelphia and Erie division of Pennsylvania R. R.

**Sterling's Mills,** p.-v. and tp., Robeson co., N. C. P. 1088.

**Sterling Valley,** p.-v., Sterling tp., Cayuga co., N. Y. P. 172.

**Stern'berg,** town of Austria, province of Moravia, has important manufactures of linen and cotton fabrics, which are widely known under the name of "Sternberg wares." P. 13,500.

**Sterne** (Laurence), b. at Clonmel, Ireland, Nov. 24, 1713, son of a lieutenant in the British army; was educated at Jesus College, Cambridge, where he graduated in 1740; entered into holy orders, and was presented by his uncle with the valuable benefice of Sutton, Yorkshire, to which that of Stillington, 1½ miles distant, was soon after added. Here he lived for nearly twenty years. In 1759 he published the first two volumes of *Tristram Shandy,* which became popular at once, and gained for him from Lord Falconbridge the additional curacy of Cotswold. He had been married nearly twenty years, and now, leaving his wife and daughter at York, he went to London, where or upon the Continent most of the remainder of his life was spent. He published several occasional sermons, and at intervals 7 volumes entitled *The Sermons of Mr. Yorick, or Sermons by Laurence Sterne, A. M., Prebendary of York,* etc. (1760–69). His *Life and Opinions of Tristram Shandy, Gent.,* in all 9 vols., was published at intervals (1759–67). The *Sentimental Journey,* his best work, was written in France, from which, late in 1767, he returned to London to see it through the press. D. in London Mar. 18, 1768. The latest *Life of Sterne* is by Percy Fitzgerald (London, 1864).

**Stern'hold** (Thomas), b. probably in Hampshire about 1500; was educated at Oxford, and became groom of the chambers to Henry VIII. and Edward VI.; with John Hopkins was joint author of the first version of the Psalms into English metre. His 1st edition appeared in 1548, and contained 19 Psalms; the 2d, *All such Psalmes of David as Thomas Sternehold, late Groome of ye Kinges Maiesties Robes, didde in his Lifetime draw into English Metre* (1549), contained 37 Psalms translated by Sternhold and 7 by Hopkins. Other editions followed until 1562, when *The Whole Booke of Psalms collected into English Metre by T. Sternhold, J. Hopkins, and others, conferred with the Ebrue, with apt Notes to Sing them withal,* was annexed to the Book of Common Prayer. Of the entire number of

Psalms, 51 were versified by Sternhold. D. in Aug., 1549.

**Stern'inæ** [from *Sterna*, the Latin generic name of the typical genus, and the sub-family suffix, *-inæ*], a sub-family of the family Laridæ, distinguished by the straight bill with equal projecting mandibles, which are always compressed, and attenuated to the pointed tips; the base is destitute of a cere. The species are among the most common and familiar birds of the sea-coast. Several resort especially to the low sandy islands of the coast of the U. S., where they are sometimes to be seen in immense numbers, and where they breed. They lay from two to four eggs, generally in slight depressions in the sand, and sit on them chiefly in the night and cold weather, leaving, to a considerable extent, to the sun the office of calorification. The young are, however, tenderly cared for by the mother. They feed chiefly on fish, but also on other marine animals. Species are found in all parts of the world, and 72 are recognized by Mr. G. R. Gray, who admits only four genera: (1) *Sterna*, with 50; (2) *Hydrochelidon*, with 14; (3) *Gygis*, with 1; and (4) *Anous*, with 7 species. THEODORE GILL.

**Sternoptych'idæ** [from *Sternoptyx*—Gr. στέρνον, the "breast," and πτύξ, "fold"—the chief genus], a family of fishes of the order Teleocephali and sub-order Isospondyli, all containing some quite peculiar forms. The body is compressed; the skin naked, but with rows of phosphorescent spots on the sides below; the lateral line is indistinct; the head compressed; the opercular apparatus incompletely developed; mouth with moderately deep lateral cleft; upper jaw with its margin formed above by the intermaxillary, and laterally in part by the supramaxillary, bones; teeth on the intermaxillary as well as supramaxillary and dentary bones, and sometimes on the palate; branchial apertures continuous below, and very wide; branchiostegal rays 8 to 10; back with a short submedian rayed fin and a posterior small adipose fin; anal fin variable in development; pectoral fins moderately low on the scapular arch; ventral fins moderately far behind; the ovaries communicate by oviducts externally, and consequently the eggs are expelled directly into the water; pseudobranchiæ are present. The family thus defined is identical with that so named by Günther (*Cat. Fishes B. M.*, vol. v., p. 384) after the exclusion of the Chauliodontidæ. It includes fishes which are mostly inhabitants of the open or deep seas, and of small size. It is differentiated into two sub-families—viz. (1) Sternoptychinæ, distinguished by a rudimentary spinous dorsal fin, with the genera *Sternoptyx* and *Argyropelecus;* and (2) Cocciinæ, characterized by the absence of the spinous dorsal fin, with the genera *Coccia* and *Maurolicus*. It is doubtful, however, whether these are really so closely related. A species of *Maurolicus* (*M. borealis*) sometimes wanders to the northern coast of the U. S. THEODORE GILL.

**Sternopyg'idæ** [from *Sternopygus*—Gr. στέρνον, the "breast," and πυγή, the "rump"—one of the chief genera], a family of fishes of the order Gymnonoti, peculiar to South America, and embracing species nearly related to the electrical eel. The body is much elongated and somewhat eel-shaped, but with the back rounded and the sides compressed downward; the anus is situated in the breast or between the rami of the lower jaw; cycloid scales are developed; the head is conic, more or less produced forward, and naked; the opercular apparatus incomplete; the mouth terminal, and generally very small; the upper jaw not protractile, and with its margin formed above by the intermaxillaries, and laterally by the supramaxillaries; teeth variable in development; branchial apertures restricted to the sides; branchiostegal rays 4 or 5; dorsal fin entirely absent, or at most represented by a rayless band in a longitudinal groove, which readily becomes detached except anteriorly, and then appears as a whip-like appendage; anal fin very much elongated, and extending from behind the anus to the posterior end of the body; caudal absent or small; pectoral fins normally developed; ventrals none; the ovaries have oviducts, and hence the eggs are expelled from them directly into the water; the stomach is a cæcal sac, and pyloric appendages are developed; the air-bladder is quite peculiar in its development, and is connected with the ossicles of the organ of hearing. The family is especially distinguished from all except the electrical eel (Electrophoridæ) of South America, and the Amblyopsidæ and Aphredoderidæ of North America, by the advanced position of the anus; and even in this respect the species *Sternarchorhynchus* and *Rhamphichthys* are exceptional, inasmuch as in them the anus is even considerably in advance of the eyes, and close behind the symphysis of the lower jaw. In most respects the species are related to the electrical eel, but distinguished by the development of the mesocoracoid bones and other anatomical characters, as well as the presence of scales and the want of the electrical apparatus. Many species dwell in the fresh-water streams and lakes of South America, and represent as many as six genera. (See Günther's *Catalogue of Fishes*, vol. viii. pp. 1–9.) THEODORE GILL.

**Sternothær'idæ** [from *Sternothærus*, the typical genus], a family of turtles (order Testudinata) of the group Pleurodires, peculiar to Africa and the neighboring islands. The head is depressed and covered with symmetrical horny plates, and the temporal muscles with hard dermal shields; the zygomatic arch is moderately developed; the beak is naked; the lower jaw strong; the alveolar surfaces of the jaws thin, and with thin submarginal ridges; the shell is oval and depressed; "the hyosternal bones are divided transversely, giving ten bones to the plastron instead of eight;" the feet have each three series of phalanges (*Cope*) and five claws. The family is distinguished from the Pelomedusidæ by Prof. Cope on account of the number of bones in the plastron and the number of rows of phalanges in the feet. The living species are confined to Africa and the island of Madagascar; five are recognized by J. E. Gray. They are very aquatic in their habits, and rarely leave the water. THEODORE GILL.

**Ster'num** [Gr. στέρνον], or **Breast-Bone,** a bony or semi-cartilaginous plate which serves as the anterior (or inferior) point of union of many of the ribs. It represents the blended hæmal spines of the dorsal vertebræ. In fishes, batrachians, and serpents it is absent. In tortoises it becomes the lower shell or plastron, and is much widened. In most birds it is strongly keeled in front, the keel serving as a point of attachment for the strong wing-muscles. In man it consists of three pieces, of which the uppermost is the *manubrium;* the next, the *gladiolus;* and the lowest, the ensiform or xiphoid cartilage.

**Sternutation.** See SNEEZING.

**Stesich'orus,** b. at Himera in Sicily 632 B. C.; attained a great reputation as a lyrical poet. D. 560 or 552 B. C. His true name was TISIAS, but he was called Stesichorus ("arranger of choruses") from the artistic form of his poems, which consisted of choral odes composed of strophes, antistrophes, and epodes, like the chorus of the tragedy—a form which he is said to have invented. His life, as told by the ancients, is full of fables, but his fame among all connoisseurs of Greek literature—Cicero, Longinus, Quintilian, etc.—is an established fact. The existing fragments of his works have been edited by Kleine (Berlin, 1828); they are also found in the collections by Schneidewin, *Delectus Poesis Græcorum* (1839), and by Bergk, *Poetæ Lyrici Græci* (1867).

**Steth'oscope** [Gr. στῆθος, the "breast" or "chest," and σκοπεῖν, to "examine"], an instrument employed by physicians for the physical exploration of the chest. The scientific study of the sounds elicited by the heart and lungs, and to a minor degree by other organs, as the stomach and intestines, is termed *auscultation*. Direct application of the ear is termed *immediate or direct auscultation*, as distinguished from *mediate auscultation*, in which conducting media—instruments—are interposed, to isolate, convey, and intensify sound. Laennec, the founder of methodical auscultation, introduced the solid stethoscope, a tube made from a single piece of wood (Fig. 1). This instrument, modified, is chiefly employed in Europe. It is from 10 to 12 inches long, has a flanging chest-piece to receive sound, an open canal to convey sound, the solid structure also serving to conduct it, and a broad flat ear-piece for apposition to the ear and the exclusion of extraneous sounds. The medical profession is indebted to the late Dr. Camman of New York for originating the "binaural" or "double stethoscope," an instrument quite generally used by American physicians, and recognized abroad (Fig. 2). It comprises two distinct conducting tubes of silver-plated metal, capped by small rubber ear-pieces, which fit the external auditory canal, so as to exclude external sounds; they are jointed, to be self-retaining upon the listener's head, and receive through flexible rubber connections the sound collected by a single flanging chest-piece. For purposes of careful diagnosis, by concentrating local sound, conducting it to the exclusion of surrounding noise, and conveying a separate but similar and simultaneous impression to each ear, it is

FIG. 1.

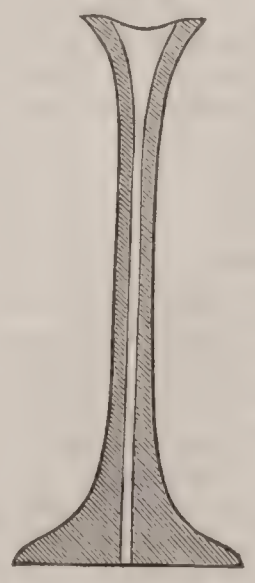
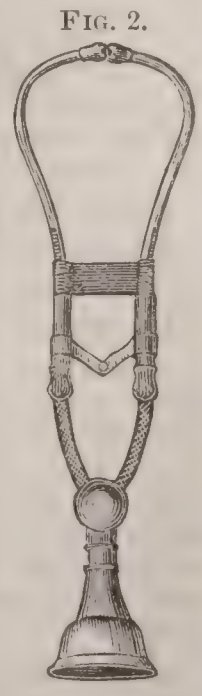


FIG. 2.



invaluable. It is further valuable in hospital and other public service, avoiding contact of the listener's head with unhealthy and uncleanly patients. It is especially serviceable in localizing the origin of sounds, as of small cavities in the lungs, valvular diseases of the heart, and in aneurism. An adventitious roaring or murmur generated in the long, tortuous conducting passages of the instrument must not be interpreted erroneously; habit quickly enables the listener to ignore this constant sound. The best auscultators prefer the unaided ear for habitual chest examination, reserving the stethoscope to aid in special and obscure cases. The habitual use of the stethoscope blunts the delicacy of the hearing.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Stet'son,** p.-v. and tp., Penobscot co., Me. P. 937.

**Stettin',** town of Prussia, capital of the province of Pomerania, on the left bank of the Oder, at its entrance into the Stettiner-Haff, and is strongly fortified. The site it occupies is hilly, and its streets are consequently uneven, but the houses are neat and substantial, and many buildings, such as the royal palace, the citadel and barracks, and the town-hall, are very handsome. Its sugar-refineries, oil-mills, glassworks, breweries, distilleries, and manufactures of anchors, sailcloth, rope, tobacco, soap, candles, hats, etc., are very important, and as a place of commerce it is the second port of Prussia. Only small vessels can reach it, however; its port on the Baltic is Swinemünde. P. 76,280.

**Stettin,** p.-v. and tp., Marathon co., Wis. P. 712.

**Stetti'ner-Haff,** an expansion of the Oder, covering an area of about 200 sq. m., with a depth of from 12 to 18 feet, and communicating with the Baltic through three narrow mouths, the Pene, the Swine, and the Delvenow, of which the middle one is the most important.

**Steuart** (Sir James Denham), b. in Edinburgh in 1713; was educated at the University of Edinburgh; became an advocate; married the daughter of the earl of Wemys, and was rapidly rising in his profession when, the rebellion of 1745 breaking out, he espoused the cause of the Stuarts, and was obliged to go into exile, where he remained ten years, when he was permitted to return to Scotland, and his estates were restored to him. He published *Apologie du Sentiment de Monsieur le Chevalier Newton sur l'ancienne Chronologie des Grecs* (1757) and *An Inquiry into the Principles of Political Economy* (1770), which preceded by several years Adam Smith's *Inquiry into the Nature and Causes of the Wealth of Nations.* D. in 1780.

**Steu'ben,** county of N. E. Indiana, bordering on Ohio and Michigan, drained by St. Joseph's and Pigeon rivers, and intersected by Fort Wayne Jackson and Saginaw R. R., which passes through its capital. The surface consists of prairie diversified with woodland, and the soil is fertile. There are many cattle, horses, sheep, and swine. Staples, Indian corn, wheat, oats, hay, wool, and dairy products. Cap. Angola. Area, 340 sq. m. P. 12,854.

**Steuben,** county of S. W. New York, bordering on Pennsylvania, drained by Canisteo, Conhocton, and Tioga rivers, and traversed by branches of Erie and other railroads. The soil is tolerably fertile, though the surface is hilly. There are numerous manufactories of carriages, agricultural implements, saddlery, leather, and iron castings, and a considerable amount of lumber is exported. Staples, Indian corn, wheat, oats, hay, wool, and dairy products. Cap. Bath. Area, 1425 sq. m. P. 67,717.

**Steuben,** tp., Marshall co., Ill. P. 1478.

**Steuben,** tp., Steuben co., Ind. P. 1253.

**Steuben,** tp., Warren co., Ind. P. 1068.

**Steuben,** p.-v. and tp., Washington co., Me. P. 1062.

**Steuben,** p.-v. and tp., Oneida co., N. Y., on Utica and Black River R. R. The township was granted to Baron Steuben 1786; he began settlement by erecting a log house 1789, and d. here Nov. 28, 1794. A monument to him was erected 1870–71. There are 8 churches in the town, of which the citizens are chiefly Welsh. A magazine in the Welsh language, maintained here since 1840, is now published in the adjoining town of Remsen. P. 1261.

**Steuben,** tp., Crawford co., Pa. P. 1020.

**Steuben, von** (Friedrich Wilhelm August Heinrich Ferdinand), Baron, b. Nov. 15, 1730, in the fortress of Magdeburg, Prussia, where his father was an officer; spent his early childhood in military encampments, including residences at Cronstadt and in the Crimea; served as a volunteer when fourteen years of age in the campaign of 1744 and the siege of Prague; educated in the Jesuit colleges of Neisse and Breslau, acquiring a superior knowledge of mathematics and a fair acquaintance with history and polite literature; entered the Prussian army as a cadet 1747; became ensign 1749, lieutenant 1753; was wounded at the battle of Prague, and distinguished at Rossbach, 1757; became adjutant-general 1758; wounded at Kunersdorf 1759; was aide to Gen. Knoblauch in his brilliant march into Poland 1761; was taken prisoner and carried to St. Petersburg; won the favor of the grand duke Peter; was soon exchanged; made captain (1762), and placed on the staff of Frederick the Great, from whom he received, with a few other selected officers, special instruction in tactics; took part in the siege of Schweidnitz, 1763; withdrew from the army at the Peace of 1763, receiving from Frederick a lay-benefice worth 400 thalers; travelled through Germany, making at Hamburg the important acquaintance of the French general, the count of St. Germain; was appointed in 1764 grand marshal to the court of the prince of Hohenzollern-Hechingen; filled that post ten years, being also made general of the prince's guard and, by the margrave of Baden, knight of the order of Fidelity; travelled extensively with the prince, visiting Paris and the courts of various German princes, where his rank procured him access to the most celebrated literary and social circles; resigned his marshalship about 1775, in consequence of a religious controversy, being a Protestant in a Roman Catholic court; resided for a time at the court of Baden at Carlsruhe; he renewed his friendship with the count of St. Germain in Alsace; became acquainted at Montpellier with the English earls Warwick and Spencer, to whom he proposed, in the spring of 1777, to visit England, but passing through Paris was then induced by St. Germain to offer his services to the American insurgents through the agency of Silas Deane; embarked for America in the autumn of that year with several other officers, taking Peter S. Duponceau as secretary and interpreter; landed at Portsmouth, N. H., Dec. 1; was received with honor by the authorities; proceeded overland to the American encampment at Valley Forge, Pa., where he was welcomed by Washington; received the appointment of inspector-general (with the rank of major-general) Mar. 29, 1778; took part as a volunteer in the battle of Monmouth in the following June; rendered memorable services, which can scarcely be overrated, in drilling the officers and men of the Continental army into efficiency; prepared a manual of instruction for the army, adopted by Congress and printed 1779; was a member of the court-martial on Major André; took command of the forces in Virginia 1780, and rendered good services at the siege of Yorktown 1781. Remaining as a citizen of the U. S. after the war, it was with difficulty that he procured an adjustment of his claims upon Congress, but was ultimately assigned a pension of $2500 and received grants of land from several States. On the tract given him by New York, in Oneida co. (now called Steuben), he settled, accompanied by North, Popham, Walker, and others of his former aides; built a log hut 1789; gave away to poor soldiers a large portion of his lands, and passed the closing years of his life in cheerful toil as a farmer. D. at Steuben Nov. 28, 1794. A *Life* by Francis Bowen appeared in Sparks's series; another containing much new material was published by Friedrich Kapp (1860), and an epitome of the latter may be found in Greene's *German Element in the War of Independence* (1876). Porter C. Bliss.

**Steu'benville,** city and tp., cap. of Jefferson co., O., on Pittsburg Cincinnati and St. Louis and Cleveland and Pittsburg R. Rs., 70 miles below the latter place, contains 17 churches, a female seminary, and 5 public schools, 2 daily, 1 semi-weekly, and 1 weekly newspapers, an extensive nail manufactory, blast furnaces, foundries and machine-shops, glassworks, an oil refinery, boiler-works, and the usual business-houses. Rich deposits of bituminous coal exist here. P. of v. 8107; of tp., exclusive of city, 2100. Joseph B. Doyle, Ed. "Herald and News."

**Ste'vens,** an unorganized county of N. W. Dakota, not included in the census of 1870. It is bounded S. W. by Missouri River, and consists mainly of the Plateau du Couteau du Missouri, the N. E. corner being crossed by Mouse River. Area, about 3100 sq. m.

**Stevens,** an unorganized county of S. W. Kansas, bordering on the Indian Territory, and intersected by Cimmaron River. Area, 720 sq. m.

**Stevens,** county of W. Minnesota, intersected by Pomme de Terre River, and traversed by St. Paul and Pacific R. R. The surface is rolling and there are several lakes. Small quantities of wheat and oats are produced. Cap. Morris. Area, 576 sq. m. P. 174.

**Stevens,** county in the N. E. of Washington Territory, touching upon Idaho and British Columbia. It is intersected by the Columbia River, and watered by numerous streams. Much of it consists of barren plains and rugged mountains, with large tracts of fertile soil interspersed. Gold is found on the bars of the Columbia and upon some

of the other streams. Cap. Fort Colville. Area, about 28,000 sq. m. P. 734.

**Stevens** (Abel), D. D., b. in Philadelphia Jan. 19, 1815; studied at the Wesleyan University, Middletown, Conn.; joined the Methodist ministry, and in 1834 was stationed at Boston; in 1837 made a European tour, and after his return was stationed at Providence, R. I.; in 1840 became editor of *Zion's Herald*, a denominational journal, at Boston, and in 1852 of the *National Magazine*, an illustrated monthly started in New York by the Methodist conference, which was discontinued after two or three years. He made a second visit to Europe in 1855, and in the following year was elected by the conference as editor of the New York *Christian Advocate and Journal*, an official organ of the denomination. He subsequently became joint editor of the *Methodist*, an independent journal established in New York, retaining this position till 1874. Besides contributions to current and cyclopædic literature, he has published—*Memorials of the Introduction of Methodism into New England* (1848), *Memorials of the Progress of Methodism in the Eastern States* (1852), *Church Polity, The Preaching required by the Times, Sketches and Incidents, a Budget from the Saddle-Bags of an Itinerant, Tales from the Parsonage, The Great Reform, Systematic Benevolence*, a prize essay, *History of the Religious Movement called Methodism* (3 vols., 1858–61), *Life and Times of Nathan Bangs, D. D.* (1863), *History of the Methodist Episcopal Church in the United States of America* (4 vols., 1864–67), *The Centenary of American Methodism* (1866), *The Women of Methodism* (1866), and *Compendium of the History of Methodism* (1868).

**Stevens** (Alexander Hodgdon), M. D., LL.D., son of Gen. Ebenezer, b. in New York City in 1789; graduated at Yale College 1807; studied medicine in London and Paris; was professor of surgery in Queen's (now Rutgers) College 1814–16, in the New York College of Physicians and Surgeons 1826–37, and again 1840–44, having meanwhile filled the chair of clinical surgery; was president of that institution 1843–55, of the American Medical Association 1848, and of the State Medical Society for several years. D. in New York City Mar. 30, 1869. He edited Cooper's *First Lines of Surgery* (2 vols., 1822) and was author of treatises *On Inflammation* (1811), *Cases of Fungus Hæmatodes of the Eye* (1818), *A Clinical Lecture on Injuries* (1837), *Lectures on Lithotomy* (1838), and addresses.

**Stevens** (Alfred George), b. at Blandford, Dorsetshire, in 1817; manifested an early artistic genius; went to Italy in 1833, where he spent nine years in studying the old masters, and upon his return to England was employed principally in decorative work for architects, founders, and manufacturers, his name being almost unknown to the public, though he was widely known among artists. In 1850 he went to Sheffield, where under his influence the Sheffield School of Art rose to the highest place of any in the kingdom. His finest decorative work is at Dorchester House, Park lane, London; it includes carvings in wood and marble, painted ceilings and panels, enamelled and metal work, all executed by his own hand. In 1858 he received the commission for the Wellington Monument in St. Paul's, London; completed the principal portions, and executed models and designs for all the rest, but, owing to ill-health and other causes, the work was left unfinished at his death, in London, May 1, 1875.

**Stevens** (Ebenezer), b. at Boston, Mass., Aug. 25, 1751; was a member of Paddock's Company of Boston Artillery, and one of the famous "Boston Tea-Party" Dec., 1773; removed soon afterward to Rhode Island; raised two companies of artillery and one of artificers for the expedition against Quebec, in which he served as lieutenant, having been commissioned May 8, 1775; became captain of Knox's regiment Jan. 11, and brevet-major Nov. 9, 1776; commanded the artillery at Ticonderoga and at Stillwater; was appointed lieutenant-colonel Apr. 30, 1778; was assigned to Lamb's regiment; served under La Fayette in Virginia; was, alternately with Lamb and Carrington, in command of the artillery during the siege of Yorktown; was one of the founders of the Society of the Cincinnati, and became after the war a leading merchant of New York in the West India and Mediterranean trade; agent of the war department, and a major-general of militia. D. at Rockaway, L. I., Sept. 2, 1823.

**Stevens** (Edward), b. in Culpeper co., Va., in 1745; became colonel of the 10th Virginia regiment 1776; distinguished himself at Brandywine and Germantown, and as brigadier-general at Camden, Guilford Court-house, and Yorktown; was a trusted friend of Washington, and for many years a member of the Virginia senate. D. in Culpeper co., Va., Aug. 17, 1820.

**Stevens** (Edwin Augustus), b. at Hoboken, N. J., in 1795, son of John and brother of Robert L. Stevens; took part in their steamboat experiments and enterprises, and in conjunction with his brothers established passenger and tow boats on the Hudson and other rivers. At the breaking out of the civil war he urged the government to put in service the iron-clad floating battery of which his brother had long before undertaken the construction, offering to complete it at his own risk, and to receive payment only in case it should prove successful; this offer being declined, he expended considerable sums on the vessel, and upon his death bequeathed it to the State of New Jersey, together with $1,000,000 for its completion; this, however, proved insufficient, and the battery remains unfinished. He had early purchased the entire site upon which the city of Hoboken has been built; by which and by his other enterprises he amassed an immense fortune; endowed the Hoboken high school, and bequeathed nearly $1,000,000 to establish at Hoboken the Stevens Institute of Technology. D. at Paris Aug. 7, 1868.

**Stevens** (George Alexander), b. in London in the first half of the last century; was a strolling player, vocalist, lecturer, and dramatist. Among his productions are—*Religion, or the Libertine Repentant* (1751), *The Birthday of Folly* (1754), *The History of Tom Fool* (1760), *Hearts of Oak* (1762), *A Lecture on Heads*, which gave rise to a curious literary controversy (1765), *The French Flogged* (1767), *Songs, Comic and Satyrical* (1782), *Trip to Portsmouth* (1773). After his death appeared *The Adventures of a Speculist*, compiled from his papers, with a *Life*, preface, and notes (1788). D. Sept. 6, 1784.

**Stevens** (Henry), son of Henry and a descendant of Capt. Phineas, b. at Barnet, Vt., Aug. 24, 1819; studied at Middlebury College 1838–39; graduated at Yale College 1843, and at Cambridge Law School 1844; established himself at London 1845, where he has since resided, as agent for American libraries in the purchase of rare and valuable books; has been instrumental in placing in the British Museum a very complete collection of "Americana," and has purchased for the Smithsonian Institution, the Library of Congress, and the chief libraries of the U. S. most of their recent valuable acquisitions. He has published several valuable bibliographical treatises and catalogues, among which are—*A Catalogue Raisonné of English Bibles* (1854), *A Catalogue of American Books in the Library of the British Museum* (1856), a *Catalogue of the Crowninshield Library* (1860), and of the library of Baron Humboldt (1861), which latter collection he had purchased, *Historical Nuggets* (2 vols., 1858), *Bibliotheca Americana* (1861), and *Bibliotheca Historica* (1870), the latter book being the catalogue of the library of his father, of whom it contains a biographical sketch. He also prepared indexes to the State papers in London relating to New Jersey (1858), Maryland (10 vols.), Rhode Island (6 vols.), and Virginia (1858), the three latter being in MS.; published a work on *The Tehuantepec Railway* (1869), and two small volumes of *Historical and Geographical Notes* (1869) relating to early explorations in America.

**Stevens** (Isaac Ingalls), b. at Andover, Mass., Mar. 25, 1818; graduated from the U. S. Military Academy July 1, 1839; served in the war with Mexico, and for gallantry at Contreras and Churubusco and at Chapultepec was brevetted captain and major. From 1849 to 1853 he was principal assistant and in charge of the office of the U. S. Coast Survey at Washington; in March of the latter year he resigned from the army to accept the governorship of Washington Territory; conducted the pioneer survey of the route for the Northern Pacific R. R., an account of which he published; delegate to Congress from Washington Territory 1857–61: on the outbreak of hostilities was made colonel of the 79th (Highlanders) N. Y. Vols. Moving his command to Washington, he was made a brigadier-general of volunteers Sept. 28, and attached to the Port Royal expedition, which left Hampton Roads a month later. On July 4, 1862, he was made a major-general of volunteers, and a week later transferred to Newport News in command of a division; at the second battle of Bull Run his division (9th corps) was hotly engaged. Near Chantilly, on the morning of Sept. 1, 1862, his division encountered the enemy, when Stevens, ordering a charge, placed himself at the head of his command, where he was shot through the head and instantly killed.

**Stevens** (John), b. in England about 1660; served as a captain in the army of James II. in Ireland after the revolution of 1688; settled in London soon afterward, and, being conversant with the chief modern languages, supported himself for many years as a translator until his death in 1726. Among the valuable works which he made accessible to the English reader were Faria è Souza's *Portuguese Asia* (3 vols., 1695) and *History of Portugal* (1698), Mariana's *General History of Spain* (folio, 1699), Veitia Linage's Spanish *Rule of Trade to the West Indies* (1700),

Sandoval's *History of Charles V.* (1703), Herrera's *General History of America* (6 vols. 8vo, 1725–26; 2d ed., 1740), and the venerable Bede's *Ecclesiastical History of the English Nation* (London, 8vo, 1723). Capt. Stevens was also author of several original works, chiefly historical, covering a wide range of subjects, among which were *Ancient and Present State of Portugal* (1705), *History of Batavia* (1715), *History of Persia* (1715), *History of the Wars of Charles XII.* (1715), *Monasticon Hibernicum* (1722), intended as a supplement to Dugdale's *Monasticon Anglicanum*, of which he made an abridgment (1718), and to which he added two volumes entitled *The History of the Ancient Abbeys*, etc. (2 vols. folio, 1722–23), *The Royal Treasury of England, or An Historical Account of Taxes* (1725, 2d ed., 1733), compiled *A New Collection of Voyages and Travels* (published in monthly numbers, 2 vols. 4to, 1708–10; 2d ed., 1719), and prepared a *Spanish and English Dictionary* (folio, 1706; 4to, 1726), in which was included a collection of 7000 Spanish proverbs.

**Stevens** (John), b. in New York in 1749; became interested in the question of navigation by means of steam, and as early as 1789 presented a memorial to the New York legislature stating that he had perfected his plans, and in 1804 launched a small vessel worked by steam with screws, and in 1807 built a steamboat which he called the Phœnix. Fulton had in the mean time built his steamboat, the Clermont, and obtained the exclusive right of navigating the Hudson by steam, and Stevens sent his vessel to the Delaware River. In 1812 he planned a revolving steam-battery to be plated with iron, and involving essentially the principles afterward embodied in the monitors, and in the same year put forth an essay on railroads, indicating the methods of operating them by steam, and suggested the construction of a railway from Albany to Lake Erie. The Camden and Amboy R. R. was planned by him. D. at Hoboken, N. J., in 1838.

**Stevens** (John Austin), b. in New York City Jan. 22, 1795, son of Gen. Ebenezer by his second wife, Mrs. Sands, sister of Col. Ledyard of Revolutionary fame; graduated at Yale College 1813; became a partner in his father's mercantile house 1818; was a delegate to the Philadelphia free-trade convention; an early member (from 1820) of the New York chamber of commerce, of which he was long the secretary; was one of the founders and the first president of the Merchants' Exchange, president of the well-known Bank of Commerce from its organization in 1839 to 1866, and president of the associated banks of New York, Philadelphia, and Boston, which, during the late civil war, saved the credit of the U. S. government by repeated loans, amounting in the aggregate to $150,000,000, and chairman of the treasury note committee which managed the details of the transaction; was widely known as a skilful financier, whose advice was often sought by the U. S. treasury department; took an active interest in benevolent institutions; long governor of New York Hospital; combined Whig with free-trade principles, and was noted among his intimate friends for literary and scientific attainments, of which he made no public display. D. in New York City Oct. 19, 1874.

**Stevens** (John Austin), Jr., son of John Austin, b. in New York Jan. 21, 1827; graduated at Harvard 1846; became a merchant in New York; was secretary of the chamber of commerce of New York 1862–68; was prominent in patriotic organizations during the civil war, and is author of *The Valley of the Rio Grande* (1864), *Memorial on Ocean Steam-Navigation* (1864), *Colonial Records of the N. Y. Chamber of Commerce, with Historical and Biographical Sketches* (1868). He is an accomplished antiquarian investigator, and has contributed to the literature of the country several valuable papers on American history.

**Stevens** (Phineas), b. at Sudbury, Mass., about the end of the seventeenth century; removed in childhood to Rutland, N. H.; was carried prisoner to Canada at the age of sixteen; was a volunteer in the expedition of 1746 against Canada; gallantly defended Charlestown (or "Fort No. 4") against the French and Indians Mar., 1747, for which he was presented with a valuable sword by Admiral Knowles; was in command of that fort until 1750, and made a visit to Canada in 1749, of which the *Journal* was printed in the *New Hampshire Historical Collection*, vol. v. D. at Charlestown in 1756.

**Stevens** (Robert Livingston), b. at Hoboken, N. J., in 1788, the son of John Stevens; became early interested in the steam-navigation ideas of his father, and made many improvements in the construction of vessels, among which was that of giving concave water-lines to the hull; and subsequently engaged largely in the building of steamboats. In 1813 he invented and made for the government elongated percussion shells for smooth-bore guns, and in 1822 used anthracite coal in a furnace, and soon after in his steamers; in 1836 introduced the T-rail on the Camden and Amboy R. R., of which he was president, and in 1842 was commissioned to build for the U. S. government an iron-plated floating battery which remained uncompleted at his death. (See Ships.) D. at Hoboken Apr. 20, 1856.

**Stevens** (Samuel), son of Gen. Ebenezer, b. in New York in 1784; graduated at Yale College 1805; studied law; became a distinguished member of the New York bar; was prominent in the politics of his native State; and rendered important service in the introduction of the Croton water, having been one of the first commissioners of the aqueduct construction. D. at New York Nov. 24, 1844.

**Stevens** (Thaddeus), b. at Peacham, Vt., Apr. 4, 1793; graduated at Dartmouth College in 1814; went to Gettysburg, Pa., where he taught in an academy, at the same time studying law; was admitted to the bar in 1816, and soon acquired an extensive practice. In the Presidential canvass of 1828 he was a strong opponent of the election of Gen. Jackson; in 1833 and several times subsequently he was a member of the State legislature, in 1836 a member of the convention to revise the State constitution, canal commissioner in 1838, and active in introducing the public-school system in Pennsylvania. In 1842 he removed to Lancaster; in 1848 was elected Representative in Congress; was re-elected in 1850, 1858, 1862, and thereafter to each Congress until his death, serving at various times as chairman of important committees, being one of the acknowledged leaders of the Republican party, and distinguishing himself for his earnest advocacy of measures in opposition to slavery, for the emancipation and enfranchisement of the colored race, and after the war for stringent proceedings against the seceding States. He was one of the most active managers in the impeachment trial of Pres. Johnson. The degree of LL.D. was conferred upon him by Middlebury College in 1867. D. at Washington Aug. 11, 1868.

**Stevens** (Walter H.), b. in New York City about 1827; graduated at West Point 1848; was appointed lieutenant of engineers, in which capacity he served at Fort Adams, Newport, R. I., 1848, in repairing the fortifications on the Mississippi River below New Orleans 1849–53, and on the defences of the coast of Texas 1853–61; was dismissed from the army May 2, 1861, having attached himself to the Confederate cause; became an officer of engineers on Gen. Beauregard's staff; rose to the rank of brigadier-general; surrendered at Appomattox Court-house, Va., Apr., 1865, after which he went to Mexico and became chief engineer of the Mexico and Vera Cruz R. R. D. at Iberville, La., in Dec., 1867.

**Ste'vensburg,** p.-v. and tp., Culpeper co., Va. P. of v. 150; of tp. 2000.

**Ste'venson,** p.-v. and tp., Jackson co., Ala., at intersection of Memphis and Charleston and Nashville and Chattanooga R. Rs. P. 1348.

**Stevenson** (Andrew), b. in Culpeper co., Va., in 1784; became a prominent lawyer, member and Speaker of the Virginia legislature and of the Federal Congress (1821–34; Speaker 1827–34), and minister to England 1836–41; was afterward distinguished as a scientific agriculturist, and became rector of the University of Virginia. D. at Blenheim, Albemarle co., Va., June 25, 1857.

**Stevenson** (Edward), D. D., b. in Kentucky in 1797; joined the Kentucky conference in 1820; rose to the highest distinction in the ministry, and took an active part in the organization of the Methodist Episcopal Church, South, and was missionary secretary and book-agent of the connection. D. in Kentucky July 6, 1864. T. O. Summers.

**Stevenson** (John), D. D., b. in England about the beginning of the nineteenth century; was long a missionary in India, and became a learned Orientalist. He translated from the Sanskrit, for the Oriental Translation Fund, *The Sanhita of the Sama-Veda* (1841), and from the Maghadi *The Kalpa Sutra and Nava Tatva—two works illustrative of the Jain Religion and Philosophy* (1848); edited from MSS. the Sanskrit text of the *Sama-Veda* (1843), and published a work on *Hindoo Caste* (1857).

**Stevenson** (Sir John Andrew), Mus. Doc.; b. in Dublin, Ireland, in 1760, son of a professor of music; became vicar-choral at St. Patrick's cathedral, Dublin, 1783; composed the music for two of O'Keefe's popular farces, Dr. Holton's opera, *The Contract*, and Mrs. Atkinson's *Love in a Blaze;* produced various original operas and glees, the fine oratorio *The Thanksgiving*, various pieces of sacred music including two volumes of *Cathedral Anthems*, and set to music some of the psalms; but won his chief celebrity by the musical arrangement of Moore's *Irish Melodies*, which occupied him much of the time from 1802 to 1816. He was knighted 1802. D. at the seat of his daughter, the marchioness of Headfort, in the county of Meath, Sept. 14, 1833.

**Stevenson** (John W.), son of Andrew, b. at Richmond, Va., May 4, 1812; graduated at the University of Virginia 1834; studied law; settled at Covington, Ky., 1841; became county attorney, member of the State legislature (1845–47), and of the constitutional convention 1849; was one of the revisors of the civil and criminal codes of practice; Presidential elector 1852 and 1856; member of Congress 1857–61; chosen lieutenant-governor 1867; was acting governor 1867–68, governor 1869–71, and U. S. Senator for the term 1871–77.

**Stevenson** (Robert), b. at Glasgow, Scotland, June 8, 1772; was engineer to the board of commissioners for Northern lighthouses 1797–1842, during which time he erected no less than twenty-three lighthouses, of which the most celebrated was that on Bell Rock in the German Ocean, 12 miles from Arbroath, on the E. coast of Scotland 1807–11; was employed on numerous engineering works, chiefly bridges, river and harbor improvements, and railway surveys; published *An Account of the Bell-Rock Lighthouse* (1824), contributed to scientific periodicals, and drew up professional *Reports* which if collected would fill four large volumes. D. at Edinburgh July 12, 1850.

**Stevenson** (Thomas G.), b. in 1836 at Boston, Mass., where he was educated. His fondness for military life was early manifested, and he became an active member of the State militia, rising from the ranks to be major of the 4th battalion of Massachusetts Infantry, which body under his care and instruction attained a high degree of excellence in discipline and drill. The outbreak of civil war in 1861 found him ready for duty in the field, and in the fall of 1861 he was commissioned colonel of the 24th Massachusetts Vols., which regiment he had organized, and which he led in the Burnside expedition resulting in the capture of Roanoke Island and Newberne, N. C. In the subsequent events in North and South Carolina the regiment bore an honorable part. His appointment as brigadier-general of volunteers was made in Nov., 1862, and he commanded a brigade from that date, though not confirmed until Mar., 1863. In the summer of the latter year he was engaged in the operations against Charleston, S. C., including the descent upon Morris Island and siege of Fort Wagner, where he was in command of the reserves. In the Richmond campaign of 1864 he commanded a division of the 9th corps (army of the Potomac) through the "Wilderness" battles, but fell on the second day of the struggle around Spottsylvania, May 10, 1864.

**Stevens' Plains,** p.-v., Westbrook tp., Cumberland co., Me., on Maine Central R. R.

**Stevens Point,** p.-v. and tp., cap. of Portage co., Wis., on Wisconsin Central R. R. and Wisconsin River, at the base of one of the most valuable pine districts in the West, has 6 churches, good schools, 3 banks, 3 foundries, 2 newspapers, machine and repair shops of the railroad, and 6 saw and 6 shingle mills. P. of v. 1810; of tp. 1895. McGlachlin & Simons, Eds. "Journal."

**Stevens's,** tp., Darlington co., S. C. P. 1918.

**Ste'vensville,** p.-v. and tp., King and Queen co., Va. P. 4077.

**Stev'inus,** or **Stevin** (Simon), b. at Bruges, in the Belgian province of West Flanders, in 1550; was teacher of mathematics to Maurice of Nassau, stadtholder of Holland, who made him inspector of the dykes. He wrote in Dutch a number of essays on statics, hydrostatics, fortification, navigation, and on various mechanical problems, which have been translated into Latin, French, and German. D. at the Hague in 1630. The French translation of his works by Albert Girard appeared at Leyden in 1634, in 2 vols. (See Quetelet, *Simon Stevin* (Brussels, 1845).)

**Steward** (or **High Steward**) **of Scotland,** an ancient hereditary office of great dignity and power at the Scottish court from the twelfth to the fifteenth century, called in Latin *dapifer* or *seneschallus*. The incumbent not only exercised a real jurisdiction over the royal household, but collected and controlled the royal revenues, and was assigned in war the post nearest to the sovereign. This office was conferred by David I. early in the twelfth century on Walter, second son of Alan, lord of Oswestry, along with extensive grants of land, including the barony of Renfrew. The title was soon assumed by that family as a surname, and became the origin of the family-name of the Stewart or Stuart dynasty by the accession of Robert, the seventh high steward, to the throne of Scotland, when the seneschalship was merged in the Crown. In 1469, by act of the Scottish Parliament, the hereditary estates of the stewards became the appanage of the king's eldest son, along with the titles of high steward of Scotland and baron of Renfrew, and it is now borne by the prince of Wales in the form of great steward of Scotland.

**Steward of England, Lord High,** anciently the first officer of state at the English court. This dignity was hereditary in the descendants of Hugh Grentmesnil, lord high steward in the time of Henry II.; passed by marriage successively to the De Bellomonts and Montforts, earls of Leicester; reverted to the Crown on the death and attainder of Simon de Montfort (1265); was granted with the earldom of Leicester to Edmund, youngest son of Henry III., and continued annexed to that title or to that of Lancaster until the accession of its incumbent, Henry IV., to the throne. Since that period the office has fallen into abeyance, but a temporary lord high steward is created under the great seal at coronations and at the trials of peers, the incumbent, after performing the required service, terminating his commission by breaking his wand of office.—This office must be distinguished from that of Lord Steward of the Household, anciently entrusted with the control of the royal servants, over whom he exercised a civil and criminal jurisdiction, not entirely repealed until about 1850, though long fallen into abeyance. It is now a merely nominal office, conferred during the pleasure of the sovereign, or rather that of the prime minister; has a salary of £2000, and confers a seat in the privy council and precedence over all peers of equal degree.

**Stew'ardson,** tp., Potter co., Pa. P. 210.

**Stew'art,** county of S. W. Georgia, separated from Alabama by Chattahoochee River, and watered by several of its tributaries. Staples, cotton, Indian corn, and sweet potatoes. Cap. Lumpkin. Area, about 500 sq. m. P. in 1870, 14,204.

**Stewart,** county of N. W. Tennessee, bordering on Kentucky, intersected by Cumberland River, and traversed by Louisville Nashville and Great Southern R. R. The surface is undulating and the soil fertile. Iron ore abounds, which is worked up into blooms and pigs. Staples, tobacco in large quantities, Indian corn, and wool. Cap. Dover. Area, 425 sq. m. P. in 1870, 12,019.

**Stewart,** tp., Fayette co., Pa. P. 1266.

**Stewart** (Alexander), b. in England or Scotland about 1740; became captain in the British army 1761, lieutenant-colonel of the 3d Foot July, 1775; served in the Southern campaign in the Revolutionary war under Lord Cornwallis; succeeded to the command of the British forces in South Carolina May, 1781, and was defeated by Gen. Greene Sept. 8, 1781, at Eutaw Springs, the last pitched battle of the war of American independence; became major-general 1790. D. in Feb., 1793.

**Stewart** (Rev. Alexander), LL.D., b. in 1781; was minister of the parish of Douglas, Scotland; one of the foremost Scottish literati, and a leading contributor to the *Edinburgh Encyclopædia*. He published several textbooks which were widely used and passed through many editions, among which are—*Cornelius Nepos, with Notes*, etc. (1819), an edition of *Mair's Introduction, Goldsmith's History of England, with a Continuation, History of Scotland, Stories from the History of Scotland, Discourses* (1829), and *Compendium of Modern History* (18th ed. 1861). D. at the Manse of Douglas Nov. 14, 1862.

**Stewart** (Alexander Turney), b. near Belfast, Ireland, Oct. 27, 1802; left an orphan at an early age, he was cared for by his maternal grandfather; distinguished himself at school, and was entered at Trinity College, Dublin, where he did not graduate. Upon the death of his grandfather, a distant relative, a member of the Society of Friends, became his guardian. He emigrated to New York about 1818, bringing with him a few hundred pounds, a part of a small estate which he inherited, and for a time taught mathematics and the classics in a private school. Having invested his ready money in a small mercantile venture, he found himself unexpectedly left alone in the business with the rent of the shop on his hands, and forced to become a trader. Returning to Ireland, he sold his other property, invested the proceeds in Irish laces and similar goods, and in 1823 opened a small store in Broadway, and commenced the business which has since grown to be the most extensive dry-goods establishment in the world, with branches in England, Scotland, Ireland, France, and Germany, besides large manufactories of woollens, carpets, and hosiery in the U. S., England, and Scotland, the whole employing about 8000 persons. In addition to his manufacturing and mercantile business, he came to be a large holder and improver of real estate in New York and vicinity, Saratoga, and other places, and at the time of his death was reputed to be one of the three wealthiest men in the U. S., the other two being John Jacob Astor, who had a few weeks before inherited the bulk of the great Astor estate, and Cornelius Vanderbilt, who acquired the greater part of his property in railway operations. He retained all through his life his early fondness for clas-

sical literature, and was a munificent patron of art in certain departments, his picture-gallery containing some of the finest examples of modern art, while he had little appreciation for the works of the old masters. Among his enterprises was the establishment of a town called Garden City, on Long Island, a few miles from Brooklyn. Here he purchased a tract of 10,000 acres, upon which he built more than 100 dwellings adapted for persons in moderate or comfortable circumstances, none of which were to be sold, but all of which would be rented furnished if desired, he himself defraying all the expenses of grading, lighting, and watering the streets and building a railway to connect Garden City with Brooklyn. Some years before, he had commenced the erection of a large and costly building in New York designed as a home for working girls; and he had also made preparation for the erection of a similar building for young working men, each structure being designed to afford accommodation for 1500 inmates. He took no prominent part in public affairs, except that during the civil war he was an earnest upholder of the national government, and in 1869 accepted from Pres. Grant the nomination as secretary of the treasury. The nomination was withdrawn, it being found that he was rendered legally ineligible for that position on account of his being engaged in the importation of foreign merchandise. He was president of the honorary commission sent by the U. S. government to the Paris Exposition of 1867. During the Irish famine of 1846 he chartered a vessel which he freighted with breadstuffs at his own expense for gratuitous distribution among the sufferers, and brought back, free of charge, as many emigrants as the vessel would carry, stipulating that all should be of good character, and taking care that situations should be ready for them upon their arrival. He made considerable donations to the sufferers of the Chicago fire of 1871 and in the Franco-German war; but apart from these, his benefactions, public or private, were not considerable, either during his life or by his will. D. in New York Apr. 10, 1876, leaving no children. By his will his entire estate, with the exception of certain legacies, was devised to his wife, who, with Henry J. Hilton, his confidential friend and legal adviser, and William Libbey, his sole surviving business-partner, were appointed executors. To Mr. Hilton was left a legacy of $1,000,000, and to several of his principal employés sums amounting in the aggregate to something more than $100,000; his wife being also requested in a codicil to make provision for others who had been long employed by him in such amounts as she should think proper; she appropriated for this purpose a further sum of a little more than $200,000, making the entire amount of his legacies, exclusive of that to Mr. Hilton, about $325,000.

A. H. Guernsey.

**Stewart** (Balfour), LL.D., F. R. S., b. at Edinburgh, Scotland, Nov. 1, 1828; educated at the Universities of St. Andrew's and Edinburgh; settled in Australia, where he was engaged in business in Melbourne 1852–54; afterward devoted himself exclusively for a year or more to the study of science; returned to Great Britain 1855; was for some months assistant to the superintendent of the Kew Observatory, and for three years assistant to Prof. Forbes in Edinburgh in his lectures and experiments upon mechanics; was appointed director at Kew July 1, 1859, secretary to the meteorological committee Jan. 1, 1867, and professor of natural philosophy at Owens College, Manchester, July 7, 1870, which post he now (1876) fills, retaining the direc-rectorship of Kew; is the discoverer of the law of equality between the absorptive and radiative powers of bodies, for which he received the Rumford medal of the Royal Society 1868; is author, jointly with Messrs. De la Rue and Loewy, of *Researches in Solar Physics*, and with Prof. P. G. Tait of papers giving the results of experiments on *Heating produced by Rotation in Vacuo*, and of a remarkable religio-scientific treatise, *The Unseen Universe* (1875), being speculations on the "physical basis of immortality"; has contributed numerous papers, chiefly on meteorology and magnetism, to the *Transactions* of the Royal Society, and has published *Elementary Lessons in Physics* (1870), *Elementary Treatise on Heat* (1871), the *Physics Primer* (1872) in Macmillan's Series, and the *Conservation of Energy* (1873) in the "International Scientific Series."

**Stewart** (Charles), b. in Scotland about 1770; went to India at an early age in the military service of the East India Company, in which he rose to the rank of major, and was subsequently professor of Oriental languages in the company's training college at Hertford. D. about 1840. He edited the Persian text of the *Anvari Soohyly, or Fables of Pilpay;* published a *Descriptive Catalogue of the Oriental Library of the late Tippoo Sultaun, to which are prefixed Memoirs of Hyder Ally Khan and his Son, Tippoo Sultaun* (Cambridge, 1809), and translations of the *Travels of Mirza Abu Taleb Khan in Asia, Africa, and Europe* (London, 2 vols., 1810), the *Memoirs of the Mogul Emperor Timur* (1830), and those of Humayun (1832), and was author of a *History of Bengal* (1813).

**Stewart** (Charles), U. S. N., b. in Philadelphia July 28, 1778; went to sea at the age of thirteen as cabin-boy in a merchant-vessel, and before he was twenty had become captain of an Indiaman. In 1798 he entered the U. S. navy as a lieutenant, and in July, 1800, was appointed to the command of the Experiment, a schooner of 12 guns, with which, Sept. 1, he captured the French privateer Deux Amis, 8 guns, and soon after the Diana, 14 guns, also recapturing several American vessels which had been taken by the French. In 1804, in command of the brig Siren, he took part in the naval operations against Tripoli, aiding Decatur in the destruction of the American frigate Philadelphia, which had fallen into the hands of the dey of Tripoli. He was made captain in 1806; in the summer of 1813 took command of the frigate Constitution, 52 guns, and in December sailed from Boston for the West Indies, making several captures of British vessels. In Dec., 1814, he sailed on a second cruise, and on Feb. 20, 1815, captured the British ship Cyane, 34 guns, and the Levant, 21 guns. The action was fought at night, and lasted forty minutes; the American loss was 15 killed and wounded, that of the British 41; the Levant was, however, recaptured by a British squadron. In 1816–20, Stewart commanded the Mediterranean squadron, in 1821–23 that of the Pacific, subsequently serving on the board of navy commissioners, as commander of the home squadron, and of the naval station at Philadelphia. He was placed on the retired list in 1857, but resumed service in 1859, and was placed in command of the Philadelphia navy-yard with the rank of senior naval officer, and in 1862 was made rear-admiral on the retired list. D. at Bordentown, N. J., Nov. 7, 1869.

**Stewart** (Charles Samuel), D. D., b. at Flemington, N. J., in 1795; graduated at the College of New Jersey in 1815; studied law at Litchfield, Conn., and theology at Princeton, and in 1822 was ordained as missionary to the Sandwich Islands, where he remained until 1826, when he returned to America to advocate the cause of foreign missions. In 1828 he was appointed chaplain in the U. S. navy; made several voyages, after which for many years he was chaplain of the naval station at New York. He published—*Private Journal of a Voyage to the Pacific Ocean and Residence in the Sandwich Islands* (1828), *Visit to the South Seas* (1831), *Sketches of Society in Great Britain and Ireland* (1834), *Brazil and La Plata* (1850), and *Personal Record of a Cruise* (1856). D. at Cooperstown, N. Y., Dec. 14, 1870.

**Stewart** (David), duke of Rothesay and earl of Carrick, son of Robert III., king of Scotland, b. about 1377; received the above titles from his father Apr. 28, 1398; became regent of Scotland Jan. 27, 1399, and defended Edinburgh against Henry IV. of England 1400, but was soon after seized by the opposite party and imprisoned in Falkland Castle, where he soon died by starvation 1401. The earls of Albany and Douglas were accused of this crime, but were declared innocent after an examination before the great council at Holyrood May 16, 1402.

**Stewart** (Dugald), b. at Edinburgh Nov. 22, 1753, son of Matthew Stewart, professor of mathematics in the College of Edinburgh; studied there and at Glasgow; was in 1774 appointed assistant professor to his father, whom he succeeded in 1785; in the same year receiving the chair of moral philosophy, which he resigned in 1810 on account of failing health, and passed the remainder of his life in literary labor at his seat on the Frith of Forth, the sinecure office of gazette writer for Scotland, with a salary of £600, having been created for him. He is one of the not unfrequent examples of color-blindness, several quite different colors having been undistinguishable by him. The following is a list of his principal works, with the dates of their original publication, many of which, however, subsequently appeared with considerable augmentations: *Elements of the Philosophy of the Human Mind* (1792), *Outlines of Moral Philosophy* (1793), *General View of the Progress of Metaphysical, Ethical, and Political Philosophy*, prefixed to the supplement to the *Encyclopædia Britannica* (1816), *The Philosophy of the Active and Moral Powers of Man* (1828). He also wrote biographies of Adam Smith, Thomas Reid, and Dr. Robertson. The best edition of his collected works is that prepared by Sir William Hamilton (1856). D. at Edinburgh June 11, 1828.

**Stewart** (Esme), lord of Aubigny, earl and duke of Lennox, b. in France about 1555, grandson of John, third earl of Lennox, and deriving his French title from Sir John Stewart of Darnley, constable to the Scots army in France in the wars of Charles VII.; arrived in Scotland in Sept., 1579, and immediately became a favorite of his

cousin, King James VI., who created him earl of Lennox Mar. 5, 1580, duke of Lennox and earl of Darnley Aug. 5, 1581; took an active part in the political intrigues of the time, instituting legal proceedings against the ex-regent Morton, and secured his condemnation and execution for the murder of Darnley; quarrelled with the Church, and was accused of treason and expelled from Scotland Dec., 1582. D. at Paris May 26, 1583.

**Stewart** (Hamilton), b. Sept. 4, 1813, in Jefferson, and reared in Scott co., Ky., and thence removed to Texas in the year 1838. In May of that year he established the *Civilian* newspaper, and continued to own and edit the same as an independent Democratic paper through all the mutations of government for a third of a century. He resided in Galveston from the foundation of the city; was repeatedly its mayor, and represented it in the legislature and in the constitutional convention in 1856. In the days of the republic he enjoyed the confidence of Presidents Houston and Jones, and was opposed to the policy of annexation, and after Texas was a State of the republic was unwilling to annul the compact. During the Presidency of Mr. Pierce and of Mr. Buchanan, he served as collector of customs in the city of Galveston, but was not retained in office during the Confederacy because of his opposition to secession. For ten years preceding the war he was regarded as the editor of the most prominent newspaper opposed to the secession doctrine. At the present time Mr. Stewart is one of the editors of the Galveston *News*, the leading newspaper of Texas. C. G. Forshey.

**Stewart** (Sir Houston), b. in Renfrewshire, Scotland, in 1791; entered the navy at an early age; served at Flushing and at the siege of St. Jean d'Acre; was chosen to Parliament 1852; was a lord of the admiralty 1850–52; was admiral and second in command in the Black Sea during the Crimean war, rendering services off Sebastopol for which he was knighted 1856; was subsequently commander-in-chief on the North American Station and at Plymouth (1860–63), and governor of Greenwich Hospital 1869–72. D. in Dec., 1875.

**Stewart** (John), b. in Ireland; emigrated to America; married a sister of Gen. Wayne; entered the Revolutionary army, commanded a corps of light infantry, and had a severe engagement at Indian Field with Emmerick's command of Tories and Indians, Aug. 31, 1778, and received a gold medal from Congress for his gallantry at the storming of Stony Point, July 15, 1779. D. near Charleston, S. C., from being thrown from his horse.

**Stewart** (Robert M.), b. at Truxton, N. Y., Mar. 12, 1815; went to Kentucky in boyhood, and in 1838 emigrated to Missouri, settling in Buchanan co.; was a member of the State constitutional convention of 1845; sat ten years in the State senate; was governor 1857–61; inaugurated the railroad system of Missouri; and was for a short time an officer of the Union army 1861, but retired on account of ill-health. D. at St. Joseph Sept. 21, 1871.

**Stewart** (Matthew), earl of Lennox, b. in Scotland about 1510, son of John Stewart, third earl, by his wife, Lady Anne Stewart, daughter of the earl of Athol; became heir-male of the Stewards of Scotland by the death of King James V.; married Lady Margaret Douglas, only child of Archibald, earl of Angus, by the queen-dowager Margaret, sister of Henry VIII., and had by this marriage two sons, of whom the elder became the well-known Earl Darnley, the unhappy cousin, husband, and victim of Mary Queen of Scots. Matthew succeeded to the earldom in 1526; spent his youth in France and in the Italian wars; returned to Scotland 1533; became a formidable rival of Bothwell at the court of the infant queen, for whom he attempted to negotiate a marriage with the English prince, afterward Edward VI.; took at first the Roman Catholic side in the civil war, but soon went over to the party of the English king; was consequently banished, declared guilty of treason, and his estates confiscated Oct., 1545; conducted unsuccessful invasions of Scotland 1545–47; was imprisoned with his countess in the Tower of London for having planned the marriage of the queen of Scots with their son Darnley 1562; was allowed to return to Scotland Sept., 1564; was restored to his estates and honors Dec., 1564; took part in the plot against Riccio 1565; was prominent in the movement which resulted in the seizure and imprisonment of the queen at Lochleven Castle June 15, 1570; was the next day declared lieutenant-governor of Scotland in behalf of his grandson, the infant prince James VI.; was elected regent July 12; conducted the war against the partisans of Mary; took Dumbarton Castle Apr., 1571, but was unable to secure that of Edinburgh; held a Parliament at Leith May 9, 1571, and when on his way to hold a Parliament at Stirling was attacked and mortally wounded by a party of the queen's friends. D. at Stirling Sept. 4, 1571.

**Stewart** (Robert). See Castlereagh, Viscount.

**Stewart** (William M.), b. in Wayne co., N. Y., Aug. 9, 1827; removed to Ohio with his family in childhood; prepared himself for college; spent eighteen months at Yale 1848–49, after which he left college for the gold-fields of California; spent two years in the mines; commenced the study of law 1852; was appointed in the same year district-attorney for the county of Nevada; was acting attorney-general of California 1854; was a lawyer in San Francisco 1854–56; afterward resided at Nevada City and Downieville; removed to the Territory of Utah (now Nevada) 1860; sat in the legislature 1861; was a member of the constitutional convention of 1863; was elected as a Republican one of the first U. S. Senators from Nevada, and was re-elected 1869 and 1875.

**Stewart Island,** also called **New Leinster,** the southernmost and smallest of the three chief islands of New Zealand, is of triangular form, about 100 miles in circumference, with an area of 1000 sq. m.; consists largely of hills, of which there are three ranges, the highest summits exceeding 3000 feet; is separated from New Leinster by Foveaux Strait, 20 miles wide, and forms a part of the province of Southland.

**Stewart's Creek,** tp., Harnett co., N. C. P. 997.

**Stewart's Creek,** tp., Surry co., N. C. P. 796.

**Stew'artstown,** p.-v. and tp., Coos co., N. H. P. 909.

**Stewartstown,** p.-v., Hopewell tp., York co., Pa. P. 212.

**Stew'artsville,** p.-v., Robb tp., Posey co., Ind. P. 135.

**Stewartsville,** p.-v., De Kalb co., Mo., on Hannibal and St. Joseph R. R.

**Stewartsville,** tp., Richmond co., N. C. P. 1887.

**Stey'er,** town of Austria, province of Upper Austria, at the confluence of the Steyer and the Ens, is famous for its manufactures of machinery, arms, files, knives, and every kind of steel and iron goods. P. 13,392.

**Stib'ium,** the Latin name of Antimony (which see).

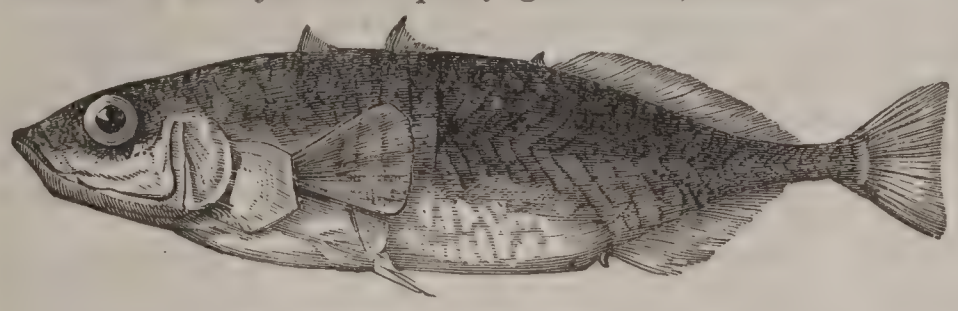
**Stichæ'idæ** [from *Stichæus*—Gr. στίχος, a "row" or "line"—the typical genus of the group], a family of fishes of the order Teleocephali and sub-order Acanthopteri, peculiar to the northern seas. The body is more or less elongated; the skin covered with cycloid scales; the lateral line sometimes absent, sometimes simple, and sometimes with ramifications and parallel branches (hence the name); the head compressed, and more or less pointed forward; the opercular bones unarmed; the mouth with a lateral oblique cleft; the upper jaw scarcely protractile; teeth present on both jaws, and sometimes on the palate; branchial apertures produced forward; branchiostegal rays six; dorsal fin very long, and sustained throughout by rigid spines; anal elongated; caudal distinct; pectorals well developed; ventrals jugular, each with two or three rays; the stomach is cæcal, and around the pylorus are developed a few cæca. The skull is depressed behind the eyes, and the skeleton offers a number of peculiarities, contrasting with the characters of the Blenniidæ and other related families. A dozen or more species are known, which, according to some authors, represent only two genera, and according to others as many as nine. Nine species inhabit the Arctic and northern waters of the Atlantic coast of America, and two (*Leptoblennius serpentinus* and *Eumesogrammus sub-bifurcatus*) are found in the New England waters N. of Cape Cod, although rather rare. Little is known of their habits, and they are of no economical value. Theodore Gill.

**Stick, Composing.** See Printing, by W. S. Paterson.

**Stick'ing-Plaster,** or **Adhesive Plaster,** for surgeons' use, is made of resin, lead plaster, and soap, melted together and spread by machinery upon stout muslin. It is an article of great value in practical surgery, but requires rather frequent renewal, as it loses its adhesive qualities. It has to be warmed before application, but is not loosened by wetting. Light adhesive plasters, court plasters, and the like, are made of silk or goldbeater's skin, covered on the adhesive side with a solution containing isinglass and gum-benzoin, while the back of the plaster receives a varnish of Chian turpentine and benzoin. These plasters are wetted before application.

**Stick'leback** (*i. e.* "back with spines"), a name applied to the species of the family Gasterosteidæ. This family, on the whole, agrees with the typical constituents of the order Teleocephali, but it and some others (Aulostomidæ, Fistulariidæ, etc.) exhibit important peculiarities which necessitate their isolation as an independent sub-order (or, according to Cope, an order) which has been named Hemibranchii (which see). The popular designation is given on account of the stout rigid spines with

which the back is armed. The form is fusiform and more or less elongated; the body naked or covered with lateral plates; the lateral line little defined and continuous; head compressed, conic, or more or less produced forward; cheeks covered by the enlarged second suborbital bones; opercular bones unarmed; mouth terminal, and with an oblique lateral cleft, but rather small; teeth villiform, and confined to the jaws and pharyngeal bones; branchial



The Stickleback (*Gasterosteus aculeatus*).

apertures continuous below; branchiostegal rays three on each side; dorsal fin represented by a variable number of free stout spines (2–15) and an oblong fin with articulated rays; anal fin obliquely opposed to the dorsal; caudal well developed; pectorals well developed, and separated by a broad area from the head; ventral fins represented by enlarged spines with an axillar ray each, and inserted more or less behind the basis of the pectorals. The stomach has pyloric cæca in small number (2), and the air-bladder is simple. The forms agreeing in these characters are differentiated by others, and several quite distinct generic types exist. These are (1) *Gasterosteus*, which has two or three free dorsal spines; (2) *Pygosteus*, which has seven to nine free dorsal spines; (3) *Apeltes*, which is distinguished by the absence of a bony cuirass between the ventral fins; and (4) *Spinachia*, peculiar in the family for its elongated form and the large number (15) of dorsal spines. Co-ordinated characters exist which serve to combine the first three genera in one sub-family (Gasterosteinæ), and the fourth in another (Spinachiinæ). The Gasterosteinæ are inhabitants of fresh and brackish as well as salt water, and the freshness or saltness of the water seems to be a matter of indifference to them; the Spinachiinæ, however, are confined to salt water almost exclusively. *Gasterosteus* and *Pygosteus* are found in North America, as well as Europe and Asia; *Apeltes* is confined to North America, and *Spinachia* to the seas of Northern Europe. The species are all small, rarely exceeding six inches, and generally very much less. Although so small, they are nevertheless extremely pugnacious and voracious, and attack without hesitation animals many times larger than themselves. The females are plain-colored, but in the breeding season the males assume resplendent hues, which render them quite attractive, and which are very changeable and affected by the nature of the ground as well as their passions. The most notable peculiarity about them is the care which they take of their young. The species are all, so far as known, nest-builders, and construct quite elaborate receptacles for their eggs; but the males do all the work. The nests of the different generic types differ in details. They are all, however, formed of particles of grass, roots, sticks, or leaves, which are united together by a viscid mucus or kind of silk-like thread exuded from the body and wound round the material collected. The *Gasterostei* excavate a cavity at the bottom of the water, and, laying therein the foundations, build up the sides and roof. The *Pygostei* select adjoining reeds some distance above the bottom, and construct their nests in mid-water. In all cases an aperture is left, and elaborately prepared at the side for the entrance of the female. After the nest is ready, the male seeks out a gravid female, conducts her to the nest, and she deposits a few eggs, and then escapes by an aperture already made or which she herself makes opposite to the one she entered by. This is repeated day after day until a considerable number of eggs is accumulated. Each time the male rubs himself against the female and passes over the eggs. For about a month, while the eggs are maturing, the male watches over them with jealous care, and only leaves when the young are hatched and ready to care for themselves. The eggs are large in proportion to the size of the fish, and few in number, not much, if at all, exceeding 100 in the common *Gasterostei*. This may be considered a characteristic, co-ordinated with the care taken of them. The habits of these fishes are the subject of quite an extensive literature. The number of species is doubtful, some naturalists admitting many and others few. In the North Pacific are several genera (*Aulorhynchus*, *Aulichthys*, and *Auliscops*) which are nearly related to *Spinachia*, but differ in such respects as to have been combined in a peculiar family named Aulorhynchidæ.

THEODORE GILL.

**Sticoah,** tp., Cherokee co., N. C. P. 398.

**Stieg'litz** (HEINRICH), b. at Arolsen, principality of Waldeck, Germany, Feb. 22, 1803; made some desultory studies in philosophy and philology at the universities of Göttingen and Leipsic, and was appointed custos in the library and teacher in the gymnasium of Berlin in 1828; in the same year he married Charlotte Sophie Willhöft (b. in Hamburg June 18, 1806). On various occasions he wrote verses for the benefit of the Greeks, in the *Berliner Musenalmanachs*, etc. Other works are—*Bildern des Orients* (4 vols., 1831–33), *Stimmen der Zeit in Liedern* (1834), etc. To arouse the vigor of his mind, his wife stabbed herself, Dec. 29, 1834. He continued to lead a wandering life; wrote poems—*Gruss an Berlin* (1838); travelling sketches—*Montenegro und Montenegriner* (1841), *Istrien und Dalmatien* (1845); confessions—*Selbstbiographie* (1865) and *Erinnerungen an Charlotte* (1865), all lean, unimpressive, insignificant, and died of cholera at Venice Aug. 24, 1849.

**Stieh'le, von** (GUSTAV), b. at Erfurt, Prussian Saxony, Aug. 14, 1823; entered the Prussian army in 1840, and made his career in the staff. In 1860 he took charge of the historical department of the staff; in 1864 he made the Danish campaign in the staff of Wrangel; was ennobled, created a lieutenant-colonel and royal aide-de-camp, and subsequently military attaché in London and Vienna; in 1866 he was a member of the staff of the king, participated in the preliminaries of Nicolsburg, and carried on the final military negotiations subsequent to the Peace of Prague; in 1870–71 he was chief of staff of the second army under the command of Prince Friedrich Charles, and concluded the capitulation of Metz with Gen. Jarras, Oct. 27, 1870. After the war he was made director of the general department of war in Nov., 1871, and lieutenant-general and commander of the 7th infantry division Oct. 29, 1875.

**Sti'gand** (WILLIAM), b. in 1827; was educated at Shrewsbury School and St. John's College, Oxford; studied equity law at Lincoln's Inn, and was called to the bar in 1852; has resided in France, Italy, and Germany, and travelled in Spain and the Orient. He has contributed to the *Edinburgh Review* and the *Quarterly Review*, and has published *A Vision of Barbarossa and other Poems* (1860), and *Athenais, or the First Crusade*, which is only the first portion, comprising six cantos, of an epic in the Spenserian metre (1866).

**Stigma.** See PISTIL.

**Stigmatiza'tion** [from Gr. στίγμα, "a puncture"], a term employed in the legendary literature of the Roman Catholic Church to denote the miraculous impression upon certain saints of marks similar to the five wounds of Christ (*stigmata*) or of the crown of thorns. The most remarkable instances are those of St. Francis of Assisi (Sept. 15, 1224) and Veronica Giuliani (1694). Many persons, among whom was St. Catharine of Siena, are alleged to have felt at regular intervals the pain of such wounds, but without any external mark.

**Stiles,** p.-v. and tp., Oconto co., Wis. P. 373.

**Stiles** (EZRA), D. D., LL.D., b. at North Haven, Conn., Dec. 15, 1727; graduated at Yale College 1746; studied theology; was ordained a Congregational minister June, 1749; was tutor at Yale College 1749–55; engaged in a series of researches with an electrical apparatus sent to the college by Dr. Franklin, and made the first electrical experiments in New England; preached for a short time to the Stockbridge Indians 1750; studied law; was admitted to the bar 1753, and practised two years in New Haven; pronounced a Latin oration in honor of Franklin on the occasion of his visit to New Haven Feb., 1755; was pastor of a church at Newport, R. I., 1755–77; was inaugurated president of Yale College June 23, 1778; acted also as professor of divinity after 1780; delivered lectures on scientific subjects; studied several Oriental languages; carried on scientific and philological inquiries by means of correspondence with travellers in remote portions of the earth; published many addresses and sermons; was author of a *History of Three of the Judges of King Charles I.* (1794) and *An Account of the Settlement of Bristol* (1785), and left to Yale College 45 bound volumes of MSS. and correspondence. D. at New Haven May 12, 1795. His daughter married Dr. Abiel Holmes, who published his *Life* (1798) and edited the *Family Tablet* (1796), containing poems by members of the Stiles family.

**Stiles** (HENRY REED), M. D., b. in New York City Mar. 10, 1832; studied medicine; practised as a physician at Galena, Ill., and afterward at Brooklyn, N. Y., and filled important medical and sanitary offices in that city and in New York. Author of a *History of Ancient Windsor, Conn.* (1859), with a *Supplement* (1863), *The Stiles Genealogy* (1863), *History of Brooklyn, N. Y.* (3 vols., 1869–70),

*Bundling, its Origin, etc.* (1869); edited the *Autobiography of Thomas Douglas* (1856), *The Wallabout Prison-Ship*, *The Revolutionary Adventures of Ebenezer Fox*, Andrew Sherburne's *Memoirs*, and the *Prison-Ship Narrative*, and has been an important contributor to the *New York Historical Magazine*, of which he was also for some time the editor.

**Stiles** (William H.), b. in Savannah, Ga., about 1810; studied law; commenced practice at Savannah 1831; was solicitor-general of the eastern district of Georgia 1833–36; member of Congress 1843–45, chargé d'affaires to Austria 1845–49, and was a colonel in the Confederate army. D. at Savannah Dec. 20, 1865. Author of a *History of Austria in 1848–49*.

**Stiles'ville,** p.-v., Franklin tp., Hendricks co., Ind. P. 205.

**Stil'icho,** son of a Vandal chieftain in the Roman service; grew up in the camp, but developed such eminent talents in military, administrative, and diplomatic affairs that the emperor Theodosius gave him his niece and adopted daughter, Serena, in marriage, made him commander-in-chief of the whole military force of the Western empire, and appointed him guardian to the young Honorius. After the death of Theodosius (in 394 A. D.) Stilicho was the actual ruler of the Western Roman empire, and it is probable that he subsequently formed an idea of placing his own family on the imperial throne; he married his son to Placidia, the daughter of Theodosius, and his daughter, Maria, to the emperor Honorius. The earlier part of his career was mostly occupied by rivalries with Rufinus, guardian of Arcadius, who had received the Eastern Roman empire, and the feuds ended with the assassination of Rufinus. But soon more serious affairs demanded his attention. In 403, Alaric invaded Northern Italy, and the empire was in imminent danger. Stilicho brought in haste the legions together which were stationed in Britain, Gaul, and all along the northern frontier of the empire; defeated Alaric first at Pollentia, then at Verona, and drove him out of Italy. A second time he saved the empire. On the withdrawal of the legions from the frontiers immense swarms of Vandals, Alans, Sueves, etc., gathered under Radagaisus, invaded Italy in 406, and besieged Florence. With a small army of veterans and some auxiliary troops composed of Visigoths and Huns, Stilicho attacked them, compelled them to give battle, and routed them completely; Radagaisus was put to death and his troops were sold as slaves. In spite of these brilliant successes, his position became by degrees totally undermined. The Roman authority was much weakened in the provinces by the recall of the legions, and in some places—as, for instance, Britain—it was never really re-established. This gave rise to a general discontent among the vainglorious Roman people, and at the court, Olympius, a eunuch, succeeded in turning the mind of the young emperor from his guardian by exciting his jealousy, and even his fear. While Stilicho was encamped at Bologna, a number of his friends were put to death at Pavia under a riot which was instigated by Olympius and the emperor. In the camp Stilicho's friends demanded, for the sake of their own safety, that he should march immediately against Pavia and punish Olympius; and when he hesitated they rebelled against him. He fled from the camp and took refuge in a church of Ravenna, from which, however, he was allured, and assassinated Aug. 23, 408.

**Still** (John), D. D., b. at Grantham, Lincolnshire, England, about 1543; educated at Christ's College, Cambridge; took orders in the Church of England; became Lady Margaret professor of divinity at Cambridge 1570; held livings in Suffolk and Yorkshire; became prebendary of Westminster 1573, master of St. John's College 1574, and of Trinity College 1577, archdeacon of Sudbury 1577, prolocutor of the convocation 1588, and bishop of Bath and Wells 1592. D. at Wells Feb. 26, 1608. Author of *A Ryght Pithy, Pleasant, and Merie Comedie, intytuled Gammer Gurton's Nedle, played on the Stage not longe ago in Christe's Colledge in Cambridge. Made by Mr. S., Master of Arts*, etc. (London, 1575). This piece, abounding in low humor, supposed to have been written as early as 1565, was long considered the first extant English comedy, but that rank is now assigned to Udall's *Ralph Royster Doyster*.

**Stillé** (Alfred), M. D., b. in Philadelphia Oct. 30, 1813; graduated at the University of Pennsylvania in 1832; became resident physician at the Philadelphia Hospital in 1836; afterward studied in Paris and other European cities, and returning to America became resident physician at the Pennsylvania Hospital 1839–41; lecturer on pathology and practice of medicine to the Philadelphia Association for Medical Instruction 1844–50; physician to St. Joseph's Hospital 1849; professor of the theory and practice of medicine in the Pennsylvania Medical College 1854–59, and in 1864 in the University of Pennsylvania. Besides contributions to journals, he has published *Medical Instruction in the U. S.* (1845), *Elements of General Pathology* (1848), *Report on Medical Literature* (1850), *The Unity of Medicine* (1856), *Humboldt's Life and Character* (1859), *Therapeutics* (1860; enlarged and revised eds. 1864 and 1874), *War as an Element of Civilization* (1862), and *Epidemic Meningitis* (1867).

**Stillé** (Charles Janeway), LL.D., b. in Philadelphia in 1819; graduated at Yale in 1839; became professor of English literature in the University of Pennsylvania in 1866, and provost of the university in 1868. Besides several literary addresses, he has published—*How a Free People Conduct a Long War* (1862), *Northern Interest and Southern Independence* (1863), *The Historical Development of American Civilization* (1863), *Memorial of the Philadelphia Central Fair for the U. S. Sanitary Commission* (1864), *History of the U. S. Sanitary Commission* (1866), and *Memoir of Rev. William Smith, D. D.* (1869).

**Stillé** (Morton), M. D., b. in Philadelphia Oct. 27, 1822; graduated in medicine at the University of Pennsylvania in 1844; subsequently studied his profession in Dublin, London, Paris, and Vienna; began practice in Philadelphia in 1847; was resident physician at the Pennsylvania Hospital 1848–49; revisited Europe 1850–52, and became lecturer in the Philadelphia Association for Medical Instruction in 1857. He prepared, in conjunction with Francis Wharton, a *Treatise on Medical Jurisprudence* (1855; 2d ed., with the medical portion revised and enlarged by his brother, Alfred Stillé, 1860). D. at Saratoga Aug. 20, 1855.

**Stil'lingfleet** (Edward), D. D., b. at Cranbourne, Dorsetshire, in 1635; was educated at Cambridge; entered holy orders; became rector of Sutton in 1657; preacher at the Rolls 1664; rector of St. Andrew's, Holborn, and lecturer at the Temple 1665; prebendary of St. Paul's 1667 and of Canterbury 1669; chaplain to Charles II. 1670; archdeacon of London 1677, and bishop of Worcester 1689, holding also several other ecclesiastical preferments. He ranks among the foremost of English polemics, his life having been an almost uninterrupted controversy with Roman Catholics, Nonconformists, and Socinians. His collected works fill 6 large folio volumes, many of them having been frequently republished in different forms. The most important are—*Irenicum, a Weapon-Salve for the Churches Wounds* (1661), *Origines Sacræ, or a Rational Account of the Christian Faith* (1662), *Rational Account of the Grounds of the Protestant Religion* (1665), *Discourse Concerning the Idolatry practiced in the Church of Rome* (1671), *Unreasonableness of Separation from the Church of England* (1681), *Origines Britannicæ* (1685), and *Discourse in Vindication of the Doctrine of the Trinity* (1697). D. at Westminster Mar. 27, 1699.

**Stillin'gia** [named for Dr. Benjamin Stillingfleet, 1702–71], an interesting genus of euphorbiaceous trees, shrubs, and herbs. The U. S. have several species. *Stillingia sylvatica*, or queen's root, is an herb of the Southern States whose root has a good reputation as an antisyphilitic remedy. Our other native species are shrubs. The tallow tree of China (*S. sebifera*) is naturalized in the Southern States. It is a beautiful tree, and from its seeds the Chinese extract large amounts of a white tallow-like fat, very useful for candles. The wood is hard, and is a good substitute for box. The leaves give a black dye.

**Still'man** (Samuel), D. D., b. in Philadelphia Feb. 27, 1737; his parents having removed to Charleston, S. C., he was educated there, and ordained as pastor of a Baptist church in 1759; was subsequently settled at Bordentown, N. J., and finally in 1765 as pastor of the First Baptist church in Boston, where he remained until his death. He was an eloquent preacher, and a warm patriot during the Revolutionary war; was a delegate to the Constitutional Convention of 1788, and one of the original incorporators of Brown University in 1764, taking a warm interest in the welfare of that institution. He published several sermons and discourses, among which are—*On the Repeal of the Stamp Act* (1766), *Ancient and Honorable Artillery Sermon* (1770), *Election Sermon* (1779), *Hon. Samuel Ward*, preached before Congress (1776), *Masonic Discourse at Charlestown* (1785), *Fourth of July Oration at Boston* (1789), and *Washington* (1800). A volume of his sermons, with a *Memoir* by Rev. Thomas Gray, was published in 1808. D. at Boston Mar. 12, 1787.

**Stills.** See Distillation.

**Still'water,** city and tp., cap. of Washington co., Min., at the head of navigation on St. Croix Lake for large steamers, and on Lake Superior and Mississippi and St. Paul Stillwater and Taylor's Falls R. Rs., in lat. 45° N.,

25 miles from Mississippi River, 18 miles from St. Paul. A regular line of small steamers plies between Stillwater and Taylor's Falls, 30 miles above, on St. Croix River. The business portion of the city is located on a small plain surrounded by bluffs, the latter crowned by fine residences. Stillwater contains 10 churches, 2 national and 2 savings banks, a public library, and a club room, and has 3 weekly newspapers. It is the fourth city in size and importance in Minnesota. There are 9 large saw-mills, with a daily capacity of 500,000 feet, employing capital to the amount of $3,000,000. P. of city, 4124; of tp. 4506. Settled in 1843. A. B. Easton, Ed. Gazette.

**Stillwater,** p.-v. and tp., Sussex co., N. J. P. 1632.

**Stillwater,** p.-v. and tp., Saratoga co., N. Y., on Hudson River and on Saratoga Lake, has 4 churches and numerous factories. The township includes the incorporated village of Mechanicsville and the post-village of Bemis's Heights, notable for the two battles of Sept. 19 and Oct. 7, 1777 (sometimes called the battles of Stillwater), which led to the surrender of Burgoyne. P. of v. 737; of tp. 3401.

**Stilt,** a name applied to birds of the genus *Himantopus* (family Recurvirostridæ), and related to the avocet. They are distinguished by the excessively long legs, the straight, slender bill, which is slightly compressed, the feet with the middle and outer toes connected by a small web and destitute of a hind toe, and the tail projecting beyond the wings. Six species of the genus are recognized by G. R. Gray as inhabitants of various parts of the world. One species is found in America, and ranges from the Northern U. S. to Paraguay. Its total length is about fourteen inches, of which the bill forms three inches, and the tail also three inches; the tarsi are about four inches in length, and rather longer than the tibiæ; the color is a glossy black on the head above, the neck behind, the back, and the wings; white on the head in front of and behind the eyes, and beneath; the bill is black, and the legs red. It not only dwells by the sea-coast, but is found far inland, at least on the lakes and rivers of the Western U. S. Individuals generally associate together in flocks of twenty or thirty, more or less. They prefer muddy flats with reedy margins. They breed in the U. S., and make nests of grasses, etc. They lay generally four eggs; these are relatively large and of a yellowish or ochraceous color, with dark-brownish blotches and lines. On the ground, whether walking or wading, according to Coues, they move gracefully and with measured steps; the long legs are much bent at each step (but only at the joint), and planted firmly and perfectly straight. When feeding, the legs are bent backward at an acute angle at the heel-joint, to bring the body lower. They feed mostly on aquatic insects, as well as the eggs and young of fishes, and small fishes of different kinds. Theodore Gill.

**Stilts** [Dutch, *stelt*], sticks or crutches upon which a person stands so as to increase the length of his stride. They are usually mere toys, employed by boys in play, but in the department of the Landes in south-western France the peasantry make use of stilts as a common method of progression through the deep sands of that region. The stilts there used are sometimes very long, and the people acquire great skill in their use.

**Stimp'son** (William), M. D., b. at Roxbury, Mass.; studied medicine, and has devoted himself especially to conchology, upon which he has published many papers in scientific journals and in the *Smithsonian Contributions*. Among his works are—*Revision of the Synonomy of the Testaceous Mollusks of New England* (1851), *Synopsis of the Marine Invertebrata of the Grand Manan* (1854), *Prodromus Descriptionis Animalium Evertebratorum* discovered in the Pacific expedition of Ringgold and Rodgers (parts i.–viii. 1857–60), *Notes on North American Crustacea* (1859), and *Researches upon the Hydrobiinæ and Allied Forms* (1865).

**Stim'ulants** [Lat. *stimulus*], a term very commonly and also very loosely used in medical parlance. It is applied to such agents as are able to promptly set on foot and keep going the immediately vital functions of circulation and respiration. Such are, pre-eminently, strongly nourishing hot food if it can be digested; if it cannot, then alcoholic or ethereal potions, ammoniacal solutions, opium, heat, etc. The term "stimulant" is also used to signify the action of a drug or poison in causing an increased display of function on the part of any particular organ or apparatus. Edward Curtis.

**Stines'ville,** p.-v., Bean Blossom tp., Monroe co., Ind., on Louisville New Albany and Chicago R. R. P. 140.

**Sting-Fish.** See Trachinidæ and Weever.

**Sting'ray,** a name applied to the species of the genus Trygon (family Trygonidæ). They all have the body rhombic and moderately broad, the skin smooth or provided with tubercles, the nasal valves coalescent into quadrangular flaps, the teeth flattened, and the tail long and tapering, and destitute of a true fin, and at most with cutaneous folds, which, however, do not extend to the extremity; the tail is armed with an elongated spine (sometimes with two) compressed from before backward, and with teeth or serratures at each side directed downward. These spines are the "stings" which have ensured the popular name to the forms in question. The species are quite numerous, 24 determinable and 5 doubtful ones having been recognized by Günther. They are found in almost all tropical and temperate seas, and are much dreaded on account of the wounds which they inflict with their spine-bearing tail. They can whip the tail around with great ease, and transfix the incautious intruder with the spines. Tetanus is sometimes the result, but the wound is a physical injury solely, and not the result of poison. A species (*Trygon centrura*) is quite common along the eastern coast of the U. S. (See also Trygonidæ.)

Theodore Gill.

**Stink'stone,** a name applied to certain bituminous limestones which on being struck emit the smell of sulphuretted hydrogen. The British Islands abound in stones of this character and of various geological ages, some of them useful building-stones.

**Stink'-Wood,** the hard, durable wood of *Oreodaphne fœtida* (order Lauraceæ). It grows in South Africa, and is handsome and valuable, but possesses a disagreeable smell, even when seasoned. *O. fœtens*, a tree of the Canaries, has wood of a vile odor, but others of this widespread genus are of pleasing fragrance.

**Stir'ling,** county of Scotland, bordering N. on the Forth, comprises an area of 489 sq. m., with 98,179 inhabitants. The western part of the county is mountainous, and rich in iron, coal, and freestone. In the northern part are found large plains of a rich clayey soil, producing good wheat, barley, beans, and clover. Agriculture, cattle-breeding, mining, and manufacturing are pursued with success.

**Stirling,** town of Scotland, capital of the county of Stirling, on the Forth, contains a fine old castle, has extensive manufactures of tartans, shawls, rope, soap, leather, and malt, and carries on an important trade both on the river and by its extensive railways. P. 14,276.

**Stirling,** p.-v. of Hastings co., Ont., Canada, 15 miles N. W. of Belleville, is the seat of considerable trade and manufacturing interests. P. 779.

**Stirling** (James), F. R. S., b. in Stirlingshire, Scotland, in 1690; educated at Baliol College, Oxford; taught mathematics for several years at Venice; conducted a nautical school on Tower Hill, London, and afterward superintended the mines at Leadhills, Scotland, where he d. in 1772. He made some remarkable mathematical discoveries in regard to Newton's "lines of the third order" and methods of differentiation, which were embodied in his Latin tracts *Lineæ Tertii Ordinis Neutonianæ, etc.* (Oxford, 1717), and *Methodus Differentialis, sive Tractatus de Summatione et Interpolatione Serierum Infinitarum* (London, 1730), and contributed to the *Philosophical Transactions* papers *On the Figure of the Earth* (1735) and *On a Machine to Blow Fire by the Fall of Water* (1745).

**Stirling** (James Hutchison), LL.D., b. in Scotland about 1835; received a thorough training in literature, philosophy, and science, and is author of *The Secret of Hegel, being the Hegelian System in Origin, Principle, Form, and Matter* (2 vols., 1865), *Sir William Hamilton, being the Philosophy of Perception* (1865), *Jerrold, Tennyson, Macaulay, and other Essays* (1868), *As Regards Protoplasm* (1869), and other works, and the translator of Dr. Albert Schwegler's *Handbook of the History of Philosophy* (1867). Dr. Stirling is an opponent of Häckel and Huxley on biological theories.

**Stirling** (Lord). See Alexander (William), Earl of.

**Stirling** (Patrick James), b. at Dunblane, Perthshire, Scotland, in 1809; studied law but never practised; became pupil of Dr. Thomas Chalmers in political economy, and published *The Philosophy of Trade, or Outline of a Theory of Profits and Prices* (1846), *Australian and Californian Gold Discoveries* (1852), and translated Frederick Bastiat's *Harmonies of Political Economy* (1860), to which he prefixed a notice of the life and writings of the author.

**Stirling** (Sir Thomas), Bart., of Ardoch, b. in Scotland about 1735; became a captain in the Royal Highlanders July, 1757; served under Abercrombie at Lake George 1758, and Amherst at Lake Champlain 1759, at the siege of Niagara, and the invasion of Lower Canada 1760; was stationed in 1765 at Fort Chartres, Ill., whence he marched to Philadelphia 1766, became lieutenant-colonel 1771, col-

onel 1779, and major-general Nov., 1782; served throughout the war of the Revolution; took part in the battles of Long Island, Fort Washington, Red Bank, Brandywine, and Springfield; was made a baronet and lieutenant-general 1796, and full general Jan. 1, 1801. D. May 9, 1808.

**Stirling** (Sir WILLIAM). See MAXWELL.

**Stith** (WILLIAM), b. in Virginia in 1689; was educated in England, where he studied theology and took orders in the Church of England 1731; became in that year master of the grammar-school of William and Mary College; chaplain of the Virginia house of burgesses 1738, and president of William and Mary College and rector of Henrico parish from 1752 to his death, at Williamsburg, Sept. 27, 1755. He was a brother-in-law of Peyton Randolph, and author of a *History of the First Discovery and Settlement of Virginia* (Williamsburg, 1747; 2d. ed. 1753), of which a reprint was recently issued by Joseph Sabin (New York, 1866). It traces the history only to 1624, has been by some critics censured as inelegant in style, but is admitted to be accurate and faithful, and the work is of the greater value since the materials on which it was based were destroyed by fire.

**Stitt'ville,** p.-v., Trenton and Marcy tps., Oneida co., N. Y., on Utica and Black River R. R. P. 243.

**Stoat.** See ERMINE.

**Stobæ'us** (JOANNES) received his surname from the circumstance of his being a native of Stobi in Macedonia. Nothing else is known of his personal life, not even the age in which he lived, though it cannot have been much earlier or later than the sixth century of our era. For the instruction of his son, Septimius, he made a collection of pithy sayings on various subjects from about 500 Greek authors, and these quotations have become of great interest to us, as in most cases the works from which they were taken have perished. They are arranged in two separate works—*Anthologion* and *Eclogæ*—both edited by Meineke, the former in 4 vols. (1855–57), the latter in 2 vols. (1860–62).

**Stock.** See GILLIFLOWER.

**Stock,** tp., Harrison co., O. P. 771.

**Stock,** tp., Noble co., O. P. 1650.

**Stock'bridge,** p.-v. and tp., Berkshire co., Mass., on Housatonic River and R. R., has 2 banks, a public library, an academy, 1 woollen, 1 paper, 4 pulp, 3 grist, and 3 saw mills; is noted for picturesque mountain-scenery; includes the beautiful Lake Mahkeenac, and has numerous villa residences, chiefly occupied during the summer by wealthy citizens of Boston. Originally called Housatonic, this township was the chief residence of the tribe of Indians of the same name, also called Stockbridge Indians, who were christianized in the eighteenth century by the labors of John Sargeant, Timothy Woodbridge, and the celebrated Jonathan Edwards (1751–57), to whose memory a monument has been erected here. The tribe, numbering 400, removed after the Revolution to Madison co., N. Y., afterward to the vicinity of Green Bay, Wis., and now reside near Fort Leavenworth, Kan. Stockbridge was the native place of several eminent persons, including Miss C. M. Sedgwick, Mark Hopkins, and Cyrus W. Field. P. 2003.

**Stockbridge,** p.-v. and tp., Ingham co., Mich. P. 892.

**Stockbridge,** p.-v. and tp., Madison co., N. Y., on Oneida Creek and on New York and Oswego Midland R. R., has 6 churches, valuable limestone and gypsum quarries, and several factories; was formerly the residence of the Stockbridge or Housatonic Indians, who came here from Stockbridge, Mass., after the Revolution, and removed to Wisconsin early in the present century. The remains of an ancient Indian burial-place and the ruins of a prehistoric fortification are pointed out. P. 1847.

**Stockbridge,** p.-v. and tp., Windsor co., Vt., on White River. P. 1289.

**Stockbridge,** p.-v. and tp., Calumet co., Wis., on Lake Winnebago, formerly the residence of the tribe of Stockbridge Indians from New York. P. 1978.

**Stockbridge** (HENRY), b. in Hampshire co., Mass., Aug. 31, 1822; graduated at Amherst College in 1845; studied law in Baltimore, and was admitted to the Maryland bar in 1848. During the civil war he took an earnest part in favor of the Union; in 1864 was a member of the legislature, and drafted the act by which a constitutional convention was convened for the abolition of slavery in Maryland; was a member of that convention, took an active part in its proceedings, exerted himself to secure the adoption of the constitution framed by it, and defended it before the court of last resort. He instituted and conducted to a successful issue in the Federal courts proceedings by which were annulled the indentures of apprenticeship by means of which the effect of the emancipation clause was sought to be evaded, and thus secured the enfranchisement of more than 10,000 colored children in the State.

**Stock Corporations.** See STOCKS, LAW OF, by PROF. J. N. POMEROY, LL.D.

**Stock'-Dove,** the *Columba œnas*, a wild European pigeon, named from its habit of nesting in hollow *stocks* or tree-stumps, although it often builds in rabbit-burrows, etc. It is a handsome gray bird, with a purplish breast, scarlet eyes, orange bill, and red toes and legs. It is some fourteen inches long. The young birds are prized as food.

**Stock'-Exchange,** an association of brokers and dealers or jobbers in stocks, bonds, and other securities created either under national, State, or municipal authority, or by corporations concerned with the business of common carriers, with mining, manufacturing, banking, or other commercial or industrial pursuits. In the U. S. such securities, when evidences of debt, importing an engagement to pay a sum of money on a future day, are denominated bonds; while under the name of stocks are included shares in the stock of corporations, representing money contributed to the particular enterprise at the outset, at the risk of the business. But State bonds are also called stocks, and sometimes stock, in the singular. In England railroad bonds are known as debentures, and seldom have the security of a mortgage, while the word "stock" is there applied: (1) to the public funds or government securities, representing money lent to the nation; and (2) to the capital stock of railway or other companies when it is not divided into shares, but is indicated as so much money, at the original par value.

Joint-stock companies, having the privilege of a limited liability of the shareholders, are among the most efficient of all the devices of modern ingenuity for the furtherance of undertakings far beyond the resources of any single individual or firm. It is a truism to say that without the aid of associated capital the grand engineering works which are a principal boast of our times would never have been possible; and it is obvious that the stock exchange acts as a powerful auxiliary to the principle of association, by attracting capital from hoards or passive investments, familiarizing the public with the comparative merits of different undertakings, holding up its attractive prizes as the rewards of judicious adventure, though, by its occasional disasters and panics, pointing out the ruinous nature of the unsound or unwarranted enterprise, and the peril which constantly attends upon over-construction and over-trading. Affording a market always at the service of any who desire to discontinue or change their investments, it has enormously enlarged the circle of investors, which would else almost have been limited to the small number of people who can hold on for a lifetime. Furnishing a demand for money on call loans, repayable at the lender's option, and secured by a deposit of pledges immediately convertible into cash, it has rendered serviceable the vast mass of floating capital always present at the chief commercial centre awaiting permanent employment.

*History.*—The earliest annals of the New York Stock Exchange are somewhat meagre, the great fire of 1835 having destroyed the record of the constitution adopted in 1817, the date of its first regular organization. A tablet in the wall of the present board-room declares indeed that the exchange was founded in 1792, but the evidence of so early an origin consists only in a document bearing that ancient date still preserved among the archives, and containing a mutual agreement on the part of its twenty-four subscribers that they "will not buy or sell for any person whatsoever any kind of public stock at a less rate than one-quarter per cent. on the specie value," and that they will give a preference to each other in their negotiations. Only a few of the names are recognizable as among the members of the institution established twenty-five years later, and the organization was probably quite imperfect. The business of a stockbroker early in the present century comprised dealings in sterling exchange, commercial paper, specie, and bullion, everything relating to exchanges of money, the procuring of loans on mortgage, and other miscellaneous negotiations, besides sales of the few stocks and bonds then current. Transactions were mostly at the Tontine Coffee-house, on the N. W. corner of Wall and Water streets—a place of great resort for merchants—and on the street near by, or under the shade of an ancient and famous buttonwood tree which grew in front of No. 60 Wall street. The revival of commerce after the war of 1812–15 gave occasion for a vigorous growth of mushroom companies and for several new local banks in or near the city, and there was soon an obvious need of a formal association of brokers. Such a need will always be felt when men congregate for the transaction of business in commodities which are liable

to sudden and wide fluctuations in price, and where bargains of magnitude require to be made in haste and without formal writings. This want led to the formation in 1817 of the New York Stock and Exchange Board. Of the founders of the association there are still (1876) two venerable survivors, Mr. John Warren (b. 1796), who only relinquished active business in 1875, and Mr. William Lawton (b. 1795). The constitution of 1817 was based upon that of the board at Philadelphia, obtained from that city by a special committee of which Mr. Lawton was one. There were at first about 25 members, and no initiation-fee was required. Anthony Stockholm is believed to have been the first presiding officer. The oldest quotations appearing on the records are of date Aug. 18, 1817, as follows: U. S. 6s, 103¼@½; Louisiana 7s, 108¼@½; ditto 3s, 65; Yazoo, 79½ bid; N. Y. State 6s, 100½; City 6s, 101; U. S. Bank, 141 bid. Exchange: on London, par (the old par of $4.44 to the £); francs, 5 fr. 40c. (to the dollar); Amsterdam, 39. Spanish dollars, 100¾. The meetings were held in the office of Mr. Samuel I. Beebee, No. 47 Wall street, then in a room in the rear of Mr. Leonard Bleecker's, and afterward in the old *Courier and Enquirer* building, near the buttonwood tree. The revised constitution of 1820, the oldest extant, was signed by 39 members before 1821. Many of these, such as Nathaniel Prime, Leonard Bleecker, John G. Warren (father of Mr. John Warren), and Philip Kearny, were gentlemen of long experience in the banking business, and of the highest character. The tone of the old records bears witness to their nice sense of commercial honor and scrupulous regard for the right, as well as their dignified and urbane manners. The membership increased slowly until 1824, when 12 were added, including J. L. Joseph, afterward eminent as a leader; his firm were agents for the Rothschilds. In 1825 we first find the name of Jacob Little, who perhaps has had the widest reputation as an operator until recent times. Other notabilities were the Wards, Samuel, John, and Henry; and, later, Morris Franklin, the Gallatins, the Nevinses, and John Alstyne. The initiation fee was fixed at $25 in 1823; raised in 1827 to $100 and to $150 in 1833. A retiring president (as, for instance, Mr. James W. Bleecker, 1827–30) was usually presented with a service of plate, and the custom has come down almost to the present. In May, 1827, the board removed to an upper room in the Merchants' Exchange, on Wall and William streets, the windows looking out on Garden street, now called Exchange Place. The sessions were invariably secret, and it was a point of honor, then as long afterward, not to reveal the names of buyers or sellers, the dealings not being recognized by law. Small lots of stock were most common, 10 or 25 shares, and 1000 would have been a handsome aggregate for a day. Transactions were chiefly on a credit of 10, 30, or 60 days, sometimes 6 or 12 months, the property meanwhile remaining with the seller, and the buyer paying interest. A list was kept of the various securities—U. S. or State stocks, shares of the U. S. Bank, the city banks, insurance companies, etc.—and these, in their order, were called up one by one. Dealings were allowed in each security only as it was reached in turn, and when the list was exhausted, business closed for the day. The secretary kept a record of all bargains, and the minutes, read over at the conclusion, were final evidence of the terms of contracts. This *call* of stocks long continued the model after which the business was conducted, and as to all but the active speculative shares it is still observed. When a contract matured, the seller delivered the property to the buyer by going to the transfer-office of the company issuing the stock and making an assignment to him of the required number of shares. When the stockholder of record could not personally attend, he gave a warrant of attorney to a third party to effect the transfer. This warrant, sometimes signed in blank, might be filled up by the holder with the name of the attorney. The buyer might or might not take out a certificate of stock, the company's books being sufficient evidence of ownership. He was bound to make payment in full, and in strictness might be required to furnish bank-notes or a certified check, though in early days such a demand was rare. The custom of delivery by transfer continued until a recent period, except in the case of companies having no transfer-office in New York, when the seller might tender a certificate, accompanied by a power of attorney to effect a transfer on the books of the corporation wherever kept; this latter is now the usual method. The call ended, the brokers returned to their offices to make private record of their doings and report to clients. In process of time a second (though informal) call was held in the afternoon. The generally steady growth of the board was checked by a severe panic in 1826. By 1830 several railroad stocks had come into the market, such as Mohawk, Catskill, and Harlem. Morris Canal and Delaware and Hudson Canal also became active. In 1834 the trade in U. S. stocks was of such magnitude and the fluctuations so violent that the "Union committee" of that day addressed a remonstrance to the board against "excessive speculations" (meaning chiefly the time-bargains at long-sellers' options), "tending to breed distrust and unsettle confidence," though the board in a dignified tone declined to recognize the propriety of "this interference." The prosperity of the association from time to time may be fairly estimated by the amount of its annual charitable donations—$550 in 1825, and so nearly every year, with occasional extra gifts, until 1836, which marks a high tide with a regular appropriation of $2100. In 1838, $1000 were contributed to the relief of sufferers by the great Charleston fire. These charities, more liberal than they now seem, are entitled to rank with the gift of $5000 to the Sanitary Commission twenty-five years later, since even in 1840 the board had only 87 active members. After the fire of 1835 the sessions were for some years held at a hall in Jauncey Court. The five years following the financial crash of 1837 were characterized by depression in the stock business as in the general trade of the country. In 1840 the surplus fund, about $20,000, was distributed among the members, many of them finding the dividend of about $200 very welcome. The initiation fee from $350 was reduced to $200, and in 1843 the officers' salaries were cut down nearly one-half. After the return of the board to a hall in the (rebuilt) Merchants' Exchange in 1842, serious detriment was experienced from a rival organization called the "Bourse," composed partly of former members of the board who had obtained discharges in bankruptcy under the U. S. law of 1841, but were not, by the rules of the Stock Exchange, entitled to readmission. This Bourse, or "open board," met at a lower room in the Exchange building. By 1846 most of its members were absorbed by the regular board, and its sessions discontinued. The year 1844 was distinguished by a long-remembered panic (June 12), with a sudden fall of 30 to 40 per cent. in some stocks.

The downfall of the "Bourse" was the signal for renewed prosperity in the Stock Exchange. The initiation-fee was advanced to $400, and many new members were received. During the ten years following, railway construction proceeded with rapidity, the volume of business, both speculative and for investment, increased many fold, and the basis for improvement was substantial, depending, not as in 1835–37 on an inflated currency, but on actual progress of the railway system, especially toward the West, and in part on the earnings of completed roads. A further stimulus was given by the influx of gold from the California mines. A rude shock was indeed experienced in 1854 from the frauds of Robert Schuyler, president of the New York and New Haven R. R. Co., who issued spurious certificates of its stock to the amount of $1,900,000, but the business of the street, with that of the country, soon recovered. Its activity was greatly heightened by the excessive issues of bank-notes, until in 1857 the sudden failure of the Ohio Life and Trust Co. brought on a panic of extreme severity, with an enormous decline in shares, widespread insolvency, and the serious crippling of many solid railroad enterprises. The fall brought large profits to a few who had looked for it, and who stood "short" of stocks, some contracts for future delivery having been settled at a profit of 50 to 80 per cent. to the bears. Quotations ruled very low for the next four or five years, stocks which now hold a high rank having been depressed in 1859–61 to 5 per cent. of their par value, since it was then doubtful whether the properties could be saved from foreclosure under mortgages. The tide first decidedly turned after the passage of the legal tender act, or after Congress most injudiciously took away from the U. S. notes their right of conversion into bonds. The outbreak of the civil war was met by a burst of loyal enthusiasm in the Stock Exchange, evidenced by liberal gifts of money, resolutions of sympathy with those of its members who volunteered, and a vote of all the surplus in the treasury in aid of the national cause. Securities of the rebellious States issued after secession were forbidden to be dealt in. The rising tide of irredeemable paper soon told upon prices, and the years 1862–63 witnessed a general advance. The U. S. loans were on a scale quite too large for the means of New York capitalists alone, though their subscriptions were most liberal, but all the new national securities were heartily welcomed to the list, and the first offer at the board to sell U. S. stocks "short" was indignantly rebuked. The suddenly-acquired riches of contractors, and the presence in New York of large amounts of Southern capital, served to fan the flame of speculation in stocks and gold, which soon attained a great height. A sudden turn of the screw by Secretary Chase in 1864 produced a fall (in Fort Wayne from 152¾ to 101) known as the Morse panic, from the failure of Anthony W. Morse, a wild leader of the "bull" movement; but the reign of high prices was in a few months restored, and the brokers were all too few for the

business crowding upon them. The sessions of the board were too few and too short; even the day was too short; the market opened before 9 A. M., filled the street and the sidewalks near the Exchange, continued through the daylight, and was then adjourned to the Fifth Avenue Hotel, where an excited crowd found midnight come too early. A new open board, organized 1863 in a William street basement, historically known as the "Coal-hole," had several hundred members and transacted an enormous business. An evening exchange up-town was the scene of great traffic until its excesses compelled the down-town board to suppress it in 1865. The "open board of brokers" soon had a fine hall of its own on Broad street, and acquired an importance for numbers and wealth which in 1865–69 brought to it a full half of the speculative business. The existence of two rival associations was found inconvenient, and after long warfare and negotiation a consolidation was effected in 1869. A branch of the old board, called the government stock department, was also absorbed. The initiation-fee for new members was raised from $3000 to $10,000, but memberships were made transferable, subject to an election as usual, and to the payment of $500 besides the purchase-money. Members have since been received only by purchase, the market-price of seats having varied between $8500 at the highest and $2500; an average of about $5500 is near the present value. From Dec., 1868, to Apr., 1876, 482 seats were sold, changing nearly half of the entire membership, which numbers 1060. In cases of failure, and inability to settle with creditors within a reasonable time, sales are compulsory, proceeds being divided among board-creditors, and any residue paid to the outgoing member. The government of the board, originally a democracy, was vested in a committee of forty, who are classified, and only one-fifth elected in each year. A sub-committee of fifteen decides upon the admission of new members, ten affirmative votes being requisite to an election.

The Black Friday gold-panic of 1869 was followed by many disasters at the Stock Exchange. The great fire at Chicago in 1871 occasioned a decrease of more than 200 millions in the market-value of securities dealt in at the board, numerous failures resulted, and the recovery was not rapid. The Boston fire of 1872 was less severely felt, though its consequences were serious. But the panic of 1873, precipitated by a discovery of unsoundness in one or two leading banking-houses, though caused by excessive outlays of capital in unnecessary and unprofitable railroad construction brought suddenly to a standstill, probably surpassed all others known to this country in duration, intensity, and destructiveness. The board was closed for ten days, during which period all dealings were irregularly effected in the streets; there existed no means of enforcing contracts; and, as confidence in the solvency of the banks was impaired, and those institutions generally declined payment in money, there was hardly any circulating medium. The life-blood of trade was so nearly wanting that 1 per cent. per diem was gladly paid for the use of large sums of money. Adjustments were mostly effected by compromises, as after the unprecedented decline both bulls and bears were involved in a common disaster. The Granger movement at the West during the two following years aggravated the depression and checked recovery, nor was the restoration of confidence in any way helped by the fresh issues of U. S. notes, as these gravitated to New York, and there long continued idle. Periods of spasmodic activity in the stock-market occasionally recur; on single days of great excitement the sales have aggregated 450,000 shares, but 200,000 would represent a good day's business. Of this only a very small fraction is done at the various *calls*. The trade in active stocks is continuous throughout the day from the opening at 10 o'clock until the close at 3. A separate group in the board-room is devoted to each security. A call of the whole list of stocks twice a day is kept up as a matter of form, and is of service in the case of a few inactive stocks. The government, State, and railroad bonds, bank stocks, etc., also have their separate calls daily in an upper room devoted to the purpose, but the transactions in these are comparatively small.

The sales are all reported to the various brokers' offices immediately on their occurrence by means of an ingenious printing telegraph, a recording instrument being placed in each office. A complete history of each day's operations is thus spread out under the eyes of clients, who can watch its gradual development. The recording instruments number more than 700, and are found in the principal hotels and other places of general resort throughout the city. A few exist in other cities, such as Boston and Philadelphia, placing the subscribers in instantaneous communication with the New York stock-market. A printed list, comprising all the transactions of each day, is made up by a printer in the employ of the board, and copies are furnished to the newspapers, giving the greatest publicity to a business which was formerly shrouded in mystery. In these reports of sales abbreviations occur which are not plain to the uninitiated—viz. *b. c.* means between calls; *c.* is cash or for ready money; *s3* or *b3* means for delivery at the buyer's option or seller's option within three days; *s60*, *s30*, *b30*, *b60*, are intelligible in like manner; *opg* is for delivery at the opening of the books of transfer; *xd* is less the dividend. Applied to bonds, *c* means coupon and *r* registered.

From 1854 to 1857 the sessions were held in a room over the Corn Exchange Bank, and afterward in a hall in Lord's Court on Beaver street. The removal to the present spacious building, erected specially for the use of the board, took place in Dec., 1865. The structure is of the most solid and durable character, thoroughly fireproof, and, if not of great outward architectural pretensions, well adapted to its purpose. It is 44 feet in front on Broad street, 86 on New street, the depth between the two being 165 feet. A wing on Wall street gives a third entrance. The extreme height is 75 feet. The board-room, 82 by 54 feet, and 48 from floor to ceiling, is at the New street end. A gallery at its south side is open to visitors. The room devoted to dealings in bonds is in the second story, fronting Broad street, and the floor above contains the committee-rooms. The extensive vaults under the Stock Exchange are most admirably suited to the safe-keeping of securities and other valuables. They contain more than 700 safes, the rental of which, largely derived from non-members, is the source of a handsome income. From the visitors' gallery the board-room presents a scene of apparent confusion and turmoil, but the seemingly inarticulate noises and the frantic gestures are no real indication of a distracted mind. The brokers perfectly well hear and understand so much of the loud talk as specially concerns themselves. A chairman presides during the whole day. When called upon to settle disputes, if unable himself to decide, he submits the question to a vote. He preserves a kind of order by occasional vigorous raps of the gavel and by inflicting fines. The number of brokers usually present is 200 to 400, reaching 600 or 700 on a busy day. The accidental intrusion of strangers on the floor, despite the vigilance of the six doorkeepers, is punished by severe though playful hustling —a practice well known also on the London Stock Exchange. The intruder is summarily ejected after being roughly handled. New members have usually a rude greeting on their first entrance. A part of the room is occupied early in the day with loans of stocks for use, and later with call loans of money on stock collateral. These loans were formerly effected on the sidewalk at great inconvenience. The rates for money have at times been distressingly dear, partly because of the usury law, which would forbid a loan at 8 per cent., while for a loan at 7 the borrower has paid a commission of $\frac{1}{8}$ or $\frac{1}{4}$, or in extreme cases 1 per cent., and this for a single day—say 360 per cent. per annum. The money-market has been known to be in a state of such stringency for weeks, or even months, together. But the panic of 1873 was succeeded by a long period of ease and low rates of interest on call-loans, averaging hardly 3 per cent.

The mass of stocks daily bought and sold, or borrowed and lent, sometimes amounting in value to 100 millions, is paid for by checks on city banks, and the varying volume of these transactions is responsible for the greater share of the bank clearings. The latter, therefore, are not, as has been supposed, any fair index of the general movement of commerce. They rather show the activity of the stock-market and the daily shifting of stock loans. Ineffectual efforts have been made to accomplish the settlements by some system of paying differences without handling the property. The London method of settling on the account-day, twice a month, has had advocates, but our system is preferable in point of safety. Failures are less frequent where the solvency of operators is brought to a daily test.

The model of transactions in stocks is the method of an investor buying for permanent holding. He pays down the full price, and the stock is delivered to him or to a broker on his behalf. If the client desire to buy more stock than his ready money will pay for, the broker may provide the means from a loan on hypothecation of the stock. As loans are easily procured to an amount within 20 per cent. of the market-value, the client advances no more than the difference between that value and the sum borrowed. This difference is called a *margin*, and so long as the loan can be continued or renewed the broker can carry the stock until it may suit the client to realize. A decline tends to exhaust the margin, increasing the difficulty and hazard of carrying. The broker calls on his principal for further margin, and if this be not furnished sells out the stock. If many are carrying stocks with a scanty provision of clients' money, they may be compelled to realize all at once, depressing the market still further. The compensation for losses by a decline is found in the position of the *bears*—namely, those who, anticipating a fall, have contracted to

deliver stocks on a future day at a fixed price, and obviously can buy at any lower price with profit. These contracts, called *short sales*, are made deliverable, at the seller's option, on any day within a certain time, say 3, 10, 30, or 60 days (but not longer), and are described as seller, 3, 10, 30, or 60. If the contract be for more than 3 days, the seller must give one day's notice before delivery. Short sales may also be made for *cash*—namely, deliverable on the same day, or for the following day (known as *regular way*). The seller then, having no stock of his own, borrows from a third party, to whom he advances, as security, a sum equal to the current price, makes his delivery, awaits a decline; buys as he can, returns his borrowed stocks, and reclaims the money advanced. Purchases by the bears check a decline, and often prevent panics. In distinction from the bears, those who carry stocks for a rise are called *bulls*, and are said to be *long*. Novices in speculation are generally bulls.

The hazard attending an excessive bull speculation has its counterpart in an oversold market—when, namely, too many operators have made contracts for future delivery, or are borrowing stocks which they have sold and delivered. Any cause tending to advance prices with suddenness may then compel a large number to come in as buyers to cover their engagements. If the stocks required are, by chance or design, nearly all concentrated in the hands of one party, called a *pool*, that party may be able to exact a very high price from the bears. This is called a *corner*. The bear's method of dealing is equally legitimate with that of the bull. He often furnishes a supply of stock which could not elsewhere be obtained, no actual holders desiring to sell. But the bear assumes the risk of a corner. The chief corners have been—Morris Canal, 1835; Harlem, 1835 and 1864; Erie, 1846; Prairie du Chien, 1865; Michigan Southern, 1866; Reading, 1871; and North-western, 1872. Bears were forced to buy North-western at 230 which they had sold at 85 and 90; Harlem and Prairie du Chien were similarly advanced. The obligation of contracts being absolute, their performance, under no matter what difficulties, is enforced by the board, under penalty of suspension for default, and the party entitled to receive stocks may name his own terms to the seller, just as the latter may do when the conditions are reversed. But justice, if not tempered with mercy, is sometimed stayed by considerations of prudence.

The rate of commissions was $\frac{1}{4}$ per cent. on the market value until 1840, when it became $\frac{1}{4}$ on the par value. It was reduced to $\frac{1}{8}$ in 1861, and so remained for many years. After a reduction to $\frac{1}{16}$, the rate of $\frac{1}{8}$ per cent. was restored in 1875. To board members the charge is $\frac{1}{16}$, or, in case the principal is substituted on the day of the bargain, $\frac{1}{32}$ of 1 per cent. On all contracts longer than 3 days, 6 per cent. interest is paid by the buyer. On 3-day contracts no notice need be given of the intention of the buyer to receive or that of the seller to deliver. At maturity, if not sooner, actual delivery of the property must be made. Either party may exact security for fulfilment by a mutual deposit of money in a trust company.

The Stock Exchange has been the object of much unreasoning and unmerited censure, and its contracts stigmatized as wagers and gambling transactions which could not be enforced at law. Indeed, before the act of 1856 the aid of legal process to collect a balance due to a broker was denied. Naturally enough, the broker insisted on a money-eyed guaranty in his own hands, and was tempted to regard the public as his settled enemies. Having, as toward his fellow-brokers, no reliance save in their honor, he all the more dearly prized that honor. Long experience has taught him that a broker's word is as good as another's bond. Bargains involving large amounts he makes in haste, in the confusion of a crowded room, without witnesses or written memorandum, but he finds that the engagements, sanctioned by honor and conscience alone, are faithfully kept, even at enormous pecuniary sacrifices. Disputes, of rare occurrence, are almost invariably the fruit of honest mistake. The few recorded instances of fraud, not more than six in a history of sixty years, have generally been found among new-comers, not regularly bred to the profession, and have invariably been punished by summary expulsion. People who are loudest in denunciation of stockbrokers are not seldom those who have not treated brokers with common fairness and equity, or have made losses in the stock-market by an extent of over-trading which borders upon fraud, and so have acquired obliquity of vision and a soured temper. Excessive speculation in stocks—namely, that which goes beyond ability to pay losses—is equally reprehensible with over-trading in any other sort of merchandise, but not more so. Stockbrokers certainly will not suffer in a comparison with other men of business in point of integrity and trustworthiness.

The Stock Exchange has always refused to accept an act of incorporation, and remains a mere club or voluntary association. But the government of the majority has at times seemed at once despotic and capricious.

The presidents of the Stock Exchange, with dates of election, have been—

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| A. Stockholm | 1817 | W. R. Vermilye | 1861 |
| G. S. Mumford | 1818 | A. B. Baylis | 1862 |
| Edward Lyde | 1824 | H. G. Stebbins | 1863 |
| James W. Bleecker | 1827 | W. Seymour, Jr | 1864 |
| R. H. Nevins | 1830 | R. L. Cutting | 1865 |
| John Ward | 1832 | Wm. Alex. Smith | 1866 |
| Robert D. Weeks | 1834 | John Warren | 1867 |
| R. H. Winslow | 1834 | Wm. Searls | 1868 |
| Edward Prime | 1835 | W. H. Neilson | 1869 |
| Robert D. Weeks | 1835 | W. Seymour, Jr | 1870 |
| David Clarkson | 1837 | W. B. Clerke | 1871 |
| Henry G. Stebbins | 1851 | Edward King | 1872 |
| C. R. Marvin | 1852 | H. G. Chapman | 1873 |
| John H. Gourlie | 1856 | G. H. Brodhead | 1874 |
| H. G. Stebbins | 1858 | G. W. McLean | 1875 |
| W. H. Neilson | 1859 | S. T. Russell | 1876 |

And the secretaries—J. Benson, 1818; I. Isaacs, 1824; Bernard Hart (one of the signers of 1792), 1832; G. H. Brodhead (assistant 1849), 1855; B. Ogden White, 1870. Treasurers—James W. Bleecker, 1833; Le Grand Lockwood, 1862; W. A. Smith, 1863; and D. C. Hays, 1866. The duty of calling stocks, performed by the president until 1853, has ever since been discharged by Vice-President M. A. Wheelock (who is, however, now called the chairman), assisted by Vice-Chairman James Mitchell, who has held office since the consolidation.

*Stock Privileges.*—These are either *puts* or *calls*, or some combination of both. A *put* is a privilege to sell a given stock within a given period at a certain price. The maker of the put stands ready to buy under those conditions if the holder should determine to sell. A *call* is a similar refusal or privilege to buy a stock at a given price within a given time, and the maker stands ready to deliver the stock if called for according to the terms specified. A put and a call may be combined in one instrument, the holder of which may either buy or sell as he chooses at the fixed price. The cost of privileges varies with the length of time they may have to run, the distance of the price named in them from the market-price on the day when made, the activity of the market, and so on. Privileges are partly like policies of insurance, and partly like tickets in a lottery, and it is only in exceptional cases that they are sources of profit to any but the person issuing them. Suppose a put on Rock Island at 100 in 60 days, the market-price now being 105. The holder of the put may buy at 105, and will then be guarantied against any more than 5 per cent. loss. If he should be able to sell Rock Island at 110, he would gain 5 per cent. If, instead, he omits buying until the price is 90, he will gain 10 per cent. by delivering according to the put, if he cannot, before the expiration of 60 days, sell at anything above 100. If none of these favorable turns of the market occur, he loses the price originally paid for the put. The operation of a call is precisely similar in principle. Privileges are little dealt in except by a class of brokers not connected with the board.

*Relief Society.*—This society was established 1858 on account of distress among the brokers resulting from the panic of 1857. The dues of its members were $12 a year until 1866, when they were abolished, as the accumulated fund had risen to $40,000. It now amounts to $100,000. Its members number about 200, and no more are admitted. The very few beneficiaries receive $20 per week.

*Life-Insurance Department.*—The Stock Exchange is pledged to pay the sum of $10,000 to the legal representatives of any member within one year after proof of his decease. This payment is a gratuity, free from all claims of creditors, and its benefits extend as well to families of suspended members—namely, those who are in temporary difficulty. For the purpose of keeping up the gratuity fund an assessment of $10 is at every death levied upon each surviving member, and in addition the fund receives one-half of the entire surplus income of the board. Payment is made, one-half to the widow and half to the children; if there be no widow, then the whole to the children; if neither widow nor children, then to the legal representatives. The system has (1876) been in operation three years, during which period the deaths have numbered 34, the low average being due to the constant renewal of the membership, keeping down the average age. The accumulations of the fund will in about twelve years enable the board to discontinue the assessments.

New York Gold Exchange.—On the suspension of specie payments in 1861 gold was not at once demonetized. The premium was only 3 per cent. in May, 1862. But with inflation the superior medium was gradually driven out of circulation, hoarded or exported, and became an article of merchandise, dealt in at exchange-offices, at the Stock Exchange, and, later, at Gilpin's reading-room on William

street, the birthplace of the Gold Exchange. This latter, established Oct. 10, 1864, after gold had reached its highest price of 285 (July 11), removed to its present commodious quarters in 1866. It has 486 members, of whom 240 are also members of the Stock Exchange, but the two organizations are entirely distinct, and were at one time almost hostile. The gold premium, another name for the discount on U. S. notes, was the barometer of our national credit during the civil war, and since 1865 has been a measure of the greater or less expectation of a speedy return to specie payments. While the war lasted the gold market was extremely sensitive to reports of military success or failure, and was in some measure controlled by the fears, hopes, or designs of politicians. Most of the decisive events of the war had less apparent influence upon the price than was properly their due, since they were generally anticipated by speculators.

Bargains in gold are chiefly made for delivery on the day following. Settlements were at first effected by actual handling of coin, and it was often necessary to send a heavy truck from office to office with bags of gold. This cumbersome and hazardous practice gave way to a system of depositing coin in the Bank of New York, and handing over its certified checks. These checks were forged in 1865 to a large amount. The next device was the use of engraved U. S. treasury certificates of deposit, issued for that purpose. But a serious loss of these by theft gave occasion for the establishment in 1866 of the Gold Exchange Bank, which has ever since acted as a clearing-house for the exchange. Transactions aggregating 100 to 200 millions a day have been settled with actual handling of no more than 2 or 3 millions, and these in treasury certificates. The clearings for single years have averaged over 50 millions per diem.

Fortunes were made by the bull speculators in gold before 1865, and again by bear operators in the long decline from 285 to 110. The latter movement was, however, much impeded by the excessive short sales and the difficulty of borrowing gold from day to day. A bonus of ½ to 1 per cent. per diem for its use was frequently paid for months together, the available stock of coin having run very low after the free exports. The quantity of gold within reach in New York City was at one time no more than 6½ millions, with a short interest twice or thrice as large. An oversold market furnished the occasion, on Sept. 24, 1869, to put up the price in a day from 141 to 162½, with the swindling device of employing a broker to buy at the extreme rate, and then deliberately to repudiate his purchases. The result was the Black-Friday panic, and the differences arising out of those operations were not adjusted for six years afterward. Both sides of the market were almost equally dangerous, since the default was common to both. The clearings of the previous day were 325 millions, and gold balances 6½ millions. The contracts of Friday aggregated 500 millions, but they were not cleared, as the machinery of the gold clearing-house was broken down, and its operations were restrained by legal process for two months. On the day after its reopening the total clearings were less than 7 millions.

The Gold Exchange has since played a less prominent part, and the price of its memberships, at one time $4000, is now about $500, the board being doomed to extinction on the restoration of specie payments, if not sooner. But meanwhile the wants of importing merchants furnish a real occasion for its continuance, and speculation in gold, whether for a rise or a fall, has a certain importance and exhibits much vitality.

*Other Exchanges.*—The Philadelphia Stock Exchange was founded about 1800, and had at first only 10 members; the present number is 205. As its first constitution was a pattern for the New York board, so it has of late years borrowed from the latter some of its best features. Memberships are transferable, and purchasers pay a fee of $250 on election. The annual dues are $10, besides fines. The routine of business resembles that at New York, but a portion of the settlements are effected through a clearing-house. A life insurance department has been added, giving $2000 to each deceased member's family. Boston, which is the natural home of numerous mining enterprises, particularly those concerned with the rich copper and silver mines of Lake Superior, has a board of stockbrokers with 88 members. Its organization dates from 1834. The Baltimore exchange, organized 1844, consists of 46 members, and has a fair trade in local securities, besides a good deal of business with New York brokers. Indeed, the boards of all these three cities furnish many orders to the Stock Exchange at New York, which is the centre of speculation in the U. S. San Francisco has three boards, the chief of which, founded 1862, has only 100 members, but its seats are worth $30,000 each. They yield large dividends, and the accumulated fund amounts to $250,000. The others, called the Pacific and the California, though of very recent origin, have a prosperous business. The dealings are wholly in mining shares. The works relating to Wall street and the stock-market which have appeared of late years are, so far as known to the present writer, largely sensational and made up of hearsay. He is indebted for valuable information to Mr. W. Lawton of New Rochelle, as well as to many fellow-members, among them Ex-President Brodhead, Mr. Charles Graham, and Mr. Secretary White; the last-named gentleman having kindly given him access to all the original records. (See also STOCKS, LAW OF.)

STRONG WADSWORTH.

**Stock'fish,** a term used in commerce for salted and dried codfish and related species. The fishes are taken care of as soon as convenient after being caught, split from head to tail, and the vertebral column in part taken out; they are then thoroughly washed and rid of the blood; after the water has been drained off, they are put in large vats, salted, and heavy weights are imposed; they are next washed and brushed, and laid out on the sandy shore and rocks. Finally, they are combined in small heaps, and become ready for the market, this stage being indicated by the assumption of a floury whitish appearance, technically designated as the "bloom." THEODORE GILL.

**Stöck'hardt** (JULIUS ADOLF), b. at Röhrsdorf, Saxony, Jan. 4, 1809; was educated in a drug-store at Liebenwerda; studied chemistry at Berlin; was a teacher at Dresden, Chemnitz, and finally professor at the College of Thorand; edited *Das polytechnische Centralblatt* 1846–49, *Die Zeitschrift für deutsche Landwirthe* 1850–55, and *Der chemische Ackermann* 1855. He has also given numerous lectures on agricultural chemistry at fairs, farmers' clubs, etc., which have contributed much to elevate agricultural industry in Saxony. His principal writings are *Schule der Chemie* (1846), translated into English by G. H. Peme (Cambridge, Mass., 1850) under the title *The Principles of Chemistry illustrated by simple Experiments; Guanobüchlein* (1851), *Chemische Feldpredigten* (1851), translated into English by J. E. Teschemaker under the title *Chemical Field-Lectures for Agriculturists* (Cambridge, Mass., 1853).

**Stock'holm,** the capital of the kingdom of Sweden, with 150,446 inhabitants in 1874, beautifully situated at the outlet of Lake Mälar in the Baltic, is divided into (1) *Staden,* the inner city, consisting of the islands of Stadsholmen, Riddarholmen, and Helgeåndsholmen; (2) *Norrmalm,* the northern part, connected with the inner city by a magnificent bridge of granite; (3) *Ladugårdslandet,* communicating E. with Normalm; (4) *Kungsholmen,* communicating W. with Norrmalm; (5) *Södermalm,* the southern suburb, connected with the inner city by two drawbridges; and (6) *Saltsjö-öarne,* comprising the islands of Skeppsholmen, Djurgården, Kastellholmen, and Beckholmen, which complete the picture of an island city cut up and traversed in all directions by water. In Staden, which mostly consists of narrow and irregular streets, and is surrounded with a quay, the most prominent building is the royal palace, one of the most beautiful in Europe (built 1697–1754), in the Italian style, and containing a rich library; here are also the palace of the stadtholder, the mint, the town-house, the church of St. Gertrude, Storkyrkan, and the Finnish church. None, however, of the churches of Stockholm have any architectural merit. Of monuments Staden contains the obelisk and the statues of Gustavus IV. and Charles XIV. John. In the island of Riddarholmen stand the Riddarholm church, containing the royal tombs, among which are those of Gustavus Adolphus and Charles XII.; the new house of deputies; and the statue of the founder of Stockholm, Birger Jarl. The bridge which leads from the inner city across the Helgeåndsholmen to Norrmalm is 380 feet long and 64 feet broad; on its eastern side extend the most beautiful promenades of the city, Strömparterren. Norrmalm has the finest streets, especially the Drottninggata, and the most remarkable public squares. In front of the bridge is Gustavus Adolphus Place, containing the equestrian statue of this king, and enclosed with palaces; the royal theatre is situated here. This part of the city also contains the Brunkeberg Place, the Hay Market, and the place of Charles XIII., surrounded on three sides by rows of linden trees, on the fourth by the sea, and ornamented by the statue of Charles XIII.; the palace of the princes, the Hammer museum, the academy of fine arts, the academy of science with rich collections, the observatory, the national museum, the Clara church, Bethlehem church, the Baptist church, the new synagogue, and the Fersen Terrace, which offers a magnificent prospect. Ladugårdslandet contains the arsenal, the barracks, the veterinary school, the academy of arboriculture, and the Hedwig Eleonora church; the Kungsholmen, the Seraphim hospital, the Carolinian

institute, the garrison hospital; and close by are Mariaberg, the military high school, and Carlberg, the cadet school. In Södermalm are Morebakken, which presents the finest view of the city, the house of the celebrated scholar and spiritualist Swedenborg, and the Catharine and Maria Magdalene churches. Södermalm and Norrmalm are connected by a railway which for boldness in construction hardly has any equal in the world. The central dépôt in Norrmalm is a fine, and, next to the royal palace, the largest, building in the city. Of the Saltsjö-öarne, Skeppsholmen is connected with Norrmalm, Kastellholmen with Skeppsholmen, and Beckholmen with Djurgården by bridges. Djurgården, a park of considerable size, is the general resort for amusement and recreation of the city. Communication between the various parts of the city is generally carried on by *ångslupar* (small steamboats), which traverse the waters in all directions, with fixed routes and a cheap fare. The surroundings are rich in beautiful points, palaces, and villas, of which the royal summer palace, Drottningholm, is the most noticeable. The city possesses excellent waterworks. Of its institutions for art and science Fria Konsternas Academien, Landtbruks Academien, Musikalska Academien, Vetenskaps Academien, and Karolinska Institutet deserve to be mentioned. Benevolent institutions and schools of all kinds are numerous. The industry is considerable, especially in manufactures of tobacco, leather, linen and cotton fabrics, iron, sugar-refining, etc. The commerce is also considerable, though navigation is closed each year for about five months, during which the harbor is covered with ice.

The city was founded toward the end of the twelfth century by Birger Jarl. In 1389 it was taken by Margrethe, queen of Denmark. On Oct. 14, 1471, the Swedes under Sten Sture defeated the Danes at Brunkeberg, close by Stockholm, and drove them out of the country; but in 1520 they again took the city under Christian II., and the Stockholm massacre took place. During the peaceful times of the nineteenth century the prosperity of the city, like that of the whole country, has much increased.

AUGUST NIEMANN.

**Stockholm,** tp., Wright co., Minn. P. 534.

**Stockholm,** p.-v. and tp., Pepin co., Mo., on Mississippi River. P. 499.

**Stockholm,** p.-v. and tp., St. Lawrence co., N. Y., on St. Regis River and on Ogdensburg and Lake Champlain division of Vermont Central R. R. P. 3819.

**Stockholm Dépôt,** p.-v., Stockholm tp., St. Lawrence co., N. Y., on Vermont Central R. R.

**Stock'ing,** a well-known article of apparel, usually knit or woven of wool, cotton, or other fibres. Though known to the Romans, as proved by paintings at Pompeii, its indispensable employment originated much later in the colder climate of Northern Europe, where in the twelfth century they were made of cloth. In the time of Edward II. they had assumed their present form, and at the courts of Spain and Italy in the fifteenth century enormous silk stockings sometimes furnished a substitute both for breeches and shoes. Their domestic manufacture by knitting had become so well established in England in the reign of Elizabeth that a patent was refused to William Lee (1589), inventor of the stocking-frame. He consequently went to France and established a factory at Rouen, but his brother subsequently introduced the invention into Nottinghamshire, where it has ever since been an important industry. The Lee machine was introduced into the U. S. shortly after the Revolution, was modified and adapted to power by Timothy Bailey of Albany 1831, and a stocking-factory established at Cohoes 1832. Several improved stocking-machines and knitting-machines have since been patented, and the hosiery business is now an important industry in the New England and Middle States, amounting in 1870 to nearly $20,000,000 and employing above 14,000 operatives. Several other articles are, however, produced by the same machines, and are classed with hosiery in the statistics. Knitting stockings by hand, however, is still practised in almost all families in the agricultural regions.

**Stock'land,** tp., Iroquois co., Ill. P. 687.

**Stock'mar** (CHRISTIAN FRIEDRICH), b. at Coburg Aug. 22, 1787; studied medicine, and practised as a physician, first in his native city, then in 1814–15 in the army; became physician to Prince Leopold of Coburg in 1816, and subsequently private secretary; was very active in various diplomatic negotiations—at the marriage of Prince Ferdinand of Coburg with Queen Maria II. of Portugal, at the accession of Prince Leopold to the Belgian throne, at the marriage of the Prussian crown prince with a daughter of Queen Victoria, etc.; he was the intimate friend of Prince Albert and Queen Victoria; received the title of baron. D. at Coburg July 9, 1863. His *Denkwürdigkeiten aus den Papieren des Freiherrn Christian Friedrich von Stockmar*, edited by his son (Brunswick, 1872), were translated into English under the title *Notabilia from the Papers of Stockmar*.

**Stock'port,** town of England, county of Chester, at the confluence of the Mersey and the Tame, is very irregularly built on rugged and uneven ground, but is one of the centres of the cotton-manufacturing industry of England. P. 53,014.

**Stockport,** p.-v. and tp., Columbia co., N. Y., on Hudson River and New York Central and Hudson River R. R. P. 1438.

**Stockport,** p.-v., Windsor tp., Morgan co., O., on Muskingum River. P. 289.

**Stocks.** See STOCK EXCHANGE and STOCKS, LAW OF.

**Stocks** [Ang.-Sax. *stocc*], a machine for the punishment of petty offenders, in which the culprit was made to sit for a time with his ankles confined in holes made in timber. It is mentioned in an English statute of 1350, and in Great Britain is not yet quite extinct. Until lately its use for the punishment of slaves was permitted in some of the United States.

**Stocks** (LAMB), b. at Lightcliffe, Yorkshire, Nov. 30, 1812; was educated at Horton, and studied engraving with Charles Rolls; for some time he was principally engaged upon prints for annuals and for Finden's *Gallery of British Art*, but subsequently executed many larger and more important engravings in line for the *Art Journal*, for the art-unions of London and Glasgow, and for the Association for Promoting the Fine Arts in Scotland. Among his best productions are—Webster's *Dame School;* Faed's *O Nannie, wilt thou gang wi' me?* Wilkie's *Gentle Shepherd;* Frith's *Bed-Time;* and the *Meeting of Wellington and Blücher*, from the picture in the Royal Gallery at Westminster. He was made associate engraver to the Royal Academy in 1853, an associate member in 1855, and an academician in 1872.

**Stocks, Law of.** The capital stock of business corporations is usually divided into equal parts called shares. The amount of the capital itself, the number of these shares, and the par value of each—$100, $50, or $25, as the case may be—are fixed by the charter. When such an association is about to be organized, the capital is contributed by those desiring to become members, each person indicating in writing the number of shares he is willing to take. These subscribers constitute the stockholders or shareholders, and are bound to pay the amount of their subscriptions to the corporation, either in one sum or in instalments, according to the terms of their agreement. As evidence of his interest an instrument called a certificate is issued to each stockholder, certifying in substance that he is the holder of a designated number of shares. In the U. S. shares of capital stock, whatever be the object and business of the corporation, are personal estate; they are things in action; they simply entitle their holder to participate in the profits resulting from the business, to aid in the election of officers, and to receive his portion of the assets remaining for distribution at the final dissolution. Shares are transferable, so that the assignee may become a stockholder. The directors of corporations may pass reasonable by-laws regulating the manner of transferring their shares. The following is the mode in general use, and it is often prescribed by statute: A book is kept by some designated officer in which is registered each certificate of shares, and the name of the person to whom it was issued. In order to complete a legal transfer the holder of the certificate must surrender it up to this officer, who thereupon issues a new one for a like amount to the assignee, registers it in the transfer-book, and cancels the old record. In this manner the directors of the corporation can preserve a correct list of the actual stockholders, keep trace of all the shares, and prevent the issue of duplicates. As it might be very inconvenient for the assignor always to appear in person and surrender his certificate, it is the universal practice to print on the back thereof a power of attorney, to be signed by such assignor, constituting the assignee his agent in order to make the surrender, to procure the cancellation, and to receive the new certificate, as above described. By means of this contrivance shares of stock are constantly transferred in the market to an enormous amount. A blank is often left in the power of attorney for the name of the agent, and the instrument in this form may pass from hand to hand through many successive owners, until at length a purchaser, desiring perhaps to hold the stock as an investment, fills in his own name as the attorney, surrenders the certificate, and takes a new one to himself. Certificates of stock thus endorsed are not strictly negotiable instruments, and yet they are practically treated by business-men in the great financial centres of the U. S. as though they possess-

ed the quality of negotiability. They may be pledged as well as sold, and are thus used to a very great extent as collateral security for loans of money or of other property. Although the bylaws of a corporation may require a surrender, cancellation, and reissue in order to complete a transfer and to create a perfect legal title, it is a settled rule of the American law that from an assignment and delivery alone the purchaser obtains an equitable title which makes him the true owner. If the corporation should refuse to accept a surrender and to issue a new certificate, he may recover from it the full value of the stock. If a transfer should be made through a forged power of attorney—that is, if the signature of the owner should be forged to a power of attorney—and by means thereof a new certificate should be issued, the corporation is responsible to him, and must furnish him with an equal number of shares and the accrued dividends thereon, or, if this for any reason be impossible, must pay him their value in money. If the holder of a certificate should sign the power of attorney in blank, and should then deliver the instrument into the possession of some person for a certain specified purpose—as, for safe-keeping—and this person in violation of his duty should fill up the blank, and fraudulently surrender the certificate and procure another one to be issued to a *bonâ fide* purchaser, what effect would be thereby produced upon the rights of the original and defrauded owner? This question has given rise to a great conflict of opinion. If stock certificates were truly negotiable, the title of the *bonâ fide* purchaser would be perfect, and the only remedy of the former holder would be against his guilty agent. It has been urged, however, that as these certificates are ordinary things in action, the assignee would acquire no title, but would take the instrument subject to all the rights of the real owner, who had never intended to part with his property. This doctrine, if established, would virtually put an end to the present mode of dealing with these securities, and would inflict a heavy blow upon the freedom of financial transactions. The New York court of appeals has recently held that the principle of estoppel furnishes a solution of the difficulty, and that the owner is estopped by his acts from setting up a claim against the purchaser in good faith. In this manner the substantial benefits of negotiability are secured. JOHN NORTON POMEROY.

**Stock'ton,** city and county-seat of San Joaquin co., Cal., at the head of a navigable channel of the same name connecting it with San Joaquin River, 3 miles therefrom, and 100 miles from San Francisco. It was laid out in 1849 by Capt. Charles M. Weber, the owner of the Rancho Campo de Los Francises, a Mexican grant, covering a large portion of the surrounding country. Being at the head of navigation and a convenient point of departure for the gold-mining regions of Calaveras, Tuolumne, and Mariposa cos., it soon became a place of considerable business importance, and commanded the trade of those prosperous counties. After the decline of the mining interest came the development of the agricultural resources of the great San Joaquin Valley, for which Stockton, on account of its location, became the natural business-centre, a distributing-point for farmers' supplies, and is now the most important interior wheat-market in California. Stockton has several large warehouses for the storage of grain, with an aggregate capacity for 3,000,000 bushels. Sailing vessels of 150 tons and steamers of 500 tons burden reach her wharves at all seasons of the year, while the main line of Central Pacific R. R. passes through the city, affording means of speedy communication with San Francisco, and ample facilities for the shipment of the immense crops of grain and other agricultural products of the surrounding country. Stockton has 4 banks, with an aggregate paid-up capital of $1,332,000, most of which is owned by her own citizens. There are 2 flouring-mills, with a capacity for manufacturing 800 barrels of flour per day; 2 extensive tanneries, 2 manufactories of agricultural implements, and 2 of carriages and wagons, 1 paper-mill, 1 woollen-mill, and 2 foundries. There are 2 newspapers—the *Independent*, a morning paper with daily and weekly editions, and the *Herald*, an evening journal, with a weekly edition. The California insane asylum is located within the city limits, occupying a handsome site of 100 acres. The site of the city is a level plain, whose monotony is relieved by scattering oaks; its streets are regularly laid out, and many of them ornamented with choice shade trees. The business portion of the city is principally constructed of brick, and has many fine buildings. There are 14 churches, some of them beautiful and costly edifices, and 5 large public school-houses. Mortuary statistics kept for twenty years show that Stockton is exceptionably healthy—a fact to be attributed to her equable climate and the prevalence during the summer of the trade-winds, which daily sweep over the city from the ocean. The average temperature in summer is 75°, in winter 40°. The average rainfall for the year is about 15 inches. A never-failing supply of pure fresh water is obtained from artesian wells bored to a depth of from 80 to 120 feet, in which the water rises within 6 feet of the surface. P. in 1870, 10,066.

N. M. ORR, ED. "INDEPENDENT."

**Stockton,** p.-v. and tp., Jo Daviess co., Ill. P. 1214.

**Stockton,** tp., Greene co., Ind. P. 1240.

**Stockton,** p.-v., cap. of Rooks co., Kan., on S. fork of Solomon River.

**Stockton,** p.-v. and tp., Waldo co., Me., on Belfast Bay, at the mouth of Penobscot River. P. 2089.

**Stockton,** p.-v., Hillsdale tp., Winona co., Minn., on Minnesota division of Chicago and North-western R. R.

**Stockton,** p.-v., cap. of Cedar co., Mo., 50 miles N. W. of Springfield, has 1 church, a graded school, 1 newspaper, 2 hotels, a tannery, carding-machine, steam grist-mill, and a wagon manufactory. Principal business, produce-trade. P. about 400. H. C. TIMMONDS, ED. "JOURNAL."

**Stockton,** tp., Camden co., N. J. P. 2381.

**Stockton,** p.-v., Delaware tp., Hunterdon co., N. J., on Delaware River and on Belvidere division of Pennsylvania R. R.

**Stockton,** tp., Chautauqua co., N. Y., on Canadaga Lake. P. 1639.

**Stockton,** p.-v., Foster tp., Luzerne co., Pa., on Hazelton division of Lehigh Valley R. R.

**Stockton,** p.-v. and tp., Portage co., Wis. P. 1023.

**Stockton** (RICHARD), b. at Princeton, N. J., Oct. 1, 1730; graduated at Princeton College in 1748; was admitted to the bar in 1754; became member of the executive council in 1768, and judge of the supreme court of the province of New Jersey in 1774. In 1776 he was chosen a delegate to the Continental Congress, and was one of the signers of the Declaration of Independence. In Sept., 1776, he was captured by a party of royalists, who threw him into prison in New York, where he was treated with great severity; his library was destroyed, and his lands laid waste; he was finally exchanged, but never fully recovered from the effects of the ill-usage which he had received. D. at Princeton Feb. 28, 1781.

**Stockton** (RICHARD), LL.D., son of the preceding, b. at Princeton Apr. 17, 1764; graduated at Nassau Hall in 1779; studied law, and was admitted to the bar in 1784, and soon rose to the head of his profession in the State. He was a Presidential elector in 1792 and 1801, U. S. Senator 1796–99, and Representative in Congress 1813–15. D. at Princeton Mar. 7, 1828.

**Stockton** (ROBERT FIELD), son of Richard (1764–1828), b. at Princeton, N. J., in 1796; studied at New Jersey College, but left in his fifteenth year to enter the navy as a midshipman Sept. 1, 1811; was distinguished for gallantry in several naval battles during the war with England; became a lieutenant 1814; captured an Algerine corsair with a boat's crew 1815; negotiated in 1821 the purchase from African native chiefs of the territory now constituting the republic of Liberia; captured many slavers and a Portuguese privateer on the coast of Africa; took part in the extermination of piracy in the West Indies; surveyed the Atlantic coast of the Southern States 1823–24; became commander 1830 and post-captain Dec. 8, 1838; was flag-officer of the Ohio in the Mediterranean 1838–39; declined the secretaryship of the navy 1841; was an early advocate of a steam navy; superintended the construction of the sloop Princeton, the first successful war-steamship, 1842; was seriously injured by the explosion of one of her guns Feb. 28, 1844, which caused the death of two members of the cabinet; was the bearer to Texas of the resolution of annexation 1845; proceeded to the Pacific as commodore of the U. S. squadron on the coast of California Oct., 1845; took possession of California for the U. S. government, and formed a provisional government 1846, and disputed with Gen. Kearny the chief command—a question subsequently investigated by a court-martial on his nominee, Col. John C. Fremont; returned home across the Plains; resigned from the navy May 28, 1850. Having earlier taken an active part in politics as a Democrat and supporter of Gen. Jackson, though also prominent in the advocacy of internal improvements, especially of the Delaware and Raritan Canal, he now returned to politics with the prestige of his recent services and controversies; was elected U. S. Senator 1851; procured the passage of the law for the suppression of flogging in the navy; opposed the project of intervention in Hungary; was mentioned as a Presidential candidate 1852; resigned his seat in the Senate 1853; was nominated in 1856 for the Presidency by the newly-formed "American party," but the ticket was withdrawn before the day of election. D. at Princeton Oct. 7, 1866. (See his *Life, Speeches, and Letters*, 1856.)

**Stockton** (Thomas Hewlings), D. D., b. at Mount Holly, N. J., June 4, 1808; studied medicine, but became a Methodist preacher, and in 1830 was stationed at Baltimore; was chaplain of the U. S. House of Representatives 1833–37, again 1859–61, and of the Senate in 1862. While in Baltimore he compiled a hymn-book and edited the *Methodist Protestant*, taking strong ground against slavery; was afterward for several years a preacher and public lecturer in Philadelphia, and subsequently resided for a time at Cincinnati. In 1850–56 he was associate pastor of St. John's church, Baltimore, and temporary pastor of a Presbyterian church, and in 1860–68 of the church of the New Testament. He also performed much literary labor of various kinds, including an edition of the New Testament arranged in paragraphs. Among his numerous productions are—*Floating Flowers* (1844), *The Bible Alliance* (1850), *Stand up for Jesus* (1858), *Poems, with Autobiographic and other Notes* (1862), *The Peerless Magnificence of the Word of God* (1862), and *Influence of the United States on Christendom* (1865). His *Life* has been written by Rev. John G. Wilson (1869). D. at Philadelphia Oct. 9, 1868.

**Stockton-on-Tees,** town of England, county of Durham, on the Tees, is well built, and has corn-mills and breweries, rope-walks and manufactures of sailcloth, blast-furnaces, foundries, engine-works, and building-yards for iron ships, and carries on a considerable trade in corn, coal, and iron. P. 27,738.

**Stock'ville,** p.-v. and tp., cap. Frontier co., Neb.

**Stock'well,** p.-v., Lauramie tp., Tippecanoe co., Ind., on Indianapolis Cincinnati and Lafayette R. R. P. 403.

**Stockwell** (Stephen N.), b. in Hardwick, Worcester co., Mass., Aug. 31, 1823; was apprenticed to learn the printing trade at the age of seventeen, and two years later he entered the composing-room of the Boston *Journal*, where he rose steadily till he became managing editor—a position he now holds. He served two years in the Massachusetts house of representatives, and one year in the senate, and has also been a member of the Boston city council. J. B. Bishop.

**Stod'art** (James), F. R. S., b. in England in 1760; became a maker of cutlery and surgical apparatus in London; aided Dr. George Pearson in his investigation of the nature and properties of the famous *wootz* or "Indian steel," proving it to be a real cast-steel of a peculiar kind, well adapted for the manufacture of surgical implements of a fine edge; assisted Davy and Faraday in their magnetic and electrical researches at the Royal Institution, with the latter of whom he contributed papers to the *Quarterly Journal of Science* (1820), and to the *Philosophical Transactions* (1822) papers *On the Alloys of Steel.* D. at Edinburgh Sept. 11, 1823.

**Stod'dard,** county of S. E. Missouri, bounded W. by St. Francis River, drained by the Castor, and intersected by the Cairo and Arkansas division of St. Louis and Iron Mountain R. R. It is a part of the "sunk country" produced by the earthquake of 1811, there being numerous swamps and lagoons. Staples, Indian corn, tobacco, sawed lumber, and flouring-mill products. Cap. Bloomfield. Area, about 800 sq. m. P. in 1870, 8535.

**Stoddard,** p.-v. and tp., Cheshire co., N. H. P. 667.

**Stoddard** (Amos), b. at Woodbury, Conn., Oct. 26, 1762; was a soldier in the war of independence 1779–82; became clerk of the supreme court of Massachusetts; was a lawyer at Hallowell, Me., 1792–98; was appointed captain of artillery June 1, 1798; was governor and civil commander of Missouri Territory 1804–05; became major June 30, 1807, and deputy quartermaster July 12, 1812; was dangerously wounded by a shell at the siege of Fort Meigs, O., and d. of tetanus May 11, 1813. Author of *The Political Crisis*, and of *Sketches, Historical and Descriptive, of Louisiana* (Philadelphia, 1812). His papers are in the archives of the Western Reserve Historical Society, Cleveland, O.

**Stoddard** (David Tappan), b. at Northampton, Mass., in 1819; graduated at Yale College 1838; went as a missionary to the Nestorians of Persia 1843, and d. at Oroomiah, Persia, Jan. 22, 1857. Author of *A Grammar of the Modern Syriac Language* (New Haven, 1855) and of various educational and religious works in Syriac printed at the mission press. A *Memoir* by Rev. Joseph P. Thompson, D. D., was published in 1858.

**Stoddard** (Elizabeth Barstow), wife of R. H. Stoddard, b. at Mattapoiset, Mass., in 1823; was married in 1852. Besides assisting her husband in several of his literary works, and contributing in prose and verse to periodicals, she has published three novels delineating life and scenery in New England—*The Morgesons* (1862), *Two Men* (1865), and *Temple House* (1867).

**Stoddard** (Richard Henry), b. at Hingham, Mass., in July, 1825; having lost his father at an early age, he became a mechanic in an iron-foundry in New York; contributed poems to various periodicals, and in 1849 privately printed *Footprints*, a small volume of poems, which was followed in 1852 by a larger volume of poems. In 1852 he received an appointment in the New York custom-house, which he retained till 1870, still pursuing his literary labors. After leaving the custom-house he devoted himself wholly to literature. Besides numerous contributions in prose and verse to periodicals, he has published—*Adventures in Fairy Land* (1853), *Songs of Summer* (1857), *Town and Country* (1857), *Life, Travels, and Books of Alexander von Humboldt* (1860), *The King's Bell* (1862), the story of *Little Red Riding Hood*, in verse (1865), *The Children in the Wood*, in verse (1865), *Abraham Lincoln, a Horatian Ode* (1865), *Putnam the Brave* (1869), and *The Book of the East*, a collection of his later poems (1871). He has also edited *The Aldine*, a literary and artistic journal (1870 *seq.*), *Gen. Nathaniel Lyon's Political Essays*, with a memoir (1861), *The Loves and Heroines of the Poets* (1861), J. G. Vassar's *Twenty-one Years around the World* (1862), *Madrigals, mostly from the Old English Poets* (1865), *The Late English Poets* (1865), enlarged and revised editions of Griswold's *Poets and Poetry of America* (1870), and of Griswold's *Female Poets of America* (1874), *The Bric-à-Brac Series*, being condensations of various recent works upon literature and society (1874 *seq.*), and the *Life and Correspondence of B. R. Haydon* (1876).

**Stoddard** (Solomon), b. at Boston, Mass., Oct. 4, 1643; graduated at Harvard 1662; became fellow and librarian of Harvard 1667–72; spent two years in Barbadoes for his health, acting as chaplain to Gov. Serle and preaching to the dissenters, and was ordained Sept. 11, 1672, pastor of the church at Northampton, where he remained until his death, Feb. 11, 1729, his grandson, Jonathan Edwards, having been his colleague 1727–29. He published *The Trial of Assurance* (1696); *The Doctrine of Instituted Churches* (London, 1700), in which he contended, in opposition to Increase Mather's *Order of the Gospel*, that the Lord's Supper is a converting ordinance, and thereby gave rise to a theological controversy which lasted some years; *An Appeal to the Learned* (1709), *Guide to Christ* (1714), *Answer to Cases of Conscience* (1722), *Question on the Conversion of the Indians* (1723), *The Safety of appearing in the Day of Judgment in the Righteousness of Christ* (1724); and printed some miscellaneous sermons.—His son, Col. John, b. at Northampton in 1681, graduated at Harvard 1701; took part as captain in an expedition against Canada during which he kept a *Journal* printed in the *Genealogical Register* (Jan., 1851); was for many years member of the council of Massachusetts, chief-justice of common pleas, and colonel of militia. D. at Boston June 19, 1748.

**Stoddard** (Solomon), b. in 1800; graduated at Yale College 1820; became professor of languages at Middlebury College, Vt., and co-author with E. A. Andrews, LL.D., of a *Grammar of the Latin Language* (Boston, 1836), which has been more widely used than any similar work in America, having passed through more than 60 editions. D. in 1847.

**Stoddart** (Sir John), LL.D., b. at Westminster, England, in 1773; graduated at Christ Church, Oxford, 1794; studied theology and law, was admitted to the bar 1801; was king's advocate and admiralty advocate at Malta 1803–07; began writing for the London *Times* 1810; was political editor of that paper 1812–16; started the *New Times* (1817–28) in opposition to it; took an active part in the formation of the Law Amendment Society; was caricatured by Cruikshank and others as "Dr. Slop;" was a voluminous political, historical, and philological writer; was knighted 1826, and held the office of chief-justice and judge of the vice-admiralty court at Malta 1826–39. D. in London Feb. 16, 1856. His most valuable works were contributions to the cabinet edition of the *Encyclopædia Metropolitana* entitled *Universal Grammar, or The Pure Science of Language* (vol. ii.), *Glossology, or The Historical Relations of Languages*, and *An Introduction to Universal History* (vol. xi.). The two former works were edited by William Hazlitt in a single volume, *The Philosophy of Language* (1849; 3d ed., 1860).

**Stoddert** (Benjamin), b. in Maryland in 1751; served in the Revolutionary army, attaining the rank of major; was many years a merchant at Georgetown, D. C., and was secretary of the U. S. navy 1798–1802. D. at Bladensburg, Md., Dec. 17, 1813.

**Stoe'ver** (Martin Luther), Ph.D., LL.D., b. at Germantown, Pa., Feb. 17, 1820; graduated at Pennsylvania College, Gettysburg, 1838; was tutor in Pennsylvania College 1839–40, afterward principal of its preparatory department and professor of Latin, history, and political economy until

his death, July 22, 1870. He was for many years secretary of the General Synod of the Lutheran Church and editor of the *Evangelical Quarterly Review*, in which he published an interesting series of *Reminiscences of Lutheran Ministers;* edited the *Literary Record* (1847–48); wrote biographies of Dr. H. M. Muhlenberg (1856) and of Dr. P. F. Mayer (1859), and a *Brief Sketch of the Lutheran Church in the U. S.* (1860); had made extensive preparations for a fuller history of the same subject, and was well known for his philanthropy, public spirit, and patriotism, especially as manifested during the civil war by repeated visits to the Union armies under the auspices of the Christian Commission. He rendered valuable aid to Rev. Dr. Sprague in the Lutheran department of his *Annals of the American Pulpit*, and was a frequent contributor to the *Eclectic Magazine*, the *Lutheran Home Journal*, and other periodicals.

**Sto'ics** [Gr. Στωϊκοί], an ancient philosophic sect, deriving its name from the ποικίλη στοά ("Painted Porch"), in which its founder, Zeno of Citium in Cyprus (flourished about 350–258), kept his school. This school he founded about B. C. 310, and he numbered among his immediate disciples Persæus of Citium, Ariston of Chios, Herillus of Carthage, and Cleanthes of Assos, who succeeded his master. Cleanthes was succeeded by Chrysippus of Soloi, who reduced the Stoic doctrines to something like a system, and he by Zeno of Tarsus. Other celebrated Greek Stoics were Diogenes of Babylon, Antipatrus of Tarsus, Panætius of Rhodes, and Poseidonius of Apamea. Owing mainly to Panætius, Stoicism found numerous disciples among the Roman nobility, and for centuries exercised a great and good influence upon the stronger minds of the empire. Among the Roman Stoics may be mentioned Q. Mucius Scævola, L. Annæus Cornutus, A. Persius Flaccus, L. Annæus Seneca, C. Musonius Rufus, Epictetus, and the emperor Marcus Aurelius.

Stoicism was an offshoot from Cynicism, Zeno having been at first a disciple of Crates the Cynic. It, however, dropped some of the most objectionable elements of Cynicism, and became a civilized philosophy—as civilized, indeed, as ever a philosophy of reflection can be. It was divided by its adherents into three parts—logic, ethics, physics—of which the last was held to be most important, although the second received by far the most attention. Indeed, Stoicism, like all the post-Aristotelian philosophies of antiquity, was essentially ethical.

(A) Under *logic* the Stoics included dialectic and rhetoric, the former of which was in reality a theory of cognition. They attached great importance to what they called a criterion of truth, although they were never able to fix upon any that would satisfy them as absolute. Their theory of sense-perception was essentially the same as that of Locke, the sentient soul being considered as a *tabula rasa*, impressed or otherwise affected by external objects. Perception was followed by memory and conception. Their highest concepts (τὰ γενικώτατα), by which they replaced Aristotle's ten categories, were (Trendelenburg, *Kategorienlehre*, p. 220 *seq.*)—

| | | | |
|---|---|---|---|
| 1. | Ὑποκείμενα | substrata. | |
| 2. | " ποιά | " qualified | (essentially). |
| 3. | " " πως ἔχοντα | " " | accidentally. |
| 4. | " " " " πρός τι. | " " | " thro' relation. |

The Stoics, in the matter of general terms, were nominalists, or, more strictly, conceptualists. Under *dialectic* they included grammar, in the development of which they did some very good work. (See Lersch, *Die Sprachphilosophie der Alten*, pt. ii. pp. 25 *seq.;* Steinthal, *Gesch. der Sprachw. bei den Griechen u. Römern*, pp. 277–363.)

(B) Under *physics* the Stoics included theology. They replaced Aristotle's quaternity of cause by a duality, viz. force and matter, inseparable, and conceived very much as they are by modern physicists. Everything, even God, contains both. Their physical theory was in the main that of HERACLITUS (which see), even down to the notion of a periodical ἐκπύρωσις or return of the universe to primeval fire. At the base of all lies necessity or providence—a tenet perhaps borrowed from Empedocles (περὶ φύσεως, line 1). With periodical conflagration, individual immortality was of course incompatible. The individual, a mere temporary emanation, returns at last to his source.

(C) In their *ethics* the Stoics, if not what is now called altruistic, were essentially unselfish—that is, they rigidly maintained that the end of life was virtue for virtue's sake. What virtue was they found it difficult to define, their "living agreeably to nature" being very vague, not to say that they sometimes made nature mean human nature, sometimes universal nature. Man exists for society, for only in that is virtue possible. Virtue is sufficient for happiness; and pleasure, which naturally accompanies activity, is not to be sought for its own sake. The cardinal virtues are practical wisdom, courage, self-restraint, and justice (φρόνησις, ἀνδρία, σωφροσύνη, δικαιοσύνη), and it requires the possession of them all to constitute the truly wise man, who is free and the equal of Jupiter himself. The Stoics drew a broad distinction between acts and motives, and made the moral quality of acts depend entirely upon motives. Of the works of the Stoics only fragments remain, the most important of which is Cleanthes's splendid *Hymn to Zeus*, of which there is an English rendering in Francis Newman's *The Soul, its Sorrows and Aspirations*, and another in *The Radical* (Boston, 1867). The best and most complete presentation of the Stoic philosophy is in Zeller's *Philosophie der Griechen* (vol. iv., pp. 26–340).

THOMAS DAVIDSON.

**Stokes,** county of North Carolina, bordering on Virginia and drained by a branch of Dan River. It has a hilly surface and fertile soil. Staples, tobacco, Indian corn, wheat, oats, wool, and honey. Cap. Danbury. Area, 550 sq. m. P. in 1870, 11,208.

**Stokes,** tp., Union co., Ill. P. 1573.

**Stokes,** tp., Logan co., O. P. 673.

**Stokes,** tp., Madison co., O. P. 986.

**Stokes** (GEORGE GABRIEL), D. C. L., F. R. S.; b. in Ireland in 1819; educated at Bristol College; graduated 1841 as senior wrangler at Pembroke College, Cambridge, where he was elected to a fellowship; has been since 1849 Lucasian professor of mathematics in that university; was elected to the Royal Society, and made in 1851 the brilliant discovery of the change in the refrangibility of light (since known as "fluorescence"), for which he was awarded the Rumford medal of that society 1852; became one of its secretaries 1854; published the experiments and inductions on which his discovery was based in an extended memoir of 100 pages in the *Philosophical Transactions* (1852); made a series of careful experiments at the Kew observatory, for determining the index of friction in different gases; contributed papers on mathematical physics to the *Transactions* of the Cambridge Philosophical Society, and to the *Philosophical Magazine;* made by experiment the rediscovery of the fact (already pointed out by Dr. Thomas Young) that the luminiferous ether is, in relation to the transmission of light, an elastic solid, although, of course, a fluid in relation to the motions of the heavenly bodies. Prof. Stokes has contributed to the *Transactions* of several learned societies, and annually delivers professional lectures on hydrostatics, mechanics, and optics, more especially upon the physical theory of light, at the University of Cambridge and at the Museum of Practical Geology in London. In 1869 he was president of the British Association for the Advancement of Science at its meeting at Exeter. PORTER C. BLISS.

**Stokes** (JOHN), C. B., b. at Cobham, Kent co., England, June 17, 1825; educated at private schools and at the Royal Military Academy, Woolwich, and commissioned second lieutenant royal engineers Dec. 20, 1843, first lieutenant 1846, captain 1854, lieutenant-colonel 1867; served in the Kaffir wars of 1846–47 and 1850–51 (medal); deputy assistant quartermaster-general 2d division of the army in Kaffraria Jan.–July, 1851; instructor in surveying and field-works at Royal Military Academy, Woolwich, 1852–55; appointed in 1855 chief engineer to the Turkish contingent engineers, which he raised, organized, and equipped for field-service, and with which he constructed the lines round Kertch in the Crimea during the winter of 1855–56, and Lord Panmure's commissioner for breaking up the Turkish contingent May–July, 1856; British commissioner for improving the navigation of the mouths of the Danube and carrying out the terms of the Treaty of Paris of Mar. 30, 1856, Aug., 1856–Dec., 1871; British delegate to the international conference held at Constantinople (1873) for the purpose of agreeing to an international system of measuring the tonnage of ships, and for the settlement of the Suez Canal dues; commanding royal engineer at Chatham since Jan., 1875, where (Nov. 1, 1875) he was appointed, also, commandant of the school of military engineering. In Dec., 1875, he accompanied the Right Hon. Stephen Cave, M. P., on a special mission to Egypt. Author of a paper on *Engineer Field Equipment of the Turkish Contingent*, and *On Improvement of the Mouths of the Danube and other Rivers*, and of two papers in the *Professional Papers of the Royal Engineers.*

**Stokes** (WHITLEY), b. in Dublin, Ireland, about 1830; educated at Dublin University; became a distinguished barrister in London; was for some years secretary to the Philological Society, assistant secretary to the government of India, home department, and legal adviser to the viceregal government of India at Calcutta, and is a high authority upon Celtic and Oriental philology, Irish history, and the history of the growth of legal and social institutions. Author of *Irish Glosses* (1860), *The Play of the*

*Sacrament, a Middle English Drama* (1862), *Old Irish Glossaries* (1864), *Gwreans an Bys, the Creation of the World, a Cornish Mystery, with a Translation and Notes* (1864), *The Indian Succession Act* (1865), *Hindu Law-Books, edited with Notes and an Index* (Madras, 1865), *Goidilica, or Notes on the Gaelic Manuscripts preserved at Turin*, etc. (Calcutta, 1866), and other philological and legal treatises.

**Stoke-upon-Trent,** town of England, county of Stafford, in a district called the "Potteries," comprising 10,490 acres and celebrated for its manufactures of earthenware, which are carried on in about 200 factories. P. of town 11,390; of parliamentary borough, 130,985.

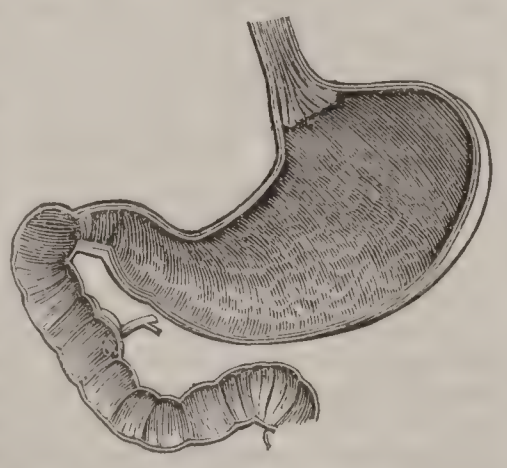
**Stol'berg, von** (CHRISTIAN), COUNT, b. at Hamburg Oct. 15, 1748; studied (1769–74) at Göttingen, where he was one of the principal members of the so-called *Dichterbund*, to which also Bürger, Voss, Hölty, and Leisewitz belonged; held an office in Holstein under the Danish government 1777–80, and lived afterward on his estate, Windebye, near Eckernförde, in Sleswick, where he d. Jan. 18, 1821. He wrote love-poems, patriotic songs, dramas with choirs in Greek style, and translated Sophocles.—His younger brother, FRIEDRICH LEOPOLD, count von Stolberg, b. at Bramstedt in Holstein Nov. 7, 1750; studied also at Göttingen; held different court offices—as ambassador from the prince-bishop of Lübeck to the court of Copenhagen, as Danish ambassador to the court of Berlin, as president of the episcopal government at Entin, etc.; retired in 1800 from public life, and lived on his estate, Sondermühlen, in Hanover, where he d. Dec. 5, 1819. From his mother he had received a very strong religious bias, which was nourished afterward by his friendships and acquaintances, especially with the princess Gallitzin, and in 1800 he was converted to Roman Catholicism after a visit to Rome, and wrote *Geschichte der Religion Jesu Christi* (15 vols., 1811–18). Like his brother, he had belonged to the *Dichterbund*, and he developed great literary activity, writing odes, dramas, novels, etc., and translating Homer, Plato, and Ossian. The poetical works of the two brothers were published in a collected edition of 22 vols. (Hamburg, 1821–26). (See Nicolovius, *Friedrich Leopold, Graf zu Stolberg* (1846); Wilhelm von Bippen, *Entiner Skizzen* (1862); Menge, *Der Graf Friedrich Leopold von Stolberg und seine Zeitgenossen* (1864).)

**Stole** [Gr. στολή, a "robe"], in the Greek, Latin, and Anglican churches a silk band or scarf worn upon the shoulders of priests.

**Stol'pe,** town of Prussia, province of Pomerania, on the Stolpe, which here becomes navigable, has valuable salmon fisheries and manufactures of spirits, tobacco, linens, and articles of amber. It carries on an active trade in corn and cattle. P. 12,483.

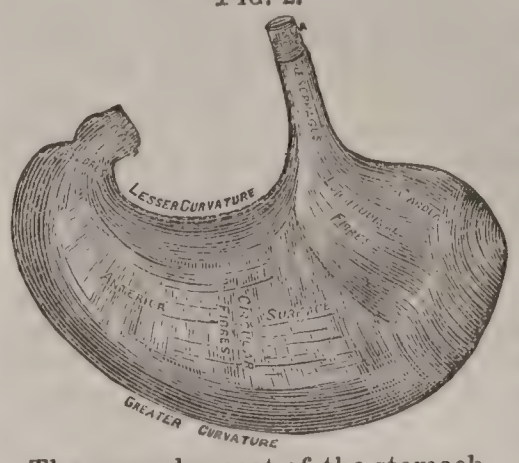
**Stom'ach, The, and its Diseases** [Gr. στόμαχος, from στόμα, "a mouth," or "outlet"], the chief organ of digestion; the expansion of the superior end of the alimentary canal for the reception of food, its disintegration and solution, and the digestion of albuminoid matter. The stomach is situated on the left side of the body, below the diaphragm, behind and beneath the free ribs. Its lower extremity extends across the median line. It is a membranous bag or sac, capable of great distension by food and gas, but often flaccid and collapsed when empty. When full it is twelve inches long and four high. The stomach receives food from the œsophagus through its upper or cardiac (Gr. καρδία, "the heart") orifice, so termed because adjacent to the heart. The body of the stomach is beneath the ribs of the left side, and is termed the *fundus, cul de sac*, or *great pouch*. The *greater curvature* of the stomach is the lower, convex surface; the *lesser curvature* is concave and above. Food leaves the stomach through its lower orifice, the *pylorus* (Gr. πυλωρός, from πύλη, "a gate"), and enters the duodenum, the first section of the small intestine. The stomach has four coats: (1) The external serous layer, a reflection of the peritoneum, covering it at all points except the entrance of the nutrient vessels and nerves in the great and small curves. (2) The muscular layer, which has three separate sets of fibres—the longitudinal, the circular, and the oblique. These muscular bands, acting in different directions, propel the contained food from side to side of the cavity, aiding in its chemical disintegration by thorough admixture with gastric juice. This spiral movement is termed *vermicular* ("worm-like"), and also *peristaltic* (Gr. περιστέλλειν, to "surround" or "wrap up"). (3) The cellular coat, consisting of loose areolar tissue, connects the muscular to the internal mucous coat. It is called also the sub-mucous coat and the vascular coat, as it contains the blood-vessels which supply the elaborate capillaries beneath the secreting glands of the mucous membrane. (4) The mucous coat is thick, especially at the lower or pyloric end, presents large longitudinal folds when the stomach is but partially filled or empty, which disappear when it is distended. Closely inspected, the mucous surface is found to be perforated by innumerable closely-aggregated orifices of the gastric tubules. These are of two kinds: (1) The mucous glands, situated at the pyloric end; (2) the peptic glands, found in all parts other than the pylorus, and secreting the gastric juice. The stomach is constantly lubricated by secreted mucus, which may become excessive in digestive disorders. Gastric juice is chiefly secreted after the ingestion of food. (See DIGESTION and GASTRIC JUICE.) The peptic glands are imperfectly developed in children before the eruption of the teeth. They are partially atrophied in advanced age, when the digestive powers are weak. The stomach is intimately related to important adjacent viscera by both vascular and nerve connections. Its main artery, the gastric, springs from a common root with the hepatic and splenic arteries, and it also receives two branches of each of them. By branches of the sympathetic nervous system its functional activity is influenced by the health of each organ and part of the body; it receives the terminal branches of the pneumogastric nerve, which gives off branches controlling the action of the heart, lungs, and in a measure the larynx and pharynx. It is by these connections that gastric indigestion may cause palpitation of the heart, difficult and sighing breathing, irritability of the larynx, and hoarseness, and by reflex influence many morbid sensations in various parts of the body.

FIG. 1.



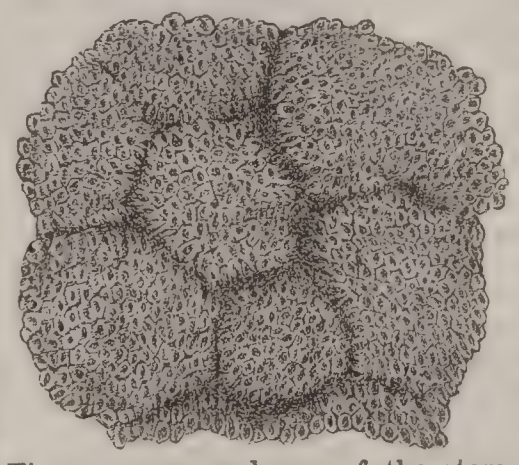
Section of œsophagus, stomach, and duodenum.

FIG. 2.



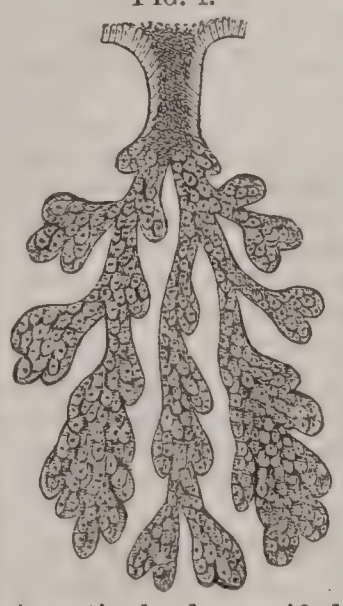

The muscular coat of the stomach.

FIG. 3.



The mucous membrane of the stomach, orifices of the glands; magnified 20 diameters (*Sappey*).

FIG. 4.



A peptic gland, magnified 100 diameters (*Sappey*).

The most frequent diseases of the stomach are its functional disorders. (See INDIGESTION.) In addition to these milder and chronic conditions, the stomach is liable to acute and organic disease. Acute gastritis is of rare occurrence, the result of violent mechanical or chemical irritation, incised and punctured wounds, swallowing corrosive poisons or putrid and acrid food. It is characterized by violent ejection of all food, gastric mucus, traces of blood and bile, by sense of local burning pain, by pallor of the face, feeble flickering pulse, cold extremities, and collapse. Perforating ulcer of the stomach may occur in both sexes from tubercle or specific gummy tumor of the gastric walls, but most frequently exists in young women, often of full habit, due to rupture or embolism of some small blood-vessel, and resulting softening of a conical segment of the stomach-wall thus deprived of nutriment. The symptoms are pain in the stomach upon reception of food, its rejection, and occasional hæmorrhage when the ulcerative process has eroded a blood-vessel. Hæmorrhage from the stomach is termed *hæmatemesis*, and must be carefully discriminated from *hæmoptysis*, the spitting of blood from the lungs.

Cancer of the stomach occurs more often in men than in women—most often occupies the pyloric end, rarely the upper cardiac orifice. It is usually the hard or scirrhus form of cancer. It often occurs in persons of cancerous family history, in others with no hereditary taint and previous personal health, following irritative dyspepsia. When at the pylorus, food is detained in the stomach, and after a time is ejected in great quantity, mixed with mucus, blood, and many fungous products of fermentation, especially Torulæ and Sarcinæ ventriculi. There is a local darting pain, and often a local indurated tumor felt at the epigastrium through the emaciated abdominal wall; the face is dark and cachectic, the body wasted, strength fails, death comes by exhaustion. Extreme neuralgia of the stomach —gastralgia or gastro-dynia—may occur, dependent on deranged nerve-centres or rheumatic or gouty vice of the blood. E. Darwin Hudson, Jr. Revised by W. Parker.

**Stom'ach-Pump,** a form of the syringe which has a flexible tube, designed to be passed down the œsophagus into the stomach, after which water is injected through it into the stomach and then withdrawn by reversing the action of the syringe. The operation may be repeated until the stomach is thoroughly washed clear of its contents. The instrument is especially useful in removing poisons from the stomach, and in feeding insane patients who refuse to eat, intending to starve themselves.

**Sto'mapod,** or **Stomatopoda** [Gr. *στόμα*, "mouth," and *πούς*, "foot"], a group of podophthalmous or thoracastracous crustaceans, by some regarded as a peculiar order, but by most as a sub-order. The name has been applied to groups of various extent. By H. Milne-Edwards it was employed for all those Podophthalmia which are destitute of thoracic branchiæ lodged in internal cavities, and consequently embraced the Mysidæ and certain larval forms, as well as the Squillidæ. By later writers it is mostly limited to the Podophthalmia which have an elongated form, a small carapace, leaving exposed the last three or four thoracic segments, five pairs of maxillary appendages, the three posterior pairs of limbs with split extremities (*i. e.* with each a jointed palpiform appendage by the side of the last joints of each of the feet), and with external ramose branchiæ. The Squillidæ form the only recognized family. Theodore Gill.

**Stomata.** See Respiration of Plants.

**Stomatitis.** See Mouth, Diseases of, by E. Darwin Hudson, Jr., M. D.

**Stomiatidæ.** See Appendix.

**Stone.** See Calculus, by Prof. Willard Parker, M. D., LL.D., and Lithotomy, by Gurdon Buck, M. D.

**Stone,** in Great Britain, is a weight of 14 pounds avoirdupois, but 24 pounds of wool and 8 of butcher's meat make a stone. In other European countries there are weights called stone differing in pounds avoirdupois.

**Stone,** county of N. Arkansas, formed in 1873 from portions of other counties, bounded N. E. by the White and watered by Little Red River. The surface is irregular and well timbered; the soil fertile, and well suited for cotton, tobacco, grains, and fruit. Cap. Mountain View.

**Stone,** county of E. Dakota, not included in the census of 1870. The surface is a rolling table-land, forming a part of the Côteau des Prairies. Area, about 700 sq. m.

**Stone,** county of W. Missouri, bordering on Arkansas, intersected by White River, and crossed in its N. W. corner by Atlantic and Pacific R. R. It has a broken surface, but a fertile soil, with extensive forests and large iron-mines. Staples, Indian corn, wheat, oats, and a little tobacco. Cap. Galena. Area, about 500 sq. m. P. in 1870, 3253.

**Stone** (Amasa, Jr.), b. at Charlton, Mass., Apr. 27, 1818, of a Puritan family which came from England in 1632; learned the trade of a builder, and on becoming of age engaged in railroad and bridge building in Massachusetts; in 1845 became superintendent of New Haven Hartford and Springfield R. R.; in 1846 designed and built a railroad bridge over Connecticut River at Enfield Falls in forty days; in 1848 became one of the contractors to build Cleveland and Columbus R. R., and also Cleveland Painesville and Astabula R. R., of both of which he subsequently became superintendent, and in 1852 president; also aided in building and equipping Chicago and Milwaukee R. R., of which he was president at one time. He has founded car-factories, rolling-mills, and woollen-mills in various Western States, and is the inventor of several valuable improvements in railway construction and machinery. He was president of Lake Shore R. R., from Buffalo to Chicago, from 1869 to 1875. J. B. Bishop.

**Stone** (Andrew Leete), D. D., b. at Oxford, Conn., Nov. 25, 1815; graduated at Yale College 1837; was three years professor in the New York institution for the deaf and dumb, at the same time studying theology; for some years in the service of the American Sunday School Union at Philadelphia; ordained pastor of a Congregational church at Middletown, Conn., Sept., 1844; pastor of the Park street church at Boston, Mass., 1849–65, and has since 1865 been settled in San Francisco, Cal. Author of numerous published sermons and addresses.—His brother, David Marvine, b. at Oxford, Conn., Dec. 23, 1817, was long a contributor to literary periodicals, and has been since 1849 editor and one of the proprietors of the *New York Journal of Commerce*.

**Stone** (Charles P.), b. at Greenfield, Mass., in 1826; graduated at the U. S. Military Academy in 1845; when appointed in the army a brevet second lieutenant of ordnance; first lieutenant 1853. In the war with Mexico he served from Vera Cruz to the capture of the City of Mexico, gaining the brevets of first lieutenant and captain for gallantry at Molino del Rey and Chapultepec; ordered to California in 1851, he constructed the Benicia arsenal, at the same time performing the duties of chief of ordnance of the division of the Pacific. In Nov., 1856, he resigned and engaged in the banking business for a year in San Francisco, when (1857) appointed by the Mexican government chief of a commission to survey and explore its lands in Sonora and Lower California. Returning East in 1860, he was appointed Jan. 1, 1861, to organize and drill the District of Columbia militia for defence of the capital. Appointed colonel of the 14th U. S. Infantry May 14, and a brigadier-general of volunteers May 17, he served under Gen. Patterson during the latter's operations in the Shenandoah in July, receiving in Aug., 1861, an independent command of a "corps of observation" guarding the upper Potomac. In Feb., 1862, he was placed in confinement in Fort Lafayette, New York harbor, and held until Aug. 9, when released, not only without charges being preferred against him, but without explanation of the cause of his arrest. In May, 1863, he was ordered to duty in the department of the Gulf, participating in the siege and capture of Port Hudson. Gen. Banks soon after selected him as his chief of staff, which position he held until Apr., 1864, being engaged in the battles of Sabine Cross-roads and Pleasant Hill, Apr. 8 and 9. An order mustering him out of the volunteer service (dated Apr. 4) soon after reached him, and he was unemployed until Aug., 1864, when assigned to command of a brigade in the Army of the Potomac, but on Sept. 13, 1864, he resigned his commission in the regular army. In 1870 he entered the military service of the Khedive of Egypt.

**Stone** (Collins), b. at Canton, Conn., in 1812; graduated at Yale College 1832; was for nineteen years (1833–52) teacher in the American asylum for the deaf and dumb at Hartford, Conn.; was principal of the Ohio State asylum at Columbus 1852–63, after which he returned to the Hartford asylum as principal—a post he retained until his death at that place by a railroad accident, Dec. 23, 1870. He had studied theology with Rev. Dr. Hawes at Hartford, and been ordained in Ohio in 1853.

**Stone** (Edmund), F. R. S., b. in Scotland about 1690, was the son of a gardener to the Duke of Argyll at Inverary; was at the age of eighteen accidentally discovered by that nobleman while reading Newton's *Principia;* was found to be conversant with geometry, Latin, and French; thereupon taken under the duke's protection and enabled to complete his studies; published treatises on *Conic Sections* (1723), *Fluxions* (1730), and *Mathematical Instruments* (1758), a *New Mathematical Dictionary* (1726), *The Elements of Euclid* (2 vols., 1731), *The whole Doctrine of Parallaxes* (1763), and *Reflections on the Figure of the Earth* (1768); contributed to the *Philosophical Transactions* a paper on *Lines of the Third Order* (1740), in which he pointed out two such lines not noticed by Newton or Stirling (see Stirling, James); translated from the Latin Dr. Isaac Barrow's *Geometrical Lectures* (1745), and edited an English translation of David Gregory's *Elements of Astronomy, Physics, and Geometry* (2 vols., 1713; 2d ed., 1726), with additions. In his later years he subsisted by giving private mathematical lessons in London, where he died poor in 1768.

**Stone** (Edwin Martin), b. at Framingham, Mass., Apr. 29, 1805; edited the *Boston Times* (1827), and subsequently the *Independent Messenger* and *Salem Observer;* entered the ministry, and was for thirteen years pastor of a Congregational church in Beverley, Mass., and in 1847 became minister at large, residing at Providence, R. I., contributing to periodicals; has published—*Biography of Elhanan Winchester* (1836), *Hymns for Sabbath Schools* (1837), *Hymns and Tunes for Vestry and Conference Meetings* (1842), *History of Beverley* (1843), *Life and Recollections of John Howland* (1857), *History of the Providence Association of Manufacturers and Mechanics* (1860), *Historical Sketches of the*

*Rhode Island Regiments* (1861–65), *The Invasion of Canada in 1775* (1867), and *The Architect and Monetarian*, a memoir of Thomas Tefft (1869).

**Stone** (Frank), b. in Manchester, Eng., Aug. 23, 1800, the son of a cotton manufacturer; was engaged in his father's business, at the same time practising painting in water colors; in 1824 adopted art as a profession; went to London in 1831, and in the following year became a member of the Society of Painters in Water-Colors, beginning soon after to paint also in oil, sending to the Academy his *Legend of Montrose* in 1840. Among his numerous works are—*Philip van Arteveld*, engraved under the title *The Heart's Misgivings* (1840), *Charles I. and the Infanta of Spain* (1841), *The Bashful Lover and the Maiden Coy* (1842), *The Last Appeal* (1843), *Cross Purposes* (1844), *The Queen and Ophelia* (1845), *Evening* (1846), *The Impending Mate* and *Mated* (1847), *Christ and the Woman of Bethany* (1848), *The Duet* (1849), *The Gardener's Daughter* (1850), *Bassanio receiving Antonio's Letter*, which gained his election as an associate of the Royal Academy (1851); *Dr. Hooker in the Himalaya* (1852), *The Master is Come* (1853), *The Old, Old Story* (1854), *Doubt* (1856), *Bon Jour, Messieurs!* (1857), and *The Merry and Sad Heart*, not quite finished at the time of his death. D. Nov. 18, 1859.—Marcus Stone, his son, has painted *Elizabeth obliged to attend Mass by her Sister Mary* (1869), *Henry VIII. and Anne Boleyn observed by Queen Katharine* (1870), and *The Royal Nursery 1538* (1871).

**Stone** (Horatio), M. D., b. in New England about 1810; received a classical and medical education; practised some years as a physician in New York; was led by his artistic inclinations to exchange that profession for that of a sculptor, in which he was chiefly self-taught; settled at Washington, D. C., 1846, opening there a studio and becoming known as a gentleman of rare literary culture and ability; as a poet and essayist contributed frequently to the press, though usually without his signature; studied in Italy 1856–57, and during a second visit there d. at Carrara in Sept., 1875. Among his best-known works are the fine statues of Hancock, Hamilton, Taney, and Benton, executed for the U. S. government.

**Stone** (James Kent), D. D., b. in Boston, Mass., in 1840; graduated at Harvard 1861; studied in Italy and at the University of Göttingen, 1861–63; served in the Union army, from which he soon retired after being disabled; became professor of Latin in Kenyon College, Gambier, O., 1863, of mathematics and soon afterward president 1867; exchanged that post for the presidency of Hobart College, Geneva, N. Y., 1868; became a Roman Catholic 1869, and resigned and joined the congregation of Missionary Priests of St. Paul the Apostle, in New York City. In 1870 he published *The Invitation Heeded*, an account of the steps leading to his becoming a Roman Catholic.

**Stone** (John Augustus), b. in Concord, Mass., in 1801; made his début upon the stage in the character of Old Norval, but acted only at intervals. For Edwin Forrest he wrote the three plays, *Metamora*, *The Ancient Briton*, and *The Banker of Rouen*. Among his other dramas are *La Roque, the Regicide; The Demoniac;* and *Tancred*. Drowned himself, while in a fit of derangement, in the Schuylkill June 1, 1834.

**Stone** (John Haskins), b. in Maryland; early in the war of the Revolution entered the army as captain in Smallwood's regiment; rose to be colonel in 1776; distinguished himself at the battles of Long Island, White Plains, Princeton, and Germantown, in the last of which he was severely wounded, and obliged to leave the service in 1779. In 1781 became clerk in the office of Robert R. Livingston, secretary of foreign affairs; was subsequently a member of the executive council of Maryland, and governor of the State 1794–97. D. at Annapolis Oct. 5, 1804.

**Stone** (John Osgood), M. D., b. at Salem, Mass., about 1812; graduated at the medical school of Harvard College 1836; pursued further medical studies in Europe; settled on his return as a physician at New York, where he achieved eminence; was long a surgeon at Bellevue Hospital, and was an active member of the metropolitan board of health 1866–70. D. in New York City June 4, 1876. His services in connection with the ventilation and sanitary drainage of tenement houses were of great value.

**Stone** (John Seely), D. D., b. at West Stockbridge, Mass., in 1795; graduated at Union College in 1823; studied at the General Theological Seminary, N. Y., and took orders in the Episcopal Church 1826; was rector of churches at Litchfield, Conn., Frederick, Md., New Haven, Conn., Brooklyn, N. Y., Brookline, Mass., and of St. Paul's, Boston; became lecturer in the Philadelphia Divinity School, and in 1867 was chosen dean of the faculty of the Massachusetts Theological Seminary, to reside at Cambridge. Besides several sermons and articles in periodicals, he has published—*Life of Bishop Griswold* (1844), *The Mysteries Opened* (1844), *The Church Universal* (1846; revised and enlarged as the *Living Temple*, 1868), *Life of James Milnor* (1848), *The Contrast, or the Evangelical and Tractarian Systems Compared* (1853), *The Christian Sacraments*, and *Lectures on the Christian Sabbath* (1867).

**Stone** (Lucy), b. at West Brookfield, Mass., in 1818; graduated at Oberlin College, and became an agent and lecturer for the American Anti-Slavery Society, and was also an early advocate of the cause of woman's rights. In 1855 she was married to Mr. Henry B. Blackwell, still, however, retaining her own name, and for some years lived in seclusion in New Jersey. In 1867 she canvassed the State of Kansas, and established the *Woman's Journal* in Boston 1870.

**Stone** (Robert King), M. D., b. in Washington, D. C., in 1822; took the degree of M. D. at the University of Pennsylvania 1845, and then visited London, Edinburgh, Vienna, and Paris, studying particularly diseases of the eye and ear; soon after his return was made assistant professor of anatomy in the National Medical College at Washington; was thrown from his carriage and received an oblique fracture of the thigh, which confined him to the practice chiefly of aural and ophthalmic surgery. D. at Philadelphia of apoplexy Apr. 23, 1872. Paul F. Eve.

**Stone** (Samuel), b. at Hertford, England, about 1600; studied at Emanuel College, Cambridge, 1623–27; took orders in the Church of England; attached himself to the Puritan section of that Church, for which reason he underwent many annoyances from the authorities; embarked for New England on the Griffin with 200 emigrants, headed by Hooker, Cotton, and Haynes 1633; became colleague pastor with Hooker at Newtown (now Cambridge) 1633, and removed with the church to the banks of the Connecticut River 1636, at which time the present city of Hartford was founded and named in honor of Stone's native place. After the death of Hooker, in 1647, he succeeded to the pastorate; was noted for wit and humor, and distinguished as a controversialist, and was engaged in important theological discussions. D. at Hartford July 20, 1663, leaving many MSS. on theology.

**Stone** (Thomas), b. at Pointon Manor, Charles co., Md., in 1743; was educated by a private tutor; studied law at Annapolis, and in 1764 commenced practice at Frederickton, whence in 1771 he removed to Charles co. He was a member of the Continental Congress 1775–79, and advocated the establishment of an independent government, although at first instructed by the legislature of Maryland to oppose it; the State receding from its opposition, he was one of the signers of the Declaration of Independence; was again elected to Congress in 1783, and was a member of the committee to draft a plan of confederation, and was appointed a delegate to the convention of 1787, but was unable to attend. D. at Port Tobacco, Md., Oct. 5, 1787.

**Stone** (Thomas Treadwell), D. D., b. at Waterford, Me., Feb. 9, 1801; graduated at Bowdoin College 1820; studied theology; was pastor of the Congregational church at Andover, Me., 1824–30; principal of Bridgeton (Me.) Academy 1830–32; pastor of the Congregational church at East Machias 1832–46, of the First church (Unitarian) at Salem, Mass., 1846–52, of the First Congregational church at Bolton, Mass., 1852–60, and of the First ecclesiastical society at Brooklyn, Conn., 1863–71, after which he retired from active service, and now (1876), resides at Bolton, Mass. He received the degree of D. D. from Bowdoin College 1868. Author of a volume of *Sermons on War* (1829), *Sketches of Oxford County* (1830), another volume of *Sermons* (1854), *The Rod and the Staff* (1856), and of separate sermons and addresses; was a contributor to the *Dial*, the *American Quarterly Observer*, the *Biblical Repository*, and other religious periodicals, and was one of the early members of the so-called "Transcendental school." (See *History of Transcendentalism in New England* (New York, 1876), by O. B. Frothingham.)

**Stone** (Warren), M. D., b. at St. Alban's, Vt., Feb., 1808; took his diploma from a small medical college in Massachusetts; sailed in a little brig for a new home in the South-west; was wrecked off Charleston, S. C., in the vessel which first brought the Asiatic cholera South, and finally reached New Orleans poor in health and almost destitute; yet in a few years he was the admitted head of the profession in the South-west; in 1836 began to teach anatomy; the next year was made professor of that department in the University of Louisiana, and on the death of Prof. Luzenburg was transferred to surgery, which he held at his death, Dec. 6, 1872. He visited Europe, and contributed papers to professional journals. Paul F. Eve.

**Stone** (William Leete), b. at New Paltz, N. Y., Apr. 20, 1792; removed to Cooperstown 1809; entered a print-

ing-office; became editor of the Herkimer *American* 1813, subsequently of other political newspapers at Hudson, Albany, and Hartford; conducted at Hudson a literary periodical, *The Lounger*, and was one of the proprietors and editors of the New York *Commercial Advertiser* from 1821 to his death, at Saratoga Springs Aug. 15, 1844. He was for many years one of the political and literary celebrities of New York; had his full share of controversies in both capacities; was a prominent advocate of compulsory education, and for some years superintendent of common schools in New York City. Author of *Letters on Masonry and Anti-Masonry* (1832), *Tales and Sketches* (2 vols., 1834), *Border Wars of the American Revolution* (2 vols., 1834), *Matthias and his Impostures* (1835), *Ups and Downs in the Life of a Gentleman* (1836), *Maria Monk* (1836), *Letters on Animal Magnetism* (1837), *Life of Brant* (2 vols., 1838), *Life of Red Jacket* (1841), *The Poetry and History of Wyoming* (1841), and *Uncas and Miantonomoh* (1842). His *Life of Sir William Johnson*, left incomplete at his death, was finished and published (2 vols., 1865) by his son, W. L. Stone, Jr.

**Stone** (William Leete, Jr.), son of the above, b. in New York City Apr. 4, 1835; graduated at Brown University 1858 and at Albany Law School 1859; prefixed a *Memoir* of his father to the 2d ed. of the former's *Life and Times of Red Jacket* (1866), and completed his *Life of Sir William Johnson* (Albany, 2 vols., 1865); edited new editions of the other historical works of his father (1864–65); translated from the German the *Letters and Journals* (1867) of Baroness Riedesel and the *Memoirs, Letters, and Journals of Gen. Riedesel* (2 vols., 1868); contributed to magazines and literary periodicals; is editor (1876) of the *New York School Journal*, and author of *Saratoga Springs* (1866), *Life and Writings of Col. William L. Stone* (1866), *History of New York City* (1868; new ed. 1872), *The True History of the Jane McCrea Tragedy* (1874), *Reminiscences of Saratoga* (1874), and *Centennial Sketches* (1876); is engaged upon a *History of the Six Nations* and a work upon *The Campaign and Surrender of Burgoyne*, and has accepted the appointment of "Centennial historian" of the State of New York.

**Stone** (William Murray), D. D., b. in Somerset co., Md., in 1789; was educated at Washington College, Md.; took deacons' orders in the Episcopal Church in 1802; was for many years pastor of his native parish, and in 1830 was consecrated bishop of Maryland. He published a charge, a pastoral letter, and a sermon. D. near Salisbury, Md., Feb. 26, 1838.

**Stone** (William Oliver), b. at Derby, Conn., Sept. 26, 1830; became a painter in New Haven, where most of his early works were destroyed in the burning of his studio; removed to New York in 1851, where his first work, *The Mantilla*, was exhibited in 1854, and he was chosen a member of the National Academy in 1859. He painted the portraits of many noted persons, and excelled especially in those of women and children. D. at Newport Sept. 15, 1875.

**Stone, Artificial.** Several kinds of artificial stone have come into use within the last twenty-five years for architectural and artistic purposes, and for the pavements of cellars, footpaths, areas, and other localities not subjected to the tread of heavy animals. Some of them possess very considerable positive merit, and are of great value in districts where durable and cheap building-stone is not supplied by nature.

*Hydraulic concrete*, or *béton* (see articles Masonry and Cements), is a species of artificial stone admirably adapted to a variety of most important uses. For foundations in damp and yielding soils and for subterranean and submarine masonry, under almost every combination of circumstances likely to be met with in practice, it is superior to brick masonry in strength, hardness, durability, and economy, and in some cases is a safe substitute for the best natural stone, while it is almost always preferable to the poorer varieties. For submarine masonry, concrete possesses the advantage that it can be laid, under certain precautions, without exhausting the water and without the use of a diving-bell or submarine armor. On account of its continuity and its impermeability to water it is an excellent material to form a substratum in soils infested with springs; for sewers and conduits; for basement and sustaining walls; for columns, piers, and abutments; for the hearting and backing of walls faced with bricks, rubble, or ashlar-work; for pavements in areas, basements, sidewalks, and cellars; for the walls and floors of cisterns, vaults, powder-magazines, etc. Groined and vaulted arches, and even entire bridges, dwelling-houses, and factories, in single monolithic masses with suitable ornamentation, have been constructed of this material alone.

*Béton-Coignet* is an artificial stone of superior quality which has been introduced by M. François Coignet of Paris after extended experiment and research. Its usual ingredients, and those used and recommended by M. Coignet, are—Portland cement, silicious hydraulic lime, like that obtained at Teil, France, and clean silicious sand, mixed together with a little fresh water. For the sake of economy, common lime is sometimes used instead of the Teil lime, in whole or in part. When this is done, the proportion of Portland cement must be increased. It is deemed essential that only materials of the first excellence of their kind, whether common or hydraulic lime, and Portland cement, should be used for the matrix; that the quantity of water should not exceed what is just sufficient to convert the cement and lime into a stiff viscous paste; and that the sand be incorporated with the matrix by a thorough and prolonged mixing or trituration, producing an incoherent mixture in which every grain of sand is completely coated over with a thin film of the paste, leaving only a very little, if any, of the paste in excess to compensate for imperfect manipulation. A handful of this mixture, when pressed together between the fingers and the palm of the hand, will retain its form without being at all plastic, and if dropped upon the floor will fly apart, resuming its state of incoherency. M. Coignet recommends that the hydraulic lime-paste should first be prepared by trituration in a suitable mill of such design that it will act by both compression and friction; a pug-mill with helicoidal arms will produce this effect. After this, the sand is added and the materials passed through the mill again, or even more than once if necessary to produce a thorough and complete incorporation of the ingredients. If Teil hydraulic lime is used without any common lime, it is not deemed necessary to add any Portland cement for ordinary massive work. When, for any special purpose, it is desired to introduce Portland cement into the mixture in order to increase its hardness and the rapidity of its induration, it had better be done during the process of trituration with the sand, adding at the same time the requisite increment of water if any more be necessary, so that after thorough mixing the material will present the appearance of incoherent pasty powder, which is the characteristic property required. In ordinary practice, when sand and hydraulic lime only are employed, it will be found to answer very well to mix the two together dry with shovels, and then to spread them out on the platform and add the requisite quantity of water by sprinkling. The dampened materials are then shovelled into the mill and triturated thoroughly by passing it through more than once if necessary. When a portion of Portland cement is used, it may be incorporated with the other ingredients before the water is added, or it may be introduced into the mixture in the mill, as may be preferred. When Portland cement alone, or with only a little common lime, is used for the matrix—as will commonly be the case in the U. S., where no good hydraulic lime has yet been discovered—the process is the same as when hydraulic lime alone is used, except that the trituration should be more prolonged, especially if the cement be rather quick-setting. With Portland cement and silicious hydraulic lime similar to that of Teil the following proportions will answer for divers purposes. The mixtures in the two right-hand columns need seldom be used except for ornamental work, requiring removal and handling within two or three days after being made:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sand, by measure | 5 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 5 |
| Hydraulic lime, by measure | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Portland cement, dry, by measure | 0 | 0 | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{1}{4}$ | $\frac{1}{2}$ | 1 | $1\frac{1}{4}$ | $1\frac{1}{2}$ |

When the hydraulic lime is omitted, some one of the following proportions will answer, it being understood that the strength and hardness of Portland cement are diminished by the addition of either sand or lime:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sand, by volume | 6 | 5 | 4 | 4 | 3 | 3 | 2 | 2 |
| Common lime, by volume | 1 | 1 | 1 | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{4}$ | $\frac{1}{8}$ | 0 |
| Portland cement, by volume | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

In cases where a stone is to be subjected to wear, like a paving-block, the upper surface for the thickness of one-half to three-quarters of an inch is made richer in cement than the body of the block. The proportion of 1 of cement to 1 of sand for the surface, and 1 of cement to 3 or 4 of sand for the rest of the block, is sometimes used.

The mixing of the ingredients having been accomplished in such manner that each and every grain of sand is coated all over with a thin film of the matrix—almost entirely exhausting the matrix thereby—the material is compacted by ramming in successive layers in a mould of the form and dimension required for the stone. The mould should be capable of sustaining a heavy pressure from within, and of being taken apart and removed from the stone. If the mould be for a detached building-block, and

not for monolithic masonry, a quantity of the mixed material is thrown in and roughly spread out with a shovel to the thickness of 1½ to 2 inches. It is then thoroughly compacted by the repeated and systematic blows of an iron-shod rammer until the layer is reduced to about one-third its original thickness. Its surface is then scratched or roughened up with an iron rake, in order to secure a perfect bond with the succeeding layer, and then more of the material is added and compacted in the same manner. This process is continued until the mould is full. The upper surface is then struck with a straight-edge and smoothed off with a trowel, after which the full mould may be at once turned over on a bed of sand and the bottom, side, and end pieces removed. The block is then finished, and if small may be removed in a day or two. Large blocks, like sills, lintels, and platforms, require a longer time to harden, especially if the proportion of cement used is rather small. The construction of monolithic masonry is conducted in essentially the same manner as when common concrete is used. When a pug-mill cannot be procured for mixing the materials, tolerably good results can be obtained by the use of a cubical box of planks rigidly attached to a horizontal axle passing through diagonally opposite corners. The box may measure about 3 feet on each edge, containing 27 cubic feet, and may be arranged to work by horse- or hand-power. A proper charge for it would be about 14 to 16 cubic feet of the materials. It is provided with a trap-door about 20 inches square for charging and emptying. The door is located near one of the six angles farthest from the axle. The ingredients—the cement, sand, and water—are first roughly mixed together on a platform, and then passed into the box with shovels or wheelbarrows, or a large bucket swung from a crane. The grinding and rubling process of mixture, deemed so important in the preparation of the material, may be secured by putting in the box, with the cement, sand, and water, a number of rounded pebbles or cobble-stones weighing 6 to 8 pounds each. After the batch is emptied upon the platform, these stones are taken out for future use.

From the foregoing description it may be inferred that béton-Coignet is nothing more than a hydraulic concrete or béton, from which the coarse fragments or ballast have been omitted, and upon which all the advantages to be derived from a judicious choice in the quality and proportions of the ingredients, and from their thorough manipulation, have been conferred. The most important and costly work that has yet been undertaken in this material is a section, 37 miles in length, of the Vanne aqueduct for supplying water to the city of Paris. This aqueduct, which traverses the Forest of Fontainebleau through its entire length, comprises 2½ to 3 miles of arches, some of them as much as 50 feet in height, and 11 miles of tunnel, in nearly all of which the only sand used was the material excavated at the locality, known as Fontainebleau sand. It includes also eight or ten bridges of large span (57 to 125 feet) for the bridging of rivers, canals, and highways. The pipe is 6½ feet in interior diameter, with a thickness of 9 inches at the top and 12 inches at the sides at the water-surface. The construction of the arches was carried on about two weeks in advance of work on the pipe, and the centres were struck from seven to ten days later. The writer made a personal examination of this work in the winter of 1869–70, when it was only about two-thirds done. Water had been let into a portion of the pipe several months before, and its impermeability found to be perfect. An entire church, with its foundations, walls, and spire constructed of béton-Coignet, at Vesinet, near Paris, was also examined. The steeple is 130 feet high, and shows no cracks or other evidences of weakness. Over 31 miles of the sewers of Paris were laid in the same material prior to June, 1869. The proportions for the sewers were, by measure, sand 5, hydraulic lime 1, Paris cement (said to be as good as Portland) $\frac{1}{5}$. Several large city houses, some for residences and others for business purposes, were built with it in Paris. In one of them, having a cellar below the street-level, and six full stories surmounted with a Mansard roof above, the thickness of the exterior walls was established as follows: cellar, $19\frac{7}{10}$ inches; first story, $15\frac{7}{10}$; second story, $13\frac{8}{10}$; third story, $12\frac{8}{10}$; fourth story, $11\frac{8}{10}$; fifth story, $10\frac{8}{10}$; sixth story, $9\frac{8}{10}$.

Béton-Coignet was used for the fluted columns and other interior finish of the Roman Catholic cathedral in Fifth avenue, New York, and for a handsome carriage-way bridge spanning a footpath in Prospect Park, Brooklyn. It has been extensively used in the cities of New York and Brooklyn, and to some extent elsewhere in the U. S., for sills, lintels, steps, and platforms, and for facing the exterior walls of houses. In France the cellars of houses constructed with this material are usually divided into two large compartments by a wall parallel to the street, and these are each covered by a flat arch of the béton, the usual proportions of which are a rise of about one-tenth the span, a thickness at the crown of 5 to 6 inches, and a thickness at the springing lines of 8½ to 9 inches. Although this material does not attain its maximum strength and hardness until after the lapse of some years, it is amply strong when made into building-blocks to be used in a few days after moulding. Experiments made upon specimens varying from fifteen to thirty months in age, composed of 1 measure of dry hydraulic lime, 4 measures of sand, and ¼ to ¾ of a measure of Portland cement, gave resistances to crushing varying from 2634 to 7495 pounds per square inch. A crushing strength exceeding 6000 pounds per square inch on 3½ to 4 inch cubes represents an exceptionally strong specimen when the proportions are kept within the limits above mentioned. In Paris a considerable trade in statuary, vases, pedestals, etc., made from this material has grown up within the last twelve years. It resists frost and the solvent action of sea-water. Its cost in the U. S., with good Portland cement at $3.75 to $4.75 per cask of 400 pounds, will be from $9 to $12 per cubic yard for labor and materials, with these advantages over brick masonry—that a considerable degree of ornamentation and any desired color, from a light-drab or fawn to a dark-gray or brown, with shades of dark-red and dark-blue, may be conferred upon it at a trifling addition to the cost. By the use of Vicat cement, instead of Portland, a harder and stronger béton can be made, on account of the relative superiority of the former cement. Its cost will also be augmented.

*Ransome's Patent Silicious Concrete Stone.*—The process of making this stone, as followed for many years after the first patent was issued to Mr. Frederick Ransome of London, England, in 1856, consists in forming in the interstices of sand, gravel, or any pulverized stone a hard and insoluble cementing substance or matrix by the mutual decomposition of two chemical compounds in solution. The compounds employed are silicate of soda ("soluble glass," "liquor of flints") and chloride of calcium. These, when mixed together, form almost instantaneously, by double decomposition, silicate of lime and chloride of sodium (common salt), and the value of the artificial stone thus produced depends on the strength, hardness, and durability of the silicate of lime which binds the particles of sand together. The raw materials employed are principally sand, gravel, flints, chalk, limestone, caustic soda, chloride of calcium, and water. The silicate of soda or soluble glass is made by boiling and dissolving flints in a strong solution of caustic soda, under pressure. It should be of the consistency of molasses, and possess a specific gravity of about $1\frac{7}{10}$. To every bushel of sand about 1 gallon of the prepared silicate of soda is added, and the mass is then thoroughly mixed together in a mill until it attains a putty-like, semi-plastic condition, suitable for compacting into moulds by ramming or by compression. The prepared material is then compressed into moulds of wood or metal, or it may be rolled into slabs when that form is required, as for roofs, footpaths, etc. The slab as soon as formed, and before the process proceeds further, may be cut into pieces of any shape that will adapt it to the uses to which it is to be applied. When the material is once compacted in moulds, it may be taken out immediately, and is not liable to warp, crack, or undergo any subsequent change of form. The moulded blocks or the slabs are then at once drenched with a solution of cold chloride of calcium, which acts rapidly upon the silicate of soda, producing insoluble silicate of lime, whereby the mass is hardened and solidified to such degree that it can be removed and handled without danger of breaking during the remaining steps of the process. The blocks are then conveyed into a tank or cistern containing a solution of chloride of calcium of a specific gravity of about $1\frac{4}{10}$, heated to a temperature of 212° F. In this bath the chemical action is completed, resulting in the formation of silicate of lime through the mass, and the production of a homogeneous artificial stone. After this, the blocks are removed from the cistern, and thoroughly drenched with cold water for a longer or shorter period, depending on their size. By this the chloride of sodium formed during the operation is washed out. The work is then finished and the block ready for immediate use. An essential condition of success is, that the bath of hot chloride of calcium must be applied while the silicate is still moist—that is, as soon as the material is moulded into form. From the reported tests of this stone it appears that the tensile strength obtained by different experimenters is extremely variable, ranging from about 97 to 533 pounds to the square inch, while the strength to resist crushing, obtained on one occasion with 4-inch cubes, is stated as high as 6720 pounds per square inch. Other reports give it a crushing strength of 4200 pounds per square inch on 4-inch cubes. The crushing strength of the samples that gave a tensile strength of only 97 pounds per square inch

is not reported, but would probably not exceed 1200 to 1500 pounds to the square inch. The Ransome stone is adapted to many kinds of architectural embellishment, such as cornices, capitals, door and window dressings, copings, balusters, railings, finials; for garden decorations; for steps, platforms, footpaths, sidewalks, grindstones; for monuments, tombs, and other cemetery requirements. The writer visited the Patent Concrete-Stone Co.'s works, operating the Ransome patent, at East Greenwich, near London, some years ago, and found that the manufacture of grindstones had become a very important and lucrative branch of their business. They are perfectly uniform in hardness and homogeneous in structure, and have been found to be superior to those made from the best natural sandstones of England. Quite recently, a great improvement has been made in the method of producing this stone by which the cost is considerably diminished. It consists in the use of a silicious earth more or less readily soluble in caustic soda or potassa at moderately low temperatures. This material is mixed with lime (or substances containing lime), silicate of soda, and sand, and the mixture is then moulded into the required form in the manner already described. Nothing further is required except sufficient time for induration, which begins as soon as the materials are brought into intimate contact, and goes on gradually, as in the case of a good hydraulic cement. The reactions which produce hardness are simply that the silicate of soda is decomposed, the silicic acid entering into combination with a portion of the lime present, forming a silicate of lime, while a portion of the alkali set free seizes upon the natural soluble silica which constitutes one of the ingredients, and thus forms a fresh supply of silicate of soda (or potash). This, in its turn, is decomposed by a fresh quantity of lime. It appears that the whole of the alkali is not set free at these successive decompositions, but that a portion of it becomes permanently fixed in the formation of a compound silicate of lime and soda. The whole of the alkali thus becomes gradually fixed, obviating the necessity of subsequent drenching with water to secure its removal. The stone made by the new process, after the lapse of three or four months, is fully equal in strength to that produced in the chloride-of-calcium bath.

*The Sorel Artificial Stone.*—Some years ago, M. Sorel, a French chemist, discovered that the oxychloride of magnesium possessed the hydraulic energy in a remarkable degree, and this cement is the basis of the Sorel stone. It is formed by adding a solution of chloride of magnesium, of the proper strength and in the proper proportions, to the oxide of magnesium obtained by calcining carbonate of magnesia, or *magnesite.* There are several steps in the process, which may be briefly stated as follows: *First.* The magnesite is burnt in ordinary limekilns at a dark cherry-red heat for about twenty-four hours, producing protoxide of magnesium. This is then reduced to a fine powder between horizontal millstones. The best varieties are perfectly white. *Second.* For making stone the burnt and ground magnesite is mixed dry in the proper proportion with the material to be united and bound together—that is, with powdered marble, quartz, emery, silicious sand, soapstone—of which the stone to be imitated or reproduced is composed. The usual proportions are, for emery-wheels, 10 to 15 per cent. of oxide of magnesium by weight; for building-blocks, such as sills, lintels, steps, etc., 6 to 10 per cent.; and for common thick walls, not more than 5 per cent. The dry ingredients may be mixed together by hand or in any suitable mill, care being taken to secure their thorough and intimate incorporation with each other. *Third.* After this mixing they are moistened with chloride of magnesium, for which bittern-water (the refuse of seaside saltworks) has been found to be a cheap and suitable substitute. The bittern-water should be of the density of 15° to 30° Baumé. The moistened material is then passed through a mill, which subjects it to a kind of trituration by which each grain of sand or other solid material becomes entirely coated over with a thin film of the cement formed by a combination of the chloride with the oxide of magnesium. *Fourth.* The mixture is formed into blocks of the required shape and size by ramming or tamping it in strong moulds made of iron, wood, or plaster, in the manner already described for béton-Coignet. The block may be taken out of the mould at once, and nothing further need be done to it. The setting or hardening is progressive and simultaneous throughout the mass, as with other hydraulic cements; the maximum hardness is not attained for several months. This stone so closely resembles the natural stone, from which the solid ingredients are obtained by crushing and grinding, that it is not easy in the absence of chemical tests to detect any difference in either texture, color, or general lithological appearance. The Union Stone Co. of Boston has been operating for some years under the Sorel patent, and has built up a large business in the manufacture of emery-wheels, of which many sizes are made, from the small wheel attached to sewing-machines for sharpening needles to the large grindstone, 48 inches in diameter and 12 inches thick, for manufacturing establishments. The strength of this stone, as well as its hardness, exceeds that of any other artificial stone yet produced, and may, when desirable, be made equal to that of the natural stone which furnished the powder or sand used in its fabrication. From a number of specimens furnished the writer by the Union Stone Co., comprising coarse and fine sandstone of various shades of color, hones, white and variegated marble, emery-wheels, building-blocks, etc., some small blocks were prepared and subjected to crushing, with the results given below. The age and composition were also given by the company:

| Inert material. | Oxide of magnesium by weight. | Age. | Size of blocks. | Crushing strength per square inch. |
|---|---|---|---|---|
| | | | Inches. | Lbs. |
| Coral sand | 12 per cent. | 1 year. | $2\times2\frac{1}{6}\times1\frac{7}{8}$ | 6235 |
| Pulverized quartz | 12 to 15 p. c. | 1 year. | $1\frac{3}{4}\times2\times1\frac{3}{8}$ | 7272 |
| Washed flour of emery. | Not known. | 2 years. | $1\frac{3}{8}\times2\times1\frac{3}{8}$ | 19636 |
| Fine marble | 15 per cent. | 3 years. | $1\frac{1}{8}\times1\frac{1}{8}\times1\frac{1}{8}$ | 11555 |
| Mill-sweepings | 12 to 13 p. c. | 9 months. | $1\frac{7}{8}\times2\times1\frac{7}{8}$ | 6133 |
| Marble and sand | 12 per cent. | 2 years. | $1\frac{5}{8}\times2\times1\frac{1}{8}$ | 4923 |
| Marble | Not known. | ..... | $1\frac{1}{4}\times1\frac{1}{4}\times1$ | 7680 |

The speed recommended for the emery grindstones is 3500 feet per minute at the perimeter or grinding surface; the large stones will sustain a speed of 3 to 4 miles per minute at the circumference without breaking. For making sills, steps, lintels, etc., a mixture containing 100 pounds of clean sharp sand, 10 pounds of powdered marble, 10 pounds of the powdered oxide of magnesium, and 10 pounds of the chloride of magnesium in solution will answer very well. The materials for 1 cubic foot of stone will cost about 60 cents, to which should be added 20 to 25 cents per cubic foot for labor. This price may be reduced 10 to 12 cents per foot by incorporating large pebbles and cobblestones in the mixture at the time of moulding the blocks when their form and dimensions are such as to render it admissible. For foundations and plain massive walls the proportion of cement may be reduced and the quantity of cobblestones increased.

*The Frear Artificial Stone* consists of a mixture of silicious sand and hydraulic cement, to which gum-shellac is added in order to increase its strength and hardness. The cement is first thoroughly incorporated with the sand in the proportion of about 1 measure of cement to $2\frac{1}{2}$ measures of sand, and the mixture is then moistened with a solution obtained by dissolving 1 pound of gum-shellac in from 2 to 4 ounces of concentrated alkali in aqueous solution. This is diluted with water to such degree that about 1 ounce of the shellac is distributed through the cement and sand used in making one cubic foot of the stone. The dampened mixture, after thorough incorporation, may be compacted in moulds by the method already described for béton-Coignet. Some samples of the stone, reduced to 2-inch cubes and then crushed, gave the following results. The mixtures contained 1 part of cement and $2\frac{1}{2}$ parts of sand by measure, and 1 ounce of gum-shellac to the cubic foot. Portland cement was used in Nos. 1, 2, and 3, and Louisville (Ky.) cement in No. 4:

No. 1, 4 weeks old, crushed at 18,000, or 4500 lbs. per sq. inch.
No. 2, 4 weeks old, " " 18,500, or 4620 " " "
No. 3, 3 weeks old, " " 9,000, or 2250 " " "
No. 4, 6 months old, " " 8,000, or 2000 " " "

A 4-inch cube of the same composition and age as Nos. 1 and 2 sustained 57,000 pounds, equal to $3562\frac{1}{2}$ pounds to the superficial inch, under compression, and was not crushed. The introduction of gum-shellac into any mixture of hydraulic cement and sand doubtless adds to its strength while the mixture is yet new or only a few months old; but whether it will add to the strength and hardness acquired by age, particularly where Portland cement supplies the matrix, is certainly questionable. The durability of gum-shellac when exposed to the weather is by no means certain. It readily yields to the solvent power of the alkalies, and should be employed with great caution in localities exposed to such influences.

*Portland Stone* is the name given to a mixture of Portland cement and sand, or sand and gravel, compacted into form by tamping or otherwise. When properly made, it possesses the essential requisites of strength and hardness in a degree proportionate to the value of the cement employed. The proportions of 1 measure of dry cement to 2 or $2\frac{1}{2}$ measures of sand will answer for most purposes. The manipulation should be prolonged and thorough to ensure the production of a homogeneous stone. When used for flagging, the surface layer to the thickness of about half an inch may advantageously be composed of 1 measure of ce-

ment to 1¼ or 1½ of sand, and coarse gravel should be omitted from it.

*The strength and hardness* of all varieties of artificial stone which owe their induration to the hydraulic properties of the cement or lime used in their manufacture vary directly with the ultimate strength and hardness attainable by the hydraulic ingredients of the stone. An obvious means of improving their quality, therefore, is the employment of the highest grades of cement and hydraulic lime. I am not aware that any good silicious or argillaceous hydraulic lime has ever been manufactured in the U. S., and I know of no calcareous deposit capable of producing such a lime. There are plenty of argillo-magnesian limes, occupying in their composition, properties, and intrinsic value an intermediate position between the common limes and the argillo-magnesian cements, but their employment offers no advantage that cannot be readily secured by a mixture of common lime and cement, while many of them contain more or less unslaked lime, which, by subsequent extinction, might endanger the stability of the work into which they are introduced. The silicious hydraulic lime obtained from Teil on the river Rhone in the canton of Viviers, department of Ardèche, France, possesses properties which render it specially valuable for artificial stone. The best hydraulic cement for this purpose is the Vicat cement, which is made by mixing together, in suitable proportion, quicklime and clay, tempering the mixture with water, and then forming it into cakes or balls of the proper size for burning in a kiln. These, after drying, are burnt to nearly a white heat, and then ground to a fine powder, which completes the process. It is a stronger cement than Portland, and proportionally more expensive.

Investigations into the laws which govern the breakage of stone should begin with those of homogeneous structure, if such can be found, as properly preliminary to any intelligent discussion of the complications introduced by grain, form of crystallization, and stratification. The artificial stones approach more closely to homogeneity than most natural stones, although there are many limestones and sandstones that will split with almost equal freedom in all directions. Homogeneous stones in small cubes appear to break in all cases in the manner shown in Fig. 1. The forms of the fragments *a* and *b* are approximately either conical or pyramidal. More or less disk-shaped pieces, *c* and *d*, are detached from the sides of the cube with a kind of explosion. In the angles *e* and *f* the stone is generally found crushed and ground into powder by the attrition of the larger fragments. These general results are of course modified by the nature and quality of the grain in the stone, and by those other inherent causes of dissimilarity between any two cubes, although they may have been cut directly apart from each other. This general form of breakage occurs also in non-homogeneous stones when crushed on their beds, but in this case the modification which the grain of the stone produces must be taken into account, as it renders the cube liable to split into more or less rectangular fragments. This frequently lengthens the cone or pyramid in cubes crushed on the bed of the stone, and causes those crushed on edge, or parallel with the quarry-bed, to split into rectangular disks. If cubes of different sizes, cut from a homogeneous stone like any of the artificial stones above described, be crushed between steel plates, it will be found that their resistances per square inch increase with the increase in the dimensions of the cube; so that a 2-inch cube with a pressing surface of four square inches will sustain, before crushing, more than four times the weight which crushes a 1-inch cube. Similar results will be obtained with cubes of natural stone; and the more nearly homogeneous the stone is, the more readily can the results be expressed by mathematical formulæ. Experiments were made under the direction of the writer at Fort Tompkins, N. Y., with two varieties of sandstone from Berea, O., upon cubes of various sizes, from ¼ inch to 4 inches, from the results of which the two curves in Fig. 2 were constructed. The stone which gave the lower was the yellowish-gray variety. The cubes were crushed between plates of pine wood varying from $\frac{1}{16}$ of an inch in thickness for the ¼-inch cubes to a little over ⅜ of an inch in thickness for the 4-inch cubes. The bluish stone gave the upper curve, the cubes being crushed between steel plates. This stone being comparatively strong, a 2¾-inch cube was the largest that the press would crush with safety. In the curves the abscissas (X) represent the sides of the cubes in inches, and the ordinates (Y) the crushing-pressure in pounds per square inch of bed-surface—that is, the total resistance of the cubes in each case divided by the number of square inches in one of its faces. The form of the theoretical curve is that of a cubic parabola with the equation $Y = \sqrt[3]{X \times a}$, in which *a* is the cube of the unit strain, or, in other words, the cube of the pressure in pounds that will crush a 1-inch cube of the material. In the lower curve *a* is the cube of 7000 pounds, which is the force, in round numbers, required to crush a 1-inch cube of the yellowish-gray stone between plates of pine wood. In the upper curve *a* is the cube of 9500 pounds, the force required to crush a 1-inch cube of the bluish stone between steel plates. The equation for the lower curve will therefore be $Y = 7000 \times \sqrt[3]{X}$, and for the upper one $Y = 9500 \times \sqrt[3]{X}$. *Hence,* for 4-inch and smaller cubes, *The total crushing-pressure in pounds per square inch of bed-surface is equal to the crushing-pressure of a* 1*-inch cube of the same material, multiplied by the cube root of the side of the cube under trial.* No satisfactory experiments upon larger cubes have been made. Q. A. GILLMORE.

FIG. 1.

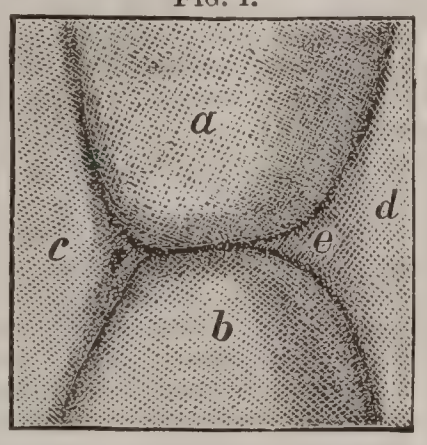
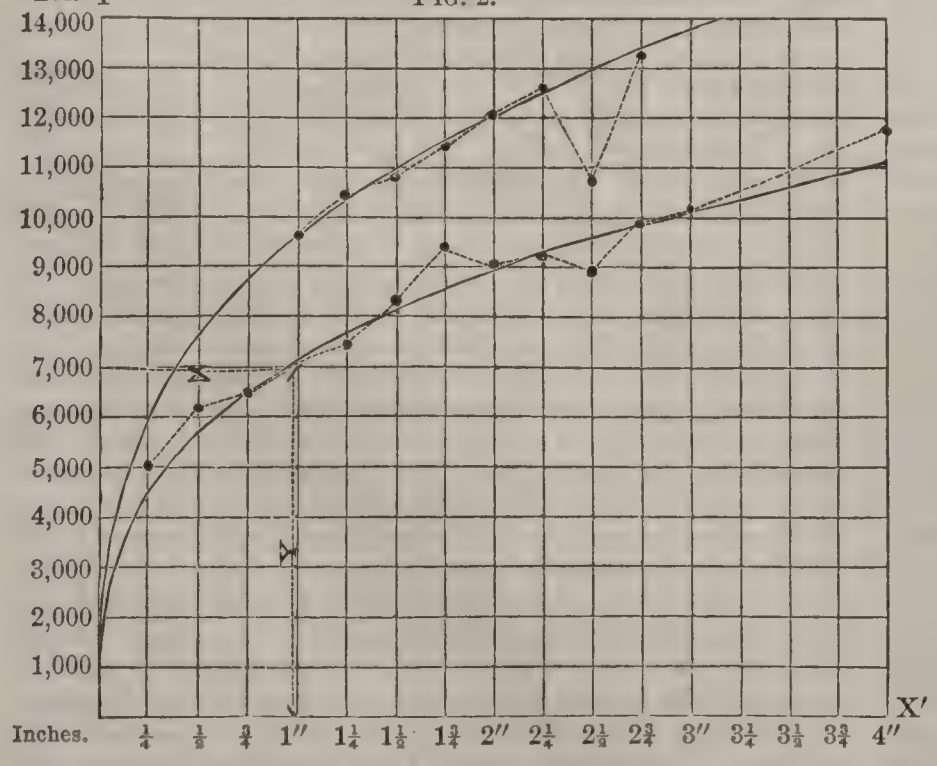



FIG. 2.




**Stone-Borer.** See APPENDIX.

**Stone′borough,** p.-b., Sandy Lake tp., Mercer co., Pa., on Jamestown and Franklin branch of Lake Shore and Michigan Southern R. R. P. 471.

**Stone** [Ang.-Sax. *stân*], **Building.** In the articles MARBLE, GRANITE, SLATE, LIMESTONE, etc., most building-stones have been already described, but a general review of the subject, with comparisons between the different kinds, seems required to give it completeness.

The varieties of building-stone most generally employed are granite, marble, sandstone, and limestone. Trap, serpentine, porphyry, alabaster, and other rarer stones are also used in certain localities. The qualities which are most important in stone used for construction are (1) cheapness, (2) strength, (3) durability, (4) beauty.

The elements that contribute to the *cheapness* of a stone are abundance, proximity of quarries to the place of use, facility of transportation, and the ease with which it is quarried and worked.

The *durability* of a stone is a quality of primary importance in all expensive and permanent structures. The most durable of all building-stones are granite and the stronger and more silicious sandstones. Where an untried stone is offered in market, it has been customary to test its durability by chemical analysis, by exposure to great alternations of temperature by freezing mixtures and otherwise, and by boiling in saline solutions. All these tests are, however, of little value as compared with an examination of the natural outcrops of the rock. By such examination it will be found that some stones soften and disintegrate by weathering, while others have held their angles and faces hard and sharp through countless ages of exposure.

The *strength* of a stone is in some instances a cardinal quality, as when it is to form piers or columns that are to support great weights, or capstones that span considerable intervals. This is also an indispensable attribute of stone that is to be exposed to mechanical violence or unusual wear, as in steps, lintels, door-jambs, etc. The strength of a building-stone is generally tested by applying measured force to cubes of it until they are crushed. This is accomplished by several machines, of which perhaps the most complete is that manufactured by Fairbanks & Co., where the application of power is measured by clockwork,

and the force at which the stone is crushed is recorded on a graduated bar by a stoppage of the machinery. A large number of tests have been applied to the building-stones of the U. S. at the navy-yard in Washington by Gen. Franklin of Hartford, by Maj.-Gen. Q. A. Gillmore, U. S. A., by Prof. Gustave Heinrich of Iowa, by Robt. G. Hatfield, architect, New York, and at the School of Mines of Columbia College. In the reports of these experiments, contained in the documents of which the titles are given below, the methods pursued and the results obtained are fully set forth. By a comparison of these results it will be seen that the strongest of all building-stones now in use in this country are the traprocks of New Jersey, which sustain a pressure of from 20,000 to 24,000 pounds to the cubic inch. With these should be placed the so-called granite of Staten Island, which is in fact a dolerite. The granites vary in strength from 12,000 to 21,000 pounds to the cubic inch; limestones, from 7000 to 14,000; marbles, from 6000 to 14,000, the average being about 10,000; sandstones, from 1600 to 17,000. The following table gives the resistance to a crushing-force of some of our best-known building-stones:

*Strength of Building-Stones.*

| | Strength in pounds per cubic inch. | Weight per cubic foot in pounds. | Authority. |
|---|---|---|---|
| *Traps.* | | | |
| Staten Island, N. Y. | 22,250 | 178.8 | Gillmore. |
| Jersey City Heights | 20,750 | 189.5 | " |
| Pompton, N. J. | 24,040 | ..... | " |
| *Granite.* | | | |
| Westerly, R. I. | 17,750 | 165.6 | " |
| Richmond, Va. | 21,250 | ..... | " |
| Fox Island, Me. | 15,062 | 166.3 | " |
| Port Deposit, Md. | 19,750 | 170. | " |
| Bay of Fundy (red) | 11,812 | 162.5 | " |
| Quincy, Mass. | 17,750 | 166.2 | " |
| *Marble.* | | | |
| Tuckahoe, N. Y. | 12,950 | 179.7 | " |
| Dorset, Vt. | 7,612 | 164.7 | " |
| Italian, Italy | 11,250 | 168.2 | " |
| Canaan, Conn. | 5,812 | ..... | Franklin. |
| Canaan, Conn. | 8,294 | ..... | " |
| Lee, Mass. | 13,444 | ..... | " |
| Lee, Mass. | 9,616 | ..... | " |
| Pittsford, Vt. | 12,239 | ..... | U. S. navy-yard. |
| Pittsford, Vt. | 9,028 | ..... | " " |
| Statuary marble, Carrara, It. | 9,723 | ..... | Franklin. |
| *Limestones.* | | | |
| Caen, France | 3,650 | 118.8 | Gillmore. |
| Joliet, Ill. | 11,250 | 159.3 | " |
| Canton, Mo. | 8,450 | 146. | " |
| Marblehead, O. | 11,250 | 150. | " |
| Kingston, N. Y. | 13,900 | 168.2 | " |
| Glens Falls, N. Y. | 11,475 | 168.8 | " |
| *Sandstones.* | | | |
| Little Falls, N. Y. | 9,850 | 140.6 | " |
| Belleville, N. J. | 10,250 | 141. | " |
| Middletown, Conn. | 6,950 | 148.5 | " |
| Medina, N. Y. | 17,250 | 150.6 | " |
| Berea, O. | 8,300 | 153.1 | " |
| Amherst, O. | 6,650 | 133.7 | " |
| Amherst, O. | 7,832 | ..... | Franklin. |
| Vermillion, O. | 8,450 | 135. | Gilmore. |
| Bass Island, Wis. | 5,450 | 127.5 | " |
| Dorcester, N. B. | 9,150 | ..... | " |
| Massillon, O. | 8,750 | 131.8 | " |

It very rarely happens that a pressure of more than 50,000 pounds per square foot is sustained by any part of a structure of stone. The pillars of the church of All Saints at Angers are said to sustain a pressure per square foot of 86,000 lbs., the columns of the Pantheon at Paris, 60,000 lbs., but in most of the great architectural monuments the weight sustained is not more than half these. From these facts it might be inferred that any of the varieties of stone above mentioned would meet the requirement of strength, but it should be remembered that no stone is perfectly homogeneous; and, what is of still more importance, the pressure is very likely to be unequally distributed, and so localized as to require for safety a very large excess of strength. No stone should be placed in a position where the pressure upon it will be greater than one-fourth of its normal power of resistance, and all sedimentary rocks should be placed in their natural position. Formerly, it was the habit of architects to interpose a sheet of lead between the stones exposed to great pressure, for the purpose of equalizing the bearing. Recent experiments have, however, demonstrated that their resistance is greatly reduced by the interposition of lead or any other soft substance. The explanation offered of this is that the softer material spreads under the pressure, and tends to tear apart the stone.

Some of the comparative excellences and defects of the best-known American building-stones are briefly stated in the following notes:

*Trap*, although the strongest of building materials, and exceedingly durable, is little used for architectural purposes from the great difficulty with which it is quarried and wrought. It is an exceedingly tough rock, and, being generally without cleavage or bedding, is especially intractable under the hammer or chisel. It is, however, sometimes used with excellent effect in cyclopean architecture, the blocks of various shapes and sizes being fitted together with no effort to form regular courses.

*Granite* is the strongest and most durable of all the stones in common use. It generally breaks with regularity, and may be quarried in simple shapes with facility; but it is extremely hard and tough, and therefore can only be wrought into elaborate forms with a great expenditure of labor. For this reason the use of granite is somewhat limited. Its strength and durability commend it, however, for foundations, docks, piers, etc., and for massive buildings; for these purposes it is in use the world over. Granites are usually either gray or red in color, the gray being the more abundant. Serviceable varieties of both are common in all mountainous districts, where the rocks are mostly metamorphic. Excellent granites are found in New England, throughout the Alleghany belt, in the Rocky Mountains, and in the Sierra Nevada. Both gray and red granite have recently come into vogue as a material for sepulchral monuments. Since it is capable of receiving a very high polish, monuments made of it, when carefully dressed, are very handsome and almost imperishable. Most of the granite used in the Atlantic States comes from Rhode Island, Massachusetts, or the coast of Maine. The beautiful varieties of red granite used here are brought from Peterhead, near Aberdeen, Scotland, and from the Bay of Fundy.

*Marble* is confessedly the most beautiful of all building materials. It was highly esteemed by the beauty-loving Greeks, and all their great masterpieces of architecture, as well as sculpture, were wrought from it. In modern times it has retained something of its ancient repute, and is still the favorite material for the construction of the finest buildings; but the old order of things has passed away, and the reign of democracy has succeeded to that of despotism. As a consequence, temples, cathedrals, and kings' palaces are no longer built, while the palace of industry, the council-hall, and the comfortable abode of the family in the middle class of society are the objects for which architectural designs and building materials are required. These structures are generally utilitarian and modest in plan and material as compared with the castle or palace of olden time, and marbles, the "purple and fine linen" of architecture, are chiefly employed, if at all, in the decoration of interiors. With the increase of wealth and the diffusion of culture, however, the æsthetic qualities of marble are destined to reassert themselves, and the churches, capitols, and other public buildings will in another generation be much more generally built of marble than heretofore. The pure white marbles are too cold in color to be popular among the inhabitants of the temperate zone, and in the cities where soft coal is used are liable to be stained and disfigured by smoke; but the variety of color found in marble is almost infinite, and the clouded, gray, and dove-colored marbles admit of the nicest adaptation of color to climate, surroundings, and architectural design. Much may be done also to relieve the brilliant and pronounced effect of the lighter marbles by avoiding monotony of surface, and correcting lightness of color by shadow-lines. Inexhaustible supplies of the coarser marbles, well adapted to purposes of construction, are known to exist in Westchester co., N. Y., and at various points farther S. in the Alleghany belt. Of the finer marbles every desirable variety may be found in Rutland co., Vt., those of Pittsford especially being capable of fully supplying the wants of the architect as regards both color and texture.

*Limestone* presents the greatest diversity of qualities as a building material. Sometimes it is jet black, like that of Glen's Falls, is compact, and capable of receiving a high polish; sometimes gray, like that of Lockport; of a delicate dove or cream-color, like the Athens marble, or very light-colored and soft, like the Caen stone, the Bermuda coral-rock, and the Florida *coquina*. All these have their excellences and defects as building materials. The darker limestones are too sombre in their normal state, and weather irregularly gray on exposure by the oxidation of the organic coloring-matter. The lighter-colored and fine-grained limestones to which reference has been made are, when sawed and used as ashlars, deservedly esteemed as among our best building materials. They are, however, less easily and accurately worked under the chisel than sandstones, and for this reason and their greater rarity are

far less generally used. The gray limestones, like that of Lockport, when hammer-dressed, have the appearance of light granite, and, since they are easily wrought, they are advantageously used for trimming in buildings of brick. Some of the softer limestones possess qualities which specially commend them for building materials; for example, the cream-colored limestone of the Paris basin (*calcaire grossier*) is so soft that it may be dressed with great facility, and yet hardens on exposure, and is a durable stone. Walls laid up of this material are frequently planed down to a common surface and elaborately ornamented at small expense. The Topeka stone, found and now largely used in Kansas, has the same qualities. It may be sawed out in blocks almost as easily as wood, and yet is handsome and durable when placed in position. The Bermuda stone and *coquina* are treated in the same way. The limestones most esteemed for building purposes in the U. S. are the Dayton stone, quarried at Dayton, O., and largely used in Cincinnati and other Western cities, and the Athens marble, found in Northern Illinois, a favorite stone in Chicago. Both these are derived from the Niagara group, are light-brown or dove-colored, and are very strong and handsome. Excellent building-stones are also obtained from the Corniferous limestone about Sandusky and Charloe, O., and Louisville, Ky., and from the Carboniferous formation at Bowling Green, Ky., and Elletsville, Ind.

*Sandstones* vary much in color and fitness for architectural purposes, but they include some of the most beautiful, durable, and highly-valued materials used in construction. Whatever their differences, they have this in common, that they are chiefly composed of sand—that is, grains of quartz—to a greater or less degree cemented and consolidated. They also frequently contain other ingredients, as lime, iron, alumina, manganese, etc., by which the color and texture are modified. The value of sandstones as building materials depends on several qualities, such as their color, texture, strength, durability, and facility of working. Where a sandstone is composed exclusively of grains of quartz, without foreign matter, it may be snow-white in color. Examples of this variety are known in many localities. They are rarely used for building, though capable of being employed for that purpose with excellent effect. They have been more generally valued as furnishing material for the manufacture of glass. The color of sandstones is frequently bright and handsome, and constitutes one of the many qualities which have rendered them so popular. It is usually caused by iron—when gray, blue, or green, by the protoxide as carbonate or silicate; when brown, the hydrated; and when red, the anhydrous oxide. The purple sandstones usually derive this shade of color from a small quantity of manganese. The texture of sandstones varies with the coarseness of the sand of which they are composed and the degree to which it is consolidated. Usually, the material which unites the grains of sand is silica, and this is the best of all cements. This silica has been deposited from solution, and sometimes fills all the interstices between the grains. If the process of consolidation has been carried far enough, or the quartz-grains have been cemented by fusion, the sandstone is converted into quartzite, the strongest and most durable of rocks, but, in the ratio of its compactness, difficult to work. Lime and iron often act as cements in sandstones, but both are more soluble, and less strong than silica. Hence, the finest and most indestructible sandstones are such as consist exclusively of grains of quartz united by silicious cement. In some sandstones part of the grains are fragments of feldspar, and these, being liable to decomposition, are elements of weakness in the stone. The very fine-grained sandstones often contain a large amount of clay, and thus, though very handsome, are generally less strong than those which are more purely silicious. The durability of sandstones varies with both their physical and chemical composition. When nearly pure silica and well cemented, sandstones are as resistent to weather as granite, and very much less affected by the action of fire. Taken as a whole, they may be regarded as among the most durable of building materials. When first taken from the quarry and saturated with "quarry water," a weak solution of silica, they are frequently very soft, but on exposure became much harder by the precipitation of the soluble silica contained in them. Since they form an important part of all the groups of sedimentary rocks, sandstones are abundant in nearly all countries; and as they are quarried with great ease, and are wrought with the hammer and chisel with much greater facility than limestones, granites, and most other kinds of rocks, these qualities, joined to their various and pleasant colors and their durability, have made them the most popular and useful of building-stones. In the U. S. we have a large number of sandstones which are extensively used for architectural purposes. Among these may be mentioned—(1) The *Dorchester stone*, which comes from the coal-measures of New Brunswick. This is a pale, olive-green sandstone, of which the color is apparently produced by the silicate and oxide of iron. It is a strong and usually homogeneous stone, although its value is sometimes impaired by balls or particles of pyrites, which, decomposing, produce cavities or black stains. (2) The *brownstone*, of which the Atlantic cities are so largely built. This is derived from the Triassic series, and the most important quarries which furnish it are located at Portland, Conn., Belleville and Newark, N. J. The popularity of this stone may be supposed to attest its excellence, but it varies much in quality. Some varieties are laminated, and are liable to exfoliate, especially when set on edge. It also often contains much lime and feldspar, both of which are elements of weakness and lead to disintegration. Although most of the buildings in which this stone has been used are comparatively new, many instances might be cited where it is already much decomposed; and, on the whole, we are compelled to regard it as lacking in durability. (3) The *Ohio stone*, derived from the Berea grit, a member of the Lower Carboniferous series in Northern Ohio. The principal quarries are located at Amherst and Berea. The stone from Amherst is generally light-drab in color, very homogeneous in texture, and composed of nearly pure silica. It is very resistant to fire and weathering, and is on the whole one of the best and handsomest building-stones known. The Berea stone is lighter in color than the Amherst, but sometimes contains sulphide of iron, and is then liable to stain and decompose. (4) The *Waverley sandstone*, also derived from the Lower Carboniferous series, comes from Southern Ohio. This is a fine-grained, homogeneous stone of a light-drab or dove-color, works with facility, and is very handsome and durable. It forms the material of which many of the finest buildings in Cincinnati are constructed, and is justly highly esteemed there and elsewhere. (5) The *Lake Superior sandstone*, a dark, purplish-brown stone of Potsdam age, quarried at Bass Island, Marquette, etc. This is rather a coarse stone of medium strength, but homogeneous and durable, and one much used in the Lake cities. (6) The *St. Genevieve stone*, a fine-grained sandstone of a delicate drab or straw-color, very homogeneous in tone and texture. It is quarried at St. Genevieve, Mo., and is one of the handsomest of all our sandstones. (7) The coal-measures of Pennsylvania, Ohio, and other Western States supply excellent sandstones for building purposes at a large number of localities. These vary in color from white to dark-red or purple, though generally gray or drab. While strong and durable, they are mostly coarser and less handsome than the sandstones which have been enumerated above. (8) The *Medina sandstone*, which forms the base of the Upper Silurian series in Western N. Y., furnishes a remarkably strong and durable stone, much used for pavement and curbing in the Lake cities.

*Serpentine* occurs in numerous localities in the Alleghany belt and in the Coast Mountains of California. It is generally a soft rock, unfit for architectural purposes, but a somewhat compact variety found in Chester co., Pa., is not only largely used for construction in that vicinity, but has recently been sent to Philadelphia, and there employed either as the sole material for the walls of buildings or as an adjunct to other stones in their ornamentation. It is of a grayish-green color, and structures built of it assume immediately the soft and pleasing tint that is only acquired by other materials with age. The new building of the University of Pennsylvania and several churches are built of it, in all cases with fine effect.

The following books and papers may be consulted for further information: *A Treatise on the Building and Ornamental Stones of Great Britain and Foreign Countries*, by Edward Hull; *Report of Commissioners on Building-Stones for the new Houses of Parliament* (1839–45); *Economic Geology*, by David Page; *Rocks Classified and Described*, by B. Von Cotta, translated by Lawrence; Ansted's *Practical Geology; Report on the Building-Stones of the U. S.*, by Q. A. Gillmore, Bvt. Maj.-Gen. U. S. A.; *Report on the Building-Stone of Iowa*, by Prof. Gustave Heinrich and Lieut. W. P. Butler (1871); *Report on the Marbles, etc. for the U. S. Capitol Extension*, President's Message 1852 (architect's report); *Smithsonian Report for 1856* (p. 303); *Experiments on the Resistance of Stones to Crushing*, made under the direction of Gen. Franklin at Hartford, Conn.; *Trans. Amer. Soc. Civ. Eng.* (No. xlviii.); *Experimental Tests of Building-Stones*, by R. G. Hatfield, N. Y.; *Trans. Amer. Soc. Civ. Eng.* (lvi.). J. S. NEWBERRY.

**Stone-Chat,** a European bird of the family of warblers (Sylviadæ) and genus *Pratincola*, the *Pratincola rubicola* or *Saxicola rubicola* of authors, about five and a quarter inches in length. The male, in the breeding season, has the head, neck above, and back nearly black; the chin and throat black, and the neck on the sides white; breast chestnut in front and lighter backward; the wing-coverts

of the tertials white, but partly hid by the other coverts, which are blackish-brown, edged with lighter brown: upper tail-coverts white, and tail-feathers blackish; bill and legs black. (*Yarrell.*) The female, as usual, is distinguished by duller colors. The species is common in most parts of Middle Europe and Northern Africa. It is claimed to be a resident throughout the year in England, though mostly migratory in corresponding latitudes on the Continent. It feeds on insects. THEODORE GILL.

**Stone-Crop.** See CRASSULACEÆ.

**Stone'-Fly,** a name sometimes given to neuropterous insects of the family Perlidæ. These have long flattened bodies, whose sides are parallel, and which have a large prothorax; the antennæ are filiform and elongated; the mandibles are generally aborted, but labial palpi present; the wings are unequal in size, the anterior comparatively small, the posterior broad, triangular, and generally extending beyond the abdomen; the tarsi are three-jointed. The pupæ are active, and resemble the adult save in the want of wings, and dwell in streams, under stones, etc. The adults mostly inhabit damp lowlands. They are used to a considerable extent, especially in England, as a bait for fishes. THEODORE GILL.

**Stone Fort,** p.-v. and tp., Saline co., Ill., on Cairo and Vincennes R. R. P. 798.

**Stone Fruits,** a popular name for those fruits which are known in botany as drupes. Most of them belong either to Amygdaleæ or Chrysobalaneæ, sub-orders of the Rosaceæ. The first-mentioned group includes plums, prunes, apricots, peaches, nectarines, and cherries; those of the other group are chiefly tropical. (See DRUPE.)

**Stone'ham,** tp., Oxford co., Me. P. 425.

**Stoneham,** p.-v. and tp., Middlesex co., Mass., on Boston Lowell and Nashua and Boston and Maine R. Rs., 9 miles N. of Boston, contains 5 churches, a public library, 1 bank, excellent public schools, 2 newspapers, a box-factory and steam planing-mill, a machine-shop, waterworks, and the manufacture of shoes and leather, which forms the principal industry. P. 4513. E. B. FAIRCHILD.

**Stone'henge** [from the Ang.-Sax. for "hanging stones"], an interesting mass of the remains of rude stone structures, usually referred to Druidical times, though the tendency among recent archæologists is to assign it to some pre-historic race. It stands on Salisbury Plain, 2 miles from Amesbury, Wiltshire, England. It is at present much defaced, but within the memory of man was composed somewhat as follows: At the centre was a large slab of blue limestone, a supposed altar. Around this were nineteen granite posts, some 20 feet in average height, set in an ellipse. Around this was another ellipse of sandstone posts, bearing a transom or lintel of sandstone across the top. There seem to have been six of these triliths. Outside this ellipse was a circle of thirty rough pillars of granite, some 6 feet high. Outside of this there was a circle of thirty sandstone posts, 3½ feet apart and 16 feet high. A horizontal course of stone, dovetailed and mortised to the tops of the uprights and to each other, ran around this circle. Without this circle there was a ditch and double mound of earth. Many sepulchral barrows are found in the vicinity. (See also STONES, STANDING.)

**Stone'house,** tp., James City co., Va. P. 828.

**Stone Lick,** p.-v. and tp., Clermont co., O. P. 1880.

**Stone Lily.** See ENCRINITE.

**Stone Mountain,** p.-v., De Kalb co., Ga., on Georgia R. R., at the foot of a bare and isolated peak of granite 2200 feet high, much resorted to by tourists. P. 690.

**Stone River, Battle of.** See MURFREESBORO'.

**Stones, Standing.** Large, unhewn monoliths raised to an erect position have been found in almost all parts of the world. They are notably numerous in the British Isles, where they sometimes stand singly and sometimes are arranged in groups. It was long supposed that they were in some manner connected with the Druidical worship of the Celtic races, but the results of modern investigation throw much doubt on this theory, while failing to give any other plausible explanation of their origin or purpose. Sometimes they were clearly erected as monuments to preserve the memory of some remarkable event. Thus, one in Scotland is traditionally known as the "Cat Stane" (from Celtic *cath*, "battle"), and another in Norway is known as the *bauta stein* (battle-stone); not unfrequently in Scotland they are now known merely as *hair stanes* (boundary-stones), having from time immemorial served as well-known landmarks, while the original purpose of their erection has been wholly forgotten. A religious idea is certainly connected with many of these stones. One of the most noted is the Lia Fail of Ireland, which was brought to Icolmkill for the coronation of Fergus Erc, was afterward removed to Scone, where it became the coronation-stone of the Scottish kings, and, being carried to England by Edward I., now forms part of the coronation-chair of the sovereigns of Great Britain. Myths are connected with many of the British monoliths, whether standing singly or in groups. Thus, one at Stennis in Orkneys, having in it a hole large enough to admit a man's head, was known as the "Stone of Odin," and within a century past was used for the solemnization of matrimonial and other vows, the person who violated a vow here made being held to be especially infamous. Another series of monoliths in the island of Mull is traditionally affirmed to be a line of guide-posts to point the way for pilgrims visiting the sacred shrine of Iona. There are several remarkable groups of standing stones, the arrangement of which evinces a definite purpose, but what that purpose was is as yet wholly a matter of conjecture. The most noted of these groups is that of Stonehenge. (See STONEHENGE.) The "standing stones" of Stennis, in one of the Orkney Islands, are about 80 in number, and are grouped in two separate circles of 360 and 100 feet in diameter. The standing stones at Avebury, in Wiltshire, stand in two concentric circles, surrounded by an outer circle of 100 stones, the whole being approached by two long avenues of similar stones standing in double lines. Another remarkable group is found at Calbernish, in the island of Lewis. These form four circles, near together, but having no apparent relation to each other. In the principal circle a double line of upright stones runs northward from a large stone in the centre, while to each of the other cardinal points of the compass runs a single line of stones, so that the whole figure is in the form of a cross. That some astronomical idea was in the minds of the builders is apparent from the fact that when upon a clear night one looks over the single line of stones running southward to the top of the large central stone, the apex of this points out exactly the position of the pole-star. At Carnac, in the department of Morbihan, France, is a still more remarkable group of standing stones, of which more than 1000 are still erect, and this is hardly a fourth of their original number. (See CARNAC.) A. H. GUERNSEY.

**Stone'wall,** tp., Appomattox co., Va. P. 2559.

**Stonewall,** tp., Frederick co., Va. P. 3388.

**Stonewall,** tp., Highland co., Va. P. 1632.

**Stonewall,** tp., Rappahannock co., Va. P. 1763.

**Stonewall,** tp., Richmond co., Va. P. 1397.

**Stonewall,** tp., Rockingham co., Va. P. 2212.

**Stonewall,** tp., Shenandoah co., Va. P. 2410.

**Stoneware.** See POTTERY AND PORCELAIN MANUFACTURE, by C. F. CHANDLER, M. D., PH. D., LL.D.

**Stoney Creek,** v., Pasakenta tp., Tehama co., Cal. P.76.

**Sto'nington,** p.-v. and tp. and seaport of New London co., Conn., on Stonington and Providence and Stonington and New London R. Rs., and the terminus of Stonington and Providence steamship line, has 6 churches, 3 public-school buildings, 2 banks, and 2 newspapers. Sealing-vessels are fitted out every year for the South Shetland Islands, this industry and whaling being the principal business engaged in. P. 6313. J. S. ANDERSON, ED. "MIRROR."

**Stonington,** tp., Christian co., Ill. P. 738.

**Sto'ny Battery,** tp., Newberry co., S. C. P. 1901.

**Stony Brook,** p.-v., Brookhaven tp., Suffolk co., N. Y., on Hicksville and Port Jefferson branch of Long Island R. R., has a good harbor and some coasting trade.

**Stony Creek,** tp., Colusa co., Cal. P. 686.

**Stony Creek,** p.-v., Branford tp., New Haven co., Conn., on Stony Creek Bay of Long Island Sound and on New York New Haven and Hartford R. R.

**Stony Creek,** tp., Henry co., Ind. P. 934.

**Stony Creek,** tp., Madison co., Ind. P. 1082.

**Stony Creek,** tp., Randolph co., Ind. P. 1212.

**Stony Creek,** tp., Warren co., N. Y. P. 1127.

**Stony Creek,** tp., Caswell co., N. C. P. 1368.

**Stony Creek,** p.-v. and tp., Somerset co., Pa. P. 1526.

**Stony Creek,** tp., Sussex co., Va. P. 1510.

**Stony Fork,** p.-v. and tp., Watauga co., N. C. P. 366.

**Stony Point,** p.-v. and tp., Rockland co., N. Y., on the W. bank of Hudson River, at the entrance of the Highlands, opposite Verplanck's Point, takes its name from a small rocky peninsula now crowned with a light-house and fog-bell tower, and connected with the shore by a marsh. The house of Joshua Hett Smith, where Arnold held his treasonable interviews, is in this town. The promontory of Stony Point was fortified by the Americans early in the war of the Revolution, but having been cap-

tured, strengthened, and garrisoned by the British, it was retaken by Gen. Wayne in a night-attack July 16, 1779, and the garrison of 543 officers and men taken prisoners. A simultaneous attack was made upon Verplanck's Point, but was unsuccessful, and the fortifications of Stony Point were consequently destroyed and abandoned July 18.

**Stop,** in the organ, a series or set of pipes of similar tone and quality, tuned in regular gradation according to the order of the scale, and corresponding with the key-board either in the whole or a part only of its range. These stops are either simple or compound. A "simple" stop (as a diapason, flute, or trumpet) has only one pipe allotted to each key on the keyboard, but in a "compound" stop (as the sesquialtera or mixture) there are from two to five pipes for each key. The stops in a large organ are not only of various *qualities* of tone—soft, loud, delicate, bold, shrill, and the like—or imitations of the trumpet, violin, flute, etc., but are also distinguished by peculiarities of *pitch*, some stops giving the sound represented by the finger-keys to which they belong, others the octave or double octave below or above, while others are tuned in triple octaves above, and even in double and triple thirds and fifths, the whole combining and blending together with united effect, as if each key sounded only one richly-toned pipe. The theoretical basis or *rationale* of this latter class of stops we have already endeavored to explain in the article Harmonic Stops, to which we here refer the reader in order to avoid repetition. In structure, organ-pipes are of two classes—viz. *flue*-pipes and *reed*-pipes. The former are either metallic cylinders of various forms and proportions, with a mouth and lip resembling those of the ordinary pitch-pipe; or are square wooden tubes producing sound on the same principle. The latter are chiefly metallic tubes of tapering form, provided with flexible reeds of brass or other metal, the vibrations of which produce a sound richer and more penetrating than that of the flue-pipe. Among the flue-stops are the diapasons, principal, twelfth, fifteenth, tierce, and the compound stops; also the gamba, keraulophon, and the various flute-stops. In the class of reed-stops the most prominent are the trumpet, trombone, horn, bassoon, clarion, cremona, hautboy, and vox humana. The names of the stops are sometimes arbitrary or fanciful, but ordinarily are descriptive—(1) of their quality of tone, as the dulciana, tuba mirabilis, etc.; or (2) of their imitative effect, as the trumpet, hautboy, flute, etc.; or (3) of their pitch, as the quint (or fifth), the twelfth (or octave fifth), the fifteenth (or double octave). Some of the compound stops, however, have names which cannot readily be accounted for, as the sesquialtera, cornet, mixture, and furniture. As many of the simple stops sound octaves, etc. to the finger-keys, it has been found expedient to classify them by a simple rule which shows at once the relation of their *pitch* to that of the diapasons. In the open diapason a pipe eight feet long gives the sound of C C, and on this account it is called an "eight-foot stop." And as the diapasons give the true and proper sound represented by the keyboard, every other stop which is in *unison* with the diapasons is said to be an "eight-foot stop." Taking this, then, as a standard, all stops sounding an octave above the regular pitch are called "four-foot stops," and those sounding the double octave above are "two-foot stops." A pipe, however, with a plug or stopper sounds an octave lower than an open one of the same length, and an eight-foot "*tone*" may therefore be obtained from a pipe only four feet long; hence, as the stopped and the open diapason give the same *tone*, or are of the same pitch, they are both said to be stops of eight-foot tone, or, briefly, eight-foot stops.

William Staunton.

**Stop'page in Trans'itu,** a peculiar mercantile remedy, given under certain circumstances to the seller of merchandise. When goods have been sold on credit, and have been delivered to a carrier or other middleman for purpose of transport and delivery to the vendee, and while this transit continues the vendor discovers that the buyer has become or is insolvent, such vendor may stop the goods, retake them into his own possession, and thus, by putting an end to the transit, prevent them from coming into the purchaser's custody. This remedial right of the seller to protect himself, and the act by which the right is enforced, are termed "stoppage in transitu." There have been some doubt and confusion as to the true legal principle which lies at the basis of this special rule. According to the English and American law, as soon as the contract of sale is entered into, the property in the goods at once passes to the buyer without a delivery; but if the sale is for cash, the seller has a lien on the articles, so long as they remain under his control, as a security for their price. The doctrine is now settled that the vendor's remedy of stoppage in transitu is not a recision of the sale, but is rather an extension by analogy of his lien; it is an equitable enlargement of a common-law principle which was originally narrow and special. The vendor does not, by the exercise of his right, become the absolute owner of the goods; he holds them as security, in the nature of a pledge; if the vendee or his assigns should demand them and offer to pay the stipulated price, the seller would be bound to accept the offered payment and to surrender the property. Stoppage in transitu was originally exercised only in cases of water transport, but has since become and now is extended to every species of transit, whether on the high seas, on inland waters, or by land-carriage.

*By whom and on what occasion may the Right be exercised?*—The right belongs only to a vendor who has sold goods on credit; but this description includes the case of a consignor who sends merchandise to a factor for sale, when the latter would be clothed with at least their apparent ownership, and would become a debtor for their proceeds to his principal, since the relation of vendor and vendee virtually exists under such circumstances. The occasion of the right is the fact that the buyer is discovered after the sale to be insolvent. It is not essential that the insolvency should have actually occurred subsequent to the contract of purchase; if at that time the vendee was really insolvent, but the vendor was ignorant thereof, and only makes the discovery afterward, the right of stoppage arises if the transit has not ended. If, however, the vendor sells goods on credit knowing that the purchaser is then insolvent, he assumes the risk and abandons all right to interfere with them while on their way. It is not necessary that the vendee should have been judicially declared a bankrupt or an insolvent; mere inability to pay his debts as they become due constitutes the insolvency contemplated by the law. Of course, the burden of proof rests upon the seller, who exercises his right of stoppage, to establish this fact in case it is denied and the validity of his proceeding is controverted. When the vendor might stop the goods *in transitu*, he may retain them if they have not yet passed from his actual possession.

*How long does the Right continue?*—in other words, What facts, acts, and circumstances end or defeat the right? It is wholly impracticable to mention even the numerous particular cases which may arise or have arisen in the transactions of business, and the special questions suggested by them; the broad general principle which determines all these cases and answers these questions can alone be stated. The right of stoppage continues as long as the transit lasts, and ends when the transit ends. The transit itself continues as long as the goods are not yet under the control of the vendee, but are in the hands of a middleman for the purpose of being expedited toward the *final destination* contemplated by the original contract. The transit ends when the goods have arrived at that final destination, and have there come into the custody or under the control of the vendee. This is the settled doctrine in its most general form, and must be applied under the infinite variety of circumstances to the merchandise in the hands of carriers by land or by water, of warehousemen, wharfingers, forwarders, and of every other species of agent or middlemen concerned with their transport or their storage. When the goods have arrived at the place of their destination, and are there placed in the vendee's own warehouse or on his wharf, or in a warehouse or on a wharf which he is in the habit of using as his own and of making the repository for his merchandise, the transit and the right of stoppage have ended. When, also, the goods have arrived at the place to which the vendee intended they should be carried, and where they will stop awaiting his orders and subject to his direction as to what shall be done with them, although not perhaps his regular place of business, the transit has ceased. But when, on the other hand, they are sent to an intermediate party *for the purpose of being forwarded by him* to the purchaser, the transit is not ended by their coming into his possession, although they may there await the vendee's orders as to the time when they are to be forwarded to him. The doctrine concerning the duration of the transit was so clearly and comprehensively announced by one of the most eminent of American judges that I quote his statement in a somewhat condensed form: While the goods remain in the possession of persons concerned in their transportation to the place of destination named by the purchaser, they may, in the event of his failure, be reclaimed by the seller. It is not material whether the person in whose possession they are when the seller interposes his claim be a carrier, a warehouseman, a wharfinger, a packer, or other depositary, or an agent for the purpose of forwarding, nor by which of the parties to the sale he was employed. He may be the agent of the purchaser, designated, paid, and employed by him; yet if the purpose of his employment is to expedite the property toward its destination, or to aid those en-

gaged in forwarding it, the seller's right to stay the final delivery continues. When the seller attempts to claim the goods, the question is, whether they have arrived at the end of their transit; and this depends upon the further question, whether the party in whose hands they are found is acting in the character of an *agent for transportation* or as agent for the purchaser, holding them simply for his use, unconnected with the business of forwarding them. The circumstances of the transaction may be such that the delivery to the vendee is immediate, and that any subsequent transport of the goods is made *by* him in the course of his own business, and is not a conveyance *to* him as contemplated by the original contract of sale; in such a case no right of stoppage arises. If the merchandise arrive from abroad in the port of the consignee, and is there taken by the customs officers and warehoused by reason of his failure or delay in paying the duties, it may still be reclaimed by the consignor. If, however, goods so arriving are placed in a public warehouse, and the consignee by giving the requisite bonds is entitled to withdraw them at any time upon payment of their duties, the constructive delivery to him is complete and the seller's right is defeated. If while the goods are on their transit they should be seized on execution or attached by a creditor of the vendee, the seller's remedy of stoppage is not prejudiced, but can be exercised as against the interfering creditor and the persons acting on his behalf. One of the most interesting questions connected with this subject, and one which gave rise to the gravest judicial controversy, relates to the effect produced upon the consignor's right of stoppage by the consignee's assignment of the bill of lading of the goods when they are transported by ship. The doctrine is thoroughly established that a bill of lading is not completely a negotiable instrument, like a bill of exchange or a promissory note; and the assignee thereof, although taking it in good faith and for value, is not always protected against the real owner or rightful claimant of the goods. A bill of lading is, however, a *quasi* negotiable instrument; it represents the merchandise described in it; it is constantly treated by merchants as a muniment of title; transfers of cargo or parts of cargo on board "to arrive" are made by its endorsement and delivery to the purchaser. If goods are shipped and their bill of lading, originally drawn to the consignee or his assigns, is sent to him, or, being originally drawn to the consignor, is regularly endorsed by him and sent to the consignee, the possession of this written evidence of title by the latter under these circumstances makes him the apparent owner of the property, and clothes him with the apparent power of disposition. If with such a state of facts the consignee, having in his possession a bill of lading regular on its face and vesting him with the apparent ownership, assigns the same to a *bonâ fide* purchaser for a valuable consideration and without notice of the consignor's claims, it being intended by the transaction to transfer the property in the goods themselves, this act will defeat the consignor's or vendor's right of stoppage, although the actual transit has not ended, and although the consignee or vendee, being indebted for the price, is or becomes insolvent.

*How the Right should be exercised.*—The vendor himself or his agent may interpose and arrest the transport and the delivery to the vendee. The purchaser's insolvency, however absolute and notorious, is not alone sufficient; there must be some positive act of interference by which the seller's right is asserted. This act may be a manual taking possession of the property, but such an exercise of ownership is never required, and would often be wholly impracticable. A notice to the carrier or other middleman of the vendor's right, accompanied by a prohibition from making a delivery to the vendee, and by a demand to surrender up possession to the seller or his agent, is always sufficient, and is the usual mode of exercising the right of stoppage. If the middleman should refuse to comply with the notice, and even if he should violate it by a delivery to the vendee, the vendor's lien would still be preserved; he could recover possession of the goods or their value either from the buyer or from his assignees, while the middleman would also be responsible to him for the damages caused by his own wrongful act. The carrier, however, has a lien upon the goods for his freight earned in their transport, and the warehouseman or wharfinger for his charges, and their claims must be satisfied by the vendor before he can lawfully obtain possession of the merchandise. JOHN NORTON POMEROY.

**Storax.** See STYRACACEÆ.

**Sto'rer** (BELLAMY), LL.D., b. at Portland, Me., about 1798; graduated at Bowdoin College 1818; studied law at Cincinnati; was a Representative in Congress 1835–37; subsequently judge of the superior court, and professor in the Cincinnati Law College; at the time of his death was a vice-president of the Evangelical Alliance. D. at Cincinnati June 1, 1875.

**Storer** (DAVID HUMPHREYS), M. D., b. at Portland, Me., in 1804; graduated at Bowdoin College in 1825; devoted himself especially to natural history, and besides contributions to scientific periodicals has published *Genera, Species,* etc. *of Recent Shells* (1837), *Ichthyology,* etc. *of Massachusetts* (1839), *Fishes of North America* (1846), and *History of the Fishes of Massachusetts* (1853, and, with plates, 1866).

**Storer** (FRANCIS HUMPHREYS), b. in Boston in 1832; graduated at the Lawrence Scientific School in 1855, and is professor in the Massachusetts Institute of Technology; has contributed to scientific periodicals; was the American editor of Barreswill's *Répertoire de Chimie appliquée,* and has published *Alloys of Copper and Zinc* (1859), *Manufacture of Paraffine Oils* (1860), *First Outlines of a Dictionary of the Solubilities of Chemical Substances* (1863–64), and with Charles W. Elliot, *Manual of Inorganic Chemistry* (1869), and *Manual of Qualitative Chemical Analysis* (1870).

**Storer** (HORATIO ROBINSON), M. D., b. in Boston in 1830; was professor of obstetrics and medical jurisprudence in the Berkshire Medical College; has contributed largely to medical literature, and has published *Why not? a Book for every Woman,* which received the gold medal of the American Medical Association (1866), *Is it I? a Book for every Man* (1867), *Decrease of the Rate of Increase of the Population in Europe and America* (1867), *Nurses and Nursing* (1868), and with F. F. Heard, *Criminal Abortion, its Nature, its Evidence, and its Law* (1868).

**Sto'rey,** county of W. Nevada, lying between Truckee and Carson Rivers. In the valleys are small tracts of arable land, but silver mining is the principal industry. On Mount Davison, 7000 feet high, is the famous Comstock Lode, one of the richest in the world. Cap. Virginia. Area, 420 sq. m. P. 11,359.

**Storey** (WILBUR F.), b. in Salisbury, Vt., Dec. 19, 1819; served an apprenticeship to the printing business, went to New York City, and was employed on the *Journal of Commerce.* In the spring of 1838 he removed to Laporte, Ind., where he began the publication of a weekly Democratic newspaper. This and a similar venture at Mishawaka, Ind., in 1841, proving unsuccessful, he established the *Patriot* at Jackson, Mich., in 1842, and in 1854 purchased the Detroit *Free Press,* which he published till 1861, when he purchased the Chicago *Times,* which he has since conducted. J. B. BISHOP.

**Stork** [Ang.-Sax. *storc*], a name given to the birds of the genus *Ciconia* and of the family Ciconiidæ, but especially to *Ciconia alba.* This is a large bird, about three and a half feet long; the head, neck, and body above, as well as below, are white, the wings partly black, and the bill and legs red. It is a migratory species, which in the warm season extends into Northern Europe, and in winter (as well as other seasons) is found in Northern Africa and Asia. It has no cry, but claps its bill together with a loud noise. Storks are great favorites with the people, who conceive that their presence brings good luck. They often build upon the roofs of houses. They display remarkable affection for their young; and according to popular belief are so attached to their old parents that they carry them upon their backs during their long and lofty flights from zone to zone. It is, however, asserted that when one of their number is sick or wounded the others fall upon it and kill it by blows of the beak. They rest by standing on one leg and dropping the beak against the breast. They devour offal, reptiles, and other vermin. The stork is of old a popular emblem of filial piety and conjugal faithfulness. A number of related species are known.

**Storks** (Sir HENRY KNIGHT), K. C. B., b. in England Apr. 5, 1811; entered the army in 1828, and served on regimental duty until 1846, when employed on the staff in the Kaffir war, 1846–47. In the Crimean war he commanded the British military establishments on the Bosphorus, the Dardanelles, and at Smyrna 1854–55; in the war-office as secretary for military correspondence 1857–59, when promoted to be major-general, and was lord high commissioner of the Ionian Islands until 1863; appointed governor of Malta in 1864; was summoned to Jamaica the next year to inquire into the Eyre outbreak on that island, the satisfactory execution of which duty brought him the honor of being sworn of the queen's privy council and becoming Right Hon. In 1868 he became under-secretary of state for war, in 1870 surveyor-general of the ordnance, and in 1871 lieutenant-general and member of Parliament from Ripon. D. at London Sept. 6, 1874.

**Storm Lake,** p.-v. and tp., Buena Vista co., Ia., on Iowa division of Illinois Central R. R., has 3 churches, a fine school, 2 banks, 1 newspaper, 2 parks, and 1 steam flouring-mill. P. 256. W. L. VESTAL, ED. "PILOT."

**Stor'mont,** county in the E. of Ontario, Canada, bounded S. by St. Lawrence River. It is traversed by Grand Trunk Railway. Cap., Cornwall. P. including Cornwall, 18,987.

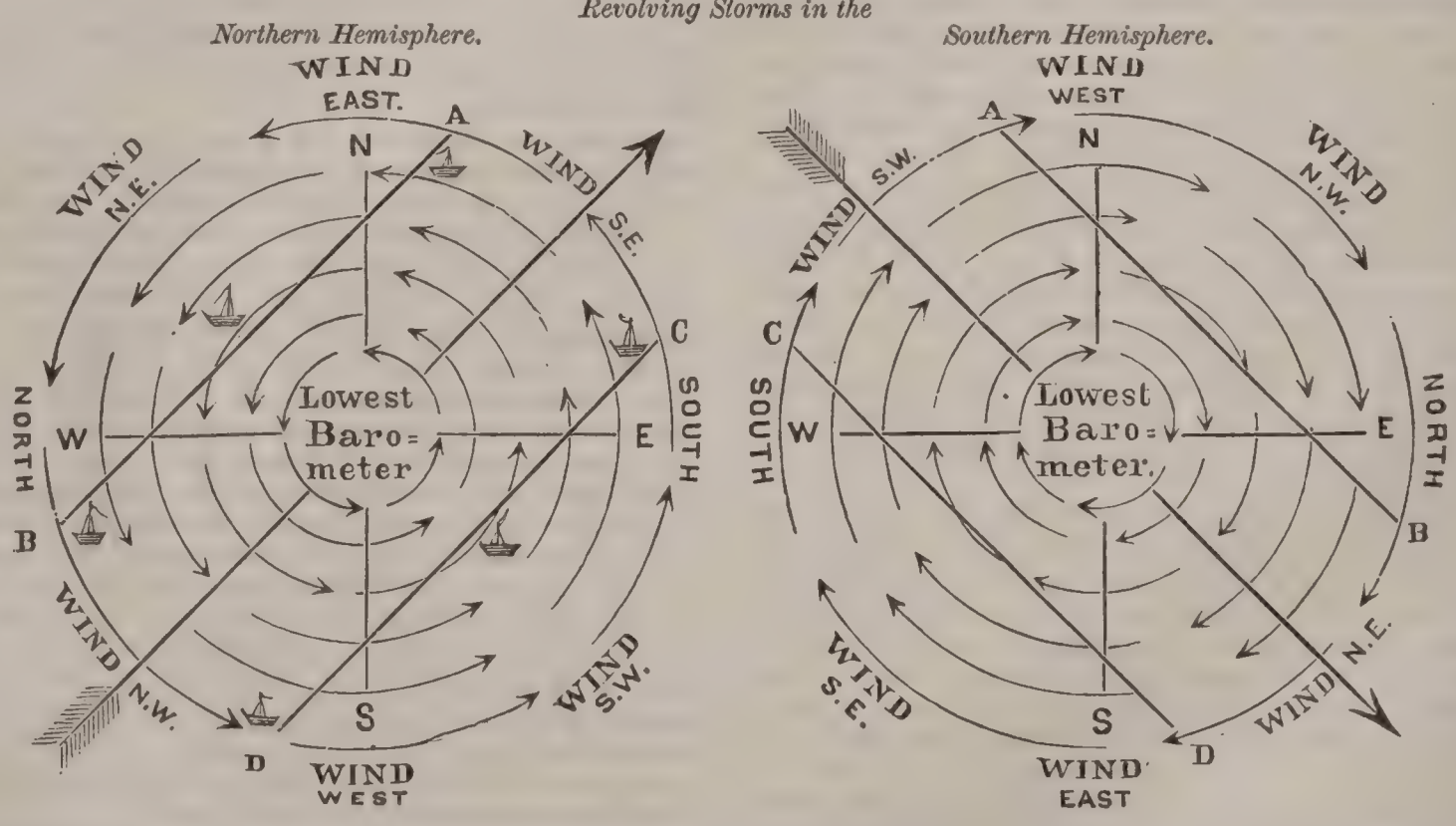
**Storms, Hur'ricanes,** and **Cy'clones.** When currents of air moving in different directions encounter each other, they impart to the atmosphere a whirling motion, as may often be seen when wind carries up the dust off the ground. Such a movement, on a grand scale, is a storm, which is usually accompanied by rain or snow when the contending winds are of different temperatures. Storms vary in their nature according to their immediate causes, some being due to struggling horizontal, some to ascending, currents of air, modified in their course by chains of mountains and inequalities of the surface; some, again, to mere local causes. The most remarkable for violence and the regularity of their course are the *hurricanes* of the West Indies and of Mauritius in the Indian Ocean, the *cyclones* of the Gulf of Bengal, and the *typhoons* of the South Chinese Sea.

*Law of Storms.*—All the facts collected with great care and industry by Mr. Redfield of New York, Gov. Reid of Bermuda, Piddington of Calcutta, and Prof. Dove of Germany prove that in these great storms the air has a strong rotary motion round a centre where calm prevails and the barometric pressure is least. All around the wind blows in various and opposite directions, while at the same time the body of the storm has a progressive motion, its course being marked by the track of the centre. In the northern hemisphere this rotary motion is from right to left, or contrary to the direction of the hands of a watch. In the southern hemisphere it is reversed. These storms usually begin within the tropics, but extend far into the temperate regions, where they gradually spend their force. In both regions they follow the course of the general winds peculiar to each zone, by which they are, as it were, borne along. The West India hurricanes usually originate in the Eastern Antilles (see Map in WINDS), and first move westerly toward the tropics. Beyond the limits of the trades (see diagram at the bottom of Map in WINDS) they suddenly turn around, and, carried by the general motion of the atmosphere, sweep over the eastern coast of North America, and after raging in the Atlantic cross to Western Europe, where they finally expire. The Mauritius hurricanes start from the southern tropical ocean, move toward the S. W. to Mauritius and Reunion islands, and thence turn at right angles beyond the tropics in the temperate latitudes. The typhoons, also born in the tropical seas of India and China, move with the monsoons, and their course bends more strongly toward the N. E. when reaching the temperate regions. All these storms cover only a small area at their point of origin, but their violence is extreme. As they advance, their circle gradually enlarges while their fury diminishes. The West India hurricanes of 1839 had a diameter of 300 miles in the Antilles, 500 at the Bermudas, and 800 in the 50th degree of latitude. They occur most frequently at the time of the breaking up of the seasons and the change of the general winds—that is, about the equinoxes. Out of 365 hurricanes which have desolated the West Indies from 1493 to 1855, 245, or over two-thirds, took place from August to October.

The position of the main regions of hurricanes above mentioned, on the S. E. side of the three great continents and near the tropics, is very remarkable, and proves that they are the result of the struggle between the general winds, intensified by the influence of the great bodies of land, varying with the season. Next to the grand volcanic eruptions and earthquakes, no natural phenomenon is more awe-inspiring than these tremendous tempests. The portentous calm and lurid sky which precede the bursting of the storm, the profound obscurity which follows the descending clouds, the extreme violence of the wind uprooting whole forests, tearing down the most solid edifices, sinking the largest ships in a few moments or lifting them up in the air to break them on the shore, and covering their path with ruin and desolation, place these hurricanes among the long-remembered events whose recurrence is ever dreaded by all. (See WHIRLWIND.)

A knowledge of the law of storms enables the navigator to steer his vessel so as to avoid a direct encounter with these tempests. He can ascertain what part of a circular storm he is coming into by observing how the wind begins to veer. In the northern hemisphere, within the tropics, if the wind is N. E., the centre of the storm is on the S. E. of the ship while its body is moving to the N. W. (See figure.) The commander must therefore sail to the S. W., and leave the storm behind him. Within the temperate

*Revolving Storms in the*




regions, the body of the storm moving toward the N. E., he will steer W. or N. W., and thus get out of the path of the storm. In the southern hemisphere the opposite course must be taken.

*North-easters.* — Our great winter and north-easterly storms are but the left, or western half, of such a revolving mass of air. Suppose the storm strikes a place first at the point A (fig.), the wind will be N. E. The storm passing over it along the line A B, the wind will successively blow from the N. N. E., N. N. W., and finally N. W., clear and cold; after which the storm is over. If the storm begins with a S. E. wind, as at point C, we are in the right-hand half, and while it is passing along the line C D the wind gradually veers to the S., S. W., W., and N. W.; which is always the end. It is thus easy to understand why it is that the wind, though coming from the N. E., blows at Washington and Philadelphia, as Franklin first remarked, before it is felt in New York and Boston.

The *northers* are violent, cold, dry polar winds descending from the top of the atmosphere, and sweeping, mostly during the winter, over Texas and Louisiana, and sometimes reaching Mexico and the Antilles. The *sirocco* of Italy, the *khamsin* of Egypt, the *harmattan* of Guinea, the *simoom* of Arabia, are hot winds from the zone of deserts of Africa and Western Asia, blowing with great fury, more or less periodically at certain seasons.

*Tornadoes* and *water-spouts* repeat on a small scale, but with scarcely less violence, the phenomenon of cyclones. When opposite winds of different temperatures meet in the upper atmosphere, a vast amount of vapor is condensed into a thick black cloud, and a whirling motion is given to the air, which soon takes the shape of a vast funnel descending lower and lower into the quiet atmosphere beneath as the rapidity of its motion increases. This long revolving column of black cloud draws up in its vortex all the objects in the path of the tornado. On a narrow track, from a few yards to a quarter of a mile wide, trees are uprooted, houses unroofed or carried up into the air by this fearful power of suction. A tornado passing into the sea becomes a *water-spout*. The dark column, descending near the surface, raises the water, which joins in its whirling motion and binds together, as it were, the clouds and

the sea. Like the cyclones, the tornadoes usually move with the general south-westerly winds. A. GUYOT.

**Storrs** (CHARLES BACKUS), brother of Dr. Richard Salter, Sen., b. at Longmeadow, Mass., May 15, 1794; educated at Princeton and at Andover Seminary 1820; preached at Ravenna, O., from 1822 to Mar., 1828, when he became professor of Christian theology in Western Reserve College, and was chosen president of that institution 1831. D. at Braintree, Mass., Sept. 15, 1833.

**Storrs** (RICHARD SALTER), D. D., b. at Longmeadow, Mass., in Feb., 1789, descended from a long line of ministers, his father, who bore the same name, having been thirty-three years pastor at Longmeadow (b. at Mansfield, Conn., 1763; graduated at Yale College 1783; d. 1819); passed a year at Yale College 1802–03; taught in the Clinton Academy, East Hampton, L. I., 1804–06, after which he entered the senior class at Williams College, graduating 1807; studied theology with Rev. Aaron Woolworth at Bridgehampton, L. I.; was licensed by the Suffolk presbytery 1808; preached at Islip and Smithtown, L. I., 1808–09; spent a year at Andover Seminary, graduating 1810; was ordained pastor of the First Congregational church at Braintree, Mass., July 11, 1811, and, with the exception of one period of five years spent as agent of the Home Missionary Society, remained there until his death, Aug. 11, 1873, after a pastorate of sixty-two years. Editor of the *Boston Recorder* (1817–25), and senior associate editor of the *Congregationalist* (1850–56); contributed to the *Panoplist*, the *Home Monthly*, and other periodicals; furnished introductions to Willison's *Sacramental Meditations* (New York, 1850) and to the *Life of Rev. Daniel Temple* (Boston, 1855), and published a *Memoir of Rev. Samuel Green*, about twenty single sermons, one of which was on *Continuance in the Ministry, a Discourse on the Fiftieth Anniversary of his Ordination* (Boston, 1861).

**Storrs** (RICHARD SALTER), D. D., son of the preceding, b. at Braintree, Mass., Aug. 21, 1821; graduated at Amherst College in 1839; studied law, and afterward theology at the Andover Seminary, where he graduated in 1845, and after serving for a year as pastor of a Congregational church in Brookline, Mass., became in 1846 pastor of the Church of the Pilgrims, Brooklyn, N. Y., a position which he still occupies. He has contributed much to current literature, and was from 1848 to 1861 one of the editors of *The Independent*, a religious weekly. He has published a *Report on the Revision of the English Version of the Bible* undertaken by the American Bible Society; *The Graham Lectures on the Wisdom, Power, and Goodness of God, as manifested in the Constitution of the Human Soul* (1856); and a series of lectures on *The Conditions of Success in Preaching without Notes* (1875).

**Storrs** (WILLIAM LUCIUS), LL.D., b. at Middletown, Conn., Mar. 25, 1795; graduated at Yale College 1814; studied law at Whitestown, N. Y., where he was admitted to the bar 1817; returned soon afterward to Middletown; was a member of the State assembly 1827–29, and its Speaker 1834; member of Congress 1829–33, and again 1839–40; was appointed associate judge of the State supreme court of errors June, 1840, and chief-justice 1856, and was professor of law in Yale College 1846–47. D. at Hartford June 25, 1861. His decisions, which were regarded by jurists as extremely able, are found in the *Connecticut Reports*.—His elder brother, HENRY RANDOLPH, b. at Middletown in 1787; graduated at Yale College 1804; practised law at Champion, Whitestown, and Utica, N. Y.; was for five years first judge of Oneida co.; sat in Congress 1819–21 and 1823–31; published a number of Congressional *Speeches;* removed about 1832 to New York City, where he took high rank in his profession. D. at New Haven, Conn., July 29, 1837.

**Sto'ry,** county of Central Iowa, intersected by Skunk River, and crossed by the Chicago and North-western R. R., which passes through the capital. It has an undulating surface and fertile soil. Staples, Indian corn, wheat, oats, hay, wool, and dairy products. Cap. Nevada. Area, 550 sq. m. P. in 1870, 11,651.

**Story** (ISAAC), cousin of Judge Joseph, b. at Marblehead, Mass., Aug. 25, 1774; graduated at Harvard 1793; practised law at Castine, Me., where he edited the *Journal*, and at Rutland, Mass.; contributed to Russell's *Columbian Centinel* and to Denny's *Farmer's Museum;* published a poetical *Epistle from Yarico to Inkle* (Marblehead, 1799), *Consolatory Odes* (1799), and *The Parnassian Shop, by Peter Quince* (Boston, 1801). D. at Marblehead July 19, 1803.

**Story** (JOSEPH), LL.D., b. at Marblehead, Mass., Sept. 8, 1779; graduated at Harvard College in 1798; studied law, and in 1801 commenced practice at Salem; was a member of the State legislature 1805–08, and the acknowledged leader on the Republican side, defending Jefferson's proclamation of embargo as the only measure, short of war, by which American commerce could be protected from the ignominious restrictions of the belligerent European powers. In 1808 he was elected a representative in Congress, where he urged a repeal of the embargo act, on the ground that it was a temporary measure, the purpose of which had now been attained. Having declined a re-election to Congress, he was in 1810 again chosen a member of the State legislature, of which he was elected Speaker. In 1811 he was appointed associate justice of the Supreme Court of the U. S., and in 1820 was a member of the convention for the revision of the State constitution. In 1829 he was chosen Dane professor of law in Harvard University, a position which he held for the remainder of his life, during which the law-school of which he was the head became the foremost one in the U. S. In 1804 he published an unsuccessful volume of poems entitled *The Power of Solitude*, and in 1806 *Memorial of the Inhabitants of Salem*, a pamphlet addressed to Pres. Jefferson relating to the infringements by foreign powers upon the neutral trade of the U. S. He also published many addresses, literary discourses, and reviews, but his fame rests mainly upon his decisions, and especially upon his legal *Commentaries*, of which the following are the principal, all of which have passed through several editions, and most of which have been translated into German: *On the Law of Bailments* (1832), *On the Constitution of the U. S.* (1833), *On the Conflict of Laws, Foreign and Domestic* (1834), *On Equity Jurisprudence, as administered in England and America* (1835), *On Equity Pleadings* (1838), *On the Law of Agency* (1839), *On the Law of Partnership* (1841), *On the Law of Bills of Exchange* (1843), *On the Law of Promissory Notes* (1848). He also edited Chitty *On Bills of Exchange*, and Abbott *On Shipping*, and contributed important legal articles to the *Encyclopædia Americana*, and left in MS. a *Digest of Laws*, supplementary to that of Comyns. His commentaries and written decisions in his circuit comprise 27 volumes, and his judgments in the Supreme Court an important part of 34 volumes more. A collection of his *Miscellaneous Writings* was published in 1852, and his *Life* has been written by his son, William W. Story (1851). D. at Cambridge, Mass., Sept. 10, 1845. A. H. GUERNSEY.

**Story** (WILLIAM WETMORE), son of Hon. Joseph Story, LL.D., b. in Salem, Mass., Feb. 19, 1819; studied law; was admitted to the bar, and published several legal books —*Report of Cases* (1842–47), *Treatise on the Law of Contracts* (1844), *The Law of Sale of Personal Property* (1847), edited the *Life and Letters of Joseph Story* (1851); wrote *The American Question* (1862), *Roba di Roma* (1862), *Proportions of the Human Figure* (1866), *Graffiti d'Italia* (1869), *A Roman Lawyer in Jerusalem* (1870), *Judas Iscariot;* and has published five volumes of poems. As a sculptor he is known chiefly by his large allegorical statues, *Medea*, *Cleopatra*, *The African Sibyl;* by the statue of George Peabody executed for the corporation of London; the statue of Edward Everett in the Boston Public Garden; and busts of his father, J. R. Lowell, Josiah Quincy, and Theodore Parker. Mr. Story has resided in Rome for nearly thirty years, and is better known as an artist on the other side of the Atlantic than at home. He is a man of ardent temperament and various accomplishments. His work is characterized by beauty, grace, and elegance, rather than by originality of conception or depth of sentiment. O. B. FROTHINGHAM.

**Stosch, von** (ALBRECHT), b. Apr. 20, 1818; received his education in the Prussian corps of cadets; entered the 29th Infantry in 1835 as a lieutenant; held various special commands; was one of the tutors of the crown prince of Prussia, and accompanied him on his journey to the opening of the Suez Canal. From 1866 to 1870 he was director of the economy department of the ministry of war, and together with Gen. Podbielski he formed the main support of the minister Von Roon. During the war of 1870–71 he was superintendent-general of the commissary department of the German army in France. In Dec., 1870, he was appointed chief of staff of the army of the Loire, under the grand duke of Mecklenburg, and subsequently chief of staff of the army of occupation left in France after the peace. On Jan. 1, 1872, when the department of the navy was separated from the war department, he was placed in charge of the former, and has since worked with great success for the development of the German fleet. July 26, 1870, he was made a lieutenant-general, 1872 general of infantry, and in Aug., 1875, received the title of admiral. AUGUST NIEMANN.

**Stoth'ard** (CHARLES ALFRED), son of the succeeding, b. in London in 1786; early distinguished himself by his skill as an artist, being especially successful in the delineation of ancient costumes. His best known painting, *The Death of Richard II.*, was exhibited in 1810, and

in the following year he began the publication of the *Monumental Effigies of Great Britain*, a magnificent series of etchings with descriptions, completed (1811–23) after his death by others. He was selected by the Antiquarian Society to make drawings of the famous Bayeux Tapestry, and in 1819 made sketches from the newly-discovered old pictures on the walls of the Painted Chamber of the House of Lords. D. at Bere Friars, in Devonshire, May 27, 1821, by the giving way of a scaffolding on which he was standing.—His widow, ANNE ELIZA, assisted her brother, Mr. Kempe, in the completion of the *Monumental Effigies*, and was afterward the widow of the Rev. Edward Bray; she was the author of several creditable novels written during her second marriage; of the *Traditions, Legends, and Sketches of Devonshire* (1838), *Handel, his Life*, etc. (1859), and memoirs of her father-in-law and both her husbands.

**Stothard** (THOMAS), R. A., b. in London Aug. 17, 1755; was apprenticed to a designer of patterns for the silk-trade, but soon became an illustrator of books, and finally a painter. He was elected fellow of the Royal Academy in 1794, and its librarian in 1812. His illustrations for books number more than 4000, among them being those for Milton, Shakspeare, Chaucer, Spencer, the *Pilgrim's Progress*, *Don Quixote*, *Robinson Crusoe*, and Rogers's *Italy*. Among his best paintings are—the *Canterbury Pilgrims*, the *Flitch of Bacon*, and *Four Periods in a Sailor's Life*. D. in London Apr. 27, 1834.

**Stouchs'burg,** p.-v., Marion tp., Berks co., Pa. P. 397.

**Stough'ton,** p.-v. and tp., Norfolk co., Mass., on Old Colony and Providence R. Rs., 17 miles S. of Boston, has 6 churches, a public library, schools, 1 newspaper, 3 hotels, and woollen manufactories. Business, boot and shoe making. P. 4914. D. S. HASTY, ED. "SENTINEL."

**Stoughton,** p.-v., Dane co., Wis., on Chicago Milwaukee and St. Paul R. R., contains 7 churches, good schools, 1 newspaper, manufactories of brooms, cigars, harness, etc., 3 hotels, an extensive carriage-factory, and 1 mill. P. 985. GEO. W. CURRIER, Ed. "COURIER."

**Stoughton** (ISRAEL), b. in England; emigrated to America, and was one of the early settlers at Dorchester, Mass.; was member of the general court 1634–37; denied some of the powers claimed by the governor and his assistants, for which he was pronounced disabled, but this judgment was soon revoked; in 1637 commanded the Massachusetts troops sent against the Pequot Indians; was commissioner to administer the government of New Hampshire in 1641; assistant to the governor of Massachusetts 1637–42, and again in 1644, when he returned to England. He held large landed estates in Massachusetts, and gave 300 acres to Harvard College. D. at Lincoln, England, in 1645.

**Stoughton** (JOHN), D. D., b. in England about 1815, is an Independent minister, and author of *Lectures on Tractarian Theology* (1843), *Notices of Windsor in the Olden Time* (1844), *Spiritual Heroes, or Sketches of the Puritans* (1848), *Philip Doddridge, his Life and Labors* (1851), *The Lights of the World* (1852), *Scenes in other Lands* (1853), *Stars of the East* (1853), *Ages of Christendom before the Reformation* (1857), *The Pen, the Palm, and the Pulpit* (1858), *The Song of Christ's Flock in the Twenty-third Psalm* (1860), *Windsor, a History and Description of the Castle and the Town* (1862), *Church and State Two Hundred Years Ago, a History of Ecclesiastical Affairs in England from 1660 to 1663* (1862), *Shades and Echoes of Old London* (1867), and other works; edited Cheever's *Wanderings of a Pilgrim*, etc. (1859) and Rev. William Walford's *Autobiography* (1851), and has written largely for theological and literary periodicals.

**Stoughton** (WILLIAM), son of Israel, b. in England Sept. 30, 1631; was brought to Massachusetts when an infant; graduated at Harvard College in 1650; studied theology; went to England and became a fellow of New College, Oxford, but was ejected at the restoration of Charles II., and in 1662 returned to New England, where he acquired high reputation as a preacher, but declined any settlement as a pastor. He was an assistant to the governor from 1671 to the dissolution of the government in 1686, and was agent in England for the colony 1676–79; was elected assistant and governor in 1686, but declined to serve; was a justice of the court and a member of Andros's council 1686–89, when he became one of the council of safety who deposed and imprisoned Andros. In May, 1692, he became lieutenant-governor of Massachusetts, and in December chief-justice of the superior court, over which he presided in the Salem witchcraft trials. He was a liberal benefactor of Harvard College, left a tract of land for the support of students there, and another tract for the benefit of schools. D. at Dorchester July 7, 1701.

**Stoughton** (WILLIAM L.), b. in New York Mar. 20, 1827; studied law, and commenced practice at Sturges, Mich., in 1851; was prosecuting attorney 1856–60 and U. S. district attorney 1861; early in the civil war joined the army; became colonel of the 11th Michigan Vols. in 1862, distinguishing himself at the battle of Stone River; commanded a brigade at Chickamauga, Missionary Ridge, and Atlanta, where he lost a leg, and was brevetted a major-general of U. S. volunteers. He was elected attorney-general of Michigan 1866; Representative in Congress in 1868, and re-elected in 1870.

**Stour'bridge,** town of England, county of Worcester, on the Stour, manufactures iron, glass, earthenware, and fire-bricks, the latter from a peculiar kind of clay called "Stourbridge clay," on which fire has only a small effect. P. 8773.

**Stout'land** (formerly STOUTSVILLE), p.-v., Camden co., Mo., near Gasconade River, on Atlantic and Pacific R. R., is a new and thriving railroad town, and near the famous Lead Mountain; has 2 weekly newspapers.

**Stouts'ville,** p.-v., Monroe co., Mo., on Salt River and on Missouri Kansas and Texas R. R.

**Stoutsville,** p.-v., Clear Creek tp., Fairfield co., O., on Cincinnati and Muskingum Valley R. R. P. 160.

**Stove,** an apparatus for retaining and diffusing heat, either for warming and ventilating or for culinary purposes. Stoves are not a very recent invention. A fixed stove (*stuba*) was used by the Romans in the times of the Empire for heating their baths, and in Germany and Scandinavia for baths and for hot-houses (whence our partially obsolete use of *stove* for a conservatory or hot-house). In the Middle Ages they were used for warming dwellings. These stoves were generally constructed of brick or tiles, sometimes of slate or steatite. They were large structures, occupying sometimes the whole side of a room, and in Scandinavia in winter their broad flat surface was, like the Oriental divans, the sleeping-place of the household. The fire was kindled at the bottom, and the heat and smoke passed through various flues before making their exit into the chimney. These stoves saved fuel, a matter of much importance in some of the countries of Europe. Some of them were faced with porcelain or highly ornamented tiles, and formed a stately tower, in the niches of which were statues of porcelain or bisque. These were in the homes of the rich. A specimen of these porcelain stoves was exhibited in the Swedish department at the Centennial Exposition in Philadelphia in 1876. They have ovens and flues for cooking, and when once thoroughly heated require feeding but once in twenty-four hours. One of the first attempts at making a stove or closed fireplace of iron was that of Cardinal Polignac in France about the beginning of the eighteenth century. The cardinal published a description of this in 1709 under the assumed name of Gauger. His treatise was entitled *La Mécanique du Feu, ou l'Art d'en augmenter les Effets, et d'en diminuer la Depense*. The Polignac fireplaces, as they were called, were constructed with hollow backs, hearths, and jambs of iron, to economize the heat. In 1716, Dr. Desaguliers translated and published Cardinal Polignac's treatise in London, and modified his fireplaces to use them for coal instead of wood. But neither these nor the Holland stoves, which were introduced soon after (plain box stoves with a small smoke-pipe or flue at the top, and a single door into which the wood or coal was thrown), ever became popular in England, owing to the strong prejudice of the people in favor of open and visible fires. Dr. Franklin, writing of stoves after the invention of his own in 1745, speaks of a German stove then recently introduced into England, an iron box made of five plates fastened together with screws, one side of which was left open, but when the stove was set, this open side, with the smoke-pipe, was in an ante-room, while the body of the stove projected through the partition to warm a larger room, the fire being fed and the smoke conducted off in the ante-room. There is possibly a reference to this in Bunyan's *Pilgrim's Progress* among the things which Christian saw at the House of the Interpreter, but, if so, it must have been in use before 1650. Franklin's stove was a great advance on all that had preceded it. While it was, in its ordinary use, a fireplace, it was capable of being closed completely, and had a downward draught, distributing the heat through the air-boxes in its sides, till at last the small remainder of the heat made its escape with the smoke through a flue leading into the base of the chimney. A register or "damper" of sheet iron was introduced into the descending flue, which checked and controlled the fire to any desired extent. The principle of action was the same as that of the air-tight stoves which were introduced many years later, and the stove would have been air-tight had it been possible at that time to make the castings sufficiently accurate and close-fitting. In 1771 and the years following Franklin invented several other stoves—one for burning bituminous coal which would con-

sume its own smoke and had a downward draught; and another intended for the same purpose, having a basket grate or cage, with movable bars at the top and bottom, supported by pivots at its centre, and which, after being filled and kindled at the top, could be inverted, and so made to burn from the base. The next inventor of stoves, ovens, and heating and cooking apparatus was Benjamin Thompson, Count Rumford. Between 1785 and 1795 this eminent philosopher devised several improvements in stoves, ovens, and cooking and heating contrivances, all intended to economize fuel and heat. The box stove now in the State-house in Richmond, Va., bearing date 1770, is one of the so-called Holland stoves, and was probably imported from England, as the castings, though rude, are better than American castings of that day.

Previous to 1825 the use of stoves, generally of the box pattern, and very rude, was confined to shops and offices, bar-rooms of hotels, school-houses, court-houses, and churches in the cities and larger villages. In the country the churches were not usually warmed, but the matrons and older women carried their foot-stoves, and the men protected their feet from the cold by stout leather overshoes, technically known as "boxes." In a few of the most wealthy families in the cities cannel and other English coal—"sea coal" was the general term for it—was burned in imported grates, or, in some instances, in the Rumford stove lined with fire-brick. A somewhat larger number, but only in the cities and larger villages, used the Franklin stove, burning wood and making an open fireplace of it. The Franklin coal stove, as he invented it, was not much used in this country. As for the rest of the world, they used the old open capacious fireplace, in which were deposited in the course of the year many cords of fire-wood. Wood was cheap in those days. For the parlor there was a smaller fireplace, but this was only used on great occasions. A huge brick oven adjoined the kitchen fireplace, and required a large quantity of dry wood to heat it. The cheapness of fuel, the cheerfulness of an open fire, and the great weight and roughness of the castings of the stoves of those days, prevented any general use of them either for cooking or heating; and though the old box stove had an oven over the fire and a boiler-hole on the top, it could scarcely be called a cooking stove. Up to the year 1835 stoves in the U. S. were made almost exclusively in blast furnaces, and directly from the ore, instead of being made in foundries or cupola furnaces from pig iron, as they now are; and they were consequently much heavier and ruder than now, and had loose and imperfect joints. Most of them were made in the furnaces of New Jersey and Pennsylvania, though a few were cast quite early in the furnaces at Coldspring, N. Y., and at Salisbury and Canaan, Conn., and from 1820 to 1835 a considerable business was done in stove-making in Rutland co., Vt. During the period from 1795 to 1820 or 1825, though there were some slight modifications of form, there was no material progress made in the construction of stoves. Those for heating purposes were either made on the old German plan—box stoves—to which an oven was sometimes added, placed directly over the fire, or on Franklin's plans of a portable and partly open fireplace. For cooking purposes Count Rumford's cooking stoves or ranges lined with fire-brick or soapstone, and with a ventilating oven, which had been introduced into New York City as early as 1798, and into Boston about 1800, were gradually coming into use, though as yet only English or Welsh coal and wood were used for fuel. The stoves cast in Pennsylvania and New Jersey were mostly either Franklin or box, although a few Rumfords had been cast at heavy expense for particular customers in New York City; but the Vermont stoves were but slight variations from Rumford's patterns. Among the patterns made by these Vermont stove-makers, whose works were at Pittsford and perhaps some other points in Rutland co., Vt., were the Rumford heating stove, the James's cook stove, the Conant cook stove, and the Farmer's stove. These were made as early as 1820, and perhaps earlier. Two brothers by the name of Granger, of Pittsford, were the pioneers in this business. After the opening of the Erie and Champlain canals, the introduction of steamboats on navigable rivers, and the first small beginnings in railroad travel, the facilities for transportation for heavy goods were so much increased that the manufacture of stoves, and especially of cooking stoves, soon became a leading industry. As yet, these were universally wood stoves, but the anthracite coal, which was coming into use in blast furnaces and wherever a high degree of heat was required and a very strong draught was possible, was destined to create a revolution in stoves. The first attempts to use it in New York and Philadelphia were failures. Jordan L. Mott and James Wilson, both of New York, made self-feeding stoves between 1827 and 1831 which would burn the English or Welsh coals, and were an improvement on all previous inventions; but it was not until 1833, when Mr. Mott had demonstrated that an anthracite fire could be made successfully from nut and pea-sized coals, and that the depth of the column of coal in his self-feeders must be in direct proportion to its size, the largest coal requiring the highest column, that anthracite coal stoves became salable. An immense mass of refuse coal and screenings had accumulated at the great coalyards on the Schuylkill. In 1835, Mr. Mott purchased this mass of refuse, had it screened into nut and pea sizes, and shipped to New York, and sold it to the purchasers of his stoves. Early in the same year he erected a small cupola furnace and cast his stove-plates from pig iron of the best quality, fluting them to prevent their cracking. This was the first attempt to make stove-plates from pig iron and to make the plates light, even, and smooth; its speedy failure was predicted, but it proved so successful that before the close of 1835 other cupola furnaces were erected in New York, and in Albany that of W. V. Many & Co., built for another purpose, was utilized for making stove-castings of good quality by Joel Rathbone, who had then recently entered upon the business of stove manufacture. This was the beginning of the immense stove business of that city. Providence, R. I., commenced about the same time the manufacture, which is still extensively carried on there. The first cooking stoves manufactured in Albany were of the old ten-plate oval pattern, with oven above the fire and a single hole on the top. These were followed by the saddle-bag pattern, having the oven in the middle over the fire, and the stove-collar and pipe over it, while on either side was an oval projection with a boiler-hole on a level with the stove-top; these projections resembling very closely an inverted pair of saddle-bags. The next pattern was the horse-block (so called from the rear portion of the stove, which contained the oven, being a step higher than the front). The rotary stove, having a movable top revolved by means of a crank, so as to bring any desired vessel directly over the fire, was another invention of about this period. Then came the Buck stove, both for wood and coal, having the fire above the oven and reversible flues, which carried the heat and flame around, behind, and below the oven before reaching the smoke-pipe, which was nearly on a plane with the oven-floor. There have been hundreds of modifications of this pattern—with two ovens, one on each side of the fire; with the fire on one side and the oven behind it; with ovens above, on either side, etc.—but in all of them the reversible flue has been the predominating feature. In heating stoves there has been a great variety of forms, and some new principles have been introduced, though many of these seem to have been anticipated by the inventions of Dr. Neil Arnott, an eminent British philosopher and philanthropist. The problem of adapting the heating stove to the use of anthracite coal, and utilizing its great heat-producing power economically, was one which, simple as it now seems, was solved with great difficulty. Dr. Nott, president of Union College, and one of the most eminent philosophers and mechanical geniuses of his time, spent years of time and thousands of dollars in perfecting stoves for the combustion of anthracite. The self-feeder had been invented in New York, but one of its applications was a device of Dr. Nott; and the base-burning principle was undoubtedly discovered by him and applied to several stoves, though others seem to have hit upon the same principle with no knowledge of his discovery. Thus, Dr. Arnott's "perfected" stove or "thermometer" stove, which he had in use in 1836, and of which he gave the invention to the British people, was self-feeding and base-burning, and he described in 1837 a contrivance for removing the clinkers from its grate without extinguishing the fire. His stove was also wonderfully economical, the fire being kept up in his library, without once going out, for the entire cold season, and maintaining a uniform temperature of 60° to 63° F. (he states that with the same fuel he could have maintained a higher temperature), with a combustion of only six pounds of Welsh stone coal in the twenty-four hours. The names best known in this country in connection with these heating stoves and fireplace heaters using coal as a fuel, after Dr. Nott, are Alexander Bradley of Pittsburg, Pa.; Dr. Horace Bushnell of Hartford, Conn.; Treadwell, J. S. Perry, Joel Rathbone, S. H. Ransom, and D. G. Littlefield of Albany; Latrobe of Baltimore; Jordan L. Mott, J. Wilson, Youle & Sabbaton, Gould Thorp, and W. Sanford of New York; Anson Atwood, now of Brooklyn, who is believed to have introduced the hot-air current to facilitate combustion and radiation of heat; Frost, Moore, Spear of Philadelphia, and others.

In the cooking stoves and fixed and portable ranges the number of inventors and manufacturers is still larger. One of the most original and ingenious inventors of cooking stoves was Rev. P. P. Stewart of Troy, whose stoves were, and with some modifications still are, very popular. Dr.

Nott also invented several excellent cooking stoves. Albany, Troy, New York City, and Buffalo; Philadelphia and Pittsburg in Pennsylvania; Cleveland, Dayton, and Cincinnati in Ohio; Chicago, St. Louis, Milwaukee, Boston, Providence, Portland, Manchester, Wheeling in West Virginia, and Norwich, Conn., have each a number of manufactories largely engaged in the production of stoves, ranges, and heaters. The efforts of the stove-makers during the last thirty years have been directed rather toward completing the adaptation of the principles of self-feeding, base-burning, hot-air feeding, and the anti-clinker arrangement to stoves, and greater accuracy and perfection of the castings, than to the discovery of any new principles. In some instances claims have been honestly made to the discovery of some of the principles named, when investigation proves that they had been discovered and used many years before. The portable range, a large-sized cooking stove, but with a hot-water arrangement, is one of the more recent improvements in stove manufacture. They are well constructed, have all the improved facilities for labor- and fuel-saving, and are particularly noteworthy for the perfection of their castings and finish. One or two manufacturers make stoves entirely of steatite or soapstone. These retain the heat for a long time, and require but a small amount of fuel, as they utilize the whole which they consume.

Another class of stoves are those using either gas or petroleum oil as fuel. The gas stoves are convenient for summer use, and are in demand among housekeepers with small families for the preparation of the lighter meals; but the smell of the burning gas and soot is offensive, and all attempts to use them for heating purposes have proved objectionable. In many towns and cities, also, the price of gas is so high that they are not economical. Six or eight patterns of petroleum stoves have been patented, and are now on the market. Most of them have been objectionable from the odor of the kerosene or petroleum oil, the supposed necessity of having an open reservoir of water over the oil to prevent its becoming vaporized by the heat, and the danger of leakage and vaporization of the oil which attended their use. Two of the recently-patented stoves of this kind dispense with the water-reservoir—Sharp's, by a plate lined with asbestos between the lighted wicks and the oil, and the Florence (Edwards's patents), by a zinc plate elevated on pillars and having a current of cool air constantly passing between this plate and the closely-covered and soldered oil-reservoir. In other respects, the Florence is an improvement on all preceding petroleum stoves, the reservoir of oil being of cast iron cast in one piece and galvanized, while the others are of tinned sheet iron either stamped or soldered, the soot and products of combustion being consumed by the stove, all odor or deterioration of the air being prevented by the peculiar construction, and the stove being provided with a three-hole boiler-plate, as well as a flat-iron heater and two excellent ovens. (The last two items are also in Sharp's and some of the others.) The cooking cylinder can be removed, and a heating cylinder, with downward draught and great heating power, illuminating the room as well as heating it, can be substituted for it. For the purposes for which it is designed this seems to be a decided advance on former inventions.

The preceding table, furnished for this article by John S. Perry, Esq., of Albany, a former president of the National Stove Manufacturers' Association, gives the statistics of the stove manufacture in the U. S. for the year ending Apr., 1876. It does not, we believe, include furnaces nor soapstone, gas, or petroleum stoves. L. P. Brockett.

*Estimate of Stove Manufacture in the U. S. 1876.*

| States. | Foundries. | Men employed. | Tons produced. | Stoves produced. | Value. |
|---|---|---|---|---|---|
| Maine | 3 | 75 | 900 | 7,200 | $126,000 |
| New Hampshire | 5 | 100 | 1,200 | 9,600 | 168,000 |
| Vermont | 2 | 30 | 360 | 2,880 | 50,400 |
| Massachusetts | 12 | 1,450 | 17,400 | 139,200 | 2,436,000 |
| Rhode Island | 6 | 850 | 10,200 | 81,600 | 1,428,000 |
| Connecticut | 3 | 230 | 2,760 | 20,080 | 386,400 |
| New York | 45 | 7,975 | 95,700 | 765,600 | 13,898,000 |
| New Jersey | 2 | 150 | 1,800 | 14,400 | 252,000 |
| Pennsylvania | 29 | 5,215 | 62,580 | 500,640 | 8,761,200 |
| Maryland | 2 | 250 | 3,000 | 24,000 | 420,000 |
| Virginia | 1 | 150 | 1,800 | 14,400 | 252,000 |
| West Virginia | 7 | 700 | 8,400 | 67,200 | 1,176,000 |
| Georgia | 1 | 50 | 600 | 4,800 | 84,000 |
| Michigan | 2 | 500 | 6,000 | 48,000 | 840,000 |
| Ohio | 42 | 4,725 | 56,700 | 453,600 | 7,938,000 |
| Kentucky | 6 | 915 | 11,100 | 88,800 | 1,554,000 |
| Missouri | 7 | 1,900 | 22,800 | 182,400 | 3,192,000 |
| Illinois | 10 | 1,250 | 15,000 | 120,000 | 2,100,000 |
| Indiana | 7 | 675 | 8,100 | 64,800 | 1,134,000 |
| Wisconsin | 5 | 500 | 6,000 | 48,000 | 840,000 |
| Iowa | 1 | 150 | 1,800 | 14,400 | 252,000 |
| Kansas | 1 | 75 | 900 | 7,200 | 126,000 |
| California | 1 | 75 | 900 | 7,200 | 126,000 |
| Total | 200 | 28,000 | 336,000 | 2,686,000 | $47,040,000 |
| The past year having been one of uncommon depression, and many foundries having been run on one-half or three-fourths time, Mr. Perry proposes to deduct, for an average of one-quarter the time not in operation | ..... | ..... | 84,000 | 671,500 | 11,760,000 |
| Making the actual amount of the year's business | 200 | 28,000 | 252,000 | 2,014,500 | $35,280,000 |

**Stove Creek,** tp., Cass co., Neb. P. 480.

**Stow,** p.-v. and tp., Oxford co., Me., on Saco River. P. 427.

**Stow,** p.-v. and tp., Middlesex co., Mass., on Marlborough branch of Fitchburg R. R. P. 1813.

**Stow,** tp., Summit co., O. P. 925.

**Stow** (Baron), D. D., b. at Croydon, N. H., June 16, 1801; graduated at Columbian College, D. C., in 1825; edited the *Columbian Star* 1825–27; became pastor of the Baptist church at Portsmouth, N. H., in 1827, of the Baldwin Place church, Boston, in 1832, and of the Rome street church in 1848. He was prominent in the missionary enterprises of the denomination, and president of the trustees of Newton Theological Seminary. Besides numerous contributions to religious periodicals, he published—*Memoir of Harriet Dow* (1832), *Helen's Pilgrimage* (1835), *History of the English Baptist Mission to India* (1835), *The Danish Mission on the Coast of Coromandel* (1837), *Daily Manna* (1842), *Question-Book of Christian Doctrine* (1848), *Christian Brotherhood* (1859), *First Things* (1859), and, in conjunction with Rev. S. F. Smith, *The Psalmist,* a collection of hymns largely used by the Baptist denomination (1849). His *Life* has been written by R. H. Neale (1870). D. in Boston Dec. 27, 1869.

**Stow** (John), b. in London about 1525; a tailor by trade, he acquired a taste for antiquarian studies, to which, from the age of about forty, he devoted himself with great assiduity and amidst many difficulties, which reduced him to such indigence that at the age of eighty he was constituted, by royal letters patent, a licensed public beggar, being recommended to charity on the ground that he had "compiled and published diverse necessary books and chronicles." His principal works are—*A Summarie of Englysh Chronicles* (1561), *Summarie of Englysh Chronicles Abridged* (1566), *Annales, or a Generall Chronicle of England from Brute vnto this Present Yeare of Christ* (1580), *A Survay of London* (1598), and *The Successions of the History of England,* probably a fragment of a larger work (1638). All of these works have passed through many editions, with additions and continuations by various editors. D. Apr. 5, 1605.

**Stow Creek,** tp., Cumberland co., N. J. P. 1122.

**Stowe,** tp., Allegheny co., Pa. P. 739.

**Stowe,** p.-v. and tp., Lamoille co., Vt., on Waterbury River, has a picturesque mountain-peak called "The Nose," and is the nearest point to Mount Mansfield. P. 2049.

**Stowe** (Calvin Ellis), D. D., b. at Natick, Mass., Apr. 6, 1802; graduated at Bowdoin College in 1824, and in 1828 at Andover Theological Seminary; was assistant professor of sacred literature at Andover, and assistant editor of the Boston *Recorder* 1828–30; professor of languages in Dartmouth College 1830–33, biblical literature in Lane Seminary 1833–50, and of natural and revealed religion in Bowdoin College 1850–52. In 1852 he became professor of sacred literature in Andover Seminary, resigning the office in 1864. In 1832 he married Harriet Elizabeth Beecher. In 1836 he was sent by the State of Ohio to examine the public-school systems of Germany; upon his return he published a report on *Elementary Education in Europe,* which was distributed at the public expense to every school district in Ohio, and was also adopted by the legislatures of several other States. He translated from the German Jahn's *History of the Hebrew Commonwealth* (1828); prepared from the *Prælectiones* of Lowth a volume of *Lectures on the Sacred Poetry of the Hebrews* (1829); commenced an *Introduction to the Criticism and Interpretation of the Bible,* of which only vol. i. was published (1835), and the *Origin and History of the Books of the Bible* (Part I., containing the New Testament, 1867). He has also published several addresses and educational reports, and contributed largely to religious periodicals.

**Stowe** (Harriet Elizabeth Beecher), daughter of Lyman Beecher and wife of the preceding, b. at Litchfield, Conn., June 14, 1812; taught for several years at Hartford, and in 1832 was married to Prof. Stowe, then of Lane Seminary, Cincinnati, O. In 1849 she published *The Mayflower, or Sketches of the Descendants of the Pilgrims,* and

in 1851 commenced in the *National Era* of Washington a serial story which was published separately in 1852 under the title *Uncle Tom's Cabin*, and attained a rapid and almost unparalleled success at home and abroad; within ten years there had been made from it two or three French versions and more than a dozen German ones. It has also been translated into Danish, Swedish, Portuguese, Spanish, Italian, Welsh, Russian, Polish, Hungarian, Wendish, Wallachian, Armenian, Arabic, Romaic, Chinese, and Japanese. In 1853 she put forth a *Key to Uncle Tom's Cabin*, in which were set forth the main facts upon which the story was based, together with many incidents in corroboration of its truthfulness. In 1853 she accompanied her husband and her brother to Europe, and upon her return published *Sunny Memories of Foreign Lands* (1854). Her subsequent writings have usually first appeared in periodicals, especially in the *Atlantic Monthly* and in the *Hearth and Home*, of which she was for a time one of the editors. Among these, as published separately, are—*Dred, a Tale of the Great Dismal Swamp*, subsequently published under the title *Nina Gordon* (1859); *The Minister's Wooing* (1859), *The Pearl of Orr's Island* (1862), *Agnes of Sorrento* (1863), *Old Town Folks* (1869), *My Wife and I* (1872).

**Stow'ell** (William Scott), Baron, b. at Haworth, Durham, Oct. 17, 1745, the son of a merchant of Newcastle; was educated at Oxford, where he took his degree in 1764; became a fellow, then a tutor, and in 1774 professor of ancient history in the university; studied law, and was called to the bar in 1780; rose rapidly in his profession, becoming advocate-general in 1787, and shortly afterward judge of the consistory court and vicar-general of the ecclesiastical province of Canterbury, and in 1798 judge of the high court of admiralty and a privy councillor. He was knighted in 1788, and in 1791 was unanimously returned to Parliament for the University of Oxford, retaining his seat until the coronation of George IV., when he was raised to the peerage. He was the elder brother of John Scott, Lord Eldon. D. Jan. 28, 1836.

**Stoyes'town,** p.-b. and tp., Somerset co., Pa. P. 288.

**Strabane',** tp., Adams co., Pa. P. 1547.

**Strabismus.** See Squinting, by E. Darwin Hudson, M. D.

**Stra'bo,** b. at Amasia, Pontus, in the latter part of the first century B. C., received an excellent education; studied philosophy under Xenarchus, and undertook extensive travels in Asia Minor, Egypt, Greece, and Italy. At a mature age he wrote a history, which is lost, and a geography in 17 books, which has come down to us nearly entire, and the value of which to us is so much the greater as it contains a great number of historical notes. D. in the reign of Tiberius, after A. D. 21. Editions by Kramer (3 vols., 1844–52) and Meineke (3 vols., 1852–53). English translation by Falconer and Hamilton (3 vols., 1854–57). The French translation, made by La Porte du Theil, Coray, and Gossellin, at the command of Napoleon I. (5 vols., 1805–19), is very rich in notes.

**Strach'an** (John), D. D., b. at Aberdeen, Scotland, Apr. 12, 1778; graduated at the University of Aberdeen in 1796; studied theology at St. Andrew's; taught a village school until 1799, when he emigrated to Canada, where he taught school at Kingston; took orders in the Episcopal Church; was ordained priest in 1804, and appointed to a mission at Cornwall, where he conducted a grammar school; became rector of York in 1812, executive councillor in 1818, archdeacon of York in 1825, and bishop of Toronto in 1839. From 1818 onward he was a political leader, and the Canadian insurrection of 1837–38 grew out of the strife between his party and that headed by W. L. Mackenzie. The establishment of Trinity College, Toronto, was in a great measure owing to his exertions. D. at Toronto Nov. 1, 1867.

**Strachey** (William), b. in England about 1585; was the first secretary to the colony of Virginia 1610–12, having been shipwrecked on the Bermudas 1609 with Gates, Somers, and Newport; wrote *A True Reportory of the Wracke and Redemption of Sir Thomas Gates, upon and from the Islands of the Bermudas*, in Purchas's *Pilgrims* (vol. iv. lib. ix. cap. vi.), upon which Shakspeare appears to have drawn in his description of a storm in the *Tempest* —an inference strengthened by the reference in the same drama to the "still-vexed Bermoothes;" compiled *For the Colony in Virginia Britannia, Lawes Divine, Morall, and Martiall* (London, 4to, 1612); and was author of *Historie of Travaile into Virginia Britannia*, written as early as 1618, and first published by the Hakluyt Society from an original MS. (No. 6, 1849) under the editorship of Richard H. Major—a quaint and valuable work, which has but recently supplied the means of correcting the false details of the early history of Jamestown (especially in relation to Pocahontas) which have been so often repeated upon the authority of Capt. John Smith. Strachey projected a larger work, of which this volume forms but "the first and second books of the first decade." The time and place of his death are unknown.

**Stradel'la,** town of Italy, province of Pavia, about 17 miles N. E. of Voghera. Stradella was a fortified town of some importance, but was dismantled toward the close of the fifteenth century. It is now a place of considerable industry. P. of commune, 8075.

**Stradella** (Alessandro), b. in Naples 1645; bore the flattering title of "Apollo della Musica." His oratorio, *San Giovanni Battista*, and his opera, *La Forza dell' Amor Paterno*, were much admired. As a writer of songs, too, in the sacred style, he excelled. His fame rests chiefly on the oratorio, his singing in which at the church of St. John Lateran in Rome is said to have disarmed the assassins who had gone there to take his life. D. in Genoa, assassinated by a jealous rival, in 1678. O. B. Frothingham.

**Stradiva'rius** (Antonio), b. at Cremona, Italy, in 1644; learnt the art of making violins and other string instruments from Nicolo Amati, under whom he worked for several years; in 1668 began to make violins marked with his own signature, and by degrees not only rivalled, but even outshone his master. His best instruments were made in the period between 1700 and 1725, and command from $1000 to $3000. D. Dec. 17, 1737.

**Straf'ford,** county of S. E. New Hampshire, bordering upon Maine, watered by numerous streams and crossed by several railroads. The surface is generally rocky and uneven, but the valleys contain some good land. There are numerous manufactories of boots and shoes, cotton and woollen goods, leather, and lumber. Staples, potatoes, Indian corn, oats, barley, hay, wool, and dairy products. Cap. Dover. Area, 675 sq. m. P. 30,243.

**Strafford,** p.-v. and tp., Strafford co., N. H. P. 1669.

**Strafford,** p.-v. and tp., Orange co., Vt. P. 1290.

**Strafford** (Thomas Wentworth), Earl of, b. in London Apr. 13, 1593; studied at Cambridge; travelled on the Continent; married at the age of eighteen; at twenty-one came into possession, by inheritance, of large estates; was knighted and returned to Parliament for the county of York, sitting in several successive sessions, in which he became prominent as an opponent of the court, an associate of Hampden and Pym, and was once imprisoned for his bold opposition to the royal will. But in 1628 he went suddenly over to the king's side; was created Baron Wentworth, then viscount, lord president of the council of the North, a privy councillor in 1629, and lord deputy of Ireland in 1633. His rule in Ireland was harsh and despotic, treating the country as one conquered in war and wholly at the mercy of the victor; and he acquired the designation of "the bad earl." It was his boast that in Ireland he had made the king "as absolute as any prince in the whole world." In Jan., 1640, he was created earl of Strafford, and the title of lord lieutenant of Ireland was conferred upon him, and soon afterward he was appointed to command against the Scots. The royal troops were routed, and Charles I. accepted the terms which the Scots demanded. Strafford had come to be obnoxious as, with Laud, the upholder of all the wrongful and oppressive measures of the king, and was moreover hated by the liberals as a renegade from their side. He foresaw the coming peril, and when Charles was compelled to summon a new Parliament, begged to be sent back to Ireland; but the king sacredly promised that not a hair of his head should be hurt, and he braved the issue. The famous "Long Parliament" convened Nov. 3, 1640, and within eight days Pym appeared before the bar of the House of Lords and in the name of the House of Commons impeached Strafford of an attempt to overthrow the public liberties and subvert the public rights. He defended himself personally, and with such ability that the Commons abandoned their original impeachment and passed a bill of attainder. The Peers were fairly overawed by the fierce attitude of the Commons, and dared not refuse their assent to the bill, which was sent to Charles for his sanction. The king wished to save his minister, for whose safety he had pledged himself, but was cowed by apprehension of a violent revolution, and reluctantly gave his assent, and Strafford was brought to the block on Tower Hill May 12, 1641. That he had been proved guilty of no crime which by the strict letter of the law was a capital one is certain, and the bill of attainder was in fact a retrospective law, justifiable only on grounds sufficient to warrant any other revolutionary proceeding. But, whatever may be said of the course of the Commons in passing the bill, the conduct of Charles I. in sending Strafford to the block for acts which he had himself approv-

ed and sanctioned, and after solemn pledges that he should suffer no harm, is one of the deepest stains upon his memory. The act of attainder was reversed in 1662, after the restoration of Charles II., and the estates of Strafford were restored to his son. His *Letters and Despatches*, edited by Dr. Knowles, were printed in 1739; his *Life* has been written by Elizabeth Cooper (1874). A. H. GUERNSEY.

**Straghn,** v., Washington tp., Van Wert co., O. P. 68.

**Straight University,** at New Orleans, La., incorporated in 1869, and open to all without regard to race or sex. It is intended to embrace departments of theology, law, medicine, collegiate, normal, and academic. In the term of 1872–73 the faculty consisted of 10 instructors, and there were 429 students, of whom 233 were males and 196 females; of these, 294 were in the elementary department, 85 in the preparatory and academical department, 30 in the normal department, and 20 in the collegiate, medical, and theological departments.

**Strain** (ISAAC G.), b. at Roxbury, Pa., in 1821; entered the navy as midshipman; in 1845, at the head of a small party, made explorations in the interior of Brazil, and in 1848 in Lower California. In 1849 he crossed South America from Valparaiso to Buenos Ayres, publishing a narrative of this journey under the title *The Cordillera and the Pampa* (1853). In 1850 he was for a short time attached to the Mexican boundary commission. He afterward commanded an expedition to explore a route for a ship-canal across the Isthmus of Panama, the party suffering extreme hardships and losing several of its members; an account of this expedition, compiled from his papers by J. T. Headley, appeared in *Harper's Magazine* in 1856. In 1856, in the steamer Arctic, he made soundings which demonstrated the practicability of a telegraphic cable between the U. S. and Great Britain. D. at Aspinwall May 15, 1857.

**Strait,** tp., Dorchester co., Md. P. 987.

**Strait's,** tp., Carteret co., N. C. P. 991.

**Straits Settlements,** including Malacca, Penang or Prince of Wales Island, with the province of Wellesley on the continent, and Singapore, were made a separate dependency of the British crown in 1853, and placed under the governor-general of India. On Feb. 1, 1867, the connection with India ceased, the province became a crown colony, and is administered by a governor residing at Singapore. The British possessions of 1215 sq. m. are inhabited by 308,097 persons; the native Malay states of the peninsula (Queda, Perak, Salangor, Rambow, and Johor) are bound to the English crown by treaties, and number 21,460 sq. m., with 209,000 inhabitants. One thousand English troops and a few vessels are sufficient in time of peace to maintain order in the interior and punish piracy. But the revolt in Perak in 1875–76 demanded greater exertions. The English supported the legitimate heir, but he was hated by the higher classes. The resident official, Mr. Birch, was murdered, and the English had to order native troops from India, European soldiers from England, and to raise local troops in Malacca. In Mar., 1876, they succeeded in capturing the chief, and quiet was restored. But a regular administration is still wanted in these countries. Every one takes what he can, and bloody feuds and devastations of the country are the results. Meanwhile, the Chinese, who were expected to immigrate in large numbers, but who, as well known, are not very warlike, have turned away to other countries better governed. E. SCHLAGINTWEIT.

**Stral'sund,** town of Prussia, province of Pomerania, on the narrow strait which separates the island of Rügen from the mainland, has a good harbor and is strongly fortified. It is an old town (founded in 1209), and played quite a conspicuous part—first, as a member of the Hanseatic League, then, during the Thirty Years' war, as a fortress, after which time it fell to Sweden, which kept it till 1815. It has a very old-fashioned and quaint but neat and interesting appearance, and carries on, besides its manufactures of tinware, paper, tobacco, oil, spirits, and mirrors, an extensive export-trade in grain, wool, cattle, and horses. P. 26,731.

**Stramo'nium** [Lat.], a drug consisting of the seeds and leaves of *Datura Stramonium*, an annual plant of the natural order Solanaceæ, growing rankly as a weed throughout almost all the temperate and warmer countries of the world. The herb, called "thornapple," and in this country also "Jamestown weed," is a hardy plant, found mostly in rank soil near the habitations of men. Its average height is about three feet. It has an erect stem, with many branches beset with large triangular leaves irregularly sinuate and dentate. The flower is large, white, solitary; the fruit, a large, fleshy, four-celled capsule, thickly covered with sharp spines. The seeds are flat and of a dark-brown color. Both leaves and seeds contain an alkaloid, *daturia*, closely analogous, both in chemical properties and poisonous character, to *atropia*, the alkaloid of belladonna. Medicinally, stramonium is a duplicate of belladonna, and is used for similar purposes. One of its most frequent employments is for the relief of asthmatic attacks, for which purpose the dried leaves or powdered root are smoked. Stramonium is a powerful poison, the effects being, again, identical with those of belladonna.

EDWARD CURTIS.

**Strange** (Sir ROBERT), b. on Pomona, one of the Orkney Islands, about 1721; studied painting, but in 1745, having joined the army of the Pretender, was obliged to conceal himself; afterward went to Paris, where he became a pupil of Le Bas, the famous engraver, and in 1751 established himself in London as an historical engraver, in which department of art he acquired great eminence, and has been styled "the father of the line manner of engraving in Britain," and was knighted in 1787. He published *A Descriptive Catalogue of Pictures, etc. collected and drawn by Sir Robert Strange* (1769), and *An Inquiry into the Rise and Establishment of the Royal Academy of Arts* (1755; new ed. 1850). A collection of fifty of his principal engravings has been issued in a magnificent atlas, and his *Memoirs*, by James Dennistoun, appeared in 1855. D. in 1792.

**Stran'ger,** p.-v. and tp., Leavenworth co., Kan. P. 1323.

**Strang'ford** (PERCY CLINTON SYDNEY SMYTHE), VISCOUNT, b. in 1780; was educated at Trinity College, Dublin, and in 1801 succeeded his father as sixth viscount in the Irish peerage, previous to which he had been for a short time secretary of legation at Lisbon, where he made a translation of the poems of Camoens. He was subsequently employed in the diplomatic service, being sent as ambassador to Portugal in 1806, to Sweden in 1817, to Turkey in 1820, and to Russia in 1825; and in 1825 was raised to the English peerage as Baron Penshurst. He was an ardent lover of the fine arts and of literature, a frequent contributor to the *Gentleman's Magazine* and to *Notes and Queries*, and vice-president of the Society of Antiquaries. His *Poems from the Portuguese of Luis de Camoens, with Remarks on his Life and Writings*, was first published in 1803. D. in 1845.—His son, PERCY ALLEN FREDERICK, who succeeded his elder brother as eighth viscount (b. 1825, d. 1869), was a contributor to various periodicals, and 2 vols. of his *Selected Writings, Political, Geographical, and Social*, appeared soon after his death.

**Stran'gles,** in the horse, is an abscess which occurs between the branches of the lower jaw. If possible, induce the animal to eat. Foment the throat thoroughly, and as soon as the sore comes to a head, open it, and recovery generally follows. Sometimes, however, the lymphatic glands appear to be inflamed, and occasionally metastatic abscess appears in distant parts of the body. This disease is considered contagious, and there is a similar infectious disease of swine called also "strangles."

**Strangula'tion** [remotely from the Gr. στραγγάλη, a "halter"] denotes, primarily, the mechanical closure of the air-passages of the neck, so as to prevent respiration. Death by strangulation is speedy, but there may be a chance of recovery for a considerable period. Artificial respiration, stimulant applications to the extremities and chest, and of ammonia to the nostrils, should be tried. Only when all other means have failed should the galvanic battery, a dangerous instrument, be employed. After apparent recovery, death may speedily ensue from secondary causes.

**Stran'gury** [Gr. στράγξ, a "drop," and οὐρεῖν, to "urinate"], a suppression of the urine. The name is especially applied to such suppression when it depends on the presence of spasm or tenesmus of the urethra. It may be caused by the too free use of Spanish-fly blisters or of oil of turpentine, or it may attend the presence of calculi in the bladder. The warm bath, hot fomentations, mucilaginous drinks, bland enemata, and the like will usually relieve the untoward symptom.

**Strasbourg',** or **Strass'burg,** fortified town of Alsace, owes its prosperity chiefly to the political and military importance of its location in the great pass which connects France and Germany, and has been, from old times, at once a much-contested strategical point and a flourishing centre of industry and commerce. It is in a beautiful plain on the Ill, the Breusch, and the Rhine-Marne Canal, 3 kilomètres W. of the Rhine, and forms the connection between the railways of Southern Germany and France. It is not well built, the streets being narrow and the houses high, as is generally the case in fortified places; since the Franco-German war, however, it has become more open and regular, as those parts which were destroyed by the bombardment have been rebuilt, and the fortifications which the Germans are erecting leave more space for the

development of the city. The most remarkable of its public buildings is the cathedral, with a tower 142 mètres high, the highest in Europe. The first foundation of this building is said to have been laid in 510 by Chlodwig, but this older structure was destroyed by lightning in 1007. In 1015, Bishop Werner of Hapsburg laid a new foundation, and in 1275 the main building was finished. The tower was commenced in 1277 by Erwin von Steinbach, and completed in 1439 by J. Hültz of Cologne. Among the many curiosities which this building contains is the famous clock (made 1547–80), representing our planetary system and its constellations. Besides the cathedral, the church of St. Thomas, founded in 1031, and containing the monument of Marshal Saxe, and the New Church, are noticeable. Other interesting buildings are—the palace, containing the lecture-rooms of the university, the former palace of the prefect, the exchange, the palace of the commander, the academy, the fruit-hall, the dépôt, the post-office, etc. In the Gutenberg Square stands the statue of Gutenberg; in the Kleber Square, that of Gen. J. B. Kleber. A German university was opened May 1, 1872, and numerous educational and benevolent institutions exist. Commerce and industry flourish in consequence of the favorable situation; by river navigation the city communicates with the Netherlands and Switzerland. Important tobacco-factories are in operation, numerous breweries, printing establishments, oil and saw mills, wool-spinning establishments, manufactures of oilcloth, straw hats, gloves, paper-hangings, chocolate, mustard, goose-liver pies, soap, candles, chemicals, musical instruments, furniture, jewelry, etc. The cultivation of vegetables, fruits, and flowers is considerable. The surrounding country is fertile and beautiful, studded with fine villas. Along the Rhine the city possesses fine forests. The fortifications are very important. Under French dominion the city had a strong bastioned circumvallation, but since it has become part of the German empire a new system of fortification has been applied, consisting of a number of large, strong forts surrounding the inner fortifications, so that an army can encamp between the city and the forts, while the city is entirely protected from the enemy's fire by the outer forts. P. 85,654.

Strasbourg was founded by the Romans under the name of *Argentoratum*. During the Middle Ages it was one of the most powerful free cities of the German empire; its citizens defeated the bishops and lords of the surrounding country in numerous battles. Sept. 30, 1681, Louis XIV. captured it, and by the Peace of Ryswick he retained it. By the Peace of Frankfort (1871) it returned to Germany, and is now the seat of the civil and military government of Alsace-Lorraine. (See BOMBARDMENT and SIEGE.)

AUGUST NIEMANN.

**Stras'burg,** p.-v., Franklin tp., Tuscarawas co., O., on Sugar Creek. P. 142.

**Strasburg,** p.-b. and tp., Lancaster co., Pa., at S. terminus of Strasburg branch of Pennsylvania R. R., has several manufactories, a thriving trade, and 1 weekly newspaper. P. of b. 1008; of tp. 1864.

**Strasburg,** p.-v., Davis tp., Shenandoah co., Va., on N. branch of Shenandoah River, at the junction of Harper's Ferry and Valley branch of Baltimore and Ohio R. R. with Manassas division of Washington City Virginia Midland and Great Southern R. R.; was the scene of a notable defeat of the Union forces under Gen. Banks by "Stonewall" Jackson, May 24, 1862. P. 580.

**Strassburg.** See STRASBOURG.

**Strat'egy** [Fr. *stratégie*] is, in general terms, the science of military command; or, in a more precise technology of military art and science, it is the art of directing troops upon decisive points, or of manœuvring armies within a theatre of war, but beyond the range of an enemy's cannon. Including all combinations which may lead to the profitable display of tactical skill or win a campaign without joining issue in battle, this is obviously the most important branch of the military art. Its principles are well established, but only superior generalship can under the varying conditions of actual warfare so reconcile its requirements with those of the other branches of the art—engineering, logistics, and tactics—as to derive the maximum advantage from a campaign. A fault in tactics may forfeit strategic advantages, or the display of the most faultless skill on the field of battle may lead to no decisive result where strategic considerations have been neglected. Strategic points, in military parlance, are simply such objects and localities as have for the time being an important or decisive influence upon military operations, either from their military strength or geographical location, or for political considerations. Strategic lines are in a like technical sense the routes of communication from bases of operation upon the objective points. These "points" may therefore embrace large areas of country, and the "lines" may be many miles in width. (See WAR.)

R. N. SCOTT.

**Strat'ford,** town of England, county of Essex, on the Lea, 4 miles N. E. of London, has several breweries, corn-mills, shipbuilding slips, and manufactories of chemicals and carriages. P. 15,994.

**Stratford,** p.-v., cap. of Perth co., Ont., Canada, on the river Avon, at the crossing of Grand Trunk Railway and its Buffalo and Goderich division. It has extensive repair-shops, a fine railway-station, good water-power, extensive manufactures, a town-hall, and 3 weekly newspapers. It is an inland port of entry. P. 4313.

**Stratford,** p.-v. and tp., Fairfield co., Conn., on Long Island Sound, at the mouth of Housatonic River and at junction of Naugatuck with New York and New Haven R. R., is one of the oldest towns of the State, and is noted for beautiful rural scenery, for refined society, and as the birthplace or residence of several persons distinguished in the history of Connecticut. P. 3032.

**Stratford,** p.-v. and tp., Coos co., N. H., on Connecticut River and on Grand Trunk R. R. P. 886.

**Stratford,** p.-v. and tp., Fulton co., N. Y., on Canada Creek, includes v. of Nicholsville. P. 1163.

**Stratford de Redcliffe** (STRATFORD CANNING), VISCOUNT, b. in London Jan. 6, 1788; was educated at Eton and Cambridge; in 1807, while still an undergraduate, received an appointment in the foreign office, and in 1809 was made secretary of embassy at Constantinople. Returning to England, he re-entered the university, and in 1813 took his degree of M. A. In 1814 he was sent as minister to Switzerland, in 1820 on a special mission to the U. S., in 1824 to Russia, and in 1825 as ambassador to Turkey. Diplomatic intercourse having been interrupted by the naval battle of Navarino, he returned to England; was returned to the House of Commons for government boroughs until 1841, when he was again sent as ambassador to Turkey, retaining that position till 1858, during which time his influence at the Ottoman court was very great, and always exercised in favor of reforms, especially those involving the amelioration of the condition of the Christian population of Turkey. He was raised to the peerage in 1852, and was made knight of the Garter in 1869. He has published an essay, *Why am I a Christian?* (1873), and a drama, *Alfred the Great in Athelney* (1876).

**Stratford-on-Avon,** town of England, county of Warwick, on the Avon, has 3872 inhabitants. The house in which Shakspeare was born is still preserved; that in which he died has been razed.

**Strath'am,** p.-v. and tp., Rockingham co., N. H., on Grand Bay and on Concord and Portsmouth R. R. P. 769.

**Strath'clyde,** or **Scottish Cumbria,** an independent kingdom formed in S. W. Scotland at the dissolution of the ancient Britannic confederacy, and consisting chiefly, as its name imports, of the broad valley or dale of Clyde. The capital was the fortress of Alclyde, now Dumbarton. The annals of its sovereigns are involved in deep obscurity, little more than their names being known. It fell to the crown of Scotland early in the twelfth century, was held for some years by Prince David as an independent kingdom, and was permanently united to Scotland on his accession to the throne in 1124.

**Strathnairn'** (Right Hon. HUGH HENRY ROSE), BARON, son of the late Right Hon. Sir George H. Rose, b. in 1803; educated at Berlin (his father being British minister there), and entered the British army as ensign in 1820; attained the rank of lieutenant-colonel (by purchase) in 1839; served in the Syrian campaign 1840–41, in the Eastern campaign 1854–55, and as queen's commissioner at the head-quarters of the French army, and wounded before Sebastopol. Throughout the Indian mutiny (1857–58) he commanded the Central India field force, making extended marches and fighting many successful actions, receiving for his eminent services the thanks of Parliament and promotion to the rank of lieutenant-general 1860, besides the order of G. C. B. He subsequently succeeded Lord Clyde as commander-in-chief in India, and during his term the queen's forces were united with those of the late East India Company. In 1865 he took command of the British forces in Ireland; was raised to the peerage in 1866; promoted to be general in 1867, and in 1869 was appointed to the command of the Royal Horse Guards. In 1870 he resigned his command in Ireland.

**Strath'roy,** p.-v., Middlesex co., Ont., Canada, on the river Sydenham and on Great Western Railway, 40 miles E. of Sarnia. It has manufactures of woollens, castings, agricultural tools, etc., and supports 3 weekly newspapers. P. 3232.

**Stratification and Stratum.** See GEOLOGY, by PROF. J. W. DAWSON, LL.D., and GEOLOGY, CHEMICAL, by PROF. T. STERRY HUNT, LL.D.

**Strat'ton,** tp., Edgar co., Ill. P. 1621.

**Stratton,** p.-v. and tp., Windham co., Vt., at the head of Deerfield River. P. 294.

**Strat'tonville,** p.-b., Clarion tp., Clarion co., Pa. P. 356.

**Strau'bing,** town of Bavaria, on the Danube, has several good educational institutions and an active trade in corn and cattle. P. 11,480.

**Strauss** (DAVID FRIEDRICH), b. in Ludwigsburg, Würtemberg, Jan. 27, 1808. His parents lived in moderate circumstances; his chief talent seems to have been inherited from his mother. As a child he was retiring and of weak constitution, but fond of study and thorough in his acquisitions. At an excellent school in Blaubeuren and at the University of Tübingen he pursued his classical and theological course with zeal and independence; Baur was one of his teachers in both places. In philosophy he was at first repelled by Kant, but attracted by Schelling, Jacobi, and the famous German mystic Jacob Böhme, following also with eagerness the new revelations of Kerner and others on "the dark side of nature" and in the sphere of the so-called animal magnetism. In the latter part of his course he was strongly influenced first by Schleiermacher, but chiefly by Hegel, whose severe and comprehensive system, sufficient, as was supposed, for all things, was just coming into general notice. Schleiermacher's lectures on the life of Jesus, which Strauss heard in Berlin in 1831, and Hegel's logic, were the preludes to the *Leben Jesu* of Strauss, which, published in 1835, made an epoch in the history of German theology. This work was written in the course of a year, while he was *Repetent* at Tübingen (since 1832), when the author was only twenty-seven years of age. In the learned world of Germany it brought matters to a crisis, both in respect to biblical criticism and the relations of faith to speculation (4th ed. 1840; translated into English by Marian Evans (George Eliot), Lond., 1846; New York, 1850; into French, by Littré, 4 vols., 1840). Strauss lays down in the preface the general principle that nothing which is supernatural, neither prophecy nor miracle, can be historical. The force of his criticism of details rests on this assumption. He resolves all the supernatural elements of the gospel story into myths; his hypothesis is known as the "mythical theory"—that is, the transforming of popular religious beliefs into facts supposed to have been realized in the life of Christ. The work had the merit of bringing together all the scattered objections to the life of Christ, and shaping them into a theory. But unless the supernatural cannot be manifested, the underlying theory falls to the ground. In his concluding essay he applies the Hegelian logic to the life of Christ in such a way that, though he denies the facts as historical, he yet admits that there are certain essential ideas at their basis. Historical Christianity is true, not as history, but as idea. The Hegelian philosophy is to be substituted for Christianity. The work was written in a clear and trenchant style, at once popular and scientific. It was replied to by some of the most eminent divines in Germany (such as Neander and Tholuck) and in other countries. In 1837–38, Strauss replied to his critics in several *Streitschriften* (3 vols.) and in 1838 in *Zwei friedliche Blätter*. He lost his theological position at Tübingen (a full account of the ecclesiastical proceedings, including the letters of Strauss, is given by Weizsäcker in the *Jahrbücher f. deutsche Theologie*, 1875, 4th part), and became a teacher in Ludwigsburg and Stuttgart. He was called to be professor of dogmatics and church history in Zurich in 1839, but was deprived of his chair by a popular insurrection, though retaining for life half his salary. In 1839 he published a volume of *Charakteristiken und Kritiken*, embracing essays on Schleiermacher, Daub, and Kerner, on animal magnetism and modern possessions, etc. In 1841 he was married to a once-celebrated actress, Agnese Schebest, but their characters, says Zeller, were so incompatible and the marriage so unhappy that they separated by mutual consent after five years. The wife lived in Stuttgart until her decease, Dec. 22, 1870. In 1840–41 he attempted to do for theology what he supposed he had accomplished for the life of Christ. Under the title *Die christliche Glaubenslehre in ihrer geschichtlichen Entwickelung, etc.* (2 vols., which reached a second edition) he tried to resolve the whole of theology into philosophy. But this work, though learned and acute, made a comparatively slight impression. Having thus, in his opinion, disposed of historical and dogmatic Christianity, he betook himself for twenty years to general literature, interspersed with political speeches and action, leading the life of a wanderer from city to city. In 1847 he published a pamphlet, *Der Romantiker auf dem Throne der Cäsaren*, an ingenious parallel between Julian the Apostate and King Frederick William IV. of Prussia, made up chiefly of apt and sharp citations. In the revolutionary period of 1848 he failed in an attempt to be elected to the noted Frankfort Parliament, but he was chosen to represent his native town in the diet of Würtemberg, where, to the surprise of his adherents, he denounced democracy, and in his very latest work he takes special pains to disparage republican institutions. His political views are contained in *Sechs Theologisch-politische Volksreden* (1848). In 1849 he published *Schubart's Leben in seinen Briefen* (2 vols.). In 1851 appeared a memorial of one of his friends, Christian Märklin; in 1855, the *Life and Writings of Nicodemus Frischlin*, representing the German culture of the sixteenth century. In 1857 he produced a more important work, the *Life of Ulrich von Hutten* (2 vols.; an abridged ed. 1871), prepared for Böcking's edition of Hutten's works; and in 1860 a volume of Hutten's *Conversations*. It was here first that he so highly eulogized and vindicated the German nationality, which he afterward advocated in such a brilliant style in his correspondence with Renan (1870). In 1862 he revived the memory of a German rationalist of high critical attainments—a forerunner of Lessing—Hermann Samuel Reimarus. These and other literary and biographical works, all wrought out with æsthetic care, added to his reputation for general scholarship. In 1864 he returned to theology in the attempt at writing another life of Christ under the title *Das Leben Jesu für das deutsche Volk bearbeitet*. The school of Baur of Tübingen and the progress of historical criticism had effectually supplanted the mythical theory of Strauss's first *Leben Jesu*. His object in the second work is, in general, to show what remains of Christ for the people after German criticism has had its full course. And he still grants that "Christianity is a moral and spiritual power in the earth;" that "we cannot do without it, nor can it be lost;" that Jesus "stands foremost among those who have given a higher ideal to humanity." In 1865 he reviewed Schleiermacher's *Life of Christ*, then first published, in a work entitled *Der Christus des Glaubens und der Christus der Geschichte*. In 1866, under the title *Die Halben und die Ganzen*, he criticises the half-theology of Schenkel even more severely than he does the unbending orthodoxy of Hengstenberg. His essays on *Voltaire* (1870; 3d ed. 1872) were prepared for the Princess Alice, and are praised for their critical skill and elegant diction as standing by the side of Göthe's *Wahrheit und Dichtung*. His last work, *The Old Faith and the New, a Confession*, appeared in Oct., 1872. It is intended to give the result of his life's thought and work. It rapidly went through 7 eds. in Germany, was published in French, and in an English version by Mathilde Blind in London and in New York (1873). It has been fully reviewed by Prof. Vera of Naples, Prof. Huber of Munich, Dr. Rauwenhoff, professor at Leyden, and Dr. Nippold of Berne. From the philosophical side it was most ably criticised by Prof. Ulrici of Halle in his *Zeitschrift für Philosophie* (vol. xvi., 1873; translated and edited with full notes by Dr. Krauth, provost of the University of Pennsylvania, Philadelphia, 1874; comp. *Presbyterian Quarterly*, Apr., 1874). The *Old Faith and the New* undertakes to answer four questions—viz. (1) "Are we still Christians?" (2) "Have we still a religion?" (3) "What is our conception of the universe?" (4) "What is our rule of life?" On the first of these questions the answer is in the negative: "We must acknowledge that we are no longer Christians." By the "we" he, of course, means those who are avowed pantheists and materialists. His former veneration for Christ as a religious genius is specifically repudiated, and he asserts that, so far as we can know anything about him, his chief characteristic is a "fantastic fanaticism." The resurrection of Jesus is stigmatized as a "world-historical humbug." All Christian doctrines, even the hope of immortality, are denied. His reply to the second question, "Have we still any religion?" is that we can only believe in an absolute dependence upon the universe; an absolute being cannot be conscious or personal. To the third question he says that the only idea of the universe we can frame is that of a development from a blind force or law, without any foreseen end. The special point in his theory is that materialism and pantheism are really at one, having the same ultimate ideas, and equally opposed to Christianity. The contest between them is not essential. They ought to work together, for they equally deny all that is supernatural. Christianity must henceforth take its place with the heathen mythologies, and a materialistic or pantheistic evolution is the only idea of the universe which we can retain. From all which it follows that in answer to his fourth inquiry, "What is our rule of life?" he can only say that we must live for this world and for the human race—for the good we can find here, for science and for art. We must aban-

don ourselves to destiny, and find our happiness in resignation to an unknown, unconscious, and unfathomable power.

Strauss founded no school, either in philosophy or theology. He was a critic, learned, sagacious, yet without any well-defined ultimate system. His life is a reflex of the most extreme anti-Christian theory of human life. He began as an idealist and ended as a materialist. He gave up his early Hegelian pantheism to the latest theory of atheistic evolution. (His friend, Prof. Eduard Zeller of Berlin, has described his life and writings in a short, critical, and finished memorial (Bonn, 1874). Dr. A. Hausrath, in his work on *Strauss and the Theology of his Times*, of which only the first volume has been published, gives an able and detailed review of his whole career.) D. at his native place of cancer, after long and patient suffering, Feb. 9, 1874, and was buried, by his own direction, without any church service. H. B. Smith.

**Strauss** (Johann), b. at Vienna Mar. 14, 1804; was first apprenticed to a bookbinder, but early gave up this profession from love to music, entered the orchestra of Lanner; began to compose dancing music; and became soon a favorite among the Viennese, whom he almost intoxicated with his rich and original melodies, his graceful and charming rhythms, and his varied and piquant instrumentation. In 1824 he formed an orchestra of his own, with which he made a concert-tour through Europe 1833–37, and d. at Vienna Sept. 24, 1849, as music director at the court balls. On the social life of Vienna he exercised no small influence, inducing by his music the higher classes to visit those music-halls which hitherto had been frequented only by the middle classes, and elevating the tone of the numerous dancing-halls of a lower order.—His three sons, Johann, Joseph, and Edward, have formed orchestras, made concert-tours, and acquired celebrity as composers of dancing music.

**Straw'berry** [Ang.-Sax. *streaw-berige*], a well-known plant of the genus *Fragaria* and of the family Rosaceæ, found wild throughout most of the northern temperate zone, but more commonly in a cultivated state, is a stemless perennial herb, throwing out runners to form new plants, bearing on long stalks, with compound leaves made up of three obovate, wedge-shaped, deeply-serrated leaflets. The calyx is 10-cleft, with the segments alternately smaller, five petals, many stamens, and simple pistils seated upon a convex receptacle, which at the ripening of the ovaries rapidly increases in size and becomes the delicious edible berry popularly but incorrectly regarded as the fruit, the real fruit, in the botanical sense, being the small seed-like *achenia* or ripened ovaries scattered over the surface of the berry. The species are very numerous, and improve or degenerate rapidly under domestication, so that new varieties are constantly appearing in the market-gardens, and it is very difficult to determine the original species to which the cultivated berries belong. The best-known and most widely-spread species are the Alpine (*F. vesca*), called in England the wood-strawberry, and the Virginian (*F. Virginiana*), or common wild strawberry of the U. S., supposed to be indigenous to America, being found E. of the Rocky Mountains from the Arctic Ocean to the Gulf of Mexico; on the Pacific slope, from British Columbia nearly to Cape Horn southward, the Chilian strawberry (*F. Chilensis*), a robust, large-leaved species, bearing a yellowish-white or rose-colored berry, often as large as a small hen's egg. Among the delicious varieties largely grown for the markets of the Atlantic cities of the U. S. are "Hovey's Seedling," "Wilson's Albany," "Agriculturist," and "Monarch of the West." They are planted in rows two feet apart, require careful cutting and a highly fertilized soil, are often grown in hot-houses, and require in winter a covering of straw, whence the name.

**Strawberry,** tp., Lawrence co., Ark. P. 1144.

**Strawberry Point,** p.-v., Clayton co., Ia., on Davenport and St. Paul R. R., 50 miles W. of Dubuque, has 3 churches, excellent schools, 1 newspaper, 1 bank, 3 hotels, a cheese-factory, and 1 machine-shop. It is an extensive grain and produce mart. P. about 1200.

G. E. Delavan, Ed. "Free Press."

**Straw** [Ang.-Sax.], **Manufacture of.** The braiding or plaiting of slender vegetable stalks, leaves, and filaments, so as to form tissues, is one of the primitive arts. In its simplest stages it is purely manual, requiring the use of no artificial implement. It is therefore suited to tribes in the earliest phases of social life, and it is accordingly found among the rudest tribes, as well as among those more advanced in civilization and art. The stems and leaves of grasses are commonly the material employed, and mats for sleeping upon seem to be generally the earliest domestic fabrics to which the art is applied. The fragility and perishable nature of the vegetable filaments used for plaiting ensure the rapid decay of the tissue, and consequently few if any very ancient specimens of braided work are extant. We know, however, that straw hats were worn in summer by the lower, if not sometimes by the higher, classes of the Romans, and it is presumable that like manufactures existed among other ancient and cultivated peoples. The semi-barbarous tribes of our own time exhibit great dexterity in the fabrication of braided articles, which, according to the use for which they are intended, are of loose or of firm texture. Thus, the poisonous juice of the cassava is extracted by filling long, flexible, loosely-plaited cylinders with the pulp, and then squeezing the fluid through the interstices of the cylinders by pulling, rolling, and pressing. On the other hand, some of the South Sea islanders braid baskets (or rather bags) of native grasses so close in texture as, though still very flexible, to be impervious to fluids and to serve for water-buckets. The exquisitely fine hats and cigar-cases of Panama work are indeed in forms dictated by European taste, but the fabric is of native origin.

The manufacture of this sort which has the greatest economical importance is from the straw or stem of the cereals, especially wheat and rye, which is employed either in its natural form—*i. e.* whole—or split into slips according to the size of the straw and the particular tissue designed, a single straw sometimes being divided into as many as fifteen slips. Wheat straw is preferred, but rye straw has longer stems and can be braided into more delicate and even tissues. It is, however, less durable, and does not wash so well as wheat. The hats which are exported from Italy under the name of *rice* straw are not manufactured from the stem of that plant, but from the bark of a variety of willow found abundantly near Modena. Tuscany was long almost the sole seat of this industry, and the Leghorn hats, as they are called, are still preferred in most foreign markets. A grand-ducal decree of 1575 enumerated the dealers in straw hats among the Tuscan traders liable to a matriculation tax; but according to a monumental inscription in the church of San Miniato at Signa, near Florence, Sebastiano Michelacci di Bologna, who died in 1739, was the first to export straw hats to England, and he is hence regarded as the founder of that branch of national commerce. The hats exported at that time were of coarse fabric, and designed only for the use of the laboring classes. The manufacture of fine hats for the English market is said not to have commenced until the year 1800, or, according to some, 1825. The latter date is certainly erroneous, for a ballad called *The Straw Hat*, satirizing the fashionable use of this headgear, was in popular circulation some years earlier; and even 1800 is apparently too late a date, for Lastri in his georgic poem, *Il Cappello di Paglia*, printed in 1801, says that the finer qualities "had the honor of passing the columns of Hercules and reaching the shores of the richer hemisphere." This might, indeed, refer to the trade with Spanish America, but it probably included England also. The Tuscan produce and exportation has fallen off, because other Italian provinces have entered into competition in both the domestic and the foreign market, and other countries also have engaged largely in this industry, and have introduced new processes in the formation and finish of the *bodies*. Hence, Tuscany, which formerly sent abroad only the completely manufactured product, now exports considerable quantities of braid, and even of straw, which is wrought after patterns suited to the local taste, and not easily imitated in Italy. The first fine Tuscan hats sent to England were simply such as were worn by the *contadine* or female peasants, and still are in common use. These are very broad-brimmed, plain hats, finely braided, but of flexible texture. They sold—and the best, called *fioretti*, still sell—at high prices, $100, and even more, being sometimes paid for the labor on a single hat. Straw is employed not only for the bodies or forms of hats, but for rosettes, borders, and other trimmings, as well as for baskets and other fanciful objects, in the manufacture of which the women of Fiesole exhibit much ingenuity and taste. In these fabrics silk or other fine thread or hair often forms a part of the tissue, and machinery is employed for certain purposes in the work, though plain *braid* is always made by hand, and in general no implements are used except the needle for sewing the long strips of narrow braid together, a tool in the shape of a short cylinder with sharp projecting ribs for splitting the straw into slips, and a species of sieve for sorting the straw according to size. Work of this sort demands little or no muscular effort, nor is it so complicated as to be beyond the capacity of very young persons. Hence a great deal of the Tuscan straw braid is the work of the merest children. Their gains are indeed small, but as they could in general earn absolutely nothing by any other industry, the straw manufacture is a valuable resource to the poorer classes in Italy. The straw industry of Tuscany has been minutely described in all its

processes by Lastri in the poem above referred to. Further information may be found in the later treatises of Jacopo Ricci, *Catechismo agrario* (Firenze, 1815); Ricci di Lapo, *Antologia* (No. 58, Oct., 1825); Bettoni, *Notizie sulla Cultura della Paglia da Cappelli* (Firenze, 1826); Francalanci, *Sulla Cultura della Paglia da Cappelli* (Firenze, 1825); Muriotti, *Notizie Storiche ecc. intorno all' arte della Paglia in Toscana*. The various reports of the universal expositions of the last twenty-five years at London, Paris, Vienna, etc. may also be consulted.

The beauty of the straw tissue has led to many imitations, in the fabrication of which machinery is largely employed. Many species of palm leaf are used advantageously, and chip hats, called *navarinos*, in compliment to the great battle fought about the time of this invention, in which thin and narrow slips of birch, poplar, and other woods take the place of straw, have been manufactured on a great scale. Stamped paper, too, can be made to imitate the texture and color of straw hats to great perfection.

The best straw is that of a variety of spring wheat—*grano da paglia*, as it is called in Tuscany—thickly sown, preferably on sandy, hilly ground, in February or March, according to season and local climate, and harvested by *pulling*, like flax, as soon as the stalk begins to turn. The straw is left spread upon clean ground or grass for some days, for the sake of the action of the dew in bleaching it; it is then gathered into sheaves, from which the laborers draw out the stalks, breaking them at the joints and breaking off the heads. They are then sorted by a species of sieve composed generally of sixteen tin plates pierced with holes of different diameters and briskly moved by a wheel. Three workmen can sort about seventy-five pounds a day. The straw is now bleached by sulphur, and stored for working up at a convenient season. The peasantry braid it into narrow strips, which are flattened by pressure and sewed together, with an almost imperceptible seam, at the edges, and the hat, already nearly in its proper shape, is sent to the straw-factories in the towns, where breaks and other defects are remedied, the projecting points of the straw inside broken off, and discolored straws removed. It is now plunged for some time in a warm weak solution of acetate of lead, and then ironed with a hollow flat-iron containing charcoal to keep it hot. Straw hats, however, are by no means always manufactured from braided strips, but often plaited directly with the stalks, in which case, as also often when formed of braids, the straw is whole or unsplit, and consequently produces a much stronger tissue.

Tuscany exports not only hats, but braid to be wrought elsewhere. In the years 1851–55 the exportation rose from $1,600,000 to $3,700,000 in value, of which about two-thirds consisted in finished hats and nearly one-third in braid, besides $5000 in unwrought sorted straw. From 1863 to 1869 the exportation fell off greatly, but has since risen very considerably, especially in finished hats. Belgium, Holland, Switzerland, and Germany are powerful competitors with Tuscany in this industry, and some of the Swiss wares are scarcely inferior to the best Italian.

GEORGE P. MARSH.

**Straw-Work in the U. S.** Straw-work as a domestic industry, limited to the wants and conveniences of the household, was a characteristic of New England and Northern social life generally from the founding of the colonies, but under these conditions little was attempted in the selection of fine materials or in the preparation of graceful forms. Nor was there any general purchase or sale of straw or its manufactures as merchandise until a comparatively recent period; like many other domestic industries, the supply required by the family was carefully provided, and both the materials and the finished articles cost much time and care in excess of that required to produce superior fabrics now. During this early period fine straw hats were imported for the wealthy, however, and the luxuries of Tuscan straw were enjoyed by a favored few, without thought on the part of the people generally that they could be imitated or made available to persons of moderate means. Some effort in this direction was made, however, at the time of the great efforts made in England to develop the straw-industry, the long European wars having cut off the supply from Italy. The celebrated Dunstable straws were the fruit of those efforts in England, and they became as much the fashionable attraction as the Leghorn or Tuscan straws had been. The British Society of Arts made great efforts to sustain this industry after peace was restored, and in 1822 this society awarded a silver medal and twenty guineas to Miss Sophia Woodhouse of Connecticut for a new material for fine plaits, the *Poa pratensis*, then supposed to be equal to the Italian straw for making fine braids. At this time there was some successful straw-industry in the U. S., but the finer hats could only be made from Italian material, which began to be imported both in flats and in braids. The precise source or mode of preparation of this fine Tuscan material is imperfectly known,* but its excellence and cheapness in time reduced the consumption of Dunstable straw, and developed an extensive system of manufacture in the U. S. from imported braids. Nearly thirty years since the more enterprising local dealers in the small towns of Massachusetts and New York began the collection of straw manufactures, both of the coarser and finer forms, for sale and general distribution to localities where the manufacture did not exist; and out of this an immense business has been developed. For a long period the braiding and sewing were done by members of families as incidents of other household occupations, the coarser straws being prepared at home, and the finer being purchased at the stores where the finished products were disposed of. Establishments for stamping and shaping soon grew up, some of which attained to a large business twenty years ago in Eastern Massachusetts. Then began very large importations of Tuscan braid, with some from Switzerland and Germany, and more recently very large quantities from Canton and other ports of China. In 1860 the census reports several establishments for straw-work in Massachusetts, producing goods to the value of $150,000 to $400,000 each, and in the entire State there were 26 establishments, employing 6218 persons, and producing goods to the value of $3,398,406. In the entire U. S. there were 39 establishments, employing 801 men and 6802 females, and producing straw goods to the value of $4,395,616. The steady growth of this industry is shown by the returns of the census of 1870, there being then 75 establishments, with $2,119,350 capital, employing 24 steam-engines of 341 horse-power, 1988 men, 12,594 females, 343 youths, paying $2,122,870 in wages, and making straw goods to the value of $7,282,086. Since 1870 the growth has been even more rapid, and the product is now largely in excess of that reported for that year. Since the establishment of steam pressing and moulding establishments, some fifteen years ago, the general business has been conducted by an association of the manufacturers, who regulate prices and endeavor to give stability to the trade. Within five years steam-power has been applied to sewing the braids, the Bosworth and the Knowlton sewing-machines being first and most generally used, but several others have recently been adapted to the work. These adaptations have now been introduced in England from the U. S. Hydraulic power is also applied to the moulding or shaping blocks, some of these machines, to each of which several blocks may be attached, being capable of stamping 300 dozen in a day. For this vast industry the supply of material is now chiefly from foreign countries, almost all the material for ladies' and children's hats being foreign, though much of that used for men's hats is from American straw. The importations of straw braid from foreign countries in 1874–75 were as follows: From China, direct, $637,355; from England, in part Chinese and in part Italian, $310,995; from France, $968,455; Italy, direct, $189,810; Germany, $113,684; all other countries, $105,240; total value imported, $2,325,539. A part of this, perhaps $150,000 in value from France, is in finished hats, and about $100,000 in value is of palm-leaf; the exact divisions are not given in the official returns. The average value of braids imported has been about $2,000,000 annually for five years. A small export of domestic straw hats, etc. exists, reaching $68,425 in 1874–75, and of foreign re-exports the value was $70,328. In consequence of the great cheapness and skill of the labor employed in braiding straw in Europe and China, work of this character is here chiefly confined to coarse straw for men's hats. At one time the English success in Dunstable straws was copied here, and at intervals within twenty years braiding of fine split straw has been successfully attempted in Massachusetts, but it is now practically given up. Children and females prepare the straw and braid it in the mountainous districts of Italy, Bohemia, and Switzerland with extraordinary skill and rapidity, and the straw grown there is admitted to be superior to any other known. The sewing of braids is now performed by lapping, and with the added pressure of the moulding-machines the requisite smoothness of the work is secured almost as well as by the joining at the edges, which was once considered essential. Still, the finest Tuscan hats are only made of braids united at the edge, and imported in the form of flats when not in finished shapes. The commercial character which the straw-

* The Austrian official reports of the Vienna Exhibition represent the source of the finest straw plaits to be the districts of Bohemia at the foot of the Erz Mountains, where the best wheaten straw is grown, the upper part only being taken for the fine plaits, and other parts for coarser plaits. Women and children are trained to this industry from an early age, and attain great proficiency in making plaits, children of eight to thirteen years of age making pieces of twenty-four ells in length in ten to forty-three minutes. The straw is first bleached, then split by using an iron instrument with sharp teeth, and scraped smooth in pieces about six inches long. (See vol. i. p. 702 of *British Official Reports, Vienna Exhibition.*)

industry of the U. S. has recently attained constitutes its leading feature. Large establishments, with much machinery and employing steam-power, now control the production of all forms of straw-work entering into general trade. It is energetically directed, producing and selling products to the value of about $10,000,000 yearly. There still remains a share of the former domestic production of men's hats which does not enter into this general trade, but is made for and sold in local markets; and there is also a share of the former household work of Massachusetts made in families for the factories of the vicinity, but very much less than was so made ten and fifteen years ago, the tendency recently being to bring the sewing into the factory building, where it is made efficient by improved machinery and steam-power. LORIN BLODGET.

**Strays.** See ESTRAY.

**Straznicky** (EDWARD R.), M. D., Ph. D., b. in Moravia in 1820; graduated at one of the principal universities of Vienna. While there, in addition to the German language, he acquired a speaking knowledge of the Russian and modern Greek. On the completion of his studies he made a pedestrian tour of a large portion of the continent of Europe, and as he made it his habit to study the languages of the various countries which he visited, he thus at length acquired a general knowledge of linguistics. He was also a good classical scholar, and on the completion of his university course he took his degrees of M. D. and Ph. D. On the breaking out of the Austro-Hungarian war he sided with the Hungarians, and held a commission in the army. The Hungarian defeat compelled him to leave his country, with the forfeiture of his property. He lived for a short time in London, and then came to this country. On his arrival in the U. S. he became connected with a mercantile establishment in Philadelphia, and subsequently, in 1859, coming to New York, he obtained his appointment as assistant librarian in the Astor Library. On the retirement of Mr. Schroeder from the office of its superintendent, Dr. Straznicky became the incumbent. He was also secretary to the American Geographical Society. His death, which was rather sudden, took place on Feb. 9, 1876. F. SAUNDERS.

**Streat'or,** p.-v., La Salle co., Ill., on Chicago and Alton, Chicago Burlington and Quincy, Chicago Pekin and South-western, and Chicago and Paducah R. Rs., 100 miles W. of Chicago, has 8 churches, 3 public schools, 2 newspapers, 2 banks, a fire department, and 3 factories. The head-quarters of the Vermilion coal-fields are located here. P. 1486. FREDERICK D. DALTON, ED. "MONITOR."

**Street** (ALFRED BILLINGS), b. at Poughkeepsie, N. Y., Dec. 18, 1811; studied law with his father, and commenced practice at Monticello, N. Y., but removed to Albany in 1839, and was for many years State librarian. He contributed largely, both in prose and verse, to periodicals. He has published in verse *The Burning of Schenectady, and other Poems* (1842), *Drawings and Tintings* (1844), *Fugitive Poems* (1846), *Frontenac* (1849). Collected editions of his poems appeared in 1847 and 1866. His prose-works were *The Council of Revision of the State of New York* (1859), *Woods and Waters, or the Saranacs and the Racket* (1860), *Digest of Taxation in the U. S.* (1863), and *The Indian Pass* (1869).

**Street** (AUGUSTUS RUSSELL), b. in New Haven, Conn., Nov. 5, 1792; was graduated from Yale College in 1812; studied law, but never practised his profession. Poor health from youth upward precluded the pursuits of active life. He was a man of scholarly tastes, and, possessing wealth, increased his culture by travel and observation. He founded the Yale School of the Fine Arts in Mar., 1864, erecting at his sole expense a very costly building. He also endowed the Street professorship of modern languages and the Titus Street professorship in Yale Theological School. His gifts to the university and his endowments were marked by a liberality, sagacity, and wisdom in advance of his times in regard to educational matters. D. in New Haven June 12, 1866, aged seventy-four. J. M. HOPPIN.

**Street** (GEORGE EDMUND), b. at Woodford, Essex, in 1824; was educated at the collegiate school, Camberwell, and afterward studied architecture under able instructors. In 1850 he was appointed architect for the diocese of Oxford, and subsequently for those of York, Ripon, and Winchester. His predilection is mainly for the Gothic style, and he has written numerous essays and papers in support of his views. His architectural structures are very numerous and important; among them are churches in Garden street, Westminster; Sts. Philip and James, Oxford; All Saints, Clifton; St. Margaret, Liverpool; St. Mary, Paddington; the Crimean Memorial church, Constantinople; and the new nave and the two western steeples of Bristol cathedral. Among his church restorations are, Eccleshall; Jesus College chapel, Cambridge; Uffington, Berkshire; Stone, Kent; Wendover, Buckinghamshire; and the nave and choir of Christ church cathedral, Dublin. In 1847 he won one of the £100 prizes for a design for a new foreign office, and in 1868 was appointed architect of the buildings for the new courts of law, but his original design was sharply criticised, and afterward considerably modified. He is the architect of the mansion of the earl of Crawford and Balcarras at Dunecht, New Brunswick. He is a member of the British Institute of Architects, of the Vienna Imperial Academy of Fine Arts, of the American Institute of Architects, an associate of the Royal Academy (1866), and a royal academician (1871). Besides numerous essays and lectures upon architecture, he has published *The Brick and Marble Architecture of North Italy in the Middle Ages* (1855) and *Some Account of Gothic Architecture in Spain* (1865).

**Street Road,** p.-v., West Town tp., Chester co., Pa., on West Chester and Philadelphia R. R.

**Streets'borough,** p.-v. and tp., Portage co., O. P. 706.

**Strel'itz** [Russ. *Streltzi*, "arquebusiers"], an ancient and famous Russian corps of troops, originated in the militia of Ivan the Terrible, organized about 1546. They became the *élite* of the Russian army, but they were induced in 1689 to revolt in favor of the grand duchess Sophia. In consequence, Peter the Great decimated them in 1698, and banished the rest to Astrakhan, where the whole were executed for disloyal conduct in 1705.

**Strength of Materials,** or, more comprehensively, the **Resistance of Materials.** Whenever any solid body is acted on by an external force, and is at the same time connected with one or more fixed points of support, it will yield more or less to the action of the force, and become changed in form or dimensions or in its line of position. In the act of yielding it will oppose a resistance, increasing with the amount of the distortion, until the external force is effectually counteracted. This is called the property of *elastic resistance.* Thus, if a weight be suspended from a fixed point by an iron rod, the rod will be elongated until an elastic resistance is developed that will sustain the weight; or if a beam resting horizontally on two points of support be loaded at its middle, it will bend under the load, and in so doing may oppose an elastic resistance equal in intensity to the load. Such effects are the result of displacements occurring in the relative positions of the ultimate parts of the body, and are limited in amount by the resisting forces developed by these displacements. These internal resisting forces are called *forces of elastic resistance.* The external applied force is termed a *stress,* and takes its special designation from the particular circumstances of its action. When its line of direction passes through a point of support, it is called a *tensile stress,* or *pull,* if it tends to elongate the piece, as in the case of a suspension rod; and a *compressive stress,* or *push,* if it has the opposite tendency, as in the case of a pillar supporting a weight. If the applied force is not directed through an immediate point of support, it acts *transversely* to the piece, and is called a *transverse* stress. Transverse stresses are ordinarily perpendicular to the length of the piece. When the active force causes a twisting of the body, it is called a *torsive stress.* Every external stress that takes effect on a body gives rise to internal forces which constrain the particles to occupy new relative positions. These constraining forces are called *strains.* They are immediately counteracted by the elastic resistances to the displacements they produce. In speaking of the effect of the load or other external stress on the piece as a whole, a tensile stress is said to produce a *tensile strain;* a compressive stress, a *compressive strain;* a transverse stress, a *bending strain;* and a torsive stress, a *torsive strain.* But at any point within the piece there are but three possible varieties of strain—a tensile strain, or a forcible separation of contiguous particles; a compressive strain, or a forced diminution of the distance between them; and a *shearing strain,* or a constrained movement of one line or plane of particles parallel to another line or plane. The load or other stress applied to a piece may produce a certain definite amount of distortion, or it may be so great as to produce rupture. Accordingly, the resistance of materials comprises two general problems—the problem of *elastic resistance,* or *resistance to distortion,* and that of *ultimate resistance,* or *resistance to rupture.* The load required to produce fracture is called *the breaking load,* and measures the *ultimate strength* of the piece supported and loaded in the manner supposed. In practice, beams and other parts of structures are not loaded or strained to the point of incipient rupture. The design is that they shall never be subjected to a stress sufficient to occasion a distortion increasing with the duration of the stress or with each renewal of it. The *safe load* indicated by this criterion, when ascertained by actual trial, is called *the proof load* or *proof strength.* The actual

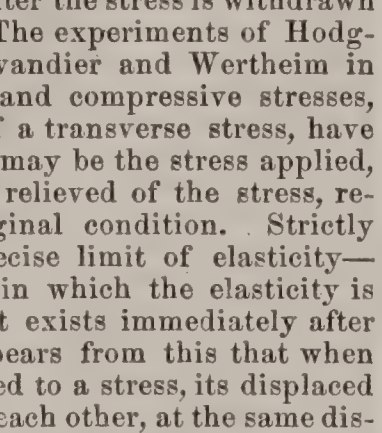
strain which the piece is intended to bear is, however, but a fraction of the safe or proof load, termed *the working load*.

With the view of determining the laws of the elastic resistance of materials many extensive series of experiments have been made by engineers and mechanicians, on a great variety of materials, subjected to every variety of stress, and supported in diverse ways. These experiments have conducted to the following

*Fundamental Principles of Elastic Resistance.*—(1) All bodies are made up of innumerable ultimate parts or particles. These are termed *molecules*, or often *particles* simply. (2) When, as the result of the action of an external force, the distance between two contiguous molecules of a body is altered, an effective resistance to the change of distance is developed, which consists in an effective action of the one molecule on the other. This effective action is an attraction if the distance is increased, and a repulsion if the distance is diminished. It is the elastic resistance opposed by a single pair of molecules to their relative displacement. (3) The intensity of this elastic resistance is proportional to the amount of the displacement, within certain limits. (4) If the applied load be removed, the piece will tend to return to its previous condition under the operation of the mutual actions of its displaced particles, which are now left unopposed. The property of *elasticity* in bodies involves both that of elastic resistance to a force of stress and that of undergoing an *elastic recoil* after the stress is withdrawn. (5) When the restoration to the former condition is complete, the piece is said to be *perfectly elastic* under the degree of stress applied. If the recoil is only partial, the elasticity is imperfect under the strains experienced. (6) As a matter of fact, all bodies may, from a practical point of view, be regarded as perfectly elastic within certain moderate limits of strain. But in every instance there exists a limit of strain beyond which the piece obviously ceases to recover itself. This is called the *limit of elasticity*. The residual elongation, compression, or deflection that obtains after the stress is withdrawn is termed the *set* of the piece. The experiments of Hodgkinson in England and of Chevandier and Wertheim in France in the cases of tensile and compressive stresses, and of the writer in the case of a transverse stress, have established that, however small may be the stress applied, the piece seldom, if ever, when relieved of the stress, recovers at once its precise original condition. Strictly speaking, then, there is no precise limit of elasticity—that is, no limit of strain within which the elasticity is perfect, and consequently no set exists immediately after the stress is withdrawn. It appears from this that when any solid piece has been subjected to a stress, its displaced molecules no longer exercise on each other, at the same distance, the same intensity of action as before, and hence do not return precisely to their original relative positions. This must be true of the displaced particles in general or of a portion of them. In this fundamental fact must lie the origin of the imperfect elasticity of solids.

The simplest general conception of the mechanical condition of a solid that can be formed from which a consistent theoretical exposition of the facts and laws of elastic resistance can be given, that fully accords with the entire range of experimental facts, is, that the molecules occupy the angular points of a series of geometrical cubes, and that within every elementary cube each pair of its eight molecules is, by itself, habitually in equilibrium under the action of opposing attractions and repulsions. But when an external stress takes effect, each elementary cube suffers a change of dimensions or of form, and between any two of its molecules that become relatively displaced a force of elastic resistance is developed. The effective molecular force exerted in the direction of either diagonal should be less, for an equal displacement, than that which takes effect in the direction of one of the sides, since the separating distance is greater. In this sense, of exerting unequal effective forces in different directions, the molecule may be said to have *polarity*. Let the effective force developed between the molecules $a$ and $b$, $c$, or $d$ (Fig. 1), by a minute change in the length of a side of the cube, be denoted by $f$, the corresponding force between $a$ and $e$, $f$, or $g$, resulting from an equal change in the length of a face diagonal, by $f'$, and the corresponding force between $a$ and $h$, separated by a long diagonal of the cube, by $f''$. If we have regard to the several cubes that have a common point $a$, and consider all the resisting molecular actions that can ensue when $a$ is displaced in any direction, it may be readily shown that the entire elastic resistance developed by the displacement of $a$ is expressed by $f + 2f' + 1\frac{1}{3}f''$, whatever may be the direction of the displacement, provided it is in the direct line of an external reaction. The cubical arrangement of particles here conceived must be regarded as the normal type, from which there may be greater or less deviations in different materials and in different parts of the same body; but such deviations are seldom of such a nature as to give rise to an essential disagreement with the general theory based upon an ideal uniformity.

FIG. 1.




TENSION.—Let a weight P be suspended from a point by means of a homogeneous prismatic bar. Experiment has established that under the ordinary circumstances of such suspension the elongation produced by the weight will vary directly as the length of the bar, and be the same for each unit of its length, and will be inversely proportional to its cross-section. We may conclude, therefore, that all the vertical filaments or lines of particles of which the bar may be conceived to be made up are equally strained, and that the vertical distances between the successive particles in each filament is increased by a fractional amount equal to that of the elongation of the entire bar, and hence that the strain is the same at all points of its length. Every cross-section of the bar is separated an equal amount from that above it, and the entire elastic resistance to this separation is equal, at all points of the length, to the weight. We here, and in what follows, disregard the weight of the bar itself. Within the elastic limits the elongation is proportional to the weight suspended. It will also obviously be less in proportion as a greater elastic resistance is offered by the material to the separation of its parts. If we divide the portion of the suspended weight P that takes effect on each square inch of section of the bar by the elongation of each inch of its length, the ratio obtained is called the *coefficient of elasticity*, or, by many writers, the *modulus of elasticity*. It is invariably denoted by E. It is also defined as the weight that would be required to extend a bar that is one square inch in section and one inch in length by the amount of one inch if the elasticity continued perfect. It is expressed in pounds, and is far greater than the greatest actual load that a square inch of the bar is capable of sustaining, since no bar, of any ordinary material, can be extended beyond a very small fraction of its length without breaking. The coefficient of elasticity of wrought iron is no less than 25,000,000 pounds, while its tensile strength is only about 56,000 pounds. When the elongation of a bar of any material one square inch in cross-section, produced by a given weight, has been experimentally determined, the coefficient of elasticity of the material may be obtained by observing that it bears the same ratio to the weight that the length of the bar bears to the measured elongation. (See 5th column of Table III., p. 565.) The comparative values of E for different materials serve as a measure of the comparative *stiffness* under a tensile strain, and $\frac{1}{\mathrm{E}}$ is a measure of the comparative extensibility.

*Elongation of a Bar of Uniform Cross-section.*—Let $l$ denote the length of the bar in inches, K its cross-section in square inches, E the coefficient of elasticity as given by Table III., P the suspended weight in pounds, and $\lambda$ the elongation produced by the weight P; then, by the definition above given of E, $\mathrm{E} = \frac{\mathrm{P}}{\mathrm{K}} \div \frac{\lambda}{l}$, from which we derive

$$\lambda = \frac{\mathrm{P}\,l}{\mathrm{E}\,\mathrm{K}}, \quad \ldots \qquad (1)$$

and

$$\mathrm{P} = \frac{\lambda}{l}\,\mathrm{E}\,\mathrm{K}. \quad \ldots \qquad (2)$$

The elongation of a bar of uniform section that results from its own weight is the same as would be produced by half its weight suspended from its lower end.

When the weight is suddenly brought into action, as when a support underneath it is suddenly withdrawn, the elongation and strain may be twice as great as when it is applied gradually. If a weight is hanging from a suspension-rod and another weight falls upon it, the force of the shock will of itself produce a certain elongation and strain. If W is the permanent weight suspended, and the weight P descends upon it from a height $h$, and $l$ denotes the length, K the cross-section, and E the coefficient of elasticity of the rod, the elongation $\lambda$ resulting from the shock is approximately given by the equation

$$\lambda = \frac{\mathrm{P}}{\mathrm{W} + \mathrm{P}} \sqrt{\frac{2\,h\,l}{\mathrm{E}\,\mathrm{K}}}. \quad \ldots \qquad (3)$$

When the rod has experienced its maximum extension from the combined effect of the shock and the newly-added weight P, it will suffer contraction, then undergo another elonga-

tion, and alternate contractions and elongations, gradually diminishing in extent, will ensue, until the movement ceases with the bar at the point of permanent elongation due to the two weights P and W. The longitudinal vibrations of the bar, and the attendant vertical oscillations of the suspended mass, P + W, are isochronous. The continued diminution in the amplitude of the vibrations, and their final suppression, result from some change experienced in the effective resistances to the molecular displacements within the bar, which is designated the *viscosity* of solids.

*Lateral Contraction, resulting from Longitudinal Tension.*—If a bar or rod be subjected to a tensile stress, the distances between its contiguous particles will be increased not only in the longitudinal direction, but also in oblique directions. Cohesive attractions will thus come into operation between these particles, which will have the effect to compress the particles upon one another in the lateral direction. It thus happens that the diameter of a rod is diminished by a longitudinal tensile stress. According to the experiments of Cagnard Latour, Wertheim, and Kirchhoff, with rods of various materials, the fractional diminution of the diameter falls between one-fourth and two-fifths of the fractional elongation. This result of experiment is in accordance with the general conception of the mechanical condition of solids before stated, if we suppose the tensile stress to be exerted in the direction of the side of an elementary cube. This gives for the ratio of the lateral compressive action to the direct resistance to tension, for a single molecule, the expression

$$\frac{f' + 1\frac{1}{3}f''}{f + 2f' + 1\frac{1}{3}f''}.$$

The value of this for all admissible values of $f'$ and $f''$, as compared with $f$, lies between the limits $\frac{1}{4}$ and $\frac{2}{5}$.

*Resistance to Rupture by Tension.*—The resistance of a bar or rod to rupture by tension is the same for every square inch of its section. The ultimate resistance per square inch is called the *modulus of tenacity*, or simply *the tenacity*. In formulas it is denoted by T. The total resistance, or the breaking load, is equal to the tenacity multiplied by the number of square inches in the cross-section of the bar. The moduli of tenacity of various materials are given in Table III. The tenacity of steel exceeds that of all other substances. Specimens of cast steel have been obtained having a tenacity of over 170,000 pounds; the higher grades of steel have a tensile strength of over 100,000 pounds; the tenacity of good bar iron is from 50,000 to 70,000 pounds; iron wire has a tensile strength of 70,000 to 100,000 pounds; the average tensile strength of cast iron is 16,500 pounds, but by a special process a specimen has been obtained that had a tension of 46,000 pounds. The tenacity of the different kinds of wood varies between wide limits. The strongest kinds, as locust, box, ash, and beech, have a tenacity of 20,000 to 17,000 pounds; the weakest, as white pine and poplar, of 4000 to 7000 pounds. These statements refer to thoroughly-seasoned timber, and to tensile strains exerted in the direction of the fibres. The tenacity of unseasoned timber is much less. The tenacity at right angles to the fibres is many times less. Careful experiments made at Woolwich dockyard, England, have shown that good bar iron is not weakened by strains even up to the point of rupture. Its strength is, in fact, apparently greater after having been subjected to great strains than before. Wrought iron offers a remarkable exception to the general fact that heat diminishes tenacity. In a series of experiments made by Fairbairn upon rolled plates of iron it was found that the strength remained nearly the same up to 395° F. Beyond this temperature it decreased, and was reduced 25 per cent. at a red heat. In similar experiments with rivet iron the strength was found to increase up to 325° F.; the increase at that temperature amounted to nearly 30 per cent.

*Resistance of Cylinders to an Internal Pressure* (as water-pipes and cylindrical boilers).—A cylinder exposed to an internal pressure of water or steam is more liable to be torn asunder longitudinally than at any cross-section. The thickness at which rupture is liable to occur may be calculated by the formula $2\mathrm{T}\,t = p\,d$, in which $t$ denotes the thickness, and $d$ the internal diameter of the hollow cylinder, both in inches, T the tenacity of the material (Table III. p. 565), and $p$ the internal pressure in pounds per square inch. If the thickness is any considerable fraction of the diameter, the following more accurate formula may be used: $2(\mathrm{T} - p)\,t = p\,d$. In calculations of safe thickness for wrought-iron steam-boilers, joints double riveted (according to Fairbairn), T should be taken as low as 4250 pounds, or one-eighth the actual tensile strength of double-riveted plates. That a cast-iron water-pipe may have the requisite strength to resist the strains to which it may be exposed from its own weight and external causes, the calculated thickness has to be increased. The following is the formula in general use for determining the proper thickness of cast-iron water-pipes: $t = 4 \times \frac{150 \text{ lbs.} \times d}{2 \times 16{,}500} + 0.40$ in. The tenacity is taken at 16,500 pounds, and a factor of safety, 4, used. The pressure $p$ is taken at 150 pounds. This formula gives almost the exact thicknesses of the cast-iron main pipes, of various diameters, laid down in New York City. In the U. S. all pipes that are to be subjected to an internal pressure of water or steam are tested by the hydraulic press at 300 pounds. The formula used in the establishment of the water-supply of Paris is equivalent to

$$t = 3.55 \times \frac{150 \text{ lbs.} \times d}{2 \times 16{,}500 \text{ lbs.}} + 0.315 \text{ in.},$$

$$\text{or to } t = 4 \times \frac{150 \text{ lbs.} \times d}{2 \times 18{,}600 \text{ lbs.}} + 0.315 \text{ in.}$$

Compression.—When a downward pressure from a superincumbent weight is exerted equally upon all parts of the upper face of a prismatic block standing firmly on its base, it has been experimentally ascertained that the fractional diminution of its height is directly proportional to the pressure, and inversely proportional to the area of the base, unless the height be so great that the block has a tendency to bend under the pressure. We must conclude, then, that all the vertical filaments of the mass are compressed equally at all points of the height, and that the resulting elastic resistances are equal at all points to the vertical pressures on the various points of the upper face. The coefficient of elasticity E is found to have nearly the same value for small compressions as for small tensions. Formulas 1 and 2 apply, then, as well to compression as to tension, and the values of E given by Table III. may be used.

*Resistance to Crushing.*—The ultimate resistance of a short block to crushing under a uniformly-distributed pressure varies as the area of the base or transverse section. The ultimate resistance per square inch is called the *crushing strength* of the material, or modulus of crushing strength. It is designated by C in formulas. Table III. gives its value as experimentally determined for various materials. The crushing strength of a prismatic block of any material may be obtained by multiplying the value of C by the number of square inches in the base. As rupture by crushing is a separation of parts, it cannot be a direct consequence of the compression experienced in the line of direction of the pressure. It immediately results from attendant compressive actions that take effect obliquely to the line of pressure. These occasion an expansive tendency at right angles to this line. When this expansive tendency prevails over the lateral cohesion, rupture must occur. It is in this way that rupture occurs, except in the case of materials of a granular texture, like cast iron, stone, and brick. Hard, homogeneous substances of a glassy texture, like vitrified bricks, crush under a vertical load by *splitting* in the vertical direction into several fragments. Ductile and tough materials, like wrought iron, are crushed by *bulging* or lateral swelling. In the case of wood and other fibrous substances the lateral adhesion of the fibres is overcome, and what is called *buckling* or crippling ensues. When blocks of a granular material are crushed, they give way along lines or planes inclined somewhat more than 45° to the base, and passing through the edge of the base or outside of it. This is the result of a shearing strain developed along such lines by the vertical pressure, which produces rupture before the lateral tenacity is overcome. The crushing strength of steel far exceeds that of all other substances. Some specimens of cast steel have resisted a pressure of nearly 400,000 pounds to the square inch. The crushing strength of cast iron averages about six times its tenacity. That of a good quality of cast iron is about 100,000 pounds; that of the strongest specimens is nearly 150,000 pounds. The crushing strength of a medium quality of wrought iron is less than 50,000 pounds. The crushing strength of most kinds of timber when dry is from one-half to two-thirds its tenacity. Moisture in timber weakens the lateral adhesion of the fibres, and reduces the resistance to crushing to about half its amount in the dry state. The average compressive strength of good building-stone is about 12,000 pounds.

*Strength of Pillars.*—Ordinary pillars or columns are of such length compared with their diameter that they tend to bend under a load, and, if the load be sufficiently great, break by bending or suffer *cross-fracture*. The laws of variation of their strength have been experimentally determined by Hodgkinson. He found that when both ends of a pillar are flat, its strength is about three times as great as when both ends are rounded, and when both ends are firmly fixed, it is about four times as great. The other laws are embodied in the following formulas, by means of which calculations can be made for special cases:

| Column. | Rounded ends. Length more than fifteen times the diameter. | Flat ends. Length more than thirty times the diameter. |
|---|---|---|
| Solid cylindrical column of cast iron, | $P = 14.9 \frac{d^{3.76}}{l^{1.7}}$. | $P = 44.26 \frac{d^{3.55}}{l^{1.7}}$. |
| Hollow cylindrical col. of cast iron, | $P = 13 \frac{d^{3.76} - d_1{}^{3.76}}{l^{1.7}}$. | $P = 44.3 \frac{d^{3.55} - d_1{}^{3.55}}{l^{1.7}}$. |
| Solid cylindrical column of wrought iron, | $P = 42 \frac{d^{3.76}}{l^2}$. | $P = 133.7 \frac{d^{3.55}}{l^2}$. |
| Solid square pillar of Dantzic oak, | ..... | $P = 10.9 \frac{d^4}{l^2}$. |
| Solid square pil- of red dry deal, | ..... | $P = 7.8 \frac{d^4}{l^2}$. |

P = crushing weight in gross tons; $d$ = external diameter, or side of column, in inches; $d_1$ = internal diameter of hollow columns in inches; $l$ = length of column in feet. If the length of the column fall below the limit given in the table, and is more than four or five times the diameter, the strength is approximately given by the formula $W = \frac{P.C K}{P + \frac{3}{4} C K}$, in which P = the breaking weight by preceding formulas for long columns; C = crushing strength of the material, given by Table III., expressed in gross tons; and K = transverse section of column, in square inches.

The following formula, derived from Hodgkinson's experiments, known as "Gordon's formula," is that most frequently used in the calculation of the ultimate strength of struts and pillars:

$$P = \frac{f S}{1 + a \frac{l^2}{d^2}}.$$

P = crushing load in pounds, S = sec. area in inches, $l$ = length, and $d$ = external diameter (or extreme breadth), both in terms of the same linear unit; $f$ and $a$ are coefficients. Their values for pillars fixed at both ends, by having flat capitals and bases, are given in the following table, for cast iron, wrought iron, and timber, and for pillars of diverse forms:

| Material. | Value of $f$. | Value of $a$. | Form of pillar. |
|---|---|---|---|
| | Pounds. | | |
| Cast iron..... | 80,000 | $\frac{1}{400}$ | Hollow cylindrical. |
| " " ..... | 80,000 | $\frac{1}{533}$ | Hollow square. |
| " " ..... | 80,000 | $\frac{1}{266}$ | Solid. |
| Wrought iron..... | 36,000 | $\frac{1}{4500}$ | Hollow cylinder, thin. |
| " " ..... | 36,000 | $\frac{1}{6000}$ | Hollow square, thin. |
| " " ..... | 36,000 | $\frac{1}{3000}$ | Solid rectangular. |
| " " ..... | 36,000 | $\frac{1}{2250}$ | Solid cylinder. |
| " " ..... | 36,000 | $\frac{1}{1500}$ | Angle iron, of equal ribs. |
| " " ..... | 36,000 | $\frac{1}{1500}$ | + form. |
| Timber ..... | 7,000 | $\frac{1}{250}$ | Rectangular. |

The values of $a$ given in the table must be multiplied by 4 for pillars or struts rounded or jointed at both ends, and by 2 for those fixed at one end and jointed at the other. Connecting-rods of steam-engines are jointed at both ends, and piston- and pump-rods are fixed at one end and jointed at the other. Gordon's formula, with the above values of $f$ and $a$ for a hollow cylinder of cast iron, gives the crushing load for columns with flat ends from 5 to 25 per cent. less than that derived from Hodgkinson's formula, and for columns with round ends from 25 to 50 per cent. less, the percentage of difference varying with the length and diameter of the column. Neither formula accords exactly with the results of Hodgkinson's experiments, but in the case of columns with round ends—which pillars and struts are generally assumed to be—the disagreement is much the greatest with Gordon's formula, but the errors lie on the safe side.

*Collapse of Tubes under External Pressure.*—The tubular flues of a steam-boiler are subjected to such an external pressure. According to Fairbairn, the resistance of a tube to collapsing is inversely proportional to the diameter and length of the tube, and increases nearly as the square of the thickness. He gives the following formula for calculating the strength of wrought-iron tubes subjected to external pressure:

$$P = 806{,}300 \frac{k^{2.19}}{L\,d};$$

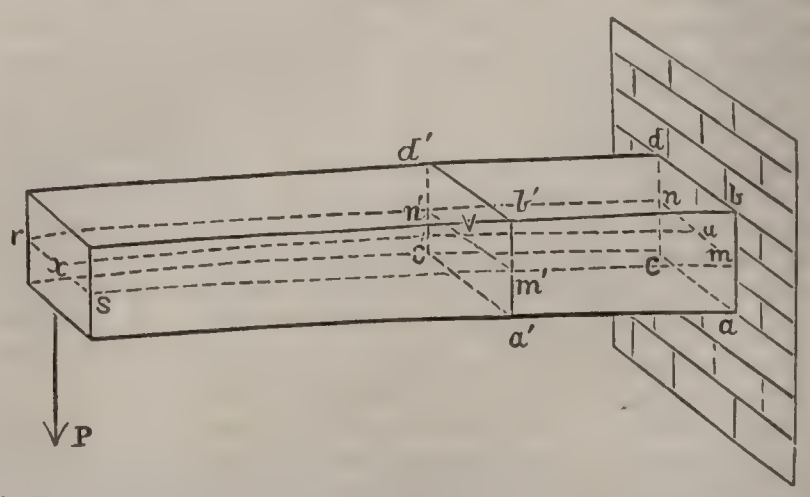
in which L is the length of the tube in feet, $d$ its diameter, and $k$ its thickness, both in inches, and P the ultimate resistance to compression, in pounds per square inch. For logarithmic computation we have $\log.P = 1.5265 + 2.19 \log.100\,k - \log.(L.d)$. To find the thickness $k$, in inches, of a wrought-iron tube to resist collapsing under a known pressure P, we have $\log.100\,k = \frac{\log.P + \log.(L.d)}{2.19} - 1.203$.

In this formula, L is to be taken in inches. For each thickness of tube there is a certain length beyond which the resistance to external pressure is less than that to internal pressure. If the thickness of the sheet-iron tube is $\frac{1}{4}$ inch, this limiting length is 2.59 feet.

Shearing.—Shearing is a forced sliding movement of one part of a body over an adjacent part, as occurs in the action of a pair of shears, when the two blades urge adjacent portions of the material in parallel and opposite directions, and sever them along the section between the blades. That shearing may take place, it is not necessary that the tendencies to parallel and opposite motions should be directly communicated to contiguous parts of a body, as in the operation of shears. The two external actions may be exerted in parallel planes separated by a small or a considerable distance, and the shearing tendency will exist at all intermediate points. Also, one of the actions here referred to may be a force of reaction taking effect at a fixed point of support. Thus, when a beam resting horizontally on two props is loaded at the middle, there will be a shearing strain at all cross-sections between the middle and each prop, equal to the reaction of the prop, or half the weight. In this case the shearing is said to be *transverse*. Rivets, pins, and keys used in fastening joints, and tenons of beams inserted in mortises, are liable to a transverse stress, and so to transverse shearing. *Longitudinal shearing* will take place if a longitudinal stress is exerted along a line not directed through a point of support. When a beam supported horizontally at one or at two points is loaded with weights, the shearing is at right angles to its length, and the shearing strain at any cross-section is equal to the reaction of the point of support on either side of the section, minus the sum of all the weights on that side intercepted between the section and the point of support. A similar rule applies to all cases of direct transverse shearing. For any section of a loaded beam the shearing strain will then be as follows: When the beam is fixed at one end, it will be the weight at the free end, or if it is uniformly loaded, the weight between the section and the free end; when the beam rests on two points, it will be half the load if this is at the middle, and the load between the section and the middle if the beam is uniformly loaded. The resistance to shearing strain per square inch of section is called the *modulus of shearing*. The following are the values of the modulus of shearing for some of the principal materials in use: cast iron, 30,000 to 40,000 pounds; wrought iron, 40,000 to 60,000 pounds; steel, 60,000 to 90,000 pounds; wood, with the fibres, 500 to 1200 pounds; wood, across the fibres, 500 to 2000 pounds; treenails of English oak, across the fibres, 4000 to 5000 pounds. The shearing strength of wrought iron is practically equal to its tensile strength; that of cast iron is double its tenacity, and that of steel about three-fourths its tenacity.

Flexure.—When a beam is bent by a transverse stress, the fibres on the convex side are extended and those on the concave side compressed. Between the extended and compressed fibres there is a surface in which the fibres are neither extended nor compressed, but retain their original length. This is called the *neutral surface;* it is nearly a plane when the beam is slightly bent. If we consider only a medial longitudinal section of the beam, we have a neutral line or filament simply, which is called the *neutral axis* of the beam. If a cross-section of the beam be taken at any point, it will intersect the neutral surface in a horizontal line, termed the *neutral axis of the section*. It passes through the centre of gravity of the section, and the neutral axis of the beam passes through the centres of gravity

Fig. 2.




of all transverse sections. In Fig. 2, $m\ n\ r\ s$ represents the neutral surface, $u\ v\ x$ the neutral axis of the beam, and $m'$

$n'$ the neutral axis of the section $a'\ b'\ d'\ c'$. The curve assumed by the neutral axis of the bent beam is called the *elastic curve*. The depression of the lowest point of this curve is the *linear deflection* of the beam. The comparative deflections for beams variously loaded and supported are given in Table II., p. 564.

According to the received theory, the following are the general laws of the deflection of rectangular beams: It is directly proportional to the load and the cube of the length, and inversely proportional to the breadth and the cube of the depth. But an extensive series of experiments made by the writer on the deflection of rectangular bars of wood, iron, and steel of moderate dimensions, loaded at the middle, have established that in pieces of such dimensions, and presumably in beams of similar relative dimensions, the deflection neither varies directly as the cube of the length nor inversely as the cube of the depth, but in ratios less rapid than these laws give. The length of the bars used in the experiments varied from 2 feet to 6 feet, and the breadths and depths of the wooden pieces from 1 inch to 6 inches, and those of the bars of iron and steel from $\frac{1}{4}$ inch to 1 inch. The entire series of experiments are accurately represented by the formula

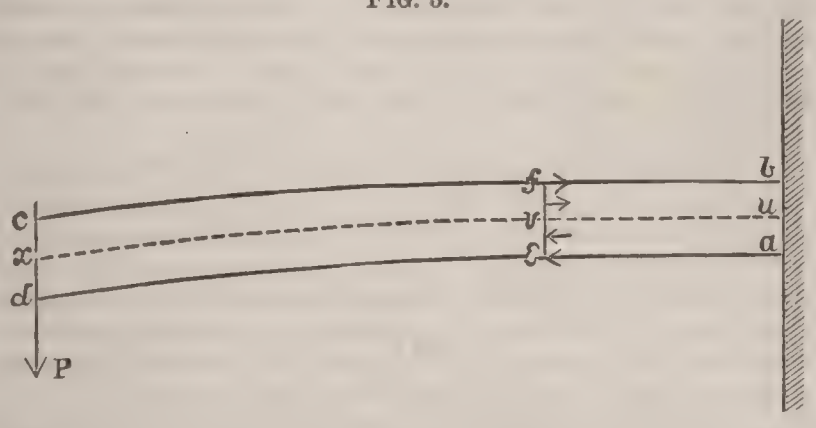
$$\Delta = \frac{m}{8\,\mathrm{E}} \cdot \frac{\mathrm{P}\,l^2}{b\,d} + \frac{\mathrm{P}\,l^3}{6\,\mathrm{E}\,b\,d^3}, \quad \ldots \qquad (4)$$

in which P denotes the applied weight or pressure, $l$ the length, $b$ the breadth, and $d$ the depth of the piece, E the coefficient of elasticity, and $m$ the ratio $\frac{\mathrm{E}}{\mathrm{G}}$ of the coefficient of elastic resistance to shearing to that of elastic resistance to tension or compression. The value of $m$ varies with the position of the layers of fibres in the piece. For the white pine sticks used, $m$ has the value 4 when the layers are horizontal, and 2 when they are vertical. For the wrought-iron and steel bars, $m$ is a little less than 2 when the bar rests edgewise on its supports, and 4 when it rests flatwise.

*Comparative Stiffness of Beams of same length and same quantity of material.*—The rigidity of such rectangular beams is proportional to the square of the depth. Hollow rectangular or cylindrical beams are more rigid than solid ones. The I and I form of iron beam and rail in common use is much more rigid than the solid rectangular bar. The general principle is, that fibres impart stiffness, as well as strength, under a transverse stress, in proportion as they are more remote from the neutral axis of the cross-section. With horizontal beams under a vertical load, the neutral axis of the cross-section is horizontal; it is in all cases perpendicular to the direction of the bending force.

*Ultimate Resistance to Flexure*, or *Strength of Beams under a Transverse Stress.*—Let the beam be fastened at one end and loaded at the other, as shown in Fig. 3, and consider any cross-section, as $e\,f$. The upper fibre $b\,f\,c$ will

FIG. 3.




at the point $f$ be under a tensile strain, tending to draw $f$ toward $c$; and this strain will be counteracted by the elastic resistance exerted in the opposite direction, as shown by the arrow. The same will be true of every fibre above the neutral axis $u\,v\,x$; only that the strain will decrease with the distance from the neutral axis. Below this axis the strains will be compressive, or acting toward the fixed end of the beam, and will be counteracted by the elastic reactions, as shown by the arrows. Accordingly, the part $d\,c\,f\,e$ of the beam is essentially in the condition of a bent lever, of which the axis or fulcrum is at $v$; and the weight $P$ is held in equilibrium by the elastic resistances of all the fibres above and below the axis to the strains they undergo. If we take the sum of the moments about $v$ of all these resistances at all points of the section considered, we shall have what is called the *moment of resistance*, or resisting moment, of the section. The equilibrium, on the principle of the lever, requires that this moment of resistance shall be equal to the moment $\mathrm{P} \times x\,v$ of the weight P about the same point. This latter moment is called the *moment of stress*, or bending moment. Accordingly, the general equation of equilibrium between the external and internal forces, is

Moment of stress = moment of resistance of cross-section.

For beams loaded or supported in any other way the same general equation of equilibrium holds good. The moment of stress in each case is obtained by considering all the external forces, reactions included, that are in operation on one side of the cross-section considered. It is the sum of the statical moments of all of these forces that tend to produce a rotation in one direction about the neutral axis of the section regarded as an axis of rotation, minus the sum of the moments of those which tend to produce a rotation in the opposite direction. Practically, that ideal cross-section is taken at which the moment of stress has its maximum value, and so the longitudinal strains on the fibres are the greatest. This is called the *dangerous section*. In the case of a beam fastened at one end, however it may be loaded, the dangerous section is at the fixed end. If a beam rests on two supports, and is loaded at the middle, or uniformly, the dangerous section is at the middle. If it is fixed at both ends, under similar circumstances the section of greatest strain is at the fixed ends. When the load applied to a beam is sufficient to produce rupture, the rupture begins in the dangerous section, and with the fibres most remote from the neutral axis, on the side on which the ultimate resistance to the longitudinal strain is first reached. With rectangular beams of wrought iron and wood, as the crushing strength is less than the tenacity, the rupture begins on the compressed or concave side. With rectangular beams of cast iron the tenacity is much less than the crushing strength, and the outer fibres rupture first on the convex side. The ultimate resistance of the outer fibres for a square inch in section, on the side which first ruptures, is called the *modulus of rupture*, and is represented by R. The values of R, as determined experimentally for a great variety of materials, are given in Table III. The moment of stress, answering to the dangerous section, which results from the breaking load, is termed the *maximum moment of stress*, or the moment of rupture. (See 3d column of Table II. For the expressions for the moment of resistance of various forms of cross-section see Table I.) By putting the maximum moment of stress for a beam loaded and supported in the manner supposed, equal to the moment of resistance for the supposed form of cross-section, and taking the proper value of R from Table III., we may readily determine the breaking load when the dimensions of the beam are given, or find what dimensions a beam should have not to suffer fracture under a given load. When there is occasion to take the weight of the beam into account, it is to be regarded as a uniformly distributed load W, and the maximum moment of stress for such a load added to that of the applied load.

*Comparative Transverse Strengths of Beams* of different forms or dimensions, but of uniform cross-section.—(1) If the beams differ only in length, the breaking load is inversely proportional to the length. (2) If the length and form are the same, but the transverse dimensions different, and the cross-section either a rectangle, circle, or triangle, the breaking load is proportional to the area of the cross-section multiplied by the depth. Thus, for rectangular or triangular beams of the same length and sectional area, the strength increases as the depth. The same proportion holds very nearly for hollow rectangular or circular beams if the thickness of the solid part is small in comparison with the exterior dimensions; also for beams and bars of the I or I form, in ordinary use, in which the vertical rib is comparatively small, and the quantity of material in the two flanges is the same or has a definite ratio. (3) The breaking load of rectangular beams of the same length varies directly as the breadth and the square of the depth. Such beams are then strongest with their greatest transverse dimension vertical. The strength of circular beams of the same length increases as the cube of the diameter. (4) Beams of different forms, with the same section of material, differ in strength. A square beam is nearly one-fifth stronger than a circular one of the same sectional area. Rectangular beams of equal sections are stronger in proportion as their breadth is less and depth greater. Hollow beams are stronger than solid ones, and those of the I or I form are stronger than rectangular beams.

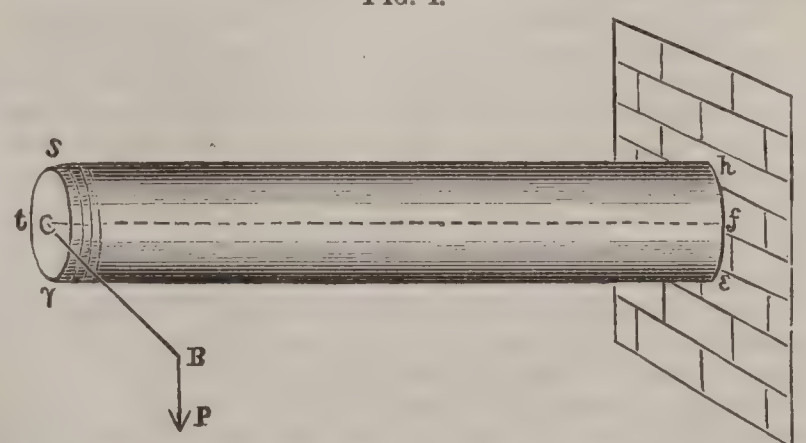
*Section of Greatest Strength.*—According to the experiments of Hodgkinson and Fairbairn, the strongest form of cross-section for an iron beam is that consisting of a vertical rib uniting two horizontal flanges, the areas of which bear to each other the inverse ratio of the ultimate resistances of the material to extension and compression. In the case of the cast-iron beam of strongest form, resting on two supports, the sectional area of the lower flange is six times that of the upper flange. With the steel beam the same flanges bear the ratio of 2 to 1. In the wrought-iron beam of strongest section the area of the upper flange is nearly double that of the lower flange. The formula for

the breaking weight is $W = c\frac{a\,d}{l}$, in which $a$ is the area of a section of the bottom flange in square inches; $d$, the depth of the beam in inches; $l$, the length, or distance between the supports in inches; and $c$, a coefficient. The value of $c$ for the cast-iron beam is 26 gross tons, and for the wrought-iron beam is 60 gross tons. In the I or I form of beams or rails in general use, the angles are rounded off, and the vertical rib has sufficient thickness to resist the shearing strain and vertical and lateral shocks. Recent experiments have shown that when a cast-iron I beam is loaded only on one side of the flange, the area of the lower flange should be three times that of the upper, instead of six times.

*Beams of Uniform Strength.*—A beam of uniform strength is one in which an applied weight occasions the same strain on the outer fibres at all points of the length; and hence the liability to break is theoretically the same at all cross-sections. Every such beam, if the cross-section be rectangular, decreases either in breadth or depth, or both, from the section of greatest to that of least strain. The precise form and varying dimensions in any particular case can be obtained by placing the moment of stress for any section equal to the general expression for the moment of resistance of the section—viz. $\frac{R\,u\,y^2}{6}$, in which $u$ denotes the breadth and $y$ the depth of the section. Either of these may be supposed to have a constant value, and the varying value of the other may be obtained by the equation. Thus, if the beam be fastened at one end, and support a weight P at the other, and $x$ represent the distance from P to any one of the rectangular cross-sections, the equation will be $Px = \frac{R\,u\,y^2}{6}$. If the breadth be constant, the outline of the vertical longitudinal section will be parabolic in form. If the depth be constant, the beam will be wedge-shaped in horizontal outline. Under similar circumstances, if the load were uniformly distributed, to be of uniform strength, with a constant breadth, the beam would have to be wedge-shaped in vertical outline. If the beam be supported at the ends and loaded at the middle, or supported at the middle and loaded at the ends like the beam of a balance, and the breadth be constant, to be of uniform strength it must taper from the middle toward either end in a parabolic curve.

Torsion.—Let $e\,h\,s\,r$ represent a cylindrical shaft, one of whose transverse sections, $e\,f\,h$, is immovably fixed, and let P be the twisting force acting perpendicularly to

Fig. 4.




C B in the plane of the section $r\,s\,t$. Suppose the cylinder to be divided by ideal planes of section into an indefinite number of circular disks. The first disk will be urged by the twisting force to turn around its centre C. This movement will necessitate the slipping or shearing of this disk upon the next, which will develop a force of shearing strain and an opposing elastic resistance. The shearing action of the first disk on the second will cause the second disk to turn around its centre, and slip or shear upon the third; and this will be made to turn upon the fourth, and so on to the fixed end of the shaft. When the final equilibrium obtains between the successive shearing actions propagated from P and the reactions that return from the fixed end, each disk will have turned by the same amount upon the next, and the consequent shearing action will be counteracted by the elastic resistance to the same. From this state of things we may draw the following conclusions: (1) The entire shearing strains are equal at all sections. (2) Throughout any one section the strains increase proportionally to the distance from the axis of the shaft. (3) The angular movement of the free end of the shaft, at which the twisting force acts, is proportional to the distance between the free and fixed ends, or the length of the shaft. This angle is called *the total angle of torsion.* The corresponding angle for a unit of distance along the shaft is called *the angle of torsion.* (4) Every longitudinal fibre or filament is twisted into a uniform spiral line.

*Angle of Torsion.*—Let $t^0$ denote the angle of torsion, expressed in degrees and fractional parts of a degree. The theoretical expression for it is

$$t^0 = 36.474\frac{P\,a}{G\,r^4}; \quad \ldots \qquad (5)$$

in which P is the twisting force, $a$ its lever-arm C B, $r$ the radius of the shaft, and G the coefficient of elastic resistance to shearing. If $t^0$ be multiplied by the length of the shaft, the result will be the total angle of torsion. What is called the length of the shaft must be understood to be the distance between the sectional plane in which the twisting force acts and that in which the external reactions to this force occur. In wheelwork the reactions occur at the section where the shaft is connected with the gearing that is driven by the revolving shaft. The following mean values of G are adopted by Morin in his *Resistance of Materials:* soft iron, 8,530,680 pounds; iron bars, 9,480,918 pounds; German steel, 8,533,680; cast steel, very fine, 14,222,800; cast iron, 2,844,560; copper, 6,209,670; bronze, 1,516,150; oak, 568,912; fir, 615,850.

*Rupture by Torsion.*—When the internal elastic resistances of the shaft just suffice to prevent rupture, an equilibrium subsists between the twisting force and the entire shearing resistance to the turning of any one material cross-section around its centre. The centre of motion or tendency to motion is the centre of the section, and all the resistances act in the plane of the section, and tangentially around its centre. Accordingly, the equation of equilibrium between the external and internal forces is

Moment of twisting force = moment of resistance of section.

The moments are taken with respect to the centre of the section. This gives for circular shafts,

$$P\,a = 1.5708\,J\,r^3, \quad \ldots \qquad (6)$$

P, $a$, and $r$ stand for the same quantities as in equation (5), and J is the *modulus of torsion.* For approximate calculations J may be taken at four-fifths of the value of R given in Table III. For square shafts the formula is

$$Pa = 0.2356\,Jb^3, \quad \ldots \qquad (7)$$

in which $b$ is the side of the square section. In calculating by either of these formulæ the proper dimensions to be assigned to a shaft that is to receive a torsive strain, the known twisting force P should be multiplied by 4 or 5 for iron shafts, and by 8 or 10 for wooden shafts, the larger factors being taken if the shaft is to be exposed to shocks.

Testing the Strength and Elasticity of Materials.—The component parts of structures, such as bridge-trusses, railways, etc., are not only exposed to strain from a constant load, but are also liable to strain from the action of a passing load or transient pressure. The operation of a passing load is attended, more or less, with shocks which augment the strains experienced. Accordingly, it is the practice to test the capability of the material and form of piece intended to be used to resist strains due both to a dead load and to shocks. The tests applied consist in determining the ultimate resistance to rupture, the resistance to strains within the practical limit of elasticity, the position of this limit, the amount of permanent elongation, deflection, or other distortion produced by a transient pressure or shock above this limit, and the actual distortions from given loads or shocks. Shocks definite in amount are experimentally obtained by allowing a given weight to fall through a given height. The product of the weight by the height of fall is the measure of the energy of the shock. The energy of the resistance which neutralizes the shock is called the *resilience,* or spring of the piece. It is measured by the product of the alteration of figure by the mean resistance that comes into operation during the change. If the shock just suffices to produce rupture, the *ultimate resilience* of the piece is brought into operation. The value of this is given in inch-pounds for various materials, as experimentally determined by Prof. Thurston of the Stevens Technological Institute, in Table IV. The shock is neutralized by the tensile resistance of a suspension-bar of the material experimented on, and the number of inch-pounds given in the table expresses the ultimate resilience for a square inch of section and one foot of length. This multiplied by the number of square inches in the cross-section of the suspension-bar, and by its length in feet, will give the resilience of the whole bar in inch-pounds. The ultimate resilience shows the capability to resist shocks without rupture. It depends not only on the tenacity, but also on the amount of extension at the point of rupture. Thus, the specimens of iron or steel which have the greatest resilience are those which have at the same time a high tenacity and are especially ductile or tough. If the maximum strain resulting from the shock falls just below the limit of elasticity, the proof resilience is experienced. The proof resilience of a suspension-bar

may be obtained from the expression $\frac{f^2}{E} \cdot \frac{Kl}{2}$, in which K is the cross-section, and $l$ the length of the bar, $f$ the proof tenacity, and E the coefficient of elasticity of the material. The fraction $\frac{f^2}{E}$ is called the *modulus of resilience*. It is given in inch-pounds in Table IV. This modulus, multiplied by the square inches of cross-section of the bar, and half its length in feet, will give the entire proof resilience of the bar. The corresponding result obtained for a rectangular beam resting horizontally on two supports, if divided by 9, will give the proof resilience of the beam —that is, the energy of the greatest transverse shock it can receive without injury. If this be divided by a given weight, the quotient will be the height in inches through which the weight must fall to produce the shock supposed.

The effects of dead loads are experimentally ascertained by *testing-machines*. For tensile and compressive stresses the requisite power is obtained by a combination of levers or by the hydrostatic press. One of the best testing-machines, of moderate power, is Riehlé's longitudinal testing-machine. The straining force is obtained by means of a hydrostatic press, and its intensity is measured up to 4000 pounds by a differential lever. Much more powerful machines have been constructed, capable of applying and measuring a stress of even 500 tons. Prof. Thurston's autographic recording testing-machine measures and records the resistance to a torsive stress, and has been successfully employed not only in testing the strength of materials, but also in investigating their diverse mechanical qualities. In the testing apparatus devised by the writer, and used in making experiments on the deflection and set of bars from a transverse stress, the stress is applied by means of a vertical screw, and measured up to 1000 pounds by a Fairbanks dynamometer, and the depression of the middle of the bar is measured to the $\frac{1}{20000}$th of an inch by means of a lever and micrometer-screw.

As a specimen of the process of testing in a given case, we shall cite the tests applied to iron rails used by the Northern and Orleans R. R. of France. Each of the rails selected for trial, weighing 75 pounds per yard, is placed on supports 3.6 feet apart, and must sustain in the middle between the supports 26,400 pounds for five minutes without preserving any sensible set. The same rail in the same position must support for five minutes, without breaking, a load of 66,000 pounds. The rail is then broken by an increase of load, and each of the broken pieces is placed on two very firm supports 3.6 feet apart, and should support without breaking the shock of a weight of 660 pounds falling from a height of 6.56 feet. In the case of steel rails of the same weight, the pressure tests are 44,000 pounds and 77,000 pounds, and the shock test is with a weight of 660 pounds falling through 8.2 feet. Another mode of testing for cases in which pieces are to be subjected to strains indefinitely repeated is to apply pressures and shocks with a great number of repetitions, and so ascertain the stress which may be indefinitely repeated without injury. A. Wohler of Germany has kept up such a series of experimental trials of iron and steel for a period of twelve years, from which he concludes that the safe working-strain for wrought iron, strained alternately in opposite directions like a piston-rod, is 8800 pounds, and when strained repeatedly in one direction, 16,500 pounds; and for steel rods, not hardened, under corresponding circumstances, is 13,200 pounds and 24,200 pounds.

Remarks on the Use of the Tables.—Tables I., II., III., and IV. furnish the data and expressions to be introduced in the general formulæ already given when special calculations are to be made. If it is proposed to calculate the safe or *working load*, certain fractional parts of T, C, or R, as the case may be, must be used, called *moduli of safety*. The following values are generally assumed for the moduli of safety, which we shall denote by T′, C′, and R′: wrought iron (T′, C′, or R′), 10,000 to 12,000 pounds; cast iron (T′) 3000 to 4000; (C′) 15,000 to 20,000; (R′) 6000 to 8000; wood (T′) 1200; (C′) 800; (R′) 1000; stone (C′), granite, 800 to 1200; limestone, 600 to 1200; sandstone, 300 to 800.

If calculations for the case of a transverse stress are made with the formula, max. moment of stress = coefficient of rupture × area of cross-section × depth, the value of S given in Table IV. should be divided by 5 for iron or steel, and 10 for wood. (See Tables I. and II.) In calculating the proper dimensions to be assigned to a tie, strut, or beam in a frame, as a bridge or roof-truss, the greatest stress that can actually come upon the piece is to be multiplied by a factor of safety. This factor is generally taken at from 4 to 6 for wrought or cast iron, 10 for wood, and 10 to 15 for stone. The other process of calculation for the case of a transverse stress is by means of the general equation: Maximum moment of stress = moment of resistance of cross-section. The expressions for these moments may be taken from Tables I. and II., and the value of R from Table III. If the strains are not to exceed the safe limit, then R′ (= R divided by the factor of safety) is to be used, or the known maximum load is to be multiplied by the factor of safety.

Rectangular, square, and triangular cross-sections, $b$ = breadth, $d$ = depth. Hollow rectangular, square, and I form, $b$ = extreme breadth, $d$ = extreme depth, $b'$ = breadth of vacant portion, $d'$ = depth of vacant portion, and $t$ = thickness of material. Circular form, $r$ = radius, $\pi = 3.1416$. Hollow cylindrical, $r$ = radius of outer circle, $r'$ = radius of inner circle, and $t$ = thickness of material. I cross-

Table I.—*Moments of Inertia and Resistance of Cross-Sections of Beams of Diverse Forms.*

| Form of beam. | Moment of inertia, I. | Moment of resistance, M. | Distance of outer fibre from neutral axis, $d_1$. | Coefficient of rupture, $u$. |
|---|---|---|---|---|
| Rectangular | $\frac{b\,d^3}{12}$ | $\frac{R\,b\,d^2}{6}$ | $\frac{d}{2}$ | $\frac{1}{6}R\,(=S)$. |
| Square | $\frac{d^3}{12}$ | $\frac{R\,d^3}{6}$ | $\frac{d}{2}$ | S. |
| Circular | $\frac{\pi r^4}{4}$ | $\frac{R\,\pi\,r^3}{4}$ | $r$ | $\frac{3}{4}$ S. |
| Triangular | $\frac{b\,d^3}{36}$ | $\frac{R\,b\,d^2}{24}$ | $\frac{2d}{3}$ | $\frac{1}{2}$ S. |
| Hollow rectangular | $\frac{b\,d^3-b'd'^3}{12}$ | $R\,\frac{b\,d^3-b'd'^3}{6d}$ | $\frac{d}{2}$ | $1\frac{3}{4}$ S (wrought-iron box beam). |
| Hollow square | $\frac{d^4-d'^4}{12}$ | $R\,\frac{d^4-d'^4}{6d}$ | $\frac{d}{2}$ | $2\,S\,(1-2\,\frac{t}{d})$*. |
| Hollow cylindrical | $\frac{\pi(r^4-r'^4)}{4}$ | $R\,\frac{\pi(r^4-r'^4)}{4r}$ | $r$ | $\frac{3}{2}\,S\,(1-2\,\frac{t}{d})$.* |
| I cross-section | $\frac{b\,d^2-b'd'^3}{12}$ | $R\,\frac{b\,d^3-b'd'^3}{6d}$ | $\frac{d}{2}$ | 1.3 S† (wrought-iron rolled beams). |
| I cross-section | $\frac{a_1a_2d^2}{A}$ | ..... | ..... | 2 S (cast-iron beams). 1.5 S † (wrought-iron rolled beams). |

Table II.—*Maximum Moments of Stress, Breaking Loads, etc. of Beams loaded and supported in different manners.*

| How supported. | How loaded. | Max. moment of stress. | Breaking load. | Maximum deflection. | Transverse rigidity. |
|---|---|---|---|---|---|
| Fixed at one end, | Load at free end, | $Pl$ | $P'\left(=\frac{M}{l}\right)$ | $k=\frac{P\,l^3}{3EI}$ | $r\left(=\frac{1}{k}\right)$ |
| | Uniform load, | $\frac{1}{2}Pl$ | $2P'$ | $\frac{3}{8}k$ | $2\frac{2}{3}r$. |
| Supported at the ends, | At the middle, | $\frac{1}{4}Pl$ | $4P'$ | $\frac{1}{16}k$ | $16r$. |
| | Uniform, | $\frac{1}{8}Pl$ | $8P'$ | $\frac{5}{128}k$ | $25\frac{3}{5}r$. |
| Fixed at one end and supported at the other, | At the middle, | $\frac{3}{16}Pl$ | $5\frac{1}{3}P'$ | $\frac{7}{160.5}k$ | $23r$. |
| | Uniform, | $\frac{1}{8}Pl$ | $8P'$ | $\frac{4}{247}k$ | $61\frac{3}{4}r$. |
| Fixed at both ends, | At the middle, | $\frac{1}{8}Pl$ | $8P'$ | $\frac{1}{64}k$ | $64r$. |
| | Uniform, | $\frac{1}{12}Pl$ | $12P'$ | $\frac{1}{128}k$ | $128r$. |

* These are very nearly the theoretical coefficients of rupture when the thickness of the solid portion is small in comparison with the whole depth or breadth.

† These coefficients of rupture for wrought-iron rolled beams are for beams without bracing to prevent lateral flexure. They have been determined experimentally.

section, $a_1$ = area of upper flange, $a_2$ = area of lower flange, A = sum of areas of the two flanges, $d$ = distance between the centres of gravity of the two flanges, or, approximately, the whole depth. The expression for the moment of inertia of the I section is only approximate; and is obtained by neglecting the vertical rib, and assuming that the neutral axis passes through the centre of gravity of the two flanges. P = load applied, $l$ = length of beam, M = moment of resistance of cross-section, I = moment of inertia of cross-section, E = coefficient of elasticity of material. The values of E, I, and M may be obtained from Tables I. and III.

TABLE III.—*Moduli and Coefficients of Materials.*

| Name of material. | Tenacity per sq. in. in lbs., T. | Crushing load per sq. in. in lbs., C. | Modulus of rupture, R. | Coefficient of elasticity, E. |
|---|---|---|---|---|
| *Cast Iron.* | | | | |
| British, gray | 12,700 to 17,800 | 64,500 to 110,000 | 33,000 to 43,000 | 12,000,000 to 18,000,000 |
| " average, 15 spec | 14,750 | 93,670 | 36,500 | 15,000,000 |
| " good medium | 16,500 | 99,000 | 38,000 | 16,000,000 |
| " white, Devon, No. 3 | 22,000 | ..... | 43,500 | 22,474,000 |
| " Stirling's toughened | 26,000 | 125,000 | | |
| American, pig and ordinary cast | 13,000 to 20.000 | 100,000 | 40,000 | 16.000,000 |
| " cannon | 38,000 | | | |
| *Wrought Iron.* | | | | |
| British, rolled bars, mean of 188 | 57,560 | | | |
| " angle, mean of 72 | 54,730 | | | |
| " plate, mean of 167 | 50,740 | | | |
| " wire, 1st quality | 100,000 | | | |
| " 1-10 in. diam., medium | 81,000 | ..... | ..... | 25,000,000 |
| " rivet, average | 65,000 | | | |
| " ham'd bar, good med. | 56,000 | 42,000 | 51,500 | 25,000,000 |
| " chain cable | 38,000 | | | |
| Swedish, best rolled bar | 73,000 | ..... | ..... | 30,000,000 |
| American, hammered bar, av. | 54,700 | | | |
| " rolled bars and beams, super | 60,700 to 67,000 | 40,000 to 60,000 | ..... | 23,000,000 to 29,000,000 |
| " wire, 1-6 in. to 1-3 in. dia. Phillipsburg, Pa. | 74,000 to 89,000 | ..... | ..... | |
| " strongest | 100,000 | ..... | ..... | |
| " wire rope | 51,500 | ..... | ..... | |
| " plate, medium | 60,500 | ..... | ..... | |
| Phœnix columns (length = diameter), | ..... | 55,000 to 67,000 | | |
| *Steel.* | | | | |
| Eng., Russ., and Swedish cast steel, mean of 30 best spec. | 106,850 | 225,500 + | ..... | 31,000,000 |
| Krupp's, hardened in water | 122,000 | | | |
| " " in oil | 173,000 | | | |
| Bessemer, ham'd, Eng., med. | 103,000 | 225,500 + | ..... | 29,104,000 |
| " Swed., carbon, 0.01 | 105,000 to 173,000 | | | |
| " " carbon, 0.003. | 71,000 | ..... | ..... | |
| " Amer., ingots, best | 87,000 | ..... | ..... | |
| " " rolled and ham'd | 125,000 | ..... | ..... | |
| " " tempered | 142,000 to 214,000 | 186,000 to 338,000 | ..... | 30,000,000 to 33,000,000 |
| " Swedish, rolled, best | 141,000 | ..... | ..... | |
| Uchatius, rolled, best | 145,000 | ..... | ..... | |
| Plates, English and Scotch | 68,000 to 112,000 | ..... | ..... | |
| " Swedish | 64,000 to 109,000 | ..... | ..... | |
| " American, Pittsburg | 94,000 | ..... | ..... | |
| Chrome steel | 180,000 | 195,000 + | ..... | |
| *Other Metals.* | | | | |
| Copper, cast, English | 19,000 | 117,000 | | |
| " Lake Superior | 24,200 | | | |
| " wrought, English | 33,800 | 103,000 | | |
| " sheet, " | 30,000 | | | |
| " wire | 60,000 | ..... | ..... | 17,000,000 |
| Brass, fine yellow, cast | 18,000 | 51,000 | ..... | 9,000,000 |
| " wire | 91,300 | ..... | ..... | 14,000,000 |
| Gun-metal, bronze, English | 36,400 | ..... | ..... | 9,900,000 |
| " " American | 30,000 to 52,000 | | | |
| Lead, cast | 1,800 | 480 | | |
| " sheet | 3,300 | ..... | ..... | 720,000 |
| Tin, cast | 4,700 | 970 | ..... | 4,600,000 |
| Zinc, rolled | 15,000 | ..... | ..... | 14,000,000 |
| Speculum metal | 7,000 | | | |
| Silver, standard | 41,000 | | | |
| *Stone.* | | | | |
| Granite, English | ..... | 6,300 to 13,400 | | |
| " American | ..... | 7,700 to 22,200 | | |
| " " Quincy | ..... | 15,000 to 18,000 | | |
| Sandstone, English | 450 to 1,000 | 3,000 to 11,000 | | |
| " " medium | ..... | 5,000 | | |
| " American | ..... | 4,000 to 17,000 | | |
| " " brown | ..... | 5,000 to 10,000 | | |
| Marble, English | 550 to 700 | 5,000 to 9,000 | | |
| " White Italian, veined | ..... | 9,700 | 1,060 | 25,000,000 |
| " American | ..... | 7,600 to 20,000 | | |
| Limestone, English | ..... | 4,000 to 18,000 | | |
| " American | ..... | 7,600 to 25,000 | ..... | 25,000,000 |
| Basalt | ..... | 8,300 to 17,200 | | |
| Oolite, Portland stone | ..... | 4,150 | | |
| Slate, Welsh | ..... | 11,500 | ..... | 16,000,000 |
| Brick | ..... | 600 to 3,000 | | |
| " fire, Stourbridge | ..... | 1,700 | | |
| Brick masonry, common | ..... | 400 to 1,000 | | |
| Cement, Portland, artificial | 440 | 6,000 (in 9 months) | | |
| " " natural | 640 to 710 | | | |
| Artificial cement and sand (1 to 1) | 265 (in 9 months) | 4,560 (in 9 months) | | |
| Mortar, ordinary | 30 | 120 to 240 | | |
| Concrete (lime 1, gravel 3) | ..... | 620 | | |
| Glass, thin plates | 5,000 | | | |
| " rods | 2,500 | 30,000 | ..... | 8,000,000 |

| Name of material. | Tenacity per sq. in. in lbs., T. | Crushing load per sq. in. in lbs., C. | Modulus of rupture, R. | Coefficient of elasticity, E. |
|---|---|---|---|---|
| *Timber.* | | | | |
| Ash, foreign | 17,000 | 9,400 | 12,200 | 1,645,000 |
| Beech, " | 11,500 | 9,400 | 9,300 | 1,350,000 |
| Birch, " | 15.000 | 6,400 | 11,570 | 1,645,000 |
| Box, " | 20,000 | 10,300 | | |
| Elm, " | 13,000 | 10,300 | 6,500 | 1,000,000 |
| Oak, " | 11,000 | 10,000 | 8,500 | 1,700,000 |
| Locust, " | 20,000 | ..... | 11,500 | 1,940,000 |
| Spruce, " | 10,000 | 6,800 | | |
| Chestnut, " | 13,000 | | | |
| Pine, pitch, " | 7,650 | 6,800 | ..... | 1,225,000 |
| " red, " | ..... | 5,370 to 6,200 | 8,000 | 1,840,000 |
| Walnut, " | 8,100 | 6,100 to 7,200 | | |
| Mahogany, Spanish | 14,000 | 8,200 | ..... | 1,255,000 |
| Ash, American | 8,500 | | | |
| Beech, " | 9,500 | | | |
| Birch, black, " | 7,000 | | | |
| Elm, Canada, " | 13,000 | | | |
| Hickory, " | 11,000 | | | |
| Oak, white, " | 10,000 | | | |
| Pine, red, " | 5,400 | | | |
| " white, " | 3,600 | ..... | ..... | 1,000,000 |

NOTE.—The coefficients and moduli for timber are those of highly-seasoned timber. The tenacities of different specimens of iron and steel are per square inch of original area of cross-section of material. The results of recent experiments by C. B. Richards, M. E., indicate that the long wrought-iron tie-bars and suspension-bars in ordinary use, when made of the best iron, cannot be relied on as having a greater tensile strength than 50,000 pounds per square inch. Careful experiments have shown that a Phœnix column 18⅝ feet long, 8 inches in diameter, and ⅜ inch in thickness of metal, will bear 33,000 pounds per square inch of solid transverse section. The values of R given in the table are obtained by means of the moment of resistance of rectangular sections, $\frac{R\,b\,d^2}{6}$, but it is certain that the actual strain on the outer fibre at the moment of rupture is often materially different from the value of R thus found. This fact, however, occasions no error in the calculations with the formulæ and coefficients as indicated on page 564.

TABLE IV.—*Additional Coefficients and Moduli.*

| Material. | Weight of cubic foot in lbs. | Coefficient S, in Table I. | Modulus of resilience. | Ultimate resilience. |
|---|---|---|---|---|
| Cast iron, bars | 444 | 6,000 | 21.4 | 25 |
| Wrought iron, medium | 480 | 8,600 | 165.5 | 15,000 |
| " " 1st quality | 486 | 10,000 | ..... | 20,000 |
| Steel | 487 | 30,000 | 372 | 10,000 |
| Steel rails | 488 | ..... | ..... | 30,000 |
| Copper, cast | 540 | ..... | ..... | 200 |
| " forged | 552 | ..... | ..... | 40,000 |
| Brass, cast | 525 | ..... | ..... | 6,000 |
| Bronze | ..... | ..... | ..... | 6,000 |
| Granite, American | 168 | | | |
| Limestone, " | 165 | | | |
| Sandstone, " | 138 | | | |
| Slate, Welsh | ..... | 1,960 | | |
| Ash, American | 38.1 | 1,550 | | |
| Beech, " | 48.5 | 1,720 | | |
| Black birch, " | 42.5 | 1,850 | | |
| Hickory, " | 54.3 | 1,700 | | |
| White oak, " | 40.2 | 1,700 | | |
| White pine, " | 27.0 | 1,230 | | |
| Red pine, " | 36.0 | 1,530 | | |
| Yellow pine, " | 31.7 | 1,200 | | |
| Canada elm, " | 43.7 | 1,870 | | |

W. A. NORTON.

**Strepsip'tera** [Gr. στρέψις, "twisting," and πτερόν, "wing"], a group of insects of disputed rank. By the older English entomologists, as well as by some recent authors (*e. g.* Gerstäcker), they were ranked as a peculiar order, but by many recent entomologists, and especially the American ones (*e. g.* Leconte, Packard), they are very decidedly claimed to constitute a simple family of the order Coleoptera and group Heteromera. On the one hand, it is asserted that the forms in question have really no characters exclusively common with the Coleoptera; on the other, it is claimed that "the characters common to a strepsipteron and various Coleoptera are these: (1) Hyperametamorphosis of the larva (Meloidæ); (2) parasitism (*Rhipidius*); retention of the pupa within the skin of the larva (Lampyridæ, tribe Lycini, genus *Calopteron*); (4) unfitness of anterior wings for flight (a character also found in Orthoptera and Hemiptera, which, however, have no metamorphosis); (5) large development of metathoracic segment." (Leconte in *Proc. Acad. Nat. Sci. Phila.*, 1864, p. 50.) In the males the metathorax is excessively large, and its dorsal sutures all distinct; the wings are very large, fan-shaped, and folding like a fan, but with a slight twist (whence the name of the group); the mesothorax is short, and with a pair of slender, coriaceous, club-shaped appendages, whose inner margins are membranous, representing the elytra of typical beetles; the prothorax is very short; the head large, transverse, and peduncated at the sides, wherein are situated the eyes, which are convex and coarsely granulated; the mouth-parts are atrophied, except

the mandibles and one pair of palpi; the antennæ are frontal; the abdomen is small; the legs short, having tarsi without claws, and joints each with a membranous lobe beneath. The females are sac-like. The species are remarkable not only for their peculiar characters, but for their parasitism. They belong to two genera—*Stylops* and *Xenos*—and constitute the family Stylopidæ. (For illustration of *Stylops Dalii*, see ENTOMOLOGY.) All known are parasites of bees and wasps, and are found between the joints of the abdomen of those insects. The animals thus infested are said to be "stylopized." The females are viviparous. THEODORE GILL.

**Strick'land** (AGNES), b. at Reydon Hall, Suffolk, July 19, 1796; with her four sisters was carefully educated under the care of her father, and commenced her career of authorship at an early age, in most of her works being assisted by one or the other of her sisters. Her first work, in conjunction with her sister Susannah, was a volume of *Patriotic Songs*, which was followed by *Worcester Field*, an historical poem (1812), after which she appears to have published nothing for more than twenty years, her next work, also a poem, being *Demetrius, a Tale of Modern Greece* (1833), followed by *The Pilgrims of Walsingham*, an historical romance (1835), and at intervals by many other volumes of biography, poetry, and fiction, among which are—*Queen Victoria, from her Birth to her Bridal* (1840), *Alda, the British Captive* (1841), *The Rival Crusoes* (1845), *Historic Scenes and Poetic Fancies* (1850), *Lives of the Bachelor Kings of England* (1861), *How will it End?* a novel (1865), *Lives of the Seven Bishops* (1866), and *Lives of the Tudor Princesses* (1868). Her most important works, both prepared in conjunction with her sister Elizabeth, whose name, at her own desire, did not appear as author, are—*Lives of the Queens of England* (12 vols., 1840–49) and *Lives of the Queens of Scotland* (8 vols., 1850–59)—works based wholly upon original documents. She also put forth a collection of the *Letters of Mary Queen of Scots*, with an historical introduction and notes (1842–43; new ed., with considerable additions, 5 vols., 1864). In 1871 she received a pension of £100 in consideration of her long and valuable literary services. D. in London July 13, 1874.—Her sisters, SUSANNAH (Mrs. Moodie) and CATHARINE (Mrs. Traill), resided for a time in Canada, and published works illustrative of life in the Dominion.

**Strickland** (HUGH EDWIN), b. at Righton, Yorkshire, Mar. 2, 1811; was a private pupil of Dr. Arnold at Laleham, and graduated in 1832 at Oriel College, Oxford, where, and subsequently while residing with his father at Tewkesbury, he devoted himself especially to geology and ornithology; in 1835 made a tour in Asia Minor, and published in the *Transactions* of the Geological Society papers on the *Geology of the Thracian Bosphorus*, the *Geology of the Neighborhood of Smyrna*, the *Geology of the Island of Zante*, on *Currents of Sea-water running into the Land in Cephalonia*, and a *General Sketch of the Western Part of Asia Minor*. In 1850 he succeeded his former preceptor, Dr. Buckland, as reader in geology in the University of Oxford. He was one of the earliest members of the Geological Society, and one of the founders of the Ray Society, which he induced to undertake the publication of Agassiz's *Bibliographia Zoologiæ et Geologiæ*, which he undertook to edit from the MSS. of Agassiz, making considerable additions of his own. He had completed and published (in 1848) three vols. of this, and a fourth, edited by Sir William Jardine, was issued in 1854, after his death. He assisted Sir Roderick I. Murchison in the preparation of his *Silurian System* and other works, and contributed 86 papers to scientific periodicals. He published separately *The Dodo and its Kindred* (1848), and after his death was published his *Ornithological Synonymes*, edited by his widow and Sir William Jardine. D. Sept. 14, 1853, being killed by being run over by a railway train while making examinations of a deep cutting near Clarborough Tunnel, on the Great Northern R. R. A *Memoir of H. E. Strickland, with his Scientific Writings*, edited by Sir William Jardine, appeared in 1858.

**Strickland** (WILLIAM), b. in Philadelphia in 1787; studied architecture; planned the Chestnut Street Theatre, and was for many years employed upon the U. S. Bank, the Merchants' Exchange, the U. S. Mint, the U. S. Naval Asylum, and other public buildings in Philadelphia. In 1825 he went to Europe to study the railway systems of England, and upon his return superintended the construction of the railway between Newcastle and Frenchtown, Md. He designed the State capitol at Nashville, Tenn., which was commenced in 1845, but not completed until 1857, after his death. D. at Nashville Apr. 7, 1854.

**Strickland** (WILLIAM PETER), D. D., b. in Pittsburg, Pa., Aug. 17, 1809; graduated at the Ohio University; entered the Methodist ministry in 1832; was for several years stationed in Cincinnati, and subsequently became agent for the American Bible Society, and in 1856 removed to New York, where he engaged in literary work, mostly for the Methodist Book Concern; in 1862 was chaplain of a New York regiment stationed at Port Royal, S. C., and in 1866 became pastor of a Presbyterian church at Bridgehampton, L. I. He has published *History of the American Bible Society* (1849; new ed., continued to 1856), *History of Methodist Missions* (1850), *Genius and Mission of Methodism* (1851), *Christianity Demonstrated* (1852), *Memoir of Rev. James B. Finley* (1853), *Manual of Biblical Literature* (1853), *The Light of the Temple* (1854), *The Astrologer of Chaldea* (1856), *Pioneers of the West* (1856), *Life of the Rev. Francis Asbury* (1858), *Life of Jacob Gruber* (1859), *Old Mackinaw* (1860); and edited the *Autobiography of Rev. Peter Cartwright* (1856).

**Strickland's,** tp., Sandford co., Ala. P. 658.

**Stric'ture** [Lat. *strictura;* Gr. στέγνωσις], a constriction or compression of the tubiform organs of the body, as the œsophagus, the larynx, the windpipe, the intestines, the anus, the urethra, the lachrymal ducts, and others. Strictures are produced either by new formations on the inside of the tubes, or by pathological changes in the walls and coatings of the same (cicatrization), or by the pressure of new formations or of atrophies outside. Examples of the first class are croup and diphtheria, which by deposition of fibrinous masses on the interior of the larynx and the windpipe narrow in these organs sometimes to suffocation. A stricture of the third class is frequently produced in the œsophagus by a neighboring cancer, which may compress it to impermeability. The most frequent strictures are those of the urethra; they are generally produced by pathological changes in the coatings of the organ. Injuries of the perinæum and the penis, with or without rupture of the urethra, may originate them, but their most general cause is inflammation of the mucous lining of the urethra, gonorrhœa. Inflammation, if it spreads a little beyond the mucous lining, gives rise to new formation of connective tissue, which either directly compresses the urethra, forming a callous ring around it, or contracts it by atrophic cicatrization around the tube. The immediate consequences of urethral stricture are symptoms of impediment to free micturition. The urethra behind the stricture is dilated by the pressure of the accumulated urine. The bladder is not thoroughly emptied, and undergoes inflammatory irritation by chemical decomposition of its contents. The urine becomes alkaline, with a putrid and pungent smell of ammonia. The desire to urinate is very great, and never ceases. In more advanced stages the urine sometimes breaks through the wall of the urethra behind the stricture, and either makes a fistula by breaking also through the skin, or infiltrates the surrounding tissue, and so causes uræmia, and often death. In other cases, inflammation of the bladder extends to the kidneys, and there produces pyelitis and inflammation of the kidney proper. Strictures sometimes close up the urethra entirely, or become so narrow that the urine can only be passed out in single drops by the strongest and most painful efforts. Speedy relief by operation is necessary in such cases to save the life of the patient. The treatment of stricture consists either in gradual dilatation or in external or internal urethrotomy. Gradual dilatation is effected by inserting bougies, or catheters, or sounds of increasing sizes. Every day or less frequently a larger instrument is passed through the stricture to the bladder, until the normal size of the urethra is attained. After this, the last bougie is used occasionally for some time to prevent a relapse. The majority of the authorities now consider gradual dilatation the best, surest, and safest treatment of stricture. In cases where no instrument can be passed through the stricture, or where for other reasons dilatation cannot be resorted to, external urethrotomy is indicated. The operation is performed by cutting into the urethra from the perinæum, thereby opening the stricture lengthwise. It is kept open by regular cathetrization, so that the healing wound leaves a canal of normal size. Internal urethrotomy is only applicable in cases where a sound can still be passed through the narrowed passage large enough to guide a small knife, which cuts and opens the stricture from inside. Another method sometimes resorted to is the rupture of the stricture by forcing through it a large, conically-shaped steel sound (forcible dilatation). F. ZINSSER.

**Strie'gau,** town of Prussia, province of Silesia, on the Striegau Water, manufactures leather, cloth, linens, and tiles. P. 8561.

**Stri'gel** (VICTORIN), b. at Kaufbeuren, Bavaria, Dec. 26, 1514; studied theology at Wittenberg under Melanchthon, and was appointed professor at the University of Jena in 1548. Entertaining synergistical views of regeneration, he came in conflict with Flacius, at whose instiga-

tion he was for some time kept in prison. Not satisfying his adversaries fully by his retractions, he removed in 1562 to Leipsic, and in 1567, as professor of ethics, to Heidelberg, where he d. June 26, 1569.

**Strig'idæ** [from *Strix*, the ancient Latin name of the owl, one of the genera], a family of birds embracing the owls. These are all easily recognizable by their peculiar physiognomy. In form generally they agree with the related types of birds (Falconidæ, etc.), but the skull is broad and foreshortened; the eyes directed forward, and each surrounded more or less by radiating feathers (together forming a broad heart-shaped or facial disk or area in front), and the plumage is very lax and soft, and the feathers destitute of an after-shaft; the bill is compressed, short, with the culmen much decurved and the tip hooked; the nostrils basal, and separated by a bony partition; the wings usually short and rounded; tarsi generally short, sometimes rather elongated, extremely flattened, and with strong lateral ridges, usually densely covered with feathers, as are also frequently the toes; toes four, the outer reversible, the posterior well developed and on a level with the others; claws long, decurved, and very acute. The skull is characteristic, according to Huxley, in that the bones enclosing the cerebral cavity have a spongy diploë, and the maxillo-palatines are tumid and spongy, and separated by an interval which may be wide throughout or reduced to a cleft below; the lachrymal is also spongy, and remains for a long time distinct; basipterygoid processes are always developed; "the proximal ends of the clavicles are comparatively little expanded or recurved, and become very slender toward their symphysis; the clavicular process of the coracoid fits into an excavation in the outer surface of the clavicle; the scapular process of the coracoid is prolonged forward to meet the clavicle; the lower larynx possesses one pair of intrinsic muscles." (Huxley, *Proc. Zool. Soc. London*, 1867, p. 463.) Such are the characters common, so far as known, to all the species. The type is manifested, however, under two very decided modifications, which have been deemed by a late writer (R. B. Sharpe) to be of family value, and which are at least of sub-family value. In the Striginæ (Strigidæ proper of Sharpe) the sternum has its hinder margin entire, with an emargination, however, but no distinct cleft, and the furcula is joined to the sternum at its keel; the inner toe is about as long as the middle, and the claw of the latter is serrated. In the Buboninæ (Bubonidæ of Sharpe) the sternum has its hinder margin indented by two or more distinct fissures or clefts, and the furcula is entirely free from it; the inner toe is always shorter than the middle, and the claw of the middle one is never serrated. The Striginæ are represented by only two genera (*Strix* and *Phodilus*) and six species; the Buboninæ are numerous in genera and species, Sharpe recognizing 17 of the former and about 184 of the latter. These are furthermore combinable into two great groups: one sub-family (Buboninæ of Sharpe) has the ear-conch not larger than the eye, without an operculum, and the facial disk unequal, the portion below the eye being always much greater than that above it; the other (sub-family Syrniinæ of Sharpe) has the ear-conch much larger than the eye, with a very large operculum shutting in the ear, and the facial disk is always distinct, and extends as far above as below the eye. The family is cosmopolitan, and is more or less well represented by species in every quarter of the globe. They mostly procure their food during the night, and their eyes are well adapted for nocturnal vision, as is their plumage for carrying them noiselessly after their quarry. Some species are, however, strictly diurnal. They feed chiefly upon small quadrupeds (*e. g.* mice) and birds, as well as reptiles. Eleven generic types are represented in the U. S.—viz. of the Striginæ, *Strix;* of the Buboninæ, *Bubo*, *Nyctea*, *Scops*, *Surnia*, *Speotyto*, *Glaucidium*, and *Micrathene* of the group Bubones, and *Asio* or *Otus* and *Syrnium* of the group Syrnii. The latest authority on the family is R. B. Sharpe (*Catalogue of the Striges, or Nocturnal Birds of Prey, in the Collection of the British Museum*, London, 1875, 8vo). (See further Owl.)

Theodore Gill.

**Strikes** [Ang.-Sax. *strîcan*]. The word *strike*, as denoting the refusal of a number of workmen in combination to work on the terms offered by employers, is not in Dr. Johnson's *Dictionary*, nor does it occur in Adam Smith's *Wealth of Nations*, and in the present century English political economists found themselves in the presence of a perplexing phenomenon. Not that strikes took place then for the first time in the history of England; they were known on a tremendous scale five centuries earlier, after the great plague of 1349. The crops then rotted on the ground for lack of reapers; whole flocks and herds perished for want of caretakers; houses were left unfinished by the builders, even the workmen employed at the king's palace deserted their business; and unless for wages which were considered "outrageous" labor was not to be had in country or town. These strikes in the fourteenth century were encountered with measures which illustrate the fundamental difference between mediæval and modern political economy. A "statute of labor" was passed ordaining that every man and woman, free or bond, within the age of threescore years, and not having landed property or other means of livelihood, should work for any employer requiring their labor at the old rate of wages. This statute was followed by a series of enactments, royal mandates, and municipal regulations rigorously suppressing combinations of workmen, and inflicting fines, imprisonment, and the punishment of the stocks on all artificers, laborers, and servants refusing to serve for the ancient wages, or even leaving the hundred or town wherein they had hitherto dwelt.

In our own age a succession of strikes in England has been encountered with a law widely differing in character from Edward III.'s famous "statute of labor." The law enunciated in the nineteenth century was simply an alleged law of political economy, which was supposed to fix the price of labor beyond the control of either laborers or employers. In place of new restraints on the movements and combination of workmen, old restrictions have been repealed, trades-unions have been legalized, and the classes most opposed to strikes have contented themselves with denouncing them as at once mischievous and ineffectual. On the last point the actual results have been conflicting. Many strikes have been successful in raising wages or reducing the hours of work, but, on the other hand, many have failed; in not a few cases it has been demonstrated that the state of trade, prices, and profits left no margin for compliance with the demands of the workmen, and in some it is certain that employers were positive gainers by the suspension of business. These conflicting facts, and the public attention which strikes have engaged, have led to a whole literature on the subject, but the matter of it may be stated in a very few words.

It is urged against strikes that profits in a particular business cannot continue above the average rate, and consequently if the state of trade admits of a rise of wages or other advantages to the workmen, they will come spontaneously from the competition of capitalists; while if they are brought about by a strike, the value of the labor unemployed while it lasts is lost both to the workmen and to the public. Capital, too, is wasted, and the accumulation discouraged, to the detriment of labor. In several cases strikes have contributed to cause the transference of a branch of manufacture to another locality, for trade moves along the lines of least resistance, and its course is easily altered. The emigration of capital from England to the New World proves that profits are already at a minimum in the former, and can bear no further reduction. The ignorance of the real conditions of trade, it is added, which is at the bottom of strikes, has repeatedly been proved by the fact that at the time of their occurrence it was actually an advantage to the capitalists to close their works. Sad evidence, too, is forthcoming in abundance of the misery which strikes have occasioned to working people, and the load of debt and loss of comfort and respectability under which they have had to recommence life, as it were, without furniture and other household articles which it had taken years to accumulate, and which disappeared in a few weeks. On the other hand, it is contended that the equality of profits is a theoretical fiction; that the profits of employers in particular trades are often enormous, and huge fortunes are amassed in a few years; and even if the ultimate notoriety of this fact should at length attract additional capital and competition, the public may then derive some benefit through a fall in prices, but the workmen may obtain none. The occasional failure of strikes, moreover, is no proof of their impolicy; even unsuccessful strikes may act on the minds of employers so as to secure a rise or prevent a fall of wages on a future occasion; and to produce this effect they must actually take place from time to time, whether successful or otherwise. As for the temporary suffering they cause to the workmen, present sacrifices for future gain are in accordance with one of the fundamental principles of the political economy to which employers are so fond of appealing; but, in fact, a multitude of strikes have been crowned with immediate success, and have compelled employers to concede terms which at first they peremptorily refused. As for the emigration of capital from countries like England, it no more proves that profits are at a minimum there than new branches of manufacture and trade, new railways and steamships, new speculations, prove that all earlier investments of capital have become unprofitable; it only proves that the sources of profit have become more numerous. Indeed, Mr. Cairnes, the English economist, who has laid principal stress on

this argument, has admitted that the majority of recent strikes in his own country have been successful. He argues, indeed, that the explanation of their success is to be found in an exceptionably prosperous state of trade, which would before long have attracted additional capital and demand for labor; but the obvious reply is that in the mean time the workmen would have gained nothing but for the strikes, and the ultimate gain, if any, without them might accrue to consumers in a reduction of prices. Mr. Cairnes's argument, moreover, virtually involves the position that profits in the U. S., and other new countries to which British capital is constantly flowing, are high enough to bear a reduction by means of higher wages, even if such a reduction were a necessary consequence; which is far from being the case, since increased efficiency of both capital and labor may follow.

The conclusion to which these arguments on both sides, and a careful consideration of the actual history of strikes, really lead, is, that no universal or unconditional proposition can be laid down with respect to their justice or policy. Some writers have been led by observation of their results to infer that strikes for a rise of wages usually succeed, but strikes to prevent a fall usually fail. The principle underlying this inference is that strikes for higher wages have usually taken place in a time of prosperous trade, when profits were high enough to bear a reduction; whereas employers have seldom if ever attempted to lower wages unless in a time of depression. This empirical generalization, however, affords no foundation for any positive rule for future guidance. The proposition which may with best reason be affirmed is, that the chief benefit to the working classes from past strikes is that they have contributed to bring about measures which, besides other beneficial results, tend to prevent their occurrence in future. Co-operation, industrial partnership of capitalists and workmen in various forms, boards of conciliation and arbitration, wiser rules and policy on the part of trades-unions, all owe something to the lessons learned from strikes. No panacea is likely to be discovered in our age which will put an end altogether to disputes between labor and capital, but something has already been done to render their relations more harmonious in many trades. The subject involves various questions treated of under LABOR, TRADES-UNIONS, and WAGES. T. E. CLIFFE LESLIE.

**String'field** (THOMAS), b. in Kentucky in 1796; served under Gen. Jackson in the war of 1812, and was wounded in the forehead by an Indian; in 1816 joined the Tennessee conference of the Methodist Episcopal Church, and in that and in the Holston conference he signalized himself as an able polemic. He edited the *South-western Christian Advocate* for five years. D. in Tennessee June 12, 1858.
T. O. SUMMERS.

**String'ham** (SILAS H.), U. S. N., b. Nov. 7, 1797, in New York; entered the navy as midshipman June 19, 1810; became lieutenant in 1814, commander in 1831, captain in 1841; retired in 1861, and appointed rear-admiral on the retired list in 1862; commandant of the Charlestown navy-yard 1864–66, and port-admiral of New York in 1867. D. Feb. 7, 1876. Served in the last war with Great Britain, in the Algerine war, and in the war with Mexico, and commanded the squadron during the civil war which reduced Forts Hatteras and Clark, and enabled our vessels to get possession of the sounds of North Carolina.
FOXHALL A. PARKER.

**String'town,** p.-v., Salt Creek tp., Pickaway co., O. P. 71.

**Stris'ores,** the name applied to a group of birds by some modern systematists, and to which diverse limits have been assigned. They are defined in Baird's *Birds of North America* (1860) as forms with "toes either three anterior and one behind (or lateral), or four anterior; the hinder one is, however, usually versatile, or capable of direction more or less laterally forward; tail-feathers never more than ten; primaries always ten, the first long;" the larynx is destitute of complex vocal muscles, and the species not gifted with the power of true continuous song, but simply capable of emitting unmusical notes or a stridulous noise (whence the name). By some authors the group has been regarded as a peculiar order, and by some as a sub-order of Insessores or Passeres. The chief and generally-accepted members are the Trochilidæ, Cypselidæ, and Caprimulgidæ. Burmeister further includes the Halcyonidæ and Prionitidæ (referred to the Clamatores by others), and Cabanis the Opisthocomidæ and Musophagidæ. The first three are nearly allied, and form a natural group variously named Macrochires, Cypselomorphæ, Cypseli, etc. The others are, however, very unlike, and have affinities with several other groups. The combination of Strisores as a whole is therefore now generally rejected.
THEODORE GILL.

**Stromate'idæ** [from *Stromateus*—Gr. στρωματεύς, "parti-colored fish"—a generic name], a family of fishes of the order Teleocephali, sub-order Acanthopteri, distinguished by the armature of the œsophagus. The body is compressed and more or less ovate; the scales cycloid, and very small and imbedded; the lateral line simple and continuous; the head ends in a blunt snout; the opercula are unarmed; mouth small, but with a lateral cleft; upper jaw not protractile; teeth minute and conic on the jaws, but none on the palate; branchial apertures confluent below; branchiostegal rays in five to seven pairs; dorsal fin elongated, with a few partially free or enveloped spines in front, and numerous branched rays; anal fin also elongated, and with a few free or enveloped spines and many rays; caudal free and emarginated; pectorals well developed, and with branched rays; ventrals sometimes perfect (*i. e.* with a spine and five rays), but generally more or less reduced and atrophied; the œsophagus is well armed with masses of teeth; the stomach is cæcal, and pyloric appendages are developed in large or moderate number; the air-bladder is small or absent; the vertebræ are in moderate number, but generally at least in excess of the typical series (*e. g.* 15 + 21 and 11 + 14). The forms embraced in this family were formerly referred to the Scombridæ, from which they are now known to differ very much. The species are not numerous, but representatives are quite diffused in the various seas. About fifteen species are known, of which three inhabit the eastern American waters (*Peprilus Gardenii*, *Poronotus triacanthus*, and *Palinurichthys perciformis*), and one the California waters. The species are of little or no economical importance. THEODORE GILL.

**Stromb'idæ** [from *Strombus*—Gr. στρόμβος, a "top"—one of the generic names], a family of gasteropod mollusks



The Stromb.

of the order Pectinibranchiata and sub-order Tænioglossa, containing the giant fountain-shell, so commonly used about gardens and houses, and kindred forms. The animal is entirely retractile within its shell; its mantle is but moderately developed, and not reflectible over the shell; the siphon is well defined, and more or less elongate; the gills are comb-like, and on the left side of the mantle; the head is produced into an elongated muzzle; the eyes are highly organized, and at the ends of long cylindrical pedicels; the tentacles are slender, and arise from the ocular pedicels; the teeth of the lingual ribbon are in seven longitudinal rows, the middle broad and multidentate, the inner lateral rhomboid and denticulated, the two outer lateral of each side claw-like, and denticulated on their outer edges; the foot is compressed and narrow, rather dilated in front, tapering backward; the operculum is claw-shaped, and serrated on the outer edge. The shells vary considerably in superficial character, but all have a more or less conic spire, and in most the outer lip is expanded and deeply notched anteriorly. Species are generally diffused in all tropical seas, and between 70 and 80 are now known. They are divisible among two sub-families—viz. (1) Strombinæ, including the genera *Strombus*, *Pteroceras*, *Harpago*, *Rostellaria*, and related genera; and (2) Seraphyinæ, embracing only *Seraphs* and allied fossil types. They are distinguished by the peculiar form of the foot, which is fitted for leaping rather than the crawling progression common to most gasteropods, and by the pedicels bearing the eyes and tentacles. They are quite active, but are reputed to be chiefly

carrion-feeders. Species are often employed as ornaments in parlors and about houses, and especially is this the case with the *Strombus gigas*, often known as the fountain-shell. This is the largest of the family, and sometimes weighs as much as four or five pounds. It is not only used in the manner indicated, but is employed for the manufacture of cameos and for porcelain-works in large numbers.

THEODORE GILL.

**Strom'boli,** one of the Lipari Islands, in the Mediterranean, off the N. coast of Sicily, is 12 miles in circuit and has 1452 inhabitants. It is wholly of volcanic formation, and has a still constantly active volcano 3100 feet high. Cotton, wine, and fruit of superior quality are produced, and sulphur and pumice-stone are largely exported. On the E. side lies a small town of the same name.

**Stronach,** p.-v. and tp., Manistee co., Mich. P. 281.

**Strong,** p.-v. and tp., Franklin co., Me. P. 634.

**Strong** (CALEB), b. at Northampton, Mass., Jan. 9, 1745; graduated at Harvard College 1764; studied law, and commenced practice in 1772; took an active part in the cause of liberty; in 1775 was one of the committee of safety, in 1776–80 member of the legislature; in 1787 aided in the formation of the Constitution of the U. S.; in 1789–97 was a Senator in Congress, and governor of Massachusetts in 1800–07 and in 1812–16. D. at Northampton Nov. 7, 1819.

**Strong** (GEORGE C.), b. at Stockbridge, Vt., in 1833; graduated at the U. S. Military Academy in July, 1857, when appointed brevet second lieutenant in the ordnance corps of the army, second lieutenant 1859, first lieutenant 1861, captain 1863. In the early days of the civil war he commanded, temporarily, at the Watervliet arsenal, West Troy, but seeking active service, was on the staff of Gen. McDowell as ordnance officer at the first battle of Bull Run, and subsequently on similar duty with Gen. McClellan until Sept., 1861, when transferred to the staff of Gen. Butler, and in October appointed assistant adjutant-general of volunteers, with rank of major. He at once entered upon the organization of the New Orleans expedition, which he accompanied, and in Apr., 1862, commanded the successful expedition from Ship Island to Biloxi, Miss. Among the first to enter New Orleans, he shortly after became Gen. Butler's chief of staff, but sickness soon compelled him to return North. Resuming his duties in September, in that month he led the successful expedition to Pontchatoula, resulting in the destruction of a large amount of property and the breaking up of Jeff Thompson's head-quarters. In Nov., 1862, he was appointed a brigadier-general of volunteers, and in June, 1863, assigned to command of the brigade which, in the operations about Charleston, effected the landing on Morris Island, July 10, 1863, Gen. Strong leading the successful assaulting column, as also the ineffectual assault on Fort Wagner the following morning. Again, a week later (July 18), his brigade led the second assault on that work, at the head of which Strong fell mortally wounded, after having gained the parapet of the fort. D. in New York City July 30, 1863.

**Strong** (GEORGE TEMPLETON), b. in New York in 1820; graduated at Columbia College; studied law, and became prominent as a real-estate lawyer. He was a man of high general culture; contributed essays of much merit to leading periodicals; was a trustee of Columbia College, and one of the founders of its School of Mines; was also president of the Philharmonic Society and of the Church Music Association; two years before his death was chosen controller of Trinity church, New York, of which he had been a vestryman for many years. During the civil war he was treasurer of the U. S. Sanitary Commission. D. in New York July 22, 1875.

**Strong** (JAMES), S. T. D., b. in New York Aug. 14, 1822; graduated at Wesleyan University in 1844; taught in Troy Conference Academy, Poultney, Vt., 1844–46; in 1847 removed to Flushing, L. I., where he became a prominent citizen; projected and built the Flushing R. R., of which he was president; superintended various local improvements, and gave private lessons in Greek and Hebrew. In 1856, although not a clergyman, he received the degree of doctor of sacred theology from Wesleyan University; in 1858–61 was professor of biblical literature and acting president of Troy University, and in 1868 became professor of exegetical theology in Drew Theological Seminary at Madison, N. J. He is a member of the Anglo-American commission for the revision of the English version of the Bible. In 1873 was chosen chairman of the archæological council of the Oriental Topographical Society, and in 1874 made an extended tour in the East; contributed to religious journals; prepared for Lange's Commentary the English translation of the part on the book of Daniel, and published *Harmony and Exposition of the Gospels*, in English (1852), *Harmony of the Gospels*, in Greek (1854), and brief manuals of the Gospels and of Greek and Hebrew grammar. About 1853 he projected, in association with Rev. John McClintock, D. D., a *Cyclopædia of Biblical, Theological, and Ecclesiastical Literature*, upon a scale hitherto unattempted in any language, his associate taking charge of the departments of theological and ecclesiastical literature, and Dr. Strong of that of biblical literature, including not only the books of Scripture, but sacred geography, antiquities, and natural history, he himself writing nearly all the important articles in his department. The first volume appeared in 1867, the sixth in 1876, and three or four more will be required to complete the work. Dr. McClintock died in 1870, since which time Dr. Strong has assumed the general supervision of the entire work.

**Strong** (JAMES H.), U. S. N., b. Apr. 26, 1814, in Canandaigua, N. Y.; became a lieutenant in 1841, commander in 1861, captain in 1865, commodore in 1870, rear-admiral in 1873. Served on the W. coast of Mexico during our war with that country, and commanded the Monongahela in the battle of Mobile Bay. Commended for gallantry.

FOXHALL A. PARKER.

**Strong** (NATHAN), D. D., b. at Coventry, Conn., Oct. 5, 1748; graduated at Yale College 1769; was tutor there 1772–73; became pastor of the First Congregational church in Hartford 1774; served as army chaplain in the war of the Revolution, and subsequently held a high place among the clergymen of New England; was editor of the *Evangelical Magazine*, which he originated in 1801, and founder of the missionary society of Connecticut. He contributed to the *Hartford Selection of Hymns* (1799); published a number of occasional discourses, two volumes of *Sermons* (1798 and 1800), and *The Doctrine of Eternal Misery consistent with the Infinite Benevolence of God.* D. at Hartford Dec. 25, 1816.

**Strong** (THEODORE), LL.D., b. at South Hadley, Mass., July 25, 1790; graduated at Yale College in 1812; was tutor in Hamilton College 1812–16, and professor of mathematics 1816–27, occupying the same position in Rutgers College from 1827 to 1862. He contributed mathematical papers to *Silliman's Journal;* solved by a direct method a problem in cubic equations which had long baffled the best mathematicians; discovered a direct process of extracting the cube root of any integral number; published a *Treatise on Elementary and Higher Algebra* (1859), and at the time of his death was preparing a work on the *Differential and Integral Calculus.* D. at New Brunswick, N. J., Feb. 1, 1869.

**Strong** (THERON R.), b. at Litchfield, Conn., Nov. 7, 1802; received a good English and classical education; studied law under his father, Judge Martin Strong; settled as a lawyer at Palmyra, N. Y., 1826; was long a master and examiner in chancery; was member of Congress 1839–41, and of the legislature 1842; was judge of the supreme court of New York 1852–60, being for one year of that period a member of the court of appeals; rendered notable decisions from the benches of both those courts; resided at Rochester from 1853 until 1867, when he removed to New York City; established an active practice before the State and U. S. courts, and was frequently called to act as referee. D. in New York May 15, 1873.

**Strong** (WILLIAM), LL.D., b. at Somers, Conn., May 6, 1808; graduated at Yale College in 1828; was admitted to the bar in 1832, and commenced practice at Reading, Pa.; was Representative in Congress 1849–54; in 1857 was elected a judge of the supreme court of Pennsylvania for fifteen years; resigned the position in 1868, and resumed practice at the bar, and in 1870 was appointed associate justice of the Supreme Court of the U. S.

**Strong's Prairie,** p.-v. and tp., Adams co., Wis., on Wisconsin River. P. 1043.

**Strongs'ville,** p.-v. and tp., Cuyahoga co., O. P. 896.

**Strongyl'idæ** [from *Strongylus*—Gr. στρογγύλος, "round"—a generic name], a family of intestinal nematoid worms. The body is very elongated and round (*i. e.* cylindrical) or filiform; the integuments finally striated crosswise; the mouth at the anterior extremity, and diversiform as to shape and armature, but generally surrounded by papillæ; the œsophagus muscular, but not dilated; the generative organs of the males are toward the posterior extremity of the body in a peculiar pouch, whose margin is surrounded by papillæ terminating in rib-like muscular ridges, and generally two spicules are developed; the vulva of the female is anterior or posterior. Some are oviparous, and others viviparous. The family comprises nine or ten genera, the best known of which are *Strongylus*, *Eustrongylus*, *Ancyclostomum*, and *Sclerostomum*, of which the first three are represented by parasites in the human body.

THEODORE GILL.

**Stron'tium,** the metallic basis of strontia, one of the alkaline earths, first obtained from native carbonate of

strontium by Sir Humphry Davy in 1808, is of a pale yellow color, burns with a crimson flame, emitting sparks, decomposes water, liberating hydrogen gas, is hard, ductile, and malleable, and is obtained from the anhydrous chloride by electrolysis. Specific gravity, 2.54; atomic weight, 87.5; symbol, Sr. Its most important compound is the oxide, called strontia, a grayish-white, porous mass, which combines with water to form a white powder, the hydrate of strontium ($SrO.H_2O$), deposited from the hot saturated solution in needle-shaped crystals. The principal salts are chloride ($SrCl_2$), iodide ($SrI_2$), and bromide ($SrBr_2$). The nitrate ($Sr2NO_3$) is much employed for the manufacture of the crimson lights in fireworks. The sulphate ($SrSO_4$) is found native, and is known as a crystalline mineral by the name of celestine, in beds of gypsum, rock-salt, and trap rocks. Fine specimens are found in Trenton limestone on Strontian Island, Lake Huron, also at Schoharie and Lockport, N. Y.

**Strophomen'idæ** [from Gr. στρόφος, "twisted," and μήνη, "moon"—*i. e.* "crescent"], an extinct family of brachiopods which lived down to the close of the Liassic period. The shell was transverse or elongate; the "valves usually concavo-convex, regularly arched, geniculated or depressed, so that the valve, which is convex in some species, is concave in others, and *vice versâ*;" the hinge-line rectilinear; the ventral valve had the area flat, and a fissure overarched in part by a pseudodeltidium; the dorsal a projecting bifid cardinal process, which filled up almost the entire cavity of the fissure left open by the pseudodeltidium in the opposite valve. THEODORE GILL.

**Stroth'er** (DAVID HUNTER), b. at Martinsburg, Va., Sept. 26, 1816; studied drawing and painting in New York 1845–49, and in 1853 began to contribute to *Harper's Magazine*, under the signature of "Porte Crayon," a series of illustrated papers, mostly on the South, the drawings being made on the wood by himself; which have been continued at intervals to the present time. Some of the earlier of these papers have been collected into a volume, *Virginia Illustrated* (1857). During the civil war he entered the national service as captain and assistant adjutant-general; became colonel of the 3d West Virginia Cavalry, and resigned Sept., 1864; in 1867 was brevetted brigadier-general "for meritorious services." He resides at Berkeley Springs, West Va.

**Stroud,** town of England, county of Gloucester, on the Frome, is one of the principal seats of woollen manufactures in Western England, and has 9090 inhabitants.

**Stroud,** tp., Monroe co., Pa. P. 2160.

**Stroud** (GEORGE MCDOWELL), b. at Stroudsburg, Pa., Oct. 12, 1795; graduated at New Jersey College in 1817; was admitted to the bar in 1819, and was for many years presiding judge of the court of common pleas of Philadelphia. He published pamphlets and contributions to legal journals, and a *Sketch of the Laws relating to Slavery in Several of the States* (1827; enlarged in 1856). D. at Germantown, Pa., June 29, 1875.

**Strouds'burg,** p.-b., Stroud tp., cap. of Monroe co., Pa., on Delaware Lackawanna and Western R. R., has good water-power, several manufactories, and 3 weekly newspapers. P. 1793.

**Stru'ensee** (JOHANN FRIEDRICH), b. at Halle, Prussian Saxony, Aug. 5, 1737; studied medicine; took his degree as doctor before he was nineteen years old, and settled as a physician at Altona in the Danish province of Holstein; became intimate with the Holsatian nobility, and was recommended to the Danish king, Christian VII., whom he attended as physician-in-ordinary on his travels through Germany, France, and England in 1768. Christian VII. was by nature kind-hearted and well-gifted, but premature dissipation early sunk his mind into fatuity and foolishness, and Struensee was the only man who knew how to direct and command his imbecile soul. The queen, Caroline Mathilde, a sister to George III. of England, was a noble-hearted, high-spirited, and passionate woman, and at the Danish court Struensee was the only man in whom the unhappy young wife could put full confidence. Thus he soon acquired an influence, and even a power, which no subject had ever had before in Denmark. In 1771 he was made minister of state, and a royal decree gave full authority to any orders he might issue, whether they were signed by the king or not. But his power was very short-lived; it lasted hardly one year. On Apr. 28, 1772, he was beheaded, and he would probably have been forgotten very soon if the enormous reformatory activity which he excited had not given the social development of the country an impulse which no reaction was able afterward to check. Many of his reforms were very beneficial. He made the courts independent of the great landholders among the nobility, who hitherto had held the right of appointing the district judges—which offices they often filled with their lackeys—and in some cases even of exercising the judicial power themselves; as, for instance, in debt-cases between themselves and their tenants. He formed a permanent committee for the investigation of the condition of the peasantry and of all agricultural relations, and he started that series of reforms by which, in the last two decades of the eighteenth century, the whole of Danish society was reconstructed on the basis of a free peasantry. He granted liberty of the press and brought order and activity into the administration. But some of his measures, although good in themselves, were introduced in a reckless manner, which made people misunderstand them. Thus, he diminished the number of holidays accompanying the Christian church-festivals from eight to two; and this very sensible reform came to be considered as a "piece of atheism," and excited general indignation. Still greater scandal was caused by his establishing a foundling hospital, which was considered as a direct encouragement of vice; and in some cases his lack of dexterity and regard rose even to clumsy and reckless impertinence. Thus, he ordered that all memorials presented by the Danish people to the Danish government should be written in German, as he did not understand Danish—an order which offended all, and which was obeyed in a somewhat unexpected manner: no more memorials or petitions were presented. A conspiracy was formed against him, and in the night between the 16th and 17th of Jan. the conspirators broke into the bedroom of the crazy king and compelled him to sign orders of arrest against the queen, Struensee, and several of his adherents. The queen was brought to the fortress of Kronborg; Struensee was imprisoned. He was accused of having had criminal intercourse with the queen, and he confessed, but he was threatened with the rack, and he was a coward. From her, too, there exists a sort of confession, but she was told that such a paper from her hand would mitigate Struensee's destiny; and she loved him. Of legal evidence there was none. CLEMENS PETERSEN.

**Struthiine.** See SAPONINE.

**Struthion'idæ** [from *Struthio*—Gr. στρουθίων—the ancient name of the ostrich], a family of birds of the group (order or sub-order) Ratitæ, represented at present only by the ostrich of Africa and Arabia, the ostriches of South America belonging to the family Rheidæ, and the cassowaries and emus to the family Casuaridæ. The bill is rather elongated, nearly straight, gradually depressed forward and narrowed toward the extremity, which is rounded, and the culmen is flattened; the nostrils are elongate ovate, and in a broad membranous groove near the middle of the bill; the feathers are destitute of after-shafts; the wings are imperfect, and furnished with long curving soft plumes; the tail is moderate, and consists of curved pendent feathers; the tarsi are elongated, robust, and mostly covered with hexagonal scales, but in front toward the toes with transverse ones; the toes are two in number, with pad-like under surfaces, the inner (third) large, the outer (fourth) small; the claws short, curved, and blunt.

A number of osteological characters support the differentiation of the family from the others of the group, and have been formulated by Prof. Huxley—viz. the maxillary processes of the palatine bones are prolonged forward beneath the maxillo-palatines (as in most birds); the latter are thickened at their inner edges, and articulate with facets upon the sides of the vomer; the vomer is quite short, and does not articulate with either the palatines or pterygoids behind; the prefrontal processes of the primordial cranium are deficient in ossification; the sacral vertebræ are united by their bodies with the anterior ends of the pubes and ischia; the sternum has two shallow notches on each side at the posterior margin; the fore limb is distinguished by its proportions, the humerus being about equal in length to the distance between the pectoral arch and the ilium, and therefore much longer than the scapula; the antebrachium is not half as long as the humerus; the manus possesses the ordinary three digits, and of these the radial and middle have claws; there is a union of the pubes in a symphysis; the hallux is not only aborted, but also the distal end of the metatarsal bone and the phalanges of the second digit of the foot; there are 35 precaudal vertebræ. But one species of this family (the *Struthio camelus* of Linnæus) is generally recognized, and this extends from the Sahara desert to the Cape of Good Hope, as well as into Arabia. It is suggested, however, that several forms may be confounded under one name. There are said, *e. g.*, to be certain marked differences between the Northern and Southern African birds. "The most noticeable differences observable in the living birds are that the naked skin in the Cape examples is bluish (not reddish), and the neck thickly feathered, the top of the head being also covered with hair-like feathers. In the Barbary bird the top of the head is

bare." The eggs of the two birds also differ, those of the northern form being larger and pitted, while those of the southern bird are smaller and almost smooth. (See Sclater in *Trans. Zool. Soc. London*, vol. iv., pp. 354, 355.) The ostrich is the largest of the living birds. It feeds upon the grass and other vegetation of the plains and deserts which it most affects, and has a well-known reputation for voracity and digestibility. Individuals generally associate together in considerable flocks. Its ordinary gait is a stately walk, but it can run with great swiftness, and is then assisted by its wings. The nest is scratched in the sand, and is little more than a slight excavation of about six feet in diameter. Generally, two females lay in the same nest about twenty eggs, while in a surrounding trench several more are deposited, which are believed to be for the use as food of the newly-hatched young. The male sits on the eggs and cares for the young. As is well known, the plumes of the ostrich are much esteemed as ornamental feathers, and of late years birds in large numbers have been reared for their supply. THEODORE GILL.

**Strutt** (JOSEPH), b. at Springfield, Essexshire, Oct. 27, 1742; was apprenticed to an engraver, but devoted himself specially to the study of British antiquities. His principal works in this department are—*The Regal and Ecclesiastical Antiquities of England* (1773; new ed. by Planché, 1842); *Horda-Angel-Cynnan*, being a view of the customs, arms, etc. of the inhabitants of England from the arrival of the Saxons till the reign of Henry VIII. (1774); *The Chronicle of England*, completed only to the time of the Norman Conquest (1777); *Complete View of the Dress and Habits of the People of England from the Establishment of the Saxons to the Present Time* (1796; new ed. 1875); *The Sports and Pastimes of the People of England* (1801; enlarged by Hone in 1830, and often republished). He also published a *Biographical Dictionary of Engravers* (1785), and left several tales, one of which, *Queen Hoo Hall*, was edited after his death by Sir Walter Scott. D. in London Oct. 16, 1802.

**Stru've, von** (FRIEDRICH GEORG WILHELM), b. at Altona, Holstein, Apr. 15, 1793; studied first philology, and afterward astronomy, at the University of Dorpat; received an appointment at the observatory in 1813, and became its director in 1817. From 1834 to 1839 he planned and superintended the construction and erection of the observatory at Pulkova, near St. Petersburg, the best in the world, which he has described in his *Description de l'Observatoire central de Russie* (1845), and of which he was director to his death, Nov. 23, 1864. The earlier part of his career was mostly occupied by studies of double stars and of the construction of the Milky Way—*Observationes Dorpatenses* (8 vols., 1817–39), *Catalogus novus Stellarum Duplicium* (1827), *Stellarum Duplicium mensuræ Micrometricæ* (1837), *Stellarum Fixarum, imprimis compositarum positiones mediæ* (1852), and *Études d'Astronomie stellaire* (1847). Subsequently, he undertook several great geodetic works, such as the triangulation of Livonia (1816–19) and the measurement of a meridian arc in the Baltic provinces (1822–27), which he continued to the North Pole in connection with Hansteen, and to the Danube in connection with Gen. Tenner, and which he has described in his *Arc du Meridien entre la Danube et la Mer glaciale* (1861).

**Struve** (GEORG ADAM), b. at Magdeburg, in the present Prussian province of Saxony, Dec. 27, 1619; studied law at Jena and Helmstedt; held several high positions in the Saxon government, and became known as the author of a great number of juridical works, of which the *Jurisprudentia Romano-Germanica forensis* was the most remarkable. D. at Weimar Sept. 15, 1692.—His son, BURKHARD GOTTHELF STRUVE, b. at Weimar May 26, 1671, studied law at Jena, Helmstedt, and Frankfort-on-the-Oder; travelled much, and was appointed professor at Jena, first in history (1704), then in jurisprudence (1730). D. May 24, 1738. The most remarkable of his numerous writings are—*Corpus Historiæ Germanicæ* (1730), *Bibliotheca Historica* (11 vols.), and *Bibliotheca Historiæ Literariæ Selecta* (3 vols.).

**Struve, von** (OTTO WILHELM), b. at Dorpat May 7, 1819, son of F. G. W. von Struve, under whom he studied astronomy; succeeded him as director of the observatory of Pulkova, and became known in the history of astronomy by many valuable discoveries, communicated in the memoirs of the Academy of Science of St. Petersburg, and mostly relating to the rings of Saturn and the periodic motions of double stars. He also published a catalogue of the library of the observatory.

**Strychnine,** or **Strychnia.** See NUX VOMICA.

**Strych'nos** [Gr. στρύχνος, the deadly nightshade], a genus of trees and climbing woody vines of the order Loganiaceæ, found in the tropical parts of both continents. Most species, but it is said not all, are poisonous. *S. nux-vomica* of India, a tree of moderate size, yields the alkaloids strychnine, brucine, and igasurine, all active poisons in over-doses. So also does *S. Ignatia* of the Philippines, and *S. tieute*, a climbing vine of Java. The East Indian *S. ligustrina* and *S. colubrina* are reputed to afford a cure for snake-bites. *S. pseudo-quina* of Brazil yields copalche-bark, a valued febrifuge; *S. potatorum* of India is the clearing-nut tree; and *S. toxifera* of South America probably affords the dreaded curare (or woorari) poison.

**Stry'ker,** p.-v., Springfield tp., Williams co., O., on Lake Shore and Michigan Southern R. R. P. 671.

**Strymon.** See MACEDONIA.

**Strype** (JOHN), D. D., b. at Stepney, Nov. 12, 1643; was educated at St. Paul's School and at Jesus College, Cambridge, and from 1669 to about 1732 held the living of Low Leyton in Essex. His important works are—*Annals of the Reformation in England* (1709), and lives of *Thomas Cranmer* (1694), *Sir Thomas Smith* (1698), *John Aylmer* (1701), *Sir John Cheke* (1705), *Edmund Grindall* (1710), and *Matthew Parker* (1718). Editions of the *Historical and Biographical Works of John Strype* were issued from the Oxford press in 27 vols. (1827–40). D. Dec. 13, 1737.

**Stu'art,** p.-v., Penn tp., Guthrie co., Ia., on Iowa division of Chicago Rock Island and Pacific R. R., has several locomotive and machine shops and 1 newspaper.

**Stu'art,** or **Stewart,** a royal family which has given several sovereigns to Scotland and England, all of whom are mentioned under their proper names—CHARLES, JAMES, MARY, and ROBERT (which see). Tradition affirms that the family is descended from that Banquo who was murdered by Macbeth, but the more probable account is that among the Normans who accompanied William the Conqueror was one Alan, who received large gifts of land in England. His second son went to Scotland, entered the service of King David I. (about 1130), by whom he was made steward of the kingdom, the dignity remaining hereditary in the family, who assumed the title as their family name. The sixth of these Stewards or Stewarts married in 1315 a daughter of Robert Bruce, and his son Robert in 1371 succeeded David Bruce on the throne of Scotland under the title of Robert II. The following are the sovereigns of the Stuart line, with the dates of their accession: ROBERT II. (1371). ROBERT III. (1390), a feeble ruler who left the actual government to his brother, the duke of Albany. JAMES I. (1424) was for many years a prisoner in England, and was assassinated by his subjects in 1437. JAMES II. (1437) was crowned at the age of six, and was killed by the bursting of a gun at the siege of Roxburghe in 1460. JAMES III. (1460) had a troublous reign, embroiled by several revolts of his nobles, and was either killed in battle or murdered afterward in 1488. JAMES IV. (1488) married Margaret Tudor, daughter of Henry VII. of England, and was killed at the battle of Flodden Field in 1513. JAMES V. (1513) was crowned at the age of eighteen months, his mother acting as regent until 1529, when he assumed the government. His whole reign was a series of disasters. He became involved in quarrels with Henry VIII. of England; was defeated in 1542 in an engagement, and soon after died of chagrin, leaving the crown to his infant daughter, then only eight days old. MARY Queen of Scots (1542), daughter of James V. and Mary of Guise, married successively to the dauphin (afterward Francis II.) of France, Henry Darnley, and James Hepburn, duke of Bothwell; was executed in England in 1587. JAMES VI., son of Mary and Darnley (1567), crowned when only a year old, his mother having been deposed by her subjects. Queen Elizabeth dying in 1603, James became king of England in right of his descent from Margaret Tudor, daughter of Henry VII., taking the title of James I. of England. D. in 1625. CHARLES I. (1625) succeeded his father at the age of twenty-five; became involved in disputes with his people, and was beheaded in 1649. CHARLES II. (1649), his reign nominally beginning with the death of his father, although he did not actually ascend the throne until 1660; d. in 1685, without legitimate children. JAMES II., brother of CHARLES II. (1685), deposed in 1688 by the people, who raised to the throne his daughter Mary and her husband, William, prince of Orange. D. in 1701. He had one legitimate son, JAMES FRANCIS EDWARD (which see), who upon the death of his father assumed the title of James III., and is known in history as the Old Pretender; d. in 1765. His eldest son, CHARLES EDWARD (which see), is known as the Young Pretender; d. in 1788. The second son of the Old Pretender, HENRY (see STUART, HENRY BENEDICT MARIA CLEMENT), entered the Roman Catholic priesthood, and rose to the cardinalate under the title of Cardinal York; d. in 1807, and with him ceased the royal line of the Stuarts, perhaps the most unfortunate family which ever sat upon a throne. The present royal family of England are descended only indirectly, and in the female

line, from the Stuarts, through a granddaughter of James I. of England, upon whom the succession was bestowed by the British Parliament. A. H. GUERNSEY.

**Stuart** (ALEXANDER H. H.), b. at Staunton, Va., Apr. 2, 1807; studied at William and Mary College and at the University of Virginia, and was admitted to the bar in 1828; in 1836–38 was a member of Virginia house of delegates, and in 1841–43 a Representative in Congress; in 1850 was appointed secretary of the interior by Pres. Fillmore; in 1857 was elected to the State senate of Virginia; in 1866 was a delegate to the national Union congress convened at Philadelphia.

**Stuart** (ARABELLA), b. at Chatsworth about 1575. Her father was Charles Stuart, earl of Lennox, brother of Henry, Lord Darnley, the husband of Mary Queen of Scots, and father of James I. of England. Her great-grandmother was Margaret Tudor, daughter of Henry VII., who had married James IV. of Scotland, and she was therefore in the direct line of descent to the English crown, standing in the same degree of relationship to Elizabeth as did her cousin James, and she became almost from birth a subject of constant intrigues. Upon the death of Elizabeth in 1603, an unsuccessful plot, in which it is said Sir Walter Raleigh was implicated, was formed to place her instead of James upon the throne; and from this moment she became an object of jealousy to her cousin; this was still more inflamed when in 1610 she was secretly married to William Seymour, grandson of the earl of Hertford, who was descended from another daughter of Henry VII., and thus also in the line of descent. Seymour was flung into the Tower, and his wife was placed in the custody of the bishop of Durham. She managed to escape, and made her way to the coast, where a French vessel was waiting for her and her husband, who had escaped from the Tower, He did not succeed in reaching the vessel, which sailed without him, but found another one, by which he reached France. The vessel in which was the Lady Arabella was captured by an English ship, and she was committed to close confinement in the Tower, where she became insane, and d. Sept. 27, 1615.

**Stuart** (CARLOS D.), b. at Berlin, Washington co., Vt., July 28, 1820; was in early life engaged as clerk in a country store, at the same time devoting himself to study and reading, and writing poems for the local newspapers. In 1840 he came to New York, and became a contributor to journals and periodicals, and soon afterward was for a short time a preacher of the Universalist denomination, but soon devoted himself to journalism, becoming editor of the New York *Sun;* then established the *New Yorker*, and afterward was on the *Mirror*, writing both prose and verse. D. at Northampton, Mass., Feb., 1862.

**Stuart** (GEORGE HAY), b. at Rose Hall, county Down, Ireland, Apr. 2, 1816; was educated at Bainbridge, Ireland: emigrated to America, taking up his residence in Philadelphia, where he engaged in business, and is president of the Mechanics' National Bank. He is distinguished as one of the most active Christian philanthropists of the day. During the civil war he was president of the U. S. Christian Commission, and subsequently of the Indian commission; is president of the Philadelphia branch of the Evangelical Alliance, a vice-president of the American Sunday-School Union, of the American Bible Society, the American Tract Society, and other philanthropic associations. (For a sketch of his life, by his pastor, Rev. Dr. Wylie, see in Billingley's *From the Flag to the Cross, or Scenes and Incidents of Christianity in the War* (1872).)

**Stuart** (GILBERT), b. in Edinburgh in 1742; was educated at the University of Edinburgh; studied jurisprudence, but devoted himself specially to literature, publishing in 1767 an *Historical Disquisition on the Antiquity of the British Constitution*, which gained for him the degree of LL.D., and was followed next year by a *View of Society in Europe, in its Progress from Rudeness to Refinement.* Failing to receive the appointment of professor of law in the university, he went to London, where he wrote for the journals, and returning to Scotland in 1773 commenced the *Edinburgh Magazine and Review*, which was continued for four years, and was noted for its virulent attacks upon Scottish literati. He published *Observations concerning the Public Law and Constitutional History of Scotland* (1789), *History of the Establishment of the Reformation in Scotland* (1780), and *History of Scotland from the Reformation to the Death of Queen Mary* (1782). D. at Musselburgh Aug. 13, 1786.

**Stuart** (GILBERT CHARLES), b. at Narragansett, R. I., in 1756. His first instructor, Alexander, a Scotch artist, took him to Edinburgh, but soon died, and the youth worked his way back to Newport. Thence he removed to Boston. The stir of the Revolution drove him to New York, and thence in 1778 to London. There, after months of poverty, friendlessness, and ill-success, he became acquainted with Benjamin West, who gave him encouragement, showed him every kindness, and even took him to his home. A full-length portrait of West, now in the National Gallery, gained for him reputation and opportunity. He soon rose to eminence in London, and painted people of rank—George III., the prince of Wales, a duke, an earl, John Kemble, Joshua Reynolds (of whom he was held to be the peer). The duke of Rutland invited him to Dublin, and there he lived in splendor as the artist of the nobility. In Paris he met with similar fortune, having as a sitter the king, Louis XVI. A desire to revisit his native country and to paint the portrait of Washington, whom he profoundly revered, brought him to America in 1793, and led him to Philadelphia without unnecessary delay. The first picture was destroyed as unsatisfactory; the second, the original sketch whereof is in the Boston Athenæum, is the accepted portrait. Besides Washington, Stuart painted John Adams, Jefferson, Madison, Monroe, John Jay, distinguished men and women of the day. The last was John Quincy Adams, which was finished by Sully. From 1806 till his death Stuart resided in Boston, and painted industriously. D. in Boston, Mass., July, 1828. No complete catalogue of his portraits exists. They are very numerous, and are greatly prized. In the painting of heads he rivals Copley, but the details are sketchy. Stuart was a brilliant man, eccentric, sensitive, proud, a wonderful talker, a penetrating observer, a genius in his art. In his early years he was an accomplished musician. His pictures are widely scattered, but may be seen to advantage in Boston, Philadelphia, New York, and Baltimore. O. B. FROTHINGHAM.

**Stuart** (HENRY BENEDICT MARIA CLEMENT), b. in Rome in 1725, the son of the Pretender, James Francis Stuart, by whom he was created duke of York, and brother of Charles Edward, the Young Pretender; he was the last male descendant of the royal line of the Stuarts. He was preparing to join his brother in the rising of 1745 with a force of French troops when that prince was overthrown at Culloden; subsequently took orders in the Roman Catholic Church, and in 1747 was raised to the cardinalship by Pope Benedict XIV. as Cardinal York, taken from his ducal title. His brother, the Young Pretender, dying in 1788, he assumed the style of Henry IX., king of England —*gratia Dei, non voluntate hominum*, as expressed on a medal struck upon the occasion. When the French troops in 1798 took possession of the Papal States he retired to Venice, and during the later years of his life was maintained by a pension from the British government. D. at Frascati in 1807.

**Stuart** (ISAAC WILLIAM), son of Moses, b. at New Haven, Conn., in 1809; graduated at Yale College 1828; became a teacher at the Hopkins Grammar School, Hartford; was for some years professor of Greek and Latin in the College of South Carolina; subsequently returned to Hartford, where he acquired and resided upon the Wyllis estate, on which stood the celebrated "Charter Oak;" was several times a member of the Connecticut senate, and was distinguished as an orator. D. at Hartford Oct. 2, 1861. Author of a *Life of Nathan Hale* (1856), *Hartford in the Olden Time* (1853), and a *Life of Jonathan Trumbull* (1857); translated, with notes, Greppo's *Essay on the Hieroglyphic System of Champollion* (1830), and edited, with notes, the *Œdipus Tyrannus* of Sophocles (1837).

**Stuart** (JAMES), known as "Athenian Stuart," b. in London in 1713; until nearly thirty years of age was a decorator of fans and similar articles; made his way to Rome, where he studied Greek and Latin art and archæology; in 1752 accompanied the antiquarian Nicholas Revett to Athens, where he remained three years, making drawings from the remains of Greek architecture; in 1755 returned to London; became eminent as an architect; was appointed surveyor of Greenwich Hospital, and in conjunction with Revett began the great work, *The Antiquities of Athens, Measured and Delineated* (3 vols., 1762–94; supplementary volume, edited by Joseph Woods, 1816). He also published *Critical Observations on the Buildings and Improvements of London* (1771), and furnished the illustrations for a *Picturesque Tour through part of Europe, Asia, and Africa* (1793). D. Feb. 2, 1788.

**Stuart** (JAMES E. B.), b. in Patrick co., Va., in 1833; graduated at the U. S. Military Academy July 1, 1854, when appointed a brevet second lieutenant in the regiment of mounted rifles, receiving his full commission in October. In Mar., 1855, he was transferred to the newly-organized 1st Cavalry, in which regiment he attained a first lieutenancy in the following December, and a captaincy Apr. 22, 1861. During the Kansas political troubles of 1855–58 he served with his regiment, and in 1859 was a volunteer aide to Col. R. E. Lee during the John Brown insurrection at

Harper's Ferry. On May 14, 1861, he was appointed colonel of a Virginia cavalry regiment, and was in chief command of the cavalry at the first battle of Bull Run. Promoted to be brigadier-general in the Confederate army in Sept., 1861, and major-general early in 1862, he served thenceforth with the Army of Northern Virginia. Gen. Lee, assuming command of this army (June, 1862), and having reorganized it, determined upon a bold reconnoissance prior to resuming the offensive. Accordingly, on the morning of the 13th of June, Stuart, with some 1500 cavalry and 4 guns, left Richmond, and by daylight of the 15th reached Hanover Court-house, where he dispersed two squadrons of the 5th U. S. Cavalry; proceeding down the Pamunkey as far as Old Church, thence toward New Kent Court-house, striking the railroad at Tunstall's Station and crossing the Chickahominy at Jones's Bridge the next morning, was safely back in Richmond that night, having made the circuit of McClellan's army with the loss of but one man. It caused much commotion in the Union army, and was the source of valuable information in the subsequent movements of Jackson, where Stuart led the advance. During Pope's campaign in Northern Virginia, Stuart surprised the head-quarters' train of the former near Catlett's Station on the night of Aug. 25, 1862, capturing the personal baggage and official correspondence of Pope, and the next night, in connection with two regiments of infantry, made a descent on Manassas Junction, capturing 8 guns, several hundred prisoners, 10 locomotives, and immense quantities of quartermaster and commissary stores. During the invasion of Maryland by Gen. Lee in September, Stuart covered the Confederate rear, resisting the Union cavalry advance at South Mountain and holding the Confederate left, and engaged at Antietam. During the period of inaction he crossed the Potomac above Williamsport with 1500 cavalry, and passing through Maryland, he entered Pennsylvania and occupied Chambersburg, and recrossed the Potomac below Harper's Ferry. In the battle of Fredericksburg his command formed the extreme right of the Confederate line. At Chancellorsville, after the fall of Stonewall Jackson, and A. P. Hill had been disabled, Stuart succeeded to the temporary command of Jackson's corps, which he led with ability in the severe fighting of Sunday, May 3. In anticipation of the proposed invasion of Pennsylvania, a large cavalry force had been accumulated at Culpeper under command of Stuart, against which Gen. Hooker despatched two divisions of cavalry and two brigades of infantry, which, crossing at Beverley and Kelly's Fords (June 9), soon encountered Stuart advancing to cover the flank of the main movement. A determined engagement between the cavalry on both sides ensued, resulting in a loss to each of 500 or 600. During the subsequent operations of the year, he rendered important service. In the campaign of 1864, Stuart by a wide detour succeeded in interposing himself between the Confederate capital and Sheridan's advancing column. Concentrating all his forces at Yellow Tavern, near Richmond, he was here attacked by his able rival. During the obstinate but ineffectual struggle Gen. Stuart was mortally wounded. D. May 11, 1864, soon after reaching Richmond. G. C. Simmons.

**Stuart** (John), earl of Bute. See Bute.

**Stuart** (Moses), b. at Wilton, Conn., Mar. 26, 1780; was graduated at Yale College in 1799; studied law, and was admitted to the bar in 1802, and for two years was tutor in Yale College; afterward studied theology, and in 1806 was ordained pastor of a Congregational church in New Haven. In 1809 he became professor of sacred literature in the theological seminary at Andover, and occupied the chair until 1848. He published several Hebrew and Greek grammars, commentaries on various books of the Bible, and *Elements of Interpretation* from the Latin of Ernesti (1822), *The Sabellian and Athanasian Modes of Representing the Doctrine of the Trinity*, from the German of Schleiermacher (1835), *Philological View of Modern Doctrines of Geology* (1836), *Hints on the Prophecies* (1842), *Critical History and Defence of the Old Testament Canon* (1845), *Conscience and the Constitution* (1851), etc. D. at Andover, Mass., Jan. 4, 1852.

**Stubbs** (William), D. D., b. at Knaresborough June 21, 1825; was educated at the grammar school at Ripon and at Christ Church, Oxford, where he took a first class in the classics and a third class in mathematics, and was elected to a fellowship in Trinity College; took holy orders in 1848; became vicar of Navestock in 1852; librarian to the archbishop of Canterbury at Lambeth in 1862, and was inspector of schools in the diocese of Rochester 1860–66, when he received the appointment of regius professor of modern history at Oxford, in 1869 that of curator of the Bodleian Library; was chosen as a member of the hebdomadal council in 1872, and in 1875 received the presentation of the rectory of Cholderton, Wiltshire. He has published—*Hymnale secundum Usum Sarum* (1850), *Registrum Sacrum Anglicanum* (1858), *The Foundation of Waltham Abbey* (1861), a new translation, with a continuation to the present time, of Mosheim's *Institutes of Church History* (1863), *Chronicles and Memorials of Richard I.* (1864), the *Chronicle ascribed to Benedict of Peterborough* (1867), the *Chronicle of Roger de Hoveden* (1868), *Select Charters, etc. of English Constitutional History* (1870), *Memorial of Walter of Coventry* (1872), *Memorials of St. Dunstan* (1874), and *The Constitutional History of England* (vol. i., 1875 *seq.*).

**Stuc'co** [It.], a plastic, adhesive composition applied to walls both internally and externally in order to give them a smooth and even surface, either decorative or plain in color or form. The cementing medium of the composition for inside-work is common lime or calcined gypsum, or a combination of the two, generally mixed with a certain proportion of sand, depending on the special object to be secured. The word *stucco* technically applies to a mixture of lime-putty and white sand or powdered marble, and to a coating produced with this compound. The rudest example of the plasterer's art is the application of a single coat of mortar composed of lime-paste and common sand laid on the surface of a wall with the trowel, while the highest consists in imitating fine marbles and other beautiful building-stones by using pure calcined gypsum, mixed with gum, isinglass, and suitable coloring-matter, laid on in a variety of decorative forms in order to produce panels, pilasters, mouldings, cornices, etc. The implements used by the plasterer are of the simplest kind and few in number. They comprise a lathing-hammer, the hawk, the plastering or laying-on trowel, the float, a brush, and straight-edges and moulds of various kinds, together with a screen, shovel, rake, and hod for his attending laborer. The hawk is used by the plasterer for holding the mortar in his left hand while he applies it with the trowel held in his right hand. It is simply a piece of board about ten to eleven inches square, held by a stout handle fixed on the under side in the centre of the board and at right angles to it. The laying-on trowel is a thin plate of hardened steel or iron about three inches wide and nine to ten inches long, rounded slightly at the front end, square at the other end, and a little convex on the face. It is provided with a handle on the back parallel to the blade. The hand-float is of wood, shaped something like the laying-on trowel. It is used to rub down finished work and give it a hard, smooth, and even face. A cork float is sometimes used upon surfaces which are to receive a high degree of polish. A derby is a long, two-handed float, used principally in forming the floated coat of lime and hair. Jointing-trowels are of steel, the plate being triangular, with an acute angle at the front end, the handle being attached to the heel or base of the tool. They are used about cornices and mouldings in forming the mitres where fine workmanship is desired. Moulds are pieces of hard wood cut to the form of the cornices or mouldings that are to be formed, to assist the workman in securing accuracy and uniformity in his work. They are sometimes made of copper plates inserted in a wooden stock. The plasterer's brush is broad and thin, and is used for keeping the material wet and plastic until it is finished to the required form. The plasterer's materials are lath-nails, laths, lime, calcined gypsum or plaster, hydraulic cement, and sand, together with various pigments for giving the requisite colors.

The mortars used for inside plastering are "coarse stuff," "fine stuff," "gauge stuff," called also "hard finish" and "bastard stucco." Coarse stuff is simply common lime-mortar, of the quality suitable for brick masonry, mixed with well-switched bullock's hair free from all animal and vegetable matter. The proportions of 1 cask of common lime, producing 8 to 9 cubic feet of paste, 16 to 18 cubic feet of clean, sharp sand, and $1\frac{1}{8}$ to $1\frac{1}{4}$ cubic feet of hair will answer. When rapid hardening is desirable, 12 to 15 per cent. of the lime-paste may be advantageously replaced by an equal volume of calcined plaster or hydraulic cement. Coarse stuff forms the principal mixture for all inside plastering. In three-coat work the proportion of hair in the second coat may be somewhat diminished. Fine stuff is prepared by slaking pure lump-lime with a small quantity of water, and afterward adding water until the paste is diluted to the consistency of cream. It is then allowed to stiffen by evaporation to the proper condition for use. It is then sometimes called "putty." It is used for the finishing coat, but always with some fine sand or calcined plaster, except for what is known as a slipped coat, and even for slipped work fine sand may be added in small quantities. Gauge stuff is composed of putty or fine stuff and calcined gypsum, in the proportion of 3 or 4 of the former to 1 of the latter. It is used for the finishing coat of walls and for mouldings, cornices, and other kinds of ornamentation. As the gypsum renders it very quick setting, it should be mixed in small quantities as required for use. The mixture

called stucco is prepared with lime-putty and white sand, and is used only for a finishing coat. The usual proportions are 3 or 4 parts of sand to 1 of putty.

No description of the process of lathing walls and ceilings is deemed necessary here. It may be stated, however, that the lath-ends should not form a continuous joint on the same joist, and that the spaces between laths should not be less than three-eighths nor exceed half an inch. Preferably, the spaces should be three-eighths of an inch. One coat of plastering on laths is said to be *laid*, and the coat is called a *laying* coat; and work in two coats is said to be *laid* and *set*, and the coats are styled a *laying* coat and a *set* coat. In three-coat work on laths the first is called the *pricked-up* or the *scratch* coat, the second is the *floated* coat, and the third the *set* coat. On masonry, plastering in one coat is styled *rendering;* two-coat work is said to be *rendered* and *set;* and three-coat work *rendered*, *floated*, and *set*. In good two-coat work upon laths, and also upon uneven masonry, the first coat should be a *screed* coat—that is, laid in *screeds* and "filling out." The screeds are strips or ledges of coarse stuff, six or eight inches in width, applied at the angles of the room, and also in parallel strips three to four feet apart all over the walls and ceiling. They are carefully worked on, so that all those on the same wall or ceiling shall be accurately in the same plan, as determined by the frequent application of the straight-edge in all possible directions. When the screeds have become somewhat firm, the spaces between are filled in flush with the surfaces already established, so as to produce a continuous straight and even surface. In three-coat work the second is the screed coat. One-coat work on either laths or masonry—that is, either *laid* or *rendered*—although an inferior quality of work for walls and ceilings, is in common use for attics, kitchens, cellars, vaults, and places of like character. It is formed of a rather thick layer, say about half an inch, of well-tempered coarse stuff of moderate stiffness, possessing sufficient tenacity to prevent its falling apart. If upon laths, it should be applied with enough pressure from the trowel to force portions of it through the spaces, so that it will bend down of its own weight behind the laths, and thus form a strong key when it shall have set. This is a precaution of special importance on ceilings. If upon masonry, the pressure is necessary to secure intimate contact and adhesion. A light hand-floating adds greatly to the appearance of single-coat work. Two-coat work on laths, if not required to be of the best quality of work, is done in a *laying* coat and *set*, otherwise in a *screed* coat and *set*, when the laying coat becomes a screed coat. In either case the coarse stuff is applied in about the same thickness as in one-coat work, and with the same care to obtain a firm key. The object of a screed coat, as already stated, is to bring the surface to a true plane. When good work is aimed at, the first coat should be hand-floated to give it solidity and density. This is done by using the float in the right hand and a hair-brush holding water in the left. Both implements are passed quickly over the wall simultaneously. The brush precedes the float, and moistens the surface. Hand-floating can be done at a moderate expense, and it adds greatly to the hardness and tenacity of the plastering. It must take place while the mortar is green if intended as a preparation for a setting coat. After the first coat of two-coat work has become partially dry, so that it will not break up under the trowel in the work which follows, it is in readiness for the *set* or finishing coat, which may be in *slipped work*, *stucco*, *bastard stucco*, or *hard finish*. In either case the surface should be slightly roughened up with a birch or hickory broom, and moistened if it has become too dry. The application of a slipped coat consists simply in smoothing off the first coat of coarse stuff with the least thickness of lime-putty that will suffice to secure a rather smooth and even surface. It is seldom sufficient to cover up the coarse stuff entirely, but answers very well for surfaces that are to be finished in distemper or covered with paper-hangings of common quality. Four or five per cent. of white sand is sometimes added to the lime-putty to make it work more freely. For slipped work the trowel alone is used. Finishing or setting in stucco is proper for a screed coat, but is not applied upon rough, inferior work, on account of the extra labor which it requires. It is put on with the trowel to the thickness usually of about one-eighth of an inch, bearing in mind that the straight surface secured by previous screeding should be carefully preserved, which can only be done by applying the finishing coat in a layer of uniform thickness. Stucco should be thoroughly hand-floated, with a free use of the water-brush. After the wooden float has been used, it is usual in fine work to float the surface again with a cork float, which on account of its softness leaves the surface in a suitable condition for polishing with the trowel and brush. When the stucco is intended to present a rather rough surface, for ornamentation in any style of distemper or for painting, it should not be polished. Bastard stucco is used in the same manner and for the same purpose as stucco—that is, as a set coat on screed work. It is done in stucco-mortar, in which the proportion of sand is somewhat smaller than in the genuine stucco, and to which a little fine hair is sometimes added. It is not hand-floated, and less trowelling is put upon it than upon trowelled stucco. It is superior to ordinary slipped work as a preparation for paper-hangings. Hard finish is applied with the trowel to the depth of an eighth of an inch, and may be polished with the water-brush and trowel, but not hand-floated. It is frequently used as a preparation for painting, although inferior to stuccoed walls for that purpose. It may, however, be well finished in distemper. A suitable mixture for distemper consists of 10 pounds of Paris white and 1 pound of glue, colored as may be required. Hard finish requires less labor than stucco, and is extensively practised in the U. S. In three-coat work on laths, the first coat—the *pricked-up*, the *scratch*, or *brown coat*—is applied in the same way as *laying*, with the exception that inasmuch as it is designed to form merely a good foundation for the *screed* coat, its thickness does not usually exceed one-quarter to three-eighths of an inch. After it has become partially dry, but while still soft, the mortar is *scratched* over nearly to its entire depth with a stick cut on the end into pointed teeth. The scratching is done in two sets of parallel scorings at right angles to each other, each running diagonally across the surface. The lines are about two inches apart, and are designed to assist the adhesion of the screed coat which follows. The second and finishing coats are applied as already described for a screed coat and set.

The estimated cost of labor and materials for 100 square yards of lath-and-plaster work is given below:

| Materials. | Three coats—hard-finish work. | | Two coats of slipped work. | |
|---|---|---|---|---|
| Good common lime | 4 casks | = $4.00 | 3⅓ casks | = $3.33 |
| Lump lime for fine stuff. | ⅔ cask | 90 | | |
| Plaster of Paris | ⅓ cask | 75 | | |
| Laths | 2000 | 4.00 | 2000 | 4.00 |
| Hair | 4 bushels | 60 | 3 bushels | 45 |
| Common sand | 7 loads | 2.00 | 6 loads | 1.75 |
| White sand | 2½ bushels | 20 | | |
| Nails | 13 pounds | 60 | 13 pounds | 60 |
| Mason's labor | 3½ days | 8.75 | 3 days | 7.50 |
| Laborer | 3 days | 3.75 | 2 days | 2.50 |
| Cartage | | 2.00 | | 1.50 |
| Cost of 100 yards | | $27.55 | | $21.63 |

For *exterior plastering* a mortar composed of common lime and sand is not the most suitable, although frequently used upon the walls of common buildings well protected by projecting eaves. A cheap and useful surfacing of this kind is made by first cleaning off and roughing up the surface, and raking out the joints to the depth of half an inch, and then rendering it with a not very thick coat of lime-paste and hair. When this has set, another coat of the same mixture is laid on evenly with the trowel without floating; and as soon as a few square yards are executed, a semi-fluid and thoroughly-incorporated mixture of strong lime and fine clean gravel is firmly applied. This is at once, while soft, tinted to any desired color with an ochreous mixture put on with a brush. The whole dries and hardens into a compact mass.

Common lime forms the basis of some very good outside stuccoes, which, when properly applied, are very durable. Water holding coarse brown sugar or molasses in solution may be used for mixing the mortar, with beneficial effects on its subsequent induration. One pound of sugar to eight gallons of water will answer for all except the surface coat, which should contain four times this proportion of sugar. Powdered slaked lime, mixed with the scales from a smith's forge and tempered with bullock's blood, produces a moderately hydraulic and durable mortar, frequently used for exterior stucco. The wall should be previously coated over with boiled oil. In the U. S. hydraulic cement and clean, sharp sand, mixed up with fresh water to the consistency of plasterer's mortar, is most commonly used for the exterior coating of walls, more especially of brick walls. Suitable proportions are 1 volume of cement-powder to 1½ to 1¾ volumes of damp, compacted sand, mixed in such quantities, from time to time, that it will not set before it is used. The joints of the wall, whether it be of brick or stone, should be previously raked out to the depth of about half an inch, cleansed of dirt and dust, and then thoroughly wetted in order that the mortar shall not be too rapidly deprived of its moisture by absorption, and its density and strength thereby impaired. The mortar is usually applied in two coats in one operation; that is, the second coat is put on while the first is yet soft and plastic, so that the two become one. The workman never covers more than two or three superficial feet at one time, finishing it off

with the second coat as he goes along. The aggregate thickness of both coats should be about half an inch. It should be protected from the direct rays of the sun for some days, and kept moist by sprinkling with a hose or brush. Sometimes the first coat is replaced by a wash of thick cream of pure cement, put on with a brush just in advance of the mortar. Faithful workmanship is most essential in this kind of plastering. The mortar must be put on under a firm pressure with the trowel, in order to secure intimate contact with the wall, and the surface must not be too dry. Deficient adhesion will result from neglect of these precautions. When a cement is too dark to give an agreeable shade of color, a judicious use of white sand, common lime, and ochres, singly or in combination, may generally be depended upon to greatly lessen if not entirely remove the objection. After the stucco has been on a few days, and has become somewhat hard and dry, it should be carefully sounded all over with some small metal implement or a small piece of metal, such as a spike or a small tack-hammer, by which all spots destitute of adhesion will be at once detected by their hollow sound. At these places the coating should be removed, the surface roughened up and wetted, and another application of mortar made.

Certain precautions are indispensable to the durability of stucco upon the exterior faces of walls. In the first place, the sand used must be perfectly clean, and should therefore be washed, repeatedly if necessary, until it will no longer discolor clean water. If this is neglected, the vegetative powers of the earthy impurities will be brought into action in warm weather, and the beauty as well as the strength of the stucco will become impaired. But the most destructive agent to be guarded against is frost, or alternate freezing and thawing, when accompanied by the penetration of moisture between the stucco and the wall, which will inevitably result in throwing off the mortar. Hence the importance of securing intimate and continuous contact and adhesion over the whole surface. In well-trowelled and hand-floated work all the vertical surfaces will shed the water with sufficient promptness to prevent that degree of saturation which would be likely to receive injury from frost. The points to be specially looked to are at the eaves and gables, the projecting portions of a wall, and the jambs of windows and doors. A projecting roof will afford sufficient protection to the upper edge of the stuccoed surface. Where the stucco abuts against a projection like a sill or a lintel, the joint should be cleaned out to the depth of at least three-fourths of an inch, and the mortar firmly calked into it. At the jambs of openings extra care should be taken to secure close adhesion throughout, followed by a careful inspection by sounding and the renewal of all spots where the stucco has failed to unite with the wall.

Q. A. Gillmore.

**Stuhlweis'senburg,** town of Western Hungary, on a marshy plain, from which a considerable quantity of soda is extracted. It has several fine buildings, a gymnasium, a military academy, a Magyar theatre, manufactures of potash, leather, linen, and woollen fabrics, and extensive trade in oil, wine, corn, cattle, and wool. P. 22,683.

**Stuke'ley** (William), b. at Holbeach, Lincolnshire, in 1687; was educated at Cambridge; devoted himself to medicine; resided in London, and afterward at Grantham, where he acquired high reputation as a physician. Forced by attacks of the gout to abandon his profession, he took holy orders, and was in 1729 presented to the living of All Saints, Stamford, and in 1747 to the rectory of St. George-the-Martyr in London. He was a zealous and diligent, though often fanciful, antiquarian, and published, among other works, *Itinerarium Curiosum,* an account of the antiquities and curiosities of Great Britain (1724); *Palæographia Sacra,* relating to the monuments of antiquity bearing upon sacred history (1736); *An Account of Stonehenge* (1740); *Palæographia Britannica* (1743–52), and *The Medallic History of Carausius, Emperor in Britain* (1757). Of him Gibbon says, "I have used his materials and rejected most of his fanciful conjectures." D. in London in 1765.

**Stump Sound,** tp., Onslow co., N. C. P. 1515.

**Stump'town,** v., Taneytown tp., Carroll co., Md. P. 41.

**Stu'por** [Lat.]. Stupor or coma is that condition in which, when fully developed, the functions of the brain, so far as the mind is concerned, are entirely suspended, and the individual lies unconscious, breathing heavily, and without the power of voluntary motion. It may be induced by pressure upon the brain, as from a depressed piece of bone of the skull or the entrance of some foreign body, as a bullet; by a blow or fall, causing concussion of the brain or compression from extravasated blood; by the rupture of a blood-vessel, causing cerebral hæmorrhage; by the circulation of poisoned blood through the cerebral vessels, as occurs, for instance, when an over-dose of opium or alcohol has been taken. Stupor is to be distinguished from sleep, with which, though sometimes confounded, it has in reality little or no analogy. In the first place, stupor never occurs in the healthy individual, while sleep is a necessity of life. It is easy to awake a person from sleep, while it is often impossible to arouse him from stupor. In sleep the mind may be active; in stupor it is, as it were, dead. An increased amount of blood in the brain will cause stupor, whereas sleep is the result of a diminished quantity of blood in the cerebral tissue.

Stupor is a symptom of serious importance in various injuries and diseases to which the brain is liable. It may exist in all degrees of severity; and in the partial forms the subject is either not entirely unconscious, or, if so, may be roused by impressions made upon the organs of the special senses, though usually only for a short time. There is a form of stupor, met with in certain diseases of the brain, in which the individual, though unconscious, is nevertheless not altogether deprived of the power to think and to move the limbs. There is, in fact, a marked degree of restlessness, though the movements are, as it were, automatic, and the speech is incoherent. This condition is known as "coma vigil." It generally only occurs in cases of great gravity, and it indicates a fatal termination.

William A. Hammond.

**Stur'bridge,** p.-v. and tp., Worcester co., Mass., on Quinnebaug River, is noted for romantic mountain-scenery, has 2 cotton and 1 woollen mill, a tool-factory, 2 hotels, 3 churches, and 15 schools. P. 2101.

**Sturge** (Joseph), b. at Elverton, Gloucestershire, England, in 1793; was a member of the Society of Friends; in 1820 established himself as a corn-factor in Birmingham, where he acquired great wealth, and devoted himself especially to the abolition of slavery. With a special view to study the question of slavery, he visited the West Indies, and published *The West Indies in 1837* (1838); four years later he travelled in America, and published *Visit to the United States in 1841* (1842). D. at Birmingham May 1, 1859. His *Memoirs,* by Henry Richard, were published in 1864.

**Stur'geon** [Lat. *sturio;* Fr. *esturgeon*], the common English name applied to the species of the family Acipenseridæ. This family belongs to the super-order Chondroganoidei and order Chondrostei (see Fishes), and is a very natural group, having no near relations in the existing fauna. All the species have the body elongated and subcylindrical, or slightly compressed and tapering backward into a rather slender caudal peduncle; the skin is generally armed with minute osseous plates, as well as five rows of larger keeled bucklers, one dorsal, one pair lateral, and one pair on the sides of the abdomen; there is no well-defined lateral line; the head is produced into a more or less incurved and projecting snout, which is provided below with four barbels in a transverse row; the opercular apparatus is imperfect, but the operculum proper well developed; the nostrils are double, and in front of the eyes; the mouth is inferior, transverse, protractile, with fleshy lips, and of small size; teeth entirely wanting in the adult; branchial apertures mostly limited to the sides, the branchial membrane being attached below to the isthmus; branchiostegal rays none; fins all composed of numerous fine and closely-approximated rays, and the vertical with fulcra in front; the dorsal far behind, and short; the anal still nearer the tail than the dorsal; the caudal heterocercal—*i. e.* with the upper lobe prolonged and vertebrated; pectoral narrow and low on the scapular arch; ventral behind the centre of gravity. The skeleton is cartilaginous, and has numerous vertebræ. The stomach is not cæcal; the pyloric appendages are numerous; the rectum has a spiral valve; the air-bladder is large and simple, and communicates with the œsophagus through its upper surface; the gills are four in number, and in addition are two accessory gills. Species are found in all the temperate portions of the northern hemisphere. All breed in the fresh water, but some are residents of the sea part of the year, while others are permanent denizens of the lakes and rivers. They nearly agree, in fact, in distribution with the salmonids, save that they are less generally found in streams, on account of their larger size. There are two primary types—(1) *Acipenser,* which embraces several subordinate sub-genera or genera; and (2) *Scaphirhynchops,* of which only two species are known, one (*S. platyrhynchus*) confined to the Mississippi River and its tributaries, and another (*S. Fedtschenkoi*), lately described by Kessler (1872), from Toorkistan. The number of species of *Acipenser* is uncertain, Duméril (1870) recognizing over 80, while Günther (1870) admits only 19. The most common American species are the anadromous *A. brevirostris,* or short-nosed sturgeon, and *A. oxyrhynchus,* or sharp-nosed

sturgeon, which ascend the rivers of the Atlantic slope, and the fresh-water *A. rubicundus* of the great lakes and their tributary rivers. The sturgeons ascend the Hudson River in large numbers, and are called "Albany beef" near the head of navigation. Their flesh is reddish-colored, and is by some highly esteemed. Their eggs are often made into caviare; their air-bladders can yield a kind of isinglass; and a not bad oil may be expressed from them. They are the largest of fresh-water fishes, the *A. huso* sometimes exceeding the length of fifteen feet and the weight of 2000 pounds. (See also STERLET. For illustration see FISH.) THEODORE GILL.

**Sturgeon,** p.-v., Boone co., Mo., on North Missouri R. R., 130 miles N. W. of St. Louis, has 3 churches, a high school, 1 newspaper, 1 flouring-mill, 2 hotels, and a court-house. Principal business of neighborhood, stock-raising. P. about 800. THOMAS S. CARTER, ED. "LEADER."

**Sturgeon** (WILLIAM), b. at Whittington, Lancashire, in 1783; was apprenticed to a shoemaker, and subsequently enlisted as a private in the royal artillery. While in this position he began to employ his spare moments in scientific study and experiments, especially in the department of electricity; mastered the discoveries of Oersted, Faraday, Arago, and Ampère, and even made improvements upon the rotary cylinders of Ampère. In 1824 four papers on electricity were furnished by him to the *Philosophical Magazine,* and in 1825 he devised an improved electro-magnetic apparatus, for which the Royal Society awarded him a silver medal and a purse of thirty guineas. He was for many years professor of experimental philosophy in the East India Company's military academy at Addiscombe, and in the latter part of his life lecturer on science at the Royal Victoria Gallery, Manchester. D. at Manchester in Dec., 1850.

**Sturgeon Bay,** p.-v. and tp., Door co., Wis., located on an arm of Green Bay, 2 miles from Lake Michigan, contains 3 churches, good schools, 2 newspapers, 5 hotels, and 2 saw-mills. P. 690. Sturgeon Bay, on which it is situated, is 8 miles long by 2 miles wide, and affords an excellent harbor for the largest vessels.

H. HARRIS, ED. "DOOR CO. ADVOCATE."

**Stur'ges** (JONATHAN), b. at Southport, Conn., Mar. 24, 1802; came to New York in 1821; entered as clerk in a mercantile house, in which he became a junior partner in 1828, and senior partner in 1836, remaining until 1868, when he retired from business with a large fortune. He was a director of the Illinois Central R. R., the success of which was in a great measure due to his exertions. During the civil war he gave his earnest support to the national government; was president of the Union League Club in 1863, and was subsequently prominent in the measures to break up the "Tweed Ring" and inaugurate a municipal reform in the city of New York. He was active in religious movements, and gave largely for philanthropic and charitable purposes. D. at New York Nov. 28, 1874.

**Stur'gis,** p.-v. and tp., St. Joseph co., Mich., at the junction of Lake Shore and Michigan Southern and Grand Rapids and Indiana R. Rs., has 6 churches, a union school, 2 banks, 1 newspaper, 2 hotels, and several manufactories. P. of v. 1768; of tp. 2306.

A. H. WAIT, ED. "JOURNAL."

**Sturgis** (SAMUEL DAVIS), b. at Shippensburg, Pa., in 1822; graduated at West Point 1846; served as lieutenant of dragoons in the Mexican war; was made prisoner while on a reconnoissance just before the battle of Buena Vista; subsequently served in California, New Mexico, and on the frontiers, and was made captain in 1855. At the breaking out of the civil war he was in command of Fort Smith, Ark.; all his officers resigning, he abandoned the fort, thus saving his command and most of the material. In May, 1861; was made colonel of cavalry, serving in Missouri; in August a brigadier-general, and assigned to the Army of the Tennessee, afterward to the command in Kansas, and in 1862 to that of the fortifications at Washington, subsequently serving in the field at the battle of Fredericksburg and in the South and West; in 1865 he was brevetted brigadier-general and major-general. His rank in the regular army is colonel of cavalry.

**Sturleson** (SNORRE). See SNORRE STURLESON.

**Sturm's Method,** or **Sturm's Theorem,** a method for the determination of the number of real roots of a numerical equation which are included between given limits, discovered by J. C. F. Sturm (1803–55), and embodied in a memoir read to the French Academy of Sciences May 23, 1829.

**Sturt** (Sir CHARLES), b. in England early in the present century; entered the army at an early age, and in 1825, having reached the rank of captain, was stationed at Sydney, New South Wales. In 1828 he was the leader of an expedition organized by government to explore the unknown region of the interior of Australia, during which he discovered the Macquarie, Castlereagh, and Darling rivers, and soon after led another expedition which explored the course of the Murrumbidgee River, and in June, 1830, discovered the great Murray River, which he followed to its mouth in Lake Alexandrina, returning early in 1831. In 1844 he undertook a still more difficult journey, penetrating to the great stony desert nearly in the centre of the continent, and upon his return was made register-general and subsequently colonial secretary of South Australia. In consequence of his exposure in these expeditions he became totally blind, and returned to England, where he was knighted a short time before his death. He published *Two Expeditions into the Interior of Southern Australia in 1828–31* (1833) and *Narrative of an Expedition into Central Australia in 1844–46* (1849). D. at Cheltenham June 16, 1869.

**Stur'tevant** (JULIAN M.), D. D., b. at Litchfield, Conn., in 1805; became professor of mathematics, and in 1844 president of Illinois College, a position which he still retains. He has contributed through the *Biblical Repository, New Englander,* and other journals largely to the theological literature of the day, and published a lecture on *The Present Attitude of England toward the United States* (1864).

**Stutsman,** county of Dakota, formed since the census of 1870. Cap. Jamestown.

**Stuttering.** See STAMMERING, by W. A. HAMMOND, M. D.

**Stutt'gart,** capital of the kingdom of Würtemberg, with 107,273 inhabitants in Dec., 1875, is in a charming valley among hills covered with forests and gardens, and is regularly and beautifully built. The Altstadt, occupying nearly the centre, and grouped around the market-place, contains several small and narrow streets, but the new parts of the city, mostly erected during the nineteenth century, and surpassing the Altstadt twelve times in extent, have broad and beautiful streets and symmetrical squares. The most prominent point is the palace square, ornamented with gardens and fountains, containing the jubilee column, 16 mètres high, and surrounded with magnificent buildings. Among these the new palace is the most remarkable—a very handsome structure, with two projecting wings, the central building bearing an immense gilded crown and containing 365 rooms rich in art-works by Dannecker, Gegenbaur, Thorwaldsen, and others. To the right of this edifice stands the old palace, built 1553–70, a gloomy castle with towers and pinnacles, but containing a beautifully-painted chapel and large halls, the curious Reitschnecke, a spiral horse-path giving access to the third floor, and in the court the equestrian statue of Eberhard, the first duke of Würtemberg. In the left wing of the new palace is the royal theatre, finished in 1846, and opposite the palace is the Königsbau, a beautiful structure with an Ionian colonnade, built by Leins 1855–59, and containing numerous shops, elegant cafés, a concert-hall, and other assembly-rooms. Near the palace square is the new dépôt, an immense building, with a tasteful portal on columns, large, beautiful halls, and rich interior ornamentation; and opposite this is the new post-office, also an elegant structure. In the rear of the old palace is the Schiller Square, containing the statue of the poet, the immense building of the palace of the princes, and the parish church, erected 1436–90, and restored in 1841 by Heideloff. One of the most beautiful and most important streets is the Neckar-strasse, running from the palace square in a north-eastern direction, and containing the museum of natural science with a rich collection of mammals; the national library, comprising 300,000 volumes, 130,000 pamphlets, 3600 manuscripts, 2300 incunabula, and a collection of 8700 Bibles in 89 different languages; the museum of art, containing an art school and collections of paintings and statues, etc. Nearly parallel with the Neckar-strasse runs the Königs-strasse, traversing the palace square, dividing the city into two parts, an eastern and western, and containing the royal stables with many noble horses; the royal central hall for commerce and industry, with a good library and a very complete collection of native and foreign industrial products, models, fabrics, machines, etc. Other remarkable buildings are the museum for Würtembergian antiquities, the polytechnic school, the new market-hall; and among the churches, the Leonhard's church, Johannis church, a Roman Catholic and a new English church, and the magnificent synagogue. The finest promenade is the palace garden, a park with lakes, fountains, statues, etc., stretching from the palace for a distance of about 2 miles. In the vicinity are the royal summer palaces, Solitude, Villa Rosenstein,

Wilhelma, and the Villa, and the charming town of Cannstadt on the Neckar, with 12,000 inhabitants, much frequented as a bathing-place, connected with the city by a railway, and reached in eight minutes. The industry in woollen manufactures is important; a wholesale cloth-fair is annually held in August. The manufactures of pianofortes, carriages, chocolate, sugar, and machinery are also considerable. The commerce of the city is extensive; the book and art trade are especially important. The name *Stuttgart* first occurs in history in 1229. The city was held by Austria from 1519 to 1534, and occupied by Alba in 1546 in the Schmalkaldian war. In the period from 1634 to 1638 one-half of the inhabitants died (8810) from the plague. In the wars of Louis XIV. it was three times taken by the enemy; also several times during the wars of Napoleon. AUGUST NIEMANN.

**Stutt's,** tp., Lauderdale co., Ala. P. 1028.

**Stuy'vesant,** p.-v. and tp., Columbia co., N. Y., on Hudson River and Hudson River R. R. P. 2263.

**Stuyvesant** (PETER), b. in Holland in 1602; served in the West Indies; was director of the colony of Curaçoa; lost a leg in an attack upon the Portuguese island of St. Martin; returned to Holland in 1644, and in 1647 was made director-general of the New Netherlands, retaining the position till 1664, when the colony fell into the hands of the English, who changed its name to New York. Upon his arrival at New Amsterdam (now the city of New York) in May, 1647, he made peace with the Indians, whom his predecessor had provoked to hostility, and in 1650 went to Hartford, Conn., where he arranged with the English commissioners the boundary-line between the Dutch and the English possessions in North America. In 1651 the Dutch had built a fort on Delaware River, then called the South River, in distinction from the Hudson, or North River, which the Swedes claimed to be an encroachment upon their rights; and in 1654 the Swedish governor Rising took possession of the fort, which occupied the site of the present Newcastle. In 1655, Stuyvesant sailed for the Delaware with seven vessels conveying 600 or 700 men, recaptured the fort, and took possession of the entire colony of New Sweden. For nearly ten years there was no trouble from abroad, but discontents had sprung up against the arbitrary administration of the Dutch West India Company. In 1653 a convention of two delegates from each settlement in the colony assembled and demanded that obscure and obsolete laws should not be revived, and that no officer should be appointed except with the approbation of the people. Stuyvesant replied that the magistrates derived their authority from God and the Dutch West India Company, and not from a few ignorant subjects, and ordered the convention to disperse under pain of condign punishment. The embers of discontent, however, still smouldered, and the governor and the people were on ill terms. The English colonies in New England, in spite of the repeated remonstrances of the governor, began to encroach upon the boundaries of New Netherlands. In 1664, Charles II. of England issued a charter to his brother, the duke of York, afterward James II., bestowing upon him all the country between the Hudson and the Delaware, including New Netherlands, as well as some territory which had previously been granted to the New England provinces. In August of that year, although England and Holland were at peace, Col. Nicolls, with an English fleet, appeared in the bay and demanded the surrender of New Amsterdam. Stuyvesant at first refused, but the municipal officers, seeing little hope of successful resistance, and having no very warm attachment to their Dutch masters, insisted that he should yield, and the town was surrendered Sept. 3, 1664, and its name changed to New York—a designation soon extended to the whole province of New Netherlands. Stuyvesant went to Holland the next year to render an account to his superiors of his administration and the loss of the colony, but returned soon after, and passed the remaining eighteen years of his life at his farm, called the *Bouwerij,* which has given its name to the present street called the Bowery, then a quiet country-road, long afterward known as Bowery Lane, which ran past it. A pear tree which he had brought from Holland in 1647, and planted in his garden, was standing at the corner of Thirteenth street and Third avenue and bore fruit until about 1860. He was buried in the vaults of a chapel which he had built at his own expense upon his farm, and dedicated according to the ritual of the Reformed Dutch Church. Its site is now occupied by the Episcopal church of St. Mark's in the Bowery, and the stone which had been placed over his grave is built into the eastern wall of the church. The inscription reads: "In this vault lies buried Petrus Stuyvesant, late captain-general and commander-in-chief of Amsterdam, in New Netherlands, now called New York, and the Dutch West Indies. D. in Aug., A. D. 1682, aged eighty years." A. H. GUERNSEY.

**Sty** [Ang.-Sax. *stigend*], (*hordeolum*), a small boil which occurs on the edge of the eyelid. It should be treated with a warm-water dressing or light wet poultice; after the discharge of a little pus and a slough, it usually gets well at once. If there be a long succession of sties, as sometimes happens, iron and quinia, with occasional mild laxatives, will be useful.

**Style, Old and New.** See CALENDAR, by PRES. F. A. P. BARNARD.

**Stylites,** or PILLAR SAINTS (which see).

**Stylites, St. Simeon.** See SIMEON STYLITES.

**Styptics.** See BLEEDING.

**Styraca'ceæ** [*i. e.* the storax family; from the typical genus, *Styrax*], a small order of trees and shrubs, exogenous and gamopetalous, diplostemonous or polyandrous; the stamens commonly monadelphous or polyadelphous, and adnate to the base of the corolla; the calyx more or less adnate, and the seeds few and large, with a bony coat; the leaves alternate and simple. Mainly tropical or subtropical, Asiatic and American, but with several representatives in the U. S. Two species of *Halesia,* the snowdrop tree, not rare and much prized in ornamental cultivation, grow wild from Virginia to Florida. Our species of *Styrax* are handsome flowering shrubs, but unimportant. Other species yield fragrant gum-resins containing benzoic acid and some aromatic principles. Storax exudes from wounds of the trunk of *Styrax officinale* of Syria, benzoin from *S. Benzoin* of Java, etc.; both are used for incense in the Latin and Greek churches; benzoin also in the preparation of paregoric, in the cosmetic called "virgin's milk," and formerly was an article of considerable repute in medicine. Benzoin in English commerce is called gum-benjamin. The leaves of *Symplocus tinctoria* (called sweet-leaf) are used in Carolina for dyeing yellow. ASA GRAY.

**Styrax.** See STYRACACEÆ.

**Styr'ia** [Ger. *Steiermark*], province of Austria, bounded N. by Upper and Lower Austria, E. by Hungary, S. by Croatia, and W. by Illyria. Area, 8658 sq. m. P. 1,137,990, of whom 710,000 are of German and 427,000 of Slavic descent. With the exception of the southern part, where there are some plains, on which and in the valleys are raised wheat, though not enough for home consumption, maize, tobacco, flax, hemp, wine, and fruit, the whole province is mountainous, and cattle-rearing, dairy-farming, mining, and manufactures of metallic wares are the principal branches of industry. The Noric Alps cover the surface between the Ens and the Mur; the Styrian Alps, between the Mur and the Drave; and the Carnic Alps, between the Drave and the Save. These mountains rise to a height of between 7000 and 8000 feet, and are rich in iron, copper, salt, alum, marble, and coal: 516,136 cwts. of iron, 404,986 cwts. of coal, 160,000 cwts. of salt, 4145 cwts. of alum, 1047 cwts. of copper are annually raised, besides some lead, silver, gold, zinc, and vitriol. Cap. Grätz.

**Styx** [Στύξ, "the Hateful"], in the Greek mythology, was a river of Hades which flowed nine times around the lower world. At the entrance to Hades was the abode of the nymph or goddess Styx, by whom the most solemn oaths of the gods were sworn.—STYX was also the name of the highest waterfall in Greece, near Nonacris in Arcadia. The ancients, like the modern residents of the vicinity, considered its waters fearfully poisonous, and it was believed that no vessel could hold any of it unless made of the hoof of an ass or horse. The ancients associated this waterfall with the mysterious Styx of the lower world.

**Suabia.** See SWABIA.

**Suak'im,** town belonging to Turkey on a small island in the Red Sea, near the African coast, in lat. 19° 10′ N., is important as a station for the pilgrims passing from and to Africa. P. about 8000.

**Suam'ico,** p.-v. and tp., Brown co., Wis., on Green Bay. P. 1074.

**Sua'rez** (FRANCISCO), b. in Granada, Spain, Jan. 5, 1548; entered the order of Jesuits at an early age; became professor in succession at Alcalá, Salamanca, Rome, and Coimbra. He was a voluminous writer; his complete works, filling 23 folio volumes, were published at Mentz and Lyons (1630 *seq.*); new editions at Venice in 1640, and at Besançon in 1856–62. His *Defensio Fidei* (1613) was ordered by the Parliament of Paris to be burned, because it maintained that the pope had power to coerce kings. D. in Lisbon Sept. 25, 1617.

**Suber'ic Acid** [from the Lat. *suber,* which designates both "cork" and the "cork tree;" Ger. *Korksäure*]. The name was originally due to the fact that this acid was first obtained by the action of nitric acid on cork. Fats generally, however, yield it by the same treatment, and it is by no means a characteristic product of cork. Suberic

acid is a homologue of oxalic and succinic acids, and its general characters are those of that dibasic family of acids. Its empirical formula is $C_8H_{14}O_4$, and its rational constitution is most likely $O_4.C_2.6H_2C.H_2$, the last $H_2$ being metalloidal or basic, and replaceable by one metallic dyad or two metallic monads, while the other twelve equivalents of H, being enclosed in the radical or *homologen* molecules (see HOMOLOGY and VOLUMES, MOLECULAR), are not thus replaceable. To obtain suberic acid free from the other acids produced by the action of nitric acid on fats, the mixed product is treated with cold ether, in which this acid is almost insoluble. It is necessary, however, to purify it further by recrystallization. It may be obtained in large needles, which sublime like oxalic acid. It is sparingly soluble in cold, but easily in boiling water, and soluble in alcohol. Density not recorded as yet, so that its molecular volume cannot be compared with that of oxalic acid—a comparison which, when possible, will give us, by simple difference, the volume of the six homologen molecules present. HENRY WURTZ.

**Subia'co** [anc. *Sublaqueum*], town of Italy, province of Rome, about 44 miles E. N. E. of the city of Rome. It derived its name from its situation below a villa belonging to Nero, in the grounds of which were three lakes. The town stands on a hill on the right of the Teverone, which is overlooked by the Simbruini chain. The views from this town, and especially from the ruins of Nero's villa, 1½ miles higher up the river (where, Tacitus tells us, the table at which the emperor was feasting was once overthrown by lightning), and from the still more elevated monastery of St. Benedict, are of surprising beauty, and draw hither, in spring and early summer, artists from all parts of Europe. The fine old castle, with all its historic associations, the picturesque waterfalls, the grand old monasteries, the superb forests of the neighborhood, all unite to charm the eye and the imagination. Even the dark and gloomy interior of the town pleases the traveller from its mediæval air. The monastery of Santa Scolastica (founded in the fifth and restored in the tenth century) contains much that is worthy of notice, architecturally and otherwise; its once-celebrated library, so rich in MSS., is now dispersed, but it is still remembered with interest as the place where the printing-press was first used in Italy, a *Donatus* and a *Lactantius* (1465) being the first issues. The monastery of St. Benedict, the first founded by the saint himself, was rebuilt in 817; the churches connected with it are of the eleventh, twelfth, and thirteenth centuries, but all are very curious. The modern town is of no special interest. P. 7367.

**Sub'lette,** p.-v. and tp., Lee co., Ill., on Illinois Central R. R. P. 1300.

**Sublimate.** See SUBLIMATION.

**Sublima'tion** [Lat. *sublimatio*]. This is a chemical process of separation and purification, applicable only occasionally in cases in which a volatile substance condenses or crystallizes from the condition of vapor directly to the *solid* condition, and not to the usual liquid form. In such cases this method of obtaining bodies in pure and crystallized form is highly convenient and valuable. Among the more important substances to which this method is applicable are *sulphur, iodine, vermilion, corrosive sublimate, calomel, salts of ammonia, arsenious oxide, oxalic, benzoic, succinic, and pyrogallic acids, camphor, caffeine,* etc. As, while in a state of vapor, those substances which volatilize at low temperatures will readily pass through porous diaphragms like paper, it is often convenient to cover the lower vessel, containing the substance to be volatilized, with paper, which will prevent the crystals that condense in the head or upper inverted vessel from falling back and causing waste of time. In cases of bodies requiring high temperatures wire-gauze screens may be employed in the same way. H. WURTZ.

**Sublime'** [Lat. *sublimis*], **The.** Contradistinguished from the beautiful, which charms and attracts us, the sublime awes us, moves us with a feeling of pleasure mixed with fear. The sublime in nature is usually found in the boundless expanse of the ocean, in the resistless might of its waves when moved by a storm, or more frequently in the thunderstorm with its threatening look, its vivid and destructive lightnings, and its deafening crashes of thunder. But still more adequate is the manifestation of the sublime in instances of moral heroism—in deeds of daring and self-denial; the sublime in art has most frequently made use of this phase. Kant in his *Critique of the Judgment* (§ 23–53) has given the first thorough and systematic treatment of the sublime. According to him, "while the beautiful in nature appertains to the form of an object—hence to its circumscribed limits—the sublime, on the contrary, is to be found also in formless objects: a want of limitation attaches to it. It is, however, represented as a whole, and not as something merely fragmentary. The beautiful may therefore be regarded as the portrayal of an idea of the understanding (not a mere concept), but the sublime is rather the portrayal of an idea of the reason, which from its nature cannot be adequately represented by material things." "The pleasure of the beautiful appertains to the quality of an object, while the sublime is manifested chiefly in the quantitative aspect of it." "To the charm of the beautiful there is frequently joined a sportiveness, but the sublime is always earnest." "The sublime in its proper form is not presented in a sensuous manner, but concerns only ideas of the reason, whose very incommensurability with sensuous forms, being exhibited, stirs the heart." "The beautiful pleases us immediately, but in its presence we feel disinterested; the sublime pleases us, but through its hostility to our sensuous interests." Cousin (*On the True, Beautiful, and Good*, lecture vii.) says: "A beautiful object is something completed, circumscribed, limited, which all our faculties easily embrace, because the different parts are on a somewhat narrow scale. A sublime object is that which, by forms not in themselves disproportional, but less definite and more difficult to seize, awakens in us the sentiment of the infinite." Hegel (*Æsthetics*, 2d part, div. i. chap. ii.) makes the sublime a province of symbolic art, whose chief function is to portray the purification of spirit and its separation from the world of sense and all visible existence. "The highest principle is regarded as existing apart by itself, and as incapable from its very nature of finding adequate expression in the finite appearances of the real world." "The sublime arises in an attempt to express the infinite without finding in the domain of visible phenomena an object capable of representing it. The infinite elevates itself above particular existences, considered either in themselves or in their totality; they are as nothing before it; and the positive relation which sensuous objects have to the beautiful, in the sublime changes to a negative relation which is more in conformity to the divine nature. God is thus represented as purified of all contact and participation with visible appearance." "In the Orient, in India, the One, or Substance, is conceived as immanent in contingent existences created by it; they are portrayed as mere instruments of the divine power, or as mere ornaments for the display of the glory of the Absolute." In the *Bhagavat Gita* (ch. xi.) the vision of the Universal Form of Vishnu furnishes us the highest example of this phase of the sublime. The speech of the *Erd-Geist* in Goethe's *Faust* is an example quite similar in form and content. In Hebrew poetry Hegel finds the highest realization of the sublime: "Jehovah is not 'immanent' in nature but 'transcendent'—lord over the universe—and in his presence the entire creation is devoid of power and sinks into nothingness. The grandeur of the Lord is revealed by the fact that the real world, with all its splendor, pomp, and magnificence, is a mere accident, an instrument, an ephemeral appearance in comparison with the eternal and immutable Being. In the 104th Psalm, God is represented as covering himself with light as with a garment, and as stretching out the heavens like a tent. 'He layeth the beams of his chambers in the waters; he maketh the clouds his chariot; he walketh upon the wings of the wind; he looketh on the earth, and it trembleth; he toucheth the hills, and they smoke. He laid the foundations of the earth, that it should not be removed for ever.' In the psalm of Moses (Ps. xc.) the finitude of man furnishes the contrast which makes the portrayal of the omnipotence of God sublime." For genial essays on this subject the reader is referred to the writings of Burke, Dugald Stewart, and Addison. The famous treatise of Longinus (Περὶ Ὕψους) should not be omitted. WILLIAM T. HARRIS.

**Sublime Porte.** See PORTE.

**Subluxation.** See SPRAIN.

**Submarine Blasting.** See APPENDIX.

**Submarine Forests.** See FOSSIL BOTANY and FOSSIL FORESTS, by PROF. J. S. NEWBERRY, M. D., LL.D.

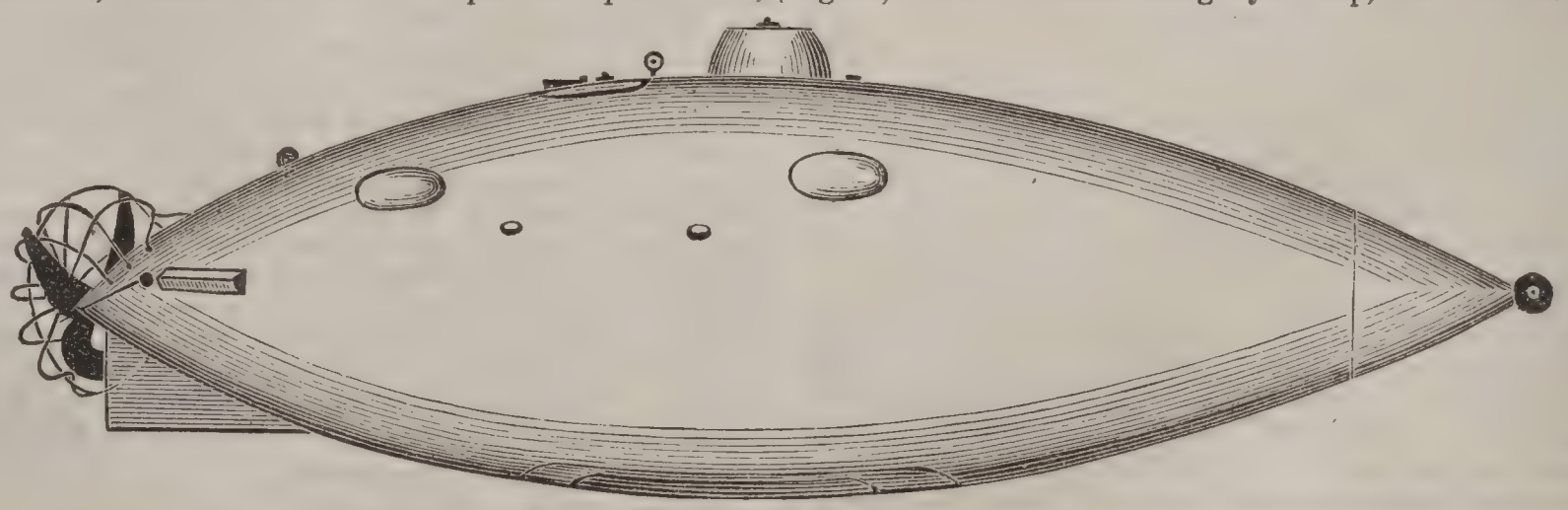
**Submarine' Naviga'tion,** the art of navigating a submerged vessel. It has been said that man, who was created to live on the surface of the earth, is impelled by thirst of adventure to dig into its bowels, search the depths of its waters, and to raise himself into the clouds. These desires, which date from the most remote times, are further stimulated by the necessities of warfare. Divers were employed at the siege of Syracuse to remove the barriers placed below the surface of the water to obstruct and damage the Grecian vessels which might attempt to enter the harbor. The Syracusans trained persons for the same purpose, and for getting beneath and injuring the enemy's vessels. But as the diver, unaided, cannot usually remain under water more than one minute, and never more than two and a half or three minutes, nor descend to a greater depth than 12 to 20 fathoms, his ingenuity must soon have led him to devise means for prolonging his stay beneath

the water. It is probable that observation of the instinctive action of the elephant, in raising his trunk when swimming across lakes and rivers, first suggested the idea of an air-tube with a floating funnel attached. It is also very probable that the ancients, who built many subaqueous works, such as foundations of piers, bridges, and the like, had some contrivance like the diving-bell, and means for furnishing the workman with air. Finally, the moderns, by the use of an impermeable dress, a regulated supply of air, and the aid of the submarine lamp, remain under water three or four hours, and execute any class of work. All of these contrivances, however, confined the operations of the diver to a limited area and moderate depths, which may be termed submarine exploring.

In submarine navigation, of which authentic accounts do not date more than a couple of centuries, it is requisite that the course shall be held in any direction and at any depth, and with no communication with the surface except at long intervals. To accomplish these objects it is necessary (1) that the boat shall be of sufficient displacement to carry the necessary machinery for propulsion, also men and materials to perform the desired operations; (2) of such form as to be easily propelled and steered; (3) to have space for the crew to operate; (4) to carry a sufficient supply of pure air to support life, or to have means of purifying it and exhausting the foul air; (5) to be able to rise and fall at will to a determinate depth, either when stationary or in motion; (6) to allow the crew to enter or leave the boat without external assistance; (7) to have sufficient light within to see to steer a given course and perform necessary operations; (8) to be of a sufficient strength to prevent collapse at the depth to which it is necessary to descend.

The displacement necessary to transport an individual from place to place is small, but to overcome tides and currents, and have room for air, either condensed or at normal pressure, requires a capacious interior. Manual-power for propulsion applied by oars or paddles, and in later times by the screw, was naturally the first method; but this is exhausting labor in a confined space, and the insufficient speed soon urged inventors to devise mechanical methods. Compressed air has obvious advantages, since it may be used for propelling and afterward for respiration. Electric engines, liquid carbonic acid, ammonia, and even steam, have been proposed and experimented with. In using steam it has been proposed to raise it in the usual manner above water, and when about to submerge to draw fires and use the steam from the heated water, as in the well-known fireless boiler. A symmetrical figure is obviously of less resistance, steers with greater facility, and for these reasons a circular spindle or cigar shape has been adopted by most inventors. All projections on the surface diminish speed. Head-room is requisite to permit the crew to occupy comfortable positions. To merely support life, 520 cubic inches of air per man per minute are required; but the air is further vitiated by carbonic acid exhaled and animal impurities. A supply of compressed air may be carried in suitable tanks, and the foul air permitted to escape by a cock in the upper part of the boat, the carbonic acid being removed by washing the air with a fine spray or absorbing it by suitable chemicals. The same air may continue respirable by supplying the exhausted oxygen from a receiver, and destroying the animal impurities by the introduction of ozone produced in various ways. The displacement of the vessel, with all its permanent weights attached, must obviously be greater than its bulk of water. Therefore, to sink it when stationary, water must be admitted into some of its compartments; this may be done either by pumping in water or by allowing the air to escape and be replaced by water. Provision must be made for automatically adjusting and preserving the boat's horizontality, for when wholly submerged and at rest it is in a state of unstable equilibrium. To rise, the water must be pumped or forced out by compressed air. In motion the boat is made to descend or rise at will by the use of diving-fins or rudders. The depth is ascertained by water-gauges. Since the ultimate object of the voyage is either the exploration of the bottom of the sea, of wrecks, or attacking an enemy, some independent mode of entrance and exit should be provided both at the top and bottom of the vessel. For the former, a simple circular or oval manhole, covered with a plate secured from within, is usually adopted; but a small telescopic or tubular turret, to be raised or lowered at will, has been devised to furnish when raised a lookout when the boat is at the surface, and prevent it from swamping in rough water if necessary to open the manhole. Lowered within the hull, it shows no external projection. In the bottom large traps can be opened to permit the occupants to examine the bottom beneath, and divers to issue forth to explore wrecks, lay or remove submarine mines, or attach torpedoes to the bottom of a vessel. Some means of anchoring the boat must also be provided. Light penetrates the sea to but a limited depth, and but a small portion can reach the interior through bull's eyes. Candles consume too much of, and vitiate, the air; the electric light, on the whole, appears preferable, since by the production of ozone it also purifies the air. A feeble light, sufficient to observe the water-gauges and compass, may be produced by phosphorized oil. The water-pressure tending to collapse the sides, a circular spindle is the best form to resist external pressure.

Many plans have been presented, which in a more or less complete manner accomplish these objects. First, as most complete, is the Plongeur of Admiral Bourgois and M. Brun, fully described by Admiral Paris in his report on naval affairs at the Paris Exhibition of 1867. Second, a boat in possession of the U. S. navy department, now lying at Brooklyn navy-yard, called the "intelligent whale" (see figure). She is 26 feet long by 9 deep, has a centre and



Intelligent Whale.

bilge keel; propelled by four men; two small tanks contain compressed air; two large tanks, at bottom, contain water for sinking the boat, and communicate with the air-tanks and with the water outside of the boat; steering-rudders and diving-fins are provided; also an iron cupola, having bull's eyes in it for the lookout. A compass to indicate the course, a water-gauge to show the depth, and an air-gauge to show the pressure of air in the boat, are provided; rectangular valves for entrance or exit through the bottom. There is also a circular opening on top. An apparatus is provided for spraying water through the air when it becomes foul, and escape-valves are placed in the top of the boat for the escape of foul air. The water-tanks are filled for sinking the boat by opening a valve, and can be emptied by pumps or forced out by compressed air. Two 15-inch shot are fitted for anchoring with wire rope cables working through water-tight stuffing-boxes. This boat will hold thirteen persons, and has been tried with that number of persons on board. For a short time she can make a speed of 4 miles an hour. To sink, admit water into the bottom tanks until the boat sinks below the surface; the men at the cranks propel the boat, and the man at the lookout works the diving and steering rudder until the proper depth is reached. Having reached the desired position, the boat is anchored, and air let from the tanks into the boat until the air-gauge shows a pressure greater than the water-pressure for that depth. The bottom valves may then be opened, and a diver pass out. Wishing to rise, this valve is closed, communication is opened between the air- and water-tanks, water is driven out, and the boat rises.

It is apparent to the writer that while short voyages can be performed, and a certain time be spent beneath the water, successful submarine navigation is a chimera. The difficulties of navigation on the surface in a dense fog, even when guided by a compass, are familiar to most persons; but when the fog assumes the density of water, the difficulties are increased tenfold. In fact, with the insufficient speed given to a body wholly submerged it becomes impossible to direct a vessel upon a given object. It is probable that the most successful application of this principle will

be that adopted in the construction of the "fish torpedo-boat" used during the civil war by the Confederates at Charleston, a cigar-shaped boat of galvanized iron, about 35 feet long, 3 feet wide, and 5 feet high in the middle. It was propelled by a screw worked from the inside by seven or eight men. It had two manholes, which could be tightly closed from the inside, when it contained air enough for two or three hours' submersion. It had outside two fins, which caused it to rise and fall when in motion. The manholes were provided with bull's eyes to permit seeing in every direction. The intention of the designer was that it should move to attack just awash, and on approaching an enemy dive, dragging a floating torpedo behind it which should explode as it struck the bottom of a ship under which the fish had passed. While practising to pass under a large receiving-ship in Charleston harbor, it went down with such velocity that it stuck its bow in the mud, and could not rise again by any efforts of its crew. Before it could be found and raised, all on board were asphyxiated, Mr. Hunley, the owner, being of the number and in charge. The same boat afterward, in 1864, sunk the U. S. S. Housatonic with a pole torpedo, but was drawn into the hole occasioned by the torpedo, went down, and drowned the crew. (This information is derived from a letter of Gen. Beauregard to Gen. J. G. Barnard, U. S. corps of engineers, and by him communicated to the writer.) W. N. Jeffers.

**Subpœ'na** [Lat. *sub*, *pœna*, "under a penalty"], in law, is a writ or process by which either parties or witnesses are compelled to appear in court or before a judicial officer and answer or testify, as the case may be, under a penalty for their disobedience. There are several different kinds of this writ. In the courts of chancery it was for a long time the ordinary process issued upon filing a bill of complaint, for the purpose of procuring the defendants to appear and answer. This use, however, was abolished in England some time before the recent consolidation of the law and equity courts and procedure, and the defendant in a chancery suit was simply served with a copy of the bill, and with a notice or summons endorsed thereon or accompanying the same. The common species of subpœna now used in all the courts, civil and criminal, is the subpœna *ad testificandum*, for the purpose of ordering witnesses to attend upon a trial or other judicial examination, and to give their evidence thereat. It generally purports to be issued by the court, to be signed by its clerk, and sealed with its seal, but in reality, according to the loose practice prevailing in many States, it is issued by the attorney. It commands the person to whom it is addressed to lay aside all excuses and pretences, and to appear before the court or officer at the time and place mentioned, and testify on behalf of the party issuing it, under a penalty in case of a neglect to comply with the order. A variety of this species is termed the subpœna *duces tecum*, and contains an additional clause directing the witness to bring with him into court certain books, papers, etc., in his possession which may be useful as evidence. Both these forms are compulsory; the witness must obey the mandate, and it is for the court alone to decide whether his evidence or the documents he is ordered to produce are material and proper. If the witness violates the command, an action for damages may be maintained against him by the party who is materially injured by his default. The subpœna is served by exhibiting the original to the witness and delivering to him a copy thereof, and paying him his lawful fees for travel and for attendance. Both the subpœna *ad testificandum* and the subpœna *duces tecum* may be used by committees of legislatures and other *quasi* judicial bodies lawfully constituted for the purpose of carrying on investigations, as well as by courts and magistrates.

John Norton Pomeroy.

**Subroga'tion** [Lat. *subrogare*, to "substitute"], in law, is the substitution of another person in the place of an original creditor, to whose rights and remedies, in respect of the debt and against the debtor, the party thus substituted becomes entitled. The doctrine of subrogation was borrowed from the Roman law by the courts of equity, and is now to some extent recognized and enforced by the courts of law; it is, however, a part of the equity rather than of the common-law jurisprudence. Although the substitution of one creditor for another may be effected by contract, yet the most important cases, and those to which the term "subrogation" is technically applied, result immediately by operation of the law itself from the performance of certain acts which modify the prior relations of all the parties interested. It may be stated, as a general principle, that whenever a person *secondarily* liable for a debt pays the same, the demand is not thereby absolutely discharged, but he at once and by operation of the equitable doctrine succeeds or becomes subrogated to all the rights, remedies, and securities which the creditor held against the debtor primarily liable, and may enforce the same as a creditor against such debtor in order to reimburse himself for the outlay which he has made on behalf of that party. The following are some of the most common and important instances which result from an application of this general principle to different facts and circumstances: (1) When a junior mortgagee pays the debt due to a prior mortgagee of the same land, he becomes entitled to the prior mortgage, is regarded as its equitable assignee, and can compel its actual assignment to himself. The rule applies to all cases where a junior creditor pays the demand of a prior creditor; he succeeds to the latter's claim and is entitled to all the securities held for its enforcement. (2) When one of several joint debtors pays the entire demand, he is entitled to a contribution from the others for their respective shares, and acquires the rights and securities of the creditor against them. (See Contribution.) (3) The principle is most frequently applied in the case of the surety who pays the demand primarily owing by his principal debtor. He is entitled to recover their contributory shares from his cosureties, if any, and the entire amount which he has advanced from his principal. To aid him in enforcing these rights, he is entitled to hold and use all the collateral securities given by the principal debtor to the creditor. For example, if as such surety he pays off a mortgage-debt, he is an equitable assignee of the mortgage itself. If the creditor has recovered a judgment against the principal and surety, or against the principal alone, and the surety pays the demand, he is not only entitled to hold this judgment, but he is permitted to enforce it by execution against the principal. (See the articles Suretyship and Substitution.)

John Norton Pomeroy.

**Subscrip'tion,** a legal term denoting a contract by which a person agrees with others to furnish a definite sum of money for a common object. The validity of this class of contracts is of difficult enforcement in the courts, owing to a usual indefiniteness in the statement of the conditions and the lack of evidence of any valid consideration for the promise. Subscriptions for charitable objects have, however, frequently been enforced when their objects are clearly expressed in the paper.

**Subsist'ence of Ar'mies.** In densely-peopled countries there will almost always be found such a superfluity of supplies beyond the immediate requirements of the population that a great army may subsist upon the country; yet even here the bringing of supplies to a considerable body of men is one of the highest problems of the art of war, for an interruption in the operations of the commissariat department must in a very few days dissolve the bravest and best disciplined army. This difficulty is greatly enhanced when an army is on the march, and as a soldier cannot carry upon his person food for more than about a week, provisions and supplies must be sent after the marching body by means of convoys; and these are always a special object of attack by a vigilant enemy, and their safety is one of the first objects of a commander. In our late civil war the issue of the most important campaigns was decided more by the question of supplies than by actual combat on the battlefield. The Atlanta campaign was a series of movements of which the main object of the Union commander was to interrupt the communication of the enemy with his sources of subsistence, and the Confederate general rarely made a stand except for the purpose of defending his line of supply. So in the final operations before Richmond and Petersburg, nearly all the operations of Gen. Grant had for their object the cutting off of the subsistence of the army under Gen. Lee, who, in fact, only abandoned his intrenchments when he could no longer subsist his army; and the final surrender of the remnant of the Confederate force was mainly owing to the fact that supplies for a few days failed to reach the troops in their retreat, compelling them to halt, and finally to break up into squads to procure food in an exhausted region. With subsistence for a few days within their reach, the Confederates might have made good their retreat into Southern Virginia and North Carolina, where they might have protracted the contest for an indefinite period. So in the Franco-German war, Paris was taken less by force of arms than by starving out the army which defended the city. Since the introduction of railroads the problem of subsisting an army, even at a distance from its great dépôts of supplies, has been greatly simplified. (See Army and Commissariat.)

**Sub'stance** [Gr. *οὐσία*; Lat. *substantia*; Ger. *Substanz*] appears as a philosophical term first in Aristotle, who uses it in two senses, between which it has wavered ever since. Logically, it is the first of the categories as opposed to the other nine, which are its accidents (*συμβεβηκότα*). There are first and second essences, the first always designating singulars—*e. g. a man, a horse*; the second being general terms, as *man, horse* (*Categ. V.*). It is also used in the

sense of εἶδος or constituting essence, in which acceptation it is sometimes rendered into Latin by *essentia* (*Metaph. IV.*, 8). The logical οὐσία is the first of induction (πρῶτον πρὸς ἡμᾶς); the metaphysical οὐσία, the first of deduction (πρῶτον φύσει). None of the post-Aristotelian philosophical schools had profundity enough to require the category of substance until the rise of the Neo-Platonists, who re-established it. Plotinus criticises Aristotle rather severely for not distinguishing between material and spiritual substance (*Enneads*, bk. vi.), as he himself did. Porphyry and Simplicius accepted the Aristotelian doctrine. In the Middle Ages the metaphysical view prevailed, and substance was identified variously with God, person, etc. The same is true of modern times, dating from Descartes. He regarded substance as that which can exist independently of anything else, and Spinoza (*Ethics*, i. def. iii.) as "that which is in itself and is conceived by itself"—a definition which, of course, identifies it with God. Leibnitz identified with substance the monads, whereby he sought to reconcile the dualism of Descartes with the monism of Spinoza. Locke looked upon substance as a mere imagined substratum, holding attributes together, but did not altogether deny its validity, as did Hume (*Human Nature*, pt. i. § 6). Kant classed substance in his Transcendental Table of the Concepts of the Understanding along with Cause and Community under the head of Relation, and defined its scheme as the "permanence of the real in time" (*Critique of Pure Reason*, p. iii., Meiklejohn's translation). Hegel defines substance as the "absolute, as relation to itself" (*Logik*, 2ter Th., S. 185, ed. 1834), and as "the unconditioned essence (*Wesen*) existing in and for itself, as being immediate existence" (*Propædeutik*, p. 105). Mill and the English school mostly follow Locke. In the orthodox doctrine of the Trinity, substance is used of the essential unity of the Divine Being as distinct from the tripersonality.

THOMAS DAVIDSON.

**Substitu'tion** [Lat. *substitutio*], a term in theoretical chemistry applied alike to a very wide range of phenomena or transformations, whose identity in nature is in some cases more than doubtful. The simplest cases included under the term are those in which one element presented to a compound of another, under appropriate conditions, expels or eliminates that other in the elementary form, taking its place in the new compound formed. Instances of this kind are the precipitation of metals from their solutions by other metals, expulsion of hydrogen from aqueous acids by metals, the decomposition of gaseous or vaporous chlorides by oxygen at elevated temperatures, chlorine being set free; and multitudes of others. These are the simplest cases of substitution, and appear to have suggested the word, which is here decidedly appropriate. On the discovery, however, by Gay-Lussac and Dumas, of the first facts relating to the reactions between elementary chlorine and hydrocarbon compounds—facts which soon multiplied enormously in the hands of Laurent and others—an analogy seems to have been assumed with the above real cases of substitution, and the idea arose that acidic or electro-negative elements could play the part, *when substituted therefor*, of basylic or electro-positive elements. From that time the *electro-chemical* ideas which Berzelius had begun to introduce into the science were dropped, and have been of late almost altogether neglected. Berzelius and his school protested, and urged that in these supposed substitutions there might be really complete molecular metamorphoses, new radicals being formed containing chlorine; but the discovery that the chlorine in chlorinated hydrocarbon compounds might be again removed and replaced by hydrogen, by the action of sodium-amalgam (or *nascent* hydrogen generally) was regarded as establishing the views of Laurent, and hence arose Dumas's grand *type-theory*, according to which, as now interpreted, substitution may take place in any compound, of any one or more of its elements or radicals, by any other elements or radicals, so long as the replacing elements or radicals have, without regard to position in the electro-chemical scale, the same amount of equivalency or atomicity as those displaced. The resulting compound is then maintained to retain the same *type*. (Under VOLUMES, MOLECULAR, some facts will be stated looking to a return, in a certain measure, to the track followed by Berzelius.)

In mineral chemistry the term substitution is applied to designate the admitted fact that a basylic element or metal may be replaced, in equivalent proportions, by certain other basylic elements, without changing the type, so long as the same relations of proportion remain between the aggregate oxygen belonging severally to the acids and to the bases that are present. (See SILICATES, CHEMISTRY OF.) For example, the general formula of *pyroxene* is $MO.SiO_2$, but, according to the views held by Dana and other leaders in mineralogy, a pyroxene might exist having the composition $(Ca.Mg.Mn.Fe.Na_2.K_2.Al^2_3,H_2)O.SiO_2$, or even one more complex still, in which the sum of the equivalencies of all the elements enclosed in the brackets would be that of M, or of one equivalent of a dyadic metal. Such a complex compound should still have the crystalline form, cleavage, hardness, and some other characters, of pyroxene. It is not to be denied, however, that several difficulties environ this mode of viewing silicates in the present state of our knowledge. Other similar cases of substitution occur among mineral sulphides and arseniets, in which iron, cobalt, manganese, nickel, and other metals replace each other in equivalent proportions, without alteration of species, while antimony and bismuth also replace arsenic, and selenium and tellurium replace sulphur. HENRY WURTZ.

**Substitution,** in law, denotes the putting one person in the place of another, so that the rights and powers which had been held by or given to the first may devolve upon the substitute. For example, in powers of attorney the agent appointed thereby is often clothed with an express power of "substitution"—that is, of naming a delegate who can act in his own place. In its more restricted and technical meaning the word belonged originally to the Roman civil law, and whenever thus used at the present day it describes certain legal facts or relations which are borrowed directly from that system of jurisprudence. In such special senses a substitution may occur in several different modes: (1) When through some act or proceeding of his own a person is substituted in place of one who was an original creditor, and assumes his right as creditor in relation to the debtor and the debt. The most familiar example is the case of a surety who pays the demand for which he and his principal are bound, and thereby acquires the position of creditor toward that principal. The name "subrogation" is now more commonly given to this species of substitution. (2) The term denotes certain forms of devises and legacies which were known to the civil law, and signifies the putting one person in place of another, so that the second may receive the testamentary gift instead of the first. A direct substitution occurred when a legacy or estate was given to A, and in case of his failure to take it, then to B. Another form permitted the substituted heir or legatee to take the gift directly from the first beneficiary; and it occurred when the testator gave his estate or a legacy to A, and directed that the latter should at his death or at some other time transfer the same to B. This species of substitution, called "fidei-commissary" (*fidei-commissa*), was undoubtedly the origin of the uses and trusts of the English and American law. JOHN NORTON POMEROY.

**Subtrac'tion** [Lat. *subtrahere*], the operation of finding from two given quantities a third which added to the second will give the first. The first is called the *minuend*, the second is the *subtrahend*, and the third is the *difference*. In arithmetical subtraction the subtrahend cannot exceed the minuend, but in algebra there is no such limitation. In all cases of algebraic subtraction the difference may be found by changing the sign of the subtrahend, and adding the result to the minuend. To distinguish this result from the arithmetical difference, already explained, it is called the *algebraic difference*. W. G. PECK.

**Sub'way,** a passage under the streets of a city for the reception of sewer-pipes, water-pipes, gas-pipes, telegraph-wires, etc. Subways were first introduced by J. W. Bazalgette, C. B., and are extensively employed in London and other British towns. They do away with the interruption of travel during the repair of breakages, but the first cost is very considerable. The term has also been made to include passages for underground street railways.

**Success',** v., Stratford tp., Coos co., N. H. P. 5.

**Succes'sion** [Lat. *successio*]. (1) As an original technical term of the common law, this word describes the quality or mode by which subsequent members of a corporation acquire the property and other rights which had been held by a different and prior set of persons who were members thereof. The power of perpetual "succession," by which the artificial body is kept in existence as one legal being, and its rights are transmitted through all its changes of membership, is one of the essential attributes of a corporation. (2) An entirely different meaning of the word has been borrowed from the Roman law by many modern English and American text-writers, and is applied by them to describe in a general way the devolution of estates from deceased owners upon the persons who by operation of law or by will become the recipients, and especially such devolution of personal estates. The word was a technical term of the Roman law, and has thence passed into all the systems founded upon that ancient jurisprudence. There is some confusion in this modern use and in the meanings given to the word. Sometimes it denotes the act or process of transmitting the estate from the deceased to the recipients; at others, the right to such transmission held by the recipients; and at others, still, the entire estate to be transmitted, with all its rights and

liabilities, regarded as a single legal entity—"the succession." The two former of these senses were embraced in the *successio* of the Roman law; the latter was expressed by the word *hæreditas*—inheritance. The essential conceptions which entered into the Roman system of succession were the following: Upon the death of a proprietor his physical being alone died; his legal or juridical person survived, and passed to another individual, who became the representative, or, as it were, the continuation of the defunct. This successor, whether a single person or more than one, was called the "heir" (*hæres*). The entire mass of property and other rights held by the deceased, and the entire mass of obligations resting upon him, were considered as one legal entity—a *universum jus*—and constituted the inheritance (*hæreditus*). This inheritance passed to and vested in the heir, and its passage to and acquisition by him was the "succession." The essential notion of a succession consisted, therefore, in there being no change in the legal subject—in the legal relations, rights, and liabilities—but only in the individual to whom that subject and those rights and duties attached. The heir succeeded to the deceased, prolonged his legal existence, and perpetuated his legal condition. The heir thus inherited all the property and claims of the defunct, and became chargeable with all his liabilities. An heir might be appointed in two different ways—either by will, the testamentary heir, or in case of intestacy he was designated by the law the legitimate heir. A Roman will had little resemblance to the English or American testament; it simply named the heir—whether one person or more—and perhaps added some legacies, which were special gifts out of the estate to particular individuals, chargeable upon the heir, and which he was bound to pay. If the deceased died intestate, the heir was selected by the law from among his relatives—first, the children or other descendants, and in their absence the nearest of the collaterals, according to settled rules establishing the degrees of relationship. The Roman law of succession passed through many progressive phases. In the earliest period the heir was bound to accept the inheritance with all its burdens, and thus became liable to pay all the debts of the deceased—a liability from which he could not escape. At a later period the law was modified so as to relieve certain classes of heirs from this forced responsibility. If slaves were named as heirs by will, they were still obliged to accept the inheritance with all its burdens, and were thence denominated "necessary heirs." To all other classes of heirs a certain time was given after the death to examine into the condition of the inheritance, and to elect whether they would accept or reject it. When, however, they once accepted and assumed the character of heirs, the full responsibility for all the obligations of the deceased devolved upon them. The ancient rule was further relaxed by Justinian. To all but the "necessary" heirs was given the benefit of an inventory; in other words, they were released from all responsibility for the debts of the defunct beyond the amount of the property received with the inheritance. After the Code and Pandects had been completed, the emperor Justinian in the 115th, 118th, 127th Novels remodelled the whole system, without, however, abandoning the fundamental conceptions upon which it was based. He determined in particular the heirs in cases of intestacy, ascertained the different degrees among the next of kin, and fixed in detail the portions belonging to each in various contingencies. Although the common-law doctrine of descents and inheritance of land was derived wholly from the feudal institutions, the English statutes of distributions, which regulate the succession to personal property, were largely patterned after this latest legislation of the Roman emperor. The English statutes have in substance, although with variations in detail, been generally adopted through the American States. In the English and American system of successions the administrator or executor, so far as his legal title is concerned, takes the place of the Roman heir. JOHN N. POMEROY.

**Succession Wars** were the natural result of the absolute monarchy, and became of a portentous frequency in the history of continental Europe in the eighteenth century. The Spanish succession war (1700–13) was followed by the Polish (1733–38), the Austrian (1740–48), the Bavarian (1777–79); and the first and the third of these wars caused an immense loss of life and property, the devastation of some of the most prosperous regions of Europe, and unspeakable sufferings and misery in thousands of families. Subsequently, the nonchalance with which Napoleon treated crowned heads, old dynasties, and their pretended rights opened people's minds to the truth of the ideas of the French revolution, and in the nineteenth century succession wars, in the strict sense of the word—wars for merely dynastic purposes, and devoid of any political, religious, or commercial interest—have become an impossibility.

*The Spanish Succession War.*—Charles II., king of Spain (1665–1700), had no children and no collateral male heirs, but, according to Castilian law, females were competent of succession, and there existed two female lines of the royal house of Spain, represented by the two most powerful dynasties of Europe, the Bourbon in France and the Hapsburg in Austria. Louis XIV., king of France, was a son of Anne of Austria, the eldest daughter of Philip III., and married Maria Theresa, the eldest daughter of Philip IV.; Leopold I., emperor of Germany, was a son of Maria Anne, the youngest daughter of Philip III., and married Margaret Theresa, the youngest daughter of Philip IV. Thus far, the French line had the preference, being the oldest, but both the Spanish princesses who went to France had formally renounced their claims to the Spanish crown, while those who went to Austria had not—a circumstance which much embarrassed Louis XIV. in his ambitious schemes, though without restraining him from pursuing his goal. To the other European powers the question was also of great interest. The Spanish monarchy comprised, besides Spain, Sicily, Naples, Sardinia, Milan, the Spanish Netherlands, nearly corresponding to the present Belgium, and vast possessions in America. A union between these dominions and either France or Austria would look very much like the beginning of a universal monarchy, and threaten the very existence of the other European powers. Both the candidates were aware of this difficulty, and neither of them put forth his claims in his own name, but both in that of some collateral heir: Louis XIV. contended for his second grandson, Philip of Anjou; Leopold I. for his second son, Archduke Charles. Meanwhile, a solution of the question was found and agreed upon. Leopold I. had a daughter, Maria Antonia, who had married Maximilian II., elector of Bavaria, and borne a son, Joseph Ferdinand, and this son was chosen heir-apparent by Charles II. and the Spanish Cortes, and acknowledged by France and Austria; but on Feb. 6, 1699, he suddenly died, and the question was reopened. In the intrigues which now ensued Louis XIV. was victorious, and on Oct. 2, 1700, Charles II. made a will by which he bequeathed all his dominions to Philip of Anjou. Shortly after (Nov. 1, 1700) he died, and Philip immediately repaired to Spain, and was accepted by the Spanish people as king, and also acknowledged by the other European powers with the exception of Austria, which began hostilities immediately in Northern Italy. But success made Louis XIV. incautious. His most difficult adversary was William III. of England, at once the shrewdest and the most irritated; and him he provoked in a manner which could not be forgiven. When he sent his grandson to Spain, he told him never to forget that he was a Frenchman. Shortly after, he began to regulate his northern frontier, thus approaching Holland, of which William III. was stadtholder. Finally, when the deposed and exiled king, James II., died at St. Germain (Sept. 16, 1701), Louis XIV. formally acknowledged his son, the elder Pretender, as king of England. William III. now formed an alliance between England, Holland, Hanover, and Austria, which was afterward joined by Prussia, the German empire, and Portugal, against France, which found no other allies than the prince-archbishop of Cologne, the elector of Bavaria, and, for a time, the duke of Savoy. For more than ten years the war was carried on in four different places—Catalonia, the valley of the Po, the Rhine countries, and the Spanish Netherlands. In Spain the French were generally successful. In 1704 the archduke Charles landed at Lisbon, and invaded Spain from the W. with an army composed of Dutch, British, and Portuguese troops. At the same time, Mordaunt took Barcelona, and penetrated from the E. into the country. The French were defeated and driven across the Pyrenees. But under the command of the duke of Berwick they soon retrieved their failures, and when (in 1707) Mordaunt, whose vanity and flimsiness provoked the archduke, left Spain, they again became masters of the country after the brilliant victory at Almanza, Apr. 25, 1707. In 1710, Berwick was recalled, and Charles once more succeeded in occupying Madrid and driving the French back across the Pyrenees, but Vendôme now took the command, and in a short and rapid campaign routed the English under Stanhope and the Germans under Starhemberg, carried the king back to Madrid, and put an end to the war in Spain. More dangerous was the struggle at the other points. In Italy the war commenced in 1701, and the Austrians under Prince Eugene conquered Milan and Mantua. But in 1703, Prince Eugene was recalled on account of the rebellion in Hungary under Francis II. Rakoczy, an intriguer of Louis XIV., and Vendôme was placed at the head of the French army. The result was, that in a short time the Austrians lost all their conquests, and were able to hold only a few points on the Po. After the battle of Ramillies, however, Ven-

dôme was removed to the army of the Rhine, and Prince Eugene returned to Italy. A complete change immediately took place in the fortunes of the two armies, and after being totally routed in the battle of Turin (Sept. 7, 1708) the French were compelled to withdraw altogether from Italy. Prince Eugene even penetrated into Southern France and besieged Toulon, though in vain. At the same time the English had conquered Sardinia, the Austrians Naples, and the only one of her great Italian possessions which Spain still retained was Sicily. But the decisive battles were fought on the northern and north-eastern frontiers of France. In 1702 a French army under Villars crossed the Rhine and united with the Bavarian army under the command of the elector himself. But in June, 1703, the elector again separated, having formed a plan of penetrating through the Tyrol and joining Vendôme in Italy. The Tyrolean diversion was very disastrous, and Villars recrossed the Rhine in disgust. Meanwhile, the duke of Marlborough approached at the head of a Dutch-British army, carrying one fortified point in the Spanish Netherlands after another, and defeating the French-Bavarian army at Schnellenberge July 2, 1704, while Prince Eugene forced his way up the plains between the Black Forest and the Rhine. A junction between Eugene and Marlborough was effected, and the French-Bavarian army was completely routed at Höchstädt (or Blenheim) Aug. 13, 1704. Still greater disasters followed. Villeroi was defeated at Ramillies, May 23, 1706; Vendôme at Oudenarde, July 11, 1708; Villars at Malplaquet, Sept. 11, 1709; and the French gained no victories where Marlborough or Eugene commanded. One fortress after another fell, and the French frontier lay open. Under these circumstances Louis XIV. asked for peace, but the demands of the allies were too humiliating; and although France was nearly exhausted, the old king was preparing for a new onset when a series of fortunate circumstances suddenly turned the scales in his favor. In Sept., 1710, the Tories came into power in England with Bolingbroke, and the great Whig general, the duke of Marlborough, was not looked upon with much sympathy by the new government. The emperor Joseph I., the eldest son of Leopold I., died without male issue Apr. 17, 1711, and his brother, Archduke Charles, succeeded him as Charles VI. But a direct union between Austria and Spain was as much dreaded by England and the other European powers as one between Spain and France, and by his accession to the imperial throne Charles lost all his allies. A congress was opened in Utrecht Jan. 29, 1712, and on Apr. 11, 1713, treaties of peace were signed between France, England, Holland, Prussia, Savoy, and Portugal, by which it was stipulated that the two lines of the Bourbon house, the French and the Spanish, should renounce all claims of inheriting from each other, and the two crowns should never be held by the same person. On July 13, 1713, Spain made peace with England and Savoy; June 26, 1714, with Holland; Feb. 6, 1715, with Portugal; and finally, by the treaties of Rastadt (Mar. 6, 1714) and Baden (Sept. 7, 1714), peace was concluded between Spain and France on the one side and Austria on the other. Spain ceded all its Italian and Dutch possessions to Austria, and Gibraltar and Minorca to England.

*The Polish Succession War.*—After the death of Augustus II., king of Poland and elector of Saxony, Feb. 1, 1733, one party of the Polish people wished to recall Stanislaus Lezczynski, who lived in exile in France, while another declared for the son of the late monarch, Augustus III. The former was supported by France, the latter by Russia and Austria, and the contest was decided by a Russian army which invaded Poland and expelled Stanislaus. By the Peace of Vienna (Oct. 3, 1735) Augustus III. was placed on the Polish throne, and Stanislaus received the duchy of Lorraine as a pension.

*The Austrian Succession War.*—As the emperor Charles VI. had no male heirs, it was the sole purpose of all his diplomatic negotiations during the latter part of his reign to obtain the accession of all the powers concerned to the Pragmatic Sanction, by which it was stipulated that after his death all the Austrian possessions, comprising, besides Austria proper, Bohemia, Hungary, Northern Italy, and the so-called Spanish Netherlands, should be transferred undivided to his eldest daughter, Maria Theresa, who was married to the grand duke Francis Stephan of Tuscany. The nearest claimant to the Austrian inheritance, the elector of Bavaria, Charles Albert, descending from Anne, a daughter of Ferdinand I., never gave his consent to the Pragmatic Sanction, and when Charles VI. died (Oct. 20, 1740) a general desire was manifested among the other European powers to break up the Austrian state and divide its dominions. Spain demanded the Italian territories; Augustus III., married to the eldest daughter of the emperor Joseph I., demanded Bohemia, etc.; and France was more than willing to see its old enemy, the house of Hapsburg, humiliated. Availing himself of this feeling, Frederick II. of Prussia marched his army into Silesia in Dec., 1740, and began the first Silesian war, which became the signal of a general attack. His claims to Silesia were neither better nor worse than such claims generally are, but the manner in which he enforced them was such that a man who in private life would employ such measures would no doubt soon be put in jail. Even in the diplomatic world his barefaced ambition astonished people, though they did not hesitate to follow his example. On May 18, 1741, a coalition was formed at Nymphenburg, near Munich, between France, Spain, and Bavaria, and soon after Prussia, Saxony, Sardinia, and Naples joined it. A French-Bavarian army under the command of Belleisle invaded Upper Austria and took Linz, and penetrated thence into Bohemia and occupied Prague. Another French army approached the Austrian Netherlands, and a Spanish-Neapolitan army attacked the Austrian possessions in Italy. On Jan. 24, 1742, the elector of Bavaria, Charles Albert, was crowned emperor of Germany in Frankfort, under the name of Charles VII. In Austria the situation was nearly desperate. The finances were in disorder and utterly exhausted; the army was disorganized, and all resistance seemed impossible. In this emergency Maria Theresa, fleeing from Vienna, repaired to Presburg, convoked the Hungarian diet, addressed it in person (Sept. 11, 1741), setting forth in a simple, natural, undiplomatic way how the world treated her, and what she wanted the Hungarians to do for her; and such a yell of enthusiastic cries, such a peal of clanging arms, answered her that the young queen fainted on her throne. But a few weeks later, 50,000 Magyars galloped toward the theatre of war; Upper Austria was cleared; the queen returned safely to Vienna; Bavaria was invaded; and on the very day when the new emperor was crowned, his capital, Munich, was taken and the Magyar horsemen encamped in his bedroom. In England, Maria Theresa found a good ally. The English government immediately furnished her with money, and negotiated a peace between her and her most dangerous enemy, Frederick II., by which she ceded Silesia, but got her armies free to be used against the French. Belleisle was compelled to leave Prague and retreat behind the Eger. An English fleet appeared before Naples and compelled the king to withdraw his troops from the Austrian dominions in Italy. An English-Austrian army was formed in the Netherlands under the command of George II., and defeated the French under Noailles at Dettingen June 27, 1743. In September of the same year Sardinia was bribed to leave the coalition by a promise of a small extension of her territory, and in December, Saxony too joined Austria. The whole of Bavaria was conquered, and in the spring of 1744 the Austrian army crossed the Rhine and penetrated into Alsace. This extraordinary success made Frederick II. uneasy. He knew very well that if Austria came out of the contest completely victorious, he would be called to account for his robbery of Silesia, and he determined to try to turn the scales before it should prove too late. In Aug., 1744, he began the second Silesian war for the "defence of the German empire and its representative." At the same time a reverse took place in the Austrian fortunes at other points of the contest. In Upper Italy a French army joined the Spanish, and fought with great success, and in the Netherlands, Maurice of Saxony (generally known as Marshal Saxe) began his brilliant campaign with the victory at Fontenoy, May 12, 1745. Soon, however, events occurred which gradually prepared people's minds for peace. On Jan. 20, 1745, the unhappy emperor, Charles VII., died; on Apr. 22 his son, Maximilian Joseph, concluded peace with Austria, and renounced all his claims to the Hapsburg inheritance; on Sept. 13 the husband of Maria Theresa was elected emperor of Germany under the name of Francis I. Frederick II. had become thoroughly disgusted with his allies, the French, and in the death of Charles VII. he found an opportunity of retiring from the coalition; peace was concluded between Prussia and Austria on Dec. 25, 1745. On July 9, 1746, Philip V. of Spain died; his wife, Elizabeth of Parma, the "arch-plotter," now lost her influence, and her ambitious desires of forming an Italian principality for her younger son, which hitherto had acted as one of the principal fomentations of the war, found no great sympathy with the new Spanish government. France itself became inclined to peace. Marshal Saxe gained brilliant victories in the Netherlands —at Rancoux, Oct. 11, 1746; at Laffeld, July 2, 1747—and penetrated into Holland, where he took Bergen-op-Zoom and Maestricht. But the English had nearly destroyed the French shipping and conquered many French colonies, and when Russia, in June, 1747, joined Austria and sent an auxiliary army to Germany, France was willing to make peace. A congress was opened at Aix-la-Chapelle in the spring of 1748, and on Oct. 18, 1748, the final treaty of

peace was signed. Elizabeth of Parma carried her point—Austria was compelled to cede Parma, Piacenza, and Guastalla to her son, Don Philip.

*The Bavarian Succession War*, also called the *Potato War*, because it was carried out without any fighting, took place after the death of the elector Maximilian Joseph, Dec. 30, 1777. He left no male issue, and the Bavarian possessions now fell to a collateral line of the house of Wittelsbach, represented by Charles Theodore of the Palatinate. His claims were contested, however, by Saxony, Mecklenburg, and Austria, and in order to secure at least some portion of the inheritance, Charles Theodore, who had no legitimate children, and chiefly wished to come into power in order to provide for his many illegitimate sons, made an agreement with Austria by which he surrendered to her Lower Bavaria. Against this extension of the Austrian territory in Germany, Frederick II. protested in a most energetic manner, thereby inaugurating that policy which in our days has made Prussia great, and by the Peace of Teschen (May 13, 1779) Austria only retained a few insignificant districts. CLEMENS PETERSEN.

**Succin'ic Acid** [Lat. *succinum*, "amber;" Ger. *Bernsteinsäure*], one of the dibasic $O_4$ series of homologues, of which oxalic acid is the first member. Its composition is $C_4H_6O_4$, and in constitution it is probably $O_4.C_2.2H_2C.H_2$, differing from oxalic acid ($O_4.C_2.H_2$) by two molecules of homologen. The difference of molecular volumes confirms this. By Housemann's experimental density of sublimed oxalic acid = 2., this has volume = 45000, and by Richter's figure for succinic acid = 1.55, this has volume = 76129. The difference is 31129, while twice the cube of 25 = 31250. (See VOLUMES, MOLECULAR.) Succinic acid was known to the ancients as *volatile salt of amber*, from which it is obtainable by distillation. It is found ready formed in several plants, and even in animal bodies. It has been identified in the urine of dogs and rabbits. It is formed, with SUBERIC ACID (which see) and others of this homologous series, by the action of nitric acid on fatty substances. Pasteur found that it is an invariable product of the acetic fermentation of alcoholic liquids. Many other organic transformations engender it. It is found in the watery part of the products of the distillation of amber, in solution, and crystallizes out by cooling. Warming with nitric acid will destroy the impurities, and enable pure succinic acid to be obtained by recrystallization. It is, however, obtainable much more cheaply from MALIC ACID (which see), or rather from crude *calcic malate*, prepared from the mountain-ash berries. This is fermented with yeast or rotten cheese, and the calcic succinate formed decomposed by sulphuric acid. Succinic acid crystallizes well, and is soluble in 5 parts of cold water. It melts at 356° F., and boils at 455° F., and is decomposed with formation of water and another body, $C_4H_4O_3$, regarded as anhydrous succinic acid.

*Succinates.*—There are neutral and acid succinates, formed by the replacement of either both or only one of the two molecules of metalloidal H in the constitutional formula above. The alkalic and magnesic succinates are soluble in water, while those of calcium and other dyads, and of alumina and ferric oxide, are insoluble. The precipitate formed with ferric solutions, when neutral, is very much like that formed by benzoic acid. Succinate of ammonia is a salt used in the laboratory as a reagent, chiefly in certain separations of iron from other substances. Succinic acid and succinates have been used in medicine, but are not now regarded as possessing any marked virtues.

HENRY WURTZ.

**Succory.** See CHICORY.

**Suchet'** (LOUIS GABRIEL), duke of Albuféra and marshal of the Empire, b. at Lyons Mar. 2, 1770. According to O'Meara, Napoleon, when asked which was the ablest of his generals, replied, "It is hard to answer, but I am inclined to say Suchet." Entering the army in 1792, he served under Bonaparte, Brune, Masséna, Joubert, and Moreau in the campaigns in Italy and Switzerland, passing through the grades of *chef de bataillon* (major), colonel, general of brigade, of division, to that of lieutenant-general before the age of thirty. Subsequently, he distinguished himself at Ulm, Jena, and Austerlitz. Under orders of Lannes he served (with the 5th corps) at the siege of Saragossa, and was designated by him to Napoleon on his departure for the command in Aragon. In this latter capacity he entered on the career which earned him his fame and the appreciation of Napoleon, as above expressed. A series of battles and sieges (of Lérida, Mequinenza, Tortosa, Tarragona) gained for him the baton of *maréchal d'empire* (July 8, 1811), and after the battle of Albuféra (see ALBUFÉRA) and the siege and capture of Valencia (including that of the Spanish army, comprising the best generals and all the regular troops which remained to Spain), he was created duc d'Albuféra (Jan. 24, 1812). The greatness of Suchet as a soldier was equalled by his wisdom as an administrator and ruler of conquered provinces. Napoleon said that if he had had *two* Suchets in Spain, "he would have not only conquered the Peninsula, but preserved it." "It is their misfortune," he added, "that sovereigns cannot improvise for their needs men like him." The *Mémoires du Maréchal Suchet, sur ses Campagnes en Espagne*, form one of the classics of military literature. D. at Marseilles Jan. 3, 1826. J. G. BARNARD.

**Suckasun'ny,** or **Succasunna,** p.-v., Roxbury tp., Morris co., N. J., on Delaware Lackawanna and Western R. R.

**Suck'er,** a name given to a number of very different kinds of fishes, and from no resemblance to each other, but simply because they "suck" in some way or other. 1. In the U. S. and Canada in the interior it is applied to members of the family Catastomidæ, which have small mouths, into which they take their food by a kind of suction. The species are quite numerous. (See CATASTOMIDÆ, in APPENDIX.) 2. Along portions of the coast (*e. g.* Buzzard's Bay) the term is applied to the species of Echeneididæ, which are characterized by a flat ovate suctorial disk on the top of the head and front of the back, and which is homologous with the first dorsal fin of other fishes. By means of this disk they suck and cling with great tenacity to other larger fishes (especially species of sharks), and are to some extent parasites. (See REMORA and ECHENEIDÆ, in APPENDIX.) 3. In England the name is given to representatives of the families Cyclopteridæ, Liparididæ, and Gobiesocidæ. These have the ventral fins peculiarly modified and adapted for adhering to rocks and other bodies. The species are quite numerous, and each family is represented on the coast of the U. S., but the American species (except the *Cyclopterus lumpus*) are not known under any popular names. THEODORE GILL.

**Suck'ling** (Sir JOHN), b. at Whitton, Middlesex, in 1609; was educated at Trinity College, Cambridge, and inherited a great fortune from his father, who had been comptroller of the royal household. In 1631–32 he offered his services as a volunteer to Gustavus Adolphus, king of Sweden, who was waging war against the emperor of Germany. Returning to England, he was attached to the court of Charles I., and in 1639 equipped a troop of horse for the royal service against the Scotch. In 1640 he was elected to the Long Parliament, but was obliged to flee to France in consequence of his complicity in a plot to rescue the earl of Strafford from the Tower. His works, most of them first published after his death, include four plays, a number of songs (of which two or three are among the finest in the language), some letters, and *An Account of Religion by Reason.* A complete edition of his *Poems, Plays, and Remains* was published in 1874. D. in Paris about 1642.

**Sucre,** cap. of Bolivia. See CHUQUISACA.

**Suc're, de** (ANTONIO JOSÉ), b. in Cumana, Venezuela, in 1793; was educated at Caracas; joined the revolt against the Spaniards in 1811; was made brigadier-general in 1819, and in May, 1822, won the victory of Pichincha, which compelled the Spaniards to evacuate Quito; in 1823 he led a force from Colombia to Peru; found Lima in possession of the Spaniards, and was shut up in Callao until the successes of Santa Cruz compelled them to abandon Lima. In 1824 he won the victory of Ayacucho, which secured the independence of Peru, and finally of Bolivia, of which he was made president in 1826. An insurrection broke out in 1827, and in 1828, Sucre was driven from the country by Gamarra, but returned at the head of a Colombian army and reinstated himself. In 1830, having apparently pacified Bolivia, he went as commissioner to propose friendly relations with Venezuela, and while on his way back to Quito was assassinated near Pasto, in Ecuador, in June, 1830.

**Sudam'ina** [plu. of *sudamen*, from the Lat. *sudare*, to "sweat"], a fine eruption of vesicles on the skin. Their appearance is often accompanied by profuse sweating, whence the name. They may appear in comparative health, but are not important except when they are symptoms of some of the fevers.

**Sudan.** See SOODAN.

**Sud'bury,** town of England, county of Suffolk, on the Stour, has some manufactures of silk and some malting and brickmaking industry. P. 6908.

**Sudbury,** p.-v. and tp., Middlesex co., Mass., on Sudbury River and Lowell and Framingham and Massachusetts Central R. Rs., has prosperous manufactures, a lyceum, and a library of 5000 vols., and is celebrated for the battle of Apr. 21, 1676, in which Capt. Wadsworth and

fifty men were killed by the Indians. The bi-centennial anniversary was celebrated 1876. P. 2091.

**Sudbury,** p.-v. and tp., Rutland co., Vt., on Otter Creek. P. 601.

**Su'deten-Gebir'ge,** a range of mountains which separates Silesia from Moravia, and connects Riesengebirge with the Carpathian Mountains. They are low, 2000 or 3000 feet high, covered with pine forests, rich in coal and metals, and form plateaus with single peaks, rather than continuous chains.

**Sudorif'ics** [Lat. *sudor,* "sweat," and *facere,* to "make"], a term used in medicine to refer to such means as produce sweating. Heat is the one all-powerful sudorific, applied externally in the form of the hot-air or vapor bath, and internally as hot drinks. The effect of heat is hastened and intensified by alcoholic and ethereal potions, opium, especially in the form of Dover's powder. (See Opium.) The newly-introduced drug *jaborandi* seems to have a decided effect in causing sweating. Sweating is one of the phenomena attending nausea, and hence such drugs as tartar-emetic and ipecac prove sudorific among their other effects. Edward Curtis.

**Sudoriparous Glands.** See Histology and Sweat.

**Sue** (Marie Joseph Eugène), b. at Paris Dec. 10, 1804; studied medicine, and held a position as a surgeon first in the army, then in the navy, until 1829, when, having inherited a considerable fortune, he retired and devoted himself to literature. His first novels, *Kernock le Pirate, Plick et Plock, Atar-Gull, La Salamandre, La Coucaratcha, La Vigie de Koatven* (13 vols., 1831–34), are evidently inspired by Cooper. He then turned from the more or less historical to the strictly social novel—*Cécile, Arthur, Le Marquis de Létorière, Jean Cavalier* (4 vols.), *Thérèse Dunoyer, Latréaumont* (1834–41), *Mathilde* (6 vols., 1841), *Les Mystères de Paris* (10 vols., 1842–43), *Le Juif-Errant* (10 vols., 1844–45), *Martin* (12 vols., 1847), *Les Sept Péchés capitaux* (16 vols., 1847–49), *Les Mystères du Peuple* (1849–56). Elected to the Constituent Assembly in 1850, he took his seat among the farthest-going radicals. After the *coup d'état,* he left France and settled at Annecy in Savoy, where he died Aug. 3, 1857. He wrote about 50 vols. of novels which are not mentioned here.

**Sue'ca,** a rich and well-built town of Spain, province of Valencia, on the Jucar, 4 miles from the Mediterranean, has 11,340 inhabitants.

**Su'et** [Lat. *sebum*]. The solid fat of the sheep and of beef, and chiefly that from the kidneys and loins, is called *suet.* Mutton suet is the firmest and hardest of the animal fats, melts at 122° F., and being composed chiefly of stearine, with palmatine and but little oleine, it has long been used in domestic economy to produce "dip candles." It is the high melting-point of mutton fat which requires the use of hot plates in serving mutton at table. Beef suet, or ox fat, melts at 116° F. It contains more palmatine than mutton fat. Chemically, there is no distinction between suet and tallow. (See Tallow, Fats, Soap, Stearine, and under Oils.) *Suet Butter,* or *"Oleo-Margarine,"* is a substitute for butter, the process for preparing which is described under Butter. B. Silliman.

**Sueto'nius Tranquillus** (Caius), probably b. about the beginning of the reign of Vespasian, and educated for the position of a teacher in grammar and rhetoric; enjoyed the patronage and friendship of the younger Pliny, several of whose letters are addressed to him, and who introduced him to the emperors Trajan and Hadrian. The latter employed him for some time as his *magister epistolarum,* but dismissed him, jealous of his too great intimacy with the empress, Sabina. The date of his death is unknown. He wrote several works, some of which have entirely disappeared, while of others portions have been preserved (lives of poets, distinguished grammarians, and rhetoricians, on Roman institutions, etc.). About the authorship of some of the works ascribed to him scholars disagree. His principal work, however, *Duodecim Cæsarum Vitæ,* has come down to us entire and in authentic form. It contains biographies of the first twelve Roman emperors, beginning with C. Julius Cæsar and ending with Domitian, and these biographies, or rather collections of anecdotes from the private lives of the emperors, bear a general character of reliability which makes the work an invaluable historical document. In æsthetic respects it has no merits. Best editions by Baumgarten-Crusius (Leipsic, 1816), C. B. Hase (Paris, 1828), and Roth (Leipsic, 1858). The other writings are best given by Reifferscheid (Leipsic, 1860). English translations by John Clark (London, 1732), and by Thomson and Forrester in Bohn's "Classical Library" (1855).

**Sue'vi,** originally a collective name, comprising several individual Germanic tribes which formed a kind of union. It is thus used by Cæsar and Tacitus. The Suevi of Cæsar lived between the Rhine and the Weser, where they had 100 towns, though no strongholds, and whence a number of young men emigrated annually to seek occupation in war. To the union belonged the Semnones, the Catti, and other tribes. The Suevi of Tacitus lived farther to the E., from the Danube to the Baltic, and comprised, among other tribes, the Marcomanni and the Quadi. Tacitus calls the Baltic the Suevic Sea, and the Suevus of Ptolemy is probably the Oder. In the fourth century the name was applied to a single tribe, one branch of which settled in the regions along the Neckar, afterward called Suabia, while another branch broke into Gaul, and in 409 crossed the Pyrenees and penetrated into Spain, where they embraced Christianity, conquered Galicia, and formed a kingdom, which in 585 was united with the Visigothic empire.

**Su'ez,** town of Egypt, at the head of the Gulf of Suez, an inlet of the Red Sea, in lat. 29° 58′ N. and lon. 32° 34′ E. The surrounding country is a complete desert, and provisions and water must be brought to the town from a great distance. Nevertheless, since the opening of the railway from Cairo to Suez, and especially since the construction of the Suez Canal, the city is rapidly progressing, and during the last five years its population is said to have increased from 1500 to 8000.

**Suez,** p.-v. and tp., Mercer co., Ill. P. 1176.

**Suez Canal,** connecting the Mediterranean with the Red Sea, and thus greatly abridging the voyage between Europe and India and China. According to Strabo and Pliny, these seas were indirectly joined by a canal as early as 1300 B. C., but it was probably used only for the purpose of irrigation, not for navigation. According to Herodotus, Pharaoh Necho about 600 B. C. projected and partially executed a navigable canal upon the same route. We find mention of this canal for a long course of centuries, until it was finally blocked up by the sands of the desert about 767 A. D. In modern times the first idea of a ship-canal across the isthmus was conceived by Napoleon I. during his invasion of Egypt, but his engineers reported that the surface of the Red Sea was thirty feet above that of the Mediterranean—an error which was not exploded until 1840. In 1847 the project of a canal here was seriously entertained by the European powers, and again in 1853. In the next year, M. Ferdinand de Lesseps, a French diplomatist, obtained a concession from the pasha for this purpose, and succeeded in organizing a company for carrying on the work. The entire length of the canal is about 100 miles, of which 75 miles are actual excavation, the remainder being through shallow lakes which in some places had sufficient depth of water, but usually were to be deepened. The usual width of the excavation is 325 feet at the top and 72 feet at the bottom, with a depth of water of 26 feet. The work was fairly commenced in 1858, and the canal was officially opened Nov. 17, 1869. The capital of the company was originally 200,000,000 francs, which was increased in 1867 to 300,000,000, a considerable portion of which remained in the hands of the Egyptian government; and this was in 1875 purchased by the British government, which thus, directly or indirectly, exercises a controlling influence in its management. The Red-Sea terminus of the canal is at Suez, on the Gulf of Suez; the Mediterranean terminus is at Port Saïd, an artificial harbor, where a considerable town has sprung up. The formation of the harbors at the termini of the canal was in fact a work of greater magnitude than even the excavation of the channel itself. (See Ship-Canals, in Appendix.)

**Suez, Gulf of,** the western and larger of the branches into which the Red Sea divides itself, lying between Egypt and the peninsula of Sinai. Its extreme length is about 180 miles, with an average breadth of 20 miles. It was known to the ancients as the Gulf of Heroöpolis, and the generally-received scene of the passage of the Red Sea by the Israelites is a few miles from the present head of the gulf.

**Suez, Isthmus of,** a neck of land connecting the continents of Asia and Africa, and separating the Mediterranean from the Red Sea. Its extreme breadth from the Gulf of Suez to that of Pelusium is about 72 miles in a straight line, but following the course of the canal the distance is 100 miles. The surface is low and sandy, having an average elevation of not more than 6 or 8 feet above the sea, but in places reaching to 50 or 60 feet. In general, the isthmus is almost a desert; where, however, irrigation has been practised it is quite fertile. It is probable that the whole isthmus was once covered by the waters of the Mediterranean and Red seas, which were then connected.

**Suf'fern,** p.-v., Ramapo tp., Rockland co., N. Y., at the junction of Piermont branch with the main line of Erie R. R.

**Suf'field,** p.-v. and tp., Hartford co., Conn., on Suffield branch of New York New Haven and Hartford R. R. P. 3277.

**Suffield,** p.-v. and tp., Portage co., O. P. 1444.

**Suffocation.** See ASPHYXIA.

**Suf'folk,** county of England, bounded N. by the Ouse, S. by the Stour, and E. by the North Sea, comprises an area of 1487 sq. m., with 348,479 inhabitants. The surface is flat, and the soil for the most part very productive and excellently cultivated. Wheat, barley, beans, oats, hemp, and hops are raised, dairy-farming is extensively carried on, and butter is one of the principal products of the county. Cap. Bury St. Edmunds.

**Suffolk,** county of E. Massachusetts, lying upon Massachusetts Bay, comprising the cities of Boston and Chelsea and the townships of Revere and Winthrop. The manufactures are numerous and important, the number of establishments in 1870 being 2546, with a capital of about $48,000,000, employing 43,550 operatives, using raw material costing nearly $60,000,000, the value of the products being about $112,000,000. The garden and dairy products, especially milk, are very considerable. (For special statistics see BOSTON.) Cap. Boston, which is also the capital of the State. Area, 44 sq. m. By the census of 1870 the pop. of the county was 270,802, but the annexation of Charlestown, Brighton, and West Roxbury from other counties added 41,973 to the number, raising the pop. within the present limits of the county to 312,775; in 1875, according to the State census, it was 364,880.

**Suffolk,** county of S. E. New York, comprising the E. portion of Long Island, besides several small islets, having the Atlantic Ocean on the E. and S. and Long Island Sound on the N., drained by several small streams, of which the Peconic is the chief, and traversed by Long Island and other railroads. It is hilly in the N., but generally level in other parts. The soil is sandy, but is rendered very productive by the use of fertilizers. The coast is indented by numerous inlets, forming good harbors for small craft; besides several shipyards and flouring-mills, there are considerable manufactures of carriages, cotton and woollen goods, saddlery, paper, brick, sails, and fish oil. Cattle, horses, sheep, and swine are numerous. Staples, potatoes, Indian corn, oats, wheat, hay, wool, and garden and dairy products. Cap. Riverhead. Area, 1200 sq. m. P. 46,924.

**Suffolk,** p.-v., cap. of Nansemond co., Va., on Atlantic Mississippi and Ohio and Seaboard and Roanoke R. Rs., 22 miles from Norfolk, has 6 churches, 2 high schools, 3 newspapers, 2 steam-factories, 3 hotels, and 6 workshops. P. 930. W. B. WELLONS, ED. "CHRISTIAN SUN."

**Suffolk,** EARLS AND DUKES OF. These titles have been borne in English history by persons of several different families. Those of importance will here be treated in chronological order: MICHAEL DE LA POLE, EARL, b. about 1330, was the son of Sir William de la Pole (a wealthy merchant of Kingston-upon-Hull, of which town he was the first mayor, and was knighted upon occasion of having sumptuously entertained Edward II. when on his way to Scotland; d. 1366); devoted himself to arms; served in the French wars under the Black Prince and John of Gaunt, and in 1369 was made admiral in the northern seas; was employed in various diplomatic missions, and in 1383 became lord chancellor, being the second layman who attained to that station; in 1385 was created the first earl of Suffolk. In 1386 he was impeached by the Commons for alleged abuses committed as lord chancellor, fined, and imprisoned, but on the dissolution of Parliament was restored to royal favor; in 1388 was attainted of treason, and his estates were confiscated. He made his escape to France, where he d. Sept. 5, 1388.—MICHAEL DE LA POLE, EARL, son of the preceding, b. in 1368; obtained a reversal of his father's attainder in 1398, and in 1403 regained the estates and earldom; accompanied Henry V. to France, and was killed at the storming of Harfleur, Sept. 14, 1415.—WILLIAM DE LA POLE, EARL, MARQUIS, and DUKE, son of the preceding, b. in 1396; served in the French wars, and after the death of the earl of Salisbury, Nov., 1428, commanded in the siege of Orleans; was foiled by Joan of Arc and made prisoner; regaining his liberty, he became a favorite at court, and in 1444 negotiated the marriage of Henry VI. and Margaret of Anjou, for which he was created marquis of Suffolk, and became virtually the first minister of the kingdom. In 1447 he was suspected of complicity in the murder of Humphrey, duke of Gloucester, and became unpopular on account of having surrendered Anjou and Maine to France, but his favor at court was continued, and in 1448 he was created duke of Suffolk. In 1450 he was impeached by the Commons, committed to the Tower, and without trial sentenced to five years' imprisonment, but having been set at liberty upon his own oath of innocence, he embarked for France; was pursued by a vessel belonging to the constable of the Tower, overtaken, and beheaded at sea in May, 1450.—JOHN DE LA POLE, DUKE, son of the preceding, married a sister of Edward IV., by whom he was in 1463 restored to the dukedom. He was one of the three dukes who aided in placing the crown upon the head of Richard III.—EDMUND DE LA POLE, EARL, second son of the preceding, date of birth uncertain; his elder brother, John, earl of Lincoln, supported the pretensions of Lambert Simnel, who claimed to be one of the sons of Edward IV. who were supposed to have been murdered in the Tower by Richard III.; was killed in the battle of Stoke, and his estates attainted. Upon the death of their father in 1491, Edmund succeeded to the ducal title, which he waived in consideration of the restoration by Henry VII. of a part of his estates, and accepted the rank of earl in 1497. He subsequently entered into political intrigues; retired to France in 1502, but in 1507 fell into the hands of Henry VII., who kept him imprisoned in the Tower for seven years, and then caused him to be beheaded, Apr. 30, 1513.—RICHARD DE LA POLE, brother of the preceding, upon the death of Edmund assumed the title of duke of Suffolk; was exiled; entered the service of the king of France, and was killed at the battle of Pavia, Feb. 24, 1525, being the last of his house.—CHARLES BRANDON, duke of Suffolk, b. about 1490, was the nephew of Sir William Brandon, who bore the standard of Henry of Richmond at the battle of Bosworth; was early taken to court, and became the playfellow of Prince Henry, afterward Henry VIII., upon whose accession he was created Viscount L'Isle. A mutual attachment sprang up between him and Mary, the sister of Henry; she was forced, in 1514, to marry the old king Louis XII. of France, her brother having promised her that she should have liberty to please herself next time. Louis died within three months, and Brandon, who had been created duke of Suffolk, was sent over to congratulate Francis I. upon his accession, and was soon after privately married to the young widowed queen. Henry was with some difficulty appeased, but the duke was in time received into favor; commanded an English force in France by which, in 1523, Paris was seriously menaced, and was present at the capture of Boulogne, 1544. D. Aug. 22, 1545. His daughter, the Lady Frances, was the wife of the succeeding.—HENRY GREY, last duke of Suffolk and father of Lady Jane Grey, created duke Oct. 11, 1551; caused his daughter to be crowned July, 1553, and was sent to the Tower by Queen Mary, but was soon pardoned; joined Wyatt's insurrection; was tried for high treason, and beheaded on Tower Hill Feb. 23, 1554.—THOMAS HOWARD, first earl of Suffolk of the present family, b. in 1553; knighted for services against the Spanish Armada 1588; made privy councillor and created earl of Suffolk 1603, lord chamberlain 1604, lord high treasurer 1614, dismissed 1618; arraigned before the Star Chamber, and with his wife sent to the Tower 1619; liberated and restored to royal favor 1620. D. May 28, 1626.—CHARLES JOHN HOWARD, seventeenth earl of the present line, b. Nov. 7, 1804; was a member of the House of Commons 1832–41; succeeded his father as earl Dec. 4, 1851. A. H. GUERNSEY.

**Suf'fragan** [from the Lat. *suffragans*, "to support with one's vote," "to be favorable to;" hence, "an assistant or a subordinate"]. (1) Bishops of simple dioceses in an ecclesiastical province are suffragan to the metropolitan of that province—that is, subject to his ecclesiastical authority. (2) A coadjutor is sometimes said to be suffragan to his superior bishop. A bishop of a limited part of a diocese is a suffragan to the bishop of the diocese. For instance, the bishop of Dover Precincts is a suffragan of the archbishop of Canterbury, while all bishops of the province of Canterbury are suffragans of the same metropolitan in a different sense.

**Suf'frage** [Lat. *suffragium*, "vote"], in constitutional law and political science, is the right conferred upon a person to vote at elections of public officers of a nation, State, or municipality. The Constitution of the U. S. provides that "the electors in each State shall have the qualifications requisite for electors of the most numerous branch of the State legislature." The XIVth Amendment declares that "No State shall make or enforce any law which shall abridge the privileges and immunities of citizens of the U. S." The XVth Amendment says, "The right of citizens of the U. S. to vote shall not be denied or abridged by the U. S. or by any State on account of race, color, or previous condition of servitude." The Constitution originally placed the regulation of suffrage under the exclusive control of the States. The Supreme Court has recently decided that the XIVth and XVth Amendments have not departed from nor modified this fundamental principle, with the single exception that race, color, or previous con-

dition of servitude cannot be made a ground for withholding the right from U. S. citizens. The principle is also settled that suffrage is not a right, privilege, or immunity inhering in or flowing from U. S. citizenship. A denial of the franchise to any class of citizens, except on account of race, color, etc.—as, for example, to women—is not therefore inhibited by either of these amendments. To the States still belongs, with the single exception made by the XVth Amendment, the sole power of conferring or withholding the electoral right, of determining what classes of persons may or may not enjoy it. In the exercise of this authority the States have, in their constitutions, with great unanimity granted the suffrage to all male citizens of the U. S. who have attained the age of twenty-one years. There are, however, deviations from this general rule. In several Western States male persons of twenty-one years may vote, although they are not yet citizens, provided they are actual residents of the State and have been so for one year or more. In a very few States some discrimination is made against naturalized citizens; as, for example, in New York they must have been citizens at least ten days before voting, and in Rhode Island they must possess a small property-qualification. In one or two of the States—Connecticut and Massachusetts—a literary qualification is required from the elector, and he must be able to read and to write. As the universal rule, convicted felons, lunatics, and public paupers are excepted from the class of voters. The extension of the suffrage to women has been advocated by a considerable number of zealous reformers, chiefly upon the assumption that it is an essential manhood right inherent in the condition of citizenship. Our political institutions, however, are not framed upon this theory, and its adoption would require a radical change in all the existing legislation relating to the subject.

JOHN NORTON POMEROY.

**Su'fis** [Arab. and Pers. *sûfi*, "wise," "pious;" kindred to Gr. σοφός], a mystical sect among the Mohammedans and their system of belief. The Sufis hold that there are four attainable degrees of sanctity, the lowest involving merely a strict observance of all the precepts and rituals of Islam, ascending by degrees to the last, in which the devotee is admitted into direct communication with the Deity and to a mysterious union with him. The sect was founded in the ninth century by Abul Khair, and exists principally in Persia, and has contained among its members many of the most noted Mohammedan scholars and poets. Schamyl, the famous Circassian leader, is said to have belonged to this sect, and to have given to it a semi-political character, directing it especially against the aggressions of the Russians.

**Sufism.** See SUFIS.

**Su'gar** [Fr. *sucre;* Gr. *Zucker;* Lat. *saccharum;* Sansk. *shakará*], a name which is given to a variety of sweet principles found in plants and animals. It does not include, however, all substances possessing a sweet taste. Glycerine, acetate of lead ("sugar of lead"), hyposulphite of silver, and salts of glucinum, though possessing a sweet taste, are not sugars.

I. VARIETIES OF SUGAR.—The sugars are mostly of vegetable origin. They are soluble in water, generally crystallizable, have a sweet taste, are neutral to vegetable colors, and in many cases their solutions rotate the plane of vibration of polarized light to the right or left to a greater or less degree. They are composed of carbon, hydrogen, and oxygen, and most of them are "carbohydrates;" *i. e.* they contain hydrogen and oxygen in the proportions in which they exist in water, 2 atoms of hydrogen to 1 of oxygen; thus, cane-sugar is $C_{12}H_{22}O_{11}$. They are all decomposed by heat, yielding first water, and afterward a variety of products of destructive distillation, as carbonic oxide (CO), carbonic dioxide ($CO_2$), marsh-gas ($CH_4$), acetic acid, aldehyde, acetone, furfurol, liquid hydrocarbons, etc. Under the influence of oxidizing agents they yield acids, such as mucic, saccharic, tartaric, formic, oxalic, and carbonic acids. They often act as reducing agents on metallic salts, as those of silver, copper, etc.; the glucoses, more powerfully than cane-sugar and its isomeres. Very strong nitric acid, or a mixture of this with sulphuric acid, generally converts sugars into nitro-substitution products analogous to gun-cotton and nitro-glycerine, nitryl ($NO_2$) taking the place of H. Cane-sugar yields nitro-saccharose, $C_{12}H_{18}(NO_2)_4O_{11}$. Weaker acid merely oxidizes, yielding saccharic acid ($H_2C_6H_8O_8$), oxalic acid ($H_2C_2O_4$), etc. Dilute acids convert cane-sugar and its isomeres into glucose:

Cane-sugar. Dextro-glucose. Lævo-glucose.

$$C_{12}H_{22}O_{11} + H_2O = C_6H_{12}O_6 + C_6H_{12}O_6.$$

Concentrated sulphuric acid decomposes cane-sugar and its isomeres, forming a black carbonaceous mass, and liberating sulphurous anhydride ($SO_2$) and other products. The glucoses are less affected. Toward alkalies, sugars act like weak acids, forming compounds by exchanging hydrogen for metal. Heated with alkalies, they are decomposed, the glucoses most readily, with the production of brown humus-like bodies. Under the influence of ferments most of the sugars undergo fermentation, the products varying with the kind of sugar, the nature of the ferment, and the conditions. The glucoses are directly susceptible of vinous fermentation under suitable conditions, but cane-sugar and its isomeres are first changed to glucose. (See FERMENTATION.)

The chemical relations of the sugars have not been fully established; they are subdivided into—(1) *Alcohols*, as erythrite ($C_4H_6(OH)_4$), pinite and quercite ($C_6H_7(OH)_5$), mannite, dulcite, and isodulcite ($C_6H_8(OH)_6$). (2) *Glucoses* ($C_6H_{12}O_6$), which may be regarded as aldehydes of the hexatomic alcohols ($C_6H_8(OH)_6$), formed by the removal of $H_2$, thus:

Mannite. Glucose.

$$C_6H_8(OH)_6 - H_2 = C_6H_{12}O_6.$$

The following are known: dextro-glucose, maltose, lævo-glucose, mannitose, galactose, inosite, sorbine, and eucalyn. (3) *Polyglucosic alcohols*, formed by the combination of 2 molecules of glucose and the elimination of 1 molecule of water:

Glucose. Cane-sugar.

$$2C_6H_{12}O_6 - H_2O = C_{12}H_{22}O_{11}.$$

The following are known: cane-sugar, or saccharose, parasaccharose, melitose, melezitose, trehalose, mycose, milk-sugar or lactine or lactose, synanthose.

The sugars are intimately related to the starches, gums, dextrine, and cellulose, which are carbohydrates, and which are capable of conversion into glucose and subsequent fermentation. Gum-arabic (arabine) is believed to be isomeric with cane-sugar ($C_{12}H_{22}O_{11}$). Starch, dextrine, and cellulose ($C_{12}H_{20}O_{10}$ or $C_{18}H_{30}O_{15}$) are considered as anhydrides of the polyglucosic alcohols, thus:

Glucose.

$$C_6H_{12}O_6 - H_2O = C_6H_{10}O_5.$$

Diglucosic alcohol.

$$C_{12}H_{22}O_{11} - H_2O = C_{12}H_{20}O_{10}.$$

Triglucosic alcohol.

$$C_{18}H_{32}O_{16} - H_2O = C_{18}H_{30}O_{15}.$$

(1) *Erythrite*, *Erythro-glucine*, or *Phycite* ($C_4H_{10}O_4 = C_4H_6(OH)_4$ occurs in *Protococcus vulgaris*. It crystallizes in large transparent prisms, has a sweet taste, is readily soluble in water, slightly in alcohol. It does not affect the plane of polarized light, and is not fermentable. It is a tetratomic alcohol.

(2) *Pinite* or *Pine-Sugar* ($C_6H_{12}O_5 = C_6H_7(OH)_5$) occurs in the sap of the California pine (*Pinus Lambertiana*). It forms hard, white, crystalline nodules, as sweet as cane-sugar, very soluble in water, nearly insoluble in alcohol. It rotates the plane of polarization to the right; is not fermentable. It is a pentatomic alcohol.

(3) *Quercite* or *Acorn-Sugar* ($C_6H_{12}O_5 = C_6H_7(OH)_5$) occurs in acorns. It forms hard crystals, soluble in water and in hot dilute alcohol. It has a sweet taste, rotates the plane of polarized light to the right, and is not fermentable. It is a pentatomic alcohol.

(4) *Mannite* or *Manna-Sugar* ($C_6H_{14}O_6 = C_6H_8(OH)_6$) occurs in manna, the concrete juice of two species of ash which grow in Southern Europe and the East, *Fraxinus ornus* and *F. rotundifolia*, in the roots of many plants, as celery, etc., the bark of *Canella alba* (8 per cent.) and of other plants, the leaves and twigs of many plants, in coffee-beans, many fungi (mushrooms), certain algæ (seaweeds), etc. It is formed abundantly during the viscous fermentation of cane-sugar (see FERMENTATION), and also by the action of sodium amalgam on glucose. It crystallizes in thin, four-sided prisms, soluble in 6½ parts of water at 64.4° F., and in 80 parts of alcohol (sp. gr. 0.898). Its solution does not become syrupy by spontaneous evaporation, and its taste is only slightly sweet. It does not affect polarized light except when mixed with boric acid, when its rotation is to the right. It does not ferment except under very unusual conditions; does not darken when boiled with caustic alkalies, nor reduce cupric oxide in alkaline solutions. It is a hexatomic alcohol. By oxidation it yields mannitose ($C_6H_{12}O_6$), isomeric with glucose. Heated with organic acids, it forms compound ethers (after the manner of alcohols), which considerably resemble the fats. (For an account of the different mannas see Johnston's *Chemistry of Common Life*.)

(5) *Dulcite*, *Dulcose*, *Dulcine*, or *Melampyrite* ($C_6H_{14}O_6 = C_6H_8(OH)_6$) occurs in a crystalline substance of unknown origin which is brought from Madagascar; also in *Melampyrum nemorosum* and other plants. It is produced by the action of sodium amalgam on milk-sugar, inverted milk-sugar, and galactose. It resembles mannite in many of its properties, but differs in crystalline form, melting-

point, and in yielding mucic acid instead of saccharic when oxidized by nitric acid. It does not ferment with yeast, but, like mannite, may be made to undergo fermentation by contact for several weeks with cheese and chalk, yielding alcohol and lactic and butyric acids. It has no effect on polarized light, is not darkened by caustic alkalies, and does not reduce cupric oxide in alkaline solutions. It is a hexatomic alcohol, and yields compound ethers with acids.

(6) *Isodulcite* ($C_6H_{14}O_6$) is produced by the action of dilute acids on quercitrine. It forms large crystals, like those of cane-sugar, is sweeter than grape-sugar (glucose), is very soluble in water, in 2.08 parts at 64.4°, and in absolute alcohol. It rotates the plane of polarized light to the right, reduces oxides, becomes yellow or brown when boiled with caustic alkalies, and does not undergo fermentation.

(7) *Dextro-glucose, Dextrose, Ordinary Glucose, Grape-Sugar, Fruit-Sugar, Starch-Sugar, Potato-Sugar, Diabetic Sugar*, etc. ($C_6H_{12}O_6$), occurs abundantly in sweet fruits, frequently with cane-sugar, and generally with so much lævo-glucose (levulose) that the mixture rotates the plane of polarized light to the left. It rarely occurs in nature free from lævo-glucose. Cane-sugar, which exhibits right-handed rotation, is changed by acids and other agents to a mixture of dextro- and lævo-glucose, and as the action of the latter predominates, the rotation becomes left-handed; hence this mixture of the two glucoses is called *inverted* sugar:

Cane-sugar. Dextro-glucose. Lævo-glucose.

$$C_{12}H_{22}O_{11} + H_2O = C_6H_{12}O_6 + C_6H_{12}O_6.$$

The rotation of cane-sugar is + 73.8° (right), of dextrose + 56°, of levulose — 106° (left); $\frac{-106° + 56°}{2} = -25°$; hence the rotatory power of inverted sugar is — 25° (left). Honey, especially when long kept, contains dextrose and levulose, produced by the inversion of the cane-sugar originally present. The crystallization of the glucoses causes the granulation so often noticed. Dextrose is also found in the liver, blood, chyle, yolk and white of hens' eggs, and often, to the extent of 8 or 10 per cent., in diabetic urine (free from levulose), and in minute quantity in healthy urine. It is also liberated by the decomposition (fermentation) of bodies called glucosides, such as amygdaline. (See GLUCOSIDES and ALMONDS, OIL OF.) Dextrose is produced by the action of dilute acids, diastase, saliva, pancreatic juice, etc., on starch, dextrine, glycogen, etc. (see DEXTRINE and DIASTASE), by the action of sulphuric acid, hydrochloric acid, or chloride of zinc or cellulose, and, together with levulose, by the action of dilute acids, yeast, and other agents on cane-sugar, as mentioned above. In the manufacture of beer from barley and of alcohol from potatoes, corn, etc., the conversion of the starch into dextrose is one of the steps of the process. (See BEER.) Dextrose is made in large quantities from potato and corn starch, to be added to grape-juice for making wine, as a substitute for a portion of the malt in making beer, for confectionery, and as an addition to sugar-house syrup. In 1873 there were 51 grape-sugar factories in Germany, using potatoes, and making 24,000,000 pounds of solid glucose, 32,500,000 pounds of glucose-syrup, and 3,000,000 pounds of coloring for liquors per annum. Since that time the industry has much increased. The process of manufacture is very simple. A suitable quantity of water is heated to boiling; the sulphuric acid, previously diluted with 3 parts of water, is then added; and finally the starch, reduced with water to the consistency of milk, is run in. The whole is boiled till the conversion of the starch is complete. Chalk is then added to neutralize the acid; the clear liquor is drawn off from the deposit of sulphate of lime, evaporated to about 16° B., filtered over bone-black, and then evaporated to any desired consistency. When sufficiently concentrated it may be run into vats and allowed to crystallize. Suitable proportions are—starch 100, acid, 60° B., 2, and water 300–400 parts. Wagner gives the following analyses of German grape-sugar:

| | | | |
|---|---|---|---|
| Dextrose | 75.8 | 67.5 | 62.2 |
| Dextrine | 9.0 | 9.0 | 8.8 |
| Water | 13.1 | 19.5 | 24.6 |
| Foreign substances | 2.1 | 4.0 | 4.4 |
| | 100.0 | 100.0 | 100.0 |

In the boiling of solutions of cane-sugar there is always a partial conversion into dextrose and levulose (inversion); and as the latter sugar interferes with the crystallization of the other two, a certain proportion of uncrystallizable molasses is produced. This is the reason that solid sugar is so difficult to obtain from sorghum. From its aqueous solution, dextrose may be obtained in granular masses, consisting of a hydrate ($C_6H_{12}O_6.H_2O$); from alcohol, in anhydrous needles. It is less soluble in water than cane-sugar, requiring 1½ parts of cold water for solution. It forms a sweet syrup, not so ropy as the syrup of cane-sugar. It is not as sweet as cane-sugar, 1 part of which sweetens as much as 2 or 2½ parts of dextrose. Heated to 248° F., it loses water and becomes anhydrous ($C_6H_{12}O_6$); heated from 284° to 338° F., it loses a further quantity of water, and forms glucosane ($C_6H_{10}O_5$) and caramel. Heated with caustic alkalies, it is decomposed, with the formation of melassic acid and a brown humus-like substance. A boiling solution of dextrose and caustic potassa reduces copper salts to red suboxide of copper, and silver and gold salts to metallic silver and gold. Dextrose readily undergoes fermentation: (1) vinous, with the production of alcohol and carbonic acid with small quantities of glycerine and succinic acid, etc.; (2) lactous, with the production of lactic acid; (3) viscous, with the production of mannite and gum, or other forms of fermentation according to the conditions. (See FERMENTATION.) Glucose (dextro or lævo) may be detected even in the presence of cane-sugar—(1) by the yellow or brown color produced on boiling it with caustic potassa; (2) by the dark coloration produced by basic nitrate of bismuth in the solution, to which carbonate of soda is previously added; (3) by the reduction of copper salts ("Trommer's test"); (4) by the decoloration of an alkaline solution of ferricyanide of potassium. It is readily distinguished from cane-sugar by its not blackening under the influence of strong sulphuric acid. Trommer's test is especially useful for testing urine for grape-sugar. It may be applied in various ways: (1) by adding to the urine in a test-tube a grain of sulphate of copper, then an excess of caustic potassa, and applying heat; the presence of grape-sugar is indicated by the formation of red suboxide of copper; (2) by placing a little sulphate of copper solution in a test-tube, adding a little tartaric acid, then an excess of caustic potassa; this is then heated, and while boiling, the urine, previously diluted, is poured in, a few drops at a time. The formation of a red precipitate indicates the presence of grape-sugar. This test is made quantitative by using a definite amount of the copper salt, and determining how much of the urine or other solution of grape-sugar is required to completely precipitate the copper. The following is a very satisfactory method: A solution of pure sulphate of copper in water is prepared, containing 34.639 grammes in a litre; 10 cubic centimètres of this solution require .05 of grape-sugar for their reduction. This quantity of the solution is measured out with a pipette, and placed in a small flask or evaporating-dish. It is then diluted to three times its volume by the addition of water. A little tartaric acid is now added, and a considerable excess of caustic potassa. This solution is then boiled, and the urine, diluted to one-tenth of its original strength, is added slowly from a graduated burette till the liquid above the red precipitate no longer shows a trace of blue color. If $a$ = the cubic centimètres of diluted urine used, and $x$ the percentage of grape-sugar, then $\frac{a}{10} : .05 = 100 : x$. This equation assumes the cubic centimètre of urine or other liquid to weigh exactly 1 gramme, which is not the case. By dividing the percentage thus obtained by the specific gravity of the urine, the true percentage will result. (For other facts with regard to dextrose see GLUCOSE.)

(8) *Maltose* is a variety of glucose observed by Dubrunfaut (*Ann. Ch. Phys.* [3], xxi. 178). It is produced by the action of malt or diastase on starch-paste, resembles dextrose in crystalline form and most other respects, but its dextro-rotatory power is three times as great, and it appears to be less easily altered by alkalies. It is converted into dextrose by boiling with dilute sulphuric acid.

(9) *Lævo-glucose* or *Levulose* ($C_6H_{12}O_6$) occurs associated with dextrose in honey, in many fruits, in molasses, and in other vegetable products. The mixture of the two glucoses in equal quantities constitutes *fruit-sugar* or *inverted sugar*. Some fruits—certain apples and pears—contain an excess of levulose. Icery (*Ann. Ch. Phys.* [4], v. 350; *Jahresb.*, 1869, p. 819) finds this glucose associated with cane-sugar in the sugar-cane, especially in the upper parts of the stem, which are still enveloped by the green leaves, and thereby protected from the light. Here it sometimes amounts to $\frac{1}{6}$th the quantity of the cane-sugar, while in the lower part of the stem it does not exceed the $\frac{1}{75}$th to the $\frac{1}{50}$th part. As the leaves dry up, and the upper portion of the stem is exposed to the light, it appears to be converted into cane-sugar. Icery infers from this that the cane-sugar is a secondary product, formed by the action of light on the levulose. A solution of cane-sugar, when left to itself, warmed with dilute acids, or subjected to the action of yeast or pectase, the ferment of fruits, loses its dextro-rotatory power, and acquires lævo-rotatory power. This transformation or inversion amounts when complete

to —38° left for every +100° right of the original rotation. As already mentioned, this is due to the assimilation by the cane-sugar of water (5 per cent.), and its resolution into equal quantities of dextrose and levulose. "To separate the levulose, the inverted sugar obtained from 10 grammes of cane-sugar is mixed with 6 grammes of slaked lime and 100 grammes of water, whereby a solid calcium-compound of levulose is formed, while the whole of the dextro-glucose remains in solution, and may be separated from the precipitate by pressure. The calcium salt of levulose suspended in water, and decomposed by carbon dioxide, yields a solution of pure levulose, which may be filtered and concentrated by evaporation." (*Dubrunfaut.*) Pure levulose may be obtained directly by boiling inuline with dilute acids or for a long time with water. Levulose forms a colorless, uncrystallizable syrup or an amorphous solid mass. It is as sweet as cane-sugar, and acts as a purgative. It is more soluble in alcohol than dextrose. Its rotatory power for polarized light is —106° (left). In contact with yeast it readily undergoes fermentation. In most of its properties levulose is similar to dextrose, but it is more easily altered by heat or by acids, but less easily by alkalies or ferments.

(10) *Mannitose* ($C_6H_{12}O_6$) is a glucose produced with mannitic acid when mannite is oxidized with the aid of platinum-black. It is prepared by saturating the liquid with lime, removing the mannitate by adding alcohol, evaporating the solution to a syrup, again adding alcohol, again filtering, and evaporating to dryness. It is syrupy, uncrystallizable, fermentable, and inactive to polarized light, and resembles the other glucoses in its chemical reactions.

(11) *Galactose* ($C_6H_{12}O_6$) is produced by boiling milk-sugar with dilute acids. It is soluble in water, slightly in alcohol, and crystallizes more readily than dextrose. Its dextro-rotatory power is +83.3°. It ferments readily, and resembles dextrose in most of its properties. It differs from dextrose, maltose, levulose, and mannitose in yielding mucic instead of saccharic acid when treated with nitric acid.

(12) *Inosite* or *Phaseomannite* ($C_6H_{12}O_6$) occurs in the heart, lungs, kidneys, liver, spleen, and brain, and in urine in case of Bright's disease. It occurs in kidney-beans, peas, cabbage, potato-shoots, asparagus, etc. Hilger (*Ann. Ch. Pharm.*, clx. 333) states that inosite occurs abundantly in the juice of the grape. Jacobsen determined the quantity of inosite in the flesh of animals, finding 0.08 per cent. in the flesh of a young porpoise and 0.30 in horse-flesh.

(13) *Sorbine* ($C_6H_{12}O_6$) is obtained from ripe mountain-ash berries (*Sorbus aucuparia*). The juice of the berries is allowed to undergo fermentation; it is then concentrated, yielding crystals of sorbine, which are purified by solution, filtration over animal charcoal, and recrystallization. As no sorbine is found in the fresh juice, and the malic acid present disappears during the process, Delffs (*Chem. News*, 1854, 664) supposes the sorbine to be derived from the malic acid, perhaps thus:

$$\underset{\text{Acid malic ether.}}{C_2H_5.H.C_4H_4O_5} + H_2O = \underset{\text{Sorbine.}}{C_6H_{12}O_6}.$$

Sorbine appears in beautiful trimetric octahedral crystals, as sweet as cane-sugar. It is readily soluble in water, almost insoluble in alcohol. Its lævo-rotatory power is — 46.9° left. It does not undergo fermentation in contact with yeast, but with cheese and chalk, at 104° F., undergoes fermentation, yielding much lactic acid, with some alcohol and butyric acid. The name "sorbite" is sometimes applied to this sugar, but Boussingault (*Compt. rend.*, lxxiv. 939) restricts this name to a non-fermentable sugar ($C_6H_{14}O_6$), isomeric with mannite and dulcite, which exists in the fresh juice. It does not affect the plane of polarized light, nor does it reduce oxide of copper in Trommer's test. It differs from mannite and dulcite in several particulars.

(14) *Eucalyn* ($C_6H_{12}O_6$) is an unfermentable sugar produced by the fermentation of melitose, the sugar of the *Eucalyptus* of Tasmania:

$$\underset{\text{Melitose.}}{C_{12}H_{22}O_{11}} + H_2O = 2CO_2 + \underset{\text{Alcohol.}}{2C_2H_6O} + \underset{\text{Eucalyn.}}{C_6H_{12}O_6}.$$

It is obtained as an uncrystallizable syrup, with a rotatory power of +50°. It reduces copper in the Trommer test, and does not ferment, even after treatment with sulphuric acid. In some respects it resembles sorbine.

(15) *Cane-Sugar*, *Saccharose*, or *Sucrose* ($C_{12}H_{22}O_{11}$) occurs—(1) In the stems and roots of many grasses, especially in the sugar-cane (*Saccharum officinarum*) 18 per cent., Chinese sugar-cane (*Sorghum saccharatum*) 9 to 9½ per cent., Indian corn, the juice of which just after flowering contains 7.4 to 7.9 per cent., etc. (2) In fleshy roots, as the beet (7 to 14 per cent.), carrot, turnip, sweet potato, mallow, etc. Madder-root contains 8 per cent., with nearly as much more inverted sugar. (3) In the stems of many trees, as the date and other palms, and especially in the vernal juices of the sugar-maple (*Acer saccharinum*), the birch, and walnut. (4) In most sweet fruits, often with inverted sugar—pumpkins, melons, bananas, etc. Some, as walnuts, hazel-nuts, almonds, coffee-beans, and St. John's bread, contain only cane-sugar. (5) In the nectar of flowers and in honey, often with inverted sugar; the nectar of cacti is almost wholly cane-sugar; that of *Rhododendron ponticum* shows crystals of cane-sugar, as does also the honey of the American wasp, *Polybia apicipinnis*; the cane-sugar rapidly disappears from honey by inversion under the influence of ferments present, the honey becoming granular from the crystallization of the dextrose. (6) In manna; Sinai manna, from *Tamarix mannifera*, contains 55 per cent. of cane-sugar, 25 of inverted sugar, and 20 of dextrine; Kurdistan manna, 61 of cane-sugar, 16.5 of inverted sugar, and 22.5 of dextrine.

*Preparation.*—Cane-sugar is prepared by evaporating the vegetable juices, the free acids being neutralized by lime, and the temperature kept as low as possible to prevent inversion. The first product, or *raw sugar*, is purified by dissolving it in water, straining through bag filters, filtering over bone-black to remove color, salts, etc., and boiling down in vacuum-pans to the crystallizing-point. After it has crystallized into loaves, it is washed with a saturated solution of pure sugar in water, to remove the mother-liquor or molasses. The manufacture and refining of sugar are more fully discussed in the latter part of this article.

*Properties.*—The cane-sugar from the plants mentioned above is all identical when completely purified. The difference in the appearance and apparent sweetness of the sugar from the beet, used on the continent of Europe, and that from the cane, used in England and the U. S., is entirely due to the fashion of the countries, which demands in the former a fine-grained sugar, in the latter a coarse-grained loaf. The Paris refiners boil from the same raw beet-sugar a fine-grained product for home consumption and a coarse-grained product for the English market. Much of the white loaf-sugar used in England is beet-sugar refined in France and Belgium. Cane-sugar crystallizes readily when pure. The individual crystals are colorless and transparent; masses of small crystals, loaf-sugar, appear white, owing to the numberless reflections and refractions of the light by the crystals. When broken or rubbed together in the dark, the sugar emits a phosphorescent light. The specific gravity of cane-sugar is 1.606; it is the heaviest compound of carbon, hydrogen, and oxygen known. (*Wanklyn.*) The sp. gr. of milk-sugar is 1.53; starch, 1.53; cellulose, 1.5; gum-arabic, 1.355; glycerine, 1.27. Heated to 320° F., cane-sugar melts to a clear liquid, which solidifies on cooling to a transparent mass, "barley-sugar," which in time becomes opaque and crystalline. At a higher temperature it gives off water, and probably becomes glucosane, $C_6H_{10}O_5$. At 410° more water is given off, and caramel remains, a mixture of (1) brown caramelane ($C_{12}H_{18}O_9$), soluble in water and alcohol; (2) reddish-brown caramelene ($C_{36}H_{50}O_{25}$), soluble in water, sparingly in strong alcohol; (3) black carameline ($C_{96}H_{102}O_{51}$); three modifications of which are known—A, soluble in water; B, insoluble in water, soluble in other liquids; C, insoluble in all ordinary solvents; and (4) other bodies. After losing 10 per cent. of water the product is nearly pure caramelane; after 14 or 15 per cent., it is rich in caramelene; after a loss of 20 per cent., it consists almost wholly of carameline. At still higher temperatures it undergoes destructive distillation, giving off carbonic oxide, marsh-gas, carbon dioxide ($CO_2$), acetic acid, acetone, aldehyde, and brown oils, which contain furfurol, a bitter principle, assamar, and other compounds. A considerable residue of brilliant charcoal remains behind. Cane-sugar is very soluble in water, and has a pure sweet taste. It is 2 or 2½ times sweeter than dextrose. Its concentrated solutions are syrupy. Cold water dissolves three times its weight of cane-sugar, hot water larger quantities. It is insoluble in ether and in cold absolute alcohol; boiling alcohol dissolves 1¼ per cent. of it. Aqueous alcohol dissolves it much more readily. C. Scheibler has investigated the solubility of cane-sugar in aqueous alcohol of different strengths and at different temperatures (*Deut. Chem. Ges. Ber.*, v. 343). Gerlach (1864) gives in the following table the specific gravity of sugar solutions, with the corresponding percentage of cane-sugar at 17.5° C.:

| Percentage cane-sugar. | Specific gravity sol. | Percentage cane-sugar. | Specific gravity sol. | Percentage cane-sugar. | Specific gravity sol. |
|---|---|---|---|---|---|
| 75 | 1.383342 | 67 | 1.332370 | 59 | 1.284054 |
| 74 | 1.376822 | 66 | 1.326188 | 58 | 1.278197 |
| 73 | 1.370345 | 65 | 1.320046 | 57 | 1.272379 |
| 72 | 1.363910 | 64 | 1.313946 | 56 | 1.266600 |
| 71 | 1.357518 | 63 | 1.307887 | 55 | 1.260861 |
| 70 | 1.351168 | 62 | 1.301868 | 54 | 1.255161 |
| 69 | 1.344860 | 61 | 1.295890 | 53 | 1.249500 |
| 68 | 1.338594 | 60 | 1.289952 | 52 | 1.243877 |

| Percentage cane-sugar. | Specific gravity sol. | Percentage cane-sugar. | Specific gravity sol. | Percentage cane-sugar. | Specific gravity sol. |
|---|---|---|---|---|---|
| 51 | 1.238293 | 33 | 1.144150 | 16 | 1.065606 |
| 50 | 1.232748 | 32 | 1.139261 | 15 | 1.061278 |
| 49 | 1.227241 | 31 | 1.134406 | 14 | 1.056982 |
| 48 | 1.221771 | 30 | 1.129586 | 13 | 1.052716 |
| 47 | 1.216339 | 29 | 1.124800 | 12 | 1.048482 |
| 46 | 1.210945 | 28 | 1.120048 | 11 | 1.044278 |
| 45 | 1.205589 | 27 | 1.115330 | 10 | 1.040104 |
| 44 | 1.200269 | 26 | 1.110646 | 9 | 1.035961 |
| 43 | 1.194986 | 25 | 1.105995 | 8 | 1.031848 |
| 42 | 1.189740 | 24 | 1.101377 | 7 | 1.027764 |
| 41 | 1.184531 | 23 | 1.096792 | 6 | 1.023710 |
| 40 | 1.179358 | 22 | 1.092240 | 5 | 1.019686 |
| 39 | 1.174221 | 21 | 1.087721 | 4 | 1.015691 |
| 38 | 1.169121 | 20 | 1.083234 | 3 | 1.011725 |
| 37 | 1.164056 | 19 | 1.078779 | 2 | 1.007788 |
| 36 | 1.159026 | 18 | 1.074356 | 1 | 1.003880 |
| 35 | 1.154032 | 17 | 1.069965 | 0 | 1.000000 |
| 34 | 1.149073 | | | | |

(For the equivalents of the specific gravities in Beaumé degrees see HYDROMETER.)

The aqueous solution of cane-sugar rotates the plane of polarized light to the right; for the transition tint $[\alpha] = +73.8$. The rotatory power varies but little with changes of temperature. This property of cane-sugar is the basis of optical saccharimetry, which is mentioned more fully in the latter part of this article. By prolonged boiling with water, cane-sugar is converted into a mixture of dextrose and levulose, *inverted* sugar. "The action of water and of various saline solutions on cane-sugar has been studied by Clasen (*J. pr. Chem.*, ciii. 449; *Zeitschr. f. Chem.* [2], iv. 604; *Am. Chemist*, iv. 90), with the following results: (1) Cane-sugar in dilute aqueous solution in glasses covered with paper is gradually converted into glucose at ordinary temperatures, *before the formation of fungi takes place on the surface;* but no alteration of the sugar takes place when its dilute solution is boiled for several hours immediately after preparation. (2) The formation of glucose is prevented by gypsum, by a mixture of gypsum and sal-ammoniac, and by nitre; retarded by magnesium sulphate. (3) When a sugar solution mixed with gypsum, potassium nitrate, or magnesium sulphate, after standing for several days at 70° R., is heated for a few hours only, a considerable quantity of glucose is formed. (4) When a sugar solution is mixed with gypsum and sal-ammoniac and heated, ammonia is given off and the solution turns acid. In presence of this saline mixture glucose is formed, even when the sugar solution is recently prepared. (5) In all other cases no acid reaction of the liquid was observed, and the transformation must be ascribed wholly to the action of the water. (6) Whether the product formed was actually grape-sugar or some other kind of sugar which reduces potassio-cupric tartrate, was not determined." (*Watts's Sup.*) (For Maumené's experiments on the action of water and heat see *Bull. Soc. Chim.* [2], xvii. 442.) E. M. Raoult (*Compt. rend.*, lxxiii. 1049) says that a solution of 1 part of sugar in 5 of water, enclosed in a sealed tube from which the air had been expelled by boiling the liquid, after five months' exposure to light was found to be about half converted into glucose (inverted sugar), while a similar solution kept for the same length of time in the dark remained unaltered. U. Kreusler (*Am. Chemist*, vi.) repeated these experiments, and found that access of air is necessary, and that light merely hastens the action of the ferment-germs derived from the air. Cane-sugar is not directly fermentable, but when its dilute solutions are mixed with yeast in considerable quantity, and exposed to a warm atmosphere, the sugar is converted into glucose by the soluble ferment of the yeast, and the glucose undergoes vinous fermentation. Diastase and pectase (fruit-ferment) change cane-sugar to glucose. Pure solutions of cane-sugar in water, when very concentrated, remain unaltered for years; when dilute, they suffer decomposition. (See FERMENTATION.) Saccharine solutions are also liable to undergo viscous fermentation. Strong solutions of sugar are used for preserving fruits, etc. Dilute acids, especially mineral acids—and sulphuric acid most rapidly—convert cane-sugar into glucose—slowly in the cold, rapidly when heated. Acid salts act in the same manner. Long-continued boiling with even very dilute acids results in the formation of brown ulmine, ulmic acid, etc. (See HUMUS.) If the air has access, formic acid is also produced. Grote and Tollens obtained a peculiar acid, levulinic ($C_5H_8O_3$), by heating cane-sugar with sulphuric acid (*Am. Chemist*, v. 424). E. Felz has found (*Am. Chemist*, iv. 317) that certain organic acids—citric, for instance—prevent the inversion of cane-sugar by mineral acids. Strong sulphuric acid destroys cane-sugar rapidly, evolving sulphur dioxide ($SO_2$), and forming a black carbonaceous mass. This reaction distinguishes cane-sugar from glucose. Concentrated hydrochloric acid decomposes cane-sugar rapidly. Acetic anhydride forms substitution-products with cane-sugar, in which hydrogen atoms are replaced by acetyl ($C_2H_3O$), as hepta- and octo-acetyl-saccharose, $C_{12}H_{15}(C_2H_3O)_7O_{11}$ and $C_{12}H_{14}(C_2H_3O)_8O_{11}$. Cane-sugar solutions are not decomposed on being heated with caustic alkalies, although a combination takes place between the sugar and alkaline base. This is decomposed by carbon dioxide ($CO_2$), the sugar having undergone no change. Long boiling with potash-lye results finally in the decomposition of cane-sugar. Glucose is quickly decomposed when heated with alkalies or alkaline earths, forming yellow or brown (humus) solutions.

"Cane-sugar is very easily oxidized. It reduces *silver* and *mercury salts* when heated with them, and precipitates *gold* from the chloride. Pure *cupric hydrate* is but slowly reduced by it, even at the boiling heat; in presence of alkali, however, a blue solution is formed, and on boiling the liquid cuprous oxide is precipitated. An alkaline solution of *cupric tartrate* is very slowly reduced by cane-sugar. Cane-sugar takes fire when triturated with 8 parts of *peroxide of lead*, and forms with *chlorate of potassium* a mixture which detonates on percussion, and burns vividly when a drop of oil of vitriol is let fall upon it. Cane-sugar, distilled with a mixture of *sulphuric acid* and *manganic peroxide*, yields formic acid. Heated with *dilute nitric acid*, it yields saccharic and oxalic acids. 1 part of sugar mixed with 3 parts of nitric acid of specific gravity 1.25 to 1.30, and heated to 50°, is wholly converted into saccharic acid:

$$C_{12}H_{22}O_{11} + O_6 = 2C_6H_{10}O_8 + H_2O.$$

At the boiling-heat the product consists chiefly of oxalic acid. Sugar is likewise oxidized by *chloride of lime*, but the products have not been examined." (*Watts.*) (See *Am. Chemist*, v. 277, for experiments by J. M. Merrick on the action of chloride of lime on cane-sugar.) "Dry *chlorine* does not attack sugar at ordinary temperatures, but at 100° a brown substance is formed, partly soluble in water. On passing chlorine into sugar-water, hydrochloric acid is slowly formed, together with carbonic acid, a brown substance, and an uncrystallizable organic acid. *Perchlorides* act upon sugar (and other carbohydrates) in the same manner as free chlorine, producing dark-colored products. This reaction is applied by Maumené (*Compt. rend.*, xxx. 314) to the detection of sugar and analogous substances in liquids. For this purpose a drop of the liquid is placed on a strip of white merino, previously steeped in a solution of stannic chloride and dried, and the strip is warmed over a hot coal or the flame of a lamp; the presence of any saccharine substance will then be indicated by the production of a black spot." (*Watts.*) Hlasiwetz and Habermann (*Ann. Ch. Pharm.*, clv. 120) find the acid produced by chlorine in cane-sugar solutions to be gluconic, $C_6H_{12}O_7$. Nascent hydrogen, produced by sodium amalgam in the aqueous solution, converts cane-sugar into mannite or dulcite and monatomic alcohols, ethyl, isopropyl, and hexyl.

Cane-sugar, added to a mixture of nitric and sulphuric acids, is converted into *nitro-saccharose*, $C_{12}H_{18}(NO_2)_4O_{11}$?, an explosive compound corresponding to gun-cotton and nitro-glycerine. With bases cane-sugar forms definite compounds called *sucrates*. Potassium and sodium compounds ($C_{12}H_{21}KO_{11}$ and $C_{12}H_{21}NaO_{11}$) are obtained as gelatinous precipitates on adding an alcoholic solution of sugar to potash or soda-lye. Cane-sugar solutions dissolve large quantities of magnesia, lime, strontia, baryta, oxides of lead, copper, etc. Carbon dioxide ($CO_2$) decomposes these sucrates, precipitating carbonates of the metals. The addition of sugar to solutions of many metals prevents their precipitation by alkalies. Citric, tartaric acid, and many other fixed organic bodies possess the same property. This is notably the case with aluminum, chromium, zinc, iron, manganese, cobalt, nickel, copper, etc. (See Grothe, *J. f. pr. Chem.*, xcii. 175.) Lime dissolves readily in solutions of cane-sugar, forming a very caustic alkaline solution, having a bitter taste. Compounds of cane-sugar with 1, $1\frac{1}{2}$, 2, 3, and 6 molecules of CaO have been observed.

All these compounds are decomposed by carbon dioxide ($CO_2$), with separation of calcic carbonate and a sugar syrup unimpaired. The tricalcic sucrate is but slightly soluble in water, and separates even from its dilute solutions, on the application of heat, as an amorphous mass. Rousseau proposes converting the sugar of the cane-juice into this compound on the plantations, drying it, and exporting it to the countries where it is to be consumed, when it can be refined with much less loss than by the present system of manufacture. When a certain quantity of carbonic acid has been passed into a solution of lime in cane-sugar syrup, there is produced a gelatinous magma which contains sugar, lime, and carbon dioxide. Bouvin and Loiseau use this mass in their process of sugar-refining as a defecating agent with great success in some of the largest refineries in Paris. There has been considerable discussion with regard to the nature of this precipitate. Bouvin

and Loiseau consider it a definite compound, the *sucrate of hydrocarbonate of lime*, while others consider it a mechanical mixture of carbonate of lime with sucrate of lime. (See the *Am. Chemist*, i. p. 8.) Sugar dissolves oxide of copper as well as the subacetate (verdigris), and, according to Orfila, the poisonous properties of the copper are very much diminished by the presence of the sugar.

Cane-sugar unites with some alkaline salts, forming definite crystalline compounds, which have been recently reinvestigated by Gill (*J. Lond. Chem. Soc.*, 1871, 269). He obtained the following definite compounds: (1) $2C_{12}H_{22}O_{11}.3NaCl.4H_2O$, (2) $C_{12}H_{22}O_{11}.NaCl.H_2O$, (3) $2C_{12}H_{22}O_{11}.3NaI.3H_2O$. From the last compound he infers that the formula for cane-sugar should be doubled to $C_{24}H_{44}O_{22}$.

The crystallization of cane-sugar is much hindered by the presence of certain salts, especially sodic chloride, and to a less degree potassic chloride. A. Marschall has carefully studied this subject, using salts which occur in the beet-root (*Zeitsch. d. Ver. f. Rüb. Ind.*, 1870, 339, in abstract in *Am. Chemist*, ii. 406). He classifies these salts as follows: (1) salts favoring crystallization: sodic sulphate, nitrate, acetate, butyrate, valerate, and malate; potassic aspartate; magnesic nitrate, sulphate, and chloride; calcic nitrate and chloride; (2) indifferent salts, without influence: sodic carbonate, oxalate, citrate, and aspartate; potassic sulphate, nitrate, and chloride; calcic hydrate; (3) salts preventing crystallization, and consequently favoring the formation of molasses: potassic carbonate, acetate, butyrate, and citrate. Magnesic sulphate promotes the crystallization of 10 times, magnesic chloride of 17 times, calcic chloride of 7½ times, its weight of cane-sugar. The addition of sulphuric acid often promotes the crystallization by converting injurious carbonates, etc., into harmless sulphates. Much remains to be learned on this subject. Dubrunfaut has introduced the process of osmose for the purpose of separating salts from molasses, in order to make it possible to obtain crystallized sugar from it. (See Endosmose for description of his apparatus.)

(16) *Parasaccharose* ($C_{12}H_{22}O_{11}$), a modification of cane-sugar, produced when a solution of cane-sugar containing ammonic phosphate is allowed to stand, exposed to the air, for several months during the summer. Dextrose is produced at the same time. It can be crystallized, is very soluble in water, nearly insoluble in 90 per cent. alcohol, has a dextro-rotatory power of +108°. It reduces the alkaline copper solution, but only half as strongly as dextrose. It is not perceptibly altered by dilute sulphuric acid, even at 212° F. (Jodin, *Compt. rend.*, liii. 1252; lv. 720; lvii. 434; *Jahresb.*, 1861, 722; 1862, 472; 1863, 572.)

(17) *Melitose* ($C_{12}H_{22}O_{11}$), a sugar found in the manna of *Eucalyptus* species in Tasmania. It crystallizes in slightly sweet needles, soluble in 9 parts of cold water and in boiling water. Its dextro-rotatory power is +102°. It does not reduce the alkaline copper solution, is not altered by boiling alkalies, and is changed by hot dilute sulphuric acid into a fermentable sugar, probably dextrose, and non-fermentable eucalyn, $C_{12}H_6O_{12}$. In contact with yeast it undergoes the same change, the dextrose subsequently undergoing vinous fermentation. (Johnston, *Mem. Chem. Soc.*, i. 159; Berthelot, *Ann. Ch. Phys.* [3], xlvi., 66.)

(18) *Melezitose* ($C_{12}H_{22}O_{11}$) is a sugar which occurs in Briançon manna from the larch (*Larix Europæa*). It crystallizes from the alcoholic extract in small, hard, shining, efflorescent crystals. Its dextro-rotatory power is + 94.1°. It is readily soluble in water, nearly insoluble in cold, slightly soluble in boiling alcohol. Melezitose decomposes at about 392° F. It is carbonized by cold strong sulphuric acid. By an hour's boiling with dilute sulphuric acid it is converted into glucose. In contact with yeast it passes slowly, or sometimes not at all, into vinous fermentation. It is not altered at 212° F. by aqueous alkalies, and scarcely by potassio-cupric tartrate.

(19) *Trehalose* and *Mycose* ($C_{12}H_{22}O_{11}.2H_2O$). Trehalose is a sugar contained in *Trehala manna* from Persia, which consists of the hollow cocoons of a coleopterous insect (*Larinus maculatus*). The larva of this insect feeds upon the branches of *Ethiops persica*, extracting sugar, gum, starch, etc., and forming from them its cocoon. The sugar is extracted by boiling alcohol. Mycose is a sugar found in the ergot of rye. These sugars crystallize in shining rhombic crystals, are very sweet, soluble in water and in boiling alcohol. The dextro-rotatory power of trehalose is +199, of mycose +192.5°. By long boiling with dilute sulphuric acid they are converted into dextrose. They are not altered by boiling with caustic alkalies, nor do they reduce the potassio-cupric tartrate. In contact with yeast they pass slowly and imperfectly into vinous fermentation. They are believed to be identical.

(20) *Lactose, Lactine, or Milk-Sugar* ($C_{12}H_{22}O_{11}.H_2O$), an important constituent of the milk of all Mammalia, amounting to one-third or more of the solid constituents. Cow's milk contains from 4 to 5 per cent., human milk more. (See Milk.) It was first prepared by Fabrizio Bartholetti in 1619 from whey, thence called *manna* or *nitrum serilactis*, afterward *galacticum Bartholetti*. Bouchardat has recently examined the saccharine matter obtained from the juice of the sapota tree (*Achras sapota*) of Martinique, and found it to consist of 45 per cent. of milk-sugar and 55 per cent. of cane-sugar. It is prepared from milk by coagulating the caseine with sulphuric acid or rennet, separating the curd, which includes both the caseine and the butter, filtering, and concentrating the whey to the crystallizing-point by evaporation. Sticks are introduced for the crystals to collect upon. By solution, filtration over animal charcoal, and recrystallization, or by repeated precipitation by alcohol, it is obtained pure. Large quantities are prepared in Switzerland from the whey left in making cheese. It forms hard, white hemihedral trimetric crystals, which feel gritty between the teeth, and, dissolving very slowly, have but a faintly-sweet taste. Subjected to a temperature of 266° F., milk-sugar loses 5 per cent. of water, exactly 1 molecule, leaving the anhydrous milk-sugar ($C_{12}H_{22}O_{11}$) as a colorless melted mass, which solidifies in the crystalline state on cooling. It is soluble in 5 or 6 parts of cold, 2½ of boiling water, but does not form a syrup. It is slightly soluble in alcohol. Its dextro-rotatory power is +59.3° (*Berthelot*), + 60.28° (*Biot*). The rotatory power of the solution diminishes on standing or on heating. Heated to 320° F., milk-sugar turns brown, and at 347° is converted into *lacto-caramel* ($C_{12}H_{20}O_{10}$); at a higher temperature it yields a humus-like body. Boiling with dilute sulphuric acid converts it into *galactose* ($C_6H_{12}O_6$), which has been already mentioned. Strong sulphuric and hydrochloric acids and alkalies decompose it, especially when heated, with formation of brown or black products. Milk-sugar is readily oxidized; with nitrate of silver it forms a mirror-like deposit of metallic silver, which has been used as a substitute for the ordinary tin-amalgam mirrors. It decomposes the potassio-cupric tartrate even in the cold, precipitating red cuprous oxide, and giving rise to *galactic* and *pecto-lactic* acids. Alkaline permanganates oxidize it to carbon dioxide ($CO_2$) and water. Moderately strong nitric acid converts it into mucic, saccharic, tartaric, and racemic acids, and finally oxalic acid. Very strong nitric, or a mixture of nitric and sulphuric acids, converts it into nitro-lactine. Distilled with oxidizing mixtures, such as sulphuric acid and manganese dioxide, it yields formic acid. When yeast is added to a solution of milk-sugar, it gradually passes into a state of vinous fermentation. When cheese or gluten is added, lactous fermentation occurs, with the formation of lactic acid, always, however, with the formation of some alcohol. In the presence of chalk or oxide of zinc this fermentation continues till all the sugar is converted into lactic acid.

The ordinary souring of milk is due to the transformation of the milk-sugar into lactic acid, the curd being precipitated by the free acid produced. Fermented milk is called *koumiss*; when distilled, it yields a kind of spirits called *arraca* or arrack. (See Fermentation, Milk, Koumiss, and Lactic Acid.) Milk-sugar forms compounds with potassa, soda, lime, and baryta, but not with sodic chloride. Fudakowski announces two new varieties of sugar obtained from milk-sugar. The quantitative determination of milk-sugar may be accomplished with the potassio-cupric tartrate, as in the case of dextrose, etc., or by noting the rotatory power of its solution. (See *Saccharimetry*, further on in this article.)

(21) *Synanthrose* ($C_{12}H_{22}O_{11}$), a variety of sugar which is found in company with inuline in the roots of the dahlia, Jerusalem artichoke, etc. It is deliquescent, readily soluble in water and in dilute alcohol, is optically inactive, does not reduce the copper solution. It has a faint taste, but is not sweet. Dilute acids convert it into dextrose and levulose. Like cane-sugar, when in contact with yeast it does not ferment directly, but is converted into dextrose and levulose, which subsequently undergo fermentation. Caustic alkalies do not turn it brown. (O. Popp, *Ann. Ch. Pharm.*, clvi. 181.)

(22) Several other sugars have been noticed, but have not as yet been fully investigated. *Rhamnegine-sugar* ($C_6H_{14}O_6$), isomeric with mannite, is obtained by boiling rhamnegine with dilute sulphuric acid. *Abietite* ($C_6H_8O_3$), resembling mannite, is obtained from the needle-like leaves of *Abies pectinata*. *Dambornite* ($C_4H_8O_3$) exists in Gaboon caoutchouc, and *dambose* ($C_3H_6O_3$ or $C_6H_{12}O_6$) is formed from it, and *bornesite* ($C_{14}H_{14}O_{12}$) is extracted from Borneo caoutchouc. Dambornite and bornesite are said to be volatile without decomposition. *Pectine-sugar* ($C_6H_{12}O_6$) is a glucose with a greater dextro-rotatory power (+118°) than any other sugar except trehalose and lactose. It was obtained by Scheibler by boiling the metapectic acid of turnips with strong acids (*Deut. Chem. Ges. Ber.*, 1868, pp.

58, 108). It readily reduces copper, but is not brought into vinous fermentation by yeast. It turns brown when heated with alkalies.

II. The Manufacture of Cane-Sugar.—Although cane-sugar occurs in a great variety of plants, there are very few from which it can be economically manufactured. These are the following:

| | Gross tons. | Per cent. |
|---|---|---|
| The sugar-cane, supplying | 1,700,000 | 59.34 |
| The beet, " | 1,000,000 | 34.90 |
| The date-palm, " | 100,000 | 3.49 |
| Sorghum (sold as molasses), supplying | 50,000 | 1.75 |
| The maple tree, supplying | 15,000 | 0.52 |
| | 2,865,000 | 100.00 |

A small quantity of sugar is said to be made in Mexico from maize, but no reliable statistics with regard to it are available. The estimated production from sorghum is based on the census report of the U. S. of 1870, which returns 24 hogsheads of sugar and 16,050,089 gallons of molasses from this plant. In reducing this to sugar, the molasses has been assumed to contain 7 pounds of sugar per gallon, which is probably high. Since 1870 the sorghum crop has fallen off very considerably. The estimated production of maple-sugar is also derived from the census report, which returns 28,443,645 pounds of sugar and 921,057 gallons of syrup. The syrup is assumed to contain 5 pounds of sugar per gallon.

III. Sugar from the Sugar-Cane.—The sugar-cane (*Saccharum officinarum*, L., and possibly other species of *Saccharum*) is not known in a wild state. It is probably a native of South-eastern Asia, and as Capt. Cook found it on the islands of the Pacific (?), it must have been indigenous there also. According to Humboldt, the sugar-cane was unknown in America and the adjacent islands before the advent of the Spaniards. Sugar was first made in Bengal, and the name is derived from the Sanskrit word *shakará* or *sarkará*, which signifies "small grains." The cultivation of the cane and the manufacture of sugar extended over Eastern Asia, China, Java, etc., then to Western Asia, Arabia, Northern Africa, Egypt (as early as 766), Tripoli; was introduced into Spain by the Moors soon after 714; was carried to Malta, Cyprus, Candia, and especially to Sicily, where large quantities of sugar were manufactured as early as 1148. About 1420 the Portuguese introduced the cane into Madeira and the Canaries, and until the discovery of America those islands supplied most of the sugar consumed in Europe. The cultivation of the sugar-cane was established in Hispaniola (now Santo Domingo and Hayti) soon after its discovery, and in 1518 there were 28 factories on the island. The industry extended to Brazil, Cuba, Porto Rico; the Danish islands, St. Thomas (60 factories in 1520), Santa Cruz, etc.; the English islands, Barbadoes (1641), St. Christopher (1643), Antigua, Jamaica, etc.; the French islands, Guadeloupe (1657), Martinique, etc.; the Dutch islands; Mexico, Peru, Chili; the Pacific islands, especially Manila in the Philippines, and the Sandwich Islands; to Louisiana in 1751, and to New South Wales in 1852.

Fig. 1.



Sugar-cane.

*The sugar-cane* belongs to the family of Gramineæ or grasses. It has a solid stem, from an inch to an inch and a half in thickness, and from eight to twenty feet in height. The stem is jointed about every three to six inches, and sends forth leaves, which fall off with the ripening of the plant. They are three or four feet long, and one to two inches in breadth. In the eleventh or twelfth month of their growth the canes send up at their top a sprout seven or eight feet high, nearly half an inch in diameter, smooth and without joints, called the arrow, which bears an ample panicle about two feet long, divided into numerous ramifications, carrying soft, silky flowers. When ripe, the stem contains a dirty-white pith or open cellular tissue, which is filled with the very pure saccharine juice.

*The varieties of the sugar-cane* are numerous: some, as the Chinese, *S. sinense*, are thought by many to be distinct species. (1) The creole, Madeira, or common sugar-cane, originally introduced at Madeira, is the longest known. It is distinguished by its thin, very knotty stem and green leaves. It grows freely in every region within the tropics, on a moist soil, as high as 5000 feet above the sea. (2) The Otaheite or Tahiti cane is much cultivated. It is taller, stronger, longer-jointed, quicker in its growth, and more productive in sugar than the creole cane. It matures quickly, yielding four crops, while the creole yields three, and its juice is purer and more easily crystallized. It includes two minor varieties—the ribbon cane, red and green striped, and the Bourbon cane. (3) The Batavia or purple-violet cane from Java. It is covered with purple stripes, grows eight or ten feet high, and has a heavy foliage. The joints are covered with a resinous or waxy film. In Jamaica it is used as a border for other canes to defend them from cattle. (4) The Chinese cane is very hardy, withstanding cold and drought, and with abundant rain sending out as many as thirty shoots. It resists the white ants, which cannot penetrate its hard crust, and the teeth of jackals. It requires a very strong mill. There are numerous other varieties.

*The geographical distribution* of the sugar-cane has been already indicated; it flourishes best where the mean temperature is from 75° to 77° F., but it thrives and can be economically cultivated where the mean temperature is as low as 66°. While, therefore, it is most productive within the tropics at low elevations, it is extensively cultivated in the warm temperate zones, and even on high table-lands, as at Nepaul in India (4500 feet) and in Mexico (4000–6000 feet above the sea-level).

*The propagation* is effected by cuttings, as the cane rarely ripens its seed even in the most propitious localities; in fact, the cane is rarely allowed to come to flower. Pieces of cane 15 to 20 inches long, generally taken from the top just below the leaves, are placed in the ground, and germination takes place on opposite sides of alternate joints. The planting takes place in September and October. The creole cane is then ripe for the mill in the beginning of the second year, and the crop may be finished early in June. After the cane is cut the roots or stoles send up sprouts or suckers, which furnish a new crop of canes, ripening in about two years. This process is repeated, so that a single planting may supply canes for many—sometimes even twenty—years before the old roots run out. These canes are called *ratoons*, to distinguish them from the *plant-canes*, the first growth from the cuttings.

*The cutting of the canes*, when ripe, is effected as close to the root as possible, the lower joints being richest in sugar, and the ratoons growing more vigorously than when the ends of the old canes are left standing above ground. The tops are cut off, and the canes are carried at once to the mill.

*The composition of the cane*, like that of all other plants, includes a great variety of organic and inorganic principles. The most complete analysis published is the following, by Payen, of Otaheite cane:

| | |
|---|---|
| Water | 71.04 |
| Cane-sugar | 18.00 |
| Cellulose, lignine, pectine, and pectic acid | 9.56 |
| Albumen, and other nitrogenous principles | 0.55 |
| Cerosine wax, fats, resins, coloring-matters, essential oils, etc. | 0.37 |
| Soluble salts | 0.16 |
| Insoluble salts | 0.12 |
| Silica | 0.20 |
| | 100.00 |

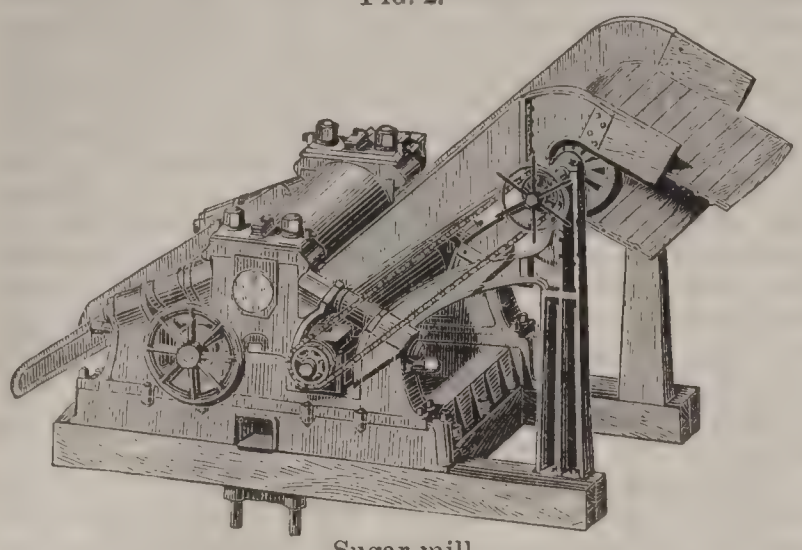
Many partial analyses have been published, from which the following are presented:

| | Mauritius, Icery. | Cuba creole, Casaseca. | Martinique, Popp. | Egypt, Popp. |
|---|---|---|---|---|
| Water | 69. | 77. | 72.22 | 72.15 |
| Cane-sugar | 20. | 12. | 17.80 | 16.00 |
| Glucose | ... | ... | 0.28 | 2.30 |
| Cellulose | 10. | 11. | 9.30 | 9.20 |
| Salts | 0.7 to 1.2 | ... | 0.40 | 0.35 |
| | 100.00 | 100.00 | 100.00 | 100.00 |

E. Icery (*Ann. Chim. Phys.* [4], v. 350) finds glucose, dextrose, and levulose in the cane. The smallest quantity occurs in the lower ripe, dark-colored, leafless portion of the cane, while the proportion is larger in the upper green end of the cane, which is protected by leaves from the direct rays of the sun. The extremes were $\frac{1}{75}$th to $\frac{1}{50}$th of the whole sugar in the lower joints, to $\frac{1}{6}$th in the shaded, and even to $\frac{1}{3}$d in the imperfectly-developed joints. In young canes, covered with leaves and growing in moist, shady places, he found the fruit-sugar to equal 40 per cent. of the saccharine matter. This sugar disappears as the leaves drop off and the canes ripen, passing from green to dark tints. The ashes of the cane, according to Dr. Stenhouse, yield—

| | | | | |
|---|---|---|---|---|
| Silica | 46.46 | 41.37 | 46.48 | 50.00 |
| Phosphoric acid | 8.23 | 4.59 | 8.16 | 6.56 |
| Sulphuric acid | 4.65 | 10.93 | 7.52 | 6.40 |
| Lime | 8.91 | 9.11 | 5.78 | 5.09 |
| Magnesia | 4.50 | 6.92 | 15.61 | 13.01 |
| Potassa | 10.63 | 15.99 | 11.93 | 13.69 |
| Soda | ..... | ..... | 0.57 | 1.33 |
| Chloride of potassium | 7.41 | 8.96 | | |
| Chloride of sodium | 9.21 | 2.13 | 3.95 | 3.92 |
| | 100.00 | 100.00 | 100.00 | 100.00 |

FIG. 2.



Sugar-mill.

*Extracting the Juice.*—The canes are cut with a large knife. The leaves and tops are then chopped off and left in the field, while the ripe cane is carried to the factory for the extraction of the juice. This is effected by pressure. The pressure is usually applied by mills; hydraulic presses have been tried, but have not proved advantageous. The sugar-mill usually consists of three horizontal rolls—two below, the third above. The cane is carried by an endless feeder, and passes downward between the upper ("king") roller and the first lower ("side") roll; then upward, and between this upper and second side (or "macasse") roll, being squeezed twice. The rolls are of various sizes, according to the extent of the plantation—from 18 inches in diameter and 3 feet in length to 40 inches in diameter and 8 feet in length. The latter dimensions are those of Fig. 2, the largest mill ever constructed. It was made by Paulding, Kemble & Co. at the West Point Foundry at Cold Spring, N. Y., and is in use at the plantation Las Cañas near Havana. The three rolls alone weighed 59,000 pounds, while the total weight of the mill was 203,310 pounds. It has a capacity of 50 tons of dry sugar per day of twelve hours. Vertical mills have been used, but they are not in favor. The pressed cane or residue after the removal of the juice is known as "bagasse," "megass," "cane-trash," or "straw." It is dried and used under the boilers, often constituting the only fuel employed on the plantation. No system of pressure serves to extract all the juice from the cane, as the moist bagasse always retains a considerable percentage of it. Duprez estimates the average yield of juice at from 56.4 to 61.2 per cent., according to the character of the mill and the power used in driving it. With the best mills and special care, 70, 75, and even 80 per cent. of juice is sometimes obtained. The juice is opaque, frothy, and of a yellowish-green color. The green matter may be filtered out, leaving a clear yellow fluid. It varies in gravity from 1.046 to 1.110, but is generally between 1.070 ($9\frac{1}{2}$° Beaumé) and 1.090 (12° B.). The following analyses of the juice have been published:

| | | |
|---|---|---|
| Sugar | 18.20 | 20.90 |
| Other organic matters | 0.45 | 0.23 |
| Inorganic matters, salts, etc | 0.35 | 0.17 |
| Water | 81.00 | 78.70 |
| | 100.00 | 100.00 |

Peligot finds the following substances in the ash from 100. of cane-juice:

| | |
|---|---|
| Silica | 0.01707 |
| Earthy phosphates | 0.03604 |
| Calcic carbonate | 0.03519 |
| Calcic sulphate | 0.01224 |
| Magnesic carbonate | 0.02499 |
| Potassic carbonate | 0.04537 |
| | 0.17100 |

Beet-juice contains 0.8 to 1.7 per cent. of salts—from five to ten times as much as cane-juice. It also contains 0.8 to 1.2 per cent. of organic matters, besides sugar, while the cane-juice contains only 0.23 (*Peligot*) to 0.43—from one-fourth to one-half as much.

*Diffusion.*—The loss of sugar which occurs when mills are used, and which amounts to from one-fourth to one-third of the sugar present in the cane, has led to experiments with diffusion. The juice of the cane is contained in cells, the walls of which permit the passage of the juice by liquid diffusion. If these cells are surrounded by water, sugar passes into the water until a uniformity of saccharine contents is established, the percentage of the sugar passing out from the cell depending upon the ratio of water to juice. If a gallon of water is used for every gallon of juice present, then one-half, or 50 per cent., of the sugar would be extracted. By submitting the cells to a second bath of water, one-half of the sugar left would be extracted. Thus, the first treatment would leave $\frac{1}{2}$ of the sugar in the cells, the second $\frac{1}{4}$th, the third $\frac{1}{8}$th, fourth $\frac{1}{16}$th, fifth $\frac{1}{32}$d, sixth $\frac{1}{64}$th, etc. To make the process economical, the water used on the first lot of cells must be applied to a second lot, and thus strengthened in sugar; then to a third, and so on. So, while the cane is passed through successive baths until it is practically exhausted, the baths are applied to successive lots of cane until they become finally nearly as rich in sugar as the juice. Marggraf first called attention to this principle, and in 1830 it was adopted by many manufacturers of beetroot-sugar in Germany, according to the system of Dombasle. Since that time various applications of this principle have been brought out. In some a battery of vessels is employed, so connected by tubes that the liquids can be passed from any one vessel to any other, to secure the application of liquors in the proper order. In others, the beets in slices or ribbons are made to meet and pass through a current of water moving in the opposite direction. (For details see Walkhoff's *Rübenzucker Fabrikant.*) Roberts's system is one of the best known. The cane is cut obliquely into thin slices, and then submitted to the action of water, the slices becoming ultimately reduced to a pulp. The advantage of diffusion is not limited to the extraction of nearly all the sugar in the cane, but results in the production of a purer juice, as the cells are not fractured and the albuminoid and other nitrogenous bodies are not extracted, such bodies not passing readily through the cell-walls. The diffusion process has been introduced at Aska in the Madras presidency with great success. (*Sugar-Cane*, iii. 225.) Six cutting-machines are in use, each capable of cutting 32 tons of cane in twenty-four hours, and each requiring 1 horse-power to run it. An engine of 12 horse-power runs the entire diffusion plant. The average quantity of cane actually cut is 96 tons daily. There is a double battery of diffusion vessels of ten each. The vessels have a capacity of 170 cubic feet each, and are filled twice daily, running day and night. The juice is bright yellow and very pure—gives very little scum in the clarifiers. When the cane is ripe it is not necessary to filter it over bone-black. Its density is 12° to 14° of Balling's saccharimeter, while the juice from the mill is 17° to 19°. This indicates an addition of 20 per cent. of water to the juice. The quantity of cane treated in the years 1868, 1869, and 1870 was 3300, 6739, and 5025 tons. The yield of juice, reduced to the original density, was 84.5, 84, and 81.9 per cent. The highest previous yield of mills was 70 per cent., the gain averaging 19 per cent. Owing to the greater purity of the juice, there was a further gain in the percentage of crystallized sugar. The yield of green sugar, saccharine matter, and salts, was 13 to 14.1 per cent. of the cane; the yield of crystallized sugar 9 to 9.9 per cent.; of sugar in the molasses, 4 to 4.9 per cent. The total gain in crystallized sugar was 43 per cent. over the mill process. Experiments on a large scale, made on the Monrepos plantation in the island of Guadeloupe, with an apparatus composed of six levigators, established the following facts: (1) That by a methodical maceration and washing of the pulp an artificial juice is obtained very nearly equal in density to the natural juice of the cane. (2) That a methodical maceration and washing, continued for one hour and a half, is sufficient to exhaust completely the tissue of the cane of the sugar which it contained. The yield of sugar in these experiments was $12\frac{1}{2}$ to 13 per cent. of the weight of the cane in *white* sugar. Adopting this figure, the results between the process by lamination in mills and diffusion compare as follows (*G. Bouscaren*):

*Process by Lamination, as still Applied on a great number of Plantations.*

| | Pounds. |
|---|---|
| Crystallized (brown) obtained | 65 |
| (which is $\frac{65}{180} = 0.36$ of the total weight of sugar contained in the cane.) | |
| Sugar in the molasses | 25 |
| Sugar remaining in the bagasse | 90 |
| Sugar contained in 1000 pounds of cane | 180 |

*Process by Lamination with all Modern Improvements.*

| | Pounds. |
|---|---|
| Crystallized sugar obtained | 108 |
| (which is $\frac{108}{180} = 0.60$ of the total weight of sugar contained in the cane.) | |
| Sugar in the molasses | 32 |
| Sugar remaining in the bagasse | 40 |
| Sugar contained in 1000 pounds of cane | 180 |

*Process by Diffusion.*

| | Pounds. |
|---|---|
| Crystallized sugar (white) obtained | 130 |
| (which is $\frac{130}{180} = 0.72$ of the total weight of sugar contained in the cane.) | |
| Sugar in the molasses | 40 |
| Lost | 10 |
| Sugar contained in 1000 pounds of cane | 180 |

The gain in crystallized sugar may therefore be stated to be—over the present improved mill process, 72 — 60 = 12 per cent.; over the present unimproved mill process, 72 — 36 = 36 per cent. A surplus of from 12 to 36 per cent. of the total weight of sugar in the cane will be obtained in a crystallized state; which means that the production of sugar with the same amount of cane will be increased one-fifth in the first instance, and be doubled in the other. The molasses will be of better quality, being of lighter color and more agreeable to the taste. It is claimed that the surplus profit realized in two years running on a large plantation by the diffusion apparatus will pay its cost.

J. Roberts has introduced a new system of diffusion at his beet-sugar factory in Selowitz in Austria. He employs but a single vessel, the water running in at the top, and the beets being fed up by a mechanical feeder from the bottom, and removed from the top by a mechanical rake. (See *Sugar-Cane*, iii. 225, and *Dingler's Pol. J.*, cci. 257.) (For further details on diffusion see works on beet-sugar at the end of this article; also Walkhoff (*J. pr. Chem.*, clxxxiv. 149); Duquesne and Gill (*Dingl. Pol. J.*, cxcvi. 83); Cech (*Ibid.*, cxcvii. 278, 445); Schultz (*Ibid.*, cci. 262).)

*Clarification or Defecation of the Juice.*—Owing to the presence of albumen and other nitrogenous bodies, cane-juice, when left to itself, rapidly undergoes fermentation. Sugar is inverted and destroyed, and free acids are developed. Twenty minutes are in some cases sufficient to initiate this change. To prevent this, as well as to free this juice from suspended impurities, such as fragments of tissue, particles of wax, etc., clarification is resorted to. The clarifiers are large hemispherical vessels of iron or copper, holding about 500 gallons, and heated over a free fire, or better by steam coils or jackets. The juice, after passing through copper strainers, is brought to a suitable temperature—some say 104° F., others 122°, 140°, or 150°. A suitable quantity of slaked lime is added, and the whole raised nearly to boiling. The acids are thus neutralized and the albumen is coagulated. The flocks of albumen entangle the suspended impurities and carry them to the surface in the form of a dark-colored scum. The quantity of lime added depends upon the character of the cane, its ripeness, etc., and upon the condition of the juice; enough is generally used to give the juice a faintly alkaline reaction to litmus-paper—from one to 4 pounds to 500 gallons. After an hour's repose the scum is swept off into a gutter on the side of the clarifier, and the clarified juice, called *guarapa*, is either evaporated at once, or first filtered through bone-black. The scum (dried) contains, according to Avequin—

| | |
|---|---|
| Cerosine, a peculiar wax | 50.0 |
| Chlorophyl, etc. | 10.0 |
| Cellulose, albumen, etc. | 22.7 |
| Phosphate of lime | 3.3 |
| Silica | 14.0 |
| | 100.0 |

It is used, on account of the saccharine juice adhering to it, for the manufacture of rum. Sometimes it is pressed to extract the juice. Bag-filters are often used to separate the scum, etc., especially when the juice is to be concentrated in the vacuum-pan. The pure juice contains about 81 per cent. of water, 18.20 of sugar, 0.45 of gum, acids, etc., organic matter precipitable by basic acetate of lead, and 0.35 of saline matter. Sulphurous acid and certain sulphites are considerably used to prevent the fermentation of cane-juice and to improve its color. It is probably best used in the form of the free gas produced by burning sulphur. In Texas the juice from the mill is passed through strainers, and thence through the "sulphur-box." (J. P. Carson, E. M., *Am. Chemist*, i. 423.) This box, made of cypress-wood, is 12 feet long, 2 feet wide, and 3 feet high, and is provided with a horizontal shaft, bearing agitators, which passes lengthwise through the box. The sulphur is burned in an iron pan, and the gas, often passing through a washer or molasses barrel half filled with water, enters at one end of the box. The juice enters through a perforated plate on the top of the box, and drops down through the gas in spray: 1 barrel of sulphur is sufficient for 1000 hogsheads of sugar (*Carson*), 1½ pounds of sulphur for 1000 imperial gallons of juice (*Hjardenmaal*). Bisulphate of lime may be added to the juice, but it is not as advantageous as the free gas, and its use has been generally abandoned (*Goessmann*). Sulphite of soda and monosulphite of lime ("Icery process") have also been recommended. (See *Sugar-Cane*, June 1, 1872, p. 301.) Some recommend adding a minimum of lime at first, heating to coagulate the albumen, then skimming, adding an excess of lime, heating and skimming again, and finally carefully neutralizing the excess of lime with hydrochloric acid or phosphoric acid in the form of superphosphate of lime, leaving only a slight alkaline reaction.

*Evaporation* is conducted in various ways: (1) in open kettles over direct fire; (2) in open (free-fire) kettles to 29° or 30° Beaumé, and then to crystallization in open kettles heated by steam; (3) exclusively in open kettles heated by steam; (4) by the aid of evaporators, which involves blowing heated air through the juice or passing the juice over heated surfaces; (5) in open (free-fire) kettles to 29° or 30° B., and then to crystallization in a vacuum-pan; (6) in open steam-heated kettles to 29° or 30° B., then to crystallization in a vacuum-pan; (7) in vacuum-pans altogether.

*Evaporation in open kettles or coppers over the direct fire* is the oldest method in use. The series of four or five kettles is called a "battery" or "Jamaica train." The hemispherical kettles are made generally of cast iron, sometimes of wrought iron or copper. They vary in size. In the British colonies an ordinary battery consists of two kettles or pans of 225 gallons capacity, two of 600 gallons, and a clarifier of 650 gallons. These are set in a row in brickwork, the clarifier next to the chimney and farthest from the fire, which is directly under one of the small pans, called the *teache*, *tayche*, or striking-pan, in which the concentration is completed. In Louisiana the pans vary from 400 to 100 gallons, the largest being called the *grande*, serving as the clarifier; the second smaller, called the *flambeau*, because it is so situated that the flame of the fire just reaches it; the third, the *sirop*, because the juice is here boiled to a syrup; the fourth, the *batterie* or *striking-pan*. The pans are made of diminishing size, in order that although the juice is reduced in volume by the evaporation, it will still be sufficient in quantity to fill the pan and prevent any portion of the metal becoming overheated, which would result in the caramelization and burning of the liquor. When the contents of the striking-pan have become so concentrated that a drop placed between the thumb and forefinger, and pressed, may be drawn into a thread which exhibits a granular appearance, the evaporation is completed, and the contents of the pan are transferred to the cooler to crystallize. The pan is then filled again from the *sirop*, the *sirop* from the *flambeau*, and the *flambeau* from the *grande*. Each pan is kept full from its weaker neighbor. This process of evaporation is very wasteful. It is laborious, requires much fuel, yields a dark-colored sugar and an enormous proportion of molasses. Fleischmann says every hogshead of 1000 pounds of sugar yields 55 gallons or 660 pounds of molasses. The chief objection to the open-pan evaporation arises from the high temperature required to boil sugar solutions in the open air, which converts the crystallizable sugar into inverted sugar, glucose. The more concentrated the juice becomes, the higher the boiling-point. Gill gives the observed temperatures as follows: in the grande, 210° F.; the second, 212°; the tayche, 225°; and at proof, 233° F. Wray says the temperature at the completion of the boiling is usually from 240° to 250° F. Gill states that as much as 17 per cent. of the cane-sugar in the juice is sometimes inverted in the batteries to glucose; and as each per cent. of glucose detains a per cent. of cane-sugar in the molasses, this represents a loss of one-third the sugar of the original juice. On another occasion he states that the proportions of glucose to 100 parts of cane-sugar were—in the grande, 10.7; the second, 15; the tayche, 22.7; thus demonstrating the change of cane-sugar to glucose during the boiling. The laborious character of the batteries process is due to the constant skimming necessary and the bailing of the juice from one pan to the other. When sufficiently concentrated, about 41° B., the syrup is baled into coolers of wood or iron about 12 feet long, 6 wide, and 1 foot deep. As it cools and the sugar granulates (crystallizes), it is stirred occasionally to make the granulation uniform. The striking-pan is emptied several times into the cooler before it is full, each strike being well mixed with the contents of the cooler. When full, it is left to cool and become hard. It is then dug out with shovels and placed in hogsheads having holes in the bottoms loosely stopped with plugs of sugar-cane; through these holes the molasses drains off. The sugar which remains is then sent to market as *muscovado*. A smaller yield of better sugar is obtained by *claying*, the product being called *clayed* sugar. The concentrated juice, boiled somewhat stronger than for muscovado, is ladled into the cooler, which is large enough to hold three or four strikes. Here it is beaten up by a revolving cage to cool it rapidly and to prevent the formation of large crystals. It is then trans-

ferred to conical moulds of pottery or sheet iron, the opening at the tip being carefully plugged. In from twelve to eighteen hours the sugar is set, and the plug is removed to allow the molasses to drain off. Each cone is placed upon an earthen or iron pot which receives the molasses. At the end of twenty-four hours the sugar is sufficiently drained, the cones are transferred to empty pots, and the claying begins. The upper surface of the sugar is cut smooth, and a plaster or magma of wet clay or tenacious loam is applied. The water gradually separates from this, passes down into the sugar, dissolving a portion of it, and displacing the less pure molasses from the interstices of the grains. This is practically washing the sugar with water to free it from molasses, the product being diminished in quantity, but improved in quality. The object of the clay is to let the water upon the sugar very slowly and uniformly, so as to prevent channelling. The writer saw this process in actual use in an Antwerp refinery as recently as 1869. When the clay cover becomes hard from the loss of water, it is readily removed in a sheet, to be replaced by a second, third, and often fourth application of wet clay, until the sugar becomes tolerably white. The claying occupies about three weeks. When the cone of sugar is removed from the mould, it is found that the layer at the base, which was the top during the claying, is white for about two inches, then yellowish or grayish, and lastly, toward the apex, it is brown. This is due to the more complete washing which the upper layers have received during the claying. The cone is cut transversely, so as to separate it into three qualities of sugar, which are dried and boxed separately as *white-clayed*, *yellow* or *gray-clayed*, and *brown-clayed* sugar. Some planters divide into five varieties—*white*, *second white*, *first* and *second yellows*, and *brown*. The drying is conducted either by artificial heat or in the sun. Clayed sugar is made from the juice of the *ripest* canes, as that from other canes contains so much gluten that it is liable to be burned and darkened in boiling, so that it becomes impossible to produce a clayed sugar of good color. Such juice must be made into muscovado. The syrups which run off from the cones during the claying process are boiled separately, and yield a fair grade of sugar, or they are boiled down rapidly to a solidifying point, and sent to market, without separating any molasses, under the name of *clayed melada*. The molasses from the muscovado hogsheads and from the cones is either shipped at once, or boiled again for the production of a second crop of inferior sugar, *molasses sugar*. Sometimes it is even boiled a third time. As the molasses drains from the sugar, it carries with it a small quantity of very fine crystals of sugar; these gradually settle in the molasses-tanks, and form a distinct layer, which is removed when the tanks are emptied and sold under the name of *cistern bottoms*.

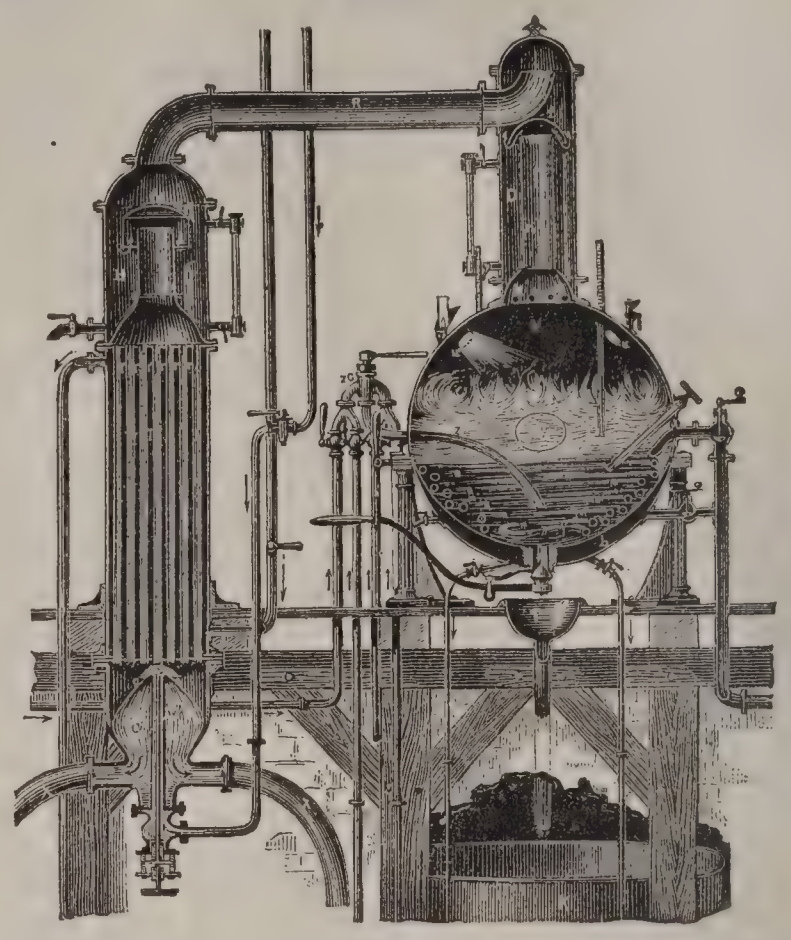
*Evaporation in Open Kettles and Steam-Pans.*—Open kettles heated by steam-coils are especially useful as clarifiers, and as evaporators they possess the advantage of uniformity of temperature and of permitting the boiling to be stopped instantaneously. Alfred Stillman of New York invented in 1843 a system of evaporation in open kettles and open steam-pans, and in 1846 a steam sugar-pan.

*Open High-Pressure Steam-Pans.*—Duplessis's system has never been used with any success.

*Evaporators* for hastening evaporation by securing a larger surface have proved very effective in some cases. Kneller blew air through a copper pipe into the evaporating juice. This reduced the temperature and carried away the vapor of water. Hallète used a cylindrical steam-jacket, and caused the syrup to cover the surface of the inner cylinder. Chevalier combined steam-pipes and air-currents. Modern evaporators are constructed upon the principle of taking up a small quantity of hot liquor and exposing it to the air. In one evaporator there is a revolving drum or reel of steam-pipes half immersed in the liquor. As the drum revolves, one half is in the liquor, while the other half is covered with a thin film of hot liquor. Another consists of a series of flat hollow steam-heated disks, which revolve, one half in the liquor, the other half in the air.

*Open Kettles and Vacuum-Pans.*—In 1813, Edward Charles Howard patented the evaporation of saccharine solutions in the vacuum-pan. (The specification of his patent can be found in the *Sugar-Cane* of Sept. 1, 1875, p. 481.) By the use of the vacuum the boiling-point is lowered, and it is possible to boil at as low a temperature as 130° F. In practice, this temperature is only sufficient for "clear proof;" good color with small grain can be secured at a temperature not above 140°; but for large, firm grain 170° or 180° is necessary. These temperatures are far below the temperatures of 233° and 250°, reached in the open striking-pan. The vacuum-pan is a closed vessel of copper or iron provided with an air-pump to maintain a vacuum, a condenser to condense the aqueous vapor from the evaporating juice, a steam-jacket, and one or more steam-coils to supply heat to the juice, and a tap-stick to enable the operator to draw a sample without admitting air to the pan. Fig. 3 shows such a pan, complete except the air-pump:

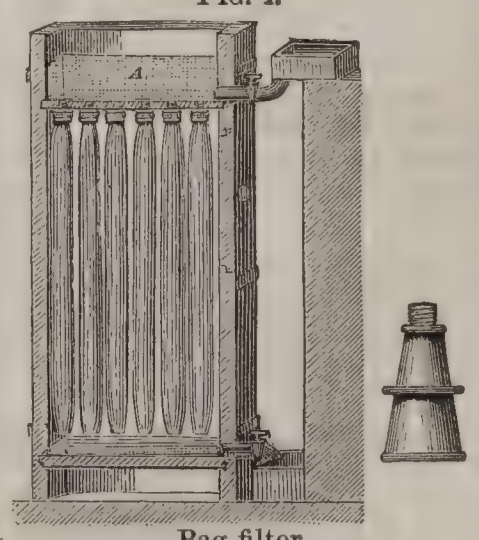
Fig. 3.



Vacuum-pan.

The estimated capacity of a pan 10 feet in diameter is 28,000 pounds daily; 9 feet, 18,000 pounds; 8 feet, 14,000 pounds; 7 feet, 7200 pounds; 6 feet, 5400 pounds; 5 feet, 4600 pounds. A common plan is to boil the juice in open kettles to syrup of about 29° to 30° B., and then finish to grain in the vacuum-pan. In this way the high temperatures of the striking-pan are avoided. As there is no opportunity to skim the liquor in the vacuum-pan, the clarification must be very complete before the juice enters it. Modern improved systems require steam-defecators and bone-black filters; bag-filters are sometimes used in connection with the defecation. The bag-filter is an ample bag of cotton cloth surrounded by a small sheath of twine, which secures a folding of the cotton, which facilitates filtration. These bags are held in position by iron nozzles. (See Fig. 4.) The boiling in the vacuum-pan involves four successive operations: (1) concentrating the syrup; (2) forming the grain; (3) enlarging the grain; (4) increasing the quantity of grain. (For the details of these operations see *American Chemist*, ii. 461.) One of the most important points in the management of the vacuum-pan is the temperature of the steam admitted to the jacket and coil; this should be kept as low as possible to prevent caramelization, which results in darkening of the color and inversion of cane-sugar. The temperature of this steam is often 260° F., while it should not be much above 212°.

Fig. 4.



Bag-filter.

Degrand invented an improvement on the simple vacuum-pan which has been found very useful on sugar-plantations. The condenser of the vacuum-pan is a vertical series of tubes, and the fresh juice is used as the condensing liquid in place of water. The juice is thus concentrated to a certain degree by the waste heat of the vacuum-pan. This apparatus is manufactured by Dérosne & Cail of Paris, and is known as the Dérosne apparatus. The vacuum-pan secures a larger yield of better sugar, which may be simply drained as muscovado or clayed.

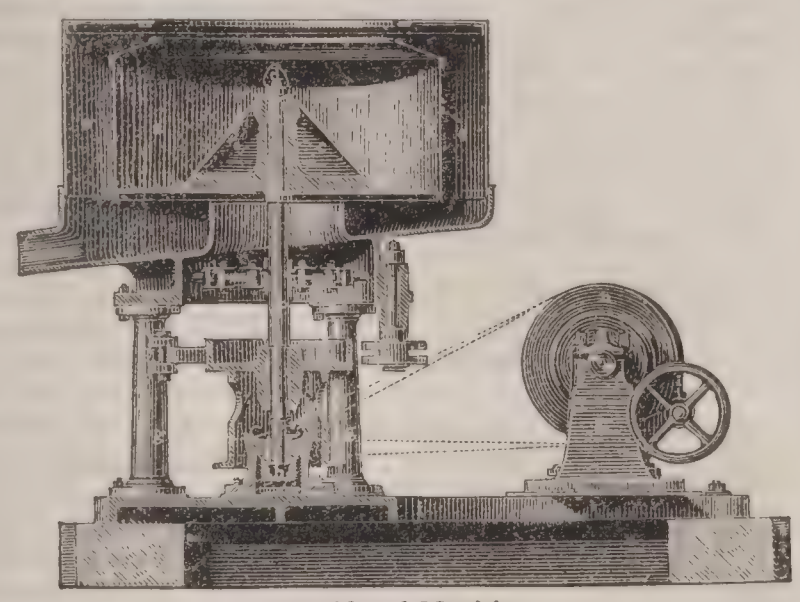
*Open high-pressure steam-kettles and the vacuum-pan* are sometimes used, but this combination really possesses little advantage, if any, over the previous.

*Vacuum-Pans altogether.*—In place of the open kettles, the vacuum-pan may be applied to the juice at once. The simplest arrangement consists of two vacuum-pans. The defecated juice is concentrated to 28° or 29° B. in a vac-

uum-pan, then defecated, filtered, passed over bone-black, and finally boiled to grain in a second vacuum-pan, the steam coils and jacket of the first pan being heated by the vapor from the syrup in the second. The idea of thus applying the heat of the escaping vapors originated with Rillieux of New Orleans, who patented a combination of four pans on this system, known as Rillieux's apparatus. At present, the best combination is of three pans, known as the *triple effet*, consisting of three vacuum-pans, the second heated from the first, the third from the second. The first cost of this apparatus is high, but its use results in great economy of fuel, with a marked improvement in the quality and quantity of sugar produced.

*Centrifugal machines* constitute one of the greatest improvements in the manufacture and refining of sugar. They are designed to separate the molasses from the sugar, and accomplish in a few moments what requires days in the draining of muscovado in hogsheads or of clayed sugars in moulds. The centrifugal machine consists of a round box, supported from above or below, the wall of which is formed of finely-perforated metal, and which is made to revolve in a horizontal plane 1000 to 1700 times a minute. The solid sugar, cut up to a uniform magma by a cutting-machine or "mixer," is introduced into the box of the centrifugal; this is then set in motion, when the sugar quickly rises from the bottom and forms a lining of uniform thickness on the interior, while the molasses is driven through the perforated metal and caught in the surrounding drum. A very small quantity of water is then thrown into the centrifugal with a syringe to wash the sugar. The machine is then stopped, and the sugar scraped out with a trowel. Fig. 5 is a German centrifugal. The suspended centrifugals are preferred in the U. S. in refineries. Four of Hepworth's centrifugals purged 28,000 pounds of sugar in four hours in Cuba with Chinese laborers. Muscovado, clayed, and refined sugars may all be purged in the centrifugal.

FIG. 5.



Centrifugal Machine.

Perhaps the best illustration of the improved modern system of extracting sugar from the cane will be the following description of the outfit for a Cuban plantation, supplied by Cail & Co. of Paris: A 3 roll-mill, rolls 78¾ inches long, 31½ in diameter; 6 clarifiers, 5 feet diameter, 4 feet 7 inches deep, supplied with steam-coils; 10 bone-black filters, 3 feet 7 inches diameter, 6 feet 11 inches high, with steam-pressure to force the syrup through the black; a bone-black furnace; 2 condensing evaporators, each consisting of two series of 21 tubes, 6 inches diameter, 13 feet long; 3 vacuum-pans (triple effet), two of which are connected with the condensing evaporators; 9 centrifugal machines; engines 150 horse-power, tanks, moulds, etc., etc. The capacity of this plant is 100 tons of cane daily, or 8 tons of sugar. Its cost was £32,000.

The yield of sugar varies from a ½ ton to 2½ tons solid sugar per acre with the variety of the cane, the nature of the soil, the season, and the apparatus and machinery on the plant. The loss of sugar is enormous, owing chiefly to the imperfect method for extracting the juice from the cane and the inversion of crystallizable cane-sugar into glucose. It has been estimated that by the old processes only about one-third the sugar of the cane was obtained in crystalline sugar, thus:

| | |
|---|---|
| Left in the bagasse | 6 per cent. |
| Left in the skimmings | 2½ " " |
| Left in the molasses | 3 " " |
| Sent to market as sugar | 6½ " " |
| Total percentage in the cane | 18 per cent. |

The improved machinery above described has increased the yield to above 8 per cent.

*Concreting the Juice of the Cane.*—Alfred Fryer of Manchester has devised an evaporating apparatus by which the juice is rapidly converted at a low temperature into a solid concrete, ready for shipment at once. The juice flows upon a slightly-inclined iron table about 50 feet long and 6 wide, which is provided with numerous cross-ridges, which compel the juice to flow back and forth from one side of the table to the other about sixty times on its way down the table, thus prolonging the flow. There is a furnace at the upper end of the table, where the juice enters, and the flame travels down to the lower end, where the waste gases are utilized to heat a current of air which passes first through a revolving cylinder, the outside of which is covered with the concentrated juice as it leaves the table, then over the surface of the evaporating liquid in the opposite direction, the current of air being impelled by a fan. The liquor leaves the table at about 25° to 30° B., and on leaving the cylinder cools to a tolerably hard dry cake of *concrete*, containing only 6 to 8 per cent. of water. Dubrunfaut gives the following analysis of the concrete:

| | |
|---|---|
| Crystallizable cane-sugar | 78.00 |
| Uncrystallizable glucose | 9.10 |
| Other organic matters | 2.40 |
| Ash | 2.80 |
| Water | 7.70 |
| | 100.00 |

*Sucrate-of-Lime Process.*—Rousseau and Bonnaterre propose to add a sufficient quantity of lime to the fresh juice to convert all the sugar into an insoluble sucrate of lime—to dry this, and transport it to the refineries, where it could be at once converted into refined loaf-sugar, being readily decomposed into sugar and insoluble carbonate of lime when submitted to the action of carbonic acid gas and water. Although some encouragement was given the inventors by the French government, the process has not proved successful.

*The composition of raw sugar* is very complex. Many of the minor constituents have not been identified. The following are the most important: (1) cane-sugar; (2) glucose, consisting of dextrose and levulose; (3) mannite; (4) gum; (5) coloring-matter; (6) albuminoids; (7) lactic, acetic, propionic, butyric, and other organic acids, free or in combination; (8) ammoniacal salts, with the organic and inorganic acids; (9) phosphates, sulphates, carbonates, and organic salts of potassa, soda, lime, and magnesia; (10) silica; (11) sand, dirt, fragments of cane, etc.

Mulder gives the following analyses:

| | Java, 10 samples. | Havana, 6 samples. | Surinam, 4 samples. |
|---|---|---|---|
| Cane-sugar | 98.6–83.1 | 97.0–87.3 | 92.3–85.4 |
| Glucose | 5.5– 0.3 | 3.7– 0.9 | 4.4– 1.6 |
| Extractive matter — gum, acids, etc | 3.5– 0.5 | 4.5– 0.4 | 2.1– 1.1 |
| Ash | 1.9– 0.2 | 1.1– 0.0 | 1.4– 0.8 |
| Water | 6.3– 0.3 | 3.8– 0.9 | 6.9– 4.0 |

Dr. Wallace gives the following table of analyses:

*Raw Cane-Sugars.*

| | Cane-sugar. | Glucose. | Extractive, etc. | Soluble salts. | Insoluble salts. | Water. | Color, Dutch standard. | Cane-sugar obtainable. |
|---|---|---|---|---|---|---|---|---|
| Cuba, muscovado | 92.35 | 3.38 | 0.66 | 0.62 | 0.15 | 2.84 | 13 | 85.9 |
| Grenada | 92.31 | 4.06 | 0.66 | 0.37 | 0.04 | 2.56 | 13 | 86.4 |
| Trinidad | 90.41 | 3.84 | 0.95 | 0.86 | 0.22 | 3.72 | 10 | 82.3 |
| Demerara | 90.80 | 4.11 | 0.77 | 0.92 | 0.20 | 3.20 | 10 | 82.1 |
| St. Vincent | 89.00 | 5.85 | 0.76 | 0.62 | 0.05 | 3.72 | 10 | 80.0 |
| Pernambuco | 88.31 | 4.82 | 0.94 | 0.80 | 0.73 | 4.40 | 8 | 79.5 |
| Paraiba | 84.90 | 6.00 | 1.28 | 1.20 | 1.10 | 5.52 | 8 | 72.9 |
| Bahia | 86.80 | 5.03 | 1.72 | 1.21 | 0.92 | 4.32 | 7 | 75.8 |
| Manila, unclayed | 79.00 | 11.76 | 1.32 | 1.95 | 0.63 | 5.34 | 6 | 57.5 |
| Amoy | 74.50 | 16.13 | 1.70 | 1.61 | 0.54 | 5.52 | 7 | 50.4 |
| Formosa | 76.53 | 13.38 | 2.47 | 1.86 | 0.16 | 5.60 | 9 | 53.8 |
| Concrete | 84.20 | 8.45 | 1.70 | 1.10 | 0.00 | 4.55 | 12 | 70.2 |
| Melada | 67.00 | 11.36 | 1.93 | 0.76 | 0.15 | 18.80 | ... | 51.8 |

The Dutch standards are an arbitrary series of numbered specimens of raw sugar, selected in Holland and used as standards all over the world.

Three samples of melada gave the writer the following results:

| | I. | II. | III. |
|---|---|---|---|
| Cane-sugar | 76.5 | 75.0 | 73.0 |
| Water | 9.7 | 13.0 | 13.4 |
| Glucose, ash, etc | 13.8 | 12.0 | 13.6 |
| | 100.0 | 100.0 | 100.0 |

The following partial analyses of low-grade raw sugars are given in the *Sugar-Cane*, viii. 397:

| | Cane-sugar. | Glucose. | Potassa. |
|---|---|---|---|
| Dutch bastards | 84.60 | 7.81 | 0.33 |
| Guatemala | 88.50 | 6.12 | 0.40 |
| Penang | 88.03 | 4.62 | 0.71 |
| Penang (low) | 74.01 | 17.44 | 0.57 |
| Penang (medium) | 84.93 | 8.22 | 0.23 |

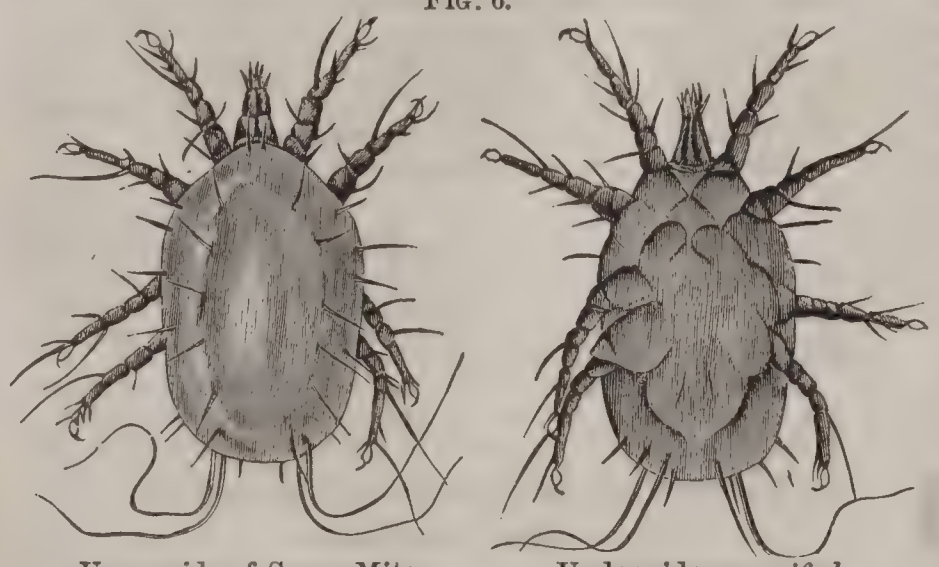
| | Cane-sugar. | Glucose. | Potassa. |
|---|---|---|---|
| Egyptian | 83.76 | 7.81 | 0.63 |
| " | 86.00 | 5.10 | 0.53 |
| " | 85.43 | 6.58 | 0.80 |
| Jaggery | 78.85 | 10.42 | 0.49 |
| Manila (clayed) | 84.54 | 8.22 | 0.23 |
| " (Ilo-Ilo) | 82.73 | 9.46 | 0.58 |

The writer had occasion to determine the percentage of chlorides in ten raw sugars from New Orleans, calculated as chloride of sodium; the percentages varied from 0.030 to 0.146, averaging 0.065.

*The various qualities of raw sugar* have been mentioned in describing the different processes of manufacture. The following list presents the most important: (1) *Ordinary muscovado*, boiled in open kettles and purged in hogsheads. (2) *Centrifugal muscovado*, boiled in open kettles to syrup, and in vacuum-pans to grain, or entirely in vacuum-pans, etc., with or without the use of bone-black filters. (3) *Potted sugars*, boiled in open kettles, crystallized in earthen moulds, drained, but not clayed. (4) *Clayed sugars*, potted sugars clayed. The cones are divided into from three to five qualities—(*a*) white (*florets*), (*b*) second white, (*c*) first yellow, (*d*) second yellow, (*e*) brown (*cocoruchers*). (5) *Melada*, muscovado not freed from the molasses by draining. (6) *Concrete*, same as melada, but boiled harder—*i. e.* drier. (7) *Molasses sugar*, made from the molasses, generally boiled in vacuum-pans and purged in the centrifugal. (8) *Cistern bottoms*, the sugar deposited in the molasses-tanks. There are several varieties of molasses, corresponding to several of the raw sugars. The most important are—(1) *Muscovado*, which is the richest in crystallizable sugar. (2) *Clayed molasses*, the next richest. (3) *Centrifugal molasses*, the poorest, does not yield any appreciable quantity of sugar when boiled again.

Raw sugar generally contains a living insect in large numbers, the *Acarus sacchari*, or sugar-mite, which belongs to the same genus as the *Acarus scabei*, or itch-insect, and strongly resembles it in appearance. The animal is very small, hardly perceptible to the naked eye, and the only objection to it is its possible connection with the "grocer's itch." Hassel states that he found these animals in almost every one of 100 samples of raw sugar, but none in refined sugar. He found some alive, others dead, and fragments of others, as well as undeveloped eggs. In 15 grains of one sample he found over 100 living *Acari*, or 42,000 to the pound. He also found the sporules of a minute fungus in raw sugars.

FIG. 6.



Upper side of Sugar-Mite. Under side, *magnified.*

*The composition of molasses* is similar to that of raw sugar, as far as the nature of the constituents is concerned, but the proportions of these present are quite different; the percentage of cane-sugar is low, while the percentages of water, glucose, gum, coloring-matter, and salts are high. Dr. Wallace gives the following analysis of West India molasses:

| | |
|---|---|
| Cane-sugar | 47.0 |
| Glucose | 20.4 |
| Extractive and coloring-matter, etc | 2.7 |
| Salts (ash) | 2.6 |
| Water | 27 3 |
| | 100.00 |
| Specific gravity | 1.36 |

Payne gives the following analysis:

| | |
|---|---|
| Cane-sugar | 63.083 |
| Glucose | 13.083 |
| Gum, etc | 0.636 |
| Albuminoids | 0.420 |
| Acetate of potassa | 1.744 |
| Chloride of potassium | 0.947 |
| Sulphate of potassa | 0.712 |
| Acetate of lime | 0.135 |
| Phosphate of lime | 0.433 |
| Phosphate of copper | 0.018 |
| Silica | 0.200 |
| Water | 15.000 |
| | 96.411 |

IV. SUGAR FROM THE BEET.—In the year 1747, Andreas Sigismund Marggraf, a chemist in Berlin, examined a variety of roots, and discovered cane-sugar in a number of them. From the beet (*Beta cicla*) he obtained, by means of alcohol, from 4.6 per cent. in the red variety to 6.2 per cent. in the white. This discovery attracted little attention at the time, and it was reserved for a pupil of Marggraf, Franz Carl Achard, forty-nine years later, to demonstrate the possibility of making beet-sugar on a large scale. Achard and Hermbstädt made many experiments on beets, and found them always to contain cane-sugar, obtaining about 6 per cent. of crystallized sugar and 4 per cent. of molasses. In 1796, encouraged with pecuniary aid by Frederick William II. of Prussia, Achard established an experimental factory at Cunern in Lower Silesia. Here he worked up 70 cwt. of beets daily, obtaining 6 per cent. of yellow raw sugar and 3 per cent. of molasses. These results were so satisfactory that Baron von Koppy established a factory at Olbendorf, and Herr Nathusius one at Hohensleben. Factories were established in Bohemia as early as 1802. Louis Napoleon states that while Achard's experiments were going on the British government, alarmed lest the discoveries of Achard should injure the colonial interests of Great Britain, offered him anonymously 50,000 thalers, and subsequently 200,000 thalers, if he would report that his experiments resulted unfavorably. The offer was rejected with contempt, and the successful results of his experiments made public. (*Analyse de Question de Sucre*, 170, 171.) Achard showed that, besides the sugar and molasses, the pulp would be a useful product as food for fattening cattle, whose manure would be of value for other crops; also, that the molasses would serve for the manufacture of spirits and of vinegar. The introduction of beet-sugar did not expand, however, at this time, nor for many years, although the First Napoleon encouraged the industry by having 32,000 hectares of land put to beets, and appropriating 1,000,000 francs for the enterprise (1811). The Russian government also encouraged the cultivation in Thule by a gift of 50,000 rubles and a remission of the taxes on land devoted to beets. The industry was, however, almost entirely abandoned in Germany, but under government encouragement was developed in France, till in 1829 the product amounted to 4,000,000 kilos, or 8,800,000 pounds, and in 1835 to 40,000,000 kilos, or 88,000,000 pounds. The French harvest of 1865–66 yielded from the beet—

| | |
|---|---|
| Sugar | $31,250,000 |
| Spirits | 6,750,000 |
| Potash | 2,500,000 |
| Pulp | 5,000,000 |
| | $45,500,000 |

In the mean time, it was revived in Germany and Austria, and extended into Russia, Belgium, Denmark, Holland, and Sweden. At present more than one-third of all the sugar of the world is made on the continent of Europe from the beet. (See statistics at the end of this article.) Efforts have been made with little success to establish the beet-sugar industry in England, Ireland, and the U. S. According to Dr. C. A. Goessmann (*Historical Notes on the Progress of the Sugar-Beet Cultivation for the Manufacture of Sugar within the U. S., Am. Chemist*, July, 1872, p. 18), the first beet-sugar enterprise in the U. S. was started by Messrs. John Vaughn and James Donaldson of Philadelphia in 1830, but failed for want of information. The average yield of sugar from beets was at that time only 4 to 5 per cent. in Europe. In 1838, David Lee Child of Northampton, Mass., made 1300 pounds of beet-sugar. For the next twenty-five years nothing appears to have been done in this direction. In 1863, Gennert Brothers established a large factory at Chatsworth, Ill., which has gone through many discouraging experiences, and was in 1869 moved in part to Freeport, Ill. In 1867 a company was organized at Fond du Lac., Wis., and another in 1870 at Black Hawk in the same State. In 1860 experiments were undertaken in California, which finally resulted in the formation of the Alvarado Sugar Co., which began work in 1870. Two other companies have since been organized in that State. Some of these companies promise to prove successful. The difficulties thus far encountered appear to have resulted from bad locations, want of capital or of practical experience, and the want of much information as to suitable soils, localities, etc., which can only be gained by experience. The development in Europe was hastened by the invention of new processes for treating the beets and the juice; and the business could not exist at the present time had not experience taught the farmers what varieties of the beet, and what soils and fertilizers, were necessary to enable them to produce roots from which the present yield of over 8 per cent. can be obtained. The composition of the beet offers obstacles to the manufacture

of sugar which are never met in treating the cane. The percentage of sugar is only about two-thirds that of the cane, and the juice is highly charged with impurities, which it is necessary to remove before the sugar is merchantable.

*The sugar-beet* is, like the common mangold-wurzel, derived from the *Beta cicla* and *Beta vulgaris*, which grow wild near the sea-shores of South-western Europe. Cultivation has developed many improved varieties, some of which contain 13, and even 14, per cent. of sugar. The following is a description of the more important varieties:

(1) *The Silesian beet*, a pear-shaped root, white in the body and light green on the top; it is not so rich in sugar as some other varieties, but is much more extensively cultivated in France and Germany, for the reason that it yields a larger weight of roots to the acre, is of vigorous growth, and produces the largest amount of sugar per acre.

(2) *The French or Belgian Vilmorin sugar-beet* has small leaves and a slender spiral root, close in structure, and white in flesh.

(3) *The Quedlinburg sugar-beet* is a slender rose-colored root, rich in sugar, and maturing fourteen days before any of the other varieties.

(4) *The Siberian beet*, called also "the white-ribbed beet," a coarse pear-shaped root, leaves abundant, light green, ribs almost white; weight per acre larger than with Silesian, but the percentage of sugar smaller.

(5) *Imperial beet*, slender, pear-shaped, very white, rich in sugar; does not yield as well as the Silesian.

Beets of good quality are firm, brittle, emit a cracking noise when cut, and are perfectly sound within. The 45th degree of latitude appears to be the southern limit of their successful growth for the manufacture of sugar.

*Composition of the Beet.*—The beet-root consists of a mass of small cells containing a colorless fluid. Scheibler discovered a peculiar base, betaine, $C_5H_{11}NO_2$, in the sugar-beet; young beets contain 0.25, ripe beets 0.10 per cent.; beet-molasses much more. (See the article "Betaine" in the 1st and 2d supplements to *Watts's Dictionary*.) The composition varies considerably, but the following is a fair average:

FIG. 7.



Best Silesian Sugar-beet; weight 1lb. 5oz.

FIG. 8.



French Vilmorin Sugar-beet; weight 1lb. 4oz.

| | Per cent. |
|---|---|
| Water | 82.60 |
| (1) *Insoluble Constituents.* | |
| Cellulose | 0.80 |
| Pectose, pectase, pectic, and pectosic acids; Metarabic acid; Fatty, waxy, and resinous bodies; Albuminoids; Pectates, parapectates, metapectates, pectosates, oxalates, and phosphates of magnesium, calcium, iron, and manganese; Silica, | 0.30 |
| (2) *Soluble Constituents.* | |
| Cane-sugar | 11.30 |
| Glucose. | |
| Albumen, caseine, etc | 1.50 |
| Asparagine ($C_4H_8N_2O_3$) | |
| Betaine ($C_5H_{11}NO_2$) | 0.10 |
| Pectine, parapectine, metapectine, and pectase; Gummy bodies; Cromogene; A body which turns black by oxidation; A yellow extractive body; Parapectic, metapectic, aspartic, citric, and malic acids; Pectates, parapectates, metapectates, citrates, malates, oxalates, aspartates, sulphates, phosphates, nitrates, and chlorides of potassium, sodium, rubidium, and ammonium; Citrates, malates, aspartates, sulphates, nitrates, and chlorides of magnesium, calcium, iron, and manganese; Silica, | 3.40 |
| | 100.00 |

Near Magdeburg, where the beet is extensively cultivated, the general results give—

| | |
|---|---|
| The greatest sugar-production as | 13.3 per cent. |
| That from inferior beets | 9.2 " " |
| The average beets | 11.2 " " |

12½ tons of beets yield on the average 1 ton of raw sugar.

The following analyses are from S. W. Johnson's *How Crops Grow:*

*The Composition of Sugar-Beets.*

| | Water. | Albuminoids. | Sugar. | Org. acids, pectine, etc | Crude fibre. | Ash. | Analyst. |
|---|---|---|---|---|---|---|---|
| Hohenheim | 81.5 | 0.87 | 11.90 | 3.47 | 1.33 | 0.80 | Wolff. |
| Möckern | 84.1 | 0.82 | 9.10 | 3.90 | 1.05 | 0.99 | Ritthausen. |
| " 2 pounds | 81.7 | 0.84 | 11.21 | 3.86 | 1.36 | 0.94 | " |
| " ½ " | 79.5 | 0.90 | 12.07 | 5.09 | 1.52 | 0.88 | " |
| Bickendorf, 1½ pounds | 80.0 | 0.70 | 12.90 | 5.00 | 1.20 | 0.70 | Grouven. |
| Slanstädt, 2 pounds | 80.0 | 0.68 | 13.37 | 5.21 | | 0.74 | Stöckhardt. |
| Lockwitz, 1¼ " | 79.9 | 0.65 | 13.32 | 5.53 | | 0.60 | " |
| Tharand, 1½ " manured | 82.7 | 0.93 | 12.34 | 3.24 | | 0.79 | " |
| " 2 " " | 81.8 | 1.16 | 10.15 | 5.77 | | 1.12 | " |
| " 3¼ " " | 82.1 | 1.14 | 9.25 | 6.36 | | 1.15 | " |
| " 4 " " | 82.5 | 1.05 | 8.45 | 7.07 | | 0.93 | " |
| Silesia, unmanured | 84.4 | 1.14 | 9.80 | 3.96 | | 0.69 | Bretschneider. |
| " man'd with nit. soda. | 82.7 | 1.42 | 11.57 | 3.63 | | 0.68 | " |
| " man'd with phos. lime | 84.1 | 1.20 | 9.82 | 4.04 | | 0.77 | " |
| Average | 81.5 | 0.95 | 11.5 | 3.7 | 1.3 | 0.85 | |

Dr. Voelcker has published in the *J. Roy. Ag. Soc.* [2], v. 347, and vii. 60, numerous analyses of beets grown in England, Ireland, and on the Continent.

*The manufacture of sugar* from the beet consists of the following operations: (1) washing and cleansing the beets; (2) extracting the juice; (3) defecation by lime and heat; (4) carbonatation, removal of the lime with carbonic acid gas; (5) filtration, to remove suspended impurities; (6) filtration through bone-black; (7) evaporation to a thin syrup; (8) second filtration over bone-black; (9) evaporation to crystallization; (10) separation of the sugar from the molasses. The first molasses is evaporated again, to furnish a second crop of sugar, and a third and fourth crop are subsequently obtained. The final molasses is too offensive in taste and smell to serve as food, and is diluted and subjected to fermentation and distillation for the production of alcohol, the residue from the distillation being evaporated to dryness and calcined for the production of potash.

*Washing and cleansing* the beets is effected in a revolving drum of open iron- or wood-work placed beneath the surface of water in a long trough.

*Extraction of the juice* is effected by—(1) Pressing the pulp, (2) macerating the pulp in water, (3) exhausting the pulp in centrifugals, (4) diffusion.

*Pressing.*—The cleansed roots are reduced to pulp by a rotary rasping-machine, which consists of a drum armed with 250 saw-blades set on its periphery, parallel with its axis. The drum is from 20 to 24 inches long and 32 to 40 inches in diameter; it revolves from 1000 to 1200 times a minute, and reduces 800 to 1000 cwt. of beets to pulp in twenty-four hours. A little water is generally run into the rasping-machine with the beets. The pulp is then subjected to pressure, either in sacks or bags, between iron plates in the hydraulic press, under a pressure of 500 to 600 pounds, or through a series of linen cloths by means of a stone or iron roller; 100 pounds of beets yield 80 to 85

pounds of juice of the 95 to 96 present. *The residue* or exhausted pulp is largely fed to cattle. The following analysis by Wolff of the residue from the presses at Hohenheim are from Wagner's *Technology:*

| | Refuse. | | |
|---|---|---|---|
| | Pressed with 20 per cent. of water. | Pressed with 14 per cent. of water. | Pressed without water. |
| Sugar | 7.86 | 7.58 | 6.72 |
| Proteine substances | 1.05 | 1.67 | 1.02 |
| Other nutritious substances | 11.36 | 11.05 | 14.36 |
| Cellulose | 6.25 | 6.04 | 6.68 |
| Ash | 5.47 | 5.74 | 5.28 |
| Water | 68.01 | 67.92 | 65.94 |
| | 100.00 | 100.00 | 100.00 |

The result of the pressing is seen in the following table, which shows what part of each constituent passes into the juice, and what part remains in the residue:

| | Fresh roots. | Juice. | Residue. |
|---|---|---|---|
| Sugar | 11.88 | 10.17 | 1.72 |
| Proteine substances | 0.87 | 0.58 | 0.28 |
| Other nutritious substances | 3.47 | 0.63 | 2.84 |
| Cellulose | 1.33 | ..... | 1.47 |
| Ash | 0.89 | ? | 1.27 |
| Water | 81.56 | 65.95 | 15.61 |
| | 100.00 | 76.80 | 23.20 |

Marguerite ferments the press-residue and distils off the alcohol.

*Maceration* is a system of exhausting the beet-pulp with water. Suppose the beet-pulp contains 96 per cent. of juice, containing 12 per cent. of sugar, and it is mixed with 96 per cent. of water; the juice will then be diluted with an equal bulk of water to half its original strength. If 96 per cent. of this weak juice is drawn off, it will carry half the sugar contained in the beet. On adding another 96 per cent. of water to the half-exhausted pulp, and drawing off an equal volume again, one-half of the remaining half of the sugar, or one-fourth of the original quantity, will be gained. Continuing this washing ten times in succession, there will be removed of the sugar contained in the beet, $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\frac{1}{64}+\frac{1}{128}+\frac{1}{256}+\frac{1}{512}+\frac{1}{1024}=\frac{1023}{1024}$, leaving only $\frac{1}{1024}$th of the sugar in the exhausted pulp. Considering the percentage of sugar, there will have been removed, first, 6 of the 12 per cent. in the juice, then 3, 1.5, 0.75, 0.375, 0.1875, 0.09375, 0.046875, 0.0234375; and on the tenth washing 0.01171875 per cent., making a total of 11.98828125 per cent. The resulting solutions would of course be very dilute, but by bringing them in contact with fresh beet-pulp, they would be rendered more concentrated, till they finally almost equal the original juice in strength. The weakest mixed with fresh pulp would yield a juice containing $\frac{12.+0.01171875}{2}=$ 6.005859375 per cent. of sugar. This mixed with fresh pulp would yield juice containing $\frac{12.+6.005859375}{2}=9.+$; and by repeating this process the juices obtained will contain successively 10.5, 11.25, 11.625 per cent., and so on. By this system of maceration the beets are completely exhausted, and at the same time a liquid is obtained nearly as strong as the original juice. The apparatus consists of a series of ten or twelve macerators, vessels provided with rotary stirrers and false bottoms. These are charged successively with fresh pulp, and the liquors pass from one to the other successively, the fresh water coming first in contact with exhausted pulp, and lastly with fresh pulp; the pulp being washed first with a liquor nearly as strong as juice, and lastly with water. Schützenbach has modified this process as follows: "The roots are cleaned, and then cut in slices by a cutting-machine. They are then passed to a drying chamber heated to 50°, and subsequently ground to a meal. Four parts of this meal are allowed to macerate in nine parts of water, to which sometimes sulphuric acid is added. Another method is to moisten the dried beet-meal with milk of lime, and afterward continue the operation in a bath of water heated to 80°. These methods are largely used in Germany, where in general practice it is found that 4.75 cwts. of green roots yield 1 cwt. of dry beet-meal." (*Wagner.*)

*Extraction of the juice by centrifugals* is practised in some factories. The pulp is placed in the centrifugal machine (Fig. 5), and a considerable portion of the juice is at once thrown out by the rapid rotation. Water is then applied to the still rotating pulp by a sprinkler, and a very considerable portion of the remaining juice is thus displaced. The drum of the centrifugal is usually about 29½ inches high and 25½ inches in diameter. The usual speed is about 1200 revolutions per minute. The pulp is mixed with 40 per cent. of water, and 242 pounds of the mixture, consisting of 176 pounds of pulp and 66 (8 gallons) pounds of water, constitutes a charge. When the flow of juice from the drum slackens, water to the amount of 165 pounds (20 gallons) is introduced through a sprinkler. Three charges per hour can be worked off; so one centrifugal exhausts 176 pounds $\times 3 = 528$ pounds per hour, or 11,616 pounds in twenty-two hours. The yield of juice varies with the amount of water used. Pure pulp yields 65 per cent. of juice, but the application of 45 per cent. of water increases the yield to 87.5 per cent. Of the 45 per cent. of water used, 31 goes into the juice and 14 remains in the residue, which retains also 7.3 of the original 95 per cent. of juice in the pulp. Thus,

Juice... 95<br>Fibre... 5<br>Pulp... 100<br>Water.. 45

yields...

Liquor:<br>Juice... 87.5, and<br>Water.. 31.0<br>118.5

Residue:<br>Juice.... 7.5<br>Water... 14.0<br>Fibre.... 5.0<br>26.5

By increasing the quantity of water, a still larger yield can be obtained, but excessive dilution would result, which is more serious than a small loss of sugar. Stammer gives the following results from 100 pounds of beet-pulp, actually containing 95 pounds of juice, when using different quantities to wash the residue in the centrifugal:

| Water used. | Liquor obtained. | Percentage of sugar in the liquor. | Juice in the liquor. | Water in liquor. | Juice in residue. |
|---|---|---|---|---|---|
| 40 lbs. | 115.0 | 10.2 | 82.5 | 32.5 | 12.5 |
| 60 " | 129.5 | 9.8 | 89.5 | 40.0 | 5.5 |
| 70 " | 136.5 | 9.4 | 90.0 | 46.5 | 5.0 |
| 80 " | 144.0 | 8.9 | 90.5 | 53.5 | 4.5 |

Walkhoff gives the following as the average composition of the residue from the centrifugal:

| | | | |
|---|---|---|---|
| Sugar | 2.4 | to | 2.4 |
| Soluble substances | 1.5 | " | 0.6 |
| Fibre | 13.5 | " | 12.0 |
| Water | 82.6 | " | 85.0 |
| | 100.0 | | 100.0 |

*Diffusion* has been already explained in describing the methods employed in extracting the juice from the cane. It is now very extensively practised in the European beet-sugar factories. The beets are cut into ribbons about $\frac{1}{25}$ inch thick and ¼ to ½ wide. A cutting-machine, the cutter rotating 160 times a minute, will cut 220,000 pounds of beets in twenty-four hours. The diffusion battery consists of ten cylinders, provided with manholes and covers and the necessary series of tubes to carry the liquors to and from each cylinder in the series. The cylinders hold from 2000 to 4000 pounds of beets. Compressed air is used to force the liquors from one cylinder to another. Supposing the battery to be in full operation, eight of the cylinders will be in use, all containing beets; at one end of the series the beets will be nearly exhausted, and the liquor little more than pure water; at the other end the liquor will have nearly reached the strength of real beet-juice, while the beets will as yet have given up very little of their juice. Every hour a fresh cylinder of beets is added at this end of the series, and a cylinder of exhausted beets is thrown off from the other end. The liquor in the last cylinder is run into the warming-kettle and heated to from 170° to 200° F., and then run into the cylinder of fresh beets. After remaining in contact with the beets for twenty or thirty minutes, it is drawn off, and is ready for defecation. Water runs into the exhausted end of the series, and the liquors pass from cylinder to cylinder toward the fresh beets. A small quantity of lime is added to the water used, to neutralize the free acids of the juice and retard fermentation. Care is taken not to add so much lime as to cause an alkaline reaction. Carbolic acid (phenol) is sometimes added in small quantity to prevent fermentation. As water is run in upon the beets until it ceases to extract any more juice, all the juice present is obtained; so diffusion yields about 95 per cent. of juice. As the beets are not reduced to pulp, the cells are not ruptured, and the albuminoids, etc., of the juice are left behind; consequently, a purer juice results than by any of the other methods of extraction.

*Choice of Extraction Methods.*—Great difference of opinion exists as to the economic advantages of the different methods of extraction. Maceration and diffusion are most effective, as they yield nearly all the juice in beet. Diffu-

| | Presses. | Maceration. | Centrifugals. | Diffusion. | Total. |
|---|---|---|---|---|---|
| Austria | 61 | ... | 1 | 183 | 245 |
| Germany | 176 | 27 | 11 | 120 | 334 |
| Russia | 225 | ... | ... | 42 | 267 |
| Holland | 30 | ... | ... | 2 | 32 |
| Denmark | 1 | ... | ... | 1 | 2 |
| Sweden | ..... | ... | ... | 4 | 4 |
| Italy | 3 | ... | ... | ..... | 3 |
| Total | 496 | 27 | 12 | 352 | 887 |

sion yields the purest juice. Centrifugals yield the weakest juice, but require the least capital. In the campaign of 1873–74 the 337 factories in Germany were divided as follows on this question: 214 used presses, 31 maceration, 12 centrifugals, and 80 diffusion. (*Wagner's Jahresb.*, 1875, 779.) The *Sugar-Cane*, July, 1876, gives the preceding table of factories, omitting France.

*Underground transportation* of the juice is now resorted to on large estates. Extraction-works are established at convenient points, and the juice is forced underground in iron or earthen pipes to the central factory, when it is defecated and evaporated.

*The juice* contains, besides the soluble constituents of the beet, a variable quantity of torn cells and their insoluble contents, by which it is rendered turbid. It contains, therefore, all the substances contained in the original beet, though the insoluble constituents are present in much smaller proportion than the soluble. This statement applies, however, especially to the juice from the presses and centrifugals—less to that from maceration, and still less to that from diffusion. The latter is very free from the insoluble constituents of the beet, and also from the soluble colloids —*i. e.* albuminoids, pectine, etc., gummy bodies, and soluble silica, owing to the fact that, the beets being cut into ribbons, the cells are not ruptured to any great extent. The following is about the average composition of the juice:

| | |
|---|---|
| Sugar | 12.00 |
| Albuminoids | 1.25 |
| Salts | 0.72 |
| Water | 86.03 |
| Total | 100.00 |

Michaelis determined the following substances in 100 parts of juice:

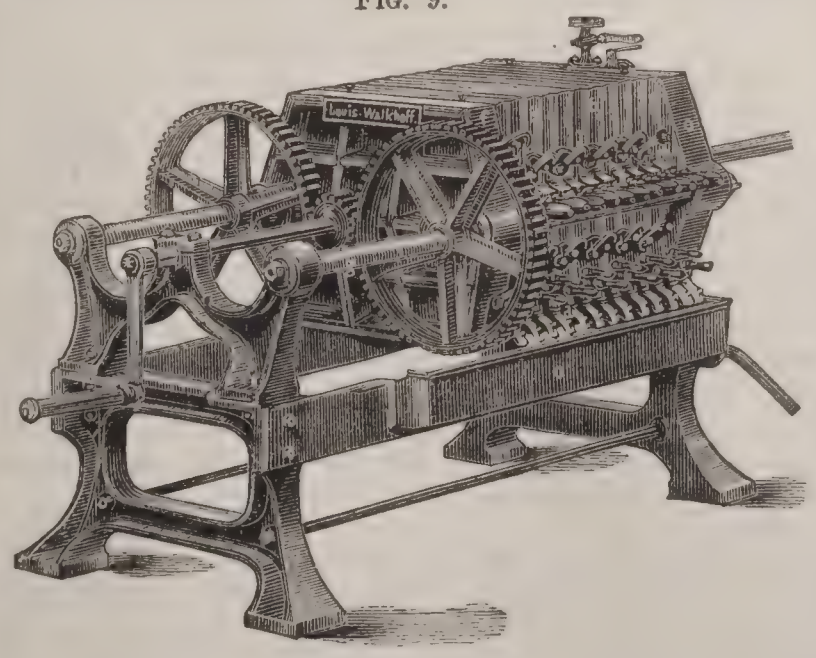
| | |
|---|---|
| Fat | 0.0735 |
| Gluten | 0.1154 |
| Legumine | 0.2026 |
| Albumen | 0.1358 |
| Extractive matters | 0.3000 |
| Total | 0.8273 |

Also in—

| | Magdeburg beets. | | Hung. beets. |
|---|---|---|---|
| Silica | 0.0083 | 0.0069 | 0.0410 |
| Chlorine | 0.0173 | 0.0279 | 0.1656 |
| Phosphoric acid | 0.0848 | 0.0827 | 0.0230 |
| Oxalic acid | 0.0545 | 0.0944 | 0.0944 |
| Citric acid | 0.1743 | 0.0785 | 0.0758 |
| A peculiar acid | Not determined. | | |
| Protoxide of manganese | 0.0031 | 0.0019 | 0.0003 |
| Protoxide of iron | 0.0046 | 0.0133 | 0.0117 |
| Lime | 0.0097 | 0.0179 | 0.0300 |
| Magnesia | 0.0665 | 0.0442 | 0.1109 |
| Soda | 0.1876 | 0.1387 | 0.1003 |
| Potassa | 0.1893 | 0.2335 | 0.4556 |
| Total | 0.8000 | 0.7409 | 1.7088 |

*Defecation of the juice* is generally effected by boiling with the addition of ½ to 1 per cent. of lime in jacketed copper kettles holding about 500 gallons. The free acids are neutralized; the albuminoids largely precipitated, as are also the magnesia, iron, manganese, and much of the silica; insoluble phosphates, oxalates, and malates are produced; pectose and pectine, etc., are converted into nearly insoluble lime-salts; the chromogene is converted into insoluble lime-salts of ulmic acid, etc.; the lactic acid formed by fermentation is converted into a soluble lime-salt, as are also the citric, aspartic, and some other acids; the alkalies are set free, and the excess of lime forms an alkaline saccharate with a little of the sugar; the caseine

FIG. 9.




Filter-press.

forms a compound soluble in the now alkaline juice, as does a portion of the albumen, etc.; the betaine is decomposed with the formation of calcic oxalate, and the asparagine with the formation of ammonia. As the temperature rises to about 190° F., large flocks form, which rise to the surface and soon produce a thick, compact scum of a dark color. The juice loses its turbidity and black color, and becomes almost colorless. When the boiling is finished, the clear portion of the juice is drawn off, and the turbid portion, containing the scum and precipitates, and amounting to from 18 to 30 per cent. of the whole, is filtered by bags or presses. Fig. 4 shows bag-filters; Fig. 9 a filter-press, generally used in Germany and France for separating the scums in sugar factories and refineries. The pressed scum is valuable as a fertilizer. It is said to develop a mould or ferment fungus, the spores of which find their way into sugar solutions, syrups, etc., and do much harm; hence it should be removed at once from the factory. The following analysis of the dried scum is interesting, as showing the nature of the substances removed with the lime during defecation:

| | | | |
|---|---|---|---|
| Carbonate of lime | 16.60 | | |
| Lime combined with acids, etc. | 17.36 | | |
| Magnesia | 1.90 | | |
| Alumina and oxide of iron | 8.00 | | |
| Potassa and soda | 0.39 | 50.70 | |
| Chlorine | trace | | |
| Sulphuric acid | 0.05 | | |
| Phosphoric acid | 1.90 | | |
| Residue | 4.50 | | |
| Organic matter | | 44.85 | Nitrogen... 1.579; Albumen... 9.995 |
| Water | | 4.45 | |
| | | 100.00 | |

*De-liming, or saturating the juice with carbonic acid* (*carbonatation*), is the next step in the manufacture of sugar. The object of this treatment is to precipitate the excess of lime, to carbonate the caustic alkalies, and to precipitate soluble organic matters, albuminoids, acids, etc., which are soluble in caustic alkalies, but are precipitated as lime-salts and lakes. The carbonic acid gas is obtained by burning coke or charcoal, or by passing superheated steam over ignited limestone. It is washed and stored in gas-holders, and is bubbled into the defecated juice as long as it is absorbed. The juice is then heated to decompose any soluble bicarbonate of lime that may have been formed, and the precipitate is separated by the filter-press. The bluish-violet coloration which the juice shows after treatment with carbonic acid is said to be due to a compound of glucic acid and iron.

*Other Methods of Treating the Juice.*—Chloride of calcium has been added to convert the caustic alkalies into chlorides, and reduce their tendency to form molasses to a minimum. (*Balling* and *Michaelis.*) It was added before the lime in defecating. Chloride of aluminum was used for the same purpose, and to remove color. (*Siemens* and *Breunlin.*) Phosphoric acid, acid phosphate of lime, and phosphate of ammonia have been used to remove the free lime after defecation, as have also caseine, soap, fatty acids, sulphate, oxalate, and acetate of alumina, and pectic acid. Hydrofluo-silicic acid has been used to remove potassa.

*Frey and Jelinck's process* of purification is one of the most important improvements in treating beet-juice. The juice is heated to 77° to 100° F., and a large quantity of lime added, 2 to 4 per cent.—more than enough to convert all the sugar present into saccharate of lime and to combine all the acids. Carbonic acid gas is immediately introduced through perforated tubes, and allowed to bubble through the juice. As the saturation of the lime proceeds, the temperature is gradually raised, till, when the saturation is complete, it is about 200° F. The whole is then sent through the filter-press, or, after standing, three-fourths are drawn off clear, and the remaining one-fourth sent through the press. Only about 0.05 to 0.07 per cent. of lime remains in the juice. The advantages of this process are—(1) one operation completes the purification; (2) the purification is more complete; while the old processes of defecation and carbonatation removed only 20 per cent. of the albuminoids, this process removes 50 per cent.; (3) the increased purity of the juice diminishes the quantity of bone-black required for the subsequent filtration; (4) the use of less bone-black leads to the production of less sweet water; (5) the juice is not darkened by being boiled with caustic potassa, soda, and lime; (6) the lime in the scum being all in the form of carbonate, the filtering-cloths last longer.

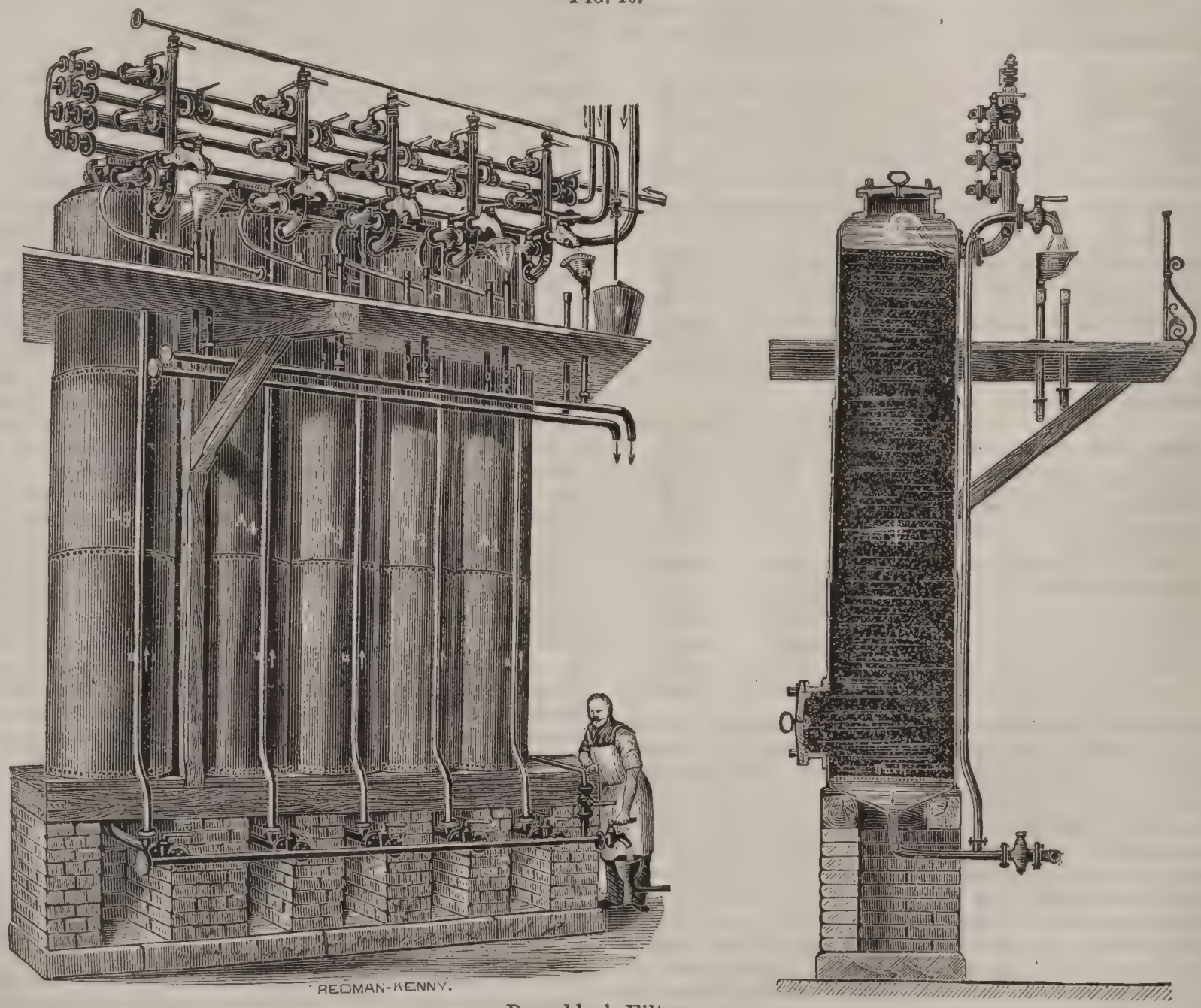
*The montejus, or juice-lifter*, is employed to raise the juice to the top of the bone-black filters. It takes the place of pumps, which would become sticky and promote the fermentation of the juice. It is simply a closed vessel which is filled with the defecated juice. The entrance-tube is closed, steam pressure is admitted at the top, and the juice is forced upward through a tube which descends to

near the bottom of the vessel. The elevating power is equivalent to 29 feet for every 15 pounds of pressure in the boiler.

*Filtration over bone-black* is the next step in the treatment of the juice. Bone-black, *bone-coal, animal charcoal, char, spodium*, is the charcoal of bones, which is obtained by heating them in retorts. (See BONE-BLACK.) The decolorizing properties of charcoal were noticed in 1798 (1790? *Stohmann*) by Löwitz of St. Petersburg. In 1809, M. Guillou, a refiner, employed wood-charcoal for decolorizing sugar and syrup. In 1811, M. Figuier of Montpellier published a note on animal charcoal in which he mentioned its wonderful decolorizing power on vinegar and wine. In 1812, Dérosne proposed to use it on sugar solutions. M. Payen, a manufacturer of sal-ammoniac from animal matters, followed out the suggestion, using the bone-charcoal which was produced as a by-product in his factory. The yield of sugar was increased 10 per cent., while the quality of the various grades of refined sugar and syrup was greatly improved. The finely-pulverized bone-black was at first boiled with the sugar solutions in the defecator, but in 1822 the bone-black filter was introduced, in which the sugar solution is made to pass down through a column of bone-black in coarse grains. In the Paris refineries the writer saw in 1869 the use of powdered black in the defecator still continued, although the liquors were afterward sent through the bone-black filters. The powdered black can be used but once, and consequently the quantity used must be small, while the coarse black of the filter can be washed and revivified, and used again and again, which makes it possible to use larger quantities.

*The bone-black filter* at first used was the Taylor bag-filter (Fig. 4), which was filled with bone-black, the cistern above, A, also containing a layer of black. In 1828, Dumont introduced the filter which bears his name. It consisted of an upright wooden box with a perforated false bottom. The false bottom was covered with cotton cloth; the box was then nearly filled with coarse black, and the hot sugar-liquor was then run in and allowed to filter through. This filter, enlarged and somewhat modified in detail, is the one now used. It is made of boiler plate or cast iron, and is often closed at the top to enable the operator to filter under pressure. In large refineries these filters are now made of enormous dimensions, reaching a diameter of 10 feet and a height of 30 feet. Fig. 10 shows a set of five such filters:

FIG. 10.




Bone-black Filters.

The hot juice is introduced at the top, and passes out at the bottom. It is sometimes raised and sent through a second filter. The effect of the black on the juice is most important. It removes (1) the coloring-matters; (2) other organic substances, such as albumen, gluten, legumen, dextrine, and other gummy bodies and extractive matters; (3) caustic lime, if present; (4) salts, sulphate of lime, potassa, and soda-salts; (5) soluble silica. It was at first supposed that the action of the black was limited to the removal of the coloring-matter, but it is now known that this is one of the less-important effects of bone-black filtration. The other substances which are removed all interfere with the subsequent crystallization of the sugar, and their removal, though partial, results in a considerable increase in the yield of sugar and a consequent diminution of the quantity of molasses formed. The effect is much greater on hot than on cold liquors, and much greater on the thin juice than on the concentrated juice. Walkhoff gives the following table, showing the effect of each operation on the quantity of inorganic salts (ash) in the juice:

| | | |
|---|---|---|
| Fresh juice | 0.456 | 100 |
| Defecated juice | 0.852 | 187 |
| Carbonated juice | 0.600 | 132 |
| Juice once filtered over black | 0.370 | 81 |
| Juice twice filtered over black | 0.130 | 29 |

The increase in defecating is due to the lime used.

*Organic Bodies, not Sugar.*

| | |
|---|---|
| Fresh juice | 100 |
| Defecated and carbonated | 92 to 87 |
| Once filtered | 76 to 70 |
| Twice filtered | 44 to 24 |

The black becomes charged with matters removed from the juice, and its action gradually diminishes; but by passing the latter runnings through a second filter, uniformity in the product can be maintained. Walkhoff found that while the partially-concentrated juice running from a freshly-charged filter had lost 55 per cent. of its salts, that running during the sixth hour had lost only 17 per cent. Stamm found that thin juice, which, when the filter first began to run, had lost 42 per cent. of its salts, lost only 27 per cent. toward the end of the filtration.

*How the black acts* has always been an interesting question. The action is supposed to be chiefly mechanical, due to the porosity of the black, but this theory would hardly account for the apparently discriminating action of the black. Anthon says the lime is held by the free carbonic acid in the pores of the coal, which forms with it an insoluble carbonate. Divés (*Sugar-Cane*, June, 1872, 314) doubts this. Wernekinck thinks the color and some other

organic bodies are destroyed by the free oxygen absorbed by the coal from the air. Scheibler disproves this by successfully using coal which has been ignited and cooled in an atmosphere of hydrogen. (*Dingl. Polyt. J.*, cciv. 236–240.) Divés says color is absorbed, but not destroyed. That the coal exerts a powerful action is shown by the fact that it decomposes saccharate of lime, holding the lime, and that it even decomposes alkaline sulphates and many other metallic salts. Graham says it affects salts in three different ways: (1) it absorbs some unaltered; (2) it reduces some salts to a lower degree of oxidation; (3) it precipitates some as basic salts. Other forms of animal charcoal possess higher decolorizing powers, but bone-black is best adapted to all the requirements in purifying sugar solutions. The following table by Bussey is interesting:

| Species of charcoal. | Weight. | Indigo test consumed. | Molasses testconsumed. | Blanching by indigo. | Power by molasses. |
|---|---|---|---|---|---|
| | gram. | litres. | | | |
| Crude bone-black | 1 | 0.032 | 0.009 | 1 | 1 |
| Blood calcined with potassa | 1 | 1.60 | 0.18 | 50 | 20 |
| Blood calcined with chalk | 1 | 0.57 | 0.10 | 18 | 11 |
| Blood calcined with phosphate of lime | 1 | 0.38 | 0.09 | 12 | 10 |
| Gelatine calcined with potassa | 1 | 1.15 | 0.14 | 36 | 15.5 |
| Albumen calcined with potassa | 1 | 1.08 | 0.14 | 34 | 15.5 |
| Starch calcined with potassa | 1 | 0.34 | 0.08 | 10.6 | 8.8 |
| Charcoal from acetate of potassa | 1 | 0.18 | 0.04 | 5.6 | 4.4 |
| Charcoal from carbonate of soda by phosphorus | 1 | 0.38 | 0.08 | 12 | 8.8 |
| Calcined lamp-black | 1 | 0.128 | 0.03 | 4 | 3.3 |
| Lamp-black calcined with potassa | 1 | 0.55 | 0.09 | 15.2 | 10.6 |
| Bone-black treated with hydrochloric acid and potassa | 1 | 1.45 | 0.18 | 45 | 20 |
| Bone-black treated with hydrochloric acid | 1 | 0.06 | 0.015 | 1.87 | 1.6 |
| Oil calcined with phosphate of lime | 1 | 0.064 | 0.017 | 2 | 1.9 |

*The composition of bone-black*, when new, is shown in the following table:

| | | | | Average. |
|---|---|---|---|---|
| Carbon | 6.00 | to | 12.00 | 11.00 |
| Nitrogen | 1.00 | " | 1.50 | |
| Phosphate of lime | 75.00 | " | 80.00 | 80.00 |
| Phosphate of magnesia | 1.00 | " | 1.50 | |
| Carbonate of lime | 6.00 | " | 9.00 | 8.00 |
| Sulphate of lime | 0.11 | " | 0.59 | 0.20 |
| Sulphide of calcium | 0.01 | " | 0.07 | trace. |
| Chloride of sodium, etc | 0.77 | " | 1.29 | 0.40 |
| Iron | 0.10 | " | 0.30 | 0.10 |
| Sand, etc | 0.30 | " | 0.80 | 0.30 |
| | | | | 100.00 |

Bone-black, both new and old, retains appreciable quantities of gases, which are often combustible. These escape when the filters are filled with the liquors, and when mixed with air become explosive. Bone-black contains a variable quantity of moisture, either absorbed from the air or added to cool it.

*The active constituents of the black* are the porous nitrogenous carbon—which performs all the peculiar work of the coal—and the carbonate of lime, which neutralizes the free acids, often present in the liquors in the case of sugar from the cane.

*The subsequent treatment of the black* consists in washing with hot water, treating with dilute hydrochloric acid to remove a portion of the carbonate of lime, fermenting either in vats (*wet fermentation*) or in heaps (*dry fermentation*) to destroy organic matters, drying, and reburning in kilns to destroy organic matters. A subsequent washing would be of advantage, and is often resorted to. Some of these processes are often omitted, and additional processes are in use, but the reburning is almost invariably resorted to. Eissfeldt revivifies without reburning, subjecting the coal successively to the action of fermentation, hydrochloric acid, steam, and ammonia-water. (See *Am. Chem.*, i. 216.) The coal is sometimes boiled with caustic soda or carbonate of soda to remove organic matters, and to change the sulphate of lime into carbonate, that it may be removed by hydrochloric acid. It is very important to wash with pure water, as the coal will extract lime-salts from impure well-water. Bone-black becomes gradually deteriorated, and, were it not for frequent additions of fresh black to replace that sifted out, would ultimately become almost worthless. Judicious management reduces this deterioration to a minimum, however. (1) Allowing the hot black from the kiln to come in contact with the air causes a loss of carbon and the black becomes gray. (2) Careless washing leaves organic matters in the coal, which are charred in the kiln and fill up the pores, giving the coal a glaze and increasing the percentage of carbon. (3) Carelessness in handling the liquors, allowing them to become acid, may charge the coal with iron; this is specially noticed in some refineries using sugar from the cane. (5) The black may be injuriously enriched or impoverished in carbonate of lime. (6) It may be charged with an excess of sulphate of lime. (7) It may be reburned at too high a temperature, by which a partial fusion of the phosphates results, reducing the porosity of the coal. By this cause, and also by the pulverization of the softer and more porous portions of the coal, the gravity of the coal increases in use. A cubic foot of new coal weighs 37 to 46 pounds, while old coal weighs 48 to 76 pounds. (See Arnot, *Chem. News*, xxi. 1, and Wallace, *Am. Chem.*, i. 139.)

*Testing Bone-black.*—The quality of bone-black is determined—(1) by testing its decolorizing power on indigo, burnt sugar, or raw sugar (see *Chem. News*, xxi. 31); (2) by determining the quantity of lime absorbed from lime-water or saccharate of lime; (3) by determining the ratio of sugar to the total solids in saccharine solutions before and after filtration; this is the only reliable test of the effective action of the coal; (4) the percentage of moisture, the weight per cubic foot, the color, porosity, average size by sieves, and appearance under the microscope, are also important sources of information.

*Evaporation of the juice* is effected in a vacuum-pan (Fig. 3), or usually in a series of two (*double effet*) or three (*triple effet*) vacuum-pans, in which the heat is applied by steam coils or tubes to the one which the juice enters last, while the others are heated by the steam given off by this one. These pans are constructed with vertical tubes. The evaporation is continued till the sp. gr. is about 1.31 or 25° Beaumé. The "thick juice" is then ready for—

*The second filtration over bone-black*, which is in every respect similar to the first.

*The final concentration* to the crystallizing-point is conducted in a single vacuum-pan, like Fig. 3. The semi-solid mass of crystals is then allowed to cool, and is placed in the centrifugal machines (Fig. 5) to separate the crystals from the mother-liquor. The latter is again boiled, and a second crop of crystals of inferior sugar is obtained. A third, a fourth, and often a fifth crop is obtained by repeating the boiling, etc. The latter crops are not boiled to crystals, but are boiled "blank," and the crystals form on standing in cisterns, many weeks being required for the later crops.

*Analyses of Raw Beet-Sugar and Molasses.*

| | Cane-sugar. | Other organic matters. | Ash. | Water. |
|---|---|---|---|---|
| 1. First product | 98.00 | 0.31 | 0.54 | 1.15 |
| 2. " " | 96.00 | 0.94 | 1.08 | 1.98 |
| 3. " " | 95.10 | 2.05 | 1.41 | 1.44 |
| 4. Second " | 93.70 | 1.63 | 1.67 | 3.00 |
| 5. " " | 90.50 | 2.76 | 3.66 | 3.08 |
| 6. " " | 91.60 | 1.94 | 3.69 | 2.77 |
| 7. Third " | 92.10 | 2.24 | 2.76 | 2.90 |
| 8. " " | 90.80 | 3.27 | 2.76 | 3.17 |
| 9. " " | 87.00 | 3.98 | 4.04 | 4.98 |
| 10. Molasses | 53.30 | 15.88 | 14.78 | 16.04 |
| 11. " | 52.39 | 17.24 | 16.40 | 13.97 |
| 12. " | 46.60 | 17.19 | 10.70 | 24.80 |

*The molasses* is so charged with salts and other impurities that it cannot be used as food. It is diluted, fermented, and distilled for spirits, and the liquor left in the still is evaporated, and the residue calcined, yielding crude potash. Dubrunfaut has applied the principle of osmose to the purification of the molasses, removing a portion of the alkaline salts and recovering an additional percentage of crystallized sugar. (His process is described and apparatus figured in the article ENDOSMOSE.)

*Ashes of Beet-Molasses* (*Stammer*).

| | I. | II. |
|---|---|---|
| Potassa | 51.72 | 47.67 |
| Soda | 8.00 | 11.43 |
| Lime | 5.04 | 3.60 |
| Magnesia | 0.18 | 0.10 |
| Peroxide of iron | 0.30 | 0.18 |
| Alumina | 0.17 | 0.11 |
| Carbonic acid | 28.90 | 27.94 |
| Chlorine | 6.05 | 8.16 |
| Sulphuric acid | 1.33 | 1.52 |
| Phosphoric acid | 0.57 | 0.55 |
| Silica | 0.02 | 0.17 |
| | 102.28 | 101.42 |
| Oxygen counted twice | 1.36 | 1.84 |
| | 100.92 | 99.58 |

The yield of sugar in the French factories is estimated as follows by Vivien. Of 100 kilogrammes of sugar in the juice, there is obtained—

| | | |
|---|---|---|
| Sugar of 1st run | 41.03 | |
| " 2d " | 17.09 | 63.00 |
| " 3d " | 4.88 | |
| Sugar in the molasses | | 18.50 |
| Sugar lost by transformation into various compounds | | 18.50 |
| | | 100.00 |

*The beet-sugar establishment* is often of great magnitude. The following description is by Waldron Shapleigh in the *Am. Chem.*, iv. 281:

"*The Cambrai Central Beet-Sugar Works in France.*

"The râperies are at distances varying from 4 to 20 miles from the central usine, and are seventeen in number, having in all 87½ miles of tubing, varying from 90 to 250 millimètres in diameter; it is intended to increase the râperies to twenty-five and the length of tubing to 95 miles, in order to supply the works with the juice of 250 million kilos. of beets per season, for which they were constructed. Each râperie has a force-pump to give sufficient pressure to send the juice to the works; previous to its departure it is charged with 1 per cent. of lime, in the form of milk of lime of 22° B., to prevent any change. At a distance of 400 mètres from the works is a large reservoir of boiler iron, holding 5000 hectolitres, to receive any surplus and allow short stoppages for clearing, etc. Near this receiver is the lime-quarry, connected with the furnace by a horse railroad. The main buildings are of brick, covered with an iron roof, and consisting of a main building in the form of a grand saloon 100 mètres long by 18 wide and 30 high; extending from one side are four small buildings—one for the repairing-shop and milk-of-lime vats below, and the filter-presses above; one for the steam-boilers; one for the revivifying furnaces for the bone-black; and the fourth containing, below, the tanks for the second and third products, forty-five in number, each holding 1000 hectolitres; above is the packing and storing-room for sugar, of 1800 square mètres area. At a short distance from this main building are the gas-works, furnishing 500 cubic mètres per day, and the furnace for the carbonic acid gas, built of brick and iron, and holding 500 cubic mètres, and fed by an elevator. The steam boiler-room contains sixteen boilers, having a heating surface of 200 square mètres each, the total horse-power being 2400. The building for revivification of bone-black is furnished with two Schreiber's furnaces, each supplying 150 hectolitres per day. In the main building are the machines and apparatus for working the juice proper. On the ground floor are the engines and turbines, and running along one side, on platforms, are the tanks for the first and second carbonatations, the 'triple effet,' and vacuum-pans.

"The juice, arriving from the râperies, first passes into a heating tubular boiler of 400 square mètres surface, supplied with the waste steam from the 'triple effet,' previous to its passing into the condensing apparatus, then into the tanks for the first carbonatation; these are four in number, each holding 500 hectolitres; here 1½ per cent. of lime is added, and after the carbonatation the liquid is passed into corresponding settling-tanks of boiler iron immediately below, and allowed to settle, the clear liquid drawn off into the two tanks for the second carbonatation, while the turbid juice is forced by two 'montejus' into the filter-presses, eighteen in number. The first carbonatation requires about two hours—the second about one hour. In the second, ½ per cent. of lime is added, and the process conducted as in the first: the clear juice, however, goes into the bone-black filters. Here an innovation has been made; instead of having a number of small filters, as is customary, there are two large ones, used alternately, each being 3½ mètres in diameter by 3 mètres high; these are working very satisfactorily. The juice is pumped from these filters into the 'triple effet' by a pumping arrangement connected with an engine of 70 horse-power that produces the vacuum in the 'triple effet;' the arrangement consists of two pumps connected by the same piston-rod—a larger one to force the juice into the first boiler of the 'triple effet,' and a smaller to remove it from the third after it has been evaporated to a syrup of 20° to 25° B., forcing it into a tank where it is heated previous to passing into the filters for the second filtration; these filters are three in number, much smaller than those for the first.

"The 'triple effet' is a grand piece of apparatus, built of copper, encased in iron, and is a vacuum-evaporating apparatus of treble action, consisting of three boilers, the lower half of which is tubular, the juice circulating through the tubes, which are surrounded by steam. The first, into which the juice passes, is heated by steam from the boilers; the steam arising from the boiling syrup passes into the second, while the excess is condensed by the engine; the steam from the second into the third, and that from the third, after passing through the boiler that heats the juice on its arrival from the râperies, is condensed; the temperature of the second and third is not as great as in the first, but the vacuum produced by the engine assists the evaporation. The water condensed from the steam is returned to the steam-boilers by a pump. The three boilers of the 'triple effet' are respectively 4.50 m., 5 m., and 5.60 m. in diameter, and are capable of working 20,000 hectolitres of juice per twenty-four hours.

"After the syrup passes the filters for the second filtration, it passes into a tank that supplies the vacuum-pan, which is also an apparatus of grand proportions, similar in appearance to one of the boilers of the 'triple effet,' but is heated by three banks of steam-coils; like the former, it is of copper encased in iron, and is of sufficient size to furnish 600 to 700 hectolitres of crystallized mass or 'cuite' for ten hours, having a diameter of 5.50 m. and 4 mètres high. The 'cuite' passes into a large tank immediately below; after cooling, it is shovelled into a mixing-apparatus, and sufficient diluted syrup of the first run is added to make it turbine easily; it is then conveyed by a small wagon on an elevated track to the hoppers of the turbines. These are twenty-four in number, six being used for the second and third products; the turbines will be increased to forty-five. The second and third products are boiled in a vacuum-pan like the former, but much smaller. The sugar of the first product is exceedingly fine in appearance, being very white, the grain even in size, and hard.

"Sixty thousand kilos., or sixty-six tons, are manufactured daily—about sixty-six hundred tons per year; as the second and third products have not been worked this year, it would be difficult to say what will be the total yield of sugar and molasses. The works proper give employment to 400 men, or, including the râperies, to about 1500 men and women."

The following estimate for a factory capable of making 12,000 to 15,000 tons of beet-sugar per annum is from Dr. Cameron's pamphlet *On the Cultivation of the Silesian Beet: Steam-power.*—4 Cornish steam boilers of 75 horse-power each; 1 2-horse-power engine; 1 cylinder or reservoir to receive the condensed steam. *Washing, Cutting of Roots, etc.*—1 8-horse-power engine, to drive the pump and machinery for lifting beet-roots to the washers and cutting-machine; 1 mechanical beet-root lifter; 2 beet-root washers; 1 cutting-machine; 2 patent iron wagons for bringing beet-root slices to the diffusion-apparatus; 12 diffusion-vessels, complete; 2 iron wagons, for removing pulp to presses; 2 presses (Klüzeman's system); 2 tanks for providing hot water; 2 tanks for providing cold water. *Defecation, Charcoal Filters, etc.*—6 copper defecation-pans; 16 iron tanks, of which 8 are provided with copper tubes (*serpentins*) for providing steam and carbonic gas; 1 12-horse-power engine (*pompe à gaz*), to pump the carbonic gas into above tanks; 2 montejus for ditto; 1 apparatus for making carbonic gas, complete; 4 filter-presses, to extract the juice remaining in the refuse after defecation; 10 filters (charcoal); 1 evaporating apparatus, consisting of three iron cylinders, provided with tubes, complete, called in French factories *triple effet;* 1 condenser, for ditto; 1 engine, 12-horse-power, for ditto (*pompe à vide*); 1 apparatus for boiling the sugar (vacuum-pan), with condenser, complete; 1 10-horse-power engine, for ditto (*pompe à vide*); 6 montejus, in connection with the different parts of the manufacture, and sundry tanks. *Production of (grain) Sugar.*—4 centrifugal machines, complete; 1 6-horse-power engine for driving the above, etc.; 1 montejus; 2 tanks for receiving the syrup from the vacuum-pan; a number of tanks to contain the second and third products; copper pipes, etc., for conducting the juice to different parts of machinery; tanks for storing water, preparing lime, etc.; charcoal furnace and charcoal-washers; sundry small apparatus, used in the second and third processes.

V. Sugar from the Maple.—The sugar-maple (*Acer saccharinum*) grows abundantly in Northern New England, New York, Michigan, Wisconsin, and Canada. Two varieties are selected for the manufacture of sugar, the rock-maple and the black sugar-maple. As soon as the frost begins to leave the ground the sap begins to ascend, and as the first sap is richest in sugar and freest from other substances, the farmer hastens to tap the trees as soon as the snow melts around the stems. This is toward the end of February, in March, or early in April, according to the season. Trees twenty or thirty years old give the best yield. Two holes, three-fourths of an inch in diameter, are bored on the S. side of the trunk, about five inches apart, and eighteen or twenty inches from the ground, about one-half an inch into the alburnum or white bark. Spouts of elder or sumach, eight or ten inches long, are then driven in, and a trough or pail is placed below to receive the sap. The sap continues to run for three or four weeks, but finally deteriorates very much in quality. The trees are tapped year after year without injury. The sap contains from 2 to 2½ per cent. of sugar, or from 2⅔ to 3⅓ ounces per gallon. The sap is collected every day, and carried to the sugar-camp, where it is poured into a cask to be evaporated. If neglected a day or two, it is liable to undergo fermentation. It is boiled down in shallow iron or copper pans to the consistency of honey, then strained, and allowed to stand eight or ten hours to deposit suspended impurities. To clarify it, the white of egg or milk is added, the whole boiled and skimmed.

Much of the product is sold without further concentration as *maple-syrup*. For the production of solid sugar the evaporation is continued until the syrup is very thick, when it is carried to the farm-house and boiled to semi-solidity, and then poured into moulds to cool. Maple-syrup and sugar are prized on account of the peculiar flavor which they possess. By refining this is lost, when the sugar cannot be distinguished from that from the cane or the beet. The yield of sugar is variable: 1150 trees in Canterbury, Vt., gave one season 618 barrels of sap, or 19,776 gallons, from which 4000 pounds of sugar were obtained; this is 1 pound of sugar to five gallons of sap, or 3½ ounces per gallon, and is equivalent to 3½ pounds per tree; 75,730 trees in Cambridge, Vt., gave, in 1869, 221,350 pounds of sugar, which sold for $26,500; 100 trees in Berkshire, Mass., are said to have yielded 500 pounds of sugar in the first five days, or a pound of sugar per tree per day.

Dr. Wallace gives the following analysis of maple-sugar:

| | |
|---|---|
| Cane-sugar | 72.60 |
| Glucose | 13.95 |
| Extractive matter, etc. | 2.11 |
| Soluble salts | 1.35 |
| Insoluble salts | 0.03 |
| Water | 9.96 |
| | 100.00 |
| Cane-sugar obtainable | 51.90 |

VI. Sugar from the Palm.—Most palm trees yield a sweet juice when the top shoot or spadix is cut or bruised. Enormous quantities of sugar are made from this juice in the East. In Bengal the *Phœnix sylvestris*, either growing wild or cultivated in large plantations, furnishes the largest supply of sugar. The trees are tapped, a bamboo spout is inserted, and a pail suspended to receive the sap, which must be frequently collected, and boiled at once to prevent its undergoing fermentation. It is boiled down to a solid, and sold as a dark, deliquescent mass under the name of *goor*. A purer product, called *kham*, is obtained by pressing the molasses out of the blocks of goor. By applying wet grass to the kham contained in baskets, a kind of *claying* occurs, by which the sugar is rendered tolerably white and pure. The sugar is generally sold, however, in the crude form under the name of *jaggery*. Sugar is also made from the wild date-palm (*Phœnix dactylifera*) and other species of *Phœnix*. In the Philippine and Molucca islands much sugar is made from the gommerto palm (*Saguerus saccharifer*), in the South Sea islands from the cocoanut palm, and in Ceylon from the kitul tree (*Caryota ureus*), the palmyra tree (*Borassus flabelliformis*), and the *Cocos nucifera*. Dr. Wallace gives the following analyses of palm-sugar:

| | Calcutta date. | Jaggery. |
|---|---|---|
| Cane-sugar | 86.05 | 86.73 |
| Glucose | 6.95 | 6.04 |
| Extractive matter | 0.65 | 1.29 |
| Soluble salts | 0.68 | 0.88 |
| Insoluble salts | 0.56 | 2.01 |
| Water | 4.10 | 3.04 |
| | 98.99 | 99.99 |
| Color by Dutch standard | 8. | 6. |
| Cane-sugar obtainable | 76.7 | 76.3 |

VII. Sugar from the Chinese Sugar-Cane.—The Chinese sugar-cane is a name given to shaloo or sugar-grass (*Sorghum saccharatum*, W., or *Holcus saccharatus*, L.), a species of durra millet. The sorghum species are coarse grasses, with thickly-crowded panicles. The seed is round, and somewhat larger than mustard-seed. They are natives of the East Indies, and are extensively cultivated in Asia and Africa, particularly *Sorghum vulgare*, common durra, which is the principal cereal of Africa. *S. saccharatum* is cultivated in warm portions of Asia and Africa. Its seeds are pleasanter to the taste than those of common durra. The durra does not make good meal, but is used as a substitute for rice. The sweet pith of the culm is eaten, and is valuable as a source of sugar. Both the leaves and stems of the durra are valuable as food for cattle and horses. Some years ago a French missionary saw the sorghum used in the interior of China for the manufacture of sugar. The French consul-general procured seed, and sent them to France in 1851. Since that time the plant has been extensively used for the production of alcohol. D. G. Brown, travelling for the U. S. patent-office, saw a field of sorghum in the S. of France, and induced the office to order a quantity of the seed for experiment in the U. S. The success of the experiment is proved by the statistics at the end of this article, by which it appears that, in 1870, 16,000,000 gallons of sorghum-molasses were made in the U. S. Since 1857 the plant has been cultivated in all parts of the U. S., even as far N. as Maine. There are several varieties of *S. saccharatum*. The *sorgho*, *sorgo*, or common *sorghum* is from the Chinese seed; the *imphee*, from African seed. The former variety is found to give the best results in the U. S. Rich land is best suited for it, and deep ploughing is very important. Calcareous soils furnish the best syrup. It does not flourish on soils abounding in black muck, on soils standing over cold, wet subsoils, upon undrained lands, nor on soils rich in soluble saline matters. Before the seeds are fully ripe the leaves of the plant are stripped off, the top piece cut off for 2½ to 3 feet, and the stem cut 6 or 8 inches above the root. The average weight of the stems or canes is 1½ to 2 pounds. They yield 65 to 70 per cent. of juice. Dr. C. A. Goessmann, in his important paper on sorghum (*Trans. N. Y. State Ag. Soc.*, 1861), gives the following analysis of the fresh sorghum-cane:

| | |
|---|---|
| Water | 78.94 |
| Sugar | 9.25 |
| Gum, salts, and other soluble matter | 0.97 |
| Albuminous bodies | 1.40 |
| Cerosine (wax) and insoluble earthy compounds | 1.24 |
| Cellulose | 8.20 |
| | 100.00 |

"The leaves contain dry matter 73 per cent., water 27 per cent.; 100 pounds of fresh leaves are equivalent, as food for cattle, to 80 or 85 pounds of hay. Seven canes furnish a pound of fresh leaves."

In large establishments the cane is crushed between horizontal rolls driven by steam or water, similar to those used for sugar-cane, and the bagasse is used as fuel; in smaller farm-factories a vertical mill, driven by one or two horses, is employed. The outfit for a small "domestic" establishment is very simple. In 1869 the cost of the plant for 40 acres of sorghum was as follows:

| | |
|---|---|
| 1 2-horse vertical mill | $100 |
| 3 evaporators | 80 |
| Brick, etc., for furnaces | 30 |
| Skimmers, etc. | 30 |
| | $240 |

The plant for making 1000 gallons of syrup per day of twenty-four hours costs for building and machinery about $3000 (1865). (For details of machinery, etc., see *Report on Sorghum and Beet-Sugar*, by John Stanton Gould, *Trans. N. Y. State Ag. Soc.*, 1865.) The sorghum-canes contain 90 per cent. of juice; the actual yield varies from 30 to 70 per cent., according to the mill employed.

The fresh juice is greenish-yellow, of a density of 9° Beaumé, and exhibits a slight acid reaction. On standing it deposits a voluminous slimy sediment consisting of torn cells, chlorophyl, wax, etc. According to Goessmann, the composition of the juice is as follows:

| | |
|---|---|
| Cane-sugar | 9.950 |
| Gum, albumen, etc. | 1.510 |
| Acids | Not determined. |
| Ash | 0.309 |
| Water | 88.231 |
| | 100.000 |

The ash yields—

| | |
|---|---|
| Phosphate of lime and magnesia, with traces of iron | 0.091 |
| Alkaline carbonates, mostly potassic | 0.130 |
| Sulphuric acid ($SO_3$) | 0.028 |
| Phosphoric acid ($P_2O_5$) | 0.033 |
| Chlorine | 0.027 |
| | 0.309 |

No sugar besides cane-sugar, and no ammonia salts, were found in the juice. The juice is neutralized with slaked lime and boiled in evaporators, with constant skimming, to a density of 18° B. It is then drawn off into a tank and allowed to deposit suspended impurities, and then introduced into a second evaporator and boiled down to from 35° to 40° B. If the herbaceous flavor has not disappeared, a fresh addition of slaked lime is made and boiling repeated. Defecating agents are used by some boilers. Silicate of soda has been used in conjunction with lime and dilute hydrochloric acid to produce a gelatinous precipitate in the syrup, and thus clarify it. With the crude processes employed in the U. S. it is not practicable to make sugar from sorghum; the juice is simply boiled to syrup, and used as such, or sold to the refineries, where it is purified.

Fig. 12.



Chinese Sugar-cane.

The following analysis of sorghum-syrup was published in the *Scientific American* in 1862, p. 329:

| | |
|---|---|
| Cane-sugar | 45.00 |
| Glucose | 28.00 |
| Gluten (?) | 3.50 |
| Other substances | 1.50 |
| Water | 22.00 |
| | 100.00 |

The yield of syrup varies from 80 to 160 gallons per acre. In 1857, Joseph S. Lovering experimented on sorghum with very flattering results, which he published (*A Detailed Account of Experiments and Observations upon the Sorghum saccharatum*, Philadelphia, 1858). He obtained in one case 625½ pounds of sugar and 123¾ gallons of syrup per acre; in another, 1222 pounds of sugar and 74⅓ gallons of syrup. Such results have never been obtained on a large scale.

VIII. Sugar from other Plants.—*Sugar and Starch from Sweet Potatoes.*—According to Mr. Henry Bartol (*J. Frank. Inst.*, 1869), the juice of the North Carolina sweet potato contains:

| | |
|---|---|
| Sugar | 10.50 |
| Starch | 6.00 |
| Gum, etc. | 0.33 |
| Salts | 1.17 |
| Water | 82.00 |
| | 100.00 |

The density of the juice is 10.5° Beaumé. He thinks powerful presses would give a yield of 90 per cent. of juice, and yield over 6 per cent. of sugar, with a production of 9 tons of potatoes per acre. *The common pumpkin* (*Cucurbita pepo*) is said to yield a saccharine juice of 10° to 11° Beaumé. It is even asserted that sugar has been made from pumpkins, on a large scale, in Hungary, in factories designed for beet-sugar. *Sugar from melons* has attracted some attention in California. *Sugar from Maize* (*Indian corn*).—According to Johnston (*Chemistry of Common Life*), sugar was made from maize prior to the Spanish invasion, and has been made successfully by many farmers in the U. S. for domestic consumption. He also mentions a factory near Toulouse in the S. of France where about 20,000 pounds of sugar are annually made from this plant.

IX. Sugar Refining.—The raw sugar from the plantation is not sufficiently pure for use. It contains sand, clay, albuminous matters, coloring-matters, etc., and is not agreeable to the eye or to the taste. Raw beet-sugar is free from sand and clay, but contains, even when quite white and almost chemically pure, a peculiar substance which gives it a most offensive taste and smell. To remove these impurities refining processes are resorted to.

(1) *Refining the Sugar from the Cane.*—The proper selection of raw sugar for refining is a matter of considerable importance. The percentage of crystallizable cane-sugar chiefly determines the refining value, but the glucose and the salts prevent crystallization and cause the production of molasses. Extractive and coloring matters determine chiefly the quantity of char required. Insoluble substances are troublesome to filter. In France the refining value of the raw sugar is determined by subtracting from the percentage of cane-sugar shown by the optical saccharimeter the percentage of glucose and five times the percentage of ash.

(A) *The old sugar-baker's process*, which is now almost entirely abandoned, was carried on at the beginning of this century in Antwerp, Hamburg, and other seaport towns of Europe by a large number of firms. There were at one time 500 or 600 of these small refineries in Hamburg alone. The raw sugar was dissolved in hot water in a copper kettle; a little lime and blood were added; the whole was boiled, filtered through bag-filters (Fig. 4), and the clear solution was boiled down in the same kettle over a free fire to the proper degree of concentration, and then transferred either to earthen moulds to solidify in small crystals, or to copper pans, across which strings were stretched, to crystallize slowly in large crystals of *candis* or rock-candy. In the former case, when the loaf had become solid it was allowed to drain into a pot, and was then clayed, as already described, the loaf being afterward dried and turned down to proper form and size for market. The liquors draining from the loaf were again boiled and crystallized in the mould, yielding a moist, colored, pulverulent sugar, called *bastards*. The thick, dark, almost black, liquor which drained from the bastards was known as sugar-baker's molasses. The writer found several of these establishments still in operation as recently as 1869 in the above-named cities, all engaged, however, in the manufacture of candis on a very small scale, each treating only from 60,000 to 1,000,000 pounds of raw sugar annually.

(B) *Mould-houses.*—The introduction of steam, bone-black filters, and vacuum-pans has made a complete revolution in sugar refining, and has concentrated the business in a few large establishments. Notwithstanding the enormous increase in the consumption of sugar, there are not now 300 refineries in the world, but some of these have a capacity of 1,000,000 pounds of raw sugar daily. *The melting* of the raw sugar is effected most advantageously on the ground floor of the refinery. The melter is an iron vessel with an agitator and a steam coil, into which the raw sugar is thrown, with about 30 per cent. of water, and sometimes a little lime-water to neutralize the free acids present and prevent the inversion of cane-sugar—*i. e.* its conversion into glucose. In some establishments the *sweet water*, the washings from the bone-black filters, is used to dissolve the raw sugar. But this is a most objectionable practice, as these waters are charged with sulphate of lime and other substances which interfere with the subsequent crystallization. They should be treated separately or added to inferior liquors at a later stage of the process.

*Defecation.*—The liquor from the melter is forced to the upper story of the house to cisterns, and thence drawn into the "blow-ups," large iron vessels provided with steam coils. Here the liquor is diluted and heated to about 180° F. Lime is often added, and sometimes blood, to aid, by the flocculent precipitate of albumen which it produces when heated, in clarifying the solution. Both the lime and blood are omitted by some refiners, as they necessitate an increase in the amount of bone-black required, and render the molasses impure. The temperature should not be higher than is necessary, as over-heating darkens the color and increases the amount of molasses. A scum rises to the surface, which is very voluminous when blood is used, and a flocculent precipitate is produced at the same time. The liquor is brought as nearly as possible to a density of 1.225, or 28° Beaumé. After standing a few minutes the scum is removed, and the liquor is run hot upon the bag-filters (Fig. 4). To avoid the injurious action which lime exerts upon the glucose, decomposing it with formation of dark-colored products, Kessler (*Rep. Chim.*, App. 1863, 252) substituted magnesia, which has been used to some extent. Sulphate of alumina has been used with lime, but is objectionable, as it produces sulphate of lime and gives the black more work to perform. Fine bone-black has been recommended, and is generally used, in defecating beet-sugar. Phosphate of ammonia has also been suggested. (*Am. Chem.*, iii. 57.) Lagrange advises the use of this salt, together with baryta. (*Am. Chem.*, iv., 410.) *The bag-filters* are hung in iron boxes, containing about 200 each, and are kept hot by steam. *The scum and sediments* from the bags are blown up with water, folded in cloths, and pressed to recover the sugar they contain, the runnings from them being added to the second or third product of the house. *The bone-black filters* (Fig. 10) next receive the liquor. It is very important that this filtration should be carried on at a high temperature, about 155° F.—never below 150°. At lower temperatures fermentation is liable to set in—either lactous fermentation, which produces sour liquors, changes cane-sugar to glucose, and dissolves iron, or viscous fermentation, which produces "smear." (See Fermentation.) If passing through a single filter does not sufficiently remove the coloring and other matters from the liquor, it is sent through a second filter. A pound or more of black is required for each pound of sugar filtered. When the black is exhausted, hot water is run upon the filters, and drives out the saccharine liquor. The coal is then washed with hot water. When the liquor from the filters is reduced by the wash-water to 15° B., it is collected in a separate cistern as "sweet water," and not allowed to dilute the strong solution. The washing is then continued. It is very important that the black should be washed with water which is boiling hot; and the purest available water should be used, as the black will absorb lime salts from impure well-waters. Washing-machines are often used to secure the complete cleansing of the coal. The coal is then removed from the filters and subjected to revivification. Some treat it with dilute hydrochloric acid to remove carbonate of lime, and then allow it to undergo fermentation to destroy organic matters. It is then dried and passed through the kilns, where it is exposed for a short time to a red heat. When sufficiently cooled, it is ready for use again. The action of the black has been explained in speaking of beet-sugar.

*Boiling in the Vacuum-Pan.*—The decolorized and purified liquor is now introduced into the vacuum-pan (Fig. 3), and rapidly boiled at temperatures ranging from 120° to 150° F.—the lower the better. At first, the liquor is run in in sufficient quantity to cover the lowest coil or worm; steam is admitted to this coil, and when the liquor has been somewhat concentrated, a little more is let in, and so on. When the second coil is covered by liquor, steam is admitted to it; and so with the third coil. At the outset the liquor is boiled to grain—that is, until it is filled with microscopic crystals of sugar. These are gradually enlarged to the desired size as the boiling proceeds. When

the proper degree of concentration is reached, the contents of the pan are dropped into the *agitator*, which keeps the crystals in suspension till the mass can be filled into the moulds. These are of several sizes, according to the disposition to be made of the sugar—*loaf moulds*, the smaller, employed when the sugar is to be sent to market in loaves; *tittlers*, when the sugar is to be broken or cut; *bastards*, when it is to be used for making white liquor. The moulds are mounted on wagons, and are drawn successively under the spout of the agitator and filled with the hot, semi-solid mass of crystallized sugar. In a few hours the mass becomes perfectly solid. The plug is removed from the bottom of each mould, and it is placed upon an iron pot to drain. When the mother-liquor, "first greens," has run out, the rough top of the loaf is cut out, the mould is placed on a fresh pot, and a quantity of "white liquor" is poured upon it. The white liquor is a saturated solution of pure sugar, which is prepared by dissolving the tips of the loaves and the bastards made from the last runnings of the filters. The white liquor passes down through the loaf, and presses out the colored mother-liquor, leaving the loaf perfectly white; the liquor which drains from it during this "claying" is called "drips," and is added to the next solution of raw sugar. When the white liquor has all disappeared, the loaf is taken out of the mould, and the wet tip is cut off, to be used for making white liquor. If the sugar is to be sent to market in loaves, the moulds are placed in rubber sockets on pipes connected with the air-pump, and the last portion of the white liquor is drawn out of the tips. These loaves are turned in a kind of lathe, then dried and packed in papers. The loaves from the tittlers may be shaved on a cutting-machine, and sent to market as (1) moist white "A sugar;" or dried on a granulating table, and sifted out from the powder, and sent out as (2) granulated sugar; or the loaves may be dried in a hot-air chamber, and then broken in a crushing-mill, and separated by a sieve into coarse (3) "crushed sugar" and (4) "powdered sugar," or cut into (5) "cube sugar." The greens or mother-liquor from the first crystallization are diluted, blown up, filtered through bag-filters and over bone-black, and again boiled in the vacuum-pan. The concentrated mass is drawn from the agitator either into bastards or into large iron wagons. When cold and solid, it may be drained in the bastards into pots, or it may be thrown into a mixer, which is provided with revolving knives, and when homogeneous sent into centrifugal machines (Fig. 5) to be freed from the "second greens." This second crystallization is of a light buff color, and is sold moist as "C" or "coffee" sugar. The second greens are diluted, defecated, filtered over bone-black, boiled blank, run into wagons, and allowed to crystallize, and then separated by the centrifugals into moist "X" or "yellow sugar" and "green syrup." The green syrup is diluted, blown up, run over bone-black, concentrated to from 39° to 45° B., and sold as "golden syrup."

*The composition of the products* is about as follows:

| | A. First product, dry. | C. Second product, moist. | X. Third product, moist. | Syrup. |
|---|---|---|---|---|
| Cane-sugar | 100. | 87.00 | 83.00 | 34. |
| Glucose | ..... | 3.85 | 4.90 | 28. |
| Organic matters | ..... | 4.60 | 5.44 | 8. |
| Ash | ..... | 0.55 | 0.66 | 2. |
| Water | ..... | 4.00 | 6.00 | 28. |
| | 100. | 100. | 100. | 100. |

Considerable variations from the above routine prevail among refiners, as far as the production of special grades is concerned. Some take out a fourth crystallization; some boil the last runnings from the black separately as an inferior quality of first crystallization, etc.

The above-described process, which is practised in mould-houses, requires time and space. Several weeks elapse before the last product is ready for market, and room must be provided for the thousands of tittlers and bastards. This and other considerations have led to the adoption of

(C) *The Scotch or Greenock System.*—In this system no moulds are used. The sugar is dissolved in the melter, and immediately run through the bags without any addition of lime, blood, or anything else; run through the black, boiled down in the vacuum-pan, run warm into the centrifugal, cooled, and barrelled for shipment in forty-eight hours after it entered the refinery. Another peculiarity of this system is that no syrup is made; it is all sent to market as part of the second and third products, the little syrup that drains from the third product being added to the melter. These moist centrifugal sugars are known as "pieces" in England.

(D) *Molasses-houses* are devoted to the extraction of a small percentage of yellow C sugar, from raw muscovado molasses from Cuba. The molasses has a gravity of about 38° B., and contains about 50 per cent. of cane-sugar. From 2½ to 3½ pounds of extra yellow C sugar are obtained from the gallon, and the mother-liquor is either sold as "treacle" for shipment to England or refined and sold here as syrup.

(2) *The refining of beet-sugar* differs but little from that of the sugar from the cane in mould-houses. Powdered bone-black and blood are generally added in defecating, and only the first product is sufficiently pure for consumption. The second *bastardes*, third *vergeoises*, fourth *cuviers*, fifth *cuves*, and the molasses, are all too offensive to be used, and must be again refined. There is a limited demand for bastardes and vergeoises among the manufacturers of chocolate. The bastardes stand two days to crystallize, the vergeoises five, the cuviers three weeks, and the cuves three months.

Owing to the richness and purity of the raw beet-sugars, the loss is small. In one of the Paris refineries the yield for a year was, after working over the second, third, etc., products—

| | |
|---|---|
| White loaf-sugar | 89. |
| Molasses, 41½° B. | 9.5 |
| Loss | 1.5 |
| | 100.0 |

In another Paris refinery the yield was for six months—

| | | |
|---|---|---|
| White loaf | 76.31 | 90.67 |
| Bastardes, vergeoises, cuviers, and cuves | 14.36 | |
| Molasses | | 7.86 |
| Loss | | 1.47 |
| | | 100.00 |

The average composition of all the raw sugar refined during this period was as follows:

| | |
|---|---|
| Cane-sugar | 95.495 |
| Glucose | .086 |
| Extractive matter, gum, etc | 1.022 |
| Salts | 1.139 |
| Water | 2.258 |
| | 100.000 |

The following analyses of molasses of the Paris refineries are by Dubrunfaut (*Sugar-Cane*, iii. 91):

| Maker's name. | Density, Beaumé. | Cane-sugar. | Glucose. | Salts. |
|---|---|---|---|---|
| Lebaudy Frères | 44° | 44.50 | 5.47 | 8.95 |
| Jeante et Provost | 44.1° | 45.25 | 6.30 | 9.80 |
| Moitessier | 43.9 | 44.50 | 5.50 | 10.07 |

The molasses is sold to special houses, where it is refined. For clarification, 1000 kilogrammes of molasses receive an addition of 50 kilos. of fine bone-black and 20 kilos. of blood, and water sufficient to reduce it to 24° B. There is also added a quantity of glucose-syrup made from potato-starch, varying from 50 to 100 per cent. of the molasses. The whole is blown up, filtered through bags and over bone-black, and boiled down in vacuum-pans.

(3) *New processes* have been suggested for refining raw sugar, more or less comprehensive in their details. (1) Dr. August Seyferth uses sulphurous acid in the vacuum-pan on the second and third products and on the syrup. This process has been extensively introduced. (*Chem. News*, xxii. 248, and Wagner's *Jahresb.*) (2) Marguerite proposes to remove the coloring-matters and other impurities with acidulated alcohol. (*Chem. News*, xix. 197; *Am. Chem.*, ii. 366.) (3) Boivin and Loiseau prepare a curious gelatinous compound of sugar, lime, carbonic acid, and water—the *hydrosucrocarbonate of lime*—which they use as a defecating agent. The process has been adopted in two large refineries in Paris and in one in England. (*Am. Chem.*, i. 8; ii. 286.) (4) Marix proposes to use hydrofluosilicic acid and chalk to remove potassa from sugar solutions. (*Bull. Soc. Chim.*, xi. 346.) (5) Tamin-Despalles proposes to use the ammonium salt of this acid for the same purpose. (6) Duncan and Newlands propose sulphate of alumina for the same purpose. (*Sugar-Cane*, v. 539; viii. 395.)

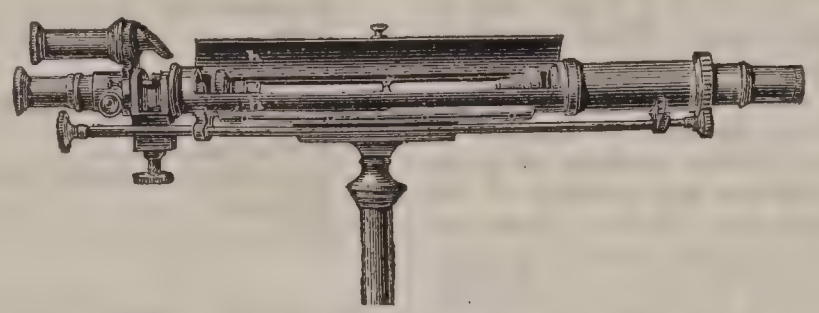
(4) *The adulteration of refined sugar and syrup* has often been alleged. The idea is very prevalent that marble-dust is added to powdered sugar, and that poisonous metals are used in the refineries and left in the sugars. There is no foundation whatever for this belief. The writer has examined a great number and variety of sugars sold at retail in New York, and has never found an adulterated or unwholesome specimen. A similar idea is entertained with regard to syrup. The only foundation for this is the fact that (1) one or two establishments prepare a syrup by combining sugar-house molasses with glucose-syrup prepared from Indian corn, which is entirely harmless; and (2) some refiners have used minute quantities of a tin salt and free acid to improve the color of syrup, but the quantities employed were too small to give any cause for alarm. (3) The fact that the coffee and yellow sugars and the syrup

often produce an inky color with tea has been supposed by many to indicate adulteration. But this is due to the presence of a very small quantity of iron, which is dissolved by the sugar solutions from the tanks, blow-ups, and tubes of the factory or refinery, and is entirely unobjectionable, perhaps useful.

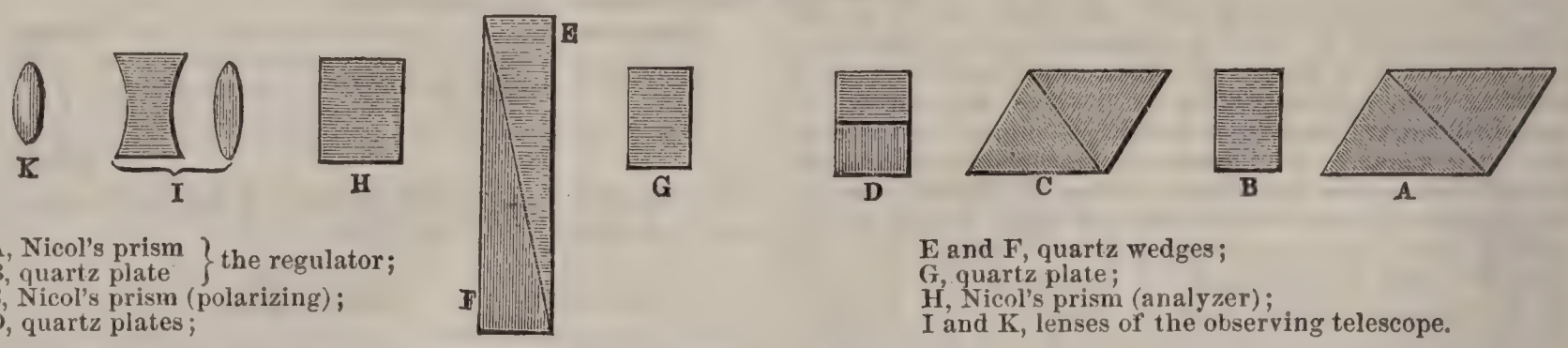
X. SACCHARIMETRY, or the determination of the composition of impure sugars, has acquired great importance in connection with the manufacture of beet-sugar and sugar refining. It involves not only the determination of the cane-sugar, but also of the glucose, salts, water, etc.

(1) *The determination of cane-sugar* is effected by a variety of methods: (*a*) If the solution contains no other substance, it may be determined by observing the density and consulting the tables which have been carefully prepared, showing the relation between density and percentage. (*b*) If other bodies are present, which is usually the case, the cane-sugar may be determined by the aid of polarized light; by dissolving out the impurities with alcohol; by determining by a standard acid the amount of lime dissolved by the solution; by converting it into glucose, and determining its reducing power on an alkaline solution of cupric oxide (Trommer's test); by fermenting the solution and measuring the carbonic acid gas set free. *The optical method* was devised by Biot, and depends upon the fact that a solution of cane-sugar rotates the plane of polarized light. (See POLARIZED LIGHT.) He constructed a simple *saccharimeter*, by which he could place a glass tube containing a solution of the sugar to be tested in the path of a beam of polarized light, and measure the amount of rotation which it suffered. By comparing the result with observations on solutions of known strength, he ascertained the percentage. The instrument was greatly improved by Soleil, who introduced a second active substance (quartz) as a compensator. This rotates the plane in an opposite direction. As the quartz is in two wedge-shaped pieces, the thickness of quartz interposed can be increased or diminished by sliding them over each other until they exactly neutralize the effect of the sugar. A scale is connected with the quartz on which the percentage of sugar corresponding to their positions can be read off at once.

FIG. 12.



Veutzke-Soleil Saccharimeter.




A, Nicol's prism } the regulator;
B, quartz plate }
C, Nicol's prism (polarizing);
D, quartz plates;
E and F, quartz wedges;
G, quartz plate;
H, Nicol's prism (analyzer);
I and K, lenses of the observing telescope.

Fig. 12 is Veutzke's improved Soleil instrument. The compensator is so connected with the scale that when the tube R is filled with water, and the wedges are drawn apart till they just cease to rotate the plane of polarized light to the left, the scale stands at zero. When the glass tube is filled with an aqueous solution containing 26.05 grammes of pure cane-sugar in 100 cubic centimètres, it is necessary to slide the quartz wedges over each other to neutralize the right-handed rotation of the sugar till the scale marks 100. To make a test, we have only to weigh out 26.05 grammes of the sugar to be examined, dissolve it to 100 c. c., fill the tube with the solution, and set the compensator at the point where it just neutralizes the action of the sugar, and read off the percentage of cane-sugar in the sample. If the solution is turbid or colored, it must be decolorized and filtered before placing it in the tube. (For details and very important considerations relating to this test see Ganot's *Physics*; *Am. Chem.*, iii. 356; *Sugar-Cane*, v. 309, 373, 490. Also on Jellett's saccharimeter see *Sugar-Cane*, ii. 71; iv. 484, 495, 550, 576; on use of bone-black in purifying the solution see *Am. Chem.*, i. 378; ii. 167; *Pharm. J.* and *Trans.* [2], i. 926. The other methods for analyzing sugars can be found as follows: Payen's, in *Am. Chem.*, i. 302; Peligot's, *Am. Chem.*, i. 345; *Chem. News*, xx. 159; Apjohn's, *Chem. News*, xxi. 86; Dupré's, *Chem. News*, xxi. 97; Scheibler's, *Am. Chem.*, iii. 330; iv. 85. General discussion of methods: Landolt, *Am. Chem.*, iv. 16; P. Casamajor, *Am. Chem.*, iv. 127, 161, 447; Violette, *Am. Chem.*, v. 296; Humphrey, *Am. Chem.*, vi. 204; Nicol, *Am. Chem.*, vi. 218.) Scheibler's process for valuing raw sugars has attracted considerable attention, and is considered by many chemists to be of the greatest value, as the pure white sugar is actually separated and weighed. The apparatus is simple; the time required for the analysis is short—about two hours; and several analyses can be carried on at the same time. Twenty grammes of the sample are placed in a tube and washed with a mixture of absolute alcohol and ether, to remove water and precipitate dissolved sugar. It is then washed successively with 96, 92, and 86 per-cent. alcohol, each saturated with pure sugar, by which all soluble substances save pure sugar are removed. The residue is then dried by a current of air, weighed, and its percentage of sugar determined by polarization. The last portions of the wash-liquors are drawn from the tube by a Bunsen pump or a Scheibler exhauster. All the air admitted to the tubes is first dried by passing over chloride of calcium.

XI. STATISTICS.—*Sugar and Molasses produced in the U. S. in 1870 (U. S. Census Report).*

| | Sugar. | | | Molasses. | | |
|---|---|---|---|---|---|---|
| | Cane. | Sorghum. | Maple. | Cane. | Sorghum. | Maple. |
| | Hhds. | Hhds. | Pounds. | Gallons. | Gallons. | Gallons. |
| Alabama | 31 | .. | ..... | 166,009 | 267,269 | 3 |
| Arkansas | 92 | .. | 1,185 | 72,008 | 147,203 | 75 |
| California | .... | .. | ..... | ..... | 333 | |
| Connecticut | .... | .. | 14,266 | ..... | 6,832 | 168 |
| Dakota | .... | .. | ..... | ..... | 1,230 | |
| Delaware | .... | .. | ..... | ..... | 65,908 | |
| Florida | 952 | .. | ... ..... | 344,339 | | |
| Georgia | 644 | .. | ..... | 553,192 | 374,027 | |
| Illinois | .... | .. | 136,873 | ..... | 1,960,473 | 10,378 |
| Indiana | .... | .. | 1,332,332 | ..... | 2,026,212 | 227,880 |
| Iowa | .... | 15 | 146,490 | ..... | 1,218,636 | 9,315 |
| Kansas | .... | .. | 938 | ..... | 449,409 | 212 |
| Kentucky | .... | .. | 269,416 | ..... | 1,740,453 | 49,093 |
| Louisiana | 80,700 | .. | ..... | 4,585,150 | 180 | |
| Maine | .... | .. | 160,805 | ..... | ..... | 28,470 |
| Maryland | .... | .. | 70,464 | ..... | 28,563 | 374 |
| Massachusetts | .... | .. | 399,800 | ..... | ..... | 2,326 |
| Michigan | .... | .. | 1,781,855 | ..... | 94,686 | 23,637 |
| Minnesota | .... | .. | 210,467 | ..... | 38,735 | 12,722 |
| Mississippi | 49 | .. | 125 | 152,164 | 67,509 | |
| Missouri | 49 | .. | 116,980 | ..... | 1,730,171 | 16,317 |
| Nebraska | .... | .. | 10 | ..... | 77,598 | |
| Nevada | .... | .. | ..... | ..... | 3,651 | |
| New Hampshire | .... | .. | 1,800,704 | ..... | ..... | 16,884 |
| New Jersey | .... | .. | 419 | ..... | 17,424 | 5 |
| New Mexico | .... | .. | ..... | ..... | 1,765 | |
| New York | .... | .. | 6,692,040 | ..... | 7,832 | 46,048 |
| North Carolina | 35 | .. | 21,257 | 33,888 | 621,855 | 418 |
| Ohio | .... | .. | 3,469,128 | ..... | 2,023,427 | 352,612 |
| Oregon | .... | .. | 11 | ..... | ..... | 30 |
| Pennsylvania | .... | 9 | 1,545,917 | ..... | 213,373 | 30,385 |
| Rhode Island | .... | .. | ..... | ..... | 20 | |
| South Carolina | 1,055 | .. | 2 | 436,882 | 183,585 | |
| Tennessee | 1,410 | .. | 134,968 | 3,629 | 1,254,701 | 4,843 |
| Texas | 2,020 | .. | ..... | 246,062 | 174,509 | 5,032 |
| Utah | .... | .. | ..... | ..... | 67,446 | |
| Vermont | .... | .. | 8,894,302 | ..... | ..... | 12,023 |
| Virginia | .... | .. | 245,093 | ..... | 329,155 | 11,400 |
| Washington | .... | .. | ..... | ..... | 612 | |
| West Virginia | .... | .. | 490,606 | ..... | 780,829 | 20,209 |
| Wisconsin | .... | .. | 507,192 | ..... | 74,478 | 31,218 |
| Totals | 87,043 | 24 | 28,443,645 | 6,593,323 | 16,050,089 | 921,057 |

*Raw Sugar and Molasses from the Cane, 1870 (U. S. Census Report).*

| | Florida. | Louisiana. | Total. |
|---|---|---|---|
| Establishments | 27 | 686 | 713 |
| Hands employed | 143 | 21,156 | 21,299 |
| Capital | $8,950 | $10,239,525 | $10,248,475 |
| Raw sugar produced (hhds.) | 407 | 76,910 | 77,317 |
| " " " (value) | $40,760 | $8,076,748 | $8,117,508 |
| Molasses (gals.) | 1,500 | 4,367,187 | 4,368,687 |
| " (value) | $750 | $2,265,110 | $2,265,800 |
| Total product, value | $41,510 | $10,341,858 | $10,383,368 |

*Sugar and Molasses (Cane) refined 1870 (U. S. Census Report).*

| | Establishments. | Hands employed. | Capital. | Wages. | Materials. | | Products. | | | Value of products. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Molasses. | Sugar. | Molasses. | Sugar. | Syrup. | |
| | | | | | Gallons. | Pounds. | Gallons. | Pounds. | Gallons. | |
| California | 3 | 255 | $1,300,000 | $166,000 | ..... | 35,000,000 | ..... | 28,176,618 | 572,711 | $3,904,045 |
| Louisiana | 3 | 141 | 365,000 | 75,000 | 630,000 | 3,971,125 | 810,000 | 1,758,900 | ..... | 643,085 |
| Maine | 3 | 185 | 775,000 | 117,000 | 3,470,000 | 13,931,260 | ..... | 19,027,376 | 847,062 | 3,142,132 |
| Maryland | 4 | 437 | 958,000 | 198,551 | 1,324,121 | 52,398,951 | ..... | 49,416,750 | 1,018,163 | 7,007,857 |
| Massachusetts | 4 | 460 | 2,200,000 | 226,848 | ..... | 62,479,008 | ..... | 50,971,600 | 1,723,945 | 7,665,485 |
| Missouri | 1 | 302 | 2,000,000 | 175,000 | 60,000 | 39,960,000 | ..... | 24,455,500 | 547,000 | 4,135,250 |
| New Jersey | 3 | 404 | 645,000 | 272,000 | 1,267,597 | 100,000,000 | ..... | 84,202,000 | 1,571,000 | 11,199,740 |
| New York | 18 | 864 | 6,375,000 | 1,229,956 | 5,416,000 | 342,957,409 | ..... | 297,749,314 | 3,591,095 | 42,837,184 |
| Pennsylvania | 15 | 1,241 | 5,619,000 | 663,408 | 11,438,333 | 161,410,674 | ..... | 186,365,593 | 8,052,863 | 26,731,016 |
| Rhode Island | 2 | 153 | 258,000 | 46,560 | 346,080 | 1,300,000 | ..... | 11,489,000 | 244,440 | 1,600,980 |
| Texas | 3 | 155 | 50,220 | 7,025 | ..... | ..... | 29,560 | 398,300 | ..... | 75,137 |
| | 59 | 4,597 | $20,545,220 | $3,177,288 | 23,952,131 | 804,408,427 | 839,560 | ..... | ..... | $108,941,911 |

*The European Sugar-Industry in 1875 (from the Sugar-Cane, July 1, 1876).*

| | | | | | |
|---|---|---|---|---|---|
| France | 552 | beet-root | factories, | 49 | refineries. |
| Austria and Hungary | 245 | " | " | 6 | " |
| Germany | 339 | " | " | 68 | " |
| Belgium | 151 | " | " | 37 | " |
| Holland | 32 | " | " | 15 | " |
| Russia | 267 | " | " | 10 | " |
| Denmark | 2 | " | " | 3 | " |
| Sweden | 4 | " | " | 7 | " |
| Italy | 3 | " | " | 2 | " |
| Spain | 20 | cane-sugar | factories, | 0 | " |
| Great Britain | 0 | " | " | 62 | " |
| Portugal | 0 | " | " | 7 | " |
| | 1615 | beet-root | factories, | 217 | refineries. |

Wagner's *Jahresbericht* for 1875 gives the number of beet-sugar factories actually in operation in Germany during the winter of 1873–74 at 337, using 3,500,000 tons (of 2240 pounds) of beets, and producing 290,000 tons (638,000,000 pounds) of raw sugar, equal to 8.21 per cent.

*Production of Beet-Sugar in Europe (Licht's Monthly Circular).*

| | |
|---|---|
| 1874–75 | 2,318,921,990 pounds. |
| 1873–74 | 2,442,365,420 " |
| 1872–73 | 2,513,272,850 " |
| 1871–72 | 1,921,215,340 " |
| 1870–71 | 2,073,695,140 " |
| 1869–70 | 1,861,577,850 " |
| 1868–69 | 1,448,091,920 " |
| 1867–68 | 1,462,753,820 " |
| 1866–67 | 1,505,317,110 " |
| 1865–66 | 1,481,490,560 " |
| 1864–65 | 1,199,102,850 " |
| 1863–64 | 971,639,130 " |
| 1862–63 | 1,074,367,030 " |
| 1861–62 | 918,600,430 " |
| 1860–61 | 851,288,680 " |

*Estimated Crop of Beet-root Sugar on the Continent of Europe for the Ensuing Season, compared with that of the Three Previous Seasons (from Licht's Monthly Circular).*

| | 1875–76. Tons. | 1874–75. Tons. | 1873–74. Tons. | 1872–73. Tons. |
|---|---|---|---|---|
| France | 475,000 | 460,000 | 396,578 | 408,649 |
| Germany (Zollverein) | 305,000 | 345,000 | 288,972 | 258,663 |
| Austro-Hungary | 170,000 | 155,000 | 169,250 | 214,107 |
| Russia and Poland | 150,000 | 150,000 | 150,000 | 150,000 |
| Belgium | 75,000 | 80,000 | 70,366 | 75,978 |
| Holland and other countries | 30,000 | 30,000 | 35,000 | 35,000 |
| Total | 1,205,000 | 1,220,000 | 1,110,166 | 1,142,397 |

*Total Production of Sugar in 1867.*

| | Kilogrammes. | Pounds. | Per cent. |
|---|---|---|---|
| Cuba (exportation) | 530,000,000 | 1,168,448,600 | 22.72 |
| Porto Rico (exportation) | 60,000,000 | 132,277,200 | 2.57 |
| Antilles, Eng., Danish Guiana | 250,000,000 | 551,155,000 | 10.72 |
| French colonies | 150,000,000 | 330,693,000 | 6.43 |
| Louisiana | 30,000,000 | 66,138,600 | 1.28 |
| Mexico | 32,000,000 | 70,547,840 | 1.37 |
| Peru (exportation) | 1,000,000 | 2,204,620 | 0.04 |
| Brazil | 130,000,000 | 286,600,600 | 5.57 |
| Sandwich Islands | 10,000,000 | 22,046,200 | 0.42 |
| Spain | 5,600,000 | 12,345,872 | 0.24 |
| Port Natal | 6,000,000 | 13,227,720 | 0.25 |
| Queensland | 500,000 | 1,102,310 | 0.02 |
| China | 14,200,000 | 31,305,604 | 0.61 |
| Penang (exportation) | 3,000,000 | 6,613,860 | 0.12 |
| Siam | 5,200,000 | 11,464,024 | 0.22 |
| Java | 130,000,000 | 286,600,600 | 5.57 |
| East Indies (exportation) | 24,000,000 | 52,909,880 | 1.03 |
| Mauritius | 100,000,000 | 220,462,000 | 4.29 |
| Manila (exportation) | 60,000,000 | 132,277,200 | 2.57 |
| Egypt (exportation) | 10,000,000 | 22,046,200 | 0.43 |
| Cane-sugar | 1,551,500,000 | 3,420,467,930 | 66.47 |
| Beet-sugar, Europe | 650,000,000 | 1,433,003,000 | 27.87 |
| Palm- or date-sugar | 100,000,000 | 220,462,000 | 4.29 |
| Maple-sugar, North America | 30,000,000 | 66,138,600 | 1.28 |
| Total sugar | 2,331,500,000 | 5,140,071,530 | 100.00 |
| Sorghum-syrup, gallons | 18,000,000 | | |

M. B. Dureau, editor of the *Journal des Fabricants de Sucre*, gives the preceding table in his *État de l'Industrie du Sucre*, one of the jury reports of the Exposition Universelle of 1867.

*The Average Sugar-Crop of the World, 1869–73 (the Sugar-Cane).*

| | | |
|---|---|---|
| Cuba | 701,431 | tons. |
| Java | 175,623 | " |
| Brazil | 136,000 | " |
| Mauritius | 118,126 | " |
| Porto Rico | 95,532 | " |
| Manila | 81,816 | " |
| British Guiana | 63,922 | " |
| Louisiana | 61,863 | " |
| Trinidad | 51,199 | " |
| Jamaica, Barbadoes, Martinique, Guadeloupe, Réunion, Peru, Mexico, Egypt, etc. | 178,189 | " |
| Total from the cane | 1,663,701 | tons. |
| Europe, beet-sugar | 946,000 | " |
| Total | 2,609,701 | tons. |

*Consumption of Sugar in the World (Journal des Fabricants de Sucre, 1875).*

| | Consumption. Pounds. | Pounds per head. |
|---|---|---|
| England | 1,826,000,000 | 50.6 |
| United States | 1,694,000,000 | 44.0 |
| Holland | 88,000,000 | 24.2 |
| Belgium | 110,000,000 | 22.0 |
| Germany | 673,000,000 | 16.5 |
| Sweden | 121,000,000 | 15.6 |
| France | 550,000,000 | 15.4 |
| Austria and Hungary | 374,000,000 | 10.5 |
| Argentine Republic | 66,000,000 | 9.8 |
| Switzerland | 24,200,000 | 9.0 |
| Portugal | 33,000,000 | 6.0 |
| Italy | 220,000,000 | 5.9 |
| Spain | 110,000,000 | 6.6 |
| Russia | 330,000,000 | 6.0 |
| Turkey | 55,000,000 | 3.3 |

*Imports of Foreign Sugar into the U. S. (in tons).*

| | 1862. | 1865. | 1868. | 1871. |
|---|---|---|---|---|
| At New York | 166,920 | 229,591 | 259,073 | 313,609 |
| Boston | 28,366 | 39,298 | 62,237 | 81,679 |
| Philadelphia | 29,741 | 40,210 | 66,121 | 55,918 |
| Baltimore | 16,658 | 27,655 | 53,458 | 84,675 |
| New Orleans | ..... | 14,469 | 19,706 | 13,331 |
| Other ports | 5,330 | 11,020 | 10,380 | 13,885 |
| Total imports | 247,015 | 362,243 | 470,975 | 563,097 |

*Refined Sugar exported from U. S. in 1875 (in pounds).*

| | Great Britain. | Canada. | Other countries. | Total. |
|---|---|---|---|---|
| March | ..... | 299,668 | 863,081 | 1,163,749 |
| April | 515,714 | 1,467,204 | 1,155,604 | 3,168,592 |
| May | 3,331,001 | 792,742 | 2,845,631 | 6,969,374 |
| June | 5,803,730 | 455,684 | 885,025 | 7,144,439 |
| July | 1,486,065 | 351,898 | 1,949,268 | 3,788,921 |
| August | 1,586,225 | 210,998 | 2,795,063 | 4,592,276 |
| September | 1,327,376 | 381,914 | 4,012,836 | 5,722,126 |
| October | 3,167,646 | 229,143 | 858,517 | 4,255,306 |
| November | 2,977,768 | 1,116,861 | 1,886,702 | 5,981,331 |
| December | 3,409,268 | 568,055 | 1,734,111 | 5,711,434 |

*The Glucose Industry of Germany (Deutsche Industrie Zeitung, 1875, No. 31).*

| | 1873. | 1874. |
|---|---|---|
| Number of factories | 51 | 47 |
| Glucose, solid | 24,733,280 pounds. | 24,733,280 pounds. |
| Glucose-syrup | 32,522,380 " | 32,632,600 " |
| Coloring, for liquors, etc. | 3,189,450 " | 2,873,200 " |

XII. LITERATURE.—*The Sugar-Cane* (Manchester, Eng.); *Journal des Fabricants de Sucre* (Paris); *La Sucrerie indigène* (Compiègne, Oise, France); *La Sucrerie Belge; Zeit-*

*schrift für Zuckerindustrie* (Prag); *Berichte des Vereins Ostböhmischen Zuckerfabrikanten* (Prag); *Zeitschrift des Vereins für die Rübenzucker Industrie in Zollverein* (Berlin); *Jahresberichte der Zuckerfabrikation* (Braunschweig); Wagner's *Jahresberichte der Technischen Chemie;* Bache and McCulloh, *Report of Investigation in Relation to Sugar and Hydrometers* (Senate Doc., Washington, 1848); Scoffern, *The Manufacture of Sugar* (London, 1849); H. Bessemer, *New System of Manufacturing Sugar* (London, 1852); Schmidt, *Handbuch der Zuckerfabrikation* (4te Auf., Weimar, 1858); Basset, *Guide pratique du Fabricant de Sucre* (Paris, 1861–65); R. Nicoll, *Essay on Sugar-Refining and Sugar* (Greenock, 1863); Reed, *The History of Sugar and Sugar-Yielding Plants* (London, 1866); Otto, *Essig, Zucker und Stärke Fabrikation* (4te Bd., 2te Gruppe, Bolley's *Chem. Tech.*, Braunschweig, 1867); Zoega, *Nouveau Manuel complet du Fabricant et du Raffineur de Sucre* (Manuel Roret, Paris, 1868); Siemens and Grothe, *Die Zuckerfabrikation* (from Muspratt-Kerl's *Tech. Chem.*, Braunschweig, 1871); Wagner, *Chemical Technology* (New York, 1872); Stohmann and Engler, *Handbuch der Tech. Chem.* (Payen's), (Stuttgart, 1874); Stammer, *Lehrbuch der Zuckerfabrikation* (Braunschweig, 1874); Ure's *Dictionary;* Muspratt's *Chemistry;* Payen's *Chimie industrielle;* Porter, *The Sugar-Cane* (2d ed., London, 1843); Evans, *The Sugar-Planter's Manual* (London, 1847); Wray, *The Practical Sugar-Planter* (London, 1848); Fleischmann, *Report on Sugar* (*U. S. Pat. Office Report*, 1848); Goessmann, *Notes on the Manufacture of Sugar in Cuba* (Syracuse, 1865); Dubrunfaut, *Art de Fabriquer le Sucre de Betteraves* (Paris, 1825); Schulz, *Die Fabrikation des Zuckers aus Rüben* (Berlin, 1862–65); Grant, *Beet-root Sugar* (Boston, 1867); Walkhoff, *Der Praktische Rübenzuckerfabrikant und Raffinadeur* (4te Auf., Braunschweig, 1872); *Rapports du Jury International Exposition univ. de 1867* (t. viii. p. 295, Paris, 1868); D'Aligny, *The Manufacture of Beet-root Sugar* (*Reports of the U. S. Commissioners to the Paris Univ. Exposition* (vol. v., Washington, 1870); Crookes, *On the Manufacture of Beet-root Sugar* (London, 1870); Stansbury, *The Chinese Sugar-Cane* (New York, 1857); Stewart, *Sorghum and its Products* (Philadelphia, 1867); Mandelblüh, *Leitfaden zur Untersuchung der versch. Zuckerarten* (Brünn, 1867); Violette, *Dosage du Sucre* (Paris, 1868); Cammerson, *Guide pour l'Analyse des Matières sucrées* (Paris, 1868); Wild, *Anleitung zum Gebranch des Wild'schen Polaristrobometer* (Berne, 1868); Monier, *Guide pour l'Essai et l'Analyse des Sucres* (Paris); L'Abbé Moigno, *Saccharimétrie optique, chimique et mélassimétrique* (Paris, 1869); Terril, *Notions pratiques sur l'Analyse chimique des Substances saccharifères* (Paris, 1875); *American Chemist*, numerous articles (vols. i. to vi., New York, 1870, to date). C. F. CHANDLER.

**Sugar-berry.** See HACKBERRY.

**Sugar-Cane and Culture.** See SUGAR.

**Sugar Creek,** p.-v. and tp., Benton co., Ark. P. 1988.

**Sugar Creek,** tp., Scott co., Ark. P. 476.

**Sugar Creek,** tp., Boone co., Ind. P. 3138.

**Sugar Creek,** tp., Clinton co., Ind. P. 964.

**Sugar Creek,** p.-v. and tp., Hancock co., Ind. P. 1897.

**Sugar Creek,** tp., Montgomery co., Ind. P. 1176.

**Sugar Creek,** tp., Parke co., Ind. P. 878.

**Sugar Creek,** tp., Shelby co., Ind. P. 1028.

**Sugar Creek,** tp., Vigo co., Ind. P. 2054.

**Sugar Creek,** tp., Cedar co., Ia. P. 739.

**Sugar Creek,** tp., Poweshiek co., Ia. P. 910.

**Sugar Creek,** tp., Miami co., Kan. P. 444.

**Sugar Creek,** tp., Barry co., Mo. P. 2112.

**Sugar Creek,** tp., Cass co., Mo. P. 1559.

**Sugar Creek,** tp., Harrison co., Mo. P. 1133.

**Sugar Creek,** tp., Randolph co., Mo. P. 2896.

**Sugar Creek,** tp., Allen co., O. P. 1016.

**Sugar Creek,** tp., Greene co., O. P. 1482.

**Sugar Creek,** tp., Putnam co., O. P. 1037.

**Sugar Creek,** tp., Stark co., O. P. 1779.

**Sugar Creek,** tp., Tuscarawas co., O. P. 1482.

**Sugar Creek,** tp., Wayne co., O. P. 2006.

**Sugar Creek,** tp., Armstrong co., Pa. P. 1023.

**Sugar Creek,** p.-v. and tp., Venango co., Pa. P. 1656.

**Sugar Creek,** tp., Walworth co., Wis. P. 992.

**Sugar Fork,** tp., Macon co., N. C. P. 356.

**Sugar Grove,** p.-v. and tp., Kane co., Ill. P. 787.

**Sugar Grove,** tp., Dallas co., Ia. P. 506.

**Sugar Grove,** p.-v., Fairfield co., O. P. 254.

**Sugar Grove,** tp., Mercer co., Pa. P. 511.

**Sugar Grove,** p.-v., Warren co., Pa., 37 miles S. of Dunkirk, N. Y., has 7 churches, good schools, 1 newspaper, 2 medicine-factories, 1 hotel, 5 saw, 3 shingle, 2 stave, and 2 planing mills. Principal business, farming and dairying. P. 1729. JACOB HORTON, ED. "HOME JOURNAL."

**Sugar Grove,** p.-v. and tp., Pendleton co., West Va. P. 984.

**Sugar Hill,** p.-v. and tp., McDowell co., N. C. P. 547.

**Sugar Island,** tp., Chippewa co., Mich. P. 238.

**Sugar Loaf,** tp., Boone co., Ark. P. 827.

**Sugar Loaf,** tp., Marion co., Ark. P. 130.

**Sugar Loaf,** p.-v. and tp., Sebastian co., Ark. P. 2059.

**Sugar Loaf,** tp., Van Buren co., Ark. P. 259.

**Sugar Loaf,** tp., Alexander co., N. C. P. 707.

**Sugar Loaf,** tp., Columbia co., Pa. P. 759.

**Sugar Loaf,** tp., Luzerne co., Pa. P. 1240.

**Sugar-Molasses.** See SUGAR.

**Sugar, Mountain-Ash.** See SORBITE.

**Sugar Notch,** p.-b. and tp., Luzerne co., Pa. P. 724.

**Sugar of Lead.** See LEAD, by H. WURTZ, A. M.

**Sugar of Milk.** See MILK, by PROF. C. F. CHANDLER.

**Sugar Ridge,** tp., Clay co., Ind. P. 1140.

**Su'gartree Bottom,** tp., Carroll co., Mo. P. 2186.

**Sugar Tree Ridge,** p.-v., Concord tp., Highland co., O. P. 88.

**Suggestion.** See ASSOCIATION OF IDEAS.

**Suggs'ville,** p.-v and tp., Clarke co., Ala. P. 935.

**Suhl,** town of Prussia, province of Saxony, on the Hasel, is famous for its manufactures of steel and iron goods, and has very rich iron-mines in its vicinity. P. 8987.

**Suhm** (PETER FREDERIK), b. at Copenhagen Oct. 18, 1728; studied law and philology at the university of his native city; settled in 1751 in Trondhjem in Norway, where he lived till 1765, devoting himself to the study of Danish and Norwegian history and antiquities; returned in the latter year to Copenhagen, and d. there Sept. 7, 1798. His many writings relating to the history of Denmark—*Forsög til Forhedringer i den gamle danske og norske Historie* (1757), *Om de nordiske Folks ældste Oprindelse* (1770), *Om Odin* (1771), *Critisk Historie af Danmark i den hedenske Tid* (4 vols., 1774–81), *Danmarks Historie* (14 vols., 1782–1828)—exercised a great influence on the Danish civilization, and he spent a large part of his fortune in order to encourage studies and literature. His magnificent library, containing 100,000 vols., he bequeathed to the Royal Library. Of *Scriptores Rerum Danicarum Medii Ævi* he edited vols. iv.–vii. (1776–92).

**Su'icide** [Lat. *sui*, "one's self," and *cædere*, to "kill"] is the deliberate intentional act of self-destruction by a person of sound mind and having attained to years of discretion. The taking of one's own life as the result of an insane delusion or impulse is not suicide in a legal sense, although the term is sometimes popularly applied to the act when done under such circumstances. At the common law, suicide was a felony. If any one counselled or advised the deceased to commit the crime of self-destruction, and was present at its consummation, he was held guilty as a principal of murder. The deceased himself was punished by the forfeiture of all his goods and chattels real, and various other kinds of property, and by denying to his body a Christian burial—that is, a burial in consecrated ground with the appointed rites of the Church. To stamp the offence with peculiar abhorrence, the body was buried in the night-time and at the crossing of two highways. These severities, or rather brutalities, of the old law were, however, generally avoided by the verdicts of the coroners' juries, which almost invariably found that the deceased was insane. The criminal law of the U. S. does not inflict any forfeiture or penalty upon the one who takes his own life, but a person who aided and abetted the act would be guilty of murder in some one of its degrees, or of manslaughter. Suicide may also produce some direct effects upon civil rights. By the ancient common law a will of personal property was made void by the testator's act of self-destruction. A different and more reasonable doctrine has been established by the modern decisions. The testator's suicide immediately subsequent to the making of his will does not necessarily show that he was insane at the time of its execution; in other words, the insanity which will avoid the will must be established by other evidence than the mere fact of his having taken his own life. How far life-insurance policies are affected by a suicide of the person insured is a question which has given rise to much forensic discussion and conflict of judicial opinion. All policies now contain provisions, varying somewhat in form, that if the person whose life is insured shall commit suicide,

or shall take his own life, or shall die by his own hand, the contract shall thereby become void. If such person should intentionally destroy himself while in the full possession of his mental faculties, the policy would of course be avoided. The difficulty arises when the act is the result of insanity. Two widely-different conclusions have been reached by the courts. It has been held by some of them that, although the person might be so insane that he was unable to appreciate the moral quality of his act, and although he might be laboring under an irresistible insane impulse, still, if he was able to form an intention to take his own life, and possessed sufficient reason to know that in carrying out this intention the physical acts done by him would result in his own death, then his act of self-destruction would come within the terms of the contract and would render it void. Other courts have applied the test which determines the degree of criminal responsibility in cases of insanity, and have held that if the person was incapable of distinguishing between right and wrong in relation to his act, however much he might have intended to produce his own death, the self-destruction would not be *his* within the meaning of the policy, and the contract would remain binding upon the insurers. The former rule is supported by the decisions in England, in Massachusetts, and New York, while the Supreme Court of the U. S. and the courts of many States maintain and enforce the latter doctrine.

JOHN NORTON POMEROY.

**Suicide.** Among the ancients suicide was considered neither a crime nor dishonorable, Demosthenes, Themistocles, Mark Antony, Cleopatra, Hannibal, and many others having chosen this way of ending their days. The Scriptures and the Apocrypha furnish many examples; as, Samson, Eleazar, and Judas Iscariot. In modern times history furnishes numerous striking suicides. The famous suicides among the ancients followed various motives, the vindication of honor being a common object. Mithridates and Hannibal died in this way, rather than be taken prisoners. Others have committed suicide through false pride or timidity: a striking case in point was the death of Cato; determined not to live under the despotism of Cæsar, he stabbed himself, but having fainted, his wound was dressed. When he recovered he tore off the bandages, let out his entrails, and expired.

Many writers have defended this crime, the most able of whom were Madame de Staël, Gibbon, and Hume. Suicide is never committed except when the functions of the brain are impaired, and the action of the mind perverted and directed in improper channels. It stands hand in hand with murder, and in many cases the two crimes are committed at the same time. In many instances the crime has been greatly palliated, and almost seemed justifiable, so carefully and sensibly (?) did the suicide complete his task, and so logically did he state his reasons.

Suicide has sometimes been epidemic in character. A remarkable epidemic prevailed in Versailles in the year 1793. The number of suicides in that year reached 1300, a number greatly disproportionate to the population. Instances have been cited where children have followed the example of one of their number and have taken their own lives. An epidemic of this character took place in the army of the First Napoleon, and it was only after a strong appeal made by the emperor to the pride and courage of the men in the ranks that it was finally stopped. One of these outbreaks followed the suicide of a convict, who hanged himself to the cross-bar of his cell. Five others hanged themselves on the same bar within two weeks. The public prints probably have much to do with the increase of suicide. A morbid person who reads the account of such a case will very often have a train of thought started that will crop out in the commission of the act. Favorable opportunities for the accomplishment of self-murder will also produce a sudden irresistible impulse. People who have gone up into towers and monuments, or above precipices, have often refrained with difficulty from casting themselves down. The writer has known a case where the sight of razors and other sharp-cutting instruments excited a suicidal desire. The manner of execution of the suicide's purpose is worthy of study. If marked insanity is at the bottom of it, we find a romantic state of affairs. An interesting case was that of the young woman who a few years ago, in an attack of religious melancholia, while imagining that she was fated to sacrifice herself in a truly classical manner, built a funeral pyre, upon which she laid herself after setting fire to some brushwood beneath. Instances are mentioned in the books where several different plans have been adopted effectually to destroy life. In one of these the victim first took poison, then suspended himself, and finally blew out his brains. It is a curious fact that many suicides repent of the act when it is too late. An illustration of this occurred in the case of Romilly, who cut his throat during an attack of cerebral congestion. The loss of blood relieved the congestion of the brain, and the normal self-restraint, before lost, now asserted itself when the deed was committed. The medico-legal points in certain cases are of great interest. It is often difficult to tell whether the body found is that of a suicide or of some person murdered and afterward arranged by the assassin to give the impression that he had taken his own life. The non-existence of evidence of asphyxia, should the patient be found suspended, will clearly point to homicide. The direction and character of the wound or bullet-hole will sometimes clear up the question whether death has occurred by self-inflicted cutting or shooting. People who have drowned themselves have been known to tie their hands to prevent an involuntary act of swimming and thus to save life.

The literature of suicide is extremely interesting. The French, noted for this proclivity, choose the most romantic and dramatic methods of self-destruction. A case is related of two young lovers whose match had been opposed by their parents. They went out into a lonely copse, drew two daggers, the handles of which were tied to the ends of a long band of blue ribbon, and at a signal plunged the bright blades into each other's breasts. A case related by the late Forbes Winslow is striking on account of its originality. A shoemaker named Lovat, when suffering from an attack of religious insanity, determined to crucify himself. Procuring a large cross, which he balanced in a large window of his house, facing a public square, he proceeded with the horrible details of his work. He made a large net, which he fastened beneath the cross. Lying at full length, he placed a crown of thorns on his head, and next, striking his hand against the floor, managed to drive a large nail through the palm into the cross. He then placed his feet on the bracket prepared at the foot of the cross. A nail was driven through them with the free hand, and he next wounded himself in the side with a knife. He was unable to nail the other hand. Next edging himself to the window, he overcame the balance of the cross, which slid out of the window, and remained suspended in view of the street. The ropes above held it in place, and the net below prevented him from slipping. He was rescued by people who saw him, and ultimately recovered. The proportion of suicides in this country is increasing very rapidly, and this depends to a great extent upon the cosmopolitan character of the population. The greatest number of suicides are committed by the Germans, who either from loneliness and homesickness or other reasons find life distasteful. The form of death they choose is usually poisoning, and Paris green is the favorite with them. Druggists and photographers use the chemicals they are most familiar with, and cyanide of potassium in the hands of the latter is a common form of poisoning. Hanging and shooting are also often resorted to, but find more favor with other nationalities than with the Germans. The common time of life for this crime is the period between the twentieth and the fortieth year, although cases have been known to occur among young children and at the age of seventy. Suicide is more common in the country, and in this respect it resembles insanity. We do not hear of all the cases that occur in the country, while those in the cities are registered.

As causes of suicide, depression, failure, delusion, unrequited love, drunkenness, and disease may be enumerated. The insane neurosis predisposes to it, and probably there is a nervous history in most of the cases. The time of year in which the greatest number of suicides occurs is the spring abroad, while in this country the summer months are those chosen. Foggy or dark weather does not increase the statistics, although Montesquieu insisted that the English were a suicidal race on account of their fogs. Statistics prove this to be a mistake.

ALLAN MCL. HAMILTON.

**Suidæ.** This family is described under SUS.

**Su'idas** [Σουΐδας], a Greek lexicographer of whose life nothing is known; even the age in which he lived is uncertain, though it may be fixed not later than the twelfth century. His book contains explanations and notices of Greek words and names, illustrated by extracts from older Greek writers. It has evidently gone through many hands before it reached the form in which we now possess it, and it is generally of very little critical value; but as many of the works from which it quotes passages are lost, it has great historical interest. Editions by Gaisford (Oxford, 1834), Bernhardy (Halle, 1834), and Bekker (Berlin, 1854).

**Suisun',** p.-v. and tp., cap. of Solano co., Cal., on California and Oregon R. R., 40 miles S. W. of Sacramento, on an arm of Suisun Bay, has an excellent harbor, 3 churches, good schools, 1 bank, 1 newspaper, and 3 hotels. The surrounding country comprises one of the richest agricultural districts of California. Large shipments are made to San Francisco by the bay. P. of v. 462; of tp. 1842.

C. F. MONTGOMERY, ED. "SOLANO REPUBLICAN."

**Sul'idæ** [*Sula*, the Latin name of the gannet, the generic type], a family of swimming birds of the minor group or super-family Steganopodes or Dysporomorphæ, limited to the gannets. The form is not essentially different from that of its allies, the pelicans and cormorants; the neck is moderately elongated; the bill about as long as the head, straight, but with the tip decurved, with the lateral grooves well defined, composite as in the other members of the group, and with the edges serrate; nostrils linear and in the lateral grooves; no gular pouch developed; wings moderately long and pointed; tail long and cuneate, and with twelve to fourteen feathers; legs inserted normally backward, and with the tarsi moderately short; toes (four, as in all Steganopodes) well developed, and connected by a full membrane. The skull is of the desmognathous type, and exhibits modifications co-ordinate with the external characteristics. The species are almost exclusively marine, and one or other is found on the sea-coast of every country. Nine species are recognized by G. R. Gray, but several are imperfectly known. (See also GANNET.) THEO. GILL.

**Suliman' Mountains,** forming the boundary between India and Iran, range from N. to S., and reach their greatest height, 11,300 feet, in Takht-i-Suliman, in lat. 31° 25′ N. They connect S. with the Kurlekhi Mountains of Kelat, and N. with the Safed Koh, which is 15,622 feet high and ranges from E. to W. The descent toward India is steep, but gentle toward the Afghan plateaus; the valleys drain eastward to the Indus. The most convenient ascent to Kandahar is effected along the Gomal from Dera Ismael Khan on the Indus. Climate and products are Indian; conifers occur on the northern slope. The inhabitants are Afghans, divided into many tribes and jealous of their independence; no Europeans have ever entered their villages. E. SCHLAGINTWEIT.

**Suli'na,** the name of one of the delta-branches of the river Danube. The Danube divides at about 50 miles from the coast into the Kilia and Toultcha branches, of which the former conveys two-thirds (about) of the entire discharge. The latter and more southern branch again divides into the St. George and Sulina arms, the latter running eastward nearly. The St. George conveys nearly one-third, leaving to the Sulina but two twenty-sevenths. The mouth of the Kilia and St. George are about 40 miles separated, the Sulina mouth nearly midway between them, the trend of the coast-line being N. and S. The ratio of the discharge of this arm to the total discharge of the Danube is about the same as that of the S. Pass of the Mississippi to *its* total discharge. (For an account of the improvement of the Sulina mouth, by which it has been made the main entrance to the Danube, see HARBOR.) J. G. BARNARD.

**Su'liotes** [from *Suli*, one of their former villages in the Cassopeian Mountains], a Greco-Albanian people whose ancestors in the seventeenth century fled from Turkish oppression to the almost inaccessible mountains of the Epirus, where they maintained for more than 100 years a democratic government. In consequence of their hostility to the Turkish government, Ali Pasha made several attempts to exterminate them, and in 1803 a large proportion were put to the sword, some 4000 retiring to Parga, whence they were finally driven to the Ionian Islands. Recalled in 1820 by Ali Pasha, they took a prominent part under Marco Bozzaris in the war of Greek independence; but Suli, their chief village, in 1822 was taken by the Turks, and when the boundary-line between Greece and Turkey was established the Suliote Mountains remained a part of Turkey. Most of the Suliotes, however, became citizens of Greece.

**Sul'la** (a word of doubtful etymology), the surname of a patrician family in ancient Rome, belonging to the Cornelia gens. The family was poor, and the only member of it who attained historical importance, LUCIUS CORNELIUS SULLA FELIX, the dictator, b. 138 B. C., grew up in rather pinched circumstances. He contrived, nevertheless, to acquire a brilliant education and to lead a very gay life. While still a youth he was well known in Roman circles as a man thoroughly initiated in all the arts and refinements, in all the vices and profligacies, of Greek civilization. A courtesan, Nicopolis, left him her fortune, and thereby enabled him to aspire to the honors of the state. In 107 he was elected quæstor, and sent at the head of a squadron of cavalry to the camp of the consul, Caius Marius, commanding in Africa in the war against Jugurtha. The rough and boorish leader of the radical party despised his new quæstor, whom a sensuous and lazy temperament, a fastidious and voluptuous taste, seemed to make entirely unfit for war. But Sulla turned out to be an excellent general of cavalry, active, audacious, equal to any emergency, a born commander, the idol of his soldiers; and when Marius sent him to negotiate with King Bocchus for the surrender of Jugurtha, he proved to be a master in diplomacy. He made such an impression on the mind of Bocchus that this man became his friend for life, and he returned to the Roman camp with Jugurtha in chains. From this moment the spite of Marius turned into jealousy, and as time went on the jealousy grew into a deadly hatred. In the war against the Cimbri and Teutones (104–101), Sulla commanded with distinction, first under Marius, then under Lutatius Catulus, and in 92 he was sent as proprætor to Cilicia, where he defeated Gordius, the general of Mithridates, reinstated Ariobarzanes as king of Cappadocia, and received an embassy from Arsaces, king of Parthia. There was in all he did something which caught the imagination of the people—Jugurtha, the most obstinate enemy of the republic, in chains, the embassy from Parthia, a name never heard before in Rome, etc.—and Marius felt that as the leader of the patrician or aristocratic party, which he now had become, Sulla was a most formidable rival. In the Social war both commanded with success, but it was Sulla who defeated Papius Mutilus, the chief of the Samnites, and took Bovianum, their capital. His star was rising, that of Marius setting. For the year 88 he was elected consul almost unanimously, and, to the deep mortification of Marius, appointed commander in the Mithridatic war. Marius had no political talents; he needed war in order to sustain his position, and he had in many ways instigated this war, sure to be chosen general. By various means, exceedingly violent, though in form legal, Marius succeeded in subverting the appointment of Sulla and getting himself appointed, but during the riot which took place in Rome, Sulla escaped, fled to Nola in Campania, where his army was stationed; and now he did what no Roman had ever done before, what no Roman suspected that a citizen would ever venture to do: he marched against Rome. His officers left him, but the rank and file followed him. Marius fled to Africa; all the leaders of the popular party dispersed; the city was terrorstruck, and Sulla was perfect master of the situation. At the bottom of his character lay a peculiar indifference—neither stoical nor cynical, neither to be admired nor to be abhorred—which enabled him always to do that which he considered necessary, whether it was to keep quiet and bide his time or to leap to the point and deal an atrocious blow. He showed this peculiar disposition by marching against Rome, to a Roman citizen the holiest which existed; and he showed it again by leaving the city almost immediately after the victory. He knew that without the army he was nothing, and he knew that the soldiers thirsted feverishly after the war in Greece and Asia, the old countries, where the work of millions of hands through thousands of years was treasured up, and plunder was plenty. He consequently took such precautions as he could, and then proceeded with the army to Greece. He stayed away four years (87–83). Shortly after his departure he was declared a public enemy; his property was confiscated; his friends were persecuted or slain. Marius returned, and the Marian party domineered in Rome and Italy. But of all this Sulla took no notice; he simply prosecuted the war. It had originated from the avaricious schemes of the legates in the Roman province of Asia. Provoked in many ways, Mithridates at last sent an army into the province which easily overran the whole country, and so hated were the Romans by the Greeks in the Asiatic cities that Mithridates' order, that on a certain day all Romans and Italians in Asia should be massacred, was literally carried out by the inhabitants. Mithridates, who liked to appear as the leader and protector of the Greek nation, induced several cities of Greece to join him, and sent two powerful armies into that country. But Sulla took Athens by storm Mar. 1, 86, and gave it up to plunder. Shortly after, he routed one of the hostile armies at Chæronea; next year he totally destroyed another at Orchomenus, and having expelled Mithridates' troops from Greece and pacified the country, he crossed the Hellespont in 84. Pressed at the same time by another Roman army sent out by the Marian party under Flaccus and Fimbria, ill supported by his Greek subjects in Asia, who found him as unamiable as the Romans, and nearly exhausted by his enormous losses in Greece, Mithridates now sued for peace, and after a personal interview between him and Sulla a treaty was concluded, according to which he returned all his conquests in Asia, surrendered a fleet of 70 large vessels, and paid 2000 talents. Sulla now turned against Fimbria, whose soldiers deserted him, and who committed suicide; he then regulated the affairs of the province of Asia, from whose cities he made enormous conscriptions, and finally set sail for Italy, where he landed at Brundusium in the spring of 83. His soldiers were now rich, and they knew that the final success of their general was a condition of the enjoyment of their riches; they clung firmly to him, and he acted cautiously. Marius was dead, but his son was consul and his party in power, strengthened by an alliance with the discontented Italian nations. The final battle was at the Colline gates, where Sulla's veterans struggled desperately

with the Samnites under Marian leaders: 50,000 are said to have fallen on each side, and those of the Samnites who outlived the battle were driven the next day to the Campus Martius and massacred. Sulla was made dictator for life; that is, absolute power over the life and property of all Roman citizens was given him. It was not his purpose, however, to establish a monarchical constitution in Rome. The legislation which he enacted as dictator, the so-called *Leges Corneliæ*, aimed simply at the restoration of the old aristocratic constitution, the extension of the authority of the senate, the restriction of the power of the tribunes, etc. In order to establish this constitution firmly and safely, he first determined to extirpate its adversaries, the Marian party. Thousands of men fell under his *proscriptio;* that is, they were outlawed and slain, and their property was confiscated and given to somebody else. He then attempted to form a steady support for it by settling his veterans in military colonies on such Italian soil as had been confiscated in the Social war or afterward, and by organizing a body-guard stationed at Rome. When he considered his work finished, he assembled the people, abdicated the dictatorship, retired to his villa at Puteoli, and returned to the lazy, voluptuous habits of his youth. He was writing his memoirs, which have perished, when in 78 the bursting of a blood-vessel caused his death. CLEMENS PETERSEN.

**Sul'livan,** county of S. W. Indiana, separated from Illinois by Wabash River, and traversed by Evansville and Crawfordsville R. R., which passes through the capital. The surface is generally level, the soil fertile and well wooded. There are large numbers of cattle, horses, sheep, and swine. Staples, Indian corn, wheat, oats, maple-sugar, sorghum-molasses, wool, lumber, and dairy products. Cap. Sullivan. Area, 430 sq. m. P. 18,453.

**Sullivan,** county of N. Missouri, watered by tributaries of Grand River. The soil is fertile, about one-third being wooded, the remainder prairie; bituminous coal is found. There are numerous cattle and horses, and very many sheep and swine. Staples, Indian corn, wheat, oats, rye, hay, tobacco, wool, lumber, and dairy products. Cap. Milan. Area, 648 sq. m. P. 11,907.

**Sullivan,** county of W. New Hampshire, drained by affluents of Connecticut River, and traversed by several railroads. The valley of the Connecticut is level and fertile, the other parts hilly and rugged, but well adapted to grazing and sheep-raising, cattle and sheep being very numerous. There are manufactures of cotton and woollen goods, wooden ware, paper, machinery, leather, and lumber. Staples, Indian corn, oats, potatoes, hay, butter and cheese, wool, and maple-sugar. Cap. Newport. Area, 820 sq. m. P. 18,508.

**Sullivan,** county of W. New York, separated from Pennsylvania by Delaware River, watered by numerous streams, and traversed by Delaware and Hudson Canal and by several railroads. It is crossed N. E. and S. W. by several elevated ridges, with fertile valleys between. There are many manufactories of leather, carriages, and sawed lumber. Cap. Monticello. Area, 880 sq. m. P. 34,550.

**Sullivan,** county of N. E. Pennsylvania, watered by tributaries of Susquehanna River. The surface is hilly, but adapted to grazing. Staples, Indian corn, oats, potatoes, buckwheat, wool, hay, and butter. Cap. Laporte. Area, 450 sq. m. P. 6191.

**Sullivan,** county of N. E. Tennessee, bordering on Virginia, intersected by Holston River and traversed by East Tennessee Virginia and Georgia R. R. The surface is extremely hilly, but well timbered and fertile. Coal and iron are found. Cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, some tobacco, sorghum-molasses, butter, and wool. Cap. Blountsville. Area, about 300 sq. m. P. 13,136.

**Sullivan,** tp., Livingston co., Ill. P. 921.

**Sullivan,** p.-v. and tp., cap. of Moultrie co., Ill., on Chicago and Paducah and Terre Haute Paris and Decatur R. Rs., has 3 churches, a fine public-school building, 1 newspaper, an opera-house, a woollen and soap factory, 2 banks, and a machine-shop. P. of v. 742; of tp. 2658.

SMYSER & MIZE, EDS. "PROGRESS."

**Sullivan,** p.-v., cap. of Sullivan co., Ind., on Evansville and Crawfordsville R. R., 26 miles S. of Terre Haute, has excellent schools, 1 bank, 3 weekly newspapers, and 3 boot and shoe manufactories. Rich deposits of coal exist here. P. 1396.

JAMES A. HAYS, ED. "SULLIVAN CO. UNION."

**Sullivan,** p.-v. and tp., Hancock co., Me. P. 796.

**Sullivan,** p.-v. and tp., Cheshire co., N. H. P. 347.

**Sullivan,** tp., Madison co., N. Y. P. 4921.

**Sullivan,** p.-v. and tp., Ashland co., O. P. 825.

**Sullivan,** p.-v. and tp., Tioga co., Pa. P. 1637.

**Sullivan,** tp., Laurens co., S. C. P. 2132.

**Sullivan,** p.-v. and tp., Jefferson co., Wis. P. 1556.

**Sullivan** (ALEXANDER MARTIN), b. at Bantry, Ireland, in 1830; commenced studying for an artist, but became connected with journalism, and in 1855 with the Dublin *Nation*, of which he is now editor and proprietor. In 1868 he was indicted for sedition in consequence of articles referring to the Manchester executions, and sentenced to four months' imprisonment. During this period he was nominated for lord mayor of Dublin, but declined the honor. Upon his release a committee was formed to present him with a national testimonial, but he declined to accept anything of pecuniary value, and a sum of £300 which had been collected was, by his desire, appropriated toward a statue of Henry Grattan, to be erected in Dublin. He was returned to Parliament in 1874 in the Home-Rule interest, a movement with which he has been especially identified. He has published several works, among which is a pamphlet descriptive of a tour in America made in 1857.

**Sullivan** (ARTHUR S.), b. in London in 1844, the son of a teacher of music; was early trained in the art, singing when a mere child in the chapel-royal; at the age of fourteen gained the Mendelssohn scholarship, which enabled him to pursue his studies under the best masters at home and abroad. For *The Tempest* of Shakspeare he composed incidental music, which was performed for the first time at the Crystal Palace in 1862. His compositions include overtures, symphonies, songs, and piano music; the operettas *Box and Cox*, *Thespis*, and *Contrabandista;* the cantatas *The Bride of Neath Valley*, *Kenilworth*, and *On Sea and Land;* the oratorios *The Prodigal Son*, brought out at the Worcester musical festival in 1868, and *The Light of the World*, produced at the Birmingham festival in 1873; and an opera, the libretto by Chorley, entitled *The Sapphire Necklace*, not yet performed.

**Sullivan** (BARRY), b. in Birmingham, England, in 1824; made a successful début on the stage at Cork in 1840, acting thereafter in the principal towns of Ireland, Scotland, and England, and making his first appearance in London in 1851 as Hamlet. He visited the U. S. in 1857; returned to Great Britain in 1860, and in 1861 made a profitable professional visit to Australia, returning to England in 1866. He subsequently became lessee of the Holborn Theatre, London, and in 1875 made a second and not very successful visit to the U. S.

**Sullivan** (FRANCIS STOUGHTON), LL.D., b. probably in Ireland near the middle of the last century; became professor of common law in the University of Dublin, and was the author of two legal works of great value, *Historical Treatise on the Feudal Law, and on the Constitution and Laws of England* (1772), and *Lectures on the Constitution and Laws of England* (1776).

**Sullivan** (JAMES), LL.D., b. at Berwick, Me., Apr. 22, 1744; studied law; practised at Biddeford, and in 1770 was appointed king's attorney for York county. As the Revolution approached, he espoused the patriot cause; was a member of the provincial congress of Massachusetts, of which Maine was then a part, and was one of a commission of three who were in 1775 sent on a secret mission to Ticonderoga. In 1776 he was appointed a judge of the superior court, in 1779–80 a member of the State constitutional convention, and a delegate to Congress in 1784–85. He removed to Boston, for which he was repeatedly chosen representative in the legislature; was a member of the executive council and judge of probate in 1787; attorney-general of the State 1790–1807; elected governor in 1807, and again in 1808. He was the projector of the Middlesex Canal, a member of the American Academy of Arts and Sciences, and for many years president of the Massachusetts Historical Society. Among his works are *Observations on the Government of the United States* (1791), *History of Maine* (1795), *Review of the Causes of the French Revolution* (1798), and *History of Land-Titles in Massachusetts* (1801). D. in Boston Dec. 10, 1808.

**Sullivan** (JOHN), LL.D., brother of James, b. at Berwick, Me., Feb. 17, 1740; studied law and practised successfully; was a member of the first general congress, and Dec., 1774, led a company which captured a fort near Portsmouth, N. H., and seized 100 barrels of gunpowder and some cannon. In June, 1775, Congress appointed him a brigadier-general, and during the siege of Boston he commanded on the left under Gen. Lee. In the spring of 1776 he was sent to Canada with reinforcements for the invading Northern army in Canada, to the command of which he succeeded on the death of Gen. Thomas, and conducted the retreat from the province after the failure at Trois Rivières. Sullivan received the thanks of Congress for his skilful management, but the command of the army was given to Gen. Gates, and Sullivan was sent to join the army under

Gen. Washington. On Aug. 10, 1776, he was made a major-general, and in the battle of Long Island commanded, temporarily, the division of Gen. Greene, owing to the illness of the latter. He was taken prisoner, but soon afterward exchanged and returned to duty. In December he succeeded to the command of the division of Gen. Lee upon the capture of the latter, and which he led with credit at Trenton and Princeton. He planned the expedition against Staten Island, which under his leadership nearly achieved success in the descent of Aug. 22, 1777. At the battle of Brandywine he commanded the right wing of the army, and defeated the British left at Germantown. Transferred in the winter to command in Rhode Island, he laid siege to Newport in Aug., 1778, expecting to receive the assistance of the French fleet under Count d'Estaing, which failing to co-operate, compelled him to raise the siege and withdraw his forces from the island, after defeating the enemy at Butt's Hill Aug. 29. In the summer of 1779 he led an expedition against the Indians of the Six Nations, and Aug. 29 at Newtown (now Elmira) defeated a body of Indians under Brant, and of Tories under Johnson, Butler, and others, and after dispersing them destroyed their villages, crops, and laid waste the country to prevent their return. Shortly after, he resigned from the army, and in 1780 was again a member of Congress. Resuming the profession of law in New Hampshire, he was attorney-general 1782–86 and president of the State 1786–89, in which station, by his firmness and vigorous efforts, he subdued the insurrectionary spirit existing at the time of the troubles in Massachusetts, and in 1788 his exertions secured the adoption of the Constitution. In Oct., 1789, he was appointed U. S. district judge of New Hampshire. D. at Durham, N. H., Jan. 23, 1795.

**Sullivan** (John Langdon), M. D., son of James, b. at Saco, Me., Apr. 9, 1777; graduated at Harvard College in 1797; engaged in mercantile business; travelled in Europe to study the modes of construction of canals in England and France, and in 1804 was appointed engineer of the Middlesex Canal, connecting Boston harbor with Merrimack River, the earliest enterprise of the kind in the U. S. He invented a steam towboat, for which he received a patent in 1814, having clearly shown his priority of invention over Robert Fulton, whose application was presented at the same time. In 1824 he was appointed associate civil engineer of the U. S. board of internal improvements, and made a report in favor of the practicability of a canal across the Alleghany Mountains. Subsequently, he studied medicine; began practice in New Haven in 1837; removed to New York in 1847; adopted the homœopathic system, and made some valuable discoveries in his profession. D. in Boston Feb. 9, 1865.

**Sullivan** (William), LL.D., son of James, b. at Saco, Me., Nov. 30, 1774; graduated at Harvard College in 1792; was admitted to the bar in 1795, and rose to the head of the Suffolk county bar, and for many years was almost constantly a member of one or the other branch of the Massachusetts legislature. He was an excellent scholar, an eloquent pleader, a brigadier-general of militia, and a member of several learned societies. Besides several addresses, he published—*Political Class-Book* (1831), *Moral Class-Book* (1833), *Historical Class-Book* (1833), *Familiar Letters on the Public Men of the Revolution* (1834), republished under the title *The Public Men of the Revolution*, with a biographical sketch by his son (1847), and *Historical Causes and Effects* (1838). D. in Boston Sept. 3, 1839.

**Sullivan's Island,** a long, narrow island in Charleston co., S. C., 6 miles from Charleston, and on the N. side of the entrance to Charleston harbor. It is the site of Fort Moultrie (which see), and is becoming a fashionable resort for sea-bathing. There are many summer residences. The island is connected with Charleston by steam-ferryboats, which convey some 200,000 passengers annually. The island is 6 miles long, and is separated from the main land by a tidal channel.

**Sul'livant,** tp., Ford co., Ill. P. 141.

**Sullivant** (William Starling), LL.D., b. near Columbus, O., Jan. 15, 1803; graduated at Yale College in 1823; took charge of the extensive landed estates left by his father, and devoted himself with great zeal to botany, making the mosses a special subject of study. He published—*Catalogue of Plants Native or Naturalized in the Vicinity of Columbus, O.* (1840), *Musci Alleghanienses*, to produce which he made a journey from Maryland to Georgia (1845), *Musci and Hepaticæ of the United States E. of the Mississippi River* (1856), *Mosses brought Home by Wilkes's Exploring Expedition* (1859), *Mosses and Hepaticæ, collected mostly in Japan* (1860), *Musci Cubenses* (1861), and *Icones Muscorum*, containing representations of most of the mosses peculiar to Eastern North America not previously figured (1864), and a posthumous supplementary volume in 1874, the whole work containing 200 plates from his own sketches, of exquisite execution. He also issued, in conjunction with L. Lesquereux, two series of *Musci Boreali Americani*. The genus *Sullivantia* was founded by Torrey and Gray upon a rare plant of the saxifrage family discovered by him. D. in Columbus Apr. 30, 1873.

**Sul'livanville,** p.-v., Veteran tp., Chemung co., N. Y. P. 157.

**Sul'ly,** county of Dakota, formed since the census of 1870. Cap. Fort Sully.

**Sully** (Alfred), b. in Philadelphia in 1821; graduated at West Point in 1841; served in the Florida and Mexican wars, and was made captain in 1852. During the civil war he was made major, and subsequently colonel; commanded a brigade during the Peninsular campaign, and was present at the battles of Fair Oaks, Malvern Hill, Antietam, Fredericksburg, and Chancellorsville. In 1863–66 commanded a brigade in Dakota, and was brevetted as brigadier-general for services in the campaign against the Indians of the North-west, and in 1870 was assigned as colonel of the 19th Infantry. He has published *Manual for the Non-commissioned Officers of Infantry and Riflemen of the U. S. Army* (1861).

**Sully** (Maximilien de Béthune), Baron of Rosny, Duke of, b. at Rosny, department of Seine-et-Oise, Dec. 13, 1560, of a Protestant family; was from his eleventh year educated with Henry of Navarre; accompanied him through his shifting fortunes at the court and in the camp, and became his minister of finance and chief adviser in all public and private affairs when he ascended the throne under the name of Henry IV. He was an excellent financier. Although he diminished the taxes, he had always money ready for public undertakings, and amassed a reserve of 40,000,000 livres. His economical views were narrow—he considered agriculture as the only productive source of the wealth of a nation—but they suited the actual state of the country. He also distinguished himself as an engineer—in war by reducing fortresses held to be impregnable, and in peace by constructing roads, canals, harbors, etc. After the assassination of Henry IV., he resigned his offices and retired into private life. D. Dec. 22, 1641. Of his *Memoirs*, 2 vols. were published by himself in 1634, and 2 more in 1662 by Jean le Laboureur; translated into English by Mrs. Lenox (1834).

**Sully** (Thomas), b. in Horncastle, Lincolnshire, England, June, 1783; came to America with his parents, who were actors, in 1792; lived first in Charleston, next in Richmond, next in New York, and finally in Philadelphia; painted Jefferson, La Fayette, *Washington crossing the Delaware*, Fanny Kemble, Charles Kemble, Mrs. Wood, Cooke the tragedian, and other actors of celebrity. In England he painted a portrait of Queen Victoria for the St. George's Society of Philadelphia. His best pieces are there; the *Jefferson* at West Point, the *Washington* in Boston. Sully did not, like Stuart, confine himself to portraiture. He undertook to illustrate *Robinson Crusoe* and Shakspeare, but this was by no means his best work. D. in Philadelphia Nov. 5, 1872. O. B. Frothingham.

**Sulmo'na,** the ancient *Sulmo*, town of Italy, province of Abruzzo Ulteriore II., has some manufactures and trade in wine. Ovid was born here. P. 12,594.

**Sulphates.** See Sulphuric Acid and Sulphates.

**Sulphatoxygen.** See Salt-Radicals, by Henry Wurtz.

**Sul'phides,** also called **Sulphurets,** compounds of sulphur with metals, and other elements more basylic or less electro-negative than itself. This class of compounds is probably quite as large in number as the oxides. Indeed, sulphur combines with one element, *fluorine*, which is not known to combine with oxygen at all. There seems a general strict analogy between sulphur and oxygen in combination, running through very extended ranges of compounds. The sulphides of the metals possessing practical importance will generally be found described in this work under the head of each metal. H. Wurtz.

**Sulphites.** See Sulphurous Acid and Sulphites.

**Sulphocar'bonates,** compounds belonging to the class of sulphur-salts, formed by sulphocarbonic acid, $CS_2$, with some metallic sulphides. Some of the sulphocarbonates—namely, those of calcium and barium—have assumed considerable importance of a commercial kind within two or three years from having been brought forward by the French chemist Dumas as remedies for the *Phylloxera*, or parasite that attacks the grapevine. The absorption of bisulphide of carbon in the process of purification of coal-gas by lime is due—as was first shown by the present writer in 1868—to the formation of sulphocarbonate of sulphide of calcium, $CaS.CS_2$. The use of sulphide of calcium for

the special purification of gas, with a view to abstract wholly this very offensive impurity, bisulphide of carbon, has since been made the subject of patents both in Great Britain and the U. S. by Mr. R. H. Patterson. H. WURTZ.

**Sulphocarbon'ic Acid,** the compound $CS_2$, also called **Bisulphide of Carbon** and **Disulphide of Carbon.** It is a transparent, colorless liquid, very volatile, like ether, which is formed by the action of sulphur-vapor on carbon at a high red heat. Density (theoretical), 1.291 (Pierre at 0° gives 1.293). Boils at about 116°–117° F.; inflames at an extremely low temperature, much lower than sulphur; has a very offensive odor as found in commerce, but not at all so when carefully purified, which may be effected by redistilling from lime or from a metal. $CS_2$ has great solvent powers, which give it much commercial value. H. WURTZ.

**Sulphocyan'ic Acid,** also called **Hydrosulphocyanic Acid** and **Sulphocyanhydric Acid** [Ger. *Schwefelblausäure*; Berzelius called it *Rhodanwasserstoffsäure*], (CNHS), analogous in composition to cyanic acid, CNHO. It occurs in saliva, and in some sulphuretted essential oils of plants, such as *mustard* and *radish*. It may be prepared from *sulphocyanate of mercury*, which is first made by precipitating a mercurous salt with sulphocyanate (sulphocyanide) of potassium, and which is the material of the so-called "Pharaoh's serpents," a dangerous toy much in vogue a few years ago. The mercuric sulphocyanate is heated in a current of dry $H_2S$ or HCl gas, when the sulphocyanic acid distills as a colorless liquid, which may be crystallized. This acid and its compounds are highly interesting to science, and of some practical interest, but for their complete description the chemical textbooks must be resorted to. *Sulphocyanate of potassium* (CNKS) is a salt of much interest from being an important and delicate laboratory reagent for ferric compounds, with which all soluble sulphocyanates strike a deep and characteristic blood-red color. The potassium-salt is prepared by fusing cyanide of potassium and sulphur together, and subsequent purification. HENRY WURTZ.

**Sulphovinic Acid,** also called **Sulphethylic Acid** and **Ethylsulphuric Acid** ($C_2H_6SO_4$), a compound which is formed by the action of sulphuric acid upon alcohol or ether. Hennel found, as confirmed by Berthelot, that it is formed by the direct combination of oil of vitriol with ethylene gas. It is obtained from sulphovinates, which are produced by saturating with baryta a mixture of equal parts of alcohol and oil of vitriol that has been heated to 212° F. for twenty-four hours, and crystallizing. The crystals are then decomposed by an exact equivalent of sulphuric acid, the liquid filtered from the baric sulphate, and concentrated *in vacuo* over oil of vitriol. Sulphovinic acid, thus obtained, is an oily liquid of density (theoretical) 1.33 at 0°. (It will be further referred to under VOLUMES, MOLECULAR.) H. WURTZ.

**Sul'phur** [Lat.; Fr. *soufre*; It. *zolfo*; Ger. *Schwefel*], also called **Brimstone,** one of the most important of the elements of matter, very abundantly and almost universally distributed throughout the earth and the sea. It occurs native, as a mineral, in many countries. It is also found in mineral form as GYPSUM (which see), and in a great variety of metallic SULPHIDES (which see); also dissolved in the ocean as sulphates. It is an important essential element of the blood, muscles, skin, hair, and other parts of animals, and exists also in some essential components of plants, though not in the *woody* substance thereof. It is evolved also from volcanoes, both as vapor of sulphur and as sulphuretted hydrogen and sulphurous dioxide gases, these gases being doubtless products of the action of oceanic water, that has penetrated to the volcanic focus, upon metallic sulphides it finds there. Indeed, it is more than probable that such action is itself one *vera causa* of vulcanicity.

Most commercial sulphur is merely the native mineral purified by fusion or further by distillation and sublimation. In Sicily, where the crude sulphur, mixed more or less with other minerals, is very abundant and fuel scarce, the method is often adopted of making a portion of the sulphur of the ore furnish the heat (not very great in amount) necessary to fuse out and separate the rest of the sulphur. The ore is piled in heaps, sometimes in kilns, so constructed that a portion of it can be set on fire and heat the whole mass throughout to the fusing-point of the sulphur. The latter then collects slowly in liquid form in cavities formed for the purpose, and may be ladled out and sold or refined. The Sicilian sulphur, being free from *arsenic*, which is the most objectionable impurity liable to occur, is highly prized for making SULPHURIC ACID (which see). Much sulphur is likely to be furnished to commerce from the western coasts of the U. S. In Lake co., Cal. (with *cinnabar*), Humboldt co., Nev., and numerous other places near these coasts, large deposits are reported, some of which are already worked. The refined sulphur (*brimstone*) of commerce, and the pulverulent material known as *flowers of sulphur*, are products of distillation and sublimation—operations which are often conducted simultaneously, there being duplicate condensing chambers, the first of which, being hot, condenses liquid sulphur, which is drawn off and cast into sticks or cylinders; while in the second, which is kept cool, the vapor precipitates in the form of "flowers," these flowers being, when freshly prepared, composed of a special allotropic modification of sulphur. (See below.)

Sulphur is one of those elements most liable to assume allotropic states when isolated. These are characterized by differences of crystalline form or by amorphous character, different relations to solvents, and different densities, but not so much as in the case of phosphorus-allotropes, by differing colors. There are known to be many sulphur allotropes, but their study seems to present many difficulties, so that only a few of them are as yet well identified and characterized. (See *Allotropism*, under ISOMERISM, for some account of the sulphur-allotropes.) Native sulphur often occurs in very beautiful and brilliant transparent yellow crystals, which are orthorhombic in form, with two imperfect cleavages. Among these the densities at 0° C.—2.048 (Karsten 2.05) and 2.088 (Dumas and Roget 2.086)—indicate two distinct modifications. The density of the common opaque brimstone, crystallized from fusion, is lower, and there are several variations in this also. Its crystallization is monoclinic. Very beautiful crystals of this form are easily obtained by breaking the crust upon a cooling mass of melted sulphur and pouring out the liquid interior. On breaking the mass after cooling, the cavity will be found filled with slender brilliant prisms. Sulphur, on heating, passes through a succession of allotropic changes, melting at about 120° C. to a thin yellow liquid, of density (theoretical) at 0° = 1.821 (Playfair and Joule found 1.815). If now again cooled, it becomes a permanently *transparent* solid (density unknown). Above 120° the sulphur becomes thick and viscid, losing its fluidity altogether, and assuming a brown color at about 250° C. Heat is absorbed, and becomes latent in the formation of this allotrope. At 300° the mass again becomes liquefied. At 440° C. (822° F.) sulphur boils, forming an orange-yellow vapor. Some of the sulphur-allotropes, including the two crystalline forms above described, are *soluble* in several liquids, such as bisulphide of carbon, oil of turpentine, and others. The bisulphide-of-carbon solution, on evaporation, yields beautiful transparent crystals, similar to those of native sulphur. Flowers of sulphur are composed of an *amorphous* soluble modification, the recorded densities of which vary so widely as to be incomprehensible at present. Sulphur inflames in air at a remarkably low temperature, about 482° F., burning with the well-known blue flame and suffocating evolution of sulphurous oxide gas, $SO_2$. HENRY WURTZ.

**Sulphur,** tp., Sebastian co., Ark. P. 713.

**Sulphur, Acids of.** See SULPHURIC ACID AND SULPHATES.

**Sul'phuretted Hydrogen,** called also **Hydrosulphuric Acid** and **Sulphohydric Acid** [Fr. *acide sulfhydrique*; Ger. *Schwefelwasserstoff*, or *Hydrothionsäure*], a gas, of composition $H_2S$, which seems to be a parallel compound to water, $H_2O$, and might therefore be expected to perform similar or parallel functions, but this latter has not yet been clearly shown. The gas was first discovered by Rouelle the younger, but Scheele first ascertained its nature and properties. Sulphuretted hydrogen is emitted naturally by mineral springs and from volcanoes, and, in combination with ammonia, is evolved in the putrefaction of animal and vegetable matters. The smell of rotten eggs and that of a privy, generally attributed to sulphuretted hydrogen itself, are due chiefly to the compound it forms with ammonia or *sulphide of ammonium*. Artificially, this gas is prepared by the action of a dilute mineral acid on certain metallic sulphides, of which *ferrous sulphide* of commerce is the one generally employed, though the native *sulphide of antimony* may also be used. If hydrogen gas be passed through melted sulphur, this compound is formed; and it has recently been asserted that a convenient way to evolve sulphuretted hydrogen for laboratory use is to melt together in a flask sulphur and *paraffine*. When pure, sulphuretted hydrogen is a colorless gas, of an intense odor, which somewhat recalls that of bitter almonds, which produces immediate vertigo in the case of some persons, and acts as a deadly poison upon some animals, even in very small proportion. Many persons will, however, inhale it in diluted form without much apparent effect for a considerable time, so that it cannot be regarded as necessarily a dangerous poison in the case of mankind, though its unnecessary inhalation in quantity ought to be avoided. The density of the gas is 1.175, air being unity. Faraday reduced it by compression to a

liquid whose density he gives as about .9. The solubility of the gas in water is given by Bunsen as 4.37 per cent. of its volume at freezing, and about 3.2 per cent. at normal temperature. Alcohol takes up about three to four times as much as water. It is combustible, with a blue flame, burning to water and sulphurous dioxide. This gas is a very important reagent in the laboratory for precipitating metals from their solutions in processes of analysis, and in many processes of preparation of organic compounds in pure state; particularly in cases of organic acids, which are first converted into lead-salts, to be decomposed afterward by sulphuretted hydrogen. HENRY WURTZ.

**Sulphur Fork,** p.-v. and tp., Lafayette co., Ark. P. 1570.

**Sul'phuric Acid and Sulphates.** Sulphuric acid is called also *oil of vitriol,* from its having been originally obtained by distillation from *vitriol,* or sulphate of iron (Fr. *acide sulfurique ;* Ger. *Schwefelsäure* or *Vitriolsäure*). This acid was probably known to the Arabian proto-chemists. Basil Valentine, however, is the first known author who, writing in the fifteenth century, mentions the making of sulphuric acid by distilling iron-sulphate. The manufacture by burning sulphur, as now practised, was introduced in England by Dr. Roebuck about 1720. The general method is to burn sulphur, either as brimstone or in the form of metallic sulphides, as pyrites, in a draught of air, which is passed into very large chambers built of metallic lead, where the sulphurous oxide gas formed by the combustion is mixed with steam, and a quantity of nitrous fumes evolved from a mixture of saltpetre or nitrate of soda with sulphuric acid. The oxides of nitrogen convert the $SO_2$ into $SO_3$, the complete reaction, with nitric peroxide, being as follows:

$$\underset{\text{Oil of vitriol.}}{2(H_2SO_4)} + \underset{\text{Nitric dioxide.}}{N_2O_2} = N_2O_4 + 2SO_2 + 2H_2O.$$

The gas $N_2O_2$, however, combines again at once with oxygen present in the excess of air, to form the red gas $N_2O_4$ once more, which again reacts with more $SO_2$, so that the operation of a limited amount of nitrous fumes is continuous, acting as a carrier of oxygen to the sulphurous dioxide without consumption of its own substance. More than 100,000 tons of oil of vitriol are now annually made in this way in England. The product precipitates with condensing steam upon the walls and floors of the leaden chambers as diluted sulphuric acid, which is then concentrated to oil of vitriol—first, in pans of lead, and when it has become strong enough to attack these, the boiling down is completed in large stills made of *platinum.* (For further details regarding this important manufacture, which would occupy too much space, the works upon chemical technology must be resorted to.) The substitution for native sulphur, in this manufacture, of the less expensive mineral sulphides of iron and copper has made much progress in Europe of late years, notwithstanding the fact that the acid thus made is much less pure, and is particularly liable to contain *arsenic* as a contamination, which renders it especially unfit for one of its most extensive applications, that of making *fertilizers.* In America, on the contrary, the utilization in this way of our mineral sulphides does not make much headway; and this notwithstanding the fact that a marked feature of these minerals throughout the Eastern U. S. is a strange and generally an absolute freedom from the presence of arsenic. The present writer urged many years ago that the highly sulphurous coal-seams—almost useless for any other purpose—that lie in the valley of the upper Monongahela alone, in West Virginia, would be adequate to furnish the whole region of the valleys of the Mississippi and its tributaries with cheap sulphuric acid for agricultural purposes, altogether free from arsenic, for centuries to come. These ideas do not appear to have attracted any notice from capitalists. Among other American chemists, Sterry Hunt has likewise urged strenuously a similar utilization of the enormous beds of pyrites so abundant throughout the Carolinas and the East Tennessee region.

Sulphuric acid, or oil of vitriol, when fully concentrated, has a density at 0° C. of 1.846. It is an oily, colorless, inodorous liquid, which boils at 620° F. and freezes at — 31°. It absorbs water rapidly from the air, being one of the most useful agents in the laboratory for drying air and for absorbing moisture from other substances, which are for this purpose simply placed in a confined space with a quantity of oil of vitriol, which, through the medium of the air, will gradually abstract all the moisture from such substances. When mixed with water, great heat is developed, with a great condensation of the molecules of the water. The writer has found, as a result of certain new computations, that the first equivalent of water thus combined with oil of vitriol contracts (after cooling) from its original equivalent volume of 18 to that of 11.408. The vastness of the chemical forces involved may be faintly conceived when we consider what an almost *incalculable* power would be required to compress the water to this extent *mechanically.* The hydrate thus formed, $H_2SO_4.H_2O$, may be crystallized by cold, and is hence called *glacial sulphuric acid.* Its density, according to Wackenröder, is at 8° C. = 1.784 (theoretical at 0° = 1.799).

*Nordhausen,* or *Fuming Sulphuric Acid.*—This is the acid obtained by distilling ferric sulphate. It has the composition $H_2S_2O_7$, and is considered by some chemists as containing sulphuric trioxide $SO_3$ or as $H_2SO_4.SO_3$, but this seems hardly in accordance with the fact that it crystallizes as a whole in transparent crystals at zero. When gently heated, however, it breaks up into SULPHURIC OXIDE (which see), which distills over and condenses as a solid body, and ordinary oil of vitriol, which remains behind in the retort. Its name of *fuming* acid comes from the fact of its forming white fumes in the air, due apparently to the evolution of vapor of $SO_3$ even at ordinary temperatures. Fuming oil of vitriol is used in the laboratory for dissolving indigo and as a reagent in gas analysis, to absorb the *illuminant hydrocarbons* from ordinary coal-gas.

*Diluted Sulphuric Acid.*—It is very useful in chemical and technical operations to be able to determine the strength of a dilute acid from its density as taken with the hydrometer. The following figures are condensed from the latest tabulated determinations of densities of dilute sulphuric acid by J. Kolb:

| Degrees Baumé. | Densities. | $SO_3$ in 100 parts. |
|---|---|---|
| 1 | 1.007 | 0.7 |
| 5 | 1.037 | 4.7 |
| 10 | 1.075 | 8.8 |
| 15 | 1.116 | 13.2 |
| 20 | 1.162 | 18.0 |
| 25 | 1.210 | 23.2 |
| 30 | 1.263 | 28.3 |
| 35 | 1.320 | 33.9 |
| 40 | 1.383 | 39.5 |
| 45 | 1.453 | 45.2 |
| 50 | 1.530 | 51.0 |
| 55 | 1.615 | 57.1 |
| 60 | 1.711 | 63.8 |
| 65 | 1.819 | 73.2 |
| 66 | 1.842 | 81.6 |

*Uses of Sulphuric Acid.*—Among those materials and products of science and art that constitute the main pillars of modern civilization sulphuric acid occupies incontestably a first rank. Probably none other except the metal iron could be justly ranged with it in this regard. This will appear on a mere enumeration of some of the principal products necessary to human life, health, comfort, luxury, or necessity which are dependent, directly or indirectly, upon sulphuric acid as an essential agent in their production: *soda* from common salt, and, through this, *glass, soap, sodium, aluminum, magnesium ; nitric* and *hydrochloric acids,* upon which depend the arts of *refining gold and silver* for money and jewelry, with the *electroplater's* and *photographer's* arts; artificial *mineral waters ;* all the *vegetable acids* and *alkaloids ; alum ; ammonia ; ultramarine ;* the *aniline colors ; bleaching-powder ; chrome compounds ; chloroform* and *ether ; phosphorus* and *matches ; artificial fertilizers ;* and so on almost without end.

*Sulphates.*—Among the compounds of sulphuric acid with metals are many of commercial value and importance which we can here do little more than enumerate in part. Many of them will be found described under the heads of the different metals.

*Aluminum Sulphates.*—Of these there are several known, some of which occur as native minerals. The normal sulphate is $O_{12}S_3Al_2.18H_2O$, constituting the mineral *alunogen.* The alums (see ALUM) are double salts of normal aluminum-sulphate with the sulphates of potash, ammonia, or soda, containing 24 equivalents of crystal-water.

*Ammonium Sulphate,* $O_4S(NH_4)_2$.—A commercial salt of great importance, anhydrous, not deliquescent, made largely from the ammoniacal liquor of the gasworks, and used as a fertilizing agent.

*Barium Sulphate,* the mineral *barite, barytes,* or *heavy spar* ($O_4SBa$).—Insoluble in water, very heavy; densities, 4.123 and 4.554. The source of most commercial barium compounds. Is ground, purified, and sold largely as a pigment or inferior substitute for white lead.

*Calcium Sulphates ;* the mineral *anhydrite* is $O_4SCa$. It is orthorhombic. *Minimum* and *maximum* densities, 2.911 and 3.104. GYPSUM (see this head; also SELENITE) has already been described.

*Cobalt Sulphate* ($O_4SCo.7H_2O$).—The mineral *bieberite.*

*Copper Sulphate* ($O_4SCu.5H_2O$).—*Blue vitriol,* an important commercial salt. Crystals triclinic.

*Iron Sulphates* ($O_4SFe.7H_2O$).—*Copperas* or *green vitriol.* A large article of commerce. Crystals monoclinic. This is

*ferrous sulphate*. *Ferric sulphate* (normal) is $O_{12}S_3Fe_2.9H_2O$, as the mineral *coquimbite*. There are many basic ferric sulphates.

*Lead Sulphate* ($O_4SPb$).—The mineral *anglesite*. Splendid orthorhombic crystals. *Minimum* and *maximum* densities, 6.2 and 6.42.

*Magnesium Sulphate, Epsom Salt* ($O_4SMg.7H_2O$). See MAGNESIA.

*Manganese Sulphate* ($O_4SMg.7H_2O$).—Monoclinic, like green vitriol.

*Mercury Sulphates*.—Mercurous sulphate is $O_4SHg_2$, and mercuric sulphate is $O_4SHg$. The former is insoluble, like calomel or mercurous chloride; the latter soluble, like corrosive sublimate or mercuric chloride. The mercuric salt is obtained by boiling mercury with oil of vitriol.

*Nickel Sulphate* ($O_4SNi.7H_2O$).—Very beautiful green crystals, right rhombic and isomorphous with Epsom salt. This salt, of much commercial importance now by reason of its large use in nickel-plating, is liable to contain iron and copper as impurities, both wholly destructive to its usefulness. In 1858 the present writer published a general method of separating iron from sulphates, including sulphates of nickel, copper, and others, by oxidizing the iron to ferric oxide and then precipitating with baric carbonate. The French chemist Terreil in 1875, apparently unaware of the previous publication eighteen years before, brought forward this device as new. The writer's mode, specified in 1858, for oxidizing the iron, boiling with dioxide of lead, was much in advance of Terreil's recent specifications. Copper must be separated by precipitation with metallic iron before boiling with the lead dioxide.

*Potassium Sulphate* ($O_4SK_2$).—A hard anhydrous salt, crystals trimetric; *minimum* and *maximum* densities, 2.423 and 2.888. Much less soluble than other potash-salts generally. Water at 0° C. dissolves but 8.36 per cent. It is a considerable article of commerce now for fertilizing purposes, for which it has great power.

*Silver Sulphate* ($O_4SAg_2$).—Trimetric crystals, turned green by light. Requires as much as 200 parts of cold water for solution.

*Soda Sulphate, Glauber's Salt*. See SODA.

*Strontium Sulphate* ($O_4SSr$) forms the beautiful mineral *cœlestine*; trimetric. Densities, *minimum* and *maximum*, 3.589 and 3.992.

*Uranium Sulphate* ($O_6SU_2.3H_2O$).—Small lemon-yellow prisms.

*Zinc Sulphate* ($O_4SZn.7H_2O$), *White Vitriol*, also the mineral species *goslarite*.—Orthorhombic and isomorphous with nickel-sulphate and Epsom salt. HENRY WURTZ.

**Sulphuric Ether,** an incorrect name given to ordinary ETHER (which see), which, though made usually with the agency of sulphuric acid, contains neither this nor sulphur in any form. It is usually regarded as an oxide of the hypothetical alcohol-radical *ethyl*, as diethylic oxide, or $2(C_2H_5)O$; but under VOLUMES, MOLECULAR, proofs are presented that it has the constitution $H_2O.4H_2C$.

HENRY WURTZ.

**Sulphuric Oxide** ($SO_3$), called also **Sulphuric Trioxide, Sulphuric Anhydride, Anhydrous Sulphuric Acid.** Sulphurous oxide, $SO_2$, mixed with oxygen and subjected to electric sparks, will form $SO_3$, but it is generally obtained, as mentioned under SULPHURIC ACID, by distilling the fuming or Nordhausen acid. It condenses in crystalline needles, snow-white, resembling asbestos; has a peculiar toughness. It melts at about 64° F., and boils at 95°. Density variable, there being doubtless several allotropes. The approximate range is from 1.94 to 2. It combines greedily with water with a hissing noise, forming oil of vitriol or its hydrates. HENRY WURTZ.

**Sulphur, Medicinal Uses of.** Taken internally, sulphur produces little effect beyond that of a mild and somewhat slow laxative. Externally, applied in the form of ointment, it is a powerful parasiticide, principally employed to kill the little insect that produces the itch disease. *Potassium sulphide* is a sharp irritant, and in large dose internally a corrosive poison. It may be used instead of the simple sulphur ointment as a local remedy in itch and in other skin diseases, and dissolved in water as a bath is used in skin disease and in lead-poisoning.

EDWARD CURTIS.

**Sulphurous Acid and Sulphites.** Sulphurous dioxide gas, passed into water, forms sulphurous acid. A crystalline hydrate, $O_3SH_2.8H_2O$, was obtained by Pierre. Döpping obtained the pure acid, $O_3SH_2$, in cubical crystals; density not determined. Sulphurous acid is a strong reducing agent. It deoxidizes iodic, arsenic, chromic, and permanganic acids and chloride of gold, precipitating metallic gold from the latter.

*Sulphites*.—Of these the sulphites of calcium and of sodium only are of much practical interest, they being prepared commercially to some extent for bleaching purposes and for the prevention of fermentation of wines, syrups, and other organic liquids. There are two soda-salts—one neutral, $O_3SNa_2$, and one acid, $O_3SNaH$. The latter is obtained as a crystalline precipitate on cooling a warm solution of sodic carbonate which has been supersaturated with sulphurous oxide gas. This salt is used in the laboratory as a reagent. HENRY WURTZ.

**Sulphurous Oxide,** or **Dioxide** ($SO_2$), also called **Sulphurous Anhydride** [Fr. *acide sulfureux*; Ger. *Schweflige Säure*], the gaseous substance formed by the combustion of sulphur in the air. Even in pure oxygen the same compound is formed. It is emitted by volcanoes. It may be obtained artificially, in a pure state, by heating oil of vitriol with some metals, copper and mercury being among these. Sulphate of the metal and water are at the same time formed: $Hg + 2(O_4SH_2) = O_4SHg + 2H_2O + SO_2$. It is also obtainable pure by heating together sulphur and sulphuric trioxide, $SO_3$, in one limb of a sealed U-tube. It then appears as a liquid, condensed by the pressure, in the other limb. Sulphurous oxide gas is colorless, with the well-known suffocating odor. Bunsen gives its density as 2.21122 (air being 1), and its solubility in water as about 69 per cent. of the volume of the latter at zero, and 41 per cent. at normal temperature. Alcohol at zero takes up nearly five times as much as water. A pressure of about three atmospheres, or the cold of snow and salt, condenses it to a liquid of density 1.4311 at zero, as shown by volumic molecular computation, which at the same time proves it to be $S_2O_4$. This liquid produces so much cold in its evaporation as to freeze water when poured upon it. Sulphurous oxide has strong bleaching-power over most vegetable colors, and is therefore used for bleaching straw, wood, etc. HENRY WURTZ.

**Sulphur Springs.** See WATER.

**Sulphur Springs,** tp., Calhoun co., Ala. P. 560.

**Sulphur Springs,** tp., Montgomery co., Ark. P. 192.

**Sulphur Springs,** tp., Polk co., Ark. P. 768.

**Sulphur Springs,** tp., Searcy co., Ark. P. 226.

**Sulphur Springs,** tp., Johnson co., Ill. P. 1197.

**Sulphur Springs,** tp., Morgan co., Ill. P. 627.

**Sulphur Springs,** p.-v. and tp., Henry co., Ind. P. 246.

**Sulphur Springs,** tp., Cleaveland co., N. C. P. 1222.

**Sulphur Springs,** tp., Rutherford co., N. C. P. 967.

**Sulphur Springs,** p.-v., cap. of Hopkins co., Tex., has 4 churches, 5 schools, Masonic and Odd Fellows' lodges, 2 newspapers, 3 cotton-gins, 3 flouring-mills, and 1 foundry. There are several sulphur springs. P. 921.

FOSTER & RILEY, EDS. "GAZETTE."

**Sulphur Springs,** tp., Carroll co., Va. P. 1846.

**Sulpi'cians,** a Roman Catholic congregation of missionary priests founded in Paris in 1642 by Abbé J. J. Olier. They were confirmed in 1645. They have quite a number of European and a few American houses. Their chief work is the training of young men for the priesthood. They are properly called the Congregation of St. Sulpice, from the parish where first organized.

**Sulpi'cius Seve'rus,** b. in Aquitania about 363 A. D., though the precise date is not known. He was descended from a noble family, and in his youth had a career of distinction at the bar and in public life open before him. The loss of his wife, to whom he was greatly attached, led him to abandon the career on which he had entered about 392 A. D., and to give himself up to solitude and religious meditation. He entered the Church; became a presbyter and a devoted admirer of St. Martin of Tours, whose life he wrote. The date of his death is not known, but it was some years after 400. His chief writings are—*Historia Sacra*, or *Chronica*, in two books, from the Creation to A. D. 400; *Vita S. Martini Episcopi et Confessoris; Tres Epistolæ*, all relating to his patron St. Martin, and a sort of continuation of the *Life; Dialogi duo* (in some editions *tres*); to these are added *Epistolæ Septem*, though doubtfully ascribed to Sulpicius. The best editions of his collected works are that of De Prato (2 vols. 4to, Verona, 1741–54) and that of Halm (Vienna, 1866, 8vo), in which the seven doubtful epistles are given as an appendix.

H. DRISLER.

**Sul, Rio Grande do.** See RIO GRANDE DO SUL.

**Sul'tan** [Arab., "mighty"], the title ordinarily given to the hereditary ruler of the Ottoman empire. It is also assumed by other Mohammedan monarchs, such as the rulers of Acheen, Zanzibar, Borneo, the Maldive Islands, etc. Most of the numerous minor sultanates are over African and Malay states.

**Sulu Islands.** See SOOLOO ISLANDS.

**Su'mach,** or **Sumac** [Arab. *summak*], the common name for plants of the genus *Rhus*, which includes the cashew, mango, and other tropical fruits. In the U. S. there are about twelve species of sumachs, all of which are shrubs or small trees; of these the most common is the well-known smooth sumach (*Rhus glabra*), which is often found covering large tracts of barren ground, where it grows to a height of from two to twelve feet, with leaves a foot long. The yellowish-green flowers appear in June, and have a fragrant odor. The fruit is in dense crimson clusters with a velvety appearance and a pleasant acid flavor; the leaves are among the earliest to take on their autumn colors of yellow and scarlet. The stag's-horn sumach (*R. typhina*) sometimes reaches the height of thirty feet, and is readily distinguished by the soft down at the extremity of the branches. The dwarf or mountain sumach (*R. copallina*) is rarely more than six or eight feet high, with dark shining leaves, which in autumn become a rich purple. A still more diminutive species (*R. pumila*), erroneously supposed to be poisonous, is found in the pine barrens from North Carolina southward. The fragrant sumach (*R. aromatica*) ranges from Vermont to Florida, and as far westward as the Rocky Mountains; its leaves are among those which are smoked by the Indians in lieu of tobacco under the name of killikinick. The *Toxicodendron* group of the sumach family includes two species, with white or dun berries and a very poisonous foliage. One of these, the poison oak or poison ivy (*R. toxicodendron*), has leaves of three leaflets, flowers in loose slender panicles, fruit smooth and of a pale brown, and is abundant in most shady places, sometimes erect and sometimes creeping or climbing; it is highly poisonous to many persons upon contact, while others are not affected by it. The poison sumach, poison elder, or poison dogwood (*R. venenata*) is a beautiful shrub, from six to eighteen feet high, found from Canada to Louisiana; the fruit is greenish-white, hanging in loose clusters; the juice is milky, and dries to a black varnish; it is still more poisonous than the preceding species. The sumach of commerce formerly consisted of the leaves of the *R. coriaria*, closely resembling our stag's-horn sumach, which is largely cultivated in Sicily, and used in tanning, dyeing, and calico-printing; but it has been proved that our native sumachs are quite as valuable, and the collection and preparation of the leaves has become an important industry in some parts of the South. The Japan wax is yielded by the *R. succedanea*, being prepared from the white coating of the seeds within the capsules. The Japanese lacquer is prepared from the juice of *R. vernicifera*, a shrub closely resembling our poisonous sumach. The Chinese galls are the result of the deposition of the eggs of an insect on the leaf-stalks and young shoots of *R. semialata*, and are largely imported into England for dyeing and tanning purposes.

**Sumarokoff** (Alexei Petrovitch), b. at Moscow Nov. 14, 1718; founded the first Russian theatre in St. Petersburg, and wrote, besides lyrical poems and epics, a number of tragedies and comedies which found favor both at the court and among the people. D. at Moscow Oct. 13, 1777. His works (10 vols., 1787) have been several times reprinted.

**Suma'tra** (when Australia is not reckoned), the third largest island of the earth, extends from N. W. to S. E., between lat. 5° 45′ N. and 5° 55′ S., and between lon. 90° 40′ and 105° 5′ W., divided by the equator into two equal parts. Its area has been computed at 169,538 sq. m., its population at 2,000,000. Through its whole length it is traversed by a mountain-range, Boukit Barissan, which reaches its greatest height, 9655 feet, in Ophir, in lat. 0° 4½′ N., lon. 100° 1′ E. The range runs as a narrow ridge nearer to the western than to the eastern coast; a true mountain-region is formed only in the centre of the island, where some ranges run transversely. The principal rocks are granite, syenite, gneiss, mica-slate, and red sandstone, none of which are found in Java, whose geological and chorographical formation is entirely different from that of Sumatra. Six volcanoes are known, situated near the equator. The south-eastern part is rich in streams, navigable even for large vessels far into the interior. These streams carry large masses of mud and earth to the sea, the result of which is a considerable extension of the coast-line; at the same time the surface of the island, like that of Java and Borneo, appears to be rising slowly, but steadily. The several river-systems are connected with each other by arms and canals, and on the banks, in the midst of a luxuriant vegetation, stand the towns and villages. The climate is different in the different parts of the island, but generally it is healthy, with the exception of the low coast-regions to the W. The heat varies on the coast between 82° and 86° F., and at an elevation of from 2500 to 3000 feet between 64° and 73°; these highlands are celebrated for their healthy climate. The monsoons are not so steady and regular here as elsewhere. The dry season lasts N. of the equator from October to May, and S., from the end of April to the end of October. The natural productions of Sumatra are more varied and more abundant than those of any other island in the archipelago. Of metals, gold, iron, copper, and tin occur; brown coal occurs, but anthracite is not found. The development of the vegetable kingdom is grand. Rice forms the principal food, then sago, beans, and roots (varieties of jolichos, batatas, and dioscorea). The most palatable among the fruits are the mangosteen, durian, rambutan, rambei, pisang, pineapples, etc., many of which thrive only here, and cannot be introduced into other countries. Of the species of trees, the *Sideroxylon* (justly called *kayu* ("wood") *besi* (iron"); that is, "iron-wood") yields the best wood for shipbuilding, it being so hard that it blunts the sharpest arrow; teak is not found. The most important plants entering into commerce are cotton, black pepper, caoutchouc, benzoin, gutta-percha, various dyestuffs, and camphor, for which the island was celebrated among the ancients. The Dutch have introduced coffee, tobacco, and cacao; the nutmeg-plantations will not thrive. The fauna, Indian in its general character, corresponds nearer to that of Borneo than to that of Java. Of mammals there are 80 species, among which are the elephant, rhinoceros, tapir, tiger, panther, and bear; among the ruminants, the *Cervus equinus* is noticeable; among the many species of apes are the orang-outang and two other anthropoids, the siamang (*Siamanga syndactyla*) and the wau-wau (*Hylobates variegatus*); the buffalo occurs both in a wild state and domesticated; the horse is small, but vigorous, adapted to a mountain country. The population, formerly estimated at 5,000,000, but recently computed at 11 to the sq. m., belongs to the Malayan race, with the exception of 25,000 Europeans, mostly Dutch, some Chinese, and other Asiatic races. Of the native population, the Malays proper form the majority. Sumatra was their cradle as a nation; in the interior they founded the empire of Manang-Kaban, once very powerful. Next to them the Battaks are the most important division; they formerly inhabited the country N. of lat. 1° N., but now the population of Achin has separated from them, and they themselves have decreased in number, and are crowded together in a small space. The Orang Koabos live in the forests; in physical respects they do not differ from the other inhabitants of the island, but they are uncivilized, though harmless; they are agriculturists. The Malays are all Moslems; they write their sonorous language with Arabic letters, have a comprehensive literature, devote themselves less to agriculture than to commerce, navigation, and occasionally to piracy, and are well versed in several kinds of trade, especially in the manufacture of arms. With respect to their character they are said to be unreliable, treacherous, and addicted to sensual enjoyments. The Battaks are fetich-worshippers and addicted to cannibalism—a custom which the Dutch have tried in vain to abolish.

*History.*—The oldest history is very obscure. Remains of Hindoo temples and Indian idols, and the introduction into the language of numerous words belonging to the Sanskrit, show that the communication with Hindostan must at one time have been very intimate. The celebrated historical work, *Soulâlat* or *Salâthin*, is very untrustworthy; a reliable chronology does not begin until the introduction of Islam. Ptolemy calls the island *Aurea Chersonesus*, the Arabs *Fantsaur;* the name *Sumatra* occurs in 1330, used of the city of Samatrah. The Arabs visited Sumatra about 860 A. D.; Islamism was introduced into Achin in 1205; the Venetian merchant Marco Polo landed here in 1290, the Portuguese under Alvaro Talesso in 1506, the Dutch in 1597; an English squadron appeared before Achin in 1602. At that time the island consisted, in political respects, of three principal divisions—the southern part, called Batangharie, comprised the present Dutch residences of Palembang, Lampong, and Bencoolen, and was subject to Java; the central part was occupied by the Malayan empire of Manang-Kaban; the northern, called collectively Battak, comprised the countries of the Battaks, besides Achin, Pedir, etc., on the north-eastern coast. The Dutch East Indian Company, founded in 1602, rose rapidly to a great commercial and political power. In 1618 it established settlements on the E. coast; in 1646 at Salida on the W. coast; between 1664 and 1670 it extended its power by treaties with the minor chiefs and with the empire of Manang-Kaban, which now began to decay. England tried to compete with Holland, and succeeded on the W. coast, but was compelled in 1783 to return all its possessions in Sumatra to Holland. In 1811 it once more occupied the island, but by the treaty of Mar. 17, 1824, it exchanged all its possessions in the archipelago for the Malayan peninsula, and thus Holland became the only European power holding dominion in Sumatra. Between 1819 and 1845 the Dutch made war on the adherents of the

religious sect Orang-Padri; they succeeded, and transformed the W. coast into the richest and most profitable province—an achievement which was chiefly due to Gen. Michiels, who fell in 1849 in the island of Bali. In 1839–40 war was waged against Achin; it succumbed, but continued to harass the Dutch as their most inveterate enemy. An incorrect wording of the treaty of 1824 made it uncertain whether England could lay claims to Achin or not, but an additional treaty of 1871 gave Holland free hands, and she made no delay, but declared war immediately against Achin on account of piracy and anthropophagy. In the beginning the Dutch were defeated; the war had been commenced in the wrong season and with an inappropriate force. But in the summer of 1873, Van Swieten received the command, and then success followed success. At present, Holland possesses in Sumatra more than one-half of the whole area, with a population of 1,630,000. This part of the island, now perfectly subdued, consists of the government of the W. coast of Sumatra, with its capital, Padang, and a population of 950,000; the residency of Bencoolen, capital of the same name, and a population of 130,000; the residency of Lampong, with a population of 100,000, capital Telok-Betong; and the residency of Palembang, with a population of 450,000, capital Palembang. Holland also exercises authority over the kingdoms of Jambi, Indragiri, Siak, and the minor states of Arsahan, Deli, Serdang, etc., on the E. coast. The extension of the Dutch authority to these regions took place in 1863–65. The chiefs are very closely watched by the Dutch officials, and restrained from all arbitrary use of their power. Independent, and neither directly nor indirectly subject to Dutch authority, are Achin, the country of the Battaks, and the small district of Korintji in the eastern part of Jambi. In Korintji the interior relations are peaceful, equitable, and not unhappy. The same is the case in the country of the Battaks. One would rather like to see them continue independent, were it not for the anthropophagy still existing in them both. In Achin, on the contrary, there has reigned for more than a century a state of affairs which cannot be better described than as a continuous struggle between anarchy from below and despotism from above, now the one, now the other getting the upper hand, but the populace suffering equally in either case. In spite of all the great moral blemishes ascribed to them, the Battaks surpass, nevertheless, the other tribes of Sumatra in courage, valor, and enterprise. It can hardly be doubted that they would improve greatly, both in moral and material respects, under the Dutch sceptre, especially if at the same time their capital could be made prosperous. The influence of European civilization would reach the independent Battaks more rapidly and with greater effect from Achin than from the distant Dutch government of the W. coast of Sumatra, and thus anthropophagy among the Battaks be sooner destroyed. E. Schlagintweit.

**Sumba'wa,** an island of the Malay Archipelago, is bounded N. by the Java Sea, S. by the Indian Ocean, W. by the Strait of Allass, separating it from Lombok, and E. by the Strait of Sappi, separating it from Flores. Area, estimated at 6000 sq. m.; pop. at 80,000. It is high, mountainous, and volcanic. The still active volcano Tomboro, on the N. coast, 8940 feet high, caused a terrible destruction by its eruption in 1815; the ashes fell in Sumatra, 840 miles distant, and in a large part of the island itself all vegetation was completely destroyed. The sea also rose and swept away men and houses. More than 12,000 people are said to have lost their lives. Another eruption, less destructive, occurred in 1836. The principal products are gold, sulphur, saltpetre, rice, various kinds of wood, and a fine breed of horses. The inhabitants, closely allied in habits and manners to those of Celebes, live in six states which are under Dutch authority—namely, Tomboro and Sumbawa on the N. coast; Bima on the E. coast, where the Dutch governor resides; and Dompo, Sangar, and Papekat.

**Sum'bul,** a drug imported from India and Russia, is the root of some unknown plant, probably umbelliferous. It is used as a substitute for musk, both by perfumers and physicians. It has very nearly the odor of true musk, and as a nerve-stimulant it appears to possess much merit. It is but little used in the U. S.

**Summary Proceedings,** in law, are proceedings of various kinds, usually judicial in their nature, for the purpose of establishing or protecting some civil right or inflicting some penalty, in which the ancient common-law forms and methods are disregarded. As the name indicates, they are intended to be brief, expeditious, inexpensive, and efficient, and to avoid the delay and trouble which a close adherence to the customary modes of the common-law procedure necessarily involves. They are and must be entirely of statutory origin, and in prosecuting them the statutory provisions both as to form and purpose must be accurately followed. The number and objects of the common-law actions were definitely fixed; all their steps, including the commencement, pleadings, issues, trial, and judgments, were well defined. Summary proceedings differ from these actions in many essential features, often in the absence of a jury trial, or in dispensing with the formal pleadings, or in the manner of commencement, or in the tribunals before which they may be brought. The legislation upon this subject greatly varies in the several States, and the number of different proceedings is large. The following instances are examples of the forms which are quite common: A proceeding by which a landlord may dispossess a tenant who holds over after the expiration of his term or who fails to pay his rent; a proceeding to determine the title to chattels levied on under execution which are claimed by a third person; the proceedings by which railroad companies and other corporations may acquire lands under the right of eminent domain; proceedings after an execution has been returned unsatisfied to discover property of the judgment debtor; and in many States the proceedings for forcible entries and detainers, and those to enforce mechanics' liens. The power of legislatures to authorize summary proceedings is very much restricted by the provisions of the State constitutions, which preserve the jury trial in all cases, civil or criminal, where it had formerly been used, and which require "due process of law" to be observed in all means by which a person may be deprived of life, liberty, or property. When the proceedings established by statute violate these constitutional guaranties, the statutes creating them are void. John Norton Pomeroy.

**Sum'mer,** the warm season of the year, astronomically including the period between the vernal and autumnal equinoxes, from about June 21 to Sept. 22, but popularly, in the northern hemisphere, the months of June, July, and August; in the southern hemisphere the summer months are December, January, and February. Within the tropics there is of course, strictly speaking, no summer season. The so-called "Indian summer" (see Dark Day, in Appendix) is a period of warm pleasant weather which is usual in the northern parts of the U. S. after the cessation of the autumnal storms, often continuing for many weeks.

**Summer Duck.** See Wood Duck.

**Sum'merfield,** p.-v. and tp., Dallas co., Ala. P. 1467.

**Summerfield,** p.-v. and tp., St. Clair co., Ill. P. 770.

**Summerfield,** tp., Monroe co., Mich. P. 1464.

**Summerfield,** p.-v., Marion tp., Noble co., O. P. 470.

**Summerfield** (John), b. at Preston, England, Jan. 31, 1798; was educated at a Moravian seminary; at the age of fifteen went to Dublin, where he joined the Wesleyan society, and became a preacher in 1818; came to America in 1821, and at once attracted great crowds by his rare eloquence, first in New York, and subsequently in Philadelphia, Baltimore, and Washington. His health failing, he went to Europe in 1822; travelled in England and on the Continent, returning in 1824 to New York, where he d. June 13, 1825. He was the founder of the American Tract Society. During his lifetime he published only a single discourse, in behalf of the New York institution for the deaf and dumb; a collection of 83 of his *Sermons and Shetches of Sermons* was published in 1842. His biography has been written by Rev. John Holland (1829) and by Rev. William M. Willett (1857).

**Summer Hill,** p.-v. and tp., Cayuga co., N. Y. P. 1036.

**Sum'merhill,** p.-v. and tp., Cambria co., Pa. P. 752.

**Summerhill,** tp., Crawford co., Pa. P. 1232.

**Sum'mers,** county of Central West Virginia, formed since the census of 1870 from a portion of Nicholas county; bounded S. W. by Meadow River, and intersected by Gauley River. It is hilly, with fertile valleys adapted to wheat, Indian corn, and grazing. Cap. Hinton.

**Summers,** tp., Wilkes co., N. C. P. 760.

**Summers** (James), M. A., b. in the first quarter of the present century; studied at Magdalen Hall, Cambridge; became an assistant librarian in the British Museum, and subsequently professor of Chinese in King's College, London; edited the *Chinese and Japanese Repository* (1863–64) and the *Flying Dragon*, a Chinese newspaper (1866 *seq.*), and has published *Lectures on the Chinese Language and Literature* (1853) and *Hand-Book of the Chinese Language* (1864).

**Summers** (Thomas Osmond), D. D., LL.D., b. near Corfe Castle, Isle of Purbeck, Dorsetshire, England, Oct. 11, 1812; came to the U. S. and prepared for the ministry; was "admitted on trial" into the Baltimore conference of the M. E. Church in Mar., 1835, and afterward ordained deacon and elder; was a missionary in Texas 1840–Dec., 1843; was one of the nine preachers who constituted

the Texas conference at its organization, Dec., 1840, and secretary for four sessions; was transferred to the Alabama conference, of which he has continued a member till this time (1876); was stationed at Tuscaloosa in 1844, where and when he married; sent to Livingston station in 1845, and to Mobile in 1846; at the General Conference May, 1846, was sent to Charleston, S. C., as assistant editor of the *Southern Christian Advocate*, with Dr. (now Bishop) Wightman; was secretary of the Louisville convention in 1845, at which the M. E. Church, South, was organized, and has been secretary of all the General Conferences; was chairman of the committee that compiled the hymnbook, which he edited, and has compiled other hymnbooks for the connection, having devoted much attention to hymnology; has been the general book-editor of the Church from its organization; started the *Sunday-School Visitor*, and edited it four years in Charleston and three years (since the war) in Nashville, whither he removed in 1855, the publishing-house being there located; edited the *Quarterly Review of the M. E. Church, South*, for several years immediately preceding and during the war; has revised and edited hundreds of books for the Church, and written introductions, notes, indexes, etc., for many of them—*e. g.* Wesley's *Sermons*, Watson's *Sermons*, *Theological Institutes*, *Biblical and Theological Dictionary* (which he enlarged by adding a great many original articles), *Life of Wesley*, and *Observations on Southey's Life of Wesley*, and the standard Wesleyan *Catechisms*, which were also compiled by Watson. Dr. Summers is the author of *Commentaries on the Gospels, the Acts, and the Ritual of the M. E. Church, South* (6 vols.); a *Treatise on Baptism*, one on *Holiness*, *The Sunday-School Teacher, or the Catechetical Office of the Church*; *Seasons, Months, and Days*; *Talks Pleasant and Profitable*; *Refutation of the Theological Works of Paine* (not answered in Bishop Watson's *Apology*); *The Golden Censer, an Essay on Prayer*, with a collection of forms for all occasions; and sundry pamphlets, tracts, sermons, etc. During the war, he returned (Feb., 1862) to Alabama, and performed pastoral work in Tuscaloosa 1862–65, and in Greensboro' a part of 1866; at the General Conference, which met that year in New Orleans, was re-elected general editor, and editor of the *Sunday-School Visitor*; is also editor of the *Christian Advocate*; is professor of systematic theology in the Vanderbilt University and dean of the theological faculty, and *ex-officio* pastor of that institution, of which his only son is professor of anatomy and histology in the medical department.

**Sum'merset,** tp., Saline co., Ill. P. 800.

**Summerset,** tp., Adair co., Ia. P. 439.

**Sum'merside,** a port of entry, the second town in size in Prince Edward's Island, is in Prince co., and has a good harbor, rather hard of access, a large export trade, considerable shipbuilding, 2 weekly newspapers, 5 churches, a public hall, a market, and several manufactories. It is 40 miles by land W. N. W. of Charlottetown. P. about 1700.

**Summers's,** tp., Caldwell co., N. C. P. 1353.

**Summers's** (or **Somers's**) **Islands.** See BERMUDAS.

**Sum'merville,** p.-v., cap. of Chattooga co., Ga., 43 miles S. of Chattanooga, has 2 academies, Masonic and Templar halls, 1 newspaper, a cotton-gin, county-seat buildings, and 1 steam saw and grist mill. P. 281.

JOHN A. HENRY, ED. "GAZETTE."

**Summerville,** p.-v., Cass co., Mich. P. 184.

**Summerville,** p.-v., Harnett co., N. C.

**Summerville,** p.-v., Clover tp., Jefferson co., Pa., on Allegheny Valley R. R.

**Summerville,** p.-v., Charleston co., S. C.

**Summerville,** tp., Nicholas co., West Va. P. 645.

**Sum'mit,** county of N. W. Colorado, bordering on Utah, and watered by Bear, Blue, Grand, and White rivers. The W. portion is densely wooded, and contains large beds of coal, with mines of iron, copper, lead, and zinc; the E. portion includes a portion of the area reserved as the "Middle Park." Almost the entire population is in the S. E. corner, upon the head-waters of Blue River, where there are gold placer-mines. Cap. Breckinridge. Area, about 8500 sq. m. P. 258.

**Summit,** county of N. E. Ohio, drained by Cuyahoga and head-waters of Tuscarawas rivers, and traversed by several railroads and by Ohio Canal, the highest point of which is in this county. The surface is uneven, abounding in water-power, and having extensive coal-mines. There are many manufactories of agricultural implements, carriages, cooperage, stone and earthenware, leather, machinery, paper, woollen goods, iron castings, and brick. Cattle, sheep, horses, and swine are numerous. Staples, Indian corn, wheat, oats, hay, wool, lumber, butter, and cheese. Cap. Akron. Area, 400 sq. m. P. 34,674.

**Summit,** county of N. E. Utah, bordering on Wyoming, containing the head-waters of Bear and Weber rivers, and traversed by Union Pacific R. R. It is mountainous, and contains mines of gold, silver, lead, and coal. Staples, wheat, potatoes, hay, and dairy products. Cap. Coalville. Area, 1250 sq. m. P. 2512.

**Summit,** p.-v. and tp., Blount co., Ala. P. 630.

**Summit,** tp., Effingham co., Ill. P. 1432.

**Summit,** v., Prairie tp., Henry co., Ind. P. 108.

**Summit,** tp., Marion co., Ia. P. 1484.

**Summit,** tp., Jackson co., Mich. P. 863.

**Summit,** tp., Mason co., Mich. P. 257.

**Summit,** tp., Steele co., Minn. P. 322.

**Summit,** p.-v. and tp., Pike co., Miss., on New Orleans St. Louis and Chicago R. R., has 2 weekly newspapers.

**Summit,** p.-v. and tp., Union co., N. J. P. 1176.

**Summit,** p.-v. and tp., Schoharie co., N. Y. P. 1631.

**Summit,** tp., Monroe co., O. P. 970.

**Summit,** tp., Butler co., Pa. P. 1304.

**Summit,** tp., Crawford co., Pa. P. 1034.

**Summit,** tp., Erie co., Pa. P. 1047.

**Summit,** tp., Potter co., Pa. P. 145.

**Summit,** tp., Somerset co., Pa. P. 1493.

**Summit,** tp., Juneau co., Wis. P. 722.

**Summit,** tp., Waukesha co., Wis. P. 1358.

**Summit Hill,** p.-b., Carbon co., Pa., on Central R. R. of New Jersey, has good schools, 1 newspaper, 4 hotels, and rich deposits of coal, from which it derives its principal support. It is a favorite summer resort. P. about 4000.

ROBERT HARRIS, ED. "WEEKLY INTELLIGENCER."

**Summitville,** v., Washington tp., Cambria co., Pa. P. 177.

**Sum'monsville,** tp., Craig co., Va. P. 815.

**Sum'ner,** county of S. Kansas, bordering on Indian Territory, intersected by Arkansas River, consists mainly of fertile prairies. Cap. Sumner. Area, 1152 sq. m. P. 22.

**Sumner,** county of Central Mississippi, formed in 1874 from portions of other counties, and drained by Big Black River. The surface is undulating and the soil fertile. Staples, cotton, Indian corn, and sweet potatoes. Cap. Greensborough. Area, 408 sq. m. P. in 1875, about 8000.

**Sumner,** county of N. Tennessee, bordering on Kentucky, drained by branches of Cumberland and Big Barren rivers, and traversed by Louisville Nashville and Great Southern R. R. It has an undulating surface and fertile soil. Horses, cattle, sheep, and swine are very numerous. Staples, Indian corn, tobacco, wheat, oats, hay, sorghum-molasses, wool, and dairy products. Cap. Gallatin. Area, about 500 sq. m. P. 23,711.

**Sumner,** tp., Kankakee co., Ill. P. 1081.

**Sumner,** p.-v. and tp., Lawrence co., Ill. P. 672.

**Sumner,** tp., Warren co., Ill. P. 998.

**Sumner,** p.-v. and tp., Bremer co., Ia. P. 582.

**Sumner,** tp., Buchanan co., Ia. P. 550.

**Sumner,** tp., Iowa co., Ia. P. 692.

**Sumner,** tp., Webster co., Ia. P. 574.

**Sumner,** tp., Winneshiek co., Ia. P. 909.

**Sumner,** p.-v., cap. of Sumner co., Kan.

**Sumner,** p.-v. and tp., Oxford co., Me. P. 1170.

**Sumner,** p.-v. and tp., Gratiot co., Mich. P. 815.

**Sumner,** tp., Fillmore co., Minn. P. 988.

**Sumner,** tp., Guilford co., N. C. P. 1120.

**Sumner,** tp., Jefferson co., Wis. P. 468.

**Sumner,** tp., Trempealeau co., Wis. P. 889.

**Sumner** (CHARLES), b. in Boston Jan. 6, 1811, the eldest son of Charles Pinckney Sumner (b. in Milton, Mass., Jan. 20, 1776; graduated at Harvard College 1796; d. Apr. 24, 1839) and Relief (Jacobs) Sumner (b. in Hanover, Mass., Feb. 27, 1785; d. in Boston June 15, 1866). His twin sister, Matilda, d. Mar. 6, 1832. The Sumners had long been prominent in Massachusetts. Increase Sumner, governor in 1797, was of this family. Job Sumner, the Senator's grandfather (Harvard College, 1778), was a major in the Revolutionary army. The family was noted for physical as well as intellectual vigor—tall, strong, and stalwart. The Senator's father was, however, a spare man, about the average height. He delivered and published addresses and poems, was a wide student, with fine literary taste, a well-read lawyer, took an active part in politics, and was sheriff of Suffolk county from 1825 till his resignation just before his death; complimented by Hon. Josiah

Quincy as "the only sheriff, except Walter Scott, born on Parnassus." His manners had the exact and formal courtesy of a former generation. He was considered a brilliant man in his youth, and many anecdotes of his rather grim humor are still current in the courts. Charles was educated at the Boston Public Latin School; entered Harvard College 1826, and was graduated there 1830. He was a recluse and studious boy, hardly ever joining in any amusement or athletic games; and this mood lasted through his college years. Though a diligent student at college, he gave more attention to general literature than to the special studies of the university. After his graduation he gave a year to science, belles-lettres, history, and art. In 1831 he joined the Harvard Law School, then under the charge of Judge Story, and entered on the study of law with enthusiasm, renouncing all other subjects, and giving himself, without any relaxation, to a profound study of law. His leisure was devoted to preparing a catalogue, with learned notes, of the law library, and contributing to the *American Jurist*, of which he became chief editor. This devotion gained him the warm friendship of Story, who treated him as a son. Admitted to the bar in 1834, he visited Washington with such earnest letters of introduction from Story as secured him the friendship of Kent, Horace Binney, Judge Marshall, and others, who frankly expressed their wishes that before long he should find his place on the bench. Appointed by Story reporter to his circuit court, he published three volumes of Story's *Decisions*, and often supplied his place as lecturer at the law school, where he was himself lecturer from 1835 to 1837 and in 1843. In 1836 he edited Dunlap's *Admiralty Treatise*. He never had much practice at the bar, and seldom appeared in court. In 1837 he went to Europe with numerous letters of introduction from Story and others to lawyers and judges in England, France, and Germany; was received with most flattering attention, and became personally acquainted with almost every leading man and woman in Europe. But while his days were passed in society and galleries, his nights were spent in diligent study, for he early showed that almost incredible power of working which distinguished him through life. Rest he never needed, and always seemed to scorn. Returning in 1840 from Europe, he again opened a law-office, and, with J. C. Perkins, edited twenty volumes of Vesey's *Reports*. It was during this labor that his health broke down, and an illness followed which nearly proved fatal. He could have had, after Story's death (1845), his professorship at the law school, but declined it. In 1845 he was chosen by the city of Boston to pronounce the Fourth of July oration, and took for his subject the *True Grandeur of Nations*. This was a plea for peace, and was bitterly criticised at home, though welcomed abroad, and pronounced by Cobden "the most noble contribution made by any modern writer to the cause of peace." His protest against war he repeated frequently in later years.

Sumner had returned from Europe the pet of Boston society, more than welcome in its best circles. His choice of the Fourth of July to advocate peace was the first blow at his popularity. His interest in prisons brought him again into collision with Boston feelings. In 1846 and 1847 there was a warm discussion between Dr. S. G. Howe and Mr. Sumner on one side, advocating the Pennsylvania system, and Hon. S. A. Eliot and others, defending the Massachusetts method. Mr. Sumner's arguments were warmly praised by Tocqueville and others in Europe, but his opposition to the Massachusetts method gave another blow to his home popularity. He had planned a lawyer's life, and his highest ambition was to reach the bench. But when (1845) it was proposed to admit Texas to the Union, he turned to politics, speaking and working against such admission, and protesting against the war with Mexico which followed. When the Whigs nominated Gen. Taylor, a slaveholder, for the Presidency, he quitted the Whig party, joined (June, 1848) the Free-Soil party, which he assisted to form, supported its nominee, Van Buren, for President, was chairman of its State central committee, and took an active part in the canvass. In Oct., 1846, he had refused to be a candidate for Congress, but in Oct., 1848, he consented to stand as the candidate of the Free-Soil party in opposition to Mr. R. C. Winthrop. Although he was defeated, this step gave such serious offence to the circle in which he moved, and to the class from which his professional business was to come, that his fees for legal services thenceforth dwindled to almost nothing, and, with the exception of Longfellow, Prescott, and one or two more, all his old acquaintances closed their doors against him. Pet as he had been in society, and with such promise at the bar, his decided anti-slavery position created a resolution to crush him socially and professionally. This hostility pervaded Boston society, her merchants, and the Suffolk bar till the rebellion broke out. Sumner valued his social position very highly. He had not inherited it, but had himself achieved it. It is unspeakably to his credit that when he saw this long-coveted and hardly-earned distinction and all his professional prospects crumbling around him, though too fond perhaps of praise and keenly sensitive to blame, he never retreated an inch or remodelled a phrase to regain his place or conciliate opposition. But from this moment he was recognized as the leader of the young men of the Commonwealth, and hidden in their hearts. No matter that in after years the legislature censured, the press abused, and politicians criticised him. He always had, to the day of his death, the hearty, entire, steadfast, and loving confidence of the young men of Massachusetts. This explains his strength and influence in years when, judging of public opinion by the ordinary signs, he seemed to have lost his hold and to be near defeat. His mistakes were more than forgiven: they never checked for a moment the flow of trustful and loving admiration. Whatever party or leader was arrayed against him was sure to be broken to pieces. This unchanging trust was fully deserved by his honesty of purpose, his unselfishness, and by a life guided by a single eye to the public service. But that in such revolutionary times, and girt with such burning questions, this trust never did falter, is proof of the rare quality of his constituency, and gives fresh faith in republics.

In 1849 he maintained before the supreme court of Massachusetts the unconstitutionality of separate schools for whites and blacks. The decision was against him. In this argument he introduced to English speech the phrase "equality before the law," which he afterward traced (Apr., 1864) to the French constitution of 1793, to Voltaire, and Herodotus, and which is the keynote of many of his later arguments. In 1851, by a coalition between Free-Soilers and Democrats, he was elected Senator of the U. S., the first civil office, and the only one, he ever held. Mr. R. C. Winthrop was the Whig candidate. There were twenty-six ballotings, and the struggle lasted three months. He took his seat Dec. 1, 1851. Remembering the scorn with which Southerners affected to treat his cause and its advocates, he adopted the course of never seeking an introduction to any Senators, but waited till they chose to approach him. At that time an anti-slavery speaker was not considered "respectable" by the Senate. His remarks were not so much heresies as blasphemies. Once in the Senate, the force of his will, the almost entire devotion of his time to one cause, the aggressive attitude he took, and the vigor and ability of his incessant assaults, made him indisputably the leader of the political anti-slavery movement. No other man watched every point so vigilantly, no one suggested so many plans of attack, no man did so much to inform and arouse the public mind, no one enriched the treasury of anti-slavery argument more than he did. From this moment his life becomes in a large sense the history of the anti-slavery cause in Congress. While other members were active and efficient, and in some instances outdid him in the sagacity of their methods, the elaborate finish of his speeches, their vast array of facts and copious illustrations from history and science, created an anti-slavery literature, to which his position in the Senate secured prompt attention. He was equally at home in all parts of the subject, and especially vigilant that each step should be thorough and final. Added to this, the unquestioned honesty and fiery enthusiasm of the speaker compelled attention, while the personal peril which constantly surrounded him created the keenest interest in his course.

In Aug., 1852, he began his Congressional assault on slavery by a masterly argument for the repeal of the Fugitive Slave law, entitled *Freedom National—Slavery Sectional*. This phrase became the watchword of his party, and gives the key to most of his later arguments. In May, 1856, he made one of his ablest speeches, *The Crime against Kansas*, advocating the admission of that State to protect it from slavery. His comments on the conduct of several Senators who had taken a part in the debate, especially Butler of South Carolina, Douglas of Illinois, and Mason of Virginia, and his indignant reply to their personal attacks on himself, led to a scene which Sir G. C. Lewis characterized as "the beginning of civil war." On May 22, 1856, Preston S. Brooks, a nephew of Senator Butler, and one of the Representatives from South Carolina, approached Mr. Sumner while seated at his desk in the Senate chamber engaged in writing, and struck him, without warning, repeatedly over the head with a heavy gutta-percha cane. Mr. Sumner, blinded by the blows, strove to rise and free himself from the restraint of the desk. He succeeded in wrenching it from the floor to which it was screwed, but fell unconscious from the repeated blows. Keitt, Douglas, Toombs, and other members of Congress looked on the scene in silence. Mason of Virginia, Jefferson Davis, leading Senators, the Southern press, and some of the Northern, applauded the act. The indignation at the North was wide

and hot, but it shows the lines which bounded his popularity that while Massachusetts and the North generally thrilled with indignation, leading citizens of Boston refused to take part in meetings called to protest, and when Mr. Sumner returned to Boston Nov. 3, 1856, though received by crowds in the streets and by the State authorities, the windows of every house in Beacon street, through which he passed, except those of Prescott and Samuel Appleton, had their blinds closed to show indifference or contempt.

His injuries proved more serious than was at first supposed. Illness detained him nearly four years from his seat, with the exception of one brief attempt in the winter of 1857 and 1858 to attend the Senate sessions, to which he found himself unequal. Two visits to Europe, rest, and the best medical skill of both hemispheres enabled him at last to resume his seat on Dec. 5, 1859. During his illness, on Jan. 13, 1857, he had been elected unanimously by the senate, and almost unanimously by the house of representatives of Massachusetts, to the Senatorship. Again in Jan., 1863, and subsequently in 1869, he was re-elected, passing the last twenty-three years of his life in the Senate.

His attention was by no means given exclusively to slavery. His speeches cover all topics of national importance, and are always able. He took a leading part in all great debates. His speech in Jan., 1862, advocating the surrender of Mason and Slidell, taken from the British mail-steamer Trent, is a masterly exhibition of maritime law, and did much to reconcile the country to that distasteful course. His speech on the Alabama claims in 1869, bitterly offensive to all his English friends and severely criticised by John Bright, was undoubtedly a fair representation of American opinion, and was the basis of final settlement. His addresses on the constitutional law respecting rebel States, on reconstruction, the war powers of the government, international relations, internal improvements, etc., exhaust the subjects of which they treat. His sketches of Story, Allston, Granville Sharpe, Lincoln, and La Fayette show rare powers of portraiture. His articles on *White Slavery in the Barbary States*, *Prophetic Voices concerning America*, and other literary efforts, show good taste, ingenious research, and exact scholarship.

He was among the very first to insist that we should seize the opportunity the rebellion gave not only to fortify the Union, but to abolish slavery, and that abolition was inevitable. He early and constantly urged Lincoln to emancipate by proclamation; so of the enlistment of black troops and the recognition of negro citizenship by an amendment of the Constitution. He maintained that under our Constitution, Congress could give the negro the right to vote; hence he gave no support to the Fifteenth amendment, considering it unnecessary. During the session of 1870 he exerted himself vigorously to defeat Grant's St. Domingo policy, criticised the administration and the President severely on that and other grounds, and protested earnestly against the renomination of Grant, quitting the Republican party, and giving his support to the nomination of Mr. Greeley. His friend, Mr. Motley, had been removed in 1870 from the embassy to London, and now, Feb., 1871, he himself ceased to be chairman of the committee on foreign affairs, a post for which he was eminently fitted, and which he had held since 1861.

Worn down by the labor and excitement of the session, and by a return of the illness which Brooks's assault produced, he again sailed for Europe on Sept. 5, 1872, returning in November. In May, 1862, he had moved in the Senate that the names of victories in our civil war should not be inscribed on our regimental flags. Dec. 2, 1872, the first day of the session, he introduced a similar resolve to the Senate. For this he was censured by the legislature of Massachusetts Dec. 18, 1872. But this was rather a political trick than any real expression of Massachusetts feeling. The censure was rescinded the last month of his life. During this session of 1872–73, and the following one, he gave most of his time to his Civil Rights bill, which puts the negro on the exact level of the white in respect to inns, juries, schools, churches, public conveyances, and all civil privileges. But his health was much broken. An attack of his old malady, agony of the chest, in the Senate Mar. 10, 1874, proved fatal in his own house, Washington, on Mar. 11, 1874. Almost his last words were addressed to Judge Hoar: "Take care of my Civil Rights bill." No American, unless Washington and Lincoln, ever received such respect as was paid Mr. Sumner's memory. Cities and States listened to eloquent eulogies, and highways were crowded for scores of miles by sorrowing men and women as his body was borne from Washington to Mount Auburn, near Boston.

His natural powers were not of the highest order. "Industry was his talisman." By an indomitable will and tireless toil he supplied every deficiency and surmounted every obstacle. He knew how to work, and had, as he said of Story, "the genius for labor." In mind he was more like Story, trained to exhaustive research and clear statement, than like Kent and Marshall, born lawyers. In preparing to write or speak he ransacked libraries, laying under contribution all ages and tongues. Besides Latin and Greek, he read German, Italian, Spanish, and French, and spoke the last with facility. He had read everything and listened to everybody. His memory never lost a phrase or a fact he had once heard, and could always recall it at the right moment. His wealth of illustration was no effort, but the natural action of a full and ready mind. When first in the Senate his speeches were carefully prepared and written out. It took him five or seven years to acquire the power of extemporaneous debate. But to the last he usually wrote out his speeches. It has been generally supposed he was a mere scholar, fit only for investigation or debate. In truth, no man in Congress was more methodical, exact, painstaking, prompt, and efficient in attending to the details of business pertaining to his office. His eloquence belongs to the school of Burke, whom he liked to be thought to resemble, as indeed he did, in features. His speeches had more learning than Burke cared to show, but in wealth of illustration, gorgeous rhetoric, lofty tone, and a "gigantic morality which treads all sophistry under foot," the resemblance was close. His real power lay in the sincerity and fiery enthusiasm of the speaker, whose whole soul freighted his words, and in the fact that there was "always a man behind the speech." The massive grandeur of his presence and the dignity of his bearing added largely to the effect of his speech. He had no drop of bitterness in his nature; and no matter how angry the debate, he was the last man to be stirred to any discourtesy. Constantly and malignantly abused, neither in private nor in public could be detected the slightest personal animosity toward any one. Hardly a line that stirs a smile can be found in his speeches, though he enjoyed humor in others. A serious purpose or a lofty indignation writes every word. The imperiousness in debate sometimes charged on him grew out of a nature conscious of its own purity of purpose, terribly in earnest, that would never condescend to trifling, and could not understand it, or from a conscientiousness which had faithfully prepared itself for the discussion by gathering all the help human learning and the most diligent thought could give, and was naturally impatient when superficial opinions, borrowed from a morning-newspaper article, presumed to claim as much influence as his carefully-educated judgment. His alleged want of tact was sometimes a real defect, but it was oftener an unwillingness to compromise absolute justice, and especially in revolutionary times, when compromise is equally out of place and useless.

"History will lay bare no secret that will tarnish the whiteness of his fame." The fact that corruption did not dare even to approach him—"the whitest soul" R. W. Emerson "ever knew"—is proved by the simplicity of the remark Judge Hoar ascribes to him: "People talk about the corruption of Washington: I have lived here all these years, and have seen nothing of it." Though he loved the luxuries of life, money had no temptation for him. He did not know what fear was. Alone in Baltimore on Apr. 18, 1861, he yielded no inch to that mob which the day after shot down the Massachusetts troops. For ten years he walked Washington streets, his life constantly threatened, and well knowing that if a fanatic's or drunkard's hand took his life the assassin would not only be sheltered by the power of ten States, but petted and applauded as a champion. When he entered the Senate, free speech could not be said to exist there. To him, as much as to any man, was due the breaking of that chain. Mr. Sumner was exact in all etiquette, careful in dress, fond of society, easy of access, and had always time for every comer, his hours of study running to midnight and long after. His manner was always courteous, but in his last years had a marked tenderness. To the very last day of his life he was a loving student of the classics of all languages; a "bite of the classics" being his preparation for bed somewhere about two or three o'clock in the morning. He cultivated art, and was a diligent collector of autographs, pictures, rare books, bronzes, and other objects of *virtu*, most of which he bequeathed to the Art Museum of Boston and to Harvard College. To the college library he also gave one-half of his estate. He was married Oct. 17, 1866, to Alice (Mason) Hooper, widow of W. S. Hooper of Boston. They separated very soon, and he was divorced May 10, 1873.

Eleven volumes of his works, with copious notes, have been published under his own supervision (Boston); four more, with a memoir, are expected.

His life may be best summed up in the remark Tocqueville made to him, and which he loved to repeat: "Life is neither a pain nor a pleasure, but serious business, which it is our duty to carry through and conclude with honor."

WENDELL PHILLIPS.

**Sumner** (Charles Pinckney). See Sumner (Charles).

**Sumner** (Charles Richard), D. D., b. at Kenilworth, Warwickshire, in 1790; educated at Eton and Cambridge; entered holy orders; became rector of Abingdon, and librarian and historiographer to George IV.; was made prebendary of Worcester in 1822 and of Canterbury in 1825; dean of St. Paul's, prebendary of London, and bishop of Llandaff, all in Apr., 1826; in 1827 was transferred to the more important see of Winchester, which he resigned in 1869 on account of the infirmities of age. He published *Prælectiones Academicæ Oxon. habitæ* and the *Ministerial Character of Christ* (1824), besides several *Charges*, and discovered and translated the long-lost Latin manuscript of Milton, *De Doctrina Christiana* (1827), which gave occasion to Macaulay's brilliant essay on Milton. He was a brother of John Bird Sumner, archbishop of Canterbury. D. Aug. 15, 1874.

**Sumner** (Edwin Vose), b. in Boston, Mass., in Jan., 1796, where educated; was employed principally in the Indian country until 1846; served during the Mexican war, leading the charge at Cerro Gordo, where severely wounded (brevetted lieutenant-colonel for gallantry), and at Molino del Rey commanded the cavalry, which held in check that of the enemy, for which he was brevetted colonel; was governor of New Mexico 1851–53; in 1857 made a successful expedition against the Cheyennes; in Mar., 1861, appointed brigadier-general in the army in the place of Twiggs, and succeeded A. S. Johnston in command of the Pacific department; recalled to the East, commanded the 1st corps of the Army of the Potomac throughout the Virginia Peninsular campaign of 1862, being twice wounded; appointed major-general of volunteers July 11, 1862, and commanded the 2d corps; also commanded at Fredericksburg Dec. 13, 1862; at his own request was relieved Jan. 25, 1863, and in March ordered to command of the department of the Missouri, but on his way thither was taken ill, and died Mar. 21, 1863, at Syracuse, N. Y.

**Sumner** (George), brother of Charles, b. in Boston Feb. 5, 1817; studied at Heidelberg and Berlin; travelled extensively in Europe, Asia, and Africa, studying public and international law, and the manners, customs, institutions, and philanthropic organizations of the various peoples, and was often consulted by foreign governments upon points of political economy. To him and Dr. S. G. Howe is especially due the establishment in this country of schools for idiots. He was an accomplished scholar; contributed largely to European and American reviews; lectured extensively in the U. S. on philanthropic topics, and published several valuable addresses and pamphlets, among which are—*Memoirs of the Pilgrims at Leyden* (1845), *The Pennsylvania System of Prison Discipline* (1847), *The Progress of Reform in France* (1853), and an *Oration delivered before the Municipal Authorities of Boston* (1859). D. in Boston Oct. 6, 1863.

**Sumner** (G. W.), U. S. N., b. Dec. 31, 1841, in Michigan; graduated at the Naval Academy in 1861; became lieutenant in 1862, lieutenant-commander in 1866; served in the mortar flotilla at the bombardment of Forts Jackson and St. Philip and the Vicksburg batteries in 1862, and handsomely mentioned in Lieut.-Com. J. M. Wainwright's official report of Apr. 25, 1862. Foxhall A. Parker.

**Sumner** (Increase), LL.D., b. at Roxbury, Mass., Nov. 27, 1746; was admitted to the bar in 1770, and commenced practice in his native town; was representative in the legislature 1776–80, State senator 1780–82, associate judge of the supreme court 1782–97, governor of Massachusetts 1797–99, and in 1789 member of the convention for the adoption of the U. S. Constitution. D. June 7, 1799.

**Sumner** (John Bird), D. D., b. at Kenilworth, Warwickshire, in 1780, of a clerical family, his grandfather having been provost of King's College, his father vicar of Kenilworth, and his younger brother bishop of Winchester; was educated at Eton and at Cambridge, where he took high honors; entered holy orders; became rector of Mapledurham, canon of Durham in 1820, bishop of Chester in 1828, and archbishop of Canterbury and primate of all England in 1848. Besides several volumes of sermons and a number of charges, he published *Essays tending to show that the Prophecies now accomplishing are an Evidence of the Truth of the Christian Religion*, being the Hulse prize essay (1802), *Treatise on the Records of Creation*, which received the Burnet prize of £400 (1816), *The Evidence of Christianity* (1824), *Practical Expositions in the Form of Lectures upon the Gospels and Epistles* (8 vols., 1831–40), and *Practical Reflections* (1859). D. in London Sept. 6, 1862.

**Sumner** (William Graham), b. at Paterson, N. J., Oct. 30, 1840; prepared for college at the Hartford (Conn.) grammar school; graduated at Yale College 1863; travelled in Europe, residing at Geneva during the winter of 1863–64; studied philosophy at the University of Göttingen 1864–66, and at Oxford, England; was tutor in Yale College 1866–69; took orders in the Protestant Episcopal Church Dec. 29, 1867; was for a time assistant minister of Calvary church, New York; appointed professor of political and social science at Yale College 1872. Author of a *History of American Currency* (1874).

**Sumner** (William Hyslop), son of Increase, b. in Dorchester, Mass., July 4, 1780; graduated at Harvard College in 1790; was admitted to the bar 1802; member of the State legislature 1808–19; adjutant-general 1818–34. He published *Inquiry into the Importance of the Militia* (1823), *Reminiscences* (1854), *Memoir of Increase Sumner, Governor of Massachusetts* (1854), and *History of East Boston* (1858). D. at Jamaica Plains, Mass., Oct. 24, 1861.

**Sump'ter,** tp., Cumberland co., Ill. P. 1751.

**Sumpter,** tp., Wayne co., Mich. P. 1106.

**Sumpter,** p.-v., Trinity co., Tex. P. 145.

**Sumpt'uary Laws** are laws to restrict the expenses of citizens within defined limits. They have respect to certain articles of consumption and to the general style of living. Such laws involve always an abridgment of individual liberty and of the natural right of every man to do what he will with his own, provided he works no wrong or ill to his neighbor. They involve the assumption that a government, in the exercise of its paternal authority over its subjects, can judge better than themselves what will best subserve their welfare in the use of what they have. The wasteful extravagance apparent in every community seems to call for the interposition of government to curb the lavish outlays for dress, diet, equipage, etc. Hence, such laws are found on the statute-books of almost all nations. Under an aristocratic organization of society such enactments have been made in part for the purpose of maintaining class distinctions, certain features of dress and style being made the symbol of rank. This legislation has, however, almost entirely failed of its object, because it is so easily evaded, and because the laws are so directly at variance with men's common sense of right. This actual experience, and a better understanding of the true functions of government, have led to the abandonment, in modern times, of all sumptuary laws properly so called. Some laws for the regulation of public morals are demanded for the general good. The public liberty in this light may require some limitation of personal rights. For this end, it is both legitimate and wise to restrict the sale and the use of articles which cause disease, pauperism, and misery, and so increase the burdens of a whole community. Yet even for this object laws are found to be of little avail, except as they are sustained by a prevalent public sentiment and usage. A. L. Chapin.

**Sum'ter,** county of W. Alabama, bordering on Mississippi, drained by Tombigbee and Noxubee rivers, and intersected by Alabama and Chattanooga and a branch of Mobile and Ohio R. Rs. It has an uneven surface and fertile soil. Staples, Indian corn, wheat, and cotton. Cap. Livingston. Area, about 800 sq. m. P. 24,109.

**Sumter,** county of Central Florida, lying E. of Withlacoochee River. The surface is often swampy, and there are several small lakes. There are many swine and large herds of cattle. Staples, sweet potatoes, Indian corn, and some cotton. Cap. Leesburg. Area, 1370 sq. m. P. 2952.

**Sumter,** county of S. W. Georgia, lying W. of Flint River, and traversed by South-western R. R. It has a level surface and fertile soil. Staples, cotton, Indian corn, and sweet potatoes. Cap. Americus. Area, 600 sq. m. P. 16,559.

**Sumter,** county of E. South Carolina, bounded W. by Wateree River, drained by Black River and its branches, and traversed by Wilmington Columbia and Augusta R. R. The surface is generally undulating, with extensive pine forests. Staples, cotton, Indian corn, rice, lumber, tar, pitch, and turpentine. Cap. Sumter, or Sumter Courthouse. Area, about 900 sq. m. P. 25,268.

**Sumter,** tp., McLeod co., Minn. P. 315.

**Sumter,** p.-v. and tp., cap. of Sumter co., S. C., on Wilmington Columbia and Augusta R. R., 145 miles from the former place, contains 8 churches (3 colored), 2 female academies, 3 public schools, an opera-house, 2 newspapers, and a cotton-factory. About 10,000 bales of cotton are shipped annually from this place. P. of v. 1807; of tp. 3659. Darr & Osteen, Props. "True Southern."

**Sumter,** tp., Williamsburg co., S. C. P. 1679.

**Sumter,** tp., Sauk co., Wis. P. 847.

**Sumter** (Thomas), b. in Virginia in 1734; removed in early life to South Carolina; participated in the Cherokee war, and was a prominent actor in the events which preceded the Revolution; was appointed lieutenant-colonel of the 2d regiment of riflemen in Mar., 1776, of which he became colonel; served in the interior of the State until

the fall of Charleston; went to North Carolina and raised a large force, with which he defeated (July 12, 1780) a force of British and Tories: made an unsuccessful attack on the post at Rocky Mount Aug. 1, but Aug. 6 he defeated and routed the Prince of Wales regiment at Hanging Rock, and dispersed a large body of Tories; captured a valuable convoy Aug. 16, but was in turn defeated and routed by Tarleton on the 18th at Fishing Creek; a few days later was again in the field at the head of a considerable force, with which he scoured the country; gained a victory at Broad River Nov. 12, and on the 20th defeated Tarleton at Blackstocks, and was severely wounded; had previously been appointed brigadier-general of South Carolina militia, and Congress in Jan., 1781, passed a vote of thanks for his eminent services; in February was again in the field, and the following month, having raised three regiments of rangers, co-operated with Marion, Pickens, and other partisan leaders; was member of the convention which adopted the Federal Constitution; was member of Congress 1789–93 and 1797–1802, U. S. Senator 1801–10, and U. S. minister to Brazil 1809–11. D. at South Mount, near Camden, S. C., June 1, 1832.

**Sumter, Fort.** See FORT SUMTER.

**Sum'terville,** p.-v. and tp., Sumter co., Ala. P. 1577.

**Sun** [Ang.-Sax. *sunna*]. The sun is the centre of the solar system, controls by its attraction the motions of the planets, and by its heat is the prime mover and maintainer of all activity upon their surfaces. Hence it has always been to astronomers a subject of earnest and careful study, never more so than at present, and to mankind in general an object of admiration, and sometimes, as with the Peruvians and ancient Persians, of worship. The principal numerical facts relating to it are the following:

| | |
|---|---|
| Mean equatorial horizontal parallax | $8.86'' \pm 0.05''$ |
| Mean distance from the earth, miles | $92{,}260{,}000 \pm 500{,}000$ |
| Difference between greatest and least distance, miles | 3,100,000 |
| Mean apparent diameter | $32'\ 3.6''$ |
| Diameter in miles | 860,000 |
| Diameter (earth's taken as unity) | 108.7 |
| Mass, " " " | 320,000 |
| Density, " " " | $\frac{1}{4}$ |
| Specific gravity | 1.42 |
| Force of gravity at sun's surface (earth's as 1) | 27.1 |
| Inclination of sun's equator to the ecliptic | 7° 15′ |
| Longitude of node of sun's equator | 73° 57′ |
| Mean time of rotation on its axis | 25.38*d.* |

Radiation of heat per second, sufficient to melt 287,200,000 cubic miles of ice.

Nearly all the above given data depend upon the first as a foundation, and since the parallax, as at present known, is itself subject to a probable error of at least $\frac{1}{200}$th of its whole amount, a corresponding uncertainty affects all the rest.

The problem of the solar parallax is accessible by many different methods, each of course liable to its own peculiar difficulties. The following are the principal ones hitherto employed: (1) Observations of the transits of Venus; (2) observations of the oppositions of Mars; (3) calculation from lunar irregularities; (4) experimental measurements of the velocity of light, combined with observations of the eclipses of Jupiter's satellites; (5) calculations based on the secular perturbations of the orbits of the planets. Of these, the first is considered capable of giving the most precise results, and hence the greatest interest was felt in the transit of 1874 and in the approaching one of 1882, and very extensive preparations were made for the observation of the first with all the accuracy and completeness possible in the present state of science. The reduction of the observations is now (1876) in process, and will require not less than another year. It is confidently expected that as a result the margin of error will be reduced at least one-half. From the transits of 1761 and 1769, Encke in 1824 deduced for the parallax of the sun 8.58″, corresponding to a distance of a little more than 95,000,000 miles; and this value remained generally accepted until about fifteen years ago, when the evidence of its incorrectness became overwhelming. Grave doubts were first suggested by Foucault's experiments on the velocity of light in 1852; and these were greatly strengthened by Hansen's investigations on the moon's motions, made public in 1853. Within a very few years after this, the researches of Powalky in Germany, Stone in England, Leverrier in France, and Newcomb in this country settled the matter completely.

A good deal has been said by some who do not very well understand the limits of astronomical accuracy about this long-standing error of 3,000,000 miles in the sun's distance. The remark of Sir John Herschel is in point: "The recent correction of the solar parallax corresponds to the apparent breadth of a human hair at a distance of 125 feet; . . . and moreover *the error has been detected and the correction applied*, and the detection and correction have originated with the friends and not with the enemies of science."

The distance of the sun, 92,000,000 miles, is so great that a railroad train travelling without stops at the rate of 40 miles an hour would require 263 years to accomplish it. Sound, moving with the same velocity as on the earth, would be fourteen years on the way.

When examined by the telescope (which requires for the purpose an eyepiece so constructed that most of the light is rejected, while only a small percentage is sent to the eye) the surface of the sun presents a peculiar curdled or mottled appearance, much like that of coarse-grained drawing-paper. Near the edge the disk is noticeably darker than at the centre, and is marked here and there with long, irregular streaks of light, called faculæ, which closely resemble the flecks of foam floating on the surface of an eddy below a cascade. But the most striking objects are the *spots*, of which there are usually several visible at once. Fig. 1 gives a very good idea of their general appearance. They consist of a nearly black central portion, called the nucleus or umbra, of irregular form, and around it a fringe less deeply dark, called the penumbra. In magnitude they vary greatly, from minute black pores to blotches which are even visible to the naked eye and have a diameter of nearly 100,000 miles. They generally go in groups, and are distributed in two zones upon the solar surface, on each side of the equator and parallel to it, being seldom found very near the equator itself, and almost never as distant from it as 40° of solar latitude. Their forms and dimensions are no more permanent than those of our clouds, but are continually changing, old spots closing up and disappearing, while new ones break out to take their place. One group maintained its existence for eighteen months in 1840–41, but this is extreme: many last only a few days. The changes of form and appearance which they undergo when they approach the edge of the disk prove them to be *hollows* in the luminous surface of the sun, and the spectroscopic phenomena show that these hollows are filled with dense light-absorbing gases and vapors. Their depth appears to be somewhere between 3000 and 10,000 miles, at least usually. By watching them we are able to ascertain the period of the sun's rotation and the position of its equator as given in the table of numerical data. But it is a most important fact that they show the surface of the sun to move, not like that of a solid globe, but in such a way that while near the equator the time of rotation slightly exceeds 25 days, at a solar latitude of 44° it is 28 days. The formula which Faye gives to express the velocity of the rotation at any latitude is $R = 862' - 186'\sin^2 l$, where R is the daily angular motion, and $l$ the solar latitude in question. No satisfactory explanation of this peculiar law of rotation has yet been reached, and it is at present one of the most fundamental and important of all the problems of solar physics. Besides this systematic difference between the velocities of spots according to their distance from the equator, it is also found that they have proper motions of their own. Any great change in magnitude or form, especially any separation into two or more, is generally accompanied by a sudden forward movement in the direction of the sun's rotation.

FIG. 1.



But the most singular fact about the spots remains to be stated. Their number is periodically variable, the periodicity being somewhat irregular, but the time not differing much from eleven years. This discovery was first announced by Schwabe in 1851, and has since been abundantly verified. The number of different spot-groups observed during a year sometimes rises as high as 350, or nearly one new one every day, and sometimes falls as low as 24, or only two a month. 1828, 1837, 1848, 1860, and 1871 were years of spot-maximum; equally-marked minima occurred in 1833, 1844, 1855, and 1867. It is found that, during the years of maximum, the magnetic disturbances on the earth are also at a maximum, and *vice versâ*. Very recently also Hornstein announces a variation in the average *height of the barometer* and its daily range following the same law, and Meldrum, Lockyer, and Symons think they find a relation between the annual amount of *rainfall* on the earth's surface and the number of the spots; the rainfall, according to their calculations, being some 20 per cent. greater during the years of spot-maximum than at the minimum. Jelinek, however, denies this as the result of his investigations, and the fact can by no means be regarded as established.

As to the constitution of the sun, and the cause and nature of the spots, opinion is still much divided. The small

specific gravity of the whole mass, however, is greatly in favor of the present prevailing doctrine that the sun is mainly gaseous, but covered by a sort of luminous shell of cloud formed by the precipitation of the vapors which are cooled by external radiation. According to this view—of which Faye claims to be the originator and is the main defender—the central core of the sun is only feebly luminous because purely gaseous, while the dazzling surface, or *photosphere*, as it is called, owes its brilliance to the minute liquid incandescent particles which result from condensation. The spots are supposed to be cavities in this cloud-layer, which according to Faye are caused, like eddies in a river, by the unequal velocities of neighboring portions of the photosphere, resulting from the peculiar law of the sun's rotation which has been already stated. These eddies, Faye supposes, would form funnel-shaped hollows into which the cooler overlying atmosphere—of which more anon—would settle, and by its absorption produce the observed darkening. According to this view, of course the spots ought to be nearly round, and to exhibit a marked gyratory movement, which, unfortunately, is seldom the case. And yet no other theory seems to be on the whole more satisfactory, or even as much so. Secchi maintained for a time that they were openings formed by explosions from below, a view much resembling that proposed by Herschel long ago; and Zöllner, who, however, considers the body of the sun to be *liquid*, sees in them slags or scoriæ floating on a molten surface and surrounded by clouds; and Vicaire substantially agrees with him. As matters stand, it must be admitted that no theory yet proposed meets all the conditions.

As to the periodicity of the spots, Carrington and De la Rue consider that their observations show a connection between the positions of the planets and the number of spots: this, however, remains very doubtful, and it is difficult to imagine what can be the bond of connection.

The amount of heat radiated by the sun per minute admits of pretty accurate measurement, and was determined many years ago by Pouillet and Sir John Herschel, whose results have since been verified and slightly corrected. It is found that the sun's radiation would melt a shell of ice covering its own surface to a depth of between 39 and 40 feet in one minute of time. This, however, gives us no knowledge of the *temperature* of the solar surface, which as yet is entirely undetermined, and probably undeterminable, for there is no reason whatever to assume that it is anything like uniform throughout. At any rate, the estimates of different authorities are discrepant. Secchi sets it at 20,000,000° F., Ericsson at 7,000,000, Zöllner as 60,000, and Vicaire at 4000 to 6000, and Violle, the most recent and thorough investigator of the subject, agrees with him. The temperature and amount of radiation have not materially changed for the last 2000 years, as evidenced by terrestrial climatology. According to Faye, the expenditure of heat is supplied by the passing of portions of its mass from the gaseous state to the liquid or solid, with a corresponding diminution in its bulk. A contraction of about 125 feet per year in the solar radius would satisfactorily account for the whole.

The photosphere is overlaid by an atmosphere containing in its lower regions nearly all the materials which enter into the composition of the sun, while higher up the lighter gases alone prevail, the distribution not following, however, the laws of gases in equilibrium, but being largely dependent on dynamical actions. This atmosphere is of course invisible under ordinary circumstances, but reveals itself to the spectroscope, and at an eclipse forms the so-called *corona*, the most beautiful of all the spectacles ever seen in the heavens.

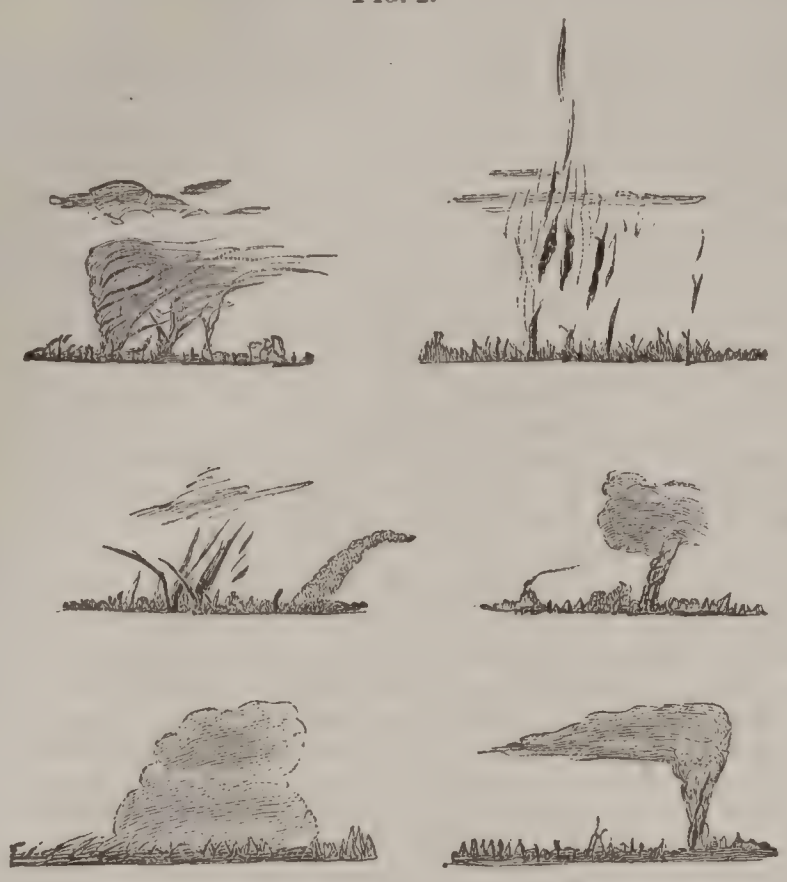
As every one now knows, the spectrum of sunlight is a continuous band of color crossed by numerous black lines, which are especially crowded and intense in the indigo and violet. The cause of these lines remained a mystery until, in 1859, Kirchhoff explained it by showing that they are due to the filtration, so to speak, of the light from the photosphere through an atmosphere containing metallic vapors. He showed that while such a vapor by itself would give a characteristic spectrum of bright lines, this spectrum would be *reversed*, and show itself as a spectrum of black lines, whenever a light of sufficient intensity was made to traverse the vapor from behind. Thus, in the lines of the spectrum is found certain proof of the existence in the solar atmosphere of the following substances—viz. iron, titanium, calcium, manganese, nickel, cobalt, chromium, barium, sodium, magnesium, copper, hydrogen, zinc, sulphur, cerium, strontium, and potassium. The portion of the solar atmosphere containing these substances, at least in quantity and condition to be accessible to spectroscopic observation, does not extend more than from 500 to 1500 miles above the photosphere. For a few moments at an eclipse, when the last segment of the sun has just vanished, the spectrum of this lower atmosphere becomes visible: the lines, which we are accustomed to see intensely black, flash out brilliant with color, and then as the moon moves on fade rapidly away, enduring only for two or three seconds.

During an eclipse also certain other very beautiful and singular appearances present themselves. Hanging on the edge of the moon there are usually several rose-colored "prominences" or "protuberances," to use the non-committal names by which they were first described in 1842. After their nature had been long debated, the spectroscope was applied to them in 1868, and at once showed them to be great clouds or flames (mainly composed of hydrogen, though also containing other elements) which seem to float above the sun in some upper atmosphere like our terrestrial clouds. Immediately afterward, almost simultaneously, but independently, Janssen and Lockyer made their elegant discovery, that with the spectroscope these objects can be observed without an eclipse, and Lockyer showed them to be mere extensions of a stratum of incandescent hydrogen which overlies the photosphere and atmosphere of metallic vapors. To this rose-colored stratum, whose existence, however, had been recognized before by Arago, Grant, and others, he gave the name of "chromosphere." As seen with the spectroscope, it is found to have an average depth of from 3000 to 8000 miles, but its upper surface, though well defined, is exceedingly irregular, resembling a sheet of flame tormented and driven by the wind. It seems to be not a continuous *layer* of gas, but rather to be made up of countless jets and flames, expelled through spiracles and vents in the photosphere. Its spectrum shows, besides the four bright lines of hydrogen, a brilliant line of unknown origin in the yellow, designated as $D_3$ from its being very near to the so-called D lines of sodium, but a little more refrangible; also a line about two-thirds of the way from F toward G, which Lorenzoni has called *f*, and which coincides with one of the lines of cerium, and a seventh faint line of unknown origin about one-third of the way from *a* (not A) toward B. In addition to these seven lines, those of magnesium, sodium, barium, and many others are *generally* present, and at times the number becomes very great. The writer has published a catalogue of 273. The protuberances are mere extensions of this chromosphere: here and there, especially in the neighborhood of spots, the chromospheric jets ascend to a great altitude, and the incandescent hydrogen spreads out into enormous clouds, of forms as beautiful, varied, and changeable as those to which we are accustomed in our terrestrial sky. It is customary to distinguish them into two classes, the cloud-formed and the eruptive. The former are comparatively permanent, floating often for days over the same region, usually connected by slender filaments to the chromosphere below, but sometimes free; generally cirrous in their texture, but sometimes rounded in outline like a cumulus. They are often enormous in their dimensions, attaining altitudes of from 30,000 to 100,000 miles, and a horizontal extent twice as great. They are found alike in the polar and equatorial regions, and seem generally to indicate comparative quiet in that portion of the solar atmosphere where they happen to be lying. The eruptive prominences, on the other hand, are generally composed of comparatively short and nearly vertical jets and filaments, of vivid brightness, and the most vivacious instability of form and motion. Velocities of 20, 50, and even 200 miles per second are often observed. These phenomena are especially common *around* (not *in*) the spots. When a spot approaches the limb of the sun, the whole neighboring region is usually found to be alive with jets and eruptions. Faye accounts for this by supposing that the chromospheric hydrogen is sucked down by the vortex which he considers to constitute the nucleus of the spot, and then being liberated rises from below through the photosphere immediately surrounding. Directly over the centre of the spot, according to Respighi, the chromosphere is somewhat depressed, but Secchi denies this. The changes in the appearance of the eruptive prominences are exceedingly rapid. They have been known to attain an elevation of 200,000 miles in twenty minutes of time, and then entirely disappear within half an hour. Fig. 2 illustrates some of the different prevailing forms.

The corona with which the sun is surrounded during a total eclipse was long a subject of hot dispute. Its appearance is much like the "glory" with which the old painters encircled the heads of saints. Close to the sun is a ring of pearl-colored dazzling light, which rapidly decreases in brightness as the distance from the sun increases, and assumes a distinctly radiated structure. Its rays, with here and there distinct dark gaps between them, extend to a distance equalling the radius of the sun, and sometimes its diameter, and are terminated by an irregular outline somewhat star-like in form, having from four to six points, but not symmetrically placed. Some held that it was caused

by the action of a lunar atmosphere, long since, however, proved not to exist, at least in extent and quantity to account for the observed appearances. Others, and notably

FIG. 2.



Mr. Lockyer, contended almost obstinately that it was mainly if not wholly a phenomenon of our own atmosphere, being led to this belief by the fact that the appearance of the F line in the spectrum of the chromosphere shows that at the surface of the sun the pressure of the solar atmosphere is very small (not more than three or four inches of mercury). It is of course a natural inference that the solar atmosphere cannot be very extensive; and yet it is a mistaken conclusion. Whether the smallness of the pressure exerted by the "coronal atmosphere," as Janssen calls it, upon the underlying strata is due to its intrinsic and almost inconceivable rarity, like that of comets' tails, or whether it is due to the possible fact that its particles do not rest at all upon what is below them, but are flying out into space, repelled by some unknown force, or whether the difficulty is to be removed by some as yet unimagined explanation, is not certain; but that this "coronal atmosphere" exists, and is the principal cause of the phenomena described, is beyond doubt. Its existence was first demonstrated by the observations of Prof. Harkness and the writer at the eclipse of 1869, when they found the spectrum of the corona to be characterized by a bright line in the green, at 1474 of Kirchhoff's scale. The observation, conclusive if correct, was for a time discredited in some quarters, but was fully confirmed at the eclipse of 1870; and in 1871, photography finally, and to the satisfaction of all, completely settled the matter by showing the identity in extent and details of the phenomena visible at stations many hundred miles apart along the track of the shadow. Of what material this coronal atmosphere is composed is still uncertain. The line 1474, with an ordinary spectroscope, appears to coincide exactly with a line in the spectrum of iron; but with a powerful diffraction spectroscope the writer has recently found that the corresponding dark line in the ordinary solar spectrum is *double*, the less refrangible component being due to iron, while the other, which is the true corona line, is probably due to some as yet unknown substance as much rarer than hydrogen as that is lighter than anything else with which we are acquainted. The real nature of the corona, and the causes of its peculiar configurations and structure, remain a problem as yet unsolved; we have, apparently, somewhat analogous phenomena in our own terrestrial aurora borealis and in those presented by the tails of comets, but whether the resemblances are based on any substantial identities is yet to be determined.

In preparing this article continual reference has been made to Proctor's *The Sun Ruler of the Planetary System*, and to Secchi's *Le Soleil* and its German translation by Schellen, which contains in an appendix a very complete account of the bibliography of the subject. To these works the reader is referred for completer information, and to the papers by Faye, Secchi, Vicaire, and others which have appeared in recent numbers of the *Comptes Rendus* of the French Academy, as also those in the *Astronomische Nachrichten* by Spörer, Zöllner, and Wolf. C. A. YOUNG.

**Sun'apee,** p.-v. and tp., Sullivan co., N. H. P. 808.

**Sun'-Birds,** the Promeropidæ, a family of small, brilliantly-colored, slender-billed birds, found in the Old World, and chiefly in hot countries. They represent the humming-birds of the New World, and some of them approach quite near the humming-birds in appearance and habits.

**Sun'bury,** county of New Brunswick, Canada, bisected by the navigable river St. John. Area, about 1000 sq. m. It is level, densely timbered, and in some parts very fertile. Cap. Oromocto. P. 6824.

**Sunbury,** tp., Livingston co., Ill. P. 891.

**Sunbury,** p.-v., Berkshire tp., Delaware co., O., on Cleveland Mount Vernon and Columbus R. R., has 1 weekly newspaper. P. 236.

**Sunbury,** v., Clay tp., Butler co., Pa. P. 216.

**Sunbury,** p.-b., cap. of Northumberland co., Pa., on Philadelphia and Erie, Northern Central, Shamokin Valley, Sunbury and Lewistown, and Danville Hazleton and Wilkesbarre R. Rs., 53 miles N. of Harrisburg, contains several churches, good schools, 1 bank, 1 daily and 3 weekly newspapers, 2 planing and saw mills, fine hotels, and the repair-shops of the Philadelphia and Erie R. R. P. 3131.

J. E. EICHHOLTZ, ED. "DEMOCRAT AND DAILY."

**Sun'cook,** p.-v., Pembroke tp., Merrimack co., N. H., at confluence of Suncook and Merrimack rivers, and at junction of Suncook Valley with Concord R. R. of New Hampshire.

**Sun'da Islands** is the common name of that chain of large islands belonging to the Malay Archipelago which, commencing with Sumatra and ending with Timor, separates the Java Sea from the Indian Ocean.

**Sun'day** [Sax. *Sunnan dæg;* Lat. *Dies solis;* in Sanskrit and other languages of India the name of the first day of the week has the same signification], the secular name of the first day of the week, which is held among Christians as a Sabbath or rest-day and in remembrance of Christ's resurrection. As soon as the Christian religion came to be recognized by the state, laws were enacted for the observance of the Sunday. Constantine (321) prohibited all business except agricultural labor, and all legal proceedings except the manumission of slaves. Subsequent emperors made similar enactments. Theodosius II. (425) forbade games and theatrical exhibitions on Sunday (*Cod. Theod.*, xv. tit. 7). The most strict of these laws is that of Leo and Anthemius (469, *Cod. Justin.*, iii. tit. 12). The laws of Theodoric the Great, several kings of France, and especially Charlemagne (813), prohibited servile work and secular business.

In England, Sunday laws were of very early origin. The common law distinguished Sunday from other days by allowing no judicial acts on that day, according to the maxim, *Dies dominicus non est juridicus.* The code of Ina, king of the West Saxons (about 693), punished servile work by fine. Alfred the Great (876) forbade work, traffic, and legal proceedings on Sunday. Similar laws were in force through all the Saxon period, and were often enacted in subsequent reigns. The statute 27 Hen. IV. c. 5 enacts that all fairs and markets on Sundays, except in harvest, shall cease on pain of forfeiture of goods. The statute 5 and 6 Edw. VI. c. 3 makes Sundays, with Christmas, Easter, etc., holy days, but permits work in harvest and in other cases of need. The statute 1 Eliz. c. 2 punishes by fine persons absenting themselves from church without excuse. In 1618, James I. issued his *Book of Sports*, in which he declares certain games, sports, etc. lawful on Sundays after divine service. Charles I. in 1638 reissued the *Book of Sports.* The most important of the English statutes is 29 Chas. II. c. 7, which prohibits all worldly labor or business (works of necessity and charity only excepted), the sale of goods, travelling for purposes of trade, and the serving or executing of any process or warrant, except in case of treason, felony, or breach of peace. The dressing of meat in families, and its sale in inns and eating-shops, and the crying of milk before nine and after four, are allowed. This statute, somewhat modified by subsequent laws, is the present Sunday law of England, and lies at the basis of the Sunday laws of this country.

In France, during the Revolution, when the Christian calendar was abolished and the decade substituted for the week, each tenth day was made a rest-day, and its observance was enforced by a law (17 Thermidor, An. VI.) which required the public offices, schools, workshops, stores, etc. to be closed, and prohibited sales except of eatables and medicines, and public labor except in the country during seed-time and harvest. On the restoration of the Gregorian calendar, Sunday was recognized in the *Code Napoléon* (Art. 25, 260). A law of 18 Nov., 1814, prohibited ordinary labor, traffic, etc., and, though declared by the courts in 1838 and 1845 to be still in force, it has been for many years a dead letter. In Switzerland, recent legislation has granted to railway employés and all government office-holders the concession of at least one Sunday in every three. In some of the cantons steps have been taken for

the further restriction of Sunday labor. The question is agitated in Belgium and Germany of better protection by law of Sunday-rest for operatives.

The early American colonists brought with them the observance of Sunday, both as a religious and as a civil institution, and both the religious and secular observance of the day was enforced by laws similar to the English statutes, though modified by the popular feelings and modes of life. The early laws of Massachusetts, Connecticut, Georgia, South Carolina, and Virginia compelled attendance at church, the Massachusetts law (1782) providing that such attendance was not required where there was no place of worship which the person could conscientiously attend. (The oft-quoted "Blue Laws" of Connecticut are a pure fiction, first published in London in 1781 by Samuel Peters in revenge for being driven from the colony on account of his obnoxious royalism.) After the establishment of the Federal government, as the separation between Church and State came to be more fully understood and carried out, the earlier Sunday laws were modified in conformity with this principle, and the legislatures and courts have been careful to distinguish between Sunday observance as a religious and as a civil institution, and to enforce only the latter. The existing Sunday laws rest chiefly upon the following grounds: The right of all classes, so far as practicable, to rest one day in seven; the right to undisturbed worship on the day set apart for this purpose by the great majority of the people; the decent respect which should be paid to the religious institutions of the people; the value to the state itself of the Sunday observance as a means of that popular intelligence and morality on which free institutions are conditioned. Sunday laws exist in every State of the Union, with the partial exception of Louisiana, which at the time of its admission was inhabited by persons of French descent, with laws and usages differing from those of the other States, where the Anglo-Saxon element predominated. The Federal Constitution provides that Sunday shall not be reckoned in the ten days within which the President may return any bill; the Federal courts and the offices of the departments are closed; the service of the post-offices is restricted; no session of Congress is held, and provision is made by act of Congress for the observance of Sunday in the army and navy. Beyond this, Sunday legislation does not come within the sphere of the Federal government. The statutes of the States differ somewhat in details and strictness. Sunday is everywhere held as a *dies non*. Public affairs are suspended; the legislatures do not sit; courts are not held, except that in some cities police courts are open for an hour or two; legal processes are not served. In most of the States common labor and traffic are prohibited; contracts made or for service on Sunday are invalid; public amusements are restricted or forbidden. In many of the States exception is made in favor of those who observe the seventh day of the week. In Louisiana the only Sunday law is that which makes it (with Christmas, New Year's Day, etc.) a public rest-day, and provides that citations shall not issue, nor proceedings be had, nor suits instituted on that day, and that it shall not be reckoned in computing interest and in protests, etc. The constitutionality of Sunday laws has been decided frequently by the highest courts of the several States.

(Robert Cox, *Literature of Sabb. Question* (Edinb., 1865); *Amer. Law Review*, vol. ii.; *Prot. Epis. Quar. Rev.*, vol. vii.; Mark Hopkins, *Sabb. and Free Institutions*, in Doc. 29 of N. Y. Sabb. Committee; Judge W. F. Allen, opinion in *Lindenmüller* vs. *The People*, 33 Barbour, 548. See LORD'S DAY, SABBATH.) W. W. ATTERBURY.

**Sunday Letter.** See EASTER, by PRES. F. A. P. BARNARD.

**Sunday-Schools.** The importance of this subject may be inferred from the fact that in 1874 there were said to be 2,900,000 pupils in Sunday-schools connected with Methodist, Baptist, Presbyterian, and Congregational churches in the U. S. Sixty years before, such an institution as a Sunday-school connected with a church was a thing almost unknown. The Sunday-school of the present day has several distinctive features: (1) It is held on the first day of the week, a day observed by Christians as holy time, a day on which there is a general suspension of secular labor, on which public schools everywhere are closed, and which affords peculiar facilities for instruction in religious truth. (2) It is a school for positively religious instruction. It is not its object to teach reading, writing, and arithmetic, or to furnish occupation for the idle and entertainment for the listless, or merely to secure a reformation of manners and morals. Its aim is higher and avowedly religious. (3) It is thoroughly a Bible school. The Holy Scriptures furnish the basis, and almost exclusively the textbook, of instruction. Ecclesiastical history, systems of theology, denominational controversies are subordinated to the study of the Bible. Even Church catechisms are not made prominent; indeed, to a great extent they are laid entirely aside, and the pupil's attention is directed to the meaning of the Scriptures, and to the duties which are to be inferred from them. (4) It is for children and youth universally, whether rich or poor, Christian or pagan, educated or illiterate. Its advantages are freely offered to all, without any charge, direct or indirect, for tuition or for incidental expenses. (5) The pupils are usually grouped together in small classes, comprising those of equal attainments, and each class is brought into very close relations, it may be for a number of consecutive years, with its teacher. (6) Instruction is given by unpaid lay teachers, who undertake their task as one of the attractive and appropriate forms of Christian work. (7) The instruction is supplementary to that given by the family, the state, and the ministry. While many pupils may be found whom the public schools do not reach or who are under no Christian influences at home, the great mass of Sunday-school children attend the common school throughout the week, belong to nominally Christian families, and come in some measure within the reach of pulpit instruction. The Sunday-school has a field upon which the state cannot enter, gives instruction with a regularity and method which few households can secure, and gains a nearer access to young minds than preachers in miscellaneous assemblies expect to find. (8) The Sunday-school is to a very large extent independent of ecclesiastical control. The direction of its affairs is not usually given to the constituted authorities of the congregation. The ecclesiastical books and digests prescribe no rules for conducting it. It is rather an *imperium in imperio*, or at least a voluntary organization very informally constituted, quite flexible in its methods, having no pecuniary interests to create trouble, and managed very much as the superintendent and teachers prefer.

*History.*—To Robert Raikes of Gloucester, England, is to be ascribed the distinction of having originated a movement in the interests of philanthropy some results of which are now seen in the modern Sunday-school system. His plans, first made public in the *Gloucester Journal* (1783), of which he was editor, were afterward unfolded more at length and discussed in various numbers of the *Gentleman's Magazine*. Having had his attention called in 1781 or 1782 to the ignorance and poverty of certain children in the suburbs of his native city, he started among them, on his own responsibility, what in modern phrase would be called a missionary enterprise, hiring some women to teach them to read and to recite the Church catechism. Boys and girls were received from six to fourteen years of age. They were taught from ten to twelve o'clock on Sunday mornings, and again in the afternoons before and after church service. A clergyman, the Rev. Mr. Stock, consented to assist by going the rounds on Sunday afternoons to examine the progress made and enforce order and decorum. Aiming thus to benefit the very poor, and to teach children for whom no public instruction was provided, the founder regarded the Sunday-school as a means of "civilizing the common people of the kingdom." The success which attended these schools in Gloucester commended them to public favor. The queen admitted Mr. Raikes to an audience at Windsor, and talked with him for an hour about the results. In 1785 a society was formed for establishing Sunday-schools throughout the British dominions. Four years later, 300,000 scholars were enrolled as attendants. The teachers continued for some years to receive wages, the men being paid two shillings a day, and the women one shilling or one and sixpence, and each teacher having thirty or forty scholars. In the schools founded by the society reading was taught, but not writing or arithmetic. The schools, however, encountered occasional opposition—sometimes on the ground that they were not under the direction of clergymen, and sometimes from persons who discountenanced all education of the poor. In Scotland, on the other hand, it was argued that Sunday-schools of that sort were unnecessary, inasmuch as sufficient secular instruction was given in the parish schools, while religious training was provided for in other ways.

These movements in Great Britain attracted attention on this side of the Atlantic, and led to the organization in Jan., 1791, of the Philadelphia Society for the Support and Institution of First-Day or Sunday-Schools. Among the founders were Bishop White, Dr. Rush, and Mathew Carey, the first of whom was president. The object aimed at was to furnish education to youth who lacked advantages, and to promote a reformation of morals and manners. Paid teachers were employed, and they gave instruction in reading and writing. The society was afterward incorporated, and in 1800 had expended $4000 and given instruction to 21,027 pupils. At the present time it expends about $600 per annum on schools in the city. The extensive organi-

zation of Sunday-schools for *religious* instruction characterizes the second decade of the present century. In 1811 and 1812 the Rev. Robert May, an English missionary on his way to India, visited New York and Philadelphia and opened evening schools on the English plan. In 1814, Mrs. Isabella Graham of New York began a Sunday-morning school for ignorant adults. Many schools were founded in Connecticut in the year 1816. In October of that year one was commenced in Dr. Morse's parish in Charlestown, Mass., but not without some hesitation, lest the giving of secular instruction should be a profanation of the Lord's Day. In Massachusetts the law made ample provision for teaching children to read and write, and Sunday-schools were regarded as necessary only for such cities as New York and London, where ignorant parents neglected the religious education of their children and no adequate provision was made for secular tuition. In many cases the churches looked askance upon the Sunday-school, made no provision for its maintenance, and left the organization and management of it entirely to individuals. Consequently, its growth as a religious institution was attended with serious disadvantages, which were, however, counterbalanced by the organization of union societies for the founding and nurture of Sunday-schools. Thus, in 1816 were founded the New York Female Union Society for Sabbath-Schools and the New York Sunday-School Union; in 1817, the Philadelphia Sunday and Adult School Union; in 1824, the American Sunday-School Union; in 1825, the Massachusetts Sabbath-School Union; and in 1827 the Sunday-School Union of the Methodist Episcopal Church. In these societies Christian people of different communions cordially co-operated. Many schools founded in cities and in new settlements were entirely undenominational, and had no connection with any Church, while in other places the custom grew up to have a school organized for the children and youth of every distinct congregation. In 1830 the American Sunday-School Union announced its purpose to establish a Sunday-school through the Western States in every neighborhood that was without one, and three years afterward it enlarged its plan so as to include the Southern States. Schools thus founded became in multitudes of cases the *nuclei* for churches. Similar work of a missionary character has been extensively prosecuted by other societies under strictly denominational management; and so heartily have the people approved of the Sunday-school as a permanent institution that for thirty years or more it has been expected as a matter of course that the members of every local church would sustain such a department for the religious nurture of their children.

It would be a mistake, however, to infer from the recent date at which the modern Sunday-school system came into favor that the importance of the religious education of youth had not been appreciated previously by the Protestant churches. Two hundred years before the days of Raikes a rubric in the Book of Common Prayer directed the curate of every parish, half an hour before evensong on Sundays, to examine the children of his parish in the catechism, and enjoined on fathers and masters to send their children and servants to him for this purpose. The schools established by Luther in Germany were kept seven days in the week, thoroughly providing for the religious instruction of the pupils. John Knox introduced into Scotland a system of Sunday-schools. The early history of New England shows that a weekly exercise in the Westminster Assembly's Catechism was one of the ways by which the children of Christian families were indoctrinated in the truth, and this was supplemented by the instructions of the parish minister. John Wesley is said to have instituted Sunday-schools in Savannah in 1737. According to I. D. Rupp, Sunday-schools were established in Lancaster co., Pa., before the period of Raikes, and C. S. Rafinesque asserts that they have existed for centuries in Italy.

The establishment of Sunday-schools is but part of a modern movement in respect to general education. Robert Raikes was the contemporary of Rousseau, Basedow, and Pestalozzi. The *Emile* of the former maintained the doctrines that it is the function of the State, and not of the Church, to teach, and that teachers should be of the laity, and generally married. Basedow founded a model school at Dessau in 1774, reducing to practice the ideas of Rousseau, and Pestalozzi in 1775 gathered fifty pauper children into his own house, aiming to relieve their wretchedness and impart to them instruction. Thus early were influences at work to revolutionize the methods of secular education, and the fruit is seen not only in colleges and public schools, but also in the provision now made for the religious training of children in schools where the laity, and not the clergy, are the teachers, where Church catechisms and tenets are generally laid aside, and where the ecclesiastical organization attempts no control over the appointment of teachers, or even the selection of topics for study.

Sixty years have witnessed not only a large increase in numbers of schools and pupils, but also great changes in the accessories of Sunday-schools. It is sufficient to mention such apparatus as libraries, question-books, hymn- and tune-books, illustrated papers, blackboards, maps, and mottoes. Each school must have its circulating library of juvenile literature, its hymnal arranged with sprightly, fascinating music, its pictorial paper enlivened with anecdote and replete with instruction, and some form of text-book to outline the course of study and instruction. Furthermore, the Sunday-school has ceased to be an institution for the poor exclusively or for the young exclusively. Special inducements are indeed presented to the poor by providing them garments and by occasional gifts at Christmas, but social distinctions are done away, and all classes of the people are expected to be represented. Not seldom a whole congregation of adults becomes organized as a Sunday-school for Bible study, in which the eldest have their place no less than the children. Sunday-schools have had their effect even on church architecture, so that no house of worship now claims to be complete which does not provide special accommodations for teachers and scholars engaged in the study of the Bible. Different rooms are needed for the various departments, the arrangement of seats must bring the pupils near to their several teachers, and all must be so arranged as to make it easy for all to have in common some general exercises of devotion.

While, on the one hand, the union character of Sunday-schools is less marked than formerly, as each school is sheltered under a denominational roof, the system has such flexibility that those who are personally interested in it are often brought together in consultation without being fettered by sectarian rules. Hence we hear of county and State conventions for the discussion of matters of common concern. A system of uniform lessons for all the Sunday-schools of the country has of late years become very popular, and has been adopted by many schools in Great Britain and on the Continent, and it has been estimated that more than 5,000,000 people are now studying the same passage of Scripture every Lord's Day. It is impossible to recount the immense service which the Sunday-school has rendered as a means of Christian education or as a work of philanthropy among the poor and degraded. Multitudes of children from poor and ungodly homes have learned for the first time in Sunday-schools the gospel story, and have carried home with them new ideas which have ripened into new lives. Visits from their teachers on week-days have brought the extremes of society into personal contact, and opened doors of influence which otherwise had remained closed; and besides the remote effects which have to do with a future life, the time and money spent on Sunday-schools are more than compensated by their inculcation of virtue, their steady influence in the regeneration of society and the amelioration of its woes, and saving from vice and crime millions who have enjoyed their advantages.

*Literature.*—A full list of books referring to the history and theory of Sunday-schools would include not less than 200 volumes. Among them are such as these: (1) *History.* *The Gentleman's Magazine* (1785–1800); Belcher's *Life of Robert Raikes;* Powers's *Rise and Progress of S. S.*, containing *Life of Raikes and Fox* (1863); Bray's *History of S. S.* (1847); *History of Mass. S. S. Society* (1850); Ferris's *Semi-Centennial Discourse* (1866); Watson's *First Fifty Years of the S. S.* (London, ? 1863); *American Quarterly Register for 1829;* Baird's *Religion in America* (1844); Sprague's *Life of Dr. Morse* (1875); also the *Annual Reports* of American S. S. Union (1825 *seq.*), New York S. S. Union (1817 *seq.*), New York Female Union (1817 *seq.*), Massachusetts Sabbath S. Union (1826 *seq.*), Massachusetts S. S. Society, Connecticut S. S. Union (1825 *seq.*), Methodist S. S. Union (1841 *seq.*), Foreign S. S. Association. (2) *Theory and Practice.* Packard's *Teacher Taught* (1841) and *Teacher Teaching* (1865); Todd's *S. S. Teacher* (1837); Collins's *Teacher's Companion* (1842); Mrs. David's *The Sunday-School* (London, 1847); Inglis, *The Sabbath-School* (1850); Alexander's *American S. S. and its Adjuncts* (1856); Hart's *Thoughts on S. S.* (1864) and *S. S. Idea* (1870); Taylor's *Sunday-School Photographs* (1864); Tyng's *Forty Years in S. S.* (1866); Pardee's *S. S. Index* (1868); House's *S. S. Handbook* (1868); Eggleston's *Manual* (1869); Trumbull's *Children in the Temple* (1869); Vincent's *Church School and its Officers* (1872); Cachemaille, *Church S. S. Handbook* (London, 1872); *Evangelical Alliance Essays* (1874). (3) *Periodicals.* *American S. S. Magazine* (1823 *seq.*); *Church S. S. Magazine* (London, 1865 *seq.*); *S. S. Teacher* (Chicago, 1866 *seq.*); *S. S. Teacher* (London, 1868 *seq.*); *The Hive* (London, 1868 *seq.*); *S. S. Helper* (Chicago, 1870 *seq.*); *S. S. World, S. S. Times,* and many others.

E. W. GILMAN.

**Sun'derbunds,** the name generally given to that part of the delta of the Ganges which extends between the

Hoogly and the Megna. It consists of a great number of smaller and larger islands, covered with dense forest vegetation, and infested by tigers and crocodiles of uncommon size and singular ferocity. As this tract of land is in the highest degree pestiferous, the government has taken measures in order to improve it, or at least make it innoxious, and in many places the forests have been cleared and the ground transformed into sugar and rice fields.

**Sun'derland,** town of England, county of Durham, on the Wear, near its mouth on the North Sea, forms, together with its suburbs—Wearmouth on the S. bank and Monk-Wearmouth and Southwick on the N. bank of the river—one parliamentary borough of 104,490 inhabitants. It has extensive docks and shipbuilding yards along its harbor; large manufactures of glass, earthenware, rope, sailcloth, anchors, and other ironware, and is, next to Newcastle, the greatest coal-shipping port in the world.

**Sunderland,** p.-v. and tp., Franklin co., Mass., on Connecticut River and on New London Northern R R., is noted for the beautiful mountain-scenery of "Sunderland Park" and for a cavern of considerable dimensions. P. 832.

**Sunderland,** p.-v. and tp., Bennington co., Vt., on Batten Hill River and on Harlem Extension R. R. P. 553.

**Sunderland** (La Roy), b. in Exeter, R. I., in 1804; entered the ministry of the Methodist Church in 1823; became prominent in the temperance and anti-slavery movements and in other reforms of the day, especially in those relating to physiology and psychology; was connected, as editor or contributor, with various journals and periodicals, and published many works, among which are—*A Question on Temperance* (1828), *Essay on Theological Education* (1834), *Testimony of God against Slavery* (1834), *Anti-Slavery Manual* (1837), *Christian Love* (1837), *Mormonism Exposed* (1842), *Pathetism,* etc. (1843, 1847, 1850), *Book of Psychology* (1852), *Book of Human Nature* (1852), *The Trance, and how Introduced* (1860), and *Manual of Self-Healing by Nutrition, without Medicine* (1862).

**Sunderland** (Spencer, Earls of). Henry Spencer, the first earl, b. in 1620; succeeded upon the death of his father in 1633 to the title of Lord Wormleighton; joined Charles I. at the beginning of the civil war; fought at Edgehill; was created earl of Sunderland in June, 1643, and was killed at the battle of Newbury, Sept. 20, 1643. His wife was the sister of Algernon Sidney.—Robert Spencer, his son, the second earl, b. in Paris about 1641; lived on the Continent during the time of the Commonwealth; returned to England at the restoration of Charles II.; was sent on embassies to Madrid and Paris in 1671, and became a privy councillor in 1674 and secretary of state in 1678. He at first opposed and then supported the bill for the exclusion of the duke of York, afterward James II., and was removed from office by Charles in 1681, but was reinstated in 1682, and exercised a controlling influence in the government during the remainder of the reign, and was continued in office by James II., who succeeded to the throne in 1685. He turned Roman Catholic in 1687, but was detected in a secret intrigue with the prince of Orange; was dismissed in 1688, and took refuge in Holland; was specially excepted in the act of indemnity granted by the prince of Orange upon his accession as William III. Having become Protestant again, he returned to England in 1690; gained the favor of William, and in 1695 was made lord chamberlain and privy councillor, but retired from public life in 1697 with the reputation of having been the basest public man of his age. D. at his seat of Althorp Sept. 28, 1702.—Charles Spencer, his son, the third earl, b. in 1674; professed liberal principles, and was returned to Parliament for Tiverton in 1695. His first wife, a daughter of the duke of Newcastle, having died, he married in 1699 a daughter of the duke of Marlborough, thereby strengthening his alliance with the dominant Whig party. He succeeded to the earldom in 1702; in 1705 was sent on embassies to Vienna and Berlin; in 1706 took part in negotiations for the union between England and Scotland; in 1707 was appointed secretary of state by Queen Anne; was dismissed in 1710, declining a large pension offered him by the queen. Upon the accession of George I. in 1714, he was made lord lieutenant of Ireland, in 1715 lord privy seal, and in 1717 secretary of state again and president of the council, and in 1718 first lord of the treasury. He was apparently deeply involved in the "South Sea Bubble," but the case having been investigated by the House of Commons, he was acquitted by a vote of 233 to 172, but was driven from office by Walpole in 1720. D. Apr. 19, 1722. By his marriage with the daughter of John Churchill, the great duke of Marlborough, he became the progenitor of the present ducal house, their son being created the second duke, and assuming the family name of Spencer-Churchill. A. H. Guernsey.

**Sundew.** See Drosera, Insectivorous Plants, and Pitcher Plants.

**Sun-Dial.** See Dial.

**Sun'field,** p.-v. and tp., Eaton co., Mich. P. 1106.

**Sun-Fish,** a name given for various, but never very obvious, reasons (but chiefly, apparently, because the species bask in the sun or have brilliant colors) to different aquatic animals. (I.) In the U. S. and Canada it is most frequently applied to species of fresh-water fishes belonging to the family Centrarchidæ, and chiefly to the genera *Pomotis* and *Lepomis.* These are readily recognized by the extension of the opercula backward into more or less enlarged or elongated membranous, highly-colored, ear-like lobes, and the radial formula—viz. dorsal fin with ten spines and ten or eleven rays, and anal fin with three spines and nine or ten rays; the colors are always quite brilliant. *Pomotis* has the pharyngeal bones wide, and armed with pavement-like teeth, and *Lepomis* has narrower pharyngeal bones provided with acutely conic teeth. The species are quite numerous, there being about three species of *Pomotis* and nine or ten of *Lepomis.* The best known in the Northern States are the (1) *Pomotis aureus* (= *P. vulgaris*); (2) *Lepomis auritus* (= *Pomotis appendix* or *rubricanda* of many authors); and (3) *Lepomis incisor.* The *P. aureus* is the common "sun-fish" of New England and the Middle States, and is at once recognizable by the ear-flaps being black tipped with scarlet, and by the orange spots of the sides. (1) The *L. auritus* is equally readily distinguishable by the very long black but bluish-edged ear-flaps. (3) The *L. incisor* has squarish black ear-flaps. The first is the smallest, and the last two the largest, of the species mentioned. Wherever found, they are generally among the most common fishes, and afford much sport to at least boyish anglers. They are quite carnivorous and bold fishes, and take the hook baited with the common earth-worm with avidity. (II.) On the sea-coast, to some extent, but more especially in England, it is given to species of Orthagoriscidæ (which see). (III.) In some parts of England the name is also applied to the basking shark (*Cetorhinus* or *Selache maximus*). (IV.) It is also frequently applied by sailors to the species of acalephs or jelly-fishes floating on the surface of the ocean.

Theodore Gill.

**Sunfish,** tp., Pike co., O. P. 628.

**Sun'flower,** the *Helianthus annuus,* a coarse and tall annual plant of the order Compositæ. It is often seen in gardens, and is well known for its large and showy compound flowers. It is a native of America, probably of Northern Mexico, but its original home is uncertain. In Europe the plant is raised for its seeds, which afford a good drying oil, nearly equal to that of linseed. The leaves are fed to cattle, the seeds to poultry, and the flowers yield good honey. The planting of sunflowers is reputed to be a preventive of miasmatic fevers. The pith is sometimes used instead of the true moxa.

**Sunflower,** county of N. W. Mississippi, intersected by Sunflower River. The surface is level and swampy, but very fertile. Cattle and swine are numerous. Staples, cotton, Indian corn, and sweet potatoes. Cap. Johnsonville. In 1874 a portion of the county was set off to form Leflore county. Area, 720 sq. m. P. 5015.

**Sungaria.** See Soongaria.

**Sunn Hemp,** the fibre of *Crotalaria juncea,* a leguminous herb of Bengal, extensively cultivated in India both for its fibre and as a forage-plant for cows. The sunn hemp is exported extensively. It is inferior to true hemp, but better than jute, and is used for cables and canvas.

**Sunnas.** See Sunnites.

**Sun'nites,** the principal of the two great divisions of Mohammedans, so called from their maintenance of the authority of the *Sunna* (Ar., "custom" or "legal usage"), a compilation of the sayings and teachings of Mohammed, his companions and immediate successors, which is rejected by the Shias (which see). They are therefore the orthodox believers, and comprise the Moslems of Arabia, Northern Africa, the Turkish empire generally, and most of those of Toorkistan. They are subdivided into four sects, the Hanefites, Malekites, Shafeites, and Hanbalites, named after their respective founders, of whom the two former flourished in the second, and the two latter in the third century after the Hegirah. The collection now known as the *Sunna* consists of many thousands of short "traditions," laws, apologues, and parables from many sources, few of which, however, are authentic.

**Sun Prairie,** p.-v. and tp., Dane co., Wis. P. of v. 626; of tp. 1610.

**Sun'rise,** tp., Chicago co., Minn. P. 240.

**Suns'bury,** tp., Monroe co., O. P. 1428.

**Sun'stroke, Insolatio,** or **Coup de Soleil,** prostration of the animal vitality from long exposure to the direct heat of the sun. The method of this nervous exhaustion may be by peripheral nerve-irritation in the extensive tract of overheated, congested skin, but more often is due to the overheating of the blood in the peripheral capillaries, and the sedative influence exerted by it upon the nutrition of the central ganglia. Sunstroke has been regarded as a state of paralysis of the vaso-motor or ganglionic nervous system. In its first form or stage, that of congestion and excitement, the surface of the body is intensely red and hot—a condition often disconnected with any actual sunburn, but due to general capillary relaxation and congestion consequent upon the impairment of the nerve-centres which control the elastic arterial walls. For the same reason, the various large glands and organs of the body—liver, spleen, kidneys, lungs—are engorged with blood, swollen, and very tender to touch. The brain is congested, stimulated to excessive and incoherent mental action. The temperature of the body may be 112° F. or more; the pulse full, hard, bounding; the heart's action tumultuous; the breathing is hurried, labored, and noisy; the conjunctiva reddened, pupil contracted; there may be headache, delirium, convulsions. In graver cases, either at the outset or later as a second stage, one of depression or shock following that of excitement, the various vital functions may be alarmingly depressed, indicating suspended nutrition and organic change of the irritated nerve-centres. The patient becomes unconscious; the pulse feeble, compressible, and irregular; breathing slow, irregular, stertorous; the surface may be cool and pale; convulsive action is absent, and the muscular system completely relaxed. Death may occur suddenly by syncope or paralysis of the heart, by pulmonary congestion, by exhaustion, or by convulsion. After death the blood does not coagulate, hence there is no marked *rigor mortis* or rigidity of the body. Physical fatigue, exhaustion, over-clothing, bad ventilation, deficient drinking-water, alcoholic excess, are predisposing causes of sunstroke. Disturbance of the natural moisture, evaporation and radiation from the skin, is regarded the immediate cause of the overheating of the blood; hence, a murky, damp heat is attended with more cases of sunstroke than when the atmosphere, though hot, is dry and clear. The treatment of sunstroke consists in promptly withdrawing caloric from the overheated body, or, when shock and coma are present, by diffusible stimulants and revulsive agents, maintaining strength and relieving cerebral congestion. The cold douche to the head, neck, and chest, evaporating lotions or ice-bag to the head and spine, the wet sheet swathing the entire body, and cold immersion are agencies to be employed with judgment to the overheated body with the best results. Bromides may be employed, but arterial sedatives, as digitalis or veratrum, are dangerous. Reversely, in coma and the sinking stage or form, sinapisms, blankets, and heat may be applied to the surface, rich liquid food, ammonia, and alcohol administered by mouth or rectum, blisters applied over the nape of the neck.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Sun-Worship** is an essential part of the religious system of the Parsees (which see). The ancient Peruvians, who worshipped every aspect of nature, paid the chief honors to the sun. The old Egyptians, the Greeks, the Italians, and the Celtic and Teutonic races, the East Indians, and some African pagans, were, as some heathen races still are, sun-worshippers. In fact, sun-worship is one of the most widely-diffused forms of nature-worship, the genial and fructifying warmth and brightness, the mysterious nature, and the constant course of the great luminary appealing powerfully to the religious feelings of the ruder peoples.

**Supercar'go,** a person who accompanies a cargo shipped to a foreign port, and is entrusted by the owners with its sale or exchange. The supercargo, as such, has no control over the management or navigation of the vessel, on board of which he is merely a passenger until the port is reached, although he may receive authority to direct the destination of the voyage. He is simply the agent of the owners of the cargo, and derives his sole authority from their instructions, although it is held that if by any unexpected emergency he is rendered unable to comply with the letter of his instructions, it is his duty to do the best he can for the interests of the owners.

**Supereroga'tion** [Lat. *supererogatio*, "more than is required"], **Works of,** in the Roman Catholic Church, good works performed by a Christian over and above his simple duty. These works constitute a fund of merit which is applied to the relief of souls in purgatory.

**Superheated Steam.** See Steam, by Prof. W. P. Trowbridge, A. M.

**Supe'rior,** tp., Osage co., Kan. P. 966.

**Superior,** tp., Washtenaw co., Mich. P. 1268.

**Superior,** tp., Williams co., O. P. 1627.

**Superior,** p.-v. and tp., cap. of Douglas co., Wis., at the head of Lake Superior, in lat. 46° 38′ N., lon. 91° 3′ W., contains a fine natural harbor, 3 churches, 3 excellent public-school buildings, handsome court-house and park, 1 newspaper, 1 lumber and 2 shingle mills, and 2 hotels. P. 1122. C. S. Douglas, Ed. "Times."

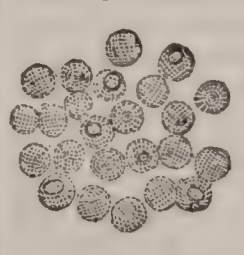
**Superior, Lake,** the largest fresh-water lake in the world, and indeed the largest of all lakes except the Caspian Sea, which is salt. It is roughly triangular in outline, and is bounded N. W. by Minnesota and the province of Ontario, N. E. by Ontario, and S. by Wisconsin and Michigan. Its area is over 31,400 sq. m.; elevation, 627 feet above the sea and 49 feet above Lake Huron. Its mean depth is about 1000 feet. The greatest length is 355 miles; breadth, 160 miles. The northern shores are high and broken, composed of Laurentian and Huronian rocks, and abounding in valuable silver-ores. The American side is generally lower and more sandy, and is especially rich in its abundant deposits of native copper, with which native silver is often associated, and in the not less valuable beds of red hematite iron ores, which are extensively wrought. Whitefish, sturgeon, and several noble species of lake-trout abound in its waters, which are singularly clear and cold. The lake is subject to severe storms, and the effect of the waves upon the sandstone of the Pictured Rocks and of Grand Island may be seen in the remarkably fantastic forms which attract hither many summer visitors. The islands are not very numerous. Isle Royale, the largest, also Grand Island and the Twelve Apostles, belong to the U. S.; and Pie, Michipicoten, St. Ignace, Montreal, Leach, the Slate Islands, Sandy Islands, Caribou, Silver, and many smaller islands are Canadian. Silver Island, though small, has extremely productive mines of silver. The lake never freezes over in winter, but is unnavigable at that season on account of the shore ice. (See also Lake.)

**Supernatural.** See Miracles, by Pres. J. H. Seelye, LL.D.

**Supper, The Lord's.** See Eucharist, by Pres. F. A. P. Barnard.

**Supplement,** in trigonometry, the result obtained by subtracting an angle from 180°. If the given angle exceeds 180°, its supplement is negative.

**Suppura'tion** [Lat. *suppuratio*, "abscess"], a term employed in medicine and surgery to designate the process of pus-formation on the granulating surface of wounds in abscesses and in unhealthy action or inflammation of the mucous and serous free membranes. Pus, popularly termed "matter," is a creamy-yellow, opaque fluid, composed of a liquid portion, *liquor puris*, and *pus-cells* or *corpuscles*. As it is developed in abscess or granulating wounds, either from degeneration of existing tissues or from hasty, imperfect, or retrograde cell and tissue formation, its constituents are to be studied only as vitiated and changed forms of the cellular and liquid elements of the blood or of the elementary cells, as lymph, epithelial, and mucous cells, which have but recently developed from the blood. The creamy consistency and yellow color of pus varies with the abundance or scarcity of the pus-cells in the liquor puris or colorless pus-serum. These pus-cells, though somewhat larger than the white blood, lymph, and mucous corpuscles, are not easily distinguishable. They are lacking in power to organize and form cells and tissues, and are characterized by the presence of one or several nucleated masses, which are rendered visible by dilute acetic acid, which clears away the granular opacity of the albuminoid cell-contents. Pus-cells tend to speedy disintegration, their contents undergoing fatty degeneration, and their cell-walls rupturing, disseminating fatty and necrosed or dead granules throughout the *liquor puris*. Such pus is not creamy and yellow, but often thin, watery, dirty or brown in color, and has an offensive smell, and is termed ichorous pus; pus is often discolored by blood. The pus formed on free surfaces, as on the mucous lining of the nose or bronchial tubes, is largely a product of cast-off or rapidly-formed and degenerated epithelial cells. In other places, as abscesses, where congestion or inflammation exists, good authorities maintain that the white blood-corpuscles migrate through the coats of the capillaries, and, failing to organize, become pus-cells. This occurs either as the result of over-pressure, inflammations of dense structures notably terminating in suppuration, or



Pus corpuscles, as seen in healthy pus.



The same, after the addition of acetic acid.

in consequence of impurity of the blood or lowered vitality of the nervous force. Suppuration when *circumscribed* constitutes abscess, which tends to discharge through the nearest surface, either of the exterior of the body or of some internal cavity. Diffuse suppuration occurs in erysipelas and in catarrhal inflammations, as of the air-passages, stomach, and intestines and bladder. The formation of pus is hastened by applications of heat and moisture—hot fomentations and poultices. Its formation is often announced by a slight chill, and accompanied by a febrile disturbance and pulsating, throbbing pain, either dull or intense, at the point of pus-formation. Diffuse or uncircumscribed suppuration of the solid tissues endangers life by absorption of purulent or ichorous septic matter; pus absorbed into the blood develops pyæmia or septicæmia, characterized by lowered vitality, hectic fever, sallow cachectic complexion, sweet breath, multiple abscesses in different parts of the body, exhaustion, and death.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Supra-renal Capsules.** See Kidney, by E. Darwin Hudson, Jr., M. D.

**Surajah Dowlah.** See Clive, and India, its History, by R. C. Caldwell.

**Surat′,** town of British India, presidency of Bombay, on the Taptee, in lat. 21° 12′ N., lon. 72° 47′ E. It is 6 miles in circumference, and surrounded with walls surmounted by towers. At the end of the eighteenth century it is said to have had 800,000 inhabitants, but now its manufactures have died out and its trade is lost. Many of the Portuguese, French, and Dutch establishments which flourished in the last century are deserted, and the place is most important now in a military point of view. P. 95,000.

**Surety.** See Guaranty and Suretyship.

**Sure′tyship** is a contract whereby one person, called the "surety," is bound to be answerable for the debt, default, or miscarriage of another, called the "principal," or whereby he engages that the principal shall do some act, or undertakes himself to do some act in case the principal fails to do the same. It necessarily implies two obligations to the same creditor—one, the direct original liability of the principal; the other, the collateral, auxiliary undertaking of the surety. This contract enters very widely into the transactions of business and the administration of both public and private affairs, and assumes a very great variety of forms. One of the most common instances is the mercantile guaranty. (See Guaranty.) The bonds given by public or private officials for the faithful discharge of their duties, the various kinds of bail in civil or criminal proceedings, the undertakings on appeal to higher courts, and those required by statute in many dealings with the government, are also familiar examples of the contract. No particular form of words is necessary to create the obligation of suretyship, and whether or not it exists depends upon the actual relations and intentions of the parties. For example, if a promissory note is accommodation-paper, although it resembles in all respects an ordinary business note, yet either the maker or the endorser, as the case may be, will be a surety for the other. By the statute of frauds the contract must always be in writing, signed by the party to be charged thereby. (See Frauds, Statute of, and Guaranty.) The undertaking of the principal and of the surety may be contained in one single instrument; as, for example, a note or a bond jointly signed by several makers or obligors, whereof one may be the principal debtor and the others his sureties, or the undertaking of the surety may be in a separate instrument, as in the case of a guaranty. There must, however, always be an existing obligation of the principal, either commencing at the same time with that of the surety or entered into previously. Not only must the contract be in writing; it must always be supported by what the law regards as a valuable consideration; but it is not necessary that this consideration should be any benefit to the surety; it is sufficient if it is a legal detriment to the creditor. When the contract of the principal debtor is executed simultaneously with that of the surety, and is entered into upon the strength of the latter's liability, the one consideration is sufficient to support both obligations. But if the original is already executed, so as to be binding upon the principal debtor, the collateral responsibility of the surety must be sustained by a new and independent consideration. The original liability of the principal is always the limit of the surety's obligation, and cannot therefore be transcended. The surety cannot, except by his own consent, be held to any greater responsibility, either in respect to amount or time, than that originally assumed by himself and by his principal. His undertaking being for the benefit of another, and not of himself, is construed strictly, and is never extended by implication or by a loose interpretation. The nature of his liability of course depends upon the terms of his agreement. Sometimes the creditor may sue him either jointly with or separate from the principal, or may enforce his liability before proceeding against the principal; sometimes the creditor must first exhaust his legal remedies against the principal before any steps can be taken against the surety and in order to fix the latter's responsibility. The nature, object, and language of each particular contract determine into which of these two classes it falls. The surety is discharged by performance, by payment, by release, or by any other act which puts an end to the principal's obligation, and also by any material change in the legal relations between the creditor and the principal, even though the change is not actually injurious to him. He must judge for himself on what state of facts he is willing to be held responsible, and, having so determined, no one can shift his liability on to any other ground without his own consent; he can stand upon the terms of his contract. It is therefore the settled doctrine that his undertaking cannot be extended, enlarged, or changed either by operation of law or by any arrangements between the creditor and the principal debtor. The changes which will discharge the surety from all liability are of many kinds and forms. Among them are the substitution of a new contract between the creditor and the principal in place of the original one; alterations in the terms of such original agreement; a modification of the parties, and the like. If the creditor enters into an agreement with the principal, which is supported by a consideration and binding upon them, whereby the time of payment or other performance of the original undertaking is extended, the surety is discharged. Mere delay on the part of the creditor, or indulgence given by him to the principal, although in the mean time the latter should become insolvent, does not discharge the surety, for he may himself pay the debt at any time, and then enforce his own claim for remuneration against the principal debtor. If the surety should request the creditor to go on and enforce his demand against the principal, and after such request the creditor should neglect for an unreasonable time to do so, and the debtor should meanwhile become insolvent, there is a conflict of judicial opinion as to the effect produced thereby upon the surety's liability. Many of the decided cases, and perhaps a majority of them, hold that the surety is discharged; others maintain that he is not. The following are the most important incidents of this contract: If the surety himself pays the debt or any part thereof, or performs the obligation which he has undertaken, he is entitled as against his principal to be fully exonerated—that is, he is entitled to be wholly indemnified and relieved from all loss or damage sustained by means of his engagement. Whatever money he pays he can recover back from the principal in an action based upon the latter's equitable liability to refund and to make his surety completely whole. A most important auxiliary in enforcing this demand for compensation and exoneration is supplied by the equitable doctrine of subrogation. Upon the fulfilment of his own collateral undertaking the surety is subrogated to all the rights of the creditor against the principal debtor. In other words, he is substituted in the place of the creditor, and becomes clothed with the rights of that creditor, and can use all the means which the latter could have used against the principal. He may not only enforce the original contract, and the judgment thereon, if any, which the creditor has recovered, but he may demand, obtain, and avail himself of all the collateral securities which had been delivered to the creditor by his principal. (See Subrogation.) Finally, when there are two or more sureties, and one of them pays the debt, he is entitled to a contribution from his co-sureties, so that the shares of all shall be equalized, and he shall be refunded what he has paid in excess of his own equitable proportion. (See Contribution.)

John Norton Pomeroy.

**Surface Geology.** See Geology, Chemical.

**Surf′-Bird,** a turn-stone (*Aphriza virgata,* family Charadriadæ), a small wading bird of the American Pacific coasts, about ten inches long, named from its habit of allowing the surf occasionally to dash over it as it seeks its prey on the rocky shores. Its flight is short and irregular.

**Surf′-Duck,** a sea-coast duck of America, one of the group called scoters in Great Britain and coots in the U. S. It is the *Oidemia perspicillata,* and is quite black, except a little patch of white on the head, and another on the nape. Its flesh is not eatable.

**Surgeon.** See Acanthurus Chirurgus.

**Surgery.** See Appendix.

**Su′ricate** [Fr. *surikate*], sometimes called **Zenick** [*Ryzæna* (*suricata*) *capensis*], a carnivorous mammal of South Africa, about twelve inches long, with a tail of something more than half that length, and closely resembling the ichneumon; of a grayish-brown color, tinged with yel-

low, and faint darker bands across the back. Its habits are nocturnal, dwelling in burrows, and it is often domesticated, when it is very useful as a destroyer of vermin.

**Surinam,** or **Dutch Guiana.** See GUIANA.

**Surmullet.** See MULLET and MULLIDÆ.

**Surnames.** See NAME, by C. G. LELAND, A. M.

**Sur'plice** [Lat. *super pellicium*, "over the pelisse"], a clerical garment worn in churches by priests and all clerics, and even by acolytes and choir-boys. It is considered to be a shortened stole.

**Surprise Valley,** tp., Siskiyou co., Cal. P. 649.

**Surratt',** tp., Prince George's co., Md. P. 775.

**Sur'rey,** inland county of England, bordering N. on the Thames, which separates it from Middlesex, comprises an area of 748 sq. m., with 1,090,270 inhabitants. It is intersected from E. to W. by a range of low hills, whose highest point, Botley Hill, rises 880 feet, and which slopes gently northward to the Thames, while to the S. the ground is more elevated and broken. In the northern part the soil is very fertile; in the southern it consists mostly of clay, chalk, and iron-sand, and in the whole western part the land is heath. Wheat, hops, and vegetables for the London market are raised; hogs and poultry are extensively reared. Near London manufacturing industry is carried on.

**Surrey** (HENRY HOWARD), EARL OF, b. in 1516, was the eldest son of Thomas Howard, duke of Norfolk; passed his youth at the court of Henry VIII., and was one of the most accomplished noblemen of the time, a brave soldier, and a fine poet. In 1544 he commanded the English forces in France; was made field-marshal, and subsequently governor of Boulogne. In Jan., 1546, he suffered a reverse, in consequence of which he was recalled and committed to the Tower, from which he was soon released, but in December was again arrested upon charge of treason for having quartered the royal arms upon his escutcheon. Upon his trial he proved conclusively that he had a right to bear these arms together with his own, but was notwithstanding condemned, and beheaded upon Tower Hill Jan. 21, 1547. His works consist of sonnets, amatory poems, elegies, paraphrases of the Bible, and translations of the second and fourth books of the *Æneid*. They present the earliest instances of the use of blank verse and the sonnet in English poetry, and have been several times republished, the latest edition being that of George F. Nott (1871).

**Sur'rogate** [Lat. *subrogare* or *surrogare*, to "substitute"]. Originally, this officer was a deputy of the bishop in the English diocesan courts, appointed by him to act in his stead as judge in the matters over which such courts had jurisdiction. Prior to the year 1857, when the court of probate and divorce was created, the diocesan courts of the bishops had jurisdiction not only in ecclesiastical causes, but also in certain civil affairs, particularly in the probate of wills and the granting of letters testamentary and of administration; and the court of the archbishop of Canterbury was the chief tribunal of England for these purposes. As the bishop himself could not always hear and decide causes, he was in the habit of appointing a deputy or substitute, called the "surrogate," to act as judge, especially in respect to civil matters. At an early day this delegate would be an ecclesiastic; at a later time he was a professional lawyer. This practice, which commenced without express authority of law, was afterward sanctioned by numerous statutes. The surrogate thus became the actual officer of the diocesan courts who exercised judicial functions in testamentary and administration cases, while in the archbishop's court a permanent judge was appointed, who was also the chief judge in admiralty and in matrimonial causes. This civil jurisdiction of the ecclesiastical tribunals was taken away in 1857. In the U. S. there is a separate court of each State having a general jurisdiction over the settlement of decedents' personal estates, and often a special judisdiction over certain matters connected with their real estates. In New York these tribunals, of which one exists in each county, are called the surrogates' courts, and the judges thereof the surrogates. As a general rule, the county judge is *ex-officio* the surrogate—that is, the same person holds the two offices. If the population of the county exceeds 40,000, a surrogate is chosen in addition to the county judge. He is elected by the electors of the county, and holds his office for six years. He has an official seal, and wills admitted to probate, letters testamentary and of administration are recorded in his office. He has exclusive jurisdiction over the probate of wills, the appointment and removal of executors and administrators, and original jurisdiction over the settlement of their accounts. He may also appoint and remove guardians, and settle their accounts, admeasure dower when the right thereto is not disputed, and order the sale of decedents' lands when the personal property is insufficient to pay the debts. An appeal lies from his decrees to the general term of the supreme court, and thence to the court of appeals. In some other States also the officer possessing the same general functions is termed the surrogate, but he is more frequently called the judge of probate. In one or two States, as in New Jersey, a subordinate official of the probate court is denominated the surrogate, but his powers are rather those of a clerk than of a judge.

JOHN NORTON POMEROY.

**Surrounding Hill,** tp., Woodruff co., Ark. P. 248.

**Surrounding Hills,** tp., Prairie co., Ark. P. 635.

**Surry,** county of N. W. North Carolina, drained by Yadkin, Fisher, and Ararat rivers. The surface is hilly, and in parts mountainous, Ararat or Pilot Knob Mountain in the S. E. being the most elevated point in this part of the Alleghany range. There are manufactures of cotton goods and chewing tobacco. Staples, Indian corn, tobacco, wool, butter, and honey. Cap. Dobson. Area, about 500 sq. m. P. 11,252.

**Sur'ry,** county of S. E. Virginia, lying between James and Blackwater rivers. The surface is somewhat hilly and the soil generally fertile. Staples, Indian corn, peas and beans, potatoes, wool, and sawed lumber. Cap. Surry Court-house. Area, 340 sq. m. P. 5585.

**Surry,** p.-v. and tp., Hancock co., Me. P. 1242.

**Surry,** p.-v. and tp., Cheshire co., N. H. P. 318.

**Surry Court-house,** p.-v. and tp., cap. of Surry co., Va.

**Sur'tees** (ROBERT), b. at Durham Apr. 1, 1799; took his degree of B. A. at Christ Church, Oxford, in 1800; studied law at the Middle Temple for two years, and upon the death of his father in 1802 settled upon his estate at Mainsforth, where he devoted himself to antiquarian pursuits and to the preparation of his *History and Antiquities of the County Palatine of Durham*, of which vol. i. appeared in 1816, vol. ii. in 1820, vol. iii. in 1823, and vol. iv., completed after his death by Rev. James Raine, with a *Memoir* by George Taylor, in 1840. The Surtees Society for the publishing of inedited MSS., founded in 1834, and named in honor of him, has issued more than fifty volumes, relating mainly to the districts included in the ancient kingdom of Northumbria. D. Feb. 11, 1834.

**Survey'ing** [Lat. *super*, "over," and *videre*, to "look"], a branch of applied mathematics whose object is to determine the relative positions of points on or near the surface of the earth. It may be divided into two great branches—*plane surveying* and *geodesic surveying*. In plane surveying the curvature of the earth is not taken into account, the general surface being regarded as a plane; in geodesic surveying, the curved form of the earth's surface is considered. The former is employed when only a small portion of the earth's surface is to be examined; the latter when a large extent of territory is involved.

*Plane Surveying.*—A plane survey may be undertaken for any one of a great number of objects. We have, accordingly, a great number of branches of the subject, of which the following are the most important: (1) *Land Surveying.* In this branch the object to be attained is the determination of the area and shape of a tract of land. (2) *Topographical Surveying.* The object of this branch is to determine not only the directions and lengths of the principal lines of tract to be surveyed, but also the undulations of the surface, the directions and locations of its water-courses, and all the accidents, whether natural or artificial, that distinguish it from the level plane. (3) *Hydrographical Surveying.* Here the object to be attained is the determination and location of the general outline of coasts; the shore-lines of harbors, bays, and inlets; the positions, depths, and character of channels; the situations of islands, shoals, and sunken rocks, and, in general, all the facts relating to lines of ocean navigation or that may be of interest to those engaged in commerce. (4) *Railroad Surveying.* In this branch the object is to ascertain the best line of communication, whether by railways, common roads, or canals, between two given points. It embraces the conditions incidental to facility of transit, cheapness of construction, and capacity for trade and travel, together with all considerations connected with the question of accommodation to intervening towns and villages. This branch of surveying includes all surveys for the location of aqueducts for supplying water to towns, cities, or manufacturing establishments. (5) *Mining Surveys.* Mining surveys may be undertaken either for the purpose of determining the location and position of the shafts, galleries, and underground excavations of a mine already in existence, or it may be required for determining the proper positions for the shafts and galleries of a mine yet to be opened. This branch involves, incidentally, a thorough knowledge of all the branches heretofore named,

and also a knowledge of the general principles of geology. (6) *General Reconnoissance.* A reconnoissance is a rough survey which may be undertaken for any one of a great variety of objects; it may be either civil or military. (See RECONNOISSANCE.) Besides the branches of plane surveying already enumerated, we may mention geological surveys, surveys for sanitary purposes, such as sewerage, ventilation, and the like, and surveys for works of military defence.

*Geodesic Surveying.*—A geodesic survey may be made for the purpose of determining the length of an arc of the earth's meridian, or for the more general object of ascertaining the grand outlines of an extended tract of country. To the former we may refer the survey commenced by France in the latter part of the last century for determining the length of a meridional arc through Paris reaching from the equator to the pole. This survey resulted in finding a value for this arc in terms of the *toise*, and the value found, divided by 10,000,000, was made the basis of the French system of measures and weights—a system known as the "metric system," and now adopted by many nations. To the latter we may refer the trigonometric surveys that have been carried on by almost all civilized nations of the earth for ascertaining the geographical features of their respective territories. As examples we may mention the trigonometric survey of Great Britain, known as the *Ordnance Survey*, the great survey of India, and the survey of our own country now in progress, and at present known as the *Coast Survey*. In all geodesic surveys the first operation consists in measuring, to the last limits of accuracy, one or more distances called *base-lines*. These base-lines, which are from 5 to 7 miles in length, are connected by the processes of triangulation with a multitude of points, so taken that the lines joining them shall constitute a network of triangles extending over the entire tract to be surveyed. These points serve as points of reference, to which other points are referred by the process of *secondary triangulation*. The latter points in turn serve as starting-points from which the more minute filling up of the survey is completed. The positions of the principal or primary points of the system are not only determined with respect to the extremities of the base-lines, but their absolute positions are fixed by the astronomical methods for determining latitude and longitude. In addition, the lines radiating from the principal triangulation-points are fixed with respect to the meridian by means of angles called azimuths. When the geodesic survey is carried on for geographical purposes, it is usually connected with the accompanying hydrographic work, the points of the former serving as the basal points of the latter. (For full particulars see GEODESY and HYPSOMETRY.)

In all kinds of surveys, whether plane or geodesic, two classes of operations are required: *first*, the measurement of certain lines and angles, which can only be done in the field; and, *secondly*, the reductions and computations, which can best be conducted in the office. The former class of operations, which consist chiefly in the measurement of lines and angles, constitute what is called the *field-work* of the survey; the latter class of operations, which embrace not only the computations, but also the entire work of delineation known as plotting and charting, constitute what is known as *office-work*. In plane surveying the instruments employed are the chain or tape, the compass, and the theodolite, with their necessary accompaniments. In geodesic surveying the same instruments are used, together with the plane-table and all necessary astronomical instruments, such as the portable transit, the altitude and azimuth instrument, Talcott's zenith sector, and the like. (See COAST SURVEY, GEODESY, and HYDROGRAPHY.)

*Survey of the Public Lands.*—The public lands consist of those vast tracts of territory that belonged to the U. S. after the Revolution, together with all that was afterward ceded by individual States soon after the formation of the Constitution, with the additions that have since been made by treaty with Indians or by conquest. In 1802, Col. Mansfield, then surveyor of the North-western Territory, inaugurated a plan for surveying and recording such portions as were offered for sale; which plan, with slight alteration, has continued in use to the present time. The general features of the plan then adopted, and still in use, are as follows: The entire public domain is first divided into parts called *land districts*, each of which is put in charge of an officer called a *surveyor-general*, who controls all the surveys in his particular district. In each district a meridian line is run, extending through the entire district, and from some point of this meridian an E. and W. line is run, which also extends through the district. These lines are determined astronomically, and when located serve as axes to which the subdivisions of the district are referred. Parallel to the axes, and on each side of them, other lines are run 6 miles apart, dividing the whole territory into squares, each containing 36 square miles. These squares are called *townships*. To take into account the obliquity of the meridians, suitable offsets are made in accordance with an established system. The townships lying between two consecutive meridians 6 miles apart constitute a *range*, and the ranges are numbered from the principal meridians, both E. and W. In each range the townships are numbered both N. and S. from the principal E. and W. line. Thus, if a township lies 12 miles E. of the principal meridian and 18 miles N. of the principal E. and W. line, it is called township 3 N., range 2 E. Each township is divided by meridians and E. and W. lines into squares having a mile on each side. These are called *sections*, and each contains 640 acres, more or less. The sections of a township are numbered from the N. E. corner, running along the northern tier of sections to No. 6, thence backward to section No. 12, which lies exactly S. of No. 1, and so on alternately, running from right to left and from left to right, to the south-easterly corner, which is No. 36. The four middle townships are numbered respectively 15, 16, 21, 22. In some of the Western States township No. 16 is set apart for school purposes, and is therefore called the *school township*.

If the land is very valuable, the sections are divided into half sections by meridians, and sometimes into quarter sections by lines running E. and W., and then again are divided into eighths by meridians. To designate one of these subdivisions, we say, for example, that it is the W. half of the S. W. quarter of section No. 16, township No. 7 N., range 3 W.; and if necessary we add the designation of the land district. (For a more detailed account of the method of surveying the public lands see Gillespie's *Surveying*, pp. 363–378.) W. G. PECK.

**Survey, Trigonometrical.** See GEODESY, by J. E. HILGARD, and SURVEYING, by PROF. W. G. PECK, LL.D.

**Surville', de** (CLOTILDE), b. about 1405, of the noble family Vallon-Chalis; married, in 1421, Berenger de Surville (who fell at the siege of Orleans in 1428), and d. over ninety years old. Her poems were not published until 1803—*Poesies de Clotilde*, edited by Ch. de Vanderbourg—and on their first publication their authenticity was much contested. It is now generally agreed upon, however, that these poems really are by her, but have been interpolated and retouched by one of her descendants, the marquis de Surville, who was put to death in 1798.

**Surviv'orship.** When two or more persons are jointly interested in certain legal relations, and one of them dies, the others are termed "survivors;" and not only the mere act of being thus left, but more especially the sum of legal rights and duties belonging to them by virtue of being thus left alive, is termed "survivorship." The peculiar and essential feature of survivorship consists in the fact that, so far as the joint relation extends, the legal rights and obligations of the deceased pass to his survivors, and not to his heirs or administrators; or, to speak more accurately, these rights and duties *remain* in the survivors, having been entirely extinguished in respect to the deceased. As illustrations: If two persons are joint owners of land, and one dies, the other continues to be the sole and absolute owner, the heirs of the deceased inheriting nothing; and if two persons, A and B, are joint debtors, and A dies, at the common law B remains the sole debtor, the estate of A not being liable in any manner or to any extent. This ancient doctrine has been somewhat modified; for, although the estate of the deceased debtor A is still, in England and in most of the American States, not liable *at law*, it may be sued *in equity* if the creditor cannot enforce his claim in a legal action against the survivor B. The doctrine of survivorship exists in the following legal relations: (1) joint owners of land, (2) trustees, (3) joint debtors, (4) joint creditors, and (5) partners. Its peculiar operation in the cases of joint owners of land and of joint debtors has already been described. If one of several trustees dies, the survivors, down to the last one, are clothed with all the powers and responsibilities of the original number. This particular rule has been changed by statute in certain States, as, for example, in New York, and on the death of one or more trustees others may be appointed by the court to act in their stead with the survivors. When one of two or more joint creditors dies, the survivor or survivors have the right and power to enforce the demand, the legal interest belonging to them alone, but they are accountable to the estate of the deceased for his share. The case of partners includes both that of joint creditors and of joint debtors. Upon the death of a member of the firm, the survivor is the legal owner of all rights and claims due to the partnership, and is the legal debtor for all liabilities owing by it. He alone can recover by suit or otherwise what belongs to the firm, and he alone can settle its debts or be sued at law by its creditors. He

must account to the administrator of the deceased, however, for the latter's share in the concern; and such administrators may, under the circumstances before mentioned, be sued in equity. Some of the foregoing rules, especially those in respect to suits against surviving partners and other joint debtors, have been changed by statute in certain States, the creditor being permitted to prosecute the survivor and the estate of the deceased at once, either jointly or separately, as he chooses.

JOHN NORTON POMEROY.

**Sus** [the Latin name of the hog], the principal genus of the Suidæ, a family of mammals of the order Ungulata, sub-order Artiodactyla, and section Omnivora or Non-ruminantia, typified by the common hog. In contrast with the other families of the section, it offers the following characters: The form in all is essentially like that of the domesticated hog, but mostly less gross; the feet are unguligrade (*i. e.* with the hoofs only touching the ground), and the external toes and hooflets are reduced in size and do not assist in progression, the median (third and fourth of normal series) only being of functional use in walking; the snout is disciform, and provided with a cartilaginous ring, and in the disk the nostrils are open and forward; the mammæ are in considerable number (4–10), ventral as well as inguinal; the back has no dorsal scent-gland; the tail is short or rudimentary; the tegumentary appendages are developed as stiff bristles; the skull has the palato-maxillary axis little deflected, and nearly parallel with the occipito-sphenoidal axis; the orbits are directed outward and forward; the occipital bones have long deflected styliform paroccipital processes in front of the occipital condyles, and emit transverse internal ridges in which are the condyloid foramina; the basiphenoid is normal, and has no pouch-like cavities; the squamosals have the articular processes projecting directly outward from their bases (and thus aloof from the auditory bullæ), and the zygomatic processes overlie the malar bones; the articular surfaces for the lower jaw are transversely concave, antero-posteriorly convex, and limited by no post-glenoid processes; the pterygoid bones are twisted and reflected outward, the crest continued upward and backward into the temporal region; the malar bones are elongated, and have long inferior processes; the lower jaw has no preangular expansion, and its condyles are triangular; the teeth are generally in full number—*i. e.* M $\frac{3}{3}$, P. M. $\frac{4}{4}$ ($\frac{3}{3}$), C. $\frac{1}{1}$, I. $\frac{3}{3}$ ($\frac{2}{3}$) $\times$ 2 = 44; the molars have corrugated cusps, presenting, when worn, deeply-sinuated insular areas; the canines of the upper jaw, in the males, are more or less twisted outward and upward, and parallel with the lower. The feet in their anatomy offer characters shared with the wart-hogs and peccaries, and differentiating from the hippopotamids; the last phalanges are elongated and trihedral; the manus (or front foot) has an unciform little or no broader than deep, and the second phalanx not wedged between the trapezoid and magnum; the pes (or hind foot) has a cuboid deeper than broad, and emarginated behind, and separate from the navicular. Such are the chief distinctive characters common to all the Suidæ, and distinguishing them in combination from the other kindred forms of the order. The living representatives of the family are aboriginally peculiar to the Old World, although in the Tertiary epoch species appeared to have existed in America. Exclusive of the domesticated forms, seventeen species have been recognized by the latest systematic inquirer into the subject, J. E. Gray. Eleven of these belong to the genus *Sus*, and are all peculiar to Asia, except *S. scrofa* (the wild-boar of Europe) and *S. sennaarensis* of Northern Africa; two represent in India the genus *Porcula;* three in Africa, the genus *Potamochœrus;* and a single species in India and the Archipelago exemplifies the very strongly-marked genus *Babirussa*. The domesticated swine are subject to great variation, and Gray has even differentiated them into two peculiar genera—*Scrofa* for most of the breeds, and *Centuriosus* for a peculiar race of Japan and China, distinguished by the strongly-defined concentric wrinkles of the face. (See further BABYROUSSA, BOSCH-VARK, HOG.) THEO. GILL.

**Su'sa** [the *Shushan* of the Scriptures, the Greek τὰ Σοῦσα, "the city of lilies"], an ancient city of Persia, the capital of the province of Susiana, and one of the residences of the Persian monarchs. Even in ancient time there was some doubt with respect to its precise site, some placing it on the Choaspes, others on the Eulæus. In modern time both Shuster and Sus have been designated as occupying the site of the ancient city, until the accurate researches and the excavations by W. F. Williams and Loftus have decided the question in favor of Sus. The city was at the time of Alexander the Great one of the largest and most magnificent cities of the world, celebrated for its delicious climate, containing a gorgeous palace and temple, and used as the treasury of the realm. The booty which Alexander took here was immense, and enabled him to pay a sum to each of his soldiers and a largess to the generals.

**Susan'nah, History of,** a short apocryphal book, considered by the Roman Catholic Church to be canonical, and regarded as the thirteenth chapter of Daniel. In the common English Bible it is, however, made a distinct book. It relates the story, the temptation, and virtue of Susannah, a beautiful Jewish matron, the punishment assigned her by her enemies, her final rescue from death, and the overthrow, by the judgment of young Daniel, of the wicked men who designed her ruin. Whether the incidents recorded are historical or fictitious is a disputed point. The story was probably written in Greek. Its authorship is not known.

**Su'sanville,** p.-v. and tp., cap. of Lassen co., Cal., has 2 weekly newspapers. P. 638.

**Su'so** (HEINRICH), b. at Ueberlingen, in the present grand duchy of Baden, Mar. 21, 1300; entered a Dominican monastery in Constance in 1313; studied theology at Cologne under Eckart; led for several years a life of seclusion and the severest asceticism; became then an itinerant preacher, and wrote several religious works of a mystical character, which made a deep impression, and of which the most remarkable, *Von der ewigen Weisheit* (*Horologium Sapientiæ Æternæ*), has been translated into all European languages. D. at Ulm Jan. 25, 1365. His collected works were translated into new High German by Diepenbrock (Regensburg, 1829), but his writings have not so much interest as those of the other German mystics—Eckart, Tauler, etc.

**Suspen'sion,** in music, the prolongation of one or more notes of a chord so as to extend over and occupy part of the time of the next succeeding chord. A suspension is, as it were, a temporary overlapping of one chord by some of the members of another chord preceding it, or the delay of a dissonance in reaching the chord into which it is to be resolved. (For illustrations of the nature and various kinds of suspensions see latter part of MUSIC.)

**Suspension,** p.-v. and tp., Bullock co., Ala. P. 880.

**Suspension Bridge.** See BRIDGE, by GEN. J. G. BARNARD, A. M., LL.D.

**Suspension Bridge,** p.-v., Niagara co., N. Y., on Niagara River, 1½ miles below the Falls, so named from the great railway suspension bridge. (See BRIDGE.) It is 800 feet long, 24 feet wide, with the rail-track 18 feet above the carriage-way. It is one of the most brilliant triumphs of modern engineering, and one of the few structures that not only harmonizes with the grand scenery of the vicinity, but even augments its impressiveness. Begun in 1852, the first locomotive crossed in Mar., 1855. It is used by New York Central and Erie Railways, connecting them with Great Western and Canada Southern Railways on the Canada side. The village has 1 weekly newspaper, 1 grist-mill, and 3 churches. The U. S. government has a large, well-built stone edifice, used for custom-house and post-office. P. 2276. GEORGE W. HOLLEY.

**Susquehan'na,** county of N. E. Pennsylvania, bordering on New York, watered by affluents of Susquehanna River and traversed by several railroads. The surface is hilly throughout, but well adapted for grazing and heavily timbered with pine, and there is a large trade in lumber. There are manufactories of agricultural implements, carriages, furniture, iron castings, woollen goods, saw-mills, flour-mills, and tanneries. Staples, oats, Indian corn, buckwheat, wheat, potatoes, wool, and dairy products. Cap. Montrose. Area, about 800 sq. m. P. 37,523.

**Susquehanna,** tp., Cambria co., Pa. P. 1106.

**Susquehanna,** tp., Dauphin co., Pa. P. 2264.

**Susquehanna,** tp., Juniata co., Pa. P. 890.

**Susquehanna,** tp., Lycoming co., Pa. P. 346.

**Susquehanna Dépôt,** p.-b., Oakland tp., Susquehanna co., Pa., on Susquehanna River and on Erie R. R., at N. terminus of Jefferson branch, has locomotive repair-shops, manufactures, and 2 weekly newspapers. P. 2729.

**Susquehanna River** is formed by the union of its E. and W. branches at Northumberland, Pa. The E. branch, the larger, rises in Otsego Lake, Otsego co., N. Y., at an elevation of 1300 feet. Its course is S. and then S. W. to the Pennsylvania line, which it crosses twice, afterward flowing S. E., and thence S. W. to the junction. The W. branch rises in Cambria co., Pa. It has a very tortuous and generally eastward course through a region abounding in timber and coal, but less celebrated for its fertility and beauty than the valley of the E. branch, a portion of which, called the Wyoming Valley, is world-renowned for the historic events of which it has been the scene, as well as for the mineral wealth which it contains. The main Susquehanna flows first in a S. and then in a S. E. course through

a wide, open, exceedingly fertile, and very picturesque country of Devonian slates and limestones. It reaches the head of Chesapeake Bay at Port Deposit, Md. It is a wide and stately stream, but is shallow, and is nowhere navigable to any extent, save in the spring, when the freshets bring down great rafts of logs and lumber and some loaded boats. The length of the main stream is 150 miles, of the W. branch 200 miles, of the E. (or N.) branch 250 miles. The branches afford great water-power. The main stream and both branches have been canalized, but the railroads have to a great extent rendered the canals useless.

**Sus'sex,** county of England, S. of Surrey and bordering on the English Channel, comprises an area of 1466 sq. m., with 417,407 inhabitants. It is intersected from E. to W. by a range of low hills, called the South Downs, consisting of chalk covered with fine turf and affording excellent pasturage, where the celebrated breed of sheep called the Southdowns is reared. To the N. of the range is an extensive forest-region, famous for its timber from time immemorial; to the S. the ground is wholly under tillage, and large crops of wheat, barley, beans, turnips, and hops are raised, and hogs, fowl, and rabbits are reared.

**Sussex,** county of S. Delaware, bordering on Maryland, drained by affluents of Nanticoke and Pocomoke rivers and traversed by Philadelphia Wilmington and Baltimore and Junction and Breakwater R. Rs. The surface is level and the soil fertile. Staples, Indian corn, wheat, tobacco, sweet potatoes, lumber, wool, and dairy products. Cap. Georgetown. Area, about 1000 sq. m. P. 31,696.

**Sussex,** county of N. New Jersey, bordering on New York and Pennsylvania, drained by affluents of Delaware River and traversed by Sussex R. R. The Blue Mountains cross the W. part, and the Hamburg and Wayawanda Mountains the E. part, the entire surface being hilly, with a fertile soil. There are several small lakes, of which Hopatcong in the S. E. part supplies the summit-level of the Morris Canal. Franklinite iron ore, zinc, and slate occur. There are flouring-mills, saw-mills, ironworks, and distilleries. Staples, Indian corn, oats, wheat, rye, buckwheat, hay, potatoes, wool, and dairy products. Cap. Newton. Area, about 600 sq. m. P. 23,168.

**Sussex,** county of S. E. Virginia, drained by Blackwater and Nottoway rivers and traversed by the Atlantic Mississippi and Ohio and Richmond Potomac and Fredericksburg R. Rs. The surface is hilly and the soil fertile. Staples, Indian corn, oats, tobacco, and wool. Cap. Sussex Court-house. Area, about 400 sq. m. P. 7885.

**Sussex** (Earls and Dukes of). This title has been borne by persons of different families: Thomas Ratcliffe, earl of Sussex, b. in 1526; was sent in 1553 as English ambassador to the emperor Charles V. to negotiate the marriage between Queen Mary and Philip of Spain, son of the emperor; on his return was made knight of the Garter and lord deputy of Ireland, and in 1569 president of the North, in which capacity he put down the insurrection against Elizabeth headed by the dukes of Northumberland and Westmoreland, and during the reign of James I. was made lord chamberlain. D. without issue July 9, 1583.—Augustus Frederick, duke of Sussex, sixth son of George III., b. at Buckingham Palace Jan. 27, 1773; was sent to Göttingen to complete his education; went to Italy, and there, being still a minor, contracted a marriage with Lady Augusta Murray, daughter of the earl of Dunmore. A marriage between a prince of the blood-royal and a subject without the royal assent was prohibited by law, and the court of prerogatives pronounced this marriage to be null and void; but the prince and the lady lived together as man and wife until her death in 1830. Their eldest son, known as Sir Augustus d'Este, claimed to be of legitimate birth, but this claim was never allowed. Their daughter, known as Mademoiselle Augusta d'Este, married Sir Thomas Wilde, an eminent lawyer, who in 1850 was raised to the peerage as Baron Truro. The marriage of Prince Augustus Frederick was highly offensive to his father, and he was always in disgrace at court, and it was not till 1801, when he was twenty-eight years old, that he was created duke of Sussex, with an allowance of £12,000 a year, which was afterward increased to £18,000. He took no part in public affairs, but, although of very moderate abilities and attainments, collected an extensive library, which was especially rich in editions of the Bible in various languages, and was fond of presiding at public dinners. D. Apr. 21, 1843, leaving directions in his will that his body should be buried in the cemetery at Kensal Green, and not at Windsor. The title is now dormant.

**Sussex Court-house,** p.-v. and tp., cap. of Sussex co., Va. P. 1778.

**Sut'cliffe** (Matthew), LL.D., b. in Devonshire about 1550; entered Trinity College, Cambridge, as a civilian, but took holy orders, and became archdeacon of Taunton in 1586, dean of Exeter in 1588, and prebend of Wells in 1592. He founded a college at Chelsea, of which he was the first provost, the fellows of which were to devote themselves to writing the annals of their times and to combating popery and Pelagianism; but the institution fell into decay, became an asylum for invalid soldiers, and finally a part of Chelsea Hospital. He wrote many polemical works, among which are—*Treatise on Ecclesiastical Discipline* (1590), *Disputatio de Presbyterio* (1591), *De Catholica et Orthodoxa Christi Ecclesia* (1592), *De Pontificis injusta Dominatione in Ecclesia* (1599), *De Purgatorio* (1599), *De Vera Christi Ecclesia* (1600), *De Missa* (1603), *De Indulgentiis et Jubileo* (1606). D. in 1629.

**Suth'erland,** county of Northern Scotland, bordering on the Atlantic and on the North Sea, comprises an area of 1754 sq. m., with 23,686 inhabitants. The surface is elevated, mountainous, and rugged, interspersed with large tracts of moorland or covered with extensive forests, where herds of red-deer roam wild. Agriculture is in a very improved state, but, on account of the physical character of the country, confined to a few places. Rearing of cattle and sheep and fishing of salmon and herring are the principal occupations.

**Sutherland** (Alexander John), M. D., b. about 1810; was educated at Christ Church, Oxford; published *Clinical Lectures on Insanity* and the *Pathology of Insanity*, and was one of the authors of the report on the *Treatment of Insanity* (1845). D. in 1867.

**Sutherland** (Dukes of). George Granville Leveson-Gower, the first duke, b. Jan. 9, 1758, was the son of the marquis of Stafford; entered the House of Commons while young; was ambassador to France 1790–99, and was raised to the peerage in 1799 as Baron Gower. His uncle, the duke of Bridgewater, dying in 1803, he inherited his immense property, which, with the estates which he already held, made him the most wealthy nobleman of England. He was created duke of Sutherland in 1833, and was a munificent patron of the fine arts. D. July 19, 1833. The Bridgewater estates were entailed upon his second son, Francis (who was afterward created earl of Ellesmere, thus founding a new house), while the remainder of the property devolved upon the eldest son, George Granville Sutherland-Leveson-Gower, the second duke (b. in 1786; d. Feb. 28, 1861), who is chiefly noted as the husband of Harriet Elizabeth Georgiana, daughter of the earl of Carlisle, famous for her beauty and accomplishments, and for her patronage of anti-slavery and other philanthropical movements (b. May 21, 1806; d. Oct. 27, 1868). The present and third duke is George Granville William Sutherland-Leveson-Gower, b. Dec. 19, 1828; was member of the House of Commons for Sutherlandshire 1852–61, succeeding to the dukedom Feb. 21, 1861. He is one of the wealthiest of British peers, having large estates in England and Scotland, and for residences Stafford House, London; Dunrobin Castle and Loch Inver House, Sutherlandshire; Trentham Hall, Staffordshire; Lilleshall House, Shropshire, and Tarbat House, Ross-shire.—His eldest son, by courtesy marquess of Stafford (b. July 20, 1851), a lieutenant in the life-guards, has since 1874 represented Sutherlandshire in the House of Commons.

**Sutherland** (John), M. D., b. early in the present century; studied at the University of Edinburgh, where he took his degree as M. D. in 1831; subsequently held several minor appointments; represented the British government at the international quarantine conference held in Paris in 1851, and in 1856 was sent as royal commissioner of sanitary arrangements to the army of the Crimea. He was afterward made medical superintendent and inspector-general of the board of health, a member of the royal commission to inquire into the condition and health of the Indian army, and a commissioner for the improvement of barracks and hospitals.

**Sut'lej,** the easternmost of the "five rivers" of the Punjaub, rises in Thibet in lat. 31° 5′ N., lon. 81° 6′ E., at an elevation of 20,000 feet above the sea, breaks through the Himalaya as a furious torrent at an elevation of 8494 feet, flows in a south-western direction, and joins the Indus in lat. 29° N. as a calm, majestic stream, 700 yards broad, 30 feet deep, and navigable at all seasons.

**Su'tra** [Sansk., a "thread"], in Sanskrit literature, the technical name of the numerous series of religious aphorisms and rules which constitute an important part of Hindoo literature, including all the ritual, grammatical, metrical, and philosophical works. They consist of brief sentences to be committed to memory, and were usually written separately on dried palm-leaves tied together by a string, whence the name.

**Suttee'** [Sansk., *Sati*, "a virtuous wife"], a term incorrectly applied by English writers to denote the practice

formerly common in India of a widow burning herself on a funeral pile along with the body of her husband. The practice was unknown to the primitive Aryans, and is not alluded to in the Vedas, except in a single passage of the *Yajur-veda* of disputed authenticity, and is not sanctioned by the laws of Menu, but rests upon the authority of the later Sastras and Puranas. Between 1815 and 1826 there were above 7000 cases of suttee in Bengal alone. A prohibitory law was enacted in 1829, and rigidly enforced in Bengal by Lord William Bentinck, and was extended to the allied native states in 1847, since which time the practice has virtually ceased.

**Sut'ter,** county of Central California, lying between Sacramento and Feather rivers. It is mostly level bottom-land, with the exception of the Sutter Buttes, an isolated group in the N. part. Timber is very scarce. Staples, wheat, barley, hay, wine, and wool. Cap. Yuba City. Area 576 sq. m. P. 5030.

**Sutter,** tp., Amador co., Cal., on Sutter Creek. P. 1966.

**Sutter,** tp., Sacramento co., Cal. P. 1078.

**Sutter,** v. and tp., Sutter co., Cal., on California Pacific R. R. P. 1075.

**Sutter** (John Augustus), b. at Kandern, Baden, Feb. 15, 1803; graduated as a Swiss military officer at Berne, and in 1834 emigrated to America; established himself as a trader at Santa Fé, New Mexico; in 1838 crossed to the Pacific coast, sailed for the Sandwich Islands, thence back to Alaska, and while voyaging down the coast was stranded in what is now known as the Bay of San Francisco, July, 1839. He made his way into the interior, received a Mexican grant of land, and in 1841 built a fort and founded a settlement which he called New Helvetia, on the site of the present city of Sacramento. The Mexican government made him governor of the northern district of California, and when the Americans came into possession of the region he was appointed alcalde and Indian agent. He was in Feb., 1848, engaged in enlarging the race of his saw-mill, when gold was discovered in the excavation. This discovery soon proved his financial ruin; his laborers deserted him; his lands were overrun by gold-diggers, and he failed to secure any recognition of his claims beyond an annual allowance of $3000 from the State. In 1873 he left California and took up his residence at Litiz, Lancaster co., Pa.

**Sutter Creek,** p.-v., Sutter tp., Amador co., Cal.

**Sut'ton,** p.-v. and tp., Worcester co., Mass., on Blackstone River and Canal and on Providence and Worcester R. R., has 3 churches, 2 cotton-mills, 8 saw-mills. P. 2699.

**Sutton,** p.-v., cap. of Clay co., Neb., on Burlington and Missouri R. R. in Nebraska, 60 miles W. of Lincoln, has 3 churches, an excellent school, a handsome park, 2 hotels, a large flouring-mill, and 1 newspaper. P. about 500. Wellman Bros., Props. "Times."

**Sutton,** p.-v. and tp., Merrimack co., N. H. P. 1155.

**Sutton,** tp., Meigs co., O., on Ohio River. P. 4369.

**Sutton,** p.-v. and tp., Caledonia co., Vt. P. 920.

**Sutton** (Amos), b. at Sevenoaks, Kent, in 1798; in 1824 was ordained as a missionary to India, and stationed at Orissa, where, with the exception of a single visit to England and America, the remainder of his life was passed. He compiled an Oriya dictionary, grammar, and lesson-book, translated the Bible and other books into that language, in which he also put forth several tracts. In English he published a *Hymnbook for the Mission Congregations*, a *Guide to the Saviour, Family Chaplain* (1831), and *Orissa and its Evangelization* (1850). D. at Cuttuck, India, Aug. 17, 1854.

**Sutton** (Charles Manners), b. in 1780, was the eldest son of the archbishop of Canterbury (also Charles Manners Sutton, b. 1755; bishop of Norwich 1792; archbishop of Canterbury 1805; author of several sermons and papers on natural history; d. 1828); was educated at Eton and Cambridge; called to the bar in 1805; returned to Parliament for Knaresborough in 1807, representing that borough until 1832, when he was elected for the University of Cambridge. He was chosen Speaker of the House of Commons in 1817, and was re-elected to successive Parliaments until 1835, when he was defeated by Mr. Abercrombie by a majority of 10. He was shortly afterward made a peer under the titles of Viscount Canterbury and Baron Bottsford, but is better known by his original name. D. July 21, 1845.

**Sutton** (J. H. T. Manners). See Canterbury, Viscounts.

**Sutton** (Thomas), b. at Knaith, Lincolnshire, in 1532; was educated at Eton and Cambridge, afterward studying law at Lincoln's Inn; became secretary to the earl of Warwick, and in the rebellion of the dukes of Northumberland and Westmoreland was made master of ordnance at Berwick, and in reward for his services was created for life master-general of ordnance in the North, commanding a battery at the siege of Edinburgh in 1573. While thus employed he purchased from the bishop of Durham two manors in which extensive coal-mines were discovered, which soon produced for him an immense fortune, which he expended in a magnificent manner. But upon the death of his wife, in 1602, he resolved to devote his great wealth to charitable uses, and purchased the dissolved monastery of Chartreux, which had been bestowed upon the duke of Suffolk, where he founded the hospital and school of Charter-house. (See Charter-house.) He died before the edifice was fully completed, and his remains, which were at first interred elsewhere, were removed to a vault prepared for them in the chapel of the Charter-house. D. Dec. 12, 1611.

**Sutton's,** tp., Williamsburg co., S. C. P. 466.

**Su'ture** [Lat. *sutura*, "seam"], in anatomy, is the line of union of two bones between which there is no motion. Where motion is intended, the union is a joint or diarthrosis. The most general term for the immovable joint is synarthrosis; this includes the suture (*sutura*); the schindylesis, in which a thin lamina of bone is received between two laminæ of another bone; and the gomphosis, in which a long process is inserted into a socket. The fixed joints called sutures (*suturæ*) are of two primary kinds, called *sutura vera* and *sutura notha*. Sutura vera, the true suture, presents three species—*sutura dentata*, where the bones are joined by tooth-like processes; *sutura serrata*, where the bones have serrate edges; and *sutura limbosa*, where they overlap like selvages of cloth, but with notched processes. Of sutura notha, the bastard suture, there are two kinds—*sutura squamosa*, scaly suture, where two beveled margins overlap each other; and *harmonia*, where two rough surfaces are simply applied to each other.

**Suwal'ki,** town of Russian Poland, government of Augustovo, has many educational institutions. P. 16,896.

**Suwan'nee,** county of N. Florida, drained by Suwannee River and traversed by Jackson Pensacola and Mobile R. R. The surface is undulating, with several small lakes and swamps. Staples, Indian corn, oats, sweet potatoes, peas, and beans, with a little cotton and sugar. Cap. Live Oak. Area, 790 sq. m. P. 3556.

**Su'warow,** or **Su'voroff** (Alexei Vasilievitch), Count Rimnikski, Prince Italiski, b. in Finland Nov. 24, 1729; entered early the Russian army, and was made a colonel after the battle of Kunersdorf, Aug. 12, 1759, and a general in 1783, after the campaign against the Tartars on the Kuban. As commander-in-chief in the Turkish war of 1787 he defeated the Turks at Kinburn Oct. 1, 1787, at Fokshany Aug. 1, 1789, on the banks of the Rimnik Sept. 22, 1789, and took Ismail with great slaughter Dec. 22, 1790. In 1794 he commanded in Poland, and took Pragawitz Sept. 24, 1794, after which Catharine II. made him field-marshal. But his most brilliant exploit was his Italian campaign in 1799. He had fallen into disgrace under Paul I., and had even been deprived of his rank, but on the demand of the emperor of Austria he was, nevertheless, made commander-in-chief of the Russian army which was sent to Italy to co-operate with the Austrians against France. He defeated the French at Trebia July 17–19, 1799, and at Novi Aug. 15, 1799, and then crossed the Alps to join the Austrians under Korsakoff and Hotz. But both the Austrian generals had been defeated, and Suwarow was compelled to retreat. Shortly after the Russian-Austrian alliance was dissolved, and the Russian army withdrawn from the theatre of war. Died a few days after his return to St. Petersburg, May 17, 1800. His *Autobiography*, written in French, was edited by Glinka in 2 vols. (Moscow, 1819).

**Svend'borg,** town of Denmark, on the island of Funen, has a good harbor, considerable shipbuilding, and an active export-trade. P. 6700.

**Swa'bia,** or **Suabia** [Ger. *Schwaben*], was formerly the name of a territory of South-western Germany, corresponding to the present Würtemberg and Baden, and bounded S. and W. by the Rhine, which separated it from Switzerland and France, and N. and E. by the Palatinate, Franconia, and Bavaria. Its original name was *Alemannia*, but when, in 496, the Alemanni were conquered by Clovis, the country received the name of Swabia after the Suevi, who inhabited large parts of it. In 1080 the emperor Henry IV. made it a duchy, and bestowed it as an hereditary fief on Frederick of Hohenstaufen. Under this family the country, which is one of the most beautiful and fertile in Germany, prospered and became the seat of a flourishing civilization. But when the family became extinct with Conradin, who, as the head of the Ghibelline party, was executed at Naples in 1268, Swabia was broken up into many small dominions and free cities, which acknowledged no other authority than the emperor himself, and

out of the different coalitions and unions and leagues which these petty states formed in order to defend themselves, and which several times played a conspicuous part in German history, came, at last, the two duchies of Würtemberg and Baden. From 1563 to 1806, Swabia was one of the ten circles into which the German empire was divided.

**Swain,** county of S. W. North Carolina, formed since the census of 1870 from Jackson county, and separated from Tennessee by the Great Smoky Mountains. The surface is well adapted for stock-raising. Cap. Charleston.

**Swain** (Charles), b. in Manchester, England, in 1803; was employed in the business of his uncle, a dyer, until thirty years old, when he became an engraver, having in the mean time contributed verse and prose to various periodicals, in time becoming known as "the Manchester poet," and in 1857 receiving a pension of £50 from the civil list. He published many volumes of poems, among which are—*Metrical Essays* (1827), *Beauties of the Mind*, etc. (1831), *Dryburgh Abbey* (1832), *Cabinet of Poetry and Romance* (1844), *Rhymes for Childhood* (1846), *Dramatic Chapters*, etc. (1848), *English Melodies* (1849), *Letters of Laura d'Auverne*, etc. (1853), *Art and Fashion* (1863), *Songs and Ballads* (1867), and a *Memoir of Henry Leversege* (1835). A collection of his poems was published in Boston in 1872. D. at Manchester Sept. 22, 1874.

**Swain** (David Lowry), LL.D., b. near Asheville, N. C., Jan. 4, 1801; graduated at the University of North Carolina; was admitted to the bar in 1823; elected to the State legislature 1824; appointed judge of the supreme court 1831; was governor of the State 1832–35, and from 1835 to his death president of the University of North Carolina. He wrote many valuable historical papers, and published *History of the British Invasion of North Carolina in 1776* (1853). D. at Chapel Hill, N. C., Sept. 3, 1868.

**Swains'borough,** p.-v. and tp., cap. of Emanuel co., Ga. P. 108.

**Swain'son** (William), b. in Liverpool Oct. 8, 1789; served in the commissary department of the British army 1807–15, devoting himself especially to the study of natural history; accompanied the German naturalist Koster in his travels in South America 1815, after which he settled in London, and began in 1820 the issue of his works on natural history. In 1841 he emigrated to New Zealand, where he was attorney-general, and subsequently published several works on the natural history and social and political condition of that colony and Tasmania. Among his works, many of which have become standard and have passed through several editions, are—*Zoological Illustrations* (1st series, with 318 colored plates, 1820–23; 2d series, with 136 plates, 1829–33); *Exotic Conchology* (1821–22; new ed. 1841); *The Naturalist's Guide for Collecting and Preserving all Subjects of Natural History and Botany, particularly Shells*, 1840; 11 vols. on zoology, etc., in Lardner's *Cabinet Cyclopædia* (1834–40), including Classification, Quadrupeds, Birds, Fishes and Reptiles, Habits and Instincts, Malacology, Taxidermy, and Biography of Zoologists; *Birds of Western Africa*, and *Fly-Catchers* (in Jardine's *Naturalist's Library*, 1837–38); *Ornithological Drawings*, of birds from Brazil and Mexico (1834–41); *Observations on the Climate of New Zealand* (1840); *New Zealand*, being the subject of a lecture on the colonization of that island (1859); and *New Zealand and the War* (1862). He also made a government survey and report of the forests and trees of Tasmania; furnished papers to scientific periodicals and the journals of learned societies; prepared the article on the geographical distribution of man and animals in Murray's *Encyclopædia of Geography;* assisted Sir John Richardson in the account of North American birds contained in his *Fauna Boreali-Americana* (1831); and with Mr. Shuckard prepared the *History and Natural Arrangement of Insects* (1840). He appears to have been living as late as 1876.

**Swal'low** [Ang.-Sax. *swalewe*], the English name given (sometimes with and sometimes without specific qualifications) to the birds belonging to the family Hirundinidæ, and which are distinguished by their wide deep gape, allusion to which is evidently conveyed in the name. They all have the form familiar in the common swallows of the U. S.; the neck is rather short; the head full; the bill short, but comparatively broad and depressed, triangular, the sides rapidly converging, and the whole slightly decurved toward the tip; the gape is very deep, and continued backward nearly as far as, or quite under, the eyes; there are no distinct rictal bristles; nostrils sub-lateral; the wings are very long and pointed, and have only nine primaries, of which the second is generally longest, but the first is nearly or quite equal to it; the tail is forked or emarginated, and normally consists of twelve feathers; the



legs are weak and small, the tarsi being not longer than the middle toe; the tarsi have each two lateral undivided plates, meeting behind in a sharp ridge; the toes are not versatile, long and slender, three anterior and one posterior, and with the normal number of joints; the claws curved and acute, but slender. Such are the principal external characters of the family. Some anatomical features are noteworthy, inasmuch as they demonstrate the close relationship of the family with the ordinary singing birds (such as the sparrows, thrushes, etc.), and the great differences from the swifts, which resemble them so much as formerly to have been generally united with them. Thus, as in the Coracomorphæ or Passeres generally, "the sternum has a forked manubrium," and "its posterior edge has a single notch on each side;" "the clavicles have expanded T-shaped scapular ends, and send back a vertical process from their inferior junction;" and the muscles of the larynx are modified after the type common to the Oscines or singing birds. The species are quite numerous, and representatives are found in almost every land and every zone save the extreme polar regions. By G. R. Gray (*Hand-List of Birds*, vol. i. pp. 68–75) 111 species are recognized. The several genera have been differentiated by one writer (R. B. Sharpe in *Proc. Zool. Soc. London*, 1870, p. 288) into two groups, called by him sub-families—viz. (1) Hirundininæ, in which the outer edge of the wing is smooth-feathered, containing almost all of the species; and (2) Psalidoprocninæ, in which it is serrated or armed with stiff recurved hooks, represented by the African genus *Psalidoprocne* and the American *Stelgidopteryx*. The species are among the most active and graceful of birds, and their circling and sweeping flight is well known to observers. They feed almost exclusively on insects, which they take on the wing. Their mode of nesting is various. The female lays in most cases five or six eggs. The most common American species are *Progne subis*, the purple martin; *Petrochelidon lunifrons*, the cliff or eave swallow; *Hirundo horreorum*, the barn swallow; and *Cotyle riparia*, the bank swallow or sand martin. The chimney swallow is a swift or cypselid. (See Swift; also Martin.)

Theodore Gill.

**Swal'lowing,** or **Deglutition,** is the physiological act by which food (in man and most vertebrates, after more or less trituration by the teeth) is carried from the mouth to the stomach by means of the pharynx and œsophagus. The process of swallowing is, in the higher animals, an exceedingly complicated one. It is initiated by voluntary muscles, which pass the food or drink from the mouth into the pharynx. Here the process becomes essentially an involuntary one. The mechanism of the pharyngeal part of the act of swallowing is not perfectly understood, or, at least, physiologists are not quite agreed as to the functions of the epiglottis and the neighboring structures which serve to prevent the passage of the food and drink into the larynx. (For a discussion of the whole question see Flint's *Physiology*, part ii. pp. 181–207.)

**Swam'merdam** (Jan), b. at Amsterdam Feb. 12, 1637; studied medicine, especially anatomy, at Leyden and Paris;

settled in Amsterdam, and acquired a great reputation both as a physician and as an entomologist, but was induced by the Bourignon revival to turn away from science, and sold his collections, and even his manuscripts. D. at Amsterdam Feb. 15, 1685. His entomological works, *General History of Insects*, *Natural History of Bees*, and *History of the Ephemeras*, were translated into English by T. Floyd in 1758.

**Swamp'scott,** p.-v. and tp., Essex co., Mass., on Massachusetts Bay and on Eastern R. R., is a fashionable watering-place and has several elegant hotels. P. 1846.

**Swan** [Ang.-Sax.], a name applied to those swimming birds of the family Anatidæ which have a bill nearly equally broad throughout and as long as the head; the cere soft and extending to the eye; the front toes with a large web; the hind toe without a lobe; the tail short and rounded; the second and third wing-quills the longest. They are the largest species of the family, and among the largest of birds. Some put all the swans into one genus, *Cygnus;* others admit four genera, *Cygnus*, *Olor*, *Chenopis*, and *Coscoraba*. *Chenopis* includes the black swan of Australia, *C. atrata*. There are considerable anatomical differences among the swans. The North American swans, *Cygnus americanus* (whistling swan) and *C. buccinator* (trumpeter swan), are fine birds, both white. The tame swans are of two European species—*C. olor* (red-billed swan) and *C. immutabilis* (Polish swan). The European wild swans are *C. ferus* and *C. minor*. South America has two—*C. nigricollis* and *C. coscoraba*. In all, about ten species are known. Swans live to a great age. They are mostly beautifully white, and their down is prized for trimming ladies' garments. The flesh is not very good except when the birds are young.

**Swan,** tp., Warren co., Ill. P. 1007.

**Swan,** p.-v. and tp., Noble co., Ind., on Grand Rapids and Indiana R. R. P. 1295.

**Swan,** tp., Marion co., Ia. P. 1001.

**Swan,** tp., Vinton co., O. P. 1062.

**Swan** (James), b. in Fifeshire, Scotland, in 1754; came to America at an early age; was clerk in a mercantile establishment in Boston; published a *Dissuasion to Great Britain and the Colonies from the Slave-Trade to Africa* (1772); espoused the patriot cause; was one of the "Boston tea party;" aide-de-camp to Warren at Bunker's Hill, where he was wounded; became captain of artillery, secretary to the Massachusetts board of war, member of the legislature in 1778, and afterward adjutant-general of the State. He went to Paris in 1787, deeply involved in debt; wrote *Causes qui sont opposées au Progrès du Commerce entre la France et les États-Unis de l'Amérique* (1790), which gained considerable reputation for him. He acquired a large fortune, returned to America in 1795, and became famous for his munificence. In 1798 he returned to Europe, and was engaged in important commercial and financial enterprises until 1815, when, upon the suit of a German with whom he had transactions, he was arrested and thrown into the prison of Ste. Pélagie in Paris, where he remained fifteen years, living in sumptuous style and maintaining an unceasing litigation in the French courts. Besides the works already mentioned, he published—*On the Fisheries* (1784), *Fisheries of Massachusetts* (1786), *National Arithmetick* (1786), and an *Address on Agriculture, Manufactures, and Commerce* (1817). D. in Paris Mar. 18, 1831.

**Swan** (T. L.), U. S. N., b. Aug. 23, 1841, in Maryland; graduated at the Naval Academy in 1860; became a lieutenant in 1862, a commander in 1874; served in the Brooklyn at the battle of Mobile Bay, Aug. 5, 1864, and was thus mentioned in the official report of his commanding officer, Capt. James Alden: "Lieut. Thomas L. Swan, the ordnance officer, had everything ready, and the working of his department was admirable; he was principally occupied during the action with the bow-chasers."

Foxhall A. Parker.

**Swan** (William Draper), b. at Dorchester, Mass., Nov. 17, 1809; was for many years principal of the Mayhew Grammar School, Boston; afterward became a publisher, and in 1862 was elected to the State senate; prepared a series of ten popular spelling and reading books for schools, and in connection with his brother, Robert Swan and Daniel Leech, a series of three volumes of arithmetic; also published *The Critic criticised and Worcester vindicated* (1860). D. at Dorchester Nov. 2, 1864.

**Swan City,** tp., Saline co., Neb. P. 418.

**Swan Creek,** tp., Saginaw co., Mich. P. 427.

**Swan Creek,** tp., Fulton co., O. P. 1100.

**Swan Lake,** p.-v. and tp., cap. of Turner co., Dak.

**Swan Lake,** tp., Meeker co., Minn. P. 539.

**Swann,** tp., Taney co., Mo. P. 1787.

**Swann** (Thomas), b. at Alexandria, Va.; was educated at Columbian College and the University of Virginia; studied law at Washington, and was appointed secretary to the Neapolitan commission; settled at Baltimore in 1834; became a director of the Baltimore and Ohio R. R. in 1836, and its president 1847–53, and was also president of the North-western Virginia R. R.; in 1856, and again in 1858, was elected mayor of Baltimore. He emancipated his slaves previous to the opening of the civil war, and was an earnest Union man throughout that contest. In 1864 he was elected governor of Maryland, and in 1866 Senator in Congress, but declined to leave the executive chair. In 1868 he was chosen a Representative in Congress, and subsequently at each term, becoming in 1875 chairman of the committee on foreign affairs.

**Swannano'a,** p.-v. and tp., Buncombe co., N. C. P. 1526.

**Swan Quarter,** p.-v. and tp., cap. of Hyde co., N. C. P. 1115.

**Swans'borough,** p.-v. and tp., Onslow co., N. C. P. of v. 141; of tp. 1475.

**Swan'sea,** town of England, county of Glamorgan, South Wales, at the mouth of the Tawe, where a good harbor, lined with convenient quays and docks, has been built. When, in 1830, the rich coal-fields in the vicinity and the peculiar adaptability of the coals for smelting purposes were thoroughly explored and understood, the town became the centre of the English copper production, and developed very rapidly. Copper ore is brought hither not only from Great Britain and Ireland, but also from Cuba and Australia, and 185,000 tons of copper are annually produced. Very important too are its breweries, tanneries, and manufactures of iron, pottery, and porcelain, and of a peculiar kind of patent fuel, a mixture of culm and tar compressed into the shape of bricks. P. 51,720.

**Swan's Isle,** p.-v. and tp., Hancock co., Me. P. 451.

**Swan'ton,** tp., Lucas co., O. P. 447.

**Swanton,** p.-v. and tp., Franklin co., Vt., on Missisquoi River, near Lake Champlain, and on Vermont Central R. R., has several manufactories, an academy, and 1 weekly newspaper. P. 2866.

**Swan'ville,** p.-v. and tp., Waldo co., Me. P. 770.

**Swan'zey,** or **Swan'sea,** p.-v. and tp., Bristol co., Mass., on Mount Hope Bay and on Providence Warren and Bristol R. R., has 5 churches, and is noted in New England history for the massacre of several men by Indians June 24, 1675, which gave rise to "King Philip's war." P. 1294.

**Swanzey,** p.-v. and tp., Cheshire co., N. H., on Ashuelot River, has cotton and woollen factories. P. 1626.

**Swarth'more,** p.-v., Delaware co., Pa.

**Swartz** (Olaus), b. at Norrköping, Sweden, in 1760; studied natural science, especially botany, at the University of Upsal; travelled extensively in Finland, Lapland, the West Indies, etc., and was appointed professor of natural history in the Medico-Chirurgical Institute of Stockholm, where he d. in 1818. The most remarkable of his writings are *Flora Indiæ Occidentalis* (3 vols., 1806), *Synopsis Filicum* (1806), besides a number of minor essays in the *Transactions* of the Linnæan Society in London.

**Swata'ra,** tp., Lebanon co., Pa., on Swatara Creek, includes the v. of Swatara Gap, on Lebanon and Pine Grove branch of Philadelphia and Reading R. R. P. 2015.

**Swa'tow,** or **Chow-Chow,** town of China, province of Quang-Tong, on the China Sea, has a good harbor, which was opened to foreign commerce by the treaty of Tien-Tsin. Its trade has rapidly increased since that time. Sugar, rice, paper, and tobacco are exported; opium, cotton and woollen goods, and metallic wares are imported.

**Swayne,** tp., Mississippi co., Ark. P. 93.

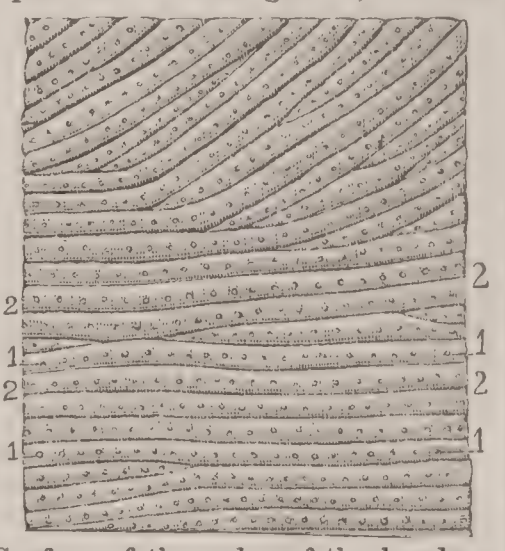
**Swayne** (John Wager), son of Noah H., b. at Columbus, O., in 1835; graduated at Yale College in 1856; studied law and practised at Columbus; major of Ohio regiment 1862; became colonel; served through the Atlanta campaign, losing a leg at Salkahatchie; brevetted brigadier and major general 1865, and was afterward assistant commissioner of refugees, etc., and retired from the army July, 1870.

**Swayne** (Noah Haynes), LL.D., b. in Culpeper co., Va., Dec. 27, 1804; was clerk in an apothecary's shop in Alexandria; studied law; was admitted to the bar in 1824, and commenced practice at Coshocton, O.; in 1829 was elected to the State legislature; was U. S. district attorney 1830–39; was chosen judge of the court of common pleas in 1834, but declined the office; was again elected to the legislature in 1836, and was prominent in organizing asylums and institutions for the deaf and dumb, the blind, and the insane; in 1861 was appointed a justice of the U. S. Supreme Court.

**Swe'aborg,** or **Sveaborg,** a fortress of Russia, on the northern coast of the Gulf of Finland, occupying seven small islands which outlie the town and harbor of Helsingfors, and are connected by boat-bridges. The place was originally fortified by Sweden. When (1809) Finland became a province of Russia, the latter made it a military and naval dépôt. The isle of Vargoe is the central or principal fortress; the isle of Great Oester-Svartoe the principal naval dépôt and dockyard. The place was bombarded by the allied fleets in 1855. (See BOMBARDMENT.)

J. G. BARNARD.

**Sweat,** or **Perspiration,** the exudation, through the pores of the skin, of water, with numerous excretory elements in solution. The amount of water exhaled from the skin either in the form of the insensible perspiration, which maintains its softness and moisture, or in perceptible sweat, is but little less than the volume of the urine or the equivalent in water of the moisture exhaled from the lungs in breathing. It varies with the seasons and climate, sweat being most profuse in summer and the warmer regions. The action of the skin is complementary to that of the kidneys, chilling of the integument producing renal hyperæmia. The amount of solid excretory matter and carbonic acid gas eliminated by the skin is small, but cannot be suppressed without danger to life. Experiments of closing the pores by a coating of varnish or tin-foil, both in man and lower animals, have induced alarming depression and death. Reversely, the artificial stimulation of the perspiration is a valuable channel for eliminating morbific matter in impaired health or disease. Bathing, friction, and clean clothing, by favoring activity of the sweat-glands and open pores, are means of preserving health. The sweat is secreted by the sudoriparous or sweat glands, a coiled tubular mass beneath the skin, with an excretory tubule terminating on the surface. (See HISTOLOGY, "sweat-glands.") The tube is about $\frac{1}{370}$th of an inch in diameter, the coils or glands vary from $\frac{1}{125}$th to $\frac{1}{25}$th or $\frac{1}{12}$th of an inch in diameter. The number of sweat-openings varies on different surfaces; thus, as enumerated by Krause, to the square inch the palm of the hand (see figure) has 2736, the back of the hand 1490, sole of the foot 2685, top of the foot 924, forehead 1258, cheek 548. The number of sweat-glands in the body is estimated at 381,248, and the aggregate length of tubules as $2\frac{1}{3}$ miles.




Surface of the palm of the hand; a portion of the skin about one-half an inch square, magnified four diameters (*Sappey*): 1, 1, 1, 1, openings of the sweat-ducts; 2, 2, 2, 2, grooves between the papillæ of the skin.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Sweat'ing Sickness,** one of the several prevalent and fatal epidemics occurring during the fifteenth, sixteenth, and early part of the seventeenth centuries. It was also known as "pestilent sweat" and as the "English ephemera," as the English people both at home and abroad were chiefly attacked. In Germany, Holland, Sweden, and Denmark it prevailed more mildly. It first appeared in England in 1485. It was of brief period both in individual cases and in duration of single epidemics. Fully half of the population in infected towns were taken down with the disease, the mortality great, but where death did not result all danger was past in twenty-four hours, and epidemics rarely lasted a month. Of the five great English epidemics of the sweating sickness, the remaining four were in 1506, 1517, 1528, 1551. The attack consisted of a febrile and sweating period. It commenced with pains in the back, shoulders, and limbs, flushes of heat, oppression at the liver and stomach, pain in the head, delirium, palpitation, followed by heaviness and desire to sleep, which in fatal cases tended to become profound coma or stupor. Profuse sweating now set in, in favorable cases leading to speedy convalescence. The patient was liable to one or many relapses. The disease spared the aged and young, attacking chiefly middle-aged, plethoric men of all classes and rank. Both in England and on the Continent the greater prevalence of this disease among Englishmen was attributed to their peculiarly gluttonous, excessive diet. By Hecker, Guy, and others the several epidemics of this disease are ascribed to preceding periods of atmospheric and telluric insalubrity, the influence of gathered armies, and to the absence of house and street drainage in the larger cities and towns. Its period of incubation, rapid progress, and speedy convalescence disconnect it from epidemics of the typhus class. Hecker has termed it "a rheumatic fever in the most exquisite form that has ever yet been seen in the world." It has also been regarded a form of influenza or catarrhal fever. Guy considers it undoubtedly of malarial nature, an ague with short febrile and sweating stages, often malignant and fatal in the first or congestive period, and in convalescence leaving, as in all malarial periodic disorders, a temporary lassitude and frequent recurrences. The treatment most successful in these epidemics was absolute rest for twenty-four hours, and blanketing, warm air, and warm drinks to hasten profuse sweating.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Swed'berg** (JESPER), b. at Fahlun, Sweden, Aug. 28, 1653; studied theology at the University of Upsal, and was appointed pastor at Vingaker in 1690, professor of theology at Upsal in 1692, and in 1702 bishop of Skara in West Gothland. D. July 26, 1735. He was the author of the first Swedish grammar, and published in 1694 a hymnbook which was suppressed as pietistic. His father's name was Isaksson; the name Swedberg he assumed from an estate; he was the father of EMANUEL SWEDENBORG (which see).

**Swede Grove,** p.-v. and tp., Meeker co., Minn., on St. Paul and Pacific R. R. P. 446.

**Swe'den** (KINGDOM OF) occupies the larger part of the Scandinavian peninsula, extending between lat. 55° 20′ 18″ and 69° 3′ 21″ N., and comprising an area of 444,814 quadrate kilomètres, of which 407,446.51 is land and 37,367.49 water; 49 per cent. of the whole area is productive soil, besides the pastures, 42.6 is forest, 6.4 under cultivation; or, expressed in hectares, 17,568,000 is forest, 2,547,700 is arable land, 1,986,100 is natural meadow, 26,400 is garden, etc. Agriculture forms the principal occupation, and employs about 3,000,000 people—that is, three-fourths of the whole population; there are 253,650 land-owners. Formerly, a most peculiar kind of husbandry prevailed: the forest was felled and burnt, and in the ashes the grain was sown. But that has now nearly ceased. In the northern districts, however, the fields are sown every year till they are completely exhausted; they then lie fallow for a series of years, and are used as pasture-ground. A perfect system of rotation is employed only on the larger estates in the middle and southern provinces. Rye thrives everywhere, wheat only in the southern parts; barley is the most common cereal. Oats, peas, and beans can be raised only as high as lat. 64° N., but potatoes everywhere. The annual production of grain is estimated at 31,000,000 hectolitres, of potatoes at 18,500,000; which is more than the country needs, although grain forms the most important item of exportation. The cattle-breeding is still capable of great development. There are many cattle, but not improved. In 1872 there were 446,309 horses, 2,103,319 horned cattle, 1,659,644 sheep. The horned cattle and the horses are small but vigorous; the sheep yield only coarse wool. In 1870 there were 124,326 goats. The number of reindeer is estimated at 100,000. The profit of cattle-breeding (horses not reckoned) was estimated in 1870 at 115,000,000 francs. The forests form a considerable part of the national wealth, and their management is of the highest importance. Wood is not only used as fuel, but, outside of the two larger cities, Stockholm and Göteborg, most houses are built entirely of this material, and it forms a valuable export. About 20 per cent. of the forests belongs to the state or public property. They consist chiefly of fir and spruce, mixed with birch, alder, and ash; S. of the Dal-Elf the oak appears, and in the southernmost provinces the beech. About 890,000,000 cubic feet of firewood, 110,000,000 cubic feet of timber, and 150,000,000 cubic feet of lumber for exportation—in all, 1,150,000,000 cubic feet or 30,000,000 cubic mètres of wood—are annually felled. Mining and smelting are of great importance. Sweden is rich in ores, especially in iron ores. They occur chiefly within a belt extending from E. to W., from Uppland and the southern parts of Gesbrikland, through Westmanland, Nerike, and the southern parts of Dalarne, to the eastern part of Wermland, and it is simply due to the difficulty in procuring the necessary fuel that the iron production is not still more important. Sweden possesses coal only in the province of Skåne, and had to import 26,906,103 cubic feet of coal and coke in 1872. The forests in the neighborhood of the mines are nearly exhausted. The iron ore produced in 1871 amounted to 662,539,460 kilogrammes; 4939 persons were employed in raising it. In the same year 298,760,740 kilogrammes of pig iron, 187,692,650 kilogrammes of bar iron, and 8,033,930 kilogrammes of Bessemer steel were produced; 3812 persons were employed at the blast-furnaces, 6073 at the rolling-mills, 5104 at the foundries and manufactories. Large quantities of iron and steel are exported,

especially to England. Next to iron, copper is the most important; 1,420,860 kilogrammes were produced in 1871, and 96,580 kilogrammes of sulphate of copper. Only small quantities of gold are produced; of silver 975 kilogrammes in 1871, of lead 89,050 kilogrammes, of zinc 32,171,990 kilogrammes. Salt, manganese, sulphur, graphite, and feldspar occur, though only in small quantities. Of peculiar importance is the country's richness in peat. According to recent estimates, about 12,000 quadrate kilomètres are covered with peat to a depth of from 2 to 10 mètres, which substance is used of late more and more for smelting and other purposes. Hunting was regulated by a law of Oct. 21, 1864, and definite shooting-seasons determined for the elk, stag, deer, wild reindeer, beaver, hare, woodcock, moorhen, heathcock, grouse, swan, duck, eider goose, snipe, etc. The bear, wolf, lynx, glutton, fox, and birds of prey are always chased, and a prize is paid for every specimen of the four first species killed; 99 bears, 47 wolves, 107 lynx, 139 gluttons were annually killed between 1866 and 1870. The fisheries yield a considerable profit, especially the herring fisheries along the Baltic coast (about 3,000,000 crowns a year) and the salmon fisheries in the rivers. The chemico-technical industry, though still very young, is highly developed in several directions. Thus the Swedish matches, for instance, are celebrated all over the world. The largest factory, employing about 1500 persons, is located in Jönköping, but there are about 30 more. The exportation of this one article amounted in 1872 to more than 6,000,000 kilogrammes. Manufactures of acids and salts are established at Stockholm, Göteborg, and Fahlun; of manures at Stockholm and Göteborg; of fats and soaps, mineral and wood oils, of dyestuffs, etc., at several places. Sugar-refining is an important branch of industry; of whisky about 38,000,000 litres are annually produced; 99 tobacco manufactories were in operation in 1871, and produced about 4,000,000 kilogrammes of goods, valued at about 7,000,000 crowns. The manufactures of woollens at Norrköping, Stockholm, Halmstad, Malmö, Landscrona, and other places consume annually 1,750,000 kilogrammes of foreign wool, without satisfying the demands of the country; woollen fabrics valued at about 15,000,000 crowns are annually imported. The cotton industry has been very fluctuating since the American war; it reached its maximum in 1871, with a production of about 12,000,000 kilogrammes, but in 1872 only about 6,500,000 kilogrammes were produced. The linen manufactures are chiefly dependent on home industry, though there are large weaving-factories at Almedal and Göteborg. The silk industry stands at the same point of development as centuries ago, and is unimportant; the value of the annual production amounts to 1,500,000 crowns. The leather industry is small; 4,500,000 kilogrammes of hides and skins were imported in 1871. The manufacture of metallic wares is not so important as it ought to be with such excellent iron and steel; the centre of this branch of industry is the town of Eskilstuna in Södermanland. The standard of gold and silver is regulated by the government; imported articles of these metals are examined, and if they do not come up to the standard of the country, they cannot be sold. The industry in wood is considerable, though chiefly home industry; there exist only a few factories for cabinet-work—3 in Stockholm, 1 at Sandarna. The potteries and the stone and glass factories produce fine articles. The building material is mostly granite; the porphyry articles from Elfdal in Dalarne are celebrated; the glass manufactories at Kosta and Limmared are important; earthenware is made at Rörstrand, Gustafsberg, and Höganäs. The hardware manufactures are small, but the paper manufacture has recently increased, and several fine inventions have been made in the manufacture of paper from wood. In 1871 the number of persons engaged in trade comprised 26,281 males and 13,256 females, to which must be added 883 master mechanics. There were 1955 manufacturers, employing 40,420 operatives. The commerce is steadily increasing. In 1861 there were 10,199 dealers and 5755 clerks; in 1871 there were 13,431 dealers and 8750 clerks. Foreign commerce is also increasing. The principal articles of exportation are the products of agriculture, the forests, the mines, and the fisheries. The principal articles of importation are colonial goods, spinning materials, textile fabrics, hides, leather, guano, coal, salt, and railway materials. The following table shows the development of the commerce of the country:

| | Value of imports. | Value of exports. |
|---|---|---|
| 1850, | 36,354,000 crowns | 38,625,000 crowns. |
| 1860, | 82,469,000 " | 86,496,000 " |
| 1865, | 105,863,000 " | 108,086,000 " |
| 1870, | 141,686,000 " | 152,502,000 " |
| 1871, | 169,179,000 " | 161,623,000 " |
| 1872, | 216,366,000 " | 199,815,000 " |
| 1873, | 271,440,000 " | 221,904,000 " |

In the last year the traffic with foreign countries was as follows, counted in thousands of crowns:

| | Importations from. | Exportations to. |
|---|---|---|
| Denmark | 37,240 | 21,874 |
| Norway | 13,549 | 7,424 |
| Finland | 5,554 | 3,614 |
| Russia | 13,436 | 3,497 |
| Germany | 62,057 | 18,249 |
| Great Britain | 95,015 | 120,915 |
| Holland and Belgium | 15,834 | 12,619 |
| France | 9,367 | 19,189 |
| Spain and Portugal | 2,850 | 2,888 |
| Mediterranean countries | 1,225 | 2,304 |
| United States | 7,960 | 6,951 |
| Canada | —— | 171 |
| West Indies | 1,314 | 31 |
| Brazil | 3,419 | 674 |
| Rio de la Plata | 2,154 | 100 |
| Cape | 260 | 266 |
| Australia | 205 | 1,138 |

Nearly all the foreign commerce is carried on by sea, and for the greater part by foreign vessels; Swedish vessels carried 43 per cent. of the imports and 30 per cent. of the exports. In 1873 the statistics of navigation showed—entrances, 7422 vessels, of 306,739 lasts burden, of which 4367, of 149,349 lasts, were Swedish, and 3055, of 157,390 lasts, foreign; clearances, 14,913 vessels, of 713,819 lasts burden, of which 7991 vessels, of 248,466 lasts, were Swedish, 6922 vessels, of 465,353 lasts, were foreign. At the end of 1873 the merchant fleet comprised 4078 vessels, of 142,144 lasts burden, of which 3490 were sailing vessels of 125,542 lasts burden, and 588 steamers of 16,602 lasts burden and 20,675 horse-power; 1781 sailing vessels, of 25,350 lasts burden, and 432 steamers, of 4754 lasts burden and 10,542 horse-power, were engaged in the home trade. The number of sailors was 24,732. By the law of Nov. 10, 1865, measures and weights were determined as follows: the unit of length is the *fot* (foot); 10 *fot* = 1 stång, 10 stång = 1 *ref*, 1 *fot* = 10 tum (inches), 1 tum = 10 lines. The dry measures are: 1 cubic foot = 10 *cans*, 1 *can* = 100 cubic inches. The weights are: 1 *nyläst* = 100 cwts., 1 cwt. = 100 pounds, 1 pound = 100 *ort*, 1 *ort* = 100 grains. The mile = 36,000 feet; and the acre = 56,000 quadrate feet. By the law of Feb. 3, 1855, the *riksdaler*, a silver coin, was made the basis of the coinage. Of 2 pounds of coinage silver, consisting of 12 parts of silver and 4 parts of copper, 100 *riksdaler* were made: 1 *riksdaler* = 100 *öre*. A gold coin, the *karolin*, equal to 10 francs, was also made. By the convention of Dec. 18, 1872, between Sweden, Norway, and Denmark, the *krona* (crown), a gold coin equal in worth to the old *riksdaler*, was made the basis of the coinage. The coin gold contains 90 parts of gold and 10 parts of copper. The notes of the state bank pass as legal payment. The state bank was founded in 1668 in Stockholm, and has branch offices in Göteborg, Malmö, Wisby, and Luleå. On Dec. 31, 1874, the population numbered 4,341,559. In 1872 there were 29,470 marriages, 131,128 births, 72,947 deaths, 4145 still-born. The average annual emigration between 1860 and 1870 amounted to 12,245; the emigration was 29,003 in 1870, 17,450 in 1871, 15,915 in 1872, 13,580 in 1873. In 1870 there were 4,162,087 Evangelical Lutherans, 3809 Baptists, Mormons, and Methodists, 190 Reformed, 573 Roman Catholics, 30 Greek Catholics, and 1836 Jews. The most important towns are Stockholm (150,446), Göteborg (63,748), Malmö (30,676), Norrköping (26,365), Gefle (16,787), Carlskrona (16,643), Jönköping (12,548), Upsala (12,367), and Lund (11,680). Politically, the country is divided into 25 *län*—Stockholm City, Stockholm-län, Upsala, Södermanland, Östergötland, Jönköping, Kronoberg, Kalmar, Gotland, Blekinge, Kristianstad, Malmöhus, Halland, Göteborg and Bohms, Elfsborg, Skaraborg, Wermland, Örebro, Westmanland, Kopparberg, Gefleborg, Westernorrland, Jemtland, Westerbotten, Norrbotten. But the geographical division of the country into three parts is also still in use—Swealand, the central part; Götaland, the southern part; and Norrland, the northern. Lapland, the northernmost part of the country, belongs to Norrland. Norrland and Lapland comprise an area of 246,053 quadrate kilomètres—that is, more than one-half of Sweden—but it has only 530,000 inhabitants—2.1 to 1 quadrate kilomètre. Götaland is the most densely-peopled part of the country, having 28 inhabitants to 1 quadrate kilomètre; Swealand has 16. The established Church is the Lutheran. The ecclesiastical division comprises 12 episcopal sees—namely, Upsala, Strengnäs, Linköping, Wexiö, Kalmar, Wisby, Lund, Göteborg, Skara, Karlstad, Westerås, and Hernösand. The government is a constitutional monarchy. The fundamental laws are—the constitution of June 6, 1809, the succession act of Sept. 26, 1810, the law on the freedom of the press, July 16, 1812, and the act of the constitution of the representative assembly, June 22, 1866. An act of July 31 and Aug. 6, 1814, regulates the relations to Norway. All government business is laid before the king in the state council, and there despatched. The state council consists

of 10 members, among which are the chiefs of the seven departments of justice, foreign affairs, war, navy, interior, finances, and worship and education. The popular representation, called the *riksdag*, consists of two houses. To be a member of the second house an income of 800 crowns and an age of twenty-five years are demanded; of the first, an income of 4000 crowns and an age of thirty-five years. The consent of both houses is necessary to issue a law, to fix the budget, to levy taxes and duties, etc. In questions relating to the ecclesiastical constitution the consent of the church assembly (*kyrkomöte*), convened every five years, is necessary. Every third year the chiefs of the nobility assemble in a congress of nobles to discuss their own affairs, but the nobility has no prerogatives. The interior self-government, which is very old, received its present form by the law of Mar. 21, 1862. Each of the 90 towns, and in the country each parish—of which there are about 2300—forms a community. The *läns* form communities of a higher order, in which self-government is carried on by assemblies of deputies. The Swedish law is not based on the Roman law, but developed independently, according to the wants of the people. It dates from 1734, but has received many extensions since that time, one of the most important of which is the criminal code of Feb. 16, 1864. Juries are employed only in press cases. The budget of 1876 shows —ordinary receipts, 25,917,000 crowns, among which 14,600,000 from the railways; extraordinary receipts, 41,590,000, among which 20,000,000 from the custom-houses, 13,130,000 from taxes on whisky, etc.; collateral receipts, 28,169,013; total receipts, 95,676,013. Expenses —ordinary, 55,185,400, among which 1,266,000 to the royal family, 11,772,300 to the army, 13,091,000 to the interior, 4,617,600 to the navy, 11,357,700 to the finances; extraordinary, 27,329,200, among which 9,850,842 to the army and navy, 12,000,000 to the railways; collateral expenses, 13,161,413; total expenses, 95,676,013. At the end of 1874 the debt amounted to 130,477,920, of which 37,813,900 was home debt, and 92,664,020 foreign debt. The army consists of five classes of soldiers: (1) *värfvade*, volunteers who are engaged for six years; (2) *indelta*, troops in cantonment, who receive a certain payment in money or naturalia, possess house and ground, and annually serve for several weeks; they are bound to serve as long as capable; (3) *beväring* or *landvärn*, troops levied by conscription, among which every Swede is bound to serve from his twentieth to his twenty-fifth year; (4) the militia of Gotland, which is not bound to serve outside of the island; (5) the volunteer tirailleurs, established in 1861. The infantry of the permanent army comprises 2 regiments of body-guards, 2 regiments of body-grenadiers, 17 regiments of infantry, 1 regiment of chasseurs, 1 grenadier battalion, 1 grenadier corps, and 3 chasseur corps. In peace each regiment has two battalions of four companies—in war, three. The cavalry consists of 47 squadrons—namely, 1 regiment of body-guards, 3 regiments of hussars, 1 corps of hussars, 1 regiment of dragoons, 1 corps of mounted chasseurs. The artillery consists of 30 batteries, among which 22 are field artillery, 6 are mounted, and 2 batteries are on foot. The engineers consist of 1 battalion of pontoniers, 1 company of military telegraphers, and 1 battalion of sappers. In 1873 the army numbered 35,646 men of the line, 86,101 in the reserve, and 29,026 in the militia; in all, 150,773 men. In 1873 the navy consisted of 1 ship of the line, of 350 horse-power, 66 guns, and 735 men; 1 frigate, of 400 horse-power, 16 guns, and 316 men; 3 corvettes of 1100 horse-power, 22 guns, and 565 men; 4 monitors, of 610 horse-power, 8 guns, and 330 men; 10 small monitors, of 403 horse-power, 10 guns, and 411 men; 112 gunboats, 1 transport vessel, 2 avisoes; in all, 4183 horse-power, 139 guns, and 3078 men, besides 10 sailing-vessels, with 140 guns and 1625 men; and 87 rowing vessels, with 113 guns. Of railways, there were in Sept., 1875, in operation, 1509 kilomètres belonging to the state, and 2091 kilomètres in private possession; and under construction, 600 kilomètres belonging to the state, and 2000 to private associations. In 1873 there were 641 post-stations, and 15,011,874 letters were despatched, of which 1,412,689 were to foreign countries. Receipts from the post, 3,170,561 crowns; expenses, 2,869,986. In 1874 the telegraph comprised 7848 kilomètres of lines, of which 194.4 kilomètres were submarine, with 18,633 kilomètres of wires and 159 stations; 986,397 telegrams were despatched; receipts, 1,229,678 crowns. The popular education is obligatory and good. At the end of 1871 there were 7528 institutions for popular instruction, and 9 seminaries for the education of teachers; 77 higher schools, 21 academies, 2 universities—in Upsala and Lund.

*History.*—The introduction of Christianity and the consolidation of a national empire were accomplished during the reign of Eric IX. (d. 1160), who subsequently was worshipped as the patron of the country. The contest between the two royal families—that of Sverker and that of Eric—which began in 1061, continued, however, up to 1250. During these controversies, replete with open battles and secret murders, there arose a number of powerful families which, in connection with the higher clergy, suppressed the people and opposed the royal power. The most powerful of these families was that of the Folkunger, from which issued many jarls, and finally also a new dynasty (1266–1365). By the battle of Enköping (1365) Albert of Mecklenburg obtained the crown, but was defeated at Falköping (1389) by the Danes, and Margrethe, daughter of the Danish king Waldemar, and widow of the Norwegian king Haco, now became queen of Sweden. Her grand-nephew, Eric of Pomerania, was chosen heir-apparent at Kalmar (July 20, 1397), and at the same time a union was concluded between Sweden, Norway, and Denmark. But Eric's government was so bad that the Swedes separated and determined nevermore to obey a foreign king. Nevertheless, in Oct., 1440, Christopher of Bavaria ascended the Swedish throne. In 1448 the Swede, Charles Knutson, succeeded him as king, but was expelled by the treacherous archbishop Oxenstiern, who crowned Christian I. of Oldenburg king of Denmark and Norway June 19, 1457. Knutson, however, returned by the aid of the Swedish peasants, and reigned till May 15, 1470. Under his successor, Sten Sture, the peasants again defeated the Danes at Brunkeberg (Oct. 11, 1471), and Sten Sture reigned till Dec. 13, 1503, though under perpetual warfare. During the anarchical state which followed his death, Christian II. of Denmark seized the crown, but made himself hateful by his cruelty (the Stockholm massacre, Nov. 8, 1520), and by the valor of the peasants of Dalarne, Gustavus Wasa succeeded in expelling him, and ascended the throne in 1523. He broke the power of the Roman Catholic clergy, but under his successors, Eric XIV. and John III. (1560–92), they recovered their influence, and the country was agitated by religious disturbances. Sigismund (1592–1600), a Roman Catholic, was overthrown by his uncle, Charles IX. (1600–11), a zealous Protestant; and his son, Gustavus Adolphus (1611–32), became a celebrated king and general, the champion of Protestantism, and the dangerous enemy of Austria during the Thirty Years' war. Nevertheless, under his reign the nobility were powerful and the people were poor. The power of the nobility still more increased under the government of Queen Christina and the chancellor Oxenstiern. Sweden obtained by the Peace of Brömsebro (1645) the island of Gotland and other important territories from Denmark, and by the Westphalian peace (in 1648) Pomerania, Rügen, Wismar, Bremen, and Verden. Her political influence was considerable. Charles X. Gustavus (1654–60), a cousin of Christina, count-palatine of Zweibrücken, involved the country in wars with Denmark, Poland, and Russia, but gained by the Peace of Roeskilde (1658) Skåne and the whole southern part of the present Sweden from Denmark. Charles XI. (1660–97) regulated the relations of Sweden to Poland, Brandenburg, and Austria by the Peace of Oliva (May 6, 1660), to Denmark by the Peace of Copenhagen (June 26, 1660), and to Russia in 1661, and left the country in a good state to his son, Charles XII. Sweden had at that time reached the culminating point of its power. It comprised, besides its present territories, Finland, Esthonia, Livonia, Carelia, Ingria, Pomerania, Rügen, Bremen, Verden, and the city of Wismar. But Charles XII. ruined it for a whole century by his senseless wars. He maintained its political power, but became, nevertheless, the first cause of its subsequent decline. Even the great northern war, in which he gained such fine laurels, hurt the prosperity of the country. By consenting to the establishment of a constitutional government, Ulrica Eleonora, the sister of Charles XII., and married to Friedrich of Hesse, was chosen regent in preference to the nearest heir, Duke Charles Friedrich of Holstein. On Feb. 21, 1719, she made oath on the constitution, according to which a state council of twenty-four persons was to take part with the king in the government. Meanwhile, the war went on, but unfortunately; by the Peace of Stockholm (Jan. 20, 1720) Sweden ceded Bremen and Verden to Hanover, and Stettin and part of Pomerania to Prussia; and by the Peace of Nystad (Sept. 10, 1721) it ceded Esthonia, Carelia, and Livonia to Russia. Two parties arose in the state councils—the *Hats* and the *Caps*—and from 1720 to 1772 their rivalries greatly disturbed the country. The Hats were the friends of the king—the Caps contended for freedom and progress. In 1741 the Hats prevailed with the king, and the war with Russia was renewed, but it was unlucky, and by the Peace of Åbo (in 1743) Sweden lost a part of Finland. On Mar. 25, 1751, Adolphus Friedrich of the house of Holstein-Gottorp ascended the throne, but the state council had at this time assumed the whole power of governing. The king was almost without influence, and when in 1756 the state council arraigned and decapitated several of the king's friends, he was unable to

save them. In the Seven Years' war Sweden joined France, but with small effect. Gustavus III., who ascended the throne in 1771, broke the power of the nobility, but was assassinated Mar. 29, 1792, and succeeded by his son, Gustavus IV. Adolphus. Under his government Sweden interfered in a most awkward manner in the affairs of Europe. First, it fell out with England, lost the island of St. Bartholomew, and saw an English fleet victorious in the Baltic; then it successively came into conflict with France and Russia, and lost Pomerania and Finland; finally, the army rebelled and deposed the king Mar. 29, 1808. The duke of Södermanland succeeded, and reigned from June 6, 1809, as Charles XIII., but as he had no children, the French marshal Bernadotte was chosen crown prince, and he soon became the real ruler of the country. He refused to join Napoleon in his war against England, concluded an alliance with Russia, and led the Swedish army in 1813 and 1814, in reward for which he obtained Norway from Denmark by the Peace of Kiel (Jan. 14, 1814). After the death of Charles XIII. (Feb. 5, 1818), Bernadotte ascended the throne as Charles XIV. John. His measures for the material development of the country were successful, but in other respects his government was destitute of any definite character—a perpetual yielding to the nobility. He d. Mar. 8, 1844, and was succeeded by his son, Oscar I., who promised a reform of the constitution in a liberal direction, but did not carry it out, and who in 1854 showed a desire of joining France and England against Russia in order to reconquer Finland, but remained neutral. During the reign of his son, Charles XV., who succeeded him July 8, 1859, the constitutional reform was accomplished, June 22, 1866. He d. Sept. 18, 1872, and was succeeded by his brother, Oscar II. AUGUST NIEMANN.

**Sweden** (LANGUAGE AND LITERATURE OF). See SWEDISH LANGUAGE AND LITERATURE.

**Sweden,** p.-v. and tp., Oxford co., Me. P. 549.

**Sweden,** tp., Monroe co., N. Y. P. 4558.

**Sweden,** p.-v. and tp., Potter co., Pa. P. 357.

**Swe'denborg** (EMANUEL), b. in Stockholm, Sweden, Jan. 29, 1688. His father, Jesper Swedberg, was bishop of Skara in West Gothland, and was charged with the care of the Swedish churches in England and in the North American colonies. His family was ennobled by Queen Ulrica in 1719, and took the name of Swedenborg. He thereafter took his seat with the equestrian order of nobles. His education was the best which could be given him. After leaving the University of Upsala, he travelled widely through Europe. In the course of his life he visited Italy, France, and Germany, and spent much time in Holland and in England, publishing most of his books in those countries. He applied himself with great industry to mathematics and mechanics, and later to the natural sciences, and especially to physiology. In 1716 he was made assessor of the board of mines by Charles XII. He assisted the king at the siege of Frederickshall in 1718 by transporting some vessels over fourteen miles of land by machines of his own invention. Between 1718 and 1733 he published many small mathematical and philosophical works; among them were treatises on chemistry, in which he attempted to apply geometry to the phenomena of chemistry and physics; on the elemental nature of fire; on a new method of finding longitudes by lunar observations; on a method of constructing docks and dikes; and on a mode of ascertaining the powers of vessels by the application of mechanical principles. At Leipsic, in 1722, he published *Miscellaneous Observations* on various scientific questions; among them were proofs that some of the Swedish mountains, and much of what is now dry land, were once under the sea, and that the whole earth was at one time probably covered with water; that the transmutation of metals, then sought by many, was impossible; that there is no central fire in the earth. In the same year he published a treatise on the Swedish currency. For the next ten years he published nothing, being occupied with the duties of his office. In 1734 he published, at the expense of the duke of Brunswick, his *Philosophical and Mineralogical Works*, in 3 vols. folio, of which the first volume is his *Principia, or the First Principles of Natural Things, being new Attempts toward a Philosophical Explanation of the Elementary World.* This very remarkable work is a complete cosmogony, and it would be impossible to give here even a general account of it; but some of his views may be stated. He held that matter is resolvable in the last analysis, not into definite atoms or molecules occupying space, but into points of dynamic force. This view Faraday held, and some of his remarks imply that he considered it demonstrable. The same view is expressed at the close of De la Rive's great work on electricity as the only one which accounts for electrical phenomena. Swedenborg in his *Principia* sets forth distinctly the nebular hypothesis. Laplace, who is regarded as its originator, says Buffon first suggested it to him, and a copy of Swedenborg's *Principia* is now in London which was owned by Buffon, and has his autograph on the title-page. Swedenborg asserts that nature is everywhere the same, in great as well as in little, mere size making no difference. Hence he maintained a peculiar doctrine of vortices, looking on each molecule, which is derived from the primal point, and each sun and earth formed of molecules, as all having the gyrating force of the primal point, which he defines as "pure and total motion," and as the origin of all things in nature. These vortices were entirely different from those of Descartes and Leibnitz, which Newton's theory of gravitation superseded. He held also that heat, light, and electricity were but modifications of one element, one ether, and that magnetism is in all matter, latent or active, and is one of the means and forces by which matter exists. This view also is very similar to that which Faraday held. But it is difficult to present his views on these subjects intelligibly in few words. In 1734 he published in Leipsic a small work on *The Infinite, and the Prime Cause of Creation, and the Mechanism of the Operation of the Soul and the Body.* In 1740 he published *The Economy of the Animal Kingdom;* in 1744 and 1745, *The Animal Kingdom* and *The Worship and Love of God.* At that time his reputation as a man of science and a philosopher was firmly established. He was a member of many learned societies, and had been invited in the most flattering terms to become a professor of pure mathematics in the University of Upsala. From that time to the present eminent scientists who have studied his works have borne testimony to his wide and exact learning and profound thought, and acknowledged that important discoveries in science were anticipated by him.

He had always been a thoroughly religious man, but for a few years before 1745 his diaries and notebooks (which have been published to the extent of 12 or more 8vo vols.) show that he was changing the direction of his studies from the physical and natural to the psychical and spiritual. In that year, he tells us, he "was called to a new and holy office by the Lord himself, who manifested himself to him in person, and opened his sight to a view of the spiritual world, and granted him the privilege of conversing with spirits and angels." In 1747 he resigned his office of assessor, which he had held for thirty years, requesting that half of his salary might be continued to him. The king accepted his resignation, and granted him a pension for life equal to his full salary. He wrote to a friend: "My sole view in this resignation was, that I might devote myself to that new function to which the Lord had called me. On resigning my office a higher degree of rank was offered me, but this I declined, lest it should be the occasion of inspiring me with pride." From 1749 to 1756 he published the *Arcana Cœlestia* in 8 4to vols.; in 1758, *An Account of the Last Judgment and the Destruction of Babylon; On the White Horse mentioned in the Revelation; Heaven and Hell; On the Planets in our Solar System and in the Starry Heavens,* and *On the New Jerusalem and its Heavenly Doctrines;* in 1763, *The Doctrine of the New Jerusalem concerning our Lord,* same *Concerning the Sacred Scriptures,* same *Concerning Faith,* same *Concerning Life,* a *Continuation concerning the Last Judgment and the Destruction of Babylon,* and *Angelic Wisdom concerning the Divine Love and Wisdom;* in 1764, *Angelic Wisdom concerning the Divine Providence;* in 1766, *The Apocalypse Revealed:* he had written a much larger work, *The Apocalypse Explained* as far as the 10th verse of the 19th chapter, which he did not publish, nor, as far as is known, finish—it has been published since his death; in 1768, *The Delights of Wisdom concerning Conjugial Love;* in 1769, *A Brief Exposition of the Doctrine of the New Church,* and a small work entitled *The Intercourse between the Soul and the Body,* which is called in the English translation *A Treatise on Influx.* In 1771 he published his last work, *The True Christian Religion, containing the Universal Theology of the New Church.* He also left voluminous manuscripts, of which Dr. J. F. S. Tafel, professor and librarian in the University of Tübingen, published many. After the publication of the *True Christian Religion* he went to London, and while there, on Christmas Eve in 1771, he was struck with hemiplegia. After a few weeks he recovered his speech, and his faculties were clear to the last. His strength gradually declined, and he died, without pain or struggle, Mar. 20, 1772.

He has never been charged with imposture. In his system religion and philosophy are one, and in neither of them can there be found anything to suggest the idea of unsoundness of mind. His scientific and philosophical works, published before what his disciples call his illumination, are characterized by exact statement and sustained and coherent argument. The same qualities are to be found

in his theological writings so far as they relate to principles or doctrines. For thirty years he held an important public office, and how well he discharged its duties may be inferred from the favor of his king when he resigned it. As one of the nobles of Sweden he took an active part in their deliberations. Count Höpken, in 1761 and for many years prime minister of Sweden, said, in an address delivered after his death, "The most valuable and well-written memorials on finance were presented to the diet of 1761 by Swedenborg." This was after he had published for years, and while he was continuing to publish, his relations of things seen and heard in the spiritual world, and was widely known in Sweden as professing to have his spiritual senses open. What must have been the strong sense and sound judgment which could thus commend themselves to men of business and overcome the prejudice against him as a visionary! He had the friendship and confidence of the sovereigns of Sweden to his death. His rules of life exhibit the man. They were: "I. Often to read and meditate on the word of God; II. To submit everything to the will of Divine Providence; III. To observe in everything a propriety of demeanor, and to keep the conscience clear; IV. To discharge with fidelity the functions of my employment and the duties of my office, and to render myself in all things useful to society." They who think he was insane must rest that opinion on the fact that for more than twenty-five years, with brief intermissions, he claimed that he was in the spiritual world whenever he wished to be there, and published what would fill volumes of things there seen and heard. He held that we live while in this world because we have a spiritual body, which fills and animates our material body; that this spiritual body is formed of spiritual substance, and at death (which usually occurs about the third day after apparent death) leaves the material body and rises into a world of spiritual substance; that spiritual substance stands to the spiritual organs of sense and the mind therein as material substance stands to the material senses, and is related to and affects them in a similar way; that this material substance, while the spiritual body is within it, is an instrument by which the spiritual senses perceive material things, and a barrier between them and spiritual things; and that when it pleases Providence this barrier ceases, wholly or partially, to obstruct the perception by the spiritual senses of spiritual things. Then the spiritual senses are "open."

It may be added that Swedenborg exhibited in many instances a knowledge of facts which, as it seemed, implied an opening of his spiritual senses. Kant, the German philosopher, examined into and related some of them. In 1759, Swedenborg was in Gottenburg, and on the 19th of July dined at the house of William Castel with a large party. About six o'clock he appeared much disturbed, and stated that a dangerous fire had broken out in Stockholm at the Sudermalm, and was spreading rapidly. He then described the progress of the fire, and at eight o'clock declared that it was extinguished. This was reported to the governor, who sent for Swedenborg and received from him a description of the fire. On the 21st a messenger arrived from Stockholm (which is 300 miles from Gottenburg), announcing the fire and describing it precisely as Swedenborg had done. Another case is this: Marteville, ambassador from Holland to Sweden, died, and his widow married again; a claim was brought against his estate for 28,000 guilders, which she knew her husband had paid, but the receipt could not be found. A story arose that Swedenborg had helped her to it. Her second husband, being applied to, made the following statement: She had requested Swedenborg to learn from her husband where the receipt was. He replied he would do so if he could; a week afterward Marteville came to her in a dream and described to her a secret drawer in his cabinet where she would find the receipt, and also a valuable jewel which had been lost. She arose at once, found the drawer, and in it the receipt and the jewel. Early the next forenoon Swedenborg called and stated that he had seen Marteville the preceding night, who told him he should go and impart to his wife a matter of much moment to her. The queen of Sweden, seeing Swedenborg at court, made some inquiry of him respecting her brother, the prince of Prussia, who had recently died. He replied that he had not seen him. A week afterward he came again to court, went at once to the queen, and in a low tone made a communication to her. She was much moved, and said to those about her, "Only God and my brother can know what he has just told me." Of these incidents Kant simply says the evidence is unanswerable, but does not himself testify to them or to his belief of them. His religious views Kant entirely rejected. Of his philosophy he makes this singular statement: "The system of Swedenborg is unfortunately very similar to my own philosophy. It is not impossible that my rational views may be considered absurd by reason of that affinity. As to the offensive comparison, I declare we must either suppose greater intelligence and truth at the basis of Swedenborg's writings than first impressions would give, or that it is a mere accident when he coincides with my system—a *lusus naturæ*. Such a wonderful agreement exists between his doctrines and the deepest results of reason that there is no other alternative whereby the correspondence can be explained." Many other circumstances similar to the foregoing narratives might be mentioned. But Swedenborg never regarded them as proofs of his mission, or as of importance in any way, holding that the doctrines of the New Church (for a brief statement of which see article on the NEW JERUSALEM CHURCH) could be received only in freedom, and by those to whose desire for goodness they commend themselves, and whose reason they satisfy.

THEOPHILUS PARSONS.

**Swedenborgians.** See NEW JERUSALEM CHURCH, by T. PARSONS, LL.D.; and SWEDENBORG.

**Swedes'borough,** p.-v., Woolwich tp., Gloucester co., N. J., on Raccoon Creek, at S. terminus of Philadelphia and Swedesborough branch of West Jersey R. R., has 1 newspaper and several manufactories, and is situated in the midst of a fine fruit-growing region.

**Swedes'burg,** v., Upper Merion tp., Montgomery co., Pa., on Schuylkill River. P. 386.

**Swedish Language and Literature.** The Swedish language is a modern development of that Teutonic language which in ancient times was spoken uniformly throughout the whole of Scandinavia, Denmark, Norway, and Sweden under the name of *Norræna* or *Dönsk Tunga*, and which, in the ninth century, was brought to Iceland by the Norwegian colonization of that island, where it still lives in its original form under the name of the Icelandic language. It is impossible to tell exactly at what time this primitive language began to separate into the different branches, Danish and Swedish. The Runic inscriptions, in which Sweden is very rich, and which are found from the southern frontier of Denmark to the northern part of Sweden, show that the separation had not taken place in the eleventh century. Nevertheless, in the sixteenth century, at the time of the Reformation, Swedish had become an individual language, as different from its mother-tongue, the Icelandic, as from its sister-tongue, the Danish; and from that time it went on developing on its own principle, but influenced first by the German, and then by the French language, until in the eighteenth century it became finally settled in its present form, a little earlier than the Danish. Of the Scandinavian languages, the Swedish is, without any qualification, the most beautiful. Its materials are purer than those of the Danish, richer than those of the Norwegian, and in its grammatical forms it is more varied and less weakened than the Danish, more easy and less encumbered than the Norwegian. Its speech is sonorous and melodious, like that of the southern languages, remarkable for its clear, beautiful vowels, and marred with no harsh consonants. But the style in which it is written is inferior. Only on two fields, the humorous song and the historical narrative, has the Swedish style attained any high degree of excellence, and succeeded in establishing this degree of excellence as the general standard. On other fields exaggeration and vagueness are not uncommon.

A series of detached literary monuments from the fourteenth and fifteenth centuries, a more collected effort in the sixteenth, brought about by the Reformation, and a rather fantastical attempt in the seventeenth, inspired by Queen Christina, form the introduction to the history of the Swedish literature, which begins in the eighteenth with Olaf Dalin. The oldest literary monuments are provincial laws of the thirteenth; *Kämpavisor* and some religious writings, the revelations of St. Brigitta of Wadstena (1302–72), of the fourteenth; *Riddarvisor* and rhymed chronicles of the fifteenth century, of which the *Kämpavisor* and *Riddarvisor* are the most remarkable. They are popular songs, the first of a more heroic, the second of a more chivalric character, and they exhibit the closest resemblance to the Danish *Kjæmpeviser*, both in the subjects they treat and in their general treatment, tone, and language. But they have had a very different fate. In Denmark all singing ceased from the middle of the seventeenth century, and when once more a song was heard in that country, in the last decade of the eighteenth century, it was a product of literature and an affair of society; it flourished a short time, and then it died out almost entirely. In Sweden the popular song continued flowing in one uninterrupted stream from pagan times to our days. The skald, the knight, the peasant, the soldier, the priest, the student, followed one after the other, and their songs rang in every corner of the country. The popular song is the golden leaf in Swedish literature. A Swedish song

means the same as a Dutch picture or a Greek statue, the best the nation has produced. In 1476 a university was founded at Upsal; in 1483 a printing-office was established at Stockholm; and thus Sweden was possessed of the two most effective literary instruments which modern times have invented. Nevertheless, the literature which the Reformation called forth in Sweden was not great. Olaus Petri (1497–1552) translated the New Testament, composed a comedy of the book of Tobit, and wrote a Swedish chronicle. Laurentius Petri (1499–1573) translated the Old Testament and published a collection of sermons and hymns. But although these two men, who stood at the head of the whole movement, were not exclusively theologians, the literature which resulted from the spiritual fermentation of the time was mostly confined to theology. Under Gustavus Adolphus (1611–32) several libraries were captured in Germany and carried to Sweden, and his daughter, Queen Christina (1632–54) invited many of the most celebrated literary men of Europe to her court—Descartes, Salmasius, Vossius, Huet, Heinsius, Puffendorf, and others. Thus, broader views were originated and new starting-points formed, but the whole had an artificial and fantastical character. The two most conspicuous men of this time were Olaf Rudbeck (1630–1702) and Georg Stjernhjelm (1598–1672). Rudbeck was one of the most extraordinary men of his time. He studied medicine and discovered the lymphatic vessels; he lectured on botany at Upsal and founded the botanical garden; he became professor in anatomy and was deeply versed in the science of mechanics. But he became most famous as an antiquarian. His work, *Atlantica sive Manheim*, is one of the most learned and ingenious books ever written, though the sum-total of the whole argumentation is that Adam and Eve were Swedes, and Paradise located at Upsal. Stjernhjelm is less fantastic, because he was less gifted, but he is more artificial, for he was only an imitator. On account of his *Hercules*, a didactic epic, written in hexameters, he is generally called the father of Swedish poetry, but that is only a title.

In the beginning of the eighteenth century Swedish literature rid itself of the aspect of insulated efforts and incidental talents, and assumed the character of conscious education and representative taste. This period, which extends into the next century, to 1809, went through three different phases of rising (Dalin), culminating (Gustavus III.), and falling into decay (the Academy), but it may be generally characterized as the reign of French taste. Great activity was shown both in science and in literature proper. It was the time of Linnæus (1707–78) and Swedenborg (1688–1772). Christopher Polhammer (1661–1751) constructed the Trålhætta Canal and the dock at Carlscrona. Johan Ihre (1707–80) wrote his Swedish dictionary and a grammar of the Latin language, which was extensively used also outside of Sweden. Olaf Rudbeck the younger (1670–1740) was a good ornithologist, and C. V. Scheele (1742–86) a great chemist. But it was from the poet Olaf Dalin (1708–63) that the period received its true character. He was not a man of genius and great creative power, but he had versatile talents, taste, education, and knowledge. He could not awaken new life, but he could form a standard, and for nearly a century his countrymen followed the direction he had given them. He studied first medicine, and then law, but turned later to history, and his *Svea Rikes Historia* (4 vols., 1747–62) exercised a great influence, not on account of its new and elevated views—for as a critical and philosophical work it is rather deficient—but on account of its noble narrative and elegant style. Still greater was the effect of his *Den Svenska Argus*, a literary periodical, an imitation of Addison's *Spectator*, which he published in 1733 and 1734. It made him the centre of the Swedish civilization, and the influence of his talent and taste was still more strengthened by his relations to the court; he was the tutor of the young crown prince and a favorite of the queen, Luise Ulrike, a sister of Frederick II. of Prussia. Of his poetical works, *Den Svenska Friheten*, an allegorical epic, and *Brynhilda*, a tragedy, are cold and trivial to our taste, but in their own time they were models, and looked like inspirations; and his satires and minor poems are often witty and ingenious, always lively and elegant. Of a very different character were the poems of Mrs. H. C. Nordenflycht (1718–63), but it was only a difference of talent, not of taste. The literary circle of which she formed the centre, and which later developed into a literary society, "Utile Dulci," was nothing but a propaganda for French taste. The most prominent members of this circle were G. P. Creutz (1729–85), the author of *Atis och Camilla*, an idyl, which charmed all people, and G. F. Gyllenborg (1731–1808), who wrote *Tåget öfver Belt*, an epic. During the reign of Gustavus III. (1771–92) the period reached its culmination. Gustavus was a highly-gifted man, eloquent, ambitious, and with a lively sense for poetry and art. His craving for magnificent action, and more especially for the admiration which generally accompanies great deeds, found only a scanty gratification in real life, but with so much the greater intensiveness it turned to the ideal. The king became a poet himself, and he and his court stood actually at the head of Swedish literature. Like his uncle, Frederick II., he was deeply imbued with French ideas and French taste, but he was more successful in making his court the seat of the Muses and Graces, for he was less narrow. I. H. Kellgren (1751–95), C. G. Leopold (1756–1829), and J. G. Oxenstiern (1750–1818), the three greatest celebrities of the period, and intimate friends of the king, were not imported from France, like Voltaire and Maupertuis; nor were they mere imitators. The French period in Sweden was always thoroughly patriotic; the subjects were taken from Swedish life and history. And it was national, at least so far as it generally took its pictures from Swedish landscapes. A certain independence it also showed by preferring the English edition of the French taste to the original. Pope and Addison were followed more closely than Boileau and Voltaire. And it admitted within its pale Bellmann (1740–95), the very opposite to the classical ideal, a romanticist before romanticism was discovered. He dashed down on paper, with a few broken lines, some grotesque figures in some still more grotesque situations, such as he had seen in his nightly carousals in the suburbs of Stockholm, and with a few dots here and there he indicated the Swedish landscape which formed the background of the scene. But couched as these strophes are in a most original music, which he composed himself, the whole forms a picture of a delicacy, depth, and power of impression which are rarely equalled. There is ten times more elegance in the representation Bellmann gives of a drunken corporal than in that Voltaire gives of a princess; and his countrymen felt it immediately, and accepted him. But on literature at large Bellmann had no influence.

A transition from the classical to the romantic ideal, from the French to the German influence, was formed critically by C. A. Ehrensvärd (1745–1800) and C. H. Hoijer (1767–1812), and poetically by F. M. Franzén (1772–1847) and J. O. Wallin (1779–1839). Ehrensvärd's *De fria Konsternas Filosofi* ("The Philosophy of the Fine Arts") was very slow in gaining acknowledgment, but Hoijer's lectures on philosophy at the University of Lund were heard with enthusiasm. Of the works of Franzén and Wallin, it is their hymns which connect them with the new time that suddenly burst upon Sweden after the political revolution of 1809. Great scientists arose—in chemistry, Johan Jakob Berzelius; in botany, Elias Fries and K. A. Agardh; in history, Fryxell and Geijer; in medicine, Retzius; in philosophy, Boström; in theology, Reuterdahl and Thomander; and it is worth noticing that the Latin language was now abolished in scientific communications and supplanted by the Swedish. In literature proper the new time announced itself under two forms, the romantic and the national, of which the former was most conspicuous in the contest with the old, while the latter became the true representative of Swedish taste and Swedish civilization. The romantic school, called the "Phosphorists," from *Fosforus*, the name of its journal, was headed by P. D. A. Atterbom (1790–1855) and L. Hammarsköld (1785–1827), the first as poet, the latter as critic. Atterbom was a rich genius, deep though somewhat mystical, and generally true in spite of the exuberance of his imagination. But his turn of mind was more reflective than plastic. His lyrical poems, many of which are very long, have already lost some of their impressiveness. But his book on the history of the Swedish literature, *Svenska Siare och Skalder* (6 vols., 1841–55), is a work of the very first rank. Also Hammarsköld's *Svenska Vitterhedens Historia* ("The History of Swedish Literature") is an interesting and valuable book, though somewhat partial and confused. Influenced by the romantic school, although not belonging to it, stood E. J. Stagnelius (1793–1823), perhaps the greatest poetical genius the Swedish people have produced, perhaps only considered so on account of the peculiarity of his mind, which he lived long enough to show, but not long enough fully to expose. The national school, called also the Gothic, and represented by the journal *Idunna*, was headed by TEGNÉR and GEIJER, on whom special articles will be found in this book, as well as on the later representative, RUNEBERG. The Goths emancipated themselves very soon from the character of being a school, of which character they had borne very strong marks at their first appearance, especially in the writings of P. H. Ling (1766–1839). Men like Tegnér and Geijer form no schools; they make a national literature, and they found in the next generation many and various talents which followed out in every direction the principles given. CLEMENS PETERSEN.

**Swedo'na,** p.-v., Richland Grove tp., Mercer co., Ill. P. 359.

**Sweet Bay.** See BAY.

**Sweetbrier.** See EGLANTINE and ROSE.

**Sweet-bread.** See PANCREAS.

**Sweet Chalyb'eate,** p.-v., Alleghany co., Va., so named from its mineral springs, a place of summer resort.

**Sweet Flag.** See ACORUS CALAMUS.

**Sweet Gale.** See GALE.

**Sweet Gum.** See GUM TREE.

**Sweet Home,** tp., Clarke co., Mo. P. 1000.

**Sweet Land,** tp., Muscatine co., Ia. P. 1510.

**Sweet Pota'to,** the *Batatas edulis*, a convolvulaceous twining plant, a native of Southern Asia, whose rich sweet tuberous roots are employed as food. The sweet potato is extensively cultivated as an article of food in the U. S. It is grown as far N. as New Jersey, and does well in S. Michigan. It is the potato of the older English writers.

**Sweets'burg,** p.-v., Dunham tp., Missisquoi co., Quebec, Canada, on South-eastern Counties Junction Railway, 41 miles W. by N. of Stanstead. P. about 300.

**Sweet'ser** (CHARLES HUMPHREYS), b. at Athol, Mass., Aug. 25, 1841; graduated at Amherst College in 1862; founded the *Round Table*, a literary journal, in New York; was connected with other newspapers, and in 1867 was one of the originators of the *Evening Mail;* he, however, discontinued his connection with this, and in 1869 commenced the *City*, which ill-health compelled him to discontinue. He published *Songs of Amherst College* (1860), *History of Amherst College* (1860), and *Tourist's and Invalid's Guide to the North-west* (1867). D. at Pilatka, Fla., Jan. 1, 1871.

**Sweet Sop,** the soft, sweet, and aromatic fruit of *Anona squamosa* (order Anonaceæ), a small shrub, a native of tropical America, now common in most hot countries. It is extensively used as an article of food. Its seeds have an acrid, perhaps a poisonous quality, shared by the leaves, which have also a disagreeable smell.

**Sweet Springs,** p.-v. and tp., Monroe co., West Va. P. 1354.

**Sweet'water,** county of Central Wyoming, extending from Montana on the N. to Colorado and Utah on the S., crossed by the Wind River and Rocky mountains, watered by Big Horn, Green, and Sweetwater rivers, and traversed in the S. part by Union Pacific R. R. Some gold and iron have been found. Cap. Green River City. Area, about 35,000 sq. m. P. 1916.

**Sweet Water,** p.-v. and tp., Menard co., Ill. P. 230.

**Sweet Water,** p.-v., Monroe co., Tenn., on East Tennessee Virginia and Georgia R. R., 42 miles W. of Knoxville, in the heart of Sweetwater Valley, has several churches, 2 schools, 1 foundry, 1 newspaper, and 3 machine-shops. It is the business-centre of Monroe co. P. about 1200.

C. B. WOODWARD, ED. "ENTERPRISE."

**Swetchine'** (ANNE SOPHIE), b. at Moscow in 1782; was educated at the court of Catharine II.; married in 1799 Gen. Swetchine, and kept one of the most celebrated salons in St. Petersburg. In 1815 she turned to Roman Catholicism. She then removed to Paris, where she d. Sept. 10, 1857. After her death De Falloux published *Mme. Swetchine, sa Vie et ses Œuvres* (2 vols., 1859). The *Life and Letters of Madame Swetchine* and *The Writings of Madame Swetchine* were translated into English by Harriet W. Preston (1867 and 1869).

**Swett** (JOHN APPLETON), M. D., b. in Boston Dec., 1808; graduated at Harvard College in 1828 and at the Harvard Medical School in 1831; studied in Paris, especially in the hospitals; returned to America, and became connected with the New York Dispensary, where he delivered a series of lectures which were regularly reported and published in the New York *Lancet*. In 1842 he was elected one of the physicians to the New York Hospital, and in 1853 was appointed professor of the theory and practice of medicine in the University of New York. D. Sept. 17, 1854. He left a considerable legacy for the benefit of the orphans and widows of medical men; and published a *Treatise on Diseases of the Chest*, being a course of lectures delivered by him in the New York Hospital (1852).

**Swett** (SAMUEL), b. at Newburyport, Mass., June 9, 1782; graduated at Harvard College in 1800; studied law, and entered upon practice, but subsequently became a merchant; was a representative in the legislature of Massachusetts, and during the war of 1812 served on the northern frontier, on the staff of Gen. Izzard, with the rank of major. He published—*Abstract of Baron de Rogniat's Considerations on the Art of War* (1817), *History of the Battle of Bunker's Hill* (1826), *Sketches of a Few Distinguished Men of Newbury and Newburyport* (1846), *Who was the Commander at Bunker's Hill?* (1850), *Defence of Col. Timothy Pickering against Bancroft's History* (1859), *Original Planning and Construction of Bunker's Hill Monument* (1859), and fugitive poems. D. at Boston Oct. 28, 1866.

**Sweyn,** or **Sven,** king of Denmark and father of Canute the Great; invaded England, conducted several successful campaigns, and proclaimed himself king, but died (1014) before he had firmly established his power, leaving Canute as his successor.—Another SWEYN, son of Godwin, earl of Kent, a powerful Anglo-Saxon noble, and connected by marriage with Sewyn of Denmark, ravaged Wales in 1046; abducted an abbess; fled to Bruges, thereby forfeiting his estates; served in the English fleet against the count of Flanders; was restored to his estates; murdered his kinsman, Bjorn, and in expiation went on a pilgrimage to Jerusalem. Died on his way home, about 1050.

**Swietenia.** See MAHOGANY.

**Swie'ten, van** (GERARD), b. at Leyden May 7, 1700; studied medicine, pharmacy, and chemistry at Louvain and in his native city under Boerhaave, and was appointed professor of medicine, but was subsequently compelled to resign his office because he was a Roman Catholic. He went to Vienna, where he was appointed physician to the empress Maria Theresa, president of the faculty of medicine, and director of the imperial library. D. at Schönbrunn June 18, 1772. He wrote *Commentarii in H. Boerhaavii Aphorismos de cognoscendis et curandis Morbis* (5 vols., Leyden, 1741–72).

**Swift,** the name given to certain swift animals. I. It is most familiar in connection with birds of the family Cypselidæ, evidently bestowed on account of their swiftness of flight, and has been extended as a popular scientific term to all the members of the family. These have the same general form as the swallows, and, as is exemplified in the familiar "chimney swallow" (a true swift) of the U. S., the neck is short; the head depressed; the bill is very small and short, much depressed, and transversely triangular, being broad at the base, and with the sides converging rapidly toward the tip; the gape is very deep, and extends backward beneath the eyes; there are no well-defined rictal bristles; nostrils superior and close together; the wings are very long and pointed, incurved and pointed, and have ten primaries, of which the first and second are longest; the tail is diversiform, but always composed of ten feathers; the legs are very short and weak (much more so than in the swallows), the tarsi being much shorter than the middle toe; they are destitute of distinct scutellæ; the toes are of normal structure, each three-jointed (the modifications serving to differentiate the species into sub-families), but the hinder is always more or less versatile; the claws are well developed, curved, and acute. Co-ordinate with these superficial characters are some important osteological and myological ones. The sternum is almost if not quite destitute of a manubrial process, and its posterior border is entire, being sometimes convex and rarely concave; the scapular ends of the clavicles are not T-shaped; and the muscles of the lower larynx have not more than one pair of intrinsic muscles. The humerus is very short and the manus very long, in this respect agreeing with the corresponding parts of the goatsuckers, the near relatives of the swifts, and much exceeding the tendency in the same direction exemplified in the swallows. The species are less numerous than the swallows, Gray recognizing only 69. Remarkable differences in the structure of the feet differentiate the species into two sub-families—viz. (1) Cypselinæ, in which the three anterior digits have each three phalanges; and (2) Chæturinæ, in which the digits have, respectively, the outer five, the middle four, and the inner three phalanges, as in birds generally. Their distribution nearly coincides with that of the swallows, almost every country having its species. They also agree in most respects as to habits with the swallows, but their voice differs, and instead of being a kind of cheerful twitter, as in the swallows, is a feeble scream. The North American species are (1) *Panyptila melanoleuca*, white-throated swift; (2) *Nephœcetes niger*, black swift; and (3) *Chætura pelagica*, chimney swallow. The first two are Cypselinæ, the last Chæturinæ. To this family belong the birds (*Collocalia*) which make the celebrated edible nests so esteemed in China. II. In some parts of the U. S., especially of the Southern States, swift is also the name given to certain lizards of the family Iguanidæ, and especially to the *Sceleporus undulatus*, a species which runs with great celerity.

THEODORE GILL.

**Swift,** county of W. Minnesota, formed since the census of 1870, drained by Minnesota, Chippewa, and Pomme de Terre rivers, and traversed by St. Paul and Pacific R. R. The surface is rolling, with several small lakes, and the soil good. Cap. Benson. Area, about 750 sq. m.

**Swift** (JONATHAN), D. D., b. in Dublin Nov. 30, 1667. His father died seven months before the birth of his famous son, leaving his widow and an infant daughter in extreme

penury. His uncle Godwin made some provision for the family, and, when Jonathan was fifteen, had him entered at Trinity College, Dublin, where in 1685 he received his degree of B. A. by special favor. He seems to have remained at college until 1688, his uncle Godwin having in the mean time died insolvent, his maintenance and education being now assumed by his uncle William, of whom Swift always spoke with gratitude and affection. Subsequently, Swift joined his mother in England, where she was living on the bounty of relatives, one of them the wife of Sir William Temple. Sir William received him into his household at Moor Park in Surrey, making use of his services as an amanuensis, and apparently giving him the means of entering himself at Oxford for a short time, where he obtained his degree as M. A. in 1692. While residing at Moor Park he read much, but greatly impaired his constitution by what he ambiguously styles "a surfeit of stone-fruit." Whatever this surfeit may have been, among its consequences were frequent attacks of vertigo, prostration, and those forebodings of ultimate insanity which shadowed his whole life, and caused him to observe his birthday as a day of mourning. His position at Moor Park was an unpleasant one, and he went over to Ireland, and not without difficulty succeeded in 1695 in gaining admittance to holy orders and the prebend of Kilroot, worth £100 a year. Temple soon missed his services, and invited him to resume them; Swift was weary of living in a remote Irish town, and accepted the invitation. It was during this second residence at Moor Park that the intimacy grew up between Swift and Esther Johnson, known best as the "Stella" of Swift's life. She was a pretty, black-eyed girl of about thirteen, who with her mother occupied an anomalous position in the household; nominally, she was an attendant of Lady Giffard, Temple's sister, but was always called "Miss Hetty," and was generally, but without sufficient grounds, supposed to be a natural daughter of Sir William. Swift, who was more than twice her age, took a sort of charge of her education, and as she grew up she became devotedly, and beyond all doubt innocently, attached to him. Swift's position was greatly improved; he saw Temple's visitors, of whom King William III. was not seldom one, who promised that the young secretary should some day have an English prebend. Temple died in 1699, leaving a legacy of £1000 to "Miss Hetty" and a sum of money to Swift, with the charge of editing his posthumous works—a task which he performed, dedicating the volume to the king, and confidently expecting some substantial acknowledgment. But none came, and Swift accepted an offer of Lord Berkeley, who had been appointed one of the lords justices of Ireland, to accompany him as chaplain and private secretary. But his lordship was told that the post of secretary was unfitted for a clergyman, and Swift was persuaded to surrender it upon promise of receiving the first good church benefice which should fall vacant. This proved to be the vicarages of Laracor and Rathbeggan and the prebend of Dunlavin, all worth about £350 a year. He took possession of Laracor in 1700, and Stella, accompanied by an elderly female friend, came over to Ireland, took lodgings in a neighboring village, but made her residence at the rectory whenever Swift went to London, which he did every year. Swift while at Moor Park had written considerable, the famous *Tale of a Tub* probably being written at this time, but had as yet published nothing. In 1701, on his first visit to London, he made his earliest essay as a political writer in a pamphlet purporting to be a *Discourse on the Contests between the Nobles and the Commons of Athens and Rome*, but which was really a defence of the Whig leaders. This was received with great favor, and brought him into immediate connection with the political and literary chiefs of the party; but no preferment was offered him which he thought worth his acceptance, and in 1708 he went directly over to the Tories, who now came into power. He had set his heart upon an English bishopric, which was precisely what they dared not give, for his *Tale of a Tub* had been published, and the archbishop of York had persuaded Queen Anne that the author of that witty but indecent burlesque was unfit to wear the lawn sleeves; the most they could venture was to promote Dr. Sterne, the dean of St. Patrick's, to the bishopric of Dromore, and give the deanery thus vacated to Swift, who in 1713 went back to Ireland. Some four years previously he had become acquainted with Hester Vanhomrigh, whom he celebrates as "Vanessa," the daughter of a widow who would have upon the death of her mother a fortune of about £4000. She was less than twenty, he more than forty years old; she fell violently in love with him, and urged him to marry her; this he evaded, rather than positively declined, but their intimacy, an entirely innocent one, continued, and at length, her mother having died, she followed him to Ireland, much against his wish, and, ignorant of the claims of Stella, continued her eager suit to him. She finally learned of his relations with her rival, and in 1723 wrote to her demanding to know in what position she stood to Swift. Stella sent this letter to him; he rode straight to the residence of Vanessa, flung the letter before her without saying a word, and left her. Her heart was broken, and she died within a short time. The year which witnessed the death of Vanessa was a notable one in the life of Swift. There was a scarcity of small coin in Ireland, and a patent was granted to one William Wood for coining brass farthings and halfpence to the amount of £108,000; and this scandalous privilege had been granted at the instance of the duchess of Kendall, one of the king's mistresses, who was to share the profits. The people were indignant; the Irish Parliament vainly remonstrated, until one day a letter appeared in a Dublin newspaper bitterly denouncing this debased coinage, and signed "M. B., Drapier," followed in quick succession by several others. The *Drapier Letters* struck the right chord and gave form to the popular feeling. No one would take the obnoxious halfpence. The government offered a large reward for the discovery of the author of the letters, and urged a prosecution of the printer, but in spite of the rage of the judge the grand jury refused to find a bill against him. When at length it was found that Swift was the author, he became the popular idol, and when the English ministry proposed to arrest him, they were assured that a force of 10,000 men would be required to do this. The *Travels of Lemuel Gulliver* were published anonymously in 1726, in which and the following year Swift visited London, and renewed his intimacy with Bolingbroke, Pope, Gay, Arbuthnot, and others of his old friends; but after the death of Stella, in 1728, he never left Ireland. For several years he kept on writing with all his old vigor and bitterness upon matters connected with Ireland, and composed many verses and epigrams. In 1736 the attacks of vertigo had so seriously shaken him, physically and mentally, that he could no longer continue his literary labors; by 1740 his memory had almost entirely failed, and he became subject to bursts of passion which resulted in furious lunacy, which lasted for two years, when he sank into a state of complete idiocy, continuing three years, until his death. He had some time before made his will, by which he bequeathed the bulk of his property, amounting to about £10,000, to found a hospital for the insane. D. Oct. 19, 1745. The character of Swift was by no means a lovely one, but was far less unlovely than represented by Macaulay and Thackeray. As a humorist Swift occupies the first rank; as a poet, a very low one. The *Tale of a Tub* is his wittiest production. The first two parts of *Gulliver's Travels*, containing the voyages to Liliput and to Brobdingnag, are inimitable as satires upon the times in which he lived. The other two parts, fortunately less read, containing the visits to Laputa and the country of the Houyhnhnms and the Yahoos, are in the main disgusting—the production, let us hope, of a man verging upon insanity. The works of Swift have appeared in numerous forms. (For a list of them see *Allibone*.) The best edition is that edited by Sir Walter Scott (19 vols., 1814). His biography has been written by Dr. Johnson in his *Lives of the Poets*, and by Scott, forming a volume of his edition of Swift's works, which must still be considered the standard biography; for that begun by John Forster, who had collected much new material, was cut short by his death soon after the publication in 1875 of the first of the three proposed volumes.

A. H. Guernsey.

**Swift** (Joseph Gardner), LL.D., b. in Nantucket, Mass., Dec. 31, 1783, son of Dr. Foster Swift, U. S. army, and descendant of Thomas Swift and Hopestill Foster, the first settlers of Dorchester, Mass.; in 1800, Joseph was appointed a cadet at the U. S. Military Academy, from which institution he was the first graduate, Oct. 12, 1802, when promoted second lieutenant in the corps of engineers, rising through successive grades to be chief engineer, with rank of colonel, July 31, 1812, during which period he was mainly engaged in the construction of fortifications on the Atlantic coast. In the war of 1812 he first served in the Carolinas on the staff of Maj.-Gen. Pinckney; in 1813, as chief engineer of the army, was engaged in Gen. Wilkinson's campaign on the St. Lawrence, participating in the battle of Chrystler's Field, and subsequently (1813–14) superintended the defence of New York, including Brooklyn and the heights of Harlem; for these services was brevetted brigadier-general Feb., 1814; after the war assumed the direct supervision of the Military Academy, of which he was (*ex-officio*) the superintendent, and was its inspector for a short period previous to Nov. 12, 1818, when he resigned in consequence of the appointment of the French officer Gen. Bernard to the rank of brigadier-general and "assistant engineer" of the U. S. (See Bernard (Simon).) Upon his resignation he was appointed surveyor of the port of

New York, which position he held until 1827. In 1829, Pres. Jackson appointed him to superintend the harbor improvements on our great lakes, on which duty he continued until 1845, meanwhile (1830–31) constructing the railroad from New Orleans to Lake Pontchartrain, said to be the first road laid in America with T-rails. (See RAILROADS.) The successful completion of this work through a cypress swamp heretofore considered impassable added much to Gen. Swift's reputation; was chief engineer of the New York and Harlem R. R. 1833; on peace mission to the British provinces 1841. D. at Geneva, N. Y., July 23, 1865. G. C. SIMMONS.

**Swift** (WILLIAM H.), b. at Taunton, Mass., Nov. 6, 1800; was a cadet at the U. S. Military Academy from 1813 to 1818, when ordered (as a cadet) to join Major Long's Rocky Mountain expedition, with which he served until 1821, having meanwhile (1819) received his commission as second lieutenant of artillery; from 1821 to 1832 served on topographical duty in making surveys of military defences of the Atlantic coast; of the Chesapeake and Ohio Canal; of the Florida Canal, and rivers and harbors of the Gulf of Mexico; in constructing a map of the post-offices and post-roads of the U. S.; and in 1828–29 made a survey of the Ithaca and Oswego and Catskill and Ithaca R. Rs., N. Y., and 1831–32 of the Boston and Providence, Norwich and Worcester, and Providence and Stonington R. Rs.; in 1832 was appointed brevet captain and assistant topographical engineer, and for ten years was employed as assistant on the geodetic survey of the Atlantic coast, being in charge of river and harbor improvements from Maine to Connecticut 1837–42; from 1836 to 1840 was also resident and constructing engineer of the Massachusetts Western R. R., from Worcester to the western boundary of Massachusetts; was assistant to the chief of topographical engineers 1843–49, during which period he made (in connection with Ex-Gov. John Davis of Massachusetts) an examination of the ILLINOIS AND MICHIGAN CANAL (which see), and report thereon, resulting in a loan by means of which the canal was completed; from 1847 to 1849 was engaged in constructing the iron-pile lighthouse at Minot's Ledge, Massachusetts Bay, which was destroyed by the great gale in Apr., 1851. (See LIGHTHOUSE CONSTRUCTION.) In 1849 he resigned from the army, and was president of the Philadelphia Wilmington and Baltimore R. R. 1849–51, and of the Massachusetts Western (Worcester, Mass., to Albany, N. Y.) 1851–54; since 1845 has been president of the board of trustees of the Illinois and Michigan Canal, and continued as such until 1871; chairman of trustees of the land mortgage of the Hannibal and St. Joseph R. R. Co. since 1856. G. C. SIMMONS.

**Swift** (ZEPHANIAH), LL.D., b. at Wareham, Mass., in Feb., 1759; graduated at Yale College in 1778; studied law, and practised at Windham, Conn.; was Representative in Congress 1793–96, and in 1800 secretary to Mr. Ellsworth, minister to France; was appointed judge of the supreme court of Connecticut in 1801, and was chief-justice 1806–19; was several times elected to the State legislature, a delegate to the Hartford Convention, and a member of the committee to revise the laws of the State; published an oration on *Domestic Slavery* (1791), *System of the Laws of Connecticut* (1795–96), *Digest of the Law of Evidence*, etc. (1810), *Digest of the Laws of Connecticut* (1822–23; new ed., revised by Henry Dutton and N. A. Cowdrey, 1849–53). D. at Warren, O., Sept. 27, 1823.—His daughter, MARY A., published about 1833 *First Lessons on Natural Philosophy*, which was a popular textbook for many years, and was translated in 1846 into the Karen language, and in 1848 into Burmese.

**Swift Creek,** tp., Edgecombe co., N. C. P. 2383.

**Swift Creek,** tp., Pitt co., N. C. P. 1800.

**Swift Creek,** tp., Wake co., N. C. P. 1445.

**Swim'ming.** The specific gravity of the human body being slightly greater than that of water, swimming with man is an artificial operation, but one easily learned, with or without an instructor. There is no better method than that suggested by Dr. Franklin: Let the learner wade out to where the water is breast-deep, turn toward the shore, and throw a white pebble or any other object easily discernible into the water a short distance before him, and plunge after it; the resistance which the water makes to his struggles to reach it will buoy him up, and the moment he has acquired sufficient confidence and command of his limbs to strike out regularly, he has learned to swim. Teachers usually support the breast of the pupil with their hand, and then cause him to strike out properly with his hands and feet; then suddenly withdraw the hand, leaving him to himself. Corks and floats of any kind are a hindrance rather than an aid in learning to swim. When one has learned to keep himself afloat, the next thing is to learn how to propel himself. The body being as nearly as may be in a horizontal position, draw the arms and legs slowly toward the body, and then extend them with a quick and strong impulse. The hands should be kept flat, the fingers closed; in beginning the stroke, the farther forward the arms are thrown the better; the legs should at the beginning be well apart, and in the act of kicking they will be brought together. One will naturally learn first to swim on the belly, striking with all four limbs at once, but the practised swimmer will soon adopt the side stroke. Throwing himself, say, on his left side, he puts forward the left arm so as to form a kind of cutwater, while with the right arm, directed downward and backward, and with both legs, he makes a strong stroke; thus three limbs are always moving at once in the same direction. This method, however, requires much more muscular exertion than that of belly-swimming, and can be kept up only a short time without change. Swimming on the back is very easy, and may be kept up for a long time; one can indeed swim in this position without making any use of the arms, which may be folded over the breast, though they will usually be kept close by the side of the body, and a very gentle movement of them is sufficient to keep the face well out of the water; or one may float upon the water merely by this slight movement of the arms. The specific gravity of salt water being greater than that of fresh, it is much easier to swim in it. Indeed, if the saturation is very great, as in the Dead Sea and the Great Salt Lake, the specific gravity is greater than that of the human body, and a man cannot sink in it. Expert swimmers attain a very considerable speed. A British soldier swam 2½ miles in 45 minutes in the Red Sea; a professional swimmer near London swam a mile in 26 minutes; at Chester, Pa., in a swimming-match, J. B. Johnson made 10½ miles in 3h. 10m.; and not long since two young girls swam from London Bridge to Greenwich pier, a distance stated to be nearly 5 miles, the one in 1h. 7m. 45s., the other in 1h. 8m., which is the most rapid swimming on record, although exceeded in other respects by Capt. Webb, who in 1875 swam from Blackwall pier to Gravesend, 20 miles, in 4h. 42m. 44s. Webb also in the same year performed the astonishing feat of swimming from Dover to Calais, in a zigzag course about 50 miles, in a little less than 22h., his body being lubricated with porpoise oil, and he being accompanied by a boat from which he was occasionally furnished with a little refreshment, of which he partook while treading water. These are, however, professional feats which the ordinary swimmer cannot expect to accomplish. (See also DROWNING and RESUSCITATION.) A. H. GUERNSEY.

**Swim'ming Pens,** tp., Sumter co., S. C. P. 1634.

**Swin'burne** (ALGERNON CHARLES), b. near London Apr. 5, 1837; received his education partly at Eton, partly in France, and in 1857 entered Baliol College, Oxford, where he remained only a short time, and subsequently made a visit to Italy. He has published—*Rosamond* and *The Queen Mother*, two dramas (1861); *Atalanta in Calydon*, a tragedy constructed after the Greek model, in which he first manifested his peculiar powers (1864); *Chastelard, a Tragedy* (1865); *Poems and Ballads*, which were so severely criticised for their erotic character that the English publisher endeavored to suppress them, and which were put forth in New York under the title *Laus Veneris* (1866); *William Blake, a Critical Essay* (1868); in conjunction with W. M. Rossetti, *Notes on the Royal Academy Exhibition* (1868); *A Song of Italy* (1867); *Siena, a Poem* (1868); *Ode on the Proclamation of the French Republic* (1870); *Bothwell, a Tragedy* (1870); *Songs before Sunrise* (1871); *Essays and Studies* (1875); *Erechtheus*, another successful drama on the Greek model (1875); and several minor poems, essays, and critiques.

**Swine.** See SUS, and also BABYROUSSA, HOG, and BOSCH-VARK.

**Swinemün'de,** town of Prussia, province of Pomerania, on the island of Usedom, and forms the port of Stettin. It is fortified, has a good harbor, carries on a considerable trade, and is noted as a bathing-place. P. 6970.

**Swin'ton** (WILLIAM), A. M., b. in Edinburgh Apr. 23, 1833; came to the U. S. in 1843; studied at Amherst College; in 1853 taught in a female seminary at Goldsborough, N. C., and subsequently in a private school in New York; during a considerable part of the civil war was the correspondent, mainly with the Army of the Potomac, of the New York *Times;* in 1866 received the degree of A. M. from Amherst College, and was subsequently appointed professor of belles lettres in the University of California. He has contributed to *Putnam's Monthly* and the *Atlantic Magazine*, and has published—*Rambles among Words* (1859), *The Times's Review of McClellan* (1864), *Campaigns of the Army of the Potomac* (1864), *The Twelve Decisive Battles of the War* (1870), *History of the New York Seventh Regiment during the Rebellion* (1870), and *Word Analysis* (1872).

**Swir,** a river of Russia, government of Olonetz, issues from the south-western extremity of Lake Onega, and enters, after a course of 130 miles, the eastern part of Lake Ladoga. It is navigable throughout its whole course, and forms part of the great water-road which connects the Neva with the Volga, and thereby the Baltic with the Caspian.

**Swiss Guards.** Bodies of mercenary Swiss troops have since the fifteenth century been employed in many European countries as body-guards and for duty about courts. The Parisian *Gardes Suisses* were organized in 1616. They were very faithful to the interests of the Bourbons. In 1789 they were roughly handled by a mob, and Aug. 10, 1792, almost every man was killed in the heroic defence of the Tuileries. They numbered about 2000 men. Their heroism is commemorated by Thorwaldsen's *Lion of Lucerne,* erected in 1821 near Lucerne. Louis XVIII. reorganized the Swiss Guard in 1815. In the revolution of 1830 they were defeated and dispersed. At the Vatican the pope's body-guard is composed of Swiss mercenaries.

**Swiss'helm** (Jane G. C.), b. at Wilkinsburg, Pa., in 1816; was editor of the Pittsburg *Saturday Visitor* from Jan., 1845, to Sept., 1856, and of the St. Cloud (Minn.) *Visitor* from Jan. to July, 1858, after which she took charge of the St. Cloud *Democrat.* She was a frequent contributor to Neal's *Gazette,* the *Dollar Newspaper, Commercial Journal,* New York *Tribune,* etc., and published in 1853 *Letters to Country Girls.*

**Switz'er** (Stephen), settled as a gardener in Hampshire, England, where he d. in 1745; published *Country Gentleman's Companion, Account of Grass-Seed, Practical Fruit-Gardener, Kitchen Vegetables, Introduction to Hydrostatics and Hydraulics,* etc.

**Switz'erland, Confederation of** [Ger. *Schweiz;* Fr. *Suisse;* It. *Svizzera*]. This little state occupies, in the heart of Europe, the culminating region of the continent, from which the land slopes in every direction toward the surrounding seas. Like a natural fortress it rises in the midst of large states without yielding its independence to any of its powerful neighbors. From France, on the W., it is separated by the Jura Mountains. On the N. the Rhine and Lake Constance mark its boundary toward Germany; on the E., the deep valley of the Rhine and the snowy ranges of the Rhætian Alps border it along the Austrian dominions; on the S., the main chain of the Central Alps forms a natural barrier toward Italy. Its territory is comprised between 45° 48′ and 47° 48′ N. lat. and 5° 58′ and 10° 30′ E. lon. from Greenwich. Its extreme length from E. to W. is 208 miles; its greatest width from Tessin on the S. to Schaffhausen on the N., 138 miles. Its surface, according to the federal survey, is 15,992 English sq. m., or not much more than one-thirteenth of the area of France.

*Physical Structure.*—The general figure of Switzerland is an oblong square with irregular outlines, extending from the S. W. to the N. E., the long sides being formed by the Alps and Jura, the small ones marked by the two large lakes of Geneva and Constance. There are, therefore, three physical regions, each with a special character—the narrow belt of the Jura, the broad belt of the Alps, and the plain or hilly plateau between the two.

A. The Alpine Region, though the poorest in resources for man, is by far the most characteristic of Switzerland, and is also the most extensive, covering little less than two-thirds of its area. It is not composed of a single chain, but is a broad and high mountainous zone, scooped out into innumerable sharp ridges and valleys, mostly deep and narrow, comprising the greater part of the Central Alps, with the loftiest peaks and largest snow and ice fields of the whole Alpine system. Its limit toward the central plain is approximately marked by a line drawn from Lausanne, on Lake Geneva, to Arbon, on the shores of Lake Constance; on the S. it runs along the snowy peaks of the central chain, except in Ticino; its width, on the Swiss territory, is over 60 miles. A single glance at a good physical map enables one to distinguish in this apparently confused mass of mountains two main chains, running toward the E. N. E., separated by a long, almost continuous furrow, in which flow, in opposite directions, the two largest streams of Switzerland, the Rhone and the Rhine. These two chains nearly unite their bases in the group of the Gothard, which forms a high swell from which the waters flow in every direction.

*The Southern or Main Chain,* which divides the Italian waters from the northern, is composed of four groups: (1) The high but short and narrow chain of the Mont Blanc, which, by a political trick at the close of the Franco-Italian war, was given to France, against nature and international treaties. It stretches from S. W. to N. E. between the valley of Chamouni and Val d'Entrèves; its highest peak, Mont Blanc proper, 15,781 feet, is also the culminating point of the continent of Europe. The sharp picturesque peaks, or needles, formed by the gradual decay of the vertical strata of crystalline rocks; the rounded form of the central dioritic dome; the mighty glaciers flowing all around from its crests and filling its deep gorges, among which is the world-renowned Mer de Glace, the scene of the researches of Forbes and Tyndall; the blue Glacier des Bossons and the vast Glacier de la Brenva, both descending from the central pinnacle, the first in the Vale of Chamouni, the other on the Italian slope, toward the Allée Blanche,—all these phenomena, so often described, need only to be alluded to here. (2) The group of the Pennine Alps, running nearly due E. from the col of the Great St. Bernard to the Col du Simplon, between the valleys of the Rhone and Val d'Aosta. Its culminating points are the Grand Combin, 14,170 feet, on the W.; the bold pyramid of Mont Cervin, or Matterhorn, 14,712 feet, in the centre; the broad cluster of the Monte Rosa, 15,217 feet, on the E. This is the most massive of the Alpine groups. It sends out long and heavy spurs, some of which rival in height and bulk the main chain, such as the chain of the Mischabelhörner, between the valleys of Saas and St. Nicholas, rising in the Dom to 14,948 feet; and near by the snowy range of the Dent Blanche, 14,321, with the Weisshorn, 14,803 feet. This grand Alpine scenery has of late been made accessible, and the tourist, placing himself in its very centre, on the Gorner Grat, has in view around him the imposing peaks of Monte Rosa, the giant form of Mont Cervin, and a score of other snow-capped heights, measuring from 13,000 to 15,000 feet, with as many glaciers descending along their slopes to the valleys below. Farther E. the Fletschhorn, 13,182 feet in height, along the Simplon road, marks the limit of the Pennine Alps. (3) The group of the Gothard, along the upper waters of the Rhone and Rhine, extends between the Simplon and Lukmanier passes, and includes the Alps of Ticino. Though its main chain is crowned with snow, the high peaks disappear, and seldom exceed 10,000 feet, while their bases and the bottom of the valleys rise higher. The watershed is transferred more to the N., between the two small longitudinal valleys of Urseren, 4738 feet, and Airolo, 3868. (4) The group of the Grisons, or Rhætic Alps, from the Lukmanier pass to the eastern boundary of Switzerland, is the most extensive, but most irregular and complicated. It begins with high snow-peaks near the sources of the Rhine, among which the Rheinwaldhorn rises to 11,148 feet; but the salient feature is given by two snowy chains enclosing the valley of the upper Inn, or Engadine, placed farther S., almost on a line with the Pennine Alps, and following the normal trend of the Alps. The northern or Albula range separates the waters of the Rhine from those of the Inn and Danube; on the southern side the wild Alps of the Bernina, 13,294 feet, at the head-waters of the Inn and the Adda, divide the basin of the Danube from that of the Po.

*The Northern Chain,* though occupying the second rank, has perhaps a more controlling influence on the topography of the better part of Switzerland than the central chain. It follows closely the long valleys of the Rhone and Rhine, and terminates where these two streams cut transversely the Alpine chains. Its short slope is turned toward them, and its long slopes toward the northern plain. Deep transverse valleys divide it into three groups, closely corresponding to those of the central chain: Between the Rhone and Aar, the Bernese Alps, opposite the Pennine, or Alps of Valais; between the Aar and Reuss, the Alps of Uri and Unterwald, adjoining the Gothard group; between the Reuss and Rhine, the Glarides or Alps of Glarus, opposite the Alps of Grisons. (1) The Bernese Alps are the largest, and by far the most remarkable, of these groups. Beginning with the Dent de Morcles, 9639 feet, near the Rhone, they increase in elevation toward the E., through the Diablerets, 10,666 feet, and the Wildhorn, 10,722 feet, to the magnificent mountain-knot of the Bernese Oberland, whose highest peaks, the Finster-Aarhorn, 14,026 feet, the Aletschhorn, 13,803 feet, and the Jungfrau, 13,672, are but a trifle lower than Mont Blanc and Monte Rosa. Here lie the lofty snow-fields which feed the glacier of the Aar, the spot of Agassiz's classical investigations; that of Aletsch, the longest of the Alps; those of Grindelwald, which extend farther than any into the lower cultivated regions. While by the grandeur of its outlines and extent of its glaciers the Bernese Oberland fully equals its rivals, it surpasses them in the beauty of its cascades, the charm of its lakes, and the loveliness of its valleys. (2) In the middle group, which appears like a continuation of the Bernese Oberland, the Alps of Uri rise in the Schneestock to 11,920 feet, in those of Unterwald the Titlis reaches 10,627 feet, while Pilatus, 7003 feet, and the Rigi, 5877, with their comfortable hotels, are placed on the border of the plain, like observatories in front of this vast curtain of snowy heights. (3) In the group of the

Glarides the chain of the Tödi, 11,887 feet, is the controlling feature, and more to the N., just above the village of Glarus, the Glärnisch, 9539 feet, reaches the snow-limit. To the N. E., between the lakes of Wallenstadt and Constance and the valley of the Rhine, an isolated group, with the chain of the Churfirsten, 7565 feet, and the Sentis, 8215, fills the greater portion of the cantons of St. Gall and Appenzell.

It is interesting to see how much these natural divisions have influenced the formation of the political communities. Each forms the centre, or the whole, of one or more of the twelve Alpine cantons, as any map will show—Valais, Ticino, Grisons, on the S. of the central valley, and on the N. Freiburg and Berne on one side, the four primitive cantons in the centre, Glarus, St. Gall, and Appenzell on the other.

A striking feature of the Alps is the great depth of their indentations, which increases both the facility of communication and the chance for cultivation. The bottom of the valleys, like those of Chamouni, Zermatt, Grindelwald, is from 10,000 to 11,000 feet below the neighboring peaks. Deep notches, or *cols*, cut down to one-half the height of these snowy chains, and corresponding to the heads of transverse valleys, afford a comparatively easy passage from one side to the other, and render possible the construction of highroads between the opposite slopes. A carriage-road crosses the main chain by the Simplon, 6595 feet, leading from the Rhone valley to Lago Maggiore and Milan—a masterpiece of engineering, constructed by the order of Napoleon I. It was the first of the kind, and is still the only one in the western section. The St. Gothard road, 6595 feet, between the Reuss and Ticino, is scarcely less remarkable, and the only one crossing both chains in the central knot from Lake Lucerne to Lago Maggiore. In Western Grisons is the San Bernardino road, 6768 feet, from the Hinter Rhein valley through Val Misocco to Lago Maggiore, and more to the E. is the Splügen, 6946 feet, from the same valley to Lago di Como, both roads leading through the fearful gorges of the Via Mala. Eastern Grisons has the Julier Pass, 7503 feet, and the Albula, 7589 feet, from the Rhine to the Upper Engadine; the Maloggia, 5942 feet, leading from the head of the Inn valley to the Splügen road and Lago di Como; and the Bernina Pass, 7644, from the Engadine to the Valtellina, or valley of the Adda. In addition to these ten passes, fine military roads have lately been built, connecting the Rhone and Rhine through the Furca Pass, 7992 feet, the valley of Urseren and the pass of Oberalp, 6732 feet, opening thus an uninterrupted carriage-travel through the heart of the Alps from one end of Switzerland to the other. Nor did the enterprise of the Swiss stop here. A proposed railroad through the Simplon having failed, another more central, forming the most direct communication between Germany and Italy, has been traced through the St. Gothard. (See St. Gothard, Tunnel of.) It enters the mountain at Göschenen, in the Reuss valley, at 3650 feet above the sea, and emerges at Airolo, 3868 feet, on the Italian side, thus passing 2800 feet below the top of the present road. The tunnel is to be 9 miles long, the longest as yet attempted. The boring advances at the rate of 15 to 20 feet a day, and is expected to be finished within a few years. Besides these great highways there are a number of bridle-paths, much frequented during the good season, among which may be named the Great St. Bernard, 8110 feet, with its famous hospice and benevolent monks, across the Pennine Alps, from Martigny to Aosta; the Lukmanier, 6292 feet, E. of St. Gothard, from the sources of the Rhine to the Ticino; the Sanetsch, 7369 feet, from the upper Sarine; over the Bernese Alps to the Valais; the picturesque Gemmi, 7556 feet, from Lake Thun; and the Grimsel, 7103 feet, from the Aar to the sources of the Rhone.

The predominance of transverse valleys over those which run parallel with the Alpine ranges is a marked feature of the Swiss Alps. To these valleys, which, cutting through all secondary chains, open the shortest way to the heart of the snowy regions, the Alps owe most of the beauties which attract so many visitors. Rapid slopes, foaming torrents, wild gorges connecting occasional open green, flat bottoms, perhaps basins of former lakes, following one above the other as resting-places for the turbulent waters in their wild course; high and steep walls, enlivened by waterfalls; lakes with the view of distant snowy peaks in the background,—these are scenes found in all, but greatly varied in each. The valley of the Aar, with its celebrated cascades; of the Reuss, with the wild scenery of the Devil's Bridge; of the Rhine, with the stupendous gorges of the Via Mala,—are types which once seen are not likely to be forgotten.

The *geology* of the Swiss Alps is a complicated problem not yet fully solved. As a general fact, we may accept the results of the latest investigations of Prof. B. Studer, and distinguish a central zone composed of several distinct masses of crystalline rocks, granite gneiss, and crystalline slates, flanked on each side by wide chains of Secondary rocks and slates, and bordered on the outside by Tertiary conglomerates and sandstones. The strata of the crystalline rocks are more or less vertical, often assuming a fan-like expansion, while those of the middle chains, on both sides, are raised against and around them, folded and contorted, the outside Tertiaries even turned over, all bearing evidence of a strong lateral pressure by which they seem to have been upheaved. Of the six crystalline centres that Studer counts from Mont Blanc to the Rhætic Alps, the most remarkable is that of the Bernese Oberland, which extends as far as the Glarides. In crossing the Alps we pass successively from the younger to the older formations, until we reach the central zone, beyond which we find again the same formations in reversed order. Rich as the Alps are in beautiful and rare minerals, they are poor in useful ones, and mining has never been anywhere extensively carried on.

B. The Jurassic Belt—*the second physical region*—which comprises only a portion of that mountain-system, is, in structure and outline, a complete contrast to the Alpine region. Long, uniform, parallel chains, without the marked indentations and projecting peaks so characteristic of the Alps, intercept open, trough-like valleys, with gentle acclivities. The general system deviates slightly to the N. from the direction of the Alps, but the single chains tend to keep in parallelism with them. This structure of the Jura is explained by assuming that it was originally a simple plateau, whose southern edge has been folded into long ridges by successive upheavals of the Alps, toward which its greatest heights and steepest slopes are turned, while the altitudes diminish in proportion to their distance from them. The highest point, Le Crêt de la Neige, which is in the French Jura, opposite Geneva, has an elevation of 5653 feet; La Dôle, the first on Swiss territory, 5505 feet; the Chasseron, in the canton of Neufchâtel, 5286 feet; the Hasenmatt, in Soleure, 4751 feet; the Lägeren, in Zurich, 2828 feet. The interior valleys communicate among themselves and with the plain by deep gorges, called *cluses*, furnishing an escape for the waters. Some are of large size, as the Val de Ruz, Val de Travers, in Neufchâtel, 2500 feet high, and Val Delémont, in the Bernese Jura, 1500 feet. Their moderate elevation permits of agriculture, while the higher and colder valleys, like those of La Chaux de Fonds and Locle, over 3000 feet, only admit of grazing. All the Jura mountains are made up of a series of Mesozoic limestones, whose geological name, Jurassic formation, is taken from them. Along their base only, and in the bottom of the interior basins, layers of the lower Cretaceous rocks are found covered over by more recent Tertiary deposits. On the slope looking toward the Alps are spread, up to an elevation of 2300 feet, a vast number of erratic boulders of Alpine origin, among which the granites of Mont Blanc and the rocks of the Pennine Alps are the most abundant, some of them reaching a size of 20 by 40 feet. Large rock-surfaces, admirably polished and striated, indicate the work of the ancient glaciers which once covered the plain of Switzerland and transported to the Jura these débris of of the Alps.

C. The Plain of Switzerland is the third physical region. It is so called by contrast to the mountain-land, but is in reality a hilly plateau of an average elevation of 1400 feet, with a few alluvial plains. It has a gentle inclination from the Alps to the Jura, and another, still less marked, from the S. W. to the N. E. along the base of the Jura. On both extremities, however, the lakes of Geneva, 1230 feet, and Constance, 1306 feet, mark two depressions below the general level, which receive the waters of the Rhone and the Rhine. The basin of the Lake of Geneva is separated from the general plain by the gentle heights of the Jorat, 2500 feet; that of Lake Constance by the hilly region of Thurgovia. This vast region was in geological times covered with waters which have left deep deposits of a soft greenish-gray sandstone, called *molasse*, full of fossils, mostly of marine origin, and used extensively for building purposes. These strata, which belong to the middle Tertiary age, have been laid bare by the last upheaval of the Alps, and raised in their neighborhood to hills of 2000 and 3000 feet elevation.

*The river system* of Switzerland shows a remarkable symmetry of arrangement, which is but the consequence of the regularity of the physical structure above described. From the central swell of the St. Gothard and its glaciers the Rhine and the Rhone flow in opposite directions between the two main chains. At about the same distance from their source each quits the valley to cross the northern chain at right angles—the Rhine to enter Lake Constance; the Rhone, the Lake of Geneva. Leaving Lake Constance, the Rhine runs to the W., forming just below Schaffhausen

the celebrated Rheinfall, the Niagara of Europe. Further it gathers in its course most of the waters of Switzerland, and turning suddenly to the N. at Bâle, carries them to the North Sea and the Atlantic. Issuing pure and clear from Lake Geneva, the Rhone, after receiving its main tributary, the Arve, from Mont Blanc, crosses the chain of the Jura at the Perte du Rhône, where it disappears for a short distance in a deep fissure, and descends by rapid strides to the Mediterranean. From the same Gothard region flow four other rivers—the Aar and Reuss to the N., the Ticino and Tosa to the S.—which, placed two by two opposite each other, complete the symmetrical arrangement of this remarkable hydrographic centre. On the northern slope the Aar drains the Bernese Oberland, the Reuss the Alps of the four primitive cantons; on the southern, the Tosa and the Ticino drain the Gothard Alps. All these streams, like the Rhine and Rhone, before entering the plain, pour their turbid waters into deep lakes, from which they flow out pure and transparent. The Aar fills the Lake of Brienz, 1857 feet in altitude, and the Lake of Thun, 1850 feet; the Reuss, the quadruple lake of Lucerne, 1434 feet; the Ticino and Tosa, the long and deep trough of Lago Maggiore, 646 feet. The two extreme divisions of the northern chain have also each their river. The Linth gathers the waters of the Glarides and of Lake Wallenstadt, 1394 feet, and forms the Lake of Zurich, 1342 feet, from which it issues at Zurich under the name of Limmat. The Sarine leads the waters of the Bernese Alps through Freiburg into the Aar. The Emme, the Suhr, the Glatt, and the Thur, all of third rank, rise in the border Alps. All these streams follow the general slope of the plain toward the Jura; but the most important is the Aar. Reaching the base of the Jura near the Lake of Bienne, it turns at right angles, and, continuing its course along that chain, receives all the waters of the central plain, including those of the lakes of Neufchâtel, 1427 feet, Morat and Bienne, 1424 feet, and, uniting with the Reuss and Limmat, carries them by a single channel to the Rhine through the last spurs of the Jura.

The second great hydrographical centre is found in the Alps of Grisons, in the Upper Engadine, where the waters of the Rhætic Alps flow through the Inn and the Danube into the Black Sea; through the affluents of the Hinter Rhein to the Atlantic; through the Maira, Lago di Como, 699 feet, and the Po, to the Adriatic. Thus, little Switzerland, thanks to its commanding position in the midst of the continent, sends to all the seas surrounding Western Europe the waters flowing from its everlasting stores of ice and snow.

*Climate.*—In a country where the differences of altitude are so considerable the temperature and moisture of different places vary greatly, according to their elevation and physical situation. We can here give only a few general features more especially applicable to the central plain, which, containing the greater part of the cultivated land, is the most important. For the mountainous parts the difference in the character of vegetation and culture will express more clearly than an array of figures the differences of climate due to altitude. Under the general influences which make Europe the warmest of the temperate continents, the climate of Switzerland is milder than that of any mountain-country in the same latitude, while the quantity of rain is rather above the average. This is shown by the following table, which gives the average temperature of the year and the warmest and coldest months, together with the average amount of rain in inches, at the following cities of the plain:

| Places. | Latitude. | Altitude. | Temperature. | | | Amount of rain in inches. |
|---|---|---|---|---|---|---|
| | | | January. | July. | Year. | |
| Geneva..... | 46.12 | 1250 | 31.5 | 65.4 | 48.5 | 32 |
| Neufchâtel.... | 47.0 | 1600 | 32.3 | 66.5 | 49.0 | 33 |
| Berne..... | 46.51 | 1770 | 26.9 | 62.6 | 46.0 | 46 |
| Zurich..... | 47.23 | 1350 | 29.2 | 65.7 | 48. | 33 |
| Bâle..... | 47.34 | 900 | 33.0 | 66.4 | 49.1 | 25 |

This shows that Geneva, though 1300 feet above sea-level, and nearly 4° of latitude farther N., has an annual temperature equal to that of Boston, with cooler summers and milder winters. The extremes of temperature seldom exceed 90° or fall below 10°. The spring is early and pleasant; the first flowers appear in March, and May is the month of roses. The summer has frequent rains; September is clear and mild, but in October the weather begins to be raw; November and December, however, are often quiet and warm in the heights, while the plain, and especially the lake region, is covered with a thick layer of fog, which, seen from the Jura, appears like a vast sea of clouds studded with islands and bordered by the glistening chain of the Alps. The quantity of rain in the plain is rather greater than in the neighboring portions of France and Germany—33 inches against 25—and increases near the mountains. It is 46 inches in Berne, and on the southern slope of the Alps, which is struck by the warm S. wind, it sometimes reaches even a considerably higher figure. The prevailing winds are, as in all Europe, the alternate normal equatorial and polar currents—the first, from the S. W., warm and rainy; the other, called the *Bise*, from the N. E., cold and dry. A peculiar wind called the *Foen*, felt especially in the eastern part of Switzerland, and more frequently during the winter, is noted for its great heat and dryness, flowing from the S. across the Alps, and descending with great fury along the northern valleys. Its origin is disputed, some taking it for the sirocco of the Mediterranean, others believing it to be a part of the returning trades. Under its influence the snows of the mountains melt with such rapidity as to cause the most destructive inundations.

The various *zones of vegetation* which can be distinguished, from the lowest valleys to the limit of permanent snow, are—(1) *The lower region*, comprising all the central plain and its lower hills, and extending from 700 to 2000 feet above sea-level. It is the zone of deciduous trees, the chestnut, walnut, oak, and beech, and of the vine. Here the cultivation embraces all the European grains, including even maize to a certain extent. Extensive vineyards along the borders of the lakes of Geneva and Neufchâtel produce wines of considerable reputation. The wines of Eastern Switzerland are less esteemed. All the fruits of temperate latitudes grow abundantly, and acquire in the Jura a rare degree of excellence. In the southern valleys the fig and the olive flourish; chestnut forests are abundant, and vineyards rise from 500 to 700 feet higher than on the northern slopes. To this zone belongs the central plain, which is the great agricultural region, the richest and most cultivated, as well as the most populous, of Switzerland. Here also we find all the great cities, which are either situated at the outlet of the Alpine valleys and lakes, as Geneva, Berne, Lucerne, and Zurich, or along the base of the Jura, as Neufchâtel, Soleure, and Aarau. (2) *The second region* is that of the lower mountains, from 2000 to 4000 feet. In the lower half the hardier deciduous trees, such as the beech, ash, and maple, are still abundant, and the cereals and hardy fruits, apples, pears, and plums, are cultivated. In the upper half, comprising the higher valleys of the Jura and the lower Alps, spruce forests, extensive pastures, and a scanty cultivation of oats and barley are characteristic. (3) *The sub-Alpine region*, or zone of conifers, extends from 4000 to 5500 feet on the N., and from 4000 to 6000 feet on the S. It comprises the middle Alps, and its upper limit is also that of the growth of trees. The forests are composed of spruce, larch, and in its highest parts the alpine form of the *Pinus cembra* is characteristic. Here agriculture ceases, but the rich grassy pastures of the Alps begin, on account of which this region is often called "the Cattle Alps," or similar names. In it are also found, mostly in Grisons, the highest permanent villages. Silvaplana, at the sources of the Inn, lies at 5958 feet; Bivio, in Val Oberhalbstein, at 5827; Cresta, in Val Avers, at 6365 feet above the sea. (4) *The Alpine region*, from the limit of trees, 6000 feet, to the limit of permanent snow, 9000 feet, begins by a zone of shrubs, reaching to 7000 feet, among which the lovely Alpine roses (*Rhododendron ferrugineum* and *hirsutum*), the creeping azaleas, junipers, willows, and alders are the most conspicuous. The rich pastures of the preceding region are replaced by a short, thick, aromatic turf, growing in isolated patches on the surface of the rocky soil, and studded with the short-stemmed and brilliant flowers which make the charm of the tiny Alpine flora. But soon these humble shrubs also disappear, and leave the entire field to those puny representatives of the vegetable world which grow among every heap of débris, in every nook and crevice of rock where a scanty soil can lodge, or spread on every tuft of verdure their bright, well-nigh stemless, corollas. The deep-blue gentianas, the sky-colored myosotis, the light-pink *Silene acaulis*, the delicate purple *Soldanella alpina*, and over 200 other species, grow to the very edge of perpetual snow, and even far above, to 10,000 and 11,000 feet, on the bare rocks too precipitous to retain snow on their slopes. The nimble chamois, the steinbock, or rock-sheep, now nearly extinct, the lämmergeyer, or large eagle, the formidable enemy of the lamb, the sleepy marmot, are the representative animals of the Alpine region. (5) *The region of perpetual snow* in the Alps is broader and more extensive than in any other mountain-system of Europe. Its lower limit is found in the Bernese Alps at 8800 feet of altitude; in the Grisons, at 9200 to 9400 feet; on the southern slope it rises to 9000 and 9800 feet. There is, therefore, even in midsummer, an uninterrupted zone of snow from 6000 to 7000 feet high, such as is offered by no other mountain-chain, neither on the continent of Europe nor on that of North

# MAP OF SWITZERLAND

Drawn and Engraved on Copper-Plate EXPRESSLY FOR JOHNSON'S UNIVERSAL CYCLOPÆDIA

Scale of Miles 5 10 20 30

Longitude East from Greenwich

Longitude East from Washington

6 7 8 9 10 83 84 85 86 87 46 47

BADEN WURTEMBURG BAVARIA TYROL

LAKE OF CONSTANCE

SCHAFFHAUSEN THURGAU APPENZELL ST. GALLEN GRISONS

BASEL AARGAU ZURICH ZUG LUZERN SCHWYZ GLARUS URI UNTERWALDEN FRIBOURG VAUD NEUCHATEL VALAIS TICINO LOMBARDY FRANCE SAVOY

Rhine Aare Reuss Limmat Linth Rhone Ticino Adda Inn

Basel Zurich Geneva Lausanne Bern Lucerne Fribourg Schaffhausen Constance Coire Chur Bellinzona Lugano Locarno Sion Martigny Brieg Aigle Thun Interlaken Altdorf Schwyz Glarus Appenzell St. Gallen Frauenfeld Winterthur Aarau Soleure Neuchatel Chaux de Fonds Porrentruy Delemont Langenthal Zofingen Baden Rheinfelden Lorrach Waldshut Mulhausen Ensisheim Bale

Mont Blanc 15,750 ft. Le Grand St. Bernard 12,600 ft. Matterhorn Pic Blanc Monte Rosa Finsteraar Horn Schreckhorn Jungfrau Wetterhorn Titlis Tödi Scesaplana Splugen Bernardino Septimer Julier Albula Bernina Umbrail Malenco Disgrazia Sentis Rigi Pilatus Napf Chasseral Mont Terrible Dent de Morcle Mont Velan Grand Combin Dent du Midi Gemmi Furka Oberalp Lukmanier Gotthard Simplon Monte Leone Weissthor Finsteraarhorn Aletsch Glacier Rhone Glacier Lake of Geneva Lake of Constance Lake of Lucerne Lake of Zurich Lake of Neuchatel Lake of Thun Lake of Brienz Lake of Wallenstadt Lake of Zug Lake of Lugano Lake of Como Lake of Maggiore Lake of Iseo Lake of Garda

America, occupying a large portion of the Swiss territory. From the lower limit of these vast snow-fields long streams of ice, which are but a mode of melting of the snow, the glaciers, pass through the several zones of vegetation just described, and reach in the glaciers of Grindelwald within 3000 feet of the level of the sea. In a single day's walk the traveller may thus pass from the cold but brilliant abode of everlasting winter, through all the intermediate steps, marking as many different climates, to the evergreen region of an almost perpetual summer, and admire under the shade of the olive and the fig tree the Alpine rose which he plucked the same morning at the foot of the snow-fields. These are the contrasts which lend so much charm to the Alpine scenery and make it without rival. A. Guyot.

**Switzerland, History of.** The most ancient records of the inhabitants of Switzerland are found in the pre-historic implements and traces of ancient lake-dwellings in most lakes of that country. The constructions of the lake-dwellers seem to indicate that their builders were of Asiatic origin. But who were those who erected them? Did they belong to one and the same people? How, when, and by whom were they exterminated? These are questions which may remain unsettled for ever. Like structures have been found in other places N. and S. of Switzerland, but nowhere in so great a number. It is remarkable that no human débris was discovered among the thousands of specimens of workmanship left by that ancient people. The Helveti were thus not the first inhabitants of Switzerland, but they are the first whose name has been transmitted to us by history. Situated as they were between the Romans and the Germanic tribes of the North, which were incessantly endeavoring to open their way toward better climates, the Helveti had to suffer from both these neighbors, and their mountains and valleys had to witness many a battle. The Helveti made several attempts to leave such an unsafe country and to establish themselves to the westward, but they continually found either the Gauls or the Roman armies to stop them. They always fought with great valor, and even once compelled the Romans themselves to pass under the yoke. But what could a small tribe do alone against a powerful enemy always able to send new armies into the field? The Helveti, notwithstanding their valor and partial successes, were on all occasions compelled to fall back to their mountains. They once had the temerity to attack Cæsar's army in a place near the Rhone, at the outlet of this river from the Lake Lemannus. Here, again, they were overpowered by the legions of the mighty Romans, their military tactics, and their superior discipline. The remainder of the tribe of the defeated Helveti were forced to retreat, and to repair again to their valleys. After this they received the name of "confederates" from the Romans, who assured them of their protection. The duty of the Helveti was now to form a bulwark on behalf of Rome against the Germans, and their country became a Roman province. The E. was occupied by the Rhæti, the S. by the Pennini, the centre by the Helveti proper, and their next neighbors W. were the Sequani, belonging to the Gauls.

The time came, however, when the Romans had to withdraw their forces and make room for other invaders, the Ostrogoths, the Alemans, the Burgundians, and the Franks, who occupied Switzerland up to 879, the date of the foundation of the first kingdom of Burgundy. The last of the Burgundian kings parted with his sovereignty in favor of the emperor Conrad II. in the year 1016, so that the greater part of what is now Switzerland was placed under the immediate rule of the emperors. At the beginning of the twelfth century the emperor granted to the dukes of Zähringen, as vassals, besides many other lands, the greater part of Western Switzerland and the Lesser Burgundy. At the death of the last Zähringen (1218) Switzerland was again put under the paramount authority of the emperor, who, however, conferred several parts thereof on other vassals, whom the Swiss were not always ready to acknowledge as their lords. The Swiss were willing to submit themselves to the emperors as their paramount lords, but bore uneasily the rule of the imperial vassals. The latter were sometimes at war with each other. The leagues of these nobles induced the Swiss communities to form like associations; the three forest cantons, Uri, Schwytz, and Unterwalden, formed such a league in 1291, which was indeed the nucleus of the twenty-two cantons of the present confederation.

The house of Hapsburg, which had been instituted by the duke of Zähringen protector of the "Lands"—for such the forest cantons were called—attempted to increase their rights and domains; the Lands opposed, and tried in their turn to free themselves from the dominion of the house of Hapsburg. The Swiss were successful, but did not conquer their liberty without many an encounter or battle. The league of the Swiss of 1291 was renewed in 1313, after the famous battle of Morgarten, gained by them over the Austrians, and which has been called the Thermopylæ of Switzerland. In the western part of that country the house of Savoy had an authority almost as considerable as that of Hapsburg in the centre and the E.; but in the first part of the fourteenth century the influence of both these houses began to decline. In 1336 the Swiss again routed the Austrians at Sempach. The period from 1412 to 1431 witnessed the annihilation of the Austrian power and the undermining of the house of Savoy, which was to lose all its domains in Switzerland at the time of or after the Reformation. In the fifteenth century the Swiss, still victorious, had again to fight several battles with foreign armies—the Armagnacs, under Louis XI., at St. Jacob, near Bâle, in 1444, and the veteran troops of Charles the Bold of Burgundy, at Grandson and Morat, in 1476.

Another period of the history of Switzerland extends to 1643. It witnessed, first, the extinction of the last vestige of the house of Savoy and the establishment of the principles of the Reformation. This was a period of intestine wars with the aristocratic element, which, combining with the ecclesiastical lords, invoked in their behalf the privileges they had obtained, many of them as far back as the twelfth century. Treating the country people, the peasants, as subjects, the latter were generally reduced to silence during these wars, and it required on the part of the latter renewed efforts during several centuries before they were put on the footing of a perfect equality guarantied by constitutions. Throughout the same period religious wars took place between the Roman Catholics and the Reformers—wars in which the former were sustained by France. These wars were not terminated before the beginning of the eighteenth century. The followers of both faiths are now living on an equal footing, and have their respective rights secured; which does not, however, prevent majorities from sometimes laying a heavy hand on minorities. After each of the religious wars treaties of peace were made, but peace did not return. The Thirty Years' war nearly put an end to the Swiss confederation. Happily for her, the Treaty of Westphalia (1648) declared Switzerland independent of the German empire.

Up to the time of the death of Louis XIV. the greatest disorder existed in Switzerland, and this disturbed condition of things continued until the outbreak of the French revolution, the principles of which gained ground easily in Switzerland. The number of malcontents increased, and the Swiss were to be seen in opposing armies. The mighty canton of Berne, the largest of the states, fought valiantly to the last against the new ideas and the foreign republican armies, but without success, for she was overpowered. Thus, Switzerland fell into the hands of foreigners, sustaining within an anti-national party. She was to be converted into a republic, "one and indivisible," according to the views of the French Directory. This lasted four long years. To that form of government succeeded a sort of league based upon federal principles. Under this constitution Switzerland recovered an appearance of peace, but the mediator of that "mediation act" (Feb. 13, 1803) was a mighty neighbor and a despotic ruler. The mediation lasted ten years, and came to an end at the fall of the French empire. Then Switzerland threw herself into the arms of the Holy Alliance. The European reaction against France took place, and Switzerland had to participate in it; her soil was invaded by the allies, as it had been so often and so long by the French armies. By the Congress of Vienna (1815) her independence was again acknowledged and guarantied. The spirit of self-preservation and sense of dignity developed themselves in Switzerland, and new efforts were made to give the country a stronger and more independent basis. Switzerland was led to it by new internal disturbances and external occurrences—notably, the revolutions in France in 1830 and 1848. Constitutions were framed, one after the other, more on the basis of political theories than on the practical development of history. The last constitution voted by the people bears the date of May 29, 1874.

If Switzerland has been for a very long time suffering from want of a sufficiently central power, it is obvious that the tendency of our age is to increase that centralization to the detriment of the sovereignty of the cantons. Here is the danger for that country, as well as for other federal states. In 1802 a delegation was sent to Paris to ask the First Consul's opinion as to the form which should be given to a new constitution which Switzerland had in view. His answer was, "Nature made you to be a federative state: no reasonable man attempts to conquer nature." A true word, indeed, but how many times did he observe his precept? George A. Matile.

**Switzerland, Statistics of.** Switzerland consists, according to the census of 1870, of the following cantons:

| Cantons. | Area in sq. m. | Population. | Roman Catholics. | Protestants. |
|---|---|---|---|---|
| Aargau | 542 | 108,873 | 89,180 | 107,703 |
| Appenzell, Outer Rhodes | 100 | 48,726 | 2,358 | 46,175 |
| Appenzell, Inner Rhodes | 63 | 11,913 | 11,720 | 188 |
| Bâle, city | 14 | 47,760 | 12,301 | 34,455 |
| Bâle, country | 162 | 54,127 | 10,245 | 43,523 |
| Berne | 2,660 | 506,561 | 66,015 | 436,304 |
| Freiburg | 643 | 110,832 | 93,951 | 16,819 |
| Geneva | 109 | 93,239 | 47,868 | 43,639 |
| Glarus | 267 | 35,150 | 6,888 | 28,238 |
| Grisons | 2,774 | 91,782 | 39,843 | 51,887 |
| Lucerne | 579 | 132,338 | 128,338 | 3,823 |
| Neufchâtel | 312 | 97,284 | 11,500 | 84,334 |
| St. Gall | 780 | 191,015 | 116,060 | 74,573 |
| Schaffhausen | 116 | 37,721 | 3,051 | 34,466 |
| Schwytz | 350 | 47,705 | 47,047 | 647 |
| Solothurn | 303 | 74,713 | 62,078 | 12,448 |
| Thurgau | 382 | 93,300 | 23,454 | 69,231 |
| Ticino | 1,095 | 119,619 | 119,350 | 194 |
| Unterwalden, Upper | 183 | 14,415 | 14,055 | 358 |
| Unterwalden, Lower | 112 | 11,701 | 11,632 | 66 |
| Uri | 415 | 16,107 | 16,018 | 80 |
| Valais | 2,026 | 96,887 | 95,963 | 900 |
| Vaud | 1,244 | 231,700 | 17,592 | 211,686 |
| Zug | 92 | 20,993 | 20,082 | 878 |
| Zurich | 665 | 284,786 | 17,942 | 263,730 |
| Total | 15,988 | 2,669,247 | 1,084,525 | 1,566,345 |

During the same year the movement of the population comprised 18,610 marriages, 83,300 births, 72,838 deaths; during 1871, 19,514 marriages, 81,629 births, 77,998 deaths. The emigration to America averaged from 1868 to 1872, 4465 a year; in 1873 it amounted to 4957, in 1874 to 2672. The cantons, however, of Uri, Freiburg, Solothurn, Vaud, and Geneva are not included here, as they give no record of emigration. In 1870, 94.3 per cent. of the population, or 2,517,599, were natives; 5.7 per cent., or 150,907, were foreigners. The foreigners comprised 62,228 Frenchmen, 57,245 Germans, 18,073 Italians, 5872 Austrians, 360 Hungarians, 2297 Englishmen, 1599 Russians, 1404 Americans, 492 Belgians, 349 Spaniards, 260 Hollanders, 93 Danes, 123 Swedes and Norwegians, 389 from other countries, and 123 of unknown birth. German was spoken in 384,538 households, French in 133,575, Italian in 30,079, Romansh in 8778.

The constitution of Aug. 7, 1815, was superseded by a new one Sept. 12, 1848, of which a revision was adopted May 29, 1874. According to this revised constitution, the legislative power of the government of the federal republic is vested in the federal assembly, consisting of the national council and the council of states. The national council is formed of delegates elected by the people at large, one for each 20,000 souls; so that, according to the census of 1870, the assembly consisted of 135 members. Every voter, not a clergyman, is eligible. The council of states consists of 44 members, each canton sending 2. Besides its legislative power, the federal assembly has the right to make treaties and alliances with foreign powers, declare war and conclude peace, take measures for neutrality or intervention, sanction the constitutions of the cantons, etc.; but all federal laws and all general measures in which the whole confederacy is concerned, and which are not of a pressing nature, are subject to a popular vote on the demand of 30,000 voters or 8 cantons. The executive power belongs to the federal council, whose seven members are chosen by the federal assembly for three years from among the whole mass of Swiss citizens eligible to the national council. More than one member, however, cannot be chosen from the same canton, and no member can hold any other office either in the confederacy or in any single canton, nor can he carry on any business. The president of the federal council, who is also the president of the confederacy, is chosen by and among the members of the council for one year, and he cannot be re-elected until after the intervention of one year. The federal court consists of 9 members and 9 substitutes chosen by the federal assembly for six years. Under its jurisdiction belong all cases between the confederacy and the cantons, between canton and canton, between the confederacy or the cantons on the one side and a corporation or private individual on the other, etc. The cantons have each its own constitution, and form 25 republics, with 25 different constitutions, Bâle, Unterwalden, and Appenzell being each divided into two. These constitutions range from purely democratic to perfectly representative systems, but each constitution must be sanctioned by the federal assembly before it can come into force. Ecclesiastical authorities are, in the Reformed Church, the synods, assemblies of the whole clergy; and at their side stands in each canton, as the highest administrative authority, an ecclesiastical council—in Geneva a consistorium. The Roman Catholic Church has 5 bishoprics—Bâle (residence, Solothurn), Chur, Lausanne-Geneva (residence, Freiburg), St. Gall, and Sion.

On the occupations of the inhabitants the mountainous character of the country exercises great influence. 31 per cent. of the soil is unproductive, 69 productive; 19 are covered with forest, from 35 to 38 are meadows and pastures. Only the cantons of Bâle (country), Lucerne, Schaffhausen, Solothurn, Thurgau, and Zug produce more grain than they use; those of Aargau, Berne, Freiburg, Vaud, and Valais produce just enough for home demand; but the other cantons must import grain. The total production of grain averages annually 5,000,000 hectolitres; that of potatoes, 9,000,000. The production of fodder is very considerable, and is estimated at an annual average of 45,000,000 cwts. The cultivation of vines, fruit trees, and garden-plants is flourishing. The cattle-breeding is celebrated. On Apr. 21, 1866, the country possessed 993,291 cattle, mostly of excellent breeds, 100,324 horses, 375,482 sheep. An important source of wealth is the exportation of wood. The products of the chase are of small importance, but fishing is carried on with great success. Mining yields no great profit; the country is poor in metals. About 600,000 cwts. of salt are annually raised, and much building-stone is quarried. Mineral springs are numerous. The manufacturing industry is very considerable, especially of cotton, which employs about 70,000 hands and has its centre at Zurich—silk, straw goods, leather, paper, woodenware, machinery, watches, jewelry, etc. Watches are made especially at Geneva and Neufchâtel—more than 1,000,000 a year. The manufacture of embroidery flourishes, especially in St. Gall and Appenzell; that of silk ribbon in Bâle, Aargau, Berne, and Thurgau. The commerce is also important; its transactions amount to about 1,300,000,000 francs a year. The principal articles of export are cotton and silk goods, watches, and cheese; those of importation, raw cotton and silk, iron, grain, and colonial products. There exist no official records of the commercial transactions, but the value of exports is estimated at about 500,000,000 francs; that of imports at about the same; and that of the transit traffic, which is very important on account of the central position of the country between Germany, Italy, and France, at about 300,000,000 francs. In Oct., 1875, there were 2000 kilomètres of railway in operation; all the lines are private. In 1874 the post-office comprised 742 bureaus, 1916 stations, and 30 agencies in foreign countries, and carried 63,252,884 letters—namely, 48,519,764 domestic and 14,733,120 international—besides 39,623,445 domestic papers and 2,027,899 from Germany and Austria. Receipts, 14,465,622 francs; expenses, 13,932,545 francs. At the end of 1874 the telegraph had 815 public and 84 railway stations. At the end of 1873 it comprised 5843 kilomètres of lines, 14,169 kilomètres of wires, and 715 stations. In 1874 it carried 2,652,104 despatches—namely, 1,846,898 domestic, 562,205 international, and 216,001 transit—besides 58,895 government despatches. Receipts, 1,855,813 francs; expenses, 1,855,731 francs. Public education is under the control of the separate cantons, and occupies, generally, a high standard; also in the Roman Catholic cantons, where the separation of school and Church has been carried out with good effect. The country has 3 universities—Bâle, Zurich, and Berne—and 3 academies—Geneva and Lausanne for theology, jurisprudence, and literature, and Freiburg for jurisprudence and natural science. According to the budget for 1875, the receipts of the confederacy amounted to 39,033,209 francs, the expenses to 39,766,000 francs. At the close of 1873 the public debt amounted to $5,650,000, and the value of the federal property to $5,691,000. The army consists of (1) the regular army, formed of men between 20 and 32 years; and (2) the Landwehr, comprising all men between 33 and 44 years. The staff consists of 3 colonels, 16 lieutenant-colonels and majors, and 35 captains; in all, there are 784 officers in the regular army, and as many in the Landwehr. The regular army numbers 106,102, the Landwehr 97,036. But this army does not exist as a standing army; it is formed only when the federal assembly finds it necessary for order and safety.

AUGUST NIEMANN.

**Switzerland,** county of S. E. Indiana, separated from Kentucky by Ohio River. It has an undulating surface and fertile soil. There are flour-mills, saw-mills, and manufactures of woollen goods, carriages, and cooperage. Staples, Indian corn, wheat, hay, potatoes, sorghum-molasses, wool, and dairy products. Cap. Vevay. Area, 220 sq. m. P. in 1870, 12,134.

**Switzerland,** tp., Monroe co., O. P. 1342.

**Sword,** a curved or straight weapon, usually with one or two cutting edges and a sharp point, but also made (scimitar, etc.) without a sharp point or (rapier) without a cutting edge. Swords of pre-historic and even much later times were often of bronze, but for many ages steel has been the material exclusively employed, except that occasionally some other material has been used for swords designed for state occasions and pageants. Damascus, To-

ledo, Pistoja, Bilbao, and Milan are among the cities of the Old World which have been famous for the excellence of their swords. Among the forms of the sword are the sabre, scimitar, rapier, broadsword, small-sword, etc.

**Sword'-Fish,** a common name for fishes of the family Xiphiidæ, remarkable for having the upper jaw prolonged forward in the shape of a bony sword. The common sword-fish (*Xiphias gladius*) ranges from our Atlantic coast eastward to the Mediterranean. It is often from ten to sixteen feet long, has very fine scales, no ventral fins, a long broken dorsal fin, and a large and deeply-forked caudal. It is a very rapid swimmer, and is reputed to assail the largest whales with its sword. It sometimes strikes ships with such force as to penetrate several thicknesses of plank, and the sword is often broken off and left *in situ*. It is generally esteemed as food, and taken by the harpoon, thus affording an exciting and dangerous sport. (See also XIPHIIDÆ.)

**Swords,** tp., Cherokee co., Ala. P. 379.

**Swoszowice,** small town of Western Galicia, circle of Wadowice, is famous for its sulphur-mines, which produce annually more than 7000 cwts. of pure sulphur.

**Swy'naerde,** town of Belgium, province of East Flanders, has celebrated manufactures of laces and tiles. P. about 2000.

**Sya'grius,** the last Roman ruler in Gaul, was a son of Egidius. After the death of Majorianus (in 461), Egidius, governor of Gaul, refused to acknowledge his successor, Severus, made himself independent, and even subjugated some of the neighboring Frankish tribes. His son, Syagrius, who inherited the country, was less successful in his dealings with the Franks, and it finally came to a decisive battle between him and Clodwig, the chief of the Franks, at Soissons in 486. Syagrius was defeated, and fled to the Visigothic king, Alaric II., who surrendered him to Clodwig, by whose command he was put to death.

**Syb'aris,** city of Magna Græcia, in Lucania, was founded by Achæans and Trœzenians about 720 B. C., 3 miles from the Tarentine Gulf, between the rivers Crathis and Sybaris, the modern Crati and Coscile. It rose rapidly to a great prosperity, founded other colonies—Posidonia, Laüs, and Scidrus—covered a space of 6 miles in circumference, and was notorious for the luxury and effeminacy of its inhabitants. In 510 B. C. Telys, a demagogue, succeeded in overthrowing the oligarchic constitution of the city, and 500 of the wealthiest citizens emigrated to Crotona. Telys demanded their surrender, and as this was refused, he declared war against Crotona. But the Crotoniats routed and massacred the Sybarite army, and destroyed the city utterly by changing the course of the river Crathis and flooding the site of Sybaris with its waters. The city never recovered, but in 443 B. C. Thurii was founded in its neighborhood.

**Sy'bel, von** (HEINRICH), b. at Düsseldorf Dec. 2, 1817; studied history under Ranke at Berlin, and was appointed professor at Marburg in 1845, at Münich in 1856, at Bonn in 1861, and director of the archives at Berlin in 1875. His first work was the *Geschichte des ersten Kreuzzugs* (1841), but his principal work is the *Geschichte der Revolutionszeit* (3 vols., 1853–57, afterward continued; translated into English by Perry, London, 1868). He also wrote *Entstehung des deutschen Königthums* (1845), *Die Erhebung Europas gegen Napoleon I.* (1860), besides a great number of minor essays, partly historical, partly political, such as the *Klerikale Politik im neunzehnten Jahrhundert* (translated into English by J. S. Henderson, London, 1874).

**Sycami'na,** city of Palestine, situated near the present Haifa, between Acre and Cæsareia Palæstinæ, at the northern basis of Mount Carmel. It was here that Ptolemy Lathyrus, son of Cleopatra, landed the army of 30,000 men which he had brought from Cyprus to besiege Ptolemais; and in 1831, Ibraham Pasha also selected the place to land his troops.

**Syc'amine** [Gr. *συκάμινος*], an ancient name for the mulberry, both black and white, also for the true sycamore.

**Syc'amore** [Gr. *συκόμορος*, from *σῦκον*, a "fig," and *μόρον*, a "mulberry;" Heb. *shik'mah*], a tree and its fruit, the *Sycomorus antiquorum*, a near relative of the fig. It is a widespreading, shady tree, much planted in the Levant for its shade. Its light, fragile wood is reputed to be indestructible. Its fruit is inferior in quality to that of the fig, but is abundant and palatable. In some parts of the U. S. the buttonwood or plane tree is improperly called sycamore, and in England that name is applied to a kind of maple (*Acer pseudoplatanus*).

**Sycamore,** p.-v. and tp., cap. of De Kalb co., Ill., on Sycamore and Cortland R. R., has 8 churches, good schools, 1 semi-weekly and 5 weekly newspapers, 3 banks, a large harvesting-machine and other manufacturing interests. Principal business, farming and dairying. P. of v. 1967; of tp. 2852. H. L. BOIES, ED. "TRUE REPUBLICAN."

**Sycamore,** tp., Montgomery co., Kan. P. 547.

**Sycamore,** tp., Hamilton co., O. P. 5460.

**Sycamore,** p.-v. and tp., Wyandot co., O., on Miami Canal. P. 850.

**Sycamore,** tp., Barnwell co., S. C. P. 1359.

**Syc'ophant** [from *σῦκον*, a "fig," and *φαινεῖν*, *φαντεῖν*, to "disclose," to "inform"], originally an informer on fig-exporters, and was formed at a time when it was strongly forbidden to export figs from Attica. In this, its original meaning, however, it does not occur in the Greek literature. By the older writers it means an informer in general, a slanderer, a backbiter, but subsequently it came to designate a mean flatterer, a wretch who tries to get a good meal, present, etc., by catering to people's vanity, and in this meaning it has been adopted in most modern languages.

**Syd'enham** (CHARLES EDWARD **Poulett Thomson**), BARON, b. at Waverley Abbey, Surrey, England, Sept. 13, 1799, son of a wealthy merchant trading to Russia; became clerk, and subsequently partner, in the St. Petersburg house; was afterward a partner in the London firm; met with some losses by investing in Mexican mines 1825; became intimate with Bentham and his circle of political economists, whom he represented in Parliament from 1826; vice-president of the board of trade and treasurer of the navy Nov., 1830; president of the board of trade June, 1834; obtained a seat in the cabinet 1835; appointed governor-general of Canada Aug., 1839; created Baron Sydenham Aug., 1840, and after a brief administration, in which he effected the union of Upper and Lower Canada, he d. at Kingston, Canada, Sept. 19, 1841, from the results of a fall from his horse. His *Memoirs* were published in 1843 by his elder brother, George Poulett Scrope, M. P.

**Sydenham** (FLOYER), b. in 1710; was educated at Wadham College, Oxford, where he took his degree of M. A. in 1734; became eminent as a Platonic scholar, translating into English several of the *Dialogues* of Plato, and publishing a *Dissertation on the Doctrine of Heraclitus, so far as it is mentioned or alluded to in Plato* (1775), and the *Onomasticum Theologicum, an Essay on the Divine Names according to the Platonic Philosophy* (1784). He fell into great pecuniary distress, was arrested on a trifling debt due to his victualler, and thrown into prison, where he d. Apr. 1, 1787. The sympathy excited by his fate gave rise to the establishment of the Literary Fund.

**Sydenham** (THOMAS), b. at Winford Eagle, Dorsetshire, in 1624; was educated at Oxford, and in 1648 became a fellow of All Souls' College; studied medicine at the college of Montpellier, France; took his degree of M. D. at Cambridge, and established himself about 1660 as a physician in London, where he soon attained the foremost place. He abandoned the mere routine system of practice then prevalent, basing his own upon the theory that there is in nature a recuperative power which it is the province of the physician to aid, not to oppose. He was especially acute in observing and describing the symptoms of diseases, and carefully studied the relations between epidemics and the conditions of the atmosphere. Among the services which he rendered to medical practice was the treatment of intermittent fever by cinchona and the administration of cooling remedies in smallpox. His works, which are not numerous, comprising in all only a single volume, were written in Latin, but have been frequently translated. In 1843 was founded the Sydenham Society, for the purpose of printing important medical works in English and other languages. Its first issue was the complete works of Sydenham, in Latin (1846), and translated into English by Dr. Greenhill, with a memoir by Dr. Latham (1848). D. in London Dec. 29, 1689.

**Syd'ney,** the capital of the English colony of New South Wales, Australia, is on the southern shore of Port Jackson, which, whether for beauty of scenery or adaptability as a port, is unrivalled by any other harbor in the world. Although Sydney has now a formidable rival in the metropolis of Victoria, the natural advantages she possesses place her in the position of the first city of Australia, justly entitling her to the appellation of the "Queen of the Pacific." The city occupies the centre of a great Carboniferous basin. A great portion of it is built upon sandstone rock of the finest and most compact kind. The aspect of Sydney, when seen from the harbor, is splendid. Along the rocky, deeply-indented coast-line, behind the forest of tall masts, stretch the long rows of stone houses, broken now and then by larger edifices, churches and manufacturing establishments, with their tall chimneys. On a hill to the left stands a castle, the palace of the governor, built in Gothic style, and a little below, on a steep promontory, is situated Fort Macquarie, which, however,

seems built more for the luxury of saluting English men-of-war than for the purpose of a serious encounter. The city is somewhat straggling and irregular in form, and occupies a site of various elevation. The observatory, on the hill to the N. W. of the town, is in lat. 33° 51′ 4″ S. and lon. 10° 4′ 46″ E. The greatest length of the city is 3⅜ miles, the greatest breadth nearly 3 miles. The most prominent streets are George, Pitt, Bridge, York, Bent, and Macquarie streets. The most remarkable buildings are—the university, a structure of immense dimensions and very rich decoration, the museum of natural history, the market-hall, the post-office, and a number of schools and churches, large and small, in good taste and in bad. Twenty-three suburbs or townships surround the city; they are all incorporated boroughs; the most important are Glebe, Paddington, Waverley, Southhead, Newtown, St. Leonard, etc. Business is most lively along the Darling harbor, occupied by the numerous coasting vessels, while the large, sea-going vessels anchor at Sydney Cove, beside Fort Macquarie. The city is lighted by gas, and provided with water from the Lachlan and Botany swamps; it is rich in public promenades and charitable institutions. For parliamentary purposes the city is divided into two electorates, each of which returns four members to Parliament. The general government of the city is in the hands of a municipal council consisting of 16 aldermen. Sydney is the entrepôt for the products of the colony, and carries on itself an important manufacturing industry in iron, machinery, linen, cloth, soap, and tobacco. Its commerce is very great. In 1874 the colony was visited by 4385 vessels of 1,990,894 tons burden. The value of its imports amounted to £11,293,739, that of its exports to £12,345,603. By far the largest part of this traffic goes through Sydney. New South Wales was originally intended for a convict colony, and on Jan. 28, 1788, 1000 convicts and soldiers were first settled here; now it is a rich and important colony, and its capital has developed with extraordinary rapidity. Capt. Phillip, chief of the fleet which carried the convicts, selected the place and founded the city; in 1800 it numbered about 26,000 inhabitants. Between 1861 and 1871 the population increased 32 per cent. Of the 134,756 inhabitants the city comprised in 1871, 75,945—namely, 38,142 males and 37,803 females; and the suburbs 58,810—namely, 28,555 males and 30,255 females. Deportation ceased entirely in 1850. AUGUST NIEMANN.

**Sydney,** a seaport, cap. of Cape Breton co., N. S., on Cape Breton Island, on the S. W. arm of Sydney harbor. It was once the capital of the island. It is connected by rail with Bridgeport and other coal-mining centres. Coal, butter, and cattle are the principal exports. It has 6 churches, 2 weekly newspapers, and a fine court-house. Sydney mines are 18 miles distant. (See NORTH SYDNEY.) Sidney light is in lat. 46° 18′ N., lon. 60° 9′ W. Steamers ply regularly to Halifax (284 miles distant) and several other ports. The harbor is excellent. P. 2900.

**Sydney** (ALGERNON and PHILIP). See SIDNEY.

**Syene.** See ASSWAN.

**Syenite.** See GRANITE.

**Sykes** (GEORGE), b. at Dover, Del., Oct. 9, 1822; graduated at the U. S. Military Academy in 1842, when appointed a brevet second lieutenant in the 3d Infantry, his first service being against the Seminoles in Florida. In the war with Mexico he served with credit from Vera Cruz to the Mexican capital, gaining the brevet of captain for gallantry at Cerro Gordo. From 1848 to 1861 he was almost constantly with his regiment on the frontier, serving on numerous expeditions and being engaged in frequent actions with hostile Indians. In 1855 he attained a captaincy, and in the early part of 1861 was serving with his company in Texas. Hastening North, he was in May appointed major of the newly-authorized 14th Infantry, and in July commanded the battalion of regular troops in the battle of Bull Run. Commissioned a brigadier-general of volunteers in September, he commanded the regular infantry in the defences of Washington during the winter of 1861–62, and in the Virginia Peninsular campaign of 1862 the division of regulars (Porter's corps) which so stubbornly maintained its position on the right at the battle of Gaines's Mill. In the succeeding campaigns he continued in command of this division at the second battle of Bull Run, Antietam, Fredericksburg, and Chancellorsville, and on the appointment of Gen. Meade to the command of the Army of the Potomac (June, 1863) Sykes succeeded to that of the 5th corps, which a week later was engaged at Gettysburg, and at the head of which he continued during the ensuing operations of the Army of the Potomac until Apr., 1864, when ordered to duty in the department of Kansas. For gallantry at Gaines's Mill he was brevetted colonel, brigadier-general for Gettysburg, and major-general for gallant services during the rebellion. Mustered out of the volunteer service in Jan., 1866, he returned to duty with the 5th Infantry, of which he had been appointed lieutenant-colonel in Oct., 1863. In Jan., 1868, he became colonel of the 20th Infantry.

**Sykes** (OLIVE **Logan**), daughter of Cornelius A. Logan, b. in New York in 1841; made her début on the stage in Philadelphia 1854; went to England 1857; pursued a course of study at a female college; became a contributor to English and French papers; published two novelettes (1860); reappeared on the stage at Wallack's, New York, in 1864, in *Eveleen*, a play written by herself; had considerable success on the stage, but retired in 1868, since which time she has devoted herself principally to lecturing on woman's rights and on other social topics, magazine-writing, and newspaper correspondence, and has published two or three volumes of essays and lectures. From 1857 to 1865 she was the wife of Edmund A. Delille, and is now (1876) the wife of Wirt Sykes, U. S. consul at Cardiff, Wales, whence she corresponds with several American periodicals, retaining as her literary signature her maiden name.

**Sykes** (WILLIAM HENRY), F. R. S., b. in Yorkshire, England, in 1790; joined the Bombay army 1804; served under Lord Lake at Bhurtpoor; commanded a regiment at Kirkee and Poona in the Deccan campaign 1817–20; qualified as interpreter of the Hindustani and Marathi languages; became statistical reporter to the Bombay government; retired with the rank of lieutenant-colonel 1831; became a commissioner of lunacy for London 1840; was subsequently a director in the East India Company, and its chairman 1856–57; was elected lord rector of the University of Aberdeen 1854; was at one time chairman of the Society of Arts; was chosen president of the Royal Asiatic Society 1858, and of the Statistical Society of London 1863; entered Parliament for Aberdeen as a Liberal 1857; was a severe critic of the British military policy in India and China after 1860; published many papers in scientific periodicals on the natural history, geology, meteorology, and statistics of India, and was author of *Notes on the Religious, Moral, and Political Condition of Ancient India, The Origin and Progress of the Taeping Rebellion in China* (1863), and other publications on military science and on vital statistics. D. June 16, 1872.

**Sykes'ville,** p.-v., Freedom tp., Carroll co., Md., on Baltimore and Ohio R. R.

**Sylamore,** tp., Izard co., Ark. P. 400.

**Sylla.** See SULLA.

**Syl'labus** [Lat.; literally, an index of words or heads of a book, a table of contents; also a collection or résumé] is a document issued by Pope Pius IX. Dec. 8, 1864, which condemns eighty current doctrines of the age as heresies, referring for particulars to the various earlier official documents of the same pope. Its full title is: *A Syllabus, containing the Principal Errors of our Times, which are noted in the Consistorial Allocutions, in the Encyclicals, and in other Apostolical Letters of our Most Holy Lord, Pope Pius IX.* As the pope has since been declared infallible (by the Vatican Council in 1870), this digest of errors must be regarded as infallible, for it is certainly an official utterance addressed to the whole Catholic world, and sent to the bishops with a papal encyclical. The document is purely negative, but indirectly it teaches and enjoins the very opposite of what it condemns as error. It is divided into ten sections. The first condemns pantheism, naturalism, and absolute rationalism; the second, moderate rationalism; the third, indifferentism and latitudinarianism; the fourth, socialism, communism, secret societies, Bible societies, and other "pests of this description;" the fifth, errors concerning the Church and her rights; the sixth, errors concerning civil society; the seventh, errors of natural and Christian ethics; the eighth, errors concerning Christian marriage; the ninth, errors concerning the temporal power of the pope; the tenth, errors of modern liberalism. Among the errors condemned are the principles of civil and religious liberty, and the separation of Church and State. The Syllabus indirectly asserts the infallibility of the pope, the exclusive right of Romanism to recognition by the civil government, the unlawfulness of all non-Catholic religions, the complete independence of the papal hierarchy, the power of the Roman Church to coerce and enforce, and its supreme control over public education, science, and literature. It reasserts all the extravagant claims of the mediæval papacy, and is a declaration of war against modern civilization and progress. It is irreconcilable with an independent state. It has provoked the new conflict between the papal and the civil power in Prussia, Austria, Brazil. The Syllabus is printed in the *Acta et Decreta Concil. Vatic.* (Friburg, 1871), and in Schaff's edition of Gladstone's pamphlet on the *Vatican Decrees* (New York, 1875, p. 109). See Schaff, *History of Creeds,* vol. i. p. 128; Pronier, *La Liberté re-*

*ligieuse et le Syllabus* (Genev., 1870); Gladstone, *Vatican Decrees*, the replies of Cardinal Manning and Dr. Newman to Gladstone (1875), and Gladstone's second pamphlet, *Vaticanism* (1875), in triumphant self-vindication. Newman's defence of the Syllabus is ingenious but feeble, and virtually denies its dogmatic force, saying (p. 108), "We can no more accept it as *de fide*, as a dogmatic document, than any other index or table of contents." PHILIP SCHAFF.

**Syllacages,** tp., Talladega co., Ala. P. 1034.

**Syllogism.** See LOGIC, by PROF. W. D. WILSON, LL.D., L. H. D.

**Syl'van,** tp., Osceola co., Mich. P. 43.

**Sylvan,** p.-v. and tp., Washtenaw co., Mich. P. 1931.

**Sylvan,** p.-v. and tp., Richland co., Wis. P. 888.

**Sylvan Grove,** tp., Dale co., Ala. P. 524.

**Sylva'nia,** p.-v., cap. of Screven co., Ga.

**Sylvania,** p.-v. and tp., Lucas co., O., on Lake Shore and Michigan Southern R. R. P. 1400.

**Sylvania,** p.-v., Columbia tp., Bradford co., Pa. P. 212.

**Sylvania,** tp., Potter co., Pa. P. 267.

**Sylvant,** tp., Richland co., Wis. P. 888.

**Sylves'ter,** p.-v. and tp., Green co., Wis. P. 1034.

**Sylvester,** the name of two popes and an antipope. What is told of SYLVESTER I. (314–335), that he converted and baptized the emperor Constantine, and received Rome and its temporalities as a donation, is only fable.—SYLVESTER II., whose true name was GERBERT, was born in Auvergne; studied in Spain under Bishop Hatto of Barcelona, and with the Arabs at Seville and Cordova; travelled in Italy; acquired a great reputation for learning, and was appointed by Otto II. teacher to his son, Otto III. While director of the school of Rheims, to which he attracted many students, he was elected archbishop of that diocese in 991 by a synod which deposed Archbishop Arnulf, but he was not confirmed by the pope, and had to give up his see to Arnulf. He then left Rheims, and repaired to Otto III., by whose aid he became archbishop of Ravenna in 998, and in the following year pope. His knowledge of mathematics, astronomy, and physics led people to consider him a magician.

**Sylvester** (JOSHUA), b. in England in 1563; became eminent as a linguist; was a member of the Company of Merchant Adventurers at Stade, Holland. D. at Middleburg, Holland, Sept. 28, 1618. Author of numerous poems and tracts, but best known as the translator into English of Du Bartas's *Divine Weekes and Workes* (1621).

**Syl'vius** (JACOBUS), (JACQUES DUBOIS), b. at Louville, near Amiens, France, in 1478; studied medicine at the University of Paris, where he was appointed professor in 1550, and d. Jan. 13, 1555. He was the first to practise injection of the blood-vessels during their dissection; a fissure of the cerebrum is called the fissure of Sylvius. His *Opera Medica* were collected by René Moreau, and appeared at Geneva in 1630.

**Symbols.** See SIGN.

**Symbols, Chemical.** See CHEMISTRY, by PROF. G. F. BARKER, M. D.

**Symbols,** in zoology. See ZOOLOGY.

**Syme** (JAMES), M. D., b. in Edinburgh, Scotland, in 1799; graduated in surgery 1821; was lecturer and professor of surgery at Edinburgh many years, and originated many improvements, including the resection of diseased joints in place of amputation, the process known as "Syme's operation" for amputation of the foot at the ankle-joint, and the removal of large tumors of the lower jaw by excision of the entire bone. D. at Edinburgh June 26, 1870. Author of *The Excision of Diseased Joints* (1831) and *Principles of Surgery* (1832), both reprinted at Philadelphia (1866). A *Memorial of the Life of James Syme, M. D.*, was prepared by Dr. Robert Patterson (Edinburgh, 1871).

**Sym'machus,** b. at Sinagia, in Sardinia, about 440; was elected pope Nov. 22, 498, after the death of Anastasius II., but his election was contested, and Laurentius was elected antipope. Symmachus was supported by Theodoric, king of Italy, and Laurentius by the Byzantine emperor. The contest lasted for several years, but was finally decided in favor of Symmachus. But of more interest are the enactments of the various synods held during his reign, and which contributed much to the development of the papal power. In 502 a synod of Rome decreed that no layman should interfere in the affairs of the see of St. Peter without incurring the severest penalties; and in 503, when the pope was accused of peculation and adultery, another synod of Rome declared that the occupant of the see of St. Peter could be judged by none but God. Symmachus d. July 19, 514, and was declared a saint; his feast is celebrated on the day of his death.

**Symmachus** (QUINTUS AURELIUS), b. and educated in Gaul, but acquired great fame as an orator, and held some of the highest civil offices in Rome in the latter part of the fourth century A. D. Of his works, the *Epistolarum Libri X.* have come down to us, and are of considerable historical interest; editions by Juretus (1580), Scioppius (1608), and Pareus (1651). Fragments of his speeches were discovered by Cardinal Mai, and published in *Scriptorum Veterum nova Collectio* (1815) and in Meyer, *Orat. Rom. Fragm.*, p. 627–636. He was one of the last champions of paganism, but a noble and pure character.

**Symmes,** tp., Edgar co., Ill. P. 1185.

**Symmes,** p.-v. and tp., Hamilton co., O. P. 1377.

**Symmes,** tp., Lawrence co., O. P. 995.

**Symmes** (JOHN CLEVES), b. on Long Island, N. Y., July 21, 1742, was a member of the Continental Congress 1785–86; judge and chief-justice of the supreme court of New Jersey; was appointed judge of the North-west Territory 1788, and was the founder of the settlements in the Miami Valley. D. at Cincinnati Feb. 26, 1814.

**Symmes** (JOHN CLEVES), nephew of the preceding, b. in New Jersey about 1780; entered the army as an ensign 1802; was a captain in the war of 1812, serving on the Niagara frontier; settled at Newport, Ky., and made himself notable throughout the West by propounding a theory that the earth is hollow, open at the poles, and habitable within, containing several other concentric hollow spheres. He published several arguments and delivered many lectures (from about 1818) in support of his theory, and petitioned Congress to fit out an expedition to test it. D. in poverty at Hamilton, O., May 19, 1829. A son of his has recently (1876) revived the theory.

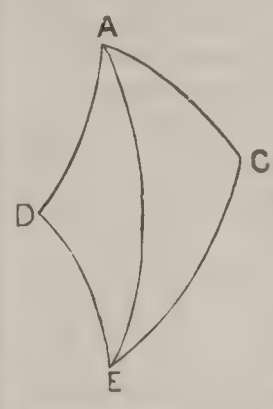
**Symmes** (THOMAS), b. at Bradford, Mass., Feb. 1, 1678; graduated at Harvard 1698; was minister at Boxford, Mass., 1702–08, and at Bradford from 1808 to his death, Oct. 6, 1725. Author of *Historical Memoirs of the Late Fight at Piggwackett, with a Sermon, occasioned by the Fall of the Brave Capt. John Lovewell* (1725; republished, with notes by Dr. Nathaniel Benton, 1861), and the *Sermon* was republished by Frederick Ridder in his *Expeditions of Capt. Lovewell* (1865).

**Symmes's Corners,** p.-v., Fairfield tp., Butler co., O. P. 127.

**Sym'metry** [Gr. *συμμετρία*], a mathematical term implying regularity in the arrangement of the parts of a mathematical figure. Two points are said to be symmetrically disposed with respect to a straight line when they are on opposite sides of the line and equally distant from it—that is, when they are so situated that a line joining them is bisected by the given line. A curve is symmetrical with respect to a line when its points, taken in pairs, are symmetrically disposed with respect to that line—that is, for each point on one side of the line there is a corresponding point on the other side, equally distant from it. In this case the given line is called an *axis of symmetry*. Thus, in the ellipse, for every point on one side of the transverse axis there is on the other side a second point such that the chord joining them is bisected by that axis. The transverse axis of the ellipse is therefore an axis of symmetry.

There is a species of symmetry called *oblique symmetry*, differing from that just explained in the fact that the chords joining the corresponding points are oblique to the line that bisects them. Thus, in the ellipse any diameter bisects all chords parallel to its conjugate. The ellipse is therefore said to be obliquely symmetrical with respect to any one of its diameters.

The idea of symmetry may be extended to surfaces, lines of symmetry being replaced by planes of symmetry. A surface is said to be symmetrical with respect to a plane when for each point on one side of the plane there is a corresponding point on the other side, such that the line joining them is bisected by the plane. If the chords are perpendicular to the plane, the symmetry is said to be *right*; otherwise it is said to be *oblique*. A plane of symmetry is often called a *diametral* plane, and is then defined to be a plane which bisects a system of parallel chords of the surface.




Symmetrical triangles on the surface of a sphere are spherical triangles whose sides are equal each to each, but not similarly situated. Thus, if the triangles A C E and A D C have the side A E common, the side A C equal to A D, the side C E equal to D E, the angles at A and E being equal, as well as the

angle at C and D, the triangles are symmetrical. Although they are equal in all their parts, they cannot be superposed so as to coincide.

In analysis an expression is said to be symmetrical with respect to two letters when the letters may change places without changing the form of the expression. Thus, the expression $x^2+y^2=R^2$ is symmetrical with respect to $x$ and $y$. W. G. Peck.

**Sy'monds** (John Addington), M. D., b. at Oxford, England, Apr. 10, 1807; educated at the University of Edinburgh, where he graduated in medicine 1828; became physician to the general hospital at Bristol about 1832; lecturer at the Bristol Medical School 1834; Gulstonian lecturer 1858; president of the British Medical Association at Bristol 1863, and took a prominent part in the social science congress of 1869. D. at Clifton Feb. 25, 1871. Author of *Sleep and Dreams* (1851), *The Principles of Beauty* (1857), of various poems, addresses, and essays, and of a posthumous volume of *Miscellanies* (1871) containing some fine descriptions of Italy and some intelligent art-criticism.

**Sy'mons** (Jelinger Cookson), b. in England in 1809; graduated at Corpus Christi College, Oxford, 1831; was called to the bar 1843; edited the *Law Magazine* several years, and became government inspector of schools 1847. D. at Great Malvern Apr. 7, 1860. He edited J. W. Smith's valuable *Lectures on the Law of Contracts* (1847), wrote several professional treatises, and was author, among other works, of *Railway Liabilities* (1846), *Tactics for the Times* (1849), *School Economy* (1852), *Lunar Motion* (1856), in which he denied the rotation of the moon upon her axis, and *William Burke the Author of Junius, an Essay on his Era* (1859).

**Sympathetic Inks.** See Ink, by Prof. B. Silliman, M. D.

**Sympathetic Nervous System.** See Ganglionic Nervous System, by E. C. Seguin, M. D., and Histology, by Col. J. J. Woodward, M. D.

**Sym'phony,** or **Sinfonia** [Gr. *σύν* and *φωνή*], in music, a term originally signifying the concurrence, agreement, or combined effect of several sounds, as in harmony, or in the blending of several voices in unison. In modern usage a symphony is an elaborate composition designed for performance by a full orchestra, and consisting of several distinct movements (usually four in number), each of which has its own individual character, as the *allegro, andante, adagio, minuet, scherzo,* etc., while the whole unite in forming one symmetrical and complete work of art. There appears to have been no important difference between the symphony and the overture until about the end of the last century. The symphony may be regarded as an expansion or development of the overture, as the latter usually consists of only one real movement, though often marked off into two divisions (as in the *Zauberflöte*), in the first of which the principal theme travels out of the original key, and in the second returns to it after being worked out and enriched by artistic treatment. In a more general sense, symphonies are those short instrumental passages which are intermingled with vocal music, as at the beginning and ending, etc., of songs, hymn-tunes, choruses, and other compositions having an instrumental accompaniment.

William Staunton.

**Symphytum.** See Comfrey.

**Symp'toms** [from the Gr. *συμπίπτω*, to "concur," to "fall together"], in medical diagnosis and prognosis, are the phenomena by which the physician judges of the nature and probable course of the disease he deals with. Symptoms are *objective*—that is, perceptible to the physician's senses—or *subjective,* perceptible only to the patient's senses, such as pain, deafness, etc. Each may be valuable, but the former are as a rule much more to be depended upon. These are by some writers called *physical signs,* as distinguished from *vital symptoms,* but these are sometimes objective, and practically all are classed as symptoms. Few symptoms are absolutely *pathognomonic,* or infallible signs of some one disease; but in general the import of symptoms can be learned only by the use of careful observation and patient and logical thought, guided by experience.

**Syn'agogue,** the place of worship of the Jews [from Gr. *συναγωγή*, class. Gr. "collection," "gathering;" LXX. "assembly," "meeting;" New Testament and ecclesiastical writers = בית הכנסת, "house of assembly;" Προσευχή = בית תפלה. For distinction between *συναγωγή* and *ἐκκλησία* see Trench, *Synonyms of the N. T.,* § 1]. Early tradition, both Jewish and Christian, refers the origin of synagogue-worship to the patriarchal or Mosaic age. Of the private and social religious life in Israel previous to the Exile almost nothing is known, and it seems clear that it had no centre away from the temple and feasts at Jerusalem. The prophets exercised great influence among the people, and gathered them together for instruction (2 Kings iv. 23), but these meetings were irregular, infrequent, and never became general among the people (2 Chron. xvii. 9). It was undoubtedly during the Captivity, when the people, afar from temple and native land, assembled privately on their sabbaths and feast-days for reading the Law and devotion, that the system had its origin; but not until after the Greek conquests, and the consequent dispersion of the Jews throughout Western Asia and Europe, was it fully developed as one of the characteristic features of Judaism. Wherever the Jews went they carried their religion and laws with them, and in every settlement of ten בטלנים (*i. e.* men at leisure to attend service and hold the communal offices) they built a synagogue, supplying, as a centre of their social religious life, the place of the temple. In Palestine the development was more gradual, but at the time of Christ synagogues are found in every town and village throughout the country, and he makes use of them for much of his teaching. Since the destruction of the temple, the synagogues, which have been the only place of worship of the Jews, have exercised an immense influence on the Jewish religious and national character; to such an extent have they cultivated the idea of local worship that the temple is almost eliminated from their religion.

As the founders of the early Church were brought up under synagogue influence, the intimate connection of the forms of worship, officers, and order of the Christian Church with that of the synagogue is most natural. (Comp. זקנים = *πρεσβύτεροι* = "elders;" גבאי צדקה = *διάκονοι* = "almoners," "deacons;" שליח צבור = *ἄγγελος ἐκκλησίας* = "minister," "teacher;" חזן = *ὑπηρέτης* = "sexton.")

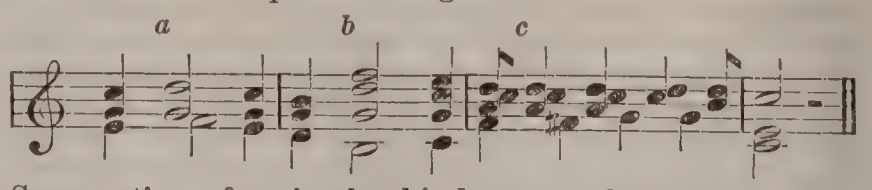
*Literature.*—(See Winer and Herzog (Leyrer), under "Synagogue;" Smith (Plumptre), Kitto (Ginsburg), "Synagogue;" Vitringa, *De Synagoga Vetere* and *Archisynagogus;* Zunz, *Gottesdienstliche Vorträge der Juden, Der Ritus des synagogischen Gottesdienstes geschichtlich entwickelt;* Allen, *Modern Judaism;* Bernard, *Synagogue and Church;* Jerusalem, Megillah, iii.; Maimonides, יד חזקה; Engelmann, הגיון לב.) (Compare also various histories of Israel—Herzfeld, Jost, Grätz, Ewald, etc.)

*The Great Synagogue* (כנסת הגדול).—A body of 120 men (אנשי כנסת הגדול), who, according to Jewish tradition (*Baba bathr.,* fol. xiv. 2, xv. 1; Megilloth, 17 b. 18 c.; *Pirke Aboth.,* i. 1), were constituted by Nehemiah (x. 1–10), after the return from the Exile, for the reorganization of religious worship and civil order. To them is attributed the formation of the canon of the Prophets (נביאים), etc. Many (Simon, Spinoza, Alting, Rau, Aurivillius, De Wette; see below) regard, without sufficient ground, the whole account as an invention of the later Rabbinical schools. Most probably Ezra and Nehemiah gathered around them a council (Neh. viii. 13) for aid and advice in re-establishing the Jewish Church and State, and this body perpetuated itself until it developed into the Sanhedrim.

*Literature.*—See above under Sanhedrim. See also Rau, *De Synagoga Magna,* Aurivillius (ed. J. D. Michaelis), *De Synagoga vulgo dicta Magna;* Grätz, in Frankel's *Monatsschrift,* vi. 31 ff., 61 ff.; Spinoza, *Tractatus theol-polit.,* x. 343; Alting, *Opp.* v. 382; Hartmann, *Die enge Verbindung des A. T. mit dem N. T.,* p. 120 ff.; Hitzig, *Gesch. des Volkes Israel,* p. 318; Ewald, *Gesch. des Volkes Israel,* (2. Ausg.) iv. 191 ff.; Jost, *Gesch. Judenthums and seiner Sekten,* i. 41; Löw, בן חכביה, 1858, p. 102 ff., 194. Compare various introductions to Old Testament: Simon, *Histoire Crit. du Vieux Testament,* lib. i. cap. viii.; Bleek, *Einleitung,* p. 690; Keil, *Einleitung,* p. 499; also De Wette, Horne, Stähelin, etc.; Bertheau (*Comm. zu Esra,* p. 101). Thomas C. Murray.

**Synaptase.** See Emulsin.

**Syncopa'tion** [Gr. *συγκοπή*], in music, a certain arrangement of notes which often produces a sudden check of the rhythmical movement, thus disturbing the regular accent, and rendering emphatic that part of a bar or measure which would otherwise be unaccented. See *a, b,* and *c* in the example following:




Syncopation of a simpler kind occurs when the last note of any bar and the first note of the bar succeeding are tied together by a "bind," and thus form in reality only one note. Formerly, instead of writing two notes separately with a bind, it was usual to write only one (equal to the

sum of both), and place it directly across the bar-stroke. Syncopations are also called "driving notes."

WILLIAM STAUNTON.

**Syn'cretism** [Gr. *συγκρητισμός*] is said to have originated in ancient times as the designation of a custom characteristic of the inhabitants of Crete, who forgot or overlooked all their internal dissensions as soon as a controversy occurred with any foreign country. In the sixteenth century the word was used to denote those attempts which were made by Pico de Mirandola, Bessarion, and others to reconcile the philosophy of Aristotle with that of Plato. But a still more extensive use for the name was found in the seventeenth century, it being applied to the views of George Callixtus and his followers, who hoped to heal the schism of the Christian Church by acknowledging the traditions of the first Christian centuries beside the Bible, and declaring the *Symbolum Apostolicum*, the common basis of the various Christian denominations, as sufficient for the definition of true Christianity.

**Synec'doche** [Gr. *συνεκδοχή*] means a figure of speech by which the abstract and concrete, the general and individual, the whole and a part of it, etc., are interchanged in order to give the expression life and color; as, for instance, when *knife* is used for *weapon*, *hearth* for *home*, *Cicero* for *orator*, etc.

**Syn'ergism** [Gr. *σύν*, "with," and *ἔργειν*, to "work"] denotes those views of the work of regeneration according to which the human volition is not absolutely passive, and the divine grace not the only activity. In the time of the Reformation these views were represented by Melanchthon, and in the latter part of the sixteenth century vehement controversies arose between the synergists, Pfeffinger, Strigel, etc., and the orthodox, Flacius, Arnsdorf, etc. The question was finally settled by the *Formula Concordiæ* in favor of the orthodox.

**Syne'sius,** b. about 375 in Cyrene, the civil metropolis of the Libyan Pentapolis; studied philosophy in Alexandria under Hypatia, of whom he became an enthusiastic disciple; was sent at the head of a provincial embassy to the emperor Arcadius at Constantinople in 397, and stayed there for three years, which time he describes as exceedingly painful; visited Athens in 402, but found himself greatly disappointed, and spent most of his time in rural retirement near the frontier of Cyrenaica, occupied with the study of philosophy and literary pursuits. In 410 he was elected bishop of Ptolemais, the ecclesiastical metropolis of the province, but his relation to Christianity previous to his election is rather obscure, and it cannot be made out with certainty whether he was baptized or not. He accepted the election with great reluctance. Many of the Christian doctrines he could not reconcile with the ideas of the Neo-Platonic philosophy which formed his innermost conviction; he felt averse to the large secular business connected with the episcopate; he was married, and he was absolutely unwilling to renounce wedlock. Nor did he feel happy in his new office, which, however, he filled with conscientiousness and energy. The date of his death is not known, but about 430. Of his works are extant several essays, among which *De Insomniis*, a wild Neo-Platonic speculation; several orations, among which that held before Arcadius; a number of hymns, often translated into modern European languages; and letters of great and varied interest. Collected edition, with Latin translation, by Petavius (Paris, 1612; 2d ed. 1640); critical editions by Krabinger of separate works. (See H. N. Clausen, *De Synesio*, Copenhagen, 1831, and C. Thilo, *Commentarii in Synesii Hymnos*, Halle, 1842–43.)

**Syngenesia.** See COMPOSITÆ.

**Syngnath'idæ** [Gr. *σύν*, "together," and *γνάθος*, "jaw"], a family of marine acanthopterygian fishes distinguished by a highly-elongated form, with little flesh, the body almost covered with partially-ossified plates, the head and snout long and tubular, and the males having pouches in which the eggs of the female are hatched. The type of the family is the pipe-fish (*Syngnathus*), a genus of the order LOPHOBRANCHII (which see), containing more than twenty species, which are sometimes grouped as the subfamily Syngnathinæ, which is characterized by the egg-pouch being always on the tail, which is open through its whole length. They attain a length of two or three feet, live upon small marine animals and the eggs of other fishes, and have great affection for their young, which after being hatched often return to the egg-pouch of the male parent for protection. Not all the pipe-fishes belong to this family, that name being often given also to the fishes forming the family Fistularidæ, also called pipe-mouths and flute-mouths.

**Synodites.** See CENOBITES.

**Synod of Dort.** See DORT, SYNOD OF.

**Syn'onym** [Gr. *συνώνυμον*], a term applied to one of a group of two or more words of the same language, all of which have the same meaning. Practically, however, there are few strict synonyms, the words that pass for such being expressions of ideas nearly but not perfectly identical. There are consequently few instances where one word can be made to do the work of another without some qualification or circumlocution. The English language is peculiarly rich in what are called synonyms, and they confer upon it the power of expressing nice shades of thought in condensed and forcible terms. Some of the Oriental tongues, however, far excel ours in the number of synonyms, but in many cases these are figurative, highly poetical, and entirely conventional uses of terms by no means in themselves synonymous. This style of utterance is with us tolerated only in poetry.

**Syno'vial Mem'brane** [Gr. *σύν*, "with" or "resembling," and *ὠόν*, "egg"], a membrane in the animal in structure resembling serous membrane, but having a secretion unlike the thin watery product of the latter, and termed synovia or synovial fluid, denoting that it is thick, viscid, and glairy like the white of an egg. There are three classes of synovial membranes in the human body: (1) The articular, or those lining the lateral and antero-posterior walls of the closed cavities of the joints, and secreting a fluid to lubricate the opposed cartilaginous surfaces of the articulating bones. (2) Vaginal or sheath-like synovial membranes, which surround the tendons when passing through osseo-fibrous canals or grooves in the surfaces of bones, as is the case in the hand and foot. (3) Bursæ (Gr. *βύρσα*, "a bag"), little synovial sacs or cushions interposed between parts moving one upon the other with friction, as where a tendon glides over or presses directly upon a bony prominence. The synovial fluid consists of nearly 95 per cent. of water, rendered viscid by mucus, epithelial cells, fat, albumen, and salts. The synovial membranes are frequently the seat of disease. Acute synovitis, acute inflammation, may attack any joint as the result of violent injury, exposure to cold, rheumatic taint, or less often from vitiated blood in the course of fevers and other diseases. The symptoms are local swelling, extreme tenderness upon touch or pressure, pain when moved, and often persistent agonizing pain caused by the distension of the sensitive inflamed cavity by a hypersecretion of fluid. Penetrating wounds of the large synovial cavities, whether gunshot, incised, or occurring in connection with fractures, are serious, often necessitating the loss of a limb. Chronic synovitis is often a product of tubercular or scrofulous hereditary taint, with injury or over-use as incipient or exciting cause. The destructive process often involves the ends of the bones and the ligaments, which are softened and disintegrated. Abscess, partial dislocations, and ankylosis, or stiff joint, are the chief misfortunes which result. The synovial bursæ often become swollen and prominent by hypersecretion, and also by injury and inflammation. Such is the ganglion or "weeping sinew" of the back of the wrist. It resembles a cystic tumor; its contents must be evacuated and the membranous sac irritated or lacerated to obliterate it by adhesive inflammation. The occurrence of distended bursæ, and difficulty of cure in many cases, are due to their connection with the cavity of an adjacent joint.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Syntax.** See GRAMMAR.

**Synthesis.** See ANALYSIS.

**Synthet'ic Divi'sion,** in arithmetic, which corresponds with Horner's method for the synthetic division of algebraic quantities, is an ingenious method invented by George Suffield of performing the division of numbers in such a manner that the portion of the quotient already found shall be utilized to facilitate the finding of the remaining portion; it is especially valuable for abbreviating calculations which by the ordinary processes of division are long and tedious. To popularize the method it will be first explained for those who understand the first four rules of arithmetic only: We know that if we multiply the divisor and the quotient into each other, the product will be equal to the dividend, and in certain cases we shall be able to observe the quotient itself occupying a place among the partial products obtained in the process of multiplication; thus, $305963 \div 401 = 763$, and multiplying the quotient by the divisor, we have—

$$\begin{array}{r} 763 \\ 401 \\ \hline 763^{*} \\ 305200 \\ \hline 305963 \end{array}$$

where the partial product, marked *, is the quotient itself, and the other partial product is 400 times greater than the

quotient; so that if we can find a means of taking away 400 times the quotient from the product, we shall leave the true quotient. But as we do not know the true quotient, we cannot at once determine what figures will represent 400 times the true quotient; yet, as a sufficient portion of the larger partial product is unaffected by the partial product obtained by the multiplication by the unit figure to enable us to find the first figure of the true quotient, we can readily find the product of the true quotient $\times$ 400. Taking the dividend, 305963, we first divide the 30 by 4, which gives us 7, with a remainder (at present we only want the 7), and we know this 7 must be that resulting from the multiplication of the figure in the hundreds' place of the true quotient by the figure in the units' place of the divisor; if, therefore, we subtract this 7 from the figure in the hundreds' place of the dividend, we shall obtain the fourth figure of the larger partial product; 7 from 9 leaves 2, and as the fifth and sixth figures must be ciphers, 305200 must be equal to the true quotient multiplied by 400; and since, by subtraction,

305963
305200
...763

it follows that 763 is the quotient resulting from the division of 305963 by 401. This is synthetic division *subtractive*, and in practice is formed thus:

4)305.963
...763

The mental process is this: We say 4 in 30 = 7, and 2 over; write 7 under 9; 4 in 25 = 6, and 1 over; write 6 under 6; 4 in (19 − 7) 12 = 3, and no remainder; 4 in 6 − 6 = 0; 4 in 3 − 3 = 0; therefore, 763 is the exact quotient arising from the division of 305963 by 401. To facilitate synthetic division in arithmetic it is desirable to have the divisor near 10 or some multiple of 10; yet the divisor must not be 10 nor any multiple nor aliquot part of 10. Suitable divisors are obtained by multiplying or by dividing both dividend and divisor by such a number as will make the divisor some multiple of 10 or near it. Supposing, to take a simple example, 2680235791 is to be divided by 857, we multiply both dividend and divisor by 7, and quickly obtain the true quotient by short synthetic division *additive*, thus:

6)18761650.537
....3127463.000

In this instance the mental process is: 6 in 18 = 3, write 3 under 1; 6 in 7 = 1, and 1 over; 6 in 16 = 2, and 4 over; 6 in (41 + 3) 44 = 7, and 2 over; 6 in (26 + 1) 27 = 4, and 3 over; 6 in (35 + 2) 37 = 6, and 1 over; 6 in (10 + 7) 17 = 3, minus 1; 6 in (5 + 4 − 10, for the 1 must of course be carried as 10, because we are using it with figures one place lower in the scale of local value), minus 1 = 0 − 1; 6 in (3 + 6 − 10) − 1 = 0 − 1; 6 in (7 + 3 − 10) 0 = 0; therefore, 3127463 is the quotient, and there is no remainder. Hence the *Rule:* First multiply or divide the divisor by a number that will bring it very close to a multiple of 10 (401 is already a suitable divisor, and 857 $\times$ 7 = 5999); next add or subtract that figure which will make the partially-converted divisor (401 or 5999) a power of 10 (400 or 6000); and, having multiplied or divided the dividend by the figure used to manipulate the divisor, point off in the converted dividend as many decimal places, commencing at the units' place, as there are ciphers in the converted divisor (400 or 6000). Place the first figure of the quotient as many places from the beginning of the converted dividend as would be required for the first division by the synthetic divisor with the ciphers annexed (we must have 3059 to divide by 400, and 18761 to divide by 6000; we therefore place the first figure of the quotient under the 9, or four places, and under the 1, or five places, from the beginning respectively). Divide as in the ordinary process, but add in the quotient figure standing in vertical line with the figure of the dividend which is being manipulated. The integer portion of the quotient will be complete when the decimal point in the dividend is reached.

By using the processes of ordinary division in combination with synthetic division, the number of divisors reducible to synthetic divisors applicable to the short-division process may be almost indefinitely increased; thus, supposing we have to divide by 117, the first synthetic divisor directly obtainable would be 117 $\times$ 7 = 819 = synthetic divisor 82; but 39 $\times$ 3 = 117 = 3 $\times$ synthetic divisor 4; we may therefore divide synthetically by 4, and in the ordinary way by 3, commencing with either process. Of divisors of this class more will be learned hereafter.

The general principle of the process may now be readily considered by adopting Mr. Suffield's arrangement of commencing with the period of circulating decimals. When $q$ is a prime, the "cycle of $q$" (that is, the period or periods of the decimals equal to all the vulgar fractions, in their lowest terms, whose denominator is $q$) has $q-1$ places of figures; but when $q$ is *not* prime, some of the $(q-1)$ fractions will not be in their lowest terms, and will therefore have periods belonging to another cycle, and there will be altogether as many places of figures in the "cycle of $q$" as there are numbers less than $q$ and prime to $q$; that is to say, $q \cdot \frac{a-1}{a} \cdot \frac{b-1}{b} \cdot \frac{c-1}{c}$, etc. places. In the case of terminating decimals, $q = 2^m \cdot 5^n$, and the above formula gives $2^m \cdot 5^n \cdot \frac{2-1}{2} \cdot \frac{5-1}{5}$ as the number *not* of decimal places, but of the different decimals which can be formed from all fractions in their lowest terms with a denominator $q$. All the periods of the same "cycle" are of equal length, and when $q$ is prime, the number of figures in any period is $(q-1)$ or an aliquot part thereof. But when $q$ is not prime, but $= a.\ b.\ c.$, etc. (these being prime factors of $q$, and all unequal), then if $\alpha$, $\beta$, $\gamma$, etc. represent the number of figures in each of the periods of the "cycles" of $a$, $b$, $c$, etc., respectively, the number of figures in any period of the "cycle of $q$" is equal to the least common multiple of $\alpha$, $\beta$, $\gamma$, etc. If in reducing $\frac{p}{q}$ to a decimal a remainder occurs equal to the sum or difference of two previous remainders, $r$ and $r'$, or an exact part, as $\frac{1}{m\text{th}}$, of a previous remainder, the rest of the period may easily be found by adding or subtracting the terms already found for $\frac{r}{q}$ or $\frac{r'}{q'}$, or by dividing those for $\frac{r}{q}$ by $m$, always taking care to bring down the newly-obtained decimals to the right hand of the decimals by the addition, subtraction, or division of which they are produced. If in reducing $\frac{p}{q}$ to a decimal, a remainder occurs $= q-p$, the last half of the period is obtained by subtracting each of the figures of the first half from 9. If the cycle have only one period, the digits of the first and last half of the period will be "complementary" to each other; otherwise each period of the "cycle" will either consist of two complementary halves, or the "cycle" will consist of complementary pairs of periods; therefore, the complementary digits 0 and 9, 1 and 8, etc., must exist in every cycle in *pairs*. If $q$ be a prime, the decimals of all the fractions $\frac{1}{q}$, $\frac{2}{q}$, or $\frac{q-1}{q}$ are contained in its cycle, and form an arithmetical progression; and if the whole "cycle" be known, the decimal answering to any of the above fractions can be determined by inspection. The importance of knowing this when a long series of closely-similar calculations has to be made will be apparent; but under ordinary circumstances the results can be more quickly obtained by calculation than by inspection. The period of the reciprocal of a number may be obtained backward by multiplication.

The principles explained above are developed in Mr. Suffield's rule for synthetic division: "*To find* Q, *the quotient of* A ÷ B.—Let $a_{n-1}$, $a_{n-2}$, etc. $a_1$, $a_0$ be the digits in the $n$ last places of B. Then if $9-a_{n-1}$, $9-a_{n-2}$, $9-a_{n-3}$, etc., $9-a_1$, $10-a_0$, be added respectively to these digits, it will convert B into a number with a significant part (which call the synthetic divisor), followed by $n$ ciphers." Point off $n$ places of decimals from the units' place of A, and divide it by the synthetic divisor so as to find $q$, the first figure of Q; then above or below each of the $n$ places of the dividend, which would in common division have to be brought down to find the next $n$ figures of the quotient, write respectively $(9-a_{n-1})q$, $(9-a_{n-2})q$, etc. etc., $(9-a_1)q$, $(10-a_0)q$, leaving room at the right hand of each multiple for the same multiple of all the other figures of the quotient when found. Now suppose all the figures of the quotient *known*, and thus treated, the result would be (including the dividend) $n+1$ horizontal rows of figures, and their sum (adding the figures as they stand, and putting the decimal point of their sum under the decimal point of the dividend), divided by synthetic divisor, would give the same quotient Q, and remainder, as A ÷ B. But Q is not known until the division is completed; therefore to form the true dividend which, divided by the synthetic divisor, gives Q, we must find one figure of Q at a time, and operate on it when found according to the rule, thus forming the true dividend as we proceed with the division." To prove the rule, let B =

$$\text{Syn. div.} \times 10^n - \{(9-a_{n-1}).10^{n-1} + (9-a_{n-2}).10^{n-2} + \text{, etc., } + (9-a_1).10 + (10-a_0)\};$$

$$\therefore -Bq = -q \text{ syn. div.} \times 10^n + q(9-a_{n-1}).10^{n-1} + q(9-a_{n-2}).10^{n-2} +, \text{ etc.}, + q(10-a_0).$$

If the $n$ last digits of the divisor be each $=9$, the general rule will be much simplified. There will only be two rows of figures to add together—the dividend and the quotient, whose first figure will be placed above or below the $n$th figure of the dividend to the right of the units' place of the first remainder, and in determining the period of the circulator the quotient will be the sole dividend. If there be $(m+1)$ rows, including the dividend, to add together, we can never in performing the addition have more than $m$ to carry; therefore, if a certain figure of the quotient would give a remainder $<$ synthetic divisor $-m$, it is the right figure to take; otherwise, it is a doubtful case, and we must give this figure the *largest* value it will admit of, supposing it introduced into the multiple quotients, and taking into account the figure which on that supposition might have to be added to the remainder. The "doubtful case" will occur most frequently for *small* values of synthetic divisor. When the synthetic divisor is large, the same process is applied with *long* instead of short division.

In his pamphlet Mr. Suffield has given a large number of examples to elucidate the system. (See *Synthetic Division in Arithmetic, with some Introductory Remarks on the Period of Circulating Decimals*, by George Suffield, M. A., Clare College, Cambridge (Cambridge and London, 1863).) EDWARD DAVID HEARN.

**Syphax.** See MASINISSA.

**Sy'pher** (JOSIAH R.), b. at Liverpool, Pa., in 1832; graduated at Union College in 1858; studied law, and was admitted to the bar in 1862; contributed to various journals and periodicals, and in 1865 became one of the editorial staff of the New York *Tribune*, of which journal he established the Philadelphia branch office in 1867. He has published *History of the Pennsylvania Reserve Corps* (1865), *School History of Pennsylvania* (1868), and, in conjunction with E. A. Apgar, *School History of New Jersey* (1870).

**Syph'ilis,** a specific chronic contagious disease peculiar to the human organism, and more or less remotely associated with the venereal act. It is always acquired through contact with a human being, one suffering from syphilis, or from contact with some material which has been in contact with the vitiated secretion of a syphilitic. The term *syphilis* is an arbitrary one, and dates back to Frascatorius, A. D. 1521 (Baumler: *Ziemssen's Encyclopedia*, vol. iii. p. 4), who relates, in a poem concerning the disease, that "a herdsman of King Alkithous, Syphilus by name, was afflicted with it by Apollo in punishment for paying divine homage to the king instead of to the god." Syphilis has been recognized and described, under various names, in the earliest written history of every quarter of the globe. The Chinese account of it dates back to the writings of Hoan-Ti, 2637 years before the Christian era. (*La Médecine chez les Chinois*, Paris, 1863, translated by Capt. Dabry, and referred to by M. Lancereaux in his treatise on *Syphilis*, Paris, 1866.) In India its record appears in the Ayur vedas of Sucrutas, a treatise on Indian medicine written A. D. 400. (Berkeley Hill on *Syphilis*, London, 1868, p. 3.) Celsus, Hippocrates, and others describe the disease as existing among the ancient Greeks and Romans. (*Ibid.*, p. 4.) The Abbé Brasseur de Bourbourg (*Histoire des Nations civilisées du Mexique et de l'Amérique centrale durant les Siècles antérieurs à Christophe Colomb*, Paris, 1857, p. 181) writes that "numerous documents in the languages of the tribes of the valley of Anahuac, etc. have proved to him conclusively the existence of syphilis in America prior to its discovery by Christopher Columbus." (Lancereaux, vol. i. part 10, p. 7.) Mr. Berkeley Hill, in his excellent treatise on syphilis, cites Duremberg, who "quotes from a manuscript of the ninth century (now in the Imperial Library at Paris) which contains a very complete enumeration of ulcers, fissures, condylomata, etc.; these affections, it further says, may also spread to or affect the genitals." (*Ibid.*, p. 8.) Lanfranco of Milan (A. D. 1295) even separates ulcers of venereal origin into three varieties. Bernard Gordon, who taught at Montpellier in the latter end of the thirteenth century, mentions a case of eruption which was communicated through venereal contact. The existence of syphilis can thus be shown in very remote periods in the history of mankind, but it is only from the year 1494 that well-authenticated records of its European recognition are handed down to us. In that year a notorious outbreak of this disease occurred in the army of Charles VIII. of France (who was at that time besieging Naples). It was characterized by ulcers upon the genitals, pains in the bones, and eruptions of the skin, and was known as the *morbus Gallicus*, or the French disease. It prevailed to a fearful extent, not only among the soldiery, but among the people of the country: even the dignitaries of Church and State, monks, nuns, etc., did not escape, and a terror of it was spread throughout the land. The cause was attributed to various occult influences, chiefly atmospheric, and to the evil influence of certain unfavorable planetary combinations. It was found to be contagious, and supposed to be communicated by the breath. The celebrated Cardinal Wolsey was publicly accused of communicating this disease to King Henry VIII. by whispering in his ear. After a time, however, it was recognized as the result of venereal contact, and was then claimed by some to have been introduced by the sailors of Columbus, who had returned about this time from the discovery of America; nevertheless, this was not generally accepted.

The literature of that time ascribed the locality of origin to various regions, and designated it as "mal Anglais," "morbus Gallicus," "maladie de Naples," "pox," "la grosse vérole," "lues venerea," etc. It was then recognized as distinct from the contagious genital ulcer, the action of which was simply local, and which had long been known, and also from gonorrhœa, and was appreciated as a constitutional disease, capable of hereditary transmission. Within a comparatively short period, however, the distinctions between syphilis, the local ulcer (or chancroid), and gonorrhœa, were lost sight of, and all were accepted as of common origin, differing only in development, from some constitutional idiosyncrasy or predisposition, until the latter part of the eighteenth century, when Benjamin Bell of London claimed a distinct origin for gonorrhœa, and M. Philip Ricord of Paris in 1831 proved the fact by a long series of ingenious and conclusive experiments. M. Bassereau, a pupil of M. Ricord, in 1852 demonstrated a distinct and characteristic difference between the local contagious ulcer (the *chancroid*) and the lesion (*chancre*) which was followed by constitutional syphilis, and proved by a large number of observations that the local contagious ulcer (the chancroid) was not followed by, nor was it capable of producing, any constitutional disease, while the true syphilitic sore (chancre) was *always* followed by the constitutional manifestations of syphilis. Subsequently to the enunciation of this important fact by M. Bassereau, M. Clerc, a contemporaneous observer, while admitting the facts advanced by M. Bassereau, claimed to have proved a unity of origin for the chancre and the chancroid, and stated his conviction that the chancroid was the product of the inoculation of the secretion of a syphilitic sore (chancre) upon a person who was or had been the subject of syphilitic disease.

The medical profession at the present day is still divided in regard to the position of M. Bassereau and M. Clerc. Those believing with the former the distinct nature and origin of chancre (syphilis) and chancroid (the local ulcer) are known as *dualists*; those accepting the view of M. Clerc are known as *unicists*. Dr. Bumstead of New York was the first to separate, in a systematic treatise *On Venereal Diseases* (New York, 1861), the two forms of venereal lesion, and treat of them as separate and distinct diseases.

The question involved in this controversy—one of great importance—has failed to find an adequate solution, for the reason, chiefly, that clinical observations, which have been relied upon almost wholly for the solution of this matter, are made under peculiar embarrassments, moral, mental, physical, and circumstantial, so that the same apparent conditions falling under the notice of one observer, often present phases and peculiarities in the practice of another, that warrant entirely different conclusions; and hence, notwithstanding that the disease (syphilis) has been studied by numerous earnest and competent observers for a very long period, wide and honest differences of opinion exist in the matter of unicity and duality. These can never be completely settled until some other and more philosophic mode of arriving at conclusions can be adopted than that afforded by clinical observation alone. To this end the science of venereal diseases demands attention, more especially as the great advances in general physiology and pathology within the past few years have rendered it possible to understand many morbid conditions and processes which no amount of ability, earnestness, or opportunity could have deduced from clinical research.

The nature of syphilis, and the manner in which the human system is infected by it, are yet equally undetermined. Opinions in regard to these points have been almost as numerous as the writers on the subject since its affirmed European advent in 1492. Mr. Acton, a valued English authority, writes (*On the Urinary and Generative Organs*, London, 1860, pp. 279–347), "We must, however, frankly admit that in the present state of science it is impossible to determine where or under what circumstances the virus or its effects first appeared. . . . My own opinion is, that syphilis originally arose from some poison introduced into the economy from animal or decomposing matter, and that, thus produced, it has been transmitted from one individual to another." Of syphilitic infection he says: "Clinical observation teaches us only the *fact*—the *modus operandi*

remains undiscovered. We have no means of detecting the poison in the solids or in the liquids of the syphilitic sore. The blood taken from veins in the neighborhood contains no new or altered element that can be detected by chemical investigation; the only apparent difference is a greater proportion of albumen and a diminution in the number of the red globules. Still, the system is contaminated, and our form of expression is, that a poison has been conveyed into the constitution, but the real explanation of the matter we do not know." Dr. Lionel S. Beale of London, whose name is associated with most laborious and scientific investigations in regard to the origin and nature of contagious diseases, announced in 1863 (*Disease-Germs, their Real Nature*, London, 1870, p. 61) his discovery of living animal disease-germs in fresh vaccine lymph, with the declaration that its active properties were due solely to these germs. They were described as consisting of minute particles of bioplasm or germinal matter, readily seen under a microscopic power of from 1000 to 2000 diameters; and, says Beale, "I think they consist of a peculiar kind of living germinal matter, the smallest particle of which under favoring conditions will grow and multiply, giving rise to millions of living particles like itself, . . . and which, like itself, may retain life after the death of the organism in which it was produced; living matter which has descended from the living matter of health, but which has acquired the property of retaining its life under new conditions; living matter destroyed with difficulty, and possessing such wonderful energy that it will grow and multiply when removed from the seat of its development and transferred to another situation, provided only that it is supplied with suitable nutrient pabulum." Like disease-germs were shown to exist in other diseases, and a similar source of origin was claimed by Beale in 1866 for syphilitic disease.

Thus far, however, our knowledge of the active principle of syphilis is chiefly, if not wholly, of a negative character. It is entirely free from any irritating property when separated from purulent combination; the transparent secretion of an unirritated syphilitic lesion shows, under the microscope, only the débris of epithelial cells, small round cells, and free granular matter; when inoculated upon the surface of a healthy person, it shows no sign of virulence, and healing of the wound takes place as promptly as when no such inoculation has been made. Subsequent to this healing, a period of complete rest ensues—the so-called *period of incubation*—varying from twenty-four hours to seventy days in well-authenticated cases, when a thickening or induration of the integument at the point of inoculation is noticeable. The epidermis becomes thin and friable, and a moist secreting surface soon presents. This secretion, under the microscope, shows no signs of ulcerative action; only the normal constituents of cell-proliferation are seen. The process thus far has been one of growth, resulting in the indurated papule. This, excised and examined under the microscope, shows only normal cell-elements — white blood-corpuscles—packed so closely that the induration is reasonably accounted for, and this embarrassing the circulation, so that the friability and final exfoliation of the overlying epidermis is readily explained. As this cell-proliferation or accumulation goes on, the nutrition of the more deeply-implicated tissue is cut off, a necrobiosis (death from altered life — *Virchow*) follows, which results in an open lesion or loss of tissue; and this, with its indurated base, is known as the *chancre* or initial lesion of syphilis. Up to this time the disease appears to have been purely local, but on examination the lymphatic glands in immediate connection with the part will be found enlarged and hardened, and if examined under the microscope will be found closely packed with the same sort of cells which were seen in the section of the indurated papule. Various influences (such as the simultaneous inoculation of the syphilitic principle with vicious purulent or other secretions, or from local irritation) may change the character and course of the *chancre*, but otherwise there will be no evidence of diseased action except that resulting from the aggregation of cell-material, and this apparently confined to the line of lymphatic vessels. Up to this time the disease is known as *primary syphilis*. Another period of apparent rest now occurs, the so-called *secondary incubation* of syphilis. During this period also there is no consciousness, on the part of the subject of the trouble, of any general discomfort, the disease is still confined to the point of inoculation and the group of lymphatic glands in immediate connection; this period continues from four to six weeks, or even longer, when groups of lymphatic glands remote from the point of inoculation—in the neck, in the axilla, and in the arms—will be found enlarged and hardened. The whole trouble, apparently, is still confined to the lymphatic system, until a rash, rose-colored and somewhat like measles, breaks out on the cutaneous surface. This is apparently the result of a sudden impression upon the sympathetic nervous system, consequent upon the entrance of the vitiated proliferating elements into the general circulation. Up to this time, their advent into the general blood-current has been delayed in the lymphatic system through obstructions afforded by gland-structures between the point of inoculation and the thoracic duct. This rash, which is known as syphilitic roseola, and marks the invasion of the second or constitutional stage of syphilis, is dependent, like all other varieties of roseola, upon a paresis of the vaso-motor nerves of the skin, and is of variable continuance, sometimes passing off in a few hours, again remaining, gradually exchanging the rosy hue for a copper color. This deeper color is due to the exudation of the coloring-matter of the blood (through prolonged stasis in the relaxed capillaries), and may continue for many weeks.

At about this period, probably through the extensive engagement, and consequent interference with the normal functions of the lymphatic system, the subject of syphilis experiences headaches, chiefly at night, pains in the bones, with increase of temperature, and a general malaise which is known as the *syphilitic fever*. There is also at this period a marked increase of the white corpuscular element in the blood, which is now found (like the secretion of the chancre and the cell-accumulations in the glands) to be capable of communicating syphilis by inoculation. This stage, which is also termed the *active* period of syphilis, is still further characterized by a tendency to engorgement and inflammation of parts closely allied to the lymphatic system, as the tonsils (which not unfrequently go on to active ulceration, with considerable loss of tissue), and to parts rich in lymphatic vessels, as the pharynx and velum pendulum palati. The syphilitic principle, which has thus far been traced, along with the excessive proliferation of the germinal or white-blood cells, from the point of inoculation, throughout the lymphatic system and into the blood-current, will, curiously, be found continuing its line of development independently of the general organism, except so far as is recognized in the localized accumulation of those cells which have hitherto characterized its progress. The lymphatic system, as far as known, is an under-drainage system,* one office of which seems to be to return to the general circulation the nutritive material carried out by the blood-vascular system in excess of the demand. Now, at the nearest point of contact of these systems of vessels (the lymphatic and arterial) we should expect to find collections of surplus material, which, having escaped from the arteries, were unable from any cause to effect an entrance into the under-drainage vessels, the lymphatics. The arrangement of these vessels in the skin, as described by Teichman (*Rindfleisch*, p. 277), is as follows: "The blood-vessels lie around the circumference of the papillæ (winding up, cork-screw fashion, around the papilla until they reach its apex), while the lymphatic vessels lie exactly in the centre of the papillæ, and no lymphatic vessels are found in the sebaceous follicles, the sweat-glands, or the hair-bulbs. Consequently, it is in this juxtaposition of the blood-capillaries surrounding the papillæ and the lymphatic capillaries, passing up through their centres, that we should expect to find materials escaped from the blood-capillaries detained in their transit into the lymphatic capillaries. Now, it is a well-recognized clinical fact that at the period of syphilis when evidences of general constitutional disturbance begin to be manifest—that is, from six weeks to six months after the enlargement of glands contiguous to the initial lesion—and simultaneously with or soon after the appearance of the roseola, we have a distinct papular eruption as a characteristic feature of syphilis. The papules, which may vary in size from a pin-head to a split pea, or even larger, and may occupy the breast, back, arms, face, or all these localities, and to a certain extent symmetrically on either side of the body, are *confined to the papillæ cutis*. Section of one of these papules, examined under the microscope, shows the same crowding of white-blood cells (germinal elements) which was found to characterize the induration of the initial lesion and the enlarged and indurated lymphatic glands. Inoculation of healthy persons with the materials forming the papule is known to result in the communication of syphilis. This *papular* or *secondary eruption* of syphilis, as it is sometimes called, may be interspersed with pustules, or may become pustular as a result of a low state of the system, or from some peculiar dyscrasia of the individual affected. Papules occurring upon the mucous membranes are known as *mucous patches*. Their surface soon becomes eroded and covered, especially at the borders, with a whitish fibrinous exudation, which is esteemed a characteristic of this lesion. Mucous patches always occur upon mucous membranes richly endowed with lymphatic vessels, as upon the soft palate, the tonsils, the gums, the inner surfaces of the

* Von Recklinghausen Stricker (Syd. ed., vol. i., p. 297).

cheeks, the tongue, the walls of the pharynx, etc. Papules occurring on integument at points of unusually abundant lymphatic distribution, as about the vulva, the anus, or the scrotum, about nails of fingers, toes, etc., often assume the characteristics of the mucous patch, and are termed *mucous tubercles*. The secretions of both mucous patches and mucous tubercles are highly inoculable, and constitute, from this fact, one of the most important features in the disease. The inoculation of a healthy person with syphilis frequently occurs through contact with the secretion of a mucous patch situated in the mouth, and results through contact, as in kissing, the only required condition being a crack or an erosion or simple eruption (cold sore). Numerous examples are recorded where the disease has been acquired through contact with a spoon or a pencil or a pipe, or even of a stick of candy, which has been contaminated with the secretion of a mucous patch. Fortunately, the syphilitic principle requires for its introduction into a healthy organism a pre-existing lesion of the skin or mucous membrane. A specific exudative inflammation of the *eye* (syphilitic iritis) is not an infrequent occurrence in early constitutional syphilis. Dr. Bumstead says: "We have no certain means of distinguishing *syphilitic iritis* from that dependent upon injury, rheumatism, or other causes. At an early stage of the disease the pupil assumes a dull appearance, owing to commencing changes in the interior capsule of the lens; it may also be somewhat irregular. This irregularity of outline, due to adhesion between its margins and the capsule of the lens, or to exudation into its substance, becomes more marked as the disease progresses, and is especially evident if the pupil be dilated by belladonna or atropine, when its margin is found scalloped. In some cases the adhesions become continuous around the whole circumference, and the capsule of the lens is covered with a layer of lymph which completely blocks up the pupil."*

The structures of the eye, especially the more delicate, as the iris, the retina, the conjunctiva, etc., have hitherto been considered entirely deficient in a lymphatic circulation. Schwalbe has nevertheless fully demonstrated its presence in all these structures, and has shown an especially generous distribution to the iris, and in excess of the neighboring tissues. With the presence of a vitiated germinal element free in the general circulation, with its known power to cause obstruction to the lymph-circulation, and a consequent hyperplasia, we find, as a natural sequence, exactly what we should expect *a priori*—viz. that in the advance and course of syphilis the delicate structures of the eye often suffer through the same causes that result in hyperplasias in other parts richly endowed with lymphatic vessels.

Pains in the bones are often associated with the active or secondary period of syphilis. Sometimes they are of a wandering character, and again are localized, usually at some point in the long bones of the arm or leg. Occasionally, a circumscribed spot of periostitis occurs, leaving a slight bony elevation termed a node. Affections of the hair and nails occasionally present themselves in early constitutional syphilis. The hair loses its lustre and falls, sometimes partially and in spots; at others not only does entire baldness result, but a loss also of the beard, eyebrows, and eyelashes. The nails may become dry, lustreless, and brittle, while sometimes papules occur about the borders which arrest growth and cause considerable irritation.

Recent observations have shown the presence of an extensive distribution of lymphatic vessels in every structure and tissue of the human organism. Even in the fibrous and cartilaginous tissues these vessels have been absolutely demonstrated. (*Lymphatics of Cartilage and Fasciæ*, Ludwig and Schweigger Seidel, Leipsic, 1872.) Wherever blood-vessels are present, an accompanying system of lymph-vessels is also found, thus going far to confirm a recent view of one of the offices of the lymphatic system as a necessary adjunct to the blood-vascular system in gathering in and returning to the general circulation the excess of germinal material exuded for purposes of nutrition. With this view of the uses of the lymphatic system, it is a comparatively easy matter to account satisfactorily for many diseased conditions heretofore considered anomalous, and to appreciate the causes of the multiform lesions of syphilis which have hitherto puzzled acute clinical observers, and conveyed the impression that this disease is developed by no fixed laws, but results from a general and, almost necessarily, permanent vitiation of the entire affected organism.

The active stage of syphilis is of varying duration, covering a period of rarely less than one or more than two years. During this time the secretions of all lesions and the blood are inoculable. Its course, as formerly described, is marked by a gradual invasion of the organism, and always in the line of lymphatic distribution. Many cases, however, are so mild that nothing more than slight glandular enlargements can be recognized, and again so severe that every possible manifestation is in progress at one and the same period. The causes of variation appear to depend upon different degrees of activity in the material inoculated, and in the condition and antecedents of the subject. Syphilis may be transmitted to offspring through the influence of a syphilitic parent, but only during the active period of the disease. Abortions, still-births, and imperfectly-developed children may result from uterine and ovarian changes dependent upon antecedent syphilis, for a long period subsequent to the termination of active syphilis. It is a rule, however, to which there are few, if any, exceptions, that syphilis is transmitted by hereditary taint only while the lymphatic glandular enlargements remain. The complete disengagement of the lymphatic glandular system, with or without treatment, is the assurance of immunity from the danger of hereditary transmission.

Properly speaking, syphilis terminates with the secondary stage, and in the great majority of cases, as a result of treatment or by natural evolution, the subject of it remains in every respect well. In this regard it resembles a gonorrhœa which has pursued a favorable course, but in a certain number of cases a damage has occurred which is followed by consequences (such as stricture of the urethra) widely differing from the original disease. So in syphilis, the SEQUELÆ which result, and are generally described as the *tertiary* or *third period* of syphilis, may be assumed to be the effects of injury occurring during the active stage of syphilis. They lack in the first instance the element of contagion; in the second, the manifestations are unsymmetrical; in the third, they supervene after an interval of perfect health at periods varying from a few months to forty or more years from the active manifestations of the disease. They are characterized by the infiltration or deposit of lymphatic elements in the skin, in the muscles, in the bones, in the viscera. Such collections are termed syphiloma, or more generally gummata. The most exhaustive examinations discover in them only the débris of lymphatic or cicatricial elements. The results produced are only such as might reasonably be predicated upon a mechanical interference with the lymphatic circulation. Germinal material, imprisoned by interrupted natural channels, exhibiting in certain localities a low formative power, sufficient to produce constriction of vessels and tissues, but incapable of entering into the composition of any useful tissue; present, therefore, only as an obstruction, as a foreign body, or as cicatricial tissue, which may result finally in the compression and strangulation of important vessels and organs.

In the skin the earlier and more common sequel of syphilis appears as an eruption of a tubercular character, from the size of a grape-seed to the circumference of a dime, occurring singly or in groups, the latter variety being as a rule discrete; the former of a dark-red color, often scarcely ulcerative, but still leaving permanent cicatrices. The larger variety usually, when in groups, assumes a crescentic form, and is characterized by a free serous exudation, which dries and accumulates in thick brown scabs, underneath which a painless ulceration, usually superficial, goes on. This is termed syphilitic impetigo. Solitary lesions may occur which pursue a similar course, involving larger surfaces, often one and even two inches in diameter, with deeper and more abrupt loss of tissue, and are known as syphilitic rupia. Or, usually, at a later period, the obstructive element may be so superficial that a dry scaly eruption called syphilitic lepra or psoriasis may occur. Again, profound obstructions of the integument occur, which may result in large and deep ulcerations extending through the entire thickness of the integument, involving the subcellular tissue and pursuing sometimes a tortuous course, when they are termed *serpiginous* ulcerations of syphilis. On the other hand, accumulations of the gummous material may be localized under the integument, and attain a considerable size, painless and sluggish, and when out of the line of pressure or external irritation may exist for a long time without serious inconvenience. These are known as *gummy tumors*. This same material may also accumulate in the testicle, so that it shall acquire the size of a large orange, or it may aggregate in the kidney (in both of which organs large lymph-sacs are shown by His and Langer to exist). More rarely, the liver may be the subject of the deposit, when it often results in cicatricial contractions of its vessels and substance. The lungs, the brain, the heart, may each and all be involved in difficulty from the aggregation in their parenchyma of the gummous element. In the fibrous covering of the bones it may be imprisoned, causing periostitis, and consequent growth of new and imperfect bony mate-

* *Venereal Diseases* (3d ed., p. 660).

rial, called *syphilitic nodes*, or within the osseous substance, causing necrosis or death of the bone. And yet in all these varied and grievous accidents no constituent of the disturbing cause can be discovered to have any specific property, none which may not be reasonably attributed to a purely mechanical obstruction of the vessels of the lymphatic system. In the absence of any other alleged cause, this obstruction may be assumed as the result of the contraction of fibrous material laid down in the early active stage of syphilis.

The Treatment of Syphilis from the earliest times has been a subject of controversy, but in every age of which we have record mercury, in some form, has been the sheet-anchor, ultimately relied upon for the amelioration and cure of the active forms of the disease. Originally administered as an *antidote* to syphilis as early as the fourteenth century, it was often pushed to such extremes that the effects of the drug were recognized as more damaging than the results of the disease, and from century to century it was by turns in favor and disfavor, until a knowledge based on more intelligent clinical observations showed that its beneficial effects were more surely and safely produced by a gentle and prolonged mercurial influence. The iodide of potassium, first introduced by Wallace of Dublin in 1832, has also, since that time, been held in high esteem for its influence in combating syphilitic disease, especially in its later forms. And while various plans of treatment have at times found favor, such as decoctions of guiacum-wood, sarsaparilla-bark, and numerous herbs, treatment by baths and various modes of sweating, diuresis, and purgation, and syphilization; mercury and the iodide of potassium have held the field, up to the present day, as the safest and most efficient means of treating syphilitic disease in all its forms. It is a curious and instructive fact that all modes of treatment which have ever found even a transient favor in the management of syphilis have been practically based upon a similar theory—namely, *a stimulation of the metamorphosis of tissue;* and that, although the power of acting as an antidote to the so-called syphilitic virus has been claimed for some, and more especially for mercury and the iodide of potassium, yet these very remedies are universally recognized as the most potent agents for bringing about tissue-metamorphosis known to science.

The behavior of syphilitic disease under a treatment which is simply calculated to hasten the metamorphosis of normal tissue would lead to the inference that the excessive accumulations of cell-growth which are shown to be characteristic of every stage of its development play an important part in the causation of the different manifestations of syphilis, and induce us to pause before claiming an especial virus as essential to the explanation of the different morbid conditions which characterize its advent and progress. The contagious element, which alone suggests the presence of a virus, would appear to act only in stimulating the normal cell-proliferation to a degree in excess of the ability of the natural processes to assimilate and utilize. This cell-excitation would seem capable of being communicated from one cell to another, and the rapid fission would of necessity result in a decreased ability to develop into permanent structures. Thus, we have the exact material which is known to make up the indurations and useless cell-accumulations which are associated with syphilis in all its forms and stages. This view of syphilis would explain the benefit known to result from the use of remedial measures capable of hastening the metamorphosis of tissue. Looking, then, upon imperfect cell-proliferation and accumulation as the *materies morbi* of syphilis, its removal by means which are most efficient, and yet least liable to affect the normal constituents of the organism, will constitute the legitimate aim of medicine. Large doses of mercury, in health, act in producing a rapid fatty degeneration of normal tissues. One of the prominent constituents of the salivary secretions caused by a full mercurialization is a fœtid fat resulting from rapid tissue-metamorphosis. Small doses of mercury, sufficient only to accelerate in a slight degree the normal tissue-changes, may be administered for a very long period, not only without damage, but often with the effect of promoting healthful action. Now, if, as premised, the *materies morbi* of syphilis is an imperfect cell-proliferation, having less vitality, less organizing power, than normal cells, holding its forms by a feebler tenure than healthy tissue, then we might expect exactly what we do find as a result of clinical experience and observation—viz. that small doses of mercury, long continued, are efficient in removing—nay, in curing—syphilis without marked damage to the general organism. Such a degree of mercurialization as is sufficient to effect the destruction and elimination of the syphilitic elements, and yet not sufficient to disturb to any important degree any of the normal tissues or processes, constitutes the highest ideal of mercurial influence in the treatment of syphilis. The iodide of potassium is recognized as a potent agent in stimulating the lymphatic, vascular, and glandular systems, and in otherwise aiding in the normal processes of tissue metamorphosis. With less power to effect the disintegration of healthy and diseased structures than mercury, it is found less potent in the treatment of the active manifestations of syphilis; but from its known ability to unite with and render active the mercurial medicines, conjointly or previously administered, it constitutes a philosophical and invaluable adjunct in the treatment of syphilis, especially in its later forms, which have been described under *Sequelæ*, or *third period*.

F. N. Otis.

**Syphiliza'tion,** a term applied to the treatment of syphilis by the repeated inoculation of the purulent secretion of venereal sores, originated by M. Auzias of Turin in 1844. In his attempts to communicate syphilis to the lower animals, M. Auzias found that the pustules resulting from repeated inoculations of venereal sores gradually decreased in size and virulence, until, after a time, no effect was produced either by inoculation of the pus derived from previous inoculation, or even by that obtained from fresh sources. This modified action he attributed to the saturation of the system by the syphilitic virus; which point once reached, he claimed that no reaction occurred from the further introduction of the syphilitic virus, and hence an immunity from all harm from subsequent syphilitic exposures was attained. This point of saturation or tolerance, having in the same way been established in man, it was assumed, would afford a lasting security against the acquirement of syphilis. M. Auzias also claimed for this plan of treatment, which he termed *syphilization*, a promptly *curative* influence in all forms of syphilis, and communicated his views to the French Academy in 1851. They were at once combated by M. Ricord and his school. They received support from MM. Malgaigne, Gosselin, Diday, and others, but gained no permanent standing in France. In Italy numerous experiments were made by M. Sperino, but were finally discontinued on account of the public feeling against them. The most earnest advocate and exponent of syphilization was Prof. Boeck of Sweden, who claimed to have treated more than 1000 cases of syphilis by so-called syphilization between the years 1852 and 1865 in one of the public hospitals of Christiania, Sweden. The purulent secretion of both syphilitic lesions (infecting chancres) and the chancroid (the local non-infectious venereal sore) were used indifferently by him in making the inoculations. Prof. Boeck found it necessary, however, to irritate the syphilitic sore (the chancre) until it secreted a purulent fluid before a successful inoculation could be produced. Inoculations were made with the point of a lancet, first on the sides of the chest by three punctures, which in successful cases produced small pustules in about forty-eight hours. In the same manner inoculations were repeated from these pustules on the third day after their appearance. This process was continued on alternate sides of the chest (progressing from above downward) until the resulting sores (which, as a rule, became smaller on each succeeding inoculation) ceased to produce any purulent matter. Pus from a fresh source was then introduced, and the inoculations continued as before until the inoculating property was in like manner exhausted; and again a third and a fourth supply, until no reaction followed the introduction of pus from any source. A similar procedure was then instituted upon the arms, and finally upon the thighs; and when no inoculations could be made to succeed on any part of the body, the patient was said to be *syphilized*, and to enjoy a perfect immunity from the influence of syphilis. Under this process of *syphilization* it was claimed that persons afflicted with any form of syphilitic lesion rapidly improved to a final and complete recovery. The number of inoculations in each case varied from 100 to several hundred, and the time required to complete the syphilization was from three months to a year or more. It was claimed that the ulcers resulting from properly-performed inoculations rarely became of sufficient size to give much trouble. Prof. Boeck visited England in 1865, and by invitation of the surgeons of the Lock Hospital of London treated twenty-seven syphilitic patients in that institution by the process of syphilization. The results of this experiment were summed up in the report of a committee appointed for the purpose. In this report, while acknowledging the disappearance of syphilitic symptoms and lesions under repeated inoculations, the committee expressed the opinion that "syphilization is not a treatment which can be recommended for adoption; and that even if it could be admitted to possess all the advantages claimed for it by its advocates, these advantages would not compensate for its tediousness, its painfulness, and the lifelong marking it entails upon the patient." Prof. Boeck visited the U. S. in 1869, and treated seven patients by syphiliza-

tion in the Charity Hospital of New York City in the service of Prof. F. J. Bumstead. In the latest edition of his work on venereal diseases, issued in 1870, Prof. Bumstead, after a very friendly personal tribute to Prof. Boeck, and a fair summing up of the annoyances, difficulties, and dangers of the treatment of syphilis by syphilization, finally closes by saying: "I feel obliged to subscribe to the opinion of the London committee (Messrs. Lane and Gascoyen), that 'syphilization is not a treatment which can be recommended for adoption.'"

The claim of the advocates of syphilization, that the system of the patient is saturated or surcharged with the syphilitic virus by the repeated inoculations of pus from syphilitic or chancroidal sores, has been shown to be fallacious by demonstration of the fact that the purulence associated with a true syphilitic lesion is accidental, and quite independent of the syphilitic virus, and that the pus of the true chancroid never contains the syphilitic principle. Pus from the chancroid was chiefly and preferably used in the so-called syphilizing process, as it was always promptly auto-inoculable, while the secretion from the true chancre, the initial lesion of syphilis, furnished inoculable pus only after the application of some local irritant. That the pus so produced does not necessarily contain the virus of syphilis is shown by the known fact that inoculation of syphilitic blood, or non-purulent secretion of a syphilitic subject, often conveys syphilis to a healthy person independently of any suppurative action. Hence, the pus used in the inoculations for syphilization, not of necessity containing the syphilitic virus, could not surcharge the system with syphilis. Danielssen of Christiania inoculated a leper, who had never had syphilis, 400 times with the purulent fluid used by Boeck for syphilization, without other effect than the production of local sores; after which an inoculation of this patient with the secretion of an unirritated infecting chancre resulted in the prompt communication of constitutional syphilis. Lindmann (quoted by Van Buren and Keyes *On Syphilis*, p. 514) inoculated himself a number of times with chancroidal pus, always with success, but with no syphilis; finally, inoculating himself with the secretion of a well-determined lesion of syphilis, this was followed, after forty-five days, by an eruption of constitutional syphilis. Warnery of Lausanne (*ibid.*, p. 516) inoculated himself plentifully with pus from chancroids, which produced only local ulcers. Finally, employing the syphilitic virus once, an indurated chancre appeared after twenty-three days' incubation. This was followed in due course by constitutional syphilis. It was thus clearly shown that the system was not saturated with syphilis by the repeated inoculations of the syphilization process, nor in the least degree protected by it from the acquirement of syphilis; and yet a certain curative influence was acknowledged by all to result from the treatment of syphilis by this method. This was attributed by the opponents of syphilization solely to the counter-irritation and the depurative action caused by the suppurative process. With the view of proving the truth of this position, Drs. Lindmann, Hjort, Faye, and Danielssen treated a large number of cases of syphilis by inoculation with tartarized antimony, and with the result of obtaining not only a tolerance, or so-called saturation, after repeated inoculations, but nearly, if not quite, an equal measure of success in mitigating or curing syphilis by this plan, which was facetiously entitled *tartarization*. The theory that counter-irritation and depuration were the sole curative agents in the treatment of syphilis by syphilization, so called, first advanced by Prof. Faye of Christiania, Sweden, is now generally received, and since the death of Prof. Boeck in 1875 the treatment of syphilis by syphilization may be said to have fallen into merited disuse.

F. N. Otis.

**Syphon.** See Siphon.

**Sy'ra** [anc. *Syros*], island of Greece, in the Ægean Sea, with an area of 55 sq. m., with 35,000 inhabitants. It is high and mountainous, the highest peak rising about 4000 feet above the level of the sea, but it is rocky and rather bare. It produces wheat, wine, figs, fruits, etc., but not in sufficient quantity to supply the demands of the inhabitants. Before 1821 it was an insignificant place, and had hardly 1000 inhabitants, but as it kept neutral in the great struggle between Greece and Turkey, it became a place of refuge to many Greek fugitives from the other islands, and the enterprising spirit and commercial skill they brought with them made the island prosperous in a short time.

**Syra,** or **Hermopolis,** capital of the island of Syra, is well built and has a safe, spacious, and convenient harbor. Its trade is very important. It owns about one-third of the whole Greek merchant fleet, and nearly one-half of all the imports to Greece goes through this harbor. Besides its trade, its shipbuilding is important. P. 20,996.

**Syr'acuse** [It. *Siracusa*], city of Sicily, chief town of the province of the same name, on the E. coast of the island, in lat. 37° 0′ N., lon. 15° 20′ E. The modern town occupies the rocky islet Ortygia (1 mile in length, ½ mile in breadth), which serves as an irresistible breakwater to protect the large harbor on the W., and across the mouth of which it lies. This harbor was formerly one of the finest in the world, and is even now the best, perhaps, in Sicily. Ortygia, though at some periods united to the main island by a viaduct or causeway, is now connected with it only by bridges. The small harbor, Porto Marmoreo, lies N. of Ortygia. The present town is fortified by walls and a citadel of the Byzantine period, as well as by works of the time of Charles V. and of Charles III. of Naples, so that it is, in fact, one of the strongest places in the kingdom of Italy. There is, however, little commerce here (the whole number of vessels entering the two harbors annually not exceeding 1200), and the industry is, if possible, even less, so that the general aspect of the town, in spite of the extraordinary beauty of its situation, is depressing in the extreme. Its chief interest consists in the still existing monuments of its former greatness, to understand which a brief sketch of its earlier history and topography will be necessary. According to Thucydides, Ortygia was colonized by the Corinthians 758 B. C., though the Phœnicians had probably made an earlier settlement here. Possessing every advantage of position and climate, with an adjacent country of marvellous fertility, the young colony grew with great rapidity, threw itself over upon the main island, and soon began to plant new settlements in various parts of Trinacria. When, after long and cruel wars, the Romans obtained possession of the rest of Sicily, Syracuse, together with some important places in its neighborhood, was left to Hieron II. (275 B. C.), who had become an ally of Rome. Under this king the city rose to its highest point of magnificence, and is said to have contained an immense population within its walls, then, according to some authorities, 22 miles in circumference; according to others, 14 miles. The grandeur of the edifices and the artistic wealth and refinement of Syracuse were altogether worthy its colossal size. But in the course of the Second Punic war, Hieronymus, the successor of Hieron, broke off the alliance with Rome and joined the Carthaginians—a step which proved the ruin of his kingdom. After a long and desperate resistance, in which the celebrated Archimedes exerted all the powers of his wonderful mechanical genius in the defence of his country, Syracuse fell into the hands of the Romans under Marcellus (212 B. C.), by whom it was barbarously sacked and an immense booty carried off to Rome. Even the great Archimedes himself was put to death—accidentally it is said, in the general slaughter. Cicero tells us that he himself recognized the tomb of Archimedes by the cylinder and sphere engraved upon it. From this time Syracuse, as well as the rest of Sicily, was but a subjugated Roman province, unscrupulously oppressed and plundered by that power for its own aggrandizement. The town at the time of its capture consisted of *four* distinct quarters—or *five*, if Epipolæ be included, as it no doubt was by those ancient writers who describe it as a *pentapolis*. Epipolæ, however, seems to have served rather as a citadel and fortress to defend the town on the N. W., and was probably never thickly inhabited. The four quarters proper were—(1) Ortygia, or the islet; (2) Achradina, occupying the eastern coast of the main island, N. of Ortygia; (3) Tycha, W. of Achradina; (4) Neapolis, S. of Tycha. The most important remains of ancient Syracuse are found on the main island, though some objects of interest are still to be seen in the modern town. The Duomo occupies the site of an ancient temple, according to tradition the temple of Minerva mentioned by Cicero with such admiration, but some recent investigators hold it to have been dedicated to Diana, from its vicinity to the celebrated Fountain of Arethusa, which is very near this church. A large number of fine columns from the old temple have been made use of in the architecture of this church, but no trace is left of the doors of gold and ivory and other splendid adornments which made the pagan edifice the admiration of the world. Among the ruins of what is usually called the temple of Diana (Vico di San Paolo) the remains of a very remarkable Greek temple have lately been uncovered. The museum, near the Duomo, contains ancient inscriptions, papyri, vases, statues more or less mutilated, etc., but its great treasure is the marble Venus (found 1804), considered by many as second only to the celebrated Venus of Milo. Unfortunately, this exquisite figure lacks the head. Only a few among the many objects, more or less ruinous, of antiquarian interest to be seen on the main island can be enumerated here, and the reader is referred for further details to the authorities at the end of this article—the gigantic walls of Dionysius (405–368 B. C.), which unite at Fort Euryalus; the vast Latoniæ, or quarries, which served both for prisons and as places for sepul-

ture, and in which 7000 Athenian prisoners are said to have died of starvation (414–412 B. C.); the famous Ear of Dionysius; the Ara of Hieron (650 feet long, 75 feet broad), on which 450 oxen were sacrificed yearly; the amphitheatre, the theatre, the nymphæum, the aqueducts, the Street of Tombs, the splendid temples of Bacchus and of Proserpine, built by Gelon (480 B. C.) from the spoils of Carthage, etc. etc. Of the ancient church of Santa Lucia, patroness of Syracuse, the W. portal only remains. The same is true of S. Giovanni, in the crypt of which St. Paul is believed to have preached. The catacombs below and near this church are very much like some recently-discovered Phœnician tombs. The Fountain of Cyane (Pisma) is reached by crossing the great harbor and ascending the Anapus, which is half choked with water-plants and overshadowed by the papyrus, the tufted, plumy crowns of which are sometimes lifted by the slender triangular stalks 15 feet or more above the water. These reeds are the support of luxuriant creeping plants, which shelter countless aquatic birds. The great temple of the Olympian Jove (sixth century B. C.) stood on a hill above the right bank of the Anapus, near the ancient bridge, but only two shafts of columns are now standing. It was from a statue in this temple that Dionysius the Elder took off the golden mantle placed upon it by Gelon, declaring that it was "too cold for winter and too heavy for summer." The site of the monuments of Gelon and Demarete is also near this temple. The sea-coast caves on the E. side of Achradina are scarcely inferior in beauty of color to the celebrated Blue Grotto at Capri. (See Serradifalco, *Antichità di Sicilia;* Gregorovius, *Wanderjahre in Italien, Siciliana* (1872); Smith, *Dictionary of Greek and Roman Geography*, article "Syracusæ," and authorities there cited.) CAROLINE C. MARSH.

**Syracuse,** p.-v., Turkey Creek tp., Kosciusko co., Ind., on Turkey Lake, has 1 weekly newspaper. P. 227.

**Syracuse,** p.-v., Morgan co., Mo.

**Syracuse,** p.-v. and tp., Otoe co., Neb., on Midland Pacific R. R. P. 640.

**Syracuse,** city, cap. of Onondaga co., N. Y., on the line of Erie Canal and New York Central and Hudson River R. R., 150 miles W. of Albany. It was settled about 1796, passing under different names until 1824, when it was called Syracuse. It was incorporated as a village in 1825, and as a city in 1847. It is noted especially for its extensive saltworks, which in years past have been a source of great wealth to those engaged in the manufacture of this staple article. The quantity manufactured has reached, in the most productive years, the annual amount of 9,000,000 bushels, but the ordinary average yield is from 7,000,000 to 8,000,000 bushels. The manufacturing establishments of Syracuse are numerous, and furnish employment to a large number of workmen. Among these establishments are 2 rolling-mills, numerous furnaces, glassworks, steelworks, agricultural machine works, and many others. The wholesale trade of the city is very large, aggregating many millions of dollars annually. There are large wholesale houses in dry goods, groceries, clothing, drugs and medicines, leather, boots and shoes, malt liquors, tobacco and cigars, etc. Syracuse has 10 banks, 2 savings banks, and several private bankers. The deposits in the savings banks amount to over $7,000,000. Each of these institutions has recently erected a large and elegant banking edifice in the central part of the city. The public and charitable institutions include the New York State asylum for idiots, the Home association for elderly females, the Onondaga county orphan asylum, the asylum of St. Vincent de Paul, the House of the Good Shepherd, and St. Joseph's Hospital. The Onondaga county penitentiary is a large establishment, and furnishes accommodations for criminals of surrounding counties. A large State armory, erected for military purposes, is also located here. Syracuse is a central point for numerous railroads. In addition to New York Central, there are Delaware Lackawana and Western R. R., Syracuse Northern, Syracuse and Chenango R. R., and Syracuse and South-western R. R. There are also 5 street railways running to the suburbs of the city. There are 3 daily newspapers, 9 weekly papers, and several monthlies. The educational advantages of Syracuse are of a superior character. The public-school system is complete in all its appointments, and in the most prosperous condition. The plan for popular education embraces a high school and about 20 graded schools, all under the charge of a board of education elected by the people. The Syracuse University is located here, and comprises a college of liberal arts, a college of medicine, and a college of fine arts, all well supplied with competent professors. There are 3 public libraries—the Central Library, located in the high school building, and containing 14,000 volumes; the library of the court of appeals, in the court-house, containing 8000 to 9000 volumes, generally of a legal character; and a small library in the rooms of the Young Men's Christian Association, designed especially for the use of that organization. The church organizations of the city are numerous, representing 12 or 14 different denominations, and numbering not less than 44 congregations. Many of them have large and commodious houses of worship. There is a large number of societies of a miscellaneous character, embracing social, military, temperance, benevolent, literary, musical, and secret organizations. The fire department is an efficient organization, having 5 steamers and a fire-alarm telegraph. There are 7 cemeteries, of which Oakwood and St. Agnes are large and laid out with great taste and beauty. The growth of the city has been rapid, the population increasing from 28,000 in 1860 to 43,051 in 1870, and 54,000 in 1876, and some of its citizens now living have seen the settlement of Bogardus Corners, with two log houses in 1796, change into the busy, thriving, and populous city of Syracuse in 1876.

J. G. K. TRUAIR, ED. "SYRACUSE JOURNAL."

**Syracuse,** p.-v. and tp., Meigs co., O., on Ohio River. P. 1273.

**Syren.** See *Sirene,* in ACOUSTICS.

**Syria** [Turk. *Suristan;* Arabic, *Esh-Sham*], at present forming, together with Palestine, a division of Asiatic Turkey, extends between lat. 31° and 37° 20′ N. along the Mediterranean from the Gulf of Iskanderoon to the Isthmus of Suez, and is bounded N. by Asia Minor, from which it is separated by the Taurus Mountains; E. by Mesopotamia, from which it is separated by the Euphrates and the Syrian desert; S. by Arabia. Its area is estimated at 60,000 sq. m., but its eastern and southern frontier, along the Syrian and Arabian deserts, is indefinite. Of its population no official statistics exist, but it is estimated at from one to two millions. The configuration of the country is quite remarkable. Connected to the N. with the Taurus Mountains, but losing themselves to the S. in the plateaus of the Arabian desert, two systems of mountain-ranges run parallel through the middle of the country, enclosing a valley of varying breadth and depth. The western system consists of the Lebanon, which rises in Jebel Timarum to a height of 10,533 feet, and ends abruptly on the banks of the Litany; the Samaria hills and the highlands of Judæa, which connect with the Sinaitic group. Toward the Mediterranean these mountains fall rapidly and in terraces, often sending spurs far into the sea, but generally leaving at their feet a belt of low, level, or undulating coast-land, from 10 to 15 miles broad. The ranges of the eastern system are generally lower, though the Anti-Lebanon in Mount Hermon reaches a height of about 10,000 feet, less sharply defined and more broken up in separate groups, the mountains of Moab, of Seir, etc. To the E. they roll off gradually into the plateaus of the Syrian desert. The depression between these two systems of mountain-ranges comprises the beautiful and fertile valley of Cœle-Syria (*El-Bukaa*), between Lebanon and Anti-Lebanon, from 10 to 20 miles broad, and elevated 2300 feet above the level of the sea. To the S., at the point where the Litany breaks through the western wall to the Mediterranean, the valley of Cœle-Syria connects by a narrow, rapidly-descending gorge, 15 miles long, with the valley of the Jordan (*El-Ghur*), which at the Lake of Merom (*El-Huleh*) is on a level with the Mediterranean, but at the Lake of Tiberias 650 feet, and at the Dead Sea about 1300 feet, below it. Here, as well as in several other places, the country bears a strongly-marked volcanic aspect, and earthquakes are frequent, and sometimes very destructive; Safed was fearfully devastated in 1837, Antioch in 1872, etc. The principal rivers are the Jordan, the Aasy, and the Litany. The Jordan rises in Mount Hermon as a wild mountain-torrent; forms the Lake of Merom, which is a swamp rather than a lake, covered with water-plants and overgrown with rushes, but teeming with fish; traverses the Lake of Tiberias, also called the Lake of Gennesaret or the Galilean Sea, a beautiful sheet of water encircled by high cliffs of chalk and basalt; and enters, finally, the Dead Sea, whose sluggish waters, which have no outlet, are so heavily laden with salt that salt thrown into them will not dissolve, and so strongly impregnated with sulphur and bitumen that no fish can live in them. Large lumps of bitumen and salt float on its waves, and innumerable pits of bitumen, extensive layers of stinking sulphur, and numerous hot mineral springs, whose waters ulcerate the skin, line its plantless, desert-like shores. The Aasy (that is, "the indomitable," the ancient *Orontes*) rises in the Anti-Lebanon and turns directly N., whence it is called by the Arabs *Nahr al Maklub,* "the perverse river," as all the other rivers of that region, the Jordan, Litany, Euphrates, etc., flow S. Afterward it turns to the W., and through a deep gorge between the Lebanon proper and the hills which connect it with the Taurus Mountains it reaches the Cilician Gulf

as a broad but calm and shallow stream. In the time of the Crusades it could be navigated by large vessels as far as Antioch; now its waters can hardly bear a boat. Besides the Litany (or Leontes), which rises on Mount Hermon and enters the Mediterranean a little above Tyre, there are about forty streams descending from the Lebanon to the sea, but most of them run dry in summer, and none are navigable.

Wherever the supply of water is sufficient, the soil, generally of a sandy and light character, proves to be very productive; all the choicest plants of the tropical and temperate zones grow luxuriantly. Nevertheless, in extensive districts and at certain seasons the country has a barren and desolate aspect. The climate, although different according to location, is dry and hot. Summer rains are rare, and in the coast-region and El-Ghur the summer heat is very oppressive; at Aleppo the thermometer often rises above 100°. The true cause, however, of the desolation of the country is not its difficult climate, but the circumstance that through centuries of bad fortune it has become almost depopulated and its few inhabitants degenerate. The implements and methods of cultivation are rude; the terracing of the slopes and the works of irrigation have been destroyed or have fallen into decay; the magnificent forests have well-nigh disappeared. In many places, however, the mountain-slopes are still covered with fine cedar, pine, and fir; terebinth and laurel groves occur in the valleys, and dwarf oaks, remarkable for the excellent gall-nuts they yield, grow on the table-lands. Wheat, barley, and beans are the common cereals, but also rice, dhurra, peas, and lentils are raised. Cotton and hemp, madder and indigo, tobacco and capsicum, melons and cucumbers, artichokes and potatoes, are extensively cultivated; and with comparatively little attention plantations of fig, olive, and mulberry trees succeed well, also orchards of peach, pomegranate, orange, lemon, apricot, and almond trees, and vineyards producing a delicious grape. Mules, asses, camels, horses of an excellent breed, horned cattle of an inferior race, broad-tailed, fine-woolled sheep, goats with pendent ears and silky hair, are the common domestic animals. Jackals, hyænas, and antelopes are found in the desert regions, the Syrian bear, wild-boars, and deer in the forests, wolves and wild buffaloes on the table-land. Silk-worms are extensively reared. Of minerals, some coal is found in the southern regions, abundant salt, sulphur, and bitumen in El-Ghur, iron in the Lebanon, but mining is not carried on with any degree of energy. Manufacturing industry is mostly confined to coarse articles for home use, though some fine silks, stuffs of gold and silver thread, carpets, and arms, are produced. The population is a very much mixed race. Shemitic blood, however, is the prevailing element; the Osmanlee Turks, of the Turanian race, are the rulers. Arab is the language commonly spoken and written. The old Syriac or Aramaic has nearly died out. In the cities on the coast Greek is everywhere understood. The religion of the country comprises a great number of Mohammedan, Christian, and Jewish sects, some of a very peculiar character, such as the MARONITES, DRUSES, NUSAIRIEH, ASSASSINS (which see), but all of a very passionate temper. Outbursts of religious fanaticism are quite common. In 1860 the Mohammedans fell upon the Christians at Damascus, and at the same time the Druses fought with the Maronites. The bloodshed was finally stopped by the interference of England and France.

The oldest inhabitants of Syria were all of Shemitic descent, though belonging to various branches of the family and living in separate social organizations. When the Jews immigrated into Canaan, they found the promised land densely peopled, and covered with cities ruled by kings. But the Canaanites, like the Jews themselves, were Shemites, and so were the Phœnicians, who inhabited the coast-regions, where they had built Sidon and Tyre, whence they founded Carthage and established commercial stations all around the Mediterranean. So were also the Aramæans, who occupied Damascus and extended eastward toward the Euphrates. This territory, Syria proper, became subject to the Hebrew monarchy in the time of David; but after Solomon's death, Rezin made himself independent in Damascus, and while the Jewish empire was divided into two kingdoms, the Aramæan kings of Damascus conquered and incorporated the whole northern and central part of the country. In 740 B. C. the Assyrian king, Tiglath-Pileser, conquered Damascus, and in 720 the kingdom of Israel. In 587 the kingdom of Judah was conquered by Nebuchadnezzar, king of Babylon, and Syria, with Palestine, was now successively handed over from the Assyrians to the Babylonians, from the Babylonians to the Medes, and from the Medes to the Persians, and many non-Shemitic elements were introduced into the population. After the battle of the Issos (333 B. C.) Alexander the Great conquered the country, and with him came the Greeks. After his death, they formed here a flourishing empire under the Seleucidæ, who reigned from 312 to 64 B. C. Seleucus I. (312–281) founded Antioch and made it his capital; it grew rapidly, and was for several centuries the largest and most brilliant city of the Orient. Beautifully situated at the foot of the Libanon, it received the surname of *Epidaphnes* from the neighboring grove of Daphne with its magnificent temple of Apollo. By the Orontes it had easy access to the Mediterranean, and by the Cilician passes it was connected with the principal caravan-routes to the East. An extensive and flourishing commerce sprang up, and on the basis of this traffic and the wealth it accumulated there arose here, as in Alexandria, a most peculiar form of civilization, a blending of Greek and Asiatic elements, which has left long and large traces of itself in the history of the human race. After the victories over Antigonus at Ipsus in 301, and over Lysimachus at Cyropedion in 282, the empire of Seleucus actually comprised the whole empire of Alexander with the exception of Egypt. But his son, Antiochus I. Soter (281–260), lost Pergamum, and failed in his attempts against the Gauls who invaded Asia Minor; and Antiochus II. Theos (260–247) lost Parthia and Bactria. Antiochus the Great (223–187) conquered Palestine, which by the division of Alexander's empire had fallen to the Ptolemies of Egypt; but under Antiochus Epiphanes (174–164) the Jews revolted, and after a contest of twenty-five years they made themselves independent. Under Antiochus XIII. (69–64) Pompey conquered the country and made it a Roman province, governed by a proconsul. After the conquest of Jerusalem (70 A. D.), Palestine was added to this province, and the whole placed under a *præfectus prætorio*. By the division of the Roman empire Syria fell to the eastern or Byzantine part, and the various phases of a decaying civilization which were developed in Constantinople repeated themselves at Antioch. In 632 the country was conquered by the Saracens, and from this time Syria and Palestine, the birthplace of Christianity, became and continued to be a Mohammedan country. In 654, Damascus was made the capital of Syria, in 661 of the whole Mohammedan empire; Antioch fell into decay. Damascus was an old and celebrated city. It stood in the centre of a large and exceedingly fertile plain, was strongly fortified, and many branches of industry were here carried to perfection. But it was principally a manufacturing place, not well fitted to be the capital of a great empire. The Abbassides removed their residence to Bagdad, and Syria sank into a mere province. In the eleventh century the Seljook Turks conquered the country, and an entirely new element of race was introduced, as different from the original Shemitic as from the subsequent Aryan. The establishment of the Latin kingdom by the Crusaders in 1099 was of short duration and of little advantage. They held Jerusalem till 1187, Acre till 1291, but they proved more rapacious and more cruel than the Turks; and it was nothing more than justice when the greatest and best among the crusaders bowed to Sultan Saladin as their superior—yea, as their model. When in 1291 the Mameluke rulers of Egypt finally drove the Christian knights out of the country, its cities were in ruins, its fields devastated, and its population degraded. Still worse things were in waiting—the invasions of Tamerlane and his successors, which actually transformed large regions into deserts and the inhabitants into savages. In 1517, Sultan Selim I. conquered the country, and since that time it has formed part of the Turkish empire, with the exception of the short period from 1832 to 1841, when Ibrahim Pasha governed it under the authority of his father, Mehemet Ali. But the Turkish government, though it has given the country peace, has by no means been able to develop its natural resources and revive its old prosperity.

CLEMENS PETERSEN.

**Syr'iac** [see SYRIA and ARAMÆA], a dialect of Aramæan or Low Shemitic, known to us only through a Christian literature so often called *Christian Aramæan*, also incorrectly called *West Aramæan*, as distinguished from Chaldee, East Aramæan. It first comes to our notice in the second century A. D., though there can be no doubt of its existence long before as a vernacular. It was spoken in various dialects throughout Syria, but the form in which it is preserved to us in literature is probably the cultivated dialect of Edessa. From the third to the eighth century it was the common language of Western Asia, but after the Mohammedan conquest (636) it began rapidly to decay, and has been replaced by the Arabic. During the tenth and eleventh centuries Syriac was given up in the cities, and by the end of the thirteenth it had disappeared from the villages and country; since then it has been practically a dead language, used only as the "ecclesiastical language" in the Syrian churches, and spoken in a very corrupt idiom in some few mountain-districts of the Lebanon and on Lake Urumeyah. As containing the most extensive literature of any Aramæan dialect, a knowledge of it

is necessary in the study of the Shemitic languages: it is, besides, of great importance for exegetical and historical theology, not only in its Bible versions (see below), but also in its extensive theological literature, which has preserved to us many of the most valuable works of the Greek and Latin Fathers. The alphabet consists of 22 letters, all consonants, and read from right to left, as follows:

| SYRIAC.* | | NAMES. | POWER. | HEBREW. |
|---|---|---|---|---|
| ܐ | ܐ | Olaph. | Light breathing. | א |
| ܒ | ܒ | Beth. | B, b. | ב |
| ܓ | ܓ | Gomal. | G, g. | ג |
| ܕ | ܕ | Dolath. | D, d. | ד |
| ܗ | ܗ | He. | H, h. | ה |
| ܘ | ܘ | Wau. | W, w. | ו |
| ܙ | ܙ | Zain. | Z, z. | ז |
| ܚ | ܚ | Cheth. | Ch, ch. | ח |
| ܛ | ܛ | Teth. | T, t. | ט |
| ܝ | ܝ | Yud. | Y, y. | י |
| ܟ | ܟ | Koph. | K, k. | כ |
| ܠ | ܠ | Lomad. | L, l. | ל |
| ܡ | ܡ | Mim. | M, m. | מ |
| ܢ | ܢ | Nun. | N, n. | נ |
| ܣ | ܣ | Semkath. | S, s. | ס |
| ܥ | ܥ | ʿe. | ʿ, ʿ. | ע |
| ܦ | ܦ | Pe. | P, p. | פ |
| ܨ | ܨ | Tsode. | Ts, ts. | צ |
| ܩ | ܩ | Qoph. | Q, q. | ק |
| ܪ | ܪ | Rish. | R, r. | ר |
| ܫ | ܫ | Shin. | Sh, sh. | ש |
| ܬ | ܬ | Tau. | T or th. | ת |

The above character, called *P'shîtô* ("the simple," *i. e.* character), now generally in use, is a later caligraphic modification of an older character called *'Est'rangélo*, in common use before A. D. 800, and still used by Nestorians and in title-pages of books. (Comp. Cufic and ordinary Arabic characters.) There are five vowels, denoted by diacritical points or Greek vowels, A E H O Y, inverted, as follows:

ܰ or ÷ = ă

ܶ or ¨ = ĕ

ܺ or ˙ = ĭ

ܴ or ˙ = ā or ō

ܘ or ˙ = ū

In grammar it shares the common Aramæan peculiarities. In lexicon it is less copious than the other Shemitic dialects. It contains a great number of Persian, Greek, Latin, Arabic, Tartar, and even some French and English words, traces of the various races who in turn have ruled the country. The vocabulary is peculiarly rich in abstract and philosophical terms.

*The first column represents the initial letters; the second, the manner of joining the initial, medial, and final letters, as in Beth, Gomal, etc., or the junction of a letter with a preceding one only, as in Olaph, Dolath, etc.

TEXTBOOKS.—Thoroughly scientific textbooks are as yet wanting; for full list see Hoffman, *Gram. Syr.*, §§ 4 and 5.

(*a*) *Lexicons.*—Abul' Hassan, *Isa bar Bahlul* (963), the best native lexicon and basis of all modern lexicography, in MS. in Bodleian; Schaaf (C.), *Lexicon Syriacum Concordantiale* (Leyden, 1708), best for the New Testament and valuable as concordance; Castell (Edmund), in his *Lexicon Heptaglotton, Hebraicum, Syriacum*, etc. (London, 1669); the Syriac part, revised by John Dav. Michaelis, was reissued as *Edm. Castelli Lexicon Syriacum* (Göttingen, 1788). This remains still the only available lexicon, though entirely inadequate to the demands of the present. Bernstein (G. H.) collected a great mass of material for a lexicon, but only issued one part, *Lexicon Linguæ Syriacæ*, fasc. i. (Berlin, 1857). Smith (R. Payne), *Thesaurus Syriacus*, now publishing in Oxford, contains valuable material collected from papers of Bernstein, Quatremère, Lorsbach, etc., but the arrangement leaves much to be desired.

(*b*) *Grammars.*—Chris. Ben. Michaelis, *Syriasmus* (Halle, 1741), first Syriac grammar written on scientific principles, and still of great use. Hoffman (A.G.), *Gram. Syriaca* (Halle, 1827), the most exhaustive, but not always reliable; revised and enlarged (but not improved) by A. Merx, *Gram. Syr. quam post opus Hoffman refecit A. Merx*, 2 parts, all that have appeared (Halle, 1867–70); an abridged translation is Cowper's (B. H.) *Syriac Grammar*. Uhlemann (Fr.), *Grammatik der syrischen Sprache, etc.* (2d ed., Berlin, 1858), most serviceable, but by no means scientific; translated by Hutchinson (E.), (2d ed., New York, 1875); *New Syriac*, Stoddart; Nöldeke, *Grammatik der neusyrischen Sprache* (Leipsic, 1863).

(*c*) *Chrestomathies.*—Kirsch (G. W.), *Chrestom. Syr.*, revised by Bernstein (Leipsic, 1832), the lexicon extremely valuable; Rödiger, *Chrestomathia Syriaca* (2d ed. 1868).

LITERATURE.—Syriac literature reflects the situation of the country, which was continually subject to foreign dominion and devastated by hostile inroads; it has no freedom of range or originality in character. It is very largely made up of translations, and is almost exclusively religious.

FIRST PERIOD.—Up to the Mohammedan conquest, A. D. 636. Syriac a spoken language, and the Syrian universities of Edessa and Nisibis centres of learning for the entire Orient.

*Bible Versions.*—A. The Peshito (*i. e.* "The Simple") edition, the oldest Syriac literature that has come down to us. It exerted an immense influence in moulding the language, as well as all the subsequent literature, and has remained the accepted version among all parties of the Syrian Church. (*a*) *Version of New Testament.*—Earliest and most important translation of New Testament, invaluable for its critical study; made at Edessa in the second century. Editions: Widmannstadt and Moses of Marden (2 vols., 1555); *editio princeps*, best, but very rare. Serviceable is Henderson's edition of Gutbier's text, published by Baxter. *Literature.*—See various introductions to New Testament. Cureton has published in his *Remains of a very Ancient Recension of the Four Gospels in Syriac*, etc. (London, 1858), a text of the Peshito older than that of the MSS. on which our printed editions are based. (*b*) *Version of Old Testament.*—Valuable translation, made directly from Hebrew. It is the work of Christian editors, and probably contemporaneous with the version of the New Testament. Editions: *Vet. Test. Syriace*, S. Lee (London, 1823); also many editions of the Psalter. *Literature.*—Perles, *Meletemata Peschitthoniana* (Breslau, 1859), and various introductions to Old Testament.

B. *Philoxenian Version*, a critical version of the New Testament prepared under direction of Xenagas or Philoxenus, bishop of Mabug (488–518), mainly preserved to us through the revision of Thomas of Harkel (hence called "Harklensian Revision"), made in Alexandria A. D. 616. Its design was to render literally the Greek original, which is slavishly followed. Editions: White (Oxford, 1778–1803, 4to). *Literature.*—Bernstein, *De Harklensi N. T. trans. Syriaca* (Breslau, 1854).

C. *Hexaplar Version of O. T.* (formerly called Figurata), made 617 A. D. by Paul, bishop of Tella, from Origen's text of LXX., extremely valuable for textual criticism of LXX. MS. is in Milan. Editions: Various portions of it have been edited by Norberg, Bugati, Ceriani. Recently a photo-lithograph of MSS. has been published.

D. *Syro-Palestine*, a lectionary of inferior importance, in a corrupt dialect of Palestine, and probably belonging to the sixth or the seventh century; discovered by Adler. Editions: *Evangeliarium Hieros. Meniscalchi* (Verona, 1861–64); Ephrem Syrus (306–373), a celebrated Syrian Church Father and a very copious writer in all branches of literature: *S. Ephraem. Syri Opera omnia* (Rom., 1732–46, 6 vols. folio), edited by Petrus Benedictus and S. E. Assemani. Narses (d. 496); James of Sarug (522), *De Vita et Scriptis S. Jacobi Sarugi*, etc.; I. B. Abeloos (Louvain,

1867); Isaac the Syrian; Xenagas or Philoxenus of Mabug (d. 520).

Second Period (636–1318 A. D.).—Period of decay of Syriac; Arabic and Syriac spoken languages. Writers at the close of this period make use of both. James of Edessa (d. 708), learned scholar, celebrated grammarian, and linguist; Barsalibäus (d. 1166); Barhebræus; Gregory Abul' Faradsch (1226–86); best known are his civil and ecclesiastical histories, the great source of our knowledge of Western Asia during many centuries. (*a*) *Chronicon Syriacum*, ed. Bruns and Kirsch (Leipsic, 1789, 2 vols.). (*b*) *Chronicon Ecclesiasticum*, ed. Abeloos and Lamy (Louvain, 1873). Besides this he wrote a number of grammars, treatises, commentaries, etc. Ebed Jesus (d. 1318).

Third Period (1318).—Arabic the spoken language; Syriac cultivated only as a learned and ecclesiastical language, chiefly in the Maronite college in Rome. Amira (1644), grammarian; the Assemanis.

(*a*) Joseph Simon: *Bibliotheca Orientalis* (Rom., 1719–28, 3 pts., 4 vols. fol.), a complete history of Syrian literature, and the source from which our knowledge of it is largely derived. (*b*) Stephan Evodius: *Acta Sanctorum Martyrorum* (Rom., 1748, fol.).

Syriac MSS.—The chief collections of Syriac MSS. are in the British Museum, the Vatican, the Bibliothèque Nationale in Paris, and the Bodleian in Oxford. The oldest MSS. are of the fifth century. Wright, *Catalogue of Syriac MSS. in British Museum* (1870–72); Zotenberg, *Catalogues des MSS. syriaques, etc. de la Bib. Nat. Paris* (1874).

Printed Books.—See list in *Conspectus Rei Syrorum Lit.*, ed. G. Bickell (Munster, 1871). 16th century: Widmannstadt (see above). 17th century: Editions of N. T. by Frost (Cöthen, 1619); Gutbier (Hamburg, 1664); O. T. in Paris Polyglot (1629–45), London Polyglot (1657); in both an unreliable text. 18th century: Edition of N. T. by Leusden and Schaaf (1708 and 1719); works of the Assemanis; chronicles of Barhebræus (see above); issues of Hexaplar Text by Norberg and Bugati. 19th century: Wm. Cureton (d. 1864), *Gospels* (see above); *Festal Letters of Athanasius* (London, 1848); *Corpus Ignatianum—Complete Collection of Ignatian Epistles* (London, 1845–49); *History of Martyrs in Palestine, by Eusebius* (London, 1861), etc.; Samuel Lee, *V. T. Syriace* (see above); *Theophany of Eusebius* (1842); Lagarde (Paul Anton de), *Libri Veteris Test. Apocryphi Syriace* (Leipsic, 1861); *Analecta Syriaca* (Leipsic, 1858); *Geoponica Syriaca* (Leipsic, 1858); *Clementis Recognitiones Syriace* (Leipsic, 1861); *Didascalia Apostolorum Syriace* (Leipsic, 1854); Wright (Wm.), *Homilies of Aphraates* (London, 1869); Land (I. P. N.), *Anecdota Syriaca* (Leyden, 1862); Martin, *Œuvres grammaticales d'Aboul' Farady di Bar Hebræus* (Paris, 1872), and valuable grammatical articles in *Journal asiatique*; Nöldeke, Syriac Text and grammatical articles in *Zeitschrift der deutsch. Morgenländ. Gesellschaft.*

T. C. Murray.

**Syrian Rite.** See United Syrians.

**Syrin'ga** [Gr. *σῦριγξ*, a "tube"], a genus of Old-World shrubs of the order Oleaceæ, to which the lilacs belong. (See Lilac.) Popularly, the beautiful shrub *Philadelphus coronarius*, of the order Saxifragaceæ, is called syringa, or seringo. It is a native of Japan, often seen in our gardens, and its cream-colored, fragrant flowers somewhat resemble orange-blossoms.

**Syr'inge** [Gr. *σῦριγξ*, a "tube"], an instrument identical in principle with the ordinary suction-pump. A vacuum is formed, either by means of a piston or a compressible chamber of india-rubber, fitted with suitable valves. Water or some other fluid now rushes in and fills the vacuum, and a second application of pressure causes a jet of the contained liquid to be thrown out. The syringe is of many forms, chiefly employed in surgery, in horticulture, etc.

**Syro-Chaldæan Rite.** See Chaldæan Christians.

**Syros.** See Syra.

**Syr'tis Major** and **Syrtis Minor,** the ancient names of the two large inlets, or rather of the two opposite angles (E. and W.) of the great almost rectangular re-entrant in the southern coast of the Mediterranean, of which the margins are the coasts of Tunis and Tripoli, which now are called respectively the Gulf of Sidra and the Gulf of Cabes. They are shallow and dangerous to navigate on account of quicksands and the uncertainty of the tides.

**Syrus** (Publius). See Publius Syrus.

**Syzran',** town of Russia, government of Simbirsk, on the Syzran, near its influx into the Volga, and in the centre of a very fertile district, from which it exports large quantities of corn. P. 20,000.

**Szabad** (Emeric), b. in Hungary; became secretary of the national Hungarian government in 1849; after the overthrow of the revolutionary movement, went to England, where he contributed to the *Encyclopædia Britannica*; entered the Italian military service, which he left in 1861; emigrated to the U. S.; became a captain in the Union army, serving in West Virginia. He has written for journals, and has published *Hungary, Past and Present* (1854), and *Modern War, its Theory and Practice* (1863).

**Szabadka** [Ger. *Maria-Theresiopel*], town of Southern Hungary, county of Bacs, on Lake Palicz, has manufactures of linens and leather, important cultivation of tobacco and breeding of cattle, and a brisk trade in horses, cattle, sheep, wool, and hides. It consists of the town proper and 16 suburbs, and is rather indifferently built, though it contains several handsome buildings, such as the church of St. Theresa, the beautiful Greek church, the town-house, the new barracks, etc. P. 56,323.

**Sza'lay** (sŏh'loi), (Laszlo), b. at Buda Apr. 18, 1813; studied at the University of Pesth, and was admitted to the bar in 1833; devoted himself to history, jurisprudence, and politics; became editor of various leading reform papers, and published a collection of political essays in 1847, and of political biographies 1847–52; was the most prominent member of the commission for the revision of the Hungarian penal code, a work which earned great admiration outside Hungary; was sent as ambassador in 1848 to the provisional government of Germany in Frankfort; resided subsequently in London and Switzerland, occupied with historical studies; returned to Hungary in 1861. D. at Salzburg July 17, 1864. His principal works are a *History of Hungary* (6 vols., 1850–63), *Eszterházy Miklós* (2 vols., 1862–66), etc.

**Szar'vas** (sŏr'vosh), town of Hungary, on the Körös, was formerly fortified, but its fortifications have now fallen into decay, and it derives its importance mostly from its trade in corn and cattle. It suffered severely during the sieges of 1595 and 1685. The surrounding country is swampy and marshy, but famous for its extensive bee-cultivation. P. 18,917.

**Szathmar-Nemethi** (sŏt'mar na-met'), town of Hungary, on the Szamos, has extensive manufactures of slibowiz, a kind of brandy distilled from plums. P. 18,353.

**Széchenyi** (sā'ken-ye), (István), Count, b. at Vienna Sept. 21, 1791, of an old and celebrated Hungarian family; served in the Austrian wars with Napoleon, but retired from the army in 1825, and devoted himself wholly to the material and spiritual development of his native country. He took a prominent part in the foundation of the Hungarian Academy of Science, of the first Hungarian theatre, of the conservatory of music in Pesth, etc., and in the erection of the great bridge across the Danube at Buda-Pesth, in the regulation of the course of the Danube through the Iron Gates, in the establishment of steam navigation on the Danube and the Theiss, etc. But it was his idea that the progress of Hungary could not be effected unless by the aristocracy and in close alliance with Austria, and he consequently opposed Kossuth very strongly. Nevertheless, in 1848 he consented to be a member of the Bathyanyi-Kossuth ministry, but on the outbreak of the war with Austria he became insane, and was brought to the asylum of Döbling, near Vienna. Here he nearly recovered, but in Mar., 1860, the Austrian police, suspecting him of being the author of a political pamphlet which criticised the government very severely, undertook a search of his rooms and papers, and this excited him so violently that he relapsed, and shot himself Apr. 8, 1860. He was author of several spirited pamphlets.

**Szegedin',** town of Hungary, at the influx of the Maros in the Theiss, is fortified and has several fine buildings, though in general it is ill built and most of its streets are unpaved. It manufactures soda, tobacco, cloth, and a celebrated kind of soap, and it carries on an active trade in corn, wine, salt, and timber. Its two annual fairs are, next to those of Pesth and Debreczin, the best frequented in Hungary, and exchanges of vast amount are here effected, especially in salt from Transylvania, grain from the Banate, wood and wooden ware. Even at the time of Matthias Corvinus it was one of the most important towns of the country. On Aug. 3, 1849, the Hungarians were defeated here by the Austrians. On its wharves are built the best river-boats in Hungary. P. 70,179.

**Szeghalom',** town of Hungary, on the Berettyo Canal, carries on some trade in corn, wine, cattle, and horses. P. 6112.

**Szégszard,** town of Hungary, near the Danube, celebrated for its wines. P. 10,500.

**Szeklers,** or **Szechs.** See Transylvania.

**Szigeth',** town of Hungary, at the influx of the Iza in the Theiss, has large saltworks. P. 6408.

**Szolnok',** town of Hungary, on the Theiss, has a large trade in corn, salt, and timber. P. 15,847.

# T.

**T,** a consonant, classed as a lingual mute. It is subject to numerous interchanges with other consonants. T. as an abbreviation stands for Titus, ton, treble.

**Taa'singe,** an island of Denmark, in the Baltic, immediately S. of Funen. Area, 27 sq. m. P. 4500.

**Tabanidæ.** See Horse-Fly.

**Tabas'co,** state of the Mexican confederation, bordering N. on the Gulf of Mexico, and bounded E. by Yucatan, comprises an area of 15,600 sq. m. The surface is a flat plain sloping toward the sea, and in many places so low that it is regularly inundated. The climate is very hot, and in the marshy and swampy districts very unhealthy. But the soil is exceedingly fertile. The surface is to a great extent covered with primeval forests, and in openings in the forests indigo and cacao grow wild. Sugar, coffee, tobacco, vanilla, and cacao are cultivated; the value of the annual cacao-harvest is estimated at from $1,000,000 to $1,500,000. Pop. 83,707, chiefly Indians.

**Tabasheer** [Pers. *tâbshir*, "clay"], a natural glass obtained from the hollow stems of certain bamboos. It appears to be the product of an exudation of the silicious sap of the plant into its internal cavity. It is very light, brittle, porous, and has hygrometric properties. There are several varieties. The transparent kinds have the lowest refractive power of all known substances except the gases. Its refraction of the mean yellow ray has the index 1.111. The Hindoos ascribe to it great medicinal virtues.

**Ta'berg,** p.-v., Oneida co., N. Y. P. 400.

**Tab'ernacle,** tp., Randolph co., N. C. P. 1296.

**Tabernacle,** tp., Orangeburg co., S. C. P. 355.

**Tabernacle** [Lat. *tabernaculum*], **The,** a large and costly tent erected by the Israelites near the close of their encampment at the foot of Mount Sinai, and subsequently carried with them in their wanderings in the wilderness and into the Holy Land. Its construction, together with all its hangings and furniture, was under especial divine direction, even in its minutest details. It was designed as the place where God should especially manifest his presence to his people, and where they should offer to him their sacrificial worship. For the same purposes it was continued in Palestine until replaced under Solomon by the temple, a reproduction of it in more durable material, but with each of its dimensions exactly doubled. In structure it consisted essentially, in ground-plan, of two adjoining rooms, with an outer court surrounding both. The inner room, which was an exact cube, contained the ark of the covenant with its contents; over this were the figures of two cherubim, and between them the Shekinah. The only access to this room was from the outer room, of the same width and height, but just twice the length. Between them hung a veil, which was passed only by the high priest, and by him only on one day of the year, the great day of atonement. In the outer room was the golden censer, the golden altar on which incense was burned every morning and evening, the table of shew-bread, on which were twelve loaves of bread, replaced each week, and the golden candlestick, the lamps of which were trimmed every morning and lighted every evening. Into this the high priest and the priests entered daily in the course of their regular ministrations, but no others. This was entered at the eastern end from the court in front. In the court the principal object was the large brazen altar, on which all burnt-offerings and the appointed parts of other sacrifices were burned. Between this and the sanctuary itself was placed the brazen laver for the frequent ablutions of the priests. This court was entered not only by the priests and Levites, but by all Israelites—who must be ceremonially clean—who came to offer sacrifices. The entrance to this was also by a hanging of curtains gorgeously wrought in colors, supported on pillars, and was 20 cubits in width. The three entrances were thus in one line, all facing eastward. In the temple other courts were added beyond, and in this court were various fixtures for the convenience of the sacrificers. The dimensions of the court were $100 \times 50$ cubits; it was enclosed on all sides by pillars of brass 5 cubits high and 5 cubits apart, resting in sockets of brass; and on these were hung, by hooks of silver, curtains, one for each side, of "fine twined linen." The sanctuary itself, within the court, was a tent covered with a series of curtains; but under these curtains was a structure $30 \times 10$ cubits, having its sides and rear of acacia boards 10 cubits high. Each board had at the bottom two silver tenons fitting into silver sockets placed on the ground, and at the top on the outer side a ring of gold through which ran bars of acacia to hold all together. This was divided by a curtain so as to form the holy place, $20 \times 10$ cubits, and the holy of holies, $10 \times 10$ cubits. The covering rose in the form of a triangle to an apex over the centre, and extended 5 cubits on each side beyond the boards, and also 5 cubits in front, forming a sort of porch. This covering was formed of four sets of curtains, of which the innermost was of finely-wrought linen and hung down over the front; the next of goats' hair; the third of rams' skins dressed with the wool on, and dyed red; the fourth, which according to Fergusson was only placed over the joint of the last, was of "badgers'" (probably, seals') skins. The two inner coverings were made in strips sewed together, but so as to leave two parts in each, which were joined together with buckles of gold.

The tabernacle in all its structure was arranged for convenient packing, transportation, and setting up; but nevertheless, in size, in beauty of workmanship, and in costliness of material, was a magnificent structure for the wilderness. It was plainly intended to impress immediately upon the people in the strongest way the majesty of God, whose presence was there manifested, and to whom they there drew near in their sacrifices. It was also in every part symbolical of divine truth. The most salient points of this symbolism are expressed in the Epistle to the Hebrews. *Literature.*—Art. "Tabernacle" (Plumptre) in Smith's *Dict. of the Bible;* Neumann, *Die Stiftshütte* (1861); Riggenbach, *Die mosaische Stiftshütte* (1863); Lange's *Commentary* (Schaff's edition) on Lev. xxiv. *seq.* and 1 Kings vi. *seq.* Frederic Gardiner.

**Tabernacles, The Feast of,** one of the three great festivals at which all the males of Israel were required to present themselves at the sanctuary. It began on the 15th Tisri, the first month of the civil and seventh month of the ecclesiastical year, corresponding to the last part of September or first part of October, and continued seven days, with a supplementary eighth day. On the first and on the eighth day there were "holy convocations," when no *servile* work might be done, although the other activities of life were allowable. On the remaining days there was no legal restriction on labor, but from the manner of keeping the feast it must have been largely suspended.

The feast was pre-eminently a thanksgiving festival after the close of the agricultural labors of the year, and was far more joyously kept than any of the other feasts. Its position, also, five days after the great annual day of atonement, the only fast-day prescribed in the Law, contributed to this result. According to the ordinances of the Law, it was distinguished by two peculiar observances, and in the course of time several others of great significance and beauty grew up around these. The first of these characteristics resulted from the command to the Israelites to dwell in *booths* during the seven days of the feast; the command did not apply to the supplementary eighth day. These booths were to be constructed of the branches of "goodly trees," and were not tents. According to Jewish tradition, the sides were built up of boards, and only the roof made of branches, and they were placed on the roofs and in the courts of the houses, and in any unoccupied places in the streets. As little furniture as possible was to be placed in them, and it was not required that women and children should dwell in them, but only men. Tradition interpreted the word *dwell* to mean taking at least two meals a day in them. This dwelling in booths connected the harvest festival with the national and religious life of Israel, and was expressly made in the Law a remembrancer of their deliverance from Egypt. Some writers have thought that at certain seasons of the year during the wanderings in the wilderness the Israelites escaped from their tents to temporarily-constructed booths; but it seems more likely that the reference is to their first encampments on the march out of Egypt, especially at Succoth (= "booths"), when they had not yet had time to provide themselves with tents. The other legal peculiarity of the feast was in the sacrifices. These were not only of great abundance, but were arranged in a singular manner. There was offered on each day a kid for a sin-offering, with two rams and fourteen lambs for a burnt-offering; but besides this, there was a further burnt-offering of bullocks, thirteen on the first day, twelve on the second, and so on diminishing by one on each successive day, until only seven were offered on the

seventh day. On the eighth day the sacrifices were a goat for a sin-offering, one bullock, one ram, and seven lambs for a burnt-offering. The Law required that at the feast of tabernacles in the sabbatical year the Law should be publicly read to the whole people, men, women, and children.

In addition to the dwelling in booths, it was customary for each Israelite to carry in his hand during the festival the *lulab* or bundle of green branches tied together, and also some fruit, usually understood to be the citron. This custom added much to the joyous scenes of the festival. Two other customs arose at an early date, and are thought to be alluded to in the New Testament. One of the priests drew water in a golden pitcher from the Pool of Siloam, and brought it through the water-gate of the temple to the altar. As he entered, the trumpets sounded, and the people in the mean time had repaired to the temple in holiday attire and with their *lulabs* in their hands. Then, just before the offering of the sacrifices, the water was poured upon the altar, amid the joyous chanting of Ps. cxviii. and the shaking of the *lulabs*. So great was the joyousness of the occasion that it became a rabbinical proverb, "He has never seen joy who has not seen the joy of the pouring out of the water of Siloam." To this custom allusion is made in John vii. 37, 38. In the evening of the day of "holy convocation" the men and women assembled in the courts of the temple expressly to rejoice over the drawing of the water of Siloam in the morning, and gave themselves up to unrestrained hilarity. On this occasion two great lights were set up in the court, each consisting of four lamps, the oil for which was supplied by the sons of the priests, and the wicks made of cast-off priestly garments. The light is said to have reached over nearly the whole city. The passage John viii. 12 is supposed to allude to this light. FREDERIC GARDINER.

**Tabernæmontana.** See COW-TREE and FORBIDDEN FRUIT.

**Tabertown,** tp., Cass co., Ind. P. 447.

**Taberville,** p.-v., St. Clair co., Mo. P. 160.

**Ta'bes Dorsa'lis, Phthisis Spinalis, Duchenne's Disease,** better known as **Progressive Locomotor Ataxia,** a degenerative condition of the posterior gray column of the spinal cord, usually by the successive steps of fatty degeneration, granular disintegration, and atrophy, from which the terms *tabes* and *phthisis*, denoting "wasting." The term "progressive locomotor ataxia" is descriptive of the chief features of the disease. Ataxia (Gr. α privative, and τάξις, "arrangement" or "order") designates the peculiar loss of control in this disease over groups of muscles which in health are co-ordinated or employed in unison. This deranged, inharmonious action of muscles is limited chiefly to the lower extremities, and manifested when attempting to walk; hence the term "locomotor," while the affix "progressive" indicates the steady and hopeless progress of the malady. The sight aids greatly in the precision and certainty of walking. Hence, in the early stage of ataxia the gait may be unsteady only at night, twilight, or when the eyes are closed. In more advanced stages the patient has not sufficient control to stand with the eyes shut, and, on attempting to walk, the limbs move irregularly and wildly, the feet coming down abruptly with a flapping sound, the patient catching at support or falling. The limbs, though wholly beyond control for walking, are not paralyzed, and retain full power, as demonstrated by the dynamometer. Intense pains, of electric rapidity and lancinating severity, shoot from the feet to the thighs, trunk, and often to the head. The soles of the feet often are anæsthetic, and seem to the patient puffy, as if walking on down or velvet. There may be anæsthesia of other parts. The rectum and bladder may be impaired, and the sexual appetite and power are usually annihilated. There may be local dull pain over the spine, denoting the point of disease, and also a slight sense of constriction at a corresponding level, as if a string were tied round the body. The mind, as a rule, is sound, except so far as long-continued intense pain, sleeplessness, and knowledge of the desperate and hopeless nature of the disease dispirits and demoralizes. Alcohol freely taken relieves the pain, and opium, especially administered subcutaneously. But the pain constantly recurs, and hence either the alcohol or opium habit is apt to become established in ataxic patients. Cold and changeable weather intensifies their distress. Hence, they should be placed in warm, sunny rooms, protected from damp and chilly air, and well housed in winter. This disease of the spinal cord is in some cases induced by intemperance; in others by licentious excess and specific disease; in others it would seem the reflex result of disease of the bowel and the urinary tract, as in stricture of the rectum, hæmorrhoids, urethral stricture, etc. Habitual exposure to inclement weather and the rheumatic and gouty vices of the blood may induce it. When due to specific blood-states, as rheumatism, gout, and syphilis, there is hope of cure or arrest of the disease by specific treatment. But more often the cause is obscure and of slow, insidious approach; it is surely "progressive," and treatment is limited to general tonic and hygienic measures, and assuaging pain by anodynes.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Table Bluff,** p.-v. and tp., Humboldt co., Cal. P. 408.

**Table-Land,** or **Plateau.** See EARTH, by PROF. A. GUYOT, PH. D., LL.D.

**Table Mound,** tp., Dubuque co., Ia. P. 1137.

**Table Mountain,** in Pickens co., S. C., 20 miles N. W. of Greenville, rises 4300 feet above tide, and there is on one side a long line of cliffs 1000 feet in perpendicular height. The vicinity abounds in imposing and beautiful scenery, and is becoming a place of summer resort.

**Table Rock,** tp., Izard co., Ark. P. 257.

**Table Rock,** p.-v. and tp., Sierra co., Cal. P. 759.

**Table Rock,** tp., Siskiyou co., Cal. P. 327.

**Taboo',** or **Tabu',** a Polynesian custom by which persons, places, or things become so sacred that certain persons cannot touch or come near them without becoming defiled and outlawed. The system of taboo penetrates the whole social life of most of the unchristianized South Sea Islands, and is a potent engine in the hands of chiefs and priests for the management and subjection of the people.

**Ta'bor,** p.-v. and tp., Fremont co., Ia. P. 310.

**Tabor College,** Fremont co., Ia., was incorporated under the name of Tabor Literary Institute in 1854, and reincorporated under the name of Tabor College in July, 1866. It is an outgrowth of a colony of Congregationalists from Oberlin, O., who formed the settlement at Tabor in 1851 under the leadership of Deacon George B. Gaston and Rev. John Todd. Many citizens of Tabor gave largely of their property to the college at the opening of the college department. The first nineteen donors gave in cash and notes 60 per cent. of the assessed value of their property. In the admission of students no distinction is made on account of sex or race. An academy was opened in 1857, and a college department in 1866. Tabor College includes, besides the college department, a ladies' department, a teachers' department, and a preparatory academy. In all departments the number of students during the year has varied from 156 to 210, about one-fifth the average attendance being in the college course. Rev. Wm. M. Brooks, the present incumbent (1873), was principal of the academy and first president of the college. The college has two buildings, 234 acres of land, a library of 3200 volumes, and a cabinet of 3150 specimens. The endowment, including unpaid subscriptions, is $55,000. The number of students from the first exceeds 1000. WM. M. BROOKS.

**Ta'borites** [named from *Tabor*, one of their strongholds], a sect of the Hussites organized in 1420 under Ziska. They opposed the Calixtines or Utraquists, no less than the Romanists, and waged long defensive wars. They finally took the name of BOHEMIAN BRETHREN (which see).

**Taborit'ic** (or **Thaboritic**) **Light.** See HESYCHASTS.

**Ta'bor, Mount,** an insulated mountain of Northern Palestine, in Galilee, 6 miles S. E. of Nazareth, rises 1000 feet, and commands a large and beautiful view of the surrounding country. It is often mentioned in the Old Testament, and was from the fourth century generally regarded as the scene of the transfiguration of Christ, until recent researches showed that at the time when that event took place, its summit was occupied by a populous town.

**Tabreez',** town of Persia, capital of the province of Azerbaijan, is surrounded with a brick wall 3½ miles in circuit, but is ill built, with crooked, narrow, and dirty streets, and no remarkable public edifices. Its bazaars are mean buildings, but extensive, and a large and important trade is carried on here, partly in the manufactures of the city itself, silk, arms, shawls, tobacco, and leather, partly as a transient trade between Russia and Turkey and Persia and India. The surrounding country is very fertile and well cultivated, mostly consisting of orchards and vineyards. P. estimated at 50,000.

**Tacahout,** or **Mahu,** a nutgall which grows on *Tamariscus Indica*, a species of TAMARISK (which see). It is valuable as a prolific source of gallic acid. Large quantities are exported from India and Barbary.

**Tac'amahac.** (1) The resin of *Fagura octandra*, a tree of Curaçoa and Venezuela; (2) that of the buds of balsam poplar, which grows in the U. S. (*Populus balsamifera*); (3) that of *Calophyllum Calaba*, *C. inophyllum*, and *C. Tacamahaca*, Old-World tropical trees, producing East Indian tacamahac; (4) the Mexican COPAL (which see). These articles are sometimes used in medicine; all but the second are employed in varnishes, incense, etc.

**Taché** (Alexandre), brother of Sir Etienne P., b. at Kamouraska, Lower Canada, in 1822; graduated at the college of St. Hyacinthe; became a member of the order of the Immaculate Conception; was ordained priest 1843; went as a missionary to the Red River country, and thence among the Indians of the valley of the Saskatchewan; became coadjutor bishop of St. Boniface, Manitoba, 1851, bishop 1853, and archbishop 1871; exerted himself as a peacemaker during the Riel insurrection of 1869–70, and established a college and theological seminary at St. Boniface, opposite Fort Garry. Author of *Vingt Années de Missions dans le Nord-ouest de l'Amérique* (Montreal, 1866), *Esquisse sur le Nord-ouest de l'Amérique* (1869), and numerous reports on Indian missions in the *Annales de la Propagation de la Foi*.—His brother, Jean Charles, M. D., b. at Kamouraska in 1821, is author of several works in French, including *Esquisse sur le Canada sous le Point de Vue économiste* (Paris, 1855), and *Des Provinces de l'Amérique du Nord et d'une Union fédérale* (Quebec, 1859), and works on legal and industrial subjects, in French and English.

**Taché** (Sir Etienne Paschal), M. D., b. at St. Thomas, Quebec, Canada, in 1795; served as a militia officer in the war of 1812–15; afterward studied medicine, and interested himself in literature, science, and politics; entered the assembly 1841; was deputy adjutant-general 1847, commissioner of public works 1848–49, Speaker of the legislative council 1856–57; was knighted by Queen Victoria Nov., 1858; became colonel and aide-de-camp to the queen 1860. D. at St. Thomas in 1865. Author of *Du Développement de la Force physique chez l'Homme* (1829), *Réflexions sur l'Organisation des Voluntières* (1863), etc.

**Tachygloss'idæ** [from *Tachyglossus* — Gr. ταχύς, "quick," and γλῶσσα, "tongue"—the generic name of the species], a family of mammals of the order Monotremata, confined to Australia and its adjuncts, and represented there by the so-called "hedgehogs," but which must never be confounded with the hedgehogs of Europe. The name *Tachyglossus* refers to the swiftness with which it can use its tongue in protrusion and retraction. *Echidna*, a name often used, was preoccupied in zoology. The general form is somewhat like that of the hedgehog of Europe; the face and jaws are, however, produced into a long and tubular rostrum; at the end of this is the small mouth; teeth are entirely wanting, but on the palate are robust horny spines, pointing backward; the tongue is subcylindrical, and very long, flexible, and protractile, and armed with numerous horny warts; the surface of the body and head above and on the sides is armed with long, stout, tapering, and pointed spines, intermingled with coarse hair, and below is clothed chiefly with simple coarse hair; the limbs are short and robust, each provided with five toes; those of the anterior feet with graduated long, compressed curved claws; those of the hinder feet with abruptly unequal claws—viz. the inner with a broad rounded nail, the second with a very long, and the others with regularly graduated, moderately compressed curved claws (the males are provided with horny spurs to the hind feet, which are wanting in the females); the tail is rudimentary. The family is represented by but one known genus (*Tachyglossus* or *Echidna*), which has representatives in (1) Australia generally, and (2) Van Diemen's Land. The forms of both countries are very nearly allied, and have been designated by some authors (*e. g.* Waterhouse) as distinct species under the names (1) *Echidna aculeata*, and (2) *E. setosa*, and by others (*e. g.* Krefft) as simple varieties. They attain a length of about eighteen inches. They chiefly feed on ants and other small insects, as is indicated by their small mouth and extensible tongue, but sometimes take in grass. They are capable of sustaining life for a long time without food, and are supposed to remain dormant during the dry hot months of summer, as they are at least chiefly seen during winter. They are also said to be to some extent proof against the bites of poisonous snakes. "The strength of the echidnas is most wonderful, and their digging capabilities will scarcely be credited. The animal often appears to be nailed to the ground, and if sheltered in some convenient corner, where the soil is stiff clay, a spade is necessary to dislodge it. In soft alluvial soil or sand an echidna will disappear before the observer's eyes without any apparent effort, gradually sinking out of sight." (*Krefft.*)

Theodore Gill.

**Tachygraphy.** See Stenography, by J. F. Meyer.

**Tachypet'idæ** [from *Tachypetes*—Gr. ταχυπέτης, "fast-flying"—the name of the only known genus], a family of birds represented by the "frigate-bird" or "man-of-war" of mariners. The form is essentially the same as that of the pelicans, but the neck is rather shorter, and the anterior position of the legs imparts to the bird a peculiar physiognomy; the bill is moderately long (longer than the head), rather slender and contracted toward the middle, and nearly straight, but with the end strongly hooked; its sheath is composite or grooved, as in all the Pygopodes; the edges are entire; the nostrils are in the lateral grooves and very narrow; the gular pouch is moderately, or even largely, developed; the wings are very long and pointed; the tail is also very long, and is very deeply forked, and has twelve feathers; the legs are inserted unusually far forward (an exceptional shortness of the sternum being co-ordinated with this character), and rather small; the tarsi are very short (much more so than the outer toe), and much compressed and plumose; the toes are slender, and the web between them deeply indented; the claws moderate and curved, and the middle one pectinated. The family belongs to the same group (Pygopodes) with the Phæthontidæ (tropic-birds), Plotidæ (snake-birds), Phalacrocoracidæ (cormorants), Pelecanidæ (pelicans), and Sulidæ (gannets). (As to habits of species, see Frigate-Bird.)

Theodore Gill.

**Tac'itus** (C. Cornelius). The place and date of his birth are not known, but he married a daughter of C. Julius Agricola in 78 A. D.; was prætor in 88; consul suffectus in 97, and probably survived Trajan, who died in 117. He had already acquired great reputation as an orator when Pliny entered public life. They became intimate friends. Of Pliny's letters, eleven are addressed to him, and it is apparent that his friendship was considered by Pliny as a distinction. As an author he was much appreciated by his own times and the next century. The emperor Tacitus claimed relationship to him, and ordered his works to be placed in all public libraries, and ten copies to be made every year at the public expense and deposited in the Archeia. During the latter part of the Roman epoch and during the Middle Ages, however, he was not much read, and most of his works have come down to us only in a mutilated and corrupted form. The dialogue *De Oratoribus* is his earliest work; its authenticity has been denied by some scholars, but is generally accepted. *Agricola* is a biography of his father-in-law, a masterpiece in artistic respects, and of special interest on account of the fact that Agricola spent so much of his time in Britain. *De Moribus et Populis Germaniæ* is an essay which probably had originally a moral purpose as much as an historical. Of his *Historiæ*, written before the *Annales*, only the first four and a half books are extant, giving the history of the years 69–70 A. D. Of the *Annales*, beginning at the death of Augustus and ending at the death of Nero, only the first four books, parts of the fifth, the sixth, and from the middle of the eleventh to the middle of the sixteenth, are extant. The style of these writings is very peculiar. To the common reader it is harsh and obscure, yet at the same time exceedingly powerful. Scholars who are familiar with the author generally admire not only the intellectual and moral, but also the literary character which these works reveal. Editions by Bekker (1831), Orelli (1846 and 1848), Ritter (1848), and Halm (1863); English translations by Gordon (1728–31), by Murphy (1793), and by Church and Brodribb (London, 1864).

**Tacitus** (M. Claudius), Roman emperor Sept. 25, 275–Apr. 9, 276, b. at Interamna, the present Terni, in Umbria, about 200; was noted as one of the oldest senators and one of the wealthiest citizens when the senate, after the death of Aurelian, elected him emperor. He was an upright and honest character, and possessed of great literary interest. It was his idea to reinstate the senate in its former authority, and to check the steadily-increasing licentiousness and confusion in all public affairs; but the task proved too much for his years, and he died 200 days after his election, at Tarsus or at Tyana, of a fever, or, as some say, put to death by the impatient army.

**Tack'ing** is a doctrine of the English equity jurisprudence whereby a third encumbrancer in good faith of land may, by a union of his own security with a prior one, compel an intermediate encumbrancer to pay off both the liens if he wishes to redeem from the one which is first in order of time. The rule is most frequently applied to the case of three successive mortgages held by different persons, the last having been taken without notice of the second. Under these circumstances the junior mortgagee may purchase and take an assignment of the earliest encumbrance, and, in the language of the books, may "tack" his own to it. If the second mortgagee then desires to redeem, he must not only discharge the first, which is prior, but also the third, which is subsequent to his own. The privilege, however, is not extended to a third encumbrancer by judgment, since he is not regarded as a purchaser; but if his encumbrance is by mortgage, it makes no difference whether the first and second liens are by mortgage or by judgment. The American courts have wholly rejected

this doctrine of tacking, both because they consider it as extremely inequitable, and because it is wholly inconsistent with the statutes concerning the recording of mortgages which have been adopted in all the States.

JOHN NORTON POMEROY.

**Tackmahack,** or **Tacamahac.** See POPLAR and TACAMAHAC.

**Tac'na,** town of Peru, South America, on the Tacna, at an elevation of 1700 feet above the sea, in lat. 18° S., lon. 72° 10′ W. It is well built, and carries on an active trade with Bolivia. P. 11,723.

**Taco'ma,** p.-v., Pierce co., Wash. Terr., the W. terminus of Northern Pacific R. R., on Tacoma Bay, has several churches, 2 schools, 1 newspaper, and 1 saw-mill. Deposits of coal exist in the neighborhood. P. 73.

THOMAS W. PROSCH, ED. "PACIFIC TRIBUNE."

**Taconic,** or **Taghkanic,** a range of mountains extending nearly N. and S. along the eastern boundary of New York, and uniting the Green Mountains of Western Massachusetts with the Highlands of the Hudson. The "Taconic system" of Prof. Ebenezer Emmons was named from the characteristic strata of this range, a metamorphic rock, which that geologist believed to be older than the Silurian system, and to extend S. W. along the whole extent of the Appalachian chain, attaining sometimes a thickness of above 30,000 feet.

**Tactics, Grand.** See TACTICS, MILITARY.

**Tac'tics, Mil'itary,** is defined as the art of bringing troops into action, or of handling them in the presence of an enemy and within range of his fire. This branch of the military art is divided into *grand tactics*, or the tactics of battle, and *elementary tactics*, or those of instruction. The first is on the field of battle what strategy is in the theatre of military operations—simply the art of being the stronger at a decisive point, regardless of the respective strengths, as totals, of the opposing armies. The second is to the first, or ought to be, the simplest means sufficient to the end. Beginning with the individual recruit and "awkward squad," the drillmaster should mould the sentient masses with which the issues of battle are decided, but with methods of drill and details of minor tactical formation this article does not deal.

The tactical "arms" into which modern armies are divided are the ARTILLERY, CAVALRY, and INFANTRY (which see), which, excepting the mobile artillery, in their respective formations still bear strong resemblance to their prototypes in classic antiquity. The grand tactical elements, or units, of these "arms" are battalions of infantry, batteries of artillery, and squadrons (or battalions) of cavalry; and these elements are, as occasion requires, organized into brigades, divisions, army corps, etc., either of the respective arms or of mixed troops.

*Grand Tactics.—Battles* are general engagements between armies, in contradistinction to conflicts, in which but a small portion of the opposing forces are actually engaged, the latter being called, according to their nature, "affairs," "combats," "skirmishes," etc. Battles are defensive when given in a chosen position by an army awaiting attack; offensive when made on an enemy in position; mixed, or unforeseen, when happening between armies unexpectedly confronted. The principles upon which all battles should be fought are well established, but circumstances, ever varying, present alternations of original and reflex action that, if perceived at all, are simply perplexing to the incompetent commander. The strategy of a campaign may be predetermined in cabinet council; questions of logistics and military engineering may be solved by the assistants; but on the actual field of battle the individuality of the general is made manifest. His plans must be quickly conceived and stubbornly maintained, or readily abandoned for alternatives, as circumstances may demand.

Speaking in general terms, the most promising tactical positions are those neutralizing any superiority that the enemy may possess, and affording facilities for the ready employment of the special arm or arms in which one's own army may be the stronger. The position should allow the concentration of artillery fire on each avenue of approach, should permit the free and unperceived movement of one's own troops and expose the enemy's advance, should afford protection to the flanks, and should not present obstacles to one's own retreat. All of the desirable conditions can rarely be secured in one combination. In securing some of them others must often be yielded to the enemy.

*Orders of Battle.*—"A line of battle is the general name applied to troops drawn up in their usual order of exercise without any determined manœuvre; an order of battle is the particular disposition given to the troops for a determined manœuvre on the field of battle." These orders may be parallel, oblique, perpendicular, concave, convex, in echelon, or arranged by combinations of two or more formations. The parallel order may be simple, or with a crotchet, as that of the Austrians at Prague, or reinforced on one or both wings, or, as were the Romans at Zama, in the centre. Oblique formations may have the advanced wing reinforced, as in the Theban order at Leuctra. An instance of the perpendicular order is found in Frederick's attack at Rosbach. The English formation at Poitiers was convex, and at Agincourt was a combination of the concave and echelon orders. Echelons are formed on a wing, on the centre, and in rare instances on both wings.

Infantry and cavalry are employed in extended order or thin lines, in lines of battalion or regimental columns, in deep columns consisting of several battalions, and in combinations of lines, squares, columns, etc. Artillery should be distributed so as to concentrate its fire—when upon the defensive on the enemy's columns of attack, and when on the offensive upon his guns or the objective of our own assault. The artillery is purely a pyro-ballistic arm; cavalry, as such in contradistinction to mounted infantry, is in battle a potential force solely by corporal impact; but the infantry is effective both by "fire" and impulsion.

While the principles of grand tactics are immutable, we find in "orders of battle" an habitual adaptation to the prevailing weapons, with special formations designed to meet peculiar conditions in the localities of conflict or disposition of the enemy's forces. Modern formations must recognize the general supremacy of missile weapons, and yet be susceptible of ready transformation into orders of mobility. With improvement in range, accuracy, and rapidity of fire there has been a corresponding tendency, especially for defensive purposes, to extended orders of battle; but for both cavalry and infantry this extension implies corresponding immobility in the recognized tactical units, and may be carried to consequential impotence. The extended order, if carried, as some theorists advocate, to a general adoption of the loose-order or "skirmish-line" formation, will, to prevent disintegration, demand a maximum amount of discipline and instruction in the troops, supplemented by exceptional intelligence and entire self-reliance on the part of the individual soldier. These conditions are wellnigh irreconcilable. The sort of discipline that enabled Wellington at Almeida to swing his army as on a pivot with perfect order on a plain four miles in breadth and in presence of a hostile army, is obtainable only at the expense of individuality; and the individuality and exceptional intelligence of our Revolutionary sires were of no avail, under ordinary circumstances, against the British regulars. In fact, it was not till the Prussian drillmaster (Steuben) had introduced the drill and discipline of the great Frederick into the American armies that they were capable of any grand tactical movements before an enemy of respectable force.

At the beginning of the present century troops were successfully handled in masses that would now invite certain destruction from a well-served artillery; and to-day is advocated a dispersion of troops in such open order as practically constitutes each *man* an autonomic tactical unit; and, singularly enough, this formation is assumed to be particularly suitable for the undisciplined and ignorant novice in the art of war. Between the two extremes is undoubtedly the common sense, and therefore the true tactical, mean.

ROBERT N. SCOTT.

**Tactics, Naval.** See NAVAL TACTICS, by CAPT. S. B. LUCE.

**Tacun'ga,** or **Lactacunga,** town of Ecuador, South America, on an elevated plateau, is well built, and has a good college with a well-arranged chemical laboratory. Saltpetre and powder are produced. P. about 16,000.

**Tacusah,** tp., Christian co., Ill. P. 1182.

**Tade'ma** (LAURENZ ALMA), b. at Drouryp, West Friesland, Holland, Jan. 8, 1836; was educated in the gymnasium of Leeuwarden, where he especially devoted himself to the study of Roman and Egyptian antiquities; entered in 1852 the academy of fine arts at Antwerp; studied painting under Leys, and settled in 1870 in London. The most prominent of his pictures are—*Ancient Egyptian Festival* (1862), *Entrance to a Roman Theatre* (1866), *Ancient Roman Siesta* (1868), *Claudius Imperator* (1870), *The Last Egyptian Plague* (1872).

**Tadmor,** or **Thadmor.** See PALMYRA.

**Tadoli'ni** (ADAMO), b. at Bologna in 1789; studied the art of sculpture first in his native city, afterward at Rome under Canova. Prominent among his works are—*Venus and Cupid, The Abduction of Ganymede, A Bacchante,* and a statue of Washington.

**Tadousac,** p.-v., Saguenay co., Quebec, on the N. shore of the St. Lawrence, just below the mouth of the

river Saguenay, 140 miles below Quebec. It is a place of summer resort, has wild and sublime scenery, good salmon fishing, and a large lumber-trade. Here stands a stone church, the first built in Canada. P. of sub-district, 765.

**Tad'pole,** (1) a name given primarily to the larval or young stage of the frogs (Ranidæ), which is distinguished by the large head, compressed tapering tail, and (in the youngest stage) want of legs. (2) The name is also applied to the corresponding stage in other amphibians. (3) It is furthermore employed for the larvæ of many ascidians, having a superficial resemblance to the tadpoles of frogs. (See also BATRACHIA, FROG, TUNICATA.)

**Tael,** a Chinese measure of weight equivalent to $1\frac{1}{3}$ ounces avoirdupois, employed as the standard of foreign coin, and as applied to silver is equal to 1.386th of a Mexican dollar.

**Tænia.** See TAPEWORM.

**Tænioi'dea** [Gr. *ταινιοείδης*, "like a ribbon"], a family of sterelmintoid intestinal worms, of which the type is the TAPEWORM (which see).

**Tae-Ping Rebellion.** See CHINESE EMPIRE, by C. W. GREENE, M. D.

**Ta'fel** (JOHANN FRIEDRICH LEONHARD), PH. D., b. at Sulzbach, Würtemberg, Germany, Feb. 6, 1800; graduated at the University of Tübingen 1820; was professor of languages for many years in gymnasia at Stuttgart, Ulm, and Schorndorf; introduced the Hamiltonian interlinear method of teaching languages, publishing textbooks for French, Spanish, Italian, Latin, and Greek; edited Livy (3 vols., Stuttgart, 1823); translated into German Xenophon and Dion Cassius, many novels of Sir Walter Scott, and select works of Cooper, Dickens, and Thackeray; wrote two theological treatises and edited several periodicals. In 1853 he came to the U. S.; was for three years professor in Urbana University, O., and ultimately settled at St. Louis, Mo. With his son, Ludwig H., he published *A New and Complete English-German and German-English Pocket Dictionary* (Philadelphia, 1870).—His son, RUDOLPH LEONHARD, PH. D., professor of languages at Washington University, St. Louis, b. at Ulm, Germany, Nov. 24, 1831; came to the U. S. in 1847; was joint author (with his father) of *Latin Pronunciation and the Latin Alphabet* (1860); published *Emanuel Swedenborg as a Philosopher and Man of Science* (Chicago, 1867), and contributed to the American Philosophical Society's *Proceedings* a treatise which was also separately published with the title *Investigation into the Laws of English Pronunciation and Orthography* (1862).

**Taffe,** tp., Wayne co., Neb. P. 182.

**Tafilet',** or **Tafilelt,** a division of Morocco, extending S. E. of the Atlas Mountains, comprises several oases—Tassimi, Sahra, etc.—of which that of Tafilet is the largest, situated between lat. 30° 45′ and 31° 10′ N., and between lon. 3° 3′ and 3° 25′ W., and inhabited by about 100,000 Arabs, Berbers, and Jews. It is traversed by two rivers, which are lost to the S. in the sands of the desert, but it is sufficiently watered only during the winter and spring seasons; in summer-time the water is often consumed before reaching Tafilet, and a perfect desert climate, with droughts, sandstorms, etc., sets in. Dates, wheat, and barley are raised, sheep and goats are reared, carpets and woollen stuffs are manufactured, lead and antimony are produced, and a considerable trade is carried on with Morocco and Algeria. The principal town is Abuam.

**Taganrog',** town of Russia, government of Yekaterinoslav, on the northern shore of the Sea of Azof, opposite the mouth of the Don. It was founded by Peter the Great, and was the favorite residence of Alexander I., who died here; and it has many monuments, edifices, establishments, and institutions which remind one of the two czars. Its harbor is shallow, and ships must load and unload in barges half a mile from the shore, yet it carries on a considerable export-trade in corn, timber, flax, and hemp. P. 25,027.

**Taggarts,** tp., Wood co., West Va. P. 1050.

**Taghkanic,** p.-v. and tp., Columbia co., N. Y. P. 1485.

**Tagliacozzi** (GASPARO). See TALIACOTIUS.

**Tagliacoz'zo,** town of Italy, province of Aquila degli Abruzzi, on the slope of a hill about 12 miles N. of Avezzano. It was a strong mediæval fortress, generally held by the Colonna family, and it gave its name to the famous battle which took place in its vicinity, and in which Conrad was taken prisoner by Charles of Anjou. P. 7407.

**Taglio'ni,** the name of a celebrated family of dancers and ballet-masters, of Italian origin, but principally connected with the royal theatre of Berlin. The most illustrious member of this family was MARIA TAGLIONI, b. at Stockholm in 1804. She made her début in Vienna in 1822, danced subsequently in all the capitals of Europe, and created a great enthusiasm, especially by her performance of the title-rôle in her father's ballet *La Sylphide*, in which she completely succeeded in producing the impression of being borne along by her wings. She retired in 1847, and lives partly in Venice, partly at Lake Como.—Her brother, PAUL TAGLIONI, b. at Vienna in 1808, ballet-master at the royal theatre of Berlin, composed the ballets *Sardanapal*, *Satanella*, *Flick und Flock*, etc.

**Ta'gus,** one of the principal rivers of Spain, rises in the Sierra Albarracin, in lat. 40° 38′ N., lon. 1° 35′ W., flows mostly in a western and south-western direction through Spain and Portugal, and falls into the Atlantic at Lisbon, after a course of about 540 miles. It is navigable 115 miles from its mouth.

**Tahi'ti,** or **Otahei'te,** the principal of the SOCIETY ISLANDS (which see), is in the Pacific Ocean, in lat. 17° 29′ S., lon. 149° 29′ W. It is high, its highest point rising 8500 feet, but traversed by beautiful and fertile valleys, in which all tropical plants grow luxuriantly. It is 120 miles in circumference, and has about 13,800 inhabitants, who have been converted to Christianity, and are described as industrious, peaceable, honest, and cheerful.

**Tah'lequah,** p.-v., cap. of Cherokee Nation, Ind. Ter., in the valley of Illinois River, a tributary of the Arkansas, distant 15 miles E. from Missouri Kansas and Texas R. R., has 2 schools, a weekly newspaper in Cherokee and English, and a capitol, a brick edifice, built at a cost of $20,000. P. about 3000.

**Tail, Estate.** See ENTAIL, ESTATE, and FEE.

**Taillandier'** (RENÉ GASPARD ERNEST), generally known under the name SAINT-RENÉ TAILLANDIER, b. at Paris Dec. 16, 1817; studied philosophy and literature in Paris and Heidelberg; was appointed professor of foreign literatures at Strasbourg in 1841, at Montpellier in 1843, at the Sorbonne in 1863, and became in 1870 secretary in the department of public education. Besides poems, he has written *Scott Érigène* (1843), *Histoire de la jeune Allemagne* (1849), *Études sur la Révolution en Allemagne* (2 vols., 1853), *Michel Lermontoff* (1856), *Maurice de Saxe* (2 vols., 1865), etc.

**Tail'or,** a name applied in the U. S. to different species of fishes. I. At and in the neighborhood of Philadelphia, Baltimore, and Washington, as well as along other parts of the coast, it is given to the *Pomatomus saltatrix* (*Temnodon saltator* of most old authors), known at New York and designated in most angling works as bluefish. (See BLUEFISH.) II. About Washington and at some other places the name is employed either alone or qualifying herring (tailor herring) for the *Pomolobus mediocris*, a species of the herring family. It is probably applied to the blue-fish on account of its sharp cutting teeth, but its applicability to the clupeid is not apparent. THEODORE GILL.

**Tailor-Bird,** the English name of the *Orthotomus longicauda*, a representative, according to some, of the family Turdidæ, or, according to others, of the family Luscinidæ. It is a small bird, about five inches long, with a slender subtrihedral and slightly decurved bill, short and rounded wing, and very long cuneiform tail composed of narrow feathers; the color is an olive-green above and white beneath on the body, and bright red on the top of the head. Its name is due to the manner in which it makes its nest, and sews, as it were, the leaves which it uses in the composition of it. Generally, two leaves at the end of a bough are brought in contact, or a dead one with a living one, and sewed together by the bill, vegetable fibres being used as the threads; sometimes a large leaf is rolled together and sewed at its margins. Within the cavity thus formed are deposited soft downy or cottony vegetable substances, and the nest is then completed for the reception of the eggs. From six to eight eggs are laid. The bird is insectivorous, like the other members of the family. It is an inhabitant of India, as well as Ceylon and Burmah. About fourteen species of its genus are known, but it is uncertain to what extent the other species resemble the *O. longicaudus* in habits. THEODORE GILL.

**Taine** (HIPPOLYTE ADOLPHE), b. at Vouziers, in the Ardennes, France, Apr. 21, 1828; was educated at the Collége Bourbon and the normal school of Paris, and became professor of æsthetics in the school of fine art in 1864. His earliest writings, *Essai sur Tite Live* (1854) and *Les Philosophes français du XIX^e^. Siècle* (1856), attracted much attention by their originality and their polemical tendency. His *Essais de Critique et d'Histoire* (i., 1857; ii., 1865) and *De l'Intelligence* (2 vols., 1869) have a similar character. Free of polemics are his *Philosophie de l'Art en Italie* (1866), *Voyage en Italie* (2 vols., 1868), *L'Idéal dans l'Art* (1867), *Philosophie de l'Art dans le Pays Bas* (1868), *Philosophie de l'Art en Grèce* (1870), etc. His principal works are *Histoire de la Littérature anglaise* (4 vols., 1864) and

*Les Origines de la France contemporaine* (i., 1875). He has also been a frequent contributor to the *Journal des Débats* and the *Revue des Deux Mondes*. Most of his works have been translated into English.

**Tainter,** tp., Dunn co., Wis. P. 206.

**Tait** (Archibald Campbell), D. D., LL.D., b. at Edinburgh, Scotland, Dec. 22, 1811; educated at the high school and academy at Edinburgh, at the University of Glasgow, and at Baliol College, Oxford, where he became public examiner; was one of the leading opponents of the "Tractarians" or "Puseyites;" took orders in the Church of England; was head-master of Rugby School from 1842 to Apr., 1850, when he accepted the deanery of Carlisle; was at the same time a member of the Oxford University commission; succeeded Dr. Blomfield as bishop of London Aug., 1856; originated in 1863 the successful scheme of raising a fund of £1,000,000 for supplying the deficiencies of church accommodation in London, and succeeded Dr. Longley as archbishop of Canterbury 1868. Author of *The Dangers and Safeguards of Modern Theology* (1861) and *The Word of God and the Ground of Faith* (1863), besides addresses, sermons, etc.

**Tait** (Peter Guthrie), b. in England about 1825; graduated at Cambridge; became fellow of St. Peter's College, professor of mathematics in Queen's College, Belfast, and in 1862 professor of natural philosophy in the University of Edinburgh. Author of *A Treatise on the Dynamics of a Particle* (1856), in conjunction with William J. Steel; of *An Elementary Treatise on Quaternions* (1867), *Thermodynamics* (1868), *An Elementary Treatise on Natural Philosophy* (vol. i., 1867), in conjunction with Sir William Thomson; and of *The Unseen Universe* (1875), in conjunction with Prof. Balfour Stewart.

**Tai-Wan',** a large but declining town of China, capital of Formosa, on the south-western coast of that island, in lat. 23° N. Its trade was formerly considerable, but its harbor has now been entirely silted up, and only coasting vessels of very small draught can visit it.

**Tai-Yuan',** town of China, province of Shan-Si, on the Fuen-Ho, an affluent of the Hoang-Ho, in lat. 37° 53′ N. It was for a long time the residence of the emperor, and contains many magnificent tombs and mausoleums. Its manufactures of sword-blades and knives are celebrated.

**Talave'ra de la Rey'na,** an old but well-built town of Spain, province of Toledo, on the Tagus, in an exceedingly fertile plain, covered with vineyards and olive-groves, and has some manufactures of silk and earthenware. P. 9285. Here was fought a severe battle on July 28, 1809, between the French and the allied Spaniards and Englishmen, in which the latter were victorious.

**Talbert's,** tp., Edgefield co., S. C. P. 1117.

**Tal'bot,** a breed of snow-white hounds now nearly extinct. The Talbot had very long ears, a very broad muzzle, and seems to have been kept for show rather than for use, but was sometimes used in the chase.

**Talbot,** county of Western Georgia, drained by Flint River and several other streams, and traversed by South-western R. R.; surface hilly, soil fertile. Staples, Indian corn, cotton, hay, and live-stock. Cap. Talbotton. Area, 524 sq. m. P. in 1870, 11,913.

**Talbot,** county of Eastern Maryland, bounded W. by Chesapeake Bay; surface generally level, soil very fertile; Maryland and Delaware R. R. terminates at the county-seat. Staples, Indian corn, wheat, and wool. Cap. Easton. Area, 250 sq. m. P. in 1870, 16,137.

**Talbot** (James), LL.D., F. R. S., Baron Talbot de Malahide, b. in Ireland Nov. 22, 1805; educated at Trinity College, Cambridge, where he obtained a scholarship, and graduated with high honors in mathematics and classics; was chosen to Parliament 1832; succeeded to his father's Irish peerage 1850; was made a baron of the United Kingdom 1856; is a distinguished archæologist; has been president of the Geological and Zoological societies of Dublin, of the Royal Irish Academy, and of the Archæological Society of Great Britain and Ireland, in which capacities he has rendered distinguished services to science.

**Talbot** (Matthew), b. in England about the middle of the eighteenth century; became a wealthy currier at Leeds, and spent his leisure in distributing the verses of the English Bible according to their sense, publishing as a result *An Analysis of the Holy Bible, containing the whole of the Old and New Testaments, collected and arranged systematically in 30 Books, which are subdivided into 285 Chapters and 4144 Sections* (Leeds, 4to, 1800). This work was reproduced in the U. S. by Rev. Nathaniel West, D. D. (New York, 1853), reducing the books to alphabetical order and adding a consulting apparatus of nine tables and indexes; and the latter edition was made the basis of the *New and Complete Analysis of the Holy Bible* (New York, A. J. Johnson, 1869), prepared by Rev. Roswell D. Hitchcock, D. D., which has been accepted as a standard manual for biblical reference.

**Talbot** (Richard). See Tyrconnel.

**Talbot** (Silas), b. in Rhode Island about 1750; at the beginning of the war of the Revolution was captain in a Rhode Island regiment, and was present at the siege of Boston; in 1776 accompanied the army to New York, where he conducted operations against the British shipping, for which he received a commission as major and the thanks of Congress; was severely wounded in 1777 at the defence of Fort Mifflin, and in 1778 aided Gen. Sullivan by transporting the American forces from the main land to Rhode Island; he captured the British floating battery, the Pigot, and was appointed captain Sept., 1779; in 1780 was made prisoner and sent to England, but was exchanged in Dec., 1781; was a member of the New York legislature, and in 1793 Representative in Congress; when the navy was reorganized in 1794, he superintended the construction of the frigate Constitution, which was his flagship during a cruise in the West Indies in 1799. His *Life* has been written by H. T. Tuckerman (1850). D. at New York June 30, 1813.

**Talbot** (William Henry **Fox**), LL.D., b. at Chippenham, Wiltshire, England, Feb. 11, 1800; graduated at Trinity College 1821; sat for Chippenham as a Liberal in the first reformed Parliament 1832–34; pursued for some years from 1833 a series of experiments which resulted in Sept., 1840, in the discovery of the essential principle of the art of photography; received in 1842 a medal from the Royal Society, and has of late years devoted himself to antiquarian pursuits and philological studies, being one of the few scholars who have successfully deciphered the Assyrian cuneiform inscriptions. Many of his versions from the Assyrian are found in the *Transactions* of the Royal Asiatic Society, of the Society of Biblical Archæology, and of the Royal Society of Literature, as also in the series of volumes known as *Records of the Past* (1874 *seq.*). Author of *Hermes, or Classical and Antiquarian Researches* (vol. i. 1828; vol. ii. 1839), *Legendary Tales in Verse and Prose* (1830), *The Antiquity of the Book of Genesis illustrated by some New Arguments* (1839), *The Pencil of Nature, a Collection of Genuine Specimens of the New Art of Photography* (6 parts, 1844–46), and *English Etymologies* (1847).

**Tal'botton,** p.-v., cap. of Talbot co., Ga., in the W. central part of the State. It has 5 churches, a seminary and high school, 1 newspaper, and a healthful climate. P. 796. W. E. Munford, Ed. "Standard."

**Talbotype.** See Talbot, W. H. F., and Photography.

**Talc** [Ger. *Talk;* from the same root, possibly, as our English word *tallow*, which in German and Swedish is *Talg;* in Dutch *talk*, and in Danish *tælg*, and having reference to the greasy, tallow-like *feel* of the mineral], a highly-important mineral species, a silicate of magnesia, usually somewhat hydrated, which sometimes makes up the mass of great geological formations. Talc, when crystallized, is right rhombic. It belongs to the softest of minerals, ranking with graphite in this respect, and is used as the lowest member, No. 1, of the *scale of hardness*, classing minerals according to their hardness. It is not often found well crystallized, but usually in compact or in foliated masses, the foliation arising sometimes from the cleavage of the mineral, which is micaceous in its character. Its most usual color is a light green, due usually to ferrous oxide associated with the magnesian base; but this color and this constituent are not essential, and it is found perfectly white, sometimes with a silvery lustre. The massive varieties are called Soapstone (which see). The average composition of the commoner varieties of talc is stated as $O_{16}Si_5Mg_6.2H_2O$; but there is an anhydrous talc, not separated from this species by Dana and other authorities, and which, according to analyses of Genth, Senft, Lychnell, and Kersten, computes distinctly to the formula $O_{16}Si_6Mg_4$. Dana suggests that *quartz* may have been present, as an impurity, in these; but this would not account for the entire absence of water from many of the analyses; and, moreover, what is entirely conclusive, the *density* would be diminished by quartz, whereas one of Lychnell's anhydrous talcs gave the maximum density of all, 2.795. The other extreme of the range of authoritative densities is a hydrous talc, a *rensselaerite*, from Charleston Lake, Canada, for which Sterry Hunt gives the figure 2.644. By investigation of the molecular volumes the writer discovers that one of the anhydrous talcs, that of Senft, from Kittelsthal (D. = 2.694), contains the magnesium (the *variable* electro-positive molecule) in its heaviest—*epsomite*—volume; while the heaviest hydrous talc of Scheerer, from Piedmont (D. = 2.79), contains the magnesium in the more

condensed volume it has in *periclase*, *brucite*, *kieserite*, and some others—a volume which is less condensed, however, than it has in *magnesites*, some *enstatites*, and other heavier magnesian compounds. (See VOLUMES, MOLECULAR.)

HENRY WURTZ.

**Tal'ca,** town of Chili, capital of the province of Talca, on the Maule, was founded in 1742, and is a well-built and steadily-increasing place. It has several educational institutions, some manufactures, and a good trade. P. 17,900.

**Tal'cott,** p.-v., Roanoke tp., Charlotte co., Va., on Richmond and Danville R. R.

**Talcott** (ANDREW), b. in Connecticut about 1798; graduated at the U. S. Military Academy July 24, 1818, when appointed brevet second lieutenant in the corps of engineers; after a year's service on construction duty, he accompanied Gen. Atkinson, as engineer, on the expedition to locate military posts on the upper Missouri and Yellowstone rivers; returning to duty with his corps in 1821, was thenceforward engaged in the construction of the defences of Hampton Roads, Va., Fort Delaware, etc., until 1835; from 1832 to 1836 was also engaged as astronomer for determining the boundary-line between Ohio and Michigan, and was in charge of the improvement of the Hudson River 1834–36; resigned from the army Sept. 21, 1836, to become division engineer on the Erie R. R.; in 1837 returned to duty in a civil capacity under the government as superintendent of the improvement of the delta of the Mississippi River 1837–39; member of commission for exploration and survey of the N. E. boundary of the U. S. 1840–43; of joint army and navy board to visit the Portsmouth and Pensacola navy-yards and prepare plans for drydocks and other important works 1844–45; from 1848 to 1855 was chief engineer of the Richmond and Danville R. R.; of the Ohio and Mississippi R. R. 1856–57, in which year he went to Mexico as chief engineer of the proposed railroad from Vera Cruz, *viâ* the City of Mexico, to the Pacific Ocean.

**Talcott** (GEORGE H.), b. in New York in 1811; graduated at the U. S. Military Academy in 1831; ordered to Florida, and engaged against the Seminoles Dec. 31, 1835; was transferred to the ordnance bureau July, 1838; in the war with Mexico served at Cerro Gordo, Contreras, Churubusco, and Molino del Rey, where wounded and disabled; in July, 1848, was reinstated as captain of ordnance; was in command of Augusta arsenal, Ga., 1851–54. D. at Indian Springs, Ga., June 8, 1854.

**Talcott** (JOHN), b. in England; came to Connecticut when young, about 1636; was ensign in the militia in 1650, and captain in 1661; representative in the legislature 1660; represented the State in the congress of the New England colonies 1669, 1673, and 1676; distinguished himself in the Indian war of 1676, saving the town of Hadley from an attack by 700 savages. D. July 23, 1688.

**Tal'ent** [Gr. τάλαντον], an ancient Greek weight containing 60 minæ, about 82 pounds avoirdupois. There was a Babylonian and an Æginetan talent, which were to the Attic as 5 to 3; the Euboic talent was to the Attic nearly as 4 to 3; the Tyrian was equal to the Attic; the Cilician was half the Attic, etc. The above is often called the great or silver talent. There was also a gold or Sicilian talent of about three-fourths of an ounce avoirdupois, called also the little talent. A talent in money was originally a talent's weight of silver or of gold, but the talent finally became a money of account. It was among all the Greeks the monetary unit. Its value varies with the kind of talent used and with the purchasing power of gold and silver. The Attic silver talent was smaller than the commercial talent, 72 pounds of silver, worth some $1056 of our money.

**Tal'fourd** (Sir THOMAS NOON), D. C. L., b. near Stafford Jan. 26, 1795, was the son of a wealthy brewer; studied at a dissenting grammar school, and afterward under Dr. Valpy; was entered at the Middle Temple; studied law with Chitty, the celebrated pleader, and was called to the bar in 1821; practised on the western circuit, acting at the same time as law-reporter for the London *Times;* in 1835–41, and again in 1847–49, was a member of Parliament for Reading, and in 1849 was made a judge of the common pleas. In Parliament he was especially distinguished for his advocacy of the custody-of-infants act and of the English copyright act of 1842. He was among the earliest admirers of Wordsworth, and an intimate friend of Charles Lamb, whose biographer he became, and of nearly all the prominent authors of his day. He published many speeches and essays, some of which have been collected under the title *Critical and Miscellaneous Essays of Thomas Noon Talfourd* (1842). Among his works are—*Poems on Various Subjects* (1811), *An Attempt to estimate the Poetical Talent of the Present Age*, one of the earliest public tributes to the genius of Wordsworth (1815); *History of Greek Literature*, *History of Greece*, and *History of the Roman Republic*, all originally published as articles in the quarto edition of the *Encyclopædia Metropolitana*, and afterward issued as separate volumes in the cabinet edition of that work; several distinct volumes relating to the life and writings of Charles Lamb, subsequently put forth as one work, *Memoirs and Correspondence of Charles Lamb* (1837); *Final Memorials of Charles Lamb* (1848); four tragedies—*Ion* (1835), *The Athenian Captive* (1838), *Glencoe* (1840), and *The Castilian* (1854); *Recollections of a First Visit to the Alps* (1842), *Vacation Rambles* (1844), and *Supplement to Vacation Rambles* (1846). While judicially addressing the grand jury at the Stafford assizes, he was stricken by apoplexy, and d. almost before he could be carried from the court-room, Mar. 13, 1854.

**Taliaco'tius** (GASPAR), b. about 1546; renowned for his autoplastic method of restoring lost lips, noses, ears, etc., explained in his *De Curtorum Chirurgia per Insitionem Libri II.* (Venice, 1597). D. at Bologna in 1599.

**Taliaferro** (pron. tol'liver), county of N. E. Georgia, drained by affluents of Little and Ogeechee rivers, and intersected by Georgia R. R.; surface hilly, soil generally fertile; granite, gneiss, sulphuret of iron, and magnetic ore are found. Staples, Indian corn and cattle. Cap. Crawfordsville. Area, 185 sq. m. P. in 1870, 4796.

**Taliaferro** (BENJAMIN), b. in Virginia about 1751; during the war of the Revolution served with marked distinction in Morgan's rifle corps in the actions at Saratoga and Monmouth, and at the siege of Savannah. In 1780 he acted as volunteer aide to Gen. Lincoln at Charleston, S. C., where he was taken prisoner. He took up his residence in Georgia in 1784; was a Representative in Congress 1799–1802, a delegate to the Georgia constitutional convention of 1798, and subsequently president of the State senate and a judge of the superior court of the State. D. in Wilkes co., Ga., Sept. 3, 1821.

**Tal'iesin,** a Welsh bard, said to have flourished during the twelfth century, and whose name has been handed down, together with that of the two Merlins, as the three principal Christian bards, Taliesin being styled *Pen Beirdd*, "the chief of the bards." Many compositions ascribed to him are preserved in the *Archæology of Wales*.

**Tal'ipat Palm,** the *Corypha umbraculifera* and *C. Talliera*, noble East Indian trees. The first mentioned affords great leaves, which are used for covering houses, making umbrellas, and for making a substitute for writing-paper extensively used in the East, as well as for many other purposes. The pith affords a kind of sago. The tree grows in Malabar and Ceylon.

**Talipes.** See CLUB-FOOT.

**Tal'isman** [Arab., from the Gr. τέλεσμα, "tribute"], a charm more powerful than an amulet. It is a figure cut in stone or metal at the proper astrological conjunction and with appropriate magical ceremonies. It especially averts disease and a violent death from the wearer.

**Tallade'ga,** county of N. E. Alabama, drained by Coosa and other rivers, and traversed by Selma Rome and Dalton R. R.; surface moderately hilly, soil fertile. Staples, Indian corn, cotton, and wheat. Cap. Talladega. Area, about 700 sq. m. P. in 1870, 18,064.

**Talladega,** city and tp., cap. of Talladega co., Ala., on Selma Rome and Dalton R. R., 110 miles N. E. of Montgomery, contains 6 churches (2 colored), Talladega College, a fine graded school for freedmen, a synodical institute, 1 bank, 2 newspapers, 1 hotel, and is the fifth city in the State. Pop. 1933; of tp. 2640.

EDWARD BAILEY, ED. "OUR MOUNTAIN HOME."

**Talladega,** tp., Jefferson co., Ark. P. 526.

**Tallahal'a Creek,** tp., Jefferson co., Miss. P. 280.

**Tallahas'see,** city, cap. of Leon co. and of the State of Florida, at the junction of St. Mark's branch with Jacksonville Pensacola and Mobile R. R., beautifully situated on high ground, and regularly laid out with wide, well-shaded streets and squares, has a State capitol building, a court-house, the West Florida Seminary, a State institution, with separate male and female departments, 5 churches, 2 weekly newspapers, several free public schools, the railroad car and machine shops, and a cotton-factory. P. 2023.

**Tallahatch'ie,** county of N. W. Mississippi, intersected by Tallahatchie River, and partially traversed by Mississippi and Tennessee R.R.; surface level and swampy, soil fertile. Staples, Indian corn, cotton, live-stock, lumber. Cap. Charleston. Area, about 750 sq. m. P. 7852.

**Tallahatchie River** rises in Tippah co., Miss., and after a devious course of more than 250 miles, in a generally S. S. W. direction, unites with the Yallobusha to form the Yazoo. Throughout more than half its extent it is navigated by steamboats at all stages of water.

**Tallapoo'sa,** county of E. Alabama, intersected by Tallapoosa River and traversed by Savannah and Memphis R. R.; surface hilly, soil in some parts fertile. Staples, Indian corn, cotton, and live-stock. Cap. Dadeville. Area, about 700 sq. m. P. in 1870, 16,963.

**Tallapoosa River** rises in Paulding co., Ga., and finally joins the Coosa to form Alabama River. It is 250 miles long, and is navigable by steamboats some 40 miles.

**Tallassee,** tp., Elmore co., Ala. P. 2048.

**Tallegalla.** See BRUSH TURKEY and MEGAPODIDÆ.

**Talley** (ALEXANDER NICHOLAS), M. D., b. in Washington, Ga., Oct. 27, 1827; graduated in the South Carolina Literary College 1848, and received his medical degree at the college in Charleston; subsequently pursued his professional studies in Europe, and on his return settled in Columbia, S. C., where, in conjunction with another physician, he established in 1858 a preparatory medical school; during the civil war he resided in Richmond, president of the army medical board. At its close he was elected professor of practice in the South Carolina State University; in 1870 was president of the State Medical Association.

PAUL F. EVE.

**Talleyrand'-Périgord', de** (CHARLES MAURICE), DUKE, prince of Benevento, b. at Paris Feb. 13, 1754; was compelled by his family to renounce his right of primogeniture on account of his being lame, and was educated for the Church. He studied at St. Sulpice, the Sorbonne, and at Rheims, and attracted much attention by his wit and other brilliant gifts. In 1775 he received the abbey of St. Denis, and was ordained priest in spite of the notorious licentiousness of his life; and in 1780 was chosen agent-général for the clergy. This position brought him into connection with the chiefs of the government, and so great was the admiration which his extraordinary business talent excited that in 1788 the king made him bishop of Autun. Elected a deputy to the States General, he was one of the first of the clergy who joined, and prompted his colleagues to join, the *tiers état,* and in intimate harmony with Mirabeau and Siéyes he took a prominent part in the debates of the Assembly. Oct. 10, 1789, he proposed the confiscation of all Church property, and Feb. 13, 1790, the suppression of all religious orders; July 14, 1790, he officiated at the grand national festival in the Champ de Mars, read the mass with the tricolor over the episcopal robe, and consecrated the new colors of the national guard; Dec. 28, 1790, he took the oath to obey the constitution, and when the pope excommunicated him (May 1, 1791) he resigned his episcopal see. In the Representative Assembly his speeches on the issue of assignats, on the introduction of a uniform system of weights and measures, and on public instruction, etc., evinced an intellect of the highest order, and exercised great influence immediately and afterward. Nevertheless, a rumor came out that he was conspiring with the duke of Orleans, and his friends saved him only by procuring for him a kind of diplomatic mission to London. A letter was found from Laporte, the royal steward, in which he was mentioned as a man "willing to serve the king," and his name was immediately placed on the lists of *émigrés.* He lived for some time in London, afterward in the U. S., but returned to Paris in 1796; was one of the most frequent and most conspicuous visitors of Madame de Staël-Holstein's salon, and became minister of foreign affairs in July, 1797, which office he held to Aug., 1807, with one short interruption. He had a wonderful intuition with respect to Napoleon. He recognized the immense force involved in his character, and gave him his support loyally in his struggle onward to power. He understood his plans, even before they were unfolded to him, and carried them out with eminent success. He negotiated all the various treaties of peace of this epoch —the concordat with the pope, who relieved him from excommunication and secularized him; the confederacy of the Rhine, after which he was made prince of Benevento, etc. But he also understood the faults of Napoleon. He disapproved his English policy, opposed his plans with respect to Spain, and when, after the Peace of Tilsit, an alliance was formed between France and Russia, he resigned his office and retired to his estates at Valençay. Before the Russian disaster he predicted the downfall of Napoleon, and entered into communication with the Bourbons; and during the last three years of Napoleon's career he was one of his most active and most dangerous enemies. He negotiated the first Peace of Paris, and represented France at the Congress of Vienna. Here he succeeded in dissolving the general feeling of concord with which the powers met, and produced a confusion of jealousy, mistrust, rivalry, and hatred which he understood how to use to the advantage of France. After the second restoration, however, he fell into disgrace. The reason is not well understood, but during the reigns of Louis XVIII. and Charles X. he took very little part in public life. In Sept., 1830, Louis Philippe sent him as ambassador to London, and he completely succeeded in establishing a cordial and intimate relation between the courts of St. James and the Tuileries, and concluded the quadruple alliance between England, France, Spain, and Portugal Apr. 22, 1834. Shortly after, he returned to France. D. at Paris May 17, 1838. His *Mémoires* were intended by him to be published thirty years after his death, but in 1868 the publication was postponed for twenty-two years on the proposition of Napoleon III. His political principle was the constitutional monarchy, and he seems to have worked consistently and loyally for it. But the means he employed were intrigue and deception. He had a marvellously sharp eye for the weak point in a man's character, and he imposed on all with unfailing success because he never let anybody into his secret—never allowed an angry word or a vain mien to hint that he knew anything which was not known to the whole world. Of this peculiarity, which originated simply as an elegance of manners, but which in the course of time became part and parcel of his mental organization, like the lameness of his bodily constitution, he himself has given a characteristic expression by saying, and often repeating, that "men speak only in order to conceal their thoughts."

CLEMENS PETERSEN.

**Tallien'** (JEAN LAMBERT), b. at Paris in 1769; became noted in 1792 as the editor of a Jacobin journal, *L'Ami du Citoyen;* received some appointment in the municipal government of Paris; was elected a member of the Convention by the department of Seine-et-Oise; sided with Marat; advocated the condemnation and immediate execution of Louis XVI., and attacked the Girondins with senseless fury. In 1793 he was sent to Bordeaux to exterminate the moderate party, but here he became acquainted with Madame de Fontenay, one of the most beautiful women of that time, witty, kind-hearted, generous, and frivolous, and this acquaintance suddenly changed him from an extreme radical to a decided moderate. He was immediately recalled, his name was erased from the lists of the Jacobin Club, Madame de Fontenay was thrown into prison, and he himself seemed utterly lost. But in this emergency he rallied the partisans of Danton and Hebert, and by his energy and coolness at the decisive moment the overthrow of Robespierre and the Terrorists was accomplished July 27, 1794. He now became one of the most conspicuous figures in the republic, and married Madame de Fontenay. Treated as a traitor by the republicans, and, after the fusillading of the royalists at Quiberon, also considered a traitor by the monarchists, he was driven out of the Council of Five Hundred under the Directory, and very glad to accompany Bonaparte on his campaign to Egypt as savant. Gen. Ménon, however, sent him back to France in 1800. He was captured by some English cruisers and brought to London, and here he enjoyed the last triumph of his life, being feasted and flattered by the Whig party as a hero. On his return to Paris he was divorced from his wife (who formerly had been divorced from M. de Fontenay, and afterward married the prince of Chimay) and received a pension from the First Consul. D. at Paris Nov. 16, 1820.

**Tal'lis** (THOMAS), b. about 1529; was perhaps organist to Henry VIII., and certainly gentleman of the chapel to Edward VI., Mary, and Elizabeth, and organist to the last; and has been styled "the father of English cathedral music." In conjunction with his pupil, William Byrd, he put forth *Discursus Cantiones Sacræ,* etc. (1575), which are masterpieces, and were protected for twenty-one years by Elizabeth, this being the first patent of the kind granted by her. There are also extant his *Order of Daily Service* (ed. by Bishop, 1843, and by Rimbault, 1847), *Full Cathedral Service* (ed. by Rimbault, 1847), and *Order for Morning Prayer, with the Litany Noted* (new ed. 1854). It is said that for portions of his *Service* he was indebted to Peter Marbeck, organist of Windsor. D. Nov. 23, 1585.

**Tall'madge,** p.-v. and tp., Ottawa co., Mich., on Grand River. P. 1451.

**Tallmadge,** p.-v. and tp., Summit co., O., on Atlantic and Great Western R. R. P. 1277.

**Tallmadge** (BENJAMIN), b. at Setauket, L. I., Feb. 25, 1754; graduated at Yale College 1773; taught a high school at Wethersfield, Conn.; entered the Continental army at the outbreak of the war of the Revolution; was made lieutenant June, 1776; soon after became adjutant, and ultimately colonel, of a Connecticut regiment; performed a brilliant exploit in crossing the Sound, surprising and capturing 500 Tories at Lloyd's Neck, L. I., Sept. 5, 1779, without the loss of a man of his own force; planned and executed the capture of Fort George at Oyster Bay and the destruction of British forces on Long Island May, 1780;

was engaged in several prominent battles; was a member of the military family of Gen. Washington, whose entire confidence he enjoyed; was entrusted with the custody of Maj. André, and superintended his execution; became after the war a successful merchant, and was a member of Congress 1801–17, and was one of the last survivors of the Revolutionary war who had attained any celebrity, and during his closing years enjoyed a wide and deserved veneration. D. at Litchfield Mar. 7, 1835. His *Memoirs* were published in 1859 by his son, Frederick A. Tallmadge.

**Tallmadge** (Frederick Augustus), son of Col. Benjamin, b. at Litchfield, Conn., Aug. 29, 1792; graduated at Yale College 1811; studied law under Judge Tapping Reeve at Litchfield, where he was admitted to the bar; commenced practice in New York City 1814; soon became one of the most successful advocates, and filled many public posts, including those of member and president of the State senate, judge of the supreme court of errors, recorder of New York, member of Congress 1846–48, superintendent of the metropolitan police 1857, and clerk of the court of appeals 1862–65. He became best known for the energy he displayed while recorder in suppressing the "Astor-Place riot" of May, 1849. D. at New York Sept. 17, 1869.

**Tallmadge** (James), LL.D., b. at Stamford, N. Y., Jan. 28, 1778, son of Col. James (1744–1821), an officer of the Revolution; graduated at Brown University 1798; studied law, which he practised several years, but gave his chief attention to agriculture; was for some time private secretary to Gov. George Clinton; held a military command in New York City during the war of 1812–15; was member of Congress 1817–19; introduced an amendment to the bill admitting Missouri excluding slavery from the region W. of the Mississippi; took a prominent part in the New York constitutional conventions of 1821 and 1846; sat in the assembly 1824; was lieutenant-governor 1826–27; visited Europe 1835; was instrumental in introducing into Russia several American mechanical inventions, especially cotton-machinery; was one of the founders of the University of New York; was for nineteen years president of the American Institute, and was a leading exponent of the Whig doctrine of protection to American industry. D. in New York City Sept. 29, 1853. He published a number of speeches and addresses.

**Tallmadge** (Nathaniel P.), b. at Chatham, N. Y., Feb. 8, 1795; graduated at Union College 1815; studied law; was admitted to the bar 1818; chosen to the New York assembly 1828; State senator 1830–33, U. S. Senator 1833–44, and governor of Wisconsin Territory 1844–55. D. at Battle Creek, Mich., where he had resided for some years, Nov. 2, 1864. He published some political speeches and miscellaneous writings.

**Tal'low.** This term includes the hard fat of animals, more properly called *suet*, and also those fats of a less degree of hardness; *e. g.* lard and grease, as distinguished from oils. The fats obtained from the "rendering" of animal fats of all kinds are technically known as "tallow," and are chiefly used by the tallow-chandler for the production of soap and candles. The animal fats are hard in proportion as they contain more stearine and palmitine and less of oleine. The quality of animal fats is much influenced by the mode of feeding and the quality of the food. The quality of tallow is also very dependent on its being "rendered" at a low temperature by steam, and the cleanliness of the operation, the character of the animals treated, etc.

*Vegetable tallow* is found in the seed of many plants, as its name implies. Chinese vegetable tallow is from the husk about the berries of *Stillingia sebifera;* the berries contain a liquid fat. The solid commercial product is white, sp. gr. 0.818, and melts at 99° F.; it is rich in palmitine. *Bayberry tallow*, from *Myrica cerifera*, also called "myrtle wax," is a pale-green, brittle, solid fat from the berries of the plant. It moulds in the fingers like wax when warm. It contains myristic acid in a free state, and also combined with glycerine, and a large quantity of palmitic acid, but no oleic or volatile acids (*Moore*). Other hard vegetable fats are found in nutmeg, palm oil, Japan wax, cocoa-butter, cocculus grains, and various species of *Bassia*, for a description of which see Gmelin, *Handbook*, xvi. 385–400. (See also Fats, Suet, Stearine, and under Oils.) B. Silliman.

**Tallow, Mineral.** See Mineral Tallow.

**Tal'low-Tree** (1) of the Southern U. S. and of China, see Stillingia; (2) the *Pentadesma butyracea* of West Africa, a guttiferous tree whose fruit yields a kind of yellowish tallow; (3) a name of the piny dammar tree of India, *Vateria indica*, a huge dipterocarpaceous tree, whose seeds on boiling yield an excellent white tallow.

**Tallula,** p.-v. and tp., Menard co., Ill. P. 339.

**Tallulah,** p.-v., tp., and county-seat of Issaquena co., Miss.

**Tal'ly,** a stick on which are notches and other marks indicative of an account, pledge, or other commercial transaction. In the British exchequer tallies consisting of bits of peeled wooden rods were used until 1783. The tally was split in such a way as to divide certain of the notches cut on it. One half the tally was given to the payer and one half retained by the exchequer; and the transaction might be verified at any time by fitting the two halves together, when the notches would be found to *tally* with each other if the check had not been tampered with. This rude and antiquated system, we are told, served its purpose admirably.

**Tally Ho,** p.-v. and tp., Granville co., N. C. P. 2138.

**Talma'** (François Joseph), b. at Paris Jan. 15, 1763, the son of a dentist; was educated partly in London, partly in Paris in his father's profession, but was irresistibly drawn to the stage, and made his début in 1787 at the Comédie Française as Séïde in Voltaire's *Mahomet*. His début was successful, but he produced the first great impression by his performance of the title-rôle in Marie-Joseph Chenier's tragedy, *Charles IX.*, Nov. 4, 1789, from which date he rapidly rose in the estimation of the public until in the first decade of the nineteenth century he stood acknowledged by the whole world as the greatest tragedian of his time. He was a favorite with Napoleon, who liked to converse with him, and whom he accompanied to Erfurt in 1808, where he played for a parterre of kings, and to Dresden in 1813. The Bourbons also showed him great favor, and in his art he continued unrivalled and improving till his death, Oct. 19, 1826, some of his last rôles, Sylla, Oreste, etc., being also his grandest creations. As in all manifestations of art which strike people as new and great, the novelty and greatness of his acting depended on a deeper conception of human nature and a closer, more energetic, and more veracious expression of the conception; and in one point at least his influence became decisive. Before his time the tragic heroes, Brutus, Cæsar, Catiline, Nero, etc., always appeared on the stage in a sort of fancy costume, not very different from the costume of the age, and with high powdered peruke on the head. Talma was the first to throw away the peruke and put on a correct costume. He wrote *Réflexions sur Lekain et sur l'Art théâtral* (1815), and left an *Autobiography*, which was edited by Alexander Dumas in 4 vols. (1849–50).

**Talmadge Plantation,** tp., Washington co., Me. P. 80.

**Tal'mage** (Rev. Thomas De Witt), D. D., b. in Boundbrook, Somerset co., N. J., Jan. 7, 1832. He entered New York University in 1849, graduating in 1853, and graduated from New Brunswick Theological Seminary in 1856, and the same year was called to the Reformed church, Belleville, N. J. In 1859 he became pastor of the Reformed church in Syracuse, N. Y. In 1862 he was called to the Second Reformed church of Philadelphia. In 1869 he accepted the call of the Central Presbyterian church of Brooklyn. In 1870 a new church was built of wood and iron, semicircular in form, holding over 3000 people. This was known as "the Brooklyn Tabernacle." In 1871 this building was enlarged, but was destroyed by fire Dec. 22, 1872. On Feb. 22, 1874, a massive structure of brick and stone was dedicated, and, an appeal being made, $40,000 was raised by the audience, which cancelled its debt. The new tabernacle is Gothic in style, retains the semicircular form, and has sittings for 4600. It is the largest Protestant church-building in America. In 1872, Mr. Talmage organized in the old church-building a Tabernacle Lay College for training young men who desire to enter the ministry, but cannot afford the time and expense of a regular collegiate course. The college is open to all of evangelical belief. Instruction is given by a corps of professors in general literature, sacred history, natural and systematic theology, sacred rhetoric, and the evidences of Christianity. Since Sept., 1873, he has edited an undenominational religious journal, *The Christian at Work*. He has also published 5 volumes of sermons, besides *The Almond Tree, Crumbs Swept Up, Abominations of Modern Society, Around the Tea-Table, Old Wells Dug Out, Sports that Kill*, and *Every-Day Religion*. M. H. Bright.

**Tal'mud,** a work whose authority was long esteemed second only to that of the Bible, and according to whose precepts the whole Jewish people, with the single exception of the Karaites, have continued to order their religious life down almost to the present day. In reality, it is composed of two distinct works, which were compiled at different epochs —namely, the Mishna and the Gemara. The word *Talmud* is of Hebrew origin (derived from *lamad*, to "learn"),

and had at first the same signification as *Mishna*—*i. e.* "doctrine"—but in the course of time the word, as technically applied, underwent various important modifications of meaning. In the oldest terminology of the schools Talmud came to mean "a deducing one thing from another," and designated more especially the process of seeking in the sacred writings support for laws not expressly provided therein. On this account, the Mishna, which embodied these deductions, and contained in many instances not only the new enactments, but also the scriptural authority from which they were derived, was also known as Talmud. (See Aruch, *s. v. Talmud.*) Later on, when learned disputations upon and discussions of the Mishna became more frequent in the Jewish academies, the name Talmud, as applied to the Mishna, disappeared altogether, and was then employed in a new sense, to denote these more recent discussions in contradistinction to the Mishna proper. They were also called Gemara (the Chaldaic equivalent of Talmud). It was only at a very late epoch, when for the sake of convenience the Mishna and the Gemara were no longer transcribed separately, when the Mishna was divided into short paragraphs, and to each of these paragraphs the portions of the Gemara proper to it were immediately subjoined,—it was then only that it became customary to apply the name Talmud to the whole great work consisting of both Mishna and Gemara.

A. *Mishna.*—The name Mishna does not signify, as has been erroneously held by some, the second—*i. e.* the oral—law as distinguished from the written law of the Pentateuch. Greek writers have indeed rendered it δευτέρωσις, but this is due to a misapprehension of its proper meaning. It signifies simply "doctrine." It was used to designate, first, each individual ordinance; secondly, a group of interconnected ordinances; lastly, the entire system of ordinances; and thus it came to be used for the whole great compilation now known as the Mishna. In the Talmud of Palestine, however, each individual Mishna is called Halacha.

(*a*) *The Structure and Arrangement of the Mishna.*—It consists of six divisions (*Sedarim*, literally, "orders"): (1) *Seraim*, seeds and products of the field; (2) *Moed*, festival celebrations; (3) *Nashim*, laws relating to women; (4) *Nesikin*, legal provisions; (5) *Kodoshim*, sacred things; (6) *Toharoth*, the distinctions of clean and unclean. Each division is subdivided into *Mesachtoth* ("tracts"), of which the first division has 11; the second, 12; the third, 7; the fourth, 10; the fifth, 11; the sixth, 12—being altogether 63 tracts. (Maimonides and others count three tracts of the fourth division as one; and this explains why the whole number of tracts is occasionally given as 61.) Each tract is again subdivided into *Perakim* ("chapters"), of which the total number is 523, and each chapter into paragraphs. The order of sequence of the Sedarim, as well as that of the tracts which belong to each, is fixed and undisputed. (There is no conclusive evidence to support the assertion of Brück (*Pharisäische Volkssitten*, p. 10) that the original subdivision of the Sedarim differed from our own.) Concerning the sequence of tracts and chapters, however, and the proper subdivision of the latter into paragraphs, the same unanimity does not exist. In this respect some difference appears between the two versions of the Mishna (that of Palestine and that of Babylon), as well as among the early commentators, and also in the various editions of the Talmud.

A strictly methodical arrangement and disposition of the subject-matter of the Mishna is not apparent. Matters are occasionally brought up for discussion in tracts to which they do not belong, and are omitted elsewhere where we have a right to expect them. The same thing is repeated twice and even three times in different places, and discussions relating to the most diverse subjects are connected into a single series with sole regard to a general resemblance in the didactic forms of presenting the subject. On the whole, however, the plan of the work is clear and lucid, and, considering the vast material which it was intended to embrace, amply deserves our admiration.*

(*b*) *The Origin, Enlargement, and Close of the Mishna.*—During the whole epoch of the first Temple the Mosaic religion was almost entirely neglected. After the return of the Jews from captivity in Babylon, Esra the Sofer ("scribe") was actually the first to recall it to life. But he was compelled by the altered circumstances of the time to enlarge, complete, and in many respects remodel it. A system of theocracy like that laid down in the Pentateuch, intended to embrace the entire public and private life of man, could not but require important modifications when nearly all the relations of life had undergone change. Not only the forms of temple-worship, the many dietary laws, and laws of Levitical purity, but even the agricultural regulations and the whole judiciary code, had to be included in the work of reconstruction. A thousand problems urgently demanded solution; and Esra solved them. His word became law. His successors, called after him Soferim ("scribes"), otherwise known as the "Men of the Great Assembly," continued his work in the spirit of the master. That which they taught and ordained received the sanction of popular practice, and came to be looked upon as the rule of life. When they retired from the scene, the Sanhedrin of Jerusalem took their place, became the chief tribunal, and decided whatever doubts and difficulties arose. From its decisions there was and could be no appeal. Thus, in the course of several centuries a vast stock of laws and usages had accumulated, which the Tora did not directly authorize, but which had been transmitted orally from generation to generation, till at last the accumulated mass became too unwieldy for the unassisted memory. Academies arose for the cultivation and propagation of this stock of tradition, and simultaneously efforts began to be made to found the traditional enactments upon a biblical basis and support. This tendency received an additional impetus by the fact that the germs of Sadducean opinions began to manifest themselves, and men arose who unhesitatingly declared everything not founded on the words of the Law a dangerous and blameworthy innovation. The discussions in the academies became more frequent, opinions conflicted, and finally the mass of traditions, together with the discussions to which they gave rise, threatened to become a labyrinthine chaos. Then arose Hillel the Elder, also called the Babylonian, because descended from a noble Jewish family in Babylon. After he had been installed (B. C. 32) as patriarch in Palestine, and at the same time became the head of a numerous and learned school, he arranged the mass of traditional laws in six Mishnic divisions; and this general arrangement was accepted by all his successors. He was also the first to lay down hermeneutic rules, seven in number, for expounding the written law and widening its scope. But, while Hillel introduced a new method of interpreting Scripture for the sake of extending its provisions, he did not himself pursue his method to the utmost limits. In like manner, in the arrangement of the traditional laws in six main groups he confined himself to the proposal of the general plan—a plan to which he no doubt adhered in his own teaching, leaving, however, to later authorities the task of further applying and perfecting it. It was long, indeed, before such authorities arose to continue his work. For almost a century and a half history is silent about any efforts in this direction. R. Elieser b. Jacob, head of a school which flourished shortly after the destruction of the Temple, is, it is true, mentioned with commendation because his Mishna was *kab wenaki* (brief and concise), but it is doubtful whether the words "his Mishna," as here used, refer to a collection of Mishnas, or merely to his mode of instruction. At all events, even if the former is meant, we are only justified in concluding that R. Elieser was the author of a kind of epitome, not that he elaborated a complete work. It was R. Akiba, the celebrated martyr to his religion and patriotism, who first took up the task which Hillel had begun. He was the greatest of the Talmudists of his own and of succeeding times—the man of whom, as the legend says, even Moses was for a moment jealous when in a vision he surveyed the generations of the distant future. His keen and penetrating intellect enriched the substance of tradition with many valuable deductions of his own. But besides this, being impressed with the importance of systematic arrangement, he also instituted a more correct division and a more skilful disposition of the material which had thus far accumulated; and in this way laid the foundation of the Mishna as it now exists. Among all his distinguished disciples, R. Meir holds the highest rank. (His real name was *Nehorai*, "the enlightened one," but his contemporaries preferred to call him *Meir*, "the enlightening one.") He continued to build up the work of the Mishna in the spirit of his master; and to him the most ancient of the Gemarists agree in ascribing the majority of the anonymous canons contained in the Mishna. Yet with all these endeavors the great work still remained a mere fragment.

Then arose R. Jehuda, also called simply "Rabbi." Since the year 120 A. D. he had been clothed with the patriarchal dignity; he was a descendant of Hillel in the seventh generation, and a man of uncommon ability and lofty virtue. He made it the business of his life to establish a code of undisputed authority among his people

* Long after the close of the Talmud a number of tracts, composed in the form of the Mishna and treating of different questions of the Law, made their appearance, which are appended to our editions of the Talmud under the general title of "Minor Tracts." Besides these, seven lesser tracts were edited in 1851 in Frankfort-on-the-Main, by R. Kirchheim, from an ancient manuscript; and others of the same kind are said to exist in Northern Africa (see Jost, *Geschichte des Judenthums*, ii. p. 238). They are all of Palestinian origin, of obscure authorship, and have never been regarded as authorities.

in order to ensure unity of religious observance. With this end in view, he undertook to bring to a close the work which his predecessors had begun, and even considerably advanced, but which still remained unfinished, and therefore did not command general recognition. Although strictly adhering to the traditional arrangement, he examined anew the whole vast accumulation of ordinances which centuries had contributed to heap up, and sifted and arranged them. He abridged in one place and amplified in another; now he gives merely the canon, without mentioning the name of its author, and again he quotes both name and title in full; contenting himself sometimes with stating only the conclusion arrived at, repeating at other times the whole argument; and in still other instances adding his own decision to the record of conflicting opinions. In short, his indomitable energy and rare independence of spirit enabled him to master the whole difficult subject. He was the last, the most devoted, the true author of the Mishnic compilation.* It is deserving of remark that Rabbi preserved the teachings of the Fathers not only in their general purport, but that he incorporated them into his work, so far as they met with his approval, in exactly the form in which he had received them. In this way the diversity of style and mode of expression which the Mishna exhibits in different places is explained, and the critic is thus enabled frequently to distinguish its component parts, separating the older from the more recent. Thus, the greater antiquity of the opening passages of the tracts is attested beyond a doubt by their terseness and the peculiar grammatical forms and constructions employed. The like certainty is, of course, no longer attainable throughout. The compilation of the Mishna was finished by Rabbi. Here and there a few additions were made by later teachers, of which the greater part fall under the head of Hagada. They are chiefly to be found at the end of the tracts. Whether the division of the Sedarim into tracts was the work of Rabbi or of his predecessors whom we have mentioned above, it is impossible to decide. Certain it is, that the tracts, as such, were known to the doctors of the Gemara, since the Gemara occasionally cites them by name and argues the question of their proper order of sequence. As regards the division of the tracts into Perakim, Frankel has conclusively shown (*Darke ha-Mishna*, p. 264) that the Babylonian Gemara was already familiar with it. The arrangement of the chapters, however, in their present order was (according to Seder Tanaim We-Amoraim; see *Kerem Chemed*, iv. 189) the work of the Sabureans. The precise year in which Rabbi applied the finishing-touch to his work cannot be ascertained. Certain it is, that late in life he undertook a complete revision, and prepared, as it were, a second edition of the Mishna, in which (according to Tr. Shebuoth, p. 4) he not only inserted many new canons, but even such as directly contradicted decisions in the previous edition, without cancelling the former. Whether this was done with a distinct purpose in view, or from mere inadvertence, we cannot tell. Thus, the origin of various discrepant statements in the Mishna becomes clear. The period of time which includes the men who are mentioned as authors of canons in the Mishna extends over five and a half centuries—namely, from the last of the scribes to the death of Rabbi; and the number of those thus distinguished by name, taking no account of such general quotations as "the scholars say," "the school of Shamai," "the school of Hillel," "the ancient doctors," and the like, amounts to more than 100. In the post-Mishnic epoch the name Tanaim (teachers) was applied to those who had advanced opinions of their own in the disputations of the academies. The line of Tanaim commences with the foundation of the academies—*i. e.* with Shamai and Hillel; it extends through six generations, over a period of 210 years.

(*c*) *Language of the Mishna.*—The language of the Mishna, though essentially Hebrew, differs from the more ancient Hebrew of the Bible in important particulars. This difference is due partly to the natural development which the language had undergone, and partly to its fusion with the Aramaic dialects, especially with the Syriac and Samaritan. The advanced stage of the Hebrew of the Mishna appears first in the fact that new and modified meanings have, in numerous instances, sprung up by the side of the old; secondly, in the invention of new terms to express more modern and more comprehensive ideas; lastly, in the formal changes which biblical words had undergone in order to adapt them to the expression of new modes of thought. These changes consist mainly in the formation of new derivatives from biblical primitives, and, conversely, in the employment of ancient derivatives to serve in turn as primitives. At the same time, it would be wrong to refer words and word-meanings to the invention of the Mishnic epoch simply because, at first sight, they appear to be wanting in the vocabulary of Scripture. Many of them are no doubt relics of the time when Hebrew was the vernacular, such as still lingered in the memory of the people. On this account the language of the Mishna may frequently be applied with advantage to the explanation of difficult passages of Scripture, as the example of the oldest commentators and many of the best Jewish grammarians and exegetists of later times amply proves. As to the influence of the Aramaic of which we have spoken above, suffice it to say that not only were Aramaic words received bodily into the language of the Mishna, but in its grammatical forms and syntactical constructions the latter bears also the deep impress of its sister dialect.

Besides this, the direct intercourse of Palestine with lands of Grecian culture favored the introduction of many Greek terms, and also, indirectly, of some Latin ones. These were used especially to designate objects and ideas till then unknown, and being familiarly employed in the language of the common people, they were admitted into the Mishna as well. Most of them, however, passed through Syrian channels on their way to Palestine, and they appear more or less modified in form to suit the exigencies of the Syriac. This explains why in the case of some such words the corresponding Greek word and its meaning are evident at the first glance, while others, though their Greek origin is equally evident, are quite uncertain in meaning, and admit of widely divergent explanations.

(*d*) *The Composition of the Mishna.*—That the Mishna was not cast in a single mould must be plain to every one who is acquainted with its contents, form, and language. It is a composite work. It consists of ancient and more recent elements; it embraces fragmentary compendiums in which the premature attempts of a previous age at codification are apparent. The manifest and manifold incongruities which the work exhibits in every direction are capable of explanation on no other hypothesis. We have already observed above how in many places the Mishna simply lays down the Law, omitting to mention the conflict of opinions that existed in regard to it, and which is sometimes reported in other parts of the work, while elsewhere even the slightest diversity of opinion is carefully noted. Often a mere summary of the ordinances and disputations is deemed sufficient; then again, the whole argument in all its details is repeated. Could we for a moment attribute inconsistencies such as these to so thoughtful and circumspect an author as the editor of the Mishna, supposing him to have been fettered by no other consideration than that of compact and logical arrangement? But there are other and more remarkable anomalies to be noticed. Let us briefly indicate a few of the most important. *Repetition.* (1) Certain ordinances are twice and three times repeated in various connections, and form parts of various distinct series. The principle of unity which governs such a series may be that of common authorship, whether of an individual teacher or a school; it may be the uniform employment of some particular method of deduction; it may be nothing better than mere outward agreement in the form of expression. (2) Occasion offering, the whole of a series is repeated, or a part only. (3) Either all or some few of the ordinances thus repeated are abridged or developed and enlarged, while again, at other times, the repetition takes place without any modification at all. (4) One and the same ordinance is sometimes supported by totally different arguments in the different places in which it occurs. (5) Certain ordinances are omitted in those tracts to which they properly belong, and are introduced in others where their connection is purely formal. All this points with unmistakable certainty to the conclusion that a considerable number of minor compilations already existed in the days of the compiler of the Mishna—that he adopted them as he found them into his larger work, and arranged and inserted them in such order as seemed to him most fitting.

(*e*) *Reduction of the Mishna to Writing.*—It was an undisputed principle with the men of the Talmud that the traditional law, elaborated in their academies, ought not to be committed to writing. There was to be one holy "Scripture" only. It is a fact that, nevertheless, the Mishna and the Gemara were actually written down. Later writers seek to reconcile the two facts by explaining that upon the authority of a certain passage in the Bible it was deemed better to transgress a single precept than to suffer the whole body of traditional precepts and laws to fall into neglect and be forgotten. Concerning the exact time at which the Mishna was written down, diversity of

* The assertion of Zuckermandel (Grätz, *Monatschrift*, 1874, and *Die Erfurter Handschrift der Tossefta*, Berlin, 1876) that the Mishna is not the work of R. Jehuda, but was edited in Babylon, made as it is in bold opposition to the overwhelming testimony of both Gemaras, and founded as it is simply on the wildest hypotheses, need only be stated to be at once rejected by common sense.

opinion has prevailed among the most eminent Jewish scholars during the last nine centuries. Rabbi arranged the Mishna in his own mind without the help of pen, delivered it, the same in form and contents as it stands to-day, in his academy, and thus transmitted it by word of mouth to his disciples. They again delivered it to succeeding generations, and it was thus preserved with verbal accuracy down to the time (exactly when no one can say) when the academies sank in importance, and the authorities of the day (who these were is again uncertain) found it necessary to fix the existing stock of traditions in writing. Such is the opinion of the "spirits that deny," at their head Sherira the Gaon (tenth century), in his celebrated *Iggereth* ("Epistle"). He was followed by Sal. Jizchaki, called Rashi (eleventh century), in his commentary on Baba Mezia, 33 *a*, and on Erubin, 62 *b*; by Moses Coucy (thirteenth century) in the preface to his *Book of Commandments*; by Tosaphoth on Megilla, 32 *a*; by Jac. Chagis (seventeenth century) in the preface to his commentary to the Mishna; in modern times by S. D. Luzzato in the preface to *Oheb Ger* and in *Kerem Chemed*, iii. p. 62; by Rapoport, *ibid.*, p. 48, and vii. p. 157; by Reggio, *ibid.*, p. 80; by Hirsch Chajuth in *Mebo Ha-Talmud*, p. 27 *a*, and in *Torath Nebiim*, p. 7; lastly, by Jost, *Gesch. d. Judenth.*, ii. p. 121; Grätz, *Gesch. der Juden.*, iv. p. 244, and in Frankel's *Monatschr.* for 1862, p. 272, and 1873, p. 35. Opposed to these we find a series of scholars, no less eminent, who affirm—some of them also adducing proof—that Rabbi himself wrote out the Mishna in full. They are the following: Samuel the Nagid (eleventh century) in the introduction to his *Mebo Ha-Talmud*; Mose ben Maimon, called Maimonides, in the preface to his commentary on the Mishna, in the preface to his *Mishneh Torah*, in his notes to *Mishna Sanhedrin*, 5, 2, and in the *Iggereth*, p. 53 *a*; Bechaij ben Asher (thirteenth century) in his commentary on the Pentateuch, *Ki Thissa*, p. 122; David ebn Simra (sixteenth century) in the *Responses*, iii. 232; Lippman Heller (seventeenth century), notes to *Mishna Yebamoth*, 3, 6; finally, in our own day, Geiger in *Wissensch. Zeitschr.*, iv. 412, and Frankel, *Darke Ha-Mishna*, 217. A unique and peculiar view, forming a compromise, as it were, between the opposing parties, is that maintained by Gedalja ibn Jachija in his *Shalsheleth*, p. 23 *b*. He holds that Rabbi did, indeed, commit his work to writing, but not as a well-arranged whole, but in scattered sheets which were afterward united. In our opinion, the arguments which Geiger and Frankel have adduced in support of their opinion ought to convince every impartial judge. Those who are still inclined to reserve their judgment in the matter may find additional proof in the foregoing paragraph on the composition of the Mishna.

(*f*) *Authenticity of the Mishna.*—The text of the Hebrew Bible was guarded with jealous care by the Masorah; its letters were counted, and every trifling detail rigorously investigated and determined. Yet it did not escape important modifications in the course of time, as the numberless diverse readings of the manuscripts attest. Such alterations may be looked for in still greater profusion in a work like the Mishna, which never enjoyed the same advantages, and which passed through the hands of so many copyists and compositors. The Mishna is to-day before us in three recensions—one embodied in the Babylonian Talmud, another in the Talmud of Palestine, the third being the complete collection of the Mishna, published separately, without the commentaries of the Gemara. All three differ, not only in points of style and verbal expression, but often even in the subject-matter. As appears from the writings of the older commentators, the text of the Mishna which was before them differs in many places from that of any of the three recensions mentioned above. Negligence and misapprehension proved fruitful sources of confusion. Especially was this the case with respect to the names of the doctors. As it was for the most part customary to designate these names by abbreviations, as many of the names, moreover, were closely akin in sound, the chances of error were multiplied, and the true authorship of various ordinances rendered uncertain—a circumstance which has contributed not a little to impede the progress of investigation. However, we ought not to charge the inroads upon the work of Rabbi solely to the transcriber and the printer. Frankel has shown (*Mebo*, p. 20) that even during the lifetime of Rabbi, and soon after his death, the great authorities in Palestine did not scruple to subject his work to revision, making such additions and alterations that in the very next generation no less than three different redactions of the Mishna existed in Palestine. Under these circumstances it does not appear strange that criticism of the text of the Mishna should have begun at a time when textual criticism in any other field was utterly unknown. It plays an important part in both the Gemara of Babylon and of Palestine, but with a remarkable difference. The doctors of Babylon were acquainted with the Mishnic text in one shape only—that, namely, which R. Abba, commonly called Rab, had brought to Babylon about 219 A. D. They were thus led to indulge in the most far-fetched combinations, to adopt the most impossible conjectures, whenever some difficult or corrupt passage came up for explanation; and even where these means did not avail, and a correction of the text seemed absolutely necessary, they nevertheless contented themselves with merely suggesting the correction, without daring to alter the inviolable text itself. The doctors of Palestine, on the other hand, being familiar with several redactions of the Mishna, were accustomed to employ greater freedom in dealing with a text thus uncertain, and but too often solved a knotty point by the arbitrary method of changing the reading to suit the occasion. Tiberias, the chief seat of Palestinian learning, which did so much toward securing and preserving the text of the Bible, was culpably lax in dealing with a work that had arisen on its own soil. It can hardly be hoped that the acumen of scholars will ever succeed in restoring the Mishna to its original form.

(*g*) *Commentaries on the Mishna.*—The Mishna being the stock and essential component of the whole Talmud, the attention of Jewish scholars was directed at a comparatively early period to its elucidation. Maimonides (twelfth century) heads the list with his commentary, written in Arabic (though it has been published only in a Hebrew version). He was followed by R. Tanchum of Jerusalem, who wrote a lexicon of the Mishna, also in Arabic, which has never been published at all. The only four copies of the MS. extant are contained among the treasures of the Bodleian Library at Oxford. Since then an uninterrupted series of Hebrew commentaries, written by prominent rabbis, either upon the whole or some select few of the Mishnic tracts, have continued to appear down to the present day; and it is but just to these authors to remark that, though differing in scientific capacity, they have all conceived their task worthily, and have faithfully striven to fulfil its requirements. They have all, without exception, aimed at a clear, simple, and correct understanding of the text, nowhere suffering themselves to be betrayed into mere scholastic subtlety.

(*h*) *Translations of the Mishna.*—Since about the middle of the seventeenth century the desire to become acquainted with the contents of the Mishna was manifested also by Christian scholars, and from this time we may date the period of *translations*. Such translations have at various times been given to the world in the Latin, Spanish, Italian, French, English, and German languages. They embrace either all or only single portions of the Mishna, some being accompanied by annotations, while others are without them. The middle of the eighteenth century beheld a further step in advance in the beginnings of a methodical investigation of the Mishna in the interest of linguistic studies. A number of Christian scholars attempted, though with slender success, to determine the character of the Mishnic idiom. It was reserved for the present century, and more particularly for the last few decades, to see eminent men like Hartmann, Landau, Loewisohn, Geiger, Dukes, Luzzato, Frankel, and others turn their efforts into this channel. They explored the whole territory of the Mishna in different directions, pursued their investigations with energy, ability, and devotion, and in various valuable works laid down the results of their labors. (For the details of this literature, as also for an account of the numerous editions of the text of the Mishna, see Fürst's *Bibliotheca Judaica*, ii. p. 40 *seq.*) We may add, as a literary curiosity, that some one has gone to the trouble to provide every word of the Mishna with accents of vocalization, probably because it was customary to recite it in the schools to the accompaniment of a kind of chant. The work has not been printed, but was seen and mentioned by Jos. Sal. del Medigo (b. 1591). (See *Mazref la Chochma*, p. 22.)

B. *The Gemara.*—The term *Gemara* is of Aramaic origin, and its signification is the same as that of Talmud—"teaching." Like the latter term, it is frequently employed to designate the method of deduction current in the schools of the rabbis. It was also used in the sense of tradition (the teaching communicated by one doctor to another). In common parlance it denotes the whole body of controversies and teachings which arose in the academies after the close of the Mishna, and which, being collected in writing, now form the second and major part of the work of the Talmud. There are two different Gemaras—the one elaborated in the academies of Babylon, the other having Palestine for its birthplace. The customary appellation applied to the latter, "the Gemara of Jerusalem," is erroneous. After the destruction of the temple by Titus, no academy existed in Jerusalem, and it was, in truth, Tiberias to which pre-eminence as the chief seat of Palestinian learning rightfully belonged.

(*a*) *The Gemara in its Relation to the Mishna.*—The relation of the Gemara to the Mishna is commonly described as that of a commentary to the text; and this description, though by no means complete, is correct enough as far as it goes. The Gemara uniformly attaches its discussions to the words of the Mishna, explains terms and things wherever necessary, seeks to elucidate difficulties and to fortify the Mishnic ordinances by adducing proofs for the same. It endeavors to harmonize discrepant statements, and to refer anonymous decisions to their proper authors. At times it takes occasion to trace the plan adopted by the Mishna in arranging and grouping its contents. In explaining the Mishna the Gemara never loses sight of extra-Mishnic compilations in which the same subject is treated, and discusses at length whether and to what extent both may be brought into agreement. Furthermore, it formulates new ordinances, these being in part based upon previous decisions, in part distinct and independent productions. Finally, it reports in full the harmonious or divergent opinions, and the controversies that took place in the academies in respect to all these and kindred subjects. To this extent the Gemara is, indeed, a vast and comprehensive commentary on the Mishna. On account of this, its most distinctive feature, the authorities of the Gemara who lived subsequently to the close of the Mishna, are called *Amoraim* ("expounders") in contradistinction to the Mishnic authorities, who are known as *Tannaim* ("the original teachers").

But the Gemara is more than a mere commentary. It has sedulously gathered, without any reference to their connection with the Mishna, whatever utterances had for centuries dropped from the lips of the great masters, whatever tradition had preserved concerning their life and actions, whatever bears directly, or even distantly, upon the great subjects of religion and ethics. Thus, it contains *legal enactments, homiletical exegesis of Scripture, gnomes, moral maxims, popular proverbs, parables, tales, manners and customs*, both of the Jews and of other nations. Beside these, there are also *medical, mathematical, astronomical, scientific* data, etc. (Dogmatic doctrines, like those of revelation, of reward and punishment, the future state, the resurrection of the body, the judgment of the dead, the coming of the Messiah, and the like, are taken for granted in the Gemara, and seldom mentioned. Only a few of these points are now and then brought up for discussion.) This vast and complex material is distributed throughout the different portions of the great work, as the name of an author, a casual quotation from Scripture, or some other coincidence in thought or style presents the semblance of a *point d'appui*.

The Talmud itself assigns its various component elements to two distinct classes, which are distinguished both in name and in substance. To the one class belong all laws and regulations that bear upon the practice of religion. These include the ritual and ceremonial, the civil and criminal laws, and also the chief heads of ethics. This class is called *Halacha*, a term meaning originally "custom," then "law." Everything else is embraced under the term *Hagada*, or, as it is written in Chaldaic fashion, *Agada* (and also *Agadetha*), meaning "that which is narrated," "delivered in a discourse." In general, the term Hagada refers to mere individual utterances in which no general and binding authority resides. There are, however, some Hagadistic sentences which, entering deeply into the region of faith, became so hallowed by tradition, so profoundly rooted in popular belief, that even the Halacha does not scruple to employ them as the basis of some of its enactments. (See *Tr. Arub.*, 43 *b*.) Of the two classes mentioned above, the Mishna is exclusively occupied with Halacha. A few Hagadistic elements crop out sporadically in its pages, chiefly at the end of the tracts, but they were undoubtedly later additions. A single Mishnic tract (*Aboth*, "Fathers"), and that one of pre-eminent importance, is exclusively devoted to Hagada; but this too is of later origin, as Frankel has rightly conjectured (*Darke Ha-Mishna*, p. 216).

(*b*) *Ancient Elements in the Gemara.*—Shortly before and after the close of the Mishna a number of prominent authorities undertook to prepare various collections of ordinances and disputations. They interspersed the sterner Halacha with more or less Hagada. They differed in the methods employed. A few of these compilations, though considerably expanded by later writers and greatly corrupted in the course of time, are still preserved. They are—the *Tosephta*, composed after the manner of the Mishna, the *Mechilta*, *Siphra*, and *Siphri*, all three arranged in the form of a running commentary on the Bible. Other collections there were of the same kind, which, though they have long since disappeared, were still extant, and more or less esteemed, in the time of the Amoraim. They bore the general title of *Mathnitha* ("collection of teachings"), rarely *Beraitha* (meaning "extraneous productions," with reference to their being extra-Mishnic compilations). In the post-Talmudical period, however, the name *Beraitha* came to be applied to them to the exclusion of their former title. These Beraithoth are often quoted in the Gemara, sometimes for the purpose of throwing light upon obscure passages of the Mishna, at other times with a view to determining their own value or the reverse, and not unfrequently for the sole purpose of extending the scope of the disputation. The Beraithoth, as they appear in the Gemara, present a spectacle of sad confusion, and offer no little difficulty to the student. Some of them are similarly repeated in both the Palestinian and Babylonian Gemara; others, again, differ largely in expression and in the subject-matter. Nay, the same Beraitha as cited in the two Gemaras appears as containing contradictory assertions. When a Beraitha occurs both in Tosephta, Mechilta, etc., and in the Gemara, its reading sometimes agrees with that of the Babylonian, sometimes with that of the Palestinian Gemara; at other times it diverges from both. We may add that many Beraithoth, quoted from the lost collections above referred to, are to be found in the Gemara of Babylon only, others exclusively in that of Palestine. At all events, the Gemara deserves credit for having preserved these ancient elements. It is the business of the critic to determine how far they have been correctly transmitted, and to restore, if possible, their original shape.

(*c*) *Scope of the Two Gemaras.*—The Gemara of Babylon does not cover more than thirty-seven of the Mishnic tracts. Of the first and sixth divisions, one tract only in each has been supplied with Gemara, evidently because, with the exception of those two tracts, the laws with which these divisions are concerned had become obsolete after the destruction of the temple. The like cause did not prevent the tracts of the fourth division from being commentated, though they deal for the most part with the laws of sacrifice, and on this account appear to be no less antiquated than the others. The reason is, that, in the opinion of the Talmudists, the sacrificial rite was not restricted to the temple proper, but might at any time be resumed on its former site; also, because the study of the sacrificial law was deemed equally meritorious with the performance of the sacrifice itself. (See Rashi, notes to *B. Mez*, p. 114 *b*.) Gemara is wanting for the tract Shekalim of the second division, which likewise treats of matters relating to the temple and the hierarchy; also for two tracts of the fourth and two of the fifth division. In the latter instance the omission is partly due to the same cause which has just been described, partly to other and subtler causes too complex to be included within the scope of the present article. It would be erroneous, however, to suppose that the tracts omitted in the Gemara were on that account entirely neglected by the Amoraim of Babylon. On the contrary, most of the topics of these tracts are frequently mentioned in the Gemara of other tracts, and have there become the subjects of elaborate disputation; and yet the claims of these tracts were not considered equally urgent with others, and the editor of the Gemara contented himself with the assurance that whatever they contained of any importance had received sufficient attention by its casual discussion in diverse scattered portions of the work.

The Gemara of Palestine, as we possess it, extends over thirty-nine tracts, among which are all the tracts of the first division, and the tract *Shekalim*, wanting in the Babylonian Gemara. On the other hand, in the Palestinian Talmud there is no Gemara for any tract of the sixth division, and all the tracts of the fifth division, though fully discussed in the Babylonian Gemara, are wanting in the Gemara of Palestine. The text of the Palestinian Gemara is full of gaps, even in the tracts which it annotates, and sometimes whole chapters are missing. Considering both what it still contains and what has perished, we are led to conclude that the Palestinian Gemara was originally designed to embrace, and actually did embrace, the whole of the Mishna without any exception, and that so much of it has been irretrievably lost is due to the force of adverse circumstance that weighed so long and so heavily upon the Jews of Palestine and their academies. Apart from these considerations, we find abundant evidence in the writings of the elder commentators to show that they were acquainted with portions of the Palestinian Gemara which are now missing.

(*d*) *The Language of the Two Gemaras.*—The ancient Aramaic branched off in the course of time into East Aramaic or Chaldaic, and West Aramaic or Syriac. The former continued to preserve its close relationship to the Hebrew; the latter diverged gradually more and more from it. On this account, the Babylonian Jews, while in general they accepted the Chaldaic vernacular, introduced Hebrew words and phrases bodily into it, and also "Chaldaicized" Hebrew terms. In a certain sense they spoke a mixed dialect of Hebrew-Chaldaic, somewhat as the German Jews in the Middle Ages originated a so-called Jewish-German dialect. In this mixed Hebrew-Chaldaic dialect

the Babylonian Gemara is written. It is a Chaldaic idiom, nearly approaching the Hebrew, but it has suffered so much from popular caprice and negligence that it appears quite impossible to refer its linguistic phenomena to strict grammatical rules. The Palestinian Gemara is written in the popular dialect which prevailed in Palestine at the time of the Amoraim—*i. e.* in the Syriac, with but a very slight sprinkling of Hebrew. This vulgar Syriac dialect is marked by the following peculiarities: first, letters belonging to the same organ of speech frequently interchange, especially in the case of gutturals and labials. Secondly, words are abbreviated; two or even three short words are combined into one, whole syllables are omitted at the beginning of words —*e. g. mar* for *amar, ba* for *abba*. By the joint effect of interchange and omission the original *Abba* was even attenuated to *Wa*. Thirdly, many Greek words and phrases occur, for which the dominion of the Greeks, and, at a later period, of the Romans, in Syria easily accounts. These foreign words were greatly corrupted in the speech of the people, and their etymology is therefore encumbered with very serious difficulties.

(*e*) *The Form of Discussion in the Two Gemaras.*—In *style* and *form* both Gemaras exhibit the common attribute of pregnant brevity and succinctness; elliptical expression is a constantly recurring feature; whole sentences are often indicated by only a single word in the text. Thus, *e. g.*, *minai*, "whence," stands for "whence do you draw the proof of your assertion?" *Miklal*, originally only meaning "from other statements"—*i. e.* "from other statements it follows"—enlarged its meaning in the later terminology of the schools, came to mean inference in general, and in this sense is to be rendered by the phrase "from which we may conclude."* One of the features of this excessive brevity of expression is that question and answer are stylistically so closely interwoven, and there is such an entire absence of any indication of the separating line, that the practised eye of an experienced scholar alone can distinguish where the one ends and the other begins. The Palestinian Gemara is even still more economical in the use of words. Examples will be found in Frankel's *Mebo*, p. 17 *seq.* In the *material and method* of discussion a characteristic difference divides the two Gemaras—a difference which, however, appears already between the more ancient and younger Amoraim of Babylon. The former aim at condensation, seek to elucidate the subject-matter by following the prevailing rules of exegesis and deduction, and, as for the rest, restrict themselves to the use of plain and simple terms. The younger Amoraim, particularly since the days of Abaye and Raba (about the middle of the fourth century), are far less anxious to discuss only for truth's sake. They argue for the sake of the mental exercise, and are fond of indulging in intellectual tournaments; they love to raise artificial difficulties where none are apparent, to intertwine the threads of argument and to unravel them again, and thus, with a prodigious display of hair-splitting dialectics, to raise a towering mountain of discussion on the basis of the merest trifle. It is true, the Babylonian Gemara affirms its preference for plain, matter-of-fact learning (though in this it simply endorses a dictum of Palestinian origin), which it symbolically calls "Sinai," and places it above dialectical shrewdness, which it designates figuratively as "the uprooting of mountains." (See end of Berachoth and Horioth.) And yet the latter obtained the ascendency both in the discussions of the schools and in practical life. While in former times it had been customary to follow the older school of Amoraim in cases of conflicting authority, the decisions of the younger being practically ignored, the rule was reversed since the days of Abaye and Raba. So much for the Babylonian Gemara. That of Palestine refrained altogether from all such attempts at unbridled dialectics, and from first to last confined itself within the proper limits of calm and temperate discussion. We have observed that sobriety on the one hand, and extravagance and subtlety on the other, are the distinguishing features that mark the Halacha of the Palestinian and Babylonian schools. The same traits are no less evident in their respective treatment of the Hagada, only that in this case each method reveals advantages and disadvantages of its own. The Palestinian Hagada is purer, more rational, freer from superstition and mysticism, little interested in demons, magical arts, and supernatural things in general. On the other hand, it is often prosy, unattractive, and rarely appeals to any deeper emotion; while the Babylonian Hagada, with all its gross exaggerations, and with all the superstitious rubbish which it borrowed from the Parseeism that surrounded it on all sides, and which it mingled with the noblest moral principles and dicta, yet exhibits greater vigor and a richer fund of sentiment; and in consequence of these its method of presentation is often suffused with a poetic coloring.

(*f*) *The Teachers of the Two Gemaras.*—From the time of the older Amoraim (end of the second century) to the middle of the fourth century, when the disorders of war and the insecurity of the roads put an end to regular intercommunication, an unbroken bond of friendly reciprocity had connected the high schools of Palestine and Babylon. Young students from Babylon, eager for knowledge, and with them many a riper scholar, sought the Palestinian academies, to return to their homes after years of absence and after enriching themselves with fresh learned material. Occasionally, though less often, it would happen that Palestinian scholars emigrated to Babylon and enriched the minds of their brethren with the new stores of erudition which they brought with them. This explains how it happens that names and teachings of Palestinian authorities are met with in very considerable number in the Gemara of Babylon; while, conversely, though not to the same extent, the opinions of Babylonian masters found a place in the Gemara of Palestine. Even the surprising fact that the words of Palestinian authorities are in some instances reported only in the Babylonian Gemara, those of Babylonian teachers exclusively in that of Palestine, presents no real difficulty after what has been said. It is quite plausible that some one individual student, having received a casual communication from his master, did not repeat it until he had arrived in his new home, and in consequence it never became known in its original home. However, inaccuracies and errors of various kinds could hardly be avoided when ideas were carried from one country to another through the uncertain channel of verbal communication, and in some instances, too, by immature minds. The Babylonian and Palestinian Gemaras sometimes ascribe a given ordinance to different Babylonian Amoraim, and the same confusion exists in the two Gemaras with regard to Palestinian authorities. Even palpable contradictions are not wanting; *e. g.* that the same teacher is made responsible for opposite statements in the two Gemaras. On the whole, it would be fair to assume that the Gemara of Babylon is correct where Babylonian teachers are concerned, and that of Palestine where the teachers mentioned belong to the Holy Land. But the corruption of the texts, and especially of the Palestinian, renders even this criterion uncertain.

(*g*) *The Compilers of the Gemaras, and the Date of their Compilation.*—The concurrent testimony of ancient chronicles has established, and the results of modern investigation have confirmed, that the compilation of the Babylonian Gemara took place toward the close of the fifth century of our era, and that its editor was R. Ashi (d. 427), who for more than fifty years presided over the academy of Sura, and whose uncommon zeal in the propagation of knowledge secured him the just and general esteem of his contemporaries. By this, however, we are not to understand that R. Ashi was the first, last, and only one engaged in the work. Some of the tracts of the Gemara differ so strikingly from others in shape, style, and course of thought that they cannot possibly be the work of a single writer. Besides, the repetition and dissimilar treatment of the same topic in different tracts hardly leave room to doubt the conjecture of Chajoth (*Mebo*, p. 28) that many if not all the tracts had been previously edited by various Amoraim before the time of R. Ashi, and that the latter only re-examined, arranged, corrected, and perhaps also completed them. Moreover, that R. Ashi by no means completed the compilation of Gemara is already recognized by tradition, which mentions as co-editor R. Abina, though he survived the former about fifty years; and it is confirmed beyond the possibility of doubt by the circumstance that a number of authorities are mentioned in the Gemara who belong to the half century succeeding R. Ashi's death. The whole Gemara of the tract *Tamid* is, according to Frankel's masterly research (*Monatsschrift*, x. p. 193), and also Chajoth (*Mebo*, p. 27 *b*), the work of the Saboreans, or of the still more recent Gaons, having been patched together from scattered passages in the Gemara into a single tract. To say that the Gemara was closed by R. Ashi, or by any one else, is therefore too broad a statement to be literally true. The work was never formally closed; it was simply interrupted by the adverse circumstances of the times, then taken up again and carried forward by some until their energies flagged and the work remained unfinished. It was not even intended by the authors of the Gemara to close it up in the sense of setting it up thenceforward as an infallible canon from whose provisions there should be no departure. Nowhere is there a trace of such a design. The motive of its compilation was evidently only the preservation of the accumulated store of learning, without a thought of curtailing the independent expression of opinion of future teachers. All this has long since been correctly set forth by

* Even the Mishna already uses a single word, *e. g. Hare* (B. K. 1. 1), with which it was customary to begin a deduction, as a technical term to denote the general idea of proof.

Maimonides in the preface to his *Mishne Tora*. It is a simple fiction, contrary to all the facts of the case, when Grätz asserts (*Gesch. d. Juden*, iv. p. 474), speaking of those who, as he says, completed the edifice of the Talmud, "They sanctioned the compilation which they had undertaken . . . as finished and complete in itself, to which further additions and extensions could no more be admitted." Such additions and extensions were actually made in great number over and above those which we have already mentioned. Some of these may be recognized at the first glance; others can only be discovered by comparing older and authentic manuscripts or by searching criticism. Not only have marginal notes crept into the text, but even long passages of Halachic tendency, not to speak of numberless Hagadas, have been purposely interpolated into the Gemara by competent as well as incompetent parties. Illustrious rabbis of the Middle Ages did not hesitate to acknowledge these facts, and scientific inquiry has contributed further discoveries in the same direction. (See Rapoport in *Ker. Chemed*, vi. p. 249 *seq.*, and *Erech Millin*, p. 5 and p. 10 *seq.*) It became a mooted point whether R. Ashi himself wrote down the Gemara, or whether he only arranged it verbally, and it was written out considerably later; and eminent names may be cited in support of the latter view, among them, Rashi in the notes to *Bab. Mez.*, p. 33 *b*, although he does not undertake to say exactly when the work was reduced to writing. In modern times the learned Luzzato has taken the same ground in the preface to his *Oheb Ger*. Wiesner (*Gib. Jerushal*, p. 5) is of opinion that the first written copy of the Gemara was prepared about two centuries after R. Ashi. To us it appears that sound common sense must regard it as impossible that so voluminous a work, and one, too, full of such intricate controversies, should have been orally arranged, fixed, and transmitted with perfect accuracy from generation to generation. There exists, besides, an authentic tradition (*B. Bathra*, p. 157) that R. Ashi revised and somewhat modified the Gemara in a second edition, as Rabbi had done in the case of the Mishna.

The Palestinian Gemara displays far greater uniformity in language, style, and methods than the Babylonian, and this leads us to expect less difficulty in determining the questions of its authorship and the date of its completion; but this is decidedly not the case. Both questions are involved in dense obscurity, and the light of scholarship has hitherto struggled in vain to pierce it. By an ancient tradition, that is still frequently cited, the authorship of the Palestinian Gemara is ascribed to R. Jochanan (end of the second century). A glance at any page of this Gemara is sufficient to prove the incorrectness of this tradition, for everywhere we meet the names of Amoraim who flourished centuries after R. Jochanan. To save the tradition, some have interpreted it to mean that Jochanan made a beginning, laid the foundations of a Gemara. Frankel believes (*Mebo*, p. 48) that the passage cited does not refer to Jochanan personally, but to the academy of Tiberias, of which he was the founder. But this is a mistake, as the said academy had undoubtedly existed and attained celebrity long before Jochanan. The probability is, that the tradition we speak of referred originally to the form of the Mishna which is contained in the Palestinian Talmud (and which frequently diverges from that in the Babylonian Gemara, as we have shown above), and indicated that R. Jochanan was the author of this recension. This seems to be its true purport, but by some later misunderstanding this tradition was made to extend to the Gemara of the Palestinian Talmud. In the mean time, the question of the authorship of this Gemara is at present involved in the greatest obscurity.

The same uncertainty prevails with regard to the date of its composition. Isaac Alfassi, the celebrated epitomist of the Babylonian Talmud, in his *Halachoth* (end of the tract *Erub.*), obviously relying on the received opinion of R. Jochanan's authorship, asserts that the authors of the Babylonian Gemara were already acquainted with the Gemara of Palestine, and during the whole period of the Middle Ages all deferred to his authority. From the time that critical study first began to be applied to the texts, down to the present, this subject has been carefully investigated, without, however, any definite results having been thus far achieved. Zuns (*Die Gottesdienstlichen Vorträge*, etc., p. 53) only expresses himself guardedly to the effect that the Palestinian Gemara certainly was not edited before the last third of the fourth century. Jost (*History of Judaism*, ii. p. 124) declares quite apodictically, and without a shadow of proof, that it was edited barely 100 years after the close of the Mishna; and he even commits the absurdity to present it as uncertain (p. 201, *ibid.*) whether the Palestinian Gemara may not have been composed in Babylon. There are more thorough and thoughtful scholars, like Rapoport (*Bikkure ha-Ittim*, 1831, p. 66) and Chajoth (*Mebo*, p. 28 *b*), who agree with Alfassi, because they thought that they had proved that the Babylonian Gemara presupposes certain portions of its Palestinian rival, and has even occasionally copied directly from it. Frankel (*Mebo*, p. 48 *b*) refutes their arguments, but concedes that the close of the Palestinian Gemara preceded that of the Gemara of Babylon by several centuries. Wiesner, on the contrary, labors to prove (*Gib. Jerushal*, p. 7) that the Palestinian Gemara frequently presupposes the Babylonian, and places the date of its compilation several centuries after that of the latter; on p. 52 he assigns to its completion even so late a period as that between 760 and 900. Krochmal's investigations (in *Jerushal. habenujah*, p. 30) lead him to believe that the close of the Palestinian Gemara was simultaneous with the abolition of the patriarchate of Tiberias in the last quarter of the fifth century. The only conclusion that can be drawn from these contradictory critical researches is, that the date of the composition of the Palestinian Gemara is a problem which is still unsolved.

(*h*) *The Condition of the Text of the Gemaras.*—We should hardly expect to find the text of so comprehensive a work as the Babylonian Gemara, and which has passed through the hands of so many copyists and compositors, to be entirely correct. The most loyal intentions and attention would not prevent the creeping in of errors and misapprehensions. But the disfigurement of the text as it stands is great beyond all expectation—greater than in the case of any other work which has been handed down to us from ancient times. In numerous instances well-meaning but incompetent men have foisted the marginal notes of some anonymous writer upon the text; others, no doubt from mere inadvertence, have omitted whole sentences, which, fortunately for us, have been in part discovered in the writings of the older commentators (see Chajoth, *Mebo*, p. 25); others, again, making light of their task, have confused names and things in such fashion that the Talmud now abounds in contradictions and other difficulties which have cost its learned expounders much toil and trouble. Nor has the number of those self-conceited, would-be critics been small who early began to make uncalled-for changes in the text to suit their pleasure, which abuse is already complained of by Hai the Gaon. For nearly 900 years the ablest commentators, at their head R. Chananel, labored to restore the text to at least approximate correctness, without any permanent success; later copyists and printers caused ever-new confusion. Recently, R. Rabbinowicz has collated a Munich MS. of the Talmud of the year 1334 with the standard editions, and began to publish the *variæ lectiones* in his valuable work, *Dikduke Sopherim*. The astonishing number of these *variæ lectiones* which he has gathered from a single MS. gives us some faint conception of the wealth of new and important readings which we might expect to find were we fortunate enough to possess other and older MSS. That we have them not is due to the bigotry of the mediæval popes, who often consigned whole cartloads of Talmud MSS. to the flames. The disordered condition of the text, bad enough in itself, was still more complicated by the interference of pious censors, who continued to pursue the literature of the Jews with fanatical hatred down almost to the present time, and found a peculiar pleasure in venting their spite upon the Talmud. Ignorant and over-zealous as most of them were, they not only expunged the few passages that refer to the founder of Christianity, but also many others which in their opinion seemed to reflect upon Christians and their belief. Such, for instance, as treat of idolatry and idolaters, or make mention of Babel, Rome, Greece, the Gentiles, and the like, were looked upon as disguised attacks upon Christianity, and mercilessly cut out. Suspicion is easily aroused in the minds of the ignorant, and in the case of the Talmud many an innocent paragraph fell a prey to its ravages. Matters arrived at such a pass that even Jewish editors and proofreaders, in fear of the censor and of the frequent accusations and persecutions, undertook of their own accord to suppress and erase whatever a mournful experience had taught them was liable to give offence. In this way they sometimes changed the names of nations and of sects that might possibly be suspected, and in general toned down any too pointed expressions. There is a single exceedingly rare edition of the Talmud—and, we regret to say, one only—which has escaped defacement at the hands of the censors, having been printed in Holland. Fortunately, the most important passages, those which have elsewhere been expunged or disfigured, have been extracted from this edition and published separately. The editors, however, were deficient in scholarship, and their work leaves much to be desired.

Since the invention of printing there have been published forty-five complete editions of the Talmud, not to speak of hundreds of single tracts, of which certainly no two editions are quite alike. The complete editions are for the most part in twelve folio volumes. (For an enumeration and description of them see Rabbinowicz, *Dikduke*

*Sopherim*, 1829, p. 42.) We may here remark that A. Geiger (*Posthumous Works*, ii. pp. 18 and 20) assumes two different recensions of the Babylonian Gemara to have existed—the one, Oriental-Spanish, represented by Maimonides; the other, Italian-French, represented by Rashi, the text we now possess being derived from the latter. No evidence is given to bear out this assertion, and we fear it would be difficult to discover any valid proof in its favor.

If the Babylonian Gemara has been unfortunate, the Palestinian has fared still worse. The corruption of its text is visible on every page. It has been less accessible to censorial interference, and has suffered less from mistakes of copyists; for during a long period it remained unknown, even in the foremost of the high schools, and then, even after it had become known, was barely noticed, much less critically studied, by scholars. (See Frankel, *Mebo*, p. 132 *b*.) The great source of injury in its case seems to have been, first, the Syriac idiom in which it is written, and which few of its readers or transcribers were capable of understanding; secondly, the want of proper attention. Errors and arbitrary alterations, when once they had been introduced, remained fixed. It was not favored, like the Babylonian Gemara, with a Chananel or one like him to undertake the arduous task of purifying its text. As a further consequence of this deplorable neglect, the text was open on all sides to the inroads of incompetent persons, who freely availed themselves of its unguarded condition to interpolate at pleasure. That the Palestinian Gemara is actually full of spurious passages, especially in its Hagadistic portions, has not escaped the notice of modern critics. Wiesner even undertakes to say (*Gib. Jerushal*) that many passages which are evidently aimed against the reputation of the great bearers of Talmudic tradition were surreptitiously introduced by the Karaites, whose chief seat was, as we know, in Palestine. (See Geiger, *Zeitschrift*, viii. p. 227 *seq.*) A somewhat disguised passage in *Tr. Challu*, 2d chap., we are inclined to think, points more directly to Karaite interference with the text. Two Amoraim are engaged in discussion. The point of difference between them is the same as that which mainly divides the sects of the Pharisees and Sadducees; the coincidence, however, is not referred to. In the end, the very argument which in the Babylonian Gemara (*Rosh Ha-Shanah*, 13 *a*) finally disposes of the objections of the Sadducees is here triumphantly refuted. The point in dispute relates to the words "on the morrow after the sabbath"—the day, namely, when, according to Lev. xxiii. 11, the sheaf of first-fruits is offered by the priest, and the people are thereupon permitted to partake of the new harvest. The Pharisees interpret the word "sabbath" here in the general sense of "day of rest," and explain that it designates the first day of the feast of Passover. The Sadducees retain the word in its ordinary signification, the seventh day of the week. Now, in the passage of the Palestinian Gemara to which we refer a certain R. Bun takes occasion to quote Josh. v. 11, where it is plainly stated that the people partook of the new harvest on the day after the Passover, and thus to argue by implication, though ostensibly in connection with another subject, in defence of the Pharisaic opinion. In replying to him, R. Elasar ingeniously remarks that the word *Pessach*, where it occurs in the Bible without further qualification, does not at all refer to the festival, but rather to the sacrifice of the Passover, which is offered on the day before the Passover feast. He proves his point conclusively by quoting Num. xxxiii. 3, and with this rebuttal of the Pharisaic argument the discussion closes so far as the Palestinian Gemara is concerned. As a point of curious interest, we add that Aben Esra, in his notes to Lev. xxiii. 11, speaking in the name of a certain scholar of Rome, details what is exactly the argument of R. Bun, just mentioned; and on his part refutes it exactly in the manner of R. Elasar. Maimonides, too, though he was thoroughly versed in the Palestinian Gemara, and frequently adopted its decisions, and though he greatly valued Aben Esra's works, as appears from one of his letters,* yet in his *Mishne Tora* (*Tmidin*, vii. 11) again repeats the verse from Joshua in reply to Sadducean objections, just as R. Bun and the "scholar of Rome" had done before him. Maimonides seems to have totally overlooked that what he considers an invincible argument had already been successfully combated both in the Palestinian Gemara and in Aben Esra's commentary. It is interesting to note in this connection that Juda Rosanis, in his notes to the *Mishne Tora* of Maimonides, exclaims, exultingly, that the above argument "is original on the part of Maimonides, and every way worthy of his fame," while, in truth, it is neither original nor tenable. In leaving this subject we may remark that R. Moses of Coucy (*Book of Commandments*, No. 199) ascribes the argument of R. Bun and of the "scholar of Rome" to R. Meshullam ben Calonymos. As the family of Calonymos had originally settled in Rome (see Rashi, notes to *Tr. Beza*, p. 24 *b*), and during several generations had been renowned for the erudition of its members, and as, moreover, this R. Meshullam flourished but a short time before Aben Esra (see W. Heidenheim, *Piutim and Paitanim* s. v. *Meshullam*), it is safe to conclude that "the scholar of Rome" and R. Meshullam Calonymos were identical persons.

(*i*) *The Literature of the Talmud.*—For full thirteen centuries, with rare exceptions of local and temporary character, Jewish thought moved within a sphere whose centre is the Talmud. What Scripture says of Israel in Egypt is true of the intellectual activity of the Jews in later times: the more it was oppressed by its enemies, the more fruitful did it become. An immense literature has grown out of the Talmud. A bare list of those works which have at various times been published would alone fill a bulky volume, leaving aside the far greater number of those that have never been given to the world, and all those others that have perished in the course of time. We shall content ourselves with noting merely the main groups to which the vast mass of writings that have accumulated up to the present day may be respectively referred. They are—(1) Epitomes (*Halachoth*); (2) Commentaries, primary and secondary; (3) Novellæ (extended disquisitions on Talmudic topics); (4) Digests and commentaries on them; (5) Books of commandments (containing the Talmudic ordinances in peculiar arrangement); (6) Questions and answers; (7) Collections of Hagadas and their commentaries; (8) Religious discourses; (9) Polemical and apologetic writings; (10) Lexica and encyclopedias; (11) Collections of proverbs; (12) Bibliographical works; (13) in modern times also monographs and larger treatises of a scientific character; (14) Critical investigations in various directions. This great literature is written mainly in Rabbinical Hebrew, but a large number of works have appeared in Arabic, and latterly in almost every European language. The German especially has during the last half century been employed by scholars of the first rank as a medium of communicating the results of their labors.

(*k*) *Some Auxiliaries to the Study of the Talmud.*—The composite character of the dialect of the Babylonian Gemara and the manifold corruption of its text, to which we have frequently referred above, render the work of preparing a Talmudical grammar unusually difficult. No one has hitherto been courageous enough to attempt the task, and almost all the researches that have been made in this direction are contained in stray articles dispersed in various periodicals. Of separate treatises which are adapted to the needs of the beginner we may mention—A. Geiger, *Lehr- und Lesebuch zur Sprache der Mischnah* (Breslau, 1845); L. Dukes, *Sprache der Mischnah* (Esslingen, 1845); S. D. Luzzato, *Elementi Grammaticali del Caldeo Biblico e del Dialetto Talmudico Babilonese* (Padua, 1865); J. H. Weiss, *Mishpat Leshon ha-Mishnah* (Vienna, 1867); M. J. Landau, *Geist und Sprache der Hebräer nach dem zweiten Tempelbau* (Prague, 1822); A. Stein, *Talmudische Terminologie* (Prague, 1869). As to lexica, we are more favorably situated. They are the following: The *Aruch*, by R. Nathan of Rome. This work received at a later time some additions at the hands of Benjamin Musaphia, and in modern times it has been again edited, somewhat enlarged, and supplied with definitions in German by M. J. Landau (Prague, 1819–24. See Rapoport's scholarly and comprehensive review of Landau's work in *Biccure ha-Ittim*, 1830). Buxtorf, *Lex. Talmudicum*. This lexicon has been latterly reprinted, with numerous corrections, and considerably enlarged by B. Fischer (Leipsic, 1875). S. and M. Bondi, *Or Esther* (Dessau, 1812); J. Levi, *Chaldäisches Wörterbuch über die Targumim und einen grossen Theil des rabbinischen Schriftthums* (Leipsic, 1867). For the Palestinian Gemara, excepting only what is contained in Frankel's *Mebo*, nothing whatsoever has yet been done.

(*l*) *General Character and Importance of the Talmud.*—To define an object in brief and wholly adequate terms, so as to include its entire scope, and nothing beyond, is acknowledged to be among the most difficult tasks of the scientific investigator. Where the object, by the very complexity and comprehensiveness of its nature, eludes the grasp of logical definition, we are frequently compelled to resort to symbolical terms. This has been done in the case of the Talmud. From early times it has been known among scholars as the "Ocean of the Talmud;" and the metaphor does indeed express, as no definition could, the distinctive features of this work, so gigantic in proportions, so unique in the world's literature. The Talmud is an ocean, vast in extent, unfathomable in depth—no less in depth of thought than of sentiment and soul. Whatever streams have flown from the fountain-head of Jewish

* Perhaps this may serve as an additional argument to prove that the above-mentioned letter of Maimonides is spurious. (See Rosin, *Ethic des Maimonides*, p. 21, n. 9.)

thought have during many centuries mingled their waters with this ocean and contributed to increase its volume. Like the sea, it swarms with a thousand varied forms of life, and on its ever-undulating surface new aspects of existence are for ever rising and disappearing in endless succession; for the interests of nations and individuals in all their actual or conceivable relations, from the cradle to the grave, are here made the subject of minutest discussion. The intellectual current, too, which encircles and pervades the whole is again an intensely living force. The Talmud is no dry handbook, no mere register of traditional controversies between individual scholars or schools, but it reflects in its greater part the very life of the debate. Here we meet with no long speeches. The arguments are as compact as they are weighty; they follow blow with blow; there is an intellectual battle, a continued attack and repulse, a persistent struggle for victory in the realm of ideas. Besides all this, there is another particular in which the Talmud resembles the ocean, to which it has been compared, though the men who originated the comparison would hardly have admitted its application in such a sense. Innumerable pearls and much priceless treasure is hidden in its depths, but it also covers much that is lifeless, and occasionally casts up putrid and refuse matter. The Talmud is the mirror of its age, and the men of the Talmud, however exalted they may have been in intellect and character, were none the less children of their age, and they cannot be expected to be altogether free from its influence.

He who would navigate securely this sea of the Talmud must be familiar with the compass and the rudder; *i. e.* he must be intimately acquainted with its language and modes of thought and of discussion. And even when one is provided with all this apparatus, it requires prolonged practice under the eye of an experienced master to meet with success. Many have ventured upon this Talmudic sea, and were shipwrecked on treacherous shoals. Many of the best and most faithful of Christian scholars have attempted the study of the Talmud, and have given it up in course of time on account of the insurmountable difficulties which seemed to bar their progress. Others, deceiving themselves, proceeded some distance, came back reporting marvellous discoveries, and covered themselves with ridicule. But he who sets out upon the Talmud ocean fully equipped, thoroughly trained, and with experience to guide him need not fear the dangers of the voyage, and will return in the end with many precious stores of valuable knowledge. Let us take a general survey of the treasures hidden in the Talmud.

(*m*) *Science.*—The religion of Judaism has in the course of time become a religion of life in the most comprehensive sense of the word; it accompanies its adherent from the cradle to the grave in all his doings, prescribes observances for every possible situation in health and disease, for every class of society, for occurrences of every kind, and in this manner its ceremonial forms surround not only man, his inner emotions and his outer development, but also the whole actual world around him. The Talmud, therefore, whose very object it was to develop religion to that extent and culmination, had not rarely, in its Halachic part, to touch and treat of questions of general science, and hence it affords us an insight into the state of a number of scientific pursuits of the men of that time. The Hagada offers further scientific material in abundance, with which the Halacha has nothing to do. The following branches of knowledge are amply represented, and sometimes treated of at length, in the Talmud:

(1) *Mathematics.*—Apart from scattered allusions, entire chapters of several tractates are devoted to it for the purpose of fixing various religious observances. (For writings on mathematical subjects in the Talmud see Steinschneider, *Ha-Maskir*, 1875, p. 128.)

(2) *Medicine*, which is treated of in numerous places in the Talmud, but until now no one possessed of the necessary knowledge has arisen to collect all this information and to display it for the benefit of science. A scanty beginning has been made by J. Wunderbar in *Biblisch-talmudische Medicin* (Riga and Leipsic, 1850). See also S. Cohn, *De Medicina Talm.* (Breslau, 1846).

(3) *Botany.*—This is represented in great abundance in the Talmud—in the tract *Kilajim* alone 53 species of plants are mentioned—but this field still lies entirely fallow, and has not yet attracted the attention of scientific workers.

(4) *Zoology.*—It has been treated by L. Lewysohn in *Zoologie des Talmud* (1858).

(5) *Astronomy.*—In addition to scattered notices on the subject, it is specially discussed in the tractate *Rosh Ha-Shanah* in its relation to fixing the new moon.

(6) *Technology.*

(7) *Law.*—In this direction the Talmud offers vast material, which has long since attracted the attention of the learned and given rise to numerous valuable monographs. The most thorough and reliable contributions have naturally been furnished by Jewish scholars of modern times. We mention Frankel, *Der Gerichtl. Beweis nach mosaisch-talmudischem Rechte* (Berlin, 1846); idem, *Zur Kenntniss des mosaisch-talmudischen Criminal- und Civilrechts* (Berlin, 1860); idem, *Grundlinien des mosaisch-talmudischen Eherechts* (Breslau, 1860); H. Fassel, *Das mosaisch-rabbinische Gerichtsverfahren in civilrechtlichen Sachen* (Gross Kanizsa, 1859); Bodenheimer, *Das Testament;* M. Duschak, *Das mosaisch-talmudische Strafrecht* (Wien, 1869); Mayer, *Die Rechte der Israeliten, Athener und Römer* (Leipsic).

(8) *History.*—For this the Talmud is a prolific mine, a treasury of traditions, a collection of decisions and institutions, products of the labor of the Jewish mind during a period of 1000 years; it, and it alone, offers us the means to follow and to understand the religious formation, the growth, and the entire course of the development of Judaism from the close of the Bible to the close of the Babylonian Gemara; and not only the history of the religion of the Jews, but also that of their culture and civilization in general, in various countries and at various times, is lighted up in numerous directions by data contained in the Talmud. Much information may also be derived from it toward completing our historical knowledge of those nations with which the Palestinian and Babylonian Jews of that time came into contact. The Talmud offers generous archæological material which awaits research and publication. The Talmud is especially important to a proper understanding of original Christianity, on which so much has lately been written. Many legends and sayings in the New Testament, as in the Koran, have their source in the Talmud. It alone presents the Jewish sects, with which Jesus was in frequent intercourse, in their proper light. But, even apart from this, the whole ground from which Christianity originally grew is Jewish ground, and the spirit of the time which assisted at its birth was the spirit which at that time animated and ruled Jewish life, and which is reflected in the pages of the Talmud. It is also certain that essential germs of Christianity are to be sought for in the philosophy of the Alexandrian Jews, which again cannot be completely understood without a knowledge of its connection with the Jewish views that prevailed at the time in Palestine, and to which the Talmud furnishes the key.

(9) *Geography.*—As may be expected from a work that contains such rich historical materials, the Talmud also furnishes geographical information of Palestine, Syria, Babylonia, and other countries in great abundance and of decided value to science—a fact that has long been known, but has been almost neglected. (Comp. Zunz, *Gesammelte Schriften*, i. p. 152–154.)* It is only recently that a work has at last appeared in which the vastly scattered material has been collected, sifted, and treated with masterly ability; it is Adolph Neubauer's *La Géographie du Talmud* (Paris, 1868), which received the prize of the French Académie des Inscriptions.

(10) *Pedagogics.*—Among all the nations of the earth, the education of youth dates back farthest and was most universal among the Jews. Even before the destruction of the temple in Jerusalem, elementary schools for children and higher schools for adults existed all over Palestine. It follows, therefore, almost as a matter of course, that the Talmud has preserved many sayings and precepts on the subjects of schools and instruction. They have been collected and published by S. Marcus, *Zur Schulpädagogik des Talmud* (Berlin, 1866).

(*n*) *Ethics.*—With the consideration of the ethical significance of the Talmud we approach the highest level, the crowning portion of the whole work. Not but that we meet with passages that must be rejected by a pure morality; prevailing views and embittering experiences have certainly exercised a disturbing influence on the ethical views of various spiritual heroes of the Talmud; but these are isolated phenomena, and disappear, compared with the moral elevation and purity of the overwhelming majority of the men of the Talmud, and compared with the spirit that animates the work as a whole. What is laid down as the moral law in the Talmud can still defy scrutiny at the present day; and the very numerous examples of high moral views and actions on the part of Talmudists are such as cannot be found in any work of antiquity, and must still excite the admiration of the reader of the present day, in spite of the ceremonial fetters which they bore, and in spite of the occasional narrowness of their point of view. Certainly, in former times there was no want of accusations against the ethics of the Talmud, but they proceeded from persons who knew them only from hearsay, or

* Even the many scholars who have occupied themselves with the geography of Palestine alone, with the exception of Munk and Schwarz, did not avail themselves of the great resources of the Talmud in this direction.

who garbled them intentionally to serve their malicious purposes. Men acquainted with its contents, and free from prejudice, such as Reuchlin and his associates, were ever its strenuous defenders; scholars of the first order, such as Buxtorf (in *Florilegium Hebraicum*), Herder, and a host of German authors, have endeavored to garner from the overflowing store of Talmudic legends, sayings, and proverbs the grains of gold, and to offer them to the reading public as elements of culture. To characterize the moral height on which the Talmud stands, it is sufficient to point to the single sentence, "The pious of all nations participate in the bliss eternal," in which the central idea of religion is pointed out as resting not on belief, not on ceremonial observances, but on morality alone. But there is a still more speaking and conclusive witness to this fact —the Jewish people. The long centuries of the Middle Ages did all that was possible to break down the spirit and the moral strength of this people, to degrade it intellectually, morally, and in its emotional life to the lowest level. They have not succeeded; it was saved by the Talmud, which was almost their exclusive means of culture, which furnished them with light in their darkness, and whose spirit passed over to them and became part of their own.

We close this article with the words of Buxtorf (dedication of his *Lexicon*): "The Talmud contains many legal, medical, physical, ethical, political, astronomical, and other excellent documents of sciences, which admirably commend the history of that nation and time; it contains also luminous decisions of antiquity; excellent sayings; deep thoughts, full of grace and sense; and numerous expressions which make the reader not only better, but also more wise and learned, and which, like unto flashing jewels, grace the Hebrew speech not less than all those Greek and Roman phrases adorn their languages." SAMUEL ADLER.

**Talpa.** See TALPIDÆ.

**Talp'idæ** [from *Talpa*—the Latin name of the mole—the typical genus], a family of mammals of the order Insectivora, generally understood to embrace two quite distinct types: (1) the moles, and (2) the desmans, or shrew-like animals. Contrasted with the Soricidæ (their nearest relatives), they present the following characters: The ears are rudimentary, and the eyes very small; the skull is nearly smooth, and the posterior ridges are obsolete; the foramen magnum is oblong, and inclined far forward below; there are no distinct postglenoid processes; the tympanic elements form auditory bullæ; the infraorbital canals are extensive transverse apertures arched over by very narrow osseous bars; the zygomatic arches are slender rods; the lower jaw has erect ascending rami destitute of cavities at the bottom of the coronoid processes (as are developed in Soricidæ); the teeth are in number M. $\frac{3}{3}$, P. M. $\frac{3-5}{3-5}$, C. $\frac{1}{1}$, I. $\frac{2-3}{1-3} \times 2$, and also diversiform in development; in the upper jaw the true molars mostly (*i. e.* M. 1 and M. 2) have each four primary external and two primary and more elevated internal cusps (the outer and inner connected together by oblique ridges, and thus circumscribing two triangular areas pointed inward), and an internal ledge bearing a cusp along its inner wall, but no secondary lower ledge behind the principal internal one; in the lower jaw the true molars have each two primary external cusps (anterior and posterior), and three primary internal ones (anterior, antero-median, and posterior), connecting, and by their union circumscribing, triangular areas; the other teeth vary much in the several groups; the vertebræ are characteristic in that the cervical have no hypapophyses, and the dorsal and lumbar no hyperapophyses; the sternum has a broad and keeled manubrium; the anterior members are generally developed more than the posterior (in the Talpinæ much more so; in the Myogalinæ, little); the carpi are more or less enlarged, and have at least each an additional ossicle developed as an os intermedium; the scapulæ are long and narrow. Such are the characters shared in common by all the members of the family. These, however, differ greatly in external appearance as well as osteological modifications, and have been therefore segregated into two sub-families—(1) Talpinæ, and (2) Myogalinæ. (1) The Talpinæ include the moles, and have, all, the form familiar in connection with the common species—*i. e.* the body is large and subcylindrical, the neck short, and the fore limbs short and very wide, and eminently adapted for digging; the skull is inflated at the pterygoid regions, and has no distinct pterygoid fossæ; the lower jaw is contracted under the ascending rami; the incisor teeth are in good number ($_3\frac{3}{2}$); the sternum has a very elongated manubrium; the clavicles are short and broad, the humeri broad, and enlarged at their angles; and the carpi have each an enlarged, sickle-shaped bone. (2) The Myogalinæ are in external appearance considerably like the shrews or long-snouted mice; the skull is not inflated at the pterygoid regions, and has distinct pterygoid fossæ; the lower jaw is extended below under the ascending rami; the incisor teeth are in reduced number ($\frac{2}{2}$ or $\frac{2}{1}$); the sternum has a manubrium of moderate size; the clavicles are elongated; the humeri sub-cylindrical; and the carpi have no sickle-shaped bones. The family is entirely confined to the northern hemisphere, the so-called golden moles of Africa (Chrysochloridæ) belonging to a very different group, and each great region is characterized by peculiar forms. Of the moles, the typical species (forming the group Talpæ, distinguishable by dental characters) are represented by five genera in Europe and Eastern Asia, and aberrant groups (Cordyluræ and Scalopes) are exemplified by three genera in North America—viz. *Cordylura*, *Scalopes*, and *Scapanus*. Of the Myogalinæ, one genus (*Desman* or *Myogale*) is represented by species in certain parts of Europe (*e. g.* Pyrenees) and Asia; another (*Uropsilus*) is peculiar to Southern China or Thibet, and a third (*Urotrichus*) has species in Japan and America W. of the Rocky Mountains. The moles, as is generally known, are expert diggers, and lead chiefly an underground life, burrowing with great vigor and rapidity in search of worms, which are their ordinary prey, and forming long ways in the earth. They also make under ground and under hillocks their domiciles, or so-called fortresses, and (at least in case of the European species) form two circular galleries (an upper, smaller, and lower, larger), with radiating and transversely-communicating outlets and inlets, and in the centre of all, and communicating with the upper circular gallery, is the abode of the animal, which also has a communication from beneath with the highway. They are very voracious in appetite, and are rather beneficial than injurious to farmers. The Myogalinæ (or at least the typical species) are aquatic animals, and depend chiefly on water-insects and mollusks, as well as frogs and fishes, for their food. They have well-developed musk-glands, and the large species are sometimes called musk-rats, but are by no means to be confounded with the musk-rat of the U. S., which belongs to the family Muridæ. THEODORE GILL.

**Talpinæ.** See TALPIDÆ.

**Ta'ma,** county of Central Iowa, intersected by Iowa River and Chicago and North-western R. R.; surface undulating and well timbered, with good water-power; soil fertile. There are manufactories of carriages, saddlery, furniture, lime, marble, and flouring products. Staples, wheat, Indian corn, oats, wool, and live-stock. Cap. Toledo. Area, 720 sq. m. P. 16,131.

**Tama,** tp., Tama co., Ia. P. 1161.

**Tama City,** p.-v., Tama co., Ia., on Chicago and North-western R. R., near the centre of the State, has 3 churches, 2 school-houses, 2 banks, 2 newspapers, fine water-power, 3 hotels, 1 foundry, plough and butter-tub factories, 2 flouring and 3 saw mills, a sash and blind factory, 1 pump and 2 broom factories, and a park. P. about 500. F. J. M. WONSER, ED. "HERALD."

**Taman'dua,** a corruption of the name applied among Brazilian aborigines to a species of ant-eater (family Myrmecophagidæ), distinguished by its arboreal habits, long and prehensile tail, and the development of five teeth in the upper and four in the lower jaw on each side; the hair is short; the color of the head, shoulders, fore limbs, hind limbs outside, and tail along the middle is white; a stripe from each side of the neck over the shoulder and remaining part black. The native name has been accepted as a generic term, and the species is now known as *Tamandua bivittata* (Gray). (See MYRMECOPHAGIDÆ.) THEODORE GILL.

**Tama'qua,** p.-v., Schuylkill tp., Schuylkill co., Pa., on Catawissa R. R., and at the terminus of several other railways, in the midst of a mining district, and with considerable manufactures. There is a national bank, a State bank, a daily and a weekly newspaper. P. 5960.

**Tamarack.** See HACKMATACK and LARCH.

**Tam'arin,** a name sometimes applied to species of the monkey family, MIDIDÆ (which see).

**Tam'arind** [Arab. *tamar*, a "palm," and *Hindi*, "Indian," hence "Indian palm or date"], a beautiful leguminous tree, *Tamarindus indica*, from Southern Asia and Africa, now naturalized in most warm regions. The pods are filled with a pleasant sour pulp. This pulp is preserved with sugar, and is used for making a drink for fever-patients, etc. The wood is very hard and handsome.

**Tam'arisk** [Lat. *tamariscus*, *tamarix*, diminutive of Arab. *tamar*, "palm"], a name applied to the trees and shrubs of the order Tamaricaceæ. They belong to the genera *Tamarix*, *Myricaria*, and *Trichaurus*. They are found in the northern half of the eastern hemisphere only,

and abound in the desert regions and in the Mediterranean basin. They have tonic properties, and some yield nut-galls; *Tamarix orientalis* affords a sort of manna.

**Tamaroa,** p.-v. and tp., Perry co., Ill., on Illinois Central R. R., has 1 bank and 1 newspaper. P. 937.

**Tamauli′pas,** state of the Mexican confederation, bounded N. by Texas and E. by the Gulf of Mexico. Area, 30,334 sq. m. P. 108,778, mostly mestizoes. The coast-land is low, separated from the sea by a belt of sand-banks. Farther inland the ground rises and becomes by degrees mountainous. In the coast-land the climate is hot and unhealthy; in the more elevated parts it is temperate and healthy. All cereals, fruits, and vegetables of the tropic and temperate zones are grown, immense herds of cattle are fed on the extensive pastures, and many horses, mules, sheep, and goats are reared. The mineral wealth of the country is considerable, but of the thirty mines of gold, silver, and copper which formerly were worked, only four are worked at present, the rich resources of the state being very little developed on account of the thin population. Much salt is manufactured along the coast. Cap. Victoria.

**Tambourine′** [Fr. *tambourin*], a musical instrument resembling a drum, consisting of a wooden or metallic hoop over which a parchment is stretched, and furnished with a set of bells; is held in either hand, and beaten with the knuckles or fingers of the other hand, or sometimes also with the elbow. It has been in use from time immemorial in the Basque provinces of Spain and in the retired regions of Italy, especially in the Abruzzi, and is chiefly known from its employment by gypsies and wandering musicians, being a favorite instrument for accompanying their dances.

**Tambov′,** government of European Russia, in the south-eastern part of the country, on the Oka. Area, 25,542 sq. m. P. 2,150,971. Here are found large forests yielding fine timber and excellent pasturage. Woollen fabrics, tallow, and spirits are largely manufactured.

**Tambov,** town of European Russia, capital of the government of Tambov, on the Zua, was founded in 1636, and is well built, though most of its houses are of wood. It has a college, an ecclesiastical seminary, a high school for ladies, a military academy, and several other educational institutions, and it manufactures woollen cloth, tallow, spirits, etc., and has an active trade. P. 28,617.

**Tamburi′ni** (Pietro), b. at Brescia in 1737; studied theology, and was appointed director of the Irish college at Rome in 1772, director of the Germano-Hungarian college at Pavia in 1772, professor of ethics and international law at the university of that city in 1797, and dean of the faculty of law in 1818. D. at Pavia in 1827. He wrote *Idea della Santa Sede* (1784), *Introduzione allo Studio della Filosofia* (1797), *Lezioni di Filosofia morale* (4 vols., 1806–12), *Elementa Juris Naturæ* (1815), *Cenni sulla Perfettibilita dell' Umana Famiglia* (1823).

**Tamative′,** city of Madagascar (which see).

**Tame Animals, Law as to.** The common law has always made a broad distinction between wild and tame animals. The former can be the objects of property only while they are in the actual possession of the party exercising dominion over them. Complete property, as in respect to any other chattels, may be had in animals perfectly tamed and domesticated, and used for burden, food, or husbandry, such as horses, cattle, sheep, and the like; while an inferior or more limited property may be had in those others, which, though partly domesticated, never wholly lose their wild nature and instincts, such as dogs and cats. The following special rules have been applied to all tame and domesticated animals—in addition to those which include them and all other kinds of chattels—because they possess the power of locomotion, and of acting within a certain extent according to the guidance of their own wills or instincts. From a very ancient period the common law provided for the seizure and impounding of cattle found wrongfully straying upon the lands of another, and for their release and surrender to their owner upon his making an application in a proper form, and his paying the damage done by the estrays to the crops, etc. of the landed proprietor. This common-law doctrine of "estrays" has been reduced to a statutory form in most of the American States, while in some of them the injured proprietor has been clothed with powers far in excess of those conferred by the common law. This latter form of legislation has been sustained or condemned in different States according as it has been held to fall within or to transgress the constitutional provisions which protect the rights of property by forbidding summary proceedings which violate the "due process of law." The doctrine also prevails throughout the U. S. and England that the owner of a *vicious* animal is liable for the damages done by it, either to the person or property of another; but in order that such liability may arise, the owner must have a previous knowledge of the vicious habit or propensity which was the immediate cause of the injury; and this knowledge may be proved by direct or by presumptive evidence. In many of the States special legislation has recently provided for the punishment of cruelty to animals, whether perpetrated by their owners or by others.

John Norton Pomeroy.

**Tamerlane.** See Timur.

**Tamil′, its Language and Literature.** Tamil is one of the most highly cultivated, ancient, logical, exact, and generally interesting languages of India. Considerable attention must be devoted to it, as it is the queen of Dravidian tongues, much in the same way as Sanskrit is the king of the Aryan dialects. In connection with this article the reader should consult the 2d ed. of the *Comparative Grammar of the Dravidian Languages,* by the Rev. R. Caldwell, D. D., LL.D., etc.; Dr. Caldwell *On the Substitution of the Roman for the Indian Characters* (*Madras Journal of Literature,* 1858–59); Dr. Bower, on *Tamil Language and Literature* (*Calcutta Review,* vol. xxv.); *Lecture on Auveiyar, a Tamil Female Poet,* by the same author; Sir George Campbell's *Ethnology of India* (*Journal of the Bengal Asiatic Society,* vol. xxxv.), and his *Specimens of the Languages of India* (Calcutta, 1874); Kasi Chetty's *Tamil Plutarch* (Jaffna, Ceylon, 1859); Mr. Gover's *Folk-Songs of Southern India* (Madras, 1871); Dr. Graul's *Tamil Grammar; Der Kural des Tiruvalluvar,* by the same author; Dr. Gundert's *Dravidian Elements in Sanskrit* (*Journal of the German Oriental Society for 1869*); Dr. Hunter's *Comparative Dictionary of the Non-Aryan Languages of India* (London, 1868); Rev. Mr. Kennet's *Notes on Early Printed Tamil Books* (*Bombay Indian Antiquary,* 1873); Dr. Kittel's *Dravidian Element in Sanskrit Dictionaries* (*Bombay Indian Antiquary,* Aug., 1872); Dr. Murdoch's *Classified Catalogue of Tamil Printed Books, with Introductory Notices* (Madras, 1865); all of the Rev. Dr. G. U. Pope's works on Tamil, especially his *Grammar* and *Handbook* (published at Madras); *Inscriptions in Tinnevelly and Travancore,* by His Highness Râma Varma, first prince of Travancore (*Indian Antiquary,* Dec., 1873); Col. Yule's *Marco Polo* (2d ed., London, 1875); Col. Yule's *Map of Ancient India* (see Dr. Smith's *Atlas of Ancient Classical Geography,* London, 1875); Dr. Winslow's *Tamil Dictionary* (Madras, 1862); and Mr. R. C. Caldwell's papers on *Tamil Popular Poetry,* in the *Bombay Indian Antiquary,* Apr., etc., 1872. A word of explanation may be offered with reference to the foregoing list of works which ought to be consulted. Though it looks so large, it is really very incomplete, and necessarily so. Tamil, though an ancient language, has only lately been carefully studied with a view to its origin, history, grammar, literature, methodical arrangement, affinities, and genius. Year by year new beams of light are thrown upon it by scholars in all parts of the world, and the list given above might be enlarged.

Tamil is a *cultivated* Dravidian dialect. In its phraseology it is rich and copious. When a scholar is heard to speak it, it does not perhaps sound mellifluous like Telugu, the Italian of India, but it has a robust and sonorous power that is unmistakable. Of course, the lower orders speak it very differently, but we would not go to the mine or dockyard or remote fishing village to hear English correctly pronounced. There are two kinds of Tamil—the Shen-Tamil and the Kodun-Tamil—which vary greatly. A Tamil poetess speaks of "*Sanga Tamil mûndru*"—viz. "three kinds of Tamil, authorized" (by the Holy Synod of Literature, which was wont to be held in Madura, the sacred city of Tamil-land), but on this and kindred points there is little need to enter into a discussion which only a very few scholars could appreciate. Throughout all of the vast plain of the Carnatic, Tamil in some form or other is spoken. From a little N. of Madras to where triple lines of white breakers flash over the nets of Tinnevelly and Travancore fishermen who ply their trade round about Cape Comorin, Tamil is the common vernacular. It is spoken by 14,500,000 Hindus. Though Southern India is the home of the Tamil, it is also spoken where enterprising bands of the natives of Southern India penetrate. Tamil is thus spoken in Ceylon, at Cannanore in the Malayalam country, at Bangalore in Mysore, at Secunderabad, the British station in the nizam of Hyderabad's territory, in Pegu, Penang, and Singapore, in many a colony of Africa, in Mauritius, and in parts of the West Indies. Tamil may frequently now be heard in the dockyards of London and Liverpool; and Americans who have lived in Southern India often bring their old and trusted Tamilian servants to New York. It is a great mistake, committed by such eminent writers as Max Müller and Hunter, to affirm that Tamil and "Malabar" were not identical names of the same language. Malabar was the

name given three centuries ago to Tamil by the Portuguese. Tamil-land is marked down in the Peutingerian Tables as *Damirice*. Peutinger discovered the Roman maps which bear his name, and these maps are invaluable as elucidating the ancient geography of the south of India, where Tamil has from time immemorial been spoken. The meaning of the word *Tamil* is supposed to be "sweetness" or "a fragrant odor." This is a very poetical but a hardly defensible derivation. Tamilians love to speak of their own language as "*teli-têN Tamil*"—literally, "honey-clear Tamil," and certainly poetical and polished Tamil is very sweet and mellifluous. In ancient times Tamilians were divided into three great subdivisions—namely, the Chôlas, the Chêras, and the Pândyas. The Pândya kings ruled over a part of the Malabar coast during the time of Pliny; and Strabo mentions the name of the Indian king who sent an embassy to the Roman emperor Augustus as "*Pandion*" (Tamil, *Pândiyan*). Megasthenes speaks of a country in India called Παvδαίη, which is evidently Pândya-land, a part of Tamil-land. The same old author speaks of pearls being procurable in Παvδαίη; and to the present day the pearl-fishery of Southern India is famous. The Chôla dynasty (in Tamil, "*Chôra*") is spoken of by Ptolemy as the Σῶραι. The Chêras were the people of Kêrala, but it is difficult to distinguish them clearly from the other two subdivisions of Tamilians. Mussulmans call Tamil *Aravam* (*a-rava*, "destitute of sound"), probably because Tamil is the only Indian language which is totally devoid of aspirates. But this is a point which it is avowedly almost impossible to determine.

Tamil may be described as an aboriginal Indian language. It was spoken in Southern India before the flood of Aryan invasion came into India from the North-west. When Sanskrit thus entered Hindustan, Tamil may have been driven farther S.; indeed, it is almost reasonable to suppose that many tracts of Central or even Northern Indian hill-country were primitively occupied by tribes who spoke modifications of the Tamil language. It seems perfectly certain that Tamil was spoken in India 1000 years before Christ. When the fleets of Solomon traded with that ancient emporium of the East, Ophir, the Israelite mariners must have come across the Tamil trader. We read of "peacocks" being a part of the merchandise these mariners brought back to Palestine—"gold and ivory, apes and peacocks." The Hebrew word in the Bible for peacocks is almost identical with the old Tamil word "*tôkei*," the peacock—*i. e.* "the bird with the (magnificent) tail." The ships of Tarshish, sailing southward from some port of the Red Sea, must, in all probability, have touched at some South Indian harbor where Tamil was spoken, or at Ceylon, at Galle harbor, according to Sir Emerson Tennant's ingenious theory. Certainly, Galle was in very ancient times an important Oriental emporium, and in the present day Tamil is almost as generally spoken there as is Singhalese. It is true that sites distant from South India have been ascribed to Ophir, but the testimony which links that port with some ancient South Indian one is too strong to be overlooked lightly.

Classical Tamil differs almost as widely from ordinary colloquial Tamil as Latin does from Italian. The vocabulary of the most ancient, most polished, and most poetical forms of the Tamil language is most exhaustive, precise, and extensive. Centuries must have elapsed before the methods elaborated could have become crystallized and authoritative in the literature of the language. Dr. Caldwell, speaking of the antiquity of Tamil, says: "Shen-Tamil grammar is a crowded museum of obsolete forms, cast-off inflexions, and curious anomalies." He goes on further to state: "The extraordinary copiousness of the Tamil vocabulary is shown by the fact that a school lexicon of the Tamil language, published by the American missionaries at Jaffna, contains no less than 58,500 words; notwithstanding which, it would be necessary to add several thousands of technical terms, besides provincialisms, and thousands upon thousands of authorized compounds, in order to render the list complete."

Tamil has an enormous number of synonyms. As a language it must be affiliated with Scythian, and not the Indo-European family of tongues. The whole of this question is exhaustively reviewed in Dr. Caldwell's *Comparative Grammar*. The Tamil also is the language which stands at the head of those South Indian or Dravidian tongues which are thus affiliated. It is also the language which best represents the primitive condition of the Dravidian tongues. There is reason to believe that ancient Tamil and Malayalam were identical; and there are the clearest evidences that the cultivation of the other Dravidian languages of India was long subsequent to that of Tamil. This is most plainly proved by the early Tamil inscriptions which exist. These are always in Tamil character, and no Sanskrit inscriptions are to be met with in Tamil-land with an antiquity higher than that of the fourteenth century A. D. But in Telugu and Camarese countries it is different. We there come across no Dravidian inscriptions of early date, and all early inscriptions are in the *Nâgari* or Sanskrit character. We have already alluded to the earliest written relic of the Tamil language—namely, that to be found in the *tuki* or *tûki* (the peacock) of Kings and Chronicles in the Hebrew Bible. It has also been remarked that *arisi*, the Tamil word for husked rice, is identical with ὄρυζα, the common Greek word for the name. Ctesias speaks of κάρπιον, and Herodotus of κάρφεα, when they allude to cinnamon; and *kârppu* is Tamil for the spice. (See Dr. Caldwell's *Dravidian Grammar*, Introduction, p. 93.) Dr. Caldwell gives a score of other instances in which Tamil names of places, etc. became early petrified into Greek and Latin; and these are extremely interesting, as showing the ancient cultivation of the Tamil language, and the date at which South India began to be slowly revealed to the foremost pioneers of European civilization.

We have now briefly to speak of Tamil literature. This is of large extent, but all the more ancient portion of it is composed in intricate and elaborate verse. Every treatise, whether relating to ethics or grammar, medicine or theology, astronomy or any science or art, was by the unalterable law of custom written in metre. It is only of late years that a Tamil prose literature has been springing up and flourishing. Tamilians ascribe the formation of their alphabet to the sage Agastya. To this somewhat mythical personage they also ascribe a number of small poems, which, unfortunately, bear the plainest internal evidence of being recent compositions. The fact is, we have no specimen at present extant of the earliest Tamil classics. Written upon leaves, rarely copied, passed from hand to hand, frequently composed in stormy times, they have passed away, and left no trace behind them. The earliest work, probably, which we still possess is the old grammar called the *Tol Kâppiyam—i. e.* "the ancient poem." Yet this work, as Dr. Caldwell remarks, "must have been preceded by many centuries of literary culture." It is full of rules of prosody which could not well have been framed did no poems exist at the time. But as for the precise date of the rise of Tamilian literature nothing is known with absolute certainty. The works of the greatest writers might have been composed a century or two earlier than computed, or a century or two later. The ripest Tamilian scholars can do no more than guess when any question of date crops up with regard to many of the chief authors whose works have made the language they study and built up its stately literature. Take, for instance, the greatest work (as most esteem it) in the Tamil language. It is entitled the *Kural* of Tiruvalluvar. ("Kural" literally means "sport." Perhaps the Latin title "*brevia*" comes up nearly as possible to its meaning.) It is a magnificent ethical poem of 1330 distichs. Each distich is a poetical aphorism of rare beauty—some of them of such beauty as will bear comparison with the finest passages of the poets of Europe. Yet the precise date of the production of this noble work is still involved in mist. All that can be said with any degree of certainty is that it was composed in every probability *before* the tenth century A. D. How many centuries before it is impossible to determine with absolute certainty. Tiruvalluvar, the author of the *Kural*, was a pariah. His name signifies "the sacred pariah priest." Most remarkable legends are current with respect to him. In his days the great Madura college flourished. This was a synod of the first literati of the day, who used to meet at Madura, and pass their opinions on literary works submitted to them. Their power in the world of Tamil literature was unbounded, and no work could pass into the language as a recognized classic without the imprimatur of the savants of Madura. They were in number forty, and sat on a golden bench on the border of the sacred temple-tank of the city. One day the pariah poet came to them with his poem in his hand. Could they, Brahmins of the Brahmins, deign even to touch the book of an outcast? So the legend goes on to relate how they drew back with horror from the contaminating touch of the volume. But Tiruvalluvar boldly approached, and laid it on the sacred golden bench. Suddenly a miracle was performed. Lights gleamed about, music and celestial fragrance filled the air. The bench shrank, so as to be large enough only to bear the new poem. The judges were flung off by unseen hands, and, filled with chagrin, straightway drowned themselves in the tank. Such is the legend; the kernel of it is evidently the truth that the work of a pariah poet excelled all others in Tamil. The following two stanzas are from the *Kural:*

"'The flute is sweet!' 'The lute is sweet!' say they
Who have not heard the prattle of their own children."

"Sweeter than the sweetness of nectar
Is the commonest rice-water to those
Whose children's little fingers have dabbled therein."

Many better and higher examples of Tiruvalluvar's poetry might be quoted, but the above will be sufficient to show the pure domestic sympathies of the poet. Latter-day Brahmins gloss over Tiruvalluvar's birth. They declare him to be an avatar or incarnation of Yama.

Auveiyar, or Auvei ("the venerable matron"), was a Tamil poetess who was reputedly Tiruvalluvar's sister. She is the Sappho of Southern India, and many of her writings possess the highest poetic beauty. The following may be quoted:

"Gold vessels, broken, still *as gold* we prize,
And wise men in adversity are wise;
But worthless men, when ruined, what are they?
Vessels of clay, when broken, *are but clay.*"

Two of the greatest works, as also the oldest, are the *Nâladi* and the *Chintâmani*. The former is an ethical poem, and is remarkable for great sweetness of rhythm. It is composed in stanzas of four lines each throughout. The *Chintâmani* ("the jewel which gratifies every wish") is by far the greatest epic poem in the Tamil language. It contains some 15,000 lines. The versification is sonorous and striking, but the phraseology in which it is couched is of great difficulty, abounding in archaic forms and obsolete idioms. Another great poem is the *Ramâyana*, in Tamil. The version is by Kamban, one of the most fluent and ornate of Tamil classical writers. The Tamil *Ramâyana* is not a slavish translation of Valmiki's great Sanskrit epic, but it is rather an adaptation—the great poem of a great Tamil poet composed on the model of a great poem in another language by another great poet. Pope's *Iliad* falls much farther short of Homer's than Kamban's *Ramâyana* does of Valmiki's. Two other famous Tamil poets of Kamban's time are Pugalêndi and Ottakkuttan. For some two centuries after the death of Kamban there appear to have arisen no great Tamil authors, till suddenly there sprung up a literary revival. A new poet, Athivîrarama Pândya, now flourished, and this elegant writer produced the *Neidadam*, the *Kâsikandam*, and *Vettri Verkei*—the latter a small poem which has attained enormous popularity. About this time, too, Villiputturâr translated the Sanskrit *Mahabhârata* into Tamil verse. At this period, too, was probably composed the greatest of the Vedantic poems in Tamil, the *Gnâna Vâsishtham*. Not much later than this time were written those elegant poems, full of similes, and metaphors, and pleasant moral aphorisms, which are now taught in every Tamil vernacular school in the Madras presidency. About and after this time the Sittar school of Tamil poets flourished—men who openly taught anti-Brahminical doctrines. Amongst others, Tirumûla and Konkanar occupy a prominent position in this school. But the foremost place must be ascribed to Pattira Giriyar and Sivavâkkiar. Pattira Giriyar's chief poem is entitled *Lamentations*. Some of the stanzas are highly poetical. For example, the poet, tired of the trammels of earthly life, cries out:

"Ah! when shall I my weary being steep
In that Existence which is sleepless sleep?"
"Ah! when shall I, with eyelids dropt, ascend,
And with God's being my own being blend?"

Such thoughts, couched in mellifluous Tamil, are very striking. Sivavâkkiar is a bolder poet, more original, more uncompromising—an iconoclast at heart, a hater of shams, and one who deigns only to worship the unseen "Audar-Kôn," the "Shepherd of the Worlds," to whom the sun and stars are but as sheep, which he guides whithersoever he willeth. Sivavâkkiar has a contempt for stocks and stones; and those who fancy all Orientals to be image-worshipping heathen should consider the following lines, which are translated *verbatim* from Sivavâkkiar's poem entitled *Words about God:*

"Stones resonant ye fashion
To idols; then adore:
With flowery wreaths adorn them,
With ashes smear them o'er:
The stone upon your threshold
Grows worn out, being trod;
But of these two stones, neither
Affords delight to God."

Since the beginning of the eighteenth century several writers of the highest eminence have flourished in Tamilland. Amongst these Pattanathu Pilla need not be included, as, although a melodious writer, he does not occupy a very high place amongst South Indian poets. But Tayumânavar of Trichinopoly and Beschi of Madura have left an imprint of their genius on the literature of Tamil which will not be erased as long as that literature exists. Tayumânavar is perhaps the purest and chastest of Tamil writers; his style is a model of elegant simplicity. His poems have a high philosophic and religious tone, and in some of them distinct traces of the influence of Christian ideas are to be met with. Beschi was an Italian of the order of Jesus. Shortly after arriving in India he exhibited a wonderful linguistic talent, and in the course of a quarter of a century composed more than a work a year in many different languages, and some of them grammars and dictionaries, the composition of which must have entailed immense labor. He also composed a large number of controversial treatises, as well as a Tamil satirical novelette, the first in the language. It is greatly owing to Beschi that Tamil possesses now a prose literature. But it was especially as a poet that the learned Italian left his mark upon Tamil. His great poem, the *Tembâvani*, is recognized by the most learned Hindus as a Tamil classic of the highest merit. Brahmin pandits named him Vira Mâmuni, "the heroic devotee." No European has ever been able even to rival Beschi in his own department. Dr. Mill of Calcutta comes next to him, but the *Christa Sangita* of that author is, as a work of genius, vastly inferior to the striking and sonorous epic of the great Jesuit. The three chief personages of the *Tembâvani* are Christ, the Blessed Virgin, and St. Joseph. The whole poem is marvellously rhythmical, and full of those never-ending flowery images, similes, metaphors, assonances, and harmonious combinations of sounds which so please the voluptuous literary taste of the Oriental. Since Beschi's time the literature of Southern India has been enlarging itself at a prodigious rate, but though there is a large quantity of works produced, their quality has sadly fallen off. However, some dozen works might be mentioned, but we may content ourselves with one. The new revised edition of the Tamil Bible possesses a literary excellence not frequently met with in translations from a European language into an Oriental one.

R. C. CALDWELL.

**Tamise'** [Flem. *Temsche*], town of Belgium, province of East Flanders, on the Scheldt, manufactures salt and sailcloth, and has several flax and cotton spinning factories. P. 8188.

**Tam'many Society,** an institution originally organized for charitable purposes in New York City May 12, 1789, deriving its name from a Delaware chieftain who had recently died at the age of above a hundred years, and who for his reputed virtues was in the latter years of the Revolution facetiously chosen patron saint of the new republic. Secret societies under the auspices of St. Tammany were organized in Philadelphia and other cities; but the institution soon fell into oblivion except in New York, where it was soon turned to account as a political lever, and it ultimately became the principal instrument of the managers of the Democratic party in New York City, exerting a considerable influence also upon State politics. The society was much discredited by the participation in its honors of William M. Tweed and his accomplices in fraud, but it was reorganized, and to some extent reformed, after the Tweed prosecutions. The officers and members of the society are still known by the names of sachems, sagamores, warriors, etc., and much is said about tomahawks, war-paint, and calumets. Tammany Hall is on Fourteenth street, near Union Square.

**Tam'pa,** p.-v. and tp., cap. of Hillsborough co., Fla.

**Tampa Bay,** on the W. coast of Florida, is chiefly in Hillsboro' co. Its upper portion is divided into two parts, Old Tampa Bay and Hillsboro' Bay. It is some 35 miles long and from 6 to 15 miles wide. A line of keys fences its entrance from storms, so that it constitutes a safe, spacious, accessible, and excellent harbor. The bay contains many small islands, and abounds in fish and turtle. On Egmont Key, at the entrance, stands a brick lighthouse 86 feet high, lat. 27° 36′ N., lon. 82° 45′ 15″ W.

**Tampi'co,** town of Mexico, state of Tamaulipas, on the Panuco, 5 miles from its mouth in the Gulf of Mexico, is well built, with broad and airy streets, and, though good drinking-water is scarce and yellow fever now and then occurs, it is much healthier than Vera Cruz. On account of the bar at the mouth of the Panuco, its harbor is not accessible for large vessels, which must anchor in an open roadstead; nevertheless, its trade is considerable and steadily increasing. P. 7000.

**Tampico,** p.-v. and tp., Whitesides co., Ill. P. 634.

**Tampico,** tp., Darke co., O. P. 67.

**Tamworth,** tp., Carroll co., N. H. P. 1344.

**Tan'agers,** a group of passerine birds dignified by most authors as a family with the name Tanagridæ, but whose true distinctive characters yet remain to be given. The following have been assigned: the bill is usually thick and conical, sometimes depressed and attenuated, usually more or less triangular or dilated at base, and with the cutting edges not much inflected, and generally notched or

toothed behind the tip; the angle of chin is not far forward; the nostrils are placed very high; the wings are moderate, angulated, have nine primaries, and the inner secondaries are not produced; the legs are short, with tarsi clothed with undivided plates on the sides, with front toes short and stout, and with the hinder ones stout and comparatively long. The outer lamellæ of the palatine bones are developed in a vertical plane, with the hinder border more or less emarginated, and the anterior palatine processes are broad and united, by a truncated border, to the high and broad upper mandible, as in the Fringillidæ (*Carus*), from which the species are indeed scarcely separable as a family. The colors are in almost all the species quite brilliant and positive. The group is peculiar to the New World, and is chiefly developed in the tropical regions. Over 300 species have been described and arranged under 43 genera. Messrs. Sclater and Salvin, in their *Nomenclator Avium Neotropicalium*, admit 292. One genus (*Pyranga*) is represented in the U. S. by four species, the most conspicuous of which are the scarlet tanager (*Pyranga rubra*) and summer redbird (*Pyranga æstiva*). The species feed upon grains as well as insects, etc. THEODORE GILL.

**Tanais.** See DON.

**Tanaka Fujimaro,** b. in the province of Owari, Japan, about the year 1843; was highly educated in the Japanese and Chinese classics; was at one time a secretary attached to the cabinet or councillors; visited America with the imperial embassy in 1871, and went to Europe on a special mission connected with education; on his return to Japan devoted himself with great zeal to the cause in which he had enlisted, and was made vice-minister of the department of education, in which highly responsible position he was still serving at the close of the year 1875.

F. A. P. BARNARD.

**Tananarivo.** See ANTANANARIVO.

**Tan'cred,** one of the most celebrated heroes of the first crusade, b. in Sicily in 1078, a son of Odo and Emma, the sister of Robert Guiscard; in 1096 raised an army in Apulia and Calabria, crossed over to Epirus, joined his cousin, Bohemund of Tarent, and distinguished himself greatly by his valor, sagacity, piety, and chivalric forbearance toward a defeated enemy during the campaigns in Asia Minor and Syria, but still more at the conquest of Jerusalem, July 19, 1099, and in the battle of Askalon, Aug. 12. He was made prince of Tiberias, and governed with great wisdom not only his own principality, but also that of Bohemund, who had been captured by the Saracens; but most of his time was taken up in petty warfare, partly with Baldwin and the other Christian princes, partly with the Saracens. D. at Antioch in 1112. His exploits have been narrated in prose and verse by Raoul de Caen in his *Les Gestes de Tancrede*. He also plays a conspicuous part in Tasso's *Gerusalemme Liberata*.

**Ta'ney,** county of S. W. Missouri, bordering on Arkansas, and drained by White River and its affluents; surface hilly, soil fertile, and there is a gold-mine. Staples, Indian corn, wool, and live-stock. Cap. Forsyth. Area, about 700 sq. m. P. 4407.

**Taney** (ROGER BROOKE), LL.D., b. in Calvert co., Md., Mar. 17, 1777; graduated at Dickinson College in 1795; studied law, and was admitted to the bar in 1799, commencing practice in Calvert co., from which he was chosen a delegate to the general assembly of Maryland; removed to Frederick, Md., in 1801, and in 1816 was elected to the State senate; removed in 1822 to Baltimore, where he resided until his death. Originally belonging to the Federal party, he became in 1824 a supporter of Gen. Jackson, by whom in 1831 he was appointed U. S. attorney-general, and in 1833 was nominated as secretary of the treasury in place of Mr. Duane, who had been dismissed in consequence of his disagreement with the President in the matter of the removal of the public deposits from the U. S. Bank; but the Senate, by a vote of 28 to 18, refused to confirm the nomination, although he had for nearly nine months exercised the functions of secretary and had ordered the removal of the deposits. Chief-Justice Marshall having died in 1835, the President appointed Mr. Taney as his successor, and the administration having secured a majority in the Senate, the nomination was confirmed in Mar., 1836, he taking his seat upon the bench in the following January, and occupying it until his death. In the administration of this office his most noted act was his decision in the DRED SCOTT CASE (which see) in 1857. Chief-Justice Taney again came somewhat prominently into notice in May, 1861. A Mr. John Merryman had been arrested in Baltimore by order of a Federal general for alleged treason; the chief-justice issued a writ of *habeas corpus* to bring the prisoner before him; the officer in charge of Merryman refused to obey, on the ground that he had been empowered by Pres. Lincoln to suspend the execution of the writ of *habeas corpus;* whereupon the chief-justice wrote out a formal opinion to the effect that the President had no constitutional authority to suspend the writ, and that this could be done only by the legislative authority. D. in Washington Oct. 12, 1864. A notice of his career is contained in Santvoord's *Sketches of the Lives and Judicial Services of the Chief-Justices of the United States* (1854), and a memoir, embodying an autobiography down to 1801, has been written by Prof. Samuel Tyler (1872). A bronze statue of him, ordered by the State of Maryland, was inaugurated at Baltimore Dec. 10, 1872.

**Taneytown,** p.-v., Carroll co., Md. P. 413.

**Tanganyika,** a lake of Central Africa, S. of Lakes Albert and Victoria, between lat. 3° and 9° S. and between lon. 29° and 32° E., extends for about 400 miles from N. E. to S. W. It was first discovered by Burton and Speke in 1858, and afterward explored by Livingstone and Cameron. It has an elevation of 2711 feet above the level of the sea, deep and clear water, and a very irregular form, its width varying from 10 to 60 miles. Its shores are generally rich in beautiful scenery, especially those of the northern part, which are set with mountains and hills covered with a luxuriant vegetation. The surrounding country is in many places densely peopled. The most important town is Ujiji, on the eastern shore.

**Tan'gencies** [Lat. *tangere*, to "touch"]. The problem of the tangencies appears to have been first propounded by Apollonius Pergæus, who lived A. C. 247. He described them as ten in number, the last being to draw a circle tangent to three circles. By supposing either of these to become either a point or right line, all the other problems are stated. Sir Isaac Newton, in his *Universal Arithmetic*, problems 45, 46, and 47 (Horsley's ed. of Newton, pp. 133–136), gave some algebraic solutions. But Descartes, who died in 1650 (when Newton was eight years old), had already obtained a geometrical solution of the highest problem in the tangencies—viz. "To draw a sphere tangent to four spheres." (See Cousin's *Œuvres de Descartes*, vol. vi. p. 99.) Cousin, who, it is said, published the most perfect edition of Descartes's works, gives the date of his letter announcing it to Mersenne as Apr. 15, 1630. Descartes had also (see Montucla, p. 264) applied algebraic analysis to the problems in circles, obtaining some unsatisfactory expressions. Fermat, who lived 1601–65, published a geometrical dissertation on the tangencies of spheres, and classified the problems as fifteen in number. (See Lawson's trans. of Vieta's *Apollonius on the Tangencies*, with a supplement giving a translation of *Fermat on Spherical Tangencies*, London, 1771.)

In general, eight circles can be drawn tangent to three given circles, and sixteen spheres tangent to four given spheres. Of algebraic solutions, M. Chasles (in his *Rapport sur les Progrès de la Géométrie*, p. 34) records the following: First, two solutions of Euler in 1779, to the Academy of St. Petersburg; second, Carnot's (in his *Géométrie de Position*), of which Chasles says, "He proposes to determine the radius of the sphere sought by a trigonometrical solution very simple, but of painful length (*longueur pénible*);" third, by J. Français; fourth, by Poisson; fifth, by J. Binet; sixth, by Hachette. The two solutions of Euler (who died in 1783) were not published until 1810, in the *Mémoires de l'Académie de St. Petersbourg*, vol. ii. pp. 17 and 24. As evincing the attention paid to this subject, we add that the papers of Binet and Hachette and Gaultier occupy 112 pages in the 9th and 10th vols. of the *Journal de l'École Polytechnique*. M. Hachette claims that the first analytical solution of the problem of the tangencies of spheres was that of Poisson (*Bulletin de la Société Philomathique* for 1812, p. 141).

But the first to present a general geometrical solution was Gaultier de Tours in 1812. (See 9th vol. *Journal de l'École Polytechnique*, p. 124–214.) His paper was entitled *Memoir to construct graphically a Circle determined by three conditions, and a Sphere determined by four conditions.* He in this memoir announced his important discovery of the curious properties of "radical axes and radical centres, and axes of similitude."

J. D. Gergonne in the 4th vol. (1814) of *Annales de Mathématiques* gave the most elegant general solution (both in circles and in spheres) which had appeared. It had previously been published in the memoirs of the Academy of Turin. It was arrived at analytically, being revised and completed in the 7th vol. of the same journal (for 1817). In fact, Gaultier had nearly obtained the same solutions. But J. B. Durrande, in the 11th vol. (July, 1820) of *Annales de Mathématiques*, reached by a purely geometrical investigation the same solution as Gergonne. Gergonne obtains the points of contact in circles substantially as follows: Each axis of similitude is the radical axis of a pair of the

required circles. The pole of this axis of similitude for one of the given circles must be on the line joining the points of contact, and this line must pass through the radical centre. Thus, find for each of the four axes of similitude the pole within each given circle; join the radical centre with said pole, and the points in which the line cuts the circumference are the required points of contact for that pair of the required circles. There are four such axes, and thus eight solutions in all.

In Durrande's construction he calls "the polars of similitude" of two of the given circles two right lines (perpendicular to the line joining their centres), having for a common pole, in reference to these two circles, one of their centres of similitude. These "polaires" are called internal or external according as the centre of similitude which is the common pole is internal or external. To find the required points of contact, determine for any one of the given circles its "polars of similitude" with the two others, having care to take the external polaire for the circles which ought to be touched in a similar manner, and the internal for that which ought to be touched in a different manner by the circle sought. These polaires will intersect in a certain point, and the homologous polaires relative to the two other circles (and parallel to the other polaires) will intersect in a second point. Join those two points by a line; this line will cut the first-mentioned circle at the points of contact of that pair of the required circles. It must also pass through the radical centre.

Thus, the method of Durrande is only a way of arriving at the pole referred to by Gergonne, but it leads him to add to the very curious properties of circles, first made known by Monge and Gaultier, the new lines called "polars of similitude."

In the question in spheres, Gaultier and Heegmann (*Mémoires d'Académie de Lille*, 1823; J. A. Serret, *Crelle*, vol. xxxvii.) have founded their demonstrations on the theorem of Dupuis—viz.: "When a variable sphere touches constantly in the same manner three fixed spheres, each of the three points of contact describes a small circle on the corresponding fixed sphere." But Rouché and Comberousse in part 2, p. 244, of their *Traité de Géométrie*, show that it is only a corollary of the solution of Gergonne.

Gergonne gives (4th vol. *Annales de Mathématiques*, p. 354) an analytical solution to the problem of the tangencies as applied to three given circles upon the surface of a sphere. His solution, with analogous properties of radical axes, etc., has been readily extended to that question upon the surface of a sphere. A like extension is given by Steiner of his solutions in the 1st vol. of *Crelle* (Berlin, 1826), whose discussions are in the main founded on "radical axes" and other properties deduced from the discoveries of Gaultier.

The radical axis of two circles is the handle, as it were, by which the relations of two circles to each other are known and discussed. It is the common chord if they intersect. If they do not intersect, it is the line (perpendicular to the line joining the centres) from any point of which all the tangent lines to the two circles will be equal to each other. In that case their intersection becomes imaginary, and this consideration leads to interesting results. The radical centre (which is the centre of the orthogonal circle) and the axes of similitude of three circles are in like manner the means of discussing the relations of three circles to each other. The radical centre of four spheres (which is the centre of the sphere orthogonal to four spheres) and the planes of similitude have equally important properties in reference to those spheres. Justly did Gaultier de Tours take a pride in his discovery, and record the day (June 15, 1812) in which it was first read to L'École Polytechnique.

A very valuable analytical exposition of these fruitful properties is given in the 9th chapter of *Conic Sections*, by George Salmon (3d ed., London, 1855). Steiner, in his papers, calls the radical axis "the line of equal powers;" if from any point of it a right line is drawn cutting one of the circles, the product of the secant into its external segment is constant—viz. equal to the square of the tangent to either circle. To find the radical axis of two circles, draw any circle cutting both circles; the secants drawn through the points of intersection will unite on said line; draw a second auxiliary circle, and two points of said line are thus obtained. If there were three given circles, the radical centre of those circles would, in like manner, be obtained by the use of two auxiliary circles, the radical centre being the point at which the three radical axes of the several pairs will unite.

An analytical solution of the problems in the tangencies of spheres is given by C. W. Bauer (in *Journal de Schlomilch*, Leipsic, vol. v.); one in the tangencies of circles in George W. Hearn's *Researches on Curves of the Second Order* (p. 22, London, 1846); one in tangencies of circles and spheres by George W. Coaklay of New York University, in vol. ii. p. 116 of *Mathematical Monthly* for Jan., 1860. H. A. Newton of Yale College gave a solution of the problem in circles, "provided two of the given circles cut each other, by the method of transformation of curves by reciprocal radii vectores," in vol. i. p. 239 of *Mathematical Monthly* for Apr., 1859. Gen. J. G. Barnard of U. S. engineers presented to the National Academy of Science in 1864 an analytical solution of the problem in circles and in spheres, containing some interesting geometrical interpretations of his results.

A memoir was published by the present writer, entitled *The Tangencies of Circles and of Spheres*, in the 8th vol. of *The Smithsonian Contributions to Knowledge*, published in 1855. It is a geometrical solution based on the principle to which he has since given the name of "The Principle of the Converging Chords"—viz. "If a fixed circle is cut by any circle which passes through two fixed points in the plane of the given circle, the common chord passes through a fixed point on the line passing through the two fixed points." He claims that this is immediately derived from the well-known fundamental principle of tangencies, that "the tangent circle is the limit of all secant circles." In a memoir not yet published he has extended the use of "the principle of converging chords" to a generalization of the question of the intersection of circles, the tangency being only a case where the angle of intersection is 0° or 180°.

After a recent diligent search, the first record found of any solution embracing (not in name, but in fact) the principle of converging chords, is in the *Monthly Review* (London) for Oct., 1764 (name of the author not given), in solving the question to draw a circle through two points tangent to a given circle. Thus, the writer claims not the first use of the principle, but the first generalization of all the problems as based upon it. He cannot learn that it was ever before applied to spheres. It was used by him as early as 1835. It appears as a porism in the *London Mathematician* for Nov., 1843. In the same number, p. 29, are two papers, one by William Rutherford and one by Stephen Fenwick, giving analytical solutions of the question "to find a sphere tangent to four given spheres which are in mutual contact." The books have numerous modifications of the original problems in the tangencies; *e. g.* that the required tangent sphere should have a certain radius and fulfil three other conditions. But the purpose of this sketch has been to enumerate the principal papers on the original questions. BENJAMIN ALVORD.

**Tan'gent.** A line is tangent to a curve when it touches it at a single point: this point is called the *point of contact*. The tangent to a curve at a point may be regarded as the limit of a secant through that point; for, suppose a secant to be drawn through the point of contact and any other point of the curve; then let the second point be moved along the curve toward the first; the secant will continually approach the tangent, and when the second point falls on the first, the secant will become a tangent; if the motion of the second point is continued, the line will become a secant on the other side. From this explanation we infer that only one tangent can be drawn to a curve at a given point. There is, however, an exception to this principle, for in the case of a multiple point there may be two or more tangents. (See SINGULAR POINTS.)

According to the theory of the infinitesimal calculus, a curve is to be regarded as a broken line whose sides are infinitesimal; the consecutive vertices of this polygonal line are called *consecutive points*, and the prolongation of any side is a *tangent*; we therefore say that a tangent to a curve is a line passing through two consecutive points of the curve. The first point in the order of generation is the point of contact. Continuing this view of the subject, we say that two curves are tangent to each other when they have two consecutive points in common, in which case they will have a common rectilineal tangent. We also say that two surfaces are tangent to each other when two lines of the one are respectively tangent to two lines of the other at a common point. If two surfaces are tangent to each other, every secant plane through the point of contact cuts a line from each surface, and these lines are tangent to each other at the point of contact of the two surfaces. These principles form the basis of the theory of tangents in descriptive geometry. In trigonometry the tangent of an arc is the tangent to the arc at one extremity, and limited by the prolongation of the diameter through the other extremity. W. G. PECK.

**Tangent Galvanometer.** See ELECTRICITY.

**Tangential Co-ordinates.** See TRILINEAR CO-ORDINATES.

**Tan'ghin,** an ordeal poison formerly in vogue in Madagascar. It is the exceedingly poisonous seed of *Tanghinia venenifera*, an apocynaceous tree of that island, one of the most powerful poisons known. A small portion of the

powdered seed was administered to the suspected person, whose only hope was in the emetic action which the drug sometimes exerts.

**Tangier'**, an old but decaying town of Morocco, beautifully situated on an inlet of the Straits of Gibraltar. It is surrounded with walls and defended by forts, but it is miserably built, and with the exception of some Mohammedan mosques and Jewish synagogues, and the houses of the foreign consuls, it contains hardly any decent edifices. Its harbor was in 1871 visited by 461 vessels of 50,858 tons burden, going in, and 463 vessels of 50,814 tons burden cleared. P. about 12,000.

**Tangier,** tp., Somerset co., Md. P. 1563.

**Tangipahoa,** parish of S. E. Louisiana, bounded by Mississippi River and Lakes Pontchartrain and Maurepas, intersected by Tangipahoa River, and traversed by New Orleans Jackson and Great Northern R. R.; surface low and flat, soil in some places fertile, in others sandy. Staples, cotton, Indian corn, sweet potatoes, rice, and livestock. Cap. Amite City. Area, about 720 sq. m. P. 7928.

**Tangipahoa,** p.-v. and cap. of Tangipahoa parish, La. P. 236.

**Tan'gle** and **Sea-Tangle,** names for several seaweeds, but especially for *Laminaria digitata*. The young shoots are sometimes used as food and forage, and the plants are employed in the production of iodine. The stalks of the European sea-tangle are used in making uterine tents for surgeons' use, but those growing on the North American coast have been found unfit for this purpose.

**Tan'häuser,** the hero of a German legend of the early Middle Ages; spent some years in wild dissipation at Venusberg, but was finally smitten by conscience, and went to the pope to get remission of his sins and escape damnation. The pope, however, answered that his sins could as little be forgiven as the wand which he (the pope) held in his hand could become green again; and Tanhäuser walked back to Venusberg to forget his despair in new dissipations. But a few days after, the pope's wand suddenly began to sprout. The connection between the legendary hero and the minnesinger Tanhäuser of the beginning of the thirteenth century is well established, but not of any interest. The legend has often been treated poetically by the Germans—by Tieck, Richard Wagner, and others.

**Tanis.** See ZOAN.

**Tanjore'**, town of British India, capital of a district of the same name in the presidency of Madras, on a branch of the Cavery, in lat. 10° 50′ N., lon. 79° 15′ E. It is a large city, 6 miles in circumference, well built and strongly fortified, carrying on a lively trade and extensive manufactures of silks, muslins, and calicoes, and containing many fine buildings and magnificent monuments. Its great pagoda, rising pyramidically and surmounted by a lofty dome, is one of the finest specimens of Hindoo architecture, and its colossal bull statue of black granite, 16 feet long and 12 feet high, is the greatest and most finished work of Hindoo sculpture. P. about 80,000.

**Tank-Worm.** See GUINEA-WORM.

**Tan'nahill** (ROBERT), b. in Paisley, Scotland, June 3, 1774; bred as a weaver, he worked at the loom all his life; wrote occasionally for periodicals, and in 1807 published *The Soldier's Return, with other Poems and Songs, chiefly in the Scottish Dialect*, which was received with considerable favor; but the publisher hesitating to issue a new and enlarged edition, he fell into a fit of despondency, burned all the new poems which he had written, and drowned himself in a pool near Paisley May 17, 1810. A complete collection of his writings, with a memoir by Ramsay, was published in 1838, and new eds. in 1848 and 1874.

**Tanneguy-Duchâtel.** See DUCHÂTEL (C. M. T.).

**Tannehill** (WILKINS), b. at Pittsburg, Pa., Mar. 4, 1777; removed to Lexington, Ky., thence to Nashville, Tenn.; was co-editor of the Nashville *Whig*, and for many years editor of the Nashville *Herald*, the first newspaper in Tennessee which supported Henry Clay for the Presidency; afterward established the *Orthopolitan*, a literary journal, and in 1848–49 conducted the *Portfolio*, a journal of Freemasonry. During the later years of his life he was entirely blind. He published the *Freemason's Manual*, a standard work; *Sketches of the History of Literature from the Earliest Period to the Revival of Letters in the Fifteenth Century* (1827); and *Sketches of the History of Roman Literature, from the earliest Period to Constantine the Great* (1845). D. at Nashville June 2, 1858.

**Tan'ner** (HENRY S.), b. in the State of New York in 1786; removed to Philadelphia, where he resided till 1850; engraved and published many atlases and separate maps, and contributed geographical and statistical articles to various periodicals, and was a member of the geographical societies of Paris and London. Among his numerous maps are—*New American Atlas* (1817–23), *Map of North America* (1822), *The World on a Globular Projection* (1825), *The United States of America* (1827), *General Atlas*, of 76 maps (1828). He also published—*Memoir on the Recent Surveys in the United States* (1830), *View of the Valley of the Mississippi* (1832), *American Traveller* (1836), *New Picture of Philadelphia* (1840), and *Description of the Canals and Railroads in the United States* (1840). D. in New York in 1858. Although not a conchologist, he formed a fine private cabinet of shells.

**Tanner** (THOMAS), D. D., b. at Market Lavington, Wiltshire, in 1674; was educated at Oxford, and was made fellow of All Souls in 1696; entered holy orders; became successively rector of Thorp, prebend of Ely, archdeacon of Norfolk, canon of Christ Church, and in 1732 bishop of St. Asaph. His principal works, published posthumously, are—*Notitia Monastica*, an account of the religious houses, colleges, hospitals, etc. founded in England and Wales before 1540 (1744), and *Bibliotheca Britannico-Hibernica*, an account of the writers who flourished in England, Scotland, and Ireland up to the beginning of the seventeenth century (1748). He left a large collection of MSS., which he bequeathed to the Bodleian Library. D. in 1735.

**Tanner's Creek,** tp., Norfolk co., Va. P. 2989.

**Tannery West,** a suburb of MONTREAL (which see), included in the municipality, is situated at an important junction of the Grand Trunk Railway, and has some manufactures. P. about 4000.

**Tannhäuser.** See TANHÄUSER.

**Tan'nic Acids,** or **Tannins** [Ger. *Gerbsäuren;* Fr. *acides tanniques*]. These are astringent principles which are very widely disseminated in the vegetable kingdom. The most important sources of these compounds are the barks of varieties of the oak and pine, sumach, gall and valonia nuts, kino, divi-divi, and catechu; the bark and berries of many forest and fruit trees, such as the elm, the willow, the horse-chestnut, the plum, the pear. Numerous shrubs and roots, such as the whortleberry, the tormentilla, and the bistort, contain notable proportions of some modification of tannic acid. Less important in this respect are coffee, tea, nettles, etc. All of the forms of tannic acid were formerly supposed to be identical with the tannin contained in the gall-nut, the differences in chemical composition presented by them being accounted for by the presence of accidental impurities; but at present there is no doubt of the existence of several distinct acids, which possess, however, many properties in common.

The tannins produce characteristic precipitates in solutions of ferric salts; these precipitates are usually of a bluish-black color, which in presence of a free acid acquire a dark-greenish hue; but some tannins, as those obtained from catechu, give a green precipitate, while others, such as that contained in the common nettle, cause a grayish precipitation. They have an acid reaction, and are further characterized by the intense astringent taste they possess; by their forming insoluble compounds with gelatine, albumen, fibrine, and the vegetable alkaloids; and by the avidity with which they are oxidized and converted into colored products when moist or in presence of alkaline solutions. The term "pathological tannins" has been applied to those obtained from diseased vegetable excrescences, such as the gall-nut; those which are contained in barks, etc., being designated as "physiological tannins." The latter only are adapted to the manufacture of leather. The most important and best-investigated form of tannin is that known as *gallotannic* acid. Other modifications are *caffetannic*, *catechutannic*, *morintannic*, *quercitannic*, and *quinotannic* acids, which, although very similar in many properties, possess different compositions.

*Gallotannic acid* occurs in the gall-nut, an excrescence produced by the puncture of a small hymenopterous insect upon the leaves and stalks of the species of oak *Quercus infectoria*, sometimes in a proportion as high as 60 per cent. of the mass. The tannin of the sumach, although formerly considered identical with gallotannic acid, appears to be a distinct compound. The acid is extracted by digesting the pulverized gall-nuts with aqueous ether, to which a small quantity of alcohol is sometimes added. This fluid is decanted, and allowed to remain at rest for some time, when it separates into two layers, the denser of which possesses a yellow color, and consists of a concentrated solution of the tannin. This operation is repeated as long as the lower layer continues to increase, the upper layer—which contains the gallic acid present in the nuts, together with ether, alcohol, and a small quantity of tannic acid—being then removed, and the solution of gallotannic acid washed with ether and evaporated *in vacuo*, when the acid is obtained as a porous mass. Pure gallotannic acid has

the composition $C_{14}H_{10}O_9$. Prepared as above, it is an amorphous buff-colored solid, easily soluble in water; it also dissolves in aqueous alcohol, but only with great difficulty in *pure* ether. It has an intense astringent taste, imparts a strong red color to litmus, enters into double decomposition with bases, and liberates carbonic acid from the carbonates. It is difficult, however, to obtain the gallotannates in a state of purity, owing to the tendency they exhibit to become oxidized on exposure to the air, and converted into compounds identical with that produced by gallic acid under similar conditions. Gallotannic acid is precipitated from its aqueous solution by the addition of potassic, sodic, and ammonic chlorides and many other salts, and by sulphuric and hydrochloric acids; by the action of nitric acid it is decomposed into oxalic and saccharic acids. In diluted aqueous solution it slowly absorbs oxygen from the air, and is converted into gallic acid; the change is facilitated by the action of a peculiar ferment present in the gall-nut. When boiled with dilute sulphuric or hydrochloric acid, or with a strong alkaline solution, a similar reaction occurs, gallic acid and carbonic acid being produced. The exact change that takes place is not clearly settled. It is highly probable that gallotannic acid is not a glucoside, as formerly believed, and that the glucose formed by its decomposition originates from accidental impurities; indeed, natural tannin frequently contains ready-formed sugar, from which it can be completely separated only with great difficulty; and Schiff has quite recently prepared absolutely pure gallotannic acid which, on treatment with hydrochloric acid, was entirely converted into gallic acid, no glucose being formed. On heating gallotannic acid to 325° C., pyrogallic and metagallic acids are produced with evolution of carbonic acid:

Gallotannic acid. Pyrogallic acid. Metagallic acid.

$$C_{27}H_{22}O_{17} = 3C_6H_6O_3 + C_6H_4O_2 + 3CO_2.$$

The formation of pyrogallic acid is characteristic of gallotannic acid, the other tannins (notably those which turn ferric salts green) giving pyrocatechine, $C_6H_6O_2$, when submitted to dry distillation. Gallotannic acid is tribasic, and forms neutral, acid, and basic salts. Of the gallotannates, the ferric salt is especially characteristic and important. It is obtained, upon adding a solution of the acid to a solution of a ferric salt, in the form of a violet-black precipitate. This reaction is exceedingly delicate. The basis of common writing ink is ferric gallotannate. In common with most forms of tannin, gallotannic acid forms with gelatine an insoluble compound. The affinity of the acid for gelatine is so great that when a skin is immersed in its aqueous solution all the tannin is ultimately removed. This property of gallotannic is often utilized in its quantitative estimation in nut-galls, etc., a standardized solution of gelatine, with a small quantity of alum or ammonic chloride, being employed for this purpose.

*Caffetannic Acid.*—The magnesium and calcium salts of this acid are contained in the coffee-berries in a proportion varying from 3 to 5 per cent.; it also occurs in Paraguay tea. The formula first assigned to caffetannic acid was $C_{16}H_{18}O_8$, but Gerhardt prefers $C_{35}H_{38}O_{17}$, which would indicate that it is a homologue of gallotannic acid, differing from it in composition by $8CH_2$.

*Catechutannic acid* is prepared from the aqueous extract of catechu. Its composition is $C_{18}H_{18}O_8$.

*Morintannic acid* is obtained from fustic (*Morus tinctoria*) by treatment with boiling water, when it is deposited in a light-yellow pulverulent form, consisting of microscopic prisms. It is soluble in water, alcohol, and ether; the aqueous solution has an acid, astringent taste. The formula is probably $C_{13}H_{10}O_6$, although when dried at 100° C. it has the composition $C_{13}H_{10}O_6.H_2O$.

*Quercitannic acid* is the tannin of the oak-bark. It gives with ferric salts the same reaction as gallotannic acid, but differs from this by not being converted into gallic acid by acids, and by not giving pyrogallic acid when submitted to distillation. Its composition is unknown. The most important compound of quercitannic acid is the one it forms with gelatine, which is the basis of leather.

*Quinotannic acid* occurs in the cinchona-bark. It is light-yellow, hydroscopic, with a sour, astringent but not a bitter taste—composition $C_{42}H_{30}O_{35}$. It gives the same reaction with gelatine as gallotannic acid, but imparts a green color to ferric salts. J. P. Battershall.

**Tanning and Tawing.** See Leather, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

**Tan'nin** [Fr.], **Medicinal Uses of.** Tannin is a powerful astringent, peculiarly characterized by its freedom from the irritant properties of the mineral astringents, such as the persalts of iron and salts of silver, copper, zinc, and lead. Taken internally, it is also devoid of any poisonous action. Its uses in medicine are solely as an astringent to catarrhal mucous membranes, and occasionally as a styptic to control bleeding from small vessels. Locally, it may be applied dry, as powder, or in solution in water or glycerine. Internally, for diarrhœal affections, it is most commonly given in pill. Edward Curtis.

**Tann, von der** (Ludwig), Baron, b. at Darmstadt June 18, 1815; was aide-de-camp to the crown prince Max of Bavaria when, in 1848, in the Schleswig-Holstein war, he organized a corps of volunteers; became chief of staff to Prince Eduard of Saxony in 1849, and chief of staff to Gen. Willisen in 1850, but left the Schleswig-Holstein army soon after; returned to the Bavarian service, and was made a lieutenant-general and adjutant-general to the king. In the war with Prussia in 1866 he was chief of staff of the Bavarian army, and the failure of the war was generally ascribed to him by public opinion. In 1869 he was made a general of infantry, and he commanded the first Bavarian corps in France. Here he distinguished himself in the battles of Wörth, Beaumont, and Sedan, and in the battle of the Loire. August Niemann.

**Tan'rec,** the French name given to certain insectivorous mammals of the genus *Centetes,* for which it is used as the equivalent in French works. In external appearance and size the species considerably resemble the hedgehogs (*Erinaceus*), but are very different anatomically. Their head-quarters are the island of Madagascar, and there they are esteemed by the natives as food, although they emit a strong musky odor. Theodore Gill.

**Tan'sy** [Fr. *tanaisie*] (*Tanacetum vulgare*) is a perennial plant bearing doubly-pinnatifid leaves and yellow flowers, blossoming from July to September. It was originally introduced into the U. S. from Europe, where it is indigenous. It is cultivated in gardens, but also grows in fields. It possesses a very strong, not unpleasant, odor, and an acrid and aromatic taste; which properties are exhibited by its aqueous and alcoholic infusions. The leaves contain, besides the usual proportions of chlorophyll, lignine, stearine, resin, tannin, etc., a peculiar volatile oil and an acid termed *tanacetic acid.* The latter is crystalline, forms salts with potassium and sodium, and precipitates solutions of calcic, zincic, argentic, and mercuric salts. The volatile oil of tansy has a sp. gr. of 0.92; when distilled with potassic chromate and sulphuric acid, it yields a volatile crystalline substance isomeric with ordinary camphor; it possesses poisonous properties. The seeds and leaves of tansy are employed, to a slight extent, as medicinal agents. J. P. Battershall.

**Tantal'idæ** [from *Tantalus*—a mythological name—the representative genus], a family of birds comprising the ibises and related kinds. The general form is that familiar in connection with the ibis; the bill is very long, more or less slender, compressed, and decurved toward the tip, or even sickle-shaped; the gape extends nearly as far back as the eyes; the nostrils are lateral, but near the culmen and the base of the bill, and linear; the wings are obtuse, but long (the humeri turned backward, passing beyond the acetabula); the tail moderate or small and even; the legs elongated, with the tibiæ exposed, and toward the knees featherless, and with the tarsi covered in front with transverse or hexagonal scales, and behind as well as on the sides with small scales; the toes are all well developed, the anterior connected by deeply-cut webs, the posterior free; the claws are arcuate and well developed. The family is most nearly related to the Ciconiidæ (storks) and Plataleidæ (spoonbills), and have been by some authors combined with them in one family (Ciconiidæ). The species are chiefly inhabitants of warm countries in all parts of the world. Thirty-one species are known, which have been arranged by Gray in two sub-families and three genera—viz. (1) Tantalinæ, with the single genus *Tantalus* (5 species), and (2) Ibidinæ, with the genera *Ibis* (7 species) and *Geronticus* (19 species). The species whose range extends more or less within the limits of the U. S. are *Tantalus loculator* (the wood ibis), *Ibis rubra* (the red ibis), *Ibis alba* (the white ibis), *Ibis Ordii* (the glossy ibis), and *Ibis guarauna* (the bronzed ibis). The species of the family mostly live on the borders of lakes and rivers, and subsist, some on fishes and reptiles chiefly, and others on worms and insects for the most part. They are birds of passage, and change their resorts with the seasons. The females build nests, some on the ground and some in trees, and lay but few (generally two or three) eggs. (See also Ibis.) Theodore Gill.

**Tan'talum** [Lat. *tantalus*], one of the rarer elements, a metal discovered in 1802 by the Swedish chemist Ekeberg in two Swedish minerals, one of which was *tantalite,* composed mainly of tantalic oxide, $Ta_2O_5$, and ferrous oxide. Ekeberg named the metal and mineral after the mythological being Tantalus, in jocular allusion to the tantalizing difficulties he encountered in analyzing the mineral. For many years it was confounded with the Columbium (which

see) of Hatchett. Tantalum is found also as tantalate of yttria in the mineral *yttro-tantalite;* in the American, Bavarian, and Greenland *columbites*, with columbic acid; in Nordensjöld's *hjelmite;* in *euxinite*, *æschynite*, etc. H. Rose obtained metallic tantalum as a black powder, of density 10.78. Its equivalent weight is accepted as 182 from determinations of Marignac. *Tantalic pentoxide* ($Ta_2O_5$), which forms tantalic acid by reacting with water, and tantalates by combining with bases, is an infusible white powder, which has been obtained by different methods in a number of modifications, varying in density from 7 (*Hermann*) up to 8.26 (*H. Rose*). There is another oxide known, $TaO_2$, and a sulphide, $TaS_2$, which is black and brass-yellow when burnished. A solid yellow chloride, $TaCl_5$, is known, which may be sublimed. HENRY WURTZ.

**Tan'talus,** in Grecian mythology, a wealthy king of Argos, Corinth, Phrygia, or Paphlagonia, who committed some great crime against the gods, either by divulging their secrets entrusted to him, or by stealing nectar and ambrosia from their table, or by testing the omniscience of Zeus by cooking his own son Pelops and serving him as a dish for the god. As a punishment, Tantalus was placed in a lake in the lower world whose waters receded from his lips whenever he tried to drink, surrounded by rich fruits which withdrew whenever he attempted to eat of them, and with a huge rock suspended over his head and always threatening to fall and crush him.

**Tan'tum Er'go** [Lat.], a popular eucharistic hymn in Latin, is a portion of the PANGE LINGUA (which see). It is sung in Roman Catholic churches during eucharistic services at the benediction.

**Tan Yard,** tp., Pike co., Ala. P. 1440.

**Taormi'na** [anc. *Tauromenium*], town of Sicily, province of Messina, situated on Monte Tauro near the seashore. Founded by the Siculi, besieged in vain by the elder Dionysius, for a time in the hands of Carthage, it became under Andromachus one of the powerful cities of Sicily. With Syracuse it fell under the Roman dominion (212 B. C.), but its population never equalled that of Messina or Catania. The principal antiquities of interest are—the ancient theatre, originally Greek, but rebuilt by the Romans, and in some respects one of the most perfect existing; the so-called naumachia, also Roman; the sepulchres; five Roman reservoirs, of which one is still in good condition. There are also some Saracenic and mediæval ruins worthy of notice, besides the actual walls and towers, which are mostly of Saracenic construction. The castello or citadel occupies the highest point of the old town. The modern village is of no interest except for the almost unrivalled beauty of its position and climate. A very good hotel has recently been opened here. P. 3000.

**Ta'os,** county of N. W. New Mexico, bordering on Colorado and Arizona; watered by the Rio Chama, the San Juan, and the Rio Grande, and crossed by several spurs of the Rocky Mountains. There are quartz gold-mines. Staples, Indian corn, wheat, and wool. Cap. Fernandez de Taos. Area, about 7500 sq. m. P. 12,079.

**Tapa,** a kind of paper-cloth made by the South Sea islanders from the bark of small branches of the paper mulberry (*Broussonetia papyrifera*). The natives take the moistened slips of the bark, beat them together, and then suffer them to dry. The same material affords the excellent paper of Japan.

**Tapa'jos,** river of Brazil, rises in the S. of the province of Matto Grosso under the name of Jarnenna, assumes the name of Tapajos after its entrance into the province of Para, and joins the Amazon, after a northward course of about 1100 miles, in lon. 55° W. It is navigable till within a few miles from its sources, and these are only a few miles distant from the Paraguay.

**Tap'estry** [Gr. τάπης, a "carpet;" Fr. *tapisserie*], an ornamental carpet-work for decorating walls and furniture, brought into general use in Western Europe by the Saracans of Spain, from whom it was often called in French *sarrazinois*. The oldest known specimen is the BAYEUX TAPESTRY (which see), commemorating the Norman conquest of England. In the fourteenth and fifteenth centuries the fabrication of tapestry by the loom became an important industry in Flanders, and was introduced into England early in the sixteenth century. The most important manufactory at the present time is that of gobelins. (See GOBELINS TAPESTRY.)

**Tape'worm,** a parasitic worm of flattened, tape-like form, living in the intestine of man and many of the lower animals. It belongs to a group of worms distinguished by the fact that they are of a soft consistency throughout, having no resisting integument; that they are without an intestinal canal, and accordingly have neither mouth nor anus; and that the sexes are united, the male and female organs existing together in the same body. The anterior extremity or "head" of a tapeworm is very small, of a spheroidal or oblong form, provided with muscular suctorial cavities or appendages, and in many cases with movable, sharp-pointed, curved spines of horny consistency, by means of which it attaches itself to the intestinal mucous membrane. Next the head comes a slender, neck-like portion, and beyond that the body, which gradually becomes thicker and wider, and is marked off into rectangular divisions or articulations. The articulations become more distinct and completely organized as they recede from the situation of the head. Each articulation contains both male and female generative organs, and is self-fecundating, so that those which are fully mature contain fertile eggs enclosing living embryos. The articulations are provided with muscular fibres, both longitudinal and transverse, and are capable of contraction and expansion in various directions. Underneath the integument are imbedded a large number of smooth, rounded, highly-refractive, calcareous granules. A double series of vascular canals, containing a limpid colorless fluid, runs parallel with each lateral edge of the tapeworm, communicating with each other in each articulation by transverse branches. These vessels are undoubtedly connected with the process of nutrition, but their exact function is not understood. As there is no mouth, the absorption of nutritious material from the exterior must take place through the general integument. The whole tapeworm thus forms a long, narrow, ribbon-like chain of articulations, anchored by its head to the intestinal mucous membrane. It is not regarded as a single animal, but as a colony composed of many individuals, all belonging to the same species, but differing in structure and function. The so-called head is adapted for holding the colony in position. It also has the power of developing the other parts by a budding process, the successive articulations thus formed producing at last eggs and embryos, and in this way continuing the species by sexual generation. The mature articulations remain connected with the colony until their eggs and embryos have reached a certain grade of development. They then discharge their eggs, and are themselves thrown off, or else they are detached entire, still retaining an independent vitality. In either case, the eggs and embryos are finally set free, to continue their growth in a different locality. This constitutes an important feature in the development of the tapeworm. The eggs and embryos, after leaving the intestine of the animal in which they were produced, are devoured by some other animal of a different kind, and while within its body reach an intermediate stage of development in an encysted form. Subsequently, the flesh of the second animal is devoured by another of the original species, and the encysted embryos, having arrived in an intestine suitable for their complete development, again reproduce the tapeworm colony. Thus the parasite exists naturally under two different forms—namely, a small, encysted, sexless form in the tissues of one animal, and a largely-developed, sexual tapeworm-form in the intestine of another. These two necessarily alternate with each other in the reproduction of the species, and both are equally essential to its continued existence.

The numerous varieties of tapeworm found in different animals are included in two principal genera—namely, *Tænia* and *Bothriocephalus*, both of which are represented by species infesting the human subject.

I. *Tænia* [Gr. ταινία, a "fillet" or "ribbon"].—This genus is distinguished by the armament of its head and by the position of its genital orifices. The head, which is nearly spherical in shape, is provided with four muscular suckers of a disk-like form, and usually bears upon its anterior part a collar of horny hooks. Each articulation contains both testicle and ovaries, the external orifices of which are seated together upon its lateral border. In the mature articulations the eggs contain embryos of a vesicular form, provided each with three pairs of slender horny spicules or claws. The species most liable to occur in man is the *Tænia solium*, or solitary tapeworm. It occupies the cavity of the small intestine, where it may attain a length, when stretched out, of twenty to twenty-five feet, often comprising over 1000 articulations. It is of a white color, and from a quarter of an inch to half an inch in width. The mature articulations are longer than they are broad. The head is a little over $\frac{1}{50}$th of an inch in thickness, with a circular crown of about twenty-six hooks, arranged in a double series, alternately larger and smaller, but so placed that their curved points, radiating outwardly, all fall in the same circumferential line. The common orifice of the male and female genital organs is situated about the middle of the lateral border of each articulation, but it alternates irregularly from side to side in successive articulations. The eggs are spherical, and about $\frac{1}{750}$th of an inch in diameter. The mature articulations, still contain-

ing their eggs and embryos, separate one by one from the parent colony and pass out of the intestine, either spontaneously or with the evacuations. If deposited upon the ground in a damp place and protected from desiccation, they may retain their vitality and power of locomotion sufficiently to attach themselves to the neighboring herbage or leaves of growing plants, and are thus liable to be devoured by various animals. Such contractile movements have been actually observed in separate articulations for a considerable time after their expulsion, and, according to Küchenmeister, the articulations may be kept alive for eight days in carefully-renewed white of egg. There is reason to believe that the eggs may also continue for a time uninjured when suspended in watery fluids, even after the substance of the articulation has become lacerated, or decomposed and diffluent. These circumstances indicate the probable mode in which the tapeworm articulations or their young brood may become mingled with the food and drink of inferior animals. The species in which they usually reach their next stage of development is the pig. When introduced into the stomach of this animal, the substance of the articulation is dissolved by the digestive juices, and the embryos are set free. They then begin an active emigration from the cavity of the intestine, penetrating its walls and the neighboring tissues, and dispersing in this way throughout the body. This passage is effected by a boring process by means of the three pairs of spicules with which the embryos are provided and the contractile movement of their membranous walls. When once disseminated through the cellular tissue of the body and limbs, they become encysted, by the formation of an external envelope from the neighboring parts. They then increase in size, and pass into their next stage of development. They lose the six spicules which mark their previous condition, and acquire instead a neck and head with four suckers and a crown of hooks, like those of the adult tapeworm. The head and neck, however, at this time are inverted upon themselves, and thus enclosed in the interior of a globular vesicle, the enlarged spherical body of the embryo. If the external cyst be now opened, the contained parasite may be turned out of its bed in the form of a globular vesicle with a superficial depression at one spot, marking the situation of the inverted head. By gentle compression the inverted parts may be gradually extruded, and the organism then presents the appearance of a fully-developed tapeworm head and neck, terminating behind in a dilated vesicular extremity. In this condition it is known by the name of *cysticercus* (Gr. κύστις, "vesicle," and κέρκος, "tail") or "bladder-tail," and from its locality in the cellular tissue it is called the *Cysticercus cellulosæ*. When the flesh of the pig is thus infected with *Cysticercus cellulosæ*, it is sprinkled more or less abundantly throughout with thin-walled, semi-transparent cysts, and in this condition it is known as "measly pork." When about one month old, the cysts are $\frac{1}{25}$th of an inch in diameter; when fully grown, they may attain the size of one-third of an inch, or even more, and are sometimes so numerous in certain spots as to touch each other. After reaching this stage of development, the parasites remain for an indefinite time encysted in the cellular tissue. While in this situation they undergo no further change, unless it be a very gradual process of atrophy, with partial collapse and calcification of the cyst, which may occur after the lapse of several years.

The subsequent history of this species relates to the reintroduction of the *Cysticercus* into the human intestine, and its development there into the adult tapeworm. When a portion of swine's flesh containing *Cysticercus* is swallowed by man in an uncooked or imperfectly-cooked condition, the enveloping sac is digested by the gastric juice, and the parasite is set free. On arriving in the upper part of the small intestine, the head attaches itself to the mucous membrane; and the neck, absorbing nourishment from the intestinal fluids, increases in length and width. The transverse wrinklings of its substance become more distinctly marked, and regular articulations make their appearance, assuming the form of a continuous chain, and exhibiting finally the characteristic sexual organs, with mature eggs and embryos. The human subject is therefore infected with tapeworm by swallowing the live *Cysticercus*, usually derived from measly pork. It is not, however, the most thoroughly diseased pork which is the most dangerous in this respect, since its unhealthy appearance is too marked to escape notice. In many instances the cysts are comparatively few and scattered, and such meat may be prepared for food without the presence of the parasite being observed. Butchers, sausage-makers, and provision-dealers are also liable to infect themselves by careless handling of the fresh meat, placing between their lips the blade of the knife used in cutting it up, or taking food while at their work or immediately afterward without washing their hands. By such means they may easily, without knowing it, introduce one or two small *Cysticerci* directly into the mouth, or contaminate with them bread and other articles of food. This mode of infection is the more likely to produce tapeworm because there is no protection by cooking, which in the meat itself, when used for food, is generally sufficient to destroy the vitality of the parasite.

When a *Tænia solium* is fully established in the human intestine, it becomes a source of annoyance and sometimes of marked distress. A great variety of symptoms are enumerated as having been observed in cases of *Tænia solium*, but none of them are sufficiently definite or uniform to give any certain indication of its presence. All writers agree that the only sure sign of the existence of a *Tænia* in any given case is the discharge of its articulations from the intestine. The truth seems to be, that in robust and otherwise healthy persons it may be present for an indefinite time without causing any serious effects; but in those of an enfeebled constitution or irritable temperament it may give rise to abdominal pains, indigestion, loss of flesh, restlessness, and even hysterical convulsions. The treatment consists in the administration of drugs intended to destroy the vitality of the worm, and thus cause the head to loosen its hold upon the mucous membrane. This is essential to the cure; for, although ordinary purgatives or an accidental diarrhœa may detach and bring away considerable portions of the articulated body, if the head remain the articulations are in time reproduced, and the parasite is again as large as before. But if the head be discharged, no reproduction takes place and the malady is at an end. The most successful remedies for this purpose are the bark of the pomegranate-root and the extract of the root of the male fern. According to Küchenmeister, the best results are obtained by administering a mixture of both these drugs in two or three successive doses, followed by an ordinary aperient to bring away the detached worm.

It is a circumstance of some importance in this connection that *Cysticercus* also occurs in the human subject. Though never present in man as abundantly as in the pig, it is not unfrequently found singly, and sometimes in greater numbers. Its different localities are, in the order of their frequency—the cellular tissue beneath the skin, between and in the tissue of the muscles, the surface and the interior of the brain, the envelopes and inner chambers of the eyeball, the heart, the lungs, the mesentery, and the lymphatic glands. The effects produced by its presence depend on the importance of the organ invaded and on the abundance of the parasite in a given locality. In the subcutaneous cellular tissue it is nearly or quite harmless, while in the eye even a single one may produce serious disturbance of vision, and in the brain the local irritation may cause vertigo, paralysis, or convulsions.

The mode in which *Cysticercus* happens to be developed in the human system is undoubtedly from the accidental swallowing of the ripe eggs of *Tænia solium*. It is not likely that it ever comes directly from a tapeworm in the intestine of the same person; for even when such a tapeworm exists, its mature articulations are detached and discharged with the eggs still contained in their interior; and the young embryos, so far as we know, are never set free within the intestine harboring the parent tapeworm. It seems to be necessary that the detached articulation should pass anew into the alimentary canal and undergo stomach digestion, or in some other way suffer disintegration, before the embryos can be liberated from their envelopes. In an individual infested with *Tænia solium* the detached articulations sometimes pass out of the bowels by themselves, independently of the alvine evacuations. Such an articulation, if roughly handled, is liable to be ruptured, and its microscopic eggs may then adhere to the fingers of the person handling it, and may be afterward transferred to various articles of food, especially in households where the usual precautions of cleanliness are habitually neglected. The person harboring a tapeworm may thus indirectly infect himself or other members of his family with *Cysticercus cellulosæ*. Another probable source of this infection is the use of fresh, uncooked vegetables, such as lettuce, radishes, and the like, when imperfectly washed. The evacuated tapeworm articulation is liable, as above mentioned, to attach itself to low-growing herbaceous plants, and even after its disintegration its eggs may remain for a time protected by the shade and moisture of the leaves. Unless the plants, therefore, when gathered, are thoroughly cleansed before use, they may thus convey into the system the germ of *Cysticercus cellulosæ*.

II. *Bothriocephalus* (Gr. βόθριον, a "furrow," and κεφαλή, "head").—This genus is distinguished from the preceding, first, by the structure of its head, which is elongated in form, destitute of the crown of hooks, and, instead of the four orbicular suckers, has usually two narrow lateral pits or furrows; and secondly, by the position of its genital orifices, which are seated on the flat surface of each articulation,

in the median line. The species met with in man is *Bothriocephalus latus*, so called from its width and the shape of its mature articulations, which are considerably broader than long. The worm is found in the cavity of the small intestine. It is of a bluish-white color, often brownish in its middle parts. Its length is often very great, amounting to over 2000 articulations, and its width in the lower part of the chain averages about one inch. The head is a long oval, $\frac{1}{25}$th of an inch in its transverse diameter, but very contractile, and capable of assuming considerable variations of form. Its two lateral furrows are long and narrow, presenting the appearance of longitudinal fissures. The male and female genital openings are distinct from each other on the surface of each articulation, the male orifice being situated more in front, the female behind. The mature eggs are oval in form, $\frac{1}{370}$th of an inch in length, and provided with an operculum or lid at one extremity, which on opening allows the escape of the embryo. The outer membrane of the embryo is covered with movable, hair-like filaments or cilia; and within it is a vesicular body, with three pairs of spicules like those in the embryo of *Tænia*. The mature articulations do not separate one by one, but are thrown off in chains or fragments of considerable length, and only after they have discharged their eggs. They are consequently evacuated in an empty and more or less deformed and collapsed condition. The symptoms to which this worm gives rise are similar to those caused by *Tænia solium*, and the treatment required is the same for both.

The history of development of *Bothriocephalus latus*, subsequently to the expulsion of its eggs, has not yet been ascertained, and consequently the source of infection by this worm for the human species is unknown. It is suspected by naturalists that it passes through its intermediate condition, as an encysted parasite, within the bodies of certain kinds of fish or of some aquatic invertebrate animals liable to be used as human food. The grounds for this supposition are that most species of *Bothriocephalus* inhabit the bodies of fish, while they are very rare in terrestrial mammalians. In this respect they differ from *Tæniæ*, which are quite frequent in mammalians and birds, but rare in fish. In some fishes, as in the stickleback, the *Bothriocephalus* parasite is in an incomplete and unsexual condition, occupying the cavity of the abdomen, but, according to Siebold, becomes a fully-formed sexual tapeworm in the intestine of birds or of larger predaceous fish which feed upon the smaller ones. The existence of an enveloping membrane with movable cilia in the embryo of this species also indicates that it is adapted for temporary migration in a watery medium, and is thus enabled to reach the interior of the animal in which it is to become encysted. It has long been noticed that while *Tænia solium*, as a human parasite, is found in the most different countries—in Europe, Asia, and Africa, and on both sides the Atlantic—the occurrence of *Bothriocephalus latus* is limited in Europe to particular regions. It is most frequent in Western Switzerland, especially about Geneva, next in the N. of Russia, in Sweden and Poland, and occurs also in Holland and Belgium. It is very rare in England, and is never found in the U. S. except among foreigners from the above-mentioned European localities. No doubt, some habit of life or kind of alimentation common to these districts is the immediate cause for the production of *Bothriocephalus*, but what it is has not yet been determined with any approach to certainty. J. C. Dalton.

**Tapio'ca,** the starch of the *Janipha* (or *Jatropha*) *manihot* (cassava-plant), from which it is prepared by pressing the washed and dried roots under water, when it is obtained in a mealy form, which is converted into a granular condition by drying over hot plates. Upon drying and pressing the pulp remaining in the water, *cassava-bread* is obtained. This, when pulverized, is known as *manjok flour*. Tapioca is largely consumed as an article of food. J. P. Battershall.

**Tapioca Starch.** See Tapioca.

**Tapir.** See Tapiridæ.

**Tapir'idæ** [from *Tapirus*—a Latinized form of a Brazilian aboriginal name—the typical genus], a family of mammals of the order Ungulata and sub-order Perissodactyla, related to the rhinoceroses and horses (Equidæ), and not at all to the hogs (Suidæ) or hippopotamuses, as is popularly believed. In form, however, the tapirs perhaps more resemble the hogs than their nearer relations, but they are peculiar in that the hind quarters or buttocks project notably backward, and the snout is produced into a rudimentary flexible proboscis; the nostrils are at the end of the proboscis; the ears are erect and moderately developed; the neck abbreviated; the tail very short; the anterior feet have each four toes, the posterior three. The teeth are in almost full number—viz. M. $\frac{3}{3}$, P. M. $\frac{4}{3}$, C. $\frac{1}{1}$, I. $\frac{3}{3} \times 2 = 40$; all the molars, as well as premolars in part (P. M. 2, 3, 4), are nearly similar, squarish, and each with the anterior crest marginal, but with an anterior cingulum terminating in a cusp at the antero-outer angle of the tooth; the hindermost molars (M. 3) have no posterior lobes; the outer incisors of the upper jaw are enlarged, and like canines; the true canines very small; the incisors of the under jaw uniform; the canines large. The skull has a nasal aperture very large, and encroaching far behind into the frontals and on each side of the nasal bones, leaving apparent sideways the septum between the nares, and separated from the orbits only by the thin frontal bones; the axis formed by the basioccipital and basisphenoid bones is very narrow; between it and the periotic elements are large vacuities; the periotic bones are free from (not ankylosed with) the squamosal and tympanic; the tympanic are "exceedingly rudimentary, forming a small irregular floor to the tympanic cavity, with an oval lip for the attachment of the membrana tympani, and always become detached in macerated skulls" (*Flower*); the post-tympanic processes elongated, and connected with them halfway are the paroccipital processes of the exoccipitals; between the two behind are narrow projections of the mastoid bones; the nasal bones, when fully developed, form together a hastiform figure, broad behind and tapering forward; they are enclosed by the mesethmoid, whose upper edge is correspondingly dilated, and which becomes more or less ossified in the adult; the supramaxillary bones are free and enrolled at their upper margins, or laminar and clasp the mesethmoid; the intermaxillaries are well developed and tectiform; the orbits separated from the temporal fossæ only by slight angular processes of the malar bones; the lower jaw has moderately deep rami, whose angles are convex and project considerably backward. These are the principal characteristics of this well-marked family, and which contrast with the Equidæ and Rhinocerotidæ. It is at present represented by five and possibly more species—viz. (1) *Tapirus terrestris*, a species widely spread over South America in the lowlands, and extending from the Isthmus of Panama to Paraguay; (2) *Tapirus pinchaque*, confined to the Andes of South America, especially Ecuador and New Granada; (3) *Rhinochœrus Indicus*, an inhabitant of the Malaccan Peninsula, Sumatra, and Borneo; (4) *Elasmognathus Bairdii*, a native of the Isthmus of Panama, and extending northward into Southern Mexico; and (5) *Elasmognathus Dowii* (a somewhat doubtful form), found in Nicaragua. The *Tapiri* and *Rhinochœri* have the margins of the upper jaw rolled inward, but the *Elasmognathi* have them spread out so as to firmly embrace the mesethmoid. All the species are denizens of deep forests, but near where water abounds, to which they love to resort. They vary in size from that of a small ass to that of a moderate horse, the *Tapirus pinchaque* being the smallest, and the *Rhinochœrus Indicus* the largest. The *Elasmognathus Bairdii* is the largest American species. All the species (except possibly *E. Dowii*) are striped or spotted in early youth, but soon assume the uniform or bicolored livery of full age. Although now represented by species so singularly isolated as are the American and Malaccan species, in the Tertiary epoch the family was widely diffused, and species roamed over Europe and America far to the northward. The species, too, are the nearest relations of the Eocene Lophiodontidæ, which are among the oldest of known placental mammals.

Theodore Gill.

**Tappahan'nock,** p.-v. and port of entry, cap. of Essex co., Va., on the S. bank of Rappahannock River, 64 miles below Fredericksburg, has 2 churches, excellent schools, 1 newspaper, a large sumac and bark mill, a carriage-factory, and 2 hotels. There are steamers twice a week each way from Norfolk and Baltimore. P. about 800. A. R. Micou, Ed. "Index."

**Tap'pan** (Arthur), b. at Northampton, Mass., May 22, 1786, son of Benjamin (1748–1831), a Revolutionary patriot and merchant: received a good common-school education; served at Boston a seven years' apprenticeship (1800–07) to the hardware business, after which he set up for himself in the same line at Portland; soon removed to Montreal, Canada, and became a successful importer, but closed up the business at a great sacrifice upon the outbreak of the war of 1812; established himself in New York as an importer of British dry goods 1814; built up a prosperous business; became widely known for public spirit and philanthropy, and as a liberal patron of religious organizations; was one of the chief founders of the American Tract Society, and the largest donor for the erection of its first building; was a liberal benefactor of the American Bible Society, and originator of the effort to place a Bible in the hands of every family in the U. S.; endowed Lane Seminary at Cincinnati, a professorship at Auburn Theo-

logical Seminary, erected Tappan Hall at Oberlin; joined his brother Lewis in founding the New York *Journal of Commerce* (1828); furnished the money for establishing the *Emancipator* newspaper at New York in the spring of 1833; formed at his own rooms the nucleus of the New York City Anti-Slavery Society, which was publicly organized under his presidency at Clinton Hall Oct. 2; was the first president of the American Anti-Slavery Society, formed at Philadelphia Dec. 4, 1833, and contributed to that society for several years $1000 per month, but withdrew from it in 1840 on account of the aggressive spirit manifested by many members toward the churches and the Union; was obliged to suspend payments in the great crisis of 1837, but by great sacrifices ultimately met all his engagements; was nevertheless forced to go into bankruptcy in 1842, when he caused the whole of his personal property to be sold; incurred the hatred of Southern slaveholders by his frequent aid given to fugitives and by his rescuing Garrison from imprisonment at Baltimore. During his later years he was connected with the "mercantile agency" established by his brother Lewis. D. at New Haven, Conn., July 23, 1865. (See his *Life*, by Lewis Tappan, New York, 1871.)

**Tappan** (Benjamin), brother of Arthur, b. at Northampton, Mass., May 25, 1773; learned the arts of copperplate engraving and printing and portrait-painting; subsequently studied law; settled in Ohio 1799; was chosen to the legislature 1803; was aide-de-camp to Gen. Wadsworth in the war of 1812–15; was for seven years president judge of the fifth Ohio circuit; was appointed U. S. district judge by Pres. Jackson 1833; published a volume of *Reports* (Steubenville, 1831) of cases at common pleas; was U. S. Senator 1839–45; was an active Democratic politician, and joined the Free-Soil movement of 1848. D. at Steubenville Apr. 12, 1857.

**Tappan** (David), D. D., b. at Manchester, Mass., Apr. 21, 1752; graduated at Harvard College in 1771; studied divinity, and in 1774 became pastor of a Congregational church in Newbury, Mass., where he remained until 1792, when he was chosen Hollis professor of divinity in Harvard University, a position which he held until his death. He printed several occasional sermons and discourses, and after his death were published—*Sermons on Important Topics*, with a biographical sketch by Rev. Abiel Holmes (1807), and *Lectures on Jewish Antiquities*, delivered at Harvard University. D. Apr. 27, 1803.

**Tappan** (Henry Philip), D. D., b. at Rhinebeck, N. Y., Apr. 23, 1805; graduated at Union College in 1825; studied theology at Princeton, and after having been a year associate pastor of a Dutch Reformed church in Schenectady, became in 1828 pastor of a Congregational church in Pittsfield, Mass.; in 1832 became professor of moral philosophy in the University of the City of New York; resigned in 1838, and opened a private school, and in 1852 was elected chancellor of the University of Michigan; resigned in 1863, and has since resided chiefly in Europe. He published—*Review of Edwards's Inquiry into the Freedom of the Will* (1839), *The Doctrine of the Will determined by an Appeal to Consciousness* (1840), *The Doctrine of the Will applied to Moral Agency and Responsibility* (1841), *Elements of Logic* (1844; revised and enlarged 1858), *Treatise on University Education* (1851), and *A Step from the New World to the Old, and Back Again* (1852).

**Tappan** (Lewis), brother of Arthur and Benjamin, b. at Northampton, Mass., May 23, 1788; engaged in commercial business and cotton manufacture at Boston; removed to New York 1827; aided his brother in founding the *Journal of Commerce* 1827, and was sole owner of that paper 1828–31; had his house sacked by a mob in consequence of his anti-slavery sentiments July, 1834; was involved like his brother in the financial crisis of 1837; afterward established a "mercantile agency," the first of the kind in the U. S.; was prominent for many years in anti-slavery, religious, and philanthropic associations, especially in the American Missionary Association, founded chiefly through his efforts, of which he was long the treasurer, and ultimately president; was an early member of Plymouth church, Brooklyn, and published a *Life* of his brother Arthur in 1871. D. at Brooklyn June 21, 1873.

**Tappan** (William Bingham), b. at Beverly, Mass., Oct. 29, 1794. His early advantages were limited, but he acquired a sound education, and was for six years a successful teacher in Philadelphia; in 1826 removed to Boston; became general agent of the American Sunday-School Union, and was licensed as a preacher in 1840. He published *New England and other Poems* (1819), and several other volumes of poems at later periods, and *Memoirs of Capt. James Wilson* (1842). Nearly all of his poetical works, with his final revisions, are comprised in the following volumes: *Poetry of the Heart* (1845), *Sacred and Miscellaneous Poems* (1846), *Poetry of Life* (1847), *The Sunday School, and other Poems* (1848), and *Late and Early Poems* (1849). D. at West Needham, Mass., June 18, 1849.

**Tappan Sea,** or **Tappan Bay** [Dutch, *Tappaan Zee*], is an expansion of Hudson River. Its lower end is 24 miles N. of New York. It is 12 miles long, and its greatest breadth is 4 miles. It extends from Teller's Point to Piermont.

**Tap'ping** (*Paracentesis*), in surgery, is the piercing of the walls of a cavity so as to draw off a dropsical or other collection of fluid. The abdomen, chest, scrotum, and even the head, are often tapped for the removal of such effusions. The trocar and canula answer for the performance of the operation in many simple cases. In some others the contained fluid has to be removed by an instrument acting as a pump or syringe. Tapping often affords great relief, and occasionally is of great service toward recovery, especially in cases of pyothorax and hydrothorax.

**Tapsfield,** tp., Washington co., Me. P. 463.

**Tap'ti,** river of British India, presidency of Bombay, rises in lat. 21° 46′ N., flows W. through Surat, and falls into the Bay of Cambay after a course of 441 miles. It is navigable only for a short distance from its mouth, and only for small vessels.

**Tar, Coal,** or **Pitch.** The term *pitch* is applied to a variety of solid resinous substances of dark color and brilliant lustre: (1) mineral pitch, called asphaltum and bitumen, abundant at the Dead Sea ("Jews' pitch"), Barbadoes, Trinidad, Mexico, Cuba, Ritchie co., West Va. (grahamite), Albert mine, Nova Scotia (albertite), Peru, California, etc. (see Bitumen); (2) Burgundy pitch, the melted resin of *Abietis resina* or *Thus;* (3) wood-tar pitch, prepared by boiling down (distilling off the naphthas) wood-tar; (4) coal-tar pitch, prepared in the same way from coal-tar. Little is known with regard to the chemical composition of pitch; that from pine-wood tar is resinous. Pitch is used in medicine and for roofing, paving, calking ships, making varnishes, etc. C. F. Chandler.

**Tara,** or **Taro** (which see).

**Taraika.** See Saghalien.

**Tar'antism,** an epidemic dancing mania, formerly prevalent in Apulia, and especially at Taranto, whence its name. It was popularly believed to be caused by the bite of the Tarantula (which see), and doubtless the fright attending the bite may have aggravated the nervous symptoms of the patient. Not only dancing, but catelepsy, was one of the symptoms. It was believed that the patients possessed an ardent passion for music and the dance and for bright and beautiful objects. The most successful cure was from hearing and dancing the music of the tarantella, the national dance of the Sicilians. It also prevailed in Barbary.

**Ta'ranto** [Gr. Τάρας; Lat. *Tarentum*], town of Italy, province of Lecce, in lat. 40° 26′ N., lon. 17° 16′ E., at the N. extremity of the large gulf of the same name which forms the hollow below the heel of the *Boot*. The town is built on an island connected with the mainland by two stone bridges, and on both sides a deep bay sweeps inland, thus forming a double basin, that to the W. being called the Mar Grande, that to the E. the Mar Piccolo. Two low islands (anc. *Chœrades*), San Pietro and San Paolo, lie as a protection across the harbor, which, if not the finest in Italy, is at least second only to that of Spezia. The main entrance is between Cape S. Vito and the island of S. Pietro, and admits shipping of the heaviest tonnage; the N. W. passage is practicable only for small vessels. With a few not very expensive improvements, this port, from its advantageous situation with respect to the Suez Canal, and as the most favorable marine station in Southern Italy, will doubtless become of great commercial importance. At present the whole number of vessels entering the harbor annually is only about 1500, and the town lacks good hotels and many of the comforts necessary to modern civilization. There is little to interest the visitor beyond the exceptionally beautiful views of sea and land to be had at many points, and the abundance and richness of the almost tropical vegetation, which can hardly be less luxuriant now than when Horace wrote his *Ode*, 6, b. ii. Even the date-palm bears fruit here, though not in its perfection. The honey, the oil, and the fruits of the neighborhood have as great a reputation as ever, and the waters abound in excellent fish of many varieties. The remains of the ancient town, the largest of all the cities of Magna Græcia (founded 707 B. C.), and once boasting an army of 30,000 foot and 5000 horse, besides a strong navy, are very insignificant. Taranto is not without a place in mediæval history, and is especially remembered as the fief of Bohemond the Norman crusader. P. 27,546.

**Taran'tula** [from TARANTO, which see], a name applied to several different kinds of animals. (1) Primarily, it was given to the *Lycosa tarantula*, a spider of Southern Italy. Its bite was supposed to cause the disease called TARANTISM (which see), but by modern observers it is pronounced less severe than the sting of the common wasp. (2) In warm, temperate, and tropical countries it is extended by the English-speaking races to sundry large spiders, and especially those of the genus Mygale (family Mygalidæ). (3) Some lizards are also popularly styled tarantulas, and there is a genus, *Tarentola*, of the family Geckotidæ, having representatives in warm climates.

**Tarare',** town of France, department of Rhone, on the Tartine, is celebrated for its manufactures of muslins, shawls, and silks. P. 14,569.

**Tarascon',** town of France, department of Bouches-de-Rhône, on the left bank of the Rhone, has large manufactures of linen, cotton, woollen, and silk fabrics, brandy, oil, and vinegar. In its vicinity teasles, madder, almonds, and fruits are extensively cultivated. P. 13,489.

**Taraxacum.** See DANDELION.

**Tarazo'na,** town of Spain, province of Saragossa, on the Queiles, has a fine cathedral with a spire of brick, and about 6000 inhabitants, mostly engaged in agriculture.

**Tarbagatai',** town of China, in Toorkistan, near the Russian frontier, in a fertile plain in lat. 46° 8′ N., lon. 82° 38′ E. It has hardly 4000 inhabitants, but a very important trade between China and Russia is carried on here.

**Tarbes,** an old but well-built and handsome town of France, capital of the department of Hautes-Pyrenées, on the Adsur, has several good educational institutions, and some manufactures of oil, leather, paper, cutlery, and copperware, and carries on an active general trade. P. 16,535.

**Tar'boro',** p.-v. and tp., cap. of Edgecombe co., N. C., on a branch of Wilmington and Weldon R. R., 60 miles S. E. of Raleigh, has 4 churches, male and female academies, 1 bank, 1 newspaper, 1 hotel, agricultural implement manufactory, and a fire insurance company. Pop. of v. 1340; of tp. 3102. W. P. WILLIAMSON, ED. "SOUTHERNER."

**Tardigra'da** [from Lat. *tardus*, "slow," and *gradus*, "walk"], a name proposed as a family term by Illiger in 1811 for the sloths, but adopted by later writers as a subordinal designation for the existing Bradypodidæ (sloths) and extinct Megatheriidæ. The principal superficial characters by which they are distinguished from the other members of the order Edentata or Bruta to which they belong are as follows: (1) The integumentary appendages are developed as simple hairs; (2) the facial portion of the skull is more or less abbreviated; (3) teeth are developed in small and definite numbers (*e. g.* $\frac{5}{4} \times 2$) in the supramaxillary and dentary bones, but never in the intermaxillary or front of the lower jaw; (4) these teeth are composed of a large central axis of vascular dentine, with a thin investment of hard or unvascular dentine, and a thick outer coating of cement (*Owen*); (5) the teeth are also monophyodont—*i. e.* only one set is developed; (6) they are adapted for an herbivorous or rather phyllophagous (leaf-eating) regimen; (7) the placenta is discoid and deciduate, and much resembles that of the anthropoid Primates (man and monkeys). There are two families, Bradypodidæ and MEGATHERIIDÆ (which see). THEO. GILL.

**Tardigrada,** the name used by Doyère in 1840, and subsequently by a number of others, for a group (order or sub-order) of mite-like animals of the class of arachnids. They have been defined by Claus as hermaphrodite arachnids with sucking and stinging mouth-parts, and short, stumpy legs, and destitute of heart and respiratory organs. Only one family is admitted—*i. e.* Arctiscidæ. They resemble the rotifers in habits, and have been associated with them in classification, but, as is now evident, erroneously. THEODORE GILL.

**Tare,** a name of various leguminous plants, especially applied to some of the species of *Vicia*. Some of them are common weeds in the cultivated grounds of the U. S. and Europe. *V. sativum* is itself cultivated as a forage-plant. Its rather scanty herbage is very nutritious. It does well on poor lands, but in the U. S. is best known as a weed. It is probable that the plant called tare in the English New Testament is either DARNEL or CHESS (which see).

**Tarentum.** See TARANTO.

**Tarentum,** b., Allegheny co., Pa., on Allegheny R. R., has a national bank. P. 964.

**Tar'get** [Fr. *targe*], commonly designates the object shot at in practice with firearms or in archery. Target-practice is of the utmost importance since the introduction of the recently-improved "arms of precision," both for infantry and artillery. In Great Britain the principal seat of rifle target-practice is at Wimbledon, England. In the U. S. the most complete establishment of the kind is that at Creedmoor, L. I., N. Y.

**Tar'gums** [Chaldee for "interpretation"], the name of certain paraphrases of the Hebrew Scriptures, written in the popular or Aramaic tongue, and giving the rabbinical and traditional interpretation of the text. They are of very ancient and obscure origin. The Targum was at first oral. The Babylonian Targum, as it exists now, consists of parts of several ancient redactions of this oral Targum. The Targum of Onkelos belongs to the Babylonian Targum. That of Onkelos is the most important paraphrase of the Pentateuch that has come down from an early date. There are also extant large fragments of a later Jerusalem Targum, full of curious rabbinical lore.

**Tari'fa,** town of Spain, province of Seville, on the Strait of Gibraltar, is the southernmost city of Europe. It is surrounded by walls and defended by an old Moorish castle and a modern fort. Its harbor is shallow, but its tunny and anchovy fisheries are very important. P. 12,000.

**Tar'iff,** a table or list of duties, drawbacks, and bounties charged or allowed on the importation or exportation of goods from one country, state, or city to another. The name is derived from the Moorish town of Tarifa, N. of the Strait of Gibraltar, where duties were collected upon the objects of African commerce. In the U. S. the term is exclusively applied to a law of Congress fixing the amount of the duties on imports.

**Tar'iffville,** p.-v., Hartford co., Conn., at the junction of several railroads.

**Tar'ki,** or **Tschanchalova,** town of Russia, in Transcaucasia, is picturesquely situated on an eminence on the western coast of the Caspian Sea, and is fortified. P. about 12,000.

**Tar'kio,** tp., Page co., Ia. P. 363.

**Tarkio,** tp., Atchison co., Mo. P. 1120.

**Tar'latan,** a very delicate fabric of cotton, often dyed or printed, and used for ladies' dresses for evening parties and balls. Switzerland and France are the seats of its manufacture. Great quantities are made at Tarare.

**Tar'leton** (Sir BANASTRE), b. in Liverpool Aug. 21, 1754, son of the mayor of Liverpool; commenced the study of law, but at the beginning of the Revolution purchased a cornetcy in the dragoon guards; served under Howe and Clinton in the campaigns of 1777–78; rose to the rank of lieutenant-colonel and to the command of the British Legion, with which he served under Clinton and Cornwallis in the South. "The war in the Carolinas was the principal service of Tarleton, and to this hour his name is employed by black nurses to terrify white children into submissive silence." (*Blackwood.*) His American antagonists on the Waxhaw and in the swamps of the Carolinas, MARION and SUMTER (which see), rivalled his exploits, happily without achieving an equal notoriety for cruelty. He took part in the battles of Camden and Guilford Court-house, receiving there his only severe wound, the loss of half his right hand, and at the battle of the Cowpens, Jan. 17, 1781, was defeated by Col. Morgan, and in the pursuit was slightly wounded by the hand of Col. William Washington. He served with Cornwallis during the remainder of the war, being among those surrendered at Yorktown. Returning to England, he was promoted to the rank of colonel, and in 1790 was returned to Parliament for Liverpool, and became an intimate and partisan of the prince of Wales in the unhappy differences with the king, George III.; in 1798 married the daughter of the duke of Ancaster. He was promoted to be major-general 1794, lieutenant-general 1801, general 1812, having previously been appointed governor of Berwick and Holy Island, and was created a baronet and a G. C. B. in 1818. He published a *History of the Campaign of 1780–81 in the Southern Provinces of North America* (1787). D. Jan. 23, 1833. (The reader is referred to *Interesting Revolutionary Incidents and Sketches of Character, chiefly in the Old North State*, by Rev. E. W. Caruthers, D. D., and also to article "Sir Banastre Tarleton," *Blackwood's Mag.*, Oct., 1874.)

**Tarl'ton,** tp., Pickaway co., O. P. 407.

**Tar'ma,** town of Northern Peru, has greatly declined since the times of the Spaniards, when it was a flourishing place; but it is still celebrated for the exquisitely fine woollen stuffs it manufactures, and is much resorted to by invalids on account of its fine climate. P. about 5000.

**Tarn,** department of South-western France, on both sides of the river Tarn, an affluent of the Garonne, comprises an area of 2185 sq. m., with 352,718 inhabitants. The ground is elevated, and the surface is mostly an undulating plain, except in the south-eastern part, which is covered with spurs of the Cevennes. Forests of oak and beech are numerous, and large crops of wheat, wine, and

hemp are raised. Coal and iron abound and are extensively worked; 1,140,200 cwts. of coal are annually raised, and 11,000,000 gallons of wine of good quality produced. Of 43,435 children of school age, 16,532 received no school education in 1857. Cap. Albi.

**Tarn-et-Garonne,** department of South-western France, between the rivers Tarn and Garonne, comprises an area of 1405 sq. m., with 221,610 inhabitants. The surface is an elevated and undulating plateau, traversed by several deep valleys along the rivers. The soil is very fertile, and the climate temperate and healthful. Agriculture is the principal occupation, and wheat and wine the principal products; manufactures are rather insignificant. Of 24,390 children of school age, 9898 received no school education in 1857. Next to Vaucluse, Tarn-et-Garonne is the smallest department of France, of course with exception of that of the Seine. Cap. Montauban.

**Tarno'pol,** town of Austria, in Galicia, on the Sered, is celebrated for its horses and horse-markets, which are the most frequented in the country. P. 17,210.

**Tar'now,** town of Austria, in Galicia, on the Dunajec, has a fine cathedral and many good educational institutions. P. 8459.

**Ta'ro** [the native name], the root of *Colocasia macrorhiza,* of which many varieties are grown in the Pacific Islands. The tops are used as a potherb, and the starchy root is one of the most important articles of food in Polynesia. In New Zealand the same name is applied to *Pteris esculenta,* a fern whose roots afford an edible starch.

**Tarpeia.** See TARPEIAN ROCK.

**Tarpei'an Rock,** at Rome, was the southern portion of the Capitoline Hill. Here Tarpeia was buried, a vestal virgin who during the reign of Romulus betrayed the Capitoline citadel to the attacking Sabines, having obtained from them the promise that they would give her what they wore upon their left arms, meaning certain gold ornaments. But they kept their promise by crushing her beneath their shields. In later times it was customary to hurl from the Tarpeian Rock persons condemned for treason or the exercise of dangerous political powers.

**Tarquin'ius,** the name of a Roman family which, according to legend, played a very important part in the earliest history of the city of Rome, and two of whose members became kings. The family was of Greek origin. Demaratus emigrated from Corinth and settled at Tarquinii, a town of Etruria. His son, Lucumo, married Tanaquil, an ambitious and cunning woman, daughter of one of the most prominent Etruscan families, and she induced him to emigrate to Rome, where he soon acquired the rights of citizenship and assumed the name of (1) LUCIUS TARQUINIUS PRISCUS. His wealth and his wisdom made him one of the most prominent citizens. The king, Ancus Marcius, appointed him guardian of his children, and after the death of Ancus Marcius, in 616 B. C., the senate and people unanimously elected him king. His reign was very glorious. He waged successful wars against the Sabines, Latins, and Etruscans, and extended the power of Rome. He built the Cloaca Maxima, laid out the Circus Maximus and the Forum, and commenced the Capitoline temple and the stone wall around the city. He instituted the Roman games, added 100 new members to the senate, etc. But the sons of Ancus Marcius hated him, and fearing that he would try to secure the succession to the throne for his son-in-law, Servius Tullius, they assassinated him in 578 B. C. They did not accomplish their purpose, however; Servius Tullius became his successor.—(2) His son, LUCIUS TARQUINIUS SUPERBUS, assassinated Servius Tullius in 534 B. C., and seized the crown, probably by the aid of an aristocratic reaction. At all events, his first act as king was to abolish all the democratic reforms which Servius Tullius had introduced, and to punish with death or exile those senators who had sanctioned the reforms. Tarquinius was, as his surname, *Superbus,* the "Proud," indicates, a very high-handed master. The vacant places in the senate were not filled, and the advice of this body was very seldom asked, and at the same time that he slighted the higher classes he sorely oppressed the lower by heavy taxes and forced labor. The result was that a very embittered sentiment pervaded the whole nation, and neither his successful foreign policy nor his brilliant public edifices were able to propitiate the feelings of the people. Finally, the rape of LUCRETIA (which see) became the occasion of a general outbreak. Tarquinius was deposed and the monarchical government abolished in Rome. He made three attempts to reconquer his power by the aid of the Tarquinii, of Porsenna, and of the Latins, but in vain. Died a wretched old man at Cumæ in 495 B. C.

**Tar'ragon** [Sp. *taragona*], an aromatic perennial herb of the family Compositæ, a native of Northern Asia, but acclimated in European gardens, where, especially in France, it is cultivated for the sake of the young shoots, which are used in the dressing of salads and for the flavoring of vinegar with an infusion of its leaves, which have a taste resembling anise. Tarragon vinegar, thus prepared, is an article of commerce.

**Tarrago'na,** town of Spain, capital of the province of Tarragona, at the mouth of the Francoli in the Mediterranean, consists of an upper town, surrounded with walls, and a lower and modern town, defended by two castles. Its harbor is accessible only for small vessels, yet it carries on a considerable trade in corn, wine, oil, and fruit; large quantities of nuts, almonds, figs, and oranges are annually exported. The city was taken in 1810 by the French after a long siege, and nearly destroyed. P. 18,433.

**Tar'rant,** county of N. W. Texas, intersected by the W. fork of Trinity River; surface undulating, partly timbered, and partly prairie; grazing is the principal occupation. Staples, live-stock, Indian corn, and oats. Cap. Fort Worth. Area, 900 sq. m. P. 5788.

**Tarra'sa,** town of Spain, province of Barcelona, on the Ripoll, has large manufactures of kerseymeres, broadcloth, and flannel, and holds annually two large fairs. P. 8721.

**Tar River** rises in Granville co., N. C., and after a somewhat indirect E. S. E. course falls into Pamlico Sound. Its wide estuary, for some 40 miles, is called Pamlico River. The Tar has a rapid current, is 180 miles long, and is navigable for steamboats 85 miles, to Tarborough.

**Tar'rytown,** p.-v., Westchester co., N. Y., on the Tappan See (Hudson River) and upon New York Central and Hudson River R. R., 26 miles N. of New York City, has 11 churches, excellent schools, 1 national and 1 savings bank, and 2 newspapers. It is celebrated as containing the home (Sunnyside) and burial-place of Washington Irving. Sleepy Hollow is included within its precincts, and there are a number of elegant mansions along its heights.

M. D. RAYMOND, ED. "ARGUS."

**Tar'shish** is often mentioned in the Old Testament as a large and important commercial emporium, but it is doubtful where it was located, whether in Cilicia (*Tarsus*), or in the Grecian archipelago (*Thasos*), or in Spain (*Tartessus*), or in Ceylon, or somewhere else.

**Tar'sia,** or **Intarsiatu'ra,** a kind of mosaic made of pieces of wood of different colors, so disposed as to form regular patterns or more artistic designs, and then strongly glued together. These designs are sometimes inlaid in tablets of walnut or other wood; in other cases the work is wholly composed of sections varying in size according to the character of the effect to be produced. In architectural scenes and landscapes, in the representation of birds, fruits, flowers, etc., the pieces employed are in general very small, while in parquette floors, etc., they are larger. Very fine tarsia may be seen in many church choirs in Europe, especially in Italy, where the climate ensures its durability. The cathedral of Siena contains remarkable works of this kind, executed early in the thirteenth century, still fresh and perfect. This town retains her old reputation for skill in this art, and the tarsia manufactory there is still celebrated. Sorrento is now famous for the manufacture of small objects in wood-mosaic of great beauty, such as tables, writing-desks, fancy boxes, etc. In Nice this work is also carried to great perfection. The exquisite inlaid work in ebony and ivory now executed in Rome is usually called *tarsia,* and even the *lavoro commesso,* or Florentine mosaic, though entirely of stone, as well as inlaying in metal, sometimes receives this name. (For a very full account of this art see Count Demetrio Carlo Finocchietti, *Delle Industrie relative,* etc., Florence, 1869.)

**Tarsier.** See TARSIIDÆ.

**Tarsi'idæ** [from *Tarsius*—so named from the length of the tarsi—the representative genus], a family of mammals of the order Primates and sub-order Lemuroidea or Prosimiæ, distinguished by the length of the tarsi and the dentition. In external appearance they present nothing peculiar in contrast with the Lemuridæ, except the very long hind limbs and very long tail, and the female has inguinal mammæ; the teeth are in number 34—viz. M. $\frac{3}{3}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$, I. $\frac{2}{1} \times 2$; the true molars have the lobes, the crowns, especially the outer ones, produced into acute points; the premolars are conical, and successively increase in size from first to last; the canines are normally developed, those of the lower jaw not being incisiform as in the lemurs; the median upper incisors are longest. The skull has the orbits slightly closed behind by the union above of the alisphenoid with the malar bone; the fibulæ are partially ankylosed with the tibiæ; the hind feet or pedes have their second and third toes armed with subulate nails, and the rest provided with flattened pointed nails. Thus is the family distinguished from the lemurids. Only one

species is known, the *Tarsius spectrum*, an inhabitant of the forests of the islands of Borneo, Celebes, and Banka, sometimes called malmang, spectre lemur, and (adopted from the French) tarsier. Its size is about that of the common rat. It feeds chiefly on insects. THEO. GILL.

**Tarsiped'idæ** [from Lat. *Tarsipes—tarsus*, "tarsus," and *pes*, "foot"—the name of the only known genus], a family of mammals of the order Marsupialia and sub-order Syndactyli, and so called on account of a fancied (not real) resemblance of their hind feet to those of the Tarsiidæ. The general form of the animal is similar to that of a rat; the head, however, is at once distinguishable by its elongated slender conic snout; the tongue is very long, slender, and exsertile; the fore and hind limbs differ but little in length, although the latter are somewhat longer; the feet, front as well as hind, have each five toes; those of the front are rather small, slightly enlarged toward their tips, and provided with minute scale-like nails, "impressed, as it were, into the flesh, on the upper surface of the toe;" of those of the hind feet, the inner toe is thumb-like, slender, and destitute of a nail, the second and third very short (joined together as usual in the sub-order), and armed with small nails which are directed upward almost at right angles to the toes, and the fourth and fifth larger (free), and furnished with scale-like nails; the tail is long and slender, scaly, like that of a rat, and sparsely hairy. The teeth are very small and simple, and not functionally differentiated as incisors, canines, and molars; morphologically, however, there are, according to Waterhouse, M. $\frac{3}{3}$ (or more), C. $\frac{1}{0}$, I. $\frac{2}{1} \times 2$; they are separated from each other by greater or less intervals, except the lower incisors, which are largest and proclivous, as in other families. The stomach is small and simple, and has very thin walls; the intestine has no cæcum. The skull is very thin and almost papery; the lower jaw has very slender and almost straight rami, without distinct coronoid or angular processes, and with elongated foramina in their posterior halves. This type is one of the most extraordinary and exceptional of mammals. But one species—the *Tarsipes rostratus*—is known. It is about as large as a mouse. It is an inhabitant of Western Australia, and "is generally found in all situations suited to its existence, from Swan River to King George's Sound," but is very rarely obtained. It is nocturnal in its habits, and in the night is very active. It is insectivorous and mellivorous, and it will dart at passing flies and kindred insects with great celerity; having caught one, it retires to a corner or rests on the spot on its hind legs, holds the fly between its front paws, and proceeds leisurely to eat it. It is also very fond of honey, which it extracts from flowers by means of its long tongue.

THEODORE GILL.

**Tarsus.** See FOOT, STRUCTURE OF, by PROF. E. HITCHCOCK, A. M., M. D.

**Tar'sus,** town of Asiatic Turkey, on the Cydnus, 12 miles from its mouth in the Mediterranean, was for several centuries before and after Christ the most important city of Asia Minor, the capital of the Roman province of Cilicia, and celebrated both as a seat of learning and as a centre of commerce. The apostle Paul was born here, and Julian the Apostate was buried here. But in the confusion of the Middle Ages, and under the mismanagement of the Turkish government, the city has greatly declined, and more than half of the space it formerly occupied is now covered with ruins and rubbish. It has still some importance, however, as the place from which are exported the rich harvests of cotton, wheat, and fruits which the fertile districts in the neighborhood produce, but its progress is impeded by its unhealthy site. During summer poisonous evaporations from the delta of the Cydnus compel the inhabitants to leave the city, and thus its population may vary between 4000 and 30,000. A new port, Mersin, is building now some miles farther S.

**Tar'tar** [Gr. τάρταρος, "nether world"], a term applied to all salts of tartaric acid, but more especially to the acid tartrate of potassium or hydric-potassic tartrate. Crude tartar or ARGOL (which see) is obtained as a deposit in the interior of the casks in which fermenting wines are stored in the form of a hard crystalline crust, possessing either a light-pinkish or a deep-red color, according to the color of the wine from which it is formed. The best varieties of crude tartar contain from 77 to 85 per cent. of acid tartrate of potassium, the chief impurities being tartrate of calcium and coloring or mucilaginous matters. From these latter it is purified by dissolving in hot water, and precipitating the flocculent matter by means of finely-powdered clay and charcoal; the solution is then concentrated and crystallized. The purified commercial article usually contains from 85 to 98 per cent. of the acid tartrate. The name *cream of tartar* is given to the product purified by recrystallization. This salt, which is the pure hydric-potassic tartrate, has the composition $KHC_4H_4O_6$. It forms oblique rhombic prisms, which are very sparingly soluble in cold water, 180 parts, but dissolve in 15 parts of boiling water. It has an acid reaction, and forms double tartrates with numerous metallic oxides. Upon calcining in a closed vessel it is converted into a mixture of potassic carbonate and unconsumed carbon; this product, which is known as *black flux*, is frequently employed in the laboratory. If the salt be calcined with an excess of nitre, *white flux*, or potassic carbonate, is formed. Tartar is extensively employed in the manufacture of tartaric acid and as a mordant in the dyeing of wool; it is also used in the preparation of potassic carbonate, and to some extent in cookery. J. P. BATTERSHALL.

**Tartar, Cream of.** See CREAM OF TARTAR, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Tartar Emetic, Tartarized Antimony, Stibiated Tartar,** or **Potassio-antimonous Tartrate.** This well-known salt (formula $2K.(SbO).C_4H_4O_6 + Aq.$) is made by boiling acid potassium tartrate (cream of tartar) with antimony trioxide in water. It forms in transparent crystals, which become white and opaque by exposure to the air, but in the shops it is generally kept in the form of powder. It dissolves in 20 parts of cold water, and in between 2 and 3 of boiling, but all aqueous solutions spontaneously decompose on keeping. It is insoluble in alcohol, but soluble in proof spirit or wine. If pure, a solution of tartar emetic yields no precipitate with barium chloride, nor, when diluted, with argentic nitrate, nor does it turn blue with potassic ferrocyanide. Tartar emetic can be recognized as an antimonial compound by the following tests: Heated on charcoal before the blowpipe with sodic carbonate, it yields a brittle globule of metallic antimony, and at the same time a white deposit of antimonous oxide. In the presence of hydrosulphuric acid or ammonic sulphide an orange or reddish-brown precipitate of antimonous sulphide is formed, soluble in excess of ammonic sulphide. The same precipitate, dried, is insoluble in ammonia, but dissolves in boiling hydrochloric acid. A little of this solution, if the acid be not in excess, will, on being added to a considerable bulk of water, throw down a white flaky precipitate of the oxychloride (powder of algaroth). Dilute nitric, hydrochloric, or sulphuric acid, added to a solution of tartar emetic, throws down a white precipitate, soluble in an excess of the acid, and soluble in a solution of tartaric acid. Ammonic hydrate also throws down from a solution of tartar emetic a white precipitate, in this case insoluble in excess of the reagent. When boiled in water containing one-sixth part of hydrochloric acid, a bit of metallic copper immersed in the boiling fluid becomes covered with a gray deposit of metallic antimony, or in cold solution with 10 per cent. of the same acid a strip of bright tin-foil becomes similarly covered with a black coating. Tested in Marsh's apparatus (see ARSENIOUS OXIDE), antimoniuretted hydrogen is formed, which, ignited, yields a metallic stain upon a cold porcelain plate under the same conditions that arseniuretted hydrogen does, but the antimonial film is distinguishable from the arsenical by being generally a dull black in the centre, by insolubility in solution of calcic hypochlorite, and by other characteristics.

Tartar emetic has rather a nauseous, harsh metallic taste, and upon the animal system is both a local irritant and a powerful constitutional poison. Applied to the skin, as in ointment, it causes burning pain, redness, and finally the eruption of a crop of painful pustules. Taken internally, small doses, as a small fraction of a grain, tend to reduce the force and frequency of the pulse and promote perspiration. Somewhat larger quantities cause nausea and vomiting, with relaxation of the bowels and of the muscular system, reduced action of the heart, and a general feeling of depression and weakness. Still larger doses cause an intensification of the above symptoms, with burning pain in the stomach, the induction of a choleraic state, characterized by violent and prolonged nausea, vomiting, and serous purging, colic, cramps, great enfeeblement of the heart and general strength, and finally collapse and death. After death decided inflammation of the stomach and bowels is generally found. Sometimes, however, both this lesion, and the irritative symptoms dependent upon it, are absent even in fatal poisoning. Death does not generally occur until several days after the poisoning. The minimum fatal dose is not known, but is probably somewhere between 10 and 40 grains. Yet two grains once killed an adult already debilitated by disease, and four grains produced very profound poisoning. In cases of tartar-emetic poisoning, tannic or gallic acid, or some vegetable infusion containing the same, such as green tea, decoction of oak-bark, of cinchona, etc., should be administered, and free vomiting promoted. The inflammation and great cardiac and constitutional depression which the poison occasions must be treated on general medical principles. Tartar emetic is a well-

known remedy in medical practice, but is at present much less used than formerly. It has been much employed in minute doses to reduce the pulse and promote sweating in acute fevers, but less harsh vegetable drugs are now supplanting it. It is often made an ingredient of mixtures to relax the inflamed mucous membrane and promote free secretion in the early stages of bronchitis, and may also be employed as an emetic. But from its depressing effects, and the prolonged nausea and vomiting it occasions, other emetics are generally preferable. Locally, it is sometimes used in ointment to produce pustulation for the purpose of persistent counter-irritation, and here, again, less violent means are usually found sufficient. EDWARD CURTIS.

**Tartar'ic Acid** [Fr. *Acide tartrique;* Ger. *Weinsäure;* the acid of TARTAR (which see); Sax. *teart;* D. *taart;* Sp. *tarta.* It is not impossible that these words, as applied to the acid and deposit from sour wines, may have been derived from the Latin *Tartarus,* "hell," as if such sour wines were suitable only for that region]. At present six acids isomeric with the tartaric are known, which have the same composition and possess nearly the same chemical properties, but differ essentially in their crystalline structure and in their behavior toward polarized light.

*Ordinary tartaric acid* (dextrotartaric or dextroracemic acid) is quite widely disseminated in the free state in various plants and berries; its chief source, however, being the grape, in which it occurs as the hydric-potassic tartrate (cream of tartar). It is prepared by dissolving crude tartar in boiling water, and slowly adding pulverized chalk as long as the mixture effervesces. Usually, 1 part of chalk is sufficient to decompose 4 parts of tartar. Insoluble calcic tartrate and soluble potassic tartrate are formed by this operation. Upon filtering, and adding the equivalent quantity of calcic chloride, all the tartaric acid is obtained as a precipitate of calcic tartrate. The two precipitates are then united, washed, and decomposed into insoluble calcic sulphate and free tartaric acid by 3 parts of sulphuric acid diluted with 7 of water for every 5 of the salt taken. The filtrate is evaporated in leaden pans, and allowed to crystallize. This acid can also be artificially produced by the oxidation of milk-sugar, glucose, starch, gum, etc., with nitric acid. Dextrotartaric acid has the composition $H_2.C_4H_4O_6$, being dibasic. It forms colorless transparent rhombic prisms, which become strongly electrical when gently heated. It is easily soluble in water and in alcohol; the aqueous solution becomes mouldy on standing, and is gradually converted into acetic acid. Dextrotartaric acid is distinguished from its isomeres by the fact that in aqueous solution it exerts a strong right-handed rotation on polarized light. In its crystalline structure it bears an interesting relation to the isomeric lævotartaric acid. The crystals of the two acids resemble one another perfectly in form, excepting that ordinary tartaric acid presents hemihedral faces on the right of the crystal, which in lævotartaric acid are situated on the left or opposite side; so that the reflection of a crystal of the dextro-acid represents one of the lævo-acid. The dextro- and lævo-tartrates exhibit the same difference in their crystalline form. In pyro-electrical relations also crystals of dextrotartaric acid present properties opposite to those of the lævo-acid. Dextrotartaric acid precipitates solutions of the caustic alkaline earths; also solutions of plumbic, argentic, and potassic salts. The precipitate with potassium compounds (cream of tartar) serves for the detection of the acid in the presence of other organic acids. Potassic acetate is the most advantageous precipitant, the addition of alcohol, in which the precipitate is insoluble, and of a little acetic acid if the fluid be neutral, being also advisable. Boiling tartaric acid reduces argentic, auric, and platinic salts, and prevents the precipitation of the salts of copper and iron by the alkalies, the latter property being frequently utilized in chemical analysis. Dextrotartaric acid melts at 338° F.; at a higher temperature it is converted into several isomeric acids. By increased heat, pyruvic (or pyroracemic, $H_2.C_6H_6O_6$) and pyrotartaric ($H_2.C_5H_6O_4$) acids are produced. When heated with the alkalies, it loses water, and the oxalate and acetate of the base are formed. By oxidation dextrotartaric acid is decomposed into carbonic and formic acids; when treated with reducing agents, either one or two atoms of hydrogen are eliminated, and malic or succinic acid is obtained. Tartaric acid is formed on the tetratomic type, but it is, for the most part, a dibasic acid, two of the hydrogen atoms being also replaceable by acid or alcohol radicals. It forms acid, neutral, and double salts. Three varieties of the latter are well defined—those containing monatomic metals, such as Rochelle salt, $KNaC_4H_4O_6.4H_2O$, which is analogous to cream of tartar; those formed from monatomic and diatomic metals, in which the oxide of the latter is combined with the same proportion of acid as the monatomic element, such as potassio-ferric tartrate, $K.FeO.C_4H_4O_6$; and those analogous to tartar emetic, such as argento-antimonious tartrate, $Ag.SbO.C_4H_4O_6$. The only quadribasic tartrates as yet prepared are those of lead and zinc. The dextrotartrates possess the peculiar crystalline, rotatory, and pyro-electrical characters of the dextro-acid. The neutral tartrates of the alkalies are easily soluble in water; those of the earthy and heavy metals are, for the most part, insoluble. When strongly heated, all tartrates are carbonized and emit the odor of burnt sugar.

The isomeric *lævotartaric acid* is obtained upon neutralizing equal parts of racemic acid, one with soda, the other with ammonia, mixing the fluids, and allowing the double salt to crystallize; half of the crystals formed possess the hemihedral faces common to dextrotartrates, the remainder showing those characteristic of the lævo-salts. Upon mechanically separating the two varieties, dissolving them in water, adding plumbic nitrate, and decomposing the precipitates with sulphuric acid, solutions of the dextro- and lævo-acids are obtained. Lævotartaric acid is also produced by the complete fermentation of racemic acid, by which the dextro-acid present is decomposed, and by the fractional crystallization of cinchonicine racemate. It turns the plane of a ray of polarized light to the left, but possesses the same chemical properties as the dextro-acid, excepting that it gives with asparagine a gummy compound, whereas the analogous dextro-salt is crystalline. When equal amounts of the dextro- and lævo-tartaric acids are mixed and evaporated, racemic acid is produced; in the same manner racemates are obtained from mixtures of dextro- and lævo-tartrates.

RACEMIC ACID has already been described under that head. It has lately been obtained upon heating the dextro-acid with water for some time in sealed glass tubes.

Tartaric acid is extensively used in dyeing and in the preparation of effervescing drinks and baking-powders. Some of the tartrates, such as tartar emetic, Rochelle salt, and the potassio-ferric tartrate (*tartarus chalybeatus*), possess valuable medicinal properties. J. P. BATTERSHALL.

**Tar'tars,** or, more properly, **Tatars,** is not a strictly-defined ethnological name, but used by some in a wider, by others in a narrower, and always in a somewhat vague, sense. The word *Ta-tar* is of Chinese origin, and was first applied to those Mongolian tribes who on their swift horses descended from the Altai plateaus into the Chinese lowlands, robbing and plundering. When adopted by the Europeans, the word was changed into *Tar-tar,* with an allusion to the classical Tartarus, and it was applied to all those tribes and races which Genghis Khan had brought under his sway and led into Europe, including not only Mongolian, but also Tungusian and Turkish races. At present, the name is used partly in a wider sense, comprising all the various tribes and races inhabiting the plateaus of Central and Northern Asia, and not belonging to the Aryan family; partly, in a more restricted sense, comprising the Kirgheez, the Oozbeks, and some other tribes inhabiting Toorkistan and the adjacent regions.

**Tar'tarus** is used synonymously with *Hades* by the later Greek and Latin writers, but with Homer it means a separate place, as far below Hades as the heavens are above earth, into which Zeus had thrown the worst offenders against his authority. Later poets, however, sometimes make a distinction between Tartarus and the Elysian Fields as two divisions of Hades, the former occupied by the criminals, the latter simply inhabited by the dead. As a personification, Tartarus is represented as the son of Æther and Gea (air and earth), and by his mother he was father to the Gigantes, Typhoeus and Echidna. The appellation *pater Tartarus* is used for Pluto.

**Tar'tary,** one of those geographical names which change meaning according to time and place, but which never and nowhere attain any well-defined signification. In the Middle Ages the name denoted the whole central part of Eastern Europe and Asia from the Dnieper to the Sea of Japan. Later, a division into European and Asiatic Tartary took place, and the name of European Tartary was soon confined to the territory now called Crimea, while that of Asiatic Tartary first signified the whole empire of Genghis Khan and his successors, then Toorkistan alone, with the exclusion of Toorfan, Mongolia, and Mantchooria, and now only that part of Toorkistan which does not belong either to Russia or to China.

**Tarti'ni** (GIUSEPPE), b. at Pirano, Istria, Apr. 12, 1692; studied law at the University of Padua, where he led a very wild life, and finally eloped with the niece of Cardinal Cornaro; kept concealed for two years in a monastery of Assisi, where he studied music under Father Boëmo; continued subsequently his musical studies under the violinist Veracini, and became the first violinist of his time. He lived for some time in Prague and Vienna at the court of the emperor Charles VI., afterward in Padua, where he d. Feb. 16, 1770. Of his compositions, his *Sonate du*

*Diable* is still performed now and then; he also wrote a couple of treatises on music.

**Tartrates.** See TARTARIC ACID.

**Tarudant′,** town of Morocco, province of Soos, near the southern slope of the Atlas Mountains, 4 miles from the river Soos and 44 miles from the Atlantic. It is surrounded with walls, has several fine mosques and a citadel, but is else poorly built. Its dyeworks and manufactures of leather and copperware are important. P. estimated at 30,000.

**Taschereau′** (ELZÉAR ALEXANDRE), D. D., b. at Quebec, Canada, in 1818; studied divinity in the seminary of that city; ordained a Roman Catholic priest 1842; professor of mental philosophy, director of studies, and superior of the seminary; appointed professor of canon law in Laval University 1856; administrator of the diocese 1870, and consecrated archbishop of Quebec Mar. 19, 1871.

**Taschereau** (JULES ANTOINE), b. at Tours Dec. 19, 1801; became very early a frequent contributor to the Parisian press, and was one of the founders of the *National;* entered the civil service of the government shortly after the revolution of July, 1830, but soon returned to his journalistic activity; was one of the editors of *Historiettes de Tallemant des Réaux* (6 vols., 1833–34), and founded the *Revue rétrospective* (20 vols., 1833–37); was a member of the Chamber of Deputies 1838–42, and of the Constituent Assembly 1848; received an appointment at the National Library in 1852, and became its director-general in 1858. D. at Paris Nov. 11, 1874. He published editions of the works of Molière, Boufflers, etc.; superintended the publication of the catalogue of the National Library, and wrote *Histoire de la Vie et des Écrits de Molière* (1825) and *Histoire de la Vie et des Ouvrages de Corneille* (1829), both of which have been reprinted several times.

**Tashkend′,** capital of the Russian dominions in Toorkistan, and the most populous city in Central Asia, in a gently-sloping, well-watered, fertile plain, covered with numerous fruit trees, at the foot of the Alatan and Chatkal mountains, and has 76,072 inhabitants (1871), of whom 46,000 are Sartes—that is, descendants of the ancient Persian population of the country; the rest consist principally of Kirgheez, Tatars (Oozbeks), some Jews, and merchants from other parts of Asia, who, like the Russians, numbering from 2000 to 3000, inhabit separate quarters of the city. The old city is surrounded with a wall 7 miles long and pierced by nine gates; it forms an oval whose greater axis lies in the direction W. to E., and which is bent inward to the S. In the hollow thus formed the Russian town, the so-called European town, is built. It is laid out after the manner of European cities, and regularly built; the streets are broad, well lighted, and lined on both sides by canals of running water and rows of shady trees. S. W. of the European, and S. of the Asiatic city, is situated the Russian citadel, an immense construction, with barracks and military stores, and surrounded by a bastioned wall. Many houses in the European city were built after European fashion by Sartes, and are let out by them to foreigners. The new great caravanserai forms the centre of the wholesale business. The Asiatic city has narrow, crooked, and ill-paved streets, lined with houses with flat roofs. Tashkend is one of the oldest and largest cities of Central Asia, from old times the seat of an important agriculture and a brisk trade. Here the roads from Kashgar meet with those which lead S. from Samarcand, N. from Orenburg and Siberia, into Central Asia. The value of foreign goods exchanged in the city amounted during the second half of the year 1873 to 10,600,000 rubles; the principal articles of exportation and importation are cotton fabrics, metal ware, and silk. The Arab geographers of the Middle Ages called the city *Shash;* from the sixteenth to the eighteenth century it was the capital of the Kirgheez Kosaks; in 1810 it was taken by the khan of Khokan, and Sept. 12, 1867, it was occupied by the Russians.

E. SCHLAGINTWEIT.

**Tas′man** (ABEL JANSSEN), b. at Hoorn, province of North Holland, probably in 1600; was sent by the governor-general of the Dutch East India Company, Van Diemen, to circumnavigate the Australian continent; left Batavia Aug. 14, 1642; passed Mauritius Oct. 8; discovered Nov. 24 the island which he called Van Diemen's Land, but which now is called Tasmania; Dec. 13, the southern island of New Zealand; Jan. 6, the Friendly Islands; Feb. 6, the Fejee Islands; and returned to Batavia June 15, 1643. Of this voyage he published an account which was reprinted at Amsterdam in 1722, together with the voyage of Coreal. Jan. 29, 1644, he set out on a new voyage along the coasts of New Guinea and New Holland, but from this voyage he never returned, and no particulars concerning it were ever received.

**Tasma′nia,** an island belonging to Great Britain, situated to the S. E. of Australia, between lat. 40° 44′ and 43° 38′ S., was called Van Diemen's Land up to 1854; comprises an area of 26,215 sq. m., and has the form of an irregular quadrangle, with steep, rocky coasts indented with numerous bays, which afford good harbors. Three mountain-ranges, of whose highest peaks the Humboldtsberg reaches 5200 feet, the Benlomond 4700 feet, traverse the island in the direction from N. W. to S. E., but the general character of the surface is that of a plateau diversified by hills and valleys, tolerably well watered, and covered almost entirely with forests. The principal rivers are the Tamar, Derwent, and Arthur, which flow through fertile plains rich in meadows. The climate does not allow the cultivation of tropical plants, but is favorable to all the plants and fruits of Central Europe; agriculture and cattle-breeding are carried on with success. The mountains are rich in iron and copper ore, coal, marble, alum, and crystals. Characteristic among the native animals are the emu, an ostrich-like bird, and the kangaroo, but they have of late been so ruthlessly hunted that they have now become nearly extinct. The original inhabitants were Papuans, and in 1815 they still numbered 5000, but they have been treated so cruelly by the foreigners who settled in the island that, although colonization did not begin until 1803, the native population is now wholly exterminated; the last Papuan died in 1869. Dec. 31, 1874, the population mustered 104,176, of which 55,117 were males and 49,054 females. The immigration is inconsiderable; 6265 immigrated in 1874, but 7714 emigrated. Agriculture and cattle-breeding are the principal occupations. Mar. 31, 1875, there were under cultivation and in crops 57,633 acres of wheat, 5129 of barley, 32,704 of oats, 29 of rye, 5174 of peas, 511 of beans, 96 of tares, 6978 of potatoes, 1777 of turnips, 109 of carrots, 1041 of mangel-wurzel, 52 of onions, 1803 of artificial grasses, 30,486 of hay, 2 of tobacco, 658 of hops, 5976 of gardens and orchards, 1058 of green forage, 93,176 of permanent artificial grasses, 22,512 of bare fallow, 59,629 of other cultivated land; total land in cultivation, 326,486 acres, of which 3880 acres were new land broken up during the year, 13,880 under rotation of crops. In the year ending Mar. 31, 1875, there were produced 1,066,861 bushels of wheat, 125,469 of barley, 877,243 of oats, 474 of rye, 99,556 of peas, 12,312 of beans, 1378 of tares, 23,031 of artificial grass-seed, 150,978 of apples, 31,020 of pears, 26,169 tons of potatoes, 12,603 of turnips, 1021 of carrots, 12,569 of mangel-wurzel, 182 of onions, 41,144 of hay, 2150 pounds of tobacco, 811,476 of hops. In 1874 an acre of crown-land was bought for £1 2*s.* 1½*d.* in the country, and for £9 10*s.* in the city. Mar. 31, 1875, the colony possessed 23,208 horses—22,849 on private property, 359 on crown-land; 110,450 horned cattle—105,416 on private property, 5034 on crown-land; 1,714,168 sheep, including lambs—1,590,511 on private property, 123,657 on crown-land; 2579 goats, 10 mules, 13 asses, 51,468 pigs. In trades and manufactories 3391 persons were engaged as masters—namely, 105 bakers, 177 blacksmiths, 322 boot and shoe makers, 200 butchers, 179 carpenters, 308 general dealers, 153 grocers, 102 hawkers, 402 publicans, etc. In 1874, 185 persons were engaged in gold-mining, and the value of the product amounted to £18,491, of which £8899 was in Mathinna and £9592 in Nine Miles Springs; 9276 tons of coal were raised, 14,000 cubic feet of flagstone, 877 tons and 24,920 cubic feet of freestone, 1400 tons of iron ore, 7612 bushels of lime, 445 tons of limestone, 250,000 slates, and 490 tons of tin ore. The commerce, chiefly carried on by the cities of Hobart Town and Launceston, is very brisk: 214 vessels, of 63,302 tons burden, entered, and 228 vessels, of 62,302 tons burden, cleared the harbor of Hobart Town in 1874; 393 vessels, of 51,404 tons burden, entered, and 392 vessels, of 57,548 tons burden, cleared the harbor of Launceston. Including the minor ports of Stanley, Wynyard, Leith, and Torquay, the total entrances amounted to 607 vessels, of 119,706 tons burden, the total clearances to 620 vessels, of 119,801 tons burden. Three vessels were from the U. S., the rest from Great Britain and her colonies. The value of the imports amounted to £1,257,785, of the exports to £925,325. The principal articles of exportation are bark, bran, and pollard, butter and cheese, flour, fruit, gold, grain, hides, skins and leather, hops, horses, sheep, oatmeal, oil, timber, vegetables, wool. The value of the wool exported amounted to £350,713. The internal traffic is very limited. There is only one railway, the Launceston and Western, 45 miles long, and belonging to the government. Its construction and equipment cost £427,946; its revenue and expenditure in 1874 amounted to £18,328 4*s.* 10*d.*; 91,264 passengers and 24,802 tons of goods were carried over it. In 1874 the postal department had 163 stations, 186 officials, 1530 miles of post-roads, and carried 1,282,854 letters, 34,617 packets, and 990,588 newspapers; its revenue was estimated at £12,700, its expenditure at £20,002. The telegraph had

23 stations, carried 42,092 messages, earned £7901 5*s.* 11*d.*, and spent £6348 17*s.* 3*d.* A submarine cable connects Low Head at the mouth of the Tamar with Queensland. Of great importance for the internal traffic are the exertions to make the Tamar navigable above Launceston; after several years' labor the Whirlpool Reach Rock, 390 feet long and 90 feet broad, has been blasted. In administrative respects Tasmania is directly under the British colonial secretary, has a governor and commander-in-chief, an executive council, legislative council, and a house of assembly to which each electoral district sends a deputy. Hobart Town is the seat of government. The budget of the colony for 1874 showed a revenue of £327,925, an expenditure of £374,078, and a public debt of £1,476,700. With respect to education and religion, Tasmania has 147 public schools, with about 8000 pupils. In 1870 there were 55,939 persons who could read and write, 13,945 who could only read, and 29,444 who could neither read nor write. There were 316 churches, chapels, etc.; 53,047 persons belonged to the Church of England, 22,091 to the Roman Catholic Church, the rest to other sects. Among the charitable establishments may be mentioned the general hospitals in Hobart Town, Launceston, Campbell Town, and New Norfolk, the queen's asylum for destitute children, the Cascade pauper establishment, the invalid dépôt in Launceston, etc.

*History.*—Tasmania was discovered in 1642 by the Dutch explorer Tasman, and called Van Diemen's Land, after the Dutch governor of the East Indies. In 1803 it was colonized from Sydney. Gov. Ring sent Lieut. Bowen hither with 3 soldiers and 10 male and 6 female convicts, and these settled near the point where now Hobart Town stands. A few months later two English vessels arrived, and the settlement was increased by a number of convicts. Hard times came, full of famine, robbery, murder, fights among the colonists themselves and with the natives, with bushrangers, escaped convicts, etc., and the importation of convicts continued to be very heavy. In 1842, 59,000 free and 20,000 convicts lived in Tasmania. In 1825, Tasmania was separated from New South Wales and established as an independent colony, and from that time it has progressed steadily though very slowly. AUGUST NIEMANN.

**Tassaert'** (NICOLAS FRANÇOIS OCTAVE), b. at Paris July 26, 1800; studied painting at the school of fine art and under Girard and Lethière; began to exhibit in 1831, and painted, besides portraits, historical and genre pieces, of which the most remarkable are *Funérailles de Dagobert à Saint-Denis* in the museum of Versailles, *Le Marchand d'Esclaves*, *Le Sommeil de l'Enfant Jésus*, etc. D. Apr. 26, 1874.

**Tassisudon',** the capital of BOOTAN (which see), in lat. 27° 30′ N., lon. 89° 40′ E., on the Gaddada, an affluent of the Brahmapootra. It contains a palace for the two rajahs, of whom the dherma-rajah lives in a high tower, together with a beautiful idol, and the deb-rajah in a square edifice which encloses the tower. The whole palace is furthermore surrounded by rows of smithies, in which metallic idols are manufactured, and outside of these factories extends the town. The style is thoroughly theocratic.

**Tas'so** (BERNARDO), b. at Bergamo Nov. 11, 1493, of a noble family; received an excellent education; accompanied the prince of Salerno as secretary to Tunis and Flanders; married in 1539 the beautiful and wealthy Porzia de' Rossi, and settled at Sorrento, where he wrote his great epic in 100 cantos, *L'Amadigi*, founded on the story of Amadis de Gaul. In 1547 he left Sorrento, having lost his wife and being persecuted by the Spanish Inquisition. He entered the service first of the duke of Urbino, afterward of the duke of Mantua, and d. as governor of Astiglia in 1569. His lyric poems were much admired, but his fame as a poet was subsequently overshadowed by that of his son, Torquato Tasso. His letters, edited by Seghezzi (3 vols., Padua, 1733–51), are of great interest for the literary history of that time.

**Tasso** (TORQUATO), b. at Sorrento Mar. 11, 1544, a son of the preceding; educated first by the Jesuits at Naples, Rome, and Bergamo, then at the court of the duke of Urbino in Pesara, finally by his father at Venice, and entered the University of Padua in 1557 to study law. He felt himself more attracted, however, to literature and poetry. In 1562 he published a romantic epic, *Rinaldo*, in 12 cantos, and the applause with which it was received determined him to give up jurisprudence altogether and devote himself entirely to poetry. He repaired to Bologna, where he studied philosophy, especially Plato, and commenced work on his great epic, *Gerusalemme Liberata*. In 1565 he entered the service of Cardinal Este, whom he accompanied to Paris and on other diplomatic missions, and who brought him into connection with his brother, Alfonso II., reigning duke of Ferrara. In 1570, at which time he had finished the first eight songs of his epic, he left the cardinal, received a kind of court appointment and a pension from Alfonso II., and settled at Ferrara, where he lived very happily for several years, enjoying the intimate friendship of the duke and his two sisters, Lucrezia and Eleonora. *Aminta* was written and performed at the court with great splendor, and in 1575 *Gerusalemme Liberata* was completed. But in the mean time a peculiar melancholy had developed in his mind, and it sometimes burst into open lunacy. His relation to the ducal family had been disturbed, whether on account of a vehement passion for the princess Eleonora or from some other cause is not known. The criticisms, rivalries, and intrigues which as a poet and a courtier he could not escape overwhelmed his imagination; he grew suspicious toward all, saw a secret enemy in everybody, and finally fled from the court in 1577. He sought refuge with his sister at Sorrento, and here his mind soon became calm and clear again. He now yearned for Ferrara, wrote to the duke, and, although the answer he received was very cool, he returned. But he had hardly arrived before the disease again seized his mind. Once more he fled, and once more he returned. His anxiety to re-establish the old relation to this family became more and more passionate as it became more and more evident to him that such a re-establishment was impossible. His manners, his denunciations, became finally so provoking that the duke confined him in a lunatic asylum in 1579. Here he remained seven years, while his great work was read not only in Italy, but all through Europe, and made his name one of the first of his age. At last, in 1586, the duke released him, and he now resided for a short time in Mantua, and then settled at Naples. He was poor, sick, and suffering. In 1594, Pope Clement VIII. invited him to come to Rome and be crowned on the capitol, but he died before the solemnity took place, Apr. 25, 1595, and lies buried in the church of San Onofrio in Rome. Besides the above-mentioned works he wrote *Torrismondo*, a tragedy, a number of beautiful lyrical poems, some dialogues and essays, some letters, etc. A complete edition of his works appeared in 33 vols. at Pisa (1821–32); a select edition in 5 vols. at Milan (1823–25). Biographies have been written by Manso (Naples, 1619), Serassi (Rome, 1785), Black (Edinburgh, 1810), Milman (London, 1850). (See also Richard Henry Wilde, *Conjectures and Researches concerning the Love, Madness, and Imprisonment of Torquato Tasso* (2 vols., New York, 1842). English translations of *Gerusalemme Liberata* by Edward Fairfax (London, 1600) and by J. K. James (2 vols., 1865).) CLEMENS PETERSEN.

**Taste.** See SENSES and HISTOLOGY, by COL. J. J. WOODWARD, M. D.

**Tatars.** See TARTARS.

**Tate,** new county of N. W. Mississippi, formed in 1873 from De Soto and Marshall, is traversed by Coldwater River and by Mississippi and Tennessee R. R., has a rolling surface, and a fertile soil productive of wheat, Indian corn, sweet potatoes, and cotton. Cap. Senatobia. Area, 406 sq. m. P. about 12,000.

**Tate,** tp., Clermont co., O. P. 2678.

**Tate** (NAHUM), b. in Dublin in 1652; was educated at Trinity College; went to London, devoted himself to literature, and in 1692 fitly succeeded Shadwell as poet-laureate; fell into pecuniary straits, and died in the precincts of the Mint, where debtors were privileged from arrest. He assisted Dryden in the composition of *Absalom and Achitophel*, most of the second and poorer part belonging to Tate; perpetrated an alteration of Shakspeare's *King Lear*, which kept the stage for a long time in place of the original; as poet-laureate produced commonplace birthday odes and elegies; and put forth several works in prose and verse, among which are about half a score of dramatic pieces. He is chiefly known as a psalmodist, the versions of the Psalms executed by him and Nicholas Brady being still retained in the English *Book of Common Prayer;* these first appeared under the title, *Essay of a New Version of the Psalms of David, consisting of the first Twenty, by N. Brady and N. Tate* (1695), which was followed by *The Book of Psalms, a New Version in Metre, fitted to the Tunes used in the Churches, by N. Tate and N. Brady* (1696), and *A Supplement of Church Hymns* (1700). D. at Southwark Aug. 12, 1715.

**Tate** (THOMAS), b. in England about 1820; became professor of mathematics and lecturer on chemistry in the National Society's Training College at Battersea, and subsequently in the Kneller Training College at Twickenham; is a member of several scientific associations, and a contributor to their *Transactions* and to various periodicals. Author of an extended series of mathematical textbooks in high repute in England, and of *Exercises on Mechanics and Natural Philosophy* (1846), *Outlines of Experimental Chem-*

*istry* (1850; new ed. 1854), *Elements of Mechanism* (1851), *Hydrostatics, Hydraulics, Pneumatics* (1851), *Mechanical Philosophy* (1853), *Electricity for Beginners* (1854), *Magnetism and Electro-Dynamics* (1854), *Light and Heat* (1854), *Mechanics and the Steam-Engine* (1855), *Philosophy of Education* (1854; 3d ed. 1860), *The Little Philosopher* (4 parts, 1855–58), and other educational works.

**Tat'ham** (WILLIAM), b. at Hutton, England, in 1752; emigrated to Virginia in 1769, and entered a mercantile establishment on the James River; served as adjutant-general of militia against the Indians, and wrote biographical sketches of some of their principal warriors; served during the Revolution as colonel in the Virginia cavalry, and was one of the party who stormed the redoubt at Yorktown Oct. 14, 1781; and in 1780, in connection with Col. John Todd, compiled the first trustworthy account of the Western territory. He afterward studied law, was admitted to the bar in 1784, and two years after established himself at Lumbarton, N. C., and in 1787 was elected to the legislature of North Carolina. He visited England in 1789, and again in 1798, and in 1801 became superintendent of the London docks. Returning to Virginia in 1805, he became a military storekeeper in the U. S. service. In his old age he was reduced to penury, and on the anniversary of Washington's birthday, Feb. 22, 1819, after indulging in festivities at the Richmond arsenal, in which he was employed, he flung himself before the mouth of a cannon just as it was fired off, and was instantly killed. Among his publications are—*Memorial on the Civil and Military Government of the Tennessee Colony, Analysis of the State of Virginia* (1794), *Plan for insulating the Metropolis by Means of a Navigable Canal* and *Remarks on Inland Canals* (1798), *Political Economy of Inland Navigation* (1799), *Communications on the Agriculture and Commerce of the United States* (1800), and *History and Practical Essay on the Culture and Commerce of Tobacco* (1800), the last five published in London.

**Tatia'nus,** b. about 130 A. D. in Syria or Assyria; studied philosophy and rhetoric; went to Rome about 162; enjoyed the friendship of Justin Martyr; was converted by him to Christianity, and wrote one of the earliest apologies for Christianity against the pagan philosophers, *Oratio ad Græcos,* which is still extant, edited by Worth (Oxford, 1700). After the death of Justin (166), Tatian returned to the East, adopted very strange, heterodox ideas, and formed a sect which attracted considerable attention. The dogmatical views of Tatian he had borrowed from various systems of gnosticism; his morality was asceticism. He forbade marriage, animal food, wine, etc.; in the celebration of the Eucharist the sect used water, whence they were often called Hydroparastatai. (See Daniel, *Tatian der Apologet,* Halle, 1837.)

**Tatler.** See ADDISON and STEELE.

**Tat'nall,** county of S. E. Georgia, lying between Altamaha and Cannouchee rivers, and intersected by the Great Ohoopee; surface level, soil poor and sandy. Staples, livestock, wool, Indian corn, oats, sweet potatoes, and a little cotton. Cap. Reedsville. Area, about 1200 sq. m. P. 4860.

**Tatnall** (JOSIAH), b. at Bonaventura, near Savannah, Ga., in 1762; was sent to school at Nassau, island of New Providence, but ran away from it; in 1782, at the age of eighteen, joined the army of Gen. Wayne at Ebenezer, Ga.; was made colonel in 1793 and brigadier-general in 1800; took an active part in the military affairs of the State, and was several times elected to the legislature; was U. S. Senator from Georgia 1796–99, and governor of the State 1801–02. D. at Nassau, New Providence, June 6, 1803.

**Tatnall** (JOSIAH, JR.), son of Josiah, b. at Bonaventura, Ga., Nov., 1796; entered the navy; served under Decatur against the Algerines; commanded a gunboat in the expedition against the West Indian pirates; was made commander in 1838, and stationed at the navy-yard at Charlestown, Mass.; in the Mexican war participated in the attacks on Tampico, Panuco, and Vera Cruz; in 1850 was promoted captain, and in 1856 was sent as flag-officer of the East India squadron; in 1859 aided the British in the capture of the Peiho forts, near Canton, China; in 1860 brought the Japanese ambassadors to the U. S.; was stationed at Sackett's Harbor, N. Y., in 1861, when Georgia seceded; entered the Confederate service; was subsequently commander of the iron-clad Virginia; after the close of the war resided in Nova Scotia for several years, when he returned to Savannah, where he was elected harbor-master. D. at Savannah June 15, 1871.

**Ta'ton's,** tp., Columbus co., N. C. P. 879.

**Tat'ta,** town of Sinde, Hindostan, in the delta of the Indus, in lat. 24° 46′ N., lon. 68° E., has some manufactures of silk and cotton, and one noteworthy building, a mosque of brick, but else it is a miserable place, surrounded by ruins of its former splendor. P. estimated at 10,000.

**Tat'tam** (HENRY), D. D., LL.D., F. R. S., b. in Ireland Dec. 28, 1788; educated at Trinity College, Dublin, and at the universities of Göttingen and Leyden, where he received his doctorate respectively in laws, theology, and philosophy; took orders in the Church of England; was rector of St. Cuthbert's, Bedford, 1818–45, also rector of Great Woolstone, Bucks, during a portion of that time; became archdeacon of Bedford 1845, and rector of Stamford Rivers, Essex, 1849, and was afterward a chaplain in ordinary to the queen. D. at Stamford Rivers Jan. 8, 1868. During his travels in the East, early in the century, Dr. Tattam laid the foundation of an intimate knowledge of Oriental languages, concerning one of which, the Coptic, he became the chief modern authority. He discovered at the convent of Nitria in the N. W. desert of Egypt, and secured for the British Museum, a splendid collection of ancient Syriac MSS., which now constitutes the basis of recent researches in that language. Author of *A Compendious Grammar of the Egyptian Language, etc.* (1828), *Lexicon Ægyptiaco-Latinum ex veteribus Linguæ Ægyptiacæ Monumentis, etc.* (Oxford, 1835), *Duodecim Prophetarum Minorum Libros, in Lingua Ægyptiaca, vulgo Coptica seu Memphitica Latine, etc.* (1836), *The Ancient Coptic Version of the Book of Job the Just, translated into English and edited* (1847), *The Apostolical Constitutions in Coptic, with an English Translation* (1849), *Prophetæ Majores in Dialecto Linguæ Ægyptiacæ* (Oxford, 2 vols., 1852), and several charges and theological treatises. Among the Syriac MSS. secured by him were the *Ecclesiastical History of John, Bishop of Ephesus* (Oxford, 1853), and the *Epistles of Ignatius* (1845), both edited in the Syriac text by Dr. William Cureton, and the former translated into English by Dr. R. Payne Smith (1860).

**Tat'tler,** a name applied to numerous birds of the snipe family. At least, as the terms are practically employed, there is no valid distinction between the tattlers and the sandpipers, many birds being by some writers called by the one or the other name at random. The tattlers are of several genera and many species. Some of them are very fine game-birds.

**Tauch'nitz** (KARL CHRISTOPH TRAUGOTT), b. at Grosspardau, near Grimma, Saxony, Oct. 29, 1761; learned the printing trade at Leipsic; worked for some time in Unger's establishment in Berlin, and opened in 1796 a printing-house in Leipsic, to which was added in 1798 a bookstore, in 1800 a type-foundry, and in 1816 the first stereotype-foundry in Germany. From his establishment, which soon grew and became one of the largest of the kind in Germany, issued those celebrated editions of Greek and Latin authors which in correctness, convenience, and cheapness surpassed all other editions which had hitherto appeared. —After his death (Jan. 14, 1836) his son, KARL CHRISTIAN PHILIPP TAUCHNITZ, b. at Leipsic Mar. 4, 1798, continued the business until 1865, when on his retirement it was broken up or went into other hands.—His cousin, CHRISTIAN BERNHARD TAUCHNITZ, b. Aug. 25, 1816, established a publishing-house in Leipsic in 1837, from which issued the well-known *Collection of British Authors,* of which over 1000 vols. have been published. He was made a baron in 1860.

**Tauism and Tauists.** See LAOU-TSZE, by C. G. LELAND, A. M.

**Tau'ler** (JOHANNES), b. at Strasbourg in 1290; entered the order of the Dominicans in 1308, and studied theology at the University of Paris. The scholastic method, however, of the theology of that time did not satisfy him; he felt himself drawn toward the mystical and speculative writers on religion and philosophy; and this tendency was still more strengthened within him after his return to Strasbourg, where he met with Meister Eckart. Eckart's pantheism, however, as well as Suso's sentimentalism, remained foreign to him. His character was of a more practical turn, and it is the moral bearing of the religious ideas which forms the essence of all his writings. With the exception of a few excursions to Cologne, Bâle, etc., he lived and worked in Strasbourg to his death, June 16, 1361, enjoying the reputation of being the greatest preacher of his time, and setting a rare example of Christian courage, self-denial, and persistency during times of papal ban, of plague, and other hardships. His writings, consisting of sermons, the celebrated work on *Following the Lowly Life of Christ,* etc., were first collected in 1498. A translation into new High German was given by Schlosser (Frankfort, 1826). (See Schmidt, *Johannes Tauler von Strasburg* (Hamburg, 1841), and Miss Winkworth, *Life and Times of Tauler* (1857), containing 25 of his sermons; American reprint, ed. by R. D. Hitchcock, 1858.)

**Taun'ton,** an old but well-built town of England, county of Somerset, on the Tone, has some manufactures of cotton and silk, and trade in agricultural and dairy produce. P. 15,466.

**Taunton,** city, port of entry, and cap. of Bristol co., Mass., incorporated as a town in 1639, as a city in 1864, is situated in the valley of Taunton River, and is distant 33 miles S. from Boston, in the centre of a prosperous agricultural and manufacturing community. Its business interests are diversified. Principal manufactures, locomotives, cotton machinery, nails and tacks, stoves and hollow-ware, copper, yellow metal, cotton cloth, cutlery, crucibles, stove-linings, fire-brick, silver and britannia ware, cotton yarns, machinists' tools, steam-engines, oilcloth, and brick. The city has 3 national banks, 2 savings banks, public library, paid fire department, fire-alarm telegraph, 1 daily and 2 weekly papers, and a system of waterworks in process of completion. It is the centre of a system of railroads connecting it with Boston, New York, Providence, and the East and West, and carries on an extensive trade in coal and grain with the interior. The Bristol County Agricultural Society possesses a fine estate in the centre of the city, which is annually the scene of a most successful agricultural and mechanical exhibition. The charitable institutions are a home of aged ladies, and a city mission with commodious chapel. Within the city limits there are 20 incorporated companies, doing business with an aggregate capital of $2,675,000, besides a large number of unincorporated manufactories. There are 19 churches, a system of public schools, and an incorporated academy maintained by a fund. Valuation of city, $18,000,000. P. 18,629.

WM. REED, JR., ED. "DAILY GAZETTE."

**Taunton River,** a pleasant navigable stream, is formed by the union of Matfield and Winnetuxet rivers near Halifax, Mass. Passing Taunton, it expands into a wide estuary, which opens into Narragansett Bay.

**Tau'rida,** government of Russia, bordering on the Dnieper, the Black Sea, and the Sea of Azof, comprises an area of 25,856 sq. m., with 658,549 inhabitants, and consists of the peninsula of the CRIMEA (which see) and some extensive districts of the mainland. The north-western part of the Crimea and the mainland are desert steppes interspersed with salt lakes; they are inhabited by Tartars, who contrive to feed large herds of cattle and sheep on the steppes and cultivate some millet. The south-eastern part of the Crimea is beautiful, resembling Italy, producing olives, wine, etc., and inhabited by Russians, Greeks, and Jews.

**Tau'rine** [Lat. *taurus*, "bull"], a neutral organic compound, occurs in the bile of the ox and other animals, in which it is formed by the action of acids and alkalies upon taurochloric acid; it is also contained in certain mollusks. Upon treating ox-bile with hydrochloric acid, filtering the liquid, and evaporating the filtrate, it is obtained in crystals mixed with sodium chloride, from which it is separated by crystallization. Taurine has been looked upon as an amide of isethionic acid, from which it can be artificially formed by heating the ammonic salt:

Ammonic isethionate. Taurine.

$$H_4NC_2H_5SO_4 - H_2O = C_2H_7NO_3S.$$

The composition of taurine is $C_2H_7NO_3S$; it forms large and transparent monoclinic crystals, which dissolve in water, especially when hot, but which are nearly insoluble in alcohol. It is isomeric with sulphite of aldehyde-ammonia. Although taurine contains about 25 per cent. of sulphur, it is a remarkably stable compound. By the action of nitrous acid it is converted into isethionic acid, nitrogen being evolved:

Taurine. Isethionic acid.

$$C_2H_7NO_3S + HNO_2 = H.C_2H_5SO_4 + H_2O + 2N.$$

J. P. BATTERSHALL.

**Tauromenium.** See TAORMINA.

**Tau'rus** [Lat., "bull"], a constellation, one of the twelve signs of the Zodiac, occupying the region corresponding to the sign Gemini, and chronologically to the month Apr. 20–May 21. It includes the remarkable groups of stars the Pleiades and Hyades, and is rich in telescopic stars. (See ZODIAC.)

**Taurus,** the name of a range of mountains in Asia Minor, stretching in an E. to W. direction from the Euphrates to the Gulf of Adalia. By the Alma-Dagh it communicates with the Lebanon Mountains in Syria, and by one branch of the Anti-Taurus with the Caucasian Mountains. It rises in terraces from the Mediterranean to a height of 10,000 feet, and encloses between itself and Anti-Taurus an elevated plain, arid, dotted with salt lakes, and evincing the same character as the plateaus of Central Asia.

**Tauss,** town of Bohemia, has breweries, distilleries, tanneries, and manufactures of cotton and linen fabrics. P. 7382.

**Tautog',** a corruption of the aboriginal name (*Tautoga onitis* or *nigra*), a well-known fish of the eastern American coast, of considerable economical importance. It belongs to the family Labridæ and sub-family Labrinæ, and is related to the wrasses of Europe, but is the only member of its genus. It is an oblong fish, with small smooth scales; the opercular bones scaleless, and the cheeks with few, distant, and imbedded scales; the teeth on the jaws conical and in two rows, and none behind developed as canines; the dorsal spines numerous (17), and only three anal spines; the rays are D. xvii.–10, A. iii.–8; the color in the adult is sometimes an almost uniform black, but generally more or less blotched, and in the young banded and otherwise decorated. It is common on the Atlantic coast from Massachusetts to Carolina, and rarer farther northward and southward. Its average weight is not over two pounds, but it frequently weighs nine or ten pounds, and an exceptionally large one of twenty-two pounds has been noticed. It makes its appearance in large numbers and in shallow waters on the New England and New York coasts between the months of April and November, and is most abundant in May and October. It is then, on some parts of the coast, the most abundant of the larger fishes, and is a staple market-fish, and sells for about twelve to fifteen cents a pound. It spawns in May or June. When it first makes its appearance in shallow water, it refuses the hook, but soon takes it readily, and is one of the most frequently caught of the salt-water fishes. It prefers rocky places and slight currents. It keeps near the bottom, and preys upon crustaceans and mollusks. In the spawning season, which takes place in June, it seeks weedy places and where eel-grass grows, and therein deposits its eggs.

THEODORE GILL.

**Tavern.** See HOTEL, by C. G. LELAND, A. M.; HOTELS IN AMERICA, by L. P. BROCKETT, A. M., M. D.; and INNKEEPERS, by PROF. J. N. POMEROY, LL.D.

**Tav'ern,** tp., Pulaski co., Mo. P. 796.

**Tavernier'** (JEAN BAPTISTE), b. at Paris in 1605; undertook while still a very young man extensive journeys in the Low Countries, Germany, Hungary, and Italy, and made from 1630 to 1633 his first great journey to the East —from Constantinople, through Erzeroom, Tabreez, Ispahan, Bagdad, and Aleppo, to Rome. Subsequently, from 1638 to 1669, he made five more voyages to the East, through Asia Minor and Persia to Hindostan, and as far as Batavia. He possessed great skill in valuing precious stones, and by trading in jewelry he amassed a great fortune. He also promoted French commerce in the East Indies in various ways, and on his return from his last voyage Louis XIV. made him a baron. His fortune, however, he lost, and, being a Protestant, was compelled to seek refuge in Switzerland after the Revocation of the Edict of Nantes. He afterward went to Berlin, and was made director of an East Indian company which the elector of Brandenburg was founding. On a seventh journey to the East he d. at Moscow in July, 1689. A report of his first six voyages was edited by Chappuzeau (2 vols., 1676–77), and a third by La Chapelle (1679), under the title *Les Six Voyages de J. B. Tavernier.*

**Tavi'ra,** town of Portugal, province of Algarve, at the mouth of the Sequa, is well built and handsome, and carries on a general trade and considerable fisheries. P. 9000.

**Tav'istock,** town of England, in Devonshire, on the Tavy, has some few manufactures of serges and coarse linens, and 7720 inhabitants, mostly engaged in agriculture.

**Tavoy',** town of British Burmah, capital of a province of the same name, at the mouth of the river Tavoy, in lat. 14° 7′ N., on the Tenasserim coast, Farther India. It is described as a neat and handsome town, of a thoroughly Indian character, built of bamboo and on piles, half concealed by luxuriant orchards and fruit-gardens, and standing in the centre of rich ricefields, that fill the air with malaria, which, after emaciating people by intermittent fever, kills them by dysentery. The population of the whole province is 54,074; that of the town is unknown.

**Tawas,** tp., Iosco co., Mich. P. 1381.

**Tawas City,** p.-v., Tawas tp., cap. of Iosco co., Mich., on Tawas Bay, 65 miles N. E. of Bay City, has 2 churches, a graded school, a fine court-house, 1 newspaper, 4 hotels, and several mills. Principal business, manufacturing and shipping lumber. Rich deposits of salt exist, and it has one of the finest natural harbors on the chain of lakes. P. about 1000. H. E. HOARD, ED. "IOSCO CO. GAZETTE."

**Tawing and Tanning.** See LEATHER, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Tax'ation** [Lat. *taxatio*, from *taxare*, to "rate," to "value," to "estimate"], the means employed to gather from a people the contributions needed for the purposes of its government. The prosperous industry through which men acquire wealth, and the well-ordered condition of society by which men are made secure in the possession and happy in the enjoyment of wealth, depend on good government efficiently administered. Every individual of the state has therefore an interest with regard to his own well-being in the maintenance of government, and it is wise and right that he contribute a portion of his wealth to its support. Since the government, as an agency for promoting the general good, represents a common public interest, superior to any private interest, its claim very properly takes precedence of all others, and in a sense it has a first lien on the entire wealth of the nation. The rightfulness of taxation in the abstract stands thus on incontestable principles of sound economy and of essential justice. In despotic governments the will of the ruler determines arbitrarily both the methods and the measure of taxation. The people's wealth is consequently exposed to the unrestricted plunder of an army of tax-gatherers, and great inequality and oppression prevail. It is a fundamental principle of free government, however, that taxes shall be imposed by representatives of the people alone, through proportional and reasonable assessments on all estates, and shall be collected through uniform and responsible agencies, acting under defined powers and direct accountability.

To devise and carry out an equitable system of taxation is one of the profoundest problems of political economy. A perfect result has never yet been attained. Every scheme hitherto proposed involves more or less of injustice, or gives place to evasions and frauds which render it in application unequal. Hence there is found to be an advantage in combining different systems, so that the defects of one shall be balanced by the defects of another, while the advantages of all are secured. In studying the problem, taxation should be regarded with respect simply to its one object—viz. the raising of a revenue for the state. Whether or not it can be wisely employed, also, as a means of protecting and encouraging particular industries or of regulating extravagant expenditures are distinct and independent questions. (See FREE TRADE, PROTECTION, and SUMPTUARY LAWS.) The one thing to be aimed at is to make the burdens laid on the people as light and equable as possible, consistently with providing means ample for the support of the government. This involves two things: (1) fair and impartial assessments; (2) efficient and economical collection.

Adam Smith laid down the four following maxims with regard to taxes in general: "(1) The subjects of every state ought to contribute toward the support of the government as nearly as possible in proportion to their respective abilities; that is, in proportion to the revenue which they respectively enjoy under the protection of the state. (2) The tax which each individual is bound to pay ought to be certain, and not arbitrary. The time of payment, the manner of payment, the quantity to be paid, ought all to be clear and plain to the contributor and to every other person. (3) Every tax ought to be levied at the time or in the manner in which it is most likely to be convenient for the contributor to pay it. (4) Every tax ought to be so contrived as both to take out, and to keep out, of the pockets of the people as little as possible over and above what it brings into the public treasury of the state." It may be questioned whether it is true, as seems to be implied in the first maxim, that the abilities of different individuals are measured in due proportion by their respective actual revenues or incomes. It is obvious that the abilities of one whose income is $500, and of another whose income is $50,000 per year, to pay a tax of 2 per cent. on their respective revenues, are not equal. Hence the need of some further discrimination in estimating abilities. With this qualification, these maxims of Mr. Smith are believed to embody principles of equity, and have met with general approval as furnishing a test to which various schemes of taxation may be referred.

The terms *direct* and *indirect* are used to distinguish two prominent methods of taxation. According to J. S. Mill, "a direct tax is one which is demanded from the very persons who it is intended or desired should pay it. Indirect taxes are those which are demanded from one person in the expectation and intention that he shall indemnify himself at the expense of another." A poll-tax, a tax on land, and, strictly speaking, an income-tax, are examples of direct taxes; though, according to the interpretation adopted by Congress, an income-tax is not a direct tax in the sense of the term used in the U. S. Constitution with respect to the apportionment of direct taxes among the States. Duties laid on imports and excises on articles of home manufacture are examples of indirect taxation, the importer or manufacturer who pays the tax adding the amount of the tax to the price of the goods, to be ultimately paid by the consumers. Direct taxation, with fair assessments and honest returns of property, may be most fully conformed to the equitable principles embodied in the maxims just stated. But if applied to all kinds of property, it involves much labor and expense in collection, and is apt to prompt concealment and evasion, and to provoke dissatisfaction and complaint on the part of tax-payers, because they know precisely when and how much they have to pay. Indirect taxes, on the other hand, are more cheerfully submitted to, and more easily collected, because laid on the goods at the port of entry or at the manufactory, and no one thinks of the tax he pays when he buys the goods. But under this method the burden is imposed very unequally, each one's proportion being determined not at all by his ability, but by his necessities. So, often, a poor man with a large family to provide for actually contributes more for the support of the government than his neighbor with ten times his wealth and ability. It is only a partial relief to this inequality which is gained by a discrimination that lays heavier duties and excises on luxuries than on necessities; for the proportion which each bears of the burden is still determined not by his ability, but by what he consumes. In most countries it is now adopted as a rule of indirect taxation that those commodities, such as intoxicating liquors, the consumption of which is regarded as injurious, shall be most heavily taxed. Actual experience has shown that the consumption of such articles is not materially diminished by the tax. But when the tax is so high as to raise the price of an article considerably above the cost of production, the temptation to smuggling and illicit manufacture is very great, the expense of maintaining the law and collecting the tax is immensely increased, and corruption more or less on the part of revenue officers is almost inevitable.

In the U. S. there are two general systems of taxation: (1) That instituted by the national government; (2) that instituted by the State governments, including all local taxes imposed under authority of the State by counties, cities, towns, and school districts. The Constitution authorizes the Federal government to impose taxes in every form, subject only to the qualification that direct taxes must be apportioned to the several States according to their respective populations, and that all duties, imposts, and excises shall be uniform throughout the U. S. It expressly forbids any State to lay any imposts or duties on imports or exports except for executing its inspection laws. In consequence of these constitutional provisions, the taxes laid by the national government have been hitherto, with only slight exceptions, indirect, while the State governments rely almost exclusively on direct taxes. The proceeds of duties on imports proved sufficient to meet the needs of the general government for the most part until the recent civil war. Since then it has been found necessary to impose excises on various domestic manufactures. Duties are imposed by act of Congress establishing a tariff—*i. e.* a list of articles to be taxed—and the tax is collected by government officers at the ports of entry as the goods come into the country, before they pass into the hands of the importer or consignee. The duties are either *specific*—*i. e.* so much per pound, yard, etc.—or *ad valorem*—*i. e.* a percentage charged on the value of the goods as invoiced. The tariff, as now adjusted, embraces a great number of articles, and both kinds of duties, specific and ad valorem duties, being often applied to the same article. Hence the system is exceedingly complicated and the collections expensive. Excises are imposed by act of Congress on certain articles specified, and are collected by the sale of stamps to be affixed by the manufacturer or by an officer of government before the goods are thrown upon the market. The number of articles thus taxed is now quite small, liquors and tobacco yielding the greatest part of the internal revenue from this source. The following table shows the amount and distribution of taxes collected by the national government for the fiscal year ending June 30, 1875:

| | | |
|---|---|---|
| Customs duties | | $157,167,722.35 |
| Taxes on distilled spirits | $52,081,991.12 | |
| " fermented liquors | 9,144,004.41 | |
| " tobacco | 37,303.461.88 | |
| " banks and bankers | 4,097,248.12 | |
| Adhesive stamps | 6,557,229.65 | |
| Penalties, etc | 281.107.61 | |
| Back taxes under repealed laws | 1,080,111.44 | |
| Total internal revenue | | 110,545,154.23 |
| Tax on circulation and deposits of national banks | | 7,268,379.16 |
| " seal-skins | | 317,494.75 |
| Total of taxes | | $275,298,750.49 |

A large portion of the revenue of the British government is derived from excises and stamps. The following tables, showing the results of these forms of taxation in that country, are of interest in this connection:

*Statement showing in terms of U. S. Money the Amount of Revenue collected from Excise in the United Kingdom during the year ending Mar. 31, 1875.*

| | |
|---|---|
| Spirits | $72,490,254.97 |
| Malt | 37,699,510.21 |
| Licenses | 17,031,562.58 |
| Other receipts | 5,410,905.62 |
| Total | $132,632,233.38 |

*Statement showing the Amount of Revenue derived from Stamps in the United Kingdom for the same year.*

| | |
|---|---|
| Deeds and other instruments | $9,712,521.77 |
| Probates of wills | 10,481,453.10 |
| Legacies and successions | 16,547,924.94 |
| Marine insurance | 607,018.01 |
| Bills of exchange, bankers' notes, etc | 5,083,039.78 |
| Receipts and drafts | 3,636,740.32 |
| Other receipts | 5,261,825.26 |
| Total | $51,330,523.18 |

Under State authority all taxes are direct, laid upon persons by poll-taxes and upon property by assessment. The poll-tax is ordinarily a small amount levied upon every male inhabitant who has reached his majority. It recognizes the protection which the government extends to the persons as well as to the property of its citizens. It is made in theory a condition of the electoral franchise, he who pays the tax and votes being regarded as the head of a family, in both acts representing a household. It is objected to this tax that to collect it of all is difficult and expensive, so that the theory is not carried out; and further, that it is unjust to give to those who pay only a poll-tax, on that ground, an equal and direct vote respecting public expenditures, since they have no personal interest in such expenditures, except it may be the hope of profitable employment. Many of the States lay no poll-tax. The method of imposing taxes on property is essentially the same in all the States. The State authority, by statute, requires the election or appointment annually of assessors in every town and city, who make a valuation of all property which the law subjects to taxation. Real estate and such articles as are open to their inspection are estimated by the assessors. Personal property is returned in prepared lists by the owners, who may be required to make oath to the truthfulness and completeness of their returns. The usage of different States varies, but commonly real estate is set down at from 25 to 50 per cent. less than its market-value. Since assessors in different places may adopt different standards of valuation, the original assessments are, in most of the States, referred to boards of equalization appointed for each county, and their judgment is subsequently reviewed by a general board for the State. Upon the basis of the valuation of property so determined, the taxes to be raised for the purposes of the State are apportioned to each county, city, or town. By general statute or by special city charters each county, city, town, and school district is authorized to levy taxes for local purposes. These also are apportioned on the basis of the State valuation, except in case of certain improvements in cities, such as opening, paving, and lighting streets, which are charged upon the adjoining property in proportion to the benefit conferred. Generally, all of these taxes for the State, the county, the city, the town, and the school district are collected in each town or city ward by one collector at one time, he being furnished with a tax-list covering all. If other means fail, he is authorized to levy upon goods to secure the tax, and according to forms prescribed by law, lands may be sold for delinquent taxes, the title thus given being made complete and valid after a certain period allowed the original owner for redemption. (See TAX SALES.)

This direct local taxation by State authority has been thus far adjusted on the principle generally admitted, that equitable taxation requires that property of every kind shall be assessed. In actual experience it is found, however, that property in the form of real estate bears by far the larger share of the burden. Personal property can be easily concealed or moved by those who wish to evade their share of contributions to the public weal. On this matter the prevalent moral sentiment is low, and consciences are weak to resist the strong temptation to make false statements, and even to commit perjury when detection is almost impossible. The difficulty of attaining a perfect result is aggravated by the complexity of our government. Property, such as railroad and bank stocks, being within the jurisdiction of one State, while the owner resides in another, is liable to assessment in both States. So, too, in the case of evidences of debt, such as mortgages; if the real estate pledged is taxed to its full value, and the mortgage is also taxed as personal property, there seems to be a double taxation, since there is in reality but one property, of which the mortgagor and the mortgagee are joint owners. These and other like considerations have given occasion recently to much earnest discussion on the part of political economists and financiers respecting the accepted principles and methods of taxation. In theory, it is admitted that taxation to be equitable must draw in due proportion from all kinds of property, but the attempt fairly to apply the theory fails, and involves such manifest and glaring inequality that a cry is raised for some radical reform. This is not the place to enter into the discussion of the questions raised. The drift of thought in the direction of change is indicated by the proposition to abandon all attempt to assess personal property, urged by one who has given much study to the subject, thus: *First.* "The assumption that it is necessary to assess everything in order to tax equitably involves an impossibility, and therefore unavoidable inefficiency, injustice, and inequality in administration. *Second.* As popularly used in respect to matters pertaining to taxation, the term *property* is made to apply equally to entities and to symbols or non-entities, which in itself is an absurdity. *Finally.* The outcome of all this is a system which powerfully contributes to arrest and hinder national development, to corrupt society, and is without a parallel in any country claiming to be civilized." Another says, in answer to the question, What should be taxed, and how should it be taxed? "Never tax anything that would be of value to your State that could or would run away, or that could or would come to you." The world is not ready to accept at once these proposed innovations. But there is hope that from the interest and attention now awakened on the whole subject, and from investigations and discussions now carried on, there will come action intelligently and wisely taken to correct defects and equalize more perfectly the public burden.

Questions are also rife respecting taxing the property of savings banks and other banking institutions, of railroad corporations, insurance companies, and the like. These are comparatively new problems, the wise solution of which will no doubt be reached by further experience and discussion. Present usage varies much in different States. (For the particular presentation of certain other methods of taxation see INCOME-TAX, LICENSE LAWS, SUCCESSION, etc.) The facility with which a considerable revenue may be raised by a very slight stamp-tax laid on various instruments and forms of business, such as bank checks, deeds, contracts, etc., commends that method for a wider application than is given it in our country. Such a tax, once properly instituted, is hardly felt, and by scarcely any other method is a more just and equitable distribution of the public burden secured. It touches directly the wealth of the country in transition, and naturally diffuses itself through the whole community.

The following are the chief exemptions made in legislation for taxes: (1) Public property of both the State and the nation, including public lands, custom-houses, court-houses, public-school buildings, parks, etc.; (2) the property of incorporated institutions of learning endowed by private beneficence; (3) houses of worship, and to some extent other church property; (4) cemeteries belonging either to towns or to chartered corporations; (5) personal property of individuals, so far as to cover the necessities of life. The propriety of continuing exemptions in the second and third cases named is now much questioned and discussed. In favor of these exemptions it is urged that the prime object of all taxation is the public welfare, and that educational and religious institutions are most intimately identified with the public welfare, as they furnish the foundation of national prosperity by fostering general intelligence, virtue, and godliness; furthermore, that the public spirit of a people is promoted by encouraging voluntary sacrifices and contributions in this form for the public good; that these agencies bring in special influences of the highest importance to qualify and improve all that is done by the instrumentality of the state for the intellectual and moral culture of its people; and that such a favor, granted impartially to all religious denominations, precludes the support of the state to any one order or class more than to others, and holds it in its true position as the guardian of freedom of conscience for all, while it recognizes, fosters, and protects religion in all legitimate forms as a source of stability and purity for the commonwealth. Great benefits are secured at the least possible expense by the slight increase of the general assessments caused by these exemptions. On the other hand, it is urged that these institutions are not properly agents of the state, nor controlled by the state, but are maintained for special private ends of various religious corporations; that the exemptions favor a portion of the community at the expense of others not interested; that the policy involves a union of Church and State at variance with the fundamental principle of our government; and that it involves a liability to the accumulation of great wealth, to be held in mortmain by never-dying corporations independent of the state, possibly subject to foreign control, which may be

used against the best interests of the public. The agitation of this question is healthful, as it calls attention to real dangers. It will no doubt lead to some careful qualifications and limitations of these exemptions.

(For the full presentation of this subject of taxation in its modern phases see recent works on political economy, the special treatises of writers in England, as Leone Leri, Sir Morton Peto, R. Dudley Baxter; of American writers, R. S. Blackwell, Francis Hillard, William Endicott, Enoch Ensley, George H. Andrews, David A. Wells; the reports of commissioners and State officers in Massachusetts, Virginia, Rhode Island, New York, Delaware, and Maine; and for the actual legislation of different countries, *Archives de Droit international et de Legislation comparée.*)

A. L. CHAPIN.

**Tax'idermy** [Gr. τάξις, "arrangement," and δέρμα, "skin"], a term applied to the art of preserving and mounting for exhibition skins of animals. Before the year 1828 taxidermy was probably not practised, if indeed it was known, as an art in America. In that year an Englishman named Scudder established a museum in the "Old Almshouse" on Chambers street, New York, where he prepared in the rude manner of the time birds and quadrupeds. Charles Waterton did much to elevate taxidermy to a high position, and through the genius of Titian R. Peale the art in this country improved. The late Jules Verreaux of Paris brought it to a degree of perfection that fairly rivals some of the best examples of the higher plastic art. Certain appliances are used that give expression to the skins of quadrupeds, and if the operator have the artistic faculty, the result is quite within the realms of art. The same faculty produces similar results with the feathered kind. The skin is drawn over a form which is moulded to counterfeit nature as closely as possible; the material is not so tractable, yet it is the sculptor's art that fulfils the highest requirements of taxidermy. The African lion and the long-tailed sheep in the American Museum at Central Park, work of the late Jules Verreaux, are examples of the highest rank. The late Dr. Kaup of Germany attained remarkable skill in expressing action and the characteristic attitudes of birds, effecting a wonderful similitude to the living in the act of singing.

Desirable as it certainly is that this art should attain all that is possible in the artistic or æsthetic sense, much more important is the mode of preparation of the skin. There are numerous books on the subject published both in this country and in Europe; the scope of this article will not allow of a detailed account of the processes; we therefore refer the reader to them. The Smithsonian Institution at Washington will supply a concise treatise on the subject which has been prepared for use in the field. This includes all of the various manipulations required for the preservation of birds' eggs, the mounting of insects, curing of alcoholic specimens, etc., as well as directions for skinning and mounting birds and quadrupeds. Swainson's "Taxidermy" in Lardner's *Cabinet Encyclopædia* is regarded as good authority. The Illinois State Natural History Society at Bloomington issued an illustrated pamphlet on the subject for private use, in which the author, Mr. Richard H. Holder, gives the results of a long and ripe experience, rendered additionally valuable from association with Audubon and Bell. As the latter is by far the best book we have seen, an outline is here presented.

In a preliminary chapter on hunting the author recommends No. 6, 8, and 10 shot. For humming-birds, sift No. 10 through a common meal-sieve; a few charges of "dust shot" to each pound may be obtained. A pair of short-bladed, sharp-pointed scissors; a large, strong pair; a pair of spring forceps; and a pair of forceps with long blades, —these tools are quite necessary. Wire-cutters, plyers, needles, and some other items will be readily suggested to an ingenious operator. The bird or quadruped that has been killed for mounting should immediately be examined, and all shot-holes and natural openings plugged securely with cotton to prevent the blood or ejecta from soiling the exterior. In the field cones of paper are serviceable to keep the birds smooth and free from injury; place the bird head downward in a cone, and fold the loose paper neatly over the tail. Specimens that require cleansing from blood or grease may be washed in soap and *tepid* water; plaster of Paris proves exceedingly valuable then to absorb the moisture; it may be used in large quantities; rub it off repeatedly, and add the plaster until the feathers are dry and found to be free from blood or grease. The whitest plumage may be made entirely clean by this process. Having the bird in hand, you separate the feathers upon the breast, where they are sparsely set—that is, on a line parallel with the breast-bone—whilst with the knife make an incision, just through the *skin only*, from the lower end of the breast-bone to the vent. Sprinkle a little plaster upon the exposed surface to absorb moisture. Careful manipulation with the forceps and fingers will suffice to remove the skin on both sides as low down as convenient. Place the thumb and forefinger of your right hand upon the skin over the breast, press downward, and you will expose the whole breast to the neck. Now insert a hook in the neck near the body, the hook being suspended above. Take hold of the neck, pull upward, at the same time forcing your thumb and forefinger under the neck, bringing it clear of the skin sufficiently to insert your scissors, when you sever the neck. Lay hold at the wing, pushing down, at the same time opening a place under the wing-bone with your fingers, in which place your scissors and cut off at the shoulder. Having cut off both wings in this manner, you now carefully separate the skin from the back, using great care as you reach the loins, as here it adheres so closely that it is easily torn. Now take the leg at the lower joint with the left hand, and with the thumb and forefinger of the right on either side of the thigh press down the skin; insert the scissors at the joint, and sever. Then carefully force down the skin to the base of the tail, and cut off; remove the oil-sac and flesh adhering. Next strip the legs of all fat or flesh; take the wing-bone, draw out to the fore-arm, and with your fingers force the skin down sufficiently to expose the flesh, and with your knife remove it, *not* separating the shafts of the feathers from the bone. In large birds, especially geese, hawks, etc., the wings can be more easily cleaned from the outside; making an incision the whole length of the fore-arm on the under side, separate the skin and remove the flesh; the opening need not be sewn up. The neck is now reached. Take hold of it with your left hand, and with the right *strip* to the skull; here, carefully turning the skin, you reach the ears, which seize with your nails and *tear* out; then force down the skin, leaving bare the eyes; insert the point of your spring forceps in the socket and work around, loosening the eye; then lift out and tear loose from the lids. Next with the knife cut loose the tongue, and separate the neck at the base of the skull. Now with scissors cut down each side of the jaw and through into the skull, removing the roof of the mouth and exposing the brain, which may be scooped out with the forceps. Apply an abundance of arsenic to all parts of the skin, especially about the head and base of the tail; then fill the eye-sockets with cotton, turn back the head, being careful not to stretch the skin, adjust the feathers, and the bird is ready for mounting or to stuff as a "skin" for the cabinet. Ducks, geese, cranes, and some others have such large heads that it is necessary to cut the neck a little to let the parts through; this incision may be neatly sewn before mounting. In cases where the skin is much loaded with fat, plaster of Paris should be used freely; corn-meal is also a good absorbent. Before the arsenic is applied, the skin should be cleansed completely of fat, and all extraneous matter removed from it. Following the above directions, one may prepare skins for the cabinet or for exchange. To "set up" a skin requires some mechanical skill; with the facilities now at hand, from books and from operators, a knowledge of the art may be easily attained. For scientific purposes each bird should be mounted on a separate stand, and real or imitation foliage and moss should be avoided.

The best agent for preserving the skin is *pure* pulverized arsenic; it is not always found in drug-stores, but is sold by the reputable *wholesale* druggists of the large cities. This is important, as the learner will be puzzled to choose from a number of preparations, called "arsenical soaps," etc. It is well known that *pure* arsenic, in powder, is a perfect preservative, and is the most convenient form.

To preserve fishes, common table-salt is found the best when arsenic is not at hand or desirable. Corrosive sublimate (bichloride of mercury), in solution, is used by expert operators on the fur and extremities of animals, but this is often attended by a chemical action that is ruinous to the specimen; the bleaching properties of the chloride render it unsuitable in the hands of the learner. A strong solution of arsenic, applied freely and at intervals upon the bill and legs of birds, or, in the event of the actual presence of insects, on the fur of quadrupeds, is entirely efficient. Specimens of large quadrupeds are particularly liable to the attacks of *Anthrenus* and *Dermestes;* certain parts escape the arsenic dressing—the hoofs, around the horns, the nose, and the thicker parts of the skin. Very successful experiments were tried at the American Museum to resist this evil. In a pailful of hot water dissolve two pounds of carbonate of potash; *pure* pulverized arsenic may then be added as long as the liquid remains free from sediment; that amount of hot water will take up several pounds of arsenic. This solution may be applied *ad libitum* to the entire coat of the animal, leaving no trace of the mineral in sight.

J. B. HOLDER.

**Taxonomy.** See BOTANY, by PROF. ASA GRAY, M. D., LL.D.

**Tax Sales.** This term denotes the public official sales of lands made in pursuance of law for the non-payment of the taxes which have been laid upon them. The whole subject is regulated by statute, and forms a very important head of American jurisprudence. The legislation of the various States differs very much in the provisions concerning the assessment of taxes, the mode of selling lands when they are unpaid, the effects of such sales, and the right of redemption given to the owners; but notwithstanding this diversity, certain general principles have been settled which apply to all or nearly all the statutes and regulate the proceedings thereon. The land must be liable for the tax, it must not be exempt, and the tax must remain unpaid or undischarged. Payment or even tender by the owner, or by any other person whose interests in the land would be damnified, destroys the right to sell. In order that a sale may be valid all the statutory requirements which prescribe the prior official proceedings, down to and including the sale itself, must be substantially and accurately complied with. This is the fundamental doctrine established in all the States, although there is a considerable difference in the means and methods by which this regularity may be judicially determined in any subsequent controversy between the purchaser and the original owner. The principle thus stated applies to and includes all the preliminary steps, whatever they may be, for the assessment and laying the tax, the preparation of the assessment roll, and its delivery to the proper officer for collection, and also all the subsequent steps connected with the non-payment of the tax and the proceedings thereafter preparatory to the sale. The sale itself must be properly advertised and noticed, must be held at the designated time and place, must be public, and must be conducted in all respects pursuant to the statutory mandate. The land having been sold to the highest bidder for cash, a certificate is issued to him in most of the States which entitles him to a deed at the expiration of the time fixed by statute. At the termination of this period, during which the owner is generally permitted to redeem, a deed is executed on behalf of the State which recites the prior proceedings with more or less fulness, and conveys, or purports to convey, the title to the purchaser. There is a marked difference in the legislation of the States in respect to the effect of this tax-deed. At the common law the burden of proof lies wholly upon the purchaser, and he must show by affirmative evidence that all the prior steps necessary to the validity of his title were regularly taken. A class of statutes have modified this common-law doctrine, and made the deed *prima-facie* evidence that all the proceedings on the sale itself were properly performed; but the purchaser is still obliged under them to prove that the tax was duly assessed and laid, and that the assessor and collector have performed their respective duties. More recent statutes in many of the States—and this is now the general rule—have made the deed *prima-facie* evidence that all the proceedings, from the first step in laying the tax to the last one on the sale, were regular, and that the purchaser's title is valid. This, it is plain, wholly shifts the burden of proof from the purchaser on to the owner, but still permits him, if possible, to contest and avoid the conveyance. In one State at least, Iowa, the statute goes much farther, and makes the deed conclusive proof that the land was regularly listed and assessed, and properly advertised and sold. Very little is thus left for the owner to allege in opposition to the validity of the sale. In a few States a judicial determination that the taxes are unpaid is made a pre-requisite to any sale of lands on account of the delinquency. An opportunity is always given for a redemption by the owners or other persons having interest in the land. There is great diversity among the statutes on this subject, some being much more liberal than others in respect to the period of time during which the right lasts, the amount to be paid, and the conditions to be performed. Although these statutes are construed so as to guard the rights of redemptioners, their requirements must be followed; the courts have no power to open a valid tax-sale and permit a redemption which is not authorized by the legislature. (For more particular and detailed information the reader may consult Cooley on *Taxation* and Blackwell on *Tax-Titles*.)

JOHN NORTON POMEROY.

**Tay,** a river of Scotland, flows from Loch Tay, at an elevation of 355 feet above the level of the sea, to the German Ocean, which it enters through a large estuary, the Frith of Tay, from 1 to 3 miles broad. Its entire course is about 120 miles, and it is navigable for vessels of 500 tons burden up to Newburgh, 15 miles from its mouth.

**Taya'bas,** town of the Philippines, the capital of a district of the same name, on the southern shore of the island of Luzon, in an unhealthy region. It is a clean, well-built, and handsome town, carrying on quite a considerable trade. P. about 18,000, most of whom are Chinese mestizoes.

**Taychee'dah,** tp., Fond du Lac co., Wis. P. 1522.

**Tayler** (JOHN JAMES), D. D., b. at Nottingham, England, in 1798, son of a Unitarian minister; educated at the dissenting college at York; graduated at the University of Glasgow 1818; studied theology; became minister of a Unitarian congregation at Manchester 1820; was secretary to the college at York from 1822 to 1840, when it was removed to Manchester; became at that time professor of ecclesiastical history, and subsequently of doctrinal theology; was secretary and vice-president of the Manchester Literary and Philosophical Society; removed to London 1853, along with the college, of which, under the name of Manchester New College, he became principal; was for some years pastor, along with his friend, Rev. James Martineau, of the Unitarian congregation in Little Portland street, and represented the English Unitarians at the tercentenary festival of the denomination at Forda, Hungary, 1868. D. at Hampstead, near London, May 28, 1869. Author of *A Retrospect of the Religious Life of England* (1845), *Christian Aspects of Faith and Duty* (1851), *An Attempt to ascertain the Character of the Fourth Gospel* (1867), *A Catholic Christian Church the Want of our Time* (1867), *Christianity, What is it? and What has it done?* (1868), and other works on religious subjects, some of them posthumously published under the editorship of Mr. Martineau. His *Life and Letters* (1872) were published by Rev. John Hamilton Thom.

**Tay'lor,** county of N. Florida, lying on the Gulf of Mexico and drained by Ocilla River; surface level, soil sandy. Staples, live-stock, wheat, and a little cotton and sugar. Cap. Perry. Area, about 1100 sq. m. P. 1453.

**Taylor,** county of W. Georgia, drained by Flint River, and intersected by South-western R. R.; surface undulating, soil generally fertile. Staples, cotton, Indian corn, live-stock. Cap. Butler. Area, about 400 sq. m. P. 7143.

**Taylor,** county of S. W. Iowa, bordering on Missouri, and drained by East Nodaway, Platte, and other rivers; surface generally level, soil fertile. Staples, Indian corn, wheat, oats, wool, live-stock, flouring products, and lumber. Cap. Bedford. Area, 560 sq. m. P. 6989.

**Taylor,** county of Central Kentucky, drained by affluents of Green River; surface hilly, soil fertile. Staples, tobacco, Indian corn, distilled spirits, wool, and live-stock. Cap. Campbellsville. Area, 275 sq. m. P. 8226.

**Taylor,** county of Nebraska, recently formed, and not included in the census of 1870.

**Taylor,** county of N. W. Texas, drained by Clear fork of Brazos River. Area, about 900 sq. m. P. not returned in the census of 1870.

**Taylor,** county of N. West Virginia, intersected by Tygart's Valley River; surface very hilly, with some fertile valleys. Iron ore and bituminous coal abound, and there are tanneries, iron-foundries, flour-mills, and saw-mills. Staples, Indian corn, oats, wool, flouring products, and lumber. Cap. Pruntytown. Area, 130 sq. m. P. 9367.

**Taylor,** tp., Columbus co., Ark. P. 830.

**Taylor,** tp., Ogle co., Ill. P. 402.

**Taylor,** tp., Greene co., Ind. P. 1677.

**Taylor,** tp., Harrison co., Ind. P. 1259.

**Taylor,** tp., Owen co., Ind. P. 757.

**Taylor,** tp., Allamakee co., Ia. P. 863.

**Taylor,** tp., Appanoose co., Ia. P. 1059.

**Taylor,** tp., Benton co., Ia. P. 3331.

**Taylor,** tp., Dubuque co., Ia. P. 1742.

**Taylor,** tp., Harrison co., Ia. P. 525.

**Taylor,** tp., Wayne co., Mich. P. 867.

**Taylor,** tp., Greene co., Mo. P. 998.

**Taylor,** tp., Shelby co., Mo. P. 920.

**Taylor,** tp., Sullivan co., Mo. P. 628.

**Taylor,** tp., Cortland co., N. Y. P. 1016.

**Taylor,** tp., Union co., O. P. 1141.

**Taylor,** tp., Blair co., Pa. P. 1368.

**Taylor,** tp., Cambria co., Pa. P. 1670.

**Taylor,** tp., Centre co., Pa. P. 512.

**Taylor,** tp., Fulton co., Pa. P. 868.

**Taylor,** tp., Lawrence co., Pa. P. 736.

**Taylor,** tp., Orange co., Va. P. 3957.

**Taylor,** tp., Scott co., Va. P. 1783.

**Taylor** (ALEXANDER S.), b. in Charleston, S. C., in 1817; travelled extensively for several years, residing at different periods in the West Indies, China, India, and Ceylon, and

in 1848–60 at Monterey, and subsequently at Santa Barbara, Cal. He has contributed to various periodicals articles upon ethnology, natural history, and the history of California, among which are *History of Grasshoppers and Locusts of America* (in the *Smithsonian Reports* of 1858) and *The Indianalogy of California* (150 numbers in the *California Farmer*, 1860–64).

**Taylor** (Alfred Swaine), M. D., F. R. S., b. at Northfleet, Kent, England, in Dec., 1806; educated at a private school; studied surgery under Sir Astley Cooper at Guy's Hospital and in the chief medical schools of France, Germany, and Italy; became professor of chemistry at Guy's Hospital, and first professor of medical jurisprudence in the same institution. Author of *A Manual of Medical Jurisprudence* (1843), for which in 1859 he received the Swiney prize of £200; *Photogenic Drawing* (1840), *On Poisons in Relation to Medical Jurisprudence and Medicine* (1848), *On Poisoning by Strychnia* (1856), and *The Principles and Practice of Medical Jurisprudence* (1865); joint author with Dr. W. T. Brande of a standard *Manual of Chemistry*, and editor for many years of the *Medical Gazette*.

**Taylor** (Ann Hinton), wife of Isaac Taylor of Ongar, and mother of the second Isaac Taylor and of two daughters, Jane and Ann, all of whom acquired literary repute; d. in 1830. She published—*Advice to Mothers* (1814), *Maternal Solicitude for a Daughter's Best Interests* (1814), *Practical Hints to Young Females* (1815), *Present of a Mistress to a Young Servant* (1822), *Reciprocal Duties of Parents and Children*, and the tales *The Family Mansion* and *Retrospection;* also, in conjunction with her daughter, Jane Taylor, *Correspondence between a Mother and her Daughter at School* (1817).—Her second daughter, Ann Taylor (d. in 1866), widow of the Rev. Joseph Gilbert, prepared a memoir of her husband, and in conjunction with her sister, Jane Taylor (which see), wrote *Original Poems for Infant Minds, Hymns for Infant Minds, Original Hymns for Sunday Schools, and Rhymes for the Nursery*, of all of which numerous editions have been published. The *Autobiography and other Memorials of Mrs. Gilbert, formerly Ann Taylor*, edited by Josiah Gilbert, appeared in 1874.

**Taylor** (Archibald A. E.), D. D., b. at Springfield, O., Aug. 27, 1834; graduated at Princeton College in 1854, and at Princeton Theological Seminary in 1857; became successively pastor of Presbyterian churches in Dubuque, Ia., Georgetown, D. C., and Cincinnati; and in 1873 was elected president of Wooster University. He has contributed largely to religious periodicals, and was for a time one of the editors of *Our Monthly*, a literary magazine.

**Taylor** (Bayard), b. at Kennett Square, Pa., Jan. 11, 1825; in 1842 became apprentice to a printer; in 1844–45 made a pedestrian tour in Europe at an expense of not more than $500, and after his return published *Views Afoot, or Europe seen with Knapsack and Staff;* in 1847 became one of the editorial staff of the New York *Tribune*, with which he has been connected ever since, though often travelling, and publishing in that journal originally the substance of most of his works of travel. In 1849 he visited California; in 1851 set out upon a long tour in the East, ascending the Nile and going over much of Asia Minor, Syria, and Europe; in 1852 set out from England; crossed Asia to Calcutta, where he joined Perry's expedition to Japan, and made several other journeys. In 1862–63 he was secretary of legation, and for a while chargé d'affaires at St. Petersburg; in 1874 went to Egypt, and thence to the millennial celebration in Iceland. He has resided at intervals several years in Germany, where he married, and since 1872 has been engaged upon a biography of Goethe and Schiller. Several of his works have been translated into German, French, and Russian. His books of travel are—*Views Afoot*, etc. (1846), *El Dorado, or Adventures in the Path of Empire* (1850), *Journey to Central Africa* (1854), *The Lands of the Saracen* (1854), *Visit to India, China, and Japan* (1855), *Northern Travel—Summer and Winter Pictures of Sweden, Denmark, and Lapland* (1857), *Travels in Greece and Russia* (1859), *At Home and Abroad, a Sketch-Book of Life, Scenery, and Men* (1859; 2d series, 1862), *Colorado, a Summer Trip* (1867), *Byways of Europe* (1869), and *Egypt and Iceland* (1874). He has written four novels —*Hannah Thurston* (1863), *John Godfrey's Fortunes* (1864), *The Story of Kennett* (1866), and *Joseph and his Friend* (1870). He has published the following volumes of poems: *Ximena, or the Battle of the Sierra Morena, and other Poems* (1844), *Rhymes of Travel, Ballads, and other Poems* (1848), *The American Legend*, delivered before the Phi Beta Kappa Society of Harvard University (1850), *Book of Romances, Lyrics, and Songs* (1851), *Poems and Ballads* (1854), *Poems of the Orient* (1855), *Poems of Home and Travel*, selected from his earlier productions (1855), *The Poet's Journal* (1862), *The Picture of St. John* (1866), *The Ballad of Abraham Lincoln* (1869), *The Masque of the Gods* (1872), *Lars, a Pastoral of Norway* (1873), *The Prophet, a Tragedy* (1874), *Home Pastorals and Lyrics* (1875), and a *Centennial Ode* (1876). He has edited a *Hand-Book of Literature and the Fine Arts*, in conjunction with George Ripley (1852), *Cyclopædia of Modern Travel* (1856), *Frithiof's Saga*, translated from the Swedish of Tegnér by W. L. Blackley (1867), Auerbach's *Villa on the Rhine* (1869), and the *Illustrated Library of Travel, Exploration, and Adventure* (1872 *seq.*), and has translated into the original metres both parts of Goethe's *Faust* (1870–71). Besides the foregoing he has written largely in prose and verse for many periodicals; contributed notes on Loo-Choo and Japan to the *Narrative of Perry's Expedition*, and an introduction to R. H. Stoddard's *Life, Travels, and Books of Alexander von Humboldt*, and has lectured extensively in nearly every part of the U. S. In 1876 he published *The Echo Club, and other Literary Diversions*, and delivered the poem at the Centennial celebration of the anniversary of the Declaration of Independence, at Philadelphia, July 4, 1876.

A. H. Guernsey.

**Taylor** (Benjamin Franklin), b. at Lowville, N. Y., in 1822; was educated at what is now Madison University, Hamilton, N. Y., where his father, Stephen W. Taylor, was professor; became literary editor of the Chicago *Evening Journal*, of which during the civil war he was military correspondent with the armies in the West, and after the war became a resident at La Porte, Ind. He has published—*The Attractions of Language* (1845), *January and June* (1853), *Pictures in Camp and Field* (1867), *The World on Wheels* (1873), *Old-Time Pictures and Sheaves of Rhyme* (1874), and *Songs of Yesterday* (1875).

**Taylor** (Brook), b. at Edmonton, near London, Aug. 18, 1685; entered St. John's College, Cambridge, in 1701; distinguished himself in music, painting, and mathematics; in 1708 wrote his treatise on *The Centre of Oscillation*, which was published in the *Philosophical Transactions* for 1713; in 1712 was chosen a fellow of the Royal Society, of which he became secretary two years later, and put forth several papers on magnetism and mathematics; and in 1715 he had a controversial correspondence with Count Raymond de Montmort upon the philosophical theories of Malebranche. He published *Methodus Incrementorum*, etc. (1715), which contains the first announcement of the famous "Taylor's theorem," which was almost unnoticed by mathematicians until 1772, when Lagrange adopted it as the basis of the differential calculus; and *New Principles of Linear Perspective* (1719). He left several works in MS., of which the *Contemplatio Philosophica* was published, with a memoir, by his grandson, Sir William Young (1793). D. in London Dec. 29, 1731.

**Taylor** (Rev. Charles), D. D., M. D., b. in Boston, Mass., Sept. 15, 1819; was prepared for college in an academy taught by his father, the Rev. Dr. Oliver Swaine Taylor, in the State of New York; entered the University of New York, and supported himself throughout the whole course, and graduated with the highest honors of his class in 1840; taught the ancient languages in the South Carolina Conference High School at Cokesbury 1842–44; joined the conference Dec., 1844; graduated in medicine in Philadelphia in 1848, and forthwith went as a missionary to Shanghai, China; while there published a *Harmony of the Gospels* and several tracts in Chinese. During the great rebellion in China ran the blockade of the imperial fleet, and carried books and tracts into the camp of the insurgents. His wife's health failing, he returned to the U. S. in 1854. He was professor (1855–57) and president (1857–58) of the Spartanburg Female College, and (1858–62) was general Sunday-school secretary of the M. E. Church, South. He was four years presiding elder of Wadesboro' district, and four years president of the Wesleyan University at Millersburg, Ky. He resigned that position to re-enter the pastoral work. The degree of D. D. was conferred on him by the University of New York. He is the author of an excellent work, *Five Years in China*, and *Baptism in a Nutshell*. He has contributed largely to the periodical press. He is now stationed in Maysville, Ky. T. O. Summers.

**Taylor** (Christopher), b. at Skipton, Yorkshire, about 1640; was a Puritan preacher, but became a proselyte of George Fox, and joined the Society of Friends, in which he became an eminent minister, and was several times arrested, fined, and imprisoned. He was an excellent scholar; taught classical schools in several places, the last being at Edmonton, near London, whence he emigrated to Pennsylvania in 1682, and immediately upon his arrival was chosen a representative in the assembly; was made a member of the first provincial council, retaining the office until his death, and was also register-general and a justice of the Chester court. He published a *Compendium Trium Linguarum* (1679). D. in Philadelphia in 1688.

**Taylor** (Edgar), b. in 1793; was a solicitor in London, and an elegant and profound scholar. He published several legal and other pamphlets; contributed to periodicals; was one of the founders of the Camden Society; edited an edition of Griesbach's Greek Testament, of which he also made a translation—*The New Testament, Revised from the Authorized Version, with the Aid of other Translations, and made conformable to the text of J. J. Griesbach, Revised by a Layman* (1840); translated from the German and edited *German Popular Stories, collected by the Brothers Grimm* (1823), and *Gammer Grethel's Fairy-Tales and Popular Stories* (1839), both illustrated by George Cruikshank, and *Lays of the Minnesingers* (1825). He also published *The Book of Rights, a Collection of Acts of Parliament relative to Civil and Religious Liberty* (1833); translated into English prose *Master Wace, his Chronicle of the Norman Conquest* (1837), and edited *The Suffolk Bartholomian, or, The Domestic History of Rev. John Meadows* (1841). D. Aug. 9, 1839.

**Taylor** (Edward T.), b. in Richmond, Va., Dec. 25, 1794; was originally a sailor; united with the Methodist society, and was ordained as a preacher in 1819; about 1830 became preacher at the Seamen's Bethel in Boston, continuing in the position nearly forty years, and being universally designated as "Father Taylor." He went as chaplain to the U. S. frigate sent to Ireland with relief during the famine in 1846, and delivered public addresses in several places. D. in Boston Apr. 5, 1871.

**Taylor** (Emily), b. and residing in England, has within the last forty years put forth many works, mostly for the young, several of which have been republished in America. Among these are—*Pictorial Illustrations of Scripture; Sabbath Recreations*, a volume of poetical selections, republished in Boston under the title *Lays for the Sabbath*, with an introduction by John Pierpont (1860); *Tales of the Saxons; Vision of Las Casas and other Poems; England and its People* (1839; 7th ed. 1866), *Irish Tourist* (1843), *Norah Toole* (1844), *Van Ti, Chinese Tales* (1844), *Ball I Live on* (1846), *Historical Prints of English History, Historical Prints of Greece, Boy and Birds* (1848), *Chronicles of an Old English Oak* (1859), *The Knevets* (1862), *Flowers and Fruits from Old English Gardens* (1864), *Dear Charlotte's Boys, and other Stories* (1864), and *Contemporary Poets, with Selections from their Writings* (1868).

**Taylor** (Fitch Waterman), b. at Middle Haddam, Conn., Aug. 3, 1803; graduated at Yale College in 1828; studied divinity; received orders in the Episcopal Church, and was for a time settled over a parish in Maryland. In 1841 he was appointed chaplain in the navy, and continued such, either at sea or on land, until his death. He published *The Flag Ship*, a narrative of a voyage around the world in the U. S. frigate Columbia (1840), and *The Broad Pennant*, an account of a cruise in the Gulf of Mexico, and including a history of the Mexican war (1848). D. in Brooklyn, N. Y., July 24, 1865.

**Taylor** (George), b. in Ireland in 1716; came to America as a "redemptioner" in 1736; was engaged as a common laborer in an iron-foundry at Durham, Pa., the proprietor of which paid his passage over; became clerk in the foundry, and, the proprietor dying, married his widow; established large ironworks on the Lehigh River, and acquired a considerable fortune. In 1764 he was elected to the colonial assembly, in 1770 became a judge of the county court, and in 1775 was elected to the provincial assembly, and was earnest in the advocacy of Revolutionary measures. He was elected to fill a vacancy in the Continental Congress July 20, 1776, and so was not a member when the Declaration of Independence was passed, but was one of those who signed the document. He retired from Congress in Mar., 1777, and took up his residence in Delaware. D. at Easton, Pa., Feb. 23, 1781.

**Taylor** (George), b. in Wheeling, Va., Oct. 19, 1820; studied medicine, and afterward law; was admitted to the bar in 1840, and commenced practice in Indiana; removed to Alabama in 1844, thence to New York in 1848, and in 1856 was elected a Representative in Congress. He has written and lectured in behalf of popular education, and has published *Indications of the Creator* (1851).

**Taylor** (George W.), b. at Clinton, N. J., in 1808; at nineteen entered the navy as a midshipman, and after serving three years became a farmer in New Jersey; entered the army during the Mexican war as lieutenant, and rose to be captain; resided three years in California; then returned to New Jersey, and engaged in mining and manufacturing. At the outbreak of the civil war he became colonel of a New Jersey regiment in the Army of the Potomac; was made brigadier-general May, 1862, and engaged under McClellan in the battles on the Peninsula, and under Pope near Manassas. D. at Alexandria, Va., Sept. 1, 1862, from wounds received in the second battle of Bull Run.

**Taylor** (Rev. Gilbert), M. D., b. at Hare Forest on the Rapidan, Va., Nov. 18, 1791, in the same house in which his relative, Pres. Taylor, was born. He received his medical education in Philadelphia, and served as a surgeon under Gen. Jackson through the whole campaign in the war of 1812; was promoted to the general's staff; gave up a lucrative practice in Pulaski and entered the ministry in the Tennessee conference. D. in Pulaski, Tenn., Aug. 6, 1870. T. O. Summers.

**Taylor** (Sir Henry), D. C. L., b. in 1800; entered the colonial office in 1824, in which he has for many years been one of the five senior clerks. He has contributed to periodicals, and has published—*Isaac Comnenus*, a drama (1827); *Philip van Artevelde*, a tragedy (1834); *The Statesman*, a series of essays (1836); *Edwin the Fair*, an historical drama (1842); *The Eve of Conquest, and other Poems* (1847); *Notes from Life*, a series of essays (1847); *Notes from Books*, containing essays on the poems of Wordsworth and Sir Aubrey de Vere (1849); *The Virgin Widow*, a comedy (1850); *St. Clement's Eve*, a play (1862); and *A Sicilian Summer, and Minor Poems* (1868). A collective edition of his plays and poems was issued in 3 vols. in 1863.

**Taylor** (Isaac), known as "Taylor of Ongar," b. in London in 1759; was a successful engraver in London; removed to Lavenham, Suffolkshire, in 1786; was minister of an Independent congregation at Colchester 1796–1810, and subsequently of one at Ongar until his death. He superintended the education of his children, and, besides a number of sermons, published, mainly for the young—*Advice to the Teens, Beginnings of British Biography, Beginnings of European Biography, Biography of a Brown Loaf, Book of Martyrs for the Young, Bunyan explained to a Child, Character Essential to Success in Life, Child's Birthday, Child's Life of Christ, The Little Library*, comprising, in separate volumes, *The Mine, The Ship*, and *The Forest; Mirabilia, or the Wonders of Nature and Art; Scenes in America, in Asia, in England, in Europe, in Foreign Lands*, all separate works; *Scenes of Commerce, Scenes of British Wealth, Self-Cultivation Recommended*, and *Twelve Addresses to Youth, with Hymns*. Nearly all of his works have been frequently republished. He was the father of Ann, Jane, Jeffreys, and Isaac Taylor, Jr. (which see). D. at Ongar, Essexshire, Dec. 11, 1829.—His elder brother, Charles Taylor (b. 1756, d. 1821), was the editor of *Calmet's Dictionary of the Holy Bible*.

**Taylor** (Isaac), LL.D., son of Isaac "of Ongar," b. at Lavenham, Suffolkshire, Aug. 17, 1787; was designed by his father for an artist; began to study for a dissenting minister, but, having become a member of the Established Church, turned his attention to the bar, and finally devoted himself to the study of mechanical inventions, especially to the production of a machine for engraving upon copper the rollers used in calico-printing, and to literary labor. Besides numerous contributions to the *Eclectic Review*, he published the following works: *Elements of Thought* (1823), *History of the Transmission of Ancient Books to Modern Times* (1827), *The Process of Historical Proof Exemplified and Explained* (1828), *Balance of Criminality, or Mental Error compared with Immoral Conduct* (1828), a translation of *Herodotus*, with notes (1829), *Natural History of Enthusiasm*, one of his best works (1829), *New Model of Christian Missions* (1829), *Saturday Evening* (1832), *Fanaticism*, a continuation of the *Natural History of Enthusiasm* (1834), *Spiritual Despotism* (1835), *Physical Theory of Another Life*, the first work published under his own name, and which greatly enhanced his reputation (1836); *Home Education* (1838), *Ancient Christianity and the Doctrines of the Oxford Tracts for the Times* (1839; with supplement and indexes, 1844), *Man Responsible for his Dispositions, Opinions, and Conduct* (1840), *Loyola, and Jesuitism in its Rudiments* (1849), *Wesley and Methodism* (1851); *The Restoration of Belief* (1855), *The World of Mind* (1857), *Logic in Theology* (1859), *The Liturgy and the Dissenters* (1860), *Ultimate Civilization* (1860), *The Spirit of Hebrew Poetry* (1861), and *Considerations on the Pentateuch*, a reply to the work of Bishop Colenso (1863). In addition to these he edited *Edwards on the Will*, prefixing an essay on the *Application of Abstract Reasoning to the Christian Doctrine*, which was afterward published separately in 1832; translated from the German Pfizer's *Life of Christ*, with an introductory essay, and contributed to the *Edinburgh Review*, the *North British Review*, and the *Encyclopædia Britannica*, for the last of which he furnished the elaborate article on "Jesuitism." In 1836 he was a candidate for the chair of logic and metaphysics in the University of Edinburgh, but was unsuccessful, receiving 14 votes, while 18 were cast for Sir William Hamilton. In 1862 a pension of £100 was bestowed upon him from the civil service fund, "in public acknowledgment of his eminent services to literature, especially in

the departments of history and philosophy, during a period of more than forty years." D. at Stanford Rivers, Essexshire, June 28, 1865.—His son, ISAAC TAYLOR, a clergyman of the Church of England, has published—*Words and Places*, an explanation of the local names in Great Britain (1865); *The Family Pen, Memorials, Biographical and Literary, of the Taylor Family of Ongar* (1867); and *Etruscan Researches* (1874). A. H. GUERNSEY.

**Taylor** (ISIDORE SÉVERIN JUSTIN), b. at Brussels Aug. 15, 1789; studied art at Paris; served for several years in the army; travelled much; was appointed royal commissary of the Comédie française, where he introduced the dramas of Victor Hugo; induced by his petitions the Legislative Assembly (1818–30) to vote the restoration of the mediæval monuments in France; was sent to Egypt to negotiate the transfer to France of the obelisk of Luxor, and was made a senator in 1869. He wrote *Voyages pittoresques et romantiques dans l'Ancienne France* (1820–54), *Voyages pittoresques en Espagne*, etc. (1826 *seq.*), *La Syrie, l'Egypte*, etc. (1837), *Voyages en Suisse, Italie, Angleterre*, etc. (1843).

**Taylor** (JAMES), b. at Midway, Va., Apr. 19, 1769; emigrated to Kentucky in 1792; during the war of 1812 served as quartermaster of the army of the North-west under Gen. Hull, and became subsequently one of the largest landed proprietors in the West. D. at Newport, Ky., Nov. 7, 1848.

**Taylor** (JANE), daughter of Isaac Taylor of Ongar, b. in London Sept. 23, 1783. Her first poem, *The Beggar Boy*, appeared in a periodical in 1804; she afterward united with her sister, ANN TAYLOR (which see), in the preparation of several volumes of poems and hymns for young persons and for Sunday-schools; and with her mother was the author of *Correspondence between a Mother and her Daughter at School* (1817). To the *Youth's Magazine* she furnished the *Correspondence of Q. Q.* (1816–22; collected and published, with some additions, in 1826). She published *Display*, a tale (1815), and *Essays in Rhyme on Morals and Manners* (1816). After her death appeared *Memoirs, Correspondence, and Poetical Remains of the late Jane Taylor*, edited by her brother, Isaac Taylor (1825). D. at Ongar, Essexshire, Apr. 12, 1824.

**Taylor** (JANET), long a teacher in a nautical and mathematical academy in London, and noted for her scientific attainments. Has published—*Luni-Solar and Horary Tables, with their Application in Nautical Astronomy* (1833), *Lunar Tables* (1834), *Epitome of Navigation and Nautical Astronomy, with Improved Lunar Tables* (2d ed. 1851), *Diurnal Register for Barometer, Sympiesometer, Thermometer, and Hygrometer* (1844), *Planisphere of the Fixed Stars* (1846), *Handbook to the Local Marine Board Examinations*, and *Guide to the Use of Maury's Charts*. In 1859 her great services to science were acknowledged by a pension of £50 on the civil list.

**Taylor** (JEFFERYS), b. in 1792; wrote chiefly for the young. His works are—*Description of the Earth, Harry's Holiday, Little Historians, Month in London, Old English Sayings in Prose and Verse* (1827), *Parlor Commentaries on the Constitution, Ralph Richards the Miser, Tales and Dialogues in Prose and Verse, The Farm* (1834), *The Forest* (1834), *Young Islanders* (1841), *Cottage Traditions* (1842), *Incidents of the Apostolic Age in Britain* (1844), *Æsop in Rhyme* (1846), *Glance at the World around us* (1848), *The Family Bible newly opened*, which he was unable to finish on account of illness, and it was completed, with a preface, by his brother, Isaac Taylor. D. at Broadstairs, Kent, Aug. 8, 1853.

**Taylor** (JEREMY), D. D., b. in Cambridge, England, in 1613, where his father was a barber, although descended in a direct line from the famous Rowland Taylor; in 1626 entered Caius College as a sizar, or a student who in his time waited at the public tables, and after the fellows had finished their meal ate from what was left without payment; took his degree; gained the friendship of Bishop Laud, and in 1636 obtained a fellowship at Oxford, and in 1638 was presented to the rectory of Uppingham. In the civil wars he adhered to the cause of Charles I., who made him his chaplain, and in 1642 commanded that the degree of D. D. should be conferred upon him on account of a treatise which he had written in defence of episcopacy. But in that year his rectory was sequestered by Parliament, and he was forced to take refuge in Wales, where he supported himself by teaching a school; wrote some of his noblest works; preached occasionally in London; was several times imprisoned for giving utterance to royalist sentiments, and in 1658 took up his residence in Ireland upon the invitation of the earl of Conway. In 1660 he went to London to publish his *Ductor Dubitantium*, and was one of the signers of the royalist declaration of Apr. 24, which paved the way for the restoration of Charles II. He had married for his second wife Joanna Bridges, an illegitimate daughter of Charles I., and soon after the Restoration was made by Charles II. bishop of Down and Connor, to which the small see of Dromore was added, and was also made a member of the Irish privy council and vice-chancellor of the University of Dublin. He labored earnestly, but with indifferent success, for the firm establishment of the English Church in Ireland. As a preacher, and in certain respects as a writer, he occupies a foremost rank in our literature. Coleridge pronounced him "the most eloquent of divines," adding, "had I said of men, Cicero would forgive me and Demosthenes nod assent." Besides his *Sermons*, his principal works are—*The Sacred Order and Offices of the Episcopacy* (1642), *Discourse on the Liberty of Prophesying*, setting forth the iniquity of persecution for differences in opinions, by some held to be the ablest of all his works (1647); *The Great Exemplar of Sanctity and Holy Life* (1649), *The Rule and Exercise of Holy Living* (1650), *The Rule and Exercise of Holy Dying* (1651), *Ductor Dubitantium*, which Hallam pronounces to be "the most extensive and learned work on casuistry which has appeared in the English language," and *Dissuasives from Popery, addressed to the People of Ireland* (1664). Many of his separate works have been frequently republished. His *Whole Works*, with a *Life* of the author and a critical examination of his writings by Bishop Heber, in 15 vols., appeared in 1820–22; his *Life* has also been written by R. A. Willmott (1847). D. at Lisburne, Ireland, Aug. 13, 1667. A. H. GUERNSEY.

**Taylor** (JOHN), b. in Gloucestershire in 1580; was educated at a free school in Gloucester; went to London, where he was apprenticed to a waterman, and followed this occupation during the greater part of his life, whence he is styled "the water-poet." In 1596 he served on board the fleet under the earl of Essex, and was present at the attack upon Cadiz; upon his return plied his boat upon the Thames; was made collector of the dues of the lieutenant of the Tower upon imported wines, and subsequently kept a public-house near the waterside in London. His productions in prose and verse, of which about 140 are known to collectors, have some interest in showing the manners and customs of the times. The following are the titles of a few of them—*Greate Britaine all in Blacke for the incomparable Loss of Henry, our late worthy Prince* (1612); *Taylor's Urania, or his Heavenly Muse*, containing a versified account of all the sieges and sackings of Jerusalem (1615); *Taylor's Revenge, or the Rimer, William Fennor, firkt, ferrited, and finely fetcht over the Coals* (1615); *Taylor's Travels in Germanie, or three Weekes, three Daies, and three Houres Observations and Travel from London to Hamburgh* (1617); *The pennyles Pilgrimage, or the moneylesse Perambulation of John Taylor, alias the King's Majestie's Water-Poet, from London to Edenborough on Foot* (1618); *The Scourge of Baseness, a Kicksey Winsie, or a Lerry come Twang, wherein J. T. hath satyrically suted 750 of his bad Debtors who will not pay him for his Returne of his Journey from Scotland* (1619); *Taylor's Motto: Et Habeo, et Careo, et Curo: I have, I want, I care* (1621); *Wit and Mirth, chargeably collected out of Taverns, Alehouses, Tobacco-Shops*, etc.; *A Shilling, or the Travailes of 12 Pence* (1622); *Taylor's Farewell to the Tower-Bottles* (1622); *Sir Gregory Nonsence, his Newes from No Place* (1622); *The Life and Death of the most blessed amongst all Women, the Virgin Mary* (1622); *Taylor's Travels and Circular Perambulation through and by more than thirty times twelve Signes of the Zodiack of the famous Cities of London and Westminster* (1626); *The Praise of Cleane Linen, with the commendable Use of the Laundress; Verbum Sempiternum*, an epitome of the Old Testament, and *Salvator Mundi*, an epitome of the New Testament, both in verse; *Drinke and Welcome*, an account of the various beverages in use in Great Britain and Ireland (1637); *Taylor's Physicke has purged the Divil, or the Divell has got a Squirt* (1641); *The Essence, Quintessence, Insence, Innocence, Lifesence, and Magnificence of Nonsence upon Sence* (1653); and *The Suddaine Turne of Fortunes Wheele*, an imaginary conversation between the pope, the emperor, and the king of Spain (1631). In 1630, Taylor made a collection, in a single volume, of the 63 pieces which he had at that time put forth in brochures and broadsheets, which was in 1869 republished in facsimile by the Spencer Society, which proposed to reprint those subsequently written, of many of which only single copies were known to exist. D. in London in 1654.

**Taylor** (JOHN), D. D., b. near Lancaster, England, in 1694; taught an academy, and was for many years pastor of a Unitarian society at Norwich; in 1757 became professor of divinity in the dissenting seminary at Warrington. His principal works are—*The Scripture Doctrine of Original Sin* (1738), *The Scripture Doctrine of Atonement* (1750), *Hebrew Concordance to the English Bible* (1754), and *Scheme of Scripture Divinity* (1762). D. Mar. 5, 1761.

**Taylor** (John), LL.D., b. at Shrewsbury about 1703; was educated at St. John's College, Cambridge, of which he became a fellow in 1730, librarian to the university in 1732, advocate in Doctors' Commons in 1741, and chancellor of Lincoln in 1744. He afterward entered holy orders; became rector of Lawford in 1751, archdeacon of Buckingham in 1753, and canon residentiary of St. Paul's in 1757. He published several orations and essays, but his principal works are—an edition of the Greek text, with a Latin translation and notes, of *The Orations and Fragments of Lysias* (1739), and of some of the *Orations of Demosthenes, Æschines, Dinarchus, and Demades*, intended to comprise five volumes, but only three were completed (1743–57), and *Elements of the Civil Law* (1755). D. in 1766.

**Taylor** (John), b. in Orange co., Va., about 1750; graduated at William and Mary College in 1770; was U. S. Senator in 1792–94, again in 1803, and a third time in 1822–24; in the interval was a member of the Virginia house of delegates and the mover of the celebrated Virginia resolutions of 1798–99. He was especially devoted to agriculture and political theories, and published—*Inquiry into the Principles and Policy of the Government of the United States* (1814); *Arator*, a series of essays upon agriculture and politics (1818); *Construction Construed, and Constitution Vindicated* (1820); *Tyranny Unmasked* (1822); *New Views of the Constitution of the United States* (1823). D. in Caroline co., Va., Aug. 20, 1824.

**Taylor** (John), b. in South Carolina in 1770; graduated at Princeton College in 1790; was admitted to the bar in 1793, but, having large estates, devoted himself to planting, and was prominent in politics, being several times elected to both branches of the State legislature; a Presidential elector in 1797; Representative in Congress 1807–09 and 1817–21; U. S. Senator 1810–16; governor of South Carolina 1826–28, and was receiver of public moneys in Mississippi Territory. D. in 1832.

**Taylor** (John), b. in 1781; was an eminent publisher and bookseller in London; wrote several essays on financial topics, among which are —*Money, its Origin and Use* (1831), *The Standard and Measure of Value, Catechisms of the Currency and Exchanges* (1835), and *Currency Investigated* (1845). Also, *The Great Pyramid, why was it Built? and who Built it?* in which he argues that it was built by the sons of Joktan as a standard of measurement. He is best known by his *Identity of Junius with a distinguished Living Character*, in which he endeavors to prove that Sir Philip Francis was the author of the *Letters of Junius* (1816; with a supplement, consisting of fac-similes and other illustrations, 1817). D. in 1864.

**Taylor** (John Louis), b. in London Mar. 1, 1769; was brought to America by his brother in 1781; studied law, and settled at Fayetteville, N. C.; was several times elected to the legislature; became one of the judges of the supreme court of the State in 1798, and was chief-justice from 1810 until his death. A volume of his decisions, containing cases decided from 1799 to 1802, was published in 1802, and another volume, of cases from 1816 to 1818, appeared in 1818. He also published a *Charge to the Grand Jury of Edgecombe Superior Court, exhibiting a View of the Criminal Law of North Carolina* (1817). D. Jan. 29, 1829.

**Taylor** (John W.), b. in Saratoga co., N. Y.; graduated at Union College in 1803; studied law in Albany, and was elected to the legislature in 1811; in 1813 he was chosen a Representative in Congress, and retained his seat until 1833; was Speaker of the House in the sixteenth Congress 1819–20, by which the Missouri Compromise bill was passed, in opposition to which he made an eloquent speech; and also Speaker of the nineteenth Congress 1825–26. He was State senator in 1841–43, and in 1843 removed to Cleveland, O. D. at Cleveland Sept. 8, 1854.

**Taylor** (Joseph P.), brother of Zachary, b. in Kentucky; entered the U. S. army in 1813 as third lieutenant of the 28th Infantry; first lieutenant 1814; retained in the 3d Artillery in the peace organization of the army, and became captain in 1825; in Mar., 1829, was appointed an assistant commissary of subsistence, in which department he had been acting for the greater part of the time since entering the service; in 1838 became major, and in 1841 assistant commissary-general with rank of lieutenant-colonel; during the war with Mexico his able administrative ability was displayed in the conduct of his department, and in 1848 was brevetted colonel; upon the death of Gen. Gibson (Sept., 1861), Taylor succeeded that officer as commissary-general with rank of colonel, which by act of Feb. 9, 1863, was increased to that of brigadier-general. D. at Washington, D. C., June 29, 1864.

**Taylor** (Joseph W.), b. about 1820 in Cumberland co., Ky.; graduated at Princeton College, Ky., and in 1838 removed to Alabama; became a prominent Whig lawyer and legislator and an active promoter of the cause of education; was elected in 1865 to Congress, but not allowed a seat; afterward editor of the Tuscaloosa *Times* and president of the trustees of the Southern University.

**Taylor** (Meadows), b. in Ireland about 1810; early entered the military service of the East India Company, in which he obtained high distinction, having risen to the rank of colonel and been decorated with the knighthood of the Star of India; was president or administrator at several native courts; was a learned archæologist, and married a princess of Southern India. D. in May, 1876. Author of *Confessions of a Thug* (3 vols., 1839; new ed. 1858), *Tippoo Sultaun, a Tale of the Mysore War* (3 vols., 1840), *Notices of Cromlechs, Cairns, and other Ancient Scytho-Druidical Remains in the Principality of Sorapur* (London, 1853), *Tara, a Mahratta Tale* (3 vols., 1863), *Ralph Darnell, a Tale* (3 vols., 1865), and *The Student's Manual of the History of India, from the Earliest Period to the Present* (1870), the latter work being the only popular history of India in which adequate attention is given to the dynasties of the Dekkan. Col. Taylor contributed the Indian materials to Cassell's *Biographical Dictionary* (London, vol. i., 1869).

**Taylor** (Nathaniel William), D. D., b. at New Milford, Conn., June 23, 1786; graduated at Yale College in 1807; studied theology, and in 1812 became pastor of the Centre Congregational church in New Haven, where he rose to eminence as a preacher. In 1822 he was chosen Dwight professor of didactic theology in Yale College, and occupied the chair until his death. In 1828 he delivered the *concio ad clerum* discourse at New Haven, in which he put forth views upon the subject of the nature and extent of human depravity and kindred dogmas which were widely denounced as unscriptural and heretical, but which he continued to maintain and to uphold through the *Christian Spectator*, and which were vehemently opposed by other divines in various discourses and periodicals. After his death 4 vols. of his works, edited by Rev. Noah Porter, D. D., were published: *Practical Sermons*, preached while pastor of the Centre church (1858); *Lectures on the Moral Government of God* (2 vols., 1859); and *Essays, Lectures, etc., upon Select Topics in Revealed Theology* (1859). D. in New Haven Mar. 10, 1858.

**Taylor** (Oliver Alden), b. at Yarmouth, Mass., Aug. 18, 1801; graduated at Union College in 1825, and at Andover Theological Seminary in 1829, where he subsequently was instructor in sacred literature; in 1839 became pastor of a church in Manchester, Mass. He contributed to various religious periodicals; prepared in 1838 a catalogue of the library of Andover Seminary, and besides several poems published *Brief Views of the Saviour* (1835), *Piety in Humble Life, a Memoir of Andrew Lee* (1844), and translated Reinhard's *Plan of the Founder of Christianity* (1831), Reinhard's *Memoirs and Confessions* (1832), and *The Music of the Hebrews*. A memoir of him, by his brother, Rev. T. A. Taylor, was published in 1853. D. at Manchester, Mass., Dec. 18, 1851.

**Taylor** (Richard), grandson of John Taylor of Norwich (which see), b. at Norwich May 18, 1781; learned the trade of a printer in London, at the same time studying language and literature, and in 1803 established himself in business in London, devoting himself especially to the publication of works upon natural history. In 1822 he became joint editor, with Dr. Tilloch, of the long-established *Philosophical Magazine*, with which in 1827 was incorporated Thomson's *Annals of Philosophy;* in 1837 commenced the publication of the *Scientific Memoirs*, selected from the transactions of foreign academies and learned societies, and in 1838 established the *Annals of Natural History*. During nearly half a century he was under-secretary of the Linnæan Society, and was a prominent member of the British Association for the Advancement of Science. He prepared annotated editions of Horne Tooke's *Diversions of Purley* (1829 and 1840) and of Warton's *History of English Poetry* (1840). D. at Richmond, near London, Dec. 1, 1858.

**Taylor** (Richard), son of Zachary Taylor, b. in Florida; was a resident of Louisiana at the breaking out of the civil war, when he entered the Confederate army, and was made colonel of a Louisiana regiment, which fought under his command at the battle of Bull Run; was made brigadier-general in Oct., 1861; served under Stonewall Jackson in Virginia; became major-general; in 1863–64 commanded in the department W. of the Mississippi, especially against Gen. Banks in his unsuccessful Red River campaign; in Sept., 1864, was placed in command of the department of East Louisiana, with his head-quarters at Mobile, and on May 4, 1865, surrendered to Gen. Canby, his force being the last which remained to the

Confederacy. After the war he resided on his plantation in Louisiana.

**Taylor** (Richard Cowling), b. at Hinton, Staffordshire, Jan. 18, 1789; became eminent as a geologist and antiquary, publishing many papers and several books on these subjects; emigrated to America in 1830, making Philadelphia his residence, and devoted himself to the development of the mineral resources of the country. Before leaving England he published—*Index Monasticus, or the Abbeys, Monasteries, etc. formerly established in the City of Norwich and the Ancient Kingdom of East Anglia* (1821), *The Geology of East Anglia* (1827), and an elaborate *Index to Dugdale's Monasticon Anglicanum* (1830). After coming to America he published, among others—*History and Description of Fossil Fuel* (1841), *Statistics of Coal* (1848; 2d ed., revised by S. S. Haldeman, 1855), and many reports of his various surveys, some of which were issued in England and others in America. Among his publications are treatises on *The Geology and Natural History of the North-east extremity of the Alleghany Mountains, and a Supplement to the Natural History of the Birds of the Alleghany Range.* D. at Philadelphia Nov. 26, 1851.

**Taylor** (Robert), originally a clergyman, but subsequently the author of several books of an irreligious tendency. Among these are—*The Devil's Pulpit*, for which the author was imprisoned (1831); *The Diegesis, being a Discovery of the Origin and Early History of Christianity* (1833); *Astro-Theological Lectures on Freemasonry* (1856); *Astronomico-Theological Lectures* (1857); *Belief not the Safe Side* (1857).

**Taylor** (Samuel Harvey), LL.D., b. in that part of Londonderry now called Derry, N. H., Oct. 3, 1807; graduated at Dartmouth College 1832; entered Andover Theological Seminary 1832; was assistant teacher in Phillips Andover Academy 1833–35; tutor in Dartmouth College 1836–37; graduated from the seminary 1837, and in the autumn of that same year became principal of Phillips Andover Academy, holding the office till he died suddenly of heart disease Jan. 29, 1871. His scholarship was exact and solid, his moral tone lofty, and the drill of his classroom terribly severe. From 1852 (when Bela B. Edwards died) he was one of the editors of the *Bibliotheca Sacra.* In 1851 he assisted in editing the *History of Londonderry.* He also published—Krebs's *Guide for Writing Latin* (1843), Kühner's *Grammar of the Greek Language*, in connection with Prof. Edwards (1844), *Elementary Greek Grammar* (1846), *Method of Classical Study* (1861), *Classical Study* (1870). (See *Congregational Quarterly*, Jan., 1872.)

R. D. Hitchcock.

**Taylor** (Stephen William), LL.D., b. at Adams, Mass., Oct. 23, 1791; graduated at Hamilton College in 1817; was for fourteen years principal of the Black River Academy at Lowville, N. Y.; subsequently, for three years, teacher in a family school, and in 1834 became head of the preparatory department of Hamilton Institution, in which from 1838 to 1845 he was professor of mathematics and natural philosophy; the institution having been reorganized as Madison University, he became its president in 1851. He was eminent as a practical educator, and published an historical sketch of Madison University, several inaugural and baccalaureate addresses, and a series of essays on the theory of education. D. at Hamilton, N. Y., Jan. 7, 1856.

**Taylor** (Thomas), styled "the Platonist," b. in London May 15, 1758; studied for a while at St. Paul's School with the design of becoming a dissenting minister, but afterward entered a banking-house; devoted his spare moments to the study of Greek, mathematics, and chemistry; taught the languages and mathematics; was appointed assistant secretary of the Society for the Encouragement of Arts and Manufactures; read in the occult sciences, and set about making a translation of the works of Plato and the remains of the so-called Platonists. His works comprise 63 volumes, of which 23 are large quartos; among them are treatises on arithmetic and geometry, on the Eleusinian and Bacchic mysteries; an edition, with large additions, of the *Greek Lexicon* of Hedericus; an essay on the *Rights of Brutes*, in ridicule of Paine's *Rights of Man;* a *History of the Restoration of the Platonic Theology;* and a volume of *Miscellanies in Prose and Verse.* His main labor, however, was the translating of little-known Greek and Latin works. Besides the *Plato* and *Aristotle*, his translations include the remains of Apuleius, Celsus, Demophilus, Hierocles, Iamblichus, Julian, Maximus Tyrius, Ocellus Lucanus, Olympiodorus, Pausanias, Plotinus, Porphyry, Proclus, Sallust *On the Gods and the World*, the *Orphic Hymns*, and the *Chaldæan Oracles.* His translation of Plato (5 vols. 4to, 1804) was printed at the cost of the duke of Norfolk, who from some whim locked up nearly the whole edition in his house, where the copies remained until 1848. Of his translation of Aristotle (10 vols. 4to, 1806–12) only 50 complete copies were struck off, the expense being defrayed by W. Meredith, a retired tradesman, who gave Taylor an annuity of £100, which constituted fully half his income for the rest of his life, during which he sank into almost absolute obscurity. His latest works were translations of Proclus *On Providence and Evil* (1833) and Plotinus *On Suicide* (1834). D. at Walworth Nov. 1, 1835.

**Taylor** (Thomas House), D. D., b. at Georgetown, S. C., Oct. 18, 1799; received his collegiate and theological education in his native State; entered holy orders in the Episcopal Church, and in 1834 succeeded Dr. (afterward Bishop) J. M. Wainwright as rector of Grace church, New York. He took a high rank in his profession, and was identified with the "Low Church" side of the denomination. In 1866 he went to Europe for the benefit of his health, and after his return passed the greater part of his time at his country residence at West Park, on the Hudson. About two years before his death he was severely injured by being thrown from his carriage. After his death was published a volume of his *Sermons preached in Grace Church, 1846–67* (1869). D. at West Park, N. Y., Sept. 9, 1867.

**Taylor** (Tom), b. at Sunderland, Durhamshire, in 1817; passed two terms at the University of Glasgow, where he won three gold medals and other prizes; then went to Trinity College, Cambridge, where he graduated with high honors, and became a fellow; was appointed to the chair of English literature in University College, London, which he held for two years; wrote for periodicals, especially for *Punch;* studied law; was called to the bar in 1845; was made secretary to the board of health in 1854, and in 1858 secretary to the local government act office. He has produced, either singly or in conjunction with others, more than 100 dramatic pieces, many of which have had a marked success; among them are—*Still Waters Run Deep, The Unequal Match, The Overland Route, The Contested Election, Our American Cousin, The Ticket-of-Leave Man,* and *'Twixt Axe and Crown.* He has also published—*Life of B. R. Haydon* (1853), *Autobiographical Recollections of C. R. Leslie* (1860), *Handbook to the Pictures of the National Exhibition of 1862* (1862), furnished the letter-press to accompany *Birket Foster's Pictures of English Landscape* (1862); translated from the French of Villemarque the *Ballads and Songs of Brittany* (1865), and in conjunction with C. W. Franks prepared a *Catalogue of the Works of Sir Joshua Reynolds* (1869).—His wife, better known by her maiden name of Laura W. Barker, has assisted her husband in several of his works, and is a musical composer of decided originality and power.

**Taylor** (Virgil Corydon), b. at Barkhamstead, Conn., in 1817; author of *Taylor's Index-Staff*, a new method of musical notation, in which the keynote, whether major or minor, is indicated by a heavy line or a wide space. He has written for the newspapers articles on political topics, and has published the following musical works: *Sacred Minstrel* (1846), *The Lute, or Musical Instructor* (1847), *Choral Anthems* (1850), *The Golden Lyre* (1850), *The Concordia* (1851), *The Chime* (1854), *The Celestina* (1856), *The Song Festival* (1858), *The Enchanter* (1861), *The Concertina* (1864), and *The Praise Offering* (1868).

**Taylor** (Walter), b. probably in Virginia; emigrated to the Territory of Indiana, where he held several official stations, and in 1811 was aide-de-camp to Gen. Harrison at the battle of Tippecanoe. When Indiana was admitted into the Union as a State, in 1816, he was chosen one of the Senators in Congress, and was re-elected for a second term. D. at Lunenburg, Va., Aug. 26, 1826.

**Taylor** (William), b. at Norwich, England, in 1765, the son of a wealthy merchant; was sent to Germany to complete his mercantile education, but having mastered the language, he became charmed with its literature, and returning to England devoted himself to letters, and for a time partially to politics. He was a very voluminous contributor to the *Monthly Review*, for which he wrote the critiques during many years. He was the first Englishman to introduce to English readers a knowledge of the literature of Germany, and is best known by his vigorous translation of Bürger's *Lenore.* He published a translation of Lessing's *Nathan the Wise* (1805), *English Synonyms Discriminated* (1813), and *Historic Survey of German Poetry*, with many translations (1828). His *Life and Writings*, containing correspondence with Robert Southey and original letters from Walter Scott, was published by J. W. Robberds (2 vols. 8vo, 1843). D. in Mar., 1836.

**Taylor** (William Cooke), LL.D., b. at Youghal, Ireland, Apr. 16, 1800; was educated at the University of Dublin; went to London, where he entered upon a literary career; paid especial attention to the subject of education, and in 1846 was sent by government to examine the edu-

cational systems in use on the continent of Europe—a commission which he executed with marked ability—and had been sent to Ireland to carry out his educational views when he was cut off by cholera. His principal works are—*Historical Miscellany* (1829), *History of France and Normandy* (1830), *History of the Civil Wars in Ireland* (1831), *History of Mohammedanism and its Sects* (1834), *History of Popery* (1837), *The Bible Illustrated from Egyptian Monuments* (1838), *Manual of Modern History* (1838), *Manual of Ancient History* (1839), *Natural History of Society* (1839), *Romantic Biography of the Age of Elizabeth* (1842), *History of British India* (1842), *Revolutions, Insurrections, and Conspiracies of Europe* (1843), and *Memoirs of the House of Orleans* (1849). D. in Dublin Sept. 12, 1849.

**Taylor** (William Mackergo), D. D., b. at Kilmarnock, Ayrshire, Scotland, Oct. 23, 1829; educated at Kilmarnock Academy; graduated M. A. at the University of Glasgow 1849; studied theology at the Divinity Hall of the United Presbyterian Church in Edinburgh; was licensed to preach by the presbytery of Kilmarnock Dec. 14, 1852; ordained pastor of the U. P. congregation at Kilmarnock June 28, 1853; settled over the U. P. Church, Derby road, Liverpool, England, Oct. 23, 1855; in the spring of 1871 came to the U. S. as delegate from the U. P. Church in Scotland to the General Assembly of the Presbyterian Church at Chicago; was called to the pastorate of the Broadway Tabernacle (Congregational) church in New York City Nov. 22, 1871, and entered upon his labors there Mar. 10, 1872. In 1872 he received the degree of D. D. from both Yale and Amherst on the same day. In addition to many articles in the *Scottish Review* and many separate sermons, he has published *Life Truths* (1862), *The Miracles Helps to Faith, not Hindrances* (1865), *The Lost Found, and the Wanderer Welcomed* (1870), *Memoirs and Remains of Rev. M. Dickie, Bristol* (1872), *David, King of Israel* (1874), *Elijah the Prophet* (1875), *The Ministry of the Word* (1876). R. D. Hitchcock.

**Taylor** (William Rogers), U. S. N., b. Nov. 7, 1811, in Rhode Island; entered the navy as a midshipman Apr. 1, 1828; became a lieutenant in 1840, a commander in 1855, a captain in 1862, a commodore in 1866, a rear-admiral in 1871; retired in 1873. Served on the W. coast of Mexico during our war with that country, and as fleet-captain to Rear-Admiral Dahlgren was on board the monitors Catskill and Montauk in the fights of the 10th and 18th of July, 1863, with Forts Wagner and Sumter. Commanded the Juniata in the Fort Fisher fights. Foxhall A. Parker.

**Taylor** (William Vigneron), b. at Newport, R. I., in 1781; went to sea before the mast, and rose to be a captain in the merchant service; entered the navy as sailing-master in 1813; effectually aided Perry in equipping his fleet on Lake Ontario and in the naval victory of Sept. 13, sailing the Lawrence, Perry's flag-ship, into and during the action, and for his services was made lieutenant; was made master-commander in 1831, captain in 1841, and in 1847 commanded the Ohio, 74 guns, on a cruise to the Pacific, which was his last service. He was the father of Rear-Admiral William R. Taylor, U. S. N., and of Capt. O. H. P. Taylor, U. S. A., who was killed by the Indians in Washington Territory in May, 1858. D. at Newport, R. I., Feb. 11, 1858.

**Taylor** (Zachary), twelfth President of the U. S., b. in Orange co., Va., Sept. 24, 1784. His father, Richard Taylor (b. 1746), was colonel of a Virginia regiment in the Revolutionary war; removed to Kentucky in 1785; purchased a large plantation near Louisville, and became an influential citizen; was a member of the convention which framed the constitution of Kentucky; served in both branches of the legislature, and was collector of the port at Louisville under Pres. Washington; as a Presidential elector he voted for Jefferson, Madison, Monroe, and Clay. D. Jan. 19, 1829. Zachary remained on his father's plantation until 1808, in which year (May 3) he was appointed first lieutenant in the 7th Infantry to fill a vacancy occasioned by the death of his elder brother, Hancock. Up to this period he had received but a limited education. Joining his regiment at New Orleans, he was attacked with the yellow fever, with nearly fatal termination. Promoted to be captain in Nov., 1810, in the summer of 1812 he was in command of Fort Harrison, on the left bank of the Wabash River, near the present site of Terre Haute, his successful defence of which (Sept. 4–5, 1812), with but a handful of men against a large force of Indians which here attacked him, was one of the first marked military achievements of the war of 1812; was brevetted major, and in 1814 promoted to the full rank. During the remainder of the war Taylor was actively employed on the Western frontier. In the peace organization of the army in 1815 he was retained as captain, but soon after resigned and settled near Louisville. In May, 1816, however, he re-entered the army as major of the 3d Infantry, became lieutenant-colonel 8th Infantry in 1819, and in 1832 attained the colonelcy of the 1st Infantry, of which he had been lieutenant-colonel since 1821. On different occasions he had been called to Washington, as member of a military board for organizing the militia of the Union, and to aid the government with his knowledge in the organization of the Indian bureau, having for many years discharged the duties of Indian agent over large tracts of Western country. He served through the Black Hawk war (1832), and in 1837 was ordered to take command in Florida, then the scene of war with the Indians. As hitherto, the Indians after their attacks would retreat to their hiding-places in the swamps, beyond pursuit of the army; but Taylor determined to attack them in their strongholds. Accordingly, the battle of Okee-cho-bee was fought Dec. 25, 1837, resulting in the decisive defeat of the savages, and virtually ending the war. Taylor's loss was 112 wounded and 26 killed. For this Taylor was brevetted brigadier-general and made commander-in-chief in Florida; was transferred to command of the army of the South-west in 1840, from which command he was relieved the same year at his own request. Subsequently, he was stationed on the Arkansas frontier at Forts Gibson, Smith, and Jesup, which latter work had been built under his direction in 1822. On May 28, 1845, he received a despatch from the secretary of war informing him of the receipt of information by the President "that Texas would shortly accede to the terms of annexation," in which event he was instructed to defend and protect her from "foreign invasion and Indian incursions." He proceeded, upon the annexation of Texas, with about 1500 men, to Corpus Christi, where his force was increased to some 4000. In Mar., 1846, he was ordered to advance to the banks of the Rio Grande, opposite Matamoras, where a camp was constructed (named Fort Brown after its gallant defence by Major Brown), and established his dépôt of supplies at Point Isabel, 25 miles to the E. He was ordered by Gen. Ampudia to retire beyond the Nueces, to which he replied that under instructions of his government he should maintain his position. Apprehending an attempt to cut him off from his base of supplies, he started for that point (May 1) with the main body of his troops. On May 3 the sound of heavy cannonading warned him of an attack on his camp, guarded only by a weak garrison, and he departed to its relief May 7. The battle of Palo Alto (which see) was fought next day, and that of Resaca de la Palma (which see) May 9; Matamoras was occupied without resistance May 18, where he remained until September. Taylor was brevetted major-general May 28, and a month later (June 29, 1846) his full commission to that grade was issued. After needed rest and reinforcement, he advanced in September on Monterey (which see), which city capitulated after three days' stubborn resistance. Here he took up his winter quarters. The plan for the invasion of Mexico by way of Vera Cruz, with Gen. Scott in command, was now determined upon by the government, and at the moment Taylor was about to resume active operations he received orders to send the larger part of his force (Worth and Quitman's divisions and most of Gen. Wool's volunteers) to reinforce the army of Gen. Scott at Vera Cruz. Though subsequently reinforced by raw recruits, yet after providing a garrison for Monterey and Saltillo he had but about 5300 effective troops, of whom but 500 or 600 were regulars. In this weakened condition, however, he was destined to achieve his greatest victory. Confidently relying upon the strength of Vera Cruz to resist the enemy for a long time, Santa Anna directed his entire army against Taylor to overwhelm him, and then return to oppose the advance of Scott's more formidable invasion. The battle of Buena Vista (which see) was fought Feb. 22–23, 1847. He received the thanks of Congress and a gold medal, and "Old Rough and Ready," the sobriquet given him in the army, became a household word. He remained in quiet possession of the Rio Grande valley until November, when he returned to the U. S. In the Whig convention which met at Philadelphia June 7, 1848, Taylor was nominated on the fourth ballot (June 8) as the candidate of the Whig party for President over Henry Clay, Gen. Scott, and Daniel Webster. In November, Taylor received a majority of the electoral votes and a popular vote of 1,360,752 against 1,219,962 for Cass and Butler and 291,342 for Van Buren and Adams. Gen. Taylor was inaugurated President Mar. 4, 1849. Among the questions requiring the prompt attention of the President was the organization of the large territories newly acquired by conquest and treaty, the question of the admission of California, the formation of new Territories, and the settlement of the boundary-line between Texas and New Mexico. The free and slave States being then equal in number, the struggle for supremacy on the part of the leaders in Congress was violent and bitter.

California adopted in convention, in the summer of 1849, a constitution prohibiting slavery within its borders. Taylor advocated the immediate admission of California with her constitution, and the postponement of the question as to the other Territories until they could hold conventions and decide for themselves whether slavery should exist within their borders. This policy ultimately prevailed through the celebrated "Compromise measures" of Henry Clay, but not during the life of the brave soldier and patriot statesman. On July 5 he was taken suddenly ill with a bilious fever, which proved fatal, his death occurring July 9, 1850. One of his daughters was married to Col. W. W. S. Bliss, his adjutant-general and chief of staff in Florida and Mexico, and private secretary during his Presidency; another was married to Jefferson Davis.—His son, RICHARD TAYLOR, is noticed above. G. C. SIMMONS.

**Taylor Creek,** tp., Hardin co., O. P. 891.

**Taylor, Fort.** See FORT TAYLOR.

**Taylor's,** tp., Wilson co., N. C. P. 555.

**Taylor's Bridge,** tp., Sampson co., N. C. P. 1521.

**Taylor's Falls,** p.-v. and tp., Chisago co., Minn., on St. Croix River, has a lumber-trade, manufactures, and a weekly newspaper. P. 1003.

**Taylor's Port,** v., Boone co., Ky. P. 120.

**Taylor's Theorem,** in mathematics, a theorem first demonstrated by Dr. Brook Taylor, and published by him in his *Methodus Incrementorum* in 1715. The object of the theorem is to show how to develop a function of the sum of two variables into a series arranged according to the ascending powers of one with coefficients that are functions of the other. The formula for making the development may be written—

$$f(x+y) = n + \frac{dn}{dx}y + \frac{d^2n}{dx^2}\frac{y^2}{1.2} + \frac{d^3n}{dx^3}\frac{y^3}{1.2.3} +, \text{ etc.}$$

The first member of this formula denotes any function of the sum of $x$ and $y$, and $n$ is what that function becomes when $x$ is made equal to 0. The formula is always applicable, but it sometimes happens that $n$ or one of its successive differential coefficients reduces to $\infty$ for a particular value of $x$. This is called the *failing case* of Taylor's theorem. It is more proper to say that the function fails to be developable for the value in question. W. G. PECK.

**Tay'lorstown,** v., Washington co., Pa. P. 98.

**Tay'lorsville,** v., Bartholomew co., Ind. P. 350.

**Taylorsville,** p.-v., cap. of Spencer co., Ky., on the E. fork of Salt River, has water-power, manufactories, and a newspaper.

**Taylorsville,** p.-v. and tp., cap. of Alexander co., N. C. P. of v. 169; of tp. 1078.

**Taylorsville,** v., Highland co., O. P. 52.

**Taylorsville,** v., Muskingum co., O. P. 544.

**Taylorsville,** v., Indiana co., Pa. P. 169.

**Taylorsville,** p.-v., cap. of Johnson co., Tenn. P. 236.

**Taylorville,** p.-v. and tp., cap. of Christian co., Ill., at the junction of the Springfield division of Ohio and Mississippi and the St. Louis division of Toledo Wabash and Western R. Rs., 25 miles from Springfield, contains excellent schools, 3 newspapers, and does an extensive business in grain. P. 2180. G. W. WEBER, ED. "DEMOCRAT."

**Tay'mouth,** tp., Saginaw co., Mich. P. 638.

**Taze'well,** county of Central Illinois, bounded N. by Illinois River, intersected by the Mackinaw, and traversed by several railroads; surface mostly level prairie, soil fertile; bituminous coal is found. There are manufactories of agricultural implements, carriages, furniture, saddlery, iron castings, flour-mills, and distilleries. Staples, Indian corn, wheat, oats, wool, and live-stock. Cap. Pekin. Area, 550 sq. m. P. 27,903.

**Tazewell,** county of S. W. Virginia, bordering on West Virginia, traversed by Clinch Mountain and other ranges, and drained by the head-waters of Clinch and Holston rivers. Surface generally hilly, but with fertile valleys. There are tanneries and cloth-dressing establishments. Staples, Indian corn, oats, a little tobacco, wool, and live-stock. Cap. Tazewell Court-house. Area, about 600 sq. m. P. 10,791.

**Tazewell,** p.-v., cap. of Claiborne co., Tenn., on East Tennessee and Virginia R. R. P. 345.

**Tazewell** (HENRY), b. in Brunswick co., Va., in 1753; educated at William and Mary College; became a lawyer; was a member of the Virginia house of burgesses 1775–85, and of the committee which reported the Declaration of Rights and the State constitution of June, 1776; was chosen to a seat on the supreme bench 1785; was a member *ex-officio* of the first court of appeals, to which position he was again elevated by election 1793, and was U. S. Senator from 1794 to his death, at Philadelphia Jan. 24, 1799, having presided over the Senate 1795. Liberal in his political views, he favored the abolition of primogeniture and entail and the separation of Church and State in Virginia, took an active part in the discussions on the Jay treaty, and was considered a leader of the Republican party.

**Tazewell** (LITTLETON WALKER), son of Henry, b. at Williamsburg, Va., Dec. 17, 1774; graduated at William and Mary College 1791; began the practice of law at Williamsburg 1796; was chosen to the State legislature 1798; settled at Norfolk 1801; was a member of Congress 1800–01; was a commissioner under the Florida treaty 1820; U. S. Senator 1824–33; declined the mission to England 1829; was a prominent sympathizer with the nullification measures 1831–32, and governor of Virginia 1834–36. D. at Norfolk May 6, 1860. Author of a *Review of the Negotiations between the U. S. and Great Britain respecting the Commerce of the Two Countries*, etc. (London, 1829), reprinted from the columns of the Norfolk *Herald* of 1827.

**Tazewell Court-house,** p.-v., cap. of Tazewell co., Va.

**Tchad,** or **Tsád,** a large lake in Soudan, Central Africa, extends between lat. 12° 30′ and 14° 30′ N., and between lon. 13° and 15° 30′ E., and is about 200 miles long and 150 miles broad. Its elevation above the level of the sea is 800 feet; its depth varies from 8 to 15 feet. Its shores are low and overgrown with high reeds. It is studded with islands, densely peopled by a finely-built race, jet black, and with some civilization. It swarms with hippopotami, crocodiles, turtles, fish, and fowl.

**Tcha'o-Nai'man-Soo'me,** or **Dolou-Noor,** a town of Mongolia, in lat. 42° 25′ N., lon. 116° 18′ E., 165 miles N. of Peking. It is a large but dirty and miserable place, without streets, the houses or huts being huddled together without regularity. But its trade is very extensive, and its foundries of bells, idols, and sacred vessels celebrated wherever Booddhism is professed.

**Tcherka'si,** town of Russia, government of Kiev, on the Dnieper, has manufactures of beetroot-sugar. P. 8684.

**Tchernigov',** or **Tschernigow,** government of Southern Russia, bordering W. on the Dnieper, comprises an area of 20,231 sq. m., with 1,659,600 inhabitants. The ground is low and well watered, the surface level, the soil fertile, and the climate mild and healthy. Rye, barley, oats, potatoes, flax, hemp, tobacco, and hops are extensively cultivated, and numerous cattle, horses, sheep, and hogs are reared. Some manufactures of leather, linen fabrics, tallow, and spirits are carried on.

**Tchernigov,** or **Tschernigow,** an old town of European Russia, capital of the government of the same name, on the Desna, has 18 churches, among which one is from the eleventh century, and several educational institutions. P. 17,096.

**Tches'me,** the ancient *Cissos*, town of Asiatic Turkey, in Asia Minor, opposite the island of Scio, is fortified and has a good harbor. P. about 6000.

**Tchihatcheff'** (PETER), b. at Gatchina, government of St. Petersburg, Russia, in 1812; devoted himself to the study of geology; received an appointment in the department of foreign affairs; served for some time as attaché to the Russian embassy at Constantinople; was sent by the government to explore the Altai Mountains, and wrote *Voyage scientifique dans l'Altaï et dans les Contrées adjacentes* (1846), *L'Asie mineure, Description physique, statistique et archéologique* (8 vols., 1853–69), and *Le Bosphore et Constantinople* (1864).

**Tchisto'pol,** town of Russia, government of Kasan, on the Kama, has valuable fisheries, celebrated mineral springs, and a trade in cattle and agricultural produce. P. 9212.

**Tchoogooev,** or **Tchugujev,** town of Russia, government of Kharkow, is beautifully situated on the Douets, is fortified, and is a military station. P. 9000.

**Tchook'tchees,** a tribe inhabiting the north-eastern corner of Siberia from the 160th meridian to Behring Strait, consists of two divisions—one settled along the coast, and occupied in the hunting of the whale, the seal, and the walrus; and another wandering across the bleak, barren plateaus with their herds of reindeer. The Tchooktchees, whose number is variously estimated at from 6000 to 13,000, are a well-grown, vigorous people, hospitable and bold, but almost entirely destitute of civilization. They are dependents of the Russian government. Ethnologically, they belong to the same family as the Esquimaux of North America, and the Tchooktchee builds his house and his boat exactly like the Greenlander.

**Tchooroom',** or **Tchorum,** town of Asiatic Turkey, in Asia Minor, manufactures earthenware and leather, and has 16 mosques and 7600 inhabitants.

**Tea.** The history of tea is intimately bound up with the history of China, so far as the Western World is concerned. In very late times tea has been procured in considerable quantity from Japan, and the plant can be grown on many soils, but all its Western traditions are associated with China only. It was not known to the Greeks or Romans, nor can it have been known in very early times in India, for there is no word for tea in Sanskrit. (De Candolle, *Géog. Bot.*) Even in China no mention of the plant can be found earlier than about A. D. 350. (Williams, *Middle Kingdom.*) By the ninth century, however, tea was in general use among the Chinese, and the tax upon it was a source of revenue to the emperor, as stated by the Arabian traveller, Abuzeid el Hazen of Siraf, cited in Renaudot. Marco Polo, though for three years governor of a province in China in the thirteenth century, strangely enough, does not mention tea; but, as Humboldt has pointed out, he makes the equally strange omissions of failing to mention either the Great Wall of China or the existence of printing among the Chinese. Probably the earliest European notice of tea was in the second volume of Ramusio, first printed in 1559, though written several years earlier, where in his "Declaration," preceding Marco Polo's narrative, Ramusio quotes Chaggi Memet (Hajji Mahomed) to this effect: "And these people of Cathay do say that if in our parts of the world, in Persia and the country of the Franks, people only knew of it (tea), there is no doubt that the merchants would cease altogether to buy Ravend Cini, as they call rhubarb in those parts." (Yule, *Cathay, and the Way thither.*) The plant grows probably in every one of the eighteen provinces of China, and indeed in all the neighboring regions. It is spoken of by William Adams so early as 1598 as in general use in Japan. It is interesting to note, as showing the Chinese origin of tea, that there is still standing at Oojee, not far from Osaka, a temple sacred in the traditions of the Japanese to the Chinamen who brought the tea-plant to the island empire. The plant has been found wild in the mountainous regions of Assam and Yunnan, and it seems probable, though perhaps not certain, that this mountainous district is its native soil.

The Chinese name for tea is *tcha* or *chia*, but the inhabitants of Fuh-Kien, from whom the first cargoes were probably obtained, so pronounced the word as to give rise to the European name, *thé* or *tea*. (Williams, *Mid. King.*; Haussmann, *Voy. en Chine.*) The Chinese take neither sugar nor milk in their tea; they simply make a drawing with boiling water. The Abbé Huc speaks of tea being taken with milk among the Mongols. In Central Asia a kind of bouillon is made from brick-tea, which is mixed, in boiling, with salt and milk, and sometimes with flour fried in oil. (Timkovski, *Voy. à Peking.*) Pumpelly, in his journey from China to Russia, overland, partook of a Tartar mixture of tallow, tea, fat, salt, and cheese. In Russia the usual mode of drinking tea is with lemon; in Switzerland it is sometimes mixed with cinnamon in drawing; in England, as with ourselves, it is generally taken with milk and sugar. Among some of the peoples of Central Asia, as the Mongols and Kalmuks, bricks of tea serve as currency. (Timkovski, *Voy. à Peking.*) In China tea takes the place at once of beer and of wine. It is the ordinary beverage of all classes in the empire, while it also administers to the luxury of the epicure. The product of noted gardens is said upon native authority to sell at from $15 to $100 per pound. (*The Middle Kingdom.*) The supply for export is obtained mainly from the coast-provinces of Fuh-Kien, Cheh-Kiang, and Kiang-Su; these provinces extend from about 23° to 35° N. in the order named, and it is within these latitudes throughout the empire that the plant flourishes most. In Fuh-Kien are the important tea-centres of Amoy and Foo-Chow. Shanghai, the principal dépôt for all the northern black teas and for greens, is in Kiang-Su, close to the borders of Cheh-Kiang.

Tea is usually raised by small proprietors, each family producing what it can, as in the case of silk. There are but few large growers who cultivate extensive gardens. The men that grow the plants sometimes cure the leaves themselves; sometimes they sell them uncured, simply sorting them as to quality. The plants are raised from seeds, gathered generally in October, and kept fresh in sand and earth through the winter till they are planted in the spring. The shrub bears at the age of two or three years, and lasts for a period of ten to twelve years. The average product of a single plant seems to be about 6 ounces in weight, gleaned in three gatherings, the first of which, of the young and tender leaves, made when the leaf-buds begin to open, occurs about the middle of April; the second, of the full-sized leaves, occurs about the first of May; and the third is made about the middle of July. There is sometimes even a fourth gathering in August, but the last two pickings make only the inferior kinds. The method of curing the leaf, as might be expected of an interest existing in so wide an extent of territory, differs in detail in the different portions of the empire. (For particulars of some of the methods employed the reader is referred to the elaborate work on China by Hon. S. Wells Williams, LL.D., entitled *The Middle Kingdom*, and to Fortune's *Two Visits to the Tea-Countries of China.*) It is enough to indicate here the general features of the process, which are common to all methods. The leaves are first carefully sorted. The aim in curing is to get rid of more or less of the natural moisture of the leaf, and to preserve by thorough drying; the first point is mainly effected by pressure in rolling the leaf when it is in a flaccid state, and the latter point is attained by the careful firing to which the leaves are subjected. For export the leaves are much more highly fired than for native consumption. This is necessary in order to preserve the flavor of the leaf through the long voyage. The fact that teas sent overland through the cold climate of Siberia are less fired than those exported by sea may account in part for the reputation for quality attaching to the teas sent to Russia. Teas coming to the U. S. across the Pacific, and thus remaining in nearly the same latitude, are noticeably better in flavor than similar teas received around the Cape or *viâ* the Suez Canal. For black tea the leaves are exposed to the air a considerable time before firing. They are then tossed about till they are soft and moist, and after remaining an hour or more in heaps, they are roasted for about five minutes in iron firing-pans. Immediately afterward they are rolled upon rattan tables, and then exposed again to the air for some hours. The final process is to dry them slowly over charcoal fires, alternately firing and rolling. This frequent exposure to the air and to heat gives their dark color, and the rubbing and tossing explain their somewhat generic name of *congou*—that is to say "worked" tea. For green tea the leaves, instead of being first exposed to the air, are fired for a short time almost as soon as gathered. They are then rolled into the different forms in which they come upon the market, and immediately afterward are dried over hot fires. This process retains more of the essential oil of the leaf, and imparts a greenish hue that improves somewhat after a little time. The green tea of commerce is artificially colored, but that used by the natives is not. The coloring-matter is turmeric-powder and a mixture of gypsum and Prussian blue, or of gypsum and indigo, finely combined, the harmful elements entering in very minute proportions. It used to be supposed that black and the uncolored green teas were the product of different species of the tea-plant; it is now generally admitted that the color is the result of the manner in which the leaf is cured, both kinds being made from the same species of plant. The black color being the result of longer exposure to air and to heat, it is possible to transform green tea into black, but black tea cannot be turned into green. The Canton teas are generally scented by the infusion of the blossoms of certain aromatic plants. The names given to tea refer almost always to some peculiarity of make or the like. Thus, *souchong* means "little plant" or sort; *powchong*, "folded sort;" the former name denoting the character of the leaf, the latter the manner of packing. *Oolong* means "black dragon," and would thus appear to be an exception.

It seems certain that neither the very choicest nor the very poorest grades of tea enter into the export. The question of long transportation probably explains both facts, it being not worth while to transport the one, and impossible to preserve the delicate qualities of the other. The finest qualities exported go overland to Russia. Large quantities of what is called "brick-tea" go also to that country. Brick-tea is made by taking the common dried leaves and mixing them with some glutinous substance. They are then enclosed in square, oblong moulds, like bricks, and dried in the oven. Tea, as exported to other parts, is packed loose in wooden chests lined with sheet lead. Fortune calculated in 1848 that it took from six weeks to two months to transport the cured tea from the country districts where it was grown to the port of Canton, and about twenty-eight days to Shanghai. The time of transportation to Shanghai has been shortened eight or ten days by the use on the Yang-tse-Kiang of steamboats, which were introduced in 1860, and Shanghai is now the chief centre for the receipt and export of tea. The first steamer to take a cargo up the river was called the Scotland. (Lindsay, *Hist. of Merchant Shipping and Ancient Commerce.*)

European trade in tea commenced about 1602. (Haussmann, *Voy. en Chine.*) There seems to be little doubt that tea was introduced into Europe by the Dutch, although Portuguese intercourse with China began in 1518. The following account of the manner in which tea was first obtained is given in the history of the earl of Macartney's embassy to China: "Early in the seventeenth century some Dutch adventurers, seeking for such objects as might fetch a price in China, and hearing of the general usage there of

a beverage from a plant of the country, bethought themselves of trying how far a European plant of supposed great virtues might also be relished by the Chinese, and thereby become a salable commodity amongst them; and accordingly introduced to them the herb *sage*, so much once extolled by the Salernian school of physic as a powerful preservative of health; the Dutch accepting in return the Chinese *tea*, which they brought to Europe." The English East India Company was chartered A. D. 1600; their first order for tea was given in 1667. The first direct shipment, about 100 pounds in weight, reached London in 1669, and whatever tea was received in England previous to that year was probably brought over from Holland. From that date the direct trade increased rapidly. Up to 1834 the East India Company enjoyed a monopoly of the trade with England in tea, as in all China produce. Since then the trade has been open to all. Russian trade with China began toward the end of the seventeenth century, being conducted overland *viâ* Siberia. From the first, tea has been the staple of Chinese exports to Russia, and that mainly in the form of bricks. To this day the trade over the borders is conducted chiefly by barter, though this method has long ceased at the coast-ports. The first American ship sailed for China in 1784; the following year two vessels were despatched, and brought back 880,000 pounds of tea. In 1786–87 five vessels brought home 1,181,860 pounds. (Haussmann, *Voy. en Chine.*) The statistics at the end of this article will show the growth of the export to America and its present proportions. Up to 1845 the trade in tea was transacted almost entirely at Canton. In 1842, Shanghai, Ningpo, Foo-Chow, and Amoy were opened to foreigners by the Treaty of Nanking, and the China tea-trade now is mainly done at Shanghai, Foo-Chow, and Amoy. At Canton scented teas are still bought for England, but almost none come here. The principal kinds of scented teas are pekoes and capers. Powchong is the only tea of this class used in the U. S. In 1859 the first shipment of tea from Japan was made to England. The Japanese leaf was first brought to this country in 1860. The first direct cargo of tea from Japan *viâ* San Francisco and the Pacific R. R. was brought from Yokohama in 1868 in the American barque Benefactress in the remarkably short time of twenty-three days. In 1866 the export of tea from Formosa began; the export of this season (1875–76) was about 5,000,000 pounds. Since about 1850, Assam teas have been going to London. The English have made considerable and somewhat successful efforts to introduce the culture of tea into India, and their now rapidly-growing trade in Assam kinds is the result. The Assam tea is too heavy and powerful to be pleasant alone, and it is used altogether for mixing with the lighter Chinese teas. The export for 1875–76 will reach about 25,000,000 pounds. Tea is also grown in Brazil to a small extent, but wholly for native consumption.

So late as 1850 all vessels trading in tea carried considerable armaments, a necessary precaution because of the pirates which swarmed in the China seas during the first half of this century. In 1844 the Howqua and Montauk were built, the first of a class of vessels known as "clippers," in which speed was sought even at the expense of carrying capacity. By the clipper ships the average passage from China was shortened twenty to thirty days. In 1867 the first Pacific mail steamer, the Colorado, sailed from San Francisco for Yokohama and Hong-Kong, and steam entered the field then for the first time in the carrying-trade of tea to the U. S. In Nov., 1869, the Suez Canal was opened, and the route *viâ* Europe by steam was also thrown open to the shipper of tea. Small parcels of tea had gone to Europe across the Isthmus of Suez before the canal was opened, but steam communication practically began with the completion of the canal. By this date (1876) one-half or more of all shipments of tea to England and the U. S. are made in steam vessels, and the sailing ship is fast falling out of the China trade. Steam has even invaded the precincts of the caravan-trade to Russia by taking tea direct to Odessa through the Suez Canal. Tea reaches New York now, *viâ* San Francisco and railroad, in thirty to forty days from Japan, and forty to fifty days from Shanghai. The route *viâ* the Suez Canal takes sixty to seventy days. This is, again, a shortening of the tea-voyage by thirty to forty, or even fifty days.

At this time tea is on the free list in the U. S., the war-duty of 25 cents per pound having been reduced Jan. 1, 1871, to 15 cents, and removed entirely July 1, 1872. There is, however, a differential duty of 10 per cent. ad valorem on all teas imported from places W. of the Cape of Good Hope, if the tea has been grown E. of the Cape.

The teas used in the U. S. are principally greens, oolongs, congous, and souchongs from China, and the Japan leaf. Green teas are sold chiefly in the West and South. A standard invoice of greens should contain a number of lines, named as follows:

| | |
|---|---|
| No. 1 gunpowder, | Small, tightly-rolled, shot-like balls. |
| " 2 " | |
| " 1 imperial, | Like gunpowder, only larger and coarser. |
| " 2 " | |
| " 1 young hyson, | Small, tightly-rolled, long leaf. |
| " 2 " | |
| " 3 " | The No. 4 is often omitted. |
| " 4 " | |
| " 1 hyson, | Like the young hyson, only larger and coarser. |
| " 2 " | |
| " 3 " | The No. 3 is often omitted. |
| Twankay, | Broken and mixed leaf, very common. |

Oolongs, comprising Amoy, Foo-Chow, and Formosa kinds, are sold chiefly in the New England and Middle States. The Formosa oolongs are mainly shipped from Amoy, but somewhat from Tamsui on the island itself. They differ from the other sorts in possessing what is known as a jessamine flavor, said to be due to iron in the soil, which mineral seems to be absorbed by the plant. It is certain that in order to preserve the characteristic quality of the leaf the plant has to be cultivated continually in new places, the old ones failing to produce the characteristic flavor after one or two years. Congou and souchong are the staple of shipments to England, going from almost every one of the Chinese ports, but they meet with comparatively small sale here. The souchong leaf is longer than the congou, and draws lighter; otherwise, there is little difference between them. They find their outlet in this country in the Middle States and New England. Japans are more widely sold than any other sort, finding a market both in the East and the West. They resemble an uncolored green tea more than any other. The export of Japans to the U. S. has grown from about 17,000,000 pounds in 1873–74 to 25,000,000 pounds in 1875–76. An export trade of fair dimensions exists between the U. S. and Canada in greens, congous, and Japans, and there is an occasional call for greens to be shipped to South America.

Appended are tabular statements showing importations into the U. S. from 1801, by decades, down to the present time; also, the export from all China and Japan for 1874–75, thus displaying the present magnitude of the world's trade in tea. The former figures have been kindly furnished from the official returns by Dr. Edward Young, chief of bureau of statistics, Washington. The latter figures are from the circular of Olyphant & Co. of China. Dr. Young, in his work on *Labor in Europe and America*, computes the average consumption of tea in England at 4 pounds, against 1½ pounds per capita in the U. S.:

| Imports into U. S. | Pounds. | Imports into U. S. | Pounds. |
|---|---|---|---|
| 1801 | 3,823,709 | 1850 | 29,872,654 |
| 1810 | 7,708,208 | 1860 | 31,696,657 |
| 1821 | 4,975,646 | 1870 | 47,408,481 |
| 1830 | 8,609,415 | 1875 | 64,856,899 |
| 1840 | 20,006,595 | | |

The import into the U. S. for 1875–76 will be made up about as follows:

| | Pounds. |
|---|---|
| Greens (estimated) | 16,000,000 |
| Oolongs | 9,500,000 |
| Congous, souchongs | 2,750,000 |
| Japans | 24,250,000 |
| Say | 52,500,000 |

*Season 1874–75.—Export of Tea from China and Japan to Great Britain and the Continent.*

| From Swatow and Amoy. | From Shanghai and Yang-tse ports. | From Foo-Chow. | From Canton, Hong-Kong, and Macao. | From Japan direct. | To London. | To out-ports. | To Russia. | Total exports. |
|---|---|---|---|---|---|---|---|---|
| 937,982 | 81,918,791 | 61,647,643 | 20,062,849 | 3,108 | 158,488,092 | 1,706,270 | 4,376,011 | 164,570,373 |

*Season 1874–75.—Export of Tea from China and Japan to the U. S. Atlantic and Pacific Ports.*

| Congou and souchong. | Powchong. | Oolong. | Sorts. | Total black. | Greens. | Japans. | Total exports. |
|---|---|---|---|---|---|---|---|
| 4,225,697 | 334,136 | 13,290,770 | 33,906 | 17,884,509 | 19,218,652 | 21,969,308 | 59,072,469 |

| | | |
|---|---|---|
| Total shipments of tea, as above, to Europe, 1874–75 | pounds, | 164,570,373 |
| " " " " " America " | " | 59,072,469 |
| Add shipment from India, say | " | 22,000,000 |
| Grand total | pounds, | 245,642,842 |

(See TEA, ADULTERATIONS OF, TEA, PHYSIOLOGICAL RELATIONS OF, and TEA-PLANT.)

SETH LOW.

**Tea, Adulterations of, and their Detection.** The sophistications to which tea is subjected have received the careful attention of chemists, but not to a greater extent than the importance of the subject merits. The greater part of the adulteration undoubtedly occurs in China, but there are strong reasons for the belief that both the English and the Americans have become in this respect expert imitators of the Chinese. The chief adulterants employed are—mineral and organic substances, for the purpose of giving an increased weight and bulk; substances used to bestow artificial strength; and coloring-matters or "facings," employed to impart a suitable color and gloss to inferior grades. The first heading includes such substances as silica, metallic iron, exhausted tea-leaves, and the leaves of other plants. The presence of metallic iron is easily detected by applying a magnet to the finely-powdered sample. Silica is most readily discovered by the increased amount of the insoluble portion of the ash obtained upon calcining the tea. In genuine teas this never exceeds 0.8 per cent., while in some adulterated samples 8 to 10 per cent. has been found. The addition of exhausted tea-leaves is detected by determining the tannin, the insoluble matter, and the ash. The first estimation is best made by means of a standardized solution of plumbic acetate. Genuine black tea (which is the kind most exposed to adulteration with exhausted leaves) contains from 10 to 11 per cent. of tannin, whereas not more than 2 per cent. is present in the exhausted tea-leaf; the extent of this species of adulteration is therefore indicated by the lessened proportion of this principle contained in the sample examined. Of pure green tea about 50 per cent. of matter remains insoluble in hot water, black tea containing 60 per cent.; but in case exhausted leaves have been added the insoluble residue often reaches the proportion of 75 to 85 per cent. In genuine teas the total ash amounts to 5 or 6 per cent., 3 per cent. being soluble in water; an increase, especially of the soluble portion, being an indication of the presence of exhausted tea-leaves, as well as of foreign leaves. In order to detect the presence of the latter, however, an intimate acquaintance with the tea-plant leaf and the use of the microscope are usually necessary. Upon treating the suspected sample with hot water, separating its leaves, and comparing them with those of the tea-plant, especially in respect to their venations and serrations, foreign leaves are easily recognized. The presence of exhausted and foreign leaves is often disguised by the addition of substances which impart artificial strength and coloring power to the tea, such as tannin (catechu), "lie tea," and soluble iron salts. Catechu is frequently detected in the microscopic examination, and by the abnormally large proportion of tannic acid present in the suspected tea. The infusion of tea to which catechu has been added becomes turbid when cold, and upon adding neutral plumbic acetate, separating the precipitate formed, and adding a small quantity of argentic nitrate to the filtrate, a brownish precipitate is produced, the fluid acquiring a distinctly yellow color; under the same conditions an infusion of pure tea is merely rendered turbid by the addition of argentic nitrate. If much catechu be present, a clear green color is produced upon adding a very dilute solution of ferric chloride to the filtrate from the lead precipitate. *Lie tea* consists of the dust of tea and other leaves, mixed with mineral substances, and agglutinated into little masses resembling genuine tea by means of starch and gum; it is used in the adulteration of gunpowder teas. By the action of hot water the gum and starch are dissolved and the grains become disintegrated. The presence of starch can be detected by the iodine test. As a rule, "lie tea" gives 30 to 40 per cent. of ash. *Caper tea* is a similar preparation, and is recognized by the same methods. Soluble salts of iron, employed to impart a dark color to the tea decoction, are detected by heating the powdered sample with acetic acid, and testing the solution with potassic ferrocyanide. The artificial coloring or "facing" of teas is perhaps the most extensive species of adulteration that is carried on. In regard to the extent of this practice, it is safe to assert that nearly every green tea imported into this country has been artificially colored; in fact, if this were not the case, there would be little difference in appearance between green and black tea. The glossy and deep-green color so often noticed in so-called "green tea" is entirely different from the natural color of the leaf, and its artificial production is for the purpose of concealing the presence of foreign leaves and meeting the demand of foreign dealers. It is a very significant fact that the Chinese themselves never use these colored teas. The restoration of a poor grade of tea and the conversion of a black into a green tea (or *vice versâ*) are constant practices in England and the U. S., and have given rise to a special branch of industry. A great variety of substances are used in the coloring of tea. Those chiefly employed are prussian blue, indigo, turmeric, and kaolin, which are mixed in the proportions necessary to give the desired shades of color; and steatite, graphite, etc., which impart a glossy appearance to the tea. The detection of these substances is easily accomplished, the microscopic examination alone being frequently sufficient. Upon treating a "faced" tea with hot water, the coloring-matter often becomes detached, and is deposited as a sediment. Prussian blue is detected by warming the tea with caustic soda, acidulating the filtrate with hydrochloric acid, and adding ferric chloride, when a deep-blue color will be produced. Indigo and turmeric are often recognized in the microscopic examination of the suspected sample. Graphite is sometimes visible to the naked eye, owing to its characteristic glossy appearance, and can be separated by treating the tea with water and evaporating the infusion, when it will be deposited on the bottom of the vessel as a dark shiny coating. Pure tea should not turn black when digested with an aqueous solution of sulphuretted hydrogen, nor impart a blue color to a solution of ammonia. If the addition of a few drops of sulphuric acid produces a red coloration in the infusion of the tea, logwood is probably present. The presence of such mineral compounds as steatite, kaolin, gypsum, chalk, etc., is detected by the analysis of the ash left upon incinerating the tea.

J. P. BATTERSHALL.

**Teach'ers' Institute,** an official gathering of the teachers of the public schools of a certain district for the purpose of receiving instruction in the best methods of teaching and discipline, and the hearing of practical oral lessons from eminent instructors. Teachers' institutes have been held in most of the Northern States for many years. The first was held by Mr. Henry Barnard at Hartford, Conn., in 1839. When ably conducted, these meetings have proved extremely useful means of awakening the enthusiasm and giving a wise direction to the labor of teachers in the public schools.

**Teak,** the *Tectona grandis*, of the order Verbenaceæ, a noble forest tree of India and Farther India. It is the best timber known for shipbuilding. It is more durable than oak, more easily seasoned, equally strong, considerably lighter, and far more easily worked. It is used for making decks and planking, for the keel, timbers, and even masts and spars. Many all-teak built ships are reported to be over 100 years old, and still seaworthy. The wood somewhat resembles mahogany. Its flowers and leaves have medicinal qualities, and are used in dyeing. African teak, the wood of *Oldfieldia africana* an euphorbiaceous tree, resembles true teak, but is much inferior to it.

**Teal,** the English name given to certain ducks of small size, distinguished by the following characters: The bill is but little longer than the foot, its sides nearly parallel, and the lamellæ little or moderately developed; the tail is about two-fifths as long as the wing, and subtruncate; the wings have each a bright-colored green or blue speculum. The species thus distinguished present, however, considerable differences in other respects, and have been differentiated into two genera, which have been distinguished, so far as the North American species are concerned, by Prof. Baird (*The Birds of North America*, pp. 772, 777, 779) as follows: "(1) The blue-winged teals (*Querquedula*) have a rather broad or moderately narrow bill (the width equalling about a third or more of the lower edge); the nail is proportionately broad (about one-third of the width of the bill); the upper angle of the bill extends rather farther back than the lower edge; and the colors are characteristic in that the wing-coverts and the outer webs of some scapulars are bright blue; the greater coverts tipped with white; a grass-green speculum is just below the white of the coverts; the scapulars are streaked with yellowish buff; the top of head and chin are dusky; and the crissum is blackish. (2) The green-winged teals (*Nettion*) have a very narrow bill (the width being scarcely more than one-fourth of the lower edge); the nail proportionately still more narrow (only about one-fifth as wide as the bill); the upper angle of the bill does not reach as far back as the beginning of its lower edge; and the colors are distinctive in that the head and neck are chestnut, with a broad patch of green on the side of the head; the breast has rounded black spots; the upper part and sides are finely waved transversely with black and grayish white; the crissum is black, edged with creamy yellow; the wing-coverts are plain olive gray, the greater with a terminal band of fulvous; the speculum is green, edged externally and internally with black." The species frequent inland lakes and streams, and are among the most edible of the family. Representatives are found in almost every country, and are almost alike at home in the cold North and the heated tropical countries. The North American species are (1) the blue-winged teal (*Querquedula discors*), (2) red-breasted teal (*Querquedula cyanoptera*), (3)

green-winged teal (*Nettion carolinensis*), and (4) European teal (*Nettion crecca*), which last is, however, only a straggler within our limits. Eighteen species are recognized as inhabitants of various regions by G. R. Gray.

THEODORE GILL.

**Teall** (FRANCIS AUGUSTUS), b. in New York in 1822; a practical printer, he mastered several languages, and acted as one of the associate editors of the *American Cyclopædia*, his labors being chiefly directed to the revision of the copy and the correction of the press. He has occasionally written for journals, and has in preparation a general *Dictionary of Proper Names*.

**Tea'no,** town of Italy, province of Caserta, about 30 miles N. N. W. of the city of Naples. It is of ancient origin, and the medals found here (the workmanship of the *Sidicini*, an Oscan race) are greatly prized by antiquarians. The first Christian bishop was established here in 333 A. D. P. 12,943.

**Tea, Paraguay.** See MATÈ.

**Tea, Physiological Relations of.** The active ingredients of tea-leaves are an alkaloid called *theine*, identical with the alkaloid *caffeine* found in coffee, guarana, etc. (see CAFFEINE); an astringent principle of the character of tannic acid, which gives tea its bitter styptic taste; and a small percentage of a volatile oil, to which is due the peculiar aroma. The proportion of these ingredients varies considerably in different analyses of different samples of tea. Thus, the percentage of theine is variously stated from .43 to 1.27, 2.34, 3, and even in one case 6.21, per cent. The tannin ranges from 12 to 18 per cent., and the volatile oil from .50 to .80 per cent. Besides the above, tea contains chlorophyl, wax, resin, gum, coloring-matter, albumen, extractive, fibre, and mineral substances. The effects of tea-infusion upon the human system are the resultant of the several effects of the alkaloid, the oil, the tannin, and the hot water; and of these elements the theine probably plays the most important part. Like all the potent alkaloids, theine or caffeine is a powerful modifier of nerve-function, and numerous experiments have been made upon animals to determine how the various parts of the nervous and muscular apparatus are affected by it. Cerebral irritation, muscular rigidity, convulsions of central origin, followed by paralysis and death from failure of respiration, are the prominent toxic effects. In man, experiments with large doses of caffeine, as 8 or 12 grains, show increased cerebral irritability, as manifested by persistent wakefulness, unnatural mental activity, with uneasiness of mind, and also great physical restlessness, tremulousness of the muscles, increased frequency of the pulse, and frequent micturition. An important effect of the alkaloid, which seems now abundantly proved, is to lessen the amount of nitrogenous excreta, notably of urea; which means, to diminish the rate at which nitrogenous substances are oxidized within the body. It is probable that the volatile oil of tea may also have the same effect, since Lehmann found the volatile oil of roasted coffee to possess this property. Infusion of tea-leaves taken as a beverage is found to have the effects just described, and in cases of mental exhaustion acts, as is well known, as an agreeable restorative, dispelling fatigue and drowsiness and disposing to increased mental activity. Tea is also one of many substances, such as coffee, coca-leaves, tobacco, opium, and alcohol, which in case of deficiency of food tend to remove hunger and the distress and sinking arising from the inanition. But in considering the vivifying effects of a cup of tea, there must not be forgotten the powerful reviving influence of the *heat* contained in the steaming draught, and the true nourishment of the sugar and milk commonly added to the same. In excess, tea produces restlessness, tremulousness, wakefulness, and has a strong tendency to cause dyspepsia, with the special symptoms of gastric flatulence and a most distressing sinking at the stomach. This latter property is one perhaps not generally known, but the writer has seen many cases of dyspepsia of the above character, which had long resisted treatment, disappear immediately upon the abandonment of tea as a beverage. There is no doubt that, especially among women, and particularly with the Irish, tea is largely consumed in improper excess. In irritable stomachs, also, tea often aggravates nausea, and may even promptly determine vomiting. Medicinally, tea is not often prescribed, as in the circumstance where it would be principally useful—namely, in opium-poisoning—the stronger infusion of coffee is preferred. In making an infusion of tea, the water should be neither particularly hard nor soft, and should be poured upon the leaves when actually boiling, and allowed to steep but for a short time. Both by boiling, and by too long soaking in hot water, the tea loses much of its aroma, and by solution of an excess of the extractive matters acquires a rough and bitter flavor.

EDWARD CURTIS.

**Tea-Plant,** a shrub with bright green and smooth evergreen leaves, bearing white flowers (an inch or more broad) in their axils, resembling those of a small camellia, belonging, indeed, not only to the same natural order (*Camelliaceæ* or *Ternstrœmiaceæ*), but in the opinion of most recent botanists to the same genus. Dr. Seemann, however, pointed out a character which might distinguish them—viz. that camellias have numerous unconnected stamens within the ring of outer ones, the united filaments of which form a short tube, cohering with the base of the petals, and falling with them; while in the tea-plants there are only five or six of these inner and separate stamens. In both the blossom is succeeded by a globular, thick-walled, woody capsule, internally divided into three or four cells, tardily splitting open; each cell ripening one, or rarely a pair, of large and oily seeds, with a hard and smooth seed-coat.

As to nomenclature, Linnæus established the genus *Thea* (Latinizing the Chinese name), and, following the opinion of the time, indicated two species—*T. Bohea*, from which black tea was supposed to be prepared, and *T. viridis*, for green tea. It is known, however, that these are mere varieties, of no botanical importance, and that the difference between green and black teas results from the mode of preparation; whereupon the tea-plant generally took the name of *T. chinensis* or *T. sinensis* (of which the latter is the preferable form). But at length it appears that the tea-plant is unknown in a wild state in China; that it was probably introduced into China from some part of Upper India adjacent to the Chinese empire; and that the tea-plant indigenous in Upper Assam, which was discovered there by the English in the year 1834, and published under the name of *Thea assamica*, is specifically identical with the long-cultivated plant of China. Wherefore, the latest authorities, referring the tea-plant to the camellia genus, name it *Camellia Thea*. They might have taken the alternative course of referring *Camellia* to *Thea*, but this would have involved more extensive changes of specific names.

ASA GRAY.

**Tears** [Ang.-Sax. *tæher*], the slightly saline watery secretion of the LACHRYMAL GLAND (which see). The ordinary function of this secretion is to assist in the work of moistening and lubricating the eyeball; but in the human species, at least, the exercise of certain strong emotions acts as a powerful stimulus upon this secretion. To certain of the lower animals, as the crocodile and the hyæna, folk-lore ascribes the power of shedding voluntary tears for the deception of the beholder; and observers old and recent testify that certain species of deer and of the seal family express grief by the shedding of tears. There are certain strong-smelling plants, such as the onion, whose exhalations sometimes provoke a copious and even painful discharge of tears. Most of the lower animals do not secrete in any circumstances a noteworthy flow of tears, except after injury of the eye or in some diseases of the gland or of some adjacent part.

**Tea'sel** [Ang.-Sax. *tæsel*], the *Dipsacus fullonum* (order Dipsaceæ), a biennial plant of the S. of Europe, naturalized to some extent in the U. S. It is cultivated in Europe, as formerly in the U. S. to some extent, on account of its burs or heads, covered with hooked bracts. These heads are fastened to a revolving cylinder, and used by woollen manufacturers to raise a nap on cloth. No artificial contrivance has been found to equal the teasel for this purpose. "Male" and "female" teasels are merely varieties in size and stiffness, each adapted to the dressing of special cloths.

**Tebeau'ville,** p.-v., Ware co., Ga.

**Tebes'sa,** town of Algeria, province of Constantine, in a beautiful and exceedingly fertile district, carries on a very important trade. It contains many and interesting Roman remains. P. about 15,000.

**Te'bo,** tp., Henry co., Mo. P. 3308.

**Teche, Bayou.** See APPENDIX.

**Technol'ogy** [Gr. τέχνη, "art," and λόγος, "discourse"] is a general name for industrial science. Strictly, there is no such science, but all the sciences contribute much which is of the greatest value to the various industries; and technology is the teaching of those parts of science which are of direct industrial importance.

**Teck** was, in the Middle Ages, the name of a small duchy situated in Suabia, and called so after the castle of Teck, of which ruins still exist. In the eleventh century it came into the possession of the house of Hapsburg, which in the fourteenth century sold it to the dukes of Würtemberg.

**Tectibranchia'ta** [from *tectus*, "covered," and *branchiæ*, "gills"], an order of gasteropod mollusks belonging to the sub-class Opisthobranchiata. The sexes are combined together in one individual; the heart has but one auricle; the branchiæ generally are in a tuft on the side of the back and under a fold of the mantle; the otocysts lie

on or over the pedal ganglia; the shell is developed in the embryo, and mostly persistent through life, generally spiral and moderately well developed, sometimes scale-like or rudimentary, rarely entirely wanting. The order is quite comprehensive, and very considerable modifications of the superficial parts of the body, as well as of the teeth, are exemplified in forms which appear to be otherwise closely allied. The relations of the sexual organs also differ, and their differences have been used by J. E. Gray (perhaps incorrectly) to differentiate the order into two primary groups: in the one the organs of generation are far apart and connected by a groove, and in the other they are close together and situate in a tubercle; the former includes the bulliform and aplysiiform families, the latter the other families. The order is represented by numerous species and in every sea. About fourteen families are generally recognized; the most prominent of these are the Bullidæ, Cylichnidæ, Aplysiidæ, and Pleurobranchiidæ. THEODORE GILL.

**Tecum'seh,** tp., Shawnee co., Kan. P. 854.

**Tecumseh,** p.-v. and tp., Lenawee co., Mich., on Lake Shore and Michigan Southern R. R., 60 miles S. W. of Detroit, contains 6 churches, 4 fine school buildings, 2 banks, 2 newspapers, 2 hotels, 4 flouring-mills, 1 foundry, an agricultural implement manufactory, 2 planing-mills, 3 machine-shops, 2 carriage-factories, a paper-mill, and stove-factory. Principal business, farming, fruit-growing, and manufacturing. P. of v. 2039; of tp. 2583.

S. C. STACY, ED. "HERALD."

**Tecumseh,** p.-v. and tp., cap. of Johnson co., Neb., on Atchison and Nebraska R. R., 50 miles S. E. of Lincoln, has 3 churches, 1 high school, a public hall, 1 bank, 2 newspapers, 2 grist-mills, and 2 hotels. P. 722.

M. C. BARROW, ED. "CHIEFTAIN."

**Tecumseh,** or **Tecumtha,** a celebrated chief of the Shawnee Indians, b. near Springfield, O., about 1770; took part in the war with the Kentucky forces about 1791; was engaged in the battle of Mad River and in the attack on Fort Recovery, 1794; joined his brother, Elskwatawa (called "the Prophet"), about 1805 in the attempt to organize all the Western Indians in a confederacy against the whites; visited all the tribes on the upper lakes and in the Mississippi Valley down to the Gulf of Mexico; collected a considerable force on the upper Wabash in the autumn of 1811, which under command of the Prophet attacked Gen. Harrison, and was defeated at Tippecanoe Nov. 7, during Tecumseh's absence among the Southern tribes; went to Canada with a band of Shawnees in the following year on the outbreak of hostilities with Great Britain; was a useful ally to the British in the battles of Raisin River and of Maguaga, where he was wounded; made a brigadier-general in the British service; joint commander with Gen. Proctor at the siege of Fort Meigs, and protected the American prisoners from massacre; wounded at the battle of Lake Erie, and commanded the right wing at the battle near the Moravian towns on the Thames. Having, it is said, a presentiment of his approaching death, he laid aside his sword and uniform, put on his hunting-costume, and plunged into the hottest of the fight, in which he was killed Oct. 5, 1813. It was asserted for many years that he fell by the hand of Col. Richard M. Johnson, afterward Vice-President of the U. S. during Van Buren's administration (1837–41), and several other persons claimed the same honor, but on insufficient grounds. A *Life of Tecumseh and his Brother the Prophet, with an Historical Sketch of the Shawnee Indians* (1841), based chiefly upon the statements of numerous persons who had known Tecumseh, was prepared by Benjamin Drake of Cincinnati, and still constitutes the best source of information on an interesting episode of American history.

**Te De'um.** This most venerable hymn, commencing *Te Deum laudamus, Te Dominum confitemur*, or, in the English version, "We praise thee, O God; we acknowledge thee to be the Lord," has been sung by the whole Western Church, "day by day," on all her feasts from time immemorial. It is Morning Service of the English Church as far back as the Conquest (Blunt's *Annotated Book of Common Prayer*); very ancient ecclesiastical traditions represent the Te Deum as a hymn antiphonally extemporized by St. Ambrose and St. Augustine at the baptism of the latter (A. D. 356), and the title anciently given to it in the Psalter of the English Church was "Canticum Ambrosii et Augustini." The authorship has also been attributed to St. Hilary (A. D. 355) and Nicetius, bishop of Treves (A. D. 535), but there is reason to think it is much older, and that the first two names are connected with it merely through their introducing it into their respective churches. (*Ibid.*) It has always constituted a portion of the Morning Service (as one of its supplications, "Keep us *this day* without sin," implies) in the English and American church services between the first and second lessons for the morning, the rubric prescribing that it shall be "said or sung."

Besides the use in the Morning Service, this triumphal hymn is used, arranged to elaborate music, as a special service of thanksgiving. The sovereigns of England have been accustomed to go in state to the singing of the Te Deum after great victories, Handel's "Dettingen Te Deum" having been composed for one of these occasions. At the conclusion of coronations it has been used from time immemorial throughout Europe. When, in the ordinary Morning Service, it is "said," its verses are antiphonally recited by minister and congregation, but it is now very generally *sung* by choir and congregation. The most ancient Christian music known, the "Ambrosian Te Deum," found in a work by Boëtius (A. D. 457), has come down in connection with this hymn, but it is probably an adaptation of the temple psalmody of the Jews. No hymn or form of words has been the subject of so many musical renderings by composers of all grades, of all ages, and of all nations. Among the elaborate works are those of Handel (just cited), Romberg, Meyerbeer, etc. For ordinary purposes, that of Jackson of Exeter is the most universally in use. To the "goodly fellowship" the writer, aided by Rev. Dr. Staunton, who has himself composed a noble *Te Deum*, has added one. J. G. BARNARD.

**Ted'la,** town of Morocco, Northern Africa, at the foot of the Atlas Mountains, manufactures fine woollen cloths and shawls, which are exported to Europe. P. 11,000.

**Ted'si,** town of Morocco, province of Soos, among fertile surroundings, has a lively trade. P. about 12,000.

**Tees'water,** p.-v., Bruce co., Ontario, Canada, on Toronto Grey and Bruce Railway, 16 miles from Walkerton, has a weekly newspaper. P. about 450.

**Teeth.** See APPENDIX.

**Teeth, Chemistry of.** See APPENDIX.

**Teff,** the *Poa abyssinica*, a cereal grass of the interior of Africa, where the grain is employed extensively in making bread and beer, while the straw is a forage material.

**Tefft** (BENJAMIN FRANKLIN), D.D., LL.D., b. at Floyd, N. Y., Aug. 20, 1813, and graduated at the Wesleyan University, Middletown, Conn., 1835; was pastor of a Methodist church at Bangor, Me., and has been professor in Asbury University, Indiana, and president of the Genesee College, N. Y. In 1862 he was U. S. consul and acting U. S. minister at Stockholm, Sweden; since 1866 has been pastor at Portland, Me. He has published *The Shoulder-Knot, Hungary and Kossuth, Webster and his Masterpieces, Methodism successful, and the Internal Causes of its Success*, etc.

**Tefft** (THOMAS ALEXANDER), b. at Richmond, R. I., Aug. 3, 1826; graduated at Brown University 1851; studied architecture at Providence; made designs for many public and private edifices; published *Our Deficiency in Art Education* (1852); wrote on architecture and art in the New York *Crayon;* went to Europe 1856; presented to the British Institute of Social Science a plan for a uniform currency for all nations. D. at Florence, Italy, Dec. 12, 1859.

**Te'gea,** ancient town of Greece, in the Tegeatis, which formed the south-eastern part of Arcadia, was brought under the supremacy of Sparta in 560 B. C., and was an important town under the Roman authority, but was utterly destroyed by Alaric in 400 A. D. Remains of it are found near the village of *Piali*, 4 miles from Tripolitza.

**Teggia'no** [formerly *Diano*], town of Southern Italy, province of Salerno, about 9 miles from Sala Consilina. Of the ancient town little remains except old inscriptions, etc., that prove its former existence. The present inhabitants are chiefly engaged in agriculture, and are not wanting in industry. P. 7018.

**Te'glio,** town of Italy, province of Sondrio, on the slope of the mountains which flank the right bank of the Adda. This town is remembered as the place where was assembled (1524) a congress to regulate the political difficulties between the Grisons and the Valtellines. P. 5973.

**Tegnér'** (ESAIAS), b. at Kirkerud, in Wermland, Nov. 13, 1782. His father, who was a poor country minister, died early, and the son had to fight his way through life with his own weapons. He contrived, however, to go to Lund in 1799, and in 1802 he graduated from the university with great honor. In 1815 he became professor of æsthetics at the same university on account of a fine treatise he wrote in Latin on the fables of Æsop, and in 1812 he exchanged this professorship for that of Greek literature, having in the mean time acquired a great fame as a poet by his *Axel*, *Svea*, and a great number of lyrical poems, and having been elected a member of the Swedish Academy in 1811. In 1824 he was made bishop of Wexiö, and in this position he exercised a great and beneficial influence by his powerful eloquence, his energy in school matters, and his lofty piety. D. Nov. 2, 1846. His talent as a poet was

essentially lyrical, with a tendency toward the didactic. His best poems are those which have an epic under-structure, not so prominent as to require an objective characterization—which he was not able to give—but strong enough to lift his lyrical enthusiasm and hold the rich tracework of his imagination. *Frithiof's Saga*, which is his most celebrated work, and which has been translated into all European languages, and sixteen times into German, is a combination of ballads; and whenever the discrepancy between the rough and stern sublimity of the Northern subject, and the soft sentimentality and almost Oriental fancifulness of the poet, does not become too loud, the poem is very charming. His influence on the Swedish people was decisive. He was—and acknowledged himself to be—a disciple of the Danish poet Œhlenshläger, but Œhlenshläger's influence was only the knock at the door which awakened Tegnér's genius; he was perfectly original and thoroughly national. In opposition to the French school, which with its pompous and pedantic or superficial and frivolous elegance predominated in the Swedish literature at the beginning of this century, Tegnér unveiled the ideal of the romantic school, with its new relations between nature and art, and between art and religion; and in a very short time his powerful enthusiasm and rich imagination altered the taste of the Swedish public. He can hardly be said, however, to be more than the founder of the school; he lacked power of objective characterization in too high a degree to become its master. CLEMENS PETERSEN.

**Teha'ma,** county of California, lying between the Sierra Nevada and the Coast Range, intersected by Sacramento River, and traversed by the Oregon division of Central Pacific R. R. The E. portion is rocky, with many pine forests. Some gold is found in the Sierra Nevada, and in the S. part are medicinal and salt springs. Staples, wheat, barley, wine, wool, mill products, and live-stock. Cap. Red Bluff. Area, 2800 sq. m. P. 3587.

**Tehama,** p.-v. and tp., Tehama co., Cal. P. 881.

**Teheran',** capital of Persia, in lat. 35° 41′ N., lon. 51° 23′ E., province of Irak-Ajemi, 70 miles S. of the Caspian Sea, in a sandy and stony plain at the southern foot of the Elburz Mountains, which rise here, in Mount Demavend, 22,000 feet above the level of the sea. It is surrounded with a mud wall 4 miles in circumference, 20 feet high, and pierced with six gates. The streets are narrow, crooked, ill-paved, and filthy, and the houses low and insignificant, generally built of mud. Some mosques, bazaars, and caravanserais look well, however, and the palace of the shah, forming a city by itself adjoining the northern part of the wall, is a vast and elegant structure. Teheran became the residence of the shah in 1796, and has increased considerably since that time. It has some manufactures of carpets, cotton and linen goods, shoes and hats, and carries on a brisk trade. Its population varies much from winter to summer, as the shah and all the wealthier citizens leave it early in spring on account of the intolerable heat and unhealthy atmosphere; during winter its population is estimated at about 100,000. In the vicinity are the ruins of Rei, the *Rhages* of Scripture, the ancient capital of Parthia and the birthplace of Haroun-al-Raschid.

**Tehri', Teeree,** or **Garwhal,** a small hill-state under English control in the Himalayas, E. of Simla, with an area of 5465 sq. m., inhabited by 200,000 hill-men, famous with the Hindoos for its sacred places of pilgrimage at the sources of the Jumna and the tributaries of the Ganges, and with the Europeans for its magnificent forests consisting of sal (*Shorea robusta*), cedar, and pine trees; extended formerly in the S. to the foot of the Himalaya Mountains, and bordered to the E. the kingdom of Nepal; became reduced to its present size in 1816, when the English acquired it from Nepal, forming its southern and eastern provinces into the British district of Garwhal, of 5500 sq. m., with a population of 310,218 inhabitants, with Srinagar, a small town of 700 inhabitants on the shore of Alaknanda River, as head-quarters. E. SCHLAGINTWEIT.

**Tehuaca'na,** p.-v., Limestone co., Tex.

**Tehuacan de las Granadas,** town of the Mexican confederation, state of La Puebla, is well built and contains many handsome edifices, but is in a sandy and little-productive region. P. 5000 to 6000.

**Tehuantepec'.** The name is common to the *isthmus*, the *gulf*, the *river*, and the *city*, but, as the geographical expression for the most northern portion of the American isthmus connecting North and South America, it has its primary signification. The isthmus derives an especial interest from being one of the available interoceanic routes. Columbus, who sought to "reach the East by sailing W.," and whose objective point was probably Zipangu (Japan), believed that he had found it near where his calculations had placed it. It was many years before the conviction came that *another* continent was discovered—a conviction which served to prompt fresh efforts to find a passage in this barrier, or at least those points where it might be surmounted. New Granada, Darien, and Panama, at the other end of the American isthmus, were discovered by Bastides in 1501, and Columbus himself explored the coasts of Central America from Truxillo in Honduras to Darien. The expeditions of Cordova (1517), of Grijalva (1518), and the memorable one of Cortez (1519) established the outlines of the Gulf of Mexico. The river Cocuqualquo (Coatzacoalcos) was surveyed for several miles by Cortez *with the hope of finding an opening to the South Sea.* These successive discoveries pretty well defined what is now called the "American isthmus," which extends from the Gulf of Darien, where it connects with South America, to Tehuantepec, where North America may be said to commence. With Cortez—who, as we have seen, explored the Coatzacoalcos with that view—is said to have originated the idea of a communication by this isthmus between the two oceans; and as his hope of finding a water-communication waned, that of substituting a *portage* or road over the isthmus by which to transport to Spain the spices of India and the products of new regions he should discover, took its place. Dampier and Don Augustus Cramer, toward the close of the seventeenth and eighteenth centuries respectively, allude to the Coatzacoalcos, and describe it as an available route to the "South Sea;" in reference to which Humboldt mentions Tehuantepec as claiming attention for an interoceanic route. In 1814 the Spanish Cortes issued a decree authorizing the opening of a canal. Wars at home and in Mexico made this decree futile, and nothing further was done for nearly thirty years. In 1842 the Mexican government conferred on Don José de Garay the right of executing the work, with concession of land-grants and important exclusive privileges. A survey (or rather a reconnaissance) was made for Garay by Gaetano Moro in 1842, and attempts were made without success to raise funds in Europe for the work. After the termination of the war of the U. S. with Mexico and the acquisition of California, the rights of M. Garay were transferred to Mr. P. A. Hargous of New York, and by him to the Tehuantepec R. R. Co. of New Orleans, and during the year 1851 an elaborate survey of the isthmus for a railroad, with a view to a route to California, was made by a commission under Major J. G. Barnard, U. S. engineers, a report of which was published, containing the first full account of the isthmus ever furnished the public. (See *The Isthmus of Tehuantepec*, 1855.) The work was interrupted by a decree of the Mexican Congress annulling the Garay grant. Since that date there have been three grants issued to various parties, under which in 1857–58 the railroad surveys were resumed, and the work perfected by examining various alternative lines. An attempt was made at the same time to open a travelling route to California by a stage-road. These grants failed and were annulled, and a fourth made in 1867 to "Don Emilio la Sere," which is now held by the Tehuantepec Railway Co. (Mr. Simon Stevens president) of the U. S. The U. S. government having undertaken in 1870 to make a thorough exploration of the American isthmus with a view to deciding the question of practicability of an interoceanic canal, a survey was made in 1870–71 under Captain R. W. Shufeldt, U. S. navy, a report of which, with maps, is published by the government. (For further account of these surveys, and the questions they are intended to elucidate, consult article SHIP-CANALS, in APPENDIX.)

The *Isthmus of Tehuantepec* is that portion of the Mexican territory which lies between the Gulf of Mexico and the Pacific Ocean, where the two seas approach the nearest to each other, and comprises the eastern portion of the states of Vera Cruz and Oaxaca. From the mouth of the Coatzacoalcos, which discharges itself into the Gulf in 18° 8′ 20″ N. lat. and 94° 32′ 50″ W. lon. (from Greenwich) to the harbor of Ventosa on the Pacific, situated in 16° 11′ 45″ N. lat. and 95° 15′ 40″ W. lon., the distance in a direct line is 143½ miles. The coast-lines on either side have a general direction nearly E. and W. The isthmus may properly be said to comprise three main divisions, more or less distinct in their general characteristics—the first embracing that portion extending from the Gulf to the base of the Cordillera, and which may be called the *Atlantic plains;* the second comprising the more elevated or *mountainous districts* in the central parts; and the third including the level country bordering the ocean on the S., and known as the *Pacific plains.* The first division comprises a belt of country of some 40 or 50 miles in breadth, lying contiguous to the Gulf coast, and made up of extensive alluvial basins of exceeding richness and fertility. The principal of these hydrographic basins is that of the Coatzacoalcos, which occupies the central portion of this division,

and has a general direction of N. N. E. by S. S. W. The second or middle division may be said to extend from the Jaltepec River (tributary to the above) on the N. to within 20 or 25 miles of the Pacific coast, comprising a strip of country through the central portions of the isthmus. This division presents a great diversity of feature. The immense chain of the Cordillera, which, under different denominations, extends almost without interruption the entire length of the two Americas, traverses the country from E. to W.; but there is a sudden depression of the range in its passage across this isthmus, the continuity of the chain being nearly broken at a point directly in the line of shortest communication between the two oceans. The Cordillera here approaches very near the Pacific coast. By a narrow opening or gap in these mountains we descend suddenly from the elevated table-lands to the Pacific plains, which form the third or southern division. These plains average about 20 miles in breadth, and form, as it were, an immense inclined plane, with its side next the mountains about 250 feet above the Pacific.

Of the streams watering the northern slope of the isthmus, the most important by far is the Coatzacoalcos, by reason both of the comparatively large extent of country for the drainage of which it is the outlet, and also as furnishing the natural channel through which the projected communication between the two oceans may, in part, be effected. The river takes its rise in the unexplored part of the Sierra. It is entered over a bar having 14 feet of water on it, and affords a ship navigation with 20 feet depth above Mina-Titlan, or 30 miles inland.

The total population is about 61,000 or 62,000, mostly Indians and half-breeds. The productions are mainly sugar, tobacco, cotton, coffee, cocoa, indigo, maize. The vast forests of the Gulf slopes yield valuable timbers—mahogany, cedar, the india-rubber tree, and gums—while those of the mountains abound in pine and oak. Numerous herds of cattle are found on the table-lands of the central region and plains of the Pacific coast.

The Tehuantepec River, emptying into the Pacific, and on which is the city of that name, has a short course, and is but little more than a mountain-torrent, of copious volume during the rainy season. The city of Tehuantepec, 11 miles from the Pacific shores of the "Ventosa" Bay, the second town in the state of Oaxaca (see MEXICO), has a population of 13,000, mostly Indians or half-breeds, with a few Castilians. It has 16 churches, among which is the *parroquia*, built by the last cacique of the Zapotecos in 1530, dedicated to church-worship by the Dominican friars. There are manufactures of leather, cotton, shoes, hats, saddlery, pottery, etc. By the Gulf of Tehuantepec is meant that portion of the Pacific waters comprised in an indentation of the coast of Guatemala and Mexico, between meridians 92 and 97 W. If a straight line be drawn across, the versed sine or sagitta of the segment thus formed is about 70 miles. The bays of Salina-Cruz, of the Ventosa, mere indentations of the coast-line, the inlet of "Boca Barra," and the "lagoons," are important features of the shores of the Gulf in its relations to a ship-canal or to a railroad transit route. J. G. BARNARD.

**Te'idæ** [from *Teius*—the Latinized form of a South American name of one of the forms—the typical genus], a family of lizards (saurians) of the group Leptoglossa, distinguished, according to Cope, by the single premaxillary bones and squamous tongue. In form the species essentially resemble the typical lizards (Lacertidæ), to which they are most nearly allied; the head is pyramidal, and its upper surface is covered with regular polygonal plates; the supraorbital plates are horny; the teeth are solid and rooted; the tongue elongate and flat; the throat is generally provided with a distinct fold or "collar;" the scales of the back and sides are usually small; the members are all well developed. The family is peculiar to America (especially the tropical portions), and is quite rich in genera and species. The most noteworthy species is the *Teius teguexim* (the monitor and sauvegarde of some writers) of Brazil. This animal sometimes attains the length of six feet and more, and is quite active and strong. When pursued and brought to bay, it fights with its tail, with which it can inflict violent blows, as well as with its teeth. It is a rather indiscrimate feeder, taking almost any such small animals (mammals, frogs, and birds) as it can get, and frequently robbing bees of their honey after driving them from their nests. Its flesh is esteemed, and is somewhat like that of a chicken. THEODORE GILL.

**Teign'mouth,** town of England, county of Devon, at the mouth of the Teign in the English Channel, is much frequented for its sea-bathing. P. 5975.

**Teignmouth** (JOHN **Shore**), FIRST BARON, b. in Devonshire, England, Oct. 8, 1751; went to India as a cadet 1769; became Persian translator at Moorshedabad 1773; passed through all the subordinate stages of the civil service; accompanied Warren Hastings to England 1785; became a member of the supreme council at Calcutta 1786; took a prominent part in the formation of the revenue and judicial systems of India, especially the measure of zemindar proprietorship of the soil, which took effect under Lord Cornwallis's administration; was made a baronet 1792; was governor-general of India from Aug., 1793, to 1797; was an intimate friend of Sir William Jones, whom he succeeded as president of the Asiatic Society of Bengal Apr., 1794; was a chief author of the code of laws for Bengal published in 1793; was created Baron Teignmouth at the expiration of his term of office 1797; returned shortly after to England; was the first president of the British and Foreign Bible Society 1804–34; became a member of the board of control and of the privy council Apr., 1807, and was a prominent member of the religio-philanthropic circle known as the "Clapham Sect." D. in London Feb. 14, 1834. He edited the *Works* of Sir William Jones (13 vols.), to which he prefixed a *Memoir;* and his own *Life and Correspondence* (2 vols., 1842) were published by his son, the second baron.

**Teinds** (in the Scotch law) are similar to the "tithes" of the English law, and are the certain portion of the annual rents, increase, and profits of the land, payable by the owner or occupant thereof, and appropriated toward the support of the clergy of the Established Church of Scotland. Although teinds and tithes are somewhat analogous in their general objects, the differences between them are radical. (1) Many products tithable in England are not subject to teind in Scotland. (2) The teinds are not directly held by, nor payable to, the clergy. The ministers of the Established Church, so far as the state interferes, receive regular stipends or salaries, determined upon and paid by certain state officials. This official commission or court, therefore, holds the teinds, oversees and enforces their collection, and distributes them in making up the ministerial stipends. (3) The proprietors of land can buy in the teinds imposed thereon by paying a fixed sum, calculated upon their annual amount. The Free Church of Scotland, and all other ecclesiastical bodies legally regarded as sectarian, are wholly voluntary and self-supporting. Recent legislation concerning the Established Church has simplified the administration of teinds, and has provided more easy and equitable measures for their being funded. JOHN NORTON POMEROY.

**Tejada.** See LERDO DE TEJADA.

**Tejucigal'pa,** town of Central America, in Honduras, on the Rio Grande, which here is crossed by a fine bridge of ten arches. Although it has lost much, partly by the emigration of many old Spanish families after the emancipation, partly by the exhaustion of the adjacent gold and silver mines, it is still the finest and most lively place in the state, and contains several handsome buildings, among which the cathedral is noteworthy, both on account of its fine architecture, and because it contains the only public clock in the state. P. 12,000.

**Teka'mah,** p.-v., cap. of Burt co., Neb., on Tekamah Creek, 6 miles from Missouri River, has 2 churches, a high school, 1 bank, 1 newspaper, a safe manufactory, and 3 hotels. P. 498. GEO. P. HALL, ED. "BURTONIAN."

**Tekon'sha,** p.-v. and tp., Calhoun co., Mich., on St. Joseph River and Michigan Central Air-line R. R., 119 miles W. of Detroit, has 3 churches, a fine school-house, 1 newspaper, 2 hotels, 1 flouring and 2 saw mills, and 1 blind, sash, and door factory. It is in a rich farming section. P. 1333. WALLACE W. SWITZER, ED. "REPORTER."

**Tel'de,** town of the Canaries, on the island of Grand Canary, is well built and surrounded with palm-groves. It exports quantities of grain and cochineal. P. 12,027.

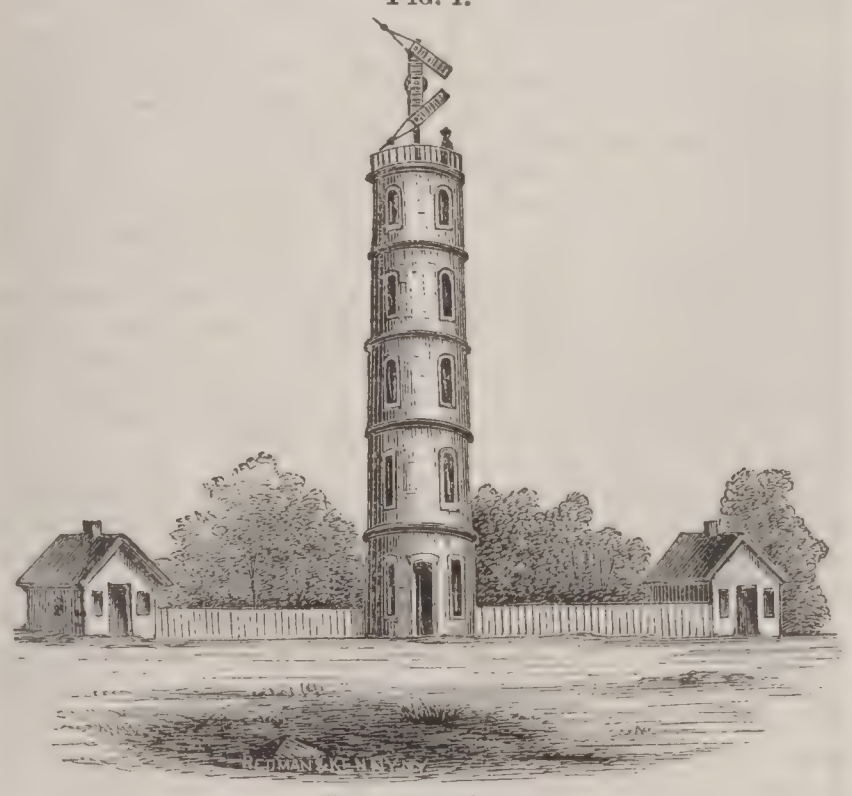
**Tel'edu,** or **Stinkard,** the *Mydaus meliceps*, a small mammal of the family Mustelidæ and sub-family Melinæ, found in the mountainous parts of Java and Sumatra. It is said rarely if ever to descend much below the level of 7000 feet above the level of the sea, and therefore its areas of distribution are quite isolated. It secretes, like the skunks of America, a most intolerably offensive fluid. It is rather nearer the badgers than the skunks in its structure and habits, as well as appearance. The chief distinctive characters are the nearly square form of the tubercular grinders, and the moderate flesh teeth, which are trigonal, with the outer edge compressed and the inner with a ridge studded by two unequal tubercles; it is of a blackish-brown color, with a broad white mark along its back and head. Its motions are slow. Its flesh is eaten by the natives.

**Tel'egraph** [from Gr. τῆλε, "afar off," and γράφειν, to "write"]. The etymology of this word implies a means of writing at a distance, but it has come to signify any

system of conveying intelligence other than by voice or writing. The idea of speed is also implied, the telegraph being seldom if ever employed when it cannot transmit intelligence more quickly than can be done by ordinary means. Sound, light, and electricity, owing to the rapidity with which they are propagated, form the most convenient means of telegraphing. Sounds, like those of bells, guns, etc., are often employed in sending a single message through short distances. For long distances, however, light and electricity are immeasurably superior to sound.

The necessity of transmitting intelligence to a distance without the employment of a carrier, and with greater rapidity and certainty, was felt by the ancients, and many expedients were resorted to under various circumstances. These were usually very simple, and exhibited little mechanical contrivance. The semaphore was the first really efficient telegraph. It was invented by Claude Chappé, and adopted by the French government in 1794. Subsequently, under various modifications, it came into use in nearly every civilized country. It consisted of an upright

FIG. 1.



The Semaphore.

post supporting a horizontal bar, which, turning upon a pivot, could be placed at various inclinations. This had two smaller arms pivoted to its extremities, and capable of being turned at various angles with them. By independent movements of the parts the apparatus was susceptible of 98 distinct positions, and of exhibiting the same number of different signals, which could be made to represent either letters, numbers, words, or sentences. The speed of transmission under the most favorable circumstances was about three signals per minute. The semaphores were placed upon high towers, usually about four or five miles apart. Much ingenuity was expended by Chappé and others in arranging a system of lights to enable the semaphore to be used at night, but with only partial success. In fogs and snowstorms, moreover, this system was entirely useless. Until the introduction of the electric telegraph almost every country in Europe maintained lines of semaphores between its capital and the most important ports upon its seaboard. Perhaps the most important and costly undertaking of this kind was the great line constructed by Nicholas I. of Russia from the Austrian frontier through Warsaw to St. Petersburg, and which was composed of 220 stations. The semaphores were erected upon the summits of substantial and lofty towers, and the whole work cost several millions of dollars.

Another system of optical telegraphy consists of alternately exposing and cutting off a continuous beam of light directed from the sending to the receiving station, the characters being formed on the same principle as those of the Morse telegraphic alphabet, by the breaking of a continuous line into sections of varying length. In 1861, Moses G. Farmer made a series of successful experiments with his method between Hull and Nantasket on the coast of Massachusetts, and it also appears to have been employed about the same time by the officers of the U. S. Coast Survey on Lake Superior, where by means of mirrors equatorially mounted, telegraphic messages were exchanged between stations 90 miles apart with ease and rapidity. In 1862 this system was taken up by Capt. Coloumb and Major Bolton and introduced into the British navy, where it is now universally used, the electric and calcium lights being employed at night and a collapsing drum closing upon its central hoop by day. During the siege of Paris messages were often sent 20 or 30 miles in this way from one elevated point to another by the use of a calcium light concentrated and directed by lenses. More recently it has been proposed to employ a similar alphabet of short and long sounds for signalling between vessels at sea, which is of course entirely feasible.

As soon as it became known that electricity could be conducted by wires to a distance, it began to be regarded as a possible means of conveying intelligence. The earliest suggestion of this kind seems to have been contained in a letter to the *Scots Magazine* dated Feb. 1, 1753, and which Sir David Brewster thinks was written by Charles Marshall of Paisley. He proposed to employ insulated wires equal in number to the letters of the alphabet, the signals being given by means of frictional electricity. In 1774, Lesage of Geneva constructed the first electric telegraph, which was almost a realization of Marshall's idea. It had twenty-four wires, each connected with a pith-ball electroscope, the signals being given by frictional electricity. From this time forward many ingenious attempts were made to employ frictional electricity for telegraphic purposes, most of which it is unnecessary to notice in detail, as they were attended with only partial success. In 1816, Ronalds constructed a telegraph, making use of frictional electricity and a single wire, and exhibited signals by the divergence of pith-balls combined with dials revolving synchronously. He fully perceived the value of his idea, and strove to bring it before the British government, but was informed that "telegraphs of any kind are now wholly unnecessary, and no other than the one now in use will be adopted." In 1828, Harrison Gray Dyar of New York invented a telegraph, the principle of which consisted in sending discharges of frictional electricity through a wire, which should be recorded by being caused to pass through a sheet of moistened litmus-paper moving at a uniform rate. The relative distances apart of the discharges were to indicate the letters of the alphabet. There is evidence that this invention was experimentally tried on Long Island the same year in which it was invented, but little is definitely known respecting the results. In 1820, Ampère suggested that the deflection of a needle by the galvanic current might be used for telegraphic purposes. In 1830, Baron Schilling constructed a telegraph having five vertical needles, and in 1835 he exhibited his invention, simplified to a single needle, at Bonn. This was shown by Moncke at Heidelberg in 1836 to W. Fothergill Cooke, who immediately set to work to devise and construct a telegraph for practical use, consisting of a pair of three-needle instruments, with keys and reciprocal system. He also invented the electro-mechanical alarm and the detector for discovering the position of faults in the lines. In Feb., 1867, he became associated with Wheatstone, and took out a patent with him the same year. In 1835 the first *actual electric telegraph* was constructed, extending from Paddington to Drayton, a distance of 13 miles. It had six wires and five needles. The wires were wound with hemp and laid in a pipe on the surface of the ground. In 1839, Dr. W.O'Shaughnessy at Calcutta, India, built the first overground line of iron wire on bamboo poles. It was 21 miles long, and worked by Cooke's single-needle instrument.

Samuel F. B. Morse of New York, during a voyage home from France in 1832, conceived the idea of making signs at a distance by means of a pencil moved by an electro-magnet and a single conducting circuit, the paper being moved under the pencil by clockwork. He constructed a working model of his invention in 1835, and exhibited it to several persons the same year, but not publicly until 1837. Several years were devoted to improving the invention and endeavoring to interest the public in the project. It was not until 1844 that the first public line was completed between Washington and Baltimore (40 miles), and the first message transmitted May 27 of that year. Within a few years, however, lines were extended to the principal cities of the U. S. The Morse telegraph was introduced into Germany in 1847, whence it has spread all over the Eastern hemisphere, and may now be said to be the universal telegraph of the world. Gauss and Weber of Göttingen, Germany, constructed a telegraph in 1833 consisting of a magnetic needle acted upon by magneto-electric currents. Their invention was taken up by Steinheil in 1836–37, and practically worked out to a high degree of perfection. The discovery that the earth may be employed as part of a telegraphic circuit was made by him. Steinheil's telegraph never went into extensive use, owing to the introduction of the Morse system in Germany.

The earliest experiment on record in submarine telegraphy was made by Dr. W. O'Shaughnessy at Calcutta in 1839. He laid a copper wire, insulated with a coating of cotton thread saturated with pitch and tar, across the river Hoogly, and transmitted signals through it. In 1847, J. J. Craven of Newark, N. J., insulated an iron wire with

gutta-percha and placed it in the circuit of the New York and Washington telegraph line, submerging it in the waters of a small creek. The success of this experiment led to the laying of a gutta-percha cable between New York and Jersey City in 1848. In 1850 an experimental line was laid across the English Channel, followed in 1851 by a permanent cable, which is still in use. The success of this undertaking at once revived the suggestion of laying a cable across the Atlantic Ocean from Ireland to Newfoundland. In 1854 the attention of Mr. Cyrus W. Field of New York was directed to the subject, and mainly through his efforts a company was formed, principally of English capitalists, to undertake the enterprise. The first attempt was made in Aug., 1857, but it was unsuccessful, the cable parting 300 miles from shore. The following year the attempt was renewed, and the enterprise successfully completed Aug. 5, 1858. The electrical condition of the cable was faulty from the first, but signals and communications were exchanged with more or less facility until Sept. 1, when the cable failed altogether. During this time 366 messages, containing 3942 words, were interchanged between Europe and America. Several attempts to pick up and repair the cable were made without success, and this disastrous result discouraged further enterprise in the same direction for a number of years. The experience gained, however, was of the highest value, and the success of the Malta and Alexandria (1861), Persian Gulf (1864), and other deep-sea cables led to a renewal of the attempt to cross the Atlantic in 1865, which again resulted in the breaking of the cable after 1186 miles had been paid out. The following year, however, a new cable was successfully submerged, being landed at Newfoundland in perfect working order July 27, 1866, and the great problem was thus at last definitely solved. In September following the lost cable of 1865 was picked up and completed. From that date such rapid progress has been made in the extension of telegraphic cables that at the present time the only isolated system of telegraphs in the world is that of South Africa.

All electric telegraphs may be said to consist of three parts: first, an apparatus for generating or producing the electric current; second, a conductor for conveying the electricity from one point to another as required; and, third, apparatus for transmitting and receiving the signals. It will be convenient to treat of the telegraphs now in use under this general classification.

I. Sources of Electricity.—The electricity used in telegraphy may be derived either from the voltaic battery, from the magneto-electric machine, or from the thermo-electric battery. Of these, the voltaic battery is the most commonly used, though latterly much has been done in developing the capacity of the magneto-electric machine, and it now seems probable that it will to some extent replace the voltaic combinations now in use. The employment of the thermo-battery has thus far been merely experimental.

A. *Voltaic Batteries.*—Of these, the sulphate-of-copper battery, invented by Daniell in 1836, is most generally employed. It is constructed in various forms, the most useful of which are (1) the gravity battery, invented by Fuller in 1853, which is now almost exclusively used in the U. S., and (2) the trough battery, another form of the same, used in England; (3) the manganese battery, invented by Leclanche in 1867, is extensively used in France and England; (4) the nitric-acid battery of Grove; and (5) the chromic-acid battery of Bunsen and Poggendorff are now but little used.

B. *Magneto-Electric Machines.*—The earliest form of this apparatus was (1) Pixii's, which is employed in Wheatstone's dial telegraph; (2) Siemens's (1855), a much more efficient apparatus, is now largely used in dial and other special telegraphs. Within a few years (3) Gramme's apparatus, which is arranged to give a continuous current, has given very promising results as a substitute for the voltaic battery in general telegraphing.

C. *Thermo-Electric Batteries.*—(1) Farmer's and (2) Clamond's have been used experimentally to some extent, the latter especially with very good results.

D. *Circuits.*—In applying electricity from any source to the production of telegraphic signals, it is generally done in one of three ways: (1) by completing the circuit of a battery or other generator, and giving signals by causing currents of a certain polarity to traverse a line normally free from electricity; or (2) by connecting the battery and line, so that a constant current will traverse the latter, the signal being given by interrupting this current; or (3) by arranging the battery and line as in the last case, and giving signals by reversing the polarity of the current instead of interrupting it.

II. Telegraphic Conductors.—Conductors are usually carried through the air, but when required may be placed under ground or under water. In either case they must be well insulated.

A. *Over-ground.*—Galvanized iron wire weighing from 320 to 600 pounds per mile is used in the U. S. The largest wire is used for the longest lines, and still larger wires are used in some of the European countries. The wires are supported on wooden poles placed along the railways or highways from 8 to 10 rods apart. From 1 to 40 wires may be conveniently placed on one line of poles, the lowest being 20 feet from the ground. Iron poles are seldom used except in desert and tropical countries. The wires are attached to the poles by insulators of a bell or inverted cup shape. In the U. S. they are usually of glass, in Europe and Asia of white porcelain, and supported by brackets of wood or iron attached to the poles. In large cities the wires are frequently carried on standards fixed upon the highest buildings. A steel wire electro-plated with copper, invented by Farmer (1867), is of late years coming into use. Copper being five times as good a conductor as iron, this compound wire combines lightness and strength in a high degree.

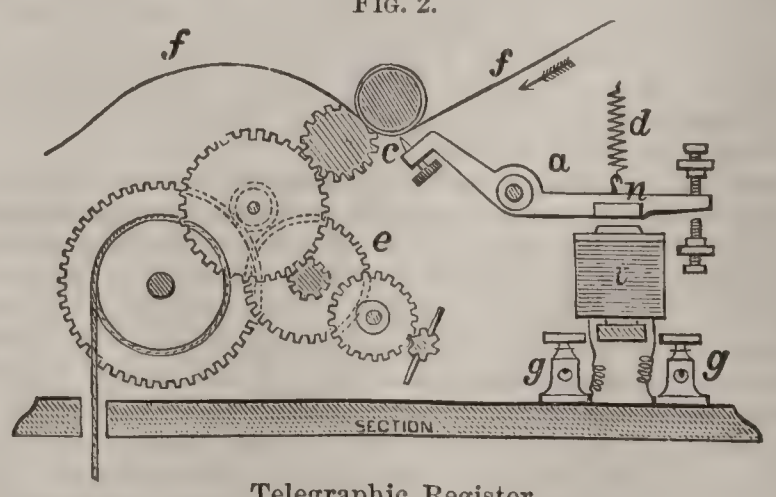
B. *Under-ground.*—Wires are at present seldom laid under ground except in the large cities of Europe, but this must eventually become necessary in New York and other cities of the U. S. An experimental line of this kind has already been laid in New York by the Western Union Telegraph Co. In London, No. 13 copper wires, coated with gutta-percha to a diameter of $\frac{3}{16}$ths of an inch, are used. The required number of these are laid in a cable served with tarred tape. The cables are made in lengths of 400 yards, and drawn into iron pipes laid 2 or 3 feet below the surface of the ground. Boxes with trap-covers are placed every 400 yards for convenience in testing wires and drawing them in and out. The same system has been adopted in other cities of Great Britain, and also in New York. In Paris the cables are placed in the sewers. The plan of stretching naked wires in a trench, and filling around them with bitumen or asphalt in a plastic state, which afterward becomes hard, has been tried in France and the Netherlands with indifferent results.

C. *Submarine.*—The first submarine lines were simply ordinary iron wires coated with gutta-percha to a diameter of half an inch. In the cable laid between Dover and Calais in 1851 four gutta-percha coated conducting wires were wrapped with hemp and enclosed in a wire rope for protection. This general plan has been followed in all cables since constructed. The Atlantic cables are composed of a copper strand of seven wires, forming the conductor, surrounded by four layers of gutta-percha and covered by a serving of jute; outside of this is a protecting armor of ten wires of homogeneous iron, each enveloped in fine strands of manila hemp. In shallow waters, where cables are exposed to injury from anchors, the armor is often made enormously thick and heavy, sometimes weighing as much as 20 tons per mile.

III. Telegraphic Apparatus.—The apparatus used in telegraphy may be conveniently divided into recording and non-recording. Of each of these there are several varieties, which will be described in order.

A. *Recording Telegraphs.*—These are of two classes, one recording arbitrary signs, and the other ordinary printed letters. (1) *Marking Telegraphs.*—(*a*) Morse's is by far the best known and the most extensively used of this class. Its most important feature is the *register*, which is constructed in many forms, but upon the general principle shown in Fig. 2. A horizontal lever *a* is mounted upon

Fig. 2.




Telegraphic Register.

a fulcrum, and armed at one end with a steel point *c* projecting upward and nearly touching a ribbon of paper *f*, which is carried along at a uniform rate by a grooved roller just above it, the roller being impelled by a system of clockwork *e*. The opposite end of the lever carries a soft iron armature *n* suspended just above the poles of an electro-magnet *t*. The end of the wire helix surrounding this magnet terminates in binding-screws *g g*, to which the

conducting wires are attached. A current of electricity traversing the helix of the electro-magnet causes it to become powerfully magnetic, attracting the armature *a* to its poles, and thus pressing the steel point *c* against the paper ribbon moving above it upon the grooved roller. A continuous line will in this manner be embossed upon the paper as long as the armature remains attached to the poles of the magnet. When the current is interrupted, the magnetism disappears, and the spring *d* draws the marking-point away from the paper. Thus, the length of the line embossed upon the paper corresponds to the greater or less length of time that the electric current is allowed to traverse the helix of the electro-magnet *t*. This is governed by the transmitting instrument termed the key, which is simply a small horizontal lever with a finger-knob at one end and a spring beneath. The wire leading from the line is connected to this lever, and when the latter is depressed by the finger of the operator, it comes in contact with a metallic stud, known as the anvil, to which the battery wire is attached; thus the circuit is completed and the current permitted to flow into the line. When the latter is but a few miles long, the battery and key are connected directly by a wire with the electro-magnet of the register; but when the distance is greater, an instrument called the *relay* is employed. This consists of an electro-magnet with a lever mounted like that of a *register*, except that the marking-point is replaced by a contact-point, which opens and closes the circuit of a local battery, and this in turn operates the register. A considerable number of relays with their registers may be placed at as many different points upon the same line, and all operated simultaneously by a key at any point; and, in fact, this is the arrangement usually adopted in the U. S. The greatest length of line usually worked in one circuit is about 500 miles, and the number of relays at different points varies from 2 to 30, and even 40. The line or main batteries are usually placed at the two ends of the route, though each station has of course its local battery of one or two cells. The alphabet devised by Morse consists of arbitrary characters composed of combinations of short lines termed dots and longer ones termed dashes, separated by varying spaces. This alphabet, it will be seen, is capable of being written with facility by means of the key and register above described. The following is the alphabet used in the U. S. and Canada.

*The American Morse Telegraph Alphabet.*

| | | |
|---|---|---|
| A — ——<br>B ——— — — —<br>C ——— — —<br>D ——— — —<br>E —<br>F — ——— —<br>G ——— ——— —<br>H — — — —<br>I — — | J — ——— ——— —<br>K ——— — ———<br>L ———————<br>M ——— ———<br>N ——— —<br>O ——— ———<br>P — ——— — —<br>Q ——— ——— —<br>R — ——— — | S — — —<br>T ———<br>U — — ———<br>V — — — ———<br>W — ——— ———<br>X — ——— — —<br>Y — — ——— —<br>Z ——— ——— — —<br>& — ——— — — |
| 1 — ——— ——— — —<br>2 — — ——— — —<br>3 — — — ——— — | 4 — — — — ———<br>5 ——— ——— ———<br>6 ——— — — — —<br>7 ——— ——— — — | 8 ——— — — — — —<br>9 ——— — — ———<br>0 ——————— |

Period (.) — — ——— ——— — —
Comma (,) — ——— — ———
Interrogation (?) ——— — — ——— —
Exclamation (!) ——— ——— ——— —

In all other parts of the world the *international Morse telegraph alphabet* is used, as follows:

| | | |
|---|---|---|
| A — ——<br>B ——— — — —<br>C ——— — ——— —<br>D ——— — —<br>E —<br>F — — ——— —<br>G ——— ——— —<br>H — — — —<br>I — — | J — ——— ——— ———<br>K ——— — ———<br>L — ——— — —<br>M ——— ———<br>N ——— —<br>O ——— ——— ———<br>P — ——— ——— —<br>Q ——— ——— — ———<br>R — ——— — | S — — —<br>T ———<br>U — — ———<br>V — — — ———<br>W — ——— ———<br>X ——— — — — ———<br>Y ——— — ——— ———<br>Z ——— ——— — — |
| 1 — ——— ——— ——— ———<br>2 — — ——— ——— ———<br>3 — — — ——— ———<br>4 — — — — ———<br>5 — — — — — | 6 ——— — — — —<br>7 ——— ——— — — —<br>8 ——— ——— ——— — —<br>9 ——— ——— ——— ——— —<br>0 ——— ——— ——— ——— ——— | |

Period (.) — — — — — —
Comma (,) — ——— — ——— — ———
Interrogation (?) — — ——— ——— — —
Exclamation (!) ——— ——— — — ——— ———

The international alphabet is preferable, as it contains no spaced letters; these sometimes give rise to errors in reading communications. In Europe and Asia an improved register called the "ink-writer" is much used. A sharp-edged wheel is kept constantly revolving in a dish of colored fluid. The slightest pressure of this against the paper suffices to make a distinct mark, and thus the relay may be in most cases dispensed with, as a very feeble current is sufficient to make a perfect record. Electro-magnets intended for use in the main circuit, whether for relays or ink-writers, usually have helices composed of several thousand convolutions of very fine insulated wire, but for local circuits a small number of convolutions of coarse wire is sufficient. In order to transmit direct between points more than 500 or 600 miles apart, two or more circuits are coupled together by means of an automatic repeater, which was first accomplished by C. S. Bulkley in 1848. By this means each circuit operates the succeeding one upon the principle of the relay. In this way direct communication has been had between points several thousand miles apart.

(*b*) Bain's electro-chemical telegraph was invented in 1846, and extensively used in the U. S., Great Britain, and Germany from 1849 to 1860, but is now superseded by Morse's. The system of signs and the transmitting key are similar to those of Morse. The record is made by passing the current from the line over an iron style and thence directly through a moving strip or disk of paper. The paper is saturated with a mixture of 10 parts of saturated solution of yellow prussiate of potash, 2 parts each of nitric and muriatic acid, and 1 part of chloride of lime. The electric current causes the solution to chemically unite with the iron of the style, forming Prussian blue. A very weak current suffices to give a distinct mark. No electro-magnet is required in this system except to operate an alarm.

(2) *Printing Telegraphs.*—The idea of a telegraph which should record messages in printed Roman letters is due to Alfred Vail of New Jersey (1837). The first model of such an instrument was made by Wheatstone (1841). (*a*) *House's Telegraph.*—This was the earliest practical printing instrument. It was introduced in 1847, and largely used in the U. S. until about 1860. It is simple in principle, though somewhat complicated in construction. The twenty-six letters of the alphabet, a period, and a blank space are engraved on the edge of a type-wheel, upon the shaft of which is a scape-wheel of fourteen teeth. The type-wheel revolves by manual power, but is held in check by a double-acting anchor escapement. The latter vibrates by the alternate action of an axial electro-magnet and a retracting spring. When at rest, the blank space on the type-wheel is in front, the circuit being complete. If it is interrupted the scape-wheel advances half a tooth, presenting the letter *A*, and when restored it again advances, presenting *B*. If the circuit is opened fourteen times and closed fourteen times alternately, the type-wheel will make a complete revolution. It is obvious that any particular letter may be presented by breaking and closing the circuit the proper number of times. This is effected in practice by a metallic contact-wheel at the transmitting station. This wheel has fourteen teeth and fourteen equal spaces; its axis is connected to the line. A flat spring connected with the battery touches each tooth as it revolves, and transmits the electric pulsations. The revolution of this contact-wheel is stopped at the proper place for each letter by a piano keyboard having twenty-eight keys. A cylinder fixed upon the axis of the contact-wheel carries twenty-eight pins arranged in a spiral, each pin turning with the cylinder underneath its own key. Each key is provided with a stop, which falls into the path of the pin and arrests the cylinder when the key is depressed. Thus, when the cylinder is turned from one letter to another, just so many contacts and interruptions are given as will advance the type-wheel the same distance. The printing is effected at the receiving station by the action of an eccentric which is automatically released when the wheel pauses at any letter. It makes a single revolution, forcing the paper against the letter presented by the type-wheel, and then advances the paper, which is in the form of a continuous ribbon, so as to leave a clear space for the impression of the succeeding letter. Thus, it will be seen that the instrument is operated wholly by manual power, the only office of the electric current being to secure a corresponding movement between the type-wheel of the receiving and the contact-wheel of the transmitting instrument. The apparatus requires a powerful battery, and it seldom operates satisfactorily on a line more than 250 miles in length. (*b*) *Hughes's Telegraph.*—This was invented by D. E. Hughes in 1855, and has been extensively used in Europe since 1860. The essential principle of the apparatus is the synchronous movement of two constantly-revolving shafts at two stations. This is effected by means of a governor consisting of a recoil escapement and a vibrating bar. The shaft at the transmitting station carries a revolving contact-maker, and the corresponding one at the receiving station a type-wheel similar to that of House. The contact-maker travels over a circular row of twenty-eight vertical pins, which are connected with the same number of piano-keys. Each pin represents a letter, and is raised by the depression of the corresponding key when a letter is to be transmitted. The contact-maker, which travels round the circle of pins

with a motion uniform with that of the type-wheel at the receiving station, comes in contact with the raised pin at the same instant that the corresponding type upon the type-wheel is passing the platen, and closes the circuit. An electro-magnet at the receiving station releases a cam which throws the platen carrying the paper against the type as it is passing, thus printing the letter. Only one pulsation is thus required for the printing of each letter, and by the use of a peculiar form of electro-magnet a very weak current suffices to do the work. (*c*) The *combination instrument* is a modification of Hughes's. It retains the principle of synchronous mechanism at the sending and receiving stations, but it differs much in details. It has an electro-magnetic governor instead of a vibrating spring, and is more simple and durable in its construction than the Hughes apparatus. It was invented in 1859 by G. M. Phelps, and has been used on many of the principal lines in the eastern part of the U. S. since that date. (*d*) *Phelps's Electro-Motor Telegraph.* This is the most effective printing instrument which has yet been produced. It was invented in 1869, but has only recently (1875) been practically used. It now seems likely to supersede all the other type-printing instruments both of the U. S. and Europe. The mechanism is driven by a small electro-motor, which is connected with a special battery. This is more convenient and economical than the manual power required by the House machine or the heavy weight and clockwork of the Hughes apparatus. The synchronous movements of the transmitting mechanism at one station and the type-wheel at the other are maintained by means of a centrifugal governor attached to the motor, which instantly reduces the strength of the local current by which the latter is propelled whenever the speed of revolution tends, however slightly, to exceed the prescribed limit. The movement of the Hughes apparatus is retained, except that both the type-wheel and the revolving contact-maker are simultaneously arrested for a given integral portion of a revolution during the transmission and printing of each letter. An improved form of the automatic unison for bringing the two instruments into correspondence whenever transmission is suspended for a few moments (invented by Farmer, 1858) has also been applied to this instrument. (*e*) *Telegraphs for Financial and Commercial Reporting.*—The method of reporting the fluctuations of the prices of stocks, gold, merchandise, etc., by means of automatic-printing telegraph instruments placed in the offices of merchants, brokers, and other interested persons, and of which several hundred are often simultaneously operated by a single person located in the central exchange, originated in New York in 1867, and has since extended to the principal cities of the U. S. and of Europe. The instruments now in use are those of Calahan, Edison, Phelps, and Smith, though many other inventors have aided in the perfection of the apparatus. The general principle is the step-by-step movement of the House apparatus, but two type-wheels are made use of—one for letters and the other for numerals and fractions—which print in parallel lines on the same strip of paper. By an ingenious device invented by Dujardin in 1867 the platen is automatically shifted from one type-wheel to the other by the operator at the central station according as he wishes to print letters or numerals. These instruments also have an automatic unison invented by Foote (1869). The printing is in most cases effected by a special electro-magnet. (*f*) *Printing Telegraphs for Private Use.*—These are constructed upon a plan similar to the instrument described in the last paragraph, and although introduced as lately as 1870, thousands of them are already in use by manufacturers and others in the U. S. The most successful are those of Gray, Phelps, Edison, Chester, and Anders. Any intelligent person after a few minutes' instruction can print a communication at any distance, even in the absence of an attendant, by depressing the proper keys upon a lettered keyboard. The speed of transmission is from 10 to 30 words per minute, depending upon the instrument used and the skill of the operator.

B. *Non-Recording Telegraphs.*—These may be divided into two classes—visual and acoustic; they give only evanescent signals, and are sometimes termed semaphores.

(1) *Visual Telegraphs.*—(*a*) *Cooke's Needle Instrument.*—This is simply an upright galvanometer needle surrounded by a coil of fine insulated wire, and is operated from the sending station by two keys, one of which sends a positive current, deflecting the needle to the right, and the other a negative current, deflecting it to the left. The alphabetical code is the same as the Morse, a deflection to the left signifying a dot, and to the right a dash. Owing to its simplicity and convenience, this apparatus was almost universally used in England from 1840 until within a few years, since which time it has been superseded on all the important lines by the Morse system. It still retains its supremacy for railway use. (*b*) The dial instrument, invented by Wheatstone in 1840, is arranged on the same plan as a type-printer, but is much more simple, as an index-hand and dial carrying the alphabet replaces the somewhat complex type-wheel and printing apparatus. These are largely used for private and police telegraphs, and in Europe for railway purposes, as they are easily operated by unskilled persons. The best known are those of Wheatstone, Siemens, Anders, Breguet, and Chester. The three first mentioned are operated by magneto-generators, and require no battery. (*c*) The gold-indicator, invented by S. S. Laws (1866), is a species of dial telegraph largely employed in New York City to exhibit the current rate of premium on gold in the offices of brokers and dealers in exchange. It is operated from the Exchange in the same manner as the stock telegraph.

(2) *Acoustic Telegraphs.*—Of these, the best known and most important is (*a*) the sounder, which is simply a Morse register stripped of all its parts except the electro-magnet, writing lever, and retracting spring. The operator interprets the sounds made by the motion of the lever up and down between its stops. This method was taken up by the American operators about 1850, and the sounder has now almost entirely superseded the recording apparatus in the U. S. and Canada, as experience proves that the speed of transmission is practically doubled, while, somewhat paradoxically, the proportion of errors is largely diminished. The same method is employed in India, and to a limited but increasing extent in England and other parts of Europe. The operator reads from the instrument, and copies the message simultaneously. For military purposes the sounder, together with a manipulating key, is often reduced in size, so as to be contained in a pocket-case not larger than a tobacco-box and weighing but a few ounces, and yet forming a completely-equipped Morse telegraph station, which may be connected with a line at any required point. (*b*) The fire-alarm telegraph, invented by W. F. Channing and M. G. Farmer of Boston (1851), is a most ingenious and useful application of the telegraph, now in use in seventy-five of the principal cities and towns of the U. S., and in some other countries. It consists of a series of locked signal-boxes placed at convenient intervals throughout a city or town (in New York City, for example, there are 600); each of these contains mechanism which, when wound up by simply pulling a hook, will instantly transmit through the connecting telegraph wires a determinate numerical signal representing that individual box, and no other. The signal thus transmitted is instantly sounded, by means of mechanism controlled by electro-magnets in the circuit, upon the church and tower bells and upon large gongs placed in all the fire-engine houses. So effective is this system in practice that frequently in less than 30 seconds after the discovery of a fire a number of engines will be on their way to the very spot. This invention has been the means of saving millions of dollars' worth of property and thousands of lives since its first introduction. By recent improvements of W. B. Watkins (1871) the fire itself is made to transmit a numerical alarm-signal automatically. Thermostats are placed in the various rooms of a building, which when heated above the normal temperature close a circuit and trip the clockwork of an automatic transmitter. The rest of the apparatus resembles Channing & Farmer's. (*c*) The district telegraph (1870) is a recent application of the above system. Signal-boxes are placed in the houses of persons desiring them, and connected telegraphically with a central station. By simply turning a crank at any hour of the day or night a messenger or policeman may be instantly summoned or a fire-alarm transmitted. More than 3000 of these signal-boxes are in daily use in the city of New York, and the system has been introduced in many other cities of the U. S.

IV. Special Methods of Telegraphy.—A. *The Automatic Process.*—At an early period in the history of telegraphy attempts were made to devise methods of transmission, by which means the capacity of each individual wire might be largely increased, and the evils which necessarily arise from a multiplication of wires in a great measure avoided. In 1846, Alexander Bain of Scotland patented an automatic telegraph, in which the messages, instead of being transmitted by a key or manipulator, were first prepared by punching out the telegraphic characters in a ribbon of paper, the dots and dashes being represented by perforations of different lengths. In order to transmit the prepared message the strip was caused to pass rapidly over a metallic roller driven by clockwork or otherwise, and a light spring or brush of metal, resting upon the paper over the roller, made contact with the latter through each of the perforations as they successively passed under it, and thus completed the electric circuit between the battery and the line. By this means several operators could be employed simultaneously in preparing messages, which could be run through the machine and recorded on chemical paper at

the receiving station at a high rate of speed. The system was tried in England and America in 1849 and 1850, but no practical advantage over hand-labor resulted in practice, perhaps largely owing to the fact that no convenient means of perforating the paper had been devised. In 1856, Dr. W. Siemens of Berlin invented a perforating-machine with three keys, by which the time required to prepare a despatch was much lessened. He applied this method in conjunction with Morse's receiving apparatus on many Russian lines in 1853–55, but the automatic feature was soon abandoned. In 1856, J. P. Humaston of Connecticut invented a keyboard perforator, which produced a complete character by the touch of a single key. The same year Siemens introduced the polarized relay, operated by alternate positive and negative currents. In 1858, Wheatstone in England modified Siemens's apparatus, and in its subsequently improved form it is now largely used on the government lines in Great Britain, especially for sending large quantities of press news in duplicate to various parts of the kingdom. In the U. S. an improved modification of Bain's method and of Humaston's perforator has been operated since 1871. The speed of transmission obtained by the Wheatstone process is 120 words per minute; by the American process 800 words have been sent in the same time a distance of 100 miles; but it is still an unsettled question, owing to the rapid improvement of other methods, whether the automatic process will succeed in permanently establishing itself.

B. *The Autographic Process.*—In 1848, F. C. Bakewell of London patented a modification of Bain's automatic process by which a fac-simile of the transmitted despatch is produced at the receiving station. The original is written on tin-foil with insulating ink, and wrapped round a metallic cylinder rotated by clockwork at a uniform rate. A style rests upon the cylinder as it turns, and also receives a slight lateral motion by a screw as the cylinder revolves; it thus describes a spiral path, passing successively over the whole surface of the tin-foil on the cylinder. The battery-current passes through the style to the tin-foil, thence to the cylinder and over the line, but is necessarily interrupted when passing over the insulating lines of the writing. The cylinder at the receiving station is covered with Bain's chemical paper, and revolves synchronously with that of the transmitter. The iron style traces a continuous blue line on the paper, except when the current is interrupted by the style passing over the lines of writing upon the tin-foil. The chemical paper therefore appears covered with fine parallel blue lines, forming a ground-tint upon which a fac-simile of the writing appears in white. This apparatus, though practically unsuccessful on account of the difficulty in maintaining sufficiently accurate synchronism, illustrates the principle of all its successors. Abbé Caselli of Florence in 1856 greatly improved this process by employing a pendulum to control the synchronous movements of the two corresponding instruments, and by so arranging his electrical connections that the fac-simile appeared in blue on a white ground. In 1865 this process was put in actual service on some of the French and Russian telegraphs, and has given very good results. The more recent inventions of Lenoir and Meyer in France record in ink by means of electro-magnets. W. E. Sawyer of Washington, D. C., has recently (1874) made some improvements in the autographic process, one of which consists in transferring the original message, written upon ordinary paper, to a metal plate for transmission. As the process of autographic transmission and reception dispenses entirely with specially skilled labor, it is not unlikely that it may yet prove to be of considerable economic value.

C. *The Multiple Process.*—The idea of increasing the capacity of a line by transmitting two or more communications through it simultaneously appears to have been first suggested by Farmer, who in 1852 made a successful experiment on one of the municipal lines in Boston. He employed two rapidly-revolving synchronous commutators, one at each end of the line, which served to bring the latter successively and simultaneously into connection with two or more short branches at each terminus, in each of which ordinary telegraphic instruments were inserted. Thus, the current in the corresponding branches at each terminus, though apparently continuous, actually consisted of rapidly-recurring pulsations. From the difficulty of maintaining synchronism, and other causes, nothing practical resulted from the experiment at that time. In 1873, Meyer of France exhibited at Vienna an apparatus on this principle capable of transmitting four simultaneous communications. It is employed in actual service between Lyons and Paris, and is said to have a capacity of 110 messages per hour. In 1853, Dr. W. Gintl of Austria invented a method of simultaneous transmission in opposite directions by connecting an auxiliary local circuit with the Morse key, which passed through a separate but opposing helix upon the instrument at the home station, and thus neutralized the effect of the current transmitted over the line upon the home instrument, while at the same time it was left free to respond to the increased current in the line caused by the depression of the distant key. Practically, it was found impossible to adjust the local current so as to perfectly compensate that of the main line. The following year Carl Frischen of Hanover substituted a branch of the main current for the local current of Gintl, and the method thus improved was used to a limited extent for many years in Austria and Holland. In 1855, Stark of Austria proposed a method of simultaneous transmission in the same direction, and suggested that it might be combined with Frischen's plan, thus enabling four simultaneous despatches to be sent over one wire, but nothing practical resulted at that time. In 1858–59, Farmer made successful experiments with a modification of Frischen's method on several American lines. J. B. Stearns of Massachusetts revived Frischen's method in 1868, and in 1872 vastly improved it by adding a condenser to compensate the effects of induction in long lines. He introduced the improved method now known as the "duplex" into general use, first in America and afterward in Europe. In 1874, T. A. Edison invented a new method of simultaneous transmission in the same direction, which has been combined with Stearns's method, forming a "quadruplex." Subsequent improvements by G. Smith and others have vastly increased the effectiveness of this method. It is now in extensive use, and is regarded as an improvement of the highest value. Since 1872 the working capacity of the lines of the Western Union Telegraph Co. alone has been, by the use of these methods, increased 25 per cent., which is equivalent to the addition of nearly 50,000 miles of wire at a comparatively trifling expense.

D. *The Harmonic Process.*—This method of telegraphy, invented by Elisha Gray of Chicago, is of recent origin, and is based on discoveries made by him in 1873 in reference to the telegraphic transmission of musical tones. By Gray's process at least eight communications may be simultaneously transmitted over one wire, and this is probably much below its actual capacity. The transmitting apparatus consists of a number of steel reeds, each tuned to vibrate at a definite rate, corresponding to some one note of the musical scale. One end of each reed is rigidly fixed, while the other is left free to vibrate by the alternate action of two electro-magnets, a local battery, and an automatic device for alternating the current of the battery between the two magnets at each vibration, so that the movement of the reed is rendered continuous as long as the current passes; but the rate of vibration of each individual reed must always correspond rigidly with the note to which it is tuned. If a line is to be equipped for eight simultaneous transmissions, the main battery is divided into eight equal sections, which are so arranged as to be thrown alternately on and off the line at each vibration of the reed connected with that section. If, then, the first reed be tuned on fundamental C, it will make 128 vibrations per second, and by depressing the corresponding transmitting key the particular section of the battery will be thrown in and out of the main circuit 128 times per second, and a corresponding number of electric waves will pass through the line. The next reed may be tuned on D, which in like manner will produce 144 waves per second; and so of the remaining six. At the receiving station a series of eight analyzers are placed in the circuit, the current passing through them all in succession. Each analyzer consists of an electro-magnet whose armature is fixed at one end and free at the other, and so arranged as to form a vibrating tongue or reed, which is tuned to the same note as the transmitting reed to which it is intended that it shall respond. When the transmitted vibrations pass through the series of analyzers, each armature takes up its own set of vibrations, rejecting all the others, and consequently gives forth its own musical note. The sound is greatly increased and intensified by mounting each analyzer upon a sounding-box or resonator adjusted to its own note. The several transmitting keys at the sending stations break up the continuous tone into the dots and dashes of the telegraphic alphabet, which may be read from the sound of the analyzer as readily as from an ordinary sounder. Indeed, by the addition of a secondary spring attached to the analyzer, having a slower rate of vibration, it may be readily made to operate the usual Morse sounder by opening and closing a local circuit. No difficulty is found in transmitting eight simultaneous communications over one wire to a distance of several hundred miles, each pair of operators sending and receiving at the same rate of speed as in the ordinary single transmission. It is obvious that musical tones may be perfectly reproduced at any distance by this method; and in fact this has often been accomplished with remarkable success. The inventor has recently brought out a type-printing instru-

ment which is operated upon the principle already described.

E. *Telegraphic Transmission of Articulate Sounds.*—The most recent improvement in telegraphic methods is an apparatus invented by Prof. Alex. Graham Bell, of Salem, Mass., by which spoken words transmitted through an electric wire are made audible at the distant station. This apparatus was first publicly exhibited by Prof. Bell at the Centennial Exhibition of 1876 in Philadelphia, where it was examined and reported on by Sir William Thomson of Glasgow, chairman of the board of judges on instruments of precision. From this report we are permitted to make the following brief extracts. Sir William Thomson, after pronouncing this invention "an achievement of transcendent scientific interest," goes on to say: "Mr. Bell perceived that he must produce a variation of strength of current in the telegraph wire as nearly as may be in exact proportion to the velocity of a particle of air moved by the sound; and he invented a method of doing so—a piece of iron attached to a membrane, and thus moved to and fro in the neighborhood of an electro-magnet—which has proved perfectly successful. The battery and wire of this electro-magnet are in circuit with the telegraph wire and the wire from another electro-magnet at the receiving station. This second electro-magnet has a solid bar of iron for core, which is connected at one end by a thick disk of iron to an iron tube surrounding the coil and the bar. The free circular end of this tube constitutes one pole of the magnet, and the adjacent free end of the iron core the other. A thin circular iron disk held pressed against the end of the tube by the electro-magnetic attraction, and free to vibrate through a very small space without touching the central pole, constitutes the sounder by which the electric effect is converted into sound." This disk, pressed against the ear, conveys distinctly to the receiver the words of the sender of the message which agitate the membrane with its iron armature at the other end of the line. The reporter adds: "This, perhaps the greatest marvel hitherto achieved by the electric telegraph, has been obtained by appliances of quite a homespun and rudimentary character. With somewhat more advanced plans and more powerful apparatus we may confidently expect that Mr. Bell will give us the means of making voice and spoken words audible through the electric wire to an ear hundreds of miles distant."

F. *Submarine or Cable Telegraphy.*—Owing to the embarrassment arising from electro-static induction in long submarine cables, special arrangements have been devised by Prof. Sir William Thomson, C. F. Varley, and others without which it would scarcely be possible to transmit through them at a sufficient rate of speed to render them commercially valuable. The method employed on the Atlantic cables is a modification of Cooke's single-needle method, and is arranged as follows: Two keys, which when depressed transmit respectively positive and negative currents, are employed at the sending station in connection with a battery of a few elements only. The current of the battery does not pass directly into the cable, but into a condenser of considerable capacity composed of tin-foil plates interleaved with paraffined paper (see ELECTRICITY), the opposite side of which is attached to the cable, and the condenser transmits a wave of electricity through the cable. As there is no actual circuit from one terminus to the other, this arrangement serves to cut off the earth-currents, which would otherwise be troublesome. The receiving instrument employed is Thomson's reflecting galvanometer, which is described in ELECTRICITY, the message being read by the right and left deflections of a spot of light upon a screen, which moves to and fro as in the ordinary needle telegraph. The recording or syphon galvanometer of the same inventor writes down the deflections by means of ink spurted from a fine glass syphon-tube attached to a coil suspended between powerful fixed magnets, and which swings to the right or left as the positive or negative pulsations pass through it. The record appears upon a ribbon of paper in the form of a straight line when no signal is passing, but with waves to the right or left when pulsations pass through the coil.

G. *Pneumatic Telegraph.*—This system has been employed for many years in Europe, but has only recently been introduced in New York. Brass tubes 2½ inches in diameter are laid in trenches under the streets. The messages are rolled up and placed in a cylindrical carrier of leather or felt about 8 inches in length, closed at the front, and provided with a flange loosely fitting the inside of the tube, while the rear end is left open. The carriers are driven in one direction by compressed air, and in the other by an exhaust, both operated by a powerful air-pump at the central station. Packages of ten or twelve messages are sent a distance of half a mile in a few seconds. This method is destined to be extensively used in the larger cities, in connection with the telegraphic system, as it is more rapid, convenient, and economical for short distances than the electric telegraph. (See PNEUMATIC TRANSMISSION.)

*The Telegraphs of the Principal Countries of the World.*

| COUNTRIES. | Year. | Line, miles. | Wire, miles. | Stations. |
|---|---|---|---|---|
| Argentine Republic | 1873 | 4,146 | 8,059 | 60 |
| Australia | 1875 | 21,989 | 27,408 | 658 |
| Austro-Hungary | 1875 | 22,482 | 67,051 | 3,099 |
| Bavaria | 1875 | 4,711 | 17,329 | 874 |
| Belgium | 1875 | 3,078 | 13,962 | 586 |
| Brazil | 1875 | 3,193 | 5,284 | 87 |
| British India | 1875 | 17,203 | 36,215 | 925 |
| British Indo-European | 1873 | 3,378 | 3,414 | 10 |
| Canada | 1876 | 15,518 | 27,191 | 1,859 |
| Chili | 1873 | 2,090 | 3,143 | 52 |
| Dutch East Indies | 1873 | 2,843 | 3,458 | 51 |
| Denmark | 1875 | 1,724 | 4,745 | 203 |
| France | 1875 | 31,001 | 84,285 | 4,266 |
| German Empire | 1875 | 22,139 | 81,846 | 4,338 |
| Great Britain | 1876 | 24,091 | 119,338 | 5,337 |
| Greece | 1875 | 1,590 | 1,962 | 60 |
| Holland | 1875 | 2,133 | 7,646 | 330 |
| Italy | 1875 | 13,408 | 46,819 | 1,726 |
| Luxembourg | 1874 | 180 | 276 | 37 |
| Mexico | 1874 | 5,735 | 5,735 | 194 |
| New Zealand | 1875 | 3,154 | 7,247 | 142 |
| Norway | 1875 | 4,449 | 7,691 | 172 |
| Portugal | 1875 | 2,190 | 4,747 | 144 |
| Roumania | 1875 | 2,369 | 4,243 | 167 |
| Russian Empire | 1874 | 50,670 | 101,569 | 1,091 |
| Servia | 1874 | 906 | 1,330 | 37 |
| Spain | 1874 | 7,452 | 16,810 | 225 |
| Sweden | 1875 | 4,935 | 12,014 | 521 |
| Switzerland | 1875 | 3,927 | 9,575 | 1,002 |
| Turkey | 1875 | 15,644 | 30,163 | 444 |
| United States | 1875 | 88,821 | 214,085 | 8,498 |
| Würtemberg | 1875 | 1,538 | 3,867 | 338 |
| Totals | ..... | 388,687 | 978,507 | 37,533 |

The number of ocean cables laid between 1850 and the close of 1875 was 206, representing a total length of 50,716 miles. Of these, 61 have been discontinued and 145 are now in operation. The longest cable is from Brest to St. Pierre, 2584 miles. Eleven other cables are projected, the total length of which will be 17,144 miles. Nearly all these lines have been laid by English companies.

*Literature.—American: The American Electro-Magnetic Telegraph*, Alfred Vail (Philadelphia, 1845); *The Electro-Magnetic Telegraph*, L. Turnbull (Philadelphia, 1853); *The Telegraph Manual*, T. P. Shaffner (New York, 1859); *History, Theory, and Practice of the Electric Telegraph*, G. B. Prescott (Boston, 1865); *Modern Practice of the Electric Telegraph*, F. L. Pope (4th ed., New York, 1871); *Handbook of Electrical Diagrams and Connections*, Davis and Rae (New York, 1876); *Electricity and the Electric Telegraph*, G. B. Prescott (New York, 1877). Also the following periodicals: *The Telegrapher*, weekly (New York); *Journal of the Telegraph*, semi-monthly (New York). *English: Handbook of Practical Telegraphy*, R. S. Culley (6th ed., London, 1874); *History and Progress of Electric Telegraph*, R. Sabine (2d ed., London and New York, 1869); *The Electric Telegraph*, Dr. Lardner, revised by E. B. Bright (London, 1867); *Manual of Telegraphic Construction*, J. C. Douglas (London, 1875); *Telegraphy*, W. H. Preece and J. Sivewright (London, 1876). Also the following periodicals: *Telegraphic Journal*, semi-monthly (London); *Journal of the Society of Telegraphic Engineers*, quarterly (London). *German: Der elektromagnetische Telegraph*, Dr. H. Schellen (5th ed., Brunswick, 1870); *Der Telegraphenbau*, L. F. W. Rother (4th ed., Berlin, 1876); *Die Copirtelegraphen, die Typendrucktelegraphen und die Doppeltelegraphie*, K. E. Zetzsche (Leipsic, 1865); *Handbuch der elektrischen Telegraphie*, K. E. Zetzsche (Berlin, 1876). *French: Télégraphie électrique*, J. Gavarret (Paris, 1861); *Traité de Télégraphie électrique*, Th. du Moncel (Paris, 1864); *Noveau Traité de Télégraphie électrique*, E. E. Blavier (Paris, 1865); *Les Systèmes télégraphiques*, C. Bontemps (Paris, 1876); *Exposé des Applications de l'Électricite*, Th. du Moncel (Paris, 1859–62; same, new ed., Paris, 1874–76). Periodicals: *Annales télégraphiques*, bi-monthly (Paris); *Journal télégraphique*, monthly (Berne). (See also ELECTRICITY.)

FRANK L. POPE.

**Telegraph, Pneumatic.** See PNEUMATIC TRANSMISSION.

**Telem'achus,** son of Odysseus and Penelope, was an infant when his father joined in the war against Troy. After the termination of the war, he sailed out, accompanied by Athena in the shape of Mentor, and visited Pylos, Sparta, and other places, where he expected to gather some information concerning the fate of his father; and on his return to Ithaca he found Odysseus living there in disguise with the swineherd Eumæus. A recognition took place, and he then aided Odysseus in slaying the suitors and clearing the house of its many burdensome guests, who ate up its wealth without bringing it any honor. His voyage forms the subject of Fénelon's epic, *Télémaque*, once so celebrated.

**Teleoceph'ali** [τέλειος, "perfect," and κεφαλή, "head"], the principal order of fishes. The diagnostic common characters are as follows: The skeleton is more or less ossified; the skull well developed, and its elements numerous; the cranial bones are as follows: of cartilage bones, basioccipital, exoccipital, supraoccipital, basisphenoid, alisphenoid, opisthotic, proötic, postfrontal, and prefrontal; of membrane bones, parietals, frontals, nasals, vomer, parasphenoid, supraorbitals, intermaxillaries, and supramaxillaries; the suspensory arch of the lower jaw has a well-developed quadrate bone, with which, on the one hand, is articulated the pterygo-palatine arch, consisting, generally, of the ectopterygoid, entopterygoid, mesopterygoid, and palatine bones, and, on the other, the hyomandibular and symplectic; the branchihyal apparatus consists of a median series of bones (glossohyal, basihyal, ceratohyal, epihyal, and stylohyal), with the posterior of which are connected four branchial arches and a modified pharyngeal arch, and with the anterior the branchiostegal arches, bearing, generally, three or more (most generally six or seven) rays on each side; the lower jaw is composed of a dentary, and, behind, of an articular, angular, and surangular; the scapular arch has an undivided proscapula (to the inner side of which are apposed at least a hypercoracoid and hypocoracoid), and is connected with the cranium by postero-temporal and post-temporal bones; the brain is differentiated, according to the current nomenclature, into (1) a cerebral part, consisting of cerebral hemispheres and optic lobes, and, in front, small olfactory lobes; and (2) a cerebellar part, cerebellum, which is moderately developed, covered, and simple. The sub-orders are Gymnonoti, Eventognathi, Isospondyli, Haplomi, Synentognathi, Percesoces, Acanthopterygii, Jugulares, and Heterosomata. THEODORE GILL.

**Teleol'ogy** [Gr. τέλος, "an end as far as accomplished"], the doctrine of final ends involved in and revealed by the phenomena of nature and history. On this doctrine is based the teleological or physico-theological argument on the existence of God. (See GOD.)

**Teleos'tomi** [Gr. τέλειος, "perfect," and στόμα, "mouth"], the name applied to the combination of teleostean and ganoid fishes, and which is equivalent to the class of fishes as here understood. It was originated by R. Owen in 1866, and refers to the fact that the upper arch of the mouth is formed by maxillary (intermaxillary, as well as, generally, supramaxillary) bones, or, in the words of Owen, "the mouth [is] formed by upper and lower jaws opening at the fore part of the head, and admitting the respiratory currents." (Owen, *Anatomy of Vertebrates*, vol. i. p. 8.) (See FISH.) THEODORE GILL.

**Te'leosts** [from τέλειος, "perfect," and ὀστέον, "bone"], the name of that sub-class of fishes which embraces the great majority of living species, and so designated (by Johannes Müller) on account of the ossified condition of the skeleton in all the representatives of the group. (See FISH and FOSSIL FISHES.) THEODORE GILL.

**Telescope.** See APPENDIX.

**Tel'fair,** county of S. Georgia, between Ockmulgee and Little Ockmulgee rivers, and intersected in its northern part by Macon and Brunswick R. R.; surface level, soil sandy, with extensive pine forests. Staples, sawed lumber, live-stock, wool, Indian corn, sweet potatoes, and a little cotton. Cap. McRae. Area, 925 sq. m. P. 3245.

**Telfair** (EDWARD), b. in Scotland in 1735; educated at Kirkcudbright grammar school; settled in Virginia in mercantile pursuits 1758; subsequently removed to Halifax, N. C., and to Savannah, Ga.; was prominent in the political struggles before and during the Revolution; sat in the Continental Congress 1778 and 1780–83; was a commissioner to negotiate a treaty of peace with the Cherokees 1783, and governor of Georgia 1786 and 1790–93. D. at Savannah Sept. 17, 1807.—His son THOMAS, b. about 1780, graduated at Princeton 1805; was member of Congress 1813–17. D. at Savannah in Apr., 1818.

**Tel'ford** (THOMAS), b. at Westerkirk, Dumfriesshire, Scotland, Aug. 9, 1757; became a stone-mason, studying architecture and drawing; went to London 1783, and was architect in the Portsmouth dockyard; in 1787 removed to Shrewsbury, where he was engaged upon the alterations in the old castle and in the construction of several bridges, and was appointed surveyor of the county of Salop, a position which he held until his death. His first great engineering work was the construction of the Ellesmere Canal, 103 miles long, which was commenced in 1793 and completed in ten years. In 1803 he was entrusted with the construction of the Caledonian ship-canal, connecting the Atlantic Ocean with the North Sea, a distance of 61½ miles, of which 23 is artificial navigation; it is 120 feet broad at the top, 50 at the bottom, and 17 deep, the highest part being 94 feet above the sea-level, the ascent and descent being accomplished by locks of a size surpassing any heretofore attempted. This was completed in 1823. Besides other works, as engineer to the commissioners of Highland roads and bridges he built about 1000 miles of road in Scotland, upon which are more than 1200 bridges; he constructed eight canals in Great Britain, the Gotha Canal in Sweden, and, above all, the beautiful suspension railway bridge over the Menai Strait. He had a turn for literature; before he left his native district wrote several very creditable poems in the Scottish dialect, taught himself Latin, Italian, French, and German, contributed valuable papers to the *Edinburgh Encyclopædia*, and left *The Life of Thomas Telford, Civil Engineer, written by himself*, published in 1838. D. at Westminster Sept. 2, 1834.

**Tell,** tp., Huntingdon co., Pa. P. 1024.

**Tell** (WILLIAM), according to Swiss legends, a celebrated marksman with the bow, living as a hunter at Bürgelen in the canton of Uri, and a member of the conspiracy which was formed against Austria at Grütli Nov. 7, 1307, by Walter Fürst of Uri, his father-in-law, Werner Stauffacher of Schwytz, and Arnold von Melchthal of Unterwalden, and which finally succeeded in freeing the country from the foreign yoke. At this time Gessler, the Austrian bailiff in Küssnacht, raised a cap on a pole in the market-place of Altorf, and ordered all passers-by to bow to the cap in token of submission. Tell refused, and was condemned to death, but pardoned on condition that he should shoot an apple from the head of his son. He ventured the shot, and succeeded, but Gessler noticed that he had put two arrows in his quiver, and asked why he had done so; and when Tell answered that if he had hit his son with the one he would have hit the bailiff with the other, he was again put in chains and taken on board the bailiff's boat to be brought to Küssnacht. While crossing the lake, the boat was overtaken by a fearful storm, and Tell was unchained in order to steer it, but at a certain point, known as "Tell's Leap," he jumped ashore, lay in ambush in a defile through which Gessler had to pass on his way to Küssnacht, and shot him; which deed became the occasion of a general rising in the cantons. Of this story about Gessler, Tell, Stauffacher, etc., the oldest Swiss chroniclers, Johannes of Winterthur, Justinger of Berne, and Hemmerlin of Zurich, know nothing. The first mention of these names and incidents is made in the latter part of the fifteenth century by *Das weisse Buch*, and a complete narrative does not occur until the middle of the sixteenth century in the *Chronicon Helveticum* by Ægidias Tschudi. The monuments erected in various places in honor of Tell are of a much later date. These circumstances early made the story of William Tell somewhat suspected, though as a general rule it was considered as real history; even Johannes von Müller accepted it. Later critics, however, have proved that the whole story is nothing but a legend, common among the nations of the Aryan race, found with all its principal features in the Persian poet Ferid ed-Din Attar, the Icelandic *Vilkinasaga*, the Danish historian Saxo Grammaticus, the English popular song on William of Cloudesly, etc., and only modified to suit Swiss circumstances. (See Ideler, *Die Sage vom Schusse des Tells* (1836); Haüsser, *Die Sage vom Tell* (1840); Hisely, *Recherches critiques sur l'Histoire de Guillaume Tell* (1843); Huber, *Die Waldstädte Uri, Schwyz und Unterwalden bis zur festen Begründung ihrer Eidgenossenschaft* (1861); Vischer, *Die Sage von der Befreiung der Waldstädte* (1867).

**Tell City,** p.-v., Perry co., Ind., on Ohio River, 75 miles above Evansville, was settled by a Swiss colonization society in 1858, and contains 3 churches, excellent public schools, 2 newspapers, 1 national and 1 private bank, 2 flouring-mills, 4 large furniture-factories, 1 chair and plough manufactory, foundry and machine-shop, 2 breweries, 1 woollen-mill, 2 distilleries, saw and shingle mills, 4 hotels, Masonic, Odd Fellow, and Druid lodges, and cigar-factories. Principal business, manufacturing. P. 1660. WM. P. KNIGHT, ED. "COMMERCIAL."

**Tellez'** (BALTHAZAR), b. at Lisbon, Portugal, in 1595; entered the order of Jesuits 1610; pursued for ten years a critical study of literature, philosophy, and theology, of which branches he was for forty years a professor in the Jesuit colleges at Braga, Evora, Coimbra, and Lisbon; became master of the house of professed Jesuits at Lisbon, and ultimately provincial of his order in Portugal. D. at Lisbon Apr. 19, 1675. Author of *Summa Universæ Philosophiæ, cum Quæstionibus quæ inter Philosophos agitantur* (1642), *Chronica da Companhia de Jesus da Provincia de Portugal* (2 vols., Lisbon, 1645–48), and *Historia Geral de Ethiopia a Alta* (Coimbra, 1660), the latter work being still the most copious and exact description of Abyssinia.

**Tellez** (GABRIEL), better known by his *nom-de-plume* of TIRSO DE MOLINA, b. at Madrid, Spain, about 1585; was educated at the University of Alcalá de Henares; took orders in the Church 1613; became a monk of the order of

Nuestra Señora de la Merced 1620; was chosen chronicler of his order, inspector of the convents in Old Castile, and prior of the convent of Soria, where he d. in 1648. Next to Lope de Vega and Calderon, he was the most prolific and successful Spanish dramatist. He stated that he had written over 300 comedies, but only 51 remain, many having been destroyed by the author and some suppressed by the Inquisition on account of their indelicacy. Among his comedies are *Prudencia en la Mujer*, *La Mujer que mansla en Casa*, *Escarmientos para el cuerdo*, *El condenado por desconfiado*, *No hay peor sordo que el que no quiere oir*, and *El Burlador de Sevilla, ó el Convidado de Piedra*. The latter piece was imitated by Molière, and is the original of the numerous *Don Juans* of modern literature. A selection of 36 of his best comedies was edited by J. E. Hartzenbusch (12 vols., 1839–42; new ed., 1 vol., 1850).

**Tellicher'ry,** town of British India, presidency of Madras, is picturesquely situated on the open sea in a beautiful, fertile, and well-cultivated district, rich in spices, rice, and cocoanut palms. It enjoys a healthy climate, has a good harbor and a fort, and carries on a considerable trade, exporting spices and sandal-wood. P. 20,000.

**Tel'lurides** [Lat. *tellus*, "earth"], compounds of the amphigen element tellurium with other metals. They constitute chiefly the native mineral compounds of tellurium.

*Telluride of bismuth* is the mineral *tetradymite*, which, as found in gold-mines in Virginia and Georgia, has the composition, according to Genth, of pure telluride of bismuth, $Bi_2Te_3$, while that from the Uncle Sam lode in Montana is $Bi_4Te_5S$. Other Montana tetradymites, however, from placer gold, were found by Genth to be free from sulphur. Genth discovered with these latter tetradymites, and also in Davidson co., N. C., a new mineral which he called *montanite*, a *tellurate of bismuth*, $Bi_2O_3.TeO_3.2H_2O$. Tetradymite is a steel-gray mineral, inflexible folia or laminæ like graphite, soft and marking paper like the latter, hexagonal in form. It may be distinguished from graphite by roasting in a glass tube open at both ends, when a white sublimate of tellurous oxide will appear, fusible to transparent, colorless droplets. It is also fusible and combustible before the blowpipe, tinging the flame bluish-green. For tetradymite free from sulphur the writer's geometric law of volumes (*Am. Chemist*, Mar., 1876) indicates the zero densities for different modifications, 7.641 (Balch, from Dahlonega, Ga., 7.642) and 7.877 (Jackson, from Dahlonega, 7.868), with others not yet definitely identified in nature.

*Telluride of Lead.*—This constitutes the rare mineral *altaite*, a white metallic sectile mineral, sometimes in cubical crystals, like galena, the corresponding sulphide. It is PbTe. It is found in the Altai Mountains, and Genth discovered two years since two American localities—one in Colorado, at the Red Cloud mine, and the other in North Carolina, at the King's Mountain gold-mine in Gaston co.

*Telluride of Silver.*—The rare mineral *hessite*, $Ag_2Te$. Metallic, iron-gray, and sectile; in crystallization right rhombic. Usually contains some gold in its composition. Found in the Altai Mountains, also at several Hungarian localities, and at the Stanislaus mine in Calaveras co., Cal. Genth has also recognized it in small quantity from the Red Cloud mine, Col.

*Telluride of Gold and Silver—Petzite.*—Found at Nagy-Ag in Transylvania, and also by Genth among the ores of the Red Cloud mine. Genth's analyses indicated 24 and 25 per cent. of gold in the composition of the Colorado petzite. It is scarcely to be distinguished in appearance or character from hessite without analysis. The auriferous mineral is, however, somewhat lighter in color and more brittle. It is right rhombic, like hessite.

*Tellurides of Gold—Sylvanite*—which, however, always contains also some silver (12 to 13 per cent. at the Red Cloud mine).—It is monoclinic, steel-gray or silver-white, and varies in composition and density within quite wide limits, containing from 23 to 30 per cent. of gold. It was found only at two Transylvanian localities in Europe, Nagy-Ag and Offenbanya, and Genth states that it was unknown in America until Prof. Silliman found it at the Red Cloud mine; but Dana gives also the Melones and Stanislaus mines in Calaveras co., Cal., as localities. Genth, however, has announced a *new* telluride of gold, *calaverite*, from the Stanislaus mine, having the composition $AuTe_4$, with about 41 per cent. of gold. Its color is bronze yellow, and its streak yellowish-gray. It is brittle, and not crystalline.

HENRY WURTZ.

**Tellu'rium** [Lat. *tellus*, "earth"], an element of matter belonging to the rarer elements, though contained in certain minerals which are of rather abundant occurrence in some very limited districts of the earth. Von Reichenstein proved its existence in such minerals in 1782. Klaproth confirmed this in 1798, and gave the element its name. Berzelius and Wöhler have been the most eminent investigators of tellurium and its compounds. It occurs native in elementary form, generally associated with native gold or telluride of gold, the *sylvanite* of Kirwan, named from Transylvania (in which, at the Maria Loretto mine, was the first known locality). Within a few years our eminent American chemist and mineralogist, Prof. B. Silliman, discovered tellurium minerals, including native tellurium, in Boulder co., Col., notably at the Red Cloud mine, near Gold Hill. (*American Journal of Science* [3], viii. 25.) Tellurium minerals have long been known to occur at several points throughout the auriferous region of Virginia, North and South Carolina, and Georgia. A very notable new locality is the Uncle Sam lode, in Highland district, Mont. It has also been found with gold at the Montgomery mine, Hassayampa district, Ara. The occurrence of tellurium in considerable abundance at so many new localities on this continent has given this element an American interest, and our eminent chemist, Dr. Genth of Philadelphia, has given much time and labor to the investigation of these American tellurium minerals. (See TELLURIDES.) Tellurium exists in the star Aldebaran and in others.

*Preparation.*—Tellurium is obtained in elemental form from any of the native tellurides by first fusing with black flux at a white heat, then boiling in water, which gives a port-wine-colored solution of telluride of the alkali-metal; which solution on exposure to the air, or more quickly by passing air through it, precipitates tellurium in metallic scales. The mineral *nagyagite*, which is telluride of gold, may also be made to yield pure tellurium by first boiling with muriatic acid till all lead and antimony are removed, and then dissolving in hot nitric acid, which gives a solution of tellurous acid, $O_3H_2Te$, which is then readily decomposed by a current of sulphurous oxide gas, $SO_2$.

*Nature, Properties, and Relations.*—Tellurium is a white, brittle, lustrous metal, highly crystalline in structure, the crystals being hexagonal. Though so metallic in appearance, it does not conduct electricity or heat very readily. Its fusing-point is placed at 932° F., about a red heat, and above this temperature it volatilizes to a vapor which has the greenish-yellow color of chlorine gas, and has a density about nine times that of air. When tellurium is strongly heated, it takes fire and burns with a strong flame of a blue color with green edges, and a smoke of tellurous oxide. Tellurium belongs to what Berzelius called the amphigen group of elements, including SELENIUM (which see) and sulphur. Most chemists also include oxygen, but this exceptional element certainly presents relations ranging it with the amphigens much fewer in number than those which separate it widely therefrom. The parallelism of tellurium with sulphur in its compounds is very complete. For the atomic weight of tellurium the number 128, four times that of sulphur, is accepted, as determined by Berzelius. The *densities* of the element on record indicate at least three allotropic modifications. The new geometric law of volumic condensation (*Am. Chemist*, Mar., 1876) of the writer indicates for two of these the densities at zero 6.149 (Klaproth found 6.115) and 6.262 (Berzelius found about 6.25). A denser one, = 6.339, was approached by Von Reichenstein. The allotropic changes of tellurium, however, unlike those of SULPHUR and SELENIUM (which see), have not yet been looked into at all by chemists.

Tellurium itself and tellurium compounds, when heated before the blowpipe, burn with an odor which is likened by some to that of rotten horseradish, and which is so characteristic as to be readily recognized by those familiar with it. Its soluble compounds are regarded as very poisonous, particularly those obtained by substitution in organic compounds. When it has been taken into the system, even in the minutest quantity, it remains there for a long time, and communicates to the breath and perspiration a peculiar fetid odor very disagreeable to others. This has happened to chemists who have attempted to investigate the tellurium compounds, and the effect found to endure for many weeks, and to impose upon them an isolation from mankind.

Tellurium forms many classes of compounds—two *oxides*, $TeO_2$ and $TeO_3$, each of which forms an acid with water and salts with bases; two chlorides, $TeCl_2$ and $TeCl_4$, the first black, amorphous, and fusible, the last liquid, transparent, and yellow when hot, but solidifying to a white mass; a gaseous compound with hydrogen, $H_2Te$, similar to sulphuretted hydrogen, $H_2S$; and others, for which the chemical textbooks must be consulted.

HENRY WURTZ.

**Temacula,** p.-v. and tp., San Diego co., Cal. P. 140.

**Temascaltepec',** town of the Mexican confederation, state of Mexico, is beautifully situated, and has 500 inhabitants, mostly engaged in the manufacture of coarse cotton stuffs. Its former rich mines are now exhausted.

**Temesvar',** town of Southern Hungary, is surrounded with walls and strongly fortified. It is well built, with

broad and straight streets lined with substantial houses; has some manufactures of leather, silks, and linen fabrics, and an extensive transit trade in corn and wine. P. 32,754.

**Temis'caming Lake** is on the boundary between the provinces of Ottawa and Quebec, Canada. It is 30 miles long and 15 broad, and is in lat. 47° 30′ N., lon. 80° W. Its waters flow into Ottawa River.

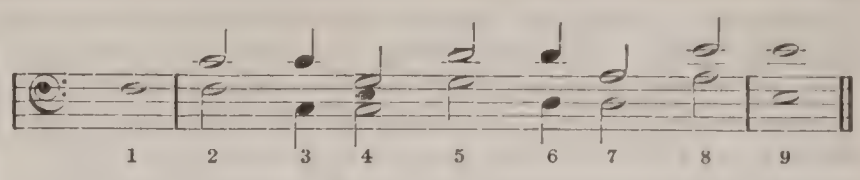
**Temiscoua'ta,** county of Quebec, Canada, bounded N. W. by the river St. Lawrence and S. E. by Maine and New Brunswick. It contains much fertile soil, but is in large part a wilderness, resorted to for its fine scenery and excellent fishing. It is traversed by Grand Trunk Railway. Cap. Isle Verte. P. 22,491.

**Temiscouata Lake,** in Temiscouata co., province of Quebec, Canada, is 130 miles E. N. E. of Quebec. It is very beautiful. Length, 22 miles; breadth, from 1 to 2½ miles. Its waters are discharged by Madawaska River.

**Tem'pe,** a valley, or rather a gorge, in North-eastern Thessaly, Greece, 5 miles long, and in some places so narrow that between the high cliffs which rise almost perpendicularly on both sides there is space only for the river Peneus, which traverses the valley, and a carriage-road. In antiquity it was very celebrated for the beauty of its scenery. It was strongly fortified at several points, and ruins are still visible of these fortifications.

**Tem'perament** [Lat. *temperamentum*]. In music, this term relates to a certain adjustment or regulation of the sounds or intervals of the scale, with the view of removing an apparent imperfection, and fitting the scale for use in all keys without offence to the ear. The musical scale now in use is a compromise, or a scale in which most of the intervals are not mathematically correct, or true to the scale of nature as deduced from the Monochord (which see), but are slightly modified by elevation or depression, a process absolutely necessary to meet the various exigencies of modern music. This modifying or nice adjustment of the sounds of the scale is the office of *temperament;* and in tuning an organ or pianoforte the first thing done is the "fixing of the temperament" by adjusting with great care a single octave in the middle of the keyboard as a pattern from which all the other pipes or strings, above or below, are to be tuned by octaves, double octaves, etc. On this subject of temperament many entire works have been written by learned musicians; and it will be obvious that in this article we shall only have space to show very briefly why temperament is necessary, and how it is effected.

It has been found by those who are conversant with the accurate measurement of intervals that though the perfect octave *seems* to be divisible into six major tones, as C—D, D—E, E—F♯, F♯—G♯, A♭—B♭, and B♭—C, yet these, when added together, are really somewhat *more* than an octave. And again, though the octave seems divisible into three major thirds, as C—E, E—G♯, and A♭—C, yet by strict measurement these three thirds prove to be *less* than the octave in extent. This is illustrated in the following manner by E. J. Hopkins, Esq., of the Temple church, London, in his work on *The Organ:* "Supposing the perfect octave to be divided into 3010 equal parts, the interval of a major tone would contain 511 of those parts. But if we multiply 511 by 6, we have 3066, instead of 3010, plus 56 parts; so that the octave contains *less* than 6 major tones by 56 parts. A major third also would contain 969 parts, which multiplied by 3 would make 2907, instead of 3010, minus 103 parts; the octave in this case containing 103 parts *more* than the three major thirds." Now, to distribute or get rid of this excess or shortcoming we have no resource but temperament—*i. e.* the modifying of several of the intervals by very slightly raising or lowering them, so as to extend or contract their whole sum to the exact limits of the octave. In the practice of tuning, this apparent irregularity or imperfection of the scale is usually treated as an *overplus*, which must be disposed of by some method which shall not so affect any interval of the scale as to make it offensive to the ear. Hence, several modes of doing this have been devised, and these are commonly classed under the heads of *equal* and *unequal* temperament, of which we shall speak presently. To set the case in a very simple light, let us undertake to tune, *without* temperament, the following series of fifths, and then observe the result: At 1, in the example below, tune F to its proper pitch by tuning-fork or otherwise; at 2, tune C a perfect fifth above the F; at 3, tune the lower C a perfect octave (simply to keep the exercise within bounds); at 4, tune G a perfect fifth above C, and also tune the E between as a major third from C, thus forming the major triad; at 5, tune D a perfect fifth above G; at 6, tune the lower D for convenience; at 7, tune A a perfect fifth above D, and at 8, tune E a perfect fifth above A:




Let this upper E, at 9, now be tried as octave of the E previously tuned at 4, and it will be found entirely *too sharp* to be endured even by the ordinary ear. Though we have tuned no more than five successive fifths, yet we discover that an overplus has been accumulating which makes the upper term of the last of these fifths quite unfit for use as octave of the first E. The only remedy for this lies in temperament. We therefore begin again, and make every fifth a little flatter than perfect, repeating the process, if necessary, till the difficulty is removed. In this manner the superfluity is distributed among the five fifths, and the upper E is so reduced as to be now the perfect octave of the E at 4. The same thing will occur if we commence another series of fifths on A, or by the reverse process of tuning *downward,* as from F to B♭, etc. And it is by pursuing this course till every degree of the chromatic scale has come under treatment that the temperament is said to be "fixed," or the aberrations of the several intervals corrected. In regard to the apportionment of temperament among the different intervals of the scale, it is to be observed that the unison and octave, on account of the simplicity of their ratios, 1—1 and 1—2, cannot bear to be tempered at all, as the slightest change would render them offensive to the ear. The fifth and fourth, being less simple (2—3 and 3—4), may be slightly tempered without producing any disagreeable effect; and the major or minor third may admit of a change quite equal to a comma, or 1—80th of a tone, sharper or flatter, which is as large an extent of temperament as is commonly required.

In the above example and its explanation we have proceeded on the ground that all the fifths were tempered in *like degree.* But the excess spoken of may also be distributed among them *unequally,* or one or two of the fifths may remain perfect, and the whole burden of the temperament be laid on the others. In the former case the temperament is called *equal,* and in the latter *unequal.* From this it will be readily understood that on an instrument *unequally* tempered some of the intervals will be smooth and agreeable, while others will be harsh and almost intolerable. In old church organs this temperament was in general use. Music formerly was written in very few keys, and modulations were seldom carried into remote scales. It was customary, therefore, in tuning instruments, to make the keys that were in common use as perfect as possible, at the expense of the other keys, on which all the roughness of the temperament was concentrated. Under the requirements of modern music, with the whole circle of the keys in common use, this unequal temperament has become obsolete, except in such cases as the accompaniment of oratorios, etc., by the organ in combination with orchestral instruments. The advantages of unequal temperament are the greater brilliance imparted to certain keys, and the better preservation of those qualities which distinguish one key from another. The disadvantage is, that keys with more than three sharps or flats are too harsh and discordant to be of practical service. The *equal* temperament now in general use is a necessity of modern music. In this temperament the excess or deficiency above noted is distributed among *all* the keys, thereby rendering them all available for use, and enabling the composer to present harmonious combinations in the remotest keys without any disagreeable effect. There are, however, several shades or degrees of equal temperament, from the strictest uniformity to any amount of inequality which is still bearable. If all keys were made exactly *alike,* there would be an undesirable loss of their individual character, and no difference perceptible except in their degree of acuteness. To avoid this, some discrimination is commonly used in favor of certain popular keys, yet not to such an extent as sensibly to injure the effect of keys less favored. A difference is recognized at once between the major keys of D and A♭, even though the instrument in use is said to be equally tempered. Some discrimination, therefore, has been exercised by the tuner; and sometimes the key which bears the greatest stress of imperfection is that which most attracts us by its beauty. It will be apparent, from what has now been stated, that by temperament all fifths on the keyboard of the organ and pianoforte are reduced below the perfect standard. There are no *absolutely perfect* fifths on such instruments; and yet the ear so readily accustoms itself to these slight changes that they are not even suspected, much less distinctly felt, by the ordinary hearer. The perfect fifths made by two open violin-strings have no counterpart on the instruments just named, but the discrepancy is so small that it invariably escapes notice except by the critical ear. In musical theory and in treatises

on harmony a tempered interval does not differ by name from an untempered one. Thus, the fifth C—G, though reduced by temperament, is still called and assumed to be a "perfect fifth;" and all terms indicating chords, combinations, and progressions remain unaffected by any influence from temperament. WILLIAM STAUNTON.

**Temperament, Physical,** once a most important consideration in physiology and symptomatology. Temperament, or crasis, denotes a mixture or tempering of essential elements of the body, whose excess or variable quantity determines the chief characteristics of mind and physique. In remote ages these elements were heat, cold, dryness, and moisture, viewed as entities. Later, Hippocrates regarded the circulating fluids of the body as constituted of four subordinate fluids—blood, phlegm, yellow bile, and atrabilis or black bile. Upon this basis a hypothetical division of temperaments arose. Persons of full habit, muscular, vigorous, plethoric, and florid, with active circulation and high body heat, were classed as of sanguineous temperament. Persons less developed, cool-blooded, light-complexioned, and less vigorous were assumed to have an excess of phlegm, and classed as of the phlegmatic temperament. Dark complexion, sluggish circulation, stolidity, or irascibility were classed as of choleric temperament; the melancholic temperament was ascribed to black bile. It is true that whole races have a prevailing temperament quite opposite to that predominating among other and even adjacent races. The English are sanguineous, the Scotch phlegmatic. With corrected views of physiology we have a corrected division of the temperaments, no longer an arbitrary classification, but indicative of the fulness of habit and relative activity of the nutritive functions and cerebro-spinal activity. Thus, sanguineous, nervous, nervo-sanguineous, and sanguineo-nervous, lymphatic, and phlegmatic are the terms now employed. The English are peculiarly sanguineous as compared with the French and Italians, who are of nervous temperament. The American is regarded as sanguineo-nervous. The lymphatic temperament includes the large mass of light-haired, light-complexioned, thin-skinned persons, among whom derangements of the lymphatics are frequent, and scrofula, struma, and tuberculosis are most liable to develop. Temperament may thus be an entity in the individual, the inheritance of his nationality or ancestry. But many so-called temperaments, as the bilious, melancholic, and lymphatic, are merely departures from health, the result of imperfect growth, bad nutrition, incorrect habits, and inactive functions of the body, and may be modified or removed by corrected habits, regimen, or medical treatment.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Temperaments, Human.** See APPENDIX.

**Tem'perance** [Lat. *temperantia*]. There cannot be a doubt that temperance in the use of all alcoholic drinks is more common now, among the more educated and refined classes in the community, than it was a century ago. At that time all classes indulged often to excess, and without a thought of the impropriety of so doing. The disgusting stories of what happened without rebuke from public opinion in Europe or America are not myths. Some of the worst of them, which would not now be tolerated in any decent society, were then generally considered as mere practical jokes. But such facts could not long occur in any reasonable community without exciting decided opposition from the more thoughtful members of it. The evils arising therefrom were too patent. Hence arose temperance societies, so called—societies of men and women pledged to promote *temperance* in the use of intoxicating drinks, *not total abstinence*, as now inculcated by many. After some years their efforts seemed weak and success impossible to the more earnest advocates. Hence have arisen various movements, all having the same general object, but some of these measures border upon, if they do not reach, the limits of fanaticism and intolerance. Between thirty and forty years ago the so-called Washingtonian movement began in Baltimore. This for a season aroused the whole people, and was the means of exciting a deep interest in the subject. It may be styled the confessional phase of the temperance movement. The pioneers and chief workers in it pleaded the cause of temperance by minutely detailing at public meetings their own erratic courses. Every drunkard became for the time being a most effective apostle, not only of temperance, but of total abstinence. But this movement did not last long, because (1) some of these apostles became backsliders; and (2) because after a time the community became nauseated with the disgusting revelations made by some of the speakers. Total abstinence was an essential article of faith for every Washingtonian. For him, certainly, that rule was supreme, and admitted by all to be absolutely necessary. Following these, have arisen societies which declare that the taking of stimulants in any amount, by *any* person, is unnecessary, and virtually a crime against society, a sin *per se*. Everybody should forego the use of all liquors because some become drunkards. This result was quite a logical and practical one for the Washingtonians. It was vital to them; a drop of liquor, if allowed to touch any of their lips, aroused all the old fires, and they were lost. But it was by no means an equally logical conclusion when applied to the whole public, as the "Prohibitionists" for many years have been trying to do. The old temperance societies opposed this idea, but either failed of meeting it or were finally subdued by it. Licenses, which had been previously given by the state, were deemed wrong in principle as licensing a crime. Hence, for thirty years or more the questions of *prohibition* and *license* have been the watchwords of bitterly-opposing partisans. Moral suasion nowadays is voted weak; Washingtonianism is not to be found. At the risk of being sustained by neither of these contending parties, but in the hope of, in some degree, meeting the views of the large body of spectators of this conflict, we propose to examine these two systems of promoting temperance.

Alcohol has been proved to be at times a food of immense value to man; without it, men and women would at times die. In order, however, to be thus valuable to mankind, it must be used legitimately and under proper safeguards. On the contrary, if used on improper occasions or too frequently or too freely, it ruins man and injures society to its very depths. These two propositions are strictly, scientifically, true. It would seem as if none but bigots of either of the contending parties could deny them. Hence it follows that we ought, under the varying circumstances of life, to take one or the other position of favoring or of opposing either license or prohibition in our dealings, practically, with the question of temperance. It has been proved by correspondents living in various and widely-separated portions of the earth's surface that a tendency to use stimulants exists among all people. From the savage to the most highly-civilized race of men there is no one of them that has not this instinct; and with the instinct naturally arises the tendency to excess in the indulgence of it. But the desire for this gratification appears to vary much according to a cosmic law of heat and climate. The isothermal lines which limit the growth of the grape N. and S. of the equator seem to divide the northern and southern hemispheres into three tolerably well-marked zones—namely, (1) the tropical, (2) the temperate or grape-growing, and (3) the northern or colder. In the first drunkenness is almost unknown, and it is deemed disgraceful, while lusts of other kinds, which are rare at the N., have full sway, unopposed by public opinion. In the second region milder drinks, such as native grape wines, mild beers, and ales, are used, perhaps in very large quantities, producing, when drunkenness follows, a milder and more jovial, less offensive, less destructive type of it than is observed in the more northern regions. In the third zone man drinks less in amount, perhaps, but it is of a more potent, fiery liquor. It makes him brutal and beastly, and frequently he becomes destructive of persons and of property. If this be so—and such seems to be the fact—it is plain that prohibition in the first zone would scarcely be thought of; in the second some enthusiast might possibly suggest it; in the third it is a most natural occurrence. Parties there would inevitably arise prepared to stop the whole traffic in liquor, because of its vile influence on man; and the violence of these parties would be just in proportion to the enormity of the evil sought to be eradicated. Surely, any reasonable plan which proposes to prevent a man from degrading and making a tiger of himself in his intercourse with others should be sustained.

Another great influence—viz. that of race, with its centuries perhaps of education, of certain habits—should always be taken into consideration in judging of this question. Undoubtedly, the Englishman carries his gross habits of drinking everywhere, even into the warmest region, but he soon finds, to his cost, that habits which were not obviously pernicious in England cannot be carried out with impunity in his more tropical abode. So other races carry their peculiar habits.

From these various considerations it seems to many people that the state, as a guardian of the public health, is bound to use its great powers to restrain its citizens by actual prohibition from the use of every alcoholic stimulus, or to allow the use of them under more or less restriction to all, provided that in so doing it does not interfere with the inherent right of the individual to use any food or drink he may prefer without injury to himself or others. In deciding these delicate questions the community may be divided into childhood and manhood. This is already done on the subject of voting and on many others. Only at certain ages does the male in the eyes of the law become a man, and the female a woman. For the former of these

classes—*i. e.* for all persons under the age of legal manhood—the prohibition of the use of liquors or a most restricted license should be inaugurated, and as far as possible thoroughly carried out. For the very young, statute law would be rarely needed if the parental authority were duly exercised. The strict rule in all families should be—no liquid stronger than milk should be allowed the youngest, and weak tea and coffee only for the elder children. The custom in some families, more common formerly than now, of allowing children to sip wine at their father's table is fraught with dangers of the most deadly kind for the future well-being of the man and of society. Statute law should provide still further for the correct guidance of the youthful years of the future citizen, and the giving or selling of liquor to a minor should be prohibited under the severest penalties. When the state appreciates its high prerogative of contributing to the best education of every citizen, then the selling or giving of liquor to a minor will be deemed one of the most heinous of crimes. After the youth arrives at manhood or womanhood—viz. at the age at which even by statute law he or she has the fullest privileges in the choice of good or evil—we cannot proceed in this arbitrary way. But in consequence of the inherent infirmity of human nature, some will then be induced to drink inordinately, and behave in a manner contrary not only to their own interests, but to the peace of the commonwealth. All such persons will need the watchful care of the state, and it must assume the parental relation or that of a stern judge. Several methods have been pursued by the state in this capacity of guardian of the public weal. Fines and imprisonment of drunkards have been tried without any permanent effect in restraining the inebriate or in doing good to the state. The fines are usually promptly paid; the individual feels that he has lost caste in the community in consequence of his public trial; but they rarely prevent a repetition of his drunkenness. If the drunkard be the head of a family, another evil results in case of his confinement—viz. that the innocent family suffers in consequence of his being taken from his work for its support. There is one method more effectual than either of the preceding. But, unfortunately, under a high sense of the essential dignity of man, it is believed that all the States except Delaware have abolished the use of it. The *whipping-post* has disappeared from all the States except Delaware, yet it may reasonably be asked whether a smart whipping, inflicted in the presence of a public officer, and which should not physically injure the culprit, would not be far more efficient to prevent a repetition of drunkenness than either fines or imprisonment. Moreover, it would not injure the family of the offender. Let it be once understood that an appearance in public in a state of intoxication should be followed by this physical suffering, with its social disgrace, it is believed that intoxication public and unblushing, such as we daily see in our streets, would become less frequent than at present. But if no one of the punishments should be sufficient to restrain the drunkard, then the state should seclude him as an insane man in an inebriate asylum. This would be appropriate when we remember that not a few drunkards are really suffering from the sins of their forefathers, who have transmitted evil habits and tendencies to their progeny. Fiery cognac, and perhaps the rich old port, sipped inordinately by aristocratic lips in one generation, have often been the prophets and moulders of the sots of a subsequent one.

Again, it has been most justly urged that the state should not only prohibit the sale of liquor to an habitual drunkard, but that the dealer who for the sake of gain violates such a law should be held responsible, not only for that violation, but for all the damages the victim may commit while intoxicated; and, moreover, that the family of the latter, which is bereft of its natural guardian, should be allowed a weekly stipend from the vender during the illness or imprisonment of the father.

Finally, the state, for its own safety and on the sacred principle of *salus populi ultima lex*, should deprive the incorrigible drunkard of his civil rights, as the state treats the felon. Virtually, the drunkard throws his recklessly away in the very act of becoming intoxicated. But shall we have prohibition or a limited license for the community at large? This question divides itself when applied to the practical customs of life. The system of open bars for the sale of the coarser liquors and the custom of "*treating*," as allowed by the English-speaking race, and especially in this country, are unmitigated evils, and should be forthwith given up or should be crushed by state power. Although they would undoubtedly exist in secret places, it would nevertheless be the greatest boon to the community to have them, at least like the felons they make, obliged to keep out of sight. But should the same prompt measures be applied to the sellers of milder beers, ales, and wines? Undoubtedly, these too should be under state and municipal surveillance. Moreover, some of the stronger English and Northern beers or ales should be classed with the coarser liquors, as they steal away the senses almost as quickly and quite as powerfully as absinthe, Bourbon whisky, or Medford rum. But the question still arises: Should the same rigid rule be applied to native light wines and German lager beer, both of which may be used more freely and with comparatively little danger if taken with caution and temperately? It is, however, argued that though these may be indulged in much more freely than stronger drinks, there is a danger, if we may believe the statement of many persons in England and Sweden, that this use of milder liquors will lead to the use of grosser ones. It is possible that this may be the case in the northern zone, where intoxication is more common and more furious in its bearings; but it has been proved by large data—*e. g.* those of the soldiery of Austria—that these milder beers do not deteriorate the race as the more potent liquors do. Doubtless, it would be wrong to allow any one having strong tendencies to intoxication, either from hereditary descent or previous bad habits, to use even these milder liquors. With all such, total abstinence is absolutely essential; but it does not follow that this rigid rule should be established for all, nor do we believe, nor have we any proof, that in Germany, situated in the middle zone above named, beer tends to develop the love of stronger drinks.

One excellent result has followed from these various and often heated discussions in our community on this all-important topic of temperance—viz. that temperance among the more educated classes has become more widely spread. No one now feels obliged to take wine in company; many habitually refuse to do so, and are not regarded as singular. Liquors are now never placed on the buffet or sideboard in the parlor, always at hand, and always to be offered to a friend as an act of hospitality, and as such rarely refused. At our dinner-parties for a man to be drunk is very uncommon. To be excited, and evidently so by liquor, is considered an unpleasant sight, and no longer a joke. In other words, temperance is honored, intemperance discountenanced, by the educated classes more than formerly. We regret we cannot say the same of the laboring classes. Perhaps among them intemperance was never more rampant than at present.

The final conclusion is this—viz. education and a cultivation of all the amenities of life should be promoted for the sake of temperance. In the school, and above all in the family, no opportunity should be lost of impressing on the tender consciences of the young the utter beastliness of drunkenness. A child should be taught to reverence the mind within him, and to shrink with horror from the thought of ever once depriving himself of its perfect control.

As it has been in the past, so it will be in the future—temperance will never prevail save with the constant labor of all in their various spheres. HENRY I. BOWDITCH.

**Temperance,** tp., Amherst co., Va. P. 3447.

**Tem′peranceville,** p.-v., Somerton tp., Belmont co., O. P. 120.

**Temperanceville,** b., Allegheny co., Pa., on Ohio River, 3 miles below Pittsburg, has extensive manufactures of iron and glass. P. 2069.

**Tem′perature, Nature of.** The term "temperature" relates to the degree or intensity of the heat of a body. In popular language, the expressions "high temperature" and "low temperature" are often employed instead of the terms "hot" and "cold" or "warm" and "cool;" but the use of the word temperature implies usually a measure of the intensity of heat. In this respect it is analogous to the word "velocity" in connection with motion. The motion of a body may be described as fast or slow, or the body may be said to have a high velocity or a low velocity. In the latter case there is implied a reference of the rate of motion to some standard or unit of velocity, which may be more expressly defined if necessary. In the same way, when it is said that a body has a certain temperature—a high or low temperature—it is implied that the condition of heat in the body may be compared with some standard. It is well known that the means of such comparison is the thermometer, and the standard condition is usually that of a body at the melting-point of ice. The thermometer applied to melting ice indicates zero; when applied to a body hotter or colder than melting ice, it indicates by a scale the degree of heat of the body as compared with one at the temperature of melting ice.

In connection with the dynamic theory of heat the measure of temperature has an important signification. Supposing the scale of numbers of any ordinary thermometer to begin at what is termed the absolute zero of heat, the temperature, or the number of such a scale which indicates the heat of a body, is proportional to the actual energy or

living force due to the molecular vibrations of the particles of the body. This assumption gives rise to one of the important axioms on which the dynamic theory of heat is founded—viz. that the capacity of a body for exerting heat-influences, or its actual heat-energy, is proportional to its absolute temperature. At the absolute zero of heat (—273° C.) all bodies cease to have the power or capacity of exerting any of the influences which arise from heat, dynamically considered, whatever be the state of aggregation of the body.

Temperature is thus considered to be a measure of the energy which arises from molecular motion and apart from atomic or chemical energy—that is, energy of chemical constitution. To illustrate: suppose a man to lift with tongs a lump of red-hot quicklime from a limekiln, and hold it over a basin of water. He has converted his muscular energy into potential energy of position. If he drop the red-hot lump, this potential will again become actual energy, and will splash a portion of the water out of the basin. Then the energy of temperature, which here, from the difference of temperature between the lime and the water, is working energy, will be transferred from the lime to the water, part of which will be transformed into steam, containing potential energy again as latent heat of steam. So far, no *chemical* change has taken place. The lime is still quicklime, and the remaining water is still water. But when these bodies have both reached the same temperature, a new class of changes begins. The temperature will again begin to rise rapidly, the water will be absorbed by the quicklime and disappear, the latter will crumble to a white powder, which will be a *new chemical compound*, slaked lime. If the proportion of water be not too large, sufficient *mobile energy* of temperature will appear to raise the mass again to nearly a red heat. It is usual to attribute this heat, developed in the familiar but wondrous phenomenon of the slaking of quicklime, vaguely to "molecular condensation." In fact, however, though it is not generally known, *there is here little or no change of volume*. The latest and best determinations of densities show that the volumes of the water and quicklime are together slightly less, if anything, than that of the resulting slaked lime. Whence, then, is this actual working energy of temperature, here so largely developed? Evidently, from conversion of some latent or potential energy into actual energy, such latent energy being what the writer proposes to call *potential energy of chemical constitution*.

This is only one of the innumerable cases of the transmutation of such potential energy of chemical constitution into actual working energy of temperature. All chemical reactions causing rise of temperature of the bodies reacting —*combustion* being one example—indicate the loss from these bodies of something which passes off as energy of temperature, and is lost for ever by diffusion throughout the universe. This loss represents *chemical energy*, and the writer believes, as he has elsewhere demonstrated (*American Chemist*, vol. vi. pp. 341, 342), that it is in reality energy of the chemical *atoms*. His view is that temperature measures energy of the chemical *molecule*, representing motion thereof as a whole, and independent of the atoms that make up the molecule, whose intra-molecular intestinal motion—upon which the occupation of space by the molecule depends, that is, the molecular volume—is the atomic energy, or energy of chemical constitution, of the body. This chemical energy is therefore mainly independent of temperature or molecular energy, within such limits as do not alter the chemical nature of the body, by dissociation or otherwise.

From this view it will follow that what is known as the (hypothetical) *absolute zero of heat*, so called, deduced from the result of the exhaustive application of the Boyle-Mariotte law to *gases*, can only be, at most, even if it applies to solids and liquids at all, the *absolute zero of temperature*, or of molecular motion, and that there would yet be in matter, even at that supposed absolute zero, an enormous, possibly inexhaustible, store of potential energy which could be converted into actual energy, at least in cases, if such there be, of bodies capable of reacting chemically at that low temperature. That there may still be such bodies at that temperature (or rather, absence of temperature) is probable from the consideration that although the incondensable class of gases would, according to the Boyle-Mariotte law, necessarily all become liquids at that point, it by no means follows that they would further become *solids*; and there would therefore be no necessary conflict with the hypothesis embodied in the aphorism, *Corpora non agunt nisi soluta*.

It may then be imagined, without unreason, that even in a universe at the absolute zero of heat, so called—or, as the writer prefers to state it, altogether destitute of temperature or molecular motion—nuclei of temperature-development could happen through conversion of potential atomic energy into molecular energy; and such conversion could extend cumulatively throughout such a universe until the present known point of heat and light development, sufficient to sustain the known present forms of vitality, might result.

HENRY WURTZ.

**Temperature of Space.** The phrase "temperature of space," derived from the illustrious Fourier, although in quite general use among physicists, is not a very accurate designation of the idea intended. Properly speaking, space itself can no more have temperature than it can have illumination. But a body situated in space must attain the temperature due to the combined effect of all the radiations received from the heavenly bodies at that particular position; and, to adopt Fourier's definition, "the temperature of planetary space, exactly defined, is that which would be indicated by a thermometer placed therein were the sun and its attendants blotted from existence." (*Annales Chim. et Phys.*, 1824, xxvii. 148.) Perhaps the least objectionable designation of this residual temperature (as the nearest analogue to star-light) would be "star-heat." Fourier supposed that this temperature could not be much less than the lowest degree of cold observed in polar regions, and estimated it at — 58° F. (— 50° C.). Following in his track, Poisson adopted essentially the same views, and the same estimate of the "temperature of space;" but he supposed that the solar system might pass in 1,000,000 years from an external pressure of + 100° C. to that of — 100° C. (*Comptes rendus*, 1837, iv. 151.) This fanciful suggestion is demonstrably impossible in fact. (See article REFRIGERATION OF THE EARTH.) When, in 1836, Arago announced to the Academy that Capt. Black's observation in his northern voyage of a temperature at Fort Reliance as low as — 70° F. (— 56.7° C.) must modify our conclusions derived from Fourier as to the "temperature of space" (it being actually 12° lower), Poisson controverted the inference, maintaining that the upper layers of the atmosphere were necessarily colder than the external "temperature of space." (*Comptes rendus*, ii. 575.) Pouillet in an elaborate and valuable *Memoir on the Solar Heat, the Radiant and Absorbent Power of the Atmosphere, and on the Temperature of Space*, presented to the Academy July 9, 1838, arrived at the value of — 224° F. (— 142° C.) for the latter. (*Comptes rendus*, 1838, vii. 64.)

Turning to English authorities, Mr. Hopkins in a communication to the Cambridge Philosophical Society, May 21, 1855, placed this star-heat as high as — 39° F. (— 39.5° C.); and he estimated from the data of Dove that the whole effect of solar heat (under our atmosphere) is nearly double that of the direct solar radiation. (*L. E. D. Phil. Mag.*, 1856, xi. 401.) Mr. Hopkins argues, from the lack of atmospheric transparency to obscure heat, that in order to allow the stellar heat to escape from our planet at as rapid a rate as it is received (or, in other words, that it may not be accumulating, and increasing the surface temperature), the exterior portions of our atmosphere must be colder than the surrounding space, with a still colder stratum below this, the minimum of temperature being "at some point within the earth's atmosphere." (*Loc. cit.*, p. 400.) When we reflect, however, that the air, even when dry, is not absolutely diathermanous, and that there is a constant tendency by conduction and convection to equalization, it would appear that the extreme limit of the atmosphere must in indefinite time attain to at least the temperature of star-heat. Sir John Herschel, in his *Treatise on Meteorology* (1857), from considerations based on the law of decreasing temperature in the atmosphere as the radiating surface of the earth is departed from, assigns — 239° F. (— 151° C.) as the probable "temperature of space." (*Meteor.*, sec. 36, *Encycl. Brit.*, 8th ed., xiv. 643.)

We have, then, as the estimates of these distinguished mathematicians, the following:

| | | | |
|---|---|---|---|
| Fourier | (1824), star-heat | — 58° F. | — 50° C. |
| Pouillet | (1838), " | — 224 | — 142 |
| Hopkins | (1855), " | — 39 | — 39.5 |
| Herschel | (1857), " | — 239 | — 151 |

While these values are very discordant, they all involve elements of great improbability. Assuming the absolute zero to be in round numbers about 500 Fahrenheit degrees below freezing water (— 278° C.), we have the startling result from Fourier's estimate that while we derive from the sun and stars a mean temperature of about 518 absolute degrees F. (289° C.), we derive from the celestial sphere (exclusive of the sun) 442 absolute degrees F. (245° C.); that is, of all the heat received by the globe, about five-sixths are due to the stars! It would appear that the mere statement should suffice to expose the fallacy of the assumptions.

Fourier appears to have quite underrated the blanketing effect of our atmosphere. The subaërial surface of our globe is practically that of an enclosed greenhouse; and if, as Hopkins allows, the actual surface temperature from

sun-heat is nearly double that due to the free solar radiation, then it follows that the "temperature of our space," under the full and unobstructed *blaze of the sun*, is as low as the lowest of the estimates above given for star-heat, or is more than 200° below the Fahrenheit zero. It is indeed wholly improbable that at our distance from the sun (92,000,000 miles) its radiant heat has sufficient energy to melt mercury (— 39°), which is Mr. Hopkins's estimate of star-heat. We know that within our tropics, under a vertical sun, the line of perpetual snow is only about 3 miles above the sea-level; that is to say, with a barometric column of 15 inches, or one-half the atmosphere above it, ice is not melted by the direct rays of the sun. The same fact is even more strikingly illustrated by the well-known circumstance that the delicate spicules of ice in the frozen cirrus clouds remain untouched by an equatorial sun, with a considerable earth-radiation on their under sides.

We have really no reason for supposing that the aggregate proportion of heat to light radiated by the stars differs materially from that radiated by our sun. The whole amount of light received from the stellar vault on either hemisphere does not probably exceed the ten-millionth of that received from the sun; and if the heat received be in the same proportion, even Herschel's estimate (the lowest on the list) must be pronounced enormously too high, and the star-heat commonly called the "temperature of space," cannot be much above the absolute zero. W. B. Taylor.

**Temperature of the Body.** The temperature of the human adult in a state of health averages from 98.4° to 98.6° F., the fractionally higher temperature existing in the warmer-blooded races, as those of Southern Europe, the lower average being found in northern nations and the Anglo-Saxon race. The fluctuations of temperature in health are exceedingly small—fractions of a degree, rarely more—dependent on physical activity or inactivity in sleep or wakefulness, or functional activity, as digestion. The extremities and surfaces may show a lowered temperature in winter, but the temperature taken by a thermometer in the mouth, rectum, armpit, or fold of the groin reveals a nearly uniform heat of the blood and internal organs. Animal heat is generated, and its uniform degree maintained, by the equal balance of nutritive supply and assimilation with destructive tissue-waste and excretion. Hence, the generation of heat in the body is a chemico-vital phenomenon. In so far as the sympathetic nervous system presides over the functions of the large organs, the secretory and excretory glands, and the capillary circulation, it may be said to regulate the temperature. As well-known examples of its office, "shock" or nervous depression causes reduced temperature, while excitement, pleasure, anger accelerate the circulation and elevate temperature. The temperature of children and infants is one to two degrees higher than that of adults. The temperature of aged persons is half a degree or more behind the adult average.

"Medical thermometry," the use of the thermometer to register and study temperature in disease, is now extensively practised in Europe and America. De Haen (during the fever at Breslau a century and more ago), John Hunter, and Currie employed the thermometer, but the German school—and notably Wunderlich—has popularized its use by the profession within the past fifteen years. The self-registering thermometer is employed, rendering observations useful to the physician taken by the nurse or attendant. Observations should be taken twice daily, morning and evening, as the uniformity of health is lost in disease, being replaced by marked increase of temperature toward and during night, and decrease or descent in the morning. In most diseases there is elevation of temperature. Exceptions to this rule are in various paralyses, gradual death by exhaustion, and stages of collapse after hæmorrhage or copious alvine evacuations. The essential fevers and all febrile disorders, local inflammations with sympathetic fever, have a period of invasion more or less abrupt and extreme. The temperature ascends from the normal 98.4° to 100°, 102°, 104° F., etc. The temperature reaches these higher points in children often from slight and temporary ailments, as indigestion or fatigue. In adults a temperature of 102°, 103°, 104° F., especially when initiated by a chill, indicates serious fever. Even during the period of chill, which is a tremor accompanying the subjective sensation of cold, the skin only is cool; the blood has been driven from the chilled, contracted skin to the internal parts, which are congested and hot. Thus, death by "congestive chill" often occurs in extremely malarial districts. Different diseases have peculiar and characteristic methods of onset. This period of access of fever is termed "effervescence." Thus, in intermittent fever in a half hour or hour the body-heat ascends from 98.4° to 104° or 106° F., while in typhoid fever it ascends 2° each day, falls 1° each morning for four or five successive days, and remains nearly stationary thereafter for several days. Typhus has a higher temperature than typhoid; the latter's average is 104°–105° F., the former 105°–107° F. A temperature of 106° or 107° F. is cause for solicitude and unfavorable prognosis, although it may go higher in rare cases, and recovery follow. Relapsing fever has a temperature ranging from 107° to 109° F., yet rarely is fatal. In many fatal cases the temperature during life has reached 110°, and 112° F. has been recorded. When in a fever patient the morning temperature is found slightly below that of the previous evening, recovery will probably ensue. The decline of temperature, approaching recovery, is termed *defervescence*. In some cases the temperature falls many degrees suddenly, coincident with the appearance of perspiration or the free secretion of urine. Then the fever is said to terminate by crisis. Thus, in typhus within a few hours it descends from 106° F. to near the normal. More often the defervescence is gradual, as in typhoid, by *lysis*, a gliding or gradual descent. After death, as a rule, the body cools as *rigor mortis* takes place. A remarkable exception exists in the body following death from Asiatic cholera. The temperature, which may have descended during "collapse" and at the time of death to 93° or 91° F., rises to 100° or 110° F., becoming hot; this is due to chemical changes in the tissues of the body, accompanied by evolution of heat. Such return of heat is often interpreted as a return of life to the dead, especially when automatic movements of the corpse coexist. The latter are induced by the irritation of the chemical changes upon the ganglionic cells of the spinal cord, which seem to retain their vitality later than the brain and medulla.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Temperature of the Earth.** See Earth, by Prof. A. Guyot, Ph. D., LL.D.

**Tempered or Toughened Glass.** See Glass, by C. G. Leland, A. M.

**Tem′pio Pausa′nia,** town of Sardinia, province of Sassari, on the slope of the Limbara chain, and almost surrounded by mountains in every direction. The climate is cold in winter, while the heat in summer is excessive, owing to the smallness of the basin in which the town lies. The buildings are of polygonal blocks of granite, and very little lime is used on account of its cost. The public edifices are respectable, and the houses of the better class are not without comfort, but those of the poor are very wretched. They have no floors but the earth; the walls, as was said above, are without mortar or plaster, and consequently allow free passage to the sharp mountain-winds; the roofs are of reeds, covered very imperfectly with clay and tiles, and admitting not only the little light which enters the hut, but the rain, the snow, and the hail as well. In winter the cows or horses, or both if the family possess them, share the one room, for generally there is but one, with their owners. Even here, however, the new order of things is beginning to be felt, and it is said that a decided advance in decency, and even in comfort, is perceptible during the last few years. The inhabitants are laborious, and export cheese, honey, wool, cork, hides, and even cattle. P. 10,096.

**Tem′plar, Knights,** or **Poor Soldiers of the Temple of Solomon,** a military and religious order founded in 1118 or 1119 by nine French gentlemen at Jerusalem for the defence of the Holy Sepulchre and of pilgrims. Their rule was prepared in the Council of Troyes, and confirmed by the pope in 1128. They were at first all noble laymen, but in 1172 secular priests were admitted as chaplains. In 1146 the red-cross banner became their distinction. They were at first bound by vows of poverty, chastity, and severe religious exercises. On the loss of the Holy Land (1192) they occupied Cyprus. They had some time previously organized chapters in most European countries, and their fame for valor and piety was great. Their wealth and luxury rapidly increased also, and were the occasion of their final overthrow. This was accomplished by the conjoined efforts of Philip IV. of France and Pope Clement V. They were accused of abominable and unheard-of crimes, and of Ophitic, Gnostic, and even Mohammedan practices, and of the worship of the Baphomet. In 1308 the pope demanded the aid of all princes and prelates in suppressing the order, and their dissolution was proclaimed in 1312 by the Council of Vienne. Their grand master, De Molay, was burned alive in 1314, and considerable numbers suffered the same fate both before and after that date. In most countries their property was in part seized by the sovereign, and in part turned over to the Hospitallers and other orders. In Portugal the order never was suppressed, but in 1317 took the name of the Order of Christ, which name it still bears; but the vows of poverty and chastity have been long since relinquished, so that it is now a strictly military order. It has a branch in Italy dependent upon the Apostolic See.

**Tem′ple,** tp., Franklin co., Me. P. 640.

**Temple,** p.-v. and tp., Hillsborough co., N. H. P. 421.

**Temple** (Daniel), b. at Reading, Mass., in 1790; graduated at Dartmouth College 1817 and at Andover Seminary 1820; went as a missionary of the American Board to the East 1822, taking a printing-press; was stationed at Malta 1822–32, and at Smyrna 1833–44; printed many volumes in modern Greek, Italian, and Armenian; edited a magazine in Greek; wrote several religious books in that language; returned to the U. S. 1844; was for two years a travelling agent of the board, and was settled at Phelps, N. Y., 1847–49. D. at Reading, Mass., Aug. 9, 1851. His *Life and Letters* (1855) were published by his son, with an introduction by R. S. Storrs, Sr., D. D.

**Temple** (Frederick), D. D., b. in England Nov. 30, 1821; educated in the grammar school at Tiverton; obtained a scholarship at Baliol College, Oxford, where he graduated with the highest honors 1842; became fellow and mathematical tutor there; took orders in the Church of England 1846; was principal of the training college at Kneller Hall, near Twickenham, 1848–55; one of the government inspectors of schools 1855–58, and master of Rugby School from 1858 to 1869, when he was appointed by Lord Palmerston bishop of Exeter. He is a chaplain to the queen; was one of the authors of the famous *Essays and Reviews* (1860), and his confirmation to a bishopric was ineffectually opposed by the conservative party in the Church. He wrote 3 vols. of *Sermons preached in Rugby Chapel* (1861–71).

**Temple** (Henry John). See Palmerston, Viscount.

**Temple** (Sir Richard), b. in Worcestershire, England, about 1825; passed through a distinguished career in the India civil service; was knighted 1867, and has been for several years (1876) lieutenant-governor and actual ruler of Bengal, in which capacity he has accomplished immense results for good, especially during the famine of 1874.

**Temple** (Richard **Grenville**), K. G., Earl, brother of George Grenville, b. in England Sept. 26, 1711; entered Parliament for Buckingham 1734; succeeded to the earldom on the death of his mother, Hester, Countess Temple, Oct. 6, 1752; advanced in political life by William Pitt, who married his sister Hester; lord of the admiralty 1756–57, lord privy seal 1757–61, and made a knight of the Garter 1760. D. at Stowe Sept. 11, 1779. His correspondence, and that of his brother George, with Pitt, was edited as *The Grenville Papers* (4 vols., 1852–53), by W. J. Smith.

**Temple** (Sir William), Bart., b. in London, England, in 1628; educated at Emmanuel College, Cambridge; travelled on the Continent for six years 1647–54; married 1654; resided several years with his father in Ireland; was a member of the Irish convention 1660; a joint commissioner of the Irish Parliament to Charles II. 1662; settled in England 1663; was sent on a secret mission to the bishop of Münster 1665; was made a baronet and minister resident at the court of Brussels 1666; visited Holland to urge the formation of a league against Louis XIV. 1667; negotiated the triple alliance between England, Holland, and Sweden Jan., 1688; assisted in perfecting the Peace of Aix-la-Chapelle, and was commissioned ambassador to the Hague 1668; returned to England Sept., 1670; was dismissed from office June, 1671, in consequence of the change of policy which had already (1670) led to a secret treaty with France, but was again appointed to negotiate a peace with the States General 1674; assisted at the Congress of Nymwegen 1675–79; devised for Charles II. the plan of his new privy council of thirty members Apr., 1679; declined the secretaryship of state in the same year; was stricken from the roll of privy councillors 1680; served in Parliament as member for the University of Cambridge for a single session; lived in retirement at Sheen or Moor Park during his later years, having as secretary and literary assistant Jonathan Swift; was visited and consulted by William III., but declined to return to political life. D. at Moor Park, Surrey, Jan. 27, 1699. Author of *Observations upon the United Provinces* (1672), *The Origin and Nature of Government, Essay upon Ancient and Modern Learning,* and other publications, collectively issued as his *Works* (2 vols., 1720), edited with a *Memoir* by Dr. Swift.

**Temple** (William G.), U. S. N., b. Mar. 3, 1824, in Vermont; entered the navy as a midshipman May 21, 1840; became lieutenant in 1855, commander in 1865, captain in 1870; served on the W. coast of Mexico during our war with that country, and in 1864 commanded the steamer Pontoosuc in both the Fort Fisher fights. Commended for gallantry and recommended for promotion by Rear-Admiral Porter in his official despatch of Jan. 28, 1865.

Foxhall A. Parker.

**Temple, The.** See Jerusalem, by Rev. Howard Crosby, S. T. D., LL.D.

**Tem′pleton,** p.-v. and tp., Worcester co., Mass. P. 2802.

**Templeton,** tp., Atchison co., Mo. P. 974.

**Templeton,** p.-v. and tp., Prince George co., Va. P. 1326.

**Tem′poral Bones** [Lat. *tempora,* the "temples" of the head], a pair of irregular bones which in man constitute a portion of the sides and base of the skull. Each consists of (1) a *squamous* portion, perhaps a part of the expanded neural spine of the second cephalic vertebra; (2) a *mastoid* portion; and (3) a *petrous* portion. Some regard these two last as parts of the splanchno skeleton rather than of the vertebral skeleton, considering them as structurally parts of the auditory apparatus, although they are functionally, at least in part, identified with the rest of the temporal bones. But others regard the mastoid as belonging to the neural arch of the second vertebra. The zygomatic process reaches forward from the outer surface of the squamous portion, and joins the malar bone, forming the zygomatic arch; while attached to the petrous portion are a long *styloid* process and a nearly circular auditory process, the pleurapophyses, or *ribs,* of the third and second vertebræ of the skull. Attached to the mastoid portion is the *mastoid* (teat-shaped) *process,* which after puberty becomes hollowed into a number of *mastoid cells.*

**Temporal Power.** See Papal States and Roman Catholic Church.

**Tenacity of Metals,** etc. See Strength of Materials, by W. A. Norton.

**Tenancy from Year to Year.** See Tenant for Years.

**Ten′ancy in Common** (in law) is a particular mode of owning the same parcel of land in undivided shares by two or more persons, so that while neither is entitled to the exclusive possession of any particular portion, each is entitled to an equal possession of the whole, and the possession of one is that of all. The statutes of the various States have so radically changed the common-law doctrines that, as the general rule, whatever in England would have been a joint-tenancy is in the U. S. a tenancy in common; *e. g.* when land is conveyed to two or more by the same deed, or is devised to them by will, or is inherited in undivided parts by a number of heirs. On the other hand, the undivided shares need not be acquired by all the holders at the same time nor from the same source, nor be of an equal amount nor of the same estate. Every owner in common has a complete power of disposal over his undivided share; it is liable for his debts; it may be mortgaged, conveyed, devised, inherited; is subject to dower or curtesy. Finally, in every case of an ownership in common, one or more of the owners may always enforce against the others a partition of the land; that is, a judicial separation of the hitherto undivided shares, and a distribution of these ascertained portions, so that the common ownership will be thereby ended, and in place thereof each person will become entitled to his own individual allotment. (See articles Joint Tenancy and Partition.)

John Norton Pomeroy.

**Ten′ant for Years, at Will, and by Sufferance.** Estates or tenancies for years are interests in land granted for some definite period of time, and embrace those for a single year or less, as well as those for any fixed number of years, however great. At the common law these interests, no matter for how long a time they are to last, even for 1000 years, are inferior to estates for life or in fee; but in some of the States leases for 100 years or more have been partially assimilated by statute to inheritances. The estate for years, with the exceptions just mentioned, possesses the quality of personal rather than of real property, for on the death of the lessee his remaining interest in the land goes not to his heirs, but to his executors or administrators. In modern law the tenancy is created by a contract called a lease, whereby one party, the lessor, and generally the owner, lets to another, the lessee or tenant, the possession of the specified land, building, or part of a building for a definite period of time agreed upon by the parties. The word "term"—from *terminus,* a "boundary"—is often used to designate both the period during which the tenant's interest is to last, and also the interest itself. By the statute of frauds leases for more than a certain designated time must be in writing in order to be fully binding according to their provisions. In England and in several of the American States this maximum period for an oral lease is three years; in New York and many other States it is one year. Verbal lettings for these terms, or for less, are in every way valid, and even a verbal contract for a longer term is not absolutely void. In addition to the letting of

the premises, leases may, and usually do, contain various stipulations, of which there are two generic classes, covenants and conditions. A covenant is simply an agreement to do or not to do some act in reference to the premises, and may be made either by the lessor or the lessee; as, for example, the latter may agree to pay rent, not to assign or underlet, not to use the premises in a certain manner, and the like, while the former may agree to repair, to rebuild in case of fire, to pay the taxes, etc. A condition is an agreement necessarily by the tenant, with a further provision that if he fails to perform, the lease is to become void at the option of the landlord, who may thereupon enter and resume the possession. Any and all agreements of the lessee may be thus fortified and enforced by conditions, but the sole remedy for the breach of a mere covenant is an action for damages. The rights of the tenant may be summed up as follows: Complete possession during the continuance of the estate, and reasonable use in all modes and for all purposes to which the premises are adapted, unless such use is restricted and regulated by the contract. As long as no condition has been broken, he has the exclusive right of possession, and neither the landlord nor a stranger can enter except by his license. If not prohibited by the contract, he may assign the lease or sublet the premises or any part thereof. An assignment consists in a transfer of the entire interest the whole remainder of the term, and the assignee then becomes liable for all the rent accruing while he continues to hold the lease, but if he in turn transfers it, his liability for any subsequent rent ceases. The duties of the tenant may be summed up by saying that he is bound to perform all his conditions and covenants contained in the instrument. The most important of these is his covenant to pay rent. His liability for the rent continues during the entire term; he does not free himself from it by assigning, since it arises out of his express contract to pay, as well as out of his possession and interest, while the assignee's liability results solely from his interest. In the technical language of the law, between the lessor and lessee there is privity both of contract and of estate, while between the lessor and assignee there is only a privity of estate. In New York and many other States the statutes provide summary proceedings by which the landlord may dispossess a tenant who fails to pay his rent, even though the lease contains no condition in reference to the matter. The tenant's liability for the rent ceases if he is evicted from the whole of the premises by a person holding a title paramount to that of the landlord (that is, by the true owner), or if he is evicted from a portion of the premises by the landlord himself. As a general rule, however, the tenant is not permitted to deny his landlord's title, and on that ground refuse to pay the rent, as long as there has been no eviction by a true owner or a change in the relations of the parties equivalent to an eviction. Unless he agrees to do so, the landlord is not bound to keep the premises in repair during the continuance of the lease. In the absence of express stipulations to the contrary, it is the tenant's duty to make all necessary repairs, and he is responsible for waste caused or suffered by himself. Even the destruction of the buildings by fire or by the elements did not, at the common law, affect the tenant's liability for rent. This hard rule has been altered by statute in New York and other States, which permits the tenant to surrender the lease if the buildings are destroyed by fire or rendered untenantable by storms, floods, or other agencies without his fault, neglect, or procurement.

A *tenant at will* is one who holds possession of lands during the will of the landlord or of himself, so that either may terminate the holding at any time by his own act. Anciently, whenever a person held possession of land under an agreement to pay rent, but without any stipulation as to time, he was a tenant at will; but in modern times such facts, and especially the rent, constitute a "tenancy from year to year," which requires a notice of six months for its termination. Tenancies purely at will now arise when the landlord permits the premises to be occupied without rent and with no agreement as to time, and also when the parties expressly agree that the occupation shall be at will, although rent is paid. At the common law no notice to quit is required to end a tenancy purely at will; any act by the landlord in assertion of his right to the possession is sufficient to produce that result. In several of the States a notice to quit is made necessary by statute; in New York it must be given thirty days before the time designated.

A *tenant by sufferance* is a person who, having been rightfully in possession of land by permission of the owner, continues to hold the same after the time to which he was entitled has expired. He has no estate, interest, or right to the possession, but simply the possession. He holds merely by the sufferance of the owner, and his only semblance of legal interest or advantage is, that he is not liable as a trespasser until the owner has entered and put an end to his occupation. JOHN NORTON POMEROY.

**Tenas'serim,** a division of the British province of Burmah, forming part of the British empire in India, contains an area of 46,730 sq. m., with 576,765 inhabitants, and is that tract of country lying between 10° to 17° N. lat., along the eastern side of the Bay of Bengal, and between it and a high chain of hills about 40 miles inland. It includes the Mergui Archipelago—that is, the chain of islands along the coast, and 15 to 20 miles distant from it. The surface of the country is mountainous, thinly populated, and much intersected by streams. The great boundary range is 5000 feet high; in the latitude of Tavoy it is 40 miles wide, whence it gradually narrows to 10 miles near Mergui. The whole range is covered with pathless jungle, and may be said to be without a human habitation. The coast is very irregular and low for some miles inland, consisting of uncultivated mangrove islands. The principal river is the Tenasserim; it gives its name to the division, rises in about 15° N. lat., and empties itself into the sea by two mouths, the northern of which is the more easily navigable for large ships. The soil is clayey, mixed with a good deal of sand. Rice is the staple product; the cultivation of sesamum and fruit trees is very productive. Coal has been discovered, and found to be well adapted for steamers, having a low specific gravity; ores of excellent tin, copper, magnesia, and iron are opened in abundance. The climate is moist and depressing for a part of the year, but cooler, and on the whole better adapted to the European constitution, than any other part of India; the mean annual temperature at Tavoy is 79.5° F. The division comprises five districts; the head-quarters are at Maulmain, a large town with 53,653 inhabitants, to which the post-steamers from Rangoon run twice a month. The gross revenue receipts of the division amount to £211,240 a year; the trade in merchandise is improving, and had risen in 1873 to £1,241,815; the principal export is rice, of which from 200,000 to 300,000 tons are shipped to China and other Eastern markets. Tavoy and Mergui were taken by the British as early as 1757; the island was ceded by Burmah in 1826. E. SCHLAGINTWEIT.

**Tench** [Fr. *tenche*], the English name of the *Tinca vulgaris*, a fish belonging to the family Cyprinidæ, abundant in European streams and lakes, and the only member of its genus. It has a compressed, fusiform shape, the trunk covered with small scales, the lateral line little decurved, the head conic in profile, the mouth small, and with a small barbel at each corner, the dorsal above the pectorals, and short, the anal also short, and the caudal little emarginated; the pharyngeal teeth are compressed, club-shaped, and in one row, generally five on the left and four on the right side; the rays are D. 11, A. 10, P. 17, V. 10; the color is generally dark greenish-olive above and on the sides, lighter below; the fins dark-brownish. It occasionally attains a length of nearly three feet and a weight of twelve pounds, but does not often weigh more than three pounds. It prefers rather deep and weedy, and apparently even foul water. It is very tenacious of life. The female spawns in the spring "when wheat is in blossom." The fish is popularly supposed to possess healing properties. It is by some rather esteemed as a table-fish. THEODORE GILL.

**Tencin', de** (CLAUDINE ALEXANDRINE GUÉRIN), MARQUISE, b. at Grenoble, France, in 1681; was compelled by her parents to enter a nunnery in her native city, much against her own will, and was subsequently removed to another monastery near Lyons of a less rigorous discipline, but fled in 1714 to Paris, and was released from her vows by the pope through the influence of her powerful friends, especially through that of Fontenelle. She was the mistress of D'Argenson, Bolingbroke, Marshal Uxelles, the duke of Orleans, Cardinal Dubois, Law (by whose aid she made a considerable fortune), Destouches-Canon (who is said to be the father of D'Alembert, the most celebrated of her children), and many others. In 1726 she was for a short time confined in the Bastile on account of a duel in which one of her lovers had been killed. But at the same time she was one of the stars of Parisian society, and is said to have exercised considerable influence on its tone. Her salon was frequented by the most celebrated littérateurs, and she herself was an authoress of repute; she wrote *Mémoires du Comte de Comminges, Le Siège de Calais, Les Malheurs de l'Amour, Anecdotes de la Cour et du Règne d'Edouard II., Roi d'Angleterre.* D. at Paris Dec. 4, 1749. Her son, D'Alembert, was rescued from the foundling hospital and educated by his father. Her works have been edited in 5 vols. (1825) by Jay and Étienne; they were formerly published with those of Madame La Fayette.

**Ten'der** [Lat. *tendere*, to "stretch" or "extend"], in law, is an offer to deliver either money or chattels due in

pursuance of some contract or obligation, in such form and manner that if accepted by the creditor the transfer will thereby be complete and the liability will be discharged. It may be made by the debtor or his agent, and to the creditor or to a person authorized to receive payment for him. In order that a tender of money may be available, it must be of such coin or other circulating medium as the law has made a "legal tender" in payment of debts, or else the creditor may refuse to accept it; but if he does not put his refusal upon that ground at the time, he cannot afterward raise the objection. The full amount due must be offered, and some cases hold that if more than that sum is tendered there must be no intention of demanding a return of the surplus. The offer must also be absolute, and without any condition annexed to its acceptance. A mere ability, readiness, willingness, or verbal proposal to pay is not sufficient; as the word itself indicates, the offer must be accompanied by an actual production of the money in the presence of the creditor, so that the power and wish to deliver it may be openly shown, unless the peremptory nature of his refusal or other conduct on his part amount to a waiver of this condition. If any specific place of payment has been agreed upon, the tender must be made there; but if no such place has been designated, it may be made wherever the creditor is found. A valid tender of money does not discharge the debt; it simply cuts off all interest from that date and all costs of suit; and even to produce this effect it must at all times be kept good—that is, the debtor must be ready and willing to pay whenever a demand is subsequently made upon him. Although a tender does not discharge the debt, it may operate to destroy a lien—for example of a mortgage—held by the creditor as security for the payment. JOHN NORTON POMEROY.

**Tendon,** in anatomy, the name of a white fibrous tissue connecting the end of a muscle with the bone which it is intended to move. It has sometimes the form of a cylindrical cord, sometimes of a broad ribbon, and in a few cases of a wide, thin sheet, but it is always inextensible and inelastic, and transfers at once the motion imparted by the contraction of the muscle to the bone into which it is inserted.

**Tendon, Achilles'.** See ACHILLES' TENDON.

**Ten'drac,** the French name conferred on the genus *Ericulus*, a member of the family Centelidæ. It is closely related to the TANREC (which see), but the teeth are larger, especially those of the lower jaw, and the premolars follow closely after the canines; there are four ($2 \times 2$) incisors in the lower as well as upper jaw. It is about a third smaller than the hedgehog of Europe, which it considerably resembles in general appearance. It is peculiar to the island of Madagascar. THEODORE GILL.

**Tene'brio** [Lat. *tenebræ*, "darkness"], (*Tenebrio molitor*), a coleopterous insect allied to the *Blaps*, of a dark-brown color, smooth, about half an inch long, with wings and wing-covers, short antennæ and stout legs; is common in granaries, mills, and other places where meal or flour is kept, and is most active during night. Its larva, about an inch long, thin, smooth, of an ochreous color with rusty bands, with six small feet and two short antennæ, is the so-called meal-worm, which often does considerable injury.

**Ten'edos,** a small island in the Ægean Sea, 17 miles S. of the entrance of the Strait of the Dardanelles, belonging to Turkey, and has a pop. of about 7000, partly Greeks and partly Turks. It is celebrated for its exquisite wine.

**Ten'ement** [Lat. *tenementum*, from *tenere*, to "hold"]. In the common law this word denotes anything of a permanent nature—that is, not a movable or chattel—which may be holden from a superior lord or of which tenure may be predicated. An ancient phrase of the English law describes real property as consisting in "lands, tenements, and hereditaments." "Tenement" is a word of broader meaning than "land," for it applies to a large class of incorporeal rights which are regarded by the law as a kind of property that may be holden, as well as to corporeal things. It includes not only land, and the buildings and other fixtures forming a part thereof, but also rights issuing out of or connected with land, such as rents, commons, easements or servitudes, profits *à prendre*, and the like. The term had its origin in the system of feudal tenures, by virtue of which all lands were held from superior lords in consideration of some feudal service, either military or having a pecuniary value. The person thus holding an estate was therefore termed a "tenant," and the property held, whether it was land or a rent in fee or for life issuing out of land, or an easement annexed to the land, was called a "tenement," a holding or thing held. If the estate in fee or for life was thus held by a "free-man," in contradistinction to a vilain or serf, it was anciently denominated a "frank tenement," and the English equivalent "freehold" came to be the generic name given to these higher grades of ownership—estates in fee or for life—in order to distinguish them from the lower grades, or estates for years. In modern and popular nomenclature the word "tenement" is often used in wills, deeds, and other instruments to designate any building for habitation or occupation, such as a dwelling-house or messuage, shop, warehouse, and the like. This use of the term probably arose from the fact that in England such buildings are generally occupied by tenants or lessees, rather than by their owners in fee. (The reader may further consult the articles on the FEUDAL SYSTEM and on the various kinds and incidents of real property.) JOHN NORTON POMEROY.

**Tenera'ni** (PIETRO), b. at Torano, near Carrara, Nov. 11, 1789; was a pupil in sculpture of Canova, and also of Thorwaldsen. His principal works are—a *Psyche with the Vase of Pandora*, a group of *Venus and Psyche*, a *Venus reclining, with Cupid drawing a Thorn from her Foot*, a *Piping Faun*, a *Crucifix*, a statue of *Bolivar* for Colombia, a bas-relief representing the *Deposition from the Cross*, the *Angel of the Last Judgment*, a statue of great power; busts of Thorwaldsen, of Pius IX., etc., and many other works for churches and cemeteries. D. at Rome Dec. 14, 1869.

**Teneriffe',** the largest of the Canary Islands (see CANARIES), comprises an area of about 900 sq. m., with about 90,000 inhabitants. The coasts are rocky and wild, and afford only one good harbor, that of Santa Cruz de Santiago. The interior is mountainous, and in the centre the ground rises in the mighty volcano of Pico de Teyde to a height of 12,182 feet. The upper half of this peak is rugged and barren, covered with pumice-stone and lava blocks, always emitting sulphurous vapors through its crevices, and generally enveloped with a girdle of clouds, through which its top pierces like a spear. The middle region is clad with beautiful forests of chestnut and oak, and the foot, as well as the hills and valleys around it, is covered with vineyards, olive and almond groves, wheatfields, and orchards in which oranges and figs ripen to perfection. Principal town, Santa Cruz de Santiago.

**Teneriffe Wine,** a white wine from the Canaries, bears a close resemblance to madeira. It is somewhat acid, and has when good a nutty and aromatic bouquet. Its percentage, by measure, of alcohol varies from 16.61 to 19.79, and it is somewhat stronger than the average sherry.

**Tenhas'sen,** p.-v. and tp., Martin co., Minn. P. 314.

**Teniers'** (DAVID), called THE ELDER, b. at Antwerp in 1582; studied painting; visited Rome; settled in his native city, and d. there in 1649. He painted genre pieces, mostly scenes of the every-day life of the lower classes of the Flemish population, picnics, fairs, alehouse scenes, charlatans, etc., and acquired a great reputation, but was, nevertheless, entirely outshone by his son, DAVID TENIERS, called THE YOUNGER, who was born at Antwerp in 1610; educated partly in his father's studio, partly in that of Rubens, and appointed court-painter to the archduke Leopold William of Austria, governor of the Flemish provinces, and afterward superintendent and director of his picture-gallery. He painted both biblical and historical subjects and landscapes, but his masterpieces are genre pictures. He resided first in Brussels, afterward at Lerck, where he built a splendid mansion, Dry Toren, and where he d. Feb. 11, 1685. He was a rapid worker, and produced more than 1000 pictures, but his fame was so great that he could hardly satisfy the demand and fill the incoming orders. Philip IV. of Spain had a separate gallery arranged in his palace for Teniers's pictures. Excellent specimens of his art are also in Vienna and at the Louvre, although Louis XIV. felt very little sympathy for him, and ordered his pictures to be removed out of his way.

**Ten Mile,** p.-v. and tp., Macon co., Mo. P. 1518.

**Ten Mile,** tp., Harrison co., West Va. P. 1736.

**Ten Mile River,** tp., Mendocino co., Cal. P. 80.

**Ten'nant** (SMITHSON), M. D., F. R. S., b. at Selby, Yorkshire, England, Nov. 30, 1761; was distinguished in childhood for his fondness for chemistry and physics; studied medicine at Edinburgh under Dr. Black 1781–82; was a resident member of Christ's College, Cambridge, 1782–86, and of Emanuel College 1786–89; travelled in Denmark and Sweden 1784, visiting the mines and becoming acquainted with the celebrated chemist Scheele, whose recent discoveries he much admired; resided for some time in Paris and the Netherlands engaged in chemical studies; became a member of the Royal Society 1785, and resided in London from 1789 until 1813, when he was elected professor of chemistry at Cambridge. D. by a fall from his horse at Boulogne Feb. 22, 1815. Author of eight papers on chemistry and mineralogy in the *Philosophical Transactions*; was the discoverer of the purely carbonic character of the diamond, of the identity of emery and corundum, and of the minerals osmium and iridium.

**Tennant** (William), LL.D., b. at Easter Anstruther, Fifeshire, Scotland, May 15, 1784; became a cripple in childhood; studied at the University of St. Andrew's 1799–1801; was for some years clerk to his brother, a corn-factor at Glasgow, and afterward in his native town; published *The Anster Concert* (1811), a poem in the Scottish dialect, and *Anster Fair, a Poem in Six Cantos* (1812), in *ottava rima*, both descriptive of rural Scottish life, which gradually acquired popularity; was parish schoolmaster of Dunins 1812–16, and at Lasswade 1816–19; acquired the Arabic, Syriac, and Persian languages; taught Oriental and classical languages in the academy of Dollar, Clackmannanshire, 1819–34; became in 1834 professor of Oriental languages in St. Mary's College, St. Andrew's, and subsequently was also professor of Hebrew in Edinburgh College. D. near Dollar Feb. 15, 1848. Author of several later poems and dramas which were not successful, of a *Syriac and Chaldee Grammar* (1840), a *Life of Allan Ramsay* (1808), and of numerous contributions to periodicals, including some translations from Oriental poets.

**Ten'nemann** (Wilhelm Gottlieb), b. at Brembach, near Erfurt, Prussian Saxony, Dec. 7, 1761; studied theology, afterward philosophy, at Erfurt and Jena, and was appointed professor of philosophy in 1798 at Jena, and in 1804 at Marburg, where he d. Sept. 30, 1819. His principal work is his *Geschichte der Philosophie* (11 vols., 1798–1819). Of this work he gave in 1812 an abridgment, *Grundriss der Geschichte der Philosophie*, which has been often republished, and translated into English by Arthur Johnson (Oxford, 1832). Among his other works is a *System der Platonischen Philosophie* (4 vols., 1792–94).

**Ten'nent** (Gilbert), b. in county Armagh, Ireland, Feb. 5, 1703; came to Philadelphia in 1718 with his father, a Presbyterian minister, whom he aided in the management of an academy; studied medicine and theology; was ordained pastor of a church at New Brunswick, N. J., 1726, where he remained until 1743; travelled in New England 1740–41, preaching with great success as a coadjutor of Whitefield in his revival labors; founded at Philadelphia in 1743 a Presbyterian church composed of followers of Whitefield; visited various parts of the colonies as a revivalist; published an account of the revival of 1744, several volumes of sermons, and many single addresses, and visited England 1753 to solicit contributions for Princeton College. D. at Philadelphia July 23, 1764.

**Tennent** (Sir James **Emerson**), Bart., LL.D., b. in Belfast, Ireland, Apr. 7, 1794, son of William Emerson, a wealthy merchant; was educated at Trinity College, Dublin; travelled after graduation (1824–25) through Europe and the Levant, also in Greece, where he met Lord Byron and became an enthusiast for Grecian independence; published *A Picture of Greece in 1825* (1826), *Letters from the Ægean or Grecian Islands* (2 vols., 1829), and a *History of Modern Greece* (2 vols., 1830); was called to the bar 1831, but never practised; married (June, 1831) the only daughter and heiress of William Tennent, a wealthy banker of Belfast, whose name and arms he assumed by royal license in the following year; was chosen for Belfast as a Whig to the first Reformed Parliament 1832, and several times subsequently; withdrew from the Whigs, along with Lord Stanley and Sir James Graham, in what was called the "Derby dilly;" was subsequently an efficient supporter of Sir Robert Peel; was secretary to the Indian board 1841–45; published a work on *Belgium* (2 vols., 1841) and a *Treatise on Copyright of Designs for Printed Fabrics* (1841); procured the passage of an act establishing copyright in designs 1843; was knighted and appointed civil secretary to the colonial government of Ceylon July, 1845; filled that post until Dec., 1850; was chosen to Parliament for Lisburn 1851; was secretary to the poor law board under the Conservative administration of 1852; was subsequently (1852–67) one of the joint secretaries to the board of trade, and retired from office with a baronetcy Feb. 5, 1867. D. at London Mar. 6, 1869. Author of *Christianity in Ceylon* (1850), *Wine, its Use and Taxation* (1855), *The Story of the Guns* (1864), and *The Wild Elephant* (1867), besides his chief work, *Ceylon, an Account of the Island, Physical, Historical, and Topographical*, etc. (2 vols., 1859). He also contributed largely to *Notes and Queries* and *Land and Water;* wrote the articles "Tarshish," "Trincomalie," and "Wine-making" in the 8th ed. of the *Encyclopædia Britannica*, and republished a portion of his larger work, with additions, under the title *Sketches of the Natural History of Ceylon* (1861), with illustrations from original drawings.

**Tennent** (William), D. D., brother of Gilbert, b. in county Antrim, Ireland, Jan. 3, 1705; came to America with his family 1718; studied theology under his brother at New Brunswick; had a remarkable catalepsy or trance which continued three days, during which he had every appearance of being dead, and so completely lost all memory of his past life that he had to be taught to read anew; recovered his memory by a sudden shock in the head, and related extraordinary visions of heaven as seen during the state of trance, and of being sent back to earth by a heavenly messenger; was ordained pastor of the Presbyterian church at Freehold, N. J., Oct. 25, 1733, as successor to his brother John, and filled that post forty-four years until his death, Mar. 8, 1777. He published a few occasional sermons, some of which were included in a volume entitled *Sermons and Essays by the Tennents and their Contemporaries* (1855). A *Life of Rev. William Tennent, with an Account of his being Three Days in a Trance* (New York, 1847), was prepared by Judge Elias Boudinot. Some "statements" of his on the subject of the famous trance may be found in Prince's *Christian History*. (See Sprague's *Annals*, vol. iii., and Storrs's *Constitution of the Human Soul*, 1857.)

**Ten'nents,** tp., Franklin co., Ala. P. 68.

**Tennessee',** one of the central States of the Union, lying mostly in the lower Mississippi Valley, between the parallels of 35° and 36° 30′ N. lat., and between the meridians of 81° 37′ and 90° 28′ W. lon. from Greenwich. It is bounded on the N. by Kentucky and Virginia, on the S. E. by North Carolina, on the S. by Georgia, Alabama, and Mississippi, and on the W. by the Mississippi River,




The Seal of Tennessee.

which separates it from Arkansas and Missouri. Its greatest length from E. to W. is 432 miles, and its extreme width 109 miles. The State is rhomboidal in shape. The area is stated in the ninth census report as 45,600 sq. m., or 29,184,000 acres, but Col. J. B. Killebrew, the secretary of the Tennessee Bureau of agriculture, and author of the *Resources of Tennessee* (Nashville, 1874), gives the area as only 42,000 sq. m., or 26,880,000 acres.

*Face of the Country and Topography.*—The State comprises eight great natural divisions: (1) The mountain-ridges of the Appalachian chain, forming the eastern border of the State. This portion of the Appalachian chain is called the Unaka Mountains. Its average elevation is 5000 feet above the sea, and its area about 2000 sq. m. Its climate is similar to that of the Catskill region in New York. The valleys among the mountains are arable, but the region generally is barren, and of little agricultural value. (2) Adjoining this on the W., and lying between the Unakas and the Cumberland Table-land, is the valley of East Tennessee. This valley, bordered by much higher lands, stretches from N. E. to S. W. in a succession of ridges and minor valleys, its average elevation being about 1000 feet above the sea, and its area 9200 sq. m. A large proportion of it is arable and fertile. (3) Next comes the Cumberland Table-land, a rocky plateau 2000 feet above the sea, its eastern face a gray, abrupt, cliff-lined rampart, rising almost perpendicularly from the valley; its western face jagged and broken, less abrupt, and having numerous finger-like spurs penetrating and separating the valleys. Its area is 5100 sq. m. (4) From the western edge of this Cumberland Table-land, the Highlands, Rim-lands, or Terrace-lands extend to the Tennessee River. They have an average elevation of about 1000 feet above the sea. This is a region of great agricultural importance. Its area is 9300 sq. m. (5) In the centre of these Highlands lies the great Central Basin, elliptical and resembling the bed of a drained lake. This basin has an average depression of 300 feet below the Highlands, and an area of 5450 sq. m. Its soil is fertile and highly productive. The elevation of the Rim-lands and of the basin is less on the N. W. side than on any other. (6) Beyond the western edge of the Highlands, and penetrated by outlying spurs from them, is the narrow W. valley of the lower Tennessee and its smaller affluents. This valley has an average breadth of 10 or 12 miles,

and extends across the State. Its area is 1200 sq. m., and its elevation about 350 feet above the sea. It is fertile, but in some places marshy, with cypress swamps. (7) The plateau or slope of West Tennessee, a broad, rolling plain about 84 miles wide, and sloping toward the Mississippi River, terminating a short distance E. of the river in a long, steep bluff. This plateau is furrowed with river-valleys. The soil is light, porous, silicious, and for the most part abundantly fertile. The area is about 8850 sq. m., and the elevation averages 500 feet. (8) The bottoms of the Mississippi, forming a flat alluvial plain, with frequent lakes and morasses, often overflowed, and having an average elevation of 295 feet above the Gulf. The soil is of exuberant fertility, and the vegetation tropical in its rank luxuriance. Its area is about 900 sq. m.

For civil purposes, the State is divided into East Tennessee, extending from the eastern boundary to the middle of the Cumberland Table-land; Middle Tennessee, from the dividing-line on the Cumberland Table-land to the lower Tennessee River; and West Tennessee, from the Tennessee River to the Mississippi. Though there are hills and bluffs in Middle Tennessee, yet East Tennessee is the only portion of the State which can be called mountainous. The Unaka Mountains have many elevated summits, of which the most noteworthy are Roan Mountain in Carter co. (6306 feet high), in the Stone Mountain Range; Buffalo Mountain and Rich Mountain, both about 5550 feet, peaks of the Bald Mountains in Washington co.; the Big Butte Range and Paint Mountain, both in Greene co., and terminating on French Broad River, have summits of about the same height as those of Washington co. The Great Smoky Mountain, in Cocke co., is one of the highest in the State, and the Chilhowee, in the same county, has elevated peaks. Frog Mountain, in Polk co., and Starr Mountain, forming the outlying ridge in McMinn and Polk cos., have also lofty summits. The highest portions of these mountains, usually destitute of trees, and hence called "Balds," have usually a thin soil, but furnish excellent pasturage. There are a few considerable elevations in the East Tennessee Valley, such as Powell Mountain, in Hancock and Claiborne cos., the Bays Mountain Group in Hawkins and Greene cos., and Clinch Mountain, in Hawkins and Grainger cos. The almost perpendicular escarpment of the eastern face of the Cumberland Plateau gives the impression of a lofty mountain-chain. It is really only about 1000 feet above the valley, and perhaps 2000 above the sea.

*Rivers.*—The State is well watered. The Mississippi washes its western border, and often overflows its alluvial lands; and its affluents within the State, the Big Hatchie, N. and S. Forked Deer, and Obion rivers, are large streams, navigable for a considerable distance. Loosahatchie and Wolf rivers are smaller streams, discharging into the Mississippi. But the principal rivers are the Tennessee and the Cumberland, which, together with their affluents, drain more than three-fourths of the State. The tributaries of the Tennessee River on the N. shore are the Clinch, Sequatchie, Paint Rock, Flint, Elk, and Duck rivers, and Shoal and other creeks; on the S. shore, the Watauga, French Broad, Little Tennessee, Hiawassee, and Big Sandy. Most of these are navigable for considerable distances. The principal tributaries of the Cumberland River in the State are Caney Fork and Stone rivers. Reelfoot Lake is rather an expansion of a stream in the bottom-lands than a lake. There are several islands in the Mississippi opposite the State, and several in Tennessee River.

*Geology.*—The geology of Tennessee represents almost every system from the metamorphic rocks and the Lower Silurian to the most recent alluvial deposits of the Mississippi river-bottoms. Beginning with the extreme eastern border of the State, we have the metamorphic rocks of the Appalachian chain, occupying in Tennessee only small portions of Johnson, Carter, Washington, Cocke, Roe, and Polk cos. They are mostly gneiss, talcose slate, and mica slate, and furnish good grazing-grounds and orchard-lands. In the Lower Silurian proper, which has an enormous development in the State, the Potsdam, the Quebec, and the Trenton are represented; the first by the Ocoee group, having an estimated thickness of 10,000 feet, and making up the greater part of the Unaka Mountains, and the Chilhowee sandstones, a whitish sandstone, having a thickness of about 2000 feet. The rocks of this period include conglomerates, sandstones, clay-slates, semi-talcose, and roofing slates, and dolomite, with veins of gold-bearing quartz. The second or Quebec period is represented by the Knox formation, ridge-lands and valley-lands, the richest and best of East Tennessee, and suitable for all Tennessee crops and fruits. The third or Trenton period has the Trenton or Lebanon group proper and the Cincinnati, or Hudson River group. It is characteristic of many of the East Tennessee valleys, but has its largest development in the great Central Basin. The lands of this formation are very fertile, and are known as "blue-grass" lands. The Upper Silurian is represented by two groups: the Niagara, divided into four sub-groups —viz. the Clinch Mountain sandstone, found mainly on narrow ridges of the East Tennessee Valley; the White Mountain sandstone; the dyestone group, containing several layers of fossiliferous iron ore; and the Niagara limestone proper. In close proximity to this is the limestone of the Lower Helderberg group. The last two formations are confined almost entirely to the western valley. The only representative of the Devonian system is a black shale, attributed to the Helderberg period, found in a few long narrow valleys in East Tennessee. This shale is bituminous, and contains pyrites and enough hydrocarbon to make it burn with flame for a time. It yields a considerable quantity of viscid petroleum oil. We find the Lower Carboniferous period represented by three groups—the Barren or Protean group, constituting the barrens of the Rim-lands or Highlands, much of it in forest, and having a thin but arable soil—good grass lands; the coral or St. Louis limestone; the "hickory barrens" of the Rim-lands, and the base of the Cumberland Table-land, a strong and tolerably productive soil, adapted to cereals and tobacco; and the mountain limestone, which is the underlying rock of the Cumberland Table-land. It is very thick in the southern part of the State, but becomes thinner toward the N., having a thickness of about 400 feet at the Kentucky line. The soil is often very rich, and much of it covered with heavy timber. The coal-measures are coextensive with the Cumberland Table-land, of which they form the superficial covering, varying in thickness from 600 to 2000 feet. They form an irregular quadrilateral, 71 miles wide at the northern end and 50 at the southern, and have an area of 5100 sq. m., covering portions of twenty-one counties. This coal-field is a part of the great Appalachian coal-field extending from Western Pennsylvania and Ohio to Central Alabama. The veins of coal are of varying thickness—in some places from 4 to 9 feet, in others from 1 to 4 feet. There are in the southern part of the coal-field at least twenty-one distinct strata or layers of coal, but not a third of them capable of profitable working. The coal is bituminous, but generally contains very little sulphur, and is admirably adapted for smelting and other purposes. The supply is ample, not only for the furnaces and manufactories of that region, but for the steamboats, locomotives, and family use of that and the adjacent States for ages to come. Above the coal-measures come the Cretaceous, Tertiary, and Lower Quaternary systems, almost wholly laid over, superficially, by the orange sand or drift, a Quaternary deposit. The Cretaceous groups are: the coffee sand of rotten limestone or greensand, with numerous fossil oyster and other shells; and Ripley limestone and sandstone, with occasional veins of greensand. To these succeed two groups belonging to the Tertiary system—the Flatwoods group, sands and clays of later formation, and the La Grange group, mainly sands of varied colors, with occasional beds of white and variegated clays and beds of lignite. These two groups have a thickness of about 700 feet, the last much the thickest. The orange sand, a well-marked Quaternary deposit which contains also beds of gravel, not only forms the superficial layer over the greater part of the plateau or slope of that part of West Tennessee and the bluffs, but is in some places of considerable thickness. The Cretaceous groups succeed one another in regular order W. of the western valley of the Tennessee, the coffee sand, rotten limestone, and Ripley groups occupying Tennessee Ridge, but all overlaid by a thin layer of this orange sand; the Flatwoods group (similarly overlaid) occupying an adjacent narrow strip extending across the State; while the La Grange group, also overlaid with the orange sand, extends from the Flatwoods deposit to the bluff or loess of the Terrace formation. Nearly all these lands, Cretaceous, Tertiary, and Quaternary, have a good soil, a mellow silicious loam, and yielding excellent crops. A portion of them form the best tobacco-lands in the State. Along the Tennessee Ridge the surface is more broken, but generally fertile. The bluff or loess, now reckoned as constituting the Terrace formation, and more recent in its origin than the Quaternary, extends in a belt of nearly 20 miles (average width) from the Plateau slope of West Tennessee to the bluffs overlooking the Mississippi. The soil is light ashen-yellowish or buff color, contains large quantities of fossil land and water shells, and is generally very rich and fertile. It has a thickness ranging from a few feet to over a hundred. The alluvium is widest and richest in the bottom-lands of the Mississippi; but the beds of the immediate tributaries of that river in the State, and the bottom-lands of the Tennessee and Cumberland, are also alluvial. The soil has a great depth, and is marvellously productive.

*Mineralogy.*—We have already given some account of the coal-fields of the State. Next in value to coal, are the iron deposits. There are four distinct iron districts in Tennes-

see—viz. (1) The eastern iron belt, along the base and in front of the Unaka Mountains, the ore being mainly limonite, or, as it is frequently called, brown hematite, and occurring in irregular masses in banks of clay or sand. There are also magnetic ores, and at one or two points red hematites. (2) The dyestone belt, skirting the eastern base of the Cumberland Table-land, and extending into the East Tennessee Valley and along Waldron's Ridge. The ore is very abundant in this belt. It is stratified, and belongs to the hematites. It yields from 50 to 60 per cent. of pure iron in the furnace. (3) The Cumberland Table-land belt, in which the ores are argillaceous, occur in nodules and layers, and yield but about 30 per cent. (4) The western iron belt, extending through the Rim-lands or Highlands on both sides of the central basin. The ore here is limonite, and occurs in immense masses in banks, and yields from 40 to 55 per cent., and the ore delivered to the furnace costs not over $2 per ton. The facilities for supplying both wood and coal for smelting, limestone for fluxes, and sandstone for hearths, are such that iron can be made more cheaply in Tennessee than anywhere else in the world, and its furnaces are increasing largely. Copper ores are found in great quantities in Polk co., varying in yield from 2 to 26 per cent. Gold is found in the State, but not in paying quantities. There is lead also at several points, but except in Union co. it is in pockets, and not in sufficient quantity to defray the cost of expensive machinery for its reduction. Zinc is also found in Union co., and mines have been worked there. The zinc ores are smithsonite and calamine, and both are very rich. The other principal minerals are black oxide of manganese, iron pyrites, sulphate of iron, barytes, gypsum, salt, nitrate of potassa, petroleum, lignite (in Western Tennessee), alum, sulphate of soda, sulphate of copper, a great variety of mineral waters. There are also marble, black, gray, red, and variegated, of great beauty and in immense quantities, in East and West Tennessee, breccia in the Little Tennessee River; roofing-slates in East Tennessee, millstone grit in Middle Tennessee, hydraulic rocks in East, Middle, and West Tennessee, limestones, sandstones, and granite for building, potter's clay and fire-clay.

*Vegetation.*—We have given with the geology a description of the soils of the State, but it remains to speak of the natural vegetation. Tennessee had 13,268,789 acres in timber or forest lands in 1870. The following are the most abundant of the forest trees of the State: white, blue, and water ash; beech, birch, buckeye, red cedar, chestnut, wild cherry, cottonwood, cypress, dogwood, white, slippery, and witch or cork elm; the balsam and black fir; the black gum and the liquidamber or sweet gum; six species of hickory, all very abundant; the linden or basswood; the black or yellow locust and the honey locust; three species of maple; the red mulberry; twelve or fifteen species of oak, including the white oak in great abundance and of excellent quality, the post, chestnut, black, scarlet, and other species; the yellow and white pine; the blue, white, and yellow poplar or tulip tree; the sassafras, both as a shrub and a forest tree; the sycamore or buttonwood; the tupelo; the black walnut and white walnut, or butternut; the yellow-wood; the cucumber tree; the laurel or bay; the holly, hop-hornbeam, box elder, chinquapin, crab-apple, hackberry, a great number of species of willow, the persimmon, etc. Fruit trees and small fruits are abundant and of the best quality. Apples, pears, peaches, cherries, plums, apricots, nectarines, and, in Western Tennessee, the fig, papaw, the most luscious grapes, and all the smaller fruits and berries, grow in great profusion. The flora is of the most varied character. The State has several valuable indigenous grasses, and all the cultivated grasses succeed well there.

*Zoology.*—The wild animals of the State are those usually found on the Appalachian chain and in the adjacent valleys. In Eastern and Middle Tennessee bears are seen rarely in the mountain-forests, while deer, raccoons, foxes, opossums, squirrels, and hares exist in great numbers. The serpent tribes include the rattlesnake and moccasin and a large number of harmless snakes. Lizards, horned frogs, etc., are common, and the alligator occasionally finds his way into the bayous of the Mississippi. The birds of prey, as well as those remarkable for beauty of plumage and song, abound.

*Climate.*—Along a line running E. and W. through the middle of the State the mean temperature of the year is 57° in East Tennessee, 58° in Middle, and 59° in West Tennessee; along the southern boundary of the State it is 58°, 59°, and 60° in these respective localities; and along the northern border, 56°, 57°, and 58°. In this statement we must except the valley of East Tennessee, which at the northern boundary has a mean not exceeding 55°, and perhaps, taking a series of years together, not 54°, while at the southern boundary it is not less than 58°. The following table gives the average mean temperature, etc., at several different points in the State, and other particulars as far as possible:

| Meteorological Data. | Knoxville, lat. 35° 56′, lon. 83° 58′; elevation, 993 feet. | Lebanon, lat. 36° 17′, lon. 86° 23′; elevation, about 536 feet. | Nashville, lat. 36° 11′, lon. 86° 53′; elevation, 504 feet. | Glenwood (Montgomery co.), lat. 36° 29′ 12″, lon. 87° 07′ 30″; elevation, 500 feet. | Falls of Caney Fork, lat. 35° 47′, lon. 85° 44′; elevation, 1092 feet. | Memphis, lat. 35° 07′, lon. 90° 07′; elevation, 299 feet. |
|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | ° | ° |
| Average mean annual temperature | 57.03 | 57.76 | 58.47 | 57.26 | 58.48 | 61.60 |
| Average maximum temp. of the year | 92 | 97 | 95 | 92.90 | 94.50 | 101.50 |
| " minimum " " | 6 | 6 | 5 | 3.25 | 3 | |
| Range of annual temperature | 86 | 91 | 90 | 89.65 | 91.50 | |
| Average mean temperature of spring | 56.3 | 58.64 | 58.93 | 56.71 | 58.86 | 60.13 |
| Maximum temperature " " | 90 | 91 | 91 | 84 | 90 | 87 |
| Minimum " " " | 6 | 12 | 11 | 31 | 10.50 | 30 |
| Range of temperature in spring | 84 | 79 | 80 | 53 | 79.50 | 57 |
| Average mean temperature of summer | 74.02 | 75.41 | 74.33 | 74.40 | 74.27 | 75.57 |
| Maximum temperature " " | 92 | 97 | 95 | 92.90 | 94.50 | 101.50 |
| Minimum " " " | 61 | 46 | 66 | 48 | 65 | 58.50 |
| Range of temperature in summer | 31 | 51 | 29 | 44.90 | 29.50 | 43 |
| Average mean temperature of autumn | 55.40 | 57.61 | 58.80 | 57.54 | 58.56 | 59.40 |
| Maximum temperature " " | 91 | 94 | 95 | 86 | 90 | 90 |
| Minimum " " " | 15 | 19 | 20 | 15 | 21 | 28 |
| Range of temperature in autumn | 73 | 75 | 75 | 71 | 69 | 62 |
| Average mean temperature of winter | 38.66 | 38 | 41.20 | 37.87 | 40.97 | 44.66 |
| Maximum temperature " " | 69 | 72.50 | 73 | 74 | 68 | |
| Minimum " " " | 6 | 6.50 | 5 | 3.25 | 3 | |
| Range of temperature in winter | 63 | 66 | 68 | 70.75 | 65 | |
| | Inches. | Inches. | Inches. | Inches. | Inches. | Inches. |
| Average annual rainfall | 59.25 | 43.61 | 54.74 | 53.48 | 58.47 | 49.39 |
| Rainfall in spring | 12.60 | 10.55 | 15.03 | 13.41 | 12.35 | 17.40 |
| " " summer | 13.15 | 9.57 | 14.37 | 13.32 | 14.02 | 7.29 |
| " " autumn | 12.40 | 7.54 | 13.39 | 11.63 | 11.83 | 14.54 |
| " " winter | 21.10 | 15.95 | 11.95 | 15.12 | 20.27 | 6.93 |
| Date of last frost in spring (average of from 3 to 23 years) | Apr. 10 | ..... | ..... | Apr. 17 | | |
| First killing frost in autumn | Oct. 18 | ..... | ..... | Oct. 20 | | |
| Number of days without frost | 166 | ..... | ..... | 173 | | |
| Number of days without killing frost | 181 | ..... | ..... | 189 | | |
| Prevailing winds in order of frequency | S. W., N. E., N., S., W., E., calm, N. W., S. E. | ..... | Calm, N. W., S., W., N., S. E., E., S. W., N. E. | S., N.W., N. E., calm, S. E., N., S. W., E., W. | ..... | N. W., S. W., N. E., S. E., calm, S., N. |

*Agricultural Productions.*—According to the census of 1870, 72.6 per cent. of the inhabitants of the State are engaged in agricultural pursuits. The census of 1870 reports 19,581,214 acres of land in the State in farms. Of this amount, 6,843,278 acres are said to be improved. The value of the farms in 1870 was said to be $218,743,747, and of farming implements and machinery, $8,199,487. The value of all farm productions, etc., was stated at $86,472,847; of animals slaughtered or sold for slaughter, $15,856,880; of home manufactures, $2,773,820; of forest products, $335,317; of market-garden products, $301,093; of orchard products, $571,520; of wages paid during the year, $7,118,003. Of the cereals, Tennessee in 1869–70 produced 6,188,916 bushels of wheat—in 1874, according to the Bureau of agriculture, 11,121,000 bushels, valued at $11,788,260; in 1869–70, 223,335 bushels of rye, and in 1874, 238,000 bushels, valued at $249,900; in 1869–70, 41,343,614 bushels of Indian corn, and in 1874 but

31,953,000, worth $21,728,040; in 1869–70, of oats, 4,513,315 bushels, and in 1874, 3,816,000 bushels, worth $2,175,120; of barley, 75,068 bushels, and in 1874, 84,000 bushels, worth $94,080; of buckwheat, in 1869–70, 77,437 bushels, and in 1874, 76,000 bushels, worth $56,240; of cotton in 1869–70, 181,842 bales, worth $12,274,335. The cotton crop of 1873–74 was somewhat more than 300,000 bales, worth in round numbers about $13,000,000. Of flax, 80,930 pounds were grown in 1869–70, 1033 tons of hemp, 153 pounds of silk cocoons, and 1,389,762 pounds of wool. Of hay, Tennessee produced in 1870, 116,582 tons—in 1874 the estimated crop was 114,300 tons, worth $2,180,844. Tennessee ranks as the third State in the Union in the production of tobacco, the crop of 1869–70 having been 21,465,452 pounds. Mr. Killebrew states that the annual product ranges from 20,000,000 to 25,000,000 pounds, the first-named amount being the minimum. The estimated crop of 1875, according to the State Bureau of agriculture, was 35,000,000 pounds. Its average value is about 10 cents per pound. In 1870, Tennessee reported 1410 hogsheads (or 1,410,000 pounds) of cane-sugar and 3629 gallons of cane-molasses; 134,968 pounds of maple-sugar, 4843 gallons of maple-molasses, and 1,254,701 gallons of sorghum-molasses. In 1870 the State produced 1,124,337 bushels of Irish potatoes and 1,205,683 bushels of sweet potatoes. This, Mr. Killebrew says, is about the usual crop. The agricultural department reports only Irish potatoes in 1874, and estimates the crop at 605,000 bushels. The amount of clover, flax, and grass seeds raised in the State is not large, being in 1870, 8564, 4612, and 11,153 bushels respectively. Peanuts are a large and generally profitable crop in Tennessee. In 1872, 680,000 bushels were raised in four counties, valued at about $1,200,000. The dairy products of the State were in 1870, 9,571,069 pounds of butter, 142,240 pounds of cheese, and 415,786 gallons of milk sold, the whole worth $3,071,545.70. There has been a large increase in these products since 1870. The live-stock of the State was valued in 1870 at $55,084,075, and consisted of 273,200 horses, 102,983 mules and asses, 682,318 neat cattle (of which 243,197 were milch cows), 826,783 sheep, and 1,828,690 swine. In Jan., 1875, the U. S. agricultural department reported 318,000 horses, 107,300 mules and asses, 242,700 milch cows, 340,800 oxen and other cattle, 325,500 sheep, and 1,193,500 swine.

*Manufacturing and Mining Products.*—In 1870 there were, according to the census, 5317 manufactories in the State, driven by 732 steam-engines and 1340 water-wheels, having an aggregate of 37,983 horse-power, employing 19,412 hands (17,663 men, 1089 women, and 660 children) and a capital of $15,595,295, paying $5,390,630 wages, using $19,657,027 of raw material, and producing goods valued at $34,362,636. Of specified industries, there were 216 flouring-mills, producing $5,666,698 of flour and meal; 349 saw and planing mills and sash-factories, producing together $3,768,976 worth of manufactured lumber; 65 furnaces, bloomeries, and foundries, producing $2,072,040 of iron; 395 establishments for tanning and currying leather, producing $1,844,138 of leather; 39 printing and publishing offices, producing books, pamphlets, periodicals, and printing to the amount of $1,022,600; 28 cotton-mills, producing cotton goods worth $941,542; 220 wheelwright-shops, making carriages and wagons to the value of $938,647; 161 saddlery and harness shops, producing harnesses and saddles valued at $650,071; 180 ready-made clothing establishments, producing clothing valued at $597,607; 2 copper milling and smelting works, producing copper to the value of $510,677; 133 wool-carding and dressing mills, producing $491,847 of woollen goods; 4 cotton-seed oil-mills, producing $490,000 worth of oil; 44 distilleries, producing $454,853 worth of liquors; 76 tin, copper, and sheet-iron ware shops, making up $437,551 of tinware, etc.; 89 cabinet-shops, producing $404,538 of furniture; 21 machine-shops, making $387,450 of machinery, and 4 car-shops, producing cars to the value of $293,624. Notwithstanding the great depression in business and manufactures, there has been a great increase in many branches of manufacture since 1870. In 1874, Mr. Killebrew stated that "in the manufacture of cotton goods and iron the establishments, if they had not doubled in number, had twice the capacity they had in 1870;" and later information makes it certain that for the present year (1876) the production is not less than three times that of 1870; the distilleries, carriage and wagon shops, and woollen-mills have doubled their product; the production of coal and iron ore has been trebled.

*Railroads.*—The railroads of Tennessee have all been built since 1850; between 1850 and 1860, 1253 miles were built; between 1860 and 1870, only 239 miles; and between 1870 and 1876, 316.80 miles, making in all 1808.80 miles, the cost of which, for road equipment, etc., was estimated in Poor's *Manual* at $58,319,555. Of these roads, the most important are the Mobile and Ohio, the Mississippi Central and New Orleans, the Memphis and Charleston, the Memphis and Ohio, the Mississippi and Tennessee, the Memphis and Paducah, the East Tennessee Virginia and Georgia, the Nashville and Chattanooga, the East Tennessee and Georgia, the Nashville and North-western, the Jackson and Birmingham, the St. Louis and South-eastern, the Jackson and Evansville, the Selma Montgomery and Memphis, the Memphis and Vicksburg, the Louisville Nashville and Great Southern, and the Cairo and Tennessee River. These are mostly trunk-roads, extending through other States and having but a part of their length in this; there are also 10 or 12 short roads, wholly within the State.

*Finances.*—The sessions of the legislature and the State reports being biennial, we have no reports later than those of about Jan. 1, 1875. At that time (or rather Dec. 20, 1874) the State funded and registered debt amounted to $22,908,400, of which all but $286,000 bore 6 per cent. interest. There was, besides, a contingent liability of the State as endorser on some railroad bonds of $1,802,000. The total receipts from all sources for the period from Jan. 1, 1873, to Dec. 19, 1874 (two years, less 12 days) were $3,618,703.52, and the total disbursements, $3,290,158.41, showing a balance in the treasury of $328,704.55.

*Commerce.*—Memphis and Nashville are both river-ports of entry, but the State has no direct foreign commerce, its large exports of cotton being made through New Orleans, Norfolk, Charleston, and New York, and exchange drawn upon the shipments either through New York or New Orleans. The internal and riverine commerce is of very large amount. The shipments of cotton from the State (two-thirds of it from Memphis) in 1873 were 613,750 bales, and in 1872, 548,913 bales; and the value of these shipments alone was from 35 to 45 millions of dollars. The tobacco shipped is worth from 2 to 2½ millions more. The wholesale trade of the State, from the data before us, cannot be estimated at less than 300 million dollars.

*Banks.*—In 1875, Tennessee had 26 national banks. These 26 banks had $3,360,000 paid capital, $3,116,500 bonds on deposit, $3,061,232 circulation outstanding. There were also 11 State banks, with a capital of $1,442,000, 8 savings banks, of which 4 reported a capital of $263,000, and 5 private banking-houses.

*Insurance.*—In 1875 there were 12 fire and marine insurance companies in Tennessee, having an aggregate capital of $2,775,750, and reported assets of $3,263,988. There were also 3 life insurance companies, with a capital of $668,300, and reported assets of $2,615,737.

*Population.*

| Census year. | Total population. | Males. | Females. | White. | Free colored. | Slave. | Natives. | Foreigners. | Density of population. | Ratio of increase. | Number of families. | Number of dwellings. | Persons to a family. | Persons to a dwelling. | Illiterate. | Of school age, 5–20. | Of military age, 18–45, males. | Of voting age, 21 and upward, males. | Citizens, males. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1790 | 35,691 | 18,520 | 17,171 | 32,013 | 361 | 3,417 | ..... | ..... | 0.85 | ..... | ..... | ..... | .... | .... | ..... | ..... | 5,919 | 7,138 | |
| 1800 | 105,602 | 53,811 | 51,791 | 91,709 | 309 | 13,584 | ..... | ..... | 2.51 | 195.05 | ..... | ..... | .... | .... | ..... | ..... | 17,600 | 21,120 | |
| 1810 | 261,727 | 134,564 | 127,163 | 215,875 | 1,317 | 44,535 | ..... | ..... | 6.23 | 147.84 | ..... | ..... | .... | .... | ..... | ..... | 43,605 | 52,345 | |
| 1820 | 422,813 | 214,873 | 207,940 | 339,927 | 2,779 | 80,107 | ..... | ..... | 10.07 | 61.55 | ..... | ..... | .... | .... | ..... | ..... | 70,433 | 84,562 | |
| 1830 | 681,904 | 347,612 | 334,292 | 535,746 | 4,555 | 141,603 | ..... | ..... | 16.23 | 61.28 | ..... | ..... | .... | .... | ..... | †217,804 | 113,622 | 136,381 | |
| 1840 | 829,210 | 419,707 | 409,503 | 640,627 | 5,524 | 183,059 | ..... | ..... | 19.74 | 21.60 | ..... | ..... | .... | .... | ..... | †261,833 | 134,801 | 165,842 | 119,947 |
| 1850 | 1,002,717 | 504,132 | 498,585 | 756,836 | 6,422 | 239,459 | 995,478 | 7,239 | 21.99 | 20.92 | 130,004 | 121,419 | 5.87 | 5.90 | *78,619 | 418,125 | 174,534 | 198,695 | 151,367 |
| 1860 | 1,109,801 | 562,718 | 547,083 | 826,828 | 7,235 | 275,584 | 1,088,575 | 21,226 | 24.34 | 10.68 | 149,335 | 147,947 | 5.59 | 5.64 | *72,054 | 443,511 | 206,423 | 235,856 | 165,365 |
| 1870 | 1,258,520 | 623,347 | 635,173 | 936,119 | 322,331 | ..... | 1,239,204 | 19,316 | 27.60 | 13.40 | 231,565 | 224,816 | 5.44 | 5.60 | *364,697 | 484,513 | 222,903 | 263,200 | 259,016 |

*Education.*—Higher education has received a somewhat remarkable degree of attention in Tennessee. In the number of her colleges and collegiate schools, her universities and professional schools, as well as in the grade of scholarship in some of them, she is beyond any other of the South-western States. In the past twenty-five years her situation relatively to the other States of the South-west has attracted attention to her, and she has received large gifts from citizens of other States for the endowment of her universities. But while these institutions are in a prosperous condition, the public schools and primary education have been almost entirely neglected. There were, in the

*The illiterate in 1850 and 1860 are persons of 20 years and upward who cannot read and write; in 1870, 10 years old and upward.

†Whites only.

more populous districts, private schools and seminaries at which the children of the wealthy could receive the rudiments of education, but for the great mass of her people even the most elementary knowledge of books was almost unattainable. "Prior to the civil war," says the Commissioner of Education, "the interest upon the school fund, amounting annually to $90,000, was for many years ratably distributed among the several counties of the State for the maintenance of free schools, but the sums thus realized by the school districts were so inconsiderable, and the provisions made for the profitable use of the money so imperfect, that but little good was or could be accomplished. The schools, thus maintained for a few weeks in the year, and taught usually by incompetent persons, were not looked to by the people as sources of instruction for their children, but rather as temporary eleemosynary establishments, at which the children of poor people might enjoy a scanty charity in the shape of bad primary instruction." In 1867 a school law was passed which was not acceptable to the people, and was superseded by the law of 1870, which in turn proving objectionable, in that it virtually restored the old condition of things before the war, remitting the whole subject to the several counties, and providing for no responsible head or superintendent, was repealed, and the law of 1873 substituted for it. This law, though better than any which preceded it, is yet very imperfect. When this law was adopted, there were in the State (says Col. Killebrew) 93,651 voters unable to read or write, a considerable portion of them whites. The results so far are shown in the following summary of the report of the superintendent for the year 1874: Amount of available school fund, $2,512,500. Receipts: interest on permanent fund, $150,750; total from taxation, $750,290.88; from other sources, $97,418.23, making the total receipts $998,459.11. The expenditures were: for sites, buildings, and furniture, $101,875.98; for salaries of State and county superintendents, $37,023.64; for salaries of teachers, $769,459.75; miscellaneous or contingent, $69,017.09; total expenditures, $977,376.46. Expenditure per capita of school population, $2.09; per capita of school enrolment, $3.40; per capita of average attendance, $5.47. The population of school age (in Tennessee 6 to 18 years) in 1874 was 420,384 (boys 216,134, girls 204,250); number enrolled in the schools, 258,577; average daily attendance, 161,089. The number of teachers was 5551 (4227 men, 1324 women); the number necessary to supply the public schools, 6000; average salary of teachers (no distinction of sex made), $33 per month. The superintendent complains of the great difficulty of finding competent teachers, and of the wretched condition of the school-houses, most of them, outside of the cities and largest towns, being log structures. Forty-six of the private schools reported to the U. S. commissioner of education in 1874–75. These had 289 instructors and 4866 scholars. There were 2022 students in the preparatory departments of the colleges. There were 4 business colleges, with 554 students, and high schools at Chattanooga, Nashville, and Memphis. In 1874 the Peabody fund aided 62 schools of the State in various amounts, the whole sum expended being about $34,000. The State University has arranged to have normal classes; and efforts are making to establish a State normal school, to which Dr. Sears, agent of the Peabody fund, offers to contribute $6000 a year if the State will appropriate a similar sum. Teachers' institutes have been held in several sections of the State with good results. There is a school for the blind at Nashville, which in 1874 had 6 instructors and teachers and 46 blind pupils; its annual expenditure was about $50,000, mostly from the State. The school for the deaf and dumb at Knoxville in 1874 had 7 professors and instructors and 136 pupils (81 males and 55 females). Its expenditures were $28,000; the value of buildings and grounds is $150,000. The following table gives as full particulars as can be obtained of the colleges, universities, female colleges, and professional schools of the State in 1874–75:

*Universities, Colleges, and Professional Schools.*

| Universities, Colleges, Female Colleges, and Professional Schools. | Location. | When organized. | Under what control. | Professors and instructors. | Students. | | | | Property, endowment, and income. | | | | | Volumes in library. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | In preparatory departments. | In collegiate or professional departm'ts. | Male. | Female. | Value of grounds, buildings, and apparatus. | Amount of endowment in productive funds. | Income from productive funds. | Income from all sources. | Aggregate amount of scholarships. | |
| | | | | | | | | | $ | $ | $ | $ | $ | |
| Beach Grove College | Beach Grove | 1868 | Non-sectarian | 5 | 106 | 18 | 78 | 46 | 30,000 | ..... | ..... | 1,600 | | |
| Bethel College | McKenzie | 1847 | Cumb. Presb. | 4 | 105 | 49 | 92 | 62 | 12,000 | ..... | ..... | 3.500 | .... | 350 |
| Central Tennessee College | Nashville | 1866 | Non-sectarian | 14 | 262 | ... | 139 | 123 | 45,000 | ..... | ..... | 993 | .... | 800 |
| Christian Brothers' College | Memphis | 1872 | Roman Catholic | 19 | 90 | 61 | 151 | ... | 40,000 | ..... | ..... | 9,100 | .... | 420 |
| Cumberland University | Lebanon | 1842 | Cumb. Presb. | 9 | 70 | 94 | 164 | ... | 20,000 | ..... | ..... | 5,000 | .... | 6,000 |
| East Tennessee University | Knoxville | 1807 | Non-sectarian | 17 | 87 | 47 | 134 | ... | 150,000 | 396,000 | 22,000 | 48,315 | .... | 3,989 |
| East Tennessee Wesleyan University | Athens | 1867 | Meth. Episcopal | 8 | 46 | 44 | 66 | 24 | 15,000 | ..... | ..... | 2,800 | .... | 1,500 |
| Fisk University | Nashville | 1866 | Cong. and non-sec. | 6 | 53 | 12 | 39 | 26 | 100,000 | 56,000 | ..... | 7,500 | .... | 1,000 |
| Franklin Female College | Franklin | 1857 | Meth. Ch., South. | 7 | ... | 145 | ... | 145 | 25,000 | ..... | ..... | 6,500 | .... | 600 |
| Greeneville and Tusculum College | Greeneville | 1794 / 1840 | Independent | 11 | 192 | 8 | 129 | 71 | 8,000 | 500 | 50 | 950 | .... | 7,000 |
| Hiwassee College | Near Sweetwater | 1849 | M. E. Ch., South. | 4 | 107 | 33 | 140 | ... | 12,000 | ..... | ..... | ..... | .... | 1,222 |
| King College | Bristol | 1868 | Presbyterian | 5 | 40 | ... | 40 | ... | 18,000 | 25,000 | 1,500 | 3,000 | .... | |
| Maryville College | Maryville | 1819 | Presbyterian | 6 | 131 | 48 | 104 | 75 | 60,000 | 13,300 | 798 | 3,298 | .... | 2,000 |
| Mosheim Male and Female Institute | Mosheim | 1869 | Lutheran | 4 | 80 | 19 | 63 | 36 | 2,500 | ..... | ..... | 900 | .... | 200 |
| Mossy Creek College | Mossy Creek | 1853 | Baptist | 3 | 112 | 38 | 150 | ... | 40,000 | 500 | | | | |
| South-western University | Jackson | 1874 | Baptist | 4 | 129 | ... | 129 | ... | 150,000 | 45,000 | 2,700 | | | |
| Stewart College | Clarksville | 1856 | Presbyterian | 6 | 75 | 65 | 140 | ... | 75,000 | 85,000 | 5.100 | 9,300 | .... | 3,500 |
| University of Nashville | Nashville | 1785 | State, in part | 13 | 156 | 30 | 186 | ... | 150,000 | 100,000 | 6,000 | 16,000 | .... | 10,000 |
| University of the South | Sewance P. O. | 1858 | Prot. Episcopal | 18 | 137 | 125 | 262 | ... | 150,000 | 50,000 | 3,000 | 24,800 | .... | 6,300 |
| Vanderbilt University | Nashville | 1875 | M. E. Ch., South. | 26 | ... | 307 | 307 | ... | 450,000 | 600,000 | 42,000 | | | |
| West Tennessee College | Jackson | 1844 | | 4 | 100 | ... | 100 | ... | 30,000 | | | | | |
| Bellevue Female College | Collierville | 1872 | Non-sectarian | 6 | 25 | 75 | ... | 100 | 12,500 | ..... | ..... | 5,000 | | |
| La Grange Female College | La Grange | 1855 | Non-sectarian | 8 | ... | 141 | ... | 141 | 20,000 | ..... | ..... | 6,000 | .... | 400 |
| Cumberland Female College | McMinnville | 1851 | Cumb. Presb. | 4 | 68 | 77 | ... | 145 | 20,000 | ..... | ..... | 3,000 | .... | 500 |
| State Female College | Memphis | 1858 | M. E. Ch., South. | 12 | 48 | 119 | ... | 167 | 75,000 | ..... | ..... | ..... | .... | 500 |
| Soule Female College | Murfreesboro' | 1852 | M. E. Ch., South. | 6 | ... | ... | ... | ... | 30,000 | | | | | |
| Savannah Female College | Savannah | 1861 | M. E. Ch., South. | 4 | ... | 125 | ... | 125 | 10,000 | ..... | ..... | 2,500 | | |
| Fairmount College for Young Ladies | Sewanee Mount | 1873 | Prot. Episcopal | 6 | ... | 40 | ... | 40 | 15,000 | ..... | ..... | 3,500 | .... | 200 |
| Washington Female College | Washington co. | .... | Presbyterian | 2 | 60 | 12 | ... | 72 | 8,000 | ..... | ..... | ..... | .... | 300 |
| Mary Sharp College | Winchester | 1850 | Baptist | 10 | 30 | 160 | ... | 190 | 20,000 | ..... | ..... | 11,074 | .... | 1,500 |
| Ward's Collegiate Seminary for Young Ladies | Nashville | 1865 | Non-sectarian | 17 | 25 | 216 | ... | 241 | 75,000 | ..... | ..... | 14,000 | .... | 2,000 |
| *School of Science.* | | | | | | | | | | | | | | |
| Tennessee Agricultural College, E. Tenn. Univ. | Knoxville | 1869 | State | .. | ... | 46 | 46 | End | owment | not se | parat | ed fro | m u | niv. |
| *Schools of Theology.* | | | | | | | | | | | | | | |
| Nashville Institute | Nashville | 1866 | Baptist | 5 | ... | 37 | 37 | ... | 40,000 | ..... | ..... | ..... | .... | 600 |
| Theological department Central Tenn. College. | Nashville | 1858 | Meth. Epis. Ch. | 7 | ... | 21 | 21 | ... | ..... | ..... | ..... | ..... | .... | 800 |
| Theological department Cumberland Univ. | Lebanon | 1857 | Cumb. Presb. | 4 | ... | 12 | 12 | ... | 15,000 | 15,000 | 1,000 | | | |
| Theological department Vanderbilt University | Nashville | 1875 | M. E. Ch., South. | 4 | ... | ... | 52 | | | | | | | |
| *Schools of Law.* | | | | | | | | | | | | | | |
| Law department Cumberland University | Lebanon | 1847 | Trustees | 2 | ... | 87 | 87 | ... | ..... | ..... | ..... | 7,000 | | |
| Law department Vanderbilt University | Nashville | 1873 | Trustees | | | | | | | | | | | |
| *Schools of Medicine.* | | | | | | | | | | | | | | |
| Depart. of Med. and Surgery Vanderbilt Univ. | Nashville | 1874 | Trustees | 14 | ... | 115 | 115 | | | | | | | |
| " " " Univ. Nashville. | Nashville | 1850 | Trustees | 8 | ... | 210 | 210 | ... | 250,000 | ..... | ..... | 15,000 | | |
| Tennessee College of Pharmacy | Nashville | 1872 | Trustees | 3 | ... | 50 | 50 | ... | ..... | ..... | ..... | 1,200 | .... | 200 |

*Charitable and Corrective Institutions.*—The Tennessee hospital for the insane, established in 1848 through the persevering efforts of Miss D. L. Dix, is in Davidson co., about 6 miles from Nashville. It has about 350 patients. Nearer Nashville are several hospitals, 2 orphan asylums, etc. In Nashville is the State penitentiary, a massive structure, and enclosed by a stone wall 25 feet high and 4 feet thick at the base. There are numerous workshops in the enclosure in which a part of the convicts are employed, but under a new system a majority of them work in coal-mines, in the construction of railroads, and upon the capitol grounds. The whole number imprisoned averages somewhat more than 900, of whom the larger portion are negroes. The county jail, the city workhouse, and a house of industry for females are also in or near the city.

*Newspapers.*—In 1870 the whole number of newspapers in the State was 91, issuing annually 18,300,844 copies, and having a circulation of 225,952 copies. Of these, 13 were dailies, with 34,630 circulation; 2 tri-weekly and 1 semi-weekly, with an aggregate circulation of 3300; 65 were weeklies, circulation 117,022; 1 semi-monthly, circulation 15,000; 8 monthlies, circulation 54,200; 1 quarterly, 1800; 1 annual,

12,000. At the beginning of 1875 the number had increased to 124, of which 11 were dailies, 1 semi-weekly, 1 tri-weekly, 97 weeklies, 12 monthlies, and 2 quarterlies. There was no report of annuals. Of these 124 papers, 80 were political (7 of them independent or neutral), 14 were religious, 3 agricultural, 3 commercial, 2 medical, 1 law, 1 temperance, 1 educational, and 5 miscellaneous. The circulation had materially increased.

*Churches.*

| Denominations. | Number of organizations, 1870. | Number of church edifices, 1870. | Church sittings, 1870. | Church property, 1870. | Church organizations, 1875. | Church edifices, 1875. | Clergymen or ministers, 1875. | Church members or communicants, 1875. | Adherent population, 1875. | Church property, 1875. |
|---|---|---|---|---|---|---|---|---|---|---|
| All denominations | 3180 | 2842 | 878,524 | $4,697,675 | 3622 | 3174 | 2319 | 287,070 | 1,243,750 | $5,934,450 |
| Baptists, regular | 942 | 877 | 245,151 | 843,675 | 1179 | 1047 | 779 | 104,312 | 468,000 | 1,147,500 |
| Baptists, Free-Will, Anti-Mission, etc. | 45 | 41 | 10,225 | 16,400 | 53 | 46 | 32 | 4,240 | 20,000 | 21,300 |
| Christian Connection and Disciples | 203 | 167 | 55,455 | 244,625 | 239 | 186 | 81 | 21,120 | 80,000 | 321,850 |
| Congregationalists | 3 | 2 | 525 | 14,100 | 8 | 8 | 11 | 522 | 2,500 | 26,500 |
| Protestant Episcopalians | 33 | 31 | 12,940 | 269,573 | 33 | 32 | 31 | 3,699 | 18,000 | 290,000 |
| Friends | 5 | 4 | 1,900 | 4,800 | 5 | 5 | ..... | 507 | 2,500 | 6,100 |
| Jews | 4 | 4 | 1,100 | 21,000 | 5 | 5 | 5 | 480 | 2,800 | 31,000 |
| Lutherans | 22 | 22 | 9,875 | 27,664 | 30 | 29 | 17 | 3,600 | 16,000 | 43,500 |
| Methodists of all kinds | 1339 | 1155 | 336,433 | 1,506,153 | 1471 | 1253 | 1023 | 117,860 | 482,000 | 1,963,250 |
| Presbyterians, regular | 262 | 241 | 83,590 | 858,105 | 249 | 237 | 151 | 14,500 | 63,750 | 1,016,550 |
| Presbyterians, Cumberland, etc | 294 | 271 | 105,380 | 400,230 | 309 | 287 | 147 | 15,120 | 68,300 | 528,000 |
| Roman Catholics | 21 | 21 | 13,850 | 486,250 | 29 | 29 | 31 | ..... | 15,000 | 549,500 |
| United Brethren in Christ | 7 | 5 | 1,600 | 4,100 | 12 | 9 | 10 | 960 | 4,000 | 8,500 |
| Union | ..... | 1 | 500 | 1,000 | ..... | 1 | 1 | 150 | 600 | 1,000 |

*Constitution, Courts, Representatives in Congress, etc.*—Under the new constitution, ratified in Mar., 1870, every male person of the age of 21 years, being a citizen of the U. S., and a resident of the State for 12 months, and in the county wherein he may offer his vote for 6 months next preceding an election, shall be entitled to vote for members of the general assembly and other civil officers. The supreme executive power is vested in a governor, who is chosen by the legal voters for a term of 2 years. He must be at least 30 years of age, and must have been a citizen of the State for 7 years next before his election. A secretary of state is appointed by joint vote of the general assembly for 4 years; a treasurer and controller of the treasury are appointed in the same manner for a term of 2 years. The State superintendent of schools is nominated by the governor and confirmed by the senate; his term of office is 2 years. The legislative authority is vested in a general assembly consisting of a senate and house of representatives, the former having 25 and the latter 75 members. They are elected for 2 years, and must have been citizens of the State for 3 years and of the county for 1 year next preceding their election. The senators must be at least 30 and the representatives 21 years of age. The judicial power is vested in a supreme court of 5 judges, elected for 8 years, having only appellate jurisdiction, and the concurrence of 3 judges being necessary to a decision—they choose for themselves one of their number as chief-justice; of circuit courts and chancery courts for the judicial districts, having original jurisdiction, and elected for 8 years. The attorney-general and reporter for the State are appointed by the judges of the supreme court for 8 years. Minor causes can be transferred from the justices' courts to the circuit courts or chancery courts on sufficient cause. The State is now entitled to 10 members of Congress.

*Counties* (93)*.

| Counties. | Population, 1870. | Males, 1870. | Females, 1870. | Population, 1860. | Assessed valuation of real and personal estate, 1873–74. | Counties. | Population, 1870. | Males, 1870. | Females, 1870. | Population, 1860. | Assessed valuation of real and personal estate, 1873–74. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $ | | | | | | $ |
| Anderson | 8,704 | 4,357 | 4,347 | 7,068 | 1,266,591 | Lake | 2,428 | 1,291 | 1,137 | ..... | 908,386 |
| Bedford | 24,333 | 11,981 | 12,352 | 21,584 | 7,104,965 | Lauderdale | 10,838 | 5,552 | 5,286 | 7,559 | 2,829,185 |
| Benton | 8,234 | 4,119 | 4,115 | 8,463 | 1,012,619 | Lawrence | 7,601 | 3,682 | 3,919 | 9,320 | 1,265,580 |
| Bledsoe | 4,870 | 2,418 | 2,452 | 4,459 | 818,229 | Lewis | 1,986 | 961 | 1,025 | 2,241 | 230,888 |
| Blount | 14,237 | 7,077 | 7,160 | 13,270 | 2,310,357 | Lincoln | 28,050 | 13,936 | 14,114 | 22,828 | 5,178,933 |
| Bradley | 11.652 | 5,641 | 6,011 | 11,701 | 2,535,820 | Loudon | new | county | ..... | ..... | 1,972,252 |
| Campbell | 7,445 | 3,737 | 3,708 | 6,712 | 992,912 | Macon | 6,633 | 3,288 | 3,345 | 7,290 | 987,802 |
| Cannon | 10,502 | 5,151 | 5,351 | 9,509 | 1,669,240 | Madison | 23,480 | 11,877 | 11,603 | 21,535 | 6,248,727 |
| Carroll | 19,447 | 9,525 | 9,922 | 17,437 | 3,787,855 | Marion | 6,841 | 3,396 | 3,445 | 6,190 | 1,263,199 |
| Carter | 7,909 | 3,846 | 4,063 | 7,124 | 1,004,451 | Marshall | 16,207 | 8,017 | 8,190 | 14,592 | 4,625,106 |
| Cheatham | 6,678 | 3,339 | 3,339 | 7,258 | 1,154,108 | Maury | 36,289 | 17,833 | 18,456 | 32,498 | 11,109,144 |
| Claiborne | 9,321 | 4,554 | 4,767 | 9,643 | 907,093 | McMinn | 13,969 | 6,714 | 7,255 | 13,555 | 2,754,753 |
| Clay | new | county | ..... | ..... | 763,615 | McNairy | 12,726 | 6,348 | 6,378 | 14,732 | 2,161,269 |
| Cocke | 12,458 | 6,012 | 6,446 | 10,408 | 1,362,032 | Meigs | 4,511 | 2,241 | 2,270 | 4,667 | 1,148.930 |
| Coffee | 10,237 | 5,035 | 5,202 | 9,689 | 1,911,074 | Monroe | 12,589 | 6,118 | 6,471 | 12,607 | 2,304,291 |
| Crockett | new | county | ..... | ..... | 3,163,589 | Montgomery | 24,747 | 12,219 | 12,528 | 20,895 | 5,716,025 |
| Cumberland | 3,461 | 1,713 | 1,748 | 3,460 | 614,009 | Moore | new | county | ..... | ..... | 1,130,168 |
| Davidson | 62,897 | 30,996 | 31,901 | 47,055 | 26,683,765 | Morgan | 2,969 | 1,437 | 1,532 | 3,353 | 398,081 |
| Decatur | 7,772 | 3,792 | 3,980 | 6,276 | 1,054,846 | Obion | 15,584 | 7,824 | 7,760 | 12,817 | 4,525,800 |
| De Kalb | 11,425 | 5,642 | 5,783 | 10,573 | 1,960,031 | Overton | 11,297 | 5,424 | 5,873 | 12,637 | 828,466 |
| Dickson | 9,340 | 4,756 | 4,584 | 9,982 | 1,232,543 | Perry | 6,925 | 3,438 | 3,487 | 6,042 | 1,235,085 |
| Dyer | 13,706 | 6,814 | 6,892 | 10,536 | 4,072,081 | Polk | 7,369 | 3,606 | 3,763 | 8,726 | 1,220,470 |
| Fayette | 26,145 | 13,165 | 12,980 | 24,327 | 6,343,325 | Putnam | 8,698 | 4,269 | 4,429 | 8,558 | 1,235,085 |
| Fentress | 4,717 | 2,299 | 2,418 | 5,054 | 413,658 | Rhea | 5,538 | 2,722 | 2,816 | 4,991 | 1,123,570 |
| Franklin | 14,970 | 7,493 | 7,477 | 13,848 | 2,081,318 | Roane | 15,622 | 7,660 | 7,962 | 13,583 | 2,210,961 |
| Gibson | 25,666 | 13,163 | 12,503 | 21,777 | 7,471,389 | Robertson | 16,166 | 8,114 | 8,052 | 15,265 | 4,516,117 |
| Giles | 32,413 | 16,176 | 16,237 | 26,166 | 7,616,921 | Rutherford | 33,289 | 16,552 | 16,737 | 27,918 | 9,614,975 |
| Grainger | 12,421 | 6,093 | 6,328 | 10,962 | 1,531,807 | Scott | 4,054 | 2,028 | 2,026 | 3,519 | 266,943 |
| Greene | 21,668 | 10,569 | 11,099 | 19,004 | 3,413,336 | Sequatchie | 2,335 | 1,171 | 1,164 | 2,120 | 347,526 |
| Grundy | 3,250 | 1,569 | 1,681 | 3,093 | 741,498 | Sevier | 11,028 | 5,393 | 5,635 | 9,122 | 1,593,648 |
| Hamblen | new | county | ..... | ..... | 1.676,665 | Shelby | 76,378 | 38,663 | 37,715 | 48,092 | 38,553,951 |
| Hamilton | 17,241 | 8,655 | 8,586 | 13,258 | 7,012,903 | Smith | 15,994 | 7,902 | 8,092 | 16,357 | 2,841,259 |
| Hancock | 7,148 | 3,427 | 3,721 | 7,020 | 519,650 | Stewart | 12,019 | 6,130 | 5,889 | 9,896 | 1,524,379 |
| Hardeman | 18,074 | 8,929 | 9,145 | 17,769 | 4,449,059 | Sullivan | 13,136 | 6,361 | 6,775 | 13,552 | 2,394,472 |
| Hardin | 11,768 | 5,743 | 6,025 | 11,214 | 1,930,970 | Sumner | 23,711 | 11,768 | 11,943 | 22,030 | 5,185,727 |
| Hawkins | 15,837 | 7,578 | 8,259 | 16,162 | 2,316,675 | Tipton | 14,884 | 7,586 | 7,298 | 10,705 | 3,354,682 |
| Haywood | 25,094 | 12,532 | 12,562 | 19,232 | 5,697,559 | Trousdale | new | county | ..... | ..... | 1,152,904 |
| Henderson | 14,217 | 6,974 | 7,243 | 14,491 | 2,311,338 | Union | 7,605 | 3,721 | 3,884 | 6,117 | 843,015 |
| Henry | 20,380 | 10,082 | 10,298 | 19,133 | 3,656,340 | Van Buren | 2,725 | 1,327 | 1,398 | 2,581 | 259,493 |
| Hickman | 9,856 | 4,858 | 4,998 | 9,312 | 1,794,307 | Warren | 12,714 | 6,288 | 6,426 | 11,147 | 2,535,768 |
| Houston | new | county | ..... | ..... | 512,100 | Washington | 16,317 | 7,951 | 8,366 | 14,829 | 2,709,541 |
| Humphreys | 9,326 | 4,640 | 4,686 | 9,096 | 1,394,935 | Wayne | 10,209 | 5,081 | 5,128 | 9,115 | 1,664,494 |
| Jackson | 12,583 | 6,188 | 6,395 | 11,725 | 1,123,915 | Weakley | 20,755 | 10,416 | 10,339 | 18,216 | 4,100,065 |
| James | new | county | ..... | ..... | 754,372 | White | 9,375 | 4,581 | 4,794 | 9,381 | 1,320,610 |
| Jefferson | 19,476 | 9,479 | 9,997 | 16,043 | 2,459,205 | Williamson | 25,328 | 12,583 | 12,745 | 23,827 | 7,629,778 |
| Johnson | 5,852 | 2,855 | 2,997 | 5,018 | 613,326 | Wilson | 25,881 | 12,753 | 13,128 | 26,072 | 6,691,164 |
| Knox | 28,990 | 14,153 | 14,837 | 22,813 | 9,503,533 | Totals | 1,258,520 | 623,347 | 635,173 | 1,109,801 | 308,089,743 |

The true valuation, according to the census report in 1870, was $498,237,724, and this is admitted by the Bureau of agriculture in the State to be a very accurate valuation.

*Principal Cities and Towns.*—Nashville, the capital of

* Bell co., mentioned by some writers, had not been organized in 1876.

the State, had in 1870 a population of 25,865; its present population exceeds 35,000. Memphis, the largest city and principal river-port of the State, had 40,226 inhabitants in 1870, and about 45,000 now; Knoxville had 8682 then, and perhaps 13,000 now; Chattanooga 6093, and now probably 11,000. The other cities in 1870 were Jackson, 4119; Murfreesboro', 3502; Clarksville, 3200; and Columbia, 2500. Brownsville, Gallatin, Lebanon, Pulaski, Trenton, and Shelbyville have between 2000 and 3000 inhabitants, and Cleveland, Franklin, Fayetteville, McMinnville, and Greenville, between 1200 and 2000.

*History.*—When North Carolina was separated from South Carolina, she claimed what was afterward Tennessee as a part of her domain, and defined its boundaries as of equal width with her own and extending to the Mississippi River. In 1757, Fort Loudon was erected on Little Tennessee River, in what is now Blount co. This was attacked and captured by the Indians in 1760, and 200 persons killed. The Indians were severely punished for this massacre. The settlers soon began to enter the region of Holston River from North Carolina, and a few also from South Carolina and Virginia. Among the latter was Capt. William Bean, from Pittsylvania co., Va., who came with his family to what is now East Tennessee, and built a cabin on Boone Creek, an affluent of Watauga River, in 1769. The growth of the settlements on the Watauga was very rapid. At the beginning of the Revolutionary war these Watauga colonists were all patriots. They met in a mass convention in 1776, chose thirteen men as commissioners, and five others—of whom John Sevier was the first—to form a court for the settlement of all disputes. They named East Tennessee the Washington district, after Gen. Washington, who had just been appointed to the command of the patriot army, and sent a memorial to the North Carolina legislature explaining that they had no desire to withdraw from North Carolina, but were willing to bear their share in the hardships and sacrifices of the war, and desiring to have its authority and laws extended over them. The North Carolina legislature responded by naming all the settlements W. of the mountains as Washington co., and inviting them to send delegates to a State convention about to assemble at Halifax. They did so, and soon after raised a regiment known as the "Watauga regiment" for the war, which was commanded by Col. John Sevier. They, with some of the Virginia troops, defeated the Indians signally in June, 1776, and subsequently fought bravely at King's Mountain and elsewhere. The settlements in what is now East Tennessee increased rapidly during the war, but none of them penetrated far into Middle Tennessee, and for forty years more West Tennessee was the peaceable possession of the Chickasaw Indians. In 1784, North Carolina made a provisional cession of the territory W. of the mountains to the U. S., but repealed it the next year, and from that time to 1788 or 1789 opposed the independence of the colonists. Early in 1785 the settlers in East Tennessee resolved to form a State government of their own. They formed a constitution similar to that of North Carolina, submitted it to the people, and chose a governor (John Sevier being their unanimous choice), elected a legislature, appointed judges, organized courts, and held treaties with the Indians. They named their new State Franklin or Frankland, and held the first and only session of their legislature at Jonesborough in 1785. At this session Martin Academy was chartered. North Carolina looked upon all these proceedings as irregular, and exercised her own legislative authority over the settlements, incorporating the same year Davidson Academy at Nashville, then a small settlement which had sprung up since 1780. In 1789, the excitement having subsided, North Carolina ceded the "territory beyond the mountains" to the U. S., and the next year the Territorial government of Tennessee was organized by the appointment of William Blount of North Carolina governor. He was a judicious and able man, and soon all discord ceased. In June, 1796, Tennessee having adopted a constitution and otherwise complied with the requisitions of the U. S., was admitted into the Union. The first capital was Knoxville. At this time there were no settlements in West Tennessee, and only a few scattering ones in seven counties of Middle Tennessee. The westward tendency of the emigration led to the gradual encroachment on the Chickasaw lands of West Tennessee, and in 1819 the Indian title to these lands was extinguished by treaty, and the Indians removed to the Indian Territory. The growth of the State was rapid, and in 1860 of its 1,110,000 inhabitants one-fourth were slaves. These were mostly in Middle and West Tennessee, East Tennessee having never held a large number. An ordinance of secession was passed (it is said illegally) May 6, 1861. During the war the State was the scene of many bloody battles—Island No. 10; the conflicts around and in Memphis; the severe battle of Pittsburg Landing or Shiloh; the numerous skirmishes and slight actions during Buell's retreat to Louisville, and the heavier fighting of Rosecrans's march to Nashville, whence he expelled the Confederate State government; the battle of Stone River; the capture of Murfreesboro', Tullahoma, and Chattanooga; and, though the battle of Chickamauga was over the line in Georgia, the subsequent battles around Chattanooga; the siege and relief of Knoxville; the actions of Cumberland Gap and Bean's Station; the battles of Columbia, Franklin, and Nashville; the retreat and pursuit of Hood, were all in this State. Almost the whole State was a battle-ground, and probably more square miles of its territory were fought over than of any other State in the Union. For a part of the time there were two State governments in operation. But the war over, the citizens of the State hastened to acknowledge their allegiance to the Union. In Apr., 1865, the State legislature ratified the Thirteenth amendment to the Constitution, and July 12, 1866, the Fourteenth amendment. The same month the State was restored to the Union, and has manifested her hearty loyalty for the past ten years.

*Governors of Tennessee.*

| | |
|---|---|
| 1. *State of Franklin or Frankland.* | Newton Cannon.....1835–39 |
| John Sevier.....1785–88 | James K. Polk.....1839–41 |
| 2. *Territory of Tennessee.* | James C. Jones.....1841–45 |
| William Blount.....1790–96 | Aaron V. Brown.....1845–47 |
| 3. *State of Tennessee.* | Neil S. Brown.....1847–49 |
| John Sevier.....1796–1801 | William Trousdale.....1849–51 |
| Archibald Roane.....1801–03 | William B. Campbell.....1851–53 |
| John Sevier.....1803–09 | Andrew Johnson.....1853–57 |
| William Blount.....1809–15 | Isham G. Harris.....1857–62 |
| Joseph McMinn.....1815–21 | Andrew Johnson.....1862–65 |
| William Carroll.....1821–27 | William G. Brownlow...1865–69 |
| Samuel Houston.....1827–29 | De Witt C. Senter.....1869–71 |
| William Carroll.....1829–35 | John C. Brown.....1871–75 |
| | James D. Porter.....1875– |

*Electoral and Popular Vote for President and Vice-President.*

| Elect. year. | Candidates who received the electoral vote. | Elect. vote. | Elect. year. | Candidates who received the electoral and popular vote. | Elect. vote. | Pop. vote. | Opposition candidates. | Pop. vote. | Third-party candidates. | Pop. vote. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1796 | Thomas Jefferson P.....<br>Aaron Burr V-P..... | 3 | 1824 | Andrew Jackson P.....<br>John C. Calhoun V.-P.... | 11 | 20,197 | William H. Crawford P..<br>Martin Van Buren V.-P.. | 312 | John Quincy Adams P..... | 216 |
| 1800 | Thomas Jefferson P.....<br>Aaron Burr V.-P..... .... | 3 | 1828 | Andrew Jackson P.....<br>John C. Calhoun V.-P.... | 11 | 44,090 | John Quincy Adams P...<br>Richard Rush V.-P..... | 2,240 | | |
| 1804 | Thomas Jefferson P.....<br>George Clinton V.-P..... | 5 | 1832 | Andrew Jackson P.....<br>Martin Van Buren V.-P.. | 15 | 28,740 | Henry Clay P.....<br>John Sergeant V.-P..... | 1,436 | | |
| 1808 | James Madison P.....<br>George Clinton V.-P..... | 5 | 1836 | Hugh L. White P.....<br>John Tyler V.-P..... | 15 | 35,168 | Martin Van Buren P.....<br>Richard M. Johnson V.-P. | 26,129 | | |
| 1812 | James Madison P.....<br>Elbridge Gerry V.-P..... | 8 | 1840 | William H. Harrison P...<br>John Tyler V.-P..... | 15 | 60,391 | Martin Van Buren P.....<br>Richard M. Johnson V.-P. | 48,289 | | |
| 1816 | James Monroe P.....<br>D. D. Tompkins V.-P..... | 8 | 1844 | Henry Clay P.....<br>T. Frelinghuysen V.-P.... | 13 | 60,030 | James K. Polk P.....<br>George M. Dallas V.-P... | 59,917 | | |
| 1820 | James Monroe P.....<br>D. D. Tompkins V.-P..... | 7 | 1848 | Zachary Taylor P.....<br>Millard Fillmore V.-P.... | 13 | 64,705 | Lewis Cass P.....<br>William O. Butler V.-P.. | 58,419 | | |
| | | | 1852 | Winfield Scott P.....<br>William A Graham V.-P.. | 12 | 58,898 | Franklin Pierce P.....<br>William R. King V.-P... | 57,018 | | |
| | | | 1856 | James Buchanan P.....<br>J. C. Breckenridge V.-P... | 12 | 73,638 | Millard Fillmore P.....<br>A. J. Donelson V.-P..... | 66,178 | | |
| | | | 1860 | John Bell P.....<br>Edward Everett V.-P..... | 12 | 69,274 | John C. Breckenridge P.<br>Joseph Lane V.-P..... | 64,709 | Stephen A. Douglas P...<br>H. V. Johnson V.-P..... | 11,350 |
| | | | 1864 | No vote. | | | | | | |
| | | | 1868 | Ulysses S. Grant P.....<br>Schuyler Colfax V.-P..... | 10 | 56,628 | Horatio Seymour P.....<br>Francis P. Blair,Jr.,V.-P. | 26,129 | | |
| | | | 1872 | Horace Greeley P.....<br>B. Gratz Brown V.-P..... | 12 | 94,391 | Ulysses S. Grant P.....<br>Henry Wilson V.-P..... | 85,655 | | |
| | | | 1876 | Samuel J. Tilden P.....<br>Thos. A. Hendricks V.-P.. | 12 | | Rutherford B. Hayes P...<br>William A. Wheeler V.-P. | | | |

(The writer acknowledges his indebtedness for many facts to Col. J. B. Killebrew, secretary of the Tennessee Bureau of agriculture; to His Excellency Gov. James D. Porter, for documents; and to W. W. Thacher, Esq., cashier of First National Bank of Memphis, Tenn., for much valuable information.)

L. P. Brockett.

**Ten'nessee,** tp., Grant co., Ark. P. 308.

**Tennessee,** tp., McDonough co., Ill. P. 2126.

**Tennessee River,** the chief affluent of the Ohio, originates in the confluence of Holston and Clinch rivers at Kingston, Tenn. It flows S. W. to Chattanooga, thence W., and again S. W. Sweeping through Northern Alabama, it turns northward, traverses Tennessee and Kentucky, and joins the Ohio at Paducah, Ky. Its drainage-area is 41,000 sq. m. Total length to the head of the Holston, nearly 1200 miles; below the confluence, 800 miles. It is navigable without obstruction 280 miles to Florence, Ala., at the foot of the MUSCLE SHOALS (which see). The shoals (20 miles long) are navigable about three weeks in the year, during spring floods. Above this point the river is navigable throughout its course for the greater part of the year by light-draught steamers. There are 925 miles of naturally navigable waters above the shoals upon this river and its tributaries for six months in the year. It might easily be increased to 1300 miles.

**Tennessee University, East.** See EAST TENNESSEE UNIVERSITY.

**Ten'ney** (SAMUEL), M. D., b. at Byfield, Mass., Nov. 27, 1748; graduated at Harvard 1772; taught school a year at Andover; studied medicine; commenced practice at Exeter, N. H., 1775; entered the military service as surgeon in the Massachusetts line June 17, 1775; served through the war, being at Saratoga and Yorktown; settled again at Exeter after the war, but did not resume practice; was an early member of the American Academy of Arts and Sciences, to whose *Memoirs* he contributed an account of the mineral waters at Saratoga and his *Theory of Prismatic Colors;* furnished the Massachusetts Historical Society an account of Exeter, N. H., and a notice of the "dark day," May 19, 1780, and wrote for the Massachusetts Agricultural Society a valued treatise on orchard-planting; wrote much on politics in the periodicals, especially in advocacy of the Federal Constitution; was a member of the New Hampshire constitutional convention 1788; judge of probate for Rockingham county 1793–1800; member of Congress 1800–07; and published in the New York *Medical Repository* for 1811 *An Explanation of Certain Curious Phenomena in the Heating of Water.* D. at Exeter Feb. 6, 1816.—His wife, TABITHA GILMAN (b. at Exeter, N. H., in 1762, d. there May 2, 1837), was author of *The Adventures of Dorcasina Sheldon* and other writings.

**Tenney** (SANBORN), b. at Stoddard, N. H., in 1827; graduated at Amherst College 1853, in which year he became instructor in natural history in the New England Naval Institution at Lancaster, Mass.; afterward studied under Agassiz at Cambridge; was lecturer on natural history in the Massachusetts Teachers' Institute 1856–65, also giving public lectures in Pennsylvania and other parts of the country; was for several years from its foundation a professor at Vassar College; became in 1868 professor at Williams College; lectured on *Physical Structure and Natural Resources* before the Lowell Institute at Boston 1873. Author of *Geology for Teachers, Classes, and Private Students* (1859), *A Manual of Zoology* (1865), *Natural History of Animals, Natural History Tablets, Elements of Zoology,* and other works.—His wife, MRS. ABBY A. TENNEY, is author of *Pictures and Stories of Animals for the Little Ones at Home* (New York, 6 vols., 1868), and contributed to the *Natural History of Animals.*

**Tenney** (WILLIAM JEWETT), b. at Newport, R. I., in 1811; graduated at Yale College in 1832; became editorially connected with the New York *Journal of Commerce, Evening Post,* and other journals, and finally one of a literary corps connected with the New York publishing-house of D. Appleton & Co. Besides much general literary labor, he completed Benton's abridgment of the *Debates of Congress,* edited an illustrated edition of *The Queens of England,* prepared the *Military and Naval History of the Rebellion in the United States* (1865), and has been the principal compiler of *The American Annual Cyclopædia* since its commencement in 1861 down to the volume for 1876.

**Ten'niel** (JOHN), b. in London, England, in 1820; showed a decided taste for art in boyhood; pursued his studies in his own way, thus developing a very original style; was a successful competitor for painting cartoons in fresco in Westminster Palace 1845; has been since 1851 one of the principal artists on the staff of *Punch,* and has illustrated many elegant Christmas books, among which are Æsop's *Fables,* the *Ingoldsby Legends,* and *Lalla Rookh.*

**Ten'nis,** a game at ball in which the ball is thrown against a wall, and upon its rebound is struck by a racket and driven again to the wall, etc. Tennis is variously played. "Rackets" (see RACKET) in England is a modern modification of tennis, which is a very ancient game.

**Ten'nyson** (ALFRED), D. C. L., F. R. S., b. at Somersby, Lincolnshire, England, in 1809, being the third of the seven sons of Rev. George Clayton Tennyson, D. D., rector of Somersby, by his wife Elizabeth, daughter of Rev. Stephen Fytche, vicar of Louth. The poet's father (d. about 1830) was a man of genius and of energetic character, remarkable for great strength and stature, and gave a careful education to his children, nearly all of whom began to write tales and verses from the time they could use a pen. The three eldest sons, Frederick, Charles, and Alfred, who have all become known as poets, entered Trinity College, Cambridge, together about 1827, and were pupils of the celebrated Dr. William Whewell, then one of the tutors of that college. A small anonymous volume of *Poems by Two Brothers* (1827) contained the earliest published verses of Charles and Alfred, and in the opinion of Coleridge and Wordsworth the poems of the former possessed the greater merit. In 1828 the eldest brother, Frederick, gained the medal for a Greek poem, and in 1829, Alfred carried off the chancellor's medal for an English poem of 250 lines on *Timbuctoo*—a performance showing many of the characteristic features of his later style, though not included in his collected works. One of his chief competitors for this prize was his most intimate college friend, Arthur H. Hallam (d. 1833), whose memory received in later years a most splendid poetical commemoration. While still an undergraduate, Alfred published a small volume of *Poems chiefly Lyrical* (1830), containing the gallery of female portraits and the elegiac verse still reprinted at the head of his poems, but including nothing of decisive promise, and which accordingly made no great sensation, though kindly noticed by several critics. It was in his third volume of *Poems* (1832) that, discarding nearly all his verses of 1827, and reprinting with great improvements the best verses from the volume of 1830, he first stamped himself as a genuine poet by such classical pieces as *The Lady of Shalott, Œnone, The May Queen,* and *The Lotos-Eaters.* This volume received warm applause from the highest authorities, but for unexplained reasons the poet published nothing more for ten years, until he fairly took the literary world by storm, and established his permanent reputation as the first poet of the age, by the new edition of his *Poems* (2 vols., 1842), substantially in the form still familiar to all readers. The author of *Morte d'Arthur, Locksley Hall,* and *The Two Voices* had nearly reached the summit of his powers, and though his fame has been steadily widening and broadening ever since, it may be doubted whether he has surpassed the "high-water mark" of 1842 by any of his later productions. *The Princess, a Medley* (1847), his first long poem, was disappointing to those critics who insisted upon seeking comparisons with the author's lyrical masterpieces, but was quite satisfactory for those who chose to take it upon its own merits as "a brilliant serio-comic *jeu d'esprit* upon the noise about woman's rights;" and the songs, which first appeared as interludes in the second edition, commended themselves to all admirers of lyrical gems. *In Memoriam* (1850), a series of marvellously pathetic monodies, written at intervals through many years, is still to many minds the poet's masterpiece. In 1850, Tennyson succeeded Wordsworth as poet-laureate, in which capacity he produced on the day of the funeral of the duke of Wellington (Nov., 1852) his immortal *Ode.* The Crimean war, with its uncertain results, exerted a depressing effect upon the poet's sensitive genius, as evidenced by his poem *Maud* (1855). After a silence of several years, the first series of *Idylls of the King* (1859), embracing four stories in blank verse drawn from the Arthurian legends, restored the poet's waning popularity, and was generally accepted as his greatest poetical effort—a verdict confirmed and strengthened ten years later when the cycle was completed by the publication of *The Holy Grail, and other Poems* (1869). *The Idylls of the King* (1870), as reconstructed by arranging the eight idylls in their artistic sequence, constitute an epic to which English literature can produce few or no rivals since the time of Milton. In the interval between the publication of the two parts of his *Idylls,* Tennyson had issued *Enoch Arden, and other Poems* (1864), a volume which fell somewhat below the standard of public expectation. He has since published *The Window, or The Songs of the Wrens* (1870), consisting of twelve brief lyrics written for music, and *Queen Mary, a Drama* (1875), represented upon the stage with moderate success in 1876; and in 1877 another drama, *Harold,* also in five acts. Tennyson resided chiefly in London during the first twenty years of his poetic career; married late in life (1851) Miss Emily Sellwood, a lady of Lincolnshire; was settled at Farringford, Isle of Wight, 1851–69, having also a residence at Aldworth in Surrey, and in 1869 established himself near Petersfield, Hampshire. His poems have been issued in many editions, and in the U. S. by rival publishers. Two editions of 1871

(Boston and New York) contain the poems of his earlier volumes of 1830 and 1832, which were cancelled by himself, and also some never collected by him from the magazines where they originally appeared. The two early volumes above mentioned were also privately reprinted in one volume in Canada (1862). The *Idylls of the King* were magnificently illustrated by Doré, and most of the other poems have received similar honors from other artists, to which painting and statuary have also lent their aid. Translations of the principal poems have appeared in several languages. Several volumes of selections have been published, and more than one volume of critical analysis, but the most remarkable evidence of his popularity is D. Barron Brightwell's *Concordance to the Entire Works of Alfred Tennyson* (London, 1869). PORTER C. BLISS.

**Tennyson** (FREDERICK), brother of Alfred, b. at Somersby, Lincolnshire, England, about 1806; graduated at Trinity College, Cambridge, about 1830; is author of a volume of poems, *Days and Hours* (1854).

**Ten-Pins.** See NINE-PINS.

**Tenrec.** See TANREC.

**Ten'sas,** parish of N. E. Louisiana, bordering on Mississippi River, and drained by Tensas River, by means of which it has water communication with the interior; surface low and flat, soil fertile. Staples, cotton, Indian corn, live-stock. Cap. St. Joseph. Area, 680 sq. m. P. 12,419.

**Tensas** (or **Tensaw**) **River,** or **Bayou Tensas,** rises in Carroll parish, La., and after a devious southerly course of 250 miles joins the Washita at Trinity, La. It is navigable 150 miles during good stages of water.

**Tensaw River,** of Alabama, is a bayou which leaves Alabama River before its junction with the Tombigbee, and pursues a course parallel with that of Mobile River. Its waters flow into Mobile Bay.

**Tension of Dissociation.** See DISSOCIATION, by PROF. C. A. JOY, PH. D.

**Tension of Electricity.** See ELECTRICITY, by PRES. H. MORTON, PH. D.

**Tension of Vapors.** See HEAT, by PROF. W. P. TROWBRIDGE, A. M.; GAS, by PROF. J. P. COOKE; and VAPORS AND VAPORIZATION.

**Tent** [from the Lat. *tentus*, "stretched"]. Both sacred and profane history tells us that tents of some sort have been used by all nomadic tribes from the earliest ages. At the present day the poorer classes in Persia, China, and indeed in most Eastern countries, dwell in tents formed of frames of wood covered with thick cloth, felt, or matting. The early Greek and Roman soldiers appear to have used tents of skins or canvas. The history of all wars in the temperate zone proves that men cannot war without tents. All military tents are now made of canvas, generally of cotton duck, sometimes of linen, cotton being considered the more suitable material, being more impervious to water and cheaper than linen or hemp.

The tents used in the military service of the U. S. comprise the following: the *hospital tent*, which is made of heavy cotton duck, 15 feet square, 12 feet high to ridge, with wall 4½ feet high, and is provided with a heavy fly or double roof. These tents are made to open at both ends, so that two or more placed together form a continuous ward. Each tent holds from six to eight beds. The wall tent for officers, 9 feet square, 8 feet 6 inches in height to ridge, having a wall 3 feet 9 inches high, and is furnished with a fly. The common or wedge-shaped tent for enlisted men, 6 feet 10 inches in height, 8 feet 4 inches in width, and 6 feet 10 inches long; it holds six men. The shelter tent, being a modification of the French *tente d'abri*, made of two pieces of cotton duck, each 5 feet 6 inches by 5 feet 5 inches, arranged to button together and stretch over a ridge supported by poles. In active field-service experience shows that the best arrangement is for each soldier to carry a portion of a shelter tent, which may serve as a cloak on the march and a cover at night, and which, joined to two or three other pieces, makes a tent to hold from two to four men. During the late civil war in the U. S. shelter or poncho tents were adopted, and came to be used very generally before the close of the war. The poncho is a piece of oil-cloth or rubber-cloth about 6 feet square, with a slit in the centre through which the head is put. Two or three ponchos form a shelter tent.

Many different plans of tents for military purposes have been tried during the past few years in Europe and in this country. A few years prior to the late civil war in the U. S. the wedge-shaped tent and the wall tent for enlisted men were replaced by the Sibley tent, which is a conical tent supported by a central pole resting on an iron tripod, and is intended to hold fifteen infantry soldiers or thirteen mounted men. One chief advantage of the Sibley tent is that it admits of being warmed by an open fire or small stove, and is admirably ventilated, having a circular opening at the apex partially covered by a movable piece of canvas so arranged as to be easily shifted according to the direction of the wind. The Sibley tent is almost exactly like the Sioux lodge, the chief difference being that it is constructed of canvas and supported by the central pole and tripod, while the Indian lodge is made of rudely-tanned buffalo hides and stretched on several long wooden poles. The use of the Sibley tent for our army was discontinued during the war. C. G. SAWTELLE.

**Ten'terden** (CHARLES STUART AUBREY **Abbot**), THIRD BARON, b. in England Dec. 26, 1834; succeeded to the title Apr. 10, 1870; has been for some years assistant undersecretary of state, and won a high reputation for ability upon questions of international law by his services at Washington (1871) and Geneva (1872) as counsel for Great Britain in the Alabama claims question.

**Tenterden,** LORD. See ABBOTT (CHARLES).

**Ten Thousand, Retreat of the.** After the battle of Cunaxa (401 B. C.), in which Cyrus fell and all his barbarian troops were dispersed, the Greek soldiers who had served in the army of Cyrus, and who numbered about ten thousand, found themselves placed in a most critical position, especially after the assassination of Clearchus and their other leaders by the Persian satrap Tissaphernes. Under these circumstances, XENOPHON (which see) was chosen leader, and he conducted them through the plains of the Euphrates and the Tigris, across the table-land of Armenia, to Trapezus (now Trebizond), a Greek colony on the south-eastern coast of the Black Sea, and from Trapezus to Chrysopolis, opposite to Byzantium. This retreat, which was effected under extraordinary difficulties, but conducted with great success, has been described by Xenophon himself in his *Anabasis*.

**Tenuiros'tres** [Lat. *tenuis*, "slender," and *rostrum*, "bill"], the name given to a group ("tribe" or "family") of birds, and including forms whose only common characters consisted in the possession of a more or less slender bill, and feet with three toes directed forward and one backward. According to Cuvier, it included the Linnæan "genera" *Sitta, Certhia, Trochilus*, and *Upupa*. The group was a very heterogeneous one, and has not been retained in the ornithological system. THEODORE GILL.

**Tenure.** See FEUDAL SYSTEM, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

**Teocal'li** [Aztec, *teotl*, "god," and *calli*, "house"—*i. e.* "house of God"], a name given to the aboriginal temples of Mexico, many remains of which are still in existence. Recent investigations have rendered it probable that many structures which, on Spanish authority, have been received as temples and palaces, were in reality but multiple houses, built on the plan of the *pueblo* structures or *casas grandes*, still inhabited.

**Te'os,** one of the most prominent of the Ionian cities in Asia Minor, was situated in Lydia, 25 miles S. W. of Smyrna, between the promontories of Coryceum and Myonnesus, and N. of the island of Samos. It had two good harbors, and carried on a considerable trade. In its vicinity was produced a celebrated wine, and its most prominent public building was a splendid temple of Bacchus. After the Persian conquest most of the inhabitants emigrated to Abdera in Thrace. Teos continued, nevertheless, to be a city of some importance until the time of the Romans, when it gradually fell into decay. Ruins of it, of its walls, theatre, and temple, are visible near the present village of *Sighajik*.

**Tepic',** town of the Mexican confederation, state of Jalisco, on an elevated plateau 2500 feet above the sea, encircled by high mountains and surrounded with orchards and gardens, has about 9000 inhabitants, mostly engaged in sugar cultivation, cotton manufacture, and agriculture.

**Teplitz.** See TÖPLITZ.

**Tequendama, Cataract of.** See BOGOTÁ.

**Ter'amo,** town of Southern Italy, province of the same name, about 35 miles S. of Fermo. It is beautifully situated on an elevated plain between two streams, somewhat above the site of the old *Interamna*, of which the modern name is a corruption. Little is known of the origin or history of this ancient town, whose ruins are still visible, but the Roman colony, a walled city 4 miles in circumference, was destroyed by the Goths, rose again under the Lombards, and afterward experienced many and great vicissitudes. It is now an industrious and thriving place, having manufactories of porcelain, of hats, tartaric acid, licorice, etc. Good and even elegant household furniture is also extensively made here. P. 19,721.

**Ter'aphim** [a Heb. plural of doubtful meaning], a name given to images or figures, probably used by the ancient Hebrews either as objects of household worship or as religious symbols of some kind. Nothing satisfactory is known of their character, origin, or use.

**Terashima Münenori,** b. in the province of Satsuma in 1830; educated in the provincial schools until his thirteenth year, when, because of his superior talents, he was sent to Yedo (now Tokio) to study medicine; had for his instructor a famous physician; acquired a thorough knowledge of the Dutch language, and was noted for his scholarship when Commodore Perry visited Japan; also became a good English scholar; was attached to the Japanese embassy which visited America in 1861; in 1865 was sent by the prince of Satsuma to England as a commissioner to take charge of several students, where they all remained for about two years; was made one of the councillors in the new government in 1868; was appointed governor of Kanagawa in 1869, acting at the same time as assistant secretary of foreign affairs; held the governorship for two years, and became senior vice-minister of foreign affairs; in 1872 was sent as envoy extraordinary and minister plenipotentiary to Great Britain; on account of his health he resigned that position in 1873, when he was appointed a privy councillor, or *sangi*, and also minister for foreign affairs, in which position he still continues.

F. A. P. Barnard.

**Teratol'ogy** [Gr. *τέρας, τέρατος*, "monster," and *λόγος*, "discourse"]. In this article under the term *teratology* will be comprised all that is usually included in the several terms "malformation," "monster," "double monster," "parasitic monster," "fœtus-in-fœtu," etc., or a summary of the principal deviations from the normal type occurring in the vegetable and animal kingdoms. Elementary considerations only will be entered upon in this article. The reader must bear in mind the important distinction between *primitive* anomalies or congenital malformations, such as have been developed during intra-uterine life, and *acquired* deformities, such as have arisen *after* the birth of the fœtus. The former belong to the province of teratology, while the latter are embraced in the field of medical and surgical pathology.

*General Considerations.*—Teratology is a subject which to those who have bestowed but little thought upon it is likely to be regarded as affording a very limited field of research; it, however, embraces the consideration of so many facts pertaining to its history, literature, classification, and description, and the embryology of the multitudinous forms of simple and compound malformations, including the so-called single, double, and parasitic monsters, fœtus-in-fœtu, and supernumerary development, as to require the extended limits of one or more considerable volumes, with numerous and expensive pictorial illustrations, to treat it in a satisfactory or anything like an exhaustive manner.

*History.*—For many centuries the more remarkable deviations from the normal type of the human or animal body were called monsters, a term derived from the Latin *monstrum*, "anything strange," a derivation from *monstrare*, to "show;" as, for example, the box in which relics were anciently kept for display was called *monstrum*. They not only attracted the attention of philosophers, but excited the wonder and superstitious awe of the illiterate. The writings of most of the ancient naturalists and anatomists abound in frequent allusions to the subject, among whom Hippocrates, Aristotle, Pliny, and Galen may be cited, and even Empedocles and Democritus noticed the more remarkable malformations occurring in both men and brutes; they also attempted explanations of the causes which they believed to have operated in their production. All that can be found in any of the ancient authors who have attempted to discourse upon the subject—or, indeed, in any of the works written previous to the beginning of the eighteenth century—is of very little scientific value, and for the most part consists of a confused and perplexing mass of marvellous and apocryphal tales, inaccurate descriptions founded on fanciful resemblances, and absurd and superstitious notions regarding the origin and portentous signification of monsters. While remarkable malformations among the lower animals were regarded as monsters portending dire calamities, human monstrosities were considered as evidences of divine anger or as the direct result of demoniacal influence, and hence looked upon with apprehension and dread, being interpreted by the augurs of the times as prodigies entailed upon parents as punishments, and frequently as wonders of bad omen to the public, foreshadowing some general calamity. In a curious and rare work printed at Bâle a little more than three centuries ago (1557), the author, Conrad Lycosthenes, collected with more industry than discrimination all the prodigies which had been recorded, as he tells us, from the beginning of the world down to his own time. This curious folio is profusely illustrated with wood-engravings, affording good examples of the existing state of the art, as well as illustrating the absurd popular notions of that day. Accompanying the picture of a malformation, human or animal, single or double, follows a representation of the special calamity of which it was believed to be the immediate precursor, whether an earthquake, flood, fire, pestilence, or war. After narrating an instance of a monstrous child, calf, or lamb being born in a certain province, he follows it with an account of its correlative event, such as the death of a bishop or the destruction of a city, represented in flames or toppling down by earthquakes, or its houses and inhabitants floating off in floods of water. The general belief that monsters had a satanic origin gave rise to the horrid practice of destroying them, either by drowning, strangling, or casting them into the flames, with the hope of thus diminishing or entirely exterminating the progeny of the devil. Notwithstanding that the greater part of the cases reported in the old literature of teratology consisted of fabulous stories concerning supernatural prodigies, such as could have had no real existence, yet there are to be found a few genuine cases quite accurately described. Some of the cases which at first would appear to be fabulous are, when examined by the light of modern science and compared with recent examples, found to be identical with recognized forms. The result of a careful study of the older works on monsters, such as Lycosthenes, Licetus, and Androvandus, will diminish the number of cases heretofore regarded as spurious, and elevate our respect for the observation and veracity of our ancestors. It was not until the early part of the eighteenth century that painstaking observations of the anatomical structure of monsters were fairly instituted in place of the mere superficial examination and description of the external configuration which had previously constituted the ultimate limit of physical inquiry on this subject. Corresponding with an increased knowledge of the anatomical structure, theories concerning the genesis and embryological development of monstrosities, and systems of classification, partook of a more rational if not of a scientific character. It would, perhaps, interest many readers to follow the history of teratology through its traditional, transitional, and scientific periods; the limited space allotted to an article in a work of this character only admits of reference to works devoted to the subject as cited in the appended bibliography.

*Classification.*—Various systems have been proposed by the numerous writers on teratology, among whom may be mentioned Licetus, Buffon, Breschet, Blumenbach, Meckel, Geoffroy Saint-Hilaire and his son Isidore, Gurlt, Otto, and Bischoff. Some of these systems of classification have been very complex and elaborate, while others have been sufficiently simple. There are many obstacles in the way of a satisfactory and scientific classification. Vrolik ignored all attempts in this direction, and arranged analogous forms under mere general groups. It is true that the multiplicity of forms under which malformations occur will admit of an arrangement into an unbroken series, the inferior degrees of which are represented by the existence of a mere rudimentary fragment or minus proportional of the entire body, and thence through many intermediate forms approaching the plus quantity or normal type of the species, which now becomes the point of departure for the series of excessive or redundant developments whereby more than belongs to a single being is produced, and through another long chain of transitional links, ranging from the addition of an insignificant member or part of a member, as a finger or toe, to the complete duplication of the body, as seen in the famous Siamese Twins. In systematic treatises on teratology some sort of classification is absolutely required, and at least a provisional nomenclature adopted. In this article the two heads of *simple* and *compound* malformations, corresponding with single and double monsters, will serve the writer's purpose.

*Causes of Malformation.*—This inquiry has given rise to much fruitless speculation; and although a degree of obscurity still remains as to the essential cause of the several vices of conformation and more remarkable anomalies of organization which occur among all the divisions of the animal kingdom, in common with the human species, yet we are gradually approaching to a clearer understanding of the genesis of all the varieties of malformation. The superstitions and absurd explanations of a former age, which to some extent still hold in the minds of a few from whom more rational views should be expected, have chiefly vanished, in consequence of the light which modern embryological investigations have shed upon the subject. Certainly, nothing can be more irrational than an attempt to explain the anomalies of organization which occur in

man by maternal mental emotions, when corresponding malformations, in every respect identical in character, occur among the lower order of animals, viviparous or oviparous —among birds, reptiles, and fishes; indeed, we may go still farther, and find analogous malformations in the vegetable kingdom, where single and double monsters also abound—developments which apparently result from defective or excessive formative power. Such flimsy explanations would certainly fail to account for the fact that deep-seated organs, the existence of which is unknown to the pregnant woman, are frequently malformed, as in examples of congenital malformations of the heart, kidneys, intestinal canal, the abnormal distribution of blood-vessels, more or less than the typical number of vertebræ, ribs, etc. This subject has been somewhat exhaustively discussed by the writer in an article to be found in the *American Jour. of Insanity* for Jan., 1870. External mechanical influences, such as blows, falls, etc., may by shock or by affecting the general health of the mother have power to disturb the normal development of the fœtus in utero; it, however, remains to be proved that any form of malformation has ever resulted from such a cause.

*Original malformation of the germ* has been reckoned among the causes of anomalous development. The germ is now considered a product of ovarian secretion upon which the male sperm acts; hence we may suppose it possible for the germ to be malformed. (*Vrolik.*) This view of the embryogenesis of at least some of the primitive anomalies receives force from the fact that repetition of the same kind of malformation by the same parents has been observed in a number of cases. It may be ascribed to the mother when the malformation is repeated, and to the father where his children, by different wives, are malformed in the same manner. An additional evidence of original defect in the germ is the hereditary transmission of certain deformities through several generations, examples of which in an excessive number of digits, hare-lip, hypospadias, and other structural vices, are not very infrequent.

*Diseases of the Ovum and of the Fœtus.*—The late Prof. Simpson of Edinburgh wrote several elaborate essays upon intra-uterine pathology (*Ed. Med. and Surg. Jour.*, Apr., 1836, Oct., 1838, July, 1839); also Prof. Montgomery (*Dublin Jour. of Med. Sci.*, 1832, and in his work on *Pregnancy*, and article "Fœtus" in *Cyclop. of Anat. and Physiol.*). The late Dr. William C. Roberts of New York City, on *Diseases of the Fœtus*, etc. (*Amer. Jour. Med. Sci.*, Aug., 1840, Oct., 1841), as well as Vrolik, Otto, and many others, have greatly enlarged our knowledge of this interesting subject. Otto maintains that many malformations may be ascribed to diseases of the fœtus, while Vrolik contends that very few are attributable to this cause. Chronic inflammation of the brain may produce dropsy of the ventricles, and this the malformation called *acrania* (no cranium). Spontaneous amputation of the limbs *in utero* by constriction of the umbilical cord, and also some other congenital deformities, are described under this head.

We now come to the chief cause of malformation—viz. impeded or retarded development of the fœtus from whatever cause. The doctrine of Serres and others, that monstrosities result from defect of the vascular or nervous system, is untenable. Embryogenesis teaches that the several parts of the body are formed independently, and Vrolik, an eminent authority in embryology and teratology, and to whom the writer is so much indebted in the preparation of this article, concludes that no malformation whatever proceeds from a central system, but is occasioned merely by impeded development, the cause of which remains concealed. Retardation or arrest of development may be confined to one part or extended to others, as seen where several malformations coexist. Wolff, Tiedemann, and J. F. Meckel have elaborated the theory that "most malformations represent certain stages of the development of the embryo and of its organs, at which stages formation has stopped short, or from which ulterior development has ceased to follow the normal type." This is doubtless the most rational of all the views which have been proposed or entertained upon this subject, yet the various malformations which are known and have been so often repeated do not precisely represent the exact form at which the fœtus was arrested in its development, for the reason that important modifications result from the growth of the normal parts in the progressive nutrition of the fœtus. It has been observed by eminent embryologists that the transient forms of the human fœtus, in its several stages of development, bear a striking resemblance to the persistent types of the lower orders of animals; hence the human malformations which result from arrest of development often acquire the appearance of brutes, while those occurring in animals for the most part have the forms of those still lower in the scale, instead of the higher orders. The deviations from the normal type of a species are never so great as to destroy all semblance to it. There is a limit beyond which abnormalities never pass. In reaching her ultimate anomalies Nature observes the law of propriety (*lex proprietatis*, Fleischmann), and makes her approach through a series of transitional gradations. Dissimilar parts and organs are never found fused or united together, nor transpositions of viscera beyond the limits of their natural locality; as, *e. g.*, the brain in the abdomen, or intestinal tube in the cranial cavity.

There are several facts which have been observed in relation to monsters which are so constant that they can be considered as fixed organic laws: That they occur in definite number, the relation being about 1 to 3000 births; that in the greater part of malformations the sex is female; that certain species of animals are more liable to produce monsters than others—for example, cyclopia in swine, double monsters in man (*Vrolik*); in the constancy of form in monsters, even among animals of the most diverse orders (we find cyclopia, acrania, and double monsters occurring in birds, possessing the identical characters as in the Mammalia); and, lastly, the greater predisposition to monstrosity among certain animals, being greater among domestic than wild animals, 75 per cent. among mammals to 25 among birds.

We shall now proceed to the consideration of simple monsters, resulting from arrest of development; the merest abstract of the various forms is all that can be given here, in doing which Vrolik's article in the *Cyclopædia of Anatomy and Physiology* is quite closely followed.

Malformation of the Ovum.—(1) The so-called moles are the product of disease of the ovum. The vesicular masses which have been so often regarded as hydatids are but degenerations of the chorion, consisting of its enlarged villi filled with serous fluid. Occasionally the mass contains a small fœtus which has been blighted at an early stage of development. (2) The placenta and cord may undergo various alterations, the former divided into large lobes, the latter being abnormally long or thick, or vary in the number of its vessels or in the persistency of the umbilical vesicle.

Malformations of the Fœtus.—These are so numerous that only the more notable can be referred to here. First, simple malformations, or such as result from arrest or retardation of development, and lastly of compound monstrosities.

*Cleft Malformations*, or such as result from non-closure of those parts of the body which are open in an early stage of normal development, but which at a later period should become closed, furnish an explanation of many forms of fœtal anomaly.

*Non-closure of the Anterior Parts of the Body.—Fissure of the Thorax.*—The cavities of the chest and abdomen are open in the earlier periods of embryonic development, and close in the later months of fœtal life. The sternum does not commence to ossify until the fourth or fifth month of pregnancy; the ossific centres in the broad cartilage are at first widely separated in the middle of the sternum, but subsequently fuse into one bone. This furnishes an explanation of some of the malformations of the sternum, as its abnormal breadth, the openings which are found in it, and its separation into two parts, which is generally seen in *ectopia* of the thoracic and abdominal viscera. In some cases the sternum is found separated, and the heart and part of the lungs enclosed and merely covered by the skin. In rare cases the breast-bone is absent, and no other defect. In still more rare instances the front walls of the chest and abdomen consist merely of the skin, the bony and fleshy parts being entirely wanting. The writer of this article has met with an instance of a child born with the entrails covered with what appeared to be merely the peritoneum; it was a thin, transparent membrane, which took on inflammation from exposure to the air, gave way on the third day after birth, and allowed the intestines, etc., to hang out of the child's abdomen, in which condition it survived to the end of the fifth day. Instances are on record where a persistence of the normal separation of the front walls of the body has resulted in the birth of a child with the heart protruding without even its own proper covering, the pericardium —*ectopia cordis* (*Br. and For. Med. Rev.*, Oct., 1841, p. 533); and others in which the entire contents of the abdomen are uncovered and protruding at the time of birth. Congenital umbilical hernia, or rupture of the navel, as it is popularly called, is the result of a less degree of fissure of the anterior walls of the belly, the parts near the navel being the last to close.

*Fissure of the Pubic Region.*—It sometimes happens that this region alone remains open. Congenital fissure of the urinary bladder, with or without imperforate anus, occurs. The prolapsed or inverted bladder, as it has been called, forms a red spongy tumor, situated a little above the separated pubic bones. In male children the openings

of the seminal vessels can be found in the lower part of the tumor. The tubes which convey the urine from the kidneys open into the interior of the bladder, and can be seen on its naked surface as two papillary eminences. The urine drops constantly from them, and is sometimes seen to flow in small streams. It has taxed the ingenuity of surgeons and instrument-makers to devise methods which would render the lives of those who are the subjects of this malformation endurable. In these cases the pubic bones are widely apart, as in the early stage of embryogenesis—in some cases four inches—without intermediate cartilage, but merely a ligament. The penis is split open along its upper surface (*epispadias*), the testes are small, even in adults, and often retained in the abdomen or in the inguinal or groin canals. Various other defects have been observed in both sexes associated with this malformation. It is evident that all of the cases of malformation above alluded to are the result of non-closure of parts which in the early embryo are formed in two bilateral parts, and later, when not arrested, unite at the middle line. Imperforate anus is the persistent condition of the early embryogenic state of the rectum.

*Fissure of the Face.*—In order to properly understand the various forms of fissure of the face, the several changes which occur during the development of the head must be briefly stated. Vrolik gives the following summary: Originally, there is a common oral and nasal cavity. The place of the nose is occupied by two fissures, which extend from the internal angles of the eyes to the upper margin of the cavity of the mouth. There is at this period not the least indication of a palate, so that the mouth and the nose form one cavity. The first rudiment of a palate is found in the fœtus when a little less than an inch in length. (*Meckel.*) This rudimentary palate is in the form of an arc, which is gradually completed on the sides, so as at first to be open at its back part, but subsequently closed, when it becomes a complete transverse septum between the mouth and nose. Arrest of development at these different stages results in the production of the various forms of facial fissure. In the greatest degree of cleavage of the face the fissures extend from the angles of the mouth to the internal angles of the eyes, the eyeballs, the nose, and the mouth forming but one cavity. (*Vrolik, Van Doeveren, J. S. Meckel.*) It may be confined to one side only, and in some cases it is merely a shallow groove. When the fissures are restricted to the upper jaw, double hare-lip, with cleft palate, results; if confined to one side, single hare-lip, with or without cleft palate; or cleft palate may occur without hare-lip. Fissure of the under lip and separation of the lower jaw have occurred, but very rarely.

*Fissure of the Skull* (*Acrania*).—This malformation has received various names—microcephalia (small head), anencephalia (no head), and hemicephalia (half head). In systematic treatises on teratology several types are described. In the first the brain is entirely wanting, and also the walls of the cranium; the whole base of the skull is exposed. In some cases not even the terminations of the cranial or cerebral nerves can be discovered. The absence of the cranium, the low forehead, and the protrusion of the eyeballs give to these distorted monsters a brute-like aspect, the cat's head or *Katzenkopfe* of the Germans. The bones of the face are also frequently malformed, and the vertebræ of the neck cleft. In the second type the base of the cranium is occupied by a rudimentary brain in the shape of a spongy substance, with which the nerves may or may not be connected. The spine may be perfect or cleft. Specimens of this form of malformation have been found among the Egyptian mummies. In the third type the back part of the skull may be closed, the spongy tumor occupies the place of the brain, all of the nerves are present, and the cranial bones partly developed. In the fourth and last type the skull is flat, with a large opening through which the brain protrudes (*cerebral hernia*). The brain is covered with the skin, and generally hangs like a bag resting on the back of the neck. Unlike the other types, the head is never turned with the face upward, and the ears do not rest on the shoulders. All of the forms referred to are the result of arrested and defective development of the skull and brain. Their origin cannot be accidental, since the cases are quite numerous, and bear a perfect resemblance and constancy of form in all anatomical museums and in the illustrations of reported cases. The bodies and limbs of these monsters are generally well formed and well nourished. They are mostly born living at the end of full term; they, however, rarely survive more than a few hours. In some cases of cerebral hernia life has been protracted twenty, thirty, and even sixty years. Among the causes of acrania, inflammation and dropsy of the brain probably are the chief agents. Rupture of the cerebral vesicle at an early period of embryonic life will explain some of the cases; also arrests of development.

*Spina bifida*, split or cleft spine, is doubtless generally caused by inflammation and dropsy of the sheath of the spinal cord. It is analogous to acrania, above described. In one case of spina bifida in the lower part of the back the subject lived twenty-eight years. In some cases there has been a complete want of the spinal cord, while in others the cord has been cleft in two right and left portions as if it were double. In the early life of the embryo the two lateral halves of the spinal cord are evolved separated, and subsequently, if not arrested, become united.

Acephalia, or headless monsters, occur under many forms and in different degrees of development. In some of the more imperfect forms there is only a rounded fleshy mass covered with skin, without any indications of extremities; it contains a fold of intestine, and receives blood through the vessels of the navel-string. In other cases there exists one or both of the lower limbs, and through a series of transitional forms we come to cases in which the chest and abdomen and all the extremities are present and seem to be more or less imperfectly formed. Even in these cases there is scarcely an indication of a head. To the spinal column are added the vertebræ of the neck, and sometimes confused rudiments of cranial bones. In these cases there is usually a diaphragm, but neither heart nor lungs; sometimes a liver. As this form approaches nearer to the normal type, cases are found in which an amorphous head is seen, with indications of eyes and nose, but neither ears nor mouth. In other cases the body and extremities are perfectly well developed, and having a neck, which is wanting in all the other types; which neck is merely surmounted and terminated by the ears. In the last type the headless monster consists of a body only, without the least indication of upper or lower limbs. Only one case is known. In this, which had reached the mature period of development, the chest contained a large heart, imperfect lungs, a malformed liver, a stomach and intestinal canal. It has been observed that nearly all the types of acephali are twins, being born with one or more perfect children. The question has been raised whether quantity affects quality in these cases. It is easy to reduce the external appearance of these monsters to the early periods of development, in which the head is not yet distinct from the trunk, and in which the limbs are not yet protruded.

Want and defective formation of the trunk have already been alluded to. In its extreme degrees neither body nor limbs are formed; several cases are described in which the head was the only part found. Vrolik mentions a case, which he saw, which was born with a well-formed calf, the tongue being the only well-developed part in this imperfect head. This case would seem to prove that each part of the body is evolved quite independently of the rest—vessels without the heart, nerves without brain or spinal cord, etc. In less degrees of malformation the upper part of the body is found without the lower limbs. In some examples only one of the lower limbs exists. In other cases there is apparently but one lower limb, which is composed of the elements of two, being fused and terminating in a caudal extremity, and hence *monstra sireniformia*. In this deformity the anus is closed, the genitals defective, and the navel-string has but one artery. The fused limb may terminate with a single or a double foot, or none at all.

Want of all of the extremities is an arrest of development at that period in which the limbs are not yet formed, and in which small tubercles occupy their places. The upper may alone be wanting. Adult examples of this defect are often exhibited in "side-shows" in whom the feet are made to act as skilful hands. Cases have been met with in which the intermediate parts of the limbs are wanting, so that the hands are attached to the shoulder and the feet to the hips. This may occur to one or all of the extremities. In less degrees the limbs are merely too short, all their elements being present. Another deformity is where one or more of the limbs terminate abruptly in a stump. Where the stump presents a cicatrix, it is due to amputation *in utero*, caused by constriction of the coil of the navel-string. In cases where the stump is terminated by one or more rudimentary fingers, the cause is from arrest of development. It is not infrequent that cases are met with in which the only malformation that exists in a well-formed child is the absence of one or more of the fingers or toes. Coalescence of fingers or toes to a greater or less degree is called web-fingered or web-toed. Congenital club-foot is a mere abnormal direction of the foot.

*Cyclopia*, or one-eyed monster, arises from defective development of the middle line of the face—cleft deformity—and fusion, more or less complete, of the two eyeballs, in which case the nose forms a sort of proboscis, and hangs from above the compound eye. Want of the under jaw often coexists with cyclopia; sometimes total defect of the opening of the mouth; in others a mere fissure represents the mouth. The under jaw may be merely too short. This

whole series consists, as Bischoff says, in an imperfect development of the first visceral arc.

*Compound monsters* include all cases in which more than belongs to a single being is developed; in its lower degrees the mere addition of an extra finger or toe, and in the highest complete duplication by the union of two well-formed fœtuses. That the genesis of double monsters is not a mere freak of nature, but the result of obedience to laws as invariable as those which govern normal development, will be seen by the following general considerations: (1) *The Law of Unity of Sex.*—Out of over 500 cases of human double monsters, as also of innumerable cases in the lower order of animals, in no instance has this law been violated. The account of a double monster of both sexes, given by a clergyman of Giessen, is very properly rejected by Virchow and all teratologists. The individuals of a double fœtus will always be found to have the same sex, either both males or both females. It is also a fact that in the vast majority of cases they have been found to be females, whether human or animal. (2) *The Law of Homologous Union.*—The union of the two fœtuses of a compound monster obeys the law of homologous union as uniformly as in the union of the two lateral halves of a single fœtus in normal embryogenesis. In other words, there is an equal balancing of parts and organs in each individual. The same muscle of one fœtus unites with the same muscle of the other; bone to bone; the same nerve or blood-vessel to the corresponding parts; and so on until all the parts and organs which are situated adjacent to each other are fused, heart to heart, stomach to stomach, etc. In cases of apparent exception to this law—such as a fœtus by inclusion or of a parasitic monster—it has been found that the union was homologous in the early embryonic periods, but that the growth of one fœtus being arrested or retarded, this blighted one was overlapped and included by its fellow. (3) *The Law of Right and Left Symmetry.*—On examination of the structure and relative position of the internal organs of a double fœtus there will be found a transposition of the viscera of each individual in order to dispose them symmetrically in relation to the common median axis of the compound body. If the double fœtus has two hearts, they will be right and left in position, and their apices will converge toward the line of fusion of the two bodies. This will be found true also of the livers and spleens and of the stomachs. The universality of this law is less positively proven than the two previously stated.

Several theories have been suggested to explain the production of double monsters: (1) The notion which attributes them to maternal impressions has already been referred to, and dismissed as untenable alike to double or single monsters. (2) The theory that they result from the fecundation of a double egg—*i. e.* of two distinct yolks enclosed in one capsule—has been proved by repeated experiments to be incorrect. (Prof. Panum of Kiel with eighty double eggs of the domestic fowl.) The product of hatching such eggs is twins, separate and of the same or of opposite sexes. (3) A more plausible hypothesis claimed that all double monsters were originally twin conceptions, but that the membranes separating them being absent, imperfect, or absorbed, the two bodies were brought into close contact with each other, and coalesced by reason either of some inflammatory action or of the strong formative power existing at that period of uterine life. The late Prof. Charles D. Meigs entertained this theory, which is obviously wrong, since it fails to explain the law of unity of sex, homologous union, and right and left symmetry. Twins often differ in sex, and one-third of twins are contained in *one* amniotic sac, the very condition claimed to be most favorable to fusion, and yet in these cases the twins are usually of opposite sexes. Should union occur under these conditions, they would be joined in the most accidental and heterogeneous manner. (4) It has been demonstrated by early embryos in the eggs of birds, and by observations under the microscope of the transparent eggs of fish, that a double monster is the product of a single ovum, whose vitelline membrane develops two primitive traces—*i. e.* two neural axes—instead of one. In some cases the primitive traces were not entirely separated nor precisely equal in size, while in other cases the neural axis was only partially bifid. The various degrees and the extent to which the primitive trace is cleft, from the slightest amount of duplicity to complete duplication, account satisfactorily for all the forms of duplex development. Thus it is seen that the compound monster proceeds from a single germ, single sexuality, and being governed by identical germinal laws, homologous and symmetrical development and fusion must result. The degree of duplicity and the extent of fusion depend upon the proximity or remoteness of the primitive traces and the relative inclination of their axes.

The so-called parasitic monster is the minus proportional, the lesser or imperfectly-developed half, of a double monster. When the two individuals of a compound monster are equal and symmetrical, they represent the plus quantity. In a series of cases of non-symmetrical duplex developments we find every degree of falling off that pertains to the malformed single fœtus, resulting from the same causes—viz. arrested, retarded, or embarrassed development. Two authentic cases of triple-headed monsters are recorded, one human and one of a lamb. Their embryogenesis is readily explained by a double splitting of the primitive trace, whereby the cephalic extremity of the neural axis becomes trifid.

Limited space forbids us going into a detailed account of the numerous forms of double monsters which have occurred, even in the human subject. For particulars those interested may consult the essays of the present writer on *Diploteratology* in the *Transactions* of the Medical Society of the State of New York for the years 1865, 1866, 1867, and 1868, comprising 200 pages and 126 lithographic illustrations. It contains a chronological bibliography of the subject, embracing several hundred titles of works published during the past three centuries. The student of teratology will seek the works of Isidore Geoffroy Saint-Hilaire, Otto, Vrolik, Förster, Braune, and many others.

GEORGE JACKSON FISHER.

**Ter'bium,** the name given by Mosander to a substance associated with erbium and yttrium in the mineral gadolinite, and supposed by him to be a new metal, but the experiments of other careful analysts have failed to discover such a metal, and its existence is consequently a matter of doubt. (See ERBIUM and YTTRIUM.)

**Ter'burg** (GERARD), b. at Zwolle in the Netherlands in 1608; received probably his first instruction in painting from his father; travelled through Germany and Italy, whose art, however, had no influence on him; painted in 1648 the sixty-nine plenipotentiaries who concluded the Peace of Münster; was invited to Madrid; visited Paris and London; gained great favor everywhere both by his person and by his art; returned home rich and renowned, and settled in Deventer, where he was chosen burgomaster. D. in 1681. His pictures are mostly genre pieces, representing scenes of the easy and elegant life of the upper classes. They are scattered all over Europe, and command immense prices.

**Terce'ira,** one of the Azores Islands (see AZORES), comprises an area of 220 sq. m., with about 40,000 inhabitants. The coasts are steep, wild, and, with exception of a few strongly fortified places which afford good harbors, perfectly inaccessible. The interior is much broken up by volcanic agencies, but the soil, mostly consisting of decomposed lava and tufa, is exceedingly fertile, and wine, oranges, and timber are largely exported. Cap. Angra.

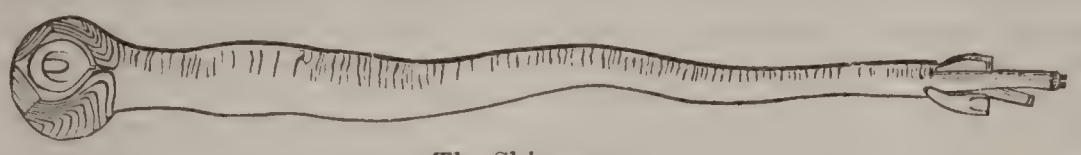
**Ter'ebinth, Tiel Tree,** or **Turpentine Tree,** the *Pistacia terebinthus,* of the order Anacardiaceæ. It is some thirty or forty feet high, and grows in the Levant. It produces the valuable Chian turpentine. The terebinth tree is noted for its extreme longevity.

**Terebratula.** See TEREBRATULIDÆ.

**Terebratu'lidæ** [Lat. *terebrare,* to "bore"], a name applied to a family of brachiopods of the order Arthropomata. The group, like the old Linnæan genus, has been much modified in extent, and successively restricted: at first it was nearly coequal with the order to which it belongs, but is now restricted by Davidson and others to include certain genera agreeing in the following characters: The shells are diversiform in shape in the several groups, but the beak is always more or less prominent and truncated by a subcircular perforation (for the passage of the peduncle), partly completed by a deltidium in one or two pieces; the shell-substance is punctated; the labial appendages are connected with each other by a membrane, are variously folded on themselves, and are more or less supported by calcified processes, which are diversiform in shape, but never spiral. The species live in the ocean, attached by a peduncle to rocks and other bodies. They are the most numerous and varied in development among the living brachiopods. In time the family has existed from at least the close of the Silurian period to the present time. The following genera are recognized by Davidson, and by Dall have been distributed under several sub-families—viz. (1) Terebratulinæ, including the genera *Terebratula, Dielasma* (*f.*), *Rensselæria* (*f.*), *Terebratulina, Waldheimia,* and *Macandreuia;* (2) Stringocephalinæ, represented by the genus *Stringocephalus* (*f.*); (3) Magasinæ, embracing the genera *Terebratella, Terebrirostra* (*f.*), *Kingena* (*f.*), *Megerlia,* and *Magas;* (4) Kraussininæ, including the genera *Kraussina* and *Bouchardia;* (5) Platidiinæ, typified by the genus *Platidia;* and (6) Megathyrinæ, represented by the genera *Megathyris* or *Argiope, Cistella,* and *Zellania:* the genera *Mannia, Guynia, Tropi-*

*dolepis* are also admitted by Mr. Davidson, and so are a number of sub-genera by Mr. Dall. (See Dall in *Am. Journ. Conch.*, vol. vi. pp. 88–147.) The greater number of these genera are still represented by living species, and those now extinct are indicated by the letter (*f.*) after them. (See also LAMP-SHELL.) THEODORE GILL.

**Teredin'idæ** [from *Teredo*, Gr. τερηδών, the typical genus], a family of conchiferous or lamellibranchiate mollusks, notable in connection with the so-called "ship-worms," which are its chief representatives. The several forms are in nowise related to worms, and the only feature common between the two is the elongation of the body and of the tube which they form; they have, however, the



The Ship-worm.

true molluscan organization, and the elongation is simply due to the excessive protraction backward of the siphonal tubes and the reduction of the body. The abdominal or shell covered portion of the animal is comparatively very small and almost subglobular, and the siphonal portion is in proportion extremely long and worm-like; the siphons are united for the greater part of their length, but free toward their ends, and there armed with two peculiar elongated shelly appendages called "styles" or "siphonal palettes;" the mantle is well developed, its lobes united except at the pedal opening, reflected behind over the valves of the shell, and developed above into lobe-like expansions, which are also reflected over the hinges of the shell, and serve to keep the valves in place; the gills are large, and extend far into the siphonal portion; the mouth is provided with palpi, the foot is subcylindrical and sucker-like, with a foliaceous margin, moderately protractile, and well supplied with nerves, the shell is composed of two equal valves of peculiar form; these valves are not united at the hinge, but are only kept in place by the reflections of the mantle above referred to, and are thus susceptible of much independent interaction; the valves are, in the typical forms, severally divisible into three regions, indicated by a decided anterior notch as well as groove, and by a posterior furrow or groove crossing the shell in a curved line from behind the umbonal region; these limit (1) the anterior projecting cockle-like part, (2) the median deep part, and (3) the posterior true shell-like (*e. g.* like the posterior portion of the shell of a *Pholas* or *Mya*) part. The sculpture often varies much on these several parts, although all resulting from modifications of the lines of growth. In the *Teredo navalis*, *e. g.*, (1) the anterior portion is ribbed like a cockle-shell, the ribs (developed from lines of growth) radiating backward from the incurved anterior margin, transversely furrowed, and abruptly terminating at the groove dividing the anterior and median regions; (2) the median portion, on its anterior slope, has the lines of growth developed into rows of acute cuneiform denticles; and (3) the rest of the surface has concentric wave-like folds or distant striæ; the incurved protuberances of the valves support long spine-like apophyses which point downward within the shell toward the lower margin. The animal forms a long trabes in which it conceals itself. Such are the principal characters which distinguish this type. The significance of some of the details noted will be soon obvious. First, however, the several modifications of the type should be adverted to. The family has quite a number of representatives, most of which bore in wood, but a few live in the bottom of the water, and the tubes they form in that case serve to protect them from the inflow of mud into their burrows. The members of the several subordinate groups and species are essentially similar, but differ much in details as to form and sculpture of their shells, and still more in modifications of the siphonal palettes. On the modifications of those elements the family has been differentiated by E. Percival Wright into six genera—viz., *Teredo*, *Nausitora*, *Kuphus*, *Calobates*, *Xylotrya*, and *Uperotus*. Still another genus, *Lyrodus*, has been introduced by A. A. Gould. Not far from 40 species have been recognized by recent naturalists, most of which belong to the typical genus (*Teredo*). Representatives of the family are widely diffused, and some, more or less, are found in the seas of almost every country.

Great ravages have been committed by species of the genus *Teredo*—especially *Teredo navalis*—and government commissions of inquiry have been instituted to investigate the natural history of the animals with a view to staying their destructive work. The literature involving the subject is therefore very voluminous. The most noteworthy reports are those made during the years 1860–65 by a commission authorized by the government of the Netherlands, and of which an abstract was published in 1866 by the secretary of the commission, E. H. von Baumhauer. In this abstract the subject is considered under the following heads, with the results indicated:

I. *The Mechanism of the Apparatus by means of which the Teredo navalis perforates its galleries.*—Recalling the armature of the valves already described—the file-like ribs and rows of denticles—it was inferred, and has been demonstrated by experiment, that the excavations of the animal are effected by the continuous action of the valves, whose hard anterior surfaces act by attrition in the manner of a file, and gradually rasp away the wood attacked. The foot is a delicate organ of touch, and serves to guide the animal.

II. *On the Mode of Life of the Teredo.*—The sexes are divided, and in unequal number, there being about twenty males to one female, according to Quatrefages. The female is oviparous, and expels the eggs through the branchial siphon in the months of June and July in Middle Europe. The young attach themselves to wood, and soon (within even two weeks) perforate into it, the openings being naturally small and the holes increasing with the size of the animal. The wood is bored in different directions, but the several individuals skilfully avoid intrusion into the burrows of their neighbors, although frequently leaving very narrow partitions. Thus, the wood is often honeycombed, and, yielding to very slight force, is readily demolished. The fine particles of wood ground away are conveyed through the shorter siphon into the open water. The animal flourishes in clear pure water. Its most formidable enemy is a kind of worm, the *Lycoris fucata*, which penetrates into its burrows and devours it.

III. *On Circumstances which favor the Ravages of the Teredo.*—It has been found that the ravages of the animal have suddenly increased in certain years—*e. g.* in the Netherlands in the years 1731, 1770, 1827, 1858, and 1859—and it has been ascertained by elaborate investigations that this increase was co-ordinated with three concurrent circumstances—viz. (1) the fall of a diminished amount of rain; (2) the consequent diminution of the inland bodies of water; and (3) the resulting increase of the saltness of the sea. In other words, the salter the sea is within certain limits, the better flourishes the *Teredo*.

IV. *Experiments undertaken to preserve Wood from the Attacks of the Teredo.*—These have been very numerous, and it must suffice to indicate that the Netherlands commission came to the conclusion that the only preservative against the ravages of the *Teredo* is creosote oil. Care must be taken as to the quality of the liquid, the manner of its application, and the nature of the wood on which it is employed. (Consult especially articles by E. H. Baumhauer (*Sur le Taret et les Moyens de préserver les Bois de ses Dégâts*, in *Archives Neerland. de Sciences exactes et Nat.*, vol. i. pp. 1–45, pl. 1–4), G. W. Tryon (*Monograph of the Family Teredidæ*, in *Proc. Acad. Nat. Sc.*, Philadelphia, 1862, pp. 453–482), and E. Percival Wright (*Contributions to a Natural History of the Teredidæ*, in *Trans. Linn. Soc. London*, vol. xxv. pp. 561–568, pl. 64–65). In these other references will be found.) THEODORE GILL.

**Teredo.** See TEREDINIDÆ.

**Ter'ence** (PUBLIUS TERENTIUS AFER), b. at Carthage 195 B. C.; became, though in a manner not known, the slave of Publius Terentius Lucanus. On account of the talents he early evinced he received a careful education, was manumitted, and lived, after the performance of his first comedy, *Andria*, in 166 B. C., in intimate intercourse with some of the best men in Rome, such as the younger Scipio, Lælius, and others. In 160 B. C. he went to Greece, and is said to have translated 108 comedies by Menander during his stay there; but he never returned. The reports of his death, however, differ very much, some even asserting that he was drowned before he reached Greece. Six of his comedies have come down to us—namely, *Andria*, *Hecyra*, *Heauton-timoroumenos*, *Eunuchus*, *Phormio*, and *Adelphi*. They all belong to the so-called *fabula palliata*—that is, they represent Greek characters, Greek customs, and Greek life; and they all are borrowed, to some extent, from Greek originals by Menander, Apollodorus, or Diphilus, two Greek comedies being often melted down into one by the Latin author. By the Roman public at large they were not received with any great applause; people left the theatre when they were played to see the acrobats; but their purity of language, elegance of diction, and refinement of humor and sentiment—merits which the rivals of Terence ascribed to the co-operation of Scipio and Lælius—made them great favorites and subjects of much imitation after the revival of letters in the Middle Ages. Among the latest editions are those by Parry (London, 1857), Wagner (London, 1869), and Umpfenbach (Berlin, 1870). There are

translations into English by Patrick (1745), Colman (1765), and Riley (1853).

**Ter′govist,** town of Wallachia, on the Jalomnitza, was formerly the capital of the country, and had celebrated glassworks and 30,000 inhabitants, but has now declined very much, and contains not more than 2600 inhabitants.

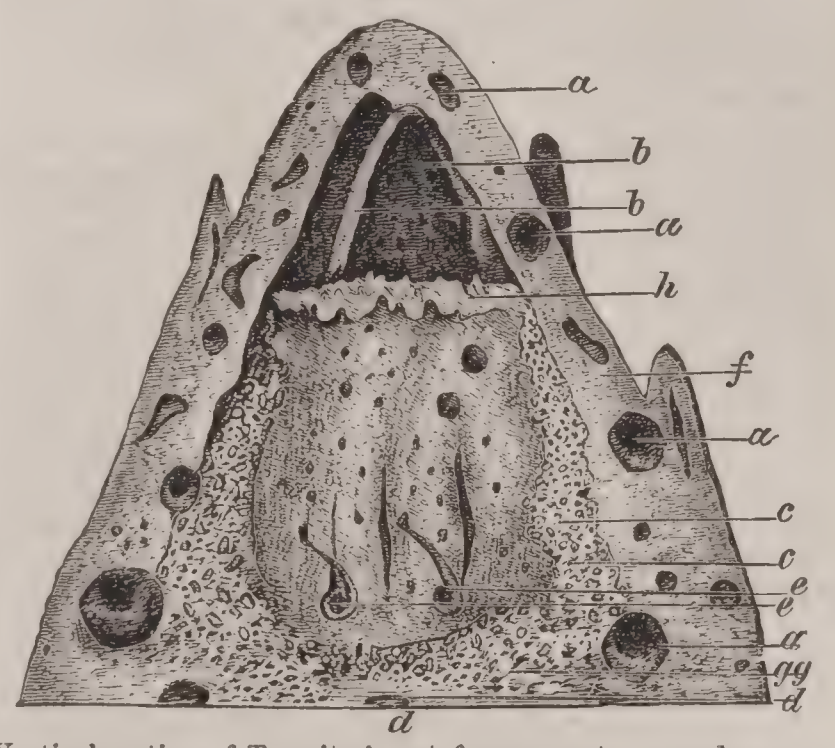
**Terhune** (Mary Virginia Hawes), known by her *nom de plume* "Marion Harland," b. in Amelia co., Va., about 1835; in 1856 married Rev. E. P. Terhune, then a clergyman in Virginia, who in 1859 became pastor of a Dutch Reformed church in Newark, N. J., which has since been her residence. She began to write for the press at a very early age, and when sixteen contributed to *Godey's Lady's Book* a sketch entitled *Marrying from Prudential Motives*, which was copied without credit into an English periodical, thence translated into French, from which it was retranslated into English, and in that shape republished in England and America. She has published—*Alone* (1854), *The Hidden Path* (1855), *Moss Side* (1857), *Miriam* (1860), *Nemesis* (1860), *Husks* (1863), *Husbands and Homes* (1865), *Sunnybank* (1866), *The Christmas Holly* (1867), *Ruby's Husband* (1868), *Phemie's Temptation* (1869), *Helen Gardner, The Empty Heart, At Last* (1870), *Common Sense in the Household*, a manual of domestic housewifery (1871), *True as Steel* (1872), *Jessamine* (1873), *From my Youth Up* (1874).

**Terliz′za,** town of Italy, province of Bari delle Puglie, in a fertile plain about 7 miles from the Adriatic, and very near the town of Barletta. It was a place of great strength during the Middle Ages, and the emperors of Germany and the kings of Aragon sought refuge here at different times. The old castle and the solid walls and towers of the city are still standing, but the deep and broad trench has lately been converted into a kind of boulevard. There is said to be a fine private gallery of pictures here. Grain, wine, oil, and fruits are exported to some extent, but good roads are greatly needed as a means of communication with the neighboring country. P. 18,261.

**Ter′mini Imere′se** (*Thermæ Himerenses*), town of Sicily, province of Palermo, 25 miles S. E. of the city of Palermo. It is situated on a hill on the left bank and near the mouth of the river Termini, which, as well as the town, derives its name from the warm springs in and near this place. It is a walled town, with a castle on the seaward side, and it contains a few noticeable buildings. In the principal church there are respectable paintings. On the Gothic front of the church of St. Caterina may be seen some very old bas-reliefs, and in the interior there are frescoes of interest. The exports of Termini are chiefly grain, fruits (especially almonds), sumach, cantharides, etc., and these will greatly increase with improved means of communication. It was under the walls of the ancient *Himera* that Gelon obtained his great victory over the Carthaginians (480 B. C.), and when, seventy years after, the Punic armies destroyed the city, the refugees made the new settlement of *Thermæ Himerenses*, which was a flourishing town in the time of Augustus. Little is heard of it during the Middle Ages, and its present interest consists chiefly in the ancient objects already excavated in and near the town, and in the promise it gives of a still richer antiquarian harvest. P. 19,739.

**Ter′mites,** improperly called **White Ants,** belong to the order Neuroptera, suborder Pseudoneuroptera. Though most abundant in hot climates, this family of insects reach far beyond the tropics, extending in our hemisphere N. and S. from New England to Chili, and E. and W. from ocean to ocean. The African species (*T. bellicosus*) build great pinnacled nests, 15 feet in perpendicular height and 60 feet in circumference at the base. Formerly, the plains of Africa were in many places thickly studded with these hills, but the advance of civilized man has driven them back from the neighborhood of the foreign settlements. The nests are destroyed partly to obtain the clay, which is valuable for building purposes, but principally to rid the country of the insects, which are the most formidable pests of that climate. In founding a nest the termites erect first a single pinnacle several feet high, and very small about the base, and then others near it; finally, these are all consolidated into a single dome, and the middle pinnacles, having performed their part as scaffolding, are removed. The pinnacles are built only while the nest is being enlarged. When it has reached its maximum size, the nest is a rounded dome, upon whose outer surface grass and weeds grow freely; in the dry season it looks not unlike a haycock. The outer shell (Fig. 1, *f f*) is built of hard, solid clay, which the sun bakes to a light-yellow color; within is the dwelling proper. In the centre, at or above the level of the base, lies the queen's chamber *d d*. The walls of the royal cell are built of solid clay from one inch to one-eighth of an inch in thickness. The floor is flat and smooth; from this an oval arch springs up, forming a chamber in the shape of a half ellipsoid cut through its major axis. In large nests the royal chamber sometimes measures 8 inches in length. Above and around this cell are irregular clay chambers *g g*, forming anterooms, where the royal attendants wait; or magazines, stored with gums and inspissated juices of plants; other chambers are scattered among these, which are formed of bits of wood glued together by means of what appears to be vegetable gums. These cells are nurseries, and in them the eggs are placed and the young reared. The nursery-walls are always found invested with what seems to be mould covered with small white specks. Under the microscope these specks are seen to be fungi not unlike the edible mushroom, and in large measure this forms the food of the larvæ. The congeries of cells extend to the outer shell of the nest on every side and two-thirds of the way up the enclosing dome. Between the roof of the cells *h* and the enclosing clay wall *f f* is left the arched hollow chamber *b b*, which serves as an air-chamber, and secures the proper degree of warmth and moisture. The walls of the dome are penetrated with many galleries *a a a*, and by means of these all parts of the dwelling intercommunicate; in some places arched bridges *e e* are sprung from the lower to the upper stories to secure quick and easy transit. There are no direct openings from the nest to the outside air; but from the interior long underground passages, sometimes 12 or 15 inches in diameter and many feet long, open into the outer world. The domes or pinnacled clay nests are so strong that they are used by the wild buffaloes as sentry-posts when they are guarding the feeding herds below. The clay of which the nest is built is hardened by some secre-

Fig. 1.




Vertical section of Termites' nest, from apex to ground; *a, a, a*, galleries penetrating outer dome; *b, b*, air-chamber; *c, c*, magazine and nurseries; *d, d*, royal chamber; *e, e*, bridges; *f, f*, outer shell; *g, g*, congeries of royal ante-chambers.

tion of the insects. *T. atrox*, another African species, erects mushroom-shaped nests filled with magazines and nurseries much like those already described. *T. arborum* builds upon trees huge nests of fragments of wood glued together, which are sometimes as large as a hogshead and 80 feet above the ground. *T. flavipes*, *T. lucifugus*, and others perforate stumps or fallen trees with innumerable galleries, leaving the surface intact, and some varieties even make their nests in the ground beneath flat stones.

In each nest there are several kinds of individuals: (1) sexual individuals, kings and queens; (2) neuters, abortive males and females, which are both workers and soldiers; (3) larvæ of males and females, workers and soldiers; and (4) nymphs of the same. The males and females when they come to maturity have wings. (Fig. 4.) Some time from May to September, according to the species and habitat, the perfect insects emerge from the nest in myriads and take flight. In a few hours they shed their wings—some authorities state that they voluntarily rid themselves of the wings like the ants—and they then fall victims to their numerous enemies, being greedily devoured by men and animals. Not more than one pair in a million escape, are secured by a queenless colony, and fulfil the apparent purpose for which they are created. In those species which incarcerate their royal pairs the cell is immediately built up about them. The size of a perfect king or queen is about thirty times that of a worker. The king retains this size, but the queen soon begins to grow; the skin (Fig. 5, *s*) between the abdominal rings *r* extends till the abdomen measures 4 inches or more in length and about 3 in its largest circumference. The figures given are of *T.*

*lucifugus*, where the proportions are not so greatly changed as in *T. bellicosus*. In the latter the head, legs, and thorax are not larger than those of our large black ants, while the abdomen measures several inches. The queen is the common mother of the community, and is estimated by some observers to lay 80,000 eggs a day. The workers measure from $\frac{1}{6}$th to $\frac{4}{6}$ths of an inch in length, according to the variety. They have soft white bodies, two articulated antennæ, two mandibles, and no eyes or ocelli; their

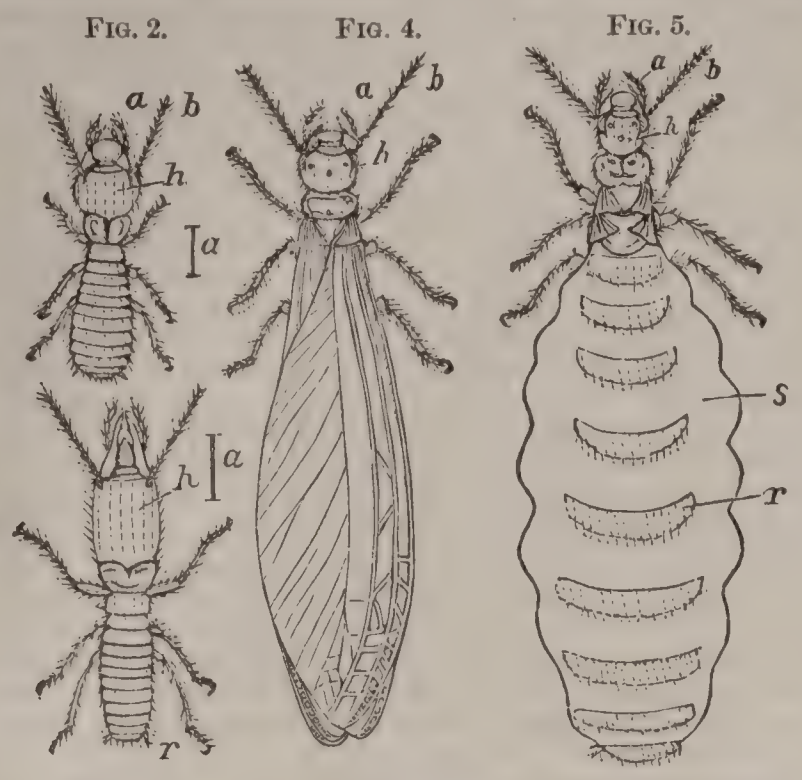



Fig. 2. Fig. 4. Fig. 5.

Fig. 3. Fig. 2, Worker.—Fig. 3, Soldier. *a*, real length. Perfect insect, male and female. Fully-developed Queen.

business is to take the eggs when laid by the queen, carry them to the nurseries, where they are slightly glued to the walls, care for the larvæ when they hatch, and feed them, sometimes taking down the food themselves, and then regurgitating for the young. When the time comes for the metamorphosis of the nymphs, the workers assist in effecting it. Besides this, they collect the material for the nest, and build it, excavate the galleries, procure and store away the food, tend the sick, and provide for the royal wants. The soldiers (Fig. 3) form about 1 per cent. of the neuters; they resemble the workers except about the head, which is long, cylindrical, and furnished with large and strong serrated mandibles, which snip like a pair of sharp scissors; like the workers, they are totally blind. They stand posted at the entrances of the galleries in times of peace, but when the nest is attacked, one or more rush out, survey the ground, return to the nest, and soon return accompanied by hosts of comrades. They attack everything which comes in their way, striking about in a blind fury. When building or repairing is going on, the soldiers of *T. bellicosus* stand about as overseers, and idleness or relaxed energy calls forth a reprimand from them. The huge mandibles are struck upon the wall against which the soldier has posted himself; this call from the overseer is responded to by a hiss from the delinquent workers, and followed by redoubled industry. In *T. viarum*, the marching termites, the neuters have eyes. When making a progress through the wood, soldiers mount the grass and plant-stalks which overhang the moving column, and give admonitory strokes, which sound like the ticking of a watch. To this sound the column responds by a hiss, and redoubles its speed. In *T. lucifugus*, a French species, the soldiers do not oversee the workers.

The injuries wrought by these insects are terrible; they invade every vegetable fibre except cotton, and destroy wood, matting, linen and woollen clothing, books, and parchment by sap and mine. They habitually avoid the air and light, not because of an antipathy to them, but because of their helplessness and their necessity of a moist atmosphere. In consequence of this peculiarity their ravages are unobserved till everything sinks into ruins. When they desire to reach a certain point, a covered gallery is immediately built to that point, that they may reach it unseen. African villages which have been abandoned in a year or two have utterly disappeared, and the ground on which they stood is found covered with vegetation. Posts are sometimes so riddled that a slight kick will dissipate them, leaving nothing in their stead but a heap of dust and débris. At Tournay, Charente, France, a whole dinner-party, guests, host, table, and all, were let down through the floor into the cellar without a moment's warning in consequence of the termites' depredations in the flooring and beams. When *T. bellicosus* penetrates a room, the entire wood-work is destroyed in the course of twenty-four hours. Though so destructive, these little insects perform an important office in hot climates. They never attack living wood, but they hasten to assist and render harmless the rapid decomposition of vegetable matter in the tropics. Decaying matter which might poison the air for weeks is by their agency removed quickly and without harming any one. Ants are among the most dangerous enemies of the termites; when they meet, they invariably fight, and the ants, having the advantage of vision, a horny integument, and warlike instincts, generally come off victorious. Some of the native Africans make use of this antipathy of the ant, and when their huts are rendered almost uninhabitable by the presence of termites, they bear a colony of black ants to the spot; the soft, helpless termites are soon routed from their stronghold and destroyed.

S. B. Herrick.

**Tern.** See Sterninæ.

**Ternant', de** (Jean), Chevalier, b. in France about 1740; served in the French army in America during the war of the Revolution; was appointed by Baron Steuben sub-inspector, with the rank of major, Apr., 1778; became lieutenant-colonel, and inspector of the troops in South Carolina and Georgia, Sept., 1778; taken prisoner at Charleston 1780; soon exchanged, and rendered good services in the Yorktown campaign; ambassador to the U. S. 1790–93; a colonel during the wars of the French revolution, and noted for ability and varied attainments. D. at Conches, Normandy, in 1816.

**Ternate.** See Moluccas.

**Ternaux'** (Guillaume Louis), Baron, b. at Sedan Oct. 8, 1763; at the age of sixteen retrieved the fortunes of his family by his successful management of his father's woollen factory; represented the department of the Seine as deputy 1818–23; re-elected in 1827, and with 220 deputies stood against the government, bringing about the revolution of July, 1830, in which he was ruined; wrote several treatises on finance and manufactures, and was among the first to naturalize Thibetan goats in France and introduce spinning-machines for cotton and woollen fabrics, and greatly improved the national finances. D. at St. Ouen Apr. 2, 1833.

**Ternaux** (Louis Mortimer), b. at Paris Nov. 22, 1808; was educated at the Collége Charlemagne; entered the civil service of the government in 1830; was elected a member of the Chamber of Deputies in 1842; joined the opposition in 1845; represented the Ardennes in the Constituent and in the Legislative assembly of 1848–49; protested against the *coup d'état* of 1851, and retired into private life. He published *Histoire de la Terreur, 1792–94, d'après les Documents authentiques et des Pièces inédites* (7 vols., 1862–69), besides several minor works.

**Ternaux'-Compans'** (Henri), b. in France about 1810; was for many years in the French diplomatic service; collected a library peculiarly rich in MSS. and early printed books upon America, and edited two series of ten volumes each of *Voyages, Relations et Mémoires* (Paris, 1836–40), translated into French, chiefly from unpublished Spanish MSS. upon the discovery and conquest of America—a work of great value to the historical student. He also published a *Bibliothèque américaine, 1493–1700* (Paris, 1837), and various other works. D. in Dec., 1864.

**Ternay', de** (Charles Louis d'Arsac), b. in France in 1722; was descended from an ancient and noble family of Bretagne; entered the French naval service 1738; commanded the squadron which captured St. John's, Newfoundland, June 2, 1762; was governor of the island of Bourbon 1772–79, and was in command of the fleet sent by France to the assistance of the U. S. in 1780, which conveyed the army of Count Rochambeau, landing at Newport, R. I., July 10. D. at Newport Dec. 15, 1780.

**Ter'ni** (*Interamna Umbrica*), town of Italy, province of Perugia, pleasantly situated near the banks of the Nera, about 10 miles S. S. W. of Spoleto and 55 N. N. E. of Rome. It is surrounded by a very ancient wall with square towers. Similar towers were once very common throughout the city, but they were nearly all destroyed by a brother of Boniface IX., who used them as material for the construction of a new fortress. One of the five gates is called *Tre Monumenti*, so named from the monuments of the historian Tacitus and of the emperors Tacitus and Florian, all of whom were born here. The streets are tolerably commodious, and open upon a very large square near the centre of the town. The cathedral is very old, and contains many early monuments and inscriptions, but the basilica of San Valentino is still more ancient. The church of San Salvadore is built on the ruins of a temple of the sun—that of Sant' Alò over a temple of Cybele. The episcopal palace stands, in part, on the site of an amphitheatre of the time of Tiberius, which, judging from the foundations, was capable of holding 10,000 spectators.

In the communal palace many Roman inscriptions are preserved. Terni was probably one of the ancient Umbrian cities, founded nearly as early as Rome itself. It was given up by Sulla to his soldiers; was sacked by Totila, and again by the Lombards; and had its share in the crimes and sufferings of the subsequent centuries. It is now a place of more than usual industry; besides woollen cloths, leather, etc., iron is manufactured here on an extensive scale. The environs of Terni are very attractive, and there are many villas in the neighborhood. P. 15,500.

**Terodant′,** town of Morocco, capital of the province of Soos, in an exceedingly beautiful and fertile region which produces much sugar, and is celebrated for its excellent leather and its dyed ostrich-feathers. P. 22,000.

**Teror′,** town of the Canaries, on the island of Grand Canary, has some warm mineral springs, which are resorted to on account of their curative effects. P. about 5000.

**Terpan′der,** b. at Antissa, island of Lesbos, in the first half of the seventh century B. C.; settled in Sparta, where, in 676 B. C., he gained the prize in the first musical contest instituted at the feast of Apollo Carneius. He is generally considered the founder of Greek music, as he increased the number of the strings of the lyre from four to seven; was the first to set poetry to music, both his own verses and those of Homer; established the first regular school of music, and made music a part of education.

**Terpenes.** See ISOMERISM, by H. WURTZ, A. M.

**Terpsich′ore,** one of the nine Muses, presided over song and choral dancing, and was represented with lyre and plectrum in her hands, and a wreath of flowers on the head.

**Terraci′na** [anc. *Anxur,* afterward *Tarracina*], town of Italy, province of Rome, on a hill near the seashore, not far from the mouths of the Ufento and the Amaseno, about 62 miles S. E. of the city of Rome. The town is divided into two parts, the old and the new; the former is badly built, but contains the cathedral, erected on the site of the temple of Jupiter, the great portico of which is still standing. The floor and the pulpit are of the time of Constantine. The new town is below, near the sea, and possesses some fine buildings. Terracina was an important Volscian city, and was finally subjugated by the Romans 400 B. C.; made a colony 329. Prosperous during the best Roman times, it was sacked by Totila, held for a century by the Arabs, and for a long time after their expulsion it was frequently plundered by African corsairs. The ancient port is now nearly filled up; the modern and smaller one only is used. The commerce and general industry of Terracina are insignificant, and to the fatal malaria is added the curse of brigandage. P. 7376.

**Terra Cotta.** See POTTERY, by S. BIRCH, LL.D.

**Terra Cotta Records.** See PRINTING, by W. S. PATERSON.

**Ter′ra del Fue′go** ("the land of fire"), a group of islands between lat. 52° 40′ and 56° S., at the southern extremity of South America, from which it is separated by the Strait of Magellan. It consists of one large island (King Charles's South Land or East Terra del Fuego), 21,260 sq. m. in area, and a number of small isles, of which the southernmost, Cape Horn, is the most remarkable. All the islands are high, mountainous, and probably of volcanic origin. The eastern shores are much indented and well wooded; the western are rugged, barren, and desolate. The climate is the most wretched on earth; storms of rain, hail, and snow drift in from the Atlantic, Antarctic, and Pacific oceans in everlasting succession, only broken by violent gusts of wind. Perpetual snow and ice cover the tops of the mountains, and glaciers, greenish-gray, descend from the sides to the sea. On the eastern shores forests of stunted trees, the Antarctic beech, are found at the foot of the mountains, and higher up a belt of alpine herbs; but the wild celery and the spoon-wort are the only edible plants. The animal kingdom is represented by shellfish, sea-otters, fowls, mice, and dogs, and mankind by an ugly, savage race, who in hard times eat first their dogs and then their old women, and whose most splendid feasts are dirt, filth, and misery. Several attempts to introduce Christianity among them have been in vain. Terra del Fuego was discovered in 1520 by Magellan, and received the name of the "Land of Fire" from the volcanic fires he observed along its coasts. Missionaries have sometimes tried to give quite an attractive description of the island, but sailors who have doubled Cape Horn describe this arena, where the tempests of the Pacific and Atlantic oceans meet and fight till those of the Antarctic step in and decide, as the most dreary and horrible region of the globe.

**Terra di Bari,** Italy, now BARI (which see).

**Ter′ra di Lavo′ro,** or **Caserta,** province of Italy, stretching along the Mediterranean N. of the province of Naples, and traversed by the Garigliano and the Volturno, comprises an area of 2206 sq. m., with 697,403 inhabitants. Its agriculture, cattle-breeding, and manufacturing industry are flourishing. Cap. Caserta.

**Terra di Otranto.** See OTRANTO, TERRA DI.

**Ter′ra Fir′ma,** a term sometimes used to designate the Spanish main or the north-western portion of South America; also, that part of the Italian mainland which formerly acknowledged Venice as mistress. The term designates continental regions as opposed to islands.

**Ter′ra Japon′ica** [Lat.], an old pharmaceutical designation of CATECHU (which see), which was formerly regarded as an earthy mineral.

**Terrano′va di Sici′lia,** town of Sicily, province of Caltanisetta, on the S. coast of the island, near the mouth of the river of the same name. It is well built, has good churches, and the inhabitants are engaged in traffic and navigation. The harbor has been recently somewhat improved, and about 800 vessels enter it annually. This town occupies the site of an ancient city (probably *Gela*), as is proved by the remains of a Doric temple and by the many old sepulchres found in the neighborhood, whose contents have enriched the museum of Palermo. P. 14,911.

**Ter′rapin** [Fr. *terrapène*], a name given to tortoises (Testudinata) of the family Emydidæ. (1) It is by some applied to all the typical forms (Emydinæ) of the family. (2) In the U. S. it is more specifically used for the *Malaclemmys* (*Malacoclemmys*) *palustris* (see EMYS), or salt-water terrapin, a species held in high estimation for the delicacy of its flesh. This species is an inhabitant of the salt-water marshes from New York to Texas. It has a large head, covered with a soft naked skin (whence the name *Malaclemmys*), and the alveolar surface of the upper jaw is broad and divided in front by only a slight groove; the neck is short and thick; the shell oval, moderately convex, slightly keeled, and the scales marked with concentric, generally impressed, lines; the skin is gray, spotted, and otherwise marked with black. It rarely much exceeds eight inches in length, and is generally less than that. It is the most esteemed for the table of any species of the family, and is caught in large numbers for the markets of Baltimore, Philadelphia, New York, and other cities. It commands a price of from $12 to $36 a dozen, according to season and demand. It is shy and active in the water, swimming well, and on land running with considerable speed. (See TORTOISES.) THEODORE GILL.

**Terrebonne′,** county of Quebec, Canada, extending N. W. from the river Jésus, called also the N. branch of the Ottawa. It is fertile. Cap. St. Jérôme. P. 19,591.

**Terrebonne,** p.-v., Terrebonne co., Quebec, on the N. shore of the navigable river Jésus, 16 miles by land N. of Montreal. It is a beautiful place, and is the seat of Masson College (Roman Catholic), a large and prosperous school. It has a fine water-power, utilized in a number of manufactories. Its stone-quarries are valuable. P. 1050.

**Terrebonne,** parish of South-eastern Louisiana, bordering on the Gulf of Mexico, drained by Bayous Terrebonne, Black, and Caillou, and intersected in its N. part by Louisiana and Texas R. R. Surface flat and marshy, with numerous shallow lagoons. Staples, sugar, molasses, Indian corn, rice, and a little cotton. Cap. Terrebonne. Area, 1640 sq. m. P. 12,451.

**Terrebonne,** p.-v., cap. of Terrebonne parish, La., on Morgan's Louisiana and Texas R. R., 56 miles W. of New Orleans.

**Terre Haute,** p.-v. and tp., Henderson co., Ill. P. 139.

**Terre Haute,** city and cap. of Vigo co., Ind., on Fort Harrison Prairie (a long, narrow area of gently-rolling prairie-land in the western portion of the State) and on Wabash River. The county, on account of the rare fertility of its soil, is hardly surpassed in the State for agricultural purposes. In Vigo and adjacent counties is found a superior quality of block coal in almost inexhaustible quantities; consequently, Terre Haute has many extensive manufactories, affording employment for a large number of mechanics. It has a newspaper press not excelled by that of any other Western city of equal population, comprising 3 dailies, 1 tri-weekly, and 6 weeklies. It is rapidly becoming a prominent railroad centre, and has 9 railroads. It contains churches of all denominations, and the State Normal School, the finest educational structure in the State. The city is noted for the beauty of its streets and its many elegant private residences. It has gas and waterworks, and all the modern metropolitan conveniences. P. 16,103 (1870), 25,000 (1876). GEO. H. HEBB, MANAGER "EXPRESS."

**Ter′rell,** county of S. W. Georgia, drained by affluents of Flint River, and traversed by South-western R. R. Surface nearly level, soil productive. There are saw-mills and several manufactories. Staples, cotton, Indian corn,

and lumber. Cap. Dawson. Area, about 300 sq. m. P. 9053.

**Terre Noire,** tp., Clarke co., Ark. P. 576.

**Terre Rouge,** tp., Hempstead co., Ark. P. 1439.

**Terrestrial Magnetism.** See MAGNET, by PROF. A. M. MAYER, PH. D.

**Ter'rier** [from *terra*, the "earth," since they were once employed to enter the burrows of game], a name for a large number of breeds of small dogs distinguished for vivacity and courage. Among the best known are the English or black-and-tan terrier; the bull-terrier, a miniature bull-dog in courage, and often in shape; the fox-terrier, formerly used to unearth foxes; the Scotch or rough-haired terriers, including the Skye, the Dandie Dinmont, and other strains; and the toy-terriers, crosses with some of the small lapdogs. Most of the various breeds of terrier are especially trained to the killing of rats and other vermin.

**Ter'ritories,** a term technically employed in the U. S., and in some Spanish-American republics which have derived it from the U. S., to denote an incipient State before being endowed with the plenitude of sovereignty, and still under the direct control of Congress. Territories are erected by Congressional enactment from the unsettled or sparsely-settled public lands now confined to the Upper Missouri and the Pacific slope. The governor and the administrative and judicial officers are appointed by the President, but a Territorial legislature is entrusted with limited powers, subject to the approval of Congress. When a Territory attains a population sufficient to entitle it to one Representative in Congress, it is usually given permission by a special act to form a State constitution, and is then admitted into the Union with rights equal to those of the other States. There are at present but 6 Territories, and they may all be expected to become States within a score of years.

**Terror, Reign of.** See REIGN OF TERROR.

**Terry,** p.-v., Hinds co., Miss.

**Terry,** tp., Bradford co., Pa. P. 1079.

**Terry** (ALFRED HOWE), b. at Hartford, Conn., Nov. 10, 1827; educated at schools in New Haven and at the law school of Yale College; entered upon the practice of law in 1848, and was clerk of the superior and supreme courts of Connecticut from 1854 to 1860. For some years prior to the civil war he had been an active member of the State militia, and since 1854 in command of the 2d Connecticut militia, which regiment was mustered into the service of the U. S. in response to the call for three months' troops, and, with Terry still in command, was engaged in the first battle of Bull Run. Returning at the expiration of the three months, Terry then organized the 7th Connecticut Vols., of which regiment he was appointed colonel, Sept., 1861, and which he commanded in the expeditionary corps of Gen. T. W. Sherman at the capture of Port Royal, S. C. At the siege of Fort Pulaski he was commended for zeal, and placed in command of that work upon its capture. Promoted to be brigadier-general of volunteers in Apr., 1862, he served in the operations about Charleston, in making a successful demonstration up Stone River during the descent on Morris Island, and in the siege operations at Forts Wagner and Sumter. In the Virginia campaign of 1864 he commanded a division in the army of the James, and was engaged at Drury's Bluff, Bermuda Hundred, and siege of Petersburg, being in command of the corps May–July, 1864. Upon the failure of the first attempt to capture FORT FISHER, N. C. (which see), Terry was selected in Jan., 1865, to command the new expedition, which successfully carried that work by assault Jan. 15. For his services on this occasion he was promoted to be a major-general of volunteers and made a brigadier-general in the regular army. Congress passed a vote of thanks to him and his command. In the capture of Wilmington he rendered efficient aid, and in Mar., 1865, was placed in command of the 10th corps, which he held during the subsequent operations of the campaign in North Carolina. In June, 1865, he was placed in command of the department of Virginia; commanded the department of the South 1869–72, and the department of Dakota 1872.—In the summer of 1876 he took the field in the active operations against the hostile Sioux Indians. G. C. SIMMONS.

**Terry** (EDWARD), U. S. N., b. Jan. 24, 1839, in Connecticut; graduated at the Naval Academy in 1857; became a lieutenant in 1861, commander in 1871; during the civil war served on board the Richmond in the battle of New Orleans, the passage and reduction of Vicksburg and Port Hudson, and the battle of Mobile Bay, and was everywhere conspicuous, according to the reports of his commanding officers, for "heroic conduct and marked ability." FOXHALL A. PARKER.

**Terry** (SILAS W.), U. S. N., b. Dec. 28, 1842, in Kentucky; graduated at the Naval Academy in 1861; became a lieutenant-commander in 1862; served with great gallantry during the Red River expedition, and highly commended by Rear-Admiral Porter in his official despatch of Apr. 28, 1864. FOXHALL A. PARKER.

**Ter'rysville,** p.-v., Litchfield co., Conn.

**Terschel'ling,** the third of the chain of islands which lie in the North Sea along the north-eastern coast of Holland, comprises an area of 45 sq. m., and consists of low and rich meadow-land protected by downs and dykes against the sea. The inhabitants, numbering 3128, are much engaged in shipbuilding, fishing, and pilotage.

**Ter'tiaries,** in the Roman Catholic religious orders, are those members who from marriage or other cause are not received into the full order, but nevertheless take lifelong vows. The members of the Third Order of St. Francis are the most celebrated class of Tertiaries. They have long, in fact, constituted a separate order in the Church, and have a general of their own. The Third Order embraces congregations of both males and females. Other orders have houses of Tertiaries, who are not to be confounded with the lay brethren and sisters of the orders.

**Tertiary Strata** and **Tertiary Time.** See GEOLOGY, by PROF. J. W. DAWSON.

**Tertul'lian** (QUINTUS SEPTIMIUS FLORENS), father of Latin theology and of the church language, one of the greatest men of the early Church, was b. about 160 in Carthage, and was the son of a Roman proconsular captain of the legion. He received a liberal secular education, all his writings showing that he was well trained in law, philosophy, the learning of the day, and that which could fit him for a place in politics, which he seems to have occupied. He lived in heathenism, a reckless, licentious life, till his conversion at the age of thirty or forty, when he joined the Christians from a deep conviction of the truth of their doctrines. He threw himself into his new life with the same fiery and fearless spirit he had shown before, but turned from every trace of moral laxity to even excessive austerity. He entered the ministry of the Church, and served at Carthage, and perhaps at Rome. He remained a presbyter through life. In 202 he followed the bent of his ascetic spirit and joined the puritanic sect of the Montanists. They were orthodox in doctrine, but stern in spirit and discipline. Tertullian was attracted by these characteristics and their chiliasm, and was perhaps influenced, according to Jerome's account, by the worldliness that had already shown itself in the Roman Church, and by the envy and insults of the clergy. He remained true to the faith of the Catholics, but fought them vehemently on matters of morality and discipline. He was also a representative of the African opposition to Rome. He was a rare genius, original, fresh, eccentric, having vehement passions, large culture, though not a broad spirit. In his writings he appears glowing, fervid, witty, keen, skilful, learned in law and philosophy, though not symmetrical, writing on almost all Christian topics, a vehement debater, and a remorseless opponent. He died still a Montanist, in 220 or 240. He has left rich writings in which, with all their errors, are the seeds of the theology wrought out by Augustine and the Reformers.

ISAAC RILEY.

**Teruel',** town of Spain, capital of the province of Teruel, on the Turia, is an old-fashioned place, built by the Moors and in Moorish style—that is to say, the streets narrow to keep the sun out, but the houses substantial, and even elegant. It has a fine cathedral and some manufactures of leather. P. 10,500.

**Tesch'en,** town of Austrian Silesia, on the Elsa, manufactures woollen and linen stuffs, leather, liqueurs, glassware, and firearms. P. 9779.

**Tes'tament** [Lat. *testamentum*], in the Roman law, was the act or instrument by which a person nominated an heir who should succeed to the inheritance—that is, the one to whom the entire aggregate of the testator's property, rights, and obligations should pass. For a long time the testament simply named the heir, and the law then conferred upon him the whole inheritance. Although this always continued to be its essential and chief feature, yet in later times the practice arose of adding particular gifts, called legacies, out of the inheritance, to designated individuals; and the heir was bound to pay over these gifts to the legatees. Various laws and imperial constitutions regulated the proportionate part of the inheritance which could thus be diverted from the heir and given to legatees. In the earliest and strictest periods of the Roman law there were three modes or forms of making a testament. In the first, called *calatis comitiis*, the testator declared his will before the *comitia curiata*, or assembly of the patrician

gentes. The second, termed *procinctum*, was made by a soldier just before the army set out (*in procinctu*), and required less formalities than the others. The third, *per æs et libram* (by the copper and balance), was a feigned sale of the inheritance by means of the form called "mancipation" (*mancipatio*). The seller summoned five witnesses and the official "balance-holder" (*libripens*), and in their presence and by their aid sold the inheritance to a sort of trustee called the *familiæ emptor*. The testator then declared orally what disposition this purchaser should make of the inheritance, or else produced a writing in which his intentions were stated. The *familiæ emptor* was bound to follow these instructions, and hand over the inheritance to the designated heir. In process of time the sale was disused, and the written instrument became the principal act. At length the prætor, by virtue of his legislative power, introduced another kind of testament, which consisted simply of a written instrument published and declared by the testator in the presence of seven witnesses, who must affix their names and seals thereto. This simple form was recognized by various constitutions, and continued in use without substantial change during the remaining periods of the Roman law. Exceptions were made in favor of soldiers when in active service. They were permitted by various constitutions to execute a testament in the most informal manner, and even an oral declaration in the presence of witnesses was valid under the name of a "nuncupative testament." The term "testament" is used in the English and American law as synonymous with "will," although the modern will has little resemblance to the Roman testament.

JOHN NORTON POMEROY.

**Testament'ary Guard'ian** is a guardian appointed by the last will of a father over the persons and property of his infant children, whose office continues, unless otherwise directed by the will, until the wards reach the age of twenty-one years. The power to create this guardianship was first conferred in England by the statute 12 Car. II., ch. 24, which enacted that a father may by will or deed dispose of the custody of all his infant children, born or to be born, who should be unmarried at his decease; that he may provide for the guardianship to last until the children are twenty-one, or for any less time; that such appointment shall be effectual against all persons claiming as guardians in socage or otherwise; and that the guardian shall have custody of the infant's person and of all his property, real and personal. The statute does not confer any such privilege on the mother, nor does it extend the father's authority to his illegitimate children. The same legislation substantially has been enacted in most of the States of this country. The legislature of New York in 1861 materially restricted the power of the father in that State by prohibiting him from disposing of the custody of his infant children, and from appointing a testamentary guardian over them, unless their mother, if alive, should consent thereto in writing. (For a description of the testamentary guardian's powers and duties see GUARDIAN.)

JOHN NORTON POMEROY.

**Testaments, Old and New.** See BIBLE, by PROF. W. G. SUMNER, A. B.

**Testicle.** See HISTOLOGY, by COL. J. J. WOODWARD, M. D.

**Testimony.** See EVIDENCE, by PROF. J. N. POMEROY, LL.D.

**Test'ing, in Chemistry.** The methods of testing substances chemically for detecting the presence or absence of different elements belong to *qualitative analysis*, which will be found explained under the head of CHEMICAL ANALYSIS, by PROF. S. W. JOHNSON.

**Test Oath.** See OATH, by PROF. T. W. DWIGHT, LL.D.

**Testudinata.** See TORTOISES.

**Testudin'idæ** [*Testudo*—the old Latin name of a species—the typical genus], a family of tortoises (Testudinata) distinguished by their club-shaped feet and their special adaptation for terrestrial life. In general aspect they are not very dissimilar from the box-tortoise (*Cistudo clausa*) of the Northern U. S., and the gopher of the Southern part of the U. S. is a true representative species; the neck is retractile in a longitudinal axis under the shell, and of moderate length; the head of moderate size; the jaws naked, and with the upper overlapping the lower; the shell is oval, with the carapace more or less convex, and behind decurved, and the plastron connected with it by very wide bridges; the shields are in normal number on the carapace and plastron, save that generally the posterior marginal shields of the carapace are united, although sometimes (in *Manouria*) separate as usual; the feet are club-shaped or columnar, with the toes short and enclosed together; the claws are four or five in number, and generally the anterior are blunt and straightish, and the posterior subacute and curved. Less superficial characters are found in modifications of the head, shell, and feet; the skull is massive and has complete orbits, whose hinder edges are moderate; the zygomatic arches are well developed, and there are large cavities for the temporal muscles above; the plastron has four transverse pairs of bones; the toes have each only two phalanges. This family contains all the pre-eminently land tortoises, the so-called "land-turtle" of the Northern U. S. (*Cistudo*) being a member of the family Emydidæ, and having webbed feet. Species are found in the tropical and subtropical or warm temperate countries of all the continents except Australia, and on many neighboring islands. Indeed, two groups of islands —the Mascarene (Bourbon and Mauritius) and the Gallapagos—are remarkable for the gigantic species which they now (or rather formerly) possess. The latest monographer of the family—Dr. J. E. Gray in 1870 and 1872—recognized 32 species, which he distributed among 9 genera under two sections—viz. I., with the genera *Testudo, Peltastes, Testudinella, Pyxis, Chersina, Homopus*, and *Kinixys*; and II. (Manourina), with the genera *Manouria* and *Scapia*. The North American species are *Testudo carolina* and *Testudo Agassizii*. The species are long-lived and very tenacious of life, and can live for a long time without food; they subsist upon herbage (grass, vegetables, and roots), and travel, in some cases at least, periodically to watercourses to drink. In temperate climates they hybernate in burrows through the winter.

THEODORE GILL.

**Tet'anus** [Gr. τέτανος], a dangerous spasmodic disease characterized by paroxysms of tonic muscular contraction, succeeding each other with varying frequency for days or weeks. The spasms usually appear first in the muscles of mastication, producing the condition popularly known as "lock-jaw," then involve the large muscles of the trunk, then those of the extremities and those concerned in respiration. In a paroxysm the patient's face is livid or purple, his respiration suspended, his whole body rigid and usually arched backward, owing to the greater power of the muscles of the back. Such a spasm lasts several seconds, and may cause death by arrest of respiration. Fever of varying intensity is present, and extreme exhaustion follows the paroxysms. Death is the more common issue in acute cases, occurring in two or five days. Occasionally, tetanus of less intense type becomes chronic, lasting weeks. The causes of tetanus are wounds, especially ragged and punctured wounds in parts richly supplied with nerves, and certain atmospheric conditions not yet accurately known. Dampness and great variations between the diurnal and nocturnal temperature seem to favor the occurrence of the disease. It is probable that tetanus arises from unknown causes independently of injury. The essential pathological condition of the nervous system in tetanus is not known, though a number of recent investigations seem to indicate that in many cases there exists a diffuse central myelitis, or inflammation of the spinal cord. Tetanus has been successfully treated by chloral hydrate, opium, chloroform, and by timely removal or separation of the nerves which are irritated by the wound.

E. C. SEGUIN.

**Tête de Pont** [Fr., "head of a bridge"], in fortification, a fieldwork, generally open at the gorge, resting its flanks on the banks of a river in order to cover one or more bridges. (See FORTIFICATION.)

**Tête des Morts,** tp., Jackson co., Ia. P. 920.

**Tetradec'apods** [Gr. τέτρα-, "four," δέκα, "ten," and πούς, "foot"—fourteen feet], an order of Crustacea which normally have seven cephalic segments and pairs of appendages, and seven foot-rings or pairs of feet, of which the ISOPODS (which see) are an example.

**Tet'rads** [Lat. *tetras*], a term applied in chemistry to the tetravalent elements or radicals, each of which in combining represents four atoms of hydrogen. (See CHEMISTRY.)

J. P. BATTERSHALL.

**Tetradymite.** See TELLURIDES, by PROF. H. WURTZ.

**Tetragonur'idæ** [from *Tetragonurus*—Gr. τετράγωνος, "quadrate," and οὐρά, "tail"—the only known genus], a family of teleost fishes of the order Teleocephali and presumably of the suborder Percesoces. The body is elongate-fusiform and subcylindrical, and the tail is flattened and keeled above and below, giving a quadrangular aspect, to which the generic name alludes: the scales are moderate, and arranged in oblique coherent rows, leaving the exposed surfaces rhomboid, and exhibiting elevated striæ parallel with the axis of the body: the lateral line is slightly curved upward, and continuous; the head is conoid in profile and scaly; the eyes are lateral; the opercular bones unarmed; the nostrils double; the mouth has a lateral cleft; the upper jaw is not protractile; the lower has

deep rami; the teeth are compressed and uniserial on the jaws, and are also developed on the palate; the branchial apertures are wide and confluent below; branchiostegal rays five; dorsal fins two, the first elongate and with slender short spines, the second oblong, anal opposite and similar to the second dorsal; caudal moderate, recurrent above and below on the tail; pectorals small; ventrals sub-abdominal, inserted considerably behind the bases of the pectorals. There are four gills and pseudobranchiæ; the stomach is pointed behind, and near the pylorus is thickened; pyloric cæca are developed in large number; there is no air-bladder; the vertebræ are numerous, 36 abdominal and 22 caudal having been observed in *Tetragonurus Cuvieri*. This singular type has been variously distributed by ichthyologists, but most have referred it to the same family with the Mugilidæ or Atherinidæ, or isolated it as a peculiar one near them; it seems amply to deserve full family rank. But one species, the *Tetragonurus Cuvieri*, is certainly known, and that is very rare, and has only been found in the Mediterranean Sea and at the island of Madeira; it is apparently an inhabitant of deep water. It attains a length of somewhat more than a foot, and is of a blackish color. THEODORE GILL.

**Tetragram'maton** [Gr.], the name of the mystic number four, often symbolized to represent the Deity, whose unpronounceable name was expressed in Hebrew by four letters, יהוה. (See JEHOVAH.)

**Tetrahe'dron** [Gr. τέτρα-, "four," and ἕδρα, "side"], a solid having four bounding planes, four angles, and six edges. If regular, its sides are equilateral triangles.

**Tetraon'idæ** [from *Tetrao*—the generic name of the grouse—and the family suffix *-idæ*], a family of birds comprising the grouses, the partridges and quails, and related forms. The general aspect of the birds is familiar in connection with the kinds just indicated; the bill varies considerably in size, being in some quite robust and in others rather weak; it is broad at the base, and thence compressed, and the culmen is always arched to the tip, which is obtusely hooked and decurved over the lower mandible; the nostrils are basal and lateral, in some (*e. g.* Tetraoninæ) concealed by feathers, in others partly covered by a hard scale; the wings are short, rounded, and concave; the tail diversiform, but generally short and depressed; the tarsi strong, variously clothed; the toes moderate, the three anterior free, the posterior elevated; the claws stout and adapted for scratching. With these are associated certain osteological characters, indicated by Prof. Huxley, contrasting with those exhibited by the nearly-allied Phasianidæ: "(1) The post-acetabular area is very broad; the ilia are truncated, nearly opposite the end of the sacrum, and it is the external angle of the posterior edge of the ilium which is rather the longer; (2) the ulnar and distal edge of the basal phalanx of the second digit is produced; and the phalanx of the third digit has a strong basal tubercle; (3) the anterior margin of the deltoid crest is less oblique, and the angle of the crest is sharper and more prominent; (4) the hypocleidium has straight edges and a triangular form, the apex of the triangle being directed forward; (5) the tarso-metatarsus is not half as long as the tibia; (6) the mandibular foramen is very large." (Huxley, *Proc. Zool. Soc. London*, 1868, p. 301.) These characters are best expressed in the grouse, and are deviated from somewhat in the less typical forms. As here defined, the family embraces five of the six sub-families admitted in it by G. R. Gray—viz. (1) Tetraoninæ, (2) Ortyginæ or Odontophorinæ, (3) Perdicinæ, (4) Rollulinæ, and (5) Caccabininæ (in part); the Turnicinæ have been isolated by Huxley not only as a distinct family, but as a peculiar super-family or sub-order, under the name Turnicimorphæ. (See also TETRAONINÆ, ORTYGINÆ, and PERDICINÆ.) THEODORE GILL.

**Tetraon'inæ** [from *Tetrao*—as above—and the sub-family affix *-inæ*], a sub-family of the family Tetraonidæ, containing the various species of grouse. The distinctive characters of the group are found in the bill and feathering of the nostrils and tarsi; the bill is moderately produced and compressed (essentially as in the Perdicinæ and not as in the Ortyginæ), and the lower mandible unarmed; the nasal fossæ are filled with feathers, which cover up the nostrils; and the toes have pectinated margins, resulting from modifications of the scales. The species are confined to the northern hemisphere, and some of them (the ptarmigans or *Lagopi*) are among the most northern of birds. They are found in Europe and Asia, but their head-quarters are North America. About twenty species are known, and these have been distributed among eight genera—viz. (1) *Tetrao*, with two or three species in Northern Europe, the best known of which is the "capercailzie" or "cock of the wood," *T. urogallus*; (2) *Lyrurus*, also confined to the Old World, and represented by but one known species, the black grouse, *L. tetrix*; (3) *Canace*, with two species (but divisible into five sub-species) in North America and one in Siberia; (4) *Pediocætes*, represented by the sharp-tailed grouse of the Western plains, *P. phasianellus*; (5), *Centrocercus*, whose only known species is the sage cock, *C. urophasianus*; (6) *Cupidonia*, framed for the celebrated pinnated grouse or prairie hen, *C. cupido*; (7) *Bonasa*, with one species in Europe (*B. betulina*), and another (the ruffed grouse, *B. umbellus*, divided into three sub-species) in North America, and (8) *Lagopus*, including the ptarmigans, represented in both hemispheres by about six species. (See also CAPERCAILZIE, GROUSE, PRAIRIE-HEN, PTARMIGAN, SAGE-COCK, etc.) THEODORE GILL.

**Tetrapol'itan Confession** [that is, the "confession of the four cities" of Constance, Strasbourg, Memmingen, and Lindau], the confession of faith of the Sacramentarians, a former body of Lutherans, who held the doctrine of Carlstadt and Zwingli with regard to the Eucharist. The confession was drawn up in 1531, probably by Bucer. It was defended also by Capito, and was presented at the Diet of Augsburg. For many years it was received in the four cities which gave it a name.

**Te'trarch** [Gr. τετράρχης, "governor of the fourth part"], strictly designated, in ancient times, the viceroy or monarch of the fourth part of a country (Thessaly, etc.); but in later times it was a title bestowed, especially under the Romans, upon the minor tributary princes of the East.

**Tetrodont'idæ** [from *Tetrodon*—Gr. τέτρα-, "four," and ὀδούς, "tooth"—the name of the oldest genus, which was identical with the present family], a family of teleost fishes of the order Plectognathi and sub-order Gymnodontes, distinguished by the development of the jaws into four tooth-like margins. The form is normally more or less oblong, but the abdomen is capable of much distension, and thus the true form is often disguised; the skin, especially on the belly, is mostly covered with larger or smaller dermal ossifications or spines; the head is oblong and covered with skin, so that the opercular and other bones are concealed; the nostrils are diversiform; the mouth terminal or subterminal, and with the cleft mostly transverse; the intermaxillary and supramaxillary bones are confluent, but those of the opposite sides are divided by a suture, as is also the dentary bone of the lower jaw; the teeth are represented by the trenchant edges of the jaws and are otherwise wanting; the branchial apertures are narrow slits in front of the pectoral fins; the branchiostegal rays are entirely enclosed within the integuments; the dorsal is chiefly composed of articulated and branched rays, and is generally short (rarely oblong) and far behind; the anal is like the dorsal, and obliquely opposite, but rather farther behind; the pectorals are narrow and high up; the ventrals are wanting, and even the pelvic bone is undeveloped. With these characters are co-ordinated certain osteological features—*e. g.* development and relations of the maxillary bones and those of the anterior region of the skull, the development of the frontals, and the bifurcation of the neurapophyses of comparatively few (3–4) of the dorsal vertebræ—which confirm the isolation of this group as a peculiar family. It is, however, nearly related to the family Diodontidæ, which has generally been combined with it under the common name Tetrodontidæ. The species are quite numerous, between sixty and seventy being now known, and represent a number of quite distinct genera, but they have not yet been properly grouped in the genera indicated. It is certain, however, that they naturally fall into three primary groups well distinguished by modifications of the skull, although not trenchantly differentiated by external characters. These groups may perhaps be considered of sub-family rank. They are (1) Xenopterinæ, known externally by the multiradiate dorsal and anal fins (D. 32–38, A. 28–32), and represented by but one known species (*X. naritus*); (2) Tetrodontinæ, comprising most of the species; and (3) Psilonotinæ, distinguishable superficially by the compressed body, keeled back, and elongated snout, and embracing about thirteen species. Representatives of the family are found in all tropical and warm temperate seas. Several are natives of the seacoasts of the U. S., two (*Tetrodon lævigatus* and *Chilichthys turgidus*) extending to the eastern coast, and one (*Tetrodon politus*) occurring along the Californian coast. These species are called by the fishermen and others "puffers," "swell-fish," "blowers," etc. The puffing is due to the development of a largely dilatable air-sac, which closely adheres to the peritoneum, and has a valvular communication with the œsophagus, through which the air is received. The species are of no economical importance, and some are indeed poisonous. THEODORE GILL.

**Tetuan'**, town of Morocco, in lon. 5° 18′ W., near the mouth of the river Martil, in an exceedingly fertile and

well-cultivated region, especially celebrated for its oranges. The town is fortified and well built, and has several fine mosques and an active trade in woollen and silk stuffs, leather, and fruit. P. 12,000.

**Tetz'el,** or **Tezel,** a diminutive of *Tietze*, his father's name, *Thietzel, Dözel* (JOHANN), b. at Leipsic between 1450 and 1460; studied theology and philosophy at the university of his native city, and distinguished himself by industry and natural ability. In 1489 he entered the Dominican monastery of St. Paul in Leipsic, and soon became noted as a very impressive popular preacher. In 1502 he was appointed to preach an indulgence in Zwickau and its vicinity, and he was so successful—that is, he made so much money for the papal treasury—that henceforward he was steadily employed in the indulgence business for fifteen years. His territory was enlarged and his authority increased. There was some scandal connected both with the person and the business. He travelled around like a mountebank in a blaze of gorgeous advertising. His frauds and his dissipations were equally ill concealed, and all sensible people turned away from him with disgust; but the ignorant mass he caught. At Innspruck in 1512 he seduced the wife of a citizen, and was sentenced as an adulterer to be sewn in a sack and thrown into the river, but the emperor Maximilian I. commuted the sentence to imprisonment for life, and he was actually confined for some time in Leipsic. The Church, however, could not spare him; he was soon out again, and active in his business. Roman Catholic writers deny that he sold indulgences *without repentance* or indulgences for sins *not yet committed;* but their argument rests solely on the words of the papal commission, which are vague, and prove nothing with respect to the practice of the man as it has been reported by eye-witnesses. To Leo X. money was the first, decency only a secondary question, and when he determined to grant a great, a universal indulgence, he made Tetzel *inquisitor*, and commissioned him to preach the indulgence through the whole of Germany. Tetzel now appeared in his highest glory, journeying from town to town and levying his contributions, as has been described by contemporary writers; but when from Brandenburg he approached the Saxon frontier in the middle of 1517, he was unexpectedly met by Luther's *theses*, nailed to the church-door in Wittenberg Oct. 31. In the beginning he, like Leo X., considered this event simply as a tedious and impertinent disturbance. He burned Luther's theses at Jüterbogk, and wrote some theses himself, which the students burned at Wittenberg, while he defended them in a disputation at Frankfort-on-the-Oder. But this illusion did not last long; and when, in 1518, Miltitz, the papal ambassador, arrived at Leipsic, he not only suspended Tetzel, but spoke so harshly to him that the poor man fell sick of fright and humiliation, and d. in July, 1519.

**Teu'cer,** according to ancient Greek legends, was the first king of Troy, and the Trojans are sometimes called Teucri, after him. But the legends differ with respect to whether he was a native of Troy, giving his daughter, Arisbe, in marriage to Dardanus of Samothrace, or whether he immigrated, together with Scamander, into Troas from Crete. Homer mentions another *Teucer*, son of Telamon, king of Salamis, and Hesione of Troy. He accompanied his step-brother, Ajax, to Troy, and was the best archer among the Greeks. But when the Greeks returned after the capture of Troy, Telamon would not receive Teucer in Salamis because he had not avenged Ajax, and he then sailed to Cyprus, which he received from Belus, king of Sidon, and where he founded the town of Salamis.

**Teuf'fel** (WILHELM SIGISMUND), b. at Ludwigsburg, Würtemberg, Sept. 27, 1820; studied classical languages and literature at the University of Tübingen, where he became professor in 1849. Besides a number of minor essays, some of which have been collected in his *Studien und Characteristiken* (1871), he wrote *Geschichte der römischen Literatur* (2 vols., 1868–70), translated into English (London, 1874), and was one of the editors of the *Encycl. der Alterthumswissenschaft* (Stuttgart, 1839–52, 7 vols.).

**Teuthid'idæ** [from *Teuthis*, the ancient name of a cuttle-fish, unhappily applied by Linnæus to representatives of the two following families as a generic name], a name that has been bestowed in some form on two very distinct families of fishes, both, however, belonging to the order Teleocephali and sub-order Acanthopteri, and approximated next to each other in the ichthyological system.

I. By Günther (*Cat. Fishes, Brit. Mus.*, vol. iii., pp. 313–324) it is retained for the genus variously called *Siganus, Centrogaster*, and *Amphacanthus*, and to which the name Teuthis has been restricted by some authors. By others the family name Amphacanthidæ has been given to the group. These fishes have an almost quite symmetrically ovate form, the regions above and below the longitudinal axis being nearly equally developed; the body is much compressed; the scales are cycloid, very small, and closely adherent; the lateral line concurrent with the back and uninterrupted; the head is short, and has a rounded profile; the eyes are lateral; the opercular bones unarmed; the mouth is mostly transverse; the teeth on the jaws are trenchant incisors, and in a single row; palate edentulous; branchial apertures confined to the sides; branchiostegal rays in five pairs; dorsal and anal fins almost exactly opposite behind, the former with a very long spinous portion and short soft portion (xiii. + 10), the latter with a moderately long spinous portion and a short soft one (vii. + 9); caudal well developed, and on a slender peduncle; pectorals moderate, and with branched rays; ventrals inserted considerably behind the bases of the pectorals, and with the inner as well as outer rays developed as spines, between which intervene three articulated rays. The vertebral column has ten abdominal and thirteen caudal vertebræ. The family is remarkable for the constancy of its characters, especially the number of the rays, and the unique development of inner ventral spines. Between twenty and thirty species are known, which are confined to the Pacific and neighboring oceans, and are most numerous in the waters surrounding the Indo-Moluccan islands.

II. By the older naturalists were included in the same family with the preceding (generally under the name Teuthyes) certain other fishes now considered as representing a peculiar family called Acanthuridæ or Acronuridæ, and having the following characters: The form is also oval, but there is a tendency toward outgrowth of the anterior portion of the back and nape; the body is quite compressed; the scales are minute and diversiform (sometimes truly scale-like, and occasionally bristle-like), and there are generally developed on each side of the caudal peduncle lancet-like spines recumbent forward; the lateral line is concurrent with the back and continued to the tail; the head is short and diversiform, sometimes rounded in front, and at others with the forehead more or less produced forward; the eyes are entirely lateral; the opercula unarmed; the mouth terminal, and mostly transverse; the teeth on the jaws uniserial and diversely developed, and wanting on the palate; the branchial apertures are entirely lateral; the dorsal and anal fins, as far as they go, are similar and opposite, and almost exactly coterminal behind, but (unlike the preceding) the soft portions are at least as long as, if not longer than, the spinous; both are very long, the dorsal commencing behind the nape, and the anal not far behind the ventrals (D. iii.–ix. + 19–31, A. ii.–iii. + 18–31); the caudal is well developed, and inserted on a slender peduncle; the pectorals moderate, and with the rays branched; the ventrals inserted under the bases of the pectorals, and each provided with a spine, and, generally, with five (sometimes with only three) articulated rays. The vertebral column has mostly nine (or eight) abdominal and thirteen (or twelve) caudal vertebræ. Species are distributed in all tropical seas. Nearly seventy-five have been more or less satisfactorily made known. By Günther they have been grouped under only five genera—viz. (1) *Acanthurus*, (2) *Acronurus*, (3) *Prionurus*, (4) *Naseus*, and (5) *Keris*.

The species of both these families are herbivorous, and co-ordinate with the habits are the extensive cicumvolutions of the intestinal canal. THEODORE GILL.

**Teu'toburg Forest** [Ger. *Teutoburgerwald;* Lat. *Teutoburgiensis saltus*], the collective name, used only in books, of several ranges of hills and low mountains which extend for a distance of about 80 miles through Westphalia and the principality of Lippe, with an elevation of about 1500 feet. Here the Roman legions under Varus were routed and massacred by Hermann, the chief of the Cherusci, 9 A. D., and in 1875 a colossal monument by Bandel was raised in commemoration of this event on the summit of the Gortenberg, near Detmold.

**Teuton'ic Knights,** a military-ecclesiastical order organized at Acre in 1190 by Frederick, duke of Swabia, and confirmed by Celestine III. in 1192. Their first members were pious North German merchants, but soon none but noblemen were received. A little later, priests and half-brothers, not noble, were admitted. In the early times they took vows of chastity and poverty. In 1230 they were offered the sovereignty of Poland, and at once engaged in the conquest of that country. In 1241 they were expelled from Acre by the Templars. In 1243 the pope gave them Prussia. They served in the crusades of St. Louis 1248–50, and hence quartered the *fleur de lys;* founded Königsberg in 1255; attacked the heathen Lithuanians in 1283; removed their head-quarters from Palestine to Venice 1291, to Marienberg 1309. They were for many years involved in wars with Poland; held at times East

and West Prussia, Esthonia, Pomerania, and other neighboring countries. In 1466, Königsberg became their capital. In 1525 their grand master, Albert of Brandenberg, became hereditary duke of Prussia, and in 1527 their seat was transferred to Mergentheim in Swabia. In 1561 they lost all their Livonian possessions. In 1805 the emperor of Austria became grand master of the order. In 1809, Napoleon declared the order abolished, and gave its lands to various German sovereigns. In 1840 the Austrian emperor reorganized the Teutonic Knights, and in 1865 the order was still further reorganized. The Teutonic knighthood is at present a merely titular honor.

**Teu'tons.** (1) *The Name.*—Over the derivation of this substantive, as well as the corresponding adjective, "Teutonic," reigns a good deal of unclearness and uncertainty. So much, however, may be said, we think, to be true in regard to it from a *historic* stand-point—viz. that the earliest indigenous form of the noun was *thiuda*, which signifies *das Volk*, "the people," and that the indigenous adjective derived therefrom was *diutisc*, the later *deutsch*, but that our words Teutons and Teutonic are rather the Latin corruptions "Teutones" and "Teutonicus," through which language we derive them.

(2) *The Peoples embraced under the Name.*—The uncertainty about the derivation manifests itself most clearly in the extent of the application. The Greek and Latin authors seem to have used the word to designate only a certain portion of the great race then inhabiting the lands N. of the Alps and E. of the Rhine—viz. that portion with which they first became acquainted—that portion which undertook, in company with the Cimbri, to invade the Roman empire about 113 B. C., and whose original abode had been probably the W. coast of Schleswig-Holstein and the territory about the mouth of the Elbe. It was then that Rome first became aware of the *existence* of a people of untamed might dwelling N. of the Alps, and distinct from the Celtic tribes; and it is quite natural that the Romans, in their ignorance of the extent of the race, should have taken the word which this tribe used, in *common* with all the other tribes, to designate itself, and have applied it in a Latinized form in *particular* to this one, and then, upon becoming acquainted with the larger extent of the race, have adopted, as they did, another word, the Belgic-Celtic word *Germani*, for the name of the entire race. We find, however, that some of the *Latin* authors—as, for instance, Martial and Claudian—used the adjective *Teutonicus* as of like meaning with *Germanicus*, and after the beginning of the tenth century the Latin "Teutonicus" displaces, even in *German* authorship, the indigenous "Theotiscus" as the comprehensive race-adjective, while we of this modern age, still using the Latin names, have turned them wholly about in the extent of their application, designating the race by the term Teuton, and that portion of the pure or nearly pure stock inhabiting the European continent by the term *German*. In this broadest sense we must include under the name Teuton, in first degree, the Germans of the Continent—viz. the inhabitants of the German empire, of Austria proper, of the northern and north-eastern cantons of Switzerland, and of Holland and the Scandinavians of the two northern peninsulas; in the second degree, the English, the inhabitants of Lower Scotland, and the inhabitants of the U. S.; while in the ethnological composition of almost every truly European nation—that is, every nation W. of Russia proper and Turkey—the Teutonic component enters in a greater or less degree. At the close of the fifth century, when the great movement known in European history as the "migration of the peoples" ended, we find the Teutons the ruling race from Carthage to the Vistula; the Vandals in Africa from Carthage to Gibraltar; the Visigoths from Gibraltar to the banks of the Loire; the Suevi occupying about the present Portugal; Burgundians from the upper course of the Loire to the centre of the present Switzerland; the Ostrogoths from the last-mentioned boundary to that of the present Turkish empire on the E., and from the Mediterranean Sea on the S. to the Danube on the N.; the Franks from the lower Loire to Thuringia; Saxon conquerors upon the English coasts; Saxons, Frisii, Thuringians, Marcomanni, Bavarians, and Longobardi still upon the original German soil, the latter, however, moving down a little later (last half of the sixth century) into Italy, and occupying the plain of the upper Po, while the Scandinavic branch not only occupied the two northern peninsulas, but reached round the entire E. and S. E. shore of the Baltic and far inland. Within the present year (1876) Privy Counsellor von Löher, in a lecture before the Academy of Science at Munich, affirmed that he had discovered, furthermore, in the Guanchen of the Canary Islands descendants of the old Vandals, who wandered through Hispania in the fifth century, and emigrated to these islands as early as the eighth.

In the far-off lands of Africa, Hispania, South-western Gaul, and Middle and Southern Italy the Teutonic element disappeared almost entirely in the amalgamation with the great mass of the Romanic population; while, on the other hand, the inhabitants of Northern and North-eastern France, of Belgium, of Northern Italy, and of Russia's Baltic provinces manifest still most strongly the ethnological characteristics of the Teutons.

(3) *Characteristics of the Teuton.*—(*a*) *Physical.*—Besides the usual Caucasian peculiarities of the "oval head; the lines of eye and mouth dividing the whole face into three nearly equal parts; the large eyes with their axes at right angles with the line of the nose; the 90° facial angle; the full beard, covering to the ears; the white complexion, and the tall, straight, and well-proportioned stature"—which the Teuton possesses in *common* with all Europeans, he is further somewhat distinguished from these by a larger frame, a whiter and more florid complexion, a bluer eye, and a lighter shade of hair. (*b*) *Mental.*—The distinction between the Teutonic and the Romanic nature is even more manifest in the mental than in the physical constitution. The Greco-Roman world mediated the connection between the ancient civilization and the modern. Its geographical position and historical connections with the Oriental world preserved in the Greek and the Roman the inheritance of the Oriental traits, which the differences of climate and soil, geography and topography, have indeed modified, but not destroyed. The prevailing temperament of the Romanic peoples is still a mixture of the sanguine and the melancholic, the latter element predominating, while fancy and imagination, vacillation and mysticism, are among the chief traits in their intellectual, moral, and religious character. On the other hand, the Teuton, with more of the phlegm and the choler in his temperament, evinces the deeper insight, the more constant purpose, and the greater *éclaircissement*.

(4) *Institutions.*—These differences of mental constitution are most clearly seen in the fundamental institutions which they have produced. We may take the Roman imperium and the Roman Church as the great historical product of the Roman spirit. In both of these the sum and substance of all authority is viewed, imaginatively and mystically, as inherent in an office, and all law as proceeding out of it, from above down, over, and independent of the governed. On the other hand, personal individual liberty and worth were the fundamental principles of the old Teutonic life and polity. In the old assemblies of the village, the hundred, and the tribe it was the will of the freemen which was the authority of law. While in Rome the *central* power was the strongest, and there existed no local power worth the name save as an imperial agency, among the Teutons, again, the *local power* was always the strongest, and centralization always opposed, defied, and overthrown. When Marbodius the Marcomannic duke, and even the brave Arminius, to whom the German tribes were indebted for the expulsion of the Roman legions from their soil, attempted to retain in time of peace the centralized authority which they had exercised as leaders in war, the one was obliged to flee to Rome in order to save his life, while the other fell a victim to his fatal ambition. And thus we see at the very first contact of the Teutonic with the Romanic world the irrepressible conflict between freedom and authority enkindled which has shaken Europe from that day to this. Then it was Teutonic liberty against the Roman imperium. In the Middle Ages, after contact and connection with the Roman world had given the Germans kings and emperors, it was the emperor against the pope; in the transition period from the mediæval age to the new time, it was the German Protestant against the Roman Catholic; and to-day it is Teutonic science against the Syllabus and the Vatican. The Teutonic spirit has given to the modern civilization its freedom of thought and conscience, its estimation of the man above the institution, its science, its Protestantism, its doctrine of popular authority, its local self-government, and its national development. It can therefore be truly said to be the spirit of the modern civilization.

*Sources.*—*Vorgeschichte der deutschen Nation*, Wietersheim; *Geschichte der Völkerwanderung*, Wietersheim; *Die Guanchen der canarischen Inseln*, Von Löher; *Deutsche Verfassungsgeschichte*, Waitz; *Culturgeschichte des deutschen Volks*, Rückert; *Rom und die Deutschen*, Bluntschli; *De Bello Gallico*, Cæsar; *De Vita, Moribus, et Populis Germanicæ*, Tacitus; *Monumenta Germaniæ historica*, edited by Pertz.

J. W. BURGESS.

**Teutop'olis,** p.-v. and tp., Effingham co., Ill. P. 1033.

**Tewkes'bury,** town of England, county of Gloucester, on the Avon near its influx in the Severn, manufactures stockings, hosiery, malt, leather, and nails. P. 5409.

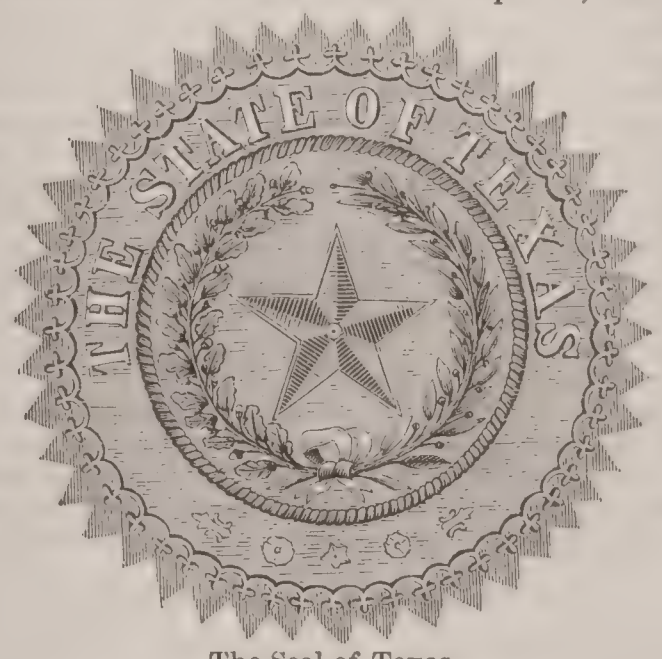
**Tewks'bury,** p.-v. and tp., Middlesex co., Mass. P. 1944.

**Tewksbury,** tp., Hunterdon co., N. J. P. 2327.

**Texa'na,** p.-v., cap. of Jackson co., Tex.

**Texarkana,** p.-v., Miller co., Ark., on the boundary-line between Texas and Arkansas, and at the junction of several proposed railroads, has a weekly newspaper.

**Tex'as,** a south-western State of the American Union, once a part of the republic of Mexico, which it still joins on its western border, lying between the parallels of 25° 51′ and 36° 30′ N. lat., and between the meridians of 93° 27′ and 106° 43′ W. lon. from Greenwich. It is of very irregular form, and most of its boundaries are natural lines of river or gulf; on the N. it is bounded by the Indian Territory, the N. fork of the Canadian forming substantially the boundary on the line of 36° 30′, and the Red River from the 100th meridian eastward, while that meridian forms the eastern boundary from the Red River to the N. fork of the Canadian; the Sabine River forms the eastern boundary between Texas and Louisiana as far as the 32d parallel, and the meridian of 94° 10′ thence to the Red River, separating it from both Louisiana and Arkansas; S. E. its long coast-line is washed by the Gulf of Mexico; S. W. the Rio Grande divides it from the Mexican republic, and where




The Seal of Texas.

that river crosses the line of American soil the Territory of New Mexico becomes its north-western and northern boundary. Its extreme length from S. E. to N. W. is somewhat more than 800 miles, and its greatest breadth is about 750 miles. As it has never been very carefully or accurately surveyed except as to the Mexican and Louisiana lines, its exact area is to some extent a matter of conjecture. The U. S. land-office and census-office give it as 274,356 sq. m., or 175,587,840 acres, but other high authorities give it as 237,504, 268,684, 274,000, and 274,365 sq. m. When the western and south-western government surveys are completed, we shall probably have the exact figures. Taking the government estimate as nearest the truth, it has almost 74,000 sq. m. more than the republic of France, whose area is 200,671 sq. m., and has territory enough for six States as large as Ohio, New York, or Pennsylvania. A still better idea of its vast size may be gained from the statement that its territory equals that of all the Atlantic States from the N. line of Pennsylvania to the southern boundary of Georgia, including West Virginia in the number—viz. Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, and Georgia.

*Face of the Country.*—This vast extent of territory has every variety of surface and soil. The coast is low and sandy; there are bars at the mouths of all the rivers; and the same formation of low and sandy islands and peninsulas which prevails along the coast of the S. Atlantic States. Galveston is built on one of these islands, and a succession of them line all the coast to the mouth of the Rio Grande, enclosing long and narrow sounds or lagoons of no great depth. This alluvial deposit, known as the "low coast belt," extends inland from 40 to 60 miles; much of it is barren and waste, and when there is vegetation it is in the form of impenetrable thickets of cactus and other thorny shrubs, commonly called chapparals. Beyond this, for a breadth of 150 miles or more, lies the "prairie belt," rolling lands with a rich and fertile soil, with islands of live-oak and deciduous forest trees, and traversed by broad streams with heavily-timbered bottom-lands. In Eastern Texas these prairies have much more extensive forest tracts than W. of the Trinity River. Beyond (that is, N. and N. W. of the prairie belt), the land rises to a height of about 1000 feet, and presents a rough, broken surface, with abrupt slopes and sharp bluffs. These lands are excellent for grazing, and much of them for cultivation, but toward the N. W. and W. they continue to rise to the arid plateaus or *mesas* of the Llano Estacado, or Staked Plain, where there are no trees except the mesquite, and the vegetation is scanty from the limited rainfall. Yet even these lands, unpromising as they seem, yield nourishing pasture to wild horses, buffaloes, and to the vast herds of cattle now driven over a part of their surface. Farther W., the region lying between the Rio Pecos and the Rio Grande is filled with mountains, outlying spurs of the great Rocky Mountain range. Beginning at the W. bank of the Rio Pecos, we have in succession the Sierra Charrote, the Horsehead Hills (lying N. of the Rio Grande), the Sierra Santiago, the Sierra del Muerto, Pahcut Mountains and other groups of the Apache range, the Guadalupe Mountains, a continuation of a New Mexican chain, and farther W. and S. W. the Sierra del Diablo, Eagle Mountains, Sierra Cariso, Sierra Monizo, Sierra Huecos, Sierra Blanca, and many others. Some of these summits attain an elevation of about 5000 feet. The gradual character of the ascending slope of the country is indicated by the following elevations, ascertained by the Coast Survey and railway surveys: Goliad, 50 feet; Gonzales, 150; Webberville, 394; Brenham, 435; Austin, 650; San Antonio, 600; Sisterdale, in Kendall co., 1000; Fort Inge, Uvalde co., 845; Fort Clark, Kenney co., 1000; Fort Davis, Presidio co., 4700; and Fort Bliss, El Paso co., 3830 feet.

*Rivers, Bays, etc.*—The State, except in the region of the Llano Estacado, is well watered. The Canadian River, an affluent of the Arkansas, crosses Bexar territory in the extreme N. of the State. The Red River, which forms part of the N. boundary of the State, has its source in the Llano Estacado, but neither this nor the Canadian has any large tributaries in the State, though each receives numerous creeks or "branches." The Sabine, which forms part of the E. boundary, and the Neches, both discharge their waters into Sabine Lake, draining the extreme eastern portion of the State. Trinity River, rising in Grayson co. in the N., and the San Jacinto, a smaller stream, both discharge their waters into Galveston Bay. The Brazos, one of the largest rivers in the State, has its source in the N., near the Llano Estacado, and flows into the Gulf of Mexico about 36 miles below Galveston; the Colorado, another large river having its source in the Llano Estacado, pursues a course nearly parallel with that of the Brazos, and empties into Matagorda Bay. Both these rivers have numerous "forks" or affluents, but none of them of great size. The Guadalupe and San Antonio rivers, each having numerous affluents, drain a considerable portion of Southern Texas, and unite just before their entrance into San Antonio Bay. Passing the Aransas River, a little stream falling into Aransas Bay, we come to the Nueces, a larger river, and at one time claimed by Mexico as the boundary between her and Texas. This stream and its affluents drain a wide region in S. W. Texas, and its waters are discharged into Corpus Christi Bay. Between this river and the Rio Grande eight or ten creeks of no great length flow sluggishly through the sands into the long land-locked sound known as the Laguna de la Madre. The Rio Grande del Norte, a very long but shallow river, having its source in Colorado, divides the State from Mexico, and with its principal tributary, the Rio Pecos, and numerous small streams and creeks, drains most of Western Texas. None of the Texan rivers are navigable for any considerable distance except at high water, but by dredging, and the construction of a short canal, Galveston Bay and Buffalo Bayou have been rendered navigable for vessels drawing 9 or 10 feet of water, as far as Houston. The only bays not already mentioned are East and West Bays, forming a part of Galveston harbor; Trespalacios, Lavaca, and Espiritu Santo bays, all connected with Matagorda Bay and harbor; and Copano Bay, lying W. of Aransas Bay. We have already spoken of the islands—long sand-reaches on the coast. There are few lakes in the State; Sabine Lake is rather an estuary than a lake. Perry and part of Caddo Lake extend from the chain of lakes in Louisiana into Marion and Harrison cos.

*Geology and Mineralogy.*—The geology of Texas, so far as explored, is simple; the coast belt, like that of the other Gulf and Southern Atlantic States, is alluvial, though less fertile than the deposits of the Mississippi delta; the prairie or rolling lands, forming a belt about 150 miles in width, are Tertiary, varying in character in different sections—in some places having extensive deposits, sometimes 6 to 8 feet thick, of lignite or the brown coal of the Tertiary system, and in others spathic or other iron ores. The Cretaceous groups succeed the Tertiary, following a line from N. E. to S. W., which begins near the corner of Arkansas and Texas, and passes due S. W. near Austin, through San Antonio to the Rio Grande at or near Palafoz in Webb co. The Cretaceous formations form the surface-rocks of the greater part of the remainder of the State, extending from the Red River to the Rio Grande in a constantly widening track, and turning northward cover the Llano Estacado

and about three-fifths of the Territory of New Mexico. Between the two arms of this vast Cretaceous deposit, extending over the western half of the Indian Territory, and following up the valleys of the Pecos and Canadian rivers, the Triassic and Jurassic rocks come to the surface, their presence being indicated by immense deposits of gypsum. In this region the Colorado, Brazos, Red, and Canadian rivers have their sources, and from it they receive their principal tributaries. Between the 97th and 100th meridians and the parallels of 32° 50′ and 34° 50′ there is an irregular tract belonging to the true coal-measures, and furnishing coal of excellent quality. Nearly in the centre of the eastern arm of the Cretaceous deposits, and occupying the greater part of Williamson, Burnet, Lampasas, San Saba, Mason, and Llano cos., is a singular outcrop of Palæozoic rocks; at the N. the lower coal-measures reappear, the coal strata being anthracite, or semi-anthracite; to this succeeds immediately an extensive and irregular outcrop of Silurian, which in turn embraces a triangular tract of gneiss and other Eozoic rocks. In the extreme western part of the State, between the Rio Pecos and the Rio Grande, the Guadalupe, Apache, Sierra Blanca, and Sierra Hueco mountain-ranges, as they rise from the chalk and clay of the plateau, have Jurassic or Triassic rocks in the foot-hills on the eastern slope, gneiss, granite, and metamorphic rocks on the abrupt western slope, and Silurian rocks generally on the summits, except the Apache Mountains, which are primitive to their highest peaks. Directly E. of the larger coal-bed in the N. W. is a long, narrow, wedge-shaped tract of Tertiary sand and clay, extending from the Red River to Fort Graham.

*Minerals.*—Copper is the most abundant metallic product of the State. The copper belt extends from the Red River and the counties of Clay, Archer, Wichita, Haskell, etc., across to the Rio Grande through the counties of Pecos and Presidio, and yields in immense quantities an ore which will smelt on an average 55.44 per cent. of pure copper, and large masses have been found yielding 68 per cent., besides some silver. This ore occurs in hills like the iron ores of Pilot Knob and Iron Mountain, and is above the surrounding levels. In the immediate vicinity are found coal, timber, limestone, and soapstone for smelting, and the Texas Pacific R. R. will pass through the entire copper belt. Argentiferous galena, very rich in silver, is found in large quantities in N. W. Texas; manganese, cobalt, nickel, and bismuth are found in such quantities as to make the deposits of commercial value. Iron occurs in the same region as copper, and in magnetic, spathic, specular, and hæmatite ores. In Mason, Llano, and more western counties magnetic iron is found in true veins in immense quantities, and average specimens yielded 74.93 pounds of metallic iron to 100 pounds of ore. The large coal-field, about 6000 sq. m. in extent, is an outlying spur of the great Missouri coal-field, and yields a bituminous coal having 52 per cent. of fixed carbon, and is of similar quality to the Belleville (Ill.) coal. The smaller coal-field, in Brown, Coleman, Comanche, and Hamilton cos., is said to be anthracite or semi-anthracite of good quality. The lignites or brown coals of the Tertiary formation occupy larger tracts, and though soft, sulphurous, and ashy, are said to be superior to the German brown coals. In Webb co., on the Rio Grande, is a cannel coal belonging to the Tertiary which is dense and fine in texture, and proves to be a fine gas-coal. Asphaltum is found in eight counties in different parts of the State. Salt is extensively produced in the State in the salt lakes near the coast and in salt springs in Lampasas, Llano, and El Paso cos. Caves in Burnet and Blanco cos. yield saltpetre largely. Gypsum is a geological formation rather than a mineral. It is found throughout the Cretaceous deposits. Potter's and fire clays, marble, roofing-slate, grindstones, soapstones, feldspar, alum, antimony, arsenic, mineral oils and pigments, marls and other fertilizers, are found in great quantities in the State.

*Vegetation and Botany.*—Eastern Texas, E. of Trinity River, is a region of abundant timber, and, although the most densely-populated portion of the State, more than one half of its surface is still covered with forests. There are two species of pine here, known as the "long-straw" and "short-straw" pine, both of large size and producing excellent lumber, while the long straw yields a superior quality of turpentine. There are also in Eastern Texas several species of oak, including the live-oak, which is found all over the State, the post oak, and black jack; the ash, elm, black walnut, butternut, pecan, box elder, pride of China; and, toward the coast, the magnolia (here a stately tree), the cypress, palmetto, etc. In Northern Texas there are two immense belts of woodland extending from the Red River southward, called the "Lower" and "Upper Cross Timbers." They are each about 40 or 45 miles wide, and extend southward from 150 to 200 miles; the first commences in Cooke and Grayson cos. along the Red River, and extends to McLennan co.; the second, which is the smaller, occupies parts of Wise, Jack, Palo Pinto, Hood, and Erath cos. Most of the trees in these forests are post oak and black jack oak, and they stand so wide apart that a wagon can be driven between them in any direction. Central Texas is mainly rolling prairie, but with plenty of timber, generally of good quality, though sometimes cottonwood, buckeye, black gum, and sweet gum in the river and creek bottoms. There are also islands of forest trees, live-oak, cypress (which grows on the hills here), post oak, and mesquite, scattered through the prairies. The coast belt has no forest trees, but frequent "chaparals," composed mainly of the opuntia or prickly pear and other species of cactus. This region has also in the spring and early summer rich and nutritious grasses and a profusion of brilliant flowering plants; Western and North-western Texas is scantily wooded, though even here the cypress, the mesquite, and to some extent the live-oak, are found. The mesquite is a very hardy and valuable tree, which endures severe drought, having roots which strike deep into the earth. It yields a sweet and nutritious bean in its long pods, which is much relished by cattle. Its sap dries into a gum like gum arabic, and its bark and heart-wood are regarded as the best materials in the world for tanning leather. The bois d'arc (or Osage orange) and the pecan tree are among the other valuable forest trees of Texas. The bois d'arc grows in almost all soils; its wood is very hard and durable, and its thorns and rapid growth make it excellent for hedges. The other plants and shrubs of North-western Texas, including the least sterile portions of the Llano Estacado, are the yucca and four or five species of cactus, including the opuntia or prickly pear, the melocactus, the mammilaria, and the cereus. The sage shrub, so common on this plateau farther N., is occasionally found here, but is not so abundant as in New Mexico and Colorado. Among the grasses of the State should be mentioned the mesquite grass, which is said to be more nutritious and better liked by horses, cattle, and sheep than any other shrub, grass, or cereal in the world.

*Zoology.*—There are large though diminishing herds both of buffaloes and antelopes in the N. W. part of the State. In Western Texas the mustang, the Mexican wild horse, still feeds on the prairies; the wolf, of great strength and ferocity, the black bear, the puma, the jaguar, the wild-cat, and the lynx are found in the wooded and thinly-inhabited districts; and deer, foxes, peccaries, raccoons, opossums, hares, and squirrels are very numerous, especially in the wooded districts. The principal game-birds are the wild turkey, pheasant, quail, snipe, many species of wild ducks, brant, and teal, wild geese, etc., and the birds of prey, the vultures, hawks, kites, pelicans, herons, kingfishers, flamingoes, cranes, etc. The streams abound in fish, of which the black bass is perhaps the finest of the fresh-water tribes, and the fish of the bays and Gulf are much the same as those of the other Gulf States. Alligators, turtles, etc., are abundant in the lower portion of the rivers and bayous, and more rarely the manatee, octopus, etc., are seen. There are in the mountainous and wooded districts rattlesnakes, moccasin snakes, and the milk adder, several species of the black snake (our North American boa), and numerous harmless snakes. The gecko and other lizards, horned frogs, salamanders, etc., are found in considerable numbers, and the insect tribes are both numerous and formidable. The centipede, the large jumping spider, the horse-flies, buffalo-gnats, and mosquitoes are sufficiently annoying, but no two of them are found in all parts of the State. The insects injurious to vegetation are less numerous here than in the older States.

*Climate.*—The great extent of the State and the varying elevation of the different sections ensure marked varieties in its climate. The isothermal curve indicating a mean annual temperature of 68° passes nearly along the parallel of 29° 40′, or from the mouth of the Sabine to the junction of the Pecos River with the Rio Grande. S. of this line the temperature increases, till at Brownsville, near the Rio Grande, in lat. 25° 57′, the annual mean is 75°; northward, this mean decreases with the greater elevation, till in the Llano Estacado, about lat. 32° 55′, it falls to near 55°. The prevailing winds for most of the year are S. and S. E. from the Gulf, but from November to February there are occasional N. winds, culminating at times in the cold wind-storms known as "northers." These generally blow for three days. The rainfall is, on the whole, increasing. It ranges from 54.47 inches at Galveston to 36.90 at San Antonio, 20 inches in the Pecos Valley, and 12 to 16 in the Llano Estacado. The following table gives more specific particulars concerning the temperature and rainfall for five prominent towns of the State, and the prevailing directions of the winds for three:

| Meteorological Data. | Galveston, lat. 29° 18′ 28″, lon. 94° 46′ 39″; elevation, 40.2 feet, 1873–74. | Austin, lat. 30° 15′, lon. 97° 47′ 02″; elevation, —— feet; 17 years' observations. | Indianola, lat. 28° 32′, lon. 96° 38′; elevation, 25 feet, 1873–74. | San Antonio, lat. 29° 25′ 22″, lon. 98° 25′ 14″; elevation, —— feet, for six years. | Morrison's, Grimes co. Two stations S. of Anderson. Rainfall only, for 16 years. Lat. lon. |
|---|---|---|---|---|---|
| *Temperature.* | ° | ° | ° | ° | |
| Mean annual temperature... | 72.8 | 68.03 | 70 | 68.85 | |
| Maximum temp. of year..... | 98.5 | 107 | 100 | 98 | |
| Minimum temp. of year..... | 35.5 | 6 | 36 | 16 | |
| Range of annual temp..... | 64.5 | 101 | 64 | 82 | |
| Mean temp. of spring..... | 69.3 | 68.78 | 69.4 | 69.94 | |
| Maximum temp. of spring... | 89.5 | 103 | 90.5 | 98 | |
| Minimum " " ... | 44 | 21 | 41 | 31 | |
| Range of spring temp..... | 45.5 | 82 | 49.5 | 67 | |
| Mean temp. of summer..... | 82.9 | 85.32 | 82.6 | 83.56 | |
| Maximum temp. of summer | 98.5 | 107 | 100 | 98 | |
| Minimum " " | 73 | 62 | 70 | 65 | |
| Range of summer temp..... | 25.5 | 45 | 30 | 33 | |
| Mean temp. of autumn..... | 75.8 | 65.95 | 70.8 | 68.95 | |
| Maximum temp. of autumn | 91 | 98 | 89.5 | 94.5 | |
| Minimum " " | 49 | 20 | 42.5 | 31 | |
| Range of autumn temp..... | 42 | 78 | 47 | 63.5 | |
| Mean temp. of winter..... | 63.3 | 52.44 | 57.4 | 52.94 | |
| Maximum temp. of winter... | 80 | 88 | 78.5 | 86 | |
| Minimum " " ... | 35.5 | 6 | 36 | 16 | |
| Range of winter temp..... | 44.5 | 82 | 42.5 | 70 | |
| *Rainfall.* | Inches. | Inches. | Inches. | Inches. | Inches. |
| Mean annual rainfall..... | 54.47 | 35.12 | 45.32 | 36.90 | 42.35 |
| Rainfall of spring..... | 12.27 | 16.00 | 5.22 | 8.15 | 7.01 |
| Rainfall of summer..... | 18.18 | 5.98 | 13.81 | 14.80 | 8.40 |
| Rainfall of autumn..... | 17.01 | 7.64 | 18.66 | 12.05 | 13.90 |
| Rainfall of winter..... | 7.01 | 5.50 | 7.63 | 1.90 | 13.04 |
| *Winds.* Prevailing directions in the order of mention.... | S., S. E., N., N. E., E., N. W., and S. W. | ..... ..... ..... ..... ..... ..... ..... | S., S. E., N., N. E., E., S. W., and W. | Calm, S. E., S., N. E., S. W., N. W., and W. | |

*Manufacturing, Mining, and other Industrial Products.*—There were in 1870, according to the ninth census, 2399 manufacturing establishments, using 13,044 horse-power to move their machinery, employing 7927 hands—viz. 7450 men, 157 women, 320 children—and a capital of $5,284,110, paying $1,787,835 wages, using $6,273,193 of raw material, and producing goods to the amount of $11,517,302. Of these manufactures the most important at that date was lumber, of which 192 saw-mills produced $1,736,482; next in importance and value were the packing establishments of beef and other meats, in which in 15 establishments packed meats, condensed meat essences, meat biscuits, etc., were put up to the value of $1,052,156; 4 cotton-mills produced cotton goods to the amount of $374,598; saddlery and harnesses were made in 138 establishments to the value of $348,307; tin, copper, and sheet-iron ware in 71 establishments produced goods to the value of $334,665. The other principal manufactures were carriages and wagons, hides and tallow, flouring-mill products, and sash, doors, and blinds, but neither of these industries produced goods to the amount of $300,000. Since 1870 manufacturing has made great progress in Texas, especially at Houston and some of the more eastern towns, and the present aggregate of manufactured goods is probably nearly three times what it was in 1870. The census of 1870 reported but 1 mining establishment in Texas, employing but 2 men, with $150 capital and $900 product, but there are now several valuable copper-mines and smelting-furnaces, a number of saltworks, and coal-mines which supply fuel to the furnaces and manufactories.

*Agricultural Productions.*—The following table shows the agricultural productions of the State according to the census of 1870, together with such particulars as can be ascertained of the production of 1875:

| | 1870. | 1875. |
|---|---|---|
| Acres of land improved | 2,964,836 | 59,306,618* |
| Unimproved, acres | 15,931,682 | |
| Value of farms | $60,149,950 | $107,641,691* |
| Value of farming implements | $3,396,793 | |
| Wages for laborers | $4,777,638 | |
| Value of farm products | $41,185,170 | est. 69,125,000 |
| Value of orchard products | $69,172 | |
| Value of market gardens | $74,924 | |
| Harvest products | $66,841 | |
| Value of home manufactures | $293,308 | |
| Value of live-stock | $37,425,194 | 38,888,734* |
| Number of horses | 429,504 | 838,232* |
| Number of mules and asses | 61,332 | |
| Number of milch cows | 428,048 | 3,182,904* |
| Number of work oxen | 132,407 | |
| Number of stock cattle | 2,933,888 | |
| Number of sheep | 714,351 | 1,632,071* |
| Number of hogs | 1,202,445 | 1,347,400 |
| Bushels of wheat | 414,103 | 1,474,000 |
| Bushels of rye | 28,521 | 40,000 |
| Bushels of Indian corn | 20,554,538 | 28,016,000 |
| Bushels of oats | 762,663 | 1,118,000 |
| Bushels of barley | 44,351 | 63,000 |
| Bushels of buckwheat | 49 | |
| Rice, pounds | 63,884 | |
| Tobacco, pounds | 59,706 | 141,000 |
| Cotton, bales | 350,628 | 340,000 |
| Wool, pounds | 1,251,318 | |
| Peas and beans, bushels | 42,654 | |
| Irish potatoes, bushels | 208,383 | 233,000 |
| Sweet potatoes, bushels | 2,188,041 | 2,325,000 |
| Wine, gallons | 6,216 | |
| Butter, pounds | 3,712,747 | |
| Cheese, pounds | 34,342 | |
| Hay, tons | 18,982 | 62,000 |
| Cane-molasses, gallons | 246,062 | |
| Sorghum-molasses, gallons | 174,509 | |
| Beeswax, pounds | 13,255 | |
| Honey, pounds | 275,164 | |

*Railroads.*—At the beginning of 1875 there were 1540.5 miles of railway in the State, the cost of which, for road, equipment, lands, etc., was about 65 million dollars. The following table gives the principal particulars of these railways:

| Railways. | Miles in operation. | Capital stock. | Stock paid in. | Amount expended. | Indebtedness. | Receipts for transportation. | Expenses. | Engines and cars. Engines. | Engines and cars. Cars. | Miles run by trains. | Men employed. | Acres of land donated by State. Sold. | Acres of land donated by State. Unsold. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $ | $ | $ | $ | $ | $ | | | | | | |
| Houston and Texas Central..... | 501.47 | 822,700 | 822,700 | 20,817,941.48 | 14,702,485.14 | 3,230,686.55 | 1,363,334.87 | 71 | 1405 | 1,517,565 | 1624 | 111,360 | 177,920 |
| Texas and Pacific..... ..... | 300.00 | 50,000,000 | 600,000 | ..... | 22,741,894.72 | 1,219,172.94 | 413,002.55 | 28 | 446 | 550,089 | 737 | ..... | 1,163,773 |
| International and Great Northern | 502.00 | 25,000,000 | 5,500,000 | 17,000,504.97 | 13,129,551.32 | 1,001,249.17 | 706,384.90 | 40 | 687 | 673,538 | 1530 | ..... | 1,112,960 |
| Gulf Western Texas and Pacific... | 68.80 | 12,000,000 | ..... | 125,581.79 | 1,386,000.00 | 223,732.32 | 135,489.10 | 5 | 70 | 71,560 | 130 | ..... | ..... |
| Galveston Houston and Henderson | 59.00 | 1,000,000 | 1,000,000 | 61,274.95 | 1,637,540.72 | 719,688.55 | 147,375.68† | 10 | 276 | 200,214 | 339 | ..... | ..... |
| Galveston Harrisburg and San Antonio..... | 109.25 | 2,000,000 | 2,000,000 | 549,750.00 | 1,605,000.76 | 251,738.82 | 77,003.49† | 7 | 11 | 108,332 | 235 | ..... | 265,600 |
| Totals..... | 1540.52 | 90,000,000 | 9,922.700 | 38,555,053.19 | 55,202,472.66 | 6,646,268.35 | 2,842,590.59 | 161 | 2895 | 3,121,298 | 4595 | 111,360 | 2,720,255 |

The only canal in the State is a short ship-canal, now nearly finished, in aid of the navigable channel from Galveston harbor to Houston. It is 4 miles long and 12 feet deep, and connects the San Jacinto River with the bay through Morgan's Point.

*Finances.*—The State debt on Feb. 1, 1876, was as follows: bonded debt, $4,249,757; floating debt, $543,137.84; making an aggregate of $4,792,894.84. Besides this there is claimed as due to the State university fund and the common-school fund $537,008.21 for warrants lost and destroyed during the late war, together with interest on this amount to Feb. 1, 1876, the whole amounting to $842,210.26. These claims are set down in the comptroller's report as of doubtful validity. If allowed, they would increase the State debt to $5,635,105.10. The receipts from all sources, including balance in the treasury from Aug. 31, 1874, to Aug. 31, 1875, the close of the fiscal year, were $2,800,075.54, and the disbursements for the same period, $2,497,276.22, leaving a balance in the treasury of $302,799.32. Of this sum, $712,022.15 was expended for frontier defence and other special accounts, and $307,525.70 for interest on the public debt. The remainder ($1,477,728.37) was for the ordinary expenses of the government and for the maintenance of public schools.

*Commerce and Navigation.*—Texas has five customs districts. The following table gives the statistics of the foreign commerce and navigation of the State for the year ending June 30, 1875:

* The returns marked with a * were those of the county assessors in 1875, and are incomplete, as well as under-estimated. Gov. Coke says that the increase from 1874 should have been at least 12 per cent., while the assessment-rolls made it but about 2 per cent. There has been a material increase in the production of butter, cane and sorghum sugar and molasses, wool, rice, and orchard and market-garden products since 1870, and ramie and several other products have been added.

† These two roads had paid in addition considerable sums (nearly $400,000 in the aggregate) for labor-rolls and other expenses.

| Customs districts. | Foreign imports for year ending June 30, 1875. | Domestic exports for year ending June 30, 1875. | Foreign goods re-exported for year ending June 30, 1875. | Entrances into port for year ending June 30, 1875. | | | Clearances from port for year ending June 30, 1875. | | | Registered, enrolled, and licensed tonnage for year ending 1875. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vessels. | Tonnage. | Crews. | Vessels. | Tonnage. | Crews. | Vessels. | Tonnage. |
| Brazos de Santiago | $2,002,748 | $833,312 | $997,658 | 49 | 30,984 | 1252 | 41 | 20,956 | 993 | 14 | 1,547 |
| Corpus Christi | 322,803 | 205,557 | 243,966 | 8 | 5,142 | 147 | 9 | 5,930 | 171 | 35 | 774 |
| Galveston | 1,218,034 | 15,876,632 | 349,275 | 163 | 91,913 | 2349 | 206 | 127,579 | 3190 | 250 | 18,116 |
| Paso del Norte | 308,991 | 40,323 | ..... | 18 | 4,080 | 234 | 18 | 4,079 | 234 | ..... | ..... |
| Saluria | 97,663 | 237,294 | 40,165 | 18 | 16,785 | 435 | 28 | 24,359 | 627 | 46 | 1,612 |
| Totals | $3,950,239 | $17,193,118 | $1,629,064 | 256 | 148,904 | 4417 | 302 | 182,903 | 5215 | 345 | 22,049 |

*Population.*—There has been no trustworthy census of the State since 1870, but there is no room for doubt that its population has increased since that date, mainly from immigration, more rapidly than that of any other Southern State, and perhaps than any other State of the Union. It is claimed that for the last four years from 200,000 to 250,000 persons have annually been added to its population, and in 1875 the State authorities estimated the number of inhabitants at 1,500,000. The number of inhabitants at the earliest dates in the following table are as estimated by its historians, usually from imperfect and partial enumerations:

| Year of enumeration. | Total population. | Males. | Females. | White. | Free colored. | Slaves. | Indians, Mexicans, and Chinese. | Natives. | Foreigners. | Density. | Ratio of increase. | No. of dwellings. | No. of families. | Persons in a family. | Persons in a dwelling. | Illiteracy. | Of school age, 5 to 20. | Of military age, 18 to 45, males. | Of voting age, 21 and over, males. | Male citizens. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1806 | 7,000 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0.02 | ..... | | | | | | | | | |
| 1834 | 21,000 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0.07 | 300. | | | | | | | | | |
| 1836 | 52,670 | 33,500 | 19,170 | 30,000 | 5,000 | ..... | 17,670 | ..... | ..... | 0.19 | 150. | | | | | | | | | |
| 1845 | 150,000 | 91,000 | 59,000 | ..... | ..... | ..... | ..... | ..... | ..... | 0.54 | 185. | | | | | | | | | |
| 1850 | 212,592 | 113,780 | 98,812 | 154,034 | 397 | 58,161 | ..... | 194,433 | 17,681 | 0.77 | 41.70 | 27,988 | 28,377 | 5.44 | 5.52 | 10,583 | 83,206 | 43,909 | 52,666 | 40,048 |
| 1860 | 604,215 | 320,167 | 284,048 | 420,891 | 355 | 182,566 | 403 | 560,793 | 43,422 | 2.20 | 184.22 | 77,428 | 76,781 | 5.49 | 5.45 | 18,476 | 233,417 | 119,362 | 143,951 | 100,042 |
| 1870 | 818,579 | 423,557 | 395,022 | 564,700 | 253,475 | ..... | 724 | 756,168 | 62,411 | 3.02 | 36.46 | 141,685 | 854,483 | 5.30 | 5.18 | 221,703 | 319,233 | 158,765 | 184,094 | 169,215 |

*Education.*—The policy of Texas, both as a State and a republic, has been to favor public-school education, and liberal endowments of its public lands were early made to aid in the maintenance of public schools. But owing to the sparseness of the population and the slow sales of public lands, very little was done for some years. In 1854 the school fund amounted to $128,668, and in that year $2,000,000 was added to it from the $10,000,000 paid by the U. S. government for the purchase of the Santa Fé territory. During the five years from 1856 to 1860 about $106,000 of interest annually from this fund was distributed among the schools. During the war the school fund was appropriated to other purposes, and the schools generally suspended. After the war, new grants of land were made for schools, and an attempt made to reorganize the school system. In 1868 the reconstruction convention set apart all the sales of public lands, one-fourth of the State revenue, and a poll-tax of one dollar per head on each male citizen between twenty-one and sixty years of age as a revenue for schools. In that year the permanent fund was said to be $2,000,000. In 1870 there were 221,512 persons over ten years of age who could not read or write, of whom 70,895 were whites and 150,617 colored. In 1871 two school laws were passed, one in April, the other in November. Both these proving objectionable, another was passed, repealing the former, May 22, 1873, which was further amended in May, 1874, and Mar., 1875. The constitutional convention of Sept., 1875, made radical changes in the school system, not generally for the better, but these have not yet gone into operation. The following are the statistics of the public schools under the laws of 1873–75: The school age was from six to eighteen. In 1875 the permanent school fund amounted to $2,604,202.95 in bonds, $80,721.61 in currency, and $41,963.69 in specie. The available school fund for the year was $10,500 in bonds of Brazos co., $728,466.30 in currency, and $125,891.15 in specie. The balance on hand after the year's disbursements was the Brazos co. bonds and $108,260.92 in currency. The enumeration taken in July, 1875, shows a school population (6–18 years) in 145 counties of 331,400. The school reports returned for 1875 were from only 97 counties; in these counties (which had a school population of 210,922) 124,567 were enrolled in the schools, and there was an average daily attendance of 84,415. There were 2924 schools organized and 3100 teachers employed; the average duration of the schools was 78 days (a little short of 4 months); the average salaries of teachers per month was $53. From these data the superintendent estimates the actual enrollment in the State as 184,705; the average attendance as 125,224; the number of schools organized as 3898, and of teachers employed 4030. The Peabody fund paid in 1875, $4800 in aid of the public schools of the State. The new constitution, adopted Feb. 15, 1876, abolishes the office of State superintendent, restricts the expenditure for school purposes to the amount of the available school fund (in 1876, $655,000), and so cripples the whole system that except in the more populous counties the existence of the public school will for the present be impossible, even in the large towns. Gov. Coke says the school age must be from eight to thirteen years if the schools are to be maintained for five months, and in many places it will only be possible to contract with private schools to give the most elementary instruction at the State's expense.

The following table summarizes the statistics of higher education:

*Universities, Colleges, and Professional Schools.*

| Universities, Colleges, and Professional Schools. | Location. | Year of organization. | Under what control. | Professors and instructors. | Students. | | | | Value of buildings, grounds, and apparatus. | Amount of productive endowment. | Income from productive endowment. | Income from all sources. | Number of endowed scholarships. | Volumes in library. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Preparatory. | Collegiate. | Male. | Female. | | | | | | |
| *Universities, etc.* | | | | | | | | | $ | $ | $ | $ | | |
| Austin College | Huntsville | 1850 | Presbyterian | 3 | ... | ... | ... | ... | 60,000 | 5,000 | 500 | | | |
| Baylor University | Independence. | 1845 | Baptist | 5 | ... | 87 | 87 | ... | 65,213 | 30,213 | 3,021 | ..... | .... | 1,300 |
| Colorado College | Columbus | .... | Lutheran. | | | | | | | | | | | |
| Henderson College | Henderson | 1871 | Non-sectarian | 5 | 100 | ... | 53 | 47 | | | | | | |
| Marvin College | Waxahatchie | 1869 | Methodist | 7 | 90 | 23 | 43 | 47 | 30,000 | ..... | ..... | 3,500 | | |
| St. Joseph's College | Brownsville | 1868 | Roman Catholic | 7 | 60 | ... | 60 | ... | 18,000 | ..... | ..... | 3,000 | .... | 200 |
| St. Mary's College | San Antonio | .... | Roman Catholic | 10 | 360 | ... | 360 | ... | ..... | ..... | ..... | ..... | .... | 1,200 |
| Salado College | Salado | 1860 | Non-sectarian | 7 | 94 | 47 | 83 | 58 | 60,000 | ..... | ..... | 5,500 | | |
| Soule University | Chappell Hill. | .... | M. E. Ch., South. | 3 | 80 | ... | 48 | 32 | 20,000 | | | | | |
| Texas Military Institute | Austin | 1868 | Non-sectarian | 4 | ... | 112 | 112 | ... | 75,000 | ..... | ..... | 7,500 | .... | 1,200 |
| Texas University | Georgetown | 1874 | M. E. Ch., South. | 4 | ... | 69 | 69 | ... | 162,000 | ..... | ..... | 2,070 | | |
| Trinity University | Tehuacana | 1869 | Cumb. Presb. | 13 | 225 | 203 | 240 | 188 | 56,000 | 15,000 | 700 | 8,200 | .... | 2,700 |
| University of St. Mary | Galveston | 1854 | Roman Catholic. | 13 | 110 | 26 | 136 | ... | 150,000 | ..... | ..... | 4,500 | .... | 320 |
| Waco University | Waco | 1861 | Baptist | 9 | 120 | 95 | 112 | 103 | 53,000 | 13,000 | 1,000 | 6,800 | .... | 2,350 |
| Wiley University | Marshall | 1873 | Methodist Epis. | 6 | 260 | ... | 145 | 115 | 20,000 | | | | | |
| The Masonic Institute | Rusk | 1872 | Masonic order | 3 | 98 | ... | 50 | 48 | 10,000 | 1,000 | ..... | 2,100 | | |
| Odd Fellows' University | Bryan | 1873 | I. O. O. F. | 3 | 22 | 50 | ... | 72 | 13,000 | ..... | ..... | 2,000 | | |
| *School of Science.* | | | | | | | | | | | | | | |
| Agricultural and Mechanical College of Texas | Bryan | 1876 | State | not | full | y or | gan | ized | | | | | | |
| *School of Theology.* | | | | | | | | | | | | | | |
| Theological department, Baylor University | Independence. | 1870 | ..... | 2 | ... | 13 | 13 | | | | | | | |
| *Professional Schools.* | | | | | | | | | | | | | | |
| Texas Medical College and Hospital | Galveston | 1873 | ..... | 7 | ... | 15 | 15 | ... | ..... | 5,000 | 500 | 3,500 | .... | 40 |
| American Dental College | Austin | 1873 | ..... | 6 | | | | | | | | | | |

There is no normal school in the State, though the organization of three or more has been strongly urged. Waco University at Waco has a normal department, and educates a considerable number of teachers.

*Special Education.*—There is an institution for the deaf and dumb at Austin, having 3 instructors and teachers and 47 pupils. The expenditure, paid wholly by the State, is about $12,000 per annum. There is also an institute for the blind at Austin, with 8 teachers and instructors and 54 pupils; its current expenses are about $10,650.

*Counties* (172 organized, 2 unorganized).

| Counties. | Total pop., 1870. | Males, 1870. | Females, 1870. | Total pop., 1860. | Assessed valuation, 1875. | True valuation, ninth census, 1870. |
|---|---|---|---|---|---|---|
| | | | | | $ | $ |
| Anderson | 9,229 | 4,664 | 4,565 | 10,398 | 2,178,743 | 1,668,141 |
| Angelina | 3,985 | 1,981 | 2,004 | 4,271 | 391,622 | 323,497 |
| Aransas | new | county. | ..... | ..... | 552,438 | |
| Archer | new | county. | ..... | ..... | ..... | 205,072 |
| Atascosa | 2,915 | 1,513 | 1,402 | 1,578 | 832,135 | 925,847 |
| Austin | 15,087 | 7,823 | 7,264 | 10,139 | 2,462,914 | 2,497,870 |
| Bandera | 649 | 369 | 280 | 399 | 203,270 | 146,181 |
| Bastrop | 12,290 | 6,467 | 5,823 | 7,000 | 2,599,833 | 2,100,947 |
| Baylor | new | county. | | | | |
| Bee | 1,082 | 550 | 532 | 910 | 630,146 | |
| Bell | 9,771 | 5,099 | 4,672 | 4,799 | 2,981,186 | 1,255,533 |
| Bexar * | 16,043 | 8,104 | 7,939 | 14,454 | 8,013,699 | 4,281,672 |
| Blanco | 1,187 | 625 | 562 | 1,280 | 517,524 | 249,599 |
| Bosque | 4,981 | 2,631 | 2,350 | 2,005 | 1,263,947 | 830,969 |
| Bowie | 4,684 | 2,372 | 2,312 | 5,052 | 1,028,263 | 575,031 |
| Brazoria | 7,527 | 3,913 | 3,614 | 7,143 | 2,067,217 | 1,681,554 |
| Brazos | 9,205 | 4,726 | 4,479 | 2,776 | 2,378,117 | 1,493,571 |
| Brown | 544 | 288 | 256 | 244 | 372,304 | |
| Burleson | 8,072 | 4,266 | 3,806 | 5,683 | 902,976 | 999,060 |
| Burnet | 3,688 | 1,966 | 1,727 | 2,487 | 1,142,878 | 484,718 |
| Caldwell | 6,572 | 3,374 | 3,198 | 4,481 | 1,643,266 | 1,229,084 |
| Calhoun | 3,443 | 1,760 | 1,683 | 2,642 | 1,012,152 | 1,609,616 |
| Callahan | new | county. | | | | |
| Cameron | 10,999 | 5,971 | 5,028 | 6,028 | 1,499,719 | 1,731,972 |
| Camp | new | county. | ..... | ..... | 541,319 | |
| Cass † | 8,875 | 4,592 | 4,283 | 8,411 | 1,470,697 | 703,435 |
| Chambers | 1,503 | 770 | 733 | 1,508 | 390,536 | 325,435 |
| Cherokee | 11,079 | 5,556 | 5,523 | 12,098 | 10,574,516 | 917,284 |
| Clay | new | county. | ..... | 109 | 228,542 | |
| Collin | 14,013 | 7,246 | 6,767 | 9,264 | 4,745,567 | 2,784,695 |
| Colorado | 8,326 | 4,258 | 4,068 | 7,885 | 2,664,155 | 1,978,675 |
| Coleman | 347 | 217 | 130 | ..... | 69,711 | |
| Comal | 5,283 | 2,788 | 2,495 | 4,030 | 1,371,540 | 1,280,536 |
| Comanche | 1,001 | 525 | 476 | 709 | 625,061 | |
| Concho | new | county. | | | | |
| Cook | 5,315 | 2,794 | 2,521 | 3,760 | 1,556,444 | 681,467 |
| Coryell | 4,124 | 2,080 | 2,044 | 2,666 | 1,302,872 | 698,376 |
| Crockett | new | county. | | | | |
| Dallas | 13,314 | 6,900 | 6,414 | 8,665 | 7,918,511 | 2,997,238 |
| Dawson | new | county. | ..... | 281 | | |
| Delta | new | county. | ..... | ..... | 554,625 | |
| Denton | 7,251 | 3,785 | 3,466 | 5,031 | 2,436,983 | 1,419,309 |
| De Witt | 6,443 | 3,313 | 3,130 | 5,108 | 1,900,238 | 1,520,711 |
| Dimmit | 109 | 74 | 35 | | | |
| Duval | 1,083 | 625 | 458 | | | |
| Eastland | 88 | 50 | 38 | 89 | 63,029 | |
| Edwards | new | county. | | | | |
| Ellis | 7,514 | 4,023 | 3,491 | 5,246 | 3,608,369 | 1,474,419 |
| El Paso | 3,671 | 2,028 | 1,643 | 4,051 | 396,527 | 454,301 |
| Encinal | 427 | 260 | 167 | 43 | 281,045 | 19,457 |
| Erath | 1,801 | 941 | 860 | 2,425 | 705,711 | 607,567 |
| Falls | 9,851 | 5,122 | 4,729 | 3,614 | 2,243,661 | 1,403,508 |
| Fannin | 13,207 | 6,868 | 6,339 | 9,217 | 3,463,745 | 1,994,170 |
| Fayette | 16,863 | 8,677 | 8,186 | 11,604 | 4,806,106 | 3,730,255 |
| Fort Bend | 7,114 | 3,562 | 3,552 | 6,143 | 2,145,892 | 1,238,995 |
| Franklin | new | county. | | | | |
| Freestone | 8,139 | 4,148 | 3,991 | 6,881 | 1,919,288 | 1,116,034 |
| Frio | 309 | 164 | 145 | 42 | 370,471 | |
| Galveston | 15,290 | 7,843 | 7,447 | 8,229 | 19,191,864 | 16,379,724 |
| Gillespie | 3,566 | 1,871 | 1,695 | 2,736 | 899,360 | 704,820 |
| Goliad | 3,628 | 1,793 | 1,835 | 3,384 | 1,170,380 | 835,401 |
| Gonzales | 8,951 | 4,603 | 4,348 | 8,059 | 2,688,195 | 1,648,715 |
| Grayson | 14,387 | 7,476 | 6,911 | 8,184 | 5,822,991 | 1,962,168 |
| Gregg | new | county. | ..... | ..... | 999,900 | |
| Grimes | 13,218 | 6,954 | 6,264 | 10,307 | 2,365,672 | 2,076,264 |
| Guadalupe | 7,282 | 3,771 | 3,511 | 5,444 | 2,057,379 | 1,736,444 |
| Hamilton | 733 | 391 | 342 | 489 | 457,380 | |
| Hardeman | new | county. | | | | |
| Hardin | 1,460 | 740 | 720 | 1,353 | 119,119 | 95,954 |
| Harris | 17,375 | 8,762 | 8,613 | 9,070 | 11,967,038 | 10,816,897 |
| Harrison | 13,241 | 6,712 | 6,529 | 15,001 | 3,950,283 | 2,912,043 |
| Haskell | new | county. | ..... | ..... | ..... | 183,419 |
| Hays | 4,088 | 2,124 | 1,964 | 2,126 | 1,432,460 | 643,520 |
| Henderson | 6,786 | 3,387 | 3,399 | 4,595 | 872,266 | 658,648 |
| Hidalgo | 2,387 | 1,313 | 1,074 | 1,192 | 295,790 | 282,424 |
| Hill | 7,453 | 3,867 | 3,586 | 3,653 | 1,729,271 | 1,295,927 |
| Hood | 2,585 | 1,362 | 1,223 | ..... | 878,877 | 411,504 |
| Hopkins | 12,651 | 6,397 | 6,254 | 7,745 | 1,945,287 | 1,196,237 |
| Houston | 8,147 | 4,053 | 4,094 | 8,058 | 2,041,164 | 1,663,911 |
| Hunt | 10,291 | 5,281 | 5,010 | 6,630 | 1,789,540 | 1,252,256 |
| Jack | 694 | 374 | 320 | 1,000 | 368,306 | 273,603 |
| Jackson | 2,278 | 1,164 | 1,114 | 2,612 | 638,846 | 912,318 |
| Jasper | 4,218 | 2,055 | 2,163 | 4,037 | 374,671 | |
| Jefferson | 1,906 | 956 | 950 | 1,995 | 741,385 | 671,405 |
| Johnson | 4,923 | 2,575 | 2,348 | 4,305 | 2,225,329 | 1,080,496 |
| Jones | new | county. | | | | |
| Karnes | 1,705 | 959 | 746 | 2,171 | 658,774 | 678,513 |
| Kaufman | 6,895 | 3,554 | 3,341 | 3,936 | 2,064,107 | 1,026,535 |
| Kendall | 1,536 | 817 | 719 | ..... | 385,335 | 360,245 |
| Kerr | 1,042 | 598 | 444 | 634 | 323,877 | 203,697 |
| Kimball | 72 | 41 | 31 | | | |
| Kinney | 1,204 | 784 | 420 | 61 | 147,089 | |
| Knox | new | county. | ..... | ..... | ..... | 91,464 |
| Lamar | 15,790 | 8,025 | 7,765 | 10,136 | 3,831,794 | 2,206,391 |
| Lampasas | 1,344 | 724 | 620 | 1,028 | 564,704 | 288,120 |
| La Salle | 69 | 43 | 26 | | | |
| Lavaca | 9,168 | 4,671 | 4,497 | 5,945 | 1,854,018 | 1,519,510 |
| Lee | new | county. | ..... | ..... | 1,416,394 | |
| Leon | 6,523 | 3,390 | 3,143 | 6,781 | 1,407,198 | |
| Liberty | 4,414 | 2,214 | 2,200 | 3,189 | 474,424 | 533,983 |
| Limestone | 8,591 | 4,523 | 4,068 | 4,537 | 2,538,462 | 1,328,368 |
| Live Oak | 852 | 497 | 355 | 593 | 733,736 | |
| Llano | 1,379 | 735 | 644 | 1,101 | 403,452 | 332,243 |
| McCullough | 173 | 97 | 76 | | | |
| McLennan | 13,500 | 6,880 | 6,620 | 6,206 | 4,663,590 | 2,637,910 |
| McMullin | 230 | 137 | 93 | ..... | 197,034 | |
| Madison | 4,061 | 2,080 | 1,981 | 2,238 | 684,777 | 574,026 |
| Marion | 8,562 | 4,453 | 4,109 | 3,977 | 1,550,499 | 2,206,099 |
| Mason | 678 | 354 | 324 | 630 | 315,684 | 134,343 |
| Matagorda | 3,377 | 1,745 | 1,632 | 3,454 | 1,340,748 | 750,753 |
| Maverick | 1,951 | 1,113 | 838 | 726 | 294,845 | |
| Medina | 2,078 | 1,080 | 998 | 1,838 | 828,404 | 552,423 |
| Menard | 667 | 533 | 134 | ..... | 56,135 | |
| Milam | 8,984 | 4,713 | 4,271 | 5,175 | 1,821,763 | 991,541 |
| Montague | 890 | 487 | 403 | 849 | 452,787 | 206,247 |
| Montgomery | 6,483 | 3,338 | 3,145 | 5,479 | 1,433,932 | 775,714 |
| Morris | new | county. | ..... | ..... | 439,215 | |
| Nacogdoches | 9,614 | 4,806 | 4,808 | 8,292 | 1,127,233 | 1,865,231 |
| Navarro | 8,879 | 4,623 | 4,256 | 5,996 | 3,567,064 | 2,064,282 |
| Newton | 2,187 | 1,101 | 1,086 | 3,119 | 259,553 | |
| Nueces | 3,975 | 2,152 | 1,823 | 2,906 | 3,352,456 | 1,330,573 |
| Orange | 1,255 | 614 | 641 | 1,916 | 394,340 | 276,733 |
| Palo Pinto | new | county. | ..... | 1,524 | 311,670 | |
| Panola | 10,119 | 5,140 | 5,979 | 8,475 | 1,281,232 | 792,947 |
| Parker | 4,186 | 2,156 | 2,030 | 4,213 | 1,557,845 | 938,129 |
| Polk | 8,707 | 4,305 | 4,402 | 8,300 | 533,667 | 761,518 |
| Presidio | 1,636 | 1,142 | 494 | 580 | 83,123 | |
| Pecos | new | county. | | | | |
| Rains | new | county. | ..... | ..... | 377,778 | |
| Red River | 10,653 | 5,382 | 5,271 | 8,535 | 1,732,787 | 1,237,822 |
| Refugio | 2,324 | 1,259 | 1,065 | 1,600 | 819,386 | 657,296 |
| Robertson | 9,990 | 5,272 | 4,718 | 4,997 | 3,185,742 | 999,245 |
| Rockwall | new | county. | ..... | ..... | 391,623 | |
| Runnels | new | county. | | | | |
| Rusk | 16,916 | 8,569 | 8,347 | 15,803 | 2,014,738 | 1,382,090 |
| Sabine | 3,256 | 1,615 | 1,641 | 2,750 | 326,061 | 292,170 |
| Somerville | new | county. | | | | |
| San Augustine | 4,196 | 2,092 | 2,104 | 4,094 | 1,039,926 | 1,210,619 |
| San Jacinto | new | county. | ..... | ..... | 471,921 | |
| San Patricio | 602 | 339 | 263 | 620 | 460,869 | |
| San Saba | 1,425 | 736 | 689 | 913 | 534,824 | 498,922 |
| Shackelford | 455 | 230 | 225 | 44 | 67,360 | |
| Shelby | 5,732 | 2,941 | 2,791 | 5,362 | 859,159 | 556,407 |
| Smith | 16,532 | 8,293 | 8,239 | 13,392 | 3,241,636 | 1,841,230 |
| Starr | 4,154 | 2,444 | 1,710 | 2,406 | 906,504 | 750,434 |
| Stephens | 330 | 190 | 140 | 230 | 22,202 | |
| Tarrant | 5,788 | 3,012 | 2,776 | 6,020 | 2,856,432 | 1,145,457 |
| Taylor | new | county. | | | | |
| Throckmorton | new | county. | ..... | 124 | 11,017 | 246,842 |
| Titus | 11,339 | 5,818 | 5,521 | 9,648 | 1,184,405 | 1,242,203 |
| Tom Green | new | county. | ..... | ..... | 189,312 | |
| Travis | 13,153 | 7,288 | 5,865 | 8,080 | 12,049,722 | 5,281,356 |
| Trinity | 4,141 | 2,066 | 2,075 | 4,392 | 554,439 | 266,516 |
| Tyler | 5,010 | 2,554 | 2,456 | 4,525 | 407,822 | 331,019 |
| Upshur | 12,039 | 6,005 | 6,034 | 10,645 | 1,006,728 | 1,458,345 |
| Uvalde | 851 | 476 | 375 | 506 | 669,871 | 491,323 |
| Van Zandt | 6,494 | 3,290 | 3,204 | 3,777 | 1,384,543 | 544,435 |
| Victoria | 4,860 | 2,415 | 2,445 | 4,171 | 1,734,424 | 1,231,405 |
| Walker | 9,776 | 5,095 | 4,681 | 8,191 | 1,561,356 | 1,452,380 |
| Waller | new | county. | ..... | ..... | 1,545,293 | |
| Washington | 23,104 | 11,938 | 11,196 | 15,215 | 5,005,125 | 4,578,381 |
| Webb | 2,615 | 1,495 | 1,120 | 1,397 | 432,651 | 367,245 |
| Wharton | 3,426 | 1,720 | 1,706 | 3,380 | 702,783 | 440,120 |
| Wichita | new | county. | | | | |
| Wilbarger | new | county. | | | | |
| Williamson | 6,368 | 3,298 | 3,070 | 4,529 | 2,701,256 | 1,665,968 |
| Wilson | 2,556 | 1,369 | 1,187 | ..... | 815,386 | 439,271 |
| Wise | 1,450 | 770 | 680 | 3,160 | 750,276 | 291,072 |
| Wood | 6,894 | 3,450 | 3,444 | 4,968 | 1,172,277 | 712,412 |
| Young | 135 | 92 | 43 | 592 | 132,963 | 330,840 |
| Zapata | 1,488 | 807 | 681 | 1,248 | 452,982 | 267,642 |
| Zavala | 133 | 71 | 62 | 26 | | |
| Total | 818,579 | 423,557 | 395,022 | 604,215 | 249,275,979 | |
| Value of 7,331,302 acres of land and town-lots rendered by railroad companies | | | | | 1,443,547 | |
| Amount of property rendered by Western Union Telegraph Company | | | | | 116,005 | |
| Amount of property rendered by Texas and Pacific Telegraph Company | | | | | 18,228 | |
| Total value | | | | | 250,853,759 | 159,052,542 |

There are also two other counties set off, but as yet unorganized—Hempstead and Wegefarth—and several others will doubtless be formed ere long from the territory in the N. W. part of the State, now comprised in Bexar and Young territories, Tom Green, Pecos, Presidio, Crockett, and El Paso cos.

*Principal Towns and Cities.*—Austin, the capital of the State, in 1870 had 4428 inhabitants; in 1875 its population was estimated at 6000. Galveston, the largest seaport and principal city, had 13,818 inhabitants in 1870, and not less than 25,000 in 1875. Houston, 9382 in 1870, and, according to a census taken in Mar., 1875, 25,968. San Antonio had 12,256 in 1870, and has largely increased since. Jefferson, Waco, Marshall, Dallas, Corpus Christi, Brownsville, Paris, Crockett, Clarksville, New Braunfels, Indianola, Laredo, and Brenham are all growing towns, ranging from 3000 to 6000 inhabitants each.

*Charitable and Corrective Institutions.*—The State lunatic asylum of Texas is at Austin. It had, Sept. 30, 1875, 152 patients (87 males, 65 females), 217 having been present during some portions of the year. Its current expenses are nearly $50,000 per annum. Of the patients discharged in 1875, 33 were discharged restored, 19 improved, 2 as incurable, 2 escaped, and 9 died; of the 90 admitted during the year, 24 had been insane from one to five years.

*Immigration.*—The greater part of the immigrants who eventually find a home in Texas are first landed at New York or other Northern ports, or at New Orleans; but in 1875, of the nearly 200,000 persons, citizens of other States as well as foreigners, who migrated thither in

* Also Bexar district, since organized as counties. P. in 1870, 1077—males 895, females 182.

† Cass county had its name changed to Davis in 1862, but has since resumed the old name.

1875, 135 (72 men and 63 women) came thither direct from Europe.

*Banks and Savings Banks.*—In 1875 there were 10 national banks in Texas, having a capital of $1,250,000, $914,000 of bonds on deposit, and $817,700 outstanding circulation. There were also 10 State banks, having an aggregate capital of $2,075,000. Two of these, having a capital of $160,000, were savings banks. There were also 90 private banking-houses.

*Insurance Companies.*—At the beginning of 1876, Texas had 8 fire and marine insurance companies, 5 of which were at Galveston, 2 at Houston, and 1 at Tyler. These 8 companies had an aggregate paid-up capital of $1,500,000, and gross assets of $2,180,130.49. Their total income for 1875 was $644,657.50, their total expenditures $565,403.09, and their total liabilities $612,172.92. There was 1 mutual life company at Galveston in 1873, with $300,000 capital and about $350,000 assets, but it has since closed up its business.

*Prisons, etc.*—The State penitentiary is at Huntsville, Walker co. It is entirely inadequate to the needs of the State, having, even with improvements not yet completed, accommodations for only 600 convicts, while the total number Jan. 1, 1876, was 1723, and 266 had escaped, 28 had been killed, 109 had died, 96 had been pardoned, and 182 could not be accounted for. The governor urges very strongly the immediate erection of two more prisons. The large number of escapes is mainly due to the fact that, owing to the want of room, there were Jan. 1, 1876, 1380 prisoners who were employed in agriculture, on railroads and saw-mills under guard in camps at different places in the State. The labor of the prisoners is leased for fifteen years from 1871 to a firm which assumes the entire expenditure, and pays to the State $5000 per year for the first five years, $10,000 for the next five, and $20,000 for the last five years; the firm also pays all salaries, $10,000 a year for sheriffs' fees, $20 and a suit of clothes to each discharged convict, and the entire expense of guarding, feeding, and clothing the prisoners. The prison is seriously mismanaged, not from any evil disposition on the part of the lessees, but from the circumstances in which they are placed. The county jails are in general very poor and badly managed.

*Newspapers.*—In 1870 there were 112 newspapers and periodicals of all classes in Texas, having an aggregate circulation of 55,250; of these, 12 were dailies, 5 tri-weeklies, 5 semi-weeklies, 89 weeklies, and 1 semi-monthly. In Jan., 1876, there were 145 newspapers, of which 20 were dailies, 1 tri-weekly, 122 weekly, and 2 monthly; 138 of the whole number are political, 4 religious, 1 temperance, 1 educational, and 1 devoted to Odd Fellowship.

*Churches.*

| Denominations. | No. of church organizations, 1870. | No. of church edifices, 1870. | No. of sittings, 1870. | Value of church property, 1870. | No. of church organizations, 1875. | No. of church edifices, 1875. | No. of clergymen, ministers, or priests. | No. of church members or communicants, 1875. | Adherent population, 1875. | Value of church property, 1875. |
|---|---|---|---|---|---|---|---|---|---|---|
| All denominations | 843 | 647 | 199,100 | $1,035,430 | 2025 | 1724 | 1259 | 124,930 | 729,400 | $1,779,700 |
| Baptists (regular) | 275 | 211 | 61,700 | 196,540 | 1047 | 853 | 590 | 59,637 | 298,000 | 427,500 |
| Christian Connection and Disciples | 18 | 17 | 4,450 | 11,650 | 30 | 28 | 19 | 2,216 | 11,000 | 27,400 |
| Congregationalists | 1 | 1 | 500 | 5,000 | 8 | 7 | 7 | 329 | 1,500 | 18,000 |
| Protestant Episcopalians | 32 | 31 | 11,400 | 109,400 | 45 | 38 | 41 | 2,612 | 12,000 | 168,400 |
| Jews | 1 | 1 | 400 | 6,000 | 2 | 2 | 2 | 210 | 1,000 | 13,000 |
| Lutherans | 23 | 21 | 7,650 | 47,900 | 43 | 39 | 22 | 3,427 | 12,000 | 73,100 |
| Methodists of all kinds | 355 | 244 | 69,100 | 251,140 | 687 | 524 | 391 | 49,293 | 265,000 | 409,800 |
| Presbyterians (regular) | 86 | 70 | 22,750 | 128,500 | 133 | 124 | 72 | 4,712 | 22,000 | 218,000 |
| Presbyterians (Cumberland, etc.) | 15 | 14 | 4,850 | 14,100 | 31 | 28 | 21 | 2,416 | 11,500 | 49,000 |
| Roman Catholics | 36 | 36 | 16,000 | 264,200 | 98 | 80 | 93 | ..... | 95,000 | 374,500 |
| Union | 1 | 1 | 300 | 1,000 | 1 | 1 | 1 | 80 | 400 | 1,000 |

*Constitution, Courts, Representatives in Congress.*—The leading provisions of the new constitution, ratified Feb. 15, 1876, are: every male citizen of the U. S. of the age of twenty-one years and upward, without distinction of race, color, or former condition of servitude, who shall have resided in the State for one year and in the county in which he offers to vote for sixty days next preceding an election, is entitled to vote, but the legislature may pass laws to exclude from office, from serving on juries, and from the right of suffrage, persons who have been convicted of bribery, perjury, forgery, or other high crimes. The governor, lieutenant-governor, treasurer, comptroller, land commissioner, and attorney-general are elected by the people for two years; the secretary of state is appointed by the governor for two years. The legislature consists of a senate and house of representatives—the senate, elected for four years, to consist of 31 members and no more; the house of representatives, of 93 members, elected for two years; the number may be increased by one additional member for every additional 15,000 inhabitants until it reaches 150. Sessions of the legislature are biennial. The judiciary consists of one supreme court of three judges, elected for six years, having appellate jurisdiction in civil cases only; of one court of appeals of three judges, elected for six years, having appellate jurisdiction in all criminal cases of whatever grade, and in all civil cases originating in the county courts and below; of 26 district courts, the judges elected for four years; of county courts for each county, the judges elected for two years; of justices' courts, not less than four nor more than eight to a county. A collector of taxes is elected for each county having over 10,000 inhabitants. Neither the State nor any county, city, or town can lend its credit to any individual, firm, or corporation, municipal or otherwise. No private corporation can be created except by general laws. Legal rate of interest, 8 per cent., but parties may agree to any rate up to 12 per cent.; beyond this is usury and punishable. No banking or discounting corporations to be created. No current wages for personal service shall ever be subject to garnishment. Wives allowed to hold property separate from their husbands. Homesteads protected from forced sale to the amount of 200 acres of land in the country, or $5000 of property in the cities. The number of members of Congress to which the State is entitled is six.

*History.*—The name of Texas has been said to be of Spanish origin, but recent investigations prove conclusively its Indian derivation, and that it was known to De la Salle, who landed at Matagorda Bay in 1687, and erected Fort St. Louis on the Lavaca, as the generic title of the numerous tribes of Indians who inhabited the region of Texas and Louisiana—the Caddoes, Lipans, Tonkawas, etc.—just as the name of Sioux includes numerous minor tribes of Indians at the North-west now. The colony of De la Salle was short-lived. He met with serious misfortunes in his attempt to return to the Mississippi, and was murdered by his own men near the Neches River in 1687. The garrison which he left in the fort was treacherously slaughtered by the Indians, except two men, who escaped and lived some years among the Indians, but finally fell into Spanish hands and were sent to the mines. A Spanish officer, Capt. Alonzo de Leon, was sent to the wild and unexplored country N. and E. of the Rio Grande to hunt out and expel the French. He described the territory of the Texas, but found the fort destroyed and only two guns remaining. In 1690 he established on the site of this fort the mission of San Francisco with 110 men and some friars, and soon after the mission and trading-post of Nacogdoches. Against these settlements Capt. de St. Denis, then commanding at Natchitoches, vigorously protested, claiming the country for the king of France by virtue of De la Salle's discovery and possession, and also because these Indians of the Texas were a part of the same family with those of Louisiana. His protest was unheeded, but a series of misfortunes and the hostility of the Indians led to the abandonment of the settlement. They subsequently established themselves at El Paso, and perhaps at one or two other places on the Rio Grande, but penetrated no farther for the time into Texas. In 1714, Crozat, then commanding the province of Louisiana, sent Capt. de St. Denis, a son of the one mentioned above, to effect a settlement on the Rio Grande. He was taken prisoner by the governor of Coahuila, but marrying the daughter of the commandant of the Spanish mission of San Juan, he was instrumental in introducing three Spanish missions into Texas. These were—one on the Bay of St. Bernard, the famous Mission Dolores, W. of the Sabine and near the coast, and the still more famous Alamo, near San Antonio. Not long after, a mission was again planted at Nacogdoches, and another near San Augustine, and the name of the "New Philippines" given to the country. The Spaniards retained their sway without molestation for twenty years; but in 1735, St. Denis, true to his old love, removed a French colony from the Red River into Texas, the Texas Indians aiding him in doing so. This time the Spaniards protested, but without effect. But neither French

nor Spaniards were long at peace with the Indians, and, after the massacre of the colonists at the San Saba Mission by the Indians in 1758, the missions declined. In the subsequent cession of Louisiana to Spain in 1763, its retrocession to France in 1803, and its sale to the U. S. the same year, Texas, which had an inconsiderable white population, was neglected; but after our Louisiana purchase, there came a conflict in regard to boundaries, Spain claiming lands E. of the Sabine, and the U. S. the territory W. to the Rio Grande. This difficulty was finally settled by an agreement between the Spanish general Herrera and Gen. Wilkinson, consenting to regard the territory between the Sabine and Arroyo Honda as neutral ground. The region afforded such facilities for smuggling that many adventurers engaged in it. It was a part of the projected empire of Aaron Burr, and within the next fifteen years at least eight or ten expeditions were fitted out either from the U. S. or the West Indies to take possession of it. Of these best known were those of Col. Ellis P. Bean, Lieut. Magee, Col. Kemper, Col. Perry, Xavier Mina, and Lafitte, called "the pirate of the Gulf." Galveston Island was repeatedly captured, and in the various battles several thousands on both sides lost their lives. By the treaty of 1819, in which Spain ceded Florida to the U. S., our government guarantied to Spain her possessions W. of the Sabine River. The Western adventurers were displeased with this, and in 1819, Dr. James Long headed a revolutionary expedition to Nacogdoches. This was a failure, but he led a second, and captured La Bahia, but was taken prisoner and sent to Mexico, where he was assassinated in 1822. Mexico having become independent, in 1820, Moses Austin of Connecticut obtained a grant of lands in Texas, but died before occupying it. His son, Stephen F. Austin, had the grant confirmed to him in 1823, having the year before led a large colony to what is now Austin co. His colony grew rapidly, and Austin made arrangements to bring 800 families into the settlement. The Mexican republic had, like the Spanish authorities, united Coahuila and Texas in one government, and, as Coahuila was exclusively Mexican, undertook to govern both entirely by Mexican officers. This led to gross injustice to the Texan colonists, and their dissatisfaction was increased by the overbearing conduct of the Mexican officials, who employed a band of American criminals and outlaws styling themselves "Regulators" to annoy and harass the colonists. In 1830 the Mexican president, Bustamente, prohibited colonists from the U. S. from entering Texas. The colonists now numbered over 20,000, and they resolved to separate from Coahuila. Foiled in this through the craftiness of Santa Anna, who beguiled them with promises and delayed their action till he could quietly occupy the state with his troops, there was nothing left for them but a revolution and open war. The first fighting occurred at Gonzales Oct. 2, 1835. They had already established committees of safety, and made Col. Stephen F. Austin their commander-in-chief. On Oct. 9 the Texans captured Goliad, and on the 28th the action of Concepcion occurred. On Nov. 12, 1835, a provisional government was organized, Henry Smith being chosen governor, and Gen. Austin, having resigned, was sent as a commissioner to the U. S., and Gen. Sam Houston succeeded him as commander. After being cannonaded for six days, San Antonio de Bexar was captured Dec. 10, 1835, by Gen. Houston, and the Mexican troops, over 1000 in number, who had surrendered, were sent to Mexico, and Texas was freed from an armed Mexican force. Santa Anna, enraged at the defeat of his favorite general, gathered a force of 7500 Mexican troops, and, commanding it in person, marched for San Antonio, which Gen. Houston had caused to be dismantled. The Alamo, a strong fort not far off, formerly a Spanish mission, was garrisoned by a force of 140 Texans (afterward increased to 172) under command of Col. W. B. Travis. The famous David Crockett was one of the garrison. Santa Anna invested this with a force of 4000 men, bombarded it for eleven days, and finally carried it by storm on Mar. 6, 1836, and put the whole garrison to the sword, sparing only a woman, a child, and a servant. The Mexican loss was over 1600. On the 27th he murdered Col. Fannin's command at Goliad in cold blood, after accepting their surrender. But in the mean time the Texans on Mar. 17 had held a convention, adopted a constitution, and elected David G. Burnet president of the republic of Texas. The atrocities of Santa Anna and several defeats of small bodies of Texan troops had created great alarm, and Gen. Houston retreated across the Colorado, the Brazos, and finally to San Jacinto, in order to scatter and divide the Mexican troops. Santa Anna followed closely, and at San Jacinto, on Apr. 21, was fought the decisive battle of the war, Gen. Houston with 800 troops defeating twice the number of Mexicans and taking 730 prisoners, including Santa Anna himself. (See SAN JACINTO, BATTLE OF.) This practically concluded the war of independence. Gen. Houston, who was wounded in the battle, resigned the command, and in Sept., 1836, was elected president of the republic. In Mar., 1837, the United States acknowledged the independence of Texas. For nearly ten years Texas maintained her existence as a republic—ten years of struggle, and at times of great despondency. Her population increased from 52,000 in 1836 to 150,000 in 1845. Twice she had sought to be annexed to the U. S., but her offers had been declined. When her condition became more prosperous, the U. S. under Presidents Tyler and Polk became the wooing party. Annexation was finally accomplished by the vote of Congress Dec. 27, 1845, and the acceptance of the act by the Texan people Feb. 19, 1846. The Texans claim that in these negotiations promises were made by the U. S. commissioners in regard to the harbors of Texas, the improvement of her rivers, fortifications, and coast defences, and her protection from the forays of Mexican banditti and the murderous expeditions of the Indians; which were declared to be authorized by the government, and without which annexation would have been spurned. They claim, further (Hon. Ashbel Smith, secretary of state under Pres. Jones, the last president of the Texas republic, being their advocate and spokesman), that these pledges have never been fulfilled. There seems to be no doubt that these stipulations were made with the Texan government by the late Major A. J. Donelson and ex-Gov. Yell, the commissioners of the U. S., but whether they were authorized to make such pledges is a matter of doubt. The Mexican war followed, and resulted in a clear title to the Rio Grande and the annexation of other territory. In Aug., 1850, Congress paid the State $10,000,000 in 5 per cent. bonds to relinquish a portion of her territory to New Mexico, and to give up her claims against the U. S. The State increased rapidly in population, and when the secession movement came up, though the governor, Gen. Sam Houston, was a Union man, the State followed the rest of the South in seceding from the Union. The Texan troops were among the bravest of the Confederacy. Several important battles were fought in the State, and it was the last of the Confederate States to surrender. The State was under military command till 1869, when, a new constitution having been adopted, and the other requirements of Congress complied with, it was restored to the Union by act of Congress in Mar., 1870. In Feb., 1876, the State adopted a new constitution. The people of Texas are now entering upon a career of prosperity which will speedily obliterate the prejudices of the past, and place their State in the front rank at the South-west. The rapid increase of its population since 1870, and the energetic efforts making to develop its great agricultural, mineral, and manufacturing resources, and to find ready access to the markets of the world, ensure a magnificent future.

*Executive Officers of Texas.*

I. *Provisional Governor before the Declaration of Independence of Mexican control.*

Henry Smith, from Nov. 12, 1835, to Mar. 18, 1836.

II. *Presidents under the Republic.*

David G. Burnet, Mar. 18, 1836–Oct. 22, 1836.
Sam Houston, Oct. 22, 1836–Dec., 1838.
Mirabeau B. Lamar, Dec., 1838–Dec., 1840.
David J. Burnet (acting), Dec., 1840–Dec., 1841.
Sam Houston, Dec., 1841–Dec., 1844.
Anson Jones, Dec., 1844–Feb. 19, 1846.

III. *Governors of the State.*

J. Pinckney Henderson.1846–47
George T. Wood.....1847–49
P. Hansborough Bell.....1849–53
Edward M. Pease.....1853–57
H. G. Runnels.....1857–59
Sam Houston.....1859–61
Edward Clark (acting)...1861–61
Francis R. Lubbock.....1861–63
Pendleton Murray.....1863–65
A. J. Hamilton, *Provis*...1865–66
J. W. Throckmorton.....1866–67
Edward M. Pease.....1867–70
Edmund J. Davis.....1870–74
Richard Coke.....1874–78

*Electoral and Popular Votes for President and Vice-President.*

| Elect. year. | Candidates for whom the electoral vote of the State was cast. | Elect. vote. | Pop. vote. | Opposition candidates. | Pop. vote. |
|---|---|---|---|---|---|
| 1848 | Lewis Cass P.<br>Wm. O. Butler V.-P. | 4 | 10,668 | Zachary Taylor P.<br>Millard Fillmore V.-P. | 4,509 |
| 1852 | Franklin Pierce P.<br>William R. King V.-P. | 4 | 13,552 | Winfield Scott P.<br>Wm. A. Graham V.-P. | 4,995 |
| 1856 | James Buchanan P.<br>J. C. Breckenridge V.-P. | 4 | 31,169 | Millard Fillmore P.<br>A. J. Donelson V.-P. | 15,639 |
| 1860 | J. C. Breckenridge P.<br>Joseph Lane V.-P. | 4 | 47,548 | John Bell P.<br>Edward Everett V.-P. | 15,439 |
| 1864 | No vote. | | | | |
| 1868 | No vote. | | | | |
| 1872 | Horace Greeley P.<br>Benj. Gratz Brown V.-P. | 5 | 66,500 | Ulysses S. Grant P.<br>Henry Wilson V.-P. | 47,406 |
| 1876 | Samuel J. Tilden P.<br>Thos. A. Hendricks V.-P. | 5 | | Rutherford B. Hayes P.<br>Wm. A. Wheeler V.-P. | |

(The writer acknowledges his obligations for documents to His Excellency Gov. Richard Coke and Hon. A. W. De Berry, secretary of state, and for valuable statistics and historical data to Hon. E. W. Taylor, secretary of Texas Centennial Association, Houston, Tex.) L. P. BROCKETT.

**Tex'as,** county of S. Missouri, drained by Current River and affluents of the Gasconade. Surface generally hilly, soil fertile along the streams, with large forests of yellow pine. Staples, Indian corn, wheat, tobacco, lumber, and live-stock. Cap. Houston. Area, about 1250 sq. m. P. 9618.

**Texas,** tp., Macon co., Ala. P. 598.

**Texas,** tp., Craighead co., Ark. P. 181.

**Texas,** tp., St. Francis co., Ark. P. 710.

**Texas,** tp., De Witt co., Ill. P. 1064.

**Texas,** v., Baltimore co., Md. P. 640.

**Texas,** p.-v. and tp., Kalamazoo co., Mich. P. 1109.

**Texas,** tp., Dent co., Mo. P. 870.

**Texas,** p.-v. in tp. of Mexico, Oswego co., N. Y. P. 150.

**Texas,** tp., Crawford co., O. P. 566.

**Texas,** tp., Wayne co., Pa. P. 4449.

**Texas,** tp., Marathon co., Wis. P. 284.

**Texe'ira** (Pedro), b. in Portugal about 1570; spent several years of his youth in Portuguese India and Malacca; returned to Portugal by way of the Philippine Islands and Mexico 1600–01; went again to Goa 1603; made a voyage up the Persian Gulf, and crossed Persia and Turkey to Italy 1604. His account of this journey, *Relacion de los Reyes de Persia y Ormuz, Viage de la India Oriental hasta Italia por Tierra el año de 1604* (Antwerp, 1610), contains a compendium of Persian history, of which it was long the most accessible account. The time and place of his death are unknown.

**Tex'el,** the first and largest of the chain of islands which stretches along the north-eastern coast of Holland, is separated from the Helder by Marsdiep, and contains about 35,000 acres of rich meadow-land. The surface is very low, but protected by dunes and dykes against inundation. The inhabitants, numbering 6176, are mostly engaged in sheep-rearing, shipbuilding, fishing, and as pilots. The northern part of the island is called Eijerland (*Eggland*), because wild birds gather here in numberless multitudes to breed; large quantities of eggs are gathered and brought into market.

**Texier'** (Charles Félix Marie), b. at Versailles Aug. 29, 1802; studied first architecture in the School of Fine Arts in Paris; devoted himself afterward to archæology; undertook under the support of the government extensive explorations in the East between 1833 and 1843, and after his return was made inspector-general of public buildings in France and Algeria. The results of his explorations he communicated in his two magnificently illustrated works—*Description de l'Arminie, de la Perse et de la Mésopotamie* (2 vols. fol., Paris, 1842–45), and *Description de l'Asie mineure* (4 vols., 1839 *seq.*), of which he published the latter part, in connection with R. P. Pullan, simultaneously in French and English. He also wrote *Édesse et ses Monuments en Mésopotamie* (1859), and in conjunction with R. P. Pullan, *Byzantine Architecture* (1864) and *The Principal Ruins of Asia Minor* (1865).

**Text'ile Fabrics.** For the constituents of the various fabrics see Fibre. For their manufacture, etc., see under the different headings of the materials. See also Knitting, Lace, Loom, Nets, Spinning, Weaving, etc.

**Te'za,** town of Morocco, capital of the province of Hiacna, on the river Teza at its junction with the Sebu, is the handsomest city of the country, with broad and convenient streets lined with fine buildings. It carries on a considerable trade, especially in grain. P. about 10,000.

**Tezcu'co,** town of Mexico, 16 miles N. E. of the City of Mexico, on the shore of Lake Tezcuco, was before the arrival of the Spaniards one of the principal seats of Mexican wealth and civilization, but it is now only a field of ruins covered with heaps of rubbish, on which a modern town has been built, having some industry. P. 5000.

**Thaa'rup** (Thomas), b. in Copenhagen Aug. 21, 1749; devoted himself to literature; was for some time director of the royal theatre. D. on his estate, near Hirschholm, 1821. He was a pupil of Thomson, and his lyrical poems and dramas, which made an enormous sensation, contributed much to introduce among the Danes a taste for English poetry.

**Thach'er** (James), M. D., b. at Barnstable, Mass., Feb. 14, 1754; studied medicine; entered the army before Boston as surgeon's mate to Dr. John Warren 1775, and served as surgeon through the war, being present at many of the principal battles, and keeping a diary, afterward published as a *Military Journal of the Revolution* (1824; 3d ed. 1854). He settled at Plymouth 1783; was a member of the Academy of Arts and Sciences, and a frequent contributor to periodicals. D. at Plymouth May 24, 1844. Author of *American New Dispensatory* (Boston, 1810), *Modern Practice of Physic* (1817), *American Orchardist* (1822), *Treatise on the Management of Bees* (1829), *American Medical Biography* (2 vols. in 1, 1828), *Essay on Demonology, etc.* (1831), *History of the Town of Plymouth* (1832), and *Observations relative to the Execution of Major John André* (1834).

**Thacher** (Oxenbridge), b. at Milton, Mass., in 1720, grandson of Rev. Peter (1651–1727), first minister of that place; graduated at Harvard 1738; studied theology, and for some time officiated as a minister, but exchanged the pulpit for the bar on account of delicate health; was a distinguished opponent of British aggressions in the Massachusetts assembly, and author of *Considerations upon reducing the Value of the Gold Coins within the Province* (1760), and of *The Sentiments of British Americans* (1764), the latter being a spirited attack upon the Navigation act. D. at Boston July 8, 1765.

**Thacher** (Peter), D. D., son of Oxenbridge, b. at Milton, Mass., Mar. 21, 1752; graduated at Harvard 1769; was ordained minister of Malden 1770; was an active patriot during the Revolution; wrote, at the request of the Massachusetts committee of safety, a *Narrative of the Battle of Bunker's Hill;* framed the spirited resolutions adopted by the town of Malden; was a delegate to the constitutional convention 1780, and frequently chaplain to the assembly; was famous for pulpit eloquence and colloquial powers, and was pastor of Brattle street church, Boston, from 1785 to his death, at Savannah, Ga., Dec. 16, 1802. Author of many published sermons, addresses, and essays, including *Observations on the State of the Clergy in New England* (1783) and *Memoirs of Dr. Boylston* (1789).

**Thacher** (Samuel Cooper), son of Dr. Peter (1752–1802), b. at Boston, Mass., Dec. 4, 1785; graduated at Harvard 1804; visited Europe with his friend, Rev. J. S. Buckminster, 1806; was librarian of Harvard 1808–11; ordained pastor of the New South church, Boston, as successor of Rev. Dr. Kirkland, May 15, 1811; was considered an elegant scholar and an eloquent preacher; contributed much to periodical literature; prefixed a *Life* to the *Sermons of Rev. J. S. Buckminster* (1814), and published several essays and addresses. D. of consumption at Moulins, France, Jan. 2, 1818. A volume of his *Sermons* (1824) was edited, with a *Memoir*, by Rev. F. W. P. Greenwood.—His brother, Peter Oxenbridge, b. at Malden Dec. 22, 1776; graduated at Harvard 1796; became a distinguished lawyer at Boston, and was municipal judge from 1823 to his death, Feb. 22, 1843. His decisions in criminal cases were esteemed high authority, and were collected and edited in 1845 by Horatio Woodman. Author of several pamphlets on legal subjects.

**Thacher** (Thomas), b. at Salisbury, England, May 1, 1620, son of Rev. Peter, minister at that place; came to Boston, Mass., 1635; studied theology under Chauncey; was ordained pastor of the church at Weymouth Jan. 2, 1644; moved to Boston 1664, and practised medicine there until chosen first pastor of the Third (Old South) church Feb. 16, 1669. D. at Boston Oct. 15, 1678. He prepared a *Hebrew Lexicon* which was never printed, and his *Brief Rule, etc. in the Small Pox and Measles* (1677) is said to have been the first medical tract published in New England. He was an ancestor of all the distinguished persons of the name above mentioned.

**Thacher** (Thomas Anthony), LL.D., b. at Hartford, Conn., Jan. 11, 1815, and graduated at Yale College, Conn. He has been professor of the Latin language in Yale College since 1842, and has published an edition of Cicero, *De Officiis*, of Madvig's *Latin Grammar*, etc.

**Thack'eray** (Anne Elizabeth), daughter of William Makepeace, b. in England about 1842; has published *The Story of Elizabeth* (1863), *The Village on the Cliff* (1867), *Old Kensington* (1873), *Toilers and Spinsters* (1873), *Bluebeard's Keys* (1874), *Miss Angel* (1876), and various miscellaneous pieces.

**Thackeray** (William Makepeace), b. at Calcutta, India, in 1811, son of a gentleman who held a lucrative post in the civil service of the East India Company, and descended from an ancient Yorkshire family; came to England 1818; was educated at the Charter-house School, London, and at Trinity College, Cambridge, where he was a contemporary of John M. Kemble and the brothers Tennyson, but left without taking a degree; was left an orphan in youth with a fortune estimated at £20,000; was noted from boyhood for literary, and especially for artistic, proclivities, being addicted to making humorous sketches illustrating every conceivable actual or possible episode of every-day life; travelled and studied on the Continent, especially in Italy, with a view to becoming a painter; spent a season (1830–31) at Weimar, enjoying free access to the ducal court and becoming intimate with the aged

Goethe and his brilliant circle; soon afterward made some incidental contributions to the press, but did not formally devote himself to a profession until about 1838, when, having lost most of his fortune, partly by the fault of others, partly by his own speculations, he resolved to support himself by his pen; became a correspondent of the *Times;* wrote humorous papers for the *New Monthly Magazine*, for *Fraser*, and for *Punch* over a variety of signatures, such as "Michael Angelo Titmarsh" and "The Fat Contributor;" published collections of his magazine articles with original illustrations, as *The Paris Sketch-Book, by Mr. Titmarsh* (1840), *Comic Tales and Sketches* (1841), including the *Yellowplush Papers, The Irish Sketch-Book* (1843), which were read with great satisfaction, but being anonymous did not at once make for him a literary reputation; visited the East in 1845, and published as the result *Notes of a Journey from Cornhill to Grand Cairo* (1846); was first recognized as a literary celebrity upon the publication of his novel *Vanity Fair*, in monthly numbers (Jan., 1847, to July, 1848); studied law, and was called to the bar May 26, 1848, but never practised; availed himself of his recently-acquired popularity to issue several small volumes made up from earlier articles, *Our Street* (1847), *The Book of Snobs* (1848), *Dr. Birch and his Young Friends* (1848), and *The History of Samuel Titmarsh and the Great Hoggarty Diamond* (1848); brought out in monthly parts (Nov., 1848, to Oct., 1850) his second novel, *The History of Pendennis*, which confirmed his already high reputation, and made him in popular estimation a rival of Dickens for the first place in modern English fiction; lectured with brilliant success on the *English Humorists of the Eighteenth Century* in London 1851, and in the U. S. 1852; published *The History of Henry Esmond* (1852), *The Newcomes* (1853–55), and *The Virginians* (1857–59), completing the series of his five really great novels; lectured in the U. S. 1855–56, and afterward in England, on *The Four Georges;* presented himself unsuccessfully as a Liberal candidate for the representation of the city of Oxford in Parliament 1857; founded the *Cornhill Magazine* (1859), in which he published his two latest novels, *Lovel the Widower* (1860–61) and *The Adventures of Philip* (1861–62), both admitted to be inferior to his earlier productions, and a series of articles collected as *Roundabout Papers* (1862), and resigned his editorship Apr. 11, 1862. D. at Kensington Palace Gardens, London, Dec. 24, 1863, being found dead in bed from effusion on the brain, and was buried in Kensal Green Cemetery. A marble bust by Marochetti has been erected to his memory in Poet's Corner, Westminster Abbey. The last years of his life were saddened by the insanity of his wife. Thackeray has been often represented as a cynic, probably on account of the keenness of his satire of human frailties, but surely without justice, as witnessed by the many noble and sympathetic creations of his genius, especially in *Esmond* and *The Newcomes*. The long-pending debate as to his merits as a novelist in comparison with Dickens can never be absolutely decided, but it may be confidently asserted that Thackeray appeals to a higher literary and artistic criterion than his great rival, and one that will probably gain in appreciation by lapse of time. He left an unfinished novel, *Denis Duval*, printed in 1867. Collected editions of his early writings appeared in the U. S. under the title *Miscellanies in Prose and Verse* (4 vols., 1855–57), and rival editions of his complete works are now published at Boston, New York, and Philadelphia. A collection of his fugitive articles was issued by James T. Fields as *Early and Late Papers* (Boston, 1867). *The Orphan of Pimlico, and other Sketches, Fragments and Drawings* (1875) was edited by his daughter. A volume of his inimitable caricatures and marginalia has since appeared as *Thackerayana* (1876). No formal biography has been written, but James Hannay, Theodore Taylor, and William B. Reed have published valuable monographs.

PORTER C. BLISS.

**Thaer** or **Thär** (ALBRECHT DAVID), b. at Celle, Hanover, May 14, 1752; studied medicine and natural sciences at Göttingen; was appointed court-physician at Hanover in 1780; established an agricultural school at Celle in 1790; removed in 1804 to Berlin; founded the Royal School of Agriculture at Mögelin, near Potsdam, in 1807; was appointed professor of political economy and agriculture at the University of Berlin in 1810. D. at Mögelin Oct. 26, 1828. He wrote—*Einleitung zur Kenntniss der englischen Landwirthschaft* (3 vols., 1798–1804), *Ueber die feinwöllige Schafzucht* (1811), *Leitfaden zur allgemeinen landwirthschaftlichen Gewerbslehre* (1816), and *Grundsätze der rationellen Landwirthschaft* (4 vols., 1809), which work has been often reprinted, and translated into English by W. Shaw and C. W. Johnson (London, 1844; New York, 1849).

**Tha'is,** an Athenian courtesan, as celebrated for her wit as for her beauty, accompanied Alexander the Great on his expedition into Asia, and is said to have instigated him, during a festival at Persepolis, to set fire to the palace of the Persian kings in revenge for the calamities which Xerxes had brought on her native city. After the death of Alexander, she entered into a connection with Ptolemy Lagi, king of Egypt, who is said to have married her, and to whom she bore two sons and a daughter.

**Thal'berg** (SIGISMUND), b. at Geneva Jan. 7, 1812, a natural son of Prince Dietrichstein; received his musical education at Vienna under the guidance of Hummel, and made his first concert-tour as a pianist in 1830; visited subsequently all the larger cities of Europe; went in 1855 to Brazil, in 1856 to the U. S., in 1863 again to Brazil. D. at his villa, near Naples, Apr. 27, 1871. His compositions for the piano, mostly consisting of *fantaisies* upon opera airs, and his two operas, *Florinda* and *Christina di Suezia*, are not of great interest, but as a performer he acquired a wide celebrity.

**Tha'ler** [for etymology, see DOLLAR], a coin and money of account in several European countries. The new German *Thaler* of silver is worth $0.729. The Norwegian specie *daler* is equal to $1.107. Denmark has a gold ten-thaler piece worth $7.861.

**Tha'les** [Θαλῆς], the earliest of the Greek philosophers, with justice called "the father of philosophy," b. at Miletus about 640 B. C., and d. about 550. He was of Phœnician descent, and his father's name appears to have been Examuel (perhaps *Samuel;* see *Acta Societat. Philolog. Lipsiensis*, vol. iv. p. 328 *seq.*). He was one of the Seven Sages, a practical man, an astronomer and a mathematician, as well as a philosopher. He was the first man in the Western World who placed reason above sense, looking for the ground of things in the former—*i. e.* in an abstraction. He defined his abstract, universal ground of things as *water*, being led to this, perhaps, by observing that all nourishment contained moisture. (See Aristotle, *Metaph. A*, 3.) He may be said to have been the discoverer of Material Cause, although of course he made no distinction between matter and form, or between being and becoming. Still less had he any notion of efficient or final cause, although, having observed the action of the loadstone, he affirmed (according to Diogenes Laertius) that all things were full of spirits (δαίμονες). Thales left no writings behind him, and even in Aristotle's time considerable doubt prevailed regarding his opinions. The chief sources of our knowledge respecting him are Aristotle and Diogenes Laertius. (Cf. Byk, *Die Vorsokratische Philos. der Griechen*, vol. i. pp. 25–34.) He is said by Herodotus (i. 74) to have predicted an eclipse of the sun which happened, according to Ottmanns, in B. C. 609; according to Airy (*Philosophical Transactions*, vol. cxliii. p. 179), in 585.

THOMAS DAVIDSON.

**Thali'a,** in Greek mythology, one of the nine Muses, presided over dramatic and idyllic poetry; later, more especially over comedy, and was generally represented with a mask in one hand and a shepherd's staff in the other.

**Thal'lium** [Gr. θαλλός, "young shoot"], one of the rarer elements, a metal, discovered in 1861 almost simultaneously by Lamy in France and Crookes in England, working independently of each other, by means of the spectroscope. It is characterized by a green band, which makes up *its whole spectrum*, and hence the name given by Crookes (from θαλλός, a "branch," "sprig," or "sprout"—a rather far-fetched derivation).

*Occurrence.*—Found as a small constituent of some iron and copper pyrites found in many parts of the world, in both native and artificial sulphur, in blende and calamine, in lepidolite, in mother-liquors of saltworks at Nauheim, etc.

*Preparation.*—The most productive source of thallium has been from the condensed fume found in the flues of furnaces in which thalliferous pyrites is burned for the manufacture of sulphuric acid. The dust from these flues is washed with boiling water, which dissolves sulphate of thallium; muriatic acid is then added to precipitate thallous chloride, TlCl, which is nearly insoluble in cold water. The impure chloride is treated with hot oil of vitriol, and the resulting acid-sulphate fused, dissolved in water, and treated with sulphuretted hydrogen, which may throw down some lead, silver, mercury, antimony, arsenic, or bismuth; the filtrate boiled with excess of ammonia, which separates iron and alumina, and then concentrated. On cooling, pure sulphate of thallium separates in long prisms. From the solution of this salt metallic thallium may be obtained by precipitation with metallic zinc or by electrolysis. It deposits in brilliant metallic plates and needles, like those of the so-called tin tree. It is best preserved, according to Böttger, under water which has been boiled to remove free oxygen. In the air it easily oxidizes almost like sodium and potassium. Willm ob-

tains the pure metal by decomposing the oxalate in a glass tube by heat, and fusing the residual metal.

*Properties.*—It is nearly as white as silver, with a high lustre. The densities on record, eight in number, indicate, by the geometric law of volumes of the writer (see *Am. Chemist*, Mar., 1876), four distinct allotropes, of which the densities, computed by the law for zero Centigrade, and obtained by experiment at normal temperatures, are as follows:

| Computed. | | |
|---|---|---|
| 11.794 | 11.777 | Werther. |
| 11.825 | 11.81 | Cast thallium, Crookes. |
| 11.87 | 11.862 | Lamy. |
| 11.938 | 11.91 | Wire, Crookes. |

It is a very soft metal, easily scratched by the nail, and even softer than lead. It marks paper like lead. Like the latter, it is almost or quite destitute of elasticity, and acquires none by hammering or rolling. It is nevertheless crystalline in its internal structure, and gives, when bent, a "cry" almost equal to that of tin. It fuses about 555° F., expanding considerably. Its density in fusion has not been ascertained. It may be *welded* perfectly at the ordinary temperature by pressure, like the soft alkali-metals. Its spectrum is the simplest one known, and becomes no more complex at intense temperatures in flames, but in sparks from an induction coil, between thallium points, five more lines come out, and the photographic spectrum is by no means simple. Thallium has not been recognized in the sun. It is strongly diamagnetic, nearly as much so as bismuth, and conducts electricity about like tin and lead. At a red heat it volatilizes in the air, giving brown-colored oxidized vapor, and boils at a heat below whiteness. Hydrogen passed over the highly-heated metal carries it along in vapor, and such hydrogen, even when cool, retains enough thallium to burn with a bright-green color. It burns brilliantly in oxygen. It is attacked with some difficulty by dilute sulphuric acid, but scarcely at all by muriatic acid; by nitric acid with violence. Its salts are highly poisonous, and some of them are sensitive to light, like silver-salts, and might be used in photography, though not sensitive enough to possess any advantages. It alloys with copper to a hard, brittle, white compound; with lead, to a malleable alloy; with platinum, very readily, with evolution of great heat; with tin, to a malleable compound. Mercury readily amalgamates it, forming a crystalline mass.

*Compounds of Thallium.*—This metal and its compounds are as yet but curiosities of the laboratory, and for details of its compounds the chemical textbooks must be consulted. Its protochloride is with difficulty soluble, like chloride of lead. It forms also a sesquichloride in yellow crystalline scales. It forms two oxides, $Tl_2O$ (being monatomic, like silver and the alkali-metals) and $Tl_2O_3$. The compound formed by thallous oxide with $H_2O_2H_2Tl_2$, called hypothetically "thallous hydrate," is soluble in water, like hydrate of baryta. Lamy made a glass containing thallous and plumbous oxides—about 7.25 per cent. of the first—which had a density of 4.233, which was more refractive, as well as denser, than any other known glass. HENRY WURTZ.

**Thal'lus** [Gr. θαλλός, a "shoot"], in cryptogamic botany, an expanded structure which may be regarded as a fusion into one mass of what in the higher grade of plants would be root, stem, leaves, etc.; in its simpler forms reduced to separate threads or rows of cells. The term is practically restricted to the lower orders of the Cryptogamia. See LICHENS.

**Thames,** a river of England, rises under the name of Isis (*Tamises*, signifying the "broad Isis," and *Isis*, signifying "water") near Cirencester, at an elevation of 376 feet above the level of the sea, and flows in an eastern direction to the North Sea. At London Bridge its width is 290 yards; at Woolwich, 490 yards; at Gravesend, 800 yards; 3 miles below Gravesend it expands into a large estuary, 6 miles broad at its mouth, at the Nore Light. Its entire course is about 250 miles, and it is navigable for vessels of 1400 tons burden up to Blackwall, 6 miles below London Bridge, and barges may ascend as far up as 200 miles from the mouth. Through a vast system of canals it communicates with the southern and western coasts.

**Thames,** a river of the province of Ontario, Canada, flows in a S. W. course for 160 miles, and then enters Lake St. Clair. The towns of London, Chatham, and Oxford are on this river. It is navigable by vessels of 8 or 10 feet draught to Chatham, 18 miles, but there is a troublesome bar at the mouth of the river.

**Thames,** a river in Connecticut, is formed at Norwich by the junction of Yantic, Shetucket, and Quinebaug rivers. It is a navigable tidal channel 14 miles long, and reaches the sea at New London, lat. 41° 18′ 58″ N., lon. 72° 5′ 4″ W.

**Thames'ville,** p.-v., Bothwell co., Ont., Canada, on the river Thames and on Great Western Railway, 50 miles S. W. of London, has a weekly newspaper, and was formerly called *Tecumseh*. P. about 500.

**Thanatophid'ia** [from θάνατος, "death," and *Ophidia*, from ὄφις, a "serpent"], a name given to those ophidians or serpents provided with poison-glands and fangs, and thereby capable to a greater or less degree of inflicting deadly wounds. The group, however, is rather a physiological than a morphological one, and embraces forms differing widely in structure. The only common and at the same time exclusive character, indeed, is the possession of poison-fangs, and some or other teeth channelled or hollowed to serve as ducts and media of ejection. Exclusive of some suspicious colubrids, the true poisonous snakes belong to seven families, which may be grouped under two primary divisions—viz. (1) Solenoglypha, comprising the families Crotalidæ, Viperidæ, Causidæ, and Atractaspididæ; and (2) Proteroglypha, embracing the families Najidæ, Elapidæ, and Hydrophidæ. THEODORE GILL.

**Thane** [Ang.-Sax. *thegen*, a "servant"], in English history, was the title among the Anglo-Saxons and early Normans of certain military tenants and freeholders in the king's service. Subsequently classed with the barons, the title of the thanes disappears in Henry II.'s time, and doubtless the descendants of the more powerful became nobles, while the less wealthy as a rule seem to have become heads of gentle but not noble families. In Scotland the thanes were a class of non-military tenants of the Crown. The opinion that the Scottish title *thane* was equivalent to *earl* is entirely erroneous.

**Than'et, Isle of,** is the north-eastern extremity of the county of Kent, England, separated from the mainland by the branches of the river Stour, and comprising an area of 26,500 acres, with about 40,000 inhabitants. The ground is elevated, the surface level, and the soil fertile though light. It contains three fashionable watering-places—Ramsgate, Margate, and Broadstairs.

**Thanks'giving Day,** an annual religious festival in the U. S., celebrated in New England from the first settlement by the Pilgrims, and long peculiar to the Northern States of the Union, but which in recent times has extended to nearly all the States, and has become a national institution since 1862. The day, which is usually the fourth Thursday of November, is designated by a proclamation signed by the governor or the President.

**Thann,** town of the German empire, province of Alsace, has a fine church of the fifteenth century with an elegant spire of open-work, and large manufactures of cotton and linen fabrics, chemicals, machinery, dyestuffs, and leather. P. 8854.

**Tha'sos,** an island in the Ægean Sea, 30 miles N. E. of Mount Athos, belongs to Turkey, and comprises an area of 85 sq. m., with about 6000 inhabitants. It is high, mountainous, covered with wood, but not very fertile. Timber, honey, marble, and oil are exported.

**Thatch'er** (BENJAMIN BUSSEY), b. at Warren, Me., Oct. 8, 1809; graduated at Bowdoin College 1826; became a lawyer at Boston; was a frequent writer for the press, especially during two years' travel and residence in Europe 1836–38. D. at Boston July 14, 1848. Author of *Indian Biography* (New York, 2 vols., 1832), *The Boston Tea-Party* (1835), *Tales of the American Revolution* (1846), and other publications; edited the *Boston Book* (1837); contributed eight articles to the *North American Review*, and left in MS. an account of his travels in Europe.

**Thatcher** (HENRY KNOX), b. May 26, 1806, in Maine; entered the navy as a midshipman Mar. 4, 1823; became a lieutenant in 1833, commander in 1855, commodore in 1862, rear-admiral in 1866; retired in 1868. Commanded the first division of Porter's fleet in both the Fort Fisher fights, and the West Gulf squadron during the bombardment of Fort Alexis and Spanish Fort in Apr., 1865, just prior to their being stormed and carried by the army, their surrender being immediately followed by that of the city of Mobile. In his official report of Jan. 28, 1865, Rear-Admiral Porter says: "Commodore Thatcher's ship, the Colorado, was handled with admirable skill. There is no reward too great for this gallant officer; he has shown the kind of ability naval leaders should possess, a love of fighting and invincible courage." FOXHALL A. PARKER.

**Thaumaturgus, St. Gregory.** See GREGORY THAUMATURGUS.

**Thay'er,** county of S. E. Nebraska, formed since the census of 1870; intersected by Little Blue and Big Sandy rivers, and crossed in its N. part by St. Joseph and Denver City R. R.; surface mostly undulating prairie, soil fertile. Cap. Hebron. Area, 576 sq. m.

**Thayer,** p.-v., Neosho co., Kan., on Leavenworth Lawrence and Galveston R. R., has an excellent school system, 1 bank, 1 newspaper, rich coal-deposits, 3 dry-goods houses, and a Masonic hall. P. about 500.

C. T. Ewing, Ed. "Head Light."

**Thayer** (John Milton), b. at Bellingham, Mass., Jan. 24, 1820; graduated at Brown University; studied law and came to the bar; went to Nebraska, where he became brigadier-general of militia and member of the Territorial legislature; in Mar., 1863, was appointed brigadier-general of volunteers for services at Fort Donelson and Shiloh; Senator from Nebraska for the term ending 1871, and was appointed governor of Wyoming 1875.

**Thayer** (Joseph Henry), D. D., b. in Boston, Mass., Nov. 7, 1828; graduated at Harvard in 1850, and at Andover in 1857; supplied the Evangelical Congregational Church in Quincy, Mass., one year; was settled over the Crombie street church in Salem, Mass., Dec. 29, 1859; was chaplain of the 40th Massachusetts Vols., nine months, from Sept., 1862; and was dismissed from his pastorate in Feb., 1864, to accept the associate professorship of sacred literature in Andover Theological Seminary, which position he still (1876) holds. Besides occasional sermons, review articles, and contributions to the American edition of Smith's *Bible Dictionary*, he has published a translation of the 7th German ed. of Winer's *New Testament Grammar*, on the basis of Masson's English translation of the 6th ed. (1869), and a translation of Alex. Buttmann's *New Testament Grammar* (1873). He received the title of D. D. from Yale College in 1873.

R. D. Hitchcock.

**Thayer** (Lorenzo Rockwood), D. D., b. at Winchester, N. H., Dec. 2, 1814; graduated at Wesleyan University 1841; has held important pastorates in the Methodist Episcopal Church, and was one of the trustees of Harvard University 1857–69.

**Thayer** (Simeon), b. at Mendon, Mass., Apr. 30, 1737; removed to Rhode Island in youth; served in Rogers's Rangers in the French war, in Arnold's expedition against Quebec, where taken prisoner 1775–76; distinguished for gallantry at Red Bank and at Fort Mifflin, for which he received a sword from the Rhode Island legislature. D. at Cumberland, R. I., Oct. 14, 1800. His *Journal of the Invasion of Canada* was edited by E. M. Stone in 1867.

**Thayer** (Sylvanus), b. at Braintree, Mass., June 9, 1785; received a classical education at Dartmouth College, and Feb. 23, 1808, graduated, after an eleven months' course, at the U. S. Military Academy, and promoted to a second lieutenancy of engineers. After some service in the defences of the eastern coast and of New York harbor, he was called to the field in 1812, and was chief engineer to Gen. Dearborn on the Niagara frontier; of the right division of the Northern army under Gen. Hampton on Lake Champlain line of operations in 1813; of Gen. Moses Porter's troops in the defence of Norfolk, Va., in 1814, where he was brevetted major Feb. 20, 1815. Subsequently ordered for professional duty to Europe, he had opportunities of witnessing the operations of the allied armies before Paris, and of studying the military works and schools of France, the Netherlands, etc., and examining the battle-fields and theatres of war. In after life there was probably no other living man (save perhaps Jomini) so thoroughly and minutely acquainted with the campaigns of Napoleon. In July, 1819, he was selected as superintendent of the Military Academy, which office he filled for fifteen years, during which time that institution was organized upon its present basis, and under his administration became one of the most thorough, comprehensive, and successful of the military educational institutions of the world. (See Military Academies.) On being relieved from the superintendency July 1, 1833, he was charged with the construction of the fortifications of Boston harbor, upon which, in union with his duties as president of the "board of engineers for permanent fortifications," he was engaged during the remainder of his term of active service. During a period embracing parts of 1857 and 1858 he was in command of the corps of engineers, exercising the functions of chief engineer of the U. S. Consistently with long-maintained views on this point, he declined to transfer his headquarters to Washington, and on his own application was placed on leave of absence. He so remained till July 1, 1863, when he was placed on the retired list with the rank of colonel. Previous to his death he had founded at Dartmouth College the Thayer School of Civil Engineering. He had also bestowed the sum of $10,000 upon the town of S. Braintree for the establishing of a public library; and in his will ("desirous of promoting the cause of education according to my ability, and of benefiting the town of Braintree, the place of my birth"), he bequeathed a large sum in trust (estimated at about $260,000) for a free school, limited to scholars who "shall have been born in Quincy, Braintree, or Randolph." The secretary of war, in announcing his death in orders, said: "The great worth and services of this veteran soldier are gratefully remembered by the graduates of the Military Academy, of which he is justly styled 'the Father,' and his name will be entwined with the laurels which many of them have gained on the battle-field." D. at South Braintree Sept. 7, 1872.

J. G. Barnard.

**Thayer** (Thomas Baldwin), D. D., b. at Boston, Mass., Sept. 10, 1812, and educated in that city; was ordained Dec. 5, 1832, and was pastor in Lowell, Mass., from 1833 to 1845, then from 1845 to 1851 in Brooklyn, N. Y.; in 1851 returned to Lowell until 1857; from 1857 to 1867 was pastor at Boston, Mass. He is editor of *The Universalist Quarterly*, and has been one of the board of overseers of Harvard College, Mass. He has published *Christianity against Infidelity*, the *Theology of Universalism*, etc.

**Thayer** (William Makepeace), D. D., b. at Franklin, Mass., in 1820; graduated at Brown University 1843; was pastor of a Congregational church at Ashland, Mass., 1849–68; subsequently returned to Franklin. Author of numerous juvenile works, including a series of biographies and a *Youth's History of the Rebellion* (4 vols., 1864–66); editor of the *Home Monthly* and the *Mother's Assistant*, and contributor to the *Puritan Recorder* and the *Congregationalist*.

**The'atines** [named from the bishop of *Theate*, afterward Pope Paul IV.], a Roman Catholic order of regular clerks and nuns, founded in 1524 by the bishop of Theate and several of his friends. They spread into various countries, opposed Protestantism, and labored for the reform of the clergy and the extension of the Oriental missions. They are now almost entirely confined to Italy. There were two bodies of Theatine nuns, those of the Congregation and those of the Hermitage, both extinct.

**Theatres, Laws as to.** In the old English law, whether common or statutory, playhouses were controlled by very stringent rules. Strolling actors, like mountebanks who travelled about the country exhibiting themselves without a license, were classed among vagrants. Although a playhouse erected in a city or town was not a nuisance *per se*, it might become such if it occasioned a disturbance in its neighborhood or if the performances therein were considered as injurious to good morals. At a very early day a special license from the lord chamberlain appears to have been requisite in order to open and maintain a theatre in any important city or town, while in smaller country places the license was granted by the local courts called the quarter or general sessions. Particular companies of actors, however, were often maintained by the king, who probably performed by virtue of his license, and for whom he sometimes made the selection of plays, as was frequently the case during the reign of Queen Elizabeth. In the process of time, as actors began to rely more upon the general support of the public than the private patronage of king and nobility, the jurisdiction over them, over the licensing and regulation of theatres, and over the production of plays became at length exclusively settled in the lord chamberlain. No new play or addition to an old one could be enacted unless it had first been submitted to the lord chamberlain for his examination, and had received his license. This peculiar function—which for a long time was freely exercised—still exists in England, although the license is granted almost as a matter of course, unless the substance of the play or its mode of acting should be personally libellous or grossly immoral. In the various States of the U. S. the authority to license and to regulate theatres has been almost exclusively left to the municipal corporations as a part of their local government. New York, and perhaps some other States containing great cities, have placed upon their statute-books some prohibitory legislation against certain classes of theatres which are grossly outrageous to public decency and exceedingly corrupting to the morals of the young. With these few exceptions, the law has seldom interfered further than to require a license and to demand payment of the fee.

John Norton Pomeroy.

**The'baine,** or **Paramorphine** ($C_{19}H_{21}NO_3$), an organic base contained in Opium (which see). It was discovered in 1835 by Pelletier. In its preparation the extract of the opium is treated with an excess of milk of lime, and the resulting precipitate washed with water, dried, and then digested with hot alcohol, which upon evaporation deposits a residue from which the alkaloid is extracted by ether. Thebaine crystallizes in square prisms possessing a silvery lustre, and an acrid and styptic taste. It is highly poisonous, producing tetanic symptoms. It is insoluble in water, but dissolves readily in alcohol, in benzene, and in chloroform; fuses at 125° C., and is colored deep red by concentrated sulphuric acid. The salts of thebaine do not crystallize easily from aqueous solutions.

J. P. Battershall.

**Thebes,** the *Diospolis* of the Greeks, the *No* or *No-Ammon* of Scripture, was for a long time the capital of Egypt, and was regarded by the ancients as the oldest city of the world. It stood in Upper Egypt, in lat. 25° 41′ N., on both sides of the Nile, and covered the whole plain between the two mountain-chains which enclose the valley of the Nile, being 3 miles broad and 5½ miles long. It was one of the largest and most magnificent cities which has ever been built; but when Lower Egypt began to rise and Memphis became the seat of the government, it began to decline. In 525 B. C. Cambyses conquered and sacked it, and in 86 B. C. Ptolemy Lathyrus pillaged it and left it in ruins. These ruins, however, are most stupendous, and give evidence of an art gigantic in its dimensions, sublime in its beauty, and most admirable in its skill; the celebrated head in the British Museum known under the name of the Young Memnon, and the famous obelisk which adorns the Place de la Concorde in Paris, are both taken from the ruins of Thebes. The western part of the city seems to have consisted mostly of a number of palaces and temples rising in terraces from the bank of the Nile, connected with each other by magnificent flights of steps and avenues of colossal sphinxes, and leading to the necropolis of the city, rows and tiers of sepulchres and gorgeous mausoleums in which the mummies were deposited, and which, hewn into the natural rock, cover for miles the side of the mountains which separate the valley from the Libyan desert. Among the most conspicuous remnants of this part of the city are the two Memnon statues, 60 feet high, of which the one is preserved almost entire, and is much spoken of as the singing Memnon on account of the sound it emitted at sunrise. The eastern part seems to have contained the bulk of the population, but it also contained the palace of Luxor and the temple of Karnak, the main hall of which is 329 feet long, 179 feet broad, and 80 feet high, the roof of the central part of the hall resting on 10 columns 66 feet high and 11 feet in diameter, and that of the other parts on 122 columns of less gigantic dimensions (42 feet high, 9 feet in diameter), and of the most exquisite workmanship.

**Thebes,** town of Greece, is regularly laid out and well built. It has about 5000 inhabitants, and is celebrated for the excellent meerschaum which is dug on the adjacent Sphinx Mountain.

The ancient Thebes occupied the same site as the modern town, and was one of the most famous and most magnificent cities of Greece. It stood at the head of the confederacy of the Bœotian cities, and was always striving to get the supremacy in Greece. It fought Athens, but without success. But when the Spartans, after the Peloponnesian war, became supreme in Greece, it was Thebes which checked them. After the decisive victory of Leuctra in 371, and as long as Epaminondas lived, Thebes was the leading city of Greece, but in her wars with Philip of Macedon she was unfortunate, and was compelled to receive a Macedonian garrison within her walls. On the death of Philip she expelled the foreign garrison, and called on all Greece to fight for its independence. But she thereby excited the anger of the young Alexander to such a degree that, with the exception of the temples and the house of Pindar, he razed the whole city to the ground and sold the inhabitants into slavery. It was rebuilt by Cassander, but did not prosper.

**Thebes,** tp., Alexander co., Ill. P. 473.

**Thecodon′tia** [Gr. *θήκη*, "case," and *ὀδούς*, "tooth"], a name formerly employed by Owen, as well as Cope, for certain reptiles now referred to the order of Crocodilians, and based primarily on the genus *Belodon* of the "keuper beds" of Würtemberg. By Cope it was characterized by having "limbs ambulatory; *a third trochanter on femur;* sacrum of two or three vertebræ; acetabulum entire; *pubes united;* ribs double-headed; *external nostrils posterior;* zygapophyses only, and chevron bones (*sic*)." (Cope, *Trans. Am. Phil. Soc.*, vol. xiv. p. 32.) The italicized parts of the diagnosis exhibit the peculiarities in contrast with the living crocodiles. THEODORE GILL.

**Thecomed′usæ** [from *θήκη*, "case," and *medusa*, a general name for acalephs], an order of acalephs recently instituted by Prof. Allman for a very small form occurring in the efferent orifices of certain horny sponges at slight depths off the southern coasts of France. It is a compound form "whose zooids are included in cup-like receptacles resembling the hydrothecæ of the calyptoblastic hydroids; but these zooids, instead of being constructed like the hydranths of a hydroid, are formed on the plan of a medusa. It has plainly very decided affinities with the Hydroida, but is nevertheless removed from these by a distance at least as great as that which separates from them the Siphonophora." For this new form—at once the type of a new family (Stephanoscyphidæ) and order (as above)—the name *Stephanoscyphus mirabilis* has been proposed. (Consult *Nature*, vol. x. p. 251, July 30, 1874.)

THEODORE GILL.

**The Dalles,** p.-v. and cap. of Wasco co., Or., has a weekly newspaper.

**Thedford,** Canada. See WIDDER STATION.

**Theed** (WILLIAM), b. at Trentham, England, in 1804; educated at Ealing, and became eminent as a sculptor. Among his works are several marble and bronze statues of Prince Albert, statues of Sir Isaac Newton, Edmund Burke, Hallam, Mackintosh, Sir Robert and Sir William Peel.

**Theft.** See LARCENY, by PROF. GEORGE CHASE.

**The Gold Mines,** tp., Franklin co., N. C. P. 932.

**The′ine** ($C_8H_{10}N_4O_2.H_2O$), the alkaloid of tea and coffee. (See CAFFEINE, and TEA, PHYSIOLOGICAL RELATIONS OF.)

**Thei′ner** (AUGUSTIN), b. at Breslau, Prussian Silesia, Apr. 11, 1804; studied theology, philosophy, and jurisprudence at the university of his native city; obtained the degree of *doctor juris* at the University of Halle for his *Commentatio de Romanorum Pontificum Epistolarum Decretalium Collectionibus antiquis* (1829); travelled with the support of the Prussian government to Vienna, Paris, and London; settled in 1831 in Rome, and was in 1851 appointed keeper of the secret archives of the Vatican. D. at Cività Vecchia Aug. 9, 1874. He held originally quite liberal views of the relation between the papal see and the Roman Catholic Church; he assisted his brother in the publication of *Die Einführung der erzwungenen Ehelosigkeit bei den christlichen Geistlichen und ihre Folgen* (2 vols., 1828). But during his residence in Rome he attached himself more and more closely to the Ultramontane party, and developed an astonishing literary activity in its service. Besides a number of minor essays and pamphlets, historical, critical, and polemical, he wrote—*Geschichte der geistlichen Bildungsanstalten* (1835), *Disquisitiones in præcipuas Canonum et Decretalium Collectiones* (1836), *Versuche und Bemühungen des Heiligen Stuhls in den letzten drei Jahrhunderten, die durch Ketzerei und Schisma von ihm getrennten Völker des Nordens wiederum mit der Kirche zu vereinen; nach geheimen Staatspapieren* (1837), *Die neuesten Zustände der katholischen Kirche beider Ritus in Polen und Russland seit Katharina II.* (1841), *Geschichte der Zurückkehr der regierenden Häuser zu Braunschweig und Sachsen in den Schoss der katholischen Kirche* (1843), *Die Staatskirche Russlands im Jahre 1839* (1844), *Le cinque Piaghe della S. Chiesa* (1849), *Zustände der katholischen Kirche in Schlesien von 1740–58* (2 vols., 1852), *Geschichte des Pontificats Clemens XIV.* (2 vols., 1852), *La Souveraineté temporelle du Saint-Siège* (1861), etc. But his principal works are his new edition and continuation of Baronius's *Annales Ecclesiastici*, and his publications of documents relating to the history of the Church among various nations—*Documents inédits relatifs aux Affaires religieuses de la France 1750–1800* (2 vols., 1858), *Vetera Monumenta Hungariam sacram illustrantia* (2 vols., 1859), *Monuments historiques relatifs aux Règnes d'Alexis Michaélowitsch, Theodor III. et Pierre le Grande de Russie* (1859), *Vetera Monumenta Poloniæ Gentiumque Finitimarum Historiam illustrantia* (4 vols., 1860–64), *Codex diplomaticus Dominii temporalis Sanctæ Sedis* (3 vols., 1862), *Vetera Monumenta Slavorum meridionalium Historiam illustrantia* (1863), and *Vetera Monumenta Hibernorum et Scotorum Historia illustrantia* (1864).—His elder brother, JOHANN ANTON THEINER, b. at Breslau Dec. 15, 1799, was appointed professor of scriptural exegesis in 1824; became a pastor in 1830; resigned his office in 1845, and joined the German Catholics; lived as a private teacher in Breslau, and was appointed secretary of the library of the university in 1855. D. May 15, 1860. He wrote, besides the above-mentioned work on celibacy, *Die reformatorischen Bestrebungen in der katholischen Kirche* (1845), *Das Seligkeitsdogma der römisch-katholischen Kirche* (1847), *Acts of the Council of Trent* (2 vols., 1866), etc.

**The′ism** [Gr. Θεός, "God"] is distinguished from pantheism by the relation which it establishes between God and the world, and from deism by the relation which it establishes between God and man. To the pantheist, God and the world are one and the same, even though his idea of the divine may approach very near to that of a free personality; while to the theist, God is not only an existence, with all the attributes of personality, but also absolutely independent of the world. In the abstract the deist's idea of God may be very similar to that of the theist, but as he rejects the doctrine of God's revelation to man, he denies that whole series of relations between God and man which to the theist results from that very doctrine. (See PANTHEISM, by DR. KRAUTH, and FREE-THINKERS, by O. B. FROTHINGHAM.)

**Theiss,** a river of Hungary, is formed by the junction of the Black and White Theiss, both of which rise in the Carpathian Mountains, and flows with a winding southern course to the Danube, which it joins 22 miles E. of Peterwardein. Its entire length is 828 miles, for the greatest part of which it is navigable even for large vessels. After entering the Hungarian plain, its breadth is from 400 to 800 feet, its shores are low and marshy, and its current is sluggish. It is rich in fish, especially sturgeon.

**Thel'wall** (JOHN), b. in London, England, July 27, 1764; was for a short time apprenticed to a tailor; studied law for several years, but from conscientious scruples did not apply for admission to the bar; went through an extensive course of private study in literature, metaphysics, and theology; afterward pursued anatomy, physiology, and chemistry; devoted himself to literature and politics; edited a magazine for some time; became a prominent orator in the societies favoring the French revolution; was thrown into the Tower, tried for treason, and acquitted along with John Horne Tooke and Thomas Hardy 1794; lectured on politics and political history for several years; began his career as a teacher of elocution 1801, meeting with great success in curing stammering and other defects of utterance, and communicated papers on that subject to medical and other journals, in which he anticipated some of Dr. Rush's leading principles. D. at Bath Feb. 17, 1834. Author of *Poems on Several Subjects* (2 vols., 1787), *Poems written in the Tower and in Newgate* (1795), *The Tribune* (3 vols., 1796), *Political Miscellanies*, *The Peripatetic* (3 vols., 1793), a novel entitled *The Daughter of Adoption*, and other publications. His *Life* was published by his widow (1837).

**The'mis,** a daughter of Uranus and Ge, the wife of Zeus, and mother to the Horæ, Eunomia, Dice, Eirene, the Mœræ, the Hesperides, etc., lived in Olympus on good terms with Hera, and held the office of convening the assembly of the gods. She represented the order of things, such as it was established by law, custom, and equity, and was imagined to preside over the assemblies of men. She was worshipped at Thebes, Olympia, Athens, Tanagra, and Trœzene, and was generally represented as resembling Athena, but having in her hands a horn of plenty and a pair of scales.

**Themis'tocles,** b. at Athens about 514 B. C., the son of Neocles, who occupied no prominent social position, and a foreign—that is, not Athenian—woman; became the political leader of Athens after the expulsion of Aristides by ostracism in 483. He was impetuous and shrewd; sagacious in his judgment of actual circumstances and their probable consequences; swift in arriving at a resolution; inexhaustible in devices for the realization of his plans; possessed of a most impressive eloquence; energetic, cunning, and unscrupulous. But the foundation of his character is very obscure. His actions show a blending of rank ambition and lofty statesmanship; of egotism sometimes even sordid, and an elevation of mind truly noble, which simply becomes the more inexplicable the better known his ways and means become. Nevertheless, in a most decisive crisis he was the saviour of Athens—yea, of Greece. After the battle of Marathon (490) people generally believed that the Persian war was ended. Themistocles, however, felt that a still heavier storm was coming, and he understood that a strong fleet would be the most effective means of victory, and the only safe means of rescue in case of defeat. Thus, the development of the Athenian navy became the goal of his policy. He induced his countrymen to spend the income of the silver-mines of Laurium, which had hitherto been distributed among the citizens, in the organization of a powerful fleet. He carried a law that twenty new triremes should be built every year. He procured, when the armament of Xerxes was heard of, and the whole of Greece became alarmed, an oracle from Delphi saying that Athens should defend herself by wooden walls—that is, by her fleet; and when, finally, the pass of Thermopylæ was forced, when the battle off Artemisium, in which he consented to fight under the Spartan commander, though the number of the Athenian ships was the greatest, had proved ineffective, and the Persian hosts streamed down over Bœotia and Attica, he persuaded the Athenians to leave their city to the protection of its tutelary deities, to bring their women and children in safety to the island of Salamis, and to go on board the fleet. In the Bay of Salamis the entire Greek fleet lay assembled; but various opinions prevailed in the council—whether to give battle here or at the isthmus, whether to give battle at all, or to separate, etc. It was Themistocles who held the fleet together by declaring that if the Greeks now separated the Athenians would leave Greece for ever, take their women and children, and set sail for Italy—a plan as sound as grand, and one which he no doubt was able to carry out. It was also he who finally compelled the Greeks to give battle by entering into negotiations with the Persian commander and hastening the approach of the Persian fleet. The Greeks were surrounded without knowing it, escape was impossible; fight had become a necessity. During the night Themistocles rowed from the Athenian division of the fleet to the Spartan, from the Spartan to the Corinthian, etc., busy to the last. In Salamis the women and children of Athens watched in prayer; on the opposite coast of the mainland carpenters were raising a throne from which Xerxes would look at the battle. In the morning (Sept. 20, 480) the Persian fleet stood up the narrow sound; the battle began, and it terminated in a most glorious victory for the Greeks. Themistocles was now the first man, not only in Athens but in Greece; when visiting Sparta, he was presented with the best chariot the nation possessed, and accompanied to the borders of Tegea by a guard of 300 horsemen—honors unheard of hitherto. To his native city he did one more great service. When, after the battle of Salamis, the Athenians began to rebuild their city, Sparta, from sheer jealousy, dissuaded them from rebuilding the fortifications, and even threatened them with an armed interference. Themistocles hastened to Sparta, bribed the ephori, deluded the assembly of the elders by lies and dissimulations, deceived the whole community, and kept the question floating and undecided until it became superfluous, the walls not only of Athens, but also of Piræus, having reached a sufficient height to be defended with effect. Then he returned home, loaded with the hatred of all Spartans. But soon after this event he disappears from public life. The last part of his history, that which follows after the rebuilding of Athens, is as obscure and confused as the first, that which precedes the expulsion of Aristides. He was accused of treasonable connections with the Persians, but acquitted; then ostracised in 471, exiled to Argos, and again accused of treason by the Spartans; an order to arrest him was issued, and he fled from Argos to Corcyra, Thrace, Ephesus, and arrived finally at Susa, the residence of the Persian king, in a covered carriage, such as was generally used to convey women to the royal harem. At the Persian court there was a party, headed by the widow of Xerxes, which demanded his execution immediately; but Themistocles understood how to impress the reigning monarch, Artaxerxes, so favorably that he was not only left unmolested, but received rich dotations and acquired considerable influence. Deeply implicated in the Persian plans for the subjugation of Greece, he d. suddenly at Magnesia in Asia Minor in 449 B. C.

CLEMENS PETERSEN.

**Thénard'** (LOUIS JACQUES), b. at La Louptière, Champagne, France, May 4, 1777; studied chemistry at Paris; became teacher in the École Polytechnique in 1798, professor at the Collége de France in 1804; was created a baron in 1821 and a peer of France in 1832. D. at Paris June 21, 1857. Besides a number of minor essays in *Annales de Chimie* and other scientific periodicals, he wrote *Traité élémentaire de Chimie théorique et pratique* (4 vols., 1813–16), which has been often reprinted, and translated into several foreign languages; and, in connection with his intimate friend, Gay-Lussac, *Physico-chemical Researches made with the Voltaic Pile* (2 vols., 1811).

**Thenard's Blue.** See BLUE and COBALT.

**Theo'bald** (LEWIS), b. at Sittingbourne, Kent, England, about 1690; educated at Isleworth, and became a lawyer, but devoted himself chiefly to literature; published *Electra, a Tragedy* (1714), *A Critical Discourse on Homer's Iliad* (1714), *A Translation of the First Book of the Odyssey* (1716), *The Censor*, a periodical (1717), *Memoirs of Sir Walter Raleigh* (1719), *The Double Falsehood* (1720), a play which he attributed to Shakspeare, and some 20 other plays, none of which had much success or are now remembered. He is chiefly known as a Shakspearian editor, having published *Shakespear Restored, or Specimens of Blunders committed and unamended in Pope's Edition of this Poet* (1726), which brought upon him the wrath of Pope, and procured him the post of hero of the first edition of the *Dunciad* (1729), and in 1733 issued an edition of Shakspeare (7 vols.) which completely superseded that of Pope. His emendations were few in number, executed with great care, and are acknowledged to possess great merit, having been reproduced without acknowledgment by many subsequent editors. D. in Sept., 1744.

**Theobroma.** See BYTTNERIACEÆ, CACAO, and THEOBROMINE.

**Theobro'mine** [Gr. Θεός, "God," and βρῶμα, "food"], ($C_7H_8N_4O_2$), an organic base present in cacao-beans, and therefore in chocolate. It is prepared by treating the beans with warm water, adding neutral plumbic acetate to the strained solution, conducting a current of sulphuretted hydrogen through the filtrate from the lead precipitate, evaporating the second filtrate, and by crystallizing from

alcohol. It may be further purified by heating between two watch-glasses, when it is obtained as a dazzling white sublimate. Theobromine is a colorless crystalline powder, but sparingly soluble in boiling water, and still less so in alcohol and in ether. It has a bitter taste, and gives crystalline salts with several of the acids. Upon heating argentic theobromide with iodide of methyl, CAFFEINE (which see) and argentic iodide are produced, which reaction is deemed by some to prove that caffeine is a methyl compound of theobromine, and not a true homologue thereof, as might be supposed from its formula.

J. P. BATTERSHALL.

**Theoc'ritus,** b. at Syracuse in the beginning of the third century B. C.; resided for some time in Alexandria, where he enjoyed the friendship of the poet Aratus and the favor of the king, Ptolemy Philadelphus, but returned afterward to Syracuse, and lived at the court of King Hiero II. He is the originator of the so-called pastoral or bucolic poetry. Besides 22 epigrams, 30 idyls by him have come down to us. These idyls give pictures of the every-day life of the Sicilian peasantry, and some of them have in this respect a very great interest; thus, the 21st idyl contains the only representation we possess of the life of the Greek fishermen. Their character is often erotic, sometimes tragical, sometimes humorous, even satirical, and their form ranges from that of an Anacreontic song to that of a Sophronian mime. Theocritus, however, is not only the originator of this genre of poetry, but also one of its best representatives. His delineation and sentiment are simpler, sounder, and more veracious than those of many later productions of the kind. Yet his idyls bear ample evidence of having been written at the court, and not in the field. They are not the genuine outbursts of the fisherman, the shepherd, the farmer's boy, etc., but a picture only in which a man finds comfort after being tired out by the intrigues of the court and the clamors of the philosophical school. The best editions are by Ahrens (Leipsic, 1855), Meineke (Berlin, 1856), Paley (Cambridge, 1869), and Fritsche (Leipsic, 1865). English translations by Creech (1681), Fawkes (1767), Polwhele (1786), Chapman (1836), and Calverly (1869).

**Theodolite.** See HYPSOMETRY, by C. A. SCHOTT, M. N. A. S.

**Theodo'ra,** b. in the island of Cyprus in A. D. 508, the daughter of one Acacius, who took care of the wild beasts of the green faction in Constantinople; became a pantomimic dancer after the death of her father, and was soon as notorious for her licentiousness as celebrated for her talent. Having gone through many adventures, she happened to attract the attention of the young prince Justinian, and by degrees she acquired so firm a hold on his passions that he married her in 525, and when he ascended the throne in 527 proclaimed her empress, and required all public functionaries to take the oath of allegiance not only in his own, but also in her name. She was a spirited and determined character, and the Byzantine historians generally agree in ascribing to her a considerable influence both on the emperor and on the government, even in ecclesiastical matters. At all events, her influence on the legislation of Justinian concerning the theatres is very apparent. At that time the theatrical manager was generally the owner of the members of his troop. They were perhaps not exactly his slaves, but he had bought them while children of their parents or guardians, perhaps for considerable sums; he had had them educated and trained them, and they were now legally bound to repay him by their services through a number of years. Thus, an illustrious actor whose name was known in every corner of the Mediterranean countries, and whose art brought in large sums every night, might be himself not only a poor man, but subjected to the most barbarous and humiliating treatment from a manager from whom he perhaps could not get loose until he drifted away an old, broken-down, valueless wretch. Still worse, the managers generally traded in the charms of their actresses, and when Theodora accompanied Ecebolus in great state to Pentapolis as his concubine, and soon after returned barefooted to Constantinople, she had perhaps learned that Ecebolus had made two bargains—one with her and one with her manager. All this was completely changed by the legislation of Justinian, and even the force of contracts already existing was broken by a law which determined that an actor who became a Christian, and felt his conscience hurt by his profession, could not be compelled to go upon the stage again. But after the enactment of such laws it became impossible for the managers to keep a troop together, and in the theatres, where once the free citizens had performed their tragedies and comedies to the honor of their gods, where afterward a number of speculating managers had exhibited the skill and the charms of their slave-troops to the appetite of the rabble, the stage now became silent and empty after the time of Theodora. D. at Constantinople in 548. CLEMENS PETERSEN.

**Theodore,** king of Abyssinia. See ABYSSINIA, by A. J. SCHEM.

**Theodore'tus,** b. about A. D. 393 at Antiochia, the only son of rich and influential parents; entered when only seven years old a monastery in his native city, and was in 420 elected bishop of Cyrus, or Cyrrhys on the Euphrates, where he d. in 457. In the discharge of his diocesan duties he was eminently successful, bringing back by his eloquence and power of persuasion numbers of heretics to the Catholic Church. At last, however, he himself was accused of heresy. He had a strong sympathy for Nestorius, and in 449 he was even deposed from his see by the synod of Ephesus, though he was reinstated by the synod of Chalcedon in 451. Of his works, comprising a history of heresies, a dialogue against Eutychianism, commentaries, etc., the *History of the Church from 325 to 429* is the most important; translated into English in 1854 in Bohn's "Ecclesiastical Library." Collected editions of his works by Schulze and Nösselt (Halle, 1769–74), and in Migne's *Patrologie grecque.*

**Theod'oric the Great,** b. about 455, the son of Theodemir, king of the Ostrogoths, who at that time were settled in Pannonia and Mœsia under the authority of the East Roman emperor; was educated at the Byzantine court, whither he was sent as a hostage while still a young boy, and where he spent about eleven years. In 475 he succeeded his father as king of his nation, and for some time was a true ally of Zeno, the Constantinopolitan emperor. But dissensions soon arose. Zeno feared the barbarian swarm which hung rather loose on the outskirts of his empire, and in 488 succeeded in persuading Theodoric to remove to Italy and fight the usurper Odoacer. Late in the fall the whole nation broke up, 200,000 warriors, it is said, on horseback, women and children and all movable property loaded on wagons drawn by oxen; and slowly this multitude moved toward the Alps to brilliant victory or complete annihilation; a third issue was an impossibility. Odoacer was defeated in three great battles—at the Isonzo, near Aquileia, Aug. 28, 489; at Verona, Sept. 27, 489; and on the Adda, Aug. 11, 490. He then shut himself up in Ravenna, was besieged there for over two years, and finally assassinated Mar. 5, 493, at a banquet shortly after he had surrendered himself. After his victories, Theodoric naturally considered the soil of Italy as belonging to himself—only the persons and the movable property were respected in those days—and a part of it, one-third, it is said, he partitioned out among his warriors, thus covering Italy with a network of Gothic military colonies. But in other respects he retained the administrative machinery of the Empire, and he understood how to work it. During his long reign Italy was not only quiet but progressive. In commerce and industry, in science and art, old damages were repaired and new undertakings started. Cassiodorus, Boethius, Symmachus, and other literary men of eminence lived at his court in Verona as his intimate friends. In his foreign policy he was also wise and successful, and among the German tribes he became a hero (*Dietrich of Berne*), around whose name legends grew thick during the Middle Ages. The last days of his life were sombre, however. He and the nation to which he belonged were Arians, and the Arians were persecuted throughout the Eastern empire. He tried to interfere, but failed. Embittered, he began to retaliate and persecute the orthodox in Italy. The pope was thrown into prison. In the heat of the conflict his passions, barbarian at the bottom, took fire, and he d. at Ravenna Aug. 30, 526, amidst murder and bloodshed. The magnificent mausoleum in which he was interred is still existing, at least partly, but after the overthrow of the Gothic authority in Italy the popes scattered to the winds the Arian dust of his body.

**Theodosia,** or **Feodosia.** See KAFFA.

**Theodo'sius,** a celebrated Roman general from whom a line of emperors descended, was sent in 367 by Valentinian I. to Britain; expelled the Picts and Scots, who had invaded the province and advanced, plundering and devastating, as far S. as the Thames; drove them back behind the rampart of Antoninus; strengthened the military positions on the frontiers, and restored security and order in the country. After his return (in 370) he was for some time stationed on the upper Danube, where he defeated the Alemanni, but in 372 was sent to Africa, where the maladministration of the governor, Count Romanus, had caused Firmus, one of the principal Moorish chiefs under Roman authority, to rise in revolt. Other chiefs had joined him, and Firmus even came into possession of the whole of Numidia and Mauritania. But Theodosius defeated him repeatedly in a long and very difficult though also very brilliant campaign, pursued him from place to place, and finally reduced the province to submission, Firmus strangling himself in despair. Short-

ly after, however (in 376), Theodosius himself was beheaded at Carthage by order of the emperor Valens, but for some unknown reason. The history of his campaigns in Britain and Africa is told by Ammianus Marcellinus.—His son, THEODOSIUS I., THE GREAT, Roman emperor from 379 to 395, was b. in Spain in 345, either at Italica, the birthplace of Trajan, or at Cauca in Galicia, and educated in his father's camp. He early received an independent command in Mœsia, and distinguished himself by a great victory over the Sarmatians in 374, but after the execution of his father in 376 he retired from public life and returned to his native place. After the defeat and death of Valens in the battle of Hadrianopolis (in 378), Gratian recalled him to the court, made him commander-in-chief against the Goths, and even declared him *Augustus* (Jan. 19, 379), placing Egypt, Asia, Thrace, Macedonia, and Dacia under his sceptre. The new emperor of the East was very successful. By shrewd negotiations he dissolved the union between the Ostrogoths and the Visigoths, drew the latter over to his side, and incorporated a considerable number of them in the Roman army, overpowered the former, and finally (in 382) succeeded in settling all the Goths as peaceful allies and *confederati* within the boundaries of the Roman empire. In 383, Gratian was defeated and killed by Maximus at Lyons, and Theodosius acknowledged the usurper as emperor of Britain, Spain, and Gaul, but secured Africa, Italy, and Illyricum for Gratian's brother, Valentinian II. In 387, however, Maximus broke from Gaul into Italy, and the weak Valentinian II. and his mother Justina, who was the true regent of the empire, fled for safety to Theodosius. Theodosius, who had first been married to a Spanish woman, Placilla, who bore him Arcadius, Honorius, and Pulcheria, but who now was a widower, became so infatuated with Valentinian's beautiful sister, Galla, that he promised to restore him to the throne in order to obtain her hand. Maximus was defeated and put to death in 388, and Valentinian II. was reinstated as emperor of the West, but in 392 was killed by Arbogastes, who, not venturing to assume the purple himself, raised the rhetorician Eugenius to the throne. Theodosius hesitated long before he entered on a new war, but in 394 he marched against Eugenius and Arbogastes, and defeated them at Aquileia, thereby uniting the whole Roman empire under his sceptre. He died shortly after, however (Jan. 17, 395), at Milan, leaving the Eastern empire to Arcadius, the Western to Honorius. Theodosius was very zealous in all religious matters, and this contributed, probably, more than his political and military successes, to his great fame with the after-world. Constantinople was at that time the chief seat of Arianism, but the emperor was educated and—shortly after his accession to the throne—baptized into the orthodox Church. Damophilus, the Arian archbishop of Constantinople, was deposed, exiled, and succeeded by Gregory of Nazianzen in 380. In 381 an œcumenical council was held in Constantinople to confirm the Nicene Creed and condemn all different opinions; and afterward edict followed edict, deposing and exiling all Arian priests, installing inquisitors to watch over the orthodoxy of the congregations, ordering the demolition of all pagan temples, punishing the Manichæans with death, etc. During the reign of Theodosius the orthodox Church of the religion of love feasted on persecutions and devastations.—His grandson, THEODOSIUS II. (408–450), b. in 401, succeeded his father, Arcadius, as emperor of Constantinople. He was weak, almost silly, and divided his time between prayers, hunting, and calligraphic exercises. The government was carried on by his sister, Pulcheria (b. in 399, declared *Augusta* in 414), and for some time by his wife, Eudoxia. The *Codex Theodosianus*, a collection of all the constitutions issued since the conversion of Constantine, was promulgated in 438.

**Theog'nis** flourished at Megara in the middle of the sixth century B. C. He was both by birth and conviction an aristocrat, and during the great political convulsions which his native city passed through at that time he shared the fortunes of his party. Having been exiled by the democrats, he visited Eubœa, Sparta, and Sicily, but returned to Megara when the oligarchs once more came into power, and d. there after 490. Of his poems, all belonging to the elegiac and gnomic kind of poetry, 1388 verses are still extant, mostly relating to the political incidents of his life. Edited by Welcker (Frankfort, 1826), in Schneidewin's *Delectus Poetarum Græcorum* (1838), and in Bergk's *Poetæ Lyrici Græci* (1868); translated in *Theognis Restitutus* by Frere (Malta, 1842).

**Theol'ogy** [Gr. Θεός, "God," and λόγος, "word"] signifies, literally, "discourse concerning God." The term has come down to us from the Greek philosophers, who used it in the sense of "account of the gods." Plato so used it in speaking of what Homer and Hesiod in their poems have said of the gods, though he also employs the word "mythology," which by common consent has been adopted by Christian writers as the more appropriate term. The word "theology" seems to have first come distinctly into Christian use during the great controversies in the fourth century respecting the divinity of Christ and his relation to the Godhead, the term then meaning sometimes the doctrine of the divine nature of Christ as distinguished from his human nature (οἰκονομία), and sometimes the doctrine of the Trinity. Theodoret in the fifth century appears to have been the first to use the term in the sense of "doctrine of God." He proposes and discusses the question, Why Moses did not preface his account of the creation with (θεολογία) the doctrine of God—*i. e.* with some explicit teaching respecting the nature and attributes of God? It was not until the twelfth century that theology assumed something like the comprehensiveness of its modern meaning. Abelard, having prepared a compend of his lectures on some of the then most prominent doctrines of faith, entitled it "Christian Theology" (*Christiana Theologia*). From the time of Abelard the term rapidly widened in meaning till it came to include all that is now comprehended under it. Theology now denotes not merely the doctrine of God, or theology proper, but also the doctrine of man in his relations to God, or anthropology; the doctrine of the salvation of man through the person and work of Christ, or soteriology; the doctrines of the final states of all men, or eschatology; and the doctrine of the Church, its constitution and government, or ecclesiology. Theology may therefore be defined as the science which treats of God and man in all their known relations to each other. It has sometimes been defined as "the science of the supernatural," and very commonly as "the science of religion." The last two definitions, however, are vague and inexact; both, with any definiteness of meaning, would necessarily include much that does not properly belong to theology, and omit still more that does. The last named, "the science of religion," from its apparent simplicity and comprehensiveness, has gained great popular currency, which has also been promoted by indefinite notions as to the nature of both religion and theology.

Religion exists as an inward state of feeling—a sense of duty toward a Being or beings regarded as divine and supreme—and also as an outward expression of that feeling in acts of worship and service. The science of religion, therefore, should analyze and classify the various religions of the world, as well as the convictions and feelings of men, of which their religions are simply the natural expression. Theology, on the other hand, deals exclusively with the facts, whether of consciousness or of revelation, from which religion, both subjective and objective, proceeds, and, educing the truths and principles which the facts embody, it formulates and groups them into the doctrines which constitute theology.

The right of theology to be called a science, which in late years has been warmly disputed, can be determined only by answering the two following questions: first, Can the facts with which it has to do be proved to be indubitably real, and what they are supposed to be? and secondly, Can the methods which it adopts in dealing with its facts be shown to be in accordance with the acknowledged laws of mind? In its broad sense as a science it must gather its facts from the wide fields of nature, consciousness, and the sacred Scriptures. In a narrower and commoner sense of the term its facts, according to one class of theologians, are to be found only in the sacred Scriptures, and are strictly historical; according to another class, even in the narrower sense of the term, the facts of the moral consciousness should not be overlooked; this latter class, holding that the ultimate and decisive appeal must ever be to the Scriptures, yet maintaining that the facts of the moral consciousness when properly scrutinized will be found to be explanatory, supplemental, and corroborative of those of the Scriptures. Now, as to the facts, so far as they are historical they are amenable to the bar of criticism, just like the facts of any other history, and must vindicate their trustworthiness by precisely the same kind of evidence; and so far as they are from the moral consciousness, they are open to the inspection of every one, and may be subjected to the same kind of analyses and tests as any other facts of mind. As to methods, there is the same liability to error in theology as in any other science. But out of various possible methods in dealing with the phenomena of nature, some one is of course admitted to be scientific, and that one, with such insignificant modification as may be necessary to fit it to its service, must be equally scientific in dealing with the phenomena of revelation; so that if a science of astronomy, and still more if a science of ethics, be possible, there may also be a science of theology. Science differs from mere knowledge in the degree of its certitude and exactness. It would be difficult to show that the essential principles of theology are less certain or less capable of exact statement than those of any other science.

The chief ground for denial of the right of theology to be called a science is found in its liability to resort to theory when facts are wanting, and to hypothesis in the absence of evidence. Its danger of becoming in this way unscientific is doubtless greater than that of most other sciences. The facts of revelation on which the science of theology rests presuppose and imply all those fundamental facts of being which it is the office of ontology (metaphysics) to interpret; and of these facts some kind of explanation or philosophy is to every enlightened mind a necessity. The theologian must have his explanation, and it is to him the source of his greatest danger of becoming unscientific. His metaphysic is perpetually suggesting to him its method of rounding his theology into the completeness of a system. To what is strictly scientific in his theology he is continually tempted to add what is purely theoretic. It is because theology has been so encumbered by what is purely theoretic—by theories of the Trinity, theories of sin, and theories of the Divine Providence, of the atonement, of regeneration, etc.—that its right to be entitled a science has been disputed. But to any one who looks impartially at the materials out of which theology builds, and at the inductive method which it may justly adopt, its right to be called a science would seem to be as clear as that of any other species of knowledge.

Theology has been divided into two kinds, which have been designated according to the supposed sources of their materials. Thus, we have NATURAL THEOLOGY (see article by PRES. CHADBOURNE) and revealed theology. By the first is meant that knowledge of God, his existence, attributes, and government of the world, which may be gathered from nature—*i. e.* from the external world and from the mental and moral constitution of man; and by the second is meant that knowledge of God and man, and of their mutual relations, which may be gathered from the Bible alone, or at least that knowledge alone which the Bible sanctions. But it may be doubted if the line of separation between the two is so clearly marked as is commonly supposed. The Bible assumes and incorporates into itself no small portion of what must be regarded as fundamental in natural theology, and few if any of the sources of natural theology have failed to be irradiated by the light of revelation. It is now wellnigh impossible to distinguish between what is taught by nature and what by revelation.

Revealed theology has been distributed into a variety of species, each of which has received its designation either from its special aim or from its special method of treatment. Thus, to particularize, we have systematic theology, the aim of which is to reduce all revealed truths to a series of statements that together shall constitute an organized whole; dogmatic, which aims pre-eminently to state what is authoritatively taught, whether by the Scriptures, the councils, or the creeds; philosophical, in which the formal statements of truth are more or less directly determined either by the postulates or by the conclusions of some special system of philosophy; metaphysical, in which the aim is to substantiate the teachings of the Bible by an appeal to those primitive cognitions and primary beliefs which the Bible always assumes; speculative, in which theory predominates over Scripture and all other authority; rational, which gives to human reason the highest authority in determining what is theological truth; biblical, which, indifferent alike to philosophy and dogma, and making system but a secondary consideration, aims simply to state the teachings of the Bible; doctrinal, which contents itself with simply formulating its statements of truth with a view to their being understood and accepted; and practical, which, on the other hand, seeks so to shape its statements of truth as to secure conformity of life with what is stated; polemical, which is quite as intent on overthrowing the positions of other systems as in defending its own; moral is a designation which has now among Protestants fallen into general disuse, but once denoted a discussion of moral law and human duty as laid down in the Ten Commandments and the Sermon on the Mount, and covered ground which is now occupied by moral philosophy or Christian ethics; and historical, which traces doctrines through the controversies amid which they were enunciated, and under the influence of which they were formulated. The term theology, unaccompanied by an epithet, now commonly denotes a completed series of the classified doctrines of Christianity. Doctrines are formal statements of Christian truth, and scientific theology consists of the whole circle of doctrines arranged according to some determinate plan.

Theology as a science has had a clearly-marked history—a history covering special controversies under which specific doctrines took form, and those broader and less violent discussions in which all doctrines, under the influence of metaphysical philosophies, were adjusted into the various systems which, taken together, now constitute the science as a whole. This history, beginning with the time immediately succeeding that of the apostles, naturally divides itself into three great periods, the first extending to A. D. 730, the second from 730 to 1517, and the third from 1517 to our own time.*

During the first period, theology was in its forming state. No complete treatise on it was then written. The nearest approach to one was by Isidore of Seville, who died 636. He wrote what he styled "Three Books of Sentences" (*Tres Libri Sententiarum*), but it was, as its title indicated, a mere collection of extracts from the Church Fathers. The period, however, was not unproductive of results. It gave to the Church universal that admirable digest of Christian faith called the Apostles' Creed. Among the churches of the East were elaborated the great doctrines of the Trinity and of the person of Christ, which were formulated in the creeds adopted by the Council of Nice in 325, of Ephesus in 431, and Chalcedon in 451. Within the same period also—that is, during the first quarter of the fifth century—the equally important doctrines of anthropology (specifically of the fall of Adam and its effects on the human race) were discussed, chiefly among the churches of the West under the leadership of Augustine and Pelagius. Augustine maintained that all men sinned in Adam; that by his fall all were physically and morally corrupted (original sin), and incapacitated to will or do aught but evil; that all there is of good in any one is by sovereign grace in fulfilment of a predestinating purpose. Pelagius, on the other hand, maintained that Adam alone was injured by the fall; that every one of his descendants begins life with a nature as pure as his was, and with a will as free to choose good as evil; that grace simply assists natural power, and is bestowed on those who by right use of natural power deserve it. Augustinism was adopted as the orthodox doctrine of the Church by the Council of Ephesus in 431. Semi-Pelagianism denied the positions of Augustine and softened the statements of Pelagius. Wiggers in his history of the three views aptly says: "Augustinism makes man to be morally *dead;* Pelagianism makes him to be morally *well;* Semi-Pelagianism makes him to be morally *ill.*"

The second period (from 730 to 1517) produced three great writers on theology—viz. John of Damascus, Peter the Lombard, and Thomas Aquinas. John (d. 754) wrote what he styled "An Accurate Summary of the Orthodox Faith" (Ἔκδοσις ἀκριβὴς τῆς ὀρθοδόξου Πίστεως, or *De Orthodoxa Fide*). He is the only writer of note on systematic theology which the Greek Church has ever produced. He drew his materials from the earlier Fathers, and chiefly from the three great Cappadocian teachers, Gregory Nazianzen, Gregory of Nyssa, and Basil the Great. He was the first to apply the formulas of Aristotle to theological investigation, and thus to introduce the dialectic or scholastic method. His views of the moral state and ability of man, like those of all the Greek Fathers, are much less rigid than those of Augustine. His work is chiefly of value to one who would understand the history of the doctrine of the person of Christ. Peter the Lombard (d. 1164) compiled from the Latin Fathers, chiefly from Augustine and Gregory the Great, what he styled "Four Books of Sentences" (*Quatuor Libri Sententiarum*). His method is formal and dialectic, but he shows great acuteness and skill in his aim at reconciling the opposing views of the authors whom he quotes—an aim the opposite of that of Abelard (d. 1142), who had sought in his "Yes and No" (*Sic et Non*) to array the Fathers against one another. The work of Peter became the great authority in the Roman Church, the ablest theologians for a long time contenting themselves with simply commenting on it. But the greatest of mediæval theologians, perhaps one of the ablest of any age, was Thomas Aquinas (d. 1274). He wrote, according to the fashion of his time, elaborate commentaries on the *Sentences* of the Lombard, to which he also gave the alternative title of "Sum of Theology" (*Summa Theologiæ*). He is pre-eminently scholastic in method, but transparent in thought and exhaustive in treatment. The Lombard simply recognized the rising controversy between the Realists and the Nominalists; Aquinas was a pronounced and earnest Realist. He was also more Augustinian in his anthropology than Lombard, and, setting aside the mythical theory of the atonement, which Lombard had accepted from the Fathers, and which made the death of Christ to have been a ransom paid to Satan,

* With a broader definition of theology than the one adopted in this article, we might distribute under *four* periods, making the first to be the apostolic period, in which case we could dwell, after the manner of Neander (see his *Planting and Training of the Christian Church*), on the theological diversities of method in the apostolic teaching. Modern Germans have carried this notion of an apostolic period of theology to the extent of writing treatises on the theology of Jesus as distinguishable from that of the apostles.

he maintained, and established for all time since, the Anselmic theory, that the death of Christ was a satisfaction for sin to the justice of God. The mythical theory had prevailed until the beginning of the twelfth century, when Anselm, archbishop of Canterbury (d. 1109), elaborated the theory which now bears his name, and the final acceptance of which made as distinctly, though less violently, an epoch in the progress of theological science as had been made more than seven centuries before in the adoption of the Augustinian views of human nature. The *Summa* of Aquinas is one of the highest authorities in the Roman Catholic Church.

The third great period, covering the last 350 years, has been more fruitful of treatises on scientific theology, and has contributed more to its progress, than all the Christian centuries preceding. Until the sixteenth century only two great doctrines or groups of doctrines—viz. of God, including the Trinity, Christology, etc., and of man, including sin, free-will, sovereign grace, etc.—had been comprehensively discussed. The Reformation under Luther turned on controversies over the doctrines of soteriology, or of the divine method of making the work of Christ available for men. The Roman Church, under guidance of mediæval theologians, had come to make the process of salvation to be a mere external work (an *opus operatum*) wrought by the efficacy of the sacraments. Luther maintained that it could be wrought only through a personal faith (a *fides justificans*). In prosecution of the controversy the Reformers, cutting loose from scholastic theology, entered at once on the study of the Bible and of Christian truth for themselves. The first Protestant treatise on scientific theology, the "Common Places" (*Loci Communes*) of Melanchthon, had its origin in a course of lectures on the Epistle to the Romans, the chief object of which was to collate and expound such passages of the Epistle as bore directly on the questions in dispute. Out of the biblical studies of the Reformers, German, Swiss, and French alike, grew those statements of soteriological doctrines now found in all systems of Protestant theology.

From the middle of the sixteenth century theology presents itself under three clearly-defined types—the Lutheran, the Reformed (the Calvinist), and the Roman Catholic. At the beginning of Protestantism the Lutherans and the Calvinists were essentially one in doctrine. Both adopted the Augustinian views of sin and grace, and both held firmly to the Nicene and Chalcedon creeds. Luther was himself pre-eminently Augustinian, and even wrote a book (*De Servo Arbitrio*) to prove that the will of man is enslaved. And Melanchthon, when he wrote the first edition of his *Loci*, as well as the Augsburg Confession (*Confessio Augustana*) and the apology for it (*Apologia Confessionis*), was no less Augustinian. But Luther propounded and defended a doctrine of the real presence of the body and blood in the Lord's Supper under the title of consubstantiation; and Melanchthon, gradually swerving from the Augustinian views of sin and irresistible grace (monergism), maintained the existence of a co-operative power of the human will in regeneration (synergism), and favored the Reformed view of the Supper rather than the Lutheran; the Reformed, under the lead of Calvin, adhered to Augustine's views of human nature, and maintained that in the Supper the Lord is present, not in the bread and wine, but in the heart of the communicant through partaking of the consecrated elements; the differences between the Lutheran and Reformed, slight at first, rapidly widened into complete separation. The historical progress of dogmatic theology may be traced under the three above-mentioned types—the Roman, the Lutheran, and the Reformed or Calvinist.

*The Roman.*—The Roman Catholic Church, in which theological studies had fallen into neglect, was roused into immediate activity by the outbreak of the Reformation. But in the canons of the Council of Trent (1545–93) it reaffirmed the theology of its mediæval writers, particularly of Aquinas, and authorized the preparation of the Roman Catechism (*Catechismus Romanus*), which popularizes and reiterates the decrees of the council. Its great writers, such as Bellarmine and Petavius, contented themselves with acting on the defensive, simply reaffirming the dogmas of the Church, and the interpretations which priestly authority had put upon them.

*The Lutheran.*—The *Loci* of Melanchthon, first published in 1521, became at once the great Lutheran authority, and was the first in a series of learned and able treatises. It was clear in thought, admirable in style, and entirely free from every trace of scholasticism both in language and method. Sixty editions in Latin and a large number (estimated at more than twenty) of translations into German were published during its author's lifetime. The later editions were so changed from the earlier as to make it almost another work. Theologians immediately succeeding Melanchthon contented themselves with writing commentaries on the *Loci;* but during the 200 years following his death (d. 1561) the Lutheran Church abounded in great writers on theology, many of whom were noted for their learning as well as for their extraordinary grasp and acuteness of intellect. Of these may be mentioned, Chemnitz, Gerhard, Callixtus, Calovius, Quenstedt, and others. Of these authors, some sided in their anthropology with Luther, but the majority with Melanchthon, while almost unanimously they went with Luther in his views of the sacrament of the Supper. But the simultaneous appearance of Rationalism and Pietism about the middle of the eighteenth century interrupted the sluggish flow of Lutheran theology, few or no treatises of any special value for a half century or more from that date having made their appearance. The Rationalists were too intent on their work of destruction to construct a scientific theology; and the Pietists, regarding religion as much more a matter of the heart than of the intellect, were indifferent to doctrinal discussions. The only strictly rationalist treatise on systematic theology worthy of note was that of Wegscheider (*Institutiones Theologiæ Christianæ Dogmaticæ*); the Pietists produced no dogmatic treatise; but Pietism and Rationalism have, one or the other, largely determined the methods and conclusions of subsequent treatises.

*The Reformed* (*Calvinist*).—At the head of all the Reformed theologians, and, in the estimation of some, of all Protestant as well, stands John Calvin. He was eleven years old when Melanchthon published the first edition of his *Loci*, and was but twenty-seven when he published the first edition of his own *Institutes of Theology* (*Christianæ Religionis Institutio*). Few if any writers on theology have surpassed him in transparency of thought, in depth or breadth of view, in strength of grasp, or in logical force and consistency. The Reformed theology has gained wide currency among different nations. Its adherents had so multiplied and organized themselves into Churches under Calvinistic creeds among different nations as to admit, with varying degrees of accuracy, of national designations. Thus we have the Swiss-French or Genevan Church, founded by Calvin (he published at Geneva the revised edition of his *Catechism* (1541), the *Creeds, Consensus Tigurinus* (1549), *Consensus Genevensis* (1552), and the revised and standard edition of his *Institutes* (1559)); the Anglican, which through Cranmer and Ridley expressed itself in the XXXIX. Articles, 1551; the German Reformed Church, which crystallized around the Heidelberg Catechism, 1562; the Dutch (Netherlands), which culminated in the Synod of Dort, 1618, and afterward signalized itself by the origin of the fœderal theory or covenant system, 1648; the Anglo-Scotch, which proclaimed itself in the Westminster Confession and Catechism, 1646–48; and finally, we have the American type of theology, which, having begun under the Westminster Symbols (the Congregationalists adopting them 1648, and the Presbyterians 1729, while the Dutch brought with them the Heidelberg Catechism, and the Episcopalians the XXXIX. Articles), now presents itself under new and ever-increasing variations.

The Calvinist theology, unlike the Lutheran, has been subject to many modifications, and has subdivided itself into a variety of schools. Some of these modifications have had their origin in reactions against extremes of view or of method, and others have resulted from the influence of special schools of speculative philosophy, to which the Reformed theology has always been much more sensitive than the Lutheran. Thus, near the middle of the seventeenth century the Calvinist writers of the Netherlands had become excessively scholastic and formal. In opposition to their method, Coccejus (in German *Koch*, and English *Cook*) conceived the fœderal method or the system of covenants—a covenant of works between God and man, and a covenant of grace between God and Christ—a method which he regarded as founded on the historical order of the Scriptures. Francis Burman at Utrecht and Herman Witsius at Leyden adopted the fœderal theory. The Cartesian philosophy, just then engaging the attention of Europe, was accepted by the Fœderalists, who adopted it so far as it taught the capacity of the unaided reason of man to know God and his character; the Scholastics assailed it, Voetius and Van Mastricht (who styled it the gangrene of theology) being specially bitter in their denunciations. And while the Netherlands were agitated with controversies about scholasticism, fœderalism, and Cartesianism, the Calvinists of France were equally moved by disputes over the two distinctively Calvinistic doctrines of predestination and imputation. The professors at Saumur persisted in modifications of the then current statements of both these doctrines. Amyraldus (Amyraut) rejected absolute predestination, but propounded in its stead a predestination conditioned by a hypothetic or ideal universalism. Associated with Amyraut at Saumur was Placæus (La Place), who denied

the doctrine of immediate imputation—*i. e.* the notion of a direct imputation of Adam's guilt to his innocent descendants—and affirmed the doctrine of mediate imputation—*i. e.* the imputation of Adam's guilt to his descendants as made guilty by an inherited evil nature (a doctrine held by Jonathan Edwards and certain writers, including the late Dr. Robert J. Breckenridge, of the Presbyterian Church of this country). The views of both Amyraut and Placæus were opposed by Rivetus in France, by Francis Turretin at Geneva, and by J. H. Heidegger at Zurich. Against them, Heidegger was appointed by the Swiss to draw up a new symbolical book, the *Consensus Helveticus*, which was much discussed, but could never be lifted into a position of authority. Turretin, a sympathizing friend of Heidegger, in his treatise on theology (*Institutio Theologiæ Elencticæ*, a great authority among a class who in this country and Scotland claim to be pre-eminently orthodox and Calvinistic) adopted the covenant theory of Coccejus and affirmed immediate imputation and absolute predestination. Again, during the first half of the eighteenth century the philosophy of Leibnitz having been adopted and adjusted to theological inquiries by Wolff, some of the Swiss theologians followed the Wolffian method. Wolff had maintained, and attempted to show by a most elaborate treatise, that the truths of natural theology were capable of demonstration, and that revealed theology, resting on natural, could thus be made to stand on a basis of science and certainty. But Wolff had also resolved all theological truths, whether of revealed or of natural religion, into mere abstract principles and definitions; and the theologians who constructed their systems after his method, while making a great show of logic, reduced theology to a mere system of formal and arid propositions. Notably of this class were Daniel Wyttenbach and J. F. Stapfer of Berne. Schleiermacher, under the triple influence of rationalism, pantheism, and the Moravian teaching of his youth, gave to the German Reformed theology, during the first quarter of the present century, a tendency and a modification which still continue. He mediated, however, between the Lutheran and the Reformed system, thus influencing to some extent the methods and results of both. His example in mediation has been followed by Nitzsch in his *System of Christian Doctrine*.

*Theologies in Antagonism with the Reformed.—Socinianism.*—At a very early period in the history of Protestant theology there was opposition to the doctrine of the Trinity. This opposition culminated in the person of Servetus, and he was put to death by burning. The opponents of trinitarianism gathered in Transylvania, and finally, organized by Faustus Socinus (d. 1604), became known as Socinians. Socinus wrote a brief treatise on theology, and a catechism which comprehended only the points in dispute between him and the trinitarians. The views of the Socinians are found in the Racovian Catechism and in the *Bibliotheca Fratrum Polonorum*.

*Arminianism.*—In reaction against the rigid high Calvinism of the Netherlands, Arminius denied the doctrine of absolute predestination, and propounded in its stead the doctrine of a predestination founded on the foreknowledge of God. Violent controversies ensued; the followers and successors of Arminius addressed a remonstrance to the state authorities; the Synod of Dort was convened, and the Remonstrants were excluded from the Reformed Church. Episcopius and Limborch elaborated the Arminian theology into a self-consistent system.

*Existing State of Theology among the Different Divisions of Christendom.*—The *Greek Church* has produced no complete system of theology. It has contented itself with its early Fathers, who discussed only christological questions, and with John of Damascus, who compiled his treatise from their writings. The *Roman Catholic Church*, which claims for itself unity and stability of doctrine, has had its full share of conflicting theories. To say nothing of mediæval controversies, of the bitter doctrinal disputes between the Jansenists and their opponents, it is only by ecclesiastical power that the dissidence of some of its living writers from the authority of its dogmas can be kept in check. There has been no dearth of modern theological treatises in the Roman Church, but the most complete and ablest of them all is that of Cardinal Perrone (*Prelectiones Theologicæ*), which first appeared in 1835, and of which very many editions have since been published. It is specially able in its presentation of the Roman theory of the Church and the sacraments. The *Anglican Church* and the *Protestant Episcopal Church* of this country have taken little or no interest in the cultivation of systematic or scientific theology. Neither of the three great parties composing these churches has any taste for this kind of literature. Stackhouse, Tomline, and Hey, whatever may have been their influence in the past, are laid aside now. Pearson on *The Creed* and the popular expositions of the XXXIX. Articles by Bishop Burnet, and more recently by Brown, bishop of Exeter, are not in any proper sense scientific treatises on theology. The *Lutheran Church* has made but little progress in its theology as a whole since the period of its great writers in the sixteenth and seventeenth centuries. Its later writers have either contented themselves with justifying the statements of its creeds by citations from the older authors, or, like Thomasius and Gess, have restricted themselves to a re-elaboration of its doctrines of the Person and Work of Christ. The *Reformed* theologians have in our day been actively engaged in a resurvey of the whole domain of systematic theology. Among the Germans may be mentioned, of the orthodox wing, Ebrard, Lange, and Heppe, and of the rationalist, Schweizer and Schenkel. Calvinist treatises on systematic theology in the English language still continue to abound. Among the Calvinist denominations of this country the study of systematic theology is pursued with unabated zeal. The *Methodists*, both of England and this country, who have inherited the theology of the Arminians, have produced no theologian since Watson. The *Unitarians*, who have inherited the faith of the Socinians, have produced no systematic theology at any time.

*Relation of Theology to Metaphysical and Physical Science.*—The rise and progress of systems of theology have always been coincident with the rise and progress of systems of philosophy. Mediæval theology is intelligible only by understanding the realistic or nominalistic philosophies of its authors; and the modern systems of Protestant theology can be fully understood only by understanding the systems of philosophy which underlie them. And it is remarkable that while the great theological writers anterior to the sixteenth century, who are appealed to as common authorities by Roman and Protestant writers alike, were philosophical realists, the chief theological systems of the Protestant Churches rest either upon avowed and unadulterated nominalism or upon nominalism in the disguised form of conceptualism. But with the traditional influence of metaphysical systems the natural sciences have in our day been rapidly coming into collision. It is the office of these sciences to ascertain what is really knowable of the processes of nature, and to reduce this knowledge to exact forms of statement. In fulfilment of this office, these sciences, in their manifold departments, are not only rendering an invaluable service to the science of mind, by bringing metaphysicians to observe its actual phenomena rather than to build on definitions of its processes, but are doing a work of equal value to theology, by requiring theologians to deal with law, government, sin, righteousness, character, and other fundamental truths, not as mere names or conceptions, but as the most real of realities. The theology of the future, which is to stand the test of criticism and control the consciences of men, must, like the teachings of the New Testament, rest on a basis of reality, and find in the consciousness of mankind an unequivocal testimony to its truth.

*Literature.*—Petavius, *Opus de Theologicis Dogmatibus;* Bellarmine, *Disputationes de Controversiis Fidei;* Möhler, *Symbolism;* Köllner, *Symbolik aller christlichen Confessionen;* Gass, *Geschichte der protestantischen Dogmatik;* Polenz, *Geschichte des Calvinismus;* Heppe, *Dogmatik des deutschen Protestantismus;* Hase, *Hutterus Redivivus;* Schweizer, *Die Glaubenslehre der evangelischen Reform-Kirche.* The church histories of Neander, Gieseler, Hase, and Guericke; Neander, *Christliche Dogmengeschichte* ("History of Christian Dogmas," translated by J. E. Ryland); Hagenbach, *History of Doctrines* (the translation revised and enlarged by H. B. Smith); Winer, *Comparative Darstellung des Lehrbegriffs der verschiedenen christlichen Kirchenparteien;* Schneckenburger, *Vergleichende Darstellung des Lutherischen und reformirten Lehrbegriffs.* The *Dogmatik* of Bretschneider, Ebrard, and Lange. Knapp, *Christian Theology*, a translation by L. Woods.

E. G. Robinson.

**Theopaschites,** the Greek name for Patripassians (which see).

**Theophras'tus,** b. at Eresus, in the island of Lesbos, about 372 B. C.; studied philosophy in Athens, first under Plato, then under Aristotle, whose favorite he became, and whom he succeeded in the Lyceum. He is said to have had 2000 disciples, and died, highly respected, at Athens about 287 B. C. According to the list of his works in Diogenes Laertius, he was a prolific writer, but besides fragments and smaller treatises, among which is a considerable portion of an essay on metaphysics, there are now extant only two treatises on botany and his *Ethical Characters*, edited by Schneider (1818–21, 5 vols.). The ethical characters, 30 sketches of general human vices under individual forms, have been frequently edited separately, and translated into most modern languages—into French by La Bruyère (1688), into English by Francis Howell (1824), into German by Schnitzer (1859).

**Theoph′ylact,** surnamed SIMOCATTA, b. at Locri, of Egyptian descent, came to Constantinople in 610 A. D., held various offices during the reign of Heraclius, and d. there about 629. From his *Historiæ Mauricii Tiberii Imperatoris Libri VIII.* (first edited with a Latin translation in 1604, lastly by Bekker in 1834), it is evident that he wrote this work, or at least commenced it, during the reign of Phocas. He also wrote 85 letters, *morales, rusticæ et amatoriæ,* and *Questiones Physicæ,* edited by Boissonade (Paris, 1835).

**Theophylact,** b. at Eubœa, seems to have come early to Constantinople, where he obtained great reputation for learning, and was appointed teacher to Constantinus Porphyrogenitus. In 1078 he was made archbishop of Bulgaria, and took up his residence at Achrida, where he d. in 1107. His ecclesiastical duties he discharged with great zeal, but he suffered much from the rudeness and barbarity of the people. He was also a prolific author, and wrote, besides a number of letters and an essay on royal education, commentaries on the New Testament, which are still consulted with advantage. His collected works were published in a splendid edition by Maria de Rubeis (4 vols. fol., Venet., 1754–63).

**Theos′ophists** [Gr. *θεόσοφοι,* "wise in respect to God"], a name vaguely applied to those religious teachers and writers who profess by meditation and superhuman illumination to have arrived at unusual knowledge of divine things.

**The Plains,** p.-v., Fauquier co., Va.

**The′ra,** or **Santorin,** an island of Greece, one of the Cyclades, is geologically very interesting on account of the volcanic phenomena which its history records. The whole island is really only but one side of an immense crater, whose other side has fallen down, and from whose middle several small islands have been raised at different periods, the last in 1710. The soil is dry but fertile; wine and cotton are produced in large quantities and of superior quality. The inhabitants, who number about 21,000, carry on extensive fisheries and a large shipping business.

**Theram′enes,** an Athenian politician whose name figures in all political transactions during the last years of the Peloponnesian war, now on the side of the demagogues, now on the side of the oligarchs, always in the character of a traitor. After the battle of Arginusæ (406 B. C.), in which he held a subordinate command in the right wing of the Athenian fleet, he was ordered to return to the scene of action and save as many as possible of the disabled galleys and their crews. A heavy storm set in, which made the execution of the order impracticable, and a great number of Athenian citizens were drowned. In order to escape the odium of this incident, Theramenes speedily repaired to Athens and accused the commanders-in-chief of having taken no measures in the case. In 404 B. C. he was sent first to Lysander, who besieged Athens, and afterward to Sparta, to negotiate a peace, but he postponed the final conclusion of a treaty until the Athenians were reduced to such a degree that they were compelled to accept any conditions whatever. After the peace he was elected one of the thirty tyrants, but as he opposed the violent measures of that body, he became suspected by Critias, was accused by him as an enemy of the state, and finally forced to drink poison. He was a man of eloquence, and, according to Diodorus, a disciple of Socrates.

**Therapeu′tæ** [Gr. *θεραπευταί,* "worshippers," "servants," or "healers"], a sect of Jewish contemplative ascetics, kindred to, though distinct from, the Essenes. Their chief seat was on Lake Mareotis in Egypt. They were not strictly celibate, but rejected wine and animal food. It has, however, been denied that they were Jews at all, and some critics question their existence at any time.

**There′sa,** p.-v. and tp., Jefferson co., N. Y., has a private bank. P. of v. 798; of tp. 2364.

**Theresa,** p.-v. and tp., Dodge co., Wis. P. 2248.

**Theresa,** or **Teresa** (SAINT), b. at Avila, Spain, Mar. 28, 1515, her full name being TERESA SANCHEZ DE CEPEDA; entered (Nov. 2, 1536) the Carmelite monastery at Avila, and in 1562 founded a reformed branch of Carmelite nuns. She made a prolonged study of theology, and wrote several mystical and ascetic treatises, which are accounted among the Spanish classics, and obtained her a great reputation. D. at Alba Oct. 4, 1582. Wrote *Discurso ó Relacion de su Vida* (1562), an autobiography giving an account of her interior conflicts and visions; *El Camino de la Perfeccion* (1563); *El Libro de las Fundaciones; El Castillo interior, ó las Moradas* (1577), a mystic description of the heavenly life; and *Santos Conceptos de Amor de Dios.*

**Theresiopel,** or **Maria-Theresiopel.** See SZABADKA.

**Theriaca.** See MOLASSES.

**Thermal Springs.** See APPENDIX.

**Thermidor′** ("hot month"), the eleventh month of the French republican calendar, began on the 19th of July and ended with the 18th of August.

**Ther′mo-Chemistry.** See APPENDIX.

**Thermodynam′ics.** The science of thermodynamics, as the term implies, relates to the principles of dynamics applied to the phenomena of heat. It is therefore to be expected that, in addition to the elementary principles which have been enumerated in the article DYNAMICS for the ordinary forms of dynamical problems, the science of thermodynamics will embrace special theorems or laws depending on observations and experience in connection with heat, and also special forms of mathematical investigation by which the applications of these laws may be brought within the scope of mathematical analysis.

The first assumption that is made (the truth of which is derived from experience) is, that the state of a body in regard to heat may be expressed by the relation

$$f(p, v, t) = 0, \qquad (1)$$

$p$, representing the external pressure upon a unit of the surface of the body; $v$, the volume of unit of weight; and $t$, the temperature. These are quantities which can be determined by measurement or observation, and it is known by experience that a change in either of them, the other two remaining the same, will alter the condition of the body in regard to heat. When such a relation is given, one of the quantities may be expressed in terms of the other two; thus, we may have the same relation expressed by the equation

$$t = f(p, v). \qquad (2)$$

Then for any change in $t$, changes will take place in $p$ and $v$, which can usually be determined by the methods of the calculus. In general, when a change in one quantity involves simultaneous changes in two others, whatever these changes may be, we may suppose the quantities to be represented by $u$, $x$, and $y$, and related in such a way that

$$u = f(x, y); \qquad (3)$$

$$\text{then } du = \frac{du}{dx}dx + \frac{du}{dy}dy. \qquad (4)$$

The quantities $u$, $x$, and $y$ may be quantities of heat, temperatures, pressures, or volumes; and when the relations expressed by the above equation (3) are known, this equation becomes a specific expression from which the differential equation may be derived. For instance, for the permanent gases it is known from observation, without regard to any theory of heat, that the above relation is

$$p, v = \text{R. T.}, \qquad (5)$$

$p$ being the pressure upon a unit of surface; $v$, the volume of unit of weight; T, the absolute temperature of the gas; and R a constant for each particular gas. These three quantities $p$, $v$, $t$, and *quantities of heat,* are the quantities which are chiefly to be considered in the study of thermodynamics.

The special theorems on which this science is founded are the *equivalence of heat and work* and the *equivalence of transformations,* sometimes called the *first and second laws* of thermodynamics. The first law of thermodynamics may be expressed by the equation

$$\text{E}\,d\,\text{Q} = d\,\text{W} + d\,\text{R} + d\,\text{L}, \qquad (6)$$

in which E represents the dynamic equivalent of a unit of heat (see HEAT); $d$ Q, an indefinitely small variation of heat; $d$ W, the variation of the living force due to a change in the vibratory heat-motions of the particles of the body; $d$ R, the corresponding variation of work of the attractive forces of the particles; and $d$ L, the variation of the work of the external pressure. If in the expression $\text{E}\,d\,\text{Q} = d\,\text{W} + d\,\text{R} + d\,\text{L}$ the symbol A is introduced for $\frac{1}{\text{E}}$, it becomes

$$d\,\text{Q} = \text{A}(d\,\text{W} + d\,\text{R} + d\,\text{L}). \qquad (7)$$

This expression may be simplified by including the terms $d$ W and $d$ R in one term $d$ U, which will then represent the *interior work,* including the work due both to change of oscillation, or work of the living force of the molecules, and the variation of the work of the molecular attractions. $d$ L will then represent the variation of the *exterior work* of the body, and the expression may be written—

$$d\,\text{Q} = \text{A}(d\,\text{U} + d\,\text{L}). \qquad (8)$$

The quantity U will represent the mechanical work stored in the body, or the energy of the body. It cannot be measured directly; but as the *augmentation* or *diminution* of the interior work is the quantity that is required in applications of the principle, the total value of U is not essential.

Since a change in the quantity U is invariably accompanied by a change in the quantities $p$, $v$, and $t$, and since

two of these variables determine such a change, U may be regarded as a function of any two—$p$ and $v$, for instance—and we shall have

$$U = F(p, v). \qquad (9)$$

Between two states the change of interior work will be $F(p_2\, v_2) - F(p_1\, v_1)$; and the change will become zero whenever the initial and final values of $p$ and $v$ are equal, whatever may be their intermediate values.

If the expression $U = F(p, v)$

be differentiated, we have $d\,U = \frac{d\,U}{d\,p} d\,p + \frac{d\,U}{d\,v} d\,v$, (10)

or, representing $\frac{d\,U}{d\,p}$ by X, and $\frac{d\,U}{d\,v}$ by Z,

$$d\,U = X\,d\,p + Z\,d\,v. \qquad (11)$$

This formula gives the variation of *interior work* when the pressure $p$ and volume $v$ of unit of weight of the body increase by $d\,p$ and $d\,v$; and since the second member of the expression is an exact differential, the law of change being invariable, we have—

$$\frac{d\,X}{d\,v} = \frac{d\,Z}{d\,p}. \qquad (12)$$

The exterior work represented by $d\,L$ depends not only on the initial and final values of the variables which determine the condition of the body—the pressure and volume, for instance—but upon their intermediate values. The difference between *interior* and *exterior* work, in this respect, is that the mode of change of interior work for any body cannot be varied or altered by any external agency, since it is governed by the physical laws of the constitution of the body; but the *exterior* work depends on the external pressure, which holds in equilibrium the elastic force of the body, and which may be varied at will; and in determining the *exterior* work it is necessary to assume the law of change of the external pressure with the change of volume.

It is also generally assumed that the external pressure shall be regarded always as equal to the elastic force of the body, or, according to the dynamical principles of equilibrium, an infinitely small difference only being supposed necessary to accompany the phenomena of external motion. This being established, an expression for the value of the external work may be found. $p$ being the pressure upon a unit of surface, normal and equal at all points, the external work for an elementary change of volume will be $p\,d\,v$, and we shall have—

$$d\,L = p\,d\,v, \qquad (13)$$

$$\text{and } d\,Q = A(d\,U + d\,L) = A(X\,d\,p + Z\,d\,v + p\,d\,v) = A(X\,d\,p + Y\,d\,v), \text{ putting } Y = Z + p.$$

The total quantity of heat involved in a change of the condition of the body between the limits in which the pressure and volume are $p_2\, v_2$ and $p_1\, v_1$, will be found by integrating the expression

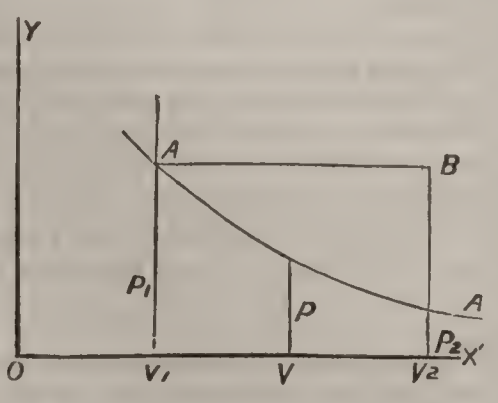
$$d\,Q = A(d\,U + d\,L),$$

$$\text{or (14)} \qquad \int d\,Q = A \int (d\,U + d\,L),$$

$$\text{or (15)} \qquad Q = \left( F(p_2\, v_2) - F(p_1\, v_1) + \int_{v_1}^{v_2} p\,d\,v \right) A.$$

This expression is integrable only when the relation between $p$ and $v$ is known. It expresses the law that the variation of *interior work* depends only on the initial and final states, but that the variation of exterior work depends on the law by which the pressure changes with the volume through the intermediate states of the body. The mode of variation of the external pressure with the volume may be indefinitely modified, and it is only by making certain assumptions in regard to it that hypothetical problems can be presented. The law of variation of pressure with variations of volume may be represented graphically, as follows (Fig. 1): Let O X and O Y represent co-ordinate axes at right angles, and let the abscissas O $v_1$ O $v_2$ represent the successive volumes, the corresponding ordinates representing the pressures. A line drawn through the extremities of the ordinates will represent the law of change of pressure. Such lines are commonly called "curves of expansion" or "compression." Those which are of the greatest interest in the dynamic theory of heat, and also in technical applications, are the curves or lines of *constant pressure*, of *constant volume*, the *adiabatic curve*, the *isothermal curve*, and the *isodynamic curve*.

FIG. 1.




If the pressure remain constant, the value of the integral $\int_{v_1}^{v_2} p\,d\,v$ will become $p \int_{v_1}^{v_2} d\,v = p\,(v_2 - v_1)$, and the line of pressures will be a straight line A B parallel to the axis of X. If the volume of the body remain constant, the variation of pressure must be represented by a straight line parallel to the axis of Y. The value of the integral $\int_{v_1}^{v_2} p\,d\,v$ will evidently in that case be 0, and the exterior work will be zero; and equation (14) shows that the heat supplied to or abstracted from the body is manifested only in a change of interior work.

The *adiabatic* curve is the curve of pressures A A, on the supposition that no heat is supplied to or abstracted from the body during change of volume. In this case in equation (14) $d\,Q = 0$ and $p\,d\,v = -d\,U$, and in equation (15)

$$\int_{v_1}^{v_2} p\,d\,v = F.(p_2\, v_2) - F.(p_1\, v_1).$$

This shows that the total change of *interior work* is equal to the *exterior* work. The expression applies to compression as well as to expansion.

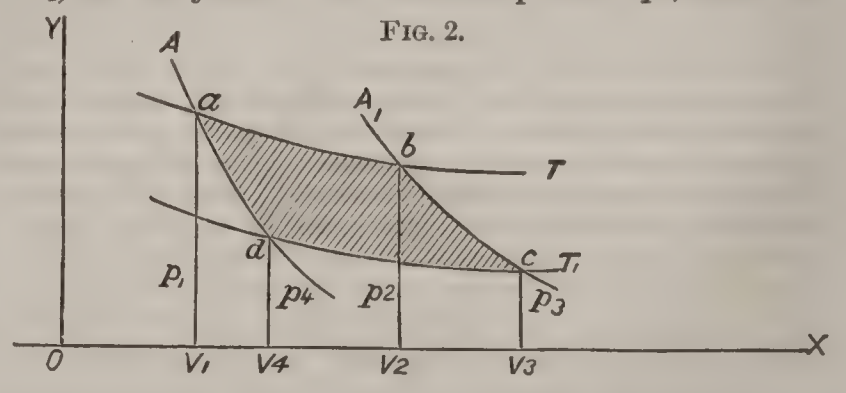
The equation of the adiabatic curve will be expressed by a relation between $p$ and $v$, under the assumption that no heat is supplied to or abstracted from the body during change of volume. Eliminating $d\,U$ from equations (11) and (14), making $d\,Q = 0$, we have

$$X\,d\,p = -(Z + p)\,d\,v. \qquad (16)$$

The integration of this equation will give the equation of the adiabatic curve in any case where the values of $X = \frac{d\,U}{d\,p}$ and of $Z = \frac{d\,U}{d\,v}$ are known, in functions of $p$ and $v$.

In the case of the isodynamic curve the *interior work* remains constant. In this case $d\,U = 0$, and the equation $d\,U = X\,d\,p + Z\,d\,v$ will give $0 = X\,d\,p + Z\,d\,v$. We also have from equation (14) $d\,Q = A\,p\,d\,v$, which shows that in the expansion of a body by the isodynamic law all the heat supplied to the body is converted into *exterior* work; and in compression for the exterior work applied to the body there must be an equivalent quantity of heat abstracted. Suppose the unit of weight of a body having the volume O $v_1$, and subjected to the external pressure $p_1$, which corresponds to the initial state represented in Fig. 2 by $a$, to expand in such a manner that the curve T represents the curve of pressures with increasing volumes; when the pressure has been reduced to $p_2$, and the volume increased to $v_2$, let the body expand according to another curve $A_1$ until the pressure is reduced to $p_3$, and the volume increased to $v_3$. Then let the volume be reduced by increasing the pressure until it just overcomes the elastic force at the pressure $p_3$, and suppose the pressures during the reduction of volume to follow the curve $T_1$, which is of the same kind as the curve T. When the volume has been reduced to $v_4$, and the pressure increased to $p_4$, let the volume be still further reduced to the original volume $v_1$, and the pressure increased to $p_1$, the pressure following the law of the curve $A_1$. The shaded area in the diagram is embraced by two couples of curves of the same kind, and the diagram represents what is called a *simple cycle* of operations or transformations. If at each instant the external pressure is equal to the elastic force of the body, such a cycle is also a *reversible* cycle, because the contour of the area may be traversed in the opposite direction.

FIG. 2.




In this cycle the external work performed by the body, which may be called positive, is represented by the two areas $v_1\, a\, b\, v_2$ and $b\, c\, v_3\, v_2$. The work performed by the external pressure on the body, or negatively, is represented by the areas $v_3\, c\, d\, v_4$ and $d\, v_4\, v_1\, a$, and it is evident from the figure that the difference between the positive and negative work is represented by the shaded area. The body has performed more work during expansion than has been expended to bring it back to its original state.

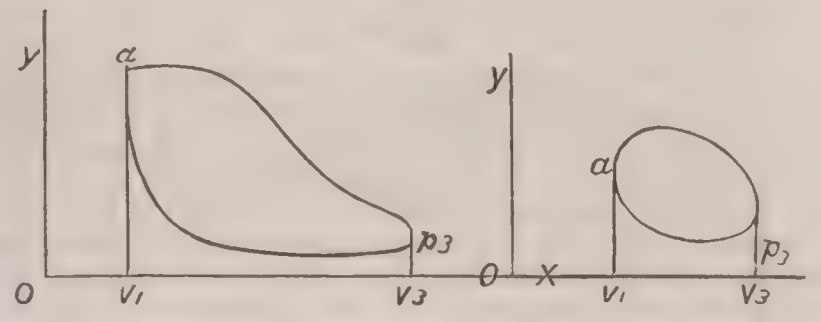
For greater definiteness, suppose the curves T and $T_1$ to be isothermal curves, and the curves A and $A_1$ to be adiabatic curves. The curve T is then that which gives the pressure when the body expands at constant *temperature*. In expanding from $a$ to $b$ at constant temperature, it will be

necessary that a certain quantity of heat shall be communicated to the body at each instant; otherwise, the temperature could not remain constant. Let $Q_1$ represent the total quantity of heat imparted to the body during the expansion from $a$ to $b$. The expansion from $b$ to $c$ is accomplished, by hypothesis, without the addition or abstraction of heat, the curve $b\,c$ being an adiabatic curve. $Q_1$ is then the total quantity of heat added to the body during the expansion from $v_1$ to $v_3$. During the compression from $c$ to $d$ heat must be abstracted, because experience shows that to prevent a rise of temperature during compression heat must be abstracted. Let the total quantity of heat withdrawn from the body be represented by $Q_2$. During compression from $d$ to $a$ by the adiabatic curve no heat is transmitted, and the temperature and pressure rise to the values corresponding to the initial state $a$.

During this cycle the *interior* work has changed, it being different in the four states $a$, $b$, $c$, and $d$; but since this interior work does not depend on the mode of variation of external pressure, its positive and negative values are equal when the body returns to the same initial state. The expression $d\,Q = A\,(d\,U + d\,L)$, integrated for the whole cycle, will give $Q = A\,F$, F being the sum of the positive and negative integrals of the exterior work represented by the shaded area in the diagram. But we have the positive values of $Q_1$, corresponding to the positive work, and the negative values $Q_2$, corresponding to the negative values of the exterior work; and hence $Q = Q_1 - Q_2 = A\,F$; which shows that the exterior work is the dynamic equivalent of the difference between the heat supplied to and abstracted from the body during the cycle. If the cycle represented in the above diagram were traversed in the opposite direction, the same reasoning and formulas would apply, but the result would show an excess of negative work, or work of compression.

Any closed curve, such as that represented below (Fig. 3), may represent a reversible cycle; it is only necessary

FIG. 3.

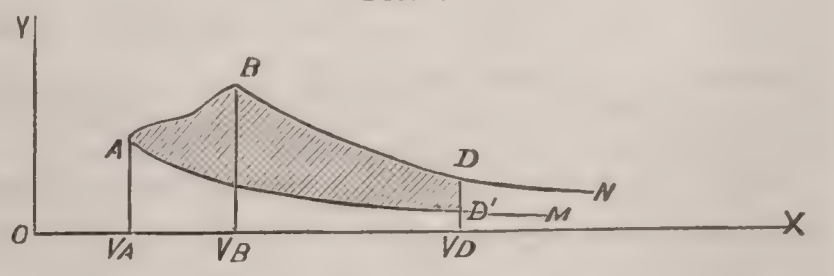



that this curve shall represent the law of pressures and volumes, and that the external pressure shall at each instant be equal to the elastic force. The perimeter of such a curve may be considered as a polygon of an infinite number of sides, these infinitely small sides being isothermal curves and adiabatic curves successively. For such a *composite* reversible cycle the same law may be proved true as for the simple cycle—viz. $Q_1 - Q_2 = A\,F$.

The simple cycle as above described, in which the influence of the interior molecular work is eliminated, was first introduced into science by Sadi Carnot. The application of this method to determine the total exterior work of a cycle represented by the expression $\int p\,d\,v$, was first made by Claperyon in his commentaries on the work of Carnot.

The following illustrations and demonstrations of Rankine are useful to fix the ideas in regard to the actual energy of any body, and the change of actual energy between two given states:

FIG. 4.




In Fig. 4 let the co-ordinates of the points A and B represent respectively the pressures and volumes of a body in two conditions of heat. Let A M and AN represent two adiabatic curves indefinitely prolonged through the points A and B, and the curve A B the curve representing the pressures as the volume changes from A to B. Suppose the body to pass through the cycle of transformations represented by the lines A B D D′ A, DD′ representing the diminution of pressure at constant volume $V_D$. The external energy exerted by the body will be represented by the shaded area of the diagram; and the farther the line D D′ is removed, the nearer this area approaches to the area included between the curve A B and the two adiabatic lines A M and A N. This area, then, represents the dynamic equivalent of the heat absorbed by the body between the states A and B. The exterior work produced by the expansion from A to B is represented by the area $A\,B\,V_B\,V_A$, and the difference between this area and the area M A B N, which represents the equivalent of the whole heat received, represents the difference between the whole heat absorbed and the exterior work produced, expressed the same units in the change from A to B. Since the line A B is common to these two areas, their difference will not be affected by the form of the line, but only by the values of the co-ordinates of its extremities. Hence the *difference* between the whole heat absorbed and the exterior energy exerted during the operation, represented by any such curve as A B, depends only on the initial and final states of the body, and not on the intermediate values of the pressures and volumes. This is a graphical demonstration of the proposition already enunciated in the equation $E.\,d\,Q = d\,W + d\,R. + d\,L$ $d\,W + d\,R$, representing the actual and potential energy stored during the change of state; and since

$$\int \overline{E.\,d\,Q - d\,L} = \int \overline{d\,W + d\,R},$$

the difference between the whole heat absorbed and the external work exerted is equal to the total variation of interior work or internal energy between the two states for which the integrals are taken.

Another law, which serves as a basis on which the general mathematical expressions of the principles of thermodynamics are founded, has been alluded to as the second law of thermodynamics. In regard to the enunciation and demonstration of this law, it is difficult to find two writers who agree either in the statement of the principle on which it is based or in the methods of establishing the principle itself. By some eminent writers it is called "the principle of Carnot," by others, "the principle of equivalence of transformations," and by others, "the second law of thermodynamics," while others regard the second law as a sort of corollary of the principle of equivalence. Whatever nomenclature may be adopted, the essential fact remains true, that in developing the mathematical expressions which constitute the fundamental equations of thermodynamics, that which results from the principle of equivalence, $d\,Q = A\,(X\,d\,p + Y\,d\,v)$, is not sufficient. This expression, if true without any further relation between $p$ and $v$ would show that the integral of $d\,Q$ depends only on the initial and final states of the quantities $p$ and $v$, and we should have

$$\frac{d\,Y}{d\,p} = \frac{d\,X}{d\,v};$$

whereas it may be shown by introducing for Y its value $Z + p$, and finding the value of $\frac{d\,Y}{d\,p}$, that instead of the above equation we shall have

$$\frac{d\,Y}{d\,p} - \frac{d\,X}{d\,v} = 1. \qquad (17)$$

This equation, just established by Clausius, constitutes the *first fundamental equation* of thermodynamics, and shows the relation which exists between X and Y, as derived simply from the principle of equivalence.

It is necessary, therefore, that a further and independent relation shall be found between Q, $p$, and $v$, or between Q and $t$, since $p$ and $v$ are by hypothesis functions of $t$. We must, then, go to the original conditions of the investigation, and find whether there is any independent relation between Q or $d\,Q$ and the temperature.

The signification of the term "temperature" has been given in the article HEAT. It is a quantity which may be divided arbitrarily into equal parts called degrees. The *absolute* temperature is the temperature estimated from an absolute zero. At the absolute zero all bodies are supposed to be devoid of heat, and as the temperature rises from this point, the power of any body to produce changes either of work or of heat in other bodies increases with the absolute temperature. The capacity of the body for producing changes either of work interior and exterior, or of heat, is known as its sensible heat, this sensible heat or energy depending on the intensity of the molecular oscillations; and it is this sensible heat that is indicated or measured by the thermometer.

The quantities $p$ and $v$, the pressure and volume, are those in terms of which the mechanical work of a body has been estimated; the quantity Q may be considered as representing the total heat which a body contains, and it also represents in thermal units the total mechanical energy which can be exerted by the body; but an indefinitely small change in the value of Q or $d\,Q$, when expressed in terms of $p$ and $v$, is not the same for all values of Q. This is the rational explanation of the fact that the expression $d\,Q = A\,(X\,d\,p + Y\,d\,v)$ is not integrable.

But admitting as an axiom established by the signification of the term "temperature," in connection with the en-

ergy of a body, that the actual energy is proportional to the absolute temperature, that axiom, applied to the mechanical work which a body is capable of performing at any instant, is expressed by Clausius in the following words: "The mechanical work which can be done by heat during any change of the arrangement of a body is proportional to the absolute temperature at which that change occurs." Here it is important to note the words "at which that change occurs," because experience shows that any change of heat involves a change of absolute temperature. The axiom may be made to accord in phraseology with similar enunciations in ordinary dynamics by stating that the *virtual* work which can be done by the heat of a body during any *virtual* or *infinitesimal* change of the arrangement of the particles is proportional to the absolute temperature.

Let, now, $d\,Q$ represent one of the infinitesimal equal parts into which the heat Q of a body may be divided, $d\,Q$ being the expression for this work in thermal units, and $A\,d\,W$ being the expression for the same quantity in foot-pounds or dynamic units. The axiom above quoted is equivalent to stating that the change of *mechanical arrangement* of the body for this infinitely small quantity of heat at different temperatures is inversely proportional to the absolute temperature. If $d\,P$ represent this change of mechanical arrangement, called by Clausius "the *disgregation* of the body," we shall have for the absolute temperatures $T_1\ T_2$—

$$\frac{T_1}{T_2} = \frac{(d\,P)_2}{(d\,P)_1} \text{ and } \frac{T_2}{T_3} = \frac{(d\,P)_3}{(d\,P)_2}, \text{ etc. etc.,}$$

$$\text{or} \qquad T_1\,d\,P_1 = T_2\,(d\,P)_2 = T_3\,(d\,P)_3, \text{ etc.} = \frac{d\,Q}{A} = d\,W,$$

or, generally,

$$\frac{d\,Q}{A} = T.\,d\,P \text{ and } \frac{d\,Q}{A\,T} = d\,P.$$

These expressions show that if the elementary changes in mechanical arrangement of a body at different absolute temperatures be multiplied by the absolute temperatures at which the changes occur, the products will represent the corresponding infinitesimal change of heat $d\,Q$, or of work $A\,d\,W$.

The proposition just demonstrated shows that the same elementary quantity of work performed by a body or impressed upon a body at different absolute temperatures will cause a change of heat in the body which will be represented by $\frac{d\,Q}{T}$, T being the absolute temperature at which the change occurs. A new relation is thus established between T, $p$, and $v$, by means of which the equation $d\,Q = A.(X\,d\,p + Y\,d\,v)$ may be rendered integrable. Dividing both members of this equation by T, we have

$$\frac{d\,Q}{T} = A\left(\frac{X}{T}dp + \frac{Y}{T}dv\right), \qquad (18)$$

and $d\,Q = A\,T\left(\frac{X}{T}dp + \frac{Y}{T}dv\right)$, which is integrable when

$$\frac{d}{dv}\left(\frac{X}{T}\right) = \frac{d}{dp}\left(\frac{Y}{T}\right). \qquad (19)$$

Effecting the differentiation, we have

$$T\left[\left(\frac{d\,Y}{d\,p}\right) - \left(\frac{d\,X}{d\,v}\right)\right] = Y\left(\frac{d\,T}{d\,p}\right) - X\left(\frac{d\,T}{d\,v}\right);$$

and since from a previous result,

$$\frac{d\,Y}{d\,p} - \frac{d\,X}{d\,v} = 1, \qquad (20)$$

we have

$$T = Y\left(\frac{d\,T}{d\,p}\right) - X\left(\frac{d\,T}{d\,v}\right). \qquad (21)$$

These two equations constitute the *first and second fundamental equations* of the dynamic theory of heat. The last equation shows the relation which exists between the quantities T, X, and Y.

Since T is a function of $p$ and $v$, we have

$$d\,T = \left(\frac{d\,T}{d\,p}\right)d\,p + \left(\frac{d\,T}{d\,v}\right)d\,v. \qquad (22)$$

We now have the following equations:

$$(a) \qquad \left(\frac{d\,Y}{d\,p}\right) - \frac{d\,X}{d\,v} = 1;$$

$$(b) \qquad T = Y\left(\frac{d\,T}{d\,p}\right) - X\left(\frac{d\,T}{d\,v}\right);$$

$$(c) \qquad d\,Q = A\,(X\,d\,p + Y\,d\,v).$$

Substituting the values of Y and X found from equation $(b)$ successively in equation $(c)$, and simplifying the results by means of equation $(a)$, will give the following:

$$(d) \qquad d\,Q = \left(\frac{A}{\frac{d\,T}{d\,p}}\right)(X\,d\,T + T\,d\,v);$$

$$(e) \qquad d\,Q = \frac{A}{\frac{d\,T}{d\,p}}\,(Y\,d\,T - T\,d\,p).$$

Equations $(a)$, $(b)$, $(c)$, $(d)$, and $(e)$ may be considered the fundamental equations of thermodynamics. The last three, $(c)$, $(d)$, and $(e)$, give identical values of $d\,Q$, and for the solution of particular problems that one may be chosen which is most convenient, or for which the relation between the variables will give the most simple solution.

These equations are applicable to problems when the relation between the pressure, volume, and temperature of a body is known, and are those which are usually applied to discussions in relation to the permanent gases and vapors. The expression $\frac{d\,Q}{A\,T} = \frac{X}{T}d\,p + \frac{Y}{T}d\,v$, when integrated for a complete reversible cycle, becomes $\int\frac{d\,Q}{A\,T} = 0$, because the integral of the second member becomes zero when the values of $p$ and $v$ are the same at the end of the cycle as at the beginning. If the cycle is not *reversible*, it may be shown that the value of the integral must always have the same sign; and the form applicable to cycles, $\int\frac{d\,Q}{A\,T} \leqq 0$, is often given as the general analytical condition expressing the second law of thermodynamics.

The determination of the *efficiency* of a fluid in heat-engines in terms of the absolute temperature may be derived directly from the second law of thermodynamics, as enunciated by Clausius, and expressed by the relation

$$\frac{d\,Q}{A\,T} = \left(\frac{X}{T}d\,p + \frac{Y}{T}d\,v\right) = d\,P,$$

$$\text{or } \frac{d\,Q}{A} = d\,W = T\left(\frac{X}{T}d\,p + \frac{Y}{T}d\,v\right) = T\,d\,P.$$

Suppose a body having an initial volume $O\,v$ (Fig. 5), and initial pressure $v\,a$, to expand according to the adiabatic curve A A. Since no heat is received or given out, $d\,Q$ in these equations will be zero, and hence $d\,P$ will be zero, or the quantity represented by (P) is constant for the same adiabatic curve. If the body expands from $a$ to $b$, according to the isothermal curve $T_1\ T_1$, the temperature being constant, the quantity of heat expressed in units of work expended will be $\int\frac{d\,Q}{A} = \frac{Q_1}{A} = T_1\,(P_b - P_a)$.

Continuing the expansion from $b$ to $c$, by the adiabatic curve, the value of the exterior work will be equal to the variation of the interior work, or $\int p\,d\,v = -\int d\,U. = -\frac{Q_2}{A}$. If, now, the body be compressed according to the isothermal curve $T_2\ T_2$ from $c$ to $d$, the quantity of work will be given by the expression $\frac{Q_3}{A} = -T_2\,(P_b - P_a)$.

Continuing the compression by the adiabatic curve $d\,a$ to the point of beginning, the work required for compression will be $-\int p\,d\,v = d\,U = +\frac{Q_2}{A}$. Adding these quantities of work, with their proper algebraic signs, we have $\frac{Q_1 - Q_3}{A} = (T_1 - T_2)\,(P_b - P_a)$. This is the quantity of heat expressed in units of work produced in the cycle, and which has been represented by $A\,F = Q_1 - Q_2$, shown in the shaded area of the diagram.

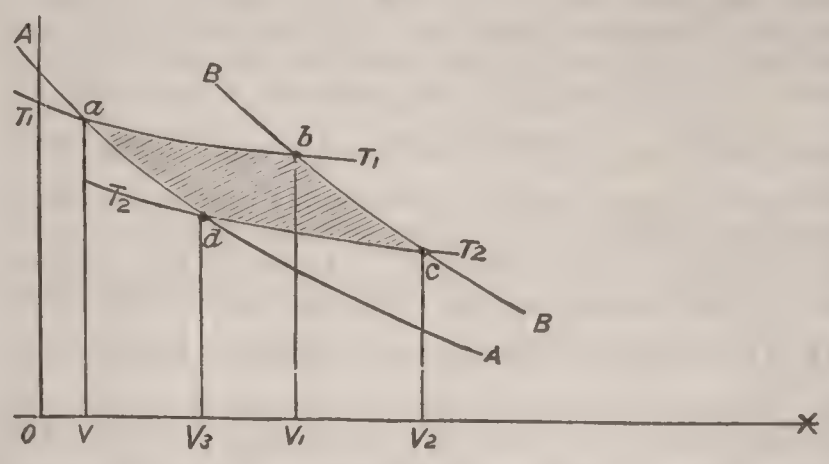
The efficiency of the body in producing work is found by dividing the expression $\frac{Q_1 - Q_3}{A} = (T_1 - T_2)\,(P_b - P_a)$ by $\frac{Q}{A} = T_1(P_b - P_a)$, member by member, which gives $\frac{Q_1 - Q_2}{Q_1} = \frac{T_1 - T_2}{T_1}$; from which we obtain $Q_1 - Q_2 = \frac{Q_1}{T_1}(T_1 - T_2)$. In this expression $\overline{Q_1 - Q_2}$ represents the heat transformed into dynamic energy, and $Q_1$ the whole heat received by the fluid or body during the cycle.

From the above expression may be obtained at once, by performing the operations indicated, $\frac{Q_1}{T_1} = \frac{Q_2}{T_2}$, or $\frac{Q_1}{A\,T_1} = \frac{Q_2}{A\,T_2}$, which shows that the ratios obtained by di-

viding the quantities of heat expended by the corresponding absolute temperatures are equal when a body expands according to the isothermal law between the same adiabatic curves.

The diagram (Fig. 5) may be assumed to illustrate an elementary heat-engine of maximum efficiency, the cycle

FIG. 5.




of changes which the fluid undergoes being such that the whole reception of heat takes place at a constant temperature, and the whole rejection of heat at another lower constant temperature. In an actual heat-engine the efficiency is theoretically in such a case the greatest possible between the given limits of temperature, and is independent of the nature of the fluid employed.

Among the most important applications of the fundamental equations of thermodynamics are those which relate to gases and vapors; and these equations are to be transformed into more specific equations for these classes of bodies by the exact relations which have been established experimentally between the pressure, volume, and temperature for any particular gas or vapor. The fundamental equations being given—

$$\frac{d\,Y}{d\,p} - \frac{a\,X}{d\,v} = 1, \qquad \text{(I.)}$$

$$T = Y\left(\frac{d\,T}{d\,p}\right) - X\left(\frac{d\,T}{d\,v}\right), \qquad \text{(II.)}$$

$$\left.\begin{aligned} d\,Q &= A\,(X\,d\,p + Y\,d\,v), \\ d\,Q &= \frac{A}{\left(\frac{d\,T}{d\,p}\right)}\,[X\,d\,T + T\,d\,v], \\ d\,Q &= \frac{A}{\left(\frac{d\,T}{d\,v}\right)}\,[Y\,d\,T - T\,d\,p], \end{aligned}\right\} \qquad \text{(III.)}$$

The transformation of these equations to forms directly applicable to gases is made under the following assumptions:

(1) A perfect gas is a substance in such a condition that it obeys the law of Mariotte and Gay-Lussac rigorously. This gives for the relation between $p$, $v$, and T, $p\,v = R.\,T$; $p$ being the pressure upon a unit of surface; $v$ the volume of unit of weight (the specific volume); R a constant; and T the absolute temperature of the gas. Air and the so-called permanent gases may also be assumed to follow the same law, the quantity R being assumed constant, although for these gases this is not strictly true.

(2) The specific heats at constant pressure and constant volume of these gases are assumed to be constant. The values of these specific heats are given by the following:

$$d\,Q_p = c_p\,d\,T, \qquad (23)$$

$$d\,Q_v = c_v\,d\,T, \qquad (24)$$

the first giving the quantity of heat to be furnished to a unit of weight of the gases when it is heated under constant *pressure* by the amount $d\,T$, and the second the quantity of heat to be furnished to a unit of weight of the gas when it is heated under constant *volume* by the amount $d\,T$.

The last of the fundamental equations ($e$) gives for $d\,Q_p$, under the constant condition ($d\,p$ being zero), or $p$,

$$d\,Q_p = \frac{A\,Y}{\left(\frac{d\,T}{d\,v}\right)}\,d\,T, \qquad (25)$$

and the second from the last ($d$),

$$d\,Q_v = \frac{A\,X}{\left(\frac{d\,T}{d\,p}\right)}\,d\,T. \qquad (26)$$

From these equations we get

$$c_p = \frac{A\,Y}{\left(\frac{d\,T}{d\,v}\right)}, \quad c_v = \frac{A\,X}{\left(\frac{d\,T}{d\,p}\right)},$$

and

$$Y = \frac{c_p}{A}\left(\frac{d\,T}{d\,v}\right), \quad X = \frac{c_v}{A}\cdot\left(\frac{d\,T}{d\,p}\right).$$

The values of $\frac{d\,T}{d\,v}$ and $\frac{d\,T}{d\,p}$ are found by differentiating the equation

$$p\,v = R.\,T.$$

$$\left(\frac{d\,T}{d\,p}\right) = \frac{v}{R'}, \quad \left(\frac{d\,T}{d\,v}\right) = \frac{p}{R'}.$$

These values, substituted in the expressions for Y and X above, give

$$X = \frac{c_v\,v}{A\,R'}, \quad Y = \frac{c_p\,p}{A\,R'},$$

and

$$\frac{d\,X}{d\,v} = \frac{c_v}{A\,R'}, \quad \frac{d\,Y}{d\,p} = \frac{c_p}{A\,R'},$$

which, substituted in the first fundamental equation, give

$$c_p - c_v = A.\,R, \qquad (27)$$

showing that the difference of specific heats is a constant quantity for each particular gas.

From this result the value of the dynamical equivalent of a unit of heat is $E = \frac{1}{A} = \frac{R}{c_p - c_v}$,

which furnishes a verification of the experimental determinations of the dynamic equivalent, R being known for air, and $c_p$ and $c_v$ by experiments. In French units $R = 29.272$, and $c_p = 0.23751$, $c_v = 0.16844$, $E = 423.80$; the number found by Joule experimentally being $E = 423.55$.

The second fundamental equation becomes, on substituting the values of X, Y, $\frac{d\,T}{d\,p}$, and $\frac{d\,T}{d\,v}$, already found,

$$T = \frac{c_p - c_v}{A\,R}\cdot\frac{P\,v}{R}; \qquad (28)$$

and since $\frac{c_p - c_v}{A\,R} = 1$ and $p\,v = R\,(273 + t)$, according to the law of Mariotte and Gay-Lussac, we have $T = 273 + t$; $t$ being the ordinary temperature in Centigrade degrees—a formula for finding the absolute temperature when the thermometric temperature is given.

The fundamental formulas furnish the means of determining the quantity of heat which is required for a change of state of a body. To apply these equations to gases, the values of X, Y, $\frac{d\,T}{d\,p}$, and $\frac{d\,T}{d\,v}$, already found for gases, are to be substituted in each particular case.

It is to be remarked, in the first place, that the specific heat at constant pressure $c_p$ for various gases is obtained from direct experiments. It is greater than the specific heat at constant volume by a quantity which is the thermal equivalent of the work required in expanding the volume of the gas against the constant pressure for an elevation of temperature of one degree. The *ratio* of these specific heats, or $K = \frac{c_p}{c_v}$, determined by various methods, is known for air, and approximately for some other gases, its value for air being $K = 1.41$; and it is by means of this ratio that the specific heat at constant volume is found. For air it is 0.16844. Denoting the specific heat at constant volume by $c$, the specific heat at constant pressure will be $K\,c$. The substitutions referred to will then transform the equations into the following for gases:

$$\text{(III.)}' \quad \left\{\begin{aligned} d\,Q &= \frac{c}{R}\,(v\,d\,p + K.\,p\,d\,v), \\ d\,Q &= c\,d\,T + \left(\frac{A\,R.\,T}{v}\right)d\,v, \\ d\,Q &= k\,c\,d\,T - \left(\frac{A.\,R.\,T}{p}\right).d\,p. \end{aligned}\right.$$

To apply these equations, it is necessary to assume the law by which the pressure changes with the volume. Among the most interesting and important cases in which this law is known are those in which the curves of expansion or compression are the isothermal curve, the isodynamic curve, and the adiabatic curve.

For the isothermal curve the equation $f(p.v.t)$ or $p\,v = R.T.$ becomes $p\,v = R\,T_1 = \text{constant}$. The isothermal curve for the permanent gases is therefore an equilateral hyperbola. This curve can be constructed when any value of $p\,v$ is known. Denoting by $p_1\,v_1$ the initial value, we have $p\,v = p_1\,v_1 = R\,T_1$, and $p = \frac{p_1\,v_1}{v_e} = \frac{R.\,T_1}{v}$.

The isodynamic curve of pressures is that followed when the interior work is constant, or $d\,U = 0$. In the general equation $d\,Q = A\,(d\,U + p\,d\,v)$ this hypothesis gives $d\,Q = A\,p\,d\,v)$, and the second of the fundamental equations (III.)′

for gases becomes, when combined with the equation $p = \frac{RT}{v}$,

$$dQ = c\,dT + A\,p\,dv; \qquad (29)$$

hence $dU = c.dT$. If $dU = 0$, then $dT$ must also be zero, or T will be constant; which shows that for the permanent gases, for which the law of Mariotte and Gay-Lussac applies, the *isothermal* and *isodynamic* curves coincide.

The quantity of heat Q expended for any degree of expansion may be found by integrating equation (29), and is $Q = c(T - T_1) + A\int p\,dv$, and for the isothermal and isodynamic curves, since T is constant, it becomes $Q = A\int p\,dv = AL$.

Moreover, since the integral of $dU$, or the interior work, is represented by $c(T - T_1)$, it is thus independent of any particular relation between $p$ and $v$ during the change of temperature $(T - T_1)$, and hence it is established that when a permanent gas passes from one state of pressure and volume to another, the temperature being the same in the two states, the heat furnished is equal to the external work divided by the dynamic equivalent of the unit of heat. The work $L = \frac{Q}{A} = \int_{v_1}^{v_2} p\,dv$ may be given in another form:

$$L = \frac{Q}{A} = \int_{v_1}^{v_2} \frac{R_1 T_1}{v}\,dv = R T_1 \int_{v_1}^{v_2} \frac{dv}{v}; \qquad (30)$$

$$L = R T_1 \log\frac{v_2}{v_1} = p_1 v_1 \log\frac{v_2}{v_1} = p_1 v_1 \log r; \qquad (31)$$

$r$ being the ratio of expansion, and the logarithms being taken in the Napierian system.

For the adiabatic curve of expansion for the permanent gas the first of equations (III.)′, when $dQ = 0$, becomes $v\,dp + K p\,dv = 0$. Dividing by $vp$, this becomes $\frac{dp}{p} + K\frac{dv}{v} = 0$. Integrating, this equation gives

$$p\,v^k = p_1 v_1^k = \text{constant}; \qquad (32)$$

$p_1 v_1$ being the initial state. This is the equation of the adiabatic curve passing through the point whose co-ordinates are $p_1 v_1$.

From the last equation may be obtained the following

$$\frac{p\,v}{p_1 v_1} = \left(\frac{v_1}{v}\right)^{k-1},$$

or

$$\frac{T}{T_1} = \left(\frac{v_1}{v}\right)^{k-1},$$

or

$$\frac{T}{T_1} = \left(\frac{p}{p_1}\right)^{\frac{k-1}{k}};$$

equations which give the relations between the temperatures and volumes, and temperatures and pressures, when the change of state occurs according to the adiabatic law.

In the work performed during expansion the equation $dQ = c\,dT + A\,p\,dv$ gives, when $dQ = 0$ (the condition that the adiabatic law is followed),

$$c\,dT + A\,p\,dv = 0,$$

$$\text{or } \int c\,dT = c(T - T_1) = \int A\,p\,dv = L;$$

hence the exterior work performed is equal to the change of interior work, and is easily found when the extreme or limiting *temperatures* are given.

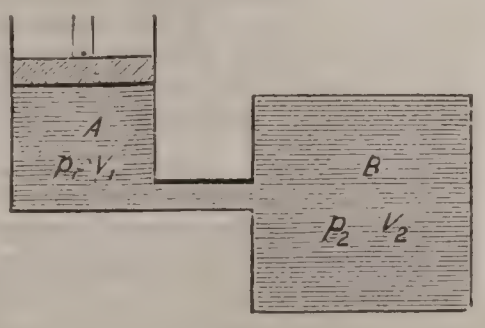
When, however, the initial and final volumes $v_1$ and $v_2$, and the initial and final pressures $p_1$ and $p_2$ are given, the exterior work is found by the equations—

$$\left.\begin{aligned} L &= \frac{c}{A\,R} p_1 v_1 \left[1 - \left(\frac{v_1}{v_2}\right)\right], \\ L &= \frac{c}{A\,R} p_1 v_1 \left[1 - \left(\frac{p_2}{p_1}\right)^{\frac{k-1}{k}}\right] \end{aligned}\right\} \qquad (33)$$

In these expressions $\left(\frac{c}{A\,R}\right)$ may be replaced by $\left(\frac{1}{k-1}\right)$.

The above cases are sufficient to illustrate the applications of the fundamental formulas. Other suppositions in regard to the pressures and volumes lead to special problems of interest; as, for instance, when the pressure remains constant, when the volume remains constant, and when the pressure and volume follow any special law, such as $p^m v^n =$ constant. It is unnecessary to follow such cases, as they may be referred to in works on the mechanical theory of heat.

FIG. 6.




Problems connected with the flow of gases and vapors from one reservoir to another, or from a reservoir into the atmosphere, may be solved by the application of the principles of thermodynamics. Suppose two reservoirs A and B, Fig. 6, to be connected by a cylindrical passage, and let the pressure on unit of area in the first reservoir be $p_1$, the specific volume in the reservoir being $v_1$. Let the pressure in the second reservoir be $p_2$, less than $p_1$, and let $v_2$ be the specific volume of the gas or vapor in the second reservoir. If V represent the velocity of flow through the passage connecting the two, the living force of unit of weight of the gas or vapor due to this velocity will be $\frac{V_2}{2g}$. The flow being caused by the elastic force of the gas or vapor, a variation of heat equivalent to the work performed by this elastic force will take place, which will be represented by $dQ = A(dU + p\,dv)$. The last term of this equation is in this case equivalent to two terms, $d\left(\frac{V_2}{2g}\right)$ and $d(pv)$, since not only actual or sensible velocity is given to unit of weight of the gas or vapor, but a certain quantity of work due to expansion from the specific volume $v_1$ to $v_2$ is performed, and we may write

$$dQ = A\left(dU + d(pv) + d\left(\frac{V^2}{2g}\right)\right),$$

$$\text{or } d\left(\frac{V^2}{2g}\right) = -d(pv) - dU + \frac{dQ}{A}. \qquad (34)$$

For a permanent gas,

$$d(pv) = R\,dT,$$

$$dU = \frac{c}{A}dT,$$

and the equation becomes

$$A\,d\left(\frac{V^2}{2g}\right) = -A\,R\,dT - c\,dT + dQ,$$

$$\text{or } A\,d\left(\frac{V^2}{2g}\right) = -K\,c\,dT + dQ, \qquad (35)$$

$$\text{since } A\,R - c = K\,c.$$

These are general equations by which particular problems are to be discussed.

The solution of any particular problem requires that the law of expansion shall be known; and since in most cases there is no heat furnished to or abstracted from the gas or vapor during the flow, the law by which the pressures are connected with the volumes may be for such cases assumed to be the adiabatic law, for which $dQ = 0$. The above expression then becomes

$$A\,d\left(\frac{V^2}{2g}\right) = -K\,c\,dT. \qquad (36)$$

In this case we have also

$$\frac{T_2}{T_1} = \left(\frac{p_2}{p_1}\right)^{\frac{K-1}{K}};$$

$T_1$ being the absolute temperature in the first reservoir, and $T_2$ that in the plane of the orifice, or near it in the second reservoir.

The value of $\frac{V^2}{2g}$ is found by integration:

$$A\,\frac{V^2}{2g} = K\,c\,(T_1 - T_2);$$

and, combining the two last equations, we have

$$V = \sqrt{2g\,\frac{K\,c}{A}\,T_1\left[1 - \left(\frac{p_2}{p_1}\right)^{\frac{K-1}{K}}\right]}. \qquad (37)$$

In practical applications the theoretical velocity must be multiplied by a coefficient, on account of loss due to friction, and the area of the outlet by a coefficient of contraction. (For a full discussion of these coefficients see Zeuner's papers published in the *Civil Ingénieur*.)

The application of the fundamental equations to vapors requires a knowledge of the relation which exists between the pressure $p$ and temperature $t$, from which the value of the differential coefficient $\frac{dT}{dp}$ may be found. The experiments of Regnault (see articles HEAT and STEAM), confirmed by others, show that no simple relation exists between $p$ and $t$, but that for saturated vapors $p = f(t)$; that is, the *pressure depends on the temperature alone*. In a given quantity of a liquid and its vapor the pressure is independent of the proportions of vapor and liquid, and depends only on the temperature. The differential coefficient $\frac{dp}{dT}$ will then be equal to $\frac{1}{\frac{dT}{dp}}$.

Regnault's *empirical* formula, applicable to all saturated vapors, for the relation between the pressure and temperature, as given by Rankine, is

$$\log.\ p = A - \frac{B}{T} - \frac{C}{T_2}, \qquad (38)$$

in which $p$ is the pressure, T the absolute temperature of the boiling-point, and A, B, and C constants. The values of these constants, where they are known from experiments, substituted in the formula, will determine the pressure for any particular vapor. From the above formula the value of $\frac{d\,p}{d\,T}$ may be obtained. The values of this coefficient, calculated for different pressures and temperatures, may be found for steam and some other vapors in works on thermodynamics.

Suppose unit of weight of a liquid at the temperature zero and a given pressure to be heated until all the liquid is transformed into vapor at the constant pressure $p$ and a given temperature $t$. The total heat required will be composed of (1) the quantity of heat necessary to raise the temperature of the liquid to the boiling-point $t$, corresponding to the pressure $p$; (2) the heat necessary to overcome the molecular attractions of the liquid; and (3) the heat necessary for the expansion of the vapor from the initial volume of the liquid to the volume of the liquid and vapor at the temperature $t$. Suppose $s'$ to be the initial volume of the liquid; this initial volume may be supposed constant, since the expansion of most liquids by heat is small. Let $s$ be the specific volume of the vapor, then the work of expansion will be $L = \int p\,d\,v = p\,(s - s') = p\,u$, $u$ being the difference $(s - s')$; and the quantity of heat in units of heat, corresponding to the third quantity of heat above mentioned, will be $(A\,p\,u)$.

The total heat of evaporation from zero degrees will be

$$\lambda = q + r,$$

$q$ being the quantity of heat necessary to raise the temperature of the liquid from 0 to $t$ degrees, and $r$ the latent heat of evaporation at the temperature $t$. If we subtract $(A\,p\,u)$ from both members, we have

$$J = \lambda - A\,p\,u = q + r - A\,p\,u.$$

The quantity $A\,p\,u$ is the part of the heat which has been transformed into external work. The quantity of heat J therefore represents the part of the heat added which remains in the liquid and vapor. Representing by $\rho$ the quantity $r - A\,p\,u$, this quantity will be that portion of the heat supplied to the liquid which remains in the vapor, or which has not been transformed into exterior work.

If we now consider unit of weight of a *mixture of liquid and vapor*, we may suppose that $x$ represents the proportion by weight of the vapor (a fraction of a pound or kilogramme), and $(1 - x)$ the proportion of the liquid, since $x + (1 - x) = 1$. The volume of the vapor will be $x\,s$, and that of the liquid $(1 - x)\,s'$; and the sum of these two volumes will be the volume of unit of weight of the *mixture*, or $v$, and

$$v = x\,s + (1 - x)\,s'; \qquad (39)$$

or, since $s - s' = u$,

$$v = x.\,u + s'. \qquad (40)$$

In this expression the quantity $u$ remains constant while the temperature is constant, and $s'$ may be regarded as constant; so that $d\,v = u.\,d\,x$. When heat is applied to this mixture, a quantity of liquid represented by $d\,x$ is transformed into vapor, and the heat required is $d\,Q = r.\,d\,x$.

From these two equations we obtain the result

$$d\,Q = \frac{r}{u}\,d\,v. \qquad (41)$$

The fundamental equation

$$d\,Q = A\,(X\,d\,p + y\,d\,v)$$

becomes, when $t$ is constant, and consequently $p$ constant, and $d\,p = 0$,

$$d\,Q = A\,Y\,d\,v; \qquad (42)$$

and the fundamental equation

$$d\,Q = \frac{A}{\left(\frac{d\,T}{d\,p}\right)}\,[X\,d\,T + T\,d\,v],$$

because $d\,T = 0$ becomes

$$d\,Q = \frac{A.T.}{\left(\frac{d\,T}{d\,p}\right)}\,d\,v = A.T.\left(\frac{d\,p}{d\,T}\right)d\,v. \qquad (43)$$

From these results we obtain

$$A\,Y = \frac{r}{u}$$

$$\text{and } \frac{r}{u} = A.\,T.\frac{d\,p}{d\,T}. \qquad (44)$$

Dividing both members of this last expression by $A\,p$, gives

$$\frac{r}{A\,p\,u} = T\,\frac{d\,p}{d\,T}, \qquad (45)$$

an expression from which the value of $A\,p\,u$ for any temperature or pressure may be determined, since $r$ and $\frac{d\,p}{d\,T}$ may be found from the results of Regnault's experiments.

When heat is applied to unit of weight of mixture of a liquid and its vapor, the total quantity of heat will be represented by the general expression $f\,d\,Q = f\,A\,(d\,U + d\,L)$, from which $d\,Q = A\,(d\,U + d\,L)$. The external work $d\,L$ may be represented by $p\,d\,v$, and this equation becomes $d\,Q = A\,d\,U + A\,p\,d\,v$. The units of heat corresponding to the interior work, $d\,U$ or $A\,d\,U$, will be represented by two terms $d\,q$, the variation of the heat of unit of weight of the liquid $(= c\,d\,t)$, and $d(x\,\rho)$, the variation of the interior work of this vapor, so that the value of $(A\,d\,U)$ will be $d\,q + d\,(x\,\rho)$; and the value of $d\,Q$ becomes

$$d\,Q = d\,q + d\,(x\,\rho) + A\,p\,d\,v, \qquad (46)$$

a general form of equation applicable to mixtures of a liquid and its vapor.

This equation contains the quantities $q$, $\rho$, $p$, $x$, and $v$, of which $q$ and $\rho$ may be expressed in terms of $p$ or $t$, and the quantities $x$ and $v$ may either be expressed in terms of the other, by virtue of the equation $v = x\,u + s'$, expressing $x$ in terms of $v$, or $x = \frac{v - s'}{u}$, and considering $q$, $\rho$, and $u$ as functions of $p$.

The equation giving the value of $d\,Q$ is transformed to

$$d\,Q = \frac{d}{d\,p}\left(q - \frac{\rho}{u}\,s' + \frac{\rho}{u}\,v\right)d\,p + \frac{r}{u}\,d\,v. \qquad (47)$$

Another transformation is obtained by supposing $s'$ constant; then $d\,v = d\,(x\,u)$ and $A.p.\,d\,v = A.p.\,d\,(x\,u)$; and putting for $(\rho + A\,p\,u)$ its value $r$, the value of $d\,Q$ may finally be written

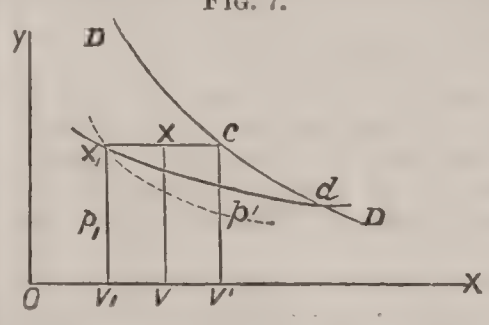
$$d\,Q = d\,q + d\,(x\,r) - \frac{x\,r}{T}\,d\,T. \qquad (48)$$

These expressions for the value of $d\,Q$ are sufficient for the solution of most practical problems in connection with vapors.

The lines or curve of expansion or compression for vapors when the external pressure is equal to the elastic force may by hypothesis be made the isothermal line, the isodynamic line, the adiabatic line, and a line or curve which has been called the *curve of quantity of vapor constant*.

In Fig. 7 let O X and O Y represent two co-ordinate axes, and suppose unit of weight of saturated vapor having a specific volume $v'$ and pressure $p'$ to expand, the introduction or supply of heat to be so regulated that the quantity of saturated vapor remains constant. In such a case there is neither condensation nor vaporization, and the corresponding curve of expansion is that of the *quantity of vapor constant*.

FIG. 7.




Dr. Zeuner gives as the probable form of equation of this curve $p\,v'^n = \text{constant}$, in which $n = 1.0646$. If, now, in a unit of weight of the mixture of liquid and vapor the quantity of vapor is $x_1$, less than 1, and the initial volume $v_1$, the point $x_1$ in Fig. 7 corresponding to the volume $v_1$ will be the point at which the pressure is $p_1$. Whatever curve of expansion be followed, if such a curve cut the line D D of quantity of vapor constant, the expansion beyond that will be that corresponding to superheated vapor.

Suppose, first, that the expansion takes place by the isothermal line. The quantity of heat required for the work of expansion, including both *interior* and *exterior* work, will be given by the equation $d\,Q = d\,q + d\,(x\,r) - \frac{x\,r}{T}\,d\,T$, which may be put under the form

$$d\,Q = d\,q + T\,d\left(\frac{x\,r}{T}\right). \qquad (49)$$

The isothermal line being that for which the temperature is constant, the quantity in this equation will become $d\,q = 0$, and $r = \text{constant}$, and

$$\int d\,Q = r \int d\,x,$$

$$\text{or} \qquad Q = r\,(x - x_1). \qquad (50)$$

It is evident, also, since $p$ is constant, that the isothermal line for vapor is a right line parallel to the axes of $x$ (or the line $x_1 - c$ in Fig. 7), and the external work $L = \int p\,d\,v = p\,(v_1 - v) = p\,u\,(x - x_1)$. The same expressions are true for compression.

Suppose, now, the expansion to take place according to the *isodynamic* line, or the line for which the interior work remains constant. In this case $d\,U = 0$, the value of $d\,U$ being given by the equation $d\,U = d\,q + d\,(x\,\rho)$. Making $d\,U = 0$, gives $d\,q + d\,(x\,\rho) = 0$. This equation and the equations $v = x\,u + s'$ and $v_1 = x_1\,u_1 + s'$ furnish the means of tracing the curve of expansion between given temperatures or pressures, and also of finding the final values of $x_1$ and $v_1$. It may be shown that in all cases there is *a greater proportion of vapor at the end of the expansion than at the beginning;* and hence when a mixture of vapor and liquid expands according to this law, the expansion is accompanied by *vaporization;* and, inversely, there is a *condensation* during compression.

The probable equation of the isodynamic curve for water is given by Dr. Zeuner, $p\,v^n =$ constant, in which $n = 1.0456$. For the quantity of heat required for expansion the general equation $d\,Q = A\,(d\,U + p\,d\,v)$ gives for $d\,U = 0$, $d\,Q = A\,p\,d\,v$; which shows that all the heat furnished for expansion is transformed into external work. It is to be observed that this curve of *expansion* can be followed only when there is liquid in presence of the vapor.

Suppose the vapor at the beginning be saturated, and the value of $x = 1$—or, in other words, no liquid being present—and let it be required to find how much heat must be supplied to cause it to remain saturated during the work of expansion; in which case the expansion curve would be the curve D D, the initial point being *c*, Fig. 7. The equation $d\,Q = d\,q + d\,(x\,r) - \frac{x\,r}{T}\,d\,T$, by substituting for $d\,q$ its value $c\,d\,T$ and effecting the integration in the second member, may be put under the form

$$d\,Q = (1 - x)\,c\,d\,T + r\,d\,x + x\left(c + \frac{d\,r}{d\,T} - \frac{r}{T}\right), \quad (51)$$

or
$$d\,Q = (1 - x)\,c\,d\,T + r\,d\,x + x\,h\,d\,T, \quad (52)$$

in which $h = c + \frac{d\,r}{d\,T} - \frac{r}{T}$. If now in this expression $x = 1$ and $d\,x = 0$, which accords with the conditions of the problem, then

$$d\,Q = h\,d\,T. \quad (53)$$

$h$ then may be regarded as the specific heat of saturated vapor, the quantity of vapor remaining constant. By integration we have

$$Q = \int_{t_1}^{t_2} h\,d\,T. \quad (54)$$

The equation which gives the value of $h$ shows that it may have a positive or negative sign; and as $h$ depends on the temperature, there will be a point of temperature for every vapor at which the sign $h$ will change. Moreover, the value of $Q = \int_{t_1}^{t_2} h\,d\,T$ shows that whether heat is to be supplied or abstracted during expansion depends on the sign of $h$. For most vapors at ordinary temperatures $h$ is negative, the vapor of ether excepted; and since $t_2$ is less than $t_1$, Q will have a positive value. It is then necessary to supply heat *during expansion in order to maintain the quantity of vapor constant.* If no heat be supplied, a portion of the vapor will be condensed. This law is reversed at the temperature at which the sign of $h$ changes; for ether this is $-150°$ C. For water the point of inversion is $520°$ C.

The adiabatic curve of expansion or compression is one for which no heat is supplied to or abstracted from the vapor during expansion or compression. This condition, introduced into the general equation $d\,Q = d\,q + d\,(x\,r) - \frac{x\,r}{T}\,d\,T$, or the same under the form $d\,Q = d\,q + T\,d\left(\frac{x\,r}{T}\right)$, gives for $d\,Q = 0$,

$$0 = d\,Q + T\,d\left(\frac{x\,r}{T}\right); \quad (55)$$

an equation which becomes, by integration,

$$\frac{x\,r}{T} + \int \frac{d\,q}{T} = \text{constant}, \quad (56)$$

or
$$\frac{x\,r}{T} + \tau = \text{constant}. \quad (57)$$

This equation furnishes the means of finding the value of $x$ and the ratio of expansion when the initial value of $x$ and the limiting temperatures are given, $r$ and $q$ being dependent on the temperature. This expression, which is applicable to a mixture of vapor and liquid, may be written

$$\frac{x\,r}{T} + \tau = \frac{x_1 r_1}{T_1} + \tau_1. \quad (58)$$

If applied to the vapor of water, it may be proved by examples that expansion by the adiabatic curve of dry and saturated vapor is accompanied by condensation, the value of $x$ diminishing during the expansion.

If liquid water only is present in the initial state, the quantity $x_1$ being zero, it appears that there will be vaporization during expansion. The same is true for most vapors at ordinary temperatures. Whether there will be vaporization or condensation during expansion depends, then, on the proportion of the mixture which exists in the liquid state at the initial temperature. For water, when the mixture is about $\frac{5}{10}$ths, or one-half, the same proportion will exist at the end of the expansion, there being at first vaporization, and then condensation of nearly the same quantity.

The quantity of exterior work performed or expended when the change of state occurs according to the adiabatic law may be found from the expression $d\,Q = A\,(d\,U + d\,L)$. Making $d\,Q = 0$, gives

$$A\,d\,L = -A\,d\,U,$$

or
$$A\,d\,L = -d\,q - d\,(x\,\rho),$$

and by integration

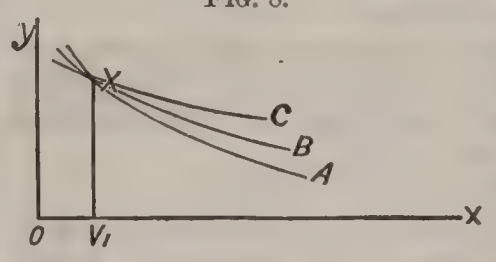
$$A\,L = q_1 - q + x_1\,\rho_1 - x\,\rho. \quad (59)$$

The equation of the adiabatic curve expressing the relation between $p$ and $v$ has a probable form for vapors, according to Zeuner, $p\,v^n = p_1\,v_1{}^n$, in which $n$ is variable, depending on $x_1$, the quantity of vapor in unit of weight of liquid at the initial temperature. For water the values of $n$ are for

$x_1 = 1$ ..... $n = 1.135$
$x_1 = 0.9$ ..... $n = 1.125$
$x_1 = 0.8$ ..... $n = 1.115$
$x_1 = 0.7$ ..... $n = 1.103$

The relative positions of the three curves, the adiabatic, the curve of quantity of vapor constant, and the isodynamic curve, for a mixture of liquid and vapor, all the curves passing through the same initial point, are shown in the following diagram, Fig. 8, in which A is the adiabatic curve, B the curve of quantity of vapor constant, and C the isodynamic curve.

FIG. 8.




The quantity of work of expansion for any gas or vapor, the equation of which is $p\,v^n = p_1\,v_1{}^n =$ constant, is

$$\left.\begin{aligned} L &= \frac{p_1 v_1}{n-1}\left[1 - \left(\frac{v_1}{v_2}\right)^{n-1}\right] \\ \text{or} \quad L &= \frac{p_1 v_1}{n-1}\left[1 - \left(\frac{p_2}{p_1}\right)^{\frac{n-1}{n}}\right] \end{aligned}\right\}, \quad (60)$$

the exponent $n$ having a value which depends on the nature of the fluid which expands. For air and the permanent gases $n$ may be taken equal to 1.410. For saturated steam, in presence of its liquid, $n$ is variable, and depends on the relative initial quantities of liquid and vapor.

For superheated vapor, according to the law of Hirn, the isodynamic curve is an equilateral hyperbola, starting from the point of condensation, its equation being $p\,v = p_1\,v_1 =$ constant. The law established by Hirn being that the product $p\,v$ is proportional to the *interior work* for superheated vapors, if that work is constant, or if the isodynamic curve is followed, the above equation will represent the curve.

The adiabatic curve for superheated vapor has the probable form $p\,v^n = p_1\,v_1{}^n$, in which $n$, according to Zeuner, is equal to $\frac{4}{3}$, or 1.333.

The isothermal curve for superheated vapor differs from that for the permanent gases. In a perfect gas all the heat introduced at constant temperature is transformed into external work, while in superheated vapor a part of this heat, especially near the point of condensation, is transformed into interior work. The equation of the isothermal curve has the probable form, according to Zeuner, of

$$p\,v = B\,T - C\,p^{\frac{n-1}{n}}, \quad (61)$$

in which for steam $n = \frac{4}{3}$, $C = 192.50$, $B = 50.933$, $p$ being expressed in kilogrammes per square mètre.

Applications of the principles of thermodynamics to the flow of vapors may be found in various works on the subject, the investigations of Dr. Zeuner being the most recent and complete. The reader is referred for full expositions of the subject of this article to the works of Clausius, Rankine, Sir William Thomson, Zeuner, Hirn, Briot, Verdet, and others.

W. P. TROWBRIDGE.

**Thermo-Electricity.** See ELECTRICITY, by PRES. H. MORTON, PH. D.

**Thermometer.** See THERMOMETRY.

**Thermom′etry** [Gr. *θέρμη*, "heat," and *μέτρον*, "measure"], the art of measuring temperatures by the expansion of solids, liquids, and gases, or by means of some electrical, acoustic, or other physical phenomena. Liquids have been found best adapted to measuring lower temperatures, the expansion of solids being too small and that of gases too great for ordinary purposes. It is probable that Cornelius Drebbel, a Hollander, in the year 1630 first proposed a method for indicating changes of temperatures by means of a glass bulb with a small elongated stem, which was dipped into a liquid; as the air became heated, the liquid was depressed by the expansion of the air, a reduction of temperature causing a corresponding elevation. This instrument, which was the origin of the air-thermometer, was open to several objections: it was too delicate in its indications and too large in size to be of much practical use; besides, differences in atmospheric pressure independent of temperature affected the volume of the air. The latter difficulty was remedied by totally excluding the air, two bulbs being blown at the two ends of a tube, which was bent twice at right angles and a liquid enclosed in the stem. But this instrument, which is termed a *differential thermometer*, only indicated differences of temperature between the two bulbs, and not variations in the atmosphere generally; for some purposes, however, it is still advantageously employed. The next improvement was effected by Boyle, who suggested the use of alcohol in a closed tube, to which a scale indicating the changes of temperature was attached. Newton next took advantage of the fact that the melting-point of ice and the boiling-point of water furnish two fixed temperatures, and divided the intermediate range between these points into equal parts, extending both above and below the two fixed marks.

Alcohol and mercury possess many advantages for thermometrical purposes. Alcohol does not solidify at any known degree of cold. Mercury has a very high boiling-point, follows nearly the same law of expansion as gases, possesses a wide range of liquidity, has a low specific heat, but a high conducting power, and can be obtained in a state of great purity. Its use in the construction of a thermometer was first suggested by Römer. The ordinary mercurial thermometer consists of a glass tube, at the end of which is blown a spherical or cylindrical reservoir, termed the bulb. In its manufacture three operations are comprised—viz. the calibration of the tube, the introduction of the mercury, and the graduation of the scale. The calibration of the tube is effected by introducing a column of mercury about an inch in length, and ascertaining that it retains the same length in all parts of the tube, care being taken that the metal is maintained at a uniform temperature. The tube, which is advantageously provided at its open extremity with a funnel or a bulb, is next filled with mercury by gradually introducing the metal, inclining the tube, and heating the bulb, in order to expel the air, until both the bulb and stem are completely filled. The mercury is then heated to boiling, and the tube hermetically sealed by melting it below the funnel or upper bulb. The graduation of the thermometer is accomplished by first determining the two fixed points—*i. e.* the melting-point of ice and the boiling-point of water. The former is ascertained by immersing the bulb and part of the tube in snow or pounded ice which is contained in a vessel provided with an aperture allowing the escape of the water: the latter, by surrounding the thermometer with steam, external contact with the air being prevented. It is also necessary, in the latter determination, to take into consideration the barometric pressure of the air, and in case this be other than 760 millimètres, a correction of the result should be made. The interval or range between the freezing and boiling points is next subdivided into equal parts or degrees. In accurate thermometers the scale is marked on the stem itself. This is done by covering the stem with a thin coating of wax, in which the divisions and their corresponding numbers are traced with a finely-pointed steel, exposing it to the action of hydrofluoric acid, which etches in the glass the traced figures, and afterward removing the remaining wax. The degrees are usually represented by a small cipher, placed above the right of the number indicating the temperature, those below the zero or freezing-point of water having the minus sign (—) placed before them. It is a source of regret that unanimity does not prevail in different countries, in regard to the number of divisions made between the two fixed points. In the thermometer used for ordinary purposes in this country and in England and Holland, *Fahrenheit's* (1720) scale is employed, in which the range between the freezing and boiling points of water is subdivided into 180 degrees. This division was based upon a very erroneous and arbitrary assumption of Fahrenheit, the original manufacturer, that the temperature indicated by 32° below the freezing-point of water represents the absolute absence of heat. In France, and on the Continent generally, the scale introduced by *Celsius* (1742) is employed. In this thermometer, which is commonly known as the *Centigrade*, the interval between the freezing and boiling points is subdivided into 100 equal parts. For scientific purposes the Centigrade thermometer is, at present, almost universally used. A third scale, suggested by *Réaumur*, is still employed in Russia and Germany. In it the range between the fixed points, which are the same as in the Centigrade scale, is divided into 80 degrees. The degrees indicating the temperature of melting ice, the intermediate range, and the temperature of boiling water in the three scales are as follows:

| | Temperature of melting ice. | Intervals. | Temperature of boiling water. |
|---|---|---|---|
| Centigrade scale (C.)..... | 0° | 100° | 100° |
| Fahrenheit's scale (F.)... | 32° | 180° | 212° |
| Réaumur's scale (R.)..... | 0° | 80° | 80° |

The reduction of degrees from one scale into those of another is accomplished by the simple formulæ:

Fahrenheit to Centigrade, $\frac{5}{9}(F.^\circ - 32) = C.^\circ$
Centigrade to Fahrenheit, $\frac{9}{5}C.^\circ + 32 = F.^\circ$
Réaumur to Fahrenheit, $\frac{9}{4}R.^\circ + 32 = F.^\circ$
Fahrenheit to Réaumur, $\frac{4}{9}(F.^\circ - 32) = R.^\circ$
Centigrade to Réaumur, $\frac{4}{5}C.^\circ = R.^\circ$
Réaumur to Centigrade, $\frac{5}{4}R.^\circ = C.^\circ$

When the measurement of low temperatures is required, the alcoholic thermometer is advantageously employed. In other instances the irregular expansion and low boiling-point of the alcohol (78.4° C.) are serious objections to its use. The latter difficulty may, however, be overcome to some extent by the substitution of amylic alcohol, which indicates correctly temperatures up to 120° C. In all cases the alcohol should be distinctly colored, usually by boiling with cochineal, and the scale compared with that of a standard mercurial thermometer.

In a good thermometer the mercury will fall through the tube on inversion, thus proving the perfect exclusion of air. Slight variations of temperature are best indicated when the capillary tube is very small and the bulb large. On the other hand, if the bulb be small, the thermometer more rapidly assumes the temperature of the surrounding medium. Upon immersing the bulb and stem in melting ice, the top of the mercury column should exactly indicate 0° C. or 32° F., and the mercury should remain stationary at 100° C. or 212° F. when the thermometer is surrounded by steam generated by boiling water in a metallic vessel at a barometric pressure of 760 millimètres. The volume of the degrees should be perfectly uniform. Whether this is the case may be ascertained by detaching a little cylinder of mercury from the main column and passing it from one part of the stem to another, when, if the scale be properly graduated, it will occupy an equal number of degrees in all parts of the tube.

Thermometers, even when constructed with the greatest care, are liable to undergo changes which affect their accuracy. One source of error consists in a deviation of the zero-point, which is liable both to a temporary depression and elevation, and to a permanent elevation. The former changes ensue when a thermometer has been repeatedly heated, a temporary fall then occurring; and when it has been much cooled, a temporary rise then taking place. The second change, which is probably due to a diminution of the volume of the bulb, and to the influence of atmospheric pressure on the stem, is avoided by allowing the filled tube and bulb to remain at rest for two or three years before the instrument is graduated. The assumption that equal increments of heat produce an equal amount of expansion is not absolutely correct; the expansion of mercury, for example, between 0° and 10° C. being less than the expansion between 90° and 100° C. In the mercurial thermometer, however, this difference is nearly equalized by the increased capacity of the glass bulb for temperatures between the freezing and boiling points; but for those above 100° C. the compensation is not so exact. Certain precautions are to be observed in reaching the temperature indicated by a thermometer: the instrument should be held in a perfectly vertical position, and, as the scale is a little distant from the mercuric column, care should be taken that the line of sight is perpendicular to the scale. In very accurate observations the bulb and stem should possess the same temperature, and the readings be taken with the assistance of a telescope.

Besides the kind of thermometers already mentioned, several other varieties are in use, generally for specific purposes.

*Breguet's metallic thermometer* is founded on the unequal expansion of metals, and is very delicate in its indications. It consists of three exceedingly thin ribbons of platinum, gold, and silver, which are coiled in a spiral form, one end

of which is fixed, the other being connected with a light needle, which moves round a scale, graduated in Centigrade degrees by comparison with a standard mercurial thermometer. The most expansible metal, silver, forms the internal side of the spiral, platinum forming the external; gold is placed between the other two metals, as its expansibility is intermediate between that of silver and platinum. When the temperature rises, the silver expands more than the gold or platinum, and the spiral unwinds, and communicates a motion to the index-needle, an opposite motion being produced by decrease of temperature.

In meteorological observations it is often necessary to know the highest temperature of the day and the lowest temperature of the night. The instruments which most readily permit of these determinations are termed *registering* or *maximum and minimum thermometers*. *Rutherford's maximum and minimum thermometer* consists of a mercurial thermometer with a horizontal stem, in the bore of which a small piece of steel wire is included above the mercury. Upon an increase of temperature the mercury expands, pushing the steel wire before it, but as it contracts and recedes the wire is left in a position corresponding to the greatest temperature recorded by the thermometer. The minimum temperature is observed by an alcoholic thermometer, arranged like the mercuric one, but having an index consisting of a small piece of enamel sunk below the surface of the liquid. As the alcohol contracts, the index is carried along by capillary attraction; when the temperature rises, the liquid readily passes the enamel, which is thus left in a position indicating the greatest point of contraction of the alcohol. The same object is attained by the use of *Six's maximum and minimum thermometer*, consisting of a large bulb filled with alcohol, to which is joined a tube bent in the form of an inverted syphon, in the lower part of which a small column of mercury is contained. The extreme points reached by the mercury, as it is moved by the expansion and contraction of the alcohol, are registered by a small enamelled wire index, sliding in the leg of the bent tube, which is prevented from falling by its own weight by means of a small spring. Six's thermometer has been applied with success in measuring the temperature of the ocean at great depths, where an ordinary thermometer would give erroneous indications in consequence of the pressure sustained by the bulb. For this purpose it is necessary to surround the bulb with a second bulb nearly filled with alcohol, which protects it from the heat caused by the compression of the water. The *maximum thermometer of Negretti and Zambra*, which is simple in form and not liable to derangement, consists of an ordinary mercurial thermometer placed horizontally with a narrow contraction in the tube just above the bulb, which allows the mercury to pass as it expands, but prevents its receding as the temperature falls. *Phillips* has constructed a *maximum thermometer*, the index of which is merely a small portion of the mercurial column, which is separated from the rest by a minute globule of air. In these two latter thermometers the mercurial column is restored to its place by placing the instrument in a vertical position and giving it a few shakes.

For the determination of temperatures higher than the boiling-point of mercury, but lower than the melting-point of glass, the method of *air thermometry of Regnault* is occasionally resorted to. It consists in employing a cylindrical glass reservoir, which terminates at one end in a narrow glass tube, bent at a right angle, and drawn out to a fine point at its extremity. The instrument is introduced into the space the temperature of which is to be estimated until it has acquired the same temperature, when the narrow orifice is closed by fusing the glass, care being taken to note the barometric pressure and temperature of the surrounding air. The sealed point of the tube is then broken off in a vessel containing mercury, and the reservoir reduced to 0° C. by surrounding it with melting ice. As the air contained in the instrument contracts, a certain amount of mercury rises in the tube. The height of the column above the surface of the mercury contained in the vessel and the position of the barometer are ascertained, the tube is closed with a little wax, and the instrument removed from the vessel and weighed at the ordinary temperature of the air. It is then again weighed when completely filled with mercury, its weight when empty being also determined. The weight of the mercury necessary to entirely fill the instrument will bear to the difference between this weight and that of the mercury contained in it at the first weighing the same proportion as the total capacity of the thermometer, at the temperature of the mercury with which it was filled, bears to the volume occupied (at 0° C., and subjected to the atmospheric pressure diminished by the column of mercury, which extended above the vessel containing the metal) by the air which the thermometer contained when its orifice was sealed. Thus, the temperature to which the reservoir was exposed can be obtained, expressed in Centigrade degrees, by means of the formula—

$$W(1+kt) = w\frac{h}{H}(1+at), \text{ or } t = \frac{W - w\frac{h}{H}}{w\frac{h}{H}a - Wk},$$

where W is the weight of the mercury which completely filled the thermometer; $w$, the difference between this and the weight of the mercury contained at the first weighing; $t$, the temperature required; H, the barometer stand when the orifice of the tube was sealed; $h$, the pressure supported by the air in the instrument when it was closed with the wax—*i. e.* the barometric pressure noted at this moment—the column of mercury extending above the vessel; $a$, the coefficient of expansion of air for 1° C. = 0.00366; $k$, the coefficient of cubical expansion of the glass of which the thermometer is constructed = 0.0000305 for common glass between 0° and 300° C.

*Radiant heat* of very low intensity can best be measured by means of an instrument termed the *thermo-multiplier* of Melloni. The sensitiveness of this thermometer is so great that the heat of the human body produces effects upon it, even at the distance of several yards. It is constructed by first arranging a *thermo-electric battery*, connecting together successive pairs of two different metals, and heating the alternate junctions, the others being kept cool. Melloni employed such a battery, consisting of 36 pairs of small bars of bismuth and antimony. The heat generated is estimated by connecting the instrument with a very sensitive galvanometer. (See ELECTRICITY.) By the use of such an apparatus he was able to estimate very small amounts of radiant heat, even that emitted by insects. (See also RADIOMETER.) In order to determine temperatures higher than the boiling-point of mercury (360° C.) a modification of the thermometer, known as the *pyrometer*, which appears to have been first introduced by Musschenbroek in 1730, is employed. Numerous forms of this instrument have since been suggested, most of which are based upon one of the following phenomena: the expansion of metals; the contraction of baked clay; the expansion of vapors and gases; the fusing of metals or alloys; the increase of temperature imparted to a weighed quantity of water by a known weight of heated platinum or iron; electrical and thermo-electrical changes. The indications furnished by pyrometers based upon the linear expansion of metals have been found to be inaccurate; the data given by the contraction of baked clay when exposed to an increase of temperature are still less reliable.

The *air pyrometer of Erman and Herter* is similar in principle to that of Regnault above, and consists of a hollow copper or platinum sphere provided with a short, conically-shaped tube having a very narrow orifice, to which a copper cylinder, furnished with a stopcock at its extremity, can be attached. In order to determine the temperature of a furnace by means of this instrument, it is so placed in the heated place that a small portion of the tube extends out. As soon as the sphere has acquired the heat of the furnace, the copper cylinder is securely connected with the end of the tube, and the stopcock is closed. The apparatus is then withdrawn from the furnace, and as soon as it has become cool it is immersed in water, and the stopcock opened, when a certain quantity of water is drawn into the sphere, from the weight of which the amount of expelled air, and thereby the temperature to which the sphere was subjected, is calculated.

A method for measuring high temperatures suggested by Pouillet, which receives extensive practical application in metallurgical operations in the determination of the heat of furnaces, consists in heating in the fire-space a known weight of iron, and immersing it in a weighed quantity of water of a known temperature. The weight of the iron and water, the original and final temperature of the water, the specific heat of water and of iron, furnish the data from which the temperature desired can be easily calculated.

Our American physicist, Alfred M. Mayer, has recently determined high temperatures by observing the action of heat upon the wave-length of a wave of sound, which is made to traverse a tube exposed to the heat to be measured. (For a description of other methods of pyrometry see PYROMETER.) J. P. BATTERSHALL.

**Thermo-Multiplier.** See THERMOMETRY.

**Ther′mopile,** also called **Thermo-electric Pile.** See ELECTRICITY, by PRES. HENRY MORTON, PH. D.

**Thermop′ylæ,** a narrow defile between Mount Œta and the Maliac Gulf, leading from Thessaly into Locris. It was the only way by which an enemy could enter from Northern Greece into Hellas, and became celebrated as the scene of the heroic death of Leonidas and his 300

Spartans in their attempt to prevent the Persian hordes from passing through the defile. The localities are much altered now by the action of the sea and the rivers.

**Thermot'ics,** the science of HEAT (which see).

**Théroigne' de Mirecourt',** whose true name was ANNE JOSÈPHE TERWAGNE, b. at Marcourt, Luxemburg, Aug. 13, 1762; was educated in a convent, but went in 1789 to Paris, where she lived as a courtesan, and at times sank very low. By embracing the Revolution with great enthusiasm she made a new departure; appeared in public meetings as the Amazon of the Revolution; made speeches, was eloquent, and acquired some influence both over the mob and in the political coteries. In 1791 she was captured by the allies on a trip in Holland, and imprisoned in Vienna for nearly a year. Restored to liberty, she repaired to Paris, and became still more popular; but on May 31, 1793, while trying to defend her lover, Brissot, she was seized by a rabble of infuriated women in the garden of the Tuileries, stripped naked, and whipped. This drove her mad, and she spent the rest of her life in La Salpêtrière, where she d. June 9, 1817. (See Fuss, *Théroigne de Mirecourt,* 1854.)

**Therol'ogy** [Gr. *θήρ, θηρός,* "wild beast," and *λόγος,* "discourse"], a name sometimes substituted for the word "Mammalogy," on the ground that the latter is a hybrid compound of Latin and Greek, and therefore inadmissible on strict philological principles. It is, however, rarely used. (See MAMMALOGY.) THEODORE GILL.

**Thesaurus.** See LEXICON.

**The'seus,** in Grecian mythology, the national hero of Attica and the founder of the city of Athens, where he established the Panathenæan festival and the Pythian games; was a son of Ægeus and Æthra, and was married first to Antiope, the queen of the Amazons, whom he carried off, afterward to Phædra. He took part in the campaign of the Argonauts, in the Calydonian hunt, in the battle with the Centaurs, etc., but his most famous exploit was the slaying of Minotaur. Attica was bound to send annually a tribute of youths to Crete to be sacrificed to this monster. In order to put an end to this misery, Theseus repaired to Crete and won the affection of Ariadne, the daughter of King Minos, who provided him with a clue to the labyrinth and a sword to kill Minotaur; he slew the monster and carried off Ariadne, whom he afterward left on Naxos. During a revolution in Athens he fled to Scyros, where he perished by the treachery of King Lycomedes, but in 469 B. C. Cimon conquered Scyros and brought his bones back to Athens, where they were interred in the celebrated temple of Theseus, one of the finest buildings in Athens, which during the Middle Ages was used as a Christian church, but now is employed as a museum. By the sculptors Theseus was sometimes represented as resembling Hercules, with a lion's skin and a club, though of a lighter and fleeter form and of a more elevated expression; sometimes as resembling Hermes, with chlamys (a short cloak) and petasos (a cap).

**Thesiger.** See CHELMSFORD.

**Thes'pis,** a native of Icaria in Attica and a contemporary of Pisistratus, became the inventor of the Greek tragedy by introducing between the dithyrambic chorus at the festival of Dionysus an interlocutor, an actor, who in monologues, or perhaps in dialogues with the leaders of the chorus, narrated, or gave a mimetic representation of, the incidents to which the songs referred. Nothing of his writings, if he wrote anything, has come down to us, but it is probable that his dramatic representations were very far from that sublime and solemn character which we know from Æschylus. Nevertheless, the curious picture of Thespis strolling around from place to place and entertaining people with shows from his wagon is a misconception of a time in which the theatre and drama had lost all religious signification, and become a mere amusement of the multitude. It is Horace who gave currency to this idea.

**Thessalo'nians, First Epistle of St. Paul to the,** was written from Athens or Corinth in 53 A. D. to the Church at Thessalonica. It contains encouragement for the infant Church, and warnings against licentiousness and avarice.

The SECOND EPISTLE TO THE THESSALONIANS was written by St. Paul from Corinth soon after the first, to counteract certain misapprehensions as to the speedy second advent of Jesus Christ, and the consequent disposition to idleness. They are first in chronological order of Paul's Epistles.

**Thessalonica.** See SALONICA.

**Thess'aly,** or **Thessa'lia,** a large division of ancient Greece, bounded E. by the Ægean Sea, N. by Macedonia, and W. by Epirus. The surface is a plain, enclosed on all sides by mountains—Pelion and Ossa on the E., Olympus and the Cambunian Mountains on the N., Pindus on the W., and Orthrys on the S. The soil is very fertile, and the land was in ancient times famous for its wheat and its fine breed of horses. The inhabitants were Æolians, but very early the Epirotes invaded and conquered the country, and made the inhabitants their slaves. The government was oligarchical, but very often disturbed by internal wars, which was the reason why Thessalia never exercised any influence on the affairs of Greece. It was conquered by Philip of Macedon, and passed from Macedonia into the hands of the Romans.

**Thet'ford,** tp., Genesee co., Mich. P. 1260.

**Thetford,** p.-v. and tp., Orange co., Vt. P. 1613.

**The'tis,** in Grecian mythology, a daughter of Nereus and Doris, and the leader of the Nereïds, was married to a mortal man, Peleus, king of the Myrmidons in Thessaly, because an oracle had declared that she should bear a son who would become more famous than his father, for which reason none of the gods wanted to marry her. She bore several children to Peleus, but they all perished under her attempts to make them immortal, with the exception of the youngest, Achilles, whom the father saved by interrupting the mother's experiments. Provoked, Thetis left Peleus and returned to the waters whence she had come, but she followed the fortunes of her son with passionate sympathy.

**Thévenot'** (MELCHISEDECH), b. in Paris about 1620; travelled much in Europe; held official positions at Genoa in 1645 and in Rome 1652–54; became keeper of the Royal Library in Paris in 1684, and published *Relations de Divers Voyages curieux* (2 vols. fol., Paris, 1663–72) and *Recueil de Voyages* (1681), containing Marquette's *Découvertes dans l'Amérique septentrionale.* D. at Issy Oct. 29, 1692.—His nephew, JEAN DE THÉVENOT, b. in Paris June 6, 1633; travelled extensively in Europe, Northern Africa, Central and Southern Asia. D. at Miana, Armenia, Nov. 28, 1667. His *Voyages* were published separately in 1664 and 1684; collected in 5 vols. in 1689. He introduced coffee into France in 1655.

**Theza,** town of Morocco, on the Sebu, in lat. 34° 9′ N., lon. 3° 55′ W., is fortified, has a fine mosque, and carries on some trade with Algiers, Tlemcen, and Fez. It is famous for its excellent water. P. 5000.

**Thian'-Shan** ("celestial mountains"), a lofty mountain-chain in Central Asia, extends in lat. 42° W. from lon. 80° to 90° E., forming the boundary between Thian-Shan-Nanloo, or Toorkistan, and Thian-Shan-Peloo, or Soongaria. It is volcanic, and several of its peaks rise to the height of 21,000 feet, but very little is known about it.

**Thibaudeau'** (ANTON CLAIRE), b. at Poitiers Mar. 23, 1765, where he subsequently practised as an advocate; was elected a deputy to the Convention in 1792; voted for the execution of the king without appeal to the people, but fell out, nevertheless, with the Terrorists; was chosen president of the Council of Five Hundred in 1796, but was proscribed by the Directory; became a member of the council of state under the Consulate and Empire, and was made a count in 1808, but was banished from France by the ordinance of July 26, 1815, and lived in Prague, engaged in mercantile business, till 1830, when he returned to France; was made a senator after the *coup d'état,* Dec. 2, 1850. D. Mar. 8, 1854. Besides several other works, he wrote—*Mémoires sur la Convention et le Directoire* (2 vols., 1824) and *Mémoires sur le Consulat et l'Empire* (10 vols., 1835).

**Thibaut',** or **Thibaud,** b. at Troyes in 1201, a posthumous son of Count Thibaut of Champagne, and Blanche, daughter of King Sancho the Wise of Navarre; was educated at the court of Philip Augustus; took an active part in the political entanglements after the death of Louis VIII.; became king of Navarre in 1234; made an utterly unsuccessful crusade in 1239; persecuted the Albigenses in his territories, which in other respects he governed well. D. at Pamplona July 10, 1253. Among the *trouvères* he occupies a high rank; 66 poems by him were published in 1742 by Lévesque de la Ravallière, and 81 are found in Tarbé's *Collection des Poètes champenois* (1851).

**Thi'baut** (ANTON FRIEDRICH JUSTUS), b. at Hameln, in Hanover, Jan. 4, 1774; studied law at Göttingen, Königsberg, and Kiel, and became professor of jurisprudence in 1799 at Kiel, in 1802 at Jena, and in 1805 at Heidelberg, where he d. Mar. 28, 1840. His *System des Pandektenrechts* (2 vols., 1803) has been often reprinted; his *Ueber die Nothwendigkeit eines allgemeinen bürgerlichen Rechts für Deutschland* (1814) was opposed by Savigny; his *Ueber Reinheit der Tonkunst* (1825) caused a vehement but very interesting musical controversy.

**Thib'et,** or **Tibet** [contracted from the Thibetan words *thub-pa* and *phod-pa,* both meaning "to be able," and combined for the purpose of increasing the power of the expression], **Eastern** and **Western,** became after Marco Polo's travels the name applied to the longitudinal

valley lying between the Himalaya in the S. and the Karakorum or Thangla "pass over the steppes" in the N., and drained on the E. by the Tsang-Po, which by some is considered to be the Brahmapootra, and on the W. by the river-systems of the Indus and Sutlej. Its eastern and western boundaries are formed by two mountain-ranges which run respectively in southern and south-western directions, under lon. 97° and 73° E. Its total area is estimated at 1,480,100 sq. m., of which Eastern Thibet, or the Chinese province of Thibet, comprises 1,000,000; Western Thibet, or the Cashmerian province of Ladak, 39,100; and the territory of the independent Kanjoot tribes in the valleys of Gilgit, Hunza, Nagar, and Yassin, W. of the Indus River, 9000 sq. m. With respect to its surface Thibet forms an elevated, undulating valley hemmed in between high mountain-ranges, whose peaks in the Kailas or Gangri (Tise) group, near the watershed between the Indus and the Sutlej, reach a height of 22,000 feet; the watershed itself is situated at an elevation of 15,500 feet. This Gangri group and the adjoining Karakorum or Thangla range, as well as the desert-steppes which extend northward to the Kün-Lün, have been explored only in their western parts; no European has ever visited the central regions. We only know that a division takes place into two almost equally high branches, which to the N. and S. enclose a depression of no considerable depth, probably of an average height of 15,000 feet, and with an inclination from W. to E. The Kün-Lün (Kwen-Lun), the northernmost of the mountain-systems of High Asia, is beyond the boundary of Thibet. Its valleys are elevated plateaus, which, as far as we know, slope gently toward the Karakorum range. Lakes are numerous and of large size, but the precipitation not balancing the evaporation, they have lost considerably in bulk, and their waters have often become briny. In Southern Thibet are the Byanbrog, commonly written *Yamdok* or *Chamdok*, a fresh-water lake situated at an elevation of 13,700 feet, comprising an area of 116 quadrate kilomètres, and containing a large inhabited island whose hills rise 3000 feet above the water; the Namtso or Tengrinor, farther to the N., explored in 1872 by Indian pandits, and situated at an elevation of 15,190 feet; and beyond this four other lakes, as yet unexplored. In the region of the sources of the Sutlej are the two fresh-water lakes Mapang, or Mansaraner, situated at an elevation of 15,250 feet, and Lang-Tso or Rakutal, both of which play a conspicuous part in the mythology and pilgrimages of the Hindoos. Of the numerous salt lakes in Cashmerian Thibet the largest are the Tsomoriri, situated at an elevation of 14,900 feet, near the English frontier, and the Tsomoqualari, or Pang-Kong, consisting of two large basins, one above the other. Numerous rivers originate in Thibet. The chief stream to the E. is Tsang-Po, which by English-Indian geographers is considered to form the trunk current of the Brahmapootra, while others hold—and probably with more right—that this river is formed by the three streams, the Tsang-Po in the W., the Dibong in the centre, and the Lohit in the E., and that the last mentioned is the principal current, as it carries the greatest amount of water. To the W. the country is drained by the Sutlej, an affluent of the Indus, and the Indus, which flows steadily in a western direction to the western frontier of Thibet, where it suddenly turns to the S. The streams descending from the Karakorum and watering Eastern Toorkistan unite in the Tarim River. In spite of the low northern latitude, the climate is very cool, even at the bottom of the valleys, on account of the great elevation of the surface. At an elevation of 12,000 feet, at which densely-peopled districts still occur, the mean annual temperature is only 41–43° F., and the lowest −4° F. In winter the rivers are covered with ice at an elevation of 7000 feet, but in valleys below 10,000 feet snow is not sure to fall, on account of the extraordinary dryness of the atmosphere; cloud-formations and summer showers are rare, and many districts have only 1 per cent. of that amount of moisture which would be necessary to saturate the ground. The rich gold-deposits of Thibet were known, according to the researches of Prof. Schiern, to the ancient writers, and gave rise to the myth of the gold-digging ants. At present the yield is brought into market in a very impure state. Rich coal-deposits are found, and borax has become an article of the world's commerce. Hot springs are numerous, and form an object of the superstitious worship of thousands of pilgrims; but medical institutions have nowhere been established. Agriculture is of subordinate importance here, as in all mountain-countries with a temperate climate; the chief wealth of the country consists in its pastures and cattle. The prevalent characteristic of the landscape is its absolute destitution of forest; from the snowfields far into the valleys the eye meets nothing but yellow, purple, or brown tints, square miles of bare rock without one speck of green. Meadows and fields are found only at the bottom of the larger valleys, and are so rare in the rest of Thibet that the villages separated many miles from each other have often received their names from their location in the neighborhood or within the limits of such a fertile spot. Single trees may be cultivated at an elevation of 12,000 feet, but generally bushes take the place of groves, and willows and poplars yield the scanty building materials. Coarse-fibred plants and dung serve as fuel. Fruit trees can be cultivated with profit only in the south-eastern and western districts; here apricots and currants form valuable articles of export. Among the cereals barley and various kinds of leguminous plants yield good crops; rye and wheat succeed in the valley of the Tsang-Po up to a height of 12,000 feet, but do not ripen until the end of September. As agriculture everywhere demands irrigation, it is confined to the bottom of the valleys and the lower slopes. The meadows are neglected, though lucerne grass yields a good crop even at an elevation of 13,000 feet. Hay is not made. The higher pasture-grounds are frequented during summer by wandering tribes, which during the winter return to the valleys. The cattle are a cross between the Thibetan bull, the yak, and the Indian cow. The sheep is the *Ovis barual* of Hodgson. Sheep are also employed as beasts of burden. The horse is small but vigorous; asses are kept only by the leaders of caravans. The goat has under its covering of long, overlapping hairs a coat of fine wool, the so-called *pashne*, which is of importance for the manufacture of shawls. Dogs are so numerous that they have become a nuisance. Poultry was introduced from Cashmere about twenty-five years ago. Game is numerous in the higher locations, where there are large uninhabited regions. The musk-deer is the most valuable game; the kyang, *Equus hemionus*, a kind of wild horse; the yak, *Bos* or *Poëphagus grunniens;* a colossal mountain-sheep, *Ovis argali*, of the size of a stag, and the *Pseudovis nahoor*, another kind of sheep, of the size of a common deer. Millions of wild yaks roam in the northern part of Thibet. A bear, *Ursus himalayanus*, of small size, and a kind of leopard, *Felis macroscelides*, are the largest beasts of prey, but they avoid the inhabited valleys. The population is estimated at 5,250,000, of which about 5,000,000 belong to the Chinese, about 150,000 to the Cashmerian part, and about 21,000 to the western valleys inhabited by the Kanjoot. Considered with respect to its total area, Thibet is very thinly peopled; nevertheless, in its principal valleys the population is as dense as in the central cantons of Switzerland, though these valleys are situated about 3000 feet higher. In 1854 the capital, Lassa (11,700 feet), numbered 15,000 inhabitants, besides 1500 soldiers and a monastic population estimated at 18,000, the single monastery of Debang containing 7700 monks. Digarchi (Shegatse), farther to the W. (11,800 feet), has 9500 inhabitants, not reckoning the inmates of the famous monastery, Tashilumpo. Le, in the valley of the Sutlej (11,354 feet), has a fixed population of 4000, which in summer increases to 10,000. Ethnographically, the Thibetans belong to the Mongolian, more especially to the Turkish, race. Beyond Thibet they pushed onward into the Himalaya, and founded empires in Bootan and Sikkim. Attempts have been made, though in vain, to prove a connection between them and the aboriginal population of British India; the bodily development is decidedly different in the two races. On the other hand, there exist both in language and exterior striking resemblances between the Thibetans and the population of the northern part of the Indo-Chinese peninsula. With the Thibetans the skull is well developed; the forehead low but broad; the bridge of the nose very flat, and so much sunk that in profile it stands out very little, and sometimes does not show at all; the eyes set obliquely; the hair dark and bristly; the chest broad; the muscles strong and well developed; hands and feet small; stature lower than in Central Europe. Caste-divisions do not exist; they are even forbidden by the religion. But polyandry is quite common. On account of the sterility of the soil, and the great difficulties in providing for a numerous family, brothers or relatives often take a wife in common, and provide in common for the children. The consequence of this arrangement is that the women are very little bashful. They generally carry on, on their own account, some small trade, the profit of which they spend for their own personal wants. The girls are very lascivious, and the monks, compelled to live unmarried, commit the greatest excesses with them. The Thibetan is generally a straightforward man, and possessed of a quick understanding, though his fear of the priests verges on superstition. The common dress is made of thick woollen stuffs, and consists for both sexes of a cloak; the men wear trousers, the women under-cloaks. Socks lined with leather serve as boots. The head is covered with a close-fitting cap. Generally, the dress is in shabby condition, partly because it wears out very rapidly in travelling along the rough mountain-paths, partly on account of the enormous taxes paid to the priests. Whole

villages depend for their livelihood on mercantile enterprises in salt, borax, rhubarb, etc., on the carrying business, forming and conducting caravans, etc.; manufacturing industry is of little importance, felt and coarse woollen stuffs being the only articles worth mentioning. Commerce with India is much obstructed on the part of the Chinese officials by annoying pass-regulations, by heavy duties, etc., but a lively intercommunication takes place between Thibet and the countries of the Yang-tse-Kiang, the native products being exchanged for tea, silks, and drugs. In Cashmerian Thibet the case is different. Here the English have constructed roads. In 1873 they compelled the maharajah of Cashmere to improve the road across the Karakorum pass, 18,550 feet high, and to abolish the heavy transit-duty, and in 1874 they opened Eastern Toorkistan for their goods by a commercial treaty with Kashgar. At the close of 1874 the newly-founded Central India Company formed a caravan at Lanor of 500 beasts of burden, loaded with English manufactures to a value of £25,000; it reached Kashgar in safety, and found a good market.

History and religion are more closely connected in Thibet than anywhere else. Tradition reaches back to the first century before Christ. At that time the country was divided into numerous small kingdoms. But in the first century after Christ fifty-three of these kingdoms became tributary to the dragon throne of China, and a prince of India united the others, on the Yarlung River, into one state. Under his successors commerce with India and agriculture flourished. The religion of Booddha was introduced in Thibet under King Srongtsan Gampo (617–698 A. D.), about twelve centuries after the appearance of its founder in India. It was brought to Thibet by some priests from Sinde, who sought refuge here from the persecutions by which, at that time, the Brahmans succeeded in extirpating Booddhism in India. These priests brought also the art of writing with them, and translated the sacred books of the Indian Booddhists into Thibetan. Monasteries were built, and they became here, as in Germany in the Middle Ages, centres of learned education and professional skill. At the same time, the empire was strengthened by conquests, the administration was improved, and the royal residence was removed from the Yarlung River W. to Lassa, the "city of the gods," which still is the capital of the country. Imprudent preference showed to the priests led in the ninth century to interior disturbances and the decay of the empire. In place of Booddhism the old worship of evil demons, the Bompa religion, was once more established, and the king was expelled. But after the lapse of eighty years a descendant of the legitimate dynasty came again into power, and with him the Booddhist priests. The western part of the country, however, separated, formed an independent state under the name of Maryul or Ladak, and became in the sixteenth and seventeenth centuries the cause of the establishment at Lassa of the temporal power of the Dalai Lama, the pope of the Booddhists of Central Asia. In the fourteenth century the priests had become mere jugglers. Then arose in Thibet a reformer, the monk Tsonkhapa, born in 1355 A. D. in the district of Amdo, where is now the famous monastery of Kunbum. Tsonkhapa strictly prohibited ordinary tricks and pretended miracles of charlatanism, and undertook with success the difficult task of uniting and reconciling the dialectical and mystical schools which Thibetan Booddhism had brought forth. He also published most comprehensive works. His innovations were never universally acknowledged; his followers, however, called Gelukpa or Galdaupa—a name derived from its principal monastery, Galdau, at Lassa—are the most numerous, and wear a yellow garb, while the others have chosen red. The old dogma that in times in which the religion of Booddha became forgotten a new Booddha should appear and show the way out of existing misery, was extended. It now taught that Booddha was always present on earth, manifesting himself through some representative. In the fifteenth century Gednu-Dub, provost of a large monastery, was the first to claim for himself the high dignity of being an incarnation of the Booddha who appeared for the last time in the sixth century before Christ. He assumed the magnificent title of the "very costliest teacher ocean." The Mongols called him Gyatso or Dalai Lama, the "priest ocean," and under this title he became known in Europe. The clergy, called lama—that is, the "upper," "superior"—soon recognized the unassailable position of their chief as an excellent means of extending their influence. The number of monasteries increased rapidly. The high priest took up his residence in the celebrated monastery, Chabrang in Lassa. The Mongols submitted to him as the highest wisdom, and afterward became the most zealous defenders of his most extravagant pretensions. The clergy favored the division of the country into numerous small principalities. Uniting with King Sengenamgyal of Ladak, the princes arose against the clergy, but the priests called in the Koshot Mongols, who were just arming for a campaign against the West, and by their aid they defeated their adversaries, and also took in 1640 the temporal government into their hands, conferring the executive power on a representative, a prime minister. Some gross impositions by which, in the beginning of the eighteenth century, a prime minister succeeded in concealing the death of the Dalai Lama for several years, led to a Chinese interference. The Chinese government assumed superintendence over the election of the Dalai Lama and the administration of the country, and from that time it has kept a standing army in the country and appoints all the officials. Thus, Thibet became a Chinese province. The election of the Dalai Lama is a mere form and a *fraus pia*. When a Dalai Lama dies, peculiar signs occur. Thus, in the midst of the snowfields one spot will suddenly become green, thereby indicating that Booddha descended to earth on this very point. But it is singular that such signs always occur at several places, and that it always is a child only a few years old which Booddha selects as his medium. An imperial committee examines the children in question, and the lots drawn with great solemnity finally decide among the pretenders. But the lots are painted on the outside according to a Chinese protocol, in order to guide the officials in the election, and prevent any child which might be disagreeable to the Chinese government from being elected. The child elected is then brought to a monastery, and trained by the priests in the pious deception which he is destined to practise all his life through. The last election took place in 1875, and a child from the western boundary, toward Ladak, was elected—a circumstance which seems to indicate a decrease of the Chinese influence, as formerly the Dalai Lama always arose in the eastern districts toward the Chinese frontier. Western Thibet, or Ladak, was in the last century exposed to frequent invasions of Turkish tribes from Toorkistan. The kings devoted themselves exclusively to religious exercises. The people became enervated, and the great number of monasteries ate up the substance of the nation. Thus the country fell without a blow to Cashmere when (in 1834) the ambitious ruler of that country, Runjeet Singh, invaded it and incorporated it with his kingdom as a province. The descendants of the old dynasty live in the capital, Le, unnoticed, upon a small annuity. Cashmere also attempted to conquer the western valleys of Gilgit, Hunza, Nagar, and Yassin. The inhabitants are Indians, not Thibetans, and present a low state of development. They are the Darden (Darada) of the Indian literature, the Kendschut of the travellers. The conquest of Gilgit was partly successful; the minor communities, however, in the more elevated valleys, are still independent and inaccessible to Europeans. An English officer, Hayward, made in 1870 an attempt to penetrate through Gilgit to the sources of the Oxus, but it cost him his life. Chinese Thibet is divided into the provinces of Kham, U, Thsang, and the territory of Guari Khorsum. The last division comprises the basins of the Sutlej and the Indus, but it is very thinly peopled on account of its great elevation, and it is occupied by China only for strategical reasons. In the three other provinces the administration is mostly in the hands of the territorial princes, who are vassals of the Chinese empire, and under the superintendence of Chinese mandarins. These mandarins, however, are generally not Mantchoos, but Thibetans, belonging to the wealthiest families, and provided with this or some other high-sounding title. The king, also, the proxy of the Dalai Lama, is a Thibetan, and always an ecclesiastic; in 1864 an insurrection, though an unsuccessful one, occurred because the king was not taken from the same monastery as hitherto. The same families hold also the lower offices of the civil service, and in the names of the supreme Chinese military or civil officers, or by misusing their authority, enormous taxes are laid on the people for the maintenance of the officials and the monasteries. The number of monasteries and monks is almost incredible: 18,000 live in and around Lassa; on an average every thirteenth, and in some places every seventh, man is a monk, and must be provided for by others. The monasteries are not only free of taxes, but receive for their support a part of the public revenue, which the monks supplement by obstinate beggary and by playing on the superstition of the people. The poverty of the people is very great—the moral depravity still greater. The Chinese keep 4000 Mantchoo troops in Thibet, and compel every secular male Thibetan between 24 and 50 years of age to serve in the militia; parts of this militia are still armed with bows. The highest military commanders are also the highest civil authorities. They form the courts in all cases between Chinese or between Chinese and Thibetans, and they have the power of taking away from the mandarins any case between Thibetans. Justice cannot of course be expected under such circumstances. Between 1854 and

1864 some French missionaries attempted to establish a Roman Catholic missionary station at Bonga, in Southeastern Thibet, in lat. 28° 30′ N., lon. 96° 45′ E. They were violently assailed by the lamas, and the Chinese authorities excused the disorder by alleging the religious fanaticism of the people. The missionaries remained unprotected, and were at last compelled to leave Thibet. On every occasion the Thibetan clergy and the Chinese officials show themselves equally eager to prevent the development of the people in order not to lose the influence which they now enjoy on account of the general ignorance and superstition. Italian Capuchins arrived at Lassa in the beginning of the seventeenth century, and in 1732, Horacio de la Penna visited it as a Roman Catholic legate, but was soon compelled to leave it. In 1811, Manning reached it from India, and in 1845, Huc and Gabet from the N. But since that time no European has entered it, the Chinese and Thibetan officials and soldiers keeping a very severe police superintendence along the frontier. The administration of the Cashmerian province of Ladak or Western Thibet has made great progress since 1867. An English official was at that time sent from British India to Le, the capital of the province, at an elevation of 11,354 feet, to superintend the fulfilment of the toll treaty. In 1871 the maharajah of Cashmere also appointed an Englishman as his commissioner, and finally conferred on him all the powers of a vizir, an office which had formerly always been filled by a Mohammedan.

*Language and Literature.*—The language is monosyllabic, and forms words and sentences by juxtaposition of roots and particles; with the verbs, however, changes in the roots are quite frequent. There is considerable resemblance between the Thibetan language and the dialects of Northern Burmah; exhaustive philological researches are still wanting, however. A circumstance of particular interest is this: the Thibetan became a written and literary language more than 1200 years ago; nevertheless, on account of the religious or idolatrous reverence with which the written word is regarded by the Booddhists, the Thibetan language has, with some few and insignificant exceptions, maintained its written forms of sounds unchanged up to this very day, while the style and the oral speech underwent considerable alterations. This clinging to the old, full pronunciation of many sounds characterizes Eastern and Western Thibet, while in Central Thibet, the principal seat of national civilization, a refined but somewhat effeminate pronunciation of the consonants may be observed; here also occurs the greatest difference between the spoken and the written sound. In 632 A. D. the Indian Devanagari alphabet was adapted to the Thibetan language by orders of King Srongtsan Gampo, and from it are derived the quadrangular letters of the Mongols; it is written from the left to the right. Paper is made from the *Daphne canabina;* it is gray and coarse. King Srongtsan Gampo ordered the sacred Indian books treating on Booddhist doctrines to be translated into Thibetan. The work of translation was carried on with a remarkable zeal; for the sake of uniformity, vocabularies of the Sanskrit proper names and of the technical and philosophical terms occurring in the original texts were prepared. King Srongtsan Gampo and his learned translators also issued books written in their native tongue, and, beginning with Tsonkhapa, the great reformer of the fourteenth century, native literature developed itself on a larger scale; even Mongolians write in Thibetan, as it is the language in the divine service. In the beginning of the eighteenth century all the Sanskrit translations were collected in two large and voluminous works, to which were added the sacred and profane native publications of different periods. These compilations bear the title of *Kanjoor* ("The Translated Word" of Booddha) and *Tanjoor* ("Translation of the Doctrine"). The *Kanjoor* contains 100 volumes, which are classed under seven divisions—discipline, transcendental wisdom, association of Booddhas, jewel-peak aphorisms, deliverance from emancipation, from existence, mysticism. The *Tanjoor* comprises 225 volumes, divided into mysticism and discipline; its contents are of a more miscellaneous character. (For a detailed abstract see Emil Schlagintweit, *Booddhism in Tibet*, London, 1863.) These collections have been printed with engraved wooden blocks; the first edition was prepared at Narthang in Southern Thibet by order of Mivang, regent of Lassa (1728–46); in Europe the whole of the *Kanjoor* and *Tanjoor*, besides many other native works not contained in these collections, are to be found in the libraries of St. Petersburg and London; the *Kanjoor* also at Paris. For printing, capital letters are always used, which for the requirements of running hand in manuscripts are somewhat modified. The books are not folded, but consist of loose leaves laid between boards kept together by a string. The Hungarian Osoma was the first who brought (1832) Thibetan language and literature within the reach of European students. In 1875 a German Moravian missionary, H. A. Jäschke, published a most learned Thibetan-German dictionary. E. SCHLAGINTWEIT.

**Thibet Language and Literature.** See THIBET.

**Thibodeaux′,** p.-v., cap. of Lafourche parish, La., on Bayou Lafourche, 55 miles W. of New Orleans, has 6 churches, 1 college and 1 female institute, 2 newspapers, a foundry and boiler-works, 1 copper and sheet-iron workshop, 2 carriage-factories, 3 hotels, and Masonic and Odd Fellows' lodges. Principal business, planting and mechanical working. P. 1922.

GRISAMORE & SANCAN, EDS. "SENTINEL."

**Thick′-Knee,** a name applied to the species of the genus *Œdicnemus.* These belong to the family of Charadriidæ or plovers, and are distinguished among them by the moderately long and straight bill (a little longer than the head), which is compressed and wedge-shaped at the terminal half, the linear open nostrils, some distance from the base of the bill, and the elongated tarsi (three or four times as long as the middle toe) covered with hexagonal scales. The species are peculiar to the Old World, save one (*Œdicnemus superciliaris*), which has been described from Peru; nine are recognized by G. R. Gray. They are migratory birds, and resort to the temperate regions to rear their young. They affect mostly open inland plains. The common European species is *Œdicnemus crepitans*, which attains a length of about seventeen inches. THEODORE GILL.

**Thielt,** town of Belgium, province of West Flanders, has several good educational institutions, and extensive manufactures of linen and cotton fabrics, lace, hats, oil, soap, and chemicals. P. 11,497.

**Thiene,** or **Tiene,** town of Italy, province of Vicenza, about 9 miles N. of the town of Vicenza. The vicinity has long been remarkable for its excellent wines. P. 5945.

**Thierry′** (JACQUES NICOLAS AUGUSTIN), b. at Blois May 10, 1795; educated at the college of his native town and the normal school of Paris; attached himself in 1814 with great enthusiasm to Saint-Simon, whom he assisted in his literary labors; became in 1817 a contributor to *Le Censeur européen*, edited by Comte, and afterward to the *Courrier français*, in which he first published in 1820 his remarkable *Lettres sur l'Histoire de la France*, but concentrated himself more and more on the study of history, especially that of France and England, and published in 1825 his *Histoire de la Conquête de l'Angleterre par les Normands* (4 vols., 1860), which attracted great attention, and has been often republished, and translated twice into English (1825 and 1847). In 1826 he became nearly blind, and could continue his studies only by the aid of secretaries and of his friends, among whom were Armand Carrel and Fauriel. A most precious assistance he received from his wife, JULIE DE QUERANGAL, known from several spirited essays in the *Revue des Deux Mondes;* they were married in 1831, but she died in 1844. Subsequently he lived mostly in his brother's house, and d. in Paris May 22, 1856. To the latter period of his life belong *Dix Ans d'Études historiques* (1834), a collection of minor essays, and *Récits des Temps mérovingiens* (1840), both translated into English. By Guizot he was appointed to edit one part of the *Collection des Monuments inédits de l'Histoire de France*—namely, the *Recueil des Monuments inédits de l'Histoire du Tiers État* (3 vols., 1849–56), which led him to write his *Essai sur l'Histoire de la Formation et des Progrès du Tiers État* (1853; translated into English by Francis B. Wells, 1855).—His brother, AMEDÉE SIMON DOMINIQUE THIERRY, b. at Blois Aug. 2, 1797, was appointed professor of history in Besançon in 1828, prefect of the department of Haute-Saône in 1830, member of the council of state in 1838, senator in 1860, and d. in Paris Mar. 26, 1873. His writings, advocating the same principles as those of his brother, but less brilliant in execution, comprise *Histoire des Gaulois jusqu'à la Domination romaine* (3 vols., 1828), *Histoire de la Gaule sous l'Administration romaine* (3 vols., 1840–47), *Histoire d'Attila* (2 vols., 1856), *Récits de l'Histoire romaine* (1860), *Tableau de l'Empire romain* (1862), *Saint-Jérôme* (2 vols., 1867), *Saint-Chrysostome* (1872).

**Thiers,** town of France, department of Puy-de-Dôme, on the Durolle, manufactures candles, paper, leather, and copper, brass, and iron goods, especially knives. P. 16,635.

**Thiers′** (LOUIS ADOLPHE), b. at Marseilles Apr. 16, 1797; studied law at Aix; was admitted to the bar in 1818, and began to practise as an advocate, but was drawn by his ambition as well as by his talents to politics and literature, and removed in 1821 to Paris. Here he became a contributor to the *Constitutionnel*, and his articles, comprising criticisms on literature, politics, and art, historical essays, and miscellaneous sketches, soon brought him into intimate connection with the leaders of the party in opposition; as,

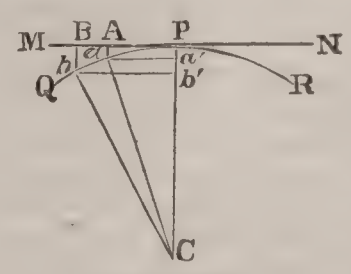
for instance, with Lafitte. Some of the articles—*De la Monarchie française, Salon de 1822, Les Pyrénées, ou le Midi de la France pendant les Mois de Novembre et de Décembre,* etc.—were also published separately, and attracted a wide attention. In 1823 he began to publish his *Histoire de la Révolution française,* finished in 1827 in 10 vols., translated into English by F. Shoberl (1838); and this book at once gave him rank among the great historians and made his name popular throughout France. In 1830 he founded the *National* in connection with Mignet and Armand Carrel, drew up the protest against the *ordonnances* of July 26, and took an active part in the revolution which effected the change of dynasty in France. In August he entered the civil service of the new government, receiving office in the department of finances, and shortly after was elected a member of the Chamber of Deputies. On Oct. 11, 1832, he was made minister of the interior; changed this department for that of commerce and public works in December; returned to it 1834; resigned with all his colleagues in Jan., 1836, but was made prime minister and minister of foreign affairs in February; in August, however, he retired from the government altogether. The most prominent features of his administration were the arrest of the duchess of Berri Nov. 6, 1832, and the pacification of the Vendée; the completion of a number of public buildings and monuments, such as Arc de l'Étoile, the Madeleine, the palace of the Quai d'Orsay, etc., and a great activity in the construction of canals, roads, etc.; the prompt suppression of the insurrections in Lyons and Paris in 1834; the adoption of restrictive laws, the so-called "September laws," on the press and jury, on account of the attempt by Fieschi on the life of the king, July 28, 1835, etc. The reason of his withdrawal from the government was the king's opposition to his plan of an armed intervention in the affairs of Spain. Once more, however, he returned to power during the reign of Louis Philippe. On Mar. 1, 1840, he was made prime minister, but he resigned in October. In the controversy between Mehemet Ali and the Porte, France was Mehemet Ali's only friend, but the question was suddenly found to have been settled by Russia, England, Austria, and Prussia, without any regard to the views of France. Thiers now demanded money for extensive armaments, proposed to fortify Paris, meditated a descent on Italy, etc., but was checked in his warlike aspirations by the absolute unwillingness of the king to enter into his plans. He now retired from public life for several years; visited England, Spain, Italy, and Germany, studying battlefields, ransacking archives, and making other preparations for his great work, *Histoire du Consulat et de l'Empire* (20 vols., 1845–62; translated into English by D. F. Campbell). But in the last years of the reign of Louis Philippe he resumed his work in the Chamber of Deputies, and made vehement opposition to the government of Guizot, especially to its foreign policy. In the banquets which preceded the revolution of Feb., 1848, he took no part, but the popularity which he had partly lost during his own administration he fully regained when he came into opposition; and when the revolution actually broke out, he was one of the men on whom many eyes rested. As a member of the Constituent and Legislative Assemblies he accepted the Republic, but advocated very restrictive measures. He voted for the presidency of Louis Napoleon, and when Bixio accused him in the Legislative Assembly of having said that the election of Louis Napoleon as president would be a shame to France, he denied it, and fought a duel with his accuser. Nevertheless, when the Empire began to develop from the policy of the president, Thiers immediately went into opposition, and on Dec. 2, 1852, he was arrested, and shortly after banished from France. He returned, however, in August, but lived in retirement until 1863, when he was elected a member of the Representative Assembly by Paris. His criticism of the policy of the emperor, the Italian and Mexican wars, the rebuilding of Paris, etc., was often very severe, though generally not very effective; he was almost the only member of the Assembly who opposed and condemned the declaration of war against Prussia. But after the downfall of the Empire, he developed an astonishing energy to save his country from utter ruin. On Sept. 17, 1870, he started on a tour to London, St. Petersburg, Vienna, and Florence in order to procure foreign intervention, and on his return in the last days of October he opened negotiations with Bismarck concerning an armistice. After the capitulation of Paris and the conclusion of the armistice, he was elected a member of the National Assembly by 26 departments, Feb. 8, 1871, and on Feb. 17 the Assembly chose him chief of the executive. On Aug. 31 his term of office was fixed at three years, and his title "president of the republic." He was very successful in negotiating the peace; he saved Belfort and one milliard for France. And he was still more successful in procuring the means of fulfilling the conditions of peace; the payment of the indemnification and the liberation of French soil from German occupation were effected in a surprisingly short time. The insurrection of the Commune was promptly put down, and order and regularity established in the administration. But his attempt at consolidating the "conservative republic" by legislative enactment failed, May 24, 1873, and he resigned. Among his other works are *Histoire de Law* (1826; translated into English by F. S. Fiske, 1859), *De la Propriété* (1848), *L'Homme et la Matière* (1875). CLEMENS PETERSEN.

**Thiersch** (FRIEDRICH WILHELM), b. at Kirchscheidungen, Prussian province of Saxony, June 17, 1784; studied theology, and afterward philology, at Leipsic and Göttingen; was appointed professor in 1809 at the gymnasium of Munich, and in 1812 at the university of the same city; visited Italy, and wrote *Reisen in Italien* (1826); resided for two years in Greece, and wrote *De l'État actuel de la Grèce* (1833); founded the philological institute of Munich; edited the *Acta Philologorum Monacensium* (1811–29); published a Greek grammar (1826), and contributed much to encourage the study of classical languages and literatures in Bavaria. D. at Munich Feb. 25, 1860.—His son, HEINRICH WILHELM JOSIAS THIERSCH, b. at Munich Nov. 5, 1817; studied theology at Erlangen, and became professor at Marburg in 1843, but resigned this office in 1849, and lived subsequently at Munich. He is the representative in Germany of the ideas of Edward Irving. He wrote *Grammatik der hebraischen Sprache* (1856), *Katholicismus und Protestantismus* (1848), *Geschichte der Kirche im apostolischen Zeitalter* (1857), *Ueber christlichen Familienleben* (1859), etc.

**Thinocor'idæ** [from *Thinocorus*—Gr. θίς, θινός, a "heap of sand" or "plain," and χορεύειν, to "leap"—the generic name of the type], a family of birds of uncertain affinities peculiar to South America. The general aspect is somewhat quail-like; the bill rather short, somewhat slender, broad at the base, and compressed forward, and with the upper mandible slightly decurved over the lower; nostrils basal and lateral, and partly curved by a horny membrane; wings long and pointed; tail moderate and produced straight backward; tarsi stout or moderate, and with the investing scales more or less small; toes four, the three anterior moderately long and free, the posterior small and elevated. The family was proposed (by Prince Bonaparte in 1850) and has been adopted (by Kaup, Gray, etc.) for a group of birds confined to the temperate and colder regions of South America. They are generally supposed to be most nearly related to the sheathbills (Chionididæ), but this remains to be verified. They go about generally in pairs or small coveys. Their flight somewhat resembles that of grouse. Open plains seem to be their chief resorts. Eight species are known, belonging to the genera *Thinocorus* and *Attagis*. THEODORE GILL.

**Thin Plates, Colors of.** When any naturally colorless transparent substance is observed in extremely thin laminæ by means either of reflected or of transmitted light, it exhibits vivid prismatic tints which vary with the thickness of the lamina and with the obliquity of the incident light. Such colors are beautifully seen in soap-bubbles resting on the surface of the liquid of which they are formed. In consequence of the subsidence of the material, the thickness gradually and uniformly increases down to the base. The tints therefore appear in parallel and horizontal zones or rings, and in the order in which they are seen in the rainbow, the violet being uppermost. In this case the film is more dense than the surrounding medium (the air); but similar colors occur in films of liquid compressed between glass plates and in the fissures of transparent minerals; and inasmuch as they appear in such fissures *in vacuo*, it is evident that the presence of a material substance between the bounding surfaces of the fissure is not essential to their formation.

The conditions under which these colors are produced were investigated by Newton. He employed in his experiments two lenses of long focus, a double convex and a plano-convex, the latter having its plane surface pressed down upon the former by means of binding-screws. In this arrangement the touching surfaces have theoretically but a single point of contact, which is the centre of an included thin plate of air. This plate regularly increases in all directions in thickness, according to the known law that the thickness varies as the square of the distance from the centre. Around this centre the colors appear in regular rings, which are commonly known by the name of "Newton's rings." In the figure annexed M N represents the plane surface of the superior lens, and Q P R the convex upper surface of



Thin Plates.

the inferior, P being the point of contact. Then, if C P, the radius of curvature, $= r$, P$a'$ or P$b'$, the abscissa $= x$, and $a$ $a'$ or $b$ $b'$, the ordinate $= y$, we have, by the equation of the circle, $2rx + x^2 = y^2$.

Supposing $r$ very great in respect to $y$, the abscissa $x$ is so minute that its square may be neglected; whence,

$$2rx = y^2; \text{ or } x \text{ varies as } y^2.$$

It was observed by Newton that in proceeding outward from the centre, which is quite black, the same tints recur periodically, so that there are as many as seven distinct series, called by him orders of colors. Of these, the second and third are the most vivid; the more distant rapidly fading out, and the first being diluted with white. The orders are—

1. Black, blue, white, yellow, red.
2. Violet, blue, green, yellow, red.
3. Purple, blue, green, yellow, red.
4. Green, red.
5. Greenish-blue, red.
6. Greenish-blue, pale-red.
7. Greenish-blue, reddish-white.

The cause of the fading with increase of distance from the centre may be made manifest by employing homogeneous or monochromatic light, obtained by isolating a portion of the rays of the prismatic spectrum whose refrangibility and color are sensibly the same. Then very many more bright rings will be observed, separated by intermediate rings entirely dark. It will also be seen that the rings of the least refrangible rays are larger than any others, and that the diameters of rings of the same order regularly diminish as the refrangibility increases. This difference of magnitude between the rings of different tints occasions the overlapping, when white light is used, of one color upon another; so that the colors observed are not simple, but resultant colors, determined in their character by the blending of the several simple tints which happen to be present in different proportions at the point of observation. This blending, moreover, to a certain extent produces white light, which dilutes or enfeebles the color formed by the combination of the predominant tints. The truth of this explanation is demonstrated by viewing the rings through a prism. This more completely superposes the rings on one side, and separates them on the other. They appear, therefore, more numerous and better defined on the side of the greatest refraction, while on the other they become nearly indistinguishable.

From a careful measurement of the diameters of all the rings, Newton ascertained that the squares of these diameters form a regular arithmetical progression proportional to the natural series of numbers, 1, 2, 3, etc., those of the bright rings corresponding to the odd terms of the series, and those of the dark to the even terms. From the law, $x$ varies as $y^2$, it therefore follows that where the bright rings appear the thickness of the plate is *once, thrice, five times*, etc. some determinate dimension; and that where the dark rings are seen it is *twice, four times, six times*, etc. the same quantity. In order to ascertain this constant, Newton made a very careful measurement of the absolute diameter of a single ring. He selected the fifth dark ring for this purpose. With this measurement, and the known value of $r$, he computed the thickness of the plate at the point observed, which being the fifth term of the series 2, 4, 6, etc., is ten times the constant desired. The value of the constant is thus found to be $\frac{1}{178000}$th of an English inch, or, decimally, $= 0.0000056$ inch. For the violet it is about 0.0000039 inch, and for the red 0.0000069 inch.

These results illustrate still more clearly the cause already pointed out, of the unequal vividness of the colors of the different orders. In the first order the thicknesses vary slowly; and as there is a certain range of variation within which each color may appear, though its greatest intensity is in the middle of this range, it happens that the colors of this order, in larger proportion than those of the orders next succeeding, mingle to form white. In the fourth, fifth, and higher orders an opposite cause—*i. e.* the rapid variation of thickness—produces a similar effect; for here the rings are so crowded together that the tints of different orders become mingled, and the resultant is sensibly colorless.

If water or any other liquid is introduced between the glasses, the rings become smaller, the squares of the diameters being inversely as the indices of refraction of the media thus introduced—a law which is of general application.

When the system of lenses above described is held between the eye and the light, another set of rings makes its appearance, formed by the light transmitted. Of these it is remarkable that the diameters are intermediate between those seen by reflected light; that is, the bright rings seen by transmission correspond to the dark rings seen by reflection, and *vice versâ*. The tints are also much feebler than those of the reflected rings, being diluted by the intermixture of a great deal of white light which has nothing to do with their formation. Moreover, the transmitted tints at any given point are complementary to those reflected from the same point, or are such as, united with them, will produce white. The centre in the transmitted system is therefore white, as in the reflected it is black.

The measurements given above are those which correspond to rings formed by light perpendicularly incident. But when the rings are observed obliquely, their diameters are rapidly increased with increase of obliquity. The law of this increase may be stated thus: The squares of the diameters of the rings of the same order observed under different obliquities are inversely as the cosines of the angles of incidence of the light producing them.

Colors resembling those of thin plates may be produced under certain arrangements by means of thick plates. A silvered glass concave mirror receiving a very small beam of light in a dark room, through a minute aperture in the window-shutter, will exhibit colored rings when the reflection is thrown upon a card held near the centre of curvature. Two thick plates having a difference of thickness comparable to the absolute thickness which will produce color in thin plates will produce color also. The causes of all these phenomena are considered under the title UNDULATORY THEORY OF LIGHT (which see). F. A. P. BARNARD.

**Thionville'** [anc. *Theodonis Villa;* Ger. *Diedenhofen*], town of the present German province of Alsace-Lorraine, on the Moselle, 19 miles N. of Metz, and in the midst of the broad level plain which the valley here exhibits. It is a walled city of the old school of fortification, ranking under that system as a third-class fortress. After the disaster of Forbach and retreat to Metz of the French, Thionville annoyed the Prussians before the latter place a good deal, and orders were given to carry it by a *coup-de-main* in August, but the attempt was abandoned; orders to take it were also issued in September and again in October, but after reconnaissances it was determined that the force necessary to accomplish its capture could not then be spared, and the attempt was postponed until after the fall of Metz. Bombarding batteries were commenced by the Prussians Nov. 16, and Thionville was bombarded by 85 guns from 7 A.M. Nov. 22 until the evening of Nov. 24, 1870, when it capitulated with 4000 men, 187 guns, and large stores of supplies. Although many buildings in the town were destroyed, the defences were left almost intact. P. about 8000.

**Third,** in music, an interval comprising two degrees of the diatonic scale. (See INTERVAL.)

**Third,** tp., Richland co., S. C. P. 1815.

**Third Creek,** p.-v. and tp., Gasconade co., Mo. P. of v. 200; of tp. 1228.

**Third Estate.** See ESTATES, THE THREE.

**Third Orders.** See TERTIARIES.

**Thirl'wall** (CONNOP), D. D., b. at Stepney, Middlesex, England, Feb. 11, 1797; displayed such extraordinary precocity that at the age of eleven years his father printed a volume of his compositions under the title *Primitiæ, or Essays and Poems on Various Subjects*, etc. (1809); took the Craven and Bell scholarships at Trinity College, Cambridge, 1815; graduated as senior chancellor's medallist 1818; became fellow and tutor there; studied law, and was called to the bar at Lincoln's Inn 1825; published a translation of Schleiermacher's *Critical Essay on the Gospel of St. Luke* (1825); took orders in the Church of England 1828; became rector of Kirby Underdale, Yorkshire; assisted Rev. Julius Charles Hare in translating Niebuhr's *History of Rome* (2 vols., 1828); was for several years examiner for the classical tripos at Cambridge, classical examiner in the University of London, and visitor of St. David's College, Lampeter; wrote for Lardner's *Cabinet Cyclopædia* a popular *History of Greece* (8 vols., 1835–40), afterward revised and enlarged in a library edition (8 vols., 1845–52); was one of the editors of the Cambridge *Philological Museum;* and became bishop of St. David's 1840, which post he resigned June, 1874. D. July 27, 1875. He published a number of sermons, charges, letters, addresses, and essays, which, with other writings, were issued under the title *Literary and Theological Remains* (3 vols., 1875–76), edited by Canon J. J. S. Perowne.

**Thirsk,** town of England, county of York, on the Codbeck, an affluent of the Swale, manufactures coarse linen, leather, and saddlery. P. 5735.

**Thirst,** a sensation normally caused by the need of water in the animal system, and consequently relieved by drinking. The great thirst of cholera and diabetes is also caused by a deficiency of water. But thirst also accompanies febrile excitement. This is only temporarily relieved by drinking, and unless contra-indicated by the symptoms small lumps of ice will usually relieve the thirst, and reduce the excessive heat with efficiency and without danger. The use of too much salt is another familiar cause of thirst.

**Thirty-nine Articles of Religion.** When the Reformation was fairly introduced into England under Edward VI. (1547–53), Archbishop Cranmer at first entertained the noble but premature project of framing an evangelical catholic creed in which all the Reformed churches could agree in opposition to the Church of Rome, then holding the Council of Trent, and invited the surviving continental Reformers, Melanchthon, Calvin, and Bullinger, to London for the purpose. Failing in this scheme, he framed, with the aid of his fellow-Reformers, Ridley and Latimer, the royal chaplains, and the foreign divines, Bucer, Peter Martyr, and John à Lasco, whom he had drawn to England, the *Forty-two Articles of Religion* for the English Reformed Church. After passing through several revisions they were completed in Nov., 1552, and published in 1553 by "royal authority" and with the approval of convocation. The re-establishment of the papacy under the short but bloody reign of Mary (1553–58) set them aside, together with the Edwardine Book of Common Prayer. Under Elizabeth (1558–1603) the Articles were revised and permanently restored. They were reduced to *thirty-nine*, and brought into that shape and form which they have ever retained since in the Church of England. The Latin edition was prepared under the supervision of Archbishop Parker, with the aid of Bishop Cox of Ely (one of the Marian exiles) and Bishop Guest of Rochester, approved by convocation, and published by the royal press 1563. The English edition, which is of equal authority, though slightly differing from the Latin, was adopted by convocation in 1571, and issued under the editorial care of Bishop Jewel of Salisbury 1571. They were made binding on all ministers and teachers of religion and students in the universities, but subscription was not always enforced with equal rigor, and bitterly complained of by nonconformists, who had scrupulous objections to the political articles. The Act of Uniformity under Charles II. imposed greater stringency than ever. But the Toleration act of William and Mary gave some relief by exempting dissenting ministers from subscribing Articles XXXIV. to XXXVI. and a portion of Article XXVII. Subsequent attempts to relax or abolish subscription resulted at last in the University Tests act of 1871, which exempts all students and graduates in the universities of Oxford, Cambridge, and Durham, except divinity students, fellows, professors, and heads of colleges, from subscription, and throws these institutions open to dissenters.

The Thirty-nine Articles are among the most important doctrinal formulas of the Reformation period. They cover nearly all the heads of the Christian faith, especially those which were then under dispute with the Roman Catholics. They affirm the old orthodox doctrines of the Trinity and incarnation, the Augustinian views on free-will, total depravity, divine grace, faith, good works, election, and the Protestant doctrines on the Church, purgatory, and the sacraments of baptism and the Lord's Supper. They are borrowed in part from Lutheran standards—namely, the Augsburg Confession of Melanchthon (1530) and the Würtemberg Confession of Brentius (1552), but on the sacraments, especially the much-disputed doctrine of the real presence in the Eucharist, they follow the Swiss Reformers, Bullinger and Calvin. In the political sections they are purely English, and teach the Erastian doctrine of the spiritual as well as temporal supremacy of the sovereign as the supreme governor of the Church of England. They have therefore an eclectic and comprehensive character, which distinguishes the Anglican Church from the Lutheran and the strictly Calvinistic churches of the Continent and Scotland, and from the dissenting denominations of England. They have often been interpreted and misinterpreted in the interest of particular schools and parties, while all claim them as favoring themselves. They must be understood in their plain grammatical sense; and when this is doubtful, the Prayer Book, the two books of Homilies, the Catechism, and the private writings of the English Reformers and the Elizabethan divines must be called to aid. The doctrinal decisions in the Gorham, Bennet, and other recent controversies favor great latitude in their interpretation.

The Protestant Episcopal Church in the U. S., after effecting an independent organization and episcopate in consequence of the American Revolution, formally adopted the Thirty-nine Articles of the mother Church at the General Convention held in Trenton, N. J., Sept. 12, 1801, but with sundry alterations and omissions in the political articles (Art. XXI. and XXXVII.), which the separation of Church and State made necessary. The only doctrinal difference is the omission of all allusion to the Athanasian Creed (Art. VIII.), which is also excluded from the American editions of the Prayer Book.

The following is the text of the American revision of the Articles:

ART. I. *Of Faith in the Holy Trinity.*—There is but one living and true God, everlasting, without body, parts, or passions; of infinite power, wisdom, and goodness; the Maker and Preserver of all things both visible and invisible. And in unity of this Godhead there be three Persons of one substance, power, and eternity—the Father, the Son, and the Holy Ghost.

ART. II. *Of the Word or Son of God, which was made very Man.*—The Son, which is the Word of the Father, begotten from everlasting of the Father, the very and eternal God, and of one substance with the Father, took man's nature in the womb of the blessed Virgin, of her substance; so that two whole and perfect natures, that is to say, the Godhead and manhood, were joined together in one person, never to be divided, whereof is one Christ, very God, and very man; who truly suffered, was crucified, dead, and buried, to reconcile his Father to us, and to be a sacrifice, not only for original guilt, but also for actual sins of men.

ART. III. *Of the going down of Christ into Hell.*—As Christ died for us, and was buried; so also is it to be believed, that he went down into hell.

ART. IV. *Of the Resurrection of Christ.*—Christ did truly rise again from death, and took again his body, with flesh, bones, and all things appertaining to the perfection of man's nature; wherewith he ascended into heaven, and there sitteth, until he return to judge all men at the last day.

ART. V. *Of the Holy Ghost.*—The Holy Ghost, proceeding from the Father and the Son, is of one substance, majesty, and glory, with the Father and the Son, very and eternal God.

ART. VI. *Of the Sufficiency of the Holy Scriptures for Salvation.*—Holy Scripture containeth all things necessary to salvation; so that whatsoever is not read therein, nor may be proved thereby, is not to be required of any man that it should be believed as an article of the faith, or be thought requisite or necessary to salvation. In the name of the holy Scripture we do understand those canonical books of the Old and New Testament, of whose authority was never any doubt in the Church. *Of the Names and Number of the Canonical Books.*—Genesis, Exodus, Leviticus, Numbers, Deuteronomy, Joshua, Judges, Ruth, The First Book of Samuel, The Second Book of Samuel, The First Book of Kings, The Second Book of Kings, The First Book of Chronicles, The Second Book of Chronicles, The First Book of Esdras, The Second Book of Esdras, the Book of Esther, The Book of Job, The Psalms, The Proverbs, Ecclesiastes or Preacher, Cantica, or Songs of Solomon, Four Prophets the greater, Twelve Prophets the less. And the other books (as *Hierome* saith) the Church doth read for example of life and instruction of manners; but yet doth it not apply them to establish any doctrine; such are these following: The Third Book of Esdras, The Fourth Book of Esdras, The Book of Tobias, The Book of Judith, The rest of the Book of Esther, The Book of Wisdom, Jesus the Son of Sirach, Baruch the Prophet, The Song of the Three Children, The Story of Susanna, Of Bel and the Dragon, The Prayer of Manasses, The First Book of Maccabees, The Second Book of Maccabees. All the books of the New Testament, as they are commonly received, we do receive, and account them canonical.

ART. VII. *Of the Old Testament.*—The Old Testament is not contrary to the New; for both in the Old and New Testament everlasting life is offered to mankind by Christ, who is the only Mediator between God and man, being both God and man. Wherefore they are not to be heard, which feign that the old fathers did look only for transitory promises. Although the law given from God by Moses, as touching ceremonies and rites, do not bind Christian men, nor the civil precepts thereof ought of necessity to be received in any commonwealth; yet notwithstanding, no Christian man whatsoever is free from the obedience of the Commandments which are called moral.

ART. VIII. *Of the Creeds.*—The *Nicene* Creed, and that which is commonly called the *Apostles'* Creed, ought thoroughly to be received and believed; for they may be proved by most certain warrants of holy Scripture.

ART. IX. *Of Original or Birth-Sin.*—Original sin standeth not in the following of *Adam* (as the *Pelagians* do vainly talk); but it is the fault and corruption of the nature of every man, that naturally is engendered of the offspring of *Adam;* whereby man is very far gone from original righteousness, and is of his own nature inclined to evil, so that the flesh lusteth always contrary to the Spirit; and therefore in every person born into this world it deserveth God's wrath and damnation. And this infection of nature doth remain, yea, in them that are regenerated; whereby the lust of the flesh, called in Greek φρόνημα σαρκός (which some do expound the wisdom, some sensuality, some the affection, some the desire, of the flesh), is not sub-

ject to the Law of God. And although there is no condemnation for them that believe and are baptized; yet the Apostle doth confess, that concupiscence and lust hath of itself the nature of sin.

ART. X. *Of Free-Will.*—The condition of man after the fall of *Adam* is such, that he cannot turn and prepare himself, by his own natural strength and good works, to faith, and calling upon God. Wherefore we have no power to do good works pleasant and acceptable to God, without the grace of God by Christ preventing us, that we may have a good will, and working with us, when we have that good will.

ART. XI.—*Of the Justification of Man.*—We are accounted righteous before God, only for the merit of our Lord and Saviour Jesus Christ by faith, and not for our own works or deservings. Wherefore, that we are justified by faith only, is a most wholesome doctrine, and very full of comfort, as more largely is expressed in the Homily of Justification.

ART. XII. *Of Good Works.*—Albeit that good works, which are the fruits of faith, and follow after justification, cannot put away our sins, and endure the severity of God's judgment; yet are they pleasing and acceptable to God in Christ, and do spring out necessarily of a true and lively faith; insomuch that by them a lively faith may be as evidently known as a tree discerned by the fruit.

ART. XIII. *Of Works before Justification.*—Works done before the grace of Christ, and the inspiration of his Spirit, are not pleasant to God, forasmuch as they spring not of faith in Jesus Christ; neither do they make men meet to receive grace, or (as the school-authors say) deserve grace of congruity: yea rather, for that they are not done as God hath willed and commanded them to be done, we doubt not but they have the nature of sin.

ART. XIV. *Of Works of Supererogation.*—Voluntary works besides, over and above, God's commandments, which they call works of supererogation, cannot be taught without arrogancy and impiety: for by them men declare, that they do not only render unto God as much as they are bound to do, but that they do more for his sake, than of bounden duty is required: whereas Christ saith plainly, When ye have done all that are commanded to you, say, We are unprofitable servants.

ART. XV. *Of Christ alone without Sin.*—Christ in the truth of our nature was made like unto us in all things, sin only except, from which he was clearly void, both in his flesh, and in his spirit. He came to be the Lamb without spot, who, by sacrifice of himself once made, should take away the sins of the world; and sin (as Saint *John* saith) was not in him. But all we the rest, although baptized, and born again in Christ, yet offend in many things; and if we say we have no sin, we deceive ourselves, and the truth is not in us.

ART. XVI. *Of Sin after Baptism.*—Not every deadly sin willingly committed after baptism is sin against the Holy Ghost, and unpardonable. Wherefore the grant of repentance is not to be denied to such as fall into sin after baptism. After we have received the Holy Ghost, we may depart from grace given, and fall into sin, and by the grace of God we may arise again, and amend our lives. And therefore they are to be condemned, which say, they can no more sin as long as they live here, or deny the place of forgiveness to such as truly repent.

ART. XVII. *Of Predestination and Election.*—Predestination to life is the everlasting purpose of God, whereby (before the foundations of the world were laid) he hath constantly decreed by his counsel secret to us, to deliver from curse and damnation those whom he hath chosen in Christ out of mankind, and to bring them by Christ to everlasting salvation, as vessels made to honor. Wherefore, they which be endued with so excellent a benefit of God, be called according to God's purpose by his Spirit working in due season: they through grace obey the calling: they be justified freely: they be made sons of God by adoption: they be made like the image of his only-begotten Son Jesus Christ: they walk religiously in good works, and at length, by God's mercy, they attain to everlasting felicity.

As the godly consideration of predestination, and our election in Christ, is full of sweet, pleasant, and unspeakable comfort to godly persons, and such as feel in themselves the working of the Spirit of Christ, mortifying the works of the flesh, and their earthly members, and drawing up their mind to high and heavenly things, as well because it doth greatly establish and confirm their faith of eternal salvation to be enjoyed through Christ, as because it doth fervently kindle their love towards God: So, for curious and carnal persons, lacking the Spirit of Christ, to have continually before their eyes the sentence of God's predestination, is a most dangerous downfall, whereby the devil doth thrust them either into desperation, or into wretchedness of most unclean living, no less perilous than desperation.

Furthermore, we must receive God's promises in such wise, as they be generally set forth to us in holy Scripture: and, in our doings, that will of God is to be followed, which we have expressly declared unto us in the Word of God.

ART. XVIII. *Of obtaining eternal Salvation only by the Name of Christ.*—They also are to be had accursed that presume to say, That every man shall be saved by the law or sect which he professeth, so that he be diligent to frame his life according to that law, and the light of nature. For Holy Scripture doth set out unto us only the name of Jesus Christ, whereby men must be saved.

ART. XIX. *Of the Church.*—The visible Church of Christ is a congregation of faithful men, in the which the pure Word of God is preached, and the sacraments be duly ministered according to Christ's ordinance, in all those things that of necessity are requisite to the same.

As the Church of *Jerusalem*, *Alexandria*, and *Antioch*, have erred; so also the Church of *Rome* hath erred, not only in their living and manner of ceremonies, but also in matters of faith.

ART. XX. *Of the Authority of the Church.*—The Church hath power to decree rites or ceremonies, and authority in controversies of faith: and yet it is not lawful for the Church to ordain anything that is contrary to God's Word written, neither may it so expound one place of Scripture, that it be repugnant to another. Wherefore, although the Church be a witness and a keeper of Holy Writ, yet, as it ought not to decree anything against the same, so besides the same ought it not to enforce anything to be believed for necessity of salvation.

ART. XXI. *Of the Authority of General Councils.**—

ART. XXII. *Of Purgatory.*—The Romish doctrine concerning purgatory, pardons, worshipping and adoration, as well of images as of relics, and also invocation of saints, is a fond thing, vainly invented, and grounded upon no warranty of Scripture, but rather repugnant to the Word of God.

ART. XXIII. *Of Ministering in the Congregation.*—It is not lawful for any man to take upon him the office of public preaching, or ministering the sacraments in the congregation, before he be lawfully called, and sent to execute the same. And those we ought to judge lawfully called and sent, which be chosen and called to this work by men who have public authority given unto them in the congregation, to call and send ministers into the Lord's vineyard.

ART. XXIV. *Of Speaking in the Congregation in such a Tongue as the People understandeth.*—It is a thing plainly repugnant to the Word of God, and the custom of the primitive Church, to have public prayer in the church, or to minister the sacraments, in a tongue not understanded of the people.

ART. XXV. *Of the Sacraments.*—Sacraments ordained of Christ be not only badges or tokens of Christian men's profession, but rather they be certain sure witnesses, and effectual signs of grace, and God's good will towards us, by the which he doth work invisibly in us, and doth not only quicken, but also strengthen and confirm our faith in him.

There are two sacraments ordained of Christ our Lord in the Gospel, that is to say, baptism, and the supper of the Lord.

Those five commonly called sacraments, that is to say, confirmation, penance, orders, matrimony, and extreme unction, are not to be counted for sacraments of the Gospel, being such as have grown partly of the corrupt following of the Apostles, partly are states of life allowed in the Scriptures; but yet have not like nature of sacraments with baptism, and the Lord's Supper, for that they have not any visible sign or ceremony ordained of God.

The sacraments were not ordained of Christ to be gazed upon, or to be carried about, but that we should duly use them. And in such only as worthily receive the same, they have a wholesome effect or operation; but they that receive them unworthily, purchase to themselves damnation, as Saint *Paul* saith.

ART. XXVI. *Of the Unworthiness of the Ministers, which hinders not the effect of the Sacraments.*—Although in the visible Church the evil be ever mingled with the good, and sometimes the evil have chief authority in the ministration of the Word and sacraments, yet forasmuch as they do not the same in their own name, but in Christ's, and do minister by his commission and authority, we may use their ministry, both in hearing the Word of God, and in receiving the sacraments. Neither is the effect of Christ's ordinance taken away by their wickedness, nor the grace of

* The Twenty-first of the former Articles is omitted; because it is partly of a local and civil nature, and is provided for, as to the remaining parts of it, in other Articles.

God's gifts diminished from such as by faith, and rightly, do receive the sacraments ministered unto them; which be effectual, because of Christ's institution and promise, although they be ministered by evil men.

Nevertheless, it appertaineth to the discipline of the Church, that inquiry be made of evil ministers, and that they be accused by those that have knowledge of their offences; and finally, being found guilty, by just judgment be deposed.

ART. XXVII. *Of Baptism.*—Baptism is not only a sign of profession, and mark of difference, whereby Christian men are discerned from others that be not christened, but it is also a sign of regeneration or new-birth, whereby, as by an instrument, they that receive baptism rightly are grafted into the Church; the promises of the forgiveness of sin, and of our adoption to be the sons of God by the Holy Ghost, are visibly signed and sealed; faith is confirmed, and grace increased by virtue of prayer unto God.

The baptism of young children is in any wise to be retained in the Church, as most agreeable with the institution of Christ.

ART. XXVIII. *Of the Lord's Supper.*—The supper of the Lord is not only a sign of the love that Christians ought to have among themselves one to another; but rather it is a sacrament of our redemption by Christ's death: insomuch that to such as rightly, worthily, and with faith, receive the same, the bread which we break is a partaking of the body of Christ; and likewise the cup of blessing is a partaking of the blood of Christ.

Transubstantiation (or the change of the substance of bread and wine) in the supper of the Lord, cannot be proved by holy Writ; but is repugnant to the plain words of Scripture, overthroweth the nature of a sacrament, and hath given occasion to many superstitions.

The body of Christ is given, taken, and eaten, in the Supper, only after an heavenly and spiritual manner. And the mean whereby the body of Christ is received and eaten in the Supper, is faith.

The sacrament of the Lord's Supper was not by Christ's ordinance reserved, carried about, lifted up, or worshipped.

ART. XXIX. *Of the Wicked, which eat not the Body of Christ in the use of the Lord's Supper.*—The wicked, and such as be void of a lively faith, although they do carnally and visibly press with their teeth (as Saint *Augustine* saith) the sacrament of the body and blood of Christ; yet in no wise are they partakers of Christ; but rather, to their condemnation, do eat and drink the sign or sacrament of so great a thing.

ART. XXX. *Of both Kinds.*—The cup of the Lord is not to be denied to the lay-people: for both the parts of the Lord's sacrament, by Christ's ordinance and commandment, ought to be ministered to all Christian men alike.

ART. XXXI. *Of the one Oblation of Christ finished upon the Cross.*—The offering of Christ once made is that perfect redemption, propitiation, and satisfaction, for all the sins of the whole world, both original and actual; and there is none other satisfaction for sin, but that alone. Wherefore the sacrifices of masses, in the which it was commonly said, that the priest did offer Christ for the quick and the dead, to have remission of pain or guilt, were blasphemous fables, and dangerous deceits.

ART. XXXII. *Of the Marriage of Priests.*—Bishops, priests, and deacons, are not commanded by God's law, either to vow the estate of single life, or to abstain from marriage: therefore it is lawful for them, as for all other Christian men, to marry at their own discretion, as they shall judge the same to serve better to godliness.

ART. XXXIII. *Of excommunicate Persons, how they are to be avoided.*—That person which by open denunciation of the Church is rightly cut off from the unity of the Church, and excommunicated, ought to be taken of the whole multitude of the faithful, as an heathen and publican, until he be openly reconciled by penance, and received into the Church by a judge that hath authority thereunto.

ART. XXXIV. *Of the Traditions of the Church.*—It is not necessary that traditions and ceremonies be in all places one, or utterly like; for at all times they have been divers, and may be changed according to the diversity of countries, times, and men's manners, so that nothing be ordained against God's Word. Whosoever, through his private judgment, willingly and purposely, doth openly break the traditions and ceremonies of the Church, which be not repugnant to the Word of God, and be ordained and approved by common authority, ought to be rebuked openly (that others may fear to do the like), as he that offendeth against the common order of the Church, and hurteth the authority of the magistrate, and woundeth the consciences of the weak brethren.

Every particular or national church hath authority to ordain, change, and abolish, ceremonies or rites of the Church ordained only by man's authority, so that all things be done to edifying.

ART. XXXV. *Of the Homilies.*—The Second Book of Homilies, the several titles whereof we have joined under this article, doth contain a godly and wholesome doctrine, and necessary for these times, as doth the former Book of Homilies, which were set forth in the time of *Edward the Sixth;* and therefore we judge them to be read in churches by the ministers, diligently and distinctly, that they may be understanded of the people.

*Of the Names of the Homilies.*—1. Of the right use of the church. 2. Against peril of idolatry. 3. Of repairing and keeping clean of churches. 4. Of good works: first of fasting. 5. Against gluttony and drunkenness. 6. Against excess of apparel. 7. Of prayer. 8. Of the place and time of prayer. 9. That common prayers and sacraments ought to be ministered in a known tongue. 10. Of the reverend estimation of God's Word. 11. Of almsdoing. 12. Of the nativity of Christ. 13. Of the passion of Christ. 14. Of the resurrection of Christ. 15. Of the worthy receiving of the sacrament of the body and blood of Christ. 16. Of the gifts of the Holy Ghost. 17. For the rogation-days. 18. Of the state of matrimony. 19. Of repentance. 20. Against idleness. 21. Against rebellion.

[This article is received in this Church, so far as it declares the Books of Homilies to be an explication of Christian doctrine, and instructive in piety and morals. But all references to the constitution and laws of England are considered as inapplicable to the circumstances of this Church; which also suspends the order for the reading of said homilies in churches, until a revision of them may be conveniently made, for the clearing of them, as well from obsolete words and phrases, as from the local references.]

ART. XXXVI. *Of Consecration of Bishops and Ministers.*—The Book of Consecration of Bishops, and Ordering of Priests and Deacons, as set forth by the General Convention of this Church in 1792, doth contain all things necessary to such consecration and ordering; neither hath it any thing that, of itself, is superstitious and ungodly. And, therefore, whosoever are consecrated or ordered according to said form, we decree all such to be rightly, orderly, and lawfully consecrated and ordered.

ART. XXXVII. *Of the Power of the Civil Magistrates.*—The power of the civil magistrate extendeth to all men, as well clergy as laity, in all things temporal; but hath no authority in things purely spiritual. And we hold it to be the duty of all men who are professors of the Gospel, to pay respectful obedience to the civil authority, regularly and legitimately constituted.

ART. XXXVIII. *Of Christian Men's Goods, which are not common.*—The riches and goods of Christians are not common, as touching the right, title, and possession of the same; as certain Anabaptists do falsely boast. Notwithstanding, every man ought, of such things as he possesseth, liberally to give alms to the poor, according to his ability.

ART. XXXIX. *Of a Christian Man's Oath.*—As we confess that vain and rash swearing is forbidden Christian men by our Lord Jesus Christ, and *James* his Apostle, so we judge, that Christian religion doth not prohibit, but that a man may swear when the magistrate requireth, in a cause of faith and charity, so it be done according to the prophet's teaching, in justice, judgment, and truth.

*Literature.*—Hardwick, *History of the Articles of Religion* (Cambridge, 2d ed., 1859); Thomas Rogers, *Exposition of the Thirty-nine Articles* (London, 1579; new ed., Cambridge, 1854); Burnet, *History of the English Reformation* (many eds.) and *Exposition of the Thirty-nine Arts.* (Oxf., 1814, and other eds.); Laurence, *Bampton Lectures* for 1834 (Oxf., 3d ed., 1838); Browne (now bishop of Winchester), *Exposition of the Thirty-nine Articles* (London, 1850; 9th ed., 1871; Am. ed. by Bishop Williams); Forbes, *An Explanation of the Thirty-nine Arts.* (Lond., 1867); Bishop White, *Memoirs of the Prot. Episc. Ch.;* Perry, *Journals of the General Convention of the Prot. Episc. Ch. in the U. S.*, 1785–1835 (vol. i. pp. 279 *seq.*); Schaff, *History of the Creeds of Christendom* (New York, 1876, vol. i. p. 592 *seq.*).

PHILIP SCHAFF.

**Thirty Tyrants,** a body of thirty magistrates in Athens (404–403 B. C.). They were appointed from the aristocratic party by the Spartans, victorious in the Peloponnesian war. The tyrants were guilty of the most cruel and shameless acts, and after one year were expelled by Thrasybulus.

**Thirty Tyrants of Rome** were a set of military adventurers who from 253 to 268 A. D. attempted to establish their own power in various parts of the empire during the reigns of Valerianus and Gallienus. The number thirty is borrowed from that of the famous Athenian tyrants.

The names of only nineteen of these adventurers have come down to us.

**Thirty Years' War, The** (1618–48), originated as a contest between the Protestant and Roman Catholic parties in Germany. By the Peace of Augsburg (1555) it was left to each state to prescribe the form of worship within its own boundaries (*cujus regio, ejus religio*), and all subjects were allowed to move from those states in which their worship was forbidden to those in which it was not. But, although a basis of religious liberty was thus established, the treaty failed to settle, even in principle, the many social and political questions involved in the religious controversy. Perpetual chicaneries kept the hostile feelings alive, and bitter strifes arose in one place before they had died out in another. During the reign of Maximilian II. (1564–76) Protestantism was spreading not only in Bohemia, where two-thirds of the population belonged to this creed, but also in Hungary, and even in Austria proper, and the Roman Catholics were made to feel that the enemy was victorious. But under his successor, Rudolf II. (1576–1612), a heavy reaction set in. The Jesuits were everywhere at work, and the Roman Catholic princes used their right of prescribing the form of worship in an outrageous manner. Alarmed by the violence and arbitrariness of the emperor's measures, the Protestant princes of the German empire formed the Evangelical Union at Ahausen, a monastery in the margraviate of Anspach, Franconia, May 4, 1608, under the lead of the elector-palatine, Frederick IV., and as a counterbalance the Roman Catholic princes formed next year (July 10, 1609) the Holy League at Munich, under the leadership of Maximilian, duke of Bavaria. Thus the materials for a great conflagration were ready, only the spark was wanting; and so far all the points at issue were purely religious or of religious origin. But when, subsequently, the contest actually took place, the interference of foreign powers brought many non-religious interests into play. Sweden intended to conquer provinces, France to crush or curb the house of Austria, etc.; and in the final results of the long and terrible war the social and political consequences were of much greater importance to Germany and Europe than the religious. On the one side, during the whole struggle, stood Austria, supported by Spain and Bavaria; on the other side the parties changed—first, Bohemia and the Palatinate, next a combination of North German princes under the leadership of Denmark, then Sweden, and finally Sweden and France; and in accordance with these changes the course of the war falls into four distinct periods.

The Bohemians had compelled Rudolf II. to issue the so-called *Majestätsbrief*, July 11, 1609, which guarantied their religious liberty, and his successor, Matthias (1612–19), had also signed it on his accession to the throne. But, having no children of his own, Matthias appointed his cousin, Ferdinand of Styria, his heir, and Ferdinand, who had been educated by the Jesuits and was a fanatic, had made an oath while still a young man to extirpate Protestantism from his countries. In 1617 he was crowned king of Bohemia, and the persecutions immediately began. In Klostergraben and Braunau, two small Bohemian towns, the Protestants had built two new churches. The archbishop of Prague and the abbot of Braunau, under whose jurisdiction the places belonged, closed the churches, and finally pulled them down. A lawsuit was instituted, and the courts decided in favor of the Roman Catholic authorities. A petition was sent to the emperor, and a very harsh answer was returned. Then the Protestants, under the leadership of Count Thurn, penetrated into the castle of Prague (May 23, 1618), threw the imperial councillors, Martinitz and Slavata, out of the windows from a height of about 60 feet, organized a general rising throughout the country, established a connection with Bethlen Gabor, prince of Transylvania, and invoked the aid of the Evangelical Union in Germany. The negotiations which the emperor Matthias opened led to nothing; the Union sent an auxiliary army of 4000 men under the count of Mansfeld; the Austrian forces proved utterly insufficient; and when Matthias died (Mar. 20, 1619) the Bohemians declared their throne vacant, and offered the crown to the young elector-palatine, Frederick V., the son-in-law of James I. of England, who accepted it. The situation of Ferdinand was very critical. The insurrection spread into Austria proper, and Bethlen Gabor approached Vienna through Hungary. Ferdinand, nevertheless, succeeded in being elected emperor of Germany Aug. 28, 1619, and secured the active support of Maximilian of Bavaria and the Holy League. An army of 30,000 men was organized and placed under the command of the Bavarian field-marshal Tilly, who speedily restored order in Austria, and thence penetrated into Bohemia, reinforced by Spanish and Austrian troops. Johann Georg, elector of Saxony, who, although a Lutheran, had never joined the Union, probably because the elector-palatine was a Calvinist, now declared against Frederick, and entered Lusatia, while a Spanish army under Spinola invaded the Lower Palatinate. The Protestant army stood before the walls of Prague on the White Mountain, but on Nov. 8, 1620, it was completely routed, and the young king—the "winter king," as he was called—fled to Holland. In a short time the whole of Bohemia was reduced to submission, and Ferdinand treated it with barbarous vengeance. The *Majestätsbrief* he tore to pieces with his own hands; the Protestant worship was absolutely forbidden; the property of all the leaders, worth more than 40,000,000 crowns, was confiscated; over 30,000 families of the Lutheran and Reformed creeds fled or were driven from the country, and the Jesuits were reinstated in full power. Immediately after the reduction of Bohemia, the Evangelical Union dissolved, and the emperor was now at liberty to turn his whole force against the elector-palatine. The margrave of Baden-Durlach was the only prince who protested against the invasion of the Palatinate by Spanish and Austrian troops and took up arms in defence of the unfortunate Frederick V.; even his own father-in-law left him to shift for himself. Nevertheless, for a moment the issue seemed doubtful. Frederick returned from Holland with an army, and Tilly was defeated at Wiesloch Apr. 27, 1622. On the dissolution of the Union, Mansfeld had not dissolved his army. He was a man who had adopted war as his business, and his army was his capital. Gifted with a great military talent, with infinite shrewdness in negotiation, with a brilliant eloquence, swift, audacious, and entirely unscrupulous, he easily gathered around himself a multitude of young men who were attracted by the adventures, the plunder, and the gross pleasures which the life of the "free soldiers" offered. He then hired himself, his talent, and his army to the highest bidder, England, France, or whosoever could furnish the largest "subsidies," and in the mean time, in the empty hours between two subsidies, he maintained himself by plunder and robbery. After the battle of the White Mountain this man had led his army to the regions of the Rhine, and he now fought here desperately against the imperial soldiers, together with Christian of Brunswick, an adventurer of the same kind, but of a lower grade. Nevertheless, Tilly defeated the margrave at Wimpfen (May 6) and Christian of Brunswick at Höchst (June 20), and Mansfeld he drove into Holland. Frederick now gave up his case in despair, and through the intervention of his father-in-law opened negotiations with Ferdinand. But Ferdinand knew no other feeling than vengeance, and when Frederick in foolish confidence dissolved his army, Tilly rapidly overran the whole Palatinate, plundering and devastating, and at the diet at Regensburg (Mar. 6, 1623) Frederick was placed in ban, bereft of all his possessions, and the Palatinate was given to Maximilian of Bavaria.

At this point the war might have ended but for the imprudence and stubbornness of the emperor. The discontent which his violent measures caused contributed much more than the exertions of the emigrants and the intrigues of the English and French courts to the formation of a union of the North German princes under the leadership of Denmark. The Danish king, Christian IV., was a man of much ability, though not of any superior talent. There was a romantic turn in his character, which made him the finest architect Denmark ever had; but in actual life, where events and circumstances will not remain standing, like brick and mortar, in the place assigned to them by the builder, he generally became lost among the details, and seldom achieved anything great. Although he entered the scene in 1625 with a well-appointed army, subsidized by England and Holland, joined by Mansfeld and Christian of Brunswick, and, at least in the beginning, tolerably well supported by his allies, he was not very dangerous, and the emperor was well prepared. Besides the army of the League under the command of Tilly, he had now a second army at his disposal, an independent Austrian army under the command of Wallenstein. Wallenstein was a most peculiar but most powerful character, possessed of brilliant talents both in the council-room and on the battle-field, and the mystical streak which pervaded his intellect, and afterward made his goal wavering and his means uncertain, appeared as yet only as an additional charm of his mind. In his own name, but for Austrian money and under the authority of Ferdinand, he had organized an army of about 40,000 men, nearly on the same principle as Mansfeld, though in a different style. He did not hire single men for the rank and file by the promise of plunder, but he hired commanders of whole regiments or army corps by the promise of independent principalities, or perhaps crowns; and so great was his success in creating and organizing an army on this principle that not only the League, but even the emperor himself, soon became jealous of him—yea, afraid of him. These two armies, Wallen-

stein to the E., Tilly to the W., now moved northward against Christian IV. Mansfeld made a diversion against Wallenstein, but was defeated at Dessau Apr. 25, 1626. He then drifted like a swift stormcloud into Hungary, where Bethlen Gabor once more had taken up arms against Austria, and Wallenstein was compelled to follow him. Bethlen Gabor, however, was induced to make peace before Mansfeld could join him. Mansfeld himself fell sick, his army dissolved, and on Nov. 30, 1626, he died at Zara, standing erect and full armed, supported by two of his adjutants. Wallenstein was now at liberty to return to Germany, but he had sustained great losses both of men and material. In the mean time, Tilly had defeated Christian IV. at Lutter am Barenberge, Aug. 27, 1626, and the two generals now agreed on a common plan of operation, Tilly drawing to the W., toward Holland, Wallenstein to the N., toward Denmark. He conquered Pomerania and Mecklenburg, and expelled the princes who had revolted against the emperor. He then penetrated into the Danish peninsula, and compelled Christian IV. by the Peace of Lubeck (May 22, 1629) to withdraw altogether from any interference in the affairs of Germany. In reward he was made duke of Mecklenburg by the emperor. Here, again, a point was reached at which the war might have ended, and many circumstances pointed toward peace. Alarmed by the independent and imperious manner in which Wallenstein conducted affairs, the League demanded that the emperor should dismiss him and disband the army, and the emperor was found willing to do so. But on Mar. 6, 1629, Ferdinand issued the "edict of restitution," ordering that all ecclesiastical estates secularized since 1552 should be returned to the Church, and all immediate sees held by Protestants transferred to Roman Catholic prelates, etc.; and in spite of the protest of Brandenburg, Saxony, Hesse, Magdeburg, and other states, the edict was carried out by force in all the free imperial cities, such as Augsburg, Ulm, Regensburg, etc., and Tilly was ordered to move northward and crush every attempt at resistance. At this critical moment Gustavus Adolphus stepped forward, and the third phase of the war began.

Various considerations brought the Swedish hero to Germany. During his war in Poland the emperor and Wallenstein had supported the Poles. The victory of Romanism in Germany would endanger his own position in Sweden, where there still was a Roman Catholic party. The whole Swedish nation was at this moment moved by an impulse of expansion, and as Sweden ruled over by far the largest part of the countries around the Baltic, it seemed the natural goal of an aggressive policy to conquer the rest and make the Baltic a Swedish sea. But beneath these and other similar considerations an enthusiastic conviction of the justice of the Protestant cause, and a deep indignation at the mass of lies and fraud with which the popes had filled Europe, were acting in his mind. In the latter part of June, 1630, he landed in the island of Usedom, drove away the imperial garrisons from Pomerania and Mecklenburg, where he reinstated the expelled princes, and formed alliances with Hesse, Saxe-Weimar, Magdeburg, and France. But he proceeded with great caution, moving only on the basis of solid alliances guarantied by the surrender of important fortresses and actual support of troops. While difficult negotiations with the electors of Brandenburg and Saxony detained him, Tilly pushed forward and took Magdeburg by storm, May 20, 1631. The city was given up to plunder and massacre, and such horrors were perpetrated that the soldiers themselves, awakening from their delirium, asked the general to put an end to the carnage; but Tilly, a monster, both bodily and mentally, a dwarf with a fiendish eye which delighted in looking at destruction, a demon rich in talents, but destitute of enthusiasm, even of ambition, wished to see the city destroyed, and after the lapse of three days over 130,000 of the inhabitants had been killed or drowned, and of the houses only 130 were left standing. The electors of Brandenburg and Saxony now joined Gustavus Adolphus, and on Sept. 17, 1631, they met Tilly at Breitenfeld, near Leipsic, where in a murderous battle his army was nearly annihilated. The two electors then passed into Bohemia, while Gustavus Adolphus pushed onward into the Palatinate. On Apr. 15, 1632, Tilly was defeated a second time in the battle on the Lech; he himself was mortally wounded, and his proud army, the whole force of the League, was dispersed. On May 17, Gustavus Adolphus and Frederick V. entered Munich. In this emergency the emperor recalled Wallenstein, and commissioned him a second time to organize an army. The situation was extremely dangerous. Not only had Gustavus Adolphus proved a general of the very first rank, but the superiority of his army was so strikingly apparent that it impressed even the superstition of people. Since the days of Alba, Don Juan, and Farnese the Spanish army had been celebrated in Europe for its discipline, its quickness in moving, its reliability in fighting. But here appeared an army whose discipline was not the product of the rod, but a simple consequence of the natural nobleness of the soldiers, and to whose perfect training in all military exercises were added personal valor and genuine warlike enthusiasm. The artillery of Gustavus Adolphus was also novel and very powerful. Wallenstein, however, did not hesitate to meet this new foe, but he saw the difficulties of the emperor, and exacted very humiliating conditions. With an army as yet only half organized he cleared Bohemia in less than a month, and he then entered the Palatinate and took up a position at Nuremberg opposite the camp of Gustavus Adolphus. For three months the two armies stood facing each other without stirring. At last, Wallenstein moved into Saxony; Gustavus Adolphus followed. At Lützen (Nov. 16, 1632) the battle took place. Gustavus Adolphus fell, but Wallenstein was defeated, and retreated into Bohemia.

With the death of the Swedish king the war changed character entirely. The religious motives disappeared, and gave place to merely political interests. Instead of broad plans, large armies, definite movements, and decisive battles, the scene became filled with an inextricable maze of intrigues, often of the meanest egotism, and a whir of small armies led to campaigns of robbery and devastation by adventurers more or less brilliant. Sweden, now governed by the great chancellor, Åxel Oxenstiern, thought only of retaining as much as possible of its conquests; and although the military valor of its army continued the same under the leadership of Banér, Horn, Torstenson, and Wrangel, its moral character sank, and the striking difference which in 1630 distinguished it from the loose and multifarious rabble gathered together under Mansfeld, Tilly, or Wallenstein, disappeared before 1648. Wallenstein remained inactive in Bohemia for more than a year, carrying on treacherous negotiations with the Swedes and the German Protestants, though, as it seems, without any fixed goal. The emperor suspected him, but dared not dismiss him at the head of a large army which clung enthusiastically to him; he was assassinated at Eger Feb. 25, 1634. The imperial army, under the leadership of Archduke Ferdinand, Gallas, and Piccolomini, then marched up the Danube, and at Nordlingen the Protestant army, under Duke Bernhard of Saxe-Weimar and Horn, suffered a very severe defeat, Sept. 6, 1634. Immediately after, the electors of Brandenburg and Saxony deserted their allies, made peace with the emperor, and even turned against the Swedes. But at the same time, Richelieu, who had subsidized Sweden from the beginning, and who considered the humiliation of the house of Hapsburg as the principal aim of his foreign policy, took Duke Bernhard and his army into the French service and declared war against Austria. The most brilliant chapter of this last part of the war was Torstenson's campaigns from 1641 to 1646. The emperor induced Christian IV. of Denmark to join him against Sweden, and the plan was to crush the Swedish army in Germany between an Austrian army from the S. and a Danish from the N.; but before the plan was ripe and could be carried out, Sweden was informed of it; and with a most astonishing rapidity of movement, and an almost uninterrupted success under the most difficult circumstances, Torstenson now defeated Piccolomini at Breitenfeld, Nov. 2, 1642, penetrated into Jutland, which he completely subdued, returned to Germany and drove Gallas before him into Bohemia, defeated a third Austrian army under Hatzfeld and Götz at Jankow, Mar. 6, 1645, and approached Vienna, which he proposed to surround and besiege in connection with Prince Rakoczy of Transylvania. But Rakoczy made peace with the emperor, and Torstenson was compelled by the gout to resign his command. The most horrible chapter formed the French participation in the war. Duke Bernhard made a successful campaign into Bavaria, but, like Wallenstein, he seems to have fought simply in order to obtain a crown for himself, and suddenly (July 18, 1639) he died under very singular circumstances; his conquest fell to France. During the subsequent French campaigns in Bavaria and Hesse these countries were fearfully devastated. In 1646 over 100 villages were burnt in Bavaria, and the inhabitants driven away. In Hesse 17 towns, 47 castles, and 400 villages had been destroyed during the war. The last contest took place in Bohemia, where the Swedish general, Count Königsmark, had conquered one part of Prague, and was about attacking the other when news came that the Peace of Westphalia had been concluded at Münster (Oct. 24, 1648). Negotiations of peace were first attempted in 1641. The Roman Catholic powers were to treat under the presidency of the pope, and the Protestant under the presidency of Denmark, but these first negotiations failed on account of certain questions of etiquette. The final success in establishing peace was due to the complete exhaustion of Austria. The em-

peror gave up not his title, but the greatest part of his authority as head of the German empire, while the power of the princes was so considerably extended that the empire became nearly dissolved. Holland and Switzerland were declared independent; Alsace was given to France, Pomerania to Sweden. In the interior still greater changes took place. Only the religious affairs were now found comparatively easy to settle; the Peace of Passau (1655) was taken as a basis for the order established.

The materials for the study of this war, now very ample, are furnished by Schiller (1802), Menzel (1835), Flathe (1840), Mebold (1840), Sölte (1840), Barthold (1842), Heilmann (1851), Klopp (1861), Hauser (1862), Gindely (1869), Ranke (1869), Stieve (1875). (See also Sir Edward Cust, *Lives of the Warriors of the Thirty Years' War*, London, 1865.) CLEMENS PETERSEN.

**This'tle** [Ang.-Sax. *thistel*], a name given to many stout spinous herbs of the order Compositæ and of the genera *Cirsium*, *Carduus*, *Centaurea*, *Onopordon*. A few have medicinal qualities, and some have fine flowers. The roots and leaves of some species were once eaten as food. The Canada thistle (*Cirsium arvense*) is a noxious weed of European origin, now naturalized extensively in America.

**This'tle-Bird,** a name given to the *Chrysomitris tristis*, generally designated as the YELLOW-BIRD (which see).

**Thistle, Order of the.** See ANDREW, SAINT.

**Tho'luck** (FRIEDRICH AUGUST GOTTREU), b. at Breslau Mar. 30, 1799; studied theology and Oriental languages at the universities of Breslau and Berlin; visited England in 1825 and Rome in 1828; was appointed professor of theology at Berlin in 1824, and removed to Halle in 1826. His works, most of which have been often reprinted in Germany and translated into English both in England and America, were published in a collected edition in 11 vols. 1863–72, and treat Oriental subjects—*Sufismus, sive Theosophia Persarum pantheistica* (1821), *Blütensammlung aus der morgenländischen Mystik* (1825), *Speculativ Trinitätslehre des spätern Orients* (1826); exegetical—*The Epistle to the Romans* (1824; twice translated into English), *The Gospel of John* (1827; translated into English by Kaufmann, 1836, and by Dr. C. P. Krauth, Philadelphia, 1859), *The Sermon on the Mount* (1833; translated into English by R. L. Brown, Edinburgh, 1860), etc.; historical—*Vorgeschichte des Rationalismus* (4 vols., 1853–62), *Geschichte des Rationalismus* (1865, etc.); ethical and dogmatical—*Wahre Weihe des Zweiflers* (1824; translated into English by Ryland under the title of *Guido and Julius, the Doctrine of Sin and the Propitiator*), *Stunden der Andacht* (2 vols., 1840).

**Thom** (JOHN HAMILTON), b. probably in Scotland about 1810; became a distinguished minister of the Unitarian Church, and was many years pastor of the congregation worshipping in Renshaw chapel, Liverpool. Author of *St. Paul's Epistles to the Corinthians* (London, 1851; Boston, 1852), *The Revelation of God and Man in the Son of God and the Son of Man* (1859), a *Memoir of Rev. John James Tayler* (1872), and other works, and edited *The Life of the Rev. Joseph Blanco White, written by himself, with Portions of his Correspondence* (3 vols., 1845).

**Thom'as,** county of South-western Georgia, bordering on Florida, drained by Ocklockonee River, and traversed by Atlantic and Gulf R. R.; surface level, soil productive. Staples, cotton, Indian corn, oats, sweet potatoes, and live-stock. Cap. Thomasville. Area, 920 sq. m. P. 14,523.

**Thomas,** unorganized county of Western Kansas, intersected by several streams; surface rolling, and well adapted for stock-raising.

**Thomas,** tp., Butler co., Mo. P. 654.

**Thomas,** tp., Darlington co., S. C. P. 1558.

**Thomas,** or **Didymus** ("the twin"), SAINT, one of the twelve apostles, of whose personal character and history nothing is known except by two or three allusions in the Gospel of John. The most important of these is his refusal to believe in the resurrection of Jesus until convinced by tangible proof. He figures largely in the apocryphal Gospels, one of which (the *Evangelium Infantiæ Christi*) was ascribed to him; was represented by later so-called "tradition" as having preached in Ethiopia, Egypt, Parthia, or India, and in the latter country the CHRISTIANS OF ST. THOMAS (which see), found by the Portuguese on the Malabar coast in the sixteenth century, claimed to originate from his preaching. This, however, is probably due to a confusion with a Nestorian or Manichæan missionary. Great efforts have been made by several Spanish, Mexican, and South American theologians to make it appear that the apostle evangelized America, and traces of his presence are pointed out in sacred caves and other sites from Paraguay to Mexico, in which latter country he has been formally identified by several native antiquarians with the Aztec divinity QUETZALCOATL (which see).

**Thomas** (ABEL CHARLES), b. in Exeter township, Pa., July 11, 1807, and educated at Lancaster, Pa. He has been Universalist pastor in Lowell, Mass., Brooklyn, N. Y., and Cincinnati, O.; published *Centenary of Universalism* (1872), and numerous tracts, pamphlets, and discussions.

**Thomas** (BENJAMIN FRANKLIN), LL.D., grandson of Isaiah, b. at Boston Feb. 12, 1813; removed to Worcester 1819; graduated at Brown University 1830; admitted to the bar 1833; judge of probate for Worcester county 1844–48; judge of Massachusetts supreme court 1853–59; resumed legal practice at Boston 1860, and member of Congress 1861–63. Author of *Law of Towns and Town Officers* (1845) and *Suggestions upon the Personal Liberty Law* (1861).

**Thomas** (CHARLES LOUIS AMBROISE), b. at Metz Aug. 5, 1811; studied music at the Conservatory of Paris 1828–32, in Italy and Vienna 1832–36; settled in Paris in 1836, and composed his first opera, *La Double Échelle*, in 1837. The most remarkable of his compositions are—*Le Caïd*, a comic opera (1849), *Le Songe d'une Nuit d'Été* (1850), *Mignon* (1866), and *Hamlet* (1868).

**Thomas** (DAVID), b. in Montgomery co., Pa., in 1776; settled near Aurora, Cayuga co., N. Y., 1805; published *Travels through the Western Country in 1816* (Auburn, 1819); was chief engineer of the Erie Canal W. of Rochester, and subsequently one of the principal engineers of the Welland Canal, Canada; was eminent as a florist and pomologist, and by his writings in the *Genesee Farmer* rendered great services to scientific agriculture. D. in 1859.

**Thomas** (EBENEZER SMITH), b. at West Cambridge, Mass., in 1775; learned the printing trade at Worcester in the office of his uncle, Isaiah Thomas; became a bookseller and editor at Charleston, S. C., 1795; resided at Baltimore, Md., 1816–29; removed to Cincinnati, O., 1829; edited the *Daily Advertiser* 1829–35, and the *Evening Post* 1835–39. D. at Cincinnati Oct. 22, 1845. Author of *Reminiscences of the Last Sixty-five Years* (2 vols., 1840).

**Thomas** (EDWARD), F. R. A. S., b. in London, England, in Dec., 1813; received a careful education; entered the civil service of the East India Company at an early age, and rose to posts of great responsibility, having been for several years British resident at Delhi; was distinguished for historical, antiquarian, and philological researches on Oriental subjects, and became on his return to England professor in the East India College at Haileybury. Author of *The Coins of the Patan Sultans of Hindustan* (London, 1847) and *Supplementary Contributions* to the same (Delhi, 1852; new ed., London, 1870), *The Epoch of the Sah Kings of Surashtra* (1848), *Coins of the Kings of Ghazni* (1848–59), *The Numismatic History of the Early Mohammedan Arabs in Persia* (1849), *Catalogue of Bactrian Coins* (1857), *Coins of the Sassanidæ*, *The Hindu Kings of Kabul*, *Miscellaneous Essays on Oriental Subjects* (1868), *Early Sassanian Inscriptions, etc.* (1868), and *Pehlevi Inscriptions, etc.* (1871), and other works of a similar character; edited James Prinsep's *Essays on Indian Antiquities* (2 vols., 1872), and contributed largely to the *Oriental* and *Numismatic Reviews*.

**Thomas** (FRANCIS), b. in Frederick co., Md., Feb. 3, 1799; educated at St. John's College; was admitted to the bar 1820; was a member of the house of delegates 1822, 1827, and 1829, being chosen Speaker in the latter year; member of Congress 1831–41, and again 1861–69; governor of Maryland 1841–44; was president of the Chesapeake and Ohio Canal Company 1839; member of the State constitutional convention 1850; was an active Union man during the civil war, and raised a brigade of 3000 volunteers, but declined a military command; was a delegate to the Philadelphia "Loyalists' Convention" 1866, and U. S. minister to Peru 1872–75. He was killed by a railway accident at Frankville, Md., Jan. 22, 1876.

**Thomas** (FREDERICK WILLIAM), son of Ebenezer Smith, b. at Providence, R. I., Oct. 25, 1808; became a cripple at the age of four years; was educated at Baltimore, Md., where he was admitted to the bar 1828; removed to Cincinnati 1830; assisted his father in editing the *Advertiser*, in which he printed his well-known song, "'Tis said that absence conquers love;" was editorially connected with the *Democratic Intelligencer* (1834) and *Evening Post* (1835); wrote also for the magazines; published his most successful novel, *Clinton Bradshaw* (1835), followed by *East and West* (1836), *Howard Pinckney* (1840), *John Randolph of Roanoke, and other Public Characters* (1853); was clerk in the treasury department at Washington, D. C., 1841–50; was for a short time a preacher of the M. E. Church in Cincinnati (1850); afterward professor of rhetoric and English literature in Alabama University; resumed the practice of law at Cambridge, Md., 1858; took charge of the literary department of the *Richmond Enquirer* 1860, and was subsequently engaged upon

the staff of the *South Carolinian* at Columbia; travelled extensively, especially in the Southern States; was a successful lecturer, and occasionally figured in politics. D. at Washington, D. C., Sept. 30, 1866.

**Thomas** (GEORGE HENRY), b. in Southampton co., Va., July 31, 1816, of parents who were of Welsh descent on his father's side and of French origin on his mother's side. Both branches of his family were among the early settlers of S. E. Virginia, where they devoted themselves to the pursuits of agriculture. In 1836 young Thomas was appointed a cadet at the U. S. Military Academy, where he graduated July 1, 1840, and promoted in the army to second lieutenant 3d Artillery. After a brief service in garrison in New York harbor, he was sent to Florida with his company, where he served against the Indians for two years, participating in Major Wade's capture of 70 Seminoles, Nov. 6, 1841, and brevetted first lieutenant for gallantry. Again in garrison in the South and South-west until 1845, his regiment in that year was ordered to Texas with the army of occupation. In the war with Mexico, which soon followed, Thomas was engaged in the gallant defence of Fort Brown, in the battle of Monterey and in that of Buena Vista; in all of which he was distinguished, and brevetted captain and major for gallantry in the last-named battles. Subsequent to Buena Vista he continued in garrison at the mouth of the Rio Grande until the close of the war, when again for a year in Florida. Transferred to West Point in 1851, he served as instructor of cavalry and artillery at the Military Academy until 1854, when ordered to California with his regiment, in which he had attained a captaincy Dec. 24, 1853. In May, 1855, Thomas was appointed major of the newly organized 2d Cavalry, with which he served continuously in Texas for upward of five years. In Aug., 1860, in a skirmish with Indians near the head-waters of the Brazos River, he received a wound in the face, and in November following came East on a leave of absence. Born and reared in a Southern State, he was held in high esteem in the aristocratic community to which his family belonged, and his native State had made him the recipient of a splendid sword in token of its appreciation of his services in the war with Mexico. Moreover, for five years preceding he had served on our Southern borders, removed from other associations than those of his brother-officers. A. S. Johnston was colonel, R. E. Lee lieutenant-colonel, and W. J. Hardee was the senior major of his regiment. Among the younger officers were Van Dorn, Kirby Smith, Fitz Hugh Lee, Hood, and others, all of whom resigned to enter the cause of the South, and bore conspicuous parts in the Confederate armies. "We have no reason to doubt that he (Thomas) shared in the general sentiments of Virginia, and deprecated any agitation which would disturb her social institutions; . . . and he regarded the growing political strife as a measureless outrage, in which both contestants were wrong, but in which Northern agitators were the first aggressors. . . . While the contest was confined to the politicians, and found expression only in constitutional theories and legal subtletics, the wisest might well be perplexed. But the flash of the first gun revealed to the clear intellect of Thomas the whole character and spirit of the controversy, and his choice was made in an instant." (*Garfield's Oration*, 1870.) Hastening at once to Carlisle barracks, Pa., where his regiment had now arrived in a disorganized condition and shorn of its equipments through the treachery of Twiggs, he reported for duty Apr. 14, and at once set about the work of reorganizing his command. Three days later, Virginia in convention was hurried into passing a resolution of secession; two months later, Thomas crossed the Potomac at the head of his command, and entered his native State to aid in the maintenance of the Union. Referring to a conversation at this date (June 16) with Thomas, Gen. Sherman says that in response to questioning him as to his feelings regarding the events then transpiring, Thomas replied, "I have thought it all over, and I shall stand firm in the service of the government." Nobly did he maintain his decision. *Firm* he certainly stood on many future battlefields where his *firmness* alone prevented disaster. In the latter part of April, Thomas was promoted to be lieutenant-colonel 2d Cavalry, and colonel May 3, 1861. (The designation of this regiment was changed in August to 5th Cavalry.) Transferred to the field of active operations in the Shenandoah Valley, he commanded a brigade at the action of Falling Waters July 2, at Martinsburg, July 3, and at Bunker Hill, July 15. Promoted to be brigadier-general of volunteers in August, and transferred to the department of the Cumberland, he was for a time engaged in mustering and organizing the 1st brigade, which formed the nucleus of the 1st division (Army of the Ohio), to the command of which he attained upon Gen. Buell's succession to the command of the department (newly designated as that of the Ohio) in November, and Dec. 31 moved against the enemy, then threatening the flank and rear of Buell's army. The battle of Mill Springs (Jan. 19–20, 1862), resulting in the defeat of Crittenden, was the most important victory yet gained in the West. The effect was to bring Thomas into general notice, and to lay the foundation of the greater fame he was yet to achieve. Continuing in command of his division until Sept. 30, 1862 (except during the advance upon and siege of Corinth, Apr. 9–May 30, when he commanded the right wing of the Army of the Tennessee), he was engaged in the movement on Nashville (Feb.–Mar.); in the Tennessee and Mississippi campaign (Mar.–Apr.); in the march on Pittsburg Landing, where held in reserve; in command at Corinth June 5–22; and in operations in Alabama, Tennessee, and Kentucky. On the advance into Kentucky he was appointed second in command of the Army of the Ohio; commanded the right wing at the battle of Perryville (Oct. 8) and subsequent pursuit of the enemy. In the latter part of October the department of the Cumberland was revived, with Gen. Rosecrans in command, the troops under him to constitute the 14th army corps, which Rosecrans organized into three grand divisions; Thomas was assigned to the centre, and in the battle of MURFREESBORO' (which see) withstood the furious assaults of the enemy. By orders of the war department the Army of the Cumberland was now (Jan. 9, 1863) divided into three army corps, and Thomas assigned to command of the 14th, with which he was engaged in the campaign of Middle Tennessee, the passage of the Elk and Tennessee rivers (July–Sept.). At the battle of CHICKAMAUGA (which see) he commanded the right and centre, where the great struggle took place for the repossession of Chattanooga, out of which the enemy had been manœuvred. The Rossville road—the road to Chattanooga, and for the possession of which the battle was fought—was successfully held by Thomas during the first day's fighting. The history of the second day's battle—the record of Thomas's wonderful resistance for upward of five hours against the concentrated efforts of the enemy after our right was routed—furnishes one of the most remarkable pages in the history of the war, and justly entitles him to be called the "Rock of Chickamauga." He now retired upon Chattanooga, which he proceeded to fortify, and here (Oct. 19) orders reached him placing him in command of the Army of the Cumberland; a week later (Oct. 27) he received the commission of brigadier-general in the regular army. The armies of Sherman and Schofield were soon after assembled at Chattanooga, with Gen. Grant in chief command, the Army of the Cumberland forming the centre of the grand army; which position it held at the storming of Missionary Ridge, and throughout the campaign of 1864 during the almost daily engagements from May to September, resulting in the capture of Atlanta (Sept. 1). On Sept. 27, Thomas was detached from the main army in Georgia, and placed in chief command in Tennessee with large discretionary powers, it being at this time a matter of doubt what were the real intentions of the Confederate general Hood, who was moving northward in the hope of causing Sherman's withdrawal from Georgia. Sherman, having determined to cut loose from his communications and strike for the coast, detached the 4th and 23d corps to Thomas's support, leaving the latter to look out for Hood and drive him out of Tennessee should he attempt invasion, or follow him closely in event of his turning on Sherman. By Nov. 5, Hood was encamped along the banks of the Tennessee with a force of some 50,000 men of all arms. The 4th and 23d corps were on their way back to Thomas, whose effective force at Nashville was now less than 25,000; but reinforcements were coming in, and in time his strength would be sufficient. The advance of Hood was skilfully resisted at Duck River and Spring Hill; the battle of FRANKLIN (which see) occurred Nov. 30, in which Hood suffered a severe defeat, checking his advance long enough to enable the two corps, by which the battle was fought, to unite with Thomas at Nashville. The next day, however, the undaunted Hood appeared before the lines by which that city was now strongly fortified. Although Thomas was now numerically equal to his opponent, his cavalry was but imperfectly equipped, and the great demand was for time in which to complete their necessary outfit and the organization of his newly-arrived troops. The period was one of intense anxiety to the country, and the government became impatient at what was deemed at Washington unnecessary delay in repelling the invaders. By Dec. 9, Thomas was ready to offer battle, but a storm of freezing rain coming on rendered an attack at that time impossible. On the 15th, Gen. Grant started from City Point to assume command himself if necessary, but was met at Washington with the news of the first day's (Dec. 15) fight, and by the next night the whole country knew of the disastrous defeat of the enemy, which was further supplemented by the intelligence of their pur-

suit beyond the Tennessee and utter destruction as an army. Gen. Grant was among the first to record that the defeat of Hood was the vindication of Thomas's judgment. The appointment of major-general in the regular army was now bestowed upon him, and Congress at its next meeting tendered him a vote of thanks. The legislature of Tennessee voted him a magnificent gold medal, and everywhere his name was mentioned with enthusiasm and affection. During the remaining months of the war he contributed materially to the overthrow of the rebellion by organizing raiding expeditions (resulting in the capture of Jefferson Davis in May, 1865) and by timely aid to other departments. He commanded the military division of the Tennessee (1865–66); the department of the Tennessee (1866–67); the 3d military district (Georgia, Florida, and Alabama), and the department of the Cumberland (1867–69). In Mar., 1866, he was a member of a board to recommend brevets to general officers, and from Nov., 1868, to May 15, 1869, was president of a court of inquiry in the case of Gen. Dyer, chief of ordnance. From the latter date he commanded the military division of the Pacific, with headquarters at San Francisco, where his death occurred Mar. 28, 1870. Congress passed resolutions of sympathy, and military honors were paid him at Troy, N. Y., where his remains are interred. GEORGE C. SIMMONS.

**Thomas** (GEORGE HOUSMAN), b. in London, England, Dec. 7, 1824; served an apprenticeship to a wood-engraver; practised that art in Paris, giving his chief attention to the illustration of books, in which he gained such popularity that his services were engaged to go to the U. S. to illustrate a newspaper; resided at New York 1846–47; furnished designs for a number of bank-notes; returned to England on account of ill-health; became one of the principal draftsmen for the *Illustrated London News;* visited Italy in the employ of that paper; produced vivid sketches of the siege of Rome, which attracted the attention of Queen Victoria, and led to his being thenceforth frequently employed by her or at her suggestion in depicting scenes of interest in which members of the royal family were engaged; produced several large oil-paintings of this character, and an album of water-color sketches belonging to the queen. His best pictures were *The Queen giving the Medals to the Crimean Heroes* and *The Queen and Prince Albert at Aldershott.* His illustrations to Thomson's *Seasons* (1858) and *Uncle Tom's Cabin* were much admired. D. at Boulogne, France, July 21, 1868.

**Thomas** (ISAIAH), LL.D., b. at Boston, Mass., Jan. 19, 1749; lost his father in childhood; was apprenticed when six years old to a printer, with whom he remained eleven years; commenced business at Newburyport 1767; was a partner with his former master in establishing the *Massachusetts Spy,* of which the first number appeared July 17, 1771; became obnoxious to the British authorities on account of the support given by his paper to the movements preparatory to the Revolution; transferred his printing-office to Worcester 1774; published a long series of reprints of popular English works, displaying good judgment in their selection; set up an additional bookstore and publishing-house at Boston 1788, under the firm-name of Thomas & Andrews; issued the *Massachusetts Magazine* (8 vols., 1789–96); was a partner of Carlisle in his printing-office at Walpole, N. H.; had business connections in many directions; conducted for twenty-six years (1775–1801) the celebrated *New England Almanac;* was author of a carefully-prepared *History of Printing in America* (2 vols., 1810; new ed., Albany, 1876), and was founder and first president (1812) of the American Antiquarian Society, for which he erected a building, gave a valuable library, and bequeathed a fund for its maintenance. D. at Worcester Apr. 4, 1831.

**Thomas** (JOHN), M. D., b. at Marshfield, Mass., in 1725; became an eminent physician in his native town and at Kingston; was surgeon to a regiment sent to Annapolis, N. S., 1746, and on the medical staff of Gov. Shirley's regiment 1747, but exchanged that post for the rank of lieutenant; attained the grade of colonel 1759; commanded a regiment under Amherst at Crown Point 1760, and took part in the capture of Montreal the same year; enrolled himself at an early date among the "Sons of Liberty;" was a delegate in 1774–75 to the Massachusetts provincial congress, by which he was appointed brigadier-general Feb. 9, 1775; received the same rank from the Continental Congress June 22, and was promoted to major-general Mar. 6, 1776; was in charge of the fortification of Dorchester Heights Mar. 4, 1776, which led to the speedy evacuation of Boston by the British; succeeded at Montgomery's death to the command of the remains of the army then besieging Quebec, where he arrived May 1, found the smallpox prevalent in camp, the forces reduced to less than 1000 effective men, and was consequently forced to raise the siege and retreat, but was attacked by the epidemic near the river Sorel, and d. at Chambly June 2, 1776.

**Thomas** (JOHN), b. at Chalford, England, in 1813; served an apprenticeship to a stonecutter; taught himself to paint sign-boards and engrave door-plates in order to earn a few shillings out of working hours; engaged in business with his brother; was an architect at Birmingham, and later at Leamington; was entrusted with the stone carvings for the grammar-school edifice at Birmingham, under the superintendence of Sir Charles Barry, who, when he became architect of the new Houses of Parliament, employed him in the same capacity for a series of years; executed a great number of commissions for architectural and decorative sculpture, and ultimately undertook with great success the execution of works of sculpture of the highest class, among which were *Musidora, Boadicea, Lady Godiva, Una and the Lion,* and several portrait-statues, including a colossal memorial of Shakspeare, and the famous majolica fountain exhibited at the Universal Exposition of 1862. He was also the architect of the seats of several noblemen. D. at Maida Hill, London, Apr. 9, 1862.

**Thomas** (JOHN A.), b. in Tennessee 1811; graduated at the U. S. Military Academy July, 1833, when commissioned second lieutenant in the 3d Artillery; captain 1843. After serving a brief term in garrison, he was recalled to West Point, where employed as instructor of infantry tactics 1834–37, as assistant professor of geography, history, and ethics 1837–41, as commandant of cadets 1842–45. In May, 1846, he resigned from the army to enter upon the practice of law in New York City; was chief engineer of the State of New York 1853–54; was advocate at London on the part of the U. S. Apr., 1853–Jan., 1854, for settlement of claims under terms of convention of Feb. 8, 1853; assistant secretary of state of the U. S. Nov., 1855–Apr., 1857. D. in Paris, France, Mar. 26, 1858.

**Thomas** (JOHN J.), son of David, b. near Aurora, Cayuga co., N. Y., in 1810; became, like his father, a distinguished writer on agriculture and pomology; was assistant editor of the *Genesee Farmer* 1834–39, horticultural editor of the *Albany Cultivator* 1841–53, assistant editor of the same and of the *Country Gentleman* for many years from 1853; contributed to the *Transactions* of the New York State Agricultural Society 1841–47 and to *The Farm* (New York, 1858); conducted the *Illustrated Annual Register of Rural Affairs* (Albany, 1857–65), and was author of *The American Fruit Culturist* (Auburn, 1849), *Farm Implements, and the Principles of their Construction and Use* (New York, 1854), and *Farm Implements and Farm Machinery* (New York, 1869).

**Thomas** (JOHN WESLEY), b. in Exeter, England, in 1798; became a Methodist Wesleyan preacher 1822; was a man of remarkable attainments as a linguist; was a good painter; author of several volumes of poems and theological essays, and executed a creditable poetical version of Dante—the *Inferno* having appeared in 1859, the *Purgatorio* in 1862, and the *Paradiso* in 1866. He was engaged in preparing a second edition at the time of his death, which occurred at Dumfries, Scotland, Feb. 7, 1872.

**Thomas** (JOSEPH), M. D., LL.D., b. in Cayuga co., N. Y., about 1811; educated at the Rensselaer Institute, at Yale College, and in medicine at Philadelphia; resided in India 1857–58, engaged in the study of Oriental languages; spent some months in Egypt with a similar object; was professor of Latin and Greek at Haverford College, Pa., and gave private lessons in the classics at Philadelphia. He was co-editor with Thomas Baldwin of a *Pronouncing Gazetteer* (Philadelphia, 1845), which in a revised edition was entitled *A Complete Pronouncing Gazetteer and Geographical Dictionary of the World* (1855; revised 1861, 1866), and of *A New and Complete Gazetteer of the United States* (1854); published *A First Book of Etymology* (1851–52), a volume of *Travels in Egypt and Palestine* (1853), *A Comprehensive Medical Dictionary* (1864), and *Universal Pronouncing Dictionary of Biography and Mythology* (1870–71); contributed geographical and biographical pronouncing vocabularies to Webster's Dictionaries, wrote the sections on muscular action and the mechanism of locomotion in Dr. S. G. Morton's treatise on *Anatomy,* and published an edition of Oswald's *Etymological Dictionary.* Has made pronunciation and etymology a special feature in all the works of reference published by him.

**Thomas** (LORENZO), b. in Newcastle, Del., Oct. 26, 1804; graduated from the U. S. Military Academy in 1823, when appointed second lieutenant of 4th Infantry, serving with that regiment in Florida until 1831; as adjutant 1828–31. After two years of recruiting service, he was on duty in the adjutant-general's office at Washington from June, 1833, to Sept., 1836; on quartermaster duty in the Florida war 1836–37, and at Washington 1837–38. Upon the organization of the adjutant-general's department he was com-

missioned major and assistant adjutant-general, and served as chief of staff of the army in Florida 1839–40; at Washington, D. C., 1840–46; in the war with Mexico he served as chief of staff to Major-Gen. Butler, both while in command of a division of volunteers and after his succession to the command of the army. In 1852 he became lieutenant-colonel, and served as chief of staff to Lieut.-Gen. Scott from Mar., 1853, to Mar. 7, 1861, when promoted to be colonel and placed in charge of the adjutant-general's office at Washington. Brigadier-general and adjutant-general of the army Aug. 3, 1861, but from 1863 employed on special duty in organizing colored troops, inspection tours, etc., until Feb., 1869, when retired from active service. At the time of Pres. Johnson's controversy with Congress he appointed Gen. Thomas (Feb. 21, 1868) secretary of war *ad interim*, but Secretary STANTON (which see) refused to vacate. D. at Washington, D. C., Mar. 2, 1875.

**Thomas** (MARY F. **Myers**), M. D., b. in Maryland Oct. 28, 1816, daughter of Samuel Myers, a Quaker associated with Benjamin Lundy in the first anti-slavery meeting held in Washington, D. C.; married to Owen Thomas in 1839; kept house, had three children, studied medicine, and graduated from Penn Medical College in Philadelphia, Pa., in 1854; was assistant physician in hospitals during the war; has been city physician, and physician for the Home for Friendless Women in Richmond, Ind.; was admitted to membership in the Indiana State Medical Society in 1876; has been an earnest advocate of temperance for over forty years; in 1851 helped to organize the first women's rights society in Indiana; addressed the Indiana legislature in 1859, and held responsible offices in the movement, State and national, to the present. Her youngest daughter won the first Greek prize at the intercollegiate contest at New York Dec., 1875. SUSAN B. ANTHONY.

**Thomas** (PHILEMON), b. in North Carolina in 1764; served in the war of the Revolution; resided some years in Kentucky, where he was chosen to the legislature; afterward settled in Louisiana; headed the insurrection in West Florida against the Spanish government 1810–11; was major-general of Louisiana militia in the U. S. service 1814–15, and member of Congress 1831–35. D. at Baton Rouge, La., Nov. 18, 1847.

**Thomas** (PHILIP FRANCIS), b. in Talbot co., Md., Sept. 12, 1810; educated at Dickinson College; was admitted to the bar 1831; was elected to the State constitutional convention 1836; was a member of the legislature 1838 and 1843–45; member of Congress 1839–41; subsequently judge of the land-office court of the Eastern Shore of Maryland; was governor of Maryland 1848–51; became U. S. commissioner of patents 1860; succeeded Howell Cobb as secretary of the treasury in Pres. Buchanan's cabinet, acting as such from Dec., 1860, to Jan. 11, 1861; was elected U. S. Senator Mar., 1867, but not admitted to a seat on the ground of having "given aid and comfort to the rebellion," and was elected a Representative in Congress 1874.

**Thomas** (RALPH), b. in England about 1835; is well-known as a zealous and accurate bibliographer. Author of *A Martyr to Bibliography, a Notice of the Life and Works of Joseph Marie Quérard* (1867), and of a useful *Handbook for Fictitious Names* (1868), both published over the anagram of "Olphar Hamst." In 1866 he issued the prospectus of a *Bibliotheca of English Law Literature*, which has not yet (1876) appeared.

**Thomas** (THEODORE), b. in the kingdom of Hanover in 1835; received his musical education from his father, and when only six years of age played the violin in public concerts; in 1845 accompanied his family to America, where, still a mere lad, he joined the orchestra of the Italian Opera in New York City, and played first violin in the orchestra which accompanied Jenny Lind in her first American concerts; in 1861 established the orchestra which became famous under his management, and in 1864 gave his first symphony concerts in New York City. He began his summer-night concerts in the same city two years later, and in 1869 started on his first annual tour of the principal American cities. J. B. BISHOP.

**Thomas** (THEODORE GAILLARD), A. M., M. D., b. in South Carolina in 1831; graduated M. D. at the Medical College of South Carolina; elected professor of obstetrics and diseases of women in the College of Physicians and Surgeons, New York City, 1862; visiting physician to Bellevue Hospital; attending surgeon to the Women's Hospital of the State of New York; physician to Roosevelt Hospital, etc.; has contributed largely to current medical literature. His chief work is a treatise on the *Diseases of Women*, which has been translated into French, German, and Italian. PAUL F. EVE.

**Thomas** (WILLIAM MOY), b. at Homerton, near London, England, in 1828; studied law, but abandoned it for a literary career; became one of Dickens's staff of writers on *Household Words* 1850; was subsequently connected with the *Athenæum* and the *Daily News;* wrote for many other periodicals, and was the original editor of *Cassell's Magazine.* Author of *When the Snow Falls* (2 vols., 1859), *Pictures in a Mirror* (1861), *A Fight for Life* (3 vols., 1868), and other novels; translated Victor Hugo's *Toilers of the Sea* (1866); edited the *Poetical Works of William Collins* (1858) and the *Letters and Works of Lady Mary Wortley Montagu* (2 vols., 1861).

**Thomas à Kempis.** See KEMPIS.

**Thomas Aquinas.** See AQUINAS (THOMAS).

**Thomas, Christians of St.** See CHRISTIANS OF ST. THOMAS.

**Thoma'sius** (CHRISTIAN), b. at Leipsic Jan. 1, 1655; studied jurisprudence and philosophy at Frankfort-on-the-Oder 1675–79; settled in his native city, and began to lecture at the university; adopted in 1687 the German language instead of the Latin in his lectures; published from 1688 to 1690 a monthly paper, in which he criticised with much witticism and good common sense the extravagances of the scholastic method in theology and philosophy; was driven away from Leipsic in 1790 by the chicaneries and open attacks of the orthodox theologians, whom he much offended by his sympathy for Francke, and settled at Halle, where he attracted much attention by his lectures; contributed much to the foundation of the university; published, among other works, his *Geschichte der Weisheit und Thorheit* (3 vols., 1693). D. Sept. 3, 1728. There is an interesting biography of him by Luden (1805).

**Thomasius** (GOTTFRIED), b. at Egenhausen, Bavaria, in 1802; studied theology at Erlangen, Halle, and Berlin 1821–26; was appointed a Lutheran minister at Nuremberg in 1829, and professor of dogmatics at Erlangen in 1842. D. in 1875. His principal works are—*Origines* (1837), *Kirchliche Christologie* (1845), *Christi Person und Werk* (3 vols., 1856). He was also one of the founders of the *Zeitschrift für Protestantismus und Kirche.*

**Thomas the Rhymer.** See RHYMER, THE.

**Thom'aston,** p.-v., Litchfield co., Conn.

**Thomaston,** p.-v., cap. of Upson co., Ga., the terminus of Upson County R. R., 70 miles S. E. of Atlanta, contains 5 churches (2 colored), an excellent mixed school, 1 newspaper, and 2 colored schools. P. about 1000.
J. C. MCMICHAEL, ED. "HERALD."

**Thomaston,** p.-v. and tp., Knox co., Me., on St. George River and on Knox and Lincoln R. R., is specially noted for its large shipments of lime, is the site of the Maine State prison, and has 2 national banks. P. 3092.

**Thom'astown,** tp., Saginaw co., Mich. P. 697.

**Thom'asville,** p.-v. and tp., cap. of Thomas co., Ga., on Atlantic and Gulf R. R., and centre of trade for a productive region, has a bank and weekly newspaper. P. 1651.

**Thomasville,** p.-v., Oregon co., Mo., on Eleven Points River, 150 miles S. of St. Louis, contains 1 church, 1 academy, a newspaper, saw and grist mills, 1 hotel, and fair-ground. Principal business, farming and stock-raising. P. about 200. J. W. BUCKLEY, ED. "SOUTH MISSOURIAN."

**Thomasville,** p.-v. and tp., cap. of Davidson co., N. C., on Richmond and Danville R. R. P. of v. 214; of tp. 2517.

**Thomists.** See AQUINAS (THOMAS).

**Thomp'son,** new county in S. Central Dakota, on both sides of Dakota River, and drained by Snake River, has a rolling prairie surface. Area, about 925 sq. m.

**Thompson,** tp., Pike co., Ark. P. 868.

**Thompson,** p.-v. and tp., Windham co., Conn., has a national bank. P. 3804.

**Thompson,** tp., Columbia co., Ga. P. 369.

**Thompson,** tp., Jo Daviess co., Ill. P. 800.

**Thompson,** tp., Guthrie co., Ia. P. 671.

**Thompson,** tp., Carlton co., Minn. P. 163.

**Thompson,** tp., Sullivan co., N. Y. P. 3514.

**Thompson,** tp., Delaware co., O. P. 866.

**Thompson,** p.-v. and tp., Geauga co., O. P. 1095.

**Thompson,** tp., Seneca co., O. P. 2070.

**Thompson,** tp., Fulton co., Pa. P. 649.

**Thompson** (AUGUSTUS CHARLES), D. D., b. at Goshen, Conn., Apr. 30, 1812; educated at Yale College, but did not graduate; studied theology at East Windsor Seminary and at the University of Berlin; has been pastor of the Eliot Congregational church, Roxbury, Mass., since July, 1842, and accompanied Rev. Dr. Anderson in his visit to the American missions in India 1854–55. Author of numerous devotional books.

**Thompson** (Benjamin). See Rumford, Count.

**Thompson** (Cephas G.), b. at Middleborough, Mass., about 1812, son of a portrait-painter, by whom he was trained to the same business; went at the age of 18 to Plymouth, where he painted portraits, chiefly of sea-captains and their families, for a couple of years; practised drawing at Boston under D. C. Johnson, and copied casts from the antique in the Athenæum; was afterward professionally employed at Providence, R. I., until 1837, when he opened a studio in the University Building, New York City; soon became one of the leading portrait-painters of New York, being employed by scores of prominent citizens; gained also much reputation by his ideal pictures; went to New Bedford 1847; soon afterward returned to Boston; married a sister of Mrs. A. M. Ritchie; spent seven years (1852–59) in Italy; made nearly unique copies of the Staffa *Madonna* of Raphael and the famous *Beatrice Cenci*, now so familiar to all artists, and has again resided in New York since 1860, enjoying a large practice and high consideration in literary and artistic circles.—His brother, Jerome, is also a painter, chiefly known by his rustic landscapes.

**Thompson** (Daniel Pierce), b. at Charlestown, Mass., Oct. 1, 1795; removed to Berlin, Vt., in childhood; taught district schools 1815–16; graduated at Middlebury College 1820; was for some time a private tutor in Virginia, where he studied law and was admitted to the bar; settled at Montpelier, Vt., 1824; became register of probate; was clerk of the legislature 1830–33; compiled a volume of statutes (1835); was county judge of probate 1837–40; clerk of the county 1843–45; afterward clerk of the supreme court and secretary of state 1853. D. at Montpelier June 6, 1868. Author of several novels, chiefly illustrative of Vermont life and of Revolutionary history, among which were *May Martin* (1835), *The Green Mountain Boys* (1840), *Locke Amsden, or the Schoolmaster* (1847), *Lucy Hosmer* (1848), *The Rangers* (1850), *Gant Garley* (1857), and published a *History of Montpelier* (1860).

**Thompson** (D'Arcy Wentworth), b. in England about 1830; was for several years classical master in the Edinburgh Academy, and subsequently professor of Greek in Queen's College, Galway, Ireland. Author of an elementary *Latin Grammar* (1859), *Ancient Leaves, or Metrical Renderings of Poets, Greek and Roman* (1862), *Fun and Earnest, or Rhymes with Reason* (1864), *Day-Dreams of a Schoolmaster* (1864), *Wayside Thoughts of an Asopho-Philosopher* (3 vols., 1864–65), *Sales Attici; Maxims of the Athenian Tragic Drama* (1867), *Wayside Thoughts of a Professor* (1868), and other works on educational topics.

**Thompson** (Elizabeth), b. in England about 1850; acquired sudden celebrity from her painting of *The Roll-Call*, exhibited at the Royal Academy, London, 1874, highly admired by the Prince of Wales, and in consequence purchased by the queen; visited Italy 1875; has painted a *Vintage Sketch in Tuscany* and one or two military pictures, and is now (1876) commissioned to execute a picture of *The Battle of Balaklava*.

**Thompson** (George W.), b. in Ohio in 1806; graduated at Jefferson College, Pa., 1826; was admitted to the bar; settled in Western Virginia, where he became U. S. district attorney 1849; was member of Congress 1851–52, and was subsequently judge in West Virginia. Author of *A Dissertation on the Historical Right of Virginia to the Territory North-west of the Ohio, A Life of Hon. Linn Boyd, The Living Forces of the Universe* (1866), and several legal, political, and educational addresses. He was a contributor to the Boston *Quarterly Review* 1839–42.

**Thompson** (Henry), b. in England in 1797; graduated at St. John's College, Cambridge, 1822; took orders in the Church of England; was for some years curate of Wrington, Somersetshire, and became in 1853 vicar of Chard. Author of a *Life of Hannah More* (1838), *A History of Roman Literature*, and a part of the *History of Greek Literature*, in the *Encyclopædia Metropolitana*, to which work he was a large contributor; translated Schiller's *Maid of Orleans and William Tell* (1845), and *Original Ballads by Living Authors* (1850); wrote for the *Lyra Messianica* and its companion volume; edited *The Complete Works of Horace from the Text of Orellius, with 250 Illustrations, and Introductory Dissertation on the Life and Poetry of Horace* (1853), and *The Complete Works of Virgil, from the Text of Heyne and Wagner, with 250 Illustrations and Memoir* (1854); contributed to a work on *Occult Sciences* (1855), and published several theological and devotional books.

**Thompson** (Sir Henry), M. D., F. R. C. S., b. at Framlingham, England, Aug. 6, 1820; educated at University College, London; studied medicine; gained the Jacksonian prize at the Royal College of Surgeons 1852, and again 1860; became professor of clinical surgery at University College Hospital 1866; was appointed surgeon to the late king of the Belgians 1863, and to the present king 1866; was knighted 1867; is an honorary member of several foreign academies, and author of a treatise on *Practical Lithotomy and Lithotrity* (1863). His writings in the *Contemporary Review* for 1873 gave rise to the movement of that year in favor of cremation.

**Thompson** (Jacob), b. in Caswell co., N. C., May 15, 1810; graduated at the University of North Carolina 1831; was admitted to the bar 1834; settled in the Chickasaw country, Miss., 1835; was a Democratic member of Congress 1839–51; chairman of the committee on Indian affairs; opposed the Compromises of 1850; secretary of the interior under Pres. Buchanan from Mar., 1857, to Jan. 7, 1861, when he resigned in consequence of the order to reinforce Fort Sumter; governor of Mississippi 1862–64, and subsequently aide-de-camp to Gen. Beauregard and inspector-general for the department of Mississippi.

**Thompson** (James), b. at Middlesex, Berks co., Pa., Oct. 1, 1806; became a practical printer; studied law; was admitted to the bar 1828; sat in the Pennsylvania legislature 1832–34; was Speaker of the house 1834, judge of the district court 1836–42; a Democratic member of Congress 1845–51, and judge of the supreme court of Pennsylvania 1857–72, serving as chief-justice during the latter part of his term. He was defeated as a candidate for re-election Oct., 1872; subsequently practised at the bar, and fell dead in the supreme court-room at Philadelphia Jan. 28, 1874.

**Thompson** (John B.), b. in Kentucky in 1810; was a Whig member of Congress 1841–43 and 1847–51; afterward lieutenant-governor, and was U. S. Senator 1853–59. D. at Harrisonburg, Ky., Jan. 7, 1874.

**Thompson** (John R.), b. in Richmond, Va., Oct. 23, 1823; studied at East Haven, Conn.; graduated at the University of Virginia 1843; studied law in the office of James A. Seddon and in the law school of the university, where he took the degree of bachelor of laws 1845, and from 1847 to its suspension at the outbreak of the civil war edited the *Southern Literary Messenger*, the ablest, most successful, and longest-lived of the Southern monthlies. During the war he edited the *Record* (1863), and went to England 1864, where he defended the Confederate cause in the columns of *Blackwood*, the *Cornhill Magazine*, and other periodicals; was connected with the editorial staff of the *Morning Herald*, and subsequently became a resident of New York, where he wrote for the *Evening Post*. D. at New York Apr. 30, 1873. He wrote many essays and poems in his own and in other magazines, and was a lecturer.

**Thompson** (Joseph Parrish), D. D., LL.D., b. at Philadelphia, Pa., Aug. 7, 1819; graduated at Yale College 1838; studied theology at Andover and at New Haven; became pastor of the Chapel street Congregational church, New Haven, Nov., 1840; was minister of the Broadway Tabernacle, New York, 1845–72; was one of the founders of the *New Englander*, a quarterly theological organ of the Congregational Church, and of the New York *Independent;* was a manager of the American Congregational Union and of the Home Missionary Society; originated in 1852 the plan of the Albany Congregationalist convention; visited Egypt, Palestine, and other Oriental countries 1852–53; has since devoted much research to Oriental subjects, especially Egyptology, on which he has written for biblical cyclopædias and reviews; and has resided since 1873 in Berlin, Germany. Author of a *Memoir of Timothy Dwight* (1844), *Lectures to Young Men* (1846), *Memoir of David Hale* (1850), *Egypt, Past and Present* (1856), *Memoir of Rev. David T. Stoddard* (1858), *The Believer's Refuge* (1857), *Christianity and Emancipation* (1863), *Man in Genesis and Geology* (1869), *Theology of Christ from his own Words* (1870), *Church and State in the United States* (1874), *Life of Christ* (1875).

**Thompson** (Launt), b. in Queen's co., Ireland, in 1833; came with his widowed mother to Albany, N. Y., 1847; began the study of medicine in the office of Dr. Ormsby; learned drawing in the mean time; was pupil and assistant of Erastus D. Palmer, the sculptor, nine years; developed a remarkable talent for medallion portraits; settled in New York Nov., 1858, and became a prominent member and officer of the Academy of Design. Among his works are busts of Edwin Booth as Hamlet, Bryant, and Gen. Dix, and a colossal statue of Napoleon. He now (1876) resides at Florence, Italy.

**Thompson** (Mortimer M.), b. at Riga, N. Y., in 1831; studied for a time at Michigan University, but left before graduating; was for some time connected with a travelling theatrical company; became about 1852 a clerk in a jewelry

store in New York; wrote some humorous letters in the Detroit *Advertiser*, which procured him employment on the New York press, and subsequently published several humorous volumes which had a wide circulation. D. in New York City June 26, 1865. Among his books were *Doesticks—What he Says* (1855), *Pluribustah* (1856), *History and Records of the Elephant Club* (1857), and *Nothing to Say* (1857).

**Thompson** (Robert Anchor), b. at Durham, England, in 1821; educated at Durham School and as an engineer student of Durham University; graduated at Catharine Hall, Cambridge, 1844; was for some years connected with the astronomical observatory at Durham, a volume of his observations having been published in 1849; took orders in the Church of England; became curate of Louth and (1854) of Binbrooke, Lincolnshire, and in 1868 was chosen master of the hospital of St. Mary the Virgin at Newcastle-upon-Tyne. Author of a volume of *Sermons* (1853), of *Christian Theism, the Testimony of Reason and Revelation to the Existence and Character of the Supreme Being* (London, 2 vols., 1855), which gained the first Burnett premium (£1800) among 208 competitors; *An Essay on the Principles of Natural Theology* (1857), *Christ the Light of the World* (1859), *The Oxford Declaration*, etc. (1864).

**Thompson** (Robert Ellis), b. near Lurgan, Ireland, in 1844; emigrated to America in 1857; settled in Philadelphia; graduated at the University of Pennsylvania in 1865 and at the Theological Seminary of the Reformed Presbyterian Church (N. S.) in 1867; became assistant editor of the *American Presbyterian*, and remained such till its extinction by the Presbyterian union of 1870. He was called to the University of Pennsylvania as instructor in mathematics and Latin in 1868; became assistant professor of mathematics in 1870, and professor of social science in 1874. In Oct., 1873, he was ordained to the ministry by the Reformed presbytery of Philadelphia. In 1875 he published *Social Science and National Economy*. He has been always the principal, and sometimes the sole, editor of the *Penn Monthly*, now (1876) in its seventh year, and is a member of the American Philosophical Society and of the Historical Society of Pennsylvania.

**Thompson** (Smith), LL.D., b. at Amenia, N. Y., in 1767; graduated at Princeton College 1788; studied law with Chancellor Kent; became district attorney in the middle district of New York 1801; was judge of the New York supreme court 1802–14, chief-justice 1814–18; secretary of the navy in the cabinet of Pres. Monroe 1818–23, and associate justice of the U. S. Supreme Court from 1823 to his death, at Poughkeepsie Dec. 18, 1834.

**Thompson** (Thomas Perronet), b. in Hull, England, Mar. 15, 1783; graduated at Queen's College 1802; entered the navy as a midshipman 1803, and the army as second-lieutenant 1806; took part in the campaign against Buenos Ayres 1807; governor of Sierra Leone 1808; issued a proclamation for the suppression of the slave-trade in the colony; recalled to England 1810 through the exertions of the slave-traders; served in the army in the Peninsular campaign 1813, in France 1814, and in the Pindaree campaign in India; accompanied Sir William Keir Grant as Arabic interpreter in his expedition up the Persian Gulf 1819, assisting in negotiating a treaty with the Arab tribes by which the slave-trade was declared piracy; published numerous pamphlets against the corn laws and upon other questions of political economy, on music, the Greek revolution, etc.; was one of the founders of and principal contributors to the *Westminster Review* (1824), and became one of its proprietors 1829; sat frequently in Parliament between 1835 and 1857; published his collected essays in 6 vols., 1842, and attained the rank of major-general 1854. D. Sept. 6, 1869.

**Thompson** (Waddy), b. at Pickensville, S. C., Sept. 8, 1798; graduated at South Carolina College 1814; was admitted to the bar 1819; was a member of the legislature 1826–30; served as solicitor for the western circuit 1830; was appointed brigadier-general of militia; sat in Congress 1835–41 as a Whig; was prominent in debate, and in 1840 chairman of the committee on military affairs; was minister to Mexico 1842–44; negotiated two important treaties with that country; obtained the release of more than 200 Texan prisoners confined in the castle of Perote and other military prisons, and published a very readable book, *Recollections of Mexico* (1846). He afterward resided alternately at Greenville, S. C., and at Tallahassee, Fla., where he d. Nov. 23, 1868.

**Thompson** (William), b. in Ireland about 1730, emigrated to Pennsylvania; served as captain of Pennsylvania militia in the French war 1759–60; settled at Pittsburg, and was one of the purchasers of the buildings of old Fort Pitt; was colonel of the regiment of Pennsylvania riflemen which marched to Cambridge June, 1775; had a skirmish with the British at Lechmere Point Nov. 10; was appointed brigadier-general Mar. 1, 1776; succeeded Gen. Lee in command at New York Mar. 19; proceeded to the army in Canada in April; commanded the attacking forces at Three Rivers June 6, when he was taken prisoner, and returned to Philadelphia on parole in August, but was not exchanged until 1778. He resided during his later years near Carlisle, Pa., where he d. Sept. 4, 1781.

**Thompson** (William), b. at Belfast, Ireland, Nov. 2, 1805; was a distinguished promoter of science, of the fine arts, and of researches in every department of natural history; was long president of the Natural History and Philosophical Society of Belfast; accompanied Prof. Edward Forbes to the Ægean Archipelago (1841), and contributed more than 70 papers on botany, zoology, and especially ornithology, to the *Transactions* of societies. D. in London Feb. 17, 1852. His great work was *The Natural History of Ireland* (vols. i., ii., and iii., 1849–51), of which the concluding volume (on *Mammalia*) appeared in 1856.

**Thompson** (William Hepworth), D. D., b. at York, England, Mar. 27, 1810; educated at Trinity College, Cambridge, where he became a scholar 1830, fellow 1834, assistant tutor 1837, and tutor 1844; was subsequently elected regius professor of Greek in Cambridge University; became a canon of Ely 1853, and on the death of Dr. Whewell in 1866 was chosen master of Trinity College. He edited William Archer Butler's *Lectures on Ancient Philosophy*, also two of Plato's *Dialogues*, with critical apparatus; is author of various papers read before learned societies, and of published addresses and sermons.

**Thompson** (Zadock), b. at Bridgewater, Vt., May 23, 1796; graduated at the University of Vermont 1823; was tutor there 1825; published a *Gazetteer of Vermont* (Montpelier, 1824), an *Arithmetic* (1825), and a *History of the State of Vermont* (Burlington, 1833); edited the *Iris* (1828) and the *Green Mountain Repository* (1832); removed to Hatley, Canada East, 1833; was engaged as a teacher there and at Sherbrooke; published a *Geography of Canada*; studied theology, and took deacons' orders in the Protestant Episcopal Church May 27, 1835; returned to Burlington, Vt., 1837; became a professor in the Vermont Episcopal Institute; published his chief work, *The History of Vermont, Natural, Civil, and Statistical* (1841–43; appendix 1853); issued a *Guide to Lake George, Lake Champlain, Montreal, and Quebec* (1845) and *The Geography and Geology of Vermont* (1848); was State geologist 1845–48; collected a valuable cabinet of the productions of Vermont; was professor of chemistry and natural history in the University of Vermont 1851–53; visited Europe as Vermont commissioner to the Universal Exposition, and published a *Journal* of his trip (1851); was appointed State naturalist 1853, and while preparing for publication a survey of the State, d. at Burlington Jan. 19, 1856. He had issued an *Almanac* as early as 1819, made for thirty-four years the astronomical calculations for *Walton's Register*, and for some years those for the *Vermont Register*. A brief biography was published by Isaac F. Redfield (1856).

**Thompson's,** tp., Alamance co., N. C. P. 775.

**Thompson's,** tp., Robeson co., N. C. P. 1708.

**Thompson's Creek,** tp., Ellsworth co., Kan. P. 444.

**Thompson's Creek,** v., Perry co., Miss. P. 80.

**Thomp'sontown,** p.-b., Juniata co., Pa. P. 280.

**Thomp'sonville,** p.-v., Hartford co., Conn., on New York New Haven and Hartford R. R., 18 miles N. of the latter place, has 5 churches, an excellent high school, 1 newspaper, a savings bank and banking company, 1 brewery, an efficient fire department, the works of the Hartford Carpet Co., and 1 planing-mill. L. H. Pease.

**Thoms** (William John), F. S. A., b. at Westminster, England, Nov. 16, 1803; was for some years a clerk in the office of the secretary of Chelsea Hospital; wrote largely for the *Foreign Quarterly Review* and other periodicals; was long a clerk of the printed papers department in the House of Lords; became in 1863 deputy librarian to the House of Lords; was for many years one of the most active members of the Society of Antiquaries; was secretary of the Camden Society 1838–73, and was the founder of *Notes and Queries*, a periodical of curious lore, and its editor until Oct., 1873. Among his publications are—*A Collection of Early Prose Romances* (London, 3 vols., 1828), *Anecdotes and Traditions illustrative of Early English History and Literature, from MS. Sources* (1838–39), a translation of Worsaae's *Primeval Antiquities of Denmark* (1849), *Choice Notes from Notes and Queries* (2 vols., 1859), and *The Longevity of Man* (1873), in which he asserted the unreliable character of most alleged cases of "ultra-centenarianism."

**Thom'son,** p.-v., cap. of McDuffie co., Ga., on Georgia R. R., 37 miles W. of Augusta, contains 4 churches (2 colored), 2 flourishing high schools, an efficient fire company, 1 newspaper, 1 mill, and Odd Fellow and Templar lodges. Principal business, cotton-growing. P. about 1500.

WHITE & HUDSON, EDS. "McDUFFIE JOURNAL."

**Thomson,** p.-v., Carroll co., Ill., on Mississippi River and Western Union R. R., has a weekly newspaper.

**Thomson,** p.-v. and tp., cap. of Carlton co., Minn. P. 163.

**Thomson** (ANDREW), b. at Sanquhar, Dumfriesshire, Scotland, July 11, 1779; studied theology at the University of Edinburgh, and was appointed minister of Spronston, Roxburghshire, in 1802, of the East church of Perth in 1808, of the New Grey Friars' church, Edinburgh, in 1810, of St. George's church, Edinburgh, in 1814. D. in Edinburgh Feb. 9, 1831. He was a man of great energy and considerable eloquence, and published *Lectures, Expository and Practical, on Select Portions of Scripture* (2 vols., Edinburgh, 1816), *Sermons on Infidelity* (1831; several times reprinted), *Sermons on Hearing the Word* (1825), *The Scripture History* (1826), *The Scripture History of the New Testament* (1827), *Sermons on Various Subjects* (1829), *The Doctrine of Universal Pardon* (1830), besides educational and religious works for children, etc. After his death appeared *Sermons and Sacramental Exhortations,* with memoir (Edinburgh, 1831; Boston, 1832). He also contributed to the *Edinburgh Encyclopædia,* and founded and edited *The Edinburgh Christian Instructor* (1810 *seq.*).

**Thomson** (ANTHONY TODD), M. D., F. L. S., b. at Edinburgh, Scotland, Jan. 7, 1778, son of the British postmaster-general of Georgia and collector of customs at Savannah; studied at the Edinburgh high school; graduated in medicine at Edinburgh University 1799; became a physician at London 1800; was a voluminous writer in periodicals on medical and literary subjects; edited the *Medical Repository;* became professor of materia medica in London University, and of medical jurisprudence 1832, holding both posts until his death at Ealing, near London, July 3, 1849. Among his works were—*The London Dispensatory* (1811), *An Authentic Medical Statement of the Case of H. R. H., the late Princess Charlotte of Wales* (1817), *Thoughts on Medical Education, and a Plan for its Improvement* (1826), *Elements of Materia Medica and Therapeutics* (2 vols., 1832–33), *Domestic Management of the Sick-room* (1841), and a posthumous *Practical Treatise of Diseases affecting the Skin* (1850), completed by Dr. E. A. Parkes, who prefixed a biographical notice. Dr. Thomson also edited Dr. Thomas Bateman's *Practical Synopsis of Cutaneous Diseases* (7th ed. 1829), to which he added an illustrative *Atlas of Delineations* (1829), and edited, with copious illustrative notes, Eusèbe Salverte's *Philosophy of Magic, Prodigies, and Apparent Miracles* (2 vols., 1846; New York, 1847) and James Thomson's *Seasons* (1847).

**Thomson** (CHARLES), LL.D., b. at Maghera, Derry, Ireland, Nov. 29, 1729; came to America at the age of eleven, landing in 1741 at Newcastle, Del., with three brothers, his father having died on the voyage; was enabled by an elder brother to enter an academy taught by Rev. Dr. Francis Alison, at Thunder Hill, Md., where he obtained a good classical and mathematical training; became a teacher in the Friends' academy at Newcastle; removed to Philadelphia, where he became an efficient teacher and obtained the friendship of Dr. Franklin; served in 1758 on a commission to treat with the Iroquois Indians at Oswego, N. Y.; was also concerned in negotiations with the Delaware Indians, who conferred upon him the honor of adoption into their tribe under the name of the "Truth-teller;" married Hannah Harrison, aunt of Pres. Harrison; was for some years engaged in mercantile business; was secretary of the American Society, and prominent in literary and patriotic associations; was chosen secretary of the first Continental Congress on the day of its assembling at Carpenters' Hall, Philadelphia, Sept. 5, 1774; filled the same post to the successive Congresses until 1789, being considered as "the Sam Adams of Philadelphia, the life of the cause of liberty;" was chosen to inform Washington at Mount Vernon of his election to the Presidency, and resided during his later years at Lower Merion, Montgomery co., Pa., where, at the venerable age of ninety-five, he d. Aug. 16, 1824. Author of *An Enquiry into the Causes of the Alienation of the Delaware and Shawanese Indians* (London, 1759), of a valuable translation of the whole Bible, the Old Testament portion being from the Septuagint (4 vols., Philadelphia, 1808), and of *A Synopsis of the Four Evangelists, or a Regular History of the Conception, Birth, Doctrine, Miracles, Death, Resurrection, and Ascension of Jesus Christ, in the Words of the Evangelists* (Philadelphia, 1815), in the language of his own version.

**Thomson** (EDWARD), D. D., LL.D., b. at Portsea, near Portsmouth, England, in Oct., 1810; came with his parents to the U. S. in 1819, and settled at Wooster, O.; received a good classical education; graduated in medicine at the University of Pennsylvania 1829; commenced practice as a physician at Wooster, but, experiencing a change in his religious views, became in 1833 a minister of the Methodist Episcopal Church; preached at Detroit, Mich., 1836; was principal of the Methodist Seminary at Norwalk, O., 1837–44; editor of the *Ladies' Repository* at Cincinnati 1844–46; first president of the Ohio Wesleyan University at Delaware, O., 1846–60; editor of the *Christian Advocate* at New York from 1860 to 1864, when he was chosen a bishop; made a missionary voyage around the world, visiting the Methodist missions in Germany, Bulgaria, India, and China, organizing in India an annual conference; visited the churches of the Pacific States and Territories, and was subsequently actively engaged in home episcopal work until his death, at Wheeling, Va., Mar. 22, 1870. Author of *Educational Essays* (1856), *Moral and Religious Essays, Biographical Sketches,* and *Letters from Europe.*

**Thomson** (JAMES), b. in Roxburghshire, Scotland, Sept. 11, 1700; studied for six years at the University of Edinburgh, with the design of entering the Church, but, abandoning this intention, went to London in 1724, where he was for several months tutor in a nobleman's family. In 1726 appeared his poem *Winter,* which speedily became popular; *Summer* followed in 1727, *Spring* in 1728, and *Autumn* in 1730, completing *The Seasons.* In the interval he had published a *Poem Sacred to the Memory of Sir Isaac Newton* (1727), and written *Sophonisba,* a tragedy, acted in 1729. He then travelled for two years as tutor to the son of Lord Chancellor Talbot, by whom he was rewarded with the post of secretary of briefs, and wrote a poem on *Liberty* (5 parts, 1735–36), which met with a very unfavorable reception, and was subsequently considerably abridged. The lord chancellor dying in 1737, the secretaryship was lost by Thomson, but he received from the prince of Wales a pension of £100, and some years later was rendered independent by the appointment of surveyor-general of the Leeward Isles, which, after paying the deputy who performed all the duties, brought him £300 a year. His works, besides those already mentioned, are—*Agamemnon,* a tragedy; *Edward and Eleanora,* a drama; *Alfred,* a masque; *Tancred and Sigismunda,* a successful tragedy; *The Castle of Indolence,* a poem in the Spenserian stanza, upon which he had labored many years, and which is his best work, though far less popular than *The Seasons;* and *Coriolanus,* a tragedy, not produced until after his death. D. at Kew Lane, near Richmond, Aug. 27, 1748.

**Thomson** (JAMES), brother of Sir William and son of James Thomson, LL.D., professor of mathematics in the University of Glasgow, b. at Belfast, Ireland, about 1816; educated there and at Glasgow, where he graduated about 1837; became a pupil in the Horseley ironworks at Tipton, Staffordshire; was employed by Sir William Fairbairn, the eminent civil engineer; settled at Belfast; was appointed professor of civil engineering in Queen's College, Belfast, 1857, and in the University of Glasgow 1872; has been extensively engaged as an agricultural engineer, especially with reference to irrigation and water-supply; invented the vortex turbine and the jet-pump and intermittent reservoir for draining swamp-lands, and solved the problem of glacial action by a series of investigations upon the lowering by pressure of the freezing temperature of water. He has contributed to the *Transactions* of the leading scientific associations over 40 papers on physics, mathematics, and mechanics.

**Thomson** (JAMES BATES), LL.D., b. in Springfield, Vt., May 21, 1803. His early life was spent on his father's farm, and he enjoyed the advantages of district-school training during the winter seasons; attended a neighboring academy for a few weeks, and commenced teaching a winter district school in his own town at the age of sixteen; was for some years alternately a farm-hand, a teacher, and a student in Chester and Kimball Union academies. A severe affection of the eyes compelled him to suspend study for four years, but he was able to teach a part of the time in Boston and Brighton, Mass. He entered Yale College in 1830, graduated in 1834, and in 1835–42 took charge of a newly-founded college at Nantucket, Mass.; his health having become impaired by his excessive labor, he resigned and removed to Auburn, N. Y., and soon after, at the request of Pres. Day of Yale College, commenced the abridgment and adaptation of his *Algebra* for the use of schools and academies. In 1843 he conducted the mathematical exercises in the first teachers' institutes held in this country, and for four or five years was actively engaged in attending teachers' institutes and promoting their efficiency. In

1845 he assisted in the organization of the New York State Teachers' Association, and in 1864 was elected its president. He returned to New York City in 1846, and afterward to Brooklyn. He has since his removal to New York been occupied with mathematical and scientific pursuits, and has published a first series of mathematical textbooks of 10 vols., from mental arithmetic to algebra and geometry; a second series, of which 3 vols., *New Mental Arithmetic*, *New Rudiments of Arithmetic*, and *New Practical Arithmetic and Key*, have already been issued, and the higher mathematics are in preparation. He has also written on the metric system, oral instruction, free schools, etc. He has been for many years a student of natural history, and is distinguished as a conchologist. In 1853 he received the degree of LL.D. from Hamilton College, N. Y.

L. P. Brockett.

**Thomson** (Katharine **Byerley**), b. at Etruria, Staffordshire, England, in 1800; married Dr. Anthony T. Thomson (which see), a medical writer; was authoress of several novels and of many works of biography and anecdotical literature, of which the later volumes, in which she was assisted by her son, John Cockburn Thomson (b. about 1825; d. at Tenby, Wales, 1860), have appeared under the pseudonyms of "Grace" and "Philip Wharton." D. at Dover Dec. 17, 1862. Among her works were—*Memoirs of the Court of Henry VIII.* (2 vols., 1826), *Memoirs of Sir Walter Raleigh* (1830), *Memoirs of Sarah, Duchess of Marlborough, and of the Court of Queen Anne* (2 vols., 1838), *Memoirs of the Jacobites of 1715 and 1745* (3 vols., 1845–46), *Recollections of Literary Characters and Celebrated Places* (2 vols., 1854), *Life and Times of George Villiers, Duke of Buckingham* (3 vols., 1860), *Queens of Society* (2 vols., 1860), and *Wits and Beaux of Society* (2 vols., 1860).

**Thomson** (Richard), b. in England about 1795; was a distinguished antiquary and bibliographer, and for thirty years librarian of the London Institution. D. at London Jan. 2, 1865. Author of *Chronicles of London Bridge* (1827), *Illustrations of British History* (2 vols., 1828), *Tales of an Antiquary* (3 vols., 1828), *An Historical Essay on the Magna Charta of King John* (1829), *Legends of London* (1832), and an elaborate *Catalogue of the Library of the London Institution systematically classed*, etc. (4 vols. royal 8vo, 1835–54), one of the best works of its kind, including several extensive reference tables, classifications, and indexes.

**Thomson** (Robert Dundas), M. D., F. R. S., nephew of Dr. Thomas (1773–1852), b. in Scotland in 1811; educated in medicine at the universities of Edinburgh and Glasgow; made a voyage to India and China as assistant surgeon in the navy of the East India Company; was for eight years a physician at London, where he was instrumental in establishing the Blenheim Free Dispensatory, acting gratuitously as one of its physicians; assisted in editing the *Annals of Medicine*, and conducted a monthly periodical, *The Records of General Science* (4 vols., 1835–36), in which he had the assistance of his uncle, Dr. Thomas Thomson, whose daughter he married, and of whom he became the assistant (1841) and successor (1846) in the professorship of chemistry at the University of Glasgow; was also editor of the *British Annual Epitome of the Progress of Science* (3 vols., 1837–39); became president of the Meteorological Society and fellow of the Royal Society; contributed largely to their publications; became professor of chemistry in St. Thomas's Hospital, London, medical officer of health and analyst for St. Marylebone (1856), and subsequently chemical member of the council of the University of London. D. at Richmond-on-Thames Aug. 17, 1864. Author of *Experimental Researches on the Food of Animals and the Fattening of Cattle, with Remarks on the Food of Man* (1846), *A School of Chemistry* (1847), and *The Cyclopædia of Chemistry, with its Applications to Mineralogy, Physiology, and the Arts* (1854).

**Thomson** (Samuel), M. D., b. at Alstead, N. H., Feb. 9, 1769; was the originator of the "Thomsonian system" of medical practice. D. at Boston, Mass., in 1843. Author of *Materia Medica and Family Physician, New Guide to Health*, and *Life and Medical Discoveries, written by himself* (Boston, 1825).

**Thomson** (Thomas), b. at Dailly, Ayrshire, Scotland, in 1768; educated at the University of Glasgow; became an advocate 1793, deputy clerk registrar of Scotland 1806; principal clerk of session 1828, and president of the Bannatyne Club 1832; was one of the founders of the *Edinburgh Review*, and occasionally acted as its editor; was esteemed the most learned antiquary in Scotland, and as such is frequently referred to in the writings of Sir Walter Scott. D. at Shrubhill, between Edinburgh and Leith, Oct. 2, 1852. He edited for the Bannatyne Club some of the works of Sir Thomas Hope, John Lesley, Sir George Mackenzie, Sir James Melville, Lady Griselda Murray, Sir James Turner, and other old Scottish writers, and superintended for the Maitland Club and the record commission other reprints of the same character. *A Memoir* (1855) was prepared for the Bannatyne Club by Cosmo Innes.—His brother John, b. at Dailly in 1778, was minister of Dailly 1800–05, and of Duddington 1805–40; wrote on physical science for the *Edinburgh Review*, and was so distinguished as a landscape-painter as to be called the "Scottish Claude Lorraine." D. at Duddington Oct. 27, 1840.

**Thomson** (Thomas), M. D., b. at Crieff, Perthshire, Scotland, Apr. 12, 1773; educated at Stirling and at the University of St. Andrew's; succeeded his brother, James Thomson, D. D. (1768–1855), as editor of the 3d edition of the *Encyclopædia Britannica*, Nov., 1796–1800; graduated in medicine at Edinburgh 1799; was for some years from 1802 the scientific editor of James Mill's *Literary Journal;* was the first to introduce the use of symbols in chemistry in articles for the *Supplement* to the *Encyclopædia*, written 1798–99, and which became the basis of his *System of Chemistry* (4 vols., 1802); first announced to the world Dr. Dalton's atomic theory, which had been privately communicated to him in 1804, in the 3d ed. of the same work (5 vols., 1807); was for many years a lecturer on chemistry, and conducted a laboratory for students; edited at London the *Annals of Philosophy* (1813–22); became in 1818 professor of chemistry in the University of Edinburgh. D. at Kilmun, Argyleshire, July 2, 1852. Among his other works were—*The Elements of Chemistry* (1810), *The History of the Royal Society of London* (1812), *Travels in Sweden and Lapland* (1813), *An Attempt to establish the First Principles of Chemistry by Experiment* (2 vols., 1825), *An Outline of the Sciences of Heat and Electricity* (1830), *The History of Chemistry* (2 vols., 1830), *Outlines of Mineralogy, Geology, and Mineral Analysis* (2 vols., 1836), and a recast of his earlier work on chemistry in three separate treatises—*The Chemistry of Inorganic Bodies* (2 vols., 1831), *Chemistry of Organic Bodies, Vegetables* (1838), and *The Chemistry of Animal Bodies* (1842).—His son Thomas was an assistant surgeon in the Bengal army, superintendent of the East India Company's botanic gardens at Calcutta, and author of *Western Himalaya and Thibet, the Narrative of a Journey through the Mountains of Northern India* (1852).

**Thomson** (Thomas), b. in Scotland about 1815; received a careful education; became a minister of the Scottish Church; wrote for the Messrs. W. & R. Chambers the supplementary vol. (v.) of their elaborate *Biographical Dictionary of Eminent Scotsmen* (1855), and (with Charles Macfarlane) *The Comprehensive History of England, Civil and Military, etc., from the Earliest Period to the Suppression of the Sepoy Revolt* (4 vols., 1858–61).

**Thomson** (William), LL.D., b. in Perthshire, Scotland, in 1746; educated at St. Andrew's University; was for some time librarian to the earl of Kinnoul and minister of the Scottish church at Monivaird; taught an academy at London, and passed his later years as a professional author, editing several magazines and writing "history, biography, voyages, travels and memoirs, novels and romances, pamphlets and periodicals, largely and well." D. at Kensington, London, Mar. 16, 1817. Among his works were—*The Man in the Moon, a Novel* (1782), *Mammoth, a Novel* (1789), and *Memoirs of the War in Asia* (1788); completed Watson's *History of Philip III.* (1783), and wrote several works published in the names of others, among which was the well-known *History of the American War* (2 vols., London, 1794), usually ascribed to Stedman.

**Thomson** (William), D. D., F. R. S., b. at Whitehaven, Cumberland, England, Feb. 11, 1819; educated at Shrewsbury School; was successively scholar, fellow, tutor, and provost of Queen's College, Oxford, where he graduated 1840; was ordained deacon 1842 and priest 1843; was incumbent of the parishes of Guildford and Cuddesden; was appointed select preacher at Oxford 1848, and again 1856; preached the Bampton lectures on *The Atoning Work of Christ, viewed in Relation to some Current Theories* (1853); became rector of All Souls', Marylebone, 1855; contributed to the *Oxford Essays* (1855) and to *Sermons at Westminster Abbey for the Working Classes* (1858); was preacher of Lincoln's Inn 1858–61; was appointed chaplain to the queen 1859, bishop of Gloucester and Bristol Dec., 1861, and archbishop of York 1863. Dr. Thomson took an active part as a member of convocation in promoting ecclesiastical reform and church extension; labored for educational reform in Oxford University; is a member of the Royal, Geographical, and Photographic societies; is president of the Palestine Exploration Fund; was examiner in logic and mental science to the Society of Arts, and in divinity at Oxford; is one of the lords of the privy council, governor of the Charter-house and of King's College, Lon-

don; wrote the *Life of Christ* and other articles for Dr. Smith's *Dictionary of the Bible;* has written much for the reviews; edited the *Aid to Faith* (1862); has published sermons, pastoral letters, and lectures, and is author of *An Outline of the Necessary Laws of Thought* (1842; 9th ed. 1868), a textbook in several British and American universities, *Sermons preached in Lincoln's Inn Chapel* (1861), and *The Limits of Philosophical Inquiry* (1869).

**Thomson** (Sir WILLIAM), F. R. S., LL.D., son of Prof. James, LL.D., b. at Belfast, Ireland, in June, 1824; educated at the University of Glasgow and at Peterhouse, Cambridge, where he graduated in 1845 as second wrangler, and was elected fellow; became in 1846 professor of natural philosophy at the University of Glasgow, a post he still occupies (1876); was editor from 1846 to 1853 of the *Cambridge and Dublin Mathematical Journal,* in which he published his researches on the mathematical theory of electricity, especially the notable paper on *The Distribution of Electricity on Spherical Conductors* (1848); invented quadrant and portable electrometers of extreme delicacy and accuracy, the former having been employed at Kew Observatory for the automatic registration of the electric state of the atmosphere; was also the inventor of the mirror galvanometer and the siphon recorder, instruments of great value in submarine telegraphy; made important experiments in magnetism, and especially in heat, among which were those upon the conversion of water at the freezing-point into ice without the expenditure of force; the specific heat of substances, the heating of india-rubber by sudden stretching, and the relation between the force expended and the heat produced in the compression of a gas. His extraordinary and fruitful generalization concerning the universal tendency in nature to the dissipation of mechanical energy was given to the world in the *Philosophical Magazine* in 1852, and many other remarkable papers have since appeared in that and in other scientific periodicals or in the *Transactions* of learned societies. He delivered in 1855 the Bakerian lecture on *The Electro-Dynamic Properties of Metals;* received for his researches the royal medal of the London Royal Society and the Keith prize of the Edinburgh Royal Society; delivered the Rede lecture in 1866, in which year he was knighted and received the freedom of the city of Glasgow on the completion of the Atlantic cable, which was rendered practicable by his discoveries; was president of the British Association at its Edinburgh session of 1871; elected president of the Geological Society of Glasgow 1872, and chosen fellow of St. Peter's College, Cambridge, in recognition of scientific eminence, Oct. 29, 1872. With Prof. Peter G. Tait he published in 1867 the first volume of an *Elementary Treatise on Natural Philosophy,* which immediately became the standard work of reference on the subject; wrote the article "Telegraph" in the 8th ed. of the *Encyclopædia Britannica* (1868), and in 1872 issued a volume of his papers on electro-statics and magnetism. Engaged in 1876 in perfecting a tide-calculating machine, in which year he visited Canada and the U. S. PORTER C. BLISS.

**Thomson** (WILLIAM M.), D. D.; graduated in 1828 at Miami University, Oxford, O.; was sent by the American Board of Commissioners for Foreign Missions to Syria and Palestine; worked there for about twenty-five years, and published *The Land and the Book, Biblical Illustrations drawn from the Manners and Customs, the Scenes and the Sceneries of the Holy Land* (2 vols., New York, 1859; London, 1860), *The Land of Promise, or Travels in Modern Palestine, illustrative of Biblical History, Manners, and Customs* (New York, 1865), besides a number of minor essays.

**Thomson's Galvanometer.** See ELECTRICITY, by PRES. H. MORTON, PH. D.

**Thonon',** town of France, department of Haute-Savoie, on Lake Geneva, has some hot springs and a few manufactures. P. 5080.

**Thor,** the wild god of strength and the terrible enemy of all evil spirits, was the most characteristic and the most conspicuous figure in the SCANDINAVIAN MYTHOLOGY (which see), and expressed by his character and in his adventures the very nature of the Scandinavian people, as Apollo, with whom he in other respects has no resemblance at all, expressed that of the Greek people. The principal attributes with which he was furnished by the mythical imagination are—the belt which doubles his strength when he fastens it around his waist; the hammer, Mjölnir, with which he can crush mountains, and which always returns to his hand when he throws it; and the chariot in which he rides across the heavens, thereby producing thunder and lightning.

**Thorac'ic Duct,** the principal lymphatic vessel in the human body, runs upward on the left side of the spinal column from the receptaculum chyli, and terminates near the junction of the left internal jugular and the left subclavian veins. It discharges into the blood-current the chyle and most of the lymph of the body. It is often represented in the lower animals by a congeries of lymphatic vessels. Birds have two thoracic ducts, one on each side. Its outlet is provided with valves which prevent the ingress of blood, and the duct has other valves which allow the contents to pass upward, but not downward.

**Thorax.** See CHEST.

**Thor'burn** (GRANT), b. near Dalkeith, Scotland, Feb. 18, 1773; was in early life a nailmaker; was engaged in some political movements which involved him in difficulties, on account of which he emigrated to the U. S., settling at New York, June, 1794, where he passed through a checkered career subsequently depicted by John Galt in his novel of *Lawrie Todd* (1830), and by himself in his autobiographies; became a successful seedsman and a prolific writer for periodicals over the signature of "Lawrie Todd," and was noted for benevolence and practical religious philosophy. He resided many years at Astoria, L. I., settled at Winsted, Conn., 1854, and d. at New Haven Jan. 21, 1863. Author of *Forty Years' Residence in America* (1834), *Men and Manners in Great Britain* (1834), *Fifty Years' Reminiscences of New York* (1845), *Life and Writings of Grant Thorburn, prepared by himself* (1852), and various other works.

**Thor'da,** or **Thorenburg,** town of Transylvania, on the Aranyos, is beautifully situated among vineclad hills, and has extensive saltworks, from which nearly 100,000 cwts. of salt are annually produced. P. 8302.

**Thor'eau** (HENRY DAVID), b. July 12, 1817—according to some authorities in Boston, according to others in Concord, Mass.—son of a maker of lead-pencils at Concord; graduated at Harvard 1837; taught school until 1840; afterward turned his hand to various occasional employments, such as land-surveying, carpentering, and other mechanical handicrafts, for which he had a natural facility; determined, however, to work no more than necessary to provide for his extremely limited wants, devoting the rest of his time to study and the contemplation of nature; was much influenced by the transcendental doctrines of his friend and neighbor, Ralph W. Emerson; spent two years from Mar., 1845, as a hermit in Concord on the shore of Walden Pond, living in a house built by himself, and subsisting at an annual expense of about $70; was noted for many eccentricities of thought and action, never voting or attending church, paying no taxes, rarely using flesh as food, and never employing a gun, though an ardent naturalist. As a matter of course, he was never married. His favorite studies were the classics, especially Homer, old English literature, and Oriental poetry and philosophy. He wrote occasionally for the *Dial* and other periodicals, but allowed more than the Horatian "nine years" to elapse between the composition and the publication of his first book, *A Week on the Concord and Merrimack Rivers* (1849), being an account of a boat-journey made along with his brother in 1839 from Concord to the head of Merrimack River, and back again, the minute narrative of the incidents being supplemented by observations in botany and natural history, descriptions of scenery, and much "transcendental philosophy." His second book, *Walden, or Life in the Woods* (1854), appeared after a similarly long interval, and is interesting for its descriptions of natural scenery and of the habits of birds, insects, and wild animals. D. at Concord May 6, 1862. Mr. Emerson published an interesting account of his life in the *Atlantic Monthly,* in which several of his sketches also appeared, and several volumes were subsequently prepared from his MSS., *Excursions in Field and Forest* (1863), *The Maine Woods* (1864), *Cape Cod* (1865), *Letters to Various Persons* (1865), with nine poems, and *A Yankee in Canada, with Anti-Slavery and Reform Papers* (1866). (See *Thoreau, the Poet-Naturalist,* by W. E. Channing, 1873.) PORTER C. BLISS.

**Thores'by** (RALPH), F. R. S., b. at Leeds, England, Aug. 16, 1658; educated at Leeds School; resided some years at Rotterdam, qualifying himself for the mercantile business, which he afterward successfully conducted, devoting, however, much of his time to antiquarian pursuits. D. in 1725. Author of *Ducatus Leodiensis, or the Topography of Leeds* (London, folio, 1715), of which a new edition was brought out by Dr. T. D. Whitaker (1816); *Museum Thoresbianum, or a Collection of Antiquities in the possession of Ralph Thoresby,* and *Vicaria Leodiensis, or the History of the Church of Leeds* (1724); all which are highly appreciated by topographers. He contributed to Gibson's edition of Camden's *Britannia,* Collins's *Peerage,* Calamy's *Memoirs of Divines,* and other works, and wrote much in the *Philosophical Transactions.* His *Diary* (2 vols., 1830) and *Correspondence* (2 vols., 1832) were edited by Rev. Joseph Hunter.

**Thori'idæ** [*Thorius*—Gr. *θορόεις*, "undeveloped"—the name of the only known genus], a family of salamanders (Gradentia), distinguished by Prof. Cope for a species found in Mexico exhibiting the "lowest grade of ossific deposit found among the tailed batrachians [whence the name], accompanied by characters of full development in other respects. The parietal and palatine bones are represented mostly by cartilage and membrane; the posterior nares are therefore not separated from the orbit, the palatine bones are not prolonged over the parasphenoid; there is no postorbital arch; teeth are developed on plates on the parasphenoid bone; the tongue is boletoid and free in front; the carpus and tarsus are ossified; the vertebræ concave behind. The single known species has been named *Thorius pennatulus*, and is terrestrial in habits." (See Cope in *Proc. Acad. Nat. Sc. Phila.*, 1869, pp. 110–112.)

THEODORE GILL.

**Tho'rium,** also **Thorinum,** one of the rare metals, discovered by Berzelius in 1828 in a Norwegian mineral which he called *thorite*, from the mythical being *Thor*. Thorite is a hydric silicate of thoria, or oxide of thorium, consisting of $ThO.SiO_2.2H_2O$. Berzelius and Chydenius both obtained metallic thorium of densities 7.657 and 7.795 by treating the chloride $ThCl_2$ with sodium. It is a gray metallic powder, which burns with great brilliancy to snow-white infusible *thoria* or *thorina*, ThO. Water does not act upon it, and nitric and sulphuric acids with difficulty, though muriatic acid attacks and dissolves it powerfully. This is the statement of Berzelius, but Chydenius makes it easily soluble in nitric and difficultly in muriatic acid. It therefore, no doubt, has different allotropic forms. Its equivalent weight is as yet uncertain, some adopting 115.7, others 118.4. Thorium occurs also in other minerals besides thorite, as *orangite* (a heavier allotrope of thorite itself), as columbate in some *pyrochlores*, as phosphate in *monazite*, and according to Chydenius in *euxenite*, as columbate and tantalate.

HENRY WURTZ.

**Thorn.** See CRATÆGUS.

**Thorn,** town of Prussia, province of Prussia, on the Vistula, is strongly fortified, surrounded with walls, and defended by forts; has some manufactures of cloth, linen, soap, tobacco, and gingerbread, and carries on an active trade in corn and cattle. Copernicus was born here, and a fine monument in his honor has been erected in the market-place. P. 16,619.

**Thorn-Apple.** See DATURA.

**Thorn'apple,** tp., Barry co., Mich. P. 1795.

**Thorn'back** [*i. e.* "back with prickles" or "thorns"], the name given in some parts of England to the *Raia clavata*. This is a short-snouted ray, whose dorsal surface, especially about the snout and interorbital space, is covered with small spines, and along the middle of the back and tail with a row of large spines, resembling somewhat the thorns of a rose-bush; the male has further still larger thorns on the sides of the head and pectoral fins, and the female has numerous spines, each arising from a large roundish base. It is very abundant along some parts of the English coast, and is the most esteemed as a table-fish of any member of the genus. It comes into the shallow water in spring and summer, and is then taken in the greatest numbers.

THEODORE GILL.

**Thorn'borough** (Sir EDWARD), b. in 1756; entered the British navy; was first lieutenant of the Falcon, one of the vessels which participated in the attack on Bunker Hill, 1775; took an active part in subsequent naval actions during the war of the American Revolution, and distinguished himself on various occasions in the war with France, rising to the rank of admiral of the white and receiving the thanks of Parliament. D. Apr. 3, 1834.

**Thorn'bury,** p.-v., Grey co., Ont., on the S. side of Nottawasaga Bay, Lake Huron, and on Northern Railway, has a trade in grain and lumber, and 1 weekly newspaper. P. about 400.

**Thornbury,** p.-v and tp., Chester co., Pa. P. 235.

**Thornbury,** tp., Delaware co., Pa. P. 990.

**Thornbury** (GEORGE WALTER), b. at London, England, in 1828; became contributor to periodicals at the age of seventeen; was connected with the *Athenæum* 1851; studied art and occasionally practised painting, but devoted himself to periodical literature, including essays, poems, novels, travels, and biographies. D. at London June 7, 1876. Author of *Lays and Legends, or Ballads of the New World* (1851), *The Buccaneers, or the Monarchs of the Main* (3 vols., 1855), *Shakespeare's England, or Sketches of our Social History during the Reign of Elizabeth* (2 vols., 1856), *Art and Nature at Home and Abroad* (2 vols., 1856), *Songs of the Cavaliers and Roundheads* (1857), *Every Man his own Trumpeter* (3 vols., 1858), *Life in Spain* (2 vols., 1859), *Turkish Life and Character* (2 vols., 1860), *British Artists from Hogarth to Turner* (2 vols., 1860), *Ice-Bound* (1861), *Cross Country* (1861), *Life of J. M. W. Turner, R. A.* (2 vols., 1861), *True as Steel* (1863), *Wildfire* (1863), *Haunted London* (1865), *Two Centuries of Song* (1866), *Old Stories Retold* (1869), *A Tour round England* (1870), *Old and New London* (2 vols., 1873–74), *Criss-Cross Journeys*, and *Historical and Legendary Ballads and Songs* (1876).

**Thorn Creek,** tp., Whitley co., Ind. P. 1343.

**Thorn'dike,** p.-v. and tp., Waldo co., Me. P. 730.

**Thorndike,** p.-v., Hampden co., Mass.

**Thorndike** (GEORGE QUINCY), b. in Boston about 1825; graduated at Harvard 1847; studied art in Paris; settled at Newport, R. I., and devoted himself to landscape-painting. Among his best-known productions are *Swans in Central Park* and *The Wayside Inn*.

**Thorndike** (ISRAEL), b. at Beverly, Mass., in 1757; received a common-school education; was commissioned captain of the privateer Warren Oct. 30, 1776; subsequently acquired wealth by commerce with China and the East Indies and by manufactures; was a member of the convention that framed the Federal Constitution; settled at Boston 1810, and in 1818 presented to Harvard University the valuable library of Prof. Ebeling of Hamburg. D. at Boston May 10, 1832.

**Thorne,** tp., Perry co., O. P. 729.

**Thorn'ton,** p.-v. and tp., Cook co., Ill. P. of v. 301; of tp. 2222.

**Thornton,** p.-v. and tp., Grafton co., N. H. P. 840.

**Thornton** (EDWARD), b. at Clapham, Surrey, England, in 1810; entered the civil service of the East India Company at an early age; spent many years in the India House, London, from which he retired 1860 with the decoration of commander of the Bath. Author of *India, its State and Prospects* (1835), *Chapters on the Modern History of British India* (1839), *History of the British Empire in India* (6 vols., 1841–45; 3d ed. 1862), *A Gazetteer of the Countries adjacent to India on the North-west* (2 vols., 1844), and *A Gazetteer of India* (4 vols., 1854; 2d ed., 1 vol., 1857). He edited William Milburn's *Oriental Commerce* (2d ed. 1825), and wrote most of the articles upon India in the 8th ed. (1853–60) of the *Encyclopædia Britannica*.

**Thornton** (Sir EDWARD), K. C. B., b. about 1820, son of Hon. Edward Thornton, British minister in Portugal, who for services rendered the government of that country was created count of Casilhas in the Portuguese nobility; entered the diplomatic service in 1842 as attaché at Turin; became paid attaché in Mexico 1845, and secretary of legation there 1851; rendered valuable unofficial services in facilitating the negotiation of the treaty of Guadalupe Hidalgo 1848; was secretary of legation at Buenos Ayres 1852–53; appointed chargé d'affaires to Uruguay 1854; also commissioned to Paraguay, which country he repeatedly visited; minister to the Argentine Republic 1859; envoy to Brazil 1865–67, and in Dec., 1867, appointed envoy to the U. S., where he still remains (1876); knighted Aug. 9, 1870; a member of the joint high commission on the Alabama claims 1871; a privy councillor 1871; arbitrator of the Mexican and American claims commission 1873, and participated in the Centennial ceremonies at Philadelphia July 4, 1876.

**Thornton** (HARRY I.), b. in Virginia; removed in early life to Kentucky. He removed to Huntsville, Ala., and became a judge of the supreme court; resided in Mobile and in Eutaw, Ala., and was a successful lawyer. Mr. Fillmore appointed him a commissioner of California land-titles in 1853, a few years after which he died.—His brother, COL. JAMES O. THORNTON of Tuscaloosa, was secretary of state of Alabama 1824–34.

**Thornton** (JAMES S.), U. S. N., b. Feb. 25, 1827, in New Hampshire; entered the navy as a midshipman Jan. 15, 1841; became a lieutenant in 1855, commander in 1866, captain in 1872; was executive officer of Farragut's flagship at the battle of New Orleans and the passage of Vicksburg, and executive officer of the Kearsarge when she captured the Alabama. D. May 14, 1875. Capt. Thornton was an officer of great gallantry and a prime seaman, highly commended by Farragut, and thus spoken of by Capt. Winslow in his official report of June 20, 1864: "I feel it due to my executive officer, Lieut.-Com. Thornton, who superintended the working of the Kearsarge's battery, to particularly mention him for an example of coolness and encouragement of the men while fighting, which contributed much toward the success of the action."

FOXHALL A. PARKER.

**Thornton** (JOHN WINGATE), b. at Saco, Me., Aug. 12, 1818; graduated at Cambridge Law School 1840; was one of the founders of the New England Historic-Genealogical Society, vice-president of the American Statistical Associ-

ation and of the Prince Publication Society; contributed to the *Historical Magazine* and other periodicals upon antiquarian subjects, and was the orator before the Genealogical Society Nov. 21, 1870, on the 250th anniversary of the signing of the compacts in the cabin of the Mayflower. Author of *Genealogical Memoir of the Gilbert Family* (1850), *Lives of Isaac Heath, John Bowles, and Rev. John Eliot, Jr.* (1850), *The Landing at Cape Anne* (1854), *Ancient Pemaquid* (Portland, 1857), *Pulpit of the American Revolution* (1860), and *Colonial Schemes of Popham and Gorges* (1863).

**Thornton** (Matthew), b. in Ireland in 1714; came to Wiscasset, Me., in youth; received an academic education at Worcester, Mass., and studied medicine; accompanied Pepperell's expedition against Louisburg as a surgeon 1745; became a physician at Londonderry, N. H., and a colonel of militia; was president of the convention which in 1775 assumed the government of New Hampshire; took his seat as a delegate to the Continental Congress Nov. 4, 1776; signed the Declaration of Independence, though he had not been a member at the time of its adoption; was afterward chief-justice of Hillsborough county, judge of the New Hampshire supreme court, and member of both branches of the legislature and of the council (1785). D. at Newburyport, Mass., June 24, 1803.

**Thornton** (Robert John), M. D., b. in London, England, about 1758, son of Bonnell (1724–68), an author of some note; was educated at Cambridge; studied medicine at Guy's Hospital, London, and on the Continent; became physician to the Marylebone Dispensary and lecturer on botany at Guy's Hospital. D. at London Jan. 21, 1837. Author of *The Philosophy of Medicine* (4 vols., 1796; 5th ed., 5 vols., 1807), in favor of the Brunonian system; *New Illustrations of the Sexual System of Linnæus* (atlas folio, 1799–1807), with 314 colored plates, also known as *The Temple of Flora;* and many other works, chiefly botanical.

**Thornton** (Thomas), b. in England about 1787; became connected with the London *Times* in 1825; was reporter of the proceedings of the ecclesiastical and maritime courts, having drawn up for forty years the famous law-reports headed "Notes of Cases," and for twenty years prepared the summaries of the debates in the House of Commons; was a high authority on East Indian affairs, and a contributor to the *Edinburgh* and other reviews. D. in London Mar. 25, 1866. Author of a *History of China* (1844), a *History of the Punjaub and of the Sikhs* (3 vols., 1846), and other works.

**Thornton** (Thomas C.), D. D., b. in Dumfries, Va., Oct. 12, 1794. His grandfather, Thomas Thornton, was a clergyman of the Church of England, who emigrated to America before the Revolutionary war, and became a firm friend of Washington; he devoted his property to the cause of independence. He graduated in Dumfries, and began to preach when only sixteen years of age. His father, being a High Churchman, at first opposed his preaching, but finally consented, and furnished him a horse and saddle-bags, and in 1813 he entered the Baltimore conference of the M. E. Church, and in 1841 was transferred to the Mississippi conference to take charge of Old Centenary College. From some misunderstanding, in 1845 he left the Methodist and joined the Protestant Episcopal Church, continuing to preach, but not submitting to reordination, as he did not believe in the uninterrupted apostolical succession. In 1850 he renewed his connection with the Methodist Church, and in 1853 with the Mississippi conference, in communion with which he died (Mar. 23, 1860). His principal works are *Theological Colloquies* and *Slavery as it is in the United States*, in reply to Dr. Channing.

T. O. Summers.

**Thornton** (Sir William), b. in England about 1775; entered the British army as ensign 1796; became major 1806; was appointed military secretary and aide-de-camp to the governor-general of Canada Aug., 1807; returned to England 1811; took part in the Peninsular war and Wellington's campaign in Southern France 1813–14; commanded the light brigade and advance of Gen. Ross's expedition up the Chesapeake May, 1814; was severely wounded and made prisoner at Bladensburg; was exchanged for Commodore Barney; commanded the advance of the British army sent against New Orleans in October, and the detached corps which operated on the right bank of the Mississippi in the battle of New Orleans, Jan. 8, 1815, when he was again severely wounded; and rose to the rank of lieutenant-general 1838. D. at Stanhope Lodge, near Hanwell, England, Apr. 6, 1840.

**Thornton** (William Thomas), b. at Burnham, Buckinghamshire, England, Feb. 14, 1813, son of Thomas Thornton, president of the Levant Company's establishment at Constantinople, by his wife, an Armenian lady; educated in the Moravian settlement at Ockbrook, near Derby; resided with a cousin who was auditor-general at Malta 1827–30; was secretary to the British consul-general at Constantinople 1830–35; was a clerk in the India House, London, from 1836 to 1856, when he was placed in charge of the public works department of that office, and in 1858 became secretary for public works in the India Office, a post he still (1876) holds. Author of *Over-Population and its Remedy* (1845), *A Plea for Peasant Proprietors* (1848; 2d ed. 1873), *Zohrab, and other Poems* (1854), *The Siege of Silistria, a Poem* (1854), *Modern Manichæism, and other Poems* (1856), *Old-Fashioned Ethics and Common-Sense Metaphysics*, and *On Labor, its Rightful Dues and Wrongful Claims* (2d ed. 1869).

**Thorn'town,** tp., Blackford co., Ind. P. 1526.

**Thorntown,** p.-v., Boone co., Ind., has a national bank and a weekly newspaper.

**Thorn'well** (James Henley), D. D., LL.D., b. in Marlborough district, S. C., Dec. 9, 1812; graduated at South Carolina College, Columbia, 1831; studied and taught till the summer of 1834, when he spent some weeks at Harvard University, Cambridge, Mass.; was settled over a small Presbyterian church in Lancaster, S. C., June 12, 1835; took the professorship of logic and belles lettres in South Carolina College in Jan., 1838; resigned to take the pastorate of the Presbyterian church in Columbia in 1840; in 1841 went back to the college as chaplain and professor of sacred literature and the evidences of Christianity; from July to Dec., 1851, was pastor of the Glebe street church in Charleston; went back once more to the college, this time to be its president, in Jan., 1852; in 1855 accepted the professorship of didactic and polemic theology in the Theological Seminary at Columbia. D. at Charlotte, N. C., Aug. 1, 1862. He visited Europe for health in 1841, and again in 1860, returning to take a prominent and influential part in the struggle then just beginning between the North and the South. He was a man of fine scholarship, of rare critical acumen, and of great personal magnetism. Besides many review articles he published—*Arguments of Romanists Discussed and Refuted* (1845), *Discourses on Truth* (1854), *Our Danger and our Duty* (1861), and *On the State of the Country* (1861). The *Southern Quarterly Review*, founded (1855) and edited by him, lived not quite two years. His *Collected Writings* were edited by Rev. John B. Adger (2 vols., 1874), and his *Life and Letters* by Rev. B. M. Palmer, D.D., LL.D. (1875). R. D. Hitchcock.

**Thor'nycroft** (Mary **Francis**), b. at Thornham, Norfolk, England, in 1814; was a pupil of her father, John Francis, an eminent sculptor of portrait-statues; married, in 1840, Mr. Thornycroft, also a sculptor, and pupil of her father; accompanied him to Rome 1842; attracted the notice and enjoyed the advice of Thorwaldsen, who recommended her to Queen Victoria when the latter was in quest of an artist who should make portrait-statues of the royal children—a task which she accomplished with great success, representing them in the character of the *Four Seasons*. Among her best-known works are *Penelope, Ulysses and his Dog, The Flower-Girl, Sappho, The Sleeping Child*, and a *Girl Skipping*, the latter having been much admired in the Paris Exposition of 1855.

**Thor'old,** p.-v., Welland co., Ont., Canada, on Welland Canal and Great Western and Welland railways, 4 miles S. of St. Catharine's. It is built on a hill, and commands a fine view of Lake Ontario and of a rich and beautiful region. It has important quarries, good water-power, extensive manufactures, an active trade, and a weekly newspaper. P. of v. 1635; of tp., exclusive of v., 2501.

**Thor'ough-Bass,** in music, the mode or art of expressing chords by means of figures placed over or under a given bass. These figures indicate the harmony *through* all the other parts, and hence the name. Thorough-bass may be considered as the first department in the study of harmony. The term is sometimes taken in a larger sense, as equivalent to musical science. (See Figured Bass, Harmony, and Music.) William Staunton.

**Thorpe** (Benjamin), b. in England in 1808; devoted himself at an early age to the study of the Anglo-Saxon and Scandinavian languages and literatures; made a complete translation of the Edda (unpublished), and received a pension from the British government. D. at Chiswick July 18, 1870. He translated Rask's *Grammar of the Anglo-Saxon Tongue* (Copenhagen, 1830; new ed. 1865); published Cædmon's *Metrical Paraphrase of Parts of the Holy Scriptures, in Anglo-Saxon, with an English Translation, Notes, and a Verbal Index* (1832); *The Anglo-Saxon Version of the Story of Apollonius of Tyre, upon which is founded the Play of Pericles, with a Translation and Glossary* (1834); *Analecta Anglo-Saxonica, a Selection in Prose and Verse from Anglo-Saxon Authors of Various Ages, with a Glossary* (Oxford, 1834; 3d ed. 1868); *Libri Psalmorum*

*Versio Antiqua Latina, cum Paraphrasi Anglo-Saxonica, etc.* (1835); *Ancient Laws and Institutes of England, enacted under the Anglo-Saxon Kings from Ethelbert to Canut, with an English Translation of the Saxon* (London, folio, 1840); *The Holy Gospels in Anglo-Saxon, edited from the Original MS.* (Oxford, 1842; new ed. 1848; New York, 1846); *Codex Exoniensis, a Collection of Anglo-Saxon Poetry, etc., with English Translation and Notes* (1842); *The Homilies of the Anglo-Saxon Church, etc., with an English Version* (2 vols., 1843–46); *The History of England under the Anglo-Saxon Kings, translated from the German of Dr. J. M. Lappenberg, with Additions and Corrections by the Author and Translator* (2 vols., 1845; new ed. 1857); *Florentii Wigorniensis Chronicon* (2 vols., 1848–49); *Northern Mythology, etc., compiled from Original and other Sources* (3 vols., 1851; new ed. 1863); *Yule-Tide Stories, a Collection of Scandinavian Tales and Traditions* (1853); *Pauli's Life of Alfred the Great* (1854); *The Anglo-Saxon Poems of Beowulf, with a Literal Translation, Notes, and Glossary* (Oxford, 1855); *Lappenberg's History of England under the Norman Kings* (1857); *The Anglo-Saxon Chronicle, according to the several Original Authorities* (London, 2 vols., 1861); *Diplomatarium Anglicum Ævi Saxonici, a Collection of English Charters, etc.* (1865).

**Thorpe** (John), b. in England about 1540; was the chief introducer, if not the inventor, of what is known as the "Elizabethan" style of domestic architecture, having built Kirby House, Northamptonshire, 1570, Burleigh, Holdenby, Audley End, Giddy Hall, Ampthill, the Strand front of Somerset House, Longford Castle, Ireland, Holland House (1607), and many others. The particulars of his life and date of his death are unknown.

**Thorpe** (Thomas Bangs), b. at Westfield, Mass., Mar. 1, 1815; educated at the Wesleyan University, Middletown, Conn.; studied art; travelled in the South-west, and resided at New Orleans, La., from 1836 to 1853; edited a Whig paper there several years; raised volunteers for the Mexican war, and proceeded to Northern Mexico as bearer of despatches to Gen. Taylor after the capture of Matamoras; was the writer of the first newspaper correspondence narrating military events on the frontier; published *Our Army on the Rio Grande* (1846) and *Our Army at Monterey* (1847); was an active political speaker in the campaign of 1848; became known, under the pseudonym of "Tom Owen, the Bee-Hunter," as the writer of a series of tales of Western life, including *Mysteries of the Backwoods* (1846) and *The Hive of the Bee-Hunter* (New York, 1843); settled in New York in 1853, devoting himself alternately to literary and artistic pursuits; has contributed to *Harper's* and *Blackwood's Magazines;* was editor of the *Spirit of the Times* and other periodicals; published *Linda Weiss, an Autobiography* (1854), *A Voice to America* (1855), and other works, and is writing (1876) a series of biographical sketches of American artists. His best-known painting, *Niagara as it is*, was produced in 1860. He was city surveyor of New Orleans during the administration of Gen. Butler (1862–63).

**Thorpe** (William), b. in England about 1350; received a good education; became a priest; preached the doctrines of Wycliffe for twenty years from 1386; was imprisoned in Saltwood Castle, Kent, as a "Lollard," 1407, and examined before Archbishop Arundel, then lord chancellor, July 3 of that year. He wrote an account of his *Examination*, which was widely circulated, and was condemned by an assembly of the clergy so late as 1530. The subsequent history of Thorpe is unknown. His *Examination*, which may be found in Foxe's *Book of Martyrs* and in Dr. C. Wordsworth's *Ecclesiastical Biographies*, is elegantly written, and is of great value as a picture of English society and manners in the time of Chaucer and Gower, and especially as a trustworthy summary of Lollard doctrines.

**Thorwald'sen** (Albert [Berthel]), b. at Copenhagen Nov. 19, 1770. His father, Gottschalk Thorwaldsen, a native of Iceland, was a wood-carver and poor, but his ancestry, there is reason to believe, was of the noblest, running back to the old Danish kings. He followed his father's calling, having no taste for any other, though with little enthusiasm for that, and soon excelled him in his humble art. His schooling was short and unprofitable until he was sent to the free school of the Academy of Arts at Copenhagen. There, at the age of seventeen, a bas-relief of Cupid reposing gained the silver medal; at twenty a sketch of *Heliodorus driven from the Temple* gained the small gold medal; two years later he drew the grand prize, which entitled him to receive the royal pension, available for five years, beginning in 1796. In Mar., 1797, he arrived in Rome. The first years there were disappointing. The country was disturbed by war, and his unaided resources were unequal to his support. He was about returning home when his model of *Jason*, which Canova praised, attracted the admiration of an English connoisseur, Thomas Hope, who gave the artist a commission to execute it in marble. This was the beginning of a great career. Other pieces followed; his fame increased; the crown prince of Denmark held out brilliant inducements to return to his native city, which, but for pressing engagements, he would have yielded to. The *Adonis*, begun in 1808, was not finished until 1832. It is the only one of Thorwaldsen's statues which was entirely carved by his own hands. It is one of the finest statues of modern times, and a triumphant answer to the charge brought against Thorwaldsen in his lifetime, that he could not work in marble. "Not work in marble!" he said. "Tie my hands behind my back, and I will hew out a statue with my teeth!" The famous bas-relief, *The Triumphal Entry of Alexander into Babylon*, which has been twice executed in marble and engraved in a series of plates, celebrated Napoleon's entry into Rome in 1812. The familiar bas-reliefs *Night* and *Morning* were modelled in 1815, it is said in a single day of mental depression, to which the artist was subject. The *Venus Victrix* (1813–16) and the *Mercury* (1818) are, with the *Adonis* just mentioned, his most perfect works. In 1819, Thorwaldsen revisited Copenhagen; was received with demonstrations of wild joy; was lodged in the palace of Charlottenburg, and welcomed in triumph by the chief cities of Prussia, Saxony, and Austria as he visited them on his way back to Rome. The well-known groups of *Christ and the Twelve Apostles* and *John the Baptist preaching* were completed in 1838 for the church of Notre Dame at Copenhagen. Another visit to his native city, where he meant to make his home for the rest of his life, delightful and honorable as his position was, was cut short by the uncongenial climate. In 1841 he went back to Italy, stayed a year, then went to Copenhagen, intending to remain for a short time only, but died suddenly of disease of the heart Mar. 24, 1844. He was buried with royal honors in the cathedral church. Funeral honors were paid him in Rome and Berlin; tributes of respect were rendered throughout Europe. Thorwaldsen died rich. He was never married, but by a Roman girl he had one daughter, who was respectably married and handsomely provided for. The chief part of his fortune was left as a perpetual endowment for the museum at Copenhagen, which is raised around his grave, and contains all his works. Thorwaldsen's fame in his own land and abroad, while he lived, was immense. It was aided by attractive private gifts—great personal beauty, charm of manner, sweetness, simplicity and heartiness of disposition, accompanied by generosity to the poor. The best and most accessible works on Thorwaldsen are Thiele, J. M., *Thorwaldsens Biographie* (4 vols., Copenhagen, 1851–56; Am. ed., translated by Prof. Paul C. Sinding, New York, I. G. Unnevehr, 1869); *Thorwaldsen, sa Vie et son Œuvre*, par Eugène Plon, with two etchings and thirty-five woodcuts (Paris, 1867; Am. ed. Boston, 1874, with the woodcuts of the Paris ed.). Thorwaldsen's works are very numerous—205 as mentioned by Thiele, the chief authority. They are of all dimensions and of every variety of theme, secular and religious, classical and Christian. Nearly every great city from Rome to Copenhagen contains something—statues, single or in groups, bas-reliefs of nearly every description, monuments funereal or commemorative, equestrian statues, pieces for the gallery and the public square.

O. B. Frothingham.

**Thoth.** See Hermes Trismegistus.

**Thou, de** (Jacques Auguste), b. at Paris Oct. 8, 1553; studied law at Orléans, afterward under Cujacius at Valence, where he made the acquaintance of Scaliger; travelled in Italy, Germany, and Holland; returned to Paris in 1574, and was made councillor to the Parliament in 1578, councillor of state in 1588, vice-president of the Parliament and keeper of the Royal Library in 1594. Henry III. and Henry IV. showed him great confidence, and employed him in many difficult diplomatic and political negotiations; but under the regency of Maria de' Medici he was slighted and retired from public life. D. May 7, 1617. Of his great work, *Historia sui Temporis*, comprising the period from 1543 to 1607, and divided into 138 books, the first part was published in 1604, the second in 1606, the third in 1614, reaching to the 80th book, and the fourth in 1620, edited by Dupuy and Rigault, the latter of whom added a continuation or conclusion after the papers of the author; complete edition in 7 folio vols. (London, 1733), French translation in 16 vols. 4to (1734). He also wrote an autobiography, edited by Masson (1838), and some Latin poems. (See John Collinson, *Life of Thuanus, with some Account of his Writings* (London, 1807).)—His son, François Auguste de Thou, succeeded him as keeper of the Royal Library; was implicated in the conspiracy of Cinq-Mars, and executed Sept. 12, 1642.

**Thouar** (Pietro), b. at Florence in 1809; labored earnestly with Lambruschini to promote popular and elementary instruction in Tuscany, and he was himself a model teacher as well as an attractive writer for children. D. in 1861. Among his works the following are still read in the Italian schools: *Il Libro del Fanciulletto, Letture Graduali, La Corsa sul Mare, Saggio di Racconti, Nuovi Racconti per la Gioventù, Racconti Popolari, Letture di Famiglia,* and others with similar titles.

**Thouars.** See Dupetit-Thouars.

**Thousand and One Nights.** See Arabian Nights, by J. Thomas, M. D., LL.D.

**Thousand Islands, The,** are in St. Lawrence River, and are all included in the 40 miles next below Lake Ontario. The islands are partly in Canada and partly in Jefferson and St. Lawrence cos., N. Y. Their number is reported to exceed 1800. The Thousand Islands have become a favorite summer resort, and are remarkable for their great and diversified beauty.

**Thought, Train of.** See Association of Ideas, by C. P. Krauth, S. T. D., LL.D.

**Thra'ce** was in ancient geography the name of that part of modern Turkey which lies between the Black Sea, the Sea of Marmora, the Struma, and the Danube. It was inhabited by a race of unknown descent, whose savage and barbarous character was proverbial; one king put out the eyes of his six sons for disobedience, and another transfixed his prisoners of war. The Thracians bought their wives and sold their children. When a man died, his wives contested with one another as to which had been best beloved by him, and she in whose favor the case was decided was with great congratulations slain by her nearest male kinsman on her husband's grave. They lived exclusively by plunder and robbery. Along the coasts the Greeks had planted several colonies—as, for instance, Byzantium, Callipolis, and Abdera—and during the Peloponnesian war the Thracians began to mix in the affairs of Greece, but without exercising any great influence. They were conquered by Philip of Macedon, and Thrace passed from Macedonia into the hands of the Romans. The old myths said that Orpheus and the Muses came from Thrace, and some ingenuity and much stupidity have been at work to solve the question how the originators of the Greek civilization could have come from the most barbarous nation of the ancient world.

**Thrale.** See Piozzi.

**Thrash'er,** a name applied in different parts of the U. S. to the species of Turdidæ or thrush-like birds belonging to the genera *Oreoscoptes* and *Harporhynchus.* These have a more or less long and decurved bill, which is scarcely or not at all notched near the tip, rather short and concave wings, and the tarsi scutellate anteriorly. *Oreoscoptes* is distinguished by its wings, which are decidedly longer than the tail, the nearly even tail, and the slightly-notched moderate bill. *Harporhynchus* has the wings decidedly shorter than the tail, the tail long and graduated, and the bill not notched and diversiform, but generally quite elongated and decurved. The color is rather plain, generally brownish or ash above, whitish or spotted on the breast. The species are the sage thrasher or mountain mocker (*O. montanus*), the brown thrasher (*H. rufus*), Cape St. Lucas thrasher (*H. cinereus*), gray curve-bill thrasher (*H. curvirostris*), California thrasher (*H. redivivus*), and red-vented thrasher (*H. crissalis*).

**Thrashing.** See Threshing Machinery.

**Thrasybu'lus,** one of the prominent leaders of the democratic party in Athens during the latter part of the Peloponnesian war, was a celebrated general, but after the surrender of Athens to Lysander and the establishment of the thirty tyrants he was banished, and took up his residence at Thebes. The violent measures, however, instituted in Athens by the oligarchical government provoked him so much that with a small band he invaded Attica and seized the fortress of Phyle, where he was speedily reinforced by other exiles and by the discontented democrats. Four days afterward he descended into the Piræus and took a strong position on the hill of Munychia, whence neither the thirty tyrants, nor the ten who succeeded them, were able to expel him. The oligarchs now called on Lysander to blockade the Piræus and attack it from the sea, but the exiles were saved from this danger by the rivalry between Lysander and Pausanias. The latter brought about a reconciliation between the two parties in Athens. Thrasybulus and the exiles entered the city, a general amnesty was granted, and a democratic government established again, though in a modified form (403 B. C.). In 390, Thrasybulus was killed by the inhabitants of Aspendus, in Cilicia, who fell upon him in his tent during the night.

**Thrasymenus Lacus.** See Perugia, Lake of.

**Thread-Worm,** the English name for the Nematoids. See Nematelmia.

**Threatening Letters.** See Threats.

**Threats,** in law, are oral or written menaces of injury to the property, character, person, or life of one individual, made by another under such circumstances that they become criminal. A threat made with a special evil intent, aggravated in its nature and form, and tending to produce mental disquietude, is an offence, at least a misdemeanor, and sometimes a felony. If, however, the menace be simply an outbreak of anger without a special evil intent, and with no evidence of malice—such as a mere threat to assault or to commit some other breach of the peace—the person making it will be bound over with sureties to keep the peace. A common example of the former class is a threatening letter, message, or other communication sent or made with an intent to extort money, ordinarily known as "black-mailing." The threat itself may be to expose a prior wrong, real or simulated, to sue, and the like. If the purpose be to extort money by holding the menace over the victim's head, the offence is committed. This whole subject, including the nature and form of the threat itself, its intent and circumstances, in order that it shall be an indictable offence, is now minutely regulated by statutes both in the U. S. and in England. In all cases, however, the menace must be of a nature calculated to affect a man of ordinary prudence and firmness, but the criterion thus stated has reference to the general character of the wrong menaced, and not to its probable effect upon the particular individual against whom it is directed.

John Norton Pomeroy.

**Three Bodies, Problem of.** The discovery of the law of universal gravitation by Newton reduced the question of the motion of the planets to one of almost pure mathematics. Newton himself was able to show, by a rigorous but intricate geometrical demonstration, that if two bodies like the sun and a planet attracted each other with a force inversely as the square of their mutual distance, they would each describe a conic section around their common centre of gravity. The planet being very small relatively to the sun, this common centre of gravity would be very near the centre of the sun, and the planet might therefore be said to describe a conic section around the sun. It was thus shown that, considering only the attraction of the sun upon the planets, each planet would revolve in an ellipse having the sun in one of its foci, which was Kepler's first law of planetary motion. But since each planet is attracted by all the other planets, as well as by the sun, this motion in an ellipse represents not the mathematical truth, but only an approximation to the real motion. Hence, mathematicians were led to propound the problem, more general than that solved by Newton: *Three bodies being projected in space with any velocity and in any direction whatever, and then left to their mutual attraction, to find the motion of each of them during all time.* The general and complete solution of this problem was found to be beyond the power of mathematical analysis, for the reason that the curves described by the several bodies would be so irregular, subject to such constant variation, and changing so greatly according to the masses of the bodies, that it would be impossible to express them by any mathematical formula. It was, however, possible to find certain general laws to which the motion would be subject. The centre of gravity of the three bodies would always move in a straight line with a uniform velocity. Certain relations were found to subsist between the masses of the bodies, their distance apart, and their velocities, and certain great principles established relating to secular changes as well as to the real permanence and stability of the solar system. (See Lagrange.)

But all this did not suffice to determine completely the motion of any one body. In consequence of the impossibility of the general solution, the efforts of mathematicians have generally been directed, not to the general problem, but to two special cases of it which occur in the solar system. The first of these cases is that of the motion of two planets around the sun, in which the masses of the bodies are very small compared with that of the sun, while their motion takes place in nearly circular orbits. The deviations of each planet from the average ellipse in which it would move if not attracted by the other, then admit of being determined with any required degree of accuracy, though not with mathematical rigor. The actual problem of planetary motion is, however, not simply that of three bodies, or two planets, but of nine bodies, there being eight large planets. But the solution of the problem of any number of planets involves no greater mathematical difficulties than are encountered in the case of two, though the labor of the numerical solution is immensely greater. The other special

case is that of the motion of the moon around the earth, under the influence of the attraction of the sun as well as of that of the earth. This is a more complicated case than that of planetary motion, because while the moon revolves round the earth, both the earth and moon revolve together around the sun. But by the researches of Hansen and Delaunay this difficult problem of the moon's motion has been solved with the same degree of accuracy as that of planetary motion.

The efforts of several generations of mathematicians since the middle of the last century have resulted in the general problems of planetary and lunar motion being rendered comparatively simple from a purely mathematical point of view. But the problem of actually calculating the formulæ necessary to determine the motion of any one planet is one of immense labor, the increased accuracy demanded by modern astronomy having more than made up for the greater simplicity of the methods now used. The reader may form an idea of the labor involved from the simple statement that the algebraic formulæ by which Delaunay represents the position of the moon occupy 120 4to pages. S. NEWCOMB.

**Three Kings.** See EPIPHANY.

**Three Mile,** tp., Barnwell co., S. C. P. 1087.

**Three Mile Bay,** p.-v., Jefferson co., N. Y.

**Three Oaks,** p.-v. and tp., Berrien co., Mich., on Michigan Central R. R. P. of v. 499; of tp. 1316.

**Three Rivers** [Fr. *Trois Rivières*], city and port of entry, cap. of St. Maurice co. and of the district of Three Rivers, province of Quebec, Canada, on the N. W. bank of the river St. Lawrence, 90 miles above Quebec and 90 miles below Montreal, at the mouth of the river St. Maurice, from which vast amounts of lumber are afforded to the commerce of Three Rivers. It is the seat of a Roman Catholic bishop, has a splendid cathedral, a college, an academy, 2 convents, a hospital, a tri-weekly, a semi-weekly, and 3 weekly newspapers, 5 churches, a court-house, jail, gasworks, and 5 fire companies. Lumber, iron, and brick are largely manufactured and exported. A branch of Grand Trunk Railway terminates at Doucett's, on the opposite side of the St. Lawrence, with which point ferryboats ply regularly. P. 8414.

**Three Rivers,** p.-v., St. Joseph co., Mich., 28 miles S. of Kalamazoo, at the crossing of Kalamazoo division of Michigan Southern and Air-line division of Michigan Central R. R., on St. Joseph River, has 6 churches, 2 union schools, 3 flouring-mills, 4 pump-factories, 2 foundries, 1 threshing-machine factory, 1 paper-mill, 2 planing-mills and lumber-factories, 2 cigar-factories, 2 newspaper and job-printing offices, 4 hotels, magnetic bath-house, 2 national banks, domestic, British, and German money-order post-office; in all, 175 places of miscellaneous business and stores. Buildings mainly brick, and new; deals largely in peppermint oil and wheat, the products of the country. The town and surroundings are beautiful, and population and business increasing. P. 1189.

WILBER H. CLUTE, PUB. "THREE RIVERS REPORTER."

**Three Rivers Point,** v., Onondaga co., N. Y. P. 43.

**Three Springs,** p.-v. and b., Huntingdon co., Pa. P. 189.

**Thresher,** a name frequently given to the *Alopias vulpes*, otherwise called FOX SHARK (which see).

**Thresh'ing Machinery.** Threshing is the separation of grain from the straw, as winnowing is the separation of threshed grain from the chaff. There are two methods of threshing—one by blows which beat out the grain; the other by a kind of trituration which breaks its hold on the straw. The former appears to have been developed from the latter. The earliest method of threshing was doubtless that of treading the grain to and fro by horses or oxen—a method still in common use on the small farms in our own country and elsewhere, especially for buckwheat, and notably for clover. Another ancient method still in use in the Orient, but probably nowhere else, is that of drawing a sled back and forth over the unthreshed straw. The primitive method of beating out the grain was by means of a flail, an implement comprising a staff wielded by the thresher, and having at one end a swingle shorter, thicker, and heavier than the staff, to which it is connected by a flexible thong. The flail is uniformly used to this day where only small quantities of grain are to be threshed. The best flails have staves made of ash and swingles of hickory; the staff in each case being provided with a wooden bow swivelled at its upper end in order that the swingle may be free to swing around the line of the staff, the swingle being attached to the bow by a looped thong made preferably of eel skin, which best resists the great and continual strain and friction brought upon it. In threshing grain with straight straw, such as oats, wheat, barley, etc., the sheaves are laid in double rows with their heads turned inward and slightly overlapping. The thresher first threshes down the middle, beating out the heads. The bands upon the sheaves are then broken, and the whole is uniformly again threshed over. It is then turned or inverted and flailed again. If the weather is damp, the straw is tougher and holds the grain more firmly; and in such cases the straw is shaken up with a pitchfork once or more as may be required, and repeatedly gone over with the flail. With buckwheat, in which the sheaves or stooks are of conical form, the stooks are placed upright, and the whole mass is beaten down upon the floor by first striking upon the tops of the stooks, the straw being turned and shaken up as often as may be required, and repeatedly threshed until the grain is completely separated. Clover, beans, peas, etc., are flung promiscuously on the threshing-floor and turned and beaten until the threshing is complete. These last, however, are readily threshed by horses trampling upon them, an attendant turning the straw at one part of the floor while the horses are trampling at another.

These primitive methods, from the very earliest times until a very recent period, were the only ones by which grain was separated from the straw, unless we except the rude method sometimes used by warlike Celtic tribes of burning the straw and gathering the parched grain left behind; also that other method in which we may detect the faintest glimmer of the principle of modern inventions—the hurdles made of planks or wide beams, stuck over with flints or hard pegs, to rub the grain-ears between them; for we have simply to curve one of these planks to the arc of a circle, and bend the other to a complete cylinder revolving within the concave, to have an imperfect representation of the two essential parts of a modern threshing-machine. It is to such germs that the principles of improved machinery may be frequently traced; and the threshing-machine of to-day finds its inception in the pegged hurdles of the ancient Romans, just as the harvester had its beginning in the comb-like reaping-blade mounted on wheels mentioned by Pliny as in use among the Gauls. When or where the first modern threshing-machines were attempted is not known, but tradition ascribes their first suggestion in Britain as coming from Holland. The first threshing-machine that could in any sense be considered a practical success, and which was the prototype of those that led to the displacement of the hand-flail, was that invented by Michael Menzies of East Lothian in Scotland, who used a number of flails attached to a revolving shaft driven by a water-wheel. This machine succeeded in threshing very rapidly, but the high velocity required soon broke and destroyed the flails, and the mechanical resources of that time were not equal to the task of constructing an apparatus on this principle which would successfully stand the wear and tear of actual use. Afterward, in the year 1758, another Scotchman, Michael Sterling in Perthshire, constructed another thresher, which appears to have been merely an experiment. This had a vertical shaft with radial arms working within a cylinder, the shaft being turned by a water-wheel. The sheaves were thrown in at the top of the cylinder and were beaten by the radial arms. This appears to have been of little utility, and was followed twenty years later by another machine, in which a number of rollers were arranged around an indented drum, the drum being revolved and the rollers rubbing out the grain. This was manifestly impracticable, as were also several modifications. At a still later date still another Scotchman, Andrew Meikle, devised a machine in which rollers and drum were retained, but in which beating was substituted for rubbing. The first machine of this kind was made in 1786, and appears to have been the earliest threshing-machine that was practically adapted to extended and successful use. In this, scutches were attached to the drum, and arranged to strike the grain from the straw. At first, this invention was adapted merely to detach the grain from the straw, and threw grain, chaff, and straw in a heap together. But early in the introduction of these machines screens were added, and the grain, separated from the straw, was passed to a winnower. This was really a most notable invention, and the threshing of grain by a machine turned by horse or steam power, which had been before at most an experiment, became now an accomplished fact. But this machine, as well as those that followed it, were expensive. A large one with suitable rakes and fanners for separating straw from the grain and chaff, and the grain from the chaff, cost £150 sterling at that time, when the purchasing power of money was at least three times what it is now. But such machines enabled one man to do the work of six, and secured 5 per cent. more of winnowed grain from a given weight of straw than was possible with hand-threshing. And as a writer remarked: "If 5 per cent. is added to the national produce,

it is as great a gain to the public as if the national territories were increased one-seventh." Notwithstanding the comparative excellence of these early British machines, they have of course been much changed, and in fact nearly metamorphosed, and the steam threshing-machines exhibited at the annual agricultural shows in Great Britain are in fact triumphs of mechanical engineering.

In this country threshing-machines were early invented, but for the reason that most of the farms were those newly cleared from the wilderness, divided into small fields and almost necessitating hand-labor in all the different departments of agriculture, it is only within a comparatively recent period—say, twenty-five or thirty years—that this class of machinery has been brought to any perfection. Among those earlier invented, the plan of rotary beaters or flails attached to a revolving shaft was the subject of much experiment. But a revolving cylinder provided with radial teeth or spikes, and working with a concave or section of a cylinder provided with similar but inwardly-projecting teeth, comprised the beating mechanism first found uniformly successful, and which continues in use to this day. The changes and improvements have related for the most part to the mode of giving motion to this cylinder, and to accessories for securing safety and convenience in the operation of the machine. Those which first came into common and satisfactory use had the cylinder actuated by intermediate gearing from a vertical driving-shaft, from the upper end of which extended radial arms. To the outer end of these arms was attached a whippletree, on which draught was exerted by a single horse. The four horses walked in a circular path, and thus gave rotatory movement to the vertical driving-shaft and rapid rotation to the cylinder. The sheaves, unbound, were fed with the heads first into the space between the cylinder and its concave. In some of the first of these machines shaking screens were so applied as to sift the grain and chaff from the straw, the latter being carried and deposited by itself, while the former passed to the hopper of a fanning-mill, which cleaned or separated the grain from the chaff, while a graduated system of sieves separated the small seeds, pigeon-weed, devil's-gut, etc. Many attempts were made to supersede this clumsy mode of driving the cylinder by an inclined endless belt constructed with transverse wooden lugs, and driven after the manner of a treadwheel by horses. This plan has been adopted with success for small dog-power machines for churning. Many experiments were made to apply the same principle in various forms to the heavier work of driving a thresher. The writer has had from the lips of the late Charles H. Metcalf an account of the first attempts of this kind made at a foundry in the village of Fly Creek, N. Y. A gentleman of that place had succeeded in making a horse-power on the plan just mentioned, which theoretically appeared to be perfect, but with which no steadiness of motion could be given to the cylinder. When the sheaves were not passing to the machine, the apparatus ran too fast for the horses; when the sheaves were applied, the apparatus choked. This, it appears, was about forty years ago; the apparatus was laid aside; and shortly after, a projector from the State of Maine came to the same foundry and had constructed a far ruder apparatus, which on trial gave a perfectly satisfactory motion to the cylinder. The constructor of the first-named device was not long in discovering that this was due to a balance-wheel placed on the main shaft of the horse-power. He added this useful appliance to the shaft of the previous machine, and from this was developed the Badger railroad horse-power, which for many years held its own as the most efficient power for driving threshing-machines. It is difficult to explain the construction of this apparatus without elaborate diagrams. It consisted, in brief, of a framework carrying at each side two endless cast-iron tracks situate in vertical planes. The endless belt was composed of two systems of iron links arranged around the two tracks, and connected by the transverse lags or wooden bars which composed the travelling floor of the apparatus. Each link carried a broad-faced wheel resting upon the upper part of the adjacent endless track. The endless belt thus constructed and arranged was of course in an inclined position, the weight of the horse walking thereon as upon a treadmill giving a motion to the endless belt, the wheels of which travelled upon and around the endless tracks, from which operation the designation "railroad" was derived. A large broad-faced wheel constituted at once the balance-wheel to give steadiness of motion and the driving-wheel from which, by means of a belt, power was transmitted to the threshing-cylinder. At a later date the construction was much simplified, and what are now termed railroad horse-powers differ materially in construction from the first representatives of the class. In the use of this class of machinery much difficulty was at first experienced from the breaking or slipping of the driving-belt, which by relieving the horse-power from the resistance of the thresher was liable to throw the horses back out of the machine, with consequent injury and loss. This was remedied a number of years ago by an ingenious application of a lever arranged in such relation with the belt that the breaking of the belt lets fall the lever, and this in its turn actuates a brake that, coming in contact with the driving-wheel, stops the motion of the endless platform.

The ordinary threshing-machine in use in the Eastern States comprises a railroad horse-power, commonly for two horses, and a thresher composed essentially of the toothed cylinder acting in conjunction with the toothed concave. An endless shaker formed with transverse wires, and operated like an endless belt, conveys the straw some distance in the rear of the thresher, a vibrating motion given to the belt shaking out the chaff and grain, these latter being passed to a fanning-mill which separates the chaff, small seeds, etc., from the winnowed grain. These machines are commonly owned by some enterprising farmer, who, aside from the threshing of his own farm, journeys from farm to farm by appointment, and threshes either for a stated cash price per bushel or for a percentage of the grain itself, commonly one-tenth. The large farms of the West and the immense quantities of grain produced have called into existence far more elaborate apparatus, in which, however, the principle of operation is substantially unchanged. The following is a sketch, made some time since by the writer, of a thresher in use during the past few years in the Western States, and which may be taken as a type of the improved threshing-machine in use in the Prairie States. In this the threshing-cylinder "is made of skeleton form, having cast-iron heads, and the central annular brace of the same material; wrought-iron bars are arranged on these parts, and form the circumferential parts of the cylinder, being held in position by the external wrought-iron rings. The bars carry the teeth, the shanks of which pass through holes in the bars, and are held by nuts firmly screwed upon their inner ends; the uniformity in shape and size of the teeth arises from their being made by machinery properly shaped in dies under a drop-hammer. The concave is of cast iron, with slots in it which allow the grain to pass through to separate from the straw at the earliest possible stage of the threshing operation. The straw as it leaves the cylinder is flung back over several transverse series of inclined rods, which permit whatever grain may yet remain in the straw to drop upon a laterally vibrating shaker, arranged below at a slight angle to the horizontal, and serving to conduct the grain to the fan-mill, the rotating fan of the latter being placed under the centre of the threshing-cylinder, and securing far greater compactness of structure than was formerly obtained."

In the Pacific States the peculiar dryness of the atmosphere greatly facilitates not only the threshing, but the reaping, of grain; the standing grain, instead of crinkling down when ripe, as is the case in the Eastern States, stands straight for many weeks; and this without the shaking out of the kernels incident to ripe grain in other portions of the country. It is, however, dry enough to thresh immediately; the threshers are driven by portable steam-engines, and the threshing is carried on in the open field. The latest attempted improvement upon the ordinary thresher in California lies in the utilization of the straw for fuel in the portable engines. And there is no reason why the immense piles of straw which ordinarily are wasted should not be made useful to this end. Straw-burning furnaces have been used in Hungary during a long period, and for many years the straw of the Southern rice-fields in this country has been utilized in the same manner. The most advanced step, however, is found in the combined reaper and thresher, an example of which was examined by the writer in San Francisco some five years since. This was calculated for threshing and sacking grain in the field. My memorandum at the time describes it as follows: A large grain frame is supported on two heavy driving-wheels, and has two lighter ones in front arranged as guiding-wheels. Projecting from the side of this frame is a platform like that of an ordinary reaper, but about 12 feet long. This runs at such height that the reciprocating sickle at the front will cut off the heads from the standing grain; the heads fall on an endless apron running longitudinally upon the platform, and are carried by this to a hopper that conducts them to a threshing-cylinder having a fanning-mill and straw-separator arranged behind it. The threshed and winnowed grain is thrown out from the fan-mill through a spout at the side directly into the mouth of a sack suspended under the spout. An attendant riding upon the platform ties the sacks when full, and throws them off upon the ground to be collected at leisure. The driving parts receive their motion from the large or driving-wheel by means of suitable bands and gearing. This apparatus was designed to be drawn by ten horses, the management of which would constitute the greatest difficulty in the operation of the

apparatus. Something similar to this has been projected in Australia, where the peculiarities of the climate permit the immediate threshing of the grain as soon as cut. It is somewhat doubtful whether so complex an apparatus will meet with perfect success in practice. But it is not impossible that an apparatus itself drawn by horses, but with the sickle and threshing-cylinder driven by a steam-engine closely boxed on the wheeled frame, might harvest and thresh the grain much more cheaply than by present methods. The plan would not be more audacious than that experimentally carried into effect a half-century since in Devonshire, England, of connecting a threshing and winnowing apparatus with a run of mill-stones, so that the grain was stripped from the straw, separated from the chaff, ground, and bolted at one continuous operation.

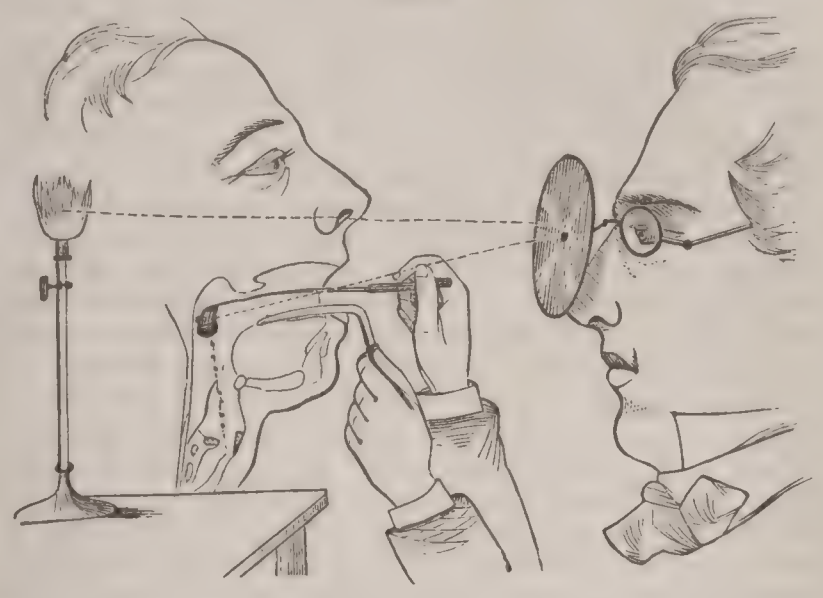
JAMES A. WHITNEY.

**Thrift,** the *Armeria vulgaris*, a European seaside and mountain plant, found also on British American shores, and often grown in gardens as an edging for flower-borders. It has diuretic powers. *A. latifolia* is a fine ornamental plant from Portugal. They are of the order Plumbaginaceæ.

**Thrips** [Gr. θρίψ], a genus of insects which gives name to the family Thripidæ, an interesting group of degraded organisms, generally considered to be hemipterous, although their position is not quite established. The Thripidæ are destructive to grain, flowers, and the bark of growing plants. *Thrips cerealium* is one of the most destructive species. It is a very minute insect, with long fringed wings, but it appears to leap rather than to fly.

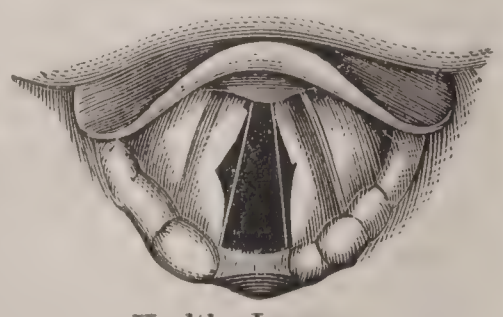
**Throat, Diseases of.** Although the specialty of the study and treatment of throat diseases is designated "laryngology," it includes diseases of the posterior nares, the fauces, pharynx, and larynx. Exceptionally, some of these diseases may be suspected or even diagnosticated from symptoms only, as laryngitis from hoarseness, stridulus, and aphonia; chronic tonsillitis from muffled voice and habitual snoring; elongated uvula and papular pharynx from habitual spasmodic pharyngeal cough. But physical exploration, the direct examination of the oral cavity and the passages to the posterior nares and larynx, is essential

FIG. 1.



both to diagnosis and to correct treatment. Simple examination—the depression of the tongue by a spoon or tongue spatula—will suffice in many cases, exhibiting the tonsils, soft palate, uvula, posterior wall of the pharynx, and the top of the epiglottis. To discover the root of the tongue, the entire epiglottis, the true and false vocal cords, the chink of the glottis, and even the upper rings of the trachea and division of the bronchia, the laryngoscopic mirror must be employed. Laryngoscopy may be performed by the use of either bright sunlight or a concentration of artificial light. Specialists employ lamps with condensing prisms, and where very bright light is desired the oxyhydrogen light is used; with such methods of illumination the examination is conducted in a dark room. A good light, whether the sun's rays or artificial, is reflected, by a concave mirror held by the physician or worn upon a head-band, into the patient's opened mouth. The patient's tongue being drawn forward and gently held, a small circular or oval laryngeal mirror is introduced. There are several sizes of mirrors, varying in diameter from one-quarter to one inch in diameter; they are attached to delicate handles at an angle, so that when passed to the back of the throat they catch the rays thrown into the mouth by the concave mirror, and reflect them downward, illuminating the larynx. The parts thus rendered luminous present a distinct picture in the small laryngeal mirror above them; and this is seen by the observer through the perforated centre of the concave mirror, since the axes of light return by reflection to the reflecting surface from which they started.

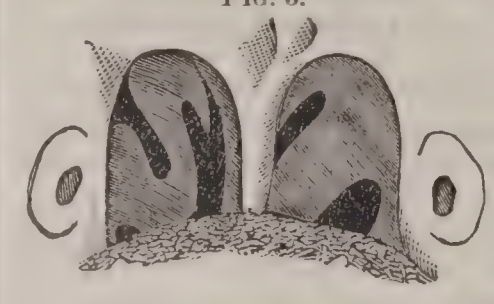
FIG. 2.



Healthy Larynx.

The laryngoscopic examination is easily accomplished after a brief period of practice. More difficult is the exploration of the upper pharynx and the posterior nares, termed rhinoscopy. The uvula has to be drawn forward, and the reflecting laryngeal mirror passed well back and turned upward. When correctly held, a distinct image of the septum between the nostrils, and of the extensive corrugated surfaces of the naso-pharyngeal spaces, is transmitted to the eye (Fig. 3). Patients are easily trained to permit the presence of the throat mirror, and even to explore their own throats (auto-laryngoscopy). The movements of the vocal cords are displayed best by phonating *a* (*eh*). All of these several connecting parts of the throat are richly supplied with blood-vessels, lined by a mucous membrane, secreting mucus. They are therefore liable to hypersecretion of mucus, or catarrh, which may be acute, subacute, or chronic; to active and passive congestions, inducing redness, heat, and swelling; to active inflammations, with formation of submucous abscess, erosion of the epithelial covering of the mucous membrane, or ulceration and sloughing of its deeper layers. Such destruction of soft tissue may induce necrosis of the underlying hard structures, the nasal and laryngeal cartilages. Inflammation may terminate in an exudation, developing organized membranes, as those of croup and diphtheria. Repeated congestions and inflammations tend to engorge and hypertrophy the structures of the mucous membrane and glandular bodies embedded in it. The papillæ of the back of the throat and of the columns of the fauces are very often thus enlarged. The surface is seen to be studded with prominent ovoid papules or tubercles, a condition known as "clergyman's sore throat," and technically as "papular pharyngitis." Polypoid growths of variable size develop in the nares, pharynx, and on and around the vocal cords—products of papular growth and of granulation process.

FIG. 3.



A most alarming and critical condition is acute œdema of the glottis. The secretion of the region of the larynx being suddenly checked, as by cold, or the seat of sudden determination of blood, serum transudes from the overloaded blood-vessels into the loose submucous connective tissue, and creates a sudden dropsy and tumefaction. The distended, swollen structures overlap the opening of the glottis and occupy the ventricles of the larynx, preventing inspiration, and threaten immediate death by suffocation. The laryngoscopic mirror definitely locates the seat of these dropsical sacs, and is the sure guide to efficient scarification and evacuation of their contained fluid. The vocal cords may be affected by spasms, producing hoarseness, aphonia, and labored respiration, in which case the mirror detects the unusual approximation and irregular action of the cords, and excludes the presence of more serious inorganic disease. One of the vocal cords may be found paralyzed, inactive, and relaxed, while the other remains normal. Such paralysis of a cord may be due to vocal inflammation or abnormal growth, or may depend upon lesions of the recurrent nerves in the neck, or again, coexisting with paralysis of one-half of the body, depend on a lesion of the brain—softening, embolism, apoplexy. Ulceration or inflammation may so seriously damage the vocal cords that cicatricial or scar-like tissues are formed, tending to contract and harden; in time the chink of the glottis becomes contracted and narrow—termed "stenosis of the larynx." The aperture being no longer adequate for the ingress or egress of air, gradual suffocation must ensue unless surgical relief is afforded. Extensive destruction of the vocal cords often occurs from syphilis and epithelial cancer.

The more accurate diagnosis of throat diseases, and intelligent study and classification by aid of laryngoscopy, have led to corresponding progress in treatment. Applications are no longer applied at random by probangs, uncertain of the condition that exists and of the parts which are reached. Remedies are applied with accuracy by various methods, with definite regard for the indications of each case. Astringents—as cold water, alum, tannin, tincture

of iron, and solutions of nitrate of silver—are employed to contract blood-vessels, lessen congestions and relaxations of surfaces. Caustics are used to remove papular and granular developments, and induce absorption of hypertrophied structure. Local applications are made to heal ulcers. Inflammation is checked, limited, and cured by warm solutions and vapors impregnated with salts of soda, ammonia, and potash, or in other cases by cold gargles or spray. The salines tend to increase and liquefy the secretions of the throat; resin oil and astringent agents lessen them; carbolic acid, chlorine, etc., disinfect them when septic. Anodynes are given to allay pain, either by the stomach or locally. Electricity is applicable directly to the paralyzed vocal cord. The knife is constantly of service in treating throat diseases, for the excision of the tonsils and uvula, opening abscesses, the incision of hard papules, preceding use of caustics, removal of polypi, the scarification of œdema of the glottis, and for the operations of tracheotomy and laryngo-tracheotomy, whenever, by congestion, inflammation, ulceration, stenosis, tumors, cancer, sudden œdema, croupous or diphtheritic membrane, or whatsoever obstruction, the larynx is closed to the passage of air and death is imminent by suffocation.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Throck'morton,** county of N. W. Texas, drained by Brazos River and its affluents; surface is generally broken and hilly, and suited to grazing.

**Throcmorton** (Sir Nicholas), b. in England about 1513; became a page to the duke of Richmond; was afterward a member of the households of Henry VIII. and of the queen-dowager; was engaged in the French campaign 1544–47; was appointed under-treasurer of the mint by Edward VI., to whom he was, as an earnest Protestant, much attached; was present at the death of Edward 1553; was concerned in Wyatt's rebellion 1554, for which he was imprisoned in the Tower and tried for treason, but acquitted; resided on the Continent during the reign of Mary; appointed by Elizabeth chief butler of England, and subsequently chamberlain of the exchequer; ambassador to France 1559–63; afterward sent on a mission to Mary Queen of Scots, and entered into the scheme for her marriage to the duke of Norfolk, for which he was disgraced and committed to the Tower 1569. D. Feb. 12, 1571.

**Throm'bus** [Gr. *θρόμβος*, a "clot"], in pathology, designates the fixed venous blood-clot. Thrombus often accompanies phlebitis. It is conceded that dilatation or contraction of a vessel, or great weakness of the heart's action, may favor the formation of thrombus, but whether a special miasmatic influence may have the same result is not settled. Thrombi are liable to putrefactive changes, whence follow metastatic abscesses and a long train of deplorable consequences. When thrombus exists, a rich diet, tonics, and pure air afford the only prospect of recovery.

**Throop,** tp., Cayuga co., N. Y. P. 1302.

**Throop** (Enos Thompson), b. at Johnstown, Montgomery co., N. Y., Aug. 21, 1784; studied law; was admitted to the bar in 1806, and removed to Auburn, N. Y.; was appointed clerk of Cayuga co. by Gov. Tompkins; elected to Congress in 1814; appointed circuit judge of the 7th district of New York by Gov. Yates; in 1828 was elected lieutenant-governor of New York, with Martin Van Buren as governor, and became acting governor on the latter's retirement from the governorship to accept a place in Pres. Jackson's cabinet; renominated and re-elected in 1830 at the head of the ticket; declining a third term, removed to Michigan, where he conducted extensive improvements in that sparsely-settled Territory. Returning to New York, he ended his days amid the scenes of his early life, his death occurring Nov. 1, 1875, at Willow Brook, on the shore of Owasco Lake, his former home.

**Throops'ville,** p.-v., Throop tp., Cayuga co., N. Y. P. 126.

**Thrupp** (Francis Joseph), b. in England in 1827; educated at Winchester School and at Trinity College, Cambridge, where he obtained a fellowship; took orders in the Church of England; travelled in the East; became vicar of Barrington, Cambridgeshire; d. there Sept. 24, 1867. Author of *Ancient Jerusalem, a New Investigation into the History, Topography, and Plan of the City, Environs, and Temple* (1855), *An Introduction to the Study and Use of the Psalms* (2 vols., 1860), *The Song of Songs, a New Translation* (1862), and other works; contributed to Dr. William Smith's *Dictionary of the Bible*, and prepared part of the commentary on the Pentateuch in the *Speaker's Commentary*.

**Thrush,** the English name applied to various species of the family Turdidæ, and especially to those of the genus *Turdus*. As understood by American authors, this genus embraces the species of which the bill is conical, subulate, and shorter than the head, the tip of the upper mandible slightly decurved, the rictus provided with moderate bristles, the wings rather long and pointed, and with the first primary small, the tail nearly even, and the tarsi with continuous plates. The genus thus understood has, however, been subdivided into five sub-genera (considered by some as genera), which exhibit differences in the relations of the sexes, the size and shape of the bill, etc. It includes some of the finest songsters and most familiar birds of the northern hemisphere. Most of the American species belong to the section Hylocichla, and among these is the wood thrush, or *T. mustelinus*, famous for its song. To the section Planesticus belongs our familiar robin (*T. migratorius*). Baird, Brewer, and Ridgway admit 8 species as inhabitants or visitants of North America and the U. S. Theo. Gill.

**Thrush,** an abscess in the sensitive frog of the horse's foot. Cleanliness and the paring away of loose pieces of the frog are useful toward a cure. Carbolic-acid lotions or occasional sprinkling with calomel will materially hasten the recovery. This disease is generally the result of neglect.

**Thucyd'ides,** generally considered the greatest historian the Greek people ever produced, was b. at Athens 471 B. C. He descended from a princely family in Thrace, and was connected with the families of Miltiades, Cimon, and Pisistratus. He was also rich; he owned those gold-mines on the coast of Thrace, opposite the island of Thasos, which later were worked with so great profit by Philip of Macedon. He received the instruction of the philosopher Anaxagoras and the rhetorician Antiphon. In the eighth year of the Peloponnesian war (424 B. C.) he commanded an Athenian fleet of seven ships destined to defend the Athenian settlements along the coast of Thrace, especially the city of Amphipolis. The Spartan general, Brasidas, attacked this city at a moment when Thucydides and the fleet happened to be absent, and offered it very alluring terms of capitulation. It accepted them, and capitulated before Thucydides could reach it, and as a punishment for this misfortune or neglect he was driven into exile, and lived for twenty years in foreign countries—in Thrace, Peloponnesus, and Sicily. In 403 he returned to Athens, but two years after he was assassinated, whether in Athens or in Thrace is uncertain. His great work on the Peloponnesian war is unfinished. It reaches only to the year 411 B. C.; and the eighth book, which differs considerably from the preceding books, is said to have been written by his daughter. Although he is only thirteen years younger than Herodotus, the difference between them is very striking. It always remains the honor of Herodotus to have invented the art of history, but from him to Thucydides this art has made great progress both in style and method. Herodotus tells everything interesting, and tells it simply because he finds it interesting, but this prolixity sometimes becomes diffuse and garrulous. Thucydides tells only that which has a direct bearing on his subject, and tells it solely on account of this relation. This iron consistency makes him sometimes obscure, but his style belongs, nevertheless, to a much more advanced civilization; it has reduced the volume of the expression one-half. Herodotus arranges his materials so as to make them all enter into a general view. With Thucydides there is very little arrangement. He takes the phenomena as they show themselves, and his labor consists in finding out the motive of the acting person and the cause of the visible effect; but this method belongs to a higher stand-point of historical art, as it is a deeper world it describes. His work has been edited by Poppo (Leipsic, 1821 *seq.*, 11 vols.), Bekker (1832), Böhme (1856), Krüger (1846), and translated into English by Rev. S. T. Bloomfield (3 vols., 1829), Rev. Thomas Dale (1856), and Richard Crawley (1874). Clemens Petersen.

**Thugs** [from the Hindoo *thugna*, to "deceive"], a religious association, worshippers of the goddess Kali, who in bands of from 30 to 300 roamed all over India, and had established connections everywhere. They decoyed persons into their company, allured them to distant places, murdered and plundered them. But their motive was not so much lust of plunder as certain religious ideas, and of the spoil one-third was given to the goddess. Between 1829 and 1837 the British Indian government succeeded in breaking up these bands entirely. (See *Ramaseeana, or a Vocabulary of the Peculiar Language used by the Thugs* (1836), by Capt. Sleeman, and *The Confessions of a Thug*, by Meadows Taylor (London, 1858).)

**Thu'le,** the name which Pytheas (at the time of Alexander the Great) gave to a land which he discovered after sailing six days in a northerly direction from the Orkney Islands. Later, the Romans used the name as a general signification for the northernmost parts of the habitable earth—*ultima Thule*. What island Pytheas meant by his Thule is unknown.

**Thumb'screw,** or **Thumb'kin,** an instrument of judicial torture formerly used in various parts of Europe,

but particularly in Scotland. The thumb was compressed by means of a screw. Its last official use was in the trial and on the person of Principal Carstairs in 1682, after the Rye-house Plot.

**Thun'berg** (Carl Peter), b. at Jönköping, Sweden, Nov. 11, 1743; studied at Upsal under Linnæus; resided at the Cape of Good Hope 1771–73, and in Japan 1773–79; returned in 1779 to Sweden; succeeded Linnæus in 1784 as professor of botany at the University of Upsal; d. there Aug. 8, 1828. His principal works are—*Flora Japonica* (1784), *Prodromus Plantarum Capensium* (1794–1800), *Icones Plantarum Japonicarum* (1794–1805), *Flora Capensis* (1807–13), and *Resa uti Europa, Africa och Asia* (4 vols., 1788–91).

**Thunder.** See Lightning, by J. Henry.

**Thun, Lake of,** in the canton of Berne, Switzerland, at an elevation of 1775 feet above the level of the sea, is 10 miles long and 2 miles broad. On its eastern shore stands Interlaken, and on its north-western—or, properly speaking, on the Aar, about 1 mile from its exit from the lake—the town of Thun. Both these towns are every season visited by a great number of tourists journeying to the Bernese Oberland. Steamers ply on the lake.

**Thur'ber** (George), M. D., b. in Providence, R. I., in 1821; became professor of mathematics, medicine, and botany in the New York College of Pharmacy, and is co-editor of the *American Agriculturist*. He has edited *American Weeds and Useful Plants*, being a second and illustrated edition of Darlington's *Agricultural Botany*, and has contributed largely upon botanical subjects to the *American Cyclopædia*.

**Thur'gau,** canton of Switzerland, bordering N. on the Rhine and the Lake of Constance, comprises an area of 384 sq. m., with 93,300 inhabitants, of whom 69,231 are Protestants and 23,454 Roman Catholics. The surface is undulating, but not mountainous, except in the southernmost districts. The soil is very fertile, and agriculture is the main branch of industry pursued; several cotton and linen spinning and weaving factories are in operation. Cap. Frauenfeld.

**Thu'rible** [Lat. *thuribulum*, from *thus*, "incense"], or **Cen'ser,** in the Roman Catholic Church service, a vessel of silver suspended by four short chains. It is charged with burning charcoal, upon which incense is placed. The thurible is borne by an acolyte called the *thurifer*.

**Thü'ringerwald** ["the forest of Thuringia"], a mountain-range in Central Germany, extends along the right bank of the Werra, from the influx of the Horsel, for about 60 miles, and joins the Frankenwald in Northern Bavaria. Its highest point is Schneekopf, 3400 feet high. It is covered with pine forests, and consists mostly of granite, porphyry, and slate, interspersed with rich veins of iron ore. The country it occupies was formerly called Thuringia, but is now parcelled into many petty states.

**Thurin'gia** [Ger. *Thüringen*], the general name for that region of Central Germany which lies between the Hartz and the Thuringian Forest, the Saale and the Werra, and which comprises parts of the Prussian province of Saxony and the Saxon duchies. The name originated from the Thuringii, who settled here, but since the fifteenth century it has had no definite political signification.

**Thurles',** town of Ireland, county of Tipperary, Munster, on the Suir, contains several fine buildings and carries on an active general trade. P. 5332.

**Thur'loe** (John), b. in Essex, England, in 1616; studied law; was called to the bar at Lincoln's Inn 1647; enjoyed the favor of Oliver St. John, through whom he obtained the post of secretary to the council of state 1652; was secretary of state 1653–60; sat in Parliament; was chief postmaster, privy councillor, governor of the Charterhouse, chancellor of Glasgow University, and suffered a short imprisonment at the Restoration. D. in London Feb. 21, 1668. His collection of *State Papers* was edited by Dr. Birch (7 vols., 1742).

**Thur'low** (Edward), Baron Thurlow, b. at Ashfield, near Stowmarket, Suffolk (according to others at Little Bracon-Ash, Norfolk), England, about 1732, his father, Rev. Thomas Thurlow, being rector of that parish; studied the classics at a school in Canterbury; entered Caius College, Cambridge, Oct., 1748; left the university without a degree on account of some breach of discipline 1751; became fellow-pupil, in a solicitor's office, with the poet Cowper; also studied law at the Inner Temple, where he was called to the bar Nov., 1754; became accidentally acquainted with one of the Scotch solicitors employed in the great Douglas case; was in consequence employed as junior counsel, gaining great distinction and the powerful patronage of the house of Douglas, one of whose members, the duchess of Queensberry, obtained for him the rank of king's counsel 1761; was elected to Parliament for Tamworth 1768; was a zealous supporter of Lord North; became solicitor-general Mar., 1770, attorney-general Jan., 1771, and lord chancellor and Baron Thurlow June 3, 1778, in reward for his powerful advocacy of the American war; retained the chancellorship by express command of the king through the succeeding administrations of Lords Rockingham and Shelburne, whose policy he vigorously and successfully opposed in the House of Lords; was excluded from the coalition ministry on its formation Apr. 9, 1783, but returned to office on the accession of the younger Pitt Dec. 23, 1783; retained the great seal eight years longer, in reliance upon the personal favor of the king, while frequently venturing to oppose the policy of the ministry; was dismissed from office on the demand of Pitt June 15, 1792, after which he became a bitter enemy of the government, but lived in comparative obscurity. He opposed the abolition of the slave-trade, and was a warm partisan of Warren Hastings. D. at Brighton Sept. 12, 1806. He was possessed of an overbearing dogmatism, which did duty for eloquence in Parliament, and had a great contemporary reputation for ability, which later generations have not confirmed. Neither his forensic nor judicial record exhibits any traces of a master mind. He had no children, but by a new patent of peerage, executed 1792, his title was made heritable by his nephews, one of whom, Edward Hovell-Thurlow, second baron (b. 1781; d. 1829), was a poet of some distinction.

Porter C. Bliss.

**Thur'man,** p.-v. and tp., Warren co., N. Y., on Adirondack R. R., the starting-point for tourists in the Adirondacks. P. 1084.

**Thurman** (Allen G.), b. at Lynchburg, Va., Nov. 13, 1813; removed to Ohio in 1819; received an academic education; studied law, and was admitted to the bar in 1835; was Representative from Ohio in the 29th Congress; elected judge of the supreme court of Ohio in 1851, and chief-justice from 1854 to 1856; Democratic candidate for governor of Ohio in 1867; elected to the U. S. Senate, in place of Benjamin F. Wade, Mar. 4, 1869, and re-elected in 1874. His term of service will expire Mar. 3, 1881; was prominent among the candidates for the Democratic nomination for President at St. Louis in 1876.

**Thurs'day** ["Thor's day;" Ger. *Donnerstag*], the fifth day of the week. The name seems to have originated among the later Roman pagans, who adopted the week of seven days, and named the fifth day *Jovis dies*, "Jove's Day" (Fr. *Jeudi*).

**Thurs'ton,** south-western county of Washington Territory, lying E. of the Coast Range, drained by Des Chutes River and traversed by Northern Pacific R. R.; surface mountainous, but with several fertile valleys. Staples, wheat, oats, potatoes, wool, and lumber. Cap. Olympia, also the capital of the Territory. Area, 672 sq. m. P. 2246.

**Thurston,** tp., Steuben co., N. Y. P. 1215.

**Thurston** (Robert Henry), son of Robert Lawton Thurston, b. in Providence, R. I., Oct. 25, 1839; was trained in the workshop of his father, and graduated at Brown University in 1859. He was engaged in the business firm of which his father was senior partner until 1861, when he entered the navy as an officer of engineers; served during the civil war on various vessels; was present at the battle of Port Royal and at the siege of Charleston; was attached to the North and South Atlantic squadrons until the close of 1865, when he was detailed as assistant professor of natural and experimental philosophy at the U. S. Naval Academy at Annapolis, where he also acted as lecturer in chemistry and physics. In 1870 he visited Europe for the purpose of studying the British iron-manufacturing districts, and in 1871 was appointed professor of mechanical engineering at the Stevens Institute of Technology. In this year he conducted, in behalf of a committee of the American Institute, a series of experiments on steam-boilers, in which for the first time all losses of heat were noted, and by condensing all the steam generated the quantity of water entrained by the steam was accurately noted. In 1873 he was appointed a member of the U. S. scientific commission to the Vienna Exhibition, served upon the international jury, edited the report of the commissioners, and published his own *Report on Machinery and Manufactures*, in 5 vols. (1875–76). In 1874 and subsequently he conducted at the Stevens Institute a series of researches on the efficiency of prime-movers and machines, and upon the strength and other essential properties of the materials of construction. In 1875 he was appointed a member of the U. S. commission on the causes of boiler explosions, and of the board to test the metals used in construction. He is a member of various scientific associations in the U. S., Great Britain, France, and Germany,

and has written numerous papers on technical subjects, which have appeared in scientific journals in Europe and America, and prepared articles upon similar topics for this CYCLOPÆDIA. Some of his more important papers are the following: *On Losses of Propelling Power in the Paddle-Wheel* (1868), *Steam-Engines of the French Navy* (1868), *H. B. M. Iron-clad Monarch* (1870), *Iron Manufactures in Great Britain* (1870), *Experimental Steam-Boiler Explosions* (1871), *Report on Test-Trials of Steam-Boilers* (1872), *Traction-Engines and Road Locomotives* (1871), *Report on the Stevens Iron-clad Battery* (1874), *Efficiency of Furnaces burning Wet Fuel* (1874), *The Mechanical Engineer, his Preparation and his Work* (1875), and a number of papers embodying accounts of original investigations of the strength and other properties of materials of construction. Among his numerous inventions are—the magnesium-ribbon lamp, a magnesium-burning signal apparatus, an autographic recording testing-machine, a new form of steam-engine governor, and an apparatus for determining the value of lubricants.

**Thurston** (ROBERT LAWTON), b. at Portsmouth, R. I., Dec. 13, 1800; was engaged as early as 1821 in building steamers and machinery; founded the Providence Steam-Engine Co. and the firms of R. L. Thurston & Co., Thurston, Greene & Co., and Thurston, Gardner & Co., which were the first to build and introduce the "drop cut-off" expansive steam-engine, invented by F. E. Sickles and N. T. Greene. D. at Providence, R. I., in 1873.

**Thy'ine Wood** [*ξύλον θύϊνον*, the "wood of the *Thuja*, or yew" improperly so called], a kind of wood mentioned in the Bible, is probably the arar or sandarach wood, the wood of *Callitris quadrivalvis*, a large tree of Barbary. This tree affords the resin called gum-sandarach, and its timber is considered imperishable by the Turks, who floor their mosques with its planks.

**Thylacine.** See THYLACINIDÆ.

**Thylacin'idæ** [from *Thylacinus*—*θύλακος*, "pouch"—the name of one of the genera], or **Dasyuridæ** [from *Dasyurus*—*δασύς*, "hairy," and *οὐρά*, "tail"—the name of another genus], a family of mammals of the order Marsupialia and sub-order Dasyuromorphia, including the chief carnivorous mammals of Australasia. The form is diversiform in the several genera, the larger species much resembling a dog externally, others an opossum, and the small species simulating mice in appearance, although anatomically they differ but little from each other; the snout is dog-like or acutely pointed; the ears moderate or large; the tail is generally more or less long, and the feet have separate toes, four or five in number. The teeth are well developed, and simulate those of the placental carnivores (dogs, etc.), and are in considerable number—viz. M. $\frac{4}{4}$, P. M. $\frac{2}{2}$ or $\frac{3}{3}$, C. $\frac{1}{1}$, I. $\frac{4}{3} = 42–46$; there is no such distinction between molars and premolars as in placental carnivores, only the last premolars (P. M. 3d) having deciduous predecessors; the molars have cusps connected more or less by sectorial ridges; the premolars are compressed, conical; the canines generally well developed and typical in form, and the incisors cylindroid and curved, and moderate or rather large. The skull superficially has much resemblance to that of a dog, but is of course radically different, and exhibits the typical marsupial modifications of the mammalian skeleton, and the small size of the cerebral cavity is indicated externally by the absence of inflation; the palate has a pair of large longitudinal vacuities between the true molar teeth of the respective sides. The stomach is simple, and there is no intestinal cæcum. The family is peculiar to the Australasian region, and its representatives there take the place in the economy of nature held by the placental carnivores and insectivores in other parts of the world. The species are quite numerous. They are primarily divisible into three groups, which may be provisionally considered as sub-families. These are (1) Thylacininæ, represented by one genus (*Thylacinus*) and two species in Van Diemen's Land; (2) Dasyurinæ, represented by two genera, *Dasyurus* and *Diabolus* (or *Sarcophilus*); and (3) Phascogalinæ, including the small insectivorous animals, represented, according to Krefft, by five genera and fourteen species—viz. *Phascogale*, with 2 species; *Antechinus*, with 6; *Podabrus*, with 4; *Antechinomys*, with 1; and *Chætocercus*, with 1. The most notable of all these are the *Thylacini* (*T. cynocephalus* and *T. breviceps*), which are called "tigers" by the colonists of Tasmania, and the *Diabolus ursinus*, which rejoices, among the same people, in the significant name "devil:" the *Thylacini* are about the size of a large dog or a wolf, and are very powerful and savage animals; the *Diabolus* is little larger than a terrier dog, but much stouter about the head and shoulders, and has enormous strength in its jaws. The several large animals of the family are very destructive to the sheep of the Tasmanian colonists. THEODORE GILL.

**Thyme** [Gr. *θύμος*], the name of certain non-American labiate half-shrubby plants of the genus *Thymus*. Two kinds are cultivated in gardens, the common, *T. vulgaris*, and the lemon-scented, a variety of *T. serpyllum* or wild thyme. Both plants afford good bee-pasture. The leaves are used for flavoring soups and forcemeats; the volatile oil is sold for oil of origanum, which it closely resembles.

**Thyme, Oil of,** a volatile oil obtained by the distillation of the herb *Thymus vulgaris* with water. It usually has a brownish-red color and a thickish consistency, although when freshly prepared it is nearly colorless and is mobile. It possesses a pleasant pungent odor and an aromatic taste, has a sp. gr. of about 0.9, and is but slightly soluble in water, although it dissolves in alcohol and in ether. Oil of thyme contains two hydrocarbons, a *terpene* ($C_{10}H_{16}$) and *cymene* ($C_{10}H_{14}$), and an oxygenated camphor, THYMOL (which see). These compounds are separated by submitting the oil to fractional distillation. When oil of thyme is distilled with a mixture of 8 parts of chloride of lime and 24 parts of water, chloroform is formed.

J. P. BATTERSHALL.

**Thym'ol** (*Thymylic Hydrate, Thymylic Alcohol, Thymylic Acid*), ($C_{10}H_{14}O$), is a homologue of phenol and an isomere of cymylic alcohol. It is obtained from the OIL OF THYME (see above), of which it is the oxygenated camphor or stearoptene, by distillation. Thymol forms crystalline rhomboidal plates, which have a weak odor and a peppery taste. It fuses at about 111° F. to a colorless liquid, which has a boiling-point of 446° F., and dissolves with difficulty in water, but easily in alcohol and in ether. By the action of chlorine, bromine, and nitric acid upon thymol, series of derivatives are formed.

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**Thy'mus** [Gr. *θυμός*, "soul"] **Gland,** a ductless gland, with no known function, located in the neck below the thyroid gland, and in the chest beneath the sternum, in the mediastinal space, as low as the fourth costal cartilage. It develops at the third month of fœtal life, weighs half an ounce at birth, grows until the second year, attaining a length of two inches. Thereafter it atrophies, and at the fourteenth or sixteenth year is obliterated, or its site marked only by a few fibres and a small deposition of fat. It has abundant blood-vessels, nerves, and lymphatics, but endless research has failed to disclose its use in either the fœtal state or during childhood.

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**Thy'roid Gland,** a glandular structure consisting of two lateral lobes, with a connecting band or isthmus, situated on the anterior surface of the neck (hence its name, from Gr. *θυρεός*, a "shield," and *εἶδος*, "like") and attached to the sides of the larynx. The gland moves with the larynx in respiration and deglutition. The isthmus bridges across from the lower or basic portion of the lobules, and covers in its transit the front of the second and third tracheal rings. By this relation and its great vascularity it has an important surgical relation to the operation of tracheotomy. The gland is ductless, and its function is as yet unknown. It has an external fibrous coat, which gives off numerous internal partitions and bands, so that the gland consists of communicating cavities like a sponge. This sponge is the seat of the peculiar disease termed GOITRE (which see).

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**Thysanu'ra** [from *θύσανος*, "fringe," and *οὐρά*, "tail"], a group of insects by some considered as a peculiar order or orders of the class, and by others as a sub-order of either the order Orthoptera or the order Neuroptera. They are wingless insects, with a hairy or scaly body, with the parts of the mouth variously and peculiarly developed, and generally more or less rudimentary, and which do not undergo a regular metamorphosis. The group embraces small insects, some of which are remarkable for the sculpture of the scales, which are common objects of microscopical examination. The formerly commonly-admitted families were Lepismidæ and Poduridæ, and to it was also later added a family, Campodeidæ or Campodeæ. Recently, however, Sir John Lubbock has completely remodelled the group, and divides it into two orders—viz. (I.) Thysanura (restricted), with three families, Lepismidæ, Campodeidæ, and Japygidæ; and (II.) Collembola (nearly coequal with the old family Poduridæ), with the families Anuridæ, Lipuridæ, Poduridæ, Degeeriidæ, Smynthuridæ, and Papiriidæ. (Consult Lubbock's *Monograph of the Collembola and Thysanura*, London, 1873. See also PODURA.)

THEODORE GILL.

**Ti,** a liliaceous tree-like plant, *Cordyline Ti*, found in the Pacific Islands and in parts of Asia. Its leaves afford roofing for houses, food for cattle, and fibre for cloth. The sap yields sugar and a stimulating drink, while the roots, when baked, afford a valuable supply of food.

**Tiahuanu'co,** a group of interesting ruins in Bolivia, 12 miles from the shore of Lake Titicaca, on an eminence which may have once been an island in that lake. The elevation is 12,930 feet, and the surrounding country is a desolate and sterile plain. The ruins at this point are confessedly much older than the age of the Incas, but there seems to be no possible clue to their date. A marked character of the ruins is the use of enormous and finely-wrought stone blocks, in some instances clamped together with bronze. Mr. Squier believes that Tiahuanuco was never a city, but a shrine or sacred place of some pre-historic race of men. The whole area is, however, very considerable.

**Tia'ra** [Gr. *τιάρα*, a Persian head-dress], the papal crown, a cap of cloth of gold having three golden circlets, two silken embroidered pendants, and at the top a golden cross. It was at first a plain round cap (worn first by Damasus II.); the first crown or fillet was added by Nicholas I. (or by Benedict VIII.); the second by Boniface VIII. (or, according to others, by Benedict XII.), the third by Urban V. or by John XXIII. Others date the wearing of the tiara from Constantine's or Clovis's time, and say that Pope Hormisdas added the first circlet.

**Ti'ber** [Lat. *Tiberis*], the most celebrated of Italian rivers, rises at the foot of Mount Aquilone, a spur projecting from the S. W. flank of the Apennines, in N. lat. 43° 45′, W. lon. 12°, at the height of 1600 feet above the sea, drains a basin of about 6500 sq. m., and after a course of 220 miles, generally in a S. direction, though with many sinuosities, empties into the Mediterranean near Ostia, 27 miles below Rome, in N. lat. 41° 45′. The mean delivery of the Tiber is about 400 cubic yards per second; its smallest observed delivery is 215 cubic yards. It is navigable from the sea to Rome for vessels of 140 tons and with some difficulty 60 or 70 miles farther for vessels of 60 tons. The Romans kept the channel of the Tiber above Rome, up to the outlet of the Nera, about 100 miles from the sea, as well as those of the lower course of the Nera, the Chiana, and the Anio, always in a boatable condition, and employed them very largely for transportation; but at present those channels are little used for any form of navigation, except, on a small scale, for flotation of firewood and lumber. Up to Rome the bed of the Tiber may be considered an estuary, for at various points below Ponte Sisto the bottom of the river is from 30 to 20 feet *below* the level of the sea. The sedimentary deposits of the river have both raised its bed and lengthened its lower course since the days of ancient Rome, and hence it is not difficult to understand that, though there is now generally depth of water only for small vessels, it was possible under the Empire for a ship to transport an obelisk weighing 400 tons from Egypt to a landing-place on the Tiber 3 miles below Rome. For the upper half of its course the current of the Tiber, though not torrential, is too rapid for navigation, and it is worth mentioning that above Rome it is not divided by a single noticeable island. Its waters are scarcely anywhere utilized as a motive-power or for irrigation, though they might be made largely available for both purposes. The epithet *flavus* ("yellow") applied to the Tiber by the Romans referred, no doubt, to the turbid appearance of its waters due to the quantity of sediment then, as now, borne down by them. Rozet calculated that the quantity of sediment annually deposited by the Tiber at its outlet had been for many centuries approximately constant, and sufficient to extend the coast seaward at the rate of a little less than 13 feet per year. Later observations show that at some points, at least, the rate of advance is greater. In general, we may say that there is no satisfactory proof of any considerable changes in the physical conditions of the Tiber, except those produced in its lower course by this accumulation of sedimentary deposit and by the creation or removal of artificial obstructions in its bed. We may add, however, that, according to the testimony of old writers, the Tiber was more frequently partially or completely frozen over in ancient than in modern times. The effects of the deposit of mineral and vegetable matter in the river-bed have been the same as similar causes have produced near the outlets of other rivers. The estuary, which originally formed the harbor of Rome, was so reduced in depth by the silt let fall by the river, as well as by sand rolled in from the sea, that it was found necessary in the days of the Empire to cut an emissary from a point considerably above Ostia to serve as a ship-canal to the sea; and this is still the only navigable channel from the Mediterranean to Rome. Besides this, an artificial harbor, known as the port of Trajan, was filled up in the same way, and the river-silt united with the sea-sand both to form shoals in what had been deep water, and to build up along the coast a vast range of banks rising above the water, behind which the overflow from the river spread out into shallow morasses of great extent, the miasmata from which not only render their immediate vicinity uninhabitable, but, as is commonly thought, are among the chief causes of the present insalubrity of Rome and the whole Campagna. The regulation of the Tiber involves the draining of these pestiferous marshes or the filling of them with the sediment brought down by the river, which some able engineers think sufficient in quantity to accomplish this great work in a relatively short period of time. To restore the Tiber to its ancient function as the great maritime approach to the capital of Italy the construction of an artificial harbor at or near its mouth is a necessity; and this, as recent works of the like sort elsewhere have shown, is not to be regarded as an undertaking technically formidable or extravagantly costly.

Aside from historical associations, into which we cannot enter, the special interest of the Tiber arises from certain peculiarities in its *régime*, and from its importance as a source of danger to the city of Rome. Of these peculiarities the most remarkable is the provision made by nature for the disposal of the precipitation in its basin. The mean annual delivery of the river is computed to equal two-thirds of the downfall in its valley, the proportion being above the mean in dry, below it in humid years. Comparatively little of the precipitation is conveyed to the channel of the Tiber by direct superficial conduction, but a vast amount of the water of rains and snows is received into subterranean cavities or absorbed by the bibulous earth which covers much of the surface, and slowly conveyed by underground conduits into the channel of the river, or possibly, to some extent, into the sea. Lombardini estimates "the subterranean discharge of the Tiber" at not less than three-fourths of the total delivery. The result of this natural arrangement is that this river has no true *low-water* stage, and at Rome, as well as far above the city, it flows always with a strong full current, its lowest known discharge being, as we have already seen, 215 cubic yards per second, or more than one-half its mean volume. Its *minimum*, therefore, is little inferior to that of the Po, while the *mean* discharge of the latter river is more than five times as great as the average delivery of the Tiber. The renewed importance of Rome as the social and political capital of a great nation, now happily restored to no small share of its ancient dignity and power, is drawing greatly-increased attention to the dangers which threaten the city from the inundations of the Tiber, and to the means by which those dangers may possibly be averted. Great floods have occurred in the Tiber at frequent intervals through the whole historic period, and some of the most ancient seem to have been almost as overwhelming and destructive as the most violent of modern times; but in general the data we possess respecting them are too vague to enable us to arrive at precise comparative results. Under the first emperors the diversion of some of the principal tributaries, and even of the main channel of the Tiber itself, was suggested as a remedy for the evil, and similar measures form a feature of several of the plans now under consideration. To this there are grave objections, and, so far as we know, there is but a single point in which all engineers agree; we mean the expediency of widening and straightening the channel at various points within and near the limits of the city—where by human encroachment or other causes it has been narrowed and made tortuous—and of removing the numerous artificial obstructions, chiefly piers and piles of old bridges, by which the flow of the current is retarded and the deposit of sedimentary matter greatly promoted. There is much difference of opinion in regard to the extent of the relief to be obtained by this measure, but it could hardly fail to be considerable, and some are of opinion that the increased velocity of the current would suffice to scour out the accumulated deposits of many centuries, lower the bed of the river to its ancient level, and render the construction of dikes or river-walls upon the banks, which most of the projects contemplate, quite superfluous. The question is complicated by doubts which have been suggested as to the stability of the coast-level at the outlet of the Tiber; and some geologists believe that not only the immediate shores of the Tyrrhenian, but the whole Campagna far into the interior, are undergoing a secular elevation.

Contrary to the general rule, the overflows of the main tributaries of the Tiber are contemporaneous, not successive, but their flood-waves reach Rome not together, but at intervals of some hours, and high water at the city is oscillating. The approach of these waves may be known by telegraph, and consequently in a certain degree guarded against.

There is another point connected with the operations for securing the lower parts of the city and its environs from overflow by the waters of the Tiber which has not been very fully investigated. We mean the action of the W. wind, either indirectly retarding the flow of the stream by impinging

upon its surface, or in raising waves in the sea at the mouth, which operate as a barrier to the escape of the river-water, or even, as some think, drive it upward with a refluent current, like a tidal wave. This effect, or at least the amount of it, is matter of dispute. Probably, it is scarcely felt as high up as Rome, but, admitting the fact, the possibility of a remedy by constructing breakwaters in the sea in front of the mouth or otherwise does not appear to have been yet much studied.

The rise of the Tiber in its great floods is very considerable. It is measured from the zero of the hydrometer at the stairs of the Ripetta at Rome, which is usually taken as the sea-level, though Possenti states that in May, 1871, the royal commission of that year found its true level to be 1.17 mètres, or 3.84 feet above the sea at low water. The lowest known surface of the Tiber at this point is 5.3 m. or 5.4 m., or 17.7 feet above this zero, its mean height 6.7 m., or 22 feet. In the highest recorded flood, that of Dec., 1598, the river rose to 19.56 m., or 63.22 feet (according to some authorities, to 20.15 mètres) above zero. In the inundation of Dec., 1870, it rose to 17.22 m., or 56.48 feet, above zero. Between 1530 and 1637 there were four floods higher than that of 1870, but in the following 233 years, from 1637 to 1870, not one of equal height. Possenti ascribes the diminished violence of the inundations during this latter period to the removal of mills, piers, and other obstructions in the bed of the river within the city, but he thinks, from various circumstances, that though the level of the surface at the Ripetta in the flood of 1598 was higher by 2.34 m. than in that of 1870, the actual quantity of water discharged by the river was not greater in the former than in the latter inundation. The pavement of the Ripetta is at 13.50 m. above the zero of the hydrometer, and the other streets near the river are but little above that level. The inundation of 1870 rose to 17.22 m.—or 3.72 m., equal to 12⅕ feet, above the pavement—and overflowed the whole N. W. quarter of the city, including the Corso and other important business streets, filling the cellars, flooding the ground-floors, and letting fall great quantities of sediment. The direct and indirect damage from such a visitation can hardly be overestimated. The mere mechanical inconvenience from the flooding of the lower parts of the city and its environs, though sufficiently serious, is not the only evil resulting from the inundations of the Tiber. The sewers are not merely checked in their flow by the water-wall which the rise of the river opposes to their discharge, but partially choked by sediment let fall by the inflowing current, and this of course interferes very seriously with the sanitary arrangements of the city. The construction of dikes on the banks would not remedy the evil; and on the contrary, might augment it from increasing the height to which the current so confined would rise. A system of great collecting sewers, with occasional siphons, is proposed, but it is not easy to find a suitable point of discharge for the accumulated sewerage of so large a city. There can, indeed, be no doubt that the obstruction to the drainage of the city at high water is deleterious to its health, but practically this temporary check of the outflow from the drains, the submerging of the streets, and the filling of the cellars in the lower part of the town, have not been shown to be so active and immediate causes of disease as would be expected. The winter of 1870–71 was not marked by any epidemic or any aggravation of endemic maladies, nor have other great inundations been always followed in a perceptible degree by such effects.

The literature of our subject is very voluminous. We have space to refer only to Lombardini, *Esame degli Studi nel Tevere* (1871) and other papers; Carcani, *Il Tevere e le sue Inondazioni* (1875); Possenti, *Piano di Sistemazione del Fiume Tevere* (1871); Possenti, *Sulle Piene del Tevere* (1872); Canevari, *Cenni sulle Condizioni altimetriche ed idrauliche dell Agro Romano* (official report, 1874); Baccarini, *Sull' Altezza di Piena massima nel Tevere urbano* (1875); Cialdi, *Nozioni sulla Costruzione dei Porti nel Mediterraneo* (1874); Dausse, *Lettre au Sujet de l'Endiguement du Tibre* (pamphlet, 1876); *Studi sulla Geographia naturale e civile dell' Italia* (Soc. Geog. Italiana, 1875). GEORGE P. MARSH.

**Tiberias.** See GENNESARET, LAKE OF, by PROF. R. D. HITCHCOCK, S. T. D., LL.D.

**Tibe'rius,** whose full name was TIBERIUS CLAUDIUS NERO CÆSAR, Roman emperor 14–37, b. Nov. 16, 42 B. C., a son of Claudius Tiberius Nero and Livia Drusilla. In 38 B. C., Livia was divorced from Claudius and married to Augustus, who thus became the step-father of Tiberius. In the imperial household he received a careful education, and he seems at one time to have been a favorite with the emperor. He was large and strong of body, with handsome features, a man of simple habits and reserved manners, and not altogether without literary taste. For military affairs he even seems to have had a talent. He commanded successively in Cantabria, Armenia, Rhætia, Dalmatia, and Germany; and although the enemies he had to encounter were not very dangerous, yet he finished the wars promptly and with honor. From Germany, where he commanded after the death of his brother Drusus, he returned in 7 B. C. to Rome, celebrated his second triumph, was chosen consul for the second time, and was the following year invested with the *potestas tribunitia* for five years. Meanwhile, the good relations between him and Augustus had become utterly disturbed. Livia seems from the very first to have striven to clear the way to the throne for her own children, and it was no doubt for this purpose that Tiberius was compelled to divorce his first wife, Vipsania Agrippina, whom he loved and who had borne him a son, Drusus, and marry Augustus's daughter, the dissolute Julia. After the lapse of one year the marriage proved equally disgusting to both parties. In these impure domestic relations, with an ambitious, scheming mother and a profligate, dishonorable wife, the bad elements of Tiberius's character came into rank growth—his jealousy, suspiciousness, hypocrisy, etc. Augustus saw and understood the development of this strange character, and Tiberius spent seven years in Rhodes in retirement, occupied with the study of astronomy. By his mother's exertions he was recalled to the court in 2 A. D., and in 4, all the male heirs of Augustus having died one after the other, he was adopted by the emperor and appointed his successor. The next ten years he spent mostly in wars on the frontiers, and in 14 he finally succeeded to the throne. His long reign of twenty-three years is by itself not very remarkable. Its most prominent feature is the monstrous development of his own character. His avarice, suspiciousness, and hypocrisy became fiendish and malicious; a feeling of hatred and vengeance filled his heart, and by degrees he sank into brutish sensuality and cruelty. A new crime was invented, *crimen læsæ majestatis*, and defined in such a manner that it might be construed into an offence to the *princeps* if anybody spoke well of anybody else. A new method of proceeding, the *delatores* (informers), was instituted, and the senate showed itself zealous in divining and fulfilling the despot's wishes before they were uttered. No man was safe if he had a name, talent, a fortune, a wife, or anything which excited the emperor's fear or his appetite, and the manner in which men belonging to the noblest families of Rome were prosecuted and put to death was often as incredible as the wildest freaks of a farce. The emperor himself, however, seems to have been the most miserable victim of his own evil passions. In 26 he retired to Capreæ, where he lived not only in retirement, but in seclusion, leaving the government mostly to Sejanus, and after his death to Macro. He was afraid of being seen. At last he was capable only of sensations of the coarsest description, while an indefinable terror seized his mind and drove him nearly mad. On a journey in Campania he fell sick at Astura, and died in the villa of Lucullus at Misenum Mar. 16, 37—it was said in an untimely way. He fell into a fainting-fit, and was believed to be dead. Caius Caligula was hailed as emperor, and all the people rejoiced. But he recovered, and asked for something to eat. Fright and confusion fell at once upon all; only Macro remained cool; he drew the bed-clothes over the old man and suffocated him. CLEMENS PETERSEN.

**Tibet.** See THIBET, by E. SCHLAGINTWEIT.

**Tibul'lus** (ALBIUS), was descended from an equestrian family of good standing in Roman society; accompanied Messala in 31 B. C. to Aquitania, and subsequently to the East, but returned to Rome on account of his health, and lived on his estates near Rome, devoting himself to poetry and literary occupation. D. very young, probably in 18 B. C. Four books of elegies ascribed to him have come down to us, but the authenticity of the third and fourth is disputed. They were edited by Dissen (1835, 2 vols.), Rossbach (1866), and Müller (1873), and translated into English by Dr. Grainger (1752). On account of the genuineness and simplicity of their feeling, these poems belong to the best the Latin literature contains.

**Tibur.** See TIVOLI.

**Tic Douloureux.** See NEURALGIA, by E. C. SEGUIN, M. D.

**Tich'borne Trial,** a noted English *cause célèbre*. Roger Charles Tichborne, b. Jan. 5, 1829, was the son of James Tichborne, presumptive heir to the titles and great landed estates of his brother, Sir Edward Tichborne-Doughty. Roger was educated in France, and afterward at the Roman Catholic college of Stonyhurst, England, and in 1849 received a commission in the army. In 1852 he proposed marriage to his cousin Kate, daughter of Sir Edward, and the proposal having been declined by her

parents, he threw up his commission, went to sea as a sailor, made a voyage to South America, and in Apr., 1854, sailed from Rio Janeiro for New York on board a vessel which was supposed to have been lost at sea with all on board. Sir Edward died in Mar., 1853, and was succeeded by the father of Roger, who died in 1862, and was succeeded by his second son, Alfred, who died in Feb., 1866, and was succeeded by a posthumous son, born in the following May. Lady Tichborne, the widow of Sir James, had come to be on ill terms with her family, and had taken up the idea that her son Roger might still be living, and in 1865 advertised in newspapers at home and abroad for intelligence respecting him. In the following year a butcher at Wagga Wagga, Australia, where he was known as Thomas Castro, gave out that he was no other than the missing Roger Tichborne. After some correspondence with Lady Tichborne, he sailed for Europe, met her in Paris in Jan., 1867, was acknowledged by her as her son, and furnished with some money. All the other members of the family treated him as an impostor. In Mar., 1867, he filed a bill in chancery, the real issue of which was to enable him to prove himself to be Roger Tichborne and the rightful owner of the title and estates. He also succeeded in raising large sums of money upon bonds payable when he should come into possession of his property. For various reasons the case did not come to trial for nearly four years, and in the mean time Lady Tichborne, whose testimony might have been of great importance, died Mar., 1868. The cause came on before the court of common pleas May 11, 1871, for the recovery of estates valued at £24,000 a year; it was twice adjourned, and was closed Mar. 6, 1872, the actual proceedings occupying 103 days. The real issue was whether the claimant was or was not Roger Charles Tichborne. He showed himself to be cognizant of many things which could hardly have been known by an impostor, while of others which must have been known by the real Roger he was wholly ignorant. His physical appearance differed from that of Roger Tichborne in a manner not to be accounted for by the lapse of less than twenty years. Roger, when he disappeared, was a tall, slender young man, with small head, straight hair, his ears adhering closely to the head; the claimant was an inch taller, enormously obese, with a large head and curly hair, the ears free, with large lobes. Roger had had his initials tatooed on one of his arms, while nothing of the kind appeared on the claimant. Roger had been well educated, and spoke French with perfect fluency; the claimant was grossly illiterate, and wholly unacquainted with French. The jury found that the claimant was not Roger Charles Tichborne, and he was nonsuited. He was taken into custody to be tried for perjury. The trial came on before the court of queen's bench Apr. 23, 1873, and after several adjournments was concluded Feb. 28, 1874, having occupied in all 188 days. In the course of the two trials it was established beyond reasonable doubt that the real name of the claimant was Arthur Orton, a native of London, who emigrated to Australia, where, for reasons growing out of some misconduct, he assumed the name of Thomas Castro. By what means and by whose assistance he gained the information which enabled him to make such show as he did of being the missing Roger Tichborne is an unsolved mystery. So great were the expenses of these protracted suits that the trustees of the infant owner of the Tichborne estates were obliged to mortgage them in order to obtain money to defend his title. In spite of the verdicts of the courts, there were many, especially among the lower and middle classes in England, who still believed that Castro or Orton was really Roger Charles Tichborne. So strong was this feeling that Mr. Kenealy, his leading counsel in both cases, who subsequently established a newspaper, *The Englishman*, which acquired an immense circulation in consequence of its attacks upon these verdicts, was in 1875 elected, mainly upon this account, to the House of Commons. (See KENEALY, EDWARD V. H.) A. H. GUERNSEY.

**Tiche'nor** (ISAAC), LL.D., b. at Newark, N. J., Feb. 8, 1754; graduated at Princeton 1775; began the study of law at Schenectady; accepted in 1777 an appointment as assistant commissary-general at Bennington, Vt., where he took up his residence; became prominent in Vermont politics; was judge of the supreme court 1791–94; chief-justice 1795–96; commissioner for adjusting the boundary dispute with New York 1791; U. S. Senator 1796–97; governor 1797–1807 and 1808–09, and again U. S Senator 1815–21. D. at Bennington Dec. 11, 1838.

**Tichvin.** See TIKHVIN.

**Tici'no,** the southernmost canton of Switzerland, on the Italian side of the Alps and on both sides of the river Ticino, borders on Lago Maggiore. Its northern frontier toward Uri and Grisons is formed by a range of the Lepontine Alps 12,000 feet high, branches of which cover the whole northern part of the canton. In the southern part the ground becomes low and the surface level. Dairy-farming and cattle-breeding are the principal occupations in the Alpine regions, and agriculture and the cultivation of grapes, olives, figs, almonds, and melons in the southern part. Area, 1082 sq. m. P. 119,619, most of whom speak Italian and are Roman Catholics. Cap. Bellinzona.

**Tick.** (1) The common name of Arachnids of the group Acarina and the family Ixodidæ. They "are mites of gigantic size, with bodies of a leathery consistence." (*Packard.*) The wood-ticks, dog-ticks, cattle-ticks, etc. (*Ixodes*) are well-known examples of these intolerable parasites, which often bury themselves beneath the skin and give rise to severe pain and inflammation. Still others of the larger parasitic Acarina are called ticks. (2) Many degraded forms of dipterous parasitical insects are called ticks. Several of these are of the family Hippoboscidæ. Such is the well-known sheep-tick, *Melophagus ovinus;* such are the horse-ticks and bird-ticks (*Hippobosca, Lipoptena, Ornithomyia,* etc.). The bat-ticks are spider-like dipterous insects of the family Nycteribidæ.

**Tick'ell** (THOMAS), b. at Bridekirk in Cumberland in 1686; was educated at Queen's College, Oxford, of which he became a fellow in 1710; became a friend of Addison, through whose influence he was in 1717 appointed under-secretary of state, and in 1725 was made secretary to the lords justices of Ireland, a post which he retained until his death. His principal works are—*The Prospect of Peace,* a poem; *The Royal Progress,* verses celebrating the arrival of George I.; a translation of the first book of the *Iliad;* and an *Elegy on Addison,* besides which he contributed papers to the *Spectator* and *Guardian.* D. at Bath Apr. 23, 1740.

**Ticket of Leave,** originally designated a "permit," given to British convicts transported to penal settlements, by which they were allowed a certain amount of liberty within certain territorial limits. At present the term designates an order remitting a portion of the sentence of a convict as a reward for his good behavior.

**Tick'nor** (GEORGE), LL.D., b. at Boston, Mass., Aug. 1, 1791; received at home a careful training in the classics; entered Dartmouth College at the age of twelve; graduated there 1807; pursued for three years a post-graduate course of studies at Boston under the direction of Rev. Dr. J. S. J. Gardiner, with whom William H. Prescott was then preparing for college; was one of the members of the Anthology Club; studied jurisprudence in the office of an eminent lawyer at Boston; was admitted to the bar 1813, but soon resolved to devote himself to a literary career, favored by the possession of an ample fortune; sailed for Europe 1815; resided two years at the University of Göttingen, chiefly occupied with classical philology and the modern literatures of Europe; spent two years more in travel, visiting most of the European capitals and forming the acquaintance of many of the chief literary and political celebrities; gave especial attention to the Spanish language, for the study of which he formed an extensive library, including many rare works; was chosen in 1817 to the Smith professorship of modern languages at Harvard; filled that post from 1820 to 1835, when he resigned; spent three years in Europe, chiefly engaged in preparatory researches for his principal work, to which he devoted several more years of assiduous labor; published in 1849 in London and New York his *History of Spanish Literature* (3 vols.), which was translated into French, German, and Spanish, and speedily became classical, even in Spain; printed some occasional essays, chiefly on educational topics, and several biographical sketches—of La Fayette (1825), Nathan A. White (1827), Daniel Webster (1831), the Buckminsters (1849), and Edward Everett (1865); wrote an elaborate *Life of William Hickling Prescott* (1864), who had been his most intimate friend and fellow-laborer in the field of Spanish literature; contributed to various magazines and reviews, and took an interest in several public enterprises, especially in the Boston Public Library, to which he was a munificent benefactor, presenting it with 2000 volumes in 1860. He was a member of the leading literary societies of Europe and America, and a correspondent of many eminent men in Europe. D. at Boston Jan. 26, 1871. The 4th ed. of his *Spanish Literature* appeared shortly after his death under the editorship of Mr. G. S. Hillard, who also published his *Life and Correspondence* (1876), one of the most notable and successful of American memoirs. PORTER C. BLISS.

**Tick'nor** (WILLIAM D.), b. at Lebanon, N. H., in 1810; became in 1832 a bookseller in Boston; subsequently added a publishing business, which attained to great importance under the firm-name of Ticknor & Fields (now James R. Osgood & Co.); founded the *Atlantic Monthly,* and made his office a centre for the brilliant literary circle connected with that magazine, including Longfellow, Holmes, Whit-

tier, Lowell, and Saxe, whose poems were issued by the firm. D. at Philadelphia, Pa., Apr. 10, 1864.

**Ticondero'ga,** p.-v. and tp., Essex co., N. Y., at the junction of Addison R. R. with the Champlain division of Delaware and Hudson Canal Co.'s lines. The town occupies a lofty promontory lying between Lakes George and Champlain, the outlet being 4 miles in length, with a fall of 220 feet, affording excellent water-power. In the township are veins of graphite, utilized for the manufacture of lead-pencils and crucibles, valuable deposits of iron ore, manufactories of lumber, an extensive cotton-factory, 2 woollen-mills, 2 foundries, 5 churches, 15 schools, and a weekly newspaper. It was nearly destroyed by fire Mar. 31, 1875, but has been handsomely rebuilt. P. in 1875, 3401. Ticonderoga was prominent in colonial and Revolutionary history from its celebrated fortress, built by the French in 1755, and originally named Carillon ("chime of bells") from the music of the neighboring waterfall. It was the head-quarters of Montcalm 1757; was unsuccessfully assaulted by Gen. Abercrombie July 8, 1758; occupied after a siege by Gen. Amherst July 30, 1759; captured by Ethan Allen May 10, 1775; retaken by Burgoyne July 5, 1777, and again by Gen. Haldeman 1780, but soon abandoned on each of the two latter occasions. There is a *History of Ticonderoga,* by Rev. Joseph Cook (Keeseville, 1858).

**Tid'ball** (John C.), b. in Virginia 1828; graduated at the U. S. Military Academy 1848, when appointed brevet second lieutenant 3d Artillery; served in Florida war 1849–50, in garrison 1850–53, on Whipple's exploration to California 1853–54, on Coast Survey duty 1854–59; thence in garrison and on frontier duty until the outbreak of civil war (Apr., 1861), when ordered to the defence of Fort Pickens. Promoted to be captain 2d Artillery May 14, 1861, he served with his battery at Bull Run (July 21), in the operations of the Virginia Peninsular campaign of 1862, the battles of Antietam, Chancellorsville, Gettysburg, etc. In Aug., 1863, he was appointed colonel of the 4th New York Heavy Artillery, which he commanded in the Richmond campaign of 1864 from the Wilderness to Petersburg. Commandant of cadets at West Point July–Sept., 1864, when, returning to the Army of the Potomac, was in command of the artillery of the 9th corps till the close of the war. Brevetted major, lieutenant-colonel, colonel, brigadier and major-general for gallantry in battle. In Sept., 1865, he returned to duty with his company; promoted major 2d Artillery Feb., 1867.

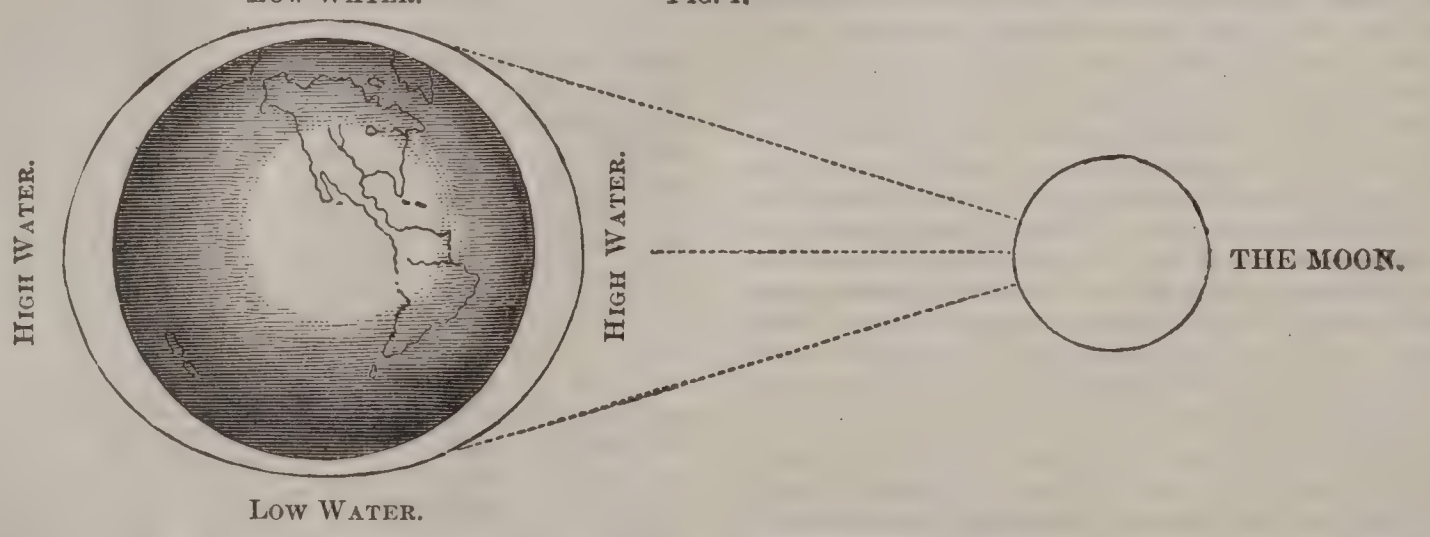
**Tide'-Mill,** an apparatus for the utilization of the water-power of the tide. In some cases, as at the old London Bridge tide-mills, the water-wheels, mill and all, were afloat, so that no adjustment of the wheels to the height of the water was necessary, and the tide was utilized both on its ebb and flow. In other cases dams are constructed which shut the water at high tide, and its outflow through a raceway gives motion to the mill; and during the return of the tide through the sluice its power may again be utilized.

**Tides, Oceanic Waves, and Currents.** The waters of the ocean are subjected to various movements, the effect either of atmospheric or astronomical causes. The principal kinds of movements are known as waves, tides, and marine currents. (For currents, see under Currents, Marine.)

*Waves* are produced by the action of the winds, and vary in their height, form, velocity, and extent, from the gentle ripple to enormous waves of great height, breadth, and volume, which break with violence against any opposing obstacle. These diversities depend upon the force of the wind, the depth of the sea, and the size of its basin, the waves in the open ocean being much larger and moving more swiftly than in the inland seas. After the wind which has disturbed the surface of the water has subsided, the ocean, with acquired momentum, continues to undulate with a movement called the *swell,* which seldom ceases entirely until a fresh storm arouses the waves again to action.

*Tides.*—Those living on the shores of the ocean see its bosom rise and fall regularly twice every day, as by a mighty process of respiration. These movements are tides. For six hours the water rises, or *flows;* then, remaining stationary for a short time, it gradually recedes or *ebbs* for another six hours; after a short lull, called *slack water,* it again rises and falls as before. The rising sea is called the *flood tide;* the receding sea, the *ebb tide.* When the water is at its greatest height, it is *high water;* when at its lowest

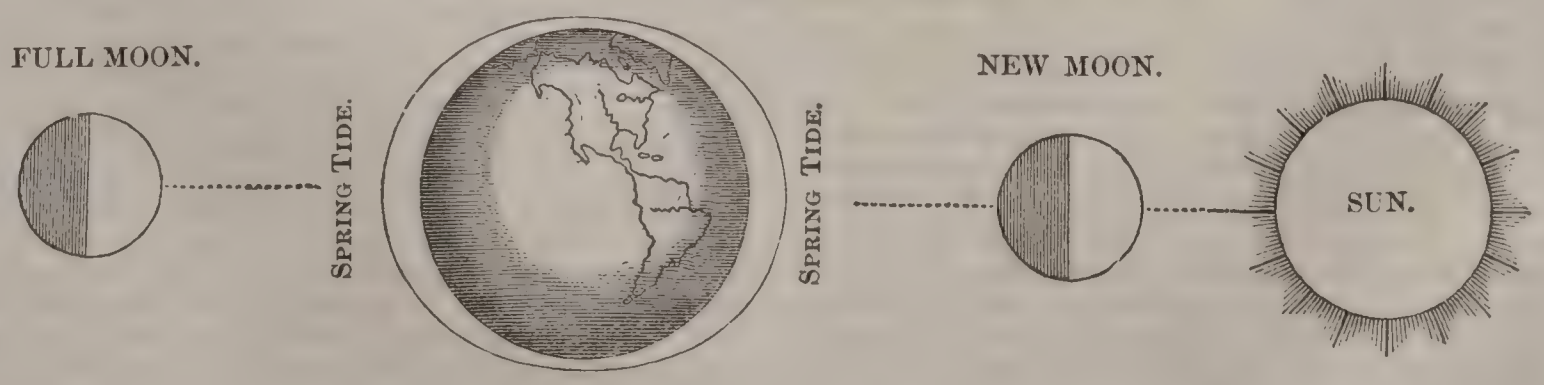
Fig. 1.




point, *low water.* There are thus daily two high tides and two low tides. The time of high water and low water, at the same place, however, is gradually changing. The interval of time between two consecutive high tides or low tides being really twelve hours and twenty-six minutes, the hour of the day at which high water or low water occurs is later every day by about fifty-two minutes.

*Cause of the Tides.*—Though the dependence of the tides upon the course of the moon seemed to point out their source, the real cause of these mysterious movements was not understood before the discovery of the law of gravitation by Sir Isaac Newton. Applying here this new principle, Newton showed that the rise of the waters was due to the attraction of the moon and the sun upon the revolving globe of the earth. As the moon, on account of its proximity, and notwithstanding its smaller mass, has an influence more than double that of the sun (100 to 38), let us consider first its action, which is illustrated by the preceding diagram (Fig. 1). Land and water alike experience this attraction, but the particles of the latter, being free to

Fig. 2.

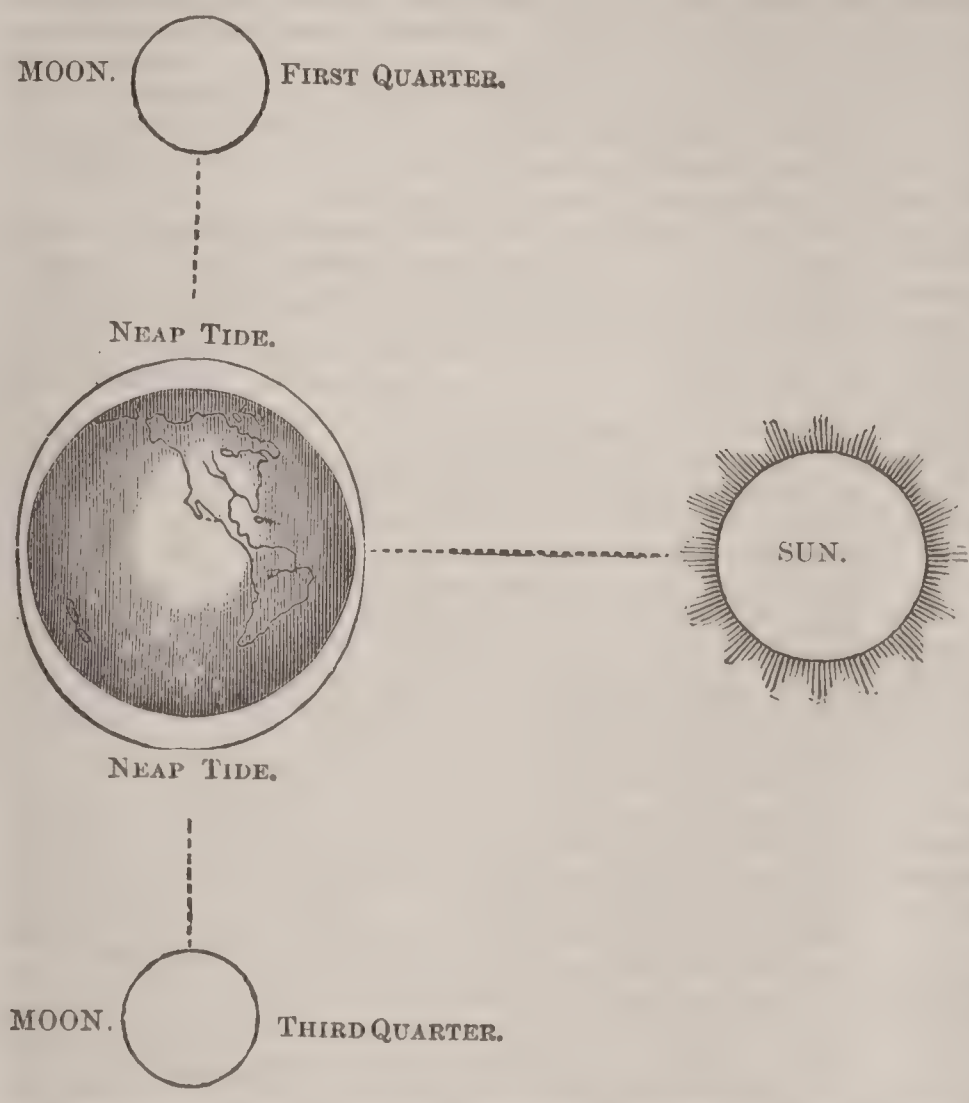



move, are lifted up toward the attracting luminary beyond the normal curve of the surface of the ocean. Thus is formed a vast swell, toward the crest of which the most distant and heavier waters are gathered from both sides, causing there a depression of the surface, or low water. On the opposite side of the globe, the waters being less attracted than its solid mass, on account of their greater distance from the attracting body, are left somewhat behind, as if the solid globe were drawn farther from the surface of the ocean. Another swell is thus produced, directly opposite the first, and occupying, like it, half the surface of the globe. There are thus always simultaneously and directly under the moon two high waters opposite each other, and two low waters at equal distances between them. Owing

to the rotation of the earth, this permanent system of swells and troughs travels from E. to W. over every part of the ocean and of its coast, and explains the regular succession of rising and falling waters, at equal intervals of time, which we call the tides.

*Spring Tides and Neap Tides.*—The sun also asserts its attractive power on the ocean, and causes a similar system of four daily tides. Owing, however, to the great distance of the sun, the solar tides are much smaller, and mostly merged in, or masked by, the lunar tides. As the relative position of the moon and sun is constantly changing, the solar and lunar tides seldom coincide. But twice a month, at new moon and full moon, the sun and moon being on a line with the earth, as shown in Fig. 2, act together, and cause an unusually high water, which is the sum of the lunar and solar tides. These are the *spring tides*. High water is then highest, and low water lowest. When the sun is placed 90° from the moon (Fig. 3)—that is, at the time of the first and third quarter of the moon—its attraction acts against that of the moon, diminishing the height of the high tide and increasing that of low water. These are the *neap tides*. High water is then lowest, and low water highest. The proportion of the rise and fall in the spring tides and neap tides is nearly as 7 to 3. The highest spring tides occur in March, a little before the vernal equinox, and in September, a little after the autumnal equinox, because the sun is then at the equator and nearest to the earth. The lowest neap tides are those occurring at the time of the solstices, in June and December, because the sun is then in a higher latitude and farther from the earth.

FIG. 3.




*Course of the Tidal Wave.*—If the ocean covered the whole earth with a uniform depth of water, the tidal wave, with its long crest extending from N. to S., would follow the apparent course of the moon, and travel from E. to W. around the globe in twenty-four hours. It would be greatest in the equatorial regions, and move there with a velocity of over 1000 miles an hour. But the continents which cut the ocean into several large basins oppose its passage, and in each of these basins the course of the tidal wave is subjected to great modifications. The regularity and velocity of the tidal wave depend upon the size of the basin, the depth of the water, and freedom from all obstacles opposing its progress. Nowhere are these conditions better fulfilled than in the southern half of the Pacific Ocean. There is formed what might be called the parent tidal wave, which, advancing rapidly westward, enters the Indian and Atlantic oceans, and seems to control their tides.

*Co-tidal Lines.* (See CO-TIDAL LINES.)

*Tides in the Pacific Ocean.*—In the middle and equatorial part of the Pacific Ocean the advance of the tidal wave is gradually slackened, and becomes very irregular when broken up by the numberless islands of the East Indian Archipelago. The influence of shallow water, and of friction on the bottom and on the coasts of the ocean, is evident in the slow progress of the tide-wave between New Guinea and Australia, and in the Chinese Sea. Its rapid motion, on the contrary, toward the N. W. in the middle of the North Pacific, shows the influence of deep and open water. Thence, however, the tidal wave ceases to be direct, and assumes the shape of a free reflected wave, which turns N. and E. toward the western coast of the North American continent. In the southern Pacific, while the main tidal wave seems to start on its westward course from the 90th meridian, it sends a reflected wave eastward along the western coast of South America, from which this coast seems to derive its tides. This meets, at Cape Horn, the Atlantic tide coming from the E.

*Tides in the Indian and Atlantic Oceans.*—The tidal wave in both the Indian and Atlantic oceans seems to be but a continuation of the great parent wave from the Pacific. The tides raised directly in these two basins are overpowered by, or merged into, it. Here, also, the course of the wave is mostly determined by the depth of the water and the form of the coasts. Somewhat retarded along the

FIG. 4.



southern coast of Australia, it turns N. with considerable velocity into the deep channel leading to the peninsula of India. Approaching the coast, these waves accumulate, producing high tides in the Gulf of Bengal and the Arabian Sea. Reaching the entrance of the Atlantic Ocean, it passes into that long channel, and moves, at the rate of almost 600 miles an hour, toward the N. W. in the deep trough, 20,000 to 30,000 feet, which runs parallel to the coast of the New World, until it strikes the eastern shores of North America. Thence bending toward the N. E., it gradually lessens its speed to 300 and 200 miles an hour, sweeps over the coasts of Europe, and, turning around the continent, loses itself in the Arctic Ocean.

The course of the tides on the coast of England, in the Channel, and the German Sea, as shown in the map of cotidal lines in that region, here annexed (Fig. 4), illustrates in a forcible manner the retardation of the tidal wave in shallow and narrow seas. The main tide wave in the broad Atlantic moves on, unobstructed, around the British Isles, reaching the Orkneys in four hours, and descends southward along the eastern coast of Scotland before the slackened tide-wave has forced its way through the Channel to Dover Straits. Each wave then continues its course, the first along the English coast, that from the Channel along the coast of Holland, causing high water and low water at different hours on the opposite shores.

*The Age of the Tide.*—This course of the tidal wave shows that the tides of the Indian and Atlantic oceans are not generated in these basins, but are mainly derived from those of the Pacific Ocean. But the tide-wave takes some time to travel over this vast extent. The map shows that in twelve hours the Pacific wave reaches Tasmania; in twelve hours more, the coast of India; another twelve or thirty-six hours brings it to the coast of North America; a few hours more, to the shores of Europe. Therefore the tide on our shores is not the one caused by the last passage of the moon over us, but the one which had its origin thirty-six hours before in the Pacific Ocean, and is, therefore, one day and a half old. It is two days old in London.

*The Height of the Tide.*—The height of the tide depends very much upon local circumstances. In the midst of the Pacific it is scarcely more than from 2 to 5 feet, which may be considered as the natural height of the tide. But when dashing against the land and forced into deep gulfs and estuaries, the accumulating tide-waters sometimes reach a very great height. On the eastern coast of North America, which is directly in the path of the great Atlantic wave, the tide rises on an average from 9 to 12 feet. In the Bay of Fundy, which opens its bosom to receive the full wave, the tide, which, at the entrance, is 18 feet, rushes with great fury into that long and narrow channel, and swells to the enormous height of 60 feet, and even to 70 feet in the highest spring tides. In the Bay of Bristol, on the coast of England, the spring tides rise to 40 feet, and swell to 50 in the English Channel at St. Malo, on the coast of France. It is obvious that differences so considerable in the level of the water will cause strong currents, constantly varying in force and direction with the tide, such as those witnessed in Hell Gate, at the outlet of Long Island Sound into New York harbor. To the same cause may be traced the dangerous whirlpools which have long been celebrated on various coasts. The famous Maelstrom off the Norwegian coast is but a tidal current rushing with great violence between two of the Lofoden Islands, causing a whirling motion, which is reversed at every new tide. So, in the Straits of Messina, are the ill-fated Scylla and Charybdis, so much dreaded by the navigators of old, and many other whirlpools of less celebrity.

*Bore.*—In estuaries into which large rivers flow the struggle between the ascending tidal wave and the opposing current of the stream produces the imposing phenomenon of a huge wave, which, like a moving wall of water, advances with great rapidity and a deep roaring noise up the river, often for hundreds of miles, to the limit of tide-water. This is called the *bore*. In the Hoogly River, one of the main mouths of the Ganges, the bore rushes up the river with great impetuosity. In the Chinese river Tein-Tang it rises to 30 feet in height, and travels at the rate of 25 miles an hour, sweeping everything before it. In the Amazon River, at the time of the equinoxes, bores of 15 feet in height follow each other in quick succession, and within the space of 200 miles five such mighty waves may be seen travelling simultaneously up the river. The Indians, imitating the roaring sound of the bore, call it *pororoca*. (See further CURRENTS, MARINE.) A. GUYOT.

**Tides, Theory of.** See APPENDIX.

**Tidioute′,** p.-b., Warren co., Pa., on Oil Creek and Allegheny River R. R., 160 miles from Pittsburg, has 6 churches, good schools, 1 banking-house, 2 savings banks, and 1 newspaper. The principal industry is petroleum, though the lumber interest is large. Allegheny River is spanned here by a fine suspension bridge. P. 1638.

CHARLES E. WHITE, ED. "NEWS."

**Tieck** (LUDWIG), b. at Berlin May 31, 1773; studied philosophy, philology, and literature at Halle, Göttingen, and Erlangen; returned in 1794 to his native city, and opened his long and brilliant literary career with a number of romances, novels, and fantastic tales, which at once revealed the peculiar romantic cast of his own genius: *Abdallah* (1795), *William Lovell* (3 vols., 1795), *Peter Lebrecht* (2 vols., 1795–96), *Peter Lebrecht's Volksmärchen* (3 vols., 1797); and his contempt for the literature of enlightenment, which was the pride of the eighteenth century: *Blaubart, Der gestiefelte Kater, Franz Sternbald's Wanderungen* (2 vols., 1798), *Phantasien über die Kunst* (1799). From 1799 to 1819 he alternately resided in various German cities—Jena, Munich, Vienna, Frankfort-on-the-Oder, etc.; visited Italy in 1805, and England in 1817; lived in intimate connection with A. W. Schlegel, Novalis, Solger, Rumohr, Steffens, etc., and occupied a very prominent position in the German literature as one of the chief leaders of the romantic school. From 1819 to 1840 he lived in Dresden, where he exercised a considerable and still noticeable influence on the development of the theatre. In 1840, Frederick William III. invited him to Berlin, and gave him a high title and a large pension; and in Berlin he d. Apr. 28, 1853. His works, which as he grew older became deeper and clearer, and entirely free of that mystic excitement and confusion of form which characterized his earlier attempts, comprise a few lyric poems, which are rather weak; several huge dramas, *Genoveva* (1800), *Octavianus* (1804), etc., which are unenjoyable on account of the vagueness of their dramatical form; 12 volumes of novels (Berlin, 1853), which contain some of the most exquisite pictures from present life and history, drawn sometimes with humor, sometimes with positive enthusiasm; one of them, *Dichterleben*, is a sort of biography of Shakspeare. But he exercised, no doubt, the greatest influence by his excellent translations — *Don Quixote* (1799–1801), *Altenglische Theater* (2 vols., 1811), *Shakespeare's Vorschule* (2 vols., 1823–29), etc.; by his editions of Solger's, Novalis's, Kleist's, and others' works, accompanied with critical and historical introductions, and by his *Kritische Schriften* (4 vols., 1848–52), which for range of view, completeness of knowledge, and acuteness of argument rarely find their equals.—His brother, CHRISTIAN FRIEDRICH TIECK (b. at Berlin Aug. 14, 1776; d. there May 14, 1851), acquired a name as a sculptor, and executed several of the busts in the Walhalla.

**Tie′demann** (FRIEDRICH), b. at Cassel, Germany, Aug. 23, 1781; studied medicine, especially anatomy, physiology, and chemistry, at the University of Marburg, and in Bamberg, Würzburg, and Paris; was appointed professor of zoology and anatomy at the University of Landshut in 1806, and in 1816 at Heidelberg, whence he retired in 1849. D. at Munich Jan. 22, 1861. His *Anatomie des Fischherzens* (1809), *Anatomie und Bildungsgeschichte des Gehirns* (1816), *Das Hirn des Negers verglichen mit dem des Europäers* (1837), attracted much attention. He also wrote *Zoologie* (3 vols., 1808–10) and *Physiologie des Menschen* (3 vols., 1830–36).

**Ti′el,** town of the Netherlands, province of Geldern, on the Waal, has several tanneries and breweries and an active general trade. P. 7748.

**Tien-Tsin′,** town of China, province of Pe-Chee-Le, at the confluence of Peking and Yuen-Ling rivers, forms the port of Peking, and was opened to foreign traffic by the Treaty of Peking (1860). It is surrounded with a wall, and although most of its houses are built of mud or sun-dried brick, its streets are well paved, broad, and straight. As the port of Peking it carries on a considerable trade. In 1873 the value of exports amounted to $12,240,602; that of imports to $27,602,314. The population is variously estimated at from 400,000 to 900,000.

**Tierce** [Fr.], a stop in the organ, tuned a seventeenth (or two octaves and a third) above the diapasons.

**Tier′ney** (GEORGE), b. at Gibraltar Mar. 20, 1761, son of a London merchant; educated at Eton and at Peterhouse, Cambridge, where he graduated in law 1784; became a lawyer in London; published a treatise on *The Real Situation of the East India Company, considered with reference to their Rights and Privileges* (1787); entered Parliament 1789; became a leader of the Whigs, and acquired celebrity as a debater and satirist; fought a duel with Pitt May 27, 1798; opposed the war with France; brought forward annually a series of resolutions in opposition to those of the chancellor of the exchequer; was treasurer of the navy 1803–04; secretary of state for Ireland 1806; president of the board of control 1806–07; was the head of the opposition after the death of Mr. Ponsonby in 1817, and was master of the mint

in the administration of Canning 1827–28. D. in London Jan. 25, 1830.

**Tierney** (Mark Aloysius), F. R. S., F. S. A., b. at Brighton, England, in Sept., 1795; educated in the school conducted by the Franciscan Fathers at Baddesley Green, Warwickshire, and at the college of St. Edmund, near Ware; was ordained a Roman Catholic priest 1818. D. at Arundel Feb. 19, 1862. Author of *The History and Antiquities of the Castle and Town of Arundel*, (2 vols., 1834); began an edition of Charles Dodd's *Church History of England, with Notes, Additions, and Continuations*, intended to extend to 14 vols., but left incomplete (5 vols., 1839–43); wrote a memoir of his friend Dr. Lingard, prefixed to vol. x. of that author's *History of England* (1854); wrote for several theological publications; contributed to and edited the volumes issued by the Sussex Archæological Society, of which he was the local secretary.

**Tierra del Fuego.** See Terra del Fuego.

**Tiers État.** See Estates, The Three.

**Tif'fin,** tp., Adams co., O. P. 1858.

**Tiffin,** tp., Defiance co., O. P. 1080.

**Tiffin,** city and cap. of Seneca co., O., on Baltimore Pittsburg and Chicago, Cleveland Sandusky and Cincinnati, and Toledo Tiffin and Eastern R. Rs., and on Sandusky River, 50 miles from its mouth. It contains 13 churches, Heidelberg College, and an excellent system of schools, 3 banks, 4 weekly newspapers, an orphan asylum, several woollen-mills and foundries, stone and tile works, machine-shops, and an agricultural implement factory. P. 5648. John M. Myers, Ed. "Seneca Advertiser."

**Tiffin** (Edward), M. D., b. at Carlisle, England, June 19, 1766; emigrated to the U. S. 1786, settling at Charlestown, Va.; became a Methodist preacher, acting also as a physician; married Mary, sister of Gov. Thomas Worthington, 1789; removed to Chillicothe, O., 1798; was Speaker of the Territorial legislature 1799; president of the Ohio constitutional convention 1802; first governor of the State of Ohio 1803–07; U. S. Senator 1807–09; commissioner of the U. S. land-office 1812–15, and subsequently surveyor-general of the North-west Territory. D. at Chillicothe, O., Aug. 9, 1829. Three of his *Sermons*, preached in 1817, were published in the *Ohio Conference Offering* (1851). A thriving city in Northern Ohio bears his name.

**Tif'lis,** government of Russia, bounded N. by the Caucasian Mountains and S. by Asiatic Turkey. Area, 18,296 sq. m. P. 606,584, consisting of Georgians, Armenians, Tartars, and Russians, who belong partly to the Christian, partly to the Mohammedan religion. The surface is mountainous, covered with branches both from the Caucasian and from the Ararat mountains, several peaks of which rise to 12,000 feet. The soil, of which only a very limited portion is under cultivation, is very fertile in the valleys, and tobacco, cotton, and indigo, wheat and other cereals, grapes, peaches, and all S. European fruits, grow abundantly. Numerous forests of oak, elm, chestnut, and maple yield excellent timber.

**Tiflis,** town of Russia, capital of the government of Tiflis and the centre of the whole Russian territory S. of the Caucasian Mountains, on both sides of the Koor, has some manufactures and carries on an active trade with Persia. In its vicinity are naphtha springs, and thermal springs which are much frequented. P. 60,937.

**Ti'ger** [Gr. τίγρις], the name, derived through the learned tongues, applied to certain quadrupeds. (1) Primarily and of right only it belongs to the *Felis tigris*, one of the largest of living Felidæ, about equal in size and superior in strength to the largest lions, and more destructive and far more dangerous to man. It is peculiar in the development of spreading thick, whisker-like hairs on the sides of the head; its tail is elongate and smooth-haired, and the color is a tawny yellow transversely striped with black. It ranges N. into Southern Siberia, and S. as far as Ceylon and the Spice Islands. E. and W. its habitat extends from Persia to the Pacific. It prefers forests and jungles near river-banks for its abode. It is much dreaded by man, especially in parts of India. The tiger has been frequently induced to hybridize with the lion in captivity. Old tigers sometimes acquire a great fondness for human flesh, and are then called "man-eaters." The hunting of the tiger is a favorite though perilous amusement in Oriental lands. (2) The name is also sometimes applied by hunters to the American Jaguar (*Felis onça*), (which see). (3) It is further transferred in Van Diemen's Land to the striped *Thylacinus cynocephalus*, a carnivorous marsupial. (See Thylacinidæ.)

**Tiger-Beetle,** a name given to the species of coleopterous insects of the family Cicindelidæ, on account of their active, bold, and carnivorous nature. They are distinguished by their large and broad heads, and the very long and formidable falcate jaws, as well as by their long and slender legs. They chiefly affect sunny and sandy places, especially by the shores of streams and lakes. They are unusually swift in their movements, and are therefore difficult to capture. The larvæ is also characterized by large head and formidable jaws. They live mostly concealed in holes near the borders of water, and there lie in wait for their prey, weaker insects which come near. Theodore Gill.

**Tiger-Cat** is a name applied to quite a large number of striped and spotted wild-cats, mostly rather small tropical animals, often arboreal in their habits.

**Tiger-Flower,** the *Tigridia pavonia*, a superb garden-flower of the order Iridaceæ. It is a native of Mexico, and is cultivated for its splendid flowers, each of which endures but for a day, a fresh one sometimes following for many days in succession. The flowers are without perfume.

**Tiger's Fork,** tp., Shelby co., Mo. P. 855.

**Tighe** (Mary **Blachford**), b. in Dublin, Ireland, in 1773; married in 1793 her cousin, Henry Tighe, of county Wicklow, a member of the Irish Parliament; published in 1805 for private circulation her *Psyche*, a poem of remarkable excellence, based on the well-known story of Apuleius. D. of consumption at Woodstock, county Kilkenny, Ireland, Mar. 24, 1810. Her *Works*, which appeared in 1811, have passed through several editions.

**Tiglath-Pileser.** See Assyria, by W. Jacobs, A. M.

**Tigra'nes the Great,** king of Armenia (96–55 B. C.), conquered in his wars with Parthia, Mesopotamia, Assyria proper, and Media Atropatene, and in his wars with the Seleucidæ, Cilicia, Syria, and Phœnicia. But having been involved in war with Rome through his father-in-law, Mithridates the Great, king of Pontus, he was defeated first by Lucullus, who took and sacked his capital, Tigranocerta, and subsequently by Pompey, to whom he had to pay an enormous sum in order to remain in possession of Armenia proper, while Lesser Armenia was given to Dejotarus, and all his foreign conquests either returned to their old masters or were incorporated with the Roman province of Asia. He was succeeded by his son, Artavasdes or Ardavast.

**Tigré,** province of Abyssinia, between lat. 12° and 16° N. and lon. 37° and 40° E., was formerly an independent state until conquered in 1855 by Theodore. Its capital is Adowa, one of the principal stations on the caravan-route between Massorah and Gondar.

**Ti'gris,** river of Asiatic Turkey, rises in the mountains of Koordistan, and after a winding but generally southeastern course of about 1000 miles, it joins the Euphrates at Korna, and forms the Shatt-el-Arab, which enters the Persian Gulf after a course of about 100 miles. The principal places on its banks are Diarbekir, Mosul, and Bagdad, and the ruins of Nineveh, Seleucia, Ctesiphon, and Opis. Along its upper course its banks are lined with fine pastures, visited by the nomadic tribes of the neighborhood. From Diarbekir, where it becomes navigable for rafts and small vessels, to Mosul, its banks are highly cultivated; but a few miles below Mosul, and down to Bagdad, almost all vegetation ceases, and the land on both sides of the river becomes a mere desert. From Bagdad to Korna the banks are steep and overgrown with high reeds and brushwood, which form the haunts of lions and other beasts of prey. The average breadth of the Tigris between Mosul and Bagdad is 200 yards, but its depth, velocity, and breadth vary very much according to season.

**Tikhvin',** or **Tichvin,** town of Russia, government of Novgorod, on the Tikhvinka, which by a canal is connected with the Volga. P. about 5000.

**Til'burg,** town of the Netherlands, province of North Brabant, is the seat of a great cloth-manufacturing industry. Several thousand persons are engaged in this business, but each family has a house of its own, to which belongs a strip of land for the cultivation of vegetables. Printworks, breweries, and soap-factories are also in operation. P. 24,345.

**Til'den** (Samuel Jones), b. in New Lebanon, N. Y., Feb. 9, 1814; graduated from Yale College; studied law at the University of New York, and was subsequently admitted to the bar in that city. He entered early into politics, and for thirteen years was chairman of the Democratic State committee of New York. He was a member of two constitutional conventions (in 1846 and in 1867), and also served two terms in the lower branch of the State legislature, first in 1846, and second in 1872. He took a prominent part in the overthrow of the Tammany Ring, and in 1874 was elected by the Democratic party governor of New York. Nominated by the Democratic national convention, at St. Louis, Mo., June 29, 1876, as candidate for the Presidency. J. B. Bishop.

**Tile** [Fr. *tuile;* Lat. *tegula*], a flat plate of baked clay, used for roofing, for flooring, and for various ornamental purposes in architecture. The more highly-ornamental varieties are called ENCAUSTIC TILES (which see). The earthenware pipes used in the drainage of land are also called tiles. They are of various patterns and sizes, are extensively manufactured by machinery, and are burned in the same way as bricks.

**Tilgh'man** (LLOYD), b. in Maryland 1816; was graduated from the U. S. Military Academy July 1, 1836, when commissioned brevet second lieutenant 1st Dragoons, receiving his full commission to that grade July 4; but without service resigned Sept. 30, 1836, to become a civil engineer, and in that capacity was engaged in the construction of railroads in various sections and of works of public improvement in Baltimore. In the war with Mexico he served as volunteer aide to Gen. Twiggs at the battles of Palo Alto and Resaca de la Palma; commanded a volunteer company Oct., 1846; superintended the construction of the defences at Matamoras in June, 1846; and in command of company of light artillery (Maryland and District of Columbia Vols.) 1847–48. Returning to his profession at the close of the war, he was principal assistant engineer of the western division of the Panama R. R. and chief engineer of several Western railroads in the U. S. He became a general in the Confederate army in 1862, and in Feb., 1862, surrendered at Fort Henry, giving himself up rather than abandon his command; exchanged in July, he served afterward in the South-west, and was killed in the battle of Baker's Creek, Miss., May 16, 1863.

**Tilghman** (TENCH), b. in Talbot co., Md., Mar. 25, 1810; graduated at the U. S. Military Academy in 1832, when appointed brevet second lieutenant 4th Artillery; resigned Nov. 30, 1833. Locating upon the family estate at Oxford, though thenceforward actively engaged otherwise, he devoted his spare time to agricultural pursuits. From 1841 to 1851 was commissioner of State public works, president Talbot Insurance Co. 1846–49, superintendent of military department of Maryland Military Academy 1847–57, U. S. consul at Turk's Island 1849, and same year at Mayaguez; was president (1855–61) of Maryland and Delaware R. R., projected and carried to successful completion by him; also U. S. collector of customs at Oxford 1857–61; was brigadier-general of State militia 1837–60, and major-general 1860–61, when he entered the service of the Southern Confederacy. For many years he was president of the Society of the Cincinnati of Maryland, and treasurer-general of the Society of the U. S. D. at Baltimore Dec. 22, 1874.

**Tilghman** (WILLIAM), LL.D., b. in Talbot co., Md., Aug. 12, 1756, son of James, secretary of the proprietary land-office; removed to Philadelphia in childhood; studied law under Benjamin Chew; practised at the Maryland bar 1783–93, and was a member of the legislature several years; was chief-justice of the U. S. circuit court 1801–02; became president of the court of common pleas July, 1805, and chief-justice of the supreme court of Pennsylvania Feb., 1806; was president of the American Philosophical Society 1824, and published several occasional addresses. D. at Philadelphia Apr. 30, 1827.

**Tilghman's Sand-Blast.** See SAND-BLAST, by G. F. BARKER, M. D.

**Tilgh'manton,** tp., Washington co., Md. P. 1489.

**Tilia'ceæ** [from *Tilia*, one of the genera], a natural order of exogenous trees, shrubs, and herbs, mostly tropical, and allied to Malvaceæ. The well-known basswood and linden trees belong to this order, as do the jute-plant and a number of timber and fruit trees of tropical regions.

**Til'lamook,** county of N. W. Oregon, bordering on Pacific Ocean, and bounded E. by the Coast Mountains, abundantly watered, and having the good harbor of Tillamook Bay; surface mountainous, and covered mostly with spruce forests, but with some small fertile valleys. The rivers abound with fish, and coal and iron have been found. Staples, live-stock, with small quantities of wheat, oats, and potatoes. Cap. Tillamook. Area, 1400 sq. m. P. 408.

**Tillamook,** p.-v., cap. of Tillamook co., Or.

**Tilland'sia** [named by Linnæus in honor of Dr. Elias Tillands, a Finnish botanist], a genus of epiphytic air-plants of the order Bromeliaceæ. There are many species, eight of which are natives of the Southern U. S. Of these, *T. usneoides*, the long or Spanish moss (so called), is the best known. It is abundant in the more humid districts of the South, where it hangs in long festoons from the trees. Its central fibre is extensively used in stuffing mattresses. The plant is used in making an ointment asserted to be a cure for hæmorrhoids, and in winter it is eaten by cattle.

**Tillemont', de** (LOUIS SÉBASTIEN LE NAIN), b. at Paris Nov. 30, 1637; was educated by the Jansenists of Port Royal; studied theology at the seminary of Beauvais; took holy orders in 1672, and became subdeacon at the St. Lambert; retired in 1677 to the monastery of Port Royal, and, when the government closed this institution in 1679, to his estate of Tillemont, between Vincennes and Montreuil, where he d. Jan. 10, 1698. He wrote *Mémoires pour servir a l'Histoire ecclésiastique des six premiers Siècles* (16 vols., 1693–1712), *Histoire des Empereurs et des autres Princes qui ont régné durant les six premiers Siècles de l'Église* (6 vols., 1692–1738). His *Vie de St. Louis* was first published by the French Historical Society (6 vols., 1847–51).

**Til'ley** (SAMUEL LEONARD), C. B., b. in Queen's co., New Brunswick, May 8, 1818, descended from a loyalist family of Massachusetts; received a good English education; settled at St. John's; took an active part in organizing temperance associations; engaged in politics on the temperance issue; was elected to the provincial assembly 1851; became a member of the cabinet and provincial secretary Nov., 1854; resigned May, 1855; again held the same office from July, 1857, to Mar., 1861; was leader of the government 1861–65; was a commissioner to confer with the governments of Canada and Nova Scotia on intercolonial trade and railways 1861, and on the project of confederation 1864; was a delegate to the British government on the railway question 1861–62, and on that of confederation 1866–67; was prominent in effecting the settlement of the latter question, and for several years from the organization of the Dominion government in 1867 was minister of customs in the Dominion cabinet.

**Tillico,** tp., St. Francis co., Ark. P. 733.

**Til'linghast** (JOSEPH LEONARD), b. at Taunton, Mass., in 1791; graduated at Brown University 1819; became a lawyer at Providence; was many years a member of the State assembly, and often Speaker of that body; was chiefly instrumental in promoting improvements in the judiciary and common-school systems, and was a member of Congress 1837–43. D. at Providence, R. I., Dec. 30, 1844. Author of *An Oration on Gen. Greene* (1813), *A Eulogy on Adams and Jefferson* (1826), and other published speeches on political subjects.

**Til'loch** (ALEXANDER), LL.D., b. in Glasgow Feb. 28, 1759; was a practical mechanic, and in 1781 conceived the idea of the production of stereotype plates for printing, and for that purpose entered into partnership with Mr. Foulis, a noted printer in Glasgow, and patents for his invention were taken out. His father was a tobacconist, and for a short time he was engaged with his brothers in that business; but he soon returned to printing, and in 1787 went to London, where he purchased *The Star*, an evening newspaper, which he conducted for more than thirty years. In 1790 he formed a plan for producing bank-notes which could not be counterfeited, but it was not carried into effect. In 1797 he established the *Philosophical Magazine*, which he edited with great success, and just before his death commenced the publication of the *Mechanic's Oracle*, a weekly journal. He was a minister of the sect known as Sandemanians, devoted much attention to the study of the prophecies, and published a volume of *Dissertations introductory to the Study of the Apocalypse* (1823). D. at Islington Jan. 26, 1825.

**Tillodon'tia** [Gr. τίλλειν, to "tear," and ὀδούς, "tooth"], an extinct group of Tertiary mammals, now regarded as forming a distinct order, possessing characters intermediate between carnivores, rodents, and ungulates. In *Tillotherium*, the typical and best-known genus, the skull resembles in shape that of the bear. It is expanded by air-cavities in the frontal region. The orbits are confluent with the large temporal fossæ, which are separated at the middle line of the skull by an obtuse sagittal crest. The nasals are stout, and expanded behind. The dental formula in the adult is incisors, $\frac{2}{2}-\frac{2}{2}$; canines, $\frac{1}{1}-\frac{1}{1}$; premolars, $\frac{3}{2}-\frac{3}{2}$; molars, $\frac{3}{3}-\frac{3}{3}$. The anterior incisors both above and below are large, curved, scalpriform, and faced in front with enamel. They grow from persistent pulps, and strongly resemble the corresponding teeth of rodents. The canines are quite small. The upper molars are peculiar, and the lower are of the palæotherium type. The brain-cavity is small. As in most if not all Eocene mammals, the hemispheres were small, and extended but slightly over the cerebellum or over the olfactory lobes. The latter were large and projected well forward. The hemispheres were evidently somewhat convoluted. The cerebellar fossa is large, expanded transversely, and extends above the cerebral cavity. The vertebræ resemble those of some carnivores: the cervicals were short, the lumbars quite large. The radius and ulna were separate and of nearly equal size. The scaphoid and lunar bones were dis-

tinct. The feet were plantigrade, apparently fitted for digging, and each had five toes. There was a well-marked third trochanter on the femur, and the tibia and fibula were distinct. The best-known species (*T. fodiens*, Marsh) was about two-thirds the size of a tapir. The first known remains of this order were found in Monmouth co., N. J., and described under the name *Anchippodus riparius* by Dr. Leidy. This genus, and even species, is now regarded as identical with *Trogosus castoridens* of the same author, from the Eocene of Wyoming. It is easily distinguished from *Tillotherium* by the presence of a small pair of incisors in the lower jaw between the large scalpriform ones. The systematic relations of these genera were not known until the discovery of *Tillotherium*. A second family of this order is represented by *Stylinodon*, in which the molars are rootless, subquadrate in transverse section, and faced with enamel within and without. *S. mirus*, Marsh, was about as large as a capybara. O. C. Marsh.

**Til'lotson** (John), D. D., b. at Sowerby, Yorkshire, in 1630; was educated at Clare Hall, Cambridge, where he was made a fellow in 1651. He was originally a rigid Puritan, and in 1657 became tutor in the family of Cromwell's attorney-general, but at the Restoration went over to the Established Church, in which he took orders, and became in succession curate of Cheshunt, rector of Keddington, preacher at Lincoln's Inn, dean of Canterbury, prebend of St. Paul's, and finally, in 1691, archbishop of Canterbury, having in the mean while served as clerk of the closet to William III. and as member of the commission appointed in 1689 to revise the English liturgy. He took an active part in measures in opposition to popery, opposed the declaration of Charles II. in favor of liberty of conscience, and was an earnest advocate of the exclusion of the duke of York from the succession. He ranks among the foremost of English preachers; published during his lifetime several volumes of sermons, and left many more in manuscript, and for the copyright of these his widow received 2500 guineas. Several editions of his *Sermons*, in 12 and 14 volumes, were published. His complete works have been published (3 vols. fol., 1707–12, and 10 vols. 8vo, 1820), and many of his sermons have been translated into French and German. D. in London Nov. 22, 1694.

**Til'ly, von** (Johann Tserclaes), Count, b. in the castle of Tilly, near Gemblours, province of Brabant, Belgium, in Feb., 1559; was destined for the Church, being a younger son, and educated by the Jesuits, but preferred the military profession; served under Farnese in the Netherlands, and under Duke Philip Emanuel of Lorraine in Hungary, and was in 1610 appointed field-marshal by Duke Maximilian of Bavaria. When the Thirty Years' war broke out, he was made commander-in-chief of the army of the Holy League; suppressed the insurrection in Bohemia after the battle of Prague, Nov. 8, 1620; conquered the Palatinate; defeated Christian IV. at Lutter-am-Barenberg Aug. 27, 1626; was made commander-in-chief also of the Austrian army after the dismissal of Wallenstein in 1630; stormed Magdeburg May 20, 1630, but was utterly defeated by Gustavus Adolphus at Breitenfeld, Sept. 17, 1631, and again on the Lech, Apr. 15, 1632, in which battle he was mortally wounded. D. at Ingolstadt Apr. 30, 1632.

**Til'sit,** town of Prussia, province of Prussia, on the Niemen, is regularly built, and in a fertile and well-cultivated district. It manufactures cloth, hosiery, oil, paper, chemicals, has several sugar-refineries and important eel and salmon fisheries, and carries on a considerable trade in grain, hemp, flax, wool, and horses. P. 20,251.

**Til'sonburg,** p.-v., Oxford co., Ont., Canada, on Big Otter Creek, 16 miles N. of Port Burwell. It has good water-power, large lumbering interests, and a weekly newspaper. P. about 1000.

**Tilt Cove,** port of entry on White Bay, Newfoundland, 230 miles by steamer N. W. of St. John. It is a picturesque village, and owes its importance to a rich copper-mine which is actively worked. There is also a vein of nickel, occurring in a regular lode; the copper, however, is in pockets or bunches. The harbor is not very good. P. 770.

**Til'ton,** tp., Fleming co., Ky. P. 125.

**Tilton,** p.-v. and tp., Belknap co., N. H., on Boston Concord and Montreal R. R., has a national bank. P. 1147.

**Tilton** (James), M. D., b. in Kent co., Del., June 1, 1745; educated at Nottingham Academy and at Philadelphia Medical School; practised at Dover, Del., until 1776, when he became surgeon to a Delaware regiment, with which he was present at the battles of Long Island and White Plains; was hospital surgeon from 1777 to the end of the war; resumed practice at Dover 1783; served many years in the legislature; was a member of the Continental Congress 1783–85; commissioner of loans 1785–1801; was appointed physician and surgeon-general to the U. S. army 1812; was many years president of the Medical Society of Delaware; published papers on agricultural subjects, on fruit-growing and the curculio, and was author of *Economical Observations on Military Hospitals* (Wilmington, 1813). D. near Wilmington May 14, 1822.

**Tilton** (Theodore), b. in New York Oct. 2, 1835; was educated at the New York Free Academy; entered upon journalism at an early age, and in 1856 was employed upon the New York *Independent*, a weekly religious journal edited by Rev. Henry Ward Beecher; married Elizabeth Richards, himself and his wife becoming active members of Plymouth church, Brooklyn, of which Mr. Beecher was pastor. Mr. Beecher resigning the editorship of the *Independent* in 1863, was succeeded by Mr. Tilton, who in 1871 also became editor of the Brooklyn *Union*, a daily newspaper, both being owned by Mr. Henry C. Bowen. In 1872, in consequence of some disputes, his connection with these journals was discontinued, and he established *The Golden Age*, a weekly journal, which he conducted till 1874. In that year he brought suit against Mr. Beecher, whom he charged with criminal intimacy with his wife, claiming damages of $100,000. The suit lasted six months, and the jury were unable to agree upon a verdict, nine being for the defendant and three for the plaintiff. He was a popular public lecturer, and has published—*The American Board and Slavery* (1860), *Memorial of Mrs. Browning* (1862), *The Fly* (1865), *Golden-Haired Gertrude* (1865), *The Two Hungry Kittens* (1865), *The King's Ring* (1866), *The True Church* (1867), *The Sexton's Tale, and other Poems* (1867), *Sanctum Sanctorum, or Proof-Sheets from an Editor's Table* (1871), *Life of Victoria C. Woodhull* (1871), and *Tempest-Tossed*, a novel (1875).

**Tim'ber,** tp., Peoria co., Ill. P. 1707.

**Timber and Timber Trees.** See Appendix.

**Timber Creek,** p.-v. and tp., Marshall co., Ia. P. 886.

**Timber Creek,** tp., Cowley co., Kan. P. 97.

**Timber Hill,** tp., Bourbon co., Kan. P. 1035.

**Timber, Preservation of.** See Preservation of Timber, by H. Wurtz, A. M.

**Timber Ridge,** tp., Morgan co., West Va. P. 657.

**Timber Trees, Culture of.** See Arboriculture, by J. J. Thomas.

**Timbre,** of the voice. See Voice, by R. R. Raymond.

**Timbre,** of tones. See Acoustics, by Prof. O. N. Rood, A. M.

**Timbs** (John), b. at Clerkenwell, London, England, Aug. 17, 1801; was for some time amanuensis to Sir Richard Phillips, publisher of the *Monthly Magazine*, in which he made his first appearance as a writer; was editor of the *Mirror*, a cheap and popular literary weekly, 1827–38, of the *Literary World* 1839–40, and one of the editors of the *Illustrated London News* 1842–58. D. in London Mar. 4, 1875. Author, among other works, of *Laconics* (1825–26), *The Arcana of Science and Art* (11 vols., 1828–38), *Knowledge for the People* (4 vols., 1831–32), *Year-Book of Facts in Science and Art* (31 vols., 1839–69), *The Illustrated Year-Book* (2 vols., 1850–51), *Things not Generally Known* (7 vols., 1856–57), *School-Days of Eminent Men* (1858), *Anecdotic Biography* (2 vols., 1859–60), *Lives of Wits and Humorists* (2 vols., 1862), *Walks and Talks about London* (1864), *Romance of London* (3 vols., 1865), *Club Life of London* (2 vols., 1865), *English Eccentrics and Eccentricities* (2 vols., 1866), *Nooks and Corners of English Life* (1866), *Wonderful Inventions* (1867), *London and Westminster, City and Suburb* (2 vols., 1867), *Notable Things of our own Time* (1868), *Ancestral Stories and Traditions of Great Britain* (1869), *Abbeys, Castles, and Ancient Halls of England and Wales* (2 vols., 1870), and *Notabilia* (1872).

**Timbuc'too,** town of Soodan, Central Africa, on a branch of the Niger, near the desert of Sahara, in lat. 18° 4′ N., lon. 1° 45′ W. It is in an unhealthy and unproductive district; provisions have to be brought to it from distant places. But for the traffic between Northern and Central Africa it is of great importance, and although it has repeatedly suffered severely from being conquered and sacked by the Moors and by neighboring tribes, it has always risen again, and is still increasing. Dates, European manufactures, firearms, gunpowder, tobacco, and paper are brought here through Sahara, and exchanged for gums, ostrich-feathers, gold-dust, and palm oil. The worst hindrance to a rapid development of its commerce is, at present, the rivalry and jealousy between the English and French merchants. The town is poorly built; it consists mainly of mud huts, and contains few buildings worth noticing. It is surrounded with walls, but the walls are in

bad repair; it has no manufactures. Its inhabitants, numbering about 13,000, are negroes.

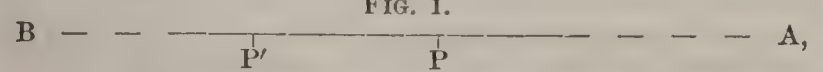
**Time** [Sax. *tima*] has been characterized as that wherein there is room for *events* to *happen*, as in *space* there is room for *things* to be *placed*. "For times and spaces," says Sir Isaac Newton, "are, as it were, the places as well of themselves as of all other things. All things are placed in time as to order of succession, and in space as to order of situation." (*Principia*, Scholium to Def. vii.) So space and duration (out of which latter time is parcelled out) are to be regarded, in accordance with all experience, as *existing relations* of things actual. The limit which occurs *when*, and not *where*, one part or portion of duration ends and another begins, but which does not occupy any portion of duration (does not *last* at all), such a limit is an *instant*. It differs from a moment, which is itself a small but indefinite portion of duration. (The busy and hurried man says, "Wait a moment, and I will attend to you.") The analogy, and yet contrast, in this case being thus perfect, it is not strange that an instant should be designated as "a point of time." The instant is that which marks the present, the *veritable now;* which thus does not last, does not endure. It seems to be in consistency with this that some of the ancient languages have no present tense.

The *practical now* has the characteristic of the moment, enduring while some specific consideration can be held before the mind; as now we are reading and comprehending this sentence. Yet this same practical now must be a sensible fraction of the life of an ephemera, which lasts only for a single day. And it is then quite conceivable that in the case of beings of a far higher order than ourselves the practical now should include a sensible fraction of a whole human life; while to the infinitely supreme Being all that has taken place in history, and all that is anticipated in the future, will be one vast, comprehensive, ever-during *now* ("the Eternal Now").

*Of the Infinity of Space and of Time.*—Space cannot bound or limit itself. It is therefore continuous on all sides, and presents in all directions, as far as it is itself concerned, an inexhaustible emptiness; and thus (viewing the matter from the physical side) we arrive at the *induction* that space is veritably boundless, *absolutely infinite*. In comparison, and also in contrast with this, we must (whatever form of belief we may otherwise cherish) accept the conclusion that *something always was*, since the zero of existence (non-existence) has in itself no energy to produce aught. The great pre-existent must then have been "from everlasting," and in that is *Eternity Past*. Then, as all our experience shows, there will be room for the successive occurrence of events in the duration to come, or in that duration parcelled out or measured—that is, in time to come—to go on or continue always, and that "*for ever and ever;*" and in that we have the characteristic of the *Eternity Future*. Now, it is the combination of both these—of the Eternity that was "from everlasting," and that which is to be "to everlasting"—nothing less than that combination, nothing short of it, that there is constituted for us the *absolute infinite of duration*.

*Comparison of Finites with Infinites.*—If a point P be assumed in a straight line, interminable in both directions (toward A and toward B, Fig. 1),

FIG. 1.




then all that division of the interminable line from P in the direction of A must, in effect, be regarded as being neither greater nor less than the other division of the line extended from P in the direction of B; the two divisions being both in effect terminated at P, but interminable otherwise, though in opposite directions; each division being thus *in effect the half* of the original interminable line. But if a new point P′ be assumed in the same line with P, and at a finite distance from P, *either great or small*, then, reasoning as before, the division toward one side of P′, but interminable in the direction of A, must, as before, be regarded as being equivalent to the division interminable in the direction of B; and so each division, as before, be *in effect the half* of the original line interminable both ways. And yet to one half thus obtained, in comparison with that which begins at P, has been added the distance P′P in the direction of A, and from another has been subtracted that same distance P P′ in the direction of B. It appears, then, that the characteristic of a line terminated in one direction, but interminable in the other, as being in *effect the half* of the line interminable both ways, is not affected by the addition or the subtraction of any *finite* portion of the *so designated half*, be that finite portion *either great or small*. So the finite portion is a *relative zero* in comparison with a line interminable in only one direction, being utterly worthless in the comparison. That it ought to be so will moreover appear from the consideration that a terminated line, *either great or small*, made use of as a measure of the line interminable in only one direction, must, in every instance, be *worthless* for such a purpose, since the continued application of the measure must ever fail to approach (and so never reach) the termination of that which, in the very direction of the advance, is itself interminable.

So in comparison again, and in contrast, the abstraction of either a thousand years or one day from the Eternity Future, to be added to the Eternity Past, will still leave either in effect the half of the absolute infinite of duration extending "from everlasting to everlasting," and thus either a thousand years or one day be alike worthless as a measure of either the past without beginning or the future without end; and thus, at least, "a thousand years be as one day, and one day as a thousand years."

*Of Absolute and Relative Time, and the Measure of Time.*—Says Sir Isaac Newton, "Absolute, true, and mathematical time, of itself, and from its own nature, flows equably, without regard to any thing external" (*Principia*, Scholium to Def. vii. of book i.); and he would make duration to be but "another name" for that; and of duration absolute time is indeed a portion. All experience, moreover, confirms us in the belief that there is room for the like succession of events within the same extent of duration; and that, in accordance with the figurative description already quoted, through the instantaneous present, the Eternity Future, moment by moment (if we estimate it), passes over into the Eternity Past. We recognize this, to some extent at least, in our ordinary language when we say, "When to-morrow comes"—not when we come into to-morrow, time being sometimes regarded as being, even in its mathematical aspect, the only *independent variable*.

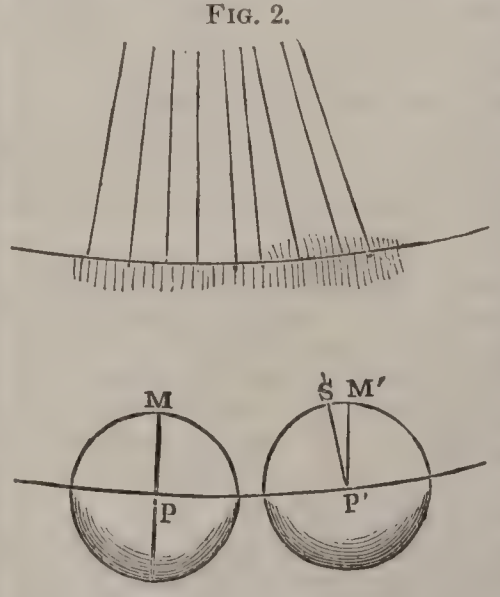
"Relative, apparent, and common time" (continues the same great author already quoted) "is some sensible and external (whether accurate or unequable) measure of duration by means of motion, which is commonly used instead of true time; such as an hour, a day, a month, a year." In its applications, such relative time, when now used, is almost always corrected by an *equation of time;* of which more hereafter.

Next, with regard to the *measures of time*, whether variable or accurate. A suitable measure of time, and withal a natural one, is to be found in the earth's rotation about its axis; which measure will be found to possess the *three requisites* which must belong to every good measure—viz. (1) It must be of suitable size or magnitude; (2) it must be readily accessible, and admit of an easy application; (3) it must, if possible, be invariable.

(1) The *sidereal day* (see MOON) which is completed in the time occupied by the rotation of the earth about its axis will be found to have in itself all these requisites, though our limits will not admit of the exposition of that.

But, admitting what has just been stated, we ought next to ascertain how we are to determine when a globe rotating about its axis, and at the same time transferred in space, has just completed one entire rotation. For this purpose, suppose two entirely similar globes to be placed as in Fig. 2, with the meridian P M of the one parallel to the P′ M′ of the other. Then, if the respective angular velocities of rotation of the globes be equal, the plane P′ M′ of the one will continue parallel to P M, and so at the end of one complete rotation P′ M′ will be found to be parallel to P M in the original position of the latter. Now, if instead of *two* globes, we suppose *one* globe, turning still with the same angular velocity, to have advanced during one rotation from the first of the two positions in the figure to the second, then the meridian P M will be in the position P′ M′, and *itself be parallel* to the position which it had at first. Now, if the plane of P M passed through or coincided with the direction of a fixed star, P′ M′ would also sensibly coincide with the same, since the directions, such as P M and P′ M′, extending to the same fixed star, would be sensibly parallel. And so between two successive transits of the same fixed star would be accurately accomplished one complete rotation and also one *sidereal day*.

FIG. 2.



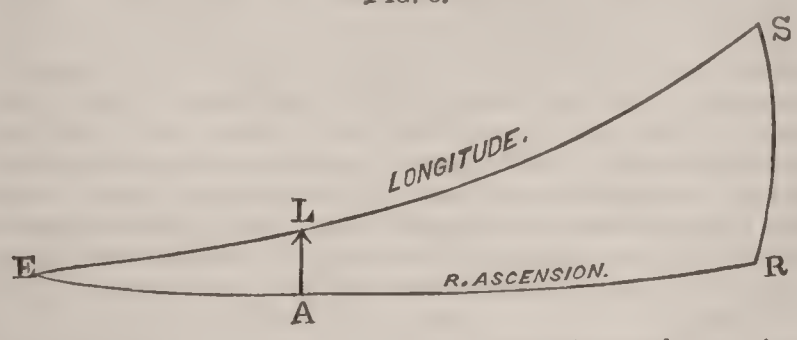

The sidereal day of astronomers begins when the vernal

equinox is on the meridian of the place of observation. As the position of the vernal equinox is affected by the very slow change due to the precession, this practical sidereal day is the veriest trifle less than the true. Moreover, the position of every terrestrial meridian is also very slowly changed, and the precession not quite that due to a uniform change. But all would make a difference in the observed time of but little more than one second in nineteen years, and therefore no correction is made for it, the whole being understood. The apparent rotation of the heavens being due to the actual rotation of the earth, it will, like the latter, be isochronous in the whole and in all its parts, which all the observations of *sidereal* time justify.

*Of Solar Time, Mean Solar Time, Apparent Solar Time, and the Equation of Time.*—If, as in Fig. 2, P M be, at any instant, the meridian, the plane of which passes through the visible place of the sun (affected by aberration), then to all places of which P M is the meridian, to which the sun is visible, the time will be that of *apparent* noon. Between that and the next succeeding noon the earth will have moved from P to P′ (the extent of the motion being here exaggerated). Before this (in accordance with what has been heretofore demonstrated), a sidereal day will have been accomplished, the meridian having in that period arrived at the position P′ M, *parallel* to its first position, P M. But in order that the plane of the same meridian should a second time pass through the apparent place of the sun, P′ M′ must rotate still farther until it arrives at the position P′ S, and then, and not before, will be completed the *apparent solar day*. The time meted out by these motions is *apparent solar time*. Now, the arc M′ S in the plane of the earth's equator is (on a small scale) an arc of *right ascension*, and P P′, in the same plane, measures, on the large scale, the motion of the earth in its orbit, also in *right ascension;* and the angle at the sun measured by P P′ is the alternate angle to M′ P S. Hence the angular excess of motion M′ P S above a whole rotation, between one noon and the next, is itself equal to the angular motion of the earth (orbital motion, that is) in *right ascension* in the same interval. Now, as will be demonstrated, the angular motion of the earth in right ascension from day to day is *variable*. Hence, although the earth's rotation is isochronous, the solar days must be unequal. But by combining a great number of them (comparing them with sidereal time), and then dividing by the whole number, we obtain the average or *mean solar day*.

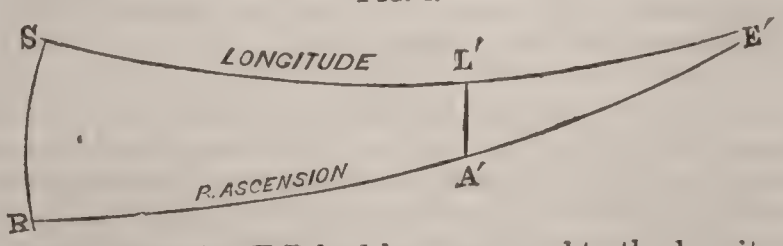
There are two principal causes of the variation in the daily increment of the earth's right ascension. One of these is obliquity of the ecliptic (earth's orbit) to the equinoctial. Did the earth's motion around the sun take place in a circle, and if that motion itself were uniform, even then the motion in right ascension would be variable; for

FIG. 3.




then, although the motion in longitude from the equinox E (Fig. 3) would in one quarter of a year amount to 90° or E S, and the motion in right ascension, E R, be also 90°, yet as respects any intermediate point L the right ascension E A would be *less* than the longitude E L. The effect of this from day to day (the gain in right ascension being less than the average) would be to make the *excess* above a whole rotation to make out a solar day *less* than the *average*, and so the solar day be made *too short* for the average, or time *too fast;* so that, if the earth even revolved uniformly around the sun, solar time would be too fast from the equinox onward to the solstice, the difference, after a while, however, becoming less and less, until at the solstice

FIG. 4.




the right ascension E R had become equal to the longitude. In going *from* the solstice *to* the next equinox, the earth going through the arrangement such as would belong to Fig. 3 turned from right to left, with E at the farther end, the differences in question would take place in inverse order; and (as in Fig. 4) the arc E′ A′ of right ascension being *less* than E′ L′, that of longitude; if each be subtracted from 90°, we shall have R A′ *greater* than S L; or the motion in right ascension, in going *from* the solstice *toward* the equinox, will be *greater* than the motion in longitude, instead of *less*, as was true in the going from the equinox toward the solstice; though 90° will be completed in longitude as well as at right ascension at the equinoctial point E′.

The summing up of this is, that in consequence of the motion of the earth in an orbit oblique to the plane of the earth's equator (and therefore also to the equinoctial) solar time would be made *too fast*, as the earth was going from *the equinox toward the solstice*, this variation being, however, exactly overcome at the end of the one quarter of the year, when the earth would arrive at the solstice. But in going from the solstice toward the next equinox, the effect of the earth's oblique motion would be to make solar time at first *too slow*, as the earth was *going from the solstice toward the next equinox; this* variation also to be overcome at the end of the one quarter of a year, when the earth would arrive at the next equinox; and the right ascension of the earth thus be the same *at the equinoxes and at the solstices* as it would be if the earth had moved *uniformly* in the plane of the equinoctial, and so had kept mean time. Solar time would thus be *right* when the earth was at either of the equinoxes or of the solstices, while *between any equinox and the succeeding solstice* solar time would be *too fast;* but between any solstice and the succeeding equinox solar time would be *too slow*, there being four *instants* (viz. at the equinoxes and at the solstices) in the course of the year at which solar time, kept by the earth's motion, would be right, with four intervening intervals within which time thus kept would be alternately *too fast* and *too slow: four* intervals for the second half of the year would repeat the effects of the first.

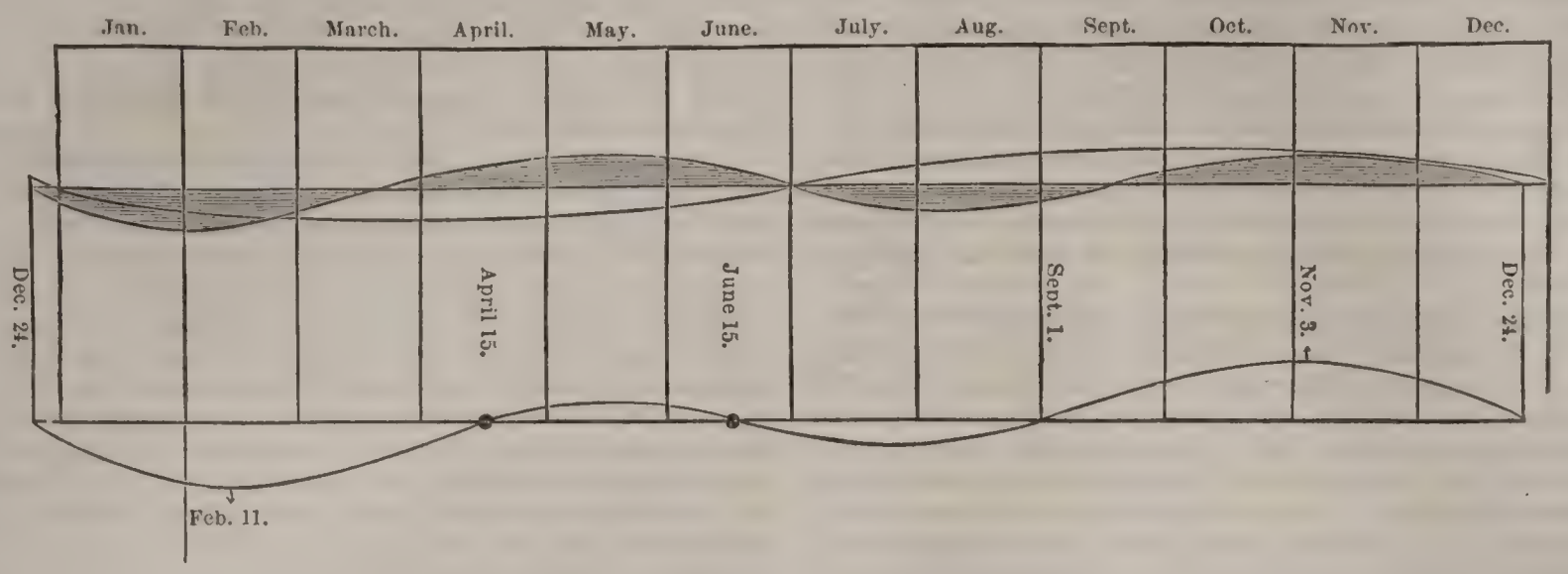
But the earth does not revolve around the sun uniformly in a circle, but in an ellipse, with a variable angular motion. (See PLANET.) Yet the *one-half* of the revolution in the ellipse, from the perihelion P (or place *nearest the sun*) to the aphelion A (or place *farthest from the sun*), is accomplished in the same time with the other half revolution (from A to P); and either the same time in which a body moving in a circle at the distance C A (*i. e.* one-half of A P) would describe its half circumference. In going, then, from P to A, the earth at first moves *faster* than the average, and so makes the arc M′ S in Fig. 2 (necessary to complete the solar day) *too large;* the day is thus made *too long*, and solar time thereby *too slow*, through the *half year* while the earth is passing from P to A (*i. e.* from about the 1st of January to about the 1st of July); the reverse being true, time made *too fast*, from the beginning of July to January (*i. e.* for the *other half* of the year), the positions at P and A, notwithstanding, being those at which the earth would be if it revolved in a circle uniformly at the mean distance A C, which is the one-half of P A. We have, then, from this cause (considered by itself), but *two instants* at which the irregularity in solar time disappears, and those *half a year* asunder, instead of *one quarter of a year*, as in the instance of irregularity due to obliquity, and the half-year periods beginning and ending at dates different from any of the *four dates of time right*, as respects *obliquity*.

Other small irregularities in the earth's elliptical motion, arising from her connection with the motions and also the perturbations of the planets, slightly modify the results of that motion as to solar time here described.

In Fig. 5 the variations from both causes now described are artificially represented, the bolder curve representing the effect of the obliquity, with the wave *above* the horizontal line when time is *too fast*, the height of the wave at any date indicating proportionally how much too fast. The *hollows* of the waves at their several dates indicate time too slow, the depth of the depression indicating, proportionally, how far too slow; the four dates at which time would be neither too fast nor too slow from this cause being at the points of intersection at the equinoxes and solstices, as heretofore shown. The *lighter curve*, after a like fashion, indicates the effect of the elliptical shape of the earth's orbit, time being represented as thereby made too slow by the hollow of the wave extending from the beginning of January to the beginning of July. Now, the sum or the difference, as the case may be, of the perpendicular heights and depressions (positive and negative *ordinates*)—*i. e.* the combined effect of both causes—is marked by means of the third curve immediately beneath the others. On this it will be seen that the considerable effect of time too fast due to the obliquity on the *15th of April* is balanced by the effect of time too slow due to the elliptical; and so time then is right. The small remaining effect of time too fast from the obliquity is balanced by the time too

slow of the other cause, on the *15th of June*. Between these two dates there is everywhere manifest no very great *excess* of time too fast. From the *15th of June* to the *1st of September* the outstanding difference apparent is everywhere small, but it is that of time too slow. From the 1st of September to the 24th of December the two causes com-

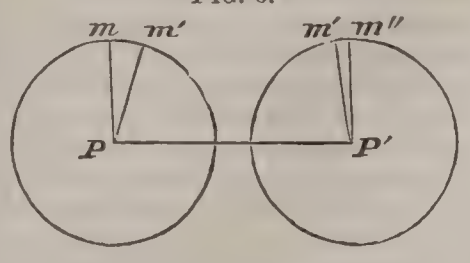
FIG. 5.




bine to render time too fast, and from the 24th of December to the next 15th of April the two causes combine to render time too slow.

It remains to be seen how we shall determine the value of these results; that is, the *extent* of variation from *mean time—i. e.* the *equation of time*—and with this, and in order to it, from what limits mean time is to be reckoned. If, as in Fig. 2, M′ S represent the excess above a whole revolution required to complete a mean solar day—which angular excess is measured, *on the large scale*, by the arc P P′ with its centre at the sun—then in the 24th part of a mean solar day this excess so measured by the earth's motion in right ascension will be the 24th part of P P′, or, in arc, also the 24th part of M′ S. As, then, a whole mean solar day will consist of the time required to describe an entire rotation, + the time of describing M′ S, so in 1 *mean solar hour* the time required will be that of describing $\frac{1}{24}$th of a whole rotation (*i. e.* $\frac{1}{24}$th of a *sidereal* day), together with the *sidereal time* required to describe $\frac{1}{24}$th of M′ S. If, then, a terrestrial meridian such as P *m′* (Fig. 6) be 15° of terrestrial longitude to the W. of P *m*, and the plane of P *m* pass through the apparent position of the sun, then in the $\frac{1}{24}$th part of a mean solar day (1 mean solar hour) the rotation of the earth will not only transfer P *m′* through the 15° belonging to 1 *sidereal* hour, and bring the western meridian to the position P *m″* (parallel to the original position of P *m*), but also (in the completion of the 1 hour of mean solar hour) the arc of excess due to the earth's motion meanwhile in right ascension, and which (on the large scale) is measured by P P′; so that at the end of the entire 1 hour of *mean solar time* the 2d meridian will have arrived at the P′ *m′* in a direction *then* passing *through the sun*, as did the meridian P *m* at first. It appears, then, that a *difference of 15° in terrestrial longitude will require a difference of 1 hour in time*, whether the time in question be *mean solar* or it be *sidereal time*.

FIG. 6.




Having thus ascertained in what measure as to time angular difference of position of meridians is to be interpreted, and having ascertained what would at any given time be the angular position of a given meridian with regard to the sun if the earth moved uniformly in right ascension in the plane of the equinoctial, and the actual angular position of the same meridian with regard to the sun in consequence of the earth's veritable motions (reckoned like the other in right ascension), the difference between these two, transformed into time measurement, at the rate of 15° to an hour, will be the *equation of time*.

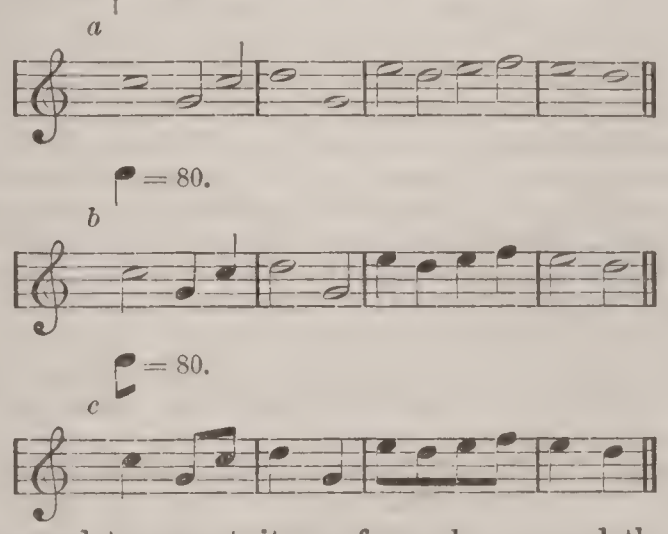
Fig. 5, in its third curve, represents the relative value of the equation of time at any date during the year, as well as the character of the equation as either fast or slow, or else zero, in comparison with mean time. The greatest equation of time fast (by the combination of the two causes of variation), as the figure indicates, occurs about the 2d of November, the sun being then too fast by almost 16m. 20s.; and the greatest equation of time slow about the 12th of February, when the sun is very nearly 14½ minutes too slow. The dates of no equation are about the 15th of April, 15th of June, 1st of September, and the 24th of December, as heretofore explained.

*Of Local Time, and the Day of the Week correspondent to the same.*—These may be best illustrated by an example in the determination of an answer to what has been esteemed a puzzling problem—viz. if we could advance westward so rapidly as to keep it always noon, when should we pass from one day of the week into another (suppose from Wednesday into Thursday)? With regard to this, it seems to have been usually forgotten, or else overlooked, that before it can be accurately determined *where* Wednesday will *end* we ought to find out where Wednesday is to *begin*. To determine this, it will be necessary to *fix upon* some meridian. And then reckoning from that meridian continuously *westward*, the local time will be found more and more *behind* that of the first meridian, until at last, in lon. 180° W., the local time will be found to be 12 hours behind that of the first meridian. But reckoning from the same first meridian continuously *eastward*, the local time will be found to be more *in advance* of that of the first meridian, until at last, in lon. 180° E., the local time will be found to be 12 hours *in advance* of that of the first meridian. In passing across the meridian in lon. 180° from the first meridian, we should therefore pass from the region of time *behind* that of the first meridian to time *in advance* of the same, or *vice versâ* when proceeding in the opposite direction. In the case supposed it would therefore be on passing lon. 180° from the W. that we should pass from Wednesday into Thursday, and in no other longitude whatsoever. (See also YEAR.) S. ALEXANDER.

**Time.** In music, every sound, and every rest or intermission of sound, necessarily occupies some portion of time. The duration of such sound or rest is not absolute, but relative—*i. e.* it is not measured by clock-time, but depends upon the rate or speed assigned to any piece of music by the composer or performer. When that rate is once determined, then the duration of each individual note or sound is also determined, as would be the case with the minutes and seconds of a clock if its rate of motion were subject to change. Notes and rests represent portions of time in the order of 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, etc. If the duration of the semibreve should be equal to 8 seconds of time, then the minim would occupy 4 seconds, the crotchet 2, the quaver 1, and so on. And if the duration of the semibreve should be arbitrarily fixed at more or less than 8 seconds, the shorter notes must all conform and preserve their relative proportions. This is the simplest and most elementary office of time in music. (See LARGE and NOTATION.) Notes written in a continued series, without any regular divisions or periodical accent, would be unmeaning and unfit for the expression of musical sentiment and beauty, except in very rudimentary forms. Regularity of time, accent, and rhythm is at the foundation of all excellence in modern music, and its absence is one chief cause of the dreary and formless character of the music of the ancients. All regular music is therefore now written in regular periods, phrases, etc., with smaller divisions into measures or bars. These measures are of several kinds, representing various styles of movement and peculiarities of accent, the leading idea being that musical sounds have a natural tendency to fall into rhythmical groups of equal duration, and that these groups may be reduced into two classes, the one consisting of two or four times in a bar, and the other of three. (Of the nature, origin, and object of these divisions or bars much explanatory matter has already been given in the article MEASURE, to which the reader is referred.) We proceed to notice some further points necessary to a full comprehension of the subject. Regularity of time is an essential element in all grades of musical composition. There is a certain degree of interest created in the mind even by the repeated strokes of a drum when marked off into groups by a periodical accent. In such a case there is no diversity of musical sound, but yet the mind receives pleasure from

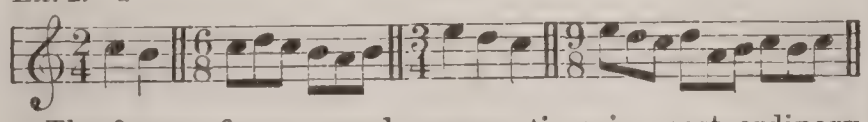
the mere marking and recurrence of equal times. A succession of such equal times will (as said above) naturally fall into groups of twos or threes, or, in technical language, it will be duple or triple, binary or ternary. Other distinctions, as imagined by musicians of the last century, are unreal and have no philosophical basis. The reduction of all musical times into the two genera of duple and triple, says a writer, "would long ago have been recognized had music made advances equal to other arts and sciences." Duple or *common* time (embracing also the quadruple) contains two or four equal times in a bar, with the accent on the first part of each bar, and (in the latter) an inferior accent on the third time. In ordinary common time each bar contains a semibreve, or shorter notes unitedly equivalent to it in value. It is known by a large C at the clef, with or without a stroke drawn through it. In church music this time is often written with two semibreves or four minims in a bar. The figures $\frac{2}{4}$ indicate another mode of writing common time, every bar containing *two-fourths* (or the half) of a semibreve. These kinds of common time are essentially one. The ear can detect no difference between them if in performance a bar of one is made equal to a bar of the other in *velocity*. Thus, the strain variously written at *a*, *b*, *c* in Ex. 1 might be played by three instruments simultaneously without the least difference being perceptible even to the most critical ear:

Ex. 1.—MM 𝅗𝅥 = 80.




In regard to accent, it was formerly assumed that in a bar with four equal times the first only of those times was accented, and in a bar of two equal times the first was accented and the last unaccented. In actual practice, however, this nice distinction vanishes. Albrechtsberger remarks that the difference between these two times is not a real one, as "a bar of four crotchets or beats is really only a double bar of two-crotchet time." *Triple* time contains three equal times in each bar. Like common time, it may be written in minims, crotchets, or quavers, and marked as $\frac{3}{2}$, $\frac{3}{4}$, and $\frac{3}{8}$, which figures give the time-value of each bar as compared with the semibreve. In old collections of music, pieces may be found in $\frac{3}{16}$ time, each bar containing only three semiquavers, or their value in other notes or rests. *Compound* time is a modification of the above simple times, produced by a mingling of the triple element with the duple or quadruple; as when the two crotchets of a bar in two-four time are turned into two groups of three quavers each, or when the same process is applied to a bar in three-four or any other triple time. (See Ex. 2, at *a* and *b*.)

Ex. 2.—*a* *b*

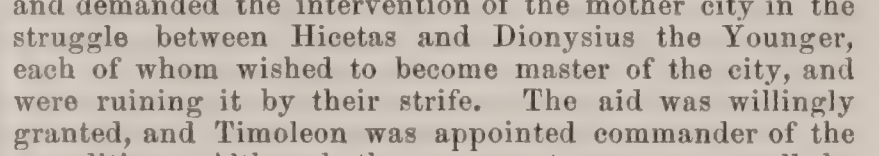


The forms of compound *common* time in most ordinary use are $\frac{6}{4}$ and $\frac{6}{8}$, the former having six crotchets (or their value) in each measure, and the latter having six quavers (or their value). The times marked $\frac{12}{8}$ (twelve quavers) and $\frac{12}{16}$ (twelve semiquavers) are less frequently used by modern composers. The forms of compound *triple* time are chiefly $\frac{9}{4}$, having the value of nine crotchets in each measure, and $\frac{9}{8}$, with the value of nine quavers. In the writings of the old masters, and even as late as the time of Beethoven, we find several other varieties of time (and various modes also of indicating the times already described), such as the following:

$\frac{2}{1}$, $\frac{2}{8}$, $\frac{3}{1}$, $\frac{4}{2}$, $\frac{4}{4}$, $\frac{4}{8}$, $\frac{4}{16}$, $\frac{6}{16}$, $\frac{9}{16}$, $\frac{12}{4}$.

Much of the difficulty attending the study of musical time would disappear if it were borne in mind that the *ear*, and not the *eye*, is the proper judge in all questions of this nature. There are indeed certain reasons of *convenience* for writing common or triple time in four or five different modes, but the *ear* infallibly reduces them all to one, provided that they all proceed at the same rate. Everything, in fact, depends on velocity, for in an *adagio* in two-crotchet time every *quaver* may equal in duration a *minim* in moderately quick or four-minim time. The ear knows only one kind of common time; and the most experienced musician cannot detect a difference between the groups at *a*, *b*, *c*, and *d* in Ex. 3 when performed at the same speed:

Ex. 3.—*a* *b* *c* *d*



That the same remarks will apply to the various forms of *triple* time will need no demonstration. They are various only to the *eye*, but are recognized by the *ear* as essentially one. It is probable also that musical science will before long cease to recognize the minute and almost imperceptible distinctions which composers of a former age thought to exist between the several cognate forms of compound times, such as $\frac{6}{8}$ and $\frac{12}{8}$, etc.; for, though differences of accent may be alleged, yet these are apt to disappear in actual practice, so that a bar of twelve-eight time is hardly distinguishable from two bars of six-eight. Whether all compound times whatever may not prove to be mere developments of the triple germ, and to be nothing more than rapid iterations of triple-time measures, is a subject worthy of investigation by those who prefer simplicity to useless distinctions. WILLIAM STAUNTON.

**Time,** in philosophy. See SPACE, by W. T. HARRIS.

**Time-Signals.** See APPENDIX.

**Times Presses.** See PRINTING, by W. S. PATERSON.

**Times, The London.** See WALTER (JOHN).

**Tim'monsville,** p.-v., Thomas tp., Darlington co., S. C., on Wilmington and Manchester R. R., has a weekly newspaper. P. 477.

**Timo'leon,** a native of Corinth and a member of one of the most prominent families of the city; put to death his own brother, Timophanes, who attempted to overthrow the democratic constitution of their native city and make himself tyrant. The date and details of this deed are variously given by Diodorus, Plutarch, and Cornelius Nepos, but the fact itself is unquestionable. In 344 B. C. an embassy arrived from Syracuse in Sicily, a colony of Corinth, and demanded the intervention of the mother city in the struggle between Hicetas and Dionysius the Younger, each of whom wished to become master of the city, and were ruining it by their strife. The aid was willingly granted, and Timoleon was appointed commander of the expedition. Although the armament was very small, he succeeded in expelling both Dionysius and Hicetas, established a democratic constitution, repeopled the city, and brought it in a very short time into a most flourishing state. This excited the jealousy of the Carthaginians, and under the command of Hasdrubal and Hamilcar they sent an army of 80,000 men against Syracuse, but Timoleon, although his force numbered only 12,000 men, attacked them while crossing the Crimissus, routed them completely in 339 B. C., and a treaty was concluded by which the Halycus was fixed as the boundary between the Greek and Carthaginian dominions in Sicily. He also expelled Hicetas from Leontini, and Mamercus from Catana, introducing free constitutions in all the Greek cities of Sicily. The last years of his life he spent in retirement in Syracuse, living as a private citizen, though enjoying the greatest fame and honor throughout the Greek world. D. in 337 B. C., and an annual festival was instituted in Syracuse in honor of his memory.

**Timoor.** See TIMUR.

**Timor',** an island of the Malay Archipelago, the largest of the chain which stretches eastward from Java, is between lat. 8° 16′ and 10° 25′ S., and between lon. 125° 25′ and 127° 10′ E. Area, 8820 sq. m. P. estimated at 200,000. It is traversed from E. to W. by a range of lofty mountains, which everywhere show marks of volcanic agencies; earthquakes are frequent. Along the shore are very fertile and densely-peopled districts, in which rice, sugar, indigo, papaw, sago, pineapples, and cocoanuts are cultivated. Buffaloes, oxen, pigs, and fowls are plentiful; turtles, pearl-oysters, and elegant coral are found along the shores; gold-dust and timber are exported. The inhabitants are partly Malayans, partly Oceanian negroes, and as the population belongs to two different races, in the same manner the fauna and flora of the island belong to two continents, to Asia and to Australia. The Dutch have a residency, Koepang, in the south-western part of the island; the Portuguese a port, Dilly, in the north-eastern.

**Timor'-Laut,** or **Tenimber Islands,** is a group of islands belonging to the Malayan Archipelago, and lying E. of Timor. Their area is estimated at 3150 sq. m.; their population at 15,000. The larger ones, Timor-Laut and Larat, are volcanic; the smaller of coral formation. Birds

are very numerous and very brilliant on these islands, especially the cockatoos.

**Tim′othy,** or **Herd's Grass** [reputed to have been named from Timothy Herd, who introduced its culture in the U. S.], the *Phleum pratense*, one of the best of forage-grasses, a native of Europe, is much cultivated there and in the U. S. (In Pennsylvania, etc., the red top, *Agrostis vulgaris*, is called herd's grass.) Timothy will not stand close pasturage, but affords fine crops of the best of hay. Others say that it was named from one Timothy Hanson, who took it to England from New Hampshire about 1780; still others, that a Quaker named Timothy sent the seed from Durant's Neck, N. C., about 1662, to England. Both traditions are doubtless incorrect. It is a native European, not an American, grass.

**Tim′othy** [Gr. Τιμόθεος, "one who honors God"], a disciple and companion of Paul, b. at Lystra or Derbe in Lycaonia, Asia Minor, probably about 20 A. D., the offspring of a mixed marriage between a Greek and a Jewess; was carefully trained in a knowledge of the Jewish Scriptures by his mother Eunice and his grandmother Lois, who were Christians, but was not circumcised until Paul in his second missionary journey selected him as a companion. He became the most constant and devoted of Paul's numerous fellow-workers; was regarded by him with truly paternal affection, and employed as "the messenger of the churches," as the apostle's "other self," in the execution of the most responsible spiritual commissions, and was doubtless his amanuensis in the preparation of most of the Epistles, his name being associated with Paul's, in a manner to suggest some degree of joint authorship, at the head of the Second Epistle to the Corinthians, those to the Philippians and Colossians, and the two to the Thessalonians. Whether he shared in the voyage to Italy is uncertain, but he afterward appears at the side of Paul while a prisoner at Rome, and finally as overseer of the important church at Ephesus, where Paul addressed him two canonical Epistles. His later history is unknown, as the tradition of his martyrdom under Domitian rests upon no evidence. Since the time of Schleiermacher a large number of German commentators have been inclined to regard him as the author of the book of the Acts, or, at all events, of the personal narrative in the second part, characterized by the use of the formula "we" in narrating the journeys of Paul. The absence, however, of all evidence that he was a companion of Paul's voyage and shipwreck, and especially a comparison of Acts xx. 4 with the following verse, seem decisive against this hypothesis, it being more probable that Titus (which see) was the writer of the itinerary in question. In the later period of his career we learn from the Epistle to the Hebrews (xiii. 23) that Timothy had been in prison, had just been released, and the subscription of that Epistle states that he was its bearer, but from whom, whence, and whither have been much debated, many modern critics inclining to the opinion that it was written by Apollos from Rome to the Hebrew portion of Timothy's churches at and near Ephesus. Timothy was identified by Calmet, Tillemont, and others as the "angel" or messenger of the church of Ephesus to whom the message of Rev. ii. 1–7 was addressed, but this theory is apparently not now held. PORTER C. BLISS.

**Timothy, First and Second Epistles to,** two short canonical books of the New Testament, addressed by Paul to Timothy as first overseer of Ephesus, the former from Laodicea, the latter from Rome, according to the (unauthentic) subscriptions. They are both chiefly occupied with instruction in the duties of a spiritual teacher, mingled with some admonitions of a personal nature and some references to Timothy's personal history; and the Second Epistle is endowed with a peculiar interest from its references to Paul's anticipated martyrdom, this being probably the last extant production of his pen. With the similar letter to Titus they constitute the so-called "Pastoral Epistles," the genuineness of which was denied by the Gnostics of the second century, and has been one of the problems most vehemently debated by German theologians of the present century. The controversy was practically begun by Schleiermacher, who, admitting the genuineness of Second Timothy and of Titus, attacked the First Epistle on the ground that its contents are all derived from the two companion Epistles, and that it presupposes a developed system of church government quite foreign to apostolic times. Eichhorn and De Wette quickly extended the range of the second argument, denying the genuineness of all the Pastoral Epistles. Other writers, especially Baur and Ewald, reinforced this argument by alleged differences of style and vocabulary from the admitted Pauline Epistles, but especially by the difficulty of fitting the data of Second Timothy into any consistent scheme of the life of Paul, it being impossible, according to them, that the journey in Asia there alluded to could have been made either before or after Paul's imprisonment at Rome. The defenders of the Epistle reply to the latter argument by maintaining a second imprisonment of Paul at Rome. (See especially the commentaries of Ellicott, Huther, and Oosterzee, the latter in Lange's series, New York, 1868.)

PORTER C. BLISS.

**Tim′perley** (C. H.), b. at Manchester, England, about 1794; entered the army, and was wounded at the battle of Waterloo; resumed his early occupation of engraver and copperplate printer, and in 1821 became a letter-press printer; wrote *Annals of Manchester*, *Printer's Manual* (1838), *Dictionary of Printers and Printing, with the Progress of Literature, etc.* (1839; the second edition of 1842 includes the two last works), *Songs of the Press, and other Poems relative to the Art of Printers and Printing* (1845). D. about 1848.

**Tim′rod** (HENRY), b. in Charleston, S. C., Dec. 8, 1829; studied for a time at the University of Georgia, but did not graduate; became a teacher, studied law, and contributed verse to various periodicals, and during the civil war wrote several stirring war-lyrics. In Jan., 1864, he became editor of the Columbia *South Carolinian*, which was discontinued after the conflagration of the city in Feb., 1865, by which he suffered severely. He subsequently took up his residence in Charleston, where he suffered from ill-health and pecuniary embarrassments. D. at Columbia, S. C., Oct. 6, 1867. A collection of his poems was published in Boston (1860), and an enlarged edition, with a *Memoir* by Paul H. Hayne, in New York (1873).

**Timuquans,** an extinct tribe of Indians of the Choctaw family, formerly occupying the coast of Florida N. of St. Augustine. Missions were maintained among them by the Spanish Franciscans from 1592 until the middle of the eighteenth century, when the tribe was nearly exterminated by war with the colonists of Georgia and Carolina, the few survivors taking refuge with other tribes. Three catechisms and a manual of confession in the Timuquan language, by Father Francisco Pareja, were printed at Mexico between 1612 and 1627.

**Timur′,** or **Tamerlane′** (the latter name being a corruption of TIMUR LENK—that is, "Timur the Lame"), b. Apr. 9, 1336, at Kesh, about 40 miles S. E. of Samarcand, the son of a chief of a Mongol tribe settled here, and descending on the mother's side directly from Genghis Khan. In 1360 he became chief of his tribe, and now began that wonderful evolution of conquering power which ended by subjugating the whole of Central and Western Asia, from the Chinese Wall to the Mediterranean and from the Siberian steppes to the mouth of the Ganges. In 1393 he stood on the banks of the Dnieper threatening Moscow, but he turned to the S., burnt Azof, and retreated into Asia. In 1398 he conquered Delhi, whence he sent an immense amount of booty to Samarcand, and meditated pushing onward to the S., when he was called to the western frontier of his realm. Here the conquest of Armenia, Georgia, and the countries on the Euphrates had brought him into contact with the Turkish empire, ruled over at that time by Bajazet, also a great conqueror. On July 20, 1402, the two huge armies, led by Bajazet and Timur, met each other on the plain of Angora, and the Turks were completely routed; Bajazet himself was taken prisoner. In 1404, Timur prepared for a grand expedition to China, and in the beginning of the following year crossed the Jaxartes at the head of an army of 200,000 veteran troops, but d. at Otrar Feb. 18, 1405, and his empire soon became scattered. His cruelty and that of his soldiers was beyond description. Before the battle of Delhi he ordered all the male captives who followed his army, said to have numbered about 100,000, to be put to death, and after the suppression of an insurrection in Herat he constructed, for the sake of warning, a pyramid in which layers of brick and mortar alternated with layers of the revolted inhabitants of the city. But in other respects he is said to have been possessed of political statesmanship, administrative ability, and even of literary taste. (See *Histoire de Timur-Bei*, 4 vols., Paris, 1722; translated into French by Pietis de la Croix from the Persian text by Sheref-ed-Din.) The works ascribed to Timur, the *Constitutions* and *Commentaries*, are of doubtful authenticity. They were translated into English in 1783 by Davy and White.

**Tin** [Ger. *Zinn;* Fr. *étain;* Lat. *stannum*], a lustrous, white metal, not easily affected even by moist air at low temperatures, soft, malleable, of low tenacity, quite ductile at 212° F. (100° C.), a moderately good conductor of heat and electricity, not sensibly volatile at ordinary furnace-heat, fusing at 442° F. (227.8° C.), having after fusion a specific gravity of 7.292. Very pure tin in blocks is sometimes disintegrated by extreme cold. It is one of the oldest

of known metals, being mentioned in the Pentateuch, and obtained long before the Christian era by the Phœnicians from the British Isles, hence called Cassiterides (from κασσίτερος, "tin"). Pliny's *stannium* was an alloy of silver and lead, perhaps also tin, which he called *plumbum album*, white lead; the alchemists called it Jupiter, and gave it the symbol of that planet, ♃. Tin ores are largely worked in Cornwall, England; Banca, Billiton, and Malacca in the East Indies; less abundantly in Saxony, Bohemia, France, Spain, Australia, Ireland, China, Japan, the United States of Colombia, and Mexico; small quantities are found in Greenland, Sweden, Finland, and California; other places in the U. S. have afforded very small quantities—viz. Paris and Hebron, Me.; Chesterfield and Goshen, Mass.; near Jackson, N. H.; near Boonville, Id.; and Missouri is said to have furnished it. Tin ores occur in veins in gneiss, granite, mica and chlorite schists, and porphyry, associated with iron pyrites, copper pyrites, zinc-blende, galena, fluor-spar, apatite, topaz, mica, and wolfram. The most important ore is the oxide, called *cassiterite*, *tin stone*, and *tin ore;* it occurs in veins, when it is called *mine tin*, and also as rolled pebbles in alluvial deposits, furnishing excellent ore, known as *stream tin* and *wood tin*. It is generally a dark-brown mineral, very hard, of sp. gr. 6.4 to 7.1; crystallizing in tetragonal prisms, with pyramidal ends; generally has a high, vitreous lustre, and contains 78.67 per cent. of tin. A far less abundant and less valuable ore is *stannite* or *tin pyrites*, a sulphuret of tin, copper, iron, and zinc, with 27.2 per cent. of tin and 29.3 per cent. of copper. Native metallic tin has probably never been found. A little tin has been detected in meteoric iron, some zinc-blendes, and several rare minerals.

In England and Germany tin ore is worked by sorting it, stamping, concentrating by washing, roasting to remove sulphur, washing again to dissolve sulphate of copper and to wash out oxide of iron, reducing in reverberatory furnaces or shaft furnaces (the former being best adapted to good ores, and being used in England), and refining. (See REFINING OF METALS.) The concentrating is so thoroughly done in Saxony that ores containing only 0.5 to 1 per cent. of tin can be treated profitably. The best tin thus obtained is known as *grain tin*, the inferior varieties as *bar* or *block tin*. When the tin ores contain much wolfram (tungstate of iron and manganese), they must be calcined with carbonate of soda, thus forming tungstate of soda, which is dissolved out before smelting the ore for tin. Banca tin is the purest in the market. Tin artificially crystallized by a voltaic current is tetragonal; it can also be obtained in crystals by fusing and slowly cooling it. Stannous chloride, $SnCl_2$, is formed by dissolving tin in hydrochloric acid; it is a powerful reducing agent, and is used as a mordant under the name of *salt of tin*. Stannic chloride, $SnCl_4$, can be formed by heating corrosive sublimate with tin filings, or by passing chlorine over melted tin. It forms with chloride of ammonium a double salt, called *pink salt*, used for a red dye. An impure stannic chloride, formed by the action of nitric and hydrochloric acids on tin, is used for brightening and fixing red colors, under the name of *nitro-muriate of tin, composition*, or *tin solution*. Stannous oxide, SnO, stannous hydrate, $Sn_2H_2O_3$, and sesquioxide of tin, $Sn_2O_3$, are unimportant commercially. Stannic oxide, $SnO_2$ (*putty powder*), is formed when tin is heated above fusion in the air. It forms two hydrates; one of these, stannic acid, $H_2SnO_3$, forms various stannates, the stannate of soda being used as a mordant in calico-printing; arsenic-stannate of soda is also employed. The other is metastannic acid, produced by the action of nitric acid of sp. gr. 1.3 upon tin. Dried at 212° F. (100° C.), it is $H_{10}Sn_5O_{15}$. It becomes anhydrous on ignition. Monosulphide of tin, SnS, and sesquisulphide, $Sn_2S_3$, are of little interest. The bisulphide, $SnS_2$ (*mosaic gold*), can be obtained by powdering an amalgam of 12 parts of tin and 6 of mercury, and heating it in a flask with 7 parts of sulphur and 6 of sal-ammoniac; other proportions are also used. Tin forms many other chemical compounds, of little general interest. The most important alloys of tin are—britannia metal, equal parts of brass, tin, antimony, and bismuth; pewter, 4 of tin and 1 of lead; queen's metal, 9 of tin, and 1 each of antimony, bismuth, and lead; fine solder, 2 of tin and 1 of lead; common solder, equal parts of each; coarse solder, 2 of lead and 1 of tin; speculum metal, 1 of tin and 2 of copper (but variable), with sometimes a little arsenic; bell metal, 78 of copper and 22 of tin, with sometimes a little zinc and lead; bronze, with less tin than bell metal, and with 3 to 4 of zinc; gun metal, best with 9 of copper and 1 of tin; sheathing for ships, 32 of copper and 1 of tin; fusible metal, with 1 of lead, 2 of bismuth, and 1 of tin, fuses at 200.7° F. (93.75° C.); type metal, for fine work, contains a little tin; amalgam of tin and mercury for coating mirrors; and Babbitt's metal. Melted tin is used to coat sheet iron (tin plate) and copper; copper, zinc, brass, and iron can also be tinned in the wet way; and tin has been successfully deposited on textile fabrics.

The following table shows the value in dollars of tin and tin products imported into the U. S. from different localities during the year ending June 30, 1873, according to the Congressional reports on commerce:

| | Blocks or pigs. | Plates. | Other manufactures. |
|---|---|---|---|
| China | 401,442 | 46 | 870 |
| Japan | 39,334 | ..... | 1,047 |
| Germany | 2,520 | 46 | 13,315 |
| British Isles | 751,790 | 14,957,585 | 54,596 |
| " North America | 5,173 | 34,535 | 4,881 |
| " West Indies | 7,125 | ..... | 324 |
| " East Indies | 1,781,855 | | |
| Dutch East Indies | 286,386 | | |
| Mexico | 1,576 | 27 | |
| U. S. of Colombia | 683 | | |
| Other sources | ..... | 1,411 | 10,096 |
| Total | 3,277,884 | 14,993,650 | 85,129 |

Phillips gives the production of tin in 1871 as follows: England, 11,320 tons; Saxony and Bohemia, about one-fifteenth as much; Banca, 4320; Billiton, 3190; South America, 1200; the total from all sources, 25,000 to 28,000 tons.

H. B. CORNWALL.

**Tinam'idæ** [from *Tinamus*—the Latinized form of *Tinamou*, a popular name—the typical genus of the group], a family of birds presenting several peculiarities, and even anomalies, of structure, which have caused their isolation as an independent "super-family," "sub-order," and even "order." In external appearance the species resemble, perhaps, the quails and partridges more than any other familiar birds; the head is rather small, the neck rather short, and the back and tail depressed; the bill is rather slender and mostly straight, but more or less decurved at the tip, and with the upper mandible overhanging the lower; the base is covered with a membrane which encroaches on the nostrils; the nostrils are large, elongate, and near the base of the bill; the wings are rounded behind, concave, and short; the tail is short, and sometimes quite rudimentary, and more or less concealed by the decumbent coverts; the legs are inserted rather far behind; the tarsi moderate or stout, and provided with large plates in front, the anterior toes well developed and entirely free, the posterior small and elevated or wanting; the claws are curved. These are all normal characters, and it is only in the osteology that great deviation from ordinary birds is manifested. As indicated by Parker and Huxley, the skull has a palate much like that of an ostrich. "In fact, the vomer is very broad, and in front unites with the broad maxillo-palatines, as in *Dromæus* (cassowary), while behind it receives the posterior extremities of the palatines and the anterior ends of the pterygoid bones, which thus are prevented, as in the Ratitæ, from entering into any extensive articulation with the basisphenoidal rostrum. The basipterygoid processes spring from the body of the sphenoid, not from its rostrum, and they articulate with the pterygoids very near the distal or outer ends of the latter bones. The head of the quadrate bone is single, as in the struthious birds." (*Huxley.*) The sternum and the pelvic bones are, however, essentially the same as in ordinary carinate birds. In view, then, of this combination of characters the family has been regarded by Huxley as the representative of one of the four groups into which the carinate birds are divided. The group has been named Dromæognathi, in allusion to the similarity of the jaws (and palate) to those of *Dromæus*. The family is peculiar to South (and Central) America, and is represented by a goodly number of forms. Sclater and Salvin have recognized 41 species, which have been distributed among 9 genera and under 2 sub-families—viz. (1) Tinaminæ, with the genera *Tinamus* (7 species), *Nothocercus* (3 species), *Crypturus* (16 species), *Rhynchotus* (2 species), *Nothoprocta* (6 species), *Nothura* (4 species), and *Taoniscus* (1 species); and (2) Tinamotinæ, with the genera *Eudromia* (1 species), and *Tinamotis* (1 species). The species differ in habits, some inhabiting the thickest forests, and others open plains. They feed chiefly on grains, and indeed resemble in many respects the partridges, etc., which they replace in South America. The females generally lay about a dozen (but some not more than half a dozen) eggs, which are deposited in rude nests made on the ground. The young follow their mother as soon as hatched.

THEODORE GILL.

**Tinamou.** See TINAMIDÆ.

**Tincal.** See BORAX.

**Tinc'tures** [Lat. *tinctura*], a pharmaceutical term used to designate solutions of medicinal substances in alcohol. In their preparation the medicine should be dried and pul-

verized, and as a rule it is found advantageous to use diluted or aqueous alcohol as the solvent, as by this means numerous substances which are insoluble in anhydrous alcohol can be brought into solution; but many of the tinctures prepared in this way undergo acetous fermentation, which objection is best obviated by preserving them in well-closed and completely-filled bottles. Usually, maceration and digestion accelerate the preparation of tinctures; percolation has also lately been extensively practised. Occasionally, the expressed juice of the plant is dissolved in alcohol, which method is especially applicable to the preparation of tinctures of narcotic substances, such as conium and belladonna. J. P. BATTERSHALL.

**Tin'dal** (MATTHEW), LL.D., b. at Beer-Ferris, Devonshire, in 1657; studied at Oxford, where he took his degree in 1676; became fellow of All Souls, and in 1685 was made LL.D., shortly after which he went over to the Roman Catholic Church, but returned to the Church of England when the revolution of 1688 seemed imminent. After the revolution he held several legal positions, and received from the Crown a pension of £200. He took an active part in the polemics of his day, and in 1706 published *The Rights of the Church Asserted*, in which he took ground against the prevalent High-Church doctrines. This gave rise to sharp controversies, during which he put forth two *Defences*, in which he treated of the obedience due to princes, the law of nations, the liberty of the press, and the rights of mankind in matters of faith. In 1710 he issued a pamphlet, the *New High Church turned Old Presbyterian*, in opposition to the famous sermon of Dr. Sacheverell. The House of Commons ordered the productions of both controversialists to be publicly burned. In 1730 he put forth his most noted work, *Christianity as Old as the Creation*, in which he argued that in Christianity there was nothing which human reason might not have discovered without a special revelation, which called forth a host of replies, and a defence by himself of the doctrines which he had advanced. He also wrote a second volume of his work, of which only the preface has been published. D. in London Aug. 16, 1733.

**Tindal** (NICHOLAS), nephew of Matthew Tindal, b. in Devonshire in 1687; studied at Trinity College, Oxford, where he graduated in 1713, and of which he became a fellow; entered holy orders, and held several valuable preferments, among which was that of chaplain of Greenwich Hospital. He put forth several historical and miscellaneous works, the most important of which is a translation of Rapin's *History of England*, with a very valuable *Continuation from 1688 to the Accession of George II.* (1744–47). D. in 1774.

**Tindale** (WILLIAM). See TYNDALE (WILLIAM).

**Tin'der** [Ang.-Sax. *tyndre*], a material, usually composed of half-burned linen, which was formerly used in kindling fires. A flint and steel ignited the tinder, which inflamed in turn a sulphur match. Amadou, touch-wood, and touch-paper were substitutes for tinder.

**Tinea.** See TINEIDÆ.

**Tine'idæ** [from *Tinea*—so called on account of the small body—the typical genus], a family of Lepidoptera rich in species, and including the moths so destructive to clothes. The developed insects are of small size, have a slender body, elongated, narrow wings, which when the insect is at rest are rolled round the body, and which are edged with long fringes; the maxillary palpi are very large, and the antennæ are long and filiform. The larvæ are elongate, and generally provided with numerous (14 to 18) feet, although occasionally entirely footless. They differ among themselves chiefly in the form and furniture of the head (whether hairy or naked), the development of the maxillary and labial palpi, and the form of the wings. The imagines mostly affect the lee side of hedges, etc.; the larvæ burrow in leaves, stems, grain, etc., of plants, as well as other substances, such as cloth. The most notable species are the clothes moth (*Tinea flavifrontella*), the carpet moth (*Tinea tapetzella*), and the grain moths (*Tinea granella* and *Gelechia cerealella*). The ravages of these, or at least of the first, are well known. The clothes moth is light buff, glanced with a silvery iridescence on the wings and tawny on the head. It makes its appearance in the Northern U. S. in May or June. The female lays her eggs in cloth, generally woollens, sometimes cotton, and a whitish larva is soon hatched therefrom. The carpet moth has yellowish-white but black-based fore wings, dark-gray hind wings, and white head. Benzine and carbolic acid, and precautions as to cleanliness, are the best antidotes to the ravages of these little pests. THEODORE GILL.

**Tin-Foil.** See FOIL.

**Ting-Hai.** See CHUSAN.

**Tin'icum,** tp., Bucks co., Pa. P. 2401.

**Tinicum,** tp., Delaware co., Pa. P. 147.

**Tin-Mines.** See APPENDIX.

**Tin'mouth,** p.-v. and tp., Rutland co., Vt. P. 589.

**Tinne,** or **Tinneh,** the name applied by recent explorers to the most northerly branch of American Indians, forming a branch of the Athabaskan family, and extending from Hudson's Bay N. W. to Central Alaska. They embrace more than twenty tribes, with a total of about 15,000 souls, having some six different languages. The best known and most typical tribes are the Chepewyans or Montagnais, the Beavers, the Dog Ribs, the Tacullies or Carriers, the Loncheux, and the Kenai. They are pacific, live chiefly on game and fish, are tall and slender, with full faces and dark complexions, and some beard. A few have been converted by the Roman Catholic and Protestant missionaries.

**Tin'ne** (ALEXANDRINA PETRONELLA FRANCINA), b. at the Hague Oct. 17, 1835, the only child of a rich merchant; received an excellent education; travelled after the death of her father through most European countries, Syria, Palestine, Egypt, etc., and settled in 1861 in Cairo. From Feb. 2, 1863, to Mar. 29, 1864, she undertook a grand journey of exploration from Khartoom to the Bahr el-Ghazal, the western arm of the White Nile. She invited Baron von Heuglin and Dr. Steudner to accompany her, and the valuable scientific results of the expedition were communicated in John A. Tinne's *Geographical Notes of Expeditions in Central Africa*, in the *Transactions* of the Historic Society of Lancashire and Cheshire (Liverpool, 1864); Von Heuglin's *Die Tinnesche Expedition im westlichen Nilquellgebiet*, supplement to Petermann's *Mittheilungen* (1865); and Th. Kotschy and Peyritsch's *Plantæ Tinneanæ* (1867). From Tripoli she started on another expedition, Jan. 30, 1869, with the purpose of reaching the upper Nile through Bornoo, but at Fezzan she was murdered by her Arabic attendants, Aug. 1, 1869.

**Tinni'tus Au'rium** [Lat. for "ringing of the ears"], a symptom which often accompanies a cold or an attack of indigestion. It may, however, attend a severe febrile or other acute disease, but is unimportant, except for the fact that when persistent it sometimes indicates disease of the auditory nerve, when it may be the forerunner of total deafness. Cases are, however, not unknown of ringing of the ears which lasts for many months with apparently good general health.

**Ti'no,** or **Ti'nos,** an island of Greece, belongs to the Cyclades, and is situated immediately S. of Andros. Area, 81 sq. m. P. 21,171. The soil is stony, and not so very productive, but it is well watered and exceedingly well cultivated. Wine, melons, figs, barley, oil, and wheat are produced. Marble, raw or worked into different kinds of vessels and ornaments, and silk, raw or manufactured into gloves and stockings, are the principal articles of export. The principal town is St. Nicholas, which has a splendid cathedral, built of white marble and visited by many pilgrims, and a small but convenient harbor.

**Tinoc'eras** [Gr. *τίνειν*, to "avenge," and *κέρας*, "horn"], an extinct genus of herbivorous mammals from the Eocene of Wyoming and Utah, and the first known representative of a remarkable group, now regarded as forming a distinct order, Dinocerata, so named from the best-known genus, *Dinoceras*. This genus may be taken as typical of the order, and its principal characters are as follows: The skull is long and narrow, the facial portion being much produced. It supports three separate pairs of osseous elevations, some of which, if not all, seem to have been the bony support for horns. They form the most conspicuous feature of the skull, and suggested the name of the genus, "the terrible-horned." The smallest pair are near the end of the nasal bones; a larger pair rise from the maxillary or cheek bones, in front of the orbits; while the largest pair are on the parietal bones, and are supported by an enormous crest, which extends from near the orbits around the lateral and posterior margins of the cranium, nearly surrounding a deep depression upon the crown of the head. The dental formula in *Dinoceras* is as follows: incisors, $\frac{0-0}{3-3}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{3-3}{3-3}$; molars, $\frac{3-3}{3-3}$. The premaxillaries are toothless, as in ruminants, and may have supported a callous pad also, as in that group. The upper canine teeth are deeply implanted in the maxillary bones. They are long, decurved, and trenchant, separated by an interval from the molar teeth, which are comparatively quite small. The lower incisors and canines were approximate, and projecting forward, and separated from the small molars. The lower jaw sends down a massive process on each side near its extremity, apparently for the support and protection of the large upper canines while the mouth was closed. The cervical vertebræ are longer than in the elephant, while the legs are short and the skull elongated, so that the head could easily reach the

ground. There was, therefore, no necessity for a proboscis, and the structure of the skull affords no evidence of its existence, although some naturalists, misled by superficial resemblances of the feet of these animals to those of the elephant, have contended that they were proboscidians. The feet were short and stout, and there were five toes before and behind, but the carpal bones form interlocking series, and the astragalus articulated with both the navicular and cuboid bones. The metapodial bones are of moderate length, and their articular surfaces for the phalanges nearly flat, or even concave, indicating but little motion in the toes. The phalanges are very short, the distal ones rugose. In the hind limb when at rest the knee-joint was straight, as in the elephant and man, instead of being considerably flexed, as in nearly all quadrupeds. The brain-cavity of *Dinoceras* is, however, the most remarkable feature of this remarkable genus. It proves that the brain was smaller than any more recent mammal, whether living or fossil, and was even less than in some reptiles. The entire brain was so diminutive that it could perhaps have been drawn through the neural canal of all the presacral vertebræ, certainly through the cervicals and lumbars. In the brain itself the most striking feature is the small size of the cerebral hemispheres, which do not overlap either the cerebellum or the olfactory lobes. The latter were large, and produced well forward. The brain, as a whole, resembled that of some marsupials. Besides the genera already mentioned, there was at least one other, *Uintatherium*, closely allied. These animals were all large, some of them nearly equalling the elephant in size, and, with their armature of horns and tusks, must have presented a formidable appearance. O. C. Marsh.

**Tintoret'to,** whose true name was Giacomo Robusti, b. at Venice in 1512, the son of a dyer, from which circumstance he received his surname; studied first under Titian, afterward independently, and made it his great aim to connect the drawing of Michael Angelo with the coloring of Titian. He worked with an astonishing ease and rapidity, and the churches, convents, and palaces of Venice are full of brilliant and dazzling representations by him of historical, mythological, and scriptural subjects, and he is well represented in almost every collection of the European continent. Toward the close of his life he fell into a somewhat gross and mechanical manner. D. at Venice in 1594. Among his most remarkable pictures are—the *Paradise*, in the palace of the doge, 84½ feet long, 34 feet high, and containing several hundred figures; the *Marriage in Cana*, in the church of Santa Maria della Salute; the *Wonder of St. Mark*, in the Academy; the *Crucifixion*, etc.

**Tio'ga,** county of S. New York, bordering on Pennsylvania, intersected by the N. branch of Susquehanna River, and crossed by several railroads; the surface very hilly, soil generally moderately fertile. There are manufactories of agricultural implements, boots and shoes, carriages, saddlery, machinery, pianos, etc., saw-mills, grist-mills, planing-mills, paper-mills, and tanneries. Horses, cattle, and sheep are numerous. Staples, oats, Indian corn, wheat, hay, dairy products, and wool. Cap. Owego. Area, 480 sq. m. P. 30,572.

**Tioga,** county of N. Pennsylvania, bordering on New York, drained by Tioga River and its affluents, and penetrated by Corning, Antrim, and Tioga R. Rs. Surface hilly, well watered, and better adapted to grazing than tillage. Iron ore is found, and bituminous coal is abundant, which finds its chief market in Buffalo. There are numerous saw-mills, tanneries, and grist-mills, and manufactories of carriages, agricultural implements, furniture, glassware, woollens, and cheese. Cattle, sheep, horses, and swine are numerous. Staples, butter, cheese, hay, lumber, oats, Indian corn, wheat, buckwheat, potatoes, and maple-sugar. Cap. Wellsborough. Area, about 1100 sq. m. P. 35,097.

**Tioga,** tp., Tioga co., N. Y. P. 3272.

**Tioga,** p.-b. and tp., Tioga co., Pa., on Tioga and Corning Cowanesque and Antrim R. Rs., contains 5 churches, a graded school, a banking-house, 4 tanneries, 1 newspaper, a handsome park, lock and firkin factories, a race-track, an excellent system of waterworks, 3 hotels, and a street railway. Principal business, farming and lumbering. P. of b. 440; of tp. 1074.

A. H. Bunnell, Ed. "Tioga Co. Express."

**Tioga Centre,** p.-v., Tioga co., N. Y. P. 304.

**Tioga River** rises in the W. part of Bradford co., Pa. Its general course is northward through Tioga co., Pa. At Painted Post, Steuben co., N. Y., its waters enter the river Chemung. The upper part of Tioga Valley affords much semi-bituminous coal of great value.

**Tiones'ta,** p.-b. and tp., cap. of Forest co., Pa., 20 miles N. E. of Oil City, has 3 churches, good schools, 2 newspapers, banks, 1 stave and 2 saw mills, and 4 hotels. Principal business, lumbering. P. of b. 320; of tp. 450.

W. R. Dunn, Ed. "Republican."

**Tioomen',** or **Tjumen,** town of Siberia, government of Tobolsk, on the Thura, an affluent of the Ob, is the oldest, but at the same time one of the handsomest and most prosperous, of the Siberian cities. It is an entrepôt for the traffic between Russia, Siberia, the Kirgheez territory, Bokhara, and China, and has extensive manufactures of leather, tallow, candles, pottery, mats, wooden articles, carpets, and coarse woollen fabrics; 400,000 skins are annually tanned and dressed here. P. 11,553.

**Tip'pah,** county of N. Mississippi, drained by Hatchie, Tallahatchie, and Tippah rivers. Surface undulating, soil fertile. Cattle and swine are numerous. Staples, cotton, Indian corn, sweet potatoes, and wool. Cap. Ripley. Area, about 500 sq. m. P. 20,727.

**Tippecanoe',** county of W. Indiana, drained by Wabash and Tippecanoe rivers, and intersected by Wabash and Erie Canal, and by several railroads. Surface generally level, soil a rich black loam. There are manufactories of agricultural implements, carriages, boots and shoes, machinery, and woollens, grist-mills, saw-mills, planing-mills, pork-packing establishments, and breweries. Horses, cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, wool, and dairy products. Cap. Lafayette. Area, about 500 sq. m. P. 33,515.

**Tippecanoe,** tp., Carroll co., Ind. P. 1109.

**Tippecanoe,** tp., Kosciusko co., Ind. P. 1236.

**Tippecanoe,** tp., Marshall co., Ind. P. 1165.

**Tippecanoe,** tp., Pulaski co., Ind. P. 833.

**Tippecanoe,** tp., Tippecanoe co., Ind. P. 2274.

**Tippecanoe,** tp., Henry co., Ia. P. 1750.

**Tippecanoe City,** p.-v., Monroe tp., Miami co., O., on Great Miami River and Cincinnati Dayton and Michigan R. R., has manufactures and a weekly newspaper. P. 1204.

**Tippecanoe River** rises in Tippecanoe Lake, Kosciusko co., Ind. It pursues a devious S. W. course for 200 miles, and falls into the Wabash. On the banks of this river, at the present village of Battle Ground, in the county and township of Tippecanoe, Gen. Harrison fought and defeated the Indian tribes commanded by the Prophet, the brother of Tecumseh, Nov. 5, 1811.

**Tippera'ry,** county of Ireland, province of Munster, borders N. and N. W. on the Shannon and Lough Derg, and comprises an area of 1659 sq. m. The soil is in most places very fertile. Wheat is grown in large quantities and of superior quality, and dairies are numerous; wheat, flour, meal, and butter are largely exported. Yet agriculture is in a backward state, and the population lives in a depressed condition. Coal, copper, lead, and zinc are found, but not worked, and the formerly flourishing woollen trade is now nearly extinct. The population numbered 331,487 in 1851, but over 40 per cent. of that population has since emigrated, and of the present population, numbering 216,715, there are 59,049 who are unable to read or write. Principal towns, Clonmel, Nenagh, and Thurles.

**Tipperary,** town of Ireland, county of Tipperary, province of Munster, is an old but well-built city, and has 6084 inhabitants.

**Tippoo' Sa'hib,** sultan of Mysore (1782–99), b. Nov. 19, 1749, a son of Hyder Ali; received a good education; was instructed in European tactics, and distinguished himself in the war against the English, defeating them at Perimbakum, Sept. 10, 1780, and on the banks of the Kolerun, Feb. 18, 1782. On Dec. 7, 1782, Hyder Ali died, and Tippoo Sahib now prepared for a still more energetic prosecution of the war. Apr. 28, 1783, he took Bednore, and soon after also Mangalore, but in the mean time peace had been concluded between England and France; the French accordingly withdrew from active participation in the war, and Tippoo Sahib felt thereby compelled also to conclude peace—at Mangalore Mar. 11, 1784—on advantageous conditions. It was his idea to drive the English out of India, but, fortunately for the English East India Company, his religious fanaticism was greater than his political ambition, and instead of making allies of the non-Mohammedan Hindoo states, he waged uninterrupted war against them. The company, which feared him and knew of his vast intrigues in France, Persia, and Afghanistan, used this circumstance, and fell upon him in 1790, together with a number of native princes, and compelled him in 1792 to sue for peace by ceding half of his dominions and paying 33,000,000 rupees. This misfortune, however, did not diminish his ardor, and when Napoleon landed in Egypt Oct. 18, 1798, the company determined to crush their enemy before it might become too late. On Feb. 22, 1799, the company

declared war against Mysore, invaded the realm with two armies, and shut up the sultan in his capital, Seringatam. Here he fell (May 4, 1799) while fighting on the walls; his dominions were confiscated by the company, and the spoils from his palace were carried to London. (See Michaud, *Histoire de l'Empire Mysore sous le Règne de Hyder Aly et Tippoo Saib* (2 vols., 1801); Wilks, *The South of India* (3 vols., 1810); and *The History of Tippoo Sultan, written by Mir Hussain Ali Khan*, translated into English by Col. Miles (1844).)

**Tipps,** tp., Wise co., Va. P. 985.

**Tip'toft** (John), Earl of, b. at Everton, Cambridgeshire, England, about 1425, son of Lord Tiptoft and Powys; educated at Baliol College, Oxford; became the most eminent classical scholar among the English noblemen of the time; was created earl of Worcester on the occasion of his appointment by Henry VI. to the post of lord deputy of Ireland, where his government was extremely rigorous; was afterward made lord high constable of the Tower, lord high treasurer, and knight of the Garter by Edward IV., whose cause he espoused in the "war of the Roses;" became obnoxious to the Lancastrians by the execution of several of their chieftains who had landed on the S. coast of England, on which occasion they fastened on him the epithet "the butcher;" visited Rome; delivered a Latin oration before the pope; made a careful inspection of the Vatican Library; went on a pilgrimage to Jerusalem, and on his return presented many valuable MSS. to the University of Oxford. He was the earliest English patron of William Caxton, who printed his translations of a part of Cæsar's *Commentaries*, Cicero's *De Amicitiâ*, and other works, but did not live to see the establishment of the press in England, having been executed on Tower Hill by the Lancastrians Oct. 18, 1470, under pretext of maladministration in Ireland many years before. Caxton pathetically deplores his death in the preface to one of the first books printed in England.

**Tip'ton,** county of Central Indiana, drained by Cicero Creek and other streams, and traversed by Indianapolis Peru and Chicago and Pittsburg Cincinnati and St. Louis R. Rs. Surface level, soil productive. There are sawmills and some manufactures of woollen goods. Staples, Indian corn, wheat, wool, lumber, and live-stock. Cap. Tipton. Area, 290 sq. m. P. 11,953.

**Tipton,** county of W. Tennessee, bordering on Mississippi River, bounded N. by Hatchie River, and intersected by Louisville and Nashville and Great Southern R. R. Surface level, soil productive. Staples, cotton, Indian corn, and wool. Cap. Covington. Area, 370 sq. m. P. 14,884.

**Tipton,** tp., Cass co., Ind. P. 1808.

**Tipton,** p.-v., cap. of Tipton co., Ind., on Indianapolis Peru and Chicago R. R., 40 miles N. of the former place, has 3 churches, good schools, 1 bank, 2 newspapers, 1 flouring and 2 planing mills, 3 hotels, 2 stove-factories, 1 tannery, and 2 furniture establishments. Rich farming lands abound. P. 892. J. T. Cox, Ed. "Times."

**Tipton,** p.-v., cap. of Cedar co., Ia., on Stanwood branch of Chicago and North-western R. R., in the exact geographical centre of Cedar county, has 7 churches, public schools, 1 bank, 2 newspapers, a steam flouring-mill, county-seat buildings, and several manufactories. P. about 1443. Charles L. Longley, Ed. "Advertiser."

**Tipton,** tp., Hardin co., Ia. P. 397.

**Tipton,** p.-v., Moniteau co., Mo., on Atlantic and Pacific R. R., has a weekly newspaper.

**Tipton,** tp., Cass co., Neb. P. 315.

**Tirabos'chi** (Girolamo), b. at Bergamo Dec. 28, 1731; educated at Monza by the Jesuits, whose order he subsequently entered; was appointed professor in rhetoric at Milan in 1766, and librarian to the duke of Modena in 1770. D. at Modena June 3, 1794. His *Storia della Letteratura Italiana* (13 vols., 1772–83) is considered a model of historical research, and is still the principal work on its subject. He also wrote *Biblioteca Modenese* (6 vols., 1781–86) and *Memorie Storiche Modenei* (3 vols., 1793).

**Tira'no,** town of Italy, province of Sondrio, lying in the Valtellina, S. W. of Bormio, and about 17 miles E. of the town of Sondrio. Though a place of considerable industry, the inhabitants, like those of this valley generally, are for the most part very poor. P. 5667.

**Tiras'pol,** town of Russia, government of Kherson, on the Dniester, has some manufactures. P. 5384.

**Tiree',** an island of Scotland, one of the Inner Hebrides, is 13 miles long and 6 miles broad, low, destitute of wood, but affording good pastures. Oats, barley, and potatoes are raised, but the inhabitants, numbering 3201, are mostly engaged in fishing and rearing cattle and poultry.

**Tire'sias,** a celebrated soothsayer in ancient Greece, was blind, but understood the language of the birds, and lived through nine generations; even after his death he did not lose his power of prophecy. He had a famous oracle at Orchomenus, but after a plague it became silent. The Greek mythology tells many stories of the origin of his blindness and soothsaying power.

**Tirlemont',** town of Belgium, province of Brabant, on the Grande-Geete, has several good educational institutions, and manufactures of woollen stuffs, blankets, carpets, hosiery, leather, soap, oil, malt, and gin. It carries on an active general trade. P. 12,354.

**Tir'nova,** town of European Turkey, in Bulgaria, on the Jantra, an affluent of the Danube, has large dyeworks and some manufactures of silk and cloth. P. 12,000.

**Ti'ro** (Marcus Tullius), the freedman and pupil of Cicero, to whom he became an amanuensis, and was also an author of some reputation, writing several works, including a life of his patron; to him is due the collection of Cicero's *Letters*. Becoming familiar with the stenography of the period, he extended and systematized it, and by its aid preserved several of Cicero's orations. (See Stenography.) It is believed he lived to the age of one hundred.

**Ti'ryns,** an ancient city of Argolis, Peloponnesus, was one of the oldest cities of Greece, but in 468 B. C. was entirely destroyed by the Argives, and never rebuilt. The remains of its fortress, with its cyclopean walls, are the grandest and most curious ruins in Greece.

**Tisch'bein** (Johann Heinrich Wilhelm), b. at Haina in Hesse Feb. 15, 1751; received his first instruction in painting from his father, uncle, and elder brother, who all were painters of reputation; went in 1770 to the Netherlands, in 1779 to Rome, in 1787 to Naples, where he was director of the academy of painting from 1790 to 1799; returned in the latter year to Germany and settled in Hamburg. D. at Entin July 26, 1829. He painted mythological and historical subjects, scenes of animal life, and produced a great number of excellent illustrations, among which the most celebrated was *Homer nach Antiken gezeichnet* (Göttingen, 1801–04).

**Tisch'endorf** (Lobegott Friedrich Constantin), b. at Lengenfeld, Saxony, Jan. 18, 1815; studied theology and philology at Leipsic 1834–38; was appointed professor of theology there in 1843. From an early period of his life he concentrated his study on a critical revision of the text of the New Testament; made extensive journeys in Europe, examining the materials for such a revision contained in the various European libraries, and visited Egypt, the Sinaitic peninsula, Syria, and Palestine in 1844, 1853, and 1859, the last time at the expense of the Russian government. From the monastery of Sinai he brought back the famous *Codex Sinaiticus*, the oldest Greek manuscript of the Bible, which is now preserved in St. Petersburg, and was published in 1862 in 4 vols. fol. at the expense of the emperor Alexander II. D. in Leipsic Dec. 7, 1874. The principal results of Tischendorf's researches were several critical editions of the New Testament, but he also published *Codex Ephraemi Syri* (1843), *Monumenta Sacra Inedita* (1846), *Evangelium Palatinum Ineditum* (1847), *Codex Amiatinus* (1850), *Codex Claromontanus* (1852), *Novum Testamentum Vaticanum* (1867), *Monumenta Sacra Inedita, nova Collectio* (9 vols., 1854–65), *Acta Apostolorum Apocrypha* (1851), *Evangelia Apocrypha* (1853), *Apocalypses Apocryphæ* (1866), *Reise in den Orient* (2 vols., 1845–46), *Aus dem heiligem Lande* (1862), etc.

**Tishabee,** tp., Greene co., Ala. P. 1440.

**Tishomin'go,** county of N. E. Mississippi, bordering on Tennessee and Alabama, bounded N. E. by Tennessee River, drained by affluents of Tennessee and Tombigbee rivers, and traversed by Memphis and Charleston R. R. Surface hilly, soil productive. There are saw-mills, planing-mills, and some woollen manufactories. Staples, cotton, Indian corn, wool, a little tobacco, and lumber. Cap. Iuka. Area, 550 sq. m. P. 7350.

**Tiskilwa,** p.-v., Bureau co., Ill.

**Tis'ri** [Heb.], the first Hebrew month of the civil year and the seventh of the ecclesiastical year. It corresponds to part of September and October.

**Tissapher'nes,** appointed satrap of Lower Asia by Darius II. Nothus in 414 B. C. After the death of Darius in 407, his younger son, Cyrus, who was viceroy of Asia Minor, tried to oust his brother, Artaxerxes II. Mnemon, from the throne, but was defeated at Cunaxa in 401 by Tissaphernes, who in reward received the command also in Asia Minor. His attempt, however, to punish the Greek cities which had supported Cyrus was unsuccessful. They were supported by the Spartans, and he was defeated by

Agesilaus in Lydia. Meanwhile, his treacherous and insidious character had made him odious even in the eyes of Artaxerxes, and on the instigation of Parysatis, the king's mother, he was assassinated at Colossæ, Phrygia, in 395.

**Tissot'** (Pierre François), b. at Versailles Mar. 10, 1768; received a good education, and was, after various vicissitudes during the Revolution, employed by Napoleon as censor, and in 1814 appointed professor of general literature at the Collége de France. After the restoration of the Bourbons, he founded the *Constitutionnel*, and gave so much offence by his Bonapartist opposition that he lost his chair, but received it again after the revolution of July, 1830. D. at Paris Apr. 7, 1854. He produced some original poems, translated Virgil's *Bucolica* and the elegies of Johannes Secundus, and wrote *Histoire complète de la Révolution française* (6 vols., 1833–36) and *Mémoires historiques sur Carnot* (1824).

**Tissot** (Simon André), b. at Grancy, canton of Vaud, Switzerland, Mar. 20, 1728; studied medicine at Geneva and Montpellier; settled as a practitioner in Lausanne about 1750; was appointed professor of clinical medicine in 1780 at the University of Pavia by Joseph II., but returned in 1783 to Lausanne, where he d. June 15, 1797. His complete works, containing many valuable contributions to medical science, were published at Lausanne in 15 vols. (1783–95), and at Paris in 11 vols. (1809–13), but it was especially his *L'Onanisme* (1760) and *Avis au Peuple sur la Santé* (1761) which attracted general attention, and were translated into most European languages.

**Tis'sues** [Fr. *tissu*], the ultimate anatomical elements which constitute the fibrillated structures of the body—the muscles, tendons, and connective tissue. (For the structure of these see Histology.) The individual tissue is developed from an antecedent nucleated cell by a transition of the round or ovoid shape to spindle shape, to live processes, and finally becoming the extended fibre. White fibrous or connective tissue tends to develop in all processes of repair of wounds, the exuded nutritive matter organizing around nuclei, probably exuded white blood-cells, and developing wavy lines. Such newly-developed tissues may gradually atrophy, the scar or inflammatory deposit disappearing: in other cases they become highly vascular, are permanent, or tend to excessive growth.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Titan'ic Diox'ide,** generally called **Titanic Acid** ($TiO_2$). This compound alone constitutes three distinct mineral species—*octahedrite*, *brookite*, and *rutile*. A synonym of octahedrite is *anatase*, and a synonym of brookite is *arkansite*. These species are referred to under Isomerism (which see), but by an error which escaped correction the synonym *arkansite* was there appended to octahedrite instead of brookite. The statements of mean densities there given, moreover, may be modified to an important degree with advantage. They were averaged from figures cited in mineralogical textbooks, but further examination of the records, made since by the writer, has developed a long list of additional figures, and these, taken into connection with the writer's now-published discovery (see *Am. Chemist* for Mar., 1876) of the geometric law of molecular volumes (see also Volumes, Molecular), enable him to compute the following precise figures for these three species, with one or two of their modifications:

| | True densities at zero. | Experimental densities. | |
|---|---|---|---|
| A *minimum* octahedrite of Boullay | 3.766 | 3.75 | Boullay. |
| The normal or *dominant* octahedrite | 3.902 | 3.89 | H. Rose. |
| The normal or *dominant* brookite | 4.177 | 4.166 | " " |
| The normal or *dominant* rutile | 4.316 | 4.3 | Hautefeuille. |
| A *maximum* rutile of Kopp | 4.464 | 4.42 | Kopp. |

Kopp's heavy rutile is cited here because a special interest attaches to it as containing a volume or molecule of titanium identical with that of *carbon* in carbonates and hydrocarbons. At the same time, it may be remarked that the *minimum* anatase (octahedrite) cited from Boullay is of equal interest, as containing one titanium molecule equal in dimensions to that of *silicon* in quartz and in crystallized silicates generally. The precise molecular volume of the silicon in quartz is still more closely approached, moreover, by *artificial* octahedrites obtained by Hautefeuille, for which he gives a range of densities running as low as 3.7. Precise parallelism in structure with quartz would require a density of 3.639. The dioxides of titanium form, therefore, doubtless, a progressive series (see Series in Chemistry) of allotropes or homologues (the geometric law of construction of homologous series being the same as that of series of allotropes, according to the writer's researches), which connects the dioxide of carbon (in combination) with the dioxide of silicon. By heat, octahedrite acquires density 4.16, that of brookite.

Of the three mineral forms of titanic dioxide, *rutile* is far the most abundant, being indeed in some districts a quite common mineral. The commoner varieties have a peculiar reddish tinge, and a lustre of a peculiar dark metallic brilliancy on the cleavages, which, with its high density, enables it to be distinguished at a glance by those expert in minerals. Its hardness is between those of quartz and feldspar. The crystals are dimetric or tetragonal, and usually prismatic, sometimes acicular, and are found in the latter form penetrating transparent quartz-crystals from side to side in a great many directions, like needles, forming interesting cabinet specimens known as "rutilated quartz." In these cases the rutile needles have evidently been first formed, crossing a cavity filled with the menstruum from which they were deposited, in which the quartz has subsequently crystallized out from the same or some other menstruum. There are a great many American localities of rutile, too numerous to mention here.

*Brookite* is trimetric or orthorhombic in crystallization, translucent, with cleavage less distinct than rutile, but having the same metallic adamantine lustre. It has been found in small crystals in North Carolina placer gold, at Paris in Maine, and at Ellenville in Ulster co., N. Y., and in a number of foreign localities. At the celebrated mineral locality at Magnet Cove, Ark., it is found as the variety *arkansite*, so called by Prof. Shepard, which is described as iron-black and opaque, though nearly pure titanic oxide, according to Whitney and Damour.

*Octahedrite*, or anatase, is tetragonal like rutile, but with very different angles and cleavages. It is usually octahedral in form, highly lustrous like diamond, and sometimes mistaken for it in placer washings. Only one North American locality is cited, in dolomite at Smithfield, R. I.

Pure $TiO_2$ may be obtained from minerals containing it, as follows: They are fluxed with 3 parts of potash carbonate, the mass washed with cold water to remove the excess of the flux, and the remaining acid titanate of potash dissolved in muriatic acid. This solution is diluted, treated with $H_2S$ to precipitate tin, and then ammonia added to precipitate the $TiO_2$, which will carry down with it sulphides of iron and manganese when present. These are dissolved out from the precipitate with a solution of $SO_2$, which leaves pure "titanic hydrate." Also, if the muriatic solution be boiled with *sulphite of ammonium*, pure titanic acid (hydrate) goes down. H. Rose found its composition to be $O_3H_2Ti$. On ignition it leaves $TiO_2$, which is yellow when hot. Dissolved in dilute mineral acids and boiled, a modification precipitates, called *metatitanic acid*, of the same composition, which is no longer soluble in acids, except in hot oil of vitriol. Titanic dioxide, as rutile, is used to a small extent to give a pale yellow color to porcelain and to artificial teeth.

Henry Wurtz.

**Titanites.** See Titanium.

**Tita'nium.** Dr. William McGregor, in examining the mineral now called *menaccanite*, from Menachan in Cornwall, in 1791, discovered the existence in it of a new element, afterward found by Klaproth (in 1794) in *rutile*, and called by him in 1797 *titanium*, in fanciful allusion to the Titans, who were the children of Uranus and Gea. (See the article Titans.) Titanium is quite an abundant element, but very little is as yet known of it in the elemental form. For a long time certain cubical crystals of a copper color found in blast furnaces were believed to be metallic titanium, but Wöhler has proved that these contain cyanogen and nitrogen. The element is obtainable by heating the double fluoride of titanium and potassium with sodium. It is described as a dark-green, heavy powder, which cannot be burnished and is infusible. Its density is unknown. Its metallic nature seems, therefore, to be quite a matter of assumption, and its analogies with the non-metallic *silicon* and *carbon* make it *possibly* not a strictly metallic element. Titanium occurs in many minerals. The three minerals *rutile*, *brookite*, and *anatase* are all Titanic Dioxide (which see). *Menaccanite* or *ilmenite*, in which titanium was first discovered, contains titanic dioxide with iron oxides. *Sphene* or *titanite* contains titanate and silicate of lime. *Perofskite* is simple titanate of lime, and it is very common in magnetic iron ores and many other minerals. Titanium forms two chlorides, $TiCl_3$, lustrous dark-violet scales, and a colorless transparent liquid tetrachloride, $TiCl_4$. It is believed to form three compounds with oxygen—TiO, which is the product of the heat of a wind-furnace upon $TiO_2$; the sesquioxide, $Ti_2O_3$, a black powder produced by igniting $TiO_2$ in a current of hydrogen; and the dioxide. (See Titanic Dioxide.) The chief practical interest that attaches to titanium is in consequence of its frequent occurrence as a constituent of iron ores, chiefly of magnetite, which passes into ilmenite or menaccanite, the two apparently occurring mixed in all proportions, and called titaniferous iron ore. Such ores are liable to be very pure—that is, free from sulphides

and phosphates—but, unfortunately, it happens that the titanium is excessively difficult to flux out from the mass, tending apparently to form slags of very difficult fusibility, thus limiting their use very greatly. It has been recently reported that some have overcome this obstacle successfully, but the subject must yet be regarded as in the experimental stage. HENRY WURTZ.

**Titanothe′rium** [Gr. τιτάν, "titan," and θηρίον, a "beast"], an extinct genus of mammals from the "Mauvaises Terres," or "Bad Lands," of White River, Dakota. The formation is regarded as Miocene, and the bones of this animal were the first fossils obtained from the region. They were made known by Dr. H. A. Prout, and the species was afterward named by Dr. Leidy *Titanotherium Proutii*. Later researches and extensive collections in the same region, and in the Miocene of Nebraska and Colorado, have shown that this species is but one of an extinct family of herbivorous mammals, now known as the Brontotheridæ, and including at least four genera—viz. *Titanotherium*, with short nasal bones, and *Megacerops*, with more elongated nasals; both genera with a diastema or toothless interval between the upper canine and molar teeth, and a short or rudimentary third trochanter on the femur; *Brontotherium*, with four incisors above and below, and *Diconodon*, with no upper and but two lower incisors, both genera without a diastema, and the first, at least, having a distinct third trochanter. The best-known genus is *Brontotherium*, and its principal characters are as follows: The skull is long and depressed, and resembles that of the rhinoceros. There is a pair of large horn-cores on the anterior part of the skull, in front of the orbits. They stand on the maxillary bones, and are placed transversely, as in ruminants. They vary much with age, and probably differed in the sexes. There are large air-cavities in the base of these horn-cores. The nasal bones are greatly developed and firmly co-ossified. They are produced in front, and overhang the narial orifice. The zygomatic arches are massive and much expanded. The occipital condyles are large and well separated. The dental formula is as follows: incisors, $\frac{2-2}{2-2}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{4-4}{3-3}$; molars, $\frac{3-3}{3-3}$. The upper incisors are small. The canine is short and stout, and placed close to the first premolar. The upper true molars are very large and powerful grinding teeth, measuring in some specimens nearly 5 inches in diameter. Each has a pair of external connate cusps, and two inner tubercles or cones. The lower molars are of the *Palæotherium* type. The brain-cavity is small in proportion to the skull. The cerebral hemispheres did not extend at all over the cerebellum, and but little over the olfactory lobes. The latter were of moderate size, and separated by a wide osseous septum. The hemispheres were comparatively large, and much convoluted. The cerebellum was small, and there is a rudimentary tentorial ridge. The neck was stout and of moderate length. The atlas is large, and much expanded transversely; the axis massive, and its odontoid process stout and conical. The lumbars are slender and smaller than the dorsals. There are four sacral vertebræ. The caudals indicate a long and slender tail. The epiphyses of the vertebræ are loosely united, as in proboscidians and many other large animals. The limbs were intermediate in proportion between those of the elephant and the rhinoceros. The radius and ulna are separate. The carpal bones are shorter than in the rhinoceros, and form interlocking series. They support four stout toes. The fibula is separate from the tibia, and entire but slender. The calcaneum is long; the astragalus short, and articulates with both the navicular and cuboid. There were three toes on the hind foot, of nearly equal size. None of the bones of the skeleton are hollow. The Brontotheridæ nearly equalled the elephant in size, but the limbs were shorter. The nose was probably flexible, as in the tapir, but there was evidently no true proboscis. All the remains yet known are from the Miocene beds of the Rocky Mountains, in Dakota, Nebraska, Wyoming, and Colorado. The name *Titanotherium* at the head of this article has been used because so well known in this country; it must, however, give way, in scientific nomenclature, to the previously-applied name, *Menodus*. O. C. MARSH.

**Ti′tans,** in Greek mythology, were the children of Uranus and Gea, numbering, according to the most common record, twelve—six male, Oceanus, Cœus, Crius, Hyperion, Iapetus, and Cronos; and six female, Theia, Rheia, Tethys, Phœbe, Mnemosyne, and Themis. Uranus feared his own children, and shut them up in Tartarus, but by the aid of Gea they broke out of the prison, overthrew their father, and placed Cronos on the throne. The curse, however, which Uranus let fall on his children was fulfilled. Cronos was dethroned by his own son, Zeus, and the Titans were once more imprisoned in Tartarus, where the Cyclopes and Hecatoncheires were set to watch them. Among their descendants were Atlas, Prometheus, Helios, Hecate, and Selene.

**Tite** (Sir WILLIAM), F. R. S., b. at London, England, in 1802; educated at a private school; was articled as a pupil to Mr. Laing, the architect of the custom-house; was entrusted with the rebuilding of the church of St. Dunstan's-in-the-East, which he executed so successfully in the Gothic style, then recently become popular, as to gain a high reputation; was employed to erect a Gothic church for the celebrated Edward Irving; subsequently built many public and private edifices, including some of the largest railway-stations of England and France; became architect to the New Royal Exchange 1840; was for some time president of the Architectural Society and of the Royal Institute of British Architects; was elected Liberal member of Parliament from Bath 1855; was governor of the Bank of Egypt and member of parliamentary committees on banking, and was knighted 1869. D. Apr. 20, 1873. He published some essays and lectures, and was author of a *Descriptive Catalogue of the Antiquities found in the Excavations at the New Royal Exchange* (1848), and other miscellaneous writings.

**Tithe** [Ang.-Sax., *teódha*, the "tenth"], the name of a tax, consisting of one-tenth of the annual profit of land, stock, or labor, which, instituted by Moses, was paid by the Jews for the maintenance of the Levites and in compensation for their service in the temple. From the Jewish theocracy the institution was gradually transferred to the Christian Church, and by the second Council of Tours (567) the tax was officially introduced by a statute, which again was confirmed by the second Council of Mâcon (585). It was not firmly established, however, in Germany, France, and England until the ninth century, and in the Scandinavian countries not until the eleventh century. Even before the period of the Reformation, but especially after that time, the tithes became subjects of bargains, of buying and selling, like other property. Originally, they were paid *in natura*, but in the eighteenth century a certain sum of money was generally substituted. In France they were finally abolished by the Revolution.

**Ti′tian** (TIZIANO VECELLIO), b. in 1477 at Tai, a village near Pieve di Cadore, in Friuli, then a Venetian possession; received his first instruction in painting from Sebastiano Zuccati, a Venetian painter and worker in mosaic, but was very early sent to Venice, where he studied under Gentile and Giovanni Bellini. Bellini was the founder of the Venetian school, whose head Titian afterward became, and on the earlier works of the latter the former exercised a decided influence. It is also probable that Titian had studied under Albert Dürer, who visited Venice in 1494 and in 1507, and very striking is the influence which at one time he received from his friend and fellow-student Giorgone. Indeed, their style was so much alike that, on the death of Giorgone in 1511, Titian could undertake to finish some of his pictures. To this period of his career belong the *Visit of Mary to Elizabeth*, in the Academy of Venice; the *Vierge au Lapin*, in the gallery of the Louvre; the *Christ with the Tribute-money*, in the museum of Dresden; and a *Resurrection*, in five compartments, in the church of San Nazaro at Brescia. In 1514 he went to Ferrara, where he painted for Duke Alfonso I. the *Arrival of Bacchus in the Island of Naxos* and *A Sacrifice to the Goddess of Fertility*, both of which are now at Madrid; the *Bacchus and Ariadne*, now in the British National Gallery; portraits of Lucrezia Borgia, Ariosto, etc.; and in 1516 he returned to Venice, where he continued to reside till 1530. During these years his style ripened into perfect originality. All foreign influences were toned down into mere elements of his own individuality, and his pictures became masterpieces. The most prominent feature of this style—which is the style of the Venetian school, but which, although it found many able disciples, has had only one master—is the coloring. With respect to composition Titian succeeded several times in representing passionate and highly pathetic subjects, such as the *St. Peter Martyr*, in the church of Santi Giovanni e Paolo in Venice, painted during this period, but destroyed by fire in 1867, and the *Martyrdom of St. Lawrence*, in the church of the Jesuits at Venice, painted at a later period, but both belonging among his greatest productions. Nevertheless, the general character of his compositions is a noble repose. The scene may involve the deepest feeling, but it is without passion—such as the *Assumption* and the *Presentation of the Virgin*, in the Academy of Venice; the *Entombment of Christ* and *Christ crowned with Thorns*, in the gallery of the Louvre; the *Last Supper*, in the Escurial; several representations of the *Holy Family*, among which the *Virgin and Child with Saints*, in the Uffizi gallery in Florence, and the *Madonna with Saints*, in the museum of Dresden, etc. Often the composition comprises only one or two figures, and the situation is almost without movement, like that of a statue, such as the

numerous *Madonnas*, *Magdalens*, *Venuses*, *Danaës*, etc., scattered over all European collections. But just this kind of composition was the best suited for that kind of coloring which was Titian's mastership, not to say his genius. Without employing any violent contrasts of light and shade, or of one color to another, he worked out a peculiar light, golden, mellow ground-tone, which by itself exercises a magical charm, into innumerable small but significant shades, and produced thereby, especially in his portraits and in the representation of the nude female form, an almost complete illusion of life. In 1530 he was invited by Charles V. to Bologna to paint his portrait, and he painted him several times afterward—in 1532, in 1536 at Asti, on his return from Africa, and in 1550 at Augsburg. In 1543 he again visited Bologna, Ferrara, and this time also Rome, where he met Michael Angelo and painted the celebrated portrait of Pope Paul III. In 1548 he went to Augsburg, again on the invitation of the emperor, who was his great patron, made him a count, and gave him a pension, which was continued after the abdication of Charles by Philip II. of Spain. After 1550 he resided almost without interruption at Venice, busy with his art to the very last of his life. He was eighty-one when he painted the *Martyrdom of St. Lawrence*, and several others even of his most remarkable pieces are of a still later date. D. at Venice Aug. 27, 1576, not of old age, but of the plague, and was buried in the church of Santa Maria de' Frari, which contains one of his most beautiful pictures, the *Madonna on the Throne*. He educated numerous disciples — Bonifazio, Domenico Campagnola, Girolamo Rumanino, Pordenone, Bordone, etc.—but he exercised the greatest influence on the development of modern art by the method he adopted of filling out the background with the representation of a real landscape. In this point he was imitated by the Carraccis, Poussin, and Rubens, and thereby he became the founder of modern landscape-painting. His *Life* has been written by Northcote (2 vols., London, 1830) and by Crowe and Cavalcaselle (1875).

**Titica'ca,** the largest lake of South America, is between lat. 15° 15′ and 16° 35′ S., and between lon. 68° 40′ and 70° W., at an elevation of 12,800 feet above the level of the sea, and surrounded by the high and towering peaks of the Andes. It covers an area of about 4000 sq. m., receives several smaller streams, and discharges its surplus water through the Desaguadero. It contains a great number of islands, which are very interesting on account of the remains of old Peruvian architecture which are found on them. Its depth is 120 fathoms near the shore, and probably considerably more in the middle.

**Tit'lark,** or **Pipit,** name given to species of birds of the genus *Anthus* and group or sub-family Anthinæ. These are generally associated with at least the wagtails (Motacillinæ) in a family, Motacillidæ, and contrasted with them by the comparative shortness of the tail (shorter than the wings), which is emarginated, and has the two central feathers shorter than the lateral, and all broadest near their ends, and boldly round at the extremities. They are mostly grayish-brown, and in the under parts variously streaked. Over 50 species are known, and almost every land has representatives of the group. By some authors (*e. g.* Gray) they are all combined in one genus, but by most distributed among several. They are birds of passage, insectivorous and graminivorous as to food, rather fine songsters, and graceful in appearance and movements. Two species are found in the U. S.—namely, *Anthus ludovicianus* (American titlark or pipit) and *Neocorys Spraguei* (Missouri skylark); a third species (*Anthus pratensis*, or European titlark) sometimes straggles into Greenland and Alaska.

THEODORE GILL.

**Ti'tle** [Lat. *titulus*], in law. Although this word is often used as synonymous with property or right of ownership, in its proper and technical signification it denotes the sources of such right, or the facts and events which are the means whereby property in land is acquired. In this sense the common law divides all titles into two classes—by descent and by purchase. Title by descent includes the single mode of acquisition through inheritance; title by purchase embraces all other methods. The descriptions given by the standard English text-writers tend to mislead the American reader by reason of the radical differences between the law of Great Britain and that of the U. S. Following the arrangement of an able American author, the means of acquiring property in lands otherwise than by descent may be separated into two divisions—title not by grant, and title by grant. The first class includes escheat to the state; prescription, as a means of gaining incorporeal rights; accretion, or the acquisition of additional soil by the gradual operation of natural causes; estoppel; and adverse possession, aided by the statute of limitations. In the second class are found (1) governmental grants, which may be in the form of statutory concessions and donations, the patents issued by the national government to purchasers of and settlers on the public lands, and similar conveyances made by the States. (2) Office grants, or conveyances made by persons acting in an official capacity in pursuance of some statute or of some judicial order or decree. The instances of this subdivision are very numerous. Among the most important are assignments in bankruptcy or insolvency, the conveyances directed in foreclosure and partition suits, suits for assignment of dower, and in proceedings to settle the estates of decedents, sheriffs' deeds, deeds given on tax sales, and the proceedings to acquire property under the right of eminent domain. (3) Private grants, or the ordinary deeds of conveyance whereby property in land is transferred. (4) Devise, or the conveyance of land by last will and testament. The foregoing enumeration embraces the various species of title, or means of acquiring and transferring property in land, known to our law. It will be seen that the public patents from the U. S. or from the States, and most of the methods of transfer through official acts, as well as the devise by will, are merely varieties or modifications of the deed or simple grant, for nearly all official conveyances are actually consummated by the execution and delivery of a deed. All these modes are often described together as "title by alienation." (For more detailed information concerning the several titles above mentioned the reader may consult the articles on DESCENT, HEIR, ESCHEAT, PRESCRIPTION, and others.)

JOHN NORTON POMEROY.

**Tit'mouse, Tit, Tomtit,** and **Chickadee,** names given by the English-speaking peoples to species of birds of the group or sub-family Parinæ. These have been defined by Baird as distinguished by a compressed body, soft and lax plumage, the bill shorter than the head, the wings rounded and short, and with the second quill as short as the tenth, the tarsi larger than the middle toe and claw, and the expansion of the sides of the toes into a palm. Their affinities are in dispute, some (*e. g.* Baird, Brewer, and Ridgway) associating them with the nuthatches in a family, Paridæ, others (*e. g.* Gray, Coues) isolating them as a peculiar family, etc. The species are numerous, but ornithologists are again in disaccord as to their grouping; for example, G. R. Gray, admitting only five genera in the sub-family, while others (*e. g.* Baird) greatly multiply the genera. There are about 87 species scattered over all parts of the world. Of these, 12 are found within the limits of the U. S., and belong to the extended genus *Parus* of Gray, but are differentiated by American authors into the genera *Lophophanes* (4 species), *Parus* (6 species), *Psaltriparus* (1 species), and *Auriparus* (1 species). They are rather small birds, mostly between four and six inches long. They feed upon insects and seeds. Some of them (*e. g. Parus atricapillus*) are very familiar, and rather prone to resort near the habitations of man. They are remarkable for devotion to their young. Their nest is usually built near the ground, and in it are laid generally not more than eight eggs, which are mostly white sprinkled with reddish or brownish.

THEODORE GILL.

**Titmouse, Cape.** See CAPE TITMOUSE.

**Tittabawassee,** tp., Saginaw co., Mich. P. 864.

**Ti'tus,** county of N. E. Texas, lying between Sulphur fork of Red River and Big Cypress Bayou, and intersected by White Oak Bayou. Surface level, soil well timbered and productive, with some iron ore. Cattle and swine are numerous. Staples, cotton and Indian corn. Cap. Mount Pleasant. Area, about 940 sq. m. P. 11,339.

**Ti'tus,** a disciple and companion of St. Paul, to whom one of the canonical Epistles of the New Testament is addressed. He was a Gentile, but his native place is uncertain, the probability being in favor of Antioch, as he first appears as a delegate from the church of that city, accompanying Paul to Jerusalem. He was a companion of the apostle in his next missionary journey to Asia Minor and Macedonia, and was twice charged with important missions to the church at Corinth. By some he has been thought to have been a companion of Paul in his voyage and shipwreck, and has even been identified with the writer of the memoranda or itinerary upon which the second part of Acts is based; while others would make him the author of the whole book of Acts (in which, singularly enough, he is not mentioned by name), and consequently of the Gospel usually ascribed to Luke. At some time—whether before or after Paul's (first) imprisonment cannot be ascertained—Titus took part with Paul in founding the churches in Crete, where he was laboring as evangelist when Paul's pastoral Epistle was written. He appears to have rejoined Paul at Nicopolis in Epirus, and was thence sent into Dalmatia, from which time all certain traces of him disappear.

**Titus, Epistle to,** one of the so-called pastoral Epistles of the New Testament canon, written by Paul to

convey instruction as to the work in Crete, with the execution of which Titus had been commissioned. If the hypothesis of Paul's second imprisonment be true, this Epistle and the first to Timothy were written during Paul's journey to Asia Minor and Greece, before his last imprisonment. The Epistle, it is thought, was written from Nicopolis, probably the Epirote town of that name, and not the Macedonian city. (On the question of authenticity see TIMOTHY, EPISTLES TO.)

**Ti'tus Fla'vius Sabi'nus Vespasia'nus,** commonly called by his prenomen TITUS, Roman emperor (79–81), b. Dec. 30, 40 A. D., a son of Vespasianus and Flavia Domitilla. Vespasianus was of mean extraction, but he had acquired a great fame as a general, and, although Nero disliked him, his son Titus was nevertheless educated with Britannicus, the son of Claudius, with whom he formed an intimate friendship. When, in 66, Vespasianus was sent to the East as commander in the Jewish war, Titus accompanied him, and when, in 69, Vespasianus was declared emperor and returned to Rome, Titus was left as commander-in-chief, and finished the war by taking and destroying Jerusalem, Sept. 8, 70. As cæsar and co-regent with his father he did not give great promise; on the contrary, the people feared that he would be another Nero. After his accession, however (June 24, 79), he proved a kind and conscientious ruler. The *delatores* (informers) were branded and banished, and no one was prosecuted for *crimen læsæ majestatis*. Many splendid public buildings, the Colosseum, the baths, etc., were finished and dedicated with magnificent festivals for the people; but the emperor deserved most praise for the energy he developed in aiding the people under the great calamities which befell them during his reign—the destruction of Herculaneum, Pompeii, and Stabiæ by the terrible eruption of Vesuvius; the conflagration in Rome in the following year, by which the Capitol, the library of Augustus, and many of the most magnificent edifices of the city were destroyed; and, finally, the plague. But his reign was very short. He d. Sept. 13, 81, at Reate in the Sabine country, probably poisoned by his younger brother, Domitian, who succeeded him.

**Titus Livius.** See LIVY.

**Titus'ville,** city, Crawford co., Pa., in the extreme S. E. corner of the county, originally a part of Oil Creek township. It was incorporated as a city in 1867. Oil Creek—originally so called on account of the petroleum which was occasionally found floating upon its surface—flows through the S. part of the city from W. to E., affording good water-power. It is regularly laid out upon a plateau which gently slopes to the S., affording natural facilities for sewerage, which have been taken advantage of in the construction of an excellent system of drainage. The principal streets are well built, laid with block pavements, and lighted with gas. The Holly system of waterworks supplies every part of the city with the purest water, and furnishes the fire department with the means of subduing fires so quickly that a serious conflagration has not occurred since the system was inaugurated. The Presbyterian, Baptist, Methodist, Episcopal, Universalist, Irish and German Roman Catholic, M. E. Zion, and German Reformed Church organizations all have well-built houses of worship. The city owns a fine building used for official purposes. The public schools are of a high order. Two of the school edifices are brick, and two are frame, buildings. Four banks, with an aggregate capital of over $500,000, carry on the financial operations. It has 2 newspapers. The Pittsburg Titusville and Buffalo R. R. passes through the city, and its Union City branch has its southern terminus here. The Dunkirk Allegheny Valley and Pittsburg R. R. also terminates in this city. A railroad from Cambridge on the Atlantic and Great Western Railway is projected and partly built. Petroleum was discovered in the eastern confines of the city in 1859, since which time thousands of wells have been bored, from Bradford on the N. to Butler county on the S. Titusville has always been a large refining-point, and can turn out 4000 barrels of refined oil per day. The industries connected with the production and refining of petroleum, such as the manufacture of engines, boilers, oil-well boring and pumping tools, iron tanks, stills, barrels, etc., have largely centred in this city, giving employment to large machine-shops, with thousands of skilled mechanics. An oil exchange regulates the buying and selling of crude and refined petroleum. It has good hotel accommodations, and one of the best opera-houses in the State. P. 8639. BLOSS & COGSWELL, EDS. "MORNING HERALD."

**Tiv'erton,** town of England, in Devonshire, at the confluence of the Exe and Laman, has some educational institutions, a fine church, and manufactures of lace which employ more than 1000 hands, and of woollen cloth. P. 10,025.

**Tiverton,** tp., Coshocton co., O. P. 804.

**Tiverton,** p.-v. and tp., Newport co., R. I. P. 1898.

**Ti'voli** [anc. *Tibur*], town of Italy, province of Rome, 19 miles E. N. E. of the city of Rome, on a plateau formed by a spur of Monte Ripoli, about 900 feet above the sea, and down which the Anio tumbles in its course toward the Tiber. This town, founded at least 500 years before the first stones were laid in old Rome itself, is most interesting, not only for its historical associations, but for the extraordinary beauty of the natural scenery in the midst of which it stands. The celebrated falls of the Anio or Teverone, so praised by the Roman poets, are perhaps even more beautiful now that changes in the bed of the river, brought about by the violence of floods, have compelled the hand of art to lend its aid to nature. The last great work, made necessary by the destructive flood of 1826, was the turning of the Anio into an entirely new channel by cutting two tunnels (885 feet and 980 feet in length, respectively) through the limestone rocks of Monte Catello on the opposite side of the valley. This was effected by the very able Roman engineer Folchi in 1832, and the river now takes a single leap of 320 feet, forming a cascade as grand as it is graceful. The Cascatelle are a series of smaller but most picturesque falls, produced by diverting, for manufacturing purposes, a portion of the water of the main stream of the Anio. On a rock overlooking the cascades stands the beautiful little temple generally called that of the Tiburtine Sibyl, though probably dedicated to Vesta—a circular structure (21½ feet in diameter) surrounded by an open portico composed originally of eighteen columns, only ten of which now remain. These columns, of the Corinthian order, the shafts being 18 feet in length and the capitals ornamented with lilies, are formed of travertine covered with stucco—a thing not common in ancient architecture. The entablature is very rich, and on the architrave is inscribed "L. Gellio. L." The neighboring oblong Ionic temple, also of travertine, is now converted into a church. The so-called Tempio della Tosse, circular and covered with a dome, is probably a sepulchral monument of the time of the first Christian emperors. Traces of old Roman villas are found everywhere, though few can be identified as belonging to a particular family. The very extensive Villa of Cassius is one of the latter, and the Vatican and other museums have derived some of their choicest treasures from excavations made here. The Villa of Mæcenas has no authority for its name, but its vast size, its ruined Doric temple, and the magnificent view from the terrace make it well worthy a visit. The old castle near the Porta Santa Croce, with its five circular towers, is a very striking object and the most interesting relic of mediæval Tivoli. From the Villa d'Este (1549), from the Villa Braschi, and indeed from very many other points, the views, reaching over the Campagna to the sea, and embracing the Eternal City itself, are altogether beyond description. It is greatly to be regretted that this place, so favored in other respects by nature, should suffer from malaria—a circumstance which alone prevents it from becoming a most favorite summer resort. As it is, though many noble Roman families have superb villas here, yet they seldom occupy them more than a few days at a time. The manufacturing industry of the modern town is, however, very considerable. Important ironworks were established by Lucien Bonaparte among the ruins of the Villa of Mæcenas; large paper-factories are also in operation, and an incombustible fabric is here made from asbestos.

The settlement of Tibur by the *Siculi* is variously fixed between 500 and 700 years before the foundation of Rome. Syphax, king of Numidia, died here 202 B. C. Under the Roman emperors it was very flourishing; Horace, Virgil, Catullus, and Propertius have praised it in their immortal verses. It was here that Queen Zenobia, after her glorious but vain resistance to the arms of Aurelian, lived in luxury and died in peace. The destruction and rebuilding of the city by Totila (sixth century) is a memorable event; the subsequent mediæval history of Tivoli is intimately connected with that of the city of Rome itself, and is filled with violence and disaster. It was for a time the headquarters of Cola di Rienzi. P. 8105.

CAROLINE C. MARSH.

**Tivoli,** p.-v., Red Hook tp., Dutchess co., N. Y. P. 452.

**Tiwappity,** tp., Scott co., Mo. P. 580.

**Tizza'na,** town of Italy, province of Florence, on a beautiful hill about 10 miles S. W. of Pistoia. Its mediæval wall and castle are now in ruins. The wines produced here are among the best in Tuscany. P. 9352.

**Tlaxca'la,** or **Tlascala** [Mexican, "land of maize"], a state of the Mexican republic, occupying a portion of the central table-land, N. of the Valley of Puebla and E. of the Valley of Mexico. It is the smallest of the Mexican states, having an area of only about 1500 sq. m.; is bounded W. by Mexico, N. W. by Hidalgo, and on all other sides

by Puebla. The territory is mountainous on the N. and W., and the centre of the state is occupied by the celebrated mountain Malinche; the N. valley between Malinche and the Sierra de Puebla is traversed by the Mexico and Vera Cruz R. R., completed in 1872, and from Apizaco in the N. W. a branch diverges S. to the city of Puebla. The soil is somewhat hard, and usually bare of trees, but extremely productive of maize (whence the name), and in some parts produces the maguey or pulque-plant. Hemp has lately been successfully introduced near Apizaco, a town which owes its growth to the railway. There are no towns of great importance, Huamantla, the largest, having less than 10,000 inhabitants, and the city of Tlaxcala, the capital, having less than 5000. Tlaxcala is celebrated in the annals of the Conquest as the seat of a warlike Indian republic, which made a gallant resistance to Cortez under its chief Xicotencatl, and subsequently became his most faithful and efficient ally in the siege of Mexico. The city of Tlaxcala was reported by Cortez to have numbered 20,000 families; doubtless a gross exaggeration, as there are no existing remains to prove such former greatness, though there are preserved in the archives of the *Cabildo* numerous documents and relics of that period, as well as the banner of Cortez and authentic portraits of the Tlaxcalan senators. The oldest Franciscan convent in Mexico is at Tlaxcala, which was the seat of the first Mexican bishopric, now transferred to Puebla. The people are nearly all of Indian blood, are intelligent and industrious, though poor, and have taken a large part in the civil and foreign wars of Mexico. A *History of Tlaxcala*, written in the sixteenth century by Camargo, a native of the city, was published there in 1870 by the care of the governor, Don Miguel Lira y Ortega, a descendant of the celebrated Magiscatzin, who was at the head of the Tlaxcalan senate at the Conquest. PORTER C. BLISS.

**Tlemcen′,** town of Algeria, province of Oran, is well built and is in a fine plain, sheltered against the scorching S. winds by a chain of lofty mountains, cultivated with great care, and producing olives, figs, grapes, and other kinds of fruit in abundance. Tlemcen has some manufactures of leather, ironware, carpets, and woollen fabrics, and a considerable trade in wool, ivory, and ostrich-feathers. P. 21,728.

**Toad** [Ang.-Sax. *tade*], the English name for various species of Salientia or anurous amphibians, agreeing in having a stumpy body, short legs, as compared with the frogs, and a warty skin. Animals thus distinguished, nevertheless, may differ much in other respects, and severally be related to forms differing in external characters; and indeed the name cannot be definitely applied to a natural group. Under this heading, however, may be considered the typical toads and those immediately related to them. The toad, then, is the representative of a group (Bufoniformia) of families called Bufonidæ, Rhinophrynidæ, and Batrachophrynidæ. This group or superfamily (or, according to Cope, sub-order) Bufoniformia is distinguished by the absence of teeth in the jaws, the development of a sternum which is deficient in a manubrium, the dilation of the diapophysis of the sacrum, and the absence of articulate ribs.

I. In the Bufonidæ the skin is warty; both a tympanum and cavum tympani are developed; there are well-developed (two) eustachian tubes and parotid glands, and the tongue is free behind. Other less superficial characters have been indicated by Cope; the superior plate of the ethmoid is completely ossified, and usually covered by the fronto-parietals, which are mostly completely ossified, or by them and the prefrontals together; there is no pterygoid; the epicoracoids are divergent from the coracoids; the "latter dilated, nearly or quite in contact, each connected with the former on the same side by a cartilaginous arch, of which that on the right (the animal being on its back) overlaps with its convexity the left coracoid, and that of the left coracoid underlaps that on the right." The family is quite rich in species, and very generally distributed; it is represented by many species of *Bufo* in the northern hemisphere, as well as by some in Asia, Africa, and South America, and by other genera of more restricted range. At least 10 species of *Bufo* occur within the limits of the U. S., and these are the only North American representatives of the family. The common toad of the Northern States is *Bufo lentiginosus;* the common one of Europe, *Bufo vulgaris*. They all live upon insects, and their appetite is almost insatiable. Their skin, on provocation, emits an acrid secretion, which is believed to be poisonous by many people, but erroneously so, although a person of bad constitution with an open wound may suffer from touching it with the wounded part.

II. In the Rhinophrynidæ, the skin is also rough, neither tympanum nor cavum tympani are developed; the eustachian tubes are rudimentary or absent; there are no parotid glands, and the tongue is free in front (fixed behind); the ethmoid septal walls are ossified to the end of the muzzle, separating the prefrontals, and the superior plate is covered by the fronto-parietals, which are co-ossified; there is no pterygoid bone; the epicoracoids and coracoids are divergent, and connected by a single narrow cartilage, which is in contact with or slightly separated from that of the opposite side. The family is represented by a single genus, confined to tropical America.

III. In the Batrachophrynidæ the skin is smooth; there is neither tympanum nor cavum tympani; no eustachian tubes; no parotid glands; the tongue is mostly adherent, the middle part only of the hind border being free; the cranial characters have not been indicated; the "arciform epicoracoid cartilages not united, the right being the lower." The family has been proposed for a single genus of two species from Peru. (See also BATRACHIA and FROG.) THEODORE GILL.

**Toad-Fish,** the name applied to the species of fishes representing the families Batrachidæ and Maltheidæ. These two forms belong to entirely distinct groups (orders) of the class, and have really nothing in common except a certain hideousness of aspect other than fishes generally have with each, although they were formerly associated together, even by scientific ichthyologists (*e. g.* Cuvier).

I. The Batrachidæ belong to the order Teleocephali, and are characterized by their subcylindrical body, but compressed backward, and gradually diminishing from the head to the tail; the skin is naked or covered with minute scales; the head is more or less quadrate, broad, and depressed, and distinctly differentiated from the body; the opercular bones are mostly invested in the skin, but the operculum emits one or more spines; the mouth is large, nearly horizontal, and mostly transverse; the teeth are mostly conical on the jaws and palate; the branchial apertures are narrow, vertical slits in front of the pectorals; the branchiostegal rays conspicuous externally, and in six pairs; the fins normally developed; the dorsals represented by (1) a small anterior fin, with two or three very short rigid spines, and (2) a long posterior rayed fin; the anal also moderately long; the caudal well developed and mostly free; the pectorals are not pediculated, and have the usual form and flexure, and their rays are branched; the ventrals are jugular, and have two soft rays. There are three gills, and no pseudobranchiæ; the intestinal canal has no pyloric cæca, and an air-bladder is developed. The skeleton has 12 abdominal vertebræ, and from 17 to 27 caudal ones. The family is represented by carnivorous fishes in many tropical and temperate seas, although not very rich in species. They are bottom fishes, living mostly in the mud, and in some instances ensconce themselves in the empty valves of shells. The Batrachi are to be feared on account of their bite, as their teeth and jaws are quite strong, and the *Thalassophrynes*, on account of the wounds which they can inflict with their opercular spines. The opercular spines of most of the species are solid, but those of *Thalassophryne* are hollowed, and at their bases are poison-glands. The species are generally of moderate size, but one (the so-called *Batrachus gigas*), made known by Günther in 1869 (*Ann. and Mag. Nat. Hist.*, vol. iii. p. 131), from the Seychelles Islands, ranks among the largest of true fishes. Less than 20 species of the family are known, which have been generally distributed under three genera, *Batrachus*, *Thalassophryne*, and *Parichthys*, but the first is a heterogeneous group.

II. The Antennariidæ (or Chironectidæ) belong to the order Pediculati, and are distinguished by the high compressed or sacklike body; the skin is generally covered with minute spines, but sometimes naked; the head is large and compressed, and not differentiated externally from the trunk; the opercular apparatus is entirely concealed under the integuments; the mouth is cleft laterally, and almost or quite vertically; the teeth are small and conic on the jaws and palate; the branchial apertures are holes in or behind the inferior axils of the pectoral fins; the branchiostegal rays are invisible externally; the fins in part are singularly modified; the dorsals are represented (1) by a slender spine or tentacle on the snout; (2) by two true spines (generally, but not in *Chaunax*) more or less connected (but mostly very slightly) by membrane, homologous with the first fin of typical fishes; and (3) by an elongated posterior rayed fin; the anal is short, the caudal distinct; the pectorals are pediculate and flexible downward and forward, and capable of assuming the functions of legs; the ventrals are generally present far forward, nearly under the eyes, and composed of several rays, but occasionally wanting. There are, typically at least, three and a half gills, and no pseudobranchiæ; the stomach is very large, and there are no pyloric appendages; the air-bladder is sometimes present, sometimes absent. The skeleton has a reduced number of

vertebræ (*e. g.* A. 9 + C. 9, and A. 12 + C. 10). The family is quite rich in species, remarkable for their grotesque physiognomy and often rich colors. They are mostly inhabitants of the open or deep tropical seas. Not far from 50 species are known. They are divisible among 3 subfamilies and 6 genera—viz. (1) Antennariinæ, with the genera *Pterophryne, Antennarius, Histiophryne,* and *Saccarius;* (2) Brachionichthyinæ, with the genus *Brachionichthys;* and (3) Chaunacinæ, with the genus *Chaunax.* The *Pterophryne lævigata* builds a nest in the floating seaweed of the open sea, and is the one specially signalized in this connection by the late Prof. Agassiz. THEODORE GILL.

**Toast** [so called from the old custom of putting toasted bread into punch and sack] is the liquor drunk to one's health; also a sentiment uttered on festal occasions, to be responded to in a short speech. Sometimes it designates the person, especially a lady, whose health is proposed.

**Tobac'co** [Sp. *tabaco;* Fr. *tabac;* Ger. *Tabak*], an important plant or genus of plants introduced to the knowledge of civilized nations on the discovery of America, where it was found in use by the natives of both the islands and the continent as far N. as Virginia. During the first century of communication with the New World little notice appears to have been taken of it, but after 1650 tobacco began to enter largely into the trade of the colonies with Europe, and its consumption became general. Though often violently opposed and denounced, it made steady progress, until now there are but few single products exceeding it in importance or in the extent of its use. The purpose to which it is applied is solely as a tonic, stimulant, or sedative through smoking, chewing, or snuffing. Though no form of direct nutrition is possible, its application to the palate and sensory organs of the mouth undoubtedly supports the strength of those accustomed to its use, calms nervous excitability, and relieves hunger, pain, constraint, and *ennui* in a remarkable manner. The common testimony of almost all nations and all races ascribes value to this singular plant, though it cannot be taken into the stomach without injurious results, and is essentially poisonous in its general properties. There are several species of the genus *Nicotiana* (so named from Nicot, French ambassador to Portugal, by whom it was first brought to the attention of scientific men, and who did much to render its use fashionable in France). *N. tabacum* is the common tobacco of the U. S.; *N. fruticosa* and *N. repanda* are grown in Cuba and other tropical countries of America; *N. quadrivalvis* and *N. nana* are species found growing wild in the interior near the upper Missouri, and there put to use by the Indians for smoking, it is said, long before the advent of the whites. *N. rustica* is cultivated on the coasts of the Mediterranean and at Latakia, Turkey. The tobacco-plant is everywhere an annual, forming broad, ovate-lanceolate leaves near the ground, which enlarge to eighteen inches in length by six inches in width or more as the strong fleshy stem rises, on which other leaves, diminishing in size, alternate to the top. The flowers are in a loose terminal panicle, with purple or light-red petals, with funnel-form corollas, and a small seed-capsule, ripening many small black seeds. It belongs to the natural order Solanaceæ, all the genera of which are acrid, inedible, and poisonous as plants or fruits. In the tobacco-plant the distinctive and valuable properties are found only in the leaf, which is thick, heavy, and pubescent, becoming oily and semi-resinous as it ripens. This leaf, when the plant approaches maturity, is dried and cured by partial sweating, which effects a chemical change, removing the characteristics of the fresh leaves, and developing a powerful aroma, with strong narcotic and acrid properties. After the curing, tobacco, either in leaf or manufactured, will remain a long time without decay or other change than by drying, and of the vast quantities that enter into commerce very little is lost from such causes. The essential properties that give tobacco its value are readily soluble in water and alcohol, but they have little value as an extract. By the analysis of Posselt and Riemann 10,000 parts of fresh leaves contain 6 of *nicotine,* 1 of *nicotianine,* 287 of bitter extractive, 174 of gum, 26.7 of green resin, 26 of albumen, 104.8 of a substance analogous to gluten, 51 of malic acid, 12 of malate of ammonia, 20.6 of potash-salts, 40.6 of lime-salts, 8.8 of silica, 496.9 of lignine, and 88.28 parts of water. The *nicotine* is a crystallizable alkaline substance, to which, and to an acrid dark-brown oil which is more easily separated, the distinctive qualities of the plant are due. The alkaloid nicotine contains nitrogen in larger proportions than any other product of its class, its composition being $C_{10}H_{14}N_2$, and it is one of the most virulent poisons known. Orfila states that Havana tobacco yields 2 per cent. of this alkaloid, Maryland 2.6 per cent., and Virginia 6.9 per cent. *Nicotianine* is supposed to be the odorous or volatile principle of tobacco.

The history of tobacco in its use as a stimulant is remarkable for the violent opposition it has constantly encountered, and for the severity with which it has been denounced as both useless and dangerous. The early colonists of America were attracted to imitate the uses to which it was put by the Indians, but in Europe systematic and strenuous efforts were made at frequent intervals during the first century to prevent its introduction altogether. Various incidents of vigorous social resistance to its use have occurred, and James I. of England himself wrote a *Counterblast to Tobacco,* which was expected to overthrow the social habit altogether. Pope Urban VIII. issued a bull excommunicating those who should use tobacco in churches; Amurath IV. of Turkey, the grand duke of Muscovy, and the emperor of Persia also prohibited the use of tobacco in their several dominions during the seventeenth century. Modern society is not without demonstrations against the use of tobacco, and literary skill has often directed satire or denunciation against chewing and snuff-taking particularly. In some localities snuff is applied to the palate with a small wooden spoon, the practice being called *dipping.* This is a gross form of using it, and should be exposed and broken up.

*Production of Tobacco.*—The production of tobacco is greater in the U. S. than in any other country, and it may fairly be estimated to furnish one-half the quantity entering into the general commerce of the world. The average crop in the U. S. for five years ending with 1875 was nearly 450 million pounds each year, of which an average of 250 million pounds was exported to foreign countries, and 180 million pounds were manufactured in the U. S., almost wholly for consumption here. Internal revenue tax was paid in the year ending June 30, 1875, on 168,435,874 pounds, and undoubtedly a small percentage escaped taxation, and another small portion was consumed in the leaf or lost. The census returns of tobacco produced in the U. S. for 1840 were 219,163,319 pounds; for 1850, 199,752,655 pounds; for 1860, 434,209,461 pounds; and for 1870, 262,735,341 pounds. These last are greatly in error, since the export for the same year was 195,780,712 pounds, and the home consumption not less than that amount in addition. The average production per acre in the U. S. is nearly 1000 pounds, and about 450,000 acres of the richest cultivated land are devoted to its growth. No crop is more exhausting than tobacco, in consequence of the large proportion of mineral elements and nitrogenous matter found in its leaves, the ash of the dried leaves yielding 21 per cent. of mineral constituents. Inferior soils will not produce it successfully, and under the higher prices prevailing for it for the last twenty years its growth was extended to the richer soils of Connecticut, Massachusetts, New York, Ohio, and all the Western States in this latitude. The greatest quantity is now grown in Kentucky; Virginia, Ohio, Tennessee, Maryland, and North Carolina follow in order, with Indiana, Connecticut, and Massachusetts, the three last furnishing 8 to 10 million pounds. Its cultivation is possible in a range almost as great as Indian corn, but it is destroyed by frost, and the risk in this respect in the Northern States is very great. In Connecticut, Hartford co. produces a great quantity, and in Massachusetts, Franklin, Hampden, and Hampshire cos. produce 2 to 3 million pounds each. The largest-producing countries other than the U. S. are tropical or semi-tropical. Cuba may be estimated to produce 60 million pounds, chiefly in the Yara district or Vuelta del Abajo, a rich plain S. W. of Havana, 80 miles in length by 20 in breadth. In 1852 there were in Cuba 7979 tobacco-plantations, producing for that year 59,750,000 pounds. A government monopoly long existed in Cuba, but the production and trade were thrown open in 1820. The finest leaf is grown in Cuba for the manufacture of cigars both there and in the U. S. and Europe. Porto Rico produces tobacco in considerable quantity, but not so good as that of Cuba. In 1840 the exports were 4,247,484 pounds, valued at $169,100. Hayti produces much more than Porto Rico, chiefly in the N. E. part of the island. The exports were 3,219,690 pounds in 1841, and are now twice as great, going chiefly to Bremen and France. Mexico produces largely, and exports a small share only to England and France. The Central American states produce and export not more than Mexico; New Granada and Venezuela produce and export largely, furnishing 20 million pounds to general commerce, and consuming freely in addition; the town of Varinas is a chief place of export. Peru furnishes a small quantity; Brazil has recently greatly enlarged its production, and with Uruguay and the Argentine Confederations contributes very largely to the European supply—perhaps 20 million pounds. The imports at Bremen alone from Brazil in 1874 were 156,067 bales.

British India produces inferior tobacco, which is largely consumed there, and exported to a small extent to Europe. The Philippine Islands produce 2 million pounds for export, chiefly to England and Bremen, from Manila. Java furnishes 20,000 piculs (2,670,000 pounds) for annual export, and China and Japan together as much more, which is brought to Europe. Turkey produces a considerable quantity of fine tobacco, the best being sent from Latakia in Syria. Other localities on the eastern shores of the Mediterranean produce tobacco for the general European supply, and in Italy, Spain, France, and Germany a considerable quantity is grown which does not enter into general commerce, the several state or government monopolies taking practical charge of it, as well as of all that is imported. Where a monopoly of sale exists, as in France, importation is free of duty, but only for the manufactures conducted by the government. The present system was established in 1811, under which a certain extent of land is allowed to be cultivated in tobacco, averaging about 20,000 acres, and producing nearly 20 million pounds yearly; with this a much larger quantity of imported tobacco, mostly from the U. S., is manufactured, and the whole sold only under authority of the government, producing 275 to 300 million francs annual revenue. In Germany the cultivation of tobacco is allowed in many districts, a tax of 180 to 360 silver groschen per acre being laid, according to quality of the soil, in Saxony; in other states the tobacco raised was taxed, the revenues so raised being greater than the customs duties on imported tobacco in some states, and in others less. The amount grown in Germany is less than in France. In Austria the best soils of Hungary and Transylvania have long been devoted to the growth of tobacco, the average annual produce being 45 million pounds, of which about one-tenth is exported.* A considerable quantity is imported, and revenues are raised largely by monopoly of sale and to a small amount by import duties. In Belgium less tobacco is grown than formerly, and the imports are large. In Holland a small amount of tobacco is grown, in Guelderland chiefly, and a very large amount imported. In Italy the sale of tobacco is a royal monopoly, and its cultivation has for a long time been prohibited, except in the Papal States, where 2 million pounds yearly were grown previously to the union. A little is still grown, paying an excise, but nearly all consumed is imported by the government and sold as a monopoly. In England its growth was prohibited, first in part in 1652, and effectively by act of 12 Chas. II. c. 34, which ordered that no tobacco should be planted in England under penalty of forty shillings for each rod of ground, and directed justices of the peace to search for and destroy all that should be planted. But this did not apply to Ireland; it was grown there until 1830, when by acts of 1 & 2 Will. IV. c. 13, its cultivation was forbidden, and all existing plantations were destroyed. These severe measures were deemed necessary to secure the customs and excise duties on which so much reliance is placed in the British revenue system.

*Cultivation.*—The tobacco-plant is a strong-growing herbaceous annual, capable of being greatly changed by high cultivation, and requiring a rich soil and favorable climate to attain perfection. The value being wholly in the leaves, every care is taken to increase their size and to concentrate the strength of the plant upon them. The best rise from the ground or from the stem near the ground, although the flower-stem rises from three to six feet, and if left for seed the upper leaves are retained, though less valuable. Usually, the flower-stem is pinched or cut off at half its natural height, the operation being called "topping." The leaves, as well as all parts of the plant, are covered with a viscid down, and a resinous exudation appears as they mature, adding to their weight and thickness. The seeds are sown thickly in covered or protected beds in March, and the young plants are developed as much as possible before planting out in the open field in April or May, care being taken to avoid frosts. They are planted in rows two to three feet apart in the U. S., and usually with the purpose of cultivating with a horse and plough at least one way. The soil must not only be fertile, but the cultivation thorough, to produce the best tobacco. All broken or injured leaves are removed, the flower-stem topped, and the strength of the plant concentrated on eight to twelve large succulent leaves, cutting off lateral shoots also if any appear. Insects must be watched, particularly the destructive tobacco-worm (*Macrosila carolina*), which cuts the leaf with great rapidity. Four months are thought necessary as the period of growth, and in August or September, according to the latitude, the proper color and characteristics appear, and the plant is ready to be cut. The process usually is to cut the whole stem close to the ground, sometimes splitting very large plants, and removing them to an open shed or partial shelter for preliminary drying. They are sometimes hung on poles, and sometimes thrown in heaps for partial sweating or curing, the leaves being then stripped, and further dried or cured before packing for market. Usually, the full curing is done on the plantation, and the bundles there packed for shipment, but sometimes the final curing is done months afterward, and the packing for market is done by machinery, not available on the small plantation. If the leaves are fermented before being stripped, they are then stripped and dried more readily and tied in bundles for packing. Much depends on the state of the weather during cutting and curing; usually some weeks are required to perfect the drying in the curing-house, and the tobacco-barns or curing-houses are prepared to use artificial heat if the weather is damp and cool. Sometimes a second curing or sweating is resorted to before the final manufacture; and it is conceded that fermentation is essential to the development of the best qualities of the leaf, and some fanciful views have been put forth as to the changes effected in the constituent principles by successive fermentations. The crop is packed in hogsheads on the plantation or at the nearest market-town, and immediately inspected as a preliminary to sale. Inspection is provided by State authority in nearly all the tobacco-growing States, and the brand given it by the inspector establishes its grade, and consequently its value. It is packed in hogsheads 48 inches in length and 32 inches at the head, containing 950 to 1200 pounds, according to the size and richness of the leaf, for most of that grown in Virginia and the adjacent States. Maryland tobacco is packed for export of lighter material, stems, lugs, etc., and weighing but 650 to 800 pounds the hogshead. Western tobacco is packed in heavier hogsheads, those of Ohio weighing 1500 pounds or more; in Kentucky the weight is also heavy, but less than in Ohio. Leaf tobacco is also packed in bales of about 250 pounds each for export, and manufactured tobacco in cases of the same average weight. Much inferior and scrap tobacco is sent from Maryland and Virginia factories to the German market, where it is cut and mixed for smoking chiefly. The lowest qualities of shipping tobacco are called *lugs*, and these are distinguished into "factory lugs" and "plantation lugs," both being the stems, strippings, and broken leaves attached to them. The best full leaves are usually packed separately as "wrappers," and the value of these last is six to ten times as great as the lowest "lugs."

The export trade of the U. S. in tobacco exhibits the largest movement in this article known, about 250 million pounds annually being sent to English and continental markets. The following tabular statement shows the quantity and declared value exported for each year from 1850 to 1875, inclusive; for the first five years of the period the statement was in hogsheads only; next, from 1855 to 1865, inclusive, the returns were made in hogsheads, cases, and bales; while from 1866 to 1875, inclusive, the actual weights were given. For the several years previous to this return of actual weights a calculation of weight has been made at an average of 1000 pounds the hogshead and 250 pounds each for cases and bales. The values are given as originally returned:

*Exports of Tobacco and Manufactures of Tobacco from the U. S., 1850 to 1875* (fiscal years ending June 30).

| Year. | Pounds. | Value. | Value per pound in cents. |
|---|---|---|---|
| 1850 | 108,730,375 | $6,417,251 | 6 |
| 1851 | 102,767,740 | 10,362,768 | 10 |
| 1852 | 145,591,628 | 11,398,905 | 8 |
| 1853 | 170,454,333 | 12,990,819 | 7½ + |
| 1854 | 136,316,439 | 11,566,373 | 9 |
| 1855 | 166,489,814 | 16,212,581 | 9¾ + |
| 1856 | 133,847,751 | 14,031,000 | 10½ |
| 1857 | 169,371,067 | 21,720,325 | 12½ |
| 1858 | 143,750,574 | 19,419,991 | 13½ |
| 1859 | 220,965,811 | 24,408,439 | 11 |
| 1860 | 175,487,000 | 15,917,901 | 9 |
| 1861 | 185,246,828 | 16,545,241 | 9 |
| 1862 | 123,906,802 | 13,402,000 | 11 |
| 1863 | 127,536,172 | 22,150,273 | 17¼ |
| 1864 | 122,868,873 | 26,466,505 | 21½ |
| 1865 | 211,613,324 | 45,209,512 | 22½ |
| 1866 | 197,360,877 | 31,258,815 | 16½ |
| 1867 | 194,488,549 | 22,572,743 | 11½ |
| 1868 | 216,520,621 | 26,007,987 | 12 |
| 1869 | 192,564,127 | 23,347,719 | 12⅛ |
| 1870 | 195,780,112 | 22,705,225 | 11 1/10 |
| 1871 | 216,700,638 | 21,995,957 | 10¼ |
| 1872 | 244,953,984 | 26,659,121 | 11 |
| 1873 | 227,009,376 | 25,331,946 | 11¼ |
| 1874 | 328,124,420 | 32,968,528 | 10 |
| 1875 | 233,927,167 | 28,547,862 | 12¼ |

The destination of this vast amount of tobacco exported has been most largely to Bremen and other ports, for Germany and the Low Countries, about 70,000 hogsheads

* "Hungary produces annually 250,000 to 300,000 centners (of 123⅛ pounds), of which 60,000 are used in that kingdom, 120,000 to 150,000 in Austria, and 20,000 to 30,000 exported."—*Macgregor.*

yearly; next to England, about 42,000 hogsheads yearly; to France, 38,000; to Italy, 24,000; to Holland, 20,000; to Austria, 5500; to Portugal, 3250, etc. The aggregate to Germany, Belgium, and the Low Countries reaches 95,000 hogsheads. To each of these countries American tobacco is a necessary source of revenue, and the exportation is therefore regular and sustained. The greatest general market in Europe is Bremen, and Liverpool is next. One-third or more of the American export to the Continent goes to Bremen, or more than 35,000 hogsheads yearly. The following statement of the receipts at Bremen for 1874 and 1875 show the extent of that market:

| | 1874. | 1875. |
|---|---|---|
| Ohio, Maryland, and Virginia leaf, hhds | 42,168 | 13,206 |
| " " " stems, " | 16,014 | 5,567 |
| Florida, chests | 121 | 36 |
| Cuba (Havana and Yara), serons | 49,276 | 16,110 |
| San Domingo, serons | 90,438 | 77,004 |
| Seed-leaf (Connecticut), chests | 59,705 | 15,151 |
| Porto Rico, bales | 6,074 | 2,763 |
| Peru, Esmeralda, bales | 2,204 | 1,800 |
| Venezuela, Varinas, rolls | 10,562 | 2,103 |
| Colombia, serons and bales | 107,011 | 99,155 |
| Brazil, serons and bales | 156,067 | 95,094 |
| Java, bales | 3,178 | 4,116 |
| Manila, bales | 430 | 1,623 |
| Mexico, bales | 562 | 96 |
| Turkish, bales | 5,057 | 5,234 |
| Other sorts, bales | 7,064 | 2,991 |
| Total, packages | 555,931 | 342,049 |

At the lowest estimated weight, the total would be 120 million pounds for 1874. At Liverpool the annual receipts are less than 40 million pounds; the actual quantities received, consumed, and remaining in warehouse in England for each half-year ending June 30, 1874, 1875, and 1876 were—

| | Pounds. | Pounds. | Pounds. |
|---|---|---|---|
| Received, first six months of | 1874, 19,003,844; | 1875, 20,635,510; | 1876, 14,596,797 |
| Consumed, " " " | 22,469,512; | " 23,059,459; | " 23,723,796 |
| In warehouse end of 1874, | 68,232,705; | " 81,865,563; | " 65,236,134 |

At London there is a general market for the tobacco of remote and tropical countries, but the amount received is much less than at Liverpool. At Havre there are large receipts for the French government, but no general market. The production of European countries does not enter into general commerce unmanufactured. The export of Brazil for five years, 1869 to 1874, averaged 14,975,504 kilogrammes yearly, or 33,015,000 pounds, and the average value was 6540 milreis, or $3,568,224. (*Official Account of Brazil,* 1876.)

*Manufactured Tobacco* is technically distinguished from both the cured leaf and from cigars or snuff. It is made from ordinary or inferior leaf by twisting, pressing, or cutting, and assumes various forms and names. Syrups and licorice are largely used in its preparation, particularly in the U. S., though adulteration with other leaves or deleterious substances rarely occurs here. In England adulteration is carried to great extremes, and stringent laws have been enacted to suppress it. Great improvements have recently taken place in cutting, preparing, and flavoring tobacco manufactured for chewing and smoking. About 10 million pounds of manufactured tobacco are yearly exported, at an average value of 25 cents per pound. Cavendish, navy, twist, negrohead, etc., are standard names or brands in the trade for that which is compressed in solid forms; "fine-cut" is shredded and loose in fibrous masses, cut by delicate machinery from leaf of good quality and flavored acceptably. Smoking tobacco is prepared of every grade and quality, but usually from broken leaves, stems, and inferior parts. Less of such grades, or of smoking tobacco generally, is made or consumed in the U. S. than in Europe, and the tax being relatively higher compared with the small original cost of the materials, little is manufactured in this form here for general trade.

*Cigars* (Sp. *cigarro;* Fr. *cigare*)* constitute the most important form in which tobacco is consumed for smoking, and in fact the largest aggregate in general consumption in any form; and their greater value induces every effort to produce leaves suited to covering cigars by the growers. The cigar is of Spanish or Spanish colonial origin, and it was long in use there before its general adoption by other nations. The greatest skill in the manufacture of cigars has always been shown by Spanish or Cuban artificers, and Havana has been the seat of the best manufacture for a century or more. The materials used for filling must be good, and must be skilfully arranged and combined so as to secure a proper firmness with a good draught. The wrappers must be of elastic and moistened leaf, so applied as to form a perfect ovoid cylinder, one end of which is closed and the other open. Uniformity in size, length, weight, and color is essential. They are tied in bundles of twenty-five to fifty cigars each, and these are packed in boxes of Spanish cedar containing two, three, or four bundles, usually 100 in a box. The Spanish cedar is largely imported into the U. S. for making boxes, and is also imitated in American cedar, but the general form of tying and packing is tenaciously adhered to. Nearly one-half in value of all tobacco grown is made up into cigars; and in the U. S. revenue system 25 pounds of rough leaves are allowed to manufacture 1000 cigars. Of this one-third or more is wasted in stems or lost in drying, the average weight of cigars manufactured being 15 to 17 pounds per 1000. The growth of the cigar manufacture in the U. S. has been rapid, even under the highest tax on materials imported and on the finished product. Since 1868, when the tax was reduced to $5 per M., the quantity made has advanced from 992,191 M. to 1,866,718 M. in 1874, and 1,926,661 M. in 1875, having more than doubled. The average wholesale selling price is over $50 per M., making the total value of cigars consumed in the U. S. nearly $100,000,000, few being exported.

The relation of tobacco and its manufactures to the revenue systems of civilized states is a striking and important feature of its history and present position. In all civilized countries it is the subject of heavy taxation, and in many countries its sale in any form is a government monopoly. In Great Britain its cultivation is forbidden in order to secure greater revenues on its importation. In the U. S. every form of preparation of the leaf for consumption is taxed, and thus its cultivation comes to a great extent under the observation of the government. Producers of leaf tobacco are required to account for all they prepare and sell, and all dealers and manufacturers must take out a license and keep books showing their transactions. In France, Italy, Spain, and several South American states similar internal revenue systems exist. Internal taxes were levied on tobacco in the U. S. to some extent under the early systems of 1792 to 1820, but nothing was subsequently levied until a tax was imposed on manufactured tobacco Sept. 1, 1862; after this date many changes were made, increasing or diminishing the tax, as follows, the rate being given in cents per pound:

| | Sept. 1, 1862. | Mar. 3, 1863. | July 1, 1864. | May 3, 1865. | July 13, 1866. | July 20, 1868. | June 6, 1872. | Sept. 1, 1875. |
|---|---|---|---|---|---|---|---|---|
| Smoking (of stems only), | 2 | 5 | 15 | 15 | 15 | 16 | 20 | 24 |
| Smoking, fine, | 5 | 5 | 25 | 35 | 40 | 32 | 20 | 24 |
| Twisted, by hand, | 15 | 15 | 35 | 30 | 30 | 32 | 20 | 24 |

On snuff the same rates were charged as on chewing tobacco. On cigars the rates were $1.50 to $3 per M. under the act of 1862; advanced in 1864 to rates varying from $3 to $40 per M.; in 1865 all were put at $10 per M.; in 1872 all were reduced to $5 per M.; and Sept. 1, 1875, all were advanced to $6 per M. The revenues received from these taxes advanced rapidly, from $3,055,562 in the first fiscal year 1862–63 to $37,303,462 in the fiscal year 1874–75, including all paid as excise and internal revenue taxes on all forms of tobacco and cigars, exclusive of duties on imports. These duties for the same year being $5,271,094, the total revenue to the U. S. government from tobacco and its manufactures was $42,574,556. The internal revenue alone for seven calendar years was as follows:

| Years. | From manuf. tobacco. | From cigars. | Total. |
|---|---|---|---|
| 1869 | $17,371,063 | $4,960,053 | $22,331,116 |
| 1870 | 24,300,483 | 5,718,780 | 30,019,263 |
| 1871 | 25,560,539 | 6,598,173 | 32,158,702 |
| 1872 | 24,570,776 | 7,566,157 | 32,136,963 |
| 1873 | 23,397,858 | 8,940,391 | 32,338,249 |
| 1874 | 21,938,955 | 9,333,592 | 31,272,547 |
| 1875 | 25,200,754 | 10,140,384 | 35,341,238 |

For the year ending June 30, 1876, the receipts of internal revenue from tobacco in various forms were as follows:

| | | Receipts. |
|---|---|---|
| Cigars and cheroots, number | 1,828,782,297 | $10,969,572.49 |
| Cigarettes, number | 77,407,166 | 135,462.54 |
| Snuff, pounds | 3,317,086 | 1,061,467.64 |
| Tobacco, other, pounds | 107,064,051 | 25,694,398.05 |
| Stamps for tobacco and snuff exported | | 6,694.30 |
| Manufacturers of cigars | | 153,075.26 |
| Dealers in leaf tobacco | | 112,954.63 |
| Dealers in manufactured tobacco | | 6,615,208.38 |
| Manufacturers of tobacco | | 11,375.64 |
| Peddlers of tobacco | | 35,066.50 |
| Total receipts | | $39,795,275.43 |

These sums show a steady increase, and strikingly establish the importance and permanence of this source of revenue. The maximum rate on tobacco has, however,

* There appears no good reason for the change of spelling of this word to *segar*. The original is Spanish, and it follows naturally and easily in French, Portuguese, German, and all European languages. Its actual derivation is not known, but it is not important.

evidently been exceeded in the advance from 20 to 24 cents per pound made in 1875; the former rate produced a larger revenue, and the higher one being found to react injuriously on the producer, to whom the ordinary grades and qualities have become almost valueless. The customs revenue from tobacco and cigars is also large, and important as an increasing sum. The law of July 14, 1862, first made the duties specific, at 35 cents to $1 per pound on cigars, and 25 cents to 35 cents per pound on tobacco. On July 30, 1864, these rates were increased about threefold on cigars, and nearly doubled on tobacco. On July 28, 1866, all cigars were put at $3 per pound and 50 per cent. *ad valorem;* and on July 20, 1868, the rates were reduced to $2.50 per pound and 25 per cent. *ad valorem;* which rate continues, leaf tobacco paying, under the law of 1864, 35 cents per pound, and manufactured tobacco 50 cents per pound. Under these rates the sums received were, in 1870–71, $4,801,577; 1871–72, $5,469,237; 1872–73, $6,219,317; 1873–74, $6,150,000; and 1874–75, $5,269,042. These sums are made up almost equally from cigars and from leaf, a very small amount only being yielded by other forms.

The revenues received by other nations are in almost all cases large from tobacco. The most recent receipts were as follows: Great Britain (1874–75), from customs £7,305,047, licenses £85,057 (duties 3*s.* to 4*s.* 6*d.* the pound); France (1875), from monopoly of sale 295,988,000 francs; Germany (1874), from customs 1,019,460 marks; Alsace-Lorraine, from tax on manufacture (1874), 800,000 marks; Zollverein (1873), from customs, 16,255,000 marks; Austria-Hungary (1874), budget, monopoly, 59,705,000 florins; Hungary, alone (1874), monopoly, 29,237,346 florins; Italy (1873), from monopoly of sale 73,232,144 francs, tax on cultivation 50,760 francs; Portugal (1874–75), from customs 2,205,200 milreis, licenses 24,500 milreis; Russia (1873), from taxes on consumption 10,266,000 roubles. In Russia duties on importation are also levied, but the amount received is not stated. In Spain the sale of tobacco is a monopoly of the Crown, but there is no recent distinct return of the revenue yielded; stamps, lotteries, and tobacco together yielded, in 1871, 156,467,671 pesetas (or francs). Sweden and Norway levy duties on importation. In every country revenue in some form is raised on the importation or the sale of tobacco, and it generally constitutes a more productive source than any other. In the U. S. it now yields 42 million dollars; in England, 37 million; in France, 60 million; in Austria, 42 million; in Italy, 15 million. It would be quite impossible to supply the place of so desirable a subject of taxation.

Tobacco as a crop is deprecated by the better agriculturists in consequence of its exhausting character. In the early history of Virginia the light lands of the eastern counties were cultivated in tobacco, extensive shipments to England being made from towns on the Chesapeake long since abandoned. Less than a century of tobacco-growing completely exhausted the coast-counties, and left the towns, mansions, and churches that once flourished there buried in forests of new pine.

*Snuff* has been made from a very early period, first and most largely by the Spanish, who prepared it with care and scented it with various materials. Next the Low Countries, Scotland, and England extended and popularized the use of snuff. For the last half-century or more, Scotch snuff has been the favorite in commerce, and large manufactures have existed in England, with a moderate production in the U. S. The export and import of snuff have not been usually distinguished from manufactured tobacco; the amount, however, has been large, and the consumption in England larger than all elsewhere. The amount of snuff manufactured in the U. S. in the year ending June 30, 1876, was 3,317,086 pounds, yielding $1,061,467 revenue. The manufacture was originally conducted by grinding the leaf in conical mortars, and more or less was produced in all tobacco-consuming countries. It is now ground in iron mills by steam-power. The old and standard brands of snuff were *maccaboy*, originally from Martinique and Spain; *rappee*, or the French; and that known as Scotch or *Lundyfoot*. There has been a great decline in the use of snuff in England and Germany within the last twenty years, and in the U. S., with local exceptions, an even greater decline. *Cigarettes* are small rolls of fine smoking tobacco enclosed in white-paper wrappers; they are largely made in Cuba and in the U. S. They are ranked and counted as cigars for revenue purposes. *Cigarillas* is the Spanish term for cigarettes or small cigars. LORIN BLODGET.

**Tobac'co** [Span. *tabaco*], **Chemistry and Physiological Relations of.** The most important ingredient of the tobacco-leaf is the alkaloid *nicotine*, which is present in quantities varying from 2 to 6 per cent. Pure nicotine ($C_{10}H_{14}N_2$) is a colorless, oily liquid of a strong alkaline reaction, disagreeable smell, and hot, acrid taste. It is volatile, inflammable, soluble in water, alcohol, ether, and oils. On exposure to light it turns to a reddish-brown color. With acids it forms crystallizable salts. Nicotine was first isolated by two German chemists, Posselt and Reimann, in 1828. It is a virulent poison, a single drop sufficing to kill a rabbit in less than four minutes. *Nicotianine*, or *tobacco camphor*, is a principle obtained by distilling the leaves, whether fresh or dry, with water. This is a fatty substance, occurring in the form of minute acicular crystals, having little taste, but a tobacco-like smell. Besides these principles, tobacco contains albumen, resin, and gum, and an unusual quantity (from 16 to 27 per cent.) of inorganic ingredients. Lime composes from 25 to 50 per cent. of the ash, and potash about 30. Nitric, phosphoric, and malic are among the acids that occur. By dry distillation tobacco affords a dark empyreumatic oily substance ("oil of tobacco"), of the peculiar strong smell of old, foul tobacco-pipes, and an exceedingly acrid, sharp, disagreeable taste. This oil is apparently a complex substance, and, like nicotine, is an exceedingly powerful poison.

The *effects of tobacco upon the animal system* have been critically studied by experimenting with nicotine upon animals. This alkaloid is one of the most powerful of nerve-poisons, producing tetanic convulsions, followed by paralysis, and death through failure of respiration. The cerebrum is little affected, and the pulse-rate, while first lessened, is afterward quickened. The pupil is contracted. In man, tobacco taken in sufficient quantity to show poisonous effects produces giddiness, faintness, and an indescribable feeling of sinking and misery, followed shortly by intense nausea, severe and long-continued vomiting, and great relaxation and feebleness of the muscular system. The skin becomes pale and moist, and the pulse exceedingly feeble. More or less of these effects may persist for a day and more after the poisoning. They are familiarly seen in young lads when first beginning to smoke. As to poisonous dose, there is none, for not only do different persons vary in their susceptibility to tobacco, but habit also makes an enormous difference in the effect following a given dose; so that, as is well known, very large quantities of tobacco can be smoked or chewed without the development of any of the above-mentioned poisoning. In sufficient dose, tobacco proves a dangerous and even fatal poison. The symptoms are, in general, an intensification of those just described—namely, intense nausea and vomiting, faintness, muscular debility, cardiac failure, and general prostration. Often, too, there are violent pains in the abdomen, cramps, convulsions, and profuse purging. An injection *per rectum* of an infusion representing the strength of 30 grains of tobacco has several times killed, and death may take place within an hour from the time of receiving the poison. Extensive *external* applications of tobacco may also cause poisoning, and even death. There is no antidote, and in cases of acute poisoning the stomach or bowels should be evacuated by appropriate means, and restorative agents employed, such as alcoholics, ammonia, the application of heat, friction, and artificial respiration. *Chronic poisoning* by tobacco, such as occurs from undue indulgence in the weed as a luxury, shows itself in *dyspepsia*, the smoker experiencing loss of appetite, especially in the morning, dry foul tongue and thirst; and in *nervousness*, as evinced by a general physical and mental restlessness, with undue susceptibility to external impressions, and by tremulousness of the muscles and palpitation or irregular action of the heart. With smokers, also, a form of chronic irritability, and even inflammation, of the throat and tonsils is exceedingly common. Graver evils, such as paralysis, mental decline, and loss of sight from wasting away of the optic nerve, have been charged to excessive use of tobacco; but when we consider the enormous number of persons who indulge heavily in the weed, and the comparatively rare occurrence of the affections in question, where there is not some other obvious and valid cause for the same, the claim that tobacco is to blame for the disease must be received with caution. *Moderate* use of tobacco by persons with whom it "agrees" (*i. e.* does not produce obviously injurious effects) often calms and soothes the exhausted or irritated nervous system, helps digestion, promotes the function of the bowels, removes the sense of fatigue, and tends to compensate for an insufficient food-allowance. The popular question, whether good or harm follows the habitual use of tobacco, is too broad to admit of a single sweeping answer. According to present physiological knowledge, the facts bearing on this subject are as follows: In the first place, tobacco is not a general necessity for the human race; for individuals, whole classes, and even entire races of men, have attained the highest possible physical and mental development without the use of the agent. In the second place, to young persons, under twenty-five

years or so, tobacco, even in small quantity, is so apt to disorder health in some way or other that for such it should be considered generally harmful. Thirdly, many persons, even adults, can never indulge at all in tobacco without being to some degree poisoned. For such individuals common sense teaches that the weed is to be regarded as wholly noxious. Fourthly, an enormous number of persons can and do use tobacco (the actual quantity consumed varying with the individual) not only without apparent present disturbance of health, but with maintenance of as full physical and intellectual vigor, freedom from sickness, and longevity, as are found with non-consumers. To say that such individuals, did they abstain, would be still more hearty or long-lived, is to assert that which obviously can be neither proved nor disproved. Finally, the exigencies of our artificial civilization often demand a continued overtaxing of either the physical, intellectual, or emotional faculties, and in some such cases, especially where the sufferer be past the most vigorous period of life, tobacco in moderation often seems to counteract in some measure the evil effects of the strain, disposing to emotional and physical calm, removing fatigue, assisting digestion, and supplementing a scanty food-supply. If, then, the abatement of morbid symptoms and restoration of the bodily functions to their normal status be beneficial, we must accord to tobacco in the present instances the right to be regarded as a useful agent. But in connection with this topic it is proper to bear in mind the fact, that while tobacco in due moderation may be often apparently harmless, and even, under some circumstances, useful, yet that to indulge in an excess which, for the individual, *is* injurious, is both easy and tempting, and, as a matter of fact, is an exceedingly common habit. Any tobacco-consumer, by reverting to the symptoms of chronic tobacco-poisoning detailed above, can easily determine for himself whether he is or not crossing the "poison-line" in his use of the luxury. As to the relative power of the various modes of consuming tobacco, it is probable that a given quantity of a given leaf will most promptly and powerfully affect the system if *chewed*, next if *smoked*, and least if taken as *snuff*. In the matter of smoking, again, less of the active principles will reach the mouth if the dose of tobacco be smoked in a clean pipe than if a foul one be taken, and less with a pipe, if clean, of porous material, like meerschaum, and with a reasonably long stem, than where the same tobacco is smoked as a cigar. With both pipe and cigar, again, the last portion smoked is proportionately stronger than the first, for it becomes saturated with a certain percentage of the smoke-ingredients of the earlier portions, mechanically arrested in their passage. The time of day and state of the stomach also modify the effect of tobacco, the influence being comparatively stronger earlier in the day or upon an empty stomach than in the evening or after a meal.

*Medicinal Uses.*—In medicine tobacco is used solely for its relaxing influence upon the muscular system. Before the introduction of anæsthetics it was thus sometimes employed in cases of visceral spasm, or where hernias or dislocations were to be reduced, but its use in these circumstances is now almost obsolete. In tetanus the drug has been tried, and shows, as might be expected, a certain power in blunting the irritability of the motor tract of the spinal cord, and thus reducing the severity of the spasms. It has been given in this disease in the form of nicotine, administered by subcutaneous injection in doses of a small fraction of a drop. In asthma some sufferers find relief from smoking tobacco, but as a rule the remedy is not of much use. The most common way of administering tobacco for medicinal purposes is by giving an infusion of the leaf by enema, but great prudence is necessary, as the drug thus introduced is a powerful and even dangerous remedy. Externally, lotions and ointments of tobacco have been used for various purposes, but anything like an extensive application is in the highest degree dangerous, fatal poisoning having more than once occurred in consequence.

EDWARD CURTIS.

**Tobacco-Pipe.** See PIPE.

**Toba′go,** an island in the West Indies, in lat. 11° 25 N., lon. 60° 32′ W., 18 miles N. E. of Trinidad, belongs to Great Britain. Area, 97 sq. m., with 15,410 inhabitants. The surface is mountainous and rugged, covered for a large part with primitive forest, but presenting several fine and well-watered valleys. The principal product is sugar, of which 90,265 cwts. were exported in 1866, together with 5533 cwts. of molasses and 119,292 gallons of rum. Coffee is also extensively cultivated. The climate is utterly injurious to Europeans.

**Tobin,** tp., Perry co., Ind. P. 2345.

**To′bit, Book of,** an apocryphal book of the Old Testament, whose text is found in the Septuagint, the Syriac, and the Hebrew; none of which texts are considered to be the original one. According to Ewald, it was probably written in Hebrew or Chaldee by a Jew of Palestine in the fourth century B. C. It is canonical with the Roman Catholics and some of the Orientals.

**Tobolsk′,** government of Siberia, bounded W. by the Ural Mountains, and extending from the Kirgheez territory to the Arctic Ocean, comprises an area of 564,825 sq. m., with 1,105,855 inhabitants. The western and southern part of the country is occupied by spurs of the Ural and Altai mountains, from which the land slopes toward the Arctic Ocean in one extensive plain. The northern portion of this plain, between lat. 66° N. and the ocean, is a frozen swamp during nine months of the year; the middle portion, between lat. 58° and 66° N., is a forest region, inhabited by hunters and producing excellent fur; the southern portion is good agricultural land, where rye, barley, oats, and the fruits of Middle Europe are raised. Iron, copper, silver, gold, and platinum abound in the Ural Mountains, and mines are extensively worked. Manufactures of leather, soap, and woollen fabrics, and a very important transit-trade between Europe and Asia, are carried on.

**Tobolsk,** town of Siberia, capital of the government of Tobolsk, at the confluence of the Tobol and the Irtish, in lat. 58° 12′ N., is a neat and handsome town, though most of its houses are built of wood, and it carries on extensive manufactures of leather, soap, and tallow, besides important fishing and shipbuilding. P. 20,330.

**Toboyne,** tp., Perry co., Pa. P. 914.

**To′by,** tp., Clarion co., Pa. P. 1140.

**Tobyhan′na,** tp., Monroe co., Pa. P. 477.

**Tobyhanna Mills,** p.-v., Monroe co., Pa.

**Tocantins′,** river of Brazil, South America, rises in lat. 14° S., flows northward with a great western bend, receives the Araguay in lat. 6° S., and joins, 130 miles from the Atlantic, the Para, the southern branch of the mouth of the Amazon. The entire course of the Tocantins is 1100 miles, for the greatest part of which it is navigable, though its navigation is difficult on account of sandbanks and rapids.

**Toc′coa,** p.-v. and tp., Habersham co., Ga., has a weekly newspaper. P. 713.

**Tock, The Crowned,** the *Buceros coronatus*, an African passerine bird of the family Buceridæ, having an enormous red bill. It feeds on carrion, and probably on vegetable food also.

**Tocology.** See OBSTETRICS, by PAUL F. MUNDÉ, M. D.

**Tocqueville, de.** See DE TOCQUEVILLE.

**Tod** (DAVID), b. at Youngstown, O., Feb. 21, 1805, son of Judge George (1773–1841), a distinguished jurist, under whom he was trained to the law; was admitted to the bar 1827; practised at Warren until 1842; was elected to the State senate as a Democrat 1838; was defeated as a candidate for governor 1844; was minister to Brazil 1847–52; was in 1860 first vice-president of the Charleston convention, in which he warmly supported Stephen A. Douglas, and became presiding officer after the withdrawal of the Breckenridge element; was a champion of the "peace policy" 1861, but being elected governor of Ohio 1862, he gave Pres. Lincoln an unhesitating support during the two years of his official term. D. at Youngstown, O., Nov. 13, 1868.

**Tod** (JAMES), b. in Scotland in 1782; went to India as a cadet 1800; took part in several wars in Central India, attaining the rank of lieutenant-colonel; made a topographical survey of the Rajpoot country, completed in 1815; was political agent in Mewar and other Rajpoot states 1817–23, returned to England 1823. D. at London Nov. 17, 1835. Author of a splendidly-illustrated work, *Annals and Antiquities of Rajasthan, or the Central and Western Rajpoot States of India* (London, 2 vols., imp. 4to, 1829–32), and of *Travels in Western India* (1839), published posthumously.

**Toda, Tuda,** or **Tudawa,** a singular race of people inhabiting parts of the Neilgherry Hills in Southern India. In 1858 they numbered only 337 persons, yet they are the dominant people of their region, and receive from the inferior tribes a heavy tribute. They have a peculiar language, which is unwritten. Their religion is the worship of departed spirits and of the sun. Their only industry is the herding of buffaloes for their milk and butter. They practice polyandry, all the brothers of one family having but one wife in common. The men, however, claim and receive, at certain seasons, the rights of temporary husbands to the women of the subject villages. The Toda men are tall, well-proportioned, and in many respects are a superior race of men.

**Todd,** county of S. E. Dakota, bordering on Nebraska, and lying between Missouri and Niobrara rivers. The uplands are mostly prairies; the soil of the river-bottoms is fertile. Cap. Fort Randall. Area, about 550 sq. m. P. 337.

**Todd,** county of S. W. Kentucky, bordering on Tennessee, drained by Pond River and several considerable creeks, and intersected by Louisville and Nashville and Great Southern and St. Louis and South-eastern R. Rs. Surface generally hilly, soil fertile. Swine, sheep, and cattle are numerous. Staples, tobacco, Indian corn, wheat, and wool. Cap. Elkton. Area, 350 sq. m. P. 12,612.

**Todd,** county of Central Minnesota, watered by Long Prairie and Partridge rivers, and crossed in its N. part by Northern Pacific R. R. Surface generally level, interspersed with many small lakes; soil productive. Staples, wheat, oats, and potatoes. Cap. Long Prairie. Area, 960 sq. m. P. 2036.

**Todd,** tp., Crawford co., O. P. 1156.

**Todd,** tp., Fulton co., Pa. P. 634.

**Todd,** p.-v. and tp., Huntingdon co., Pa. P. 781.

**Todd** (Charles Scott), son of Judge Thomas, b. near Danville, Ky., Jan. 22, 1791; graduated at William and Mary College 1809; became a lawyer at Lexington 1811; took part as brigade quartermaster and judge-advocate of Gen. Winchester's division in the war of 1812; became captain of the 28th Infantry May, 1813; was aide to Gen. Harrison at the battle of the Thames; was appointed assistant inspector-general Nov. 1, 1813, inspector-general (rank of colonel) Mar. 2, 1815; settled at Frankfort, Ky.; was secretary of state of Kentucky 1817, member of the legislature 1817–18, confidential agent to the republic of Colombia 1820–21; editor of the Cincinnati *Republican* 1840, in which capacity he took a leading part in the campaign in favor of his former commander, Gen. Harrison, to whose biography, prepared by Benjamin Drake (1840), he also contributed; and was minister to Russia 1841–45. D. at Baton Rouge, La., May 14, 1871.

**Todd** (Henry John), b. in England in 1763; graduated at Hertford College, Oxford, about 1785; took orders in the Church of England; became successively a minor canon of Canterbury, vicar of Milton 1792, rector of All Hallows, London, keeper of the MSS. at Lambeth Palace 1803, rector of Settrington, Yorkshire, 1820, prebendary of York 1830, and archdeacon of Cleveland 1832. D. at Settrington Dec. 24, 1845. He wrote biographies of Milton, Spenser, Gower, Chaucer, Cranmer, and Bishop Walton; edited Johnson's *Dictionary* (4 vols., 1814); demonstrated Bishop Gauden to be the author of *Eikon Basilike;* published *An Authentic Account of our Translation of the Bible, and of the Translators* (1834), and other works.

**Todd** (James Henthorne), D. D., b. in Dublin, Ireland, Apr. 23, 1805; graduated at Trinity College, Dublin; became a fellow there 1831; took orders in the Church of England; became regius professor of Hebrew 1849, and librarian of the University of Dublin 1852; was twice chosen Donellian lecturer; was treasurer and precentor of St. Patrick's cathedral 1864; was the chief founder of the Irish Archæological Society, and president for five years of the Royal Irish Academy. D. at Rathfarnham, near Dublin, June 28, 1869. Author of numerous theological and miscellaneous writings, including *Historical Memoirs of the Successors of St. Patrick and Archbishops of Armagh* (2 vols., 1861), and *St. Patrick, Apostle of Ireland* (1863), and editor of *The Wars of the Danes in Ireland, The Irish Version of the Historia Britonum of Nennius* (1848), *The Martyrology of Donegal, The Book of Hymns of the Ancient Church of Ireland* (1855), and other rare MSS. and tracts in the Irish language; also of three treatises of Wycliffe, and wrote much for the *Transactions* of learned societies.

**Todd** (John), b. in Pennsylvania about 1740; educated in Virginia; became a lawyer at Fincastle; emigrated to Kentucky 1775; located land near Lexington 1776; accompanied Gen. George Rogers Clarke in his expedition against Kaskaskia and Vincennes; succeeded him in command at Kaskaskia; was appointed by the Virginia legislature in 1777 colonel in command of the Illinois region, then erected into the "county of Illinois;" was colonel of a frontier regiment 1778, delegate to the Virginia legislature 1780, and killed in fighting against the Indians at the battle of Blue Licks, Ky., Aug. 19, 1782.

**Todd** (John), D. D., b. at Rutland, Vt., Oct. 9, 1800; graduated at Yale College 1822 and at Andover 1826; was pastor of a Congregational church at Groton, Mass., 1827–31, of the Edwards church at Northampton 1833–36, of the First Congregational church in Philadelphia 1836–42, and of the First church at Pittsfield, Mass., 1842–72; was one of the founders of Mount Holyoke Female Seminary, and for some years president of the trustees of the Young Ladies' Institute at Pittsfield, where he d. Aug. 24, 1873. Author of *Lectures to Children* (Northampton, 2 vols., 1834), *Student's Manual* (1835), *Index Rerum* (1835), *Truth made Simple* (1839), *The Young Man* (1843), *The Daughter at School* (1854), *Mountain Gems* (4 vols., 1864), *Woman's Rights* (1867), *Sunset Land, or the Great Pacific Slope* (1869), *Old-Fashioned Lives* (1870), and many other popular works, some of which, especially the *Student's Manual,* have had an immense circulation, and exerted great influence both in the U. S. and in England. (See *John Todd, the Story of his Life, told mainly by himself,* New York, 1876, edited by Rev. John E. Todd.)

**Todd** (John Blair Smith), b. at Lexington, Ky., Apr. 4, 1814; graduated at the U. S. Military Academy 1837; served during the Florida and Mexican wars, and subsequently on frontier duty till 1856; resigned and became a trader with the Indians in Dakota; delegate to Congress 1861–65; during the civil war was brigadier-general of volunteers, and commanded the 6th division of the army in Tennessee; was Speaker of the house in the Dakota legislature 1867–69, governor 1869–71, and one of the founders of Yankton, where he d. Jan. 5, 1872.

**Todd** (Robert Bentley), M. D., brother of James Henthorne, b. at Dublin, Ireland, in 1809; educated at Trinity College, Dublin; settled as a physician in London 1831; acquired an extensive reputation; became professor of physiology and anatomy in King's College 1837; took a leading part in the founding of King's College Hospital 1839, and was professor of clinical medicine there until his death, at London Jan. 30, 1860. He was joint editor (with Dr. Grant) of *The Cyclopædia of Anatomy and Physiology* (5 vols., 1836–59), joint author with Dr. William Bowman of *The Physiological Anatomy and Physiology of Man* (2 vols., 1845–56), and author, besides other professional works, of three series of *Clinical Lectures* (1854–60), of which a new edition was prepared (1860) by his eminent pupil, Dr. Lionel Smith Beale, who has written a memoir of his life.

**Todd** (Thomas), b. in King and Queen's co., Va., Jan. 23, 1765; received a good English education; was a soldier in the war of the Revolution; emigrated to Kentucky 1786; became a lawyer at Danville; was several years clerk of the district court, and subsequently of the court of appeals, of which he was judge 1801–06; was chief-justice of Kentucky 1806–07, and a justice of the U. S. Supreme Court from Mar. 3, 1807, to his death, Feb. 7, 1826.

**Todd Creek,** tp., Johnson co., Neb. P. 542.

**Todhunter** (Isaac), b. at Rye, England, in 1820; graduated in 1848 as senior wrangler at St. John's College, Cambridge, where he became fellow, tutor, and principal mathematical lecturer. Author of a series of textbooks in calculus and the higher mathematics, of a *History of the Mathematical Theories of Attraction and the Figure of the Earth* (2 vols., 1873), and of a monograph on the literary productions of Prof. Whewell (2 vols., 1874).

**To'di** [anc. *Tuder, Tudertum*], town of Italy, province of Perugia, on a high hill overlooking the Tiber, not far from the confluence of the Naja with that river, about 30 miles S. of the city of Perugia. This was an ancient Italic city, and the innermost of its three ruinous walls is still a fine specimen of the old cyclopean or Etruscan construction. Portions of a temple and other fragments of buildings belonging to the Roman era may still be seen. The Gothic cathedral contains good frescoes by Lo Spagna, etc., but the church of S. Maria della Consolazione is especially noteworthy. It is the work of the celebrated Bramante, and by many thought to be his masterpiece. This church is characterized by connoisseurs as "one of the most perfect structures in Italy." The city of Todi was not without importance in Italian mediæval history, but there is little life or industry of any kind in the modern town. P. 14,934.

**Tod'idæ** [from *Todus*—Latinized form of an Indian name—the designation of one of the genera], a family of birds peculiar to the tropical regions of America. They resemble in physiognomy and form the Alcedinidæ (kingfishers), to which they are allied: the bill is moderately long (at least as long as the head) and much depressed, with the tip rounded or pointed; the nostrils are sublateral near the base, and open; the wings short and rounded; the tail rather short; the tarsi quite slender and long; toes three in front and one behind, all well developed; and the anterior "syndactylous"—*i. e.* united by their first joints; claws short and well curved. In most details of structure of the skeleton and other parts, so far as examined, they resemble the Momotidæ and Alcedinidæ, and belong to the same great group (or super-family) of Coccygomorphæ. They dwell mostly in damp places in South and Central America and the West Indian islands. Except in the

breeding season, they remain generally single and alone. When at rest they sit "in a crouched manner on the branches, with the head drawn in between the shoulders, and are so dull and stupid that they are easily approached sufficiently near to be caught with the hand." (*Gray.*) They are nevertheless sufficiently spry to readily catch insects that come near them. They are said to make their nest generally in holes in the ground, and to lay about three or four eggs. Five species are recognized by Sharpe, the latest monographer of the group. (*Ibis*, 1874, pp. 344–355.) Their characteristics and relations have been best discussed by Marù (*Prac. Zool. Soc. London*, 1872, pp. 664–680), and to this reference must be made for a full exposition of the characters of the family.

THEODORE GILL.

**Tod'leben** (FRANZ EDUARD), b. at Mitau, Courland, May 8, 1818; educated in the schools at Riga and at the school of engineering at St. Petersburg; served in the Caucasus against Schamyl 1848–51; was distinguished in the campaign on the Danube 1853–54, and on the outbreak of the Crimean war in the latter year was ordered to Sevastopol on the invasion of the allies. To his genius in developing the inchoate works and in improvising defensive expedients adapted to the peculiar circumstances is attributed the so long successful defence by which the place resisted for nearly a year (349 days) the efforts of the allied armies. (See SEVASTOPOL.) Within the course of a year he had risen from the rank of captain through successive grades to be major-general, and was also honored with the appointment of A. D. C. general to H. T. M. the emperor. Besides other honors, that of the decoration of the third class of the order of St. George was conferred on him—a distinction only bestowed for services of the most distinguished and brilliant character. He was subsequently entrusted with the defence of Nikolaief and Cronstadt. In 1869 he attained the grade of general (of engineers). As "adjoint" to the inspector-general of engineers in Russia (the grand duke Nicholas), Gen. Todleben exercises *de facto* the functions of that office. Aside from his eminent military distinction, he commands esteem for his high personal character and affable manners. His important work (using the French title), *Défense de Sevastopol, Ouvrage rédigé sous la direction de Lieutenant-Général E. de Todleben*, etc., etc., in 2 4to vols., with elaborate maps, appeared (1863–70) simultaneously in the Russian, French, and German languages; it was drawn up under the sanction of the Russian government, with full access to the archives, and after French and English special works relating to the siege had appeared, and after a thorough survey of the localities, designed to rectify discrepancies in the various accounts. Though commenced in virtue of his position as chief of engineers as a redaction of the "journal of the defence," the author states that "a more thorough study of the matter confirmed in me this conviction, that any purely technical description of the operations of siege and defence of places, if not accompanied by the detailed narrative of the co-operation of the other arms (*i. e.* infantry and artillery), must be utterly inadequate to furnish a correct idea of the progress (*marche*) of the attack or of that of the defence. Just as the art of the engineer is closely associated with the science of the artillerist and of the tactician, so also the success of the defence through the engineer depends in a great degree on the power and on the *matériel* of the artillery, on the character of the weapons of the infantry, and especially on the aptitude of the troops for the combat." Among the important "conclusions" Gen. Todleben draws from the siege is the following: "Many military men have expressed the opinion that the defence of Sebastopol showed conclusively that it is useless in time of peace to expend immense sums in the construction of permanent fortifications: . . . *the defence of Sebastopol has proved directly the reverse*"—a conclusion confirmed by Marshal McNiel, and illustrated by Gen. Todleben by various arguments drawn from the actual facts.

J. G. BARNARD.

**Tody.** See TODIDÆ.

**Toe River,** tp., Mitchell co., N. C. P. 619.

**Tofana.** See AQUA TOFANA.

**To'ga** [Lat.], the distinctive garment of the Roman citizen, was of probable Etruscan origin. The youth wore it in the form called *toga prætexta*, and not till they came of age could they put on the *toga virilis*, or manly gown. It was a loose and ample long cloak, not much worn by rustics and artisans, and was, at least in later times, almost distinctive of the upper classes.

**Togrul Beg.** See SELJOOKS.

**Tokat',** town of Asiatic Turkey, in Asia Minor, 20 miles S. of the Black Sea, is beautifully situated in a valley among vineclad hills on the banks of a small river, but it is meanly built, and although the neighborhood contains rich marble-quarries, most of its houses are built of sun-dried brick, or even of mud, and huddled together in dirt and confusion. It was formerly the entrepôt of an important transit-trade, but the route of the traffic has changed of late, going now by Trebizond, and the commercial importance of the city has greatly declined. It has some dyeworks and manufactures of silks and copperware, the copper ore from the mines of Diabekir being brought hither on camels for smelting. P. 45,000, partly Turks and partly Greeks, Armenians, Tartars, and Jews.

**Tokay',** small town of North-eastern Hungary, county of Zemplin, on the right bank of the Theiss, at the influx of the Bodrog, is famous as the entrepôt of the celebrated Tokay wines, which are produced in the neighborhood. P. 5012.

**Tokay Wines.** See WINE.

**Tokio,** or **Tokei,** the new name of Yedo. See JAPAN, by C. LANMAN.

**To'land** (JOHN), b. near Redcastle, Londonderry, Ireland, Nov. 30, 1669, of Roman Catholic parents; was originally called JANUS JUNIUS, but changed his name while at school at Redcastle, where he also became a zealous Protestant, and under the patronage of some dissenters entered the University of Glasgow 1687; removed to that of Edinburgh, where he graduated M. A. 1690; studied theology two years at Leyden, with a view to becoming a dissenting minister; made the acquaintance of Leibnitz and other eminent men; resided several years at Oxford, where he spent his time in the Bodleian Library and prepared his first work, *Christianity not Mysterious* (London, 1696; 2d ed., Amsterdam, 1702), which made a great sensation, was censured by convocation, replied to by Stillingfleet and many others, and burnt by the hangman at Dublin by order of the Irish Parliament Sept. 11, 1697; the author being then in that city, proceeded to London, where he published an *Apology for Mr. Toland* (1697); went to Amsterdam; published there the first edition of Milton's *Works, Historical, Political, and Miscellaneous, with a Life* (3 vols. fol., 1697–98), in which he made an indirect attack on the Gospels, which was replied to by Dr. Blackall in a sermon preached before the House of Commons; wrote a rejoinder entitled *Amyntor, or a Defence of Milton's Life* (1699), which occasioned a polemic with Dr. Samuel Clarke and others; turned his attention to politics; wrote a pamphlet entitled *Anglia Libera* (1701) in favor of the succession of the house of Brunswick, which procured him the favor of the princess Sophia at the court of Hanover, and employment in a quasi-diplomatic capacity at Berlin and other German courts; held a theological discussion with Beausobre; returned to England and published *Vindicius Liberius* (1702), a new defence of his first book, in which he asserted his claim to be "a true Christian" and "a good Churchman," but in his *Socinianism truly Stated* (1705) avowed himself a pantheist; in 1704 published *Letters to Serena* (that is, the queen of Prussia); resided abroad in the employ of Harley 1707–10, and was subsequently a voluminous pamphleteer in London. D. at Putney Mar. 11, 1722. Among his numerous works were *State Anatomy of Great Britain* (1714), *Nazarenus, or Jewish, Gentile, or Mahometan Christianity, containing the History of the Ancient Gospel of Barnabas, etc.* (1718), *Tetradymus* (four treatises, 1720), and a *Life* of Servetus (1724). A biography appeared in 1722, and a collection of his miscellaneous pieces, with a memoir, was published in 1726 by Peter des Maizeaux (again in 1747).

**Tole'do,** one of the oldest cities of Spain, and the capital of a province of the same name, is built on an immense granite rock at an elevation of 2400 feet above the level of the sea, and enclosed on three sides by the Tagus, toward which the rock presents steep and abrupt sides, while on the fourth side, where the ground slopes gently, it is defended by two walls—an inner wall built by the Goths in the seventh century, and an outer built by Alfonso VI. in 1109—both profusely adorned with towers and gates. From 467 to 714 it was the capital of the Goths, from 714 to 1085 that of the Moors, and after 1085 it was the residence and capital of the kings of Castile. Its most remarkable edifice is the cathedral, the metropolitan church of Spain, and one of the most magnificent church buildings in the world, founded in 587, 404 feet long, 204 feet wide, and in its chief nave almost overloaded with sculpture. Besides the cathedral, the city contains 26 other churches, 37 monasteries, a splendid though never completed royal palace, and other architectural monuments; but its general aspect is gloomy, and almost desolate. The splendor has become sepulchral; an air of decay has crept in; the place, which once contained about 200,000 people, is now inhabited by only 20,000. Its once flourishing industry has also died out, the only two branches still alive being the manufactures of sword-blades and confectionery; but Toledan blades

and Toledan marzipan are still exported to every country in Europe.

**Toledo,** p.-v. and tp., cap. of Tama co., Ia., on Toledo and North-western branch of Chicago and North-western R. R., has 8 churches, good schools, 2 banks, 1 newspaper, 2 elevators, and 2 grain-warehouses. P. of v. 888; of tp. 1579. JAMES B. HEDGE, ED. "CHRONICLE."

**Toledo,** p.-v. and tp., Chase co., Kan. P. 368.

**Toledo,** city, cap. of Lucas co., O., on the bank of Maumee River, 9 miles above its junction with Lake Erie. Incorporated in 1836 on the union of the two villages of Fort Lawrence and Vistula, the straggling settlement then numbering less than 1000 souls, it has increased to a city with a pop. of 60,000 in 1876. This development has resulted, first, from remarkable natural and acquired advantages as a collecting, shipping, and distributing point; and, second, from the energetic and enterprising character of the people who have directed her industries during the past twenty years. Besides her intimate connection with the great inland lake-navigation of the North-west, Toledo is the terminus of Wabash and Erie and Miami canals. Her railroad system includes 13 working lines, 4 of which have independent Eastern connections, while the two new roads to be completed in 1876 will bring to the city the vast coal-deposits of South-eastern and Central Ohio. Her narrow-gauge lines number 2 completed and 2 projected roads; 7 lines of horse railway intersect her streets. The city is governed by a mayor, board of aldermen, and council, and patrolled by a police force of 50 men. It has a central station-house costing $72,000, and a house of refuge and correction capable of containing 150 youth. The property of the city is protected by a paid fire department, distributed among 9 engine-houses, equipping 6 steam fire-engines, and controlled by a complete fire-alarm telegraph system. To this is added an extensive system of waterworks on the standpipe plan, having 46½ miles of pipes, the whole having been established at a cost of $1,000,000. The educational interests of Toledo are represented by 25 public and 12 parochial schools, a university of the arts and trades, and a free public library of 10,000 vols. She has 3 daily, 1 semi-weekly, and 14 weekly newspapers, and semi-monthly publications. Fifty churches minister to her spiritual needs, while 106 societies—including 3 hospitals, 3 orphans' homes, a home for friendless women, and an industrial school for children—are effectively organized for charitable, benevolent, and miscellaneous purposes. Twenty hotels provide for travellers; 6 national, 3 savings, and 3 private banks are in active operation, and are supplemented by 6 building loan associations. The jobbing trade in all its branches is an important and steadily-increasing element of Toledo's prosperity, and her numerous wholesale firms are dealers in books and stationery, crockery, cutlery, drugs, dry goods, notions, furnishing goods, groceries, boots and shoes, hardware, hats and caps, lumber and hard woods, wines, liquors, etc. Many of her leading houses now import goods directly from Europe. The extensive manufacturing interests of the city are headed by the largest wagon-works in the country, and embrace 14 planing-mills, 7 manufactories of sash and blinds, 4 moulding-factories, 3 pump-factories, and other establishments devoted to bridge and boat building, carriage-making, and the manufacture of furniture, cabinet ware, bent-work, etc.; 1 furnace, 6 foundries, 1 car-wheel factory, 1 for the casting of ploughs, 4 for boiler-making, 5 for the building of steam-engines, and 1 for the construction of mowers and reapers. The miscellaneous manufacturing interests of the city are numerous and diversified. The Toledo Produce Exchange, numbering 60 life members, holds daily sessions; 11 elevators have been erected, with a capacity of 4,175,000 bushels, the largest having a storage for 1,500,000 bushels. The lake marine numbers 78 vessels. Toledo received during 1875, for distribution throughout the West and South, 92,946,379 feet of lumber, 15,390,000 lath, and 16,303,000 shingles. There were shipped by lake and railway during the same time to Eastern and foreign markets, 740,758 barrels of flour, 6,709,686 bushels of wheat, and 14,928,589 bushels of corn. P. in 1870, 31,584. J. P. JONES, PROPRIETOR "TOLEDO BLADE."

**Toledo War, The,** was a strife which almost reached bloodshed between the State of Ohio and the Territory of Michigan in regard to their dividing-line. In the ordinance of 1787 for the government of the Territory N. W. of the Ohio River, Congress granted certain rights to the inhabitants, and reserved to itself the right to form one or two States "in that part of said Territory lying N. of an E. and W. line drawn through the southerly bend or extreme of Lake Michigan." In the act of 1802 for the admission of Ohio as a State the same line is described as its northern boundary, but the people specified a more northerly line in their State constitution. The only data then extant as to the position of Lake Michigan was a map published by Mitchell in 1755, on which the "southerly bend or extreme" of that lake is shown at 42° 32′ N. lat. Its true location is 41° 37′ 19″, or nearly 64 miles S. of what Mitchell represented. Had his map been correct, the boundary-line would have passed due W. from the mouth of Detroit River. In 1805, Michigan Territory was organized, the boundary being defined according to the ordinance of 1787; but when the States of Indiana and Illinois were subsequently organized, this boundary was ignored, and they stretched N. of it. The difference between the acts of Congress and the constitution of Ohio in regard to her northern boundary caused that State to apply for a survey of the same. Congress ordered a survey in 1812, but it was not made until 1817. The line then run was called the "Harris line;" one run according to the words of the act was called the "Fulton line." The former is the present boundary, while the latter intersects Lake Erie E. of the mouth of the Maumee River, and includes within Michigan the important city of Toledo. This city, as the outlet of the Wabash and Erie Canal, was the apple of discord, and gave its name to the "war." While measures were in progress for the admission of Michigan into the Union under the provisions of the ordinance which authorized such a measure when her free population should reach 60,000 (it having been ascertained in 1834 to be 87,273), the legislature of Ohio (Feb. 23, 1835) passed an act to organize the disputed tract of about 650 sq. m. into townships, and provided for a resurvey of the "Harris line." Up to this time, Michigan Territory had held undisputed possession as far S. as the "Fulton line," and all the local officers had been amenable to Michigan. Her authorities being informed of the contemplated encroachment, on Feb. 12, 1835, passed an act to prevent any foreign jurisdiction within the limits of the Territory, in which it was made a penal offence to exercise any official functions within her borders save those derived from the government of the U. S. or of the Territory. It being understood that Michigan would resist both the resurvey of the "Harris line" and the assumption of jurisdiction by Ohio over the disputed tract, Gov. Robert Lucas of Ohio called out the militia to protect his surveyor, and Acting Gov. Stevens T. Mason of Michigan summoned his militia to assist the civil authorities in repelling the expected invasion. Both State and Territory made urgent appeals to Pres. Jackson to support their respective claims. He referred the matter to Attorney-General B. F. Butler, who wrote an opinion favorable to Michigan. The President took no action save to send three commissioners for effecting an amicable settlement, if possible; but as neither party would yield a hair's breadth, this peace commission failed. The attempt by Ohio to exercise jurisdiction over the disputed tract led to several squabbles and the arrest of officers from Ohio and their sympathizers by the authorities of Michigan. The rival governors directed the proceedings in courts of law which followed these disturbances. On Sept. 6, 1835, Acting Gov. Mason assumed command of the militia *en route* for Toledo to prevent the organization of Wood county by the Ohio authorities, which was to take place at Toledo Sept. 7. Although the Michigan militia occupied the town, a detachment of Ohio forces, accompanying the proper officers, entered at 3 o'clock A. M., and, having gone stealthily through the formalities, withdrew. Ohio having gained her point, the militia on both sides were disbanded. Orders to supersede Acting Gov. Mason, on account of his zeal and nerve in the cause of Michigan, were issued by the President Aug. 29, 1835. After a sharp debate in Congress, Michigan was admitted into the Union by act of June 15, 1836, on condition of her acceptance of the "Harris line." At the same time she received the addition of the territory known as the Upper Peninsula from Wisconsin. She thus exchanged a strip of farming land for one of the richest mineral regions of the world. A convention of delegates, called to consider this proposition on Sept. 26, 1836, rejected it by 28 yeas to 21 nays. A second convention of delegates, called without authority of law by the Democratic county committee of Wayne county, was elected, and gave its full assent (Dec. 14, 1836) to the above conditions. Its authority being recognized at Washington, Michigan came into the Union as a State Jan. 26, 1837, under her constitution framed and adopted in 1835. The "Toledo war" cost the poor pioneers of that region $250,000; but by voting to become a State prior to Jan. 1, 1837, Michigan saved her share of the surplus revenue then distributed by the general government, and the 5 per cent. on the sales of public lands within her borders, amounting to $500,000 or more. So the "submissionists" had solid justification.

W. S. GEORGE.

**Tolenti'no,** town of Italy, province of Macerata, on an elevated bank of the Chienti, which is here crossed by a solid stone bridge dating from the thirteenth century. Of

the several churches, the most venerated by the inhabitants is that of San Nicola, the miracle-working patron of the city, who was buried here in 1310. There is considerable traffic and manufacturing industry in this town, iron-foundries, woollen-mills, tanneries, etc., being in active operation. Tolentino stands near the site of an early Greek settlement, afterward superseded by a Roman colony, which was totally destroyed by the Northern invaders. The present town, which rose up during the Middle Ages, enjoyed a popular government for a long period, though it did not escape the disorder of the times. It is now chiefly known as the place in which was concluded (in 1797) the celebrated peace between Pope Pius VI. and Gen. Bonaparte as representative of the French republic. It was also near Tolentino that Murat suffered a defeat by the Austrians (1815) which cost him his throne, and eventually his life. P. 11,229.

**Tolera'tion** [Lat. *tolerare*, to "endure"] denotes the endurance of something which is not wholly liked, especially of religious opinions or worship contrary to the religion established by law. The ancient heathen states were little called to the exercise of this quality, because their religions consisted in forms chiefly, while doctrine was vague and unformulated. Yet at Athens *asebeia*, or want of due veneration to the gods, was a punishable offence in various shapes; it was on accusation of this offence that the most religious Greek, Socrates, suffered death. Greeks and Romans punished novel *rites*, especially secret ones, until under the emperors of Rome so many new religions rushed into the western parts of the empire that they could not be repressed. In the Jewish system nothing but the worship of Jehovah without images was endured at all. The plan was much the same when Christianity became the religion of the empire; and in the Middle Ages nothing was tolerated that deviated, in faith or form, from the Catholic Apostolic Church. Protestantism, by its free thought and doctrine of the right of private judgment, paved the way for a multitude of minor differences of opinions; and yet where the prince, as representing the people, set up an established Church, all were obliged to conform to it under severe penalties. These penalties contributed to make the Established Church in England so odious that, with the help of political allies, the dissentients from the Church overturned both Church and State, and settled everything on a new basis. After the Restoration everything went back to its old order, but the dissenters were now an important third party in the state, which must not be forced to ally itself with the court and the Roman Catholics in order to secure its own religious liberties. The harsher restrictions on Protestant religious worship other than that of the Established Church were removed by the Toleration act of 1 Wm. and Mary, which, however, was arbitrary, unequal, and unsystematic in its provisions. (See Macaulay's criticisms on it in his *History*, iii. 86, and onward.) It removed no disabilities and repealed no penalties of the earlier legislation against the nonconformists. An Independent who could accept all but five or six of the articles of the Church of England was still subject to the persecuting laws, but a Quaker who rejected the Eucharist could preach without making any declaration of his faith. (Macaulay, *u. s.*) This law, however, as an entering wedge, was a great gain for religious liberty. The unpersecuting but indifferent eighteenth century went considerably further. Warburton's work on the alliance between Church and State, or the *Necessity and Equity of an Established Religion and a Test-law Demonstrated*, first published in 1736, shows the position that a firm Churchman, who was yet an enemy of persecution, could take on this subject. His doctrine is that the care of civil society extends only to the body and its concerns, and the care of religion to the soul. The civil magistrate, if he will avail himself of the benefits of religion for civil society, must seek some union or alliance with a Church, and, if there are several claiming to be such, with that one which is the largest, and so the best fitted to secure the ends of the alliance. "When the Church," he says, "loses its superiority of extent to any considerable degree, the alliance becomes void." After discussing the motives for such alliance—from which he excludes altogether the wish on the part of the Church to engage the State to use force on behalf of the establishment, as being contrary to the natural right of every man to worship God according to his own conscience—he considers the terms of the alliance, which, although a very important part of the treatise, does not concern us here. He then shows that the Christian religion is best fitted for such an alliance with the state, and the English establishment is the most perfect of all. His last argument is spent on the propriety and necessity of a test-law, or of such a law as shall keep out from offices of trust under the State those who do not belong to the Church by law established.

The argument of Warburton being based on the principle that the care of the state ends with the body and goods, and that the true end for which religion is established is not to provide for the true faith, but for civil utility, gave a platform for a certain kind of toleration on the most earthly grounds. A defence for the abolition of all laws imposing tests would be that they conflict with personal rights, that there is no possibility in any such way of producing a harmony of opinions in society on the subject of religion, and that there is danger of alienating from the state those who, while otherwise competent, cannot hold office on account of their religious scruples.

In modern times *toleration* has disappeared from most Protestant and some Roman Catholic countries, in order to give place to entire religious equality of all sects and eligibility to office of all persons of every confession. Toleration is the intermediate state between persecution for opinion's sake and separation of State from Church.

T. D. Woolsey.

**Toll** [Ang.-Sax.], the duty imposed on travellers and goods passing along public roads, rivers, bridges, etc. In the later Middle Ages it formed a considerable item in the revenues of a monarch, but exercised a very bad influence on the free development of trade and traffic. Thus, heavy tolls were levied on the Rhine by the German emperor and other minor German princes; on the Elbe and in the Sound by the Danish kings, etc. This form of toll has now been entirely abolished.

**Tol'land,** county of N. E. Connecticut, bordering on Massachusetts, drained by Willimantic and Hop rivers, and intersected by several railroads. Surface in the W. part level and fertile, in the E. part hilly and unproductive. There are numerous manufactures of cotton, woollen, and silk goods, of shoddy, hosiery, leather belting and hose, carriages, boots and shoes, boxes, machinery, and iron castings, bleaching and dyeing establishments, and flour-mills. There are many cattle, swine, and sheep. Staples, Indian corn, oats, potatoes, tobacco, hay, and dairy products. Cap. Tolland. Area, 440 sq. m. P. 22,000.

**Tolland,** p.-v. and tp., cap. of Tolland co., Conn., on New London Northern R. R. P. 1216.

**Tolland,** p.-v. and tp., Hampden co., Mass. P. 509.

**Tol'lens** (Hendrik Corneliszoon), b. at Rotterdam Sept. 24, 1780; was educated for mercantile business, but devoted himself to poetry; published in 1802 his first volume of poems, and won in 1804 the second ("Lierzang op Hugo de Groot"), and in 1806 the first prize ("Egmond en Hoorne") of the Academy of Amsterdam. Of his dramas, the most remarkable are *De Hoekschen en Kabeljaauwschen* and *Andromache;* of his epics, *De Overwintering der Hollanders op Nova Zembla;* of his lyrics, his patriotic songs, *Wapenkreet* and *Vaterlandisch Kriigslied.* His *Gezamentlijke Dichtwerken* (8 vols.) were published 1855–57. D. at Ryswick Oct. 21, 1856.

**Tol'na,** town of Southern Hungary, on the Danube, has manufactures of leather, potash, tiles, and spirits, and in the neighborhood saffron, wine, and tobacco are extensively cultivated. P. 6852.

**Tolo'no,** p.-v. and tp., Champaign co., Ill. P. of v. 777; of tp. 1413.

**Tolo'sa,** town of Spain, province of Guipuzcoa, at the confluence of the Orria and Araxes, has important manufactures of paper and arms. P. 7639.

**Tol'tecs,** an ancient Indian nation of the Mexican table-land, so called from their capital, Tula, situated in the valley of the same name in the present state of Hidalgo, about 50 miles N. of the City of Mexico. According to tradition, they had settled there about the seventh century, and long lists of their emperors and accounts of their wars have been given by several writers, though but little reliance can be placed upon such data. In the period preceding the advent of the Aztecs and other Nahuatl tribes the Toltecs are represented as having exercised supremacy over a vast region, but to have been conquered by the Chichimecs, and to have emigrated in great numbers to Guatemala, where they are supposed to have founded the Quiché empire. At the time of the conquest there were no pure Toltecs remaining in Mexico, but the principal monuments of Mexican architecture, as well as their hieroglyphics, their knowledge of astronomy and of mechanics, and their civilization generally, were ascribed to the half-mythical Toltecs. Modern researches do not discover any confirmation of these legends in the vicinity of Tula.

**Tolu' Balsam,** a balsamic juice obtained from *Myrospermum toluiferum*, a lofty tree of the natural order Leguminosæ, growing in Venezuela and New Granada. The tree averages seventy feet in height, with a straight trunk rising forty feet without branching. The balsam is ob-

tained by slashing the bark of the stem through to the wood in many places, and allowing the juice which spontaneously exudes to collect in small calabashes fixed to the tree. The balsam when fresh is a light-brown, thick, resinous substance, but by keeping concretes into a solid, brittle in cold weather, but easily softened by slight warmth. It has a delicate and fragrant odor, most perceptible when the balsam is warmed, and a correspondingly pleasant taste. Its most important constituents are an amorphous resin and cinnamic acid. Balsam of tolu was found in use by the natives when South America was first explored, and was introduced into Europe in the latter part of the sixteenth century. It is now exported from New Granada. This balsam has scarcely any medicinal virtue, but is largely used in pharmaceutical preparations and extemporaneous prescriptions to impart to mixtures its agreeable odor and taste. The officinal preparations of it are a syrup and a tincture, and it is an ingredient of the compound tincture of benzoin. EDWARD CURTIS.

**Tolu'ca,** town of the Mexican confederation, 20 miles S. W. of the City of Mexico, is regularly built, in the centre of a fertile and well-cultivated plain, and has extensive manufactures of soap and candles. Many swine are reared here, and the place is famous for its hams and sausages. P. 12,000.

**Tol'uene** (*Toluol, Hydride of Benzyl, Hydride of Tolyl, Methyl-Benzene*), ($C_7H_8$), was discovered in 1837 by Pelletier and Walter in the oily product of the dry distillation of resins. It is obtained by the dry distillation of tolu balsam and many resinous bodies, by the action of potash on benzylic alcohol, and by heating toluic acid with lime; but is most readily prepared by collecting the portion of coal-naphtha which distills between 212° and 248° F., agitating it with sulphuric acid, and redistilling, and collecting the part that goes over between 226° and 230° F. Toluene is the second member of the benzene series of hydrocarbons (see HOMOLOGY), as is shown by its formation from monobrombenzene by the action of methyl-iodide. It forms a mobile liquid of sp. gr. 0.883 at zero Centigrade, and boils at 230° F. It is soluble to some extent in alcohol, in ether, and in the fixed and volatile oils, and dissolves iodine, sulphur, and many resins. A large number of substitution-products of toluene are known, the most interesting of which are those of chlorine and nitric acid. J. P. BATTERSHALL.

**Tolu'ic Acid** (*Toluolic Acid, Toluylic Acid*), ($C_8H_8O_2$), an aromatic homologue of benzoic acid and an isomere of methylic benzoate, is produced by the action of nitric acid on cymene or xylene, and by the action of sodium and carbonic acid on bromotoluene. In a pure state it is colorless and tasteless. The fusing-point of the acid is 347° F.; at a higher temperature it sublimes without decomposition, forming fine needles. When heated with lime, toluic acid is decomposed into TOLUENE (which see) and carbonic acid. Toluic acid is monobasic, and forms crystalline salts, which, however, have not been fully investigated.

J. P. BATTERSHALL.

**Tolu'idine** (*Amido-Toluene*), ($C_7H_9N$), an isomere of benzyl-amine, is produced by reducing nitro-toluene with ferrous acetate or sulphuretted hydrogen. It dissolves in boiling water, and in alcohol, ether, and chloroform. From a dilute alcoholic solution it crystallizes in large colorless laminæ, which evaporate somewhat at the ordinary temperature of the air, and possess a burning taste. Toluidine fuses at 104° F. to a liquid which boils about 388° F. It imparts a slight blue color to reddened litmus, and forms a series of compounds with many of the acids.

J. P. BATTERSHALL.

**Tom,** tp., Benton co., Mo. P. 799.

**To'mah,** p.-v. and tp., Monroe co., Wis., at the junction of Wisconsin Valley and Ohio Milwaukee and St. Paul R. Rs., contains good schools, 2 newspapers, 1 bank, 5 hotels, and is in close proximity to several extensive cranberry-marshes. It is principally engaged in agriculture and lumbering. P. of v. 837; of tp. 1666.

J. A. WELLS, ED. "JOURNAL."

**Tom'ahawk** [Algonkin, *tomehagen*], strictly, was the war-club of the North American Indians, but for a long time the name has been given, probably through misapprehension, to the war-hatchet, originally of stone. Europeans introduced steel tomahawks, which were sometimes so made as to serve as tobacco-pipes, the handle forming the stem. The natives used this weapon as a battle-axe, and also possessed great skill in throwing it so that its edge would strike first.

**Tomahawk,** tp., Searcy co., Ark. P. 719.

**Tomales,** p.-v. and tp., Marin co., Cal. P. 1121.

**Toma'to** [Mex. *tomatl*], the *Lycopersicum esculentum*, a plant of the order Solanaceæ whose fruit is extensively employed as an article of food, both raw and cooked. It is a native of tropical America, but is much grown in kitchen-gardens in nearly all warm and temperate countries. The tomato enters into the composition of a great number of dishes, as well as sauces and pickles.

**Tom'bac** [Malay, *tambâga*, "copper"], a term applied to different alloys of copper and zinc, with about 85 per cent. of copper. An English tombac gave, copper 86.38 and zinc 13.61. A German tombac gave, copper 84 and zinc 15.5. The alloy of copper 84.5 and zinc 15.5 is very malleable and ductile. Dutch metal, pinchbeck, imitation bronze, prince's metal, and Mannheim gold are similar alloys. A *white tombac,* or *white copper,* has been made, containing copper 75 and arsenic 25. H. B. CORNWALL.

**Tombig'bee River** rises in Tishomingo co., Miss., and after a very indirect S. by E. course of 450 miles in Mississippi and Alabama, joins the Alabama River 45 miles above Mobile, and the united stream is called Mobile River below the junction. It is navigable to Aberdeen, Miss., 410 miles from Mobile Bay.

**Tombs** (Sir HENRY), K. C. B., V. C., b. in Gloucestershire, England, in 1824; educated at Addiscombe and at the Sandhurst Military College; entered the service in 1842, when ordered to join the Bengal Artillery, and soon engaged in the Gwalior campaign and subsequent active operations; appointed to the artillery staff and engaged in the Sutlej campaign. On the outbreak of the Indian mutiny, Tombs was a brevet major in command of a troop of horse artillery; ordered to join the army for besieging Delhi, he led the force which captured the Eed Gate and commanded the horse artillery at the final assault. Under Sir Colin Campbell he was then engaged in the Oude campaign at Lucknow, etc. Made lieutenant-colonel Jan., 1858; colonel the following July, and named commander of the Bath. Besides the many medals of honor heretofore won, the Victoria Cross was now added. Commanded the Bhootan expedition, and named K. C. B.; major-general 1867. D. at Newport, Isle of Wight, Aug. 2, 1874.

**Tom'cod** [perhaps corrupted by the Newfoundland fishermen from the French *tacaud,* applied to the *Gadus luscus* of Europe], a name applied in the U. S. to small codfishes, forming the genus *Microgadus.* These, in external characters, do not differ from the large codfishes (*Gadus*), having, like them, three dorsal and two anal fins, a barbel at the chin, and teeth on the vomer; the anus, however, is under the last rays of the first dorsal fin, instead of being under the first ones of the second, and the skull is essentially different; it is inflated laterally and on each side of a sphenoidal groove; the epiotics are obtusely rounded, and their posterior or outwardly descending ridges blunt; the frontal has an anterior low crest, continued forward, dividing into narrow lateral wings, and the anterior frontals are mostly covered by the frontal in front. The species on the eastern coast is the well-known *M. tomcodus,* that on the western (California, etc.) the *M. proximus.* The species are not of much economical importance, although the eastern one at least is brought in considerable quantities to the eastern markets. They are often caught from the wharves by anglers who seek them there. THEODORE GILL.

**Tomes** (ROBERT), M. D., b. in New York City in 1816; graduated at Washington College, Hartford, 1837; studied medicine at Philadelphia, Edinburgh, and Paris; settled as a physician in New York; made several voyages as surgeon to the Pacific Mail Steamship Co.; translated various works from the French; wrote for several magazines, and was for some time assistant editor of the New York *Evening Post;* wrote the American portion of Appletons' *Cyclopædia of Biography* (1855); aided Dr. Hawks in preparing for the press the official narrative of Commodore Perry's expedition to Japan, and drew up a popular abridgment of that work (1857); was a contributor to Appletons' *New American Cyclopædia,* and for two years after the civil war resided at Rheims, France, as U. S. consular agent. Author of *The Bourbon Prince* (1853), biographies of *Richard the Lion-Hearted* (1854) and *Oliver Cromwell* (1855), *Panamá in 1855* (1855), *The Battles of America by Sea and Land* (3 vols., 1859–60), *The War with the South, a History of the Great American Rebellion* (3 vols., 1867), both of which histories were originally published in semi-monthly 4to numbers; and *The Champagne Country* (1867).

**Tom Green,** county of S. W. Texas, bordering on New Mexico, bounded S. W. by Pecos River, and intersected in the E. by the head-streams of the Colorado. It was formed in 1874, and, with Crockett co., formed in 1875, constitutes what was formerly known as the Bexar region or territory. Cap. Ben Ficklin. Area, about 14,000 sq. m.

**Tom'linson** (CHARLES), F. R. S., b. in London, England, in 1808; became lecturer on physical science in King's College School, London; made many valuable scientific experiments, which were communicated to the *Philosophical Magazines* of London and Edinburgh and to the *Transactions* of scientific societies; was a member of the editorial staffs of Knight's *English Cyclopædia* and of the *Encyclopædia Britannica* (8th ed.); was editor of several of the publications of the Cavendish Society and of the Geological Association; and author, among other works, of *The Student's Manual of Natural Philosophy* (1838), *Rudimentary Mechanics* (1840), *Amusements in Chess* (1845), *The Chess-Player's Annual* (1856), *The Cyclopædia of Useful Arts and Manufactures* (2 vols., in parts, 1852–53; 4th ed., 3 vols., 1867), of a series of small treatises on physical phenomena (1859–61), *Experimental Essays* (1863), *The Rain-Cloud and the Snow-Storm* (1865); and edited, with a memorial of the author, Sir William Snow Harris's *Treatise on Frictional Electricity, in Theory and Practice* (1867).

**Tomlinson** (GIDEON), LL.D., b. at Stratford, Conn., Dec. 31, 1780; graduated at Yale College 1802; became eminent as a lawyer at Fairfield; was a member of Congress 1818–27, governor of Connecticut 1827–31, and U. S. Senator 1831–37. D. at Fairfield Oct. 8, 1854.

**Tommase'o** (NICOLÒ), b. at Sebenico, in Dalmatia, in 1802; his education was begun in Dalmatia, but he took his legal degree at the University of Padua. Literary criticism, however, especially attracted him, and on the invitation of Vieusseux he went to Florence, where he became one of the principal writers for the well-known periodical, *L'Antologia*. This journal being suppressed for an article for which Tommaseo, though not the author, generously assumed the responsibility, he was banished and retired to France. Previous to his exile, however, he had published an important work, *Il Dizionario dei Sinonimi* (Florence, 1832). In France he wrote several works on education, besides two novels, *Il Duca d'Atene* and *Fede e Bellezza*. After this he went to Corsica, where he made a collection of popular songs, which were preceded in their publication by a volume of Tuscan songs, and followed by a collection of Greek and Illyrian popular songs. In 1839 he returned to Venice, where he published *Memorie Poetiche*, and his first *Dizionario Estetico*, which is a collection of his best critical articles. Having taken part in the national movements of 1847–48, he was imprisoned with Daniel Manin. Being liberated at the same time by the people of Venice, and the provisory government proclaimed, Manin, as president, invited Tommaseo to take part in it. He accepted the portfolio of instruction, and was soon after sent as minister to Paris. On the fall of the Venetian republic Tommaseo retired to Corfu, but in 1854 returned to Piedmont, where he continued to labor incessantly, though nearly blind, until 1859, when he went back to his old friend Vieusseux in Florence. There he prosecuted his literary work with unabated zeal (being engaged on the largest Italian dictionary yet published, and which is now advanced as far as the letter T) until his death, in 1874. Florence honored him with an imposing funeral.

**Tomp'kins,** county of Central New York, drained by tributaries of Cayuga Lake, which lies partly in the county and is connected with the Erie Canal, and intersected by several railroads. Surface generally hilly, soil better adapted for grazing than for tillage. There are manufactories of woollens, agricultural implements, carriages, furniture, iron castings, machinery, organs, printing paper, tobacco and cigars, hubs and wagon materials, and railway cars, grist-mills, saw-mills, tanneries, and currying establishments. Cattle, sheep, horses, and swine are numerous. Staples, oats, Indian corn, wheat, barley, buckwheat, potatoes, flax, tobacco, wool, lumber, and dairy products. Cap. Ithaca. Area, 506 sq. m. P. 33,178.

**Tompkins,** tp., Warren co., Ill. P. 2245.

**Tompkins,** p.-v. and tp., Jackson co., Mich. P. 1262.

**Tompkins,** tp., Delaware co., N. Y. P. 4046.

**Tompkins** (DANIEL D.), b. at Scarsdale, Westchester co., N. Y., June 21, 1774; graduated at Columbia College 1795; was admitted to the bar of New York City 1796; was elected to the legislature, and also to the convention for revising the State constitution 1801; was a member of Congress 1804–05; appointed judge of the New York supreme court 1804; was governor of the State 1807–17; was conspicuous as an advocate of "Jeffersonian principles" and an opponent of the banks; commanded the 3d military district during the war of 1812–15, to the success of which he contributed by his energy in calling out troops and equipping them for service, but by his carelessness in keeping accounts was afterward charged with being a defaulter; was chosen Vice-President of the U. S. 1816 on the ticket with Monroe, and re-elected 1820, when he was an aspirant for the Presidential nomination; recommended by a special message of Jan. 28, 1817, the abolition of slavery in New York, which was effected by an act to take effect July 4, 1827; was chancellor of the University of New York; delegate to the State constitutional convention of 1821, and for a time its president. D. on Staten Island June 11, 1825.

**Tompkinsville,** p.-v., cap. of Monroe co., Ky. P. 218.

**Tompkinsville,** p.-v., Richmond co., N. Y.

**Tomp'son** (BENJAMIN), b. at Braintree, Mass., July 14, 1642, son of Rev. William, minister of that parish; graduated at Harvard 1662; was master of the Boston Public School 1667–70, and afterward of that at Cambridge preparatory to the college for about forty years. D. Apr. 9, 1714, and was buried at Roxbury, where his tombstone commemorates him as the "learned schoolmaster and physician and y^e^ renowned poet of New England." Author of a poem of some length upon King Philip's war, entitled *New England's Crisis*.

**Tomsk,** government of Siberia, bounded W. by Tobolsk, E. by Yeniseisk, and S. by China, between lat. 49° and 61° N., and between lon. 75° and 90° E. The surface is one vast plain sloping from the Altai Mountains, which occupy the southernmost part. The foot of the mountains is covered with extensive forests of oak, cedar, and pitch trees, and on the adjacent steppes live large droves of wild horses and herds of oxen. Where agriculture is pursued, in the central parts of the government, good crops of rye, barley, oats, hemp, and flax are raised, as the climate generally is mild. The northern part is marshy, and partly covered with sombre forests of fir and pine. The inhabitants live as nomads; hunting and fishing form important occupations. In the southern part an extensive mining business is carried on. Gold-washing is in many places very remunerative, and, being free, it has attracted large multitudes of people. The mineral wealth is very considerable, and an important transit-trade between Russia and China is carried on on the large system of lakes and rivers which the government contains. Of manufacturing establishments there exist several tallow-smelting works, tanneries, breweries, tileworks, and ironworks. Area, 329,027 sq. m. P. 838,756.

**Tomsk,** town of Siberia, capital of the government of Tomsk, at the Tom, an affluent of the Obi, in lat. 56° 29′ N. It is well built, has many handsome edifices, important foundries, tanneries, soap-factories, and other manufactories, and carries on, besides its transit-trade, an active trade in furs, grain, and cattle. Snow falls in October, and in December quicksilver freezes, but the summer is beautiful and the climate generally healthy. P. 24,431.

**Tom's River,** p.-v., cap. of Ocean co., N. J., on Southern New Jersey R. R., 56 miles S. of New York City, has 4 churches, a graded school, 1 bank, 1 newspaper, building and loan association, 2 hotels, and Masonic, Odd Fellow, and Sons of Temperance lodges. Principal business, coasting-trade and cranberry-raising. P. about 3100.

GEORGE M. JOY, ED. "NEW JERSEY COURIER."

**Ton.** See WEIGHTS AND MEASURES.

**Tonawan'da,** p.-v. and tp., Erie co., N. Y., at the mouth of Tonawanda Creek, a tributary of Niagara River, on the Erie Canal and Erie and New York Central R. Rs., has manufactures, a private bank, and weekly newspaper. Part of the v. lies in Niagara co. P. of v. 2125; of tp. 3039.

**Tonawanda,** v., Wheatfield tp., Niagara co., N. Y. P. 687.

**Tone** [Lat. *tonus*; Fr. *ton*; Ger. *ton*], in music, a word having for its primary meaning a *sound*, or the impression made on the ear by a vibrating string or other sonorous body. The derivative meanings of the term relate to the qualities, relations, or conditions of such sounds, as (1) their place on the scale, a high tone or a low tone; (2) the interval made by two sounds, as a major or a minor tone; (3) any special quality of a sound, as a fine, clear, rich, sweet, or feeble tone. In a more technical sense a tone (or whole tone) means one of the steps of the scale, as C — D, G — A, etc. This is capable of division into two *semi*tones. (See INTERVAL.) WILLIAM STAUNTON.

**Tone** (THEOBALD WOLFE), b. in Dublin, Ireland, June 20, 1763; educated at Trinity College, Dublin; studied law in London; was called to the bar at the Middle Temple 1789; wrote a number of pamphlets to expose English misgovernment in Ireland; was an ardent sympathizer with the doctrines of the French revolution; promoted the combination of the Irish Roman Catholics with the Protestant dissenters in opposition to the British government; founded at Belfast the first society of United Irishmen 1791; became secretary and agent of the Roman Catholic committee 1792; was involved in secret negotiations with France, on account

of which he came to the U. S. 1795; resided a few months at Philadelphia and at Princeton, N. J., but sailed for France Jan., 1796; aided the French Directory in fitting out Hoche's projected expedition to Ireland, in which he was appointed brigadier and adjutant general; served in the Bavarian army 1797; was captured in Sept., 1798, on board a French squadron bound for Ireland; was taken to Dublin, tried by court-martial, and sentenced to death, but committed suicide by cutting his throat with a pen-knife Nov. 19, 1798. His *Autobiography* was published by his son, William Theobald Wolfe Tone (Washington, D. C., 1826), who served in the French armies under Napoleon, and subsequently in the army of the U. S.

**Toner** (Joseph Meredith), M. D., b. in Pittsburg, Pa., Apr. 30, 1825; studied at the Western University and at St. Mary's College; graduated at the Vermont Medical College in 1850, and at the Jefferson Medical College in 1853; began the practice of medicine at Summitville, Pa., and in 1855 took up his residence at Washington, D. C. He is a member and officer of many medical societies and other learned associations; in 1872 founded the Toner lecture to encourage the discovery of new truths in medicine, placing a fund in charge of the Smithsonian Institution, the interest of which is paid for two annual essays on medical science; has contributed largely to medical literature and to medical biography, and devised a system of symbols to indicate geographical localities, which has been adopted by the post-office department. Among his numerous publications are—*Abortion in its Medical and Moral Aspects* (1859), *Maternal Instinct, or Love* (1864), *Compulsory Vaccination* (1865), *History of Inoculation in Massachusetts* (1867), *Necrological Notices of Deceased Surgeons of the Rebellion* (1870), *Natural History, etc. of Yellow Fever in the United States* (1874), *Medical History and Physical Geography of Maryland* (1875), *Biographical Sketch of Dr. J. D. Jackson* (1875), *Medical Men of the Revolution* (1876), and has in preparation a *Dictionary of Deceased American Physicians*.

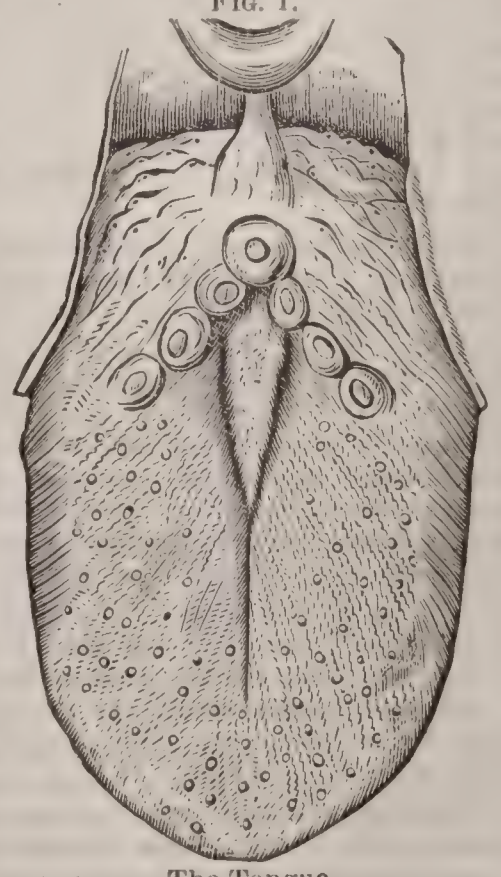
**Tonga Islands.** See Friendly Islands.

**Tonganoxie,** p.-v. and tp., Leavenworth co., Kan. P. 1600.

**Tongres** [Flem. *Tongern*], town of Belgium, province of Limburg, on the Jaar, has breweries, tanneries, and manufactures of tiles and chicory. In its neighborhood is a hot mineral spring, which was well known in ancient times, and is mentioned by Pliny. P. 7080.

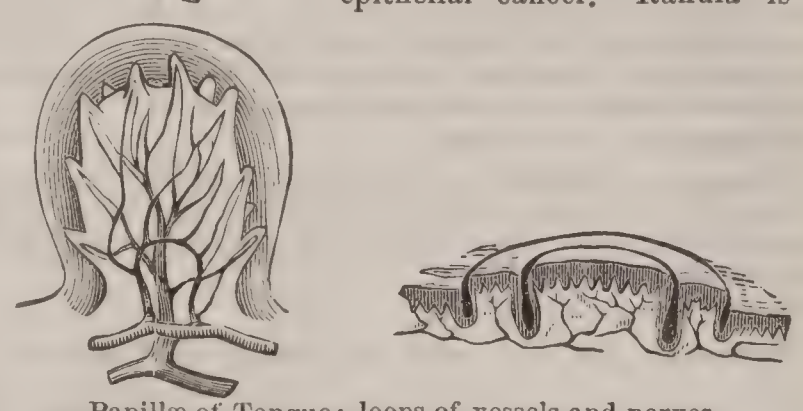
**Tongue (and Diseases of)**, the organ of the special sense of taste, situated on the floor of the mouth. This body consists of muscles by which it can be protruded, retracted, and curved upward, downward, and laterally. The base or root of the tongue is attached below to the hyoid bone, and the tip of the tongue, when inactive, rests forward against the inner surface of the lower incisor teeth. The tongue consists of two symmetrical halves, with a fibrous middle septum; hence, one side may be paralyzed and the other active, as in cases of apoplexy. The muscles of the tongue are supplied by the hypocervical motor nerve. The upper surface or dorsum of the tongue is essentially the seat of taste. (See figure of taste-bulbs in Histology.) It is covered by delicate processes or papillæ, which contain the ultimate ramifications of blood-vessels and the terminal fibres of the nerves of sensation and taste. The fore part and sides of the tongue derive their sense of taste from the gustatory branch of the fifth nerve. The base of the tongue and sides and the larger papillæ receive their special sense through the lingual branch of the glossopharyngeal nerve. The facial nerve also has an influence upon taste, paralysis of this nerve impairing the special sense. The papillæ vary in size and length on different parts of the tongue—broad, "circumvallate" near the base, "fungiform" and "filiform" on the anterior part. Food and viands of decided flavor can be definitely tasted and distinguished by a single papilla, as found when applied through cylindrical glass rods. It is claimed that only the circumvallate and fungiform papillæ contribute to the sense of taste, the filiform to sensation. Sensation (tactile) is more acute in the tongue than elsewhere in the body. Thus, Valentine found that distinct perception of two needle-points was obtained at the tip of the tongue when the points were separated only .483 of a Paris line, the most sensitive part of the body, the tip of the finger, requiring .723 of a line. The several papillæ are imbedded in the "corium" or body of the mucous membrane, which corresponds to the cutis vera of the skin, and are covered with scaly epithelial cells. The tongue may be inflamed from various causes, as hot drinks and irritants. It is often the seat of apthæ, ulcers, "cancers," the result of catarrh of the mouth. The "coated tongue" may be in fact due to a relaxed, flaccid, and pale condition of the papillæ, and when noticeably coated has an accumulated stratum of thickened saliva and rapidly exfoliated epithelial cells; the yellow color the result of the fatty metamorphosis which the cast-off cells speedily undergo. When the stomach is inflamed or irritable, the papillæ of the tongue will often appear as distinct points. The tongue is occasionally attacked by epithelial cancer. Ranula is a cystic tumor beneath the tongue, due to occlusion of some one of the salivary ducts. When any part of the tongue is the seat of motor paralysis, loss of sensation or taste, the part so deprived may be experimentally defined, and a study of the nerve-supply of the tongue will point to the part of the brain in which the lesion exists. Exceptionally, in infants the "frænum" or fibrous cord beneath the tongue is too short; the "tongue-tied" infant cannot nurse well, and when older speaks imperfectly; the cure is by cutting.

Fig. 1.



The Tongue.

Fig. 2.



Papillæ of Tongue: loops of vessels and nerves.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Ton'ic,** in music, the keynote, root, or prime of a scale.

**Ton'ica,** p.-v., La Salle co., Ill., on Illinois Central R. R., 100 miles S. W. of Chicago, has 3 churches, a large graded school, 1 bank, 2 newspapers, and a large mill. P. about 700. Alfred Heath, Ed. "Local."

**Ton'ics,** in medicine, a term used to refer generically to the various means employed by the physician to remove the condition of *debility*, general or special. Nourishing food, fresh air and exercise, cold bathing, etc., are thus spoken of as having a tonic effect. Among drugs, such as directly improve nutrition, or indirectly accomplish the same end by exciting the appetite and increasing digestive power, are called "tonics." The most prominent examples of the former are *iron*, which in anæmia directly stimulates the manufacture of the red blood-corpuscles; *cod-liver oil*, which operates as a fatty food of unusually easy assimilation; *phosphorus*, which in some cases of nervous exhaustion or functional nervous derangements seems to improve the nutrition of the nerve-structures; and preparations of some of the higher *metals*, as silver, zinc, mercury, arsenic, which in peculiar conditions of malnutrition tend in some unknown way to determine the nutritive processes back into the healthy channels. Of the drugs which are "tonic" by improving digestive power, the most serviceable are vegetable bitters, as cinchona and its alkaloids, gentian, columbo, quassia, nux vomica, etc.; aromatics and spices; acids, both mineral and organic; and weak alcoholic beverages in very moderate quantity. But the list might be greatly extended, for it is a general property of irritants that, taken internally in small doses, their irritation tends to increase the activity of the digestive organs and the secretion of the digestive fluids. Edward Curtis.

**Tonkin',** or **Tonquin,** the northernmost province of the kingdom of Anam, opened to foreign commerce by the

French treaty of Aug. 31, 1874, extends on the western coast of Farther India, between lat. 20° and 23° N., along the Gulf of Tonkin, and is traversed by the river Songka, which enters it from the Chinese province of Yun-Nan, and is navigable up to the Chinese frontier. At its mouth is situated the principal port, Hai-Phong, in lat. 20° 53′ N., lon. 106° 45′ E.; on its middle course the capital, Hanoi. Hai-Phong can be reached by vessels drawing 20 feet, Hanoi only by vessels drawing from 4 to 6 feet. Three small river-steamers belonging to a Hong-Kong firm ply on the stream. The climate is comparatively healthy. Europeans spend several years here without experiencing any serious influence on their health. The range of temperature is similar to that of Hong-Kong. The soil is very fertile, and specially adapted to the cultivation of rice, which yields two crops a year. The production of silk and the cultivation of cotton are also important. The country is rich in metals; 14 gold, 7 silver, 3 copper, 1 zinc, 17 iron, and 3 salt mines are in operation; coal deposits are found in the neighborhood of the coast. Commerce, however, will not be able to draw any great advantage from the above treaty until Tonkin becomes the road to Yun-Nan with its immense wealth of metals. The inhabitants are very poor; moreover, they are suspicious and avaricious; direct business with them is impossible. Chinese middlemen are indispensable, and the government does not favor foreigners. E. SCHLAGINTWEIT.

**Tonneins′,** town of France, government of Lot-et-Garonne, on the Garonne, manufactures sailcloth, cordage, leather, tobacco, and trades in hemp and plums. P. 7947.

**Ton′qua Bean,** the seed of a noble leguminous tree of South America, the *Dipterix* (or *Coumarouna*) *odorata*. It abounds in the fragrant principle coumarine; is used in scenting snuff and tobacco, and in perfumery. It is also employed to keep moths from woollens. In medicine, it relieves the paroxysm of whooping cough.

**Tonquin.** See TONKIN.

**Tonquin′, Gulf of,** an inlet of the China Sea, bounded S. and W. by Cochin-China, N. by China, and E. by the island of Hainan. Its fisheries are very rich and very important.

**Tonsilitis.** See QUINSY.

**Tonsils.** See HISTOLOGY, by COL. J. J. WOODWARD, M. D.

**Ton′son** (JACOB), b. at Holborn, London, England, in 1656; was apprenticed to a bookseller; set up business for himself as a stationer in Chancery Lane, near Fleet street, about 1677; soon published some of Otway's and Tate's plays and Dryden's *Troilus and Cressida* (1678); was thenceforth the regular publisher of the writings of Dryden, who edited for him the famous *Miscellanies;* brought out the first good edition of Milton's poems and the first complete octavo edition of Shakspeare; brought out in 1703 a *Cæsar,* admitted to be the handsomest specimen of English typography to that date; established his shop at Gray's Inn Gate 1697, and at the Shakspeare Head in the Strand 1712; had a warehouse in the Savoy and a printing-office in Bow street; was printer to the excise, publisher to most of the fashionable authors of the day, and stood at the head of his trade; was secretary to, and one of the founders of, the famous "Kit-Cat Club," for whose use he built a room at his fine villa at Barn Elms on the Thames, which became a place of assembly for the wits. He retired from business in 1720, and devoted himself to the management of an agricultural estate. D. Mar. 18, 1736. His collection of portraits of the members of the Kit-Cat Club, by Sir Godfrey Kneller, is still kept intact by his present heir at Bayfordbury Park, Hertfordshire.

**Ton′sure** [Lat. *tonsura,* a "shaving"], in the Roman Catholic and Oriental churches, the shaving of the beard and of a portion of the hair from the head of an ecclesiastic. In the Roman Catholic Church the size of the tonsure is not uniform, but its place is at present upon the crown of the head. This is the tonsure of St. Peter. In the ancient Irish and British churches the tonsure of St. James formerly prevailed, in which the front part of the head was shaved as far back as a line passing over the top of the head from ear to ear. The Eastern churches anciently shaved the whole head. In former times the controversies with regard to these forms of the tonsure were very bitter. The tonsure is one of the preparations for orders, and it is regarded as symbolizing the crown of thorns worn during our Lord's Passion.

**Tontine.** See LIFE ASSURANCE, by J. H. VAN AMRINGE.

**Tontog′any,** p.-v., Wood co., O.

**Tonty, de** (HENRY), CHEVALIER, son of Lorenzo Tonti, b. about 1650; entered the French army as a cadet; served also in the navy; accompanied La Salle to Canada 1678 and in his exploration of the Mississippi; was left in command of a fort near Peoria 1680; made an unsuccessful attempt to found a settlement in Arkansas; took part in an expedition of the Western Indians against the Senecas 1685; twice descended the Mississippi to its mouth in search of La Salle, and a third time to meet Iberville; remained in that region, and d. at Fort Louis (now Mobile) in Sept., 1704. He contributed to Margry's *Relations et Mémoires* an *Account of La Salle's Last Expedition,* of which an English translation appeared in London 1698; was republished at New York 1814, and is included in vol. i. of Benjamin F. French's *Historical Collections of Louisiana and Florida* (1846).

**Tooe′le,** county of W. Utah, bordering on Nevada and bounded N. E. by the Great Salt Lake. A great portion of it is a barren desert, although there is in the E. part some arable and grazing land, and mines of gold, silver, copper, and lead. In the W. part are fertile valleys and several mining-districts. Cap. Tooele. Area, 8320 sq. m. P. 2177.

**Tooele,** p.-v., cap. of Tooele co., Ut.

**Tooke** (JOHN **HORNE**), b. at Westminster, England, June 25, 1736, son of John Horne, a wealthy poulterer; educated at Westminster and Eton schools; graduated at St. John's College, Cambridge, 1758; became usher in a school at Blackheath, Kent; took orders in the Church of England at his father's desire, but much against his own wishes; became incumbent of a chapel at New Brentford 1760; visited France as tutor to a son of Elwes, the famous miser; began his political career in 1765 by writing a defence of Wilkes, entitled *The Petition of an Englishman;* became intimate with Wilkes, whose election to Parliament he strongly advocated, and aided him in founding the Society for Supporting the Bill of Rights 1769, but soon afterward had a bitter quarrel with him; was in consequence denounced in the *Junius* letters, and defended himself with vigor 1771; resigned his living and resumed the study of the law at the Middle Temple 1773; started a subscription for the widows and orphans of the Americans "murdered by the king's troops at Lexington and Concord 1775," for which he was prosecuted by the ministry for libel July, 1777; conducted his own defence; was found guilty of libel, sentenced to a year's imprisonment and a fine of £200; wrote while in prison a *Letter to John Dunning, Esq.* (1778), in which he examined the legal aspects of his trial, and incidentally started upon a grammatical disquisition on the irregularities of the English language; was refused admission to the bar 1779 on the ground of being a clergyman; assumed his additional name in 1782 out of regard to Mr. Tooke of Purley, who made him his heir; published his chief work, ΕΠΕΑ ΠΤΕΡΟΕΝΤΑ, or *The Diversions of Purley* (1786, vol. ii., 1805), an ingenious treatise on etymology which occasioned much controversy, and has been widely read; wrote several political pamphlets, including letters on parliamentary reform to Lord Ashburton (1782) and Dr. Richard Price (1794); was an unsuccessful candidate for Parliament at Westminster 1790 and 1796; was an active member of the Society of Correspondence formed by the admirers of the French revolution, on which account he was committed to the Tower, tried for high treason 1794, but acquitted, being defended by Gibbs and Erskine; obtained a seat in Parliament for Old Sarum 1801, and passed his later years in affluence at Wimbledon, where he d. Mar. 18, 1812. He was never married, but had several natural children, to one of whom he left his large estate. (See his *Memoirs,* by Alexander Stephens, 2 vols., 1813.)

**Tooke** (THOMAS), son of William, b. at St. Petersburg, Russia, in 1774; was for more than forty years successfully engaged in the Russian trade; was a pioneer of free-trade doctrines. Author of numerous writings on the currency, the corn laws, finance, and banking, including a valuable *History of Prices and of the State of the Paper Circulation from 1798 to 1856, etc.* (6 vols., 1838–56); wrote the famous "Merchants' Petition" for free trade in 1820; was the founder of the Political Economy Club (1831), and the promoter of many public enterprises connected with industrial and philanthropic reforms. D. in London Feb. 26, 1858. After his death, his admirers raised a subscription with which they endowed in King's College, London, a "Tooke professorship" of economic science and statistics.

**Tooke** (WILLIAM), b. at Islington, London, England, Jan. 18, 1744; originally a printer, was ordained in the Church of England 1771; became soon afterward minister of the English church at Cronstadt, Russia, and was chaplain to the factory of the Russia Company at St. Petersburg 1774–92. D. in London Nov. 17, 1820. Author of *Russia, or A Complete Historical Account of all the Nations which compose the Russian Empire* (4 vols., 1780–83), *Life of Catharine II., Empress of Russia* (3 vols., 1797), *A View*

*of the Russian Empire during the Reign of Catharine II.* (3 vols., 1799), *A History of Russia A. D. 862–1762* (2 vols., 1800), *Varieties of Literature* (London, 1795, 2 vols. 8vo), *Extracts from Foreign Literary Journals and Original MSS.* (London, 1796, 2 vols. 8vo), of several volumes of sermons, novels, and translations, among which was *The Works of Lucian*, from the German translation by Wieland (2 vols. 4to, 1820), and editor of vols. i.–v. of the *General Biographical Dictionary* (1798).—His younger son, WILLIAM, b. at St. Petersburg in 1777, was a London solicitor, a Liberal member of Parliament 1835–37, and one of the founders and long the treasurer of the Society for the Diffusion of Useful Knowledge. D. in London Sept. 20, 1863. He edited the *Works* of Charles Churchill (2 vols., 1804), and wrote *The Monarchy of France* (1855).

**Too'la,** or **Tula,** government of Central Russia, bordering N. on the government of Moscow, comprises an area of 11,875 sq. m., with 1,154,292 inhabitants. The surface is level or slightly undulating, the climate temperate, and the soil fertile. One-sixth of the surface is covered with forest; around the capital are extensive iron and coal mines; the rest is under tillage. Corn, hemp, flax, mustard, turnips, potatoes, tobacco, and hops are raised; sheep, cattle, and horses are reared. Breweries, distilleries, and manufactures of ironware are numerous.

**Toola,** or **Tula,** town of European Russia, capital of the government of Toola, on the Oopa, is well built and has a fine cathedral, 28 other churches, a theatre, several museums, several technical schools, and other educational institutions. Its manufactures of hats, silks, leather, platina-ware, jewelry, and ironware are very important. Locks, tea-urns, cutlery, bells, muskets, pistols, sword-blades, etc. are made to perfection in large quantities. The imperial manufactory of arms employs 7000 men, 9600 women, besides 3500 hands in subsidiary occupations. P. 58,150.

**Toombs** (ROBERT), b. in Wilkes co., Ga., July 2, 1810. His father died when he was young, leaving a good estate. His mother looked carefully to his education, which was obtained partly at the University of Georgia, which was then under the presidency of the distinguished educator, Moses Waddell, D. D.; and partly at Union College, Schenectady, N. Y., then under the presidency of the famous Eliphalet Nott; at this institution he graduated in 1828; in 1829 he took a course of law-lectures at the University of Virginia. In every department of study he was regarded as an intellectual prodigy. In 1830, before his majority, he was admitted to the bar by special act of the legislature, and opened an office at the town of Washington in his native county, where he has continued to reside ever since (1876). Few men ever rose more rapidly in his profession than he did. William H. Crawford, Georgia's great statesman, who was then on the bench of the northern circuit, saw in the young barrister genius of no ordinary character, and often expressed the opinion that high fame awaited him. When the war with the Creek Indians broke out in Alabama in 1836, Toombs raised a company of volunteers, and led them, as captain, to the field, serving under Gen. Scott until the close of the conflict. In 1837–40 and 1842–43 he was a member of the State legislature, where from the beginning he took a most conspicuous position. He was brought up in the Jeffersonian school of politics, to which creed he has ever adhered. In 1844 he was elected a member of Congress. He then belonged to a class known as Southern Whigs, and as such supported Harrison for the Presidency in 1840, and Clay in 1844. His début in the House of Representatives was on the Oregon question, and his first speech placed him in the front rank of the debaters, orators, and statesmen of that body. He remained a member of the House until Mar., 1853, when he took a seat in the Senate. While a member of the House the most conspicuous part he acted was on the adjustment measures of 1850, and no one, not even Mr. Douglas or Mr. Clay, contributed more to the passage of those measures than he did. In the Senate he had no superior in debate. He was re-elected to that body in 1859, and continued to hold his seat in it until Georgia passed her ordinance of secession in 1861. He then resigned, and took his seat in the State secession convention, where he also acted a conspicuous part, and was chosen a delegate to the Confederate Congress at Montgomery. In that body, as in all other assemblages of which he was a member, he stood amongst the ablest and most eloquent. He was the Mirabeau of that Congress, and but for a misunderstanding, without time for an explanation, he would most probably have been chosen President of the Confederacy. After the election of Mr. Davis to that office, the secretaryship of state was tendered by him to Mr. Toombs. This Mr. Toombs at first positively declined to accept, but on the earnest entreaty of friends reconsidered so far as to agree to hold it for a short time; and accordingly in July resigned it, and took a commission as brigadier-general in the army. He greatly distinguished himself at the second Manassas and Sharpsburg battles. For causes which space will not allow to state, he resigned his commission and returned to Georgia, where he was made a brigadier-general of the State militia upon the invasion of the State by Sherman in 1864. After the close of the war, he left the country, spending his time in Cuba, France, and England, remaining abroad until after the restoration of the privilege of the writ of *habeas corpus* in 1867. He then returned home and resumed the practice of law, which he has pursued with great success ever since. His fees some years have been reported as high as $50,000. As a talker he has ever been entertaining, instructive, and brilliant. The reconstruction measures of Congress he denounced in the beginning, and still continues to denounce, with all the force and power of language he can command. ALEXANDER H. STEPHENS.

**Toomes's Grant,** tp., Tehama co., Cal. P. 40.

**Tooms'borough,** p.-v., Wilkinson co., Ga., has a weekly newspaper.

**Toon,** the *Cedrela Toona*, a large timber tree of India, belonging to the order Cedrelaceæ. It is found throughout a wide area in Asia, and its wood, though soft, is very useful. The bark is a strong astringent.

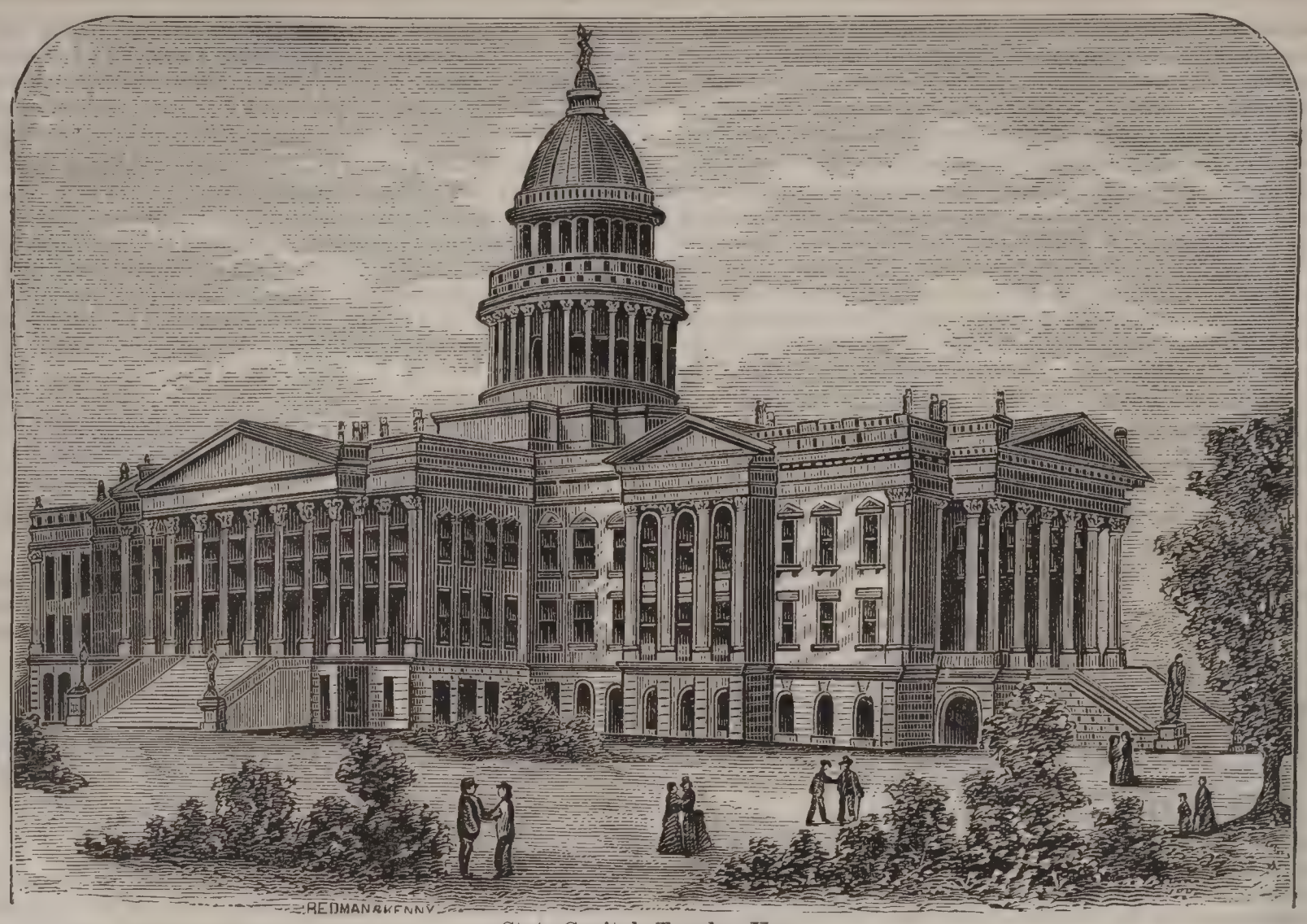
**Toorkistan.** See TURKESTAN.

**Toothache Tree.** See PRICKLY ASH.

**To'paz,** a gem, which is not the τοπάζιον of Pliny, the latter being described as "opaque and green, and probably some variety of agate or jasper." It was named from its locality, an island in the Red Sea. The *chrysolite* of Pliny and later writers, according to Dana, included our topaz. The mineral species *topaz* is orthorhombic in crystallization, with a fine basal cleavage which causes it to split into lustrous plates—a feature which will always serve to distinguish a white transparent topaz from the diamond. Its hardness is 8, lying between quartz and sapphire. The diamond will therefore scratch it very easily. It contains silica, alumina, and fluorine, but the proportions are as yet uncertain, the best analyses giving an excess of 5, or even 7, per cent.—which is undoubtedly oxygen taken up during the analysis in the conversion into oxide—of silicon which exists in the mineral as fluoride. As there is no method known as yet of determining the amount of fluorine directly, the constitution of this mineral remains, strange to say, even at this late day, largely a matter of conjecture. The hypothesis which is adopted by Dana makes it $(Al_2O_3)_2.SiO_2.SiF_2$, which requires $SiO_2$ 16.2 per cent., $SiF_2$ 28.1 per cent., and $Al_2O_3$ 55.7 per cent. (See also PRECIOUS STONES.) HENRY WURTZ.

**Tope,** the English name of the *Galeorhinus galeus* (or *Galeus canis*), a shark common in the British seas, and widely distributed elsewhere, but not found in the American waters. It belongs to the family Galeorhinidæ, and is distinguished by the following combination of characters: the teeth are nearly alike in both jaws, oblique, and notched and serrated ($\frac{34}{34}$ in number); the first dorsal is opposite the space between the pectorals and ventrals; the caudal fin has a single notch, and there are no median pits at its base; the color is the usual slate-gray above and lighter beneath. It attains a length of about six feet. It does not differ in habits or economy in nature from the common sharks of the American coast. THEODORE GILL.

**Tope'ka,** city and tp., capital of the State of Kansas and county-seat of Shawnee co., on Kansas River, 68 miles W. of the State line between Missouri and Kansas. Kansas Pacific and Atchison Topeka and Santa Fé R. Rs. intersect at this place. The location of the city is high and commanding, and some of the most charming prairie landscape-scenery in the West is observable in all directions. The legislature, supreme court, and the U. S. circuit and district courts hold sessions here. A site for a government court-house and post-office has been purchased, which will be improved as soon as the requisite appropriation is made by Congress. The city is supplied with excellent public schools, and also possesses several collegiate institutions. The College of the Sisters of Bethany, for the education of girls, is under the auspices of the Protestant Episcopal Church. The college edifice cost $80,000, and is the most complete and thorough educational institution for young ladies W. of the Alleghany Mountains. Washburn College is a Congregational institution, and is situated on 160 acres of land adjoining the city. The edifice cost $65,000, and the endowment fund is $45,000, which will soon be $100,000. The Seminary of the Assumption is a Roman Catholic school for boys and girls. The general offices and principal machine-shops of the Atchison Topeka and Santa Fé R. R. Co. are established at Topeka. A rolling-mill for the manufacture of rails is in operation here. It cost $125,000, and gives employment to 150 men.




State Capitol, Topeka, Kan.

Within 2 miles of the city one of the cottages for a State insane asylum is building; the institution when completed will cost $500,000. There are 3 daily newspapers (all of which issue weekly editions), 2 weekly, and 1 monthly. P. of city, 5790; of tp., exclusive of city, 1079.

F. P. Baker, Ed. "Daily Commonwealth."

**Töpf'fer** (Rudolphe), b. at Geneva Feb. 17, 1799; studied first painting, afterward literature and philosophy, and was appointed professor of æsthetics at the academy of his native city, where he d. June 8, 1846. In 1839 his novel, *Le Presbytère* (translated into English in 1848 under the title *The Parsonage*), attracted great attention in France and Germany; also his other novels, *La Bibliothèque de mon Oncle*, *Rose et Gertrude*, and *Nouvelles Génevoises*, were much appreciated, as well as his sketches and illustrations, *Voyage en Zigzag* and *Collection des Histoires en Estampes*.

**Tophet.** See Gehenna.

**Top'knot,** a name given in England, or at least in English books, to flat fishes (Pleuronectidæ) of the genera *Zenogopterus* and *Scophthalmus* (or *Phrynorhombus*). These do not agree in special characters, although they resemble each other in physiognomy, the wide (high) oval body, ciliated scales, sinistral and fringed eyes, narrow interorbital ridge, and long-based ventrals. *Zenogopterus punctatus* ("Ploch's topknot") has the ventral fins united with the anal; *Scophthalmus unimaculatus* has them free. Neither of them is very common on the British coasts, or at least in most places. They rarely exceed seven or eight inches in length. Theodore Gill.

**Töp'litz,** or **Teplitz,** town of Bohemia, near its north-western frontier, is beautifully situated in a valley of the Erzgebirge, and is one of the most celebrated watering-places in Europe. It has eleven hot alkalo-saline springs, whose waters are considered very effective in many diseases, and which are generally used by 10,000 persons each season. P. 6854.

**Top, Motion of the.** See Gyroscope, by Gen. J. G. Barnard, A. M., LL.D.

**Topog'raphy** [Gr. τόπος, "place," and γράφειν, to "write"]. Topography and hydrographic topography, as the subject is sometimes divided, come in general terms under the head of surveying, but their object is more limited than the aim of geodesy, being only to determine the relative positions of points of the earth that can be referred without error to a tangent plane, and therefore independent of the sphericity of the globe. The operations of a topographical survey, consequently, are two—namely, to first project a system of points upon such a tangent plane, and, secondly, to find the distances of the same above or below the plane; or, in other words, measure the lengths of the projecting normals. The first process is ordinary surveying—the second, levelling. If the tangent plane be assumed at the centre of the country to be embraced in the survey, it will result that for a surface extent even of one degree the errors will be less than in the ratio of $\frac{3}{100000}$ths, and may be considered inappreciable.

The problems of topography are such as the following: To find the distances of inaccessible points; to prolong right lines; to draw parallels to inaccessible lines; to bisect the angles of inaccessible lines; to find the radii of inaccessible curves; to lay out curves; and, in hydrographic topography, to determine on the map the position of an unknown point from which three known points have been observed, and to establish a base at sea. In the operations of hydrographic topography the surveying is done with a sextant or a compass, and the levelling by the methods of sounding. A topographical survey having been made on water by these means, or on land by aid of transit and level, or more roughly and rapidly by the plane-table and teleometer, the results are embodied in a plat of the work, on which the horizontal and vertical distances are quoted in some manner, either by a scale or written numbers; and finally the plat may be transformed into a topographical map in some of the styles adopted for that kind of finish. The object of topographical drawing is to perfect a map by shading, grading, and delineating the form and features of a surface in such a manner that it presents a picture somewhat similar to a vertical view of the country. Certain of the signs used are purely conventional; others aim to represent the appearances of nature as in a landscape, at least in horizontal projection, and therefore in topographical drawing there is field for taste as well as precision. These maps are finished either with pen and india-ink, or with brush and color. In pen topography the form of every actual outline, as of rivers, coasts at high and low tide, shoals, reefs, roads, farms, and buildings, is inked, as is usual in plats of farm-surveying, and the shading and grading are done, by consent of all draftsmen, as follows: Mountains are graded either by a series of enveloping lines close together, representing horizontal sections, which suffice best to suggest a precise idea of their form, particularly if the quotations of the horizontal lines are given on them, or else by lines of greatest declivity, which are supposed always perpendicular to the horizontal lines, whether these last are drawn or not. The steepest parts of declivities are made darkest; and this rule asserts itself necessarily in case the shading is applied in the first manner, and also to a degree in the last. Rivers, bays, etc., are shaded by lines parallel to the banks or shores, these lines diminishing in thickness and increasing in separation as they recede from the water-line. Forests, marshes, sands, meadows, and other features, whether natural or artificial, are represented by conventional signs, which for a rule are made to resemble what they stand for —sands by dots, meadows by tufts of grass, forests by a plunging view of tree-masses. In colored topography mountains are graded with sepia, darkest at top or on the

greatest declivities; water is shaded with graded tints of indigo, darkest at the shore-line; and the rest approximates closely to an actual sketch of landscape. This last method, being rapid, intelligible, and picturesque, is decidedly the best for elegant topographical maps not intended for engraving or photographing. F. L. VINTON.

**Topol'ya,** town of Austria, Servian waywodeship, has 7516 inhabitants, mostly engaged in wine-cultivation and rearing of cattle and sheep.

**Tops'field,** p.-v. and tp., Essex co., Mass., is the seat of an academy. P. 1213.

**Tops'ham,** p.-v. and tp., Sagadahoc co., Me., on Androscoggin River and on Maine Central R. R., has considerable shipbuilding. P. 1498.

**Topsham,** p.-v. and tp., Orange co., Vt. P. 1418.

**Top-Shell,** a collector's name for species of shells of the family Turbinidæ.

**To'querville,** p.-v., cap. of Kane co., Ut.

**Tor'bay,** a fishing-town of Newfoundland, 7 miles N. of St. John's. The anchorage is poor. P. 1270.

**Torbert** (ALFRED T. A.), b. in Delaware July, 1833; graduated at the U. S. Military Academy July 1, 1855, when appointed brevet second lieutenant of infantry; second lieutenant 5th Infantry July 19; served on frontier duty in Texas and Florida 1856–57, on Utah expedition 1857–60. In the civil war he was engaged, Apr.–Sept., 1861, in mustering New Jersey volunteers into service, and Sept. 16 was appointed colonel of the 1st regiment, which he led in the Virginia Peninsular campaign of 1862 at Yorktown, West Point, Gaines's Mill, and Charles City Cross-roads; assigned to command of a brigade in the 6th corps Aug. 28, 1862, and engaged in the second battle of Bull Run, at South Mountain (wounded), and Antietam. Promoted to be brigadier-general of volunteers Nov. 29, 1862, he was on sick leave until June, 1863, when again in command of brigade in 6th corps, and engaged in the battle of Gettysburg, July 2–3, and subsequent operations of that corps during the winter of 1863–64. In the Richmond campaign of 1864 he commanded the cavalry remaining with Gen. Grant's army during Gen. Sheridan's raid on Richmond, and 1st division on the latter's return May 25, being engaged in the frequent actions from May 15 to Aug., 1864, including battles of Hawes's Shop and Cold Harbor. Chief of cavalry of the middle military division, and engaged in all the operations in the Shenandoah campaign, Aug., 1864–Jan., 1865, and frequently in command. In command of the Army of the Shenandoah Apr.–July, 1865, and of various districts in Virginia till mustered out of the volunteer service, Jan. 15, 1866. Brevet major for gallantry at Gettysburg, lieutenant-colonel for Hawes's Shop, colonel for Winchester, brigadier-general for Cedar Creek, and major-general for gallant and meritorious services during the war. Resigned his commission of captain 5th Infantry Oct. 31, 1866; was consul-general to Havana 1871, and U. S. consul-general at Paris since 1874.

**Torch Lake,** p.-v. and tp., Antrim co., Mich. P. 269.

**Torch'-Wood,** the *Amyris floridana*, a small tree or shrub of South Florida, having shining leaves, clusters of yellowish-white flowers, and a resinous juice. It belongs to the order Burseraceæ.

**Tor'denskjold,** p.-v. and tp., Otter Tail co., Minn. P. 140.

**Tore'ño** (JOSÉ MARIA **Queipo de Llano**), COUNT OF, b. at Oviedo, Spain, Nov. 26, 1786; took an active part in promoting the uprising of Spain against Napoleon, 1808; was sent to England to negotiate for assistance; was a prominent member of the Cortes at the restoration of Ferdinand VII., but, like most of his companions of liberal opinions, was soon driven into exile; was recalled to Spain by the revolution of 1820; again went into exile on the triumph of absolutism 1823; returned to Spain after the death of Ferdinand 1832; became minister of finance under the regency 1834, minister of foreign affairs and president of the council 1835; was again an exile 1836–37, and once more after the revolution of Barcelona. D. at Paris Sept. 16, 1843. Author of the standard work on the Spanish war of independence, *Historia del Levantomiento, Guerra y Revolucion de España* (Madrid, 5 vols., 1835–37).

**Torfæ'us** (the Latin name of THORMODR TORFASON), b. at Engö, Iceland, May 27, 1636; studied at the University of Cöpenhagen; was sent by Frederick III. to Iceland in 1662 to collect manuscripts of the sagas; made royal antiquary in 1667 and royal historiographer in 1687. D. in Karmö, near Stavanger, Norway, in 1719. He was the first to apply the Icelandic literature to the study of Scandinavian antiquities and history, and his writings, of which the most remarkable are *Historia Vinlandiæ antiquæ* (1705), *Groenlandia antiqua* (1706), *Historia Rerum Norvegicarum* (4 vols., 1711), are still of interest.

**Tor'gau,** town of Prussia, province of Saxony, on the Elbe, is strongly fortified, and contains barracks, hospitals, magazines, and other military establishments; also manufactures woollen and linen fabrics and hosiery. P. 10,867.

**Tornadoes.** See STORMS, by PROF. A. GUYOT, PH. D., LL.D.

**Tor'neå,** river of Northern Europe, forming the boundary between Sweden and Russia, rises in Lake Torneå in Sweden, flows southward, and enters the head of the Gulf of Bothnia after a course of 230 miles. It is rapid, and celebrated for its beautiful cataracts and salmon fisheries.

**To'ro,** town of Spain, province of Zamora, on the Duero, is enclosed by walls, has 21 churches and 14 monasteries, and was in the Middle Ages a flourishing and large city; it is now rapidly decaying. P. 8430.

**Török-Sz-Miklos,** town of Hungary, on the Theiss, has valuable fisheries, and rears numerous horses, cattle, sheep, swine, and poultry. P. 10,437.

**Toron'to,** city of the Dominion of Canada, capital of the province of Ontario, is in lat. 43° 39′ N., lon. 79° 21′ W., on the northern shore of Lake Ontario, on a bay formed by an island, 3 miles long, 2 miles wide, at a distance of 333 miles from Montreal, 513 miles from Quebec, 500 miles from New York, and 593 miles from Boston. The bay forms a spacious and well-sheltered harbor, and the Grand Trunk, Great Western, Northern, Toronto Grey and Bruce, and Toronto and Nipissing railway lines connect the city with all the principal points of the provinces of Ontario and Quebec and with the U. S. The site on which the city stands was selected in 1794 by Gov. Simcoe, and the place bore the name of York up to 1834, when it was incorporated as a city. It was the capital of Upper Canada till 1841; the seat of the united government, alternately with Quebec, between 1849 and 1858; and the capital of the province of Ontario since 1867. It had 44,821 inhabitants in 1861; 56,092 in 1871. The city is finely laid out, the streets crossing each other at right angles, generally well built, and containing several fine parks and many handsome public buildings, of which the most remarkable are—the university, completed in 1859; the cathedral of St. James, commenced in 1852, with a spire 316 feet high; the cathedral of St. Michael; the city hall, the opera-house, the post-office, the Osgood Hall, etc. There are 78 churches, numerous schools and educational institutions of various grades, besides the university and University College—a normal school, a college of technology, St. Michael's College; 4 daily, 17 weekly, 4 bi-monthly, 11 monthly, and 1 quarterly paper, etc.; and many benevolent institutions—the asylum for the insane, capable of accommodating 700 patients, the city hospital, 2 houses for unprotected children, an orphan asylum (Protestant), and a house of providence (Roman Catholic), etc. The commerce and manufacturing industry of the city are considerable. Foundries, mills, tanneries, breweries, boot and shoe stores, car-shops, furniture-factories, are in operation. For the year 1871 the value of the manufactures of the city was estimated at $13,686,093. For the year ending June 30, 1874, the value of imports amounted to $14,716,824, and the custom revenues collected to $1,967,997. For the year ending June 30, 1875, the value of imports amounted to $14,436,091, and the custom revenues collected to $1,293,644. The official returns of exports are imperfect, but give a value of about $2,000,000. The city has 5 banks, besides branch offices of 5 Quebec and Montreal banks.

**Toron'to,** p.-v. and tp., Woodson co., Kan. P. 340.

**To'ropetz,** town of Russia, government of Pskow, on the Toropa at its influx into Lake Solomino. It has many educational institutions and some manufactures. P. 5248.

**Torpedin'idæ** [from *Torpedo*, the ancient name of a species], a family of selachians of the order Raiæ, famous for their electrical apparatus, by means of which they are capable of giving quite severe shocks, and species have on this account been also named "cramp-fish," "cramp-ray," "numb-fish," etc. The disk formed by the union of the body and pectoral fins is broad, and more or less inclined to roundish, squarish, or pyriform, and the tail is very fleshy and considerably like that of a shark; the skin is quite smooth and naked; the head is not produced into a snout, but is bluntly rounded, or even emarginated in front; the anterior nasal valves are confluent in a single five-margined (behind) quadrangular lobe; the mouth is small or moderate; the teeth pointed or flat; dorsal fins mostly two (in typical forms), but sometimes only one, and sometimes wanting; caudal well developed, terminal, and more or less triangular; ventrals behind the disk, and free from or united with the disk. The most noteworthy additional character is the electrical apparatus, which is situ-

ated between the head (eyes and spiracles) and the inner concealed bases of the pectorals; this is composed of numerous approximated hexagonal columns, at right angles to the surfaces of the body, and with their ends often visible through the skin above and below, occupying as the apparatus does the entire depth between the upper and under surfaces of the body; these batteries are provided with nerves from the "eighth pair." The shock transmitted from the fish is co-ordinated with a depression of the convexity of the upper surface, and immediately after it has been given the normal form is resumed: the shock is quite subject to the volition of the animal. It is used probably for offensive as well as defensive purposes. In ancient days the animal was impressed into use for medicinal purposes, and was the original electro-therapeutic medium. Its application as a remedial agent has been mentioned in connection with Dioscorides, a physician of Antony and Cleopatra. Representatives of the family are quite generally distributed throughout the warm and temperate seas of the globe. About twenty species are known, which indicate several quite essential modifications of structure. These are (1) Torpedininæ, with the genus *Torpedo* (10 species); (2) Narcininæ, with the genera *Discopyge* (1 species), *Narcine* (5 species), *Astrape* (2 species), and *Temera* (1 species); and (3) Hypninæ, with the genus *Hypnos* (1 species). The genus *Torpedo* is the only one represented by species in the northern Atlantic, and of this three are in the European seas, and one (*Torpedo occidentalis*) along the eastern coast of the U. S.; the other genera are chiefly represented in the Pacific and confluent oceans and the South Atlantic. The literature relating to the family, and especially the anatomy and physiology of the electrical organs, is very voluminous. Among the most notable are memoirs by C. Matteucci (1836–65), R. Wagner (1847), A. Ecker (1848), Marey (*Détermination de la Durée de la Décharge électrique chez de Torpille*, in *Comptes Rendus*, 1871, and *Mémoire sur la Torpille*, in *Journ. Anat. et Phys.*, 1872, pp. 468–499), and M. Reichenheim (*Beiträge zur Kenntniss des electrischen Centralorgans von Torpedo*, in *Arch. Anat. Phys.*, 1873, pp. 751–759, pls. 15–16). THEODORE GILL.

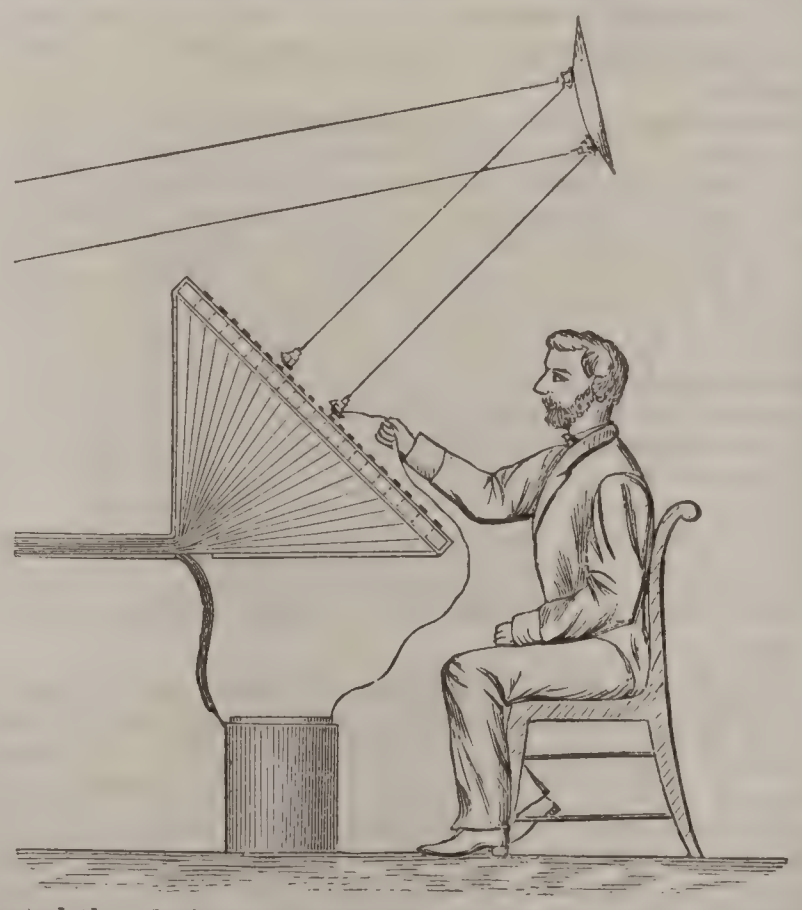
**Torpedo.** See TORPEDINIDÆ.

**Torpe'do** [Lat.], the modern name given by Robert Fulton to a submerged military mine designed to destroy hostile shipping. The germ of the idea is found in the Greek fire of the ancients, from which the torpedo of to-day has been naturally developed by reason of the introduction of gunpowder into warfare.

*Historical Notes.*—The earliest "infernal machine" on record dates from the siege of Antwerp in 1585, where an Italian engineer, Zambelli, destroyed an important bridge laid by the enemy over the Scheldt by setting adrift against it four scows, each carrying a masonry mine heavily charged with gunpowder. Ignition was to be effected either by a slow match, or by a gun-lock discharged by clockwork after the lapse of a certain time. One of these floating mines exploded against the bridge with tremendous effect, and thus stimulated investigation in a new field of warfare. Other similar attempts were made during the next two centuries by the French, English, and Russians, but, like the fiasco before Fort Fisher in our late war, they usually proved to be failures. The condition now regarded as essential in attacks directed against shipping, that the charge shall be submerged, was totally ignored. To an American engineer officer of the Revolution, Capt. David Bushnell, the credit is due not only of experimentally developing this principle, but also of devising a submarine boat, by which the first attempt to apply it to the destruction of an enemy was ever made. Capt. Bushnell was born at Saybrook, Conn., in 1742, and died in 1826. He was a graduate of Yale College (1775), and by his fertility of invention and persevering efforts to perfect the new weapon he has justly won the right to be considered the originator of submarine mining as practised at the present day. His first practical trial was made in 1776, use being made of his submarine boat, navigated by Sergeant Ezra Lee. The attack was directed against the Eagle, the flag-ship of Lord Howe, lying in New York harbor, and the vessel narrowly escaped destruction. In 1777, Bushnell caused the blowing up of a prize schooner, lying at anchor astern of the frigate Cerberus off New London, by means of a drifting torpedo which he had directed against the latter, and which was ignorantly taken on board the schooner. In the following winter he set adrift many torpedoes to annoy the British fleet in the Delaware, thus giving occasion to the so-called "Battle of the Kegs," which was commemorated in a humorous song by Hopkinson, the author of "Hail Columbia." Twenty years later, Robert Fulton revived the general ideas of Bushnell, and attempted to introduce submarine warfare in the French navy. He made a submarine boat named the Nautilus, by which in Aug., 1801, he blew up a launch in the harbor of Brest—the first instance on record of a vessel destroyed by a submerged charge of gunpowder. Rejected by France, he next induced England to organize an abortive "catamaran" expedition against the French fleet lying at Boulogne. Although supported by Pitt, and successful in experimentally destroying the brig Dorothea by a drifting torpedo, his projects were finally rejected by the British government as unsuited to the interests of a nation that enjoyed the sovereignty of the sea. Fulton returned disappointed to America, where, after some successful experiments, he finally met a like repulse, largely through the active opposition of Commodore Rogers of the navy. He ultimately abandoned his efforts in submarine mining, as his attention became absorbed in steam navigation. Although Fulton began his experiments by employing a submarine boat, experience led him to abandon this device. As finally rejected by our government, his system included four classes of torpedoes: (1) Buoyant mines, anchored in the channel to be defended, and exploded by a mechanical device set in action by contact with the enemy's hull. (2) Line torpedoes, designed to be set adrift and fouled by the cables of the hostile fleet at anchor. (3) Harpoon torpedoes, to be discharged from a gun, and thus attached to a vessel and fired by clockwork. (4) Block ship torpedoes, to be carried on booms projecting from vessels of a peculiar type, and exploded by contact with the enemy. The modern system includes all these devices in a modified form, except the third—a fact which sufficiently shows how far Fulton was in advance of his age in appreciating the capabilities of submarine warfare. In the war of 1812 several abortive attempts were made by individuals to employ Fulton's system against British shipping in our waters, but the government took little interest in the operations, and no success was achieved, although considerable alarm was excited in the fleet of the enemy.

During the next thirty years torpedo warfare was neither forgotten nor neglected in Europe, as many writings abundantly prove, but it was again left to an American, Col. Samuel Colt of Hartford, best known as the inventor of the revolving pistol which bears his name, to make the next great advance. It consisted in introducing, as the igniting agent, electricity, at that date considered rather as a toy of the philosopher's laboratory than as a practical force in engineering. Colt began his torpedo experiments in 1829 or 1830, and after years of labor elaborated a system of buoyant submarine mines, to be planted quincuncially in the threatened channel and operated by electricity. To convey the current he devised one of the very first submarine cables ever attempted, which in the winter of 1842–43 he successfully laid across East River, New York harbor. Gutta-percha was then unknown as an insulating material, and Colt employed a wrapping of cotton yarn soaked in asphaltum and beeswax, and in exposed localities enclosed in a leaden tube. When designed for torpedo purposes, each cable included two separate conductors, which, entering the mine, were united by a fine platinum wire imbedded in gunpowder. The operator, by sending at pleasure a strong current of voltaic electricity through this bridge,

FIG. 1.



heated the platinum to redness and determined the explosion. For convenience of manipulation the shore-ends of

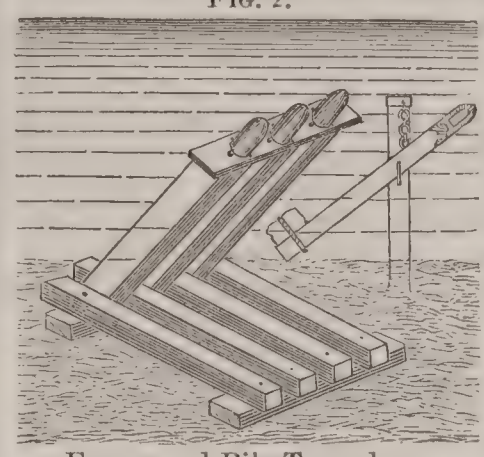
the cables were all led to a casemate. The preceding sketch, found among Colt's papers after his death, and bearing the date 1836, shows one of his devices for igniting the mines at the proper instant; it is of course only applicable to an elevated site. A secret believed to relate to a method of making the vessel telegraph her own position died with him. This sketch explains itself. One set of conductors from all the cables are united and permanently attached to a single pole of a powerful battery. The other conductors lead to a map of the channel, and each is secured at the point corresponding to the known position of its mine. The reflector is arranged to throw the image of the hostile ship upon the map, and as it passes over a wire terminal the operator with his other battery-wire closes the proper circuit and explodes the torpedo. Colt's experiments extended over a period of about fourteen years, the latter part of the time under the auspices and at the expense of the government. He destroyed several vessels at anchor, and finally, on Apr. 13, 1843, accomplished the feat of blowing up a brig under full sail on the Potomac, operating his battery at Alexandria, 5 miles distant. This decisive trial was witnessed by many members of Congress and by the President, and its success at that date stamps Col. Colt as a man of extraordinary ability. The time, however, was not yet ripe for the introduction of the new weapon, and, like those of his predecessors, Col. Colt's plans were ultimately rejected by the government.

The Anglo-French war with Russia in 1855 furnished the next occasion for the application of submarine mines to harbor defence. Sebastopol, Cronstadt, and Sweaborg were protected in this manner by devices of Prof. Jacobi. Unfortunately for the success of his system, the charges were too small (8 or 9 pounds), and although explosions occurred under two or three English frigates, no serious damage was done. The fuze consisted of a small bottle of sulphuric acid imbedded in a mixture of potassium chlorate and sugar; the mechanical breaking of the bottle by contact with the vessel effected ignition. The great improvement of placing the igniting apparatus within the torpedo, independent of external levers, is due to Prof. Jacobi, who also made use of electrical mines to be fired by an operator on shore. The Italian war of 1859 gave occasion for Col. von Ebner of the Austrian engineers to employ in the defence of Venice a system of electrical mines more carefully elaborated than any which had preceded it, but no opportunity for practically testing its merits occurred.

In fine, it was reserved for American engineers to demonstrate upon a grand scale the important part which the modern torpedo can be made to play in maritime warfare. The civil war of 1861–65 offered conditions peculiarly favorable to its development. The Southern Confederacy was possessed of no fleet worthy of the name, while a long line of seacoast and many navigable rivers exposed its territory to easy assault by water. It could, therefore, well afford to sacrifice most of those routes of communication, provided they could be closed to the war-vessels of the Union. Every variety of torpedo became, therefore, admissible. After some preliminary trials, the service was formally legalized in Oct., 1862, and an efficient bureau was established at Richmond, which continually extended the scope of its operations until the end of the war. Seven U. S. iron-clads, eleven wooden war-vessels, and six army-transports were destroyed by torpedoes, and many more vessels were more or less injured. The Confederates lost three vessels by their own mines, and a fine iron-clad, the Albemarle, by the counter-operations of the U. S. fleet. This wholesale destruction occurred chiefly during the last two years of the war; and if at its beginning the system had been as well organized as at its close, the influence which might have been exerted upon the naval operations of the Union forces can hardly be estimated. The details of the Confederate system were published to the world soon after the end of the war, and they have formed the common basis upon which different nations have begun the investigations now actively prosecuting for perfecting appliances in submarine warfare. For this reason they will be considered somewhat in detail. The several devices may be grouped in five distinct classes—stationary torpedoes or submarine mines, automatic drifting torpedoes, infernal machines, offensive spar torpedoes, and submarine boats.

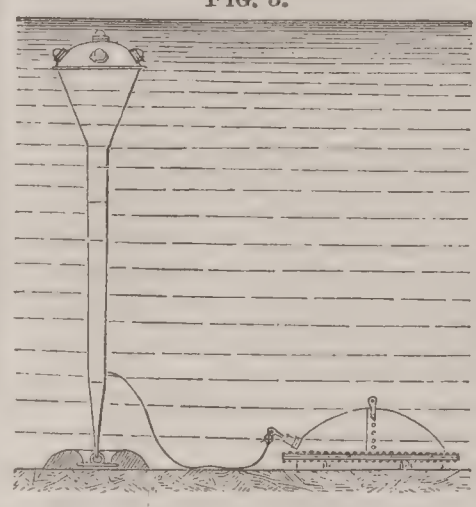
*Stationary Torpedoes, often called Sea-Mines.*—To form an obstruction in the channel which shall stop the enemy, either by his actual destruction or by his fear of it, is the object of this class. Several types were used. The frame torpedo was one of the most simple. Each shell weighed about 400 pounds, and contained 25 pounds of gunpowder. The fuze, consisting of a vial of sulphuric acid imbedded in potassium chlorate and sugar, was placed in the loading-hole, protected by a thin lead cap to be crushed by the vessel. The pile torpedo, a similar pattern of mine, also shown on the figure, was found in the water-approaches to Savannah. The swaying boom torpedo was a marked improvement upon this device, since, being free to move, it was not so easily discovered by dragging. To render it still more effective, it was often attached by a line to a "turtle" containing a fuze made upon the principle of an ordinary cannon-primer. The attempt to grapple and raise the boom torpedo exploded this auxiliary, which was planted in front, so as to be well under the bottom of the enemy. The charge of the boom torpedo was about 70 pounds, and of the turtle 100 pounds; the whole device was called the "devil-catcher." Another approved pattern was known as the Singer or Fretwell torpedo, invented by Singer and introduced by Fretwell. The principle of its action was similar to that of the "turtle," the charge (50 to 100 pounds) being fired by a percussion-cap acted upon by an external plunger released when the inverted saucer-cap was thrown off by the touch of the enemy. The weakening of the spring under continued tension, and the growth of seaweed and shellfish, were found to destroy efficiency after the torpedo had remained a few weeks in position. To obviate this difficulty—which is inherent to all mechanism acting externally—Gen. Rains, when in charge of the laboratory at Augusta, Ga., devised a fuze priming said to consist of fulminating mercury and fulminating silver, which was exceedingly sensitive, a slight blow being sufficient to cause detonation. Fuzes containing it, protected against moisture by a lead cap easily crushed by contact, were used in his barrel torpedoes. These torpedoes contained from 70 to 120 pounds of gunpowder, conical ends of light wood being added to increase flotation and to strengthen the case. The Rains fuze served its purpose well, and was used in land-mines, in hand-grenades, and in several types of torpedoes.

Fig. 2.



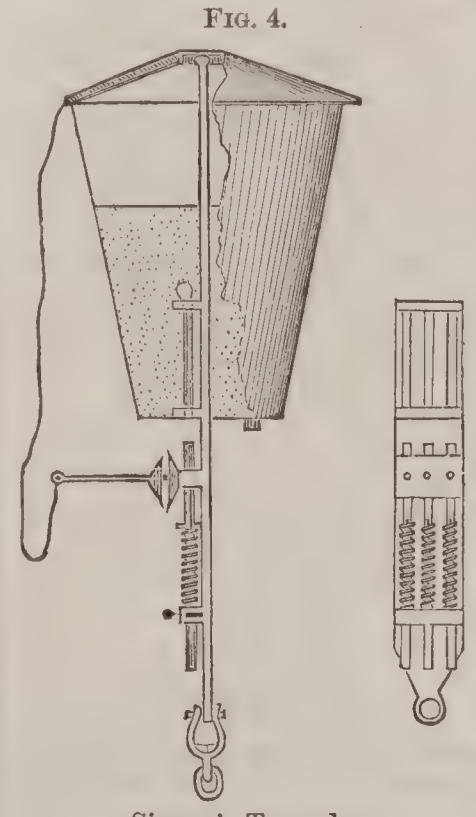
Frame and Pile Torpedoes.

Fig. 3.



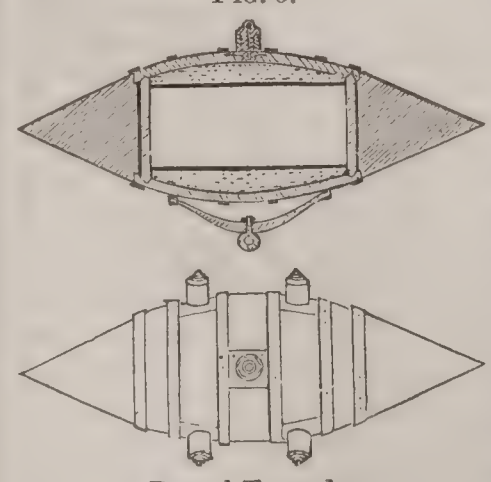
Swaying boom and turtle Torpedoes.

Fig. 4.



Singer's Torpedo.

Fig. 5.



Barrel Torpedo.

Lastly, electrical mines, to be fired by the act of an operator on shore, were employed; but the difficulty of procuring the requisite insulated cable restricted their use, and it is worthy of note that no attempt was made to make them automatic. The charges employed were usually enormous, amounting to 2000 pounds of gunpowder. The Commodore Jones was destroyed on May 6, 1864, by a torpedo of this type. It was planted in a narrow part of the channel of James River, in about 35 feet of water, and was operated from a pit on the river-bank containing a small Bunsen battery. The Commodore Jones was allowed to advance safely over the mine, which was reserved for

the flag-ship, but the operator hearing the order given to return preparatory to a more thorough search for torpedoes, the vessel was blown up as she backed down stream. She appeared to be lifted bodily by the explosion, and was utterly destroyed, more than three-quarters of her crew being killed or wounded.

*Automatic Drifting Torpedoes.*—This class was especially designed for rivers where the current, setting in one direction, could be depended upon to sweep the apparatus down to the hostile fleet, and perchance to bring it into contact with some vessel. Night was often selected for the attempt, but the ease with which a ship at anchor may be protected by nettings rendered the several devices of little avail. The simple form shown in the figure was used in great numbers on James River. A piece of slow-match was arranged to burn down the tube to the charge. These torpedoes were often caught by nets, but did no damage. A more complex arrangement is shown in Figure 7. This torpedo was often set adrift, connected to a log by a knotted line, which, fouling the anchor-chain, would bring the former to rest under the bottom, when the current acting on the wheel would release the plunger and determine an explosion.

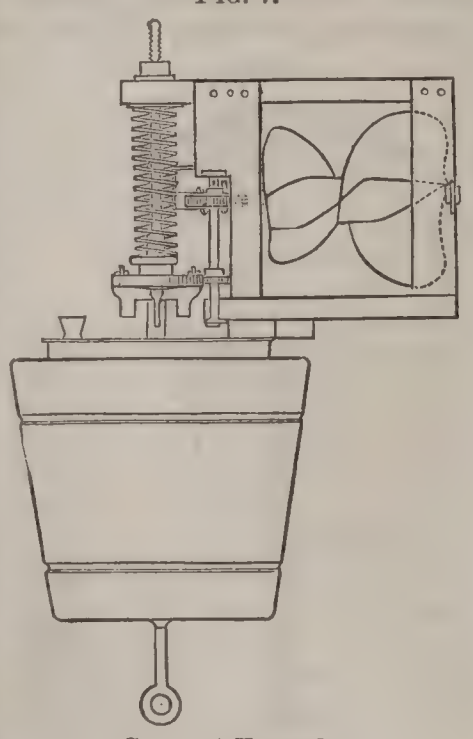
FIG. 6.



Drifting Torpedo.

*Infernal Machines.*—This class of torpedoes is not generally considered to come within the limits of legitimate warfare as practised at the present day, because it subjects non-combatants to great peril without any previous warning. It was designed to be smuggled on board the Union war-vessels or transports, and thus to effect their destruction. Two types were employed. The most simple was known as the "coal torpedo." It consisted of a metal case containing several pounds of gunpowder, cast and colored to closely resemble a lump of coal. When ignorantly thrown into the furnace, it caused the explosion of the boiler. The Greyhound was destroyed in this manner on James River, as were also several transports on the Western waters. The other type was known as the "horological torpedo." It consisted of a case containing a large charge of gunpowder and a clockwork arrangement set to run for a certain time, at the expiration of which it released a plunger and fired the charge. A disastrous explosion was caused in the army powder-fleet at City Point in 1864 by an arrangement of this character, which was placed on board one of the barges by a spy. At Mound City a similar explosion was effected.

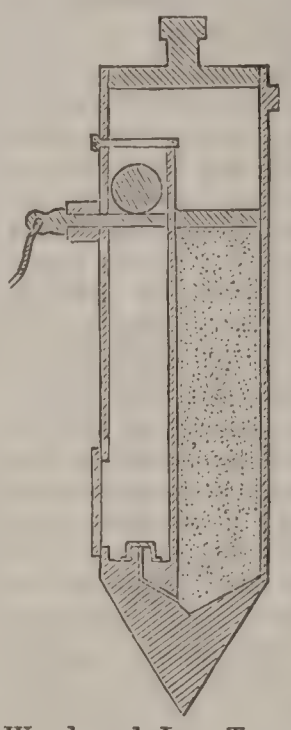
FIG. 7.



Current Torpedo.

*Offensive Spar Torpedoes.*—This form of the new weapon afforded the best opportunity for the display of personal gallantry, and several officers won distinction in its use. An outrigger spar, from 20 to 30 feet in length, carried a torpedo designed to be brought in contact with the enemy's hull and exploded in a hand-to-hand conflict. The Confederates early supplied ram torpedoes to their iron-clad fleet, but a lighter pattern was chiefly used, operated from a special craft termed "Davids," by reason of their small size and insignificant appearance as compared with their adversaries. The type used at Charleston was built of boiler iron, and was about 35 feet long, shaped like a cigar, with a low combing to exclude the waves. Small engines driving screw-propellers gave a maximum speed of about 7 knots per hour. The torpedo was of copper, charged with about 50 pounds of fine gunpowder. Under cover of the night these boats approached the hostile fleet, trusting to suddenly dart alongside and discharge the torpedo with impunity in the confusion and alarm created by their sudden appearance. Another type of this class of boats consisted of an ordinary steam-launch equipped in a similar manner. Several of the Union war-vessels—the New Ironsides on Oct. 5, 1863, the Memphis on Mar. 6, 1864, the Minnesota on Apr. 8, 1864, and the Wabash on Apr. 18, 1864—narrowly escaped destruction, and the Confederate iron-clad Albemarle was sunk at her moorings by this mode of attack. The latter feat was performed by Lieut. Cushing, U. S. N., and for its exceptional gallantry it deserves a special description. The boat was an ordinary steam-launch equipped with a Wood and Lay torpedo and a brass howitzer. This torpedo was provided with an air-chamber, and at the proper moment was to be detached from its boom and allowed to rise under the enemy. A strong pull upon the lanyard then released the ball, which, falling on the percussion-cap, ignited the charge. Lieut. Cushing with a crew of thirteen officers and men advanced 8 miles up Roanoke River, passing the Confederate pickets undiscovered. On approaching the Albemarle, moored to the wharf and protected by a pen of logs about 30 feet from her side, he suddenly darted upon her, and under a heavy fire exploded his torpedo against her bottom, thus sinking her. Most of his party were captured, and some were drowned; Lieut. Cushing himself and one man escaped by swimming and threading the swamps to the Union lines.

FIG. 9.

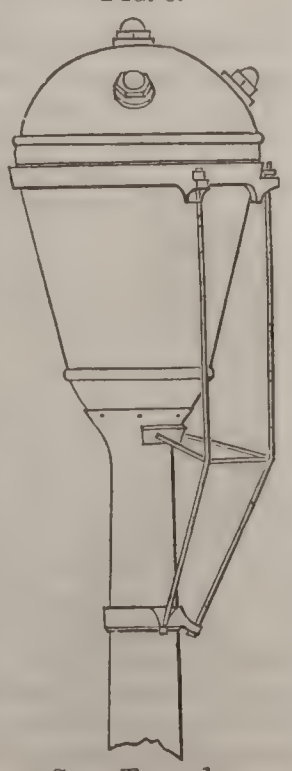


Wood and Lay Torpedo.

*Submarine Boats.*—But one boat of this character won a record during the war, and hers was sufficiently tragic to deter imitation. She was of boiler iron, 35 feet long, was propelled by hand at a maximum speed of 4 knots, and could remain submerged to any desired depth for half an hour. Her crew consisted of nine men. In the preliminary trials (see SUBMARINE NAVIGATION) she sank three times, drowning 23 men. Finally, under Lieut. Dixon, C. S. N., she sailed out of the harbor, attacked and sunk the Federal steam-sloop Housatonic, and disappeared for ever with her crew. She was designed to pass under the enemy, dragging a floating torpedo, which would explode when brought in contact with his hull, but on this occasion she was used like an ordinary David.

The Schleswig-Holstein war of 1864, although short, afforded an opportunity for employing defensive mines, and one of the invading vessels was sunk through their agency. The Paraguayan war of 1864–68 furnished the next occasion for submarine warfare. Immediately after the Brazilian fleet entered the waters of that little state, a fine iron-clad, the Rio Janeiro, was sunk by two torpedoes against which she had struck. Subsequently, a division of the fleet ran past the batteries of Curupaity, only to find itself entrapped between two lines of torpedoes, one in front and the other planted in rear, after the passage, to bar the retreat; the defective nature of these obstructions alone prevented a serious disaster. Later in the war the Tamandaré was crippled by a submarine mine. The Paraguayan torpedoes belonged to the anchored or drifting class, and the sulphuric-acid fuze was largely used. During the Franco-German war of 1870–71 no conspicuous use was made of torpedoes, but the German ports were protected by them, and the French contributed a new device to the list. It is known by the name of the "ball of Verdun," devised by Capt. Bussière of the engineers to destroy a military trestle-bridge thrown by the Prussians over the Meuse a short distance below the fortress. It consisted of a large sheet-iron sphere, over 3 feet in diameter, heavily charged with gunpowder, and provided with a clockwork train, which after a certain time was to discharge a pistol and thus ignite the mine. It was but little heavier than water, and was carefully adjusted so as to make the centre of figure and of gravity coincident. A body fulfilling these conditions will be rolled along the deepest part of the channel by the current, and will, of course, be far more difficult of detection than a floating object. The capitulation of the fortress prevented a trial of its efficiency, but many letters were introduced into Paris during the siege by similar balls caught by nets spread for the purpose.

FIG. 8.



Spar Torpedo.

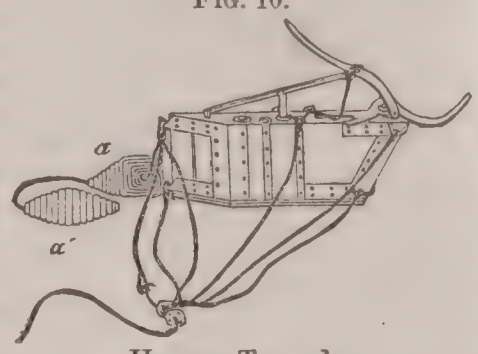
*Torpedo Warfare in the Future.*—It is apparent, from

the foregoing historical résumé, that torpedoes are no longer to be regarded as experimental devices, but that they have become recognized weapons of maritime warfare, admitting of very varied applications. They may be employed offensively in the combats between hostile vessels, or they may be used defensively to repel an apprehended attack upon a harbor or district by preventing the passage of the enemy's squadron through the channel of approach. Entirely different principles of construction and of manipulation mark these two classes of the weapon. The former requires the technical skill of a sailor to move the charge into position and explode it within destructive range. The latter differs in no essential respect from the mines so long employed in the defence of land fortifications. Accordingly, in the U. S., England, and some other countries possessing an extended seacoast, the service of torpedoes has been divided between the navy and the engineers of the army—the former operating offensively afloat, and the latter defensively from the shore. Our naval station is at Newport, R. I., where the needful investigations are conducted, and where classes of officers now receive regular instruction in the use of the new weapons. The army school is at Willett's Point, New York harbor, where the subject is experimentally studied, and where the officers and the enlisted men of the engineers are exercised in all the duties of defensive submarine mining. While, in general, the line of demarcation between the two services is thus plainly marked, some of the weapons—such, for example, as fish torpedoes steered by electricity—may be conveniently operated either from land or from shipboard, and they would be used in war either by army or navy as occasion might offer.

All maritime nations are now carefully investigating the subject of submarine warfare, but the greatest secrecy is thrown around these studies. Enough, however, has transpired to enable the following imperfect résumé of the principal results to be given:

*Offensive Torpedoes.*—In offensive torpedo warfare many improvements, not yet tested in actual battle, have been suggested, and are now under trial by naval officers. The Harvey torpedo belongs to this type. The charge is contained in a narrow copper vessel, encased in wood strapped with iron, and so ballasted as to ride vertically in the water. A tow-line of wire rope passes from the slings of the torpedo through a block on the yard of a fast steamer to a reel fitted with a brake on her deck. The enemy is passed at full speed, with the torpedo diverging at an angle of about 45° from the quarter, and the course is so directed as to bring the weapon in contact with his hull. Just before striking him the torpedo is made to dive by suddenly slacking the tow-line, and then to rise under his bottom by checking it with the brake. Explosion is effected through the agency of the projecting levers, which when struck either detonate a contact fuze or close an electric circuit, and thus cause the passage of a powerful current through a platinum fuze. These torpedoes are made of various sizes, one of the largest patterns being 4.5 feet long, 2 feet deep, and 6 inches wide, designed to contain 100 pounds of gun-cotton or dynamite. The requisite flotation is given by the cork buoys $a\ a'$, as when at rest the torpedo sinks by its own weight. This weapon was devised by a skilful sailor, Capt. Harvey of the Royal navy, and he claims that it can be successfully used on the high seas even during a gale. Official trials in 1870 at Portsmouth, England, caused it to be adopted in the English service. The torpedo was operated from a steam-tug against the iron-clad Royal Sovereign. At first the latter remained at anchor, and thus received ten attacks from different directions. In every case the torpedo struck her at depths varying from 1 to 16 feet. The iron-clad fired blank cartridges, and succeeded in discharging seven and four shots in two of the trials, and only two shots in the others. The Royal Sovereign then got under way at a speed of 8 or 9 knots, the tug moving at about 11 knots. Six attacks were thus made, all of which were successful, although every effort was made to avoid the blows. From two to twelve shots were fired at the tug in each attack while manœuvring to effect her object. The Harvey torpedo is now definitely adopted by several nations of Europe, and is highly commended by many naval officers.

FIG. 10.




Harvey Torpedo.

Another new type of offensive torpedo is that known as the Luppis Whitehead. The idea developed by this weapon is due to an officer of the Austrian marine artillery, now dead, but the first practical trials were made in 1864 by Robert Whitehead, superintendent of ironworks at Fiume, acting upon the suggestions of Capt. Luppis, an officer of the Austrian navy. The torpedo has undergone great improvements between that date and the present time, and the right to use it has been purchased by many European nations. The latest type consists of an iron and steel vessel, nearly in the shape of a spindle of revolution, 16 feet 3 inches long and 1 foot 5 inches in greatest diameter. Its weight, including the charge, is 750 pounds. It is driven by a propeller moved by compressed air, and it is claimed to be capable of maintaining a speed under water of 15 knots for a distance of 1300 feet, or 12 knots for 3500 feet. It can be projected from a launching-tube or started by hand, and is capable of regulating and preserving its depth and direction, within narrow limits, in still water; but cross-currents or seaweed may introduce large variations. It can be set to explode on contact or after a definite time, and either to sink or rise to the surface after finishing its course. Great secrecy is preserved as to details of mechanism.

Submarine rockets, carrying explosive charges and started from submarine guns, have received and are now receiving attention, both in this country and in Europe. Such a weapon, if its course can be successfully controlled, will be especially dangerous in the combats of iron-clad vessels at short range, since the blow, being delivered under the armor, cannot fail to achieve decisive results.

Submarine boats now appear to be passing out of favor with all nations, partly because their history in former wars has been nearly uniformly tragic, and partly because the necessity for their use has been done away with by the invention of the fish torpedo steered and controlled by electricity. This idea was first patented by Lieut.-Col. Ballard, Royal Engineers, in Aug., 1870, and again by Lieut.-Col. Foster, U. S. Engineers, in 1872. It has been independently elaborated by Mr. Lay and Mr. H. J. Smith in this country, and by Col. von Schelïha in Russia. A device of the kind is also patented by Mr. Adamson, assistant engineer U. S. navy. The general claim to priority in the invention has been the subject of litigation in this country; but the decision of the commissioner of patents (June 13, 1873) has awarded it to Mr. Lay, whose boat has also been brought most conspicuously before the public. This type of torpedo consists essentially of a boat of the Luppis Whitehead class, which carries and unreels a coil of insulated wire through which the electric current from a battery on shore or on shipboard can be passed at will to certain electro-magnets. By closing and breaking the circuit, and reversing the direction of the current, valves connected with the motive-power are controlled, and thus the rudder may be put to starboard or port, and the engine may be started or stopped. In this manner the motion of the fish is under perfect control from the instant of starting. The motive-power may consist of liquefied carbonic acid, or ammonia, or compressed air, or steam peculiarly applied. The boat may be made to move at the surface or below it. Her position is known to the operator from two small flags carried near the water-level, which at night are replaced by two lanterns shaded in front so as not to be seen by the enemy. A speed of about 8 knots and a range of a couple of miles have been obtained. Any of the modern explosives may be employed, and detonation results from the action of a mechanical fuze or of a circuit-closer and battery. A modification of this torpedo is proposed by Capt. Ericsson, who supplies his motive-power to the engine by a flexible tube drawn after the boat. This motive-power is compressed air generated by an engine near the operator; and by regulating the supply the boat is steered without the aid of electricity.

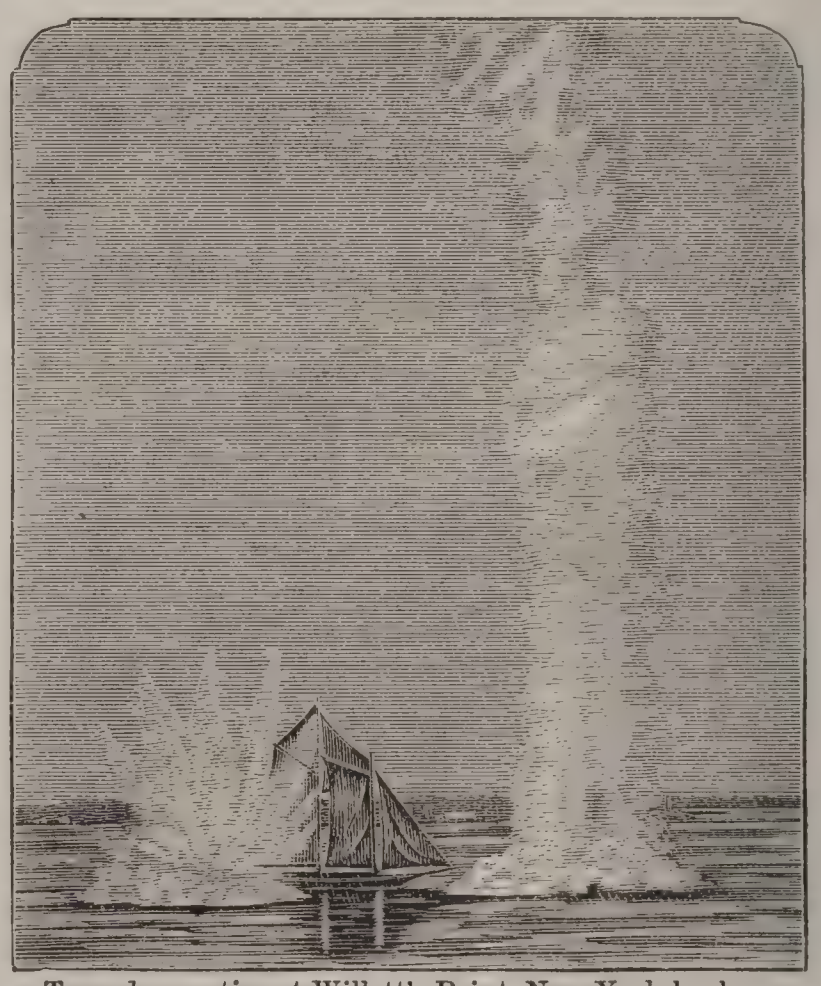
But it is not exclusively to new inventions that attention is now directed. The offensive spar torpedo, as already stated, has made a brilliant record in actual battle, and continues to be favorably regarded both in our own and foreign navies. It furnishes better opportunities for dashing exploits than any other type of the weapon, and thus naturally commends itself to gallant seamen eager for distinction. Speed and the cover of night or fog are conditions highly favorable to success. The circumstances characterizing a contest with this weapon are dramatic in a high degree; for size, heavy armament, massive iron plating, and the close vicinity of friendly ships are of little avail in repelling the dash of the tiny antagonist, which suddenly appears out of the darkness, spreading confusion on every side. Hurried slipping of cables and getting under way, accompanied by random, desperate firing, last for an instant, and then the blow is received, or the assailant is again lost to view in the surrounding gloom. It is the fight of the sword-fish and the whale introduced into modern warfare. The tendency at present seems to be toward a more general use of this type of torpedo; for while during

the late war it was chiefly operated from steam-launches or similar craft, the larger vessels of our navy are now provided with it. In Europe vessels are specially constructed for the purpose, the essential conditions being high speed, noiseless machinery, and invulnerability to small projectiles. A launch recently made in England for the Austro-Hungarian government developed a speed of 18 knots, with noiseless machinery. She was 67 feet long and 8 feet 6 inches beam, and carried two spars 38 feet long, so arranged as to deliver the attack directly ahead. A special torpedo-vessel, the Alarm, has recently been constructed under the direction of Admiral Porter for our own service. She is 166 feet long on the water-line, with a height of side of 10 feet forward and 8 feet aft. She is plated with iron, and carries a formidable ram and a 15-inch gun, trained to fire forward in the direction of her keel. Four Gatling guns are mounted to repel boat-attacks, and she can employ four spar torpedoes on iron booms shoved out through ports below the water-surface, on her bow and broadsides, to a distance of fifty feet. She is provided with a Fowler wheel, which both propels and steers the ship, giving great power of rapid manœuvring. All her movements are controlled by one man in the pilot-house, and electricity is skilfully used for conveying orders and exploding the torpedoes.

*Defensive Torpedoes.*—To understand the full importance of the submarine mine in defending our great seaports against hostile fleets, it is necessary to consider the changes in ships of war which immediately preceded its introduction. Before the invention of the screw-propeller, vessels in attacking forts were at the mercy of winds and currents; and long experience proved that one gun ashore was more effective than many afloat. Moreover, since stone walls were more resisting to shot and shell than bulwarks of oak, the rule introduced into land defence soon after the invention of gunpowder, that no masonry must be exposed to a direct fire of artillery, could be ignored in water-batteries, thus rendering it easy to mass the guns and provide a heavy fire against hostile shipping, even where the site was restricted. The screw-propeller, followed shortly after by armor-plating and big guns afloat, effected a radical change in the conditions of the problem. The fleet was now free to steam rapidly past the batteries under favorable conditions not before practicable. The new class of guns required to assail the armor-plating with a reasonable chance of success was far more bulky and difficult to manœuvre than the former armament of the forts; moreover, it was discovered that earthen parapets and substantial traverses must take the place of the compact masonry casemates heretofore in use. The defence thus found itself at great disadvantage. The hostile ships of war, more under control, less vulnerable, and possessed of much higher speed, were to be encountered by guns more unwieldy, and, in most of our harbors, much fewer in number from the naturally contracted sites available for the earthen batteries. The attention of military engineers was thus urgently directed to the devising of some obstruction which by holding the enemy under fire, and depriving him of the comparative immunity resulting from a high rate of speed, should restore to the defence its lost superiority. The modern submarine mine has accomplished this vitally-important object. Evidently, if through its influence the guns can be fired 100 times at a slowly-moving ship, instead of once at a rapidly-passing enemy, the effective power of the battery is multiplied more than 100 times. Independently, therefore, of its own destructive power, the defensive torpedo has become an essential auxiliary of the land gun. Indeed, they are inseparable in a judicious system of harbor defence, for, while the former is necessary to developing the full power of the latter, the latter is no less essential in protecting the former against the operations of the enemy; for it is an admitted principle that electrical submarine mines cannot defend themselves without the aid of flanking guns to keep off boats, and of a fort secure against assault wherein to place the necessary batteries and operating apparatus. The trifling expense and superior power of this combination as compared with monitors for harbor defence has effectually disposed of the latter, which at one time were popularly believed to be our only dependence in the future for protecting our great seaboard cities against the dangers of a bombardment. They are now reduced to the grade of a useful auxiliary reserve force, which should not be neglected in a few of our large harbors. The navy is thus released from an irksome confinement to a defensive warfare in our ports, and is free to strike effective blows where the enemy may be most vulnerable to attack, and where he will fear something more than a simple repulse as the result of an unfortunate naval action.

Some of the more important of the recent improvements in submarine mining are the following: The modern explosives (see EXPLOSIVES) have largely superseded gunpowder, because greater power with less bulk may thus be secured. The latter is an important matter, since upon the size of the torpedo depends the depressing effect of the current, and hence the amount of buoyancy necessary to keep the case always high enough to be touched by the enemy in passing. This buoyancy, of course, regulates the weight of the anchors and the size of the mooring connections, and, in fact, the principal dimensions of the system. The increase in intensity of explosive action is also important, for efforts are now making to give increased strength to the hulls of war-vessels by employing iron in the form known as the double-cellular bottom, thus reducing the destructive range of the torpedo, and exacting the employment of more powerful charges. In England experiments upon the Oberon, a vessel of this type, have shown that the horizontal destructive range of gun-cotton in charges even as large as 500 pounds is restricted to a few feet. This charge was fired on the bottom in 48 feet of water at horizontal distances from the ship of 100, 80, 60, 50, and 30 feet, and finally vertically under her side. Although she was much shaken and injured by some of these shots, only the last burst through the double bottom and sunk the vessel. At our own engineer school of defensive submarine mining at Willett's Point, N. Y., a long series of trials has been conducted to determine the effective range of different charges of different explosives sunk at different depths below the surface; and by the careful measurements of several hundred explosions the matter has been successfully brought within the scope of mathematical analysis. The formulæ and results are not yet made public, but they confirm the fact of restricted destructive range. The subject is full of interest in a scientific point of view. To illustrate one striking feature developed—viz. the effect upon the jet

FIG. 11.



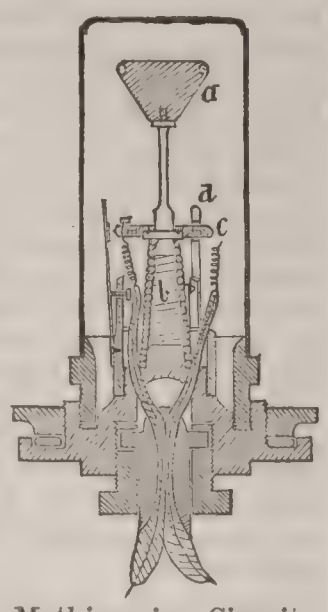
Torpedo practice at Willett's Point, New York harbor.

caused by varying the depth of submergence—the figure is given. The original picture was made by the instantaneous photographic process by Lieut. (now Capt.) Mercur, corps of engineers, and advantage was taken of the passing of an unsuspecting schooner to obtain a convenient scale of comparison. Both charges consisted of 100 pounds of mortar powder, the one on the apparent right sunk 4 feet, and the other 10 feet, below the surface. The height of the columnar jet exceeded 400 feet by accurate measurement.

Electricity is now chiefly used as the igniting agent in submarine warfare, because this enables the obstructed channels to be safely traversed by friendly vessels. The mines are usually arranged to be fired at will, or automatically by the touch of the vessel. The best systems are designed to work either on an open or closed circuit at pleasure, because this largely increases the danger of tampering with the torpedoes. By the use of proper fuzes (see FUZES) ignition may be effected with certainty. To cause the explosion to occur automatically by the touch of the vessel, a device called a circuit-closer or circuit-breaker, according to the circuit chosen, is employed. Many ingenious devices have been proposed. The figure shows the most improved form of the Mathieson arrangement, now adopted in the English service. The lead ball *a*, supported

by the coil *b*, is caused to vibrate by its inertia when the torpedo is struck by the vessel. The contact-disk *c* is thus made to close or open the circuit through the agency of the surrounding springs *d*. More simple contrivances than this are in use in some other services. Even for contact-mines unconnected with the shore, and hence under no control, electricity is now available for ignition; and its use largely reduces the danger of handling and planting the mines. A small battery is placed in the torpedo or in a hollow anchor under it, and when everything is in position the circuit to the circuit-closer is completed after the boat has reached a safe distance from the mine.

FIG. 12.

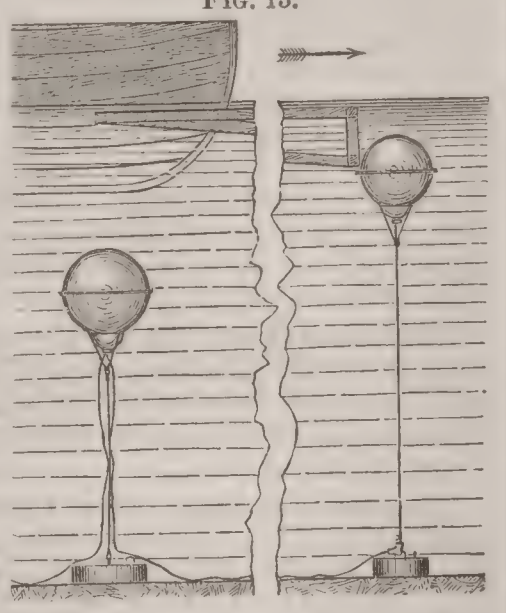



Mathieson's Circuit-closer.

In the matter of torpedo cases, experience has shown that metal, usually iron, must be employed where the mines are to remain submerged for long periods. Wood in such cases cannot be trusted to exclude water, although lager-beer kegs supply a good temporary expedient. It is an essential condition that the form shall be symmetrical, in order to reduce the tendency to rotary motion to a minimum. Wire rope is found to supply the best moorings. The electric current is conveyed by armored cable, not unlike that employed for the Atlantic telegraphs; but india-rubber is superior to gutta-percha as an insulator, because less likely to be injured by changes of temperature in storage and laying. To avoid a multiplicity of cables, as well as to reduce cost, several different cores are often united in a bundle and included in a common armor.

While the details of our own system of submarine mines, as elaborated by the writer at Willett's Point, are not made public, its general features were exhibited at the Centennial Exhibition at Philadelphia in 1876, and are as follows: Two types of electrical mine are in use, the ground and the buoyant. The former is employed in comparatively shallow water, and consists of a case resting upon the bottom and containing a large charge of dynamite. Floating near it, but so far below the water-surface as to be concealed from view, is a buoy carrying a circuit-closer or breaker to regulate the current through a fuze embedded in the former. The buoyant mine is designed for use in deep water, and consists of an anchor holding in position a torpedo floating just below the surface; the latter contains the charge of dynamite, the fuze, and the circuit-closer or breaker. If desired, the latter may be carried by a separate buoy so placed that when touched by outriggers or other torpedo-catchers, the mine will be directly under the vessel. The channel to be defended is thickly studded by lines of these mines, so arranged with respect to each other that no vessel can pass without coming in contact with one or more of them. Single-conductor electric cables running from each mine combine in multiple cables, and are extended through a subterranean gallery to a secure bombproof casemate within the fort, where is placed the apparatus by which, at the will of the operator, the mines may be fired by judgment, or be rendered either inert or automatically explosive when struck by a vessel. The system is arranged to permit easy electrical tests, by which any injury at once becomes known, as well as its nature and locus. Wires also extend from the casemate to flanking guns, so that if a boat succeeds by night in cutting a cable or in disturbing a mine, by so doing it draws upon itself a heavy automatic discharge of canister, grape, or case shot, according to its distance from the fort. Electric lights are arranged to sweep the lines of mines, and thus give additional security against hostile operations conducted under cover of the darkness. The casemate is connected by telegraph with a lookout, so that the whole system is under the perfect control of an officer who can see what is required, and instantly give the needful orders. For instance, one of our vessels might be chased by a cruiser. She could pass with absolute safety the mines, which for her pursuer would at once become deadly engines of destruction.

FIG. 13.



Detailed maps and plans for the torpedo defence of all our most important channels have been carefully prepared by the board of engineers for fortifications, and are now on file in the engineer department at Washington. The casemates and galleries for the introduction of the cables have been actually constructed at several of our forts. Large stores of torpedo material are accumulating at the engineer dépôt at Willett's Point, where, as already stated, our engineer troops receive the training needful to prepare them, in case of sudden war with a maritime power, to rapidly plant and operate the defensive mines along our extended seaboard. HENRY L. ABBOT.

**Torqua'tus** (TITUS MANLIUS), a member of the celebrated patrician family, the Manlia gens, of ancient Rome, received his surname TORQUATUS in 361 B. C. for slaying a gigantic warrior among the Gauls in single combat on the Anio, and ornamenting himself with the neck-chain (*torques*) of the fallen foe. He was several times consul and dictator, and finished the wars with the Latin League. During one of his campaigns he forbade all single combats. His son, nevertheless, fought with a Latin warrior and slew him, but when he returned to the camp and laid the spoils at the feet of his father, he ordered him to be punished with death; hence the expression, *Manlia imperia*, common in the Latin literature.—Another member of the same family, LUCIUS MANLIUS TORQUATUS, became very conspicuous in the civil war. He was prætor when the war broke out in 49 B. C., and as he belonged to the aristocratic party, he was opposed to Cæsar. He was stationed at Alba with six cohorts, but on the fall of Corfinium he abandoned Alba, and his soldiers went over to Cæsar. He subsequently joined Pompey in Greece, and in 48 had the command of Oricum, but was compelled to surrender to Cæsar, who, however, sent him away unmolested. He immediately joined Pompey again, and fought under him at Dyrrhachium. After the battle of Pharsalia he went to Africa, and here he was taken prisoner by P. Sittius at Hippo Regius, and slain. He was well versed in Greek literature, a man of elegance and taste, and a pupil of the Epicurean school of philosophy. He was a friend of Cicero, and is introduced by him in his dialogue *De Finibus* as the advocate of the Epicurean philosophy. In his letters to Atticus, Cicero calls the first book *Torquatus* in his *De Finibus*, and speaks of him with much respect.

**Tor'quay,** town of England, county of Devon, is handsomely situated on the Torbay, an inlet of the English Channel, and frequented as a bathing-place. It has a good harbor. P. 16,419.

**Torque** [Lat. *torques;* Celtic *torc*], a spirally and almost circularly bent rod of gold, worn as a personal ornament upon the neck by the ancient Celts and other rude races of the Old World. Numerous examples exist in archæological collections.

**Torquema'da** [Lat. *Turrecremata*], **de** (JUAN), CARDINAL, b. at Valladolid, Spain, in 1388; entered the Dominican order of friars in Valladolid 1403; was present at the Council of Constance 1417; afterward pursued the study of theology at the University of Paris, where he graduated 1424; became an instructor there; was successively prior of the Dominican convents at Valladolid and Toledo; was called to Rome by Pope Eugenius IV., by whom he was made "master of the sacred palace" 1431; was papal theologian at the Council of Bâle, where he contributed to the condemnation of the doctrines of Wycliffe and Huss, and advocated the doctrine of the Immaculate Conception; participated in the same capacity in the Council of Florence 1439, where he drew up the project of union between the Greek and Latin churches, for which he received from the pope the title of "defender of the faith" and the rank of cardinal; attended the Council of Bourges 1440; became bishop of Palestrina 1455, and of Sabina 1464. D. at Rome Sept. 26, 1468. Author of *Meditationes* (1467), *Expositio brevis et utilis super toto Psalterio* (1470), which were among the earliest productions of the press at Rome, *Quæstiones Spiritualis Convivii Delicias præferentes super Evangeliis* (1477), *Commentarii in Decretum Gratiani* (Lyons, 6 vols., 1519), and of several other works, as yet unprinted.

**Torquemada, de** (TOMAS), b. at Torquemada, Spain, about 1420; became a Dominican monk and prior of the monastery of Santa Cruz at Segovia; was appointed by Ferdinand and Isabella first inquisitor-general of Spain 1483; was confirmed in that post Oct. 17 of that year by Pope Innocent VIII., who gave him the title of "confessor of sovereigns;" labored with great vigor and success in organizing the Inquisition throughout Spain, especially at Seville, Córdova, Jaen, and Ciudad Real; drew up the code of procedure subsequently followed; was influential

in causing the expulsion of Jews and Moors from Spain, and burned at the stake during sixteen years from 9000 to 10,000 persons. (See INQUISITION.) In his later years his authority was curtailed by the appointment of four colleagues by express orders of Pope Alexander VI. D. at Avila Sept. 16, 1498.

**Torrear'sa** (VINCENZO), MARQUIS, b. at Trapani July 17, 1808; was inspector-general of the customs when the revolution of 1848 broke out; professing liberal ideas, was chosen president by the committee of finance; was also made president of the Sicilian Parliament, and publicly announced the fall of the Bourbons on Apr. 13; on July 10 proclaimed the duke of Genoa king of Sicily; Aug., 1848, accepted the presidency of the ministry, holding the portfolio of foreign affairs. The Bourbons being re-established, he emigrated to Nice, and put himself in communication with Cavour; in 1860 joined Garibaldi, who had entered Palermo; proposed a Sicilian constituent assembly, which was convoked in October, and took a seat in it himself as deputy; was commissioned to bear to King Victor Emmanuel the vote of Sicily for union with the kingdom of Italy; has since been vicar-president of the Italian Parliament, ambassador extraordinary from the kingdom of Italy to Sweden and Denmark, prefect of Florence, and president of the senate of the kingdom.

**Tor're del Gre'co,** town of Italy, province of Naples, on the eastern coast of the Bay of Naples, at the foot of Vesuvius, whose eruptions have destroyed it several times. It was always rebuilt, however, and it is very celebrated for its wine and fruits; tunny, anchovy, sardine, and coral fishing are carried on with energy by the inhabitants. P. 5477; before the eruption in 1861, about 15,000.

**Tor're, del'la** (GIOVANNI BATTISTA CRESCENZI), MARQUIS, b. at Rome in 1595; studied painting and architecture, and was made superintendent of public works by Pope Paul V. In 1617 he accompanied Cardinal Zapata to Madrid, where he gained the favor of Philip III. by his flower-pictures, and was entrusted with the ornamentation of the burial pantheon of the Escurial, one of the most magnificent monuments of Europe. Philip IV. ennobled him and made him a marquis, Della Torre, and his house was the rendezvous for all artists and literary people in Madrid. D. in 1660, or, according to some accounts, in 1665.

**Torre, della** (GIOVANNI MARIA), b. in Rome in 1713; was professor of natural philosophy at the Academy of Naples, and subsequently director of the royal library, museum, and printing-house. D. in Naples in 1782. He was the first who undertook to descend into the crater of Vesuvius, and wrote, besides his *Elementa Physices* (1767), *Storia e Fenomeni del Vesuvio* (1755).

**Tor're dell' Annunzia'ta,** town of Italy, province of Naples, at the foot of Vesuvius, noted for its thermal springs and its manufactures of arms. P. 15,500.

**Tor're de Moncor'vo,** town of Portugal, province of Tras os Montes, picturesquely situated on the southern slope of the Roboredo Mountain, between the Sapor and Douro, is surrounded with walls and defended by an old castle. It is supposed to be the ancient *Forum Narbasorum*. It has some silk manufactures, and the silkworm is extensively reared in the vicinity. P. about 2000.

**Tor're di Ma're,** village of Naples, at the mouth of the Basento in the Gulf of Taranto, is famous for the ruins of the ancient *Megapontum* which are found in its vicinity. Megapontum was at one time one of the wealthiest and most celebrated cities of Magna Græcia, the homestead of Pythagoras, but its prosperity received a fearful blow when, after the fatal battle of the Metaurus (207 B. C.), Hannibal was compelled to give up this part of Italy, and carried with him all the citizens of Megapontum in order to defend them from the vengeance of the Romans. In the time of Cicero the city still existed, but in a state of rapid decay.

**Tor're Don Jime'no,** town of Spain, province of Jaen, near the Guadalquivir, in a fertile and well-cultivated plain, producing excellent wines, olives, and wheat. P. 6777.

**Tor're Maggio're,** town of Southern Italy, province of Foggia, about 4 miles from San Severo. The old ducal palace is a fine building. The agricultural products of the district are abundant—grain, wine, oil, and fruits—and the pasturage is excellent. The town, however, is subject to violent earthquakes, having been almost totally destroyed in 1627, and again in 1688. P. 9260.

**Torremuz'za, de** (GABRIEL). PRINCE, b. at Palermo in 1727; devoted himself to the study of Sicilian antiquities, and published *Siciliæ Populorum, Urbium, Regum et Tyrannorum Numismata* (1767), *Siciliæ et objacentium Insularum veterum Inscriptionum nova Collectio* (1769), and *Siciliæ veteres Nummi* (1781). D. in 1792.

**Tor'rens** (ROBERT), F. R. S., b. in Ireland about 1780; entered the naval service 1797 as lieutenant of marines; rose to be colonel 1837; subsequently became major-general in India; was for some years a member of Parliament, where he was a vigorous supporter of the Reform bill, and acquired great note as a political economist; received from 1852 a pension of £200 from the civil list. D. May 27, 1864. Among his numerous treatises were an *Essay on Money and Paper Currency* (1812), *Essay on the External Corn Trade* (1815), *Essay on the Production of Wealth* (1821), *The Budget, a Series of Letters on Financial, Commercial, and Colonial Policy* (1841–43), *Tracts on Finance and Trade* (1852), and several single *Letters* on similar subjects addressed to prominent statesmen.—His son, SIR ROBERT RICHARD, b. in 1814, educated at Trinity College, Dublin, became collector of customs in South Australia 1841, treasurer 1852, subsequently chief secretary and registrar-general; returned to Great Britain about 1865; sat in Parliament for Cambridge 1868–74, and was knighted 1872. Author of works on Australian subjects.

**Torrens** (WILLIAM TORRENS **McCullagh**), b. at Greenfield, county Dublin, Ireland, in Oct., 1813; graduated at Trinity College, Dublin, 1834; was called to the Irish bar 1836; became commissioner of the poor law inquiry in Ireland 1835; private secretary to Lord Taunton 1836; sat in Parliament for Dundalk as an advanced Liberal 1848–52; was an unsuccessful candidate for Yarmouth 1852; was elected from that borough Mar., 1857, but was unseated on petition; has represented Finsbury since July, 1865; was prominent during the American civil war as an advocate of the Union cause; aided Mr. Disraeli in 1867 to carry his household suffrage bill, to which he procured the addition of the lodger franchise; introduced in 1868 the artisans' dwellings bill, which was carried after protracted debates; obtained in 1869 an important reform in the management of pauper children by the poor-law guardians in London, and secured in 1870 the adoption of the extradition act, and in the same year proposed the creation of the London school board. He is a member of Lincoln's Inn, and a practitioner at the common-law bar; assumed in 1863 the maternal name of Torrens in addition to the paternal one of McCullagh; is author of *The Use and Study of History* (Dublin, 1841), *The Industrial History of Free Nations* (2 vols., 1846), *Memoirs of Richard Lalor Sheil, with Anecdotes of Contemporaries* (2 vols., 1855), *Life and Times of Sir James Graham, Bart.* (2 vols., 1863), *The Lancashire Lesson* (1864), and *Our Empire in Asia: how we came by it* (1872).

**Tor'res-Caïce'do** (I. M.), b. at Bogota Mar. 30, 1830; devoted himself after his seventeenth year to poetry and literature; was editor of *El Progresso*, and subsequently of *El Dia*, which brought him into a severe conflict with the government; was elected a member of the legislative assembly, and filled afterward various diplomatic positions at Paris, London, the Hague, and Washington, but retired in 1864, in order to devote himself exclusively to literature. He has published in Paris *Religion, Patrie et Amour*, a collection of poems, and *Essais biographiques sur les principaux Publicistes, Poëtes et Littérateurs latino-américains* (2 vols., 1863).

**Tor'res Strait,** the name of the channel which separates New Guinea or Papua from Australia. It is 80 miles broad, but covered with islands and full of shoals and reefs, which make its navigation difficult. It was discovered by Torres in 1606.

**Tor'res Ve'dras, The Lines of,** consisted, when completed, of 152 distinct works, arranged in two lines, 25 miles N. of Lisbon, and extended from the Tagus to the sea. They were provided with an armament of 534 pieces of ordnance, and their garrisons were calculated at 34,125 men. Of the two principal lines, the advanced was 29 and the rear 25 miles in length, following the principal features of defence, the distance in a direct line between their flanks being 22 and 25 miles respectively. These works were generally small enclosed redoubts, armed with from two to six pieces of ordnance, and requiring infantry garrisons of from 100 to 300 men. The largest, "the great work at Monte Agraça," had a perimeter of 2435 feet, an armament of 25 guns, and required an infantry garrison calculated at 1590 men. Their artillery consisted of 6, 9, and 12-pounder guns and 5½-inch howitzers, mostly on rude truck-carriages. The allied army fell back and entered their line Oct., 1810, holding the invading forces at bay till Mar., 1811, when they retired discomfited. The genius and foresight of Wellington in providing this strong position was thus fully vindicated. (See Jones's *Sieges in Spain.*) (For a comparison of these lines with others, and with the defences of Washington, see *Prof. Papers Corps of Engineers U. S. A.*, No. 20.)

J. G. BARNARD.

**Tor'rey,** tp., Yates co., N. Y. P. 1281.

**Torrey** (Charles Turner), b. at Scituate, Mass., in 1813; graduated at Yale College 1833; studied theology with Rev. Dr. Jacob Ide of Medway, whose daughter he married; was successively pastor of Congregational churches at Princeton and at Salem, Mass., but relinquished his professional position to devote himself to anti-slavery labors in Maryland, where he was tried and sentenced to imprisonment for aiding slaves to escape, and died of consumption in the State prison at Baltimore May 9, 1846. His remains were buried in Mount Auburn Cemetery, near Boston. Author of a *Memoir of William R. Saxton* (1838) and *Home, or the Pilgrim's Faith Reviewed* (1845), the latter being a volume of sketches of home-life in Massachusetts possessing considerable merit, written while in prison. His biography was published under the title *Memoirs of the Martyr Torrey* (1847).

**Torrey** (John), M. D., LL.D., b. in New York City in 1798; graduated in medicine in College of Physicians and Surgeons, New York, 1818; was professor of chemistry, geology, and mineralogy in the Military Academy, West Point, 1824–27, of chemistry and botany in the College of Physicians and Surgeons 1827–55, and of chemistry and natural history in the College of New Jersey 1830–54; was chief assayer of the U. S. 1853–73; was one of the founders of the New York Lyceum of Natural History, of which he was for many years president, and at the request of which he prepared, as early as 1817, while still a medical student, a *Catalogue of Plants growing spontaneously within Thirty Miles of the City of New York* (Albany, 1819); published vol. i. of a *Flora of the Northern and Middle States* (New York, 1824) and a *Compendium* of the same (1826), both in accordance with the Linnæan system; suspended this task in consequence of the general adoption of the natural system of Jussieu in preference to that of Linnæus; was appointed botanist of the geological survey of New York 1836; published a monograph on the *Cyperaceæ of North America* (1836); began in 1838, in connection with his former pupil, Dr. Asa Gray, the publication in numbers of a *Flora of North America* in accordance with the natural system of classification, which had reached the close of the great natural order Compositæ when in 1843 the vast accumulation of materials compelled its suspension; published the *Flora of the State of New York* (2 vols., 1843–44), forming vols. vi. and vii. of the *Natural History* of that State; edited Dr. L. D. de Schweinitz's *Monograph of the North American Species of the Genus Carex* (New York, 1825) and Dr. John Lindley's *Introduction to the Natural System of Botany* (New York, 1831), to which he added an *Appendix;* was from 1822 to 1858 the chief botanical editor of the numerous reports of U. S. surveying and exploring expeditions; was a frequent contributor to the *Annals* of the New York Lyceum, to the New York *Medical Repository, Silliman's Journal,* the *Smithsonian Contributions to Knowledge,* the *Transactions* of the American Association for the Advancement of Science, and other learned societies; was a distinguished chemist, and frequently consulted by the treasury department at Washington on matters relating to coinage and currency; was many years a trustee of Columbia College, to which institution he presented in 1860 his valuable herbarium and botanical library, the fruit of forty years of research, and in which he was largely influential in extending the curriculum and organizing a post-graduate course; was a member and frequently an officer of the leading scientific associations of the U. S., and an honorary member of several similar bodies in Europe. D. in New York City Mar. 10, 1873. A brief *Memoir* by his pupil and associate, Prof. Asa Gray, may be found in the annual discourse of the latter delivered in 1874, as president of the American Academy of Arts and Sciences.

Porter C. Bliss.

**Torrey** (Joseph), D. D., b. at Rowley, Mass., Feb. 2, 1797; graduated at Dartmouth College 1816, and at Andover 1819; was pastor of a Congregational church at Royalton, Vt., 1819–27, professor of Greek and Latin in the University of Vermont 1827–42, professor of intellectual and moral philosophy 1842–67, and president of the University 1863–65. D. at Burlington Nov. 26, 1867. Author of a posthumous volume of lectures, *A Theory of Art* (1875); editor of the *Remains* (1843) of Pres. James Marsh, and of the *Select Sermons* (1861) of Pres. Worthington Smith, to both of which he prefixed carefully-prepared *Memoirs;* and translator of Neander's *General History of the Christian Religion and Church* (Boston, 5 vols., 1854), accompanied by elaborate and scholarly notes, which may be considered as the great literary work of his life.

**Torrey** (William), b. at Combe St. Nicholas, Somersetshire, England, about 1590, was descended from an eminent family of that county; received a good classical education, and emigrated to Massachusetts with his brother James about 1632, the two being ancestors of all of the name in the U. S. James settled at Scituate, and William at Weymouth, where he became a magistrate and captain of the train-band of the colony (the highest military rank at that time); was many years representative for Weymouth in the general court, of which, as he wrote a good hand, he was usually clerk or secretary, and was a member of its committees whenever they had to do with education or literature, as in the case of that appointed to examine Eliot's Indian Bible. D. at Weymouth about 1675. He wrote a work on the millennium entitled *A Discourse concerning Futurities, etc.,* first printed by Rev. Dr. Prince in 1757, with a biographical notice.—His son Samuel, b. in England in 1632; graduated at Harvard 1652; became an eminent minister at Weymouth, preached the "election sermon" three times, and twice declined the presidency of Harvard College. D. at Weymouth in 1707.

**Torrey'a** [named in honor of Dr. John Torrey, the illustrious botanist], an interesting genus of trees of the order Coniferæ, allied to the yews, but easily distinguished by the naked drupe and the ruminated albumen of the seeds. *T. Californica* is a fine ornamental species; *T. taxifolia* of Florida has a durable, strong-scented, heavy, and close-grained wood and horizontal whorled branches. It sometimes attains a height of fifty feet. Eastern Asia has several species. *T. myristica* has a useful timber. The seeds of *T. nucifera* afford an oil used in cooking food. The astringent nuts of some species are used by the Japanese courtiers to repress the renal secretion during the long audiences of their monarch. When burnt, the leaves and wood of the *Torreyas* give off a powerful and disagreeable smell. Before the formation of this genus, several unsuccessful attempts were made thus to honor Dr. Torrey by naming a genus after him. Rafinesque applied the name *Torreya* to a group of sedges, now referred to *Cyperus,* and Sprengel applied it to a proposed genus of verbenaceous plants.

**Torricel'li** (Evangelista), b. at Faenza Oct. 15, 1608; studied mathematics and physics in Rome under Castelli, and in Florence under Galileo, whom he succeeded in 1642 as professor at the Academy. D. at Florence Oct. 25, 1647. In 1644 he published his *Opera Geometrica.* His most remarkable discovery is that of the Barometer (which see).

**Torri'jos** (José Maria), b. at Madrid, Spain, May 20, 1791; was in youth a page at the court of Charles IV.; served with credit in the war of independence, gaining the rank of colonel on the field of battle; distinguished himself as captain-general of Valencia by his zeal for the constitution of 1812, which occasioned his dismissal from the army by Ferdinand VII., and his imprisonment 1817–20; was appointed by the Cortes in 1820 field-marshal and commander-in-chief of Navarre and the Basque provinces; held out to the last against the French intervention of 1823, but was finally forced to capitulate at Cartagena; lived several years in exile at London, where he was considered the head of the numerous Spanish refugees; obtained, through the influence of John Sterling in 1830, sufficient funds to equip an expedition for the liberation of Spain from the despotism of Ferdinand VII., but being unsuccessful on landing, had to take refuge at Gibraltar, whence in 1831 he made another expedition to the S. of Spain; was captured with 53 companions, tried by court-martial, and shot at Malaga Dec. 11, 1831.

**Tor'rington,** p.-v. and tp., Litchfield co., Conn. P. 2893.

**Torshok',** town of Russia, government of Tver, on the Tertza, has extensive manufactures of vinegar, earthenware, tiles, candles, leather, shoes, and gloves which are embroidered with gold and silver and largely exported. The trade in these articles and in grain and eggs is very lively. P. 12,137.

**Tor'sion** [Lat. *torqueo, torsum,* to "twist"], in surgery, the twisting of the cut end of an artery in a wound or after a surgical operation, for the purpose of restraining hæmorrhage. This method has had enthusiastic advocates, but is now seldom employed except in special cases, where no better method is safely applicable.

**Torsion Balance,** for measuring delicate electrical or other attractions and repulsions, was invented by Coulomb. The attraction or repulsion is measured by the resistance offered to it by the twist of a filament of spun glass or other fibre. (See also Radiometer.)

**Torsk,** or **Dorse** [Dan. *torsk*]. (1) The *Morrhua callarias,* or Baltic cod, a valuable food-fish of the North European seas. (2) Torsk or Tusk, the *Brosmius vulgaris,* a valuable European food-fish, considered by some as the same as the *cusk* (*B. flavescens*) of our American Atlantic waters. All the above are of the cod-family, and are eaten fresh, or more generally are salted and dried. Our Pacific

coasts have another torsk, *Brosmophycis marginatus*. (See DORSE.)

**Tor'stenson** (LENNART), b. at Torstena, West Gothland, Sweden, Aug. 17, 1603; was educated as a page at the court of Gustavus Adolphus, whom he accompanied in 1630 to Germany; distinguished himself greatly as commander of the artillery in the battle on the Lech, Apr. 5, 1632; was taken prisoner before Nuremberg Aug. 24, 1632, and kept for six months in a damp, subterranean dungeon in Ingolstadt by Maximilian of Bavaria; was appointed commander-in-chief of the Swedish army in Germany in 1641 (see THIRTY YEARS' WAR), but was compelled by the gout to resign his command in 1646; returned to Sweden; was made count of Ortala by Queen Christina and governor-general of the province of West Gothland. D. in Stockholm Apr. 7, 1657.

**Tort** [Fr. *tort*, "wrong;" Lat. *torquere*, *tortus*, to "twist," "twisted"], in law, is a wrongful act, default, or omission, not consisting in a mere breach of contract, whereby a civil injury is done to another, and a remedial right of compensation therefor accrues to him—the violation of a civil duty owing to another, and not arising solely from contract. The common law divides all civil wrongs or delicts for which a compensatory action lies into torts and breaches of contract. Although the distinction is in the main a plain one and easy to be traced, yet at certain points the two classes become intermingled, and it is very difficult to determine with accuracy in which of them a given wrongful act should be placed. Among the essential differences are the following: The duty which is violated, and the breach of which constitutes a tort, may, and generally does, spring from some other relation between the parties than that of contract. As, for example, when a man is assaulted or defamed or his land is trespassed upon, his right to his own person, reputation, or property free from molestation by others, and the corresponding duty resting upon all mankind not to molest him in his enjoyment, are not based upon any contract, express or implied, between the parties. This is in general the characteristic feature of most torts, yet it is not universal, for, as will be seen hereafter, a tortious act may be a breach of contract, or may be inseparably connected with contract. Another difference is that persons under disabilities to bind themselves by contract, as infants, married women, and even the insane, may be liable for torts which they have committed. Again, if a tort is done to the person or reputation—that is, not directly to property—and either the wrongdoer or the injured party dies, all right of action ceases; while both the right and the liability for the breach of all contracts (with a very few special exceptions) survive on the death of either contracting party. In respect to the form of the remedy, where a tort is committed by several persons jointly, a suit or suits may be maintained against all, some, each, or any of the wrongdoers; but in the case of a joint contract all the promissors or obligors must, as the general rule, be united in the action and sued together. On the other hand, torts may be closely connected with breaches of contract. The act by which a contract is broken may be in every sense of the term tortious. This dual character occurs especially where the delict or wrong consists in negligence or want of skill, but is not confined to such cases. To illustrate: where passengers are injured on railways or other conveyances, where goods are lost or damaged by common carriers, where persons hired to perform special services fail through carelessness or lack of skill, where the property of guests left in the custody of innkeepers is not forthcoming, and in many other similar relations, the defaulting party has at once violated his contract with his employer and has committed a tort. In all these instances the one who has suffered the loss or wrong has an election to regard the delict as merely a violation of contract, or to treat it as a breach of duty and sue for the tort. Fraud also, which is certainly a species of tort, is generally and almost necessarily connected in some manner with contract. Here also an election often exists, either to sue on the contract, considering the deceit as incidental, or to abandon the contract and base the right of action wholly on the fraud as an independent and separate wrong.

When torts are considered in their essential nature, they may be arranged into different classes according to their characteristic elements. In one class the delict consists in a positive act of wrong, the doing what ought not to be done, the breach of a duty to forbear. In another class it consists in a wrongful omission or default, such as negligence or want of skill, the doing something in an improper manner. In many cases the very essence of the tort and of the consequent liability lies in the wrongful intent or malice with which the act is done. In others the injurious act or omission alone constitutes the tort and the liability, without any reference to the intent which accompanied it. Certain torts are entirely of a statutory origin; as, for example, the wrongful killing a person, and the consequent action for damages which is now given to the representatives of the deceased by the legislation of England and of the American States. Finally, there is an intimate connection between torts and crimes. The wrongful intent or malice which is the constituent of certain species plainly assimilates them to criminal delicts, and many wrongs to person, character, or property may be punished as crimes, and at the same time give a right of action to recover damages. The common-law doctrine, that if the tortious act amounts to a felony, the civil right of action is swallowed up in the crime and the public punishment, has been generally rejected in the U. S. It is impossible in this article to enumerate all the species and instances of torts; and, in fact, such an enumeration can never be made complete, since new varieties of wrong are constantly invented, and the maxim *ubi jus ibi remedium* finds here its most direct and appropriate application. A general classification, however, may be made of—(1) those done to persons, in all their possible relations, private, domestic, professional, and official; (2) those against character and reputation; and (3) those done to property, real and personal. When it is considered that in all these three classes the injury may be direct or consequential, intentional or accidental, by positive acts or by omissions, it is plain that the variety of possible torts is practically unlimited.

JOHN NORTON POMEROY.

**Tor'ti** (GIOVANNI), b. at Milan 1774; d. at Genoa 1851. A volume of his poems was published at Genoa. In reference no doubt to his elegant epistle in verse on *I Sepolcri* of Ugo Foscolo, Manzoni wrote in his *Promessi Sposi* these somewhat exaggerated words: "Pochi valenti come i versi del Torti."

**Tor'toise-Plant,** also called ELEPHANT'S FOOT (which see).

**Tortoises** [Lat. *tortus*, alluding to its crooked feet], an order of reptiles, by some called Testudinata and by others Chelonia, peculiar, among all animals, in the box-like case, formed chiefly by an outgrowth of the ribs, into which they can wholly or in part withdraw their head and members. The general form is universally familiar. The skull has all its bones forming a continuous solid framework (excepting only the lower jaw and the hyoidean arch), and the quadrate bone is connected by suture with the periotic region; the lower jaw has its rami entirely and largely connected at the symphysis; the jaws are destitute of true teeth, and are generally encased in corneous sheaths simulating the bill of a bird, but sometimes (in Trionychidæ) have fleshy lips; the dorsal vertebræ are immovably connected together, and the ribs are more or less expanded, sometimes united by suture, sometimes disconnected, and, together with certain bones developed in the integument of the embryo, constitute the framework of the upper shell, which is called the carapace; opposed to the carapace, and more or less closing it from beneath, is a flattish covering of the abdomen, which is composed of bones also developed in the integument, and constituting the so-called plastron; both carapace and plastron are mostly covered with horny shields arranged in regular order (on the carapace five in a median row, eight—four in each—in the lateral rows, and generally 23 to 25 in a marginal series), but sometimes are invested in smooth thick skin; the feet are always well developed, and fitted for walking or swimming; their bones are developed in a normal manner; the heart is trilocular; the copulatory organ is simple. Such are the most prominent characters in which the tortoises contrast or compare with the other orders of reptiles. They stand alone in the development of the ribs and dermal bones into a shell, and are indeed quite isolated in this respect, no other reptiles, so far as known, living or extinct, to any considerable extent exhibiting an intermediate condition between this complete development of a carapace and the normal development of ribs. The order is well represented in the present epoch, and members thereof are found in all continental areas and almost all the older islands; but in this respect there are some notable contrasts. Thus, while there are numerous species in North America, there are very few in Europe, and none (save occasional marine stragglers) in Great Britain. In time they are claimed to have survived from the closing period of the Silurian age to our own, but the evidence as to such antiquity is unsatisfactory and based on footprints of equivocal character. They, however, indisputably existed during the Jurassic and succeeding epochs. The types flourishing in ancient days in Europe and North America were to a large extent not allied to the predominant forms now existing in those countries, but were more related to certain marine forms (the Sphargididæ) and to fresh-water

types of an inferior grade of structure now limited to the southern hemisphere, and especially South America and Australia. The members of the order have been variously distributed according to the views of systematists respecting the value of the several chief modifications of structure. Fitzinger, who seems first to have grouped the families in higher categories under the order in 1843, gave primary importance to the development of the members, and arranged (1) under the "order Tylopoda" the club-footed or true land-tortoises; (2) under an order, Steganopodes, all the web-footed fresh-water tortoises; and (3) under a sub-order, Oiacopoda, the finned marine tortoises. J. E. Gray in 1870 elevated the families and sub-families of Duméril and Bibron severally to sub-ordinal rank under the names Tylopoda (= Chersites D. and B.), Steganopodes (= Elodites cryptodères D. and B.), Pleuroderes (= Elodites pleurodères D. and B.), Trionychoidea (= Potamites D. and B.), and Oiacopodes (= Thalassites D. and B.). Agassiz differentiated the families into two sub-orders—(1) the Amydæ, or footed tortoises, and (2) the Chelonii, or finned tortoises. Cope, entirely disregarding the modifications of the limbs for primary purposes, distributed the families among three sub-orders—viz. (1) Athecæ, distinguished by the slight degree of ossification of the shell, including the Sphargididæ and extinct Protastegidæ; (2) Cryptodira, including all the tortoises which draw in their neck in a curve along the longitudinal axis of the body, and including the common sea-turtles, the Trionychidæ, the typical Cryptodères of Duméril and Bibron and Gray, and the true land-tortoises; and (3) Pleurodira, including the tortoises which draw in their neck sideways, all of which are web-footed fresh-water forms, and correspond with the Pleurodères of other authors. Finally, Huxley has divided the order into (1) Testudinea (= Chersites and Tylopoda), (2) Emydeä (= Elodites), (3) Trionychoidea (= Potamites), and (4) Euereta (= Thalassites), thus, like Duméril and Bibron, assigning primary importance to the modifications of the feet and the characters co-ordinated with them. The families admitted by Cope are the following: under Athecæ, Sphargididæ and *Protastegidæ;* under Cryptodira, Cheloniidæ, *Propleuridæ*, Trionychidæ, Emydidæ, Chelydridæ, Cinosternidæ, Testudinidæ, *Pleurosternidæ*, and *Adocidæ;* and under Pleurodira, Podocnemidæ, Chelydidæ, Hydraspididæ, Pelomedusidæ, and Sternothæridæ; those indicated by italic letters are extinct. (More detailed information is given under several of the family names, and under CHELONIA.)

THEODORE GILL.

**Tortoise-shell,** the scales which form together the carapace of *Testudo imbricata*, a large turtle found in the Indian and Pacific oceans and in the Red and Arafoora seas, and occasionally taken in the Atlantic. The species is known as the hawk's-bill turtle. Its flesh is unwholesome as food. Tortoise-shell is remarkable for its plastic quality, which enables the artificer to give it almost any desired shape while under the influence of heat. Pieces of the shell may even be welded together, and the filings and chips are moulded and shaped as desired when heated to the proper temperature. Tortoise-shell is chiefly used for making combs, inlaying boxes and toilet-articles, etc. Of late it is successfully imitated by various artificial compounds of much less cost. It is customary in some regions to apply heat to the back of the living tortoise, and then remove the plates, but the crop of shell which replaces the first is thin and of inferior quality.

**Torto'na** [Lat. *Dertona*], town of Italy, province of Alessandria, about 12 miles E. of the city of Alessandria, on a hill nearly 900 feet above the sea. Tortona was once a strongly-fortified city, but its last defences were destroyed, by order of Napoleon, after the battle of Marengo. Some of the public buildings are worthy of notice. The old cathedral, originally a Jewish synagogue, was converted into a church during the reign of Constantine, but it was destroyed by an accidental explosion of gunpowder in 1609, which at the same time demolished a large part of the town. In the new cathedral (1575) there are some valuable pictures, among them a beautiful San Sebastian; here may also be seen a grand old sarcophagus with Greek and Latin inscriptions. The library of Tortona is very rich in early ecclesiastical works. The theatre is one of the finest in Piedmont. The principal industries are silk-reeling and the manufacture of coarse cotton fabrics, both these occupations being chiefly carried on in private houses. Tortona was an important town under the Romans. Under the Lombards the Benedictines became very wealthy and powerful here, and extended their influence widely and beneficially over the neighboring country. Later, Tortona constituted itself into an independent republic, and was conspicuous during the whole mediæval period, even after the loss of popular liberty. Remains of the great aqueduct, the cloacæ, baths, and other Roman constructions are still to be seen. In the fourteenth century a rich harvest of antique statuary, vases, urns, mosaic floors, coins, etc., was discovered, and similar objects are frequently found even now. P. 13,504.

**Torto'rici,** town of Sicily, province of Messina, about 25 miles from Patti. The adjacent country is very productive, and near the town are the ruins of a grand old Roman bridge. P. 7835.

**Torto'sa,** an old but well-built and fortified town of Spain, province of Tarragona, on the Ebro, in a fertile and well-cultivated district, has manufactures of cotton and linen goods, glass, soap, and pottery. P. 15,830.

**Tortricidæ.** See LEAF-ROLLERS.

**Tortric'idæ** [from *Tortrix*, "tartar," the name of the chief genus], a family of serpents of the sub-order Angiostomata. They are worm-like in appearance; have no constriction separating the head and trunk; the head is shielded above; the maxillary bones have alveolar ridges and teeth; the pupils of the eyes are round; the body is covered with smooth scales; the tail is short and conic, and there are rudiments of posterior extremities. The skull has the mastoid entering into the cranial walls; a coronoid bone is present; ectopterygoids and prefrontals are developed; and the maxillary is horizontal and in contact with the prefrontal. (*Cope.*) The family has few species, and is mostly confined, as thus restricted, to South America, Southern Asia, and Australia. The typical species, *Tortrix scytale*, is sometimes known as the "coral snake," but is not to be confounded with the Elapidæ, which are also frequently designated by the same name; it is a South American species. The Oriental species belong to the genus *Cylindrophis*, and are said to be viviparous. (See Günther, *Ann. and Mag. Nat. Hist.*, vol. i. p. 428, 1868.)

THEODORE GILL.

**Törts'var, or Törzburg,** town of Austria, in Transylvania, on the Törz, has a strong citadel. P. 8930.

**Tortugas.** See DRY TORTUGAS.

**Tor'ture** [Lat. *torquere*, to "twist," to "torment"], the production of severe bodily pain for the purpose of extracting an avowal of guilt, the revelation of accomplices, or evidence in general. It was quite common among the Greeks, and in certain cases it even seems to have formed a standing feature of their legal proceedings. But it was inflicted only on slaves; a free Greek citizen could not be tortured. From Greece it was introduced to Rome, where it also became common, though at times it was loudly denounced by their jurists and orators as barbarous of itself and doubtful in its results. With the Romans, however, it found in course of time a wider application. During the emperors, and in cases of *crimen læsæ majestatis* also, free citizens—yea, even members of the first families—were tortured, and thus it became a part of the code of Justinian. Hence it was adopted during the Middle Ages by all European states in which the Roman law was made the basis of legislation, and in many countries—for instance, in Germany—it flourished rankly. In the town-house of Ratisbon can be seen a complete set of the various instruments of torture, and the criminal code of Maria Theresa, promulgated in 1769, was accompanied by 45 large plates of engravings representing the various methods of proceeding. It was not entirely abolished in Germany until the beginning of this century. In England it was known in the fourteenth century. In 1310, Edward II. consented, at the instance of Pope Clement V., to subject the Templars to torture. During the reign of Henry VI. the rack was introduced as an engine of state by the duke of Exeter, and in the reign of Henry VIII. torture became quite common. It was, however, never recognized by the common law except in the one case of *peine fort et dure;* it was considered a prerogative of the Crown, and during the Tudors the privy council assumed the right of issuing torture-warrants to the lieutenant of the Tower and other officers for the purpose of extorting discoveries of criminal offences. The last case occurred in 1640. Its worst application it found in the hands of the Inquisition. In the thirteenth century the Roman law concerning *crimen læsæ majestatis* began to be applied to heresy as a *crimen læsæ majestatis divinæ*, and in 1282, Pope Innocent IV. called on the secular powers to put to the torture persons accused of heresy in order to extract confessions against themselves and others. When, finally, the Inquisition was broken up, its dungeons and archives revealed horrors truly appalling. The rack, on which men were stretched till their joints were loosened, the Spanish boot, which compressed the muscles of the leg to a jelly, the thumb-screw, etc., were the common instruments of torture, but the Inquisition possessed the most ingenious tools of tormenting, besides using water, fire, melted metals, mutila-

tion, etc. In the eighteenth century Thomasius, Voltaire, Beccaria, and others wrote with some effect against the application of torture, and finally the French revolution swept it entirely out of existence.

**Torula Cerevisiæ, or Yeast-Plant.** See FERMENTATION, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**To'ry** [a word of Irish origin, probably signifying a "robber"], a name first applied to the Roman Catholic outlaws who lived in the bogs of Ireland during the reign of Charles II.; afterward extended (1679) to all those, whether English, Scotch, or Irish, who were opposed to the bill excluding the duke of York from the succession. Finally, the name came to designate the conservative party in British politics. In the Revolutionary war of the U. S. the loyalists were called Tories.

**Toscanel'li** (PAOLO DEL POZZO), b. at Florence, Italy, in 1397; became one of the keepers of the Florentine library 1427; erected, about 1468, the famous gnomon on the Duomo of Florence; was learned in the scientific and geographical literature of the Greek and Latin classics, and by his letters to Columbus was instrumental in confirming the latter in his views of the figure of the earth and the practicability of a voyage westward to Cathay. D. at Florence May 15, 1482.

**Total Abstinence.** See TEMPERANCE, by H. I. BOWDITCH.

**Tota'na,** town of Spain, province of Murcia, at an elevation of 4870 feet. Ice is an important item of its trade. P. 6875.

**Totaro,** tp., Brunswick co., Va. P. 5043.

**To'tem** [Algonkin, *totêm*], a rude figure of some object, generally of an animal, used by the North American Indians as the symbol of a tribe, or sometimes of a particular band, to which they belong. The same custom prevails in Northern Asia, Australia, Oceanica, etc., as formerly in Europe.

**Tot'ila,** chosen king by the Ostrogoths in 540 after the defeat and capture of Vitiges at Ravenna by Belisarius; besieged and conquered Rome in 546, and extended and consolidated the Ostrogothic empire in Italy after the recall of Belisarius in 549, but was defeated and mortally wounded in the battle at Taginæ by Narses in 552.

**Totonicapan,** town of Guatemala, Central America, is really only an Indian village, but the inhabitants number about 10,000, and the soil is remarkably well cultivated and very productive, though not very fertile. Some manufactures of hardware, wooden articles, and woollen stuffs are also carried on.

**Tot'ten** (JAMES), b. in Pennsylvania in 1816; graduated at West Point 1841; served in the Florida and Mexican wars as an officer of artillery; was in command of the arsenal at Little Rock, Ark., when it was seized by the secessionists; served as chief of artillery in Missouri under Gens. Lyon and Fremont; commanded an artillery division under Gen. Halleck; became successively inspector-general of the departments of the Missouri and of the Atlantic, and was brevetted major-general of volunteers 1865. D. at Sedalia, Mo., Sept. 11, 1871.

**Totten** (JOSEPH GILBERT), b. at New Haven, Conn., Aug. 23, 1788; was graduated from the U. S. Military Academy July, 1805, when commissioned second lieutenant in the corps of engineers. In 1805 he accompanied his uncle, Jared Mansfield, then surveyor-general of Ohio, to the West as an assistant on this the first systematic survey of any of the new States of the Union, and Mar. 31, 1806, resigned from the army. His tastes, however, led him back to the army, and Feb. 23, 1808, he was reappointed a second lieutenant of engineers, commencing his career as a military engineer under Jonathan Williams, the first chief of the corps, and was engaged on the construction of Castle William and Fort Clinton, New York harbor, 1808–12. At the commencement of the war with Great Britain, Totten (captain in his corps, July 31, 1812) was assigned to duty as chief engineer of the army under Gen. Van Rensselaer in the campaign of 1812, on the Niagara frontier, and in that capacity took a conspicuous part in the battle of Queenstown. He was subsequently chief engineer of the army under the command of Gen. Dearborn, in the campaign of 1813, and of the army under Gens. Izard and Macomb, in the campaign of 1814 on Lake Champlain. For "meritorious services" he was brevetted major June, 1813, and lieutenant-colonel Sept. 11, 1814, for gallant conduct at the battle of Plattsburg. In Nov., 1816, a board of engineers was constituted, with Totten as a member, with instructions to make examinations of the sea-coast, and to prepare plans for defensive works. In 1817, Totten was relieved, and placed in charge of the fortifications at Rouse's Point, N. Y.; but was again made a member of the board in 1819, which by the resignations of Gen. Swift and Col. McRee, came to consist of himself and Gen. Bernard only, and the labor of working out the fundamental principles of the system, and of elaborating the projects of defence for our great seaports, thus devolved mainly on these two officers. A series of reports drawn up by this board, mostly from the pen of Totten, exhibit in a masterly manner the principles of sea-coast and harbor defence, and their application to our own country. As soon as the original board of engineers had sufficiently matured the general system of defence, and completed plans for the works first required, its members applied themselves to the duty of construction. In 1825, Totten (a major since 1818, and brevet colonel 1824) took charge of the construction of Fort Adams, Newport harbor, and continued until Dec., 1838. This work, the second in magnitude of the fortifications of the U. S., is one of the best monuments of his genius as a military engineer. Advanced to the grade of lieutenant-colonel in 1828, he conducted (1830–31) a series of experiments on the expansion and contraction of building-stone by natural changes of temperature, and the effect of these variations on cements employed to secure the joints of stone copings; also to ascertain the relative stiffness and strength of various kinds of timber—experiments attended with important practical results. His work on *Hydraulic and Common Mortars* was published in 1838, containing, besides original experiments extending over the period from 1825 to 1838, translations of essays by the best French writers on the subject. Col. Totten was appointed colonel of the corps of engineers and chief engineer Dec. 7, 1838, and took up his residence in Washington. Since 1819, as a member of the board of engineers, Totten had also been engaged in the planning of new works, and at the date of his appointment as chief engineer the system of coast defence had been for about twenty years in progress of construction, during which period most of the important ports and harbors had been at least partially fortified. Called on by Gen. Scott, who reposed in his professional skill the most unbounded confidence, Col. Totten assumed in 1847 the immediate control of the engineering operations of the army destined to invade the Mexican capital, directing in this capacity the siege of Vera Cruz. For his services he was brevetted a brigadier-general Mar. 29, 1847, "for gallant and meritorious conduct at the siege of Vera Cruz." Having thus successfully accomplished the special task for which he had been selected, he left the army and resumed his station at Washington. During the whole time of his chief-engineership he labored indefatigably to bring the ports and harbors along the whole seaboard into a defensible condition. Generally, once in about every two years, he inspected every fort of the U. S., making himself thoroughly familiar with each detail of all the works under charge of his bureau. In addition to the manifold duties of his office, involving the inspection and supervision of the Military Academy, Gen. Totten was an active member of the lighthouse board from its organization in 1852; a regent of the Smithsonian Institution from its establishment in 1846; a corporator of the National Academy of Sciences, created in 1863; one of the harbor commissioners for the cities of New York and Boston; and a member of various scientific associations. In 1815, after careful study, Totten modelled an embrasure for casemated batteries which remained unchanged until 1858, but the casemate continued a subject of study and experiment during most of his life, establishing his right to be considered the author of the American casemate. From 1851 to 1855 he conducted a series of experiments "on the effects of firing with heavy ordnance from casemate embrasures," and also on the effects of firing against the same embrasures with various kinds of missiles. D. at Washington, D. C., Apr. 22, 1864. G. C. SIMMONS.

**Tot'tenville,** p.-v., Westfield tp., Richmond co., N. Y., at the southern extremity of Staten Island. P. 1571.

**Toucan.** See RHAMPHASTIDÆ.

**Tou'cey** (ISAAC), LL.D., b. at Newtown, Conn., Nov. 5, 1796; received a private classical education; was admitted to the Hartford bar 1818; member of Congress 1835–39, attorney-general of Connecticut 1842–44, governor 1846–47, U. S. attorney-general 1848–49, U. S. Senator 1852–57, and secretary of the navy under Pres. Buchanan 1857–61. D. at Hartford July 30, 1869.

**Touch'-Paper** is a loose bibulous paper which is soaked in solution of saltpetre and then dried. It was used in lighting fires with flint and steel, and is sometimes burnt in a room to relieve the paroxysm of asthma.

**Touch, Sense of.** Bell and Magendie established the distinction of motor and sensory bundles of nerves—the anterior and posterior roots—on either side of the spinal cord. Through these, from every part of the body, the ultimate sensory nerves, having received impressions by

their bud-like, tactile ends, return sensations to the spinal axis and to the brain; the nerves of the head communicating directly. The sensory nerves are cognizant of pain, heat and cold, size, shape, roughness, and various physical qualities of special materials and objects. This power is developed to a variable degree upon different surfaces, the tactile sensibility of some, as the finger-tips and tongue, being very acute, other parts being relatively obtuse. The acuteness of touch is due in part to the number and distribution of ultimate nerve-fibres, in part to habitual education of the part. The part which has the most finely-educated touch, the tips of the fingers, may be far less susceptible to pain, to heat and cold, or to tickling. The tactile sensibility of parts is measured by means of needle-points in arms movable upon a graduated bar—the instrument termed the "æsthesiometer." The shortest distance at which the surface appreciates distinct perceptions of the two points is thus recorded. From the experiments of Valentin the following will suffice to illustrate. The unit of measure is a line, one-twelfth of an inch:

| | | |
|---|---|---|
| Tip of tongue | .483 | of a line. |
| Palm of fore finger | .603 | " |
| " " little finger | .733 | " |
| Surface of lip | 1.500 | " |
| " " eyelid | 3.833 | " |
| Skin of cheek | 4.541 | " |
| Forehead | 6.000 | " |
| Back of hand | 6.966 | " |
| Lower part of thigh | 10.208 | " |
| Leg | 13.708 | " |
| Middle of forearm | 17.083 | " |
| " " back | 24.208 | " |

The finger, tongue, toes, and other surfaces may be highly educated. Each artisan in his special line acquires wonderful tactile recognition of the kind and quality of fabrics, minute sizes, shapes, and relative smoothness of surfaces. The blind learn to read the raised alphabet, recognize persons by feeling their features, and manufacture various articles, many of delicate structure. The part, as the region of the trifacial nerve—the face—which is sensitive to pain, but deficient in touch, has its nerves distributed more deeply beneath the superficial tissues. In the sensitive tactile part at the finger-tip the touch-corpuscles, or nerve-termini, are situated near the surface, constituting sensitive papillæ; as many as 108 have been found in one-fiftieth of a square inch. (See nerve-fibres and corpuscles in article HISTOLOGY.)

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Touch'stone,** a piece of black basalt, or, better, of the bituminous jasper called Lydian stone. Small bars of gold, silver, and of various known alloys are prepared, and kept as standards of comparison. The goldsmith makes a streak upon the touchstone with the metal to be tested, and beside it makes other streaks with the bars, which are called *touch-needles.* A rude qualitative analysis is made in this way, the artisan judging of the purity of the gold or silver by the known fineness of that metal which makes the streak nearest like that of the metal tested. The metal thus thinly spread on the stone may be tested with acid, which discolors base metal when present.

**Touch'wood,** or **Spunk.** (1) The dried fungus *Polyporus igniarius,* used in getting fire with flint and steel; also employed as a port-fire. (See AMADOU.) (2) Also, the decayed and crumbling wood of the ash or willow which has undergone dry rot. It is used for the same purposes as the foregoing; and it is remarkable that close examination shows that such wood is always the seat of a growth of fungi much like that referred to above. All the varieties of spunk are much improved by wetting with solution of nitrate or chlorate of potash and then drying. Spunk, although a native product, is also imported to this country from Europe. It is also called *punk.*

**Toughened Glass.** See GLASS, by C. G. LELAND, A. M.

**Toul,** town of France, department of Meurthe-et-Moselle, on the Moselle, is fortified, has a fine cathedral, and manufactures lace, calicoes, tiles, faïence, vinegar. P. 8506.

**Toul'min** (HARRY), son of Joshua, b. at Taunton, England, in 1767; was several years a dissenting minister at Chorobert, Lancashire; settled at Norfolk, Va., 1793; was president of Transylvania College 1794–96; secretary of state of Kentucky 1796–1804; was appointed U. S. district judge of Mississippi 1804; passed his later years in Alabama; assisted in framing the constitution of that State, and served in its legislature. D. in Washington co., Ala., Nov. 11, 1823. Author of *A Description of Kentucky* (1792), *Collection of the Acts of Kentucky* (1802), *Magistrate's Assistant, A Digest of the Territorial Laws of Alabama* (1823), and other publications, and aided James Blair in the preparation of his *Review of the Criminal Law of Kentucky* (1804).

**Toulmin** (JOSHUA), D. D., b. in London, England, May 11, 1740; educated at St. Paul's school and at the dissenting academy of Dr. S. M. Savage; was for some time minister of a dissenting congregation at Colyton, Devonshire; became in 1765 pastor of a Baptist church at Taunton, where he also conducted the business of a bookseller; subsequently adopted Unitarian views; became prominent in their advocacy, and was pastor of Dr. Priestley's former church at Birmingham from 1804 to his death at that place July 23, 1815. Author, among other works, of *Memoirs of Faustus Socinus* (1777), *Dissertations on the Internal Evidences of Christianity* (1785), of biographies of John Biddle (1789), Dr. Priestley (1804), and Rev. Samuel Bourne (1809), and was editor of Rev. Charles Bulkley's posthumous *Notes on the Bible* (3 vols. 1802) and of Daniel Neal's *History of the Puritans* (Bath, 5 vols. 1793–97), with notes and a memoir of the author, and subsequently published as a supplement to that work *An Historical View of the State of the Protestant Dissenters in England under King William* (1814). A volume of his *Posthumous Discourses* (1818) was edited by Theophilus Browne.

**Toulon',** town of France, department of Var, at the head of a narrow but deep inlet of the Mediterranean, from which it rises like an amphitheatre on an acclivity, leaning against a row of lofty hills which encircle the bay. Next to Brest, Toulon is the principal naval station of France, and a fortress of immense strength. It is surrounded by a double bastioned wall, and all the commanding heights in the neighborhood bristle with forts and redoubts. The harbor is double; one part, given up to commerce, is lined with convenient quays; the other, arranged for naval purposes, is surrounded with shipbuilding docks, cannon-foundries, ropewalks, magazines, arsenals, schools, hospitals, barracks, and naval establishments of every description; and this part of the harbor is separated from the roadstead by hollow but bombproof moles lined with batteries. Toulon carries on a considerable trade with Algeria. P. 69,127.

**Toulon,** p.-v. and tp., cap. of Stark co., Ill., on Peoria and Rock Island R. R., has a private bank and 2 weekly newspapers. P. of v. 904; of tp. 2060.

**Toulouse',** city of France, capital of the department of Haute-Garonne, had 124,852 inhabitants in 1872, and is situated in a fertile plain on the Garonne and the Canal du Midi. Although it contains several beautiful and interesting monuments; as a whole, however, it has no architectural interest, the streets being narrow, crooked, and badly paved, the houses built of brick and without any characteristic style. Of the cathedral, dedicated to St. Stephen, the nave dates from the twelfth and thirteenth centuries, the front façade from the fifteenth. The church of St. Sernin is one of the most beautiful Romanesque structures in France, commenced in the eleventh century, completed in the fifteenth, 116 mètres long, 32 mètres broad, and with a tower 64 mètres high. The churches of St. Aubin, St. Nicolas, the Jesuits, etc., are also remarkable. Very interesting are the edifices of the Jacobins from the beginning of the fourteenth century, now the seat of the faculties and the library, and among the other public buildings the Hôtel de Ville, a magnificent building, constructed by Cammas (1750–60), and ornamented with columns and beautiful sculptures; the palais de justice, in front of which stands the bronze statue of Cujas by Valois; the museum, formerly an Augustine monastery, containing a unique collection of objects from the Stone age, and rich collections of paintings and sculptures, among which are 40 marble busts of Roman emperors, found at Calagorris; the public library, with 60,000 volumes and 7000 manuscripts; the Hôtel d'Assezat, a beautiful structure of the sixteenth century; the Maison de Pierre, also of the sixteenth century, heavy, but powerful and original, etc. The Pont Neuf has suffered frequently by the inundations of the Garonne, which have carried off several bridges both above and below; at one end of the Pont Neuf stand the waterworks, which furnish the city daily with 5,000,000 litres of water. Noticeable promenades are the Jardin Royal, the Allée St. Michel, St. Étienne, des Zéphyrs, des Soupirs, and the Grande Allée, all of which connect in the Grand Rond or Boulingrin. Toulouse is the residence of an archbishop, and has seminaries, monasteries, etc., a court for the departments of Haute-Garonne, Tarn, Tarn-et-Garonne, and Ariège, a commercial court, faculties of theology, medicine, and law, many special and general schools, and numerous benevolent institutions. It is also the residence of the commander of the 12th army corps and the 34th division, and has military schools, arsenals, powder-factories, etc. The manufacturing industry is very important, especially in cloth, woollen and cotton fabrics, machinery and agricultural implements, candles, oil, soap, oilcloth, paper, paper-hangings, etc. The commerce is very active, especially in grain (2,000,000 hectolitres annually), wine, marbles from the Pyrenees, wood, etc. Four large fairs for cloth, woollens, and cattle are held annually.

Toulouse was the name of an ancient French family which ruled independently over the city and the country along the Garonne. In 852 the possession was made a dukedom, and for some time it was united to the countship of Auvergne and the dukedom of Aquitaine. In 1208, Pope Innocent III. waged war against Toulouse, conquered the country, and gave it to Simon of Montfort. His successor, pressed hard by the legitimate heirs of Toulouse, transferred his rights to Louis VIII. of France, and a war ensued between this king and Duke Raymond VII. The country was finally incorporated with France by Philip III. AUGUST NIEMANN.

**Touraine′,** an ancient province of France, in the central part of the country, on both sides of the Loire, with Tours for its capital, corresponded nearly to the present department of Indre-et-Loire. It was inhabited by the Turones when Cæsar arrived in Gallia, and was annexed to the French crown in 1203. As most of its inhabitants were Protestants, it suffered very much from the Revocation of the Edict of Nantes.

**Tourcoing′,** town of France, department of North, is a large manufacturing place, where great quantities of wool, cotton, and flax are spun and woven into very various kinds of fabrics; its breweries, distilleries, and sugar-refineries are also important. P. 43,222.

**Tourgee** (ALBION WINEGAR), b. May 2, 1838, at Williamsfield, O.; educated at the University of Rochester, N. Y.; served in the U. S. army in the civil war of 1861–65, and was twice wounded; after the war, settled in the practice of the law at Greensboro', N. C., and at the Southern loyalist convention in Philadelphia, Pa., in 1866, prepared the report on the condition of the Southern States; since 1868 has been judge of the North Carolina superior court. With Messrs. Barringer and Rodman he prepared *A Code of Civil Procedure for North Carolina* (1868).

**Tourlaville′,** town of France, department of Manche, has large stone-quarries in its vicinity, and manufactures glass, mirrors, tiles, and pottery. P. 5824.

**Tourmaline.** See PRECIOUS STONES, by PROF. H. B. CORNWALL, E. M.

**Tour′nament,** or **Tour′ney,** a military pageant of the Middle Ages, in which two armed bands of knights contended in a mock fight for the purpose of exhibiting their strength, skill, and courage, or for the honor of the ladies attending. Strictly a single combat of this kind was called a *joust*, but the distinction is not always apparent. The knights were armed with lance and sword, and depended for defence chiefly upon the strength of their armor, the weapons being used chiefly for offensive purposes. The contestants were usually mounted, and the object of each party was to unhorse as many gentlemen and to break as many spears as possible. From a dangerous and exciting struggle the tournament finally degenerated into a frivolous court pageant, conducted according to a punctilious heraldic formula.

**Tournay′,** an old but very handsome and interesting town of Belgium, province of Hainaut, was fortified by Vauban, and is on the Scheldt, which here is crossed by several elegant bridges, and lined with quays which are planted with trees and afford beautiful promenades. It contains many fine edifices, among which the cathedral is the most remarkable, and important manufactures of carpets, porcelain, hosiery, leather, and liqueurs. P. 31,003.

**Tournefort′, de** (JOSEPH PITTON), b. at Aix, France, June 5, 1656; studied botany and travelled extensively in Southern Europe; was made professor at the Jardin des Plantes in Paris in 1683; went to the Levant with the support of Louis XIV. 1700–02; was appointed professor of medicine at the Collége de France. D. at Paris Nov. 28, 1708. His *Éléments de Botanique* (3 vols., 1694) he translated in 1700 into Latin, *Institutiones Rei Herbariæ*, and this translation was republished with additions by Jussieu in 1719, and translated into English (London, 1719–30). He also wrote *Histoire des Plantes qui paraissent aux Environs de Paris, avec leur Usages dans la Médicine* (1698), enlarged by Jussieu in 1725, and translated into English by Martyn (London, 1732), and *Voyage du Levant* (2 vols., 1717; translated into English, 1741).

**Tour′niquet** [Fr.], an instrument for checking the flow of blood from wounds or during surgical operation by means of pressure applied to the principal artery supplying the blood. A rude but often very useful tourniquet may be made by tying a handkerchief around the wounded limb between the heart and the wound, passing a stick through the handkerchief, and then twisting it till the flow of blood is checked. In the more effective forms a pad is strongly pressed against the main artery by means of a screw.

**Tournus′,** town of France, department of Saône-et-Loire, on the Saone, manufactures potash, beetroot-sugar, leather and cotton goods. In its vicinity are good marble-quarries. P. 5598.

**Tou′ro** (JUDAH), b. at Newport, R. I., June 16, 1775, son of Rev. Isaac, a native of Holland, who in 1762 became rabbi of the Jewish synagogue at Newport; engaged in mercantile business in the counting-house of an uncle, in whose employ he sailed to the Mediterranean as supercargo 1798, on which occasion he was victorious in a desperate conflict with a French privateer; settled in New Orleans as a merchant 1802; served as a volunteer at the battle of New Orleans 1815, where he was severely wounded and permanently injured by a cannon-ball; acquired a large fortune, of which he made a most liberal use, contributing $10,000 to the Bunker Hill Monument Association, giving a valuable building-lot for the erection of the First Congregational church at New Orleans, and bequeathing at his death, which occurred at New Orleans Jan. 18, 1854, most of his property to the public charitable institutions of that city. Among them was the Touro Almshouse, occupied during the civil war as barracks for colored troops, by whom it was burned.

**Tours,** town of France, capital of the government of Indre-et-Loire, on a small strip of land between the Cher and the Loire, which here is crossed by one of the most magnificent bridges in Europe, and lined with handsome quays and finely-planted promenades. It has a magnificent cathedral, several other remarkable edifices, and many good educational institutions. Silk manufactures were first established here by Henry IV., and during Richelieu's time more than 40,000 hands were employed in this branch of industry. But the Revocation of the Edict of Nantes drove the workmen into exile, and gave the city a blow from which it never recovered, though its manufactures of silk stuffs, ribbons, serges, rugs, starch, and wax candles are still extensive. P. 43,368.

**Tourville′, de** (ANNE HILARION DE COTENTIN), COUNT, b. at Tourville, department of La Manche, France, Nov. 24, 1642; was educated for the navy, and made a captain in 1667; distinguished himself in the battle of Astoga, 1676; commanded the vanguard in the battle of Palermo, 1678; made several successful expeditions against the pirates of Northern Africa 1682–88; was created a vice-admiral in 1689; defeated a Dutch-English fleet off the Isle of Wight July 20, 1690, and pursued the English to the mouth of the Thames; attacked, by positive orders of the king, a Dutch-English fleet off La Hogue May 28, 1692, though it was far superior to his own, and retreated safely into port after twelve hours' fight; was made a marshal in 1693, and defeated and destroyed a Dutch-English fleet off Cape St. Vincent May 26, 1693. On the outbreak of the Spanish war of succession he was made commander-in-chief of the naval force in the Mediterranean of the two united powers, but d. in Paris May 28, 1701.

**Tous les Mois,** the starch of the tubers of *Canna edulis*, a marantaceous plant cultivated in Peru, Trinidad, and St. Kitts. It is prepared much as ARROW-ROOT (which see). It is agreeable food for invalids and infants. Other species of canna are probably employed also.

**Toussaint′** (FRANÇOIS DOMINIQUE), surnamed L'OUVERTURE, b. at Breda, near Cape St. François, Hayti, in 1743, of slave parents of pure negro blood, his father, a native African and the son of a chieftain, having been sold by slave-traders to the Count de Noé, on whose estate he was born; was known in his youth as TOUSSAINT BREDA; was favored by the director of the count's estate, M. Bayon de Libertas, who advanced him from the position of coachman to the supervision of the sugar manufactory, affording him also facilities for learning to read and write; was much impressed by reading the denunciations of slavery in the Abbé Raynal's *History of the European Colonies in the East and West Indies;* remained quiet, and apparently contented with his lot, during the slave insurrection and massacres of 1791, though strongly urged by the insurgents to join them; but after securing the escape of his former benefactor, M. Bayon, with his family and personal property, entered the negro army, at first in a medical capacity, having long since enjoyed some note for his knowledge of simple remedies; was soon advanced to the post of brigadier-general; distinguished himself by the capture of an entire army of whites under Brandicourt, the occupation of Dondon, Marmelade, and Gonaives (1795), and the defeat of the French colonel Desfourneaux; rose to be commander-in-chief of the negroes; acted at first in concert with the Spanish forces, and against the English, French, and mulattoes, but ultimately concluded to accept the proposals of the French republic, which offered the abolition of slavery and an integral union with France; succeeded in winning the other negro leaders to his views; joined his forces with those of Laveaux, the French commander, who gave him the rank of general of division; made a vigorous campaign

against the united English and Spanish, capturing twenty-eight Spanish batteries in four days; brought the whole northern division of the island under the control of France; rescued Gen. Laveaux from the mulatto leader Rigaud, who had imprisoned him; closed the campaign by receiving from the English the surrender of all their strongholds; was appointed commander-in-chief of the entire island by Southonax, the commissioner of the Directory, 1796; came into conflict in 1797 with Hédouville, the new French commissioner, who incited the mulatto leader Rigaud to an insurrection, which was only suppressed after a year's hard fighting between the blacks and the mixed race; arrested, imprisoned, and sent to France Roume, the new French commissioner, for having countenanced the slave-trade; assumed the civil government in the name of the French Directory Nov. 26, 1800; took possession of the eastern part of the island, previously under the control of Spain, Jan., 1801, thereby becoming ruler of the whole island; administered the government with considerable skill and success, restoring prosperity and security to the island; assumed great state, surrounding himself with a large bodyguard in brilliant uniforms; created a council of state consisting of eight white proprietors and one mulatto, by which body free trade was proclaimed, a constitution was drawn up, and the presidency for life conferred upon him. Toussaint sent this constitution, with a respectful letter dated July 16, 1801, to Bonaparte, then first consul, on receipt of which the latter, finding himself temporarily at peace in Europe, determined to give employment in Hayti to a large body of his officers, procured a decree of the French council "restoring the French colonies to their condition previous to 1789"—*i. e.* re-establishing slavery, from the effect of which decree Hayti was, by a subsequent decree of Bonaparte, excepted, but only temporarily; and in Nov., 1801, Bonaparte despatched his brother-in-law, Leclerc, with 66 vessels of war and 30,000 veterans, who arrived on the coast of Hayti Jan., 1802, and were accompanied by the renegade Haytiens Rigaud, Pétion, and Boyer. Toussaint responded to the menace by a proclamation dated Dec. 18, 1801, in which he professed loyalty to France, but manifested his intention to resist the invasion; rejected the advances made him by Leclerc, by whom he was declared an outlaw, Feb. 17, 1802; was deserted by his generals Christophe and Dessalines, but nevertheless maintained for some months a desperate resistance in the mountain fastnesses; was at length induced to surrender by assurances of personal immunity and a guaranty of the liberty of the negroes, given by Leclerc in a personal interview, and resided some weeks undisturbed on his plantation near Ennery, when, through a treacherous plot on the part of a French general, Brunet (probably instigated by Leclerc), he was summoned for a conference at Gonaives, seized, and placed at midnight with his family on board a French frigate, carried to France, kept a short time a prisoner at the Temple without trial, his requests for an interview with Bonaparte being refused and his family being not allowed to see him; was afterward transferred to the castle of Joux, department of Doubs, where he soon fell a victim to ill-treatment, intense cold, and insufficient food, and was found dead Apr. 27, 1803. Biographies of Toussaint have been written by James Stephen (1814), St. Rémy (1850), by Rev. John R. Beard, D. D. (London, 1853), and by Mrs. Hannah F. Lee (1853), and his career forms the subject of Harriet Martineau's novel *The Hour and the Man* (1840, 1843, 1853), and of a lecture by Wendell Phillips. PORTER C. BLISS.

**Towamen'sing,** tp., Montgomery co., Pa. P. 1209.

**Towan'da,** p.-v. and tp., McLean co., Ill., on the Chicago and Alton R. R. P. 1235.

**Towanda,** p.-v. and tp., Butler co., Kan. P. 597.

**Towanda,** p.-b. and tp., cap. of Bradford co., Pa., on Pennsylvania and New York R. R. and Susquehanna River, contains 5 churches, a collegiate institute, 2 national banks, 4 newspapers, large mills and shops, and ironworks; butter is the principal product of the county. P. of b. 916; of tp. 2696. E. A. PARSONS, ED. "BRADFORD ARGUS."

**Tow'er** (DAVID BATES), b. in Massachusetts in 1808; graduated at Middlebury College 1828; became a highly-successful teacher; was principal of the institution for the blind at Philadelphia 1839–41, and for some years professor of mathematics in the City University at St. Louis, Mo., and afterward principal of the Park Latin School, Boston, Mass. Author of a series of *Gradual Readers, Lessons in Arithmetic,* grammars, speakers, etc., of which the annual sale has been counted by hundreds of thousands. D. at Cambridge, Mass., July, 1868.

**Tower** (ZEALOUS BATES), b. at Cohasset, Mass.; was graduated from the U. S. Military Academy at the head of his class, and appointed a second lieutenant in the corps of engineers July 1, 1841. After a brief service as assistant with the board of engineers, he was recalled to West Point Aug., 1842, serving as assistant professor until Apr., 1843, and as principal assistant professor of engineering Apr.–Aug., 1843, when, returning to duty with his corps, he served as assistant engineer in the construction of the defences of Hampton Roads, Va., until 1846, in which year he accompanied Gen. Scott's army to Mexico, and was engaged at the siege of Vera Cruz and subsequent operations resulting in the capture of the City of Mexico. For gallantry at Cerro Gordo he was brevetted first lieutenant, captain for Contreras, where he led the storming column, and Churubusco, and major for Chapultepec, where wounded. From 1848 to 1853 he was engaged in the construction of fortifications at Portland, Me., and Portsmouth, N. H.; of the defences of San Francisco, Cal., 1853–58, during which latter period he also built in that city the custom-house and appraisers' store, and served as member of the board of engineers for the Pacific coast. In Feb., 1861, he proceeded to Fort Pickens, which work he placed in an efficient state of defence, and as chief engineer remained there until May, 1862, being brevetted lieutenant-colonel for gallant services, and appointed brigadier-general of volunteers from Nov. 23, 1861, the date of its bombardment. Transferred to the East in May, and assigned to command of a brigade in the Army of Virginia, he was engaged in the battle of Cedar Mountain, Aug. 9, and subsequent operations during Pope's campaign in Northern Virginia, including the actions at Rappahannock Station, Aug. 21, and Thoroughfare Gap, Aug. 28, and battle of Manassas, Aug. 30, where severely wounded and disabled until June, 1864. For gallantry at Cedar Mountain he was brevetted colonel, and the brevet of brigadier-general was conferred on him for Manassas. From July 8 to Sept. 8, 1864, he was superintendent of the U. S. Military Academy. Upon Gen. Thomas being assigned to the defence of Tennessee in Sept., 1864, Tower was appointed chief engineer of the defences of Nashville, which city he thoroughly fortified; was engaged in the battle of Nashville, Dec. 15–16, 1864; and from Oct., 1864, was inspector-general of the fortifications of the military division of the Mississippi, in addition to his duties as chief engineer at Nashville. Chief engineer of the military division of the Tennessee, July, 1865–Jan., 1866, during which time was also president of the board of appraisers of the extensive railroad property in that division. For gallant services during the war he was brevetted major-general Mar. 13, 1865. Returning to duty with his corps in Jan., 1866, in which he had attained the rank of lieutenant-colonel Nov., 1865, he was a member of various engineer and special boards, and during 1866–67 had charge of the construction of the defences of Portsmouth, N. H. In May, 1867, was appointed a member of the board of engineers for permanent fortifications and river and harbor obstructions. Became colonel of engineers Jan., 1874.

**Tower City,** p.-v., Schuylkill co., Pa. P. 358.

**Tower Hill,** p.-v. and tp., Shelby co., Ill. P. 1176.

**Tower of London.** See APPENDIX.

**Tow'ers** (JOSEPH), LL.D., b. in Southwark, England, in 1737; was for some time a printer and bookseller; became a dissenting minister at Highgate 1774, and at Newington Green 1778; was reckoned an Arian, and was closely connected with the Unitarians, though not a member of that body. D. May 20, 1799. Author of *A Review of the Genuine Doctrines of Christianity* (1763), *British Biography* (7 vols., 1766–72), *A Vindication of the Political Opinions of Mr. Locke* (1782), *Memoirs of Frederick the Great* (2 vols., 1788), *Tracts on Political and other Subjects* (3 vols., 1796), etc., and was a leading contributor to Dr. Andrew Kippis's *Biographia Britannica* (2d ed.).

**Towers, Round.** See ROUND TOWERS.

**Towhee.** See CHEWINK.

**Towian'ski,** b. in Lithuania about 1800; studied at Wilna, and made himself conspicuous early in life by his mystical enthusiasm and pretensions of receiving divine revelations. After wandering around in Europe, he came to Paris about 1841, obtained complete control of Mickiewicz, formed a sect which accepted him as a Messiah, but was expelled in 1842, and disappeared soon after altogether.

**Towle** (GEORGE MAKEPEACE), b. at Washington, D. C., in 1840; graduated at Yale College 1861, at Harvard Law School 1863; practised law in Boston 1863–66; U. S. consul at Nantes, France, 1866–68, and at Bradford, England, 1868–70, and managing editor of the Boston *Commercial Bulletin* 1870–71. Author of *Glimpses of History* (1865), *Henry the Fifth, King of England* (New York, 1866), *American Society* (Lond., 2 vols., 1870), and other works, and a contributor to English and American periodicals.

**Town** [Old English *tun,* from *tynan,* to "enclose"], a term which has several quite different significations. It is

often employed both in England and the U. S., in familiar language, as a synonym of any city, great or small, as in the expression "out of town," but more especially as a vague term nearly synonymous with "small city" in alluding to foreign countries. In England it technically denoted a municipality created by royal charter or possessing immemorial privileges. In the U. S., besides the vague meaning of the word, it has a more precise meaning as a subdivision of a county, without reference to its population, so that there are many townships entirely uninhabited. The political status of the township varies largely according to locality. In the New England States the township is the original political entity, and possesses large faculties of self-government, while the county is but an aggregation of towns, chiefly for judicial convenience. In the Middle and Western States the township enjoys considerable powers of self-government, but is subordinated in many things to the county, and in the Southern States generally the township has no separate powers whatever, being merely a geographical subdivision of the county.

**Town,** tp., Sanford co., Ala. P. 1078.

**Town,** tp., Raleigh co., West Va. P. 811.

**Town** (Salem), LL.D., b. at Belchertown, Mass., Mar. 5, 1779; was for forty years a teacher in the State of New York; was at one time elected to the New York senate, and resided many years in Aurora. D. at Greencastle, Ind., Feb. 24, 1864. Author of *A System of Speculative Masonry* (New York, 1822), *An Analysis of the Derivative Words of the English Language* (1830), of a *Speller and Definer*, etc., and with Nelson M. Holbrook, of a *Series of School Readers*, of which millions of copies were sold.

**Town Creek,** tp., Elmore co., Ala. P. 411.

**Town Creek,** tp., Brunswick co., N. C. P. 1780.

**Town'ley** (Charles), b. at Townley Hall, Lancashire, England, Oct. 1, 1737, of a Roman Catholic family; received his education on the Continent under the tutorship of the celebrated John Turberville Needham; resided at Rome 1765–72, engaged in the study of antiquities, and enjoying in that pursuit the advice and experience of Winckelmann and other celebrated archæologists; devoted his large fortune to the formation of a magnificent collection of ancient art, which he subsequently largely increased through his agents and by the purchase of the Nollekens collection, and arranged his museum in two houses which he purchased in Park street, Westminster, where he d. Jan. 3, 1805. The "Townley Marbles" were purchased by the nation for £20,000, and in 1814 his bronzes, coins, and gems were also acquired for £8200. They now form part of the Græco-Roman collection in the British Museum, of which institution Mr. Townley had been a trustee. Author of *Antiquities discovered at Ribchester* (London, folio, 1800).

**Towns,** county of N. E. Georgia, bordering on North Carolina, and drained by the head-waters of the Hiawassee River; surface hilly, soil moderately fertile. Staples, Indian corn, oats, wheat, and rye. Cap. Hiawassee. Area, about 250 sq. m. P. 2780.

**Towns** (George W. B.), b. in that part of Wilkes co., Ga., now embraced within the county of Taliaferro, May 4, 1802. Ill health in youth prevented him from receiving a collegiate education; began life as a merchant, but afterward studied law and moved to Alabama, where he was admitted to the bar in 1824, and for a time editor of a political newspaper; in 1826 returned to Georgia and settled in Talbot co., where he pursued his profession; served for several years in both branches of the legislature, and was a member of Congress from 1835 to 1839; was re-elected and served from 1845 to 1847. In the latter year he was elected governor of Georgia for two years, and re-elected in 1849. The most marked event in his administration was the calling of the sovereign State convention in 1850 to consider what action Georgia would take in reference to the admission of California into the Union, in conformity with an act of the legislature in 1849–50. California was admitted by act of Congress Sept. 7, 1850, as one of the series of the measures known as the adjustment of the slavery questions of that year. Soon after the passage of these measures, Messrs. Cobb, Toombs, Stephens, and others of the Georgia delegation addressed Gov. Towns, urging him not to call the convention, as they thought the admission of California was proper under the circumstances. He, however, called the convention, which assembled in 1850. A most exciting canvass took place in the election of delegates to that convention, in which the most distinguished defenders of the action of Congress were Messrs. Cobb, Toombs, and Stephens. An overwhelming majority was returned in favor of sustaining the action of Congress. Hon. Charles J. Jenkins was chairman of the committee to whom the subject-matter was referred; Messrs. Toombs and Stephens, members of the convention, were on the committee, the result of which was the presentation and adoption of what has ever since been known as the "Georgia Platform" of 1850, in which the admission of California was sustained, and all the other adjustment measures were accepted as a final settlement of the questions involved. Gov. Towns was a man of great equanimity of temper and amenity of manners, combined with generosity and magnanimity. D. at Macon, Ga., July 15, 1854. Alexander H. Stephens.

**Town'send,** p.-v., Newcastle co., Del.

**Townsend,** p.-v. and tp., Middlesex co., Mass., has a national bank. P. 1962.

**Townsend,** tp., Huron co., O. P. 1300.

**Townsend,** p.-v. and tp., Sandusky co., O., on Sandusky and Cleveland R. R. P. 1290.

**Townsend** (Edward Davis), b. at Boston Aug. 22, 1817. His father (David S. T.) served in the war of 1812, losing a leg on the Niagara frontier. His paternal grandfather was a surgeon in the army of the Revolution, his maternal grandfather being Elbridge Gerry, one of the signers of the Declaration of Independence. Townsend was educated at the Public Latin School in Boston, and entered Harvard University in 1832, but receiving a cadet's appointment at West Point the next year, abandoned the collegiate course and entered the U. S. Military Academy, graduating in 1837, when appointed second lieutenant of the 2d Artillery, of which he was for eight years adjutant, serving in Florida and the Cherokee country. Made captain in the adjutant-general's department in 1846, he served as assistant adjutant-general of the military division of the Pacific four years; as chief of staff to Lieutenant-General Winfield Scott in 1861, and on his retirement was attached to the adjutant-general's office, war department, of which (Mar., 1863) he was placed in charge; was assigned to the charge of arrangements for rehoisting the U. S. flag over the ruins of Fort Sumter, Apr., 1865; promoted adjutant-general, with rank of brigadier-general, Feb. 22, 1869; brevet major-general Mar. 13, 1865.

**Townsend** (Eliza), b. in Boston, Mass, in 1789; was an anonymous contributor of well-written poems to the *Monthly Anthology*, the *Unitarian Miscellany*, the *Port Folio*, and other periodicals, specimens of which have been included in all the manuals of American literature. D. at Boston Jan. 12, 1854. A collection of her best poems was privately printed in 1856 by her sister, Mary P. Townsend (d. 1861). (See Griswold's *Female Poets of America*, and an obituary notice by Rev. Dr. Convers Francis in Boston *Advertiser* 1854.)

**Townsend** (Franklin). See Appendix.

**Townsend** (George Alfred), b. at Georgetown, Del., in 1841; graduated at the Philadelphia High School 1859; became news editor of the Philadelphia *Inquirer*, and subsequently city editor of the *Press;* in 1862 war-correspondent of the New York *Herald*, in which he reported the Peninsular campaign; visited England and France; wrote for several London periodicals; returned to the U. S. early in 1865; war-correspondent of the New York *World*, for which he narrated over his own signature the incidents of the close of the war, the assassination of Pres. Lincoln, and the disbandment of the great armies, on which subjects he lectured with great success; travelled again in Europe 1866–67; described in correspondence with American papers the Austro-Prussian war of 1866 and the Paris Exposition of 1867; reported in 1867 the impeachment of Pres. Johnson for six newspapers, and was for several years from 1868 on the staff of the Chicago *Tribune* as editorial writer and correspondent. Several volumes of his newspaper correspondence have been published; he has also written a volume of poems and a novel entitled *Lost Abroad*.

**Townsend** (George Herbert), b. in England about 1835; received a good education; became a prominent London journalist in the interest of the Conservative party; compiled several volumes of anecdotes and essays; edited Fielding's *Tom Jones* and Smollett's *Roderick Random;* published an epitome of Russell's *Modern Europe* and *Summary of Persian History, The Handbook of the Year 1868*, and *The Manual of Dates, a Dictionary of Reference* (1862; 3d ed. 1870), and supervised the 7th ed. of *Men of the Time* (1868). Disappointed in his hopes of political advancement by the downfall of the Disraeli ministry in Dec., 1868, he committed suicide at Kensington Feb. 23, 1869. He left ready for the press *The Every-Day Book of Modern Literature, a Series of Short Readings from the Best Authors*, which was published in 1870.

**Townsend** (John K.), b. in Philadelphia, Pa., in 1809; devoted himself to natural history; made extensive journeys in the Western States and across the Rocky Mountains (1833–37) in company with Thomas Nuttall; visited the Sandwich Islands and South America, and was a contributor to the *Journal* of the Philadelphia Academy of

Natural Sciences. D. in 1861. Author of *A Narrative of a Journey across the Rocky Mountains to the Columbia River, etc.* (Philadelphia and Boston, 1839), which appeared in England under the title *Sporting Excursions in the Rocky Mountains* (London, 2 vols. 1840), and published in 1839 the first part of *The Ornithology of the U. S.*, a work which was not continued.

**Townsend** (Luther Tracy), D. D., b. at Oreno, Penobscot co., Me., Sept. 27, 1838; graduated at Dartmouth College in 1859; studied theology at Andover, where he graduated in 1862; adjutant in the army in 1863–64, and subsequently professor of practical theology in Boston University, a position which he still occupies. He has published—*True and Pretended Christianity, Credo, Sword and Garment, God-Man, The Arena and the Throne, Lost For Ever, Outlines of Theology*, and *The Chinese Problem*.

**Towns'hend,** p.-v. and tp., Windham co., Vt. P. 1171.

**Town'shend** (Charles), second Viscount Townshend, b. at Rainham, England, Mar. 10, 1674; succeeded to the peerage on the death of his father Horatio, the first viscount, Dec., 1687; took his seat as a Whig in the House of Peers 1695; was successively appointed lord lieutenant for the county of Norfolk, commissioner for treating of a union with Scotland 1706, captain of the Yeomen of Queen Anne's guard 1707, privy-councillor and joint-plenipotentiary with Marlborough (1709) at the conferences of Gertruydenburg for negotiating a peace with France, and ambassador to the states-general of Holland 1709–10; signed the "Barrier treaty" at the Hague Oct. 29, 1709; resigned his embassy and returned to England on the fall of the Whig ministry 1712, when he was dismissed from his captaincy; was censured by the House of Commons for having signed the Barrier treaty, and declared by vote of the same House an enemy to the queen and kingdom; entered into correspondence with the elector of Hanover, who on his accession to the throne of England made him secretary of state and prime minister Sept. 14, 1714; resigned that post, and was appointed lord lieutenant of Ireland 1717, but never took possession of that office; became president of the council June, 1720, and was again secretary of state from Feb. 10, 1721, to May 15, 1730, when he retired on account of differences with his brother-in-law and colleague, Sir Robert Walpole. D. at Rainham, Norfolk, June 21, 1738.

**Townshend** (Charles), grandson of the second viscount, b. in England Aug. 29, 1725; entered the House of Commons 1747 as a supporter of the Pelham administration; was appointed a commissioner of trade and plantations 1749, and a commissioner for executing the office of lord high admiral 1751; acquired prominence by an eloquent speech on the Marriage bill 1753; became a lord of the admiralty 1754, treasurer of the chamber and member of the privy council 1756; was secretary at war from Mar. 24, 1761, to Feb., 1763; became first lord of trade and plantations Feb., 1763, paymaster of the forces June 8, 1765, chancellor of the exchequer and lord of the treasury Aug. 2, 1766; supported Grenville's Stamp act 1765; introduced the celebrated resolutions for taxing the American colonies June 2, 1767, and having been virtually prime minister during the retirement of Pitt, was about to be entrusted with the formation of a ministry when he suddenly d. Sept. 4, 1767. For the instability of his political opinions he was commonly known as the "Weathercock," but had an immense parliamentary reputation for oratory, was a witty and genial companion, and was styled by Burke "the delight and ornament of the House of Commons, and the charm of every private society which he honored with his presence." He married the daughter and heiress of the second duke of Argyll and widow of the earl of Dalkeith; entrusted the education of his step-son, the youthful duke of Buccleuch, to the celebrated Adam Smith, and procured for his wife a peerage in her own right. His character has been largely discussed by Macaulay and by historians of the American war, especially Bancroft (vol. iv. new ed. 1876), and has been made the subject of a special biography, *Charles Townshend, Wit and Statesman* (1866), by Percy Fitzgerald.

**Townshend** (Chauncy Hare), b. in England in 1798; educated at Eton; graduated at Trinity Hall, Cambridge, 1821; took orders in the Church of England, but from ill-health never engaged in active professional life. Possessing an ample fortune, he devoted himself to poetry, literature, and art; was an accomplished musician; had considerable skill in drawing and painting; formed valuable collections of pictures and other objects of art; gave much time to the investigation of mesmerism, in which he was a firm believer, and spent much of his life at his villa of Monloisir at Lausanne, Switzerland. Early in life he obtained the friendship of Southey, whom he visited, by invitation, at Greta Hall, and was encouraged to publish his poems; and subsequently was much esteemed by a select circle of literary friends, chief of whom was Charles Dickens. D. at Park Lane, London, Feb. 25, 1868. By his will he bequeathed most of his art-collections to the South Kensington Museum, and left a sum of money and the care of his MSS. to Mr. Dickens, requesting him to publish such extracts as would illustrate his religious views, which, though liberal, were peculiar, and were believed by him to be "conducive to the happiness of mankind." Mr. Dickens accordingly issued in Dec., 1869, *The Religious Opinions of the Rev. Chauncy Townshend, published, as directed by his will, by his Literary Executor.* Mr. Townshend gained the Cambridge University prize for English verse 1828, and was author of *Poems* (1821), *A Descriptive Tour in Scotland* (1840), *Facts in Mesmerism* (1840; New York, 1841), *Mesmerism Proved True* (1854), *Sermons in Sonnets, with other Poems* (1851), and *The Three Gates, in Verse* (1851; 2d ed. 1861).

**Townshend** (George), first Marquis Townshend, eldest son of the third viscount, b. in Norfolk, England, Feb. 28, 1724; entered the British army at an early age; distinguished himself at the battles of Dettingen, Fontenoy, Culloden, and Lafeldt; entered Parliament 1747; took part as brigadier-general in Wolfe's expedition to Canada 1759; succeeded that officer in the command on his death; received the capitulation of Quebec Sept. 18, 1759; contributed to the victory of the allied forces at Fellinghausen 1761; served in Portugal 1762; succeeded to the peerage on the death of his father Mar. 12, 1764; became a privy councillor; was lord lieutenant of Ireland from Aug. 12, 1767, to 1772; became master-general of the ordnance Oct. 17, 1772; was created earl of Leicester 1784, and Marquis Townshend Oct. 27, 1787. D. Sept. 14, 1807. He was an elder brother of the Charles Townshend, author of the legislation for taxing the American colonies.

**Towns'ville,** tp., Granville co., N. C. P. 2187.

**Townsville,** p.-b., Crawford co., Pa. P. 280.

**Township.** See Town; and Surveying, by Prof. W. G. Peck, LL.D.

**Tow'son** (John Thomas), b. at Devonport, England, in 1804, son of a maker of chronometers and watches, to whose business he was trained, but early devoted himself to science; was the first person to note the fact that the luminous and chemical foci are not of the same length—a discovery which enabled Dr. J. W. Draper of New York to take the first photograph from life; was also the inventor of the process of taking photographs on glass, and the first to use in photography the reflecting camera; devoted himself in 1846 to the determination of the quickest routes across the ocean to distant countries; constructed a set of tables to facilitate great-circle sailing and for the reduction of ex-meridian altitudes, invented and brought into practice methods of composite and windward great-circle sailing; presented the copyrights of his tables to the admiralty, which caused them to be printed for the use of all mariners; received a testimonial of £1000 from the shipowners of Liverpool Jan. 9, 1857; has been since 1850 scientific examiner of masters and mates at the port of Liverpool; aided Dr. Scoresby at the meeting of the British Association in 1854 in securing the scientific investigation of the deviation of the compass on board iron ships, and prepared for the board of trade a manual published by it under the title *Practical Information on the Deviation of the Compass, for the Use of Masters and Mates of Iron Ships* (1863; 2d ed. 1875), which, as well as his other works, has been translated into several foreign languages.

**Towson** (Nathan), b. near Baltimore, Md., Jan. 22, 1784; was captain of a volunteer company of artillery and adjutant of the 7th Maryland regiment at the outbreak of the war of 1812, when he was appointed captain of the 2d U. S. Artillery (Mar., 1812); aided in the capture of the British brig Caledonia under the guns of Fort Erie Oct. 9; was engaged in the actions of Queenstown and Stony Creek, and in the capture and defence of Fort George, on which latter occasion (July 17, 1813) he was wounded; took part as commander of a battery in Scott's brigade in the capture of Fort Erie July 4, 1814; bore a prominent part in the battles of Chippewa (July 5) and Niagara (July 25), the latter being the hardest fought of the war; rendered valuable service in the defence of Fort Erie Aug. 15; brevetted major and lieutenant-colonel in May, 1816; paymaster-general 1819; brevetted brigadier-general 1834; served in the Mexican war, and brevetted major-general in Mar., 1849. D. at Washington, D. C., July 20, 1854.

**Tow'sontown,** p.-v., cap. of Baltimore co., Md., on Baltimore and Yorktown turnpike road, 7 miles N. of Baltimore, with which it is connected by a horse railway, contains 3 churches, excellent schools, 3 newspapers, 4 hotels, a money-order post-office, and court-house. The

Maryland and Pennsylvania R. R. is graded through the village. P. about 1000.

KEECH AND YELLOTT, EDS. "BALTIMORE CO. HERALD."

**Toxicodendron.** See SUMACH.

**Toxicol'ogy** [Gr. τοξικόν, "poison," and λόγος, "discourse"], the science of poisons. It embraces the nature and properties of poisons, their effects upon the animal system, including symptomatology, pathology, and treatment, their detection, and the medico-legal questions connected with poisoning.

*Definition of a Poison.*—A poison is a substance *capable* of producing seriously noxious or fatal effects upon the ordinary healthy organism otherwise than by mere mechanical action. Such substances are very numerous, and occur in all the three kingdoms, animal, vegetable, and mineral.

*Modes of Poisonous Action.*—The poisonous action may be simple or complex, but may be broadly stated as occurring in one or more of these three modes: I. By *direct local corrosion or irritation* of the alimentary canal. Here, if the poison be corrosive, death may result in a few hours from the shock of the injury; otherwise, it follows later from violent inflammation of the stomach and bowels. The symptoms come on speedily—with corrosive agents immediately, and with simple irritants within half an hour or so. They are in general an intense burning pain in the abdomen, with speedy and violent vomiting, purging, and cramps, the matters discharged being often bloody. Where the agent is corrosive, there are also an acrid burning taste in the act of swallowing and burning pain in the mouth and gullet, as well as in the abdomen. If the poison be *simply* corrosive or irritant, there are primarily no nervous symptoms proper, such as stupor, delirium, or paralysis. II. By a *general devitalizing action* upon some or all of the solids and fluids of the body, manifested after absorption of the poison into the blood. What the exact nature of the changes produced in such cases may be is generally unknown, but familiar examples of such general poisoning, as it may not inappropriately be called, are afforded by the action of prussic acid, phosphorus, and mercury. The symptoms vary so widely with the different poisons which act after this manner that no general description can be given. So, too, the period when death occurs may range from a few seconds, as with prussic acid, to many months, as in slow poisoning by mercury. III. By *specific disturbance of function* in some vital part or parts of the nervous or muscular apparatus. This most singular of all modes of poisoning takes place only after absorption of the poison into the blood, and is generally unattended by any recognizable physical or chemical change in the tissues of the affected part. Almost all the poisons which act purely or principally after this manner are of organic origin, and prominent among them are the poisonous *vegetable alkaloids*, such as morphine, strychnine, and the active principles of belladonna, aconite, hemlock, foxglove, etc. The fatal result in these cases is generally by direct interference with the function of the heart or respiratory organs; but again, the symptoms and fatal period vary so widely with different poisons that no general account is possible. But while these are in a general way the three modes by which noxious substances prove poisonous, it is most important to bear in mind that with a large proportion of poisons the action is highly complex, as where a substance like arsenic is both locally intensely irritant and also specifically poisonous after absorption into the circulation.

*Career of the Poison in the System.*—Poisons can enter the system through the surfaces of wounds or by inoculation, by the lungs (in case of gaseous or volatile poisons), by the stomach and bowels, and in some cases by the unbroken skin. These several avenues are named in the order of their absorptive power. With simple irritant and corrosive poisons, like the caustic acids and alkalies, which are taken by swallowing, the bulk of the poison goes no farther than the walls of the alimentary canal, and the whole story is one of local action. But with all other kinds of poisons some of the substance enters the blood, and then either at once begins and continues to be eliminated therefrom, under its own form, by the usual emunctories (principally the kidneys), or it first undergoes more or less chemical transformation, by which in some cases its poisonous property is destroyed (as with alcohol), or it is for a longer or shorter period temporarily fixed in the tissues, whence it is gradually reabsorbed into the blood and eliminated. The first two are the most usual modes of disposition, the last being mainly confined to certain mineral poisons, as mercury, lead, and silver.

*Circumstances modifying the Effects of Poisons.*—These are so numerous, so complex, and so potent that, especially with poisons which act only after absorption, it is impossible to predict in any case, even with a given dose of a given poison, how severe will be the effect, or at what period the symptoms will begin or cease, or death take place. Individual susceptibility, age, sex, state of health, and habitual indulgence are all important factors in determining the effect of a given poisonous dose. But the most powerfully disturbing circumstances are connected with the absorption and elimination of the poison. In general, with *absorbed* poisons, it is *only that which is taken into the circulation* that does the mischief; and again, for poisoning to occur, there must in such case be a certain percentage of the substance, differing with different poisons, actually present in the blood at some one time. Hence, a vital factor in the determining of poisonous effects is the comparative rate at which absorption on the one hand and elimination or chemical transformation on the other respectively occur. Where the substance is taken into the blood faster than it can be gotten rid of, it necessarily accumulates in the circulation, and more or less poisoning results. But if the reverse obtain, and the poison is disposed of as fast as it gains entrance, there may be no poisoning at all, even though a large dose may be passed through the system within twenty-four hours. Hence, the *avenue of introduction* often profoundly modifies the result, since different surfaces, as already hinted, absorb with different degrees of speed and certainty. And in this way it even happens that poisons like the South American arrow-poison, *curare* or *woorara*, the venom of snakes, of rabid animals, and of morbid animal fluids, which are deadly when applied to the highly-absorptive surface of a flesh wound, are harmless when swallowed. Again, where poisons are taken into the stomach, there are many circumstances which may greatly interfere with absorption, and thus prevent poisoning. These are prompt rejection of the poison by vomiting; the presence of masses of food or of substances which may chemically act on the poison; turgidity of the gastric blood-vessels, or a morbid condition of the system or of the stomach itself. The physical state of the poisonous substance also affects its absorption, the latter being far quicker and more certain with fluids or matters in solution than with solids. From all this it follows that there is no such thing as an absolute poisonous or fatal dose of any given poison. A teaspoonful of laudanum has often killed, while, on the other hand, from thirty to forty times that quantity has been repeatedly taken and recovered from.

*Diagnosis of Poisoning.*—This must be made by taking the sum of the evidence of all kinds. And while the mere *fact* of poisoning is generally easy, yet even this may sometimes be difficult to establish, especially with the certainty required to convict in a case of criminal accusation. A thorough discussion of this intricate subject in all its medico-legal relations is obviously impossible within the limits of this essay, but the following are the essential points to be borne in mind. In the first place, the diagnosis of poisoning cannot be made with *infallible* certainty from the symptoms alone, for there are no symptoms *absolutely* pathognomonic of any single poison. Neither does the mere fact, taken by itself, of the presence of a poisonous substance in the stomach, the excreta, or even the tissues of the dead body, necessarily prove that the illness or death was occasioned by the poison. On the other hand, neither does the circumstance of absence of characteristic symptoms or lesions, or of failure to detect the presence of poison, prove that the case is *not* one of poisoning. Presumptive evidence of poisoning, more or less convincing, is afforded by the following circumstances: (1) Sudden onset of the symptoms in a previously healthy individual, especially shortly after taking food, drink, or medicine. Still stronger is the presumption where several persons, so partaking, are similarly and simultaneously attacked. (2) Correspondence of the symptoms with those known to be produced by some poison. (3) Finding of a poison in the stomach, excreta, or tissues of the dead body. Proof of the existence of a poison may be obtained by chemical tests, physiological experimenting upon animals with the suspected matters, etc. But as regards chemical testing, which is very properly regarded as the means of getting most certain proof, it is important to know that in a body dead from poisoning chemistry may for many reasons utterly fail to detect any traces of the poison. This, because for some poisons no test has yet been found, and with others because the poison may have wholly disappeared by reason of volatility, or by being vomited, excreted, or decomposed during life, before the analysis is begun, to such an extent as to be no longer within the power of chemical means to detect. Hence in judicial cases it is not always necessary to demonstrate, quantitatively, a fatal dose within the person of the poisoned individual. (4) Outside corroborative circumstances. These are of course endlessly varied in character and weight. Examples are the finding of charred clothing and corrosion of the lips in a case of suspected sulphuric acid poisoning; proof of possession of the suspected poison by the adminis-

trator; finding of motive for the poisoning; proof of administration by direct or circumstantial evidence. From the more or less perfect chain afforded thus by the evidence from the symptoms, the results of analysis, and corroborative circumstances, the diagnosis of poisoning is made with greater or less certainty.

*Treatment of Poisoning.*—The aim here is to prevent absorption or local injury by combined attempts at bodily removal of the poison and chemical neutralization of its poisonous property, and then to combat the effects by general medical means. With inoculated poisons, as in bites from venomous reptiles or rabid animals, the part should be *instantly* washed, and then thoroughly sucked either by the mouth or a cupping-glass. At the same time, where practicable, a ligature should be tied tightly around the limb near the wound and between it and the heart. Then in dangerous cases the wound should be thoroughly cauterized with a red-hot iron, or caustic potassa, nitric or hydrochloric acid, etc. Silver nitrate (lunar caustic) is not a reliable agent for this purpose, as its action is very superficial. In the use of the more powerful caustics care must be taken not to injure any large artery or important organ. Where the poison is swallowed, the stomach should be evacuated with the least possible delay, and if there be one, the antidote to the poison should be immediately given. For emptying the stomach the means are emetics and the stomach-pump, but sometimes the poison itself excites such immediate and prolonged vomiting that the use of these agents is unnecessary. But generally, even if there have been some vomiting, a further thorough emptying of the stomach should be procured, and this even if the case be first seen long after the taking of the poison. For, as with opium, absorption is often so gradual that much of the poison may still be present in the stomach, unabsorbed, even many hours after administration. Of emetics, the best is the chloride of apomorphia, because it is prompt, thorough, unirritating, and, most important of all, because it will act if only put under the skin. One-fifteenth of a grain in solution in a little water should be injected under the skin by the hypodermic syringe, or double the quantity given by the mouth. Next in efficiency come the following: *cupric sulphate* (blue vitriol), given by the mouth in solution, in the dose of two or three grains, repeated if necessary; *zinc sulphate* (white vitriol), similarly given, dose from fifteen to twenty grains; common *ground mustard*, a dessert-spoonful diffused through a tumblerful of water; powdered *alum*, a teaspoonful, taken dry, mixed with sugar, or in molasses, mucilage, or solution in water. The above (except apomorphia) are all irritating, and must therefore be used with care, if at all, in irritant poisoning or with children. *Ipecac* is a safe and unirritating emetic, but is rather slow. Dose, twenty or thirty grains of the powder, or from one to two table-spoonfuls of the syrup or wine. All these doses are for an adult, and must be duly reduced for children. In all cases where an emetic is given, its action should be assisted by free drinking of nauseous potions, as warm water, warm salt and water, or warm chamomile tea. The stomach-pump is invaluable where emetics fail to thoroughly empty the stomach. This may happen where the substance is a powder, which, sticking to the mucous membrane of the stomach, cannot be dislodged by vomiting; or where, as is sometimes the case in narcotic poisoning, vomiting cannot be brought on at all. But in corrosive poisoning the stomach-pump should not be used for fear of perforating the corroded or softened walls of the stomach. When employed, water is to be repeatedly pumped into the stomach and then out again. In irritant poisoning, after evacuation of the stomach, copious draughts of bland and viscid fluids should be taken to sheathe the walls of the alimentary canal from the action of the poison. Such are mucilages, oils, flaxseed tea, milk, white of egg, barley-water, etc. As regards antidotes, the special substances to be used will be mentioned in connection with each poison. In general, antidotes act by chemically transforming the poison, while still in the stomach, into a comparatively innocuous compound. Thus, for acids *alkalies* are to be given, and, *vice versâ*, for alkalies, acids, whereby a salt is formed devoid of the caustic effect of either of its components. For the irritant metallic salts, *albumen*, as white of egg, is given to form the comparatively insoluble, and therefore inert, albuminate of the metal. In poisoning by vegetable alkaloids the antidote is *tannin* (tannic acid), or some vegetable infusion containing the same, such as strong green tea, infusion of galls, of cinchona, of blackberry-root, logwood, rhatany, etc. Here a rather insoluble tannate of the alkaloid is formed. But yet the efficacy of antidotes is generally small; they cannot reach such of the poison as has been already absorbed, and with irritant poisons, they generally come too late. Many are again, even at best, very imperfect in antidoting power (as tannin for alkaloids), and for many poisons no antidote is known. In all cases evacuation of the stomach is as necessary where an antidote is given as where not. The treatment of the effects of the poison necessarily varies greatly. In all cases, besides such local treatment as may be necessary, the special tendency to death should be recognized and intelligently combated by appropriate means.

*Detection of Poisons.*—This is by submitting the suspected matters to chemical analysis or experimenting with them upon living animals. The subject is too extensive and too purely technical to warrant its detailed discussion in this place, but the following general considerations may be properly presented. For many reasons, even in fatal poisoning, chemistry may fail to detect the poison. (See ante, *Diagnosis of Poisoning.*) In conducting an analysis in a criminal case the expert should take scrupulous care to remove as far as possible all *conceivable* sources of error. Thus, the matters to be analyzed, after once coming into his possession, should be either locked up, or the vessels containing them sealed, until the analysis be made. The mere possibility of their being exposed to tampering may vitiate at law the results of the examination. So, too, the various utensils employed must be positively known to be clean before being used, and the purity of the reagents established by actual testing. In all cases, also, the analyst should not be satisfied with one or two characteristic reactions, but should apply every known or possible test to demonstrate the poison, and, where possible, as with metallic poisons like arsenic and antimony, should obtain the metal itself and exhibit it in court. Many sad examples have occurred of the failure to convict a criminal where there was little moral doubt of guilt, and on the other hand of unwarrantable positive testimony by an "expert" as to the presence of a poison, all from neglect to observe rigidly these very obvious rules.

*Individual Poisons.*—Here only the commoner poisons will be discussed, and the symptoms and treatment of the poisoning alone treated of. (For the chemical tests and methods of conducting analyses the reader is referred to works on chemistry and toxicology.) The strong *mineral acids*, sulphuric, nitric, and hydrochloric, and also concentrated *acetic acid*, are poisonous, simply by reason of their powerful corrosive properties. Even when diluted till no longer caustic, they may in sufficient dose produce fatal irritation, and consequent inflammation, of the stomach and bowels. *Oxalic acid*, though not corrosive, is both intensely irritant and also constitutionally a virulent poison. Its soluble salts, such as *potassium oxalate* (salt of sorrel or salt of lemon), are equally poisonous. With all these acids an intensely sour taste is perceived in the act of swallowing, and the matters vomited will show a strong acid reaction. The symptoms are purely those of irritant poisoning already described (see ante, *Modes of Poisonous Action*), except with oxalic acid. With this poison there are in addition grave nervous symptoms, as profound collapse with stupor, numbness, and almost complete general paralysis. Sometimes death takes place within a few minutes from paralysis of the heart. The smallest recorded fatal doses in the adult are—for sulphuric acid, 1 drachm (about equal to a teaspoonful), for nitric, 2 drachms, for hydrochloric, ½ an ounce, and for oxalic, 1 drachm. But violent effects have followed smaller quantities, and on the other hand, as usual, much larger doses have been recovered from. The special antidote in acid poisoning is some non-poisonous base. Magnesia and lime and their carbonates are the best, as they are themselves innocent and have a high saturating power. The caustic alkalies are too corrosive. Lime is especially selected in oxalic-acid poisoning, as the resulting salt is very insoluble, and therefore inert. It may be given in the form of chalk, or powdered oyster-shell, or the scrapings of a plastered wall—a source of lime always available. Soap or wood-ashes may be used in default of the above. Evacuation of the stomach is often unnecessary in acid poisoning, from the prompt and free vomiting induced by the poison itself. Demulcent drinks should be freely given, and the inflammation and prostration from the corrosive action of the acid combated on general principles. The *alkalies*, potassa, soda, and ammonia, are powerfully corrosive, and their carbonates (including the substances commonly known as "potash," "pearl-ash," "soda-ash") are sufficiently irritating in considerable quantity and concentration to poison. The symptoms are similar to those in acid poisoning, except that an acrid alkaline taste is perceived instead of a sour one, and the vomited matters give an alkaline instead of acid reaction. Ammoniacal draughts can be told also by the odor. The antidote in alkaline poisoning is some non-corrosive acid, and none are better than the ever-ready vinegar or lemon-juice. But in poisoning by either the strong acids or alkalies such severe damage is done on the instant of swallowing that antidotes and all other treatment only too often prove utterly useless. *Potassium nitrate*

(nitre or saltpetre) in quantities of about ½ an ounce or more in concentrated solution is both an irritant and a constitutional poison; *potassium sulphate* (vitriolated tartar) is an irritant poison in large dose; there is no antidote to either. *Barium* salts are all irritant poisons. The antidote is some soluble sulphate, as sodium or magnesium sulphate. Other comparatively innocent salts, such as *cream of tartar*, *alum*, and even the ordinary purgative salts are dangerously irritant in inordinate dose, such as 2 ounces or more. With all these salts it is the concentration of the solution swallowed which determines the poisoning. In dilute solution and divided doses they are devoid of poisonous property. *Phosphorus* is intensely irritant and poisonous, and cases of poisoning occur from children eating the heads of matches or vermin-destroying compounds which commonly contain this substance. The smallest recorded fatal dose is 1½ grains, but far less quantities have produced violent symptoms. Small children have been killed by eating the heads of from two to eight matches. Phosphorus is but little given criminally, as it is easily detected by its strong and peculiar taste and smell, and by the luminosity in the dark of matters containing it, and even of the breath of the poisoned individual. (For symptoms and treatment, see PHOSPHORUS, MEDICINAL USES OF.) *Iodine*, *bromine*, and *chlorine*, like phosphorus, are all powerful irritants and constitutional poisons, but acute poisoning by them is not very common. (For chronic poisoning by iodine and iodides see IODINE, MEDICINAL USES OF, and for the effects of potassium bromide see POTASSIUM COMPOUNDS, MEDICINAL USES OF.) *Arsenic* in any combination is a well-known virulent poison, being both an intense irritant and a constitutional poison. Its effects are exerted no matter by what avenue the substance gain entry into the system. It is a favorite poison, by reason of the ease with which it can be obtained, the tastelessness of its compounds, and the small quantity necessary to produce death. Fortunately, however, on the other hand, the symptoms are strong and characteristic, and the tests for the detection of arsenic peculiarly reliable and delicate. Arsenic is most commonly taken in the form of arsenious oxide (arsenious acid or white arsenic) or cupric arsenite (Scheele's green). This latter compound constitutes wholly or in part the pigments known as emerald green, mineral green, Brunswick, Schweinfurth, or Vienna green. These are largely used in coloring wall-paper, confectionery, wafers, artificial flowers, tarlatan dresses, etc., and many cases of poisoning arise from the unwitting use of such articles. Even inhabiting a room lined with arsenicated wall-paper, or the handling of fabrics colored with these pigments, may cause death. In these cases the arsenic is probably absorbed through small particles becoming detached, floating in the air, and so being drawn into the lungs with the breath. The medicine called *Fowler's solution* or *tasteless ague drop*, which is a watery solution of potassic arsenite, 4 grains to the fluidounce, is also highly poisonous. Poisoning has also been caused by the sulphides of arsenic known as *orpiment* (yellow arsenic) and *realgar* (red arsenic). Orpiment is an ingredient of the pigment called king's or Naples yellow, and renders the latter poisonous. The symptoms in acute arsenical poison usually come on within half an hour or an hour, but may be postponed for several hours. They are, generally, those of irritant poisoning, the burning pain, thirst, vomiting, and cramps being very severe. There is great prostration, and coma, paralysis, or convulsions may supervene. Sometimes, even in fatal cases, the irritative symptoms are almost wholly absent. Death commonly takes place within twenty-four hours, but may be delayed several days. The smallest recorded fatal dose is the equivalent of 2 grains of arsenious acid. In chronic poisoning, where the arsenic is administered by repeated small doses, there will be, besides the symptoms of gastric irritation, an irritable and inflamed condition of the eyes and skin and various nervous disorders, as numbness and tingling of the extremities, with local paralyses. The sufferer becomes emaciated; may be salivated or jaundiced; hæmorrhages may take place; the hair fall out and the cuticle exfoliate, and death ensue from general exhaustion. Where the poison is introduced by inhalation, the abdominal symptoms, though present, are not so marked, and there are symptoms of bronchial irritation, as dryness of the throat, with cough and shortness of breath. The treatment of arsenical poisoning is the thorough evacuation of the stomach by emetics and the stomach-pump, and of the intestines by non-irritant cathartics, such as castor-oil, the free use of demulcent viscid drinks, and the continuous giving of large doses of the antidote—namely, the hydrated sesquioxide of iron, freshly prepared and in the moist state. This is made by taking any of the solutions of ferric salts, such as the persulphate or the common muriated tincture of iron, diluting somewhat with water, and precipitating by adding it to water of ammonia, also diluted. The bulky precipitate is then collected by straining through muslin, is well washed with water, and given freely in the pulpy state in tablespoonful doses. This antidote acts by forming an insoluble arsenical salt of iron, but as it only combines with arsenic already in solution, it is often very slow and inefficacious where the arsenic is in solid form, as arsenious acid or Scheele's green. Where the antidote cannot be had, hydrate of magnesia is to be given, also freshly made by precipitating a solution of a magnesian salt, such as Epsom salt, with water of ammonia, and straining and washing as just described. (For the tests for arsenic see ARSENIOUS OXIDE.) Compounds of *antimony* are highly poisonous, but the only two of practical toxicological importance are *tartar emetic* and *antimonious chloride*. The properties of the former are sufficiently treated of in the article TARTAR EMETIC (which see). The chloride (butter of antimony) is a highly corrosive liquid, producing effects like those of the strong mineral acids, but cases of poisoning by this substance are rare. Compounds of *mercury* vary greatly in poisonous properties, for while almost all can produce general mercurialization, some are also acutely irritant and poisonous. These latter are generally the *mercuric* compounds, as mercuric chloride (corrosive sublimate), cyanide, iodide (red iodide), oxide (red precipitate), ammoniated mercury (white precipitate), nitrate, and, in less degree, mercuric sulphide (vermilion or cinnabar). Of these, the first two are the most powerful, the cyanide being doubly poisonous from being a compound of hydrocyanic acid, and corrosive sublimate, being, as its name imports, corrosive as well as virulently poisonous. Few mineral substances indeed are more deadly, from 3 to 5 grains being easily fatal. Death commonly occurs in from three to five days. Metallic mercury, from its insolubility in the fluids of the alimentary canal, is generally harmless, even when swallowed in large quantity. The vapor of mercury, however, is highly poisonous, and artisans who work in mercury may suffer severely from constitutional poisoning. (For the details and treatment of mercurial poisoning see MERCURY, MEDICINAL USES OF.) *Silver*, *copper*, *lead*, and *zinc*, like mercury, are constitutionally poisonous when introduced into the blood, and their soluble compounds also acute irritants, lead salts, however, being less irritant then the others. Poisoning by *silver* is rare, generally occurring by the accidental swallowing of bits of argentic nitrate (lunar caustic); the antidote is common salt. *Copper* often proves poisonous by accidental impregnation of food and drink with the metal from the use of copper vessels. This occurs where *dirty* copper kitchen utensils are used, or where food is allowed to stand, *cold*, in copper vessels. *Boiling* in *clean* copper vessels is harmless. Acute irritant poisoning will also arise from swallowing cupric sulphate (blue vitriol or blue stone) or the subacetate (verdigris). The treatment is the same as with corrosive sublimate. *Lead* is a subtle constitutional poison (see LEAD POISONING), and the soluble salts, as the acetate (sugar of lead) in considerable quantity, may cause acute irritation, but are rarely fatal. The antidote in such case is some soluble sulphate; zinc sulphate may therefore be used as an emetic, and afterward Epsom salt administered. Poisoning by *zinc* is generally acute, from swallowing large quantities of zinc sulphate (white vitriol) or the chloride. The former is a sharp irritant, the latter a powerful corrosive. Treatment as in corrosive-sublimate poisoning. *Iron* is not constitutionally poisonous, but ferrous sulphate (green vitriol) and the ferric salts, as the chloride and sulphate, are, in sufficient dose and concentration, powerful irritant poisons. Treatment, again as with corrosive sublimate. Soluble compounds of *chromium*, *gold*, *platinum*, and *tin* are all irritant poisons, but accidents from them are for obvious reasons rare. Of *animal poisons*, besides the virus of rabid animals, venomous reptiles and insects, and morbid animal fluids, the most important are the following: The powdered body of the Spanish fly (*Cantharis vesicatoria*), used to make blistering plasters, is a violent irritant, producing, when swallowed, the usual effects of irritants, and also by absorption great irritation of the urinary organs with suppression of their secretion. Poisoning may even occur from external applications. Twenty-four grains of the powdered insect and an ounce of the tincture have killed. Uncooked or imperfectly cooked food containing *measly pork* (pork infested with the parasite *Trichina spiralis*), such as raw sausage or ham, may cause violent and even fatal poisoning. Poisoning with symptoms mainly of gastro-intestinal irritation often occurs from eating *unsound meat*, and also sometimes, under conditions not thoroughly made out, from eating *fish*, *shellfish*, especially mussels, and *cheese*. There are no antidotes to any of these animal poisons, and after evacuating the stomach the effects must be combated upon general medical principles. Among *vegetable substances*, there are many which like the foregoing are poisonous either wholly or in great part by reason of their violent

irritant properties. The active principle is generally, but not always, a volatile oil or an acrid resin. The principal members of this group are the drastic cathartics, *elaterium*, *croton oil* and *seeds*, the *seeds* of the *castor-oil plant* (but not the oil), *gamboge*, *colocynth*, *scammony*, *hellebore*, and in lesser degree *may-apple root* and *jalap*; also, *savin*, *colchicum*, *veratrum viride*, and *veratria*. *Carbolic acid* and *creosote* are both powerfully irritating and also intense neurotic poisons. The sufferer speedily falls insensible and collapsed. Half an ounce of strong carbolic acid has killed, and poisoning may even occur from external applications over a considerable surface. A whitened and hardened condition of the mucous membranes touched by the acid, and the peculiar smell of the substance, generally indicate the nature of the poison. There are no antidotes to any of these substances. *Hydrocyanic acid* is one of the most deadly poisons known (see HYDROCYANIC ACID); the medicinal dilute acid even (2 per cent. strength) may kill in dose of a teaspoonful. *Potassium cyanide* is similarly fatal in dose of 5 grains. Vegetable substances rich in hydrocyanic acid are also highly poisonous. The most powerful is *oil of bitter almonds*, 20 drops of which have killed. The *leaves of the cherry-laurel* (*Prunus laurocerasus*), and the water distilled from them, are poisonous if taken in considerable quantity, but their strength in prussic acid is very uncertain. Even *cherry* and *peach pits*, which contain the same substance in small proportion, have killed children who have eaten largely of them. Many species of *hymenomycetous fungi* (mushrooms or toadstools) are notoriously poisonous. Sometimes the effects are simply gastric irritation, and sometimes also a sort of intoxication and delirium, or stupor, or convulsions, are produced. There are no general distinguishing characteristics between the edible and poisonous fungi, experience alone showing what species are poisonous and what harmless. Sometimes even the edible mushrooms acquire poisonous properties, and to some persons they are always noxious. (See FUNGI.) There is no antidote to the poisonous fungi, the treatment being the use of emetics and mild purgatives (as castor-oil), and general treatment of the symptoms. Next, there are many plants which, while either but slightly or not at all irritant, contain principles which after absorption profoundly affect the nervous or muscular apparatus, and kill, generally, by paralyzing some vital part concerned in maintaining the action of the heart or lungs. In these plants the active principle is generally an alkaloid, and the action may be simple—that is, falling upon some one portion of the nervous apparatus only, as with hemlock or strychnine—or it may be highly complex, as with opium and belladonna, where several parts are simultaneously affected. In this case the influence may even be of opposite character in the different parts, functional activity being heightened in one portion of the nervous system, and simultaneously lessened in another. As might, therefore, be expected, the symptoms in this kind of poisoning vary in the widest manner, and the manner of death even differs with different poisons. By far the most prominent member of this group is *opium* and its various preparations. (For the symptoms and treatment of opium poisoning, see OPIUM.) The smallest recorded fatal doses, in the adult, of the commoner opiates are as follows: opium, 4 grains; laudanum (tincture of opium) 2 teaspoonfuls; extract of opium, 2½ grains; morphine, ½ a grain. But from many causes (see OPIUM) the effects of a poisonous dose of an opiate are very uncertain, and enormous quantities are frequently recovered from. It cannot be too strongly impressed upon the popular mind that young children are peculiarly susceptible to the poisonous action of opium, infants having repeatedly been killed by a very few drops of laudanum. The stronger opiates, such as laudanum, wine or vinegar of opium, and morphine, should therefore never be given to infants except upon physicians' prescription. "Mrs. Winslow's Soothing Syrup" is an opiate of very varying strength, and fatal poisoning has attended its use. A singular group of poisonous plants is afforded by the mydriatic Solanaceæ, all parts of which are generally poisonous. They are—*belladonna* or *deadly nightshade* (*Atropa belladonna*), *stramonium*, called also *Jamestown weed* and *thorn-apple* (*Datura stramonium*), *henbane* (*Hyoscyamus niger*), *bitter-sweet* or *woody nightshade* (*Solanum dulcamara*), *garden nightshade* (*Solanum nigrum*), and even the berries and young shoots of the common *potato* (*Solanum tuberosum*). The above are named, as near as may be, in the order of their respective virulence. The symptoms are essentially the same with all, being great rapidity of pulse, rather rapid, shallow breathing, excessive dryness of the mouth and throat, delirium, often even violent, and, most characteristic of all, wide dilatation of the pupil, the eye looking black, lustrous, and prominent, with confusion of sight, especially for near objects. Sometimes (generally in children, according to the writer's experience) the skin becomes suffused of a bright scarlet color. Death occurs from failure of respiration. The treatment is essentially the same as with opium, except that atropine, itself the active principle of belladonna, is of course not to be employed. Morphine has been recommended as a remedy on theoretical grounds, because of the benefit of atropine in opium-poisoning, but both sound reasoning and the results of experience hardly sustain the idea of its usefulness. The *purple aconite* or *monkshood* (*Aconitum napellus*) is an exceedingly poisonous plant, the root particularly. (See MONKSHOOD.) A drachm of the dried root, 5 grains of an extract, a teaspoonful of the tincture of the root, and far less of the stronger "Fleming's tincture," have severally proved fatal. Death is from failure of the heart, and special treatment must be aimed at sustaining that organ, as by ammonia, alcoholic drinks, perfect rest upon the back, artificial respiration, etc. From experiments upon animals it is probable that digitalis would prove a powerful means of stimulating the heart in aconite poisoning, but being itself a powerful poison, its administration should be entrusted to a physician only. The *purple foxglove* (*Digitalis purpurea*) is another cardiac poison, the leaves of the second year's growth being the most active part. Its primary influence is to cause the heart to beat more slowly than usual, and at the same time more forcibly, but in poisonous dose its tetanizing action upon the organ finally stops its beating altogether as surely as the paralyzing influence of aconite. With failure of the pulse in digitalis poisoning there are also associated great prostration and excessive and prolonged nausea and vomiting, with abdominal pains. The treatment is essentially the same as with aconite. The *spotted* or *poison hemlock* (*Conium maculatum*) is another potent poison. (See HEMLOCK.) Artificial respiration should be the main reliance in treatment of the poisoning. The root of the *yellow jasmine* (*Gelsemium sempervirens*) is poisonous very much in the same way as hemlock. (See JASMINE.) *Tobacco* (*Nicotiana tabacum*) and its alkaloid, *nicotine*, are, taken internally, most powerful poisons. (See TOBACCO, PHYSIOLOGICAL RELATIONS OF.) The *Indian tobacco* (*Lobelia inflata*) greatly resembles tobacco in its effects. (See LOBELIA.) *Nux vomica* and the *bean of St. Ignatius*, with their alkaloids, *strychnine* and *brucine*, are well-known virulent poisons. (See NUX-VOMICA.) Half a grain of strychnine has killed, and a sixth of a grain has caused alarming tetanic convulsions. Other noxious vegetable substances by which poisoning may occur are the *Calabar bean* (seed of *Physostigma venenosum*), *Cocculus indicus* (seed of *Anamirta cocculus*), *extract of hemp* (*Cannabis indica*), *wormseed* (buds of *Artemisia santonica*), and *santonin*, the active principle of the same, *oil of wormwood* (*Artemisia absinthium*), *camphor* in considerable quantity, *water-hemlock* or cowbane (*Cicuta virosa*), *hemlock water-dropwort* (*Œnanthe crocata*), *fool's parsley* (*Æthusa cynapium*). Among organic derivatives the following may properly be classed as poisons: *Alcohol* in large dose, as by drinking inordinately of spirituous liquors, is an acute and even fatal poison. (See INTOXICATION.) *Chloroform*, taken internally or by inhalation, may kill; inhaled, as for purposes of anæsthesia, it is especially dangerous, death often taking place quite suddenly from paralysis of the heart. Care and skill in the administration, and the use of proper inhaling appliances, vastly lessen the risk, but yet chloroform has repeatedly killed even in cautious and practised hands, and not a week passes by but a new case of death from this cause is recorded. As long, therefore, as we have in ether an anæsthetic equally efficient, while entirely free from the tendency to produce fatal syncope, the giving of chloroform as an anæsthetic is, in the opinion of the writer, entirely unjustifiable except in certain peculiar circumstances, and its *self*-administration is fraught with the highest danger. In cases of chloroform syncope the treatment is the same as for drowning—namely, artificial respiration and the application of warmth and friction. The new remedy, *hydrate of chloral*, is readily poisonous in overdose, killing much in the same way as chloroform; 30 grains have proved fatal in one case, and have caused alarming symptoms in others. The treatment is similar to that for chloroform, or, if the respiration is most at fault, the treatment for opium poisoning should be instituted. There are also various fluids which are poisonous when taken internally, such as *petroleum*, *kerosene*, *aniline*, *benzole*, *naphtha*, *fusel oil*, *nitro-benzole*, *nitro-glycerine*, *oil of turpentine*, etc., but cases of poisoning by them are too infrequent to warrant discussion. Finally, there are many of the rarer products of the chemist's laboratory which are poisonous, but they have no interest in practical toxicology.

EDWARD CURTIS.

**Toxodon'tia** [Gr. τόξον, "bow," ὀδούς, "tooth"], a name framed by Richard Owen as an ordinal designation for a group of extinct mammals whose remains have been found

in South America. They were most nearly related to the ungulates, but differed in several characters, and especially the teeth. The molars of the upper jaw were broad, and extended severally into an externo-anterior angle; those of the lower jaw were narrow, and continuous in a uniform row; the incisors had incisorial crowns, but were diversiform in shape as well as the mode of insertion and number; the feet are mostly unknown; the hind feet, however, had the astragalus at its anterior face inclined obliquely inward, and articulating in front only with the navicular, and the calcaneum had an extensive upward-extended surface for the articulation of the fibula, and a large lateral process articulating in front with the astragalus. Two generally-recognized families—the Toxodontidæ and Nesodontidæ—represent the order, and to it have also been referred certain Eocene mammals discovered in the southwestern parts of the U. S., but these last have not yet been satisfactorily demonstrated to belong to it. (See TOXODONTIDÆ; also NESODONTIDÆ, in APPENDIX.) THEODORE GILL.

**Toxodont'idæ** (see TOXODONTIA), a family of placental mammals of the order Toxodontia, which formerly flourished in South America, and which were especially distinguished by their teeth, which increased like those of rodents. The teeth were in reduced number as compared with the Nesodontidæ—viz. 36 (M. $\frac{3}{3}$, P. M. $\frac{4}{3}$, C. $\frac{0}{0}$, I. $\frac{2}{3} \times 2$); the molars had their enamel coats interrupted on the anterior and posterior walls; those of the upper jaw were mostly (P. M. 3, 4, M. 1, 2, 3) obliquely triangular, rapidly narrowed backward, and had a single simple fold re-entering obliquely forward from the inner side; the incisors of the upper jaw had incisorial crowns, and the outer ones roots of nearly uniform diameter throughout, and describing the segment of a circle (like those of rodents), and persistent pulp; the molars of the lower jaw were narrowed, especially at the posterior portions, and the incisors were developed in nearly a straight line. But one genus, *Toxodon*, is known. It was composed of large-sized mammals which lived in South America during the later Tertiary epoch. The remains first obtained of *Toxodon platensis* were found by the celebrated Darwin during his sojourn in the Banda Oriental, near the Sarandis, a tributary of the Rio Negro, about 120 miles N. W. of Montevideo, and were known to the natives as giants' bones. THEODORE GILL.

**Toxot'idæ** [from *Toxotes*—Gr. τοξότης, "archer"—the generic name of the type], a family of fishes of the order Teleocephali and sub-order Acanthopteri, remarkable for the power of "shooting" water at insects, etc., to ensure their capture. The form is peculiar in that the back declines forward in nearly a straight line from the base of the backward-placed dorsal to the snout; it is otherwise oblong and compressed; the scales are moderate or rather large; the lateral line is continuous to the caudal fin; the head is conic in profile and compressed; the eyes are large and lateral; the opercula unarmed; the mouth has a deep oblique lateral cleft; the upper jaw is very protractile, the lower jaw longer; teeth are developed on the jaws and palate, and are villiform; the branchial apertures are continuous beneath; branchiostegal rays in seven pairs; the dorsal fin is confined to the posterior half of the body, and composed of rather few (five) stout spines and a somewhat larger soft portion; the anal is opposite to, and about as long as, the dorsal, and armed with three spines; the caudal is well developed and free; the pectorals are pointed, and have the rays branched; the ventrals are thoracic, and have each a spine and five rays. The intestinal canal has few (about nine) cæca. The skeleton has ten abdominal and fourteen caudal vertebræ. The family is represented by but two known species—*Toxotes jaculator* (see ARCHER FISH for illustration) and *Toxotes microlepis*—in the East Indian and Polynesian seas. These (or at least the former) are said to catch insects and other small animals which rest on the aquatic plants or those growing on the banks near their quarters, by protruding their mouth into a tubular form and shooting at them drops of water, and it is said they can hit insects thus at a distance of three feet and more. This habit is a source of amusement to the natives of the countries which they inhabit, and they are kept to give specimens of their skill and industry. They attain a length of about six or seven inches. THEODORE GILL.

**Toyn'bee** (JOSEPH), M. D., F. R. S., b. at Heckington, Lincolnshire, England, 1815; studied surgery at St. George's and University College hospitals; devoted himself exclusively to aural surgery, on which branch he was surgeon and lecturer at St. Mary's Hospital; was vice-president of the Pathological Society and president of the Quekett Club (microscopical); organized the system of local natural history museums, and took much interest in sanitary reform. He fell a victim to his scientific zeal in the course of experiments upon himself in the inhalation of chloroform and hydrocyanic acid for the relief of singing in the ears, having been found dead at London July 7, 1866. Two papers were found in his room giving the results of a previous experiment and the partial result of the last one. Author of a standard work, *The Diseases of the Ear* (London, 1860; new ed. 1867), and other writings upon professional subjects.

**To'zer** (HENRY FANSHAWE), b. at Plymouth, England, May 18, 1829; educated at Winchester School and at University and Exeter colleges, Oxford, graduating with honors at the latter, where he became fellow 1850; has been tutor there since 1855; took orders; contributed accounts of his *Travels in Norway* to *Vacation Tourists* for 1861, and a *Visit to the Monks of Mount Athos* in the same annual for 1862; has devoted much time to classical geography, on which subject, besides articles in magazines, he has published *Researches in the Highlands of Turkey* (2 vols., 1869) and *Lectures on the Geography of Greece* (1873).

**Trac'adie,** p.-v., Gloucester co., N. B., near the mouth of Tracadie River and on the Gulf of St. Lawrence, 20 miles S. of Shippigan. It has a lazaretto for lepers. P. of settlement (chiefly of French descent), about 1500.

**Tracadie,** p.-v., Antigonish co., N. S., on the Bay of St. George, 22 miles E. of Antigonish. It has a safe harbor, a convent, and a monastery of Trappist monks from Belgium. P. of sub-district, 1882.

**Tra'cery,** in Gothic architecture, the ornamental work serving in the windows as a support for the glass, often of the richest design, and an endless variety in the different styles. Tracery is also a name given to the ornamental designs traced on panels and on the woodwork of Gothic structures.

**Trachea.** See WINDPIPE, by E. DARWIN HUDSON, JR., M. D.

**Tracheot'omy** [Lat. *trachea*, and Gr. τέμνειν, to "cut"], opening of the trachea or larynx by incision or puncture for the free ingress and egress of air when respiration is labored or suffocation is imminent from laryngeal obstruction. Older writers treat the subject under the title "bronchotomy." The operation is chiefly demanded when the larynx is obstructed by the membrane of croup or diphtheria, is the seat of acute œdema or dropsy, is closed by the impaction of foreign bodies, or contracted by previous inflammations or ulceration. It may also be performed to permit the escape of foreign bodies accidentally passing the larynx and entering the trachea and bronchial tubes. When goitre of great size compresses the upper part of the trachea, tracheotomy affords relief. Older writers advocate opening the trachea preliminary to artificial respiration in cases of asphyxia by noxious vapors or drowning, but it is seldom resorted to. The air-passage may be opened in either of three points. "Laryngotomy," the operation highest up and involving least danger, is preferable when membranous or other obstruction does not exist below the larynx; it consists in opening through the circo-thyroid membrane. Incision a little lower, cutting the cricoid cartilage and one ring of the trachea, is termed "laryngo-tracheotomy;" while incision of one or more rings of the trachea below the thyroid gland is strictly "tracheotomy." The operations are most easily performed on thin, long-necked children; infants with short necks and corpulent persons present difficulty. The incision is always vertical, and in the median line over the elected point of opening, the cutting being cautious and progressive; at every step vessels should be pushed to one side rather than cut, as bleeding delays the operation, and the entrance of blood into the air-passage endangers life by exciting broncho-pneumonia. When the trachea is fully exposed, it is incised; the lips of the cut are separated by scissor-like dilators, and a "tracheotomy tube" or canula is inserted. The canula is usually of silver or rubber, curved so as to descend in the air-passage. An inner tube is provided, slightly longer than the outer one. Mucus or membrane obstructing the end may be removed by withdrawing and cleansing the inner tube. The tube is retained in the wound by means of a tape around the neck, and should be worn until all danger from the original disease is past and the larynx is again free. Tracheotomy is performed more frequently each succeeding year, and with increasing success. It should not be left till too late; should be carefully performed at a point below all obstruction; blood should not enter the trachea; the tube should be of large size, adequate to admit air freely; an



Tracheotomy Tube.

attendant should be constantly at hand to keep the tube open; the patient should breathe a pure but moist atmosphere, and be supported by rich diet and tonics.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Trachin'idæ** [from *Trachinus*—an ancient name from τραχύς, "rough"—the typical genus], a family of marine teleost fishes, of the order Teleocephali and sub-order Acanthopteri, containing the forms known as "weevers" in England and kindred types. The body is elongated, narrowed from shoulders to tail, and compressed; the scales are cycloid and very small; the lateral line high up and continuous; the head is quadrato-conical, and terminates in a conical snout; the eyes are lateral, but separated by a narrow interval, and far forward; the opercula are unarmed except the operculum, and this has a strong acute spine arising from its upper surface and pointing backward; the mouth has a lateral oblique cleft continued backward under the eyes; teeth are developed in villiform bands on the jaws and palate; the branchial apertures are continuous below; branchiostegal rays in six pairs; the dorsal is represented by two fins, the first short and sustained by a few diverging spines, the second elongated and with branched rays; the anal is very long, and composed of articulated rays; the caudal distinct; the pectorals large, and composed of branched rays; the ventrals are approximated to each other and jugular, and have each a spine and five rays; pyloric appendages are developed in small number (about six); the vertebral column has the normal number of abdominal, but an increased number of caudal, vertebræ (A. 10–11 + C. 25–31). The family is composed of a few species, chiefly found in the European seas (where are three) and along the western African coast, but one occurs along the coast of Chili. These species by most authors have been combined in one genus (*Trachinus*), but by Bleeker have been distributed among three. They are considerably feared by fishermen and others on account of the formidable opercular spines, with which they can inflict severe wounds. These spines are generally cut off when the fishes are caught, and thus they are exposed in the markets. The species are, however, of inconsiderable economic importance. (For illustration see Great Weever.)

Theodore Gill.

**Trachypter'idæ** [from *Trachypterus* — Gr. τραχύς, "rough," and πτερόν, "fin"—the name of the representative genus], a family of teleost fishes of the order Teleocephali and sub-order Acanthopteri. The body is very long and exceedingly compressed, and gradually diminishes in height from head to tail; the skin is naked; the lateral line is low and continuous; the head is oblong and compressed; the eyes lateral, and in anterior half of head; the opercular bones unarmed, scaleless, and with radiating striæ; the mouth has a small cleft; the teeth are feeble; branchial apertures confluent below; branchiostegal rays in six pairs; the anus is in the anterior half of the length; dorsal fin very long, extending the whole length of the back, divided into a very short elevated anterior portion and a remaining continuous fin, all the rays of both of which are flexible spines (*i. e.* inarticulate as well as unbranched); anal wanting; caudal undeveloped, or composed of an enlarged upward-directed upper and a rudimentary lower portion; pectorals small; ventrals thoracic (and variously developed) or absent; there are five gills, and also well-developed pseudobranchiæ, "situated in a pouch formed by a fold of the mucous membrane (*Trachypterus*);" pyloric appendages are developed in large number; the skeleton has comparatively little consistency; the vertebræ are very numerous. This family is composed of large-sized, extremely-compressed, and thin fishes, which are inhabitants of the deep or open seas, and rarely stranded on shore or otherwise caught. They are probably more widely distributed than is at present known: specimens have been observed from time to time in many parts of the European seas, as well as in the Bermudian archipelago, the Australasian seas, the East Indian seas, and on the W. coast of North and South America. The large species have doubtless in part given rise to the belief in a sea-serpent, and been mistaken for such, as they well might from a distance on account of their size, some species of *Regalecus* attaining the length of nearly (if not more than) twenty feet. Nearly twenty species of the family are known, which are generally ranked under three genera —viz. (1) *Trachypterus*, in which the caudal is developed as above mentioned, and which has complete ventral fins; (2) *Regalecus*, in which the caudal is rudimentary or absent, and the ventrals reduced to single long filaments; and (3) *Stylophorus*, in which the tail is extended into a very long filament, and the ventrals are apparently wanting. No species has yet been found along the eastern American coast, but one (undescribed) has been obtained on the western coast.

Theodore Gill.

**Trachystom'ata** [Gr. τραχύς, "rough," and στόμα, "mouth"], a group of amphibians by some considered as a sub-order of Gradientia or Urodela, and by others (*é. g.* Cope) as an independent order. It has been constituted for the reception of the family Sirenidæ, and has been characterized by Cope as follows: "Ossa maxillaria wanting; nasalia embraced by spine of premaxillaria; prefrontalia wanting; palatina wanting; pterygoidea wanting; orbito-sphenoids large; anterior forming part of palate; mandible with condyle, without teeth on the dentale; ceratohyals, first two distinct, with branchiæ, biconcave vertebræ, and cartilaginous corpus, as characters of less intrinsic value." (Cope, *Journ. Acad. Nat. Sc. Phila.*, N. S., vol. vi. p. 102, 1866.) (See also Gradientia and Sirenidæ.)

Theodore Gill.

**Tra'chyte** [Gr. τραχύς], a variety of lava which is often porphyritic, and when containing hornblende and augite passes into the varieties of trap called basalt, greenstone, dolerite, etc.

**Tracta'rianism, and Tracts for the Times.** The movement in the Church of England indicated by these words was one of the most remarkable that has occurred since the Reformation. It was partly theological, and partly ecclesiastical, and betokened the revival of Anglo-Catholic sentiments, such as had obtained more or less at previous periods, and had been strongly developed, in some respects, under Archbishop Laud, and in others by the nonjuring clergy at the end of the seventeenth century. Much stress was laid upon the teaching of the Nicene and Ante-Nicene Fathers, of the first four councils, and of divines in the Church of England, such as Andrews, Thorndike, Laud, Heylin, Kettlewell, Hickes, Wilson (bishop of Sodor and Man), and others. The doctrine of the Trinity in its Athanasian form, and of salvation by grace in an anti-Lutheran form—one which blended together the justification and sanctification of believers after the manner of Augustine and other Fathers—were salient points in the creed of those who were leaders of the revival. To the views of salvation entertained by the evangelical section of the English Church they were decidedly opposed, and they looked askance at the whole theology of the Genevan school, and deplored its effect on the minds of Reformers in the days of Edward VI. and Elizabeth. Equally, if not with still more prominence, did they bring out extremely high ecclesiastical opinions touching the relation of Church and State, clerical orders, sacraments, discipline, and worship. They lamented the control which the civil power exerted over the spiritual; they insisted upon episcopacy as divine and essential, upon apostolical succession, upon baptismal regeneration, upon the real presence in the Lord's Supper, upon the desirableness of exercising church discipline, and upon attention being paid to what they regarded as most reverent and impressive in conducting public divine service.

The movement was a reaction against tendencies of the age manifesting themselves very strongly at the time—against the rationalism of Germany, then being imported into England in many ways; against the deadness and dulness and dryness of what had been called the High-Church party, and also against what they deemed the enthusiasm in some respects, and the indifference and carelessness in other respects, of the Low-Church party; against prevalent irreligion and spiritual insensibility; against the spread of political liberalism and the ascendency of the Whig party; against the reduction of the number of bishoprics, and other parliamentary proceedings in reference to Church affairs in England and Ireland; against certain ecclesiastical appointments of a latitudinarian kind; and, in short, against what they denounced as the Erastian spirit of the day.

A good deal of thought and feeling of the description thus indicated existed in the University of Oxford in the early part of the second quarter of the present century. It laid hold of a few earnest and able men—John Henry Newman, Robert I. Wilberforce, Richard Hurrell Froude, William Palmer of Worcester College, Arthur Percival, Hugh Rose, and John Keble. The *Christian Year* by the last of these (published in 1827) made a wonderful impression, and by exciting an indefinite and vague kind of High-Church feeling, having in it something devout and beautiful, did much to pave the way for what followed. These men, though united by strong sympathies, were not all of one mind as to the course of practical action to be pursued for reviving Anglo-Catholicism. Newman went abroad in 1832, and came back in July, 1833, greatly invigorated in health and spirits, and determined to set vigorously to work in the new direction. Keble preached an assize sermon on the 14th of that month upon *National Apostasy*. "I have ever considered, and kept the day, as the start of the religious movement of 1833," are Newman's words in

his autobiography entitled *Apologia*, which gives the inside history of the Oxford movement.

He now, as he says, "out of my own head began the *Tracts*." The first, without date, was entitled *Thoughts on the Ministerial Commission, respectfully addressed to the Clergy*. It dwelt upon their responsibility, and pointed to efforts for the renewal of church authority; and the bold tone assumed may be seen from the following sentence. Referring to bishops—and intimating how they should place themselves in the front of the coming battle—the writer says: "And black event as it would be for the country, yet (as far as they are concerned) we could not wish them a more blessed termination of their course than the spoiling of their goods and martyrdom." Another tract, on *The Catholic Church*, followed, and on Sept. 9, 1833, the first bearing a date then appeared; a third, containing *Thoughts respectfully addressed to the Clergy on Alterations of the Liturgy*, resisted stoutly any measure of the kind. These publications excited considerable alarm in the minds of some of Newman's friends, but he persevered, and was in 1835 and 1836 fully joined by Dr. Pusey, whose accession he deemed an event of immense value and importance, from his high position in the university, his distinguished family connections, and also his great learning and estimable character. Dr. Pusey had written a tract on *Fasting*, which appeared Dec. 21, 1833, but his tract on *Baptism*, in 1836, was his first great contribution. Much, however, as Dr. Pusey did to promote the enterprise, Newman remained its life and soul. He acknowledges that he wrote twenty-four out of the whole number of tracts, amounting to ninety. He thus describes what he did: "I had lived for ten years among my personal friends; the greater part of the time I had been influenced, not influencing; and at no time have I acted on others without their acting upon me. As is the custom of a university, I had lived with my private—nay, with some of my public—pupils, and with the junior fellows of my college, without form or distance, on a footing of equality. Thus it was through friends younger, for the most part, than myself, that my principles were spreading. They heard what I said in conversation, and told it to others. Undergraduates in due time took their degree and became private tutors themselves. In this new *status*, in turn, they preached the opinions which they had already learned themselves. Others went down to the country and became curates of parishes. Then they had down from London parcels of the tracts and other publications. They placed them in the shops of local booksellers, got them into newspapers, introduced them to clerical meetings, and converted more or less their rectors and their brother-curates. Thus, the movement, viewed with relation to myself, was but a floating opinion; it was not a power. It never would have been a power if it had remained in my hands." (*Apologia pro Vita sua*, p. 133.)

No doubt a great impetus was given to the movement by Pusey, Keble, and others. On and on it went, one tract appearing after another—some very short and pithy, and others long and elaborate, learned treatises, in fact, on Anglo-Catholic theology, containing large citations from early Fathers and seventeenth-century divines, with the view of pointing out a distinction between it and that of Rome as settled by the Council of Trent. The tracts, collected together, form six volumes. They attracted attention; they produced controversy. "These men are going over to Rome," cried multitudes of Protestants, "and are leading many more along with them." At last came No. 90. It was entitled *Remarks on Certain Passages in the Thirty-nine Articles*. It condemned any attempt to alter them, and protested against ordinary political methods by which professed reforms are carried or compassed in this day. Its drift was to show that the VIth and XXth Articles, on Holy Scripture and the authority of the Church, were not inconsistent with the Anglo-Catholic idea, that the true rule of faith is not in Scripture alone, but in apostolic tradition; that Article XI., on justification by faith only, did not exclude the doctrine of baptismal justification and of justification by works as well; that Arts. XIX. and XXI., on the Catholic Church and general councils, did not mean that the true Church is not infallible; but that the idea of express supernatural privilege, that councils properly called shall not err, lies beyond the scope of these articles, or, at any rate, beside their determination; that Art. XXII., on purgatory, pardons, images, relics, and invocation of saints, only condemned the *Romish* doctrine concerning them, not any other doctrine on these subjects, consequently not the Anglo-Catholic; that Art. XXV. did not deny that confirmation, penance, orders, matrimony, and extreme unction were sacraments, but only that they were not sacraments *in the same sense* as baptism and the Lord's supper; that Art. XXVIII. only condemned gross views of transubstantiation, not the mysterious presence of the body of Christ. The Articles on masses and clerical celibacy are in like manner explained away. This last tract created a greater sensation than any preceding one. At a meeting of the vice-chancellor, heads of houses, and proctors it was resolved that modes of interpretation such as were suggested in the tract were inconsistent with the statutes of the university; and four tutors, including A. C. Tait, now archbishop of Canterbury, wrote to the editor to say that, in their apprehension, the tract had a highly dangerous tendency. This letter was dated Mar. 8, 1841. On the 16th of March, Newman wrote, acknowledging his authorship of the tract in question. The violent controversy which preceded this publication became more violent afterward. Numbers of pamphlets were written which we have not space to enumerate, and the result was that the tracts were "*discontinued*," but, according to the persistent representation of Newman, "*not suppressed*." In 1846 he entered the Church of Rome.

This last event illustrated the tendency of the movement, and the tendency was further proved beyond all question by the numbers who just before or afterward took, under the same training, precisely the same step. The fact is, that in the space of a few years a transition occurred which epitomized the history of the Nicene and subsequent ages. Certain men began by being priestly, ascetic, and catholic, like Chrysostom, Ambrose, and Jerome, and they ended in being Roman Catholic, like Thomas Aquinas and the schoolmen—yea, in accepting ultimately the Tridentine decrees. Dr. Pusey and others have remained in the Church of England, and contend that stationariness is the Tractarian principle; but, however stationary some may have continued, others, who have not seceded, and are still in the bosom of the Establishment, have developed the tendency in ritualistic and other forms, of which neither Newman nor Pusey dreamt in 1833.

The literature of the subject is contained, as already shown, in the six volumes of tracts, and in a large collection of pamphlets and books arising out of their publication.

JOHN STOUGHTON.

**Tractarians.** See TRACTARIANISM.

**Tractors, Metallic.** See PERKINS (ELISHA).

**Tract Societies.** The word "tract," though commonly applied to small unbound pamphlets, includes also, by derivation and early usage, any treatise or bound volume for general circulation, of whatever size. Tract societies are the most perfect realization yet found of the purpose to imbue with religious truth, by means of the press, the people of all classes and lands. Long before the invention of printing, the importance of multiplying copies of the best religious writings was recognized, for the sake both of preserving and diffusing them. Wycliffe, the English Reformer, wrote over 100 tracts, which were much copied and very useful; some of them having reached John Huss, the Bohemian Reformer, led him to the knowledge of the truth. The wonderfully timely invention of printing opened the way for a rapid growth of this method of doing good. In Bâle there was virtually a Bible society, a colporteur association, and a tract society for France in 1524. Tyndale and Luther both employed the press, the latter with amazing energy, his numerous tracts being eagerly sought for and proving a most powerful agency in the great Reformation, as were also those of Melanchthon, Calvin, Zwingli, and other Reformers.

In the eighteenth century the friends of religion began to associate themselves for greater efficiency in this work, three societies having been organized before 1701 by members of the Church of England—one "for the propagation of the gospel in New England and America," another "for foreign parts," and the third for "promoting Christian knowledge." In 1742, John Wesley was issuing numerous tracts and books; Coke and he, forty years later, organized a society for tract distribution among the poor. In 1750 was formed the first tract society in which different denominations united—The Society for Promoting Religious Knowledge among the Poor. In 1790 Hannah More began to issue her famous "cheap repository tracts" in great numbers. In 1793 the religious Tract and Book Society of Scotland was formed. In May, 1799, The Religious Tract Society was organized in London, the Rev. George Burder being the principal mover in this enterprise, which has since become the largest and most efficient tract society in the world. The first year its entire receipts were £2340; now, that two-thirds of a century have passed, its annual income is about £160,000, and its grants £30,000. It has issued a total of nearly 13,000 different publications, large and small, and has 9800 now on its catalogue. Its publications at home and abroad are in 119 different languages, and amount to a total of 1600 millions of copies. It owns no printing and binding establishment, but manufactures all its issues by contract with outside parties. It has three

depositories in London, and auxiliaries at many prominent points of the United Kingdom. It sells largely also "to the trade" and by hawkers or book-peddlers; and in foreign countries it aids missionaries with grants of its own publications, and of money to print tracts in the native languages. Besides this great and undenominational society, each religious denomination in England has a publication board of its own; and the opponents of religion have adopted the same means of disseminating their views. There are also tract societies, in which Christians of all denominations unite, at Paris, Lausanne, Toulouse, Brussels, Geneva, and some other points on the continent of Europe; also at various foreign missionary centres.

In the U. S., where common-school education and a free press have formed an eminently reading community, and where the States of New York and Massachusetts print more newspapers than all Great Britain, tracts and volumes on religion appeared early and in great numbers, and societies for printing and circulating them were at length formed—the Methodist Book Concern in 1789; the Massachusetts Society for Promoting Christian Knowledge, at Boston, in 1803, and other societies in Boston, New Haven, Middlebury, Vt., New York, Albany, Philadelphia, Baltimore, and Hartford. Prominent among these was the New York Religious Tract Society, organized in 1812, and afterward continued in the American Tract Society, New York; and the New England Tract Society, organized in 1814, which in 1823 changed its name to the American Tract Society, and in Massachusetts (1825) became a branch of the national society of the same name, then instituted. In the present American Tract Society, Christians of all denominations, and most of the local tract associations then existing, united to publish and circulate whatever would best "diffuse a knowledge of our Lord Jesus Christ as the Redeemer of sinners, and promote the interests of vital godliness and sound morality"—with only this restriction, that it should be "calculated to receive the approbation of all evangelical Christians." Such men, of twenty different denominations, have always been found among its officers, its laborers, and its warm friends and supporters. Its great object is to glorify God and save men by diffusing gospel truths through the press. But there are many subsidiary objects of great moment, such as the following: To preserve in usefulness the best writings of earlier days; to provide a channel through which the best Christian minds of the present age may impart to the world their fresh thought and their growing life; to forestall and withstand that flood of infidelity, licentiousness, and crime which has already produced hundreds of infidel works and thousands of novels, flashy books, and papers full of corruption, and to help give to American literature a truly Christian character; to furnish such publications for all classes—not for Christians alone, but for such as need to be won from their indifference or disabused of their errors; to provide them for all ages, and in forms suited to all tastes; to care for the spiritual wants of foreign immigrants; to aid in giving a Christian literature to foreign nations wherever American influence penetrates; to aid pastors in their all-important work, furnishing doctrinal and practical books for their own use, and writings adapted to every different case arising among their people; to promote and guide revivals of religion and individual effort for the good of others; to furnish these treasures of gospel truth at low prices, and thus give them the widest diffusion; to create a channel through which the charities of good people may flow in judicious grants of the most suitable books for the destitute; and to counteract sectarianism and develop that Christian union which our Saviour makes the precursor of the millennium.

For the first two years only *tracts* were published, for adults and for children. The issue of volumes, however, was intended from the first, and in the third year volumes began to appear—first, Doddridge's *Rise and Progress*, then the *Saint's Rest, Baxter's Call, The Pilgrim's Progress*, etc. In the fourth year monthly tract distribution began to be practised in New York City and elsewhere, and was soon very widely adopted, and has continued to the present day. In the sixth year prominence was given to the value of tracts in connection with faithful personal efforts to save souls. In the eighth year the "volume enterprise" was inaugurated by an attempt to reach every family in the South Atlantic States with one or more volumes. This effort was extended in the next year to include the West, and was very widely prosecuted in many parts of the country. The next step—and an exceedingly important one—was the organization in America of colportage, in 1841, to carry the gospel to the doors of neglected, scattered thousands—at least one-third of the entire population of the U. S.—who would never seek it and whom churches did not reach. Eleven self-denying and faithful men were commissioned the first year, 23 the second year, 76 the third, 143 the fourth, and before the war over 600 men were employed for the whole or a part of each year.

Another notable point in the progress of the society is found in the establishment of its periodicals. The first three were the *American Messenger*, the *Amerikanischer Botschafter*, and the *Child's Paper*. The *American Messenger* is a monthly paper, with over 100,000 subscribers. In 1847 the *Amerikanischer Botschafter* was commenced—like the *Messenger*—for the Germans. In 1852 the *Child's Paper* was commenced, a smaller monthly paper for children, beautifully illustrated, and, like the other two, edited with great ability and care. This popular favorite has had a circulation of over 300,000 monthly. In 1871 three new periodicals were added to those above named: the *Illustrated Christian Weekly*, a beautiful pictorial paper of twelve pages for home and Sabbath reading; the *Deutscher Volksfreund* (or "German People's Friend"), an eight-page illustrated weekly; and the *Morning Light*, a small illustrated paper for beginners.

The adaptation of the society to meet new exigencies was illustrated during the four sad years of the late war in supplying 172 new publications for soldiers; and in labors for the blacks, for whom quite a number of books were specially prepared and a large model school opened at Arlington Heights. In these last years also Providence has been opening one by one, in a remarkable manner, doors of access to the Spanish and Portuguese-speaking people of North and South America, the first twenty millions, and the last nine millions, in number. They are the special charge of the Christian Church in the U. S., and this society has engaged in earnest greatly to enlarge its list of publications for them, already over 300. It should also be mentioned that cash grants in aid of foreign missions began to be made in the second year of the society's existence, and have ever since been an important branch of its work, amounting often to $20,000 yearly.

Among *results* may be mentioned the providing of 5302 distinct publications, of which 1094 are volumes, and others tracts, handbills, etc., the whole constituting a collection of religious literature for our people unsurpassed in the world, many a single tract being worth the labor of a life for the good it has done. Among the home publications are 1500 in eleven foreign languages — German, French, Spanish, Italian, Portuguese, Swedish, Welsh, Dutch, Danish, Finnish, and Hungarian—for immigrants, for many of whom scarcely any other Christian literature is provided. Of the periodicals, a total of 164,000,000 copies have been issued, or, at present rates, 8,000,000 yearly, to 550,000 subscribers. Of the other home publications, over 27,000,000 of volumes have been printed and over 2,000,000,000 pages of tracts—a flood of gospel truth which has certainly told with immense power on the character and destiny of America. Probably there is no inhabited county in the land where some of these publications might not be found, and no citizen of the U. S. who is not indirectly benefited by their effect. Annual grants to our destitute are made to the amount of over $50,000 worth of its home publications. Besides large amounts thus transmitted by our shipping to foreign nations, a total of over $620,000 in money has been granted to aid the missionaries at 70 different stations in heathen lands to print books which the society approves for their mission-work; and thus 4000 different publications have been issued abroad, including over 600 volumes, in 148 languages and dialects.

Of the good results of colportage, a volume might be written, and yet but a small part be told. In its thirty-five years it has done a work equal to that of one man for over 6000 years; it has sold 10,700,000 volumes and granted 3,000,000; it has made 11,700,000 family visits; and has to a good degree met the wants of a rapidly-advancing population where no bookstores, schools, or churches existed, where the message of salvation would not otherwise have been borne.

The total amount received in donations and legacies, and expended in the charities of the society, is $4,400,000; and the sales amount to above $9,000,000, making a total of nearly $14,000,000 from its commencement to the present time. The business of the society fairly supports itself, leaving all donations and legacies to be sacredly used in its benevolent work.

The American Tract Society of Boston, for many years a branch of the national society, withdrew from it during the anti-slavery agitation, and for a time carried on its separate operations with great vigor, but is now comparatively inactive. The Western Book and Tract Society, at Cincinnati, had a somewhat similar history, but is now working in harmony with the national society.

Besides these undenominational societies, each of the leading denominations of the Christian Church in the U. S. has its own society or board of publication, some of

them large and prolific organizations. We may mention the Methodist Book Concern, the Presbyterian Board of Publication, the Baptist, Reformed, Congregational, and Lutheran boards. But as they are severally organs of a single sect, details respecting them do not come within the scope of this article. W. W. RAND.

**Tra'cy** (EBENEZER CARTER), b. at Hartford, Vt., June 10, 1796; graduated at Dartmouth College 1819, at Andover Seminary 1822; was tutor at Dartmouth 1823–25; became a Congregational minister; was editorially connected with the New York *Journal of Commerce*, the *Journal of Humanity*, and the Boston *Recorder*, and was editor of the *Vermont Chronicle* 1826–28, and from 1834 to his death, at Windsor May 15, 1862. Author of a *Memoir of Jeremiah Evarts* (1845).

**Tracy** (EDWARD D.), b. in Norwich, Conn., Mar. 1, 1791; went to Georgia and studied law; moved to Macon in 1823; was elected its first mayor, and as such received Gen. La Fayette and his party when they passed through this State; represented the county of Bibb in the house and in the senate at different times; in 1840 was elevated to the bench of his judicial circuit. D. at Macon Feb. 20, 1849. A. H. STEPHENS.

**Tracy** (JOSEPH), D. D., brother of Rev. Ebenezer C., b. at Hartford, Vt., Nov. 3, 1794; graduated at Dartmouth College 1814; studied theology; was pastor of the Congregational churches at Thetford and West Fairlee, Vt., from June 26, 1821 to 1829; subsequently preached at his native place; edited the *Vermont Chronicle* 1829–34; was for one year editor of the Boston *Recorder*, and for nearly forty years filled at Boston the post of New England secretary of the American Colonization Society. His residence for several years was at Beverly, Mass., where he d. Mar. 24, 1864. Author of *The Three Last Things* (1839), *The Great Awakening, a History of the Revival of Religion in the Time of Edwards and Whitefield* (New York, 1842), *The History of the American Board of Commissioners for Foreign Missions* (1842), and a *Refutation of Charges against the Sandwich Island Missionaries* (Boston, 1844); edited the *Memorial of the Semi-Centennial Anniversary of the American Colonization Society* (1867); contributed to the Semi-Centennial Memorial volume of the American Board of Commissioners for Foreign Missions (1862), wrote for the New York *Journal of Commerce* and New York *Observer*, and was associated with Rev. Dr. H. B. Smith as editor of the *American Theological Review* for several years.—His brother, Rev. IRA TRACY, for several years a missionary to Siam, subsequently a financial agent of the American Board and Congregational pastor in the Western States, was author of several publications, chiefly upon missions, and was a contributor to the *Bibliotheca Sacra*.

**Tracy City,** p.-v., cap. of Grundy co., Tenn., on the summit of the Cumberland Mountains, and on the Tennessee Coal and R. R. Co.'s road, has 1 church, 1 newspaper, 1 foundry, a steam saw-mill, and the railroad car and repair shops. Coal-mining and coke-burning are extensively carried on. P. about 1200.

CHARLES FOSTER, ED. "REPORTER."

**Trade.** See FREE TRADE, by HON. D. A. WELLS, LL.D.; and PROTECTION, by R. E. THOMPSON.

**Trade, Balance of.** According to the old mercantile theory which long ruled the commercial world, trade was regarded as profitable only as it brought money into a country. It was assumed that the statistics made up at the ports of entry furnished trustworthy data for determining the comparative value of the country's exports and imports, and that the difference between the two must always be adjusted by the transmission of specie one way or the other. Hence the inference that the balance of trade must be in favor of a country when its exports exceed its imports, and *vice versa*. A better exposition of the principles of political economy has shown that the theory is false, that the data are uncertain, and that the inference is unfounded and misleading. The theory rests on the idea that money alone is wealth. But money constitutes but a small fraction of the wealth of an individual, a nation, or the world, and its value consists simply in its utility as an instrument of exchange. The true advantage of foreign trade is found in the imports. By means of it a people obtain things which either they cannot produce at all, or which they must produce at a cost beyond that of the things exported to pay for them. As Mr. Mill says, "Commerce is virtually a mode of cheapening production," and "tends to the general increase of the productive powers of the world." Trade between two nations is profitable when it yields to both this advantage, made evident by the fact that with each the value of its imports exceeds that of its exports. This supposes the estimate to be made of the exports as they leave and of the imports as they come in. Just here it is that the custom-house statistics are fallacious, since the exports are stated at their value here, and imports at their value in foreign countries. It is to be noted, further, that the custom-house returns omit altogether some important phases of the trade, and the old theory of the balance of trade sets down the real profits of the trade as against the country. This may be illustrated by one of the two hypothetical or real cases thus presented: "American merchants ship to London beef, boots, etc., worth in New York $100,000,000, worth in London $110,000,000. The avails of the sale are invested in British goods worth in London $110,000,000, worth in New York $121,000,000. The custom-house returns show for the transaction exports $100,000,000, imports $110,000,000; balance against us, $10,000,000. And yet the merchants have made a profit of $21,000,000 real benefit to the country." Again: "There are shipped to Cuba wagons, etc., worth in Baltimore $1,000,000, in Havana $1,100,000. The proceeds are invested in cigars, worth in Havana $1,100,000, in Russia $1,210,000. The avails are invested in Russia iron, worth in Venezuela $1,331,000. This is sold, and invested in South American products, worth in Spain $1,464,000. There the avails are invested in olive oil, worth in Australia $1,610,510; sold there for gold, which is brought home. The custom-house reports $610,510 excess of imports over exports set down against us, though the excess is so much profit received in that which, according to the theory, is to be considered above all things else real wealth."

The profit of a prosperous foreign trade must appear in imports whose value exceeds that of the exports; and under a sound condition of finance it is of little consequence whether the surplus brought in takes the form of money or of goods. For Americans there is one aspect in which it is of great importance that the balance of trade should be studied. It is with reference to what we are actually purchasing our imports with—whether with real products of our present industry or with promises to pay in the future. The sum-total of evidences of debt in the form of government bonds, railroad bonds, etc., which have gone abroad is enormous; the annual interest on these makes heavy drafts on our national wealth; and it is the dictate of wise economy to pause and consider how the balance stands, lest we push our credit till dishonor and bankruptcy are made inevitable. A. L. CHAPIN.

**Trade, Board of.** See BOARD OF TRADE.

**Trade'-mark.** A trade-mark is a distinctive word, mark, symbol, or device affixed to an article of trade to indicate its origin or ownership. Very few products bear in their own external appearance sufficient evidence of their real character to protect the purchaser against fraudulent imitations. Integrity in manufacture and uniformity in quality are sought for by all users and consumers of merchantable goods, and when, by long experience, the public have learned to associate these with a special brand, the wide and profitable sale of articles bearing this brand is assured, and the exclusive possession of their distinguishing mark becomes, therefore, valuable and important. The trade-mark is a guaranty of genuineness, and its value is proportioned to the business reputation of the owners and the excellence of their manufactures. In other words, the recognition of trade-marks is the standing testimony of the commercial world to the money-value of honesty in all ages and countries. It is impossible to fix the date of their earliest use, but in the very nature of things it must have been very nearly "coeval with the birth of traffic." There can be but little doubt that they existed in pre-historic times; they were certainly in use as early as the building of Nineveh and Babylon, for the maker's marks are still plain on the ancient bricks and on the remnants of pottery that still remain.

A trade-mark may be any sign, word, symbol, or device not descriptive in its character, and not used by others on the same kind of articles or goods. As a rule, the simpler and more arbitrary a trade-mark, the less liable it is to be evaded by colorable imitations. If it embraces complex figures, one similar in general effect, but in reality quite different, may be adopted by a rival in trade, or a portion only may be taken; if it bears some real or apparent analogy to the article itself, or to the name of the maker or place of manufacture, it may be open to cavil as a mere label. The validity of a trade-mark, unlike that of a patent for an invention or design or a copyright on a printed work or a work of art, is not dependent upon its novelty *per se*. The same mark may have been used upon a hundred articles, and yet be quite valid in its application to still another. The word "Centennial" during the past and present year has been registered as a trade-mark for many different varieties of goods, and the list for the same word will doubtless be still further extended. One manufacturer

may appropriate the well-known collocation of letters I X L as a trade-mark for cutlery, and another may appropriate its use for woollen stockings. So also of symbols: the figure of a lion may be applied in designating the cream cheeses of a dairyman, the cans of a tinsmith, or the volumes of a publisher, and each will be secured in the exclusive possession of the symbol for his own especial class of goods, the genuineness of which will be guarantied by the symbol, just as in mediæval times the written messages of the untaught barons were authenticated by the impress of their signet rings. But a trade-mark is not fully a trade-mark until actually affixed to an article of trade and for commercial purposes, although the commissioner of patents has decided that a trade-mark may be registered, in accordance with the patent law of July 8, 1870, previous to its actual use, the applicant for registry setting forth in his application that he proposes to use the mark upon a certain specified class of goods. The law in question, it must be remarked, is designed to supplement, not to supersede, the rights secured under the common law, and, when preferred, actions for infringement, instead of being brought in U. S. courts, may be proceeded with in State courts in the same manner as before the passage of the act. This law provides for the issue of certificates of registration protecting the use of the mark for a period ordinarily of thirty years from the date of registration, after which time the remedy for infringement lies in the common law. But trade-marks owned by persons in foreign countries affording rights of registry to American citizens may also be registered here, but the function of the registration will cease with the registry abroad, and the trade-mark will be remitted to the same position as by expiration of the term; but in all cases the trade-mark may be re-registered if application to that effect be made to the commissioner of patents six months before the expiration of the original term. The countries with which the U. S. by treaties and conventions has reciprocity in trade-marks are Austria and Hungary, by the convention proclaimed June 1, 1872; Belgium, by the treaty of July 17, 1858; France, by the treaty of Apr. 16, 1869; Germany, by the treaty of June 1, 1872; and Russia, by article to former treaty, Jan. 27, 1868. Canada, by her Trade-mark and Design act of 1868, permits the registry of American trade-marks; Great Britain, by the Merchandise Marks act of 1862, provided for the protection of trade-marks, and this was considered by our patent office as equivalent to a convention. But this makes no provision for registry. The date of adoption and public notice of exclusive claim could, however, be put on record in Stationers' Hall, London. On Aug. 13, 1875, an act of Parliament provided for the registration of trade-marks, and this has been supplemented by a set of cumbrous and imperfect rules.

As possession of a trade-mark is assumed to rest upon natural right, and not exclusively upon statute law, it might reasonably be inferred that any one could register and be protected in the use of a trade-mark, but it has been plausibly argued that many persons are excluded. For example, a trade-mark being no mark unless upon an article of trade, the person registering must, to a greater or less extent, be a trader, or, at all events, his position must not be wholly inconsistent with trade. For instance, it has been averred that a person inhibited from the pursuit of traffic by reason of clerical or monastic vows would be debarred. But with this view the writer cannot coincide. That an insurrectionist in arms or an alien enemy might be refused registry or protection is manifest; and the same would be true of one under sentence of outlawry. The opinion held by some that one pronounced *non compos mentis* by judicial authority would be incapable of holding a trade-mark is doubtless also correct, but in this case the right would inure in the hands of his legal representatives. The patent office ignores the disability of married women, under the laws of some of the States, to do business in their own names, and registers trade-marks without reference to local limitations. This is just, and it is doubtful if even the narrow spirit, in this respect, shown by the old common law would permit or warrant the flagrant wrong involved in the appropriation of an established trade-mark on any such ground as this.

A firm or corporation making or selling any vendible article may hold a trade-mark, and it is to such that the term "any corporation" is assumed to be limited in the statute. It is uncertain whether one registry will cover the same mark or symbol for an entire class of articles, or whether it must be registered for each variety included in the class. For example, whether a device can be registered broadly for, say, agricultural implements, under a single certificate, or whether separate certificates must be secured for hoes, spades, ploughs, etc. The former plan is followed in the practice of the patent office, but the latter is, for many reasons, to be preferred. In the first place, it follows closely the analogies of the patent law as concerns inventions. Again, it avoids the objection of non-user, which might hold should a portion of the articles enumerated cease to be manufactured; and further, it enables the infringement of the trade-mark as applied to one article to be met without calling into question its validity as applied to the others.

It is difficult within the narrow limits of an article to make plain the delicate shading that in many instances defines the boundaries of a valid trade-mark. It is true that a geographical name is not a trade mark, although it may form part of a label (see LABEL), yet "Congress Spring Water" for mineral water from the Congress Spring at Saratoga, "Rockland Lake Ice," for ice from Rockland Lake, N. Y., and "Codorus" for a peculiar iron ore found in Codorus township, Pa., and for iron and steel made from that ore, have all been adjudged to be lawful trade-marks. They have been thus sustained because the owners of the marks were sole and exclusive owners of the products within the geographical limits indicated by the name, and the words could not be truthfully applied to articles produced anywhere else. It is also true that in general a proper name cannot be a trade-mark. Yet when the name is of such character that it affords no opportunity for two or more manufacturers or dealers of the same name to correctly indicate the origin of their wares by the same cognomen, a name may form a valid trade-mark. Thus, Bismarck gloves or Kossuth hats or Roger Williams cloths or Garibaldi guns or Paul Jones whisky would be valid trade names. This is based upon the idea that none of the historic personages indicated, nor others of identical names, have ever engaged in the fabrication of such goods, and in all such connection the term is fanciful and arbitrary. In England the name Wedgwood has been judicially held to be a proprietary mark against all comers, but this is in reality more in the nature of a label than a trade-mark, and was sustained rather on the broad principles of justice protecting against unfair competition in trade, than by the strict application of the rules that are now deemed requisite in the administration of trade-mark cases properly so termed. Pseudonyms, if arbitrarily chosen, may be used as trade-marks, and so may a person's own signature or its facsimile, the shape of the latter making it an entity distinct from the name itself as displayed in the common or conventional imprint of type. It is true that a fanciful name may be a valid trade-mark, and frequently constitutes a most valuable one, but this fancy name must not either truly or falsely attempt to indicate the character of the article to which it is appended. If such indication is true, the mark is descriptive, and is properly a label; if false, the mark is void on the ground of fraudulent suggestion; thus, "Balm of a Thousand Flowers" was held by Justice Duer to be unworthy of protection. The compound was set forth as "the very balm and extract of healing blossoms," and was in reality a solution of highly-scented soap. So also an heraldic symbol may be a valid trade-mark, and *per se* would be so held in this country. But if registered abroad, and there declared invalid because included in the arms of some existent family, the validity of the mark in the American market might very properly be disputed on a transcript of the foreign judgment. A person cannot monopolize the national insignia of any country, but the connection therewith of his name or of another word or symbol may form a perfect trade-mark. The adoption of Masonic emblems (and by a parity of reasoning those of similar organizations) as trade-marks is not recognized by the U. S. patent office, and their use as such would probably be denied by the courts of this and other countries. Simple letters and numerals are among the most treacherous of trade symbols, being the most open to evasion on plausible grounds. A clean-cut, newly-coined word, not purely descriptive or grammatically derived from pre-existent terms, is perhaps the best, and after this a word indicative of excellence, but not descriptive. Of such the word "excelsior" is perhaps the most common. Probably the article whisky has been the subject of more delectable trade-mark names than any other; "magnolia" and "nectarine" may serve as examples. An occult suggestion of superiority, more readily appreciated than defined, is frequently an important element in attracting attention to an article, and terms having this characteristic constitute very available trade-marks. Figures of animals, or even of reptiles, form striking trade-marks, and allegorical representations, if not too complex, are also good.

But care must be taken that the mark makes no false suggestion. Thus, "Night-blooming Cereus" was declared void as a trade-mark when it was shown that the perfume to which it was applied was made not from the flower, as was pretended, but from other substances. If it had been the product of distillation from the flower of that name, it would, however, have been void for a quite different

reason—viz. it would then have been simply descriptive of the article; any one has the right to distil the perfume of any flower, and to call the product by its proper name. Medicated Mexican Balm was applied to a so-called hair tonic, and was accompanied by a false statement of its origin. This was an English case, and although the application for an injunction was denied by the master of the rolls on other grounds, there can be no doubt but the falsehood accompanying the term would have defeated it. This term, moreover, may serve as an illustration of the thin division between a trade-mark and a label. In one sense it is arbitrary and unconventional; in another merely descriptive. In either aspect it may be assumed as including a false suggestion of the place of its origin. But would the term Aztec or Toltec—adjectives that could hardly by any possibility mislead—be open to the same objection? and if not, why the distinction? The uncertainty attending the use of adjectives implying nationality in origin should, it is plain, discourage their adoption in trade-marks. The term "American Sardines" was refused registry by the U. S. patent office on the ground that it embraced a false suggestion, the so-called sardines being an inferior fish, the "moss-bunker" of the New England coast. Were the fish true sardines, the term would be purely descriptive, and no trade-mark.

As has been herein previously intimated, a lawful trade-mark holds good under the common law, independent of registration, for an unlimited time, and that registration holds good for thirty years, with the right of re-registration for a second period of equal duration. But to all this there is—according to the dictum of the patent office—an exception in the case of patented articles, by which it is held that the mark or term designating an article while patented becomes generic and lapses to the public with the expiration of the patent. I doubt if this is in accordance with sound justice or sound law. The question has never been carried to a tribunal by which it has been definitely set at rest.

If a dealer permits his trade-mark to go into use by others without asserting his exclusive right to it, he will be held to have abandoned it, and he will have no remedy. So also if he ceases to use it during a period so long that its original connection with his name and business is lost, another may adopt it, and by *bona-fide* use hold it even against the original owner. But mere non-use will not throw open the trade-mark to another so long as such use by another would tend directly to enable the infringer to trade on the reputation of his rival. This was decided in the case of Lemoine *v.* Ganton in the court of common pleas of the city of New York, Jan., 1854, and this ruling, from its manifest fairness, may be taken as authoritative. JAMES A. WHITNEY.

**Trader's Hill,** p.-v., cap., Charlton co., Ga., on St. Mary's River.

**Tra'dersville,** p.-v., Somerford tp., Madison co., O. P. 25.

**Trad'escant** (JOHN), b. in Holland about 1570; became a naturalist and antiquarian; travelled through various countries of Europe, Asia Minor, and North Africa, making a collection of objects of natural history; was in 1608 settled in Kent, England; subsequently established a botanic garden at South Lambeth, where he added largely to his collection of curiosities; had many rare exotics, and was the means of acclimatizing several useful plants in England; was employed by several of the nobility to lay out their gardens, and in 1629 was appointed gardener to Charles I. D. at Lambeth in 1638.—His son JOHN, b. at Meopham, Kent, in 1608, added largely to the collection by his travels, in the course of which he visited Virginia; enjoyed the patronage and friendship of many distinguished men, and published in 1656 a descriptive catalogue under the title *Museum Tradescantium, or a Collection of Rarities preserved at South Lambeth, near London,* ornamented with prints of the two Tradescants engraved by Hollar. D. at South Lambeth Apr. 22, 1662. The antiquary Elias Ashmole claimed possession of the museum by gift from the younger Tradescant, dating from Dec. 15, 1657, but the widow refused to surrender it, and the conflicting claims were decided by a chancery suit, which terminated in favor of Ashmole. The collection thus became the nucleus of the celebrated "Ashmolean Museum," presented by its founder to the University of Oxford 1683. A family group of the Tradescants, painted by Dobson, belongs to that museum, and was exhibited in 1866 at the National Portrait Exhibition in London.

**Trades'-Unions.** Trades-unions have undergone considerable change in their objects, character, and action, and no sound judgment can be formed respecting them without some knowledge of their origin and history. They originated in England, mainly in consequence of the breaking down, before machinery and the growth of large capitals, of the old industrial system. Production had formerly been carried on chiefly by small capitals; in a great number of employments the competition of workmen was limited by a law of apprenticeship; wages in many cases were fixed by public authority; and the poorest apprentice, if industrious and thrifty, might look forward with confidence to becoming a master and enjoying a position of comfort and independence. The steam-engine, by annihilating numerous handicrafts and creating vast accumulations of capital, revolutionized the whole organization of industry, altered profoundly the relations between capital and labor, and led to the repeal of the laws of apprenticeship; and hence workingmen in various trades formed societies to protect themselves against both the new power of capital and the new competition to which they were exposed. The conditions under which these early trade-societies were evolved, and the temper and spirit of an age far ruder than the present, must be taken into account. Their members were attacked in many cases in their means of livelihood by new methods of production; they were exposed suddenly to an unlimited competition of strange workmen, women, and children; they were deprived of their old paths to independence; and they had to deal with a new class of employers, distant from them in station, eager for gain, and possessed of novel powers over the labor-market. Starting under such conditions, and in an age which was fierce and brutal in its manners compared with our own, it is no wonder that trades-unions assumed a hostile and aggressive attitude toward both capital and external competing labor, that some of their rules are as unjust as impolitic, and that their practice was often worse than their rules. Crime and outrage are the chief incidents in the earlier annals of the trade-societies. In all the grosser forms they have since almost disappeared, and acts of violence, where they have occurred in recent years, have never been chargeable on the more powerful and completely organized societies.

In the minds of many employers, and of a large part of the public, trades-unions are identified with strikes as their promoters and principal cause. Nor can there be any doubt that the accumulated funds of which they have the disposal, and their power over their individual members, do enable them to carry on much more extensive and prolonged strikes than could otherwise take place. The capitalist, having a reserve fund, is necessarily in a better position to treat for terms than the individual laborer, and the loss of a single hand is of little or no importance to him. The workmen, on the other hand, by combination and contributing to a common fund, can often place themselves on a position of equality with, and sometimes of superiority to, the capitalist. Trades-unions thus do possess and exercise some control over wages and all the conditions of contracts with employers, and they have naturally exercised this power in the direction of raising wages and shortening the hours of work. Nevertheless, it would be nearer the truth to say that trades-unionism tends to prevent strikes and disputes with employers, rather than to make the common allegation that it foments them. The rules of many unions provide that no strike shall take place until amicable negotiations have failed, and surround them with various other preliminary conditions. And it was proved by the evidence before the British royal commission on trades-unions, which reported in 1869, that there had been fewer disputes with employers and greatest permanence in the rate of wages in the trades with the strongest, richest, and most extended unions. It is true that the diminished frequency of strikes through the action of unions has partly arisen from the fact that they have been powerful enough to obtain concessions without resort to a strike; but it is almost self-evident that responsible and intelligent leaders are less likely to resort to rash and ill-advised measures than a multitude of ordinary laborers; and that it is the direct interest of the paid officers of a union not to waste its funds in struggles which are likely to end either in defeat or in success which may cripple the trade which is the ultimate source of those funds. Every member of the union, moreover, has a vested interest in the conservation of funds to which he looks for assistance in sickness and when otherwise out of employment. Another impression which prevails widely with respect to trades-unions is, that they are generally adverse to piecework, but this is true only in a small minority of trades, respecting which there is much difference of opinion as to the expediency of piecework. It has been recently stated by Mr. Mundella, M. P., that 90 per cent. of the British exports are the produce of piecework, and that more piecework is done in England, the mother-country of trades-unions, than in any other country. No assumption, he added, could be more devoid of foundation than that trades-unions generally are opposed to piecework. In some of the largest industries, including

the ironworkers, the colliers, the shipbuilders, the printers, painters, and tailors, the stocking and lace manufacturers, the cotton and worsted trades, piecework is the established custom.

It is true that some English trades-unions maintain unreasonable and unjust restrictions on the admission of workmen and the modes of work, but this is no more than may be said of some of the regulations of the legal and medical professions in England. And when we consider the vast improvement which has already taken place in the rules and objects, and still more in the spirit and practice, of English trades-unions, we may reasonably look forward to the removal of all just ground of complaint against their organization and policy. Already the majority in England are normally occupied with objects the usefulness of which is admitted on all sides. They ascertain the requirements for labor in different localities, and distribute it so as to meet the demand; they assist emigration of surplus labor; they act as friendly and insurance societies, and promote some of the best objects of social union by means of reading, libraries, and other means of intellectual improvement. Mr. John Stuart Mill, speaking despondently of the present system of production by capital and hired labor, said that "the conversion of existing businesses into trades-unions would be the euthanasia of trades-unionism." No such transformation of the modern industrial economy is, however, likely to take place within a period for which we can reasonably form anticipations, and meantime the past history of trades-unionism justifies the hope that it may be so transformed in comparison with its earliest phases that not even an euthanasia need be desired for it by economists or even capitalists. (See LABOR, STRIKES, and WAGES.)

T. E. CLIFFE LESLIE.

**Trade Winds.** See WINDS, by PROF. A. GUYOT, PH. D., LL.D.

**Tradu'cianism** [from Lat. *tradux*, a "vine-layer"], as opposed to CREATIONISM, and the doctrine of PRE-EXISTENCE (which see), the belief that the human soul is derived from the souls of the parents, as the body is from their bodies. Tertullian, Athanasius, Gregory Nazianzen, and the Lutheran Fathers were Traducians, generally holding that the parents are the divinely-appointed means of a divine act of creation. Augustine leans toward this view, although careful not to commit himself to it.

**Traer,** p.-v., Tama co., Ia., at the terminus of Burlington Cedar Rapids and Northern R. R., contains 2 churches, 2 private banks, 1 newspaper, a handsome park, an extensive flouring-mill, 4 hotels, and fair-grounds. It is in the centre of a fine agricultural region. P. about 1200.

BARNARD MURPHY, ED. "CLIPPER."

**Traetto,** town of Italy, province of Caserta, about 12 miles from Gaeta, on the southern slope of a fertile hill at the foot of which flows the Garigliano. Near this town are striking ruins of a Roman aqueduct, supposed to have supplied the ancient city of *Minturnæ*. Traetto was a strongly-fortified place during the Middle Ages, and served as a retreat for Pope John VIII. and for various unfortunate princes. It has now a small coasting-trade. P. 7467.

**Trafalgar',** a low promontory of the south-western coast of Spain, on the Straits of Gibraltar, in lat. 36° 10′ N., lon. 6° 1′ W. Off its shores was fought, Oct. 21, 1805, the great battle between the English fleet under Nelson and the allied French-Spanish fleet under Villeneuve. The allied fleet was superior both in number of ships and of guns, but was nevertheless completely routed, 19 of its 34 large ships being captured by the English.

**Trag'acanth** (see GUM), [Lat. *tragacanthum;* Fr. *gomme adraganthe;* Ger. *Tragant;* It. *dragante*], a gummy exudation from the *Astragalus verus*. The dried gum is slightly translucent, resembling horn in appearance. It is hard, but difficult to pulverize; has no smell, and but very little taste. It does not dissolve in water, but absorbs it, swelling up and forming an adhesive paste. Upon adding an additional quantity of water to this paste, a uniform mixture is formed, from which, however, the greater part of the gum is gradually deposited. It is insoluble in alcohol. Tragacanth appears to consist of two distinct constituents, of which only one is soluble in water. This is very similar to gum arabic, but differs from it in a few chemical properties. The insoluble portion, which is perhaps identical with *bassarine* ($C_6H_{10}O_5$), and is termed *tragacanthine*, is colored blue by iodine, but the coloration is probably owing to the presence of a small proportion of starch. The analysis of tragacanth gave: gum, 53.3; tragacanthine and insoluble starch, 33.1; water, 11.1; the ash forming 2.5 per cent. Gum-tragacanth is used in calico-printing, and also to some extent medicinally.

J. P. BATTERSHALL.

**Trag'edy** [Gr. τραγῳδία], that kind of drama which represents a tragical situation or a tragical character. A tragical situation occurs when two powers, over which the individual has no control, and from which he cannot escape, clash together and crush him by their conflict. A character becomes tragical when he must perish simply because he is such as he is, it being undecided and undecidable how he became thus.

The tragical situation is principally of ethical interest. It is formed when two duties contradict each other in such a manner that the one cannot be fulfilled without a violation of the other. Thus, in the tragedy of Æschylus, Orestes cannot leave the murder of his father unavenged without incurring the wrath of the gods, nor can he kill his mother, who has slain his father, without becoming the prey of the Furies. In the tragedy of Sophocles, Antigone cannot leave the corpse of her brother unburied without committing a crime against his manes, nor can she bury it without offending the authority of the state. In both cases a violation of law takes place, and a punishment will follow. But in such situations of ethical conflict the character of the individual, his peculiar natural disposition and psychological constitution, is of subordinate consequence. With the tragical character, on the contrary, the interest is principally psychological. If a certain event takes place, the individual falls into delusions, despair, crime, miseries, death, simply in consequence of his natural disposition, above which he cannot rise, and in obedience to the necessary laws of his psychological constitution, from which he cannot emancipate himself. Thus, Macbeth might have been the glory of his country if he had not met the witches, but, having met them, he is lost. Lear might have been the happiest king in the world if he had had no daughters, but, having got them, they must kill him. (See Balzac, *Le Père Goriot.*) But in all such cases the interest is almost exclusively psychological; nobody thinks whether Othello does wrong or right in killing Desdemona.

This distinction between the tragical situation and the tragical character constitutes the fundamental difference between the ancient and the modern tragedy. The Greek tragedy always represents tragical situations, and its whole repertory contains hardly any tragical character in the above sense of the word. Medea by Euripides might form an exception. The modern tragedy, on the contrary, represents tragical characters, and every attempt which has been made in modern times to represent tragical situations in the antique sense of the word, as contradictions between duties, has failed. The classical tragedy of France, which in this respect was a true revival of the ancient tragedy, and almost without exception sought the tragical effect in the tragical situation, maintained its supremacy, even in its own day, by the elevation of its tone and the elegance of its form, rather than by any powerful representation of the tragical; and now it is almost impossible to concentrate the attention on the tragical conflicts in Corneille's *Cid*, Racine's *Athalie*, and Voltaire's *Zaire*, the masterpieces of the school, without a smile. Of all modern tragedians, however, Shakspeare is the only one who exhausts the above given idea of the modern tragedy as a representation of tragical characters. Calderon made a mistake between the simple impulses of human nature and the more or less artificial excitements of the Roman Catholic faith, and his tragedies make an impression somewhat similar to that of the classical French tragedies; there is much to admire, much which touches us, but there is no tragedy. Of the romantic school, Heinrich von Kleist in Germany and Victor Hugo in France have written tragedies on the same principle as Shakspeare, but compared with him Kleist is small and somewhat artificial; Hugo wild, exaggerated, and rather hollow. With the other great modern tragedians, Goethe, Schiller, and Œhlensläger, the tragical, although based as it must be on the character, is not developed, as with Shakspeare, from the psychological constitution alone, but produced by placing the character in conflict with the situation. A character of a certain description is placed in a situation historically necessary, which, on account of the relation which it bears to the character, must prove fatal. Compositions of this kind are neither purely ethical nor purely psychological; they are historical. Striking examples are Goethe's *Götz von Berlichingen* and *Egmont;* Schiller's *Wallenstein* and *Don Carlos;* Œhlensläger's *Hakon Jarl* and *Axel og Valborg*.

CLEMENS PETERSEN.

**Tra'gopan,** a name given to the birds of the genus *Ceriornis*, members of the family Phasianidæ and most nearly related to the genus *Gallus*. The males, however, instead of a comb, have a crest of soft feathers and a pair of soft horn-like appendages, protractile and retractile at will, above the eyes, as well as wattles in front on the throat; the tail is large, depressed, and rounded at its posterior margin; the tarsi are armed, in the male, with short conic spurs. The generally-recognized species are five in number, and are mostly confined to the pine forests of the

Himalaya Mountains and confluent and neighboring chains of Asia. They are generally solitary in their habits, dwell in the inmost recesses of their native forests, and are difficult of approach. They average about the size of the domestic poultry, or perhaps are a little larger. They feed upon grains, insects, worms, etc., and indeed resemble in this and many other respects the common gallinaceous birds. The most noteworthy feature is the remarkable development of the livery of the male at the pairing season. Then are fully developed the horns and wattles, and when entirely displayed they give him a "gorgeous" appearance. The horns, although rudimentary in the young as well as the females, are only fully developed in the male toward maturity, and the wattles are usually concealed within the rami of the jaw and by the feathers; "deflection and exposure of the wattle follows from its arterial injection, being provided with a rete mirabile whose vessels run chiefly longitudinal and parallel; the occasional rich red hue is a sanguineous effect." The male with these "shows off" in several ways: (1) sometimes, first crouching with tail bent down, he moves his head and neck with vibratory jerks, flaps his wings, erects his horns, spreads out apron-like his wattles, and then draws himself up to his full height; (2) again, he simply erects all his feathers, and elevates one shoulder without moving his head-dress; (3) at other times, standing on a perch, he tosses his head, and displays horns and wattles; and (4) on still other occasions he simply erects his horns. (See Murie in *Proc. Zool. Soc., Lond.*, 1872, pp. 730–736, pl. 60, 61.) THEO. GILL.

**Tragul'idæ** [from *Tragulus*—diminutive of τράγος, "goat"—the generic name of the type], a family of placental mammals of the order Ungulata and sub-order Artiodactyla, and containing the smallest living representatives of the order. In external appearance they are somewhat intermediate between a deer and hog, but are peculiar in the arching of the back behind and the projection of the buttocks backward; the neck is rather short; the head slender and with a pointed snout; the ears moderate; no horns are developed in either sex; the tail is moderately short; the legs are slender; the feet provided with lateral hooflets; the teeth in the normal ruminant number (M. $\frac{3}{3}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$, I. $\frac{0}{3}\times 2$), and form the chief distinctive feature, consisting of the interruption of the incisorial series at the symphysis and the enlargement and expansion of the middle incisors toward their crowns, and the development of the canines of the upper jaw as tusks in the males; the stomach is tripartite, the psalterium being incompletely developed; the placenta is diffuse; the axial vertebra has a conical odontoid process; the outer metatarsals are developed. The family is now peculiar to Asia and Africa. It is specially interesting as exhibiting an intermediate condition in the development of the stomach and some other parts between the typical ruminant ungulates and the omnivorous or hog-like forms. The type is developed under two extreme modifications—viz. (1) *Tragulus*, in which the metacarpals and metatarsals are fused into cannon-bones, as in the ruminants generally, represented by five species in the East Indies and neighboring countries; and (2) *Hyœmoschus*, in which the corresponding bones are distinct, as in the hogs, and of which only a single living species (*H. aquaticus*) is known from Western Africa. In former geological periods the family was much more widely diffused; the still existing genus, *Hyœmoschus*, had members in Southern Europe during the Miocene Tertiary, and other extinct genera were represented by allied species. (See especially an elaborate monograph by A. Milne-Edwards (*Recherches anatomiques, zoologiques et paléontologiques sur la Famille des Chevrotains*) in *Ann. des Scienc. Nat.*, 5me série, t. 2.) THEODORE GILL.

**Trail Creek,** tp., Harrison co., Mo. P. 1085.

**Trailing Arbutus.** See ARBUTUS and EPIGÆA REPENS.

**Traill,** county of Dakota, recently formed, and not included in the census of 1870.

**Traill** (CATHARINE PARR). See STRICKLAND (AGNES).

**Traill** (ROBERT), D. D., b. at Lisburn, Ireland, July 15, 1793; graduated at Trinity College, Dublin, about 1817; took orders in the Church of England 1820; became parish minister of Schull, county Cork, 1830, and fell a victim to his incessant labors to relieve his parishioners during the great Irish famine, dying of an epidemic fever in 1847. He had early completed an excellent translation of the *Jewish War* of Josephus, published in parts (1846–47), with elaborate notes by Isaac Taylor, and a remarkable series of views of the Holy Land from original sketches by Tipping, engraved on steel by a process invented by Isaac Taylor. New editions were published 1851, 1861, and 1866, and at Boston, Mass., 1868.

**Traill** (THOMAS STEWART), M. D., b. at Kirkwall, Orkney Islands, in 1782; graduated at the University of Edinburgh 1801; became a physician, and was professor of medical jurisprudence in that university from 1832 to his death, July 30, 1862. He was editor of the 8th ed. of the *Encyclopædia Britannica* (22 vols., 1853–61), for which he wrote more than 400 articles; wrote for scientific periodicals, and was author of *Lectures on Medical Jurisprudence* (2d ed. 1840; Philadelphia, 1841) and other works.

**Train** (GEORGE FRANCIS), b. in Boston in 1830; entered upon mercantile business there, and subsequently in Australia; in 1860 went to England, and attempted to introduce street railways into Liverpool and London, but was met by legal opposition; subsequently travelled extensively, wrote considerably, spoke much in public, and developed singular idiosyncrasies. Among his publications are—*An American Merchant in Europe, Asia, and Australia*, and *Young America Abroad* (1857), *Spread-Eagleism*, consisting of some of his public speeches (1859), *Young America on Slavery* (1860), *Union Speeches delivered in England* (1862), *Downfall of England* (1865), *Irish Independency* (1865), *Championship of Woman* (1868).

**Trai'na,** town of Sicily, province of Catania, beautifully situated on the Traina, has an interesting old monastery, the first ever established on the island. P. 8270.

**Train of Thought.** See ASSOCIATION OF IDEAS, by C. P. KRAUTH, S. T. D., LL.D.

**Tra'jan's Column,** "the most beautiful of all the historical columns," the masterpiece of the architect Apollodorus, erected in honor of the emperor Trajan A. D. 114, stands among the remains of Trajan's Forum at Rome. It is a column of white marble 132 feet in height, around and up which runs a scroll of bas-relief sculptures presenting a continuous history of Trajan's achievements. No less than 2500 human figures are delineated, besides horses, fortresses, etc., the whole forming an unequalled record of military antiquities and ancient costumes. A colossal statue of Trajan formerly surmounted it. A bronze statue of St. Peter was placed upon it by Pope Sixtus V. The "Colonne Vendôme" (see VENDÔME, COLUMN OF THE PLACE) is an imitation. J. G. BARNARD.

**Trajan's Wall,** in the Dobrudscha, European Turkey, extends E. from the Danube at Chernavodi to Kustendji on the Black Sea. It is a double, in some places a triple, earthwork, on the S. side of a natural fosse consisting of a narrow marshy valley. It is even now a strong line of defence. A railroad has been constructed along the route, and it has been proposed to open a ship-canal along the valley.

**Traja'nus** (MARCUS ULPIUS), Roman emperor A. D. 98–117, b. at Italica, near Seville, Spain, Sept. 18, A. D. 52, of a family of Roman descent; was educated in the camp of his father, and distinguished himself so much in the Parthian and German wars that, although not of Italian birth, he was adopted by Nerva in 97 under the general acclamation of the people; in January of the following year he succeeded him on the throne. His reign is considered, next to that of Augustus, the most brilliant period of the history of imperial Rome. The Roman arms were eminently successful. By two campaigns (101–102 and 104–106) Dacia, the region between the Theiss and the Pruth, comprising the present Transylvania, Moldavia, and Wallachia, was conquered and made a Roman province. It was the first real conquest since the death of Augustus, and the Romanization of the country must have been effected very quickly, as Transylvania is covered with splendid monuments of the time of Trajan. By another campaign (114–116) Armenia and Parthia were conquered, and Trajan was the first and the only Roman emperor who navigated the Persian Gulf. No less successful was his internal government. The vigor and probity of his administration gave rise to the phrase with which afterward a new emperor was first saluted, *Augusto felicior, melior Trajano.* Peculating governors were prosecuted, informers were punished, and Rome saw once more an honest administration of the courts and the finances. Cities were founded, colonies settled, fortresses and harbors constructed, numerous roads, canals, bridges, etc., were built throughout the empire. In Rome the Forum Trajani was erected, containing the famous column in its centre. Gorgeous festivals were given to the people, but large sums were also employed in the education of freeborn Roman children. Libraries, among which was the celebrated Ulpia Bibliotheca, were founded, and the Latin literature experienced its afterbloom in Tacitus, the Younger Pliny, Juvenal, etc. The tenth book of Pliny's letters, containing the correspondence between him and the emperor, is very interesting on account of the information it contains not only with respect to the general character of the administration, but more especially with respect to the social position of the Christians. On his return from the Parthian campaign, Trajan was taken sick at Selinus, in Cilicia, and d. there Aug. 11, 117. His ashes were

brought in a golden urn to Rome and deposited beneath the column which bears his name.

**Tralee′,** town of Ireland, capital of the county of Kerry, Munster, on the Lee, 1 mile from its mouth, is well built, and has an active trade in grain and other agricultural produce. P. 9701.

**Trall** (Russell Thacher), M. D., b. at Vernon, Ct., Aug. 5, 1812; removed to Western N. Y. in childhood; studied medicine; became a physician in New York City 1840; abandoned soon afterward the use of drugs; substituted the water-cure treatment, opening an establishment for that purpose, and founded in 1853 the "New York Hygeio-Therapeutic College," a medical school for both sexes, subsequently removed to Florence, N. J. Editor of the *Hydropathic Review* and other periodicals, and author of numerous treatises in advocacy of his views on the subject of medicine.

**Tramway.** See Railroads, by Col. J. W. Adams, C. E.

**Trance** [Lat. *transitus*, "a dying state"], a state of abeyance of most of the vital functions, resembling in some cases a profound sleep, in others closely simulating actual death. Some cases of so-called trance are clearly cataleptic, and all are associated with abnormal nervous conditions or perverted nerve-functions. Trance sometimes follows extreme religious excitement. In some cases of real or pretended trance the patient can speak, and even address public audiences, the condition being assumed at will. But in the more profound trance all sensibility and power of motion is lost, and in some no sign of breathing or of heart-beat is apparent. This condition has been known to last for months or even years. (See Catalepsy, Clairvoyance, Mesmerism.)

**Tra′ni,** town of Southern Italy, province of Bari delle Puglie, on the Adriatic, about 27 miles N. W. of the town of Bari, with which it is connected by railway. It was formerly surrounded by a castellated wall, with towers and bastions, and the three principal gates were defended by draw-bridges, but few traces of these fortifications now remain. The port of Trani was improved by the Normans, but these works have been destroyed, and the present constructions are of a more recent date. This port is well sheltered except on the N. W., in which direction the mouth of the harbor is turned; much, however, has been done at different times to protect it on this side, and during the flourishing period of Italian mediæval commerce with the East, Trani was a very important centre of maritime trade. It has the honor of never having been in subjection to a feudal lord, its relations with its different lines of sovereigns being always direct, and of a character which left its government almost entirely to itself. The cathedral, Byzantine in its architecture, was begun in the twelfth and consecrated in the thirteenth century; the tower is one of the boldest in Italy. The law school established here by Charles V. had a wide reputation. In 1799 the city was taken, sacked, and burned by the French. It is now a place of considerable industry and commerce; about 500 vessels enter the harbor annually, the exports being chiefly oil, wine, and fruits, especially almonds. A very fine calcareous building-stone, known as pietra viva, and found near Trani, is also exported to some extent. The fishermen of Trani are often found plying their craft in the Black Sea, the Sea of Azof, and the North Sea. P. 24,380.

**Tranquebar′,** town of Hindostan, on the Coromandel coast, in the delta of the Cavery, in lat. 41° 17′ N., on a small bay which forms a good harbor, is surrounded with walls, defended by forts, and well built; it is cooler and more healthy than Madras, and carries on a considerable trade. P. about 25,000. The town, with adjacent district, comprising an area of 15 sq. m., with about 250,000 inhabitants, and very productive of rice, cocoanuts, and fruits, was originally a Danish possession, but in 1846 was sold to Great Britain, which change, however, has had no marked influence on its development.

**Transcauca′sia,** the name generally given to that part of Asiatic Russia which lies S. of the Caucasian Mountains, between the Black Sea and the Caspian. The name has no political signification, however.

**Transcendent′al** [Lat. *transcendere*]. In mathematics, a quantity is said to be transcendental when it cannot be expressed by a finite number of algebraic terms—that is, by the ordinary operations of algebra, which are addition, subtraction, multiplication, division, raising to powers expressed by constant exponents, and extraction of roots denoted by constant indices. Transcendental quantities are of three kinds—logarithmic, exponential, and trigonometric. Thus, $l(1+x)$ is a logarithmic transcendental, $a^x$ is an exponential transcendental, and $\sin x$ is a trigonometric transcendental. A *transcendental equation* is an equation expressive of a relation between transcendental quantities. A *transcendental line* is a line whose equation is transcendental; thus, the cycloid is a transcendental curve.

W. G. Peck.

**Transcendental.** Kant called "transcendental" all those cognitions or elements of cognitions which are not derived *a posteriori* by experience, but underlie all experience as its necessary *a priori* conditions, and which consequently transcend the whole sphere of experience. Transcendental are all those primary, original, and *a priori* principles of knowledge which, as necessary and universal truths, underlie all contingent and particular truths derived from experience; and in this sense of the word "transcendental" is the opposite of "empirical."

**Transforma′tions, in Chemistry.** Changes which may be regarded as of a chemical kind, as resulting from chemical operations, are of two species; one, which consists merely of change of state—that is, change from solid to liquid or liquid to gaseous state, or the converse—and which usually results merely from change of temperature, without any alteration in the atomic constitution of the bodies concerned; and the other, resulting also often from simple change of temperature, but which is accompanied by production of bodies differing profoundly in nature, chemical and physical, from the bodies started with. It would be well to apply and to confine the term *transformation* in a chemical sense to the latter alone. Thus, the mere vaporization of water is but a change of state, while the dissociation of steam into its component gases by the heat of incandescence is a transformation. Double decompositions are always transformations, and crystallization of a salt from water, when accompanied by condensation of the water itself into the form of "crystal-water," is a transformation also, both of the salt and of the water. Change of state is usually only change of molecular aggregation and arrangement; while transformations are accompanied by mutations in the potential energies of the atoms inside the molecules.

Henry Wurtz.

**Transfu′sion** [Lat. *trans*, "over," and *fundere*, to "flow"] **of Blood,** a surgical operation in which blood from a strong and healthy person, or from one of the lower animals, is injected into the veins of a feeble or anæmic patient. It is especially employed after severe puerperal hæmorrhage, great care being taken to exclude bubbles of air or clots, either of which are likely to prove fatal. The blood, either defibrinated or not, is usually introduced by means of a suitable syringe. This operation, though long known and at present recognized as a legitimate one, is not as yet very common; but it may be considered as established that in well-selected cases, and when performed with proper skill, transfusion is an extremely useful and successful operation.

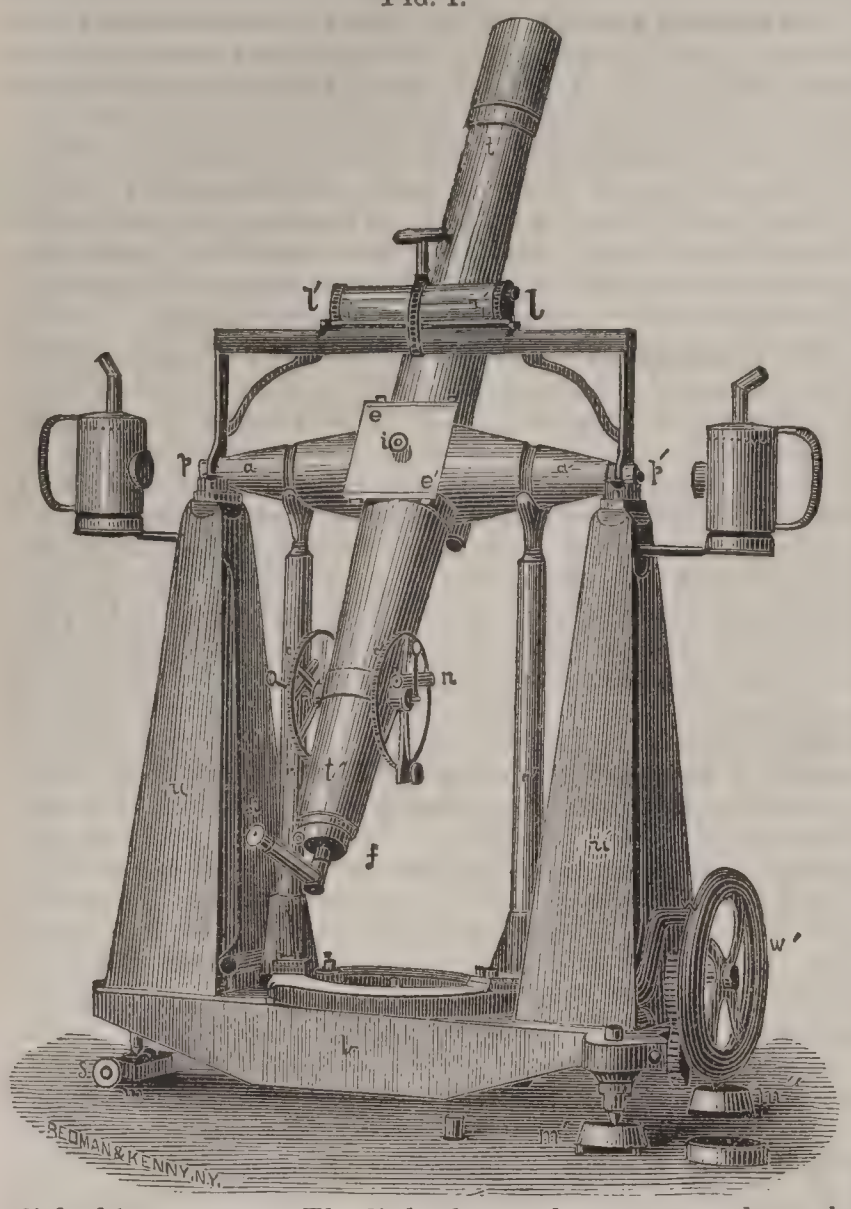
**Trans′it** [Lat. *transire*, to "go across"], the passage of a planet over the disk of the sun, or, in a broader sense, the passage of any celestial body over an arbitrary point of reference.

*Transit Instrument.*—An astronomical instrument used to determine the time of a star's passage over a fixed great circle of the heavens, usually the meridian or the prime vertical. In the latter case the instrument is called a prime vertical transit. Roemer seems to have first used a transit instrument for the determination of right ascensions in 1675, and fourteen years after that he uses it in the meridian for the determination of local time. A very excellent form of the most modern construction is shown in Fig. 1, where $t\,t'$ represents a telescope of three inches aperture and forty inches focus, which rotates around a horizontal axis $a\,a'$, and is composed of the frusta of two similar cones firmly secured to the hollow brass cube $e\,e'$ at their larger bases. The axis $a\,a'$ is also composed of the frusta of two similar cones terminating in two faces of the cube $e\,e'$ at right angles to the other two faces. This axis terminates in two pivots $p\,p'$, an inch and a quarter in diameter, made of cast steel, which rest upon V-shaped bearings firmly supported by the cast-iron piers $u\,u'$, which are firmly bolted to a base plate at $b$, which in turn rests upon three points $m\,m'\,m''$, of which the point $m$ is capable of a slight lateral motion by means of the screw $s$. The telescope is made conical in order to give it the greatest rigidity of form: it is of brass, and may be elevated to any desired angle by means of the two finding-circles $c\,c'$, which are six inches in diameter and read to minutes of arc. The setting is effected by bringing a vernier, which is attached to the small level $n$, to the required reading on the small circle, and then rotating the telescope around the horizontal axis till the bubble plays. A sensitive level $l\,l'$, which rests directly on the pivots $p\,p'$, indicates how closely the axis $a\,a'$ approaches horizontality.

For accurate work it is desirable that observations should be made in reversed positions of the axis. For that purpose an apparatus for lifting the telescope from its bearings at $p\,p'$ and for turning the axis through half a revolution is

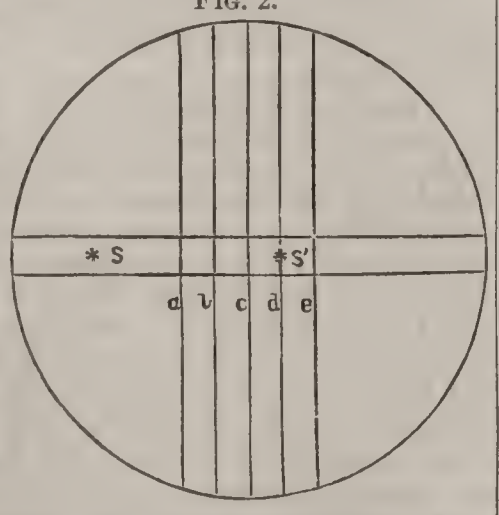
provided; by simply turning the wheel *w w'*, the two upright bars *r r'* move vertically and rotate horizontally to accom-

FIG. 1.




plish this purpose. The light from a lamp enters through an aperture in one end of the axis *p'* and strikes a diagonal reflector, the tint of the reflected light of which is controlled by the milled head *i*, operating colored glasses, and the reflector is so inclined as to reflect the light downward into the field of view; this is necessary to render visible a reticule of fine lines composed either of the finest spider's web, or ruled on glass and placed in the focus of the object-glass at *f*, where they are viewed by a diagonal eyepiece *d*. At night these lines are quite invisible without artificial illumination. The simplest form of this reticule of lines is shown in Fig. 2, where *s* is a star entering the field between two horizontal lines. The vertical line *c* is supposed to coincide with the plane in which the instrument rotates: *a b d e* are four additional lines symmetrically placed, and the time at which the star *s* is bisected by each of them, as at *s'*, is noted. The mean of these observed times is more nearly correct than the time obtained from the transit across a single wire *c* would be. Five or seven wires are usually employed when the times are noted by eye and ear; this number is increased when the times are noted with a chronograph. The instrument figured has nineteen vertical wires, and to transit them all requires for an equatorial star seventy-two seconds. The instrument was made by Buff & Berger of Boston, and weighs, complete, about 200 pounds.

FIG. 2.




To determine the local time, the instrument is set up as nearly as may be in the meridian and accurately levelled. The transit of a star which culminates near the zenith is observed, which will give the error of the timepiece employed, set approximately to local time, at least to within a few seconds. With this correction the time of transit of a circumpolar star is computed, and the star is bisected by the middle wire at that instant by moving the whole instrument. The instrument is now sufficiently near the meridian to afford the error of the timepiece employed, to within a fraction of a second by noting the difference between the observed and true times of transit of a star near the zenith. We have supposed the horizontal axis to be approximately level, and that the reticule has been so adjusted as to make the telescope axis pass through the middle wire, and that the system of wires is perpendicular to the horizon.

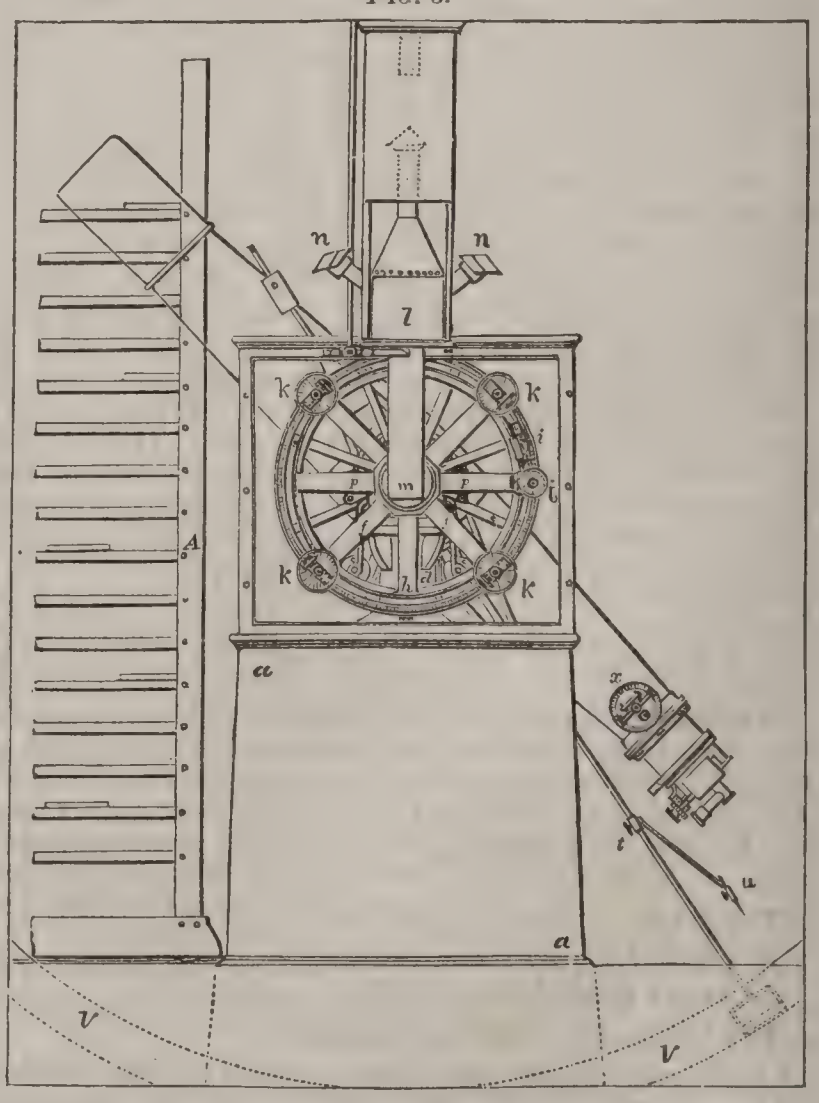
To determine the time for astronomical purposes, it is usual to observe a series of stars at various altitudes, in order to determine the influence of inaccurate adjustments upon the final determination of the time. The corrections, which are usually applied to each star of the series, may be mentioned: *First.* A correction for the variation in the running of the timepiece employed during the time of making the observations. *Second.* A correction for the inclination of the horizontal axis to the horizon. *Third.* A correction for the inequality in the size and shape of the pivots. *Fourth.* A correction to the mean of the wires to reduce it to the true centre of the instrument. *Fifth.* A correction for the deviation of the plane in which the instrument moves from the plane of the meridian. *Sixth.* A correction for the diurnal aberration of light and the personal equation of the observer. Introducing these corrections, the probable error of a time-determination by a skilful observer is usually not far from four one-hundredths of a second.

The transit-instrument rotating in a plane passing through the E. point, the zenith, and the W. point—*i. e.* the prime vertical—is used for the determination of latitude by noting the eastern and western transits of a star, and computing from these data, combined with the star's declination, the position of the observer's zenith. With the Germans and Russians a form of transit-instrument having the eyepiece at one end of the horizontal axis is in favor, on account of its greater convenience. This result is accomplished by interposing a reflecting prism in the cube *e e'*, for instance, of Fig. 1.

*Transit Circle.*—It has been usual until recently to consider the mural circle as a companion to the transit instrument in a fixed observatory: but by attaching a large circle to the horizontal axis of the transit instrument, the results formerly obtained by two instruments and two observers are now more accurately obtained by this single instrument, called the transit or meridian circle; the declination of a star being obtained from the circle reading, while its right ascension is obtained at the same time by observing its transit.

Fig. 3 shows the transit circle of the Harvard College

FIG. 3.

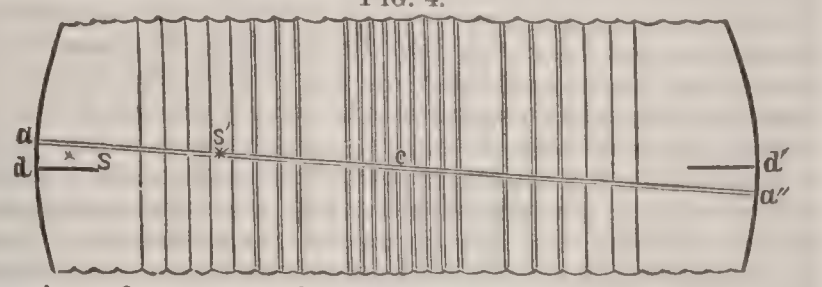



Observatory, built in 1870 by Troughton and Simms. The telescope has an aperture of 8¼ inches and a focal length of 9 feet 4 inches. The telescope pivots rest on iron castings imbedded in the solid marble block *a a*. Two circles 3 feet in diameter, graduated on silver to five minutes of arc, are attached to the axis, and move with the telescope. Four microscopes, *k k k k*, provided with micrometers, read to tenths of a second of arc the distance of the last five-minute division on the circle beyond which the telescope has been moved to bring a star into the position *s* of Fig. 4 from the centre of the microscopes. The microscopes are secured to a circular frame, which in turn is attached to the iron casting which supports the bearings for the pivots. A similar arrangement exists with regard to the circle on the other side of the telescope from the one shown in the draw-

ing. Counterpoises at *e e*, working upon the levers *f f*, diminish the amount of the friction of the pivots against their bearings. Glass cases cover both the circles. For the purpose of easily finding an object, the small finding-circles at *x* were provided, but in practice it is found more convenient to use a long arm attached to the axis, which describes the arc indicated in the lower part of the figure *v*. A lantern at *l* throws its light by a system of reflectors upon the circle. The framework at *a* is used for putting the striding-level in position. The instrument differs from the usual form of transit circles in supporting the circles above the piers, in its system of counterpoises, and in the placing of the circles so near to the floor that they may be read without the inconvenience of using steps. These improvements are due to the late Prof. Joseph Winlock, as also the using of collimators having apertures of the same diameter as the observing telescope.

Fig. 4 represents the reticule of this instrument. It

FIG. 4.




consists of a system of twenty-five vertical lines, fifteen of which are double and arranged as shown in the figure. A diagonal double line *a a'* makes an angle of 85° with the vertical system. Fractional parts of a horizontal line *d d'* extend far enough into the field to enable the observer to bring the star *s* between the lines *a a'* and *d d'* when the star enters the field. Since *a a'* would intersect *d d'* at the centre *c*, the star *s* transits the line *a a'* at some point *s'* between *a* and *c*, and by noting the time when the star is at *s'*, it becomes a matter of simple trigonometry to compute the vertical distance of *s'* from the line *d d'*, and consequently from the assumed centre of the field. The reading of the large graduated circle gives us the observed zenith distance of this central line *d d'* in space, and we are thus enabled, without any micrometrical measurements, to obtain the exact observed altitude by adding to the reading of the circle the computed vertical distance *a s'* with its proper sign. These lines were ruled on glass by Mr. W. A. Rogers (see RULING-MACHINE), and in the case of the double ones the instant the star is midway between the two components is noted. The vertical system is for right ascensions, and the components of a single double line are eight one-hundredths of an inch distant from each other.

There are several other large instruments in the U. S.—the one at the U. S. Naval Observatory at Washington, made by Pistor & Martin, of eight and a half inches aperture and twelve feet focus; the one at the Dearborn Observatory, Chicago, of six French inches aperture and six feet focus, made by Repsold, and presented by W. S. Gurmu, Esq.; and the Olcott transit circle at the Dudley Observatory, Albany, of eight inches aperture and ten feet focus, by Pistor & Martin. (For a full discussion of the transit-instrument see W. Chauvenet, *Manual of Spherical and Practical Astronomy; U. S. Coast Survey Reports* (1866, appendix No. 9; 1868, appendix No. 10), by Prof. C. A. Schott. For discussions of transit circle see W. Chauvenet (as above); Ph. Carl, *Die Principien der astronomischen Instrumentkunde* (Leipsic); *Description de l'Observatoire astronomique Central de Pulkova*, F. G. W. Struve (St. Petersburg, 1845); *Greenwich Astronomical Observations* (vol. for 1852, Appendix I.; do. 1867); *Washington Astronomical Observations for 1865.*)

L. WALDO.

**Tran'sit,** p.-v. and tp., Sibley co., Minn. P. 424.

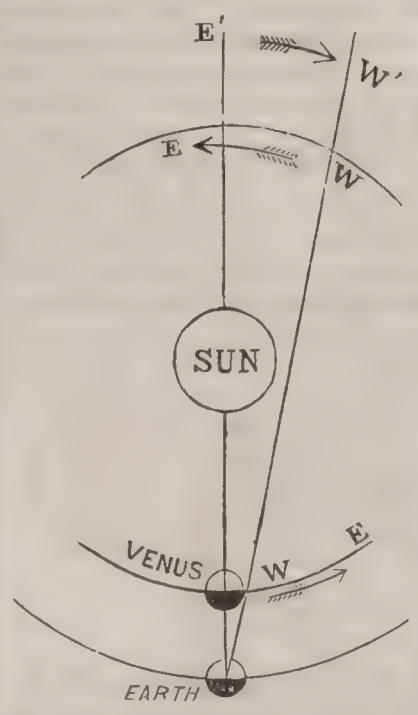
**Transit Circle.** See TRANSIT.

**Transit Instrument.** See TRANSIT.

**Transits of Venus and Mercury.** The word "transit" is from the Lat. *transitus*, a "way," or "passage over." In accordance with this etymology, the term *transit* is applied to denote the apparent passage of a planet across the sun's disk. In order that this should take place, the planet must be between us and the sun, and its orbit, consequently, must be within that of the earth; of all the known planets, Mercury and Venus are alone those to be found in this category. It will be found to be convenient to consider first the conditions under which such a transit can occur; then the intervals after which transits recur; and afterward the principal use to which the observations of such transits and their results are applied.

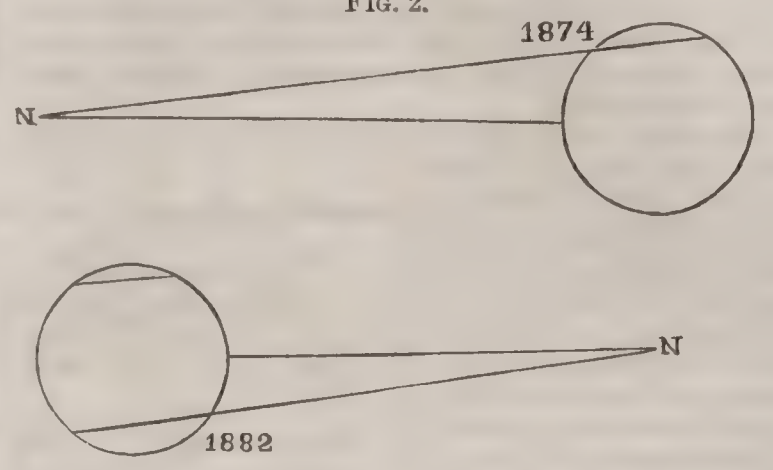
*Conditions.*—As the planes of the orbits of all the other planets are inclined to that of the earth's orbit (the *ecliptic*), a planet at the time of its transit must not only be nearly in the line drawn from the sun to the earth, as is represented to be true of Venus in Fig. 1; *i. e.* the planet must not merely be in *inferior conjunction* with the sun, or near to

FIG. 1.




that, but also at the same time sufficiently near to one of the points of intersection of its orbit with the plane of the earth's orbit (the ecliptic)—*i. e.* one of the *nodes* of that orbit, such as is represented at N in Fig. 2; and which, the motion of the planet being in the direction indicated by the arrow, is the *ascending* node; that is, the node at which the planet passes to the *north* of the ecliptic. The opposite point to this is the *descending* node, at which the planet passes to the *south* of the ecliptic. The figure represents very nearly the state of things at the time of the transit of Venus in 1874. And it is sufficiently manifest that if the conjunction with the sun had happened somewhat later, the apparent position of the planet would have been too far from the sun's centre to

FIG. 2.



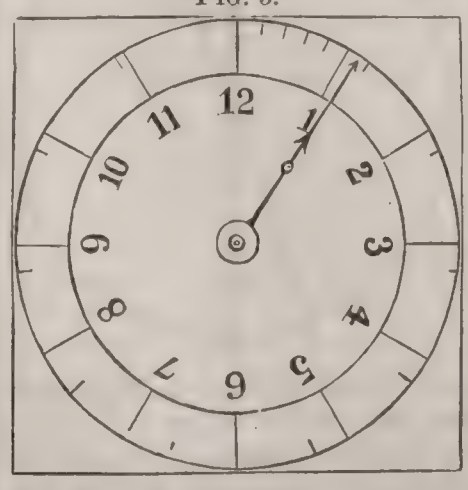

have made it appear on the sun's disk at all; the apparent position on the sun's disk being but slightly modified by the position of the observer on the earth's surface, as will be shown hereafter.

Venus is near to her ascending node in that part of her orbit in which the line drawn from the sun (the *radius* vector) lies very nearly in the same direction with that drawn from the sun to the earth, early in December; and the like will be true for many centuries to come. The direction of the opposite descending node is that of the earth early in June. Hence, transits of Venus, when they happen at all, must for many centuries to come occur only in December or in June.

If, at the time of the inferior conjunction, the distance of Venus from the node in question be greater than about $1\frac{3}{4}$ degrees, the planet will fail to be projected on the disk of the sun; and there will be no transit observed. It will be observed that while Venus, moving around the sun more rapidly (in the direction W E, as marked in the figure), passes by the earth at the inferior conjunction, that same general direction of the planet carried around will be that of W' E' on the opposite side of the orbit; but the motion from W toward E as seen from the earth and projected on the face of the sun, or on the heavens beyond, will appear to take place in the direction E' W'; *i. e.* from E. toward W., or be retrograde in the direction of the arrow in Fig. 2.

*Circumstances which regulate the recurrence of Transits.*—These may be illustrated by the coincidences, direction, etc., of the minute-hand and the hour-hand of a clock. The velocities being as 12 : 1, the minute-hand traverses the angular space due to 12 divisions of the dial-plate while the hour-hand traverses but 1; the minute-hand in traversing these 12 divisions thus *gaining* upon the hour-hand 11 divisions out of the 12. Now at 1 o'clock the hour-hand is in advance of the minute-hand the space from 12 to 1, which can be traversed by the minute-hand in 5 minutes. If, then, this 5-minute space be divided into 11 equal parts, we shall have the space due $\frac{5}{11}$ths of a minute for one of those parts; and adding this portion to the 5-minute portion from 12 to 1, we shall have what is due to the motion of the minute-

FIG. 3.



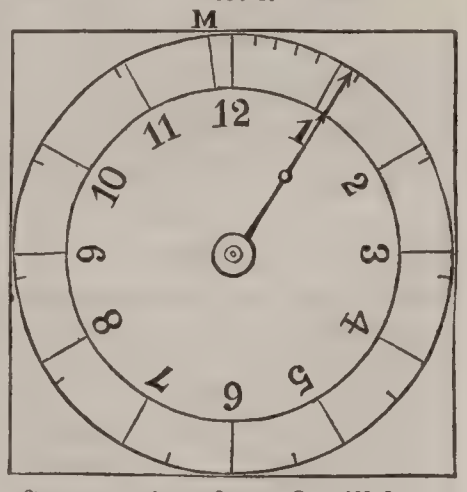
hand in $5\frac{5}{11}$ minutes, which it will then have completely accomplished at $5\frac{5}{11}$ minutes after 1. Meanwhile, the hour-hand will have accomplished only the one portion due to $\frac{5}{11}$ths of a minute; *i. e.* the $\frac{1}{11}$th part of the 5-minute portion, or $\frac{1}{12}$th of the $5\frac{5}{11}$th portion due to the minute-hand, which revolves 12 times as fast. The two hands will thus be brought into conjunction at $5\frac{5}{11}$ minutes after 1 o'clock, as they were at 12 o'clock. The time of the next conjunction—viz. that after 2 o'clock—will be found by dividing the *10-minute space* from 12 to 2 by 11, as in the former instance; and we shall find, adding, as before, that this second conjunction will take place at $10\frac{10}{11}$ minutes after 2 o'clock, etc. The successive conjunctions, then, will take place as follows:

| | | | | | |
|---|---|---|---|---|---|
| 1st at | 1h. | $5\frac{5}{11}$m. | | | |
| 2d at | 2 | $10\frac{10}{11}$ | | | |
| 3d at | 3 | $15\frac{15}{11}$, or | 3h. | $16\frac{4}{11}$m. | |
| 4th at | 4 | $20\frac{20}{11}$, or | 4 | $21\frac{9}{11}$. | |
| 5th at | 5 | $25\frac{25}{11}$, or | 5 | $27\frac{3}{11}$. | |
| 6th at | 6 | $30\frac{30}{11}$, or | 6 | $32\frac{8}{11}$. | |
| 7th at | 7 | $35\frac{35}{11}$, or | 7 | $38\frac{2}{11}$. | |
| 8th at | 8 | $40\frac{40}{11}$, or | 8 | $43\frac{7}{11}$. | |
| 9th at | 9 | $45\frac{45}{11}$, or | 9 | $49\frac{1}{11}$. | |
| 10th at | 10 | $50\frac{50}{11}$, or | 10 | $54\frac{6}{11}$. | |
| 11th at | 11 | $55\frac{55}{11}$, or | 12 | 0. | |

After 12 o'clock, then, when the minute-hand and the hour-hand are in line, it appears that there will be a series of 11 conjunctions of the minute-hand and the hour-hand; at the conclusion of which series the minute-hand and the hour-hand will again be brought into conjunction at the 12 o'clock hour-mark. At all the other conjunctions the places of meeting will be notoriously different from the exact hour-marks.

Next suppose the rate of motion of the *hour-hand* to be somewhat, though a very little, too slow. Then the minute-hand will overtake the hour-hand at *the 11th conjunction* (at a point such as M in Fig. 4), a little *before* 12 o'clock. Or, if besides, the two hands had at first been set together a little *beyond* 12, but at a *less* distance than that from M to 12, as at Q in Fig. 5, then, with the same somewhat slow rate of the hour-hand already supposed, the point of meeting at *the 11th conjunction* after starting from Q will be at M′, as much behind Q as was M behind 12 in the immediately preceding case.

FIG. 4.




Now if withal the minute-hand were broken off so as to render it shorter than the hour-hand, and a small ball attached at the extremity of the one, and another small ball at the extremity of the other, the ball at the extremity of the short arm circulating more rapidly than the other, and both around a larger ball in the middle of the dial-plate (fastened, if we please, to one of the arbors), we should then have a somewhat adequate representation of the case of Venus and the earth in their motion around the sun; and this yet more perfectly if we besides suppose the arbor of the shortened minute-hand to be somewhat bent, so that in turning the minute-hand would be carried *in front* of the face with an inclination outward in passing from 12 to 6, and, going through a long opening in the dial-plate, pass *behind* the dial-plate from 6 to 12, as represented in Fig. 6. The line from 12 to 6 will represent the line of the nodes of Venus, the ascending node being in the direction of 12, and the descending node in the direction of 6. Then, the hands being, as before supposed, set in conjunction in the direction of Q, and the motion of the hour-hand being, as supposed, a little too slow, the combination of results will be that the shortened minute-hand, passing always in front of the dial-plate from 12 to 6, and behind it from 6 to 12, will, *after a complete series of 11 conjunctions*, be brought into line with the hour-hand not quite in the direction of Q, but that of M′, a little to the other side of 12, in consequence of the somewhat too slow motion of the hour-hand.

FIG. 5.

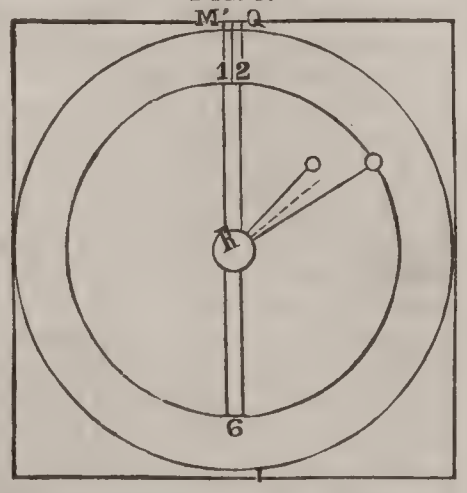
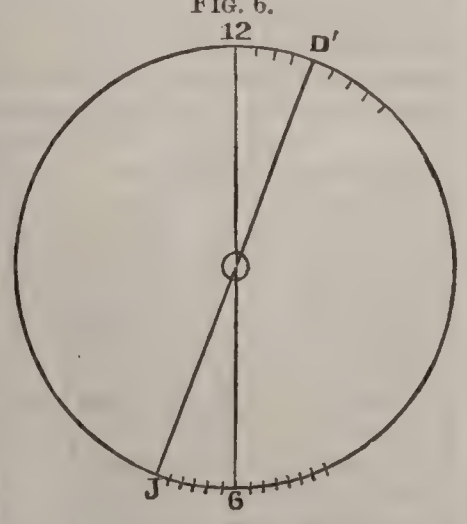



FIG. 6.




Now, as appears from the table of times of conjunctions of the minute-hand and hour-hand, as heretofore stated, the minute-hand, though originally set in conjunction with the hour-hand at 12 o'clock, is not found in conjunction again until 1h. $5\frac{1}{11}$m., so the minute-hand will then have completed an entire revolution, and the space due to $5\frac{5}{11}$m. more than that. This happened with the hour-hand going twelve times as slow as the minute-hand. But if the hour-hand had moved much faster, the conjunction in the series would have been later. And if the velocity of the hour-hand had been one-half that of the minute-hand, then when the minute-hand had completed its circuit, the hour-hand would be found pointing halfway around at 6. And when the minute-hand had completed *two* circuits, the hour-hand would just have completed *one;* and thus the hands be found in conjunction again at 12. But if the minute-hand had moved even somewhat faster than was just now supposed, the next conjunction (the first in the series) would not occur until the minute-hand had *more* than completed *two* revolutions, and the hour-hand *more than one*. And we should then have the analogy of the motions of Venus and the earth well represented, even in *that* respect. For Venus, having been in inferior conjunction with the earth, is not found in inferior conjunction again until she has all but completed two revolutions around the sun, while the earth in the same time has gone *once* around the sun, and nearly three-fifths of a revolution more: *i. e.* 1.6 an entire revolution, which of course will occupy 1.6 years. The series of conjunctions will consequently take place as follows:

| | Earth's revolutions. | Distance beyond first position. |
|---|---|---|
| 1st | 1.6 — | 0.6 — |
| 2d | 3.2 — | 0.2 — |
| 3d | 4.8 — | 0.8 — |
| 4th | 6.4 — | 0.4 — |
| 5th | 8.0 — | 0.0 — |

It appears, then, that five conjunctions will take place within *very nearly eight years*, and that at the expiration of very nearly eight years the 5th conjunction will occur in a direction a very little *short of* that from which the motions in question were reckoned; but that at all the other intermediate conjunctions the direction of the "conjunction line" will be very different from that. So that if we begin with an inferior conjunction like that in Dec., 1874, at a position like that of Q in Fig. 5, a little beyond the line of the nodes 12 . . . 6 (in the figure), and when, as in Fig. 2, the conjunction was sufficiently near to the ascending node to have a transit, then within the period of all but eight years next succeeding there will be four other conjunctions, but every one of them far from the line of the nodes; as appears from the table positions here given. But at the 5th conjunction, at the end of very nearly *eight years*, the direction will be like that of M′ in Fig. 5, a little *behind* that of Q in position, and *short* of node, but still near enough for a transit in Dec., 1882, as represented in Fig. 2 *bis* (M′ itself being withal a little nearer to the line of the nodes, because that line is found farther back after eight years).

The like results will obtain during the *next period of eight years;* but the "conjunction-line" being at the outset in the direction of M′ instead of that of Q, the 5th conjunction after the *second* period of eight years will take place still farther *back* than M′—too far back, indeed, for a transit, Venus passing below the sun. After another period of eight years the "conjunction-line" will be still farther behind the node, and differing still more from those of a transit.

Thus, then, it will not be until after many periods of eight years each, that the "conjunction-line" will have receded to the direction like that of 6 in Fig. 5, which represents that of the opposite (descending) node, the direction of Venus and the earth from the centre being that which the earth has at the opposite season of the year—viz. in June; and thus, at the end of so long a time, there will ordinarily be two transits, eight years asunder, in June instead of December; as must indeed be the case for a very long time to come.

Pursuing, however, the successive series of changes, we shall find that after another very long period the "conjunction-line" will have gone backward until it arrives very nearly in the original direction of Q; and after that will recur two December transits, eight years asunder, as before. Now, the whole period from the leaving of Q to the return, or rather very near to it, is 243 years; and the

same is true for the entire period from one June transit to a similar one again. Thus, from 1631 to 1874 is 243 years, and so from 1761 to 2004 is 243 years also. Hence, it might seem that from a December transit to a similar one in June (but at the opposite node) the period ought to be the half of 243 years; and from a June transit to a similar one in December, the other half. Yet the interval from a December transit to a similar one in June is several years longer than the other. The reason for this is found in the unequal angular motion of both Venus and the earth in consequence of the respective eccentricities of their orbits, that of the earth being proportionally far greater than that of Venus. Now, when the relative motion of the earth is the most rapid, the point M (at the date of the arrival of Venus in the conjunction-line) will be farther *back*, and so the spaces like Q M in Fig. 5 will be wider in the interval short of the eight years to which Q M is due; and if that most rapid motion took place nearly in the direction 12 (in the figure), the spaces such as Q M would become narrower and narrower, to be smallest of all about the direction of 6. And then, the arrangement being nearly symmetrical, the spaces in an inverse order would become wider and wider, to be restored to their original dimensions in the region of 12. Hence, the recess of the "conjunction-line" would not indeed be uniform, but the time occupied by the changes from 12 to 6 be, after all, very nearly the same with that of the changes in reverse order, from 6 to 12. Yet, as heretofore stated, the interval from the December to the June transits is veritably several years longer than the other. This finally arises from the fact that the line of the *symmetrical* arrangement of the intervals already described is not that of the nodes, represented by 12 . . 6 in Fig. 5, but approximating the direction to D J in Fig. 6; the spaces heretofore described, but near D, and indeed from D to 12, being the wide ones, while those near J are the narrow ones; and, indeed, more of them. So there will be more periods of nearly eight years included in the interval from 12 to 6 than in that from 6 to 12—*i. e.* a considerably longer interval in all from a December transit to a similar one in June than that from a June transit to a similar one in December. Accordingly, we have—

From Dec., 1631, to June, 1761, 129½ years,
" Dec., 1639, to June, 1769, also 129½ years;
but from June, 1761, to Dec., 1874, only 113½ years,
" June, 1769, to Dec., 1882, also 113½ years;
but from Dec., 1874, to June, 2004, 129½ years,
" Dec., 1882, to June, 2012, also 129½ years.

The respective differences are sixteen years each, equal to the sum of two eight-year periods. Reckoning from the last of one pair of transits to the first of the next pair, we have—from June, 1759, to Dec., 1874, 105½ years; but from Dec., 1882, to June, 2004, 121½ years. The year 1882 being near to the close of the nineteenth century, this whole period of 121½ years, if one may so say, bridges over the entire twentieth century, leaving it without a transit.

*Application of the Results of Transit Observations.*—It is notorious that transit observations have for their object the more accurate determination of the sun's horizontal parallax, and hence of the earth's distance from the sun, and from that the respective distances from the sun of all the other planets. The relative distances of the planets can be, and have been, accurately determined by Kepler's third law—viz. that as are the squares of the periodic times, so are the cubes of the mean distances. Hence, if the distance of the earth from the sun be taken as 1—*i. e.* made use of as the measuring unit—and the periodic times be also measured in units respectively of the earth's time—viz. 1 year—we shall have (since $1^2$ and $1^3$ are respectively = to 1):

1 : (*planet's periodic time*)$^2$ :: 1 : (*planet's distance*)$^3$,

hence, numerical value of (*dist.*)$^3$ = (*period. time*)$^2$;

$$\text{or, } dist. = \sqrt[3]{of\ (period.\ time)^2} \quad . \ . \ . \ . \ . \ (1)$$

This result will be very slightly modified when the relative masses are determined, and *that* will require the determination of the earth's distance from the sun in *some terrestrial measure*. For this we need the sun's (equatorial) horizontal parallax (see PARALLAX); and this is what the observations of the *transits of Venus* are fitted very accurately to determine.

For E C in Fig. 7 representing a chord of the terrestrial spheroid, and V the position of Venus projected on the sun's disk at *v* as seen from E, and at P, as seen from C, we have

P V : E V :: *sin. of angle at* E : sin. of angle at P,

or, angles being very small,

P V : E V :: angle E : angle P;

that is, very accurately,

$72\frac{1}{3} : 27\frac{1}{3}$ :: angle E : angle P;

the relative distances P E and P V being determined by Eq. (1); and hence also their difference. And from this last proportion, we have—

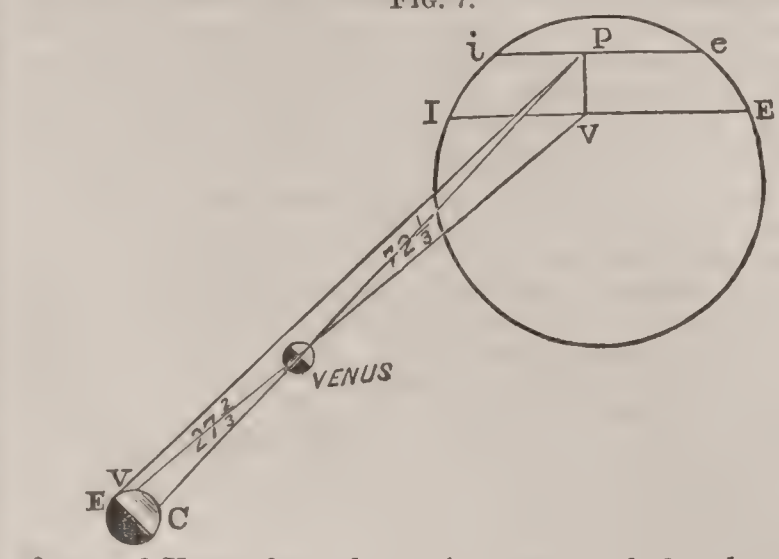
*angle at* P (subtended by E C) = $\frac{27\frac{1}{3}}{72\frac{1}{3}}$ *angle at* E (subtended by P V),

or *the solar parallax due to* E C = $\frac{27\frac{1}{3}}{72\frac{1}{3}}$ *the displacement* P *v* of Venus on the sun's disk (as measured from E), when the planet is respectively observed (at the same time) from E and from C . . . (2).

The transit observations should therefore determine such displacement. For this purpose three methods are in use.

1. *The "Direct" Method.*—This consists, in effect, in determining micrometrically the *apparent distance*, in seconds

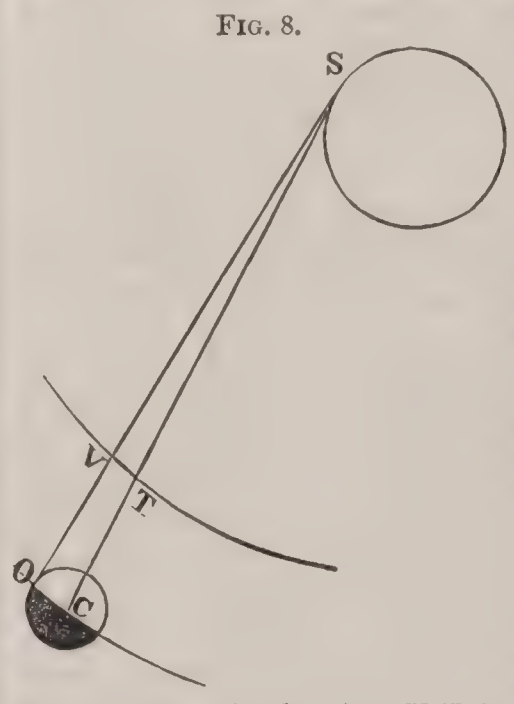
FIG. 7.




of arc, of Venus from the sun's centre, and also the *direction* of that distance as seen from the one station (E), and also as seen from the other station (C); and hence deducing the displacement P *v*.

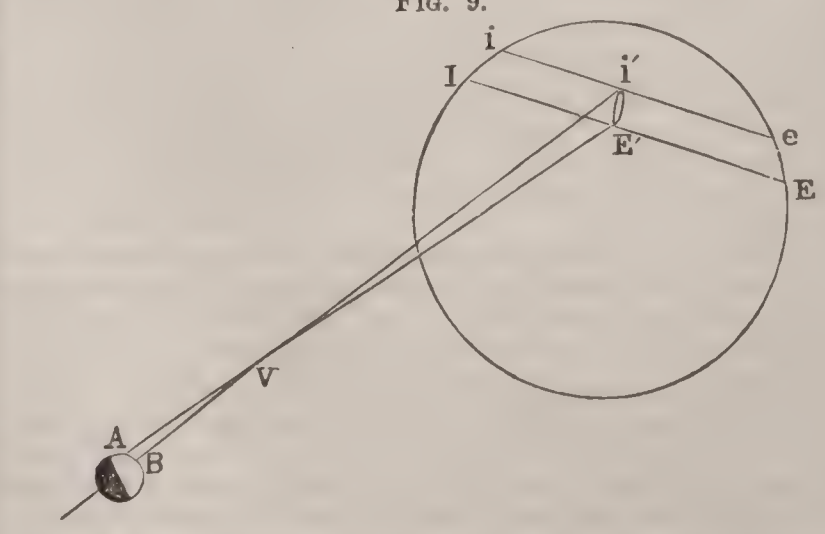
2. *The Method of M. Delisle, styled the Delislean Method.*—This, in effect, consists in determining when, as seen from the observatory O (Fig. 8), Venus appears at the edge of the sun's disk, and then, the relative motions being all known, determining when the like projection would take place on the sun's edge as seen from C, the centre of the earth. The difference between these two times will enable us to compute *accurately* the arc V T apparently described by Venus in the interval. And as the apparent motion of the planet is quite slow (the transit occupying several hours), the arc V T will thus be measured, as it were, by a screw of slow motion, and be sharply determined. And V T itself measures the parallactic angle subtended by O C at S. All this requires not only that the local time be *very accurately known*, but also the difference between that time and time at a first meridian, or the longitude of O must be accurately determined.

FIG. 8.




3. *The Method of Dr. Edmund Halley, known as the Halleian Method.*—In the application of this method the time of the immersion of Venus at I as seen from A (Fig. 9) is carefully noted, and also the time of emersion at E.

FIG. 9.




The interval between the two—that is, the *whole time of transit*—will, as in the second method, afford the means of

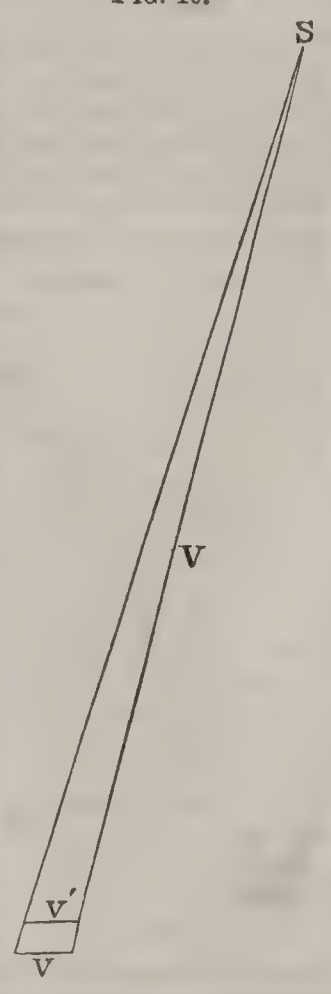
measuring I E, allowance being made for the change of position of the observer by the earth's rotation during the interval. In the same way may be ascertained if the whole duration, in manner as before, be found for the station B. Then the semi-diameter of the sun being accurately ascertained, and I E and *i e* known, the measures of the arcs of which I E and *i e* are respectively the chords, can be ascertained, and hence *i'* E' the difference of versed sines, *on the scale of the sun's semi-diameter;* and from this displacement in the direction *i'* E' the angle of solar parallax due to A B, as in the direct method.

The various positions in question in these several methods may be recorded by the photograph, and were so recorded in 1874.

Our limits will not permit us to trace the history of observations such as those here described nor that of the curious phenomena connected with them; but the learned world have recently become more than ever sensible of their obligations to the young English astronomer, Jeremiah Horrocks, for his invaluable observation of the entrance of Venus on the sun's disk in Dec., 1639 (N. S.). The succeeding transits of 1761, 1769, and 1874 have all been observed with increasing care and accuracy. M. Encke, from a careful discussion of the observations of the transits of 1761 and 1769, concluded the value of the sun's (equatorial) horizontal parallax to be 8.5776″. A rediscussion of the same observations rather seems to indicate a greater value. The same is also shown by the results of various other methods; one of which seems to require a passing notice even here.

In Fig. 10 the angle at S is the displacement in the apparent direction of a star, due to the motion of the eye of the observer combined with the motion of light—a purely optical phenomenon. As the displacement takes place in opposite directions at opposite seasons of the year, the observed positions of the star at those seasons will indicate twice the displacement in question—twice the value of the *annual* aberration of light. Then in the triangle in the figure, the side V will represent the velocity of light, and *v* the velocity of the earth's orbital motion. Now, the value of V, as *ascertained by experiment*, was found to be about $\frac{1}{30}$th less than that previously admitted. The side V being thus $\frac{1}{30}$th less, and the angle S being unaltered, *v v'* must be reduced $\frac{1}{30}$th, the ratio of *v* to V being preserved. But the velocity of the earth in its orbit being reduced $\frac{1}{30}$th, that implies (or rather means) that the space traversed in the orbit in 1 second is reduced $\frac{1}{30}$th. And every space due to 1 second of time being thus reduced $\frac{1}{30}$th of itself, the whole circuit of the orbit must also be reduced $\frac{1}{30}$th of itself, and therefore, finally, the mean distance from the central body, the sun. But the parallax is inversely as the distance; and so, as the result of several methods, the parallax was found by Prof. Simon Newcomb to be very nearly 8.85″. The earth's mean distance from the sun corresponding to this is about 92,000,000 miles.

FIG. 10.




Much has been said of the discrepancy and correction here noticed—much to the supposed disparagement of astronomical science. But with a radius of 200 miles, 1 second of a circle's circumference would be 5.119 feet, and $\frac{1}{3}$ of a second be 1.706 feet, or not quite 1 foot 8$\frac{1}{2}$ inches. How accurate the trigonometrical survey which would determine a position within 1 foot 8$\frac{1}{2}$ inches by means of an observation taken at the distance of 200 miles! And yet this well represents the error in the determining the solar parallax as it was *at first* concluded. How *very accurate* the science which could discover and correct such an error as that!

The transits of Mercury are of more frequent occurrence than those of Venus, but are of far less interest, as they cannot be used for the same purpose, Mercury being too distant from us, even at the inferior conjunction. During a transit of an inferior planet the position of that planet is affected by parallax, and so also is that of the sun; so that the displacement on the solar disk is due to *the difference* of the parallaxes. But if the apparent distance of a planet from a more remote body, such as has no sensible diurnal parallax, be measured—(*i. e.* the distance from a fixed star when the planet is very near to it), the whole parallax of the planet will be efficient. By such a comparison the parallax of Venus, as well as that of Mars, has been ascertained, and thence that of the sun. S. ALEXANDER.

**Tran'sitville,** p.-v., Washington tp., Tippecanoe co., Ind., on Toledo Wabash and Great Western R. R. P. 205.

**Transleitha'nia** is the common name for that part of the Austro-Hungarian monarchy which lies to the E. of the river Leitha, an affluent of the Danube. It comprises Hungary proper, Transylvania, Croatia, and Slavonia, or the Hungarian crown-lands.

**Transmigra'tion** [Lat. *trans*, "across," and *migrare*, to "migrate"], the doctrine of the repeated existence of the soul in different forms of matter, its form in each successive existence being determined by its merits and demerits in the preceding ones. The most striking fact in connection with this doctrine is its wide prevalence, its profound and permanent hold on certain great nations, its constant reappearance in more or less pronounced forms in all parts of the world. The ancient civilization of Egypt, whose contrasted splendors and horrors awaken astonishment more and more with each step in the progressive decipherment of its mysterious record, seems largely to have grown out of this faith. The swarming millions of India also, through the chief periods of their history, have lain under its spell, suffered their lives, wrought their great works of government, architecture, philosophy, and poetry, meditated, aspired, and exhaled their souls. Ruder forms of it are reported among innumerable barbaric tribes. It played an important part in the speculations of the early Fathers of the Christian Church, and has often cropped out in the works of later theologians. Men of the profoundest metaphysical genius, like Scotus Erigena and Leibnitz, have affirmed it, and sought to give it a logical or scientific basis. And even amidst the predominance of skeptical and materialistic influences in Europe and America at the present time, we constantly meet individuals with independent minds who earnestly believe the alluring dogma; for to a large and varied class of minds the doctrine has a transcendent attraction as well as a manifold plausibility.

Another striking fact connected with this subject is, that it seems to be a native and ineradicable growth of the Oriental world, but appears in the Western world in scattered instances, and rather as an exotic form of thought. The pantheistic tendency which possessed and overwhelmed the Brahmanic mind, shaping and tinging all its views, opened the whole range of sentient existences to an indiscriminate sympathy, and made the idea of transmigration natural, and more pleasing than repugnant. Furthermore, the Brahmanic thinkers and sages are a distinct class of men whose whole lives are absorbed in introspective reveries and metaphysical broodings calculated to stimulate the imagination and arouse to the keenest consciousness all the latent marvels and possibilities of human experience, thus furnishing the most favorable conditions for exactly such a belief as that of transmigration—an endless series of ever-varying adventures for the imperishable soul. And the vast swarms of the common people in the East are the passive followers of this high caste of thinkers, abjectly accepting what they teach. Accordingly, the mysterious doctrine of metempsychosis has held the entire mind, sentiment, and civilization of the East through every period of its history as with an irrevocable spell. On the contrary, in the Western world the characteristic tendencies are all different. Pantheistic theories are rarely held, and the dreams and emotions which those theories are fitted to feed are foreign and repulsive. An impassable barrier is imagined separating humanity from every other form of being. Speculative reason, imagination, and affection are chiefly employed in scientific studies and social pursuits, or personal schemes external rather than internal. This absorption in material things and evanescent affairs engenders in the spirit an arid atmosphere of doubt and denial, in which no efflorescence of poetic and mystic faiths can flourish. Thus, while outward utilities abound, hard negations spread abroad, and living, personal apprehension of God, an all-pervasive providence, and the immortality of the soul in any form dies out either in open infidelity or in a mere verbal acceptance of the established creed of society.

The suggestive or argumentative grounds on which this belief rests are chiefly the following: (1) The various and strong resemblances, both physical and psychical, connecting human beings with the whole family of lower creatures. They have all the senses in common with us, together with the rudiments of intelligence and will. They all seem created after one plan, as if their varieties were the modulations of a single original type. We recognize kindred forms of experience and modes of expression in ourselves and in them. Now the man seems a travesty of the hog, the parrot, the ape, the hawk, or the shark; now they seem travesties of him. As we gaze at the ruminating ox, couched

on the summer grass, notice the slow rhythm of his jaw and the wondering dreaminess of his deep soft eyes, it is not difficult to fancy him some ancient Brahman transmigrated to this, and patiently awaiting his release. Nor is it incongruous with our reason or moral feeling to suppose that the cruel monsters of humanity may in a succeeding birth find the fit penalty for their degradation and crime in the horrid life of a crocodile or a boa-constrictor. (2) The conception of a series of connected lives furnishes a plausible explanation for many mysteries in our present experience. Reference is made to all that class of phenomena covered by the Platonic doctrine of Reminiscence. Faces previously unseen, and localities unvisited, awaken in us a vivid feeling of long familiarity with them. Thoughts and emotions not hitherto entertained come to us as if we had welcomed and dismissed them a thousand times in periods long gone by. Many an experience, apparently novel and untried, makes us start as though the chambers of the soul had often before echoed to its shadowy footsteps. The supposition of forgotten lives preceding the present, portions of whose consciousness reverberate and gleam through the veils of thought and sense, seems to throw satisfactory light on this strange department of experience. (3) Much more weighty and penetrative, however, than the foregoing considerations is the philosophical argument in behalf of transmigration drawn from the nature of the soul. Consciousness being in its very essence *the feeling of itself*, the conscious soul can never feel itself annihilated, even in thought. It only loses the knowledge of its being when it lapses into unconsciousness, as in sleep or trance. The soul may indeed *think* its own annihilation, but cannot realize the thought in *feeling*, since the fainter emotional reflex upon the idea of its destruction is instantly contradicted and overborne by its more massive and vivid sense of its persistent being in immediate consciousness. This incessant self-assertion of consciousness at once suggests the idea of its being independent of the changing and vanishing body in which it is temporarily shrined. Then the conception naturally follows that the soul, as it has once appeared in human form, so it may reappear indefinitely in any of the higher or lower forms of being which compose the hierarchy of the universe. The eternity of the soul, past and future, once accepted by the mind, leads directly to the construction of the whole scheme of the metempsychosis—an everlasting succession of births and deaths, disembodiments and re-embodiments, with their laws of personality and fortunes of time and space weaving the boundless web of destiny and playing the endless drama of providence. (4) But the strongest support of the theory of transmigration is the happy moral solution it seems to give to the problem of the dark and distressing inequality and injustice which otherwise appear so predominant in the experience of the world. To the superficial observer of human life, the whole scene of struggle, sin and sorrow, nobleness and joy, triumph and defeat is a tangled maze of inconsistencies, a painful combination of violent discords. But if we believe that every soul, from that of the lowest insect to that of the highest archangel, composes an affiliated member of the infinite family of God, and is eternal in its conscious essence, perishable only as to its evanescent disguises of unconscious incarnation; that every act of every creature is necessarily followed by its legitimate reactions; that these actions and reactions constitute a law of retribution absolutely perfect; that these souls, with all their doings and sufferings, are interconnected with one another, and with the whole, all whose relationships co-penetrate and co-operate, with mutual influences whose reports are infallible, and with lines of sequence that never, never break,—then the bewildering maze becomes a vindicated plan, the horrible discord a divine harmony.

But, in spite of all that can be said in its behalf, the theory of the transmigration of souls remains, to the average modern mind of the Western world, a mere fancy, although it has a deep metaphysical basis, a strong poetic charm, and a high ethical and religious quality.

WILLIAM R. ALGER.

**Transmutation of Force or Energy.** See CORRELATION OF FORCES, by PRES. J. H. SEELYE, S. T. D.

**Transpiration of Gases.** See GAS, by PROF. J. P. COOKE, A. M.

**Transpiration of Liquids.** See LIQUIDS, by H. WURTZ, A. M.

**Transporta'tion** [Lat. *transportare*] differs from banishment by being simply a transfer of a person from one part of the dominion to another, while one banished is driven out altogether from the dominion. Transportation was adopted as a means of punishment in England in the middle of the seventeenth century, and the criminals were sent to the plantations of America, where they were treated as slaves. After the American war of independence, Australia was selected by England as the place of transportation, and the first criminals arrived at Sydney in 1787. In 1840 the whole system of transportation was abandoned by England. It is still in use in France and Russia, which latter tries by this means to settle the vast steppes of Siberia.

**Transposi'tion** [Lat. *trans*, "across," and *ponere*, to "place"], in music, the act of removing a composition into a key different from that in which it is written. By this is not meant a change of *mode* also. A piece of music written in a major key, for instance, cannot be transposed into the corresponding minor (as from C major to C minor), unless its construction has been such as to make such a transfer possible. A composition in any major key may be transposed into any other major key; and the same rule applies to compositions in minor keys. Transposition is not simply the moving of all the notes of a piece one or more degrees higher or lower, for such a change would at once destroy or impair its distinctive character. If the scale consisted of a series of regular and *equal* degrees, this might readily be done, and a composition would suffer no injury by being moved from any key to any other. But, as the scale is not a regular, but an *irregular*, series of sounds, consisting of five whole tones and two semitones arranged in a fixed and invariable order, and as all music is now written on such a scale, and no other, it follows that we cannot transfer a composition without injury into a new key until we have brought the scale of that key into conformity with that in which the piece is written. A composition in C major, for instance, if carried three degrees higher—*i. e.* into the scale of F—would be false on every fourth degree of that scale, because one of the semitones in the series differs in its position from the normal pattern in C. To rectify this, we lower the fourth (or B) by placing at the clef a flat on that degree; and by thus changing every B into B♭ we correct the scale, and transposition from C to F requires nothing more than a change of the places of the notes. Again, if we would transpose from C to G, we shall find a defect of an opposite kind on the seventh degree of the G scale, which must be corrected by changing every F into F♯. On the same principle we proceed in transposition into any other key, correcting by sharps or flats the deviations of any desired key from the model scales of C major or A minor. (For a more detailed examination of the theory of transposition and its application see the article KEY.) WILLIAM STAUNTON.

**Transubstantia'tion** [from *trans* and *substantia*, "a change of one substance into another"] is a scholastic term introduced by Paschasius Radbertus (831) to signify the change of the substance of the natural elements of bread and wine into the very body and blood of Christ in the Eucharist, while the visible form and the appearance of bread and wine remain. This miracle is supposed to take place in the mass whenever the priest pronounces the words of institution: "This is my body," "This is my blood." The doctrine was more or less clearly suggested by several Greek and Latin Fathers (under different terms, such as *transitio*, *transmutatio*); it was controverted in the Middle Ages by Bertram (Ratramnus) and Berengar, but confirmed by the Lateran Council (1215) and the Council of Trent (Oct. 11, 1551), and learnedly defended by Bellarmin, Bossuet, Möhler, Perrone, and Cardinal Wiseman (in a dissertation on John vi.). It was rejected by all the Reformers and Protestant churches, because it contradicts the testimony of our senses (sight, touch, taste) and the very nature of the sacrament, and leads to gross superstitions. It is based on a literal interpretation of the words of Christ: "This *is* my body." But the majority of biblical scholars understand these words figuratively, on the ground that the disciples could not literally eat the living Christ or his crucified body before the crucifixion. Besides, it is urged that our Lord, in distributing the wine, says, "This *cup* is the new testament in my blood" (1 Cor. xi. 25), using the cup figuratively for the wine contained therein; and that he calls the elements "bread" and "wine" *after* consecration, as does also St. Paul: "The bread which we break, is it not the communion of the body of Christ?" PHILIP SCHAFF.

**Trans'vaal** ["across the Vaal"] **Republic, The,** in Southern Africa, between lat. 22° and 28° S., and lon. 25° and 31½° E., and comprising an area of 77,964 sq. m., is bounded E. by the Portuguese possessions, the Zwazi and Zulu countries, S. by Natal and the Orange republic, and W. and N. by Hart and Limpopo rivers, which separate it from the country of the Kaffirs. In the valley of the Vaal River, which separates Transvaal from Orange, diamonds were discovered in 1870, and found in so great quantities that the Englishmen seized the territory Oct. 7, 1871, and established an independent colony, Griqua-Land West. This colony, which lies wedged in between Trans-

vaal and Orange, the gold-fields of Tati and Matibele, N. of Transvaal, and the gold-field of Maraba's Town in the north-eastern part of Transvaal, form the principal centres of the traffic of the republic. The country is mostly very thinly peopled, and chiefly used by the inhabitants for hunting and cattle-breeding; and although it contains by nature all conditions of an agricultural development on the grandest scale, it still stands at a low stage of culture. The soil is very fertile, and the surface, generally elevated 6500 feet above the sea-level, presents almost everywhere the aspect of hills and valleys covered with rich vegetation and watered by limpid streams. Two mountain-ranges traverse the country from S. W. to N. E.; other minor elevations are scattered in different directions. The principal rivers are the Vaal and the Limpopo, with their affluents. The country is perhaps richer in minerals than any other country in the world—iron, tin, lead, copper, silver, gold, porcelain-clay, alum, marble, saltpetre, coal, and diamonds. Coffee, sugar, cotton, tobacco, all kinds of cereals, apples, pears, figs, grapes, peaches, almonds, nuts, oranges, bananas, guavas, etc., are produced. Nevertheless, the inhabitants, comprising about 250,000 Kaffirs and 30,000 white, prefer to live by hunting, and by their insatiable passion for destruction they have driven to the N., even beyond the Zambesi River, the numerous herds of elephants, ostriches, buffaloes, giraffes, quaggas, etc., which formerly roamed over the plains. Yet, in 1870, game was still so plentiful that lions, tigers, and other beasts of prey did not attack man. The whites, the so-called Boers, live on widely-scattered farms, where they cultivate a small piece of field and keep large herds, but their favorite occupation is *trekken;* that is, they range around for months hunting, with huge wagons, drawn by sixteen or twenty buffaloes. Some towns have been built, however, such as Potchefstroom, with 300 houses and 1500 inhabitants; Pretoria, the seat of government, with 100 houses and 400 inhabitants; Rastenburg, of the same size; and Nylstroom, a minor settlement. A railway from Pretoria to the nearest harbor on Delagoa Bay is under deliberation. Ostrich-feathers, wool, ivory, cattle, cereals, leather, fruit, tobacco, butter, brandy, etc., are exported; all kinds of manufactured goods are imported, and are sold by strolling peddlers. For the year 1874–75 the finances showed—receipts, £71,897; expenses, £71,871. The principal items of income are direct taxes on real estate, a capitation tax on those who have no real estate, custom-house duties, etc. The public debt consists of two loans at 6 per cent., one of £63,000 and one of £19,000, made respectively in 1873 and 1874 in Cape Town. The government consists of a president as chief of the executive and a legislative assembly. English money and Dutch measures are in use. The Boers were mostly born in Cape Colony or Natal. In order to escape from the control of the English law, they retreated into the rich northern wilderness, and here they formed a state in 1858, and gave themselves a constitution. Of great importance for the development of the republic were the explorations of the Englishman Baines who first accompanied Livingstone, and subsequently acted as agent for the English company which worked the gold-mines in the vicinity of Transvaal; also the discoveries of gold-fields by the German explorers Mercuski and Mauch, who believed they had rediscovered the ancient Ophir.

AUGUST NIEMANN.

**Transylva'nia,** county of S. W. North Carolina, bordering on South Carolina; surface mountainous, and containing the source of French Broad River; soil fertile in the valleys, and well adapted for stock-raising. Staples, Indian corn, rye, wool, and tobacco. Cap. Brevard. Area, 475 sq. m. P. 3536.

**Transylvania, Grand Duchy of,** a crown-land of the Austro-Hungarian monarchy, comprising an area of 21,216 sq. m., with 2,115,024 inhabitants, is mostly mountainous, formed by a plateau which rises to an average height of 1500 feet, and is surrounded on all sides by mountains—S. and E. by the Transylvanian Alps, a range of an average elevation of 4000 feet, extending for a distance of about 80 geographical miles from the Iron Gates to the sources of the Theiss; W. and N. by the Transylvanian Ore Mountains; and S. W. by the mountains of the Banate. The Transylvanian Ore Mountains, whose single chains generally extend from E. to W., contain several high peaks—as the Kuhhorn, 6850 feet, the Bihari, 5671 feet—and form a series of longitudinal valleys through which the rivers of the plateau wind their way, such as the Maros, Szamos, etc. The Transylvanian Alps rise with their bald peaks far above the tree-line, the highest point of the southern range, the Negoi, reaching an elevation of 7830 feet; but in other places dense primitive forests add to the inhospitality of these thinly-peopled mountain-ranges, which are traversed only by a few passes—the Vulcanpass, 4330 feet, Rothethurm, 1280 feet, Tömös, 5569 feet, and Oitosz, 2729 feet. On account of the mountainous character and great elevation of the country, its climate and vegetation resemble those of more northern countries. The vine, however, is still cultivated. In the southern part rainstorms and inundations are of frequent occurrence. Mineral products abound; gold is found in the mines of Nagyag, Szekerembe, Kapnik-Banya, Zalathna, and Köröspatak, and in the sands of many streams; also silver, copper, quicksilver, iron, lead, sulphur, precious stones, valuable pebbles, chalk, graphite, and porcelain-clay. The extensive deposits of peat and coal are not utilized, on account of the country's immense wealth in wood. The salt production is important. The animal kingdom presents a great variation. Cattle-breeding is carried on with energy. Buffaloes are used for draught. Horses of a powerful breed are reared and exported. Sheep are very numerous. Of wild animals, bears, wolves, foxes, and wild-boars abound; also eagles, vultures, quails, prairie-hens, various kinds of wild-geese, ducks, etc. Bees are extensively reared, and much honey and wax are exported.

The country, on account of its being bounded on all sides by high mountain-chains, has always retained a certain independence and seclusion, and was in the oldest time inhabited by the Dacians, the Getæ, but subsequently, between the third and the tenth centuries, numerous tribes drew through it, first the Visigoths in 272, then the Huns, and, after the dissolution of the Hunnic empire in 453, the Ostrogoths, Avars, Slaves, Germans, and finally the Magyars. By these race-inundations of the Carpathian countries the Slaves became settled in the northern and southern parts, and the Magyars in the central plain, while the descendants of the ancient Dacians, the Wallachs, continued to occupy the south-eastern districts, preserving their nationality—as it had been developed in contact with the Romans—with great stubbornness through all vicissitudes; they still form the chief part of the population of Transylvania, and employ the Latin language to a remarkable extent. Besides the Wallachs, Germans, the so-called Saxons, live in the country, in the north-eastern and southern parts, and Magyars and Szechs in the eastern. The Szechs are believed to be a remnant of the first Hunnic immigration; they are allied to the Magyars, and number, together with them, about 570,000, the Saxons 235,000, the Wallachs 1,500,000. The Wallachs are chiefly Greek Catholics and non-united Greeks; the Saxons, Lutherans; the Magyars and Szechs, partly Roman Catholics, partly Calvinists. The number of Roman Catholics in Transylvania is computed to be 858,390; that of non-united Greeks 653,170; of Evangelical, 505,540; of other denominations, 78,610; and of Jews, 248,850. The principal occupations are agriculture and cattle-breeding. About 86 per cent. of the soil is productive—namely, 23 arable, 38 forest, and 25 meadow. The cultivation is poor, and the production of grain is insufficient for the home demand; the largest profit is yielded by the cultivation of the vine, tobacco, hemp, flax, and fruit. Cattle-breeding is important, and the breed of horses is celebrated. Manufacturing industry is very low, though numerous tanneries and breweries are in operation. Coarse linen is everywhere produced, but only for home use; finer fabrics are imported. Much common pottery is produced, also some glass; in Hermannstadt and Kronstadt soap and hats are manufactured, but in many districts even masons, carpenters, and smiths are wanting. The commerce is mostly in the hands of the Greeks and Armenians, who carry on the exportation of the cattle and animal products, and the importation of textile fabrics, colonial ware, and articles of luxury. The interior traffic consists chiefly in the exchange of animal products and wooden-ware, and takes place at annual and weekly fairs. Of railways there are none. In political respects the *Diploma Leopoldinum* forms the basis of the constitution. It guaranties the maintenance of the three nations, the Magyars, Szechs, and Saxons, and accordingly the country is divided into three parts—the country of the Magyars, with the cities of Klausenburg and Carlsburg; the country of the Szechs, with the cities of Maros Vasarhely and Udvarhely; and the country of the Saxons, with the capital of Hermannstadt and the towns of Schässburg, Kronstadt, and Bistritz. The Wallachian nation, which forms the majority, was not guarantied until 1863. The country belongs to the Hungarian crown, and sends its representatives to the Hungarian Parliament. The highest court of the country is seated in Maros Vasarhely, but from that an appeal can be made to the royal court seated in Buda-Pesth.

In 1003, King Stephan I. incorporated Transylvania with Hungary, and the country was governed by waywodes. In 1421 and 1433 the Turks first invaded the country; subsequently it was frequently the scene of bitter struggles between the Christians and the Moslems. From 1526 to the beginning of the eighteenth century

Transylvania formed an independent state under princes of the house of Zapolya, of whom Bethlen Gabor and Georg Rakoczi were the most celebrated. During this period Transylvania often proved a very dangerous enemy of the house of Austria, especially during the Thirty Years' war, when it allied itself with the Protestant princes of Germany and the Swedes. When the native dynasty became extinct in 1713, the country was united to Austria, and Maria Theresa made it a grand duchy. The revolution which in 1848 shook the whole Austrian state, and brought Hungary into war with Austria, caused also bloody strife in Transylvania, and ended with a complete separation of the country from Hungary by the constitution. Thus, Transylvania forms an independent crownland, though, according the constitution of Dec. 21, 1867, it belongs to the Hungarian division of the Austro-Hungarian monarchy.

AUGUST NIEMANN.

**Trap,** in geology and lithology, a term applied formerly in a vague way to a large variety of rocks which are now often distinguished by other names more or or less significant of their mineralogical composition; the word "trap" being now most generally applied to designate little more than a mode of occurrence, in the form of so-called "dikes" intersecting, or of beds intercalated between beds of, other rocks, and held by most of our geologists and lithologists to be *intrusive* in origin. The word *trap* is Swedish or Danish in derivation, *trappa* in the former and *trappe* in the latter language meaning a "stair," and was applied first, it is thought, to the columnar basaltic traps, which at times occur in ranges of columns rising above each other, like rude stairs; such contour being, however, due in all cases to different kinds of erosive action, chiefly glacial.

It is equally difficult to present a precise definition of *trap* with reference to geological origin, or to geological occurrence, or to mineralogical composition, or to general lithological character. Dikes occur, precisely similar to so-called trap-dikes, which are granitic and porphyritic, and felsitic, and trachytic, and of other types. Conformable beds, supposed intrusive, of so-called trap, occur abundantly in many sedimentary geological formations, which are only distinguishable from those above and below them by their compact crystalline structure and difference in color, bearing a relation to the enclosing strata similar to that between a sedimentary and a crystalline limestone, or between a fragmental or psammitic shale or slate of any kind, and the same in a metamorphic condition. The nearest approach, probably, that can be made to conveying the prevailing ideas of lithologists and geologists regarding traps is to say that they include all *non-volcanic* intrusive rocks which cannot be called granite or porphyry or felsite or by some other distinctive name. By *intrusive* here is not meant necessarily *igneous*, at least not by all lithologists; for few can doubt that the intrusion must in a great number, if not the vast majority, of cases have been in the form of mud or in some pasty or plastic condition not amounting to igneous fusion. Much remains to be done yet, however, in the laboratories of the chemist and the microscopist before these mysteries of modes of genesis of trappean rocks will be understood clearly.

This class of rocks is of great American interest, as some of the most remarkable and extensive formations of so-called trap occur on this continent. Among these are the magnificent Hudson River "Palisades," the Orange Mountain in New Jersey (the barrier which forms the falls of the Passaic), Mount Holyoke, East Rock and West Rock near New Haven, some of the grandest of the Lake Superior rocks (including the wonderful copper-region), many points on the Pacific side of the continent, the Bay of Fundy coast in Nova Scotia, etc. The mineralogical constitution and chemical composition of some of these rocks are now in progress of chemical, mineralogical, and optical examination by Mr. G. W. Hawes of New Haven and other chemists, and important new facts are being brought out, for which the scientific journals must be consulted. As an example of chemical composition of a trap may be cited one of Mr. Hawes's recent analyses of a sample of West Rock, called *doleritic trap*, which should be, mineralogically, a mixture of prismatic crystals of pyroxene with some magnetic iron in a paste of labradorite feldspar:

| | |
|---|---|
| Silica | 51.78 |
| Alumina | 14.20 |
| Ferric oxide | 3.59 |
| Ferrous oxide | 8.25 |
| Manganous oxide | .44 |
| Lime | 10.70 |
| Magnesia | 7.63 |
| Soda | 2.14 |
| Potash | .39 |
| Diphosphurous pentoxide | .14 |
| Water | .63 |
| | 99.89 |

Density = 3.03.

HENRY WURTZ.

**Tra′pani,** or **Trapani del Vallo,** town of Sicily, province of the same name, on one of the extreme points of the W. coast of the island, lat. 38° 3′ N., lon. 12° 30′ E. This is one of the best built and most active towns in Sicily. It stands on a peninsula, is scythe-like in form, and under the Bourbons ranked as a second-class city in point of strength. Spanish taste is still apparent in its edifices. The churches, the municipal palace, the Giudeca, etc., are worthy of notice, and contain interesting artistic objects, though most of the choice pictures have been recently removed to the Pinacoteca. The celebrated sanctuary of the Madonna of Trapani (finished 1332) is outside the town. The harbor of Trapani, though its entrance is not a little encumbered by small islands, rocks, etc., is most convenient for the coasting-trade, and it has lately been made much more safe of access for foreign vessels by a judicious erection of lighthouses on several points. About 3000 vessels enter this port annually, the trade being chiefly in wine, oil, fruits, cotton, semilino, etc. The fisheries are highly productive, and coral is taken in large quantities. Among other local industries should be mentioned works in marble, alabaster, coral, and shell. The art of cutting cameos in shell is said to have been first revived here. Cottons, linens, and woollens are also manufactured. The city of Trapani occupies the site of the ancient *Drepanum*, which Virgil makes the burial-place of Anchises, and which was probably a Carthaginian settlement; in 242 B. C. it became subject to the Romans. In the ninth century it was taken by the Mogrebbins, who were driven out by the Normans in 1077. Charles V. made it a great military station for the defence of this coast against the Saracens, and it was at this time called *Invitissima*. When Charles V. landed here after his successful campaign against Tunis, he bestowed upon the city many honors and privileges. In 1869 important palæo-ethnological discoveries were made near Trapani, showing that man once dwelt here at the same time with the elephant, the hyena, and the cave-bear. P. 33,630.

**Trape′zium** [Gr. τραπέζιον], a quadrilateral, no two sides of which are parallel.

**Trap′ezoid** [Gr. τραπέζιον and εἶδος], a quadrilateral, two of whose sides, and only two, are parallel.

**Trap Hill,** p.-v. and tp., Wilkes co., N. C. P. 972.

**Trap Hill,** tp., Raleigh co., West Va. P. 499.

**Trappe,** p.-v. and tp., Talbot co., Md. P. of v. 272; of tp. 3939.

**Trappe,** tp., Wicomico co., Md. P. 1288.

**Trap′pists, The,** a monastic order of the Roman Catholic Church, received their name from La Trappe, an abbey of the Cistercian order, situated in the department of Orne, France, and founded in the middle of the twelfth century. Here Armand Jean le Bouthillier de Rancé, who was consecrated abbot on July 13, 1664, introduced those severe reforms which made the Trappists one of the most austere orders of the Roman Catholic Church. He was at first opposed both by other Cistercian monasteries and by the monks themselves, whose practices had become so disorderly, by neglect of the ecclesiastical authorities and by other unfortunate circumstances, that they were generally called the "brigands of La Trappe." But after some years' persevering exertions, he saw his rules adopted not only in La Trappe, but also in Tamié, a Cistercian monastery near Faverges in Upper Savoy. Twelve hours of the day were given to religious exercises, and several hours to hard labor. Vegetables and water formed the fare; meat, wine, etc., were forbidden, and conversation between the monks themselves or with outsiders was avoided. The whole life tended to concentrate the mind on the sole idea of death. During the Revolution the order was suppressed in France, and it possessed at that time only two monasteries outside of France—one in Germany and one in Tuscany. In 1817, however, La Trappe was reopened, and in the mean time a Trappist colony had settled in 1803 at Pigeon Hill, near Conewago, Pa., whence they removed in 1805 to Kentucky, and finally, in 1813, to Tracadie in Nova Scotia. A second colony settled in 1848 at Gethsemane, Ky., and a third at New Melleray, near Dubuque, Ia. In France the order was dissolved in 1830, though the law of dissolution was not enforced; in Italy it was suppressed in 1870, and in Germany in 1874.

**Trap-Rock.** See TRAP, by PROF. H. WURTZ, A. M.

**Tras,** for mortar. See CEMENTS, by GEN. Q. A. GILLMORE.

**Trasimenus, Lacus.** See PERUGIA, LAKE OF.

**Trask** (WILLIAM BLAKE), b. at Dorchester, Mass., Nov. 25, 1812; was a cabinet-maker in early life, but devoted his leisure to antiquarian and genealogical studies; in 1851 became a member of the New England Historical and Genealogical Society, and its historiographer in 1862; is

one of the editors of the *New England Historical and Genealogical Register*. He assisted S. G. Drake in collecting materials for the *History of Boston*, aided W. H. Sumner in the preparation of the *History of East Boston*, besides rendering great service to other genealogists; and is one of the authors of the *History of Dorchester*.

**Tras-os-Mon'tes,** province of Portugal, bounded N. and E. by Spain, S. by the river Douro, and W. by the province of Minho, comprises an area of 4028 sq. m., with 365,833 inhabitants. It is mountainous, and of a rather rugged and wild character, but its valleys are very fertile, and produce, besides more wheat than is demanded for home consumption, excellent fruits, and the famous port wine, whose cultivation is confined to one district, called Alto Douro. The mineral wealth is great, but entirely unused; the mulberry is extensively grown, and silk-culture carried on with success.

**Travancore',** with Trivandrum on the Malabar coast as capital, one of the best administered feudatory states of the British-Indian empire, on the south-western end of the Indian peninsula, with an area of 6653 sq. m., and a population of 1,262,647 inhabitants, chiefly Hindoos, containing, however, the unusually large number of 100,000 native Christians, members of the Syrian Church, as well as remnants of ancient Jewish colonies. A most turbulent sect are the Mophlas, Mohammedans who inhabit the N. of the state. Owing to a large outlay of state money on public irrigation, works, and roads, the condition of the laboring and agricultural classes has been improved; roads connect the harbors of Quilon and Trivandrum with the interior. The British-Indian penal code, altered to suit the characteristics of the people, has become part of the law of the country. The ruling family of the maharajah is famous for its particular interest in astronomical observations and its promotion of the efforts of philanthropists. In 1875 Rama Varna, first prince of Travancore, published an essay on the infliction of capital punishment under chloroform. The revenues amounted in 1874 to £530,000; a balance is carried to the next year's accounts, which had in 1874 risen to £4,000,000. The palace expenditure is very moderate, the greater part of the revenues being devoted to public works, to religious institutions, to education, and to judicial and police establishments. The Nair subsidiary brigade amounts to 2000 men; to the Indian government is paid an annual subsidy of £80,000. The total value of exports is £7,500,000; of the imports, £4,700,000. Coffee and pepper show considerable increase; cardamoms, areca, cocoanuts were with other articles a monopoly of the rajah, but can now be obtained in open market, being only subjected to a light export duty. E. SCHLAGINTWEIT.

**Trav'ellers, Laws as to.** The special rules concerning the rights and duties of travellers are so numerous, so important, and have elsewhere been already so fully explained that to state them again in detail would simply involve the unnecessary rewriting of a large amount of matter to be found in other portions of this work. It will be sufficient if the reader is referred to the various articles in which these doctrines have been discussed and elaborated. In relation to the general rights of travellers to use all public means of conveyance, carriage, and transport, see articles HIGHWAY, TURNPIKE, CARRIERS, COMMON, etc. Concerning their liability to pay the legal rates of toll and of fare, and the power of railroads and other transporting companies to make reasonable rules concerning the use and binding effect of their own tickets, see articles TURNPIKE and CARRIERS, COMMON. For the law of the road, and the rules as to turning out and passing in order to avoid collisions when travelling upon highways, see the article ROAD, LAW OF THE. The statutory prohibitions in certain States of travelling upon Sunday, except upon works of necessity and mercy, will be found under the head SUNDAY LAWS. In respect to the innkeeper's liability for loss of or injury to the baggage of travellers while his guests, and his lien upon such baggage for his charges, see the article INNKEEPERS, and for the liability of carriers for the loss of or injury to baggage see the article CARRIERS, COMMON. In regard to the liability for personal injuries to passengers by the parties engaged in transporting them see articles CARRIERS, COMMON, and NEGLIGENCE. For the liability of third persons for personal injuries to travellers upon highways, etc., caused by negligent acts and omissions, see articles NEGLIGENCE, HIGHWAY, and TURNPIKE. In respect to the liability of towns, road-districts, and municipal corporations in certain States for injuries caused through a neglect to keep the roads and streets in repair, see article MUNICIPAL CORPORATIONS.

JOHN NORTON POMEROY.

**Trav'eller's Rest,** p.-v. and tp., Coosa co., Ala. P. 836.

**Trav'erse,** county of Western Minnesota, separated from Dakota by Sioux Wood River and Lake Traverse, and crossed in its N. E. corner by St. Paul and Pacific R. R. It was formed in 1862, but in 1870 the pop. was only 13.

**Traverse,** tp., Grand Traverse co., Mich. P. 1275.

**Traverse,** tp., Nicollet co., Minn. P. 537.

**Traverse City,** p.-v., cap. of Grand Traverse co., Mich., on a branch of Grand Rapids and Indiana R. R., at the head of the W. arm of Grand Traverse Bay, has 3 churches, a ladies' library, good schools, 2 newspapers, U. S. land-office for N. W. Michigan, and several mills. P. about 1200.

D. C. LEACH, ED. "HERALD."

**Trav'erse-Table,** in surveying, a table from which the latitude and departure of any course can be found by inspection. It is a rough table of the sines and the cosines of arcs, computed to each quarter of a degree from 0° to 90°, and for every radius from 1 to 100. In the ordinary tables the computation is only carried out to two places of decimals. If we denote the length of any course by $c$, its latitude by $l$, its departure by $d$, and the angle which it makes with the meridian by $\phi$, we have $l = c \cos \phi$, and $d = c \sin \phi$. If we give to $\phi$ in these formulas successive values advancing by quarter degrees from 0° up 45°, and if for each value assigned to $\phi$ we give to $l$ every value from 1 to 100 inclusive, and tabulate the results, the table thus found will be the ordinary traverse-table. The computations need not be carried beyond 45°, for the latitude of a course corresponding to any bearing is equal to the departure of the same course corresponding to the complement of that bearing, and the reverse. The table is used in a manner entirely similar to that of using a table of natural sines and cosines. When greater accuracy is required than can be attained by the use of the traverse-table, the latitude and departure may be computed in each case from the formulas given above. W. G. PECK.

**Trav'is,** county of Central Texas, intersected by Colorado River, which is ascended by steamboats as far as Austin, which is the terminus of a branch of Houston and Texas Central R. R.; surface somewhat hilly, soil fertile. There are breweries and saw-mills, and manufactories of carriages, saddlery, and brick. Horses, cattle, sheep, and swine are numerous. Staples, cotton, Indian corn, and sweet potatoes. Cap. Austin, which is also the capital of the State. Area, about 1000 sq. m. Pop. 13,153.

**Travis** (REV. JOSEPH), A. M., b. in Maryland Sept. 13, 1786; entered the itinerant connection of the Methodist Episcopal Church in 1806, and filled important stations as an educator and preacher in the South Carolina, Georgia, Louisiana, and Memphis conferences. D. in Mississippi Sept. 16, 1858. T. O. SUMMERS.

**Travnik',** town of European Turkey, eyalet of Bosna, on the Lastva, is ill built and unhealthy on account of the swamps which surround it. Its manufactures of sword-blades are quite important. P. about 10,000.

**Tra'vo,** town of Italy, province of Piacenza, situated among hills on the left bank of the Trebbia. The great tower of the ancient castle remains intact, the rest of the edifice having been converted into a private dwelling. The neighborhood is remarkable for an abundance of game, and for truffles and mushrooms of a superior quality. P. 5280.

**Trawl'ing,** in the fisheries, sometimes is fishing by means of a trawl, or small bag-shaped net, dragged along the bottom of the sea behind a boat. The name *trawling* is also given to a system of fishing for cod, halibut, and other large fish, by means of a great number of hooks set at intervals along a stout line which lies upon the sea-bottom. From time to time this trawl or ground-line is underrun by men in a boat, and the fish are removed. This system is extensively practised in the American fisheries.

**Tray'wick's,** tp., Russell co., Ala. P. 1280.

**Treacle.** See MOLASSES.

**Tread'mill,** a machine sometimes employed in prison discipline, was invented by Sir William Cubit, and introduced into British prisons in 1817. It is an appliance by which the prisoner's weight gives a revolving motion to a cylinder, somewhat as a horse's weight gives motion to an ordinary horse-power machine. The treadmill is sometimes attached to useful machinery. It is now but little used.

**Tread'well** (DANIEL), b. at Ipswich, Mass., in 1791; displayed in childhood his mechanical ingenuity by inventing a machine for making wood screws; brought out in 1818 a new printing-press; visited England 1819; invented the "power-press" 1822, in 1826 the system of turn-outs on single-track railroads, in 1829 a machine for spinning hemp, and in 1835 described in a memoir before the American Academy important improvements in the material and method of construction of cannon, resembling the subsequent Armstrong processes; secured a patent and a gov-

ernment contract, and filled from 1834 to 1845 the Rumford professorship of technology in Harvard College. He established with Dr. John Ware the Boston *Journal of Philosophy and the Arts* (1822). D. at Cambridge, Mass., Feb. 27, 1872.

**Treadwell** (John), LL.D., b. at Farmington, Conn., Nov. 23, 1745; graduated at Yale College 1767; studied law; was a member of the legislature 1776–85, of the Continental Congress 1785–86, county judge 1786–89, member of the council 1785–98; was judge of probate and of the supreme court of errors 1789–1808; was chosen lieutenant-governor 1798, and was governor 1809–11. He was active in establishing and managing the school fund, and was president of the American Board of Commissioners for Foreign Missions from its foundation to his death, at Farmington, Aug. 19, 1823.

**Treadwell** (John Goodhue), M. D., b. at Salem, Mass., Aug. 1, 1805; graduated at Harvard 1825; studied medicine, and established himself as a physician at Salem 1830, but devoted much of his time to scientific agriculture and gardening, aided by an ample hereditary fortune. D. at Salem Aug. 6, 1856. He bequeathed to the Essex County Agricultural Society his lands at Topsfield for an experimental farm, and to Harvard College his medical library and an estate valued at $75,000 for the foundation of a professorship of physiology and anatomy.

**Trea'son.** Treason is derived through the Fr. *trahison, trahir*, from *trado, traditio*, and denotes a crime of indefinite and variable limits against the sovereignty of the people or the person of the supreme ruler. The Romans call this crime *perduellio*, and afterward *crimen majestatis*—that is, either hostility to one's own country, such as joining its enemies in war would imply, or afterward hostile attack on the emperor, or, as the latter term denoted, the act of invading the sovereignty of the people. In the expression *lædere majestatem*, to injure the sovereignty of the people or of the state, is found the origin of the term *lèse-majesté*, used by the French to denote treason. The English definition of treason or high treason has included, especially, compassing or imagining the death of the reigning sovereign or his (or her) eldest son and heir; violation of the queen or the king's eldest daughter, being unmarried, or his eldest son's wife; levying war against the sovereign within the realm by a subject; giving aid and comfort in or outside of the realm to the sovereign's enemies; counterfeiting the great or privy seal; importing "false money, counterfeit to the king's money," besides other offences which at any time of excitement it seemed best to comprehend under the same term. The folly of such legislation led to the simple definition of our Constitution that "treason shall consist only in levying war against the U. S. or in adhering to their enemies, giving them aid and comfort." It is implied that the crime can be committed only by one owing allegiance to the U. S.

The States of the Union, to some extent at least, have admitted into their codes a crime of treason against themselves similar to that committed against the U. S. But as treason against a State must always be treason against the U. S., and as war against so limited a sovereignty as that of one of the States is hardly an act deserving the name of war, such treason is as little deserving of the name as it is likely to be frequent. If an invading force from a foreign country should land on the territory of a State and be joined by one of its citizens, he would be amenable to the laws of the U. S.; if it were joined by a man from one of the other States, the same would be true, but in this case the State could not try him for treason, as he is in no sense its subject. A general law against seditious or armed assemblages would answer all purposes equally well, and could not come into conflict by any possibility with the laws and judicial arrangements of the Union. And, on the other hand, if a man were acquitted of treason against a State, he would still be liable to indictment for treason against the U. S. for the same offence.

The law of treason with the growth of monarchy included various offences against the person of the monarch or his rights or appurtenances, and with the growth of arbitrary power stretched its penalties over various crimes or even peccadilloes that lay outside of its original limits. (See on this, and the restrictions which a free government admits into its definition, Lieber's *Civil Liberty*, ch. viii.)

T. D. Woolsey.

**Treas'ure City,** p.-v., White Pine co., Nev.

**Treas'urer of the U. S.,** an officer of the U. S. treasury department who receives and pays out money on the warrant of the secretary of the treasury, countersigned by the first comptroller and certified by the register, taking receipts for all moneys paid out. Moneys paid to the treasury are charged to the treasurer on covering-warrants, upon which he signs his receipt.

**Treasure-Trove** ["treasure found," from Fr. *trouver*, to "find"]. Whenever gold or silver coin, plate, or bullion had been *hidden in* the earth or in some secret spot so long ago that its existence was forgotten and its owner unknown, and should be accidentally found, it was termed "treasure-trove." By the common law of England if its owner is discovered it belongs to him; if not, it goes to the Crown. This peculiar doctrine may best be illustrated by a comparison with another analogous case. If valuable articles are found derelict at sea or lying *on* the land, they belong not to the Crown, but to the finder by the title of occupancy (see articles Occupancy, Personal Property), because the leaving goods in the manner last described indicates a purpose to abandon them, while the act of concealment shows an intention of retaining the property. The Roman law contained minute and specific rules concerning this subject, because at various periods of its history such concealment of valuables was necessary and frequent. There must have been a *hiding;* the finding must be purely accidental, and not the result of a search, and not made in a tomb or other "sacred" place. If the finding was by the owner of the land, the property in the whole treasure at once vested in him; if by one person in the land of another, each took equal shares; if in the public land, one-half went to the finder, and the remainder to the treasury (the *fiscus*). The things subject to these rules included not only gold and silver, but other portable articles of peculiar value, such as statues, vases, urns, etc., if not discovered in a tomb. The doctrines of the common law concerning "treasure-trove" were evidently borrowed directly from the Roman law, with the single but most important modification which substitutes the Crown in the place of the finder as the one who acquires property in the treasure thus found.

John Norton Pomeroy.

**Treasury of the United States,** a department of the executive government of the U. S., having control over the collection, management, and disbursement of the public revenue, and presided over by a secretary, who is, next to the secretary of state, the most important officer of the cabinet. The present office dates from the law of Sept. 2, 1789, drawn up with such precision and comprehensiveness by Alexander Hamilton, the first secretary, that few changes have since been made in its language. The subordinate officers consist of two assistant secretaries, a treasurer, three comptrollers, six auditors, a registrar, commissioners of customs and of internal revenue, a solicitor, and about 16,000 employés, of whom 3000 are in the bureaus at Washington, 5000 in the various custom-houses and sub-treasuries, and 7000 in the internal revenue service. There are 18 bureaus, among which are those of the mint, statistics, the Coast Survey, and the lighthouse board. Most of these multifarious officers are quite independent of their nominal subjection to the head of the treasury department, whose influence is therein confined to the appointing power.

**Treat** (Robert), b. in England in 1622; emigrated to New England, with his brother Richard, in company with Sir Richard Saltonstall; was one of the first settlers of Wethersfield, Conn.; afterward settled at Milford, where he was soon chosen a judge; was a magistrate 1661–65; became a major of Connecticut troops 1670; marched to Springfield (1675) to the relief of that place against the Indians; drove them from before the town, subsequently routed them at Hadley; participated in the great Indian battle at the Narragansett Fort in December of that year; was chosen lieutenant-governor 1676, and governor 1686–1701. D. at Milford July 12, 1710.—His son Samuel, b. at Milford in 1648, graduated at Harvard 1669, and was minister of Eastham on Cape Cod, Mass., from 1672 to his death, Mar. 18, 1717. He acquired the language of the Nauset Indians, in which he published a "confession of faith;" was successful in the conversion of those Indians, and preached the "election sermon" in 1713.

**Treaty.** See International Law, by Pres. T. D. Woolsey, S. T. D., LL.D.

**Treb'bia,** the ancient *Trebia*, a river of Northern Italy, rises in the Ligurian Apennines 15 miles N. E. of Genoa, flows northward, and joins the Po 3 miles above Piacenza. On its banks the Romans under Sempronius were defeated by Hannibal in 218 B. C. and the French under Macdonald by Suwaroff June 17–20, 1799.

**Trebi'gne,** town of European Turkey, eyalet of Bosna, on the Trebinicza, has many mosques, and was under the first Servian kings an important place. P. about 10,000.

**Tre'bitsch,** town of Austria, in Moravia, on the Iglawa, is well built and beautifully situated; manufactures liqueurs, rosoglio, leather, and cloth, and trades largely in grain, cattle, and horses. P. 6084, of whom 1400 are Jews.

**Treb'izond,** or **Tarabozan,** town of Asiatic Turkey, on S. E. coast of the Black Sea, in lat. 41° 1′ N., lon. 39°

46′ E., beautifully situated on a slope facing the sea, and surrounded with walls and defended by a citadel on a neighboring hill and forts at the entrance of the harbor. It was founded by a colony from Sinope, and was a flourishing city in the time of Xenophon. Trajan made it the capital of the province of Cappadocia, and in 1204 A. D. Alexis Comnenus established here an independent empire, which stood to 1461, when it was conquered by the Turks. It contains fine edifices, and is well built, especially the suburb which is inhabited by the Christians, and which contains the bazaars. Regular communication by steamers with Constantinople and the mouth of the Danube makes it the centre of a very important traffic. Cotton manufactures, colonial produce, spices, ironware, glass, wine, salt, and corn to the value of about $20,000,000 are annually brought to it from Europe, and exchanged for silk, wool, tobacco, wax, gall-nuts, opium, shawls, carpets, and saffron, which are brought from Persia on camels. Its own manufactures and the products of the immediate neighborhood are insignificant, with the exception of timber. P. between 20,000 and 30,000.

**Treca′te,** town of Italy, province of Novara, was a place of considerable importance during the Middle Ages, but its old fortifications are in ruins. P. 6906.

**Tred′egar,** town of England, county of Monmouth, has 9383 inhabitants, mostly employed in the rich coal and iron mines of the vicinity. The celebrated Tredegar ironworks at Richmond, Va., derive their name from this source.

**Tred′gold** (Thomas), b. at Brandon, near Durham, England, Aug. 22, 1788; was for some years a journeyman carpenter, during which time he diligently studied mathematics and architecture; was for ten years (1813–23) employed at London in the office of Mr. Atkinson, architect to the board of ordnance, extending his studies to embrace chemistry, geology, mechanics, and engineering, and for the last six years of his life practised with great success as a civil engineer, contributing meanwhile scientific articles to the *Philosophical Magazine*, the *Annals of Philosophy*, and the *Encyclopædia Britannica*. D. in London Jan. 28, 1829. Author of *The Elementary Principles of Carpentry* (1820; 5th ed. 1870; Philadelphia, 1837), *A Practical Essay on the Strength of Iron and other Metals* (1821; 6th ed. 1866), *Principles of Warming and Ventilating Public Buildings*, etc. (1824), *Practical Treatise on Railroads and Carriages* (1825), *Remarks on Steam Navigation* (1825), *Description of Iron Suspension Bridges* (1826), and *The Steam Engine* (1827), which was subsequently edited by W. S. B. Woodhouse (2 vols., 1838–40), with 125 plates in atlas folio, and in an enlarged edition (3 vols., 1850–53), with 200 engravings and 160 wood-cuts.

**Tredyffrin,** tp., Chester co., Pa. P. 1897.

**Tree** [Ang.-Sax. *treow*], a woody plant with a single trunk rising to more than the height of a man. There are all gradations between shrubs and trees. Some woody-stemmed plants are properly called trees, although of dwarf stature, the branches being elevated upon a single trunk; some, which branch or divide from the ground or near it into a cluster of trunks, reach such a height and magnitude that they must be called trees rather than shrubs. *Exogenous trees,* being the commonest in all countries, may be taken as the type or representative kind. An exogenous tree springs from an embryo having a pair of cotyledons or seed-leaves, and duly develops lateral buds as well as the terminal or primary one, and therefore branches freely. The name *exogenous* denotes that it is an outside-grower—*i. e.* the trunks, and equally the branches, increase in thickness by new wood formed outside the old. The seedling stem, almost as soon as it is formed, is traversed longitudinally by some woody threads (vascular and woody bundles or fibro-vascular bundles), which are so arranged as to surround a central portion that remains destitute of woody matter; and these increase in size and number until they form a cylindrical layer of wood (in cross-section a ring) between the soft central core, the pith, and an outer more or less soft portion, the bark. When this layer of wood in the seedling stem or other shoot of the season is completely formed, no additions are made to its inner portion, but new wood may continue to be formed on its outer surface, between it and the bark, all through the season. This justifies the name of *exogen*, or "outside-grower," from the first. When, after a suspension of growth consequent upon the diminution of temperature in all climates which have a winter, or of moisture where vegetation is arrested or checked by dryness, a second season of growth supervenes, a new layer of wood is formed upon or external to the old one, and so on year after year. Consequently, the section of an exogenous tree-trunk exhibits concentric layers—in all ordinary cases one for each year of its age—the oldest next the pith, the youngest next the bark. As the tree has made annual increments of growth in length as well as in diameter, a cross-section at the base of the trunk exhibits a number of annual layers equal to the whole age of the tree, while one at the summit has only a single layer, interposed between the pith and the bark. Radiating plates—in the cross-section lines more or less conspicuous—traverse this layer of wood from the pith to the bark, dividing it into wedges; these are continued through the succeeding layers, and new ones are interposed between them as the wedges widen; these are the *medullary rays* or *silver grain*. The bark of an exogenous tree is always clearly distinguishable from the wood, and for the most part is readily separable from it, the demarcation between the two being a thin zone of forming or formative matter, called the *cambium*. From this cambium are developed on the one side additions to the wood—on the other to the inner bark. The bark of a young tree is of three layers, different in kind. The inner bark, or *liber,* next the wood, generally contains, and sometimes largely consists of, fibres or fibro-vascular bundles, allied to the components of wood, but more flexible and loosely arranged; these in their most perfect form are called *bast*. The liber grows by thin annual concentric layers, the newer inside of the older, and next the wood. Covering the liber is the green bark, or green layer, wholly cellular and herbaceous, and containing *chlorophyl* or *leaf-green*. It is conspicuous upon young shoots of the season. The third or outer bark remains thin and more or less transparent. The latter, called the *corky layer,* or epidermal layer, consists of tabular cells, which contain no leaf-green, but assume the gray, brownish, or other hue which characterizes the twigs and branches. When it continues to grow and acquires any considerable thickness, it forms cork. While the wood, once formed, remains unaltered except as changing from sap-wood to heart-wood, the bark is subject to distention from within, to which, at length, only the inner liber, annually formed upon an enlarging circle, can continue to adapt itself. The older and outer bark is consequently sooner or later fissured and riven by the enlarging girth within, as well as worn and weathered by exposure to the elements without; so that the bark of old tree-trunks consists of the liber only, and of but a part of that. The port or character of the tree depends much upon its mode of branching, and this primarily upon the arrangement of leaves upon the twigs; for the branches of the spray proceed from lateral buds, of which there is usually a single one in the axil of each leaf. Accordingly, when the leaves are opposite, so will be the branches of the spray, while alternate leaves originate alternate branchlets; but this symmetry, however evident in the branchlets, is usually more or less obscured in the larger branches by the non-development of some of the buds and the destruction of many branchlets. When the main trunk persists and leads throughout, not being rivalled or supplanted by any of the branches, the tree is said to have an excurrent trunk: when the main trunk is lost in or replaced by the main branches, it is said to be deliquescent. Completely excurrent trunks are most common in and characteristic of—

*Coniferous trees,* in the more extensive sense including cypresses, junipers, and even yews, as well as pines, spruces, and firs. These are a kind of exogenous tree in growth and structure, but with wood composed of homogeneous cells having peculiar markings. Their flowers are also peculiar and greatly simplified, their ovules naked and fertilized by direct application of the pollen, so that they are distinguished by some as a sub-class of exogens, by others as a class, under the name of *gymnosperms,* or naked-seeded plants. They are mostly stately trees, with peculiar narrow, commonly needle-shaped or awl-shaped, leaves, of very simple nervation, mainly evergreen (the larch and our Southern bald cypress, or *Taxodium*, being exceptions), and they are developed more commonly from an embryo with the two cotyledons so completely divided, each into two or three or more leaflets, that they were naturally supposed to have a whorl instead of a pair of cotyledons, and therefore called polycotyledonous. (For an account of trees of this class see Coniferæ, Fir, and especially Pine.)

All coniferæ are woody plants, and nearly all are trees. Exogenous trees of the ordinary sort are distributed among the various natural orders, so that there are few which have not some arboreous representatives, the principal families containing herbs, shrubs, and trees. Some, however, contain herbs only; several (such as the walnut and oak families and the other amentaceous or catkin-bearing orders) are wholly arboreous, or at least woody. Even the families with peculiar port or mode of growth, such as the crassulaceous or house-leek family, with very fleshy herbage, rise to trees in some of their representatives of warm climates. All cactuses are woody as well as fleshy plants; several of them attain great length as climbers; many are erect and become arborescent; some

rise into huge fluted columns, either simple or branched, of several times the height of a man, and one, the *Cereus giganteus* of the Gila River, becomes a strange tree of fifty or sixty feet in altitude.

*Cycadeous trees*, represented by the *Cycas*, commonly but improperly known as sago-palm, are of a peculiar type, being exogenous in structure (though not forming regular annual layers), but with the port and mode of growth of palms—viz. of

*Endogenous Trees.*—Palm trees are the more common but not the exclusive representatives of this type of arboreous vegetation. They rise by a simple columnar trunk, not tapering as it ascends, terminated with a crown of large and long-stalked leaves, which are either pinnate or plume-like, as in date-palms, or palmate, as in palmetto. This simple and mainly cylindrical trunk comes from their whole vegetation being the development of a single terminal bud. Such axillary buds as they develop form the inflorescence, and therefore do not result in permanent branches. Nevertheless, a few palms branch habitually and normally after a certain age. The doum-palm of Upper Egypt and Nubia is the best-known example. In contrast with the wood of exogenous trees, that of palms, and of endogenous trees in general, has no concentric layers surrounding a central pith, and no proper bark. The wood is made up of separate bundles or threads of fibro-vascular material, longitudinally traversing and separately imbedded in the cellular and softer fundamental tissue which is represented in the exogenous stem by the central pith and the radiating medullary rays. When these wood-bundles can be traced, they are found to have their upper termination in leaf-stalks, their lower in the circumference or rind, in their course describing more or less of an arch or long curvature. The central portion of the trunk contains fewer of the woody bundles; toward the circumference they are more crowded. Consequently, the denser wood is at the circumference, the softer at the centre. The centre sometimes remains pithy, as it were, and sparsely traversed by threads of wood, but in many palm-stems nearly the whole becomes so closely packed with woody bundles as to form a very compact and hard wood. As the wood is thus more largely formed toward the circumference, and gradually fills up within, the name of *endogen* or of endogenous growth—*i. e.* "growth within"—is sufficiently appropriate, though the structure and growth are not so completely the counterpart of the exogenous as was supposed when these contrasted terms were introduced. Exogenous trunks increase indefinitely in diameter; endogenous trunks in general, and in particular those of palms, soon become incapable of further enlargement, except in height. They are accordingly cylindrical up to the crown of leaves. In place of a bark, distinct, separable, and of different layers, endogenous trunks are invested by an inseparable, more homogeneous, and permanent rind, which, along with the more solidified wood of the circumference, restricts and limits distention. Some endogenous trunks, however, notably those of dragon trees and yuccas (of the liliaceous family), continue distensible, and therefore continue to increase in diameter. They also branch when old, usually only after blossoming, which takes place from a terminal bud, thus arresting the vegetative growth, which is resumed from axillary buds. Such stems therefore fork at each flowering or other arrest of the terminal bud, and so in time form a branched head, in some respects imitating that of an ordinary exogenous tree.

*Fern trees*, or *tree-ferns*, mainly represent arboreal vegetation among *cryptogamous* plants in the present age, although in former periods other vascular cryptogams were largely arborescent. Tree-ferns are restricted to tropical regions of moist climate, or at least to those regions or habitats in which both winter and dryness are unknown. Their port is similar to that of palms, the structure of the wood peculiar, answering neither to the endogenous nor the exogenous type.

*Evergreen and deciduous trees* differ in that the latter cast off or lose all their leaves at the coming of a cold or of a dry season, while the former hold their old leaves alive, at least until after new ones are produced, some holding them for little over the year, many for two, three, or a considerable number of years. Deciduous trees are mainly if not wholly of the exogenous type.

*Trees as to climate* and distribution can hardly be here treated of, except to notice that arboreal growth, of any ordinary type, supposes and requires a considerable amount of moisture, and accordingly of rainfall, either through the year or through a growing season. An ordinary tree expands a large extent of evaporating surface, chiefly in its foliage. Leaves dry up and perish if not supplied with moisture to replace that which is evaporated or transpired. Therefore, not only are rainless districts treeless (except as water is supplied by irrigation), but regions of scanty and precarious summer rain are sparsely wooded or without forest, according to the amount of aridity or length of the dry season; or their arborescent vegetation meets the exigency and stress by some special adaptation. Broad-leaved evergreens abound where rains fall throughout the year, and especially where winter is unknown. Narrow-leaved or needle-leaved evergreen trees are chiefly in cooler or cold climates, well supplied with moisture through the year or through the season of activity. Trees with expanded foliage survive the rainless hot season of the drier tropical and subtropical regions only by dropping their leaves, upon which the stress first comes, and thereby reducing the evaporating surface to a minimum. Those which retain their foliage are such as have some peculiar provision—by fleshiness with thick epidermis in the case of succulent foliage, or by firm coriaceous texture superficially or throughout, to which, especially in Australia, is sometimes added a vertical instead of horizontal position of the leaves, which thus present their edges instead of one face to the high sun. This prevails among the Australian acacias and myrtaceous trees, which compose the larger part of the arboreal vegetation. In climates in which vegetable growth and action are arrested by winter, the trees are nearly all deciduous, except the coniferous evergreens, the leaves of which are peculiarly organized for resisting cold, and individually expose a small surface to the elements.

*Duration of Trees.*—An exogenous tree, renewing annually its twigs and foliage above, its growth of roots beneath, and zone of new wood and bark connecting the two, has no definite limits to its existence. Its actual duration depends upon external circumstances, and upon some inherent liabilities which may practically result in a certain average of life in any particular species, which, however, certain favored individuals may be expected to overpass. Increase of size, height, or spread of branches, and other inevitable consequences of age, however, bring increasing, and at length inevitable, disadvantages and liabilities, so that practically, although most trees, like most men, die an accidental death, the longest survivors may be said to die of old age in the sense in which the oldest of the human race do—that is, of the diseases or accidents which the younger generally resist or recover from, but to which the older succumb in consequence of the disadvantages of age. Various collections have been made of the data respecting the actual longevity of trees. (See De Candolle, *Physiologie végétale* (1832), and article on "Longevity of Trees" in *North American Review*, July, 1844, for a *résumé* up to those dates. See also our article Sequoia for a brief account of some of the largest, if not the oldest, of existing trees. To which it may be added that eucalyptus trees are now known in Australia which rival the California redwoods in girth and surpass them in height, but probably not in age, being very fast-growing trees. Indeed, it is probable from the known rates of growth that some of the largest bald cypresses (*Taxodium*) of the Southern Atlantic States, or at least those of Mexico, are older than any of the above, although of far less huge girth and of moderate height.) Suffice it to say, however, that exogenous trees are known, by the actual counting of their layers, throughout or in great part, to have attained the age of from 1200 to fully 2000 years; it is probable that some extant trees are considerably older. The tallest trees known rise little less than 500 feet (*Eucalyptus*, in Australia). The largest in girth are trees of *Eucalyptus*, up to 81 feet; giant redwoods in California, up to 91, and possibly 100 feet; baobab trees of Senegal, some of which have reached the latter circumference, but they are low trees of rapid growth even when old, and probably of no extreme age; and, finally, there is a Mexican *Taxodium* or bald cypress, a slow-growing tree, which measures 112 feet in circumference. If this does not consist of two or more original trunks which have grown into one—of which there are no external indications—it is probably the oldest existing tree known.

Endogenous trees like palms, which do not continue to increase in girth, are more strictly and inherently limited in their duration; perhaps they never live more than 200 or 300 years; and the same may be said of tree-ferns. When an endogenous trunk has a soft living rind, capable of unlimited expansion, and also produces branches, perhaps it may live as long as an exogenous tree. Dragon trees (*Dracæna*) are examples of this. The celebrated great dragon tree of Orotava, Teneriffe (now destroyed by a series of storms, but which when Humboldt visited it was in full vigor), was probably as old as any of the existing redwoods of California.

Asa Gray.

**Tree'-Ferns,** a name applied to large ferns having a tree-like form and size, with much the habit of the palms. Tree-ferns formed an important part of the vegetation of the coal-measures. At present they are mostly tropical or insular, but are abundant in Tasmania, New Zealand, and

parts of Australia and in the Himalayas. A few species yield a useful starchy pith resembling sago.

**Tree'-Frog,** or **Tree-Toad,** a term employed for those species of anurous amphibians (order Salientia) which are adapted for life among the trees, and which are therefor provided with terminally dilated toes. This character of dilation of the tips of the toes is of mere teleological significance, and is not co-ordinated with true morphological characteristics. By some authors, however, it has been regarded as of considerable systematic importance, and Dr. Günther especially combined all the anurous amphibians—*i. e.* "tree-frogs"—in a single series ("Opisthoglossa platydactyla"), contradistinguished from those opisthoglossate anurans which have pointed toes ("Opisthoglossa oxydactyla"). It has been since, however, amply demonstrated that the tree anurans do not form a natural group, but may to that extent be modified representatives of the most dissimilar families. Dr. Günther distributed the species among nine families, exclusively confined to forms with dilated toes. More recent authors have recombined them with the non-tree forms, and admitted the several generic types as natural allies of the oxydactylous ones. The tree-frogs and tree-toads are now mostly to be found in the families Hylidæ, Cystignathidæ, Engystomidæ, Dendrobatidæ, and Ranidæ. The North American species, however, all belong to the family HYLIDÆ (which see). THEODORE GILL.

**Tregelles'** (SAMUEL PRIDEAUX), LL.D., b. at Falmouth, England, Jan. 30, 1813, of Quaker parentage; educated at Falmouth Classical School; was for some years in the ironworks at Neath Abbey, Glamorganshire, 1828–34; was in 1835–36 a private tutor at Falmouth; shortly after devoted himself to the task of preparing a critical edition of the text of the New Testament from the most ancient MSS. and versions; studied the Oriental languages, and pursued that object through life; was associated with the small religious sect of the "Plymouth Brethren," though he never joined that organization; was an active philanthropist, a member of the company appointed by convocation for the revision of the Authorized Version of the Old Testament; visited the principal libraries of Europe for the purpose of collating MSS., and in his later years received a pension of £200 from the civil list. D. at Plymouth Apr. 24, 1875. He published—*Passages in the Book of Revelation connected with the Old Testament Scriptures* (1836), *The Englishman's Greek Concordance to the New Testament* (1839), *The Englishman's Hebrew and Chaldee Concordance to the Old Testament* (2 vols., 1843), *The Book of Revelation in Greek, edited from the Ancient Authorities, with a New English Version*, etc. (1844), *Hebrew Reading Lessons* (1845), *Heads of Hebrew Grammar* (1852), *Gesenius's Hebrew and Chaldee Lexicon* (1847), *The Prophetic Visions of the Book of Daniel* (1847; 5th ed. 1864), *The Book of Revelation translated from the Ancient Greek Text* (1848), *On the Original Language of St. Matthew's Gospel* (1850), *The Jansenists* (1851), *Historic Evidence of the Authorship and Transmission of the Books of the New Testament* (1852), *Account of the Printed Text of the Greek New Testament* (1854), *Codex Zacynthius, Greek Palimpsest Fragments of the Gospel of St. Luke obtained in the Island of Zante* (folio, 1861), *Canon Muratorianus, Earliest Catalogue of the Books of the New Testament* (1868), and *The Greek New Testament, edited from Ancient Authorities, with the Various Readings of all the Ancient Manuscripts, the Ancient Versions, and Earlier Ecclesiastical Writers, together with the Latin Version of Jerome from the Codex Amiatinus of the Sixth Century* (6 parts, 4to, 1857–72). He contributed to Dr. Smith's *Dictionary of the Bible;* rendered important aid to Dr. T. H. Horne in the revision of his *Introduction to the Critical Study and Knowledge of the Holy Scriptures* (10th ed., 4 vols., 1856), and was joint editor with Rev. J. Ayre of the final reissue of that work (13th ed., 4 vols., 1869).

**Tre'go,** county of W. Kansas, intersected by Saline and Smoky Hill rivers, and crossed by Kansas Pacific R. R.; surface rolling, soil fertile. P. 166.

**Tre'ia,** town of Italy, province of Macerata, on a hill between the Menocchia and the Potenza, exports a peculiar kind of lace. Treia is of very ancient origin, and many important antiquities have been found. P. 9286.

**Trematods** [from Gr. τρῆμα, a "hole"], an order of platyhelminths or low worms which are generally parasitic, internally or externally, on other animals. They are more or less depressed and not articulated, and the integuments are not covered with ciliæ in the adult state. They are provided with one or more suckers for adhesion to their enforced hosts. They have a forked alimentary canal, but there is no anus. The vascular system is undeveloped; there are two water-tubes, with a common excretory pore; a double ganglion is developed over the pharynx. They are mostly hermaphrodites, and there is no internal connection between the male and female organs, and consequently a union of two individuals is necessary for impregnation. (See Blumberg (1871) and Bütschli (1872).) The development is diversiform; the most noteworthy is that characteristic of certain species of Distomidæ. (See CERCARIA.) The species are quite numerous, and in some form or other are parasitic on many animals of widely-distinct classes. No less than five distinct developed species, besides four larval or doubtful forms, have been found from time to time in man alone. (See PARASITES.) The various forms have been classified by some of the best authorities (*e. g.* Van Beneden and Schmarda) in two suborders and a number of families. These are: (1) Digenea, or entoparasitic trematods, which develop numerous and small eggs and undergo a long developmental cycle, mostly passing through "alternate generations," including the families Monostomidæ and Distomidæ; and (2) Monogenea, or ectoparasitic trematods, which develop few and large eggs (with thick shells), and whose developmental course is comparatively simple, no "alternation of generations" being passed through, including the families Tristomidæ, Udonellidæ, Polystomidæ, Octocotylidæ, and Gyrodactylidæ. The representatives of these "monogenetic" families are parasitic on aquatic animals, such as fishes, crustaceans, mollusks, etc. Those which attach themselves to fishes are mostly to be found affixed to the gills. THEODORE GILL.

**Tre'mont,** tp., Solano co., Cal. P. 640.

**Tremont,** p.-v. and tp., Tazewell co., Ill. P. of v. 437; of tp. 1365.

**Tremont,** p.-v. and tp., Hancock co., Me. P. 1822.

**Tremont,** tp., Buchanan co., Mo. P. 1106.

**Tremont,** p.-v., White Plains tp., Westchester co., N. Y., on New York and Harlem R. R. P. 2025.

**Tremont,** p.-b. and tp., Schuylkill co., Pa., on a branch of Philadelphia and Reading R. R., 12 miles from Pottsville, contains 6 churches, 1 bank, 1 newspaper, ironworks, schools, waterworks, and 7 hotels. P. of b. 1709; of tp. 754. CHAS. M. WOLFF, ED. "TREMONT NEWS."

**Trempealeau',** county of W. Wisconsin, bounded S. W. by Mississippi River, and drained by Trempealeau, Black, and Buffalo rivers; surface level, soil productive. Horses, cattle, and sheep are numerous. Staples, wheat, oats, Indian corn, wool, hay, and butter. Cap. Galesville. Area, 684 sq. m. P. 14,992.

**Trempealeau,** p.-v. and tp., Trempealeau co., Wis., on Trempealeau and Prescott R. R., 12 miles S. of Winona (Minn.), has 4 churches, a fine school, 1 newspaper, a wagon manufactory, 1 planing-mill, and 2 hotels. P. 2086. CHARLES A. LEITH, ED. "REPUBLICAN."

**Trench** (RICHARD CHENEVIX), D. D., b. at Dublin, Ireland, Sept. 9, 1807; graduated at Trinity College, Cambridge, 1829; spent some years in travel; took orders in the Church of England 1833; was curate at Hadleigh, Suffolk, 1833–35, incumbent of Curdridge 1835–40, curate to Archdeacon Wilberforce at Alverstoke 1840–44, rector of Itchenstoke 1844–45; was appointed examining chaplain to the bishop of Oxford (Dr. Wilberforce) 1845; was Hulsean lecturer 1845–46, and select preacher at Cambridge 1843 and 1856; professor of theology at King's College, London, 1846–58; dean of Westminster 1856–63, and was ordained archbishop of Dublin, as successor to Dr. Whately, Jan. 1, 1864. Author of poems, *The Story of Justin Martyr* (1835), *Sabbation, Honor Neale* (1838), *Poems from Eastern Sources* (1842), *Genoveva* (1842), *Elegiac Poems* (1846), *Alma* (1854), of *Notes on the Parables of our Lord* (1841), *Notes on the Miracles of Our Lord* (1846), *Exposition of the Sermon on the Mount, from St. Augustine* (1844), 2 vols. of Hulsean lectures, *The Fitness of Holy Scripture for unfolding the Spiritual Life of Men* (1845), *Christ the Desire of all Nations, The Star of the Wise Men* (1850), *On the Study of Words* (1851; 15th ed. 1874), *On the Lessons in Proverbs* (1853), *Synonymes of the New Testament* (1854; 2d series 1863; 8th ed., recast, 1 vol., 1876), *English, Past and Present* (1855), *Calderon, his Life and Genius* (New York, 1856), *Some Deficiencies in our English Dictionaries* (1857), *The Authorized Version of the New Testament, in Connection with some Recent Proposals for its Revision* (1858), *Select Glossary of English Words used formerly in Senses different from their Present* (1859), *Commentary on the Epistles to the Seven Churches in Asia* (1861), *Studies on the Gospels* (1867), a volume of lectures *On Plutarch* (1874), 3 vols. of *Sermons preached before the University of Cambridge* (1843, 1856, and 1863), *Sermons preached in Westminster Abbey* (1860), *Sermons preached in Ireland* (1873), several single sermons, lectures, and charges to the clergy of Dublin; edited *Sacred Poems for Mourners* (1846), *Sacred Latin Poetry, chiefly Lyrical* (1849), *A Household Book*

*of Poetry, selected and arranged, with Notes* (London and New York, 1868), and the *Remains of the Late Mrs. Richard Trench* (1862), his mother. A volume of selections from his poems was edited by Rev. Dr. J. A. Spencer (New York, 1856), and another volume of his *Poems, collected and arranged anew*, was issued, probably by himself, in 1865.

**Trench'ard** (Stephen D.), U. S. N., b. July 10, 1818, in New York; entered the navy as a midshipman Oct. 23, 1834; became lieutenant in 1847, commander in 1862, captain in 1866, commodore in 1871, rear-admiral in 1875; commanded the Rhode Island in both the Fort Fisher fights, and recommended for promotion by Rear-Admiral Porter.

Foxhall A. Parker.

**Trenck, von der** (Franz), Baron, b. at Reggio, Calabria, Jan. 1, 1711, descending from a family settled in East Prussia; received a military education, and served first in the Austrian, then in the Russian army, but was both times cashiered, imprisoned, and even condemned to death for his brutal excesses; lived subsequently for some time in retirement on his estates in Slavonia, and was commissioned by Maria Theresa, on the outbreak of the Austrian war of succession, to form, at his own expense, a corps which he called the "Pandours," and at the head of which he fought in the van of the Austrian army. By his audacity and atrocity he achieved an almost European fame. His method of carrying on war was that of the fifteenth and sixteenth centuries; talents and characters like his were very common in those days. But in the eighteenth century such a phenomenon of course made a great sensation. He was suspected, however, of tampering with the Prussians, placed before a court-martial, and put in prison, where he poisoned himself Oct. 14, 1749. His *Autobiography* was at one time very much read.—His cousin, Friedrich von der Trenck, b. at Königsberg Feb. 16, 1726, was a character exactly of the same stamp, but was stopped in his course almost before entering the arena. Having distinguished himself highly in 1744, and gained the favor of Frederick II., he was suddenly imprisoned in 1745 for tampering with the Austrians, escaped, visited Moscow and Vienna, was caught in 1754 by the Prussians, and kept in a dungeon to 1763; wandered through Europe; received back his confiscated estates in 1786, and was guillotined at Paris July 25, 1794, as a Prussian spy. He too has written an *Autobiography*, as full of empty boast and threadbare lies as that of his cousin. Both were disinterred by Carlyle, and form an amusing diversion in his *History of Frederick the Great*.

**Tren'delenburg** (Friedrich Adolf), b. in Entin, principality of Lubeck, Nov. 30, 1802; educated at the gymnasium in his native town and at the universities of Kiel, Leipsic, and Berlin; was appointed in 1833 a professor *extraordinarius* of philosophy at the University of Berlin; was promoted to a full (or "ordinary") professorship in the same university in 1837, and retained this position until his death, Jan. 24, 1872. In 1846 he was elected a regular member of the Berlin Academy, and from the following year until his death he was secretary of the section for the history of philosophy. During nearly the whole of his life as professor at Berlin, Trendelenburg was a member of the governmental commission for the examination of candidates for positions as teachers in the public schools of Prussia. In this position he wielded a great and salutary influence. From 1849 to 1851, Trendelenburg was a member of the popular house of the Prussian Diet, where he sided with the moderate or patriotic party. As a university professor, Trendelenburg lectured to large classes on psychology, logic, the history of philosophy, ethics, the philosophy of law, and the theory of teaching. He was particularly eminent for his wide knowledge and understanding of the history of philosophy, and also as a philosophical critic. His own system was in a measure eclectic in its basis. The superstructure was more his own independent work.

Trendelenburg's contributions to the history of philosophy are contained chiefly in his *Historische Beiträge zur Philosophie* (3 vols.) and his *Kleine Schriften* (2 vols.). Especially noteworthy among these are his *History of the Doctrine of Categories* (vol. i. of the first-named work) and his monographs on various phases of the doctrines of Spinoza and Leibnitz, on ancient and modern ethics, and on Kant's theory of space and time. His criticism of Kant involved him in a celebrated and somewhat bitter controversy with Kuno Fischer (author of a much-read *History of Modern Philosophy*) on the true interpretation of Kant. In addresses before the Academy, Trendelenburg also made valuable contributions to Prussian history. As a critic, Trendelenburg won great celebrity by his assault upon Hegel, to some of whose lectures he had, as a student, listened. By it he was mainly influential in largely breaking the hold of Hegel's system upon the mass of thinking minds in Germany. His criticism is directed against the famous "Dialectical Method" (*Logische Untersuchungen*, vol. i. ch. iii.). Trendelenburg objects to the beginning with pure thought, on the ground that pure thought, as understood by Hegel, being utterly devoid of content, contains nothing which can impel to further development. He complains further, that the dialectical development, which claims to advance "in the element of pure thought" (*i. e.* non-empirically, or without reference to sensible experience), is in reality not effected without the surreptitious introduction of the experimental idea of motion, which contains in itself, by implication, the whole realm of sensible experience. Other criticisms are directed against the Hegelian application of the principles of identity and contradiction, and especially against the theorem of the identity of contradictories; and various sins against logic, in detail, are charged and pointed out.

The foundation of Trendelenburg's doctrine is essentially Platonic and Aristotelian. The principle for a philosophical deduction and explanation of the sensible universe is found in the Aristotelian conception (*Anschauung*) of motion. From an analysis of this idea are derived the categories which dominate our notions of concrete things (Quantity, Quality, Efficient Cause, etc.). But the principle of motion is treated as subject to a higher one, the (Aristotelian) principle of design, or the (Platonic) Idea, regarded as the finis and the end of motion. In other words, the teleological view is introduced, and is developed with constant reference to the sphere of empirical fact as illustrating and confirming it. The categories of the inferior realm of motion are not supervened, but taken up into the service of the higher realm of purpose or mind. Mechanical causation is the servant, and not the enemy, of teleology. Trendelenburg terms his philosophy the "organic view" of the world; and according to it each lower stage in existence is the basis of the higher stages, and necessarily involved in the higher. The highest stage experimentally known to man is the ethical, or the complete development of man in his totality, where the Idea (the idea of man, his supreme end, the aim of his organic development) is intellectually apprehended and is fully realized by man's own action. The soul is the self-realizing idea of man. God is the unconditioned, not directly demonstrable, but implied, with logical necessity, in the whole fabric of the universe and of human thought.

Trendelenburg's principal works, in addition to those above mentioned, are—*Platonis de Ideis et Numeris Doctrina ex Aristotele illustrata* (1826), *Elementa Logices Aristot.* (6th ed. 1868), *Erläuterungen zu den Elementen der aristotelischen Logik* (2d ed. 1861), *Naturrecht auf dem Grunde der Ethik* (2d ed. 1868). (See also *Journal of Speculative Philosophy*, St. Louis, No. 20, 1871; Nos. 21, 22, 24, 1872.) On the life and philosophy of Trendelenburg see H. Bonitz, *Zur Erinnerung an F. A. Trendelenburg* (Berlin, 1872); Ernst Bratuschek, *Adolf Trendelenburg* (Berlin, 1873); Karl von Prantl, *Gedächtnissrede auf F. A. T.* (Munich, 1873); article on Trendelenburg in the *New Englander* (New Haven, Apr., 1874).

George S. Morris.

**Trent** [Ger. *Trient*], town of Austria, in the southern part of Tyrol, on the Adige, is beautifully situated and well built, surrounded with walls and traversed by canals. Its cathedral, built of white marble in 1212, is a magnificent edifice; the palace in which the famous council held its sittings and several other buildings are also remarkable. It manufactures leather, glass, sugar, tobacco, bells, cards, and silks, and carries on an important transit-trade between Italy and Germany. P. 17,073.

**Trent,** tp., Lenoir co., N. C. P. 761.

**Trent,** river of England, rises in Staffordshire at an elevation of about 600 feet above the level of the sea, flows in a south-eastern direction, and forms the Humber after joining the Ouse. Its entire length is 170 miles, and it is navigable for about two-thirds of its course.

**Trent,** a river which rises in Rice Lake, Northumberland co., Ontario, but is the outlet of a large system of northern lakes and rivers, partly navigable. The Trent itself affords good water-power, and large quantities of lumber are floated upon it. It is 100 miles long, and discharges its waters into the Bay of Quinté at Trenton.

**Trent, Council of** (*Concilium Tridentinum*), the most important synod in the history of the Roman Catholic Church. It produced its highest standards of faith and morals, and fixed its doctrinal character in opposition to Protestantism. It was called forth by the Reformation of the sixteenth century, and demanded by both parties in the contest, but was again and again postponed by the policy of the papal court. Finally, it was convened as an exclusively Roman council by order of Pope Paul III. in the Austrian

city of Trent (*Tridentum*), in the Italian part of Tyrol (at that time a free city of the empire under a prince-bishop), on Dec. 13, 1545, and lasted, with several interruptions, till Dec. 4, 1563. In Mar., 1547, it was transferred to Bologna from fear of the plague, but the emperor Charles V. refused to acknowledge it, and hence it was indefinitely prorogued Sept. 17, 1549. It was reopened at Trent May 1, 1551, by Pope Julius III., but France protested against the continuation and withdrew her bishops. The sudden victory of Elector Maurice of Saxony over the emperor, and his march into Tyrol, scared the assembled Fathers away from Trent Apr. 28, 1552. Pius IV. recalled it for the last time Jan. 18, 1562, when it continued to its final adjournment in Dec. 4, 1563. It closed with "Anathema to all heretics, anathema, anathema."

The decrees and canons of the council were confirmed by a bull of Pope Pius IV. Jan. 26, 1564. This bull enjoins strict obedience upon all Catholics, and forbids, under pain of excommunication, all unauthorized interpretation, reserving this to the pope alone, and threatening the disobedient with "the indignation of Almighty God and of his blessed apostles, Peter and Paul." The number of attending members in the three periods varied considerably; it increased toward the close, but never reached the number of the first œcumenical council at Nicæa (which had 318 members) nor of the last of the Vatican (which numbered 764). The decrees were signed by 255 members, including 4 papal legates, 2 cardinals, 3 patriarchs, 25 archbishops, 168 bishops, two-thirds of them being Italians. Lists of the signers are added to the best editions of the Decrees.

The object of the council was two-fold: (1) To condemn the principles and doctrines of Protestantism, and to define the doctrines of the Roman Catholic Church on all the disputed points. It is true the emperor intended it to be a strictly general or truly œcumenical council, at which the Protestants should have a fair hearing. Melanchthon and Brentius, with some other German Lutherans, actually started in 1552 on a journey to Trent, but they were refused a deliberative voice, and their mission was an entire failure. (2) To effect a reformation of discipline, which was admitted by all honest and earnest Catholics to have fallen into such deplorable decay as to explain, if not to justify, the Reformation. Twenty-five public sessions were held, but about half of them were spent in solemn formalities. The chief work was done in committees or congregations. The entire management was in the hands of the papal delegates. The court of Rome, by diplomacy and intrigue, outwitted all the liberal elements. The council abolished some crying abuses, and introduced or recommended disciplinary reforms as regards the sale of indulgences, the morals of convents, the education of the clergy. In this respect the Reformation produced a salutary effect upon the Roman Church itself, as is admitted by the best historians of that Church. But in regard to the department of doctrine, although liberal evangelical sentiments were uttered by some of the ablest members in favor of the supreme authority of the Scriptures and justification by faith, no concession whatever was made to Protestantism.

The doctrinal decisions of the council are divided into *Decrees* (*decreta*), which contain the positive statement of the Roman dogmas, and into short *Canons* (*canones*), which condemn the dissenting Protestant views with the concluding "*anathema sit.*" They are stated with great clearness, precision, and wisdom. The decree on justification betrays special ability and theological circumspection. The Protestant doctrines, however, are almost always exhibited in an exaggerated form and almost caricatured, or they are mixed up with real heresies which Protestants condemn as emphatically as the Church of Rome.

The following is a list in chronological order of the articles of faith which were settled by the council in favor of the views held ever since by the Roman Catholic Church:

Session III. (Feb. 4, 1546). Decree on the symbol of faith (the Niceno-Constantinopolitan Creed as a basis of the following decrees).

Session IV. (Apr. 8, 1546). Decree on the Scriptures (including the Apocrypha) and church tradition, which are declared to be the joint rules of faith. The Latin Vulgate is put on a par with the original text.

Session V. (June 17, 1546). On original sin.

Session VI. (Jan. 13, 1547). On (progressive) justification by faith and good works, in opposition to justification by faith alone.

Session VII. (Mar. 3, 1547). On the seven sacraments in general, and some canons on baptism and confirmation.

Session XIII. (Oct. 11, 1551). On the sacrament of the Eucharist.

Session XIV. (Nov. 25, 1551). On the sacraments of penance and extreme unction.

Session XXI. (July 16, 1562). On communion under both kinds, and the withdrawal of the cup from the laity.

Session XXII. (Sept. 17, 1562). Doctrine of the sacrifice of the mass.

Session XXIII. (July 15, 1563). On the sacrament of ordination.

Session XXIV. (Nov. 11, 1563). Sacrament of matrimony.

Session XXV. (Dec. 3 and 4, 1563). Decrees approving the scholastic doctrines of purgatory, the invocation, veneration, and the relics of saints and sacred images; also on the selection of food, fasts, festive days, and providing for an index of prohibited books, catechisms, breviary, and missal, to be issued under the direction of the pope.

The council was acknowledged in Italy, Portugal, Spain, France, the Low Countries, Poland, and the Roman Catholic portion of the German Empire, but mostly with a reservation of the royal prerogatives. In France it was never published in form, and was only recognized in its doctrinal part. No attempt was made to introduce it into England. Pius IV. sent the decrees to Mary Queen of Scots, with a letter, dated June 13, 1564, requesting her to publish them in Scotland, but she dared not do it in the face of John Knox and the Reformation.

The *Canons* and *Decrees* of the council were first published by Paul Manutius (Rome, 1564), and often since in different languages. Best Latin ed. by Le Plat (1779) and by Schulte and Richter (Lips., 1853); best English ed. by Rev. J. Waterworth (with a history of the council, London, 1848).

The original acts and debates of the council, as prepared by its general secretary, Bishop Angelo Massarelli, in 6 large folio vols., are deposited in the Vatican Library, and remained there unpublished for more than 300 years until they were brought to light at last, though only in part, by Augustin Theiner (priest of the Oratory, d. 1874) in *Acta genuina SS. Œcum. Concilii Tridentini nunc primum integre edita* (Lips., 1874, 2 vols.). Most of the official documents and private reports, however, which bear upon the council, were made known in the sixteenth century and since. The most complete collection of them is that of Le Plat (*Monum. ad Histor. Conc. Trident.*, Lovan., 1781–87, in 7 vols.). New materials have been brought to light by Mendham (1834 and 1846) from the manuscript history of Cardinal Paleotto, and quite recently by Sickel (*Actenstücke aus österreichischen Archiven*, Wien, 1872), and by Dr. Döllinger (*Ungedruckte Berichte und Tagebücher zur Geschichte des Conc. von Trient*, Nördlingen, 1876, 2 parts).

The history of the council was written chiefly by two able and learned Catholics of very different spirit—the liberal, almost semi-Protestant monk Fra Paolo Sarpi, of Venice (*Istoria del Concilio Tridentino*, first, Lond., 1619, and repeatedly since in Italian, Latin, French, and German; best ed., with notes, by Courayer, Amst., 1751, 3 vols.); and in the interest of the papacy by Cardinal Sforza Pallavicini, who had access to all the archives of Rome (*Istoria del Concilio di Trento*, Rome, 1656–57, 2 vols. fol., and other eds. original and translated). Both accounts must be compared to get a full view. Professor (now Bishop) Hefele intended at first to carry his valuable *History of the Councils* (*Conciliengeschichte*) down to the Council of Trent, but gave it up at last for reasons assigned in his preface to vol. vii. part ii. (1874), and stopped with the councils of Bâle and Florence. Among Protestant historians of the Council of Trent we mention Salig (1741–45, 3 vols.), Danz (1846), Buckley (Lond., 1852), and Bungener (Paris, 1854; Eng. trans., New York, 1855). On the Tridentine standards see the author's *History of the Creeds of Christendom* (1876), vol. i. pp. 90 *seq.*

PHILIP SCHAFF.

**Trente-et-Un.** See ROUGE ET NOIR.

**Tren'ton,** port of entry of Hastings and Northumberland cos., Ont., Canada, on the Bay of Quinté, on both sides of the river Trent, and on Grand Trunk Railway, 101 miles E. of Toronto. Immense quantities of timber are rafted down the river and shipped at this place, which has large manufactures and a weekly newspaper. P. 1796.

**Trenton,** p.-v., cap. of Dade co., Ga., on Alabama and Chattanooga R. R. P. 223.

**Trenton,** p.-v., Clinton co., Ill., on Ohio and Missouri R. R., has a weekly newspaper. P. 948.

**Trenton,** v., Blackford co., Ind. P. 80.

**Trenton,** p.-v. and tp., Henry co., Ia. P. 1435.

**Trenton,** p.-v., Todd co., Ky., on Evansville Henderson and Nashville R. R., has a private bank. P. 221.

**Trenton,** p.-v., Ouachita parish, La. P. 429.

**Trenton,** tp., Hancock co., Me. P. 678.

**Trenton,** p.-v., Wayne co., Mich., on Detroit River and on Lake Shore and Michigan Southern R. R.

**Trenton,** p.-v. and tp., cap. of Grundy co., Mo., on Chicago Rock Island and Pacific R. R. and on Grand River,

has a public-school building, 2 banks, 1 woollen factory, 3 flouring and 2 saw mills, 2 newspapers, 6 hotels, marble-works, and railroad repair and machine shops. P. of v. 920; of tp. 2934. W. B. ROGERS, ED. "REPUBLICAN."

**Trenton,** city, cap. of Mercer co. and of the State of New Jersey, is at the head of tide-water and steamboat navigation on Delaware River, and is intersected by Delaware and Raritan Canal, one of the most important water-thoroughfares in the country, connecting by continuous inland navigation the cities of New York and Philadelphia, and the latter city with Baltimore. There are two lines of large propellers from Trenton, which transport merchandise and manufactured products to these points. Trenton is also situated on Pennsylvania R. R., is the southern terminus of Belvidere Delaware R. R., and is the centre of an extensive system of local State railroads, which converge here by connection with the above-named roads. It will also have connection by a spur with Delaware and Bound Brook road, the new through railroad between New York and Philadelphia. There is a regular line of steamboats to Philadelphia on the Delaware. Trenton is 27 miles from Philadelphia and 56 from New York. It is connected with Pennsylvania by two fine bridges over the Delaware. The city is mainly built on high ground, and is dry and healthy. Its streets are wide and well shaded, and have a grade which promptly carries off surface drainage to running watercourses. Several picturesque elevations in the suburbs, including a fine eminence along the river, are occupied by handsome mansions surrounded by beautifully laid out grounds. Trenton has 29 churches—8 Methodist Episcopal (2 colored), 6 Presbyterian, 3 Baptist, 3 Episcopal, 3 Catholic, 2 Quaker, 2 Lutheran, 1 Second Adventist, and 1 Jewish synagogue. It has 1 State and 2 national banks, 2 savings banks, a public library (in addition to the State library in the capitol); an opera-house with a seating capacity of 1600 and costing $110,000; several public halls; a street railway connecting the dépôt with the principal parts of the city; the oldest and one of the best-equipped volunteer fire departments in the country; a system of public graded schools, with a high-school and several private schools; 4 daily and 5 weekly newspapers, and several benevolent, educational, and charitable institutions, and hospitals, etc., connected with religious organizations. The public buildings in Trenton comprise the




State House, Trenton, N. J.

State capitol, a fine structure beautifully located on an elevation overlooking the Delaware, and surrounded with spacious, well-laid-out, and finely-shaded grounds; the State normal and model schools; the Soldiers' Children's Home; the State prison; the State lunatic asylum; the State reform school for girls; and a large U. S. post-office and court-house, now in process of construction by the Federal government. The principal source of the growth and prosperity of Trenton is its manufactures. It is the seat of the most extensive crockery manufacture in the country, more of this ware being made here than in all the rest of North America. There are also—the extensive rolling-mill of the New Jersey Steel and Iron Co., employing 600 hands and with a capital of $1,000,000; the Trenton Iron Co.; a wire-mill; the American Saw Co.; the Phœnix ironworks; the National ironworks; vise and tool works; and anvil and railroad-joint works, chain-factories, and several other ironworks of lesser magnitude. The capital invested in these is about $4,000,000, and the annual products about $6,000,000. They employ 2000 men, and disburse $1,000,000 a year in wages. There are also 3 large woollen mills, fire-brick and terra-cotta works, rubber-works, zincworks, locomotive and ordnance works (not now in operation), and a multitude of manufactories of different articles and of varied magnitude. There is a large coal dépôt here on the canal, from which hundreds of thousands of tons of coal are annually shipped by large schooners to Boston and other Eastern ports. There is a water-power = 1000 horse-power from the Delaware, and a bill has just passed the legislature allowing the city to appropriate all the water of that river (amounting on an average to 10,000 horse-power) for manufacturing purposes. P. 22,874. On the night of Dec. 25, 1776, Washington, with about 2400 men, crossed the Delaware above Trenton, which city he surprised and captured, together with the garrison of about 1300 Hessians, with their arms and 6 field-pieces. The enemy being in superior force in the vicinity, Washington recrossed the Delaware on the 26th. A few days later, however, he returned to New Jersey and took possession of Trenton, where he concentrated his forces, and whence he moved to Princeton early in Jan., 1777. WILLIAM CLOKE, ED. "STATE GAZETTE."

**Trenton,** p.-v. and tp., Oneida co., N. Y., on Utica and Black River R. R. P. of v. 294; of tp. 3156.

**Trenton,** p.-v. and tp., cap. of Jones co., N. C. P. 814.

**Trenton,** p.-v., Butler co., O., on Cincinnati Hamilton and Dayton R. R. P. 340.

**Trenton,** tp., Delaware co., O. P. 907.

**Trenton,** p.-v., Tuscarawas co., O. P. 292.

**Trenton,** p.-v., cap. of Gibson co., Tenn., on Mobile and Ohio R. R., 59 miles S. of Columbus, Ky., has 6 churches (2 colored), 2 high schools, 1 colored school, several private bankers, 1 newspaper, 2 large flouring-mills, 2 hotels, 2 carriage and 2 wagon factories, Masonic, Odd Fellows, and Temperance lodges, and 1 furniture manufactory. P. 1909.

HOLBROOK & WELLS, EDS. "NEWS-GAZETTE."

**Trenton,** tp., Dodge co., Wis. P. 1735.

**Trenton,** p.-v. and tp., Pierce co., Wis. P. 304.

**Trenton,** tp., Washington co., Wis. P. 2035.

**Trenton Falls,** a waterfall of West Canada Creek in the township of Trenton, Oneida co., N. Y. The falls are a favorite place of summer resort, chiefly on account of the remarkable wildness of the surrounding scenery. The stream flows through a ravine or chasm in the Trenton limestone

from 70 to 200 feet deep, and the water descends 312 feet in 2 miles by half a dozen cataracts and cascades. The first fall, lowest down the stream, is 33 feet in perpendicular height. Above this is Sherman's Fall, 35 feet high. Next comes the High Fall, of 109 feet in perpendicular descent. Farther up is the Mill-dam Fall, 14 feet in height. The chasm is a scene of wild and varied beauty. P. 128.

**Trenton Falls,** p.-v., Trenton tp., Oneida co., N. Y., on Utica and Black River R. R. P. 128.

**Trepan** and **Trepanning.** See TREPHINING.

**Trepassey,** port of entry of Newfoundland, 81 miles by road S. W. of St. John's, has a fine harbor and successful agricultural and grazing interests. P. 514.

**Trephine.** See TREPHINING.

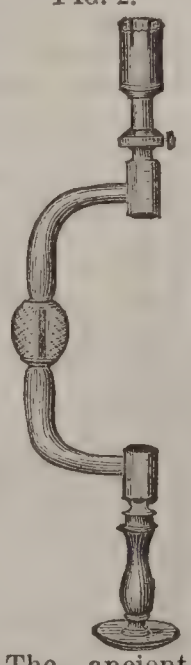
**Trephin'ing** [Gr. *τρυπᾶν*, to "bore"], or **Trepanning,** the surgical procedure of removing a "button of bone," or circular section of bone, by means of the circular instrument known as the trepan and trephine. The cutting part consists of a circular saw-toothed edge, different sizes having diameters of half an inch to an inch, the older instruments having a vertical body and smooth sides, the more modern having a slightly conical body and burred, cutting sides. The old instrument, the "trepan," was worked by a "wimble" or curved auger-handle; the modern, the "trephine," has a short handle with crossbar like a gimlet, and is worked by one hand. A "centre-pin" is provided, which acts as a pivot upon which the sawing edge can revolve: this pin is to be raised after the saw has entered the bone. The trephine is used chiefly upon the skull, although sometimes employed in other parts to evacuate pus in bony cavities, as of the face, the ends and shafts of long bones. Trephining the skull was heroically and recklessly practised by the ancients, and especially by empirics, for every fancied brain disease; often at several points, and many times upon the same person. Modern surgery limits it to cases of fracture of the skull, where bone is depressed, and to the evacuation of pus which has formed within the cranium, either the result of injuries and disease of the skull or of acute cerebral abscess. The trephine by its conical shape and rough sides is protected from cutting the brain. So soon as the "inner tablet" of the skull is cut through, the button of bone is pried out or removed by forceps, and the edges of the circular opening are cleared of all spiculæ of bone. The depressed bone is then "elevated" by means of a lever, or the abscess is incised, care being taken never to cut into the great venous sinuses. Trephining is more often performed for the relief of cerebral abscess than formerly, since modern diagnosis of the site of brain lesions is more definite. But for the relief of depressed bone in fractures of the skull it is less often resorted to. Hey's saw obviates the necessity of trephining in many cases. By it the points and angles of bone may be removed, and a point of entrance for the lever or "elevator" secured, without the loss of sound bone, which the trephine involved. Hey's saw consists of a small handle armed at its end with a double-edged saw, one edge curved, the other straight.

FIG. 1.



The Trephine.

FIG. 2.



The ancient Trephine.

FIG. 3.



Hey's Saw.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Trep'tow,** town of Prussia, province of Pomerania, on the Repa, has valuable fisheries and trade. P. 6494.

**Tres'cot** (WILLIAM HENRY), b. at Charleston, S. C., in 1822; was secretary of legation in England 1852–53, and under-secretary of state of the U. S. 1857–60. Author of *The Diplomacy of the Revolution, an Historical Study* (1852), *An American View of the Eastern Question* (1854), *The Diplomatic History of the Administrations of Washington and Adams* (1857), and other works.

**Tres'cott,** tp., Washington co., Me. Pop. 603.

**Tres Pala'cios,** tp., Matagorda co., Tex. P. 226.

**Tres'pass** [O. Fr. *trespasser*], in law, is a species of tort, consisting in an unlawful act done to the person or property of another by means of direct violence, actual or constructive. The essential feature of this delict in legal contemplation is the direct violence, which may be actual, as in the case of an assault and battery, or constructive, as in the case of an unauthorized entry upon the land of another, and doing thereby mere nominal damage. This notion was expressed in the common-law pleading by the necessary allegation that the act was committed *vi et armis*, "with force and arms." The amount of force used, the intent, and the extent of the injury done are immaterial elements in constituting the tort, and only affect the damages recovered. Trespasses are separated into three classes—to person, to personal property, and to real property. The principal trespasses to the person are assault, battery, false arrest, false imprisonment. Trespass to personal property may consist either in forcible direct injury to the chattel, or in taking and carrying it away from the custody of its owner. Trespass to real property is an unlawful entry upon the land of another—in the old legal language, "the breaking and entering another's close." The damages may be aggravated by wrongful acts done on the land, but such acts do not form the gist of this species of the tort. The commission of a legal act in an illegal manner may be a trespass, as the abuse or wrongful execution of process by an officer, and the like. It is a general doctrine of the law that if one commences to do a legal act in a proper manner, and then in its further prosecution is guilty of wrongs which amount to a trespass, he thereby becomes a trespasser from the beginning (*ab initio*). The remedy in all cases of this tort is the recovery of compensatory damages by the injured party; and if the wrong was wilful, malicious, and without excusing circumstances, exemplary or punitive damages may be added by the jury. The term "trespass" is also the name of the common-law form of action which must be used to recover damages from the wrongdoer when the delict complained of is a trespass. J. N. POMEROY.

**Trevel'yan** (Sir CHARLES EDWARD), BART., K. C. B., b. in England in 1807; educated at the Charter-house and at Haileybury College, on leaving which he entered the civil service of the East India Company; employed under Lord William Bentinck and Lord Auckland in important posts; made to the vice-regal government at Calcutta elaborate reports on various subjects, one of which led to the abolition of some oppressive imposts; secured the aid of the government to the promotion of European literature and science among the natives of India; in 1840 assistant secretary to the treasury; knighted in 1848 for services in connection with the Irish famine; instrumental in the revision of the civil establishment and in throwing open the civil service to competition; appointed governor of Madras Jan., 1859, but recalled May, 1860, in consequence of having protested against the new taxes proposed by the government; received, along with his recall, the thanks of the government for his services in promoting the queen's policy of conciliation of the princes and people of India; finance minister in India 1862–65; made reforms in the system of accounts, and co-operated in the immense extension given at that time to public works; devoted himself on his return to the question of army purchase, which system he had long opposed; created a baronet 1874, and has taken a leading part in several important charities. He married, in 1834, Miss Hannah More Macaulay, sister of the historian. Author of *Education of the People of Ireland* (1838), *The Irish Crisis* (1848), *The Purchase System in the British Army* (2d ed. 1867), *The British Army in 1868* (1869), and other works.

**Trevelyan** (GEORGE OTTO), son of Sir Charles Edward, b. at Rothley Temple, Leicestershire, England; educated at Harrow School and at Trinity College, Cambridge; entered the East Indian Civil service by competitive examination, in which he took a distinguished rank; returned from India, and was elected to Parliament from Tynemouth as a liberal 1865; became civil lord of the admiralty under Mr. Gladstone's second administration Dec., 1868; resigned office July, 1870, being opposed to the government education bill, and was, like his father, a prominent advocate of army reform, especially the abolition of the purchase of commissions. Author of *Letters of a Competition Wallah* (1864), *Cawnpore* (1865), *The Ladies in Parliament* (1869), and *The Life of Lord Macaulay* (2 vols., 1876).

**Treves** [Ger. *Trier*], town of Rhenish Prussia, on the right bank of the Moselle, beautifully situated among the vineclad hills of that river. It is the most ancient city of Germany (a fabulous Latin inscription on the wall of the *Rothen Haus* says it was built *before Rome*). The emperor Augustus established here a Roman colony under the name of *Augusta Trevirorum*. In later days it was the residence of the emperors Constantius, Constantine, Julian, Valentinian, Gratian, and Theodorus, and if not—as Ravenna was a little time afterward—the head of the Western world, at least the head of all the lands beyond the Alps. Almost annihilated during the subsequent barbarian invasions, it arose under the archbishops of Treves to nearly its earlier splendor. It is now a decayed town, but one of high antiquarian interest from its numerous Roman remains. P. 21,000. J. G. BARNARD.

**Trevi'glio,** town of Italy, province of Bergamo, about 3 miles from the left bank of the Adda and about 20 miles E. of Milan. Our knowledge of Treviglio does not ascend beyond the Lombard rule, and though it became subsequently a place of no small importance and the theatre of bitter mediæval warfare, yet its fortifications are now in ruins, and it is of no interest except as a flourishing agricultural, industrial, and commercial town. It is a great centre of the silk-trade. P. 11,883.

**Trevilian's Dépôt,** p.-v., Louisa co., Va., on Chesapeake and Ohio R. R.

**Trevira'nus** (Gottfried Reinhold), b. at Bremen Feb. 4, 1776; studied medicine at the University of Göttingen, and became in 1797 professor of mathematics at the lyceum of his native city, where he d. Feb. 16, 1837. He wrote *Physiologische Fragmente* (2 vols., 1797–99), *Biologie oder Philosophie der lebenden Natur* (6 vols., 1802–22), *Erscheinungen und Gesetze der organischen Lebens* (2 vols., 1831–32).—His brother, Ludolf Christian Treviranus, b. at Bremen Sept. 10, 1779, was appointed professor of medicine at the lyceum of Bremen in 1807, and in 1812 professor of botany and director of the botanical garden in Breslau, afterward in Bonn, where he d. May 6, 1864. He wrote *Vom inwendigen Bau der Gewächse* (1806), *Physiologie der Gewächse* (2 vols., 1835–39), and, in connection with his brother, *Vermischte Schriften anatomischen und physiologischen Inhalts* (4 vols., 1816–21).

**Trevi'so** [anc. *Tarvisium* or *Taurisium*], town of Italy, province of the same name, in lat. 45° 39′ N., lon. 12° 15′ E., lies in a very fertile region, and is rather an agricultural than a manufacturing town, though cottons, woollens, paper, etc., are made to a considerable extent, and good American machinery has been introduced into the various factories. The cathedral was begun in the twelfth century, was restored in the fifteenth, but has never been finished according to the original plan. Still, it is an imposing building, the five cupolas producing a grand effect, and in its interior, as well as in that of the church of S. Nicolò di Bari, pictures and sculpture of much merit are preserved. Even Bellini, Titian, Giorgione, Bordone, and Pordonone are represented in these and other churches. Treviso was settled before the Roman period, and admitted to the privilege of Roman citizenship in the time of Julius Cæsar. In 1000 A. D. it was an independent commonwealth; in 1108 became a fief of the celebrated Countess Matilda; in 1199 again recovered its municipal liberties, fell under the lordship of the terrible Ezzolino da Romano about 1230, and for the third time resumed its self-government for a short space in 1314. The following centuries were marked by the restless violence of the period, Treviso belonging for the most part to Venice. In 1807, the town having been occupied by the French, Mortier was named duke of Treviso. After having been an Austrian possession for some years, Treviso became a part of the kingdom of Italy in 1866. Considerable advance in prosperity is already noticeable, and much effort is making for popular education. P. 28,290.

**Trev'ithick** (Richard), b. at Illogan, Cornwall, England, Apr. 13, 1771; was brought up to the business of a mechanical engineer in the Cornish mines; constructed several steam-engines, introducing various improvements, one of which was the introduction of wrought-iron cylindrical boilers; solved the problem of introducing the steam-engine as a motive-power to run on roads and tramways by the introduction of high-pressure steam as a substitute for the condensing action; patented his new engine 1802, ran it upon a public road near Camborne 1803, placed another locomotive on a tramway at Merthyr Tydvil, where it drew a load of ten tons at the rate of 5 miles an hour, Feb. 21, 1804; subsequently made other successful experiments near Bethlehem Hospital, London; but his engine having blown up, popular prejudice was aroused and the practical use of the invention postponed for many years. Trevithick devoted himself anew to engineering work in the Cornish mines, continually inventing and making improvements in machinery; sent to Peru in 1814 nine of his small high-pressure condensing engines, for use in some mines in which he acquired an interest; went thither himself in 1816 as directing engineer; was for some time quite prosperous, but was ultimately a heavy loser by the depredations committed during the war of independence and the subsequent civil wars, in some of which he took part, experiencing many adventures; landed penniless at Falmouth 1827; resumed operations as an engineer; made various inventions and mechanical improvements of widely different kinds, including warming apparatus, iron stowage-tanks, iron buoys, a gun-carriage for single-decked ships, a furnace for purifying silver ores, an hydraulic engine, a salt-water distilling apparatus, and floating docks, some of which were patented by him, but produced him little pecuniary profit, though they added largely to the wealth and prosperity of Great Britain. D. at Dartford, Kent, Apr. 22, 1833. Porter C. Bliss.

**Tre'vor** (George), b. in England in 1809; graduated at Magdalen Hall, Oxford, 1836; was a chaplain on the Madras establishment 1836–45; became chaplain to the high sheriff of Yorkshire, rector of All Saints, York, and canon of York minster 1847; was elected chaplain of the parish church at Sheffield 1850, but was refused induction by the vicar, a proceeding which led to suits in chancery and in the court of queen's bench, in which he was successful; became rector of Burton Pidsea 1868, and was the most active promoter of the revival of the house of convocation for the arch-diocese of York, in which body he is actuary of the lower house and synodal secretary to the two houses. Author of *Christ in his Passion* (1847), *Sermons on Doctrines and Means of Grace* (1851), *Origin, Constitution, and Form of Proceedings in the Convocation of the two Provinces of Canterbury and York* (1852), *Types and Anti-types* (1864), *The Story of the Cross* (1866), *The Catholic Doctrine of the Sacrifice and Participation of the Holy Eucharist* (1869), *India, an Historical Sketch* (1858), *India, its Natives and Missions* (1862), *Russia, Ancient and Modern* (1862), *Ancient Egypt* (1863), *Egypt from the Conquest of Alexander to Napoleon* (1866), and *Rome from the Fall of the Western Empire* (1869).

**Trevor** (Sir John), b. at Brynkinallt, Denbighshire, Wales, about 1637, was a cousin of Chancellor Jeffreys, by whom he was favored in his professional career; was called to the bar at the Inner Temple May, 1661; was knighted Jan., 1671; became king's counsel 1678; was elected to Parliament 1679; chosen Speaker of the new House of Commons May, 1685; became master of the rolls Oct. 20, 1685; sworn of the privy council July 6, 1688; was dismissed from office by William and Mary; was an energetic opponent of the government in the Convention Parliament 1689, but soon made his peace with the court, with the consent of which he was unanimously elected Speaker Mar. 20, 1690; was entrusted by the government with the task of conciliating political opponents by means of promises and rewards; was made first commissioner of the great seal May 14, 1690; was restored to the office of master of the rolls Jan., 1693; was reported by a parliamentary committee guilty of bribery Mar. 12, 1695, and by vote of the House, to which he himself as presiding officer had to put the question, was declared guilty of a high crime and misdemeanor; resigned the Speakership, and was a few days later formally expelled. He retained, however, the high position of master of the rolls for the rest of his life, more than twenty-two years, and seems to have filled that office without reproach, his decisions being still quoted with respect. D. May 20, 1717, and was buried in the Rolls' Chapel.—He must not be confounded with his cousin and contemporary, Sir John Trevor (1626–72), who was envoy to France and secretary of state under Charles II., and son-in-law to the celebrated Hampden.

**Tre'vorton,** p.-v., Northumberland co., Pa., on Philadelphia and Reading R. R.

**Triacanth'idæ** [from *Triacanthus*—Gr. τρεῖς, "three," and ἄκανθα, "spine"—the name of the typical genus], a family of teleost fishes of the order Plectognathi and sub-order Scleroderma, and the most fish-like of the order. The body is compressed and oblong; the skin covered with small, rough, closely adherent scales; the lateral line diversiform; the head compressed and conical in profile; the eyes lateral; the opercular bones comparatively well developed; the mouth small and terminal; the upper jaw has its elements very imperfectly united; teeth are developed on the jaws in variable form; the branchial apertures are narrow slits in front of the pectoral fins; the branchiostegal rays are completely concealed; the dorsal fins are two in number—(1) aspinous, with from four to six spines, and (2) an oblong soft one, with rather numerous (14–25) rays; the anal is opposite to, and rather smaller than, the second dorsal; caudal well developed and forked or rounded; pectorals also well developed; ventral fins represented mostly by a pair of strong spines articulated with a long and compressed pelvic bone; the air-bladder is closed and simple; the vertebræ are in rather reduced number, there being in typical forms nine dorsal and ten caudal. The family is especially interesting as being, among the Plectognaths, the least aberrant from the typical fishes, while among the Teleocephali they are most nearly related to the Acanthuridæ and Teuthididæ. The family is composed of three well-marked genera—(1) *Triacanthus*, confined to the Indian and Australian seas; (2) *Triacanthodes*, of which a single species only has been found in Japan; and (3) *Hollardia*, one species of which has been found in Cuba.

Theodore Gill.

**Tri′ad,** in music, a chord consisting of a bass or root, with a third and fifth. (See HARMONY and MUSIC.)

**Triadel′phia,** p.-v., Deerfield tp., Morgan co., O. P. 34.

**Triadelphia,** tp., Logan co., West Va. P. 841.

**Triadelphia,** p.-v. and tp., Ohio co., West Va., on Hempville R. R. P. of v. 239; of tp. 2141.

**Tri′ads,** in chemistry, those elements or radicals which are trivalent or equivalent in their combinations to three atoms of hydrogen. (See CHEMISTRY.)

J. P. BATTERSHALL.

**Tri′ads, The Welsh,** a collection of rhythmical triplets containing historical facts and fancies, traditions, legal, rhetorical, and moral tales, and the like. They exist in the Welsh language. The oldest extant Triads are referred to Edward I.'s time, but probably contain much older fragments. Most of the Triads are of much more recent origin. The so-called historical Triads are regarded as a literary forgery, the work of one Thomas Jones, who probably made them not long before the year 1600.

**Triad, The Hindoo.** See TRIMURTI.

**Tri′al** [O. Fr. *Trial*], in law, denotes the formal judicial examination and decision of the issues pending between the parties to an action, preliminary to the judgment which finally determines the rights and liabilities of the litigants. The kinds of forensic trial used in the U. S. may be conveniently separated into three generic classes —the trial of legal actions, the trial of equity suits, and the trial of admiralty causes.

(1) *Legal Actions.*—Anciently, all legal actions were ordinarily tried before a jury. By recent legislation, both in this country and in England, the jury may be waived by the parties, and sometimes even without their consent, and the issues may be submitted to the court or to a referee. Since the proceedings before a court or a referee are in all respects similar to those before a jury, except the selection of the jurors, the judge's charge to them, and their verdict, these three modes may be described together. A cause being called and being ready for trial, the first step in the proceeding is the drawing and empanelling of a jury. From all the names of the jurors, written upon slips of paper and deposited in a box, the clerk selects at random or by lot the twelve who are to act in the particular case. As each one is announced, either party may challenge the person and proceed to ascertain whether he is incompetent for any reason to sit as a juror in that cause. In criminal trials the accused, and in many States the prosecution, are also entitled to a certain number of peremptory challenges; that is, they may exclude a certain number of the jurors drawn without assigning any cause therefor. The twelve men having been obtained, they are sworn by the clerk a true verdict to render upon the issues according to the evidence. The second stage is the production of the proofs in the presence of the jury. The counsel for the party holding the affirmative, who in the vast majority of instances is the plaintiff, briefly explains the nature of his client's claim, and examines his witnesses, who are cross-examined by his adversary. The defendant then proceeds in the same manner to state and prove his version of the case. At the close of the plaintiff's evidence the defendant may move for a nonsuit; and if in the opinion of the court no cause of action has been shown, even assuming the truth of all the facts stated by the witnesses, the motion will be granted and the cause will be at once dismissed. On the other hand, a verdict may be directed for the plaintiff if his right clearly appears from uncontradicted proofs. Generally, however, there is a conflict of evidence which requires a jury. The admission of evidence is wholly regulated by the court; he decides what facts are competent, and what incompetent, to be proved, what questions are proper, and what improper. To his rulings either party may except, and the point of law thus raised will be examined on appeal. When the proofs are closed, the counsel address the jury on behalf of their respective clients. Different rules prevail in the States as to the order of these addresses. In general, the party holding the affirmative closes, and sometimes he also opens the argument, but in several States the right of closing in criminal trials is conferred upon the accused. The next step is the judge's address or charge to the jury. In many of the States the charge is restricted by statute to a simple statement of the legal rules, and in several of them it is even required to be in writing. At the common law the judge may comment upon the facts, and even express an opinion provided the jury are left free to decide. Either party may request particular instructions. Exceptions taken to the charge or to portions thereof, or to a refusal to charge as requested, present questions of law for review by the appellate tribunal. The jury retire to a private room and consider their verdict. When a verdict is agreed upon, they return into court, announce it, and it is recorded by the clerk in his minutes. In the trial before the court or referee, instead of a verdict a written finding is filed by the judge containing his conclusions of fact and of law.

(2) *Equity Suits.*—According to the original practice in chancery, the witnesses were examined before trial by an officer called the master, who reduced their testimony to writing. The trial consisted merely in the reading of these depositions and of the pleadings, with the arguments of counsel, the decision being pronounced by the chancellor at his convenience. This practice still prevails in a few States. In most of them, however, the trial of an equity suit has been made identical in its modes and proceedings with that of a legal action before a judge or referee. Within the past few years the employment of official phonographers has become general in the superior courts of this country and of England, who preserve an accurate transcript of all the proceedings.

(3) *Admiralty Causes.*—The trial of the ordinary civil causes in admiralty substantially resembles the methods which originally prevailed in equity. Wherever admiralty has jurisdiction of criminal offences, and wherever a jury is required by statute, the forms of the jury trial in legal actions are followed.

JOHN NORTON POMEROY.

**Tria′na,** p.-v. and tp., Madison co., Ala. P. 2540.

**Trian′gle** [Lat. *triangulum*], a surface bounded by three sides, and consequently having three angles. A triangle may be *plane, spherical,* or *spheroidal.*

*Plane Triangles.*—A plane triangle is a plane surface bounded by three straight lines. These lines are called *sides,* and the points at which the sides meet are called *vertices* of the triangle. Plane triangles may be classified either with respect to their sides or with respect to their angles. When classified with respect to their sides, we have—(1) *scalene* triangles, in which no two sides are equal; and (2) *isosceles* triangles, in which two of the sides are equal: the *equilateral* triangle is a particular case of the isosceles triangle in which all of the sides are equal. When classed with respect to angles, we have—(1) *right-angled* triangles, which have one right angle; and (2) *oblique-angled* triangles, in which all of the angles are oblique; triangles of the latter class may be *acute-angled* triangles, all of whose angles are acute, or *obtuse-angled* triangles, each of which has one obtuse angle. The sides and the angles of a triangle are called *elements;* the side on which it is supposed to stand is called the *base;* and the vertex of the opposite angle is then called the *vertex* of the triangle; the distance from the vertex to the base is the *altitude* of the triangle. The following are some of the properties of plane triangles: (1) The greatest side lies opposite to the greatest angle, the least side opposite the least angle, and the intermediate side opposite the intermediate angle: if two sides are equal, their opposite angles are equal, and the reverse. (2) Any side is less than the sum of the other two, and greater than their difference. (3) The sum of all the angles is equal to two right angles: if one angle is a right angle, the sum of the other two is a right angle; if one angle is obtuse, the sum of the other two is less than a right angle. (4) Any line parallel to a side divides the other sides proportionally; and, conversely, a line that divides two sides proportionally is parallel to the third side. (5) The line that bisects any angle divides the opposite side into segments proportioned to the adjacent sides, and conversely. (6) The bisectrices of the three angles meet at a common point, which is the centre of the inscribed circle; and the perpendiculars which bisect the sides meet at a common point, which is the centre of the circumscribed circle; perpendiculars from the vertices to the opposite sides also meet at a common point. (7) If a line is drawn from the vertex to the middle of the base, the sum of the squares of the other sides is equal to twice the square of the line, *plus* twice the square of half the base. (8) In a right-angled triangle the square of the side opposite the right angle is equal to the sum of the squares of the other sides. (9) Two triangles that have an angle in each equal are proportional to the rectangles of the including sides; if the including sides are proportional, the triangles are similar, and then they are to each other as the squares of any two homologous sides. (10) The area of a triangle is equal to the product of its base by half its altitude; it is also equal to the perimeter multiplied by half the radius of the inscribed circle; it is also equal to $\sqrt{\frac{1}{2}s(\frac{1}{2}s-a)(\frac{1}{2}s-b)(\frac{1}{2}s-c)}$, in which $a$, $b$, and $c$ denote the sides, and $s$ their sum. (11) If any three elements are given, one being a side, the remaining elements may be determined either by construction or by computation.

*Spherical Triangles.*—A spherical triangle is a spherical surface bounded by arcs of three great circles. These arcs are called *sides,* and the points at which the sides meet are

*vertices*. The diedral angles between the planes of the sides are the angles of the triangles. In most cases of practice the sides of the triangles considered are supposed to be less than semicircles. Spherical triangles are classified in the same manner as plane triangles, and corresponding parts receive corresponding names. There is, however, this difference: a spherical triangle may have two right angles, or it may have three right angles; it may even have three obtuse angles. In addition to the terms common to both plane and spherical triangles, we may add the following, peculiar to the latter class: Two spherical triangles are *polar* when the vertices of each are poles of the opposite sides of the other; in this case any element of either is the supplement of the opposite element of the other. A *quadrantal* triangle is one in which one side at least is a *quadrant*. The following are some of the properties of spherical triangles: (1) The greater of two sides lies opposite the greater of the two opposite angles, and conversely; if two sides are equal, their opposite angles are equal, and conversely. (2) Any side is less than the sum of the other two, and greater than their difference. (3) The sum of the three angles may have any value between two right angles and six right angles. (4) The difference of any two sides is less than two right angles, and the sum of the three sides is less than four right angles. (5) The sum of any two angles is greater than the supplement of the third. (6) If the sum of any two sides is equal to two quadrants, the sum of their opposite angles is equal to two right angles, and conversely. (7) If the angles are all acute, each of the sides is less than a quadrant; if the angles are all obtuse, each of the sides is greater than a quadrant; if the angles are all right angles, each side is a quadrant. (8) The area of a spherical triangle is equal to its spherical excess multiplied by the area of a trirectangular triangle: the spherical excess is found by subtracting 180° from the sum of the three angles and dividing the result by 90°; the area of the trirectangular triangle is equal to one-half of a great circle. (9) If any three elements of a spherical triangle are given, the remaining three may be found by computation.

*Spheroidal Triangles.*—Spheroidal triangles are triangles taken on the surface of an ellipsoid of revolution. The vertices of such a triangle are any three points on the surface of the ellipsoid, the sides are the shortest lines that can be drawn on the surface of the ellipsoid between the vertices, and the angles are the angles between the tangents to the sides at the vertices. The sides are lines of double curvature, which approach more nearly to arcs of great circles as their lengths diminish. The triangles used in geodesic surveys are spheroidal triangles; within moderate limits—that is, when the sides are small—they may be regarded as spherical triangles. W. G. Peck.

**Triangle,** p.-v. and tp., Broome co., N. Y. P. of v. 273; of tp. 1944.

**Triangle of Forces,** a modification of the parallelogram or polygon of forces from whence we derive the inference that "if three forces in one plane be in equilibrium about a point, and if on that plane any three mutually-intersecting lines be drawn parallel to the directions of the three forces, a triangle will be formed, the lengths of whose sides will be proportional to the magnitude of the forces."

**Triangulation.** See Geodesy and Surveying.

**Trias.** See Geology, by Prof. J. W. Dawson, LL.D.

**Tribe.** See Appendix.

**Tribe's Hill,** p.-v., Mohawk tp., Montgomery co., N. Y. P. 365.

**Tribonia'nus,** quæstor, consul, and master of the offices to Justinian, who in 528 appointed him one of the ten commissioners to form the first *Codex*, in 530 one of the sixteen to compile the Digest or Pandect, and in 532 one of the three to edit the *Institutes*. He is described as a learned and highly-gifted man, but avaricious and of low moral standing. D. in 545.

**Trib'une** [Lat. *tribunus*, from *tribus*, a "tribe"] designated originally, in the primitive constitution of ancient Rome, an officer who for some purposes represented one of the tribes of which the Roman people consisted; but the term became, in course of time, a frequently-used title for offices of very different character and very unequal power. Thus, after the time of Diocletian there occurs a *tribunus voluptatum*, who superintended all public amusements, especially all theatrical performances. The two most important offices, however, bearing this title, were those of the *tribuni militum* and the *tribuni plebis*. The number of the *tribuni militum* was twenty-four, six to each legion, and each commanding the legion for two months. They were originally chosen by the consuls, but in 362 B. C. the *comitia tributa* acquired the right of electing six, in 311 sixteen, and in 169 the whole number. The consuls, however, retained the right of choosing all the tribunes for the supernumerary legions. Subsequently, the emperors assumed the right of appointing all the tribunes, and as Cæsar had modified and limited the power of the office considerably, the tribunates were generally given to young men of old and wealthy families, who thus prepared themselves for a military career. The *tribuni plebis* were instituted in 494 B. C., after the secession of the plebs to the Mons Sacer. Their office was to defend the plebeians against the arbitrariness and violence of the patricians. Their persons and houses were sacred and inviolable. Their doors were always open, and any one who sought refuge within their precincts was entitled to protection. But their authority was originally merely prohibitory. They could by personal intervention or by the interposition of their veto stop any action of any magistrate, without giving any reason for so doing or without incurring any responsibility, but they had no power of arraignment or punishment, and no share in the administration or legislation. Nevertheless, the history of Rome shows how this merely negative authority by degrees developed into a most formidable positive power, able not only to stop the whole machinery of the administration at any point, but even to mould legislation at will. Their number was originally two, and they were elected by the *comitia centuriata*, but in 471 B. C. the number was increased to five, and the election transferred to the *comitia tributa*; and finally, in 457 B. C., the number was made ten, which it remained to the end of the Empire. By the remodelling of the Roman constitution by Sulla the authority of the tribunes of the people was restricted to its original limits, but Pompey again restored them to full power. Under the Empire, when the *tribunitia potestas* necessarily became vested in the person of the emperor, the tribunate sank down from a governing power to an administrative organ, but it remained alive till the fall of the Empire.

**Tribune, The.** See Greeley (Horace), by George Ripley, LL.D.

**Tricà'rico,** town of Southern Italy, province of Potenza, on a high hill about 36 miles W. of Matera, is a walled town with towers, and contains some noticeable buildings, among others the cathedral, which is said to have been begun in the tenth century. It suffered severely in the earthquake of 1694. P. 6856.

**Trice's,** tp., Jackson co., Ala. P. 709.

**Trichech'idæ** [from *Trichechus*—θρίξ, "hair," and ἔχειν, to "have"—a generic name], or **Manat'idæ** [from *Manatus*, "handed," and the generic name], a family of placentiferous mammals of the order Sirenia, typified by the manatees or sea-cows of tropical and sub-tropical regions. The form is fish-like and elongate; the skin very thick and rugose; the head naked and depressed, and with a truncated snout; the eyes are very small; the nostrils are close together on the upper surface near the end of the snout, and are simple lunate fissures convex backward; the mouth is small; the molar teeth are typically nine (8–10) in each jaw, each provided with two large tuberculate and two smaller external transverse ridges; they have severally three roots, two on the outer and one on the inner side; incisor teeth wanting in the adult; the pectoral limbs are elongate, and oar-shaped, paddles mostly kept flexed at the elbows; rudimentary nails are developed; the tail is broad, depressed, and somewhat fan-shaped, having a convex border with a median notch or groove. The skull is noteworthy, as distinguishable from the other members of the order in that the intermaxillary bones have their branches not prolonged backward, and the anterior portions nearly or quite straight; the last or caudal vertebræ (*i. e.* $5 + x$) are subcylindrical and destitute of transverse processes. Another peculiarity is the possession of only six cervical vertebræ, instead of seven, as in almost all other mammals; the missing one has been regarded by Murie and Chapman as the third. The family, as already indicated, is represented by the manatees of tropical and subtropical regions; they are found along the coasts of seas and rivers, and live upon the herbage that grows on or near the banks. The species have not yet been certainly eliminated; by most authors, however, at least two species are recognized, one of which (*Manatus americanus*) is found along the eastern coast of North America, and another (*M. nasutus*, etc.) is found upon the western coast of Africa. They attain, when full grown, a length of at least six feet. The most recent memoirs upon these animals have been published by Dr. James Murie (*On the Form and Structure of the Manatee* (*Manatus americanus*) in *Trans. Zool. Soc. London*, viii. 1874, pp. 127–202, pl. 17–26) and Dr. Henry C. Chapman (*Observations on the Structure of the Manatee*, in *Proc. Acad. Nat. Sci. Phila.*, 1875, pp. 452–462, pl. 26). Theodore Gill.

**Trichi′na Spira′lis,** a parasitic nematoid worm infesting the muscular tissue of the pig, the rat, and some other animals, and liable to occur also in man. As commonly found, this worm is a quiescent encysted parasite, occupying, often in great numbers, the tissue of the voluntary muscles. The cysts are oval in form, more or less shuttle-shaped, or pointed at the two extremities, lying between and parallel with the muscular fibres, about $\frac{1}{60}$th of an inch long and $\frac{1}{100}$th of an inch wide. When of recent origin, they are quite transparent and colorless, and hardly discernible by the naked eye; after a certain period, they become partly opaque from the deposit of calcareous matter, and are then visible as minute whitish specks scattered through the muscular tissue. The worm lies perfectly free in the cavity of the cyst, coiled upon itself in a spiral manner, from which circumstance its specific name is derived. When stretched out, it is of a tapering, cylindrical form, $\frac{1}{28}$th of an inch long, $\frac{1}{650}$th of an inch thick in its widest portion. Its posterior extremity is blunt and rounded, but the anterior half of the body tapers gradually from behind forward, and is comparatively slender. The mouth and anus are situated respectively at the anterior and posterior extremities, and the intestine runs in a direct line from one to the other. The sexes are separate, different individuals being either male or female; but the sexual organs are incompletely developed, and do not exhibit any functional activity. The worm often moves distinctly while still in the cavity of the cyst, the movements consisting of occasional sluggish, partial flexion and extension of the two extremities. In this imperfect and practically sexless condition the parasite may continue for an indefinite time, retaining its vitality, but undergoing no perceptible change. When, however, a portion of trichinous flesh is devoured in the raw state by man or certain kinds of inferior animals, the muscular tissue and the encysting capsules are liquefied by digestion, and the worms are set free in the cavity of the intestine. Here they at once increase in size, and in about two days become developed into mature and sexually perfect trichinæ. The sexes are now readily distinguishable from each other. The male is $\frac{1}{20}$th of an inch long, with a folded spermatic tube occupying the posterior half of the body, and terminating externally at the anus, where it is provided with two projecting conical copulatory appendages. The female is half as long again as the male, and nearly the whole of its posterior two-thirds is occupied by the ovarian tube, which contains the eggs, and which terminates in an external orifice or vulva, at the anterior fifth of the body. At this time fecundation takes place by union of the sexes, and the female, at the end of seven days from the introduction of the trichinous food, begins to produce living embryos, which are discharged successively from the vulva into the surrounding cavity of the intestine. The production of these embryos is very abundant. According to Pagenstecher, it is often possible to count 500 or 600 at one time, fully formed or in process of development, in the body of a mature female; and as the generative act continues for at least a week or ten days, it is probable that each female trichina gives birth in the intestine to 1000 or 2000 living young.

The embryos, when discharged from the body of the female, are rather less than $\frac{1}{200}$th of an inch in length, nearly straight, and tapering somewhat toward the anterior extremity. They immediately begin to penetrate the walls of the intestine and disperse themselves over the body. They have been found under these circumstances in the substance of the intestinal walls, in the mesentery, the diaphragm, the peritoneal and pleural cavities, and thence outwardly in all the voluntary muscles of the trunk and limbs. Their passage takes place quite rapidly, as they may be found in the diaphragm of the rabbit on the eighth to the thirteenth day after feeding with trichinous food, and on the fifteenth or sixteenth day in the muscles generally. On their first arrival in the muscular tissue they are apparently quite free, and capable of moving slowly from one point to another; but they soon afterward become enveloped in a closed capsule or cyst, and there grow to a larger size. As they increase in length within the confined space of the cyst, they become gradually coiled up, thus assuming the spiral form characteristic of the encysted worm. They are then shut off from immediate contact with the surrounding tissues, and pass at once into the quiescent condition.

This process of the development of adult trichinæ in the intestine and the dispersion of their young throughout the system produces in man and animals a severe and often fatal illness, known as *trichinosis*. Its earliest symptoms are those of intestinal irritation, caused by the growth and activity of the ingested worms—namely, abdominal pains, nausea, vomiting, and diarrhœa. There is also fever and loss of appetite. Then follows an œdematous swelling of the face, body, and limbs, with muscular pains and tenderness, especially on motion; so that the patient lies helpless, with the arms and legs in a semiflexed position, and any attempt at either active or passive movement causes suffering. This corresponds with the period of dispersion of the embryonic worms and their establishment in the muscular tissue. There is also marked difficulty of chewing and swallowing, owing to the invasion of trichinæ into the corresponding muscles; hoarseness or loss of voice, due to their presence in the laryngeal muscles; and even in some cases serious disturbance of respiration, from a similar affection of the diaphragm and the intercostals. The fecundity of the adult worms, and the abundant emigration of their embryos into the muscular system, are fully sufficient to account for these symptoms. In man, after death from trichinosis, there have been found in the same subject in the gastrocnemius muscle of the leg 30,000 young trichinæ to the cubic inch; in the biceps muscle of the arm, nearly 70,000; and in the deltoid muscle at the shoulder, over 90,000 in the same space. The severity of the disease, other things being equal, is in direct proportion to the quantity of trichinous food ingested and the number of living parasites which it contained. In severe cases death may take place within the first two days, from the intensity of the diarrhœa and febrile disturbance. More commonly, the fatal termination occurs in the fourth or fifth week. If the patient survive this period, the chances of recovery are much increased, as the parasites have then become encapsuled and are passing into a state of quiescence. When this is accomplished, the morbid symptoms gradually subside, and the patient is restored to a comparatively healthy condition. The encysted trichinæ, however, remain imbedded in the muscular tissue for very long periods, and it is not known whether they ever entirely disappear. They have been found in a man eighteen years after the attack produced by their invasion.

The source of this infection for man is almost invariably trichinous pork; for although the rabbit, the cat, the rat, the mouse, the sheep, and the calf are all susceptible to the disease, as proved experimentally by feeding them with trichinous flesh, yet in the sheep and calf it is only exceptionally produced under these circumstances, and never shows itself spontaneously either in them or in the rabbit. It could not be produced in any of the birds experimented on by Pagenstecher—namely, the common fowl, the turkey, the pigeon, and the goose—nor in frogs or newts, nor in several species of invertebrates. The only animals in which it occurs spontaneously and frequently are the rat and the pig; and the latter has been the source of infection for man in every instance thus far known. The disease, as affecting the human subject, is most frequent in Germany, owing to the habit among certain parts of the population of eating ham, sausages, and even fresh pork in an uncooked condition. Within twelve years after the first recognized case, which happened in Dresden in 1860, there were eleven recorded well-marked local epidemics, of which the most disastrous was that at Hedersleben in 1865, where, out of 2000 inhabitants, over 300 were taken sick and 101 died. In the U. S. it is rare, occurring mainly in isolated cases or among members of a single family who have partaken of the same food.

The danger of infection by trichinosis consists in taking as food pork which is imperfectly cooked. The *fat* of pork is not injurious in this respect, as the adipose tissue never contains trichinæ. But the muscular *flesh* in any of its varieties, as fresh pork, ham, sausages, or the lean parts of bacon, is liable to produce the disease. The pig from which the meat is taken may have long since recovered from the original attack, presenting a perfectly healthy appearance when brought to the slaughter-house, and the parasitic cysts are usually too minute and transparent to attract the attention of the butcher or the provision-dealer. Neither pickling nor smoking, as ordinarily practised, will destroy the vitality of the trichinæ, and they may be found still living in ham or bacon cured by either process. The only protection is that afforded by thorough cooking. The trichinæ are killed by a temperature of 160° F., and meat which has been subjected for a short time to this temperature is harmless. Care must be taken, however, that *all parts* of the meat used be heated to the requisite point, otherwise it is as dangerous as if the whole of it were taken raw. A ham, if boiled for a short time, may be raised to a much higher temperature than 160° on the outside, while its internal parts are still below that point; and fresh pork which has been roasted or broiled may be thoroughly cooked externally, but still red and juicy within. The only safe rule to follow is that the fresh meat should be broiled or roasted until its color is changed throughout, and that for hams the boiling should be continued until the internal parts are perceptibly softened as well as the exterior. Since, in some instances, trichinæ have been found in pigs slaughtered for the market in so large a proportion as 1

in 50, these precautions are indispensable for protection from the disease.

A further consideration of importance relates to the source of infection for the pig itself. Since this is practically the only animal from which man contracts the disease, if trichinosis could be prevented or extirpated in the pig, the human subject would also be free from it. But as the encysted muscular parasite, whether in man, the pig, or the rat, is always quiescent and sexually unproductive, it is not fully evident how the continuation of its species is provided for. No doubt rats are often contaminated by each other, since they are well known to eat each other's flesh when deprived of ordinary supplies of food; and the cat is naturally infected by devouring rats and mice. But as the pig neither feeds upon human flesh nor habitually upon rats, it is not easy to see why the affection should be so frequent among swine, or how it is perpetuated and transmitted from one to the other. There are probably two modes in which this takes place: First, nearly all slaughter-houses are the abundant resort of rats, which feed upon the refuse material, and thus after a time often become trichinous. During the first period of intestinal irritation in these animals some of the adult worms may be discharged with the evacuations, and accidentally mingled with the food of the remaining pigs. It is possible, also, that pigs may occasionally seize and devour rats dead or dying from trichinosis. Secondly, the waste bits of flesh and the general débris of slaughter-houses are sometimes, when removed by washing, allowed to run into the feeding-troughs; and lastly, the flesh of a pig dead from incidental causes, and therefore not considered as fit for the market, may be used as food for the remainder of the drove. In some or all of these ways a certain number of swine may be annually contaminated, and thus serve to perpetuate the disease. The methods, accordingly, which are most likely to reduce its frequency, and, if possible, to exterminate it altogether, are—first, the maintenance in slaughter-houses of extreme cleanliness, no waste material being permitted to remain over night to serve as an attraction for rats, nor allowed to mingle with the food of the remaining pigs; and secondly, swine should never be fed with the flesh of one of their own species which has died from injury or disease.

J. C. Dalton.

**Trichinia'sis,** or **Trichino'sis,** a disease induced by eating the trichinous flesh of swine. (See Trichina Spiralis.)

**Trichinop'oly,** town of British India, capital of a district of the same name in the presidency of Madras, on the Cavery in lat. 10° 50′ N., is an exceedingly hot place and poorly built, mostly consisting of mud huts, but it is the station of a division of the Madras army, and it has important manufactures of cutlery, jewelry, saddlery, and cheroots; an excellent tobacco is grown in the surrounding district. P. 30,000.

**Trichiur'idæ** [from *Trichiurus*—Gr. θρίξ, "hair," and οὐρά, "tail"—the name of the typical genus], a family of fishes of the order Teleocephali and sub-order Acanthopteri, related to the mackerels, but distinguished by the elongated form and the imperfectly-developed anal fin. The body is more or less elongated and compressed, and terminates in a slender tail, which sometimes is filiform, but generally capped by a caudal fin; the skin is naked; the lateral line continuous; the head compressed, generally conic, rarely with a trenchant arched forehead; eyes lateral; opercular bones unarmed; mouth with a deep lateral cleft; upper jaw not protractile, the supramaxillaries more or less coalescent, and hiding mostly under the suborbital bones; teeth in the jaws and palate; branchial apertures large, and confluent below; branchiostegal rays in seven or eight pairs; dorsal fin long, generally single and uninterrupted, sometimes divided into two, with the spinous portion longer than the soft; anal fin represented by numerous almost concealed spines; no dorsal or anal finlets developed; caudal fin forked or wanting; pectoral fins well developed; ventral fins obsolete, or represented by scale-like spines behind the pectoral region. The pyloric appendages are developed in small or moderate number (*e. g.* 6–24); a simple air-bladder is developed, and pseudobranchiæ are present. The skeleton has very numerous vertebræ (*e. g.* A. 39–43+C. 57–120). The family is composed of few genera, mostly restricted to the high or deep seas. They represent several quite distinct types of structure of subfamily value—viz. (1) Trichiurinæ, in which the dorsal fin is undivided, the tail filiform and finless, and the pectorals extended (as usual) toward the upper angles, including the genera *Trichiurus* and *Eupleurogrammus;* (2) Lepidopodinæ, in which the dorsal is also entire, but the caudal fin is well developed, and the pectoral fins are produced toward the lower angles, with the genera *Lepidopus* and *Evoxymetopon;* and (3) Aphanopodinæ, in which the dorsal is divided. (See Gill in *Proc. Acad. Nat. Sci. Phila.*, 1863, pp. 224–229.)

Theodore Gill.

**Trichodont'idæ** [from *Trichodon*—Gr. θρίξ, "hair," and ὀδούς, "tooth," a generic name], a family of fishes of the order Teleocephali and sub-order Acanthopteri. The body is elongated and compressed, and regularly tapers from the head toward the tail; the skin is naked and smooth; the lateral line continuous; the head subquadrate and compressed; the eyes lateral; the preopercula each armed with five spines; the mouth has a very oblique and lateral cleft; the upper jaw is scarcely protractile; teeth are present on the jaws and palate; the branchial apertures are continuous below; branchiostegal rays five; dorsal fins two, oblong, and of nearly equal length, the first with rather numerous (14) spines, the second with simple branched rays; anal fin very long; caudal separate; pectorals large, and with the lower rays not branched; ventral fins approximated and thoracic, and each with a spine and five rays. The family has been constituted for a single genus (*Trichodon*), which is confined to the western coast of North America. Its affinities have been a matter of dispute, but it is probably most nearly related to the Trachinidæ and Uranoscopidæ. Theo. Gill.

**Trichomycter'idæ** [from *Trichomycterus*—Gr. θρίξ, "hair," and μυκτήρ, "nostril"—the typical genus], a family of fishes of the order Nematognathi, peculiar to South America. The body is elongated, and the species much resemble some of the loaches of the Old World, and others the catfishes of North America; the skin is entirely naked; the lateral line imperfect and unarmed; the head depressed and invested in the naked skin; the eyes rather dorsal than lateral; the opercula are unarmed or covered with small prickles; the nostrils remote from each other; the mouth is terminal and mostly transverse; the supramaxillaries are, as usual, invested in barbels; the teeth are diversiform; the branchial apertures generally continuous below, sometimes restricted to the sides; branchiostegal rays moderately numerous (8–12); the dorsal fin is short, and situated above or behind the ventrals; anal short, and behind the dorsal; caudal distinct; pectorals well developed laterally, and with a spine; ventrals more or less far back. The family is not thus well defined, but nevertheless seems to be a natural group, which must be confirmed or negatived hereafter by positive characters derived from anatomical, and especially osteological, modifications. The forms thus appearing to resemble each other have been combined by Dr. Günther in his seventh and eighth sub-families—"Siluridæ opisthopteræ" and "Siluridæ branchicolæ"—of the so-called family Siluridæ: these are again distinguishable into three primary groups—viz. (1) Nematogenyina, in which the dorsal is above the ventrals, including the genus *Nematogenys*, not excluding *Hetapterus;* (2) Trichomycterina, in which the dorsal is behind the ventrals, with the genera *Trichomycterus, Eremophilus*, and *Pariodon;* and (3) Stegophilina, in which the dorsal and ventral fins are very far behind and the branchiæ restricted to the sides, including the genera *Stegophilus* and *Vandellia*. The representatives of the first two have apparently essentially the same habits as the catfishes of the U. S., but those of the last seem to be peculiar in some respects. It is, for example, said that the species of *Vandellia* enter the urethra of persons while bathing, and thereby cause inflammation, and sometimes death; the truth of this is, however, extremely doubtful; the small size and elongated form of the fishes may, however, be inferred from the alleged attribute.

Theodore Gill.

**Trichonot'idæ** [from *Trichonotus*—Gr. θρίξ, "hair," and νῶτος, "back"], a family of fishes of the order Teleocephali and sub-order Acanthopteri, peculiar to the East Indian Archipelago and Australasian seas. The body is elongated and subcylindrical; the scales cycloid and of moderate size; the lateral line continuous; the head depressed and pointed; the eyes dorsal and directed upward; the opercula unarmed; the infraorbital bones small; the mouth has a wide and nearly horizontal cleft, and the upper jaw is longest; teeth are developed in villiform bands on the jaws as well as palate; the branchial apertures are very wide, and the branchiostegal membrane scarcely united below the throat; branchiostegal rays seven; dorsal fin single, long, with articulated but not branched rays, and without a distinct spinous portion; anal fin long; ventrals jugular, each with a spine and five rays; there is no papilla near the anus; the alimentary tract has no pyloric appendages; the air-bladder is suppressed; the vertebral column (in *Hemerocœtes* at least) has the normal number (10) of dorsal, but an increased (37) number of vertebræ. The family has been established for "carnivorous fishes, living near the shores of the East Indian Archipelago and of New Zealand," and their affinities are quite doubtful. Two genera have been recognized, each

with one species—viz. *Trichonotus* and *Hemerocœtes*. (See Günther, *Cat. Fishes Brit. Museum*, vol. iii. pp. 484–485.)

THEODORE GILL.

**Tri'color,** the French national flag, colored blue, white, and red in vertical divisions. It was first adopted during the First Revolution, and it is stated (though not generally believed) that the colors of the livery of Philippe, duke of Orleans (Citizen Égalité), were selected for the national flag. In point of fact, a large proportion of the flags of civilized nations are tricolors.

**Tricou'pis** (SPIRIDION), b. at Missolonghi, Greece, in 1791; studied in France and England; served in the army during the Revolution; was sent as ambassador to London and Paris several times during the reign of King Otho, and continued to participate very actively in public life till his death, Feb. 24, 1873. He enjoyed a great reputation as an orator, poet, and historian, his principal work being Ἱστορία τῆς Ἑλληνικῆς Ἐπαναστάσεως ("History of the Greek Revolution"), 1862.

**Trident'ine Profession of Faith** (*Professio Fidei Tridentinæ*), or the **Creed of Pius IV.,** is a clear and concise summary of the doctrines of the Council of Trent, suggested by that council, prepared by a college of cardinals under the supervision of Pope Pius IV., and issued by him Nov. 13, 1564. It consists of twelve articles, including the Nicene Creed, and is put in the form of an individual profession and solemn oath (*profiteor, spondeo, voveo ac juro*). It is binding upon all Roman Catholic priests and public teachers in seminaries, colleges, and universities. It is also used for Protestant converts to the Roman Catholic Church, and hence called the "Profession of Converts." (For converts from the Greek Church a modified formula was introduced by Pope Gregory XIII. in 1575.) The tenth article reads: "I acknowledge the holy Catholic Apostolic Roman Church as the mother and mistress of all churches, and I promise and swear true obedience to the bishop of Rome as the successor of St. Peter, prince of the apostles, and as the vicar of Jesus Christ." (See the Latin text in the two papal bulls of Nov. 13 and Dec. 9, 1564, and in Denzinger's *Enchiridion*, pp. 292–294.) A history of this creed, with much interesting information, was written by Mohnike, *Urkundliche Geschichte der Professio Fidei Tridentinæ* (Greifswald, 1822).

PHILIP SCHAFF.

**Trid'ymite** [Gr. τρίδυμοι, "triplets," or "trines," from the crystals being compounds of threes], an allotropic modification of silica, discovered in 1868 by the eminent mineralogist Von Rath as occurring in a volcanic porphyry from Cerro San Cristoval in Mexico. It has since been identified elsewhere, and is possibly a common mineral in some eruptive rocks, having been mistaken for quartz. An eruption of volcanic ashes from Volcano, one of the Lipari Islands, in Sept., 1873, was found by Baltzer to be composed of silica having all the characters of tridymite. Tridymite is hexagonal in crystallization, like quartz, but differs from the latter in possessing double refraction, like calcite, and its density was found by Von Rath to be about 2.3. The writer's new geometric law of condensation makes it (at zero) 2.308, while the same law gives for quartz 2.662. (See *American Chemist* for Mar., 1876, p. 331.)

HENRY WURTZ.

**Triest',** or **Trieste,** city of the Austrian empire, on the Gulf of Triest, at the N. E. extremity of the Adriatic Sea. The old town, which is surrounded with walls and mostly consists of narrow and tortuous streets, is built on a steep acclivity, at the foot of which the new town extends along the harbor; between the two parts of the town runs the Corso, a broad, elegant thoroughfare, opening into large squares lined with magnificent edifices and ornamented with fountains and monuments. Its manufactures are numerous, and some of them very important; as, for instance, its shipbuilding. White lead, candles, wax, soap, rosoglio, leather, spirits, and earthenware are extensively manufactured. It is from its commerce, however, that Triest principally derives its importance. Its harbor is safe, spacious, and deep, admitting vessels of 300 tons burden close to its quays. The value of the annual imports amounts to about £15,000,000, and that of the exports to about £10,000,000. It has a naval and a mercantile academy and a school of navigation, and it is the headquarters of the Austrian Lloyd's Steam-packet Co., which has magnificent docks and arsenals here. P. 70,274.

**Trigem'inus** [Lat.], the fifth pair of nerves, which arise from the side of the pons varolii, where its fibres are prolonged into the middle crura of the cerebellum, and are divided within the cranium into the orbital and the superior and the inferior maxillary branches. The orbital branch is divided into the frontal, lachrymal, and nasal nerves; the superior maxillary into the spheno-palatine, posterior alveolar, and infraorbital nerves; and the inferior maxillary into the internal lingual and the inframaxillary. The trigeminal nerve consists of a ganglionic and a non-ganglionic portion. (See also GANGLIONIC NERVOUS SYSTEM, HISTOLOGY, and NERVES.)

**Trigg,** county of S. W. Kentucky, bordering on Tennessee, bounded W. by Tennessee River and drained by the Cumberland; surface hilly, containing bituminous coal, iron, and limestone; soil fertile in some parts. There are flour-mills, saw-mills, tanneries, currying establishments, and ironworks. Swine, cattle, and sheep are numerous. Staples, tobacco, Indian corn, wheat, wool, leather, lumber, and dairy products. Cap. Cadiz. Area, 530 sq. m. P. 13,686.

**Triggia'no,** town of Southern Italy, province of Bari delle Puglie, in a fertile vine and olive bearing district near the Adriatic. P. 7009.

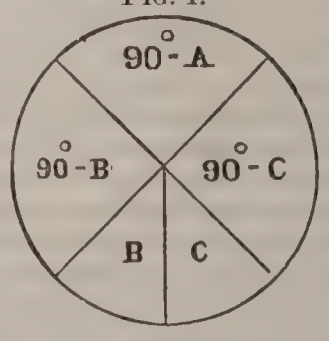
**Trig'lidæ** [from *Trigla*—an ancient name—one of the genera], a family of fishes of the order Teleocephali and sub-order Acanthopteri, including species popularly known as gurnards, sea-robins, flying-fishes, etc. The body is elongated and coniform from the postcephalic region backward; the scales are diversiform in the several groups; the lateral line is continuous; the head more or less quadrate and angular or parallelopiped; the eyes are lateral; the opercular and suborbital bones naked, and generally more or less sculptured; one of the suborbitals is very large, covering the cheek, and articulates with the preoperculum; the mouth is subterminal, and has a lateral nearly horizontal cleft; the upper jaw is slightly protracted and longest; teeth villiform, on the jaws and generally the palate; branchiostegal apertures continuous below; branchiostegal rays developed in seven pairs; dorsal fins two, the first with spinous rays, and the second with articulated ones; anal fin opposite the dorsal; the caudal distinct and well developed; pectorals more or less enlarged, and with their lower rays simple and generally isolated and distinct from the rest of the fin; ventral fins thoracic, separated by a wide area, and each with a spine and five soft rays; the alimentary canal has pyloric appendages developed in moderate number; an air-bladder is present; the skeleton has the vertebræ generally in slightly increased number (*e. g.* A. 10–15 + C. 15–22). The family has been framed for certain forms distinguished by a peculiar physiognomy. They represent three distinct subfamilies—viz. (1) Triglinæ, in which the three lowermost rays of the pectorals are elongated, enlarged, and entirely free, and the scales are small, including the genera *Trigla*, *Prionotus*, etc.; (2) Peristethinæ, in which the two lowermost rays of the pectorals are enlarged and separate, and the scales large and plate-like, represented only by the genus *Peristethus* or *Peristedion;* and (3) Dactylopterinæ, in which the lowermost rays of the pectorals are mostly united with the others, the whole forming a very large wing-like fin, which enables the animal to fly or skim over the water, and the scales are moderate and carinated, typified by the genus *Dactylopterus*. The family is represented on the eastern American coast by four species of *Prionotus* and one of *Dactylopterus*, and elsewhere, in almost every sea, by one or more generic forms.

THEODORE GILL.

**Trigonom'etry** [Gr. τρίγωνον, a "triangle," and μέτρον, a "measure"], a branch of mathematics whose primary object is to explain the method of solving triangles: it also treats of the general relations of circular functions. It is divided into three great branches—*plane*, *spherical*, and *analytical*. *Plane trigonometry* treats of the relations between the sides and angles of plane triangles; *spherical trigonometry* treats of the relations between the sides and angles of spherical triangles; and *analytical trigonometry* treats of the general relations between circular functions.

*Measure of an Angle.*—For the purposes of plane and spherical trigonometry, angles are expressed in *degrees*, *minutes*, and *seconds*, denoted by the symbols °, ′, ″; and in analysis they are expressed in terms of the radius of the arcs which subtend the angles. In the former case the right angle is the *primary* unit; in the latter case the primary unit is the angle whose subtending arc is equal to its radius. In both cases the angle is expressed in terms of the subtending arc. To explain these methods of measurement, let A C D be a right angle; then, with C as a centre, and with a radius C A equal to 1, describe an arc A P D intersecting the sides of the angle at A and D. Let the angle A C D be divided into 90 equal parts by radii; these will divide the arc A P D into 90 equal parts; the equal parts, both of the angle and the arc, are called *degrees*. If

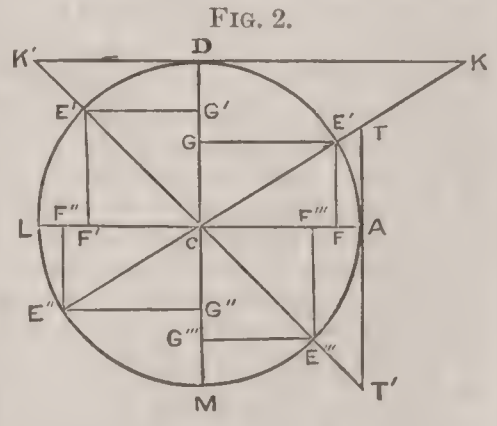
FIG. 1.



we draw any radius, as C P, the intercepted arc A P will contain as many degrees of the quadrant as the angle A C P does of the right angle. It is in this sense, and in this sense only, that we say an angle is measured by an arc. For convenience of expression, each degree is divided into 60 equal parts called *minutes*, and each minute is divided into 60 equal parts called *seconds*. Again, let the arc A P be equal in length to the radius C A; that is, to 1. If we take A C P as the unit angle, any other angle, as A C Q, will contain as many units as there are units in the quotient of the arc A Q by A P. Because the circumference whose radius is 1 is equal to $2\pi$, or 6.2832, the arc A P, in degrees, is equal to $\frac{360}{6.2832}°$; that is, to 57°.3 nearly, or, more exactly, to 206265″. If the arc A Q contains 75.5°, the linear measure of the angle A C Q is equal to 1.3 nearly; that is, it contains the unit angle 1.3 times.

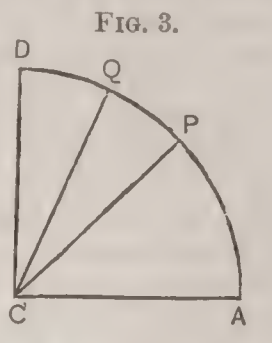
*Circular Functions.*—Angles are most readily compared by means of certain lines, whose values depend on the values of the subtending arcs, and which are called *circular functions*. The nature of these lines will be most readily explained by the aid of a diagram. Let a circumference be described from C as a centre, and with a radius C A equal to 1. Draw A L and M D, dividing the circumference into four quadrants, and call A L the *initial* diameter. Suppose every arc considered to commence at A, which is then called the *origin of arcs*, and to be estimated around in the direction A D L; let the point where the arc terminates be called its *extremity*. An arc commencing at A, and estimated around in the direction A M L, is said to be *negative*. The *complement* of an arc is the distance from its extremity around to D; it may be either positive or negative; thus, E D is the complement of A E, and E′ D is the complement of A E′, the former being positive, and the latter negative. In addition, we regard all distances estimated upward as positive, all distances downward as negative, all distances counted to the right as positive, and all to the left as negative. We have, then, the following definitions and conclusions:

FIG. 2.




(1) The *sine* of an arc is the distance from the initial diameter to the extremity of the arc: thus, F E is the sine of A E, F′ E′ is the sine of A E′, F″ E″ the sine of A E″, and F‴ E‴ the sine of A E‴. Hence, if an arc terminates in either the first or second quadrant—in which case it is said to lie in the corresponding quadrant—its sine is *plus;* if it lies in the third or fourth quadrant, its sine is *minus*.

FIG. 3.




(2) The *cosine* of an arc is the distance from the centre to the foot of the sine: thus, C F is the cosine of A E, and C F′ is the cosine of A E′. If an arc lies in the first or in the fourth quadrant, its cosine is *plus;* if it lies in the second or in the third quadrant, its cosine is *minus*.

(3) The *tangent* of an arc is a portion of a tangent to the arc at the origin, which is included between the origin and the prolongation of the diameter through the extremity of the arc; thus, A T is the tangent of A E, and A T′ is the tangent of A E′. If an arc lies in the first or in the third quadrant, its tangent is *plus;* if in the second or fourth, its tangent is *minus*.

(4) The cotangent of an arc is the tangent of its complement, the origin of the complement being taken at D: thus, D K is the cotangent of A E, and D K′ is the cotangent of A E′. If the arc lies in the first or in the third quadrant, its cotangent is *plus;* if in the second or fourth, it is *minus*.

(5) The *secant* of an arc is the distance from the centre to the extremity of the tangent: thus, C T is the secant of A E, and C K′ is the secant of A E′. The secant, being radial, is said to be positive when estimated from the centre in the direction *toward* the extremity of the arc, and negative when estimated in the direction *from* the extremity. In the first and fourth quadrants the secant is *plus;* in the second and third it is *minus*.

(6) The *cosecant* of an arc is the secant of its complement: thus, C K is the cosecant of A E, and C K′ of A E′. In the first and second quadrants the cosecant is *plus;* in the third and fourth it is *minus*.

(7) The *versed sine* of an arc is the distance from the foot of the sine to the extremity of the arc: thus, F A is the versed sine of A E, and T′ A of A E′. The versed sine is always *plus*.

(8) The *co-versed sine* of an arc is the versed sine of its complement: thus, G D is the versed sine of A E, and G D of A E. The co-versed sine is always *plus*.

The general relations between the circular functions of any arc from 0° to 360° are expressed by the following equations, in which $x$ denotes the arc, and this whether the arc is *plus* or *minus*:

$$\sin^2 x + \cos^2 x = 1. \qquad \tan x \cot x = 1.$$

$$\text{ver. sin } x = 1 - \cos x. \qquad \sec x = \frac{1}{\cos x}.$$

$$\text{co-ver. sin } x = 1 - \sin x. \qquad \operatorname{cosec} x = \frac{1}{\sin x}.$$

$$\tan x = \frac{\sin x}{\cos x}. \qquad \sec^2 x = 1 + \tan^2 x.$$

$$\cot x = \frac{\cos x}{\sin x}. \qquad \operatorname{cosec}^2 x = 1 + \cot^2 x.$$

*Limiting Values of the Circular Functions.*—The limiting values are those values which the functions assume when the arc terminates at the extremity of any quadrant. If we follow the arc around from A, through D, L, and M back to A, bearing in mind that what is true of a varying magnitude up to a limit is true at the limit, we shall have the following results: $\sin 0° = 0$, $\cos 0° = 1$; $\sin 90° = 1$, $\cos 90° = +0$; $\sin 180° = +0$, $\cos 180° = -1$; $\sin 270° = -1$, $\cos 270° = -0$; $\sin 360° = -0$, $\cos 360° = 1$. If we now substitute these results in the proper equations of the preceding group, we shall find the limiting values of the different functions, as shown in the following table:

| Deg. | Sin. | Cos. | Tan. | Cot. | Sec. | Cosec. | V. sin. | Co-v. sin. |
|---|---|---|---|---|---|---|---|---|
| 0° | +0 | +1 | +0 | +∞ | +1 | +∞ | +0 | +1 |
| 90° | +1 | +0 | +∞ | +0 | +∞ | +1 | +1 | +0 |
| 180° | +0 | −1 | −0 | −∞ | −1 | +∞ | +2 | +1 |
| 270° | −1 | −0 | +∞ | +0 | −∞ | −1 | +1 | +2 |
| 360° | −0 | +1 | −0 | −∞ | +1 | −∞ | +0 | +1 |

PLANE TRIGONOMETRY.—Every plane triangle consists of six parts—three sides and three angles. When three of these parts are given, one of which is a side, the remaining parts may be computed. The operation of finding the unknown parts is called the *solution* of the triangle. The solution is made by means of formulas which express the relations between the parts of the triangle.

*Solution of Right-angled Triangles.*—The following formulas express all the essential relations between the sides and angles of a right-angled triangle. In them the right angle is denoted by A, the acute angles by B and C; the hypothenuse is denoted by $a$, and the sides opposite B and C are represented by $b$ and $c$. Because the angles B and C are complementary, either may be found when the other is known by simple subtraction; hence, the formulas only take account of one of them. The symbols $sin^{-1}$, $cos^{-1}$, etc., are read, *The arc whose sine is, The arc whose cosine is*, etc.:

$$a = \sqrt{b^2 + c^2} = \frac{b}{\sin B} = \frac{c}{\cos B}; \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$b = \sqrt{a^2 - c^2} = a \sin B = c \tan B; \quad . \quad . \quad . \quad . \quad (2)$$

$$c = \sqrt{a^2 - b^2} = a \cos B = p \cot B; \quad . \quad . \quad . \quad (3)$$

$$B = \sin^{-1}\frac{b}{a} = \cos^{-1}\frac{c}{a} = \tan^{-1}\frac{b}{c}. \quad . \quad . \quad . \quad (4)$$

In applying these formulas the multiplications and divisions are made by means of logarithms.

*Solution of Oblique-angled Triangles.*—The solution of every case of oblique triangles may be effected by means of the following formulas, in which A, B, and C denote the angles of a triangle, and $a$, $b$, and $c$ the sides lying opposite to them, and $s = a + b + c$:

$$a : b : c :: \sin A : \sin B : \sin C; \quad . \quad . \quad . \quad (1)$$

$$a + b : a - b :: \tan \tfrac{1}{2}(A + B) : \tan \tfrac{1}{2}(A - B) \quad . \quad (2)$$

$$\sin \tfrac{1}{2} A = \sqrt{\frac{(\frac{1}{2}s - b)(\frac{1}{2}s - c)}{b\,c}} \quad . \quad . \quad (3)$$

The sine of an arc is equal to the sine of its supplement; hence, when an angle is determined by means of its sine, there may be two solutions. Whether there are two or one must be determined by a discussion of the particular case.

SPHERICAL TRIGONOMETRY.—Every spherical triangle contains six parts—three sides and three angles. When any three of these parts are given, the other three may be found.

*Solution of Right-angled Spherical Triangles.*—A right-angled spherical triangle may be solved when we have given any two parts besides the right angle, by two simple rules called Napier's rules for circular parts. If we denote the angles by A, B, and C, A being the right angle, and the opposite sides by $a$, $b$, and $c$, the sides about the right

angle, the complement of the hypothenuse, and the complements of the angles B and C are called *circular parts*. Let these parts be arranged in order, as shown in the diagram; then each part will be *adjacent* to two other parts, or will be separated from two other parts called *opposite*. When so arranged, the parts are subject to the following rules: (1) *The sine of any part is equal to the rectangle of the tangents of the adjacent parts.* (2) *The sine of any part is equal to the rectangle of the cosines of the opposite parts.*

*Solution of Quadrantal Spherical Triangles.*—A quadrantal spherical triangle is one in which one of the sides is a *quadrant*. Such triangles may be solved by passing to the corresponding polar triangles, which will be right-angled. These triangles are then solved by Napier's rules for circular parts, and from the results we may find the corresponding parts of the given triangles by the reverse process of passing back to the given triangles.

*Solution of Oblique Spherical Triangles.*—Let A, B, and C denote the angles of an oblique spherical triangle, and let $a$, $b$, and $c$ denote the opposite sides; also let $S = A + B + C$; and $s = a + b + c$; we shall then have the following formulas for solving oblique spherical triangles:

$$\frac{\sin A}{\sin a} = \frac{\sin B}{\sin b} = \frac{\sin C}{\sin c}.$$

$$\cos \tfrac{1}{2} A = \sqrt{\frac{\sin \tfrac{1}{2} s \sin (\tfrac{1}{2} s - a)}{\sin b \sin c}}.$$

$$\cos \tfrac{1}{2} a = \sqrt{\frac{\cos (\tfrac{1}{2} S - C) \cos (\tfrac{1}{2} S - B)}{\sin B \sin C}}.$$

$$\tan \tfrac{1}{2} (A + B) = \cot \tfrac{1}{2} C \times \frac{\cos \tfrac{1}{2} (a - b)}{\cos \tfrac{1}{2} (a + b)}.$$

$$\tan \tfrac{1}{2} (A - B) = \cot \tfrac{1}{2} C \times \frac{\sin \tfrac{1}{2} (a - b)}{\sin \tfrac{1}{2} (a + b)}.$$

$$\tan \tfrac{1}{2} (a + b) = \tan \tfrac{1}{2} c \times \frac{\cos \tfrac{1}{2} (A - B)}{\cos \tfrac{1}{2} (A + B)}.$$

$$\tan \tfrac{1}{2} (a - b) = \tan \tfrac{1}{2} c \times \frac{\sin \tfrac{1}{2} (A - B)}{\sin \tfrac{1}{2} (A + B)}.$$

When any part is determined by means of its sine, there may be one or two solutions. Whether there are one or two can only be determined by a discussion of each particular case.

The solution of a spherical triangle may often be facilitated by the introduction of an auxiliary angle. Thus, if we have two sides and their included angle, we may find the third side by the formulas

$$\cos a = \frac{\cos b \sin (c + \phi)}{\sin \phi}, \text{ and } \cot \phi = \tan b \cos A.$$

In like manner, if we have two angles and their included sides, we may find the remaining angle by the formulas

$$\cos A = \frac{\cos B \sin (C - \phi)}{\sin \phi}, \text{ and } \cot \phi = \tan B \cos a.$$

Formulas of this kind are particularly useful when we wish to determine a single part without completing the solution of the triangle.

Analytical Trigonometry.—Besides the formulas expressing the relation between the functions of a single arc, already given, the following, which express more extended relations, are of continual use in analysis:

$$\sin (a \pm b) = \sin a \cos b \pm \sin b \cos a.$$
$$\cos (a \pm b) = \cos a \cos b \mp \sin a \sin b.$$
$$\tan (a \pm b) = \frac{\tan a \pm \tan b}{1 \mp \tan a \tan b}.$$
$$\sin 2a = 2 \sin a \cos a; \quad \cos 2a = \sin^2 a - \cos^2 a.$$
$$\sin \tfrac{1}{2} a = \sqrt{\tfrac{1}{2} (1 - \cos a)}; \quad \cos \tfrac{1}{2} a = \sqrt{\tfrac{1}{2} (1 + \cos a)}.$$

To these we may add the following relations between the parts of a spherical triangle, due to Gauss, and of frequent use in astronomical investigations:

Let $p = \cos \tfrac{1}{2} c \sin \tfrac{1}{2} (A + B)$; $P = \cos \tfrac{1}{2} C \cos \tfrac{1}{2} (a - b)$:
$q = \cos \tfrac{1}{2} c \cos \tfrac{1}{2} (A + B)$; $Q = \sin \tfrac{1}{2} C \cos \tfrac{1}{2} (a + b)$:
$r = \sin \tfrac{1}{2} c \sin \tfrac{1}{2} (A - B)$; $R = \cos \tfrac{1}{2} C \sin \tfrac{1}{2} (a - b)$:
$s = \sin \tfrac{1}{2} c \cos \tfrac{1}{2} (A - B)$; $S = \sin \tfrac{1}{2} C \sin \tfrac{1}{2} (a + b)$:

Then will the following conditions be satisfied:
$pq = PQ$; $pr = PR$; $ps = PS$; $qr = QR$; $qs = QS$; $rs = RS$.

W. G. Peck.

**Tri'kala,** or **Tirhala,** town of European Turkey, eyalet of Salonica, has large cotton manufactures, cotton being extensively grown in the surrounding districts. P. about 10,000.

**Trilin'ear Co-ordinates.** The equation of any right line in Cartesian co-ordinates may be put in the form

$$x \cos \phi + y \sin \phi - p = 0,$$

in which $\phi$ is the angle made by the lines with the axis of $x$, and $p$ is length of a perpendicular upon it from the origin. If $x'$ and $y'$ be the co-ordinates of any point whatever, $x' \cos \phi + y' \sin \phi - p$ will express the length of a perpendicular from the point, or the *distance* of the point $x'$ $y'$ from the line. Call this distance $\alpha$. Let $\beta$ and $\gamma$ be in the same manner the distances of the point $x'$ $y'$ from any two other arbitrarily-chosen lines. We may imagine a system of *trilinear* co-ordinates in which the position of a point is defined by its distances from three fixed lines, and in which the position of any right line is defined by a homogeneous equation between these distances of the form

$$l\alpha + m\beta + n\gamma = 0.$$

The advantage of trilinear co-ordinates is, that whereas in Cartesian (or $x$ and $y$) co-ordinates the utmost simplification we can introduce is by choosing *two* of the most remarkable lines in the figure for axes of co-ordinates, we can in trilinear co-ordinates obtain still more simple expressions by choosing *three* of the most remarkable lines for the lines of reference $\alpha$, $\beta$, $\gamma$.

If the equation (Cartesian or trilinear) of any line be $\lambda x + \mu y + \nu z = 0$, then evidently, if $\lambda$, $\mu$, $\nu$ be known, the position of the line is known; and we may call these three quantities (or rather their mutual ratios, with which only we are concerned) the co-ordinates of the right line. If the line pass through a fixed point $x'$ $y'$ $z'$, the relation must be fulfilled $x'\lambda + y'\mu + z'\nu = 0$; if, therefore, we are given any equation connecting the co-ordinates of a line, of the form $a\lambda + b\mu + c\nu = 0$, this denotes that the line passes through the fixed point $(a, b, c)$, and the given equation may be called the equation of the point. Further, we may use abbreviations for the equations of points, and may denote by $\alpha$, $\beta$, the quantities $x'\lambda + y'\mu + z'\nu$, $x''\lambda + y''\mu + z''\nu$; then it is evident that $l\alpha + m\beta = 0$ is the equation of a point dividing in a given ratio the line joining the points $\alpha$, $\beta$; that $l\alpha = m\beta$, $m\beta = n\gamma$, $n\gamma = l\alpha$, are the equations of three points which lie on a right line; that $\alpha + k\beta$, $\alpha - k\beta$ denote two points harmonically conjugate with regard to $\alpha$, $\beta$, etc. (See Harmonic Ratio.) The system of co-ordinates by which, as above, the position of a line is expressed by co-ordinates, and that of a point by an equation, is that of tangential co-ordinates. (See Pole and Polar, and for fuller exposition see Salmon's *Conic Sections*.)

J. G. Barnard.

**Tril'lium** [Lat. *trilix*, "triple," so called from the division of its parts], a genus of perennial herbaceous North American plants, now placed in a sub-order of the lily family, embraces a dozen species, all of which grow wild in marshy grounds from Maine to Florida, consist of a naked stem a foot high, surmounted by three ovate netted-veined leaves, a large flower, and a purple three-celled berry. They are cultivated in gardens, highly valued for their beauty, and commonly known by the names of three-leaved nightshade, wake-robin, birth-root, or Indian balm. They have astringent, expectorant, and tonic qualities, and yield resin, tannic acid, and a volatile oil.

**Tril'obite** [Gr. τρεῖς, "three," and λοβός, a "lobe"], the common name of a group of fossil crustaceans, among the oldest of the Articulata, and were so called from the triple division of the body. They were once among the most abundant forms of animal life. The number of genera and of species is very great, being found in nearly all the older strata throughout the world. Among the American localities most noted for trilobites are Trenton Falls, N. Y., and Lebanon, O. In Adams co., O., a trilobite has been found twenty inches in length. (See Geology.)

**Trim'belle,** tp., Pierce co., Wis. P. 633.

**Trim'ble,** county of Northern Kentucky, lying on Ohio River; surface hilly, soil fertile. Staples, tobacco, Indian corn, and wool. Cap. Bedford. Area, 150 sq. m. P. 5557.

**Trimble,** p.-v. and tp., Athens co., O. P. of v. 81; of tp. 1379.

**Trimble** (Allen), b. in Augusta co., Va., Nov. 24, 1783; removed to Lexington, Ky., in infancy; settled in Highland co., O., in 1804; was clerk of the courts and recorder 1809–16; commanded a mounted regiment under Gen. Harrison 1812–13; was a member of the State assembly 1816, of the State senate 1817–26, Speaker 1819–26, acting governor 1821–22, governor 1826–30, and president of the first State board of agriculture 1846–48. As governor he promoted educational extension, penitentiary reform, and the encouragement of manufactures. D. at Hillsborough, O., Feb. 2, 1870.

**Trimble** (Robert), b. in Berkeley co., Va., in 1777; removed to Kentucky when three years old; received a scanty early education, but became a school-teacher; studied law under George Nicholas; was admitted to the bar 1803; settled at Paris, where he was chosen to the legislature; became judge of the court of appeals 1808,

chief-justice of Kentucky 1810, U. S. district attorney 1813; was district judge of Kentucky 1816–26, and justice of the U. S. Supreme Court from 1826 to his death, Aug. 25, 1828.

**Trimble** (William A.), brother of Col. Allen, b. in Woodford co., Ky., Apr. 4, 1786; educated at Transylvania University; studied law under Judge Robert Trimble, and afterward at Lichfield law school; commenced legal practice at Highland, O., 1811; served in the war of 1812–15, attaining the rank of lieutenant-colonel of U. S. infantry, which he held until 1819; was U. S. Senator 1819–21, and commissioner with Gen. Cass to treat with the Indians at Green Bay, Wis., 1821. D. at Washington, D. C., Dec. 13, 1821.

**Trim'mer** (Sara **Kirby**), b. at Ipswich Jan. 6, 1741; manifested early capacity, and in 1762 became the wife of Mr. Trimmer. She commenced her career as an authoress in 1780 by the publication of *An Easy Introduction to the Knowledge of Nature*, and continued it to the close of her life, writing especially for the young, and also for a time conducted the *Family Magazine* and the *Guardian of Education*. Among her numerous works are—*Sacred History* (6 vols.), *Outline of Ancient History, Outline of Roman History, Fabulous Histories, History of England, Abridgment of the Old and New Testaments, New and Comprehensive Lessons on the Old and New Testaments, Ladder to Learning, Instructive Tales, History of the Robins, Prayers and Meditations, Companion to the Book of Common Prayer, The Economy of Charity, Teacher's Assistant*, and *View of the New System of Education promulgated by Mr. Joseph Lancaster*. She was strongly opposed to Lancaster's system, and an earnest advocate of that of Dr. Bell. D. at Brentford Dec. 15, 1810.

**Trimûrti** [Sansk., from *tri*, "three," and *mûrti*, "form"], the Hindoo triad, an expression implying the unity of the creative, preservative, and destructive principles of the primal deity of the Hindoos. The three gods, Brahma, Vishnu, and Siva, together constitute the Trimûrti, which is, says the Matsya Purana, "one person and three gods."

**Trincomalee',** town of Ceylon, on the north-eastern coast of the island, has the "finest harbor in the world" (an expression of Nelson), but the place is exceedingly hot and unhealthy. P. about 20,000.

**Trinidad',** the southernmost island of the West Indies, opposite the mouth of the Orinoco, belongs to Great Britain. Area, 1754 sq. m. P. 84,438. A chain of mountains covered with red cedar, palms, and different kinds of trees yielding excellent timber and ornamental woods, extends along the northern shore, and sends out branches toward the S., between which beautiful valleys open into large plains which terminate in swamps along the coast. The island is of volcanic formation. Mud-volcanoes, perpetually boiling, though seldom overflowing, occur, and submarine volcanoes are found on both sides of the island. A curious phenomenon is the pitch lake, 1½ miles in circumference and covered with stiffened bituminous matter, cold and hard except in the centre, where it is still boiling. The soil is exceedingly fertile, and sugar, molasses, rum, cocoa, cotton, and coffee are largely produced. Only a small portion of the ground, however, is under cultivation. Cap. Port of Spain.

**Trinidad,** p.-v. and tp., Klamath co., Cal. P. of v. 160; of tp. 374.

**Trinidad,** p.-v., cap. of Las Animas co., Col., 95 miles from the railroad dépôt at West Las Animas, has 2 churches, 3 schools, 2 banks, 1 convent, 2 newspapers, 2 hotels, and 3 grist-mills. It is a great wool and hide market for South Colorado and New Mexico. Rich deposits of bituminous coal abound. Principal business, farming and grazing. P. about 2000. John C. Fitnam, Ed. "Trinidadian."

**Trinità'poli** [formerly *Casaltrinità*], town of Sicily, province of Caltanisetta, made unhealthy by the neighboring salt-pools, which are, however, a source of some income. P. 6662.

**Trinitarians.** See Redemptionists.

**Trinitrocarbol'ic Acid, Trinitrophenol, Trinitrophenic Acid, Carbazotic Acid, Picric Acid** ($C_6H_3(NO_2)_3O$), first observed by Hausmann in 1788, afterward examined by Liebig, Dumas, and Laurent. It is produced by the action of hot nitric acid on phenol, salicine, salicylic acid, indigo, aloes, benzoin, resin of *Xanthorrhœa hastilis*, resin of Peru balsam, silk, etc. It is usually prepared from pure crystallized phenol. It crystallizes in beautiful pale-yellow, scaly crystals or needles. It dissolves in 86 parts of water at 60° F., and in much less at 212° F. It is soluble in alcohol, ether, and benzol, and in sulphuric and nitric acids. When heated it melts, and on cooling solidifies to a crystalline mass; at a higher temperature it sublimes; when quickly heated, it explodes. Its taste is very bitter. Its solution in water is yellow, and it imparts a yellow color to the skin and to silk and wool; hence it is used as a yellow dye. By reducing agents, sulphide of ammonium, etc., it is converted into picramic acid, $C_6H_5N(NO_2)_2O$, which has been used as a dye for silk, producing a series of colors like those of catechu. Treated with a hot concentrated solution of cyanide of potassium, it yields a blood-red solution of isopurpurate of potassium. This compound has been used to dye wool maroon tints; it is very explosive, and to avoid accident it is generally supplied in the form of a paste containing glycerine. Picric acid is used as a dye for silk and wool; it was suggested by Guinon of Lyons in 1845. By mordanting with argol or alum before dyeing, the color is rendered more stable. It has been common to supply of late for this purpose the picrate of soda, which is very explosive, and has already given rise to serious accidents. A beautiful green dye is made by mixing the picric acid with indigo carmine. This mixture has been imported into New York under the name *viridine*. The Victoria yellow is trinitro-cresol, not picric acid. Leather is dyed with picric acid, particularly alum-tawed leather for belt lacings. Goods dyed with picric acid resist light well, but are liable to suffer on washing with soap. As vegetable fibres do not take picric acid, it affords a ready method for detecting cotton and flax when mixed with silk or wool. It is said to be used as a substitute for hops in making beer. Picrate of ammonia has been recommended as a substitute for quinine in medicine. Hager (*Zeit. An. Chem.*, ix. 110) suggests its use as a reagent for alkaloids. He finds it a very delicate test for some of them, even in solutions containing much sulphuric acid. It precipitates brucine, strychnine, veratrine, quinine, quinidine, cinchonine, and most of the opium alkaloids, but does not precipitate morphine, atropine, pseudo-morphine, caffeine, nor the glucosides. It is also used as a reagent for certain hydrocarbons, with which it forms beautiful crystalline compounds of different colors; *i. e.* naphthalene yellow, retene orange-yellow, anthracene ruby-red, chrysene yellow. (See Watts's *Dict.*, iv. 405; *Suppl.*, 911.) Picric acid is monobasic, and forms bitter crystalline salts, many of which are very explosive. A mixture of 54 parts of picrate of ammonia and 46 of nitrate of potassa has been used as a substitute for gunpowder. Other mixtures are, for gunpowder, picrate of potassa, nitre, and carbon. For explosive powder for torpedoes the carbon is omitted. (See Explosives.) C. F. Chandler.

**Trinitrocel'lulose** ($C_6H_7(NO_2)_3O_5$), a name given to gun-cotton, indicating its preparation from, and relation to, cellulose. (See Pyroxyline.)

**Trinity.** See God, by Prof. A. A. Hodge, S. T. D.

**Trin'ity,** port of entry, cap. of Trinity district, Newfoundland, on Trinity Bay; lat. of harbor, 48° 22′ N., lon. 53° 24′ W. It has an excellent harbor and a jail. The fisheries are the leading pursuit. P. 1434.

**Trinity,** county of N. W. California, bounded E. by the Coast Range, intersected by Trinity River; surface hilly, and in some parts mountainous, with large forests of pine, fir, and oak, and gold-mines, which are worked to a considerable extent, mining forming the chief industry. Cap. Weaverville. Area, about 1800 sq. m. P. 3213.

**Trinity,** county of E. Texas, lying between Trinity and Nueces rivers, drained by several creeks, and crossed in its W. part by Houston and Great Western R. R.; surface generally level, soil fertile. Cattle and swine are numerous. Staples, cotton, Indian corn, and sweet potatoes. Cap. Trinity. Area, 945 sq. m. P. 4141.

**Trinity,** tp., Randolph co., N. C., the seat of Trinity College. P. 1471.

**Trinity,** p.-v. and cap. of Trinity co., Tex.

**Trinity Centre,** p.-v., Trinity co., Cal. P. 160.

**Trinity College,** an institution of learning at Hartford, Conn., known until 1845 as Washington College, was opened in 1824 under the direction of the Protestant Episcopal Church. In 1872 the college grounds within the city were sold as a site for the new State capitol, producing the handsome sum of $600,000. A new structure, a vast quadrangle 1050 feet by 376, enclosing three courtyards and having an aggregate area of 4 acres, is now (1876) erecting on the new grounds (78 acres) purchased for the college, 1 mile S. of the old location. It is of the Early English style of architecture, will have a tower and spire 240 feet high, and when completed will be the most imposing college edifice in America. There are now (1876) 14 instructors and 83 students. The alumni number above 1000, a large proportion having been Episcopal clergymen. The college owns property valued at above $1,000,000, has a library of 18,000 volumes, and a valuable cabinet. The curriculum is thorough, and there is a special scientific course. There are 37 scholarships available for needy

students for the ministry. The theological school was discontinued in 1851. The first president was Bishop Thomas C. Brownell, D. D., 1824–31; the present one, since 1874, is Rev. T. R. Pynchon, D. D.

**Trinity College,** p.-v., Randolph co., N. C.

**Trinity River** rises in the N. E. part of Trinity co., Cal., and after a course first to the S. W. and then to the N. W., falls into Klamath River.

**Trinity River,** in Texas, rises by several forks in the N. part of the State. The W. fork, rising in Archer co., seems to be the largest. Next in importance is the Elm fork. Trinity River is a noble stream, flowing through a fertile, well-timbered country. At its lowest stage it is navigable to Liberty, 90 miles from its mouth in Galveston Bay, and at high water small boats have ascended 500 miles. The whole length of the main stream is 550 miles.

**Trinity-Sunday,** in the Roman Catholic, Anglican, and other churches (but not the Greek Church), the Sunday next after Pentecost. It was established as a church festival, in honor of the Holy Trinity, by Pope John XXII. in 1320. It had previously been long celebrated in some Western dioceses, but not very generally before 1400.

**Tri'no,** town of Italy, province of Novara, on the left bank of the Po, about 10 miles S. W. of Vercelli, contains good churches and palaces, but everything has an air of neglect and decay. Trino was a mediæval town of some importance, but its old fortifications are in ruins. P. 9774.

**Triodontidæ.** See APPENDIX.

**Trionychidæ.** See APPENDIX.

**Trio'ra,** town of Italy, province of Porto Maurizio, about 24 miles N. of San Remo. The mediæval wall and other defences are nearly destroyed, and it is now a place of little interest. P. 5100.

**Tripe de Roche** [Fr. for "rock-tripe"], a name applied by French Canadian *voyageurs* and hunters to several species of *Umbilicaria* and *Gyrophora*, tough and bitter lichens of the barren grounds of British North America. *Tripe de roche* is often used as food when other provisions are exhausted, and, though cathartic and unpalatable, it will sustain life. The genera have representatives growing upon rocks in many high arctic and alpine regions.

**Triple Alliance.** (1) The league between England, Sweden, and the States General (1668) for the protection of the Spanish Netherlands against Louis XIV. (2) The league of Great Britain, France, and the Netherlands against Spain and the Pretender in 1717. (3) The league of Austria, Great Britain, and Russia, concluded in 1795.

**Tri'pod** [Gr. τρίπους, "three-footed"], a three-legged table, stool, or vessel; a three-legged stand for a mathematical or other instrument. In ancient Greece and Rome the name was especially applied to the three-legged bronze or stone altars of Apollo, made in imitation of the tripod upon which sat the Pythian priestess during the delivery of the Delphic oracles. Others of the gods also received tripods as votive offerings.

**Trip'oli** [from *Tripoli* in Barbary, whence it was once imported], a polishing powder consisting of the aggregate fossil frustules of great numbers of diatomaceous plants. Tripoli is brought from Bohemia, Corfù (called Venice tripoli), and other points. It is used for polishing metals, and some red varieties are used in Europe for paint.

**Tripoli,** the easternmost of the Barbary states, North Africa, dependent of the Turkish empire, is bounded W. by Tunis, N. by the Mediterranean, and E. and S. by Barca, the Libyan desert, and Fezzan. With the exception of the districts around the metropolis, which are very fertile and produce all kinds of fruits, vegetables, and cereals belonging to the Mediterranean territories, the coast-land is an arid and desolate plain, presenting an uninterrupted series of open sandy beaches. In the interior, between the desert coast-land and the desert of Sahara, stretch two chains of low mountains, issuing from the Atlas and enclosing valleys and plateaus of considerable fertility, especially in places where sufficient water can be procured, as drought is the great curse of these regions. Of rivers there are none, and rain falls only between October and March, during which time the water is gathered in large cisterns and tanks. Dates, senna, millet, and barley are the common crops; cotton, tobacco, saffron, and wheat are cultivated, and in many places olive-groves, vineyards, orchards, and gardens yield fruit, wine, and vegetables in abundance and of superior quality. Cattle, sheep, horses, mules, and poultry are abundant; mats, carpets, and earthenware are manufactured. The area of the country is estimated at 100,000 sq. m.; the pop. at 750,000, consisting of Berbers, Moors, and Jews. The government is a complete despotism, and consequently the population and the prosperity of the country are steadily decreasing.

**Tripoli,** capital of the state of Tripoli, on a rocky promontory in the Mediterranean, has an excellent harbor, the only one along this coast for several hundred miles. The town is most miserably built, but it is strongly fortified, surrounded with massive walls, and defended by forts, and it contains some magnificent though now somewhat decayed edifices; as, for instance, the palace of the pasha, the principal mosque, the triumphal arch of Verus, etc. Leather, carpets, mantels, and tobacco are manufactured, and a great trade with Timbuctoo, Bornu, and other places S. of Sahara is carried on. Both manufactures and trade, however, are said to be rapidly declining. P. 30,000.

**Tripoli** [Arab. *Tarâbulus*], seaport-town of Syria, some 40 miles N. N. E. of Beyroot, and about the same distance N. W. of Baalbec. The ancient town consisted of three distinct quarters, not quite an eighth of a mile apart, settled by colonists from Aradus, Sidon, and Tyre, and was therefore called *Tripolis* ("the triple city") by the Greeks (Diodorus Siculus, xvi. 41). The principal settlement appears to have occupied a triangular promontory running out into the Mediterranean. N. of this was the harbor, now called *Mina;* and S. of it the other quarter. A wall 18 feet thick, which may still be traced, ran across the broad neck of the promontory nearly N. and S. Westward of this wall the whole promontory is strewn with ruins which have been quarried for centuries. The modern town, solidly built, stands nearly 2 miles from the sea, embosomed in orchards of orange, lemon, apricot, and apple trees. El-Kadisha ("the sacred river"), which starts near the famous grove of cedars on Mount Lebanon, runs through the town, rendering the whole plain exceedingly fertile, but also at times unhealthy. Just S. of the Kadisha, on a hill some 500 or 600 feet above the level of the sea, stands an old castle, built by the crusaders about 1109, and now garrisoned by Turkish troops. As Beyroot advances, the commerce of Tripoli is declining more and more, its harbor being shallow and unsafe. French steamers call here about once a week. P. nearly 20,000, more than half of whom are Mohammedans. The rest are mainly Greek Christians of Greek descent. An American Protestant mission was established here in 1848. R. D. HITCHCOCK.

**Tripolit'za,** town of Greece, was before 1827 the capital of the Morea, and had over 20,000 inhabitants, but in 1828 it was razed to the ground by the Turks. P. 11,477.

**Tripp,** county of S. Dakota, intersected by the Keya Paha, and watered in the N. by affluents of White River; surface usually of undulating prairies, but in the N. part is Turtle Hill, 2340 feet high. Area, about 1500 sq. m.

**Triqueti', de** (HENRI), BARON, b. at Conflans, department of Loiret, France, in 1802; studied at the Academy of Art in Paris; exhibited in 1831 several pictures and a marble group, *Death of Charles the Bold,* which latter attracted much attention; devoted himself subsequently exclusively to sculpture; was for a long time engaged in the interior decoration of the Madeleine. D. at Paris in 1874. The most remarkable of his works are *Dante, Jesus feeding the Birds, Bacchus, The Holy Family,* etc., besides a great number of busts.

**Trisec'tion of Angle.** The trisection of an angle was a celebrated problem among the ancient geometers. It belongs to the same class of problems as the duplication of the cube and the insertion of two geometrical means between two given lines; but, like them, it has withstood all the attacks of elementary geometry. It may, however, be solved by means of an auxiliary curve called a conchoid; it can also be solved in several ways by the principles of higher geometry.

**Trismegistus.** See HERMES TRISMEGISTUS.

**Trist** (NICHOLAS P.), b. in Virginia about 1798; married a granddaughter of Thomas Jefferson; was an intimate friend of Andrew Jackson, by whom he was appointed U. S. consul at Havana, where he became intimately acquainted with Spanish-American history and politics; became chief clerk of the U. S. state department 1845, and negotiated in Mexico (Feb., 1848) the Treaty of Guadalupe Hidalgo, which terminated the Mexican war. D. at Alexandria, Va., 1875.

**Tristan' da Cu'nha,** the largest of a group of three islets in the Southern Atlantic, in lat. 37° 3′ S., lon. 12° 19′ W., comprises an area of about 40 sq. m. It is mountainous, its centre rising into a volcanic peak 8326 feet high, but fertile, well provided with water, and healthy. It was discovered in 1506 by the Portuguese navigator Tristan da Cunha, and occupied by British troops from Cape Town during the captivity of Napoleon on St. Helena. The inhabitants, about 60 in number, descend from this garrison. The other two islets are Inaccessible Island and Nightingale.

**Tri'then** (FREDERICK HENRY), b. in Switzerland in Feb., 1820; spent his childhood in Odessa, Russia; was

educated at the University of Berlin, where he studied Sanskrit and comparative philology under Bopp; settled in England 1841; was assistant in the printed books department of the British Museum 1844–45; made a tour through Russia, Turkey, and Egypt for philological purposes 1845–47, and was appointed professor of modern languages at the Taylor Institution, Oxford, 1848—a post from which he retired in 1850 in consequence of an attack of insanity. D. near Odessa, Russia, Apr. 27, 1854. He was one of the writers for the *Biographical Dictionary* of the Society for the Diffusion of Useful Knowledge, and wrote many of the articles on Oriental subjects in the *Penny Cyclopædia*.

**Tri'ton** [Gr. Τρίτων], in Greek and Roman mythology, a marine deity, sometimes the son of Poseidon and Amphitrite, sometimes a subordinate sea-god, and sometimes even localized as the god of the Libyan Sea. In art he is represented as a young man with the body ending in two fish-tails, and with a trumpet of conch-shells.

**Triton,** a common name for the aquatic salamanders (water-newts), especially for those of the genus *Triton*. The tritons are strictly aquatic, have a compressed tail, and breathe by lungs, frequently coming to the surface of the water for fresh air. North America abounds in species.—TRITON is also the name of a genus of gasteropod mollusks of family Muricidæ. The tritons afford many of the shells called conchs. (See CONCH-SHELL.) There are about 100 living and 50 extinct species, mostly from warm seas.

**Tri'tone,** in music, the interval of the superfluous or augmented fourth, which consists of three whole tones, or rather of two whole tones and two semitones, as C—F♯, G—C♯, an interval studiously avoided by the old musicians.

**Tritura'tion** [Lat. *trituro*], an operation with the mortar and pestle, by means of which a solid substance may be more finely and uniformly divided than in the ordinary process of pulverization. To effect this, it is necessary that a circular motion, accompanied by pressure, should be given to the pestle, which should be brought in contact with all parts of the mortar. J. P. BATTERSHALL.

**Trit'yl,** or **Prop'yl,** one of the hypothetical "alcohol-radicals," recognized by many, at one time, as having an ascertained existence, but now regarded generally by chemists—with the rest of these mythical radicals—as only representing a certain amount of *equivalence* in compounds, one assumed molecule of trityl, represented by $C_3H_7$, being deemed equivalent to one molecule of hydrogen, H. Under VOLUMES, MOLECULAR, it is shown by the present writer that this group, $C_3H_7$, really represents $H.3H_2C$. A compound has been obtained which has been supposed to be ditrityl $(C_3H_7)_2$, for which Schorlemmer gives the density .6769 at 10°, boiling at 136.5° F. It has, however, the real constitution $H_2.6H_2C$, the computed density at melting ice being .685. HENRY WURTZ.

**Tri'umph** [Lat. *triumphus*], in ancient Rome, a state pageant in which a victorious general or naval commander, preceded by the senate and by the spoils and prisoners, was drawn by four horses along the Sacred Way and followed by his army to the temple of Capitoline Jove, where solemn sacrifice was offered. As a rule, no one who had not held the office of dictator, consul, or prætor could triumph. The war, too, must be one against foreign foes, and one which absolutely extended the power of the state. There were also other conditions, few of which were uniformly observed. The triumphal procession was very brilliant, and sometimes lasted two or three days. It was customary to put to death some of the hostile chiefs during the triumphal march. A slave rode in the chariot with the victor, and, according to Tertullian, from time to time repeated the words, "Look behind thee; remember that thou art a man." The first triumph was probably that of Tarquinius Priscus over the Sabines; the last was that of Belisarius at Constantinople over the Africans, in 534 A. D.

**Trium'viri,** or **Tres'viri** [Lat. *tres*, "three," and *viri*, "men"], in ancient Rome, a board of three men appointed for some special public duty. A number of kinds of triumviri are specified by Roman authors. In B. C. 60, Julius Cæsar, Pompey, and Crassus formed a coalition for the conduct of public affairs; this is called the "first triumvirate," but the men who constituted it bore no official title of *triumviri*, and exercised only an usurped power. The "second triumvirate," that of Octavian, Mark Antony, and Lepidus, was officially recognized by the senate, and the three magistrates bore the name of *Triumviri reipublicæ constituendæ* ("triumvirs for arranging public affairs").

**Trivium.** See ARTS, DEGREES IN.

**Trivoli,** tp., Peoria co., Ill. P. 1234.

**Trochilidæ.** See APPENDIX.

**Trochu'** (LOUIS JULES), b. at Le Palais, department of Morbihan, France, May 12, 1815; made his military career chiefly as aide-de-camp and in the ministry of war. He was aide-de-camp to Marshal Bugeaud in Algeria, to Marshal St. Arnaud, and afterward to Gen. Canrobert, in the Crimea, and distinguished himself at the storming of the Malakoff as commander of the 1st brigade of the 1st French corps. On account of his scientific education he was generally considered as the future minister of war, but by his pamphlet *L'armée française en 1867*, which ran through 20 editions in three years, and revealed the weaknesses of the French army, he lost the favor of the emperor Napoleon, and received no more offices of confidence. This circumstance, however, made him a favorite with the opposition, and when in 1870 the French army broke down, he was called to the imperial council and appointed governor of Paris Aug. 17. When the revolution broke out in Paris after the disaster of Sedan, he was also made commander-in-chief of all the forces defending the capital, which position he held up to the surrender of the city.

**Trœ'zen,** or **Trœze'ne,** one of the oldest cities of ancient Greece, in a fertile plain (Trœzenia) which occupied the south-eastern part of Argolis. It was founded by Ionian settlers, and was under the authority of Argos at the time of the Trojan war; but although it subsequently, by the conquest of Peloponnesus by the Dorians, received a colony of Doric settlers and became a Doric city, it still maintained its Ionian sympathies and traditions. It early grew into an important maritime place. It founded Halicarnassus and Myndus in Caria, and after the battle of Thermopylæ its harbor was appointed the place of rendezvous for the Greek fleet. It received the Athenians who fled from Xerxes with the greatest kindness, and fought with five ships and 1000 men in the battles of Artimisium, Salamis, Platæa, and Mycale. Up to the Peloponnesian war it was a firm ally of Athens, but after that time it sided with Lacedæmon, and subsequently it became a Macedonian possession. In the second century of the Christian era it was still a splendid city, as seen from the description by Pausanias of its public buildings, of which some ruins are still found near the village of *Damala*.

**Trog'lodytes** [Gr. τρωγλοδύται, from τρώγλη, a "cave," and δύνειν, to "enter"], with the ancient writers the name of races found N. of the Caucasus in Mauritania, but especially along the coasts of the Red Sea, both the Arabian and the African, which region was called *Regio Troglodytica*. Common to these tribes was their low stand-point of civilization. They lived in caves and depended on herds of cattle for their livelihood. The name is now applied in natural history to a genus including the chimpanzee and the gorilla.

**Troglodytinæ.** See APPENDIX.

**Trogonoph'idæ** [from *Trogonophis*—τρώγειν, to "eat," and ὄφις, "serpent"—the typical genus], a family of reptiles of the order Sauria and sub-order Amphisbænoidea, characterized by the development of the teeth on the edge of the jaws. The body is elongated and cylindrical; scales or shields oblong quadrangular, and disposed in transverse rings, the lateral line sunken, narrow, covered with a few minute scales; pre-anal pores wanting; the head is oblong and depressed, but rounded below; the nostrils are lateral, and in large nasal shields; the teeth conical, and inserted on the edge (and not on the inner side) of the jaws; the legs are undeveloped; the tail conical and acute. These characters have been attributed to the family by Dr. Gray, who first distinguished it as such. It is based on a single species, *Trogonophis Wiegmanni*, an inhabitant of Northern Africa. THEODORE GILL.

**Tro'gus Pompe'ius,** a Latin author descending from the Gaulish tribe of the Vocontii. His grandfather received the citizenship of Rome from Cn. Pompeius, his father was private secretary to Cæsar, and he himself wrote, probably about 20 B. C., a work, *Liber Historiarum Philippicarum*, of which there exist a few brief fragments quoted by Vopiscus, Jerome, Augustine, Orosius, Priscian, and others, and a series of excerpts by JUSTINUS (which see; see also Heeren, *Commentationes de Trogi Pompeii ejusque Epitomatoris Justini Fontibus et Auctoritate*).

**Tro'ia,** town of Italy, province of Capitanata, on the Colone, manufactures coarse woollen cloth. P. 5473.

**Troi'na** [probably *Trajanopolis*], town of Sicily, province of Catania, on a mountain from which the river Troina takes its rise. The principal church has some features of Norman architecture, and contains two pictures by Velasquez. Troina was one of the first Sicilian towns to declare for the Normans, and Roger and his queen were warmly received here, but, finding their new lord intolerable, the inhabitants called back the Saracens, and with their aid defended the city for four months against the northern invaders, and were then forced by famine to submit. The pasturage in this neighborhood is excellent, and fish and game are abundant. P. 10,193.

**Trois Pistoles′,** p.-v. of Temiscouata co., Quebec, Canada, on Grand Trunk Railway and on the S. side of the St. Lawrence, 160 miles below Quebec. Excellent limestone abounds. The place has a lively trade, a convent, and some manufactures. P. about 650.

**Tro′ja,** town of Southern Italy, province of Foggia, on a high hill, at the foot of which flows the rapid torrent Celone. It contains churches and other buildings worthy of notice, and the suppressed convents have furnished important additions to the national library at Naples. In 1093, Pope Urban II. here assembled a council for the reform of the clergy, and in 1116 another was held here by Pope Paschal. The bishopric of Troja depends directly on the Holy See. The district is fertile, and well supplied with wood and pasturage. P. 6337.

**Trol′lope** (Anthony), second son of Frances M. Trollope, b. in 1815; was educated at Winchester and Harrow schools, and from 1834 to 1867 was connected with the British postal service, for which he made many voyages, and subsequently travelled extensively in the U. S., the West Indies, and Australia. In 1869 he was an unsuccessful candidate, in the Liberal interest, for Beverly. He has written several books of travel and many novels. Most of his later novels were originally published serially, and simultaneously in British and American magazines. His published works are—*The Macdermots of Ballydoran* (1847), *The Kellys and the O'Kellys* (1848), *La Vendée* (1850), *The Warden* (1855), *Barchester Towers*, his first decided success (1857), *The Three Clerks* (1857), *Doctor Thorne*, one of his best works (1858), *The Bertrams* (1859), *The West Indies and the Spanish Main*, sketches of travel (1859), *Castle Richmond* (1860), *Framley Parsonage* (1861), *Tales of All Countries*, stories which had appeared in various magazines (1861; 2d series 1863), *Orley Farm* (1862), *The Struggles of Brown, Jones, and Robinson* (1862), *North America*, a book of travel (1862), *Rachel Ray* (1863), *The Small House at Allington* (1864), *The Belton Estate* (1864), *Hunting Sketches* (1864), *Can You Forgive Her?* (1865), *Miss Mackenzie* (1865), *Clergymen of the Church of England* (1866), *Travelling Sketches* (1866), *The Claverings* (1867), *The Last Chronicles of Barset* (1867), *Phineas Phinn, the Irish Member* (1869), *He Knew He was Right* (1869), *Sir Harry Hotspur of Humblethwaite* (1870), *The Vicar of Bullhampton* (1870), *Ralph the Heir* (1871), *The Golden Lion of Granpère* (1872), *Phineas Redux* (1873), *Australia and New Zealand*, a book of travel (1873), *The Way we Live Now* (1874), *The Prime Minister* (1875), and a series of *Short Stories*, now (1876) publishing simultaneously in England and America. A peculiarity of many of his novels is that some of the characters figure in several of them, although no novel is strictly a continuation of a preceding one.

**Trollope** (Edward), M. A., b. Apr. 15, 1817, the younger son of a baronet; was educated at Eton and at Christ Church, Oxford, where he graduated in 1839; took holy orders; received successive preferments, becoming archdeacon of Stow and prebendary of Liddington in 1867. He has published several works on architecture and archæology, the principal of which are—*Illustrations of Ancient Art* (1854), *Life of Pope Adrian IV.* (1856), *Introduction of Christianity into Lincolnshire* (1857), *Labyrinths, Ancient and Mediæval* (1858), *Fens and Submarine Forests* (1859), *Monastic Gatehouses* (1860), *Life of Hereward, the Saxon Patriot* (1861), *Battle of Bosworth Field* (1862), *Shadows of the Past* (1863), *The Raising of the Royal Standard at Nottingham* (1864), *Spilsby and other Churches* (1865), *Norman Sculptures of Lincoln Cathedral* (1866), *Grantham and other Churches* (1867), *The Roman Ermine Street* (1868), *The Norman and Early English Styles of Gothic Architecture* (1869), *Boston and other Churches* (1870), and *Sleaford and the Wappentakes* (1872).

**Trollope** (Frances **Milton**), b. probably in 1790, but perhaps ten or twelve years earlier. She was the daughter of a clergyman, and in 1809 contracted an unhappy marriage with Thomas Anthony Trollope, a barrister of good family, by whom she had six children. In 1829 she went to America, and attempted to establish herself in some kind of business at Cincinnati; failing in this, she returned to England, where she published her *Domestic Manners of the Americans* (1831), a broad and rather offensive caricature, which met with great favor in England. She followed up this success by writing a novel, *The Refugee in America* (1832); subsequently travelled on the continent of Europe, publishing narratives of her adventures and observations, and entered upon a career of literary activity, which, commencing late, lasted more than twenty years, the greater part of her works being novels. About 1844 she went to Italy, where her eldest son was residing, and where she passed the remainder of her long life. Her writings comprise more than forty separate works, most of them being in several volumes. Among her novels are—*The Abbess* (1833), *Tremordyn Cliff*, one of her best (1835), *Life and Adventures of Jonathan Jefferson Whitelaw* (1836; republished in 1857 under the title *Lynch Law*), *Life and Adventures of Michael Armstrong, a Factory Boy* (1839), *Charles Chesterfield, the Adventures of a Young Genius* (1841), *The Barnabys in America* (1843), *Father Eustace, a Tale of the Jesuits* (1846), *Lottery of Marriage* (1849), *Petticoat Government* (1850), *Life and Adventures of a Clever Woman* (1854), *Gertrude, or Family Pride* (1855), and *Fashionable Life, or Paris and London*, her last work (1856). D. in Florence Oct. 6, 1863.

**Trollope** (Thomas Adolphus), eldest son of Frances M. Trollope, b. Apr. 29, 1810; was educated at Winchester and Oxford; travelled on the Continent; published *A Summer in Brittany* (1840), *A Summer in Western France* (1841), and took up his residence in Florence, which has since been his home. He has been a constant contributor to English literary periodicals, and is now the Italian correspondent of the New York *Tribune*. Most of his writings relate directly to Italian history, life, and manners. Among these are—*Impressions of a Wanderer in Italy* (1852), *The Girlhood of Catharine de' Medici* (1856), *A Decade of Italian Women* (1859), *Tuscany in 1849 and 1859* (1859), *Filippo Strozzi* (1860), *Paul V. the Pope and Paul the Friar* (1860), *La Beata* (1861), *Marietta* (1862), *A Lenten Journey in Umbria and the Marches of Ancona* (1862), *Giulio Malatesta* (1863), *Beppo the Conscript* (1864), *History of the Commonwealth of Florence* (4 vols., 1865), *Gemma* (1866), and *Leonora Cassaloni* (1869). On subjects not Italian he has published—*Lindisfarn Chase* (1864), *Artingdale Castle* (1867), *Dream Numbers* (1868), *The Garstangs of Garstang Grange* (1869), *A Siren* (1870), and *Durnton Abbey* (1871).—Theodosia Garrow (married to Mr. Trollope in 1848; d. in 1865) was an artist, musician, and author. She translated into English Niccolini's tragedy, *Arnold da Brescia* (1846), published critiques upon Villari's *Life of Savonarola* and other Italian works; and contributed to the London *Athenæum* a series of letters on *The Social Aspects of the Italian Revolution* (1861).

**Trollope** (William), D. D., of Pembroke College, Cambridge; has published several valuable works in theology and philology, among which are—*Pentalogia Græca* (1825), *Iliad of Homer, with English Notes* (1827), *Critical, Philological, and Exegetical Commentary on the New Testament* (1828), *The New Testament in Greek, with English Notes* (1837), *Greek Grammar to the New Testament* (1841), *Greek Liturgy of St. James, with translation* (1848), and *Commentary on the Liturgy and Ritual of the United Church of England and Ireland* (1861).

**Trolls,** in the Norse and Teutonic mythologies, and in the folk-lore of the more recent times, a class of powerful spirits, hostile to man, and very often circumvented and defeated by men, since their strength was associated with extreme supineness of understanding. There is a theory that holds that the Trolls represent the Lapps and Finns who were gradually repelled by the Scandinavian race; but thus far this hypothesis has no support save in what inherent probability it may possess.

**Trom′bone** [It., "great trumpet"], a large brass wind instrument of the trumpet species, supposed to be the same as the sackbut of early writers. Its peculiarity consists in the facility of deepening the tones by means of sliding tubes, making it one of the most effective instruments in an orchestra. There are three kinds, alto, tenor, and bass, besides the double-bass, which is rarely used.

**Tromp, van** (Maarten Harpertzoon), b. at Briel in 1597; received his education in the Dutch navy, and served with great distinction under Admiral Heijn. In 1639 he was made an admiral, and gained a European fame by his two great victories in the same year over the Spanish fleet off Gravelines and in the Downs. He was less successful in the war between England and Holland, and having been defeated by Blake, he even lost his command for some time in 1652. He was soon reinstated, however, and defeated Blake completely in the Downs, Nov. 29, 1652. On Aug. 6, 1653, he attacked the English fleet between Scheveningen and the Maas. The battle lasted two days, but was finally lost by the Dutch; Tromp himself was killed Aug. 10. He is buried in the church of Delft, where a splendid monument has been erected to him.—His son, Cornelis van Tromp, b. at Rotterdam Sept. 9, 1629, achieved almost an equal fame, held the highest positions in the Dutch navy, and served with great distinction for some time in Denmark. D. at Amsterdam May 29, 1691.

**Tro′na** [probably from *natron*, Ger. for "soda"], the mineralogical name of a native carbonate of soda, the most common native form of that salt. It has the composition when crystallized $O_8C_3Na_4.4H_2O$, which may possibly indi-

cate the constitution $2(Na_2O.CO_2).(H_2O.CO_2).3H_2O$. This hypothesis, making one-fourth of the hydrogen basylic, obtains strength from the one density-figure on record, 2.11 (cited by Dana), which by the writer's geometric law of volumes will give the sodium the volume it has in the (so-called) hydrate, the sulphide, the sulphates (the heavier allotropes), the anhydrous carbonate, and the bicarbonate, while the basylic hydrogen has also the volume found in the "hydrate." Trona was originally found in soda lakes in Africa; extensive beds are now found in Nevada. The crystals are monoclinic. Another name sometimes given to it is *urao*. HENRY WURTZ.

**Trond'hjem,** the ancient *Nidaros*, the oldest town of Norway, is beautifully situated on the southern shore of Trondhjemsfjord, in lat. 63° 25′ N. Of its cathedral, which once was the largest church-building in Scandinavia, only the choir remains, in which the kings are crowned. Its breweries and distilleries are extensive and celebrated. Much copper, salt and dried fish, and timber is exported. P. 20,858.

**Troop'ial,** a name given to several small conirostral birds, mostly Icteridæ. Thus, the BOBOLINK (which see) or rice troopial, the cow bunting or cow troopial (*Molothrus pecoris*), and many others are occasionally called by this vague name. The name seems to have at first belonged to birds of the genus *Cassicus*, and to have been given on account of the vast flocks or *troops* of some of the species.

**Troost** (GERARD), M. D., b. at Bois-le-Duc, Holland, Mar. 15, 1776; educated at Amsterdam and Leyden; studied medicine and natural science; served in the army, both as a private soldier and afterward as a medical officer; was enabled by Louis Bonaparte, king of Holland, to devote himself to his favorite studies in Paris, where he translated Humboldt's *Aspects of Nature* into Dutch; embarked in 1809 on a scientific mission to the East Indies, but was taken by a French privateer and carried to Dunkirk; resided a year at Paris; proceeded to the U. S. 1810; settled at Philadelphia, where he was one of the founders and the first president of the Academy of Natural History (1812–17); established at Cape Sable, Md., the first alum-factory in the U. S. 1814; was appointed professor of mineralogy in the Philadelphia Museum 1821; settled at New Harmony, Ind., with Owen and McClure 1825; became professor of chemistry and mineralogy in the University of Nashville 1827, and was State geologist of Tennessee 1830–49. D. at Nashville Aug. 14, 1850. His mineral and geological cabinets were the largest in the U. S. Author of geological reports upon Tennessee and upon the environs of Philadelphia (1826), and of numerous contributions to periodicals.

**Tropæola'ceæ** [Lat. *tropæum*, "trophy"], a botanical order consisting exclusively of the genus Tropæolum, including the NASTURTIUM (which see), the Indian cress, and many other climbing plants, all originally from South America, many of which are highly ornamental and susceptible of cultivation. This genus is of doubtful validity, having been separated from Geraniaceæ, in which many botanists still include it.

**Tropæolum.** See TROPÆOLACEÆ.

**Trope** [Gr. τρόπος, "turn," a "change," a "figure of speech"], in rhetoric, the substitution of a literal expression by one imaginative, and thus more striking and impressive. The three principal tropes are metaphor, metonymy, and synecdoche; by some, allegory and personification are also considered tropes.

**Trope'a,** town of Southern Italy, of ancient but unknown origin, in the province of Catanzaro, on a steep promontory between the Gulf of Sant' Eufemia and that of Gioja. It is a place of considerable industry, and carries on a small coasting-trade by means of its little harbor. The vicinity furnishes a peculiar kind of earth known as *caolino*, or *arena tenera*, which is much used in the manufacture of porcelain, and is even employed in making the Ginori majolica. P. 6337.

**Tro'phy** [Gr. τρόπαιον, from τρέπειν, to "turn"], among the ancient Greeks a memorial erected on the battlefield by the victors, on the spot where the enemy *turned* to flight or retreat. Originally, trophies were of wood or of simple armor affixed to a tree. It was equally unlawful to destroy or repair a trophy, since it was very justly considered unwise to perpetuate hostile feelings. In later times the Romans adopted the custom of erecting trophies.

**Tropic-Bird.** See PHAËTONIDÆ.

**Tropics.** See SOLSTICE, CAPRICORN, CANCER.

**Troplong'** (RAYMOND THÉODORE), b. at Saint-Gaudens, department of Haute-Garonne, France, Oct. 8, 1795; studied law; practised as an advocate; held various judicial positions; was made a peer of France in 1846, president of the court of Paris in 1848, a senator and president of the court of cassation in 1852. D. Mar. 2, 1869. His principal work is *Code civil expliqué* (28 vols., 1833–58), parts of which—*Des Priviléges et Hypothèques* (4 vols.), *De la Vente* (2 vols.), *De la Prescription* (2 vols.), *Du Contrat de Mariage* (4 vols.), *Des Donations* (4 vols.)—have been published separately, and often reprinted. He also wrote *De l'Influence du Christianisme sur le Droit civil des Romains* (1843) and *Du Pouvoir de l'État sur l'Enseignement* (1844), etc.

**Trop'pau,** town of Austria, capital of Silesia, on the Oppa, is fortified, contains many palatial edifices, and is generally well built. Its manufactures comprise woollen and linen fabrics, soap, leather, and ironware, and its trade is very active. The famous Congress of Laybach held its first sittings here from Oct. to Nov., 1820. P. 16,608.

**Trot'wood,** p.-v., Montgomery co., O., on Dayton and Western R. R. P. 42.

**Troubadours.** See TROUVÈRES.

**Troup,** county of W. Georgia, bordering on Alabama, intersected by Chattahoochee River, and crossed by Atlanta and West Point R. R.; surface hilly, soil generally fertile. There are saw-mills and manufactories of boots and shoes, cotton goods, machinery, and iron castings. Staples, cotton, Indian corn, oats, wheat, and sweet potatoes. Cap. La Grange. Area, 370 sq. m. P. 17,632.

**Troup** (GEORGE MCINTOSH), b. in Alabama Sept. 8, 1780; graduated at Princeton 1797; became a lawyer in Georgia; was chosen to the legislature 1800; sat in Congress 1807–15; was U. S. Senator 1816–18, and again 1829–34, and governor of Georgia 1823–27; was an eloquent speaker and an ardent advocate of the doctrines of State rights and State sovereignty. D. in Lawrence co., Ga., May 3, 1856. His *Life* was published by E. J. Harden (Savannah, 1859). (See also UNITED STATES.)

**Troup** (ROBERT), LL.D., b. in New York City in 1757; graduated at Columbia College 1774; studied law under John Jay; entered the Revolutionary army as lieutenant 1776; became an aide to Gen. Woodhull; was taken prisoner at the battle of Long Island; confined in the Jersey prison-ship and the provost prison, New York; exchanged in 1777; became aide to Gen. Gates at Saratoga; was secretary to the board of war 1778–79; studied law at Princeton under Judge Patterson; was for several years U. S. district judge in New York and member of the legislature; was an intimate friend of Hamilton, and during his later years resided at Geneva, N. Y., as agent of the great Pulteney estate. D. at New York City Jan. 21, 1832. Author of occasional political pamphlets.

**Troups'burg,** tp., Steuben co., N. Y. P. 2281.

**Troupsburg Centre,** p.-v., Steuben co., N. Y. P. 100.

**Trous'dale,** county of Middle Tennessee, intersected in the S. E. part by Cumberland River. Formed from portions of other counties since the census of 1870. Cap. Hartsville.

**Trousseau'** (ARMAND), b. at Tours, France, Oct. 14, 1801; studied medicine at Paris; was sent in 1828 by the government to investigate endemic and epidemic diseases, at that time prevalent in the central departments of France; gained the grand prize of the Academy of Medicine in 1837 for his work on *Phthisie laryngée;* was appointed professor of therapeutics in the Faculty of Medicine at Paris in 1839. D. there June 23, 1867. He wrote *Traité élémentaire de Thérapeutique et de Matière médicale* (1836), *Nouvelles Recherches sur la Trachéotomie dans la Période extrême du Croup* (1851), besides minor medical essays.

**Trout.** See APPENDIX.

**Trout Creek,** p.-v. and tp., St. Clair co., Ala. P. 933.

**Trouvères.** The earliest example of verse in any of the dialects of *Romance* is the Northern French *Cantilène de Ste. Eulalie*, which, on pretty good grounds, is attributed to the ninth century. Lyrical poetry, however (in the secular sense), seems to have reached its bloom first in the South, and especially in Provence. Fauriel claims for the Provençals also the initiative in epical poetry, but this is more than doubtful, if we may judge by what has come down to us. The *canso* in Provence, like its derivative the Italian *canzone*, was purely lyrical, the mediæval analogue of the classic ode. The *chanson* in Northern France came at last to mean a narrative poem. It was so called because originally chaunted, though latterly a measured *recitative* probably took the place of song. Some sort of instrumental accompaniment of a simple kind seems to have been maintained to the last.

The word *trouvère* (of which *troubadour* is the Southern form) means simply a finder or inventor. The *trouvère* was the composer of poems which were sung at public festivals or at the courts of great barons and princes. Sometimes he also composed the accompanying music. If he

lacked skill or voice, he employed a *jongleur* (*joculator*) to sing his verses for him. The *jongleur* (called also in Northern French *jouglerres*, in Provençal *juglar*) was, as his name implies, a sleight-of-hand performer, who at length degenerated into a kind of Jackpudding. If we may judge by their own account of themselves, the jongleurs were the direct ancestors of the modern Bohemian.

The *chanson de geste* (epical) seems to have been a product of the north of France. It was originally a narrative of deeds (*gesta*), but the term afterward came to mean also a race or family. To the *chanson de geste* succeeded the *Roman d'avantures*, which occupied itself more exclusively with the adventures of a single hero, and whose later prose form (as in *Mélusine*) was the first step toward the modern romance. Without being too exact, we may classify under the former head the Carlovingian cycle of poems—under the latter, the Arthurian. The *fabliau* (*fabula*) was a short tale in verse, often humorous. The *lai* was narrative also, but serious, and the name seems originally to have been confined to subjects drawn, or professing to have been drawn, from British sources. In the epical poetry an imperfect assonance preceded rhyme, and verses of ten syllables those of twelve, the Alexandrine of modern French poetry. Even a certain alternation of masculine with feminine rhymes was in use so early as the thirteenth century. A single assonance or rhyme was continued to the end of each *couplet*, which often extended to more than 100 verses. Sometimes a single rhyme (or something very like it) is kept up through the greater part of a long poem, as in *Parise la Duchesse*. In later poems (as *Amis et Amiles*) the couplet closes with a verse of six syllables, with a superfluous unaccented syllable at the end. In the epic verse (perhaps to avoid monotony) such a syllable (without elision) was allowed after the second foot in pentameter, after the third in hexameter measure. The verse of the *fabliau* and *lai* was always the octo-syllabic couplet, with unessential variations, seemingly dependent on the *ictus*, like those which Milton permits himself in the same kind of metre. The *Roman d'avantures*, and sometimes the *chanson de geste*, might be in octo-syllabics; the rhymed *chronique* was generally so. It should be remembered that *Roman* did not mean *romance*, but something written in a dialect of the Romance tongue.

The trouvères left behind them a vast mass of verse, both epical and lyrical. Their productions cover a space of three centuries, though by the middle of the thirteenth a decline is evident in their epical poetry. The greater part of what remains to us of Provençal poetry is lyrical. The best, as also the earliest, of the *chansons de geste* is that of Roland. It has a simple energy of style and a directness of movement that distinguish it from all others of the same kind. The Provençal poem of *Girartz de Rosilho* equals it in everything but its succinctness, and surpasses it as a picture of manners. The Provençal *Chronicle of the Crusade* against the Albigensian heretics is also interesting. Of the other *chansons*, perhaps the best are *Guillaume d'Orange*, *Ogier*, and *Fierabras*. *Partonopeus de Blois* has more fancy and literary merit than any other *Roman d'avantures*, unless it be *Amadas et Ydoine*. Among shorter narrative poems, *Amis et Amiles* and *Jourdains de Blaivies* may be mentioned as particularly good. The best lyrists among the troubadours are Arnauld Daniel, Bernard de Ventadour, Giraud de Borneil, Bertran de Born, and Pierre Cardinal. Among the trouvères, Rutebeuf is the most distinguished as a lyrical and Chrestien de Troyes as an epic poet. But there were others nameless who deserve equal praise. As a writer of *lais*, Marie de France is pre-eminent. Of the rhyming chroniclers, Benoît de St. Maur, Wace, and Philippe Mousket are the most noted. Besides subjects from mediæval history or legend, the trouvères versified classic themes, notably the tale of Troy and the adventures of Æneas. Didactic poems, like the *Dolopathos* and the *Sept Sages*, drawn from Eastern sources, were also popular, and the *Roman de Renart*, in which beasts are the actors, had a spirit which has kept it alive to our own day. The trouvères had great gayety and inventiveness, especially in the *fabliau*. Boccaccio took some of his best stories from them; Molière owed them the plot of his *Médecin malgré lui;* and La Fontaine went to them for the coarse humor of his *Contes*. The modern drama begins with their miracle-plays. (See Barbazan et Méon, *Fabliaux et Contes;* Méon, *Nouveau Recueil;* Jubinal, ditto; De la Rue, *Essais historiques;* Leon Gautier, *Les Épopées françaises;* Gaston Paris, *Charlemagne poétique;* Raynouard, *Choix des Poésies, Lexique Roman;* Fauriel, *Histoire de la Poésie provençale, Anciens Poëtes français.*) J. R. Lowell.

**Trouville',** town of France, department of Calvados, is finely situated at the mouth of the Tomques in the English Channel, has considerable fisheries of oysters and herrings, and has of late acquired reputation as a watering-place. P. 5671.

**Tro'ver** [O. Fr. *trover*], in law, is the common-law form of action by which damages are recovered for the *conversion* of chattels. It was originally designed for the particular case of the defendant's *finding* a thing belonging to another, and appropriating it to his own use; whence the plaintiff's pleading necessarily contained an averment of the loss and finding—in law French, *trouver*. Although in progress of time the action was extended to all instances of conversion, and the notion of finding became utterly fictitious, yet with the devotion to obsolete forms which long characterized the common law the allegation was and still is retained in the declaration wherever the system of procedure prevails, but is of course meaningless and cannot be denied. In order that the action may be maintained, the plaintiff must have either a general property in the article converted, entitling him to its possession as against all persons, or he must be clothed with a special property in it, entitling him to its possession at least as against the wrongdoer. The action lies not only for the conversion of ordinary chattels, but also of written securities or evidences of debt, such as notes, bonds, mortgages, and the like. The recovery is always pecuniary damages, and their measure is ordinarily the value of the article when converted, with interest. (For a description of what constitutes a conversion, see Conversion.) John Norton Pomeroy.

**Trow'bridge,** town of England, county of Wilts, on the Biss, manufactures woollen cloth, cassimeres, kerseys, and tweeds. P. 11,000.

**Trowbridge,** tp., Allegan co., Mich. P. 1337.

**Trowbridge** (Charles C.), b. in Albany, N. Y., in 1800; removed to Detroit, Mich., in 1819; copied with his own hand all the names given in the census returns of the Territory for 1820; was mayor of Detroit in 1834; was largely engaged in banking as cashier and president until he became president of the Detroit and Milwaukee Railroad Co. in 1863.

**Trowbridge** (Edmund), b. at Newton, Mass., in 1709; graduated at Harvard 1728; became a lawyer of great eminence; was appointed attorney-general of Massachusetts 1749; was for several years a member of the council, but lost favor with the popular party in 1766 on account of lukewarmness in resisting British aggressions; became chief-justice of the supreme court 1767; presided with great fairness at the trial of the British soldiers charged with the "Boston massacre" 1770, and resigned his office 1772 in consequence of the impending conflict with England, and remained in seclusion during the Revolution. D. at Cambridge Apr. 2, 1793.

**Trowbridge** (John Townsend), b. at Ogden, N. Y., Sept. 18, 1827; settled in New York 1846 as a writer for periodicals; removed in 1847 to Boston, where he has since resided; became editor of the *Yankee Nation* 1850; wrote many popular tales over the signature "Paul Creyton;" has been a prominent contributor to the *Atlantic* and other magazines, and has been for several years editor of *Our Young Folks*. Author of *Father Brighthopes* (1853), *Neighbor Jackwood* (1857), *Cudjo's Cave* (1863), *The South* (1866), *The Vagabonds, a Poem* (1864), *Lawrence's Adventures* (1870), and other books.

**Trowbridge** (William Petit), b. in Oakland co., Mich., May 25, 1828. At the age of sixteen he received an appointment as cadet in the U. S. Military Academy at West Point, where he graduated in 1848, taking the first honors of his class in each year. During the last year of his cadetship he acted as assistant professor in the department of chemistry, the exigencies of the Mexican war rendering it impossible to render available for this purpose the services of any competent graduate of the institution. Soon after his graduation, he was ordered back to the Academy as assistant in the astronomical observatory, where he fully prepared himself for duty on the Coast Survey, to which, at his own request, he was ordered. In this survey he at first acted as assistant to Prof. Bache in the primary triangulation of the coast of Maine, which in 1852 was placed under his immediate charge; but previous to entering upon this duty he executed surveys of Appomattox River, in Virginia, with a view to the improvement of its navigation, and after his return from Maine he made similar surveys of James River near Richmond. Here he made surveys of the "Dutch Gap," and recommended the "cut-off" or canal which was subsequently executed. In 1853 he was ordered to the Pacific coast to conduct a series of magnetic and tidal observations extending from San Diego to Puget Sound, a work which occupied three years. Returning from the Pacific coast in 1856, he resigned his commission in the U. S. engineers to accept an appointment as professor in the University of Michigan, but in the following year, at the solicitation of Prof. Bache, he accepted a permanent situation as assistant in the Coast Survey, and

was for some time specially engaged in preparing for publication the results of the Gulf Stream explorations, and in 1860 was sent to Key West to superintend the erection of a permanent self-registering magnetic observatory. Upon the breaking out of the civil war he was assigned to the duty of preparing minute descriptions of the harbors, inlets, and rivers of the Southern coast for the use of the navy. In 1862 he was ordered to execute a hydrographic survey of Narragansett Bay, where there was a design to erect a navy-yard, but the results of the survey were not favorable to the project. He was subsequently transferred to the war department, and was during the remainder of the war in charge of the branch office of the engineer department in New York. In this capacity he constructed many pontoon bridges, and purchased and forwarded large amounts of material to the armies in the field and to the fortifications along the coast, and also superintended the construction of the fort at Willett's Point, the works on Governor's Island, and the repairs of Fort Schuyler. After the close of the war he became vice-president of the Novelty Ironworks in New York, having direction of their working operations—a position which he occupied for four years. In 1870 he was appointed professor of mechanical or dynamic engineering in the Sheffield Scientific School of Yale College—a position which he still holds. He has written many papers which have appeared in scientific journals, numerous memoirs which are embodied in the *Coast Survey Reports*, and a book on *Steam Generators*.

**Troy, Troja,** or **Ilium,** the scene of the Homeric poem, was the metropolis of the Troad, the coast-region extending from Cape Lectum on the Ægæan to Dardanus and Abydus on the Hellespont, and comprising a broad, undulating plain sloping from the foot of Mount Ida to the sea, and traversed by the rivers Scamander and Simoïs. This plain was densely peopled by a mixed race of Pelasgians and Phrygians, and contained many cities (Achilles boasts of having destroyed eleven), of which, however, Troy was by far the most splendid and powerful. It was founded by Ilus, the son of Tros, the grandson of Dardanus, and developed rapidly and magnificently; legend tells how, under Laomedon, the son of Ilus, Neptune himself built its walls. It had a fortified acropolis, called Pergamum, which overlooked the town proper, and contained the temples of the gods and the royal palaces. Under Priam, the son of Laomedon, it reached its highest splendor and experienced its downfall. Priam's son, Paris, carried off Helen, the wife of Menelaus, and in order to punish this outrage a Greek army landed in Troas, besieged Troy for ten years, and finally destroyed it (1184 B. C.), though the Trojan state, the kingdom of Troy, seems to have continued to exist for several centuries after the destruction of its capital. The exact site of the city is disputed. According to the Homeric description it was not situated in the plain, but stood on a hill between the Scamander and the Simoïs, which united in front of it. In ancient times it was generally believed that New Ilium, a city of little importance on the right bank of the Scamander, and of which some ruins are still extant near the present village of *Hissarlik*, occupied the same site as Old Ilium. When this New Ilium was founded is not known. It stood on a low spur of Mount Ida, separating the basins of the Scamander and the Simoïs. In the time of Alexander the Great it existed, and by the partiality which Sulla showed for it, it even became prosperous. There were, however, even in antiquity, scholars who doubted the identity of the sites of New and Old Ilium; as, for instance, Strabo, who moved the site of Old Ilium several miles farther inland to a village called Ilium. But these doubts were hardly noticed; by the ancient world it was generally believed that New Ilium stood on the ruins of Old Ilium. But in 1785, Lechevalier discovered at the village of Bunarbashi, on the left bank of the Mendereh, 5 miles S. of New Ilium, a hot and a cold spring which corresponded to those mentioned in the *Iliad*, and some ruins on the hill of Balidagh, beyond the springs, which he identified as the remains of the citadel of Pergamum. Although further excavations did not bring to light any marked traces of a great city, the views of Lechevalier were generally accepted by classical scholars. (See Lechevalier, *Voyage de la Troade*, 3 vols.) Of late, however, people seem to have returned to the views of antiquity. From 1871 to 1873 the German traveller Schliemann undertook extensive excavations on the hill of Hissarlik, by which he believes to have laid bare the walls of Neptune and Apollo, the palace of Priam, the Scæan gates, etc. (See Schliemann, *Troy and its Remains*, edited by Dr. Philip Smith (London, 1875).)

**Troy,** p.-v. and tp., cap. of Pike co., Ala., on Mobile and Girard R. R., 85 miles from Columbus, Ga., contains 4 churches, 1 female college and 2 academies, a court-house, 1 newspaper, 2 hotels, 1 carriage-factory, and steam-works. Principal business, cotton-planting. P. of v. 1058; of tp. 2650. SIDNEY HERBERT, ED. "MESSENGER."

**Troy,** tp., Mississippi co., Ark. P. 350.

**Troy,** p.-v., Madison co., Ill., on St. Louis and Indianapolis R. R., has a weekly newspaper.

**Troy,** tp., Will co., Ill. P. 918.

**Troy,** tp., De Kalb co., Ind. P. 600.

**Troy,** tp., Fountain co., Ind. P. 3156.

**Troy,** p.-v. and tp., Perry co., Ind., on Ohio River. P. of v. 480; of tp. 6086.

**Troy,** tp., Whitley co., Ind. P. 894.

**Troy,** tp., Clark co., Ia. P. 426.

**Troy,** tp., Iowa co., Ia. P. 862.

**Troy,** tp., Monroe co., Ia. P. 2490.

**Troy,** tp., Wright co., Ia. P. 248.

**Troy,** p.-v., cap. of Doniphan co., Kan., on St. Joseph and Denver City and Atchison and Nebraska R. Rs., 13 miles W. of St. Joseph, Mo., has 2 churches, a fine school-house, 1 newspaper, a private banking-house, a pork-packing establishment, 2 hotels, court-house, and a large steam flouring-mill. P. 639.

SOL. MILLER, ED. "KANSAS CHIEF."

**Troy,** p.-v. and tp., Waldo co., Me. P. 1201.

**Troy,** p.-v. and tp., Oakland co., Mich. P. 1541.

**Troy,** p.-v., cap. of Lincoln co., Mo., on St. Louis and Keokuk R. R. (unfinished), 16 miles from Mississippi River, has 6 churches, excellent schools, 1 bank, 1 newspaper, and 2 fine hotels. The vicinity is rich in coal, iron, glass-sand, and other mineral deposits. Good farming section. P. 703. JOSEPH A. MUDD, ED. "HERALD."

**Troy,** p.-v. and tp., Cheshire co., N. H., on Cheshire R. R., 10 miles S. E. of Keene, has 2 churches, good schools, 1 newspaper, 1 tannery, pail and tub shops, saw and grist-mills, stone-quarries, and a blanket manufactory. P. 767.

H. C. NEWTON, ED. "HOME COMPANION."

**Troy,** city and cap. of Rensselaer co., N. Y., at the head of navigation on Hudson River, at its confluence with Mohawk River, 6 miles above Albany. It is a centre of extensive manufacturing enterprises in iron, cotton goods, stoves, railroad cars, car-wheels, shirts, bells, cable-chain, etc. The first Bessemer steelworks in America was established here. It has large rolling mills, foundries, and blast furnaces. It makes more stoves and shirts than any city of its size in the Union. It has 10 banks, with a capital of $3,000,000, and a savings bank with large deposits. It has 49 churches, a splendid Masonic temple, the celebrated Rensselaer Polytechnic Institute, a Roman Catholic seminary for the education of priests, academies, a female seminary, a fine high school, 3 daily newspapers and 1 Sunday journal, a well-equipped hospital, the Marshall Infirmary, with an insane asylum attached, 2 orphan asylums, with some hundreds of inmates, various benevolent institutions, including church and day homes, etc. A new music-hall, just constructed at a cost of $500,000, the Troy *Times* building, the provincial seminary on a commanding hill, which may be seen at a great distance, with many fine private mansions, are among the architectural boasts of the city. A new iron bridge, costing $250,000, connects Troy with West Troy, which may be properly considered a part of the city, and where is situated the Watervliet Arsenal, with its spacious workshops and elegant grounds, Meneely's celebrated bell-foundry, and other important mechanical and manufacturing industries. Troy is practically the terminus of the Erie and Champlain canals. A daily line of steamers and various lines of barges ply to New York, and lines of propellers to Philadelphia and other points. Troy and Boston *viâ* Hoosac tunnel; Rensselaer and Saratoga, connecting Troy and Whitehall *viâ* Saratoga Springs, whence New York and Canada R. R. will speedily be constructed to Montreal; and New York Central and Hudson River R. R., afford excellent communications to all points. The Rensselaer and Saratoga road is a part of the connections of the Delaware and Hudson Canal Co.'s line, which extends to Rutland on the N. and Binghamton on the S. W. Half-hourly local trains run to Albany, and steam and horse railroad cars connect the city with Cohoes. Horse cars also run to Lansingburg and Waterford every few minutes. Oakwood Cemetery, situate on a high bluff from which a splendid view of the Cohoes Falls is obtained, is becoming famous for its natural attractions and artificial adornments. It contains the remains of Major-Gens. George H. Thomas and John E. Wool. The city has a paid fire department and electric fire-alarm, and has had a steady and healthy if not a very rapid growth, its increase of population being at the rate of about 1000 a year. P. 46,465 (1870).

W. E. KISSELBURGH, MAN. ED. "TIMES."

**Troy,** p.-v. and tp., cap. of Montgomery co., N. C. P. of v. 67; of tp. 882.

**Troy,** tp., Ashland co., O. P. 757.

**Troy,** tp., Athens co., O. P. 1830.

**Troy,** tp., Delaware co., O. P. 800.

**Troy,** tp., Geauga co., O. P. 832.

**Troy,** p.-v., Concord tp., cap. of Miami co., O., on Miami River Canal and on Cincinnati Hamilton and Dayton R.R., has manufactures, 2 national banks, and 2 weekly newspapers. P. 3005.

**Troy,** tp., Morrow co., O. P. 696.

**Troy,** tp., Richland co., O. P. 830.

**Troy,** tp., Wood co., O. P. 1057.

**Troy,** p.-b. and tp., Bradford co., Pa., half-shire town, on Northern Central R. R., 25 miles S. of Elmira, N. Y., has 5 churches, 1 graded school, 1 newspaper, 1 bank, 2 tanneries, 3 hotels, 2 flouring-mills, 4 carriage-factories, 1 steam fire-engine, 2 large foundries and machine-shops, 1 furniture-factory, and 4 secret societies. P. of b. 1081; of tp. 1479. A. S. Hooker, Ed. "Gazette."

**Troy,** p.-v. and tp., Crawford co., Pa. P. 983.

**Troy,** p.-v., cap. of Obion co., Tenn., on Paducah and Memphis R. R., has a weekly newspaper. P. 500.

**Troy,** p.-v. and tp., Orleans co., Vt. P. 1355.

**Troy,** p.-v. and tp., Gilmer co., West Va. P. 867.

**Troy,** tp., St. Croix co., Wis. P. 812.

**Troy,** tp., Sauk co., Wis. P. 995.

**Troy,** p.-v. and tp., Walworth co., Wis. P. 1176.

**Troyes,** town of France, capital of the department of Aube, on the Seine, has many splendid buildings, but is in general an old-fashioned place, partly in a state of decay, partly rebuilding. Its old ramparts have been changed into promenades, and of its many churches, that of St. Urbain and the cathedral are remarkable. Cotton fabrics, cloths, bombazines, calicoes, prints, lace, and hosiery are extensively manufactured; also wax, leather, paper, and sausages. Being the centre of a fertile and well-cultivated district, its general trade is very active. P. 38,113.

**Troy Grove,** p.-v. and tp., La Salle co., Ill. P. 1501.

**Troyon'** (Constant), b. Aug. 25, 1810, at Sèvres, near Paris, where his father held a subordinate position in the porcelain-works; studied painting, and began to exhibit in 1833, first landscapes, after 1847 also animals; attracted great attention in 1852 by his *Vallée de la Touque*, and achieved subsequently a great fame as a landscapist and painter of animals. D. at Paris Feb. 21, 1865. Among his most remarkable pictures are *Before the Storm, Working Oxen, Osier Bed, The Pastures of Trouville*, etc.

**Troy Weight** [from *Troy Novant*, a monkish name for London], a system of weight, employed in England and the U. S. for gold, silver, jewels, and drugs. The troy pound contains 12 ounces. One pound troy is to one pound avoirdupois as 144 to 175. The troy ounce is to the ounce avoirdupois as 192 to 175. (See Weights and Measures.)

**Trüb'ner** (Nicolas), b. at Heidelberg, Germany, in 1817; settled in early life in England; became a bookseller and publisher in London, in which capacity he has rendered eminent service to American bibliography, as well as to Oriental and comparative philology, and is himself distinguished for linguistic attainments, especially in Sanskrit and Basque. He has translated H. Conscience's *Sketches from Flemish Life* (1845); published a *Bibliographical Guide to American Literature* (1855), an extremely valuable work, in the 2d ed. of which (1859) he was aided by Dr. Hermann E. Ludewig, Hon. Benjamin Moran, and Mr. Edward Edwards; issued many elaborate sale-catalogues containing important bibliographical data; and edited Dr. Ludewig's posthumous *Literature of American Aboriginal Languages* (1858).

**Truce.** See International Law, Summary of, by Pres. T. D. Woolsey, S. T. D., LL.D.

**Truce of God,** in the Middle Ages, an institution which sprang up in France and Germany for the repression of private feuds and of the wrongs committed by the strong against the weak, by which nobles and princes bound themselves to keep the peace, to abstain from unlawful wars, and to protect clerics, women, merchants, pilgrims, peasants, and other non-combatants. The Truce of God was first proposed at the Council of Charroux in 989; adopted by the Council of Orleans in 1016, by the Council of Limoges in 1031, and became general, under the name of the Holy Peace, in 1033. In 1034 it was opposed by the bishop of Cambray. In 1041 the clergy of Aquitaine limited it to the time between Wednesday and Monday, not inclusive. It was afterward extended to nearly all the more important fasts, feasts, and holy seasons of the Church. England (1042) and Italy adopted the custom, which was further confirmed by several church councils, among which were the second and third Lateran Councils (1139 and 1179). The final triumph of legal over feudal government did away alike with this institution and with the necessity for it.

**Truckee,** p.-v., Nevada co., Cal., on Truckee River and on Central Pacific R. R., 120 miles E. N. E. of Sacramento, in the midst of a timbered region, has manufactures and a weekly newspaper. P. about 500.

**True** (Charles Kittredge), D. D., b. at Portland, Me., Aug. 14, 1809; studied at the Boston High School and Wilbraham Academy, and graduated at Harvard College in 1832; became pastor of Methodist churches in Massachusetts, Rhode Island, Connecticut, and New York; was principal of the Amenia Seminary, and in 1849–60 professor of moral and intellectual philosophy in the Wesleyan University at Middletown, Conn. He has contributed to religious periodicals, and has published *Shawmut, or the Settlement at Boston* (1845), and *Elements of Logic* (2d ed. 1861).

**True Cross,** or **Holy Rood, The.** After his conversion to Christianity, the emperor Constantine the Great determined to build a church on Golgotha, on the very spot where the cross of Christ had stood. The task presented peculiar difficulties, however. Two centuries before, the place had been utterly disturbed by the emperor Hadrian. The Holy Sepulchre had been filled up, a temple erected to Jupiter and Venus, and pagan altars and statues scattered all over the place. But Helena, the mother of Constantine the Great, happened to stay in Jerusalem at this time (326), and by her order the whole place was cleared and extensive excavations were undertaken. The Holy Sepulchre was discovered; the three crosses were also found, the nails, and the tablet of inscription. The latter, however, had been loosened from the cross, and the question now arose, Which of the three crosses was the true one? Bishop Macarius succeeded in solving the question. Upon his advice the three crosses were carried to the bed of a noble lady of Jerusalem who lay sick unto death. Two of the crosses she touched without any effect, but the moment she touched the third she recovered and rose from her bed. Parts of this cross and the nails Helena sent to her son; the rest was framed in silver and placed in the new church as its most precious relic. Pilgrims gathered by thousands to Jerusalem to see the Holy Rood, and splinters of it encased in gold or silver, and borne as amulets, soon became an important article of commerce. Cyrillus says that at his time the whole world was filled with these splinters, and yet, by a miracle, the cross itself remained entire, as stated by Paulinus of Nola. In commemoration of the discovery of the true cross an annual festival was celebrated in Jerusalem even in the time of Constantine. Subsequently, this festival was introduced also into the Western countries as the *Festum Inventionis Sanctæ Crucis*, and by the synod of Cologne (1281) the 3d of May was appointed the day of its celebration.

**True Friends.** See Sincere Brethren.

**True Inspiration, Community of.** See Inspired, The.

**Truf'fle** [O. Fr. *trufle*], a common name for fungi of the genus *Tuber* and other closely-allied genera (*Terfezia, Chæromyces, Hydnotrya*, etc.). They are nearly all subterraneous in growth, and are from an inch to six inches in diameter. There are several species; one of the best known is *Tuber cibarium* of Europe. The truffle is one of the choicest of the edible fungi. Dogs—or in parts of Europe swine—are employed to scent the truffle, which is dug up by a hoe or fork. Truffles have a rich aromatic taste, and are highly prized in the composition of many sauces and dishes. The culture of truffles has been attempted with some success. Truffles are found to some extent in the U. S.

**Truji'llo,** or **Truxillo,** town of Spain, province of Carceres, is picturesquely situated, but old and decaying. Rearing of cattle, sheep, and swine is its principal industry. It was the birthplace of Pizarro, and he lies buried here. P. 7858.

**Trujillo,** or **Truxillo,** town of Peru, lies in lat. 8° 7′ S., 1½ miles from the Pacific. It was founded by Pizarro, and is well built. Its trade, though not great, is increasing. P. about 8000.

**Trul'lan Syn'ods,** the name of two ecclesiastical councils, the first convened in 680 by the emperor Constantinus Pogonatus for the purpose of reconciling the Monothelites (which see) with the orthodox Church; the second in 692 by the emperor Justinianus II. in order to confirm and enforce the statutes of the fifth and sixth œcu-

menical councils, whence it is also called QUINISEXTUM (which see). The epithet *Trullan* is derived, like that of Lateran, from the place in which the assembly sat—namely, a great hall in the imperial palace of Byzantium, surmounted by an oval dome, τροῦλλα.

**Trulls,** tp., Sanford co., Ala. P. 712.

**Tru'mansburg,** p.-v., Tompkins co., N. Y., on Geneva and Athens R. R., 2 miles W. of Cayuga Lake, contains 4 churches, 1 academy, 1 bank, 1 newspaper, a mowing-machine manufactory, 1 foundry, and 3 hotels. P. 1246.

OSCAR M. WILSON, ED. "SENTINEL."

**Trum'bull,** county of N. E. Ohio, bordering on Pennsylvania, watered by Grand and Mahoning rivers, and intersected by Atlantic and Great Western R. R. and its branches, and by Pennsylvania and Ohio Canal; surface undulating, soil fertile and well adapted for grazing. Bituminous coal is found. There are manufactories of iron, machinery, carriages, cooperage, furniture, flax, bagging, and linseed oil; saw-mills, planing-mills, grist-mills, tanneries, currying establishments, and breweries. Cattle and sheep are numerous. Staples, Indian corn, oats, wheat, potatoes, flax, dairy products, wool, leather, and lumber. Cap. Warren. Area, 625 sq. m. P. 38,659.

**Trumbull,** p.-v. and tp., Fairfield co., Conn. P. 1335.

**Trumbull,** p.-v. and tp., Ashtabula co., O. P. 1084.

**Trumbull** (BENJAMIN), D. D., b. at Hebron, Conn., Dec. 19, 1735; graduated at Yale College 1759; was pastor of North Haven church from 1760 to his death; served as a volunteer soldier, and also as a chaplain, in the war of the Revolution; wrote *A Plea in Vindication of the Connecticut Title to the Contested (Western) Lands* (1776), which influenced the decision of Congress upon the validity of the Susquehanna purchase; *A Complete History of Connecticut 1630–1764* (2 vols., 1797–1818), and began a *General History of the United States of America* (vol. i., 1492–1765, Boston, 1810), left incomplete by his death at North Haven Feb. 2, 1820. He also published *Twelve Discourses on the Divine Origin of the Holy Scriptures* (1790) and several single sermons and occasional pamphlets. The MS. collections employed in the preparation of his *History of Connecticut* are in the library of Yale College.

**Trumbull** (JAMES HAMMOND), LL.D., b. at Stonington, Conn., Dec. 20, 1821; educated at Yale College in the class of 1842; aided Rev. J. H. Linsley in compiling catalogues of the mammalia, reptiles, fishes, and shells of Connecticut 1842–43; was assistant secretary of state of Connecticut 1847–52 and 1858–61; secretary 1861–65; corresponding secretary of the Connecticut Historical Society 1849–63; has been its president, and also librarian of the Watkinson Free Library since 1863; was one of the founders of the American Philological Association 1869, and its president 1874–75, and was appointed in 1873 lecturer in Yale College on the Indian languages of North America, a subject to which he has devoted much time since 1858. Editor of *The Colonial Records of Connecticut 1636–89* (3 vols., 1850–59), Roger Williams's *Key into the Language of America* (Narragansett Club, vol. i., 1866), Lechford's *Plain Dealing* (1867), Pierson's *Some Helps for the Indians* (1873), and of vols. i. and ii. of the *Collections* of the Connecticut Historical Society; author of *The Origin of McFingal* (1868), *The Composition of Indian Geographical Names* (1870), *The Best Method of Studying the Indian Languages* (1871), *Some Mistaken Notions of Algonkin Grammar* (1871), *Historical Notes on the Constitutions of Connecticut* (1872), *Notes on Forty Algonkin Versions of the Lord's Prayer* (1873), *On the Algonkin Verb* (1876); of a narrative of *The Defence of Stonington against a British Squadron in 1814* (1864), and of many other contributions, historical or philological, to literary periodicals and the proceedings of learned societies. He has prepared a glossary to a large portion of Eliot's Indian Bible, being probably the only American scholar now able to read that work.—His brother, HENRY CLAY, b. at Stonington in 1830, was a chaplain in the U. S. army during the civil war, and has since been missionary secretary for New England of the American Sunday-School Union. Author of *The Knightly Soldier, a Biography of Major Henry Ward Camp, 10th Connecticut Volunteers* (Boston, 1865), and other biographical and religious publications.

**Trumbull** (JOHN), LL.D., b. at Westbury (now Watertown), Conn., Apr. 24, 1750; was admitted to Yale College on account of extraordinary precocity at the age of seven years, but did not pursue the course until some years later, graduating 1767; wrote with Timothy Dwight a series of essays in the style of the *Spectator* (1769); was tutor there 1771–73, during which time he published *The Progress of Dulness* (3 parts, 1772–73), a satire on the methods of education; studied law; was admitted to the Connecticut bar Nov., 1773; continued his studies in the office of John Adams at Boston 1773–74; wrote for the political periodicals; settled as a lawyer at New Haven Nov., 1774; published anonymously his poetical *Elegy on the Times* (1774), and in the following year published in Philadelphia the first canto of his *McFingal*, a Revolutionary satire, in Hudibrastic verse (completed in 4 cantos in 1782), of which more than 30 unauthorized editions were sold. He settled at Hartford June, 1781; was associated with Humphreys, Barlow, and Hopkins in the production of *The Anarchiad;* was State attorney for Hartford 1789–95, member of the legislature 1792 and 1800, judge of the superior court 1801–19, and also judge of the court of errors 1808–19; was several years treasurer of Yale College, and in 1825 removed to Detroit, Mich., where he spent his last years with his daughter, the wife of Gov. Woodbridge. D. at Detroit May 10, 1831. Editions of his *McFingal* appeared in 1856, 1860, and 1864, the latter with notes by Benson J. Lossing. His *Political Works* appeared at Hartford (2 vols., 1820).

**Trumbull** (JOHN), son of Jonathan, colonial governor of Connecticut, b. in Lebanon, Conn., June 6, 1756; was graduated from Harvard College in 1773; chose art as his profession; joined the army in 1775 as adjutant; turned his skill as draftsman to account in drawing plans of the enemy's works; was promoted to aide-de-camp of Washington; accompanied the army to New York, and went as adjutant-general with Gates, who was appointed to the command of the Northern army; left the service, discontented, in 1777, and returned to his painting; in 1780 went to Paris, thence to London, and studied with West; was suspected as a spy during the excitement caused by the execution of André, and imprisoned eight months; released through West's intercession, he returned to America in 1782, and remained till peace was concluded, then went back to England to resume his studies. His first great historical work, *The Battle of Bunker Hill,* familiar through engravings, was exhibited in 1786, and was followed by *The Death of Montgomery before Quebec* and the *Sortie from Gibraltar,* both well known. In 1789 he returned to America with the purpose to commemorate on canvas the chief persons and events of the Revolution; among the likenesses taken were several of Washington. His preliminary design being completed, he returned to England as secretary to John Jay, and passed nearly ten years, from 1794 to 1804, in diplomatic service. Four years afterward he went once more and for the last time to England, and remained till 1815, painting indifferently and unsuccessfully. The next seven years were devoted to painting four grand pictures for the rotunda of the capitol at Washington—the *Declaration of Independence,* the *Surrender of Burgoyne,* the *Surrender of Cornwallis,* and the *Resignation of Washington at Annapolis*—pictures that did him less honor than his earlier works. The succeeding years were spent in revising and reducing to uniform size his different subjects. But his fame was declining, his expectations were disappointed, and finally he disposed of his whole collection to Yale College in consideration of an annuity of $1000 for the rest of his life. There were fifty-seven pictures in all, making an interesting collection. Trumbull passed the last twenty-seven years of his life mainly in New York; was president of the American Academy, succeeding De Witt Clinton and preceding S. F. B. Morse, till 1825—a working president, who gave instruction in the art of painting to a great number of pupils. D. in New York Nov. 10, 1843, and buried in New Haven. He was an active, hearty, independent man, as his pictures indicate. Their chief artistic merit is their vigor of action; their principal value is their fidelity in portraiture. His gallery may almost be called a national portrait-gallery.

O. B. FROTHINGHAM.

**Trumbull** (JONATHAN), LL.D., b. at Lebanon, Conn., June 10, 1710; graduated at Harvard 1727; studied theology and was licensed to preach, but soon devoted himself to mercantile business, and ultimately to the law; was elected to the assembly 1733; was its Speaker 1739; became an assistant 1740, to which office he was re-elected twenty-two times; was made judge of the county court and assistant judge of the superior court; was chosen lieutenant-governor 1766, thereby becoming *ex-officio* chief-justice of the superior court; became governor 1769; held that office throughout the Revolution, resigning in 1783; was an energetic supporter of the popular cause; was considered a leader of the "Whigs" of New England, and his advice was much valued by Washington. The popular epithet "Brother Jonathan," now applied as a personification of the U. S., is said to have originated from Washington's habit of addressing him by that familiar title when requesting his opinion. D. at Lebanon Aug. 17, 1785. A *Life,* by Isaac W. Stuart, was published in 1857.

**Trumbull** (Jonathan), son of Gov. Jonathan, b. at Lebanon, Conn., Mar. 26, 1740; graduated at Harvard 1759; was for several years before the Revolution a member of the legislature and Speaker of the house; was paymaster in the army 1775–78; became in 1780 secretary and first aide-de-camp to Gen. Washington, and as such was a member of his family until the close of the war; was a member of Congress 1789–95; Speaker of the House of Representatives 1791–95; U. S. Senator 1795–96; lieutenant-governor of Connecticut 1796–98, and governor from 1798 until his death at Lebanon Aug. 7, 1809.

**Trumbull** (Joseph), son of Gov. Jonathan, b. at Lebanon, Conn., Mar. 11, 1737; graduated at Harvard 1756; was a member of the Continental Congress 1774–75; was commissary-general of the Revolutionary army from July 19, 1775, to Aug. 2, 1777, and a commissioner for the board of war from Nov. 27, 1777, to Apr. 18, 1788, when he resigned on account of ill-health. D. July 23, 1778. His services were highly eulogized in a report made to Congress 1779, and a commission on the sums disbursed by him was voted to his heirs.

**Trumbull** (Joseph), LL.D., grandson of Gov. Jonathan, b. at Lebanon, Conn., Dec. 7, 1782; graduated at Yale College 1801; was admitted to the bar in Windham co. 1803; practised for some time in Ohio; afterward settled at Hartford, where for eleven years he was president of the Hartford Bank (1828–39); was several times chosen to the legislature; sat in Congress 1834–35 and 1839–43; was president of a railroad company and an active promoter of internal improvements, and was governor of Connecticut 1849–50.

**Trumbull** (Lyman), b. at Colchester, Conn., Oct. 12, 1813; educated at Colchester Academy; taught an academy at Greenville, Ga., 1833–36; studied law; was admitted to the bar 1837; settled at Belleville, Ill.; was elected to the legislature 1840; was secretary of state 1841–42, justice of the supreme court 1848–53, member of Congress 1853–55, and U. S. Senator 1855–73; was prominent as a Republican during the war, and became chairman of the judiciary committee 1861; was a delegate to the Philadelphia "Loyalists' convention" 1866, and voted against the impeachment of Pres. Johnson in 1867. Since 1863 he has resided at Chicago.

**Trum'pet** [Ger. and Span. *trompet*], in acoustics, any instrument used for the conveyance to the ear of articulate sound from a distance. In music, a well-known wind instrument, usually consisting of a brass tube some eight feet in length, expanding at the end into a bell-like shape. By means of slides and keys the inflexions of the trumpet have been of late years largely increased.

**Trumpeters,** in ornithology. See Agami.

**Trum'pet-Fish,** a name applied on the North American Atlantic coast to the *Fistularia tabacaria* (family Fistulariidæ), and on European coasts to *Centriscus scolopax* (family Centriscidæ), closely allied families of the order Hemibranchi. The first mentioned is without scales, and has a greatly-elongated snout, with the mouth at the end of a bony tube. The forked tail has one or two long central filaments. The European trumpet-fish has a large and very sharp dorsal spine, and a snout very much like that of the foregoing. (See Bellows-Fish.)

**Trumpet-Flower,** a popular name for various species of *Bignonia* and *Tecoma*, mostly shrubs and woody vines, though in tropical regions some of the species are large trees. They belong to the order Bignoniaceæ. The native species of the U. S. are *Bignonia capreolata*, *Tecoma radicans*, and *T. stans*. The first and second are fine climbers. *T. capensis* from South Africa, *T. grandiflora* from Japan, and other fine species are often cultivated.

**Trunc'ated Cone** or **Pyramid,** the portion of a cone or pyramid included between the base and a secant plane oblique to the base. It differs from a frustum in the fact that the secant plane which determines a frustum is parallel to the base.

**Trunk'-Fish,** a name applied to various fishes of the order Plectognathi and the sub-order Ostracodermi, forming the family Ostraciontidæ. They are so called on account of being encased in an angular case-like development of the integuments, recalling to mind the idea of a trunk. (For further information see Ostraciontidæ.)

**Tru'ro,** town of England, county of Cornwall, at the junction of the Allen and Kenwyn, is the centre of a rich mining district, and exports large quantities of tin and iron ore. It is situated in a hollow surrounded by hills, has a fine church of the time of Henry VII., a mining college, and a library. Pop. 10,999.

**Truro,** a handsome town, cap. of Colchester co., N. S., near Cobequid Bay, at the junction of International and Nova Scotia railways, 61 miles N. of Halifax. It contains a provincial normal school, has a weekly newspaper, and manufactures of woollens, boots and shoes, etc. Shipbuilding, fishing, agriculture, and mining are also carried on near Truro, which is a place of much wealth. P. of subdistrict, 3998.

**Truro,** p.-v. and tp., Knox co., Ill. P. 899.

**Truro,** p.-v. and tp., Barnstable co., Mass., on Cape Cod Bay. P. 1269.

**Truro,** tp., Franklin co., O. P. 1866.

**Truro** (Thomas **Wilde**), Baron, b. in London, England, July 7, 1782; educated at St. Paul's School; studied law under his father, a solicitor; was admitted an attorney 1805; was called to the bar at the Inner Temple 1817; soon became a leader upon his circuit; was a junior counsel in defence of Queen Caroline 1820; became sergeant-at-law 1824, king's sergeant 1827; entered Parliament as a Whig 1831; became solicitor-general, and was knighted Feb. 9, 1840; was attorney-general June to Aug., 1841; bore a very distinguished part in a famous debate on parliamentary privilege; became chief-justice of the common pleas July 7, 1846; was created lord chancellor and Baron Truro by Lord John Russell's administration July 15, 1850, and resigned in Feb., 1852. D. at Southgate, Middlesex, Nov. 11, 1855.

**Truss.** This word is said to be from the Latin *torquere*, to "twist," whence anything twisted or made into a bundle, as a "truss of hay." The technical meanings diverge far from that of the root: in surgery, a bandage used for hernia (see Hernia); in botany, a tuft of flowers; in engineering, the frame of timbers forming the skeleton of a roof (see Roof), and by extension a framework to which rigidity is given by staying and bracing (as distinguished from the *arch* or *suspension* principle), and used for spanning or bridging an interval. (In this connection see Flexure of Beams and Bridge.) J. G. Barnard.

**Trust** [Swed. *trost*], in law, denotes a peculiar species of ownership, whereby the legal estate, either in things real or personal, is held by one person, called the "trustee," and an equitable estate or interest of greater or less extent in the same things is held by another person, called the *cestui que trust* or beneficiary, upon a confidence reposed in the trustee that he will do or permit concerning the property whatever is required by the nature of the beneficiary's interest. Two parties are necessary, and two interests—the one legal, vested in the trustee; the other equitable, held by the *cestui que trust;* but the latter may greatly vary in the rights which it confers and the duties which it imposes. The term "trust" properly applies to and describes this entire dual ownership, and not the separate estate of either party. Trusts were first contrived or distinctively named by the courts of equity in the place of the uses which Parliament had attempted to abolish by the statute of 27 Hen. VIII. They were originally confined to lands, but have since been applied to personal property. The general doctrine of trusts has been greatly enlarged and extended with the growth of equity jurisprudence, and has, in fact, become the chief instrument by which its principles are made effective and the observance of good faith is enforced in the various relations and transactions of mankind. Trusts are separated into the following generic classes: *Active trusts* are those in which, from their very nature and from the terms of their creation, the trustee is charged with some active and positive duties toward the beneficiary in relation to the property, such as its possession, control, and management, the receipt and disposition of its rents and profits, and the like. Although the extent of the trustee's powers and duties may greatly vary, his legal possession of the subject-matter must necessarily accompany his title. *Passive trusts*, sometimes termed *pure* or *simple*, are those in which the trustee has no active management of the subject-matter, but merely holds the bare legal title, while the possession, control, rents, and profits are left to the beneficiary. They are identical with the ordinary "uses" prior to the "statute of uses." *Express trusts* arise from the direct and intentional act of the parties, evidenced by some declaration which is generally contained in a written instrument. The most common examples of this class are those created by marriage settlements, by assignments for the benefit of creditors, by deeds of conveyance, and by wills. The statute of frauds enacts that no trust over or concerning lands shall be created, assigned, or declared except by a deed or conveyance in writing, but that this provision shall not affect trusts created by will and those implied by law. *Implied trusts* do not arise from any express declaration of the parties, but are implied from their acts or omissions. There are two subdivisions of this class, termed "resulting" and "constructive." Resulting trusts are created by equity in accordance with an assumed intention of the parties shown by certain acts, while construc-

tive trusts are enforced by equity without, and even contrary to, the intention of the persons regarded as trustees by reason of acts on their part which are violations of good faith or fraudulent. In cases of implied trust the beneficiary is the equitable owner of the land or other subject-matter, and is entitled to a conveyance or transfer thereof, while equity enforces the trust by compelling the holder of the legal title, or trustee, to execute such conveyance. It is impossible to enumerate here the different varieties of implied trusts. The doctrine concerning them is most comprehensive and salutary. It is the most powerful instrument of equity in restraining fraud and protecting the rights of ownership, and has been freely extended to chattels, things in action, and even money. The Revised Statutes of New York have made great changes in the law of trusts which had been built up by the court of chancery. Implied trusts are, with one particular exception, left unaltered. All express passive trusts of land, and all express active trusts of land, except certain classes, are abolished. The express trusts which are permitted are the following: (1) to sell lands for the benefit of creditors; (2) to sell, mortgage, or lease land for the benefit of legatees or to satisfy any charge thereon; (3) to receive the rents and profits of land, and apply them to the use of any person during his life or for a shorter period; (4) to accumulate rents and profits of land for the benefit of minors during the continuance of their minority. The leading object of this statutory system is to prevent all dispositions of property by way of trust which shall create a perpetuity; that is, which shall suspend the power of alienating the subject-matter for a longer time than the life of the beneficiary. Trusts of personal property are not included in the foregoing provisions, which restrict the creation of express trusts in land to certain specified objects, but they are subject to all the statutory rules for the prevention of perpetuities. This legislation has been followed in several other States. (See TRUSTEE and USE.)

JOHN NORTON POMEROY.

**Trust, Charitable.** In the ordinary private trusts (see TRUST) there must be both a known trustee and a certain, determinate beneficiary, although if the trustee should die, resign, or refuse to accept, the court can supply the place by appointment. But property may be given in trust for specified objects where the beneficiaries are completely indeterminate—as, for example, a gift to aid in spreading the gospel or to relieve the poor—or where the beneficiaries constitute a known class, but the individuals are uncertain, as a gift to provide for the poor of a particular town or to support the scholars in a designated school. Dispositions of this form and nature, whether made by deed or by will, are termed "charitable trusts." They first appeared in the Roman empire after it became Christian, and were both legalized and fostered by several constitutions of Christian emperors. The researches of modern jurists have ascertained and established the fact beyond a doubt that the English court of chancery at an early day, by virtue of its own intrinsic authority, assumed jurisdiction over, upheld, and enforced this species of trusts. In the 43d Elizabeth a statute was passed which regulated the whole subject of charitable gifts. It created a new and special jurisdiction of the chancellor, and contained an enumeration of lawful charitable objects. In proceedings under this legislation the chancellor did not act in his ordinary judicial capacity, but as the direct and personal representative of the Crown. In determining what trusts should be upheld as charitable, the doctrine was firmly settled that all objects embraced within the spirit as well as the letter of the statutory enumeration are lawful. As the result of this principle, all trusts created for any one of the following general purposes are charitable: (1) The support, maintenance, or spread of the Christian religion; (2) the relief, aid, or support of the poor, the sick, or those in any manner disabled; (3) the foundation, erection, or support of institutions, organizations, societies, or other means of general beneficence, either for all needy persons or for particular classes, such as asylums, hospitals, dispensaries, reformatories, and the like; (4) the maintenance and promotion of education, learning, literature, science, or art by the establishment, erection, support, or aid of universities, colleges, schools, libraries, reading-rooms, museums, scientific lectures, societies, art schools or galleries, etc.; (5) any and all objects of interest or advantage to the public, as highways, parks, public gardens, water or gas supplies, and the like. These general classes contain a vast number of particular instances which it is impossible to describe or even to name. In administering charitable trusts the English court of chancery exhibited the utmost liberality in carrying out the designs of the donors and in sustaining the gifts. It even invented and applied a special doctrine, known as the principle of *cy pres* ("as near to"), in pursuance of which, when it was found impossible to carry out the design of the donor in the exact manner which he had indicated, the court would contrive and establish another scheme or mode, preserving the same general intent, and differing as little as possible in its details from the original plan. By the statute 9 Geo. II. ch. 36, it was enacted that no lands or money to be laid out on them shall be given for any charitable use unless by deed executed twelve months before the donor's death. The universities of Oxford and Cambridge and the public schools at Eton, Winchester, and Westminster are excepted from the operation of this statute. Recent legislation in England, and especially a statute passed in 1853, has completely readjusted the means and methods of regulating charitable trusts through judicial action. The statute of 43 Elizabeth has not been re-enacted in the U. S. In several of the States, however, the courts have adopted the general doctrines which had been formulated by the English chancery, so that the charitable trusts as above described are, to a certain extent, recognized in their local jurisprudence and upheld by their judiciary. The principle of *cy pres*, however, is entirely repudiated. In other States the whole system has been rejected as inconsistent with our institutions, and especially because it tends to create perpetuities, which are opposed to the policy of our laws. In New York, for example, it has been finally settled, after some vacillation, that charitable trusts were abrogated by the Revised Statutes, and that the only mode of establishing a charity in a legal and permanent manner is through the instrumentality of a corporation, which shall receive and administer the trust.

JOHN NORTON POMEROY.

**Trustee′,** in the strict and technical meaning originally given to the word, is one who holds the legal estate or property in lands or things personal for the use and benefit of another who has an equitable interest in the same subject-matter. In a more comprehensive sense the term is applied to any person who is clothed with an interest in, power or authority over, property which, in good faith and according to equitable principles, must be exercised for the benefit of another or others. In this broad view, administrators, executors, guardians, assignees of bankrupts and insolvents, the directors or other supreme managers of corporations—in short, all persons who stand in a fiduciary relation toward others in respect to the possession, use, management, or disposition of property—are trustees, and are so regarded by courts of equity. A trustee may be created by express words, or may become such by reason of his own acts or omissions. Equity in numerous instances imposes the character of trustee upon a person contrary to his intention, and compels him to hold property of which he has acquired the title for the benefit of another who is the equitable owner, and to convert the latter's equitable interest into a legal estate by a conveyance. The office and function of trustees are in the highest degree fiduciary; they must act in perfect good faith, and with the discretion and care at least of ordinary business-men under the same circumstances. The power of courts of equity to enforce these duties is complete. They may remove a trustee and appoint another; may restrain him by injunction; may call him to account and hold him personally responsible for the results of his frauds or neglects, for improper investments, for profits made or which ought to have been made, and for interest; may avoid conveyances made to himself, and those made to third parties in breach of the trust; may follow the property into the hands of such third persons as implied trustees, unless they are purchasers in good faith for a valuable consideration; may, in fact, do anything which will give equitable protection to the rights of the beneficiary. Where there are two or more trustees of land, their estate is joint, and on the death of one the whole interest vests in the survivor or survivors. This rule does not apply to a large class of quasi-trustees; and in New York, upon the death, removal, or resignation of any one or more of several trustees, the court is empowered by statute to fill the vacancy thus made by appointment. The duties and functions of a trustee, being purely fiduciary and personal, cannot be delegated. The power of management, where the trust is active, depends upon its nature and the terms of the instrument by which it is created; where the trust is purely passive, this power is merely nominal. (See TRUST.)

JOHN NORTON POMEROY.

**Truxillo.** See TRUJILLO.

**Trux′ton,** p.-v. and tp., Cortlandt co., N. Y., on New York and Oswego Midland R. R. P. of v. 314; of tp., 1618.

**Truxton** (THOMAS), b. on Long Island, N. Y., Feb. 17, 1755; went to sea at the age of twelve years; was impressed into the British navy; became in 1776 lieutenant of the American privateer Congress; equipped and commanded in 1777 the Independence, with which he made valuable prizes; afterward commanded the St. James (30 guns), with which he disabled a British ship of superior force

after a severe engagement; was engaged in the East India trade for several years after the war; became captain of the U. S. frigate Constellation (June, 1794), with which he captured the French frigate L'Insurgente Feb. 9, 1799; obtained a victory over the Vengeance Feb. 1, 1800, for which Congress voted him a gold medal; was made commander of the West Indies squadron of ten vessels 1801, and appointed 1802 to the command of the naval expedition against Tripoli, which he declined; was consequently dismissed from the service by Pres. Jefferson, and was in 1816–19 high sheriff of Philadelphia, where he d. May 5, 1822. Author of *Remarks, Instructions, and Examples relating to Latitude and Longitude, also the Variation of the Compass* (Philadelphia, folio, 1794).

**Truxton** (William T.), U. S. N., b. Mar. 11, 1824, in Pennsylvania; entered the navy as a midshipman Feb. 9, 1841; became a lieutenant in 1855, commander in 1866, captain in 1873; commanded the steamer Tacony at the taking of Plymouth, N. C., Oct. 31, 1864, and in both the Fort Fisher fights, and recommended for promotion by Commander Macomb and Rear-Admiral Porter for "coolness, intrepidity, and skilful handling of his vessel."

Foxhall A. Parker.

**Trygon'idæ** [from *Trygon*—Gr. τρυγών, an ancient proper name—the typical genus], a family of selachians of the order Raiæ, typified by the stingrays. The disk constituted by the union of the pectoral fins with the body is rhomboid or oval, and oblong or transversely expanded; the tail is thin and attenuated toward its extremity, but otherwise variously developed, being mostly very long, but sometimes very short; the skin is generally more or less armed with scattered spines or tubercles; the head is produced into a pointed snout or at least angulated in front; the nasal valves are confluent, and bound to the upper lip by a median frænum, but the hinder margin free and fringed; the mouth is moderate; the teeth mostly transversely elliptical, and ridged or cuspidate; on the back of the tail are generally one or more spines, which, in the typical forms, are compressed from before backward, and armed at their lateral edges with teeth or serrations directed downward, but these are sometimes wanting; there generally are only rudimentary dorsal and caudal fins, or none at all. The species are quite numerous, and disseminated in all seas except the extreme polar ones. They apparently indicate three primary groups—viz. (1) Ellipesurinæ, represented by the genus *Ellipesurus* (1 species); (2) Trygoninæ, with the genera *Trygon* (about 25 species), *Hypolophus* (1 species), *Tæniura* (6 species), *Urolophus* (4 species), *Trygonoptera* (2 species), and *Urogymnus* (1 species); and (3) Pteroplateinæ, with the genera *Pteroplatea* (4 species) and *Ætoplatea* (2 species). Three of these genera have members in the waters of the U. S.—viz. *Trygon centrura* and *Pteroplatea maclura* on the eastern coast, and *Urolophus Halleri* and *Pteroplatea marmorata* on the western. The Trygoninæ have the disk longer than wide, and a long tail; the Pteroplateinæ have the disk much wider than long, and a short tail. The species are to be feared on account of their spines. (See further Stingray.) Theodore Gill.

**Try'on,** p.-v., Polk co., N. C. P. 640.

**Tryon** (William), LL.D., b. in Ireland about 1725; received a good education; became a distinguished officer in the British army; married Miss Wake, a relative of the earl of Hillsborough, secretary of state for the colonies, through whose influence he was appointed lieutenant-governor of North Carolina 1764; became governor by the death of Gov. Dobbs July 20, 1765; suppressed the revolt of the "Regulators," treating the prisoners with cruelty; erected at the cost of the province a magnificent residence at Newberne; was advanced to the governorship of New York July 3, 1771; became colonel 1772 and major-general 1777; was detested by the patriots for his many acts of rigor and severity, and especially for the destruction of Danbury, Fairfield, and Norwalk, Conn., by expeditions conducted by him in person; resigned his post Mar. 21, 1778, and returned to England, where he became a lieutenant-general 1782. D. in London Feb. 27, 1788.

**Tsars'koe-Se'lo,** town of Russia, government of St. Petersburg, contains two magnificent palaces which are used by the imperial family as summer residences. The park and pleasure-grounds of the palaces cover an area 18 miles in circumference, and the palaces, vast and gorgeous buildings, contain many valuable collections. P. 10,233.

**Tschanchalova.** See Tarki.

**Tschu'di** (Ægidius), b. in Glarus, Switzerland, in 1505; studied at Bâle, Vienna, and Paris; travelled much in his native country and Italy; served in the French army 1536–44; held various important offices in Baden and Glarus; went in 1559 as ambassador to the emperor Ferdinand I. in Augsburg; was banished in 1562 on account of his strong adherence to the Roman Catholic Church, but recalled in 1564. D. in Glarus Feb. 28, 1572. On his travels and in his various offices he made very comprehensive investigations with respect to the history of Switzerland, and the last years of his life he spent in preparing his rich materials for publication, but only *Die uralt wahrhaftig Rhetia* appeared before his death. His principal work is *Chronicon Helveticum 1000–1470*, written in German and published by I. R. Iselin in 2 vols. (Bâle, 1734–36).

**Tschudi, von** (Johann Jakob), b. in Glarus, Switzerland, July 25, 1818; studied natural science at Zurich, Leyden, Paris, Berlin, and Würzburg; explored Peru 1838–43, Brazil, La Plata, and other South American states 1857–59; was appointed Swiss ambassador to Brazil in 1860, and to Vienna in 1866, and wrote *Reiseskizzen aus den Jahren 1838–42* (2 vols., 1846; translated into English in 1847 by T. Ross), *Untersuchungen über die Fauna Peruana* (1844–47), *Die Ketschuasprache* (2 vols., 1853), *Reise durch die Andes von Südamerika* (1860), *Reisen durch Südamerika* (5 vols., 1866–69); in connection with Don Mariano Eduardo de Rivera he published *Antiquidades Peruanas* (1851; translated into English by F. L. Hawks, New York, 1854).

**Tse'tse,** the *Glossinia morsitans* of Westwood, a dipterous insect a little larger than the common fly. It abounds in some parts of South Africa. but is absent from large districts. Its bite, according to Livingstone, is certain death to the ox, horse, and dog, though apparently harmless to man, as well as to goats, asses, mules, and the various wild beasts of the regions it inhabits. Recent authorities assert that the reports of its injurious nature have been exaggerated. Its venom is secreted by a little gland, smaller than a mustard-seed.

**T-Square,** an instrument used in drawing parallel straight lines. It consists of two arms, one of which is called the *stock*, and the other the *blade*. The blade is attached to the stock at its middle point by a hinge-joint and clamp-screw. The stock projects below the blade, forming a shoulder, which, when used, is pressed firmly against the edge of the drawing-board. To use the instrument, we first set the blade so as to make the desired angle with the stock; we then press the shoulder of the stock firmly against the edge of the drawing-board and slide it along that edge; the blade will move so as to remain parallel to its first position.

W. G. Peck.

**Tuano,** tp., Elko co., Nev. P. 117.

**Tu'aricks** (*Tawarek*), a race of Mohammedan nomads inhabiting a great part of the Sahara or great African desert, from Fezzan W. to the Atlantic. They are believed to be allied by race to the Berbers. Their hair is straight, their features are Caucasian rather than African, and their physical development is fine. They have a written alphabet, but no literature. The alphabet contains Hebrew, Greek, and Roman letters, with others. The Tuaricks are divided into large tribes, and greatly oppress the Tibboos (Tebu), their neighbors. Their number is estimated at 200,000.

**Tubal',** tp., Union co., Ark. P. 351.

**Tu'ber** [Lat.], in plants, a thickened subterraneous portion of the stem, bearing latent buds or "eyes," and usually composed of cellular substance richly stored with starch or some other equivalent principle. Hence, many of the tubers, like that of the common potato, are of great value as sources of human food.

**Tu'bercle** [Lat. *tuberculum*], a name applied to certain diseased and degenerative products in the animal body, and chiefly interesting in its relation to pulmonary phthisis or consumption. In the remote periods of medicine persons dying of consumption were known to have in their lungs yellow masses of cheesy consistency. These were rudely designated tubercle. By Stark in 1785, by Matthew Baillie in 1794, and Boyle in 1810, a new body was described, termed miliary tubercle; this minute body, about the size of a millet-seed, of gray color, semi-translucent, and of gelatinous consistency, has come to be regarded as true tubercle. The miliary or true tubercle is therefore to be looked for in the acute tuberculosis of children, in tubercular inflammation of the brain, pleura, peritoneum, and wherever in a consumptive and tainted constitution acute marasmus supervenes. The yellow masses, now known as crude tubercle, have been resolved by the microscope into wasted, shrivelled cells and fatty granules, which give the homogeneous cheesy consistency. Hence, so-called "yellow tubercle" may be the second and advanced stage of true tubercle, or the "fatty degenerative," retrograde stage of innocuous material in the body, as when acute inflammation has given rise to plastic lymph, which fails to organize. Under such circumstances, in a

person hitherto healthy, with no tubercular tendency, an unfortunate inflammatory attack may lead to deposits which become fatty or "cheesy;" and these caseous masses liquefy or soften, forming cavities. It is, then, the tendency of abnormal deposits, whether true tubercle or simple cheesy matter, to compress the healthy tissues and cause their waste, and to soften and form cavities, that leads to consumption and death. Yellow tubercle is most liable to develop, following acute sickness, in those who are delicate and ill-nourished. The relation of miliary or true tubercle to the scrofulous or strumous diathesis is unsettled, the opinion steadily gaining that "scrofula is the soil in which tubercle grows." Buhl, Schuppel, and others claim that tubercle develops upon the minute lymphatics which permeate all the structures of the body.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Tubercular Meningitis.** See Meningitis, by E. Darwin Hudson, Jr., M. D.

**Tu'berose,** the *Polyanthes tuberosa*, an *amaryllidaceous* plant, a native of Ceylon, much cultivated in greenhouses for its beautiful and highly-fragrant white flowers, which are extensively employed by perfumers. Some 24,000 pounds of tuberose flowers are yearly produced in the valley of the Var, in France, for perfumers' use.

**Tü'bingen,** an old but interesting town of Germany, in Würtemberg, is beautifully situated on the Neckar. Its university, founded in 1535, is a celebrated institution, and has a botanical garden, a chemical laboratory, an observatory, and several fine museums and collections connected with it. Reuchlin and Melanchthon were among its first professors, and in the beginning of this century it developed a new school of theology of great influence. The general trade of the town is very lively. P. 9313.

**Tübingen School,** the title of a group of theological and exegetical writers connected with the University of Tübingen in Germany, who opposed both the old or evangelical and the so-called rationalistic interpretation of the Bible. The founder of the school is Dr. Baur, and its principal pupils are Strauss and Zeller. Strauss, in his *Life of Jesus*, carried out the mythical theory of the gospel history. (See Strauss.)

**Tubular Bridge.** See Bridge, by Gen. J. G. Barnard, A. M., LL.D.

**Tuck** (Joseph Henry), b. at Dorchester, Mass., Mar. 12, 1812; was at first a watchmaker, then a candle-manufacturer, and in 1837 went to London, where he established himself as a civil engineer, returning to the U. S. in 1865. The inventions for which he has secured patents number more than fifty, among which are those for a candle-machine, a dredging-machine, a rotary steam-engine, and for steam-engine packing. He established the company which in 1848–49 laid the first submarine cable from Dover to Calais, and furnished the plans for excavating the Suez Canal. His present residence is in Brooklyn, N. Y.

**Tuckahoe',** the Indian name of a singular vegetable substance found under ground in the Southern States of the U. S., sometimes attaining the size, and having somewhat the appearance, of a loaf of bread, whence it is often called "Indian loaf" or "Indian bread." Its methods of growth and reproduction are unknown, it having neither roots, branches, nor cellular structure, for which reason it has plausibly been considered by Rev. M. J. Berkeley and other distinguished cryptogamists as a secondary product caused by the degeneration of the tissues of some flowering plant. It was eaten by the Indians, and is still sometimes used, when boiled in milk, as a substitute for arrow-root.

**Tuckahoe,** p.-v., Cape May co., N. J.

**Tuckahoe,** p.-v. and tp., Jones co., N. C. P. 616.

**Tuckahoe,** tp., Henrico co., Va. P. 3339.

**Tuck'er,** county of N. E. West Virginia, partially bordering on Maryland, and drained by Cheat River; surface broken and mountainous, but with fertile valleys. Staples, Indian corn, oats, and wool. Cap. St. George. Area, about 400 sq. m. P. 1907.

**Tucker,** tp., Wirt co., West Va. P. 540.

**Tucker** (Abraham), b. at London, England, Sept. 2, 1705; graduated at Merton College, Oxford, about 1725; studied law at the Inner Temple, but was never called to the bar; devoted himself from 1727 to the management of his large estate at Betchworth, Surrey; became blind 1771. D. at Betchworth Nov. 20, 1774. Author, besides other works, of *The Light of Nature Pursued, by Edward Search, Esq.* (1768 and 1778), a remarkable treatise on metaphysics, several times reprinted.

**Tucker** (George), b. in Bermuda in 1775; emigrated about 1787 to Virginia, where he was educated under the superintendence of his relative, Judge St. George Tucker; graduated at William and Mary College 1797; became a lawyer; was a member of the Virginia legislature; sat in Congress 1819–25, taking a high position as a debater and constitutional lawyer; was professor of moral philosophy and political economy in the University of Virginia 1825–45, after which he lived in retirement, chiefly at Philadelphia. D. at Sherwood, Albemarle co., Va., Apr. 10, 1861. Author of *Letters on the Roanoke Navigation* (1811), *Essays on Subjects of Taste, Morals, and National Policy* (1822), *The Valley of the Shenandoah, a Novel* (2 vols., 1824), *A Voyage to the Moon*, a satirical romance (1827), *The Principles of Rent, Wages, and Profits* (1837), *Life of Thomas Jefferson* (2 vols., 1837), *The Theory of Money and Banks Investigated* (1839), *The Progress of the U. S. in Population and Wealth in Fifty Years, 1790–1840* (1843), *History of the U. S. to 1841* (4 vols., 1856–58), *Political Economy for the People* (1859), *Essays, Moral and Philosophical* (1860), and several other works; also of contributions to numerous periodicals.

**Tucker** (Henry St. George), LL.D., son of Judge St. George, b. in Virginia Jan. 5, 1781; received a good education; became a distinguished lawyer; was a member of Congress 1815–19; professor of law in the University of Virginia 1824; chancellor of the fourth judicial district; president of the Virginia court of appeals and of the Virginia Historical and Philosophical Society. D. at Winchester, Va., Aug. 28, 1848. Author of *Commentaries on the Laws of Virginia* (Winchester, 2 vols., 1836–37), *Lectures on Constitutional Law* (1843), and *Lectures on Natural Law and Government* (Charlottesville, 1844).—His son, David Hunter, was b. at Winchester, Va., June 18, 1815; educated at the University of Virginia, and in medicine at Philadelphia and Paris; became professor in Jefferson Medical College and in the Medical College of Virginia, and was author of some medical works. D. Mar. 17, 1871.

**Tucker** (Josiah), D. D., b. at Langharne, Wales, in 1711; educated at St. John's College, Oxford; took orders in the Church of England; was successively curate, minor canon, rector, and prebendary at Bristol; became dean of Gloucester 1758; was distinguished from nearly all his contemporaries by his clear perception of the state of political affairs in the American colonies, and advocated in several pamphlets their peaceable separation. He also wrote a number of tracts upon financial subjects, in which he anticipated to some extent the economic doctrines of Adam Smith. D. at Gloucester Nov. 4, 1799.

**Tucker** (Luther), b. at Brandon, Vt., in 1802; became a printer; established in 1826 the Rochester *Daily Advertiser*, the first daily paper in New York W. of Albany; founded in 1831 the *Genesee Farmer*, the pioneer agricultural paper of New York, afterward consolidated with the Albany *Cultivator*, and in 1852 established the *Country Gentleman*.

**Tucker** (Nathaniel Beverley), son of St. George, b. at Matoax, Va., Sept. 6, 1784; graduated at William and Mary College 1801; studied law, which he practised in Charlotte co. 1809–15; resided in Missouri, where he filled a judicial post 1815–30, and was professor of law in William and Mary College from 1834 to his death, at Winchester, Aug. 26, 1851. Author of three novels—*George Balcombe*, *Gertrude*, and *The Partisan Leader, a Tale of the Future* (Washington, 1837); *Lectures on the Constitution of the U. S.* (1845); *Principles of Pleading* (Boston, 1846), and other works; contributed to the *Southern Review*, and left unfinished a biography of his half-brother, John Randolph of Roanoke, whom in character he much resembled. The *Partisan Leader* was a somewhat remarkable work. Written in 1836, it purported to narrate the events of a secession and civil war in the U. S., supposed to occur in the year 1849, during the third Presidential term of Martin Van Buren. It was reprinted in New York in 1861 as *A Key to the Disunion Conspiracy*, and had a large circulation.—Beverley Tucker, Jr., was editor of the Washington *Sentinel* 1854, consul at Liverpool 1856–60, took an active part in the rebellion, and in 1865 settled in Canada.

**Tucker** (St. George), LL.D., b. at Port Royal, Bermuda, June 29, 1752; graduated at William and Mary College 1772; studied law; was concerned in an expedition against Bermuda, where he aided in the capture of a fortification and of a large amount of stores 1776; commanded a regiment at Yorktown, where he was severely wounded in the knee and rendered lame for life; married Mrs. Frances Bland Randolph, mother of John Randolph, 1778; became a member of the Virginia legislature, professor at William and Mary College, commissioner to revise and digest the laws of Virginia, and a delegate to the convention at Annapolis, Md. (1786), which took the initiative in recommending the formation of a national constitution; was a judge in the State courts of Virginia nearly fifty years, judge of the court of appeals 1803–11, and of the U. S. district court of Eastern Virginia 1813–27, and was

noted for wit, poetical talent, and legal attainments. D. at Edgewood, Nelson co., Va., in Nov., 1827. Author of *A Dissertation on Slavery, with a Proposal for its Gradual Abolition in Virginia* (Philadelphia, 1796), *Letter on the Alien and Sedition Laws* (1799), and of a volume of poems, published under the *nom de plume* of "Peter Pindar," and edited *Blackstone's Commentaries, with Notes of Reference* (Philadelphia, 5 vols., 1803).

**Tucker** (Samuel), b. at Marblehead, Mass., Nov. 1, 1747; bred to the sea; a captain sailing from Boston to London before the Revolution; commissioned a captain in the new American navy May 15, 1777; commanded the frigate Boston, in which he conveyed John Adams, minister to France, to his destination, Feb., 1778; took several prizes 1779; aided in the defence of Charleston, S. C., but became a prisoner at its capture, May, 1780; was exchanged June, 1781; took command of the Thorn, with which he made many prizes; received the thanks of Congress at the close of the war; settled at Bristol, Me., 1792; was for several years a member of the legislatures of Massachusetts and Maine, and in 1812 captured by stratagem a British vessel which had greatly annoyed the shipping of Bristol. D. at Bremen, Me., Mar. 10, 1833. His *Life* was published by John H. Sheppard in 1868.

**Tuck'erman** (Henry Theodore), b. in Boston Apr. 20, 1813; studied in the public schools of that city; travelled in Europe, and devoted himself to literature, criticism, and the study of art, and was a frequent contributor to periodicals, many of his papers having been collected in the following volumes: *The Italian Sketch-Book* (1835), *Isabel, or Sicily, a Pilgrimage* (1839), *Rambles and Reveries* (1841), *Thoughts on the Poets* (1846), *Artist Life*, being sketches of 23 American painters (1847), *Characteristics of Literature* (1849 and 1851), *The Optimist* (1850), *Life of Commodore Silas Talbot* (1851), *Poems* (1851), *A Month in England* (1853), *Memorial of Horatio Greenough* (1853), *Leaves from the Diary of a Dreamer* (1853), *Essays, Biographical and Critical* (1857), *Essay on Washington, with a Paper on the Portraits of Washington* (1859), *America and her Commentators* (1864), *A Sheaf of Verse* (1864), *The Criterion* (1866), *Papers about Paris* (1867), *The Book of American Artists* (1867), and *Life of John P. Kennedy* (1871). In addition to these works he edited many others, to which he furnished introductory essays, such as the *Boston Book*, the *Philadelphia Book*, the *Poems of Mrs. Hemans*, Shaw's *Outlines of English Literature*, and Smith's *Smaller History of English and American Literature*. D. in New York Dec. 17, 1871.

**Tuckerman** (Joseph), D. D., b. at Boston, Mass., Jan. 18, 1778; graduated at Harvard 1798; was pastor of the Unitarian church at Chelsea, Mass., from Nov. 4, 1801, to Nov. 4, 1826; organized the "Benevolent Fraternity of Churches" for the support of a city mission called the "Ministry at Large," to which he devoted himself; was the organizer of the first Seamen's Friend Society in the U. S. 1812, and visited England for the organization of charitable institutions. D. at Havana, Cuba, Apr. 20, 1840. Author of numerous sermons and *Reports*, of eleven tracts for seamen, of a *Prize Essay on the Wages paid to Females* (Philadelphia, 1830), *Gleams of Truth, or Scenes from Real Life* (1835), and *The Principles and Results of the Ministry at Large in Boston* (1838). The Tuckerman Institute in Liverpool commemorates his philanthropic labors in England, which were fully described by Miss Mary Carpenter in a *Memoir of Dr. Tuckerman* (Lond., 1849).

**Tuck'erton,** p.-v., Burlington co., N. J., on Little Egg Harbor, and at the terminus of Tuckerton R. R., has boat-building and fisheries.

**Tuc'son,** p.-v., cap. of Pima co. and of Arizona Territory, in Santa Cruz Valley, 70 miles N. of the Sonora line, has 1 church, good public and private schools, 1 newspaper, and 1 hotel. Principal business, stock-raising, mining, and farming. P. about 3500.

John Wasson, Ed. "Arizona Citizen."

**Tucuman',** town of the Argentine Republic, capital of a province of the same name, in lat. 26° 51′ S., in a fine though not healthy locality, is well built and steadily increasing. Its trade in cattle and mules is considerable. The independence of the Argentine Republic was proclaimed and the first congress held here. P. 17,438.

**Tude'la,** town of Spain, province of Navarre, on the Ebro, which here is crossed by a stone bridge of seventeen arches and lined with a beautiful promenade. In spite of its gloomy, old-fashioned appearance, the town is lively and carries on a brisk general trade. P. 8925.

**Tu'dor,** the family name of an English dynasty which occupied the throne from 1485 to 1603, when it became extinct upon the death of Queen Elizabeth. The family was descended from Owen ap Tudor, an obscure Welsh gentleman who about 1423 married Catharine of France, widow of Henry V. of England. Their son, who was created earl of Richmond, married Margaret, daughter and heiress of John Beaufort, duke of Somerset, whose father was a son of John of Gaunt, duke of Lancaster, but born out of wedlock; he was legitimated by act of Parliament, but was expressly excluded from the succession to the crown. But upon the failure of the real Lancastrian line, Henry, the second earl of Richmond, was recognized by that party as their chief. He defeated Richard III. at the battle of Bosworth Field in 1485, and assumed the crown under the title of Henry VII., although without any legitimate right. He married Elizabeth, daughter of Edward IV., and thus united the pretensions of the rival houses of Lancaster and York. The sovereigns of the Tudor line were Henry VII. (1485–1509), Henry VIII. (1509–47), Edward VI. (1547–53), Mary (1553–58), and Elizabeth (1558–1603), all of whom are treated under their respective names.

**Tudor** (William), b. at Boston, Mass., Mar. 28, 1750; graduated at Harvard 1769; studied law with John Adams; was admitted to the Suffolk bar July 27, 1772; was a colonel and judge-advocate-general on the staff of Gen. Washington 1775–78; afterward a member of both houses of the legislature, secretary of state 1809–10, vice-president of the Massachusetts Cincinnati 1816; was one of the founders of the Massachusetts Historical Society, and delivered several published addresses. D. at Boston July 8, 1819.

**Tudor** (William), son of Judge William, b. at Boston, Mass., Jan. 28, 1779; educated at Phillips Academy, Andover; graduated at Harvard College 1796; entered the counting-room of John Codman, an enterprising merchant, in whose employ he twice visited Europe (1800 and 1810); spent some time in literary pursuits at Paris, and travelled in Italy; went on a mercantile agency for the exportation of ice to the West Indies 1805; was one of the founders of the Boston Athenæum; was a leading member of the Anthology Club, and editor of and principal writer for its literary organ, the *Monthly Anthology* (10 vols., 1803–11), aided by Ticknor, Buckminster, John Quincy Adams, and others; delivered the Fourth of July oration at Boston 1809, and the Phi Beta Kappa address at Harvard 1810 and 1815; founded the *North American Review* May, 1815; conducted it as a bi-monthly, and wrote three-fourths of its contents, until Dec., 1818, when it was changed to a quarterly and passed into other hands; published *Letters on the Eastern States* (1820), a volume of *Miscellanies* (1821), consisting of selections from his previous magazine articles, and a *Life of James Otis* (1823); was the originator of the Bunker Hill Monument (1823); was U. S. consul at Lima, Peru, 1823–27; became U. S. chargé d'affaires at Rio Janeiro, Brazil, 1827, and wrote while there his last work, *Gebel Teir* (Boston, 1829), an ingenious allegory. D. at Rio Janeiro Mar. 9, 1830. He left numerous MSS., the publication of which has been unsuccessfully urged by Quincy, Duyckink, and Allibone.

**Tues'day** [Ger. *Dienstag;* Fr. *Mardi*], the third day of the week, named in honor of *Tiu*, the German *Tyr*, god of war. It is from the *Dies Martis* of the later Roman pagans.

**Tuesday, Shrove.** See Shrove-Tuesday; and for Mardi Gras see New Orleans.

**Tufa.** See Water, by Prof. C. F. Chandler.

**Tuf'tonborough,** p.-v. and tp., Carroll co., N. H. P. 949.

**Tufts** (Cotton), M. D., b. at Medford, Mass., May 30, 1734; graduated at Harvard 1749; became a physician at Weymouth; wrote the instructions to the representatives of Weymouth to oppose the Stamp act 1765; married a daughter of Col. John Quincy, who was aunt of the wife of Pres. John Adams; was a representative of Weymouth in the general court, State councillor and senator for many years, member of the convention for ratifying the Federal Constitution; was one of the founders of the American Academy of Arts and Sciences and of the Massachusetts Medical Society, of which he was president 1787–95. D. at Weymouth, Mass., Dec. 8, 1815.

**Tufts College,** an institution of learning at Medford, Mass., under the control of the Universalist denomination, was founded in 1853 on lands given by Mr. Charles Tufts, possesses a fine three-story edifice, completed 1854, besides three large dormitories; has an endowment fund of above $1,000,000, 10 professors, 73 students, and a library of 16,000 volumes. A divinity school was opened in 1867. The first president (1854–61) was Rev. Dr. Hosea Ballou; the next was Rev. Dr. Alonzo A. Miner (1861–76), who was succeeded by Rev. Elmer Hewitt Capen.

**Tugaloo',** tp., Oconee co., S. C. P. 1436.

**Tugaloo River,** called also **Chattooga,** rises in Jackson co., N. C., and, flowing S., forms for some distance the boundary between Georgia and South Carolina,

and then unites with the Keowee to form Savannah River.

**Tuileries** [Fr.], a famous palace of Paris, on the right bank of the Seine, between the river and the Rue Rivoli, and between the Place du Carrousel and the Place de la Concorde. The ground was originally occupied by tileworks, whence the name of the palace, and was bought by Francis I. in 1518. In 1564, Catharine de' Medici commenced the erection of the buildings after the plans of Philibert Delorme, who was succeeded as master-architect by Jean Bullant. This, the original palace, which was subsequently much altered, but of which no exact drawing has been preserved, consisted of the central pavilion, Pavillon de l'Horloge, and the adjoining galleries. Under Henry IV. the southern pavilion, Pavillon de Flore, which faces the Seine, and the gallery which, running along the river, connects the Tuileries with the Louvre, were added by Duverceau and Dupérac. Under Louis XIV. the older parts of the palace were heightened, the spherical dome of the Pavillon de l'Horloge was transformed into a quadrangular one, and the northern pavilion, facing the Rue Rivoli, the Pavillon de Marsan, was built. Thus, the front façade, 336 yards long, was completed, and at the same time the garden, occupying an area of 56 acres and situated between the palace and the Place de la Concorde, was laid out by Le Nôtre. Finally, Napoleon III. built the gallery which, running along the Rue Rivoli, connects the Tuileries with the Louvre on the northern side of the Place de Carrousel. After the erection of the palace of Versailles, the Tuileries was seldom used by the French kings until Louis XVI. in 1789 was compelled to remove the royal residence hither, and since that time the palace has been the scene of some of the most stirring spectacles of the history of France. Napoleon I., Louis XVIII., Charles X., Louis Philippe, and Napoleon III. resided here, and the palace was stormed and ransacked by the people Aug. 10, 1792, July 28, 1830, and Feb. 26, 1848. In May, 1871, it was finally destroyed by fire by the Communists.

**Tuke** (Daniel Hack), M. D., son of Samuel, b. at York, England, about 1820; became visiting medical officer to the York retreat for the insane, and subsequently practised medicine at Falmouth. Author of a *Prize Essay on the Progressive Changes which have taken place since the time of Pinel in the Moral Management of the Insane, etc.* (London, 1854), *The Asylums of Holland, their Past and Present Condition* (1854), *Biography of William Tuke, etc.* (1856), *On the Canon of the New Testament* (Bristol, 1860), and of many articles, chiefly on insanity in its various aspects, in the *Journal of Mental Science* and other periodicals, and was joint author, with Dr. John C. Bucknill, of *A Manual of Psychological Medicine* (London and Philadelphia, 1858; 2d ed., London, 1862), which has become a standard text-book, and been pronounced on high authority "the most comprehensive and practical English work upon insanity now extant."

**Tuke** (Henry), son of William, b. at York, England, about 1755; was for thirty-five years, from 1780, a minister and distinguished writer of the Society of Friends. D. at York in 1814. Author of *The Faith of the People called Quakers in Our Lord and Saviour Jesus Christ, set forth in various Extracts from their Writings* (1801; 3d ed., enlarged, 1812); *The Principles of Religion as professed by the Society of Christians usually called Quakers, written for the Instruction of their Youth and for the Information of Strangers* (London, 1805; 12th ed. 1852), an authoritative manual, translated into German, French, Danish, and Spanish; *Biographical Notices of Members of the Society of Friends* (2 vols., 1813–15), and other writings collected in his *Works* (4 vols., 1815), which were edited, with a biographical sketch, by the celebrated Lindley Murray.

**Tuke** (Samuel), son of Henry, b. at York, England, about 1780; became an enterprising and successful tea-merchant; acted occasionally as a minister of the Society of Friends, and was for many years "the philanthropic and sensible director of the York retreat for the insane," founded by his grandfather, William Tuke. D. in 1857. Author of *A Description of the Retreat for Insane Persons of the Society of Friends, etc.* (York, 1813), *Practical Hints on the Construction of Pauper Lunatic Asylums* (1815), *Memoirs of Stephen Crisp* (1824), *Memoirs of George Whitehead* (2 vols., 1830), *Plea on Behalf of George Fox and the Early Friends* (1837), *Review of the Early History of the Retreat* (1846), *Identity of Religion in all Ages* (1847), *Account of the Slavery of Friends in the Barbary States toward the Close of the Seventeenth Century, etc.* (1848), *On the Character and Doctrines of the Early Friends* (1844), and other works; edited the *Annual Monitor* (1842–52), and left autobiographical *Memoirs* (2 vols., 1859), of which 26 copies only were printed for private circulation.



**Tuke** (William), b. at York, England, in 1732; was a member of the Society of Friends, and the founder in 1793 of the York retreat for the insane, the first institution in England in which lunatics were treated upon humanitarian as well as scientific principles. D. at York June 6, 1822. His *Biography*, by his great-grandson, Dr. Daniel H. Tuke, was printed at the York retreat 1856.

**Tukuzawa Ukitchi,** b. in the province of Kiusiu, Japan, about the year 1835; attained the position of a first-class scholar in Japanese, to which he added a full knowledge of English; was for years at the head of the bureau of translation under the tycoon's government; devoted his whole attention to the pursuit of literature, and published about 50 different volumes; and was attached to a commission which visited the U. S. in 1867, taking back to Japan many experiences which he made available for the benefit of his countrymen; was formerly a member of the daimian class, but all the privileges connected therewith he resigned, and chose to be considered one of the common people.

F. A. P. Barnard.

**Tula.** See Toola.

**Tula're,** county of S. E. California, lying between the Sierra Nevada and Monte Diablo ranges, drained by Kern River and other affluents of Tulare Lake, which is in its S. W. part, and traversed by the Visalia division of Central Pacific and the Tulare division of Southern Pacific R. Rs. The valley of the lake is fertile. Some gold is found, but mining is little carried on, agriculture and grazing being the principal industries. There are flour-mills and saw-mills. Sheep, cattle, and swine are very numerous. Staples, wool, barley, wheat, dairy products, and lumber. Cap. Visalia. Area, about 5600 sq. m. P. 4533.

**Tulare,** p.-v. and tp., San Joaquin co., Cal. P. 1269.

**Tulare** (or **Tule**) **Lake,** a shallow lake in Tulare co., Cal., is 30 miles long and 20 miles wide. Area, 500 sq. m. It ordinarily has no outlet, but at high water its surplus flows through a slough into San Joaquin River. It receives Kern, Tulare, and King's rivers and other streams.

**Tu'le** [Sp. ?], the *Scirpus validus*, a large club-rush or sedge (order Cyperaceæ) which grows to a great height and covers large areas of marshy ground in some parts of California. The same plant is found in nearly all parts of the U. S., but is not elsewhere of as large a size. The "tule-lands" are very fertile when once drained. It has been proposed to utilize the tule itself in the fabrication of matting, etc.

**Tule Indian Reservation,** Tulare co., Cal. P. 12.

**Tule River,** tp., Tulare co., Cal. P. 1098.

**Tu'lip** [Pers. *dulbend*, a "turban," alluding to the form of the flower], the *Tulipa Gesneriana*, a liliaceous herb from Central Asia, now everywhere cultivated for its beautiful flowers. Of this species nearly 1000 varieties are catalogued, but there are hundreds of unnamed varieties. Conrad Gesner brought the tulip from Turkey to Augsburg in 1559. Haarlem in Holland is, and long has been, the principal seat of the production of tulip-bulbs for the European and American markets. The Van Thol or sweet-scented tulips (*Tulipa suaveolens*) are smaller, earlier, and less beautiful than common tulips, but quite fragrant. Some 30 species of *Tulipa* are known, all bulbous Old-World herbs.

**Tulipoma'nia,** a violent passion for the possession and cultivation of rare varieties of the tulip. The most famous tulipomania was that which raged in Holland 1634–37. The enormous prices then paid for tulip-bulbs of choice varieties led to inordinate speculation in the article —not so much from love of tulips as from the desire to get rich. Tulips were bought and sold on speculation in the same manner that stocks, cotton, and other commodities are often bought at present, no actual goods being delivered. The excitement led finally to severe commercial disasters. A single bulb was often owned in shares, and on one occasion a bulb of the kind called *Semper Augustus* brought 13,000 florins, and three bulbs together brought 30,000 florins.

**Tulip-Tree,** the *Liriodendron tulipiferum*, a beautiful and noble forest tree of the U. S., belonging to the order Magnoliaceæ. Its bark has active tonic powers, and its wood is valued in house-carpentry and carriage and furniture making. It is often incorrectly called poplar, and sometimes whitewood. It is a fine ornamental tree.

**Tull** (Jethro), b. in Oxfordshire, England, about 1680; received a good education; studied law; was admitted as a barrister and made the tour of Europe, after which he settled first on his paternal estate, and afterward on Prosperous Farm in Berkshire, near Hungerford, and gave his attention to scientific agriculture; invented the drill-plough, and published a famous work entitled *New Horse-*

*Hoeing Husbandry* (1733), which long enjoyed great authority in England. The essence of his system consisted in planting in rows and in pulverizing the soil around the plants, but he made the mistake of thinking manure unnecessary, and his own experiments consequently involved him in serious losses. D. Jan. 3, 1740. His work was edited by William Cobbett in 1822, with the addition of some scattered essays on similar subjects.

**Tullaho'ma,** p.-v., Coffee co., Tenn., on St. Louis and Chattanooga and at the terminus of McMinnville and Manchester R. R., has a weekly newspaper. P. 589.

**Tulle,** town of France, department of Corrèze, on the Corrèze, is poorly built, but its paper-mills, sugar-refineries, tanneries, and wool-weaving factories are extensive, and its manufactures of arms employ between 600 and 700 men. P. 12,410.

**Tullius** (Servius). See Servius Tullius.

**Tul'loch** (John), D. D., b. near Tibbermuir, Perthshire, Scotland, in 1822; educated at the University of St. Andrew's; became in 1845 a minister of the Church of Scotland at Dundee; spent some time in Germany, familiarizing himself with speculative theology as there taught; became in 1849 parish minister of Kettins, Forfarshire, and in 1854 principal of St. Mary's College, St. Andrew's, a post he still holds (1876). Author of *Leaders of the Reformation* (1859), *English Puritanism and its Leaders* (1861), *The Christ of the Gospels and the Christ of Modern Criticism—Lectures on Renan's Vie de Jésus* (1864), and *Rational Theology and Christian Philosophy in England in the Seventeenth Century* (2 vols., 1872). In 1855 he entered the lists with 1200 competitors, and gained the second Burnett prize of £600 for an essay *On the Being and Attributes of God*, which was published under the title *Theism, the Witness of Reason and Nature to an All-Wise and Beneficent Creator* (1855). He has contributed articles of biography and criticism to the *British Quarterly, North British, Edinburgh,* and *Contemporary* reviews; also to the 8th edition of the *Encyclopædia Britannica.* He visited the U. S. in 1874.

**Tul'lus Hostil'ius,** according to Roman legends, the third king of Rome (673–641 B. C.). During his reign the combat between the Horatii and Curiatii took place, in consequence of which Alba acknowledged the supremacy of Rome. But subsequently the Albans meditated treason, and when Tullus discovered their foul plans he razed the city and transferred the inhabitants to Rome, where they formed the bulk of the *plebs.*

**Tul'ly,** p.-v. and tp., Onondaga co., N. Y., on Syracuse Binghamton and New York R. R., has a weekly newspaper. P. 1560.

**Tully,** tp., Marion co., O. P. 770.

**Tully,** tp., Van Wert co., O. P. 1064.

**Tully.** See Cicero.

**Tully** (William), M. D., b. at Saybrook, Conn., Nov. 18, 1785; graduated at Yale College 1806, at Philadelphia in medicine 1808, and practised in Connecticut 1815–27; held professorships of materia medica at Castleton, Vt., 1827–29, and Yale College, New Haven, 1830–41; in 1851–59 was a prominent collaborator on Webster's *Dictionary,* and wrote *Materia Medica, or Pharmacology* (2 vols. 8vo, Springfield, 1857–58). His studies of materia medica were original, the result of experimental exhibitions of medicines upon himself and a numerous class of enthusiastic and admiring students. He gave special attention to indigenous American plants, especially veratrum and conium. His works involved a new nomenclature, rigidly classical and etymological in its formation: they are not calculated to attract the medical student or general reader of medicine, but are a storehouse of valuable facts and suggestive thought for the special student. Dr. Tully also issued, with Dr. Miner, in 1822, a celebrated *Essay on Fever.* He was instrumental in founding the Retreat for the Insane at Hartford, Conn. D. at Springfield, Mass., Feb. 28, 1859. E. Darwin Hudson, Jr.

**Tulpehock'en,** p.-v. and tp., Berks co., Pa. P. 2013.

**Tul'tcha,** town of European Turkey, in Bulgaria, on the Danube, 6 miles above the junction of the Sulina and St. George's arms, has a good harbor, a citadel, and considerable trade in salt fish, wood, and grain. It is the ancient *Ægissus.* P. estimated at 13,000.

**Tum'bleston,** tp., Scott co., Ark. P. 1084.

**Tumeli,** tp., Otter Tail co., Minn. P. 139.

**Tu'mor** [Lat., a "swelling"], in pathology, is defined by Boyer as "any preternatural eminence on any part of the body," but in a narrower sense swellings which are the recognized results of inflammation and extravasation are excluded. Tumors are primarily divided into two great classes, malignant and non-malignant tumors. To the first belong all the numerous varieties of cancer, epithelioma, and the various cancroid diseases. (See Cancer.) To the second class (benign tumors) belong a vast number of varieties, the classification of which is difficult. A convenient mode is that which classes them according to the tissue of which they are composed. They may be arranged as follows: (1) Fibrous, fibroid, and connective tissue tumor, fibroma; (2) fatty tumor, lipoma; (3) cartilage tumor, chondroma; (4) bone tumor, osteoma, exostosis; (5) muscle tumor, myoma; (6) nerve tumor, neuroma; (7) erectile, cavernous, or blood tumor, angioma; (8) the so-called sarcoma, or flesh tumor, which, according to Billroth, consists of developmental connective tissue which does not become perfect bone-cartilage or other tissue, but undergoes some one or more of several peculiar degenerative changes; many varieties are noted: (9) lymphoma, or hypertrophy of the lymphatic and other ductless glands; (10) papilloma, or hypertrophy of skin elements; (11) cystoma, hollow or cystic tumor, containing a fluid or semi-fluid mass. It may be observed that many tumors combine the characters of two or more of the above classes, and also that, according to a prevalent doctrine, many apparently benign tumors approximate and may finally take on malignant characters.

**Tun'bridge,** town of England, county of Kent, on the Medway, is noted for its manufactures of toys and small inlaid wooden articles called "Tunbridge ware," such as workboxes, desks, etc. P. 8209.

**Tunbridge,** p.-v. and tp., Orange co., Vt. P. 1405.

**Tunbridge Wells,** town of England, county of Kent, 5 miles S. of Tunbridge, is celebrated for its chalybeate springs, and resorted to as a watering-place. P. 19,410.

**Tung'sten** [Swed. *tung sten,* "heavy stone," alluding to the high specific gravity of wolframite], a metal forming quadrivalent and sexvalent compounds, and apparently also quinquivalent. The chief sources are—*wolframite,* a tungstate of iron and manganese, which frequently accompanies native oxide of tin, and is found in Cornwall, England; Saxony; Bohemia; Wertschinsk, Russia; Limoges; Bolivia; Monroe and Trumbull, Conn.; and in several other places; and *scheelite,* tungstate of lime, also a somewhat abundant source of tungsten. Tungsten is found also in the following rarer minerals: tungstate of lead, or *stolzite;* of copper and lime, or *cuproscheelite;* of manganese, or *huebnerite;* and of manganese and iron, or *megabasite;* as well as in the native oxide, *tungstic ochre,* and in small quantities in samarskite, yttrotantalite, tantalite, and columbite. The metal may be obtained most simply from tungstic anhydride ($WO_3$), by heating it to redness in a stream of hydrogen, or by making it into a paste with oil, and heating it intensely for some hours in a charcoal-lined crucible. Obtained by the latter method, it is an iron-gray metal of the specific gravity of 17.6; very hard and difficult to fuse; not sensibly oxidized in air on heating, unless pulverized. By the action of aqua regia, nitric acid, the alkalies, or nitre it is converted into tungstic acid, and when pulverulent it is oxidized and dissolved on boiling in a solution of the caustic alkalies or their carbonates. It forms a dioxide, $WO_2$, and a trioxide, $WO_3$. This is often called tungstic acid, and may be obtained as a straw-yellow, tasteless powder, insoluble in water or acids, but readily soluble in alkaline solutions by heating ammonic tungstate in open vessels. There is another oxide, apparently a compound of these two, $W_2O_5$, which is produced by reducing tungstic oxide with zinc and hydrochloric acid or otherwise, and is of a fine blue color. Tungstic acid, $H_2WO_4$, obtained as a yellow powder by adding hydrochloric acid in excess to a boiling solution of tungstic oxide in an alkali, forms acid and normal salts, generally of a complex nature, and yielding a white, sparingly soluble hydrate of tungstic acid, $H_2WO_4,H_2O$, when mixed in the cold with excess of hydrochloric acid. Metatungstic acid, $H_2W_4O_{13}$, furnishes salts which are mostly soluble and crystallizable, and may be prepared by the action of tungstic acid on tungstates, or by removing part of the base by means of an acid. Tungsten yields several chlorides, oxychlorides, bromides, fluorides, sulphides, and phosphides; also silicotungstates and sulphotungstates. Its compounds are not poisonous.

Tungstate of soda, prepared on the large scale in purifying certain tin ores (see Tin), is used in place of stannate of soda as a mordant, and also to render cloth incombustible, a little phosphoric acid or phosphate of soda being added to it sometimes, to prevent its decomposition. Tungsten alloys with iron in almost all proportions, making it excessively hard. Steel containing 9 to 10 per cent. is said to possess unusual hardness, and a magnet of tungsten steel has carried twenty times its weight. Tungstates of lime and of baryta have been used for paints, and tungstate of copper is said to be used successfully in dyeing with aniline black. H. B. Cornwall.

**Tungstic Oxide** and **Acid.** See TUNGSTEN.

**Tungu'ses,** a Mongolian tribe, inhabiting the regions of Siberia between the rivers Yenisei and Lena, and mingling W. with the Ostiaks, N. with the Samoyeds, E. with the Lamuts; the Mantchoos to the N. are of Tungusian stock. The Tunguses have flat faces, olive complexion, no beards, straight black hair, and oblique eyes. They are nomads, and generally divided, according to the beast of burden which they principally employ, into reindeer, horse, and dog Tunguses. The southern are Booddhists, the northern Shamanists, but of late Russian missionaries have labored with success among them. Number, about 70,000.

**Tu'nica,** county of N. W. Mississippi, lying on Mississippi River, which separates it from Arkansas, and drained by Coldwater and other rivers; surface flat, often swampy, soil fertile. Staples, cotton and Indian corn. Cap. Austin. Area, 750 sq. m. P. 5358.

**Tu'nicates** [from Lat. *tunica*, a "tunic" or "loose coat"], a class of invertebrate animals formerly generally referred to the branch of mollusks, later by many combined with the classes of brachiopods and polyzoans in a branch called Molluscoidea, and now apparently left in a still more undetermined status. The class is of special interest, as it is regarded by many naturalists as being the type nearest the vertebrates, and that which has furnished the progenitors of the latter animals. The tunicates are animals invested in a sac-like integument (often coriaceous) having two apertures at one end—one introferent or oral, and the other excurrent or anal; the oral aperture leads into a wide "pharynx," which is more or less perforated, and from this into a contracted œsophagus, which widens into a stomach, and thence the intestinal tract, by a hæmal flexure, is recurrent forward toward the anal aperture. The anus generally empties into a chamber called the "atrium," which has as its outlet the excurrent aperture. A single ganglion is developed between the pharyngeal and the atrial regions. A heart exists, but is a simple tube, without valves, open at both ends, and operating by alternate persistaltic contractions, periodically reversing the course of the circulation. Most of the species in their embryonic condition have a caudal appendage, which has what is considered to be analogous, and even homologous, with the notochord of vertebrates; but this stage is suppressed in some. This feature, as well as the mode of development in other respects, affords the ground for the belief in the affinity of the tunicates with the vertebrates, and especially with *Branchiostoma* or *Amphioxus*, the lowest and most generalized of the vertebrates. Representatives of the class are found in every sea, and are quite numerous. Some are simple, and some compound. Considerable difference of opinion prevails respecting their classification.

THEODORE GILL.

**Tu'nis,** one of the Barbary states, North Africa, dependent on Turkey, is bounded E. by Tripoli, W. by Algeria, N. by the Mediterranean, and S. by the Sahara, and comprises an area of 75,000 sq. m., with 2,000,000 inhabitants. The coast to the E. of the Bay of Tunis is low and sandy, like that of Tripoli; to the W. it is rocky and bald, forming lofty promontories, among which Cape Bon, in lat. 37° N., is the northernmost point of Africa. The interior is traversed by the Atlas Mountains, whose average height is between 4000 and 5000 feet, and which form several elevated plateaus of great extension. The climate is dry and hot, but healthy, and the soil is, in general, exceedingly fertile, and produces, in spite of the backward state of agriculture, large crops of wheat, maize, dhurra, and barley; cotton, indigo, saffron, and tobacco are also cultivated. Olive and date plantations are very numerous and very remunerative, and all S. European fruits grow abundantly. Oxen, sheep, mules, and camels are the common domestic animals, and they are all of good breed. Salt and lead are produced, though mining, like agriculture, is very carelessly carried on. Some branches of manufactures, such as woollen fabrics, especially the well-known red caps, dyed skins, morocco leather, and coral, are extensively developed. There are about 45,000 Jews among the inhabitants, who else are Mohammedan Berbers and Arabs.

Tunis occupies nearly the territory of ancient Carthage. Together with Sicily it formed the granary of Rome. On the dissolution of the Roman empire it became a province of the Greek empire, from which it was conquered by the caliphs of Bagdad. From the thirteenth to the sixteenth century it formed an independent state, together with Tripoli and Algeria, and became the terror of all the nations around the Mediterranean on account of its piracy, which France and Spain in vain tried to stop, and which did not cease until near the middle of the nineteenth century. In 1574 the country became dependent on Turkey, but the dependency is now merely nominal.

**Tunis,** capital of the state of Tunis, on the shore of a shallow lake or lagoon which communicates with the Bay of Tunis through a narrow channel, called the Goletta. It is surrounded with a double wall and defended by a citadel. Its streets are narrow, unpaved, and filthy, but its houses, though only one story high and presenting no windows to the streets, are substantially built, and generally the interior is splendidly fitted up in Oriental style. The house is erected in the form of a court, into the yard of which all the rooms open, and this yard is generally paved with marble and provided with a fountain, which is supplied with water from a large tank or cistern on the roof of the building. The palace of the bey and several of the mosques are fine edifices, and the bazaars are large and well stocked. Silk and woollen manufactures are extensively carried on; caps, shawls, burnouses, turbans, and mantles, soap, wax, olive oil, and leather are also manufactured and exported, and the transit-trade between Europe and the interior of Africa is important. P. 120,000, of whom 25,000 are Jews.

**Tunj'a,** town of New Granada, South America, the capital of the department of Boyaca, in lat. 5° 24′ N., on an elevated plateau, has an excellent climate. Wheat, potatoes, and olives are extensively cultivated in the surrounding districts, and some manufactures of cotton cloth are carried on. P. about 7000, mostly Indians.

**Tunkers.** See DUNKERS.

**Tunkhan'nock,** tp., Monroe co., Pa. P. 263.

**Tunkhannock,** p.-b. and tp., cap. of Wyoming co., Pa., on Pennsylvania and New York Canal and R. R., 32 miles N. of Wilkesbarre, has 3 churches, good schools, 2 banks, 2 iron-foundries, 2 newspapers, and 4 hotels. It is the S. terminus of Montrose Narrow-gauge R. R. P. of b. 953; of tp. 1212. A. F. YORK, ED. "REPUBLICAN."

**Tunnel.** See FRÉJUS (COL DE), FUCINO, and SAINT GOTHARD, by HON. G. P. MARSH; HOOSAC TUNNEL, by B. D. FROST, C. E.; TUNNEL, CHICAGO, by E. S. CHESBROUGH, C. E.; TUNNELLING, by B. H. LATROBE, C. E.; the Cleveland tunnel in WATERWORKS, by J. P. FRIZELL, C. E.; the Thames tunnel in LONDON.

**Tun'nel, Chicago.** The city of Chicago, Ill., which obtained its supply of water from the shore of Lake Michigan, about half a mile N. of the mouth of Chicago River, by means of works constructed in 1852, found about ten years after that the lake at the point of supply was so affected by the sewage of the city as to render the water pumped into the mains at times very offensive to the taste and smell, and wholly unfit for domestic use, especially during the prevalence of southerly winds. Various plans were suggested for obtaining a better supply; but as the nearest, the purest, and the most abundant source was immediately in front of the city, it was decided by the city authorities, including the board of public works, to construct a tunnel under the bottom of the lake to a point 2 miles out.

The tunnel consists of a land-shaft at the western and a lake-shaft at the eastern extremity. The tunnel proper is 2 miles in length from the pumping-works, in a northeasterly direction. The lake-shaft is protected by a crib, or hollow pentagonal breakwater, from storms, vessels, and ice. The horizontal diameter of the tunnel was fixed at 5 feet, and the vertical 2 inches greater, for convenience in drawing the centres during construction. This size was determined upon for two reasons: *First*, it was sufficient to deliver a supply for 1,000,000 inhabitants at the rate of 50 gallons a day for each person, the average quantity used at that time. *Second*, experience in Europe had shown that while it was possible to make small tunnels in the most troublesome ground, attempts to make large ones had sometimes failed, and at others had been attended with enormous difficulties. This was particularly the case in works of the kind described by Minard in his *Cours de Construction* and in the earlier and later efforts to construct a tunnel under the Thames. Although there was every reason to expect good ground here, there was a possibility of meeting with deposits of quicksand or other soft material, the formation being drift clay. To remove every doubt of final success, the small size was adopted, in the conviction that whenever it should prove insufficient to supply the demand upon it, the city would be abundantly able to construct another and larger one.

The work was commenced at the land-shaft on Mar. 17, 1864. The first 30 feet, passing through wet running sand, was curbed with three sections of a cast-iron cylinder of 9 feet internal diameter and 1½ inches thick. From the bottom of the iron cylinder the clay was very good, and the shaft was bricked up with a curb 8 feet in diameter and 1 foot thick. The main tunnel proper was lined with two shells of brickwork, in all about 9 inches thick, including cement joints. The upper arch was built on a ribbed centre of boiler iron, which diminished the open space inside of the tunnel only 4½ inches, and thus allowed the cars

which conveyed away the earth to go up to the face of the excavation, usually kept from 10 to 20 feet ahead of the masonry. The iron centre was 30 inches long in the direction of the tunnel. About 2 feet in length of the masonry was usually laid at a time, and as a rule it was found safe to strike the centre within fifteen minutes after the arch was keyed. The arch was built without making the excavation any larger than the space required for the brick-work. The excavation was generally through stiff blue clay, but with the irregularities of character peculiar to the drift. It very seldom required bracing when not left to support itself more than thirty-six hours. Sometimes sand-pockets, sometimes small bodies of quicksand, sometimes clay soft enough for a miner to run his arm into, and sometimes boulders weighing several hundred pounds, were met. The greatest danger encountered was from inflammable and explosive gas. Early in the progress of the work several accidents occurred from this cause, but, fortunately, without fatal results to the workmen, though there were several narrow escapes. Cavities containing gas were detected by sound, and bored into with a small auger. The gas was ignited as soon as it began to escape, and explosions were prevented.

Side-chambers and small turn-tables about 1000 feet apart were resorted to as passing-places for the cars and store-rooms for building materials. The greatest progress made during any one week was 93 feet. Only once was a boulder so large as to require blasting met with. The ventilation of the tunnel was effected by means of tin pipes, through which the foul air was drawn out, and fresh air consequently drawn in through the main opening. Ordinarily, there was so much smoke from the miners' lamps and vapor from the heat of the workmen as to make it impossible to see distinctly enough to run the lines and levels required to keep the tunnel in the right direction. On Sunday nights, however, and on other holidays, the air became so clear as to cause sperm candles to burn with a beautiful silver brightness, visible sometimes 2000 feet.

The crib is 58 feet horizontal measurement on each of the five external sides, and 40 feet high. The inner portion, or well, has sides parallel with the outer ones, 22 feet long each, leaving the thickness of the breakwater 25 feet. Flooring of 12-inch white pine timber was laid close together. The outer and inner vertical faces and the middle wall are of solid 12-inch white pine timber, except the upper 10 feet of the outside, which was of white oak, to withstand better the action of the ice. Across the angles of the outer and middle walls were placed brace-walls about 10 feet long of solid 12-inch timber. All of the wall-timbers were fastened to each other by 1¼-inch square bolts 34 inches long, pointed and driven somewhat slanting into 1¼-inch auger-holes about 5 feet apart. The slant was given in opposite directions to the bolts nearest each other, to avoid the possibility of their being drawn out by the buoyancy of the timber—an accident which once occurred to a somewhat similar structure in the West. Three rectangular openings, each 4 feet wide and 5 feet high, were made through the breakwater at different depths below the surface of the lake, so that water could be drawn from near the bottom, middle, or top as future experience might show to be best. The whole of the outside surfaces of the outer and inner walls was sheeted with 2-inch pine plank carefully jointed, placed vertically, and spiked on. Instead of pine, 3-inch white oak was used for the upper portion of the outside, to resist ice. Apparently excessive care was taken to make the crib strong, but subsequent experience showed that this care was none too great. The crib was built on shore and launched like a ship. After the crib had been launched and towed to its place, and only time had elapsed to throw just sufficient stone into it to hold it in moderate weather, a violent storm set in and drove the vessels loaded with stone into the harbor. This storm continued for three days, and threatened, before it abated, to do serious if not fatal injury to the crib. When the storm was over, two of the inner angle-joints had parted an inch on top, and the entire crib had worked, against wind and waves, 13 feet, and the N. W. angle was 3¼ feet lower than the S. E. The great difficulty there would have been in restoring the crib to its exact position, and the fear there might be another storm in the mean time, prevented any attempt of the kind from being made. Since the crib has been filled with stones no variation whatever in position has been perceived. A tremor is sometimes felt during severe storms and when large fields of ice are passing.

The cast-iron cylinder for the lake-shaft at the E. end of the tunnel consists of seven sections, each 9 feet in length, 9 feet internal diameter, 2¼ inches thick, and in all other respects like the one for the land-shaft, except that the lowest section was turned on the outside to make it penetrate the clay more easily, and the upper end was provided with two gates for the introduction or exclusion of the lake water, each 54 inches high by 32 inches wide, and placed with their tops below the lowest known level of the lake.

The original estimate of the probable cost of the work was $307,552; the actual cost, including all preliminary and other expenses of whatever nature chargeable to the lake tunnel up to Apr., 1867, was $457,844.95. The original estimate was made when common labor was worth $1.25 per day and gold but little above par. Before the completion of the work, labor was much higher and gold rose to $2.50.

The completion of the tunnel has brought about a most gratifying change in the quality of the water supplied. The extraordinary growth of the city, and the increased rate of consumption of water per capita above what was originally estimated, have caused the construction of another and larger tunnel from the same crib, parallel with the first, to the lake shore, and thence in a south-westerly direction about 4 miles farther to a point where new pumping-engines are expected to be in operation in the summer of 1876. Both tunnels have an estimated capacity of 150,000,000 U. S. gallons per diem. Since the completion of the tunnels the old wooden crib has been replaced, from low water up, by a stone building 20 feet high, containing keepers' rooms and surmounted with lighthouse and fog-bell towers. E. S. Chesbrough.

**Tunnel Hill,** p.-v., Whitfield co., Ga.

**Tunnelling.** *Tunnels* are subterranean passages through hills and mountains or under lakes and rivers. Of the first class a great many, and of the last but few, have been executed. A tunnel through a hill becomes necessary or advisable when it will cost less to remove only as much of the material as will permit a safe passage, although at a greater expense for like quantities removed, than to make an excavation open at the top. There are occasional cases in which the difference of cost between them would be so little as to leave the choice to other considerations, such as present themselves in passing through cities or very populous vicinities where damage to property and danger to persons would make the tunnel preferable without regard to cost. The cost per cubic yard or other unit of measure is usually *not less* than five or six times as great in a tunnel as in an open cutting, and sometimes the disproportion is vastly greater. The tunnel, however, is generally the only work practicable in the case, and the only question is at what point to end the open cut or "approach" and begin the tunnel. This depends on many circumstances, but the "portals" of the tunnel are usually placed where the depth of cutting is from 50 to 60 feet. Progress within the confined area of the tunnel being comparatively slow, access to it at the earliest moment is sought through shafts sunk from the surface overhead, except in short tunnels with easy approaches. The tunnel being reached through the approaches or shafts, or both, the process of "drifting" is begun; and this operation is twofold—"heading and bottoming," the former being a preliminary work intended to open the way in advance and facilitate the removal of the rest of the material in enlarging the tunnel to its full dimensions. This advanced excavation is carried forward either at the upper or lower part of the sectional area, according to circumstances. If the material is solid rock, undivided by seams or fissures, the tunnel is excavated to its proper shape for permanence without artificial support. If the rock be deficient in hardness and cohesion, temporary props of timber are used as the work proceeds, and walls and arches of masonry are subsequently built to sustain it. Ventilation and drainage must be amply provided for during the progress of the work, the former by blowing-machines which drive fresh air to the headings and expel the smoke of blasts—the latter by pumps which raise the water, often found in copious quantity, through the shafts, except where it can pass by natural flow through the approaches. In blasting rock within the tunnel, gunpowder has been superseded almost wholly by the more recently-discovered and much more powerful explosive nitro-glycerine, combined with inert substances which render it safer in handling without materially impairing its effects. The charges are simultaneously fired by electricity, and with much greater effect than if exploded separately, as was the former method. The drilling of the blast-holes has latterly been greatly improved and cheapened and hastened by the use of tools driven by machinery worked by compressed air, which assists in ventilating the tunnel in its escape after doing its work.

*Tunnels in earth* do not require the drill or the explosive, but need support at each step, with sometimes more delay and expense than where blasting is required. The mode of temporary propping and subsequent permanent walling and arching could only be shown by detailed drawings.

Very few tunnels in America, although many in Europe, have been driven through such material. The methods of conducting the work in such ground differ only in their particulars, and vary according to the circumstances of the case.

*Subaqueous* tunnels under the beds of rivers and lakes are executed in the same manner with the preceding, only with special precautions against influx of water. The earliest tunnel noted in history appears to have been a work of this sort, by which the banks of the Euphrates are said to have been joined in the reign of Queen Semiramis. The other ancient tunnels were used as water-conduits, which occasionally perforated hills, although mostly open-air constructions, belonging more properly to the head of *aqueducts*, and were usually of small dimensions. Those designed to drain lakes were of larger area, such as that by which Lake Fucinus (now Celano) was drawn off into the river Liris, and which, becoming obstructed, was recently reopened, and much fertile land reclaimed thereby. Tunnels for *navigation* are wholly of modern origin, and together with those designed for highways and railways, will be classed as (1) *tunnels constructed and in use*, (2) *tunnels in progress*, and (3) *tunnels projected*, and which may sooner or later be executed. (1) As canals preceded railways, the first tunnel for *transportation* in the *commercial* sense was upon a canal, that of Languedoc, constructed in 1666, through the hill of Malpas, and, although but 767 feet long, was considered "something prodigious and worthy of the ancient Romans."

*English Canal Tunnels.*—The Duke of Bridgewater's and the Trent and Mersey canals come next, about a century later. The *Harecastle* tunnel upon the latter was 8640 feet long, and but 9 feet wide and 12 feet high, passing a boat only 7 feet wide, propelled by men lying on their backs and pushing with their feet against the sides and roof. This tunnel was supplemented or superseded in 1825 by one 14 feet wide and 16 feet high, with a towing-path. Upon the Leeds and Liverpool Canal is a tunnel 4920 feet long, and 17 feet wide by 18 high, showing the gradual enlargement of such works to meet advance in commerce. Thence up to 1826, when the canal-system of England was about completed, numerous tunnels of various lengths were constructed, the longest of them on the Huddersfield Canal, 3.10 miles long, and several others ranging from 2⅓ miles down to 300 feet, and making a total length of about 39 miles and an average of about $\frac{9}{10}$ths of a mile. These tunnels were through rock and other material of every variety, and met every sort of difficulty from water, foul air, and bad ground, the tools and appliances of more modern tunnelling being then unknown.

*French canal tunnels*, 23 in number, from 417 feet to 7 miles 2413 feet in length, and aggregating 24½ miles.—The longest of large section, the *Riqueval*, executed in 1803, upon the St. Quentin Canal, is 3½ miles long and 20¼ feet wide. The *Pouilly*, upon the canal of Bourgogne, 2 miles 273 feet long and 20⅓ feet wide, and some others upon main navigable canals which pass boats of good tonnage. The tunnel of Arschwiller, a mile and 2250 feet long, has a railway tunnel alongside of it and passing *under* it at one end. There are several canals of from 5 to 8½ feet wide and of considerable length, of which that of *Noireau*, of 7½ miles length and 5 feet width, is the longest, but these are feeders and lateral canals of small capacity. Of underground channels and conduits for the supply or the sewerage of cities, the drainage of mines, etc., there are upward of 80 miles in Europe.

*Highway Tunnels.*—Many of these, under the name of "galleries," occur upon the great roads across the Swiss and Italian Alps in piercing the projecting cliffs of their savage defiles.

*Railway tunnels* form by far the most numerous class, and the 957 in number and 291 in miles of them constructed to this date (1876) are the growth of but half a century. This total length is divided about thus: *Great Britain*, 140 tunnels and 87¼ miles; *France*, 259 tunnels and 82$\frac{6}{10}$ miles; *Belgium*, 20 tunnels and 4.07 miles; *Germany* and *Austria*, 270 tunnels and 51¼ miles; *Italy*, 76 tunnels and 19¾ miles; *Switzerland*, 5 tunnels and 4.08 miles; *North America*, 115 tunnels and 33 miles; *South America*, 72 tunnels and 9 miles. This statement is necessarily quite approximate, as it has been impossible to obtain accurate information within the time allowed, and several countries have either been partially heard from or not at all, as Italy, Spain, Russia, and Turkey in Europe. The present object is to give a general idea of the extent to which tunnelling has been carried throughout the world. Of *English tunnels*, the most noted for magnitude and difficulty of construction is the *Kilsby* on the North-western Railway, length 1⅓ miles, cost $1,500,000, chiefly from nearly a fifth of its length being in quicksand so saturated with water that nine months of hard pumping were required to dry it sufficiently for commencing to drift horizontally from the two enormous shafts of 60 feet diameter sunk to facilitate the removal of material and water, and for ventilation. The *Box* tunnel on the Great Western, 1¾ miles long and costing $1,750,000, met with much trouble from water; it had five shafts the whole breadth of the tunnel. Both of these, as well as the rest of the English tunnels, are for two tracks. The longest tunnel in England is the *Woodhead*, upon the Manchester and Leeds Railway. Its length is 3 miles, and it consists of two parallel tunnels, each for one track, with numerous openings between them, the many shafts required for its construction being midway of the two. The excavations were mostly in solid rock. The *Sydenham* tunnel, on the London Chatham and Dover Railway, 1⅛ miles long, had its walls and arching pressed out of shape by the swelling of the London clay through which it is carried, and required repeated additions to their thickness before they would resist the pressure. Many other English tunnels deserve description, among them the *Bleechingly*, ¾ of a mile, and *Saltwood*, ½ mile long in clay, with copious veins of water. Space does not allow more than this general reference. The English tunnels are uniformly *straight*, as far as is known.

*French railway tunnels* embrace many works of interest, as the *Nerthe* (Marseilles and Avignon Railway), nearly 3 miles long, through limestone, with twenty-four shafts, cost $2,090,076, lined with masonry for four-fifths of its length; the *Blaizy* (Paris and Lyons Railway), 2½ miles long, twenty shafts, through calcareous rock and marl, and is arched throughout; *Arschwiller* (Paris and Strasbourg), 1⅔ miles long, arched end to end, the Marne and Rhine Canal alongside, *under* which the railway passes at one end, the grade descending and the canal diverging so as to permit this, cost $515,328; *Relly* (Rheims branch of Paris and Strasbourg Railway), 2½ miles long, eleven shafts, through chalk, cost $497,904; *Lamotte* (Paris and Caen Railway), 1$\frac{6}{10}$ths miles long, eleven shafts, through chalk, marl, and greensand, cost $502,820; one-third arched, one-fourth self-supporting, rest walled on sides. All the above for two tracks. Many of the French tunnels are curved, and that of *Fesc* (548 feet long) with 800 feet radius.

*German railway tunnels* are very numerous, as above stated, but none of them of great length. Particulars in regard to them are not at hand, but the passage of the Sommering, on the Vienna and Triest route, must be noted as exhibiting very bold tunnelling through lofty cliffs, with magnificent viaducts between. The most peculiar examples are, however, on the Black Forest Railway, from Offenburg to Constance, on which the ascent to the summit between the Rhine and the Danube waters, upon a grade of 106 feet per mile, encounters in 15½ miles twenty-nine tunnels of various lengths, the longest (5600 feet) at the summit. Most of the tunnels are curved, with radii of 1000 feet, and one of them forms a complete letter S. The rock is a hard but decomposing granite, mostly requiring protection by masonry.

*Belgian railway tunnels* are not numerous; the large majority of them occur on the route from Liege to the Prussian frontier, along the narrow winding valley of the Vèsdres, on which there are eighteen, of lengths from 65 to 1964 feet, in a distance of about as many miles.

*Swiss railway tunnels*, of which the longest and most interesting is the *Hauenstein*, on the Swiss Central Railway, 1½ miles long, through limestone, sandstone, and shale, requiring masonry support nearly throughout. Three shafts were projected, but one of them was abandoned before completion, and at one of the others an accident somewhat like that at the deep shaft of the *Hoosac* tunnel occurred by the burning of the timbering, which caused the obstruction of the tunnel and the loss of many lives. The grade through the tunnel is 139 feet per mile, and the width is for two tracks.

*Italian Tunnels.*—There are accounts at hand of those only in the northern part of the peninsula. The one of chief interest is, of course, that of Mont Cenis or the Col de Fréjus, of which there is a full account in this CYCLOPÆDIA, under FRÉJUS, COL DE, by HON. G. P. MARSH. This great work was fourteen years in progress, its whole length of 7¼ miles being driven from the ends. A shaft about 1600 feet deep, 2¼ miles from the S. end, might perhaps have expedited the work, but the skilful engineers who planned the tunnel doubtless weighed well this and all other questions connected with it. The next most remarkable are the tunnels on the route of 62 miles across the Apennines from Bologna to Pistoja, on which are forty-six, the longest 1⅝ miles. This group resembles that of the Black Forest Railway in the serpentine feature which distinguishes it, many of the tunnels being curved with a radius of 1000 feet, and one of them of a similar S-like shape, and about a mile in length. The grade is 132 feet per mile, and was reduced to even this steep inclination only by developing the line

upon the mountain-slopes, as in the case of the Black Forest route.

*Railway Tunnels of the U. S.*—These occur upon a variety of roads throughout the Union, and are few or many according to the topography of the region. In New England E. of the Connecticut River there are few or none, the country, although rolling and rocky, rarely presenting such abrupt elevations as invite tunnelling. This deficiency is made up by the great Hoosac Tunnel, through the mountain-range of the same name W. of that river, and of which its resident engineer, Mr. Frost, has given an account under the article HOOSAC TUNNEL in this CYCLOPÆDIA, rendering further notice of it here unnecessary. It may be added, however, that, besides the central shaft of 1030 feet depth (where the accident from fire above referred to occurred), there was another, 318 feet in depth and half a mile from the W. end, between which and that end the chief difficulties in construction occurred, owing to the soft material requiring expensive supports. There are but two or three other tunnels E. of the Hudson, except the nine which are immediately on its bank through rocky spurs on the route from New York to Albany. The comparatively flat country on the New York Central requires none, and the Erie, although traversing a more broken district, meets with passes remarkably favorable for open-work. Farther S., in Pennsylvania, the mountains rising to greater height, the occasions for tunnelling increase, and upon the route from Philadelphia to Pittsburg there are six tunnels, of a total length of $2\frac{1}{10}$th miles, the longest (3750 feet) at the Alleghany Summit, driven through the coal-measures 400 feet below the mountain-crest, with three shafts and no special difficulty of construction. The Philadelphia and Reading R. R. has four tunnels, the longest 2100 feet, and a total length of about a mile. The Delaware Lackawanna and Western R. R. has three tunnels, the longest (4200 feet) through Bergen Hill at its eastern terminus (not far from the Erie R. R. tunnel of about the same length through the same ridge), and one of 3015 feet at another point of its line. The Amboy extension of the Lehigh Valley R. R. has an important tunnel, 4829 feet long, the *Musconetcong*, driven with one vertical and one inclined shaft, both near the W. end, most of the material being removed by drifting from the E. end. Water gave great trouble at the W. end, and was mastered with much skill by the engineers. The *Nesquehoning* tunnel, on the Lehigh Coal and Navigation Co.'s road, pierces Locust Mountain for 3800 feet, and was driven through the anthracite coal-measures and the underlying conglomerate and red shale without shafts. It required protection from masonry throughout. Upon the *low grade-line* of the Allegheny Valley Railway in Western Pennsylvania are five tunnels; the longest, at the *summit*, is 1950 feet in length, through the coal-rocks. Farther S. the Baltimore and Ohio R. R. has forty-four tunnels in all, of which upon its main track (178 miles) to Cumberland there are seven, through granite, breccia, and clay slate, of a total length of 3333 feet; upon its branch of 150 miles to Pittsburg three, making 1.422 miles, the longest of them, the *Sand Patch*, of 4800 feet, through the old red sandstone at the Alleghany Mountain summit, with two others through spurs 1600 and 1000 feet respectively. Upon the branch to Wheeling (201 miles) are twelve, of a total length of 2.04 miles, the longest, the *Kingwood*, 4200 feet long, driven through the coal-measures, with three shafts, each 167 feet deep; tunnel arched throughout. Upon the branch to Parkersburg (103 miles) are 23 tunnels, total length 3.43 miles, the longest 2700 feet, all in the coal-measures. The Chesapeake and Ohio R. R. has seventeen tunnels, from 200 to 6400 feet long, total 4.7 miles. The one through the Blue Ridge is 4200 feet long, through primitive and metamorphic rocks, the rest through the slates, limestones, and sandstones underlying the coal-measures. Two of the longest (4670 and 4033 feet) are at and near the Alleghany summit; the longest (6400 feet) is through the Big Bend of Greenbrier River. There is one of 4000 feet under Church Hill in Richmond through the drift clays, and attended with much difficulty; of course arched throughout. S. of Virginia and W. of the mountains there are but few tunnels constructed and in use, and all of them short. In Eastern Ohio there are some short ones cutting off the bends of creeks in ascending from the river to the table-land of that State. Throughout the Mississippi Valley, after leaving the spurs of the Appalachian range, there is little demand for tunnelling on the rolling prairie-lands, nor is it required upon the ascent of the Rocky Mountain chain from the eastward, the first tunnels, of which there are four, of a total length of but 1792 feet, upon the Union Pacific R. R., occurring on the descent to the great Salt Lake Basin by the cañons which lead to it. The Central Pacific has fifteen tunnels, of a united length of 6213 feet, the longest 1659 feet, in the crossing of the Sierra Nevada. These last tunnels are through granite, trap, trachyte, and conglomerate.

*South American Tunnels.*—Upon Dom Pedro the II. R. R. in Brazil are twelve tunnels, aggregating 2.84 miles, on a line of 19 miles ascending from Belem to Mendez. The longest, at the summit, is 7040 feet; all are in rock. In Peru, on the Lima and Oroya R. R., there are sixty tunnels on 100 miles of road. The longest, on the summit of the pass through the Cordilleras, is 3839 feet long and 15,648 feet above tide, being doubtless the highest tunnel on the globe by more than 2 miles of vertical altitude, as compared with either the Mont Cenis or the St. Gothard. The extreme rarefaction of the atmosphere made labor painful and ineffective, and the water which gushed into the tunnel through the numerous crevices opened by the earthquakes of that volcanic region greatly increased the difficulties of the work, for the prosecution of which tools, powder, and all other necessaries had to be brought from the lower country on mule-back. This tunnel is not yet completed, financial embarrassment having caused the suspension of the work. The preceding statements embrace all actually-built tunnels of which information could be had in time for this article.

*Tunnels in Progress in Europe.*—The one of chief interest, the ST. GOTHARD, is fully treated by HON. G. P. MARSH, whose article in this volume is referred to. Its subsequent progress to Dec. 31, 1875, shows an advance in the heading at the N. end to 3074, and the S. 2842 yards, together more than a third of its total length. The enlargement had made proportional progress, yet only 764 yards were fully completed. The original estimates fall short greatly, and an additional $20,000,000 are called for, and, as no effective response has been so far received, a suspension is threatened. Upon the 165 miles between the Swiss and Italian termini of the route there are numerous shorter tunnels, giving a total length of $16\frac{3}{4}$ miles, and with the main one about 26 miles, or a sixth of the whole distance. *In America.*—Few new tunnels are under way. Upon the Cincinnati Southern its twenty-seven tunnels, of a total length of 4.84 miles, the longest 4000 feet, are all so far advanced as to ensure their completion this year (1876). They are driven through limestone, sandstone, and shale, and will all probably require arching ultimately.

*Subaqueous Tunnels in Europe.*—There are two of these, about $\frac{1}{4}$ of a mile long each, under the Thames at London. The first, at the London Docks, completed in 1842, and seventeen years in progress, is the famous work of the elder Brunel, and involved extraordinary difficulties, which there is no room to describe here. It is a double tunnel, and was never used except by foot-passengers and visitors as one of the sights of London until lately, when it has been made available to connect some of the railways on the two sides of the river. A new cylindrical tunnel or subway of only 7 feet diameter has been since constructed opposite the Tower of London, in a year, by means of a cleverly-contrived iron shield. Passengers are conveyed in a car drawn by stationary power working a chain alternately in each direction. *In America* there are two tunnels side by side, and each two miles long, under the bed of Lake Michigan at Chicago. The first, built in 1864–67 and costing $457,845, was 5 feet in diameter; the second, as an auxiliary, of 7 feet diameter, constructed 1872–74. They connect a hollow crib in the lake with the pumps on the shore, and so draw the surface-water, free from the pollutions of the city and the mud of the lake-bottom, in the clay of which the tunnels were driven 30 feet under its bed. (See TUNNEL, CHICAGO.) The Cleveland tunnel, $1\frac{1}{4}$ miles long, completed in 1874 at a cost of $320,352, for a similar purpose, draws the Lake Erie water for the supply of the city. It is on the same plan, 5 feet in diameter, and met with great difficulty in drifting through the clay bed of the lake. There are two road-tunnels under the Chicago River at that city—one completed in 1869 on the line of Washington street and under the South Branch, where the breadth of the water is 222 feet, and depth of tunnel bottom under low water 32.4 feet. The whole length of the tunnel and approaches is 1605 feet; extreme grade of carriage-ways, 1 in 11.55; cost of work, $512,708. The other is on La Salle street (on the same general plan), finished in 1871; breadth of main river, 300 feet; total length of tunnel approaches, 1890 feet; grade of carriage-ways, 1 in 20; cost of work not stated in published reports. A tunnel under the Detroit River to connect the U. S. and Canada was commenced in 1871, and draining drifts advanced 1220 feet on the Detroit side and 370 feet on the other shore, and suspended on account of influx of water in the latter.

The preceding statements include all the tunnels of magnitude for *commercial* purpose known to the writer as constructed or in progress to this time. Of *mining* tunnels there are many of great length and importance, as (in Germany) the Freiburg, 24 miles; the Georg at Clausthal, $10\frac{3}{4}$ miles; the Joseph II. at Schemnitz, $9\frac{1}{4}$ miles; Rolh-

schenberg (Freiburg), 8 miles; Ernst August, 13½ miles; Victoria, England.

*Tunnels Projected.*—The union of the Ohio and Atlantic waters has led to the projection of two long tunnels—one at the Alleghany summit-level of the proposed Chesapeake and Ohio Canal extension of 3¾ miles, at a height of 1944 feet above tide; width of tunnel, 42 feet, and height 26; long approach-cuts and two shafts, 700 and 576 feet deep; estimated cost, $6,593,990; water 7 feet deep in tunnel as in canal outside. The *other* through the same watershed upon the line of the James River and Kanawha Canal, 7⅞ miles long; height above tide, 1709 feet; width of tunnel, 31½ feet, height 35 feet, with recesses at short intervals for passage of boats; ten shafts of various depths from 90 to 520 feet; water 11 feet deep in tunnel, 7 feet in canal outside; estimated cost, $16,192,487. The details of the Chesapeake and Ohio Canal tunnel are in the reports of Col. William E. Merrill, U. S. army, and Col. Thomas S. Sedgewick, who made the survey. Those of the James and Kanawha tunnel are in the reports of the commission of engineers, of which Gen. J. G. Barnard, U. S. army, was chairman, whose suggestions led to a valuable improvement in the original location of the tunnel by the late Mr. Lorraine, chief engineer of the canal, with whom the bold idea of so long a tunnel at so great an elevation above the ocean originated.

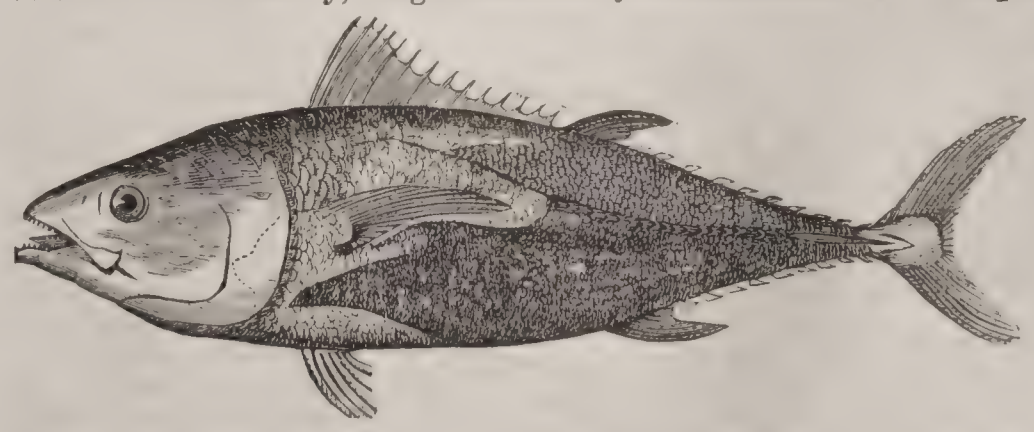
The boldest tunnel of the *subaqueous* class is that of the proposed submarine passage between England and France. The idea of spanning the British Channel by a structure *above* water having been laid aside, it was succeeded by a very ingenious and well-planned mode suggested by Messrs. Bateman & Revet, English hydraulic engineers, of a cast-iron tube upon the bed of the sea. This scheme seems, however, to have given way to that of drifting, in the usual way of tunnel-work, under the bottom of the strait through one of the various strata which compose it, and of which the preference appears properly to be given to the lower or gray chalk, in which trial shafts and drifts are now in progress, so that the project has taken a definite shape, and will, it is presumed, be prosecuted until success is assured or failure demonstrated. The tunnel and approaches would be some 23 miles long under the sea and in the approaches at a grade of some 66 feet per mile, according to the statement of Sir John Hawkshaw, the distinguished English engineer. Many other schemes of subaqueous tunnels, such as that of one under Boston harbor to East Boston, and under the Hudson River at New York, have been planned in detail, and may sooner or later be constructed, and such works between the shores of great commercial ports may receive a large extension in the future as least obstructing navigation.

*General Summary of the Tunnels of the World.*

| | | | | | |
|---|---|---|---|---|---|
| Canal tunnels..... | 86, | of a total length of | | 66¼ | miles. |
| Railway " .....957 | | " | " | 291 | " |
| Subaqueous tunnels.. 8 | | " | " | 6½ | " |
| Conduits ..... 37 | | " | " | 80¼ | " |
| Totals.....1088 tunnels | | | | = 444 | miles. |

This statement is, as already remarked, but an approximation, and could not be otherwise with the time and means at command for obtaining information. It may give a better idea, perhaps, than has been heretofore presented, of the vast extent to which this class of engineering works has reached in modern times. There are tunnels in Mexico, India, Australia, and New Zealand, of which no accounts are at present at hand, and the mining tunnels of Japan are said to be extensive and interesting for the skill and perseverance exhibited in their execution with very inferior tools and appliances. BENJ. H. LATROBE.

**Tun'ny** [Gr. θύννος], the *Thynnus vulgaris*, a large fish of the mackerel family, caught abundantly in the Mediterranean and Black seas, and sometimes in the Atlantic. It sometimes, though rarely, measures twenty feet in length, and exceeds half a ton in weight. It moves in vast shoals, and is caught by enclosing it in nets and then killing by means of the harpoon. Its flesh is highly esteemed, both fresh and salted. It is reported to have been found on our U. S. coast, where its usual representative is *Thynnus secundo-dorsalis*, the great HORSE-MACKEREL (which see).



**Tuns'burg,** Chippewa co., Minn. P. 191.

**Tuns'tall,** town of England, county of Stafford, has extensive manufactures of pottery, tiles, and chemicals. P. 11,207.

**Tunstall,** or **Tonstall** (CUTHBERT), D. D., LL.D., b. at Hatchford, Yorkshire, about 1475; entered Baliol College, Oxford, about 1491; removed thence to Cambridge, where he was chosen fellow of King's Hall, now Trinity College; studied at Padua, where he took the degree of doctor of laws; became vicar-general to Archbishop Warham and rector of Harrow-on-the-Hill 1511, prebendary of Lincoln 1514, archdeacon of Chester 1515, and master of the rolls 1516; was sent 1516–17 to Brussels with Sir Thomas More as joint ambassador to Charles I. of Spain (afterward Charles V.), with whom they concluded two treaties; made there the acquaintance of Erasmus; became prebendary of York 1519, prebendary and dean of Salisbury 1521, bishop of London Oct., 1522, lord privy seal May, 1523, ambassador to Spain 1525; accompanied Wolsey to France July, 1527; was a plenipotentiary to negotiate the Peace of Cambray 1529; bought up Tyndale's New Testaments at Antwerp and burnt them in Cheapside 1529; became bishop of Durham by papal bull Feb. 21, 1530; concurred in most of the ecclesiastical reforms of Henry VIII. and those of the first years of Edward VI., but was deprived of his bishopric and sent to the Tower on a charge of treason Oct., 1552; was restored by Mary, and conducted himself with great moderation during her reign, allowing no persecution within his diocese; was again deprived by order of Queen Elizabeth July, 1559, in consequence of having refused to take the oath of supremacy, and was committed to the custody of Dr. Parker, archbishop of Canterbury. D. at Lambeth Palace Nov. 18, 1559. He was described by Erasmus as "a man who outdid all his contemporaries in the learned languages," and was the inventor of a species of technical memory. Author of *In Laudem Matrimonii* (1518); *De Arte Supputandi* (London, 1522), one of the first books of arithmetic printed in England; *De Veritate Corporis et Sanguinis Domini Nostri Jesu Christi in Eucharistica, Libri II.* (Paris, 1554), being an elaborate defence of transubstantiation; *Compendium in X. Libros Ethicorum Aristotelis* (Paris, 1554); *Contra Impios Blasphematores Dei Prædestinationis Opus* (Antwerp, 1555); *Certain Godly and Devout Prayers in Latin*, etc. (1558), and *A Letter to Cardinal Pole.*

**Tunstall's,** p.-v., Pittsylvania co., Va. P. 4624.

**Tuol'umne,** county of E. California, bounded E. by the Sierra Nevada Mountains, N. by Stanislaus River, and drained by Tuolumne River; surface level in the W. part, mountainous in the E., and covered with excellent timber, which forms an article of large export; soil in the valleys very fertile. It was formerly an important mining district, and mining is still carried on to some extent. There are saw-mills, quartz-mills, and breweries. Sheep are very numerous. Staples, wool, wine, wheat, barley, dairy products, and lumber. Cap. Sonora. Area, 1944 sq. m. P. 8150.

**Tuomey** (MICHAEL), b. at Cork, Ireland, Sept. 29, 1805; came to the U. S. at an early age; graduated at the Rensselaer Polytechnic Institute 1835; became State geologist of South Carolina 1844, and of Alabama 1848, and filled for several years the professorship of geology, mineralogy, and agricultural chemistry in the University of Alabama. D. at Tuscaloosa, Ala., Mar. 20, 1857. Author of a *Report on the Geology of South Carolina* (1848), *First Biennial Report on the Geology of Alabama* (1850), and was joint author with Prof. F. S. Holmes of *The Fossils of South Carolina* (Charleston, parts 1–10, 1855–57).

**Tupelo.** See GUM TREE.

**Tu'pelo,** p.-v., cap. of Lee co., Miss., on Mobile and Ohio R. R., 272 miles from the former city, has 3 churches, good schools, 1 exchange bank, 1 newspaper, 2 mills and steam-gins, and 2 hotels. P. 618. J. M. ECKFORD, ED. "JOURNAL."

**Tupi'za,** town of Bolivia, South America, in lat. 2° 28′ S., near the frontier of the Argentine Republic, carries on a considerable transit-trade. P. about 5000.

**Tupoiidæ.** See APPENDIX.

**Tup'per** (BENJAMIN), b. at Stoughton, Mass., in 1738; was a soldier in the French war 1756–63; became colonel of the 11th Massachusetts infantry early in 1776; served under Gates at Saratoga; was at the battle of Monmouth 1778; was brevetted general before the close of the war; was associated with Gen. Rufus Putnam in forming the Ohio Land Company; was surveyor of Ohio lands 1785; served against the Shays rebellion 1786; settled at Marietta, O., 1787; became judge there 1788. D. in June, 1792.—His son, EDWARD W., was brigadier-general of Ohio volunteers under Gen. Harrison in 1812, and d. at Gallipolis, O., in 1823.

**Tupper** (Martin Farquhar), D. C. L., F. R. S., b. in London, England, July 17, 1810; educated at the Charterhouse School and at Christ Church, Oxford, where he graduated 1831; studied law, and was called to the bar at Lincoln's Inn, but never practised; published anonymously a volume of poems (1832), and in 1838 issued the work by which he is best known, *Proverbial Philosophy* (second series, 1842; third, 1867). Mr. Tupper has written many other volumes of prose and verse. In 1851 and 1876 he visited the U. S., and in 1875 wrote a drama in honor of the centenary of American independence. He is the owner of a fine country-seat at Albury, Surrey.—His three daughters published in 1864 a volume, *Poems by Three Sisters*, and have contributed to Dr. Rogers's *Lyra Britannica*.

**Tupp'ville,** tp., Ottawa co., Kan. P. 250.

**Turanian Race and Languages.** See Language, by Prof. W. D. Whitney, Ph. D., LL.D.

**Turbella'ria** [from *turbellæ*, plural diminutive of *turba*, a "stir," supposed to have been applied on account of the current created by ciliæ], a group of worm-like animals, by some considered as a peculiar class, and by others as an order of scolecids. They are sometimes broad, sometimes very narrow, but always depressed, and invested in an integument (the ectoderm) covered with minute ciliæ, and never segmented or articulated; the mouth is very variable in position, in some being near the middle, in others toward the anterior end, and in others toward the posterior end of the body; sometimes, too, it is simple, and sometimes proboscidiform; the intestinal canal is excavated in the substance of the body, and not differentiated in a perivisceral space; it is in some forms simple, in others ramified; also in some it has an anal outlet, and in others is closed or cæcal; the nervous system is constituted by two ganglia in the anterior portion of the body, from which extend backward two lateral cords (one on each side), besides smaller branches; the sexes are in some combined, in others separate. These various differences have been employed to separate the various forms into groups. (1) Those with an anus are the Proctucha, represented by the Nemertidæ; (2) those without an anus have been combined under the name Aprocta; (2*a*) some (Rhabdocœla) have the intestine simple; (2*b*) others (Dendrocœla) are distinguished by an intestine which is ramified, and are known as planarians. Most of the species are marine, but some inhabit fresh water, and some live in damp places on land. Theodore Gill.

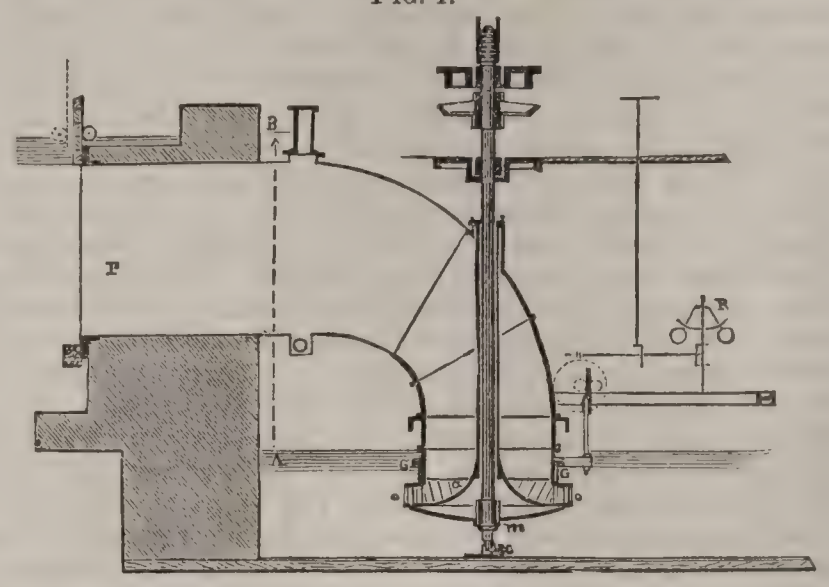
**Tur'bervile** (George), b. at Whitchurch, Dorsetshire, England, about 1530; was educated at Winchester School and at New College, Oxford, where he obtained a fellowship 1561; studied law at one of the inns of court, London; accompanied Sir Thomas Randolph to Russia as his secretary, and wrote three poetical epistles descriptive of that country, which were printed in Hakluyt's *Voyage* along with Randolph's narrative. D. about 1600. Author of *Epitaphes, Epigrams, Songs, and Sonets* (1565; enlarged in the edition of 1570, and several times reprinted in the present century), *Heroycall Epistles of the learned Poet Publius Ouidius Naso, in Englishe Verse* (1569), *The Booke of Faulconrie, or Hawking* (1575), *The Noble Art of Venerie, or Hunting* (1576), *Tragical Tales, translated out of the Italian* (1576), and left a MS. translation of Tasso's *Jerusalem Delivered*, now in the Bodleian Library.

**Tur'bett,** tp., Juniata co., Pa. P. 714.

**Tur'bine** [Lat. *turbo*]. This term is usually applied to a water-wheel revolving upon a vertical axis, as distinguished from those turning on horizontal axes, which are known as vertical water-wheels, or, simply, as water-wheels. There are two radically-different modes of applying water-power. One consists in receiving the water in buckets formed on the periphery of the wheel, in such a manner that the weight of the water causes the wheel to rotate, and overcomes whatever resistance opposes its rotation. In such a wheel the water does not move with a velocity approaching that due the head. In the second the weight or pressure of the head is employed in giving a rapid motion to the water, which by its impulse or reaction communicates motion to the wheel. Wheels with horizontal axes are suited to the first method; those with vertical axes to the second.

A few preliminary observations are necessary as to the nature of impulse and reaction. The action of water by impulse against a solid surface is the pressure against the surface caused by the change in the direction and velocity of the water's motion. As force is necessary to communicate velocity to water, so force is exerted upon any fixed surface which retards or changes its motion. Impulse against surfaces at rest has been made the subject of experiment. Bidone employed an instrument, indicated at Fig. 4, for a flat vane at right angles to the direction of the stream. In this case, when the surface is at rest, the pressure is double that which the head exerts upon an area equal to the smallest cross-section of the stream. In other

Fig. 1.



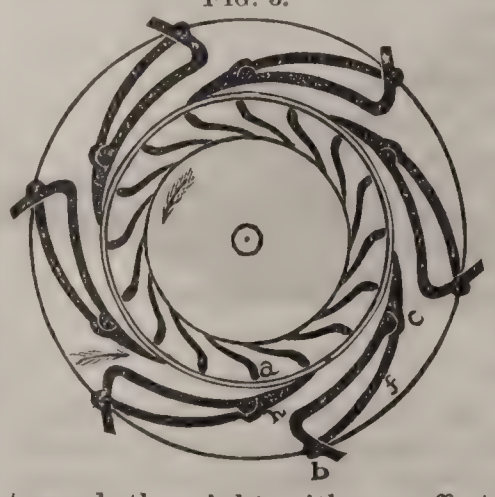
words, the pressure exerted by the water when its motion is arrested is double that exerted in putting it in motion. This would appear at first view to indicate that plane floats receiving the direct impact of the water would be a good arrangement for a water-wheel, but such is not the fact. When the float moves, the velocity of the water relatively to the float is diminished. The power developed is greatest when the float moves with one-half the velocity of the stream, and in this case is but half the absolute power of the water. That is, observing the definition of "efficiency" given further on, such a wheel could never have an efficiency greater than 50 per cent. The abrupt change in the velocity of the water caused by these floats is unfavorable to efficiency. Flat vanes inclined to the direction of the stream are more favorable to efficiency then when perpendicular, but there is here an abrupt change in the direction of the stream which causes a loss of power. In order that the stream may exert its full effect, it must not strike the vane, but must meet it by gliding along it. To show how this may be accomplished in a turbine wheel, let *c c* (Fig. 2) represent the direction and velocity with which water enters the wheel. The point *c* is moving for the moment in the direction *c b* with a velocity represented by *c b*. Relatively to the wheel, therefore, the water has the velocity and direction *c f*. This will appear when we reflect that a particle of water at *c* may be supposed to have two velocities, *c f* and *c b*, which together would give it the velocity and direction *c e*. Now, in order that the water may not strike the bucket, it is only necessary that its inner end should have the direction *c f* equal and parallel to *b e*. If the water leaves the vane with any considerable velocity, it is evident that it has not expended all its energy in giving motion to the vane. This can only occur when it leaves the vane with no absolute velocity; that is, with no velocity as regards a fixed point. It must leave the vane with the same velocity that the latter possesses, and in the contrary direction.

Fig. 2.



A third requisite of the efficient action of water on vanes is that it should be free from whirls, eddies, and counter-currents while in contact with the vane and while approaching the same. Water exerts reaction when escaping from a vessel or enclosed space. The amount of this force may be estimated by an apparatus represented at Fig. 1. A vessel suspended at *c* is kept filled with water, which escapes at an orifice *f*. The water escaping toward the left, the reaction causes the vessel to tend toward the right with an effort which may be exactly weighed by the balance, as indicated. As might be expected, the reaction is exactly equal to the impulse of the same stream on a flat vane perpendicular to its direction. Where water exerts an effort of reaction upon a wheel, it is essen-

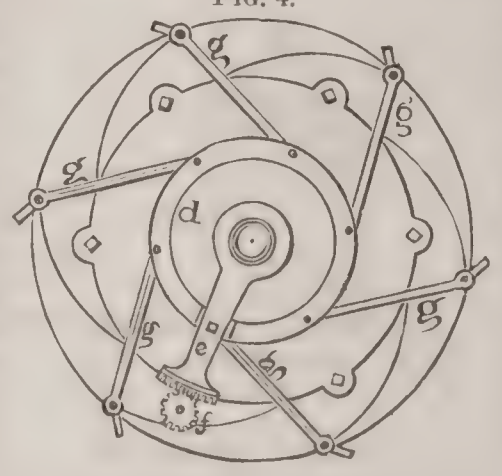
Fig. 3.



tial to efficiency that the direction of the issuing stream should be, as nearly as possible, opposite that of the wheel's motion at the point of discharge. In most turbines the water acts partly by impulse and partly by reaction.

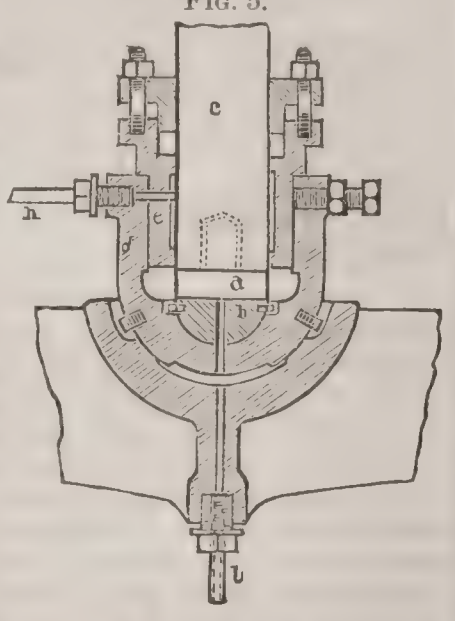
A turbine water-wheel consists of the following parts: (1) a series of fixed vanes, called guides, for giving a suitable direction to the water; (2) a series of vanes attached to a revolving rim to receive the action of the water; (3) a shaft for transmitting the movement; (4) a gate for regulating the quantity of water admitted, and consequently the velocity of the wheel. It also requires an iron or wooden flume or penstock for conveying the water to the wheel under the pressure due to the entire head or fall, and a tail-race for the escape of the water. Modern turbines may be divided into three general classes: (1) outward-flow turbines, in which the guides are within the wheel; (2) inward-flow or centre-vent turbines, in which the guides are outside the wheel; (3) parallel-flow turbines, in which the guides are above the wheel.

FIG. 4.



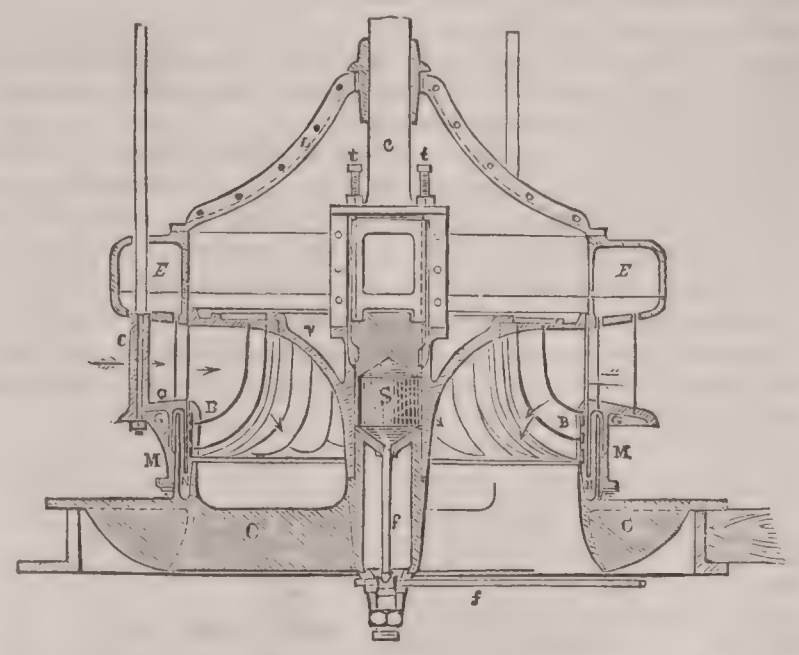

Though the turbine is not a recent discovery, its introduction and use as a motor is comparatively recent. Within the last forty years it has almost entirely superseded wheels with horizontal axes. This result is due to several advantages, among which are—(1) its compactness; (2) its property of working immersed in the water of the tail-race, utilizing the entire head at all stages of the water, and also conducing to its protection from frost, a consideration of no small importance in this latitude; (3) its high velocity, avoiding cumbrous gearing for "bringing up the speed." Its general adoption has stimulated invention in a remarkable degree, more than 1000 patents having been granted by the U. S. government for water-wheels, by far the greater number being for wheels with vertical axes. A great number of models have found their way into the market, and many establishments have been organized for the manufacture of these wheels. The great manufacturing corporations of the East have adhered mainly to wheels of scientific design and careful construction. Among the great body of millers and small manufacturers throughout the country, cheapness is usually a primary consideration. In the utilization of new water-powers it often happens that the volume of water expended is of no consequence, and true economy points to the cheapest wheel that will give the required power. The demand for cheap wheels has opened a wide field for the efforts of inventors and manufacturers, and although an immense amount of ingenuity and capital have been expended upon worthless models which have been discarded after a few years, this great activity has not failed to advance the knowledge of the principles which govern the construction of turbines, and some makers have hit upon designs showing a high degree of efficiency. Several of the leading types in use are illustrated in the accompanying cuts.

FIG. 5.




The wheel indicated in Figs. 1 and 2 may be considered a type of what is known as the Boyden turbine, so called from Mr. U. A. Boyden of Boston, to whom are due the improvements which distinguish it from its prototype, a wheel designed by M. Fourneyron of France, who in 1834 received a prize of 6000 francs from the Society for the Encouragement of the Arts at Paris for the best horizontal wheel upon a large scale. His wheel, again, had its prototype in one of earlier date constructed by Burdin. The illustration is taken from the work entitled *Lowell Hydraulic Experiments*, by Mr. James B. Francis, under whose superintendence this particular wheel was constructed. It is an outward-flow wheel. The water is conducted to the wheel through an iron supply-pipe P. At the bottom of this pipe is the funnel-shaped disk *d* supporting the guides, which direct the water upon the wheel. The disk terminates upward in a pipe within which the wheel-shaft revolves; *o m o* is the wheel, consisting of a hub *m*, attached to the shaft and carrying a broad curved plate, on the outer circumference of which are placed the

FIG. 6.




wheel-rims and buckets or floats. These surround the disk and guides, leaving an annular space in which the gate G G descends to partially or wholly stop the flow of the water. The gate is a short cylinder telescoped on the outside of the supply-pipe at the bottom. It is better shown at Fig. 12. Fig. 2 shows the shape of the guides and buckets. R is the regulator, to be described further on. The weight of this wheel is borne at the top of the shaft. To obtain sufficient bearing surface, the upper part of the shaft is formed into a series of collars, fitting corresponding recesses in a cast-iron box. They revolve in a lining of soft metal composed mainly of tin, which ensures uniform distribution of the weight.

FIG. 7.



The fall acting on a turbine is the height of the surface of the water in the supplying canal or basin above that in the wheelpit, A B, Fig. 1. The power expended is the number of pounds of water passing the wheel per second multiplied by the fall in feet. The useful effect of the wheel is the power which it is capable of exerting to drive machinery. It is estimated in pounds raised 1 foot. The efficiency or percentage of useful effect is the ratio of the useful effect to the power expended. Thus, if the wheel discharge 8000 pounds of water per second, and the fall is 12 feet, the power expended is 96,000 pounds raised 1 foot per second. If the power exerted by the wheel is equivalent to 72,000 pounds, raised 1 foot per second, the useful effect is three-quarters of the power expended, and the wheel is said to show an efficiency of 75 per cent. The Boyden turbine, with the gate fully raised, has shown a higher efficiency than any other wheel. Wheels of this class, subjected to very careful and accurate tests, have been found to utilize as much as 88 per cent. of the power expended. It usually occurs, however, that the quantity of water disposable diminishes materially in dry weather, and it is necessary to run the wheel with the gate partly closed. In this case,

FIG. 8.

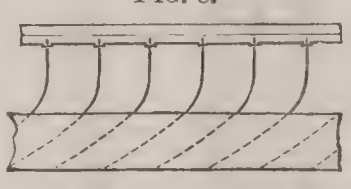
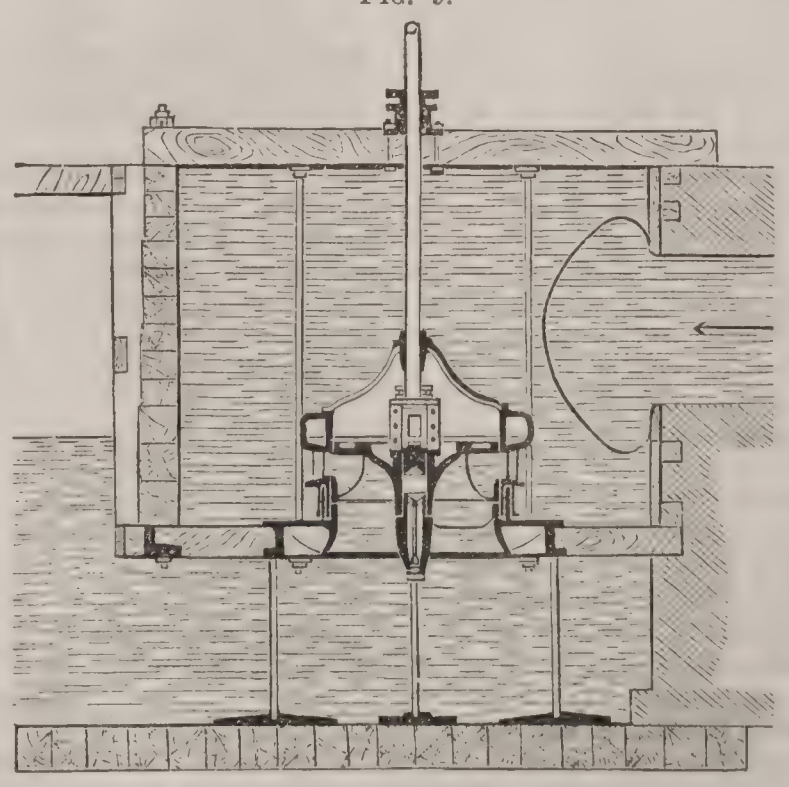


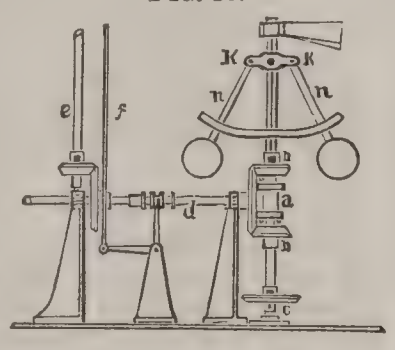
FIG. 9.



the efficiency of this wheel is very much diminished, owing to the fact that the stream of water does not fill the passages through the wheel, and expends much of its energy in eddies and commotions. The water must be used at great disadvantage at the time when it is most desirable to economize it. The attention of inventors has been largely directed to providing a remedy for this defect, and the two wheels next to be described are the most successful examples of its accomplishment.

Figs. 3 and 4 represent a wheel made at Dayton, O., and much used in the Western States. It is a wheel of the second class, discharging inwardly. *a* is the wheel, *b* one of the gates, of which there are six or more. It turns on a hinge at *c*, opening against the vertical diaphragm *f* and closing against *h*. The gates and diaphragms serve as guides. The gates are moved by an arrangement shown at Fig. 4. The wheel is covered by a casing terminating in a pipe within which the shaft revolves. This pipe passes through a circular disk *d*, carrying an arm *e* and resting upon the casing. The pipe may rise to the surface of the water or terminate in a stuffing-box. A pinion *f* gears with an arch-head on the arm *e*, and gives a rotary movement to the disk, opening and closing the gates by means of jointed bars *g g*. This wheel is stated by James Emerson to have shown an efficiency of 83 per cent. with the gates fully open, and 70 per cent. with the gates half open.

FIG. 10.




Figs. 6, 7, 8, and 9 show the Swain turbine made at North Chelmsford, Mass. This is also a centre-vent wheel. Fig. 6 is a vertical section through the centre of the wheel; Fig. 7, a horizontal section showing a portion of the wheel and guides; Fig. 8 shows the outer edges of several buckets, drawn on the supposition that the outer circumference of the wheel is spread out into a plane surface; Fig. 9 shows the wheel as working in its flume. The wheel, it will be observed, is placed over an opening in the bottom of its flume. This opening is occupied by an annular plate of cast iron supporting a short diverging pipe of the diameter of the wheel, through which the water is discharged. Three arms, one of which appears in section at C, extend across this short pipe and unite at the centre to form a hub, sustaining the weight of the wheel. The short pipe, it will be seen, extends above and below the annular plate. Outside of the short pipe another short cylinder, which we will call the curb, stands on the annular plate. The gate is of peculiar construction. It consists of two cylinders M and N, one outside and one inside the curb. It moves upward in closing. The top G G is a broad flange sustaining the guides, which pass through suitable slots into the chamber E when the gate closes. Three of the guides in Figs. 6 and 7 are thicker than the rest, and receive the rods for moving the gate. The buckets of the wheel are curved horizontally and vertically. If an orange were cut in eight equal and symmetrical parts, the rind of one of the parts would bear some resemblance to one of these buckets. *c* is the shaft, *t t* adjusting screws. The weight of the wheel is borne by the oak step S. A careful test of one of these wheels in 1870 by Mr. Hiram F. Mills of Lawrence, Mass., showed an efficiency of 81 per cent. with full gate, 77 per cent. with gate three-quarters open, and 69 per cent. with gate one-half open. A similar test by Mr. Francis at Lowell in 1875 gave an efficiency as high as 84 per cent. with full gate, 83 with three-quarter gate, 77 with one-half gate, and about 63 with one-quarter gate. The wheel indicated at Figs. 1 and 2 showed an efficiency of 79 per cent. with full gate, 76 with three-quarter, 66 with one-half, and 46 with one-quarter.

FIG. 11.

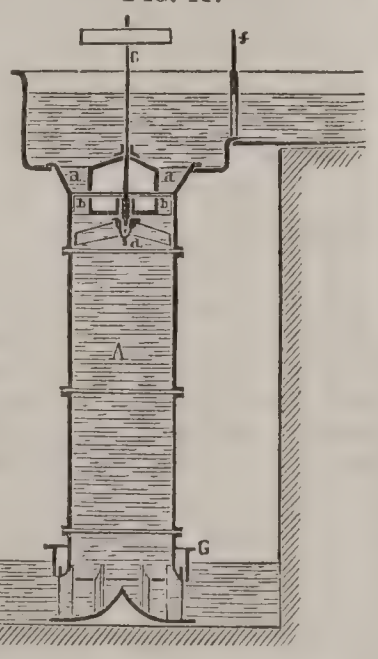
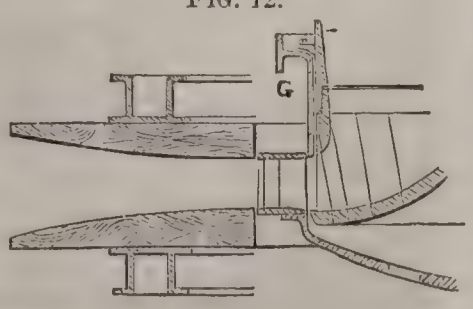
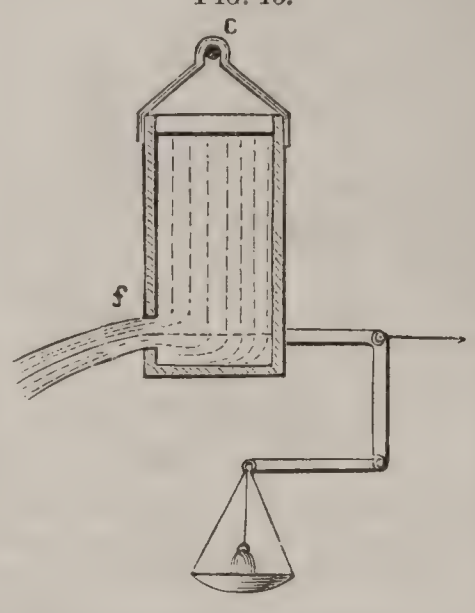



FIG. 12.




Wheels of the third class, in which the water moves parallel to the axis, are rare in this country, though often met with on the continent of Europe. Fig. 11 is the outline of an arrangement common there. *a a* are the stationary guides, *b b* the floats of the wheel, *c* the shaft, *d* the step. The shape of the guides and floats will be better understood from Figs. 15 and 16. Fig. 16 shows the outer edges of two buckets or floats, as they appear in elevation. *g*, Fig. 11, is the regulating gate, *f* the head gate for shutting off the water in order to get access to the wheel. It will be noticed that this wheel is placed above the water of the tail-race, the pipe A opening under water. The head does not act directly upon the wheel. The portion of the head below the wheel acts by diminishing the atmospheric pressure upon the under side of the wheel, and has the same effect as though it were above. This position of the wheel is quite common in the Western States, especially at the Falls of St. Anthony on the Mississippi River, where the geological formation is peculiarly adapted to the arrangement. A pipe is applied to the bottom of the flume in which the wheel is placed, receiving the water passing the wheel and discharging below the surface of the water in the tail-race. Such pipes are called draught-tubes. They do not, in this country, have a gate at the bottom, as in Fig. 11.

FIG. 13.




The processes of manufacture usually require a tolerably uniform speed, however much the amount of machinery in motion may be varied. To avoid the necessity of constant supervision, an automatic device is usually employed to control the quantity of water admitted to the wheel through the gate. Such a device is shown at Fig. 10. It consists of a revolving upright shaft carrying two arms *n n*, to which heavy balls are attached. The arms are attached to the upright shaft by joints or hinges *k k*. The upright shaft carries two bevel gears *b b*, which are fixed as to their vertical position, but do not revolve with the shaft except as described below. These two bevel gears engage with a third, attached to the shaft *d*, which, turning in one direction, raises the gate; in the others, lowers it. *a* is a collar which revolves with the upright shaft, but is capable of moving upward and downward to a slight extent. It carries a small stud at each end. Each of the bevel gears has a similar stud. In a certain position of the collar *a*, it revolves freely, neither of its studs touching those on the bevel gears. In this position the shaft *d* does not revolve. When the collar rises above this position, its upper stud strikes the one on the upper bevel gear, causing it to revolve, and turning the shaft *d*, which raises the gate. When the collar descends, it turns the lower bevel gear in the same manner, causing the shaft *d* to revolve in the opposite direction, lowering the gate. The upright shaft is hollow, and has within it a rod connected with the collar *a*. The two arms *n n* are connected with this rod by branches projecting inward from *k k*, not visible in the drawing. The position of the collar *a*, which leaves the gate at rest, corresponds to the normal speed of the wheel. If the speed exceeds this, the centrifugal force acting on the balls throws them outward, and by means of the internal rod above mentioned lowers the collar *a*, causing the gate to descend as described. When the wheel moves with less than the normal speed, the balls approach the upright shaft, and the reverse action takes place, causing the gate

FIG. 14.

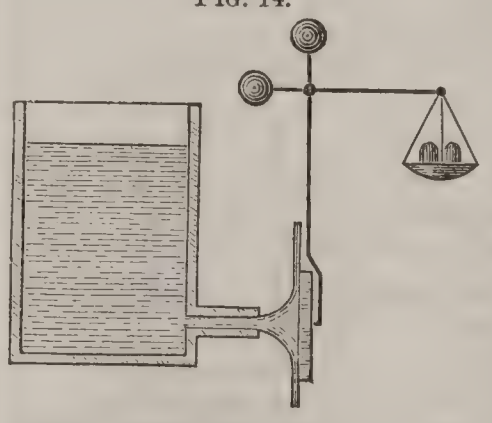
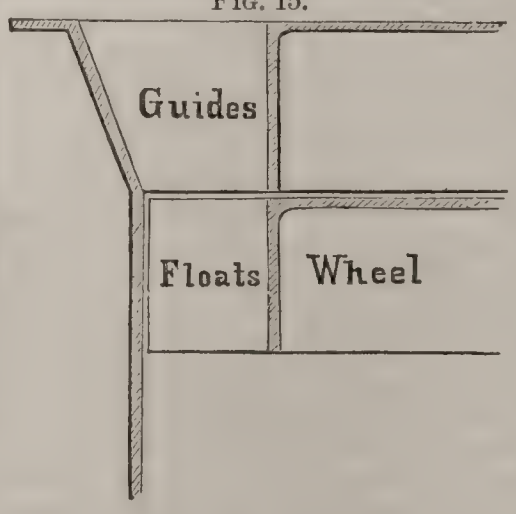


FIG. 15.



to rise. *e* is a shaft for moving the gate by hand; *f* is a rod which, being pressed downward, disconnects the shaft *d* from the regulator; *c*, a bevel gear by which motion is communicated to the upright shaft.

One of the most important accessories of the turbine is the bearing which sustains its weight while in motion. Delays and interruptions result from defects in these bearings as often as from any other cause, since, the bearing surface being necessarily small, they are liable to be destroyed by the great heat generated by friction. The suspension box, Fig. 1, is used to some extent in this country, but a wooden step at the bottom of the shaft is the most common arrangement; S, Fig. 6, is a common form of the step. In this case the constant wetting of the step is ensured by a stream of water forced through a pipe *f* and through a hole in the step. The destruction of such steps by heat is a very common occurrence, especially in wheels provided with draught-tubes. The vacuum in the tube is created by the stream of water issuing from the wheel, on the principle of the jet-pump explained under the head of PNEUMATICS. It sometimes happens, in wheels constructed without due consideration of this point, that the step is excluded from the action of the water, and the air lodges around it, leaving it dry. Such wheels require very frequent renewals of the step. Oak and lignum vitæ are used for the steps, but common second-growth maple has been found just as serviceable. On the continent of Europe a form of step prevails which admits of lubrication with oil. Fig. 5 shows such an arrangement. *c* is the shaft; *f* the case; *e* a lining furnished with a stuffing-box to exclude the water; *a* is a steel face revolving on a hemispherical seat of gun-metal. The case *f* is also hemispherical, and rests in a hemispherical socket. Oil is furnished by the pipe *h*, and passes away through *l*. This arrangement secures uniform distribution of pressure horizontally and vertically, and admits of the renewal of parts liable to wear.

FIG. 16.

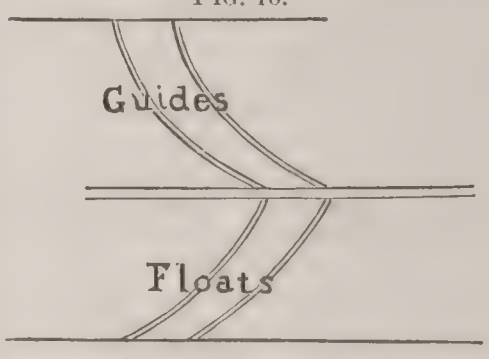



Fig. 12 shows the diffuser, an invention of Mr. Boyden. It is an annular expanding passage surrounding the wheel, and causing the water to escape from it with a gradually diminishing velocity. Its function is to utilize the velocity with which the water leaves the wheel by diminishing the back pressure. (See HYDRODYNAMICS.) J. P. FRIZELL.

**Turbot.** See PLEURONECTIDÆ.

**Turbot,** tp., Northumberland co., Pa. P. 1803.

**Tur'botville,** p.-b., Northumberland co., Pa. P. 417.

**Turdinæ,** or **Turdidæ.** See APPENDIX.

**Turenne', de** (HENRI DE LA TOUR D'AUVERGNE), VICOMTE, b. at Sedan, department of Ardennes, France, Sept. 11, 1611, a son of Henry, duke of Bouillon, and Elizabeth, a sister of William I. of Nassau-Orange; was educated by his uncle, Maurice of Nassau, and entered the French army in 1630. During the Thirty Years' war he distinguished himself in subordinate positions in the campaigns in Germany and Italy; received an independent command in 1641; conquered Roussillon in 1642; was created a marshal of France in 1643, and contributed much to the conclusion of the Peace of Westphalia in 1648 by his successful campaigns in Bavaria, the Palatinate, and Flanders. In the wars of the Fronde he first sided with Condé, but having been defeated at Rethel in 1650 and driven out of France, he became reconciled with the court, was appointed commander-in-chief of the royal troops, defeated Condé at Bleneau 1652, the Spaniards at Arras 1654, and in the Dunes 1658, and was made a marshal-general after the Peace of the Pyrenees, Nov. 7, 1659. In the war with Spain (1667) he conquered Flanders in a brilliant campaign on which the king, Louis XIV., accompanied him, and in the war with Holland (1672) his fame reached its culmination by his conquest and devastation of the Palatinate in 1674, and the destruction of two Austrian armies in the battles of Mühlhausen (Dec. 29, 1674) and Türkheim (Jan. 5, 1675). He was preparing for a last and decisive encounter with Montecuculi, when he was killed by a cannon-ball during a reconnoissance near Sarbach, July 27, 1675. He is considered the greatest general France has produced, next to Napoleon, and he was interred, by order of Louis XIV., in the royal vault of St. Denis. During the Revolution his corpse was for some years exhibited in a curiosity-shop in Paris on account of its good preservation. Napoleon ordered it entombed under the dome of the Hôtel des Invalides. Turenne left *Mémoires,* comprising the period from 1643 to 1658, published by Grimoard in 2 vols. (1782). Deschamps, an officer of his staff, published some *Mémoires* in 1687. His *Life* has been written several times—by Ramsay 1733, translated into English 1735, and by Neuber (Vienna, 1869).

**Turf.** See HORSE-RACING, by C. G. LELAND, A. M.

**Turgeneff',** the name of several celebrated authors in Russian literature. (1) ALEXEI TURGENEFF, b. in 1785; travelled in Germany, Italy, France, and Denmark to make investigations concerning the mediæval history of Russia, and published *Historiæ Russiæ Monumenta* (2 vols., St. Petersburg, 1841–42), and a *Supplementum* (1848). D. at Moscow Dec. 15, 1845.—(2) His brother, NIKOLAI TURGENEFF, b. in 1790; studied at Göttingen; was, with Baron von Stein, placed at the head of the administration of those German countries which in 1813 were reconquered from France; studied subsequently the state of the serfs in Russia; was implicated in the conspiracy of 1825 and condemned to death, but escaped, and lived afterward in Paris. D. in Paris Nov., 1871. He wrote *La Russie et les Russes* (3 vols., Paris, 1847).—(3) IVAN TURGENEFF, b. at Orel Nov., 1818; studied at Moscow, St. Petersburg, and Berlin; was appointed to the ministry of the interior; was for several years banished on account of his liberal ideas, but allowed to return to the capital, and lived subsequently mostly in Paris and Germany. In 1843 his poem *Parascha* attracted much attention, and still more his sketches of rural life in Russia, *Memoirs of a Sportsman* (1852), which was translated into several European languages. His collected works, comprising several highly-appreciated novels, *Smoke, Liza,* etc., were published in 5 vols. (1865), and have been translated into German and English.

**Tur'got** (ANNE ROBERT JACQUES), BARON DE L'AULNE, b. at Paris May 10, 1727; was educated for the Church, and appointed prior of the Sorbonne in 1749, but gave up the ecclesiastical career in 1751; studied law and national economy; became noted by his essays in the *Encyclopédie* and was appointed intendant—that is, governor—of the province of Limosin in 1761. His administration was eminently successful, and although his reforms were crippled by the egotism of the privileged classes and the stupidity of the unprivileged, they proved beneficial. In 1774, Louis XVI. appointed him comptroller-general of France—that is, minister of finance—and he immediately went to work to save, if possible, the state from bankruptcy. His ideas were essentially the same as those subsequently adopted and carried out by the Revolution, and the courtiers, the nobility, the clergy, etc., raised a veritable storm around him. For some time, however, the king supported him faithfully. But in 1775 a scarcity of grain occurred, which almost grew into a famine. The artificial barriers between the various provinces of the realm, which trammelled the free trade in grain in the interior, Turgot abolished by a *lit du justice;* he compelled the Parliament to acknowledge the measure, and the riots of the mob, excited by secret emissaries of the courtiers, were speedily suppressed by military power. But at this point the king failed. Although he said that he himself and Turgot were the only two who loved France truly, yet he suddenly dismissed him in May, 1776. Turgot retired into private life, occupying himself with scientific researches. D. in Paris Mar. 20, 1781. His *Œuvres complètes,* containing his essay on usury, on the best method of taxation, and *Réflexions sur la Formation et la Distribution des Richesses,* etc., were published by Dupont de Nemours in 9 vols. (1808–11), and often reprinted. His *Life* was written by Condorcet (1786) and Tissot (1862). He is the author of the famous line on Franklin: *Eripuit cœlo fulmen sceptrumque tyrannis.*

**Tu'ri** [probably anc. *Thuriæ Turum*], a town of Italy, province of Bari delle Puglie, on the slope of a rocky hill about 13 miles S. E. of the town of Bari. In the neighborhood, under the church of S. Oronzio, is the grotto in which that saint is said to have hid himself from the persecution of Nero, and whose natural arches, encrusted with stalactites, when illuminated by the sun shining through a rift, glow with a thousand gorgeous colors. The district is fertile, and the town improving in industry and in education. P. 6218.

**Tu'rin** [It. *Torino;* Lat. *Augusta Taurinorum*], city of Northern Italy, on the banks of the Po, in N. lat. 45° 4′, E. lon. 7° 42′, at the height of 755 feet above the sea. Turin is said to have been founded by the Ligurian tribe of the Taurini, but can hardly be said to be known in history until its colonization by Rome some time before the Christian era. In the eleventh century it was the capital of a small independent state, but passed by marriage into the family of the dukes of Savoy, of which, with the exception of the period of the Napoleonic occupation (1798–1814) and some previous brief intervals, it has ever

since been a possession. It was the political capital of the dukedom of Savoy, and afterward of the kingdom of Sardinia, until 1861, and then of the kingdom of Italy until 1865, when, in conformity with the stipulations of the convention of Sept. 15, 1864, between Napoleon III. and Victor Emanuel II., the seat of government was transferred to Florence. During the residence of the house of Savoy the population of Turin largely increased, and it was so strongly fortified as to defy the utmost power of France in the memorable siege of 1706. As its limits extended, the new parts of the town were laid out with great regularity, provided with wide streets, ample squares, and very extensive and magnificent porticoes, and abundant provision was made for the accommodation of the royal family and the transaction of public affairs by the erection of suitable palaces and other public buildings. Few European capitals could vie with Turin in convenience as a governmental city, while at the same time its university and its special and common schools, its museums and other public collections, the unsurpassed beauty of its site and its environs, the excellence of its climate, and its facility for communication with all parts not only of Italy, but of Central Europe, rendered it one of the most desirable residences on the Continent. The removal of the seat of government was a severe shock to Turin, but the energy and enterprise of its people have restored its old prosperity, and its population, which hardly exceeded 200,000 in 1861, has, notwithstanding the emigration of many thousand citizens who followed the government on its removal, now risen to 213,000.

Although the private and public buildings of Turin are generally of good design and well constructed, there are no churches or other edifices specially conspicuous for architectural merit, nor are there any important remains of ancient structures. The chapel of the Santa Sindone or Sudario, which is superstitiously venerated as a portion of the shroud of Christ, opens from the cathedral and is constructed entirely of black marble. It is among the richest ecclesiastical buildings of Turin, but in a taste which has found few admirers or imitators. A large church built for the Vaudois in 1851–53, principally with funds contributed by the state, is remarkable as one of the earliest instances of that religious liberality for which the government of Italy is now conspicuous. The church of the Corpus Domini is very profusely ornamented, and that of the Santi Martiri is sumptuous in its decorations. The Turinese churches contain few good works of art, but the cathedral has a *Virgin and Saints* ascribed to Dürer, and San Domenico contains a *Madonna* by Guercino. The Jewish synagogue, not yet finished, is very large and costly. The royal palace, though large, is not of extraordinary magnificence. It contains the king's private library, a valuable collection of 50,000 volumes, with many important manuscripts, and the royal armory, a large, well-arranged, and well-kept collection of ancient, mediæval, and modern arms and armor. Many of these objects are of much historical interest, and there are numerous weapons and pieces of defensive armor of the utmost beauty and perfection of workmanship. In equestrian armor this collection ranks among the finest in Europe. The University of Turin, now in a very flourishing condition, with an able corps of professors in the usual faculties, and 2000 students, occupies a building of plain architecture in the Via Po. Its library contains 150,000 volumes of printed books and many manuscripts of great value, among which some are splendidly illuminated. The Pinacoteca, a royal gallery of pictures, is of comparatively recent formation, but contains remarkable works by Gaudenzio Ferrari, Fra Angelico, Pollajuolo, Guido, Guercino, Paul Veronese, Domenichino, Albani, Vandyke, Paul Potter, Holbein, and other eminent masters, among which a priceless Memling, the *Passion of our Lord*, deserves special mention. The museum of antiquities, including the Egyptian collection of Drovetti, is of great interest and value, and the Museum of Natural History is highly respectable. The gallery of the Academia Albertina contains some good pictures, and the Museo Civico is well worth a visit for its collection of miscellaneous objects, among which a complete series of the editions of the celebrated Bodoni is noticeable. The country around Turin, though not enriched by splendid villas or ornamental gardening, is of the highest natural beauty, and several points in the vicinity of the city command views of the Alps which as *panoramic* prospects are not equalled by any in Switzerland. Under favorable conditions the *morning* winter view of the mountains from the Monte dei Capuccini on the right bank of the Po, 170 feet above the town, embracing the whole range from Monte Rosa to Monte Viso, a distance of 120 miles, with no break visible to the spectator less than 7000 feet above his own level, is indescribably magnificent. Even finer is the prospect from Superga, the royal mausoleum, at a height of 1600 feet above Turin, which includes all that is visible from the Monte dei Capuccini, with many additional peaks, as well as the plains of Piedmont and Lombardy, studded with cities and extending as far as the eye can reach.

In its mean, 51°, and its extreme of cold, —1° F., the temperature of Turin corresponds with that of Paris, but the mercury has not been observed to rise higher than 92°, four degrees below the maximum of heat at the capital of France. The mornings are sometimes obscured by fog from the Po, but in general the sky is clear, the air free from chill, and, notwithstanding the nearness of the Alps, the changes of temperature are extraordinarily gradual and regular, and Turin enjoys an almost total exemption from high winds.

The revival of the prosperity of Turin, temporarily checked by the removal of the seat of government, is due to its position as a convenient centre of trade in the native products of Northern Italy, and to the establishment of many manufactories for cloths, silks, candles, furniture, ironwork, tanned leather, and chemicals, besides numerous small industries in metal and in wood. The extent of some of these establishments may be inferred from the fact that a single manufactory produces 9,000,000 matches per day, and employs 450 laborers. A canal for the supply of water-power has lately been constructed by the municipality, but is not adequate for the wants of these industries. (See Covino, *Descrizione di Torino*, and especially *Il Panorama delle Alpi*, by the same author, Turin, 1874.)

CAROLINE C. MARSH.

**Turin,** p.-v. and tp., Lewis co., N. Y. P. of v. 552; of tp. 1493.

**Turkestan′,** or **Toorkistan** [properly, *Turkistan*, "land of the Turks"], formerly by geographers called **Bucharia, Great and Little,** the name of the broad, longitudinal depression between the Karakorum (Mustagh) and Hindoo-Koosh to the S., and the Thian Shan to the N., occupied by the river-systems of the Amoo Darya (Oxus) to the W., and the Tarim (Yarkand) to the E., the watershed between which is situated in the Pamir plateau, "the roof of the world," at an elevation of not less than 13,000 feet. It is bounded N. by Mongolia and the Kirgheez steppes, W. by the Caspian Sea, S. by Persia, Afghanistan, and High Asia, or the mountainous region forming the northern boundary of India, and E. by China proper. Its area has been calculated from maps at 1,576,402 sq. m. The Pamir steppes have always formed a line of separation, politically and ethnographically. Western Turkestan belonged formerly to the Iranians, now to the Russians; Eastern Turkestan was from olden times, and is up to this very day, the arena of Turkish adventurers, whose rule has been suspended, however, every now and then by the emperors of China.

*Western* or *Russian Turkestan*, the *Transoxania* of the classical, the *Maverannahr* of the Arabian geographers, comprises the government-general of Turkestan, the Trans-Caspian district, the feudatories of Bokhara and Khiva, all Russian dominions, and the Toorkoman steppes and the unexplored hilly tracts of Karategin on the upper course of the Oxus, which are still independent. As regards its physical conformation, the northern part is chiefly a plain extending from the Thian Shan hills, which cover the eastern districts (Ili, Ferghana, or Khokand), and reach Samarcand in its extreme spurs, to the shores of the Caspian, where it sinks down with a rapid declension. With the exception of a few table-lands and some bits of hard clay or loam, the soil consists chiefly of black or yellow sands, and the only land really fit for cultivation is that lying on the slopes of the hills or on the banks of rivers and canals. Two water-lines of ancient renown traverse the country at wide intervals, and in bygone ages they perhaps formed the avenues by which the tribes of Scythia found their way to Poland and Germany, while in our days they have led the Russians in turn to the habitations of the ancestors of the Turks. The largest of these rivers is the Oxus, now known by the name of *Amoo Darya*, which, rising N. of the Hindoo-Koosh in the Pamir steppes, where two of its infant rivers take their origin from noble sheets of water (Sirikul, 15,000 feet, and Karakul), flows along the territories of Afghanistan and Bokhara, and traverses then in a north-western direction the plains and deserts of Khiva, until it empties into the Sea of Aral. Its fall is, in its lower course, 0.15 centimètres in 300 mètres, and it is navigable for steamers from the mouth of the Ulkun arm to Kungrad, and still farther for small vessels; but a convenient road of traffic it can never become, on account of the rapids, 100 miles above Pitnak, and on account of the great changes which take place in its bed. The story that the Oxus formerly used to run into the Caspian, but was turned off by a dam constructed by the Toorkomans, is well known, and there is, indeed, a well-defined bed, called Usboi by Russian geographers, and which can be

traced from Khiva to the Balkan Bay of the Caspian Sea. Prof. Kiepert of Berlin, however, is of the opinion that the river became turned off by volcanic action in the oldest time of our planet, in which case the statements of the ancient and mediæval historians—which, moreover, are very indefinite—must be considered as inferences drawn from the peculiar configuration of the surface. The object of opening a water-communication from the Caspian to the foot of the Hindoo-Koosh by means of the Usboi bed could not be attained without extensive excavations of the sand which has drifted into the old bed, nor without closing the canals which absorb so much of the river water, but which are absolutely necessary to the continuance of cultivation in Khiva. The other great river, the Jaxartes, or *Sir Darya* of modern times, descends from the distant highlands of Ferghana (Khokand), at first to water lands of plenty; but as it tends northward it passes through what is now for the most part a vast desert, until it loses itself in the Sea of Aral in a wild delta of swamps and thickets. The river is navigable for a considerable distance. The main river of Bokhara is the Zerafshan, which has its source at an elevation of 7000 feet above the sea, divides N. E. of Samarcand into many branches, and flows S. W. to the steppe country. Formerly numerous canals branched off from these rivers and were led far into the deserts, where remnants of them still indicate their course; but they have been destroyed at various times, especially in 1570, when Bokhara determined to lay the northern frontier districts waste in order to prevent the predatory invasions of the Kirgheez Cossacks. The same was done at Merv, where formerly a large reservoir, Bend, gathered the waters of the Moorgaub, which now are lost in the sand before they reach the city. The Russian government builds large canals; works which are capable of irrigating 43,200 hectares were finished at Khojend in Nov., 1874. As regards the climate, spring begins in the middle of February. The annual mean temperature of Tashkend, in lat. 41° 8′ N., is 55° F. The winter is not so severe as in Russia; the spring brings abundant rain; the summer is dry and hot, even unpleasantly so, at least to Europeans; terrible sandstorms (*uragan*) occur in the steppes. Mining is still in its infancy. The iron, copper, and lead ores of the Karatan Mountains along the northern frontier of Bokhara have not yet given rise to any vigorous production of metals. Gold is found in the Ili district. The extensive coal-deposits in the Karatan have not yet been utilized, and are said to be of poor quality: layers of rock-salt have been discovered here. Forests are scarce. Peat is used as fuel in the towns. The saksaul, rising in tortuous zigzag lines to a height of 15 feet, and with a stem of a diameter of one and a half feet, occurs in the steppes sometimes as forests, oftener in thickets, and yields a valuable fuel. The high temperature of the summer has a good influence on the cultivation of the soil, which is everywhere sandy, light, and porous. Irrigation is indispensable, and plays a prominent part in agriculture. Only wheat and clover are winter crops; all other cereals, such as millet, barley, maize, pease, and rice (S. of Tashkend), are sown in April and harvested in August. Cotton succeeds in lat. 42½° N., and ripens in October. Bokhara cotton is considered one of the best kinds, and is sold at the fair of Nizhnee-Novgorod at from 12 to 20 rubles a pood; between 1,000,000 and 2,000,000 cwts. are annually brought thither. Grapes are cheaper than potatoes. The vine is chiefly cultivated S. of Tashkend, and the grape yields a good wine. Tobacco is also raised S. of Tashkend; seed from Maryland has succeeded well, and the cultivation seems to have a future. Rearing of silkworms is a favorite occupation, and produces a brilliant, fine, and strong silk, which is sold in the place at 375 marks a pood, 1750 marks for 100 cocoons, and 300 marks for 1 pound of eggs. The fruits and dyes of Bokhara are unrivalled of their kind. All agricultural implements are imperfect; very little iron is employed in their construction. The domestic animals comprise the horse, ass, cow, camel, sheep, goat; also swine, poultry, dogs, and cats. The horses are small, but light, swift, and easily satisfied with respect to fodder. The camel is the Bactrian double-humped; it travels at the rate of 3 miles an hour and carries five cwts. For cattle-breeding the Turks have no taste; the race is small, of an indefinite color, and poorly cared for. Sheep, brown-colored and with pendent ears, are reared for the sake of the flesh. A developed manufacturing industry cannot, of course, be expected, as two-thirds of the inhabitants are nomads and know no wants beyond the most common. All industry is as yet home industry, and employs only hand labor. Among the best articles produced, and which form items of exportation, are strong carpets of wool or goat and camel hair, silks, and cotton fabrics worked on huge looms. The colors are generally indefinite and sombre, and do not correspond with European taste. The whole population is animated by a strong commercial spirit. Merchants from Samarcand and Tashkend have for many centuries visited the trade-centres of Eastern Russia, China, and Persia; and in the interior the towns swarm on all market-days with nomads who are eager to buy. Since the incorporation in 1868 of Turkestan with the Russian toll-dominion, commercial statistics are wanting, but in 1867 the total Russian traffic with the countries S. of the Kirgheez toll-line was valued at 29,300,000 rubles, and since that time commerce has increased considerably; every year a greater quantity of Bokhara cotton is used in the Russian factories. The distance from Tashkend to Orenburg is 215 miles; to Troitzk in West Siberia, 1080; to Khiva, 500; to Khokand, and thence across the Terek pass, 12,000 feet high, to Kashgar, 300. Regular postal connections are established on these and several minor lines. On the chief routes the traveller finds *tarantas* (four-wheeled vehicles) or horses and camels, which latter still form the principal means of communication, though much has been done to improve the main lines of roads. The idea which M. Lesseps first broached in 1873 by his proposition of a Central Asiatic railway from Orenburg to Tashkend, and thence through Balkh to Peshawar, is now realizing in the form of a Siberian railway from Nizhnee-Novgorod to Tjumen, and thence through Troitzk to Tashkend; the line to Tjumen was finally determined upon Dec. 30, 1875.

On the basis of a census of the families, the population is estimated at 4,000,000 Russian subjects, including the inhabitants of Ferghana, formerly Khokand, and 3,600,000 in the states of Bokhara, Khiva, Karategin, and the Toorkoman steppes. Turkish blood prevails, and the Oozbeks predominate—a name first occurring in history in the fifteenth century. Like all Turks, the Oozbeks have no sense of social organization, no understanding of the advantages of fixed settlements, no love of home. Most of them are nomads; those who have fixed habitations are called Sartes; in their talent for trade other people surpass them. With respect to religion, they are Mohammedans, and most fanatical members of the Shiitic sect. But their star is now waning; they have given themselves up to their passions, make all roads unsafe, and plunder the caravans in connection with the Toorkomans—Turks with a sprinkling of Iranian blood, and still more inveterate robbers. The Toorkomans, however, are brave and revengeful, while the Oozbeks are cowardly. Only people of the higher classes can read and write. On a still lower stage stand the Kirgheez, a mountain people which by some mistake came to give its name to the Kirgheez steppes, which are inhabited by the Kasaks. On the left bank of the Oxus they have no fixed habitations, but make all passes and fords unsafe; in former times they captured even large cities. The bravest of these mountain-nomads are the Kipchaks, on the south-western slope of the Thian-Shan Mountains. They have played a conspicuous part in all the great movements which took place in this part of the world. They fought with Booddhistic China about the possession of the Mohammedan Turkestan; in Baber's army they founded the Indian empire of the Mogul; and in 1876 the Russians had to make a very difficult winter campaign to their mountain-dens in order to subdue them. Tadshik has been, since the thirteenth century, the name of those who speak Persian, comprising the Iranian part of the population, the productive class, with fixed habitations. Their suppression by the Oozbeks, which has lasted for centuries, has made them cringing, false, and avaricious. They show a great regard for the Koran, but only as long as such a regard may prove advantageous. They live mostly in the towns, and are often considered as Sartes. The language is Tartarian, a branch of the Turkish or Oozbek, interspersed with Persian and Arabic words; Turkish, however (Osmanlee), and Persian are generally understood. The letters are Arabic; the paper of an inferior quality, thick, yellow, looking like parchment. The literature represents a one-sided civilization, built up by dogmas of Mohammedan theology, legends, and some poetry, and fit only to engraft a narrow fanaticism on the Turkish-Tartarian youth, and hedge off all true enlightenment. Original works have not yet been discovered; what have become known are merely translations from the Persian and Arabian. Until the arrival of the Russians education was exclusively in the hands of the fanatical Mohammedan clergy; in their ninth year children were brought to the school (*mekteb*). Subsequently, the Russian schools were opened also for the native population, but the Moslems still prefer the scientific institutions of Samarcand and Bokhara, in which theology, jurisprudence, and medicine are taught in accordance with the Koran and the old traditions. Since 1870 there have appeared one newspaper in Russian, and one Kirgheez periodical. In customs and habits many changes must take place before the Oriental dirt which still sticks even to the best can be

removed. Boys and girls marry before they have reached the age of maturity. The family life is poor. In times of fasting the Tartar abstains during the day, but during the night he eats and drinks so much the more. Superstition regulates everything.

*History.*—Western Turkestan is the home of the ancient Scythians, who, according to historical and ethnographical researches, were Iranians. They were followed by the Sakæ, a Turkish tribe from Eastern Turkestan, who in the second century B. C. began to threaten them, especially in the northern parts, where they were less densely settled. In the fourth century B. C., Alexander the Great founded Khojend on the Sir Darya. In the first century B. C. the Chinese pushed onward to Khokand (Ferghana); they brought with them the cultivation of silk and the manufacture of iron. The ancient worship of fire and other natural phenomena was suppressed by the Mohammedan conquerors and supplanted by Islam. An Iranian noble converted to Mohammedanism laid in 874 the foundation of a monarchy ruled by the Samanides till 907, with Bokhara as capital, and extending from the sources of the Oxus and Jaxartes to the shores of the Caspian Sea and the Persian Gulf. This most glorious era was followed by centuries of confusion; even in the tenth century an Arabic geographer complains that of all the countries of Islam, none is so filled with the tumult of war as Transoxania. The condition of the fixed population did not improve much afterward. The invasions and campaigns of Genghis Khan in the thirteenth century, of Timur in the fourteenth, to whom Samarcand owes its prosperity, and of Baber in the sixteenth, resulted in the supremacy of the nomads, and up to the arrival of the Russians the history of the country was one uninterrupted series of wars and feuds. In 1847 the Russians took possession of the region between the lakes of Balkash and Issikul, established a military station at the mouth of the Sir Darya, and began to ply the first steamer on the Aral Sea. The reconnoitring expedition under Von Baramberg in 1852 terminated with an audacious and unsuccessful attack on Ak-Meshid on the Sir Darya, but advanced outposts were nevertheless pushed forward—in the W. along this river, and in the E. from Werpoje. In 1860 it was determined to connect the forts on the Sir Darya with those in the E., and the conquest of the cities of Turkestan and Chemkend in 1864 was the immediate result of the operation. With the conquest of the districts of Tashkend, Ura-Tepe, and Fizak from Khokand, and the district of Zerafshan, with the city of Samarcand, from Bokhara, whose army of 40,000 men was utterly routed by 1700 Russians under Cherniayeff, the Russian extension terminated to the S. To the E. the fertile valley of the Ili was conquered in 1870 from the Dunganes, who (see URUMTSI) had expelled the Chinese in 1863. To the W. the right bank of the Oxus was ceded in 1873 by Khiva, and the immediate result of the humiliation of Khiva was the establishment of a Trans-Caspian government comprising the territory on the eastern shore of the Caspian Sea, with Krasnowadsk as capital. The difficulties in conducting large armies through extensive deserts were overcome with rare perseverance. A winter campaign, rich in scenes of brilliant valor, increased in 1876 the Russian empire with the exceedingly fertile kingdom of Khokand, which now bears the name of Ferghana. By an ukase of July $\frac{11}{23}$, 1867, the new conquests were organized into the government-general of Turkestan, with Tashkend for its capital. This city numbers 46,000 inhabitants, is the seat of the administration, and has a gymnasium, a public library, a branch office of the imperial bank, and numerous factories established by Russians; the streets are illuminated at night. The regular army, consisting of Orenburg, East Siberian, West Siberian, and Toorkoman battalions, in which the term of service is seven years, numbered 12,000 men on Mar. 1, 1876. Four battalions of sharpshooters, comprising the choicest troops, are armed with the excellent Berdan gun, the rest with imperfect Terry-Norman breech-loaders, constructed out of old muzzle-loaders. Eight foot batteries carry muzzle-loaders of the La Hitte system. The cavalry forms the principal force, and consists of Cossacks in divisions of 100 men. The equipment is left to each man, and is consequently very various. The reserve consists of an insufficiently armed infantry of Cossacks and militia. Reinforcement of regular infantry is necessary; neither in Khiva (1873) nor in Khokand (1876) have masses of cavalry produced the old effect. In Russian works it is generally acknowledged that the conquests are not yet complete; Russia cannot stop short of the Hindoo-Koosh. Meanwhile, the approach of the Russian frontier toward India caused some uneasiness in England on account of her Indian possessions. Many prophesied an invasion of British India by Russia, and the English government felt it necessary in 1873 to declare Afghanistan and all the countries S. of the Oxus neutral ground, and the transgression of the boundary by a Russian army a *casus belli*. A Russian invasion of India is not very probable, however, but it would by no means be strange if the rapacious nomads of Central Asia, to whom Russian Turkestan now has become closed, threw themselves on Herat and Kelat, and either pushed onward to India themselves or drove other tribes thither. Thus, although any Russophobia may be unfounded, the position of Russia in Central Asia compels England to make great exertions, and it will be necessary for her to make sure of the Iranian states, which she has generally left to themselves since the failure of the Afghan war in 1838.

*Eastern Turkestan*, called *Nan-ly* by the Chinese, *Alti-shar* ("six towns") by the neighboring Mohammedans, and *Jiti-shar* ("seven towns") by its actual ruler, stretches about 250 miles from N. to S. as a gently undulating plain, shut in to the S. by the great range of mountains, comprising the Künlün and Karakorum, the watershed range between India and Central Asia; bounded W. by the Pamir steppes, and N. by the Thian-Shan range, the outward culminating ridge of the mountain-system in which the great rivers of Siberia take their rise. To the E. lies the Gobi desert, which swallows up alike watercourses and vegetation, and from which long arms of sand and shingle run back into the cultivated region up to the boundaries of the village cornfields. Since Mar., 1876, Eastern Turkestan has connected immediately on the W. with Russian Turkestan. It comprises an area of about 420,000 sq. m., and forms the transition from Western to Eastern Asia, consisting of a plateau of an average elevation of 6400 feet, with a depression in the centre to which all the waters of the plain flow—the Karakash and Yarkend from the S., the Kashgar from the W., and the Kysil-Kungei or Aksu, the Shar-yar-darya, and the Kai-du-gol from the N.—all joining the Tarim and ending in the Lob Lake. In their upper courses these rivers are mere mountain-torrents of no great depth, rushing impetuously over rocky beds; in their lower parts they are navigable when full, and the Tarim is navigable at all seasons and along its whole course. In 1874 the Central Asian Company, starting from Lahore in June, made the chief at Kashgar a present of a miniature steamboat. The climate is distinguished by great dryness; summer rains are rare. The winter is not severe; in January the thermometer sinks only a little below 0° F. Snow seldom falls in the plains; the tanks are frozen and the ice stored for summer. In August and September the maximum of heat during the day is respectively 92° and 65° F. The most remarkable of the minerals is jade or nephrite, a silicate of magnesia, found in the Künlün. In the Stone Age all the cave-dwellers of the Asiatic and European continents were provided from here with jade for their cutting tools; in the Middle Ages the quarries were worked by the Chinese, but at present the works have fallen completely into decay. Agriculture is possible only by means of irrigation; accordingly, all towns and settlements are situated along the rivers or in their neighborhood, and numerous canals and ditches are dug in the fields. In spite of their rude agricultural implements, the inhabitants have generally good crops, with the exception of years in which only a little snow falls in the mountains. Rice, wheat, barley, millet, Indian corn, and sometimes a few peas and beans, are raised in the neighborhood of the towns. Linseed is grown only for the seed, and hemp for the intoxicating extract, *charras* or *bhang*, the use of the fibre not being known. The lower classes are all supplied with cotton clothing from their own fields, but the better classes wear garments made of silk or of English or Russian cotton fabrics. Tobacco is raised in considerable quantities. Carrots, turnips, radishes, onions, cabbages, melons, cucumbers, red pepper, tomatoes, and coriander are raised in every garden; grapes, apricots, peaches, apples, pears, and figs are successfully cultivated. Mulberry and apricot trees of unusual size grow at the very foot of the mountains. Forests are wanting; most of the timber for building is either willow or poplar. Stamping-mills for crushing rice are driven by water-power, but horses and donkeys are used for treading out the corn. Excellent breeds of horses come from Aksu and Khokand; a pony fetches from £4 to £15. The Bactrian double-humped camel is found in a wild state in the swamps around the Lob Lake, but is also reared in large herds; its sure step makes it very useful in crossing the mountain-passes. Of the domesticated animals the broad-tailed sheep is of the greatest importance; the Turfani wool has a world-wide celebrity and forms one of the most important articles of commerce. The manufactures are almost entirely confined to articles required for home consumption; carpets and felts form almost the only exceptions to this rule. The dress consists of a turban or a cap lined with sheepskin, one or more loose robes of cotton cloth, a pair of trousers of cot-

ton or leather made so wide that they go over the loose robe to protect the latter when the wearer is riding or working. Stockings are worn only by the wealthier classes. All wear boots, which usually come up to the knee; they are made of untanned leather, but the better classes have them made of leather imported from India or Russia. Ancient Chinese coins, silver coins that bear the name of the actual ruler, and gold coins in the name of the caliph or sultan of Constantinople, are current. A peculiar article is the yambu (*gambu*), boat-shaped silver ingots melted from worn-out coins, varying in value from £5 to £16. The *tilla* is a Kashgarian gold coin worth about eleven shillings. The weights employed are of iron; the balances are all on the principle of the steelyard. Up to the establishment of the present dynasty in 1865, all commerce went to China, and with India only a very limited traffic took place through Khokand and Bokhara. Now, China is closed, and India and Russian Turkestan are the principal countries to which an exportation takes place. From the English side Sir D. Forsyth has great hopes of the increase of the trade with Yarkand. Before 1865 the total value of imports and exports amounted to £25,000; but after the visit of the first English embassy to the court of Kashgar in 1870, it rose to £154,000, and in 1874–75, after the conclusion of the commercial treaty of Mar., 1874, to £2,600,000. Indeed, the peddlers found the trade so profitable that in 1874 the Central Asian Trading Company was formed at Punjaub, a caravan of 500 beasts of burden organized in the same year, and the fabrics of Manchester actually introduced to the markets of Central Asia. The British-Indian government gives this trade a great support; in Le, the capital of Ladak, a province of Kashmir, it keeps an official who sees that no higher duty is levied than is agreed upon, that along the principal routes the dangerous mountain-paths are transformed into safe mule-tracks, and that provision and fodder are stored at proper places. Russia, too, makes great exertions, and she has the great advantage that for a long distance N. and W. she is the immediate neighbor of the country, and has her Cossacks stationed at a few days' distance from Kashgar; the mountains here are also less difficult and inhospitable than those along the Indian frontier. By the Treaty of Peking (Nov. 2, 1860) Russia acquired the right of keeping a consul at Kashgar, but subsequently the new chief would not acknowledge himself bound by this stipulation. On June 8, 1872, Russia succeeded, however, in concluding an advantageous treaty, and it intends to keep an ambassador at Kashgar from the beginning of 1877. Of the total value of the Russian-Kashgarian traffic no statistics exist, but the caravans still complain of extortions, and the Indian commerce is probably more important. The acquisition of Khokand, however, must have given the Russian commerce with Kashgar a new impulse.

Eastern Turkestan was most probably originally peopled by an Aryan race, mentioned in the old Indian epics as Saka and Tukhara, remnants of which are still found in the mountains and recognizable by their features. In the second century B. C. it came under Chinese authority. In the first century B. C. it was overrun by the Huns, and afterward by other Turkish tribes. At the end of the seventh century A. D. the Thibetans invaded Kashgar, and in 713 the Arabs arrived hither. In 1218, Ghengis Khan, the great Mogul conqueror, overran the country; afterward the Mantchoos came as rulers and governors; and in the last decades Tadshiks and Sartes immigrated from Khokand. Thus, the population of the towns is very much mixed; in the mountain-valleys, however, the various tribes have maintained themselves more pure, but a primitive type is wanting. A Hungarian traveller, Vambery, designates the language as Chinese-Tartarian—that is, a Turkish dialect interspersed with numerous Chinese words. The total number of inhabitants is estimated at 580,000. They are comparatively densely settled between Aksu, Kashgar, and Yarkand, but in other places the settlements are widely scattered along the rivers. A large part of the population is still nomadic. On account of the great dryness of the climate, the houses of the fixed settlers are made of sun-dried bricks.

*History.*—In antiquity and during the Middle Ages, Eastern Turkestan was constantly the apple of contention between chiefs of Turkish descent and the Chinese emperors, who got a foothold here in the second century B. C. In the eighth century A. D. the people were converted from Booddhism to Islam, and since that time the national creed has strongly influenced the political fortunes of the country. Saints, teachers, and workers of miracles claiming descent from Mohammed, and known as Khwajas, acquired great influence, and the sectaries attached to these chiefs divided the people into rival factions. Later in the seventeenth century, Khwaja or Hoja Appak, the leader of one of these parties called the White Mountain, having been expelled by the ruler of Kashgar, a Turk chief called Ismael Khan, who was a zealous supporter of the opposite party or Black Mountain, sought the aid of the Calmucks of Zungaria, who overran Kashgar, carried off its khan, and established the Khwajas of the White Mountain once more in the country, though with an authority subordinate to their own. Great discords ensued, but the khans of Zungaria continued to exercise their supremacy till 1757. In the next year the Chinese succeeded in bringing also the states of Turkestan under their rule. The Khwajas of the White Mountain took refuge in Khokand, and made more than one attempt to recover what they considered their rights. In 1827, Jehangir Khan Khwaja conquered Kashgar and Yarkand, and occupied these cities for eight months; subsequently, he was forced again to cross the Terek pass, but was surrendered by the khan of Khokand, and was executed in Peking in 1828. An expedition headed by seven Khwajas in 1852 met with even less success than the former. Nevertheless, the attempt was repeated in 1857, and Wali Khan, although repulsed again in 1858, left in Kashgar a name for ferocity and bloodthirstiness which will long remain; he erected a pyramid of human skulls, anxiously watched the gradual rise of a monument so worthy of him, and crowned this ghastly trophy with the head of Adolph Schlagintweit of Munich, the first European who ever reached Kashgar from India. The Chinese ruled Eastern Turkestan through the governor-general at Ili, who in his turn governed through military commanders (*ambans*) appointed by the court of Peking. In 1863 the Dungan Mussulmans overthrew the Chinese authority at Ili, and the Kashgarians, thus freed from their masters, now recalled the Khwajas; in 1864 the gates of Kashgar were opened for Busurg Khan of the White Mountain. He was accompanied by Mohammed Yakoob, a brave and able officer of the emir of Khokand, who in 1852–53 had successfully defended Ak Meshid (Fort Perowski) on the Sir Darya against the Russians, and subsequently often fought against them. In Sept., 1865, he compelled the Chinese garrison of the citadel of Kashgar to surrender, defeated there in a hot contest the Dunganes, led by the head of the Black Mountain, and took the forts of Yangihissar and Yarkand, which were still held by the Chinese. This success gathered numerous partisans around him, and, after Oriental fashion, as soon as he felt himself strong enough he threw Busurg Khan in prison, banished him from the country, and assumed himself the supreme authority. Religious fanaticism was now fomented in every way. Ambassadors were repeatedly sent to Constantinople and Mecca to urge the sultan to assume sovereignty over Kashgar; and although such a combination can have no political consequences, as Russia at any time can easily prevent any joint operation, it is, nevertheless, evident that some kind of alliance has been concluded, from the fact that coins are struck at Kashgar bearing the name of the sultan. Wars and conquests filled the first years of his reign. He subjugated Khotan, Aksu, Turfan—yea, even the Kalmuks N. of the Thian-Skan consented to pay a tribute. Having thus reunited all the old Altishar, he conquered in 1870 the district of Sizikol, the key to the Pamir passes, and gave his kingdom the prouder name of Jitishar. The frontier toward China is not yet regulated, and in 1871 a Chinese army of 130,000 men was sent to reconquer Kashgar. It remained near the Great Wall till 1875, made then an advance, but is said to have been thoroughly defeated in May, 1875. On account of the unsettled condition of the Chinese state it is not probable that any danger to Kashgar will arise from that direction; it is more likely that Yakoob Beg will find a rival in his own country or among the Dunganes on the northern slope of the Thian-Shan. Yakoob is a cruel despot, and governs by terror. His army has been much improved by deserters from the British-Indian army, and contains some regiments of choice troops which are wanting in those of other states of Central Asia. But the administration is miserable. Arbitrariness reigns everywhere. Civil officers and military commanders are allowed to take what they like. Wealth is nowhere found except in distant mountain-valleys, whither the legal robbers seldom come. It is believed, however, that the dynasty is not securely founded. The present state will dissolve or fall into anarchy as soon as Yakoob dies. An annexation by Russia is not probable. Neither the way to China nor that to Hindoo-Koosh leads through Kashgar, and the mountain-passes are easy to close against all disturbances. EMIL SCHLAGINTWEIT.

**Turkevi',** town of Hungary, on the Beretyo, has a trade in wine, wheat, cattle, and horses. P. 9810.

**Turkey.** See MELEAGRIDIDÆ.

**Tur'key.** The Turkish empire extends over parts of Europe, Asia, and Africa, and comprises many different races. The centre of its power is at the point where the

Black Sea flows into the Marmora, through which it connects with the Mediterranean; here is its capital, Constantinople—Stambul.

*European Turkey* comprises the larger part of the peninsula of the Balkan. The configuration of the coasts of this peninsula, especially that of the E. coast, is extraordinarily rich, and this circumstance formed one of the principal reasons of the high civilization of the nations which formerly inhabited the country. It would have the same effect now, if unfavorable religious and political circumstances did not check the development of the Turkish people. The western boundary, 72 miles long, is formed by the Adriatic and Ionian seas, with the gulfs of Drino, Durazzo, Avlona, and Arta; the southern is formed, for a distance of 23 miles, by Greece, and then, for a distance of 188 miles, by the Ægæan and Marmora seas, with the bays of Salonica, Volo, Monte Santo, Istillar, Orphano, Saros, etc. The peninsula of Gallipoli forms, with the coast of Asia Minor, the Dardanelles, Hellespont, and the Thracian Bosphorus leads into the Black Sea, which, with the two great gulfs of Burgas and Varna, forms the eastern boundary. N. and N. W. the country is bounded by Russia and Austria. The vertical configuration of the peninsula is also exceedingly favorable, especially in the eastern part. The Dinarian Alps, whose highest peaks reach an elevation of about 6000 feet, run in the direction N. W. to S. E. along the Adriatic Sea, and form the watershed between this and the tributaries of the Danube. These ranges are almost entirely destitute of forests, and the soil is not fertile. Cattle-breeding is nearly the only occupation of the inhabitants. To the N. they slope down into gentle hills, sending the Unna, Verbas, Bosna, and Drin to the Save, and the Morava in an eastern direction to the Danube. To the S. they terminate in the Alps of Montenegro, whose highest peak, the Kom, rises 8000 feet. Hence the Schar-Dagh, 8000 feet high, stretches from the S. W. to the N. E. for a distance of about 10 miles, and parallel with it run the Kurbetzka Mountains, 6200 feet high, and farther to the E. the Rilo-Dagh, rising 9000 feet, and forming the watershed between the rivers Strymon (Struma), Nestus (Karasu), Hebrus (Maritza), and Isker. The line of communication between Constantinople and Belgrade passes through the valley of the Isker, and breaks through the mountains between the Isker and the Maritza at Demir Kapi, "the Iron Gate." The city of Philippopolis dominates the entrance to this gate. To the E. of Demir Kapi rise the Balkan Mountains, the ancient *Hæmus*, first as a single range whose westernmost peaks rise more than 5000 feet, then separating, farther to the E., into two parallel ranges, the Little and Great Balkan, with difficult passes, of which the most difficult is guarded by the fortress of Schumla. The Balkan forms an important climatic boundary-line; to the N. reigns the climate of Central Europe, to the S. that of Southern Europe. To the N. extends the Wallachian lowland, traversed by the Danube, on whose banks are the four fortresses, Widdin, Nikopoli, Rustschuk, and Silistria. From the Eastern Balkan, in a south-eastern direction to the peninsula of Constantinople, stretches the Strandschea-Dagh, and parallel with it runs the Despoto-Dagh, rising over 7000 feet. Most of these mountains consist of crystalline slate; the Balkan belongs to the chalk formation. The population is composed of many different elements. In antiquity the Greek race lived in the peninsula, and worked out a rich civilization; the traveller discovers with astonishment numerous ruins of cities, with their temples and aqueducts and other traces of a former civilization, in places where there is now only scanty pasture for goats. The Greek language still lives outside of Greece in Thessaly, in the Chalcidian peninsula, and in South-eastern Thracia. In the north-western part of the country lived the Illyrians, belonging to the Indo-Germanic race; they were subdued spiritually by the Greeks, materially by the Romans. In the Middle Ages the Slaves penetrated into their territory, the present Dalmatia and Bosnia, and under the name of Albanians or Arnaouts the Slaves still inhabit the mountain-regions S. of Montenegro, as far as the Gulf of Corinth. About 1,300,000 Arnaouts live in Turkey, and about 250,000 in Greece. Thracians, Getes, and Dacians lived E. of Macedonia, in the present Bulgaria, Wallachia, Moldavia, and Transylvania. Their empire was crushed by the emperor Trajan, but, singularly enough, these nations have preserved up to this very day the Roman mark which at that time was stamped on them by violence. In the present Romania they call themselves *Rumuni*—that is, Romans. They number about 4,500,000. Of the Goths and Longobards who invaded the country in the early Middle Ages no trace can be found. Then came the Slaves, and afterward a Finnish people, the Bulgarians, whose empire lasted to the time of the Turks. They number now about 4,500,000, are Greek Catholics, and are settled S. of the Danube, in Bulgaria, Macedonia, and Thracia. Beside the Bulgarians live the Servians and Bosnians, a Slavic tribe, which immigrated from Bohemia: the distinction between the Servians and Bosnians is merely political. The Franks conquered Constantinople in 1203, and in the same century the Venetians took possession of Crete and the opposite coast-regions. Next followed the invasion of the Osmanlis from Gallipoli. They live scattered, and their number in the peninsula is not over 1,000,000. Although they are the ruling race, their number must be kept up by immigration from Asia. There are, moreover, about 400,000 Armenians, as many gypsies, 75,000 Jews, 400,000 Tcherkassians, and a minor number of other tribes in European Turkey. The cultivation of the country is very far from corresponding to the exceedingly rich resources, partly on account of the bad administration, partly on account of the indolence of the population. The soil is almost everywhere very fertile, and could produce all kinds of fruits in abundance. About 40 per cent. is in fields and vineyards, 14 in forest, 11 in pastures, 6 in meadows, and 29 is unproductive. Agriculture is carried on in a most primitive manner. Maize, wheat, and buckwheat are the principal cereals, but, with the exception of the Danubian countries, there is nowhere produced a surplus above the home demand. Beans, peas, and lentils are raised; of vegetables, onions, cabbages, beets, and cucumbers; of fruits, especially plums. Almond, lemon, orange, and olive trees are also extensively cultivated. Cattle-breeding is a very important branch of the national industry, especially in the Danubian countries, where the rearing of swine, horned cattle, and horses is carried on with energy. The horses are not equal to the Arabian; in the mountain-regions they are small and even clumsy, but they are strong and useful. The breeds of mules and asses are good. The buffalo plays a considerable part in agriculture. Sheep-breeding is extensively carried on, especially in Albania, and the rearing of bees and silkworms is flourishing, silk being one of the most important articles of export. As large districts still lie waste, wild animals, such as bears, wolves, etc., and game, such as the wild-boar, the stag, the deer, etc., abound, and hunting is a remunerative occupation. Fishing and the gathering of sponges are extensively carried on along the coasts. Mining is much neglected; some gold, silver, iron, lead, copper, sulphur, and quicksilver are produced in Bosnia, Macedonia, and Servia. The circumstance that all trades are still carried on in the old traditional fashion, and no use is made of the inventions and progress of foreign nations, is very characteristic of the state of manufacturing industry. Nevertheless, all the principal manufactures, such as carpets, leather goods, arms, etc., are distinguished both for their excellence of workmanship and their fine taste in form and color. But these good qualities are now rapidly vanishing. Formerly, many costly textile fabrics, arms, etc., were exported from Turkey, but the country has now become inundated by the importation of cheap machine-made goods, and this change has almost crushed its manufacturing industry. Woollen and cotton goods are extensively manufactured. The *abba*, a kind of coarse cloth made at Shumla, Turnova, and Salonica, is peculiar. Much silk is spun and woven in Constantinople and Salonica. The carpets of Scharkoi, Berkeridacha, and Salonica are celebrated. Leather goods, both shoes and saddlery, are good and hold a high rank. Metallic wares, especially arms, are made extensively and of good quality at the foot of the Pindus. The manufactories of guns and cannons which have recently been established have not proved successful. The traffic in the interior suffers much from bad administration and from the want of sufficient means of communication. Good roads are very scarce, and the common roads are suited only for beasts of burden or for vehicles of the most primitive construction. In the more important manufacturing cities, such as Usundschowa, near Adrianople, Nevrocope, and Marassia in Thracia, Scharkoi, Karusa, and Giuma in Bulgaria, Seres in Macedonia, Rumi and Fersala in Thessaly, annual fairs take place, by which the exchange of goods is greatly facilitated. The foreign commerce, both by land and by sea, is exclusively carried on by foreigners, Armenians and Greeks, as the Osmanli is too proud and too lazy to do it himself.

*Asiatic Turkey* comprises Asia Minor and vast adjacent territories. The western frontier is formed by the Mediterranean; to the S. the Turkish dominion stretches as far as the Isthmus of Suez, extending thence without interruption into Africa, occupying the whole of Egypt, and along the Arabian Gulf to the Strait of Bab-el-Mandeb, occupying the narrow coast-belt, bounded S. E. and E. by Arabia and Persia, N. by Russia (Caucasus) and the Black Sea. For a distance of 100 miles the Mediterranean washes the shores of Syria, flat and harborless above the promontory of Carmel, then steeper and richer in harbors, flourishing by com-

merce in the time of the Phœnicians, but now, for the larger part, desolate, the harbors having become filled up by the North African coast-current. Beyroot, which may be considered as the port of Damascus, is here the most important harbor. From the Bay of Iskanderoon the coast turns suddenly to the W., and for a distance of 150 miles it is rocky, but rich in small harbors. The W. coast of Asia Minor, about 50 miles long in a straight line, is much cut up and fringed with numerous islands. Formerly, Greek colonies flourished here, with numerous harbors and cities, but now only Smyrna is of any importance. The Hellespont and Dardanelles lead to the Sea of Marmora, the Thracian Bosphorus to the Black Sea, whose southern coast, about 180 miles long, is rather poorly articulated, but rich in good harbors, of which Sinoob and Trebizond are the most important. The mountains of Koordistan consist of an imposing system, with difficult passes, and form the western border of the plateau of Iran. The highlands of Armenia and Asia Minor are bounded S. by a range which branches off from the mountains of Koordistan, and terminates W. at the Bay of Iskanderoon, separating Armenia from Mesopotamia. To the N. the border range of the plateau continues to the vicinity of Tiflis, and runs along the coast of the Black Sea to Scutari. In the interior of Asia Minor the ranges of Taurus and Anti-Taurus reach a height of 11,000 feet, and form the boundary toward Syria. The Cilician passes afford the only communication between the two countries. Armenia is covered with high mountains, of which Ararat, 16,250 feet high, is the most remarkable. Asia Minor is to some extent steppe-land, in many places exceedingly fertile. To the S. of Asia Minor and Armenia the Lebanon system, consisting of various ranges, runs from N. to S., losing itself to the E. in the Syrian desert. Of the highland desert which forms the peninsula of Arabia, Turkey owns only the narrow coast-belt, called Hedshas, which, however, is more fertile than the rest of Arabia, as the border ranges which it contains attract some moisture. The lowland of Mesopotamia is a desert W. of the Euphrates, and between the Euphrates and Tigris a steppe-land broken up by some ranges of hills; but from the point where the two streams unite to their mouth in the Persian Gulf, a distance of about 100 miles, stretches a flat alluvial plain, which in antiquity was the richest corn-land of Asia. These two rivers are the largest in Asiatic Turkey. The Euphrates rises in the plateau of Armenia, breaks through the southern border range near the sources of the Tigris at Diarbekr, and reaches the Persian Gulf after a course of 350 geographical miles. The Tigris is 220 geographical miles long from its sources to its union with the Euphrates. The region where the two streams approach each other was very rich and densely peopled in antiquity. Here stood Babylon, and over and over again new cities arose on the ruins of the old; now, Bagdad stands near. The plateau of Syria is split by a deep furrow between the Lebanon and Anti-Lebanon ranges, in which the Orontes flows. The Leontes, Jordan, and Kishon water Syria and Palestine; the Kisil-Irmak (Halys), Mæander, and Hermus water Asia Minor. Politically, Asiatic Turkey is divided into—(1) Armenia, with the city of Erzeroom, which carries on the transit-traffic with Persia, the border fortress of Kars, and the city of Van; (2) Koordistan, with the cities of Diarbekr, Nisibin, Masdin, Mosul (in whose vicinity are the ruins of Nineveh), Bagdad (an important commercial place), and Hille (on the ruins of Babylon); (3) Irak Arabi, comprising Southern Mesopotamia, with the city of Basra, the starting-point of the caravans to Mecca; (4) El Dschesireh, comprising the northern part of Mesopotamia, with the cities of Rakka and Orfa; (5) Asia Minor or Anatolia, with the cities of Brusa, at the foot of the Olympus (up to 1458 the capital of the Osmanli empire), Scutari (a suburb of Constantinople), Kjutahia, Smyrna, Sinoob, Angora, Kaisarijeh, Adhna, Tarsus, and the island of Cyprus; (6) Syria and Palestine, with the cities of Haleb, Iskanderoon, Antakijah, Damascus, Tadmor, Baalbec, Tripoli, Beyroot, Saide, Zor, Jaffa, Jerusalem, and Gaza, the starting-point of the caravans to Egypt; and, finally, the Arabian possessions, with Mecca and Medina. The larger part of the population belongs to the Caucasian race. Of the Indo-Germanic family of this race, Persians live in the provinces of Bactria and Sogdiana, Koords in the mountains of Koordistan, and Armenians around the sources of the Euphrates and the Koor. The Armenians formerly possessed a large empire, but it has been divided between Persia, Russia, and Turkey, and the greater part of the nation now wanders around the world as peddlers; they are Christians. Of the Shemitic family, the Aramaic branch occupies the plateau of Armenia, Syria, and Mesopotamia. In these regions the Syrians and Chaldæans formerly possessed powerful empires. The Hebrew branch occupied the coast-land of Syria and Palestine. The Turkish people belong to the Tartaro-Finnic family of the Mongolian race. Issuing from the Altai Mountains, their original home, they have spread widely, and they now form the ruling race in the Asiatic part of the Turkish empire. They are most densely settled in Asia Minor, where they distinguish themselves as agriculturists. The total number of inhabitants in Asiatic Turkey is about 14,000,000.

*African Turkey* consists of the vassal states of EGYPT, TUNIS, and TRIPOLI (which see), which pay a tribute to the Sublime Porte.

The empire consists of immediate possessions and vassal states. The immediate possessions in Europe comprise an area of 6611 geographical sq. m., or 364,037 quadrate kilomètres, with a population of 8,500,000; the vassal states in Europe, Romania and Servia, an area of 2988 sq. m., or 164,528 qu. kil., with a population of 5,850,000; the immediate possessions in Asia, an area of 34,929 sq. m., or 1,927,156 qu. kil., with a population of 14,000,000, inclusive of the island of Samos, which forms a tributary principality; the African vassal states, an area of 59,242 sq. m., or 3,262,032 qu. kil., with a population of 20,072,000, of which Egypt occupies an area of about 2,500,000 qu. kil., with a population of about 17,000,000. The total area of the empire comprises 103,840 geographical sq. m., or 5,717,750 qu. kil., with a population of 47,627,000. European Turkey, exclusive of ROMANIA and SERVIA (which see), is divided into the following eyalets or vilayets:

| | Area in qu. kil. | Population. |
|---|---|---|
| Constantinople | —— | 327,750 |
| Adrianople | 66,133 | 1,349,894 |
| Danube | 87,109 | 1,995,243 |
| Salonica | 51,649 | 1,028,141 |
| Janina | 35,901 | 711,250 |
| Prisrend | 52,585 | 1,340,471 |
| Bosnia | 60,569 | 1,337,393 |
| Crete | 8,617 | 200,000 |

With regard to religion, 4,776,652 are Christians, Jews, etc.; 3,619,353 Mohammedans. All these statistical statements, however, are disputable, and still more so are those referring to Asiatic and African Turkey. Asiatic Turkey is divided into the following eyalets:

| | Area in qu. kil. | Population. |
|---|---|---|
| Constantinople | 12,802 | 796,000 |
| Brusa | 74,792 | 1,630,244 |
| Aidin | 51,688 | 1,040,570 |
| Archipelago | 14,548 | 431,197 |
| Cyprus | 9,537 | 135,000 |
| Kastamooni | 53,659 | 772,010 |
| Angora | 69,379 | 514,080 |
| Konieh | 103,766 | 775,045 |
| Adana | 36,947 | 335,520 |
| Trebizond | 37,256 | 938,140 |
| Sivas | 64,275 | 571,808 |
| Erzeroom | 132,223 | 792,104 |
| Diarbekr | 97,500 | 708,288 |
| Bagdad | 242,277 | 2,000,000 |
| Aleppo | 105,561 | 535,714 |
| Syria | 171,229 | 518,750 |
| Hedjas and Yemen | 567,836 | 1,134,375 |
| Hedjer | 81,328 | 162,470 |

The eyalets, whose governors bear the title of *valy*, are divided into sandshaks, at the head of which stand *mutessarifs;* and the sandshaks are again divided into kazas, governed by *kaimakams*, and the kazas into nahies (parishes). The tributary vassal states have their own governments, more or less dependent on the Sublime Porte, but always eager to make themselves independent. The government of the empire is despotic. The sultan is at the head as absolute ruler, as the highest authority not only in political, but also in religious respects, being the chief of all the faithful throughout the whole Mohammedan world. At the head of the administration of the empire is the vizier, whose office was established in 1754 A. D. The ministers are subordinate to him as secretaries of state. Besides him, the sheik ul Islam is the most important person. He is the chief of the Ulema, a body at once judicial and ecclesiastical, whose office it is to explain and apply the law. The ministers preside over departments organized in the same manner as those of the other European governments—namely, for foreign affairs, war, finances, commerce, public education, public buildings and quarantine, justice, and police. Among the ministers are also reckoned the president of the council of state, the president of the supreme court, the intendant of the wkafs—that is, the estates belonging to the mosques and other pious institutions—the minister of the archives, and the musteshar or council of the vizier. Besides the council of the ministers there is another deliberative body at the side of the sultan, the chancellery of the state (menasybdivanije), generally called the Divan, comprising all those higher and lower offices which collectively are called kalemijé ("the pen"), and which consist of five classes of officials, of whom the highest have the rank of a general of division. In 1868 a council of state (shurai-devlet) was organized, which has to prepare the new laws, discuss

the budget, etc., and consists of five sections—for administration in general, for finances, justice, public education, and commerce. At the same time, a supreme court was established with two sections, one for civil and one for criminal cases. The Sheriat, the civil-religious law, and the Kanun, the political law, form the basis of all legal relations; the former rests on the Koran, the Sunna or tradition, the Idshmai-ummet or commentaries of the first four caliphs, and the Kyas, a collection of judicial decisions from the first three centuries after Hedshra. According to these laws, only the faithful of Islam have perfect legal competency. Under the pressure of Christian Europe, however, the Sublime Porte has promulgated various laws, of which the Hatti-sherif of Gulhane (Nov. 2, 1839) is the most important, and by which the rajah or Christian part of the population has been placed nearly upon an equality with the Mohammedan. The slaves are now the only legally subordinate class of the population. They are the property of their master, though he is not allowed to kill or ill-use them. Else, all subjects are equal before the law. There is no aristocracy. The career of a man depends entirely on his personal ability; and manumitted slaves and the poorest people can reach the highest positions. Although Islam is the religion of the state, there exists general freedom of worship. The Mohammedan clergy comprises five classes—the sheiks or elders, who preach in the mosques; the khatibs, who lead the public prayers in the mosques; the imams, who carry out the common service in the mosques, marriages, burials, etc.; the muezzins, who cry out the hours of prayer from the minarets; and the kaims, simple servants and watchmen in the mosques. Of Christian denominations, the Orthodox Greek and the Armenian are most largely represented; the former has patriarchs in Constantinople, Antioch, Jerusalem, and Alexandria; the latter in Constantinople, Sis, Aktamar, and Jerusalem. The Roman Catholic Church, inclusive of the United Oriental Christians, has 28 patriarchs and archbishops, representing the dioceses of Aleppo, Amadia, Antioch, Antivari and Scutari, Babylon, Cilicia, Constantinople, Damascus, Diarbekr, Durazzo, Jerusalem, Smyrna, Tyre, and Sidon. Education is very low, even in European Turkey, both among Christians and Mohammedans. Of late, however, the government has commenced, after the model of its more civilized neighbor states, to establish, besides the elementary schools which have existed since 1847, middle schools and special schools in the larger cities, and especially in the capital, and higher schools for the training of teachers and officials, among which the most remarkable are the school of the sultana-mother, the normal school, the imperial schools for engineering, artillery, etc., the agricultural and veterinary schools in Constantinople, etc. The finances are in a very bad condition. The budget shows a deficit every year; the public debt is very large, and the bad method has been adopted of covering the interest by new loans. The bad state of the finances dates from the time when the Sublime Porte adopted the practice of civilized states of making loans—a practice which does not work well in a state despotically governed and badly administered. In 1854, during the war with Russia, the government issued the first loan of 75,000,000 francs at 6 per cent., placed at 80, and in 1874 the amount of this loan was still 52,000,000. Loans then followed in rapid succession, as follows, in millions of francs:

| Year. | Sum. | Interest. | Issued at. | Amount in 1874. |
|---|---|---|---|---|
| 1855 | 125 | 4 per cent. | 102⅝ | 100 |
| 1858 | 125 | 6 " | 76 | 96 |
| 1860 | 50.9 | 6 " | 53¾ | 42.9 |
| 1862 | 200 | 6 " | 68 | 138.9 |
| 1863 | 150 | 6 " | 72 | 143 |
| 1864 | 50 | 6 " | 68 | |
| 1865 | 909.1 | 5 " | 50 | 882 |
| 1866 | 150 | 6 " | 66 | 113 |
| 1868 | 150 | 6 " | 83 | |
| 1869 | 555.6 | 6 " | 54 | 531 |
| 1870 | 792 | 3 " | 45 | 789 |
| 1871 | 142.5 | 5 " | 68 | 139 |
| 1872 | 278.2 | 9 " | 98½ | 278 |
| 1873 | 694 | 6 " | 58½ | 694 |

On Jan. 23, 1874, the total debt amounted to 4,335,237,191 francs, of which 334,665,441 were floating debt. A law of Sept. 20, 1874, authorized the minister of finance to issue a new loan of 1,000,000,000 francs at 5 per cent., of which 825 millions were destined for the payment of the floating liabilities of the government. On May 10, 1875, the total debt was estimated at 5,023,860,500 francs, or £202,554,420. In Oct., 1875, the government being unable to pay the interest due, a law determined that for the next five years one-half of the interest should be paid in cash and the rest in new bonds. The budget of 1875–76 gives the following items, reckoning in purses of 500 piasters, equal to 112 francs 50 centimes, or £4½: Receipts, 4,776,588, of which 825,700 was for direct taxes; indirect, 3,373,828; revenues from the salines, domains, forests, mines, etc., 413,516; tributes, 163,544. Expenses, 5,785,819, of which the public debt was 2,973,849; dotations, 398,684, including the civil list of the sultan, 267,551; ministry of finances, 388,771; of the interior, 586,755; of war, 780,582, etc. The deficit amounted to more than £4,500,000. According to the law of June 22, 1869, the recruiting of the army is effected by volunteers and by levies of lot. Military service is compulsory for all Mohammedans; men of other confessions free themselves by the payment of a stipulated sum. The term of service is 20 years—4 in the active army, *nizam;* 2 in the first reserve, *idatyal;* 6 in the second reserve, *redif;* and 8 in the landsturm, *hiyad.* The active army consists of 150,000 men, the first reserve 70,000, and the whole force, comprising regular, irregular, and auxiliary troops, 700,000. The regular army is divided into seven army corps, *ordii.* The army corps are organized on a territorial basis. The first is in Constantinople, and contains 7 regiments of infantry, 7 battalions of sharpshooters, 7 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The second is in the eyalet of Danube, with head-quarters in Shumla, and contains 5 regiments of infantry, 5 battalions of sharpshooters, 4 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The third, Room-Elee, Monastir, 10 regiments of infantry, 8 battalions of sharpshooters, 4 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The fourth, Anatolia, Erzeroom, 5 regiments of infantry, 5 battalions of sharpshooters, 4 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The fifth, Syria, Damascus, 5 regiments of infantry, 5 battalions of sharpshooters, 4 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The sixth, Irak, Bagdad, 6 regiments of infantry, 5 battalions of sharpshooters, 5 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The seventh, Yemen, Samaa, 5 regiments of infantry, 5 battalions of sharpshooters, 2 squadrons of cavalry, 3 batteries, and 1 company of engineers. In all, the infantry numbers 39 regiments of the line, 2 regiments of Bosnians, 1 Greek and 1 Servian frontier regiment, 30 battalions of sharpshooters, 2 battalions of Herzegovinians, or 169 battalions. The cavalry numbers 27 regiments and 6 squadrons, 1 regiment mounted on camels, and 2 independent squadrons, or 170 squadrons. The artillery numbers 6 regiments of field artillery and 12 batteries, 1 regiment of reserve and 3 batteries, or 75 batteries with 450 guns. There are, besides, 10 regiments of fortress artillery and 1 corps of artillery mechanics. The engineer corps forms 1 brigade of 7 companies of sappers and 7 companies of mechanics. The irregular troops consist of 16 regiments of gendarmerie, Spahis, Bedouins, etc. The tributary vassal states furnish the auxiliary troops—Egypt, 15,000 men; Tunis, 4000; Upper Albania, 10,000; Bosnia, 30,000, etc. The actual strength of the army on a war-footing is computed as follows: active army, 203,700; first reserve, 105,600; second reserve, 24,000; gendarmerie, 32,800; *hiyad,* 120,000; total, regular army, 486,100; irregular army, 50,000; auxiliary troops, 50,000; the entire army, 586,100 men. The soldiers are excellent; they distinguish themselves by frugality, perseverance, and a wild valor. But the officers are so rude, and the administration of the army so bad, that the exertions of the soldiers seldom produce any great effect. The fleet consisted in 1873 of 21 iron-clads, with 109 guns—namely, 4 frigates, of 900 horse-power and 15 guns; 5 corvettes, of 400–500 horse-power and 4–6 guns; 6 monitors, 6 gunboats, and 100 transport-vessels. The government spends enormous sums on iron-clads, mostly built in England. But neither the commanders nor the crews understand how to manœuvre such vessels; they lie idle and decay in the harbors. The term of service in the navy is seven years, besides five years in the reserve. The total force numbers about 50,000 men.

Although most of the countries belonging to the Turkish empire have an exceedingly fertile soil and a very favorable maritime location, industry and commerce are nevertheless very little developed, on account of the bad administration. The mountains, especially those of European Turkey and Asia Minor, are richer in metals than the other mountains of Europe. Immense coal-deposits are found in Asia Minor. But the lack of social energy, of means of communication, of justice in the government, etc., causes these sources of wealth to remain undeveloped. Excellent copper, however, lead, bitumen, soda, and meerschaum are exported. Asia Minor possesses immense forests, from which all the countries of the Mediterranean could be provided with timber; the northern regions of European Turkey are almost as rich in forests. The plains S. of the Balkan, the islands, and the coast-regions of Asia produce a great abundance of fruit, on which might be based a large trade in preserved fruits, olive oil, olive-oil soap, figs, raisins, and wine. Tobacco, also a very important commercial article, succeeds

nearly everywhere. The mulberry tree is extensively cultivated, and the export of raw silk, especially from Beyroot and Brusa, is of importance to the silk-market of the whole world. The lowlands of the peninsula of Balkan, the plateaus of Asia Minor and Armenia, the plains of Syria and Mesopotamia, produce wheat, barley, hemp, sesame, and cotton, and grain and cotton form important items of export. Madder, oil of rose, opium, mastix, salep, etc., are also largely produced. The animal kingdom yields excellent fur of the marten, otter, beaver, iltis, and wild-cat; hides, tallow, cheese, bones, horn, etc., which play a considerable part in trade. There are no commercial statistics even approximately exact, but the navigation gives an idea of the state of the commerce of the empire. In the year 1872–73, 250,957 vessels, of 18,159,000 tons burden, entered its harbors, of which 178,143 were coasters, of 1,903,000 tons burden, 43,200 foreign vessels, of 12,738,000 tons burden, and 29,614 Turkish, of 3,518,000 tons burden. At Constantinople alone there arrived in 1874, 20,674 vessels, of 4,606,200 tons burden, of which 4185 were steamers, of 2,697,700 tons burden—namely, 2536 English vessels, of 1,487,800 tons burden; 4810 Turkish, of 677,300 tons; 2545 Greek, of 463,400 tons; 955 Austrian, of 571,600 tons; 790 Russian, of 429,300 tons; 277 French, of 184,100 tons; 1644 from other countries, of 628,000 tons, and 7117 coasters, of 164,300 tons. No exact account exists of the total number of vessels sailing under the Turkish flag. In 1865 it was estimated at 2200 vessels, of 182,000 tons burden, but it was evidently too low. In 1873 the number of sea-going vessels was estimated at 231, of 37,760 tons burden, of which 9 were steamers, of 3049 tons burden. In 1875 the following railway-lines were in operation: Constantinople-Adrianople, 319 kil.; Adrianople-Saremberg, 244; Tarnova-Jamboli, 80; Kulleli-Dedeaghatsch, 112; Salonica-Uskub, 244; Uskub-Mitrovitza, 122; Banjaluka-Novi, 103; Rustschuk-Varna, 225; Tschernavoda-Kustendsche, 63; total in European Turkey, 1512 kil. In Asia Minor there are lines to Smyrna, 231 kil., and between Scutari and Ismid, 43. In 1874 there were 28,038 kilomètres of telegraph-lines, 46,730 of wires, 393 stations; 910,130 despatches were forwarded. The receipts amounted to 6,729,500 francs, the expenses to 4,808,987. The armorial ensign of the empire is a green shield with a silver half-moon; the colors are a white half-moon on red ground, and the star of Jupiter. The succession is hereditary in the family of Othman, so that the eldest member of the family always becomes sultan. The imperial harem is the birthplace of all princes of the house; the wives are slaves, generally from Circassia; as daughters, sisters, and mothers of sultans they bear the title of imperial princesses, but the title is not hereditary.

*History.*—The Ottoman tribe which now rules the Turkish empire came originally from the Altai Mountains, and pushed onward to the West in connection with other Turkish tribes. Orkhan, who resided in Brusa, and conquered Nicomedia and Nicæa about 1330, is considered as the founder of the Ottoman power. He called himself *padishah*, and the gate of his palace the *Sublime Porte*, which titles are still in use. He founded the famous guard of the Janizaries and the corps of the Spahis, married a daughter of the Greek emperor Cantacuzenus, and entered into close connection with the Byzantine empire, which by degrees was shattered, and finally crushed, by the Ottomans. In 1365, Sultan Amurath I. made Adrianople his European residence; in 1389 he conquered the whole of Bulgaria, and his son, Bajazet I., called Ilderim, besieged Constantinople for seven years (1391–98), and compelled the Greek emperor to pay a tribute. In 1402 the Mongols under Tamerlane fell upon the Ottoman empire from Armenia, defeated Bajazet, and carried him away in captivity, but under Bajazet's grandson, Amurath II., the empire rose again, and with still greater splendor. He besieged Constantinople in 1422, compelled the Greek emperor to conclude an humiliating peace in 1425, and conquered Salonica. By John Hunyady, prince of Transylvania, he was defeated in seven bloody battles (1442–43), and it was not until after the death of Hunyady (in 1459) that the Ottomans succeeded in conquering Servia; but under Mohammed II. they took Constantinople (May 29, 1453), and made it the capital of their empire under the name of Stambool. Mohammed II. subjugated Greece in 1460, took several harbors in the Black Sea from the Genoese, conquered Sinoob, destroyed the empire of Trebizond in 1461, made the larger part of Bosnia an Ottoman province, waged war for sixteen years, by sea and land, against the Venetians, took Kroja and Scutari from them, conquered the Crimea, and took Moldavia from the Poles. Selim I. (1512–19) conquered Armenia as far as the Tigris, Syria, Egypt, and a large part of Arabia, with the sacred cities of Mecca and Medina. His son, Solyman II. the Magnificent (1519–66), brought the empire to the culmination of its power. In Asia he defeated the Persians and conquered Mesopotamia and Georgia. In Europe he conquered Rhodes in 1522, and half of Hungary in 1526, besieged Vienna, though without effect, in 1527, made a new campaign against the German emperor in 1532, and entertained the plan of subjugating the whole Occident; which plan was baffled, however, by his sagacious and valiant adversaries, the emperor Charles V., the Venetians, the Genoese, and the Knights of St. John. This immense success, the foundation of an empire so vast and so beautiful, the Ottomans owed to their religious enthusiasm and their frugality; but once in the possession of wealth, they gave themselves up to enervating enjoyments, and their power began to decrease. After a number of strong and powerful sultans, Selim II. (1566–74) was the first of a series of weak and voluptuous rulers. He had an able vizier, however, Sokolli, and good and bad luck alternated with each other during his entire reign. A Turkish army, invading Russia and besieging Astrakhan in 1569, was defeated by the Russians; but the islands of Cyprus, Crete, Cerigo, Zante, and Cephalonia, and several districts of the coast-land, were taken from the Venetians. Venice then allied itself with the pope, Spain, Savoy, and the Knights of St. John, and the allied fleet, under Don John of Austria, gained a brilliant victory over the Turkish fleet at Lepanto (Oct. 7, 1571). But next year a new Turkish fleet of 250 vessels appeared in the Adriatic, and compelled Venice to conclude a humiliating peace, and Tunis, which had been conquered by Don John of Austria, was reconquered by the Turks. Selim's son, Amurath III., was an incompetent ruler, the plaything of the harem and the Janizaries, and his successors, Mohammed III., Achmed I., and Mustapha I., were not much better. Osman II. fought unsuccessfully against the Poles, and was deposed in 1622 by the Janizaries. Amurath IV. was a despot, but governed the realm with a firm hand. He took, in 1635, Erivan and Tabreez from Persia; incorporated, in 1638, Bagdad and the whole of Mesopotamia with the empire; defeated the Cossacks in the Black Sea, and waged a successful maritime war against the Venetians. He was succeeded by Ibrahim, a miserable wretch, who was strangled in 1648 by the Janizaries and the Ulemas. The reign of Mohammed IV. (1648–87) was eventful and important by the undertakings of the able viziers who governed the realm. The sultan ascended the throne at the age of seven, and great confusion ensued from this circumstance. In 1651 the Turkish fleet was defeated by the Venetians; in 1653 an unfavorable peace was concluded with Poland; in 1655 an insurrection broke out in Constantinople. In 1654 Capudan-Pasha defeated the Venetians, but on July 16, 1656, the Turkish fleet was completely routed in the Dardanelles. At this moment Mohammed Köprili was placed at the head of affairs as grand vizier, and reconquered Tenedos, Lemnos, and Transylvania, suppressed the insurrection in Asia Minor, and supported successfully the Tartars against Russia. His son, Achmed Köprili, succeeded him as grand vizier, and continued the war against Austria and Venice, the two most dangerous enemies of the empire, with circumspection, and generally with success. In the course of the last century the relations to Austria had changed so that Austria no longer lived in perpetual fear of a Turkish attack, but several times took the offensive against her warlike neighbor. Thus, an Austrian army under the leadership of Montecuculi invaded Transylvania, and defeated the Turks at St. Gothard on the Raab Aug. 1, 1664; Achmed Köprili, however, retained by the Peace of Vesvan the cities of Grau, Neuhäusel, etc., which he had conquered in 1663. In 1669 he reconquered Crete and concluded an advantageous peace with Venice. With Poland the prudent vizier also succeeded in concluding a favorable peace in 1672, though the Turkish army had been defeated by the Poles. The peace did not last long, however. When Sobieski became king of Poland, he attacked the Turks, and defeated them in 1674. Achmed Köprili died soon after, and was succeeded by Kara Mustapha as vizier. Kara Mustapha waged war with Russia, but was compelled to cede Azof by the Peace of Radzin (1681). Then a war with Austria broke out. Kara Mustapha advanced to Vienna and besieged the city from July 14 to Sept. 12, 1683. He would no doubt have taken it had not the Poles under Sobieski come to the rescue and defeated the Turks. The vizier was strangled for this defeat. His successor, Ibrahim, fought against allied Austria, Poland, and Venice, but failed and was deposed, and his successor, Solyman Aindshi, was beheaded, having lost many cities, and finally the whole of Transylvania, to the Austrian general, the duke of Lorraine. In 1687, Mohammed IV. was deposed by the Janizaries, and was succeeded by Solyman III. His vizier, Mustapha Köprili, called out the Mohammedans for a religious war, took the field in 1690 at the head of a large army, conquered Belgrade and several other cities, placed his brother, Achmed II., on the throne on the death of Solyman in 1691, and invaded Hungary, but was defeated

there and killed. Mustapha II., the successor of Achmed II., renewed the war against the neighboring states, and defeated the Venetians and the Russian czar, Peter the Great, but was completely routed himself at Zeutha in 1697 by the Austrian general, Prince Eugene of Savoy. By the Peace of Carlovicz (1699) the empire lost Transylvania and Hungary to Austria, Azof to Russia, Podolia and the Ukraine to Poland, and the Morea to Venice. In 1703 the Janizaries raised Achmed III. to the throne. He concluded an alliance with Charles XII. of Sweden, declared war against Russia, and surrounded Peter the Great on the banks of the Pruth in 1711, but concluded peace on the surrender of Azof. The Morea was reconquered, but the victories of Prince Eugene at Peterwardein and Belgrade cost the empire the most important parts of Servia and Wallachia, which were ceded by the Peace of Passarovitz (1718). Mahmood I. succeeded to the throne in 1730. He distinguished himself by his interest in science and art. He was also an adroit statesman, waged successful wars against Austria and Russia, and procured for his realm a peace of fifteen years, cunningly availing himself of the state of affairs in Europe and forming an alliance with France. He was succeeded in 1754 by Osman III., and Osman III. in 1757 by Mustapha III. He, as well as his successor, Abd-ul-Hamid I. (1773–89), failed signally in his policy toward Russia. At the head of this empire stood Catharine II., and her plans of annexing Poland made the Sublime Porte feel uneasy, while at the same time insurrections in the northern provinces of Turkey seemed to indicate the presence of Russian intrigues. The Porte allied itself with France against the threatening Russian power, and a Turkish army broke through Moldavia across the Russian frontier. But the Russian generals, Romanzoff and Galitzin, defeated this army, a Russian fleet under Orloff appeared in the Archipelago, and the Turkish fleet was nearly annihilated at Tchesme (July 16, 1770). In the Crimea also the Russians were victorious under Dolgoruki, and conquered the whole peninsula. The Turks were compelled to give up the Danube as their line of defence and fall back on the Balkan. Negotiations of peace were opened, but led to nothing, as Catharine demanded too much. The war was renewed, and the Russians were victorious everywhere. Violent insurrections broke out in Egypt and Syria, and the empire was in the greatest danger. Under these circumstances the Porte consented to the humiliating Peace of Kutschuk-Kainardschi (July 21, 1774), by which Russia obtained a kind of protectorate over Moldavia and Wallachia, the important cities of Azof, Taganrog, Yenikale, Kertsch, etc., the right of navigation in all Turkish seas, etc. Not satisfied with what she had got, Catharine took possession of the whole of Crimea, which since the peace stood no longer under the protectorate of Turkey, but belonged to the Tartar empire; and shortly after, she also extended her dominion over the Caucasus. The Sublime Porte recognized the annexation of the Crimea, but the conquest of the Caucasus, by which Russia approached the Turkish frontier in Asia, became the cause of a new war; and as the sultan felt assured that Catharine and the Austrian emperor, Joseph II., had agreed on the division of Turkey, he declared war against both powers at once. At first, the Turks were successful, but shortly after the accession of Selim III. (in 1789) they received a very severe defeat from the Russian general Suworow, and Bessarabia, Wallachia, Belgrade, and Ismail were occupied by the allies. Meanwhile, Prussia and England, afraid of the growing power of Russia, exercised their influence in favor of Turkey, and by the peace with Austria at Szistowa (Apr. 4, 1791), with Russia at Jassy (Jan. 9, 1792), the allied powers surrendered nearly all their conquests. From this time dates the singular position of the Turkish power in Europe, depending more on the jealousy of the other powers than on its own strength, and supported by the Western powers simply from fear lest the Russians should take possession of Constantinople and assume a dominating position in the Black Sea and the Mediterranean. The position became still more complicated by the enmity between England and France, both of which powers were interested in the maintenance of Turkey. When Napoleon invaded Egypt in 1798, the Sublime Porte hesitated long, at the instance of Russia and England, before it declared war against France; and when it received back Egypt, it was easily won over to the French policy. Hence originated a hostile relation to Russia, who occupied the principalities of the Danube in 1806, and to England, whose fleet appeared before Constantinople Feb. 20, 1807, in order to compel Turkey to enter into an alliance against France. The immediate result was a revolution in Constantinople; Selim III. was deposed, and Mustapha IV. raised to the throne. But when the Turkish fleet was defeated by the Russians at Lemnos (July 1, 1807), a new revolution reinstated Selim in July, 1808. Mustapha had him assassinated, but did not come into power himself; Mahmood II. became sultan July 28, 1808. He concluded peace with England Jan. 5, 1809, but continued the war with Russia. The Turkish armies were repeatedly defeated, and when at last the invasion of Russia by Napoleon offered Turkey a most advantageous opportunity, the dexterous Russian diplomats brought about the Peace of Bucharest (May 28, 1812), and the opportunity was lost. The position of the empire continued to be very dangerous. The principal weakness of the empire lay in the circumstance that all its various parts had been brought together by force, and none could be considered as the true home of the Ottoman tribe. Many Christians lived in the empire, whole provinces were Christian, and Russia, steadily pursuing her aim, the conquest of Constantinople, never ceased to use the discrepancies between the Christian subjects and the Mohammedan government as a means of agitation. Thus, one insurrection followed another in the interior history of Turkey, especially after the beginning of the nineteenth century. The Janizaries also often became dangerous to the government. Between 1812 and 1826, Mahmood II. had to fight against insurrections in Servia, in various places of Asia, in Greece, and finally the Janizaries revolted, but were completely and cruelly destroyed. By their annihilation Turkey became almost defenceless, and this condition Russia used to compel her to conclude the treaty of Akjerman (in 1826), by which the political relations of Servia, Moldavia, and Wallachia were changed in favor of Russia. These provinces obtained a certain political autonomy under Russian guaranty, and thereby Russia found an opportunity of perpetually interfering in the interior affairs of Turkey. In 1828 a new and dangerous war broke out. The Porte had fought with the Greeks, and nearly subdued them; then the sympathy of Europe for Greece produced a coolness between the Western powers and the Porte, and finally led to the destruction of the Turkish fleet by an allied French-English-Russian fleet at Navarino, Oct. 20, 1827. This moment the czar Nicholas considered opportune for a vigorous attack on the Ottoman empire. War was declared Apr. 26, 1828, and Russian armies advanced into Turkey, both in Europe and Asia. Paskevitch stormed the fortress of Kars and took Erzeroom; Diebitch crossed the Balkan, and appeared in the neighborhood of Constantinople; the Turkish fleet was burnt at Nicopolis Feb. 18, 1829. The Western powers, alarmed by these successes, and repenting of the readiness with which they had served the plans of Russia at Navarino, now compelled the contending parties to the Peace of Adrianople (Sept. 14, 1829), by which Turkey retained Servia, Moldavia, and Wallachia, but paid large war indemnities and recognized the independence of Greece. New insurrections followed in various places, of which that in Egypt under Mehemet Ali was the most dangerous. He had done the empire great service, especially by aiding it against the Greeks, and he now aspired at independence. A war ensued, and the Egyptian army advanced victoriously to the gates of Constantinople. Then Russia came to the rescue of the Porte, compelled the Egyptians to retreat, and concluded with Turkey the offensive alliance of Hunkiar-Iskelessi (July 8, 1833), which considerably increased her influence in the empire. While manifold intrigues were going on in Europe—France exerting herself to place Mehemet Ali at the head of the Ottoman empire, while England and Austria wished to strengthen the power of the sultan in an anti-Russian direction—a new war broke out with Egypt in 1839. Mahmood died in the same year, and Abd-ul-Medshid, seventeen years old, ascended the throne July 31, 1830. The empire seemed near its dissolution, but Russia, fearing the preponderance of French influence in Egypt, formed the quadruple alliance between Russia, England, Prussia, and Austria, and compelled Mehemet Ali to give up Syria, Cilicia, and Crete, which he had conquered, and content himself with Egypt as an hereditary fief. Redshid Pasha, the minister of the young sultan, tried to strengthen the empire internally, especially by concessions to the non-Mohammedan population. In this respect the Hatti-sherif of Gulhane (Nov. 3, 1839) was a very remarkable document. His reforms, however, met with the most stubborn opposition from the Old Turks. In his foreign policy he leaned upon England, and used the revolutionary movements in Europe (1847–50) to form connections with the liberal powers and strengthen his position against Russia. This caused the czar Nicholas, the most powerful enemy of liberal views, to take up once more his plans of driving the Ottomans out of Europe. He demanded the protectorate over the Christians living in Turkey, and when this was refused, he occupied (in 1853) the principalities of the Danube. The Porte now declared war against Russia, and when the Russian army proved supe-

rior to the Turkish, France and England formed an alliance with the Porte in the spring of 1854, and attacked Russia in the Baltic and in the Crimea, while Austria stationed an army of observation along her frontier. The war ended by the Peace of Paris (Mar. 30, 1856), according to which the Black Sea was to be open to merchant vessels, but closed to vessels of war; the Danubian principalities were to pay tribute to the Porte and to be under the protectorate of the great powers of Europe; the lower course of the Danube to be again placed under the authority of the Porte, etc. The interior breach, however, of the state was so great, that in spite of this favorable external position no strong or sound development took place. The race itself seems incapable of development. It shows still the same qualities as when a warlike host of robber nomads. Horrible scenes of religious fanaticism are still enacted, such as the massacre of the Christians in Damascus and the Lebanon in 1860. Reforms bear no results, and the tributary states are steadily engaged in attempts at making themselves independent. In spite of the protests of the Porte, Moldavia and Wallachia united in 1857 into one state, Romania, which since 1866 has been governed by a prince of Hohenzollern. Crete revolted in 1866, and the revolt was not suppressed until after a contest of several years. With Egypt the relations have been one uninterrupted series of conflicts. On June 25, 1861, Abd-ul-Medshid was succeeded by Abd-ul-Aziz, but the latter was as incapable a ruler as the former. The differences with Greece, arising from the revolution in Crete, were adjusted by the Conference of Paris in 1869, but the khedive of Egypt obtained in 1872 the right of increasing his army and fleet and of making independent loans, and in 1873 he was made perfectly independent with respect to the whole internal administration. During the Franco-German war (on Oct. 31, 1870) Russia threw off the treaty of 1856, and the insurrection which broke out in the northern provinces, Bosnia and Herzegovina, in 1874, was evidently encouraged by her. On May 30, 1876, a revolution took place in Constantinople. Abd-ul-Aziz was deposed, and Murad V. proclaimed sultan. Aug. 30, 1876, Murad V. was also deposed, and Abd-ul-Hamid II. was proclaimed the ruler of Turkey. AUGUST NIEMANN.

**Turkey,** tp., Sampson co., N. C. P. 1167.

**Turkey,** tp., Williamsburg co., S. C. P. 981.

**Turkey-Buzzard.** See CATHARTES AURA. See also CATHARTIDÆ, in APPENDIX.

**Turkey Creek,** tp., Van Buren co., Ark. P. 80.
**Turkey Creek,** tp., Kosciusko co., Ind. P. 1336.
**Turkey Creek,** tp., McPherson co., Kan. P. 74.
**Turkey Creek,** tp., Edgefield co., S. C. P. 959.
**Turkey Grove,** tp., Cass co., Ia. P. 1166.
**Turkey Red.** See DYEING.
**Turkey Stone.** See HONE.
**Turkey Town,** tp., Etowah co., Ala. P. 685.
**Turkistan.** See TURKESTAN.
**Turkomans,** or **Toorkomans.** See TURKESTAN.

**Turks** is the name of the principal branch of the Turanian family, allied to the Magyars and Finns in Europe, to the Samoyeds in Northern Asia, and to the Mongols and Mantchoos in China. As a continuous people they inhabit the central part of Asia, from the northern frontier of Persia and Thibet to about lat. 59° N. in Siberia, and from Lake Baikal to the Caspian Sea; as a scattered population they are found in India, China, Siberia, Southern Russia, Egypt, Asia Minor, and European Turkey. They consist of many different tribes, such as the Yakoots on the borders of the Lena; the Uigurs on the frontier of China; the Toorkomans, Oozbeks, and Kirgheez in Turkestan or Turan or Free Tartary, and in Asiatic Russia; the Bashkirs in European Russia; the Ottomans in Asia Minor and European Turkey. The religion of most of these tribes is Mohammedan; the Yakoots are Shamanists; those of China are Booddhists; those of European Russia, Greek Catholics. Also in the language of the race considerable differences have developed, yet the Yakoot from the Lena and the Ottoman from Constantinople are said to understand each other perfectly well. Their history has been like a series of violent thunderstorms. Enormous empires arose suddenly, swept everything before them, and disappeared again as suddenly, leaving no traces behind them but devastation. (For further particulars see the articles on GENGHIS KHAN, MONGOLIA, SELJOOKS, TIMOUR, and TURKEY.)

**Turk's and Caicos Islands,** a former British colony, annexed in Jan., 1874, to Jamaica. These islands constitute the S. E. portion of the Bahama chain. They lie between 21° and 22° N. lat. and 71° and 72° 30′ W. lon. Until 1848 they were included in the Bahama colony, and from that time till 1874 had a separate government, though attached to Jamaica. The Caicos Islands, the most northwesterly, are the largest, but the least important. They are divided from the Bahamas by the Caicos Passage, and from Turk's Islands by the Turk's Island Passage. The principal of the Turk's Islands, all of which are small keys, are Grand Turk, Turk's Island, Salt Island, and Sand Island. Lat. of Grand Turk, 21° 32′ N., lon. 71° 10′ W. The only export is salt, which is largely sent to the U. S. It is evaporated in lagoons called salt-pans by the sun from sea-water. When the crust of salt is sufficiently thick, it is removed by rakes in the hands of barefooted men, who wade into the pans. The quality of the salt is very good, but all West India and Yucatan salt is known in the market as Turk's Island salt. The colony is self-supporting, but receives a grant of £300 a year from the British post-office. In 1870 the revenue was £9504, the expenditure, £9726; value of imports (1870), £35,345, of exports, £18,855. Tonnage of vessels entered and cleared (1864), 101,535 tons. The government is vested in a commissioner, a legislative board of four, five, or six members, appointed by the governor of Jamaica, three assistant commissioners, a judge, a queen's advocate, and a prothonotary. The U. S. and Hayti (which is but 60 miles distant) each maintain a consulate here. P. in 1861, 4372; in 1871, 4723, of whom 565 were Europeans.

**Tur'meric** (*Curcuma*), the root of *Amomum curcuma*, a native of the East Indies and Cochin-China. It contains a volatile oil, a yellow coloring-matter (*curcumine*), starch, cellulose, gum, and a brownish dye. The root of *Canna speciosa*, a plant occurring in West Africa, also possesses the same physical and chemical properties. Turmeric is used in the dyeing of silk and wool, and is extensively employed in pharmacy for coloring ointments, etc. The tincture of turmeric, or unsized paper stained with the aqueous or alcoholic solution ("turmeric paper"), is often used in chemical operations as a test for the alkalies and for boracic acid, which impart a reddish-brown color to them.

J. P. BATTERSHALL.

**Turn'back,** tp., Lawrence co., Mo. P. 967.

**Turn'bridge,** tp., De Witt co., Ill. P. 1105.

**Turn'bull,** tp., Bladen co., N. C. P. 447.

**Turnbull** (ROBERT), D. D., b. at Whiteburn, Scotland, Sept. 10, 1809; graduated at Glasgow University; was for some years a Baptist preacher in England and Scotland; settled in Danbury, Conn., 1833, at Detroit, Mich., 1835, at Hartford, Conn., 1837, at Boston, Mass., 1839, and has been since 1845 pastor of the First Baptist church at Hartford. Author of *Olympia Morata* (1842), *The Genius of Scotland* (1847), *The Genius of Italy* (1849), *Pulpit Orators of France and Switzerland* (1848), *Theophany, or the Manifestation of God in Christ* (1851), *Christ in History, or the Central Power* (1856), and *Life Pictures* (1857); translated Vinet's *Vital Christianity* (1846); edited Sir William Hamilton's *Discussions on Philosophy and Literature* (New York, 1855), and for two years conducted the *Christian Review*.

**Turnbull** (ROBERT JAMES), b. at North Smyrna, Fla., in Jan., 1775, son of an English physician who married a Greek lady of Smyrna, and obtained, in connection with Lord Hillsborough, a grant from the English government in 1772 for settling a Greek colony in Florida, but forfeited his rights by adhesion to the Revolutionary cause, and settled at Charleston, S. C. Robert was educated in England, studied law in Charleston and Philadelphia, and practised at Charleston until 1810, when he devoted himself to the care of his residence on his large plantation; became a leader of the nullification party; was prominent in the free-trade conventions at Columbia and Charleston 1831, and at the South Carolina nullification convention of Nov., 1832, which adopted from his pen an address to the people. D. at Charleston June 15, 1833. A fine monument was erected to his memory by his political associates. Author of *A Visit to the Philadelphia Prison* (London, 1797) and *The Tribunal of Dernier Resort* (1830); wrote much on politics for the Charleston *Mercury* 1827, and a collection of his articles from that paper, republished under the title of *The Crisis*, became the textbook of the nullification party.

**Turnbull** (WILLIAM), b. in Maryland 1800; graduated at the U. S. Military Academy July, 1819, when commissioned second lieutenant of artillery, but served on topographical duty until 1831, in which year he was transferred to the corps of topographical engineers with rank of captain; major 1838; was chief topographical engineer in construction of the Potomac aqueduct 1832–43. This work, the piers of which are founded by coffer-dams on rock (covered by sometimes 20 feet of mud), from 30 to 40 feet below the water-surface, was one of the earliest of important works of American engineering—the earliest of its type—the successful surmounting of the difficulties of which gives Col. Turnbull a claim to be regarded as one of the fathers of American civil engineering. He was in charge

of improvement of lake harbors 1843–46. In the war with Mexico he served as chief topographical engineer of Gen. Scott's army, from Vera Cruz to the City of Mexico, gaining the brevet of lieutenant-colonel for gallantry at Contreras and Churubusco, and colonel for Chapultepec. In 1848–49 he superintended the construction of the New Orleans custom-house; engaged in the study of the question of bridging the Susquehanna at Havre de Grâce, and expediency of an additional canal around the Falls of the Ohio 1852; on lighthouse duty and in charge of the improvement of Cape Fear River, N. C., at the time of his death, at Wilmington, N. C., Dec. 9, 1857.—His son, CHARLES N., b. at Washington, D. C. 1834; graduated at the U. S. Military Academy in 1854, and attained a captaincy in the corps of topographical engineers in 1862; served throughout the civil war; resigned Dec. 31, 1865. D. at Boston Dec. 2, 1874.

**Turnbull** (WILLIAM BARCLAY), b. at Edinburgh, Scotland, in 1811; was called to the bar of Scotland 1832, to that of England 1856; was for several years secretary to the Scottish Society of Antiquaries; founded the Abbotsford Club 1833; was its secretary until 1841; edited for it many old MSS. and reprints of rare early publications, and was appointed, although a Roman Catholic, by Sir John Romilly, in 1859, calenderer of the foreign correspondence at the state paper office, which post he resigned in 1861 in consequence of dissatisfaction with his method of presenting the religious transactions of the reigns of Edward VI. and Mary in the *Calendar* issued in February of that year. D. Apr. 22, 1863. Among his other publications were *Legendæ Catholicæ* (1840), Audin's *Life of Luther* (2 vols. 8vo, 1854), *The Poetical Works of Rev. Robert Southwell* (1856), *The Poetical Works of William Drummond of Hawthornden* (1856), and *The Complete Works of Rev. Richard Crashaw* (1858), *An Account of the Monastic Treasures confiscated at the Dissolution of the Various Houses in England* (1836), *The Miscellany of the Abbotsford Club* (1837), and *The Chronicles of Scotland* (3 vols., 1857–58), the latter forming part of the "Rolls Series."

**Turnbull's Blue** (*Ferrous ferricyanide*). See FERROCYANIDES.

**Turn'er,** county of S. E. Dakota, intersected by Vermilion River, the surface consisting of fertile prairies and bottom-lands. Cap. Swan Lake. Area, 648 sq. m. P. not given in the census of 1870.

**Turner,** p.-v., Du Page co., Ill., at the junction of Fox River Sterling and Fulton branches of Chicago and Northwestern R. R. and a branch of Chicago Burlington and Quincy R. R., contains 4 churches, a fine school system, 1 newspaper, 3 hotels, a mill for repairing railroad iron, and a round-house. P. about 1000.

J. RUSSELL SMITH, ED. "NEWS."

**Turner,** p.-v. and tp., Androscoggin co., Me. P. 2380.

**Turner** (DANIEL), b. at Newport, R. I., in 1792; entered the U. S. navy as a midshipman Jan. 1, 1808; became lieutenant Mar. 12, 1813; commanded the Caledonia in Perry's victory on Lake Erie, Sept. 10, 1813, rendering services for which the State of New York presented him with a sword of honor; was captured with his vessel while co-operating with Col. Croghan in the autumn of 1814, and carried prisoner to Montreal; became master 1825 and captain 1835. D. at Philadelphia Feb. 4, 1850.

**Turner** (DAWSON), F. R. S., b. at Great Yarmouth, England, in Oct., 1775; studied at Cambridge, but did not graduate, and became in 1796 manager of the Yarmouth branch of a London bank, a post he filled for more than half a century, devoting his mornings and evenings to literature and science, especially the study of botany and of architecture, and formed an extensive collection of autographs and MSS. illustrative of the history of England, a portion of which he sold in 1853 to the British Museum, and the remainder was ultimately dispersed by auction. D. at Old Brompton June 20, 1858. Among his publications were—*The Natural History of Fuci, or Sea-weeds* (4 vols. 4to, 1808–19), *Account of a Tour in Normandy for investigating Architectural Antiquities* (2 vols., 1820), and a *Stranger's Guide to the Roman Antiquities of the City of Treves* (1839), from the German of Prof. J. H. Wyttenbach.

**Turner** (EDWARD), M. D., F. R. S., b. in Jamaica in 1797; graduated in medicine at Edinburgh; studied chemistry and mineralogy two years at Göttingen under Stromeyer; lectured on those sciences at Edinburgh 1824, and was professor of chemistry at University College, London, from 1828 until his death, at London, Feb. 12, 1837. He contributed to the *Transactions* of the Royal societies of London and Edinburgh, to scientific periodicals, and to the *Penny Cyclopædia*. His *Elements of Chemistry* (1825) soon became a standard work; a posthumous edition was revised by Liebig and Gregory, and three American rival editions were edited respectively by Profs. Bache, Rogers, and Johnston.

**Turner** (JOSEPH MALLORD WILLIAM), R. A., b. at Covent Garden, London, England, Apr. 23, 1775, son of a hair-dresser; received a very limited education at school, but acquired some skill in sketching from nature, and was intimate as a schoolboy with Thomas Girtin, afterward the founder of the School for Painting in Water-Colors. The two boys, who displayed the same fondness for drawing and for resplendent colors, obtained from John Raphael Smith, an engraver and painter in Maiden lane, the opportunity to gratify their tastes by coloring prints, and they were afterward employed by an architect to put skies and backgrounds into his designs. They were also patronized by a Dr. Munro, who gave them access to his fine collection of paintings, and employed them to make copies in water-colors. When only twelve years of age Turner exhibited two drawings at the Royal Academy; was an assiduous student there for ten years from 1789, exhibiting no less than 59 pictures, all in water-colors; was employed to make views of English scenery for the *Oxford Almanack*, Walker's *Itinerant*, the *Pocket Magazine*, and as an illustrator of topographical books travelled extensively over England and Wales on foot, making sketches and giving lessons in water-colors; acquired wonderful skill in marine scenery; was in 1799 chosen an associate of the Royal Academy; took a studio in Harley street; exhibited during the two following years 14 pictures; was chosen an academician 1802, being already recognized as the first landscape-painter of his time; gave his attention thenceforth to oil-painting; visited France 1802; afterward made frequent artistic trips to Switzerland and the Rhine-lands, whence he brought home copious sketches and finished pictures; was chosen in 1807 professor of perspective at the Royal Academy, but was unsuccessful as a lecturer, owing to his illiteracy; published in 1808 his famous *Liber Studiorum*, a series of plates from original designs, many of which were engraved by his own hand, and which avowedly challenged comparison with the *Liber Veritatis* of Claude Lorraine, the artist whom he most admired and imitated; began about 1815 to strike out a style of his own, chiefly marked by wonderful accuracy in reproducing the phenomena of nature and by unequalled skill as a colorist, being especially fond of the most brilliant tints and contrasts; visited Italy 1819, 1829, and 1840; was liberally patronized, receiving enormous prices for his slightest sketches; acquired wealth and fame; was noted for his eccentricities, his extreme reserve, and unsocial habits, living alone in penurious style, often under an assumed name, receiving no visits, and allowing no one to enter his studio; gradually changed his style, showing with advancing years increased fondness for representing the diffusion of light in a more and more vertical manner, and with a tendency to a preponderance of blue rays, probably owing to some peculiarity of his eyesight; exhibited at the Academy during the first half of the century no fewer than 250 pictures, most of which he refused to sell at any price, and maintained nearly equal celebrity in another branch of his art by the exquisite finish of the drawings and the engraved designs which he furnished to such works as Dr. Whitaker's *History of Richmondshire*, to illustrated editions of the *Poems* of Rogers, Byron, and Scott, or published in several series *The Scenery of the Southern Coast, England and Wales, The Rivers of England, The Rivers of France, etc.*, and resided for several years, under an assumed name, at Chelsea, where he d. Dec. 19, 1851, and was buried next to Reynolds in St. Paul's cathedral. He was never married, and by his will left most of his pictures to the nation upon the condition of a suitable gallery being provided for them. They now occupy the "Turner Room" of the National Gallery. He left £20,000 to the Royal Academy, and devised the rest of his large property to found an asylum for decayed artists, to be called "Turner's Gift," but owing to the unskilful manner in which his will was drawn, his intentions were defeated and the property (near £200,000) was divided among the next of kin. It is usual to divide the artistic career of Turner into three periods, the first terminating in 1802, the second in 1829, and the third with his death. The first period was one of development, characterized by the employment of water-colors and the successful imitation of the great English landscape-painters. His chief oil-paintings of this period were *The Tenth Plague of Egypt, Dutch Boats in a Gale, The Battle of the Nile* (1799), *Calais Pier* (1802), and *The Falls of the Clyde* (1802). Of his second period, that of imitation of the great continental colonists, his own two favorite pictures, *The Sun rising through a Mist* (1807) and *Dido building Carthage* (1815), which in his will he directed to be hung next to prominent works of Claude Lorraine. Other notable paintings of this time were *The Shipwreck* (1805), *The Falls of Schaffhausen* (1805), *The Blacksmith's Shop* (1807), *The Wreck of the Minotaur, Spithead* (1809), *Mercury and*

*Herse* (1811), *Hannibal crossing the Alps* (1812), *The Bay of Baiæ* (1828), and *Mortlake* (1826–27). Of the third period, that of entire emancipation from precedent, the masterpieces were *Ulysses deriding Polyphemus* (1829), *Palestrina* (1830), *Caligula's Palace and Bridge* (1831), *Childe Harold* (1832), *The Slave Ship*, and *The Fighting Téméraire* (1839). The last ten years of his life were marked by a "decay and declination" of his genius, and he produced no painting worthy of his fame. But it was precisely during this period of decline that the great critical work of John Ruskin on *Modern Painters* (1844) asserted for him that artistic pre-eminence which has since become generally recognized. Owing to his carelessness in the composition and use of pigments and varnishes many of his oil-paintings are rapidly deteriorating, and it is probable that his reputation will ultimately rest upon the line engravings of his best works which were executed under his own supervision. He was author of a worthless poem in blank verse entitled *The Fallacies of Hope*, from which he frequently appended extracts to the titles of his pictures in the Academy catalogues. A statue of Turner by McDowell was erected in 1863 in St. Paul's cathedral; a biography by Walter Thornbury appeared in 1861. PORTER C. BLISS.

**Turner** (PHILIP), b. at Norwich, Conn., in 1740; was left an orphan at the age of twelve; adopted by Dr. Elisha Tracy, with whom he studied medicine, and whose daughter he married; was assistant surgeon to a provincial regiment at Ticonderoga 1759; settled at Norwich, Conn., where he became highly distinguished in his profession; was the first surgeon of Connecticut troops before Boston 1775; was present at the battles of Long Island and White Plains 1776; was surgeon-general of the eastern department 1777–82; settled in New York City 1800, and during the second war with England was staff surgeon to the U. S. army stationed at York Island, where he d. in the spring of 1815.

**Turner** (SAMUEL), b. in Gloucestershire, England, in 1759; became distinguished in the East India military service; was sent by Warren Hastings at the head of a mission to Thibet 1783; took part in the siege of Seringapatam 1799, and was afterward entrusted with a mission to the rajah of Mysore. D. in London Jan. 2, 1802. Author of *An Account of an Embassy to the Court of the (Teshu) Lama in Tibet* (1800), which was translated into French and German, and still remains one of the principal sources of information upon Thibet.

**Turner** (SAMUEL HULBEART), D. D., b. at Philadelphia, Pa., Jan. 23, 1790; graduated at the University of Pennsylvania 1807; was ordained deacon in the Protestant Episcopal Church 1811, and priest in 1814; was pastor of a church at Chestertown, Md., 1812–17; was elected professor of historic theology in the General Episcopal Seminary, New York, Oct. 8, 1818; removed with that institution to New Haven, Conn., 1820, and returned with it in 1821 to New York, where it was combined with the New York Diocesan Seminary under the title of the General Theological Seminary, in which he was professor of biblical learning and interpretation of Scripture from Dec. 19, 1821, to his death, and also professor of the Hebrew language and literature in Columbia College from 1831. D. in New York City Dec. 21, 1861. Author of *Notes on the Epistle to the Romans* (1824), *Companion to the Book of Genesis* (1841), *Biographical Notices of Distinguished Jewish Rabbis* (1847), *Parallel References Illustrative of the New Testament* (1848), *Essay on our Lord's Discourse at Capernaum* (1851), *Thoughts on the Origin, Character, and Interpretation of Scripture Prophecy* (1852), *Teachings of the Master* (1858), *Spiritual Things compared with Spiritual* (1859), *The Gospels according to the Ammonian Sections and the Tables of Eusebius* (1861), and an *Autobiography* (1862). He translated Jahn's *Introduction to the Old Testament* (1827), in which he was aided by Rev. Dr. W. R. Whittingham, and Planck's *Introduction to Sacred Philology and Interpretation* (1834); edited in Greek and English, with analytical and exegetical commentaries, the Epistles to the Hebrews (1852), to the Romans (1853), and to the Ephesians (1856); published several sermons and addresses; contributed to the *Biblical Repository* and other theological and literary periodicals; wrote the sketch of St. Paul's life and character in Bishop Wainwright's magnificently illustrated volume, *Our Saviour with Prophets and Apostles* (1850), and left several works nearly ready for the press, including an *Exposition of Messianic Texts*, *Notes on the Gospels*, and *Notes on the Epistles to the Corinthians*.

**Turner** (SHARON), b. in London, England, Sept. 24, 1768; became a successful attorney in London, devoting his leisure to historical, archæological, and philological researches; retired from the practice of his profession 1829, and devoted the remainder of his life to literary pursuits at his seat of Winchmore Hill, and received a pension of £300 from the Crown. D. at London Feb. 13, 1847. Author of *A History of England from the Earliest Period to the Death of Elizabeth*, published in four different instalments, with separate titles, from 1799 to 1829 (9 vols.); *A Vindication of the Genuineness of the Ancient British Poems of Aneurin, Taliessin*, etc. (1803); *The Sacred History of the World* (3 vols., 1832; 8th ed. 1848; New York, 1838); *Richard the Third, a Poem* (1845), and other productions in prose and verse. The most valuable of his writings was the *History of the Anglo-Saxons* (4 vols., 1799–1805; 7th ed., 3 vols., 1853), which was long the standard authority, and has not been entirely superseded by the more recent works of Palgrave, Kemble, Lappenberg, Pauli, and Freeman.—His son SYDNEY, b. Apr. 2, 1814; graduated at Trinity College, Cambridge, 1836; took orders; was for many years resident chaplain to the institution for the reformation of juvenile offenders at Redhill, Surrey; government inspector of reformatories and industrial schools 1857, and rector of Hampstead, near Gloucester, 1867; has edited his father's principal historical works, and written *Reformatory Schools* (1855).

**Turner** (THOMAS), U. S. N., b. in Virginia Dec. 23, 1808; entered the navy as midshipman Apr. 21, 1825; became lieutenant in 1835, commander in 1855, captain in 1862, commodore in 1863, rear-admiral in 1868; served on the E. coast of Mexico during our war with that country, and commanded the Ironsides in the first attack upon Fort Sumter, Apr. 7, 1863. Highly commended by Rear-Admiral Du Pont in his official report of Apr. 15, 1863.
FOXHALL A. PARKER.

**Turner** (WILLIAM), M. D., b. at Morpeth, Northumberland, England, about 1515; educated at Pembroke Hall, Cambridge, where he obtained a fellowship about 1531; studied medicine, botany, and theology; took orders in the Church of England; was imprisoned for preaching the doctrines of the Reformation; proceeded on his release to the Continent, and studied natural history at Zurich and Bologna; returned to England on the accession of Edward VI.; became physician to the Protector Somerset; prebendary of York 1550, dean of Wells 1550, and canon of Windsor; resided in Germany during the reign of Mary; was twice deprived of his deanery, and twice restored, 1553 and 1560, and at one time had a seat in Parliament. D. in London July 7, 1568. Author of *The Huntyng and Fyndyng out of the Romish Fox, by Will. Wraughton* (Bâle, 1543), *Avium præcipuarum, quarum apud Plinium et Aristotelium Mentio est, Historia* (Cologne, 1544), *The Rescuyinge of the Romish Fox, etc., by Wuillyam Wraghton* (Winchester, 1545), *The New Herball* (book i. London, 1551; i. and ii. Cologne, 1562; i., ii., and iii., 1568), the first scientific work on botany by an English writer; published a collation of the English Bible with the Hebrew, Latin, and Greek, and wrote the account of British fishes in his friend Johann Gesner's *Historia Animalium*.

**Turner** (WILLIAM WADDEN), b. in London in 1810; came to the U. S. 1818; was apprenticed to a printer in New York 1829; became distinguished for his attainments in modern and Oriental languages; was successively librarian to the University of New York and instructor in Hebrew in Union Theological Seminary 1842–52; assisted Dr. Isaac Nordheimer in the preparation of his Hebrew manuals; contributed to Bartlett's *Dictionary of Americanisms* (1848); translated Von Raumer's *America and the Americans* (1845), and the greater part of Freund's *Latin-German Lexicon* for Prof. E. A. Andrews; superintended the publication of Dr. S. R. Rigg's *Dakota Grammar and Dictionary* and other linguistic works issued by the Smithsonian Institution; contributed to Ludewig's *Literature of American Aboriginal Languages* (1858), to the *Transactions* of the American Ethnological and Oriental societies, *Iconographic Encyclopædia*, the *Bibliotheca Sacra*, and other periodicals. He was for several years recording secretary of the National Institute for the Promotion of Science, and librarian of the U. S. patent office from 1852 to his death, at Washington, D. C., Nov. 29, 1859.

**Turners,** p.-v., Orange co., N. Y., on Erie R. R., 46 miles from Jersey City.

**Tur'nersburg,** p.-v. and tp., Iredell co., N. C. P. 796.

**Turner's Falls,** p.-v., Franklin co., Mass., at the terminus of a branch of Vermont and Massachusetts R. R., and on Connecticut River, contains 4 churches, 3 large school-houses, 2 banks, 2 extensive paper-mills, the largest cutlery establishment in the world, a cotton-factory, foundry, and machine-shops, 1 hotel, and 1 newspaper. The vicinity is rich in fossil prints, fish, and vegetables. P. about 2000.
CECIL T. BAGNALL, ED. "TURNER'S FALLS REPORTER."

**Turnhout',** town of Belgium, province of Antwerp, has large paper-mills, tanneries, dyehouses, and manufactures of cotton, flax, hemp, and lace. P. 15,000.

**Turning.** See LATHE, by PROF. R. H. THURSTON, C. E.

**Tur'nip** [O. Eng. *turnep*], a biennial plant, abundant throughout the temperate zone, having a swollen fleshy root of great value as food both for man and more especially for cattle. It is of the same genus (*Brassica*) as MUSTARD and of the same species (*B. campestris*) as RAPE (which see), is found growing wild as a weed in Europe and Northern Asia, and is largely cultivated both as a field and as a garden crop, sometimes reaching twenty or twenty-five pounds. The most valuable kinds are the Swedish or Russian turnips, usually called ruta-bagas, of which there are numerous varieties. Turnips, when grown in gardens, must be sown early in spongy soil; when raised in the field, they are sown much later, and thrive best in moist cloudy weather. Though turnip-culture is of comparatively recent origin in England, it has already taken rank there as the most important field-crop, being fed to sheep in the fields, enclosed within hurdles or movable fences. Though an agreeable article of diet for man, it has never assumed great importance in that respect, owing to the enormous proportion of water, 87 to 92 per cent., in its composition. The leading varieties are in England, the white Dutch, white French, sweet German, and Teltow; in the U. S., the improved American and Carter's and Laing's ruta-bagas.

**Turnip-Fly,** a name common to several insects destructive to turnips. The most common is the small chrysomelian beetle called also turnip-flea (*Altica* or *Haltica nemorum*), from its prodigious leaping powers, a species having an oval body and wide head, long and strong hind legs, large black wings with two yellowish stripes, and claws notched and hooked to enable it to keep firm hold of the cruciferous vegetables which constitute its food. It eats the leaves of the turnip as soon as they appear above ground in the spring, and lays its eggs on the under side of the leaves later in the season. The larvæ thus bred upon the plant are often extremely destructive to the turnip-root, in which they burrow. Other species are the *H. striolata*, or wavy-striped flea-beetle of the U. S., the *Pontia oleracea*, potherb or white butterfly, and the *Anthyomia radicum*, a dipterous insect of the family Muscidæ, of the same genus as the cabbage-fly and the beet-fly, and especially abundant and noxious in Great Britain, where the latter is considered as the turnip-fly proper.

**Turn'pike,** in law, differs from a common public highway in the fact that it is always constructed and maintained by a board of managers or trustees, or by a corporation acting under some special statutory authority, and also in the fact that tolls are almost always imposed upon the travellers to enable the trustees or corporation to pay the cost of construction and maintenance and to receive a profit upon their investments. In England the previous special statutes were consolidated by the general acts of 13 Geo. III. ch. 64, and 24 Geo. III. ch. 9, and all existing and future turnpikes were brought under the same system of regulations. In the U. S. turnpikes are constructed and maintained by corporations created either under general statutes or by special charters. Although there is a great diversity in the details of the legislation in different States, yet all these corporations are authorized to take lands for their own uses upon payment of compensation to the owners thereof, to appropriate existing highways, and to exercise the same rights of eminent domain under similar restrictions that are held by and imposed upon railroad companies. They are also empowered to lay and collect tolls from travellers, the rates of toll and the number or distances of the gates being frequently determined by the charter itself. As this is the most important of all the franchises granted by the State, its enjoyment is carefully protected, and its use is strictly guarded by penalties enforceable, as the case may be, either against private persons or against the corporations. As concerns its use, a turnpike is in every respect a public highway, free to all upon the sole condition that the legal tolls are paid; as a consequence thereof, the rules of law concerning encroachment upon highways are equally applicable to turnpikes. In return for the franchises conferred by the legislature, the corporations are required to keep the road-bed and all its appurtenances in good repair, in the condition and form prescribed by the statute, so long at least as they do not surrender their franchises by ceasing to demand payment of tolls. If they fail in this duty, they may be made liable in actions for damages brought by persons injured through their neglect, to actions for penalties, to indictment, and to an annulment of their charter at the suit of the people. The plank roads, which have been so common in certain States, are simply a species of turnpikes, required by their charters to be constructed of a particular material. J. NORTON POMEROY.

**Turnsol,** another name for LITMUS (which see). See also ARCHIL.

**Turn'spit,** a dog employed for turning the spit upon which meat is roasted. Formerly, the turnspit was almost universally employed in the kitchens of the European gentry and many peasants; but at present, though not quite unknown, it is mostly superseded by less rude appliances. The turnspit is a very intelligent dog, with a long body, short and often crooked legs, long and pendent ears, and a very large head. It has a dash of greyhound blood. Two or more dogs are kept, and relieve each other at the task. The dog stands in a kind of treadmill, his weight giving motion to the spit.

**Turn'stone** [so called from its habit of overturning stones in search of food], the *Strepsilas interpres*, a wading bird of the family Hæmatopodidæ, allied to the plovers, and common on the shores of the U. S. and in nearly all parts of the world. On our Pacific coast is found *S. melanopus*, the black turnstone.

**Tur'pentine** [Lat. *terebinthina*; Ger. *Terpentin*; Fr. *terebenthene*; It. and Span. *trementina*], a term applied to certain vegetable oleo-resins which exude from coniferous trees, also to the resin obtained from the *Pistacia terebinthus*. They are obtained by making an excavation, having a capacity of about three pints, in the trunk of the tree, in which the exuded juice accumulates; which is collected, washed with warm water, and purified by straining through straw filters. The several varieties of turpentine are viscid solutions of resin in a volatile oil. American turpentine is chiefly procured from the *Pinus palustris* and the *Pinus tæda*, the principal supply coming from North Carolina and the south-eastern part of Virginia; but recently indications have been given that Georgia and Florida will, in the near future, furnish large amounts of this valuable product. French and German turpentines greatly resemble the American in most of their properties. Venice turpentine, which is obtained from the *Tarax europæa*, is a ropy, slightly greenish liquid, having a rather unpleasant odor and taste. Canada turpentine (Canada balsam; see BALSAM) is produced from the *Abies balsamea* growing in Canada and the northern part of Maine. The remaining varieties of turpentine are the Strasbourg, the Hungarian, and the Chian, which differ somewhat in their properties, but are in most respects very similar compounds. The turpentines, as a class, form yellowish viscid liquids, possessing a strong aromatic odor, and a bitter, pungent taste, and are very inflammable. They consist of a volatile oil (or oils) and *colophony* (*rosin*). Upon distilling the crude product with water, the volatile oil is separated, a brittle residue of rosin remaining.

*Oil of turpentine* (*spirits of turpentine*), ($C_{10}H_{16}$), is obtained by the distillation of crude turpentine, each variety of the crude product furnishing a distinct volatile oil. They all form colorless, mobile liquids of a peculiar disagreeable odor, are insoluble in water, but dissolve in alcohol, in ether, and in bisulphide of carbon. The oils of turpentine are solvents of many resins and oils, of caoutchouc, and of iodine, sulphur, and phosphorus. The chief differences exhibited by the various varieties are in specific gravity, boiling-point, and optical rotatory power. The ordinary turpentine oil of commerce has a sp. gr. of 0.864 and a boiling-point of 320° F. French oil of turpentine consists essentially of a hydrocarbon termed *terebenthene* ($C_{10}H_{16}$), of sp. gr. .8767 at zero Centigrade, at 321° F. (*Riban*). *Australene* is an analogous hydrocarbon obtained from the American oil. The oils of turpentine, on standing, slowly absorb oxygen, a portion of which is converted into ozone. Chlorine, bromine, and iodine are dissolved by them, disengagement of heat and combustion often occurring. Under the influence of heat and of acids turpentine oils assume various isomeric states; when heated to 464° F., *isoterebenethene* and *metaterebenethene* are formed; by the action of sulphuric acid, *terebene* and *colophene* are produced. Two other isomeres, *camphilene* and *terebilene*, have been prepared by treating artificial camphor with quicklime. Artificial camphors are the results of the combination of hydrochloric acid with oil of turpentine; so far, two hydrochlorates, $C_{10}H_{16},HCl$ and $C_{10}H_{16},2HCl$, having been obtained. The former, which is termed *hydrochlorate of camphene*, crystallizes in white prisms, which have an aromatic smell and taste, greatly resembling that of ordinary camphor; the latter compound possesses the characteristic odor of the oil of thyme. (See THYME, OIL OF.) A numerous variety of seeds and fruits yield by distillation oils isomeric or polymeric with those of turpentine; these have received the generic name of *camphenes* or *terebenes*. Turpentine is sometimes applied externally in medicine in the shape of salves and plasters; it is also taken internally in the form of pills. The oils of turpentine are extensively used in the preparation of varnishes, and to some extent in medicine as stimulants, diuretics, and anthelmintics.

J. P. BATTERSHALL.

**Tur'peth,** or **Turbith,** a medicinal cathartic root from India and Australia, *Ipomæa turpethum.* Spirgatis found in it a substance he called *turphethine,* $C_{34}H_{56}O_{16}$, a yellowish resin, which possessed purgative properties. It seems to be a glucoside. H. WURTZ.

**Turpeth-Mineral,** also **Turbith-Mineral,** an ancient name of what is now known as the basic sulphate of mercuric oxide, $O_6SHg_3$. It is obtained by boiling with water the neutral mercuric sulphate, $O_4SHg$. It is a lemon-yellow powder, which is very slightly soluble in cold water. It was formerly used in medicine. Notwithstanding its name, it is not a mineral substance, but is wholly artificial in its origin. H. WURTZ.

**Turpin',** or **Tylpinus,** archbishop of Rheims (d. Sept. 2, 800), was the reputed author of a Latin chronicle relating the campaigns of Charlemagne against the Saracens in Spain. The book was declared authentic by Pope Calixtus II. in 1122, translated into French in 1206, printed in 1566 in Frankfort, and lately edited by Ciampi (Florence, 1822) and Reiffenberg (Brussels, 1836). The first part of the book was evidently written simply in order to encourage pilgrimages to St. Jago di Compostella, and the rest bears the character of a romance written principally for the purpose of entertainment. Many interior features indicate that the work was produced in the twelfth century, perhaps by Pope Calixtus II. himself. (See Ciampi, *De Vita Caroli Magni et Rolandi Historia, J. Turpino vulgo tributo* (Florence, 1822), and Gascon Paris, *De Pseudo Turpino* (Paris, 1865).)

**Turquoise.** See PRECIOUS STONES, by PROF. H. B. CORNWALL, E. M.

**Turrecremata.** See TORQUEMADA.

**Turretin',** or **Turretini** (FRANÇOIS), b. at Geneva Oct. 17, 1623; studied theology in his native city, in Holland, and in France under Spanheim, Morus, and Diodati; was appointed pastor at Geneva in 1647; removed to Leyden in 1650; returned to Geneva as professor of theology in 1653. Died there Sept. 28, 1687. His principal work is *Institutio Theologiæ Elencticæ* (1679–85). His complete works were published in 4 vols., 1688.—His son, JEAN ALPHONSE TURRETIN, b. at Geneva Aug. 13, 1671; studied theology; visited Holland, England, and France, and was appointed professor of ecclesiastical history in 1697 at Geneva, where he d. May 1, 1737. His complete works were published in 5 vols. in 1775, and contain *Pyrrhonismus Pontificius,* against Bossuet's *Histoire des Variations, Historia Ecclesiasticæ Compendium ad annum 1700,* etc.

**Turret-Ships.** See SHIPS, IRON-CLAD, by ISAAC NEWTON.

**Turtle.** See CHELONIA.

**Tur'tle,** or **Turtle-Dove,** a name applied to several small pigeons, especially those of the genus *Turtur.* The *T. auritus,* or common European turtle, is a migratory bird, famed for its gentleness, its strong conjugal affection, and its loud but soft cooing note. The turtle or mourning dove of the U. S. is the *Zenaidura carolinensis,* whose gentle and mournful note is well known. It is thirteen inches in total length, and has a remarkably long tail. Pigeons of the genus *Ænа* are also reckoned as turtles. There are perhaps twenty different species of turtle-dove. That mentioned in the Bible is doubtless *Turtur risorius,* an abundant Eastern species often kept in cages.

**Turtle,** tp., Rock co., Wis. P. 1274.

**Turtle Creek,** tp., Shelby co., O. P. 1230.

**Turtle Creek,** tp., Warren co., O. P. 5560.

**Turtle Creek,** p.-v., Allegheny co., Pa., on Pennsylvania R. R., 3 miles E. of Pittsburg.

**Tuscaloo'sa,** county of W. Alabama, intersected by Gipsey and Black Warrior rivers, and traversed by Alabama and Chattanooga R. R.; surface hilly, soil fertile, with iron ore, bituminous coal, and carboniferous limestone. There are manufactories of cotton goods, stone and earthen ware, and iron castings, flour-mills, tanneries, and currying establishments. Staples, cotton, Indian corn, and sweet potatoes. Cap. Tuscaloosa. Area, 1450 sq. m. P. 20,081.

**Tuscaloosa,** city and tp., cap. of Tuscaloosa co., Ala., at the head of navigation on Warrior River, and upon Alabama and Chattanooga R. R., contains churches representing five denominations, Alabama University, Tuscaloosa Female College, Alabama Central Female College, Ursuline convent, parish and 2 colored schools, 2 banks, 2 newspapers, the State insane asylum, 1 cotton and woollen factory located in the suburbs, 1 foundry, a tannery, and 1 shoe manufactory. P. of city, 1689; of tp. 3340. JOHN F. WARREN, ED. "TIMES."

**Tuscan Order of Architecture** is generally regarded as a Roman simplification of the Doric style, having unfluted columns and no triglyphs. It seems, however, to have been Etruscan rather than Roman, and remains at Axia and other points seem to show that it was a rude attempt at the Doric style. The temple of Jupiter in the Capitol at Rome was of the Tuscan order. The general effect is low and heavy.

**Tus'cany,** formerly an independent grand duchy of Italy, was between the duchies of Parma and Modena, the Papal States, and the Tyrrhenian Sea, and comprised an area of 8586 sq. m., with 1,801,875 inhabitants. Its territory corresponded nearly to that of the ancient Etruria, and after the fall of the Roman empire it formed at first part of the kingdom of the Goths, then of the kingdom of the Longobards, and then of the empire of Charlemagne. He gave it a somewhat more independent position, erecting it unto a marquisate, and giving it away as a military fief. Guelph VI. sold his fief in 1160 to the German emperor Frederick I.; but as the connection with the German empire was somewhat loose from the very beginning, Tuscany was soon broken up into a number of independent republics, of which Florence, Pisa, and Sienna were the most important. Florence conquered Pisa and the greatest part of the Tuscan territory, but was conquered itself in 1532 by Charles V., who appointed Alessandro de' Medici duke of Florence. In 1569, Cosmo I. united the whole of Tuscany into a grand duchy, and from that time and to 1737, when it became extinct, the Medici family ruled the country and made it one of the most prosperous and civilized in Europe. In 1737 it fell to Francis, duke of Lorraine, who had married Maria Theresa and became emperor of Germany, and with exception of a few years, during which Napoleon first made it a part of the kingdom of Etruria, and then annexed it to France, it was ruled by the house of Lorraine until Aug. 20, 1859, when by an almost unanimous vote of the people it annexed itself to the kingdom of Sardinia.

**Tuscara'was,** county of E. Ohio, intersected by Tuscarawas River, traversed by Ohio Canal and by the Pittsburg Cincinnati and St. Louis and the Tuscarawas branch of Cleveland and Pittsburg R. Rs.; surface undulating, soil fertile, with an abundance of iron ore and bituminous coal. There are manufactures of woollen goods, clothing, agricultural implements, carriages, saddlery, pig-iron, and iron castings, flour-mills, saw-mills, planing-mills, tanning and currying establishments, and breweries. Horses, cattle, swine, and especially sheep, are numerous. Staples, wheat, Indian corn, oats, potatoes, lumber, leather, wool, and dairy products. Cap. New Philadelphia. Area, 520 sq. m. P. 33,840.

**Tuscarawas,** tp., Coshocton co., O. P. 2725.

**Tuscarawas,** tp., Stark co., O. P. 2412.

**Tuscaro'ra,** tp., Steuben co., N. Y. P. 1528.

**Tuscarora,** tp., Bradford co., Pa. P. 1224.

**Tuscarora,** tp., Juniata co., Pa. P. 1492.

**Tuscarora,** tp., Perry co., Pa. P. 899.

**Tuscaroras,** one of the "Six Nations" of New York Indians, resided originally in the valleys of Tar and Neuse rivers in North Carolina. With the Pamlicoes they made war (1711–13) on the whites, were severely defeated, fled northward, and were formally received by their kindred, the Hodénosaune, or Five Nations, thenceforth called the Six Nations. At present there are 448 Tuscaroras reported as living on the Tuscarora reservation, which is in the town of Lewiston, Niagara co., N. Y. They own 6249 acres in common, which they purchased with moneys paid them by the U. S. for land in North Carolina claimed by them.

**Tuscia.** See ETRURIA.

**Tusco'la,** county of the E. peninsula of Michigan, lying upon Saginaw Bay, intersected by Cass River and traversed by Detroit and Bay City R. R.; surface level, soil well timbered and fertile. There are saw-mills, flour-mills, woollen-mills, and tanneries. Staples, wheat, oats, potatoes, wool, lumber, and dairy products. Caps. Caro and Vassar. Area, about 850 sq. m. P. 13,714.

**Tuscola,** p.-v. and tp., cap. of Douglas co., Ill., on Chicago branch of Illinois Central R. R., has a national bank and 2 weekly newspapers. P. 2863.

**Tuscola,** tp., Tuscola co., Mich. P. 1110.

**Tusculum.** See FRASCATI.

**Tusculum,** tp., Dickinson co., Ia. P. 430.

**Tuscum'bia,** p.-v., cap. of Colbert co., Ala., on Memphis and Charleston R. R., 150 miles E. of Memphis, Tenn., has 8 churches (3 colored), 1 female institute, a male academy and 2 mixed schools, 2 newspapers, 2 flouring-mills, 1 hotel, and a good water-supply. Principal business, cotton-handling. P. 1214. JOS. SHACKELFORD, PUB. "NORTH ALABAMIAN AND TIMES."

**Tuscumbia,** p.-v., cap. of Miller co., Mo., on Osage River, 35 miles S. W. of Jefferson City, has a brick schoolhouse, 1 newspaper, wagon and blacksmith shops, a courthouse, steam grist and saw mill, a stone jail, and 1 hotel. P. about 300. R. GOODRICH, ED. "MILLER COUNTY VIDETTE."

**Tuske'gee,** p.-v. and tp., cap. of Macon co., Ala., 5¼ miles from Western R. R., with which it is connected by a branch road, contains a flourishing female college and 4 excellent male schools, 3 churches, broad and level streets, an orphans' home of the synod of Alabama, and 3 newspapers. The soil is very rich and fertile, and a mild and salubrious climate makes it an attractive winter resort for tourists. P. 4392. D. W. MCIVER, ED. "WEEKLY NEWS."

**Tusket,** p.-v., Yarmouth co., N. S., on Tusket River, 10 miles E. of Yarmouth. Shipbuilding is the leading interest. P. about 450.

**Tusquittee,** p.-v. and tp., Clay co., N. C. P. 341.

**Tus'ser** (THOMAS), b. at Rivenhall, Essex, England, about 1515; was singing boy at Wallingford and at St. Paul's cathedral; educated at Eton and at Cambridge; was employed at court under the patronage of Lord Paget; was afterward a schoolmaster, a farmer in Suffolk, and a chorister in Norwich cathedral, and, according to Fuller, never throve in any vocation. D. in London about Apr., 1580. Author of *Five Hundred Points of Good Husbandry, united to as many of Good Housewifery, etc.* (1573), in verse, with a metrical autobiography. Many editions have since appeared, the best being in the series of "Arber's Reprints" (1870).

**Tus'ten,** tp., Sullivan co., N. Y. P. 1028.

**Tut'tle** (CHARLES WESLEY), b. at Newfield, Me., Nov. 1, 1829; was assistant observer at the Cambridge Observatory 1850–54; discovered a telescopic comet 1853; was a member of the U. S. expedition to determine the difference of longitude between Greenwich and Cambridge 1854–55; studied law at the Cambridge law school, and was admitted to the Suffolk bar 1856; has contributed professional memoirs to the *Astronomical Journal* and to the *Annals of Harvard Observatory,* and historical articles to the *Genealogical Register,* and is author of a *Life of Capt. John Mason,* the founder of New Hampshire.

**Tuttle** (DANIEL SYLVESTER), D. D., b. at Windham, Greene co., N. Y., Jan. 26, 1837; graduated at Columbia College in 1857; studied theology in the General Theological Seminary in New York; entered holy orders, and in 1866 was elected bishop of Montana, having jurisdiction in Idaho and Utah; was consecrated in 1867. His residence is at Salt Lake City.

**Tut'tlingen,** town of Germany, kingdom of Würtemberg, on the Danube, has several wool-spinning factories, tanneries, and manufactures of cloth, knives, nails, hosiery, and paper. P. 6397.

**Tutuila,** one of the Samoan or Navigators' Islands, rises from 1200 to 2000 feet above the surface of the sea, is covered with luxuriant vegetation, and affords several excellent harbors, of which that of Pango-Pango, on the southern side, is the best. By an arrangement between the native chiefs and Com. Meade this harbor was placed under the protection of the U. S. in 1872, and in the following year a special agent was sent by the American government to negotiate the extension of the protectorate over all the islands; but in 1875 a native king was elected, and the special American agent was made prime minister.

**Tux'pan,** town of Mexico, state of Vera Cruz, on the river Tuxpan, 5 miles from its mouth in the Mexican Gulf, carries on an important trade in cedar logs. P. 5000.

**Tuxt'la,** town of Mexico, state of Chiapas, carries on a lively trade in cacao and tobacco, and has about 5000 inhabitants.

**Tver,** or **Twer,** government of European Russia, bounded S. by the government of Moscow, comprises an area of 26,031 sq. m., with 1,521,577 inhabitants. The ground is elevated, but the surface level, covered with forests, and dotted with small lakes; the Volga and several of its affluents rise here. The climate is somewhat severe, and the soil is not very fertile. Rye and oats are produced, sufficient for home consumption; flax and hemp are cultivated. Cattle are neither numerous nor good, but the fisheries are remunerative. Numerous kinds of industry are pursued, but all on a small scale.

**Tver,** or **Twer,** town of Russia, government of Tver, at the confluence of the Tvertsa and Volga, which latter here becomes navigable for steamers. The town contains an imperial palace, a cathedral, a college, various schools, and barracks, and, situated as it is on the highway from Moscow to St. Petersburg, its trade is considerable. Nails and cotton goods are extensively manufactured. There are several chalybeate springs in the vicinity. P. 29,896.

**Tweed,** river of Scotland, rises at an elevation of 1500 feet above the sea, flows eastward, and enters the North Sea after a course of 96 miles.

**Tweed** (WILLIAM MARCY), b. in New York City Apr. 3, 1823, of Scotch descent, and the son of a poor chairmaker; was put at work in his father's shop at an early age, where he remained with little schooling till he was twenty years old; when twenty-eight years old, went into partnership with his brother in the chairmaking business; in 1850 was elected alderman from the Seventh ward, serving two years; in 1853 was elected to Congress; was school commissioner of the Seventh ward 1857–59; in November of the same year he became a member of the board of supervisors of New York co., and was four times elected its president; in 1863 became deputy street commissioner; in 1867 was elected State senator; was re-elected in 1869 and in 1871, but did not take his seat for the latter term; was for many years a member of the Tammany Society, of which he was chosen grand sachem in 1869, holding the office till 1871. His appointment as deputy street commissioner in 1863 may be said to date the foundation of the famous Tammany Ring, of which he was the chief spirit; he became at once the virtual head of the department of streets, afterward the department of public works, and by extending enormously the expenditures for public improvements acquired vast political influence and began to accumulate a fortune; his position as president of the board of supervisors enabled him to increase the city's pay-roll to unprecedented dimensions, giving sinecure positions to an army of political friends. The Ring gradually grew in power and influence till 1868, and at the opening of 1869 found itself master of nearly every department of the State government; Tweed's positions as president of the board of supervisors, head of the department of public works, State senator, and grand sachem of Tammany gave him unsurpassed political influence; every officer in the State, from the judge on the bench of the court of appeals down to the smallest official in New York City, was more or less under his sway and tainted by his corrupting touch; he openly boasted that he was worth $20,000,000. In 1868 the Ring's greatest scheme of robbery, the building of a new county courthouse, was planned; the work was begun under the stipulation that the cost should not exceed $250,000; before 1871 over $8,000,000 was pretended to have been expended on it, and it was still unfinished; it is incomplete at the present time; all of the contractors were forced to pay a commission of from 15 to 65 per cent. to the Ring, and to do this increased their bills accordingly; these bills were passed by the board of supervisors at Tweed's command, and were audited by Auditor Watson, Tweed's tool; in 1870 a new charter was passed by the legislature taking away the power of auditing from the board of supervisors and placing it in a board of audit composed of the mayor, the controller, the commissioner of parks, and the commissioner of public works—Hall, Connolly, Sweeney, and Tweed. Schemes of plunder were now organized on a grand scale. Several contractors for work on the new court-house were directed to make out claims against the county for all manner of imaginary services; these fraudulent bills, amounting to $6,000,000, were passed by the board of audit at its first and only meeting; of this amount, over $1,000,000 were traced to Tweed's private pocket. Instead of meeting again, the board illegally delegated the power of auditing to Auditor Watson, and signed the bills separately, without meeting as a board. Of the whole amount of money paid in this way, the Ring received 65 per cent.; Tweed's share was usually 25 per cent. A secret account of the money thus paid was kept in the auditor's office under the title "County Liabilities." During the winter of 1870–71 a clerk employed in the auditor's office copied by stealth the items in this account and gave them to his patron, James O'Brien, an opponent of the Tammany Society. O'Brien subsequently gave the figures to the New York *Times,* and that journal published them in July, 1871. The excitement created thereby started a popular uprising which resulted in the complete overthrow of the Ring in the elections of Nov., 1871. On Feb. 10, 1872, Tweed was indicted by the grand jury for forgery and grand larceny, and his trial began on Jan. 6, and ended Jan. 31 in a disagreement of the jury; a second trial was begun on Nov. 5, 1873, and ended Nov. 19 in a verdict of guilty on every one of the fifty-one counts in the indictment; he was sentenced on Nov. 22 to twelve years' imprisonment in the penitentiary and to pay a fine of $12,300.18, one year for each of twelve counts in the indictment, and a fine of $250 each for thirty-nine other counts; he remained in the penitentiary on Blackwell's Island till June 16, 1875, when he was released by a decision of the court of appeals, on the ground that the power of the court which sentenced him was exhausted when one sentence was pronounced on one count of the indictment,

and that the cumulative sentence was void. A new warrant was immediately issued against him on an old indictment of 1872, and when he was taken from the penitentiary on June 22 he went at once to court and gave bail to the amount of $18,000 on the criminal indictments, and went to Ludlow street jail in default of the $3,000,000 bail demanded in the civil suit which had been begun in the supreme court in Apr., 1875, for the recovery of $6,198,957.85, the amounts charged in the account called "County Liabilities." On Dec. 4, 1875, Tweed, while out riding with the sheriff, was allowed to visit his wife at her house in Madison avenue, and while there escaped from his custodians and fled to Spain, where he was captured and returned to the city Nov., 1876. On Jan. 13, 1876, proceedings were begun against him in the civil suit; a struck jury was obtained on Feb. 8, and on Mar. 8 the trial ended in a verdict for damages amounting to $6,537,117.38, of which $4,719,940.35 was for principal and $1,817,177.03 was for interest. Tweed was married in 1844, and has had eight children. J. B. Bishop.

**Tweed'dale** (George Hay), Marquis of, b. Feb. 1, 1787; succeeded his father, the eighth marquis, in the peerage in 1804. During the Peninsular war he served as assistant quartermaster-general on the staff of the duke of Wellington, and was wounded at Vittoria and at Busaco. He also served in the war of 1812–15 between Great Britain and America, when again wounded. Was governor and commander-in-chief of Madras 1842–46. In 1875 he was made a field-marshal in the British army, and was colonel of the 2d Life Guards. In 1867 he was made a knight grand cross of the order of the Bath. The duchess of Wellington and Lady Peel are his daughters. D. Oct. 10, 1876.

**Tweeds,** a loosely-spun and woven woollen cloth, made principally in Scotland and chiefly used for men's wear. It is not much fulled in the mill, and as a rule contains no shoddy. Cheviot and nearly all other grades of short and middle stapled wools are used in the manufacture. The dyeing is applied to the yarn.

**Twelfth,** a stop in the organ tuned a twelfth (or an octave and fifth) above the diapasons.

**Twelfth Day** and **Twelfth Night.** See Epiphany.

**Twelve Mile,** tp., Madison co., Mo. P. 869.

**Twelve Tables, Law of.** See Law, The Civil, by Prof. J. N. Pomeroy, LL.D.

**Twes'ten** (August Detlev Christian), D. D., b. in Glückstadt Apr. 11, 1789; studied at Kiel and Berlin; professor of philosophy and theology at Kiel from 1814; called to Berlin in 1835 to fill the theological chair of the great Schleiermacher, which position he occupied till his death, Jan. 8, 1876, retaining his vigor and faithfully attending to his academic duties to the last. The students called him "the disciple that dieth not." He was also member of the Oberkirchenrath of the Evangelical Church of Prussia from 1850 till 1874. He was a pupil and admirer of Schleiermacher, but more positive and orthodox; as a teacher and writer he was remarkably clear and accurate. He wrote *Lectures on Christian Dogmatics* (vol. i. 1826; vol. ii. 1837, unfinished), *Logik* (1825), *Matthias Flacius* (1844), and an introduction to Schleiermacher's *Ethik,* which he edited (1841). Philip Schaff.

**Twesten** (Karl), son of August D. C., b. at Kiel Apr. 22, 1820; studied jurisprudence at Berlin and Heidelberg; made a career in the civil service of the Prussian government; became noted in politics as founder of the national liberal party. D. at Berlin Oct. 14, 1870. He wrote *Schiller in seinem Verhältnisse zur Wissenschaft* (1863), *Machiavelli* (1868), and *Die religiösen, politischen und socialen Ideen der asiatischen Culturvölker und der Aegypter in ihrer historischen Entwickelung,* published after his death (1873).

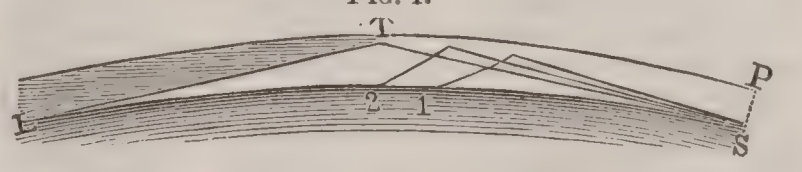
**Twick'enham,** town of England, county of Middlesex, on the Thames, opposite Richmond, has powder and oil mills, and contains many fine villas and summer residences. It was the residence of Pope. P. 10,533.

**Twiggs,** county of Central Georgia, bounded W. by Ocmulgee River, and crossed by Georgia Central and Macon and Brunswick R. Rs.; surface somewhat hilly, soil generally fertile. Staples, cotton, Indian corn, and sweet potatoes. Cap. Jeffersonville. Area, about 400 sq. m. P. 8545.

**Twiggs** (David Emanuel), b. in Richmond co., Ga., 1790; was appointed captain in the 8th Infantry in 1812, major 28th Infantry Sept. 21, 1814, and served throughout the war with Great Britain; was retained in the peace organization of the army in 1815 as captain 7th Infantry, 1st Infantry 1822, major May 14, 1825, lieutenant-colonel 4th Infantry 1831, colonel 2d Dragoons June, 1836. In the war with Mexico he served in command of the right wing of the army under Gen. Taylor at Palo Alto and Resaca de la Palma; was promoted to brigadier-general June 30, 1846; was brevetted major-general for gallantry at Monterey, and Congress presented him with a sword. Transferred to Gen. Scott's army, he commanded a brigade before Vera Cruz, and during subsequent operations resulting in the capture of the City of Mexico was in command of the 2d division of regulars; military governor of Vera Cruz 1848. In Feb., 1861, being in command of the department of Texas, he surrendered his army to Gen. McCulloch of the Confederate service, together with all the government stores, munitions, and material to the value of $1,500,000, for which he was dismissed from the service of the U. S. Mar. 1; he was soon after appointed a major-general in the Confederate army, and commanded for a while at New Orleans. Retiring to his estate upon the Mississippi, he removed thence to Georgia upon the approach of the U. S. forces. D. at Augusta, Ga., Sept. 15, 1862.

**Twi'light** [Sax. *tweoleoht;* Ger. *Zwielicht*], the light which by its increasing brightness foretokens the rising of the sun in the morning, and which lingers after sunset, becoming fainter and fainter until it disappears as veritable night comes on. The morning twilight in the Latin is distinguished by the term *aurora,* while the evening twilight is called *crepusculum*—terms which, with the usual modification, are retained in the French. But the cause is in both cases the same, and the explanation is perfect which refers twilight to the reflection and refraction of the sun's light by that portion of the atmosphere which is still illuminated by the sun's rays after he has set to us, or a similar portion on which he shines before he rises to us in the morning. Thus, let S T P (in Fig. 1) represent the upper portion of a nearly lenticular section of the atmosphere which is illuminated by the sun's rays in the evening after he has set to an observer at 1 or 2, etc., or L. Then the direction of the rays from S toward T will be somewhat bent from the perpendicular S T as the light passes from the low and dense to the upper and rarer portions of the atmosphere. This light is moreover reflected wherever notable variety of density is found among the various atmospheric strata. And thus (bent a little downward by refraction) the reflected light reaches the observers stationed respectively at 1, 2, etc., until at last it is only the light from the *mere edge* of the lenticular illuminated portion S P T, and that in the high region at T, that reaches the observer at L. Vapor in solution or partially condensed may sometimes aid the reflection of the light. All this will require that twilight immediately after sunset should be comparatively very bright and broadly extensive along the horizon, as the light then, on the hypothesis here discussed, will come from the *broad* and *dense* part of the lenticular segment S T P. Afterward the twilight ought rapidly to *fade* and appear *narrower,* until at length a mere faint line of light be left visible along the horizon. Before sunrise the same varieties must occur, but in inverse order. All this is precisely consonant with fact. The explanation, therefore, as heretofore intimated, is perfect.

Fig. 1.




The theoretical explanation of twilight is then consistent in its circumstances with fact: one of these circumstances should, however, be more completely exhibited. As, on the one side, the angle of incidence with the plumb-line extended to T is equal to the angle of reflection on the other side, and the reflected ray from these proceeding downward through the atmosphere becomes thus the inversion of the incident ray in its whole course upward, the symmetry thus introduced will require that the reflected ray when it reaches the surface at L should be a *tangent* to the surface there, and so at right angles to the plumb-line there, the earth being supposed to be a perfect sphere—a supposition quite sufficiently near to accuracy for our purpose. All this, moreover, will indicate that we shall have two equal right-angled triangles extending to the centre of the earth, with their right angles at S and L respectively. And so the plumb-line extended from the centre to T will bisect the arc S L.

*Limit of Twilight.*—This is usually stated at 18°, twilight beginning in the morning and ending in the evening when the sun is 18° below the horizon. In tropical regions the limit is less than this, and in the latitude of mid-Europe has sometimes been found to be greater. The limit, of course, varies withal in consequence of the clearness of the atmosphere or otherwise. Now, when the sun (as we ordinarily say) is *sunk* below the horizon (as at L) to the twilight limit, then the horizon at L cuts the celestial

sphere *above* the sun to the same extent; that is, above the horizon at S which passes through the sun. This being so, when S is rolled back as far as L after sunset at any place where the whole twilight occurs, or the reverse is true at sunrise, the plumb-line kept at right angles to the horizon will be rolled back just as far as the horizon at L is raised above the sun; that is, the plumb-line through L will be as far *behind* the plumb-line through S as the extent of the limit of twilight. So that if the limit of twilight be admitted to be (in the mean) 18°, that also will mark the extent of the arc S L. The *zone* of twilight will thus extend 18° behind the *terminator* which marks the limit on the earth of sunrise or of sunset. And so the secant from the centre of the earth to T—which, as already shown, bisects the arc S L—will itself be the trigonometric secant of 9°. Hence, if the length of that secant be computed, the radius of the earth being the trigonometric radius, we shall have the distance of H from the centre, and, by subtracting the radius of the earth from that, obtain approximately the height of the atmosphere at H. This would give a result of 49.3 miles. In this computation, however, we have neglected the curvature of the incident and of the reflected ray due to refraction. This, the refraction being away from the perpendicular at S, will depress the limit T. The height is therefore stated to be 45 miles. It must not, however, be concluded that no atmosphere exists in a region higher than T. Indeed, only a small portion of the faint light reflected from T can reach the eye at L, by far the greater part being obstructed by the long extent of increasingly dense atmosphere from T to L. From regions higher than T little light, if any, comes which is sufficiently bright to have any part of it visible through all the intervening atmosphere to the observer below.

Various meteoric phenomena seem to indicate the presence of very rare outer portions of the atmosphere far beyond 45 miles. "A secondary twilight may be traced even beyond the point L, consequent on a re-reflection of rays dispersed through the atmosphere in the primary one. The phenomenon seen in the clear atmosphere of the Nubian desert, described by travellers as the 'After-glow,' would seem to arise from this cause." (Sir J. Herschel, *Outlines of Astronomy* (45).) A *lunar* twilight is visible when the moon is about 6° below the horizon.

*Variety in the Duration of Twilight.*—Twilight is short in tropical regions, and the duration of twilight increases with the latitude. At the time of the equinox the central ray from the sun falls vertically in the direction S E (Fig. 2) upon the equator at E, and direct sunlight extends from the pole P to the pole P′. All places under the meridian P E P′, then, have noon, and to all under the opposite meridian P *m* P′ it is midnight. At the same time (as heretofore shown) the zone of twilight extends 18° behind the terminator P *b* P′, which is the limit of the region of direct sunlight. In the orthographic projection in the figure E *m* the half of the equator and its parallels L *l* and L′ T′ are all seen edgewise, and appear as straight lines, and the breadths of the twilight zone perpendicular to P P′ are severally sines of 18°, and the plane of rotation, such as L B *l* or L′ B′ T′, is all but coincident with the plane passing through the sun; so that by the rotation of the earth a nearly equal perpendicular breadth is to be traversed from *b* to *t* on the equator, B to T on the parallel L *l*, and not very much more from B′ to T′ on the parallel L′ T′; all on *crossing the twilight zone*. For although the arcs here in question are those that would determine *sidereal* time, the proportions of *solar* time (see TIME) would be the same.

FIG. 2.

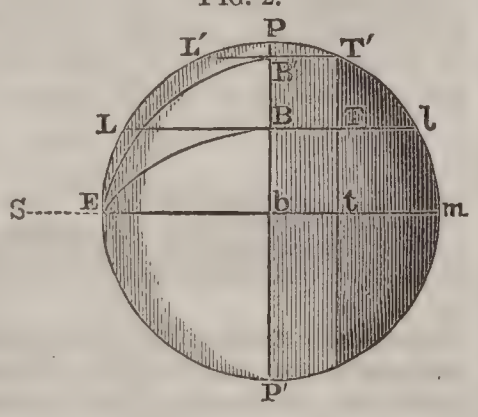
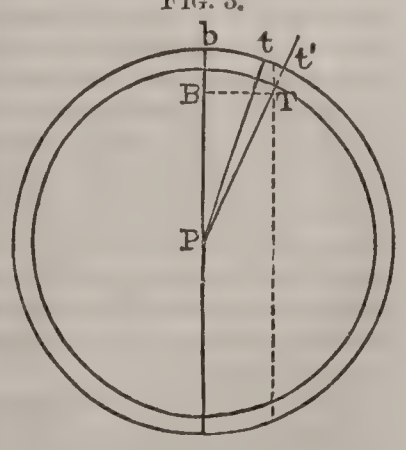
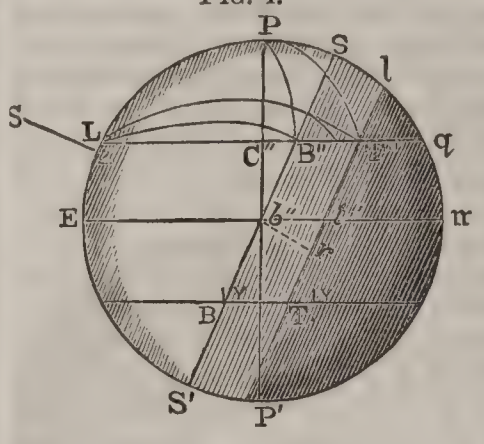



FIG. 3.




In order to discern how the *duration* of twilight will be affected on the several parallels in question, let the plane of projection be changed to one perpendicular to P P′, so that the pole P will be in the middle of the figures, as in Fig. 3. Then, while, as in Fig. 2, the width of the twilight zone *b t* in the plane of the equator is equal to the width B T in the region of the parallel L B *l* of Fig. 2, yet that same width on the *smaller* circle includes a *larger* arc of the whole circumference than the portion represented by *b t* on the equator. To represent the portion due to B T on the circumference of the larger circle, we produce P T to *t′*, and then (on the same scale) *b t′* will represent the arc of rotation passed over *in crossing the zone of twilight* on the parallel L B *l* of Fig. 2, while the part *b t* will represent the arc of rotation in passing over the same zone on the equator. And so far the *relative arc* (and so the *relative time of rotation* across the twilight zone) on the parallel will be to the arc (and consequent time on the equator) in the ratio of *b t′* to *b t*; the fact being that in order to pass over the same breadth of zone, moving in a *smaller* circuit, a *larger* portion of the whole circuit must be traversed. In addition to this, the plane of rotation of the parallel not being strictly the plane passing through the sun (as may be seen in Fig. 2), the motion in the parallel is not as directly *to* or *from* the sun as might be, and so the twilight for that reason also is *longer* on the parallel. The parallel L′ B′ T′ in Fig. 2 being itself but 18° from the pole (*i. e.* in latitude 72°), the position T′ is not reached until *midnight*, T′ being just in the farther edge of the zone of twilight, in the meridian P T′ P′ of midnight; so that even at the equinox twilight in latitude 72° lasts all night.

FIG. 4.




In so far as the condition represented in Fig. 3 is concerned, we shall have—

$$\frac{\textit{perpendicular}\ \text{B T or } b\ t}{\text{P T}} = \textit{sin of}\ \text{B P T or of}\ \textit{arc}\ b\ t';$$

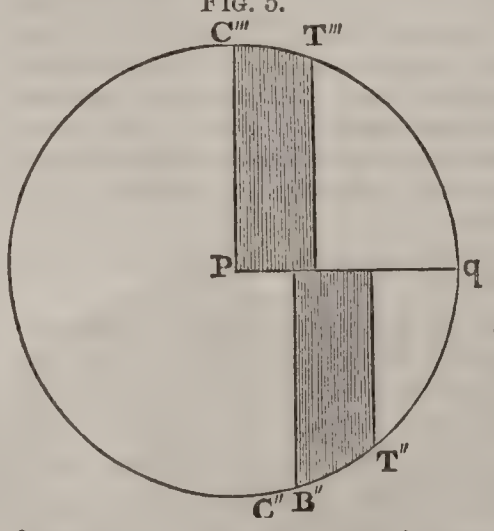
$$\text{also,}\ \frac{b\ t}{\text{P}\ t} = \textit{sin of}\ \textit{arc}\ b\ t;$$

$$\text{hence}\ \frac{\text{P}\ t}{\text{P T}} = \frac{\textit{sin}\ b\ t'}{\textit{sin}\ b\ t};$$

or the sines of the arcs of rotation are inversely as the radii.

At the time of the summer solstice the terminator of direct sunlight extends more than 23° beyond the enlightened pole, as is represented in Fig. 4, and the zone of twilight 18° behind that, the other quantities being represented as in Fig. 2. And as the inclination of the plane of the terminator *s b″ s′* has here arrived at its maximum, the motion of rotation in either the equator or its parallel here is the most oblique to the direction of the perpendicular great circle passing through the sun. In the instance of the equator the motion of rotation is in *b″ t′* instead of in *b″ r*, as was true at the equinox. The time of passing over the twilight zone (the duration of twilight) is therefore increased in both instances by that circumstance. And then on the parallel, such as L *q*, the rotation across the twilight zone does not begin (or end) in the great circle P *b″* P, as is true at *b″* on the equator, but *farther back*—viz. at B″ instead of C″. Now, that again increases the arc to be traversed on the parallel. For, looking down (as in Fig. 5) in the direction from the pole P, if the extent across the twilight zone begin (or end) as it does at B″, behind P C″, instead of C‴, in the line C‴ C″, the same width of zone will correspond to extent of arc B″ T″ *greater* than C‴ T‴, precisely because that width of B″ T″ *is* farther back than C″ C‴; on the principle that such a difference (involving that of the *sines* of the arcs C″ T″ and C″ B″) requires a *greater* difference of arcs than that extending from C‴ to T‴. Indeed, the same width of zone counted still higher up would almost extend from T″ to *q* in the diagram.

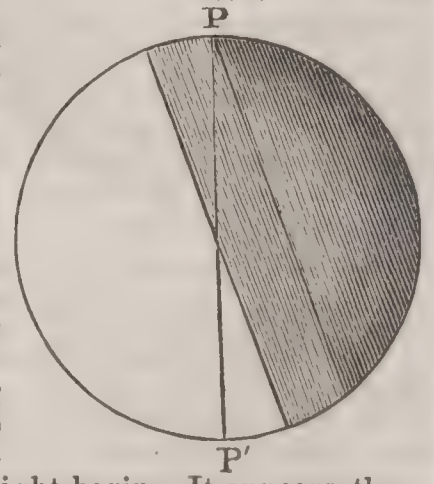
FIG. 5.




These circumstances make the twilight on both the parallel circles in question (the equator and the other) at this date the *maximum of the year*. In the opposite hemisphere, in which it is midwinter (the solstice being the winter solstice), the obliquity of rotation across the twilight band in an equal latitude is as great as the other instance; but B‴ T‴ is *not* thrown behind the terminator *s s′ in the same way*. Hence, although *another maximum* occurs under these

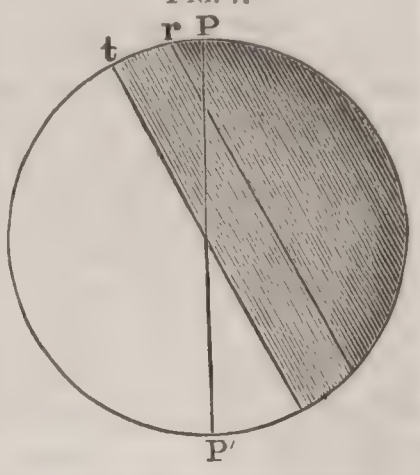
circumstances, the whole arc in question is shorter, after all, and the duration of the twilight at this maximum *not* so great. P *s* in Fig. 4 being at the time of the summer solstice 23° 27′ and *s l* the width of the twilight zone extending 18° farther, the whole polar distance P *l* = 23° 27′ + 18° = 41° 27′ for the co-latitude of *l*; *i. e.* of the limit beyond P to which twilight extends *at midnight* at the time of the summer solstice (on the longest day). The co-latitude of *q* being 41° 27′, its latitude = 48° 33′, the latitude of the limit of twilight all night on the longest day. The morning and evening twilights are there combined (but very faint at midnight), from sunset (about 2*m.* before 8 o'clock P. M.) to sunrise (about 2*m.* after 4 o'clock next morning). The (maximum) duration of either the morning or the evening twilight will thus be 4*h.* 2*m.* At the pole itself twilight begins (refraction even aiding to prolong veritable sunlight) almost immediately after the equinox of Sept. 22, which is about to introduce the polar night. And this twilight at the pole will continue, but becoming constantly more feeble, until the earth by its motion in its orbit has acquired a declination of 18° N., and the sun is in declination 18° S., when the N. pole will be in the outer edge of the twilight zone, as shown in Fig. 6. This will happen about Nov. 13. After that, the pole, with the increasing declination, will be farther in the dark until the succeeding 28th of January, when the position in Fig. 6 will be regained, and the morning twilight begin. It appears, then, that the time of absolute night occupies about two and a half months of the six months' period during which the pole receives no direct rays of the sun.

FIG. 6.



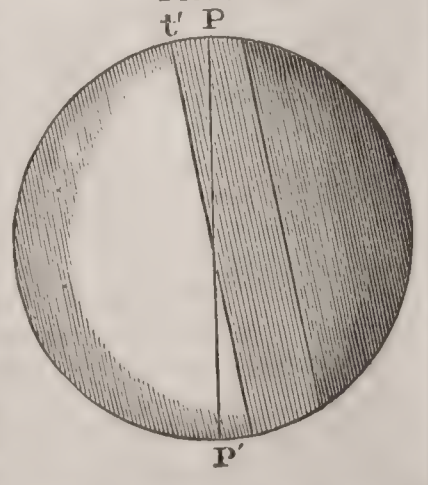

In the extreme case of the winter solstice, the middle of the polar night, the pole is 23° 27′ behind the terminator (behind *t*, Fig. 7), while the breadth of the twilight zone, extending from *t* to *v*, is but 18°. Within the very small circle at the distance of *v* P from the pole is, therefore, the region which has not even twilight at the time of our shortest day, and even that contracted region is diminished immediately thereafter. As 23° 27′ − 18° = 5° 27′, the circumference through *p* is but 5° 27′ from the pole, and is therefore in the very high latitude of 84° 33′.

FIG. 7.




Another and a very peculiar state of things is that which exists (to its largest extent) when the declination of the earth or the sun (such as is here in question) is 9°, and so the pole, as in Fig. 8, is 9° behind the terminator, and is thus in the middle of the twilight belt, and some twilight will exist all around within 9° of the pole. P *t′* (in the figure) being thus 9°, the latitude of *t′* will be 81°, and the time when the limit is thus far extensive around the N. pole is about the 16th of October, with a renewal of the same state of things about the 25th of the succeeding February. All places within this small circle 9° from the pole rotate within *a region of twilight alternately brighter and more faint*, but with no experience of either actual day or actual night. The limit in the case stated is the most extensive possible; for when the pole is not exactly in the middle of the twilight zone, the limit of the circle in question will be contracted toward the one side or toward the other. Hence, the state of things in question will not continue as low down as lat. 81° for any length of time together. In lat. 85° this brightening and diminishing twilight during all the twenty-four hours will show itself for about 22 days.

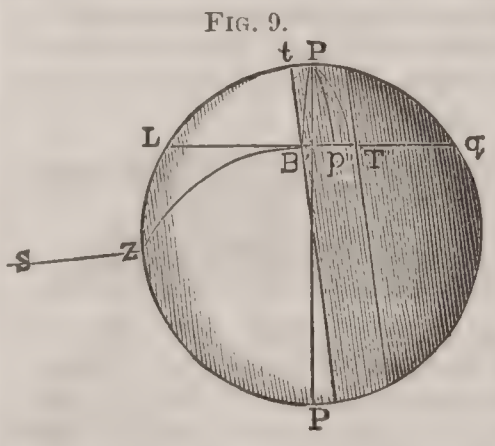
FIG. 8.




The very peculiar state of things here described was (it would seem) first noticed by the author of this article in a communication to the American Philosophical Society, and is recorded in their *Proceedings*.

*To determine the Duration and the Time of Shortest Twilight in a given Latitude.*—This problem is said to have, in some way or other, employed the two celebrated mathematicians John and James Bernouilli for five years. The solutions given of it are indirect. The following is one of those given by M. Delambre, with the exception that here the *true* motion of rotation is made use of instead of the *apparent*. As represented in Fig. 4, the evening twilight begins on the parallel L *q* at B″, and it lasts until B″ has rotated to the position T″. The sidereal time of this rotation will be expressed by "changing the measure of the angle B″ P T″ into time" at the rate of 15° to an hour; and a like rule will apply to solar time—*i. e.* to the time of duration of the twilight in question. Hence, when *the angle* B P T″ *is as small as possible* the twilight will be as short as possible; and this is condition (1). Then let B″ and T″ be united by an arc of a great circle. Then in the spherical triangle B″ P T″ the two sides P B″ and P T″ will under all circumstances be constant, they being in the one position, and the other always the co-latitude of the place in question. With these constant, then when [condition (1)] the B″ P T″ is as small as possible, the base B″ T″ will be as short as possible; which is condition (2). But in the spherical triangle, such as B″ Z T″, Z B″ is always = to 90°, as Z T″ is always = 90° + 18° = 108°. With these two sides constant, then when the base B″ T″ [condition (2)] is the shortest possible, the angle B″ Z T″ will be the smallest possible. But that angle cannot be less than nothing; so when the base B″ T″ is the shortest possible, the angle B Z T″ will be reduced to *zero;* and then the planes of the great circles Z B″ and Z T″ will coincide, and an arc of the same great circle pass through Z B″ T″; and this is condition (3). So that when, in accordance with condition (1), the angle B″ P T″ is the least possible, that will involve condition (2), that the base B″ T″ shall be the shortest possible; and that, again, condition (3), that Z B″ and T″ shall lie in the arc of the same great circle is what the *shortest twilight requires;* bringing with that also conditions (2) and (3). The shortest twilight, then, will be found when the planes of the circles Z B″ and Z T″ coincide, and Z B″ and T″ are thus all in the arc of the same great circle. This state of things is represented in Fig. 9, Z being the place at which the sun is vertical, and *t′* in the terminator. Then as Z″ B″ T″ are now all in the same great circle, the whole arc Z B″ T = 108°, the part Z B″ = 90°, and the part B″ T″ = 18°. Then, P B″ and P T″ being both the co-latitude of the place of observation, P B″ T″ is an isosceles triangle, and the perpendicular P *p*, therefore, will bisect the base B″ T″ at right angles. B″ *p* and *p* T″ will then each be equal to 9°.

FIG. 9.




So in the right-angled triangle P T″ *p* we shall have the two sides P T″ (the co-latitude) and T″ *p*, which = 9°, to solve the triangle P T″ *p*. Then in the right-angled triangle P Z *p*, Z *p* = Z B″ + B″ *p* = 90° + 9° = 99°, and the value of P *p* is known by the previous solution. Hence we can find P Z, the distance from the pole to Z where the sun is vertical, or, on the larger scale in the heavens, the polar distance of the sun itself. The solution will show that for any such place in the northern hemisphere the sun's polar distance at the time of the shortest twilight will be greater than 90°, and his declination be S. by the excess. Then, by consulting an ephemeris, we can ascertain at what time of the year the sun has the resulting declination. Here, in accordance with what has already appeared in the previous discussion of twilight in this article, it appears that the shortest twilight occurs when the place rotates (as from B″ to T″) as near as may be on a great circle, *directly toward or directly from the sun.*

At the equator the shortest twilight occurs at the time of the equinox, for then (see Fig. 2) the rotation is a great circle, the plane of which passes directly through the sun. In several other latitudes in the northern hemisphere the dates of shortest twilight are as follows:

Lat. 30°.....Morning of Mar. 9, and Oct. 4.
Lat. 40°..... " Mar. 5, and Oct. 7.
Lat. 50°.....Mar. 2, and morning of Oct. 11.

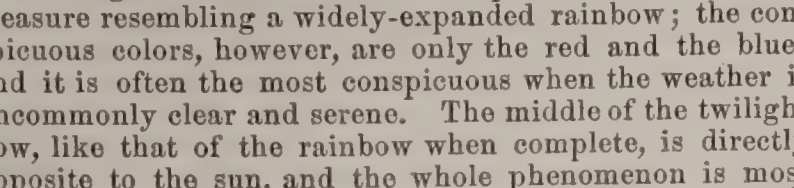
| | Maximum duration in summer. | Duration of shortest twilight. | Maximum duration in winter. |
|---|---|---|---|
| At the equator.... | 1*h.* 18¾*m.* | 1*h.* 12*m.* | 1*h.* 18¾*m.* |
| In lat. 30°..... | 1 41 | 1 23¼ | 1 30 |
| In lat. 40°..... | 2 8½ | 1 34¼ | 1 42¾ |
| In lat. 50°..... | All night, ½ duration 3*h.* 5½*m.* | 1 52¾ | 2 6 + |

In lat. 50° there is still twilight remaining at midnight (at

the time of maximum duration), as the place in that latitude is then within the belt of twilight; and so the ½ duration (for morning or for evening) is but 3*h*. 5½*m*. But at the limit in lat. 48° 33′, as heretofore shown, where the farther edge of the twilight zone is reached, the ½ duration is 4*h*. 2*m*. (A very exhaustive discussion of the subject of twilight in many of its aspects is found in the *Astronomische Nachrichten*.) S. ALEXANDER.

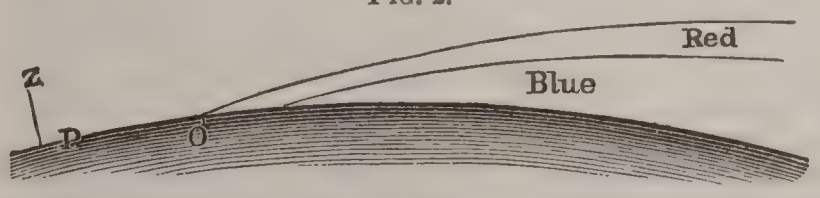
**Twilight Bow.** This is a phenomenon in some measure resembling a widely-expanded rainbow; the conspicuous colors, however, are only the red and the blue; and it is often the most conspicuous when the weather is uncommonly clear and serene. The middle of the twilight bow, like that of the rainbow when complete, is directly opposite to the sun, and the whole phenomenon is most conspicuous in the evening at the very time of sunset, and in the morning just at sunrise. The twilight bow is very fully described by Prof. Samuel F. B. Morse in the *American Journal of Science and the Arts*, vol. xxxviii. p. 389. Prof. Morse states that "the bow in the morning begins to be defined in the W. about half an hour before sunrise. The height of the arch is about 15° above the horizon, and spans nearly, perhaps quite, 180°. Its first aspect is that of a blue; the red next appears like a faint blush above the blue, producing the purple as it mingles with the blue. Then appears the yellow above the red, producing the orange as it mingles with the red. As the sun advances toward his rising, the bow descends to coincide with the horizon, and at an angle of 8° above the horizon, or about 15 minutes before sunrise, the colors are most distinct and concentrated. At sunrise the bow coincides with the horizon." Prof. Morse adds that the "bow is best seen in the clearest atmosphere," and proceeds to speak of another bow in which a second series of fainter colors is apparent. The date of his communication is Dec. 1, 1839. He seems to be inclined to attribute the whole phenomenon to actions on light similar to those which produce the corona around the moon, etc. Some of the secondary phenomena may be thus modified. But the more distinct conspicuous appearances in the twilight bow are "best seen in clear weather," and the explanation of these would seem to be as follows: The first "blue aspect" occurs when the sun is yet some

FIG. 1.



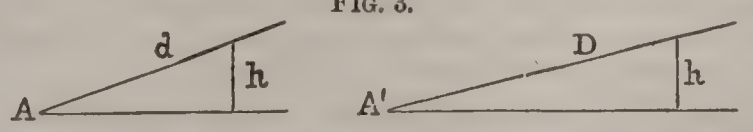

distance below the horizon of the observer. Then the tangent rays of the sun, and those immediately above them at P, are refracted *from* the perpendicular P Z, and in their passage onward the *blue* rays, being *more* refrangible than the red, are more bent, as in Fig. 1; and those blue rays reflected are bent *downward* in their passage to the observer at O, while the reflection of the red rays passes over his head. Thus only the blue is at first seen. Later, when the state of things nearer to sunrise is that in Fig. 2, the reflections of the blue from a region comparatively near, and those of the red from a region more remote, both reach the

FIG. 2.




observer at O, the red appearing above the blue. In the reverse process, after sunset, the phenomena of Fig. 1 *succeed* those of Fig. 2; and it is quite consistent to find the bow apparently rising and the ruddy parts disappearing almost overhead, having been reflected more and more too high, to be any longer noticed. The materials from which the reflected light reaches us are nearest in the direction opposite to the sun. And so the apparent altitude of the middle of the bow is greater than that of the sides, though

FIG. 3.




the actual height of the one portion and the other may not be very different. And with *h* for the height and *d* or D for the distances, we have one for the middle of the bow, the other for the side.

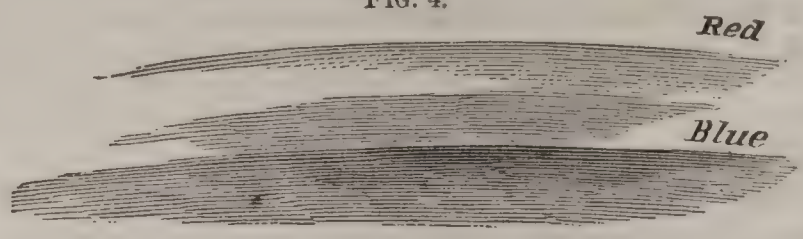
$$\frac{h}{d} = \sin A, \text{ and } \frac{h}{D} = \sin A';$$

so

$$\frac{\sin A'}{\sin A} = \frac{d}{D}.$$

The bow should then seem lower at the sides, and appears nearly in form represented in Fig. 4.

FIG. 4.




The editors of the journal already referred to add in a "*Note:* The twilight bow has, we believe, been often observed, but we do not know that any description of it is to be found in print. The blue portion of the arch appears to lie within the earth's shadow." (P. 390.) It is rather the part *below* the blue, which part does not show till just after the sun has disappeared (in the evening), of which that last remark is true: shadow—viz. *on the vapor, etc.* S. ALEXANDER.

**Twillingate,** a port of entry, on the two Twillingate Islands, off the N. E. coast of Newfoundland, 190 miles by steamer from St. John's; lat. 49° 42′ N., lon. 54° 44′ W. The islands are connected by a bridge, and the harbor is not very good. The town is the capital of Twillingate and Fogo district, N. F., and has a jail. P. 2790.

**Twin,** tp., Darke co., O. P. 1998.

**Twin,** tp., Preble co., O. P. 1799.

**Twin,** tp., Ross co., O. P. 2263.

**Twi'ning** (ALEXANDER CATLIN), LL.D., b. at New Haven, Conn., July 5, 1801; graduated at Yale College in 1820; was tutor at Yale 1824–26; professor of mathematics and natural philosophy at Middlebury College 1838–49; has been civil engineer on various canals and railroads, and invented the first practical method of producing ice by artificial means in commercial quantities.

**Twin Lakes,** tp., Carlton co., Minn. P. 21.

**Twins'burg,** p.-v. and tp., Summit co., O. P. 729.

**Twiss** (HORACE), K. C., b. in England in 1786, son of Francis Twiss, Esq. (1758–1827), author of the *Complete Verbal Index to the Plays of Shakespeare*, and of Frances, daughter of Roger Kemble; was called to the bar at the Inner Temple; sat in Parliament 1820–32 and 1835–37; favored Roman Catholic emancipation and law reform, but opposed the parliamentary reform bill; king's counsel 1827, counsel for the admiralty, judge-advocate under Lord Liverpool, and under-secretary for the colonies 1828; wrote leaders and parliamentary summaries for the *Times*, and contributed to other periodicals; vice-chancellor of the duchy of Lancaster 1844. D. May 4, 1849. Author of various poems and political treatises, and of *The Life of Lord Chancellor Eldon, including his Correspondence and Selections from the Anecdote-Book written by himself* (3 vols., 1844).

**Twiss** (Sir TRAVERS), D. C. L., F. R. S., b. in Westminster, London, about 1810; graduated at University College, Oxford, 1830; became fellow and tutor of his college; was public examiner at Oxford in classics and mathematics 1835–39; professor of political economy in the University of Oxford 1842–47, of international law in King's College, London, 1852–55, and regius professor of civil law at Oxford 1855–70; admitted an advocate in Doctors' Commons 1840; commissary-general of the city and diocese of Canterbury 1849, vicar-general of the archbishop of Canterbury 1852, chancellor of the diocese of London 1858, advocate-general Aug., 1867; knighted Nov., 1867. In 1872 he resigned all his appointments. Author of *An Epitome of Niebuhr's History of Rome* (1837), *The Oregon Question examined, etc.* (1846), *Progress of Political Economy in Europe since the Sixteenth Century* (1847), *Relation of the Duchies of Schleswig and Holstein to the Crown of Denmark and the German Confederation* (1848), *Letters Apostolic of Pope Pius IX., with reference to the Law of England and the Law of Europe* (1851), *Lectures on the Science of International Law* (1856), *The Law of Nations* (1861; new ed. 1876), and *The Law of Nations in Times of War* (1863); edited *The Black Book of the Admiralty* (vol. i., 1874), *Monumenta Juridica* (3 vols., 1875 *seq.*), and published in 1840–41 a revised text of Livy.

**Twis'tleton** (EDWARD TURNER BOYD), b. in 1809, son of Rev. Dr. Thomas J. Twistleton, archdeacon of Colombo, Ceylon, and brother of the thirteenth Lord Say and Sele; educated at Winchester School; graduated at Trinity College, Cambridge, as first class in classics 1829; became a fellow 1830; was called to the bar at the Inner Temple 1835; was commissioner of poor laws in England, Scotland, and Ireland, and civil service commissioner 1862–70. D. at Boulogne, France, Oct. 5, 1874. Author of *The Handwriting of Junius professionally investigated by Mr. Charles Chabot,*

*Expert* (1871), in which he defends the authorship of Sir Philip Francis; and of *The Tongue not essential to Speech* (1873).

**Two Creeks,** tp., Manitowoc co., Wis. P. 472.

**Two Mountains,** county of Quebec, Canada, bounded S. by Ottawa River and the Lake of the Two Mountains. Cap. Ste. Scholastique. P. 15,615.

**Two Rivers,** tp., Morrison co., Minn. P. 436.

**Two Rivers,** p.-v. and tp., Manitowoc co., Wis., on Lake Michigan, at terminus of the Two Rivers branch of Lake Shore and Western R. R., has an extensive lumber-trade and a weekly newspaper. P. of v. 1365; of tp. 2765.

**Tyaskin,** p.-v. and tp., Wicomico co., Md. P. 2691.

**Tybee′ Island,** in Chatham co., Ga., lies off the entrance to Savannah River. The island is 6 miles long and 3 wide, and is separated from the other coast-islands by Lazaretto Creek. At its N. E. end stands Tybee light-house, 134 feet high, of brick, and showing at a height of 150 feet above the sea a fixed white dioptric light of the first order, visible for 18 nautical miles; lat. 32° 1′ 20″ N., lon. 80° 50′ 31″ W. Tybee Island has become historic as the site of the batteries by which Gen. Gillmore breached Fort Pulaski on Cockspur Island, Apr. 11, 1862. (See BOMBARDMENT.)

**Tyche.** See FORTUNA.

**Tycho Brahe.** See BRAHE.

**Tycoon.** See SHIOGOON.

**Tydings** (Rev. RICHARD), b. in Maryland June 16, 1783. His father, Keely Tydings, served four years under Washington in the war of the Revolution. Richard joined the Baltimore conference of the Methodist Episcopal Church, South, in 1809, and the Kentucky conference in 1825; labored in many important fields, and was held in high esteem for his talents and usefulness; his work on *Apostolical Succession* was favorably received; was a member of the Louisville conference at the time of his death, in Kentucky Oct. 3, 1865. T. O. SUMMERS.

**Ty′ler,** county of E. Texas, lying upon Neches River; surface level, soil fertile and well timbered. Cattle and swine are numerous. Staples, cotton, Indian corn, sweet potatoes. Cap. Woodville. Area, 1130 sq. m. P. 5010.

**Tyler,** county of N. W. West Virginia, lying on Ohio River, and intersected by Middle Island Creek; surface rolling, soil productive. Iron ore, bituminous coal, and limestone are abundant. There are saw-mills and woollen-factories. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, wheat, tobacco, hay, wool, and dairy products. Capt. Middlebourne. Area, 390 sq. m. P. 7832.

**Tyler,** tp., Hickory co., Mo. P. 1285.

**Tyler,** p.-v., cap. of Smith co., Tex., on International and Great Northern R. R., 270 miles N. of Galveston, has 4 churches, 2 academies, 1 tannery, 1 foundry and machine-shop, 3 hotels, 3 newspapers, 2 sash, door, and blind factories, 1 bank, and the office of collector of internal revenue. The U. S. district and circuit courts and State supreme court hold sessions here twice each year. P. about 3000.

A. F. HUNT, FOR "NATIONAL INDEX."

**Tyler,** tp., Charles City co., Va. P. 1919.

**Tyler** (BENNET), D. D., b. at Middlebury, Conn., July 10, 1783; graduated at Yale College 1804; studied theology; was pastor of the Congregational church at South Britain, Conn., 1808–22; president of Dartmouth College 1822–28, and pastor of the Second Congregational church at Portland, Me., 1828–33; was the leader of the opposition to the theological views taught at Yale Theological Seminary known as the "New Divinity" (see TAYLOR, NATHANIEL WILLIAM, D. D.), and in 1834 became president and professor of Christian theology at the new seminary founded at East Windsor, Conn., by the "Pastoral Union" of churches in Connecticut—a post he retained until his death, at South Windsor May 14, 1858. Author of *A History of the New Haven Theology, in Letters to a Clergyman* (1837), *A Review of Day on the Will* (1837), *Memoir of Rev. Asahel Nettleton, D. D.* (Hartford, 1844), *The Sufferings of Christ confined to his Human Nature* (1845), *The Doctrine of Perseverance of the Saints, The New England Revivals* (1846), *Letters to Dr. Horace Bushnell on Christian Nurture* (2 series, 1847–48), besides a number of sermons and controversial pamphlets, and was editor of the *Remains of Dr. Nettleton* (1845). His posthumous *Lectures on Theology* (1859) were preceded by a *Memoir* from the pen of his son-in-law, Rev. Nahum Gale, D. D.

**Tyler** (DANIEL), b. at Brooklyn, Conn., Feb. 22, 1799; graduated at the U. S. Military Academy July, 1819, when commissioned second lieutenant light artillery; retained in the 5th Infantry June 1, 1821; transferred to 1st Artillery June 12, 1821; served at the artillery school of practice 1824–27, on ordnance duty 1830–34; resigned from the army May 31, 1834, and became a civil engineer, being president and constructing engineer of various railroads until the outbreak of the civil war, when appointed (Apr. 23, 1861) colonel 1st Connecticut Vols., which regiment he led to Washington, and the next month was appointed brigadier-general of Connecticut Vols., and in command of division at the action of Blackburn's Ford, July 18, and battle of Bull Run, July 21. Mustered out Aug. 11, 1861. Reappointed brigadier-general U. S. volunteers Mar. 13, 1862. Resigned Apr. 6, 1864.

**Tyler** (JOHN), tenth President of the U. S., b. in Charles City co., Va., Mar. 29, 1790, son of Judge John (1748–1813), who was governor of Virginia 1808–11; graduated at William and Mary College 1806; studied law; was admitted to the bar 1809; was a member of the State legislature 1811–16 and 1823–25, and of Congress 1816–21; voted for the resolutions of censure on Gen. Jackson's conduct in Florida; opposed the U. S. Bank, the protective policy, and internal improvements by the national government; was governor of Virginia 1825–27, U. S. Senator 1827–36; opposed the administration of Adams and the tariff bill of 1828; made a three-days' speech against a protective and in favor of a revenue tariff 1832; sympathized with the nullification measures of South Carolina in that year; was the only Senator who voted against the Force bill for the repression of that incipient secession; afterward voted for Clay's Compromise bill, and his resolutions censuring Pres. Jackson for the removal of the deposits 1835, as being an unwarrantable act, although at the same time believing the U. S. Bank unconstitutional; resigned his seat in the Senate Feb., 1836, in consequence of the vote of the Virginia legislature instructing him to vote for expunging those resolutions from the Senate journal; took up his residence at Williamsburg; was regarded as a martyr to the Whig cause, and being in consequence supported in the campaign of 1836 for the Vice-Presidency by many Whigs, received 47 electoral votes; sat in the Virginia legislature as a Whig 1839–40; was a member of the national Whig convention which met at Harrisburg, Pa., Dec. 4, 1839, by which he was nominated for the Vice-Presidency on the ticket headed by Gen. Harrison; was elected Vice-President Nov., 1840; inaugurated Mar. 4, 1841; succeeded to the Presidency on the death of Gen. Harrison Apr. 4; retained in office the cabinet of his predecessor; issued an inaugural address satisfactory to his political supporters; removed from office a large number of Democrats, filling their places with Whigs; convoked Congress to an extra session May 31, 1841; expressed in a message his approval of the establishment of a national bank; instructed his secretary of the treasury, Hon. Thomas Ewing, to submit to Congress, in response to a joint resolution, a bill for the incorporation of a "fiscal bank of the U. S.," which was passed Aug. 6; returned that bill without his approval on account of an amendment concerning branch banks, which in his veto message he pronounced to be unconstitutional; incurred thereby the resentment of the Whigs throughout the country, who accused him of desertion of their principles—a sentiment which was aggravated by his veto in September of another bill for the same purpose, to which he had privately given his assent; was abandoned by the members of his cabinet (with the exception of Daniel Webster), and severely condemned in a collective manifesto published by them; filled their places with reputed Whigs—Walter Forward, John C. Spencer, Abel P. Upshur, C. A. Wickliffe, and Hugh S. Legaré—but did not satisfy the Whig members of Congress, who published a manifesto Sept. 13 breaking off political relations; was abandoned by Mr. Webster in the following year as soon as the delicate negotiations with Great Britain concerning the N. E. boundary were terminated by the Ashburton Treaty (Aug. 9, 1842); reorganized his cabinet by the admission of three Democrats, July, 1843, followed by the appointment of John C. Calhoun and John Y. Mason as successors of Messrs. Upshur and Gilmer, killed by the accident on the Princeton Feb. 28, 1844; concluded through Mr. Calhoun a treaty for the annexation of Texas (Apr. 12, 1844), which was rejected by the Senate, but effected his object in the closing days of his administration by the passage of the joint resolutions of Mar. 1, 1845; was nominated for the Presidency by an informal Democratic convention held at Baltimore in May, 1844, but soon withdrew from the canvass, perceiving that he had not gained the confidence of the Democrats at large; was succeeded Mar. 4, 1845, by James K. Polk, and lived in almost complete retirement from politics until Feb., 1861, when he was a member of the abortive "peace convention" held at Washington, and was chosen its president; renounced soon afterward his allegiance to the U. S., and was elected to the Confederate Congress. D. at Richmond Jan. 17, 1862. Besides those above mentioned, the leading measures of his administration were the uniform system

of proceedings in bankruptcy enacted Aug., 1841, and the protective tariff of 1842. He married in 1813 Letitia Christian, who died at Washington in 1842, and contracted a second marriage (June 26, 1844) with Miss Julia Gardner of New York. By his first wife he had three sons and three daughters. One son, JOHN, has taken a prominent part in politics. PORTER C. BLISS.

**Tyler** (MOSES COIT), b. at Griswold, Conn., Aug. 2, 1835; graduated at Yale College 1857, at Andover Theological Seminary 1860; was pastor of a Congregational church at Poughkeepsie, N. Y., 1860–62; withdrew from the ministry on account of ill-health; resided in England 1863–67, engaged in study, lecturing, teaching, and writing for American periodicals; has since been professor of the English language in the University of Michigan; is a popular lecturer, a frequent contributor to the New York *Independent* and other periodicals, and author, among other works, of *The Brownville Papers* (1862), a volume of essays on physical culture.

**Tyler** (ROBERT OGDEN), b. in Greene co., N. Y., Dec. 22, 1831; graduated at the U. S. Military Academy July 1, 1853, when commissioned brevet second lieutenant of artillery. After a year passed in garrison he joined Col. Steptoe's command, which marched from St. Louis to Washington Terr., 1854–55, Tyler taking post at San Francisco; engaged in the Yakima (1856) and the Spokane (1858) expeditions, participating in the actions of the Four Lakes, Spokane Plains, and Spokane River. Transferred to Fort Ridgely, Minn., 1859, and New York harbor 1860. Engaged in the civil war on the expedition for relief of Fort Sumter Apr., 1861; in reopening communications with Washington *viâ* Baltimore May, 1861; as dépôt quartermaster at Alexandria May–Sept., when appointed colonel 4th Connecticut Vols., and in command of his regiment (known as the First Connecticut Heavy Artillery after Jan., 1862) in the defences of Washington until the spring of 1862; in the Virginia Peninsular campaign in command of siege batteries before Yorktown; in battles of Hanover Court-house, Gaines's Mill, and Malvern Hill. Promoted to brigadier-general of volunteers Nov. 29, 1862, and engaged in the battle of Fredericksburg, Dec. 13, in command of the artillery of Sumner's grand division; of the artillery reserve of the Army of the Potomac at Chancellorsville, Gettysburg, and subsequent operations, until Jan., 1864; of division of 22d army corps, covering Washington and lines of communications of the Army of the Potomac, Jan.–May, 1864; of division of heavy artillery, 2d corps, in the Richmond campaign of 1864, from the Wilderness battles to Cold Harbor, where severely wounded June 1, and disabled for further duty in the field. Commanded various departments Dec., 1864–June, 1866, when resumed quartermaster duty, in which department he became lieutenant-colonel and deputy quartermaster-general July, 1866. Brevetted from major to major-general for gallantry in action. D. at Boston, Mass., Dec. 1, 1874.

**Tyler** (ROYALL), b. at Boston, Mass., July 18, 1757; graduated at Harvard 1776; studied law under John Adams; was for a short time during the war of the Revolution aide to Gen. Lincoln, which post he also filled during the Shays rebellion 1786; settled at Guilford, Vt., 1790; was judge of the Vermont supreme court 1794–1800, and chief-justice 1800–06; published *Reports of Cases in the Supreme Court of Vermont* (New York, 2 vols., 1809–10). D. at Brattleborough, Vt., Aug. 16, 1826. He was one of the earliest American dramatists, enjoyed a high reputation as a wit, and was quite successful in the introduction in comedy of Yankee dialect and of humorous stories. Among his pieces were *The Contrast* (1790), produced Apr., 1786; *May-Day, or New York in an Uproar*, produced May, 1786; and *The Georgia Spec, or Land in the Moon*, produced 1797. He was a leading contributor of humorous verse and prose to Joseph Dennie's papers, *The Farmer's Weekly Museum* (Walpole, N. H., 1795–99) and *The Portfolio* (Philadelphia, 1801 *seq.*); wrote also for the *New England Galaxy*, the *Columbian Centinel*, the *Polyanthos*, and other literary journals, and was author of a Crusoe-like novel, *The Algerine Captive, or the Life and Adventures of Dr. Updike Underhill, Six Years a Prisoner among the Algerines* (Walpole, 2 vols., 1797). He left some unpublished dramatic productions.

**Tyler** (SAMUEL), LL.D., b. in Prince George's co., Md., Oct. 22, 1809; educated at Dr. Carnahan's seminary at Georgetown, D. C., where he acquired an unusually extensive acquaintance with Greek; graduated at Middlebury College, Vt., 1827; studied law; admitted in 1831 to the bar at Frederick City; in 1850 appointed a commissioner to simplify the pleadings and practice in all the courts of the State, and prepared a highly-esteemed *Report;* has for some years resided in Washington, D. C.; connected as professor with the law department of the Columbian University; has written for the *Princeton Review* and other periodicals, chiefly on metaphysics, in which branch his labors received commendation from Sir William Hamilton and other competent critics. Author of *A Discourse on the Baconian Philosophy* (1844), *Burns as a Poet and as a Man* (1848), *The Progress of Philosophy in the Past and in the Future* (1859; 2d ed. 1868), and a *Memoir* of Chief-Justice Taney (1872).

**Tyler** (WILLIAM SEYMOUR), D. D., b. at Harford, Pa., Sept. 2, 1810; graduated at Amherst College 1830; taught classics in Amherst Academy 1830–31; was tutor in Amherst College 1831–33; studied theology at Andover Seminary, where he graduated 1836; was in that year licensed to preach by the third presbytery of New York City, but not ordained until many years later (1858), in consequence of his acceptance of the professorship of Greek and Latin at Amherst College; became Graves professor of Greek (1847) on the division of the professorial chair; visited Europe and the East 1855, and Greece and Egypt 1869. He has published *The Germania and Agricola of Caius Cornelius Tacitus* (1847), with notes and a *Life; The Histories of Tacitus* (1849), *Prayer for Colleges* (1855), a prize essay, *Memoir of Rev. Henry Lobdell, M. D., Missionary at Mosul* (1859), *Plato's Apology and Crito* (1860), *The Theology of the Greek Poets* (1867), *The History of Amherst College* (Springfield, 1873), *Demosthenes de Coronâ* (1874), *The Olynthiacs and Philippics of Demosthenes* (1875), and has contributed to several theological reviews and to the *Transactions* of the American Philological Association.

**Tyler's,** tp., Shelby co., Ala. P. 383.

**Ty'lor** (EDWARD BURNETT), LL.D., F. R. S., b. at Camberwell, London, England, Oct. 2, 1832; educated at the Quaker school at Grove House, Tottenham; devoted himself to ethnological and antiquarian researches, in furtherance of which he visited Mexico in 1860, and has been one of the founders of the new science sometimes called "comparative ethology" (Gr. ἔθος, "a custom"), or the investigation of the manners, customs, religions, and social rites and superstitions of savage nations, many traces of which, called by him "survivals," he finds in the institutions of the most highly-civilized modern societies. He has lectured on this subject at the Royal Institution. Author of *Anahuac, or Mexico and the Mexicans, Ancient and Modern* (1861), *Researches into the Early History of Mankind and Development of Civilization* (1865), and *Primitive Culture, Researches into the Development of Mythology, Philosophy, Religion, Art, and Customs* (2 vols., 1871), and is understood to be now (1876) engaged upon a work on *Primitive Morals,* some portions of which have appeared in the English magazines. He is a contributor to the *Academy,* a weekly literary review, and wrote articles on anthropology, etc. in the 9th ed. of the *Encyclopædia Britannica* (1875 *seq.*).

**Tymochtee,** tp., Wyandot co., O. P. 1631.

**Tympanum.** See EAR, ANATOMY OF, by PROF. H. HARTSHORNE, A. M.

**Tyn'dale,** or **Tindale** (WILLIAM), b. at Hunt's Court, North Nibley, Gloucestershire, England, about 1484; studied at Magdalen Hall, and afterward at Christ Church, Oxford, where he was for some time tutor; removed to Cambridge, probably on account of having embraced the principles of the Reformation; took orders in the Church of England; resided as tutor in the family of Sir John Welch, near Bristol, incurring danger by his advocacy of the doctrines of Luther, then recently proclaimed, on which account he was cited before the chancellor of the diocese of Worcester 1522; translated into English the *Enchiridion Militis,* or *Soldier's Manual,* of Erasmus; went to London 1523; made an unsuccessful application for admission into the household of Bishop Tunstall; was protected for some months in the family of Alderman Humphrey Monmouth, who gave him £10 per annum to prosecute his theological studies in Germany, on condition of praying at stated periods for the souls of the alderman's parents; went to Hamburg Jan., 1524; resided there nearly a year, engaged in the translation of the New Testament into English, with the aid of John Frith and William Roye, the printing of which at Cologne in the office of Peter Quentell (quarto, 1525) was interrupted by the vigilance of Cochlæus; completed the printing at Worms in the office of Peter Schoeffer; issued, either at Worms or at Wittenberg, in 1526, a new octavo edition of the whole work, which obtained a wide though secret circulation in England, being prohibited by an edict of Tunstall, bishop of London, who bought up the remainder of the edition at Antwerp and burnt them at Cheapside 1529; removed to Marburg, and published there his *Obedience of a Christian Man* (1528); had an interview with Coverdale at Hamburg, and issued a 5th ed. of the *Testament* 1529; published his translation of the Pentateuch, "emprented at Marlborow [Marburg] in the Land of Hesse," 1530; had a bitter con-

troversy with Sir Thomas More, who in a witty and abusive pamphlet denounced the translation and its author 1530–31; was treacherously invited to return to England in order to seize his person—an artifice to which his assistant, John Frith, fell a victim, being burned at the stake 1533; brought out a revised and corrected edition, the first to which he put his name, 1534; wrote several doctrinal treatises and introductions, expositions, and notes to various books of the Bible; resided during his later years at Antwerp; was arrested 1535 on a charge of heresy through the agency of an emissary of Henry VIII. acting in concert with the clergy and magistrates of Brussels; imprisoned in a castle at Vilvoorden, Brabant; tried by virtue of a decree of Charles V., issued at Augsburg 1530, and the University of Louvain having urged his condemnation, with the eager approval of Henry VIII., he was convicted, and after eighteen months' imprisonment was strangled and burned at the stake at Vilvoorden Oct. 6, 1536. He met his fate with composure, his last words being a prayer, "Lord, open thou the king of England's eyes." The spot where he suffered is shown near the new penitentiary at Vilvoorden. A monument to his memory was erected at his birthplace, Nibley Knoll, Nov., 1866. His translation of the New Testament is the basis of the authorized version, and is executed with considerable accuracy and elegance. A beautiful edition, with a *Memoir of Tyndale's Life and Writings*, by George Offor, was published by S. Bagster (London, 1836), and reprinted at Andover, Mass., 1837. Another *Life*, by Rev. H. Walter, was prefixed to the Parker Society's reprint of his *Works* (3 vols., 1848–50). Other editions of the *Works* (in connection with those of Frith and of Robert Barnes) were published by John Fox, the martyrologist (London, folio, 1573), by the London Tract Society (*British Reformers*, vol. viii.), and by Rev. Thomas Russell (*English and Scotch Reformers*, vol. iii., 1828). The MSS. of Tyndale were utilized by John Rogers in the translation of the whole Bible, which he published in 1537 under the name of Thomas Matthew. PORTER C. BLISS.

**Tyndall** (JOHN), D. C. L., LL.D., F. R. S., b. at Leighlin Bridge, near Carlow, Ireland, Aug. 21, 1820; educated under the direction of his father, acquiring an intimate acquaintance with the Bible and with the standard English theologians, as well as a thorough knowledge of mathematics; became in 1839 "civil assistant" to a division of the Irish ordnance survey stationed at his native place; became in turn draftsman, computer, surveyor, and trigonometrical observer; devoted five hours a day for twelve years to systematic private studies, chiefly in the direction of natural science; was transferred to the English branch of the ordnance survey, with which he remained until 1844, when he determined to settle in the U. S., but was induced to remain in England by the offer of a position as railway engineer, which he filled for three years; was teacher of physics 1847–48 in Queenwood College, Hampshire, where Dr. Edward Frankland was resident chemist; went with Frankland to Germany, where they attended at Marburg the celebrated lectures on chemistry by Bunsen, on physics by Gerling and Knoblauch, and on mathematics by Stegmann; worked hard in the laboratory in conjunction with Knoblauch, making discoveries in magnetism and diamagnetism, which he embodied in a paper *On the Magneto-Optic Properties of Crystals, and the Relation of Magnetism and Diamagnetism to Molecular Arrangement*, published in the *Philosophical Magazine* for 1850; graduated in 1851, presenting for his degree an inaugural dissertation *On Screw Surfaces* (in German); continued his chemical studies in the laboratory of Prof. Magnus at Berlin; made the same year the acquaintance of Faraday, to whom he communicated a series of experiments of such ingenuity as to lead to his immediate election as a fellow of the Royal Society; became in 1852 a member of the British Association for the Advancement of Science, and was chosen one of the secretaries of its section of physics; was an unsuccessful applicant for a professorship in the University of Toronto, Canada, 1852; was invited in Feb., 1853, to give one of the Friday evening lectures at the Royal Institution; was elected June, 1853, professor of natural philosophy in that institution and in the government school of mines, which post he still fills (1876); visited Switzerland for the first time 1849; made a second visit, along with Huxley, in 1856, and has since made annual excursions to the Alps, where he distinguished himself by his investigations of the rate of motion of glaciers (1859) by planting thermometric stations on the sides and summit of Mont Blanc, and by scaling for the first time the Weisshorn (1861) and Matterhorn (1868); published the result of his observations in the *Philosophical Transactions* (1860), and in three volumes, *Glaciers of the Alps* (1860), *Mountaineering in 1861* (1862), and *Hours of Exercise in the Alps* (1871); had a prolonged scientific controversy with Prof. J. D. Forbes of Edinburgh upon the subject of the causes of glacial formation and motion, which he ascribed respectively to mechanical pressure and to regelation; communicated from time to time to the *Philosophical Transactions* and *Magazine* memoirs on the *Influence of Crystalline and Organic Structure upon Magnetism*, and on the *Polarity of the Diamagnetic Force*, as well as upon radiant heat—a subject which has engaged his attention since 1859, and has been the field of the brilliant discoveries described in his lectures at the Royal Institution in 1862, published under the title *Heat considered as a Mode of Motion* (1863), and in the "Rede Lecture," *On Radiation* (1865); became the successor of Faraday at the Trinity House 1866, and superintendent of the Royal Institution 1867; accompanied to Algeria the expedition sent to observe the solar eclipse of Dec., 1870; visited the U. S. in 1872 on a successful lecturing-tour, the profits of which (more than $15,000) he placed in the hands of an American committee as a fund "in aid of students who devote themselves to original research;" has been honored with the Rumford medal of the Royal Society for his discoveries in thermodynamics, and with the doctorate of laws from the universities of Cambridge (1855), Edinburgh (1866), and Oxford (June 18, 1873), and was president of the British Association in its session at Belfast Aug., 1874, when his *Address* was the occasion of a sharp theological controversy from its enunciation of the last results of the evolution theory, of which he had long been a vigorous advocate. He had already attracted attention some years before by his proposition to submit the question of the efficacy of prayer to a scientific test. His later researches have been chiefly upon acoustics in connection with the Trinity House. Besides the works previously mentioned he has published—*Sound, a Course of Eight Lectures* (1867; 3d ed., enlarged, 1875), *Faraday as a Discoverer* (1868), *Natural Philosophy in Easy Lessons* (1869), *Nine Lectures on Light* (1870), *Researches on Diamagnetism and Magneto-crystallic Action* (1870), *Seven Lectures on Electrical Phenomena and Theories* (1870), *Essays on the Use and Limit of the Imagination in Science* (1871), *Fragments of Science for Unscientific People* (1871; new ed., enlarged, 1876), *The Forms of Water in Clouds and Rivers, Ice and Glaciers* (1872, being vol. i. of the "International Scientific Series"), and *Contributions to Molecular Physics in the Domain of Radiant Heat* (1872). PORTER C. BLISS.

**Tyne,** river of Northern England, is formed by the junction of the North and South Tyne, flows eastward, and enters the North Sea after a course of 85 miles through the richest mining districts of England.

**Ty'ner** (JAMES N.), b. at Brookville, Ind., Jan. 17, 1826; received an academic education; studied law, which he practised at Peru, Ind.; was secretary of the Indiana senate 1857–61; was chosen a Presidential elector in 1860; was a special agent of the post-office department 1861–66; was a Republican member of Congress 1869–75, serving on the committees on appropriations and post-offices; was appointed governor of Colorado at the expiration of his Congressional service in 1875, but before taking possession of that post was made second assistant postmaster-general, and on the resignation of Gov. Jewell in July, 1876, succeeded him as postmaster-general.

**Tyng** (STEPHEN HIGGINSON), D. D., b. at Newburyport, Mass., Mar. 1, 1800, son of Hon. Dudley Atkins (1760–1829), U. S. collector at that port and reporter of the Massachusetts supreme court, who assumed the name of Tyng on inheriting the estate of his relative, James Tyng of Tyngsborough; graduated at Harvard 1817; was for some time engaged in mercantile pursuits; afterward studied theology; was ordained in the Protestant Episcopal Church 1821; was minister of St. George's, Georgetown, D. C., 1821–23, of a church in St. Anne's parish, Md., 1823–29; rector of St. Paul's, Philadelphia, 1829–33, of the church of the Epiphany, Philadelphia, 1833–45, and since the latter year of St. George's, New York City; has travelled in Europe; edited successively the *Episcopal Recorder*, the *Theological Repository*, and the *Protestant Churchman*; is author of *Lectures on the Law and Gospel* (1832), *Recollections of England* (1847), *Forty Years' Experience in Sunday-Schools* (1860), *The Prayer-Book Illustrated by Scripture* (3 series, 1863–67), *The Child of Prayer, a Father's Memorial to the Rev. Dudley A. Tyng, A. M.* (1858), and other works theological and biographical; published several volumes of sermons and many single addresses; edited with introductions or prefatory memoirs various works by other hands; has been a conspicuous advocate of temperance and other reforms, and enjoys high fame for eloquence in the pulpit and on the platform. —His son, DUDLEY ATKINS, b. in Prince George's co., Md., in 1825; graduated at the University of Pennsylvania 1843; studied theology at Alexandria Seminary; took orders in the Protestant Episcopal Church 1846; was assistant to his father at St. George's church, New York;

had charge of parishes at Columbus, O., Charlestown, Va., and Cincinnati, O., and was rector of the church of the Epiphany, Philadelphia, from 1854 until shortly before his death, at Brookfield, near Philadelphia, Apr. 19, 1858. He was a successful lecturer upon religious and social topics, and acquired a high reputation for ability and manliness, as well as philanthropy, by his course in preaching against slavery, which involved his dismissal from his pastorate. The touching ballad *Stand up for Jesus!* commemorates an incident of his deathbed. Author of *Vital Truth and Deadly Error* (1852), *Children of the Kingdom, or Lectures on Family Worship* (1854), republished in England as *God in the Dwelling* (4th ed. 1859), and *Our Country's Troubles* (1856). His *Life*, as above indicated, was written by his father. PORTER C. BLISS.

**Tyng** (STEPHEN HIGGINSON), JR., D. D., son of the above, b. at Philadelphia, Pa., June 29, 1839; graduated at Williams College 1858; studied theology at the Virginia Episcopal Seminary; was ordained deacon May 8, 1861; assisted his father in the ministry of St. George's church, New York, 1861–63; was ordained priest Sept. 11, 1863; became rector of the church of the Mediator, New York, 1863; went to the army as chaplain of the 12th New York Vols. 1864; organized the parish of the Holy Trinity, New York, 1865, building on 42d street a church which in 1873–74 was replaced by a large and commodious edifice; was tried in 1867 for a violation of the canon law of his Church; edited for some years a weekly religious journal, *The Working Church;* is noted for his cordial fellowship with evangelical churches of other denominations; took a prominent part in the revival movement of 1875 directed by Messrs. Moody and Sankey, and in the summer of 1876, in combination with other clergymen, commenced out-door Sunday services for the people in a "gospel tent" erected near his church.

**Tyngs'borough,** p.-v. and tp., Middlesex co., Mass., on Boston Lowell and Nashua R. R. P. 629.

**Type, Type-casting Machines, Type-founding, Type-revolving Presses, Type-setting,** and **Type-setting Machines.** See PRINTING, by W. S. PATERSON.

**Type,** in theology, denotes an image or representation prefiguring a person or thing, which then is called its antitype; thus, St. Peter describes baptism as the antitype of the ark of Noah (1 Pet. iii. 21). In this sense the word is used several times in the New Testament and by Jewish historians; and several of the Fathers, especially Augustine and Gregory the Great, are very ingenious in finding types by their interpretation of the Bible.

**Type-Theories.** In chemistry, the so-called "theory of chemical types" has played a great part in the literature of the science for a quarter of a century past. The idea arose first from the discoveries of Gay-Lussac and Dumas of the replacement of hydrogen by chlorine in organic bodies, which led the latter chemist to impugn the theoretical views of Berzelius, that had been based upon his discovery of the actual, natural, and indisputable arrangement of elements and radicals in the so-called electro-chemical series. Dumas believed his new facts, showing the actual equivalency of chlorine (and other halogens) with hydrogens, to be irreconcilable with the electro-chemical views, and, apparently rejecting the electro-chemical relations as nugatory, introduced the term *chemical type* to designate bodies derived from each other by substitution, without reference to acidic or basylic nature. Or, rather, he concluded that by virtue of such substitution the element or radical replacing the other assumed the chemical nature of the element or radical replaced, and the resulting body retained the same type as before. This was the initial point of what is now called the "new system of chemistry." Laurent and others extended Dumas's investigations largely, discovering great ranges of facts; and Laurent appears to have been the first (in 1846) to propose the hypothesis that certain series of organic bodies were molecularly derived by substitutions of this kind from those bodies in nature which are known to furnish the materials of which organic bodies are built up. His first suggestion appears to have been that the alcohols and ethers were thus derived from the type of *water*, the "residue," or hypothetical group $C_2H_5$, called now *ethyl*, being substituted, in $H_2O$, for one hydrogen equivalent to form alcohol, and for both hydrogen equivalents to form ether. The whole study was influenced by the universal hold that the so-called "dualistic" views had obtained upon the chemical world. The hypothetical *organic radicals*, some of which are even yet adhered to by many chemists, were rendered necessary in order to apply the type-theories to organic bodies, as in the initial case of ethyl, cited above. Our American chemist, Sterry Hunt, in 1848 (*Am. Journal of Science* for Sept., 1848, p. 173), first extended Laurent's suggestion to *acids*, both organic and inorganic; further proposing, in a paper read to the American Association for the Advancement of Science in the same month of that year, that *all oxygenated bodies* should be looked upon as derived from the *water-type*. Our distinguished compatriot may therefore be claimed as at least the most prominent of the founders of the famous "water-type theory," from which all the type-theories have grown, and into which, indeed, it is easy enough to merge them all. In the article on CHEMISTRY (which see for more on type-theories) it is explained how all the accepted types are really referable to one—namely, that of the $H_2$ in $H_2O$. In the American Association paper of 1848, above referred to, this idea was also fully set forth by Sterry Hunt.

The number of types or classes of typical compounds that has been admitted is *six*, which may be represented by the compounds HCl, $H_2O$, $H_3N$, $H_4C$, $Cl_5P$, $Cl_6W$. For the two highest no *hydrogen* compounds are known, but it is assumed that such compounds as $H_5P$ and $H_6W$ may exist, but have not yet been obtained. The elements here combined with the hydrogen are said to represent six different degrees of *equivalence*, or, as some express it, of *atomicity*—Cl being *monovalent, univalent, monadic* (or a *monad*), or *monatomic;* O being *bivalent, dyadic* (or a *dyad*), or *diatomic;* N being *trivalent, triatomic* (or a *triad*), or *triatomic;* C being *tetravalent, quadrivalent, tetradic* (or a *tetrad*), or *tetratomic;* P being *pentivalent quinquivalent, pentadic* (or a *pentad*), or *pentatomic;* and W, *hexavalent, sexivalent, hexadic* (or a *hexad*), or *hexatomic.*

The direct derivation of other bodies from these typical ones (or rather from *the type* generally) is supposed to consist in, or arise from, the substitution for any one or more of the equivalents of elements in the typical formula of any element, or elements, or radicals, the sum of whose equivalencies or atomicities is equal to that of the element displaced. Thus, it follows that they are all derivable from each other; as, for example, in three molecules of HCl or $H_3Cl_3$, by substituting for the three monads $Cl_3$ the triad N, we get $H_3N$, ammonia; or—to take a familiar case of *actual derivation*—when the dyadic metal zinc is dissolved in muriatic acid, $H_2Cl_2$ react with Zn, and we have formed free hydrogen and $Cl_2Zn$, a compound belonging to the water-type, or derivable directly from $H_2O$ by substitution of two monads $H_2$ for two monads $Cl_2$, and of one dyad Zn for one dyad O. An indefinite number of other similar cases might be cited; and this mode of viewing these theories is now regarded by many advanced chemists as a sort of *reductio ad absurdum*, or at least as showing that these theories are inconclusive and indeterminate, reasoning in a circle, or having no solid basis except the fundamental facts of *equivalence*, based upon the different multiple combining proportions of other elements with oxygen. The term *theory of equivalence* is therefore being rapidly substituted for "theory of types," and the typical arrangement itself regarded only as a convenient and artificial mode of classification or notation in investigating chemical transformations. Sterry Hunt himself said long since: "The various hypotheses of copulates and radicals are based upon the notion of dualism, which has no other foundation than the observed order of generation, and can have no place in a theory of the science." . . . "The chemical history of bodies is a record of their changes"—meaning their modes of *derivation:* "it is, in fact, their genealogy; and in making use of typical formulas to indicate the derivation of chemical species, we should endeavor to show the ordinary modes of their generation." Kekulé has also said, much more recently—referring to the obvious derivation of all the types from each other and from $H_2$—that it "shows plainly that the entire system is nothing more than a comparison of compounds with regard to their composition, not a true theory which can teach us anything about their actual composition itself. The several types are therefore not classes of compounds distinctly separated from one another by differences of constitution, but rather movable groups, in which compounds may be placed together according to the particular analogies which it is desired to bring to light." HENRY WURTZ.

**Type-Writers.** See WRITING-MACHINES.

**Typha.** See CAT TAIL.

**Typhlop'idæ** [from *Typhlops*—τυφλώψ, "blind," the ancient name of a species—the principal genus], a family of reptiles of the order Ophidia (serpents) and sub-order Scolecophidia, characterized especially by the development of teeth in the upper jaw (and not in the lower), and therefore called epanodontiens by Duméril and Bibron. They are worm-like animals, and about equally thick behind and before; the scales are smooth and imbricated, and nearly alike all round; the head is short, and not differentiated by constriction from the body; above, it is covered by large scale-like plates, and enlarged rostral and lateral

ones, as well as labials; the eyes are minute; the nostrils between the postrostral and labial plates; the mouth is small and crescentiform; the teeth, as already indicated, are confined to the upper jaw; the anus is a transverse fissure near the posterior extremity. The skull has no ectopterygoid bones and no prefrontals; the maxillaries are destitute of alveolar ridges or malar processes; the rudiments of a pelvis are existent, but no pubis. The family is represented by about half a dozen genera in various tropical countries. THEODORE GILL.

**Typhoid Fever.** See TYPHUS AND TYPHOID FEVERS.

**Ty′phon,** the Greek name of an Egyptian deity called Set, son of Seb or Cronos and Nut or Hannut or Rhea, b. on the third of the intercalary days of the year, brother of Osiris, Isis, Nephthys, Haroeris, and Anubis. According to the Greek legend, he was the rival and opponent of his brother Osiris, whom he destroyed. In this Typhon was aided by seventy-two conspirators and an Ethiopian queen named Aso. He enticed Osiris to lie down in a chest, which Typhon and his companions closed with a lid nailed down, and molten lead was poured over it. It was then thrown into the river, and reached the sea by the Tanitic mouth on the seventeenth of the month Athyr. Set was united to Nephthys, the mother of Anubis by Osiris. After the discovery of the remains of Osiris by Isis, Typhon again found the chest, and tore it into fourteen pieces, which he scattered over Egypt. Subsequently, Horus, the avenger of his father, gave battle to Typhon and his followers for three days and nights, commencing on the 26th of the month Thoth, having transformed themselves into beasts. Isis chained them both, but released Set at his intercession, and Horus, who had regained the human form, with a sword cut off her head, which Thoth replaced by that of a cow. This battle was supposed to have been at Antæopolis, the modern *Cau* on the eastern bank of the Nile, the ancient *Kera*. Set afterward represented the principle of evil, as Osiris that of good, in the religion. His worship was of the most remote period, and he is mentioned as early as the sixth dynasty, and in chapters of the ritual possibly older. Set —or Sutech, another name of the god—was also the god of the Aramæan and other nations, such as the Khita, the neighbors and enemies of Egypt, as well as the Shasu or Shepherds, foreigners who invaded the Delta before the eighteenth dynasty. An attempt to enforce the building of a temple to him by the Hykshos or Shepherd kings led to their expulsion. In this quality he was considered a martial god, and called very valiant or glorious, king of heaven, and lord of victory. The kings of the nineteenth dynasty, probably on account of their Semitic origin, assumed his name, two being called Seti or Sethos, and a monarch of the twentieth dynasty Nechtset or Setnecht, "the power of" or "powerful Set." In the ritual, Set is said to be the god who swallows souls and devours hearts, or Baba, another of his names, who feasts off the wicked; and elsewhere he is said to change into a crocodile to devour Osiris, who changes into an ape, and throughout he is considered the evil and hostile principle of nature. Set was also identified with the Apap or Apophis, the great dragon or serpent, the type of darkness and opponent of Ra or light. The ass was sacred to Set, and his head is supposed to be in shape of that animal, but in reality he has the head of a gryphon, and is so represented as the god of Nubti or Ombos and protector of the gold country. Human sacrifices are said to have been offered to him at Heliopolis, and were abolished by Amasis I., but men were burnt in his honor at Eileithyia, for which a red cow is said to have been afterward substituted. Many esoterical explanations have been given of Set; his name was identified with the word *root*, and he was supposed to represent the desert, or drought, or the sea, or the orb of the sun; and the number of his conspirators and of the parts of Osiris show relations between the sun and moon in the myth. In Greek mythology, Typhon, called Typhœus, was one of the giants, son of Tartarus and Gaia, or a son of Hera, with a hundred serpents' heads vomiting fire, or had a gigantic human shape, with wings at the belly, and like the giants his legs terminated in snakes. He was the father of the dog Orthros, the companion of Geryon, of Cerberus, the Chimæra, and even Sphinx according to some legends. He attacked the gods, who flew to Egypt, and when Zeus endeavored to annihilate him with a thunderbolt and *harpe* or falchion, Typhon hacked him to pieces and hid the sinews of the god. These were restored to Zeus by Hermes or Mercury, and after a fierce contest and pursuit as far as Sicily, Zeus overcame Typhon and placed him under Mount Ætna, or, according to other versions, under the earth in Cilicia. Typhon appears to represent the volcanic powers of nature, and the contest between them and the aërial, and to be modelled on the Assyrian myths of the kosmos or genesis lately discovered in the cuneiform. S. BIRCH.

**Typhoons.** See STORMS, by PROF. A. GUYOT, PH. D., LL.D.

**Ty′phus and Typhoid Fevers** [*typhus*, from Gr. τῦφος, "stupor;" *typhoid*, from Gr. τῦφος, "stupor," and εἶδος, "form"], two idiopathic or essential continued fevers, by some authorities regarded as a greater and lesser degree of one common disease, but by a majority of physicians conceded to be distinct diseases with certain resemblances. Typhus is the more acute, virulent, and fatal, the more sudden and pronounced in its onset, rapid in its course, and in cases of recovery terminating promptly by a crisis. Typhoid is insidious in its development, less abrupt in its onset, slower in the development of its symptoms, which are less acute, and terminates by a prolonged and gradual convalescence. Typhus is known as ship-fever, jail-fever, camp-fever, etc., being the product of vast aggregations of humanity under unhygienic conditions, especially deficient ventilation; so that the rebreathing of air loaded with emanations from crowded living beings is its chief cause. With the sanitary reform of barracks, ships, prisons, etc., it has been reduced to a minimum. Typhoid fever is far more prevalent, occurring in all countries, among all classes of society, in isolated and healthy country villages as well as in the larger towns and cities. It has variable degrees of severity, and a variable predominance of different classes of symptoms in different persons and seasons. It may be induced by purely external causes, as by bad ventilation, sewer-gas, exhalations of decomposing matter in cellars or near houses, privies, and especially the contamination of drinking water, as when springs or wells receive by percolation the surface-water from outbuildings. In other cases typhoid fever would seem to have a purely intrinsic origin, the morbific matter being collected within the person's system by deficient elimination. Thus, it is induced in persons of nervous temperament by prolonged and excessive mental or bodily effort, care, exposure, fatigue, and privation of food. The nervous type is then developed, justifying the German designation of "nervous fever," since the depressed nervous system suspends the nutritive processes of the body, and effete matter becomes present in excess of the nutritive supply. Typhoid fever is also known as adynamic and asthenic fever, indicating the peculiar exhaustion characterizing it; pythogenic fever (Gr. πύθος, "filth," and γενᾶν, to "generate"). In typhoid fever the PEYER'S GLANDS (which see) of the small intestine are invariably swollen, infiltrated with typhoid matter, and often ulcerated or sloughed out; hence from this specific lesion the disease is also called enteric fever, abdominal typhus, and ileo-typhus. Typhus fever has an average duration of two weeks, characterized by initial chill, active delirium, contracted pupil, dark-coated tongue, dusky suffusion of the face, a high temperature, a rapid and feeble pulse, and often weak heart-sounds. The body-heat rises steadily, remains constant at its height, when at the end of the second week speedy recovery ensues, with profuse perspiration, or the case becomes more serious or fatal. Exceptionally, the relapse is terminated by a crisis as late as the end of the third week. Typhoid is of longer duration—at least three full weeks of the active fever, and several weeks of gradual convalescence. During a week to ten days antecedent to the actual attack the specific poison or *materies morbi* is incubating, and the patient is languid, feeble, and depressed. It is ushered in by headache, chill, or chilliness, and elevated temperature; later, follow muttering delirium, semi-consciousness or "coma-vigil," wild excitement and tossing of the body, picking of the bedclothes; the face is suffused and blank, the tongue coated; the teeth may have "sordes," a deposit of blackened and dry saliva; the abdomen is tender on pressure, tumefied, and emits a drum-like sound when percussed; the bowels are often loose, the stools being "ochre-colored," and often found to contain the shreds or entire body of sloughing intestinal glands; in the second week in many cases minute spots appear on the lower part of the chest and upper part of the abdomen, coming in crops of twelve or more, each crop lasting about three days. The temperature, as shown by the medical thermometer, has a peculiar and almost diagnostic course in typhoid fever. There is after the initial rise an ascent for four or five days of about 2° F. each evening, and a descent in the morning of 1° F., making a daily gain of 1° F. Thus, the temperature reaches 103°, 104°, 105° F.; it then remains nearly constant for several days, when toward the end of the second week it has a gradual descent in the same manner of a degree daily; during convalescence there is a marked daily variation of temperature, resembling intermittent fever—an evidence of the debilitated and susceptible state of the convalescent, and of the periodic efforts of the recuperating system to cast off morbific matter. The modern treatment of typhus and typhoid may be summed up chiefly as good nursing, fresh air, food, and support by tonics and stimu-

lants. Cold water may be of the greatest value, either sponging, the cold pack, affusion, or immersion, to reduce the unusually high and dangerous temperature of the body.
E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Typography.** See PRINTING, by W. S. PATERSON.

**Tyr,** in Scandinavian mythology, the god of war, had only one natural hand; the other was made of iron. In order to persuade the wolf Feuris to suffer himself to be bound with Gleipnir, Tyr placed his right hand in the wolf's mouth as a pledge that he would be loosened again; and when the gods refused to remove Gleipnir, the wolf bit off Tyr's hand. The third day in the week is called after him: Icel. *Tyrsdagr;* Dan. *Tirsdag;* Eng. *Tuesday,* after his Anglo-Saxon name, *Tiv.*

**Tyranga,** tp., Crittenden co., Ark. P. 150.

**Ty'rant** [Gr. *τύραννος*], in ancient Greece, did not necessarily designate, as at present, a despotic and cruel ruler. The Greek tyrants were powerful citizens who by force or stratagem assumed the rulership of a state or city without lawful warrant. Sometimes, in seasons of political disturbance, the government of a *tyrannus* was highly beneficial to the state, commercially and socially. Some of the tyrants were men of wisdom and beneficence. But the natural tendency of such an unlawful exercise of power is toward oppression and injustice; hence at present the word "tyrant" designates a cruel and unjust ruler, whether a lawful king or a usurper.

**Tyrant,** in ornithology. See FLY-CATCHERS and KINGBIRD.

**Tyrcon'nel** (RICHARD **Talbot**), EARL OF, b. in Leinster, Ireland, about 1625, descended from an ancient Norman family; became notorious for daring and unscrupulous adventures in London, on which account he was recommended to the exiled princes Charles and James as a suitable person to entrust with a scheme for the assassination of Cromwell; enjoyed great favor at court at the Restoration (1660), when, in order to enable the duke of York to refuse to marry Anne Hyde, he made oath to personal knowledge of that lady's unfaithfulness to James; filled many posts of profit at court; was arrested and banished as a conspirator against Charles II. 1677; was created by James II., on his accession, earl of Tyrconnel 1685, and commander of the army in Ireland 1686; dismissed English Protestant officers from the service, replacing them with Irish Roman Catholics; was made lord deputy of Ireland Jan., 1687; proceeded to labor for the repeal of the act of settlement and for the independence of Ireland under the protection of France; formed a large army of native Irish; invited James II. to Ireland after the Revolution; received him at Cork and accompanied him to Dublin 1689; was present at the battle of the Boyne, but rendered little service; went to France Sept., 1690, and returned with French forces in the spring of 1691. D. at Limerick July 14, 1691. His second wife was the celebrated Frances Jennings, sister to the duchess of Marlborough.

**Tyre,** the *Tyrus* of the ancients, the *Tzor* of Scripture, was a daughter-colony of Sidon and the mother-city of Carthage. It was the wealthiest and most magnificent of all Phœnician cities, and flourished for 3000 years. In the time of Solomon it was the wonder of the world, and although it was taken and devastated successively by Shalmaneser, Nebuchadnezzar, Alexander the Great, Antigonus, Augustus, the Saracens, the Crusaders, and Selim I., it was always rebuilt; and it was the discovery of the route to India S. of the Cape of Good Hope, rather than its utter destruction in 1516 by Selim I., which prevented it from ever rising again. It stood 20 miles S. of Sidon, on the shore of the Mediterranean, and the locality it occupied was as strong in a military point of view as it was advantageous in commercial respects. One part of it was on the continent, and the other on an adjacent island; the narrow sound which separated these two parts formed its harbor. After conquering the continental part of the city, Alexander the Great built a mole to the island, by means of which he succeeded in conquering the insular part too. This mole has in the course of time been transformed by alluvial deposits into a peninsula. But otherwise the remains which are left of this magnificent city are few and utterly insignificant. Its renowned manufactures of purple are entirely dead, its commerce totally gone, and a miserable village straggles along the site where once stood the richest storehouses and the most splendid palaces.

**Tyre,** p.-v. and tp., Seneca co., N. Y. P. 1280.

**Tyr'ian Purple,** a celebrated dye used by the ancients, and prepared extensively at Tyre from the shell-fish MUREX (which see), from each of which only a minute quantity was obtained at an enormous cost; and hence this color became the symbol of imperial power. Tarentum, the modern *Taranto,* was one of the great murex fisheries of the Romans, and there they had a number of dyeing establishments. With the decline of the Roman empire the employment of this color ceased. Purple is now obtained from vegetable and mineral sources. (See ANILINE COLORS, ARCHIL, and DYESTUFFS.)

**Tyringham,** p.-v. and tp., Berkshire co., Mass. P. 557.

**Tyr'nau,** town of Hungary, on the Ternava, manufactures vinegar and sugar, and has 8 important annual fairs. P. 9566.

**Tyro,** tp., Davidson co., N. C. P. 985.

**Tyr'ol,** province of the Austrian empire, the ancient *Rhætia,* is bounded N. by Bavaria, W. by Switzerland, and S. by Italy, and comprises an area of 11,084 sq. m., with 885,789 inhabitants, of whom 538,000 are Germans and 348,000 Italians. The country is mountainous throughout, traversed from W. to E. by three lofty chains of the Alps—the Tyrolese Alps in the N., forming the boundary toward Bavaria; the Trent Alps in the S., on the Italian frontier; and in the middle the Rhætian Alps, the highest of the three ranges, Mount Ortler rising 12,852 feet and Gross-Glockner 12,560 feet. The valley between the Tyrolese and Rhætian Alps is drained by the Inn, which flows through Bavaria to the Danube; the valley between the Rhætian and Trent Alps is drained partly by the Adige, an affluent of the Po, partly by the Drave, which flows through Styria to the Danube. One-third of the surface is covered with perpetual snow, from which the glaciers descend to between 5000 and 6000 feet above the sea. Another third is covered with forests, and of the remaining third part most is pasture-ground. Only a small part of the country is suitable for tillage, but that part is very carefully cultivated. Wheat, rye, oats, and barley are grown, though not enough for home consumption; in the gardens, vineyards, and orchards, mostly situated in the southern valleys, excellent wine, numerous mulberry trees for the rearing of silkworms, and fine fruits, olives, and figs are raised. But the chief industry of the people is the rearing of cattle, especially sheep and goats, which in the summer-time are driven to the pastures just below the snow-line. Salt and iron are produced, and various branches of manufactures are pursued, though mostly on a small scale. Cap. Innsbruck.

**Tyrone',** an inland county of Ireland, province of Ulster, comprises an area of 1260 sq. m., with 215,765 inhabitants, of whom 55,348 are unable to read and write; in 1841 the county had 312,956 inhabitants. The surface is hilly, rising into mountains in the N. and S., and declining to a level toward Lough Neagh. In the hilly districts the soil is sandy or gravelly; in the valleys it is more productive, but agriculture is in a very backward state. Rye, oats, and potatoes are the common crops. Coal is raised for domestic purposes, and some manufactures are carried on, though on a small scale.

**Tyrone,** p.-v. and tp., Kent co., Mich. P. 730.

**Tyrone,** p.-v. and tp., Livingston co., Mich. P. 1222.

**Tyrone,** tp., Le Sueur co., Minn. P. 830.

**Tyrone,** p.-v. and tp., Schuyler co., N. Y. P. 1993.

**Tyrone,** tp., Adams co., Pa. P. 1009.

**Tyrone,** p.-b. and tp., Blair co., Pa., on Pennsylvania R. R., 131 miles E. of Pittsburg, has 7 churches, good schools, 2 newspapers, 3 banks, 6 hotels, 1 flouring and 2 planing-mills, railroad repair-shops, 1 furniture and several small factories, and a bloom forge. P. of b. 1840; of tp. 1006. C. S. W. JONES, "HERALD."

**Tyrone,** tp., Fayette co., Pa. P. 2276.

**Tyrone,** tp., Perry co., Pa. P. 1287.

**Tyrone** (HUGH **O'Neill**), EARL OF, b. in Ireland about 1550; commanded a troop of horse in the service of Queen Elizabeth in the war against the rebel earl of Desmond 1579–83; received from the Irish Parliament in 1587 the title of earl of Tyrone, which had been held by his father, Con O'Neill, in the time of Henry VIII.; obtained by a personal visit to the English court the restitution to himself, as their heir, of the confiscated estates of the rebel Shan O'Neill (d. 1567), who had virtually assumed the title of king of Ulster; married a sister of Sir Henry Bagnal, marshal of Ireland, 1588; maintained a correspondence with the English government while conspiring against it; formed an alliance with Red Hugh, the chief of the O'Donnells, 1590; assumed the title of "The O'Neill;" offered the sovereignty of Ireland to Philip II. of Spain; defeated Sir John Norris, and was proclaimed a traitor 1597; defeated and killed Marshal Bagnal at Blackwater Aug. 14, 1598; concluded a truce with the earl of Essex Sept. 8, 1599; retreated from Munster before Lord Deputy Mountjoy 1600; successfully invoked the aid of Spain, but was

defeated with his Spanish allies in an attack upon Kinsale Dec., 1601, and took refuge in a stronghold near Lough Erne; surrendered to Mountjoy; renounced the title of "The O'Neill;" received a pardon 1602; presented himself to King James, and was confirmed in his earldom and estates 1603; was suspected in 1607 of being engaged in a new conspiracy; proceeded to Brussels to invoke the protection of the Spanish government, and spent the remainder of his life in obscurity, poverty, and blindness, a pensioner of the king of Spain and of the pope. D. at Rome in 1616.

**Tyrongia,** tp., Cross co., Ark. P. 80.

**Ty'rosine** ($C_9H,NO_3$), a nitrogenous substance formed by the decomposition of albumenoid bodies by acids, alkalies, and putrefaction, was first obtained by decomposing caseine with fusing potash. It can also be prepared by heating water with sulphuric acid. It occurs ready formed in the animal organism (in the spleen, the pancreas, and the urine; sometimes in the liver and bile of diseased persons). Tyrosine crystallizes from an aqueous solution in slender silky needles, arranged in a stellate form. It dissolves in boiling water and in alcohol, but is insoluble in ether. J. P. BATTERSHALL.

**Tyr'rell,** county of E. North Carolina, bordering upon Albemarle Sound; surface level, much of it being occupied by forests of pine, cypress, and red cedar, which furnish tar, turpentine, shingles, and staves, the production of which is the principal branch of industry. Staples, forest products, Indian corn, sweet potatoes, and cotton. Cap. Columbia. Area, about 350 sq. m. P. 4173.

**Tyrrhenia.** See ETRURIA.

**Tyrrhe'nian Sea, The,** the ancient *Mare Tyrrhenum*, is that part of the Mediterranean which lies between the Italian mainland and the islands of Sardinia, Corsica, and Sicily.

**Tyrtæ'us,** according to an old tradition, a lame schoolmaster of Attica and of mean extraction. When, on the outbreak of the Second Messenian war, the Lacedæmonians sent to Athens for a leader in obedience to an oracle, the Athenians, moved by fear and jealousy, sent them Tyrtæus as the most unfit person they could find for the position. Tyrtæus, however, was possessed of eminent lyrical power, and by his songs he so excited the Lacedæmonians that they finally came victorious out of the war (668 B. C.). The fragments still extant of these songs have been collected and edited in Schneidewin's *Delectus Poesis Græcæ Elegiacæ* (1838) and in Bergk's *Poetæ Lyrici Græci* (1866); also by A. Lami (Leghorn, 1874). There is a translation into English verse by Polwhele (1786–92).

**Tyrwhitt** (ter'it), (THOMAS), F. R. S., b. in London, England, Mar. 29, 1730; educated at Eton; graduated at Queen's College, Oxford, 1750; became fellow of Merton and under-secretary of state in the war department 1756, and clerk to the House of Commons 1762; resigned the latter post 1768; devoted himself to literary criticism, and was appointed one of the curators of the British Museum 1784. D. in London Aug. 15, 1786. Among his works were—*Observations on Some Passages of Shakespeare* (1766), an edition of *Chaucer* (1773), critical dissertations on Babrius, Euripides, and Strabo, and editions of the writings of Orpheus and Isæus, and of Aristotle's *Poetics* (posthumous, 1794). He will be best remembered, however, as the original editor of Rowley's *Poems*, to which he furnished a preface and glossary, and subsequently added an appendix, showing them to have been written by Chatterton.

**Ty'son,** tp., Stanley co., N. C. P. 880.

**Tyson** (JAMES), M. D., b. in Philadelphia Oct. 26, 1841; was educated at Haverford College, where he graduated as A. M. in 1860, and in the medical department of the University of Pennsylvania, where he graduated as M. D. in 1863; is hospital lecturer on pathological anatomy and histology in the University of Pennsylvania, professor of physiology and histology in the Pennsylvania College of Dental Surgery, and one of the visiting physicians and pathologists to the Philadelphia Hospital. He has published many papers in medical journals, and *The Cell-Doctrine, its History and Present State* (1870), *Introduction to Practical Histology* (1873), and *Practical Examination of Urine* (1875).

**Tyson** (JOB ROBERTS), LL.D., b. at Philadelphia, Pa., Feb. 12, 1804; became a lawyer in his native city; served in the city councils and in the State legislature; was a member of Congress 1855–56; possessed literary and artistic accomplishments; was instrumental in procuring the publication of the archives of Pennsylvania, and projected a history of the American colonies, which he was prevented from prosecuting by his death at Woodlawn Hall, Pa., June 27, 1858. Besides miscellaneous addresses, reports, and contributions on commercial or literary topics to various periodicals, he was author of *An Essay on the Penal Laws of Pennsylvania* (1827), *A Discourse on the Integrity of the Legal Character* (1839), *On the Colonial History of the Eastern and some of the Southern States* (1842), *Social and Intellectual State of the Colony of Pennsylvania prior to 1743* (1843), and a *Discourse on the 200th Anniversary of the Birth of William Penn* (1844).

**Tyt'ler** (ALEXANDER FRASER), LORD WOODHOUSELEE, son of William, b. at Edinburgh, Scotland, Oct. 15, 1747; educated at Kensington and at the High School and University of Edinburgh; was called to the bar 1770; became in 1780 conjunct professor, and in 1786 sole professor, of civil history and Greek and Roman antiquities at the University of Edinburgh; became judge-advocate of Scotland 1790, lord of session, with the title of Woodhouselee, 1802, and a lord of justiciary 1811. D. at Edinburgh Jan. 5, 1813. Author, besides many other works, of *Essay on the Principles of Translation* (1791; 3d ed. 1813), *The Elements of General History, Ancient and Modern* (2 vols., 1801), and *Lives* of Lord Kames (2 vols., 1807) and of Petrarch (1810).

**Tytler** (PATRICK FRASER), son of Alexander Fraser, b. in Edinburgh, Scotland, Aug. 30, 1791; educated at the High School and University of Edinburgh; studied law; was admitted into the faculty of advocates 1813; accompanied to the Continent Mr. (afterward Sir) Archibald Alison, for whom he wrote several chapters of his *Travels in France* (1816); held for some years the office of king's counsel in exchequer, but ultimately devoted himself to biographical and historical researches, chiefly among the MSS. of the state paper offices, and received from 1844 a pension of £200 from the Crown. D. at Great Malvern, England, Dec. 24, 1849. Author of a *Life of James Crichton of Cluny, commonly called the Admirable Crichton, with an Appendix of Original Papers* (1819), *An Account of the Life and Writings of Sir Thomas Craig of Riccarton* (1823), *Life of John Wicklyff, with an Appendix and List of his Works* (1826), *Lives of Scottish Worthies* (3 vols., 1832–33); in Murray's "Family Library," *Life of Sir Walter Raleigh* (1833), *Life of King Henry the Eighth* (1837), *An Historical View of the Progress of Discovery on the Northern Coasts of America, etc.* (1832), the two latter works forming part of Dr. Lardner's "Cabinet Library;" and a *History of Scotland from 1149 to the Union of the Crowns in 1603* (Edinburgh, 9 vols., 1828–43; 5th ed., 10 vols., 1866), a work undertaken at the request of Sir Walter Scott, and pronounced by Earl Stanhope and other critics "the standard history of Scotland." Like his grandfather, he was a staunch advocate of Mary Queen of Scots. He edited a series of original letters under the title of *England under the Reigns of Edward VI. and Mary, with the Contemporary History of Europe* (London, 2 vols., 1839); contributed the article "Scotland" to the *Encyclopædia Britannica* (7th ed.); wrote songs and essays for the magazines. A memoir, entitled *The Portrait of a Christian Gentleman*, by Rev. John W. Burgon, appeared in 1859.

**Tytler** (WILLIAM), b. in Edinburgh, Scotland, Oct. 12, 1711; educated at the University of Edinburgh; became a writer to the signet 1744, and practised law with great success until his death, at Edinburgh Sept. 12, 1792. Author of *An Historical and Critical Enquiry into the Evidence produced by the Earls of Murray and Morton against Mary Queen of Scots* (1760), which ranks as one of the ablest of the numerous defences of Mary from the charge of being accessory to the murder of Darnley, a crime imputed in this work to Murray and Morton.

**Tywap'pity,** tp., Mississippi co., Mo. P. 1778.

**Tzana,** lake of Abyssinia. See DEMBEA.

**Tzar.** See CZAR.

**Tzarskoye-Selo.** See TSARSKOE-SELO.

**Tzetz'es** (JOHANNES), a Byzantine author of the latter half of the twelfth century. His poems, *Iliaca* (edited by Jacobs, 1793, and Bekker, 1816) and *Chiliades* (edited by Kiessling, 1826), are not of any great interest, but his commentaries on Homer, Hesiod, Aristophanes, and other ancient poets are valuable on account of the extensive learning they evince.

**Tzschir'ner** (HEINRICH GOTTLIEB), b. at Mittweida, Saxony, Nov. 14, 1778; studied theology at Leipsic; was appointed professor at Wittenberg in 1805 and at Leipsic in 1809, and was elected superintendent at Leipsic in 1815, and prebendary of Meissen in 1818. D. Feb. 17, 1828. He acquired great reputation as a preacher and by the firm and intelligent opposition he offered to the Roman Catholic reaction all around him. His most remarkable writings are *Der Uebertritt des Herrn von Haller zur katholischen Kirche* (1821), *Protestantismus und Katholicismus aus dem Standpunkte der Politik betrachtet* (1822), *Das Reactionssystem* (1824), *Briefe eines Deutschen an die Herrn Chateaubriand, de Lamennais, etc.* (published after his death, in 1828, by Krug).

# U.

**U,** a letter long used interchangeably with V, but at present *u* always represents a vowel, and *v* a consonant. The vowel *u* has four principal sounds in English: (1) the sound of *u* in *tube,* which is nearly, but not quite, as if the word were spelled ty*oob,* the *y* being slightly sounded; (2) the sound as heard in *rule,* very nearly like that of *oo,* its historic sound in English, and almost universal power in other languages; (3) the sound heard in *bull;* (4) that heard in *burn* or in *tub,* but in the latter word it has a shorter sound than in the former. Anglo-Saxon *u* (oo) often became English *ou,* as in *grund,* "ground," *hund,* "hound;" but *vund* (woond) remains in "wound," and *vonder* (*v* as *w*) has become "wonder." U in chemistry is the symbol of uranium.

**Ube'da,** town of Spain, province of Jaen, contains many splendid edifices, remnants of its former splendor, but is now generally decaying. It has a brisk trade in grain, wine, oil, fruits, and horses from the very fertile adjacent districts. P. 16,040.

**Ubicini'** (Jean Henri Abdolonyme), b. at Issoudun, department of Indre, France, Oct. 20, 1818; was educated in the lyceum of Versailles; taught rhetoric for several years; went in 1846 to Italy and the Orient; visited Greece, Turkey, and the principalities of the Danube; participated in the revolution at Bucharest in 1848, and acted for some time as secretary to the provisory government; returned subsequently to France; settled in Paris, and engaged in literature. His principal works are *Lettres sur la Turquie* (2 vols., 1847–51), *La Question d'Orient devant l'Europe* (1854), *La Turquie actuelle* (1855), *La Question des Principautés danubiennes* (1858), *Études historiques sur les Populations chrétiennes de la Turquie d'Europe* (1867).

**Ucaya'le,** or **Ucayali,** river of South America, is formed in Peru by the junction of two smaller streams rising in the Andes and passing by Lima and Cuzco. It runs N., and after a course of about 1100 miles joins the Amazon in lat. 4° 40′ S., lon. 73° 40′ W. It is navigable for steamboats from its mouth to the neighborhood of Lima, and has attracted much attention of late as a means of connecting Peru with the Atlantic. (See Amazon.)

**U'chee,** p.-v. and tp., Russell co., Ala. P. 2238.

**U'chee An'na,** tp., Walton co., Fla. P. 922.

**U'chees,** a tribe of American Indians of the Creek family, originally resided on both sides of Savannah River in South Carolina and Georgia; removed to the Chattahoochee at the time of the Yemassee war, and emigrated with the Creeks to the Indian Territory, since which time they have formed part of the Creek confederacy. They are industrious, peaceable, and well disposed; have made some progress in civilization, and retain their language, which is harsher and more guttural than the tongues of their neighbors. Their number is unknown, but does not exceed a very few hundreds.

**U'dall,** or **Woodall** (Nicholas), b. in Hampshire, England, in 1504; graduated at Corpus Christi College, Oxford, 1524, where he became a fellow; wrote verses for the City of London pageant at the coronation of Queen Anne Boleyn, May, 1533; took orders in the Church of England; was a zealous advocate of the Reformation; was master of Eton School 1534–43, where he was noted as a severe disciplinarian; published *Flovres for Latin Spekynge, Selected and Gathered out of Terence, and the same translated into Englysshe* (1533); wrote several Latin and English plays to be performed by his pupils, one of which, *Ralph Roister Doister,* probably produced as early as 1540, though not printed until 1565, is memorable as the earliest English comedy known to be extant. Udall was dismissed from the mastership of Eton in 1543 in consequence of having removed from the chapel some silver images—a proceeding for which he was charged with robbery by his Roman Catholic adversaries; was vicar of Braintree, Essex, 1537–44; entered the service of Queen Katharine Parr; obtained on the accession of Edward VI. the rectory of Calborne in the Isle of Wight; edited, with a dedication to the queen-dowager Katharine, *The First Tome or Volume of the Paraphrase of Erasmus upon the New Testament* (1549), translated partly by himself, partly by the Princess Mary, afterward queen, whose tutor he seems to have been; became canon of Windsor 1551–56, and head-master of Westminster School 1555, and wrote for the queen's entertainment various *Dialogues and Interludes.* D. at Windsor in Dec., 1556. He was author of several schoolbooks and of some poems, and translated Latin works of Peter Martyr and others. No copy of his *Ralph Roister Doister* was known to exist until 1818, when it was discovered and reprinted by Rev. Mr. Briggs; was again issued, with notes, by Mr. F. Marshall (1821), by Thomas White in his *Old English Drama* (1830), by William Durrant Cooper (1847), who edited it for the Shakspeare Society, prefixing an elaborate *Life* of Udall, and by Arber in his series of *English Reprints* (1869). It was identified as the earliest English comedy (a distinction previously accorded to *Gammer Gurton's Needle*) by J. Payne Collier in his *History of English Dramatic Poetry* (1831), by means of a quotation from it found in the *Arte of Logique* (1551) of Sir Thomas Wilson. The name of Udall also occurs under the forms *Owdall, Dowdall, Woddall, Uvedale,* and *Vuedale.*

Porter C. Bliss.

**Udell,** tp., Appanoose co., Ia. P. 907.

**U'dine** [*Utinum*], town of Northern Italy, province of same name, at the foot of the Alps, about 360 feet above the sea and 25 miles from the Adriatic. It is a walled town, nearly circular, handsomely built, with commodious streets and large squares flanked with fine porticoes, and many of its edifices, both public and private, recall Venice very strongly. The castle, near the centre of the city, on the elevation from which Attila is said to have witnessed the burning of the rich and proud Aquileia, is now used for military purposes. It was designed by G. Fontana, and occupies the site of a still earlier castle which was destroyed by an earthquake. The municipal palace was a very fine Gothic building, resembling the ducal palace of Venice and very rich in frescoes, but a recent fire has almost destroyed its contents and greatly damaged the edifice itself. The episcopal palace has frescoes by Giovanni da Udine. The Metropolitana (1236), injudiciously restored, except the W. front, in 1706, contains some admirable pictures, and there are many other churches interesting both for their architecture and their pictorial decorations. The Bartoliniana Library is well worthy the attention of the scholar, and that of the Casa dei Florio is also extremely rich. Udine first appears historically in the ninth century; was governed for a time by the patriarchs of Aquileia; was long the chief city of the duchy of Friuli, and formed an important portion of the Venetian republic when the latter fell. It is now an active centre of industry and traffic. P. 29,630.

**Udol'pho,** p.-v. and tp., Mower co., Minn. P. 380.

**Ue'berweg** (Friedrich), b. at Solingen, Rhenish Prussia, Jan. 22, 1826; studied at Göttingen and Berlin, and was appointed professor of philosophy in 1862 at Königsberg, where he d. June 7, 1871. His principal works are *System der Logik und Geschichte der logischen Lehren* (1857; translated into English by Thomas Lindsay, 1871); *Grundriss der Geschichte der Philosophie von Thales bis auf die Gegenwart* (3 vols., Berlin, 1862–66), translated into English by George S. Morris, with additions by Prof. Botta and Pres. Porter of Yale College; *History of Philosophy* (New York and London, 1874, 2 vols.), which is used as a textbook in Oxford and in several American colleges; and Berkeley's *Principles of Human Knowledge,* with notes (1869), translated by C. P. Krauth (1874).

**U'fa,** government of Eastern Russia, comprises an area of 50,742 sq. m., with 1,297,577 inhabitants. It extends along the rivers Ufa and Belaia, which flow to the Ural, and is mostly covered by branches of the Ural Mountains. The ground is to a large extent covered with forests, and only a comparatively small part of it is under tillage. The climate is cold but healthy. Mining is the main branch of industry; gold, lead, copper, and especially iron, are raised in large quantities and of superior quality. The transit-trade between Europe and Asia, or rather between Nizhnee-Novgorod and Bokhara, is important. Cap. Ufa.

**Ufa,** town of European Russia, capital of the government of the same name, on the Ufa at its influx in the Belaia, has several good educational institutions, some manufactures, and an active trade. P. 12,900.

**Uglitch',** town of Russia, government of Yaroslav, on the Volga, contains many fine buildings, among which are

24 churches, and has extensive tanneries and some other manufactories. P. 13,126.

**U'grians, The,** a Finnish tribe, inhabiting parts of the government of Tobolsk, Siberia, speak a primitive Finnic dialect, much mixed, however, with Tartaric elements, and occupy a very low stage of civilization. They are nominally Christians, but their religion is really a mixture of Christianity, Mohammedanism, and Shamanism. They are nomads, and hunting and fishing are their chief occupations. ✓

**Uhar'rie,** tp., Montgomery co., N. C. P. 480.

**Uh'lan,** or **Hulan** [Tartar for "brave" or "youthful"], a soldier of certain corps of light cavalry. Uhlans are employed in the Russian, Austro-Hungarian, and German armies. They were primarily recruited from the Turanian or Tartaric peoples; but at present the name is not indicative of any nationality or of any marked peculiarity of discipline, drill, or equipment.

**Uh'land** (JOHANN LUDWIG), b. at Tübingen Apr. 26, 1787; studied law at the university of his native city; practised in Stuttgart 1812–14; became a member of the Würtemberg assembly in 1819; was appointed professor of the German language and literature at Tübingen in 1830; sat in the national assembly of Frankfort in 1848. D. at Tübingen Nov. 13, 1862. His first poems were published in magazines in 1806; the first collection appeared in 1815, and this volume, subsequently enlarged, had in 1868 reached its 52d ed. His two dramas, *Herzog Ernst von Schwaben* (1817) and *Ludwig der Bayer* (1819), are interesting, but his ballads and lyrical poems, enriching the German literature with a new type, a new model, made the poet the head of a particular school, the so-called Suabian school. Of great value also are his scientific researches: *Ueber das altfranzösische Epos* (1812), *Ueber Walther von der Vogelweide* (1822), *Ueber den Mythus der nordischen Sagenlehre vom Thor* (1836), and his excellent collection of *Alte hoch- und niederdeutscher Volkslieder* (2 vols., 1844–45). It was, however, not so much his scientific labors which turned away his productivity from poetry as his very active participation in politics after 1819, in which field he played a conspicuous and noble part. Most of his poems have been translated into English, some by Longfellow, others by Alexander Platt (1848), by W. W. Skeat (1864), and by W. C. Sanders (1869). Biographies and reviews of him have been written by Pfizer (1837), Notter (1863), Jahn (1863), Pfeiffer (1863), Mayer (2 vols., 1867). See also *Ludwig Uhland, eine Gabe für Freunde, zum 26. April, 1865,* by Emilie Uhland.

**Uh'ricksville,** p.-v., Mill tp., Tuscarawas co., O. P. 1541.

**Uigurs.** See TURKS.

**Uintah,** county of W. Wyoming, occupying the whole of the W. side of the Territory, having Montana on the N., Utah on the S., and Idaho on the W.; is crossed by the Rocky Mountains and minor ranges, and contains the sources of rivers which finally find their way through the Columbia into the Pacific Ocean, through the Colorado into the Gulf of California, and through the Missouri into the Gulf of Mexico. In the extreme N. W. corner is Yellowstone Lake and the romantic region set apart for the Yellowstone National Park, comprising more than 3500 sq. m. Cap. Evanston. Area, about 13,500 sq. m. P. 856.

**Uintah** (or **Uinta**) **Mountains.** See ROCKY MOUNTAINS, by MAJOR J. W. POWELL.

**Uist, North** and **South,** two islands of the Outer Hebrides, belonging to Scotland. North Uist is 17 miles long and from 3 to 10 miles broad, with 3034 inhabitants. South Uist is 20 miles long and 7 miles broad, with 3406 inhabitants. Both islands are high and rocky, and ill suited for agriculture; fishing is the principal occupation of the inhabitants, who are generally poor.

**U'jhely-Satoral'ja,** town of Hungary, celebrated for the excellent wine which is cultivated and the fine marble which is quarried in its vicinity. P. 7200.

**Uji'ji,** a place in Africa, consisting of a number of mud huts, and situated on the shore of Lake Tanganyika, in a district of the same name, in lat. 4° 58′ 3″ S., lon. 30° 4′ 30″ E., became noted as the point where Stanley met Livingstone Nov. 10, 1871.

**Ukase'** [Russ. *ookáz,* from *kusatj,* to "speak"], an order, legislative or administrative, issued by the Russian autocrat or his senate. Both have the force of laws, and as such are duly collected and codified.

**Ukiah,** p.-v. and tp., cap. of Mendocino co., Cal., 100 miles N. W. of Sacramento, has 5 churches, 1 academy, 2 banks, 1 brewery, 2 hotels, 2 newspapers, and a mill. The surrounding country is picturesque, and the climate very healthy. P. 966. BELLE LYNCH, ED. "DISPATCH."

**U'kraine** (the "frontier-land"), the name commonly given to that easternmost portion of Poland which, extending on both sides of the Dnieper along its middle course, and conquered by the Poles in 1320, formed the frontier of the Polish empire against the Tartars; it hardly ever signified a political division with precisely defined boundaries, but it soon became an apple of contention between Russia and Poland. In 1654 ten Cossack tribes settled on the eastern bank of the Dnieper fell off from the Polish crown, and surrendered themselves to Russian authority; and by the Treaty of Andrussow (1667), and finally by the Peace of Grzymultowsk (1686), this territory was ceded by the Poles and annexed to Russia under the name of Russian Ukraine, or Little Russia. The rest of the country, situated on the western bank of the Dnieper, remained with Poland, under the name of Polish Ukraine, until the second division of Poland, when Russia took the whole and divided it up into various governments.

**Ulcer and Ulceration** [Gr. ἕλκος; Lat. *ulcus*], the process of molecular death or disintegration occurring on the surfaces of the body at points where nutrition is low in consequence of local irritation or injury or defective circulation and bad states of the blood. Localized inflammation is often the determining cause of an ulcer, by locally occluding the capillaries and arresting or weakening local circulation and nutrition; thus, the canker is often an ulcer in the mouth due to stomatitis; the ulcerated tonsil has been previously inflamed, either acute or chronic. Sluggish venous circulation often causes ulcers, as ulcers upon the legs from varicose veins or weak circulation of the aged; ulcers upon hæmorrhoids, or varicosity of the anus. When wounds have failed to heal promptly, their border and surface may take on the ulcerative process, and become bathed with a weak watery serum containing black granular detritus. The presence of foreign substances, as a splinter in the flesh or dead bone in a limb, creates secondary ulcers. Pressure and constant irritation are causes, as upon the feet from ill-fitting boots, and bed-sores from long lying. Lowered nerve-tone and depressed temperature favor ulceration, the paralyzed limb easily ulcerating. Ulcers are classed as—(1) Simple or healthy ulcers, if the term is not a misnomer—that is, ulcers having a healthful tendency to heal. (2) Weak ulcers, lacking the florid color and healing tendency of the first class; they often result from the debilitated health of the subject. (3) Indolent ulcers; often all recuperative power is lost; usually the border is thickened and elevated, and may be indurated. (4) Irritable ulcers are painful, and may bleed upon touch. (5) Inflamed ulcers. Ulcers are liable to become inflamed upon slight local irritation or derangement of the blood, use of alcohol, and exposure to cold. (6) Sloughing ulcers, conditions often following the inflamed ulcer or very low states of health. (7) Serpiginous ulcers, when some specific vice of the blood gives it a tendency to spread, and it pursues a tortuous, serpentine course. (8) Specific ulcers, with undermined edges, due to primary deposits beneath the skin, which soften and discharge upon the surface.

The simple ulcer needs simply to be kept clean and protected by any bland cooling lotion or ointment; the weak and indolent requires stimulating applications; the indurated often requires the incision of its thickened borders or removal by strapping with plaster; the inflamed ulcer calls for cold and evaporating lotions—the sloughing for antiseptics. In all forms the diet must be rich, the appetite maintained by tonics, and the blood enriched by iron and often alteratives.
E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**U'leaborg,** town of Russia, province of Finland, at the entrance of the Uleå into the Gulf of Bothnia, was founded in 1610, and almost entirely destroyed by fire in 1822, but was rapidly rebuilt, and carries on an active trade in pitch, tar, timber, and salt fish. P. 7602.

**Ule'ma** [Arab., "wise"], in Mohammedan countries, a judge of the law and of religion. Strictly, the name is plural, including, as a class term, all muftis, mollahs, cadis, and indeed all who are learned in religion and the law. These are designated, in a body, the ulema.

**Ulex.** See FURZE.

**Ul'fila,** or **Wulfila** [that is, "Little Wolf;" grecized, *Ulphilas*], b. in 313 among the pagan Visigoths, at that time settled on the northern bank of the Danube in the Dacian territories, and descended from a Christian family which half a century earlier, in the time of Valerianus and Gallienus, had been carried away by the Goths as captives from the village of Sadagolthina, near the city of Parnassus in Cappadocia. Thus he was educated in Christianity, and learned both the Gothic and the Greek language. In 343 he was consecrated bishop among the Goths, and so great was his success in converting them to Christianity that their chief, Athanaric, became alarmed and instituted persecutions. In consequence, Ulfila left

the Goths in 350, accompanied by a large congregation of converts, and received permission of the East Roman emperor, Constantius, to settle in the neighborhood of Nicopolis, at the foot of Mount Hæmus in Lower Mœsia. Here the Gothic colony flourished, and was much increased by immigration from the mother-tribe, for the work begun among the Goths by Ulfila was not stopped by Athanaric's persecution. New and still severer persecutions occurred, which show that the christianization of the people was still going on, and a century later the whole nation, not only the Visigoths, but also the Ostrogoths, appears to have adopted Christianity. This was chiefly the result of Ulfila's exertions. He was the apostle of the Goths. They adopted his creed, Arianism; they drew their spiritual nourishment from his translation of the Bible; and in all their numerous conflicts with the Roman emperors he acted as a mediator. It was with regard to the Goths settled within the boundaries of the East Roman empire that the emperor Theodosius convoked the Council of Constantinople (383) for the purpose of establishing a reconciliation between Arianism and the Nicene creed. The plan failed, however; the council decided in favor of the Nicene view, and Ulfila was declared a heretic. He was present at the council, and died in Constantinople in the same year. The few particulars of his life that have come down to us are due to one of his disciples, Auxentius, bishop of Dorostorus (Silistria); they are generally corroborated by the stray notices found in Philostorgius, Basilius, Socrates, and other writers. (See Waitz, *Ueber das Leben und die Lehre des Ulfilas* (1840), and Bessel, *Ueber das Leben des Ulfilas und die Bekehrung der Gothen zum Christenthum* (1860).) According to Auxentius, Ulfila was a prolific writer, but his principal work, and the only one which has come down to us, is his translation of the Bible into Gothic. For the Old Testament he used the Septuagint, for the New some Greek manuscript not known now; and for the transcribing of his work he had to invent a new alphabet, which he ingeniously composed of Gothic runes and Greek letters. This translation, which was well known in the Christian world between the fourth and the eighth century, and is frequently mentioned by Christian authors of that period, accompanied the Goths in all their wanderings through Italy, Gaul, and Spain, but in the ninth century it disappeared, together with the language and national existence of the people; and it remained unknown and forgotten till the latter part of the sixteenth century, when Arnold Mercator discovered, in the abbey of Werden, a fragment of it containing the four Gospels. It was the so-called *Codex Argenteus*, written with silver letters on purple parchment. (See PRINTING.) Somehow, it was transferred from Werden to Prague, and thence the Swedes carried it as spoil in 1648 to Upsal, where it is still preserved, and where it was published in an exact reprint by Andreas Uppström (1854–57). In 1818 another important fragment of the work, containing nearly the whole of the Epistles of St. Paul, was discovered on some palimpsests by Cardinal Mai and Count Castiglioni in the Lombardian monastery of Bobbio, and published at Milan (1819–39). Thus, the larger portion of the New Testament has been restored, but of the Old Testament only a few passages from Ezra and Nehemiah have come to light. The question of the worth of this work, considered as a translation of the Bible, has been thrown entirely in the background by the circumstance that the work is the only, or nearly the only, existing remnant of the Gothic language. On the Bobbio palimpsests some fragments were discovered of a paraphrase of the Gospels, probably from the sixth century; they were published by Massman, *Skeireins aivaggeljons thairh Johannen* (Munich, 1834). Some few other scraps have been found, and collected editions of all that remains of Gothic literature, accompanied by grammars and dictionaries, have been given by Von der Gabelentz and Löbe (2 vols., Leipsic, 1843–46) and by Stamm (Paderborn, 1858), the 5th ed. of which appeared in 1872, revised by Moritz Heine. But, besides being the only remnant of any importance of the Gothic language, Ulfila's translation of the Bible is the oldest monument of any of the Teutonic languages, and is consequently a document of paramount linguistic importance. It shows that the Gothic language, although closely related to the Icelandic, Anglo-Saxon, old High German, etc., occupied an entirely independent position among the other branches of the Teutonic family; and by this, its independent development, the Gothic language has been enabled to throw light on many peculiar features in the Teutonic languages. CLEMENS PETERSEN.

**Uliasutai,** or **Uljassutai,** an important commercial station of Mongolia, in lat. 48° 22′ N., lon. 97° E., on the line between the Russian frontier and Si-Ngan-Foo, capital of the Chinese province of Shen See, and principal dépôt for all goods destined for the markets of Central Asia. It consists of a civil and a military quarter, the latter occupied by the Chinese garrison, the former by inhabitants who are partly Chinese and partly Mongolian. The Mongolian nomads who visit the city during the time of the fair live in tents. Since 1868 it has repeatedly been visited by Russians, but it has not been possible to establish commercial connections, as the Dungan rebels from Urumtsi have occupied the city several times. EMIL SCHLAGINTWEIT.

**Ul'lin,** p.-v., Pulaski co., Ill.

**Ull'mann** (KARL), b. at Epfenbach, Baden, Mar. 15, 1796; studied theology at Heidelberg and Tübingen; lived in friendly intercourse with Hegel and Daub; afterward with Schleiermacher and Neander, was appointed professor at Heidelberg in 1821; founded in 1828, together with Umbreit, the *Theologische Studien und Kritiken,* which is still the principal representative of that school of German theology which believes in, and tries to work out, a complete reconciliation between Christianity and the modern culture; went to Halle in 1829, but returned to Heidelberg in 1836; was made president of the chief ecclesiastical council of Baden in 1856, but resigned this office in 1860 and retired into private life. D. at Karlsruhe Jan. 12, 1865. His principal writings are *Gregor von Nazianz* (1825), *Historisch oder mythisch?* directed against Strauss (1838), *The Worship of Genius* (1840; translated into English 1846), *Reformers before the Reformation* (2 vols., 1841; translated into English by Robert Menzies, 1855), *Apologetic View of the Sinless Character of Jesus* (1841; translated into English in the same year and afterward again from the sixth German edition), *Ueber das Wesen des Christenthums* (1845).

**Ullo'a, de** (ANTONIO), F. R. S., b. at Seville, Spain, Jan. 12, 1716; educated in the naval service; became lieutenant of the royal marine guards 1735, in which year he was sent to South America with Don Jorge Juan and a commission of the French Academy to measure a degree of the meridian in Peru; spent ten years in South America, making extended journeys, and being employed to fortify the Pacific coast against an anticipated attack by Lord Anson's expedition; embarked for Spain Oct., 1744; was captured by the British and carried a prisoner to London; obtained his liberty through the intervention of several scientific gentlemen; was elected a fellow of the Royal Society, and communicated to it several papers embodying results of his observations in South America; aided his companion Juan in the preparation of a narrative of their travels (Madrid, 4 vols., 1748), which appeared in French, German, and English translations, the latter under the title *A Voyage to South America* (2 vols., 1772; 4th ed. 1806); was instrumental in establishing the royal woollen manufactories and in the reform of the colleges of history and surgery, and superintended the completion of the basins of Ferrol and Cartagena; made a second visit to South America 1755; became the first Spanish governor of Louisiana 1766, but was unable to establish his government, and was soon driven away by the riots of the French population of New Orleans; published *Entretenimientos Fisico-historicos sobre la America Meridional* (1772) and a volume of *Observations of a Solar Eclipse made at Sea* (1778); rose to be lieutenant-general in the naval service; was entrusted in 1779 with the command of a squadron destined to capture an English merchant fleet and to rendezvous at Havana for an attack upon the British settlements in Florida, but, being absorbed in astronomical investigations, forgot to open his sealed orders, and returned after two months without having effected anything; was court-martialled in 1780 and acquitted, but was never again employed in active naval service. D. in the isle of Leon, near Cadiz, July 3, 1795.

**Ulloa, de** (FRANCISCO), b. in Spain about the beginning of the sixteenth century; went to New Spain shortly after its conquest; was a lieutenant of Cortez in his explorations of the Pacific coast, and commanded the expedition which in 1539–40 explored the Gulf of California, to which he gave the name of "Sea of Cortez." On his return he was assassinated in Jalisco. A narrative of the expedition by Preciado, one of the officers, may be found in Ramusio and Birney.

**Ulm,** town of Germany, kingdom of Würtemberg, at the influx of the Blau into the Danube, which here becomes navigable, is old-fashioned and queer, but curious and interesting, like a ghost of the Middle Ages. Its cathedral, begun in 1377, but never completed, is a magnificent edifice in Gothic style, 485 feet long, 200 feet broad, and 141 feet high. Ulm is fortified, and contains a great variety of manufactures, of which no single branch, however, is extensively developed. On Oct. 17, 1805, Gen. Mack, at the head of an Austrian army of 30,000 men, here capitulated to Napoleon. P. 26,290.

**Ulma'ceæ** [Lat. *Ulmus,* one of the genera], a natural order of exogenous plants, either trees or shrubs, having

rough alternate leaves, each leaf with a pair of deciduous stipules. The flowers are small and in loose clusters. The perianth is small, membranous, bell-shaped, irregular; the stamens equal in number to the lobes of the perianth, and inserted into their base; the ovary superior. The fruit is 1–2-celled, nut-like, or compressed and winged. There are about 60 known species, natives of temperate parts of the northern hemisphere. (See Elm and Nettle Tree.)

**Ulmic Acid.** See Humus, by Prof. H. Wurtz, A. M.

**Ulmine.** See Humus, by Prof. H. Wurtz, A. M.

**Ulna.** See Arm.

**Ulphilas.** See Ulfila.

**Ulpia'nus** (Domitius), b. at Tyre about 170 A. D.; entered into public life in Rome under Septimus Severus; obtained the greatest reputation as a jurist, and held various judicial offices under Septimius Severus and Caracalla; lost his influence and his offices under Elagabalus, but came again into power after the accession of Alexander Severus, who made him *magister scriniorum*, *præfectus annonæ*, and *præfectus prætorio*, but he was murdered by the soldiers in 228 before the eyes of the emperor. Of his writings, *Ad Edictum*, *Ad Sabinum*, *Ad Leges Juliam et Papiam*, only fragments exist, but about one-third of the *Digest* of Julian consists of excerpts from his books. The *Tituli ex Corpore Ulpiani*, generally called *Fragmenta Ulpiani*, were edited by Hugo (1834) and by Böcking (1845).

**Ulri'ci** (Hermann), b. at Pförten, Prussian province of Brandenburg, Mar. 23, 1806; studied law at Halle and Berlin, and entered on a juridical career, but devoted himself after 1829 exclusively to the study of philosophy, and was appointed professor of philosophy at the University of Halle in 1834. He wrote—*Ueber Princip und Methode der Hegelschen Philosophie* (1841), *Grundprincip der Philosophie* (2 vols., 1845–46), *System der Logik* (1852), *Glauben und Wissen* (1858), *Gott und die Natur* (1862), *Gott und der Mensch* (1866), *Der Philosoph Strauss* (1873), translated by C. P. Krauth (1874). Of his work, *Ueber Shakespeare's dramatische Kunst* (1839; twice reprinted in Germany, and translated into English by A. J. W. Morrison, London, 1846), the historical part contains much which is interesting and valuable.

**Ul'ster,** the northernmost of the four provinces into which Ireland is divided, borders N. and W. on the Atlantic and E. on the North Channel and the Irish Sea. Area, about 1150 sq. m. P. 2,389,263 in 1841, 2,013,879 in 1851, 1,914,236 in 1861, and 1,830,398 in 1871, of whom 894,525 are Roman Catholics, 522,774 Presbyterians, and 398,705 Episcopalians. The tables show that it is the Celtic and Roman Catholic element of the population which emigrates, while the English and Scotch colonists from the times of Elizabeth and James I. remain.

**Ulster,** county of S. E. New York, bounded E. by Hudson River, drained by Esopus, Rondout, and Wallkill creeks, traversed by Delaware and Hudson Canal, and intersected by the New York Kingston and Syracuse R. R. The surface is much broken by the Catskill and Shawangunk ridges. The soil is generally better adapted for grazing than tillage. Iron ore, limestone, and slate are found, and flagging-stone forms a considerable article of export. There are in all nearly 700 manufactories of different kinds, among which are carriages, cooperage, brick, cement, furniture, marble, paper, edge tools, machinery, paints, ironware, and glassware; many saw-mills, flour-mills, tanneries, and breweries. Cattle, horses, sheep, and swine are numerous. Staples, besides various articles of manufacture, dairy products, potatoes, oats, Indian corn, hay, wool, and lumber. Cap. Kingston. Area, 1204 sq. m. P. 84,075.

**Ulster,** tp., Floyd co., Ia. P. 500.

**Ulster,** tp., Bradford co., Pa. P. 1174.

**Ulster King of Arms,** the principal herald of Ireland and of the order of St. Patrick. The office was created in 1552 to supply the place of Ireland king of arms, whose office had long been in abeyance. Ulster has two heralds, Dublin and Cork, and four pursuivants, of which Athlone and St. Patrick are the principal.

**Ultimate Analysis,** in chemistry, a branch of the great art of Chemical Analysis (which see), which has for its object to determine the elementary constitution of bodies, as distinguished from *proximate analysis*, which merely seeks to separate the different distinct compounds which may occur, either mixed or combined, or both, in the body under consideration. Ultimate analysis is therefore more especially applicable to *homogeneous* or *definite* chemical compounds, such as *crystallized* salts and other compounds, minerals, and liquids of definite boiling-points, in order to determine their chemical constitution and place in chemical classification; while proximate analysis applies more to heterogeneous bodies. (See Organic Analysis, Proximate, and Organic Analysis, Ultimate, where these distinctions are more narrowly applied.) Henry Wurtz.

**Ultimate Ratio.** See Ratio.

**Ultramarine'** [Fr. *outre mer*, "beyond the sea"—*i. e.* from Asia], a blue pigment formerly obtained from lapis lazuli, a mineral containing silica, alumina, soda, lime, sulphuric acid, a little sulphur and iron, with a very little chlorine and water. It is found in Siberia, Transylvania, Persia, China, Thibet, Tartary, and the East Indies, and furnishes a beautiful and very durable pigment. The analysis of lapis lazuli led to the production of artificial ultramarine, a prize of 6000 francs being offered in 1824 by the Société d'Encouragement of Paris for this purpose. It was awarded in 1828 to Guimet of Toulouse, who first produced it on a large scale, although Gmelin had shortly before made it by a process essentially the same as that now followed. Wagner (*Chemical Technology*) gives the following classification of the different methods followed: The *sulphate* or *glauber's salt ultramarine* is prepared by intimately mixing 100 parts of dried kaolin, 83 to 100 parts of calcined glauber's salt, and 17 of charcoal, or else 100 of kaolin, 41 of glauber's salt, 41 of calcined soda, 17 of charcoal, and 13 of sulphur, and heating the mixture very strongly for seven to ten hours in fire-clay crucibles. The contents are then repeatedly treated with water, pulverized, washed, dried, ground, and sifted, furnishing *green ultramarine*, ready for the market. This is a pigment of inferior value, because its color is not brilliant. To convert it into *blue ultramarine*, about 4 per cent. of sulphur is mixed with it, the whole roasted at a low temperature with access of air, and this treatment repeated until the desired blue color is produced. The blue product is pulverized, washed, dried, and separated into different qualities. *Soda ultramarine* is either made with a mixture of soda and sulphate, or with soda alone, as in the following mixture: kaolin 100, soda 100, charcoal 12, sulphur 60. The ignition is best performed in a reverberatory furnace, and the conversion into blue ultramarine in a large muffle, with addition of sulphur, the product being finer than the former. By increasing, within certain limits, the quantities of soda and sulphur, blue ultramarine may be at once obtained. *Silica ultramarine* is soda ultramarine prepared with kaolin which has received an addition of 5 to 10 per cent. of silica. It is at once obtained by calcination as blue ultramarine, withstands the action of alum, and has a violet tint. Wilkens considers the presence of iron in ultramarine unimportant, and Brunner states that the substitution of sulphide of potassium for sulphide of sodium yields a colorless compound.

Ultramarine is decomposed by the mineral acids, even dilute, with evolution of sulphuretted hydrogen. The natural ultramarine is far more durable, but the artificial is now very extensively employed as a pigment for calico-printing, coloring paper and cotton fabrics, and various other purposes for which smalt was formerly used. It should not be used for coloring candies. Sometimes it is mixed with chalk, kaolin, and barytes to make the tints lighter. *Cobalt ultramarine* is Thénard's blue. (See Cobalt.) *Yellow ultramarine* is a name sometimes applied to chromate of baryta. *Ultramarine ashes* is a pale residue obtained in the preparation of native ultramarine. Ultramarine is largely manufactured in Germany, France, Belgium, and to some extent in England, about 9000 tons being annually made in Europe. H. B. Cornwall.

**Ultramon'tanism,** a tendency within the Roman Catholic Church to place an absolute authority in matters of faith and discipline in the hands of the pope at Rome —*ultra montes*, "on the other side of the Alps"—in opposition to the tendency original in Christianity, and never altogether crushed under the papal arrogance, of placing the national churches in partial independence of the Roman curia, and making the pope subordinate to the statutes of an œcumenical council. (For the scope and history of this tendency see the articles Roman Catholic Church, Council of Trent, Council of the Vatican, by Prof. Philip Schaff, and Gallicanism.)

**Ultramontanists.** See Ultramontanism.

**Ul'tra Vi'res** [Lat., "beyond the powers"]. This term has been recently introduced into the law concerning corporations, and designates the contracts and other transactions entered into by those bodies without any express or implied authority contained in their charters, and the legal consequences which result therefrom. It is a familiar doctrine that corporations obtain all their powers from their charters, or from the statutes which take the place of charters, and they are only authorized to do such acts as are expressly permitted by, or as are fairly and reasonably included within, the terms of the enactment from which they derive their existence. A contract by a corporation which is prohibited by its charter, or for which there is no express

or implied authority, or which is outside of the fair and reasonable means for attaining the objects of its creation, is *ultra vires*. The questions concerning such contracts may arise in two very different conditions: (1) When the corporation itself seeks to enforce the agreement. Here there is no difficulty. The corporation cannot take advantage of its own violation or transgression of the law, and the contract is held void, whether it has been executed or is still executory. (2) When the other party seeks to enforce the agreement, and the corporation sets up its own want of authority as a defence. There are two cases under this head: (1) where the contract is executory on both sides; (2) where it has been executed by the party dealing with the corporation, and the latter has received and retains the benefits thereof. In the first of these two cases there is no equitable reason for not holding the contract void. The corporation could not be compelled to specifically perform what the law does not authorize it to do; and as the plaintiff has parted with no consideration beyond his own promise, and as he must be presumed to have known that the defendant's promise was without legal authority, it is not inequitable that he should be prevented from recovering damages for a mere breach of that promise. Under these circumstances the defence will prevail and the agreement be held void. The second case presents much greater difficulties, and has occasioned a conflict of judicial opinion. There are three classes of decisions. The first class hold that the *ultra vires* contract is not only void, but is absolutely illegal, and that no action upon it or growing out of it can be maintained, even though the corporation retains the money or other property derived through the transaction. Another class of decisions, regarding the defence of *ultra vires* under these circumstances as utterly inequitable and unjust, have declared that unless the contract was expressly prohibited or essentially illegal (*malum in se*), and the plaintiff was an actual *particeps criminis*, the corporation is estopped from setting up its own inability as a defence. The third class of decisions occupy a middle ground. They pronounce the *ultra vires* contract void, and therefore no action can be maintained *upon it*, but it is not necessarily illegal. The party dealing with the corporation, although he knew that it was exceeding its powers, may recover the consideration—the money or other property—which he has parted with, in an action brought upon the implied contract to repay, unless the charter should absolutely forbid a recovery in any form. This doctrine seems to be sustained by the weight of authority, although very able judges have favored the rule above stated, which would generally estop corporations from denying their liability upon the contracts which they had executed. The consequences resulting to corporations from the violation of their charters by entering into unauthorized contracts and other transactions may be very serious and penal. In the first place, the State, through its attorney-general, may institute a judicial proceeding called a *quo warranto* against the offending corporation, and compel it to answer and account for the usurpation and exercise of powers and franchises not conferred in its charter. If such usurpation and unlawful exercise be shown, a judgment may be rendered forfeiting the charter and terminating the corporate existence. In the second place, if the directors or other managing officers have engaged in, or are about to engage in, transactions which transcend the powers granted by the charter, and are therefore *ultra vires*, a stockholder may maintain a suit in equity against such officers and the corporation as defendants, and restrain the further prosecution of the unlawful or unauthorized acts. This jurisdiction, which is now well established, is founded upon the equitable doctrine of trusts, since the fiduciary relation of trustee and beneficiary exists between the directors and the stockholders.

JOHN NORTON POMEROY.

**Ulugh' Beg,** b. in 1394, a grandson of Timur, succeeded his father on the imperial throne in 1447, but was put to death in 1449 by his own son. He founded the observatory at Samarcand, encouraged the study of astronomy, was a diligent and accurate observer himself, and wrote several astronomical works in Arabic, which have been translated into Persian; into Latin by Greaves (London, 1650–52) and by Thomas Hyde (Oxford, 1665); into French by L. A. Sédillot (1846–53). A new edition of his catalogue of stars appeared in the *Memoirs* of the Royal Astronomical Society, vol. xiii.

**Ul'verstone,** town of England, county of Lancaster, on Morecambe Bay, manufactures different kinds of coarse woollen and linen fabrics, and exports considerable quantities of pig iron, bar iron, iron ore, limestone, and slate. P. 6642.

**Ulys'ses,** or **Odysseus,** a son of Laërtes, the husband of Penelope, the father of Telemachus, king of Ithaca; participated in the expedition against Troy; wandered for many years after the capture of the city, and did not reach home until twenty years after his departure. He plays a very conspicuous part in the *Iliad*, and is the hero of the *Odyssey*.

**Ulysses,** tp., Butler co., Neb. P. 352.

**Ulysses,** tp., Tompkins co., N. Y. P. 3271.

**Ulysses,** p.-v. and tp., Potter co., Pa. P. 789.

**U'ma,** one of the names of the most important goddess of the modern Hindoo pantheon, the wife of Siva, otherwise called Durga, Devi, Bhavani, Kali, or PARVATI (which see; also HINDU RELIGION, by PROF. JOHN DOWSON).

**Umatil'la,** county of N. E. Oregon, bordering on Washington Territory, lying between Columbia River and the Blue Mountains, and watered by the Umatilla and other rivers. The surface is much diversified with wooded mountains, high table-lands, rolling prairies, and some fertile valleys. Gold is found in the mountains and on the bars of the Columbia; coal, iron, and copper also exist. Horses, cattle, and sheep are numerous. Staples, oats, Indian corn, wheat, wool, lumber, and dairy products. Cap. Pendleton. Area, about 5300 sq. m. P. 2916.

**Umatilla,** p.-v. and tp., Umatilla co., Or. P. 206.

**Um'bagog Lake** lies partly in Oxford co., Me., but principally in the town of Errol, Coos co., N. H. It is in a wild and beautiful region, and is famous for its fine trout. Length, 15 miles; breadth, 1 to 10 miles. It may be reached from Gorham, N. H., on Grand Trunk Railway. Its waters are discharged into a branch of the Androscoggin.

**Umbellif'eræ** [Lat. *umbellus*, "umbrella," alluding to the shape of the *umbels* or clusters of flowers and fruit], an important natural order of exogenous herbs, or rarely shrubs, abounding in both hemispheres, chiefly in cool regions. Among the useful plants of the order are the carrot, parsnep, skirret, chervil, fennel, caraway, dill, coriander, anise, parsley, celery, and others. Some are useful in medicine, many being active poisons—the medicines conium, cicuta, asafœtida, ammoniac, galbanum, etc. According to the latest revision of the order, by Bentham and Hooker, there are 152 genera and about 1300 or more known species. Most have hollow striated stems, and flowers in umbels, but these are not perfectly constant characters. Various as these plants are in aspect, it is difficult to accurately define their generic and specific distinctions.

**Um'ber** [Lat. *terra umbria, umbria;* Fr. *argile ochreuse brune, terre fine de Turquie umber*], a mineral pigment formerly obtained from Umbria in Italy, but at present chiefly imported from the island of Cyprus. Its composition is—silica, 13 per cent.; alumina, 5 per cent.; oxide of iron, 48 per cent.; oxide of manganese, 20 per cent.; water, 14 per cent.; being essentially a silicious brown hæmatite. It forms brown or yellowish-brown masses, possessing a hardness of 1.5 to 2.5 and a sp. gr. of 2.2; adheres to the tongue; shines when rubbed, and dissolves to some extent in hot hydrochloric acid, the solution giving the reaction of iron. When gently heated, water is expelled, and a dark-brown pigment termed *raw umber* is formed; at a higher temperature it is completely dehydrated, and converted into a soft red-brown modification known as *burnt umber*. The dark colors of these pigments depend upon the manganese. They are extensively used as oil and water-color pigments, and are often mixed with other colors.

J. P. BATTERSHALL.

**Umber** (*Scopus umbretta*), a bird of the heron family, found in Africa. It has a sharp furrowed and keeled bill, the upper mandible hooked. The male has a large crest on the head. The bird is of the size of a crow, but has much longer legs.

**Umbertide** [formerly *Fratta*], town of Italy, province of Perugia, on the left bank of the Tiber, and about 20 miles N. of the city of Perugia. It is a walled town, with some respectable buildings, but a large portion of the population live in suburbs outside the old walls. The ancient and celebrated Benedictine convent of Monte Corona (1050) occupies a neighboring height and is a very conspicuous object. P. 11,039.

**Umbilical Cord.** See FŒTUS, by G. H. WYNKOOP, M. D.

**Umbilical Hernia.** See HERNIA, by E. J. BERMINGHAM, M. D.

**Um'breit** (FRIEDRICH WILHELM KARL), b. at Sonneborn, Saxe-Gotha, Apr. 11, 1795; studied theology at Göttingen, and was appointed professor of theology and philosophy in 1820 at Heidelberg, where he d. Apr. 26, 1860. In connection with Ullmann he founded *Studien und Kritiken* (1828); of his other works the most remarkable are *Commentar über die Sprüche Salomos* (1826), and *Com-*

*mentar über die Propheten des alten Testaments* (4 vols., 1841–46).

**Umbrel'la-Bird,** one of the most singular birds known, is the *Cephalopterus ornatus* of South America, one of the Corvidæ of the group called fruit crows. On its head is a curious crest of blue hair-like feathers, and beneath its throat hangs a large wattle covered also with blue feathers. It is of a deep-black color, and of the size of the common crow.

**Umbrellas and Parasols.** The word *umbrella* is a diminutive from the Latin *umbra*, and signifies "a little shade." It is said to have been brought into English from the Italian *ombrella*, which has the same meaning. *Parasol* is from the Greek *para*, "against," or possibly the Latin *parare*, to "protect," and *sol*, the "sun." The two words have, then, substantially the same meaning, a shade or protection from the sun. The Germans and French are more definite in their names for these articles, the German *Regenschirm* and the French *parapluie* signifying a protection from the rain, while *Sonnenschirm* and *parasol* denote protection from the sun's rays. The umbrella, both as a protection against the rays of the sun and as an emblem of high rank, is of very ancient origin. The Egyptian and Ninevite sculptures, even those of the earliest dates, have frequent representations of it, but only in connection with royalty. The umbrella was spread over the head of the monarch, whether in his chariot, on horseback, or in his great open-air feasts; it appeared like a halo over his head. The Chinese had adopted it at a very early period of their history, and, so far as we can ascertain, were the only people, for many centuries, who did not confine its use to the king and the princes of the blood. With them, however, the man who was privileged to bear an umbrella must be a man of wealth and high position. The common people made their hats so broad and of a shape so similar to that of the umbrella that with those and their cloaks of rushes they were alike protected from sun and rain. The Japanese have used the umbrella ever since they established themselves in their island empire. The use of the umbrella or parasol is universal throughout India, but in Burmah and Siam it is a mark of rank. The king of Burmah has for one of his titles "lord of the twenty-four umbrellas." The umbrellas of the king are of white silk, and no other person is allowed to carry a white one. The princes of the blood have two gilt umbrellas, with handles ten or fifteen feet in length, borne above their heads; the other officers of the state but one. In some of the Hindoo sculptures Vishnu is represented as visiting the infernal regions with his umbrella spread above his head. In Greece the umbrella or parasol was much used by women of rank, and there are frequent allusions to it in the Greek poets. In Rome its use was confined to women and effeminate men. It was used only as a protection from the sun, and was made substantially like those we have now. It seems to have come to the Romans from the Etruscans, rather than the Greeks. Its use extended to all the countries of Southern Europe and Northern Africa. In the Middle Ages its use among women was less common, but it was an emblem of rank in the Church. The cardinals and bishops were allowed to have them borne over their heads in solemn processions. All the large churches, especially the cathedral churches, owned an umbrella to be used for these processions. The umbrella was probably introduced into England as early as the fourteenth century, for one of the Harleian MSS. (No. 603) has a drawing of an Anglo-Saxon gentleman walking out with a servant behind him carrying an umbrella over his head, with a handle that slopes backward. The parasol was introduced into general use in France and England, probably from China, about the middle of the seventeenth century. The forms in use and the material indicate their Chinese origin, though they were in use in Italy nearly seventy-five years earlier. Beaumont and Fletcher and Ben Jonson refer to their use. In England they were carried by women as a protection from the rain as well as the sun as early as about 1700. Gay, Dean Swift, and Addison all refer to this. De Foe in his *Robinson Crusoe* describes an umbrella made by Robinson and covered with skins. The allusions to them in the poems and essays of the first half of the eighteenth century are so frequent as to show that they were coming into general use for women. But Jonas Hanway, an eccentric traveller and philanthropist, is believed to have been the first man of note who carried one in the streets, and he encountered a great deal of ridicule for doing so. The umbrella generally in use at this time was made of oiled muslin or silk, sometimes of a tough oiled paper, and rarely, as in Hanway's case, of silk. They were generally very heavy. Improvements made in their construction have made them light and graceful, and they are now universally used. Aside from their hand-service in protecting the person from sun and rain, they are also largely used for carriages, where they take the place of the leather carriage-top; for express-wagons, omnibuses, trucks, etc., and a modification of them as parachutes for descending from balloons. Another modification is the umbrella tent.

The umbrella, in the general construction of its frame, has undergone very little change in thousands of years, though the materials used have been constantly changing. The Chinese frames, which have been to some extent the models of all others, were made mostly of bamboo and light but strong woods. In Europe the ribs were at first made of rattan or split bamboo, then of wood (white oak being chosen usually), afterward for many years of whalebone. The parts of an umbrella are the top-notch and runner; a notched wheel or disk into which the ends of the ribs fit, and are secured by a steel wire or sliding ring; the ribs or supports of the umbrella, now made of the best steel (and often grooved) in the finer classes of goods, and of rattan in the cheaper; at the outer end of the ribs they are tapered to a point and finished with a minute head or tip, which may be either plain, plated, or tipped with some other substance. In the cheap rattan ribs these are tipped with metallic caps. The stretchers are short iron rods, flat and light, but strong, extending from the notched wheel or disk to the ribs, each of which has a little perforated projection on its inner side, to which the stretcher is attached by a rivet through its fork-like end. The notched wheel from which the stretchers start has a metallic cylinder called the runner, which slides up and down on the stick of the umbrella; a bent wire, which by its construction forms a simple spring, over which the runner passes in the act of opening the frame, slides into a slot in the runner, and serves to keep the umbrella open; and when it is closed by pressing this simple spring inward, the runner, in the act of closing, passes over a similar spring near the handle, and, being released by the slot, keeps the umbrella closed. The other parts of the umbrella are—the stick, which may be of bamboo, metal, pimento, or any one of fifty other kinds of wood, for the cheaper grades usually of maple, and which is divided into the handle, which is often fanciful and sometimes mounted with ivory, silver or other metals gilt or silvered; the stick or staff which forms the support of the umbrella, and over which the two notched wheels and the runner play; the ferule or end, usually tipped with bone or metal; and the covering, which in the finer qualities is of silk of various grades, and next to this of mohair or alpaca; to some extent other wool or wool and cotton fabrics are used, corresponding to the merinos, cashmeres, or delaines of dress goods; these are known under various names, as regina, victoria, etc. Some waterproof goods are also used. But the larger number of umbrellas are made of ginghams and cotton stuffs of various qualities. The sections of the covering are cut out in triangular pieces and sewed together on sewing-machines, and then hemmed or corded around the outer edge in the same way. They are next drawn upon the open frame (the notched wheel at the top being forced against a little wire stop), and are sewed to the ribs, a metal cap slipped over the ferule, brought down to the covering, and secured by a rivet or pin; the closed umbrella is secured by an elastic band, and the umbrella is complete. Some manufacturers have a metallic cup in which the tips are confined, but this is not generally regarded as an improvement. The paragon frame, in which the ribs and stretchers are grooved —an English invention—has recently been improved by a slight bending inward of the ribs, so that when closed they fit compactly round the stick. Parasols are made in a similar way, though occasionally lined, trimmed, or covered with lace, etc. The English market has long been the best for umbrellas, single manufacturers there making millions of them in a year. Umbrellas have been made here since 1802, and in considerable numbers since 1812, but except for the cheapest goods, the sticks, the ribs, the stretchers, and the coverings were imported. Even now, the greater part of the silk and alpaca, the steel ribs, and a large proportion of the sticks are imported, though the duty on silk and alpaca is 60 per cent., on the ribs 45 per cent., and on the sticks 35 per cent. Our American silk manufacturers are now beginning to produce silks nearly or quite equal to the imported umbrella silk; some of the steel manufacturers are endeavoring to produce frames of quality equal to the English; and Messrs. William A. Drown & Co. of Philadelphia, who have been exporting sticks of their own manufacture for some years, have recently turned their attention to American woods, and hope to succeed in making the umbrella an entirely American production. The census of 1870 reported that there were in the U. S. that year 83 establishments for the manufacture of umbrellas and canes, employing 2618 hands and producing $4,098,032 of goods, and 10 establishments for the production of umbrella furniture, employing 578 hands, and producing goods to the

amount of $724,034. There is good reason for believing that the present production is nearly $10,000,000, as the production of four leading houses exceeds $6,000,000. Philadelphia is the principal city in the manufacture.

L. P. Brockett.

**Umbrella-Shell** (*Umbrella*), a genus of gasteropod mollusks of the family Pleurobranchidæ, containing only three known living and two extinct species. The small, flattened, umbrella-shaped shell only covers the more important organs, and the shell itself is often concealed by the mantle.

**Umbrel'la-Tree,** a small tree of the genus *Magnolia,* found in the U. S. along the Alleghany Mountains from Pennsylvania to Kentucky; has obovate-lanceolate leaves, pointed at both ends, and a rose-colored fruit. It takes its name from the fact of the leaves being crowded on the summit of the flowering branches in an umbrella-like circle.

**Um'bria,** an ancient division of Italy, between Etruria and the Ager Gallicus, which stretched along the Adriatic from Æsis to Rubicon, and was inhabited by a Gallic tribe called the Senones. The Umbrians, occupying the heights of the Apennines, were in ancient times considered the oldest inhabitants of Italy, and are often spoken of as aborigines. This view is corroborated by the fragments of their language which have been preserved on the Eugubian Tables (which see), and which prove it to be one of the oldest Latin dialects. At the end of the second century B. C. the Umbrians were thoroughly Romanized.

**Umbridæ,** a family of fishes. See Appendix.

**Um'pire.** When a controversy is referred to two or any other even number of arbitrators, it is usual to provide for the appointment of a person who shall be called in to make a final and peremptory decision in case the arbitrators themselves are equally divided, and are therefore unable to agree. This referee is called the *umpire.* He is sometimes named in the agreement or submission executed by the contestants, but the arbitrators themselves are more frequently empowered to select an umpire when one is needed. He is not regarded as a presiding officer giving a casting vote, by means of which the decision is that of a majority of the arbitrators; the decision when made is his *instead of* the arbitrators', but is none the less conclusive and binding. When two nations undertake to adjust their respective claims by treaty, and to that end a commission is created consisting of two members, one of them appointed by each of the high contracting powers, an umpire is either named in the convention or is left to be chosen by the commissioners. John Norton Pomeroy.

**Ump'qua River** rises in Douglas co., Or., in the Cascade Mountains, by two forks, the N. and the S., of which the latter is the largest. The forks unite 8 miles below Roseburg. The river's course thence is N. W. to the Pacific Ocean. Its valley is hilly and fertile, and is famous for its wool-product. Placer gold-mining has been carried on here to some extent.

**Umritsir.** See Amritsir.

**Unadil'la,** tp., Livingston co., Mich. P. 1041.

**Unadilla,** p.-v. and tp., Otsego co., N. Y., on Albany and Susquehanna R. R., 42 miles E. of Binghamton, contains an academy, the usual county-seat buildings, 2 banks, a foundry and machine-shop, 1 newspaper, and Young Men's Christian Association. P. of v. 875; of tp. 2555. G. A. Dodge, Pub. "Home and Abroad."

**Un'cas,** an Indian sachem, b. about 1600; originally a war-chief of the Pequods, he revolted against Sassacus, the sachem, in 1634; made friends with the whites, and became chief of the Mohegans. In 1637 he joined Mason's expedition against the Pequods, and was rewarded with some of their lands; made several treaties with the settlers in Massachusetts and Connecticut, and in 1643 joined them in a war against Miantonomoh, the Narragansett sachem. In 1657 he was besieged in his stronghold on Connecticut River by the Narragansetts, but when on the point of starvation was relieved by Ensign Leffingwell, to whom it is said that he granted the land upon which Norwich now stands, although he subsequently sold it to others. Many complaints were made against him by other Indians, and in 1654 he was warned by the commissioners of the united colonies that the English would not protect him in any unlawful, treacherous, or outrageous course. He was always on good terms with the whites. D. in 1683.

**Un'cial Let'ters** [Lat. *unciales literæ,* from *uncia,* "inch"], a term used in Diplomatics and Palæography (which see) to indicate characters of a large and round form used in some ancient manuscripts. The earliest Greek and Latin manuscripts are written in *majusculæ* or capital letters, which were used until about the middle of the fifth century, when the necessity for more rapid writing brought into general use characters of a smaller form composed of rounded and not straight lines, termed uncial, many of the letters resembling the majuscule, or capital, and others the minuscule, or small, letters. This style, being more easily learned than the cursive, was employed in books and manuscripts of importance from the third to the eighth, and even the tenth, century, while legal instruments, requiring despatch, were executed in a corrupted form of the Roman cursive or running hand. In Italy and to some extent elsewhere during the sixth and seventh centuries, a transitional form of writing prevailed, which approximated to the Roman cursive hand; and this gradually passed into the minuscule style, which became the usual form in manuscripts from the tenth century. (See specimens of uncial writing under Codex.)

**Unconformable Strata.** See Conformable.

**Unction, Extreme.** See Extreme Unction.

**Un'derhill,** p.-v. and tp., Chittenden co., Vt. P. 1655.

**Underhill** (John), b. in Warwickshire, England; came to America in 1630; was a representative in the Assembly from Boston, and in 1637 commanded the colony troops, who with those of Mason destroyed the Indian forts at Mystic, and broke the power of the Pequods. Banished from Boston on account of his religious opinions, he went to England, where in 1638 he published an account of the Pequod war. Returning to America, he was in 1641 governor of Exeter and Dover; removed to Stamford, and in 1646 to Flushing, L. I., and held a command in the war between the Dutch and the Indians. In 1665 he was a delegate from Oyster Bay to the assembly at Hempstead, and in 1667 the Mantinenoc Indians gave him a tract of 150 acres of land on Long Island, which is still held by his descendants. D. at Oyster Bay, L. I., about 1672.

**Under-Lease.** When a tenant lets the premises or a portion of them for a period less than the unexpired part of his own time, the contract is an under-lease. If the entire interest of a lessee is transferred, the transaction is an assignment (see Tenant for Years); but if the transfer is of a portion only, if the possession will return to the lessee before his own leasehold estate runs out, and even if he reserves the right of entry for the non-payment of the rent so that he *may* regain the possession, the transaction constitutes an under-letting. Between the original lessee and his under- or sub-lessee the relations are those of landlord and tenant. The latter is liable to the former for the stipulated rent, and both are bound by whatever covenants they choose to insert in their contract. Between the original lessor and the under-tenant there are no legal relations whatever; there is neither privity of contract nor of estate. The under-lessee is not bound to pay rent to the one who first let the premises, nor is the latter bound to accept such rent if offered. The sub-tenant acquires no rights to the possession of the premises greater than those held by his immediate landlord, the original lessee, while as against the prior lessor he is subject to all the conditions assumed by that lessee. If, therefore, the lessor is entitled to re-enter for a breach of any condition in his own lease, he may dispossess the under-tenant, although the latter may have complied with all the stipulations of his contract. John Norton Pomeroy.

**Understanding.** See Mind, by W. T. Harris, LL.D.

**Un'derwood** (Adin Ballou), b. at Milford, Mass., May 19, 1828; graduated at Brown University in 1849; studied law, and was admitted to the bar at Worcester in 1853; removed to Boston in 1855. At the opening of the civil war he was chosen captain of volunteers; colonel in 1862; took part in the battles of Fredericksburg, Chancellorsville, and Gettysburg; severely wounded at Chattanooga, and disabled from active service; brigadier-general in 1863, brevet major-general in 1865, and subsequently appointed surveyor of customs at Boston.

**Underwood** (Joseph Rogers), b. in Goochland co., Va., Oct. 24, 1791; went with an uncle to Kentucky; was educated at various schools in that State; graduated at the University of Lexington 1811; studied law, and was admitted to the bar. At Dudley's defeat in 1813 he was severely wounded, but was taken care of in a cabin near Cleveland. In 1813 he entered upon the practice of law at Glasgow, Ky.; was a member of the legislature in 1816–19; in 1823 removed to Bowling Green; was member of the assembly 1825–26; judge of the court of appeals 1828–35; Representative in Congress 1835–43; member and Speaker of the House in the Kentucky legislature 1846; U. S. Senator 1847–53, Presidential elector in 1824 and 1844, and delegate to the national Democratic convention at Chicago in 1864. D. at Bowling Green, Ky., Aug. 23, 1876.

**Underwood** (William Henderson), b. in Culpeper co., Va., Sept. 13, 1779; when a boy moved to Elbert co., Ga., with his father; his education was obtained almost entirely by his own exertions; after his majority taught a

country school for several years; studied law, and was admitted to the bar in 1810; was a captain of volunteers in the war of 1812; after the war rose to distinction in his profession, and was elected judge of the western circuit in 1825, which position he held for several years. In the controversy of the Cherokees with the State of Georgia he became the leading counsel of this aboriginal tribe, and became famous in the Supreme Court of the U. S. for the ability with which he advocated their cause. D. suddenly at Marietta, Ga., Aug. 4, 1859.

**Un′derwriter and Un′derwriting.** Insurance companies up to 1824 were prohibited from effecting marine insurances, with the exception of the London and the Royal Exchange of England, whose high rates and restrictions eventually threw the system into the hands of a few individuals, who shared the risks. These persons could not legally enter into any joint-stock action, as it could be prohibited by the above chartered companies, but held their sittings at Lloyd's coffee-house in London, and became gradually known as Lloyd's. When a merchant or a shipowner wished to insure vessel or freight, these individuals, acting in common, subscribed or *wrote under* the policy of insurance the sums for which they severally bound themselves in case the ship or cargo was damaged or lost. Most of the principal ports also had agencies of this association. The traditional system of underwriting still prevails, though co-ordinately with chartered marine insurance companies. (For marine insurance see INSURANCE.)

**Undine′** [Lat. *unda*, "wave"], in mediæval superstition, a water-spirit, corresponding nearly to the nymphs of classical mythology. Paracelsus has given several minute rules of what to do and how to act when one has happened to marry an undine, and Friedrich de la Motte Fouqué has treated the subject in a German tale entitled *Undine*.

**Undulation.** See ACOUSTICS, by O. N. ROOD; also VIBRATION and UNDULATORY THEORY OF LIGHT, by PRES. F. A. P. BARNARD.

**Un′dulatory Theory of Light,** the theory which regards light as a mode of motion generated by molecular vibrations in the luminous source, and propagated by undulations in a subtile medium, sensibly imponderable, presumed to pervade all space, including the intervals which separate the molecules or atoms of ponderable bodies. Only one other theory can be opposed to this, the theory which supposes light to consist of material particles emitted from the source, and projected in straight lines in all directions with a velocity which continues uniform at all distances, and is the same for all intensities. The relative claims of these two theories to acceptance have been considered under the title LIGHT. The phenomena of light have also been descriptively treated under their appropriate heads, as REFLECTION, REFRACTION, INTERFERENCE, DIFFRACTION, POLARIZATION, etc. The object of the present article is to show in what manner the undulatory theory satisfactorily accounts for all these phenomena.

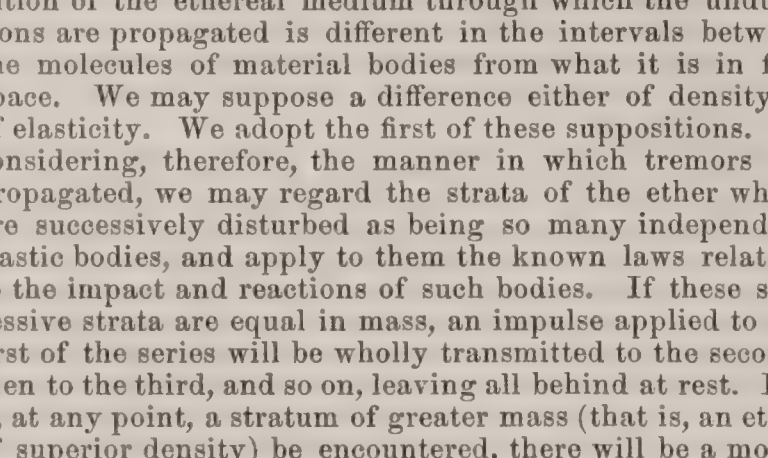
The laws of vibration, and of the composition of vibrations, must first be presumed to be understood. These are demonstrated under the title VIBRATION (which see). The manner also in which a vibrating solid generates undulations in a surrounding elastic medium is explained in the article ACOUSTICS, to which the reader is referred. In that explanation, however, mention is only made of undulatory movements excited in a single determinate direction. It is impossible, nevertheless, to disturb the equilibrium of an elastic fluid at any point, in any direction whatever, without disturbing that of the adjacent molecules, and so giving rise to tremors in all directions. Accordingly, if the original disturbance is confined to a mere point, the generated wave will be spherical; and such also will be sensibly its form, whatever be the dimensions of the vibrating body, when the distance from the body is considerable compared with those dimensions. The curvature of a spherical surface is less in proportion as the radius is greater. Hence, at a very great distance from the centre of disturbance the wave-front is sensibly plane. It should further be kept in mind that, inasmuch as the movements of the molecules in undulations may be derived from any of the possible modes of vibration, those movements may be circular or elliptical as well as linear, and, instead of being confined to the direction of the radius of the wave, may be transverse to it, or may take place in the tangent plane to the wave-surface. In the case of circular movements performed around the radius as an axis, an undulation will therefore consist of a chain of molecules occupying positions less and less advanced, in the direction of progress, in their respective circles, until the last differs from the first by 360°. Accordingly, at any instant, the molecules in such undulations, or series of undulations, will present the exact counterpart, direct or reversed, of the thread of a screw.

Now, suppose that, in the way of an advancing plane wave-surface, and parallel to it, there be interposed a plane obstructing solid, having in it a small aperture through which a minute elementary portion of the movement may be propagated, while all the remaining part is arrested, then this aperture will become the centre of a new spherical wave on the other side of the obstruction. If the solid be perforated by a great number of apertures, each of these will generate its own independent wave; and all these waves, as in their progress they encounter each other and become blended, will ultimately reproduce anew the plane wave from which they originated. By supposing the number of these apertures infinitely great, and the spaces between them infinitely small, we shall arrive at the conclusion that *a plane wave is equivalent to an infinite number of spherical waves, whose centres are infinitely near to each other in that plane,* and of which the plane wave is the resultant; so that if, at any time, we intercept any number of these component waves, either such as are contiguous to each other or such as are separated by determinate intervals, the consequences of the proceeding may be calculated *a priori* by finding the resultant of those which remain unobstructed. This principle, which is of the highest importance to the physical theory of undulation as applied to optics, was first laid down by Huyghens.

We proceed now to consider in what manner it may be applied to explain the phenomena of the reflection and refraction of light.

*Reflection and Refraction.*—In order to deduce from the theory of undulation an explanation of the phenomena of reflection and refraction, we must assume that the condition of the ethereal medium through which the undulations are propagated is different in the intervals between the molecules of material bodies from what it is in free space. We may suppose a difference either of density or of elasticity. We adopt the first of these suppositions. In considering, therefore, the manner in which tremors are propagated, we may regard the strata of the ether which are successively disturbed as being so many independent elastic bodies, and apply to them the known laws relating to the impact and reactions of such bodies. If these successive strata are equal in mass, an impulse applied to the first of the series will be wholly transmitted to the second, then to the third, and so on, leaving all behind at rest. But if, at any point, a stratum of greater mass (that is, an ether of superior density) be encountered, there will be a movement of recoil on the part of the impinging mass, as well as one of advance on that of the denser mass which receives the impact. That is, there will be a reflected as well as a transmitted undulation; and this, in the case supposed, will be an undulation by condensation. But if the stratum impinged upon is of less density than the other, it will not fully absorb the living force of the impinging stratum; and this will still advance beyond the point of equilibrium, and generate an undulation by rarefaction. We here suppose the impinging wave to encounter the stratum of different density in that stage of the undulation in which the molecules are advancing. The result would be the same, however, were we to assume it to be in the opposite phase; only in such case the phases of the reflected waves would also be the reverse of what is stated above.

FIG. 1.




Now let MN be the upper surface of a transparent medium more dense than air, and let AA′ be the front of a plane wave advancing in the direction PA, P′A′, and passing from the air into the medium between the points A and B. A will be the centre of an elementary spherical wave reflected from that point; and when the point A′ has reached B, this reflected wave will have travelled from A a distance equal to A′B. From A as a centre, therefore, with a radius equal to A′B, describe a circular arc, as at B′, and draw BB′ from B tangent to it. BB′ is the front of the entire reflected plane wave. For, if AB be divided into any number of equal parts—say two—as at C, and CA″P″ be drawn parallel to PA, and also C*b* parallel to AA′, then, as before, when *b* reaches B, the elementary

spherical wave from C will have travelled a distance equal to B$b$. Then if from C, with radius = B$b$, a circular arc as at B″ be described, the tangent from B to that arc will coincide with the tangent BB′, because

$$CB'' : AB' :: Bb : BA' :: BC : BA;$$

or the triangles BCB″, BAB′ are similar.

It is also evident that the triangles BAA′ and BAB′ are similar and equal, and consequently the inclinations of the wave-fronts AA′ and BB′ to the reflecting surface are equal. But these inclinations are also those of the rays themselves to the normal; and hence it follows that the angle of reflection is equal to the angle of incidence.

If we now turn our attention to the portion of the incident wave which enters the medium through the surface AB, we find experimentally that the beam changes its direction, so that its limiting lines PA, P′B assume directions, AR, BR′, more largely inclined to the surface, MN, than before. From B draw BB‴ perpendicular to AR. This line must represent the front of the transmitted plane wave. For B‴ must be in the surface of the elementary spherical wave generated from the centre A during the time that A′ has been advancing to B. It follows that the velocities of light in the air and in the medium respectively, which we may denote by V and $v$, will be in the ratio of A′B to AB‴; and as A′B = AB . sinA′AB, and AB‴ = AB . sinB‴BA, we have the proportion

$$\sin A'AB : \sin B'''BA :: V : v :: n : 1;$$

$n$ being assumed to denote the constant ratio of the velocities, and being the number commonly called the index of refraction. These angles are, once more, the inclinations of the wave-fronts to the surface of the medium, or of the rays themselves to the normal to that surface; and hence the Snellian law is verified, that the sine of the angle of incidence is to the sine of the angle of refraction in an invariable ratio.

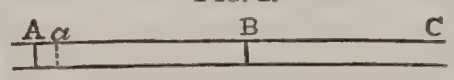
This very satisfactory theory of ordinary refraction had been proposed by Huyghens before the more difficult problem of double refraction had presented itself. On becoming acquainted with the remarkable optical properties of calcite, the crystal then known as Iceland spar, he found it necessary to suppose that the incident wave, in entering this body, is divided at the surface into two waves advancing with different velocities and generally in different directions. Both could not be spherical and still fulfil these conditions; yet the inference was irresistible that both must be of some regularly geometrical figure. That one of them is spherical was obvious from the conformity of the phenomena presented by it to the Snellian law. It seemed probable that the other must be spheroidal, and this hypothesis was, upon investigation, found to furnish a perfect explanation of all the apparent anomalies of double refraction then known. But while Huyghens was thus successful in determining the forms of the two waves generated by refraction in Iceland spar, he was unable to account for the fact of double refraction itself. He supposed the molecular movements in luminous, as in acoustic, undulations to be confined to the direction of the radius of the wave. This hypothesis suggested no physical cause for the division of a wave, or for the generation of waves of different forms. When, early in this century, however, it was suggested by Young, and independently by Fresnel, that the ethereal vibrations are transverse to the radius, or to the direction of progress, the difficulty disappeared; for in a body like a crystal, in which the molecular structure presents different aspects as considered from different directions, it is easy to suppose that such differences may affect the elasticity in different directions of the ether within the body; so that the transverse vibrations of the incident light which are distributed indiscriminately in all azimuths, may be determined to the two rectangular directions of maximum and minimum elasticity, thus giving rise to waves of unequal velocities.

The subject of double refraction will be resumed later in this article. In the mean time it may be observed that the direction from the point of incidence which will be taken by the extraordinary ray, or the ray belonging to the spheroidal wave, as well as that of the ordinary, may be determined by a generalization of the geometrical construction used above for common refraction. Thus, if a plane wave of light fall obliquely upon the surface of a crystal of Iceland spar, intersecting it in a straight line, any point of this line of intersection may be assumed as the common centre of a spherical and a spheroidal wave, having one diameter in common, parallel to the optic axis of the crystal, which common diameter is the axis of revolution of the spheroid. Moreover, as this supposition may be made of every other imaginable point of the line of intersection, it follows that there will be an infinite number of elementary waves, spherical and spheroidal, simultaneously generated. As the incident wave advances, the line of intersection will advance along the surface of the crystal, always during this advance remaining parallel to itself; and in every position of this line a new set of elementary waves will in like manner originate. By reasoning similar to that which was employed in the illustration of ordinary refraction, it may be shown that, in any position of the incident wave, all the elementary spherical waves will be touched by one and the same tangent plane, and all the elementary spheroidal waves will be touched by one plane likewise. These two tangent planes must intersect each other in the line in which the incident wave intersects, at the moment, the surface of the crystal, or the plane of that surface; but they will not coincide except in the single case in which the velocities of wave-progress are equal; that is to say, when the movement of progress within the crystal is in the direction of the optic axis.

The geometrical problem of determining the extraordinary ray in a negative crystal of one axis, like Iceland spar, reduces itself, therefore, to this: With the point of incidence as a centre describe a sphere. Upon that diameter of the sphere which coincides with the optic axis describe a spheroid of revolution, whose revolving axis is to its fixed axis as the greatest index of refraction is to the least. In the plane of incidence lay down the path of the ordinary ray according to the law of Snellius. Through the intersection of this path with the surface of the sphere pass a plane tangent to the sphere; and through the intersection of this tangent plane with the plane of the refracting surface pass another plane tangent to the spheroid. The radius of the spheroid drawn to the point of contact will be the path of the extraordinary ray.

As the theory of refraction necessitates the assumption of a change of velocity in the progress of luminous undulations passing from one medium into another, and as the component rays of different colors which make up common light are found to be differently refracted, the conclusion is unavoidable that these components after refraction proceed with unequal velocities. There is nevertheless no physical difference between the component rays except a difference of undulation-length; and the ordinary modes of investigating the velocity of wave-propagation in elastic media lead to the conclusion that this velocity is independent of wave-length. Thus, if the elasticity of a medium, or the resistance which it offers to the displacement of its molecules (measured in the atmosphere by the force with which air tends to expand into a vacuum), be represented by $e$, and if, in a column of the medium occupying the space AC, a displacement of the first stratum through the minute space from A to $a$ occur in the indefinitely small time $t$, during which same time the tremor produced by the displacement advances from A to B, the portion of the medium between $a$ and B will be reduced in volume in the proportion of $a$B to AB; and as, in elastic media, pressure is inversely as volume, its elasticity will be increased in the same proportion. The increment of elasticity will be the force which tends to propagate the tremor beyond B, and putting AB = $x$ and A$a$ = $x'$, will be represented by the expression

FIG. 2.




$$f = e\frac{Aa}{AB} = e\frac{x'}{x - x'} = e\frac{x'}{x};$$

the second form being sensibly equivalent to the first on account of the minuteness of $x'$ as compared with $x$ in the denominator.

This force for the minute time $t$ may be regarded as constant. It is capable of moving the mass AB in that time through a space $\frac{1}{2}x'$, which is the distance the mean stratum of AB will have moved, and hence of generating in the whole mass a velocity which would carry it, if continued uniform, over the entire space $x'$ in the same time. But this velocity is directly as the product of force and time, and inversely as mass. The mass is proportional to the length of the column and density of the medium; or $m$ is as $xd$, $m$ representing mass, and $d$ density. Putting, then, $v$ for this velocity, and V for that of the tremor, which is to $v$ as $x$ is to $x'$, we shall have

$$v = \frac{ft}{m} = e\frac{x't}{x^2 d}.$$

But as $\frac{v}{V} = \frac{x'}{x}$, and $x = Vt$; by substitution and reduction,

$$V^2 = \frac{e}{d}, \text{ or } V = \sqrt{\frac{e}{d}}.$$

As $e$ and $d$ are constants, the velocity of wave-propagation is uniform.

In the air, the assumption that the elasticity is inversely as volume requires to be corrected for the effect of the heat

generated by compression in increasing elasticity. This increase is in the ratio of the capacities of air for heat at constant pressure and at constant volume, represented by the symbols $c'$ and $c$. The elasticity of the air is also measured by the weight it will sustain on a unit of surface multiplied by the velocity which gravity is capable of imparting to that weight in a second. Putting, therefore, $g$ for the velocity due to gravity, $h$ for the height of the barometric column, and D for the density of the mercury in it, we have, for the velocity of sound in the air, $V = \sqrt{\frac{ghDc'}{dc}}$; a result which observation confirms.

The marked inequality in the velocity of light-waves after refraction contradicts this deduction of theory; and for a long time this fact was regarded as an almost insuperable objection to the undulatory theory of light. There is, however, an assumption in the foregoing demonstration which is not strictly true—viz. that A$a$ is too insignificant a quantity to be regarded when subtracted from AB. In the case of acoustic waves this assumption introduces no sensible error; but if the wave-theory of light be true, the undulations must themselves be excessively minute, so that it is possible, and even probable, that the amplitude of the molecular excursions may have a sensible ratio to the undulation-length. This subject has been investigated by Mr. Cauchy, who has arrived at the conclusion that the velocity of wave-propagation is a function of the wave-length, such that, *in vacuo*, the velocity is constant, while in every material medium it is greater as the waves are longer. The theoretic conclusions of Mr. Cauchy have been subjected by Prof. Baden Powell to the test of observation in a large number of cases, with results which serve to confirm their accuracy. The objection to the undulatory theory derived from the unequal velocity of the light-waves in different parts of the spectrum has, therefore, been successfully removed.

*Interference.*—In the article on VIBRATION it is shown that if a vibrating solid derives its motion from two impulses which are not synchronous, its resultant phases of vibration will be somewhere between those which the impulses would have produced separately. In its actual vibration it will therefore produce a series of undulations occupying the same situation in space relatively to those which the component vibrations would have produced, as the generating vibration occupies to those components in time. Accordingly, any two series of undulations, following the same path and interfering with each other, will, by composition, produce a resultant series, of which the phases and amplitudes of molecular excursion may be determined by the same equations which express the results of the composition of simple vibrations. Those equations are, for the effect of impulses acting in the same plane, and with a difference of time proportional to the circular arc $\theta$ (when the entire circumference, $2\pi$, is taken to represent the time of a complete double vibration),

$$A^2 = a^2 + a'^2 + 2aa'\cos\theta. \quad (1)$$

$$A\sin\psi = a'\sin\theta. \quad (2)$$

And, for impulses acting normally to each other,

$$a^2y^2 + a'^2x^2 - 2aa'xy\cos\theta = a^2a'^2\sin^2\theta; \quad (3)$$

$$\left.\begin{aligned} A &= \tfrac{1}{2}\left(\sqrt{a^2 + a'^2 + 2aa'\sin\theta} + \sqrt{a^2 + a'^2 - 2aa'\sin\theta}\right) \\ B &= \tfrac{1}{2}\left(\sqrt{a^2 + a'^2 + 2aa'\sin\theta} - \sqrt{a^2 + a'^2 - 2aa'\sin\theta}\right) \end{aligned}\right\}; \quad (4)$$

$$(A^2 - B^2)\cos^2\psi = a^2 - B^2. \quad (5)$$

From the discussion of these expressions, the effect of difference of phase upon the intensity of the light and the nature of the molecular movements in the interfering undulations is made evident. In the first, by putting $\theta = 0$, $\cos\theta$ becomes unity, and $A = a + a'$, or if $a = a'$, $A = 2a$.

If $\theta = 60$, $\cos\theta = \frac{1}{2}$, $A = \sqrt{a^2 + a'^2 + aa'}$; or if $a = a'$, $A = a\sqrt{3}$.

If $\theta = 90°$, $\cos\theta = 0$, $A = \sqrt{a^2 + a'^2}$; or if $a = a'$, $A = a\sqrt{2}$.

If $\theta = 120$, $\cos\theta = -\frac{1}{2}$, $A = \sqrt{a^2 + a'^2 - aa}$; or if $a = a'$, $A = a$.

If $\theta = 180°$, $\cos\theta = -1$, $A = a - a'$; or if $a = a'$, $A = 0$, and the undulations extinguish each other.

Again, from equation (2) it appears that if $\theta = 0$, $\sin\psi = 0$, or the resultant and both component undulations begin together.

If $\theta = 60°$, $\sin\psi = \frac{\frac{1}{2}a'\sqrt{3}}{\sqrt{a^2 + a'^2 + aa'}}$; or if $a = a'$, $\sin\psi = \frac{1}{2}$ and $\psi = 30°$.

If $\theta = 90°$, $\sin\psi' = \frac{a'}{a\sqrt{2}}$, or if $a = a'$, $\sin\psi = \sqrt{\frac{1}{2}} = \sin 45°$.

For normal impulses, putting $\theta = 0$ in equation (3),
$a^2y^2 + a'^2x^2 - 2aa'xy = 0$, or $ay - a'x = 0$;

which is the equation of a straight line; and if $a = a'$, $x = y$, or the plane of the undulation is inclined 45° to the original direction of $a$ or $a'$.

If $\theta = 90°$, $a^2y^2 + a'^2x^2 = a^2a'^2$, which is the common equation of the ellipse, $a$ and $a'$ being the semi-axes.

If $\theta = 180°$, the resultant is again a straight line, but when $a = a'$, $x = -y$, and the inclination is once more 45°, but normal to the former direction.

To find the values of the semi-axes A and B, equations (4) give, when $\theta = 0°$,

$$A = \tfrac{1}{2}\left[\left(\sqrt{a^2 + a'^2} + \sqrt{a^2 + a'^2}\right)\right] = \sqrt{a^2 + a'^2};$$

or if $a = a$, $A = a\sqrt{2}$,

$$B = \tfrac{1}{2}\left[\left(\sqrt{a^2 + a'^2} - \sqrt{a^2 + a'^2}\right)\right] = 0,$$

showing, as before, that the resultant is a straight line.

If $\theta = 90°$,
$$A = \tfrac{1}{2}[(a + a') + (a - a')] = a,$$
$$B = \tfrac{1}{2}[(a + a') - (a - a')] = a',$$

showing that the resultant is an ellipse having $a$ and $a'$ for semi-axes, which becomes a circle when $a = a'$.

For $\psi$, the inclination of the major axis of the ellipse to $a$, we have when $\theta = 90°$,

$$\cos^2\psi = \frac{a^2 - a'^2}{a^2 - a'^2} = 1; \text{ and } \cos\psi = \pm 1;$$

which, being the cosine of 0° or 180°, signifies that the major axis is coincident with $a$. It is here assumed that $a$ exceeds $a'$. If $a = a'$, $\cos^2\psi = \frac{0}{0}$, or is indeterminate. As in this case the ellipse becomes a circle, and any diameter may be regarded as the major axis, the expression for $\cos\psi$ indicates that the vibration may be understood to begin at any point of the circumference indifferently.

When $\theta$ is put $= 0°$, $\cos^2\psi = \frac{a^2}{a^2 + a'^2}$ = when $a = a'$, $\frac{a^2}{2a^2} = \frac{1}{2}$. And $\cos\psi = \pm\sqrt{\frac{1}{2}}$, which shows that the ellipse is a straight line inclined 45° to $a$.

When other values are substituted for $\theta$, the numerical expressions are less simple.

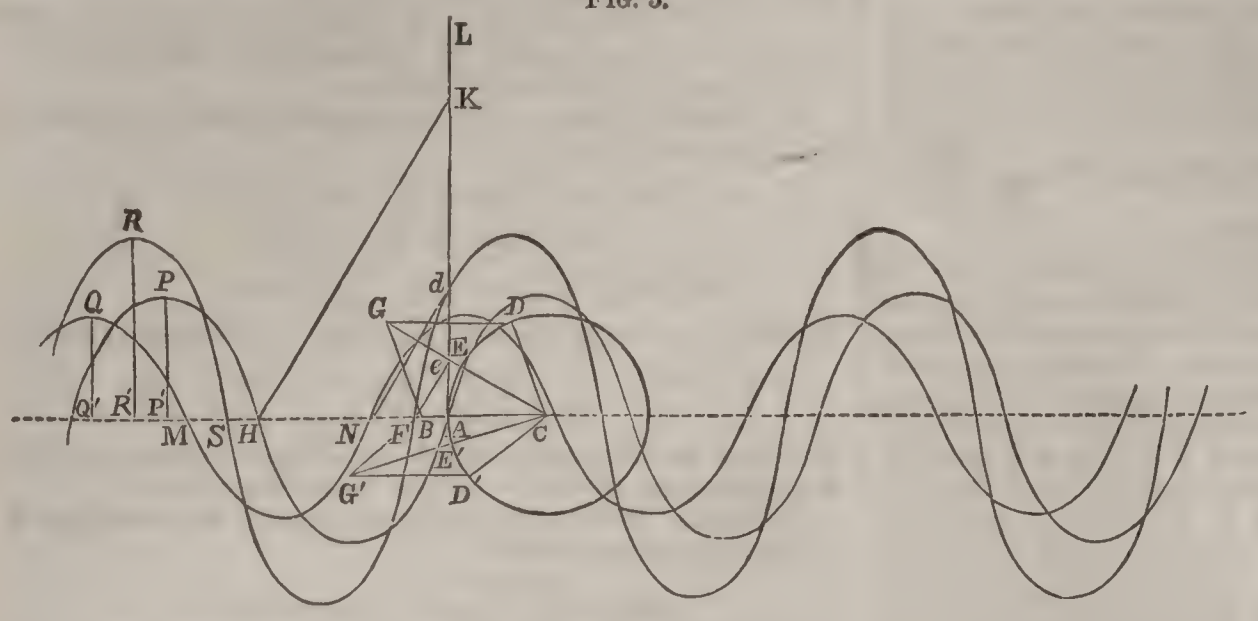
The formulæ (1) and (2) are applicable to the interferences equally of acoustic and of luminous waves; but (3), (4), and (5), which involve impulses normal to each other, apply only to waves of light. In order that they may apply, moreover, it is evident that the transverse vibrations in each of the interfering waves must be confined to a single plane—that is, that the rays must be plane polarized—or else, as in interfering rays of common light, that they must be affected with identically the same changes of plane at identically the same instants, which only occurs when they are derived from the same source. The following figure illustrates the interference of two plane polarized waves in their common plane of polarization, together with their resultant. The component undulations are represented by the two curves, PHA, QMN, whose molecular velocities are represented by ordinates drawn to the common axis, Q′MNA, and whose maximum velocities are PP′, QQ′. The undulation PHA is the more advanced in position; but, referred to any common intersecting line, as LA, the undulation QMN is the more advanced in phase.

We have seen that the resultant maximum molecular velocity, when these undulations are combined, will be the diagonal of a parallelogram, of which PP′ and QQ′ are the sides, and of which the angle of inclination of the adjacent sides shall be equal to the difference of phase between the components. Accordingly, from the point A, where the curve representing the undulation least advanced in phase crosses the axis, measure off AC, in the direction of progress, equal to QQ′, the maximum velocity of the wave most advanced in phase. From C, measure backward, CB, equal to PP′, the other component maximum velocity. From the centre C, with the radius CA, describe the circle AED, etc. At the point C lay off the angle DCA, equal to the difference of phase of the two components, thus:

Draw AL perpendicular to the axis at A. Upon this take AK, the development of the semicircle AED, etc. Join KH, and draw N$d$ parallel to it. A$d$ is the development of the arc AED, which measures the angle DCA, the difference of phase. For HA is to NA as a half undulation is to the difference of phase—that is, as a semi-circumference is to the arc which measures the difference of phase. Join therefore CD, and complete the parallelogram CDGB, drawing the diagonal CG. The angle ACE, or the arc AE, is the measure of the interval in phase between the resultant and the component CB = PP′. The curve of that component crosses the axis in A. Let, then, A$e$ be the development of AE, and draw $e$F parallel to KH. F is the point at which the curve of the resultant undulation will cross the axis in ascending. Making

FS = AH, S is the point where the same curve crosses in descending. And making SR′ = HP′, R′ is the point of maximum resultant velocity. Draw R′R perpendicular to the axis, and make it equal to GC, the diagonal of the parallelogram; R is the vertex of the resultant curve. Any other points of this curve may be found by taking the sums of the ordinates of the two components corresponding to the same abscis or point of the axis, with like signs when both components are above or both below the axis, and with unlike signs when one is above and the other below, for the ordinates of the resultant curve. The curve itself may then be drawn through the points so determined.

FIG. 3.



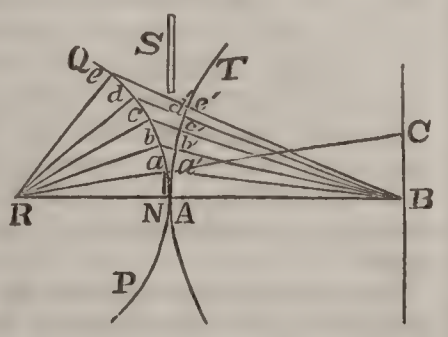

This construction enables us visibly to verify the analytical results which were just now presented. Let the radius CD revolve round the point C, the parallelogram changing its figure as the revolution advances, and the variations in the value of CG may easily be conceived.

Thus, when $\theta = DA = 0°$, the point D will fall upon CA, and the point G upon BH. CB and BG will then be in a straight line, and CG will equal $CB + BG = a + a'$. When $\theta = 90°$, DCA and GBC are right angles, and $CG = \sqrt{BC^2 + BG^2}$, or $A = \sqrt{a^2 + a'^2}$. When $\theta = 180°$, CD falls on the axis to the right of C, and BG falls on BA. Hence, $CG = a - a'$. In this case, if $a = a'$, $A = 0$; or if equal waves differ in phase by half an undulation, they destroy each other. The two curves intersect the axis in the same points, but the convexity of one of them corresponds in position to the concavity of the other. Also, if equal waves differ in phase in any manner, the crest of the resultant will fall half way between the crests of the two components.

When $\theta$ exceeds 180°, or the waves are more than half an undulation apart, the angle of the parallelogram must still be measured from A through D round to D′, and the inclination of the diagonal must be taken in the same way, from A through ED and D′ round to E′. These arcs being developed on AL produced, will give the position of the movable component and of the resultant by drawing parallels to cut KH, as before.

*Diffraction.*—The colored fringes formed by diffraction may be produced in a variety of ways. The simplest, and that first employed by Grimaldi, is to place any convenient opaque object in a divergent pencil of light in a dark room, and to observe the borders of its shadow as thrown upon any suitable surface.

FIG. 4.




The best radiant for the purpose is obtained by concentrating a small solar beam by means of a convex lens of short focus. Let R (Fig. 4) be such a radiant, PQ the front of a spherical wave proceeding from it, and BC the receiving surface. S is an opaque screen which is supposed to be first advanced to A in the perpendicular from R upon BC, so as to intercept the half wave AQ and to be subsequently gradually withdrawn. The light which reaches B will be at first the resultant effect of the unobstructed half wave AP. Divide AQ at *a*, *b*, *c*, etc., into parts such that the lines B*a*, B*b*, B*c*, etc., may successively exceed each other by the length of one-half an undulation; or such that, drawing the arc AT with B as a centre, the intercepts *aa′*, *bb′*, *cc′*, etc., may have the successive values $\frac{1}{2}\lambda$, $\lambda$, $\frac{3}{2}\lambda$, etc. Now, if the screen S be drawn upward from A to *a*, the light which reaches B will be the resultant effect of the half wave PA, combined with the resultant effect of the small additional wave-surface A*a*. This latter resultant will be compounded of the molecular movements produced at B by the infinite number of minute elementary waves, which may be supposed to originate from all the points of the given wave-front between A and *a*. Since all these elementary waves originate simultaneously, their relative phases, when they reach B, will depend on the differences in the lengths of their paths; and as these differences are the intercepts between the arcs AQ and AT, there will be none, until we reach *a*, which will differ from the wave proceeding from A by so much as half an undulation. Assuming, then, that their several intensities are equal, there will be no complete conflict between any of the elementary waves within these limits; and accordingly their resultant effect must be positive, or must add to the intensity of the light at B. If, however, we raise the screen S higher, the intercepts will begin to exceed half the length of an undulation, and some of the elementary waves originating just beyond *a* will neutralize the effect of some of those near A. Raising it to *b*, there will be a complete series of waves originating between *a* and *b*, which will be in absolute conflict with the series which originate between A and *a*; so that, if A*a* and *ab* were exactly equal, and their separate intensities, as above supposed, equal also, their resultant effect at B would be zero. A*a* is, however, a little larger than *ab*, both because of the inclination of B*a* to BA, and because of the curvature of AQ. The intensities of the elementary derivative waves are also presumed to be greater in the direction of the radius of the original wave than in directions inclined to it, though the law of such variation of intensity is not known. These causes of difference will, nevertheless, exist to no very marked degree in the immediate vicinity of the line RB, and consequently the total effect at B of the portion of wave-front A*b* will be sensibly null. If, now, the screen S be further raised to *c*, the elementary waves originating between *b* and *c* will be in complete conflict with those between *a* and *b*. Thus the power of *ab* to interfere with A*a* will be nearly neutralized, and the point B will receive, once more, nearly all the illumination which A*a* is capable of sending to it. And in like manner, if the screen be successively raised to the points *d*, *e*, etc., similar alternations of diminished and increased brightness may be inferred. After passing the fifth or seventh division, however, these successive maxima and minima cease to be perceptible in white light; a consequence partly due to the unequal lengths of the undulations of the different colors, causing the maxima of some to fall more and more on the minima of others, and partly to the diminishing length and increasing obliquity of the successive divisions of the wave-front.

Dr. Lloyd has illustrated this case in the following felicitous manner. Let the light received at B from the half wave PA be represented by 1, and that from the total unobstructed wave by 2. Represent the effect of A*a* by $+m$, that of *ab* by $-m'$, that of *bc* by $+m''$, and so on. Then we have,

$$2 = 1 + m - m' + m'' - m''', \text{ etc.}$$

Now as each of the successive literal terms is greater than that which follows it, if we cut the series at any point the value of all the terms which succeed on the right will have the same sign as the first of them; and the sum of the remaining terms on the left will be less than 2 if the value cut off is positive, and greater than 2 if the value cut off is negative.

To determine the distance of these fringes from the boundary of the shadow, suppose S to be at *a*, R*a*C being the boundary of the geometrical shadow. Draw *a*N perpendicular to RA. Call *a*N, *y*, and AN, *x*. By construction, B*a* − BA = $\frac{1}{2}\lambda$ (the undulation-length). Put RA = *r*, BA = *s*, B*a* = *q*. Then

$$q - s = \sqrt{(s+x)^2 + y^2} - s = s + x + \frac{y^2}{2(s+x)} - s = x + \frac{y^2}{2s} = \tfrac{1}{2}\lambda,$$

disregarding inappreciable terms of the root, and omitting the minute term *x* in the denominator. In the circle whose radius is *r*, $AN = x = \frac{y^2}{2r}$; whence

$$\tfrac{1}{2}\lambda = \frac{y^2}{2r} + \frac{y^2}{2s}; \text{ or } y^2 = \frac{rs\lambda}{r+s}.$$

Put $\delta$ to represent BC, and we have, from similarity of the triangles RA$a$, RBC, and assume RN = RA,

$$y^2 = \frac{r^2\delta^2}{(r+s)^2} = \frac{rs\lambda}{r+s}; \text{ and finally } \delta^2 = \frac{\lambda}{r}(rs+s^2).$$

This is the equation of an hyperbola. Hence, if the surface BC be advanced toward A, the locus of all the points in space at which occurs the first stripe of maximum illumination outside the shadow will be a hyperbolic curve of which the vertices are $a$ and R. Strictly speaking, R and $a$ are the foci and not the vertices; since the points on the moving surface corresponding to B are determined by the geometrical condition $Ba - BA = \frac{1}{2}\lambda$; whence RA + BA − B$a$, or RB − B$a$ = $r - \frac{1}{2}\lambda$, which is the property of an hyperbola whose major axis is $r - \frac{1}{2}\lambda$, and whose foci are $a$ and R. The discordance of the two results arises from the neglect of minute terms in the analysis above.

The minor axis will be $\sqrt{r^2 - (r - \frac{1}{2}\lambda)^2} = \sqrt{r\lambda - \frac{1}{4}\lambda^2} = \sqrt{r\lambda}$, nearly; and the equation of the curve, employing the exact values of the axes, is

$$\delta^2 = \frac{r\lambda - \frac{1}{4}\lambda^2}{(r - \frac{1}{2}\lambda)^2}\left((r - \tfrac{1}{2}\lambda)s + s^2\right),$$

which, when the minute terms are dismissed, simplifies itself to the expression found before.

The semi-axis major of this curve being $\frac{1}{2}r - \frac{1}{4}\lambda$, it appears that the curve itself passes behind the obstructing edge at the distance of $\frac{1}{4}\lambda$, at which distance a wave reflected from the obstacle would meet a wave advancing with a difference of $\frac{1}{2}\lambda$. Whether this theoretic indication is actually realized, it would perhaps be difficult experimentally to determine. Such a reflected wave, considering only the difference of path, would be out of harmony with the advancing wave; but, considering that its molecular movements would be reversed by reflection from the dense ether of the obstacle, the harmony would be restored.

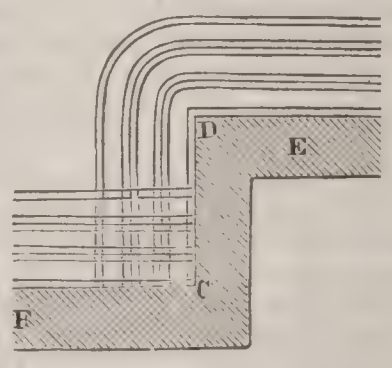
For the distance of the second fringe from the shadow, the expression already found for the first answers perfectly, if we prefix to the quantity under the radical the coefficient 3; since the difference of paths Bc − BA, by which it is produced, is equal to $\frac{3}{2}\lambda$, instead of $\frac{1}{2}\lambda$. For the third we prefix 5. Thus the successive distances are—

$$\delta = \sqrt{\frac{(rs+s^2)\lambda}{r}}; \quad \delta' = \sqrt{\frac{3(rs+s^2)\lambda}{r}}; \quad \delta'' = \sqrt{\frac{5(rs+s^2)\lambda}{r}}.$$

The second hyperbola passes at the distance of $\frac{3}{4}\lambda$ behind the obstructing edge, and the third at the distance of $\frac{5}{4}\lambda$. Owing to the great disproportion between the axes, $r - \frac{1}{2}\lambda$, and $\sqrt{r\lambda - \frac{1}{4}\lambda^2}$, which are very nearly in the ratio of $\sqrt{r} : \sqrt{\lambda}$, the curvature is very slight except for a short distance from the vertex; so that the branches in fact sensibly coincide with their asymptotes. But near the vertex the curvature is very decided.

From what has been said, it will be evident that when the obstruction presents a salient angle instead of a straight edge, the fringes will pass round the angle in circular arcs, instead of making an angle also. Indeed, the systems of fringes around such an angle are surfaces of hyperboloids of revolution. In the case of re-entering angles of 90° or less, the fringes cross each other without interference, and are continued up to the edge of the shadow on each side of the angle. These are easily seen to be necessary consequences of the theory of their formation. The annexed figure exhibits the phenomena.

FIG. 5.

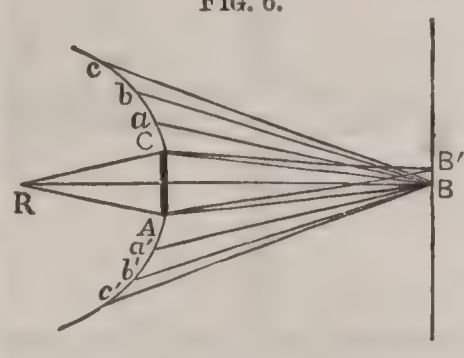



When the obstructing body is large, no fringes are seen within the shadow. Some light strays beyond the geometrical boundary of the shadow, but it rapidly fades away, and produces no very sensible effects. If, however, a very narrow object be employed, the waves from opposite sides may mingle and interfere. In this case fringes or stripes will be seen within the shadow. The light concerned in producing these fringes comes from the portion of the main wave which is close to the obstruction, as the more distant parts of each half wave will hold each other in check in the manner heretofore explained. Points being taken at $a$, $b$, $c$, $a'$, $b'$, $c'$, etc., such that the successive differences of distance of these points from B may be $\frac{1}{2}\lambda$, we shall have, on each side, a series of resultant actions alternately positive and negative, as illustrated in the foregoing case, such as—

$$+m - m' + m'' - m''' + m'''', \text{ etc.}$$

And as the effect of any portion of this series, left by cutting off terms from the beginning, depends on the sign of the first of the remaining terms—that is to say, as the effect due to the first of these terms exceeds the joint effect of all that follow—it is evident that no part of the main wave can have anything to do with producing fringes in the shadow except C$a$ and A$a'$. And since there can be no fringes produced at all unless the light from both sides reaches the same point, the centre of the shadow, which is equidistant from the edges of the obstacle—that is, from the front of the main wave—must exhibit a light stripe. On each side of this will be found positions, as, for instance, B′, where the distances from A and C differ by half an undulation, and here the darkness will be complete. A little farther on, the distances from A and C amount to an entire undulation, and here will be found once more bright stripes. If the object be very narrow, these interferences may occur not only throughout all the shadow, but to some distance into the light on either side. The fact that the light from both sides conspires to produce them is made strikingly apparent by interposing a card to intercept the light from one side. The stripes within the shadow will instantaneously disappear.

FIG. 6.




The loci of these fringes in space, since they are determined by the intersection of lines from A and C having a constant difference, must necessarily be hyperbolas with A and C for their foci. As the relation B′A − B′C = $\frac{1}{2}\lambda$ would give the first dark stripe, the principal axis of this curve would be no greater than $\frac{1}{2}\lambda$. Putting CA = $c$, the conjugate axis will be $\sqrt{c^2 - \frac{1}{4}\lambda^2}$. And putting $n$ for any integral number, even or odd, the axes of the successive trajectories will be determined by the expressions $\frac{1}{2}n\lambda$ and $\sqrt{c^2 - \frac{1}{4}n^2\lambda^2}$, in which the odd values of $n$ correspond to the dark stripes, and the even values to the light stripes. As the conjugate axis in each of these cases greatly exceeds the principal axis, the curves open out very widely, and have little curvature even at the vertices. The general equation of these curves will be

$$y^2 = \frac{c^2 - \frac{1}{4}n^2\lambda^2}{\frac{1}{4}n^2\lambda^2}\left(\tfrac{1}{2}n\lambda x + x^2\right).$$

Suppressing the minute term $\frac{1}{4}n^2\lambda^2$ from the numerator, and reducing,

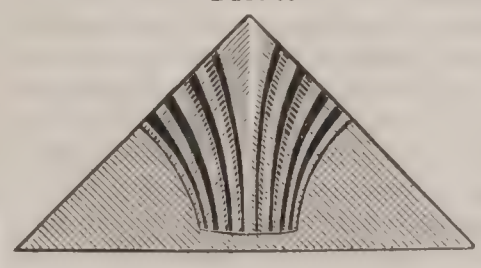
$$x + \tfrac{1}{4}\lambda = \delta = \sqrt{\frac{(4y^2 + c^2)n^2\lambda^2}{16c^2}}.$$

But $y$ is sensibly equal to BC = $s$; and $c^2$ in the numerator is inappreciable except for very small distances from C. The expression may therefore be simplified to the form $\delta = \frac{sn\lambda}{2c}$, which is the equation of a straight line.

Except very near to the obstructing body, therefore, the hyperbolic trajectory sensibly coincides with the asymptote.

The expression for the value of $\delta$ shows that the breadth of the fringes is inversely as the diameter of the intercepting object. Thus, to double the value of $\delta$ we have only to reduce $c$ by one half. Accordingly, if a tapering object, as a sewing-needle, be employed, the fringes will spread out toward the top with a beautiful plumose appearance. This becomes still more striking when the taper is more rapid, as when we use an acute-angled or even a right-angled plate of thin metal. The fringes, which in this case are very remarkable, have been called *Grimaldi's crests*.

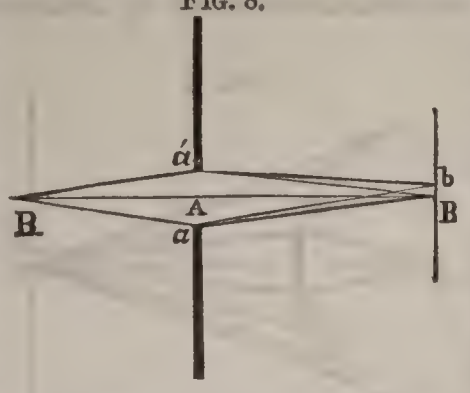
FIG. 7.



A case which is the converse of the last is that of a narrow elongated opening with parallel sides, through which the beam of light is allowed to pass. Here, as before, if RAB pass centrally through the aperture, and if B$a$ − BA = B$a'$ − BA = $\frac{1}{2}\lambda$ or less, there will be no complete conflict between different parts of the wave-front $aa'$, and B will be fully illuminated. But if B be brought nearer A, B$a$ − BA will exceed $\frac{1}{2}\lambda$, and certain marginal portions of the wave will extinguish equal portions of the centre. A position of B may be found in which A$a$ and A$a'$ shall be each equally divided into two conflicting parts, and then the central point B will be dark. At a nearer point, B$a$ − BA may be

equal to $\frac{3}{2}\lambda$, and then B will be once more illuminated; but in this case the outer two-thirds of each half of $aa'$ will extinguish each other, and the central one-third of each will only be efficient. Generally, at any distance at which $B\alpha - BA$ is an odd number of half undulations, the central line at B will be bright, but when the same difference is an even number of half undulations—that is to say, any number of entire undulations—it will be dark. When the distance has been reached at which $B\alpha - BA$ is just one-half undulation, the dark stripe will not be reproduced by increasing the distance.

Fig. 8.




When the central line is dark, it is evident that each half of the wave-front $aa'$—viz. $A\alpha$ or $Aa'$—is suppressed at B, independently of the other. If, for instance, $B\alpha - BA = n\lambda$, there will be $n$ completely conflicting pairs on each side of A. If, therefore, the sides of the aperture at $a$ and $a'$ be so far advanced toward A as to shorten $B\alpha$ or $Ba'$ by $\frac{1}{2}\lambda$, the brightness will reappear at B; or if, instead of this, an opaque obstacle, with sides parallel to those of the aperture, be placed at A, having a breadth equal to the $n$th part of $\frac{1}{2}aa'$—that is, of $A\alpha$—and its middle point exactly at A—the light at B will reappear. Also, supposing $n$ greater than 1, if this obstacle be moved parallel to itself toward $a$ or $a'$, the brightness at B will be extinguished $n$ times during the movement, with intervening intervals of reappearance. Also, if the breadth of the obstacle placed centrally be increased, and made successively two, three, four, etc., $n$th parts of $\frac{1}{2}aa'$ up to $n-1$, for every odd value the light will reappear, and for every even value it will remain extinguished at B.

On either side of the central point, B, will be found other points, $b$, where the same alternations of light and darkness will occur; *i. e.* when B is light, $b$ will be light also, with a dark stripe between; and when B is dark, $b$ will also be dark, with a bright stripe between. Only, if $B\alpha - BA = \frac{1}{2}\lambda$, $b\alpha - bA$ will be equal to $\frac{3}{2}\lambda$, and so on.

Fringes are also produced outside of the bright image of the opening, and are broader and more beautiful than those within, being, especially when the aperture is narrow, richly colored. With an apparatus in which the opposed edges are movable, the expansion of the fringes as these edges are made gradually to approach is very striking. When the aperture is a very slender isosceles triangle, they spread out widely toward the vertex. The distances $\delta$ from the central line are all determined by the same equation which was found for the fringes formed in the converse case of a narrow opaque object. The geometrical conditions are the same in both; but, the optical conditions being reversed, the even values of $n$ (the number of half undulations in the difference of path) give the dark stripes, and the odd values the light stripes. As, in the equation just referred to, it appears that $\delta$ varies directly as $\lambda$, it follows that, with homogeneous light, red will give the broadest fringes, and violet the narrowest. Hence, with white light, the different colors more or less overlap; and as $\delta$ is greater in proportion as the breadth of the aperture is less, the separation, and therefore the richness of the coloring, increases as this diameter is diminished.

If the aperture is circular, the fringes take the circular form also, and in place of the central stripe of the last experiment there appears a central spot which is alternately dark and light at different distances. If, instead of an aperture, an opaque circular disk attached to a transparent plate be employed, the central point will also be alternately dark and light; and when the brightness is at maximum, it is mathematically true that its intensity is exactly equal to that which would be produced at the same point by light passing directly through a central aperture of such diameter as would give $B\alpha - BA$ (Fig. 8) $= \frac{1}{2}\lambda$. A disk, therefore, of such dimensions as would give $B\alpha - BA = \lambda, 2\lambda, n\lambda$, suitably perforated in the middle, would produce a brightness at B twice as great as would exist there in the absence of the disk altogether.

What has been said of the appearance of dark spots at the centre of the image of an open aperture is strictly true only when the light employed is homogeneous. For the geometrical condition required to produce the extinction of light at B is that $B\alpha - BA$ shall be equal to $n\lambda$, and $\lambda$ varies with the different colors. Hence at the distance BA at which red disappears, the blue or the violet is not wholly suppressed, and so of the others. And consequently when common light is used, the central spot, instead of becoming absolutely dark, changes its color as the screen is advanced toward the aperture or withdrawn. And as the fringes surrounding the centre are themselves colored, and as their diameters are determined severally by the condition $ba - bA = \frac{1}{2}\lambda, \frac{3}{2}\lambda, \frac{5}{2}\lambda$, etc., it follows that these diameters will diminish as the screen approaches A, till each ring successively occupies the central spot and gives it its color. If the light be directly received upon the eye, with or without the aid of a magnifier, but better with one, the rings, in approaching, will seem to be successively absorbed into the aperture, and in receding to be evolved out of it.

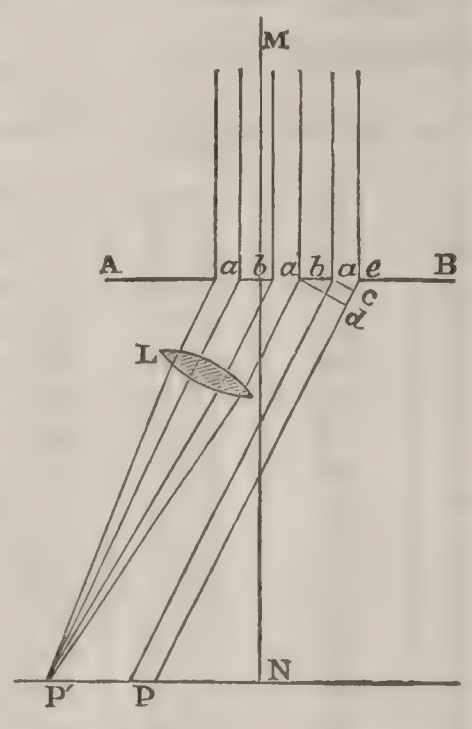
*Sharp Definition of Shadows.*—We are able now to explain what, if the undulatory theory of light is true, seems at first thought a paradoxical fact—viz. that the edges of the shadows of large bodies in ordinary light are sharply defined. This is owing to the smallness of the values of $\lambda$ for all the rays. For if we take any point within the line of the geometrical shadow, and suppose the wave-front, beginning at the edge of the opaque body, to be divided into portions whose extremes are remote from that point by distances differing $\frac{1}{2}\lambda$, these portions will neutralize each other's effects except for positions of the assumed point very near to the line of the geometrical shadow, and will be there so slight as in contrast with the neighboring illumination to be insensible. To the same cause it is owing that, in reflection and refraction, the reflected or refracted beam is as sharply defined as the incident. For, in Fig. 1, suppose that an undulation originating at B should take the direction $Bk$, different from that of the main reflected wave BQ. There will always be found at the left of B a point, as $n$, from which an undulation following the same direction, and nearly coincident with it, will differ from the first by half an undulation. Draw $no$ perpendicular to BB′, and $Bt$ perpendicular to $nh$. The angle $on\mathrm{B}$ = angle of incidence $= \iota$. Put $\rho = nBt$. Then $Bo = Bn.\sin\iota$, and $nt = Bn.\sin\rho$. When the movement whose front is $Bt$ starts from $n$, the movement which is to produce the wave from B is at $o$. There will therefore be interference, if $nt - Bo = \frac{1}{2}\lambda$; that is, if $Bn(\sin\rho - \sin\iota) = \frac{1}{2}\lambda$. As $\sin\rho$ approaches equality with $\sin\iota$, the distance $Bn$ of the origin of the interfering wave will be greater; but there will always be an interfering wave, if the surface AB is unlimited, except in the case where $\sin\rho = \sin\iota$, or in which the sine of the angle of reflection equals the sine of the angle of incidence. By similar reasoning, in the case of refraction, if we suppose a wave to take the direction $Br$, deviating from that of the regularly-refracted wave BR′, we shall find that there will be interference when $Bn(n\sin\rho - \sin\iota) = \frac{1}{2}\lambda$. And when AB is unlimited, such a wave will be found, unless $n\sin\rho = \sin\iota$. In either case, if AB is not unlimited, but is large in comparison with $\lambda$, the directions for which there will not be an interfering wave will be so close to those of the regular reflection or refraction that the deviation will be insensible. These reasonings assume that the forces of the elementary derivative waves are the same in all directions. But it is probable that these forces are less in lines *oblique* to the direction of progress of the primitive wave than *in* that direction. How far this is true could be easily investigated experimentally, by employing apertures less than the length of a half undulation in diameter, were it not that the extreme minuteness of such apertures (the mean length of a half undulation not exceeding $\frac{1}{100000}$th of an inch) would render the light too feeble for the purpose.

Some material for the formation of an opinion on this subject may, however, be gathered from certain phenomena of diffraction first observed by Fraunhofer, more remarkable and more brilliant than any which have been thus far mentioned. If a single very minute aperture will not furnish light enough for experiment, an assemblage of very many very minute apertures, closely grouped, may do so; and if these be so arranged that, for any determinate point in the shadow, they shall allow only such portions of the wave-front to pass as *conspire* in their effects at that point, while the intervals between them obstruct those portions which conflict, we shall possibly find that the tendency of a wave originating in a single molecular impulse to expand equally in all directions is much more decided than had been supposed. Fraunhofer's original experiments were made with *gratings* formed by stretching an exceedingly fine wire across two parallel screws of a great number of threads to the inch—the threads serving to keep the wires equidistant. He subsequently employed gratings formed by cementing leaves of gold to glass and cutting them through in very fine parallel lines ruled with a sharp instrument. Instead of these, also, he employed similar lines ruled with a diamond on glass itself. A beam of strictly parallel rays is in these experiments preferable to a divergent beam.

The results of such an arrangement may easily be predicted. The image of an aperture closed by such a grating will appear bright, as though the obstruction were not in-

terposed. But toward either side, in the direction perpendicular to the lines of the grating, will be found several points for which the part of the wave which the grating obstructs would if allowed to pass be more or less in conflict with those which it transmits; and which, therefore, are bright when the grating is present, and dark when it is absent. Suppose, for simplicity, that the open spaces and the opaque bars are equal in breadth. Let $a$, $a$, $a$, represent several of these open spaces, and $b$, $b$, $b$, etc., the intermediate bars. A point, P, may be found from which lines being drawn as in the figure, and perpendiculars let fall upon them from the edges of the apertures, as at $c$ and $d$, will give $ec = \frac{1}{2}\lambda$, $cd = \frac{1}{2}\lambda$, and therefore $ed = \lambda$. The distances from P to the corresponding parts of the several openings will thus differ by an entire undulation, and hence the waves which reach P through them will be in harmony. The distances from P to any points of the obstructing bars, and to corresponding points of the adjacent openings, will differ by half an undulation; hence, if the bars were removed, the wave from those points would neutralize the effects of the former, but being obstructed, the point P remains illuminated. A lens interposed as at L will give sharpness to the points, or rather lines, of illumination.

Fig. 9.




Furthermore, since the position of P is determined by the condition that $ed$ shall be the length of an undulation, it will be necessary to take P farther from B for the longer undulations and nearer for the shorter. The different colors will thus be separated, and a perfect spectrum will be formed on the screen.

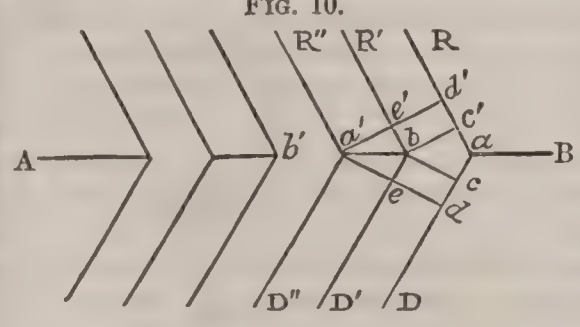
Should the point P be taken so that $ed$ is equal to two undulations, there will be no spectrum; for in this case $ec$ will be equal to one undulation, and, as in the cases we have considered of a single aperture, one-half of each opening, $a$, will hold in check the other half. If we find still another point where $ed$ is equal to three undulations, then $ec$ will equal one undulation and a half; two-thirds of each opening will then be neutralized, but the remaining third will be effective; and there will be another spectrum, but less brilliant than the first. If $ed = 4\lambda$, the spectrum again will fail; if $ed = 5\lambda$, it will return, and so on. If the bars are broader than the open spaces, there will be a spectrum for $ed = n\lambda$, $n$ being any integral number, until the light is too feeble, or until $ec = n'\lambda$, $n'$ being also any integral number. If the spaces are broader than the bars, there will be a spectrum for every integral value of $n$ in $ed = n\lambda$ until $n = \frac{a+b}{b}$ ($a$ and $b$ standing for the breadths of the spaces and bars respectively). If, however, $\frac{a+b}{b}$ is not integral, and $q$ is the greatest common measure of $a$ and $b$, $n = \frac{a+b}{q}$ will give the number of the first spectrum that will fail. Put this value of $n$ equal to $m$, and we may say generally that the $m$th spectrum will fail, and also the $n'm$th, $n'$ being also any integral number. If $a$ and $b$ are incommensurable, there can theoretically be no perfect spectra; nor will any spectrum absolutely fail, but a near approach to failure will occur for approximate values of $q$.

The construction indicates a simple expression for the deviation of each spectrum from the direction, RB, of movement of the original wave. Calling the deviation $\delta$, we have

$$\sin\delta = \frac{n\lambda}{a+b}.$$

Putting $n = 1$, $\lambda = \frac{1}{50000}$ inch, and supposing 1000 opaque lines to the inch in the grating, we have $\sin\delta = 0.02 = \sin 1v9'$. As the sines of small angles are nearly proportional to the angles themselves, the deviations of the succeeding spectra will be multiples of this. It is evident, also, that the deviations will increase with the increase of the number of lines of the grating to the unit of length, the sines being inversely as this number. With 10,000 lines to the inch, $\sin\delta = 0.2 = \sin 11°\ 32'$, or the first spectrum will deviate by this amount. The deviation of the second will be 36° 52′, and of the third 90°—too great to be observed. With 25,000, $\sin\delta = 0.5$, or the first spectrum will deviate 30°. No other spectrum can be obtained from a grating so closely ruled as this when the light is incident perpendicularly. For if we make $n = 3$, $\sin\delta$ becomes $= 1.5$, which is impossible. Moreover, even the first spectrum will fail if the sum of $a$ and $b$ be not greater than $\lambda$. Thus, if $\lambda = \frac{1}{50000}$th of an inch, and there be 50,000 opaque lines to the inch, $\sin\delta = 1 = \sin 90°$, when $n = 1$, and the spectrum is not observable. But in this case, if the incident light be oblique to the grating, and the plane of incidence perpendicular to the bars, a spectrum will be possible until the value of $a + b$ is reduced down to $\frac{1}{2}\lambda$. For in Fig. 10, let AB be the plane of the grating, and R, R′, R″ be parallel rays falling on AB at the incidence $\delta$; then if the parallel lines $a$D, $b$D′, etc., be drawn at the incidence $\delta'$, there will be a spectrum in this direction, provided $\delta$ and $\delta'$ be so taken that $(a+b)(\sin\delta + \sin\delta') = \lambda$. For, drawing the perpendiculars $bc$, $bc'$, $a'd$, $a'd'$, it is evident that if $ad + ad' = \lambda$, $ac + ac' = \frac{1}{2}\lambda$, and the part of the wave $ab$ which is in opposite phase to $ba'$ is obstructed, so that $ab'$ remains efficient; and the same is true of the other openings. Hence, so long as it is possible to find two sines whose sum is not less than $\frac{\lambda}{a+b}$, a spectrum can be produced. The maximum possible value of $\sin\delta + \sin\delta'$ is 2. Hence, there can be a spectrum so long as $2(a+b)$ is not less than $\lambda$, or $a+b$ not less than $\frac{1}{2}\lambda$. And if $\lambda = \frac{1}{50000}$th of an inch, which is near its mean value, a spectrum can be formed by employing an oblique incidence, if the number of opaque lines in the grating is less than 100,000. At 75,000, for instance, $\sin\delta + \sin\delta' = 1.5$. If the incidence be put $= 40°$, the deviation of the spectrum will be 58°. If the incidence be 46°, the deviation will be about $51\frac{1}{2}°$.

Fig. 10.




The effects produced by diffraction may be endlessly varied by employing, instead of gratings, reticulations and groups of apertures of various figures symmetrically disposed. Many of the phenomena are exceedingly rich and beautiful.

Diffraction spectra furnish the best of all possible means of measuring the lengths of the undulations corresponding to the different colors. They exhibit very distinctly the very numerous transverse spectral lines, the study of which has become, in modern physics, a matter of so much importance. These lines in every diffraction spectrum preserve necessarily the same relative distances from each other; whereas in the spectra formed by refraction these distances are modified by the media in which the refraction occurs. From the expression for deviation above given, we obtain

$$\lambda = \frac{(a+b)\sin\delta}{n}.$$

In order to calculate the wave-length corresponding to any given point or line in the spectrum, we have to measure carefully the angle of deviation, and to substitute its sine in this formula. The value of $a+b$ is presumed to be known from the construction of the grating.

The wave-lengths corresponding to the principal lines of the spectrum have been in this manner determined by Fraunhofer, Kirchhoff, Ångström, Ditscheiner, Thalen, and others. To extend the determination to the great multitude of lines which fill up the intervening intervals, a method has been devised by Prof. Wolcott Gibbs of Harvard University, of determination by comparison and computation, which has been applied by him to the preparation of the extended and valuable tables of Wave-Lengths which will be found under their proper title in this work. The method consists in measuring upon an arbitrary scale the distance between the line under investigation and another for which the wave-length has been already determined. Then, when the relation between the scale divisions and the corresponding wave-lengths is known, the wave-length sought is obtained by computation.

In the following brief table are given the wave-lengths corresponding to a few remarkable lines in the spectrum, with a view chiefly to illustrate the immensity of the numbers which it is necessary to employ in order to express the frequency of the recurrence of distinctly different physical conditions in the medium which we call light. The fact of these alternations and of the rapidity with which they succeed each other is established independently of theory; and whatever we call them, whether "undulations," with Huy-

ghens and Young, or "fits," with Newton, their existence is beyond question.

In the preparation of this table, the velocity of light has been assumed to be 187,000 miles per second—a velocity corresponding to the generally-received horizontal parallax of the sun at the present time—viz. 8.87″. The wave-lengths in millionths of millimètres are taken from the tables of Dr. Gibbs, above referred to. The lengths in ten-millionths of an inch have been computed from these. No line yet determined in the spectrum of any element has a wave-length greater than that of the line B, nor less than that of the calcium line, with which this table ends. The numbers of undulations per second are given to the nearest trillion.

*Undulation Lengths and Numbers per Second.*

| Line in spectrum. | Color. | λ in millionths mm. | No. of λ in 1 mm. | λ in ten-millionths of inch. | No. of λ in 1 inch. | Number of undulations per second. |
|---|---|---|---|---|---|---|
| Line A | Red | 760.04 | 1315 | 299.22 | 33,422 | 396,000,000,000,000 |
| Line B | " | 686.71 | 1456 | 270.48 | 36,970 | 438,000,000,000,000 |
| Lithium | " | 670.52 | 1491 | 264.18 | 37,850 | 448,000,000,000,000 |
| Hydrogen—C | " | 656.21 | 1524 | 258.27 | 38,714 | 459,000,000,000,000 |
| Strontium | " | 640.70 | 1561 | 252.37 | 39,624 | 470,000,000,000,000 |
| Lithium | Orange | 629.65 | 1588 | 248.04 | 40,316 | 478,000,000,000,000 |
| Sodium—D | Yellow | 589.51 | 1696 | 232.09 | 43,085 | 510,000,000,000,000 |
| Tellurium | " | 564.70 | 1770 | 222.44 | 44,955 | 533,000,000,000,000 |
| Calcium | " | 558.76 | 1789 | 220.08 | 45,649 | 538,000,000,000,000 |
| Uranium | " | 547.95 | 1825 | 215.75 | 46,349 | 549,000,000,000,000 |
| Thallium | Green | 534.95 | 1869 | 210.63 | 47,475 | 562,000,000,000,000 |
| Line E | " | 526.96 | 1897 | 207.48 | 48,197 | 572,000,000,000,000 |
| Cæsium | " | 497.15 | 2011 | 195.67 | 51,106 | 605,000,000,000,000 |
| Barium | " | 493.34 | 2027 | 194.10 | 51,520 | 610,000,000,000,000 |
| Strontium | Blue | 460.75 | 2170 | 181.50 | 55,096 | 653,000,000,000,000 |
| Cerium | " | 457.25 | 2187 | 179.92 | 55,580 | 658,000,000,000,000 |
| Iridium | Indigo | 450.95 | 2217 | 177.56 | 56,319 | 667,000,000,000,000 |
| Titanium | " | 439.30 | 2276 | 172.83 | 57,860 | 685,000,000,000,000 |
| Line F | " | 436.07 | 2293 | 171.66 | 58,255 | 690,000,000,000,000 |
| Line G | " | 430.73 | 2322 | 169.58 | 58,969 | 699,000,000,000,000 |
| Rubidium | Violet | 420.20 | 2380 | 165.44 | 60,444 | 716,000,000,000,000 |
| Indium | " | 410.10 | 2438 | 161.46 | 61,934 | 732,000,000,000,000 |
| Strontium | " | 407.85 | 2452 | 160.57 | 62,278 | 737,000,000,000,000 |
| Calcium—H | " | 396.81 | 2520 | 156.23 | 64,008 | 758,000,000,000,000 |
| Magnesium | Ultra violet | 394.30 | 2536 | 155.24 | 64,416 | 763,000,000,000,000 |
| Calcium | " " | 393.28 | 2543 | 154.84 | 64,582 | 765,000,000,000,000 |

*Colors of Thin Plates.*—On the theory of undulation, Newton's rings are produced by the interference of the wave reflected from the upper surface with that reflected from the lower surface of the thin plate in which they appear. To fully understand the circumstances of this interference, it will be convenient first to consider an unusual case—viz. one in which the thin plate has a refracting power intermediate between those of the bounding media, both of these being transparent. Represent the thickness of the plate by $\theta$. The ray perpendicularly reflected from the lower surface has a longer path than that reflected from the upper by $2\theta$. There should, therefore, be an extinction of light when $2\theta$ is equal to $\frac{1}{2}\lambda$ or to some odd multiple of $\frac{1}{2}\lambda$. That is, the dark rings in Newton's apparatus (see THIN PLATES, COLORS OF) should occur at the thicknesses indicated by the equation

$$2\theta = \tfrac{1}{2}\lambda(2n+1);\ \text{or when } n=0,\ 2\theta = \tfrac{1}{2}\lambda \text{ and } \theta = \tfrac{1}{4}\lambda.$$

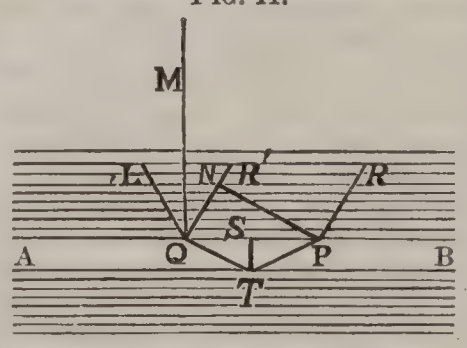
For the purposes of accuracy in this experiment it is best to use homogeneous light. We will suppose the rings to be formed between a spherical surface of low curvature and known radius and a plane surface on which a micrometric scale has been ruled. The scale enables us to measure the diameters of the rings by inspection, and with the diameters and the known radius of curvature we can calculate the thicknesses at the middle points of the several rings, dark and light. The dark rings will be found to correspond to the thicknesses $\theta = \frac{1}{4}\lambda$, $\theta = \frac{3}{4}\lambda$, $\theta = \frac{5}{4}\lambda$, and so on; while the bright rings will be produced by the thicknesses $\theta = \frac{1}{2}\lambda$, $\theta = \lambda$, $\theta = \frac{3}{2}\lambda$, and so on.

If, however, the refracting power of the thin plate is less or greater than those of the bounding media on both sides—a state of things which most usually exists—the bright rings will appear where, on the former supposition, dark ones are formed, and *vice versâ*. The reason of this difference will be found in the fact heretofore mentioned, that when a wave encounters an ether of greater density, the direction of molecular movement is reversed in the part of the wave reflected; but when it encounters an ether of less density, the direction of molecular movement in the reflected wave is maintained unchanged. When the refracting power of the thin plate is intermediate between those of the bounding media, the reflections from both surfaces take place under similar circumstances; *i. e.* both are from a more refracting, or both from a less refracting, medium; and the molecular movements in the reflected waves are either both reversed or both maintained. But when the thin plate is of either less or greater refracting power than the media which bound it, the molecular movements in one will be maintained and in the other reversed; a condition which alters their relations as to phase by half an undulation, and causes the dark rings to take the place of the light ones in the former arrangement, and the light of the dark.

This transformation may be experimentally observed by first forming the rings in a thin plate of air, as in Newton's arrangement, between a crown glass, having the index 1.5, and a flint glass, index 1.575. Introducing, then, a drop of the oil of sassafras, index 1.53, the bright rings will immediately become dark, and the dark, bright. There will also be a slight contraction of all the rings, since the value of λ is less in the oil than in the air.

When the rings are viewed obliquely their apparent diameters are enlarged. If AB, Fig. 11, be the thin plate and RP the ray incident at P, which after reflection at T emerges at Q, this ray will there fall in with another, R′Q, reflected toward L. Let PN be perpendicular to R′Q, then NQ will be the distance traversed by R′Q while RP passes over the distance PT + TQ = 2TQ. Put the angle of incidence R′QM = $\iota$, and the angle of the refraction PTS = $\rho$, and let $\theta$ = thickness, TS, as before. Then NQ = PQ sin $\iota$, and PQ = 2TS tan $\rho$.

FIG. 11.




Hence, NQ = $2\theta$ tan $\rho$ sin $\iota$.

Also $2TQ = \dfrac{2\theta}{\cos\rho}$. 2TQ − NQ is the difference of length of path. This, to produce extinction (the bounding media being both more or both less dense than the lamina), should be an even number of half undulations. But, as the undulation-lengths are inversely as the refracting powers of media, if $n$ is the index of refraction of the lamina relatively to the medium, we must divide NQ by $n$ in order to obtain in the expression 2TQ − NQ the effective difference of path. We shall have then

$$2TQ - NQ = \frac{2\theta}{\cos\rho} - \frac{2\theta\tan\rho\sin\iota}{n} = \frac{2\theta(n-\sin\rho\sin\iota)}{n\cos\rho}.$$

$$\text{But } \sin\iota = n\sin\rho \therefore 2TQ - NQ = 2\theta\left(\frac{1-\sin^2\rho}{\cos\rho}\right) = 2\theta\cos\rho.$$

And finally, $\theta\cos\rho = \frac{1}{4}\lambda(2m+1)$ for bright rings.

$\theta\cos\rho = \frac{1}{4}\lambda(2m)$ for dark rings.

If, as in Newton's experiments, the lamina AB is air, and the observation is made from above the upper dense medium in the air also, $\rho$ is the angle of incidence at the upper surface, and the thicknesses at which the several rings appear are inversely as the cosine of that angle—a result in which theory confirms his observation.

One point further requires attention, in order to complete the theory of this phenomenon. The intensity of the light reflected at the first surface is greater than that interfering with it after a single reflection from the second, both because the incident light in the latter case is less intense, and because the reflected portion on emergence is again diminished by a second reflection from the first. Yet the dark rings shown by reflection are absolutely dark, showing

that the interference is total, or that the interfering waves are equal. To understand this, we must consider that the wave emergent at the first surface after one reflection at the second is reinforced by a series of feebler emergent waves which have undergone two, three, four, etc., reflections at the same surface after being partially turned back at the first. These several components will conspire with each other in phase, and conflict with the wave reflected from the first surface, wherever the thickness of the lamina is adapted to produce a dark ring, as we shall presently see. In what follows we continue to have in mind Newton's experiment of a lamina of less density than the bounding media.

That the extinction of light may be total, the intensities of the interfering waves must be equal. Intensities are measured by the living forces which animate the masses of ether in which the molecular movements take place. Take $m$ for the mass in the denser medium, and $m'$ for that in the rarer. It will be proved further on that the velocity of molecular movement in a wave reflected at a given incidence from the separating surface of two given media, is in a constant ratio to the velocity in the incident wave. Put this ratio $= v : 1$, the incident velocity being unity. The living force of the reflected wave is, therefore, $mv^2$, and that of the wave transmitted $m(1-v^2)$. This divided by $m'$ will give the square of the molecular velocity in the rarer medium, which is the thin plate. Represent it by $u^2$. By reflection at the second surface $u$ becomes $vu$, and this by a second reflection at the first surface becomes $v^2u$. From the living force of the wave returning from the second surface, subtract the living force which it loses by re-reflection from the first, and the remainder, which is the living force transmitted through the first surface, will be $m'v^2u^2(1-v^2)$, which divided by $m$ will give the square of the first component of molecular velocity of the wave from the second surface emergent at the first. In like manner $v^2u$ becomes $v^3u$ by second reflection at the second surface; and this becomes $v^4u$ by the next reflection from the first; so that the square of the second component of molecular velocity in the reflected wave from the second surface emergent from the first will be $m'v^6u^2(1-v^2)$ divided by $m$. The next term will be $m'v^{10}u^2(1-v^2)$ divided by $m$; whence the law is evident.

Now, as to the phases of these successive components. Remembering that the direction of molecular movement is reversed in reflection from a denser medium, and maintained in reflection from a rarer, it will be perceived that reversal occurs at every reflection within the thin plate, but it does not occur in the wave reflected from the first surface without entering the plate. Let it also be borne in mind that emergent waves maintain the direction of movement of the incident waves from which they are derived. Call, then, the movement in the originally incident wave positive. Suppose the thickness of the plate to be zero (the successive reflections still going on), then the sign of movement in the waves successively emergent will be always negative for the first surface (the number of reversals being odd), and always positive for the second (the number of reversals being even).

But if the plate have a sensible thickness, $\theta$, the difference of length of path ($2\theta$) has to be considered. If $\theta = \frac{1}{2}\lambda$, $2\theta = \lambda$, and the signs will remain the same as when $\theta = 0$; *i. e.* always negative at the first surface, and positive at the second. The same will be true for $\theta = n \times \frac{1}{2}\lambda$, $n$ being any integral member. If $\theta = \frac{1}{4}\lambda$, or $(2n+1) \times \frac{1}{4}\lambda$, $2\theta = \frac{1}{2}\lambda$, or $(2n+1) \times \frac{1}{2}\lambda$. Accordingly, the sign is reversed for the first, third, fifth, and all the odd-numbered waves, but remains unchanged for the even. The direction of movement is therefore alternately positive and negative for the upper surface, and negative and positive for the lower.

Next, as to the resultant value of these components. Calling, as above, $u$ the value of the molecular movement in the ray transmitted through the first surface, and $v$ the ratio of reflected to incident light, the advancing and returning waves within the lamina will have the successive molecular velocities—

1. Advancing wave, $u$, $v^2u$, $v^4u$, $v^6u$, $v^8u$, etc.
2. Returning wave, $vu$, $v^3u$, $v^5u$, $v^7u$, etc.

And the squares of the velocities of the emergent components will be—

$$\text{1st surface, } \frac{m'}{m}(v^2u^2 - v^4u^2),\ \frac{m'}{m}(v^6u^2 - v^8u^2),$$

$$\frac{m'}{m}(v^{10}u^2 - v^{12}u^2),\ \frac{m'}{m}(v^{14}u^2 - v^{16}u^2), \text{ etc.}$$

$$\text{2d surface, } \frac{m'}{m}(u^2 - v^2u^2),\ \frac{m'}{m}(v^4u^2 - v^6u^2),$$

$$\frac{m'}{m}(v^8u^2 - v^{10}u^2),\ \frac{m'}{m}(v^{12}u^2 - v^{14}u^2), \text{ etc.}$$

The sum of the square roots of these squares is the resultant molecular velocity of the emergent wave in each case. Substitute for $u^2$ its value, reduce, and put $v'$ and $u'$ for the resultant velocities at the first and second surfaces respectively; then, for the case in which $\theta = n \times \frac{1}{2}\lambda$, $v' = (v^2-1)(v + v^3 + v^5 \ldots ad\ inf.)$. Whence $v' = -v$. The interference is therefore absolute, and the rings at these thicknesses will be perfectly dark. Also,

$$u' = (1-v^2)(1 + v^2 + v^4 + v^6 \ldots . ad\ inf.) = (1-v^2)\frac{-1}{v^2-1} = 1.$$

That is to say, the brightness of the rings seen by transmission is equal to that of the light originally incident upon the first surface.

For the case in which $\theta = (2n+1) \times \frac{1}{4}\lambda$, the alternate terms are of opposite signs—viz.

$$v' = (1-v^2)(v - v^3 + v^5 - v^7 \ldots . ad\ inf.);$$
$$u' = (1-v^2)(-1 + v^2 - v^4 + v^6 \ldots . ad\ inf.).$$

Here we may put $v''$ for the sum of the positive terms, and $v'''$ for that of the negative; thus,

$$v'' = (1-v^2)(v + v^5 + v^9 + v^{13} \ldots . ad\ inf.) = \frac{v}{v^2+1}.$$

$$v''' = (v^2-1)(v^3 + v^7 + v^{11} + v^{15} \ldots . ad\ inf.) = \frac{-v^3}{v^2+1}.$$

And $$v'' + v''' = v' = v.\frac{1-v^2}{1+v^2}.$$

The value, being positive, shows that the rings seen at these thicknesses by reflection are bright.

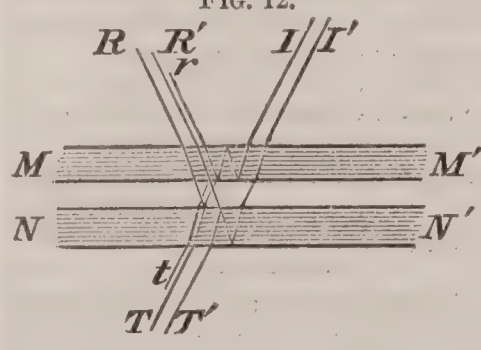
By pursuing a similar course for $u'$, we obtain

$$u'' + u''' = u' = \frac{1-v^2}{1+v^2}.$$

This is positive, but is always less than unity, showing that the rings seen at these thicknesses by transmitted light are obscure, but not dark.

Colors are also produced by repeated reflections in parallel thick plates, when the thicknesses slightly differ. This is illustrated in Fig. 12, where the rays II′ undergo repeated reflections in the plates MM′, NN′, the reflected rays finally emergent from the first surface being RR′, and those transmitted through the second, TT′. Call L the length of path for T, and L′ the same for T′. Also put $\theta$ for the thickness of MM′, $\theta'$ for that of NN′, and $\delta$ for the distance between the plates. Then by inspection it is seen that

FIG. 12.



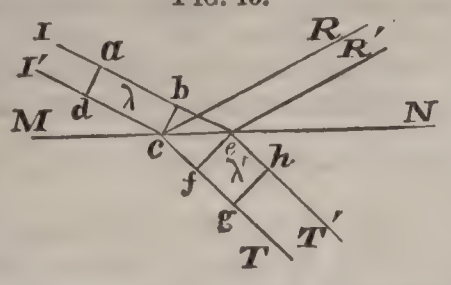

$$L = 3\theta + \theta' + \delta;\ L' = \theta + 3\theta' + \delta,\ \therefore\ L' - L = 2(\theta' - \theta).$$

Or, when the difference of thickness is equal to the thickness of a plate producing Newton's rings, similar colors may be seen in these.

*Polarization.*—A plane polarized ray is one in which the molecular movements are all performed in a single azimuth relatively to a given plane of reference. In a succession of waves proceeding directly from any natural source, such constant direction of vibratory movement is found experimentally not to exist; but after refraction or reflection, there will always be perceived a tendency toward it; and in reflection at certain angles from certain surfaces, as also in double refraction, it is completely produced. When produced by reflection, the polarized ray undergoes subsequent reflection in the azimuth of the original reflection more easily than in any other; and the plane of this polarizing reflection is called the plane of polarization. The transverse molecular movements in the polarized wave are normal to this plane, and this relation serves to fix the position of the plane of polarization for any ray. In order to investigate the theory of polarization by reflection, we must examine for two distinct cases the manner in which the living force of a wave impinging upon a reflecting surface is decomposed—first, when the molecular movements are normal to the plane of incidence, and therefore parallel to the reflecting surface; and secondly, when the same movements are in the plane of incidence, and consequently inclined to the reflecting surface. In the first case, since the movements of the incident, reflected, and transmitted waves are parallel, we may assume that the sum of the molecular velocities in the last two is equal to the molecular velocity in the first. Putting unity for this incident velocity, $v$ for that in the reflected wave, and $u$ for that in the transmitted, we have $1 = u + v$, or $1 - v = u$. In Fig. 13 let I*e*, I′*c* be the bounding limits of a mass of the ether, along which an undulation moves, meeting the reflecting surface MN in *ce*.

Let $c$R, $e$R′ be the limits of the reflected undulation, and $c$T, $e$T′ those of the transmitted undulation. Draw $cb$, $ef$ perpendicular to I$e$, $c$T. Let $cd$ be the length of the incident, and $eh$ that of the transmitted undulation. Draw $ad$, $gh$ parallel to $cb$, $ef$, respectively. We may regard the incident undulation as a mass whose bulk is the prism $abcd$, and density $\delta$, impinging upon a mass whose bulk is $efgh$, and density $\delta'$. Since the molecular movements in this case are *in* the common surface of the media, the *breadths* of the prisms, according to the second assumption foregoing, are equal to each other. Their *lengths* will be $\lambda$ and $\lambda'$, and their depths $bc$ and $ef$. Or, putting $m$ and $m'$ for their masses, $m : m' :: bc \times \lambda \times \delta : ef \times \lambda' \times \delta'$. Now, the wave-lengths are proportional to the velocities of progress of the wave in the two media (which we may denote by V and V′). Hence, if we put $\iota$ for the angle of incidence, and $\rho$ for the angle of refraction, we shall have, $\lambda : \lambda' :: V : V' :: \sin\iota : \sin\rho$. Also, $ecb = \iota$, and $cef = \rho$; from which we derive $bc = ce.\cos\iota$, and $ef = ce.\cos\rho$. And substituting—

Fig. 13.




$$m : m' :: \sin\iota\cos\iota\,\delta : \sin\rho\cos\rho\,\delta'.$$

But, in the propagation of tremors through elastic media, the velocity of progress is directly as the square root of the elasticity, and inversely as the square root of the density. Or, putting $\epsilon$ for the elasticity, $V^2 = \frac{\epsilon}{\delta}$, and $V'^2 = \frac{\epsilon}{\delta'}$, $\epsilon$ being constant. Accordingly—

$$\delta : \delta' :: \frac{1}{V^2} : \frac{1}{V'^2};\ \text{and, by substitution,}$$

$$m : m' :: \frac{\sin\iota\cos\iota}{V^2} : \frac{\sin\rho\cos\rho}{V'^2} :: \frac{\sin\iota\cos\iota}{\sin^2\iota} : \frac{\sin\rho\cos\rho}{\sin^2\rho} : \frac{\cos\iota}{\sin\iota} : \frac{\cos\rho}{\sin\rho}.$$

Now the living force in the reflected and transmitted waves must be equal to the living force in the incident; or—

$$m \times 1^2 = m \times v^2 + m' \times u^2;\ \text{that is,}$$

$$\frac{\cos\iota}{\sin\iota} = \frac{\cos\iota}{\cos\iota}v^2 + \frac{\cos\rho}{\sin\rho}u^2;\ \text{or, } (1-v^2).\frac{\cos\iota}{\sin\iota} = \frac{\cos\rho}{\sin\rho}u^2.$$

Combining this with the equation $1 - v = u$, we obtain

$$v = \frac{\sin(\rho-\iota)}{\sin(\rho+\iota)},\ \text{and}\ u = \frac{2\cos\iota\sin\rho}{\sin(\rho+\iota)}.$$

The essential sign of $v$ depends upon the relative value of $\sin\iota$ and $\sin\rho$. If the refracting power of the medium impinged upon is less than that of the medium in which the impinging wave was moving, $v$ will be positive; if greater, negative; which is in accordance with the law that when the wave passes from a more refracting to a less refracting medium the direction of molecular motion is maintained, while in the contrary case it is reversed. Understanding, therefore, by a sum of velocities, a geometrical instead of an arithmetical sum, we may make, in the expression for $v$, the angle of incidence the leading term, by putting in the original statement, $1 + v = u$, when

$$v = \frac{\sin(\iota-\rho)}{\sin(\iota+\rho)},\ \text{which is Fresnel's formula.}$$

In either case, the expression for $u$ remains unchanged and positive, as it should, since in the transmitted wave the direction of molecular motion of the incident wave is preserved.

Eliminating $\rho$ by means of the equation, $\sin\iota = n\sin\rho$,

$$v = \frac{\sqrt{n^2 - \sin^2\iota} - \cos\iota}{\sqrt{n^2 - \sin^2\iota} + \cos\iota}\qquad u = \frac{2\cos\iota}{\sqrt{n^2 - \sin^2\iota} + \cos\iota}.$$

When the incidence is perpendicular, $\iota = 0$, $\sin\iota = 0$, $\cos\iota = 1$, and $v = \frac{n-1}{n+1}$; $u = \frac{2}{n+1}$; at incidence 90°, $v = \frac{\sqrt{n^2-1}}{\sqrt{n^2-1}} = 1$; $u = 0$.

The intensity of light is measured by the living force of the molecular movements, or by the mass into the square of the velocity. The mass being the same for the incident and reflected waves, their intensities are as $1^2$ and $v^2$. But in comparing with the transmitted light, we must multiply by the expressions for measure of mass found above. Substituting for $m$ and $m'$ in the equation,

$$1^2 \times m = v^2 m + u^2 m',$$

both sides of the equation will be found $= \frac{\cos\iota}{\sin\iota}$, as they should be.

At perpendicular incidence $\sin\iota = \sin\rho = 0$, and $m$ and $m'$ become infinite; but this is of no consequence, since these terms express not the absolute masses, but only the ratio of the masses, which is all that the investigation requires. Replacing $\sin\iota$ by its equivalent $n\sin\rho$,

$$m : m' :: \frac{\cos\iota}{n\sin\rho} : \frac{\cos\rho}{\sin\rho} : \cos\iota : n\cos\rho,$$

which, when $\iota - \rho = 0°$, gives $\cos\iota = \cos\rho = 1$; and $m : m' :: 1 : n$. And at perpendicular incidence the sum of the intensities is

$$1 \times v^2 + n \times u^2 = \frac{(n-1)^2}{(n+1)^2} + \frac{4n}{(n+1)^2} = \frac{(n+1)^2}{(n+1)^2} = 1 \times 1^2,$$

the intensity of the incident wave.

Considering the general value of $v$, we find that it increases with the angle of incidence, and becomes unity when $\iota = 90°$, since here $\cos\iota = \cos 90° = 0$. For the same reason $u$ at this incidence $= 0$.

We take next the case of a wave in which the molecular movements, perpendicular to the direction of progress, are in the plane of incidence, and therefore in general inclined to the reflecting surface. The measures of mass will be the same as before, but instead of the actual velocities of the molecules we take the components of those velocities parallel to the reflecting surface. These are, for the incident wave, $1 \times \cos\iota$, for the reflected wave $v'.\cos\iota$, and for the transmitted $u'.\cos\rho$. Hence, adopting Fresnel's assumption,

$$(1 + v')\cos\iota = u'.\cos\rho.$$

Combining this with the equation of living forces, and reducing,

$$v' = \frac{\tan(\iota-\rho)}{\tan(\iota+\rho)};\quad u' = \frac{2\cos\iota\sin\rho}{\sin(\iota+\rho)\cos(\iota-\rho)}.$$

Eliminating $\rho$ as before, we obtain

$$v' = \frac{\sqrt{n^2 - \sin^2\iota} - n^2\cos\iota}{\sqrt{n^2 - \sin^2\iota} + n^2\cos\iota};\quad u' = \frac{2n\cos\iota}{\sqrt{n^2 - \sin^2\iota} + n^2\cos\iota}.$$

And at perpendicular incidence,

$$v' = \frac{1-n}{n+1};\quad u' = \frac{2}{n+1},\ \text{and at incidence } 90°,$$

$$v' = \frac{\sqrt{n^2-1}}{\sqrt{n^2-1}} = 1;\quad u' = 0,\ \text{which agree, as they}$$

should, with the results at the same incidences in the other case.

If we examine the first value of $v'$ given above, we shall perceive that it does not constantly increase with the increase of the incidence; for the denominator, $\tan(\iota + \rho)$, becomes infinite when $\iota + \rho = 90°$; so that at this incidence $v' = 0$, and there is no reflection. If, then, in the incident beam there had been a succession of waves, some polarized in the plane of incidence, and others in the plane at right angles to that, all this latter class of waves would at this particular incidence be transmitted, while a portion of the others would be reflected. The incident light, from the mixture of these two classes of waves, would be imperfectly polarized, or not polarized at all; but the reflected light would be wholly polarized in the plane of reflection. In this result we see a reproduction of the empirical law of Brewster, that at the polarizing angle the reflected and transmitted rays are perpendicular to each other; which is equivalent to saying that $\iota + \rho = 90°$.

If we take next the case of a ray which is polarized in any azimuth to the plane of reflection, we may, by decomposing its molecular movements into components, one coincident with the plane of reflection and the other coincident with the reflecting surface, proceed with these components severally according to the methods employed above. Let the given azimuth be $\alpha$, that of the molecular movements will be $90° - \alpha$. In the plane of reflection, therefore, the molecular movement will be $\cos(90° - \alpha) = \sin\alpha$; that in the reflecting surface will be $= \cos\alpha$. The living force in the reflected beam (which measures intensity, and which we may represent by R) will consequently be—the mass being assumed for convenience = unity—

$$R = \left(\frac{\sin(\iota-\rho)}{\sin(\iota+\rho)}\right)^2.\cos^2\alpha + \left(\frac{\tan(\iota-\rho)}{\tan(\iota+\rho)}\right)^2.\sin^2\alpha.$$

The agreement of this result with previous conclusions may be verified by making $\alpha$ successively $= 0°$ and $= 90°$. In the first case—

$$R = \left(\frac{\sin(\iota-\rho)}{\sin(\iota+\rho)}\right)^2;\ \text{and in the second, } R = \left(\frac{\tan(\iota-\rho)}{\tan(\iota+\rho)}\right)^2.$$

If $\alpha = 45°$, $\sin^2\alpha = \frac{1}{2}$, and $\cos^2\alpha = \frac{1}{2}$. Consequently,

$$R = \tfrac{1}{2}\left[\left(\frac{\sin(\iota-\rho)}{\sin(\iota+\rho)}\right)^2 + \left(\frac{\tan(\iota-\rho)}{\tan(\iota+\rho)}\right)^2\right].$$

This might easily be anticipated by considering that, in the supposed case, the incident beam is equivalent to two beams, each having an intensity of $\frac{1}{2}$, and polarized—one

in the plane of reflection, and the other in the plane perpendicular to it. The reflected beam should contain one-half the force in each plane which it would have done had each intensity been = 1.

Let there now be two beams, each = ½, incident together, and polarized in the azimuths $\alpha$ and $\alpha'$. From what has just been said, it is evident that the value of R will be—

$$R = \tfrac{1}{2}\left(\frac{\sin(\iota-\rho)}{\sin(\iota+\rho)}\right)^2 . (\cos^2\alpha + \cos^2\alpha'),$$
$$+ \tfrac{1}{2}\left(\frac{\tan(\iota-\rho)}{\tan(\iota+\rho)}\right)^2 . \sin^2\alpha + \sin^2\alpha').$$

In this expression, if $\alpha' = 90° - \alpha$, $\cos^2\alpha + \cos^2\alpha' = 1$. Also $\sin^2\alpha + \sin^2\alpha' = 1$. R becomes, therefore, equal to the sum of the intensities of two rays each = ½, polarized, one in the plane of incidence, and the other at right angles to it, no matter what may be the value of $\alpha$. If, then, any number of waves, in different azimuths, follow each other in so close succession as to blend their impressions upon the eye, and if their azimuths are so impartially distributed that for every value of $\alpha$ there is another = $90° - \alpha$, the forces in all these azimuths being equal, then the resultant effect of the whole must necessarily be—

$$R = \tfrac{1}{2}\left(\frac{\sin(\iota-\rho)}{\sin(\iota+\rho)}\right)^2 + \tfrac{1}{2}\left(\frac{\tan(\iota-\rho)}{\tan(\iota+\rho)}\right)^2.$$

But this is the condition of common light. The formula just stated, therefore, represents the living forces in the two principal planes, in a beam of common light after reflection, the original force being taken = 1. When $\iota + \rho = 90°$, the second term disappears. The reflected beam is then entirely polarized.

If we decompose the second term in the value of R, above, into its factors, we shall have (disregarding the numerical coefficient, and omitting the exponent)—

$$\frac{\tan(\iota-\rho)}{\tan(\iota+\rho)} = \frac{\sin(\iota-\rho)}{\sin(\iota+\rho)} \cdot \frac{\cos(\iota+\rho)}{\cos(\iota-\rho)}.$$

The molecular velocity of the wave polarized at right angles to the plane of reflection appears thus to be equal to that of the wave polarized in the plane of reflection, multiplied by the factor $\frac{\cos(\iota+\rho)}{\cos(\iota-\rho)}$. When $\iota = 90°$ (which is the greatest value it can have), the numerator and denominator of this fraction are equal, with opposite signs. The sign does not concern us at present, as it has no effect upon the value of the living force in the wave. For all values of $\iota$ less than 90° ($\rho$ being necessarily less than $\iota$ when $n$ exceeds 1) the denominator is greater than the numerator. It follows that in the reflection of common light, a larger amount of living force will, in the reflected beam, be preserved in the movements perpendicular to the plane of reflection than in those coincident with that plane; in other words, that the reflected beam will be more or less polarized in the plane of reflection. As also it follows that a larger amount of living force in the beam transmitted will be preserved in the plane of reflection than in the plane at right angles to that, we conclude that the transmitted beam will be more or less polarized, and that its plane of polarization will be normal to that of the reflected beam.

Reverting to the case of a wave polarized in azimuth $\alpha$ previous to reflection, we shall find that after reflection it is still polarized, though the azimuthal angle will be diminished. For putting $v_1$ to stand for velocity normal to the plane, and $v_2$ for velocity in the plane after reflection, we have

$$v_1 = \frac{\sin(\iota-\rho)}{\sin(\iota+\rho)}\cos\alpha;\ v_2 = \frac{\tan(\iota-\rho)}{\tan(\iota+\rho)}.\sin\alpha =$$
$$\frac{\sin(\iota-\rho)}{\sin(\iota+\rho)}\cdot\frac{\cos(\iota+\rho)}{\cos(\iota-\rho)}.\sin\alpha.$$

And the second of these expressions divided by the first will give the tangent of inclination of the resultant plane of polarization to the plane of reflection. Calling this angle $\alpha'$,

$$\tan\alpha' = \frac{\sin\alpha}{\cos\alpha}\cdot\frac{\cos(\iota+\rho)}{\cos(\iota-\rho)} = \tan\alpha\,.\,\frac{\cos(\iota+\rho)}{\cos(\iota-\rho)}.$$

If the reflected ray undergo reflection from a second mirror parallel to the first, its incident azimuth will be $\alpha'$, and after reflection it will have another azimuth $\alpha''$, of which the tangent will be

$$\tan\alpha'' = \tan\alpha'.\frac{\cos(\iota+\rho)}{\cos(\iota-\rho)} = \tan\alpha\,.\,\frac{\cos^2(\iota+\rho)}{\cos^2(\iota-\rho)}.$$

And as the law is manifest, we may say that after any number, $n$, of reflections, the tangent of the azimuth will be

$$\tan\alpha^{(n)} = \tan\alpha\,.\,\frac{\cos^n(\iota+\rho)}{\cos^n(\iota-\rho)}.$$

While $\cos(\iota+\rho)$ has any value (that is, so long as $\iota+\rho$ is greater or less than 90°), $\tan^{(n)}\alpha$ will also have a value, or the plane of polarization will not be brought by any number of reflections absolutely into coincidence with the plane of reflection; though when $\iota+\rho = 90°$, it will be so by the first reflection. When $\cos(\iota+\rho)$ is small, or $\iota+\rho$ is near 90°, the plane of polarization will after a few reflections coincide sensibly with the plane of reflection. Thus, if $\iota = 45°$ and $\alpha = 45°$, the reflecting medium being crown glass with an index of 1.5, $(\iota+\rho)$ will be about 73°, and $\frac{\cos(\iota+\rho)}{\cos(\iota-\rho)}$ = about $\frac{3}{10}$. In this case after one reflection the azimuth will be only 16° 42′; after two, 5° 9′; after three, 1° 32′; after four, 0° 28′; and after five, 0° 8½′.

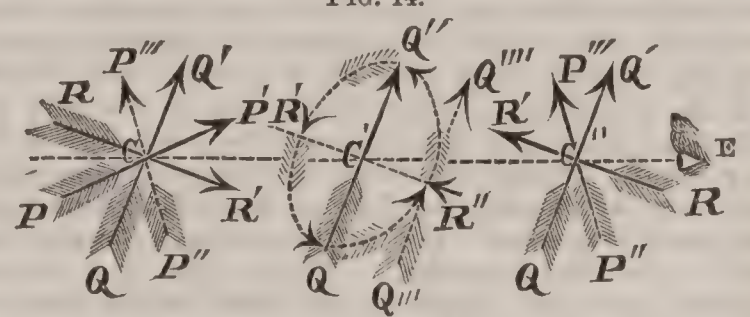
*Circular and Elliptic Polarization by Reflection.*—The expressions for molecular velocity in the reflected wave—viz.

$$v = \frac{\pm\sqrt{n^2-\sin^2\iota}-\cos\iota}{\pm\sqrt{n^2-\sin^2\iota}+\cos\iota}, \text{and } v' = \frac{\pm\sqrt{n^2-\sin^2\iota}-n^2\cos\iota}{\pm\sqrt{n^2-\sin^2\iota}+n^2\cos\iota},$$

are real for all incidences so long as $n$ is greater than unity. If $n$ = unity exactly, they are both zero for all incidences, as they should be, since in this case there is no reflection. If $n$ is less than unity, they are real for all incidences at which $\sin\iota$ does not exceed $n$, but become imaginary when $\sin\iota$ is greater than $n$. Experimentally, we know that in this case the reflection is total, and the expressions admit of the interpretation $v = -1$, $v' = -1$, verifying the equations $(1+v) = u$, $(1+v')\cos\iota = u'\cos\rho$, since $u$ and $u'$ are equally zero, there being no transmitted wave.

From the form of these expressions, Mr. Fresnel was led to infer that reflection in some manner modifies the phase of the undulation. The logic of the argument is not very clear, but the fact appears to be so. In the article Optics the conversion of plane into circular polarization by total reflection in Fresnel's rhombs has been described. It has been already shown that when two plane undulations normal to each other and of equal intensity, with a difference of phase of one-quarter of an undulation, interfere, the paths of the molecular movements become circular. In the rhomb of Fresnel it is found that two total reflections in an azimuth of 45° produce circular polarization; and hence it is inferred that of the two component waves to which the incident wave is equivalent, one in the plane of reflection and the other normal to it, one has been advanced or retarded upon the other by a quarter of an undulation. If the ray has undergone but one reflection in these conditions, the resulting molecular movements will be elliptical, and will be such as would be produced by an advancement or retardation of one of the waves upon the other by an eighth of an undulation. Fig. 14 may serve to illustrate these

Fig. 14.




effects. Let CE be the direction of progress of a plane polarized wave, PP′ being the original direction of molecular motion. This is decomposed into two movements, one of them QQ′ being coincident with the plane of reflection, and the other RR′ with the reflecting surface. If CC′ be the length of a quarter undulation, a movement commencing at C and decomposed in the directions CQ′, CR′ will have reached Q″ and R″ when the wave is at C′, if neither component is disturbed in phase. But if the movement in CQ′ stands still till that in CR′ has reached R″, and then becomes once more active, we may regard it as commencing at R″ just as the movement in CR′ is about returning toward the centre. The consequence of this combination, as shown in the article Vibration, will be revolution in a circle. The component RR′ therefore is in effect advanced, or the component QQ′ is retarded, a quarter of an undulation by two reflections in the rhomb. Four reflections double the effect; and the consequence may be inferred by supposing the movement in QQ′ to stand still while that in CR′ advances to R″ and subsequently returns to C″, when, combining with C″Q′, it produces a resultant in the direction P″P‴; that is to say, plane polarization in a plane normal to the first.

Suppose the eye of the observer to be at E, the revolution of the molecule is dextrogyre, or, as it is also called, *dextrorsum*. Conceived as viewed in the opposite direction, it would be lævogyre, or *sinistrorsum*. In the earlier history of this subject some confusion arose from the fact

that different observers applied these terms in different ways. Since observation, however, is only made upon rays approaching the observer, this is the point of view now universally adopted in naming the direction of gyration. It appears, then, that the advance of the left-hand component by a quarter undulation produces a dextrogyration, and *vice versâ*. If the plane of original polarization were P″P‴, then, in the resolution, RR′ would be reversed, and the advance of RR′ would be the advance of the right-hand component, producing lævogyration.

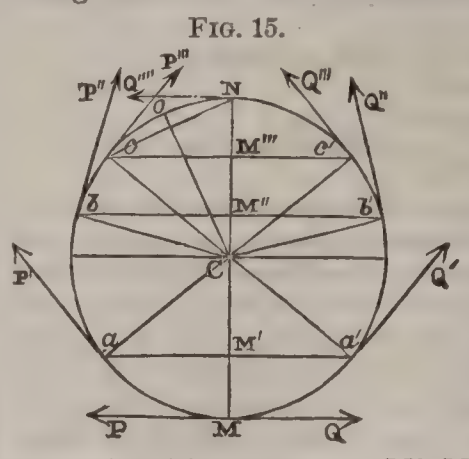
If we distinguish as *positive* the azimuths to the right of the plane of reflection, and as *negative* those to the left, we may say that a plane polarized ray in original azimuth −45°, is circularly polarized dextrorsum by passing through one of Fresnel's rhombs; and becomes plane polarized again in azimuth +45°, after passing through two. If the original azimuth be +45, the circular polarization is sinistrorsum, and the final azimuth of plane polarization, negative. One of these rhombs may therefore be used as a polariscope, to detect the direction of rotation of a circularly polarized ray.

If the azimuth of the original plane of polarization be greater or less than 45°, the intensities of the two components will be unequal, and the resulting polarization will be elliptical. If two equal waves in equal azimuths, positive and negative, be simultaneously reflected in one of Fresnel's rhombs, their opposite gyrations will produce a linear resultant. As in common light the molecular movements follow each other in all possible azimuths, it results that common light cannot be polarized by total reflection. If, however, we suppose a surface which is not a surface of total reflection to possess the power of accelerating or retarding one of the rectangular components of the incident velocity over the other, the reflected light will in general be elliptically polarized. For the two components are never equally reflected except in total reflection, and hence partial reflection can never produce circular polarization. There are very few substances which do not possess such a power, and accordingly elliptical polarization is the effect most usually attending reflection. Polarization which is sensibly plane is produced by reflection only from the surfaces of media whose indexes of refraction are near 1.414.

This subject has been thoroughly investigated, theoretically by Mr. Cauchy, and experimentally by Mr. Jamin, with mutually confirmatory results. The experimental methods are very ingenious and interesting, but space will not allow a description of them here. The most important of Mr. Jamin's conclusions are the following: Nearly all transparent bodies produce, by reflection from their surfaces, a difference of phase between the component waves polarized in the two principal planes. All whose indexes of refraction exceed 1.414 advance the phase of the component polarized in the plane of incidence. All those whose indexes are below that value retard the phase of the same component. The difference of phase augments with the incidence from $\frac{1}{2}\lambda$ at 0° to $\lambda$ at 90°, and becomes $\frac{3}{4}\lambda$ at the polarizing angle. The variations are slow and almost insensible for some distance from either 0° or 90°. They usually become sensible near the polarizing angle. The limits are nearer together as the polarization under that angle is greater. Beyond these limits the polarization is plane but imperfect. Within them it is elliptic. The two limits are nearer to each other as the index of refraction approaches 1.414. They *unite* for substances whose index has that exact value. Mr. Jamin found but two substances in which this condition is fulfilled. They were a specimen of menilite, and a crystal of alum cut perpendicularly to the axis of the octahedron. Water and glass, which under ordinary light appear to polarize perfectly, are easily seen not to do so under the strong light of the sun. In the cases in which the index has the particular value just mentioned, the advance of phase at the polarizing angle is "brusque" from $\frac{1}{2}\lambda$ to $\lambda$. This is very nearly the case with water and glass. Reflection from the surface of metals always produces elliptical polarization. The advance of phase is progressive from incidence 0° to incidence 90°. There are, however, very large differences between metals in this respect.

*Rotatory Polarization.*—The property possessed by certain crystals and many solutions of producing in the plane of polarization of a plane polarized ray a change of azimuth in a constant direction, uniformly increasing with the distance passed over in the medium, has been mentioned in the article Polarization. It is also there stated that Fresnel, by an ingenious combination of prisms, succeeded in demonstrating the existence in quartz of two circularly polarized rays gyrating in opposite directions. The wave-progress of these two rays is unequal. And as in circular undulations the molecules in a given undulation-length form at any given moment a spiral beginning and ending in the same azimuth, if there are two such spirals, beginning together and turning in opposite directions, they will also end together if the undulation-lengths are equal. Suppose these spirals to be traced on the surface of an imaginary cylinder, and that a plane perpendicular to the axis of the cylinder, or to the direction of progress, intersect this surface and move parallel to itself along the axis. The intersections with the spiral may be

Fig. 15.




supposed in Fig. 15 to be at M, $a$, $a'$, $b$, $b'$, $c$, $c'$, and so on, and the molecules at these several points will be acted upon by tangential forces represented by P, Q; P′, Q′, etc., and also by forces directed toward the centre C. The forces PQ being equal and opposite, the central force MC will prevail, and no actual circular movement will occur at all. The molecule will advance to M′, M″, etc., and the tangential forces P′, Q′, P″, Q″, etc., must be understood to be applied successively at those points in MN, and parallel to the directions shown. The practical result will be plane polarization.

But if one of these component spirals is shorter than the other, then, though the two begin together, they do not end together. When one has completed a revolution and reached the same azimuth again, the other will be short of a revolution. In like manner the first will complete any fraction of a revolution—say a half—before the other; so that the intersecting plane may, for example, cut one spiral at N and the other at $c$. At this moment the soliciting tangential forces will be P‴ and Q‴′, and the direction of motion will be from the centre in the line bisecting the arc $c$N. The movement will still be linear, but the direction will be changed in azimuth; and as it is obvious that this change must be regularly progressive, the *locus* of all these movements will be a warped surface, resembling a lamina of some material substance twisted. The tangents show the assumed direction of gyration, and, the ray being supposed to approach the observer, the rotation of the plane of polarization is in the direction of the winding of the longest spiral, but in that of the gyration in the shortest undulation.

This illustration shows us that the angular movement in azimuth during each undulation is one-half the difference of phase between the two component waves. By observing, therefore, the amount of rotation produced by a known thickness of crystal, we may determine the relative velocities of the two waves. Represent this thickness by $t$, and the observed rotation by $\theta$. Then, if $\lambda$ denote the larger wave-length and $\lambda'$ the shorter, we shall have

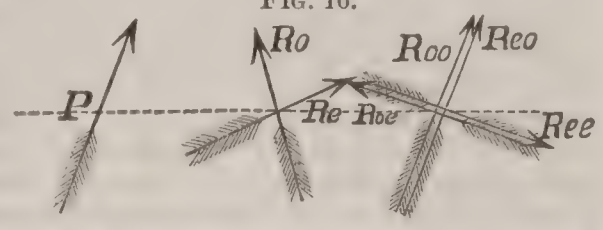
$$t = m\lambda = \left(m + \frac{2\theta}{2\pi}\right)\lambda'; \text{ or } \frac{\lambda}{\lambda'}, = \frac{m\pi + \theta}{m\pi}.$$

As $\lambda$ can be found by experiment, and $t$ is known, $m$ is ascertainable. Mr. Babinet found the value of $\frac{\lambda}{\lambda'}$ in quartz to be only 1.00003—a value which, small as it is, is the largest known for rotatory polarization.

As the two components in quartz have unequal velocities and pursue the same path, they must, for certain thicknesses of the crystal, differ in phase by a half undulation; and since their gyrations are in opposite directions, it might be supposed that they would exhibit some sensible phenomena of interference. This is not the case, and a little consideration will show the reason. Each of the two circular waves is the resultant of two elementary plane waves normal to each other and differing in phase by a quarter undulation. Let their elementary movements at any instant be represented by $q$ and $r'$, $q'$ and $r$. In the beginning $q$ and $q'$ are in the same phase; so also are $r$ and $r'$, but in a phase 90° more advanced. We may suppose $q$ and $q'$ to be situated in a plane cross-section of the wave, distant a quarter of an undulation from a similar plane occupied by $r$ and $r'$. Now, if the gaining circular undulation is that represented by $q$ and $r'$, these two components will advance out of their planes, $q$ approaching $r$, and $r'$ receding from $q'$. When $q$ has gained a quarter undulation, it conspires with $r$, and the joint intensity is maximum; but at the same time $r'$ will be distant from $q'$ half an undulation, and their joint intensity will be minimum. In like manner, at intermediate points, the values of the two resultants are compensatory, and no effects of interference are perceived. But when two circularly and oppositely polarized rays of equal undulation-length are thrown together in nearly a common direction, they exhibit the effects of interference like common light.

*Chromatics of Polarized Light.*—In the article POLARIZATION the effect of double refraction has been stated to be to generate two waves of unequal velocity and dissimilar form, polarized at right angles to each other in the doubly refracting body. In consequence of the inequality of velocity, these two waves may emerge from a surface opposite and parallel to the surface of incidence, in different phases. If not entirely separated by the deviation of their paths, they may thus, so far as phase is concerned, be in condition to interfere. But as interference is impossible between waves whose molecular movements are perpendicular to each other, if, by any contrivance, we can turn the planes of polarization of the two rays, when, by double refraction, their paths have been made to differ by half an undulation, or by any odd number of half undulations, so that these planes shall coincide, interference will be produced. It is this which is done in the arrangements described in the article referred to, by which the gorgeous colors first observed by Arago in plates of doubly refracting crystals, are made to appear. In the first place, the lamina must be doubly refracting, in order that there may be two rays. In the second place, it must be thin, that the difference of length of path may be small. In the third place, the original light must be polarized, otherwise there will be two systems of interferences compensating each other, and obliterating each other's effects. In the fourth place, the principal plane of the lamina should, in order to produce the most complete interference, be at an azimuth of 45° to the plane of original polarization—the two rays being, in this position of the crystal, exactly equal to each other. In the fifth place, we must observe the phenomena by means of an analyzer, which allows only the light polarized in a single plane to come to the eye, or which, like a doubly refracting prism, separates the emergent light which is polarized in one plane from that which is polarized in the transverse plane; otherwise in this case again we shall have the blended effects of two compensatory interferences. Finally, the principal plane of the analyzer should, in order to produce the best effect, be at an azimuth of 45° from the principal plane of the lamina. The necessity of this condition may be readily deduced from the law of Malus. The annexed Fig. 16 may illustrate the changes which take place in the passage of the ray through the system. If the arrow, P, represent the direction of an elementary molecular movement of the original polarized ray, this movement will be resolved in the lamina into two movements at right angles to each other, and each inclined 45° to P, as shown by the arrows $R_o$ (the ordinary ray) and $R_e$ (the extraordinary). Suppose these rays to emerge, without difference of path, from the lamina, and to be received upon a crystal of Iceland spar whose principal plane coincides with the direction of P. Then $R_o$ will be resolved into $R_{oo}$ and $R_{oe}$; and $R_e$ will be resolved into $R_{eo}$ and $R_{ee}$. $R_{oo}$ and $R_{eo}$ will conspire, and $R_{oe}$ and $R_{ee}$ will conflict. The first pair, on the supposition we have made, will only be effective. The second will destroy each other.

FIG. 16.

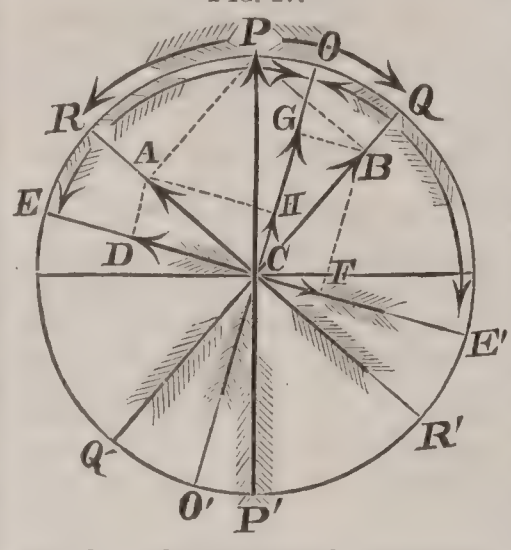



But if, as actually happens, one of these rays, as $R_{oo}$, is retarded, when this retardation amounts to $\frac{1}{2}\lambda$, $R_{oo}$ and $R_{eo}$ will conflict, and $R_{oe}$ and $R_{ee}$ will conspire. In white light, the different component undulations are unequal; and in such light a retardation which produces conflict between the shorter undulation, as in violet or indigo, will not equally do so in the red or orange. Hence light will still appear in both the planes $R_{oo}$, $R_{eo}$, and $R_{oe}$, $R_{ee}$; but it will be colored in both, and the tints extinguished in one will be present in the other.

It is common to speak of polarized light which has passed in this manner through a thin crystalline lamina, as having undergone *depolarization* in the lamina—an expression which seems to imply that it is restored to the condition of common light. This, however, is not true. There is one analogy between the cases, which consists in the fact that the vibrations of common light, when resolved into components parallel to two planes passing through the direction of the ray and normal to each other, are equivalent to those of the two rays into which the one original polarized ray is divided by the lamina. But the great dissimilarity of physical condition between the two is evidenced by the fact that in the one case the analyzer produces colors, while in the other it does not. There is a particular thickness of the lamina which produces something more resembling depolarization. It is that at which one ray is retarded behind the other a single quarter of an undulation. In this case the analyzer finds an equal amount of light in both planes, and in fact in all planes; so that, so far as this test is concerned, the light is truly depolarized. But it has been shown that this amount of dislocation of the rectangular components of molecular movement in plane polarized rays—the components being equal—produces circular polarization. In fact, the most convenient mode of producing circularly polarized light is to employ for the purpose what is called a "quarter-wave lamina." Such a lamina will convert a plane polarized ray, incident upon it in azimuth 45° to its principal section, into a circularly polarized ray.

When the lamina which is the subject of experiment is so thick that the difference of path between the two rays amounts to many half undulations, then no color can be totally extinguished in either plane. For it must be remembered that each color occupies a considerable space in the spectrum, and therefore has undulations belonging to it of many different lengths. The differences may be slight, but slight values many times repeated become large values at last; so that two red rays whose phases are for several undulations sufficiently alike to conspire, may after a larger number be sufficiently unlike to conflict. Thus, when a certain amount of retardation has been reached, there will be found undulations of all colors impartially distributed through all varieties of phase, and chromatic phenomena will cease to appear.

FIG. 17.




A general expression for all these phenomena may be found as follows: Let PP′ be the plane of polarization of the original ray; QQ′ the principal plane of the lamina; RR′ the conjugate plane; OO′ the principal plane of the analyzer, which we will suppose to be a doubly-refracting prism or rhomb of Iceland spar; and EE′ its conjugate plane. Draw PA, PB, perpendicular to QQ′ and RR′; BF, BG perpendicular to EE′, OO′; and AD, AH perpendicular to EE′, OO′. Then if CP represent the velocity of molecular movement in the original ray, CA and CB will represent its equivalent components in the directions R′R and Q′Q. If these components be further decomposed in the directions OO′ and EE′, we shall have the original velocity CP represented by the four elements CG, CH in the principal plane, and CD, CF in the conjugate plane of the analyzer.

Represent the original velocity CP by V. Put the angle $PCQ = \alpha$, and the angle $PCO = \beta$. Then the angle OCQ will be $\alpha - \beta$. The triangles PCA, PCB give $CA = V \sin \alpha$; $CB = V \cos \alpha$. And the triangles ACD = ACH, and BCF = BCG, give $CD = V \sin \alpha \cos(\alpha - \beta)$; $CF = V \cos \alpha \sin(\alpha - \beta)$; $CG = V \cos \alpha \cos(\alpha - \beta)$; $CH = V \sin \alpha \sin(\alpha - \beta)$. Then, to find the resultant of CG, CH, the molecular velocities of the two rays emergent in the plane OO′—that is, of the emergent ordinary ray—we recur to the general equation—

$$A^2 = a^2 + a'^2 + 2aa' \cos \theta,$$

in which we must substitute for $a$ and $a'$ the values of CG and CH given above; and for $\theta$ the amount of retardation in phase of one of the rays behind the other in passing the lamina, which, if $h$ represent the actual difference in length of path, may be represented by $2\pi \frac{h}{\lambda}$. The equation just stated may be conveniently transformed by adding $2aa' - 2aa'$ to the second member, when it will become—

$$A^2 = a^2 + a'^2 + 2aa' - 2aa' + 2aa' \cos \theta.$$

Or $A^2 = (a + a')^2 - 2aa'(1 - \cos \theta) = (a + a')^2 - 4aa' \sin^2 \frac{1}{2}\theta$.

Substituting now the values of $a$, $a'$, and $\theta$, we obtain—

$$A^2 = V^2 \left[ [\cos \alpha \cos(\alpha - \beta) + \sin \alpha \sin(\alpha - \beta)]^2 - 4 \sin \alpha \cos \alpha \sin(\alpha - \beta) \cos(\alpha - \beta) \sin^2 \pi \frac{h}{\lambda} \right].$$

Which may be reduced to the following:

$$A^2 = V^2 \left[ \cos^2 \beta + [\cos^2(2\alpha - \beta) - \cos^2 \beta] \sin^2 \pi \frac{h}{\lambda} \right].$$

And by pursuing a similar course with the values of the components CD, CF, of the extraordinary ray, we shall obtain for its resultant—

$$A'^2 = V^2 \left[ \sin^2 \beta + [\sin^2(2\alpha - \beta) - \sin^2 \beta] \sin^2 \pi \frac{h}{\lambda} \right].$$

The intensity of the light in either plane is thus expressed in a formula of two terms, one of which is affected

by interference, while the other is not. It is from the second that the colorific effects proceed—directly when this term is positive relatively to the first, and indirectly when it is relatively negative. This term may therefore be called the chromatic term, and the other the achromatic. By the discussion of these equations we shall find that they embrace a complete explanation of all the varying phenomena presented by doubly-refracting substances observed in polarized light.

First, if we add the values of $A^2$ and $A'^2$, the chromatic term disappears. The colors are therefore complementary, and their resultant when blended is white. It follows that in order to observe these phenomena an analyzer must be used which allows only rays to pass polarized in a single plane, and not in the transverse, such as a plate of tourmaline cut parallel to the axis, or a Nicol's prism.

Second, $A^2 + A'^2 = V^2$, or the sum of the two intensities is equal to the intensity of the original ray, as it should be on the principle of the preservation of living forces.

Third, the chromatic effects, which depend on the factor $\sin^2\pi\frac{h}{\lambda}$ for their character, depend for quantity not only on this, but on the coefficients $\cos^2(2\alpha-\beta)-\cos^2\beta$ and $\sin^2(2\alpha-\beta)-\sin^2\beta$ also. Their greatest values will therefore occur when this coefficient is maximum. The maxima, so far as they depend on $\beta$, are found by making $\alpha$ constant, and will then occur when $\alpha-\beta$, or $\beta-\alpha=45°$. If $\alpha$ is variable, they will occur when $\alpha=\pm 45°$. Hence, the absolute maxima will be obtained when the principal plane of the lamina is inclined 45° to the plane of polarization of the incident light, and that of the analyzer is in azimuth 0° or 90°—theoretic conclusions already anticipated by experiment.

Fourth, the chromatic terms in the values of $A^2$ and $A'^2$ are both affected by the positive sign. If the term itself is essentially positive, the color is that of the two interfering rays added to and diluted by the amount of white light expressed in the achromatic term. If it is essentially negative, the color will be that which is left after the subtraction of its own color from the white of the achromatic term. That the subtraction will always be possible will be apparent from an analysis of the expression; since it is apparent that the achromatic term is never less than the coefficient of the achromatic, and this coefficient is multiplied by a factor which never exceeds unity. The achromatic term, however, becomes zero in the value of $A^2$ when $\beta=90°$, and in that of $A'^2$ when $\beta=0°$; but in these cases the chromatic term is essentially positive.

Fifth, if the position of the analyzer remain unchanged, and the lamina is rotated in azimuth, $\beta$ being constant and $\alpha$ variable, the chromatic term is zero when $\alpha=\beta$, or $\beta\pm 90°$, or $\beta\pm 180°$, etc., and increases to a maximum when $\alpha=\beta\pm 45$, or $\beta\pm 135$, etc. White light therefore only is seen in the first series of positions here defined, and in the second, colored light—the same colors alternately fading and reappearing, since the chromatic term does not change its sign. But when the lamina remains at rest and the analyzer is rotated, although white light once more appears when $\beta=\alpha$, $\beta=\alpha\pm 90°$, $\beta=\alpha\pm 180°$, etc., and colored light at the intermediate positions, the colors will change in passing each neutral point, and will be complementary to each other in the successive quadrants; since it is evident from inspection that the essential value of the coefficient of the chromatic term changes from positive to negative, and the contrary, in making those passages.

Sixth, when $\alpha=0°$, 90°, 180°, etc., the chromatic term disappears for every value of $\beta$. In this case the light remains white throughout the entire revolution of the analyzer, and one or the other of the achromatic terms disappears whenever $\beta=0°$, 90°, 180°, etc.

Seventh, if the lamina and the analyzer both remain stationary, and the polarizer revolves, the chromatic term changes its sign in every quarter revolution, and complementary colors successively appear. It is hence manifest that unless the light is originally polarized no chromatic effects will be observable, since the colors produced by undulations in one azimuth will be neutralized by the complementary colors proceeding from other undulations in an azimuth at right angles to this.

Eighth, the factor $\sin^2\pi\frac{h}{\lambda}$, on which color depends, is maximum when $h=\frac{1}{2}\lambda$, $\frac{3}{2}\lambda$, $\frac{5}{2}\lambda$, etc. Hence the chromatic effect is greatest when the difference of phase of the two undulations is an odd number of half undulations.

Ninth, if $h=\lambda$, $2\lambda$, $3\lambda$, etc. the chromatic effects disappear and the equations become simplified to the forms $A^2=V^2\cos^2\beta$; $A'^2=V^2\sin^2\beta$; which are a reproduction of the law of Malus. (See POLARIZATION.)

Tenth, if $h=\frac{1}{4}\lambda$, $\frac{3}{4}\lambda$, $\frac{5}{4}\lambda$, etc.—that is to say, an odd number of quarter undulations—and $\alpha=45°$, the equations become

$$A^2=V^2(\cos^2\beta+\tfrac{1}{2}(\sin^2\beta-\cos^2\beta))=\tfrac{1}{2}V^2(\cos^2\beta+\sin^2\beta)=\tfrac{1}{2}V^2.$$
$$A'^2=V^2(\sin^2\beta+\tfrac{1}{2}(\cos^2\beta-\sin^2\beta))=\tfrac{1}{2}V^2(\sin^2\beta+\cos^2\beta)=\tfrac{1}{2}V^2.$$

This result, being independent of the value of $\beta$—that is, of the position of the analyzer—would seem to indicate depolarization of the light. It is, however, the case of circular polarization already considered. It will be seen that $\alpha$ must be 45° in order that the two component normally-polarized rays may be equal, else in any other azimuth of the lamina the polarization will be elliptical.

*Colored Rings of Crystalline Plates.*—If a lamina cut from a crystal of Iceland spar at right angles to the axis be subjected to examination in polarized light, then, as in the axial direction the ordinary and extraordinary rays are confounded, no chromatic effects will be perceived in the centre. But the rays which come to the eye converging from points not central will differ in velocity, the difference increasing with the obliquity. As every plane which passes through the axis is a principal plane, there will be an infinite number of principal planes intersecting each other in the line which forms the path of the central ray, the projections of which upon the surface of the lamina will form so many radii diverging from a centre. And as all planes which are parallel to the axis, however placed, are principal planes also, it is obvious that the planes normal to these radiating principal planes will form cylindrical principal sections having a common axis. The plane of polarization of the incident light can only coincide with one of the radiating principal planes. For that plane, the value of $\alpha$ in our formulæ will be 0°. For the principal plane at right angles to that, the value of $\alpha$ will be 90°. But when $\alpha=0°$ or 90°, the value of the chromatic term is 0. Hence there will be two planes in which no color will appear for any position of the analyzer—that is, for any value of $\beta$. But the brightness of the light seen in those planes will undergo variations of intensity, as $\beta$ varies, according to the law of Malus.

For every plane except the two which have just been mentioned, the chromatic term will have a value—very slight in the neighborhood of those planes, and maximum at 45°. Very near to the centre, converging rays will have but a slight obliquity to the axis; and as a difference in length of path of one-quarter of an undulation or less fails to produce color in white light, there will be a central area which will be alternately white and black as the analyzer turns. From this area will proceed at right angles the arms of a cross, alternately dark and bright, which from the faintness of the color in the neighborhood of azimuths 0° and 90°, will have a very sensible breadth.

At that degree of convergency which makes the amount of retardation for the most refrangible rays $=\frac{1}{2}\lambda$, will appear the first decided chromatic effect. And as, in a plate of uniform thickness, this convergency must be the same on every side, the color will take the form of a ring. This ring will be bright if the analyzer is crossed upon the polarizer; in the opposite position, dark. In order to observe the phenomena to the greatest advantage, it is best to employ homogeneous light. Then at greater convergencies, corresponding to retardations, or values of $h$, equal to $\frac{3}{2}\lambda$, $\frac{5}{2}\lambda$, etc., will be seen, with the crossed analyzer, other bright rings; while at the intermediate convergencies, corresponding to values of $h=\lambda$, $2\lambda$, $3\lambda$, etc., will be seen dividing rings, intensely dark. When white light is used, the dark rings will be mainly occupied by the smaller rings of the colors whose undulations are shorter than the mean, or the larger rings of those which are longer. Since the retardation depends directly upon the convergency, and the place of a ring of any color depends on the equality of the retardation with the length of a half undulation of that color, it will be evident without further demonstration, that the longer the undulation the larger the ring, and *vice versâ*.

Rotating the crystalline plate in azimuth will produce no change in the phenomena. For in all positions of the plate there will always be one principal place in azimuth 0°, and another in azimuth 90°.

Rotating the analyzer will cause the rings to pass by progressive changes into the complementary tints. In this rotation $\beta$ becomes $=\alpha$ and $>\alpha$ successively for every one of the radiating principal planes which it passes, up to $\beta=90°$. The sign of the chromatic term changes, therefore, in every such case. And, as the sign changes also for $\beta=\alpha\pm 90°$, $\beta=\alpha\pm 180°$, or $\beta=\alpha\pm 270°$, the color in all the quadrants will undergo similar changes simultaneously. Thus, in an entire revolution of the analyzer, the colors will be four times successively reversed; and for every position in which $\beta=45°$ or any of its odd multiples they will disappear.

The remarkable dislocations of the rings seen in crystals

cut across the axis, when examined in circularly polarized light, has been mentioned in the article POLARIZATION. This appearance is shown in Fig. 18. In the alternate quadrants, the dark rings and bright rings assume each other's positions, and no ring is continuous throughout the circle. This curious appearance is, however, easily explained, if we suppose the circularly polarized ray to be replaced by its component plane rays polarized normally to each other and differing in phase a quarter of an undulation. Call these components $p$ and $q$, and suppose $p$ to be in advance of $q$ by a quarter undulation. There will be two quadrants (which we may call one and three), in which the plane of polarization of $p$ will be radial, while in the alternate quadrants (two and four) it will be tangential. The other component, $q$, will be tangential in one and three, and radial in two and four. In the first and third quadrants, therefore, $p$ will be the ordinary ray, and in the second and fourth the extraordinary. The extraordinary ray will be accelerated in velocity, or the ordinary retarded, relatively to the other; and at such an inclination with the axis as shall produce a retardation of a quarter of an undulation, $p$ and $q$ will be coincident in phase in quadrants one and three, while their difference will have been increased to half an undulation in quadrants two and four. As the planes of polarization of $p$ and $q$ are normal to each other, no effects of interference are observable without the analyzer; but when the principal plane of the analyzer is in azimuth 45° to both components, a positive chromatic effect is produced at a certain distance from the centre in the first and third quadrants, and a negative in the second and fourth at the same distance—that is, the same ring is bright in two quadrants and dark in the two alternate quadrants.

FIG. 18.



*Crystals of Two Axes.*—In crystals of two axes neither ray obeys in general the law of Snellius. But there are three planes in which one of them does so. These are, first, that which passes through both axes, and secondly, both the planes normal to the first which bisect the angles between the axes. The terms "ordinary ray" and "extraordinary ray" in the sense in which those words have been used in speaking of crystals of one axis, are inapplicable in the present case. The following equation, deduced from the general theory of double refraction, expresses the relation between the velocities of two rays traversing the crystal in the same direction, but possessing the different polarizations produced by its double refraction:

$$\frac{1}{v'^2}-\frac{1}{v^2}=\left(\frac{1}{c^2}-\frac{1}{a^2}\right)\sin\phi\sin\phi'.$$

In this formula $v$ and $v'$ are the two variable velocities; $a$ and $c$ are the Snellian velocities (constant) in the two principal planes co-ordinate to the plane of the axes; and $\phi$ and $\phi'$ are the angles made by the common direction of the two rays with the axes themselves. Putting $vv'=ac$, and $v+v'=2\sqrt{ac}$, suppositions sensibly true near the axes, we find

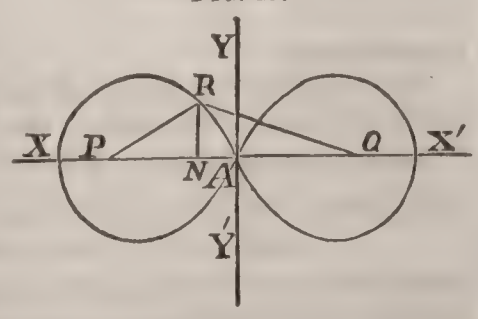
$$v-v'=\frac{v^2v'^2}{v+v'}\left(\frac{a^2-c^2}{a^2c^2}\right)\sin\phi\sin\phi' \text{ (very nearly).}$$

In the immediate vicinity of the axes, where $\phi$ and $\phi'$ are small, we may take the angles themselves, or their chords, instead of their sines. Let these chords be $r$ and $r'$. Then the equation becomes,

$$rr'=\frac{2\sqrt{ac}}{a^2-c^2}(v-v'),$$

which, if $v-v'$ be made constant, is the equation of a *lemniscate*. Fig. 19 represents a *lemniscate*, or curve whose distinguishing property is that the products of every pair of *radii vectores*, drawn from two polar points, and intersecting in the curve, are equal to each other and to a constant quantity. If PQ, the distance between the poles, be bisected at A, and PA made $=q$, then the constant value of PR × QR, divided by $q$, is called the *parameter*, and may be represented by $p$. Put PR $=r$, QR $=r'$, AN $=x$, and RN $=y$. The construction gives, immediately—

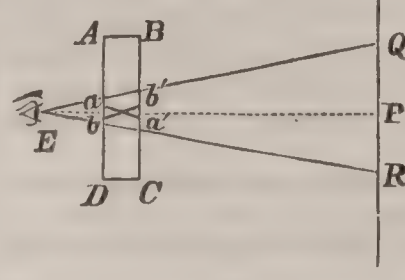
FIG. 19.




$$r'^2=(q+x)^2+y^2;\ r^2=(q-x)^2+y^2;\ \text{whence}$$
$$r^2r'^2=((q+x)^2+y^2)\ ((q-x)^2+y^2)=p^2q^2.$$
$$\text{Or } r^2r'^2=(q^2+x^2+y^2)^2-4q^2x^2=p^2q^2.$$

In the case in hand the parameter is found by substituting the values of $v$ and $v'$ in the foregoing equation and dividing by $q$. The value of $q$ itself is the tangent of half the angle between the axes, when the thickness of the lamina is made radius. This supposes the lemniscate to be referred to the surface of the lamina. When projected on a screen, or referred to a more distant surface, as QR, Fig. 20, $q$ must be increased in the ratio of EP, the distance of that surface from the eye, to AB, the thickness of the lamina; and the constant value of $rr'$ in the equation above must be increased in the square of that ratio.

FIG. 20.




When $v-v'=$ half an undulation, there will be seen—the analyzer being crossed upon the polarizer—the first bright ring. When $v-v'=\lambda$, the first dark ring will be formed. The parameter changes with $v-v'$, and the parameters of the bright rings evidently form an arithmetical series, corresponding to the odd numbers, 1, 3, 5, etc.; while those of the dark rings form a similar series with the even numbers.

The lemniscates are not perfect (though some of them are nearly so), because small errors have been admitted into our assumption. The inner curves, moreover, will in many cases form ellipses around a single pole. It is obvious that this must be the case when the constant is less than $q^2$. For $q^2$ is the smallest value that the product of the radii vectores can have; and when the parameter is not equal to $q$, there can be no lemniscate.

When the analyzer is crossed upon the polarizer, in observing these curves, if the plane of the axes is in the plane of polarization of the incident light, there will be seen a black cross intersecting the system symmetrically; the principal bar of which will coincide with the plane of the axes. The transverse bar will pass at right angles to this, halfway between the poles. In these two planes there is (in the position of the crystal supposed) no double refraction of the incident polarized ray. The light is therefore transmitted without interruption, and being cut off by the analyzer, shows the dark cross. By rotating the analyzer 90°, the cross becomes bright, as with crystals of one axis. But when the crystal itself is turned in azimuth, while the analyzer remains in one of the principal azimuths, the arms of the cross break at the centre, two of them on each side forming together a curve. At 45°, the two curves present the appearance of opposite hyperbolas. The analytic expression for these changes is by no means so simple as in the case of crystals of one axis. Wherever colorless or dark curves appear, the light passes the crystal without double refraction.

*General Theory of Double Refraction.*—The theory which embraces all the cases of double refraction in the most general manner is founded on the assumption of a difference of elasticity in the ether in the directions of three rectangular axes; and among the conclusions mathematically deducible from this assumption is the proposition that, in a medium so constituted, the molecular movements of an incident ray will be unstable except in two determinate azimuths at right angles to each other. If they are not in those azimuths, or in one of them, on entering the medium, they will be instantly turned into them; and thus the ray will be polarized in planes having transverse directions in the crystal.

If we take a crystal of two axes, and form from it prisms, of one of which the edges shall be perpendicular to the plane containing the axes, while the others have their edges respectively parallel to the lines which bisect the angles between the axes, we shall find that, in the planes of refraction of these prisms, one of the rays follows the law of Snellius; but that the indexes of refraction for these are different. These rays thus obeying the ordinary law are moreover polarized in their several planes of refraction. Their molecular movements are therefore perpendicular to those planes, or parallel to the edges of the prisms, that is to say, parallel (by construction) to three determinate fixed lines in the crystal, each at right angles to the other two. Their velocities, then, determine the elasticities in the direction of three rectangular axes. From these, as constants, is derived an equation expressing the elastic force in all intermediate directions. The three velocities are distin-

guished by the letters $a$, $b$, and $c$, in the order of their magnitude—that denoted by $a$ being greatest. And elasticities being as the squares of the velocities which they generate, the three elasticities are $a^2$, $b^2$, and $c^2$. Now if any line be taken which makes with the directions of the elasticities $a^2$, $b^2$, $c^2$, angles represented by A, B, and C, and if R denote the velocity which the elasticity in the direction of that line is capable of generating, then we shall have the equation—

$$R^2 = a^2\cos^2 A + b^2\cos^2 B + c^2\cos^2 C.$$

Giving A, B, and C all possible values, R will have all possible directions; and, considered as a radius vector, its extremity will describe a surface the squares of whose radii will be equal to the elasticities in their directions. This surface, therefore, Fresnel denominated the surface of elasticity. The surface, as might be inferred from the principle of its construction, is an ellipsoid, of three unequal axes.

The polar equation above given may be referred to rectangular co-ordinates by putting $x$, $y$, and $z$ for the co-ordinates parallel to $a$, $b$, and $c$, respectively, and assuming

$$R^2 = x^2 + y^2 + z^2;\ \cos A = \frac{x}{R};\ \cos B = \frac{y}{R};\ \cos C = \frac{z}{R}.$$

Whence

$$R^4 = a^2x^2 + b^2y^2 + c^2z^2;\ \text{or}\ (x^2 + y^2 + z^2)^2 = a^2x^2 + b^2y^2 + c^2z^2.$$

It would occupy a larger space than is allowed us here to examine analytically all the questions which can arise in the general theory of double refraction. We limit ourselves to a statement of the more important conclusions.

Every section of the surface of elasticity made by a plane is an ellipse. Every such section may represent the front of a plane wave. As the elasticities of the medium in different directions in this ellipse are as the squares of its radii, the greatest and least elasticities will be in the directions of its axes. And as the effect of the elastic resistances to a disturbing force is to turn the molecular movements into the directions of the greatest and least elasticities, the wave will be polarized in entering the medium in the planes of these two axes. Also, as the velocities of wave-progress are as the square roots of the elasticities producing them, the velocities of the two polarized waves will be as the axes in the directions of which their molecular vibrations are performed, and therefore the axes which are normal to their respective planes of polarization.

Since the two velocities are both uniform, though unequal, a plane wave is transformed into two plane waves by double refraction. Supposing the refracting surface to be also plane and of indefinite extent, and that a plane wave enters it obliquely, the intersection of the wave-front with the surface will be a straight line, and will advance along the surface parallel with itself, as the wave advances. The refracted waves necessarily both intersect the refracting surface in the same straight line. And if we suppose these refracted waves to be compounded of the infinitely numerous elementary waves which may be imagined to originate in the line of intersection, each resultant refracted wave-front will be a common tangent plane to all the elementary waves of its own kind thus generated. Though the planes of vibration of the two refracted rays are originally perpendicular to each other, yet the taking of different velocities slightly modifies this relation, but the change is hardly sufficient to be sensible.

There are two sections of the surface of elasticity which are circles. They are normal to the plane of the greatest and least axes, and their inclination ($\alpha$) to the first is such that

$$\tan\alpha = \pm\sqrt{\frac{a^2 - b^2}{b^2 - c^2}}.$$

The inclination to the same axis of the normals to these planes—that is, of the directions of progress of the waves of which they are the planes—expressed by $\alpha'$ will have for tangent the reciprocal of the last expression—viz.

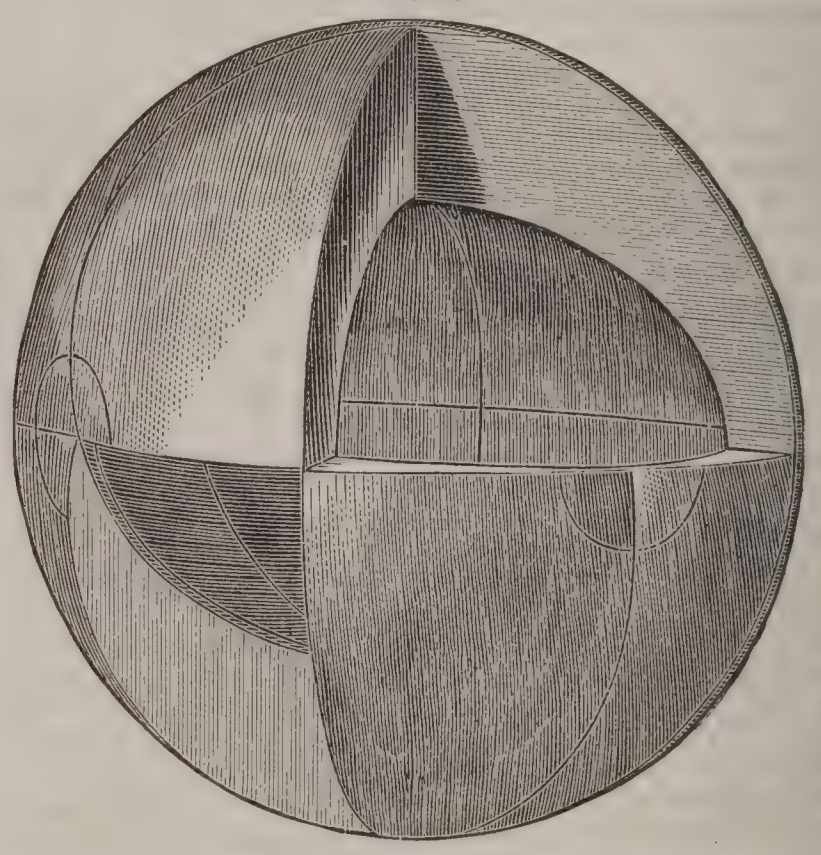
$$\tan\alpha' = \pm\sqrt{\frac{b^2 - c^2}{a^2 - b^2}}.$$

If the wave-front of the incident light coincide with one of these circular sections of the surface of elasticity, the wave can have no determinate plane of polarization. For all the radii of the section being equal, the elastic forces are in equilibrio in every azimuth. Some curious peculiarities, however, belong to this wave, which are mentioned farther on. If, in the first expression foregoing, we make $b = c$, the denominator becomes zero, and the tangent is infinite, or tan 90°. The two circular sections then coincide in the plane of $bc$ at right angles to $a$, and the crystal is a negative crystal of one axis. If $a = b$, $\tan\alpha = 0$, and the two circular sections meet in the plane of $ab$ at right angles to $c$, and the crystal is positive. If $a = c$, then, since $b$ is the mean axis, all the axes are equal, and $\tan\alpha = \frac{0}{0}$; an indefinite value, signifying that the circular sections have no fixed positions; or that all the sections are circular. In such a medium there can be no double refraction.

The direction of ray-propagation is that of the radius of the wave. When the wave is spherical, the ray is normal to the surface, but not otherwise. The velocity of wave-progress is measured by the normal let fall from the centre upon the plane which is tangent to the wave at the extremity of the ray. The direction of molecular movement in the ray is in the intersection of the tangent plane with the plane of the ray and the normal. In spherical waves, ray-progress and wave-progress are equal; in waves not spherical, the velocity of ray-progress may be greater than that of wave-progress.

*Wave-Surface.*—Could a molecular movement be produced, starting from a single point and propagated in all directions in a medium of variable elasticity of three axes, the surface defining the limits of the tremor at any moment would be the wave-surface. The same form of surface (sensibly) would be defined by an infinite number of planes tangent to a luminous sphere like the sun, moving outwardly from the body in all directions with velocities such

FIG. 21.



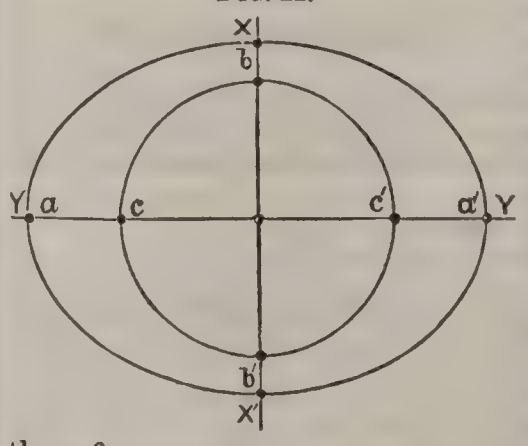
as the law of variable elasticity requires, when their distance from the body becomes very great compared with the diameter of the sphere itself. Proceeding upon this supposition, Mr. Fresnel obtained an equation for the wave-surface, which is the following:

$$a^2x^2[x^2 + y^2 + z^2 - (b^2 + c^2)] + b^2y^2[x^2 + y^2 + z^2 - (a^2 + c^2)] + c^2z^2[x^2 + y^2 + z^2 - (a^2 + b^2)] + a^2b^2c^2 = 0.$$

Or, $(a^2x^2 + b^2y^2 + c^2z^2)\,[x^2 + y^2 + z^2 - (a^2 + b^2 + c^2)] + a^4x^2 + b^4y^2 + c^4z^2 + a^2b^2c^2 = 0.$

This is an equation of the fourth degree, and represents a surface of two nappes, or sheets, inosculating at four points. Fig. 21 is a representation of this surface. In order to exhibit the interior nappe, two ungulæ are represented as cut away; one of the section planes passing through the two points of inosculation in the visible surface, and another through one of them.

FIG. 22.




The three principal sections of this surface present each two curves returning into themselves, as shown in these figures.

The equation through $a\,b$, Fig. 22, is deduced from the general equation of the curve by putting $z = 0$, when it becomes

$$(a^2x^2 + b^2y^2)\,[x^2 + y^2 - (a^2 + b^2)] + a^4x^2 + b^4y^2 + a^2b^2c^2 = 0;$$

which may be resolved into the two factors,

$$(a^2x^2 + b^2y^2 - a^2b^2)(x^2 + y^2 - c^2) = 0,$$

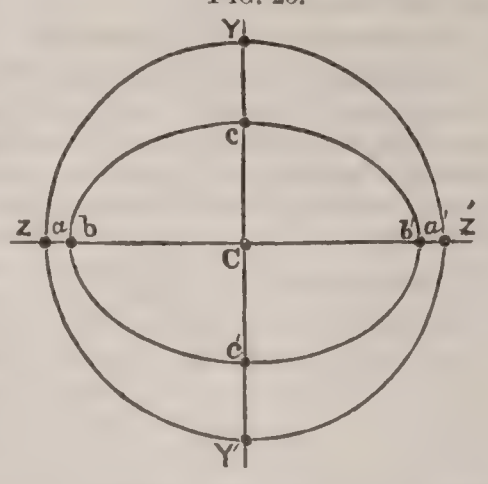
being the equation of an ellipse and a circle combined. In like manner, making $x = 0$, we obtain the equation of the section through $b\,c$, Fig. 23—viz.

$$(b^2y^2 + c^2z^2 - b^2c^3)(y^2 + z^2 - a^2) = 0;$$

and making $y = 0$, we obtain that through $a\,c$, Fig. 24—viz. $(a^2x^2 + c^2z^2 - a^2c^2)(x^2 + z^2 - b^2) = 0$.

The last section is remarkable, as showing an intersection of the circle and the ellipse. The intersection is necessary, because the diameter of the circle is the mean axis of elasticity $b$, while the major and minor axes of the ellipse are the extreme axes of elasticity, $a$ and $c$. The points of intersection shown at N, N′ are the inosculating points of the two nappes of the wave-surface.

Fig. 23.




Since the velocity of ray-propagation is measured by the radius of the wave-surface, it is evident that, along the radii drawn to N, N′, etc., there may be two refracted rays having the same velocity. These lines have a peculiar optical interest. Their inclination to $x$, or $a$, the axis of greatest elasticity (or the angle MCN), may be found from the equation (putting $\beta = \mathrm{MCN}$),

$$\tan\beta = \frac{\mathrm{MN}}{\mathrm{CM}} = \frac{\mathrm{MN}}{\mathrm{NO}}.$$

MN and NO are obtained by making both factors of the equation of the section, just given, simultaneously $= 0$. The values of $x$ and $z$ which render this possible are the values of NO and NM. We have then,

$$x^2 + z^2 - b^2 = 0, \quad \text{and} \quad a^2x^2 + c^2z^2 - a^2c^2 = 0,$$

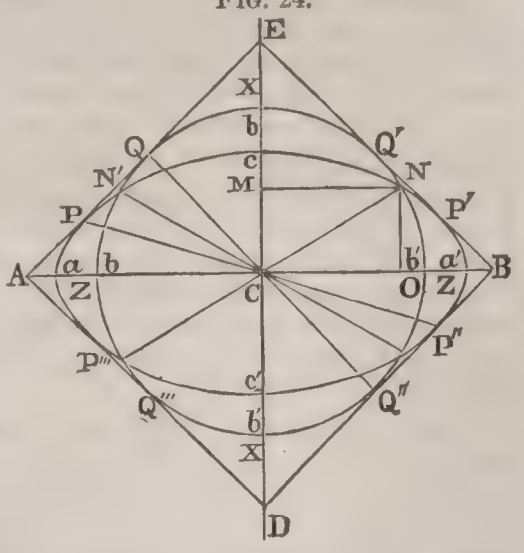
from which we obtain, by elimination,

$$x^2 = \frac{c^2(a^2 - b^2)}{a^2 - c^2}, \quad \text{and} \quad z^2 = \frac{a^2(b^2 - c^2)}{a^2 - c^2}.$$

Whence, $$\frac{\mathrm{MN}}{\mathrm{NO}} = \frac{z}{x} = \pm\frac{a\sqrt{b^2 - c^2}}{c\sqrt{a^2 - b^2}} = \tan\beta,$$

which differs a little from the value found for the tangent of inclination of the normals to the circular sections. But these normals are the directions of *equal wave-velocity;* and CN is the direction of *equal ray-velocity.* These two directions are therefore not coincident, though nearly so.

Fig. 24.

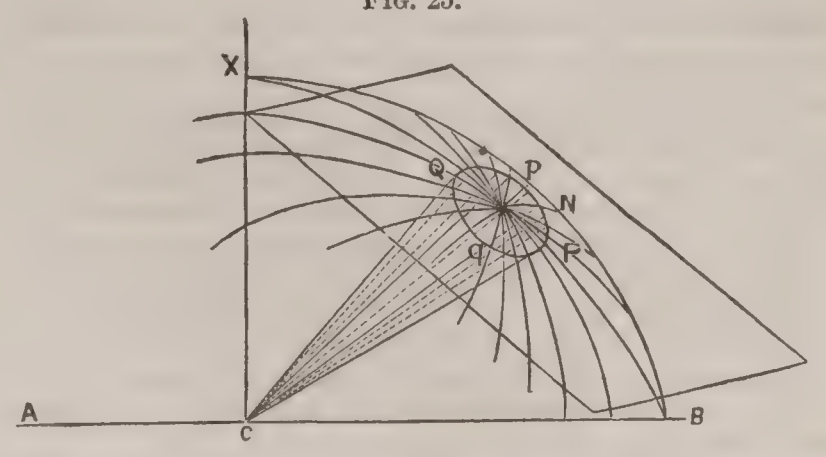



The lines drawn through N and N′ are, however, the optic axes, for it is equality of ray-velocity which makes an optic axis. But it is not true that the two rays whose velocities in CN are equal can spring from the same incident ray. Herein is an important difference between crystals of one axis and those of two. It is further true that in this latter class of crystals no single incident ray of common light can give a single refracted one; for there are no points of common tangency in which both nappes can be met by the same plane.

If a tangent plane be drawn to the wave-surface parallel to one of the circular sections of the surface of elasticity, it will take the position AE or EB in the figure, and may easily be shown to be tangent at once to the ellipse and to the circle in the principal section through the optic axes. Hence, if AB represent a refracting surface, and N′C a ray of common light incident at C, so as to take the direction CQ″ for the nappe whose section is circular, it will yield another ray CP″ for the nappe whose section is elliptical. These will be polarized in planes transverse to each other. The molecular movements of the ray CQ″ are necessarily perpendicular to the circular section, and that section is therefore its plane of polarization. Those in CP″ are of course transverse to these, but may also be inferred to be so from the fact that Q″ is the foot of the normal from the centre to the tangent plane, and P″ is the point of contact. The molecular movements in CP″ must necessarily take the direction P″Q″.

In the discussion of the tangent plane AE or EB, drawn parallel to one of the circular sections of the surface of elasticity, Sir William Hamilton made the remarkable discovery that the tangency is not confined to the points P and Q in the principal section; but that it extends throughout the circumference of a minute closed curve, sensibly circular, of which P and Q are only two points of the circumference. The point N* is, therefore, the vertex of a conoidal or umbilical depression; and all the points of the circumference of the circle of contact are equally points in the wave-front to which CQ is normal, and which is parallel to the same circular section of the surface of elasticity to which the tangent plane is parallel. The annexed fig-

Fig. 25.




ure represents this little circle. As, in this, CQ is the normal to the circular section of the surface of elasticity, and CN is the optic axis, we have—

$$\tan\mathrm{QCX} = \tan\alpha' = \pm\sqrt{\frac{b^2 - c^2}{a^2 - b^2}}, \text{ and } \tan\mathrm{NCX} = \tan\beta = \pm\frac{a}{c}\sqrt{\frac{b^2 - c^2}{a^2 - b^2}}. \quad \text{Whence } \tan\alpha' = \pm\frac{c}{a}\tan\beta.$$

In anhydrous sulphate of lime (anhydrite) in which the doubly-refracting power is uncommonly great, the ratio of $c$ to $a$ is .9725 to 1. The value of $\beta$ is $14° 3\frac{1}{2}'$, from which we deduce $\alpha' = 13° 41' 11''$, and $\beta - \alpha' = 0° 22' 19''$.

A general expression for $\beta - \alpha'$, easily found, is the following—

$$\sin(\beta - \alpha') = \frac{a - c}{c}\sin\alpha'\cos\beta.$$

In so far as the variation dependent on the trigonometrical function $\sin\alpha'\cos\beta$ is concerned, we may easily determine the outside limit. For, since $\alpha'$ is less than $\beta$, $\sin\alpha' < \sin\beta$; and $\sin\alpha'\cos\beta < \sin\beta\cos\beta$. But when $\sin\beta\cos\beta$ is at its maximum, $\cos^2\beta = \sin^2\beta = \sin^2 45° = \frac{1}{2}$. Therefore, $\sin\beta\cos\beta = \frac{1}{2}$ also. And $\sin\alpha'\cos\beta$ is always less than $\frac{1}{2}$. Hence, the sine of the angle between the optic axes and the normals to the corresponding circular sections is always less than half the difference between the greatest and least axes of elasticity, divided by the least axis.

Inasmuch as all the points of the little circle $Qq\mathrm{P}p$ are in the tangent plane, it follows that, if a ray should be incident upon a crystal in such a manner as that CQ should be its direction for one nappe and CP for the other, neither the ray CQ nor the ray CP would be confined to the point Q or P, but both would spread themselves along the circumference $Qq\mathrm{P}p$, until, by blending together, they should form a hollow cone. At their emergence they would resume their parallelism to the incident ray, and thus in their further progress would constitute a hollow cylinder. On the other hand, in every plane of intersection of the wave which can pass through CN, there may be two rays in different incidences which will equally be refracted in the direction CN; and all these together will form an incident hollow cone refracted in the crystal into the single direction of the optic axis. These, on their emergence, resuming parallelism severally to their incident directions, will form an emergent hollow cone similar to that which was incident. Should the incident cone be even a solid cone of light instead of a hollow cone, the emergent cone would still be hollow, because the interior rays of the incident cone would be diverted by double refraction to more distant parts of the wave-surface.

These deductions of theory were announced before any phenomena of the kind had been observed or suspected. At the request of the discoverer, Dr. Lloyd of Cambridge made a careful study of a crystal of aragonite properly prepared, and the result of his examination was to confirm the theory in every particular. The success of the observation requires very delicate adjustments. An apparatus for facilitating it is constructed by Mr. Soleil of Paris.

When the emergent cylinder or cone of rays is observed with an analyzer like Nicol's prism, one radius of the circle disappears. As the analyzer is turned in azimuth, this dark radius changes its position, advancing in azimuth twice as fast as the analyzer. When the analyzer is in azi-

* The letter N should stand at the centre of the depression.

muth 90° from its original position, the dark radius is in azimuth 180°; when the analyzer has completed half a revolution, the dark radius has made a whole one. This singular fact is, however, easily explained. The analyzer suppresses that ray on whose plane of polarization it is *crossed;* and the planes of polarization of the rays in this small circle are, at opposite ends of every diameter, at right angles to each other.

In the equation of the wave-surface, if $b$ be the mean axis, and we make $c = b$, we shall have, after reduction—

$$(a^2x^2 + b^2y^2 + b^2z^2 - a^2b^2)(x^2 + y^2 + z^2 - b^2) = 0.$$

If $b$ and $c$ remain unequal, and we put $b = a$, the equation is

$$(a^2x + a^2y^2 + c^2z^2 - a^2c^2)(x^2 + y^2 + z^2 - a^2) = 0.$$

These are both equations of a spheroid and a sphere, touching each other at the poles. The first is that of an oblate spheroid circumscribing the sphere, and answers to the case of a negative crystal of one axis. The second is that of a prolate spheroid circumscribed by the sphere, and answers to the case of a positive crystal. The case of quartz, so remarkable on other accounts, is peculiar also in the fact that the two nappes of its wave-surface are not in contact anywhere. The ellipsoid is entirely within the sphere, and there is no direction either of equal wave or of equal ray velocity.

These equations suggest the geometrical relations between the surface of elasticity and the wave-surface. The larger diameters of the one are at right angles to the larger diameters of the other, and the smaller have the same relation. For crystals of one axis, the surface of elasticity is an ellipsoid of revolution. If its form is prolate, it generates an oblate wave; if oblate, the wave is prolate.

The causes of varying elasticity of the luminiferous ether within crystals are not well understood. They are dependent, in some manner, upon molecular arrangement. This is evident from the fact that variations resembling those which naturally exist in crystals may be produced (see POLARIZATION) in homogeneous bodies, by heat or by the force of pressure, flexure, or torsion. So delicate a test does the polariscope furnish of inequality of temperature, stress, or mechanical force of any kind that chromatic thermometers and dynamometers founded on these principles have been proposed for determining differences of temperature, stress, or pressure too slight to be easily measured by ordinary instruments.

The literature of this subject is extensive. The theory was first proposed by Huyghens in his *Traité de la Lumière* (1690), but met with little favor; was revived by Young in the *Phil. Trans.* of London (1800–03), and systematically presented in his *Lectures on Natural Philosophy* (2 vols. 4to, 1807); was largely developed by Fresnel in very numerous papers published in the *Annales de Chimie* and the *Bulletin de la Société philomathique*, and especially in the *Memoirs* of the French Academy of Sciences for 1846 and the *Memoirs* of the Institute, vols. v. and vii. An important memoir on the subject by Fraunhofer appeared in the Munich *Transactions* in 1814. The subject is very fully treated in the elaborate article on "Light" by Sir John Herschel, *Encycl. Metropol.* (1827), by Brewster, *Encycl. Britan.*, art. "Optics," and by Arago, art. "Polarization" in the same work. Also by Peclet, *Traité de Physique* (1847), Müller, *Handbuch der Physik* (1864), and Jamin, *Traité de Physique* (1872). Special essays on the general theory or particular topics under it are—Airy, *Undulatory Theory of Light* (1831); Lloyd, *Wave Theory of Light* (1832); Baden Powell, *On the Undulatory Theory applied to the Dispersion of Light* (1841); Cauchy, *Comptes Rendus* of the French Academy of Sciences; Sir William Rowan Hamilton, *Systems of Rays* (*Memoirs Royal Irish Academy*, vols. xv.–xvii.); Lloyd, on *Conical Refraction* (*Mem. Royal Irish Acad.*, vol. xvii.); McCullagh, on *Polarization* (*Mem. Royal Irish Academy*, 1830, 1835, 1838); Stokes, on *Dispersion* (*Cambridge Transactions*, vol. ix.); Green, on *Dispersion* (*Cambridge Transactions*, vol. ix.); Schwerd, *Die Beugungserscheinungen aus den Fundamentalgesetzen der Undulationstheorie analytisch entwickelt* (1835); and a treatise by the present writer in *Report of the Smithsonian Institution* for 1862.

F. A. P. BARNARD.

**Unfermented Bread.** See BREAD, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Ung'er** (FRANZ), b. in Styria in 1800; studied medicine at Prague and Vienna; practised for several years as a physician; was in 1836 appointed professor of botany and director of the botanical garden at Gratz; removed in 1850 to Vienna; undertook extensive scientific journeys in Denmark, Sweden, and Norway, subsequently in Egypt and Syria. D. at Gratz Feb. 13, 1870. His principal works are—*Anatomie und Physiologie der Pflanzen* (1855), *Versuch einer Geschichte der Pflanzenwelt* (1852), and *Botanische Streifzüge auf dem Gebiete der Culturgeschichte* (1857), *Genera et Species Plantarum Fossilium* (1850), *Iconographia Plantarum Fossilium* (1852), *Sylloge Plantarum Fossilium* (1860), *Die Fossile Flora von Sotzka* (1850), *Die Fossile Flora von Kumi in Eubœa* (1867).

**Unghvar',** town of Hungary, on the Ungh, is well built, has many good educational institutions, and 8 well-attended annual fairs. P. 8537.

**Unguents.** See OINTMENTS.

**Un'gula** [Lat.], a segment of a volume. An ungula of a cone or cylinder is a portion of the cone or cylinder included between the base and an oblique plane intersecting the base. A spherical ungula is a portion of a sphere bounded by two semicircles meeting in a common diameter.

**Ungulata.** See APPENDIX.

**Unicoi,** county of E. Tennessee, separated from North Carolina by the Unaka Mountains, and drained by Nolichucky River and its tributaries, formed in 1875 from portions of Carter and Washington cos., is situated in a well-wooded, cold, and rugged mountain-region, several peaks being 5500 feet in height; has but little arable land, but abundance of iron ore, and is well fitted for pasturage. Area, 300 sq. m. P. about 2000. Cap. Longmire.

**U'nicorn** [Lat. *unum*, "one," and *cornu*, a "horn"], described by various writers, from Ctesias, Aristotle, and Pliny down, as a horse-like creature with a straight horn in the middle of the forehead. Its figure occurs as a heraldic charge. The word *reem* in the Hebrew Bible, translated "unicorn" in the English version, denotes some horned creature, perhaps the buffalo.

**Unigen'itus, The Bull** [from its first word, *unigenitus*, "the Only-Begotten"], a famous bull issued in 1713 by Pope Innocent XI. against 101 propositions contained in the *Réflexions morales* of Pasquier Quesnel (1634–1719). The bull excited the strongest controversies in the Gallican Church, the opposition to the pope and the king being led by Cardinal de Noailles and the other Jansenist bishops. In 1730 the bull was accepted by the Parliament of Paris.

**Un'ion,** county of S. Arkansas, bordering on Louisiana, and drained by the Washita and its tributaries; surface hilly, soil fertile. Cattle and swine are numerous. Staples, cotton and Indian corn. Cap. El Dorado. Area, 1230 sq. m. P. 10,571.

**Union,** county of S. E. Dakota, bordering on Iowa and Nebraska, and traversed in its S. part by Dakota Southern R. R.; surface rolling, soil fertile in the river-bottoms. Staples, Indian corn, wheat, oats, and dairy products. Cap. Elk Point. Area, 380 sq. m. P. 3507.

**Union,** county of N. Georgia, bordering on North Carolina, drained by the head-waters of Hiawassee and Tocoa rivers, and traversed by the Blue Mountain ridge. Iron, marble, and granite occur, and gold was formerly found in considerable quantities. The soil is generally well adapted to pasturage. Staples, Indian corn, tobacco, sweet potatoes, and wool. Cap. Blairsville. Area, about 400 sq. m. P. 5267.

**Union,** county of S. Illinois, bordering on Mississippi, and traversed by Illinois Southern R. R.; surface undulating, soil fertile. Iron ore, bituminous coal, porcelain clay, chalk, alum, and copperas occur. There are flour-mills and manufactories of agricultural implements, carriages, stone and earthen ware, and lime. Cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, Irish and sweet potatoes, wool, tobacco, and dairy products. Cap. Jonesborough. Area, 320 sq. m. P. 16,518.

**Union,** county of S. E. Indiana, bordering on Ohio, drained by the E. fork of Whitewater River, and traversed by Cincinnati and Indianapolis Junction R. R.; surface generally undulating, soil productive. There are flour-mills, saw-mills, planing-mills, and manufactories of agricultural implements, carriages, and woollen goods. Cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, wool, and dairy products. Cap. Liberty. Area, 168 sq. m. P. 6341.

**Union,** county of S. W. Iowa, drained by the head-waters of Platte and Grand rivers, and traversed by Burlington and Missouri River R. R.; surface undulating, soil fertile. Staples, Indian corn, oats, and wool. Cap. Afton. Area, 482 sq. m. P. 5986.

**Union,** county of N. W. Kentucky, separated from Indiana and Illinois by Ohio River, and drained by Tradewater and Ohio creeks; surface generally hilly, soil fertile, with much bituminous coal and several chalybeate and sulphur springs. Staples, tobacco, Indian corn, and wool. Cap. Morganfield. Area, 350 sq. m. P. 13,640.

**Union,** parish of N. Louisiana, bordering on Arkansas, bounded E. by Washita River, and intersected by Bayou

d'Arbonne, both of which are navigable by steamboats. Principal exports, live-stock, swine, and cattle. Staples, cotton, Indian corn, and sweet potatoes. Cap. Farmersville. Area, about 1000 sq. m. P. 11,685.

**Union,** county of N. Mississippi, drained by the headwaters of Tallahatchie River. Cap. New Albany. Area, about 400 sq. m. P. not given in the census of 1870.

**Union,** county of N. E. New Jersey, bounded by Passaic River, Staten Island Sound, Newark Bay, and Rahway River, drained by Elizabeth River and other streams, and traversed by New Jersey Central and other railroads; surface flat, soil generally productive. There are about 350 manufacturing establishments, among which are carriages, wagon materials, sashes, doors, and blinds, iron, machinery, cutlery, and edge tools, railway cars, cordage and twine, oilcloth, and paving materials, flour-mills, and bleaching and dyeing establishments. The number of live-stock is small. Staples, principally the foregoing manufactures. Cap. Elizabeth. Area, 101 sq. m. P. 41,859.

**Union,** county of S. North Carolina, bordering on South Carolina, and drained by Lynche's Creek and affluents of Catawba and Yadkin rivers; surface hilly, soil fertile only in portions. There are some gold-mines, which were formerly productively worked. Granite and slate abound, and there is stone excellently adapted for hones and whetstones. There are considerable numbers of swine, cattle, and sheep. Staples, cotton, Indian corn, wool, and a little tobacco. Cap. Monroe. Area, 350 sq. m. P. 12,217.

**Union,** county of Central Ohio, drained by affluents of Ohio River and intersected by Cleveland Columbus Cincinnati and Indianapolis and Atlantic and Great Western R. Rs.; surface level, soil productive. There are manufactories of carriages and woollen goods, saw-mills, flour-mills, planing-mills, and distilleries. Sheep, cattle, horses, and swine are very numerous. Staples, Indian corn, wheat, oats, wool, lumber, and dairy products. Cap. Marysville. Area, 445 sq. m. P. 18,730.

**Union,** county of N. E. Oregon, bounded N. by Washington Territory and E. by Idaho, from which it is separated by Snake River, and watered by Grande Ronde and Powder rivers. The surface is generally elevated, a large portion being covered with forests of pine, larch, and fir, most of the remainder being chiefly adapted for pasturage, but the valley of the Grande Ronde contains much arable soil. Gold and silver are found, and there are some mines worked. There are considerable numbers of cattle, swine, sheep, and horses. Staples, lumber, wheat, oats, barley, potatoes, and dairy products. Cap. La Grande. Area, about 4550 sq. m. P. 2552.

**Union,** county of Central Pennsylvania, bounded E. by the W. branch of Susquehanna River, and drained by Penn's, Buffalo, and White Deer rivers. The surface is generally hilly, being traversed in various directions by spurs of the Alleghany Mountains, but the soil along the streams is productive, and bituminous coal and limestone are abundant. There are manufactories of carriages, agricultural implements, boots and shoes, woollen goods, pig iron, and iron castings; tanneries, saw-mills, and planing-mills. There are considerable numbers of cattle, swine, and horses. Staples, oats, Indian corn, wheat, and dairy products. Cap. Lewisburg. Area, 250 sq. m. P. 15,565.

**Union,** county of N. South Carolina, bounded N. by Broad River and E. by the Ennoree, intersected by Pacolet and Tyger rivers, and traversed by Spartanburg and Union R. R.; surface hilly, soil generally productive. Gold was formerly mined, and iron ore and granite abound. There are flour-mills and ironworks. Swine, cattle, and sheep are numerous. Staples, cotton, Indian corn, wool, and a little tobacco. Cap. Union. Area, about 500 sq. m. P. 19,248.

**Union,** county of N. E. Tennessee, bounded N. by Powell's River and intersected by Clinch River; surface generally hilly, soil better adapted for grazing than for tillage. Iron and lead are found. The principal live-stock are swine and sheep. Staples, Indian corn, oats, wool, and some tobacco. Cap. Maynardville. Area, about 400 sq. m. P. 7605.

**Union,** tp., Dallas co., Ala. P. 2949.
**Union,** tp., Greene co., Ala. P. 1115.
**Union,** tp., Ashley co., Ark. P. 480.
**Union,** tp., Conway co., Ark. P. 1085.
**Union,** tp., Fulton co., Ark. P. 775.
**Union,** tp., Greene co., Ark. P. 543.
**Union,** tp., Hot Springs co., Ark. P. 423.
**Union,** tp., Independence co., Ark. P. 531.
**Union,** tp., Izard co., Ark. P. 1153.
**Union,** tp., Jackson co., Ark. P. 1061.
**Union,** tp., Marion co., Ark. P. 998.
**Union,** tp., Newton co., Ark. P. 203.
**Union,** tp., Ouachita co., Ark. P. 382.
**Union,** tp., Pulaski co., Ark. P. 360.
**Union,** tp., Saline co., Ark. P. 279.
**Union,** tp., Sharpe co., Ark. P. 177.
**Union,** tp., St. Francis co., Ark. P. 1325.
**Union,** tp., Van Buren co., Ark. P. 216.
**Union,** tp., White co., Ark. P. 1013.
**Union,** tp., San Joaquin co., Cal. P. 333.
**Union,** tp., Cumberland co., Ill. P. 1836.
**Union,** tp., Effingham co., Ill. P. 637.
**Union,** tp., Fulton co., Ill. P. 1914.
**Union,** tp., Livingston co., Ill. P. 711.
**Union,** tp., Union co., Ill. P. 781.
**Union,** tp., Adams co., Ind. P. 865.
**Union,** tp., Bartholomew co., Ind. P. 1008.
**Union,** tp., Benton co., Ind. P. 340.
**Union,** tp., Boone co., Ind. P. 1057.
**Union,** tp., Clarke co., Ind. P. 1022.
**Union,** tp., Crawford co., Ind. P. 1082.
**Union,** tp., De Kalb co., Ind. P. 3059.
**Union,** tp., Delaware co., Ind. P. 1244.
**Union,** tp., Elkhart co., Ind. P. 1221.
**Union,** tp., Fulton co., Ind. P. 1200.
**Union,** tp., Hendricks co., Ind. P. 1326.
**Union,** tp., Howard co., Ind. P. 1745.
**Union,** tp., Huntington co., Ind. P. 1016.
**Union,** tp., Jasper co., Ind. P. 196.
**Union,** tp., Johnson co., Ind. P. 1466.
**Union,** tp., La Porte co., Ind. P. 585.
**Union,** tp., Madison co., Ind. P. 851.
**Union,** tp., Marshall co., Ind. P. 1335.
**Union,** tp., Miami co., Ind. P. 982.
**Union,** tp., Montgomery co., Ind. P. 4746.
**Union,** tp., Ohio co., Ind. P. 669.
**Union,** tp., Parke co., Ind. P. 1256.
**Union,** tp., Perry co., Ind. P. 1365.
**Union,** tp., Porter co., Ind. P. 1057.
**Union,** tp., Rush co., Ind. P. 1206.
**Union,** tp., Shelby co., Ind. P. 1200.
**Union,** tp., St. Joseph co., Ind. P. 1801.
**Union,** tp., Union co., Ind. P. 1289.
**Union,** tp., Vanderburg co., Ind. P. 1040.
**Union,** tp., Wells co., Ind. P. 1263.
**Union,** tp., White co., Ind. P. 1832.
**Union,** tp., Whitley co., Ind. P. 1294.
**Union,** tp., Adair co., Ia. P. 169.
**Union,** tp., Adams co., Ia. P. 393.
**Union,** tp., Appanoose co., Ia. P. 668.
**Union,** tp., Benton co., Ia. P. 725.
**Union,** tp., Black Hawk co., Ia. P. 419.
**Union,** tp., Boone co., Ia. P. 398.
**Union,** tp., Cass co., Ia. P. 111.
**Union,** tp., Crawford co., Ia. P. 555.
**Union,** tp., Dallas co., Ia. P. 1663.
**Union,** tp., Davis co., Ia. P. 1225.
**Union,** tp., Delaware co., Ia. P. 689.
**Union,** tp., Des Moines co., Ia. P. 1362.
**Union,** tp., Floyd co., Ia. P. 978.
**Union,** tp., Guthrie co., Ia. P. 168.
**Union,** p.-v. and tp., Hardin co., Ia., has a private bank. P. 1276.
**Union,** tp., Harrison co., Ia. P. 238.
**Union,** tp., Jackson co., Ia. P. 1214.
**Union,** tp., Johnson co., Ia. P. 790.
**Union,** tp., Louisa co., Ia. P. 616.
**Union,** tp., Lucas co., Ia. P. 658.
**Union,** tp., Madison co., Ia. P. 1044.
**Union,** tp., Mahaska co., Ia. P. 1190.
**Union,** tp., Marion co., Ia. P. 765.
**Union,** tp., Mitchell co., Ia. P. 355.
**Union,** tp., Monroe co., Ia. P. 1161.

**Union,** tp., Poweshiek co., Ia. P. 824.
**Union,** tp., Ringgold co., Ia. P. 325.
**Union,** tp., Story co., Ia. P. 1089.
**Union,** tp., Union co., Ia. P. 1531.
**Union,** tp., Van Buren co., Ia. P. 1672.
**Union,** tp., Warren co., Ia. P. 1112.
**Union,** tp., Wayne co., Ia. P. 1005.
**Union,** tp., Jefferson co., Kan. P. 648.
**Union,** p.-v. and tp., Smith co., Kan.
**Union,** p.-v. and tp., Knox co., Me. P. 1701.
**Union,** tp., Branch co., Mich. P. 2121.
**Union,** tp., Isabella co., Mich. P. 657.
**Union,** tp., Houston co., Minn. P. 456.
**Union,** tp., Barton co., Mo. P. 152.
**Union,** tp., Benton co., Mo. P. 1185.
**Union,** tp., Bollinger co., Mo. P. 1436.
**Union,** tp., Clarke co., Mo. P. 1155.
**Union,** tp., Crawford co., Mo. P. 1015.
**Union,** tp., Daviess co., Mo. P. 1515.
**Union,** tp., Dunklin co., Mo. P. 797.
**Union,** p.-v. and tp., cap. of Franklin co., Mo., 55 miles W. of St. Louis, has 2 churches, schools, 1 newspaper, county-seat buildings, 1 brewery, and a steam-mill. P. 2855.
WILSON LEISER, ED. "FRANKLIN COUNTY RECORD."
**Union,** tp., Harrison co., Mo. P. 1193.
**Union,** tp., Holt co., Mo. P. 1118.
**Union,** tp., Iron co., Mo. P. 743.
**Union,** tp., Laclede co., Mo. P. 1850.
**Union,** tp., Lincoln co., Mo. P. 1361.
**Union,** tp., Marion co., Mo. P. 1471.
**Union,** tp., Monroe co., Mo. P. 1566.
**Union,** tp., Nodaway co., Mo. P. 1308.
**Union,** tp., Pulaski co., Mo. P. 958.
**Union,** tp., Putnam co., Mo. P. 2053.
**Union,** tp., Randolph co., Mo. P. 1136.
**Union,** tp., Ripley co., Mo. P. 855.
**Union,** tp., Scotland co., Mo. P. 1404.
**Union,** tp., Sullivan co., Mo. P. 1222.
**Union,** tp., Washington co., Mo. P. 1187.
**Union,** tp., Webster co., Mo. P. 1593.
**Union,** tp., Worth co., Mo. P. 1199.
**Union,** tp., Douglas co., Neb. P. 217.
**Union,** p.-v., Carroll co., N. H., on the Conway division of Eastern and Maine Central R. Rs.
**Union,** tp., Bergen co., N. J. P. 2057.
**Union,** p.-v. and tp., Hudson co., N. J. P. of v. 4640; of tp. 6737.
**Union,** tp., Hunterdon co., N. J. P. 1051.
**Union,** tp., Ocean co., N. J. P. 1923.
**Union,** p.-v. and tp., Union co., N. J. P. 2314.
**Union,** p.-v. and tp., Broome co., N. Y., on Erie R. R., 9 miles W. of Binghamton, has 3 churches, excellent public and private schools, a banking-house, flouring and saw mills, 3 hotels, 1 newspaper, 1 foundry, and a carriage-factory. Principal business, dairying and lumbering. P. 2538. MOSES B. ROBBINS, ED. "NEWS."
**Union,** tp., Lincoln co., N. C. P. 1331.
**Union,** tp., Nash co., N. C. P. 1639.
**Union,** tp., New Hanover co., N. C. P. 1381.
**Union,** tp., Randolph co., N. C. P. 597.
**Union,** tp., Rutherford co., N. C. P. 492.
**Union,** tp., Wilkes co., N. C. P. 894.
**Union,** tp., Auglaize co., O. P. 1462.
**Union,** tp., Belmont co., O. P. 1684.
**Union,** tp., Brown co., O. P. 5399.
**Union,** tp., Butler co., O. P. 2013.
**Union,** tp., Carroll co., O. P. 609.
**Union,** tp., Champaign co., O. P. 1600.
**Union,** tp., Clermont co., O. P. 1920.
**Union,** tp., Clinton co., O. P. 4227.
**Union,** tp., Fayette co., O. P. 4471.
**Union,** tp., Hancock co., O. P. 1546.
**Union,** tp., Highland co., O. P. 1455.
**Union,** tp., Knox co., O. P. 1017.
**Union,** tp., Lawrence co., O. P. 1940.
**Union,** tp., Licking co., O. P. 1855.
**Union,** tp., Logan co., O. P. 753.
**Union,** tp., Madison co., O. P. 3109.
**Union,** tp., Mercer co., O. P. 1475.
**Union,** tp., Miami co., O. P. 3291.
**Union,** tp., Montgomery co., O. P. 212.
**Union,** tp., Morgan co., O. P. 1583.
**Union,** tp., Muskingum co., O. P. 1643.
**Union,** tp., Pike co., O. P. 651.
**Union,** tp., Putnam co., O. P. 1031.
**Union,** tp., Ross co., O. P. 2790.
**Union,** tp., Scioto co., O. P. 552.
**Union,** tp., Tuscarawas co., O. P. 742.
**Union,** tp., Union co., O. P. 1336.
**Union,** tp., Van Wert co., O. P. 524.
**Union,** tp., Warren co., O. P. 1089.
**Union,** tp., Washington co., O. P. 862.
**Union,** tp., Adams co., Pa. P. 1105.
**Union,** tp., Alleghany co., Pa. P. 1986.
**Union,** b., Alleghany co., Pa. P. 1335.
**Union,** tp., Bedford co., Pa. P. 1791.
**Union,** tp., Berks co., Pa. P. 2165.
**Union,** tp., Centre co., Pa. P. 847.
**Union,** tp., Clearfield co., Pa. P. 400.
**Union,** tp., Erie co., Pa. P. 1334.
**Union,** b., Erie co., Pa. P. 1500.
**Union,** tp., Fulton co., Pa. P. 424.
**Union,** tp., Huntingdon co., Pa. P. 789.
**Union,** tp., Jefferson co., Pa. P. 595.
**Union,** tp., Lawrence co., Pa. P. 1434.
**Union,** tp., Lebanon co., Pa. P. 1614.
**Union,** tp., Luzerne co., Pa. P. 1637.
**Union,** tp., Mifflin co., Pa. P. 1469.
**Union,** tp., Schuylkill co., Pa. P. 1110.
**Union,** tp., Snyder co., Pa. P. 1091.
**Union,** tp., Tioga co., Pa. P. 1098.
**Union,** tp., Union co., Pa. P. 840.
**Union,** tp., Washington co., Pa. P. 1418.
**Union,** p.-v. and tp., cap. of Union co., S. C., at the terminus of the Spartanburg and Union R. R., has a national bank and a newspaper. P. 2845.
**Union,** tp., Barbour co., West Va. P. 1382.
**Union,** tp., Cabell co., West Va. P. 977.
**Union,** tp., Clay co., West Va. P. 434.
**Union,** tp., Grant co., West Va. P. 1033.
**Union,** tp., Harrison co., West Va. P. 1720.
**Union,** tp., Jackson co., West Va. P. 1830.
**Union,** tp., Kanawha co., West Va. P. 2449.
**Union,** tp., Lincoln co., West Va. P. 468.
**Union,** tp., Marion co., West Va. P. 1739.
**Union,** tp., Marshall co., West Va. P. 2742.
**Union,** tp., Mason co., West Va. P. 1084.
**Union,** tp., Monongalia co., West Va. P. 1618.
**Union,** p.-v. and tp., cap. of Monroe co., West Va., 10 miles S. of Chesapeake and Ohio R. R. Fort Spring is the nearest station, and is connected by a daily stage, mail, and express line. Union has 4 churches, a female academy and graded school, 2 newspapers, a court-house, 2 hotels, and 1 tannery. Large numbers of cattle are raised. P. of v. 419; of tp. 1676.
R. BURKE, ED. "MONROE COUNTY REGISTER."
**Union,** tp., Pendleton co., West Va. P. 1280.
**Union,** tp., Pleasants co., West Va. P. 338.
**Union,** tp., Pocahontas co., West Va. P. 1330.
**Union,** tp., Preston co., West Va. P. 1395.
**Union,** tp., Putnam co., West Va. P. 676.
**Union,** tp., Randolph co., West Va. P. 340.
**Union,** tp., Ritchie co., West Va. P. 2152.
**Union,** tp., Taylor co., West Va. P. 966.
**Union,** tp., Tyler co., West Va. P. 1085.
**Union,** tp., Upshur co., West Va. P. 1176.
**Union,** tp., Wayne co., West Va. P. 1690.
**Union,** tp., Wood co., West Va. P. 1362.
**Union,** tp., Crawford co., Wis. P. 348.
**Union,** tp., Door co., Wis. P. 294.

**Union,** tp., Pierce co., Wis. P. 266.

**Union,** tp., Rock co., Wis. P. 2145.

**Union,** tp., Vernon co., Wis. P. 506.

**Union,** tp., Waupaca co., Wis. P. 211.

**Union, American.** See SOVEREIGNTY, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

**Union, American.** The "United States of America" constitute a federal or "confederated republic" of a novel, peculiar, and extraordinary character. There has never been anything like it in the annals of history. It is true there have been many federal or confederated unions. But, in speaking of the American Union, and its rare and peculiar features, Lord Brougham, in his *Political Philosophy*, vol. iii. p. 336, says: "It is not at all a refinement that a federal union should be formed; this is the natural result of men's joint operations in a very rude state of society. But the regulation of such a union upon pre-established principles, the formation of a system of government and legislation in which the different *subjects* shall be *not individuals* but *States*, the application of legislative principles to such a *body of States*, and the devising means for keeping its *integrity* as a *federacy* while the rights and powers of the individual States are *maintained entire*, is the very greatest refinement in social policy to which any state of circumstances has ever given rise, or to which any age has ever given birth." Independent and separate States may become united by convention or compact in two ways—one, by forming what is called an "incorporate union," in which the sovereignty of each is merged in the new conventional state or nation thus formed; the other is a "federative union," in which each state retains its sovereignty, but delegates to the new or conventional state the exercise of certain specific, sovereign powers for the common benefit of all. A union of the first class is what the Germans style a *Bundesstaat*, and is what is known with us as an "incorporate union," or consolidated state or nation. A union of the second class is what the Germans style a "*Staaten-Bund*," or states-union. The American system under the present Constitution is neither a *Bundesstaat* nor a *Staaten-Bund*. While it differs specifically, in several particulars, from the *Staaten-Bund* (in which the acts of the conventional state are without validity until sanctioned by the several states), yet it agrees with it entirely in its essential, generic difference from the *Bundesstaat* in this, that in the American system, while the States, collectively, constitute an international unit as regards third parties, yet they do not cease to be international units as regards each other. (See decision United States Supreme Court, 13 *Peters's Reports*, p. 559, and Stephens's *Constitutional View of the Late War*, etc., vol. i. p. 393.)

The American system differs further from the *Bundesstaat* class of unions in this, that no sovereign power whatever under the American system is surrendered or alienated by the several States. The exercise of certain expressly-enumerated powers is only delegated to the conventional state. All others are expressly reserved in the Constitution to the States respectively or the people. The difference, however, between the American system and the *Staaten-Bund* class of unions, as clearly appears, is specific only; it is not generic. Ours is a newly-developed species of unions of states of the *Staaten-Bund* class or genus. This specific difference is what struck De Tocqueville as "a wholly novel theory, which may be considered as a great discovery in modern political science." Further on he says, speaking of the American system: "The new word which ought to express this novel thing does not yet exist. The human understanding more easily invents new things than new words, and we are hence constrained to employ many improper and inadequate expressions."

These new features in the constitution of a federal republic, by which the American Union presents the States thus united as "one nation as to foreign concerns, and keeps [them] distinct as to domestic ones," with a division of the delegated powers into legislative, judiciary, and executive departments, and with an organization and machinery in the conventional government thus formed for the full exercise of its delegated and limited powers, similar to those of the separate States creating it, are what chiefly distinguish that grand step in the progress of the science of government under our system which so profoundly impressed Brougham and De Tocqueville.

From this exposition clearly appears the proper solution of the vexed question whether the United States constitute a nation or not. It is clearly seen not only that they do constitute a nation, but also what sort of a nation it is. It is not a nation of individuals blended in a common mass, with a consolidated sovereignty over the whole; but a nation, the constituent elements or members of which are separate and distinct States. The American Union is, as Washington styled it, a "confederated republic." The United States of America, therefore, with their most appropriate motto, "*E Pluribus Unum*"—that is, one republic composed of many—do constitute the highest type of a nation in the annals of history, and form the first great model of what may be justly styled a nation of nations ever presented to the wonder and admiration of mankind. (See CONSTITUTION OF THE UNITED STATES and GOVERNMENT; also Stephens's *Constitutional View of the Late War*, vol. ii. p. 17 *seq.*) ALEXANDER H. STEPHENS.

For a different view of this important subject see SOVEREIGNTY, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

**Union Bridge,** v., Carroll co., Md. P. 323.

**Union (British).** The present British empire is composed of the three kingdoms of England, Scotland, and Ireland, which long preserved their independence under the same crown, Ireland having been an appendage of the English royal domain since the Middle Ages, and Scotland having been governed by the kings of England since the accession of James I. to that throne (1603). The legislative union with Scotland was consummated by a treaty signed by twenty commissioners, ratified by the English and Scotch Parliaments, and finally proclaimed May 1, 1707. The legislative union with Ireland was not consummated until 1801. (For the terms of union see articles SCOTLAND and IRELAND.)

**Union, Christian.** See EVANGELICAL ALLIANCE, by PROF. P. SCHAFF, PH. D., S. T. D.

**Union Christian College,** at Merom, Sullivan co., Ind., on Wabash River, and under the direction of the Christian Connection, was incorporated in 1859, has an endowment of $100,000, and occupies several buildings, the college edifice being of brick, four stories, 109 feet long, 65 feet broad, and 83 feet high. There are academic, business, classical, musical, and scientific departments, to which both sexes are admitted and taught by seven instructors. It also gives disabled soldiers free instruction. The president is Rev. T. Corwin Smith, A. M.

**Union Church,** tp., Bullock co., Ala. P. 1307.

**Union Church,** v., Jefferson co., Miss. P. 120.

**Union City,** p.-v., Randolph co., Ind., at the crossing of Cleveland Columbus Cincinnati and Indianapolis and Pittsburg Cincinnati and St. Louis R. Rs., 84 miles N. E. of Indianapolis, contains 7 churches, excellent schools, 2 newspapers, 2 banks, 2 steam flouring-mills, an efficient fire department, the Dean waterworks, a public well, and 6 manufactories. Forests of walnut, oak, ash, hickory, and other valuable woods abound in the vicinity. P. 1439.

BENTLEY MASSLICH, ED. "EAGLE."

**Union City,** tp., Allamakee co., Ia. P. 578.

**Union City,** p.-v., Branch co., Mich., on St. Joseph River, at the head of navigation and on the Michigan Central R. R., has a national bank and a newspaper.

**Union City,** tp., Darke co., O. A part of the v. lies in Randolph co., Ind. P. 792.

**Union City,** p.-v., cap. of Erie co., Pa., on Philadelphia and Erie, Atlantic and Great Western, and Union and Titusville R. Rs., 23 miles S. E. of Erie, has 4 churches, good graded schools, 3 newspapers, 3 banks, 3 hotels, 2 large flouring-mills, 3 barrel, 2 stave, 2 handle, 1 chair, 1 furniture and cabinet ware, and 2 pump factories, 1 oil-refinery, an extensive tannery, and 2 carriage-factories. P. about 3400. H. D. PERSONS, ED. "TIMES."

**Union City,** p.-v. and tp., Obion co., Tenn. P. 2479.

**Union College,** or **Union University,** Schenectady, N. Y., incorporated in 1795 under the name of Union College, indicative of the union of the various evangelical sects engaged in its foundation. John Blair Smith was president for four years, succeeded by Jonathan Edwards the younger, who died in 1801, and was followed by Rev. John Maxcy, D. D. In 1804, Eliphalet Nott was chosen president, and remained with the college till his death in 1866. Dr. Laurens P. Hickok was then chosen president after a service of fourteen years in the vice-presidency, and in two years resigned, and was followed by C. A. Aiken, D. D., now of Princeton; and on his retirement, in 1871, Rev. Eliphalet Nott Potter, D. D., S. T. D., became president. About 4000 alumni have left its halls. The faculty consists of 12 members, in addition to 2 tutors, and there are two courses of study in the college proper—the classical and the scientific. There is a flourishing engineering school, and the chemical and natural history departments are provided with ample means for practical study in the laboratory and the field. An academical department for preparatory collegiate instruction has been recently established under the control of the college. Ordinary and prize scholarships have been established, and there is a brilliant series of prizes for oratory, demeanor, and scholarship. Soon after the accession of Dr. Potter to the

presidency, measures were instituted to bring the college into connection with the Albany Medical and Law Schools of the Albany University and the Dudley Observatory, and an act was passed to that effect which embodies all these schools into one university bond under the title of the "Union University," in which, however, each body was to maintain its corporate rights and privileges and pursue its respective aims. A beautiful alumni hall of stone is now rising on the campus, and will soon be completed at an expense not much below $100,000. A gymnasium building of brick is nearly finished, and a new library edifice is contemplated, toward which some funds have already been contributed.

**Union Creek,** tp., Madison co., Nev. P. 256.

**Union, Evangelical,** or **Evangelische Kirche, Lutheran and Reformed.** See EVANGELICAL CHURCHES.

**Union Grove,** p.-v. and tp., Whitesides co., Ill. P. 1070.

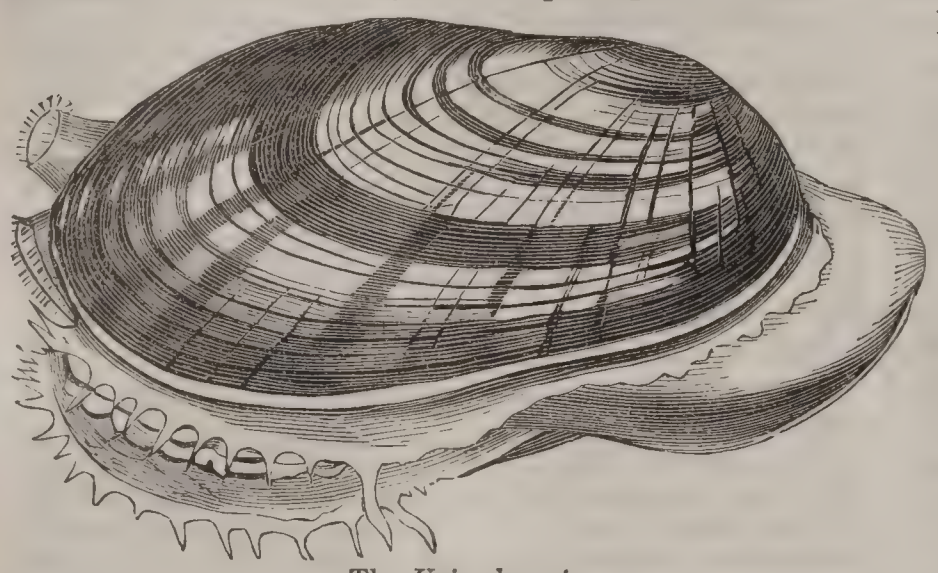
**Union Grove,** tp., Meeker co., Minn. P. 314.

**Union Grove,** tp., Iredell co., N. C. P. 1029.

**Union Grove,** p.-v., Racine co., Wis.

**Union Hall,** p.-v. and tp., Franklin co., Va. P. 1906.

**Union'idæ** [from *Unio*—an ancient name—the typical genus of the group], a family of conchiferous (bivalve) mollusks of the order Dimyaria, comprising the so-called



The *Unio elongata.*

fresh-water "mussels" and "clams." These animals are, however, not at all closely related to the true mussels (Mytilidæ) or clams (Veneridæ) of the salt water, but constitute a group peculiar to the fresh water, and very extensively developed in the streams of the U. S. Under the term Unionidæ are, however, generally confounded three distinct families—viz. (1) Unionidæ, (2) Mycetopodidæ, and (3) Iridinidæ. Of these several forms descriptions follow:

(1) *Unionidæ.*—In this family the animal and shell vary greatly in form, sometimes being extremely elongated, and at others higher than long; the mantle lobes are entirely disconnected, and not produced into siphonal tubes; the gills are double, and the outer behind united to the mantle, generally at least; the labial palps are wide and moderate, and partially attached to each other; the foot is tongue-shaped, large, thick, and compressed, and produced forward; the sexes are differentiated among two distinct individuals—*i. e.* diœcious. The shell is diversiform, but always equivalve, and with the valves tightly closing together all round; the pallial impression is entire, and not emarginated behind; the adductor scars two (anterior and posterior) and deeply marked; the pedal scars three, two behind the anterior adductor, and one in front of the posterior adductor; the ligament is external and well developed; the hinge diversiform, generally provided with cardinal and lateral teeth, but often edentulous. Such are the most prominent characteristics of the family as now understood by many naturalists. The specimens are very numerous, and exist in the fresh waters of every continent and most of the contiguous islands where there are suitable habitats. The number of species admitted by Mr. Isaac Lea, the chief authority as to the species of the group, is about 1300. Between 700 and 800 are inhabitants of North America, about 150 of South America, 13 of Europe, nearly 200 of Asia, and nearly 40 of Africa. It is probable, however, that on a rigorous comparison of the species the numbers will be very considerably reduced, in accordance with the present tendency of investigation. By Mr. Lea all these species have been combined under seven sub-genera. By most authors, however, many independent genera are recognized: Prof. Agassiz, *e. g.*, admitted 22 for the North American species alone. These have been differentiated on conchological grounds as well as on differences in the extent of the fringing of the mantle and of the siphonal openings, as well as the freedom or attachment of the gills with reference to the abdominal sac. All such characters, though, require confirmation as to their value. The females are often distinguishable from the males by having more ventricose shells, either in whole or part, the eggs sometimes filling the entire outer gill, and sometimes being confined to the hinder part of the gill. The embryonic young are very unlike the mature form: they spin a delicate byssus, and the posterior shell-muscle is very largely developed, while the anterior is rudimentary. The family has survived at least from the Jurassic epoch, when typical forms existed. Presumably, they must have lived in more or less modified forms long before.

(2) *Mycetopodidæ.*—This type is characterized by its elongated, solen-like form; the mantle lobes disconnected backward to the anal aperture, which is closed; the gills double and equal; the labial palps comparatively narrowed; the chief character is the form of the foot, which is much produced, elongated, and subcylindrical, and expanded into a disciform knob, whence the name of the family (μύκης, "mushroom," and πούς, "foot"). The shell is elongated and soleniform, the valves closed, the pallial impression entire; the adductor and pedal scars are developed essentially as in Unionidæ, but differing in details; the hinge is edentulous. The family has but one genus and few (about 8) species, confined to the streams of South America. They bury themselves in the mud, using for this purpose their peculiar foot.

(3) *Iridinidæ.*—The animals and shells are almost as diversiform as in the Unionidæ; the mantle lobes are more or less united backward, and two distinct siphons (branchial and anal) are developed; the gills are double, and the outer is "united to the mantle all the way to its extremity;" the labial palps are diversiform, but not united; the foot is tongue-shaped, thick, and compressed, as in Unionidæ; the sexes are diœcious. The shell is equivalve, the valves tightly fitting, the pallial impression generally emarginated behind, sometimes entire; the adductor and pedal scars substantially similar to those of the Unionidæ; the ligament external, the hinge varying. The family is composed of types mostly peculiar to Africa, but one is attributed to Asia and South America. The several generic types admitted by Mr. Isaac Lea (as sub-genera) are *Iridina* (including *Pleiodon*) and *Spatha* of Africa, and *Columba* (properly *Leila*), *Triquetra* (= *Hyria*), and *Prisodon* (= *Castalia*) of South America; to which should be added at least *Arconaia* of Eastern Asia, confounded by Mr. Lea with *Triquetra*, if it really belongs to this family. Mr. Lea recognized 25 species only in 1870. Little is known of the ancient history of the family. THEODORE GILL.

**Union Point,** p.-v., Greene co., Ga.

**Union Prairie,** tp., Allamakee co., Ia. P. 912.

**Union River,** Me., rises in Hancock co., and flows S. into Union River Bay. It is navigable to Ellsworth, and affords excellent water-power.

**Union Springs,** p.-v. and tp., cap. of Bullock co., Ala., at the junction of Mobile and Girard and Montgomery and Eufaula R. Rs., 55 miles from Columbus, has excellent schools, 1 cotton-gin, 3 corn-mills, a planing and saw mill, 1 sash, door, and blind factory, a cotton-gin manufactory, the county-seat buildings, an efficient fire department, and 1 newspaper. P. of v. 1455; of tp. 4664.

J. R. ROGERS, ED. "HERALD AND TIMES."

**Union Springs,** p.-v., Cayuga co., N. Y., on Cayuga R. R. and the E. shore of Cayuga Lake, 10 miles from Auburn, the county-seat, has 7 churches, 2 boarding-schools, a bank, 1 newspaper, a fire insurance company, gypsum and limestone quarries, and flouring-mills. P. 1150.

JAMES B. HOFF, ED. "ADVERTISER."

**Union Star,** v. Breckenridge co., Ky. P. 104.

**Union Stock-Yards,** the largest live-stock market in the world, within the city limits of Chicago, Ill., were built in 1865; cost, up to Jan. 1, 1875, with enlargement, $2,600,000. The receipts for the year 1874 were, 843,966 cattle, 4,258,379 hogs, 338,645 sheep, and 17,588 horses. The aggregate value of all stock received was $95,727,000. The pens and necessary buildings with solid improvements cover 110 acres of ground. NATHANIEL HART.

**Unions, Trades.** See TRADES-UNIONS, by PROF. T. E. CLIFFE LESLIE, LL.B.

**Un'iontown,** p.-v. and tp., Perry co., Ala. P. 1444.

**Uniontown,** p.-v., Union co., Ky. P. 896.

**Uniontown,** p.-v. and tp., Carroll co., Md. P. of v. 319; of tp. 3058.

**Uniontown,** p.-v., Wheeling tp., Belmont co., O. P. 156.

**Uniontown,** v., Muskingum co., O. P. 207.

**Uniontown,** b., Dauphin co., Pa. P. 299.

**Uniontown,** p.-b., cap. of Fayette co., Pa. (originally Beesontown), on Fayette County branch of Pittsburg Washington and Baltimore, South-west Pennsylvania branch of Pennsylvania Central, and the E. terminus of Uniontown and West Virginia R. Rs., 40 miles S. E. of Pittsburg, laid out by Jacob Beeson 1783, has 10 churches, schools, 4 banks, 1 woollen-factory, 5 hotels, 2 newspapers, a cement manufactory. Incorporated 1796. P. 2503.

W. A. McDowell, Ed. "Genius of Liberty."

**Union Vale,** tp., Dutchess co., N. Y. P. 1434.

**Union Village,** v., Warren co., O. P. 232.

**Un'ionville,** p.-v., Hartford co., Conn.

**Unionville,** p.-v., Udell tp., Appanoose co., Ia. P. 183.

**Unionville,** p.-v., cap. of Putnam co., Mo., on Burlington and South-western R. R., 140 miles N. of Jefferson City, has good schools, 2 newspapers, 1 bank, 2 hotels, 1 grist-mill, and the usual county-seat buildings. It is the principal business centre of the county. P. 462.

Alex. R. Webb, Ed. "Republican."

**Unionville,** p.-v., Buena Vista tp., and cap. of Humboldt co., Nev. P. 470.

**Unionville,** p.-v., Orange co., N. Y.

**Unionville,** v., Meigsville tp., Morgan co., O. P. 92.

**Unionville,** b., Centre co., Pa. P. 320.

**U'nison** [It. *unisono*], in music, two sounds of the same pitch or degree of the scale; thus, certain passages in a composition are said to be "in unison" when two or more parts sing or play the same notes.

**U'nit** [Lat. *unus*], a single thing of a kind. Thus, in the expression 20 *feet,* the unit is one foot; in the expression $\frac{3}{5}$ the unit is $\frac{1}{5}$.

**Unita'rianism** [Lat. *unitas*]. Ever since thinking man has been in the world there have been speculations about the Cause of all things—about its nature, or its action, or the mode of its existence. These speculations have always held to one Being supreme, while they have been put into various forms—polytheism, trinity, or simple and indivisible unity. The tendency, however, in successive ages has always been to the latter. In the Jewish and Christian systems this has come to be distinctly maintained; for the Trinity, at least while it is conceived of merely and abstractly as a mode of existence, has not been construed to be a denial of the Unity. It is impossible, perhaps, in strict thesis, to decide which of these views is true; for of the mode of the Divine Existence, if we presume to think upon it, we cannot undertake to form any judgment; and it is not the business of this statement to argue for one or the other, but only to give an historical account of the latter—*i. e.* of Christian Unitarianism.

Judaism was undoubtedly unitarian, and it is held that Christianity was at the start. That the first disciples, who had passed one or two years in daily intercourse with their Master, should have thought of him as God, or, if they did, should have failed plainly and pre-eminently to teach this doctrine, is doubtless hard to believe. It is certain that the earliest churches of which we have any definite knowledge upon this point consisted in the mass, or at least in great numbers, of Unitarians. Believers in Christ at the beginning were simply denominated, as at Antioch, Christians, and doubtless continued to bear that common name; but the oldest body of Christians holding a distinctive faith upon the point in question—*i. e.* the Ebionites—were undoubtedly Unitarians; and the earliest Fathers, Justin Martyr, Tertullian, and Origen, while advocating their "Economy," the initial form of Trinity, evidently wrote in an apologetic strain, as if they felt that there was a great body of opinion against them; and Tertullian at the end of the second century complains of the mass of people—"*idiotæ*" he calls them—as obstinately opposed to the Economy. And later, Chrysostom and Athanasius undertake with considerable explanation to show why the apostles did not plainly teach the sublimer doctrine of the Economy or Trinity, the reason being that the people were not prepared to receive it. Gradually, however, the early Fathers, falling in with Platonic speculations, were tending to ideas of a Trinity, but it was not till the fourth or fifth century, as J. H. Newman has shown, in his *Development of the Christian Doctrine,* that the doctrine of the Trinity was completely formulated and established. And this continued for several centuries—except with the great Arian division, which was essentially unitarian—to be the settled orthodoxy of the Church, till in the sixteenth century Unitarianism was revived by the Socini, and made a lodgment in Poland and in Transylvania, where it still exists in permanent churches.

Lælius and Faustus Socinus, uncle and nephew, were Italians of a noble family. It is the more remarkable that they should have been learned men and studious in the Scriptures, and that both should have broken off from the religion of their education and social position to embrace new and unpopular opinions—so unpopular and, indeed, dangerous to them, that they both found it expedient to leave, for their evidently honest convictions, their home and country. Lælius went to Switzerland, where he died in Zurich in 1562, after having gone to Germany and Poland and made visits of some length in those countries. After the death of his uncle, Faustus resided in Bâle, and spent some time in collecting and arranging the papers which Lælius had left to him, and then went to Transylvania, where, with the aid of the celebrated physician Blandrata, a number of Unitarian churches were formed and established. Thence he removed to Poland, and, marrying into a noble family and becoming settled in life, had leisure for study and wrote theological works, which are to be found in the *Fratres Poloni.* His opinions met with favor among the higher classes, with whom he was associated, and it appeared for a time as if he were likely to escape the usual fate of reformers. But his speculations gave offence to the lower classes; they rose against him, and that which happened to Priestley in Birmingham befell him: a mob broke into his house, tore him from a sick-bed, exposed him in the market-place, ransacked his dwelling, and destroyed his manuscripts; and he died near Cracow in 1604, a martyr to his faith. There is still left, however, in Hungary and Transylvania, a considerable body of Unitarians who inherit his faith, and by their character are doing signal honor to their progenitor. They have 106 churches, with parishes, numbering 60,000 persons. They have parish schools, and schools of theology in which are professors who are discharging their duties with salaries scarcely able to support them. These churches, with their pastors and professors, are attracting the earnest sympathy of their brethren in England and America; and it is to be hoped that they will be assisted in holding their stand, thus far manfully sustained, against Austrian bigotry.

In Germany, England, and America, Unitarianism has found a more favorable soil, and many churches in the two latter countries, about 300 in each, bear the name; besides 1000 or 2000 congregations of Universalists, and more than as many of a body which refuses every name but that of *Christians;* both of whom, without the name, hold substantially the same faith. In Germany the speculations of many of her eminent theologians and critics have taken the same direction, without any formal separation from the Lutheran Church; while in France only the honored names of the Coquerels, father and son, have been distinctly known in connection with it. In England its earliest confessors were men unknown to fame, but remarkable for their virtues—Thomas Firmin, a merchant of London, and well known as a friend of Archbishop Tillotson, and John Biddle, who set up in London the first Unitarian public worship known in England. He was a scholar bred at Oxford, who was able to expound and defend his opinions; who drew upon himself the attention of Parliament and of Cromwell, and of Archbishop Usher to convert him from his heresy; whom courts and judges pursued and hounded through five imprisonments, till on the sixth he died in a dungeon on Sept. 22, 1662, at the age of forty-seven. He was a man whose memory, for his unblemished probity, for his calmness and firmness, and for his cruel fate so bravely met, deserves to be remembered, and would do honor to the lineage of any body of men holding dear their opinions and their history.

Indeed, it is by a lineage of remarkable men that English Unitarianism has been most distinguished—in which are the names of Milton, Locke, and Sir Isaac Newton, William Penn and Sir Wm. Jones; and of authors such as William Roscoe, Samuel Rogers, Charles Lamb, Priestley, and Lardner, besides those of the present day, as Joseph Blanco White and his biographer, J. H. Thom, and James Martineau. The works which have been written expressly in its defence are Emlyn's *Humble Inquiry* and Yates's *Vindication,* and many others. Some of the later writings even of the divine Watts show that although he did not come to any decided result, he distrusted his theology and leaned to the Unitarian view. Penn wrote ably against the Trinity and its kindred doctrines in the *Sandy Foundation Shaken,* for which he was put in prison, and when he came out, sturdily said, "I have not budged a jot." There too, in prison, he wrote *No Cross, no Crown,* a work as remarkable as that other book written in prison, Boethius on *Consolation.* Also to be mentioned among English Unitarians are Dr. Samuel Clarke of a former day, Ricardo, the political economist, Sir John Bowring; and not the least to be honored John Pounds of Portsmouth, the founder of the ragged schools, and of celebrated women, Joanna Baillie and Florence Nightingale.

Boston, with its vicinity, may be called the birthplace of Unitarianism in America. The controversy which brought matters to that result in a good many churches there and in New England, carried on by Dr. Worcester of Salem and Prof. Stuart of Andover on one side, and Channing and Prof. Henry Ware, Sr., and Norton on the other, broke out in 1812. Just before, in 1810, Noah Worcester had published his *Bible News*. Nearly thirty years before, Dr. James Freeman of King's chapel in Boston had taken the same ground, and his congregation altered the Liturgy in accordance with his views. It was the first church in America that decidedly espoused the Unitarian faith, though many years before Jonathan Mayhew, pastor of the West church in Boston, was known as an Arian. In Boston and its vicinity also there were several distinguished laymen who took the same side, as the Presidents Adams, father and son, the celebrated jurist Theophilus Parsons, George Cabot, Nathaniel Bowditch the astronomer, Harrison Gray Otis, Daniel Webster, and others. As early as 1718, Dr. Gay of Hingham was settled, and became generally known as a Unitarian. In 1794, Dr. Priestley came to America, and, though he was received with attention in Philadelphia, he chose to retire to Northumberland, Pa., to pursue his philosophical studies, where he also collected a small congregation for worship. Two years after, a church was formed in Philadelphia, of which for many years Dr. Furness has been the honored pastor.

The American Unitarian Association was formed in Boston in 1825, chiefly for the publication and distribution of tracts and books. It has used its funds also to build churches and assist feeble ones, and to send out preachers in this country; and it has for a number of years supported a missionary in India, the devoted Mr. Dall, who has done an excellent work there by his schools, by circulating books, and by publications of his own, and also through communication with the Brama Somaj, with its thousand congregations—a very remarkable body of native dissenters from the idolatry and religion of their country, from which more is to be hoped for the religious condition of India than from any other cause—in which congregations, though they are not Christian, there is worship and preaching as in our own. Chunder Sen, one of their preachers, if not their chief, has visited England, and made a most favorable impression in London (as Ram Mohun Roy did before him) by his liberal and earnest inculcation of universal religious truth and virtue.

But the first general convocation of the Unitarian clergy of America was held in New York in 1865, consisting of ministers and delegates from the churches; and on this occasion arose and was keenly debated the question about a *creed*. But the word met with no favor in the conference. With regard to the distinctive tenets of Unitarians, indeed, except that which the name indicates, it is less easy precisely to define them, because Unitarianism is an embodiment of principles—principles of reasoning and criticism—rather than a collection of institutes like the *Institutes* of Calvin or the *Confessions* of Augsburg and Dort, or the *Thirty-nine Articles* of the Church of England. Its history is a history of individual opinions, rather than of organizations, measures, or methods of action. It is biographical, not national. Heresies, as they are called, rather than creeds, are the forms it has taken. Protests rather than professions have marked it. It has been called by its opposers a system of negations, though it is to be considered that every negation implies an affirmation. The affirmations of the conference were—that every man has a perfect right to judge for himself, unbound by any set of articles; that while professing itself to be a Christian body, it left every one to decide for himself what Christianity itself is—*i. e.* without forfeiting his place in the body, to choose among the conflicting views of Christian doctrine and statement that which seemed to him to be true and right.

In fact, Unitarianism is characterized not so much as being a system of thought as a way of thinking; and *that* may be called, whether for praise or blame, the rational way. Religion it regards as addressing itself to reason and conscience alike, requiring of men to believe nothing which contradicts reason, and to do nothing which they have not ability to do. Human nature, in its view, is not a mass of helpless depravity, but is endowed with moral qualities which are capable of good, and which are to be educated to virtue and religion, just as truly as the mental powers are to be educated to knowledge and the highest intelligence. Human life is appointed to be the sphere of this culture, with all its toils, cares, trials, and sufferings—its natural affections and enjoyments also not to be crushed down, but intended to minister to the same end.

In short, the stand taken by Unitarianism is for nature, for human nature, for everything that God has made, as the manifestation of his will as truly as anything written in the Bible. This world, the world of nature and of life, does not lie under the curse of Adam's sin nor any other curse, but is ordained by infinite wisdom and goodness to be the field of human training for a life to come, whose allotments are to be in accordance with the law that "whatsoever a man soweth, that shall he also reap." Righteousness, and not dogma, is the everlasting condition of all welfare in this world and the next, and what needs to be done for religion is to free it from all falsehoods, from all substitutions of ceremony, profession, and sensational experience for truth and virtue, and thus to purify and rationalize it—to lift it up, not as a terror to men, but as friendship and help, as strength and comfort, as a joy and delight, and so to relieve it of the mystery or misery that it is to many. In fine, the ground taken by this Christian body is that to which many churches are approaching, and is this—that Christianity is not a philosophy, but a divine power; that the acceptance of it is not the believing in a creed, but believing with the heart; that Jesus Christ himself in his life and death, all dogmatizing apart, is the embodiment of his religion; that he holds that supremacy in the beauty and power of his life which makes it, of all that has appeared upon earth, the fittest to be imitated and followed; and that the man who comes nearest to that is the best Christian. ORVILLE DEWEY.

**Unitarians.** See UNITARIANISM.

**Unit'ed Arme'nians,** a name applied to those Armenian Christians who acknowledge the pope, the orthodox Armenians being called Gregorians. The Armenian Rite in the Roman Catholic Church has 1 patriarch and primate (in Cilicia), 4 archbishops (at Constantinople, Aleppo, Seleucia (or Diarbekir), and Lemberg), besides 2 *in partibus*, and 16 bishops. Their union took place 1314–44. They number some 100,000, of whom 78,000 are in Turkey and Persia (20,000 under the archbishop of Constantinople, 56,000 under the patriarch of Cilicia, and 1000 in Mount Lebanon). Austro-Hungary in 1870 had 8279 United Armenians; Russian Caucasia and Siberia in 1869 had 13,722. In 1872 a very considerable part of the Turkish United Armenians left the Roman Catholic communion and joined the Old Catholic movement.

**United Brethren,** or **Unitas Fratrum.** See MORAVIAN CHURCH, by BISHOP E. DE SCHWEINITZ.

**United Brethren in Christ** (often confounded with the United Brethren, see MORAVIAN CHURCH), a denomination of Protestant Christians which arose in the U. S., about 1755, under the leadership of the Rev. Philip William Otterbein (1726–1813), a German missionary of the Reformed Church, and Martin Böhm. Their polity is a mixture of Methodism, Congregationalism, and Presbyterianism. They oppose Freemasonry and the manufacture, sale, and use of alcohol. Since 1820 they have held services in both German and English, and have prospered greatly, especially in the North-west and in Pennsylvania. In 1867 they had 3444 churches and 97,982 members. In 1870 they claimed 3753 churches, 1429 church edifices, 116,525 communicants, and church property worth $2,454,302. They have an episcopal organization, sustain a publishing-house at Dayton, O., and, like the Albrights or Evangelical Association, are popularly called German Methodists. They sustain several colleges, and seminaries.

**United Christians of St. Thomas,** a body of East Indian Roman Catholics, chiefly found in Travancore, at the southern extremity of India. In 1599 the synod of Diamper (Udiamperoor) compelled the ancient Church of St. Thomas Christians (see CHRISTIANS OF ST. THOMAS) to conform to the Church of Rome, conceding to them a modified Syrian rite. In 1653 nearly all fell away, but were soon after induced in great numbers to return, chiefly by the labors of the Barefooted Carmelites. At present more than one-half are of the Latin rite, but a portion retain the Oriental rite. They are chiefly in the vicariate apostolic of Verapoly (Latin rite), reported in 1868 as having 295 priests and 233,000 members.

**United Copts,** since 1732 the designation of a body of Roman Catholic Copts of the Eastern rite. They number (in Egypt) 12,000, and are under a vicar apostolic and bishop *in partibus*, who is of their own rite. The United Copts are of two rites, the Egyptian and the Ethiopic or Abyssinian. According to the reports of Roman Catholic missionaries, the latter would appear to be the more numerous.

**United Evangelical Church.** See EVANGELICAL CHURCHES.

**United Greek Church,** a body of Roman Catholics of the Eastern rite, who acknowledge the pope and accept the doctrines of the Latin Church, but use the Greek liturgies and follow the Greek rule as to the marriage of secular priests and the use of both kinds in the Eucharist. They

are (*La Gerarchia Cattolica*, 1872) of four rites—the Rumanian, Ruthenian, Bulgarian, and Melchite. There are also some United Russian Greeks and a few United Melchitic Copts of the Greek rite. The Melchites proper are estimated at 50,000, the Rumanians of Turkey at 35,000. The United Greeks of Bosnia are given as numbering 454,787, those of Austria-Hungary 3,941,796 (1869). The number of United Russians is given by Wetser as 6,000,000, and by others as 250,000; both of which are apparently large over-statements. In 1861 there were 75,721 United Greeks in Italy.

**United Kingdom of Great Britain and Ireland.** See ENGLAND, GREAT BRITAIN, IRELAND, SCOTLAND, WALES, and UNION (BRITISH).

**United Methodist Free Churches,** a denomination of Great Britain and Ireland, dating from 1857. In 1867 they reported in England 1119 chapels, 271 itinerant and 3246 local preachers, and 68,494 members; and in Ireland 1 minister, 8 local preachers, and 90 members.

**United Nestorians,** a body of Roman Catholics of the Syrian rite, more often called CHALDÆAN CHRISTIANS (which see).

**United Original Seceders,** a Presbyterian sect of Scotland, dating from 1820, when a number of ministers of the General Associate Synod refused to reunite with the Associate Synod. In 1867 they reported 4 presbyteries, 23 ministers, and 27 churches.

**United Presbyterian Church in England, Scotland, and Ireland** dates in its present form from 1847, when the UNITED SECESSION CHURCH (which see) was made one with the Relief Church. The United Presbyterians differ from the Established and the Free Church in taking the ground that the civil government should have nothing whatever to do with the Church, either by contributing to its support or meddling with its affairs. In 1867 they reported 26 presbyteries, 537 ministers, 504 congregations, 161,467 communicants, and 132 students in their theological college at Edinburgh; in England, 4 presbyteries, 77 ministers, 82 churches, and 212,610 members; in Ireland, 1 presbytery, 10 congregations, 9 ministers, and 853 communicants.

**United Presbyterian Church of North America** dates from 1858, when the Associate Presbyterian Church (originated in 1754) joined in one organization with the greater part of the Associate Reformed Church (dating from 1782). Its greatest strength is in the Western and Central States. It has theological seminaries in Newburg, N. Y., Allegheny, Pa., Xenia, O., Monmouth, Ill., and at Osioot and Ramleh in Egypt, where there is a successful mission among the Copts. In 1872 there were 55 presbyteries, 584 ministers, 755 congregations, 72,896 members, 96 home missionaries (besides 17 missionaries and teachers among the freedmen), 35 foreign missionaries, and a total of church property valued at $4,096,000.

**United Provinces.** See NETHERLANDS, by C. PETERSEN, A. M.

**United Secession Church** was formed in Scotland in 1820 by a reunion of the Associate and General Associate Synods. In 1847 it was united to the present United Presbyterian Church.

**United Society of Believers in Christ's Second Appearing.** See SHAKERS.

**United States, The,** a federal republic occupying the central portion of the North American continent. On the N. the territory of the United States is separated from the British dependencies and possessions by the following described boundary: From the mouth of the St. Croix River to its head, and thence due N. to the highlands which divide those rivers that empty themselves into the St. Lawrence from those which fall into the Atlantic Ocean; thence along the crest of those highlands to the north-westernmost head of the Connecticut River; down that river to and westward along the 45th parallel to and along the middle of the Ontario, Erie, Huron, Superior, and

Obverse. Reverse.




Great Seal of the United States.

Long lakes, and their water-connections, to the most northwestern point of the Lake of the Woods; and thence along the 49th parallel to the Pacific Ocean, the line at the extreme N. W. being so drawn as to exclude Vancouver's Island, but to include the islands of the San Juan group. The southern boundaries of the United States consist of the Gulf of Mexico, the Rio Grande del Norte to the plateau of the Sierra Madre, thence to the Pacific by a broken line drawn between the 31st and 33d parallels. The eastern and the western boundaries of the United States are the Atlantic and the Pacific Oceans respectively. The total area embraced within these boundaries is computed at 3,026,494 sq. m., made up as follows: The territory of the original thirteen States after the cession of their Western lands, 420,892; the lands thus ceded, being the original territory of the United States, 406,952; the province of Louisiana, acquired from France in 1803, 1,171,931; Florida, acquired from Spain in 1819, 59,268; the Texan annexation in 1845, 376,133; the first Mexican cession in 1848, 545,783; the second Mexican cession in 1853, 45,535. The single dependency of the United States is the district of Alaska, obtained by purchase from Russia in 1867. (See ALASKA.)

*Physical Features.*—The skeleton of the United States is represented by two great systems of mountain-ranges. The eastern system consists of the Appalachian ranges, the western of the complex masses to which Prof. J. D. Whitney has applied the appropriate name "the Cordilleras." The Appalachian chain extends from the promontory of Gaspé south-westerly 1300 miles into Alabama. The base from which it rises on the eastern side is the Atlantic seaboard. The elevation of the plain above the sea in New England hardly exceeds 300 to 400 feet, but farther to the S. it rises to a height of 1000 feet, and widens to a distance of 200 miles. The Appalachian chain presents the feature, especially in its middle portion, of numerous nearly parallel lines of elevation, which preserve their direction over great distances, forming long valleys of remarkable regularity. In particular, one great central valley extends from Northern New York to East Tennessee. The Appalachian chain presents three obvious subdivisions in latitude, the middle one extending from New York to the Kanawha River in Virginia. Each subdivision has a peculiar curvature and course. The northern presents its concavity to the S. E.; of the middle, the concavity faces the Atlantic shore, while the southern forms a curve concave toward the N. W. So complete is the physical break between the northern and middle divisions of the Appalachian chain that Prof. Whitney states that a rise of the ocean of 400 feet only would cut off all the region included between the St. Lawrence, the Atlantic, and the Hudson and Mohawk valleys; while a rise of 140 feet only would detach all the country E. of the Hudson and Lake Champlain. Of the northern subdivision of this chain, the most continuous, though not the highest range, is that of the Green Mountains, with the White Mountains on the E. and the Adirondacks on the W. The central division of the chain extends from the Hudson to the Kanawha, about

450 miles; is narrow toward the northern extremity, widens out in Pennsylvania, and decreases again in Virginia. It is composed of a considerable number of subordinate chains, much curved toward the W., and remarkable for their regularity, their parallelism, their abrupt declivities, and their moderate elevation, rarely rising to 2500 feet. In Pennsylvania the mountainous zone is, according to Prof. Rogers, divided into five well-marked parallel belts, which are, in order from the E. toward the W., as follows: 1st, the South Mountains, being the continuation of the New York Highlands and the equivalent of the Blue Ridge in Virginia; 2d, the Great Appalachian Valley; 3d, the Central Appalachian ridges; 4th, the sub-Alleghany Valley; 5th, the Alleghany Mountains. The southern division of the Appalachians exhibits marked peculiarities of structure. The main chain, known as the Blue Ridge, which borders the great valley on the E., bears off to the S. W., leaving a wider seaboard and rising to a great height. In the regions comprised between the Blue Ridge and the chain of the Iron, Smoky, and Unaka mountains is the culminating portion of the Appalachians. For 150 miles the mean elevation of the valley is more than 2000 feet, while the mountains rise in scores of summits to 6000 feet or more. To the W. is the Valley of the Tennessee, a portion of the great central valley already mentioned. Still farther to the W. is the plateau of Tennessee, known as the Cumberland Mountains. Such is the system of mountains which form the eastern side of the framework by which the central portion of the United States is embraced. Between these and the Rocky Mountains are no connected masses of mountain-ranges. A few short ranges skirt the S. shore of Lake Superior, and here and there appear isolated hill-ranges, notably in Missouri and Arkansas.

The Cordilleras belong to the great chain of mountains which borders the Pacific coast of North and South America. Entering the United States from Mexico, the system widens rapidly until along the line from San Francisco, by way of Salt Lake, to Fort Laramie, the mass of mountains has a width of 1000 miles. "The whole area," says Prof. Whitney, "embraced within the mountainous belt which is called the Cordilleras is but very little, if any, short of 1,000,000 sq. m.; hence it may with propriety be called the greatest physical feature of our territory." This enormous mass of a lozenge shape, the length of each side being approximately 600 miles, is formed by the Cascade Range and the Sierra Nevada on the two westerly faces, and by the Rocky Mountains, with the Big Horn, Wind River, and Bitter Root ranges, on the two easterly faces. The plateau thus enclosed has through its centre, E. and W., an elevation of 4000 to 5000 feet, falling off alike to the N. and to the S. This plateau is traversed by various ranges, of which the Wahsatch, extending N. and S. through nearly six degrees, is the most notable. Between the Wahsatch and the Rocky mountains runs the Uintah range, the only high and well-defined chain in the Cordilleras having an E. and W. trend. W. of the Wahsatch are numerous parallel ranges, generally long, narrow, and precipitous, running obliquely from the Sierra Nevada E. of N. to the Humboldt River, beyond which lies the volcanic plateau which covers a large portion of Eastern Oregon and Washington, of Northern Nevada, North-eastern California, and South-western Idaho. From the plateau W. of the Snake River rise the Blue Mountains. The highest part of the Sierra Nevada is near the parallel of 36° 30′, where the peaks rise above 14,000 feet, the passes having an elevation of nearly 12,000. Farther to the N., where the Pacific R. R. crosses, the pass is only 7000 feet above the sea-level. W. of the Sierra Nevada and the Cascade Mountains, and not always to be distinguished from them, lie the Coast Ranges of California and Oregon.

*River Systems.*—The river systems of the United States may be grouped sectionally into four grand divisions—the northern lake, the Atlantic, the Gulf, and the Pacific divisions. The first consists of innumerable streams, many of them very short, emptying into the great lakes from Superior to Ontario, with which may here, for convenience, be associated the streams emptying into the river St. Lawrence and those running N. into British America. Of the last by far the most important is the Red River of the North, which empties into Lake Winnipeg in Canada. The whole river system thus composed embraces 184,339 sq. m. of the territory of the United States, lying between the 71st and 104th degrees of lon. W. from Greenwich. The second division comprises all those streams which flow eastward or southward to the Atlantic. This division covers the total eastern side of the United States, extending from 47° 15′ to 25° 15′ in latitude, and covers an estimated area of 304,538 sq. m. The most important rivers of this division, which embraces more than one-third the population of the United States, are the Penobscot, Kennebec, Androscoggin, Merrimack, Connecticut, Hudson, Delaware, Susquehanna, Potomac, Rappahannock, James, Roanoke, Neuse, Cape Fear, Pedee, Santee, Edisto, Savannah, Ogeechee, Altamaha, Saltilla, and St. Johns. The third grand division embraces the Mississippi system, and also the rivers of Western Georgia, Western Florida, Alabama, Mississippi, Louisiana, and Texas, which empty into the Gulf of Mexico. The total area of this division is computed at 1,683,303 sq. m., of which 1,257,545 are drained by the Mississippi and its tributaries, the principal of which, with their several areas of drainage, are the Missouri (527,690), the Ohio (207,111), the Arkansas (184,742), and the Red (92,721). Other prominent tributaries are the Minnesota, Des Moines, Illinois, and Yazoo. Of the rivers in this division emptying directly into the Gulf, the most important are the Suwanee, Apalachicola, Mobile, Pearl, Sabine, Trinity, Brazos, Colorado (of Texas), Guadalupe, and Nueces, the Rio Grande del Norte forming for a considerable part of its course the south-western boundary of the United States. The fourth grand division embraces the Great Interior Basin, without outlet to the sea, between the Rocky Mountains and the Sierra Nevada (210,274 sq. m.), and the basins of the Columbia, the Klamath, the Sacramento and San Joaquin, and the Colorado, as well as the tracts drained by smaller streams flowing into the Pacific. The total area is 854,314 sq. m.

A notable peculiarity of all the streams draining the Cordilleras to the W. is want of navigability. The mighty Colorado is almost without importance for purposes of navigation; the Columbia has two portages by railroad before the Cascade Range is passed; the Sacramento is navigable for moderate-sized boats for only 60 miles. In striking contrast are the rivers of the Mississippi Valley, which offer vast reaches to steam navigation. Cairo is 1100 miles from the mouth of the Mississippi, yet only 322 feet above the level of the Gulf; Pittsburg, at the head of the Ohio, 975 miles farther from the sea, has an elevation of only 699 feet.

The following table exhibits the relation to population of each of the four grand divisions enumerated, and also of each of certain principal river-basins embraced:

| Divisions. | Population. | Area in square miles. | Inhabitants to a square mile. |
|---|---|---|---|
| Northern Lake | 4,399,604 | 184,339 | 23.7 |
| Atlantic | 14,207,453 | 304,538 | 46.6 |
| Gulf | 19,111,804 | 1,683,303 | 11.3 |
| Pacific | 339,510 | 854,314 | .98 |
| Total U. S. | 38,558,371 | 3,026,494 | 12.7 |
| Basin of the Ohio | 7,806,453 | 207,111 | 37.7 |
| " Missouri | 1,524,171 | 527,690 | 2.9 |
| " Red | 468,298 | 92,721 | 5.1 |
| " Arkansas | 517,923 | 184,742 | 2.8 |
| " Columbia | 106,718 | 219,706 | .5 |
| " Colorado | 16,144 | 264,386 | .06 |
| " Sacramento and San Joaquin | 455,972 | 66,927 | 6.8 |

*The Great Lakes.*—The upper waters of the St. Lawrence River expand between the 76th and 92d degrees of lon. W. from Greenwich into a series of lakes, which form, for the greater part of that distance, the northern boundary of the United States. These lakes are five in number—Ontario, Erie, Huron, Michigan, and Superior. They are remarkable not alone for their immense area, but for their uniformity of elevation, affording extraordinary facilities for commercial intercourse. Lake Michigan is but 19 feet higher than Erie, while Superior is but 22 feet higher still. Between Erie and Ontario, however, there is a descent of not less than 331 feet, about one-half being made at a single plunge in the Falls of Niagara. These lakes have considerable depth, their basins being below the surface of the sea. Their combined area exceeds 90,000 sq. m., one-third being covered by the waters of Superior, while Michigan and Huron have each a surface of over 20,000.

*Climate.*—To speak of the climate of the United States would be misleading. Nothing can be said of the United States as a whole in respect to temperature, humidity, or the force of winds. The United States, owing to its vast extent in latitude and to the influence of the great longitudinal chains of mountains, has many climates. The annual rainfall ranges from 72, 80, and even 100 inches upon the Upper Pacific slopes, to 12, 8, and even 4 inches only on the great interior basin between the Rocky Mountains and the Sierra Nevada. The mean annual temperature ranges from 72° or 76° F. in Southern Florida and portions of Arizona to 36° on the plains of Northern Minnesota and Dakota. Nor are such differences of heat due mainly to the great extent of the United States in latitude. The line of 44° mean annual temperature, in its course from the Atlantic to the Pacific, crosses every parallel of latitude from

34° to 45°. Nor do sections differ less in respect to the variability of temperature. The line of 20° below zero for the coldest week of the year in Minnesota crosses the line of 85° for the hottest week; while in Florida, the line of 40° above zero for the coldest nearly coincides with that of 90° for the hottest week. The annual precipitation of rain and melted snow is greatest on the Pacific slope of the Sierra Nevada and on the Coast Range above the 42d degree. In Southern California the annual precipitation is reduced to a low-average, while occasional drouths seriously affect the economical conditions of stock-raising in that section. Speaking generally, the entire Atlantic slope is well watered, the average annual fall ranging from 32 to 56 and more inches. The precipitation is greatest toward the S., furnishing the most favorable conditions for the culture of cotton. Of the Mississippi Valley, the eastern side receives an abundance of rain, though the southern portion, especially in Mississippi, is the most liberally watered. From the Mississippi River westward the rainfall runs down from an average of 44, 40, or 36 inches to an average of 20, 16, or 12 inches along the 100th degree of longitude.

In respect to the temperature of the United States E. of the 100th degree of longitude, the largest generalization which can be offered is that the line of the 39th degree of latitude, which has been the line on which the centre of population for the United States has moved from 1790 to 1870, makes a marked division between the mean annual temperature of the sections N. and S. of it. The belt of 60°, or more, mean annual temperature covers pretty much the whole cotton region, whether on the coast or in the Gulf States. W. of the 100th meridian the lines of 44° and 48° run far to the N., embracing the region of the upper Missouri as far W. as the 112th degree of longitude, allowing the cultivation of crops not elsewhere found on the continent in so high a latitude.

The region of storms in the United States is found principally N. of the 37th degree of latitude, the most numerous and severe visitations occurring throughout the Northern lake district. The plains of Illinois, Wisconsin, Iowa, Nebraska, and Minnesota are also swept by frequent local storms of great violence.

*Flora.*—The flora of the United States, as might be inferred from the wide range of soil, topography, geology, and climate, is both rich and varied. No full enumeration of plants has ever been published, but the whole number, exclusive of the lower cryptogams, probably amounts to 5000 indigenous species, many of which have a great range. There is perhaps not a single State which does not possess 1000 species; many States have 1500, while California has 2500 or 3000. The number of woody species is not less than 800, and over 400 are large enough to be called trees, 250 of which are not rare. If we consider only the larger and more important, excluding all the smaller and rarer ones, and also those tropical forms found only along the extreme southern border, there still remain about 120 species of trees within the United States in sufficient abundance to be somewhere of economic importance, which attain a maximum height of 100 or more feet. Twelve of these occur 200 feet high, and five or six are sometimes 300 or more feet. About 50 of the 120 species belong to the Coniferæ.

E. of the Rocky Mountains, a broad and treeless belt, known as "the Plains," separates two very different forest floras, only two species being common to both, neither of them of much importance. E. of the Plains the larger number of species are deciduous, or at least broad-leaved; and the entire region, excepting the prairies of the West, was originally forest-clad. But while deciduous species predominate, there are extensive pine forests from Louisiana to Maine, and some of the coniferous lumber produced has an almost world-wide fame. Along the Appalachians, from New Hampshire to Alabama, a larger number of valuable hard woods occur than is known to any other temperate climate. The Ohio Valley is known commercially for the size and excellence of some of its deciduous trees, notably black walnut, tulip, bass, and ash, while Florida is equally noted for its live-oak. In Southern Florida are many truly tropical forms, interesting to the botanist, but not sufficiently abundant to be of special economic importance. Over the regions W. of the Plains extensive forests occur only on the mountains or near the sea, and when found are essentially of Coniferæ. Broad-leaved trees occur in this region, sometimes in considerable abundance, particularly in the western and southern portions, but they are usually scattered, and never form an important forest element. Conspicuous among these are the cottonwood along streams, the mesquite of the southern parts, and several species of California and Oregon trees. Among the latter, several oaks, the madroña, laurel, Oregon ash, and the great-leaved maple are of most value, some growing to a great size and being of wondrous beauty. Along the western flanks of the Cascades and Sierra Nevada, and also near the coast from Cape Mendocino northward, are perhaps the heaviest forests on the globe. They are entirely of Coniferæ. Trees of 200 feet high are in vast abundance; trees 300 feet high and 10 to 15 feet in diameter not being rare. All these figures are often exceeded. W. of the Rocky Mountains many plains and slopes, and even mountains, which are destitute of timber, are nevertheless abundantly and often densely clothed with shrubs. Among the more noteworthy kinds of these are several species of *Artemisia* (popularly called "sage") and other shrubby Compositæ; *Cercocarpus* (called mountain mahogany), *Nuttallia*, in Oregon the vine maple, in California various species of *Ceanothus* (called wild lilac) and *Adenostoma* (chamisse), and on the southern deserts *Larrea* (creosote bush) and various *Cacti*.

Compared with Europe, the local floras are poorer in the actual number of species, but vastly richer in trees, many of which belong to older types. The hickories, magnolias, sequoias, liquidamber, sassafras, and other genera, so abundant or noteworthy in the New World, are only found fossil in the Old.

The United States has contributed a few species to the useful plants of cultivation. Many valuable varieties of grasses have originated from native species, and several fruits and nuts now but rarely cultivated will probably pass into wider cultivation and greater economic importance. Near the Atlantic coast and along our southern borders European explorers found maize, potatoes, squashes, tobacco, and other useful plants in cultivation among the Indians. Whether they were originally native, or had been introduced earlier from Mexico, cannot now be known. On the N. W. coast a poor kind of native tobacco was the only plant originally cultivated by the natives, and in the interior there were large regions where absolutely no plant was cultivated. The East has actually furnished a few useful plants to cultivation, and the West many ornamental species. In the gardens and parks of Europe it has been remarked that Asia has furnished the larger number of useful trees and shrubs (other than timber), and North America, particularly the United States, the most beautiful of the ornamental species.

*Fauna.*—No account exists of the species of the animal kingdom within the limits of the United States. In general, the fauna is the same as that of North America, which is especially rich in fresh-water forms, for the reason, doubtless, that North America has been a continent ever since the Carboniferous period. The species of Vertebrata described number 2249, distributed as follows: Mammalia, 310; Aves, 756; Reptilia, 257; Batrachia, 101; Pisces, 816; Dermopteri, 8; Leptocardii, 1. The Mollusca found in rivers and lakes number 1034 species; about 400 more are terrestrial and air-breathers; the marine species are very numerous, but nothing approaching a complete enumeration is possible. Of the number of species in the inferior divisions of the animal kingdom only the rudest estimates can be made. Of insects, Prof. Cope considers 50,000 species as probably "below the mark."

*Geology.*—In describing the geology of the United States it will be convenient to divide the territory into two great geographical areas—the eastern from the Atlantic to the base of the Rocky Mountains, and the western extending thence to the Pacific. The eastern is occupied in large part by an immense basin of Palæozoic rocks, bounded on the W. by the crystalline Eozoic formations of the Rocky Mountains; which formations, with some intervals of concealment, stretch around to Lake Superior, and thence through Canada to the mountainous regions of Northern New York and New England. They are thence prolonged south-westward in the Highlands of Southern New York, New Jersey, and Pennsylvania, and continued in the Blue Ridge as far as Alabama. Within the great basin thus enclosed on the N. and E. and W. lie the uncrystalline rocks of Palæozoic age, including representatives of all of the great divisions of Palæozoic time—Cambrian, Silurian, Devonian, and Carboniferous. These have been by American geologists subdivided into minor and often local formations, characterized by distinctive organic remains. One of the most striking facts in regard to the Palæozoic formations in this area is that they have to the N. and E. a great thickness, estimated at about 40,000 feet for the whole Palæozoic column, which in the valley of the Mississippi is represented by not more than 4000 feet—a diminution due to the thinning out, and in some cases to the entire disappearance, of important formations of mechanical origin, which had their source to the eastward of the basin. Another fact of great significance is that the strata of this wide basin, while almost horizontal over the greater part of the area, are affected in the eastern portion by numerous folds and dislocations, which are nearly parallel to the belt of crystalline rocks forming the eastern bor-

der of the basin. These folded Palæozoic rocks, more or less eroded, constitute the floor of the great Appalachian Valley, and to the W. of it the mountains commonly known as the Alleghanies and the elevated plateau which slopes off toward the valleys of the Ohio and the Mississippi to the W. While to the eastward these N. E. and S. W. folds are very sharp, and often marked by great dislocations of the strata (in which case the upthrows are on the S. E. side of the breaks), they become more and more gentle to the W. The last one of mark is the broad anticlinal which brings up at Nashville, Tenn., and at Cincinnati, O., the Silurian strata separating the great Appalachian coal-field on the E. from the coal-fields of Michigan and Illinois on the W. The eastern coal-field itself has been greatly affected by these undulations, and the detached semi-bituminous and anthracitic coal-areas of Pennsylvania, Maryland, and Virginia, lying among the Appalachian hills, are portions of what was once a great continuous coal-basin cut off by folding and subsequent erosion from the main body of the bituminous coal of Western Pennsylvania and West Virginia, and modified in character by processes apparently connected with this great geological disturbance. Beneath the coal-measures, to the eastward, is a great series of strata consisting entirely of sandstones, conglomerates, and shales, and included in the Carboniferous and Devonian divisions; but to the westward there appears at the base of the coal a limestone known as the Carboniferous limestone, which becomes a conspicuous formation in the valley of the Mississippi, and is the chief representative of the Carboniferous series in the Rocky Mountain area, presently to be described. These sandstones and conglomerates beneath the coal are important as being the horizon from which the petroleum of Western Pennsylvania is produced, though there is good reason for supposing that its original source is, like that of the petroleum of Canada, to be sought in an older limestone formation, or rather series of formations, included in the Lower Devonian and the Silurian divisions. This series, which embraces the Corniferous in New York and the underlying magnesian limestones of the Salina and Niagara formations, and to the eastward the group of the Lower Helderberg limestones at the base of the Corniferous, constitutes a second great horizon of calcareous rocks. Beneath these come the sandstones of the Medina and Oneida formations, another horizon of mechanically-formed rocks which constitute the base of the Silurian proper, and rest, sometimes, unconformably on the great Trenton limestone group of New York, with the overlying Utica and Loraine shales, and the underlying Chazy limestone and the Calciferous sandrock, a magnesian limestone which in its turn rests upon the Potsdam sandstone, regarded in Northern New York as the base of the Palæozoic series. These limestones and their associated rocks below the Medina represent the Upper Cambrian or Siluro-Cambrian, with a portion of the lower or proper Cambrian rocks.

In Eastern New York and southward, along the eastern base of the Alleghanies, stretches a great series of quartzites, limestones, and argillites, which have been regarded by some geologists as belonging to the same age as the series last mentioned, while by others they are considered as an older group, overlaid by small portions of the Siluro-Cambrian of New York. They constitute the Taconic system of Emmons, and are the floor of the great Appalachian Valley from Massachusetts to Alabama. They most probably correspond to the lower portions of the Cambrian as known in Europe, and have certain resemblances with the crystalline rocks along their eastern border. These latter have been divided into three great divisions, which in descending order are supposed to be as follows: (1) The Montalban or newer gneiss and mica-schist series, which is largely developed in the White Mountains of New Hampshire, and can be traced along the Appalachians to Alabama. This series underlies the cities of New York, Philadelphia, and Washington. (2) The Huronian, which is the great iron-bearing series of Northern Michigan, and is also largely developed in Vermont and southward throughout the Appalachians. It includes the talcose and chloritic slates and serpentines of the region, and is important for its deposits of gold and copper ores. (3) The Laurentian or oldest gneiss series, which forms the Laurentides in Canada, the Adirondacks of New York, the Highlands of the Hudson, and the South Mountain in New Jersey and Pennsylvania, and appears again elsewhere in the Appalachian chain. This series is noted for its great beds of magnetic iron ores and its deposits of graphite. To these three great divisions of the Eozoic rocks must be added a fourth, the Norian, made up chiefly of norite or labradorite rocks, which occupies a large area in Essex co., N. Y., and appears elsewhere in New England and in Canada. It has been called Upper Laurentian, since it rests unconformably on the Laurentian, but its place in the series is yet undetermined. Resting upon the Huronian, and overlaid by the lower Palæozoic beds around the basin of Lake Superior, is the Keweenaw series, a great thickness of sandstone and conglomerates, with rocks of igneous origin, remarkable for containing the greatest known mines of native copper. This group of rocks is apparently local; nothing like it has been met with elsewhere. Resting unconformably upon the Atlantic side of the Appalachian belt of crystalline rocks are several long and narrow portions of lower Mesozoic rocks, chiefly red sandstones, which probably include both the Triassic and Jurassic formations; the principal of these are the red sandstones of the Connecticut Valley and those of the belt extending from the Palisades of the Hudson to Virginia. In other and smaller areas of similar strata are the coal-beds of North Carolina and of Eastern Virginia. Rocks of Cretaceous age, overlaid in large part by Tertiary strata, extend from near the mouth of the Hudson to that of the Mississippi, forming the lowlands of the Atlantic and the Gulf States, and stretching up along the Mississippi Valley as far as the mouth of the Ohio. To the westward, between the Mississippi River and the Rocky Mountains, are found great areas of strata of Mesozoic and Tertiary ages which stretch northward into Canada.

Small portions of strata, apparently belonging to another Palæozoic basin, are found along the eastern coast of New England. To it belong little areas of fossiliferous Cambrian, Silurian, and Devonian rocks, and also the anthracites of Rhode Island and Massachusetts.

The geological structure of the great western area, including the region from the eastern base of the Rocky Mountains to the Pacific, differs widely from that of the eastern. The crystalline rocks of the Eozoic are in parts overlaid by Palæozoic strata, which, though holding the organic forms of those of the eastern basin, are unlike them lithologically, being in great measure limestones, of which a large portion are of Carboniferous age. Vast areas of more recent rocks, in great part of the newer Secondary and Tertiary periods, occur in these regions, including large deposits of coal and the remains of a great variety of vertebrate animals. These strata, which are undisturbed in the Atlantic and Gulf regions, have in the West been greatly broken and faulted and eroded, and penetrated by eruptive rocks, overflows of which cover wide territories in the north-western part of the area.

Over the north-eastern portions of the United States the strata already described are irregularly overlaid in parts by the so-called Drift formation, supposed to be the result of ice-action. The higher portions of the hard and often crystalline rocks are rounded and scratched or grooved, while in the lower levels is found the unstratified or glacial drift with boulders, overlaid by stratified clays and sands. These deposits are more recent than the Pliocene Tertiary. The southern limit of the Drift is about 40° N. lat.; beyond this the limestones and the crystalline Eozoic rocks are in great part covered with a soil resulting from their decay in place. This decayed covering is seen at intervals, where the strata have been protected from glacial action, as far N. as Massachusetts, but is remarkable in the Blue Ridge, where the hard crystalline rocks are often concealed beneath a layer of 100 feet or more of softened material, resulting from the decomposition of these *in situ*. Similar phenomena are seen in the upper valley of the Mississippi, which, like the S., has escaped the agencies of the Glacial period.

*Iron.*—The iron resources of the United States are stupendous in extent. All varieties of ore are found, most of them in great abundance, and in such juxtaposition with coal and limestone, often close upon navigable waters, as to afford the highest facility for production. Magnetic ores are found in the Adirondacks and throughout the entire length of the Alleghanies. They have been developed especially in the Champlain district about Port Henry, in Orange co., N. Y., in Northern New Jersey, and in Lebanon and York cos., Pa. These ores are largely used in the manufacture of Bessemer steel. Magnetic ores, as yet undeveloped, are also found in the Black Hills and various parts of the Rocky Mountains and the Sierra Nevada. In the Lake Superior region, and in the region of Central Missouri, where are literally mountains of iron, occur vast deposits of hæmatite ores, the production of the Lake Superior region reaching nearly 1,000,000 tons a year, the product being widely distributed, like the magnetic ores of the East, both by boat and by rail, to hundreds of furnaces, some at a great distance. Red hæmatite ores are found over broad areas from Maine to Georgia and East Tennessee, the variety known as the Clinton or fossil ore being of unsurpassed industrial importance, though not used in the manufacture of steel. Brown hæmatite or limonite ore occurs on both sides of the Alleghanies, and also in Missouri. This ore is adapted for use as an adjunct to the

magnetic ores, and at the East the two are generally worked together. Spathic iron (the sparry carbonate of iron) is found only in two deposits of economic value in the United States, in Roxbury, Conn., and near Burlington, Vt. The earthy carbonate (clay ironstone) is found plentifully throughout the Alleghany coal-field, and occurs also in Illinois and Missouri. This variety is less used than formerly, when it supplied large numbers of furnaces in Pennsylvania and Ohio, especially in Western Pennsylvania and Southern Ohio. Another carbonate of iron, blackband ore, the chief material of the Scotch iron manufacture, has been found in considerable amount in Ohio, and in small quantities in the anthracite region of Pennsylvania. The production of pig iron in the United States is stated by the Iron and Steel Association as follows:

| Year. | Anthracite. | Charcoal. | Bituminous coal and coke. | Total. |
|---|---|---|---|---|
| | Tons. | Tons. | Tons. | Tons. |
| 1854 | 339,435 | 342,298 | 54,485 | 736,218 |
| 1855 | 381,866 | 339,922 | 62,390 | 784,178 |
| 1856 | 443,113 | 370,470 | 69,554 | 883,137 |
| 1857 | 390,385 | 330,321 | 77,451 | 798,157 |
| 1858 | 361,430 | 285,313 | 58,351 | 705,094 |
| 1859 | 471,745 | 284,041 | 84,841 | 840,627 |
| 1860 | 519,211 | 278,331 | 122,228 | 919,770 |
| 1861 | 409,229 | 195,278 | 127,037 | 731,544 |
| 1862 | 470,315 | 186,660 | 130,687 | 787,662 |
| 1863 | 577,638 | 212,005 | 157,961 | 947,604 |
| 1864 | 684,018 | 241,853 | 210,125 | 1,135,996 |
| 1865 | 479,558 | 262,342 | 189,682 | 931,582 |
| 1866 | 749,367 | 332,580 | 268,396 | 1,350,343 |
| 1867 | 798,638 | 344,341 | 318,647 | 1,461,626 |
| 1868 | 893,000 | 370,300 | 340,300 | 1,603,300 |
| 1869 | 971,150 | 392,150 | 553,341 | 1,916,641 |
| 1870 | 930,000 | 365,300 | 570,000 | 1,865,300 |
| 1871 | 956,608 | 385,300 | 570,000 | 1,911,608 |
| 1872 | 1,369,812 | 500,587 | 984,159 | 2,854,558 |
| 1873 | 1,312,754 | 577,620 | 977,904 | 2,868,278 |
| 1874 | 1,202,144 | 576,557 | 910,712 | 2,689,413 |
| 1875 | 908,046 | 410,990 | 947,545 | 2,266,581 |

The product of 1875 was distributed as follows:

| State. | Whole No. of stacks completed Dec. 31, 1875. | No. tons of pig iron made. |
|---|---|---|
| Maine | 1 | 2,046 |
| Vermont | 2 | 2,400 |
| Massachusetts | 6 | 21,255 |
| Connecticut | 10 | 10,880 |
| New York | 57 | 266,431 |
| New Jersey | 18 | 64,069 |
| Pennsylvania | 278 | 960,884 |
| Maryland | 24 | 38,741 |
| Virginia | 34 | 29,985 |
| North Carolina | 8 | 800 |
| Georgia | 12 | 16,508 |
| Alabama | 14 | 25,108 |
| Texas | 1 | |
| West Virginia | 12 | 25,277 |
| Kentucky | 23 | 48,339 |
| Tennessee | 22 | 28,311 |
| Ohio | 100 | 415,893 |
| Indiana | 9 | 22,081 |
| Illinois | 12 | 49,762 |
| Michigan | 34 | 114,805 |
| Wisconsin | 14 | 62,139 |
| Missouri | 19 | 59,717 |
| Oregon | 1 | 1,000 |
| Utah | 1 | 150 |
| Minnesota | 1 | |

The production of the principal districts of Pennsylvania in 1875 was as follows:

| | |
|---|---|
| Lehigh Valley | 280,360 |
| Schuylkill Valley | 123,184 |
| Upper Susquehanna | 71,731 |
| Lower Susquehanna | 79,717 |
| Shenango Valley | 137,025 |
| Pittsburg and Alleghany co | 131,856 |
| Miscellaneous coke | 102,520 |

*Coal.*—The extensive coal-measures of the United States may be grouped into seven grand divisions: the New England basin, the anthracite regions of Pennsylvania, the Appalachian coal-field, the Michigan, the Illinois, and the Missouri basins, and the Texas coal-field. The New England basin in Massachusetts and Rhode Island occupies about 750 sq. m.; the coal is a plumbaginous anthracite. Small quantities are raised for use in smelting. The anthracite basins of Pennsylvania are estimated to embrace 472 sq. m. They are usually divided into three groups—the first, the southern, or Schuylkill basin and Mine Hill; the second, the middle, or Shamokin, the Mahanoy, and the Lehigh basins; the third, the northern, or Wyoming and Lackawanna basin. Prof. Rogers reports that the first coal-field has an average thickness of 100 feet, the second and third of about 60 feet. The Appalachian coal-fields comprise over 59,000 sq. m., distributed as follows: Pennsylvania, 12,302; Maryland, 558; Ohio, 10,000; Virginia and West Virginia, 16,000; Kentucky, 8983; Tennessee, 5100; Georgia, 170; Alabama, 6000. The Michigan basin has an area of 6700 sq. m., with 123 feet of measures and 11 feet of coal as a maximum in the centre of the basin. The coal-measures of the Illinois basin occupy about 47,188 sq. m. in the States of Illinois, Indiana, and Kentucky. In this field the beds of coal are not so thick as in the Appalachian, though their number is about the same. The coals themselves are more apt to be impure, though there is abundance of good workable beds. In Illinois the measures occupy 36,000 sq. m. In Indiana the measures occupy 6500 sq. m. In Western Kentucky this field occupies 3888 sq. m. The Missouri basin covers the largest expanse of territory, though it is thinner and with fewer beds of coal than the Appalachian. In this basin are embraced 18,000 sq. m. in Iowa; 23,100 in Missouri; 36,000 in Nebraska; 17,000 in Kansas; 13,600 in the Indian Territory; and 9000 in Arkansas; a total of 84,300 sq. m. The Texas basin embraces about 6000 sq. m.

In addition to all the above, there are considerable areas in the Rocky Mountains, underlaid with beds of lignite.

*The Precious Metals.*—The Appalachians in their southern parts present a somewhat remarkable variety of mineral deposits. Gold in greater or less quantity is found in nearly all the Southern States which share in the elevation of this chain. In North Carolina and Georgia mines have been worked from an early period, but with varying success. In 1849 the discovery of gold in California led to the development not only of a new industry, but of a new empire. In two years the population of the Pacific slope rose from 15,000 to 100,000, and now exceeds 750,000. The first form of gold-mining on the Pacific was that of diggings, the soil being shovelled into a pan, and the gold washed free of the clay, sand, and pebbles. Later came the rocker, afterward the "tom" and the sluice. The first ditch of importance was made in 1850, while in the eight years following 6000 miles of mining-canals had been constructed in California at a cost of $15,000,000. The present chief sources of gold production are (1) old placer-mining regions, where the ground is worked with sluices by miners in partnerships and gangs; (2) deep placers and cement deposits, worked by drifting and blasting and by the hydraulic process, usually by joint-stock companies; (3) quartz-mines, operated by individuals or companies. Prof. Raymond offers the following estimate of the gold product of the United States since 1847. The figures represent millions of dollars:

| Years. | California. | Other States and Territories. |
|---|---|---|
| 1848 | 10 | |
| 1849 | 40 | |
| 1850 | 50 | |
| 1851 | 55 | |
| 1852 | 60 | |
| 1853 | 65 | |
| 1854 | 60 | |
| 1855 | 55 | |
| 1856 | 55 | |
| 1857 | 55 | |
| 1858 | 50 | |
| 1859 | 50 | |
| 1860 | 45 | 1 |
| 1861 | 40 | 3 |
| 1862 | 34.7 | 4.5 |
| 1863 | 30 | 10 |
| 1864 | 26.6 | 19.5 |
| 1865 | 28.5 | 24.725 |
| 1866 | 25.5 | 28 |
| 1867 | 25 | 26.725 |
| 1868 | 22 | 26 |
| 1869 | 22.5 | 27 |
| 1870 | 25 | 25 |
| 1871 | 20 | 23.5 |
| 1872 | 19 | 17 |
| 1873 | 18 | 17 |
| | 986.8 | 252.95 |
| | 252.95 | |
| | 1239.75 | |

During the same period the production of silver is stated at $186,600,000. Mr. Clarence King has called attention to the existence of seven longitudinal zones or chains of deposits upon the Pacific slope.

"The Pacific Coast Ranges upon the W. carry quicksilver, tin, and chromic iron. The next belt is that of the Sierra Nevada and Oregon Cascades, which upon their western slope bear two zones, a foot-hill chain of copper-mines and a middle line of gold deposits. These gold-veins and the resultant placer-mines extend far into Alaska, characterized by a small amount of that metal, which is entangled in iron sulphurets, and by occupying splits in the upturned metamorphic strata of the Jurassic age. Lying to the E. of this zone, along the E. base of the Sierras, and stretching southward into Mexico, is a chain of silver-mines, contain-

ing comparatively little base metal, and frequently included in volcanic rocks. Through Middle Mexico, Arizona, Middle Nevada, and Central Idaho is another line of silver-mines, mineralized with complicated association of the base metals, and more often occurring in older rocks. Through New Mexico, Utah, and Western Montana lies another zone of argentiferous galena lodes. To the E., again, the New Mexico, Colorado, Wyoming, and Montana gold-belt is an extremely well-defined and continuous chain of deposits."

POLITICAL DIVISIONS.—*States and Territories.*—Thirty-eight States compose the Union. The relation of the States to the general government will be spoken of later. The following table exhibits the date of admission of each State not of the original thirteen by which the Constitution was adopted, as well as the area and population of each State in 1870. The date 1789 designates the original thirteen States. In the absence of official surveys, the statements of areas are necessarily approximate only:

| STATES. | Date of admission as a State. | Area and population in 1870. | | |
|---|---|---|---|---|
| | | Area in sq. miles. | Population. | Inhabitants to a sq. mile. |
| Alabama | 1819 | 50,772 | 996,992 | 19.66 |
| Arkansas | 1836 | 52,198 | 484,471 | 9.30 |
| California | 1850 | 188,981 | 560,247 | 2.29 |
| Colorado | 1876 | 104,500 | 39,864 | 0.38 |
| Connecticut | 1789 | 4,750 | 537,454 | 113.15 |
| Delaware | 1789 | 2,120 | 125,015 | 58.97 |
| Florida | 1845 | 59,268 | 187,748 | 3.17 |
| Georgia | 1789 | 58,000 | 1,184,109 | 20.42 |
| Illinois | 1818 | 55,410 | 2,539,891 | 45.84 |
| Indiana | 1816 | 33,809 | 1,680,637 | 49.71 |
| Iowa | 1846 | 55,045 | 1,194,020 | 21.69 |
| Kansas | 1861 | 81,318 | 364,399 | 4.48 |
| Kentucky | 1792 | 37,680 | 1,321,011 | 35.33 |
| Louisiana | 1812 | 41,346 | 726,915 | 17.58 |
| Maine | 1820 | 35,000 | 626,915 | 17.91 |
| Maryland | 1789 | 11,124 | 780,894 | 70.20 |
| Massachusetts | 1789 | 7,800 | 1,457,351 | 186.84 |
| Michigan | 1837 | 56,451 | 1,184,059 | 20.97 |
| Minnesota | 1858 | 83,531 | 439,706 | 5.26 |
| Mississippi | 1817 | 47,156 | 827,922 | 17.56 |
| Missouri | 1821 | 65,350 | 1,721,295 | 26.34 |
| Nebraska | 1864 | 75,995 | 122,993 | 1.62 |
| Nevada | 1864 | 104,125 | 42,491 | .41 |
| New Hampshire | 1789 | 9,280 | 318,300 | 34.30 |
| New Jersey | 1789 | 8,320 | 906,096 | 108.91 |
| New York | 1789 | 47,000 | 4,382,759 | 93.25 |
| North Carolina | 1789 | 50,704 | 1,071,361 | 21.13 |
| Ohio | 1802 | 39,964 | 2,665,260 | 66.69 |
| Oregon | 1859 | 95,274 | 90,923 | .95 |
| Pennsylvania | 1789 | 46,000 | 3,521,951 | 76.56 |
| Rhode Island | 1789 | 1,306 | 217,353 | 166.43 |
| South Carolina | 1789 | 34,000 | 705,606 | 20.75 |
| Tennessee | 1796 | 45,600 | 1,258,520 | 27.60 |
| Texas | 1845 | 274,356 | 818,579 | 2.98 |
| Vermont | 1791 | 10,212 | 330,551 | 32.37 |
| Virginia | 1789 | 38,348 | 1,225,163 | 31.95 |
| West Virginia | 1863 | 23,000 | 442,014 | 19.22 |
| Wisconsin | 1848 | 53,924 | 1,054,670 | 19.56 |

In addition to the 38 States enumerated, "the United States" embraces the District of Columbia, 63 sq. m., the seat of government, obtained by cession from the State of Maryland, eight Territories, duly organized, and the District of Alaska. Over the District of Columbia Congress exercises exclusive jurisdiction, under the Constitution. The Territories have provisional governments more or less completely organized, but are subject to legislation by Congress, even to the extent of the addition or subtraction of territory without their own consent, or to the extinguishment of their existing governments. Once admitted as States, however, they come to possess all the rights and immunities of original members of the Union, and their territory cannot thereafter be increased or diminished without their consent. In general, the government of the Territories consists of (1) a governor, who is appointed by the President of the United States, holding office for four years, unless sooner removed; is commander-in-chief of the militia of the Territory; may grant pardons and reprieves for offences against the laws of the Territory, and for offences against the laws of the United States may grant reprieves till the decision of the President be made known; commissions all persons appointed to office under the laws of the Territory, and exercises generally the executive functions, with a secretary who in the absence of the governor performs the duties of that office; (2) a Territorial legislature, comprising a council and house of representatives (the members, terms of service, and qualifications of members varying in different Territories), having powers of legislation extending to "all rightful subjects of legislation consistent with the Constitution of the United States and the Territorial organic act;" the governor of the Territory, however, possessing the veto power under provisions similar to those under which the President of the United States exercises that power; (3) a judiciary composed of a supreme court, district courts, probate courts, and justices of the peace. The following table exhibits the area and population of each of the Territories in 1870:

| Name. | Area in sq. m. | Population. | Inhabitants to a sq. m. |
|---|---|---|---|
| Arizona | 113,916 | 9,658 | 0.08 |
| Dakota | 150,932 | 14,181 | 0.09 |
| Idaho | 86,294 | 14.999 | 0.17 |
| Montana | 143,776 | 20,595 | 0.14 |
| New Mexico | 121,201 | 91,874 | 0.76 |
| Utah | 84,476 | 86,786 | 1.03 |
| Washington | 69,994 | 23,955 | 0.34 |
| Wyoming | 97,883 | 9,118. | 0.09 |

No government for Alaska has yet been organized. The secretaries of war and of the treasury, in pursuance of certain acts of Congress, exercise certain functions along the coast of this district.

*The Arithmetical Progress of Population.*—Mr. Bancroft presents the following estimates of the population of the thirteen colonies which became States of the Union:

| Year. | Whites. | Blacks. | Total. |
|---|---|---|---|
| 1750 | 1,040,000 | 220,000 | 1,260,000 |
| 1754 | 1,165,000 | 260,000 | 1,425,000 |
| 1760 | 1,385,000 | 310,000 | 2,195,000 |
| 1770 | 1,850,000 | 462,000 | 2,312,000 |
| 1780 | 2,383,000 | 562,000 | 2,945,000 |

The progress of the country in population is shown in the following table:

| Year. | Whites. | Blacks. | Total. |
|---|---|---|---|
| 1790 | 3,172,006 | 757,208 | 3,929,214 |
| 1800 | 4,306,446 | 1,002,087 | 5,308,483 |
| 1810 | 5,862,073 | 1,377,808 | 7,239,881 |
| 1820 | 7,862,166 | 1,771,656 | 9,633,822 |
| 1830 | 10,537,378 | 2,328,642 | 12,866,020 |
| 1840 | 14,195,805 | 2,873,648 | 17,069,453 |
| 1850 | 19,553,068 | 3,638,808 | 23,191,876 |
| 1860 | 26,922,537 | 4,441,830 | 31,443,321 |
| 1870 | 33,589,377 | 4,880,009 | 38,558,371 |

In addition to the elements enumerated, the totals above included in 1860, 34,933 Chinese and 44,021 Indians found living among the whites; in 1870, 63,254 Chinese and Japanese and 25,731 Indians. The Indians preserving their tribal relations have never been counted in any census of the United States, nor have their numbers ever been ascertained precisely in any way.

The following table shows the ratio of the increase in population for each ten, twenty, and thirty year period since 1790:

*Increase per cent.*

| YEAR. | In 10 years. | In 20 years. | In 30 years. |
|---|---|---|---|
| At 1800 | 35.1 | | |
| 1810 | 36.3 | 84.2 | |
| 1820 | 33.1 | 81.5 | 145.1 |
| 1830 | 33.5 | 77.7 | 142.3 |
| 1840 | 32.6 | 77.2 | 135.8 |
| 1850 | 35.8 | 80.2 | 140.7 |
| 1860 | 35.6 | 84.2 | 144.4 |
| 1870 | 22.6 | 66.2 | 125.9 |

*Immigration and the Foreign Elements of Population.*—Dr. Seybert estimates the aggregate immigration from foreign countries between 1790 and 1820 at 250,000. The following table shows the immigration from 1820 to 1870:

| YEARS. | From all countries. | From Great Britain and Ireland. | From Germany. |
|---|---|---|---|
| 1820–30 | 151,824 | 81,827 | 7,729 |
| 1830–40 | 599,125 | 283,191 | 152,454 |
| 1840–50 | 1,713,251 | 1,047,763 | 434,626 |
| 1850–60 | 2,598,214 | 1,338,093 | 951,667 |
| 1860–70 | 2,491,209 | 1,106,976 | 822,007 |

For the first time, the census in 1850 recorded the "place of birth" of the population. The number of persons of foreign birth was then determined to be 2,244,602. This number in 1860 had increased to 4,138,697, and in 1870 to 5,567,229. At the several dates named the several specific nationalities contributed to the total foreign population as follows:

| NATIONALITY. | 1850, per cent. | 1860, per cent. | 1870, per cent. |
|---|---|---|---|
| Irish | 43.5 | 38.9 | 33.3 |
| Germans | 26.4 | 30.8 | 30.4 |
| English and Welsh | 13.9 | 11.5 | 11.2 |
| British Americans | 6.7 | 6.0 | 8.9 |
| Swedes, Norwegians, and Danes | 0.81 | 1.7 | 4.4 |

The foreign immigrants to the United States have placed themselves mainly between the 38th and 46th degrees of latitude. Indeed, the geographical relation of the foreign and colored elements of the population is in a high degree complemental. Taking the States of Delaware, Maryland,

West Virginia, Kentucky, and Tennessee as a central belt common to both, we have the following numerical proportions in each 1000 inhabitants (Pacific States excluded):

| Divisions. | Total. | Colored. | Foreign. | Native white. |
|---|---|---|---|---|
| Northern and North-western States | 1,000 | 14 | 197 | 789 |
| Central States | 1,000 | 132 | 91 | 777 |
| Southern and South-western | 1,000 | 415 | 22 | 563 |

In like manner, the location of certain foreign elements will be found in turn largely complemental. Two-thirds of the Germans are located W. of Buffalo; two-thirds of the Irish E. of it. The Scandinavians are mainly W. of Lake Michigan, the British Americans E. of it.

*Colored Population.*—The following table exhibits, at ten-year intervals, (1) the total number of colored persons in the United States; (2) the percentage of the total population which this element constituted; (3) the percentage of increase within that element itself:

| Years. | No. of colored persons. | Percentage of total population. | Percentage of increase during preceding decade. |
|---|---|---|---|
| 1790 | 757,208 | 19.3 | |
| 1800 | 1,002,037 | 18.9 | 32.32 |
| 1810 | 1,377,808 | 19. | 37.05 |
| 1820 | 1,771,656 | 18.4 | 28.58 |
| 1830 | 2,328,642 | 18.2 | 31.44 |
| 1840 | 2,873,648 | 16.8 | 23.40 |
| 1850 | 3,638,808 | 13.3 | 26.60 |
| 1860 | 4,441,830 | 14.1 | 22.07 |
| 1870 | 4,880,009 | 12.7 | 9.21 |

The number of free colored persons in the United States was, in 1790, 59,527; 1800, 108,435; 1810, 186,446; 1820, 233,634; 1830, 319,599; 1840, 386,293; 1850, 434,495; 1860, 488,495. By 1870 the entire colored population had become free.

The population of 1870 was divided in respect of sex as follows:

| | | |
|---|---|---|
| Native males | 16,486,622 | |
| Foreign " | 3,006,943 | |
| | | 19,493,565 |
| Native females | 16,504,520 | |
| Foreign " | 2,560,986 | |
| | | 19,064,806 |

The colored population consisted of 2,393,263 males and 2,486,746 females.

The following table shows the respective numbers of males and of females in each State or Territory:

| With excess of females. | | | With excess of males. | | |
|---|---|---|---|---|---|
| States. | Males. | Females. | States. | Males. | Females. |
| Alabama | 488,738 | 508,254 | Arizona | 6,887 | 2,771 |
| Connecticut | 265,270 | 272,184 | Arkansas | 248,261 | 236,210 |
| Dist. of Columbia | 62,192 | 69,508 | California | 349,479 | 210,768 |
| Georgia | 578,955 | 605,154 | Colorado | 24,820 | 15,044 |
| Louisiana | 362,165 | 364,750 | Dakota | 8,878 | 5,303 |
| Maine | 313,103 | 313,812 | Delaware | 62,628 | 62,387 |
| Maryland | 384,984 | 395,910 | Florida | 94,548 | 93,200 |
| Massachusetts | 703,779 | 753,572 | Idaho | 12,184 | 2,815 |
| Mississippi | 413,421 | 414,501 | Illinois | 1,316,537 | 1,223,354 |
| New Hampshire | 155,640 | 162,660 | Indiana | 857,994 | 822,643 |
| New Jersey | 449,672 | 456,424 | Iowa | 625,917 | 568,103 |
| New York | 2,163,229 | 2,219,530 | Kansas | 202,224 | 162,175 |
| North Carolina | 518,704 | 552,657 | Kentucky | 665,675 | 655,336 |
| Pennsylvania | 1,758,499 | 1,763,452 | Michigan | 617,745 | 566,314 |
| Rhode Island | 104,756 | 112,597 | Minnesota | 235,299 | 204,407 |
| South Carolina | 343,902 | 361,704 | Missouri | 896,347 | 824,948 |
| Tennessee | 623,347 | 635,173 | Montana | 16,771 | 3,824 |
| Virginia | 597,058 | 628,105 | Nebraska | 70,425 | 52,568 |
| | | | Nevada | 32,379 | 10,112 |
| | | | New Mexico | 47,135 | 44,739 |
| | | | Ohio | 1,337,550 | 1,327,710 |
| | | | Oregon | 53,131 | 37,792 |
| | | | Texas | 423,557 | 395,022 |
| | | | Utah | 44,121 | 42,665 |
| | | | Vermont | 165,721 | 164,830 |
| | | | Washington | 14,990 | 8,965 |
| | | | West Virginia | 222,843 | 219,171 |
| | | | Wisconsin | 544,886 | 509,784 |
| | | | Wyoming | 7,219 | 1,899 |

The total number of families in the United States in 1870 was 7,579,363, which, with a population of 38,558,371, gives as the average number of persons to a family, 5.09. The lowest averages among the States were—California, 4.35; Connecticut, 4.67; Louisiana, 4.60; Nevada, 4.30; New Hampshire, 4.41; South Carolina, 4.67; Vermont, 4.69. The highest averages were—Delaware, 5.46; Kentucky, 5.67; Maryland, 5.57; Missouri, 5.43; Tennessee, 5.44; West Virginia, 5.63. The total number of dwellings in the United States in 1870 was 7,042,833, the average number of persons to a dwelling being thus 5.47. The lowest State averages were—California, 4.44; Florida, 4.57; Louisiana, 4.83; Nebraska, 4.89; Nevada, 3.27; New Hampshire, 4.75; Oregon, 4.69; South Carolina, 4.92. The highest averages were—Maryland, 6.02; Massachusetts, 6.16; New York, 6.37; Rhode Island, 6.24. In the eight principal cities the number of persons to a family was—New York, 5.07; Philadelphia, 5.28; Brooklyn, 4.95; St. Louis, 5.23; Chicago, 5.03; Baltimore, 5.35; Boston, 5.20; Cincinnati, 5.04. In these cities the number of persons to a dwelling was—New York, 14.72; Philadelphia, 6.01; Brooklyn, 8.64; St. Louis, 7.84; Chicago, 6.70; Baltimore, 6.63; Boston, 8.46; Cincinnati, 8.81.

*The Geographical Progress of Population.*—The first census, in 1790, found the population of the United States substantially all between the 31st and 45th degrees of latitude and the 67th and 83d degrees of longitude W. from Greenwich, the area actually covered by population of 2 or more persons to a square mile within these limits being 226,085 sq. m. At 1870, if we exclude the Pacific settlements and the region W. of the Rocky Mountains, the population was found between the degrees of latitude 27° 15′ and 47° 30′, and the degrees of longitude 67° and 99° 45′, the area covered by population within those limits being 1,140,329 sq. m. The following table exhibits the westward movement of population along the several degrees of latitude, the Pacific settlements being excluded, and all the areas of settlement on each degree being consolidated. The figures in the table represent the number of miles settled along each degree at each alternate census, measuring from the Atlantic westward:

| Degree of N. lat. | 1790. | 1810. | 1830. | 1850. | 1870. |
|---|---|---|---|---|---|
| 47 | 0 | 0 | 0 | 79 | 209 |
| 46 | 0 | 0 | 15 | 50 | 230 |
| 45 | 30 | 392 | 392 | 437 | 858 |
| 44 | 226 | 279 | 299 | 404 | 777 |
| 43 | 339 | 425 | 485 | 816 | 1137 |
| 42 | 234 | 568 | 691 | 984 | 1248 |
| 41 | 238 | 471 | 663 | 1107 | 1325 |
| 40 | 358 | 584 | 912 | 1140 | 1252 |
| 39 | 270 | 565 | 1038 | 1043 | 1224 |
| 38 | 425 | 707 | 871 | 1032 | 1193 |
| 37 | 344 | 706 | 797 | 1018 | 1134 |
| 36 | 462 | 682 | 878 | 1057 | 1057 |
| 35 | 384 | 391 | 961 | 1030 | 1030 |
| 34 | 302 | 362 | 707 | 938 | 938 |
| 33 | 175 | 230 | 554 | 989 | 1055 |
| 32 | 30 | 227 | 742 | 929 | 1008 |
| 31 | 10 | 240 | 634 | 860 | 991 |
| 30 | 0 | 150 | 323 | 725 | 785 |
| 29 | 0 | 0 | 0 | 255 | 372 |
| 28 | 0 | 0 | 0 | 80 | 140 |
| 27 | 0 | 0 | 0 | 0 | 25 |
| 26 | 0 | 0 | 0 | 0 | 65 |

This westward movement of population may be further shown by positing the "centre of population" at each successive census. If we assume the area of the country to be a plane surface, without weight, but capable of sustaining weight, and load it with the inhabitants both in number and in position as they were found by the several censuses, each individual being assumed to be of the same gravity as every other, and to exert pressure on the pivot directly proportioned to his distance therefrom, the points at which the population E. and W., N. and S., would have balanced were as follows:

| Years. | Position of centre of population. | | | Westward movement during decade. |
|---|---|---|---|---|
| | N. lat. | W. lon. | Approximate location by important towns. | |
| | ° ′ | ° ′ | | miles. |
| 1790 | 39 16.5 | 76 11.2 | 23 miles E. of Baltimore. | |
| 1800 | 39 16.1 | 76 56.5 | 18 " W. " " | 41 |
| 1810 | 39 11.5 | 77 37.2 | 40 " W. by N. W. of Washington | 36 |
| 1820 | 39 05.7 | 78 33 | 16 " N. of Woodstock | 50 |
| 1830 | 38 57.9 | 79 16.9 | 19 " W. S. W. of Moorefield | 39 |
| 1840 | 39 02 | 80 18 | 16 " S. of Clarksburg | 55 |
| 1850 | 38 59 | 81 19 | 23 " S. E. of Parkersburg | 55 |
| 1860 | 39 00.4 | 82 48.8 | 20 " S. of Chillicothe | 81 |
| 1870 | 39 12 | 83 35.7 | 48 " E. by N. of Cincinnati | 42 |
| | | | | 399 |

The following table exhibits the area in square miles actually covered by a population, two or more to a square mile at each census:

| Years. | Settled tracts within the continuous frontier-line. | Settled tracts outside the frontier-line, including the Pacific coast settlements after 1850. | Total area of settlement. | Average density of settlement; persons to a sq. m. |
|---|---|---|---|---|
| 1790 | 226,085 | 13,850 | 239,935 | 16.4 |
| 1800 | 271,908 | 33,800 | 305,708 | 17.3 |
| 1810 | 382,845 | 25,100 | 407,945 | 17.7 |
| 1820 | 504,517 | 4,200 | 508,717 | 18.9 |
| 1830 | 628,017 | 4,700 | 632,717 | 20.3 |
| 1840 | 805,142 | 2,150 | 807,292 | 21.1 |
| 1850 | 940,874 | 38,375 | 979,249 | 23.7 |
| 1860 | 1,087,379 | 107,375 | 1,194,754 | 26.5 |
| 1870 | 1,140,329 | 131,910 | 1,272,239 | 30.2 |

Thus it appears that while population has been advancing

westward, it has also been deepening upon the older regions of settlement. This will be best shown by dividing the total area of settlement in the above table into groups representing different densities of population. This is done in the following table, which shows the proportionate areas at each census embraced within each of five groups: I. tracts having a population of 2 to 6 to a square mile; II. 6–18; III. 18–45; IV. 45–90; V. 90 and more:

| Date. | Increase per cent. in ten years in total area of settlement. | Proportion of each group of population to total settled area. | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total. | I. | II. | III. | IV. | V. |
| 1790 | ..... | 1000 | 348 | 348 | 247 | 54 | 3 |
| 1800 | 27.4 | 1000 | 265 | 403 | 270 | 58 | 4 |
| 1810 | 33.4 | 1000 | 286 | 379 | 265 | 67 | 3 |
| 1820 | 24.7 | 1000 | 277 | 348 | 296 | 76 | 3 |
| 1830 | 24.4 | 1000 | 239 | 357 | 295 | 103 | 6 |
| 1840 | 27.6 | 1000 | 228 | 361 | 299 | 105 | 7 |
| 1850 | 21.3 | 1000 | 239 | 301 | 346 | 103 | 11 |
| 1860 | 22. | 1000 | 216 | 296 | 361 | 113 | 12 |
| 1870 | 6.5 | 1000 | 193 | 286 | 369 | 137 | 13 |

The inter-State migration is a most remarkable social feature of the United States. The following table exhibits the effect of this cause on the status of the population in 1870:

| States. | No. residing in the State who were born therein. | No. residing in the State who were born in other States or Territories. | No. born in the State who were residing in other States or Territories. |
|---|---|---|---|
| Alabama | 744,000 | 243,000 | 230,000 |
| Arkansas | 233,000 | 247,000 | 55,000 |
| California | 170,000 | 181,000 | 12,000 |
| Connecticut | 350,000 | 73,000 | 137,000 |
| Delaware | 95,000 | 21,000 | 39,000 |
| Florida | 110,000 | 73,000 | 15,000 |
| Georgia | 1,034,000 | 139,000 | 274,000 |
| Illinois | 1,190,000 | 835,000 | 290,000 |
| Indiana | 1,049,000 | 491,000 | 321,000 |
| Iowa | 429,000 | 561,000 | 89,000 |
| Kansas | 63,000 | 253,000 | 11,000 |
| Kentucky | 1,081,000 | 177,000 | 403,000 |
| Louisiana | 502,000 | 163,000 | 63,000 |
| Maine | 551,000 | 27,000 | 149,000 |
| Maryland | 630,000 | 68,000 | 176,000 |
| Massachusetts | 903,000 | 201,000 | 244,000 |
| Michigan | 507,000 | 409,000 | 66,000 |
| Minnesota | 126,000 | 153,000 | 13,000 |
| Mississippi | 564,000 | 253,000 | 139,000 |
| Missouri | 874,000 | 625,000 | 171,000 |
| Nebraska | 19,000 | 74,000 | 5,000 |
| Nevada | 3,000 | 20,000 | 2,000 |
| New Hampshire | 242,000 | 46,000 | 125,000 |
| New Jersey | 575,000 | 142,000 | 149,000 |
| New York | 2,988,000 | 257,000 | 1,074,000 |
| North Carolina | 1,029,000 | 40,000 | 307,000 |
| Ohio | 1,842,000 | 450,000 | 807,000 |
| Oregon | 37,000 | 42,000 | 6,000 |
| Pennsylvania | 2,727,000 | 250,000 | 675,000 |
| Rhode Island | 125,000 | 37,000 | 45,000 |
| South Carolina | 679,000 | 19,000 | 246,000 |
| Tennessee | 1,028,000 | 212,000 | 404,000 |
| Texas | 389,000 | 368,000 | 26,000 |
| Vermont | 244,000 | 40,000 | 177,000 |
| Virginia, West Virginia | 1,545,000 | 91,000 | 584,000 |
| Wisconsin | 450,000 | 240,000 | 97,000 |

*Cities.*—In 1790 there were 6 cities in the United States having a population of 8000 or more inhabitants. Their aggregate population was 131,472, being 3.4 per cent. of the population. The following table shows the growth of the urban population, including only cities of 8000 or more inhabitants:

| Years. | Number of cities. | Aggregate city population. | Residents of cities in each 100 inhabitants. |
|---|---|---|---|
| 1790 | 6 | 131,472 | 3.4 |
| 1800 | 6 | 210,873 | 3.9 |
| 1810 | 11 | 356,920 | 4.9 |
| 1820 | 13 | 475,135 | 4.9 |
| 1830 | 26 | 864,509 | 6.7 |
| 1840 | 44 | 1,453,994 | 8.5 |
| 1850 | 85 | 2,897,586 | 12.5 |
| 1860 | 141 | 5,072,256 | 16.1 |
| 1870 | 226 | 8,071,875 | 20.9 |

Speaking roundly, then, it may be said that at 1790 one-thirtieth of the population lived in cities; at 1800, one-twenty-fifth; at 1810 and 1820, one-twentieth; at 1830, one-sixteenth; at 1840, one-twelfth; at 1850, one-eighth; at 1860, one-sixth; at 1870, one-fifth.

The following table shows the growth of the city system, with distinction as to size of the cities embraced within the total—population in thousands:

| Years. | Cities by classes according to size. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 8 to 12. | 12 to 20. | 20 to 40. | 40 to 75. | 75 to 125. | 125 to 250. | 250 to 500. | 500 and over. | Total. |
| 1790 | 1 | 3 | 1 | 1 | ... | ... | ... | ... | 6 |
| 1800 | 1 | ... | 3 | 2 | ... | .. | ... | ... | 6 |
| 1810 | 4 | 2 | 3 | ... | 2 | ... | ... | ... | 11 |
| 1820 | 3 | 4 | 2 | 2 | 2 | ... | ... | ... | 13 |
| 1830 | 12 | 7 | 3 | 1 | 1 | 2 | ... | ... | 26 |
| 1840 | 17 | 11 | 10 | 1 | 3 | 1 | 1 | ... | 44 |
| 1850 | 36 | 20 | 14 | 7 | 3 | 3 | 1 | 1 | 85 |
| 1860 | 62 | 34 | 23 | 12 | 2 | 5 | 1 | 2 | 141 |
| 1870 | 92 | 63 | 39 | 14 | 8 | 3 | 5 | 2 | 226 |

*Government.*—The government of the United States is one of limited powers, all authority not delegated to it by the Constitution being reserved to the States severally or to the people. The legislative power has the following extent: to lay and collect taxes, duties, imposts, and excises; to pay the debts and provide for the common defence and general welfare of the United States, but all duties, imposts, and excises must be uniform throughout the United States; to borrow money on the credit of the United States; to regulate commerce with foreign nations and among the several States, and with the Indian tribes; to establish a uniform rule of naturalization and uniform laws on the subject of bankruptcy; to coin money, regulate the value thereof and of foreign coin, and fix the standard of weights and measures; to provide for the punishment of counterfeiting the securities and coin of the United States; to establish post-offices and post-roads; to secure for limited times to authors and inventors the exclusive right to their writings and discoveries; to constitute tribunals inferior to the Supreme Court; to define and punish piracies and felonies committed on the high seas, and offences against the laws of nations; to declare war, grant letters of marque and reprisal, and make rules concerning captures on land and water; to raise and support armies, but no appropriation for that purpose can be for a longer term than two years; to provide and maintain a navy; to make rules for the government of the land and naval forces, and to provide for calling forth the militia to execute the laws of the Union, suppress insurrections, and repel invasions; to provide for organizing, arming, and disciplining the militia, and for governing such part of them as may be employed in the service of the United States, there being reserved to the States the appointment of officers and the authority of training the militia according to the discipline prescribed; to exercise exclusive jurisdiction over such district, not exceeding ten miles square, as by the cession of particular States and the acceptance of Congress may become the seat of government of the United States, and to exercise like authority over all places purchased, by consent of the legislature of the State in which the same shall be, for the erection of forts, magazines, arsenals, dockyards, and other needful buildings; to make all laws which shall be necessary and proper for carrying into effect the foregoing powers, and all other powers vested by the Constitution in the government of the United States or in any department or officer thereof. By the thirteenth, fourteenth, and fifteenth Amendments to the Constitution the legislative power has been extended to the enforcement of (1) the prohibition of slavery and involuntary servitude, except as a punishment for crime whereof the party shall have been duly convicted; (2) the prohibition to the States of the power to make or enforce any law which shall abridge the privileges or immunities of citizens of the United States (which description is declared to embrace all persons born or naturalized in the United States, and subject to the jurisdiction thereof), or deprive any person of life, liberty, or property, without due process of law, or to deny to any person within their respective jurisdictions the equal protection of their laws; (3) the prohibition of civil or military office under the United States, or under any State, or of a seat in either house of Congress, or in the electoral college, to any person who, having previously taken an oath as a member of Congress, or as an officer of the United States, or as a member of a State legislature, or as an executive or judicial officer thereof, to support the Constitution of the United States, shall have engaged in insurrection or rebellion against the same, or given aid and comfort to the enemies thereof, unless such person shall by a two-thirds vote of both houses of Congress have such disabilities removed; (4) the prohibition to the States of the power to deny or abridge the rights of citizens of the United States to vote, on account of race, color, or previous condition of servitude. The legislative powers of the United States are declared not to extend to the suspension of habeas corpus unless required by the public safety in cases of rebellion or invasion; to the passage of bills of attainder or *ex-post facto* laws; to the levying of capitation or other direct tax, except in proportion to the population of the several States; to the levying of export duties, or to the

# MAP OF UNITED STATES

Drawn and Engraved on Copper-Plate EXPRESSLY FOR JOHNSON'S UNIVERSAL CYCLOPÆDIA

SCALE OF MILES 100 200 300

Longitude West from Greenwich: 117, 109, 101, 93, 85, 77, 69

Longitude West from Washington: 40, 32, 24, 16, 8, 0

Latitude: 40, 32, 24

BRITISH POSSESSIONS

DOMINION OF CANADA

WASHINGTON

OREGON

CALIFORNIA

MONTANA

DAKOTA

WYOMING

NEBRASKA

UTAH

COLORADO

KANSAS

ARIZONA

NEW MEXICO

INDIAN TERRITORY

TEXAS

MINNESOTA

WISCONSIN

MICHIGAN

ILLINOIS

INDIANA

OHIO

KENTUCKY

TENNESSEE

MISSOURI

ARKANSAS

LOUISIANA

MISSISSIPPI

ALABAMA

GEORGIA

FLORIDA

SOUTH CAROLINA

NORTH CAROLINA

VIRGINIA

WEST VIRGINIA

PENNSYLVANIA

NEW YORK

MAINE

VERMONT

NEW HAMPSHIRE

MASSACHUSETTS

CONN.

RHODE ISLAND

NEW JERSEY

DELAWARE

MARYLAND

GULF OF MEXICO

ATLANTIC OCEAN

BAHAMA ISLANDS

Tropic of Cancer

Rio Grande del Norte

Lake Superior

Lake Michigan

Lake Huron

Lake Erie

Lake Ontario

giving of preference to the ports of one State over another; to the establishment of religion; to the abridgment of freedom of speech, of the press, of religious worship, of public assembly, or of petition. The legislative powers above enumerated are vested in a Congress, which consists of a Senate and House of Representatives. The Senate is composed of two members from each State, chosen by the legislature for the term of six years. The House of Representatives is composed of Representatives from each State, in number proportioned to the population thereof, the aggregate number of Representatives to be apportioned being determined from time to time by law. Representatives are chosen by the people for the term of two years. The House of Representatives elect their Speaker; the Vice-President presides over the Senate. The House of Representatives has the power of impeachment; the Senate tries all impeachments. On the trial of the President upon impeachment, the chief-justice presides. Judgment in cases of impeachment extends no further than to removal from office or disqualification for office, the party convicted being, nevertheless, subject to trial and punishment according to law.

The President has the power of veto upon the legislation of Congress, but bills are passed over the veto if they secure a two-thirds vote in both houses.

The number of Representatives in Congress is fixed by law at 293, divided among the States as follows, on the basis of the population in 1870: Alabama, 8; Arkansas, 4; California, 4; Colorado, 1; Connecticut, 4; Delaware, 1; Florida, 2; Georgia, 9; Illinois, 19; Indiana, 13; Iowa, 9; Kansas, 3; Kentucky, 10; Louisiana, 6; Maine, 5; Maryland, 6; Massachusetts, 11; Michigan, 9; Minnesota, 3; Mississippi, 6; Missouri, 13; Nebraska, 1; Nevada, 1; New Hampshire, 3; New Jersey, 7; New York, 33; North Carolina, 8; Ohio, 20; Oregon, 1; Pennsylvania, 27; Rhode Island, 2; South Carolina, 5; Tennessee, 10; Texas, 6; Vermont, 3; Virginia, 9; West Virginia, 3; Wisconsin, 8. The aggregate vote of the States in the electoral college is 369, each State having two more votes than it has members of the House of Representatives.

The executive powers of the United States are vested in a President, who holds his office for a term of four years, and, together with a Vice-President, is chosen by electors, the number appointed in each State being equal to the whole number of Senators and Representatives to which the State may be entitled in Congress. If no person receive the votes of a majority of the electoral college for the office of President, the House of Representatives, voting by States, chooses the President from the persons having the highest number, not exceeding three, on the list of those voted for. If there be a failure from the same cause to elect a Vice-President, the Senate proceeds to a choice between the two highest candidates on the list. The President is commander-in-chief of the army and navy, and of the militia of the several States when called into the actual service of the United States; he has power to grant reprieves and pardons for offences against the United States, except in cases of impeachment; with the consent of the Senate he appoints ambassadors, judges, and all other officers of the United States whose appointments are not otherwise provided for, and all vacancies occurring during the recess of the Senate he may fill without the concurrence of the Senate; he is to take care that the laws be faithfully executed, and to commission all officers of the United States.

*Administration of Justice.*—The judicial power extends to all cases in law or equity arising under the Constitution, the laws of the United States, and treaties made under their authority; to all cases affecting ambassadors, other public ministers, and consuls; to all cases of admiralty and maritime jurisdiction; to controversies to which the United States are a party; to controversies between two or more States; between citizens of different States; between citizens of the same State claiming lands under grants of different States; and between the citizens of any State and foreign states, citizens or subjects. Within the limits of the several States the ordinary care of the peace, protection of person and property, and punishment of crime are left to the States, together with the regulation of all social and domestic interests and relations. The agencies established in the several States for the administration of justice are described under the appropriate heads. No statistics of any considerable value have ever been compiled relating to the commission or punishment of crime throughout the United States.

The judicial organization of the United States comprises district courts, circuit courts, and the Supreme Court. There are 58 district courts. Twenty-one States constitute each a judicial district; Alabama, New York, and Tennessee comprise each three districts; Arkansas, Florida, Georgia, Illinois, Michigan, Mississippi, Missouri, North Carolina, Ohio, Pennsylvania, South Carolina, Texas, Virginia, and Wisconsin, comprise each two districts. Except in Alabama, Georgia, Mississippi, South Carolina, and Tennessee, where a single judge acts for both or all the districts of the State, there is appointed for each district a United States judge, attorney, and marshal. The judicial districts of the United States are divided into nine circuits, as follows: 1st, Rhode Island, Massachusetts, New Hampshire, and Maine; 2d, Vermont, Connecticut, and New York; 3d, Pennsylvania, New Jersey, and Delaware; 4th, Maryland, Virginia, West Virginia, North Carolina, and South Carolina; 5th, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas; 6th, Ohio, Michigan, Kentucky, and Tennessee; 7th, Indiana, Illinois, and Wisconsin; 8th, Nebraska, Minnesota, Iowa, Missouri, Kansas, and Arkansas; 9th, California, Oregon, and Nevada. The chief-justice and the associate justices of the Supreme Court are allotted among the circuits by order of the court, while for each circuit is appointed a circuit judge having the same power and jurisdiction therein as the justice of the Supreme Court allotted thereto. Circuit courts are held by the circuit justice of the Supreme Court, or by the circuit judge of the circuit, or by the district judge of the district sitting alone, or by any two of the said judges sitting together. The Supreme Court consists of a chief-justice and eight associate justices, who have power to appoint a clerk, a marshal, and a reporter of the court. The court holds one term at Washington annually, and such adjourned or special terms as are found necessary for the despatch of business. The original jurisdiction of the United States is divided among the three classes of courts named. Original jurisdiction in the majority of cases is vested in the district courts. The Supreme Court has exclusive jurisdiction in all civil controversies where a State is a party, except between a State and its citizens, or between a State and citizens of other States, or aliens, in which latter cases it has original but not exclusive jurisdiction. It has also exclusively all such jurisdiction of suits or proceedings against ambassadors and public ministers and their servants as is consistent with their privilege under the law of nations; also original but not exclusive jurisdiction of suits brought by ambassadors or public ministers, or in which a foreign consul is a party. The trial of all issues of fact, in all actions at law against citizens of the United States, must be by jury. The Supreme Court also has power to issue writs of prohibition to the district courts when proceeding as courts of admiralty and maritime jurisdiction, and writs of mandamus to all inferior courts and officers of the United States where a State or an ambassador or other public minister or a consul is a party. The circuit courts have original jurisdiction of all suits of a civil nature at common law or in equity when the matter in dispute exceeds $500 and an alien is a party, or the suit is between the citizens of different States; of all suits in equity where the amount in dispute exceeds $500 and the United States are petitioners; of all suits at common law where the United States, or any officer thereof suing under authority of an act of Congress, are plaintiffs; of all suits and proceedings arising under certain acts of Congress relating to tonnage dues, the slave-trade, patents and copyrights, banking associations, etc.; of suits to recover possession of office, and of all proceedings by writ of *quo warranto;* and of all suits authorized to be brought under the acts of Congress for enforcing the later constitutional amendments. The circuit courts have exclusive jurisdiction of all crimes and offences cognizable under the authority of the United States except as otherwise provided by law, and concurrent jurisdiction with the district courts of crimes and offences cognizable therein. The circuit courts hear and determine appeals from the decrees of the district courts in causes of equity or of admiralty and maritime jurisdiction when the matter in dispute exceeds $50. All final judgments of district courts in civil actions when the matter in dispute exceeds $50 may be re-examined upon a writ of error by the circuit court holden in the same district. Jurisdiction of cases civil or criminal may also be transferred from a district court into the circuit court by reason of the disability, from sickness, interest, or other cause, of the district judge. And suits commenced in State courts wherein the matter in dispute exceeds $500 may in cases provided be removed into the circuit court on petition, for the purpose of protecting the rights and interests of aliens or citizens of States other than those in which such suits are instituted, and also where parties claim land under titles from different States. Suits against revenue and registration officers of the United States, and against corporations organized under acts of Congress, may also be removed on petition to the circuit courts of the United States.

In 1855 a United States court of claims was organized, the court being directed to hear and determine claims against the United States, and report the cases and facts to Congress, with the opinion of the court thereon. In

1863 the court of claims was authorized to render final judgments, with right of appeal to the Supreme Court.

*The executive departments* of the United States government are seven—the departments of state, of the treasury, of war, of the navy, of the interior, of justice, and the post-office department. There is also the so-called department of agriculture, which is of somewhat anomalous constitution, being independent, though corresponding otherwise to the numerous bureaus of the several departments. The functions of several of the executive departments named are so clearly indicated by their titles that it is not necessary to describe their organization and operations.

*The department of the interior* was created in 1849, and embraces the following bureaus: Indian office, pension office, patent office, general land office, census office, and the educational office or bureau. Each of these bureaus has its proper chief, from whose decisions appeals, regulated by law or custom, may be taken to the department. The secretary of the interior is also charged with the control of the public buildings and the penal and charitable institutions of the District of Columbia, with the administration of the grants of the United States to railways, and with the conduct of the geological and geographical survey of the Territories. The officers of the interior department, besides the secretary, are an assistant secretary and a solicitor.

*Pensions.*—The pension-roll of the United States on July 1, 1875, embraced 234,821 pensioners, whose annual pensions aggregated $26,289,520. The army pensioners numbered 210,363, of whom 105,478 were invalids and 104,885 widows and dependent relatives. The navy pensioners were 3420, of whom 1636 were invalids and 1784 widows, etc. A third class, 21,038 in number, were pensioners of the war of 1812, of whom 15,875 were survivors and 5163 widows. The following table shows the movement of the pension-lists from 1861 to 1875:

| Year ending June 30. | No. of invalids. | No. of widows and dependents. | Whole No. of pensioners. |
|---|---|---|---|
| 1861 | 4,337 | 4,299 | 8,636 |
| 1862 | 4,341 | 3,818 | 8,169 |
| 1863 | 7,821 | 6,970 | 14,791 |
| 1864 | 23,479 | 27,656 | 41,135 |
| 1865 | 35,880 | 50,106 | 85,986 |
| 1866 | 55,652 | 71,070 | 126,722 |
| 1867 | 69,565 | 83,618 | 153,184 |
| 1868 | 75,957 | 93,686 | 169,643 |
| 1869 | 82,859 | 105,104 | 187,963 |
| 1870 | 87,521 | 111,165 | 198,686 |
| 1871 | 93,394 | 114,101 | 207,495 |
| 1872 | 113,954 | 118,275 | 232,229 |
| 1873 | 119,500 | 118,911 | 238,411 |
| 1874 | 121,628 | 114,613 | 236,241 |
| 1875 | 122,989 | 111,832 | 234,821 |

*Indians.*—Indians "not taxed"—*i. e.* in tribal relations—are excluded by the Constitution from the basis of political representation. The several tribes are regarded as "domestic, dependent nations," governed by their own laws, yet subject to the sovereignty of the United States; having a right of occupancy in their lands, yet without the power to cede those lands except to the United States alone. Between the formation of the government and 1871 nearly 400 treaties had been made between the government and various Indian tribes, being largely treaties of cession. Except in the case of the Sioux in Minnesota after the massacre of 1862, the United States had never, without at least the formality of a treaty, taken possession of undoubted Indian lands within the limits of territory acquired by treaty with England or France. On territory acquired from Mexico the claims of Indian tribes to the occupancy of the soil have not been regarded as of equal validity, the theory of the Mexican law differing in this respect from that of the English, the French, and the Dutch. In 1871, however, Congress put an end to this system by declaring by law that no Indian tribe should thereafter be recognized as a nation capable of making a treaty.

The policy of removing the Indians to the W. of the Mississippi was inaugurated about 1825, and largely carried out in the twenty years following, especially in respect to the Southern or Appalachian Indians—the Creeks, Choctaws, Chickasaws, Cherokees, and Seminoles. The Indian Territory, so called, contains about 70,000 Indians, mainly of the tribes named, all in a somewhat advanced condition socially and industrially. Other large reservations have been set apart for Indian occupation, especially in Montana and Dakota, the aggregate amount of land being 258,953 sq. m. The total number of Indians, exclusive of those in Alaska, is about 280,000: 42,638 males, representing not far from the same number of Indian families, labor for their own support in more or less civilized fashion. The number of Indians attending school in 1875 was 10,598. The number of schools upon reservations supported by the government was 329, with 418 teachers.

Formerly, under the treaty system, a United States Indian agent was a sort of minister resident, while the tribes were governed according to their own traditions and customs by their own chiefs. By the act of 1871, already spoken of, the authority of the chief is practically destroyed, yet no agencies for administering justice and preserving the peace among the tribes have been instituted to take the place of the system thus abrogated. In consequence, the administration of the internal affairs of the Indian tribes has been thrown into much confusion.

*Census.*—The census of the United States is taken, under an express provision of the Constitution, every ten years. The first census was taken in 1790, eleven years before the first English census. The scope of the enumeration was greatly enlarged by successive enactments until 1850, when, by the act of May 23, the existing system was constituted. The United States judicial districts are made census districts, and the marshal of each district directs and supervises its enumeration. In 1870 there were 64 such districts, including one for each Territory. The marshals appoint assistants, who perform the actual enumeration. In 1870 there were about 6400 assistant marshals. The lists of names, ages, occupations, etc., are sent to the superintendent of the census at Washington, who conducts the compilation and publication of the statistical results. In addition to the personal details usually demanded in a census, the inquiries authorized by the act of 1850 relate to agricultural and manufacturing industry and to a large number of social facts—pauperism, crime, public education, public worship, etc. The machinery of the census, as erected by the act of 1850, is not generally regarded by statisticians as well adapted to secure results of the degree of exactness required by the demands of modern statistical science. No national system of registration exists for obtaining the facts of birth, marriage, and death as they occur, while only a few States have provided, and these but inadequately, for obtaining information on these points. In consequence, the vital statistics of the United States are partial, and at the best doubtful, comparing unfavorably as to range and completeness with those of almost every European country.

*Public Lands.*—The total area of lands belonging to the United States government in the States and Territories, exclusive of Alaska, was originally, as computed, 1,465,468,800 acres. Of this, there had, to June, 1875, been surveyed 680,253,094 acres. The area of Alaska is estimated at 369,529,600 acres, the title of which is in the United States. Under the bounty-land laws of 1847, 1850, 1852, and 1855 the total issues have been 60,936,230 acres. The land concessions by Congress to States for canal purposes since 1827 amount to 4,405,986 acres. The lands conceded for railroad and wagon-road purposes since 1850 are estimated to amount to 210,756,807 acres, of which 38,211,088 have been certified or patented under the grants. Large amounts have also been approved to States as swamp-lands, or certified to States for educational and other specific purposes. Apart from such special grants the public lands of the United States may be acquired by individuals in the following ways: First, under the Homestead act, by which a tract of 80 acres, at $2.50 an acre (called double minimum land), or 160 acres at $1.25, may be obtained through the payment of certain fees and commissions, ranging from $7 to $22, on condition that the applicant resides upon and cultivates the land for five years. An applicant relinquishing his "claim" under the Homestead act cannot acquire another. The public lands remaining in the Gulf States, Florida, Alabama, Mississippi, Louisiana, and Texas, can be acquired under the Homestead act alone. Second, under the Pre-emption act, through which a person may, by "entering" at the appropriate land-office a tract of 80 or 160 acres, secure a right to take the land at government rates whenever it shall be offered for sale. Third, by auction, whenever offered by proclamation of the President or public notice from the general land-office at Washington. Fourth, after a failure to sell by auction, the lands remain subject to purchase by what is called private entry at any subsequent period. No foreigner can avail himself of the privileges of the Homestead or Pre-emption acts of Congress without declaring before the courts his intention to become a citizen.

There are seventeen land-surveying districts, each with a surveyor-general, and ninety-seven land-offices. During the year 1874–75 public lands were disposed of as follows: Cash sales, 754,062 acres; military-warrant locations, 137,000; homestead entries, 2,357,058; timber-culture entries, 464,870; agricultural college scrip locations, 9432; approved to States as swamp, 47,721; certified to railroads, 3,107,643; to agricultural colleges, 22,321; for common schools, 142,388; for universities, 16,454; to States for internal improvements, 8614; Indian half-breed scrip locations, 12,718; total, 7,071,271 acres.

In their patent system the United States are far in advance of any other country. (For laws, etc., see PATENT LAWS, HISTORY OF, and PATENTS, LAWS RELATING TO.) During the year 1874–75, 21,489 applications were filed with the commissioner of patents, and 14,230 patents, including reissues and designs, were issued; 42 applications were made for extensions of patents, and 81 patents were extended; 951 applications were made for the registration of trade-marks, and 993 trade-marks were registered. The total amount received during the year from fees was $732,286.

*Department of Justice.*—The head of this department is the attorney-general, who with several assistant attorney-generals has the supervision of United States district attorneys and marshals throughout the United States. The number of civil suits to which the United States was a party pending in the circuit and district courts of the United States on July 1, 1875, was 7211, of which 4128 arose under the customs laws, 2196 under the internal revenue laws, 88 under the postal laws, the remainder being classed as miscellaneous. During the year then closing judgment had been obtained in favor of the government for $1,894,149. The number of criminal cases pending at the same date was 7667, of which 145 were customs prosecutions, 5525 internal-revenue prosecutions, 211 post-office prosecutions, 299 prosecutions under the so-called enforcement acts, etc. The total number of convictions during the year then closing had been 2804. The number of suits to which the United States was not a party which were commenced during the year 1874–75 in the circuit and district courts of the United States was 15,316—2474 being in admiralty, and 4021 under the bankruptcy acts. The number of suits terminated during that year was 9517, of which 1771 were in admiralty, and 1708 under the bankruptcy acts. The total amount of judgments for plaintiffs was $30,550,156. The number of suits brought before the court of claims between 1855 and 1862, inclusive, was 1877, upon which the court made 293 reports; between 1863 and 1875, inclusive, 8845, on which the court rendered judgments in 503 cases for defendants, and in 2955 for claimants, in a total amount of $17,032,879, leaving as apparently pending in Dec., 1875, 5247 suits, the total amount claimed being $53,630,249. The judges of the court of claims consist of a chief-justice and five associate judges.

*The Treasury Department.*—The officers of the treasury, besides the secretary and two assistant secretaries, are two comptrollers, six auditors, commissioners of customs, of internal revenue, and of the currency, a treasurer, a solicitor, and a register. The coast survey, the lighthouse board, and the bureau of statistics are also embraced within the treasury department. The following is a statement of the net receipts of the treasury during the fiscal year 1874–75 from each principal source of revenue:

| | |
|---|---|
| Customs | $157,167,722 |
| Internal revenue | 110,007,494 |
| Sales of public lands | 1,413,640 |
| Tax on circulation, deposits, etc., of national banks | 7,268,379 |
| All others | 12,142,816 |
| Total | $288,000,051 |

The net disbursements of the year on each principal account were as follows:

| | |
|---|---|
| Civil list | $17,346,930 |
| Foreign intercourse | 3,195,237 |
| Indians | 8,384,657 |
| Pensions | 29,456,216 |
| Military establishment | 41,120,646 |
| Naval establishment | 21,497,626 |
| Miscellaneous, including public buildings and cost of collecting revenue | 50,528,536 |
| Interest on the public debt | 103,093,545 |
| Redemption of the public debt | 19,405,936 |
| Total | $294,029,329 |

*The Public Debt.*—The debt resulting from the war of the Revolution was $75,463,476. In 1812 it had been reduced to $45,209,738. At the conclusion of the war with England it stood at $127,334,934. In 1835 the debt was extinguished. With the crisis of 1837 indebtedness was again incurred, and at the beginning of the war with Mexico the debt stood at $15,550,203. In consequence of war-expenditures and payments for territory acquired it stood in 1849 at $63,061,859. Since 1860 it has been as follows:

| | | | |
|---|---|---|---|
| 1860 | $64,842,288 | 1868 | $2,611,687,851 |
| 1861 | 90,580,874 | 1869 | 2,588,452,214 |
| 1862 | 524,176,412 | 1870 | 2,480,672,428 |
| 1863 | 1,119,772,139 | 1871 | 2,353,211,332 |
| 1864 | 1,815,784,371 | 1872 | 2,253,251,329 |
| 1865 | 2,680,647,870 | 1873 | 2,234,482,993 |
| 1866 | 2,773,236,174 | 1874 | 2,251,690,468 |
| 1867 | 2,678,126,104 | 1875 | 2,232,284,532 |

Of the principal of the public debt at the close of the year 1875, about six hundred and seven and a half millions bore 5 per cent. interest, fourteen millions (naval pension fund) 4 per cent., while four hundred and ninety-eight millions bore no interest, consisting of legal-tender notes, fractional currency, coin-certificates, and certificates of deposit. The remainder of the debt was almost wholly at 6 per cent.

*Revenue.*—The custom duties of the United States are collected on a wide range of imported articles. The following table shows the proportion of customs receipts to the total value of imported goods in each year from 1791 to 1871:

| | | | | | |
|---|---|---|---|---|---|
| 1791 | 15.07 | 1818 | 14.10 | 1845 | 23.48 |
| 1792 | 10.89 | 1819 | 23.28 | 1846 | 21.95 |
| 1793 | 13.68 | 1820 | 20.16 | 1847 | 17.57 |
| 1794 | 11.27 | 1821 | 20.78 | 1848 | 20.48 |
| 1795 | 8.01 | 1822 | 21.13 | 1849 | 19.19 |
| 1796 | 8.17 | 1823 | 24.61 | 1850 | 22.27 |
| 1797 | 10.02 | 1824 | 22.19 | 1851 | 22.67 |
| 1798 | 10.37 | 1825 | 20.86 | 1852 | 22.73 |
| 1799 | 8.31 | 1826 | 27.47 | 1853 | 21.99 |
| 1800 | 9.95 | 1827 | 24.80 | 1854 | 21.30 |
| 1801 | 9.66 | 1828 | 28.31 | 1855 | 20.28 |
| 1802 | 16.29 | 1829 | 30.45 | 1856 | 20.35 |
| 1803 | 16.21 | 1830 | 30.93 | 1857 | 17.69 |
| 1804 | 13.06 | 1831 | 23.47 | 1858 | 14.79 |
| 1805 | 10.73 | 1832 | 28.17 | 1859 | 14.63 |
| 1806 | 11.35 | 1833 | 19.30 | 1860 | 14.68 |
| 1807 | 11.49 | 1834 | 14.99 | 1861 | 12.08 |
| 1808 | 28.71 | 1835 | 15.33 | 1862 | 23.83 |
| 1809 | 12.22 | 1836 | 12.32 | 1863 | 27.27 |
| 1810 | 10.02 | 1837 | 7.92 | 1864 | 31.05 |
| 1811 | 24.93 | 1838 | 14.21 | 1865 | 36.23 |
| 1812 | 11.63 | 1839 | 14.27 | 1866 | 40.91 |
| 1813 | 60.09 | 1840 | 12.60 | 1867 | 42.22 |
| 1814 | 46.27 | 1841 | 11.32 | 1868 | 44.25 |
| 1815 | 6.44 | 1842 | 18.15 | 1869 | 41.18 |
| 1816 | 24.69 | 1843 | 10.88 | 1870 | 42.07 |
| 1817 | 26.48 | 1844 | 24.14 | 1871 | 38.09 |

Only three times has a system of "internal revenue" been resorted to: first, in the second term of Washington; next, during the war of 1812–15; and lastly, in the war of secession, 1861–65. In the latter period a large number of subjects were taken for taxation, including incomes, manufacturers' sales, receipts of railway, canal, gas, express, and other companies, patent medicines, matches, spirits, and tobacco. Of these taxes nearly all were repealed prior to 1873, leaving the internal revenue to be collected mainly from spirits and tobacco. The receipts from the several sources relating to distilled spirits were $52,081,991 in 1875, while the receipts from taxes on tobacco were $37,303,462. The following table shows the receipts from internal-revenue duties in the three periods. In no other years than those mentioned have the receipts from this source risen above $100,000:

| First period. | | Second period. | | Third period. | |
|---|---|---|---|---|---|
| Year. | Revenue. | Year. | Revenue. | Year. | Revenue. |
| 1792 | $208,943 | 1814 | $1,662,985 | 1863 | $37,640,788 |
| 1793 | 337,706 | 1815 | 4,678,059 | 1864 | 109,741,134 |
| 1794 | 274,090 | 1816 | 5,124,708 | 1865 | 209,464,215 |
| 1795 | 337,755 | 1817 | 2,678,100 | 1866 | 309,226,813 |
| 1796 | 475,290 | 1818 | 955,270 | 1867 | 266,027,537 |
| 1797 | 575,491 | 1819 | 229,594 | 1868 | 191,087,589 |
| 1798 | 644,358 | 1820 | 106,261 | 1869 | 158,356,461 |
| 1799 | 779,136 | | | 1870 | 184,899,756 |
| 1800 | 809,397 | | | 1871 | 143,098,154 |
| 1801 | 1,048,043 | | | 1872 | 130,642,178 |
| 1802 | 621,899 | | | 1873 | 113,729,314 |
| 1803 | 215,180 | | | 1874 | 102,409,785 |
| | | | | 1875 | 110,007,494 |

Direct taxes have been but seldom resorted to in the financial legislation of the United States. The Constitution provides that such taxes shall only be laid upon the States in proportion to population; but as the States vary widely in wealth (as at 1870 from, perhaps, $200 to $1500 per capita), it follows that if a rate of taxation be taken which really draws severely upon the resources of the old and wealthy States, it will be absolutely ruinous, or indeed impossible, in the newer and needier States. On the other hand, if the rate of taxation be limited to what the latter class of States can contribute, it will afford but a contemptible revenue from the former class of States. Consequently, direct taxes have been but seldom resorted to in the financial history of the United States, and then with but slight success. The following table shows the receipts from direct taxes in the three periods in which they have been imposed. In no other years than those given have the receipts from this source risen above $50,000:

| First period. | | Second period. | | Third period. | |
|---|---|---|---|---|---|
| Year. | Revenue. | Year. | Revenue. | Year. | Revenue. |
| 1800 | $734,224 | 1814 | $2,219,497 | 1862 | $1,795,332 |
| 1801 | 534,343 | 1815 | 2,162,673 | 1863 | 1,485,104 |
| 1802 | 206,565 | 1816 | 4,253,635 | 1864 | 475,649 |
| 1803 | 71,879 | 1817 | 1,834,187 | 1865 | 1,200,573 |
| 1804 | 50,198 | 1818 | 264,333 | 1866 | 1,974,754 |
| | | 1819 | 83,651 | 1867 | 4,200,234 |
| | | | | 1868 | 1,788,146 |
| | | | | 1869 | 765,686 |
| | | | | 1870 | 229,103 |
| | | | | 1871 | 580,355 |

*Commerce and Navigation.*—The following table shows the value of the foreign trade of the United States for each

year from 1790 to 1875. The imports are stated after deduction of foreign goods re-exported:

| Year. | Net imports. | Exports. | Year. | Net imports. | Exports. |
|---|---|---|---|---|---|
| | $ | $ | | $ | $ |
| Sept. 30, 1790 | 22,460,844 | 19,666,000 | Sept. 30, 1833 | 88,295,576 | 70,317,698 |
| 1791 | 28,687,959 | 18,500,000 | 1834 | 103,208,521 | 81,024,162 |
| 1792 | 29,746,902 | 19,000,000 | 1835 | 129,391,247 | 101,189,082 |
| 1793 | 28,990,428 | 24,000,000 | 1836 | 168,233,675 | 106,916,680 |
| 1794 | 28,073,767 | 26,500,000 | 1837 | 119,134,255 | 95,564,414 |
| 1795 | 61,266,796 | 39,500,000 | 1838 | 101,264,609 | 96,033,821 |
| 1796 | 55,136,164 | 40,764,097 | 1839 | 144,597,607 | 103,533,891 |
| 1797 | 48,379,406 | 29,850,206 | 1840 | 88,951,207 | 113,895,634 |
| 1798 | 35,551,700 | 28,527,097 | 1841 | 112,477,096 | 106,382,722 |
| 1799 | 33,546,148 | 33,142,522 | 1842 | 88,440,549 | 92,969,996 |
| 1800 | 52,121,891 | 31,840,903 | June 30, 1843* | 58,201,102 | 77,793,783 |
| 1801 | 64,720,790 | 47,473,204 | 1844 | 96,950,168 | 99,715,179 |
| 1802 | 40,558,362 | 36,708,189 | 1845 | 101,907,734 | 99,299,776 |
| 1803 | 51,072,594 | 42,205,961 | 1846 | 110,345,174 | 102,141,893 |
| 1804 | 48,768,403 | 41,467,477 | 1847 | 138,534,480 | 150,637,464 |
| 1805 | 67,420,981 | 42,387,002 | 1848 | 133,870,918 | 132,904,121 |
| 1806 | 69,126,764 | 41,253,727 | 1849 | 134,768,574 | 132,666,955 |
| 1807 | 78,856,442 | 48,699,592 | 1850 | 163,186,510 | 136,946,912 |
| 1808 | 43,992,586 | 9,433,546 | 1851 | 194,526,639 | 196,689,718 |
| 1809 | 38,602,469 | 31,405,702 | 1852 | 195,656,060 | 192,368,984 |
| 1810 | 61,008,705 | 42,366,675 | 1853 | 250,420,187 | 213,417,697 |
| 1811 | 37,377,210 | 45,294,043 | 1854 | 279,712,187 | 252,047,806 |
| 1812 | 68,534,873 | 30,032,109 | 1855 | 233,020,227 | 246,708,553 |
| 1813 | 19,157,155 | 25,008,152 | 1856 | 298,261,364 | 310,586,330 |
| 1814 | 12,819,831 | 6,782,272 | 1857 | 336,914,524 | 338,985,065 |
| 1815 | 106,457,924 | 45,974,403 | 1858 | 251,727,008 | 293,758,279 |
| 1816 | 129,964,144 | 64,781,896 | 1859 | 317,873,053 | 335,894,385 |
| 1817 | 79,891,931 | 68,313,500 | 1860 | 335,233,232 | 373,189,274 |
| 1818 | 102,323,304 | 73,854,437 | 1861 | 315,004,726 | 228,699,486 |
| 1819 | 67,959,317 | 50,976,838 | 1862 | 188,902,263 | 210,688,675 |
| 1820 | 56,441,971 | 51,683,640 | 1863 | 226,796,336 | 241,997,474 |
| 1821 | 41,283,236 | 43,671,894 | 1864 | 309,305,955 | 243,977,589 |
| 1822 | 60,955,339 | 49,874,079 | 1865 | 216,441,495 | 201,558,372 |
| 1823 | 50,035,645 | 47,155,408 | 1866 | 430,770,041 | 420,161,476 |
| 1824 | 55,211,850 | 50,649,500 | 1867 | 397,222,067 | 332,618,089 |
| 1825 | 63,749,432 | 66,944,745 | 1868 | 349,023,682 | 353,135,875 |
| 1826 | 60,434,865 | 53,055,710 | 1869 | 412,140,841 | 318,082,663 |
| 1827 | 56,080,932 | 58,921,691 | 1870 | 431,950,428 | 420,500,275 |
| 1828 | 66,914,807 | 50,669,669 | 1871 | 513,033,809 | 512,802,267 |
| 1829 | 57,834,049 | 55,700,193 | 1872 | 617,569,017 | 501,285,371 |
| 1830 | 56,489,441 | 59,462,029 | 1873 | 635,467,636 | 578,938,985 |
| 1831 | 83,157,598 | 61,277,057 | 1874 | 572,080,910 | 693,039,054 |
| 1832 | 76,989,793 | 63,137,470 | 1875 | 531,472,529 | 643,094,767 |

* Nine months.

The following table exhibits the distribution of the foreign trade of the United States among the principal foreign countries during the year ending June 30, 1875:

| Country. | Imports. | Domestic exports. | Foreign exports. | Total trade. |
|---|---|---|---|---|
| Argentine Republic.. | $5,834,709 | $1,301,294 | $138,324 | $7,274,327 |
| Belgium | 6,189,098 | 12,387,590 | 331,778 | 18,918,466 |
| Brazil | 42,033,046 | 7,634,865 | 110,494 | 49,778,405 |
| China | 13,480,440 | 1,465,934 | 90 | 14,946,464 |
| France | 63,342,631 | 50,133,711 | 620,200 | 114,096,542 |
| Germany | 40,893,386 | 52,517,913 | 1,244,332 | 94,655,631 |
| England | 144,195,531 | 321,014,343 | 4,722,108 | 469,931,982 |
| Scotland | 11,615,139 | 17,457,991 | 126,401 | 29,199,531 |
| British Australasia... | 3,755,590 | 3,505,435 | 76,180 | 7,337,205 |
| British America | 29,763,870 | 34,309,761 | 1,795,859 | 65,869,490 |
| British West Indies... | 4,642,891 | 7,587,218 | 171,497 | 14,401,606 |
| British East Indies... | 15,584,099 | 473,049 | ..... | 16,058,148 |
| Hong-Kong | 1,202,816 | 7,296,070 | 1,408,023 | 9,906,909 |
| Italy | 9,190,182 | 7,226,554 | 1,515 | 16,418,251 |
| Japan | 7,772,302 | 1,647,197 | 14,736 | 9,434,235 |
| Mexico | 11,634,983 | 3,895,792 | 1,874,991 | 17,405,766 |
| Netherlands | 2,353,658 | 7,483,010 | 60,064 | 9,896,732 |
| Dutch East Indies.... | 6,775,399 | 1,034,159 | ..... | 7,809,558 |
| Russia, European..... | 1,340,458 | 11,323,478 | ..... ..... | 12,663,936 |
| Spain | 4,534,073 | 7,540,086 | 27,290 | 12,103,249 |
| Cuba | 66,745,527 | 15,586,658 | 6,374,351 | 88,706,536 |
| Porto Rico | 6,930,082 | 2,377,757 | 108,963 | 9,416,802 |
| U. S. of Colombia..... | 12,942,303 | 4,272,950 | 226,349 | 17,441,602 |
| Venezuela | 5,690,224 | 2,423,254 | 56,075 | 8,169,553 |

The following table exhibits the distribution of the tonnage of the United States merchant marine from 1871 to 1874 inclusive:

| Year. | In foreign trade. | In coastwise trade. | In whale fisheries. | In cod fisheries. | Total. | | |
|---|---|---|---|---|---|---|---|
| | | | | | Sail. | Steam. | Total. |
| 1871 | 1,363,652 | 2,764,600 | 61,490 | 92,865 | 3,194,970 | 1,087,637 | 4,282,607 |
| 1872 | 1,359,040 | 2,929,552 | 51,608 | 97,547 | 3,326,194 | 1,111,553 | 4,437,747 |
| 1873 | 1,378,533 | 3,163,220 | 44,755 | 109,519 | 3,539,584 | 1,156,443 | 4,696,027 |
| 1874 | 1,389,815 | 3,293,439 | 39,108 | 78,290 | 3,615,042 | 1,185,610 | 4,800,652 |

The following table exhibits the number of merchant vessels and the aggregate amount of tonnage belonging to the ports of the several geographical sections of the United States, June 30, 1875:

| Districts. | Sailing vessels. | | Steam vessels. | | Unrigged vessels. | | Total vessels. | |
|---|---|---|---|---|---|---|---|---|
| | Number. | Tons. | Number. | Tons. | Number. | Tons. | Number. | Tons. |
| I. Atlantic coast | 14,258 | 1,915,421 | 1859 | 613,670 | 5,894 | 607,338 | 22,011 | 3,136,430 |
| II. Gulf coast | 1,028 | 31,037 | 253 | 47,130 | 16 | 2,409 | 1,297 | 80,576 |
| III. Western rivers | 2 | 79 | 843 | 197,368 | 826 | 176,419 | 1,671 | 373,866 |
| IV. Northern lakes | 1,631 | 328,957 | 890 | 198,433 | 2,234 | 225,326 | 4,755 | 752,716 |
| V. Pacific coast | 828 | 107,781 | 245 | 63,165 | 89 | 12,696 | 1,162 | 183,642 |
| Vessels not geographically distributed.. | ..... | ..... | ..... | ..... | 1,680 | 198,116 | 1,680 | 198,116 |
| Total United States | 17,747 | 2,383,275 | 4090 | 1,119,766 | 10,739 | 1,222,304 | 32,576 | 4,725,346 |

The following is a list of the more important customs districts of the United States, with the trade of each during the fiscal year 1874–75:

| Customs Districts. | Imports. | Domestic exports. | Foreign exports. |
|---|---|---|---|
| Baltimore, Md | $27,788,992 | $27,515,657 | $100,165 |
| Beaufort, S. C | 122,318 | 1,047,257 | |
| Boston and Charlestown, Mass. | 51,982,226 | 29,187,165 | 1,678,868 |
| Brazos de Santiago, Tex | 2,002,748 | 833,312 | 997,658 |
| Brunswick, Ga | 4,778 | 750,610 | |
| Buffalo Creek, N. Y | 2,499,004 | 727,366 | 39,579 |
| Cape Vincent, N. Y | 409,469 | 330,425 | 10,698 |
| Champlain, N. Y | 1,944,504 | 1,047,612 | 85,499 |
| Charleston, S. C | 680,343 | 19,655,966 | |
| Chicago, Ill | 561,549 | 3,427,759 | 1,596 |
| Corpus Christi, Tex | 322,803 | 205,557 | 243,966 |
| Cuyahoga, O | 348,025 | 747,360 | 6,032 |
| Detroit, Mich | 1,329,326 | 2,272,736 | 79,030 |
| Galveston, Tex | 1,218,034 | 15,876,632 | 349,275 |
| Genesee, N. Y | 324,653 | 791,439 | 1,290 |
| Huron, Mich | 891,365 | 5,030,754 | 303,472 |
| Key West, Fla | 751,412 | 591,856 | 17,270 |
| Miami, O | 164,525 | 1,729,187 | |
| Milwaukee, Wis | 56,646 | 1,390,179 | |
| Minnesota, Minn | 459,954 | 838,697 | 3,521 |
| Mobile, Ala | 1,087,745 | 10,131,260 | 928 |
| New Haven, Conn | 1,174,921 | 2,925,631 | 1,080 |
| New Orleans, La | 12,356,487 | 71,461,272 | 152,710 |
| New York, N. Y | 368,637,580 | 329,201,913 | 15,502,056 |
| Niagara, N. Y | 2,425,783 | 503,838 | 44,068 |
| Norfolk and Portsmouth, Va.. | 18,929 | 5,243,986 | |
| Oregon, Or | 1,591 | 972,981 | |
| Oswegatchie, N. Y | 1,410,221 | 758,761 | 58,000 |
| Oswego, N. Y | 5,775,127 | 1,438,677 | 43,519 |
| Passamaquoddy, Me | 478,649 | 1,488,598 | 3,586 |
| Pensacola, Fla | 15,718 | 1,330,536 | |
| Philadelphia, Pa | 24,236,387 | 28,588,019 | 23,635 |
| Portland, Me | 1,782,987 | 3,119,923 | 343,638 |
| Richmond, Va | 433,905 | 2,944,642 | |
| San Francisco, Cal | 29,697,483 | 28,949,886 | 2,288,457 |
| Savannah, Ga | 755,901 | 29,666,666 | |
| Vermont, Va | 6,911,691 | 2,496,830 | |
| Willamette, Or | 454,764 | 1,672,811 | 5,571 |
| Wilmington, N. C | 151,925 | 3,015,069 | |

The remaining customs districts are:

Alaska, Al.,
Albemarle, N. C.,
Alexandria, Va.,
Annapolis, Md.,
Aroostook, Me.,
Bangor, Me.,
Barnstable, Mass.,
Bath, Me.,
Beaufort, N. C.,
Belfast, Me.,
Bristol and Warren, R. I.,
Castine, Me.,
Delaware, Del.,
Duluth, Minn.,
Dunkirk, N. Y.,
Erie, Pa.,
Fairfield, Conn.,
Fall River, Mass.,
Fernandina, Fla.,
Frenchman's Bay, Me.,
Georgetown, D. C.,
Georgetown, S. C.,
Gloucester, Mass.,
Machias, Me.,
Marblehead, Mass.,
Michigan, Mich.,
Middletown, Conn.,
Montana and Idaho,
Newark, N. J.,
New Bedford, Mass.,
Newburyport, Mass.,
New London, Conn.,
Newport, R. I.,
Pamlico, N. C.,
Paso del Norte, Tex.,
Pearl River, Miss.,
Perth Amboy, N. J.,
Petersburg, Va.,
Plymouth, Mass.,
Portsmouth, N. H.,
Providence, R. I.,
Puget Sound, Wash.,
Salem and Beverly, Mass.,
Saluria, Tex.,
San Diego, Cal.,
Sandusky, O.,
St. Augustine, Fla.,
St. John's, Fla.,
St. Mark's, Fla.,
St. Mary's, Ga.,
Stonington, Conn.,
Superior, Mich.,
Teche, La.,
Waldoborough, Me.,
Wiscasset, Me.,
York, Me.

*The Post-Office Department.*—By the Constitution, Congress has power "to establish post-offices and post-roads." Under this provision Congress has forbidden all carrying of mails except by the authority of the general government. The officers of the post-office department are the postmaster-general and three assistant postmaster-generals. The sixth auditor of the treasury is auditor for the post-office department. The postal service of the United States in 1875 employed 51,177 persons, 384 being in the post-office department at Washington, 35,547 postmasters, 6280 contractors, 4467 clerks in post-offices, 2195 letter-carriers, besides route-agents, etc. The ordinary receipts of the department during the fiscal year 1875 were $26,671,218, and the expenditures of all kinds, $33,611,309. The num-

ber of ordinary postage-stamps issued during the year was 682,342,470, valued at $18,271,479, besides which there were issued 2,209,215 newspaper and periodical stamps, 126,916,150 stamped envelopes, 22,850,250 newspaper wrappers, 107,616,000 postal cards. The value of postage-stamps, stamped envelopes, etc., issued for the use of the government officers was $1,189,492. The number of authorized mail-routes at the close of the fiscal year 1875 was 8283, aggregating in length 277,873 miles, and in annual transportation 133,822,216 miles. The railroad-routes aggregated 70,083 miles, with an annual transportation of 75,154,910 miles, the cost being about 12.26 cents per mile; the annual transportation, 3,958,852 miles, the cost about 17.28 cents per mile. Other routes aggregated 192,002 miles, with an annual transportation of 54,708,454 miles, at an annual cost of 9.97 cents per mile. The number of post-offices in operation June 30, 1875, was 35,547, of which 3401 were "money-order" offices. The total appointments of postmasters during the year had been 9871, of which 6017 had been on resignation, 974 on removal, 187 on changes of names and sites, 380 on death, and 2313 on establishment of new offices. The number of letters exchanged with foreign countries, exclusive of Canada, during the year 1874–75, was 25,135,581. The number of money-orders issued was 5,702,573, of the aggregate value of $79,395,826. A free delivery of mail-matter is established in 87 cities.

*War Department.*—The head of the war department is the secretary of war. The relations of the secretary to the general of the army are ill-defined and the subject of much controversy. In 1869 the general of the army announced the heads of the several corps of the army and bureaus of the department as of his staff, but this order was rescinded. There are eight corps, the chiefs of which are the following officers: the adjutant-general, the quartermaster-general, the commissary-general, the paymaster-general, the surgeon-general, the chief of engineers, the chief of ordnance, the chief signal-officer. By the Constitution, Congress has power to provide for calling forth the militia of the several States to execute the laws of the Union, suppress insurrections, and repel invasions, and also for the organizing, arming, and disciplining the militia, and for governing such part of them as may be employed in the service of the States; to the States respectively being reserved the appointment of officers and the authority of training the militia according to the discipline prescribed by Congress. The President is commander-in-chief of the militia when called into the actual service of the United States.

The aggregate strength of the line of the army is 1540 officers and 24,031 enlisted men, made up as follows:

| | Officers. | Men. |
|---|---|---|
| 5 regiments of artillery | 270 | 2504 |
| 10 " cavalry | 422 | 7206 |
| 25 " infantry | 848 | 11,000 |
| Available recruits, hospital stewards, ordnance sergeants, etc. | ..... | 3321 |
| | 1540 | 24,301 |

Including the staff, the cadets of the Military Academy, Indian scouts, etc., the aggregate force of the army is 27,488. The higher officers consist of a general, a lieutenant-general, 3 major-generals, 6 brigadier-generals, and 7 chiefs of departments with the rank of brigadier-general. The army of the United States is mainly employed in keeping up the fortifications on the coast and lakes, in watching the movements of hostile or suspected Indians, and in guarding the Mexican frontier. One hundred and two signal-stations are maintained for recording meteoric changes and giving warning for the benefit of commerce and agriculture of the approach of storms. The protection and improvement of rivers and harbors are directed by the engineer department of the army under authority of Congress.

The arsenals of the United States are located at Kennebec, Watertown, Springfield, Mass., Allegheny, Watervliet, Fort Monroe, Augusta, Ga., Washington, Pikesville, Frankford, Detroit, Columbus, Indianapolis, St. Louis, Rock Island, and Benicia. The Military Academy is situated at West Point. The number of cadets in 1875 was 312. On graduation the cadets are appointed to second lieutenancies in the army.

The organized militia of the States aggregates 84,724 rank and file—the unorganized militia, 3,701,977. An annual appropriation of $200,000 for arming and equipping the militia has been made since 1808. This is manifestly inadequate to the original object of the appropriation—viz. to provide arms and military equipments for the whole body of the militia of the United States.

*The Navy Department.*—The navy, originally a branch of the war department, was made a distinct executive department in 1798. The head of it is the secretary of the navy. The naval force of the United States comprises 147 vessels, carrying in all 1195 guns, and of an aggregate measurement of 152,492 tons. Of these vessels, 26, carrying nominally 266 guns, are sailing vessels without steam-power. The steam vessels of the navy, as distinguished from iron-clads and torpedo-ships, number 95, of which 25 are tugs employed as towing, ferry, or torpedo boats. The iron-clad fleet consists of 26 vessels. Of these, 21 are of the monitor type, 2 are iron torpedo-ships, while the remaining 3 are described as wholly inefficient. Of available ships in the navy, the number is given as 80, including 16 iron-clads and 2 torpedo-boats. The total force of the navy is limited by law to 8500 men and boys. The navy-yards of the United States are located at Kittery, Boston, Brooklyn, League Island (Pa.), Washington, Norfolk, Pensacola, Mare Island (Cal.), and New London. The Naval Academy is located at Annapolis.

*Railroads.*—The following table exhibits the mileage of railways in each group of States, with ten-year intervals:

| Group of States. | 1842. | 1852. | 1862. | 1872. |
|---|---|---|---|---|
| New England | 811 | 2,973 | 3,751 | 5,053 |
| Middle | 2006 | 4,328 | 7,263 | 13,499 |
| Western, including the Territories | 244 | 2,426 | 11,657 | 32,303 |
| Southern | 965 | 3,181 | 9,422 | 14,112 |
| Pacific | ..... | ..... | 27 | 2,137 |
| Total | 3536 | 12,908 | 32,120 | 67,104 |

The aggregate capital accounts of 57,323 miles of road are thus stated in Poor's *Railway Manual:* Capital stock, $1,647,844,113; funded and other debt, $1,511,578,944; total, $3,159,423,057. Cost of railways per mile in New England States, $50,418; in Middle States, $79,427; in Western States, $50,550; in Southern States, $36,575; in Pacific States, $98,300; aggregate annual receipts of all roads, $473,241,055; operating expenses, $307,486,682; net earnings, $166,754,373; dividends paid, $64,418,151.

*Agriculture.*—The statistics of agriculture at the census of 1870 showed the number of farms in the Middle States to be 2,659,985, against 2,044,077 in 1860, and 1,449,073 in 1850. Of the farms of 1870, 6875 were under 3 acres, 172,021 were of between 3 and 10 acres, 294,607 of between 10 and 20 acres, 847,614 of between 20 and 50 acres; 754,221 of between 50 and 100 acres; 565,054 of between 100 and 500 acres; 19,593 of 500 acres and over. The average size of farms in 1870 was 153 acres; in 1860 it had been 199; in 1850, 203. The total number of acres of improved lands in 1870 was 188,291,099. The present cash value of farms was returned at $9,262,803,861; the value of farming implements and machinery at $336,878,429; the value of live-stock at $1,525,276,457. The total amount paid in wages to farm-laborers during the year had been $310,286,285; the aggregate value of the product for the year, including betterments and additions to stock, was estimated at $2,447,538,658. The number of horses upon farms was given at 7,145,370; of mules and asses, 1,125,415; of milch cows, 8,935,332; of working oxen, 1,319,271; of other cattle, 13,556,005; of sheep, 28,477,951; of swine, 25,134,569. The amounts raised of the principal crops were, in bushels, as follows: wheat, spring, 112,549,733; winter, 175,195,893; rye, 16,918,795; Indian corn, 760,944,549; oats, 282,107,157; barley, 29,761,305; buckwheat, 9,821,721; potatoes, Irish, 143,337,473; sweet, 21,709,824. Of cotton there was raised 3,011,996 bales; of tobacco, 262,735,341 pounds; of rice, 73,635,021 pounds. The wool-crop of the same year is estimated at about 160,000,000 pounds, which was inadequately represented in the census.

Of the tobacco produced in 1870, 20 millions of pounds were raised in the North Atlantic region, 64 millions in the South Atlantic region, and 177 millions in the Mississippi Valley, of which 148 millions were raised in the Ohio Valley alone. Of the corn, 54 millions of bushels were raised in the North Atlantic and 56 millions in the South Atlantic region, 36 millions in the northern lake region, 32 millions in the region drained by rivers flowing into the Gulf of Mexico E. of the Mississippi, 18 millions in the region drained by rivers flowing into the Gulf W. of the Mississippi, and 569 millions in the Mississippi Valley, of which 232 millions were raised in the basin of the Ohio, 77 in the basin of the Mississippi, and 193 millions in the aggregate in the basins of smaller streams emptying into the Mississippi above St. Louis. Of the wheat, 29 millions of bushels were raised in the North Atlantic and 17 millions in the South Atlantic region, 36 millions in the northern lake region, 67 millions in the basin of the Ohio, 15 millions in the basin of the Missouri, 95 millions in the basin of the Mississippi above the junction with the Missouri, 20 millions on the Pacific coast. In 1870, 575,000 bales of cotton were produced in the South Atlantic region, 864,000 in the region drained by streams flowing into the Gulf of Mexico to the E. of the Mississippi, 1,241,000 in

the Mississippi Valley, and 331,000 in the region drained by streams flowing into the Gulf of Mexico below the Mississippi and the Rio Grande. Of the 1,241,000 bales produced in the Mississippi Valley, 110,000 were produced in the basin of the Ohio, 340,000 in the basin of the Red, and 112,000 in the basin of the Arkansas, 679,000 in the aggregate being produced in the basins of the smaller rivers.

The quantities, number of acres, and aggregate value of the principal crops of the farm in 1874 are estimated by the department of agriculture as follows:

| Crops. | Number of bushels. | Number of acres. | Value, dollars. |
|---|---|---|---|
| Indian corn, bushels.... | 850,148,500 | 41,036,918 | 550,043,080 |
| Wheat, " ... | 309,102,700 | 24,967,027 | 291,107,895 |
| Rye, " ... | 14,990,900 | 1,116,716 | 12,870,411 |
| Oats, " ... | 240,369,000 | 10,997,412 | 125,047,530 |
| Barley, " ... | 32,552,500 | 1,580,626 | 29,983,769 |
| Buckwheat, " ... | 8,016,500 | 452,590 | 6,477,885 |
| Potatoes, " .... | 105.981,000 | 1,310,041 | 71,823,330 |
| | 1,561,161,200 | 81,361,330 | 1,087,353,900 |
| Tobacco, pounds..... | 178,355,000 | 281,662 | 23,362,765 |
| Hay, tons..... | 24,133,900 | 21,769,772 | 331,420,738 |
| Cotton, bales..... | 3,800,000 | ..... | 256,215,000 |

*Manufactures and Mining.*—The statistics of manufactures in the United States in 1870 showed the number of establishments to be 252,148, employing 2,053,996 hands, of whom 1,615,598 were males above 16, 323,770 were females above 15, and 114,628 were children and youth. The total amount paid in wages during the year was $775,584,343. The number of steam-engines employed was 40,191, of an aggregate horse-power of 1,215,711. The number of water-wheels 51,018, of an aggregate horse-power of 1,130,431. The value of materials consumed was $2,488,327,242, the value of the products, $4,232,325,442. The following table exhibits the distribution of the manufacturing industry among the several States:

| State. | Establishments. | Hands employed. | Wages. | Materials. | Products. |
|---|---|---|---|---|---|
| Alabama..... | 2,188 | 8,248 | $2,227,968 | $7,592,837 | $13,040,644 |
| Arkansas..... | 1,079 | 3,206 | 673,963 | 2,536,998 | 4,629,234 |
| California..... | 3,984 | 25,392 | 13,136,722 | 35,351,193 | 66,594,556 |
| Colorado ..... | 256 | 876 | 528,221 | 1,593,280 | 2,852,820 |
| Connecticut..... | 5,128 | 89.523 | 38,987,187 | 86,419,579 | 161,065,474 |
| Delaware..... | 800 | 9,710 | 3,692,195 | 10,206,397 | 16,791,382 |
| Florida..... | 659 | 2,749 | 989,592 | 2,330,873 | 4,685,403 |
| Georgia..... | 3,836 | 17,871 | 4,844,508 | 18,583,731 | 31,196,115 |
| Illinois..... | 12,597 | 82,979 | 31,100,244 | 127,600,077 | 205,620,672 |
| Indiana..... | 11,847 | 58,852 | 18,366,780 | 63,135,492 | 108,617,278 |
| Iowa..... | 6,566 | 25,032 | 6,893,292 | 27,682,096 | 46,534,322 |
| Kansas..... | 1,477 | 6,844 | 2,377,511 | 6,112,163 | 11,775,833 |
| Kentucky ..... | 5,390 | 30,636 | 9,444,524 | 29,497,535 | 54,625,809 |
| Louisiana..... | 2,557 | 30,071 | 4,593,470 | 12,412,023 | 24,161,905 |
| Maine..... | 5,550 | 49,180 | 14,282,205 | 49,379,757 | 79,497,521 |
| Maryland..... | 5,812 | 44,860 | 12,682,817 | 46,897,032 | 76.593,613 |
| Massachusetts..... | 13,212 | 279,380 | 118,051,886 | 334,413,982 | 553,912,568 |
| Michigan..... | 9,455 | 63,694 | 21,205,355 | 68,142,515 | 118,394,676 |
| Minnesota..... | 2,270 | 11,290 | 4,052,837 | 13,842,902 | 23,110,700 |
| Mississippi..... | 1,731 | 5,941 | 1,547,428 | 4,364,206 | 8,154,758 |
| Missouri..... | 11,871 | 65,354 | 31,055,445 | 115,533,269 | 206,213,429 |
| Nebraska..... | 670 | 2,665 | 1,429,913 | 2,902,074 | 5,738,512 |
| Nevada ..... | 330 | 2,859 | 2,498,473 | 10,315,984 | 15,870,539 |
| New Hampshire.... | 3,342 | 40,783 | 13,823,091 | 44,577,967 | 71,038,249 |
| New Jersey..... | 6,636 | 75,552 | 32,648,409 | 103,415,245 | 169,237,732 |
| New York..... | 36,206 | 351,800 | 142,466,758 | 452,065,452 | 785,194,651 |
| North Carolina..... | 3,642 | 13,622 | 2,195,711 | 12,824,693 | 19,021,327 |
| Ohio ..... | 22,773 | 137,202 | 49,066,488 | 157,131,697 | 269,713,610 |
| Oregon..... | 969 | 2,884 | 1,120.173 | 3,419,756 | 6,877,387 |
| Pennsylvania..... | 37,200 | 319,487 | 127,976,594 | 421,197,673 | 711,894,344 |
| Rhode Island..... | 1,850 | 49,417 | 19,354,256 | 73,154,109 | 111,418,354 |
| South Carolina..... | 1,584 | 8,141 | 1,543,715 | 5,855,736 | 9,858,981 |
| Tennessee..... | 5,317 | 19,412 | 5,390,630 | 19,657,027 | 34,362,636 |
| Texas..... | 2,399 | 7,927 | 1,787,835 | 6,273,193 | 11,517,302 |
| Vermont..... | 3,270 | 18,686 | 6,264,581 | 17,007,769 | 32,184,606 |
| Virginia..... | 5.933 | 26,974 | 5,343,099 | 23,832,384 | 38,364,322 |
| West Virginia..... | 2,444 | 11,672 | 4,322,164 | 14.503,701 | 24,102,201 |
| Wisconsin..... | 7,013 | 43,910 | 13,575.642 | 45,851,266 | 77,214,326 |

The statistics of mining for the same period showed 7974 establishments, employing 154,328 hands, of whom 66,178 were men above ground, 77,221 men under ground, 6916 boys above ground, 4013 boys under ground. The amount paid in wages during the year was $74,464,044.

*Education.*—The interests of education are left to the several States. The general government has, however, encouraged the establishment of common schools in the new States by grants of land, and in a single instance has by the same means provided for higher institutions through the endowment of a college in each State for instruction in agriculture and the mechanic arts. The educational institutions of each State will be found described under the appropriate title. The following summaries may be given for the United States: Of a school population of 13,735,672, 8,030,772 were in 1874 enrolled in public schools; the number of teachers was 239,873; the public-school income, $81,277,686, mainly derived from taxation, the permanent school fund being only $75,251,008. The preceding table of higher institutions is given by the U. S. commissioner of education.

| Class of Schools. | Schools. | Teachers. | Pupils. |
|---|---|---|---|
| Normal schools..... | 124 | 966 | 24,405 |
| Business colleges..... | 126 | 577 | 25,892 |
| Academies and preparatory schools. | 1,122 | 6,163 | 109,693 |
| Scientific and agricultural colleges.. | 72 | 609 | 7,244 |
| Colleges for women..... | 209 | 2,285 | 23,445 |
| Colleges..... | 343 | 3,783 | 56,692 |
| Theological schools..... | 113 | 579 | 4,350 |
| Medical schools..... | 99 | 1,121 | 9,095 |
| Law schools..... | 38 | 181 | 2,585 |

The following are among the largest and best known of the higher institutions of the United States: Harvard College, Cambridge, Mass.; Yale College, New Haven, Conn.; Columbia College, New York City; Michigan University, Ann Arbor; University of Virginia, Charlottesville, Va.; College of New Jersey, Princeton, N. J.; Dartmouth College, Hanover, N. H.; Cornell University, Ithaca, N. Y.; University of Pennsylvania, Philadelphia, Pa.; University of the City of New York; La Fayette College, Easton, Pa.; Brown University, Providence, R. I.; Bowdoin College, Brunswick, Me.; University of Missouri, Columbia, Mo.; University of Wisconsin, Madison, Wis.; University of Kentucky, Lexington, Ky.; University of Iowa, Iowa City; Amherst College, Amherst, Mass.; Williams College, Williamstown, Mass.; University of Boston; Wesleyan University, Middletown, Conn.; Ohio Wesleyan University, Delaware, O.; University of Mississippi, Oxford; University of California, Oakland; Industrial University of Illinois, Champaign; Massachusetts Institute of Technology, Boston, Mass.; Rutgers College, Brunswick, N. J.; Stevens Institute, Hoboken, N. J.; Rochester University, Rochester, N. Y.; Johns Hopkins University, Baltimore, Md. (See also article College.)

*Ladies' Schools.*—Vassar College, Poughkeepsie, N. Y.; Mount Holyoke Seminary, Mount Holyoke, Mass.; Wellesley College, Wellesley, Mass.; Smith College, Northampton, Mass.

*Agricultural Schools.*—Massachusetts Agricultural College, Amherst; Michigan State Agricultural College, Lansing; Iowa State Agricultural College, Ia.

The statistics of illiteracy show that at 1870 there were 4,528,084 persons ten years of age and over in the United States who could not read, and 5,658,144 of the same age who could not write. This latter aggregate was composed as follows:

| | |
|---|---|
| Native..... | 4,880,271 |
| Foreign..... | 777,873 |
| | 5,658,144 |

Excluding Chinese and civilized Indians, this aggregate may be further distributed as follows:

| | 10 to 15 years. | | 15 to 21 years. | | 21 years and over. | |
|---|---|---|---|---|---|---|
| | Male. | Female. | Male. | Female. | Male. | Female. |
| White... | 294,422 | 245,690 | 207,578 | 209,533 | 748,970 | 1,145,718 |
| Colored. | 243,083 | 227,510 | 237,021 | 273,500 | 862,243 | 946,332 |
| | 537,505 | 473,200 | 444,599 | 483,033 | 1,611,213 | 2,092,050 |

*Religion.*—The Constitution provides that "Congress shall make no law respecting an establishment of religion or prohibiting the free exercise thereof." No inquiry concerning religious belief has ever been incorporated in the census. The relative strength of the several communions is left to be deduced from the statistics of churches and of church accommodation. At 1870 the number of separate organizations or parishes, church edifices, and the aggregate sittings provided by each religious denomination were as follows:

| Denominations. | Organizations. | Church edifices. | Sittings. | Value of church property. |
|---|---|---|---|---|
| Baptists..... | 15,829 | 13.962 | 4,360,135 | $41,608,198 |
| Christians..... | 3,578 | 2,822 | 865,602 | 6,425,137 |
| Congregationalists..... | 2,887 | 2.715 | 1,117,212 | 25,069,698 |
| Episcopalians ..... | 2,835 | 2,601 | 991,051 | 36,514,549 |
| Evangelical Association..... | 815 | 641 | 193,796 | 2,301,650 |
| Friends ..... | 692 | 662 | 224,664 | 3,939,560 |
| Jews ..... | 189 | 152 | 73,265 | 5,155,234 |
| Lutherans..... | 3,032 | 2,776 | 977,332 | 14,917,747 |
| Methodists ..... | 25,278 | 21,337 | 6,528,209 | 69,854.121 |
| Moravians..... | 72 | 67 | 25,700 | 709,100 |
| Mormons..... | 189 | 171 | 87,838 | 656,750 |
| New Jerusalem..... | 90 | 61 | 18,755 | 869,700 |
| Presbyterians..... | 7,824 | 7,071 | 2,698,244 | 53,265,256 |
| Reformed Church in America (late Dutch Reformed)..... | 471 | 468 | 227,228 | 10,359,255 |
| Reformed Church in the U. S. (late German Reformed)..... | 1,256 | 1,145 | 431,700 | 5,775,215 |
| Roman Catholics..... | 4,127 | 3,806 | 1,990,514 | 60,985,556 |
| Second Adventists..... | 225 | 140 | 34,555 | 306,240 |
| Shakers..... | 18 | 18 | 8,850 | 86,900 |
| Spiritualists..... | 95 | 22 | 6,970 | 100,150 |
| Unitarians..... | 331 | 310 | 155,471 | 6,282,675 |
| United Brethren in Christ..... | 1,445 | 937 | 265,025 | 1,819,810 |
| Universalists..... | 719 | 602 | 210,884 | 5,692,325 |
| All others..... | 462 | 596 | 172,062 | 1,788,745 |
| Total..... | 72,459 | 63,082 | 21,665,062 | $354,483,581 |

The value of church property, as stated above, is probably far below the fact. The agencies of the census are ill adapted to the prosecution of such an inquiry, and it is not

easy at the best to fix the principles upon which church property, having no secular uses, bringing no income, and not subject to sale, should be appraised.

The following table shows the four denominations having the largest church accommodation in each of the States:

| States. | First. | Second. | Third. | Fourth. |
|---|---|---|---|---|
| Alabama | Methodist. | Baptist. | Presbyterian. | Episcopal. |
| Arkansas | Baptist. | Methodist. | Presbyterian. | Christian. |
| California | Ro. Catholic. | Methodist. | Presbyterian. | Baptist. |
| Connecticut | Congrega'l. | Methodist. | Episcopal. | Baptist. |
| Delaware | Methodist. | Presbyterian. | Episcopal. | Ro. Catholic. |
| Florida | Methodist. | Baptist. | Presbyterian. | Episcopal. |
| Georgia | Baptist. | Methodist. | Presbyterian. | Christian. |
| Illinois | Methodist. | Presbyterian. | Baptist. | Ro. Catholic. |
| Indiana | Methodist. | Baptist. | Presbyterian. | Christian. |
| Iowa | Methodist. | Presbyterian. | Ro. Catholic. | Baptist. |
| Kansas | Methodist. | Presbyterian. | Baptist. | Ro. Catholic. |
| Kentucky | Baptist. | Methodist. | Christian. | Presbyterian. |
| Louisiana | Ro. Catholic. | Baptist. | Methodist. | Episcopal. |
| Maine | Baptist. | Congrega'l. | Methodist. | Universalist. |
| Maryland | Methodist. | Ro. Catholic. | Episcopal. | Lutheran. |
| Massachusetts | Congrega'l. | Baptist. | Ro. Catholic. | Methodist. |
| Michigan | Methodist. | Baptist. | Ro. Catholic. | Presbyterian. |
| Minnesota | Ro. Catholic. | Methodist. | Lutheran. | Presbyterian. |
| Mississippi | Methodist. | Baptist. | Presbyterian. | Episcopal. |
| Missouri | Methodist. | Baptist. | Presbyterian. | Ro. Catholic. |
| Nebraska | Methodist. | Baptist. | Episcopal. | Presbyterian. |
| Nevada | Ro. Catholic. | Methodist. | Episcopal. | Presbyterian. |
| New Hampshire | Congrega'l. | Baptist. | Methodist. | Ro. Catholic. |
| New Jersey | Methodist. | Congrega'l. | Baptist. | Dutch Refor. |
| New York | Methodist. | Presbyterian. | Baptist. | Ro. Catholic. |
| North Carolina | Methodist. | Baptist. | Presbyterian. | Lutheran. |
| Ohio | Methodist. | Presbyterian. | Baptist. | Christian. |
| Oregon | Methodist. | Presbyterian. | Baptist. | Christian. |
| Pennsylvania | Methodist. | Presbyterian. | Lutheran. | Baptist. |
| Rhode Island | Baptist. | Ro. Catholic. | Congrega'l. | Episcopal. |
| South Carolina | Baptist. | Methodist. | Presbyterian. | Episcopal. |
| Tennessee | Methodist. | Baptist. | Presbyterian. | Christian. |
| Texas | Methodist. | Baptist. | Presbyterian. | Ro. Catholic. |
| Vermont | Congrega'l. | Methodist. | Baptist. | Ro. Catholic. |
| Virginia | Methodist. | Baptist. | Presbyterian. | Episcopal. |
| West Virginia | Methodist. | Baptist. | Presbyterian. | Ro. Catholic. |
| Wisconsin | Ro. Catholic. | Methodist. | Congrega'l. | Baptist. |

*Newspapers and Periodicals.*—The census of 1870 showed the aggregate number of newspapers and periodicals in the United States to be 5871, having an aggregate circulation of 20,842,475, and issuing 1,508,548,250 copies annually. The following table exhibits the distribution of this aggregate by classes and by periods of issue:

| Journals. | Number. | Circulation. | Copies annually issued. |
|---|---|---|---|
| *Classes.* | | | |
| Advertising | 79 | 293,450 | 4,689,800 |
| Agricultural and horticultural | 93 | 770,752 | 21,541,904 |
| Benevolent and secret societies | 81 | 257,080 | 6,518,560 |
| Commercial and financial | 142 | 690,200 | 31,120,600 |
| Illustrated, literary, and miscellaneous | 503 | 4,422,235 | 160,061,408 |
| Devoted to nationality | 20 | 45,150 | 4,671,000 |
| Political | 4,333 | 8,781,220 | 1,134,789,082 |
| Religious | 407 | 4,764,358 | 125,959,496 |
| Sporting | 6 | 73,500 | 3,222,000 |
| Technical and professional | 207 | 744,530 | 15,974,400 |
| *Periods of Issue.* | | | |
| Daily | 574 | 2,601,547 | 806,479,570 |
| Three times a week | 107 | 155,105 | 24,196,380 |
| Semi-weekly | 115 | 247,197 | 25,708,488 |
| Weekly | 4,295 | 10,594,643 | 550,921,436 |
| Semi-monthly | 96 | 1,349,820 | 32,395,680 |
| Monthly | 622 | 5,650,843 | 67,810,116 |
| Bi-monthly | 13 | 31,650 | 189.900 |
| Quarterly | 49 | 211,670 | 846,680 |

*Literary and Scientific Institutions.*—Of these, the United States possess but two of importance which derive a national character from acts of Congress, the Smithsonian Institution and the National Academy of Sciences. An account of the history and work of the former appears separately. (See Smithsonian Institution.) The National Academy of Sciences was established by act of Congress during the dark days of the civil war, and was intended to include the most eminent men in the various departments of natural and physical science, who should, at need, serve as a body of unpaid advisers or experts to aid the government. The first president was Prof. A. D. Bache, after the death of whom Dr. Joseph Henry was appointed. It was at first limited to 50 members, but an amendment to the constitution of the Academy permits the election of five new members annually. The annual stated meeting of the Academy is, in accordance with the charter, held at Washington in April, besides which a second meeting is held in November at some place chosen annually for the purpose. This Academy is not, as might be inferred, confined to the study of technical questions, but receives papers on all subjects of theoretical science; and indeed, in its development in this direction its original character has been to a great extent lost sight of. Unfortunately, it is without any government endowment or other funds, save a bequest from its late president, so that it has not the pecuniary means of publication, and its usefulness is thus greatly curtailed.

Among other literary and scientific societies which, though having no support or recognition from the government, require to be mentioned in any sketch of the institutions of the United States, are—the American Association for the Advancement of Science, originally the American Association of Geologists and Naturalists, but reorganized in 1848 on a wider basis; the American Philosophical Society, founded by Franklin; the American Social Science Association; the Boston Society of Natural History; the Peabody Academy of Salem, Mass.; the American Academy of Arts and Sciences of Boston; the Franklin Institute of Philadelphia; the St. Louis Academy of Sciences; the Connecticut Academy of Arts and Sciences; the New York Academy of Sciences, lately the Lyceum of Natural History; the American Geographical Society; the Philadelphia Academy of Natural Sciences; the American Antiquarian Society of Worcester, Mass.; the New England Historical and Genealogical Society; the Massachusetts Historical Society; the Institute of Civil Engineers; the Institute of Mining Engineers. Most of the above societies publish occasionally their proceedings and papers. Some publish actively. The American Association meets annually. The following have been the presidents for the last six years: Prof. T. Sterry Hunt, 1871; Prof. Asa Gray, 1872; Prof. J. S. Lovering, 1873; Prof. J. L. Le Conte, 1874; Prof. J. E. Hilgard, 1875; Prof. W. B. Rogers, 1876.

*History.*—The details of colonial history will be found under the titles of the several States of the Union. The political history of the United States begins in 1774. The mother-country had provided no common government in which the colonies should take part, and the relations into which these occasionally entered under the stress of Dutch, French, and Indian wars were voluntary and transient. Planted along the Atlantic coast, each having its own harbors and river systems, the colonies had felt no drawings toward general union. To this statement of geographical independence an exception may seem to have existed in the case of Delaware and Pennsylvania; but as these colonies remained, even after the legislative secession of 1703, under a common governor, the antagonism of interests which might otherwise have arisen out of conflicting claims to navigation was wholly suppressed. With this possible exception no colony depended on the consent of any other for the exercise of any vital privilege. One or more of the colonies had taken advantage of superior harbors to tax the products of their neighbors going out through their ports; Connecticut and Massachusetts quarrelled for a while (1647–50) over the dues levied by the former at Saybrook on goods destined for Springfield in the latter colony; Virginia and Maryland long maintained a dispute concerning their respective rights to the navigation of Chesapeake Bay and the Potomac River; while even the adoption of the Constitution has not wholly prevented controversy between New York, New Jersey, and Connecticut in the matter of the control of New York Bay, as in the case of the claim of certain patentees of New York to the monopoly of steam navigation within those waters. But none of these issues were vital, while the exigencies of a common defence against the savages were held to be sufficiently met by an occasional common armament and joint expedition of two, three, or four contiguous colonies. One exception, indeed, is found. In 1643 the four colonies of Massachusetts Bay, Plymouth, Connecticut, and New Haven, which afterward formed two of the thirteen original States, united in a confederation, known as the United Colonies of New England, for defence against the savage tribes. In this confederation the four colonies, though very unequal in size and population, were to have equal power, but all war-expenses, which were to be a common charge, were to be apportioned according to the number of male inhabitants in each colony. Runaway servants and fugitives from justice were to be mutually delivered up, and the judgments of courts of law and probates of wills in each colony were to receive full faith and credit in every other. This confederation, thus limited in extent, had but a feeble existence, and expired after about half a century with the exigency in which it had its rise.

No other attempt at confederation was made until 1754, though in the interval colonies were temporarily or permanently consolidated by the Crown of England, sometimes with and sometimes without their consent. In the year named a convention was held at Albany in New York in view of the approaching hostilities with the French and Indians, and on the instance of the British board of trade. Commissioners were present from New York, Pennsylvania, Maryland, and the four New England colonies. Delegates were also present from the famous "Six Nations" of New York. Under the leadership of Benjamin Franklin, a plan of permanent union for the colonies was adopted, to be dependent for effect on the sanction of the British Parliament. The scheme comprised a president-general, named and supported by the Crown, and a council of forty-eight members, to be chosen every three years by the legislatures of the colonies. Each colony was to have

representation in proportion to its contributions to the general cause, no colony, however, to have less than two or more than seven members of the council. The council was to undertake the common defence, apportioning quotas of men and money therefor, controlling the forces raised, and enacting ordinances of general interest. The president-general was to have a negative on all acts of the council and the appointment of all military officers. Civil officers were to be appointed by the council, with the consent of the president. This promising scheme was, however, rejected by the board of trade as conferring dangerous powers on the colonies, and by the colonies themselves as giving too much authority to the Crown in matters which they had jealously reserved to themselves; so that the colonies had to sustain the ensuing war, which broke the power of France upon the continent, with no other concert than that derived from the voluntary concurrence of the several legislatures or executives.

The forces which thus for more than a century withstood union were not found alone in the indifference growing out of the natural independence which has been noted. There was also a decided repugnancy, if not between individual colonies, between groups of colonies, arising out of differences in race, religion, and political institutions. New England was almost purely English; the populations of the middle colonies were most curiously and variously composed of a great number of nationalities. New England was chiefly Puritan; in the middle colonies the Quakers and Lutherans dominated; at the South, the Church of England had formally established its offices. But the repugnancy caused by differences of race and religion was probably less than that due to differences in the political franchises and institutions of the several sections. The charter governments of New England (excepting New Hampshire) were strongly contrasted with the proprietary governments of Maryland, Pennsylvania, and Delaware and the provincial governments of the South. The political habits and aptitudes which resulted were widely diverse, especially in respect to the forms in which political power was exercised and to the modes of taxation in use. Evidence abounds that the total effect of all these causes was to produce a strong disinclination to confederation among the colonies, and especially that the Episcopal and aristocratic prejudices against the levelling spirit of New England, and the Quaker opposition to war, to which the New England colonies were from the first exceedingly prone, constituted an obstacle to union which no cause but the single one which actually brought the colonies together could for more than one generation have overcome.

In 1765, the general opposition to Grenville's Stamp act led to a congress of delegates from nine colonies, appointed by various authority, which met at New York and formed a union for the purpose of resisting taxation by Parliament. This congress, however, assumed no powers of government; its proceedings were limited to deliberation and remonstrance, and the union expired with the repeal of the obnoxious law in 1766. In 1774, however, the opposition to Charles Townshend's measures for raising a British revenue within the colonies, inflamed by the stirring events at Boston—the "massacre" of 1770 and the "tea-party" of 1773—resulted in a congress of the colonies, which met at Philadelphia on the 5th of September. Twelve colonies were soon represented, Georgia being "the missing link," though, it is to be noted, a link at the end of the chain. This congress was in reality an assemblage of committees. The colonies voted as entire bodies, casting single votes, the question of proportional representation being waived for the sake of harmony. The congress undertook to exercise no coercive powers. Separation from England was not then determined on, and was not even generally in contemplation. The important measures of the congress of 1774 were a declaration which based the rights of the colonies on the laws of nature, the principles of the British constitution, and the several charters or compacts between the colonies and the Crown, and denied expressly and completely the right of Parliament to tax the colonies, though recognizing its power of commercial regulation; and, secondly, non-importation and non-exportation agreements, the article of tea being particularly named in the former, while rice, the product of Carolina, was specially excepted from the prohibitions of the latter. The congress adjourned in October, recommending that another congress be held in 1775, should the grievances of the colonies not meantime have been redressed. During the winter which followed, rapid progress was made toward revolution in Massachusetts. The governor, on the part of the Crown, dissolved the general assembly, and called new councillors into office by mandamus, under authority of an act of Parliament revoking so much of the charter of the colony as authorized the assembly to elect the council. The governor's councillors were compelled by a show of popular violence to resign, while a new assembly, elected by the people in defiance of an executive proclamation, met at Salem and resolved themselves into a provincial congress, whose recommendations had all the effect of law throughout the colony. On Apr. 19, 1775, occured the battle of Lexington, an unforeseen collision between the royal troops marching to seize military stores at Concord and the militia and citizens.

The second Continental Congress met at Philadelphia on May 10, following. Most of the delegations had been chosen before the battle of Lexington, when armed resistance to the obnoxious acts of Parliament was not in contemplation. "They were," says Mr. Bancroft, "committees from twelve colonies, deputed to consult on measures of conciliation, with no means of resistance to oppression beyond a voluntary agreement for the suspension of importations from Great Britain. They formed no confederacy; they were not an executive government; they were not even a legislative body." Such, indeed, they were in theory, but the course of events threw upon this body of committees the duties of a revolutionary congress. Blood had been shed; the British troops were besieged in Boston by the militia of New England; Congress, by the necessity of the situation, became the organ of the common resistance. A Continental army was raised; a commander-in-chief, George Washington of Virginia, was chosen, in whose commission the phrase "United Colonies" was first used; a Continental currency was created; a general treasury and post-office established; while the whole management of Indian affairs was assumed by Congress. Here we see emerge most of the parts of government. What, meanwhile, had become of the governments of the colonies? Much stress has been placed by some writers on the fact that the revolutionary governments of the colonies were generally not organized until after the Continental Congress had assumed powers of legislation, and had recommended the establishment of new governments in the several colonies. But no inference can justly be drawn from this fact adverse to the full political rights of each colony. The priority noted was a priority in time, not in logic. It was due to the urgent military necessity of the situation, and intimated no supremacy on the part of the Continental Congress. It is not conceivable that the latter body should have assumed to disregard the entity of a single colony, even the smallest, or have proceeded to do anything authoritatively in respect to the organization of colonial governments, or to take territory from one colony for the benefit of another. The colonies in no respect owed their existence or their political rights to the Continental Congress, which was their creature, the organ of their voluntary common action.

On June 17 was fought the battle of Bunker Hill, between the garrison of Boston and the besieging provincials. Though this action was not, as now, regarded as a substantial victory for the Americans, it did much to strengthen the purpose of resistance and to quicken the growth of revolutionary ideas. The progress of the popular mind of the colonies toward independence of Great Britain was hastened by the refusal of Parliament to receive the petition of Congress; by the bombardment of the town of Falmouth, now the city of Portland; by acts of Parliament prohibiting trade with the colonies and authorizing the capture of their vessels; and by the active impressment of seamen on the North American coast. The military operations of the autumn and winter had not been decisive. The expedition of Montgomery and Arnold against Canada had resulted disastrously; on the other hand, the British garrison had been compelled to evacuate Boston, and a British fleet had been beaten off Charleston in the action at Fort Sullivan.

On June 7, 1776, a resolution of independence was introduced into the Continental Congress by Richard Henry Lee of Virginia, and referred to a committee consisting of John Adams, Thomas Jefferson, Benjamin Franklin, Roger Sherman, and R. R. Livingston. The Declaration of Independence was drawn by Jefferson, and on the 4th of July was promulgated, the delegations being generally instructed to that end by their colonies. On the same day on which the committee was appointed to prepare the Declaration, a committee was appointed to prepare Articles of Confederation, it being fully recognized that independence of Great Britain necessitated union among the colonies, now become States. Yet this committee did not report a plan for confederation until Nov., 1777, nor were the Articles adopted by all the States before Mar. 1, 1781. During the whole of this period the States, united only by their free consent, were carrying on war with Great Britain at a distinct disadvantage by reason of the absence of authoritative government. This long delay in such an exigency affords a measure of the difficulties of union. One obstacle, however, additional to those previously mentioned, requires to be stated. Seven States, Massachusetts, Connecticut,

New York, Virginia, South Carolina, North Carolina, and Georgia, possessed considerable bodies of land to the W. of their present limits. The six States more closely defined objected to signing the Articles until these unoccupied lands, which were to be defended by the arms and resources of the Confederation, should be ceded for the benefit of the Confederation. This objection was, however, maintained with less vigor by some of these States than by others. Before the close of July, 1778, ten States had ratified the Articles. New Jersey acceded Nov. 26, 1778; Delaware May 5, 1779; Maryland remained out until Mar. 1, 1781. The contention of Maryland was that without such cession the landed States would pay their war-expenses by sales of lands, instead of by taxation; and, secondly, that when this Western territory should be settled, the communities there formed would become politically and socially the satellites of the States under whose laws and administration they had grown up. The contest was finally settled by the patriotic action of New York, which authorized (Feb. 19, 1780) its delegates to cede its Western lands. This action was accepted by Maryland as an earnest of what she had claimed, and she joined the Confederation as stated. Sooner or later, all the landed States followed suit in cession—Virginia, 1784; Massachusetts, 1785; Connecticut, 1786; South Carolina, 1787; North Carolina, 1790; Georgia, 1802.

Meanwhile, the war had been prosecuted without a government having coercive power. The States, when called upon by Congress for contributions of men and money, responded in their own time and way. The British troops under Sir William Howe defeated the American army on Long Island Aug. 27, 1776, and soon afterward occupied the city of New York and the country of the lower Hudson. Before the close of the year Washington had been obliged to retire behind the Delaware River with a small, ill-provided army, but by the brilliant surprises of Trenton and Princeton the British were thrown back and New Jersey mainly recovered. During the summer of 1777, Sir William Howe transferred the greater part of his force by water to the neighborhood of Philadelphia, which city he captured, after defeating the American army on the Brandywine, Sept. 11. A bold attack by Washington on the British forces at Germantown (Oct. 4) was repulsed. At the North, however, the cause of independence found this year a better fortune. Gen. Burgoyne, in command of an army composed of British regulars, Canadians, and Indians, in July captured Ticonderoga and Whitehall, and began a movement intended to gain possession of the Highlands of the Hudson, and by opening that river from its source to its mouth to isolate New England. The expedition was, however, wholly disastrous. A strong detachment was defeated by a militia force under Gen. Stark at Bennington Aug. 16, and in September, Burgoyne was brought to bay near Saratoga, on the right bank of the Hudson, and after two severe actions (Sept. 19 and Oct. 7) was compelled to surrender (Oct. 16) to Gen. Gates.

The decisive victory at Saratoga gave great reputation abroad to the American arms, and decided the French king to join in treaties of alliance and commerce with the United States, which were signed in Paris in Feb., 1778. Meanwhile, Washington had been reduced to straits in keeping the field against the British, and his army encountered the greatest hardships at their encampment of 1777–78 at Valley Forge, a day's march N. of Philadelphia. The want of an authoritative government was severely felt in the slow and partial responses made by the States to the requisitions of the Congress. In this strait the issue of bills of credit was resorted to. The depreciation was of course rapid. Mar. 1, 1778, $1 in specie exchanged for $1.75 in paper; Sept. 1, for $4; Mar. 1, 1779, for $10; Sept. 1, for $18; Mar. 18, 1780, for $40; Dec. 1, for $100; May 1, 1781, for $200–$500. During the operations of 1778 the co-operation of the French fleet under D'Estaing proved delusive, but the conduct of the British armies was ineffective; Sir Henry Clinton, who succeeded Howe, evacuated Philadelphia and retired on New York. During the movement an indecisive action was fought at Monmouth, the army of Washington remaining in possession of the field. The British forces still held Rhode Island, which they had occupied two years before. Toward the close of 1778, Sir Henry Clinton sent a force against the city of Savannah, which fell Dec. 29. This determined toward the South the efforts of both armies. During the summer of 1779 the British overran the whole of Georgia, but were compelled to abandon Rhode Island in view of an expected expedition by the troops and fleets of France and Spain, the latter country having declared war against England in June. In September the Americans under Lincoln, assisted by the French fleet, made a futile attack on Savannah, being repulsed with heavy loss. In Apr., 1780, Clinton in person invested Charleston, which was held by Gen. Lincoln. The defence was weak, and the city was surrendered with the garrison in May; South Carolina was completely overrun, and Cornwallis, who was left in command by Clinton, threatened North Carolina. In this emergency troops were detached from the Northern army under the command of Gen. Gates, who was reinforced by the militia of Virginia and North Carolina, but was routed with great loss at Camden, while the partisan corps of Sumter, who since the conquest of South Carolina had not ceased to harass the British outposts, was destroyed by Tarleton on the banks of the Wateree. The three southernmost States were now held by the British, while to the disaster at the South was nearly added the capture of the strongholds on the Hudson through the treachery of Benedict Arnold. In October, however, a considerable detachment of the British army was destroyed by militia at King's Mountain, inducing Cornwallis to retire into South Carolina; and in December, Gen. Greene arrived from the North, superseding Gates. The close of the year found Holland also in arms against England, though not taking part in the military operations in America.

The campaign of 1781 was destined virtually to close the war in favor of the Americans. Jan. 17, the British, under Col. Tarleton, were defeated at Cowpens, S. C., by Gen. Morgan; Mar. 15 a severe action was fought at Guilford Court-house between Greene and Cornwallis, by which the British, though they held the field, were so far weakened as to compel them to retire; on Sept. 8 was fought the severe action of Eutaw Springs, in which the Americans had the advantage. The effect of these actions, combined with the activity of the American partisans under Marion, was to compel the abandonment of North Carolina and nearly all of South Carolina by the British, who were content to hold a few places by garrisons. Meanwhile, Cornwallis, moving into Virginia with a view to forming a junction with Sir Henry Clinton, was hemmed in at Yorktown by the troops of Washington and Rochambeau, and after a siege of about three weeks was compelled to surrender his whole force, about 8000 men, Oct. 19. The surrender of Cornwallis practically ended the war. No operations of importance followed. In July, 1782, the British evacuated Savannah; a preliminary treaty of peace was signed Nov. 30 of that year at Paris; Dec. 14, Charleston was evacuated; the definitive treaty was signed Sept. 3, 1783; New York was evacuated by the close of November; in December, Washington resigned his commission as commander-in-chief.

The government which, as recited, had been brought into existence Mar. 2, 1781, was a pure federation. The States entered it as equal bodies. Its single organ was a congress of delegates. The powers of the government were limited to certain purposes. Nominally, these extended to the right to declare peace or war, to send ambassadors and envoys, to make treaties and alliances, to dispose of captures and prizes, and provide for the punishment of piracies and felonies on the high seas. In respect to internal concerns, Congress was vested with the determination in the last resort of disputes between States regarding boundaries, with the regulation of weights, measures, and coins, with the control of the postal service and of the trade with the Indians, with the government of the land and naval forces. The State quotas of contribution both of men and of money were to be fixed by Congress, which should make requisition on the States therefor. The consent of nine States was, however, necessary to all important acts of legislation or administration. The government thus formed remained the government of the United States during two years of war and six years of peace. It was, however, early shown to be a hopeless failure. It had no coercive power over States or individuals. It could not even command the attendance of its own members. In consequence, the States ordinarily neglected or refused to comply with the requisitions of Congress, and settled their disputes or contended over them without regard to the authority of the United States; while Congress itself sank to be, in the language of Mr. Curtis, "a feeble junto of about twenty persons," moving about from city to city as circumstances required.

Feb. 21, 1787, Congress called upon the States to send delegates to a convention at Philadelphia for the purpose of revising the Articles of Confederation, "to render the Federal Constitution adequate to the exigencies of the government and the preservation of the Union." The convention met in May, George Washington being president. Among the most eminent members were Benjamin Franklin, Alexander Hamilton, James Madison, Edmund Randolph, George Mason, Gouverneur Morris, John Rutledge, C. C. Pinckney, Rufus King, Roger Sherman. Rhode Island was not present by delegates. The convention was dissolved in September, having submitted a form of constitution es-

sentially different from the Articles of Confederation. The main features of the plan of government thus proposed have already been given under the title *Political Institutions and Government.* The order of ratification by the conventions of the States was as follows: Delaware, Dec. 7, 1787, unanimously; Pennsylvania, the same day, by a vote of 46 to 23; New Jersey, Dec. 12, unanimously; Georgia, Jan. 2, 1788, unanimously; Connecticut, Jan. 9, by a large majority; Massachusetts, Feb. 7, 168 to 187; Maryland, Apr. 28, 63 to 11; South Carolina, May, by a large majority; New Hampshire, June 21, 57 to 46; Virginia, June 25, by a majority of 10; New York, July 26, 30 to 27. The ratification of nine States being sufficient, the new government went into operation before Rhode Island and North Carolina had acceded, which they did shortly after. Ten amendments to the Constitution were immediately proposed and adopted, constituting a sort of "Bill of Rights" desired by some of the ratifying States.

The new government was inaugurated, nominally, on the 4th of March, really on the 6th of Apr., 1789. George Washington of Virginia was found to have received the entire number of votes in the electoral college, and was declared President, John Adams of Massachusetts, having received a plurality of second choices, was declared Vice-President. The cabinet was announced as follows: Thomas Jefferson, secretary of state; Edmund Randolph, attorney-general; Alexander Hamilton, secretary of the treasury; Henry Knox, secretary of war. At the election party distinctions had not been formulated, though it was not to be doubted that the divisions of sentiment which had been developed in the Constitutional convention would eventuate in the formation of parties within the Constitution. The cabinet even gave testimony to fundamental differences of political belief between North and South. Hamilton and Knox were pronounced advocates of what became known as Federalism; Jefferson and Randolph were strong asserters of those views of the powers of the general government, and of its relations to the States, which characterized the Republican party. Two measures of Washington's first term especially promoted the division of the country by party lines. These were the creation of a national bank by act of Congress, and the assumption by the United States of the war-debts of the several States. The former measure was opposed in the cabinet by Jefferson and Randolph, and supported by Knox and Hamilton, the latter being the author of the scheme. Washington, who had strong Federal associations and proclivities, though disowning party obligations, gave the bill his approval. The bank went into operation in 1791, the charter having twenty years to run. The State debts were assumed in a limited amount ($21,500,000) after an embittered contest in Congress, in which the party asserting the utmost fulness of national powers under the Constitution triumphed. During the administration of Washington the United States progressed steadily toward industrial and financial prosperity, and entered into diplomatic relations with several of the principal powers of Europe. War was, however, waged with the Miami confederation of the Ohio, over which, after two successive disasters to our armies under Gens. Harmer and St. Clair, Gen. Anthony Wayne, the hero of Stony Point in the Revolutionary war, won a decisive victory, which led to peace and the cession of nearly the whole of Ohio by the Miamis in 1795. No opposition was made to the re-election of Washington in 1793, but during his second term the antagonism of the Federalists and Republicans became intense. The Republicans sympathized strongly with the progress of the Revolution in France, and the more forward, incited by the acts and appeals of Genet, minister from France, strove to commit the United States to an active support of that cause, which the Federalists, who were popularly charged with English sympathies, as strongly opposed. The treaty negotiated by Chief-Justice Jay as special envoy to England was resented by the Republicans as a surrender of American rights, and the debates thereon in Congress were marked by extraordinary bitterness. This treaty, while it secured the surrender of the posts in the Western territory held by Great Britain for twelve years in violation of the articles of the treaty of peace in 1783, left other questions open to remain the cause of alienation and dissatisfaction, to ripen many years later into war. The financial policy of Congress, which was controlled by the Federalists, also experienced much factious opposition from the Republicans, which culminated in 1794 in open rebellion against the whisky tax in Western Pennsylvania, only suppressed by the levy of the militia of Maryland and Pennsylvania. The increasing bitterness of feeling in the second term of Washington led to the disruption of his cabinet, in which the eminent statesmen who originally constituted it were replaced by Oliver Wolcott, secretary of the treasury, Timothy Pickering of state, James McHenry of war, Charles Lee, attorney-general.

At the Presidential election of 1797, Washington declining to be a candidate, Jefferson was supported by the Republicans and Adams by the Federalists. The latter was elected by a vote of 71 to 68. As the second choices of the Federalists were divided, Jefferson, receiving the highest number next to Adams, became, under the Constitution as it then was, the Vice-President and the leader of the opposition. Adams's administration was an unfortunate one throughout. He mistakenly retained Washington's secretaries, who gave him no hearty support or intrigued against him in the interest of Hamilton, his rival as a Federal leader and an aspirant for the succession. Adams was finally compelled to dismiss Pickering and McHenry. The President further alienated his own party by renewing negotiations with France after that power, deeming itself outraged by the Jay treaty with Great Britain, had ordered the United States minister out of her territory, and had insulted the special envoys, Marshall, Pickering, and Gerry, who had been sent to adjust the difficulties which threatened war between the two powers to the extent that both nations prepared for action and captures and conflicts occurred on the ocean. In the United States the war-spirit ran so high among the Federalists, especially those who supported Hamilton, that the course of the President in despatching other envoys on what was deemed insufficient evidence of the better disposition of France, provoked deep hostility to Mr. Adams, and was an important cause of his subsequent defeat. The embassy was, however, successful, and a treaty was concluded in 1800. But while Mr. Adams was thus alienating sections of his own natural supporters, the Federal party as a whole was sowing the wind from which it was to reap the whirlwind by the enactment in Congress, which that party still controlled, of the Alien and Sedition laws—acts authorizing the summary removal by the executive of suspected aliens, and providing severe penalties for seditious publications. These measures, which were an excellent imitation of those by which Pitt was striving to keep down the growth of revolutionary sentiments in England, were resented as inconsistent with the genius of republican institutions, and led to the famous declarations of the right of nullification known as the "Virginia and Kentucky resolutions" of 1798–99, those of Virginia being drawn by Madison, those of Kentucky by Jefferson. During the preparations for war with France in 1798 the navy department was created, and Benjamin Stoddert of Maryland was appointed secretary. The policy of a large naval force had always been advocated by Mr. Adams from the earliest days of the Revolutionary war.

At the fourth Presidential election Adams was defeated, receiving only 65 votes against 73 for Jefferson. As, however, Aaron Burr, the intended Vice-President, received also 73 votes, there being no designation on the ballots as to which should be President and which Vice-President, the election was thrown into the House of Representatives, where the States, in such an event, have equal power, each casting a single vote. After thirty-five ballots, in which the Federalists, in order to defeat Jefferson, who was peculiarly obnoxious to them, supported Aaron Burr, Jefferson received the votes of ten States and was elected; Mr. Burr became Vice-President. This unnecessary contest, which was complicated by much personal intrigue, led to the adoption of the 12th Amendment to the Constitution, which provided that the candidates for President and for Vice-President should be voted for separately.

The defeat of the Federalists had been decisive—so much so that Mr. Jefferson was accustomed to speak of "the revolution of 1800" in referring to the election of that year; and in 1804, Jefferson was re-elected, with George Clinton as Vice-President, the Federal candidates receiving but 14 votes against 162. Jefferson's cabinet consisted of James Madison, secretary of state, Samuel Dexter of the treasury, Henry Dearborn of war, Benjamin Stoddert of the navy, and Levi Lincoln, attorney-general. Dexter was afterward replaced by Albert Gallatin, and Stoddert by Robert Smith. Consistently with his theory of government, Jefferson sat and voted with the secretaries in cabinet session upon equal terms, so that the executive resembled a directory. The President and his cabinet were, however, perfectly harmonious, and the Republican party continued to gain power rapidly in every section except New England. The principal measures and events of Jefferson's administration concerned the foreign relations of the United States.

In 1801 war was declared against the United States by the bey of Tripoli, to whom the United States had paid tribute for the privilege of navigating the Mediterranean. Hostilities continued with slight practical result, though much to the credit of the American navy, till peace was made in 1805. In 1803, Robert R. Livingston and James

Monroe, as envoys of the United States, concluded a treaty with Napoleon, by which the whole of the vast possessions of France W. of the Mississippi, embracing, as computed, 1,171,931 sq. m., were ceded to the United States for about $15,000,000. This cession greatly exasperated Spain, which deemed her possession of Florida threatened thereby. Friendly relations between the two nations were interrupted, and some acts of hostility took place. In her desperate efforts to stay the progress of Napoleon, then fast overrunning the continent of Europe, England at that period exercised with unwonted severity her always disputed rights of search and impressment, while by her orders in council neutral trade was greatly crippled. On his side, Napoleon retaliated by successive decrees—from Berlin, from Milan, and from Rambouillet—aimed at American commerce, for which not a shadow of justification could be found in the law of nations. But while France and England were equally in the wrong as regarded their attitude toward the United States as a neutral power, the superior naval force of the latter rendered her practically the more injurious. It was this view, we must assume, which constrained Jefferson and his successor more and more to overlook the wrongs done by France, and to seek to direct the public thought of the nation toward England as the real enemy of the United States, though at times the suggestion of a "three-cornered war" was made with more or less seriousness. In 1806, James Monroe and William Pinkney, as envoys, negotiated a treaty with England, by which it was sought to remove or reduce the points in dispute, but the treaty was rejected as insufficient by the President without reference to the Senate. In 1807 occurred the affair of the Chesapeake and the Leopard, which did much to arouse those feelings of exasperation which made war possible. A British frigate, in asserting the British claim to recover British seamen wherever found, attacked an American public armed vessel in American waters, and after compelling a surrender took off from her four seamen, three of whom were undoubted Americans. Reparation for this outrage was delayed four years. In Dec., 1807, on the recommendation of the President, an embargo was declared by Congress, all vessels being prohibited from sailing for foreign ports, while the coastwise trade was placed under stringent restrictions. This policy was continued until Mar. 1, 1809, the commercial interests of the country suffering meanwhile the deepest distress. The blow fell with especial severity on New England, where the exasperation of the community was carried almost to the point of open resistance to the law. Three days after the repeal of the embargo—which, though still approved by the President, could no longer be sustained against the force of public feeling—Mr. Jefferson, having declined re-election, went out of office, leaving the settlement of the disputes with England to his successor, James Madison of Virginia, who had long been his pupil in politics and his secretary of state during the eight years of his administration. Mr. Madison, with George Clinton for Vice-President, had been elected in 1808 over the Federal candidates, C. C. Pinckney and Rufus King, by a nearly three-fourths vote. The cabinet was constituted of Robert Smith, secretary of state, Albert Gallatin of the treasury, William Eustis of war, Paul Hamilton of the navy, Cæsar A. Rodney, attorney-general. For the embargo prohibiting all foreign trade were now substituted acts prohibiting trade with England and France, but containing provisions intended to induce one of those powers to seek a restoration of intercourse at the expense of the other. This policy of inviting the belligerents to bid against each other for the privilege of open trade with the United States was continued through three years, with the effect that France, after one ambiguous announcement—which the Republican party welcomed as satisfactory, while the Federal party and the English minister denounced it as insufficient and insincere—repealed her obnoxious decrees. England followed by a repeal of her orders in council; but five days before—viz. on June 18, 1812—Congress had declared war upon the recommendation of Pres. Madison, who, though personally averse to extreme measures, was urged forward by younger men now rising into power, notably Henry Clay and John C. Calhoun. The arrival of the news of the repeal led to a renewal of negotiations, but the United States feared to give time for the strengthening of the fortifications of Canada, and hostilities commenced.

The war was to be fought upon the very issues which had been evaded in the Jay treaty of 1794, but the eighteen years that had elapsed had brought a great gain of numbers and resources to the United States. The population had grown from four and a half to eight millions, and the wealth of the nation had trebled or quadrupled in the interval. The number of States was now eighteen, Vermont having been admitted in 1791, Kentucky in 1792, Tennessee in 1796, Ohio in 1802, Louisiana in 1812. The war was fought on three faces—viz. along the lakes, on the North Atlantic shore, and along the Gulf of Mexico. It opened in the N. by the invasion of Canada from Detroit by Gen. Hull, governor of the Territory of Michigan. In about a month Hull had surrendered his entire force without fighting, and Michigan and parts of Ohio were overrun by the British, whose progress was withstood by Gen. William Henry Harrison, who in the preceding year had earned distinction by defeating the Shawnees under their chief Tecumseh and his brother the Prophet. The campaign of 1813 gained little credit to the American arms. Gen. Jacob Brown successfully defended Sackett's Harbor, and Harrison routed the British and their savage allies on the Thames, killing Tecumseh; but other attempts at invasion by Wilkinson and Hampton resulted in disgraceful retreats, while the British overran Western New York and burned several towns in retaliation for the burning of Toronto (then York). In September, however, Lieut. O. H. Perry of the United States navy, in command of an extemporized fleet, defeated and captured the British squadron, giving the Americans complete control of Lake Erie. The campaign of 1814 witnessed a marked change. On the one hand, the British forces in Canada were heavily reinforced by veteran troops from Europe; on the other, the American soldiery were acquiring discipline, and able young commanders were coming to the fore. Under Jacob Brown and Winfield Scott the Americans won the victories of Chippewa and Bridgewater (or Lundy's Lane). On the other end of the Canada line the invasion of a powerful army under Sir George Prevost was defeated through the destruction, off Plattsburg, of the supporting squadron by an American fleet under MacDonough. This practically closed the war on the northern frontier. On the Atlantic coast the years 1812 and 1813 were marked by the gallant efforts of the six or eight American frigates, and as many sloops of war, to sustain themselves against the numerous cruisers, and, later, the powerful fleets, of England. In spite of victories in single combat which reflected the highest credit on American seamanship and courage, the few armed vessels of the United States were one by one captured by superior force or blocked up in the northern harbors, and in 1814 the British fleets cruised pretty much unhindered along the whole coast, depredating and destroying at will, though American privateers still swarmed over the seas inflicting great damage upon British commerce. In Aug., 1814, a British army under Gen. Ross, supported by a powerful fleet under Admirals Cockburn and Cochrane, captured Washington after an insignificant conflict at Bladensburg, and burned the Capitol and the President's mansion. In September the same force attacked Baltimore, but both the army and the fleet were beaten off, Gen. Ross being killed at North Point. The third theatre of war was at the South-west. The Creeks of Alabama having taken up arms, Gen. Andrew Jackson with a body of Western levies invaded their country, and defeated them with great slaughter at Tohopeka in Mar., 1814, compelling the cession of the larger part of the Creek lands. In the summer of the same year a British party occupied Pensacola, then claimed by the Spaniards, and later assaulted unsuccessfully Fort Bowyer near Mobile. In December the British advanced to a formidable attack on New Orleans, and Jackson prepared for its defence. A night-attack was made (Dec. 23) on the British camp, for which considerable effect has been claimed; but on the 8th of Jan., 1815, the British commander advanced with greatly superior force against the American lines, and was repulsed, himself, his second in command, and 2000 men falling in the attack, while the American loss was less than 100. Meanwhile, peace had already been concluded at Ghent, Dec. 14, 1814. By the articles of the treaty all conquests on both sides were to be restored, while the questions of search and impressment were not mentioned.

With the war of 1812–15 closed what may be called the first era of the political history of the United States—the era when the foreign relations of the country engrossed public attention. The second era, which extended from 1816 to 1843, was the era in which financial and industrial questions assumed supreme importance before the country, and gave purpose and passion to party. The war with England had, by cutting off the foreign supply, called into existence considerable manufactures of iron, of cotton, and of wool, which on the return of peace were threatened with destruction. Moreover, England had, by the corn laws of 1815, set the example of attempting to stereotype war-prices for the time of peace. But the strongest impulse to protection came from the South, where the cotton-planting interest desired the creation of a home-market. Upon the recommendation of Pres. Madison, and under the leadership of Calhoun and Lowndes of South Carolina, the first distinctively protective tariff of the United States was enacted in 1816. The charter of the first United States

Bank had expired in 1811 without renewal. The second, with a capital of $35,000,000, one-fifth owned by the government, which had a corresponding share in the direction, was chartered by Congress, after a severe struggle, in 1816.

The course of the Federal party had been downward. At the elections of 1812 the imminence of war and the unpopularity of the Embargo and Non-intercourse acts had given them a temporary strength, and at the election of that year they had polled 89 electoral votes for DeWitt Clinton against 128 for Madison, with whom was elected Elbridge Gerry of Massachusetts as Vice-President. But the opposition of the Federalists during the war, as shown in the refusal of the Federal governors of two States to allow their militia to march at the orders of the national executive, and in the holding of the Hartford Convention in Dec., 1814, at which measures for restricting the authority of the general government were discussed, and which was charged with being in the interest of a separate New England confederation, practically destroyed the party. At the election of 1816, James Monroe of Virginia —who, upon the resignation of Robert Smith on the ground of his opposition to the war with England, had become secretary of state in 1812—was elected President by 183 votes, against 34 Federal votes for Rufus King, all from the States of Massachusetts, Connecticut, and Delaware. At the election of 1820, Mr. Monroe received every electoral vote but one, and the so-called era of good-feeling began, with party lines wholly obliterated. D. D. Tompkins of New York was chosen Vice-President. Mr. Monroe constituted the cabinet as follows: John Quincy Adams, secretary of state, William H. Crawford of the treasury, John C. Calhoun of war, B. W. Crowninshield of the navy, William Wirt, attorney-general. Among the principal events of Mr. Monroe's administration were—1st, Jackson's successful expedition against the Seminoles in 1818; 2d, the cession of Florida, embracing about 60,000 sq. m., by Spain in 1819, for the sum of $5,000,000; 3d, the enunciation by the President, in his annual message in 1823, of the so-called "Monroe doctrine"—that is, that all attempts of European governments to acquire new territory on the American continent, or to reconquer provinces that had achieved independence, would be regarded as hostile acts; the declaration being especially aimed at Spain, whose South American colonies had revolted, and had been acknowledged as republics by the United States; and, 4th, the tariff of 1824, by which the system of protection to American manufactures inaugurated in 1816 was extended and fortified. But the chief political measure of this administration was the Missouri Compromise. It was the era of new States. Indiana had been admitted in 1816, Mississippi in 1817, Illinois in 1818, and Alabama in 1819. After the preliminary steps had been taken for forming a State government in Alabama, Missouri applied for admission. Of the nine States already admitted since 1789, four had been free States, five slave States. It was now claimed to be the turn of the free States. Great opposition was made to the admission of Missouri with slavery; intense feeling became aroused North and South, and threats of disunion were loudly made. Various propositions for compromise were rejected, but the admission of Maine in 1820 as a free State formed out of the territory of Massachusetts, prepared the way for an amicable adjustment, and a compromise was reached by which Missouri was admitted as a slave State, while slavery was for ever prohibited in all unorganized territory N. of 36° 30′. This was the first, and one of the most bitter, of the struggles relating to slavery under the Constitution.

At the Presidential election of 1824 four candidates, all calling themselves Republicans, were voted for in the electoral college. Andrew Jackson of Tennessee received 99 votes; John Quincy Adams of Massachusetts, 84; William H. Crawford of Georgia, 41; Henry Clay of Kentucky, 37. The election devolved upon the House of Representatives, whose choice was by the Constitution confined to the three highest candidates. Mr. Clay being thus thrown out, his friends united with those of Mr. Adams, and the latter was elected, receiving the votes of thirteen States, while seven voted for Jackson and four for Crawford. This unexpected alliance of Clay and Adams, taken in connection with the appointment, which followed, of the former as secretary of state, led to the charge of "a corrupt coalition," which was urged with great bitterness at the time, and was reiterated at a subsequent period; the correspondence of Clay, Jackson, and Buchanan, together with the speeches in Congress on the subject, forming a conspicuous feature in the political literature of the United States. The other members of the cabinet were Richard Rush, secretary of the treasury, James Barbour of war, S. L. Southard of the navy, William Wirt, attorney-general. The chief events and measures of Mr. Adams's administration were—1st, the appointment, against violent opposition in Congress, of envoys to represent the United States at Panama in a proposed congress to be composed of representatives of the principal American states—a scheme in the spirit of the Monroe doctrine, but which was abandoned, through, first, the death of the United States envoy, and subsequently through revolutions in Central America; 2d, a controversy with the State of Georgia, arising out of the action of the general government in protecting the Creek Indians against the efforts of the State authorities to extrude them under cover of a pretended treaty, during which Gov. Troup threatened open war and the State militia were embodied; 3d, a series of complications, resulting, fortunately, in the negotiation of the Gallatin treaty, by which trade was opened between the United States and the English West Indies; and 4th, the tariff of 1828, by which the protective system instituted in 1816 and extended in 1824 was carried to the highest point, the position of the several sections on this question being now reversed—New England, under the lead of Daniel Webster, advocating high duties, while the South, under the lead of Calhoun, who was the virtual author of the tariff of 1816, denounced the existing system and its proposed extension as unconstitutional.

Mr. Adams, a former Federalist, and the son of a Federal President, had been elected President in 1824, the distinction of Federalist and Republican being no longer formally maintained. But grave differences of political feeling and of constitutional theory did not lose their power for want of names to characterize them. From the day of Mr. Adams's election he was the subject of unceasing attacks having in view his defeat in 1828. Especially in the Senate, where the ablest leaders were in opposition, was the war of resolutions, motions, and speeches most fiercely carried on. The President, on his side, instead of assuming the initiative, promptly occupying the field, and by the use of his power and patronage recruiting as largely as possible that as yet unnamed political entity which was to become known as the Whig party, sought to remain the President of the whole country. As a result, the opposition by its aggressiveness won over all the loose elements of the political field, especially among young men having no party traditions, and acquired at this time that power and cohesiveness which has characterized the Democratic party. For at this period the word "Democrat," which at an earlier date had been almost a term of offence, self-assumed by only the most advanced French sympathizers, had come to supplant the word "Republican." At the election of 1828, Mr. Adams, styling himself a National Republican, was defeated by Gen. Jackson, who received 178 out of 261 votes in the electoral college. Calhoun, who in 1824 had been elected Vice-President with Adams, was re-elected. The cabinet was constituted of Martin Van Buren, secretary of state, Samuel D. Ingham of the treasury, John Eaton of war, John Branch of the navy, John M. Berrien, attorney-general. Heretofore, the postmaster-general had not been a member of the cabinet, but Gen. Jackson now appointed William T. Barry postmaster-general, with a seat at the council-board. Immediately, the maxim "to the victors belong the spoils" was put in force. Hundreds of removals from office took place in the first six months of this administration, and the civil service became, as it has remained, prostituted to the purposes of party.

The Southern States had been deeply dissatisfied at the tariff of 1828, having become convinced that a home-market for their cotton-crop was a matter of indifference, while the protection of cotton, woollen, and hempen goods and of iron manufactures at the North was in no small degree at their expense. South Carolina and Georgia had, as States, formally protested against a tariff for protection as unconstitutional. In 1832, South Carolina held a convention which proceeded to "nullify" the obnoxious acts as an invasion of the rights of the States. The ground of the "nullifiers" was that of the resolutions of 1798–99—viz. that there being "no common judge" between the States and the nation (the office of the Supreme Court, in this regard, being disowned by this party, as it invariably was by Jefferson), each State remained the proper judge for itself both "of the fact of an infraction" of the terms of "the Federal compact" and "of the mode and measure of redress." The tariff acts were declared null and void, the collection of customs duties within South Carolina was prohibited, and the convention announced that any attempt by the United States to enforce such collection would be deemed a dissolution of the Union. It was in this emergency that Jackson issued his famous proclamation, drawn by Edward Livingston, who had succeeded Van Buren as secretary of state, in which the rights and powers of the government of the United States were asserted in the fullest degree. Everything portended war. The governor of

South Carolina, Robert Y. Hayne, the antagonist of Webster in the debate on Foot's resolution in the Senate three years previous, put the State in a condition for defence, while United States troops were forwarded to reinforce the garrison of Charleston. At this juncture Virginia offered her mediation, in the very act of doing so corroborating the position of South Carolina, that a State may assert itself, by its own agencies, against the general government, instead of seeking redress and relief through the Supreme Court. At the same time, Henry Clay, in the Senate, appeared as the advocate of concession, and succeeded in carrying through the compromise tariff of 1833, by which the duties of 1828 were to be reduced in ten years, by a sliding scale, to a general rate of 20 per cent. This concession and the mediation of Virginia were accepted by South Carolina, and the ordinance of nullification was repealed.

The second Bank of the United States, chartered, as has been said, in 1816, for twenty years, had still seven years to live when Gen. Jackson was inaugurated, but its doom was sealed. The President's hostility was shown in his first message, and the bill for recharter which passed Congress in 1832 was vetoed. In the face of favorable reports from the treasury and from committees of both Houses of Congress, Gen. Jackson determined that the United States deposits should be withdrawn. This, however, by law, could be the act of the secretary of the treasury alone. Mr. McLane, who had succeeded Ingham in the treasury department, and had shown himself moderately favorable to the bank, had opportunely been translated to the state department. William J. Duane, who succeeded, refused to do the President's bidding in the matter of the deposits, and was replaced by Roger B. Taney, who had succeeded Berrien as attorney-general in the general cabinet overturn of 1831. Taney did the task for which he was appointed, and in 1833 the government deposits were placed in State banks. The United States Bank, as a national institution, had received its deathblow; after a brief struggle against the enmity of the administration, it accepted a charter from Pennsylvania, and went down in the great storm of 1837–41. The bank was charged by Gen. Jackson with many technical violations of its charter, with expending money for political purposes, and with using its vast power of discount with favoritism toward some and malignity toward others.

Gen. Jackson was re-elected in 1832 by 219 electoral votes, against 49 for Henry Clay of Kentucky, 11 for John Floyd of Virginia, and 7 for William Wirt of Maryland, the latter being the candidate of the anti-Masonic party. For years, under the high tariff of 1824 and the higher one of 1828, together with the large sales of public lands, the revenue had been in excess of the ordinary expenditures by 25, 50, and even 100 per cent. As a result, the public debt, which at the close of the war in 1815 had amounted to 127 millions, was rapidly reduced, and in 1835 was extinguished. This excess of revenue had proved a powerful weapon in the hands of the advocates of tariff-reduction in the struggle of 1828–33. It now became a serious embarrassment to the administration. What to do with the surplus was the great question of 1833–36. In the latter year the monstrous expedient of depositing $28,000,000 in the several State treasuries was resorted to. The division of this sum was according to population, although the money, having been largely raised by indirect taxation, had originally been contributed according to the consumption of taxed articles, which varied greatly among the several States and sections. The occurrence of the financial crisis in 1837 relieved the government from any further embarrassment of this nature.

During the administration of Pres. Jackson the two domestic questions of Masonry and slavery led to great agitation of the public mind. The abduction and presumed murder of Morgan in New York for betraying the secrets of the Masonic order led to the formation of an anti-Masonic party, which, however, proved unable to sustain itself in the face of a more exciting issue. No political party was yet formed adverse to slavery, but anti-slavery societies had commenced the agitation of the subject at the North and the "moral invasion of the South" through pamphlets and newspapers, leading to many riotous acts, and to efforts, through Congress and the administration of the post-office, to suppress the circulation of "incendiary documents." Two Indian wars—one (1832) known as the "Black Hawk war," against the Sacs and Foxes of the North-west, the other (1835–36) against the Seminoles of Florida under their leader Osceola, extending later to the Creeks—had their origin in the prosecution of the policy inaugurated by Pres. Monroe of removing the Indians W. of the Mississippi. In each the Indians were subdued, though in the latter case not without some dishonor to the United States on the score of treachery. The foreign policy of Gen. Jackson was throughout vigorous. Denmark, Naples, Spain, and Portugal satisfied claims of long standing for spoliations on American commerce, while France, after diplomatic complications which at one time threatened war, paid over $5,000,000 on account of depredations committed more than thirty years before.

Gen. Jackson, though declining a third term in deference to the example of his predecessors, was able to determine the succession, and Martin Van Buren of New York was elected President in 1836, receiving 170 votes against a divided opposition—now known as the Whig party, corresponding in many features to the Federal party of the earlier time. William Henry Harrison of Ohio received 73 votes, Hugh L. White of Tennessee 26, Daniel Webster of Massachusetts 14, W. P. Mangum 11. No one having received a majority of the votes for Vice-President, Richard M. Johnson of Kentucky was chosen by the Senate out of the two highest names on the list, this being the only occasion on which the Senate has been so called to act. Upon Van Buren's administration fell the financial distress which had been generated in the preceding administration, whether due, as the Whigs claimed, to the removal of protection from American manufactures by the compromise tariff of 1833, to the shock given by the war on the bank, and the excess of worthless issues by the State banks when that great regulative institution was destroyed, or due, as the Democrats claimed, to the speculation induced by the operations of the bank before the deposits were withdrawn, which operations, in their opinion, justified that withdrawal. In May, 1837, the banks of New York and other cities suspended payment, and widespread bankruptcy ensued. A second and more severe commercial shock occurred in 1839. The ordinary agencies of trade and exchange were largely destroyed, industry was paralyzed, and the revenue of the government fell sharply off. It was not until 1842 that prices and wages reached the minimum, and a revival of business with a restoration of confidence began. During the later years of this crisis eight States in whole or in part repudiated their obligations, either as to the interest or the principal. Except Lewis Cass, secretary of war, Mr. Van Buren retained all the members of Gen. Jackson's latest cabinet—namely, John Forsyth, secretary of state, Levi Woodbury of the treasury, Mahlon Dickerson of the navy, B. F. Butler, attorney-general, and Amos Kendall, postmaster-general, though he subsequently made several changes. His secretary of war was Joel R. Poinsett. The chief financial measure of Van Buren's administration was the establishment of the sub-treasury system, by which the public moneys were to be kept in government offices until required for current expenses, instead of being kept in banks, State or national. This scheme was proposed in Mr. Van Buren's first annual message (1837), but only adopted in 1840, to be repealed the next year, when the Whigs came into power. A serious difficulty, threatening the peace of the United States, arose from the acts of certain American sympathizers with the insurrection which took place in Canada in 1837. A steamer (the Caroline) in this interest was destroyed on the American shore by a detachment of British troops, and the act avowed by the British government as done in self-defence. Three years later a Canadian sheriff was arrested in New York on the charge of murdering an American citizen who had perished on the Caroline, and tried by the State authorities against the protest and threats of the British government, which demanded his release on the ground that the act was done under its authority. Fortunately, the prisoner was acquitted on the evidence.

The long-continued financial and industrial distress of Van Buren's administration had lost the Democratic party, for the time, its hold on the country, and Gen. William Henry Harrison of Ohio, with John Tyler of Virginia as Vice-President, was chosen in 1840 by 234 electoral votes, against 60 for Van Buren. At this time a "Liberty party" was formed in the anti-slavery interest, which polled about 7000 of the nearly 2,500,000 votes cast. From the inauguration of the government under the Constitution, the scheme of nominating candidates for the Presidency and Vice-Presidency had been by a caucus of the members of Congress of each party, but this had become discredited when the Republican party in 1824 repudiated the nomination of Crawford. By 1840 the scheme of national conventions, consisting of delegates chosen by the voters of the party throughout the United States, had been fully inaugurated, and has continued the accepted method of nomination ever since.

The Whig party, having come into power on the issue of opposition to the sub-treasury and a demand for protection to American manufactures, repealed the sub-treasury —or, more properly, the independent treasury—act in 1841, and in 1842 enacted a tariff by which the existing duties were largely increased. But in other respects that party

was doomed to disappointment. Gen. Harrison had scarcely constituted his cabinet when, within one month of his inauguration, he died. Mr. Tyler, who succeeded to the Presidency, had never been a Whig, but had been selected by the Whigs for his antagonism to Mr. Van Buren, the leader of the Northern and more moderate wing of the Democratic party. His veto of a bill chartering a new national bank led to an open quarrel with the party which elected him, and to the resignation of the entire cabinet except Daniel Webster, secretary of state. For his course in remaining in office Mr. Webster was severely blamed, but he was able afterward to point for his justification to the so-called Webster-Ashburton treaty, which he negotiated with England in 1842, by which the claims of the United States in several important particulars were fully conceded, and every question in dispute between the two nations, excepting that relating to Oregon, was finally adjusted. For this much was due to Mr. Webster, more perhaps to the logic of events. The thirteen States had become twenty-six (Arkansas having been admitted in 1836, Michigan in 1837, the first since Missouri in 1821), the four millions of people had become eighteen. What was denied to Jay, Madison, Monroe, Pinckney, Adams, and Gallatin was easily conceded to Webster.

A motive was now found sufficient to restore the Democratic party to power. Texas had been largely colonized between 1821 and 1835 from the Southern States. In the latter year it revolted from Mexico, and the next year asserted independence, with the unquestioned purpose of ultimately joining the United States. Independence in fact was soon achieved under the leadership of Houston, and Texas in 1837 offered herself for admission to the Union. The accession was desired by the Southern States, both on account of kinship and for the opportunity that would thus be afforded for extending slave-labor over new soil. The national instinct of territorial aggrandizement came to reinforce these motives, especially in view of the probability that England or France might seek to become the protector of the republic. Throughout the administration of Van Buren the movement acquired but little headway. Pres. Tyler, a man of strong Southern feelings, the only Senator who voted against the Force bill for compelling the obedience of South Carolina in the nullification contest, warmly approved of annexation, and a treaty to that effect was negotiated by Mr. Calhoun in 1844, which was rejected by the Senate. The question thus became the principal issue at the election of that year. The Whigs, having their main strength at the North, opposed the annexation of Texas in the interest of slavery, and nominated Henry Clay of Kentucky. The Democrats threw over Mr. Van Buren on account of his opposition to annexation, and nominated James K. Polk of Tennessee, a strong advocate of that measure. Polk received 170 electoral votes, Clay 105, but before the inauguration of Mr. Polk a resolution for the incorporation of Texas was passed by Congress and signed by Pres. Tyler Mar. 1, 1845. Florida and Iowa also came in as States about the same time.

Pres. Polk formed his cabinet as follows: James Buchanan, secretary of state, Robert J. Walker of the treasury, William L. Marcy of war, George Bancroft of the navy, Cave Johnson, postmaster-general, John Y. Mason, attorney-general. The annexation of Texas involved war, inasmuch as Texas and the United States claimed the territory to the Rio Grande, while the Mexican government insisted that Texas only embraced the territory bounded by the river Nueces. Upon this issue hostilities commenced early in 1846. Congress voted men and money, and Gen. Zachary Taylor, commanding the forces on the Rio Grande, entered Mexico and fought the victorious battles of Palo Alto (May 8) and Resaca de la Palma (May 9), and, after being reinforced by volunteers under Gens. Worth and Wool, captured Monterey Sept. 23. In February of the next year he was attacked in position at Buena Vista by a large Mexican force under the president, Santa Anna, who was repulsed with great loss, and retreated, leaving Taylor in full possession of the north-eastern provinces.

Meanwhile, New Mexico had been occupied by the United States troops, and an invasion of Chihuahua took place with partial success. At about the same time a band of Americans under Capt. John C. Fremont of the United States army declared the independence of California at Sonora July 4, 1846, and with the co-operation of a fleet under Com. Sloat, soon superseded by Stockton, succeeded in reducing that province. But the army which was to decide the issue of the war was gathering for a movement up the valley of Mexico. In Mar., 1847, Vera Cruz, long deemed impregnable, was reduced after three days' bombardment, and Gen. Winfield Scott, with about 10,000 troops, mainly regulars, commanded by Gens. Worth (who had been detached from Taylor's army), Pillow, Quitman, and Twiggs, moved on Cerro Gordo, where Santa Anna was posted with a superior force. This position was carried Apr. 18 and 19, but Gen. Scott awaited reinforcements, having lost many men by the expiry of their enlistments. In August he entered the valley of Mexico, which Santa Anna defended with 35,000 men. Sanguinary battles followed: Contreras, Aug. 19, 20; Churubusco, Aug. 20; Molino del Rey, Sept. 8; Chapultepec, Sept. 12, 13; and on Sept. 14, Gen. Scott, with 6500 men, all that remained of the invading column, entered the City of Mexico. The capture of the Mexican capital practically concluded the war, and by the treaty of Guadalupe Hidalgo, Feb. 2, 1848, Mexico ceded the whole of Texas, New Mexico, and Upper California, while the United States paid $15,000,000, besides assuming certain claims of its citizens against Mexico on account of long-continued depredations in the Gulf, which had been the subject of negotiations since 1837, to the amount of more than $3,000,000. The United States subsequently (1850) paid Texas $10,000,000 on account of her claims to territory not included within the limits of the State.

While war was waging with Mexico a rupture was threatened with Great Britain on account of the conflicting claims to Oregon. The United States claimed as far N. as 54° 40′; Great Britain claimed the mouth of the Columbia. The territory in question had long been in joint occupation, but all attempts at compromise had failed. At the election of 1844 one of the watchwords of the Democratic party had been "Fifty-four Forty, or Fight!" and Pres. Polk gave formal notice that the United States receded from the arrangements for joint occupation that had subsisted. At this serious juncture Great Britain offered terms which were accepted, by which the 49th parallel became the boundary-line of the United States on the N. W., while Vancouver's Island was relinquished to Great Britain. The failure in the treaty to define the status of the smaller island of San Juan led to further complications, which were not settled till 1871.

The important financial measures of Polk's administration were the permanent re-establishment of the subtreasury system in 1846, and the tariff of the same year, by which duties were reduced. The election of 1848 found a third party in the field. The Liberty party had polled about 7000 votes in 1840, and over 60,000 in 1844. In Aug., 1848, a convention at Buffalo, comprising the members of the Liberty party, with others, many of them Democrats, and some Whigs, disaffected by the course of the old parties respecting slavery, put forward a declaration of principles, and presented as a candidate for the Presidency Martin Van Buren of New York, with Charles Francis Adams of Massachusetts for the Vice-Presidency. The new party succeeded in polling nearly 300,000 votes, though, as it carried no State, it cast no vote in the electoral college. Its leading principle was opposition to the extension of slavery into new territory, and to the admission of new slave States out of territory already acquired. Slavery was to be sectional, freedom national—slavery to be local and exceptional, only to exist where protected by the laws of States already members of the Union; freedom was to be the general law of the land. These principles were regarded as embodied in the "Wilmot proviso," a proposition offered in 1846 by David Wilmot of Pennsylvania in prospect of the acquisition of territory from Mexico through the war then waging. The Democrats, who had accomplished the annexation of Texas and had conducted the Mexican war to its successful termination, nominated Lewis Cass of Michigan. The Whigs nominated Gen. Zachary Taylor of Louisiana for President, and Millard Fillmore of New York for Vice-President, on a platform intended to conciliate the anti-slavery sentiment of the country. Taylor was elected by 163 votes against 127 for Cass. His cabinet consisted of John M. Clayton, secretary of state, William M. Meredith of the treasury, George W. Crawford of war, William B. Preston of the navy, Thomas Ewing of the interior (that office having just been created), Jacob Collamer, postmaster-general, Reverdy Johnson, attorney-general. A little more than a year after his inauguration—viz. on July 9, 1850—Gen. Taylor died; Mr. Fillmore succeeded to the Presidency. The cabinet was entirely reconstructed, as follows: Daniel Webster, secretary of state, Thomas Corwin of the treasury, Charles M. Conrad of war, William A. Graham of the navy, A. H. H. Stuart of the interior, N. K. Hall, postmaster-general, J. J. Crittenden, attorney-general.

Congress and the country were already in heated conflict, arising out of the proposed extension of slavery to the new territory acquired by the treaty with Mexico. California had in 1849 formed a constitution prohibiting slavery, and applied for admission as a State. The Southern State Rights party, led by Calhoun, demanded the rejection of California, as well as a guaranty, through an amendment to the Constitution, against the further pro-

scription of slavery. New Mexico also appeared as an applicant for admission, while Texas made extensive claims upon the territory of New Mexico. Another imagined crisis of the Constitution ensued, and in 1850, Henry Clay again appeared as a pacificator, proposing and carrying the Compromise measures of that year, by which, on the one hand, California was admitted without slavery and the slave-trade was prohibited within the District of Columbia, and, on the other hand, extensive concessions were made to Texas, and the rendition of fugitive slaves was sought to be secured by stringent provisions. As to Utah and New Mexico, the issue was for the time avoided by leaving them under Territorial governments and remitting the question of slavery to the inhabitants. The series of measures constituting "the Compromises of 1850" passed Congress and were approved by Mr. Fillmore in September. The most important measures concerning the foreign relations of the United States in this administration were the so-called "filibustering" expedition to wrest Cuba from Spain, which resulted in the capture and execution of many of the adventurers, and the negotiation of a treaty with Japan by Com. Perry, who had entered the waters of that country with a fleet for that purpose.

The election of 1852 found both the great political parties striving to keep out the agitation of the question of slavery, insisting on the Compromise of 1850 as "a finality." Many of the dissatisfied Democrats who had voted for Van Buren in 1848 had gone back to their party, and the "Free-Soil" popular vote of 1852 was little more than half that of the election previous. Gen. Scott, who had been nominated by the Whigs, was defeated, receiving but 42 electoral votes, all from four States, against 254 votes for Gen. Franklin Pierce, who, with William R. King of Alabama for Vice-President, had been nominated by the Democrats. Pres. Pierce's cabinet consisted of William L. Marcy, secretary of state, James Guthrie of the treasury, Jefferson Davis of war, James C. Dobbin of the navy, Robert McClelland of the interior, James Campbell, postmaster-general, Caleb Cushing, attorney-general. In 1853 the United States acquired, by purchase from Mexico, the tract S. of the river Gila in Arizona and New Mexico, containing 45,535 sq. m., known as "the Gadsden purchase." Early in 1854, Stephen A. Douglas of Illinois, the most conspicuous of the younger leaders of the Democratic party, introduced into the Senate a bill for the organization of Territorial governments in Kansas and Nebraska, preparatory to their admission as States. By the Missouri Compromise of 1820 slavery was to be for ever excluded from that region, but the Kansas-Nebraska bill repealed this provision, leaving the question to be determined by the inhabitants themselves, under the principle advocated by Mr. Douglas, known as "squatter sovereignty." This attempt to leave the Territories open to slavery encountered earnest resistance from the Whigs and the few "Free-Soilers" in Congress, and aroused intense indignation in many portions of the North. The bill was, however, firmly pressed, and became a law in May. A contest at once began for the colonization of Kansas, the more southerly of the two Territories, active efforts being made in the free States to induce migration hostile to slavery, while the opposing party sought to secure Kansas both through immigration and through periodical raids from the border counties of Missouri. Violence was freely resorted to, and many undoubted wrongs were perpetrated. This struggle, which at times amounted to civil war, continued through the presidency of Mr. Pierce, and was bequeathed to his successor. The anti-slavery sentiment of the North was still further inflamed by a conference between the American ministers to France, Spain, and England, which resulted in their issuing a circular known as "the Ostend manifesto," favoring the acquisition of Cuba in the interest of slavery, and by a violent assault made in 1856 by Preston S. Brooks of South Carolina, for words spoken in debate, upon Senator Charles Sumner of Massachusetts, who, with Chase of Ohio and Seward of New York, had led the opposition to the repeal of the Missouri Compromise. The Free-Soil party of 1848 and 1852 now passed into the Republican party, which for the election of 1856 nominated John C. Fremont on a declaration of opposition to the extension of slavery into the Territories. So strong had become the sense of the inadequacy of the Whig party to offer resistance to the encroachments of the slavery propagandists that the popular vote for Fremont rose above 1,300,000. This, while nearly half a million short of the vote for Buchanan, the Democratic candidate, was yet half a million in excess of the vote for Fillmore, the former President, who had been nominated by the Whigs. In the electoral college, Buchanan received 174 votes, Fremont 114, Fillmore, 8. This passage of the Whigs into the Republican party was assisted by a violent popular agitation in 1854 against the political influence of foreigners who had been naturalized as citizens of the United States. These generally voted with the Democratic party. This agitation against foreign influence led to the formation of a secret political society known as the Native American, more popularly as the Know-Nothing order, which in 1854 carried several States and elected many members of Congress, but in 1856 fell away in the presence of the more exciting issue of slavery, as the anti-Masonic party had done in 1832. On the last day of Mr. Pierce's administration (Mar. 3, 1857), a tariff bill passed Congress which greatly reduced the customs duties of 1846. Mr. Buchanan, who as American minister to England had taken part in the Ostend conference, constituted his cabinet of Lewis Cass, secretary of state, Howell Cobb of the treasury, J. B. Floyd of war, Isaac Toucey of the navy, Jacob Thompson of the interior, A. V. Brown, postmaster-general, and J. S. Black, attorney-general.

The troubles in Kansas still continued to agitate the entire country. In the struggle between the Free-State and the Slave-State parties the power of the administration was thrown in favor of the latter, and the party in Congress, in spite of the opposition of a minority of its members headed by Stephen A. Douglas, carried through a bill submitting to the people of Kansas for ratification the so-called Lecompton constitution, which had been framed by the pro-slavery party, constituting an unmistakable minority of the State. Meanwhile, several of the Northern States passed acts intended to assert the personal liberty of their citizens against certain of the provisions of the Fugitive-slave laws, which were deemed unconstitutional, by securing a jury trial and the privilege of habeas corpus in the cases of alleged fugitives from service. On the other hand, the Supreme Court, of which Roger B. Taney, once Gen. Jackson's attorney-general and secretary of the treasury, was chief-justice, decided in the "Dred Scott" case in favor of the claim of the extreme Southern State Rights partisans, that the slaveholder should be allowed to carry his property with him anywhere under the protection of the Constitution. The question of slavery had now become the one question of national politics, and it was evident that, as the Whig party had been rent by the antagonisms developed by this issue, the Democratic party was to be likewise disrupted in the efforts of the Southern leaders to assert the nationality of slavery. The leader of the more conservative Democrats was Senator Douglas, by whose act in 1854 the question of slavery in the Territories had been reopened after the settlement of 1820. The approaching conflict of arms was intimated toward the close of Mr. Buchanan's administration by the attempt of John Brown, formerly a leader of the Free-State party in the Kansas struggles, to seize the United States armory at Harper's Ferry, Va., for the carrying out of certain plans he had formed for the wholesale escape of the slaves of that region. After a brief success and a fierce resistance, Brown and his party were overcome by a detachment of United States troops, and Brown and his surviving followers were given up to the State authorities for trial.

Among other events and measures of Buchanan's administration must be noted the expedition under Col. Albert S. Johnston against the Mormons in Utah, to assert the authority of the government, which had been defied by Brigham Young; the admission of Minnesota as a State in 1858, and of Oregon in 1859; but particularly the commercial and financial crisis of 1857, which began in September with the failure of a large trust company in New York, producing a panic which spread rapidly, until in two or three weeks' time the banks had generally suspended and numerous failures, mainly commercial, had occurred. The recovery from the effects of this disaster was, however, very prompt, and no long suspension of industry resulted. The disruption of the Democratic party, in consequence of the manner in which the issue of the nationality of slavery was pressed by the Southern wing, occurred at the national convention held at Charleston in Apr., 1860, for the nomination of Mr. Buchanan's successor, when the majority of the Southern delegates withdrew upon the passage of a resolution declaring that the constitutional status of slavery should be determined by the Supreme Court. In consequence of the secession, the convention was adjourned till June, when Mr. Douglas was nominated. The seceding delegates met later in convention and nominated John C. Breckenridge of Kentucky, who had been Vice-President with Buchanan. A convention representing what was called the "Constitutional Union" party, embracing many former Whigs, with what was left of the "Native American" party, nominated John Bell of Tennessee, with Edward Everett for Vice-President. The Republican national convention nominated Abraham Lincoln of Illinois, with Hannibal Hamlin of Maine for Vice-President, on a declaration of principles which, while leaving "inviolate the

rights of the States, and especially the right of each State to order and control its own domestic institutions," made freedom "the normal condition of all the territory of the United States." The geographical division of the electoral vote which resulted is, unhappily, of great significance. Mr. Douglas received 12 votes from Missouri and New Jersey; Mr. Bell received 39 votes from Virginia, Kentucky, and Tennessee; Mr. Breckenridge received all the Southern votes remaining, 72 in number; Mr. Lincoln received all the Northern votes remaining, 180 in number, and was elected.

The canvass preceding the election had been highly exciting. Extensive preparations for conflict followed at the South, with a general arming and drilling of the population. The Southern leaders declared the election of a President pledged to oppose the extension of slavery to be a moral invasion of the slave States, and a violation of their constitutional rights. South Carolina led in secession in Dec., 1860; other slave States followed, and in February their delegates met in convention at Montgomery, Ala., and framed a constitution for "the Confederate States of America." Jefferson Davis of Mississippi was chosen President, Alexander H. Stephens of Georgia Vice-President. Apr. 12 the troops of South Carolina opened fire on the United States garrison of Fort Sumter in Charleston harbor, which two days later surrendered. The news of actual conflict overcame alike the scruples of the Democrats at the North and of the Unionists at the South, and each section went into the war practically entire. Eleven States, with an aggregate population of nine millions, were arrayed against the government. Kentucky, Maryland, and Delaware remained in the Union, though the two former furnished many soldiers to the Confederate armies.

Mr. Lincoln had been inaugurated on Mar. 4. His cabinet was constituted as follows: William H. Seward, secretary of state, Salmon P. Chase of the treasury, Simon Cameron of war, Gideon Welles of the navy, Caleb B. Smith of the interior, Montgomery Blair, postmaster-general, Edward Bates, attorney-general.

The day following the surrender of Sumter, the President issued a call for 75,000 militia, which were put under arms in a surprisingly short time. The strong sympathy with secession in Baltimore led to an attack by a mob upon the 6th Massachusetts regiment, *en route* for Washington, Apr. 19, in which several soldiers were killed. A military occupation of the city soon suppressed the rebellious sentiment, and the arriving militia took position along the Potomac in defence of Washington, already menaced by the Confederates. In May a second call for men to about the same extent was made. The regular army of the United States could do little in such a contest. It mustered only about 15,000 men of all arms, and its efficiency had been greatly impaired by the resignation of many officers from the South. It had, moreover, been widely dispersed during Mr. Buchanan's administration, while large stores of arms and military supplies had been sent into the seceding States, to be seized by the Confederates or destroyed to avoid seizure. The forts in the Southern States fell at once into the hands of the Confederates, with two important exceptions—Fort Pickens at Pensacola, and Fort Monroe at Old Point Comfort, Va.

The operations of the war had, on the part of the Union commanders, two prime objects—at the East, the capture of Richmond, which had become the capital of the Confederacy; at the West, the opening of the Mississippi, which had been closed by the erection of Confederate fortifications on the banks. The former of these objects was sought through many campaigns of the Army of the Potomac under several successive commanders. Richmond might be assailed by five routes: the first, "the overland route," in which the Rappahannock and the Rapidan rivers were to be crossed, and supplies mainly drawn from Washington by rail; the second, a modification of the first, by which an army should be transported to Fredericksburg, thence take up the march across the North Anna and Pamunkey rivers, supplies being drawn from Fredericksburg, and afterward from a dépôt on the Pamunkey; the third, the Peninsular or James River route, by which troops should be transported to Fort Monroe, and thence moved up the peninsula of Virginia, its movements aided and its communications maintained through river-fleets having command of the James River on the one side, and of the York, and afterward the Pamunkey, on the other, with successive dépôts established on the latter two rivers; the fourth, a modification of the third, by which the final decisive operations should be S. of the James, directed to the capture of Petersburg on the Appomattox, severing the communications of Richmond with the South; last, and least approved, the route through the Valley of Virginia, threatening Richmond from the N. W. The transportation of supplies was here so difficult and so precarious that this route was only taken by comparatively small armies, co-operating with larger forces moving on some other route.

The first of these routes was taken by Gen. McDowell, who in July, 1861, moved with the hastily-equipped militia of that period, and was badly defeated on the 21st at Manassas or Bull Run, by the Confederates under Gens. Beauregard and Joseph E. Johnston. This defeat revealed the inadequacy of the preparations for suppressing the insurrection, and large levies were made of volunteers, raised in regiments by the States and mustered into the service of the United States "for three years or the war." Over the large army thus forming Gen. George B. McClellan, who had already conducted a successful campaign in Western Virginia, by which the Confederate occupation of that section had been terminated, was appointed commander. The autumn and winter were spent upon the organization and equipment of this army, now known as the Army of the Potomac; but in October a brigade under Gen. Stone, stationed on the upper Potomac as a corps of observation, crossed at Ball's Bluff, and was defeated with heavy loss by the Confederate general Evans.

In the spring of 1862, McClellan chose the Peninsular route for his advance with the bulk of the army, while Gen. McDowell, with 35,000 men, was to move from Fredericksburg, and Gens. Banks and Fremont were to operate in the Valley to threaten the western communications of Richmond. The latter commanders were, however, easily foiled and defeated in June by Gen. Thomas J. Jackson, commonly known as "Stonewall Jackson," the most important action being that of Cross Keys. The defeat of Banks and Fremont led to McDowell being retained for the defence of Washington, though the Confederate forces thus engaged were at once used to reinforce those operating against McClellan, who, after besieging Yorktown until its evacuation, had fought the battles of Williamsburg, May 5, and Seven Pines, May 31, the latter within 6 miles of Richmond, where the Confederate general Joseph E. Johnston was wounded, the command devolving upon Gen. Robert E. Lee. The Confederates, reinforced from the Valley, now assumed the aggressive, and drove McClellan back to Harrison's Landing on the James, a series of bloody actions, June 25 to July 1, inclusive, being fought during this "change of base." Of these actions the most important were Gaines's Mills, Savage Station, Glendale, and Malvern Hill. In August the Confederates turned upon Gen. Pope, who had advanced to the Rapidan in command of the combined forces of McDowell and Banks, and drove him in disorder to Washington, a battle very disastrous to the Union armies being fought at Bull Run Aug. 29 and 30, in which a portion of McClellan's army, brought hastily from the James, participated. Of the shattered forces within the defences of Washington, McClellan was again placed in command, though Gen. H. W. Halleck had been appointed commander-in-chief of all the armies of the United States. McClellan at once moved northward to head off Lee, who crossed the Potomac above Harper's Ferry, capturing that place with its garrison of 14,000 men under Gen. Miles. The Union army, forcing the passes of the South Mountain Sept. 14, fought three days later the bloody but indecisive battle of Antietam, which closed the invasion of Maryland. Later in the year McClellan undertook a forward movement, but was superseded by Gen. A. E. Burnside, who with his corps had been brought up from North Carolina to reinforce the Army of the Potomac. Burnside, choosing the second of the routes described, fought on Dec. 13, 1862, a terribly bloody and fruitless battle in the attempt to carry the heights back of Fredericksburg on the Rappahannock. Burnside was superseded by Gen. Joseph Hooker, one of the early division commanders of the Potomac army, who, in attempting to turn the Confederate intrenchments, fought the battle of Chancellorsville, May 1–3, 1863, which resulted in the retreat of the Union armies after great loss.

Impelled by the popular enthusiasm at the South, which was aroused by these two defeats of the Union armies, Gen. Lee in June undertook the invasion of Pennsylvania. Hooker, moving to intercept him, was superseded by Gen. George G. Meade, who three days later fought the great battle of Gettysburg, July 1–3, which compelled Lee's retreat into Virginia. During the fall of 1863, Meade made two attempts upon Richmond by the overland route without success, no important actions being fought. In the spring of 1864, Gen. Grant, having been appointed lieutenant-general after his Western victories (Gen. Halleck being assigned as chief of staff of the armies of the United States), came East to superintend in person the campaign of the Potomac Army, then lying near the Rapidan, of which Gen. Meade retained the immediate command. The forces of Gen. Butler in North Carolina and South-eastern Virginia, known as the Army of the James, were also brought into immediate co-operation. At the same time, Gen. Sigel,

who was soon superseded by Gen. Hunter, moved up the Valley of Virginia in some force, and sharp fighting took place at Newmarket May 15, and at Piedmont June 5. The Army of the Potomac, moving by the overland route, fought the desperate actions of the Wilderness, May 5–6, and of Spottsylvania, May 8–18, and after much fighting on the Tolopotomoy and the North Anna rivers, moved by its left to the S., until on June 3 it made its last attempt to enter Richmond by the direct route in a great charge at Cold Harbor against the identical positions which McClellan had sought to defend against the force of Jackson in the battle known as Gaines's Mills in 1862. After a bloody repulse at this point, Grant swung around S. of Richmond, and united the two armies of the Potomac and of the James in assaults upon Petersburg, June 15, 16, and 18. Failing to carry this place by assault, Grant sought by extending his lines toward the left to cut Petersburg off from its southern connections, and the operations on the Appomattox took on the character of a siege. Much fighting occurred both N. of the James and S. of the Appomattox upon attempts of the Union forces to extend their lines at either end or to force the enemy's positions in front. The most memorable affair was that which occurred on the explosion of a mine (July 30) on the front of Gen. Burnside, who had resumed the command of the 9th corps. The approach of winter found Grant still before Petersburg, his troops occupying a line 30 to 40 miles in length, while Lee's forces, weakened by battle and sickness and the increasing impoverishment of the Southern States, were barely able to man their intrenchments. During the autumn, however, Lee sought to effect a diversion in favor of his forces in Richmond and Petersburg by despatching Gen. Early to the Valley of Virginia, which had been the scene of a disastrous advance by Sigel. After a raid into Maryland, which for a time seriously menaced Washington, and after defeating Gen. Crook, Early was encountered by Gen. Philip H. Sheridan, who had been detached from the command of the cavalry of the Army of the Potomac. The Confederate forces were defeated at Winchester Sept. 19, at Fisher's Hill Sept. 22, and at Cedar Creek Oct. 19.

The opening of the campaign of 1865 saw the Union armies largely reinforced. On the last of March, Sheridan, who had been recalled from the Valley, turned the Confederate right and fought the victorious action at Five Forks, which compelled the abandonment of Richmond and Petersburg. The Confederate troops, retreating rapidly with the purpose to escape into North Carolina, were headed off by the sharp pursuit of Grant, brought to a stand, and compelled to surrender at Appomattox Court-house Apr. 9, bringing the war in Virginia to a close.

During the operations which have been recited of the Potomac Army from 1861 to 1865, two important attempts were made upon the Atlantic coast to effect diversions in favor of that army, and to weaken the enemy, by occupying territory from which their reinforcements and supplies were drawn, and by taking positions which should be a constant threat of movements into the interior. The first of these was the occupation of Beaufort in Nov., 1861, by land and naval forces under command respectively of Gen. T. W. Sherman and Com. Du Pont, and the subsequent investment of Charleston and the sustained bombardment of Fort Sumter and its other defences by Gen. Gillmore, during which an assault upon Fort Wagner on Morris Island (July 10, 1863) was repulsed with severe loss. In spite of all the efforts of the Union armies and fleets, Charleston sustained itself until its surrender was compelled by movements of the Western armies yet to be narrated. The second of these expeditions was that of Gen. Burnside early in 1862 against the coast of North Carolina. Feb. 7, about 2500 Confederate militia were captured, after a brief action, on Roanoke Island; Mar. 14, Newberne was taken after severe fighting, and later several towns on the coast were occupied. In the summer, however, as already related, Burnside with the main body of his troops was called to Virginia, and the occupation of North Carolina was continued by garrisons, with little effect on the Confederates, who could rapidly reinforce their small corps of observation, in case of emergency, from Lee's army, while the Union troops were practically shut off from co-operation with the Army of the Potomac.

At the West the great work of reopening the Mississippi went forward almost steadily from the beginning of 1862, though at the cost of many severe defeats in battle. In January, Gen. G. H. Thomas defeated the Confederates at Mill Spring. In February, Com. Foote of the United States navy reduced Fort Henry on the Tennessee River, and a few days later, after severe fighting, Fort Donelson, with about 15,000 men, was captured by Gen. U. S. Grant. These successes were followed up by the advance of Gen. O. M. Mitchel, and the Confederates lost possession of all Kentucky and a large part of Tennessee. In March, New Madrid in Missouri was occupied by Gen. Pope, who with the co-operation of Com. Foote in April compelled the surrender of Island No. 10 in the Mississippi, with about 7000 Confederates and large supplies, thus clearing the river down to Memphis.

Meanwhile, Grant had advanced to Pittsburg Landing on the Tennessee, where he was attacked Apr. 6, by the Confederates under Gens. Albert Sidney Johnston and Beauregard, moving out from Corinth. This battle, known as Shiloh, at first went strongly against Grant, who was reinforced the second day, and the Confederates retired, Gen. Johnston being among the killed. Gen. H. W. Halleck was now placed in command of the Union forces, and besieged Corinth until after its evacuation by the Confederates, May 29. Meanwhile Mitchel pushed down through Tennessee into Northern Alabama, occupying Huntsville in that State.

In June, Gen. Buell moved E. from Corinth, threatening Chattanooga, Tenn., a place of great importance to the Confederates on account of its railway connections. Anticipated here by Gen. Bragg, he was soon compelled to retreat rapidly to Louisville to meet Bragg's invasion of Kentucky, Nashville remaining strongly fortified and garrisoned by Union troops. The invasion came to nothing, and Buell, assuming the offensive, followed Bragg to Perryville, where an action was fought (Oct. 8) in which the Union troops suffered heavily. Meanwhile, Gen. Rosecrans had driven the Confederates under Price out of Iuka, Miss., but was in turn attacked (Oct. 3 and 4) at Corinth by Price and Van Dorn, who retreated with great loss. Rosecrans was now sent to relieve Buell, and, advancing from Nashville to Murfreesboro', fought the important battle of Stone River Dec. 31, 1862, and Jan. 2, 1863, which was followed by the retreat of the Confederates. Grant, meanwhile, in attempting to move against Vicksburg by land, was foiled through Van Dorn's capture of his supply-dépôt at Holly Springs; but Gen. W. T. Sherman with a powerful corps moved down the Mississippi from Memphis, and assaulted Vicksburg unsuccessfully.

Early in 1863 the forces of Grant and Sherman were united, under the command of the former, for the conquest of Vicksburg. After several engagements and the serious action of Champion Hills (May 16), the Confederate commander, Pemberton, was driven into the fortifications, and the siege of Vicksburg was begun with the co-operation of a fleet under Admiral Porter. Two powerful assaults were repulsed, but on July 3, the day of Lee's final repulse at Gettysburg, Pemberton was compelled by the failure of supplies to surrender with nearly 27,000 men.

While the efforts recited for opening the Mississippi were making from the North, the Union fleets and troops were forcing their way up the Mississippi from its mouth. In April, Capt. Farragut ran past Forts Jackson and St. Philip, and anchored off New Orleans, which was evacuated by the Confederate general Lovell. The lower forts surrendering, Gen. B. F. Butler took possession of the city, and later occupied Baton Rouge, while Farragut undertook the reduction of Vicksburg, running past the batteries with a portion of the force, and uniting with the fleet above. The bombardment of Vicksburg continued into July without success. Aug. 5, the Confederate general Breckenridge (who had been Vice-President with Buchanan) attacked Gen. Williams at Baton Rouge, but was repulsed, Gen. Williams being killed. At the close of the year Gen. Butler was succeeded by Gen. N. P. Banks, who in May invested Port Hudson on the Mississippi, which had been strongly fortified by the Confederates. Banks's assault was repulsed with great loss, but on July 8, Port Hudson was surrendered on the news of the capture of Vicksburg above, and the Mississippi was opened to the sea. In June, Rosecrans, who had been lying at Murfreesboro' since January, advanced on Chattanooga, driving Bragg thence to Chickamauga Creek, where (on Sept. 19 and 20) occurred one of the bloodiest battles of the war, Rosecrans being driven back into Chattanooga, and there besieged. All available troops were brought up to reinforce the army in Chattanooga, and in October, Gen. Grant took command. Nov. 25, coincidently with the advance of the Army of the Potomac on Mine Run, Grant attacked and drove Bragg into Georgia. This victory enabled Grant to detach forces which compelled the retreat from before Knoxville of the Confederate general Longstreet, who had been detached from Lee's army, and was engaged in disputing possession of East Tennessee with Gen. Burnside.

By the close of 1863 the Confederates at the West were confined practically to the Gulf States, while their forces on the two sides of the Mississippi were separated by the Union fleets.

In preparation for the campaign of 1864, while Grant was called East to direct operations in Virginia, Gen. W. T. Sherman was placed in command of the three

Western armies—the Army of the Cumberland, the Army of the Tennessee, and the Army of the Ohio. His lieutenants were Gens. Thomas, McPherson, and Schofield. Moving May 5, simultaneously with Grant at the East, he was able, through his superior force, to compel the Confederate general Joseph E. Johnston, who had succeeded Bragg, to give ground all the way to the Chattahoochee River, with but one severe engagement—that of Kenesaw Mountain. July 10, Johnston was driven, after heavy fighting, behind the Chattahoochee, when the command devolved upon Gen. Hood, who threw his army upon Sherman in several desperate assaults, but was driven into the intrenchments of Atlanta. About Sept. 1, Sherman compelled the evacuation of Atlanta, and in the middle of November, leaving an army under Thomas to observe Hood, who had moved into Northern Alabama, he began his famous "march to the sea" across Georgia with a column of 60,000. At once Hood advanced into Tennessee, fighting by the way the ferocious battle of Franklin, where the Confederate losses were of unparalleled severity, and besieged Nashville. Dec. 15, Thomas assumed the aggressive; the Confederates were routed with great loss, and pursued into Alabama. Meanwhile, Sherman, drawing his supplies from the country, had continued his march, molested only by cavalry and militia, and on Dec. 13 issued on the coast, carrying Fort McAllister on the Ogeechee by assault, and occupying Savannah on the 21st.

Other operations in this year had been less successful. An expedition into Florida under Gen. Seymour resulted in defeat at Olustee Feb. 20. In April, Plymouth, N. C., was surrendered by the United States troops to Gen. Hoke, and Washington in that State was evacuated in consequence. Fort Pillow, on the Mississippi above Memphis, was captured by the Confederate general Forrest, and Gen. Sturgis, on following up Forrest, was badly defeated June 10, and a second column despatched against Forrest was beaten at Tupelo, Miss., July 14. In December a land and naval expedition, under command of Gen. Butler and Admiral Porter, for the reduction of Fort Fisher on Cape Fear River, covering Wilmington, totally failed, but the place was taken by Gen. Terry, with the co-operation of the fleet, in Jan., 1865.

Feb. 1, 1865, while Grant was still in winter-quarters before Petersburg, Sherman moved northward from Savannah. On the 18th, Charleston was evacuated by the Confederates under Hardee, in consequence of the occupation of Columbia, which town was nearly destroyed by a fire caught from burning cotton. On Mar. 19 and 21, Sherman encountered the Confederates under Johnston, who had been restored to command, at Bentonville, N. C., and, pushing them back, pressed on toward Raleigh, where Johnston on Apr. 26 surrendered his command, Gen. Lee having surrendered, as recited, on the 9th.

In Alabama the conflict closed somewhat later. In Aug., 1864, Admiral Farragut entered Mobile Bay, reduced Forts Gaines and Morgan, and destroyed the Confederate flotilla. In Mar., 1865, Gen. Canby, with the co-operation of the fleet, reduced the forts on the E., and the city was occupied on the 12th. May 4, 1865, Gen. Dick Taylor surrendered the Confederate forces in that State.

W. of the Mississippi had occurred many conflicts which require to be mentioned. In Aug., 1861, was fought the battle of Wilson's Creek, between the Confederates and the Union troops under Gen. Nathaniel Lyon, who was killed. This action gained the Confederates possession of Southwestern Missouri. Fremont, taking command in Missouri, advanced against Price in September, but was superseded by Hunter, who fell back without a battle. In December, Gen. H. W. Halleck was appointed to the command of the department, and Price was driven into Arkansas after considerable losses. In Mar., 1862, Gen. Curtis gained a victory at Pea Ridge, Ark., over the Confederates, and in July occupied Helena on the river. Several actions were fought in Missouri and Arkansas, the most notable that of Prairie Grove, Ark., in December. The success was generally on the Union side. In October of this year an expedition was sent against Galveston, Tex., but the place was speedily retaken by the Confederates. Immediately following Sherman's repulse from Vicksburg a detachment from his army in Jan., 1863, captured Arkansas Post, on the Arkansas River, with many prisoners. In Aug., 1863, Little Rock was occupied by the Union troops.

Early in 1864, Gen. Banks undertook an expedition up the Red River, which resulted most disastrously, the army and the co-operating flotilla being barely saved from destruction. A movement by Gen. Steele from Little Rock, with a view to effecting a junction with Banks, was foiled. In September and October the Confederates under Price made a raid through Missouri, reaching Lexington, whence they were compelled to retreat, escaping into Arkansas with considerable loss. No other important operations took place in this region. The Confederate reinforcements and supplies were mainly directed to strengthening the armies of Lee and Johnston, and May 26, 1865, Gen. Kirby Smith surrendered the Confederate forces W. of the Mississippi.

We have taken no account of any naval engagements during the war. The Confederates at no time had a fleet which could keep the sea. Their efforts were directed to the construction of rams to operate on rivers and narrow waters. The most memorable appearances of the Confederate navy were the destruction of the wooden frigates Cumberland and Congress in Hampton Roads by the ironclad Merrimack, which was compelled to retire before the new Monitor; and the attack on the Sassacus at the mouth of the Roanoke by the ram Albemarle, which was subsequently blown up by a torpedo-boat commanded by Lieut. Cushing of the United States navy. But while the Confederates made no effort to keep the sea, they inflicted great loss upon the commerce of the United States through cruisers, mainly built in England, among them being the Alabama, Chickamauga, Florida, Shenandoah, Sumter, and Tallahassee. The Alabama, after doing vast damage, was destroyed off Cherbourg on the coast of France by the U. S. steamer Kearsarge, Capt. Winslow, in June, 1864.

The conduct of the war had been much embarrassed by fears of interference on the part of France and England. Such action was rendered more probable on the part of the latter power from the irritation caused by the seizure of Mason and Slidell, Confederate envoys to England and France, who were taken off the British vessel Trent by Capt. Wilkes of the United States steamer San Jacinto in Nov., 1861. War was only averted by the surrender of the envoys on the demand of England. The occupation of Mexico by the European powers and the establishment of Maximilian were also regarded by the United States government as a menace.

The whole number of enlistments (including second enlistments) into the United States forces from 1861 to 1865 was nearly 2,750,000; the aggregate strength of the army May 1, 1865, almost exactly 1,000,000; 304,000 officers and soldiers died in service of wounds and disease.

Perhaps in no war has the conduct of affairs been more affected by political exigencies. In 1862 and 1863 elections in several States went against the administration, and the necessity of resorting to a draft in the summer of 1863 led to riots in New York, which involved much loss of life and property, and required for their suppression considerable detachments from the army. The measures which were especially obnoxious were the suspension of the habeas corpus act, the abolition of slavery in the District of Columbia and in the Territories, the enlistment of colored soldiers, and the proclamation of the President (Jan. 1, 1863), declaring free all persons held as slaves in all States and parts of States in rebellion.

In 1864 the Democrats nominated for the Presidency Gen. George B. McClellan on a platform denouncing the arbitrary measures of the executive and declaring the war a failure. Mr. Lincoln was renominated by the Republican party, and elected, with Andrew Johnson of Tennessee as Vice-President, by 212 votes against 21 for McClellan. On Apr. 14, 1865, a little more than a month after his re-inauguration, Pres. Lincoln was assassinated at Washington by J. Wilkes Booth. Booth was killed by his pursuers, and four of his accomplices were executed on the sentence of the military court. Vice-President Johnson succeeded to the Presidency.

No one was criminally punished for participation in the war of secession. Jefferson Davis, President of the Confederacy, after the fall of Richmond escaped southward, was captured in Georgia, placed on trial, and released on bail. Several successive amnesty proclamations of increasing scope were issued between May, 1865, and Dec., 1868, the last being universal.

The financial legislation of the war covered the issue, in 1862 and subsequently, of notes of the United States, constituting a legal tender, the issue of interest-bearing bonds of several different descriptions; the establishment of the national banking system; the increase of customs duties from the low average under the tariff of 1857 to an average of nearly 50 per cent.; the imposition of a great variety of excise duties and a direct tax. (This legislation will be found in detail under the several titles *Banks, Currency, Taxation.*) The ordinary expenditures of the government which had to be thus provided for rose from sixty millions in 1860 to twelve hundred and seventeen millions in 1865. The table on the next page exhibits the direction of the government expenditures from 1861 to 1875.

The work of political reconstruction constitutes the great feature of the recent history of the United States. In 1863 fifty counties of Virginia W. of the Alleghanies were admitted to the Union as the State of West Virginia, being the thirty-fifth State, the required formal assent of

| Years. | Civil list. | Foreign intercourse. | Miscellaneous. | Military service. | Pensions. | Indians. | Naval establishment. | Net ordinary expenditures. |
|---|---|---|---|---|---|---|---|---|
| 1861 | $6,074,042 | $1,147,787 | $16,026,525 | $23,001,531 | $1,034,600 | $2,865,481 | $12,387,157 | $62,537,222 |
| 1862 | 5,886,615 | 1,339,227 | 14,160,021 | 389,173,562 | 852,170 | 2,327,948 | 42,640,453 | 456,379,897 |
| 1863 | 6,294,606 | 1,241,325 | 15,662,451 | 603,314,412 | 1,078,513 | 3,152,033 | 63,261,235 | 694,004,576 |
| 1864 | 7,999,683 | 1,239,894 | 18,332,640 | 690,391,049 | 4,985,474 | 2,629,976 | 85,704,964 | 811,283,679 |
| 1865 | 10,584,604 | 1,251,120 | 27,798,655 | 1,030,690,400 | 16,347,621 | 5,059,361 | 122,617,434 | 1,214,349,195 |
| 1866 | 11,984,774 | 1,315,749 | 27,312,591 | 283,154,676 | 15,605,550 | 3,295,729 | 43,285,662 | 385,954,731 |
| 1867 | 15,128,831 | 1,793,308 | 33,876,129 | 98,715,832 | 20,939,790 | 4,687,716 | 31,074,966 | 206,216,571 |
| 1868 | 13,127,784 | 1,442,632 | 38,092,092 | 123,107,148 | 23,792,277 | 4,100,660 | 25,734,659 | 229,397,251 |
| 1869 | *26,171,003 | 1,091,171 | 29,413,497 | 78,663,649 | 28,475,856 | 6,981,467 | 20,055,005 | 190,851,648 |
| 1870 | 15,867,336 | 1,491,215 | 36,084,809 | 57,615,802 | 28,402,241 | 3,410,279 | 21,786,592 | 164,658,274 |
| 1871 | 18,750,014 | 1,590,046 | 40,652,640 | 35,830,119 | 34,444,753 | 7,425,961 | 19,447,767 | 158,141,301 |
| 1872 | 16,085,682 | 1,838,388 | 42,935,460 | 35,347,495 | 28,533,403 | 7,057,887 | 21,239,031 | 153,037,346 |
| 1873 | 19,286,741 | 1,571,686 | 52,390,044 | 46,128,085 | 29,359,451 | 7,957,430 | 23,536,536 | 180,229,971 |
| 1874 | 17,646,253 | 1,522,570 | †66,024,307 | 42,459,986 | 29,038,412 | 6,692,562 | 30,933,120 | 194,217,210 |
| 1875 | 17,346,930 | ‡3,195,237 | 50,528,536 | 41,120,646 | 29,456,216 | 8,384,657 | 21,497,626 | 171,529,848 |

Virginia thereto being given by a legislature gathered from a few counties adjacent to Washington. In Dec., 1863, a proclamation of the President provided for the re-establishment of civil government in any seceded State on the initiative of a number of qualified voters, not less than one-tenth of those voting at the Presidential election of 1860. Under this scheme governments were instituted in 1864 in Louisiana and Arkansas. In 1865 the 13th Amendment to the Constitution, abolishing slavery within the United States and all places subject to their jurisdiction, was ratified by three-fourths of the States, and was proclaimed by the secretary of state Dec. 18. In 1865 provisional governors were appointed by the President in most of the Southern States, the regular army of the United States still remaining in occupation of the territory, though the volunteers had been disbanded. By these provisional governors conventions were to be called to place the several States in a position to resume their interrupted federal relations, the principal conditions being the repeal of the ordinances of secession, the repudiation of public debts incurred in aid of the Confederacy, and the abolition of slavery by the authority and as the act of the States themselves. Such conventions were held and ordinances passed, but the action was not satisfactory to the Republican party in Congress, with which Pres. Johnson soon broke even more completely than Pres. Tyler had broken with the Whig party in 1842. It was alleged by the Republican leaders that the Southern whites were seeking by stringent laws of apprenticeship and vagabondage to reduce the late slaves to a condition of virtual slavery. Congress therefore refused to admit the Senators and Representatives of the reorganized governments, and in April, by a two-thirds vote, passed over the President's veto the Civil Rights bill, intended to protect the freedmen, and enlarging the jurisdiction of the United States courts to this end. In June, 1865, the two houses of Congress proposed the 14th Amendment to the Constitution, which was subsequently ratified by the requisite number of States, and proclaimed July 28, 1868. This provides in its first section that all persons born or naturalized in the United States, and subject to the jurisdiction thereof, shall be deemed to be citizens of the United States and of the State where they reside, and that no State shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States; nor shall any State deprive any person of life, liberty, or property without due process of law, nor deny to any person within its jurisdiction the equal protection of the law; and Congress is authorized to enforce these provisions by appropriate legislation. The second section of the amendment sought to induce the States to confer the right of suffrage on the blacks by providing that otherwise the representation of any State should be diminished in the proportion which the excluded classes bore to the total population; but, inasmuch as a subsequent amendment conferred the right of suffrage without distinction of color and without reference to the choice of the States, this section of the 14th Amendment remains wholly without content. The third section prohibits certain classes of persons, participants in the rebellion, from holding office under the United States or any of them until such disability shall have been removed by a two-thirds vote of both houses of Congress. Successive acts, special or general, have, however, relieved nearly every person embraced within these classes. The fourth section provides that the validity of the public debt of the United States shall not be questioned, and that the United States or any of them shall never assume or pay any debt incurred in insurrection, or any claims for the loss or emancipation of any slave.

The antagonism between the President and the Republican majority in Congress gradually increased, until Congress in Mar., 1867, passed over the veto the Tenure-of-Office act, to limit the President's power of removal from office. In Feb., 1868, the President, in defiance of this law—which he deemed an unconstitutional invasion of the executive functions—designated Gen. Lorenzo Thomas, adjutant-general of the army, as secretary of war *ad interim*, removing Mr. Stanton from the office. This led immediately to an impeachment of the President by the House of Representatives, which was tried by the Senate, the chief-justice presiding. Mr. Johnson was acquitted, the prosecution failing to secure a two-thirds vote for conviction. Secretary Stanton, resigning, was succeeded by Gen. John M. Schofield, and Mr. Stanbery, a little later, was succeeded by W. M. Evarts, who had been of the President's counsel.

The Presidential election approaching, Mr. Johnson failed of renomination by either party, the Democrats putting forward Horatio Seymour, formerly governor of New York, the Republicans nominating Gen. U. S. Grant, with Schuyler Colfax of Indiana, Speaker of the House of Representatives, for Vice-President. Grant and Colfax were elected, receiving 214 votes against 80 for their opponents; three States, Virginia, Texas, and Mississippi, not being admitted to the electoral college.

The accessions to the United States during Johnson's administration had been through the admission of Nebraska as the thirty-seventh State in 1867, Nevada having been admitted as the thirty-sixth State in 1866, and the purchase of Alaska from Russia for the sum of $7,000,000. In Feb., 1869, just before the expiry of Johnson's term of office, the 15th Amendment to the Constitution was passed by Congress over the veto. This amendment provides that the rights of citizens of the United States to vote shall not be denied or abridged by the United States, or by any State, on account of race, color, or previous condition of servitude. It received the ratification of the requisite number of States, and was proclaimed Mar. 30, 1870.

President Grant's administration has been remarkable for the number of cabinet officers at various times appointed. The most notable incumbents of the several offices have been, in the state department, Hamilton Fish; in the treasury department, George S. Boutwell and B. H. Bristow; in the war department, Gen. John A. Rawlings and W. W. Belknap; in the navy department, George M. Robeson; in the interior department, J. D. Cox and Columbus Delano; in the post-office department, J. A. J. Creswell and Marshall Jewell; as attorney-generals, E. R. Hoar and George H. Williams. In this administration the office of the attorney-general, which had previously been mainly an office of advice, was enlarged to constitute the administrative department of justice, having supervision of United States district attorneys and marshals. All the States were restored to representation in Congress. Between 1869 and 1873 the tariff duties imposed during the war suffered considerable reductions, while the internal revenue duties were mainly abolished, except as to spirits and tobacco. An effort was made to reform the civil service by making it non-political and enforcing tests of efficiency, but this was abandoned after the election of 1872. The completion of the Union Pacific and the Central Pacific R. Rs., mainly at the expense of the government, making a continuous line from the Missouri to the Pacific, was effected in 1869. Out of the connection of the government with these roads arose much scandal from the alleged corruption of certain members of Congress, who were charged with receiving stock of the Credit Mobilier Co., which built the road. The charges were investigated by Congress in winter of 1872–73, with much injury to the reputation of several members.

During the Presidential election of 1868, which was the first national election after the 15th Amendment to the Constitution, numerous outrages were perpetrated upon the colored people of several of the Southern States, and intimidation was largely exercised to restrain their political action. These acts were generally committed by masked men, supposed to belong to a widespread organization to which was popularly given the name "Ku-Klux Klan."

*This includes $7,000,000 paid for Alaska.
†This includes $15,500,000, Geneva tribunal award.
‡Includes $1,929,819 awards to British claimants.

In Apr., 1871, an act was framed, under the authority of the 14th Amendment to the Constitution, enlarging the jurisdiction of the United States courts for the punishment of such offences.

In 1871 a treaty was negotiated at Washington between commissioners on the part of the United States and of Great Britain for the settlement of the Alabama and other claims against Great Britain arising out of the depredations of the Confederate cruisers built in England, and also for the adjustment of the conflicting claims of the two countries to the islands of the San Juan group between Vancouver's Island and the continent on the North-west. The latter were referred to the emperor of Germany as arbitrator, who decided in favor of the United States. The Alabama and kindred claims were referred to a tribunal to be convened at Geneva, consisting of five arbitrators, appointed, one each, by the President of the United States, by the queen of England, by the king of Italy, by the president of the Swiss confederation, and by the emperor of Brazil. The arbitrator on the part of the United States was Charles Francis Adams, who had been minister to England during the war. The tribunal assembled in Dec., 1871, and awarded to the United States a gross sum of $15,500,000, to be distributed by the government. By the same treaty certain other claims, both of American citizens against the British government and of British citizens against the government of the United States, were referred to a joint commission of three. The commissioner on the part of the United States was James S. Frazer. The commission met at Washington in Sept., 1871, and sat nearly two years, making a net award against the United States of about $2,000,000. Still another commission was provided for by the treaty for determining the disputed rights of navigation and fishing between Canada and the United States, but this commission has not yet been convened.

The unsettled condition of affairs in Santo Domingo during the years 1869–71 led to propositions for the acquisition of that territory by the United States, and the President appointed a commission to visit Santo Domingo and report respecting the state of society therein; which they did, but with no practical result.

As the Presidential election of 1872 approached, considerable dissatisfaction was developed among a section of the Republican party in consequence of many alleged abuses of the public patronage, especially the manner in which the power of the administration had been used to sustain Republican ascendency through negro votes in several Southern States where the colored electors were nearly or quite in a majority. In May a convention of Liberal Republicans met at Cincinnati and nominated Horace Greeley of New York for President. This nomination was ratified by the Democratic convention, though a very small section of the party repudiated the action and nominated Charles O'Conor of New York. The Republicans in convention at Philadelphia renominated Pres. Grant, with Henry Wilson of Massachusetts for Vice-President. The Republican ticket received the electoral vote of twenty-nine States—in all, 286 votes. The votes of Arkansas and Louisiana were thrown out for irregularities. The remaining six States, all late slave States, went Democratic, but Mr. Greeley having died before the assembling of the electoral college, this vote was scattered according to local preferences.

In Oct., 1873, the steamer Virginius, carrying the United States flag, and having on board munitions of war and recruits for the insurgents in Cuba, was captured by a Spanish armed vessel, and a number of the prisoners shot by the authorities in Cuba. War was anticipated, and considerable naval preparations were made by the United States, but the lawless character of the Virginius was fully established, and friendly relations were restored, Spain paying a sum for the relief of the families of the victims.

The Congressional elections of 1874 went strongly against the administration, and a Republican majority of sixty or seventy in the House of Representatives was turned into a nearly equal Democratic majority. Just before the incoming of the new House of Representatives, Congress passed an act declaring that specie payments should be resumed by the United States on Jan. 1, 1879.

In the autumn of 1875 the elections in the States of Ohio and Pennsylvania were severely contested between the Democrats and the Republicans on the currency issue, popularly known as "hard money" or "soft money," the position taken by the former party being that the resumption act of 1875 was arbitrary, ineffective, and injurious to the industry of the country. Both these elections were carried by the Republicans. The Democrats coming into power in the House of Representatives for the first time for sixteen years, many investigations were made by special and standing committees into the conduct of affairs by the Republicans, and reports were made censuring the conduct of various cabinet officers and subordinate officials. On the report of a committee to examine the expenditures of the war department, W. W. Belknap was impeached as secretary of war for corruption in the appointment of a post-tradership. The impeachment was tried by the Senate, and Mr. Belknap, who had resigned from office before the vote of impeachment, was acquitted, two-thirds not voting for conviction.

In May, 1876, an international exhibition was opened at Philadelphia under the auspices of the United States government, which made an appropriation of $1,500,000 for the purpose, while the private, municipal, and State subscriptions aggregated several times that amount.

One of the features of Pres. Grant's administration is the appointment of Indian agents upon the recommendation of the religious societies and missionary boards having the spiritual charge of the tribes. This has not, however, prevented three Indian wars. The first occurred with the Apaches in Arizona, who, after numerous depredations and massacres, were severely punished by Gen. Crook. A second with the Modocs, a small band under "Captain Jack," ranging in Southern Oregon and Northern California, commenced in 1873 with the massacre of Gen. E. R. S. Canby while treating with the savages, and was closed by the utter destruction of the band after severe losses to the United States troops, from the difficult character of the lava-beds in which Captain Jack made his stand. The third began in 1876 with a large body of Sioux Indians under "Sitting Bull" in Montana, who refused to receive the terms of the government and remain at the agencies established for them. In June, Gen. George A. Custer moved against the hostile Sioux with a regiment of cavalry, and, dividing his command, attacked with five companies a camp of more than 2000 warriors. In the attack Custer and every man fell, no one remaining alive to tell the tale. The other companies of Custer's command were attacked by the Indians, but were saved by the arrival of Gen. Terry with a large body of infantry. Extensive preparations were at once made by the government for punishing this band, and a formidable expedition under Gens. Crook and Terry was sent against them, but without important result.

On the approach of the Presidential election of 1876 the Republican party in convention at Cincinnati nominated for President, Rutherford B. Hayes, governor of Ohio, with William A. Wheeler of New York for Vice-President. The Democratic convention nominated for President, Samuel J. Tilden, governor of New York, with Thomas A. Hendricks, governor of Indiana, for Vice-President, on a platform demanding the repeal of the resumption act of 1875.

(I am indebted to Profs. T. Sterry Hunt, W. H. Brewer, and S. I. Smith for valuable assistance in the preparation of portions of this article relating to the physical features and natural resources of the United States. I have also made use of the writings of Profs. J. D. Whitney and J. S. Newberry.) FRANCIS A. WALKER.

**United States Bank.** See BANK.

**United States Christian Commission.** See CHRISTIAN COMMISSION.

**United States Homestead Legislation.** See HOMESTEAD LEGISLATION IN THE UNITED STATES.

**United States, Literature of.** See ENGLISH LANGUAGE AND LITERATURE. See also JOURNALISM.

**United States Lutheran Church.** See LUTHERAN CHURCH IN THE U. S., by C. P. KRAUTH, S. T. D., LL.D.

**United States Military Academy.** See MILITARY ACADEMIES and WEST POINT.

**United States of Colombia.** See COLOMBIA.

**United Synod of the Presbyterian Church,** a former organization in the Southern U. S.; seceded in 1857 from the New School Presbyterians, and in 1864 joined the General Assembly of the Confederate States.

**United Syrians.** In the Eastern rite of the Roman Catholic Church the Syrian rite comprises the Chaldæans, the Maronites, the United St. Thomas Christians, and the United Syrians proper. The latter have a patriarch at Aleppo, styled patriarch of Antioch, and archbishops of Aleppo, Babylon, Damascus, and Seleucia, besides 11 bishops. They number about 30,000. They date from the seventeenth century, when a numerous party under Andreas Achigian, their first patriarch, seceded from the Jacobites and acknowledged the pope. There had, however, been for three centuries a Romanizing party in the Syrian Church. (See also MARONITES, CHALDÆAN CHRISTIANS, EASTERN RITE, UNITED CHRISTIANS OF ST. THOMAS.)

**Un'ity,** p.-v. and tp., Alexander co., Ill. P. 570.

**Unity,** tp., Piatt co., Ill. P. 934.

**Unity,** p.-v. and tp., Waldo co., Me. P. 1201.

**Unity,** p.-v. and tp., Sullivan co., N. H. P. 844.

**Unity,** tp., Rowan co., N. C. P. 893.
**Unity,** v., Oliver tp., Adams co., O. P. 36.
**Unity,** p.-v. and tp., Columbiana co., O. P. 2286.
**Unity,** tp., Westmoreland co., Pa. P. 3624.

**Unity** of time, of place, and of action in a drama was the fundamental rule or general idea from which the French dramatic writers and critics of the classical period derived, or to which they referred, all their practical rules for the construction of a drama. Boileau and Voltaire pretended to have found this fundamental rule prescribed by Aristotle and obeyed by the Greek tragedians. But Aristotle never mentions the unity of space, the Greek dramatists never paid any regard to the unities of time and space, and the French critics never understood, as little as the French dramatists ever practised, the unity of action in the sense in which Aristotle propounded it. Unity of time means that a drama must not represent a larger space of time than that which the actual performance occupies—that is, when carried to its last consequences, the drama must not represent anything but that which it actually is; which is nonsense. Unity of place means that a drama must not use more than one decoration, a monotony which is entirely unnecessary with the present arrangement of the scene. What unity of action means is easily understood by comparing *Othello* and *The Merchant of Venice.* The latter has two actions running beside each other, and not meeting until the last scene of the fourth act—namely, one between Bassanio and Portia, and one between Antonio and Shylock. From this play it may also be learned that the critic has no reason for objection, but so much more for admiration, if the poet has power enough to preserve the unity of impression, although pursuing a double action. But this is very seldom the case. Shakespeare failed often, and the French dramatists always. In *Cid, Athalie,* and *Zaire* there is a mixture of actions of love, of honor, and of religion, which in some places is irresistibly ludicrous. As a general rule, it may be said that unity of action is necessary whenever the action requires or contains a minute and precise psychological development. But although the French critics of the classical period were very much mistaken in their theory of the dramatic unities, their criticisms are nevertheless well worth reading. They contain many fine observations on scenic effect, and these observations are generally embodied in some handy and easily-remembered rule. CLEMENS PETERSEN.

**Unity Plantation,** Kennebec co., Me. P. 68.

**U'nivalve** ("one-valved") **Shells,** in conchology, are those which consist of a single piece. The term is at present of no scientific importance except as a descriptive one, for, though a large number of gasteropods are univalve, yet some cephalopods are also one-valved, and the shells of many Foraminifera, and of some Vermes and other non-molluscous organisms, are equally entitled to the name.

**Univer'salism.*** This term indicates the belief of those who hold the doctrine of the final holiness and happiness of all intelligent beings. This doctrine, they affirm, is a legitimate deduction from the acknowledged attributes of God and from the declared principles of the gospel of Christ. They conceive it to be utterly inconsistent to affirm that a Being of infinite benevolence will doom any of his children to irremediable woe. They argue that none but a malignant Being, having the power to reclaim those of his subjects that have wandered from him, will permit them to go on in sin, and suffer its consequent miseries for ever. Universalists believe in the infinite and immutable love of the Heavenly Father, who will not permit the sinner to elude his all-conquering grace, but will follow the last lost soul to the deepest hell it may make for itself, and will find it and bring it back to his presence and to the joy of the celestial state (Luke xv. 1–10). Such are the meaning and purpose, they conceive, of the Christian religion. Jesus Christ was sent by the Father into the world to save his people from their sins (Matt. i. 21). They are fully persuaded that the Divine Saviour will accomplish the object of his mission by finally redeeming all from the dominion of sin and introducing them into the blessings of his kingdom, which consist in righteousness and peace and joy in the Holy Ghost (Rom. xiv. 17). The punishment of the wicked, however severe and terrible it may be, Universalists hold to be but a means to a beneficent end—not revengeful, but remedial; not for its own sake, but for the good of those who suffer its infliction (Heb. xii. 5–11). This doctrine, Universalists affirm, is not only to be inferred from the character of God; it is explicitly declared in the Holy Scriptures. The assurance of the ultimate destruction of all moral evil was given in the garden of Eden, when it was promised that the seed of the woman should bruise the serpent's head (Gen. iii. 15). It is also contained in the promise which was made to Abraham and renewed to Isaac and Jacob, that in them should all the families, nations, and kindreds of the earth be blest (Gen. xii. 3; xxii. 18; xxvi. 3, 4; xxviii. 14; Acts iii. 25). It finds expression in the fervent breathings of the inspired Psalmist, where it is said that all kings, nations, and kindreds shall worship Jehovah (Ps. xxii. 27; lxxii. 11, 17; lxxxvi. 9). All the holy prophets foretold the restitution of all things (Acts iii. 21; Isaiah xlv. 23, 24; lvii. 16; Jer. xxxi. 33, 34; Lam. iii. 31–33; Dan. vii. 14; Hos. xii. 14; Mic. vii. 18). Jesus Christ, the Divine Redeemer, declares that he came not to condemn, but to save the world (John iii. 17); that all the Father gave him shall come to him (John vi. 37); and that if lifted up from the earth, he would draw all men unto him (John xii. 32). The apostle Paul gives frequent expression to the doctrine, as when he says that as many as have sinned in Adam shall be made righteous in Christ (Rom. v. 12–21); that the whole creation shall be delivered from the bondage of corruption into the glorious liberty of the children of God (Rom. viii. 21); that the fulness of the Gentiles, together with all Israel, shall come in and be saved (Rom. xi. 25, 26); that all things shall be subject to Christ, and God shall be all in all (1 Cor. xv. 28); that it is the Divine will, good pleasure, and purpose to gather together in one all things in Christ (Eph. i. 9, 10); that at the name of Jesus every knee shall bow and every tongue confess (Phil. ii. 9–11); that Christ is the Saviour of all men, and that he gave himself a ransom for all (1 Tim. ii. 4–6; iv. 10); and that God has prospectively put all things in subjection to his Son (Heb. ii. 8). St. John's testimony is to the same effect, when he declares that Jesus is the propitiation for the sins of the whole world (1 John ii. 2), and that in the visions of Patmos he heard every creature which is in heaven and on the earth and under the earth, and such as are in the sea, saying, "Blessing, and honor, and glory, and power be unto Him which sitteth upon the throne, and to the Lamb for ever and ever" (Rev. v. 13).

Universalists affirm that the doctrine of universal salvation was the prevailing doctrine of the early Christian Church. Neander distinctly tells us in his *Church History* that it was the doctrine held and taught in the catechetical school of Alexandria, of which Clement and Origen were the brightest shining lights. A distinguished ex-president of a Western Presbyterian college, who has made the subject one of long and searching investigation, has published as the result that in four of the six catechetical schools which flourished in the first centuries of the Christian era —those of Alexandria, Cæsarea, and Antioch, and that of Edessa and Nissibis—the doctrine was believed and taught; while that of the annihilation of wicked souls was taught in the school of Ephesus, and that of endless punishment was held and inculcated in only the school of Carthage. It is a fact well known to all students of ecclesiastical history that it was formally condemned by a council assembled in Constantinople in the year 553. Unless widely prevalent, it would have hardly received such attention from a body of high ecclesiastics met in solemn conclave. Besides Clement and Origen, already referred to, the names of Marcellus, bishop of Ancyra; of Titus, bishop of Bostra; of Gregory, bishop of Nyssa; of Gregory, bishop of Naziansus; of Diodorus, bishop of Tarsus; of Theodore, bishop of Mopsuestia; of Theodoret, bishop of Cyrus; of Evagrius, Victorinus, and others, are conspicuous among those who advocated the doctrine of the final redemption of all souls through the mission of Christ. It is certain that Universalism was very generally held in the Christian Church at a period anterior to the supremacy of Rome in the religious affairs of the world.

Though formally condemned in 553, the doctrine was not extinguished. It appeared among the Albigenses and the Waldenses in the twelfth century, the Lollards of Germany in the fourteenth, the "Men of Understanding" in the fifteenth, and some of the Anabaptist sects in the sixteenth. Since the Reformation it has found advocates in nearly every Protestant church in Europe. In France it has been maintained with distinguished ability by the Messrs. Athanase Coquerel, father and son. The doctrine has been widely prevalent in Germany, and numbers among its advocates men like Neander, Olshausen, Hagenbach, Haln, Von Müller, De Wette, Schleiermacher, and others. In England, when the Articles of the Established Church were framed, the doctrine was formally denounced in the 42d article. This article, with two others, was subsequently dropped, leaving but thirty-nine. By an act of Parliament of 1648, Universalists were made liable to imprisonment, but it has been held among both churchmen and dissenters down to the present day—men like Archbishop Tillotson,

*The publisher of this work having laid upon me the responsibility of furnishing an article upon "Universalism," at my request the Rev. Giles Bailey has prepared this paper, which I have revised and submit to the readers of the NEW UNIVERSAL CYCLOPÆDIA. E. H. CHAPIN.

Bishop Newton, Dr. Burnett, Dr. Henry More, William Whiston, Prof. Maurice, Dean Stanley, Prof. Jowett, Charles Kingsley, and Stopford A. Brooke of the former, and Soame Jenyns, Jeremiah White, T. Southwood Smith, John Foster, and others of the latter.

Universalism was preached in America as early as 1741 by Dr. George de Benneville. Rev. Richard Clarke, an Episcopal clergyman of Charleston, S. C., maintained it for many years, both by preaching and writing. Dr. Mayhew, a Congregational pastor in Boston, advocated it in a published sermon in 1762. The first Universalist church in this country was organized by Rev. John Murray in Gloucester, Mass., in 1780. The first convention of Universalist ministers and parishes was held in 1785, and was the germ of the present Universalist General Convention. The present organization was adopted in 1870. Under it the body is composed of delegates from the State conventions, which in turn are made up of the ministers and delegates of the several parishes of the respective States. By it a uniform system of fellowship, ordination, and discipline is secured. The General Convention is the supreme power of the Church and the ultimate tribunal in all cases of difficulty. The State conventions have immediate jurisdiction over clergymen and parishes within their respective limits, subject to the right of appeal. Assent to the Winchester Confession of Faith, adopted in 1803, is required as a condition of fellowship, as follows: I. We believe that the Holy Scriptures of the Old and New Testament contain a revelation of the character of God and of the duty, interest, and final destination of mankind. II. We believe that there is one God, whose nature is love, revealed in one Lord Jesus Christ by one Holy Spirit of Grace, who will finally restore the whole family of mankind to holiness and happiness. III. We believe that holiness and true happiness are inseparably connected, and that believers ought to be careful to maintain order and practise good works, for these things are good and profitable unto men. Accepting this confession, the Universalist Church is thoroughly Christian in belief, holding inflexibly to the authority of the Bible, to the divine mission and office of Christ, to the absolute necessity of a holy life, to the certainty of a just retribution for sin, and to the assurance of the final triumph of good over evil and holiness over sin in all worlds and in all souls.

The General Convention holds a fund, called the "Murray fund," the interest of which is appropriated for the education of candidates for the ministry and for the support of missions. It also has sources of revenue in its missionary-boxes, which are designed to be placed in every Universalist family, and in the annual voluntary contributions of the parishes. The standing of the Church may be thus briefly summarized: 1 General Convention, 21 State conventions, 73 associations, 800 meeting-houses, 700 ministers, 5 colleges (one of which, Tufts College, College Hill, Mass., has an endowment of $1,000,000), 2 theological seminaries, 7 academies and preparatory schools (one of which, Dean Academy, Franklin, Mass., has assets amounting to $300,000), and a corps of more than 100 teachers, constantly engaged in its several collegiate, academic, and theological institutions.

GILES BAILEY.

**Universalists.** See UNIVERSALISM.

**Univer'sals** are either metaphysical, *universalia ante rem*, denoting the archetypal forms of things as far as they existed in the Divine Mind before the real things were created; or physical, *universalia in rem*, denoting the archetypal forms as far as they actually exist in things created; and finally logical, *universalia post rem*, denoting the archetypal forms as far as they are abstracted by the human intellect from the things. (See REALISM.)

**U'niverse, The** [Lat. *universum*], a term employed to signify the grand and total aggregate of created things.*

The knowledge we have acquired of the all but boundless creation, of which the globe we inhabit is a humble and inconspicuous member, may be succinctly summed up in the following propositions:

(1) The stars are suns as truly as our own, and like ours are endowed with self-luminosity. Some of them are furnished with one or more luminous satellites; others with satellites of which, though obscure, the existence is sufficiently proved by the phenomena presented by the phases of their brightness and by their movements.

(2) These systems, which we may call systems of the first order, and which resemble our planetary system, are governed by the force of gravity residing in a principal star, and are subject to the same Keplerian laws which reign among the planets revolving around our sun. If the secondary suns which hold the relation of satellites to the principal are also themselves surrounded by dark satellites, we have cases similar to that which truly exists among the dark stars (planets) of our own system.

(3) In many cases these simple systems are replaced by systems extremely complex, forming groups and globular aggregations of which the laws of movement and of equilibrium are still unknown. These agglomerations are formed of separate masses—that is, of stars neatly separable by the power of our instruments; and by their sole multitude they form at the centre an indistinct luminosity which is still of stellar nature.

(4) Innumerable other aggregations are of a character more or less resolvable, but of greater complication; in which yet, in consequence of the distance of the bodies and the slowness of their movements, there does not appear any trace of a centre of motion nor any law of regular concentration; still, there is no need to despair that, with lapse of time, these may be yet discovered.

(5) The Milky Way is a zone constituted of an enormous agglomeration of complicated masses of stars, which may each be regarded as composed of innumerable systems of a superior order. The form of this immense aggregation is unknown, but its profundity in different directions is unequal, and we can on certain lines penetrate beyond its depth, while in others it is impenetrable.

(6) The stars which are apparently the largest are also the nearest, and greater distance is the principal cause of the smaller apparent magnitude of the others. Probably the larger, our nearest neighbors, form one of the superior systems just mentioned, and the one to which our sun belongs, multitudes of which unite to form the Milky Way.

(7) Besides the stars, there are in the heavens very numerous masses of matter luminous *per se*, not yet condensed into well-defined bodies, but simply gaseous, which form the nebulæ. Some of these are of enormous extent and of extremely irregular density; others have a uniform density; others, still, a condensation increasing toward the centre, as if they were stars just forming; some are annular, and appear destined to form systems of a more complicated character.

(8) The largest part of these nebulous masses of gradual condensation present themselves in regions independent of the Milky Way, and seem to form systems by themselves; but, notwithstanding their aëriform and gaseous, and therefore most mobile condition, all these are remarkable for their sensibly constant forms.

(9) The absolute dimensions of the stars and the nebulæ, and their reciprocal distances, are entirely unknown in consequence of the absence of parallax; and hence we can know nothing at all positive as to their real distribution in space. Yet we can be certain that the stars are not uniformly distributed, but are most numerous and most dense—not only apparently but also really—in the plane of the Milky Way. The nebulæ, on the other hand, are in greater density and number in a plane perpendicular to this.

(10) Estimating by indirect means the stellar distances, and expressing them only in relative measures, we infer that, placing the nearest stars at the smallest distance possible—that is to say, the distance corresponding to an annual parallax of an entire second—they would be remote from us by 206,265 semi-diameters of the great orbit of the earth, and their light would occupy three years and a quarter in coming to us from them. These numbers must be increased at least tenfold in order to include all the stars in our neighborhood; because it is certain that only very few have more than the tenth of a second of parallax; and hence the magnitude of the orbit which the earth describes around the sun, though 296 kilomètres in diameter, would not appear from one of these more than an imperceptible point.

(11) Calculating with this proportion, according to the most probable elements of photometry and of proper motion, the distance of the other objects which the most powerful Herschelian instruments can reach, we find it such that, for these, light should occupy in coming to us, a time 312 times longer than for the stars of the first magnitude having a tenth of a second of parallax; that is to say, more than 10,000 years!

(12) Immense as this space may seem, it does not constitute the real limit of the creation, since our most powerful instruments fail to penetrate even all the galactic strata in all their profundity; hence, the firmament is for us unfathomable. It cannot, nevertheless, be called infinite; nothing composed of distinct and separate entities can be infinite.† But, though not absolutely infinite, the universe is for us as if it were so.

* What follows this definition formed originally the conclusion of the able article of Father SECCHI on the STARS, to which the reader is referred. It has been transferred to this place as presenting a view more likely to be sought under the present head.—ED.

† Because, it being always, absolutely speaking, expressible in numbers, it would be unavoidably either even or uneven; and in either case, by taking away a unit, the infinite would become finite; which is absurd.

In order to express celestial distances in concise numbers, the distance traversed by light in three and a quarter years, which would be the distance of a star having a parallax of one second, will be adopted as a unit of comparison. But is this distance itself conceivable by us, when we can by no means form a distinct idea of the distance travelled by light in 8¼ minutes only—that is to say, in coming from the sun; when even we cannot at all conceive the magnitude of our own globe, which light would pass over in some thousandths of a second? These artificial means of measurement are therefore only simple aids to our incapacity, but do not in reality in the least enable us any better to comprehend the incomprehensible. They are artifices by which we diminish the immense in order that we may adapt it to be contained in our own littleness.

It is said that the world ought to be infinite in order that the work may be worthy of its Infinite Creator. But if it were infinite and peopled to infinity with stars, the celestial vault ought to appear, in all its extent, as brilliant as the sun. Such is not the fact; and hence we must conclude that the stars are not infinite in number. On the other hand, in order to sustain the hypothesis in opposition to the testimony of the senses, it is supposed that there must be an absorbing medium which prevents the light of the distant stars from reaching us. That many opaque bodies exist in space which may intercept light is not doubtful, but these would be comparable to minute particles of atmospheric dust, which may enfeeble but cannot intercept light entirely. We limit ourselves to the fact of a finite physical world, and when, even under such limitation, the conception transcends our capacity, it does not seem worth while to dally with theories which are in their very nature beyond comprehension.

When once we give a loose rein to such ideas, there arises immediately the supposition that many worlds like ours may exist in space, and be unknown to us because separated from us by an absolute vacuum, devoid even of the ethereal medium through which light is propagated. As it is impossible to prove such conceits, and also impossible to impugn them, it is not worth while to occupy ourselves with them. What we see is already too much for us, not to mention what we do not see.

(13) The matter which composes this incomprehensible mass is yet always the same. The elements which the chemist studies in his laboratory are the very same elements which the spectroscope reveals in the stellar atmospheres and in the ultimate nebulæ. Small as may be the number of these elements which have been identified, it is still large enough to assure us that the laws which govern matter are the same with us and in that remote profundity; and daily discoveries bring new confirmation to this idea.

(14) But the creation which the astronomer contemplates is not a simple aggregation of incandescent matter; it is a prodigious organism, in which, where the incandescence of matter ceases, life begins. Though this life may not be discoverable by our telescopes, still, from the analogy of our globe, we can argue to its general existence in others. The atmospheric constitution of other planets, so greatly similar in some of them to ours, and that of the stars, so similar to that of our sun, are persuasive reasons for believing that those orbs are either at this moment in a similar condition with our own, or are passing through some one of those states through which our own system has already passed, or through which it is yet destined to pass hereafter.

(15) In the immense variety of objects of creation which have been or which still are in existence on our planet, we can argue the diversity which must exist yonder. If with us the air, the earth, and the waters are peopled with so large a variety of living things, changing also so often with the mere mutations of climate and of the medium which they inhabit, how much more ought we to find such in those immeasurable systems where the secondary bodies are lighted up sometimes not by a single sun, but by several in turn, and where climatic changes alternating from heat to cold must be extreme, both on account of the excessive eccentricity of the orbits, and because of variations in the absolute intensity of radiation, from which our sun itself is not exempt.

(16) But it would be a very narrow view to model the entire universe upon the pattern of our little globe, while in this relatively microscopic system there is presented so great a variety; nor is it philosophical to pretend that every star is inhabited like ours, and that in every system life is limited to dark satellites alone. It is true that with us life could not exist except between confines of temperature narrowly limited—that is, between zero and 40° to 45° Centigrade (104° to 113° F.)—but who can tell that these are not limits for our organisms only?* At any rate, even if with these limits there could be no life in stars in a state of flame, these greater stars would have always in the creation the grand office of sustaining life, by regulating through the attraction of their masses the courses of the secondary bodies, and by enlivening them with their light and their heat. And what should there be surprising if among so many millions there should be numbers, even great numbers, absolutely desert? Do we not see that, upon our own globe, regions extensive enough in proportion are incapable of sustaining life? This is by no means a disparagement to the immensity of the fabric, either in respect to its own proper dignity or in respect to the presumed design of the Architect.

(17) Life fills the universe, and with life is associated intelligence; and as beings inferior to ourselves abound, so may there in different conditions exist others of capacities infinitely greater than our own. Between the feeble light of that divine ray which glows in our frail structures, by help of which also it is permitted us to comprehend so many wonders, and the lofty wisdom of the great Author of all things, there may possibly be interpolated grades of created beings infinite in number, for some of whom theorems which to us are the fruit of arduous studies may be simple intuitions.

(18) But this is a sphere over which the astronomer may not extend his reign. His proper province is to study the material and mechanical development of the world—to trace it out in space, and lend aid to the geologist who studies it in time. In this also the scale is endless. The condensation of the nebulæ is so slow that the period of a little more than a century since our acquaintance with them began has not yet shown in them any certain trace of changes; and this considerable lapse of time can only be regarded as an instant. The double stars, small as their relative distances may be, still occupy centuries and centuries in completing their periods. The configuration of the constellations has not sensibly varied since man first looked upon the heavens. Such is the slowness with which movements are performed which still in real velocity many times surpass that of our earth! These configurations, nevertheless, will yet vary, and then perhaps it will at length be possible to obtain some idea of the relation to other stellar systems of the system to which our own belongs.

(19) Inasmuch as no new and conspicuous body has come to occupy a permanent place in the starry sphere, if any such body has at any time appeared instantaneously, we now know that this was not a new creation, but one of those great momentary conflagrations which are not rare even in our day, but are only difficult to demonstrate on account of the apparent minuteness of the bodies which are their seat. Are these conflagrations born of collisions from without, or from new transformations in the interior of the star? We know not; but we still see in them the evidence that in those depths of space, where eternal silence seems to reign, there exists nevertheless a prodigious activity. The long series of years which measures the celestial revolutions is parallel to the series according to which the geologist calculates the duration of the revolutions of our own globe; and in this the two extremes, the immensity of the heavens and the life-period of our little planet, touch each other.

(20) The comets, which have been the subject of so many speculations during the past century, are now recognized to be only visitors, strangers to our system, and parts of a great nebula of a special nature, containing gases very familiar to chemistry—not in elementary condition, as in the sidereal nebulæ, but combined with proteiform carbon, an element detected only in a portion of the stars. Their light is not wholly due to reflection from the sun, but is also in some degree their own. In order to produce such light there is not needed a proportional incandescence, or an elevation of temperature which would carry the body to redness, but only such a molecular structure as may render it capable of exciting certain waves in the ether; as, in many cold-blooded terrestrial insects and marine animalcules, we see the slightest force exciting luminosity without a proportional elevation of temperature. The modern ideas on the synchronism of undulatory motion between the ether and the molecules of bodies are such as to set at rest the so-much controverted question upon this point.

(21) Heat is the prime force animating the universe; its action is transmitted from one body to another by the instrumentality of a continuous medium which we call ether; and we are in contact with the remotest regions through this mysterious medium, whose vibrations constitute radiant heat, light, and vital chemical activity, and whose dis-

*The cessation of life at 0° arises from the solidification of water; in the deep seas, where the salt water freezes only at 3° below zero, life can exist at —2½°, or even at —3°. If water is not the only element necessary to life, but if life can be associated with any other liquid, who can fix bounds to its existence?

turbed equilibrium of density produces attraction. This medium is that which binds the whole together, and gives unity to the whole in spite of the immense distances.

(22) Gravity is the force which directly rules the entire creation, from the pebble falling upon the earth to the nebula gradually condensing in the profundity of space; but it is not the sole force which rules in the universe; perhaps even it is itself only a consequence of disturbed equilibrium in the ether. But the comets have given indications of some other force not yet well defined operating in space. The rapid development of the tails of these bodies is not explained by the action of heat alone, nor by that of gravity. Magnetism, electricity, have been invoked, but as yet nothing as to this is certain.

(23) The decennial vicissitudes of the sun, manifesting themselves in the variations of its spots and in the force of its eruptions, are reflected in the variations of terrestrial magnetism and in the electric displays of the aurora borealis; thus proving that another force besides gravity emanates from the sun, and expands itself through the space occupied by the planets, determining in them vicissitudes of the most abstruse nature. We are certain of this force, but are ignorant of its mode of action.

(24) We are not yet at the end of marvels; we shall be so only when we cease to study. There was a time when the solar system was limited to a central luminous body surrounded by a few of the larger non-self-luminous celestial objects. Not long after there were added to this, numerous systems of the second order (the satellites), and discovery was believed to be at an end. Now, on the other hand, the very idea of the system is itself radically changed. Now we know that around the sun, between Mars and Jupiter, there circulate as many as 164 small planets (Sept., 1876); that a gaseous envelope surrounds him which frequently extends as far as the earth, and forms the Zodiacal Light; and that there are also numerous comets permanently circulating within the domain of his attraction, and endowed with a luminosity of their own; there are recognized also numerous currents of extremely minute bodies ploughing in all directions the planetary spaces; and all this to make up the cortége of a star which placed at the stellar distance would be only of the sixth magnitude—that is to say, would be hardly visible to the naked eye!

(25) It is not so very long since it was believed that the stellar spaces were peopled only by well-defined and compact bodies; now there have been discovered those enormous masses of gas which are perhaps destined to constitute other solid bodies, if even already there are not some of them solidified, of which light has not yet brought us the announcement. The orbit of the greatest of our planets would hardly measure the extent of a planetary nebula. What, then, shall we say of so many others; as, for example, of that of Orion, which extends through so many degrees in its brighter part, to take no account of the fainter?

(26) How many other marvels ought we not to find in the immensity of that space which we are yet unable to sound? Who would have imagined, ten years ago, the wonders which the spectroscope was on the point of revealing? Every new improvement in art brings a new improvement also to science; and the astronomer, profiting by both art and science, is finding new revelations of the greatness of God, and giving new cause to exclaim with the royal prophet, "O Lord, how manifold are thy works! in wisdom hast thou made them all;" and thus, as the heavens declare his glory, and the firmament showeth forth his handiwork, so if the day astounds us with its wonders, the night opens up to us the very treasury of science.

P. A. Secchi,

*Translated by F. A. P. Barnard.*

**University.** See University Education.

**Univer'sity Educa'tion.** The Roman empire was divided 395 A. D. In the Eastern or Greek portion the philosophical schools at Athens, Constantinople, etc., lingered until the Turkish invasion (1353–1453). In the Western or Latin portion the dissolution of society and political organization under the conquests of the German tribes was attended by the decay of arts and letters. The imperial schools founded by Vespasian, Antoninus Pius, and Hadrian disappeared. Western Europe was undergoing a slow process of reconstruction. The little knowledge that existed was exclusively in the hands of the priests and monks, and was imparted in the cloisters and parish schools. The language employed was Latin, and the textbooks were manuals of devotion, homilies, and rudimentary expositions of Christian dogma. Charlemagne took great interest in the spread of learning, but his efforts do not seem to have met with much success. Not until the twelfth century do we find the beginnings of the modern system of higher education. Italy led the van. The great medical school of Salerno (under Constantin), and the equally great law school of Bologna (under Irnerius), became centres for many hundreds and thousands of scholars in these branches. In like manner, Paris (under the influence of Abelard) became the centre for theology and scholastic philosophy. Not much later were Oxford and Cambridge. These various institutions, be it observed, were at first private in their nature. The teachers took such pupils as offered themselves, and depended upon student-fees for support. The next step was that of incorporation. By papal bulls and royal charters the teachers and pupils of a given city were constituted into a corporation, the *universitas magistrorum et scholarium*. The conception of a "university," as an institution embracing the sum-total of studies, was of a later growth. Thus, Paris, which began with theology, rapidly assumed the foremost rank, and enlarged the range of studies so as to include also the arts (or letters), medicine, and law (1260). Certain professorships were supported from the royal purse, others by private endowment. The universities began to assume more and more the character of permanent institutions under the joint control of Church and State. Certain grades of learning in the several branches were established, and degrees conferred—*e. g.* baccalaureus, licentiate, doctor, magister. One who had obtained the highest degree, magister or doctor, had the right to teach at any university in any country. Students were grouped by "nations," according to the country from which they came. In some universities, notably in Italy, they had the right of electing the rector or president of the university. This privilege still exists in the Scottish universities. The "faculties" are to be regarded as subsequent in time to the "nations." They owe their origin to the efforts made by Church and State to put into proper shape the unavoidable classification of study, and to control the "nations." According to Meiners, the theological faculty arose out of a dispute between the doctors and magisters of theology at Paris and the mendicant orders, who also sought the privilege of teaching. The pope intervened in favor of the Dominicans and Franciscans, and conferred upon them the privilege, so that by the middle of the thirteenth century these new teachers constituted a "faculty." The example thus set in theology was followed in law and in medicine. The nations were at last merged in the faculty of arts. But the subject is involved in the greatest obscurity. The fourfold division of faculties (law, medicine, art, and theology) subsists to this day. It has given the tone to the higher education of continental Europe, especially in Germany, although in the country of its origin, France, it has been shorn of some of its best features. The "colleges" are of much later date. They were at first charitable foundations for the maintenance of poor students, especially of theology. The young beneficiaries, called bursaries (hence the modern German *Burschen*), lived together under the supervision of masters, who saw that they conducted themselves discreetly and attended lectures diligently. The masters also gave instruction intended to supplement the university lectures. This instruction consisted usually in extracts (*summæ*) from certain textbooks, to be committed to memory. In the course of time the college instruction became in many colleges the chief thing, and attendance on university lectures fell into disuse. A curriculum, or prescribed course of study, was thus established—in most cases, a dry, unproductive routine of question and answer in the so-called Socratic method. When the study of the literary treasures of classic Rome was revived by Petrarch and his associates, the colleges became the refuge of the now waning scholasticism, and declined with it. The most celebrated of all, the Sorbonne, founded 1250, which had gradually absorbed the theological faculty, was abolished in the French revolution (1789). Its buildings are now used by the professors of the present Paris faculties of theology, science, and letters; hence the university itself is not infrequently called the Sorbonne. The Collége de France, established during the Renaissance to make good the defects of the older colleges, still subsists as an institution of the highest learning, collateral with the present university. It counts among its thirty-one professors some of the most eminent scholars. As places of conjoint abode and study the "colleges" may be said to have disappeared from the continent of Europe. Their funds have been secularized and their buildings put to other uses. But in England the result has been different. The colleges and halls of Oxford and Cambridge, most lavishly endowed, succeeded in absorbing the university. They still retain the dormitory system, instruction by masters (tutors or fellows), and the enforcement of religious exercises. Each college is independent in its funds and administers its own affairs. The powers of the university corporation are practically limited to holding

final examinations and conferring degrees. The university "professors" are few in number compared with the "tutors," and attendance upon their lectures is in general not obligatory. The history of the universities of Germany affords the best example of the growth of a complete and practical system. The oldest are those of Prague (1348), Vienna (1365), Heidelberg (1386). By reason of the great number of independent states, the number of seats of learning was multiplied to excess. From 1348–1871 there were established 42 in all; many of them have disappeared or been merged in others. The existing universities (of the German empire proper) are Berlin, Bonn, Breslau, Erlangen, Freiberg, Giessen, Göttingen, Greifswald, Halle, Heidelberg, Jena, Kiel, Königsberg, Leipsic, Marburg, Munich, Rostock, Strasbourg (reorganized 1871), Tübingen, Würzburg. This list comprises only such institutions as have the four faculties. The German universities were modelled originally after the one in Paris. The common language of instruction was Latin. Students were grouped by "nations." The dissensions between the Bohemian "nation" and the Germans at Prague led to secession and the establishment of the University of Leipsic (1409). In the faculty of arts instruction was given in the trivium and the quadrivium. The former consisted of grammar, rhetoric, and dialectics, the latter of arithmetic, music, geometry, and astronomy. These seven liberal arts are summed up in the *versus memorialis*: "Lingua, tropus, ratio; numerus, tenor, angulus, astra." The course in arts was regarded as preliminary, in whole or in part, to a degree in the other faculties. In theology instruction was confined to a running commentary on the Vulgate and to the study of a few books of general authority; *e. g.* the *Sententiæ* of Petrus Lombardus. In law, the professor explained difficult passages in the *Corpus Juris Civilis* and the *Corpus Juris Canonici*. In medicine, Hippocrates and Galen were the chief authorities. The Renaissance and the Reformation revolutionized the German universities. Under the influence of Erasmus, Reuchlin, Melanchthon, and Luther—who did for Greek what Petrarch had done for Latin—a new spirit of inquiry was infused into the old seats of learning. The students learned to reject mere authority, to view with indifference the verbose disputations of the Realists and Nominalists, and to go back to the original sources of knowledge in Hebrew, Greek, and Latin. Luther, in particular, by his sermons and his translation of the Bible, labored to make the highest culture accessible to all. Subsequently, by the disputes which sprang up between Lutheranism and Calvinism, by the rise of the Jesuit reaction, but chiefly by the devastations of the Thirty Years' war, the progress of learning was retarded two centuries. The second revival came in the latter half of the eighteenth century. Outside of the universities, Lessing, Wieland, Herder, Goethe, and Schiller strove to raise the tone and tastes of the people. Within the university system, Frederick the Great and Von Zedlitz sought to effect a direct reform. The difficulty under which all the universities—not merely of Germany, but of Italy, France, and England—had at all times labored was the insufficient preparation of the students. Universities were thronged with young men who had received but scanty school-training, and were unable to make satisfactory progress in advanced studies. On this point the accounts both of the numbers of students and of their mode of life are sufficient evidence. These accounts would sound incredible were they not perfectly authenticated. In the thirteenth century there were 10,000 students of law at Bologna. In the thirteenth and fourteenth centuries one-third of the population of Paris was connected with the university in one way or another. Gambling, drunkenness, duelling, and bloodshed were of common occurrence. Although the universities professed to admit no one who had not studied three years at a grammar school, it is evident that they were thronged with ignorant and unscrupulous adventurers, who gained admission merely to abuse the immunities conferred by charter upon students. During the great religious wars in Germany the universities became almost the seats of licensed barbarism. The reform begun in the eighteenth century covered many points. Preparation for the university was taken from the hands of the local clergy, house-chaplains, and private tutors. Teaching was made a distinct vocation, for which the teacher must qualify himself specially. The schools were reorganized, and expanded so as to cover everything of a propædeutic nature. The school-teachers were appointed by the state, and the schools converted into state institutions or subjected to close supervision. Admission to the university was made to depend upon the final school-examination, which was to be controlled by state officials. These numerous and radical changes were not all effected at once. The wars with France operated as a drawback. But Frederick's successors, guided by such men as F. A. Wolf, Schleiermacher, and Wilhelm von Humboldt, succeeded in placing the university system upon its present basis. The example set by Prussia has been followed by the other German states, and perhaps surpassed even by some. Higher education in Germany, therefore, is to be regarded as the culmination of an elaborate process of preliminary training. To enter the university one must have completed a course of eight or ten years at the gymnasium or realschule, consisting of Latin, Greek, mathematics, history, German literature, one or more modern languages, and the rudiments of the natural sciences, about equal in rank to the Junior year of an American college. The university studies are professional rather than general. The student matriculates in only one of the faculties, and pursues the study of law, or medicine, or theology, or philosophy, until he applies for a degree or is examined by a state board for appointment as officeholder or teacher. In the philosophical faculty, which embraces everything not contained in the other three—viz. philosophy proper, philology, history, mathematics, the natural sciences, political economy, etc.—natural limitations are observed. The student of philology is not held to mathematics, or *vice versâ*. There are no prescribed courses of study, no term examinations, and the final degree of doctor is no longer required for state appointment except in the branch of medicine. Degrees are conferred upon passage of an oral examination and presentation of an elaborate thesis, except in theology, where the degree of D. D. is given solely *honoris causâ*. The German universities are state institutions for the professional training of clergymen, lawyers, judges, doctors, teachers in the gymnasium or realschule, and officeholders of the higher grades. They are the only places where a German can fit himself for his profession. Hence it is that the leading men in Church and State, in science and letters, are university graduates. By the new school laws (1872–73) candidates for orders in the Roman Catholic Church are no longer permitted to study in the so-called *convicta* (confessional boarding-schools) and priest seminaries, but will be held to the gymnasial and university course. At Freiberg, Munich, and Würzburg the faculties of theology are exclusively Roman Catholic. At Bonn, Breslau, and Tübingen they are paritetic—*i. e.* each system is represented by a full set of professors. The other universities are exclusively Protestant. The method of university instruction is chiefly by lecture. There are no recitations, but *seminaria* and *repetitoria*, where professor and student may discuss informally topics connected with the lectures. Attendance is not enforced. No time is prescribed within which the student must complete his work, but in most departments a minimum of three or four years is exacted. It is not necessary to remain at the same university. Students pass freely from one to another to hear particular professors. Instruction is given by full professors (*ordinarii*), half-professors (*extra-ordinarii*), and *privat-docenten*. The half-professors are not subordinates or assistants, but rather candidates for full appointment. The same is true of the privat-docenten, or resident graduates, who have habilitated themselves by special work as docents. They are free to lecture, and their lectures are received as full equivalents in the university and state examinations. Matriculation fees are very low; each set of lectures is paid for separately, the amount varying with the subject and number of hours per week, but averaging five dollars a term for a daily lecture. There are no compulsory religious exercises. Discipline is administered by a university court, composed of the rector, one or two law professors, and a state official. This body exercises the functions of a court, and has the right to imprison students for a term not exceeding two weeks, to impose small fines, to suspend or expel, and to take exclusive cognizance of actions against students for debt. The range of study is immense, and includes everything which is not of a technical nature, for which provision is made in the polytechnicums. The characteristic features of university study are liberality, thoroughness, originality, and the parity of all branches. Each university is a corporation. The professors are usually nominated by the respective faculties, but confirmed by the state. Some of the universities have large private funds, others are wholly dependent upon state subvention. But even the wealthiest rely upon the state for meeting the greater part of current expenses.

Next to Germany stands perhaps Switzerland, which has the three universities of Bâle, Berne, and Zurich and the academies of Geneva and Lausanne. The Austrian universities of Vienna, Prague, Gratz, and Innspruck are little inferior to those of Germany. In 1850 the philosophical faculty was raised from its position of subordination and placed on an equality with the others. The medical faculty of Vienna and the law faculty of Prague are renowned. Galicia has two universities, Lemberg and Cracow, and a third opened in 1875, but not yet fully organized, at Czernowitz (Bukovina). Hungary has the single university of

Pesth. Closely akin to Germany is Holland, with the universities of Leyden, Groningen, and Utrecht; Denmark, with the University of Copenhagen; Sweden-Norway, with Upsala, Lund, and Christiania. There are nine Russian universities—at St. Petersburg, Moscow, Dorpat, Kasan, Kiev, Charkov, Odessa, Helsingfors, Warsaw. The one at Dorpat, founded by Gustavus Adolphus, resembles closely those of Germany, and is frequented by large numbers of Germans from the Baltic Provinces. It has a faculty of Lutheran theology.

The present system in France is the result of many changes. The revolution of 1789 swept away the old universities. Napoleon I. reorganized higher instruction as one grand corporation, entitled the University of France. After repeated innovation the existing system was adopted in 1852. The control of all matters of education is in the hands of the minister of public instruction. There are no universities in the strict sense, but faculties for higher education in the principal provinces. Paris is the only city that has all five faculties—viz. law, medicine, theology, letters, and science—and even here they are not united in one corporate body. At Caen, Dijon, Grenoble, Poitiers, Rennes, there are faculties of law, science, and letters; at Aix, faculties of law, letters, and theology; at Toulouse, theology, law, science, letters; at Besançon, science and letters; at Bordeaux and Lyons, theology, science, and letters; at Lille, science and letters; at Montpellier, medicine, science, and letters; at Rouen, Roman Catholic theology; at Montauban, Protestant theology; at Clermont, Douai, Marseilles, and Nancy there are chairs of science and letters. At Paris, furthermore, there is the renowned school of living Asiatic languages, the no less renowned *Ecole des Chartes* for the special study of historical documents, and the Collége de France, already mentioned. Many of the professors, especially at Paris, are most eminent men. But the defects of the system are numerous and grave. The faculties in one and the same place do not constitute a homogeneous corporation, and they are too dependent on the minister of public instruction. The professors have too much the character of state officials, and there are no privat-docenten to create healthful competition and ensure the introduction of new ideas and methods. There is too much centralization and too little of scientific study. Instruction is regarded as a direct preparation for practice in law, medicine, etc., rather than as a means of promoting thoroughness and originality of research. France is inferior to Germany, not only in the quality of its learning—some brilliant exceptions aside—but also in the number of professors and in the diffusion of knowledge. The lyceums, analogous to the gymnasium and realschule, are less numerous, and teaching assumes more the form of drill. In the S. of France the illiteracy and superstition of the people are deplorable. Yet, despite these drawbacks, the number of learned men is great, the attainments of the French savants rank second to none, and the array of talent and culture in Paris is unequalled even in Germany. The Roman Catholics have obtained recently the enactment of a law permitting the establishment of a free university, to be endowed by private means and to be exempt in the main from governmental control. But this new institution under Ultramontane influence has not yet been organized.

Belgium stands between the German and the French systems, but inclined to the latter. There are two national universities, at Ghent and at Liége, a Roman Catholic at Louvain, and a free university (without a theological faculty) at Brussels. Italy has eighteen universities, of which Bologna, Florence, Naples, Palermo, Pavia, and Turin are of the first class. But in most of the Italian universities the theological faculty is wanting, the priests being trained in episcopal seminaries. The prevailing opinion is that the universities are too numerous for the population, that the professors are insufficiently salaried and appointed without due regard to qualifications, and that the schools are very backward. For the past ten years, however, there are evident signs of a revival of letters and science. Not a few of the professors at Naples, Florence, and Turin represent the most advanced thought of the day, and favor the adoption of German methods and thoroughness. Spain counts ten universities, of which the outside world hears little. The glory of these old seats of learning (Madrid (1836) is the only one of recent origin) seems to have declined with the general decay of the country. The Portuguese university at Coimbra is more prosperous. Greece has a national university at Athens (1837), modelled after the German plan. Turkey has no institution of higher learning. Roumania has the imperfectly-organized universities of Jassy and Bucharest. In India there are universities at Calcutta, Madras, and Bombay, with able professors and excellent courses in arts, law, medicine, and civil engineering. Japan, the most progressive Asiatic country, has already a number of normal schools and high schools of chemistry, technology, languages, and jurisprudence, but nothing of the nature of a university. The same must be said of Brazil.

Higher education in Great Britain, despite the prestige of English letters and science, is still defective. Oxford and Cambridge are each a congeries of colleges. Each college has its own body of students and its own buildings—not infrequently its own library. The students are not arranged so strictly in four classes as in the U. S., but the course covers practically four years. Instruction is given by the "fellows" of the college, and consists in the main of recitations upon work assigned. Candidates for honors or fellowships usually take private instruction besides from resident graduates of celebrity (whether fellows or not), familiarly called "coaches." The fellows of a college are in most instances appointed on close competitive examination; the fellowships are liberally endowed, and tenable at will or until marriage. This last feature is a relic of monasticism. Many of them are mere sinecures. Membership in the Church of England is a condition of appointment. The master and fellows of a college constitute the corporation. The public examinations for degrees and honors are held by the university at large. The course of instruction is threefold—in mathematics, in the classics, and in natural science. Until quite recently both Oxford and Cambridge were exclusively Church-of-England institutions; at Oxford no one could matriculate, at Cambridge no one could obtain a degree, without subscribing to the Thirty-nine Articles. These restrictions have been removed by act of Parliament, but the fellowships and college administration are still under the control of the Church. The number of students is small compared with the attendance at the leading universities of Germany. Neither Oxford nor Cambridge has a faculty of medicine. A few lectures on Roman law are given, but they are far from constituting an independent branch of study. The common law is studied at the inns of court in London. Even theology is rather incidental to the general course, which corresponds to that of American colleges, but is of a higher grade. So many changes have been already introduced, however, and so many more are in prospect, that it would be hazardous to foretell the condition of the English universities in the next generation. The entire system is undergoing a process of reconstruction, with a view to better utilizing the immense revenues and expanding and liberalizing the studies. The dissenting university at Durham is of minor importance. In 1826 was founded by subscription the Free University (in London), which was consolidated in 1836 with the London University, a board of examination with power to confer degrees. The present London University resembles those of Germany, but has no faculty of theology. King's College, London, was founded by Episcopalians in opposition to it. The College of Physicians and the College of Surgeons (London) are world-renowned; so also the School of Mines (London), and the Royal Institution which became famous under Young, Davy, and Faraday, and maintains its celebrity under Tyndall and Huxley. The Scotch universities of Edinburgh, Aberdeen, Glasgow, and St. Andrew's are more national in character. They are not exclusively denominational, and the students come from all classes of society. Instruction is less fettered in method, resembling somewhat the lecture system of Germany, but scholarship is not so finished as at Oxford and Cambridge. Edinburgh is renowned for its medical faculty. In general, the Scotch students do not come so well prepared as the pupils from the German gymnasiums or from the so-called public schools of England. Ireland has Trinity College, Dublin (Episcopal), the Roman Catholic University, and the Queen's Colleges at Belfast, Cork, and Galway. Trinity College resembles the English in method, but is much more liberal; the Queen's Colleges are more akin to the Scottish, but in general inferior. In Canada there are the McGill College, Bishop's College, Laval University (Quebec), and Queen's College (Toronto).

For the mere number of superior institutions the U. S. might claim the foremost rank. According to the report of the U. S. commissioner of education for 1875, there were 374 colleges and universities in operation. But close examination will show that most of them, especially in the South and West, are little more than schools, whether regard be had to the number of pupils and instructors or to the quality of the instruction. Mere titles are misleading. Thus, the institution at Forest Grove, Or., which has only four professors, three instructors, and ninety-six students—all but six of whom are in the preparatory department—has the title of "university;" whereas Yale, with a staff of ninety professors, assistants, lecturers, etc., and over a thousand students, with well-equipped departments of the arts, letters, science, law, medicine, and theology, is entitled "college." The elements of which higher education in America is composed are so heterogeneous as to render

thorough classification impossible. The chief defects are—first, the private and sectarian character of the colleges; second, the want of connection between them and the public schools. In continental Europe, as has been shown, education in all its stages is treated as a state affair. In America the state has contented itself with providing free schools for instruction in elementary so-called English branches, and has not regarded intermediate and higher education as belonging to its sphere, but has left them to private enterprise and munificence. The state requires no special training for civil appointment. Admission to the bar is often a mere form, and a diploma from any one of the numerous schools of medicine—private institutions wholly exempt from supervision—entitles the possessor to practice. The evils of this want of system are becoming more and more manifest. The college, being a close corporation, pursues its own course in disregard of the outer world. Appointments to professorships are in too many instances determined more by denominational considerations than by superiority of merit. Superficiality and narrow-mindedness are too often the result. Moreover, the great number of colleges involves a scattering of the resources of education, and a harmful because expensive rivalry. Instruction is in the form of a curriculum of four years, embracing Latin and Greek, mathematics, English studies, and the elements of political and ethical science. History is imperfectly taught. A good deal of attention is paid to physics, chemistry, and geology, but the sciences of natural history are for the most part left to special schools or subordinated to the general curriculum. The students, arranged in classes by years, usually live together in dormitories. Most of the colleges are struggling with poverty, and the funds even of the more fortunate are usually hampered by restrictions in the mode of employment. The college course, like that of England, is merely general, and not professional. Law, medicine, theology, etc., are studied at special schools. But several important exceptions to the usual system are to be noted. The University of Virginia, the work of Jefferson, does not enforce a curriculum. Students may select among several courses leading to different degrees. There are "schools" of mathematics, the languages, natural science, law, medicine, etc. Religious exercises are not compulsory, and the general tone is extremely liberal. A similar institution is the University of Michigan, the largest and most influential seat of learning in the West. Younger and less developed is the University of California. The most liberal is Cornell University, where students are not held to courses except for degrees, and are completely freed from denominational restraint. The universities of Michigan and Virginia exert an indirect but very strong influence upon the public schools of those States, and have made them virtually preparatory institutions. The State universities of Wisconsin, Iowa, and Minnesota resemble that of Michigan in tone, but are far from having attained the same degree of development. The oldest and most frequented university is Harvard. It has a very large undergraduate department, large medical and law schools, one school of Unitarian and one of Episcopalian theology, and a scientific school. The innovations made here during the past ten years are great and almost radical. The "undergraduates" have the option among numerous courses and studies. Were the so-called academic department organized as a "philosophic faculty," and a uniform and rather more advanced grade of preparation required for admission to the university at large, Harvard might rank with Göttingen or Heidelberg. The income amounted (1875) to $168,541 from student-fees and $218,715 from property. Yale is next to Harvard in prestige, but is less liberal in its policy and method. Columbia College has an undergraduate department, a school of mines, and a law school, the most frequented in the country. The College of Physicians and Surgeons is also connected with it, although not organically. The income now amounts to $205,000 from real estate and $100,000 from student-fees. It is estimated that when the present leases expire the income from this source will be doubled. The recently-established Johns Hopkins University of Baltimore (endowed with an income of $200,000) promises to become the centre of the most advanced stage of postgraduate instruction, and is thoroughly liberal in its character. But up to date several appointments of full professors have been announced, and the final plan of study is not yet elaborated. The University of Pennsylvania has an undergraduate department, a large medical school, and a school of science. Many of the colleges are founding schools of science subordinate to or co-ordinate with the old curriculum. The law, medical, and scientific schools not connected with any college—*e. g.* the Jefferson Medical (Philadelphia), the Rensselaer Polytechnic, the Boston Institute of Technology, the Stevens Institute—are numerous. Cornell University, the University of Michigan, and some others are open to women. There are also colleges exclusively for women, of which Vassar is the most notable.

The future of higher education in America is not free from perplexities, but is in the main hopeful. The most encouraging symptoms are the liberality shown by private individuals in endowing colleges and professorships ($33,000,000 were thus donated 1871–74), and the growing disposition to relax, if not to abolish, denominational restrictions and to liberalize study. But complete success is scarcely possible unless in each State one or more colleges, by reason of their wealth, liberality, and array of professors, shall attain unquestioned predominance, and thereby make themselves the resort for all classes and the final standard in matters of scholarship. (See Meiners, *Geschichte der Hohen Schulen;* Matthew Arnold, *Schools and Universities of the Continent; Das academische Jahrbuch* (1875); U. S. commissioner of education's *Annual Reports* (six since 1867); *North American Review*, Oct., 1875, and Jan., 1876; F. A. P. Barnard, *Report to the University of Alabama* (1854), *Letters on College Government* (1854), *Letter to Trustees Univ. Miss.* (1858), *Reports to Trustees Col. Coll.* (1870–71).) J. M. Hart.

**University of Virginia,** p.-v. Albemarle co., Va.

**Universol'ogy** is the name given to a universal science covering the whole ground of philosophy, of the sciences in their general aspects—in which sense it is called "sciento-philosophy"—and of social polity, or the collective life of the human world. As a philosophy, in the more common and general or less precise use of that term, the system is called "integralism," as that of Comte is called "positivism;" as a new science—in the exact sense as a new scientific method and as the philosophy of science—it is especially known as "universology;" and as a social polity—"the universal institute of humanity" (universal government, universal religion, universal social organization, etc.)—it is called the "pantarchy." Sciento-philosophy is the name which applies to the system especially in so far as it is a philosophy of the sciences, or a new philosophical system based on and derived from the objective point of view of the special sciences.

Universology claims to be reconciliative of all systems of philosophy, by virtue of positive new discovery and of the unity which it, for the first time, establishes between philosophy and science, and between both of these and the domains of art, religion, and practical life. Universology claims to be "a single and central science among the sciences, and that from which the integral education of mankind should hereafter take its departure. It embraces those laws of being which are common to all sciences and to all departments or domains of being, and which, when known and systematized, constitute the unity of the sciences in a sense alike new, peculiar, and important. Universology is based on analogy, resting in turn on the discovery and demonstration of a unific element in things otherwise diverse from each other through all spheres—not, therefore, analogy in a vague poetic sense, as mere superficial resemblance, nor in an occult and mystical sense, nor, in fine, in the narrow technical sense to which it has been confined in comparative anatomy as contrasted with homology. It is analogy in that essential sense in which it underlies all other possible analogies. Analogy, in the broad or universological sense, includes both homology and analogy in the narrow scientific sense, together with all resemblances which are fundamental, or such as grow out of an underlying unity of system (of outlay, organotaxis, or functions) in all spheres of being; or such, in other words, as rest upon the existence of a real, permanent, and traceable unific element in the midst of the overlying diversity of phenomena. The universologist is, therefore, by no means, one who *claims to know everything*, as is sometimes mistakenly supposed, but merely one who *knows* certain newly-discovered principles and laws of science which are common to all the sciences, and which serve to systematize and harmonize the sciences and the details within the several sciences, as well as—when applied in the practical sphere—to regulate the affairs of human life."

The three fundamental principles of universology, from which the whole logical and actual evolution of being is then to be rigorously deduced, furnishing all the sciences and the details within the sciences, are unism, duism, and trinism, defined as follows: Unism is the principle or spirit of the number one, duism of the number two, and trinism of the number three. Unism is not mere unity, nor duism mere duality, nor trinism mere trinity. If we were to consider a handful of printer's types, unity in respect to this collection of objects would mean either the handful as one, or a single one among the types, or each of the types in turn as a single one; and duality, in this connection, would mean either some two among the types, or

any two among the types, until the whole was exhausted by these couplings. Unism, as relating to this same collection of objects, would, on the contrary, mean no one of the ideas above attributed to unity, but a different idea, still related to unity—namely, the capacity of these types to be united into printer's forms which produce the printed page; so duism does not mean either of the ideas above attributed to duality, but another idea, which is, however, also related to or allied with two-ness—namely, the capacity of these types for being separated and distributed, each one apart from every other one, as a preparation, it may be, for other new combination or unity. So, again, trinism does not mean a mere trinity, which would consist of any three types united, but it means another idea, compounded of the unism and the duism, and related, therefore, to one and two, and indirectly therefore to three. Trinism is, in other words, the new and higher unity of the unism and the duism; that is to say, of the capacity of the types to be united for a unitary purpose, and to be separated or distributed for a dispartive purpose—the compound character, in other words, of this collection of objects enabling them to act in two opposite and contradictory methods, hinging, nevertheless, upon the inherent unity in the constitution of each type. Unism, duism, and trinism are, therefore, three *qualities* which inhere in, or pertain to, every type individually, and the sum of which qualities is the total character of the type. They are, nevertheless, qualities which are derived from quantitative discriminations, and specifically from one, two, and three; but they must by no means be confounded with the common ideas of unity, duality, and trinity.

Duism has a close relationship with Spencer's "differentiation," but it differs from it in the fact that it is the lowest or most elementary term of differentiation; that it offers, for that reason, the broadest generalization of the idea; and that it is, at the same time, more fundamentally exact. Unism and trinism are confusedly represented by Spencer's "integration."

Unism and duism crop out and reappear under many forms, and in the absence, heretofore, of any sufficiently compendious generalization, they have received a variety of namings; thus, unism is called unity, sameness, centralizing or centripetal tendency, gravitation, arrival, conjunction, thesis or synthesis, integration, combination, contraction, generality, simplicity, etc. It is the tendency to *unite* or toward *unity*, or the manifestation of the presence or results of that tendency, in thousands of modes in every sphere of being. Duism is called diversity, difference or variety, decentralizing or centrifugal tendency, repulsion, departure, separation, antithesis, analysis, differentiation, diffusion, expansion, specialty, complexity, etc. It is the tendency to *disparting* or *dividing*, or the manifestation of the presence or results of that tendency in thousands of modes in every sphere of being. Trinism is the principle symbolized by the *totality* of being, or of any particular being. It is compounded of unism and duism as its factors, constituents, or elements. Hence it is a cardinated or hingewise principle, entity, or manifestation, the type or representative of *all-concrete* or real being, unism and duism being *abstract elements of being merely*.

All orderly numbers capable of count or of falling into regular series constitute collectively unismal number, being characterized by unity in the sense in which we speak of the unity of a poem, a play, or other work of art. All chaotic and irregular numbers are then duismal, and the totality of number, embracing these two opposite aspects under one head or in one domain, is trinismal. Within the unismus of number—that is to say, within the domain of orderly numbers—the odd numbers, headed by the number one, are unismal; the even numbers, headed by the number two, duismal; and the combined series of odd and even numbers, headed by the number three, is trinismal. So all orderly, regular, or commensurable form is unismal; all disorderly, irregular, and incommensurable form is duismal; and the total domain of form as constituted of these two is trinismal. But within the proper unisms or domain of regular form, all round form, that which is constituted around one centre or regulative point, is unismal; all elongated form, the lowest term and type of which is the straight line, as that which is constituted with reference to two regulative points (the ends of the line), is duismal; and regularly modulated form, as Hogarth's line of beauty, triangular forms, and the like, as being constituted by reference to three regulative points, is trinismal form. To these elementary varieties all other forms are reducible.

In respect to position, the perpendicular, as central and uniaxial, is again unismal; the horizontal, measured by two axes, is duismal; and the incline from perpendicularity to horizontality, as relating at the same time to the one axis and to the two axes, is trinismal. As all these, however, are orderly, they are within the larger unismus of position, the corresponding duismus then being disorderly or chaotic position, and the larger trinismus being the totality of this domain of being.

It results from what has been said that orderly numeration, orderly form, and orderly position are three special instances of unism, and fall together into a new class or domain of being, which is the general unismus; that disorderly or chaotic numbers, disorderly or chaotic form, and disorderly or chaotic position are special instances of duism, and fall together into another special class or domain, which is the duismus of being at large; and that the conjunction of orderly and disorderly number, the conjunction of orderly and disorderly form, and the conjunction of orderly and disorderly position are special instances of trinism, and fall, in like manner, into a new class or domain, which is the trinismus of being at large. Unism, duism, and trinism become, therefore, the basis of a new and crosswise distribution and classification, taking in, as in this instance, a part of each particular sphere of being, as of number, of form, and of position, and uniting it with a corresponding part or portion of each of the other related spheres or departments of being.

And, again: within the unismus, odd numbers, round forms, and perpendicular positions are thrown together as allied analogically with each other; even or regular numbers, even or regular forms, and horizontal postures or positions (also called "even," then meaning level), are thrown in like manner into a special class as related analogically with each other; and finally, the combined series of numbers, odd and even, modulated form, partly round and partly elongated, and pyramidal or dome-like position, convergent from base to apex, are likewise thrown into a new special class or domain, as also analogously related to each other. This cross-division, as allied with classification, *is analogous with comparative science*, which takes a part out of each of the sciences compared, and classifies anew with reference to the relationship of these parts. The further signification and importance of this new basis of universological classification can only be exhibited in the special treatises devoted to the subject.

Abstract morphology is to universology, and to the rectified classification of all spheres, what the mathematical element is in geography, establishing definite lines of latitude and longitude, or what Mercator's projection is to navigation. It furnishes types and models for every variety of conception, and maps them out with a wonderful precision. *Uprightness* of character and the *inclinations* of the mind are no longer figures of speech, but scientific verities relating the phenomena of mind to the domain of form. Ethics, the science of government, sociology at large, and even theology and religion, are by this new method rendered rigorously amenable to scientific treatment. In a word, universology claims to be literally the science of the universe, or of all possible departments of thought, fully in accordance with the idea implied in its name.

STEPHEN PEARL ANDREWS.

**Unleavened Bread.** See BREAD, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Unleavened Bread, Feast of.** See PASSOVER.

**Un'na,** town of Prussia, province of Westphalia, manufactures stockings, hosiery, tobacco, chemicals, and tiles. In the vicinity are the rich saltworks of Königborn. P. 6417.

**Unst,** the northernmost of the Shetland Islands, Scotland, in lat. 60° 45′ N., comprises an area of 36 sq. m. and a pop. of 3042, mostly engaged in fishing and agriculture. The island is covered with rude memorials of the old Scandinavians.

**Un'terwalden,** canton of Switzerland, bordering N. on Lake Lucerne, comprises an area of 263 sq. m., with 26,116 inhabitants, who are Roman Catholics and speak German. It is surrounded and traversed by mountain-ranges, forming two long, narrow valleys which open toward Lake Lucerne. Pasturage and dairy-farming are the chief employments, cheese and timber the principal exports. Unterwalden is properly divided into two cantons—Upper and Lower Unterwalden, each with its own government; the capital of the former is Sarnen, of the latter Stanz.

**Upanishad.** See SANSKRIT LANGUAGE AND LITERATURE, by PORTER C. BLISS, A. M.

**U'pas Tree** [*Antiaris toxicaria*, from the native word *antiar*]. This tree grows in the forests of Java, where it is called *Bohun upas*. The viscid juice of the plant dries into a resinous mass termed by the Javanese *antiar*. This exudation is extremely poisonous, and when introduced into the circulation of an animal, death speedily ensues. The stories of the early travellers respecting the pernicious character of exhalations from the foliage of this tree are believed to be gross exaggerations. Specimens of the plant are cultivated in the conservatories of all large

botanic gardens. The plant belongs to the bread-fruit family. The leaves are ovate or obovate, four or five inches long, and conspicuously veined. The minute flowers are monœcious. The fruit is drupaceous. Other species of *Antiaris* are known to be innocuous. ASA GRAY.

**Up'cott** (WILLIAM), b. in Oxfordshire, England, in June, 1779; served an apprenticeship to a London bookseller, became purchasing agent for several book-collectors, and on the foundation of the London Institution in the Old Jewry, 1806, was appointed sub-librarian, the celebrated Porson being librarian. He directed his attention to the formation of a collection of works on British topography; made preparations for a history of Oxfordshire, never completed; made the most extensive known collection of autographs, which comprised more than 36,000 letters; was the discoverer and first editor of Evelyn's *Memoirs;* furnished most of the originals for the publication of the *State Letters* (1820) of Henry Hyde, second earl of Clarendon, and Ralph Thoresby's *Diary and Correspondence* (4 vols., 1830–32); wrote a continuation of Edmund Carter's *History of the County of Cambridge* (1819), and a considerable part of a *Biographical Dictionary of Living Authors of Great Britain and Ireland* (1816), and published *A Bibliographical Account of the Principal Works relating to English Topography* (3 vols., 1818). He resigned his position at the London Institution 1834, and spent his remaining years at Autograph Cottage, Islington, where he d. Sept. 23, 1845. Catalogues of his collection of autographs were printed in 1836 and in 1846. It was dispersed at auction in the latter year, but a large part was secured by the British Museum.

**Up'fold** (GEORGE), M. D., D. D., LL.D., b. at Shemley Green, near Guilford, England, May 7, 1796; came to the U. S. 1802; settled at Albany, N. Y.; graduated at Union College 1814, and in medicine in New York 1816; commenced practice at Albany, but soon entered upon the study of theology; was ordained in the Protestant Episcopal Church 1818; was minister at Lansingburg, N. Y., 1818–20; rector of St. Luke's, New York, 1820–28, being at the same time assistant minister of Trinity church 1821–25; rector of St. Thomas's church, New York, 1828–31, and of Trinity church, Pittsburg, Pa., 1832–50; and was consecrated bishop of Indiana Dec., 1849. D. at Indianapolis, Ind., Aug. 26, 1872.

**Up'ham** (CHARLES WENTWORTH), b. at St. John, New Brunswick, May 4, 1802, son of a loyalist refugee, judge of the supreme court of the province; graduated at Harvard College 1821, at Cambridge Divinity School 1824; colleague of Dr. Prince, pastor of the First church in Salem, 1824–44; left the profession on account of bronchial weakness; edited the *Christian Register;* travelled and lectured as agent of the Massachusetts board of education; was elected mayor of Salem; was member of the Massachusetts house of representatives in 1849, of the State senate 1850–51, of the national Congress from the 6th district 1854–55; State senator 1858, representative 1859–60. D. in Salem, Mass., June 15, 1875. During his ministry, which fell in controversial times, Mr. Upham made his mark as a writer by his *Letters on the Logos* (1828) and *Prophecy as an Evidence of Christianity* (1835), both written in the Unitarian interest. The *Lectures on Witchcraft, comprising a History of the Salem Delusion of 1692,* afterward, in 1867, rewritten and expanded into an elaborate work, in 2 vols., appeared in 1831. Mr. Upham was a diligent student of New England times and men. For Sparks's *American Biography* he wrote the *Life of Sir Henry Vane* (1835). In 1856 appeared from his pen the *Life, Letters, and Public Services of John Charles Fremont.* His last work was a *Memoir of Timothy Pickering* (3 vols.). He was also a frequent contributor to magazines and reviews, religious and secular. O. B. FROTHINGHAM.

**Upham** (NATHANIEL GOOKIN), LL.D., b. at Rochester, N. H., in 1801; graduated at Dartmouth College in 1820; studied law, and began practice at Bristol, N. H., but removed to Concord in 1829; was judge of the supreme court of the State 1833–43, and connected with the Concord R. R. 1843–63. He was a leading member of the Democratic party in his State, and in 1853 was appointed by Pres. Pierce one of the commissioners at London to adjust claims pending between citizens of the U. S. and British subjects; but at the opening of the civil war he left the Democratic party; was a member of the State legislature 1865–66. D. at Concord, N. H., Dec. 11, 1869.

**Upham** (THOMAS COGSWELL), D. D., b. at Deerfield, N. H., Jan. 30, 1799; graduated at Dartmouth College 1818, and at Andover Theological Seminary 1821; became assistant teacher of Hebrew in the seminary, and translated Jahn's *Biblical Archæology;* in 1823 became associate pastor of the Congregational church in Rochester, N. H.; in 1825 was chosen professor of mental and moral philosophy in Bowdoin College, a position which he held until 1867. His principal works are—*Manual of Peace* (1830), *Elements of Mental Philosophy* (1839; abridged ed. 1864), *Outlines of Disordered and Imperfect Mental Action* (1840), *Life and Religious Experience of Madame Guyon* (1847), *Life of Faith* (1848), *Principles of the Interior or Hidden Life* (1848), *Philosophical and Practical Treatise on the Will* (1850), *Treatise on the Divine Union* (1851), *American Cottage Life,* a series of poems (1852), *Religious Maxims* (1854), *Life of Madame Catharine Adorna* (1856), *Letters, Æsthetic, Social, and Moral, written from Europe, Egypt, and Palestine* (1857; new ed. 1865), and *Method of Prayer* (1859). D. in New York Apr. 2, 1872.

**Upham** (TIMOTHY), b. at Deerfield, N. H., in 1783; commenced mercantile life at Portsmouth, but in 1812 was appointed major in the U. S. army, and placed in command of the forts and harbor of Portsmouth; joined the army in the field at Plattsburg; was made lieutenant-colonel in 1813, and commanded the reserve in the sortie from Fort Erie; was collector of the port of Portsmouth 1816–29, navy agent 1841–45, and major-general of the State militia. D. at Charlestown, Mass., Nov. 2, 1855.

**Up'land,** p.-b., Delaware co., Pa. P. 1341.

**Upolu',** one of the NAVIGATOR'S (or Samoan) ISLANDS, in the Pacific Ocean (which see), is a missionary station and annually visited by English and American whalers. Its area is estimated at 60 sq. m.; its pop. at 25,000, of whom two-thirds are Christians. Cotton and cocoanuts are the principal products.

**Up'per,** tp., Crawford co., Ark. P. 357.

**Upper,** tp., Sebastian co., Ark. P. 3666.

**Upper,** tp., Cape May co., N. J. P. 1483.

**Upper,** tp., Chowan co., N. C. P. 1176.

**Upper,** tp., Lawrence co., O. P. 2146.

**Upper Al'len,** tp., Cumberland co., Pa. P. 1341.

**Upper Al'loway's Creek,** tp., Salem co., N. J. P. 3062.

**Upper Al'ton,** Madison co., Ill., on Chicago and Alton and Rockford Rock Island and St. Louis R. Rs., 2 miles N. of Alton City, has 4 churches, a college and female institution, a handsome park, 2 newspapers, 1 pottery, a street railway, and 1 hotel. P. about 2500.

E. ENGLISH, ED. "QUI VIVE."

**Upper Augus'ta,** tp., Northumberland co., Pa. P. 1246.

**Upper Bern,** p.-v. and tp., Berks co., Pa. P. 2008.

**Upper Chich'ester,** tp., Delaware co., Pa. P. 539.

**Upper Cone'to,** tp., Edgecombe co., N. C. P. 1437.

**Upper Creek,** tp., Burke co., N. C. P. 1736.

**Upper Dar'by,** tp., Delaware co., Pa. P. 3130.

**Upper Dub'lin,** p.-v. and tp., Montgomery co., Pa. P. 1588.

**Upper Fair'field,** tp., Lycoming co., Pa. P. 770.

**Upper Fish'ing Creek,** tp., Edgecombe co., N. C. P. 2064.

**Upper Fork,** tp., Burke co., N. C. P. 594.

**Upper Free'hold,** tp., Monmouth co., N. J. P. 3640.

**Upper Guinea.** See GUINEA.

**Upper Han'over,** tp., Montgomery co., Pa. P. 2197.

**Upper Hom'iny,** tp., Buncombe co., N. C. P. 1323.

**Upper Lafave',** tp., Yell co., Ark. P. 715.

**Upper Lea'cock,** tp., Lancaster co., Pa. P. 1961.

**Upper Le'high,** p.-v., Luzerne co., Pa.

**Upper Lisle,** p.-v. and tp., Broome co., N. Y. P. 247.

**Upper Lit'tle Riv'er,** tp., Harnett co., N. C. P. 1221.

**Upper Loutre,** tp., Montgomery co., Mo. P. 2458.

**Upper Macun'gie,** tp., Lehigh co., Pa. P. 3061.

**Upper Mahanoy',** tp., Northumberland co., Pa. P. 878.

**Upper Mahantan'go,** tp., Schuylkill co., Pa. P. 761.

**Upper Make'field,** tp., Bucks co., Pa. P. 1505.

**Upper Marl'boro',** p.-v., cap. of Prince George's co., Md.

**Upper Mer'ion,** tp., Montgomery co., Pa. P. 3870.

**Upper Mil'ford,** tp., Lehigh co., Pa. P. 2015.

**Upper Mount Beth'el,** tp., Northampton co., Pa. P. 3764.

**Upper Naz'areth,** tp., Northampton co., Pa. P. 740.

**Upper Ox'ford,** tp., Chester co., Pa. P. 1079.

**Upper Pax'ton,** tp., Dauphin co., Pa. P. 1371.

**Upper Penn's Neck,** tp., Salem co., N. J. P. 3178.

**Upper Petts'grove,** tp., Salem co., N. J. P. 2087.

**Upper Pig'eon,** tp., Haywood co., N. C. P. 1066.

**Upper Prov'idence,** tp., Delaware co., Pa. P. 758.

**Upper Providence,** tp., Montgomery co., Pa. P. 3202.

**Upper St. Clair,** tp., Alleghany co., Pa. P. 810.

**Upper Sal'ford,** tp., Montgomery co., Pa. P. 1705.

**Upper Sandus'ky,** city, cap. of Wyandot co., O., on Pittsburg Fort Wayne and Chicago and Columbus and Toledo R. Rs., and on the W. bank of Sandusky River, 64 miles N. W. of Columbus, contains 8 churches, excellent schools, 3 banks, 2 newspapers, and several manufactories. P. 2564. P. CUNEO, ED. "REPUBLICAN."

**Upper Sau'con,** tp., Lehigh co., Pa. P. 3487.

**Upper Swata'ra,** tp., Dauphin co., Pa. P. 1991.

**Upper Towamen'sing,** tp., Carbon co., Pa. P. 913.

**Upper Town Creek,** tp., Edgecombe co., N. C. P. 1092.

**Upper Tulpehock'en,** tp., Berks co., Pa. P. 1196.

**Upper Tur'keyfoot,** tp., Somerset co., Pa. P. 1011.

**Upper Uwch'lan,** tp., Chester co., Pa. P. 781.

**Up'perville,** p.-v., Scott tp., Fauquier co., Va. P. 422.

**Upper Wind'sor,** tp., York co., Pa. P. 2024.

**Upper Yel'lowleaf,** tp., Shelby co., Ala. P. 438.

**Upsa'la,** town of Sweden, 45 miles N. W. of Stockholm, has a beautiful cathedral and a flourishing university. The cathedral was built between 1260 and 1457, and is 370 feet long, 128 feet broad, and 92 feet high. Its interior is magnificent and richly decorated, but its exterior has suffered much from fire. The university is attended by over 1200 students, and has an excellent library of 100,000 vols., a botanical garden, an observatory, and several museums and collections. P. 12,138.

**Up-sar-o-ca, The,** or **Crow Indians,** live in Montana Territory, and number about 3000, being divided into what is known as the Mountain and River Crows. They have a fine reservation, lying along the Yellowstone River, distant about forty miles from Bozeman City. These Indians are brave, hardy, and warlike, and on many occasions have got the better of their hereditary enemies, the Sioux. Their lodges, made of dressed buffalo skins, are roomy and comfortable, and seem well adapted to the rigorous climate of Montana. During the autumn season they go to the eastward, to the buffalo-grounds, and kill great numbers of these animals, the flesh being cured and dried for winter food and the skins dressed to be used as bedding, clothing, or sold to the traders. The skins which are used for the lodges have the hair entirely removed by the adzes, or little scrapers, in the hands of the squaws, who do all the work. Deer skins are used for clothing, and bear, beaver, otter, and antelope skins are sold to the traders, or used for clothing. These Indians have a great number of horses, which they are very proud of, and their villages absolutely swarm with dogs who seem to be but one remove from wolves. They are as contented and happy a tribe of Indians as can be found on this continent.

A. G. BRACKETT.

**Up'shur,** county of N. E. Texas, lying N. of Sabine River; surface level, soil well timbered and fertile. Cattle and swine are very numerous. Staples, cotton and Indian corn. Cap. Gilmer. Area, 945 sq. m. P. 12,039.

**Upshur,** county of Central West Virginia, bounded E. by the Middle fork of Monongahela River, and intersected by the Buckhannon; surface generally rolling, but in some parts hilly, soil productive in the valleys. Cattle and sheep are the principal live-stock. Staples, Indian corn, wool, dairy products, and a little tobacco. Cap. Buckhannon. Area, about 500 sq. m. P. 8023.

**Upshur** (ABEL PARKER), b. in Northampton co., Va., June 17, 1790; studied law under William Wirt at Richmond, where he practised 1810–24; was representative in the legislature, and in 1826 was appointed a judge of the general court; in 1829 was a member of the State constitutional convention, and in 1843 was appointed secretary of the navy; was killed by the bursting of a gun on board the U. S. steamer Princeton Feb. 28, 1844. He published several essays, reviews, and addresses, and an *Inquiry into the Nature and Character of our Federal Government* (1840).

**Upshur** (JOHN A.), U. S. N., b. Dec. 5, 1823, in Virginia; entered the navy as a midshipman Nov. 4, 1841; became a lieutenant in 1855, commander in 1866, captain in 1872; served in the naval battery at Vera Cruz during the Mexican war, and in the frigate Wabash at the capture of Port Royal, and commended for gallantry on both occasions.

FOXHALL A. PARKER.

**Up'son,** county of W. Georgia, bounded S. W. by Flint River, and partially traversed by Upson County R. R., which terminates at the county-seat; surface hilly, soil moderately productive. There are some manufactories of cotton goods. Swine and cattle are the principal live-stock. Staples, cotton, Indian corn, and dairy products. Cap. Thomaston. Area, 384 sq. m. P. 9430.

**Up'ton** (P. O. name ST. EPHREM D'UPTON), v. of Bagot co., Quebec, Canada, has a mine of copper and lead-bearing limestone. It is on Grand Trunk Railway, 48 miles E. of Montreal. P. about 350.

**Upton,** p.-v. and tp., Oxford co., Me. P. 187.

**Upton,** p.-v. and tp., Worcester co., Mass. P. 1989.

**Upton,** tp., Texas co., Mo. P. 642.

**Up'ton** (EMORY), b. at New York 1840; graduated at the U. S. Military Academy May, 1861, and commissioned second lieutenant of artillery. In the Peninsular campaign of 1862 he commanded his battery at Yorktown, Gaines's Mill, and Glendale; in command of artillery brigade at South Mountain and Antietam; appointed colonel 121st New York Vols. Oct., 1862, and engaged at Fredericksburg, Salem Heights, Gettysburg, and in command of a brigade during subsequent Rapidan campaign. In the Richmond campaign of 1864 he led his brigade (6th corps) through the Wilderness battles to the front of Petersburg; transferred with his corps to the Shenandoah July, 1864, he was wounded at Opequan Sept. 19, while in command of a division. Returning to duty in December, he was assigned to a division of cavalry in the West, and was engaged in the expedition into Alabama and Georgia in the spring of 1865 resulting in the capture of Selma, Columbus, etc. Mustered out of the volunteer service Apr., 1866, he was in July transferred to the 25th Infantry with rank of lieutenant-colonel, and engaged in perfecting a *System of Infantry Tactics,* which was adopted in Aug., 1867, for the use of the army and militia of the U. S.; transferred to the 18th Infantry in 1869, and to the 1st Artillery 1870. Was commandant of cadets at West Point 1870–75. For gallantry in the field during the war he was brevetted from major to major-general.

**Upup'idæ** [from *Upupa*—a proper name—the representative genus], a family of birds typified by the common hoopoe of Europe. The form has nothing peculiar, but is essentially similar to that of most passerine and related birds—*e. g.* American cuckoos, larks, thrushes, etc.; the bill is rather elongated, slender, curved from base to tip, and laterally compressed; the culmen is keeled; the mandible within, toward tip almost plane; the nostrils are basal, and partially covered each by a membranaceous scale; the wings are long and rounded; the tail long; the tarsi moderate (shorter than the middle toe), and covered with broad scales; the toes moderate, three anterior and one posterior, the outer longer than the inner, and united at the base to the first joint; the claws of the anterior toes are moderate, curved, and compressed, that of the posterior almost straight. The singing apparatus is wanting. The osteological and other characteristics indicate that the family is related to the "coccygomorph" birds (Bucerotidæ, Meropidæ, Cuculidæ, etc.), but that it is in some respects quite distinct, and to such an extent that A. Milne-Edwards and Murie have isolated it as the type of a distinct major group (super-family) under the name Epopinæ or Epopomorphæ. According to Murie, the family is nearly related to the Bucerotidæ, and the distance between it and the living forms of that family is in some degree bridged over by the extinct genus *Cryptornis.* The family is confined to the oldest known continents (Europe, Asia, and Africa), and mostly to the warmer regions. The best discussion of the affinities and structure of the type is to be found in an article by Murie on the Upupidæ and their relationships in the *Ibis* for 1873 (pp. 181–211, pl. 5–7). (See also HOOPOE.)

THEODORE GILL.

**U'ral,** river of Russia, rises in the Ural Mountains, flows S., forming the boundary between Europe and Asia, and enters the Caspian Sea after a course of 1040 miles. It is not navigable on account of sandbanks, but is very rich in the finest kinds of fish.

**Ural Mountains, The,** a range of plateaus rather than a chain of mountains, rising from 3000 to 5000 feet, and with a breadth of from 16 to 66 miles. They begin at the Arctic Ocean, in lat. 70° N., and stretch southward to lat. 50° N., forming the natural boundary between Europe and Asia. They are exceedingly rich in metals. In 1862 6660 pounds of gold, 5328 pounds of platinum, 8,959,140 pounds of copper, and 4,365,348 cwts. of iron were extracted. Of precious stones, beryl, topaz, amethyst, and diamonds are found; coal is abundant.

**Uralsk',** town of Russia, government of Orenburg, on the Ural, trades much in fish, cattle, tallow, and caviare. P. 10,822.

**Ura′nia,** in Grecian mythology, one of the nine Muses, the goddess of astronomy, and a daughter of Zeus and Mnemosyne, was generally represented by art as holding a celestial globe in the one hand and pointing at it with the other.

**Ura′nium** [Gr. either from *οὐράνιος*, "celestial," or from *Οὐρανία*, a name of Venus, probably the first; named from the extreme beauty of its compounds]. Klaproth in 1789 gave this name to a metal whose oxide he discovered in the mineral called *pitchblende* (*uraninite* of Dana), which contains sometimes as much as 85 per cent. of uranoso-uranic oxide, $U_3O_4$. It was not until as late as 1840, however, that metallic uranium was first discovered by Peligot, what had previously passed for the metal having been ascertained by him to be only the monoxide, UO. There are quite a large number of mineral species that contain uranium, but the only one occurring in sufficient quantity to be available for the extraction of uranic compounds is pitchblende, which is found at Joachimsthal in Bohemia in sufficient quantity to furnish it to commerce, in which it is in demand chiefly for coloring porcelain and glass. One American locality only is as yet known, from the N. side of Lake Superior, of a variety called *coracite*, found by Dr. Genth to contain about 62.5 per cent. of $U_3O_4$. Several other mineral species containing uranium are known, mostly very rare, and unknown as yet in America. One locality exists on the Schuylkill River just above Philadelphia, where *autunite*, a hydrated phosphate of lime and uranium, a micaceous mineral of a beautiful lemon-yellow color, occurs in small quantity. Other localities are doubtful.

To obtain uranium compounds from pitchblende it is pounded and washed to remove impurities, roasted to remove sulphur and arsenic, and dissolved in nitric acid, evaporated then to dryness, which decomposes the ferric nitrate. Water dissolves from the dried mass little but the pure uranic nitrate, which is further purified by crystallization, and several recrystallizations when required perfectly pure. From this exceedingly beautiful salt (see Uranium, Compounds of) pure $U_3O_4$ may be obtained by ignition alone, and the protoxide, UO, by ignition with reducing agents, and the dichloride, $UCl_2$, by heating with charcoal in chlorine gas. The metal was obtained by Peligot from the dichloride by heating with metallic potassium or sodium. It is hard, but somewhat malleable, and scratchable by a file. The maximum density was 18.4; the color approached that of iron. It tarnishes to a yellowish color in air. It takes fire, when in powder, at a quite low temperature, about 500° F., burning with great brilliancy to $U_3O_4$, of a dark-green color. It does not decompose water in the cold, but evolves hydrogen with dilute acids, dissolving with a green color. It combines directly with sulphur and chlorine. Henry Wurtz.

**Uranium, Compounds of.** This metal forms with oxygen four compounds, UO, $U_4O_5$, $U_3O_4$, and $U_2O_3$. A hydrate has also been obtained of an oxide, $U_4O_3$. The protoxide, UO, supposed to be the metal itself before Peligot first obtained the latter, is procurable by igniting oxalate of uranium in hydrogen; is brown or copper-red, with a metallic lustre, with density = 10.15. It may be obtained in regular octahedral crystals (microscopic), somewhat translucent, by igniting in hydrogen the double chloride of uranium and potassium. There are other methods. Its compound with water is precipitable from uranous salts by alkalies.

*Uranoso-uranic Oxide* ($U_3O_4$), which chiefly constitutes pitchblende, when obtained by ignition of the uranic nitrate, is a green, velvet-like powder, of density about 7.4. Dilute acids dissolve it with difficulty, but concentrated with ease.

*Uranic Oxide* ($U_2O_3$).—The nitrate, when cautiously heated not above 480° F., leaves pure uranic oxide as a beautiful yellow powder. If the heating goes too far, green $U_3O_4$ is formed. A so-called "hydrate," $O_4H_2U_2$, of a fine lemon-yellow color, and density 5.93, is obtainable by heating the nitrate gently in a sand-bath, and then washing with water, as well as by other methods. When the uranic nitrate is precipitated by an alkali, instead of this body we obtain its compound with the alkali, a *uranate* of the latter.

The uranates are a class of very beautiful compounds. Those with soluble bases are readily obtainable as above, but those of lime, baryta, and some metallic oxides, not so easily. The present writer many years ago devised a simple method of obtaining these by digesting the carbonate of the base with uranic nitrate. Products were thus obtained, particularly with baryta and some other bases, which constituted pigments, yellow and orange-colored, surpassing any others known; but the expense of uranium compounds prevents their application in this way.

Uranium forms two chlorides, $UCl_2$ and $U_4Cl_6$, and an oxychloride, $U_2O_2Cl_2$. The dichloride, $UCl_2$, is formed, as stated under Uranium, by passing chlorine gas over an ignited mixture of charcoal with an oxide of uranium in a tube of hard glass. It sublimes in red vapor, and condenses as dark-green octahedrons of metallic lustre. It is deliquescent, fumes in the air, and is very soluble in water with great heat to an emerald-green liquid. This solution, which is decomposed by boiling, has great reducing power, precipitating gold and silver from their solutions and reducing ferric salts to ferrous.

*Uranic Nitrate.*—This is one of the commonest commercial compounds of uranium. It crystallizes in lemon-yellow prisms, which exhibit a greenish fluorescence peculiar to many uranium salts. Its composition is $U_2O_3.N_2O_5.6H_2O$, and its density 2.837. In vacuo the crystals lose half their crystal water, and effloresce also slightly in dry air. They dissolve in half their weight of water, also in alcohol and ether. When heated, they melt in their water of crystallization, and at a little higher heat decompose. Ordway states that decomposition does not commence till $4H_2O$ has been expelled.

Uranic oxide and the nitrate are used for communicating to glass a very rich greenish-yellow fluorescent color, which is accompanied by a slight opalescence, and which is inimitable in any other way. A black color, under the glaze, is communicated to porcelain by uranic compounds; for which purpose, however, pitchblende is used directly, or uranoso-uranic oxide prepared therefrom. H. Wurtz.

**U′ranos** [Gr. for "heaven"], in the Greek mythology, the son of Gæa, the earth, and by her the father of the Titans, Cyclopes, Hecatoncheirians, etc. He hated his children, and confined them in Tartarus, but on the instigation of Gæa, Cronos, the youngest of them, overthrew and dethroned him.

**Uranoscopoi′dæa** [from *Uranoscopus*—Gr. *οὐρανός*, "heaven," and *σκοπεῖν*, to "look up"—the oldest established genus], a super-family of fishes of the order Teleocephali and sub-order Acanthopteri, distinguished by the more or less cuboid form of the head, and the situation of the eyes on the dorsal surface, and their consequent visual direction upward; whence the name. There are three families, which are, however, generally combined in one, or divorced and relegated to two widely-different families. The following characters, however, will show their essential general agreements and differences:

(1) *Uranoscopidæ.*—In these the body is quite moderately elongated; the scales are very small and cycloid, or absent; the lateral line runs abruptly upward to the dorsal region, and is continued under the fin to its end, and thence deflected downward to the base of the caudal; the head is cuboid, and leaves more or less exposed to view the bony framework; the eyes are on the upper surface; the preoperculum is generally armed, sometimes entire; the mouth is almost vertically cleft; the teeth are acute, and on the jaws as well as palate; the branchial apertures are large and confluent below, where the membrane is doubled and forms a transverse flap between the rami of the jaws; branchiostegal rays six; the dorsal fin is diversiform, typically represented by two fins, a short anterior spinous and a long posterior rayed fin, but sometimes the two are confluent in one; the anal is long and opposite the second dorsal; the caudal distinct; the pectorals large, with wide oblique bases, and with the inferior rays rapidly decreasing in length downward; the ventrals are jugular, and each has a spine and five rays; the intestinal canal has a few pyloric cæca. The family has seven or eight genera, represented in the European and eastern American seas, as well as those of Africa and Asia. The North American species is *Astroscopus y-græcum;* it attains a considerable size (sometimes nearly two feet in length), and is not very rare along the southern coast.

(2) *Leptoscopidæ.*—In this family the body is comparatively elongated; the scales are moderate in size, cycloid, and regularly imbricated; the lateral line at first runs along the side of the back, but is soon decurved, and continued along the middle to the base of the caudal fin; the head is cuboid, and more or less invested in the skin; the eyes are dorsal; the opercula are unarmed, but the operculum is fringed; the mouth is very obliquely and almost vertically cleft; the lips are fringed; the teeth are acute, and developed always on the jaws, sometimes on the palate, and sometimes not; the branchial apertures are ample, but partly covered below by a fold of the branchiostegal membrane; the branchiostegal rays are in six pairs; the dorsal fin is very long and entire, but with its anterior rays spinous, and the rest articulated; the anal is also elongated; the caudal distinct; the pectorals have their rays branched; the ventrals are jugular, and composed each of a spine and five rays. The stomach is siphonal, and the pyloric cæca obsolete. The vertebræ are in increased number. The representatives of the family are confined, so far as known,

to the Australasian seas, and constitute two genera, *Leptoscopus* and *Crapatalus*.

(3) *Dactyloscopidæ*.—The form in the representatives of this group is also elongated, as in the last, and the scales are moderately large and imbricated; the lateral line also near its origin runs on the back, and is soon deflected, and thence median; the head is diversiform (typically cuboid, sometimes conic), but always invested in the skin; the eyes are on the superior surface; the several opercular bones unarmed, the operculum fringed; the mouth with a subvertical or oblique cleft; the lips fringed; the teeth acute on the jaws, wanting on the palate; the branchial apertures continuous below, but covered there by a fold of the membrane; branchiostegal rays six; the dorsal fin is long and undivided, with its anterior portion sustained by spinous rays, and the rest by articulated ones; the anal is long, the caudal distinct; the pectorals have the rays unbranched; the ventrals are jugular, and each composed of a spine and three unbranched articulated rays. The stomach is siphonal; pyloric appendages undeveloped. The vertebræ are in increased number. The known species belong to three genera—*Dactyloscopus*, *Dactylagnus*, and *Myxodagnus*—and inhabit the littoral waters of the tropical portions of America on the Atlantic and Pacific sides. THEO. GILL.

**U′ranus,** the seventh planet in order of distance from the sun, and, with the exception of Neptune alone, the outermost member of the planetary family. Uranus travels at a mean distance of 1,753,869,000 miles from the sun, but, his orbit being considerably eccentric, his greatest distance, 1,835,561,000 miles, exceeds his least distance, 1,672,177,000 miles, by nearly 163,400,000 miles, or not much less (relatively) than the entire span of the earth's orbit. Since the earth's mean distance from the sun is 91,430,000 miles, the opposition distance of Uranus varies from about 1,744,100,000 miles to about 1,581,700,000 miles; and as the planet is farther from the sun in the former than in the latter case, and therefore less brightly illuminated, there arises a considerable variation in the apparent brightness of Uranus. In fact, Uranus is more favorably situated for telescopic study when in opposition near perihelion than when in opposition near aphelion, in the proportion of $(17{,}441)^2 \times (18{,}356)^2 : (15{,}817)^2 \times (16{,}723)^2$, or nearly as 3 to 2 (more exactly as 63 to 43). The eccentricity of the orbit of Uranus is 0.0466. The planet completes a sidereal revolution in 30686.8208 days, or in 84 years 6.5 days. His synodical period is 369.656 days, exceeding a year by little more than four days. The inclination of the orbit to the ecliptic is about 46′.5. The mean diameter of Uranus is estimated at about 33,000 miles; the compression of his globe is not known. His volume exceeds the earth's about seventy-four times, but his mean density is so small (0.17—the earth's as 1) that his mass exceeds hers only about twelve and one-half times. It has been said that he rotates on his axis in 9½ hours, but no reliance can be placed on the assertion, as the most powerful telescopes fail to show any clearly-defined markings on this distant globe. Uranus was discovered by Sir W. Herschel Mar. 13, 1781, when he was examining the small stars in the neighborhood of $\eta$ Geminorum. He was led by the apparent size of a star in this region to suspect that it was a faint comet. Examining the object with higher powers, and finding its disk enlarged (which would not have been the case with a fixed star), he was confirmed in this suspicion. But soon after the discovery had been announced, the mathematicians who had undertaken the calculation of the stranger's orbit found the path to be an ellipse of moderate eccentricity, and concluded that the new orb was a member of the planetary family. This was placed beyond doubt before long; and in 1787 two satellites were discovered whose motions indicated that the supposed comet had a mass many times exceeding that of our earth. Sir W. Herschel proposed to call the new planet Georgium Sidus, in honor of George III. Continental astronomers for a long time called it Herschel, but the name Uranus, suggested by Bode of Berlin, is now universally adopted by astronomers. Herschel, during his later observation of Uranus, supposed that he had discovered four new satellites, but his observations were unsatisfactory, though Prof. Holden of the Washington observatory finds reason for believing that the two satellites subsequently discovered by Mr. Lassell of England were really seen by Sir W. Herschel. Four satellites are now recognized as forming the family ruled over by Uranus. Neither telescopic nor spectroscopic observation has revealed anything of interest in the physical condition of Uranus, though Secchi, Higgins, and Vogel find that the spectrum differs from that due to reflected sunlight. R. A. PROCTOR.

**Urari.** See CURARI.

**U′rates,** or **Lithates** [Ger. *Harnsäure Salze*], the compounds of URIC ACID (which see) with bases. Both neutral and acid urates are known of most metals. They are sparingly soluble in water, but dissolve in warm alkaline solutions and in solution of borax. The acid ammonic, sodic, and calcic urates are frequent ingredients of URINARY CALCULI (which see), the proportion of the calcic salt being, however, very small. The lithic is the most soluble of the urates; for this reason lithia-water is sometimes used as a remedy for gout and for superabundance of uric acid in the system. Ammonic urate is occasionally applied medicinally, in chronic cutaneous affections, in the form of an ointment; but urates should be taken internally very cautiously, as they may give rise to the formation of oxalic acid in the urine. J. P. BATTERSHALL.

**Ur′ban,** the name of eight popes, of whom the most remarkable were: (1) URBAN II. (1088–99). His true name was OTHON DE LAGNY, and he was born at Châtillon-sur-Marne, France, about 1042. After studying at Rheims, he became a Benedictine monk and prior of Cluny, and by Pope Gregory VII. was created bishop of Ostia and sent as a legate to the emperor Henry IV. to negotiate concerning the investiture. After the death of Pope Victor III., in 1088, he was elected pope by the Gregorian party at Terracina, while the imperial party at Rome elected Clement III. But in 1089, Clement III. was expelled by the Romans, and the council which Urban II. convoked in the same year at Rome excommunicated both him and the emperor. In 1091, however, Henry IV. appeared in Italy with a large army, and reinstated Clement III. Meanwhile, Urban II., who lived as an exile at the court of Count Robert of Apulia, had concluded a marriage between Matilda of Tuscany and Duke Guelf of Bavaria, and by the intrigues of Matilda he succeeded in drawing over to his side Conrad, the son of the emperor. Conrad revolted, and was crowned king of Italy at Monza by Urban II.; Clement III. was again expelled. In the spring of 1095, Urban convoked the Council of Piacenza, and in the fall of the same year that of Clermont in Auvergne. Here his stirring address to the assembled noblemen caused the formation of the first army of crusaders, which he very cunningly used for the final overthrow of the antipope. He held in all twelve councils, and contributed much to the consolidation of the papal power by his firm opposition to the emperor and the king of France, and by his vigorous enforcement of the laws of celibacy, investiture, etc. D. in Rome July 20, 1099.—(2) URBAN V. (1362–70). His true name was GUILLAUME DE GRIMOARD, and he was born at Grisac, France, in 1309. In 1353 he became abbot of Auxerre, in 1358 of Marseilles, and Oct. 28, 1362, on the death of Innocent VI., was elected pope at Avignon. He was the last pope who resided at Avignon, and made an attempt to remove the papal see back to Rome. In 1367 he returned to Rome, where he received the East Roman emperor, John Palæologus, who abjured the separatistic tenets of the Greek Church and acknowledged the supremacy of the pope; but he soon found the affairs of Italy in such confusion that he left the city, and d. at Avignon Oct. 18, 1369.—(3) URBAN VI. (1378–89), whose true name was BARTOLOMMEO BUTILLI-PRIGNANO, b. at Naples in 1318. After the death of Gregory XI. he was elected pope Apr. 8, 1378, under somewhat tumultuous circumstances, and in September of the same year a number of cardinals assembled at Anagui, declared his election invalid, and elected Clement VII. antipope. Thus began the great schism in the Roman Catholic Church. Clement VII. took up his residence at Avignon, and the two popes reciprocally excommunicated and condemned each other. Urban VI. changed the term of the celebration of the jubilee year from fifty to thirty-three years; d. at Rome Oct. 15, 1389.—(4) URBAN VIII. (1623–44). His true name was MAFFEO BARBERINI, and he was born at Florence in 1568; studied at Rome and Bologna; entered the service of the Roman curia under Sixtus V.; was created archbishop of Nazareth by Clement VIII. in 1604, and archbishop of Spoleto by Paul V. in 1608; and was elected pope Aug. 6, 1623, after the death of Gregory XV. His reign bore the general character of that of an Italian prince of that time. He organized armies, built fortresses, founded collections of arms and antiquities, had literary tastes, and wrote epigrams and paraphrases of the Bible in the metres of Horace, which were published at Antwerp in 1634 and at Paris in 1642. In politics he sided with France and Richelieu in their contest with Austria, and thus came indirectly into alliance with the Protestants of Germany. In ecclesiastical matters he condemned Galileo and Jansen, and forbade the priests the use of snuff in the churches under penalty of excommunication. But all the manifold troubles which surrounded him he took in an easy and elegant manner. D. July 29, 1644. CLEMENS PETERSEN.

**Urba′na,** p.-v. and tp., cap. of Champaign co., Ill., on Indianapolis Bloomington and Western R. R., and at the terminus of Monticello R. R., has 2 private banks and a

newspaper, and is the seat of the State Industrial University. P. of v. 2277; of tp. 3325.

**Urbana,** tp., Monroe co., Ia. P. 887.

**Urbana,** p.-v. and tp., Frederick co., Md. P. 2359.

**Urbana,** tp., Steuben co., N. Y. P. 2082.

**Urbana,** city and tp., cap. of Champaign co., O., at the crossing of Atlantic and Great Western, Cincinnati Sandusky and Cleveland, and Pittsburg Cincinnati and St. Louis R. Rs., 100 miles N. of Cincinnati and 46 miles W. of Columbus, is the centre of a rich agricultural district. The place is very elegantly improved. The business centres chiefly at Monument Square, in the middle of which is an elegant granite monument surmounted by a bronze statue of a private soldier, erected at a cost of $15,000 by the people of Champaign co. in commemoration of the fallen soldiers of the war of 1861–65. The free schools include 4 fine buildings, one of which, the high school, was erected at a cost of $125,000. The Urbana University, the only Swedenborgian school in the U. S., is located here, and has an attendance from many States of the Union. The city contains 12 churches, 3 national banks, a public library, 1 life and 1 fire insurance company, and the manufactories include the shops of the U. S. Rolling Stock Co., the Urbana Machine-works, manufacturers of ploughs, water-wheels, and corn-planters; 2 carriage-factories, 2 wagon-factories, 2 broom-factories, 1 shoe-factory, a stove-foundry, 1 steam tannery, 1 steam furniture-factory, 2 door and sash factories, 1 woollen-factory, 4 newspapers, etc., altogether employing over 600 mechanics. P. of city, 4276; of tp., 1827. J. F. Brand, Ed. "Citizen and Gazette."

**Urbi'no** (*Urbinum Hortense*), town of Italy, province of the same name, on two steep and lofty hills of the Umbrian chain, between the Metauro and the Foglia, about 25 miles S. W. of Pesaro. The walls were erected by the celebrated mathematician F. Commandini, and the town was afterward further strengthened with a castle and towers by the lords of Montefeltro (1213). The large cathedral, which contains some good works of art, is of the seventeenth century, the ancient church on this site having been destroyed by an earthquake. Other churches contained frescoes and oil paintings by Salimbeni, by Barocci, by the father of Raphael, and by Titian, but the movable pictures have been mostly transferred to the municipal gallery. The ducal palace (begun 1447) is a noble edifice in the early Renaissance style, and, besides much striking mediæval ornament, contains ancient inscriptions and bas-reliefs of great interest. Several of the private palaces also possess rare artistic treasures, especially that of the Staccoli Castracane, where Ghirlandajo, Guido Reni, G. Bellini, Barocci, Raphael, Luca della Robbia, etc., are all more or less well represented, and where there is a fine collection of the famous ceramics of Urbino, Casteldurante, and Gubbio. One of the chief points of interest here is the modest house in which the immortal Raphael Sanzio was born (1483), a fact which is commemorated by a somewhat long inscription, beginning *Nunquam moriturus*. Urbino is among the most ancient cities of Italy, acquired the rights of Roman citizenship in 89 B. C., and suffered many vicissitudes during the breaking up of the Roman empire. It recovered some importance in the early part of the thirteenth century, but the first who assumed the title of duke of Urbino was Federico di Montefeltro (1474), and he and his immediate successors, as wise and virtuous as they were prosperous, made Urbino famous in the history of the mediæval world. In 1508 the duchy passed to the Della Rovere house; in 1631 it became the direct property of the Church, and so remained, with the brief exception of the French domination, till united to the kingdom of Italy. Urbino is distinguished for the number of remarkable men to whom it has given birth, and for the general intelligence and activity of its citizens. Both rural and manufacturing industries are flourishing. P. 16,194.

**Urchin-Fish,** or **Porcupine-Fish.** See Diodon.

**Urchin, Sea.** See Echinus.

**Ure** (Andrew), M. D., F. R. S., b. at Glasgow, Scotland, May 17, 1778; educated at the universities of Glasgow and Edinburgh, where he also graduated in medicine; became professor of chemistry at the Andersonian Institution at Glasgow 1804, and director of the Glasgow Observatory 1809; removed to London 1830; was appointed analytical chemist to the board of customs 1834; acquired a high reputation by his original scientific researches, and especially by his successful application of chemical discoveries to the arts and to manufactures. D. in London Jan. 2, 1857. Author of *A New Systematic Table of the Materia Medica* (1813); *A Dictionary of Chemistry* (2 vols., 1821; republished in the U. S. by Drs. Robert Hare and Franklin Bache, Philadelphia, 1821)—a work which until the appearance of that of Watts was the undisputed standard; *A New System of Geology* (1829); *The Philosophy of Manufactures* (1835); *The Cotton Manufacture of Great Britain* (2 vols., 1836; new ed. 1861); and *A Dictionary of Arts, Manufactures, and Mines* (2 vols., 1837–39), which, as rewritten and enlarged by Dr. Robert Hunt (3 vols., 1859–60; 7th ed. 1875), still enjoys a high reputation.

**U'rea** [Fr. *urée;* Ger. *Harnstoff; Urenoxyd Ammoniak*], ($CH_4N_2O$), an isomere of ammonium cyanate, was first obtained by Rouelle in 1773, afterward in a state of greater purity by Fourcroy and Vauquelin in 1799. It is an essential constituent of the urine of mammiferous animals, particularly of the Carnivora, but is also found in that of birds and of Amphibia. Urea also occurs, to some extent, in human blood and perspiration, in the vitreous humor of the eye, and in the lymph and chyle of various animals. It is the chief outlet for the oxidized nitrogen of the tissues of the system, a healthy adult excreting more than an ounce daily. It is not formed in the kidneys, which appear merely to separate it from the blood in which it is pre-existent. Urea may be formed artificially in several ways, but its preparation by the action of cyanic acid on ammonia (discovered by Wöhler in 1828) possesses special interest as being the earliest synthetic formation of an organic compound:

$$\underset{\text{Ammonium cyanate.}}{H_4N.CNO} = \underset{\text{Urea.}}{CH_4N_2O}.$$

It is also obtained from cyanamide ($CN_2H_2$) by the addition of 1 equivalent of water, and by the decomposition of numerous complex organic compounds, such as creatine, guanine, and Uric Acid (which see); likewise by the action of phosgen gas ($COCl_2$) on ammonia; but in the laboratory it is usually prepared either from urine or by the evaporation of a solution of ammonium cyanate. In the former process the urine is evaporated to dryness on the water-bath, and the residual mass exhausted with alcohol, which is evaporated to dryness. The second residue is then extracted with pure alcohol, which, upon evaporation, leaves the urea in a slightly-colored state; or the urine is concentrated by evaporation, and nitric or oxalic acid added, by which a precipitate of nitrate or oxalate of urea is formed, from which the urea is obtained by decomposition with baric or calcic carbonate, filtering the solution, and purifying the urea by repeated recrystallization from alcohol. Urea is, however, most readily and abundantly prepared from ammonium cyanate in the following manner: Potassium cyanate is first formed by heating a mixture of 56 parts of carefully-dried potassic ferrocyanide and 28 parts of dry black oxide of manganese to dull redness. The residue, when cold, is treated with cold water, and 41 parts of ammonic sulphate are added, when ammonium cyanate and potassic sulphate are formed. The solution is then evaporated, treated with hot alcohol, from which, on cooling, the urea crystallizes out. A still more advantageous method is to digest plumbic cyanate with its equivalent of ammonic sulphate at a low heat, and evaporate the filtered liquid.

Urea has a sp. gr. of 1.30 (Bödeker) or of 1.35 (Proust and Schabus). It crystallizes in colorless striated prisms, which fuse at 248° F., but are decomposed at a higher temperature. It is very soluble in water and in hot alcohol, but is nearly insoluble in ether. Its solution possesses a neutral reaction and a cooling, bitter taste. When heated in a sealed tube to about 284° F., urea combines with 2 molecules of water, and is converted into ammonic carbonate:

$$CH_4N_2O + 2H_2O = (H_4N)_2CO_3.$$

An analogous change takes place in the organism, owing to the action of the mucus of the bladder, to which the ammoniacal odor of stale urine is due. When it is heated above its melting-point, *biuret* ($C_2O_2H_5N_3$) and *cyanuric acid* ($C_3O_3H_3N_3$) are formed, with evolution of ammonia. Urea combines with acids, forming crystalline compounds, and also with metallic oxides, such as those of mercury and silver. Numerous substitution-derivatives of urea (*compound ureas*) have also been obtained. It is easily detected in animal fluids by precipitating the alcoholic extract with nitric acid, and examining the crystalline laminæ thrown down with the microscope goniometer. They should exhibit an angle of 82°. (For the quantitative estimation of urea in urine see Urine, Chemical Composition and Analysis of.) J. P. Battershall.

**Uredin'eæ** [Lat. *urere*, to "burn"], an order of Fungi to which belong the rusts and many of the mildews which attack living plants. With regard to the species of this order, two different views are held by mycologists. The more recent continental writers consider that many of the so-called species of the older mycologists are nothing but different forms of the same species, while nearly all British and some of the older continental writers on Fungi do not consider that there is any essential connection between the

different forms. As the subject is not a little perplexing, we shall illustrate with the common black mildew of grains, found also on most of the grasses. The black spots known as mildew are found late in summer and in autumn in streaks on the leaves and stems, and occasionally on the glumes, of grasses. The black color is caused by the spores of a fungus to which the name *Puccinia graminis* has been given. The mycelium or vegetative threads of this species extend throughout the stem and leaves, and sometimes even into the roots, of the grass. They burst finally through the epidermis, and bear dark-colored spores, consisting of two cells, as shown in Fig. 1, *a*. In the following spring, or during the winter if kept sufficiently moist and warm, each of these cells germinates and pushes out a tube, as in Fig. 1, *b*,which tube quickly divides into three or four parts by cross-partitions, and bears the bodies represented in

Fig. 1.

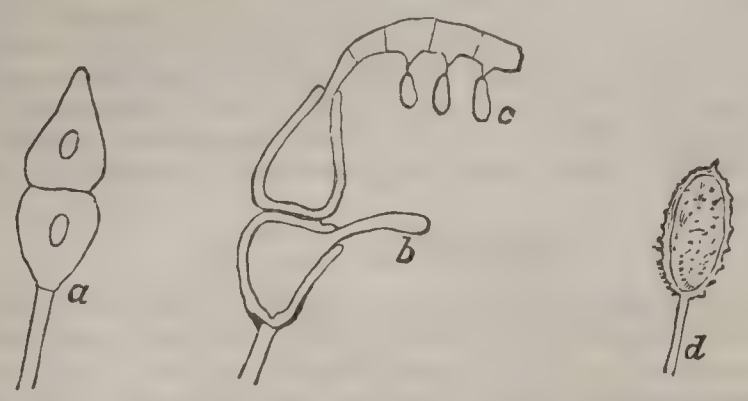
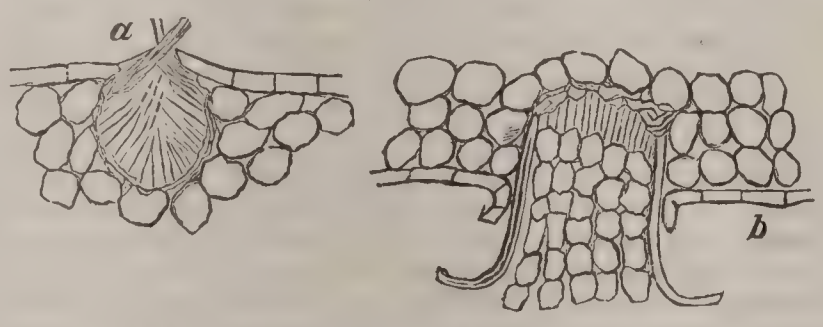



Fig. 1, *c*. The latter, if placed on moistened leaves of grass, grow by pushing out a tube for a short time, but soon perish. If, however, they are placed on leaves of the common barberry, and kept in a sufficiently moist position, the tubes may be seen to penetrate into the interior of the barberry leaf, on which, at the end of a few days, a red spot appears, and the tissue of the leaf becomes thickened. In this red spot there appears on the upper surface of the leaf a number of dark-colored bodies, which, when examined by the microscope, exhibit the structure shown in Fig. 2, *a*. Shortly afterward there grow out from the under surface of the leaf a number of cup-shaped bodies (Fig. 2, *b*), con-

Fig. 2.




taining orange-colored spores, at first arranged in rows, but soon breaking up into powder. These cup-shaped bodies are commonly called cluster-cups, and are found on the barberry in spring and early summer. The spores contained in the cluster-cup germinate at once by pushing out a tube; but if sown on barberry leaves, the germinating tubes soon perish without entering the leaves. When, however, the spores produced in the cluster-cups on the barberry are sown on moistened leaves of grass, the germinating threads which they give out penetrate into the leaves, and in a few weeks burst through the epidermis and bear a number of spores, as in Fig. 1, *d*. The spores are oval, of an orange color, slightly granulated, and borne singly on a short stalk. The spots caused by the orange-colored spores are known as rust. The rust spots are later in the season succeeded by the black spots already described as mildew. The mildew spots are produced either by the growth onward of the same mycelial filaments which have produced the rust spots, or by the germination of the rust spores.

From the above account it will be seen that the fungus growing on grain and producing the mildew has four different states—first, that represented in Fig. 1, *a*, found on grain and grasses; second, the body, represented in Fig. 1, *c*; third, the form found on barberry leaves, composed of the two bodies represented in Fig. 2, *a*, found on the upper surface, and Fig. 2, *b*, found on the under surface of the leaves; fourth, the form known as rust, found on grains and grasses, Fig. 1, *d*. The following terms have been given to the different states mentioned above:

I. Teleutospores (Fig. 1, *a*).—On grains and grasses in autumn; spores two-celled, dark colored, generally known as black mildew.

II. Promycelium (Fig. 1, *b*) and Sporidia (Fig. 1, *c*).—Growing directly from spores of first state.

III. Æcidium (Fig. 2).—On barberry leaves in spring, consists of *spermogonia* (Fig. 2, *a*) and *æcidia* (Fig. 2, *b*), which are vulgarly known as cluster-cups.

IV. Uredo (Fig. 1, *d*).—On grains and grasses in midsummer. Spores one-celled, orange-colored; vulgarly called rust.

Formerly—and the view is still maintained by British and some continental botanists—it was supposed that each of the forms above mentioned was a distinct species of fungus, and a specific name was given to each. The teleutospore state was called *Puccinia graminis*, and placed in the order Pucciniæi; the second, or sporidial state, was unknown until discovered by Gasparrini in 1848; the æcidial state was known as *Æcidium berberidis*, and placed in the order Æcidiacei; the uredo state as *Uredo rubigo*, and placed in the order Uredinei. The connection between the different forms, however, had been for a long time suspected, and De Bary in 1863 (see *Annales des Sciences*, 4me série, tome xx.) showed that the teleutospores of certain species of Uredineæ, when sown on the leaves of appropriate plants, caused in a short time an æcidium to appear. In this way an explanation was found of the fact observed by farmers, that barberry bushes growing near grain seemed to cause rust. He also showed that æcidial spores of *Æcidium berberidis* germinate upon, and make their way into, the leaves of different grains.

With the previous description of the development of *Puccinia graminis* the general characteristics of the order can be understood. The species of the order pass through different stages, either on the same or different species of phanerogams. The stages are usually four in number, as in *Puccinia graminis*, but in some cases one or more stages are omitted in the development of the fungus. Thus, in the genus *Podisoma* the stages are reduced to two, teleutospores and æcidial spores. It will easily be understood that with such a complicated system of development any attempt, at present, to classify the Uredineæ scientifically must be very imperfect. The species included under the order are very numerous, and there is scarcely any order of phanerogams which they may not attack. They are perhaps more injurious to grain than other plants, and cause damage not by attacking the grain itself, but the stalks and leaves. The Rosaceæ are very liable to their attacks, as are also the Coniferæ. Among the more curious members of the order are the species of *Podisoma*, the most striking of which is *Podisoma macropus*, which attacks the red cedar, and is known as cedar-apple. The fungus is the teleutospore or final state of a species which has no uredo state, and whose æcidium state, represented by a member of the so-called genus *Rœstelia*, is probably found on some of the Rosaceæ. Oersted first published observations to show that the Rœsteliæ were states of species of *Podisoma*. His observations, however, did not extend to the American species. The spores of the cedar-apple consist of two cells, as in the mildew of grain, and are packed together in a sort of jelly. In damp weather the jelly expands, and the juniper trees look as if covered with bright yellow flowers.

The genus *Phragmidium* differs in its perfect state from *Podisoma* and *Puccinia* in having its spores three or more celled. The species of this genus are most frequent on species of *Rosa* and *Rubus*. *Uromyces* has its final spores one-celled, and attacks frequently leguminous plants, particularly beans. But of all the genera of the order, *Puccinia* is the most injurious. *Puccinia graminis* is the common grain mildew, *Puccinia malvacearum* the hollyhock mildew, and *Puccinia zeæ* attacks the leaves of Indian corn. The spores of many of the Uredineæ germinate at once; others require a period of rest, generally ripening in the fall and germinating the following spring. This is notably the case with the species of *Melampsora*, which inhabit the thick leaves of willows and poplars, and cannot be made to germinate until after a period of repose. As yet, no sexual organs have been found in the Uredineæ. It has been supposed, but not yet certainly shown, that the spiral body sometimes found in young æcidia corresponds to the solecite or vermiform process of the *Ascomycetes*.

Those desirous of studying the general structure of this order are referred to the following monographs: Tulasne, L. R., *Annales des Sciences naturelles*, 3me série, tome vii. (1847), and 4me série, tome ii. (1854); De Bary, Anton, *Untersuchung über die Brandpilze* (1853); *Annales des Sciences naturelles*, 4me série, tome xx. (1863). (See also Ustilagineæ.) W. G. Farlow.

**Uredines.** See Uredineæ.

**Uredo.** See Uredineæ.

**Ure'ter** [Gr. οὐρητήρ], the excretory duct of the kidney. In man it is a cylindrical membranous tube about seventeen inches long, and as large as a goosequill, passing from the pelvis of the kidney to the base of the bladder. It has a fibrous (or outer), a muscular, and a mucous (or inner) coat. Each kidney normally has a distinct ureter.

**Ure'thra** [Gr. οὐρήθρα], the name of the membranous canal by which the urine is emptied from the bladder. In the

female it is but a short passage opening below the clitoris. In the male it is a canal of about 8–9″ in length, and of a somewhat complicated structure, conducting not only the urine, but also the semen. Going from the bladder outward, the urethra is divided into three parts: (1) the prostatic part, surrounded by the prostatic gland, in which (part) are the openings of the seminal ducts; (2) the membranaceous part, 8‴–10‴ long; and (3) the cavernous or spongy part, surrounded by the spongy tissues of the penis. The calibre of the urethral canal is different in the different parts and different individuals, and ranges from 3‴ to 7‴ in diameter, the orifice being the narrowest part. The urethra is lined throughout with a delicate coating of mucous membrane, which is a direct continuation of the mucous membrane of the bladder. (For obstructions of the urethra see STRICTURE.) F. ZINSSER.

**Urfah.** See OORFA.

**Ur′ga** ["palace"], the Russian name of the Mongolian **Bogdo-Kuren** or **Da-Kuren** ("holy camp"), the capital of Northern Mongolia, has 30,000 inhabitants, and is on the Tola, in lat. 47° 58′ N., lon. 106¾° E., at an elevation of 4370 feet, on the line between Kiachta and Peking which forms the principal caravan-route between Russia and China. Urga consists, like all Mongolian towns, of a Mongolian and a Chinese quarter. The latter, which contains the fort, is also called *Mai-mas-chen* ("trading-place"), and stands 2½ miles from Bogdo-Kuren. Both places are disgustingly dirty. Bogdo-Kuren contains large Booddhistic monasteries and temples, and is the seat of the supreme Mongolian Kutukhtu, who is considered the terrestrial representative of Booddha, and ranks in holiness next to the Dalai-Lama of Lhassa and the Panchess Rinpoche of Shigartse, both in Thibet. The monasteries are extensive structures of stone, and contain numerous shrines and relics, which are subjects of the deepest veneration; the occupants, the monks, are called *lama*, and number about 10,000. The other houses are miserable huts or tents of felt, incredibly dirty and swarming with clouds of parasitic insects. The custom is to not bury the dead, but to leave them, in accordance with Booddhistic doctrines, to be devoured by the dogs and birds of prey; the corpses of poor people are simply thrown into the streets; those of people better off are carried to a place outside the city; only those of priests and princes are interred. The Mongols settled here belong to the Khalka tribe. During summer, numerous pilgrims from all parts of Mongolia gather to the city, and a brisk trade springs up. The unit of value is the tea-brick. Tea, mixed with cows' blood, is moulded into the form of bricks, and from 12 to 15 such bricks are paid for a sheep, from 120 to 150 for a camel. The surrounding country has a South Liberian character; the mean temperature of the year is 25.70° F.; the number of rainy or snowy days is 41. A Russian consul is stationed here, with a small detachment of Cossacks for his protection. Russian merchants and scholars often visit Urga, and undertake from here extensive journeys into Northern Mongolia. EMIL SCHLAGINTWEIT.

**U′ri,** one of the forest cantons of Switzerland, bordering N. on Lake Lucerne, and having St. Gothard on its southern frontier, comprises an area of 422 sq. m., with 16,107 inhabitants, who are Roman Catholics and speak German. It consists of one valley, enclosed by lofty mountains and traversed by the Reuss. Rearing cattle and dairy-farming are the principal employments. Chief town, Altorf.

**U′ric Acid,** or **Lith′ic Acid** [Fr. *acide urique;* Ger. *Harnsäure*], ($C_5N_4H_4O_3$), first discovered by Scheele in 1776, and subsequently more thoroughly investigated by Wöhler and Liebig in 1838. More recently Bäyer has given special attention to the uric group of compounds. Uric acid occurs in a small proportion in human urine, but is much more abundantly contained in the excretions of insects, land-reptiles, and birds, usually as the ammonic salt. It is extensively found in the guano-beds of the Pacific islands, also in the form of ammonic urate, and is said to be contained in the human spleen, liver, and lungs; also in the blood, which latter, in certain diseases, as gout and albuminuria, contains a very considerable amount; indeed, in persons suffering from the former affection it often accumulates around the joints, forming what are commonly but incorrectly termed "chalk-stones," which consist chiefly of sodic urate. When secreted in excess, it is discharged by the kidneys, and is deposited from the urine as *red gravel*, or it accumulates in the bladder and forms a constituent of URINARY CALCULI (which see).

Uric acid is most advantageously prepared from the dried urine of serpents, by dissolving the powdered mass in a large quantity of boiling water, to which caustic potash enough to dissolve all the acid is added, and heating until ammoniacal vapors cease. The fluid is then filtered, and the potassic urate decomposed by hydrochloric acid, uric acid appearing in minute white crystals. It can also be obtained by boiling guano with a weak borax solution, whereby a solution of sodic urate is formed, from which the uric acid is precipitated by hydrochloric acid. Uric acid crystallizes in small white rhombic prisms; but if slowly deposited from a dilute solution, it frequently separates in large crystals containing 2 molecules of water; when obtained from animal fluids, its crystalline form is often very much modified. It is almost insoluble in water, requiring 10,000 parts of cold water, and is quite insoluble in alcohol and in ether. It dissolves in concentrated sulphuric acid, from which it is precipitated in a hydrated form by the addition of water. When dry uric acid is heated, it is decomposed without fusion, and hydrocyanic acid is evolved, a sublimate, consisting of cyanuric acid, urea, with ammonia cyanate and carbonate, being formed.

The most remarkable property of uric acid is the facility with which it is altered by oxidizing agents, such as nitric acid, plumbic dioxide, etc., and transformed into numerous well-defined crystalline compounds, some of which, however, are obtained from the immediate products of oxidation by the action of reducing agents, acids, and alkalies. More than thirty of these compounds (many of which are termed *ureides*) have been prepared, including the following: *alloxan, alloxantine, uramil, allantoin, glycoluril, murexide;* also the acids *uroxanic, barbituric, bioluric, thionuric, oxaluric, parabanic,* and *mesoxalic.* If the last-named acid is submitted to the action of reducing agents, *tartronic acid* is obtained; upon oxidation it furnishes oxalic acid. Uric acid, as yet, has not been synthetically produced. According to Gerhardt, it is the *diureide* of tartronic acid, but all attempts to prepare it from tartronic acid and urea have been unsuccessful, although, as stated above, tartronic acid is obtained from its dehydrogenized product (mesoxalic acid) by taking up 2 atoms of hydrogen.

Uric acid is dibasic, and forms both normal and acid salts. (See URATES.) Its presence can often be recognized with the aid of the microscope by its peculiar crystalline structure—rhombic tablets, frequently associated with dumb-bell-shaped crystals. When moistened with nitric acid and gently heated, a residue is obtained, which, upon treatment with ammonia, assumes a fine violet-red color (*murexide*), and when treated with potassa acquires a violet-blue color (*potassic purpurate*). It may also be detected by dissolving in sodic carbonate, and placing a drop of the solution on paper moistened with argentic nitrate, upon which it produces a brown spot, caused by the reduction of the silver. (For the quantitative estimation of uric acid in urine see URINE, CHEMICAL COMPOSITION AND ANALYSIS OF.) One of the uric acid series (*murexide*) has received practical application in the dyeing of silks and cotton, to which it imparts a fine purple color. Silks are dyed by simple immersion in a mixture of the dye with corrosive sublimate; cotton goods are mordanted with plumbic nitrate. J. P. BATTERSHALL.

**U′rim and Thum′mim** [Hebrew plu. abstracts, signifying "enlightenment and fulfilment" or "completion"], the name of that sacred symbol of the high priest of Israel which was given at Sinai (Ex. xxviii. 30), but lost for ever at the destruction of the first temple (Ez. ii. 63; Neh. vii. 65). It was placed either *upon* the *choshen* or breastplate of the high priest, thus being the four rows of precious stones (*Kalisch*), or else *within* its pocket. In the latter case it was composed of two precious stones (*Fürst*), or even three (*Gesenius*), and used to cast lots; or else of two symbolical images like the corresponding Egyptian ones (*Plumptre*); or, more probably, one object, either stone or parchment, bearing the most sacred name of the God of Israel (*Saalschütz*); or else, still better, a sacred pledge of "complete enlightenment" (*Bähr*), occupying the same relative position to the *choshen* and high priest's garments that the tables of the Law did to the ark and the tabernacle. C. A. BRIGGS.

**U′rinary Calculi and Deposits.** *Deposits.*—Urine in disease often deposits on standing various kinds of sediments, which differ in properties and composition according to the causes which induce their formation. Both morphological and chemical bodies are thus separated. The former class includes such substances as blood, pus, and mucus-corpuscles, epithelial scales, spermatozoa, etc.; to the latter class belong urates, uric acid, phosphates, calcic oxalates and carbonates, hippuric acid, cystine, leucine, xanthine, tyrosine, etc. These deposits form light flocculent powders or compact grains (*gravel*), or they collect in larger concretions, forming calculi. The most common sediments contain uric acid. This often separates in a free state, forming *red gravel* (see URIC ACID), or it is deposited in the form of ammonic or sodic urates, which sometimes appear in perfectly healthy urine. A crystal-

line or amorphous deposit, consisting of ammonio-magnesic phosphate, forms what is known as *white gravel.*

*Calculi in the Bladder.*—These vary greatly in size and composition, and are frequently composed of concentric layers of different composition, arranged around a clot of blood or a foreign substance as a nucleus: the exterior layer is often phosphatic, but never uric, in character. The most typical forms have the following composition:

*Uric.*

| | |
|---|---|
| Uric acid | 92.8 |
| Urates | 3.2 |
| Extractive matters | 1.0 |
| Water | 3.0 |

*Phosphatic.*

| | |
|---|---|
| Sodic urate | 9.77 |
| Calcic phosphate | 34.74 |
| Ammonio-magnesic phosphate | 38.35 |
| Calcic carbonate | 3.14 |
| Magnesic carbonate | 2.55 |
| Extractive matters, etc. | 6.87 |

*Oxalic.*

| | |
|---|---|
| Calcic oxalate | 63 5 |
| Calcic phosphate | 6.2 |
| Water and organic matters | 30.3 |

As a rule, the oxalic calculi are the hardest, the phosphatic being the softest. The following are the best characterized forms of calculi: *Uric acid calculi*, of a brownish-red color and smooth surface. When heated they fuse, and emit a peculiar odor, leaving but a little ash. They give the reactions for URIC ACID, mentioned under that head. *Ammonic urate calculus* is rare in occurrence. It is more easily soluble in water than the preceding, and dissolves in hot potassa solution, with evolution of ammonia. *Calcic oxalate* constitutes the *mulberry calculus*, which has a dark-brown color and is very hard. When heated before the blowpipe, it first blackens, then burns to a white ash consisting of calcic carbonate. It dissolves in hydrochloric and in nitric acids, but not in acetic acid. *Calcic phosphate* forms the *bone-earth calculus* ($O_8P_2Ca_3$), which is of rare occurrence, and often consists of laminæ of crystals radiating from a nucleus. It is of a light-brown color, dissolves in hydrochloric acid, but is infusible before the blowpipe. *Ammonio-magnesic phosphate,* or *triple phosphate calculus* ($O_8P_2Mg_2Am_2$), is white and brittle; fuses with difficulty, emitting an ammoniacal odor, and readily dissolves in acids. *Fusible calculus,* which appears to be a mixture of the two preceding varieties, forms white friable masses which often acquire a large size. It fuses readily, and is easily soluble in acids. *Xanthine calculi* (see XANTHINE) are of a pale-brown color, have a lamellar fracture and a polished surface, which acquires a high lustre when rubbed. They dissolve in potash solution and in nitric acid, but very sparingly in hydrochloric acid. *Cystine calculi* are semi-transparent, and have a dark-yellow color and a crystalline texture. The last two forms are of unfrequent occurrence. *Compound calculi,* consisting of a succession of laminæ composed of several of the foregoing varieties, also occur. J. P. BATTERSHALL.

**U′rine, Chemical Composition and Analysis of.** Urine in health possesses a light-amber color, a slight acid reaction, a peculiar odor, and a bitter saline taste. During the process of digestion it sometimes acquires an alkaline reaction. It has a sp. gr. of 1.024, but this also changes with the diet and state of health of the individual. It becomes more strongly alkaline on standing, owing to the formation of ammonic carbonate. (See UREA.) The urine excreted in the morning has a different composition from that passed in the evening, which has absorbed various substances taken into the stomach during the day. An average sample of healthy human urine has the following composition:

In 1000 parts, water = 956.80 parts.
In 100 parts of solid matter:

| | | |
|---|---|---|
| Organic matters... | Urea | 33.00 |
| | Uric acid | 0.86 |
| | Alcoholic extract | 29.03 |
| | Aqueous " | 5.80 |
| | Vesical mucus | 0.37 |
| Fixed salts... | Sodic chloride | 16.73 |
| | Phosphoric pentoxide | 4.91 |
| | Sulphuric trioxide | 3.94 |
| | Lime | 0.49 |
| | Magnesia | 0.28 |
| | Potash | 4.47 |
| | Soda | 0.12 |
| | | 100.00 |

Besides the above constituents, the following compounds are occasionally contained in healthy urine, usually in minute quantities: *iron, ammonia, sugar,* XANTHINE (which see), *creatine, creatinine,* and *lactic, succinic, oxalic, formic, phenylic,* and *hippuric* acids. Free gases also occur: in 100 cubic centimètres of urine, Plauer found 0.87 nitrogen, 0.06 oxygen, 4.54 free and 2.07 combined carbonic acid. Certain pigments, the composition of which is uncertain, are likewise present. According to Thudichum, the normal coloring-matter consists of a yellow amorphous mass, which he terms *urochrome,* but to which Schunck gives the name *urian* and the formula $C_{43}H_{51}NO_{26}$. *Indigo-blue* appears to be a product of the decomposition of this or other pigments, as it occurs in urine which has been exposed to the air for some time. Among the other bodies said to be contained in urine may be mentioned certain *ferments* and *albuminoid matters, caseine, leucine, tyrosine, taurine, acetone,* and *taurocholic, glycocholic,* and *cholic* acids, which latter are present only in the abnormal or diseased excretion. The acidity of urine is due to the presence of hydric-sodic phosphate, and hippuric and lactic acids. Numerous substances appear to pass unchanged through the urine, such as many alkaline salts and numerous compounds of metals, alkaloids and organic acids, while others suffer a partial or complete transformation; thus, malic acid is converted into succinic acid; sulphites and sulphides are changed into sulphates; tannic acid is converted into gallic acid; benzoic, cinnamic, and quinic acids are transformed into hippuric acid; iodine changes to alkaline iodides, potassic ferrocyanide to the ferricyanide; and indigo-blue is reduced to indigo-white. In the disease *diabetes* a large amount of grape-sugar (glucose) is contained in the urine, owing to an incomplete digestion of the food, sometimes in the proportion of over a pound in the liquid voided during twenty-four hours. In *albuminuria* a large quantity of albumen is secreted, the formation of which is due to a lack of secretive power on the part of the kidneys.

ANALYSIS OF URINE.—*Urea* may be determined in a variety of ways. *Liebig's volumetric method* is executed as follows: Dissolve 100 grammes of pure mercury in 500 grammes of nitric acid, evaporate to a syrup, add a little nitric acid, and dilute to 1400 cubic centimètres; this forms the standard mercury solution, 1 cubic centimètre of which is equal to 1 centigramme of urea. Its strength should be actually determined by estimating a known weight of urea in the manner described further on. A baryta solution is next prepared by mixing 2 volumes of baryta-water and 1 volume of a solution of baric nitrate, both saturated in the cold; 15 c. c. of this baryta mixture are then added to 30 c. c. of the urine to be tested; the liquid is well stirred, and then filtered through dry paper; 15 c. c. of the filtrate (= 10 c. c. of the original urine) are now measured off in a beaker-glass, and the standard mercury solution is slowly added from a burette as long as any precipitation occurs, the precise end of the operation being determined by adding a drop of the mixture to a solution of sodic carbonate contained in a watch-glass, when a distinct yellow color should be produced. The number of cubic centimètres of the mercury solution used is read off, each cubic centimètre indicating 1 centigramme of urea in the 10 cubic centimètres of urine. In this method the presence of an excess of urea and of sodic chloride affects the accuracy of the result, and renders a correction of the figures obtained necessary. *Bunsen's method* is based upon the decomposition of urea into carbonic acid and ammonia. A known quantity of the prepared urine is mixed with a solution of baric chloride containing ammonia; the filtered liquid is heated in a sealed tube to 400° F.; and the baric carbonate formed weighed: 1 gramme of the carbonate = .3041 gramme of urea. In *Heintz and Ragsky's method,* 20 c. c. of the urine are precipitated with platinic tetrachloride; the precipitate is washed with alcohol, dried, and weighed. From 2 to 5 c. c. of the same urine are then heated in a platinum capsule with an equal amount of sulphuric acid, and the mixture, when cold, is diluted with water, filtered, and the filtrate likewise treated with the platinic salt. Both precipitates are calculated for 100 c. c. of urine, and the weight of the first is subtracted from that of the second: the difference, multiplied by .13423, gives the percentage of urea. *Davey's method* consists in adding a small quantity of the urine to a graduated glass tube, filled one-third with mercury, completely filling the tube with sodic hypochlorite, and immersing it in an inverted position in a concentrated solution of sodic chloride, in which position it is allowed to remain for several hours, after which the quantity of gas (nitrogen) evolved is read off: 1.549 cubic inches of nitrogen at 60° F. = 1 grain of urea.

*Uric acid* is best determined by adding to about 200 c. c. of the urine 10 c. c. of hydrochloric acid, and allowing the mixture to stand for two days, when the precipitate formed is collected on a small filter, washed, dried, and weighed. Care should be taken not to use more than about 30 c. c. of water in washing the precipitate, as otherwise a partial solution of the uric acid is to be feared; and all albumen present should at first be removed by coagulation with dilute acetic acid, in which case this acid, in a concen-

trated form, should be employed as the precipitant of the uric acid.

*Sugar* (*glucose*) is estimated by its reducing action on a boiling cupric solution in presence of an alkali, or it can also be determined by adding a small quantity of yeast to the urine, and measuring the amount of carbonic acid formed by the fermentation of the sugar. (See URINOMETER.) *Albumen* is separated by heating the urine to boiling, and adding a few drops of acetic acid until complete coagulation takes place. The precipitate is dried until its weight remains constant. *Chlorides* may be estimated by a volumetric method (as with silver and potassic dichromate solutions); *phosphates* by the uranic oxide process; *ammonia* by placing 20 c. c. of the urine in a shallow dish, over which is placed a similar vessel containing 10 c. c. of a standard solution of sulphuric acid, both being covered by an air-tight bell-jar; 10 c. c. of milk of lime are then added to the urine, and the bell-jar is placed over it. In two days the ammonia will have been absorbed by the acid, and is estimated by titrating and comparing the residual acidity with that of the standard acid. (See VOLUMETRIC ANALYSIS.) J. P. BATTERSHALL.

**Urine, Retention of.** See RETENTION OF URINE, by E. J. BERMINGHAM, M. D.

**Urinom'eter** [Gr. *οὖρον*, "urine," and *μέτρον*, "measure"], an instrument used in the determination of the specific gravity of URINE (which see), by means of which the presence of albumen or other foreign matters is often indicated. Quite recently a method for estimating quantitatively the amount of grape-sugar present in urine by the loss of density which is caused by the fermentation of the same has been proposed. It is executed as follows: Determine the specific gravity of the urine; add a little dry yeast; allow the mixture to remain at rest for twenty-four hours, and then take the specific gravity again. A urinometer can be used, each degree of which corresponds to 1 grain of grape-sugar in 1 fluid ounce of urine.

J. P. BATTERSHALL.

**Uropelt'idæ** [from *Uropeltis*—*οὐρά*, "tail," and *πέλτη*, "shield"—the chief genus], a family of reptiles of the order Ophidia. The body is cylindrical, the head short and pointed, and not separated by constriction from the body; the eyes are very small; the cleft of the mouth is comparatively narrow; teeth are in both jaws, but none on the palate; there are no rudiments of posterior extremities; the tail is short and blunt, and has a naked terminal shield or keeled scales; the skull has the cranial walls partly constituted by the mastoids; ectopterygoids and prefrontals are developed; the maxillaries are horizontal, and in contact with the prefrontals, and have alveolar ridges. The family is composed of several genera, mostly confined to the East Indies and the Philippine Islands. A monograph was published in 1861 by Dr. Peters (*De Serpentium Familia Uropeltaceorum*, Berlin). THEODORE GILL.

**Ur'quhart** (DAVID), b. at Bracklanwell, co. Cromarty, Scotland, in 1805; educated at St. John's College, Oxford; entered the diplomatic service; travelled extensively in the East; was secretary of legation at Constantinople 1835–36; resigned that post in consequence of his opposition to Lord Palmerston's Eastern policy, which he denounced as subservient to the ambitious views of Russia; made a vigorous warfare upon that policy in the press for several years, and continued it in Parliament, where he sat as a Conservative member for Stafford 1847–52. Author of *Turkey and its Resources* (1833), *England, France, Russia, and Turkey* (1835), *The Spirit of the East, a Journal of Travels through Roumeli* (2 vols., 1838), *Diplomatic Transactions in Central Asia* (1840), *The Mystery of the Danube* (1844), *The Pillars of Hercules, a Narrative of Travels in Spain and Morocco* (2 vols., 1850), *The Progress of Russia in the West, North, and South* (1853), *Letters and Essays on Russian Aggressions* (1853), *Recent Events in the East* (1854), *The War of Ignorance, its Progress and Results* (1854), *The Lebanon, a History and a Diary* (2 vols., 1860), and other works and pamphlets, some of them directed against the U. S. in reference to boundary difficulties and the annexation of Texas.

**Urqui'za, de** (JUSTO JOSÉ), b. in the province of Entre Rios, viceroyalty of Buenos Ayres, in 1800, of mixed Spanish and Indian blood; rose into prominence as a leader of the Guachos or half-nomadic herdsmen in the frequent revolutions which followed the independence of the Argentine Confederation; attached himself to the "federal" party as represented by the dictator Rosas, by whom he was favored and promoted to be a general of division; became governor of his native province 1842; commanded the Argentine forces in Uruguay 1843–45, and gained over Rivera, at India Muerta, Mar. 28, 1845, an important victory, which he stained by numerous executions of prisoners; found himself in 1851 an object of jealousy and suspicion to Rosas, against whom, in self-defence, he revolted; terminated the nine-years' siege of Montevideo by the capitulation of the besiegers; made a treaty of alliance with Brazil and Uruguay; crossed the Parana Jan., 1852; defeated Rosas at the decisive battle of Monte Caseros, forcing him to flee to Europe; was recognized at Buenos Ayres as provisional dictator; called a congress at Santa Fé to form a constitution; was forced to retire from Buenos Ayres by the revolution of Sept. 11, which established the independence of that province from the confederation; was chosen president for six years 1854–60; established his capital at Bajada del Paraná; declared the Paraná, Uruguay, and La Plata rivers free to the flags of all nations; carried on alternate warfare and diplomatic negotiations with the semi-independent province of Buenos Ayres, which he ultimately added to the confederation by the treaty of Nov. 11, 1859, as the result of a victory gained at Cepeda; was appointed commander-in-chief on the expiration of his presidential term 1860, and shortly after elected governor of Entre Rios; was defeated by Mitre, the governor of Buenos Ayres, at the battle of Pavon, Sept. 17, 1861—an event which led to the reorganization of the "Argentine Republic;" retired from the governorship of Entre Rios 1864, and took little subsequent part in political affairs. He was assassinated at his country-seat of San José, Entre Rios, in May, 1870, by his son-in-law, Gen. Lopez Jordan, who headed a revolution. He possessed immense wealth in lands, cattle, and horses, lived in baronial style at his *estancia*, and had little education, but considerable political sagacity and strong passions. PORTER C. BLISS.

**Urra'ca,** queen of Castile, b. about 1070, was the only legitimate child of Alfonso VI. by his queen, Constance of Burgundy; married, about 1090, Raymond of Burgundy, count of Galicia, who d. in 1108; married Alfonso I. the Warrior of Aragon 1109; succeeded to the throne the same year; was imprisoned by her husband, and rescued by her lover, the count of Lora, 1110; was repudiated by Alfonso and their marriage declared null by the papal legate 1111; was defeated and retired into Galicia 1111; raised there a new army, with which she seized Burgos, and held an assembly there 1113; drove Alfonso back into Aragon; associated her son, Alfonso Raymond, in the government, but quarrelled and made war upon him 1116; made war also upon her half-sister Theresa, countess of Portugal, and ravaged Portugal 1121. D. at Leon Mar. 8, 1126.

**Ur'sa,** p.-v. and tp., Adams co., Ill. P. 1411.

**Ur'sa Ma'jor** [Lat., "Greater Bear"], the first of Ptolemy's northern constellations, including the fine group of seven stars known as "Charles's Wain," "The Dipper," or the "Butcher's Cleaver," near the N. pole, formerly called also *Septentriones* (likewise *Septemptriones*) and the "Plough."

**Ur'sa Mi'nor** [Lat., "Lesser Bear"], one of Ptolemy's northern constellations, containing the North Star (*Polaris*) and the group anciently known as Cynosura, the "Dog's Tail." Polaris is a double star of the second magnitude.

**Urs'idæ** [from *Ursus*, the ancient Latin name of the bear, the typical genus], a family of placentiferous mammals of the order Feræ, embracing all the species of bears. These have the body heavy, the hair abundant, the head conic, and with the snout short, but more or less pointed, the feet plantigrade (*i. e.* with the palms and soles applied to the ground in walking or resting), and each with five digits fully developed and armed with sharp non-retractile claws; the teeth in adult 36 to 42 (M. $\frac{2}{3}$, P. M. $\frac{4}{4}$ ($\frac{3}{2}$), C. $\frac{1}{1}$, I. $\frac{3}{3}$ ($\frac{2}{3}$) $\times$ 2); last true molar of the upper jaw is oblong and exceeds the first; the last premolar of the upper jaw, as well as the succeeding true molars, is tubercular; the first true molar in the lower jaw is narrow, but longest; the second oblong and broader; the skull is distinguished by its foramina, the foramen lacerum posticum being introrse and behind the postero-internal angle of the tympanic bone, and the carotid canal is little in advance of the foramen lacerum posticum. The family is widely distributed, and has representatives in the extreme arctic regions as well as in the temperate and torrid zones—in America, Europe, and Asia, and in the N. of Africa. About 15 species are known, which have been distributed by recent systematists under six genera—viz. *Thalarctos* (polar bear), *Ursus* (ordinary bears), *Tremarctos* (South American), *Helarctos* (Indian, etc.), *Melursus* (the *Ursus labiatus* of India), and *Æluropoda* (Thibetan): the last two are very distinct; the others closely related. North America has one species of *Thalarctos* (*T. maritimus*), and two or three of *Ursus* (*U. horribilis*, *U. americanus*, and perhaps *U. Richardsonii* or *U. arctos*). (As to habits, etc., and for figures, see the article BEAR.) THEODORE GILL.

**Ursula,** SAINT. See URSULINES.

**Ur'sulines,** an order of celibate women in the Roman Catholic Church, named in honor of St. Ursula, who, according to legend, suffered martyrdom in the third, fourth, or fifth century, being massacred, together with her army of virgins, by the Huns near Cologne. The order was founded by St. Angela Merici of Brescia, who in 1537 became its first superior. In 1544, Paul IV. approved the order, and Gregory XIII. and Clement VIII. gave it their sanction. St. Charles Borromeo was another powerful friend of the Ursulines. They have houses in various countries, and are chiefly devoted to the training of females.

**Urtica'ceæ** [from *Urtica*, one of the genera], a natural order of exogenous trees, herbs, and shrubs. As at present constituted, it contains (1) the Ulmeæ, or elm family; (2) the Artocarpeæ, or bread-fruit family; (3) the Urticeæ, or nettle family; (4) the Cannabineæ, or hemp family. This is a large and important order, including a very great number of useful species, mostly tropical.

**Uruguay',** or **Banda Oriental del Uruguay,** a republic of South America, between lat. 30° and 35° S., and between lon. 53° and 58° 30′ W., and bounded N. by Brazil, E. by the Atlantic, S. by the Rio de la Plata, and W. by the Uruguay, which separates it from the Argentine Republic. Area, 63,300 sq. m. P. 454,478 in 1872. The native population is a blending of Indian, European, and African blood, the aborigines having entirely disappeared. More than one-half of the inhabitants are foreigners, however—mostly Italians, 60,000; Spaniards, 30,000; French, 30,000; Basques, 30,000; Brazilians, 20,000, etc. The language is Spanish. The prevailing religious denomination is the Roman Catholic, having 47 churches, while Protestantism has only 3. The government is a republic after the model of the U. S. of North America, but the history of the country is an alternation of despotism and anarchy. For administrative purposes the country is divided into the following thirteen departments:

| | Area. | Population. | Capital. |
|---|---|---|---|
| Cerro Largo | 7,530 | 33,000 | Villa de Melo. |
| Colonia | 1,900 | 22,508 | Colonia. |
| Durazno | 4,850 | 16,281 | Durazno. |
| Florida | 4,100 | 19,900 | Florida. |
| Guadalupe | 1,600 | 48,000 | Canelones. |
| Maldonado | 5,150 | 18,750 | Maldonado. |
| Minas | 4,985 | 27,163 | Minas. |
| Montevideo | 225 | 127,704 | Montevideo. |
| Paysandú | 7,360 | 33,052 | Paysandú. |
| Salto | 8,125 | 32,602 | Salto. |
| San José | 3,890 | 20,115 | San José. |
| Soriano | 3,125 | 21,403 | Soriano. |
| Tamarembo | 10,460 | 34,000 | San Fructuoso. |

The capital is Montevideo, with 110,000 inhabitants; other principal towns are Salto, with 10,000, Villa de Melo and San José, each with 5000 inhabitants. The Atlantic coast, about 200 miles long, is low, sandy, and without safe harbors; the shore of the Rio de la Plata, about 155 miles long, is higher, rocky, and affords several good harbors; the shore of the Uruguay, about 270 miles long in a straight line, presents alternately low plains and more elevated table-lands. The interior is not well known. Several ridges traverse the country, such as the Cuchilla Grande, Carapy, Castellos, and Yerbal. They are low, and covered with forests of walnut, cedar, laurel, and myrtle trees, and contain much valuable timber, hard woods, dyewoods (such as the scarlet willow and the quebracho), and numerous medicinal plants—the poppy, sarsaparilla, balsam, liquorice, etc. Numerous streams descend from these ridges in all directions. The largest is the Rio Negro, which rises in the Sierra Santa Anna, traverses the country from N. E. to S. W., and joins the Uruguay after a course of about 350 miles. The Dayman, Queguay, San José, Santa Lucia, etc., have a length of 100–150 miles, but are not navigable for more than 15–25 miles. The general character, however, of the country is that of wide, open, grassy plains, sometimes of an elevation of 2000 feet, but generally lower. The climate is mild and healthy, though very changeable. The general range of the thermometer is from 32° to 88° F. In July and August severe frosts occur on the table-lands; in February the heat in the lowlands often reaches 100° F. Rain falls in sufficient quantity in all seasons; snow is rare. But a change in the temperature of from 20° to 40° within a few hours is of frequent occurrence. The soil is very rich, and could produce large crops of grain, vegetables, fruits, sugar, and cotton if properly cultivated; but agriculture is still in a very backward state, though progressing; the principal occupation is cattle-breeding. In 1874 the country possessed 7,254,000 cattle, 1,463,000 horses and 18,476,000 sheep of a superior breed. The principal articles of exportation are hides, wool, tallow, skins, salted and jerked beef, etc., and in 1874 the value of the exports amounted to $15,240,000, according to official records, but was in reality much larger, as many tricks are resorted to in order to avoid the heavy export duty. Gold, silver, copper, iron, marble, etc., are found, but very few mines are in operation. Of manufactures there are almost none; some coarse articles are produced, but only for home use. The principal articles of import are textile fabrics, furniture, utensils, tools, colonial wares, and coal. The value of the imports amounted in 1874 to $16,320,000. The commerce of the country is principally carried on with Great Britain, France, Brazil, and the U. S. In 1874, 1888 vessels of 986,827 tons burden entered the harbors, and 1821 of 954,712 tons burden cleared thence. 176 miles of railway lines are in operation, and 1300 miles of telegraph lines, connecting Montevideo with Buenos Ayres, Valparaiso, and Rio Janeiro. On Jan. 1, 1875, the public debt amounted to $42,357,695; the receipts for 1874 to $6,375,000; the expenses to $8,500,000.

The first European settlement was made in this territory in 1622 by the Spanish Jesuits, but soon after both Spanish and Portuguese colonies were established, and as the Portuguese wished to make the Rio de la Plata the boundary of their Brazilian dominion, the country was for a long time the subject of violent contention between the two nations. The Portuguese founded Montevideo and Colonia, but in 1724 the Spaniards were victorious; the country became Spanish, and was made a province of the vice-royalty of Buenos Ayres, under the name of Banda Oriental del Uruguay—that is, "the eastern side of the Uruguay." When in 1811 the war of independence broke out in the Spanish colonies, the Portuguese renewed their attacks on the Banda Oriental, and succeeded in 1816, and again in 1821, after the death of José Artigas, in annexing it to Brazil. But in 1825 a revolution broke out in Montevideo, and an independent republic of Uruguay was established, which in 1828 was recognized by Brazil, and in 1830 adopted its present constitution. It has suffered very much, however, during this period of freedom. The unsettled state of the national character, in which old Spanish and old Roman Catholic ideas are mixed together with the wildest vagaries of modern times, has made it possible for a long series of political adventurers to victimize the people.

**Uruguay,** river of South America, rises in lat. 28° S., lon. 50° W., in the Brazilian province of Santa Catharina, on the western slope of the Sierra do Mar; flows first W., then S., forming the boundary between the Argentine provinces of Corrientes and Entre-Rios on the one side, and Brazil and the republic of Uruguay on the other, and joins the Parana, after a course of 1020 miles, in lat. 34° S., lon. 61° 40′ W. In its lower course, up to the cataract of Salto Grande, 250 miles from its mouth, it is navigable for steamboats and minor vessels. Salto Grande, however, is frequently passed during high floods by steamers, and for vessels drawing not more than five feet the river is navigable up to the cataract of Salto Mberuy, in lat. 27° 20′ S., about 550 miles from the mouth. But as northern winds prevail in the basin, it generally takes a sailing vessel from fifty to sixty days to ascend the river as far as San Borja, about 500 miles from the mouth, and the traffic is not yet so great that it would pay to employ steam-tugs. The river is more remarkable for the volume of water it carries than for its length. It receives a great number of affluents, especially from the republic of URUGUAY (which see). It is 600 yards wide at its junction with the Ibicuy, 1500 after its junction with the Quaraim, which in lat. 30° 14′ S. forms the boundary between Brazil and the republic of Uruguay, and about 100 miles from its mouth it expands almost into a lake. It rises in September and October, on an average, 20 feet, but often its risings take place very rapidly—5 and 8 feet in one night.

**Urume'yah,** town of Persia, province of Azerbaijan, is on an elevated plain 12 miles W. of Lake Urumeyah. It is well built, and is in a densely-peopled and well-cultivated district, which by European travellers has often been compared with Lombardy. The Protestant mission has here a very prosperous station, with a printing-press, which in 1872 issued 3230 volumes in the old and new Syriac languages, and 7 native preachers and teachers. P. estimated at from 25,000 to 50,000.

**Urumeyah** (or **Urmeah**), **Lake,** in the province of Azerbaijan, Persia, 64 miles S. W. of Tabreez, covers an area of nearly 1900 sq. m. It receives several large rivers, but has no outlet. Its waters are so impregnated with saline substances that neither fish nor mollusca can live in it.

**Urumt'si,** city of Central Asia, with a population estimated at 150,000, is at the northern foot of the Thian Shan Mountains. It is the capital of the Chinese Mongolian province of the same name, and since 1862 has formed the centre of the Dungan rebellion. In the commerce of Central Asia, Urumtsi formerly occupied the same position as Nizhnee-Novgorod in that of Eastern Russia. Goods from

Russia, Turkestan, Persia, and Cashmere flowed to this place, 140 merchants' offices and 65 Chinese banks were established here, and by its well-stocked magazines Urumtsi held a perpetual fair. But the uncertainty consequent on the Dungan rebellion put an end to this traffic. Dungan, a corruption of *Tangut*, is the name of the 4,000,000 Mussulmans of Turkish-Tartarian descent who inhabit the northern provinces of China, and who on account of the enormous taxes rose in revolt in Shen-See in 1862, and pushed, devastating and destroying, into Southern Mongolia, where they took Urumtsi. In 1864 they also occupied the valley of the Ili, with the capital of Kulja, which, however, the Russians have held since 1871. But they never succeeded in forming an organization or agreeing concerning the leadership, and in 1871–73 the loose bands in Eastern Mongolia were massacred by the Chinese. South-western Mongolia, however, is still in their hands, and on account of the secluded location of the country it will be difficult to overthrow them. According to Russian reports, the chief of East Turkestan has attacked and subdued Urumtsi. EMIL SCHLAGINTWEIT.

**U'rus** [Lat.], a great and fierce animal of the ox kind mentioned by Cæsar as inhabiting the forests of Germany. It is generally conceded that the animal concerning which these exaggerated accounts reached Cæsar was the wild ox, such as still exists in a few European parks, or possibly the AUROCHS (which see).

**Us'age,** in law, denotes the collective habits, practices, manners, and methods of business-men in the transactions and operations either of all trades and occupations or of some particular trade or calling. The words "usage" and "custom" are often employed interchangeably by legal writers, but the latter term is more restricted in its meaning, and may apply to the habits and modes adopted by some particular individual or in some particular place. A usage to be available must be shown by competent evidence to be common, certain, definite, and not *contrary* to law; it may, of course, consist in acts which the law does not *require*, but not in those which the law forbids. Usage is only resorted to as an aid in the interpretation of contracts. If an agreement is expressed in ambiguous terms, or contains technical words, or is inferred from the acts of parties, its meaning may be explained by the usage of the business with which it is connected, for it is presumed that the parties knew of that usage and contracted with reference to it. If, however, the language of an agreement is clear and the intention plain, no such explanation is possible.

JOHN NORTON POMEROY.

**Usbeks,** or **Oozbeks,** a people of mixed Turkish blood inhabiting nearly all parts of Turkestan, where they are the dominant race. Intellectually and morally, they are the superiors of those about them. They are zealous Mohammedans, mostly non-nomadic, and pride themselves on their culture and civilization, which are, however, but scanty. In 1862 the Chinese Usbeks revolted from that empire, and under Yakoob Ushbegi (Ooshbegi, Kushbegi, or Yushbegi) founded a new Mohammedan empire, with 1,000,000 inhabitants and 740,000 sq. m. of territory.

**Use** [Lat. *usus*], in law, is an equitable estate in lands of a special nature, which can better be described than defined in an abstract manner. At an early day the English ecclesiastics, in order to avoid the statutes of mortmain, contrived a new mode of transfer, which was undoubtedly borrowed by them from the *fidei commissa* of the Roman law. The land was conveyed to some person in the ordinary manner, but in the deed of feoffment or in some accompanying writing there was inserted a declaration that he was to hold the land to the use of or for the benefit of a named religious corporation. This practice began during the reign of Richard II., and, proving successful, it in time became very common even in transactions between private persons. The common-law courts treated the feoffee to whom the conveyance was directly made, and who held the legal title, as the only one possessing any interest. But the equity courts enforced the trust placed in this feoffee, and regarded the beneficiary or *cestui que use* as the real owner, entitled to the possession, profits, and complete control of the land. This estate of the beneficiary was the "use." Being utterly unknown to the common law, and being the creature of the equity tribunals, it was freed by them from all the incidents and restraints of the feudal tenures; it could be devised by will, transferred without any public delivery of possession, and was not subject to any pecuniary exactions from the superior lords. Equity looked upon the legal holder as having no interest but the bare title, and would compel him to convey it as directed by the beneficial owner. In the 27th year of Henry VIII. Parliament attempted to destroy uses by a statute called the "statute of uses." This celebrated enactment provided, in substance, that whenever lands should be conveyed in fee to A for the use or benefit of B, the complete title, legal and equitable, should at once vest in B free from any use, and that no interest should remain in A. The whole statute, however, was drawn so loosely, and contained so many provisos and exceptions, that the courts of equity soon evaded it, and revived the system of uses under the name of "trusts," which has existed to the present day. Another result of this legislation was the invention of certain forms of deed, which came to be the ordinary means of conveying land in England, and so continued until Parliament by a recent statute (1845) substituted the simpler conveyance by "grant" in their stead. (See BARGAIN AND SALE. For further particulars consult the articles on ESTATE and TRUST.) Uses have been expressly abolished in many States, and it is probable that they have never existed as independent estates distinguished from trusts in any American commonwealth. JOHN NORTON POMEROY.

**Use and Occupation.** Whenever the land or building, or portion thereof, belonging to one person is occupied by another, either under an express agreement or under such circumstances that the law will infer an agreement, but without any stipulation as to the amount of rent, the owner may recover from the tenant such compensation in the nature of rent as the occupation is reasonably worth. The action under these circumstances is said to be for the "use and occupation." The right to recover is based upon the notion that the possession was taken and held in pursuance of a contract, express or implied, and is necessarily brought upon the tenant's implied promise to pay, so that the relation must resemble that of lessor and lessee. If, therefore, the entry is tortious, and the land is held adversely and not in subordination to the owner's right, no action for use and occupation can be maintained, since no promise can be inferred; the remedy of the owner is damages resulting from the unlawful trespass.

JOHN NORTON POMEROY.

**U'sedom,** a low, irregular, and little productive island belonging to Prussia, is situated at the mouth of the Oder, between the Baltic and the Stettiner Haff, and comprises an area of 148 sq. m. On its north-eastern shore is the port of Swinemünde.

**Uses.** See USE.

**Uses, Charitable.** See CHARITABLE USES.

**Ush'ant** [Fr. *Ouessant*], the largest of a group of islands of the same name, lies off the coast of Brittany, France, and belongs to the department of Finisterre. It is fertile, and has 2271 inhabitants, engaged in the rearing of cattle and in fisheries.

**Ushas.** See HINDU RELIGIONS, by PROF. JOHN DOWSON.

**Ush'er,** or **Ussher** (JAMES), D. D., b. at Dublin, Ireland, Jan. 4, 1580; educated at Trinity College, Dublin, where he became a fellow; took orders in the Church of England 1601; became chancellor of the cathedral of St. Patrick 1607; was professor of divinity at the University of Dublin 1607–20; drew up the Articles of Faith of the Irish Church 1615; became bishop of Meath 1620, archbishop of Armagh and primate of Ireland 1623; had his house destroyed by the Irish rebels 1641, while visiting England, in which country he thenceforth remained; was appointed by Charles I. bishop of Carlisle, and was preacher of Lincoln's Inn 1647–54, residing chiefly at Oxford. D. at Ryegate, Surrey, Mar. 21, 1656, and by order of Cromwell was buried with great magnificence in Westminster Abbey. Author of numerous theological treatises, mostly in Latin, of which a complete edition was published by the University of Dublin (17 vols., 1841–64), with a *Life* by Rev. C. R. Elrington. His *Annales Veteris et Novi Testamenti* (2 vols., 1650–54) contain a scheme of biblical chronology, since printed in the margin of the authorized version of the Bible, and generally adopted by English and continental historians, though now admitted to be inexact. Another *Life*, with that of John Selden, was written by Dr. John Aikin (1811). His library now belongs to Trinity College, Dublin. He was a learned antiquarian, and the Epistles of Polycarp and Ignatius were first published by him. He was twice elected by the Long Parliament to the Westminster Assembly of Divines, but did not attend, from loyalty to the king. He prepared the Irish Articles of Religion (1645), and proposed a system of reduced episcopacy as a compromise between Episcopalians and Presbyterians.

**Usher of the Black Rod.** (1) The gentleman usher of the black rod, one of the dignitaries of the British court, is also usher to the order of the Garter and to the House of Lords, in which he has executive duties. (2) Yeoman usher of the black rod is deputy of the foregoing. (3) The usher of the order of Knights of St. Patrick is called the usher of the black rod. The usher of the green rod serves the order of the Thistle, and the usher of the red rod the order of the Bath. The governments of Newfoundland, Queensland, New South Wales, Tasmania, etc.,

have ushers of the black rod, after the example of the home government.

**Us'kup,** or **Scopia,** town of European Turkey, eyalet of the same name, on the Vardar, has many fine mosques and important manufactures of leather. P. 12,000.

**Us'tick,** tp., Whitesides co., Ill. P. 1026.

**Ustilagin'eæ,** an order of Fungi to which belong the smuts. The species of this order grow upon living phanerogams, and attack most frequently some part of the floral organs, although some species are limited to leaves and young stems. In all the species the spores are very numerous and of a black or dark-purplish color, seen with the naked eye. After producing more or less distortion of the mother-plant they rupture the epidermis, and appear in the form of powdery spots or masses, which cover with a blackish dust all bodies which come in contact with them, from which fact they derive the name of smuts. The mycelium or mass of threads from which the spores are produced is in all the species of the order comparatively minute, and easily escapes notice, being often concealed by the preponderating mass of spores. The mycelium is not provided with any proper suckers, such as are found in some orders of Fungi, and is almost entirely limited to the part of the mother-plant where the smutty spots are to make their appearance. The spores are produced directly from the mycelium, without the intervention of any sexual organs, none of which have been found, with any certainty, in the Ustilagineæ. Very little is known of the development of the members of this order, which, although comparatively few in number, includes a large proportion of injurious species. The spores when ripe are either free from one another or else united in clusters of two, three, or more together. The spores of some of the species, as *Tilletia caries* and *Ustilago fœtens*, have a disagreeable odor. The germination has been studied in several species. In some, after a period of repose, the contents of the spore simply grow out in the form of a tube. In *Tilletia caries* the germinal tube, which is short, is crowned at the tip with a whorl of cells, which unite with one another in pairs by a cross-partition, thus forming a sort of conjugation. After this lateral union has taken place, certain of the cells begin to elongate into a mycelium. A similar process was observed by De Bary in *Protomyces microsporus*. In the genus *Ustilago* the spores are produced in masses, but are all free from one another. To this genus belong *U. mayidis*, which is the common smut of Indian corn; *U. fœtens*, which grows on wheat in this country; and *U. carbo*, found on oats and also on wheat. The species just named produce, at first, more or less swelling and distortion of the grains, which afterward become completely atrophied, their place being filled with masses of spores. *Ustilago longissima* attacks the leaves of *Phragmites*, and has more the habit of a *Puccinia* than an *Ustilago*, as it forms long black lines on the leaves and stem. In the genus *Tilletia* the surface of the spores is reticulated, and they have generally a very short stalk. *Tilletia caries* is the common wheat-bunt of Europe. It is also found in this country, and to the naked eye cannot be distinguished from *Ustilago fœtens*. In *Urocystis* (*Polycystis* of some writers) the spores are aggregated together in small numbers and surrounded by a number of small cells. The latter are said by De Bary not to constitute a part of the spores proper, but to be portions of the mycelium which were wound closely around them. *Urocystis occulta* is the smut of rye. It attacks principally the stem just below the fruit, causing the ears of grain to droop in a peculiar manner. *Urocystis cepulæ* is the onion-smut, which has caused great harm, particularly in Connecticut. It is closely related to *Urocystis colchici* of Europe, which attacks the meadow-saffron. The other genera of Ustilagineæ present little of interest to any but the special mycologist. (See also Uredineæ.) W. G. Farlow.

**Usting' Veli'ki,** town of European Russia, government of Vologda, at the confluence of the Yug and Sukhona, has three cathedrals and many benevolent and educational institutions, and manufactures tallow, candles, soap, leather, tiles, jewelry, silver goods, copperware, and vinegar. Its transit-trade with Asia is very considerable. P. 13,000.

**U'sury and Usury Laws** [Fr. *usure;* Lat. *usura*, from the root *uti*, to "use"]. The term "usury" was originally equivalent to "interest," the compensation paid for the use of money. Present usage restricts the term to *illegal interest*, the payment or the stipulation to pay for the use of money a rate higher than that established by law. In former times, when money was borrowed chiefly to be spent on immediate consumption, to take interest seemed to imply the taking advantage of men's necessities, and the business of money-lending came into bad repute. The ban of society was upon those who engaged in it, and they were driven to demand exorbitant rates as an offset to the odium under which they lived. This in time prompted the enactment of laws to restrict and regulate interest. (See Interest, History of, and Interest, Law concerning.) With the development of industry and trade, the co-operation of capital and labor has become a necessity, and when money is borrowed to be employed in production it is apparent that generally the borrower is, after paying interest, more benefited than the lender. The law of entire freedom to both parties in such transactions is a first principle of sound political economy. Yet the old ideas of extortion as connected with interest still linger, and perpetuate in most states usury laws—that is, laws which define a certain rate as the highest rate of interest permissible. Experience has clearly shown that such laws are not only ineffective but mischievous. There are natural causes whose normal action determines what can profitably be paid for the use of capital, the fruit of past labor, just as the wages of present labor and the price of wheat or any other commodity are determined. What money in use is worth is always indicated by a market-rate of interest adjusted to various contracts according to the form, the period, the risk, etc., involved. If the law fixes the highest rate allowed considerably above the ordinary market-rate, it will have no effect. If the legal rate is fixed precisely at the lowest market-rate at a particular time, it interferes with the adjustment of contracts to suit the fluctuations of supply and demand and the circumstances and convenience of the parties concerned. If the legal rate be fixed below the market-rate, it is equivalent to a prohibition of interest, and leads on the one hand to a withdrawal of considerable capital from use, to the detriment of general industry, and on the other to manifold evasions of the law, and to diminished respect for the obligations of law generally. Usury laws can never be thoroughly enforced. They work injury to honest and prudent people, both borrowers and lenders, for the benefit of sharpers and reckless adventurers. They offer a premium for the defiance of law, and confer a monopoly on unscrupulous extortioners. The reasons given for their enactment apply with equal force to all other things, and would require the law to fix arbitrarily the prices of commodities; which would be as absurd and futile as to attempt by legislation to regulate the tides of the ocean. Legal sanction and security for all reasonable contracts in loaning capital encourage free competition, and constitute the surest safeguards against excessive interest. The abrogation of usury laws in Great Britain and in Massachusetts may be welcomed as first steps in a reform destined soon to be universal. A. L. Chapin.

**U'tah,** a Territory of the U. S., lying mostly in the great Wahsatch basin between the Rocky Mountains and the Sierra Nevada, extending from the 37th to the 42d parallel of N. lat., and from the 109th to the 114th meridian of W. lon. from Greenwich. It is bounded on the N. by Idaho and Wyoming Territories, on the N. E. by Wyoming, on the E. by Colorado, on the S. by Arizona Territory, and on the W. by Nevada. Its greatest length from N. to S. is about 350 miles, and its greatest breadth nearly 300. Its area in 1870 was about 84,476 sq. m., or 54,065,075 acres; but in 1871 the county of Rio Virgin in the S. W., around the head-waters of the Rio Virgin River, was set off to Nevada by act of Congress, and the area is thereby diminished to about 84,000 sq. m.

*Face of the Country and Geology.*—The Wahsatch range of mountains, which form the eastern wall of the Great Basin, traverse the Territory from N. to S., trending southwestward as they approach the Arizona line. They form a continuous and nearly unbroken chain from the Uintah Mountains at the N. E. to the Iron Mountain in the S. S. W. W. of this range the rivers have no outlet, and fall into the Great Salt Lake or some of the other fresh or salt lakes of the basin. E. of the Wahsatch Mountains there is a plateau 30 or 40 miles in width, sloping down to the elevated valley or plain in which the San Rafael, Uintah, Dirty Devil, White, Green, Grand, and San Juan rivers have their sources. All these rivers cut their way through the easily-eroded rocks, and form cañons varying in depth from 2000 to 5000 feet, and, after reaching a lower plain, spread out in broad streams, which in turn unite to form the Rio Colorado of the West, and again force their way through the mountains in the Great Cañon of that river. Though elevated from 6000 to 7000 feet above the sea, a part of this eastern section is fertile and largely productive. Western Utah is also elevated, the summits of the Wahsatch rising from a plain varying from 4250 to 6000 feet in height, and attaining a further elevation of from 6000 to 7000 feet above the valley. Mount Nebo, the Twin Peaks, and some others are from 12,000 to 13,000 feet in height. In the N. W. and W. much of the elevated plateau is a barren alkaline desert,

yielding little except the sagebush or greasewood; yet even these desert lands, under the influence of irrigation, where it can be applied, may be made to yield large crops. W. of the Great Salt Lake and the other lakes of the central valley there are several chains of mountains running nearly parallel with the Wahsatch, but of lower elevation, and walling in the central valley from the desert lands farther W. These mountains, beginning at the N., bear the names of Raft River, Promontory, Oquirrh, Onaqui, Cedar, Thomas, Champlin, Goshoot, House, Beaver River, Wah-Wah, Piñon, and Needle mountains. The chains E. of the Wahsatch range are mostly portions of the Colorado Mountain system; the most prominent of them are the Uintah, the Roan or Book Mountains, the Little Mountains, the Sierra la Salle, Sierra Tucan, Sierra Panoche, and in the extreme S. E. the Sierra Abajo and the Orejos del Oso. The Wahsatch and Uintah mountains, their foothills on the western slope, and the parallel ranges W. of them are Eozoic, though a portion of their summits are crowned with Silurian and Metamorphic rocks; the elevated valleys and plains of the Great Basin are Tertiary, deposited when the Great Basin, now covering Western Utah and nearly the whole of Nevada, was a vast lake with mountainous islands. Eastern Utah is, except the immediate valley or cañon of the Rio Colorado and its larger tributaries, Cretaceous; the Colorado cuts through the Cretaceous, Jurassic, and Triassic, Carboniferous, and slightly-developed Devonian systems, down to the rocks of Silurian age, which form its bed.

*Rivers, Lakes, etc.*—Eastern Utah is drained solely by the Colorado and its affluents already enumerated. The valley, or rather the succession of valleys, lying between the Wahsatch range and the lower chain wholly within the Great Basin, abounds in lakes. The Great Salt Lake is 100 miles in length and about 50 miles in width. Its area is about 1900 sq. m. Its waters contain nearly 22 per cent. of pure salt, and no fish can exist in them. It receives the Bear and Jordan rivers and some smaller streams. Forty-five miles S. of this lake, and connected with it by the Jordan River, is Utah Lake, 22 miles long and 10 wide; it has an area of about 130 sq. m. Its waters are fresh and pure. It receives the Timpanagos, Provo, and Spanish Fork rivers. Other large lakes farther S. are Sevier, Little Salt, Preuss, and Fish lakes, none of which have any apparent outlet, though they receive considerable streams. Sevier River, which rises in Fish Lake 6674 feet above the sea, and passes through a slight depression of the Wahsatch Mountains, discharges its waters into Sevier Lake, forming an almost complete ellipse. The Preuss River, emptying into Preuss Lake, and the Rio Virgen, a tributary of the Colorado, drain the S. W. part of the Territory.

*Mineralogy.*—Gold, silver, and lead ores exist in large quantities in Utah, but hitherto the policy of the Mormon leaders has been to avoid opening mines of the precious metals. The products of gold and silver have, however, been steadily increasing for the past few years; ninety mining districts had been opened in 1876, and in 1874 the production of bullion amounted to about $5,000,000. The Territory is richer in iron ores of all qualities than any other portion of the U. S. There are ten separate deposits or mountains of hæmatite and magnetite in a distance of 10 miles in Iron co., estimated to contain about 130 million tons of iron ore, averaging from 65 to 70 per cent. of pure iron. In the Castle Valley region, on Green River, is another deposit, said to be equally extensive. Other deposits of vast extent have been found in Cache, Box Elder, Weber, and Davis counties, in the N. part of the Territory. These ores are all very rich, and both lignite and excellent bituminous coking coals are found in the immediate vicinity, as well as fluxes and the other requisites for smelting the ores. The lignites of the Great Basin are very valuable coals for fuel, but do not coke. In San Pete co. and along the cañons of Green and Grand rivers is a bituminous coal belonging to the Upper Coal-Measures, which is of great value for the furnace, and is in thick workable seams. Copper and zinc are metals which abound in the Territory. Rock-salt in vast quantities, as well as the salt procured by evaporation from Salt Lake, sulphur in extensive beds, carbonate of soda, alum, borax, etc., are among the other mineral treasures of Utah.

*Climate.*—The yearly mean temperature ranges from 48.65° to 51.51° in the N. and S. of the Territory. The spring means at Coalville were 45.9°; at Salt Lake City, 51.7°; summer, 69.2° and 75.9°; autumn, 48.9° and 54.8°; winter, 21.9° and 32.1°. The rainfall is about 15.10 inches annually.

*Zoology.*—The wild animals are those common to Nevada and to the Rocky Mountain region. They include the grizzly bear, panther, California lion, the black bear, wolf, lynx, fox, raccoon, California skunk, etc., and among the game animals the buffalo, possibly the moose, antelope, black-tailed deer, hares, especially the sage hare, and the singular animal known as Baird's rabbit; squirrels, marmots, etc. 176 species of birds belonging to the Territory have been described.

*Vegetation and Agricultural Productions.*—The mountains in the S. are wooded to near the snow-line, but the Territory contains, it is said, only about 4000 sq. m. of timber. The forest growths of the mountains in the Great Basin are those of the Pacific slope, though not generally attaining the height of the Nevada and California trees, and having a smaller proportion of hard-wood growths. The alkaline plains are treeless and destitute of shrubs, except the sage-bush. Eastern Utah belongs to the Rocky Mountain region, and its sylva and flora are similar to those of Colorado. In 1874 over 250,000 acres of land were under cultivation, much of it irrigated, the Mormon system of irrigation being admirably effective. The crops of that year were stated by Surveyor-General Kimball to have been, in round numbers, 2,000,000 bushels of wheat, 350,000 bushels of barley, 700,000 bushels of oats, 375,000 bushels of Indian corn, 2,000,000 bushels of potatoes, 300,000 tons of hay, and an immense crop of apples, apricots, peaches, pears, figs, and grapes, being more than sufficient for the supply of the Territory. The agricultural products of the year were valued at over $6,000,000. We have no later statistics of the live-stock of the Territory than those of the census of 1870. It has materially increased since that time, as much attention has been given to stock-raising. In 1870 the value of live-stock was stated to be $2,149,814; it included 14,281 horses, 2879 mules and asses, 190,934 neat cattle, 59,672 sheep, and 3150 swine. Some attention has been paid to silk-culture.

*Manufactures.*—In 1870 there were 533 manufacturing establishments in the Territory, employing 1534 hands and a capital of $1,391,898, paying $395,365 in wages, using $1,238,252 of raw material, and producing goods valued at $2,343,019. Flour and meal, sawed lumber, and woollen goods were the principal articles manufactured. In 1874 the capital employed was over $4,000,000, and many furnaces, foundries, and ironware foundries were added to the manufacturing industry of the Territory.

*Mines.*—In 1870, Utah had 6 mining establishments, reporting $44,800 capital and $14,950 product. Her mines have now more than $4,000,000 capital and over $7,000,000 product.

*Railroads.*—In 1875, Utah had 596.5 miles of railroad in operation, costing for roads and equipment $41,308,222. Of this 44 miles was narrow-gauge and built by the inhabitants of the Territory. There are about 350 irrigating canals in the Territory, several of them of considerable length and size; they have been constructed at a cost of about $2,225,000.

*Finances, Commerce, Banks, etc.*—The Territorial government is supported by taxation. The taxes (not national) in 1870 amounted to $167,355, of which $39,402 was for Territorial, $80,419 for county, and $47,534 for city and town purposes. There is no Territorial debt. The commerce of the Territory in the exportation of its bullion, ores, wool, hides, lumber, coal, etc., and the importation of general merchandise, is large in proportion to its population, amounting to not less than $45,000,000. There are 3 national banks, having a capital of $450,000 and an outstanding circulation of about $400,000; and 6 private banks and banking-houses. There are no fire or life insurance companies in the Territory.

*Population.*—Surveyor-General Kimball in 1874 estimated the population, exclusive of tribal Indians, from the assessors' returns, at 130,000.* The following table gives the census statistics of 1850, 1860, and 1870:

| Census year. | Total population. | Males. | Females. | Whites. | Indians and negroes. | Natives. | Foreigners. | Density. | Ratio of increase. | Number of families. | Persons to a family. | Number of dwellings. | Persons to a dwelling. | Illiterate. | Of school age, 5 to 20. | Of military age, 18 to 45, males. | Of voting age, 21 and upward, males. | Citizens, males. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1850 | 11,380† | 6,046 | 5,334 | 11,330 | 50 | 9,326 | 2,054 | 0.05 | ..... | 2,322 | 4.90 | 2,322 | 4.90 | 154 | 4,076 | 2,560 | 2,765 | 1,535 |
| 1860 | 40,273† | 20,255 | 20,018 | 40,125 | 149 | 27,519 | 12,754 | 0.18 | 255.0 | 9,500 | 4.96 | 10,763 | 3.75 | 323 | 13,788 | 6,744 | 8,134 | 4,520 |
| 1870 | 99,581 | 44,121‡ | 42,665‡ | 86,044 | 13,538§ | 56,084 | 30,702 | 1.03 | 147.25 | 17,210 | 5.04 | 18,290 | 4.75 | 7,363 | 33,367 | 14,603 | 18,042 | 10,147 |

* Of this 130,000, less than 15,000 are non-Mormons.
† Of these, 12,795 were Indians sustaining tribal relations.
‡ In 1850 and 1860 tribal Indians were not enumerated.
§ Sex of tribal Indians not reported.

*Education.*—The following are the statistics of the public schools of Utah for the year ending Jan. 1, 1875, the latest date we have been able to obtain: Receipts, $109,836.70, of which $33,883 was from Territorial and local taxation, and $75,953.70 from rate-bills; amount paid for teachers' salaries, $90,953.70; amount of available school fund, $15,000; number of youth in Territory of school age (4 to 16 years), 33,164 (16,635 males, 16,529 females); number enrolled, 17,742; average daily attendance, 12,916; number of school-houses and school-rooms, 260; average duration of schools, 134 days, or about 6 months and 6 days; number of teachers employed, 398 (males 209, females 189); average monthly wages of male teachers, $40, of female teachers, $16. There were 12 private schools, having 1264 scholars and 37 teachers. There are no public-school lands yet granted, and thus far no free schools. There is no normal school, though an effort is making to establish one. Several of the private schools have high school departments. The University of Deseret, at Salt Lake City, chartered in 1850, but not organized till 1869, has not yet gone beyond a preparatory department. It has in this department 8 instructors, 179 students (110 males and 69 females), and its total receipts were $5380, of which $2880 was from tuition fees. It had 2300 volumes in its library. It is wholly under Mormon control. The Protestant Episcopal Church has 4 good schools in the Territory; the Methodists and the Presbyterians, each 1. There are no scientific or professional schools. There are no charitable institutions for the deaf and dumb, blind, or insane in the Territory. The Territorial penitentiary is at Salt Lake City.

*Newspapers.*—In 1870 there were 10 newspapers in Utah, having a circulation of 14,250 and an annual issue of 1,578,400. Of these, 3 were dailies, with 2700 circulation; 3 semi-weekly, 2900 circulation; 3 weekly, 8400 circulation; and 1 monthly, 250 circulation. In 1875 the number of newspapers had increased to 20, of which 5 were dailies.

*Churches.*

| Denominations. | Church organizations, 1870. | Church edifices, 1870. | Sittings, 1870. | Church property, 1870. | Church organizations, 1875. | Church edifices, 1875. | Ministers or clergymen, 1875. | Church members or communicants, 1875. | Adherent population, 1875. | Church property, 1875. |
|---|---|---|---|---|---|---|---|---|---|---|
| All denominations | 165 | 164 | 86,110 | $674,600 | 195 | 195 | 203 | 70,363 | 86,600 | $1,070,900 |
| Baptists | ..... | ..... | ..... | ..... | 1 | 1 | 1 | 16 | 100 | 2,000 |
| Protestant Episcopalians | 2 | 2 | 460 | 30,800 | 3 | 3 | 6 | 150 | 500 | 42,500 |
| Methodists | 2 | 1 | 300 | 1,200 | 3 | 3 | 3 | 130 | 600 | 16,000 |
| Mormons | 160 | 161 | 85,350 | 642,000 | 185 | 185 | 190 | 70,000 | 85,000 | 1,000,000 |
| Presbyterians | 1 | ..... | ..... | 600 | 3 | 3 | 3 | 67 | 400 | 10,400 |

*Constitution, Courts, etc.*—The governor and secretary of the Territory are appointed for four years by the President of the U. S., but are removable at pleasure. The legislative assembly is composed of a council of 13 members, elected for two years, and a house of representatives of 26 members, elected for one year. The judicial power is vested in a supreme court, consisting of one chief-justice and two associate justices (appointed by the President), which holds a term in each of the three judicial districts each year; in district courts, probate courts, and justices of the peace. The Territory sends a delegate to Congress, who has the right to speak, but not to vote.

*Counties.*—There are twenty counties, as follows:

| Counties.* | Total pop., 1870. | Males, 1870. | Females, 1870 | Total pop., 1860. | Assessed valuation, 1870.‡ | True valuation, 1870. |
|---|---|---|---|---|---|---|
| | | | | | $ | $ |
| Beaver | 2,007 | 1,010 | 997 | 785 | 95,000 | 118,750 |
| Box Elder | 4,855 | 2,842 | 2,013 | 1,608 | 500,000 | 600,000 |
| Cache | 8,229 | 4,068 | 4,161 | 2,605 | 728,195 | 873,000 |
| Davis | 4,459 | 2,232 | 2,227 | 2,904 | 648,655 | 648,655 |
| Iron | 2,277 | 1,123 | 1,154 | 1,010 | 275,000 | 343,750 |
| Juab | 2,034 | 1,027 | 1,007 | 672 | 272,641 | 340,801 |
| Kane | 1,513 | 776 | 737 | ..... | 248,000 | 269,105 |
| Millard | 2,753 | 1,429 | 1,324 | 715 | 250,000 | 502,855 |
| Morgan | 1,972 | 995 | 977 | ..... | 320,000 | 320,000 |
| Piute | 82 | 69 | 13 | No | report. | |
| Rich | 1,955 | 1,020 | 935 | ..... | 307,950 | 307,950 |
| Salt Lake | 18,337 | 9,019 | 9,318 | 11,295 | 4,210,990 | 5,614,653 |
| San Pete | 6,786 | 3,274 | 3,512 | 3,815 | 386,385 | 1,134,987 |
| Sevier | 19 | 19 | No | report. | | |
| Summit | 2,512 | 1,349 | 1,163 | 198 | 263,592 | 263,592 |
| Tooele | 2,177 | 1,159 | 1,018 | 1,008 | 371,736 | 464,670 |
| Utah | 12,203 | 6,174 | 6,029 | 8,248 | 1,252,096 | 1,649,431 |
| Wahsatch | 1,244 | 642 | 602 | ..... | 145,027 | 145,027 |
| Washington | 3,064 | 1,532 | 1,532 | 691 | 500,000 | 772,194 |
| Weber | 7,858 | 4,112 | 3,746 | 3,675 | 1,750,000 | 1,750,000 |
| Totals | 86,786 | 44,121 | 42,665 | 40,273† | 12,565,842 | 16,159,995 |

*Principal Towns.*—The capital of the Territory is Salt Lake City, which had in 1870 a population of 12,854. The other large towns and cities are Ogden, 3127 inhabitants in 1870; Provo, 2384 in 1870; and Logan, Ephraim City, Manti, Iron City, and Mount Pleasant, which had from 1300 to 2000 each.

*History.*—Utah derives its name from the Utes, a tribe of Indians originally inhabiting it. It was originally a part of Upper California, and was conveyed to the U. S. by Mexico by the treaty of 1848. The Mormons (see Mormons), driven from Illinois and Missouri, emigrated hither in 1847 and 1848, and established themselves in a region remote from other inhabitants. In 1850 it was organized as a Territory. There have been serious difficulties between the Territory and the U. S. government, growing out of the claims of the Mormon prophet, Brigham Young, to the supreme authority, and also from the recognized practice of polygamy in the Territory. In 1857 a party of settlers, while passing through Utah, having incurred the suspicion of the community at Salt Lake City, were surrounded in Mountain Meadows, Santa Clara co., Ut., by a band of Indians, who were under the control of the Mormons, and subsequently massacred, a few children alone being spared. The government in 1875 begun an investigation to bring to justice the leaders in the massacre, and has already elicited much information. In 1862 the Mormons formed a State constitution and demanded admission to the Union as the "State of Deseret." It was refused, and much trouble followed for several years. Probably five-sixths of the inhabitants are still Mormons, and their legislature is wholly composed of Mormons, but the power of the prophet is waning. The great development of their mines has brought in many settlers who are not Mormons.

*Governors of the Territory.*

| | | | |
|---|---|---|---|
| Brigham Young | 1850–54 | Charles Durkee | 1865–69 |
| Edwin J. Steptoe | 1854–57 | J. Wilson Shaffer | 1870–71 |
| Alfred Cummings | 1857–61 | George L. Woods | 1871–73 |
| Stephen S. Harding | 1861–64 | Samuel B. Axtell | 1873–75 |
| James D. Doty | 1864–65 | George W. Emery | 1875–77 |

L. P. Brockett.

**Utah,** county of Central Utah, lying E. of the Wahsatch Mountains, comprising the most valuable portion of the Territory, containing Utah Lake, and traversed by Utah Southern and American Fork R. Rs.; surface somewhat hilly, and containing some valuable gold-mines; soil very productive when irrigated. There are saw-mills, flour-mills, and manufactories of sorghum-molasses. Sheep and cattle are the principal live-stock. Staples, wheat, potatoes, sorghum, wool, lumber, and dairy products. Cap. Provo City. Area, about 1000 sq. m. P. 12,203.

**Utah Lake.** The largest body of fresh water in the Territory of Utah; N. lat. 40° 15′, W. lon. (from Greenwich) 111° 45′. Its altitude above the sea is 4475 feet; its length from N. to S. is 25 miles; its extreme width 13 miles; its area 150 sq. m. It has no island. The valley in which it lies is part of a great trough formed by the uplift of the Wahsatch range of mountains at the E. and the Oquirrh, Lake, and Tintic ranges at the W. The eastern range is the loftier, and all the tributaries of the lake come from that side. Corn Creek, Hobble Creek, and the American Fork rise in the Wahsatch Mountains, but the Spanish Fork and Provo River head to the E. of the range, and pass through it in deep defiles. Its outlet is the river Jordan—appropriately so named, since, like the river of Palestine, it runs from a fresh lake to a salt one. The Jordan of Utah is 40 miles in length, and flows northward into Great Salt Lake. Utah Lake abounds in trout and other fish, and is visited by a great variety of waterfowl. On its eastern shore stand the Mormon towns of Lehi, American Fork, Pleasant Grove, Provo, and Springville.

G. K. Gilbert.

**Utahs, or Utes,** a tribe of American Indians of the Shoshone family, living in New Mexico, Utah, Colorado, and Nevada. They practice hunting and fishing, and also live largely upon berries, roots, and herbs, and possess a few horses, but rarely engage in agriculture. They number about 15,000, and have latterly sold most of their lands to the U. S. government, retaining a large reservation in the S. W. corner of Colorado.

* The county of Rio Virgen, reported in the census of 1870 as having a population of 450 (250 males and 200 females), was in 1871 set off to Nevada.

† This includes 1044 in counties since absorbed in others.

‡ Assessed valuation in 1873, $21,548,348.

**U′terine Diseases.** Diseases of the womb or uterus, so-called "female diseases," are comparatively infrequent in the women of aboriginal and savage tribes, and in civilized races among the women of rural districts who labor, are much in the open air, and free from artificial and effeminate habits of dress and living. For the most part, they exist in delicate women, those whose health is impaired by some other and primary disease, and relatively more often in women resident in great cities. The predisposing causes of a majority of all uterine diseases are the constant recurrence during the greater part of adult life of the menstrual period, the complications and sequelæ of child-bearing, and the intimate nervous and vascular sympathy connecting the uterus with every part of a woman's organism. Uterine diseases comprise also the derangements of the appendages of the uterus—the ovaries, vagina, and peri-uterine connective tissue and ligaments which maintain the organ normally *in situ*. The uterus is subject to congestion and to inflammation from many causes, as suppressed menstruation, catching cold, falls, blows upon the abdomen. Congestion and inflammation are indicated by a sense of fulness, weight, warmth, and pain, with tenderness on pressure in the lower part of the abdomen, especially in standing or walking; and relieved by lying down. The disease may be limited to the inner mucous membrane, to the body of the organ, or the exterior investing loose tissue, or rarely involve all. The term metritis denotes inflammation of the body proper of the organ, endo-metritis of the mucous interior, peri-metritis of the surrounding elastic tissues which fill the cavity of the pelvis. This tissue, when extensively inflamed, is often infiltrated with new plastic matter, the product of the vascular engorgement, and this, becoming set, "fixes" the uterus for a time, so that it is rigid and immovable—a condition termed pelvic cellulitis and peri-uterine cellulitis. This loose tissue is occasionally the seat of profuse hæmorrhage from a ruptured vessel, as in lifting, jumping, or falling. The effused blood remains fluid or semi-fluid, and gravitates in the pelvis; this blood-tumor, termed "pelvic hæmatocele," often presents in the vagina.

The normal uterus is a symmetrical organ, with a straight axis, and the cavity of its body and neck slightly open; its normal position is that of slight anteversion, or upright and from above inclining slightly backward. But attacks of congestion and inflammation change its shape, size, symmetry, and position. Thus, either from external pressure or adhesions, or from softening or thickening of its own walls, it may be drawn down—either backward, forward, or to either side; the organ as a whole may be tilted, giving rise to "version;" or the body may be bent on the neck, a condition termed "flexion." According to the direction which the displacement or deformity of the uterus takes, we have anteversion, retroversion, right and left lateral version, and anteflexion, retroflexion, and right and left lateral flexion. Flexions of the uterus are a common cause of "dysmenorrhœa," or difficult menstruation, since by the bending of the uterus its canal is bent and constricted, and the free escape of menstrual blood is prevented; this flexion of the uterine canal is also a cause of sterility, since seminal elements cannot enter the organ and produce conception. Whenever the uterus is enlarged, as by congestion or inflammation, is the seat of a polypus or tumor, or is pressed down by growths in the cavity of the abdomen, and also whenever in debilitated persons its ligaments and outside supports are weakened and relaxed, it tends to gravitate below its natural position in the pelvis, and even to project from the body. This "falling of the womb" is termed "prolapse," and, when extreme, "procidentia." The lower end of the uterus, the neck or cervix, is often ulcerated as the result of congestion, inflammation, contact of its end with the floor of the pelvis, and the irritation of the acrid mucus discharged in endo-metritis. Tumors may develop within the cavity of the uterus, in the substance of its walls, or upon its outer surface, either beneath its serous coverings or loosely attached by pedicles. The uterus is occasionally the seat of cancer, and chiefly at the climacteric period or "change of life." The ovaries—whose functional work, the production and periodic discharge of the ovules, is the paramount physical feature of woman's sex—are subject to attacks of congestion, inflammation, hæmorrhage, and intense neuralgia. The fibrous framework of these organs may increase and develop fibrous tumors; but especially frequent and important are "ovarian cysts" or "ovarian dropsy." The ovisac (see Ovaries) becomes distended with fluid in order to rupture and eject the ovule; it then, again, is filled by the serum of the coagulated blood from the hæmorrhage consequent upon the rupture. The ovisac is liable to fill, and by a process of vascular activity and growth in its wall becomes a cyst of greater or less size: cysts may be present of small size and in numbers, never attracting attention, or reversely, grow either by secretion or dropsical transudation to contain ten, twenty, sixty, or more pounds of serous fluid. Such ovarian cysts may be single sacs, or divided by partitions into compartments. (See Ovaries.) The broad ligaments on either side of the uterus less often are the seat of dropsical cysts developed between their folds. The vagina, the intervening passage which connects the surface of the body with the womb within, is the frequent seat of catarrhal inflammations, in which mucus is more or less profusely secreted, causing a discharge termed "leucorrhœa" (Gr. λευκός, "white" (matter), and ῥεῖν, to "flow"). It may also be acutely inflamed, "vaginitis;" the seat of ulcers, and also of spasm, with or without pain, a condition termed "vaginismus." This passage is, very exceptionally, anatomically defective, being wholly or partially wanting or constricted. Most common of all uterine diseases are merely functional derangements or irregularities of menstruation. By amenorrhœa is understood absence of menstruation; dysmenorrhœa is characterized by pain, sickness, and deficient flow at the period; and menorrhagia is a prolonged and excessive menstrual flow, or persistent loss of blood from the uterus, as when cancer or polypus exists. In the treatment and cure of uterine diseases correct diagnosis is essential at the outset. True, most of them are benefited by use of general tonics, by rest, corrected habits, and by supporting the abdominal viscera; but many are not even alleviated by these general measures. Physical exploration, both manual and by aid of the speculum, will often reveal an unsuspected disease, and point to the special topical treatment or surgical procedure which is the essential means of cure.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Utes.** See Utahs.

**U′tica,** an ancient city of Africa, was on the river Bagradas, near its entrance into the Mediterranean, and occupied the site of the modern village of Duar. When Carthage was taken and destroyed by the Romans, Utica rose in importance and became the capital of the Roman province. The remains of its temples, amphitheatre, and aqueduct show that it must have been a magnificent place. In the latter part of the seventh century it was taken and destroyed by the Arabs.

**Utica,** p.-v. and tp., La Salle co., Ill. P. 1145.

**Utica,** p.-v. and tp., Clarke co., Ind. P. 1598.

**Utica,** tp., Chickasaw co., Ia. P. 931.

**Utica,** p.-v., Macomb co., Mich.

**Utica,** tp., Winona co., Minn. P. 1370.

**Utica,** p.-v., Green tp., Livingston co., Mo.

**Utica,** city, cap. of Oneida co., N. Y., 96 miles W. of Albany. A tract in the Mohawk country, afterward known as Cosby's Manor, was granted by George II. in 1734. This included a ford over the Mohawk, near which, on the S. bank, in 1758, Fort Schuyler was built. Here was for this vicinity the chief crossing of the river, where three log cabins were put up in 1787, and a store and an inn in 1790. The village of Utica was incorporated Apr. 3, 1798; it was chartered as a city Feb. 13, 1832, and is a half-shire town with Rome. It received an impetus from the construction of the Erie Canal, and is the northern terminus of the Chenango Canal. The New York Central R. R. skirts the city on its northern limits, while the Utica and Black River R. R. runs northward to the St. Lawrence; the Delaware Lackawanna and Western R. R. connects with the coal-regions and Philadelphia, and one of the chief branches of the New York Midland R. R. commences here. The population was derived at the beginning largely from New England, but the descendants of the Netherlanders on the lower Mohawk were also early settlers, while English, Irish, and Welsh came in considerable numbers in the first years, and with Scotch, and in later years Germans especially, and a few French and Swiss, have increased and multiplied. Enterprising citizens early established stage-routes from Utica; they were pioneers in the maintenance of packets on the Erie Canal. The first electric telegraph company (the New York Albany and Buffalo) was organized and had its chief office here. Five woollen and 7 cotton factories and 2 knitting-mills are in the city and vicinity. Rich beds of iron ore lie just S., and 2 blast furnaces are run, mainly by Utica capital, a few miles distant. Ready-made clothing is extensively manufactured. Six establishments turn out annually 630,000 pairs of boots and shoes. In stoves, steam-engines, locomotive-lamps, farm-wagons, agricultural implements, millstones, and drain-tile considerable capital and labor are employed. The farms about Utica are devoted in good part to the dairy, and it is the chief market for cheese in the U. S., 200,000 boxes having been sold in 1875, at a value of $1,735,592. The waterworks have a capacity of 400,000,000 gallons a year. Three parks lie within the city, and a fine driving-park on its eastern boundary. Four national banks, 1 State bank, a savings bank, and 2 private banks are sus-

tained. Horse railroads cross the city, and connect with the adjacent villages S. and W., and with the driving-park on the E. The fire department is paid, and has an alarm telegraph. The churches are 32—5 Episcopalian, 8 Methodist, 5 Presbyterian, 4 Roman Catholic, 4 Baptist, 2 Lutheran, 1 Reformed, 1 Moravian, 1 Congregational, 1 Universalist—and the Spiritualists maintain regular services in a public hall. Of these churches, 4 conduct worship in the Welsh, and 6 in the German language. Three hospitals, 4 orphan asylums, 2 homes for the aged, a home for women, and a dispensary express the public charity. New York State supports a lunatic asylum here, with 640 patients. The Utica Mechanics' Association owns a commodious opera-house. The public library contains 6055 volumes. The common schools are graded, and in the academy the higher branches are taught; in 1875 the pupils numbered 4711. Among private schools the Utica Female Academy holds a high rank. The bar of Utica and of Oneida county has been eminent always, and its jurists have adorned the bench of the State and the nation. In politics its citizens have won their full share of distinction. There are 2 daily newspapers and 3 weeklies, a German tri-weekly, a Welsh weekly, and 2 Welsh monthlies. P. in 1870, 28,804; in 1875, 32,070.

ELLIS H. ROBERTS,
ED. "UTICA MORNING HERALD AND GAZETTE."

**Utica,** p.-v., Washington tp., Licking co., O., has a private bank. P. 384.

**Utica,** p.-b., Venango co., Pa. P. 225.

**Utica,** tp., Crawford co., Wis. P. 1260.

**Utica,** tp., Winnebago co., Wis. P. 1039.

**Utilita'rianism** [Lat. *utilitas*], a peculiar political and moral theory based on the assumption that happiness is the ultimate principle of all human actions, and characteristically symbolized by its fundamental maxim, "The greatest happiness to the greatest number." Ethical systems refusing to acknowledge any moral obligation in a postulated revelation of the will of God, denying the existence of any innate organ in the human soul by which to distinguish absolutely between right and wrong, and establishing the natural self-love of the individual as the necessary principle of his whole conduct, seem to have existed as far back in time as there existed any comprehensive reasoning on moral subjects; but in the peculiar form in which this theory has received the name of utilitarianism it originated with Jeremy Bentham. With great boldness, and not without a corresponding power of argument, he substituted in politics utility for abstract right; or, rather, the usefulness of an institution or a law was the only criterion of its justness, of its right to be, which he acknowledged. In this principle he thought he had found the means of abolishing all those laws and institutions which, although once useful, had now become a plague, and of carrying out all reforms necessary to the progress and development of mankind, without risking a revolution and a temporary relapse of society into anarchy; and, generally, his application of the principle to legislation met with approbation. But as the political system developed toward completion, the necessity arose of bringing it into harmony with the moral system which governed, or was to govern, the actions of the individual. It was necessary to apply the same principle in morals as in politics, and on this point the utilitarian theory—for it cannot be said as yet to have developed a complete moral system—met with much ridicule, and subsequently also with bitter opposition. It sounded rather harsh when Bentham declared in the face of the whole Christian civilization that happiness was and had always been the fundamental principle of human actions; and the utterance became still more provoking when he defined happiness simply as happiness on earth, and wrapped up in a bundle all the loftiest and most disinterested aspirations of the human soul, marked it as asceticism, and sent it to the waste-basket. The coarse egotism which, at least in the vulgar conception of them, characterized similar systems of past ages he succeeded in breaking by substituting the greatest happiness of the greatest number for the mere gratification of the cravings of the individual; but this very sentence has an external, arithmetical strictness, and an internal, practical vagueness, which made it a fit subject of ridicule. Moreover, Bentham's own writings on the subject—*An Introduction to the Principles of Morals and Legislation, etc.*—are sketchy and rather confused. Nevertheless, on this point also he found very able disciples—James Mill, John Stuart Mill, Sir James Mackintosh, Alexander Bain, and others—and many valuable analyses, psychological and strictly ethical, have issued from the labors of the school.

**Utlateca Indians.** See QUICHE INDIANS.

**Uto'pia** [Gr. οὐ, "not," and τόπος, "place"], an imaginary island, the abode of a people free from care, folly, and the common miseries of life, described by Sir Thomas More in his *Utopia* (1516), translated from the Latin by Burnet (1683), by Robynson (1551), and by Cayley (1808).

**Utopia,** tp., Clermont co., O. P. 80.

**U'traquists,** a Hussite sect, so called because they demanded the Lord's Supper administered to them *sub utraque specie*—that is, both bread and wine. They were also called Calixtines.

**U'trecht,** province of the Netherlands, bounded N. by the Zuyder-Zee and S. by the Rhine and Leck, comprises an area of 532 sq. m., with 176,524 inhabitants, of whom 64,143 are Roman Catholics and the rest Protestants. The surface is diversified by low hills along the Rhine, the soil is very fertile, and the climate drier and brighter than in the other provinces. Wheat, barley, oats, and tobacco are extensively cultivated; cattle, sheep, and bees are reared, and several branches of manufactures, such as the making of tiles, bricks, and pottery, are carried on on a large scale.

**Utrecht,** town of the Netherlands, capital of the province of the same name, on the Old Rhine, where the Vechte branches off from it. It is well built, traversed by canals, and surrounded with finely-planted promenades, and has, among other educational institutions, a celebrated university, with which are connected a botanical garden, a chemical laboratory, an observatory, and different museums and scientific collections. Its manufactures of plush, velvet, and carpets, of leather, soap, salt, and brandy, of metal ware and cigars, are very extensive, and it carries on an active trade in grain, cattle, and its own manufactures. It is the oldest town of the Netherlands, called by the Romans *Trajectum ad Rhenum* or *Ultrajectum*, from which latter appellation its present name is derived. Here the fusion between the seven provinces which formed the Dutch republic was organized in 1579, and here the treaty was signed (Apr. 11, 1713) between France, England, Holland, Prussia, Portugal, and Savoy, which ended the war of the Spanish succession. P. 64,275.

**Utre'ra,** town of Spain, province of Seville, is well built and pleasant; has several oil-mills and manufactures of soap, leather, and pottery, and is in a rich and beautiful district, famous for its excellent horses and ferocious bulls. P. 12,441.

**Utricularia.** See BLADDER-WORT and INSECTIVOROUS PLANTS.

**Uttara Mimansa.** See HINDU PHILOSOPHY, by PROF. JOHN DOWSON.

**Uval'de,** county of S. W. Texas, drained by the Rio Frio and its affluents. The soil is well adapted for stock-raising, but on account of the dryness of the climate not favorable for agriculture unless irrigated. Cattle are numerous, and constitute the principal live-stock. Staples, a little Indian corn, wool, and butter. Cap. Uvalde. Area, about 1000 sq. m. P. 851.

**Uvalde,** p.-v. and tp., cap. of Uvalde co., Tex. P. 163.

**Uvaroff** (SERGEI SEMENOVITCH), COUNT, b. at Moscow in 1785; studied at Göttingen; was made curator of the University of St. Petersburg in 1811, president of the Academy of Science in 1818, director of the department of commerce and industry in 1822, minister of public education in 1832; retired in 1848, and d. at Moscow Sept. 16, 1855. He was the founder of the Oriental School and the Asiatic Museum in St. Petersburg, and exercised a great and beneficial influence on all educational affairs of the empire. His writings have been collected and published under the titles *Etudes de Philologie et de Critique* (1843) and *Esquisses politiques et littéraires* (1849).

**Uvic Acid.** See RACEMIC ACID.

**Uvula.** See PALATE, by PROF. J. W. S. ARNOLD, M. D.

**Uwch'lan** (yook'lan), p.-v. and tp., Chester co., Pa. P. 794.

**Ux'bridge,** p.-v., Ontario co., Ont., Canada, on Toronto and Nipissing Railway, 43 miles N. N. E. of Toronto. It has important manufactures and a weekly newspaper. P. about 1600; of sub-district, 4762.

**Uxbridge,** p.-tp., Worcester co., Mass., on Providence and Worcester R. R., 18 miles S. E. of Worcester, contains good schools, 1 newspaper, and large cotton and woollen manufactories. P. 3058.

SPENCER BROTHERS,
PUBS. "WORCESTER SOUTH COMPENDIUM."

**Uxmal',** a ruined city of Yucatan, 15 miles S. of Merida. (See ARCHITECTURE OF THE AMERICAN ABORIGINES, by LEWIS H. MORGAN.)

**Uzbecks.** See USBEKS.

**Uzes',** town of France, department of Gard, manufactures silk hosiery and trades in silk, oil, grain, and brandy. P. 6242.

**Uzziah.** See AZARIAH.

# V.

**V,** a consonant letter formerly interchangeable with U in writing and printing. In power also V is to some extent interchangeable with the vowel U, and with the consonants B, P, F, and W. V is in English a labio-dental. V has the power of English *w* in Latin and Anglo-Saxon, from both of which we get the *w* of *wine, wind,* while the *v* of *vine, vent,* is due to Norman. V is in martyrologies an abbreviation for *virgin,* V V for *virgins; v* stands for *versus,* "against." V represents the numeral 5, and in chemistry is the symbol of vanadium.

**Vaca, de** (Cabeza). See Nuñez (Alvar).

**Va'ca Sta'tion,** tp., Solano co., Cal. P. 120.

**Va'caville,** p.-v. and tp., Solano co., Cal. P. of v. 343; of tp. 1701.

**Vaccaj** (Nicolo), b. at Tolentino, in the Papal States, in 1791; studied music under Paisiello at Naples, and began to compose operas for the Italian stage in 1811; lived as a singing-master successively at Venice, Trieste, Vienna, Paris, and London, and was appointed professor of composition in 1838 at the Conservatory of Milan, where he d. in 1849. The most remarkable of his many operas are *Pietro il Grande, Zadig ed Astartea,* and *Giulietta e Romeo.*

**Vaccina'tion** [Lat. *vacca,* "cow"], the act of inoculating an individual with *vaccinia,* or cow-pox, a disease occasionally met with in milch cows. It is done for the purpose of protecting the system against small-pox, having superseded variolation or Inoculation (which see). The subject was first systematically investigated by Edward Jenner, an English physician, who in 1798 published the results of his researches and established the practice. Cow-pox has many points in common with small-pox, and with certain varioliform diseases of several of the lower animals, particularly with horse-pox, but it differs radically from them all in that it is communicable only by actual inoculation (never by effluvium); that its cutaneous manifestations are, with very rare exceptions, confined to the point of inoculation; and that the illness to which it gives rise is ordinarily trifling in degree and of very short duration.

When a child is vaccinated, no result is observed until after the lapse of a period of incubation, generally comprising three or four days, when a pimple-like elevation of the skin forms at the point of inoculation. In two or three days more this papule has increased in size and become a flattened vesicle or "pock," with a depressed centre (umbilication). On the eighth or ninth day (inclusive) it has become still larger, is surrounded by a sharply-defined circular, bright-red disk, from one to two inches in radius, technically termed the *areola;* its central depression is more marked; the contained fluid, which was clear at first, has become somewhat turbid, and the central depressed portion has become converted into a brown crust; at this period there is slight fever. The pock continues to increase in size until the fourteenth or fifteenth day, when it has become wholly dried into a blackish-brown crust; there is little or nothing to be seen of the areola, which has faded from the centre toward the circumference, and there is no more fever. The crust remains attached until somewhere between the twenty-first and thirty-fifth days. On falling off it leaves a reddened surface, which gradually becomes paler than the surrounding skin, depressed, and sometimes "foveolated" (*i. e.* indented, like the surface of a thimble), and remains as a permanent scar. In cases of revaccination (vaccination of a person who has before been vaccinated successfully) the pock usually runs an accelerated course, and is not completely developed, although the constitutional disturbance is apt to be more marked, with chilliness, nausea, headache, pain in the back, etc.

The structure of the vaccine pock is the same as that of the vesicle or pustule of Small-pox (which see). The contained fluid is termed lymph, and is used for transferring the disease from one person to another. For this purpose it should be taken not later than the eighth day. This lymph may be directly transferred from the subject of the pock (vaccinifer) to the person to be vaccinated, constituting arm-to-arm vaccination, or it may be preserved in a liquid state sealed up in capillary glass tubes or between plates of glass, or allowed to dry on slips of quill, ivory, whalebone, and the like. Dried lymph is the most trustworthy form of stored vaccine. The fallen crusts have been used for the purpose of propagating the disease, but they are very unsatisfactory. In whatever form vaccine virus be preserved, great care should be taken to prevent its undergoing septic decomposition, as its use in such a condition is liable to produce serious results, to say nothing of its failure to convey vaccinia. In particular, it should be kept away from the action of moisture and heat. Of late years, lymph direct from the cow or calf (bovine virus) has been much used, and with very satisfactory results, since it is found to be more successful in communicating vaccinia, to produce finer pocks, to do away altogether (when properly used) with the danger of conveying syphilis and other inoculable diseases, and to furnish an abundance of vaccine available at any time in case of the sudden outbreak of small-pox. Animal vaccine can now be obtained in any of the large cities of the U. S. and continental Europe. The supply is kept up by calf-to-calf vaccinations, starting from a case of natural cow-pox. Experience does not warrant positive statements in regard to the advisability of using variola vaccine (from a variolated cow), retro-vaccine (from a cow vaccinated with humanized lymph), horse-pox lymph, etc.

The best mode of vaccinating is as follows: Make one or more abrasions of the skin by scraping off the outer cuticle with a sharp lancet or some similar instrument. Each abrasion should be of about the size of a split pea, and they should not be less than one inch distant from each other. The best situation is on the left arm, at or near the insertion of the deltoid muscle. The skin should not be punctured, cut, or scratched, but simply *scraped,* and on no account should the true skin be wounded. When the abrasion is found to present a moist surface (no matter whether or not it shows the color of blood), it is deep enough, and the lymph may now be applied. If tube-lymph be used, it is simply to be blown on to the abrasions, but dried lymph, especially if it have been kept long, should first be moistened with a drop of cold water, and then rubbed upon the abrasions for a full minute or more. No plaster or dressing of any sort need be applied; but after the pock has formed, care should be taken that it be not scratched, rubbed, or otherwise injured.

There are facts which seem to show that the efficiency of vaccination against small-pox is in direct proportion to the amount of vaccinal efflorescence—two pocks giving more protection than one, three more than two, and so on. If energetic virus be used, two insertions will generally suffice. It is safe to vaccinate a child at any age, but, unless there have been actual exposure to small-pox, it is well to wait until it is about three months old. It is desirable that it should not be teething or ill in any way, and especially that it should be free from any cutaneous eruption. It is not well to vaccinate children in very hot weather or when erysipelas is prevailing, unless in case of necessity.

Vaccinia usually runs its course without complications, and does not call for special treatment. Excessive erythema (falsely called erysipelas) sometimes occurs, but always yields readily to simple local treatment. True erysipelas occasionally follows vaccination, as it does any other wound, and in infants it is very dangerous. Eczema, as well as certain other affections of the skin, sometimes arise soon after vaccination, and are perhaps, in certain cases, caused by it. Inflammation of the glands and of the cellular tissue is not very uncommon if the true skin be wounded; otherwise, it is rare. Multiple abscess is rare. It may be due to wounding the true skin, to the use of putrid lymph, or to injury of the pock, or it may have no connection with the vaccination. Ulceration of the pock (generally due to its being injured) is sometimes troublesome, but very rarely dangerous. Much fear has been felt that certain constitutional diseases might be conveyed by vaccination. In very rare instances this has occurred in the case of syphilis. It may be prevented with certainty by using animal vaccine and a *perfectly* clean instrument. In persons already tainted with latent scrofula or syphilis, vaccination may rouse the disease to activity.

The protection which vaccination affords against small-pox is sometimes absolute and permanent, but in most persons revaccination should be performed, as a matter of precaution, about once in five years, and in addition whenever small-pox is epidemic, when setting out on a voyage, upon undertaking military duty, etc. Modified small-pox (varioloid) frequently occurs in vaccinated persons, but severe small-pox after a recent and thorough vaccination

is exceedingly rare, except in cases in which the vaccination was done after the system had already become infected with small-pox. "Suppose an unvaccinated person," says Mr. Marson, "to inhale the germ of variola on a Monday: if he be vaccinated as late as on the following Wednesday, the vaccination will be in time to prevent small-pox being developed; if it be put off until Thursday, the small-pox will appear, but will be modified; if the vaccination be delayed until Friday, it will be of no use." Vaccination has been used for other purposes than the prevention of small-pox, but experience has not proved its efficiency for such purposes. Vaccine lymph has been given internally and injected under the skin to assist in the *cure* of small-pox. There is no evidence that such a practice has the slightest effect. FRANK P. FOSTER.

**Vacherot'** (ÉTIENNE), b. at Langres, department of Haute-Marne, France, July 29, 1809; studied at the normal school of Paris, where he became professor of philosophy in 1833; in 1839 succeeded Cousin at the Sorbonne, but was dismissed in 1852, because he refused to take the oath to Napoleon III., and was condemned to three months' imprisonment in 1859 for his *La Démocratie*. In 1871 he was elected a member of the National Assembly. His principal works are—*Histoire critique de l'École d'Alexandrie* (3 vols., 1846–51), which was furiously attacked by the Ultramontane party, especially by the Abbé Gratry in his *Étude sur la Sophistique contemporaine*, to which Vacherot answered with a *Lettre à l'Abbé Gratry, La Métaphysique et la Science* (2 vols., 1858), *Essais de Philosophie critique* (1864), and *La Religion* (1868).

**Vac'uum** [Lat.], in physics, a portion of space void of matter. Whether a perfect vacuum is possible or not was a much-debated question in the ancient philosophy between the Atomists and the Peripatetics. The *Torricellian* or barometric vacuum is nearly perfect, but contains the vapor of mercury. If a receiver filled with pure carbonic acid gas be exhausted by means of a good air-pump, a small vessel having been previously introduced containing moist caustic potash, and another containing concentrated sulphuric acid, a vacuum will be produced so nearly absolute that the electric spark fails to pass through it.

**Vacuum (or Geissler's) Tubes.** See ELECTRICITY, by PRES. HENRY MORTON, PH. D.

**Va'ga, del** (PERINO), whose true name was PIETRO BUONACCORSI, b. at Florence in 1500; received his first instruction in painting from Ridolfo Ghirlandajo, from Vaga and Perino, from whom he derived his two surnames. Subsequently, he went to Rome, where he became an intimate friend of Raphael, and was generally considered his most gifted pupil next to Giulio Romano. After the death of Raphael, he lived for some time in Genoa, where he decorated the palace of Doria, but finally returned to Rome, where he formed a great school; worked much for Paul III. D. in 1547. The best of his pictures are the *Creation of Eve*, in the Vatican, and the *Singing-Match between the Muses and the Pierides*, in the Louvre.

**Vagrant and Vagrancy.** See MENDICITY, by REV. C. L. BRACE.

**Va'gus Nerve, Par Vagum** [Lat., "wandering pair," so called from its irregular course], names given—the first to either one, the second to both together—to the two pneumogastric nerves, now considered as the twelfth pair of cranial nerves, but by older anatomists reckoned a part of the ninth pair. (See PNEUMOGASTRIC NERVE.)

**Vaiden,** p.-v., Carroll co., Miss.

**Vaigats',** an island in the Arctic Ocean, between Nova Zembla and the northern coast of Russia, belongs to Russia. It is inhabited by a few Samoyeds and their herds of reindeer, but it is annually visited by a great number of Russians, who come hither during the summer to fish and to hunt.

**Vaile's,** tp., Pickens co., Ala. P. 456.

**Vaillant, Le.** See LEVAILLANT (FRANÇOIS).

**Vaiseshika.** See HINDU PHILOSOPHY, by PROF. JOHN DOWSON.

**Vaishn'avas.** The Vaishn'avas are a sect of Hindus, who regard as their peculiar patron, and as the most especial object of their veneration, the second person in the Indian Trimûrti—namely, Vishnu. The Vaishn'ava sect is itself subdivided into almost innumerable sects, all of which are only bound together by the one idea—that, above all other gods of the Hindu pantheon, Vishnu stands supreme. Roughly speaking, these sects of Vaishn'avas may be classed in bulk as the "Northerners" and the "Southerners," according to the *ipsissima verba* of Hindu theology. But the tone of Vaishn'ava opinions is constantly changing, and we find the so-called Northerners constantly contending nowadays, in the Deccan and extreme S. of India, with the Southerners. So, in reality, no hard and fast line can be drawn, and no grouping of the hundreds of sects comprising the Vaishn'ava sect can be satisfactorily made. The term *Vaishn'ava* is as elastic as that of Christian. Even the mark on the Vaishn'ava's forehead, which is shaped like a trident, cannot invariably be depended upon. One sect prolongs the central prong, so to speak, of the trident to the tip of the nose, and holds that it is necessary to salvation that this should be done. The opposing sect stops short at the eyebrows. Many a bloody feud between Vaishn'avas has arisen on account of this one controversy, with a fervor resembling that when the whole world of Christendom was convulsed about an *iota*—whether *homo-ousion* or *homoi-ousion* was the orthodox term to use. Then some of the sectarian marks differ in the thickness of the lines; and even that, in the watchful eye of a scrupulous Hindu, is of immense importance. So are also the necklaces and rosaries, the forms of the garments worn, and, above all, the sacred initiatory *formulæ*. The Vaishn'ava mark on the forehead is called in Sanskrit the *tilaka*, and in the Northern vernaculars *tilak*. In Tamil it is called *nâmam*, literally, "the name," or *tiru-nâmam*, "holy name;" and in fact it is the outward designation of the worshipper of Vishnu. Though in some form or other it is to be seen on the Vaishn'ava's forehead, yet its varieties are so peculiar in the chief six sects of the votaries of Vishnu that we must remark on these differences ere proceeding further. But in passing it should be mentioned that the differences of the sects themselves chiefly consist in the character of the supremacy which they assign to Vishnu as a member of the Trimûrti, in the nature of which they believe him to be possessed, in their mode of worship and pious exclamations, and in the light in which they regard their priests and the authority they wield.

The distinctive mark of the Northerners, of which we have spoken, is formed by two white perpendicular streaks, or two streaks converging like the lines of a V from the roots of the hair, across the forehead, to the eyebrows. These streaks are of powdered sandal-wood made into an adhesive paste. From between the eyebrows another white streak is drawn, connecting the lower portion of the V to the tip of the nose, thus making the mark resemble a Y. Some of the sectaries of these sectaries make the line along the nose stop at the middle of its ridge. The streaks of sandal on the forehead are called *gopîchandana*. The Vaishn'avas using this mark are sometimes called the "Bengal Vaishn'avas," as they most abound in that province. They also sometimes have the name of Krishna impressed with paint on their foreheads and bodies, and are also to be sometimes distinguished by "a close necklace of tulasî stalk of three strings, and a rosary of 108 or 1000 beads made of the stem of the tulasî. The distinctive mark of the Southerners consists of two white lines of chalk, perpendicular and parallel, from the roots of the hair to the eyebrows, with a streak of similar color joining the base of the lines, and running at right angles to them above the nose. In the middle, between the two perpendicular white lines, is drawn, parallel with them, a line of red paste composed of turmeric and lime, or simple red chalk. The white lines are sometimes traced by means of a fine white clay, much prized by potters. This subdivision of Vaishn'avas pay peculiar regard to the lotus, and often bear on their bodies the representations of it. Like other Vaishn'avas, they hold the basil sacred to Vishnu (the tulasî—*i. e.* sacred basil). The Vaishn'ava adores Vishnu as the personification of everything lovable, and basil is everywhere the emblem of love. The reader, for instance, will remember Shelley's lines:

> "Madonna, wherefore hast thou sent to me
> Sweet *basil* and mignonette,
> *Embleming love* and health, which never yet
> In the same wreath might be?" etc.

In the great valley of the Ganges we come to the Vaishn'ava sect of the *Râmânanda*, whose distinctive mark is similar to that of the sect we have just referred to, only the central red mark is made as narrow as possible. The Vaishn'ava followers of Vallabha Ârchâya bear on their foreheads two parallel perpendicular lines, generally of white, and joined together at the eyebrows with a semicircular line of the same color. Between the parallel lines no other line is drawn, but it is replaced by a dot of red, generally made by a paste composed of turmeric and lime. They smear themselves with black clay, which they mould on their breasts and arms in devices indicating the usual emblems of Vishnu. The Kabîr Panthis are a sect of Vaishn'avas who, as a distinctive emblem, adopt the "*tilaka*" or distinctive mark simply as a form, and are utterly careless as to its size, shape, or color. The last sect of the principal six whose distinctive religious marks need be referred to are the Mâdhwâchârayas of Central India. "The marks common to them are the symbols of Vishnu upon

the shoulders and breast, and the frontal mark consisting of two perpendicular lines made of the white clay *gopî-chandana*, and joined at the root of the nose; but instead of a red line in the centre, they make a straight black charcoal line from incense offered to Nârâyana." This black line terminates at the root of the nose in a red round dot, made of lime-turmeric paste.

So much for the marks on the foreheads of Vaishn'ava Hindus. What do these marks mean? and what is meant by the Saiva marks? One latest-born of ingenious theories is that all such frontal marks, though intended to be distinctive from the first one from the other, were primarily used by the cunning Hindu to draw away any fixed gaze into his eyes from the eyes of another. These extraordinary daubs on the foreheads of men certainly do attract the eye, and at least tempt it to wander from that steady stare of blunt fearless Anglo-Saxon honesty which so few Orientals can face. Some Orientalists consider that the marks signify the weapons of Vishnu; others think that the threefold character of the marks hint at the oneness in the person of Vishnu of the trinity of the Trimûrti. These are merely vague speculations. Of the basis of many Hindu symbols the wisest know nothing. For example, what is the real *raison d'être* of the *gopras?* There they stand, those lordly towers, a necessary adjunct of every Hindu temple. But what first prompted the Brahmans to build them? To what especial use were they designed from the very first to be put? We cannot answer such questions; we can at best only offer plausible conjectures. (See Mrs. Belnos, *The Sundhya.*)

We must now turn our attention to the differences between various Vaishn'ava sects. Let us first take the Northerners. They number more than 45,000,000 in the India of the present day. Two out of three Vaishn'avas in Bengal are of this sect. In the course of such a brief summary as this it is impossible to trace their origin or to refer to more than their most distinctive tenets. The first conspicuous doctrine we come to in the teaching of these "*Vadakalei*" Vaishavites, is that of *bhaghti* or *bhakti—i. e.* "faith." They believe that *faith* in Vishnu will save more swiftly, surely, and effectually than ever any *works* can. The virtues of pious meditation and abstraction are not to be compared to the virtues of belief. Knowledge is of little account; faith is all in all. It is good to subjugate the passions, to practise the *yoga*, to give alms, to be of a mind filled with charity, to call on the sacred name, to wear the sacred symbols on the person, to be honorable, virtuous, and meek; but FAITH is the sole and supreme fount of salvation. And yet these mild Hindus, who worship the Preserver, and believe that by *belief* alone in the nine-times-incarnate-One they shall attain heaven, coolly tell their Southern brethren of the Râmânûja sect that the latter cannot be saved unless they lengthen the middle stroke on their foreheads to the tip of their noses! The Southerners naturally reply that the performance of this lengthening of the line as a requisite for salvation is in itself a "work," so that the Northerners are inconsistent with regard to their avowed creed. In older days these theological disputes used to lead to exhibitions of physical force. Temples used to be hurled down, cities depopulated, women and innocent children butchered—all to prove whether the distinctive central mark of a Vaishn'ava's forehead should stop at his eyebrows or whether it should elongate itself to the root of his nose!

But, after all, the Northerners must be considered the most liberal. To take a very apt illustration, used by an eminent Orientalist, they are the *Protestants* of Vaishn'ava theology. They insist on *faith* as the supreme requisite. They are not so ground down by usages and multitudinous *formulæ* as are the followers of Râmânûja Âchârya. The latter are more in the hands of their priests; the former own as their great high-priest conscience. The Northerners adhere as much as possible to the simplest tie which can possibly bind them to the worship of Vishnu as a distinctive connecting link—that is, the repetition, the oftener the better, of the name of the god in the person of the greatest of his avatârs, "KRISHNA! *Krishna!* Krishna!" Only repeat this, and your worship is complete, and all ceremonial observances are wholly needless. A great prophet of this subdivision of Vaishn'avas, Haridâs, lived in a jungle-brake for many years, and uttered the holy name 300,000 times a day. But the Southerners have a far grander invocation—one that in the mouth of a Brahman is certainly as fine and pithy and suggestive as any similar adjuration in India. It is, "*Om! Râmâya Namâ!*" which might be freely translated, "O triple God! by the name of the Incarnate!" This, even if not verbally an accurate translation, elucidates the true inner spirit of the original. It is as an ejaculation only inferior to that marvellous one of the Lama priests of Thibet: *Ôm! Mani Padmê! Haun!*" (See A. Wilson's *Abode of Snow.*) This Buddhist prayer is not only one of the oldest, but is certainly the one above all others most frequently offered up in some fashion or other, not excepting our own Lord's Prayer. It means, "*God! the jewel in the lotus. Amen!*"

But the Northern Vaishn'avas are, in several of their dogmas, more degraded than any other class of their fellow-worshippers of Vishnu. Their priests are worshipped by them deliberately. Nay further. They cannot approach to worship their god, Vishnu, unless they first approach and pay divine honors to his priest. They are expressly taught and enjoined to believe that "first the *guru* (priest) is to be worshipped; then Vishnu is to be worshipped." This servility is fortified by other texts which the Bengal Vaishn'ava Brahman regards as sacred. One of these is, "When Vishnu is in anger, the priest will protect us; but when the priest is angry, who can deliver us?" Again: "The prayer is made manifest in the priest, and the priest is God himself." It is perfectly plain that, with all their freedom of thought, and belief in faith rather than in ceremonious observances, the Vaishn'ava Bengalis are exceedingly priest-ridden. Still, it must be granted that, if anything, they are freer from superstitious shackles of many kinds than are their brethren of the S. of India, who look upon outward formalities as the kernel of true religion.

The Southern Râmânûja Vaishn'avas are especially fond of worshipping Lakshmi, the consort of Vishnu. Sîtâ is even a greater favorite with them than Râma, and many a wild orgie is often carried out under the supposed sanction of the lovely goddess "with the fish-bright eyes." No South-Indian Vaishn'ava will allow any one to look on his food whilst he is eating it. A look would be pollution, and he at once would treat it as ordure and bury it out of sight. He believes that Vishnu is the spring, centre, foundation, cause, and creator of all. Matter and spirit unite in him as God and as the Incarnate. In Southern India the Râmânuja Vaishn'avas number many tens of millions, and their temples are amongst the most splendid in India. They are more Vedantist in their bent of religious thought than the Bengal Vaishn'avas, who do not believe in final absorption into the Divine Essence.

We now come to the intermediate sects. The *Vallabha-Âchâryas* are a strong, well-organized sect of Vaishn'avas, and hold their own in Central India against most influences. Their head priests are called *mahârâjas*, and some of them —nearly a dozen—live in Bombay. They have made a strange name for themselves as spiritual teachers. (See Kursandas Mulji's work on *The Sect of Mahârâjas of Western India.*) They live the most debased and debauched lives, owing their position purely to their parentage, being utterly without erudition themselves, ready to poison, cheat, forge, lie, or swindle, all under the cloak of religion. Mr. Kursandas Mulji said this, and printed his opinions publicly. A trial for libel was the result. Mr. Kursandas was honorably acquitted. The votaries of this sect of Vaishn'avas are bound to reverence the teacher as God. It is said, "The priest or mahârâjah is Vishnu himself; he is Krishna incarnate: the true believer must bestow on the priest his body-organs of sense, life, heart, faculties, wife, house, family, property, and all his own self." It need hardly be added that the grossest abuse has been made of this iniquitous and execrable tenet.

The *Madhwâ Âchârya* sect are numerous amongst the Vaishn'avites in the Telugu country. They believe in Vishnu as the great invisible First Spirit, the Prime Cause, the Originator of the Universal, the primeval Sole and Supreme, perfectly good, omnipotent, and of nature totally indescribable. This sect *brand* themselves with Vaishn'ava symbolic emblems as a preventive against schism. As a part of their worship they demand that virtue shall be invariably practised, alms freely offered, truth always told, and that kindness and protection and courtesy be shown to all men, especially strangers. This sect deny the doctrine of absorption, and so differ in a vital point of doctrine from a large number of their co-religionists. Brahma, they believe, grew out of a lotus, which itself grew out of Vishnu's navel. Their idea of heaven is that of final liberation from future births, and sharing with Vishnu in every respect the glories and felicities of his heaven. The true believer, after ascending thither, will not only be perfectly happy, but will be endued with omnipotence. The sacred color of this sect is a deep saffron. Their supreme authority is the Veda. Their priests pretend to strict asceticism.

The *Kabir Panthis* are a very numerous sect of Vaishn'avas in Northern and Central India. They are strict unitarians, believing in one sole Creator of the universe, perfect in holiness, omnipotent, irresistible, yet with corporeal form; endowed with the three senses or qualities, and embodied by a combination of five elements. All that is good in earth resembles him. The perfect man after death shares equally with Vishnu his perfection of character, blissful-

ness, and power. Indeed, God and man are identical. The whole visible creation is also God, begot by the female form, *Mâya*, created by God, to relieve his loneliness and give birth to nature. There are, however, several theories on this point, and Prof. Goldstücker's, which is best known, relies on the most ancient forms of the legend. The Kabir Panthis are very careful to teach that pure morality is the highest good and the way to God. However, one thing should be especially noted: the Kabir Panthis prefer to term the Supreme "the God-Thing," rather than "Vishnu." Indeed, they suppose some infinite, indefinable, omnipotent essence higher than any person of the Trimûrti. But of the Hindu triad they regard Vishnu as the leading power. It is said that of late years many members of this rather latitudinarian sect have joined the Brahmo Somâj, and thus become pure deists. Of all Vaishn'avas they are certainly regarded as being most liberal, especially as to the truest and best name which may be given by mortals to the Supreme.

In conclusion, a few words may be written. They are words which even ripe scholars should take to heart and expatiate upon. It has become the fashion amongst those who have a smattering of Oriental learning to praise Vaishn'avas at the expense of Sáivas. The worshippers of Siva, say they, adore a remorseless divinity, the Destroyer; but, say they again, Vishnu is the benignant preserver, and his votaries set before themselves a higher example of deity. Nothing of the sort! The Purânas tell us that from his infancy Vishnu was the patron of thieving, and that the god in his manhood was accomplished as a superb liar and very extensive fornicator and adulterer. It is a late myth which assigns to him the duties of preservation, whilst Brahma creates and Siva destroys. He is simply an embodiment of human passion without check. Generous at times, he is cunning and lustful and prodigal after the Hindu's own heart. In any case, with all his vice and all his magnanimity, he is perhaps the most striking figure in the Hindu pantheon. But, for a god, he is certainly rather diabolical. R. C. CALDWELL.

**Valais'** [Ger. *Wallis*], canton of Switzerland, bounded N. by the cantons of Vaud and Berne and S. by Savoy, consists of one valley enclosed by the Bernese and Pennine Alps, which are the highest mountains of Europe, and traversed by the Rhone, which at the western extremity of the valley enters the Lake of Geneva. Area, 1665 sq. m. P. 96,887, of whom 67,300 speak French, 21,900 German, and 8000 Italian. They are all Roman Catholics. Cattle-rearing and dairy husbandry are the chief occupations; at the bottom of the valley, where the summer heat is intense and the ground along the river level and fertile, wheat, wine, and fine fruits are cultivated with success.

**Val'atie,** p.-v., Columbia co., N. Y.

**Valc'kenaer** (LODEWIJK CASPER), b. at Leeuwarden, Holland, in 1715; studied the classical languages and literatures under Hemsterhuys, and became professor of the Greek language and antiquities at Franeker in 1741; removed in 1766 to Leyden. D. there Mar. 14, 1785. He gave good editions of various Greek authors, accompanied by excellent notes. His *Opuscula Philologica, Critica, Oratoria,* were published in 2 vols. in 1808 by Erfurdt.—His son, JAN VALCKENAER, b. at Leyden in 1759; studied law, and was appointed professor of jurisprudence, first at Franeker, afterward at Utrecht, but was compelled to leave the country in 1787 as leader of the anti-Oranian party. In 1795 he returned with the French army; became a member of the republican government; went to Spain as ambassador in 1796, and again in 1801, and held various governmental positions until the abdication of King Louis in 1810, when he retired into private life. D. at Haarlem Jan. 25, 1821.

**Valda'gno,** town of Northern Italy, province of Venice, on the right bank of the torrent Agno, about 6 miles S. E. of Recoaro, is a small place of unusual rural, industrial, and commercial activity, and a ferruginous spring, discovered in 1845 about 2 miles from the village, brings hither many strangers in summer. The waters, known as *aqua dei Vegri* or *aqua Felsinea,* are beginning to be exported. P. 6789.

**Valdegamas.** See DONOSO CORTÉS.

**Valdepe'ñas,** town of Spain, province of Ciudad Real, is celebrated for its red wine, which is considered the best produced in Spain. P. 10,768.

**Valdés, de** (JUAN), b. at Cuenca, Spain, about 1500, of a noble and wealthy family, and was early introduced at the court of Ferdinand and Isabella; after serving a short time as *camarero* to Pope Adrian VI. (1522), joined the imperial service in Germany, where he became a convert to the Reformation; took up his residence at Naples; was for a time secretary to the king, and gathered around him a small circle of congenial friends, with whom he pursued the study of the Bible untrammelled by the interpretations of the Roman Catholic theologians, and wrote commentaries and several religious works, some of which were subsequently printed and secretly circulated. D. at Naples in 1540. After his death his friends, among whom were Peter Martyr, Bernardino Ochino, Vittoria Colonna, and Giulia Gonzaga, were accused by the Inquisition of having formed a sect called "Valdesians," and some of his followers were put to death and others had to take refuge in foreign countries. The books of Valdés and his influence upon religious thought had fallen into almost complete oblivion, when his memory, like that of several other Spanish Reformers, was revived by an English Quaker, Mr. Benjamin B. Wiffen (a brother of the translator of Tasso), who began in 1848 the publication of a series of *Reformistas Antiguos Españoles* which extended to 20 vols., and included, besides works of Tomas Carrasco and Dr. Juan Perez, several by Valdés—viz. *Dos Dialogos* (1850), *Zineto y Diez Consideraciones* (1550; reprinted 1855), *Alfabeto Cristiano,* from the Italian edition of 1546, with two modern translations in Spanish and English (1861), *Dialogo de la Lengua* (1546; reprinted 1860), and *La Epistola de San Pablo á los Romanos i la I á los Corintios, ambas traduzidas i comentadas* (1556; reprinted 1856). The second of these works had been translated into French and Dutch, and had appeared in an English version by Nicholas Ferrar, with the title *Considerations on a Religious Life* (Oxford, 1638). Mr. Wiffen also published *The Life and Writings of Juan de Valdés, otherwise Valdesso, Spanish Reformer in the Sixteenth Century* (1865), with a translation from the Italian of his *Hundred and Ten Considerations* by John T. Betts. Valdés was not a Lutheran, nor did he question any doctrine of the Church, his title to the name of "reformer" resting upon his comprehensive spiritual fellowship with all genuine Christians. (See an elaborate article by Dr. E. Böhmer in Herzog's *Real-Encyklopädie für protestantische Theologie und Kirche,* vol. xvii. (1863), and the same writer's *Cenni Biografici sui Fratelli Giovanni e Alfonso di Valdesso* (1861).) PORTER C. BLISS.

**Valdez** (MELENDEZ). See MELENDEZ VALDEZ.

**Valdie'ri,** small town of Northern Italy, province of Cuneo, 2700 feet above the sea in the grand and picturesque valley of the Gessa, about 12 miles S. W. of Cuneo. This town is remarkable for the variety and efficacy of the mineral waters, both cold and hot, which are found near it, but higher up the valley and at a height of 4425 feet above the sea. These baths were known and prized by the ancients, but fell into disuse during the Middle Ages, and first acquired a modern reputation about 1560. They are now very much frequented, especially by Italians, for various affections, such as scrofula, rheumatism, paralysis, osseous tumors, etc., and particularly for diseases of the eye. The *muffa* (a gelatinous substance found on the rocks) and *mud baths* are much employed. The marble-quarries of this neighborhood are also very valuable. P. 2700.

**Valdi'via, de** (PEDRO), b. in Spain about 1505; served with credit as a soldier in Italy, participating in the battle of Pavia 1527; accompanied Pizarro to Peru as one of his captains 1532; took part in the conquest of Venezuela 1535; aided Pizarro in his civil war with Almagro, contributing largely to the decisive victory over the latter Apr. 6, 1538; was rewarded with the assignment of the province of Chili, previously conferred upon Almagro; led an expedition thither, and effected the conquest of that region 1540; founded the cities of Santiago Feb. 12, 1541, and Coquimbo 1544; was recalled to Peru by the troubles consequent upon the murder of Francisco Pizarro; took part at first with Gonzalo Pizarro against the viceroy Blanco Nuñez de Vela (1546), but subsequently aided President la Gasca in suppressing the rebellion of Gonzalo; was appointed captain-general of Chili and all the regions S. of Peru which he might be able to conquer (1548); made a series of daring campaigns in Southern Chili (1550), where he founded the cities of Concepcion, Villa Imperial, Villa Rica, and Valdivia (1551), and gained many victories over the Araucanians, but was ultimately taken prisoner by them and put to death in 1559.

**Valdosta,** p.-v., cap. of Lowndes co., Ga. P. 1199.

**Valeg'gio sul Min'cio,** town of Italy, province of Verona, about 5½ miles E. of Villafranca, is one of the prettiest towns on the Mincio, the old dismantled fortress, erected by the Scaligeri for the defence of the passage of the river, having a fine effect when seen at a distance. Within the town there are some noteworthy public and private buildings, and also some valuable works of art. In the Palazzo Nuvolini (formerly Maffei) Carlo Alberto lodged in 1848, also Napoleon III. in 1859 after the battle of Solferino. Near Valeggio sul Mincio may be seen the ruins of the famous bridge of Borghetto (rather a causeway),

erected (1393) by Gian Galleazzo to divert the Mincio from Mantua and thus reduce the place by famine. This neighborhood has, from its geographical position, been the theatre of much desperate fighting. In 1796, Bonaparte, while resting in a little farmhouse near Valeggio sul Mincio, narrowly escaped being made prisoner by the Austrians. It was here also that the disastrous battle of Custoza (1866) was in part fought. P. 5415.

**Vâḷei.** One of the great homes of the plantain (see PLANTAIN) is Southern India. There it is termed the *vâḷei*. The *ḷ* (under-dotted) is the most peculiar of letters, probably, in the whole range of the alphabets of the globe. To transliterate the letter *l* is merely an orthographical shift at best. It is like no *l* in any European alphabet. It has a peculiarly soft, strange sound, a compound, as some have deemed it, of the sounds of *z*, of *r*, of *m*, of *h*, and of *y*, and what not, combined with the permeating "intonating" undercurrent of the *l* sound. There is no word, amongst twenty millions of Indians, much more frequently upon the tips of their tongues, than *vâḷei*. The weird, melting sound of the word itself seems to be mimetic in origin. The tree and fruit of which it is the name is amongst the tenderest of trees and softest of fruits. It is certainly, next only to rice, the prime vegetable of Southern India. The plantain to the Madras aborigine is as the turnip is to the English agriculturist, or the potato to the Irishman, or the maize to the North American Indian. There are sheets of plantain-gardens in India ten times broader and longer than any of the wheat-fields of English counties. The Tanjore and Tinnevelly rice-fields are plains of fertility resembling the prairies of America in extent, without being, like them, undulatory, and resembling the richest farm-lands of England for productive capabilities. Here we have, in mute nature, the size of the giant united as it were with the wit of the dwarf. Rice may be to India what wheat is to Europe. The *vâḷei* to Southern India is what sugar and cotton combined are to the Southern States. It is the morning relish of the Anglo-Indian; it is the food of the wild animal; and the Hindu often feeds upon it solely and wholly for half each year. The large coarse plantain is plucked green by the natives and used as curry. When ripe, it is either eaten by itself as a fruit or mashed up with milk. The smaller kinds of plantains are prized for their exquisite taste as delicacies. Europeans value the smaller varieties the most. There is a green plantain, long and thin in shape, which is extremely agreeable in taste. A *vâḷei* only bears once, but sends out many shoots from its roots. All save one being cut down, a new tree springs up. But the plantain is a most exhausting growth to the soil. It requires much manure, a light sandy ground, and plenty of water. The leaf of the healthy *vâḷei* is of the deepest green, and its great size and breadth are well known. The plant absorbs an immense amount of dew in the hot season. Hindus frequently use the broad leaves as plates for their rice; indeed, Brahmans prefer these to dishes of metal or earthenware. The flower of the plantain is the emblem of fruitfulness. It is this which we see on so many Indian shawls, and which is called incorrectly the "pine" in shawl-patterns. There is hardly a plant in the world which, for its size, absorbs so much moisture. The rock-plantain is not edible. It is called "*kal-vâḷei*," but the deer of Indian forests are partial to its tender shoots. The plantain is unquestionably indigenous to India. None has doubted this, though some have refused to believe that such is the case with the palm itself. R. C. CALDWELL.



**Valence′** [anc. *Valentia*], town of France, capital of the department of Drôme, on the left bank of the Rhone, 57 miles S. of Lyons, is surrounded with walls, which, however, have no military value. It is an old town, with narrow, crooked streets, but not decaying or unattractive. Its manufactures of silks, cotton goods, glassware, leather, gloves, etc., are flourishing, and its trade in wine, timber, and its own manufactures is brisk. Its cathedral, founded in 212, contains the monument, by Canova, of Pius VI., who d. here, and it has a school of artillery and engineering. P. 20,668.

**Valen′cia,** a small island on the south-western coast of Ireland, belonging to the county of Kerry, is noted as the station of the two American cables. It is 5 miles long, 2 miles broad, and has a pop. of 2500.

**Valencia,** one of the old provinces of Spain, bordering on the Mediterranean and situated between Catalonia in the N. and Murcia in the S., is now divided into the three provinces of Valencia, Alicante, and Castellon de la Plana. From the eighth to the thirteenth century it was possessed by the Moors, and from the eleventh century to 1238 it formed an independent Moorish kingdom. It was at that time, as it still is, the best cultivated and most productive part of Spain. Nowhere in Europe are manuring and irrigation carried to such perfection as on the terraces of Valencia, where in many places the soil yields from three to five harvests annually. Besides the common Spanish products, rice is grown here in sufficient quantity to supply all Spain; also sugar is cultivated.

**Valencia,** town of Spain, capital of the province of Valencia, on the Turia, near its mouth in the Mediterranean, is surrounded by old picturesque walls, within which its narrow, tortuous streets wind along in endless confusion. But the houses are neat and substantially built; the squares, though small, are elegant; the streets, though crooked and narrow, are clean, well paved, and well lighted, and the whole city is a pleasant and enterprising place, the centre of an exceedingly fertile district and the seat of extensive trade and manufactures. Its cathedral is a vast edifice containing many excellent pictures. Its university is a well-endowed and well-attended institution, and has a good library. Its manufactures of silk, tobacco, sackcloth, and tiles are celebrated, and its export-trade in corn, rice, oil, wine, almonds, figs, and oranges is very considerable. The town proper has 87,073 inhabitants; with the suburbs and huerta, 145,512.

**Valencia,** town of South America, in Venezuela, is at an elevation of 1475 feet above the sea, and enjoys a healthy and agreeable climate. It is well built, and carries on a considerable trade between Puerto Cabello and the interior. P. about 15,000.

**Valencia,** county of Central New Mexico, separated into two parts by the southerly projection of San Miguel co., the E. part bordering upon Texas, and intersected by the Rio Pecos, the W. part bordering upon Arizona, crossed by several mountain-chains, intersected by the Rio Grande, and drained by streams, some of which finally find their way into the Gulf of California, others into the Gulf of Mexico. Sheep are very numerous, forming the principal part of the live-stock, though there are considerable numbers of cattle. Staples, wool, Indian corn, and a little tobacco. Cap. Belen. Area, about 10,500 sq. m. P. 9093.

**Valencia,** DUKE OF. See NARVAEZ (RAMON MARIA).

**Valenciennes′,** town of France, department of Nord, on the Scheldt, is fortified and defended by a citadel situated on an island in the river, and contains an arsenal, barracks, hospitals, and magazines. It carries on a brisk trade in timber, coal, agricultural produce, and its own manufactures, which are varied and extensive. Sugar-refineries, saltworks, dye-houses, bleaching establishments, and spinning and weaving factories are in operation. Its laces and fine woven fabrics are celebrated. P. 24,344.

**Valenciennes** (ACHILLE), b. at Paris Aug. 9, 1794; studied natural science; became professor of anatomy at the normal school in 1830; was the collaborator of Cuvier in his ichthyological studies; succeeded Geoffroy Saint-Hilaire in the Academy of Sciences. D. at Paris Apr. 14, 1865. Besides a number of monographs and minor essays in various scientific journals, he wrote *Histoire naturelle des Poissons* (11 vols., 1829–49) and *Histoire naturelle des Mollusques, des Annélides et des Zoophytes* (1833).

**Va′lens,** Roman emperor of the East (364–378), b. in 328, brother to Valentinian I., who shortly after his election as emperor by the officers of the army of Jovian at Nicæa, Feb. 26, 364, declared his brother Augustus or emperor of the East, in the Hebdomon, near Constantinople, Mar. 28. In 367, Valens received baptism from Eudoxus, patriarch of Constantinople and the chief leader of the Arian party; and intrigues and persecutions between the Catholics and the Arians form one of the most prominent features of his reign. Of still more importance, however, was his relation to the Goths settled in Dacia to the N. of the Danube. In 365, while Valens was at Cæsarea, a rebellion broke out in Constantinople, and Procopius was declared emperor; 3000 Goths were taken into the service of Procopius, and when he died and the insurrection was suppressed, this body of men was captured, scattered over the empire, and settled at various points under military surveillance. Athanaric, king of the Goths, demanded the surrender of these men; Valens refused, and war began. But the Romans crossed the Danube several times, and defeated Athanaric, who sued for peace. During the protracted and desultory war with Persia which now ensued the Huns appeared in Europe on the northern shores of the Black Sea. They fell upon the Goths, and drove them before them to the S. In 377 large swarms of Goths gathered on the banks of the Danube and asked permission to enter the Roman territory. They were received, and

spread over the whole of Thrace and Macedonia. But the mismanagement, frauds, and superstition of the imperial officials soon occasioned collisions between the Romans and the Goths, and the collisions rapidly developed into open war. The Romans were defeated, and large tracts of the country were devastated by the Goths. In this emergency Valens returned from Antioch, and at the head of a large army met the Goths outside of Adrianople. A severe contest took place Aug. 9, 378, and the Romans sustained a defeat unparalleled in the annals of the Empire since the battle of Cannæ. Valens was never seen or heard of afterward.

**Valentin'** (Gabriel Gustav), b. at Breslau, Prussian Silesia, July 8, 1810, of Jewish parentage; studied medicine at the university of his native city, and practised for some time there as a physician, but received in 1836 a chair as professor of physiology at the University of Berne. His principal works are—*Handbuch der Entwickelungsgeschichte* (1835), *Lehrbuch der Physiologie des Menschen* (2 vols., 1845), *Grundriss der Physiologie des Menschen* (1846), often reprinted, besides a number of monographs and minor essays—*Die Einflüsse der Vagusläh-mung auf die Lungen- und Hautausdünstung* (1857), *Versuch einer physiologischen Pathologie der Nerven* (1864), *Versuch einer physiologischen Pathologie des Blutes und der übrigen Körpersüfte* (1866), *Die physikalische Untersuchung der Gewebe* (1867), etc.

**Val'entine** (David Thomas), b. at East Chester, N. Y., Sept. 15, 1801; received an academical education, and in 1821 became clerk of the marine court in New York. In 1837 he was appointed clerk of the common council of New York, a position to which he was reappointed by every successive administration until his death. For a quarter of a century he prepared annually a *Manual of the Common Council*, the successive volumes of which embody a vast amount of curious and valuable information. He also published a *History of New York* (2 vols., 1853–56). D. in New York Feb. 25, 1869.

**Valentine** (Milton), D. D., b. near Uniontown, Md., Jan. 1, 1825; graduated at Pennsylvania College, Gettysburg, 1850, and at the theological seminary at Gettysburg 1852; was ordained to the ministry of the Lutheran Church Oct. 4, 1852; preached at Winchester, Va., 1853–54, and at Greensburg and Adamsburg, Pa., 1854–55; was principal of Emmaus Institute, Middletown, Pa., 1855–59; pastor of St. Matthew's church, Reading, Pa., 1859–66; became professor of ecclesiastical history and church polity at Gettysburg Seminary 1866, and has been president of Pennsylvania College, Gettysburg, since May 15, 1868. Author of *The Relation of the Family to the Church* (1859), *Justification by Faith, The Dynamics of Success, Knowledge by Service, Truth's Testimony to its Servants*, and various other published discourses; has been a frequent contributor to the *Quarterly Review* of the Evangelical Lutheran Church, and was one of its editors 1871–76.

**Valentine, Saint.** See Valentine's Day, Saint.

**Valentine's Day, Saint,** the 14th day of February, observed in commemoration of St. Valentinus, a bishop or presbyter who was decapitated in 270 A. D., during the Claudian persecution at Rome. The custom of sending valentines (sentimental or comic love-messages, often in rhyme, and adorned with ornamental or grotesque devices) is a very ancient one. Some tell us that on this day the birds select their mates; others trace the custom to the Roman Lupercalia (Feb. 15), when similar practices were observed. Traces of the custom have been detected among the observances of the Northern pagans of ancient Europe. Hence it is probable the tradition that ascribes its origin to a commemoration of the loving and charitable disposition of St. Valentine is a comparatively late invention.

**Valentin'ian,** the name of three Roman emperors. Valentinian I. (364–375), b. in 321 at Cibalis in Pannonia, a son of Count Gratian, and educated in the army; under Julian was a tribune of the guard, but was dismissed and exiled because, being a Christian, he refused to sacrifice to the heathen deities; reinstated by Jovian, he was raised to the throne on the sudden death of the emperor by the officers of the army, at Nicæa Feb. 16, 364, and on Mar. 28 made his brother, Valens, emperor of the East, and proceeded himself to Italy. He was a man of military talent and a laborious and prudent administrator. He had natural eloquence, but no literary accomplishments. In his personal habits he was chaste and frugal, but had a violent temper, and was often cruel; one of his secretaries, who had defrauded a widow, he ordered seized in the circus and burnt alive in the arena. In spite of his passionate and impulsive temper, he was, nevertheless, tolerant, and even forbearing. He placed the cross and the name of Jesus Christ on the Roman standards, and forbade all judicial proceedings on Sundays, but he persecuted neither the Arians nor the pagans, and promulgated several constitutions to check the greediness of the Catholic clergy. During his reign Theodosius once more extended the Roman dominion in Britannia to the wall of the Antonines in 367, and put down the rebellion of Firmus in Africa in 370, while the emperor himself fought successfully against the Germanic tribes along the Rhine and the Danube. Treves was his favorite residence, but he died at Bregetio, near Presburg, Nov. 17, 375, while addressing with great vehemence an embassy from the Quadi. He was succeeded by his oldest son, Gratian, who, however, was compelled by the army at Bregetio to take his younger half-brother, Valentinian II., as co-emperor (375–392). Valentinian, who at that time was only four years old, remained at Milan under the tutelage of his mother, Justina, while Gratian carried on the government. After the death of Gratian in 383, Justina attempted to grasp the reins, but Maximus usurped the throne of Gratian in Gaul, Spain, and Britain, and in 387 he even crossed the Alps and marched against Milan. Valentinian and his mother fled to Thessalonica, but by the aid of the Byzantine emperor, Theodosius I., Maximus was finally overthrown and Valentinian reinstated. It was now Theodosius who actually ruled both in the Western and Eastern empires, and the first attempt the young emperor made to vindicate himself cost him his life. He was at Vienna in Gaul, and here he tried to dismiss Arbogast, a Frank, a captain in the Roman army, a rude and violent man, who held Valentinian in a sort of subjection; but Arbogast simply laughed at the emperor, and had him strangled the next day, May 15, 392.—Valentinian III. (425–455), a son of Constantius and Placidia, the sister of Honorius, was only six years old when his uncle, Theodosius II., emperor of the East, established him as emperor of the West. His mother, who governed in his name, was entirely under the control of the clergy, and the empire suffered severely from the rivalry between Bonifacius and Aëtius. In spite of the great military ability of the latter, who defeated Attila at Châlons-sur-Marne in 451, the West Roman empire now began to crumble. Most of Africa fell into the hands of the Vandals; Britain was entirely given up; Merida in Spain was taken by the Suevi, and along the Rhine and the Danube one strong outpost after the other was lost. In 450, Placidia died, and in 454 the emperor killed Aëtius with his own hand, jealous of his merits and afraid of his power. In the following year, however, Valentinian himself was murdered by Petronius Maximus on the field of Mars, in the midst of a great crowd which looked on with indifference.

**Valentin'ians,** a Gnostic sect founded by Valentinus, who descended from Egypt, lived in Alexandria and Cyprus, and taught in Rome from 140 to 160. Of all the Gnostic systems, that of Valentinus was the most elaborate and the most interesting, and it was still further developed by his pupils, among whom were Ptolemæus, Secundus, Heracleon, Axionicus, and others. In this system the great mythological apparatus which the Gnostics employed is spiritualized, and transformed into speculative elements, personifications of ideas, etc.; and with this character of the system it was natural that the Valentinians should enter into a much closer connection with the pagan religions than any of the other Gnostic sects, as they considered paganism not as an aberration of the human mind, but as a divinely-ordained preparative to Christianity. The principal source of knowledge of this sect is Irenæus, *Adversus Hæreses.*

**Valentinois,** Duchess of. See Diane de Poitiers.

**Va'lenza** [*Forum Fulvii Valentinum*], town of Northern Italy, province of Alessandria, pleasantly situated on an elevated plain on the right bank of the Po, N. of the city of Alessandria, was formerly a place of great strength, but its walls and fortifications were destroyed in 1805 by order of Bonaparte. It now contains 10 churches and other noticeable public and private buildings. The inhabitants are not deficient in agricultural and manufacturing industry, and popular education receives considerable attention. Valenza was a town of some importance under the Romans, and the sieges and other vicissitudes sustained by it during the Middle Ages form an interesting chapter in Italian history. P. 9630.

**Vale'ria Gens,** one of the oldest and most prominent patrician families of ancient Rome, was of Sabine extraction, and is said to have settled at Rome with Titus Tatius. It afterward spread into many branches—the Maximi, Volusi, Poplicolæ Potiti, Corvi or Corvini, Flacci, Messallæ, etc.; also into the *plebs.* It was still powerful and flourishing in the last days of the Empire. All through the history of Rome it occupied a conspicuous position, and its members, although belonging to the highest aristocracy, generally pursued a democratic policy. Several of the em-

perors bore its name—Maximinus, Maximianus, Maxentius, Diocletian, Constantius, and Constantine the Great. But it produced only one man who attained a truly national fame—MARCUS VALERIUS CORVUS, and his exploits have a somewhat mythical aspect. He received his surname, *Corvus*, a "raven," from his success in a combat with a giant Gaul, whom he slew by the aid of a raven which alighted on his helmet at the beginning of the fight, and flew in his adversary's face. He was afterward twice dictator and six times consul, and distinguished himself greatly in the wars with the Samnites, Marsi, and Etruscans in the fourth century B. C. The so-called *Lex Valeria de Provocatione*, which gave every citizen a right to appeal in all non-military cases from the verdict of the magistrates to the assembly of the people, was established in the first year of the Republic by Publius Valerius, who therefrom received the surname *Poplicola*, and it was renewed in 449 B. C. by Lucius Valerius Poplicola Potitus.

**Vale'rian,** a genus of plants of the natural order Valerianaceæ. The most important species is *V. officinalis*, the root of which is used in medicine. This plant, called also the "great wild valerian," is a native of Europe, but is cultivated also in this country, in Vermont, New Hampshire, and New York. It is an herbaceous perennial plant, the stem being erect and round, rising from two to four feet, and bearing small white flowers in terminal panicles. The fruit is a capsule containing a single oblong seed. The root consists of an upright root-stock about as thick as the little finger, from which spring numerous slender cylindrical rootlets about three or four inches in length. This root, though nearly odorless when fresh, develops a strong and peculiar smell upon drying. The taste is somewhat bitter, acrid, and disagreeable. The important ingredient of the drug is a pale greenish volatile oil (oil of valerian), which is present in the proportion of from 1½ to 2 per cent. This oil, when fresh, has but little smell, but on exposure it slowly acidifies, becomes yellow and thick, and acquires a strong valerian smell. There is thus developed a peculiar acid (valerianic acid), which when isolated is a colorless limpid fluid of strong smell and acrid taste. With salifiable bases this acid forms soluble salts, retaining to a certain degree the odor of the acid. The active principle of valerian root is the volatile oil. This, in experiments upon animals, is found to greatly deaden the reflex excitability of the spinal cord, thus antagonizing the operation of strychnine. Upon man, preparations of valerian sometimes reduce undue nervous irritability, and are therefore resorted to in affections characterized by this condition, such as hysteria, chorea, and milder forms of so-called "nervousness." The most elegant preparation is the ammoniated tincture, but the oil itself may also be used. The valerianates of ammonium, quinine, and zinc are officinal medicines, but their effect is inferior to that of the oil or preparations of the root. A curious property of valerian is the attraction of its smell for cats. These animals seem to snuff the plant from a long distance, and are said to be excited to a kind of frenzy by it, during which they display strong sexual excitement. EDWARD CURTIS.

**Vale'rian,** Roman emperor (253–260), descended from a noble Roman family; enjoyed great reputation both for ability and integrity; held the highest offices under Decius, and by the general consent of the army, the senate, and the people was elected emperor after the assassination of Æmilianus. The empire was in a dangerous state. The Franks had invaded Gaul and Spain. The Alemanni had crossed the Danube, and descended even into Italy. The Goths devastated Mœsia, and penetrated into Thrace and Macedonia, and in the East the Persians under King Sapor had conquered Mesopotamia and Syria. Valerian, who was over sixty years old, took his eldest son, Gallienus, as co-emperor, and sent him to Gaul, while he himself hastened to Syria. In the beginning he was successful, but at Edessa (in 260) he was completely defeated by Sapor, and taken prisoner. Gallienus did nothing to effect the liberation of his father, and the emperor died several years afterward in Persian captivity. After his death, his body was flayed and his skin stuffed, and this trophy was always exhibited when a Roman ambassador visited the Persian court.

**Valerianos** (APOSTOLOS). See FUCA, DE (JUAN).

**Vale'ric** (or **Valerianic**) **Acid** [*Delphinic Acid, Phocenic Acid, Butylcarbonic Acid;* Ger. *Baldriansäure*], ($C_5H_{10}O_2$), was first obtained in 1817 by Chevreul from the fat of a dolphin, *Delphinum phocæna*, and by Grote in 1830 from the essential oil of VALERIAN (which see). In the vegetable kingdom it occurs in the berries of *Viburnum opulus*, in the angelica-root, in the root of *Athamanta oreoselinum*, and in the bark of the elder tree; in the animal kingdom it is found in numerous animal oils and in the products of the oxidation of oleic acid and other fats. It is likewise contained in decayed cheese. The acid can be obtained by passing the vapor of fusel oil through a tube filled with a mixture of lime and soda, and heated to 400° F., and decomposing the sodic valerate produced by distillation with sulphuric acid; but the best method for its preparation consists in the oxidation of fusel oil, which is accomplished by gradually adding a mixture of the alcohol and concentrated sulphuric acid to a solution of potassic dichromate, and heating the liquid in a flask provided with an inverted condenser, after which the liquid is distilled, and the distillate neutralized with sodic carbonate. The amylic valerate contained in the distillate is next removed by distillation, and the residue of sodic valerate is dissolved in water and distilled with sulphuric acid, when a fluid passes over consisting of an aqueous solution of valeric acid mixed with a hydrated acid containing 1 equivalent of water, from which it can be separated by redistillation. Valeric acid forms a limpid, colorless oil, possessing a sour, burning taste and a powerful odor, resembling that of valerian-root, also like that of rancid cheese and butyric acid. It has a sp. gr. of 0.955 at 32° F. (*Kopp*), remains liquid at 0° F., and boils at 347° F., the density of its vapor being 3.66. If the active modification of amylic alcohol is used for its preparation, the resulting acid exerts a rotatory power on polarized light. Valeric acid is sparingly soluble in water, but dissolves in all proportions in alcohol and in ether; also in concentrated acetic acid. It unites with water, forming a definite hydrate, $C_5H_{10}O_2.H_2O$, which is also produced upon decomposing a valerate with strong sulphuric acid. This hydrate is also oily, but it possesses a lower boiling-point than the anhydrous acid. *Valeric anhydride* ($(C_5H_9O)_2O$) is obtained by treating dry potassic valerate with oxychloride of phosphorus ($POCl_3$). It forms a mobile oil, is not miscible with water, and possesses a pleasant odor of apples. When a mixture of calcic formate and valerate is submitted to dry distillation, *valeral* or *valeraldehyde* ($C_5H_8O$) is formed, this compound being also produced by the partial oxidation of amylic alcohol. Valeric acid is related to amylic alcohol in the same way as acetic acid is to ethylic or common alcohol, valeral being the compound corresponding to ordinary aldehyde. It is a monobasic acid, and forms neutral (also a few acid and basic) salts, which are obtained by direct saturation. The valerates are odorless when dry, but if moistened or treated with dilute sulphuric acid, they emit the characteristic and unpleasant odor of valeric acid; with the exception of argentic and mercuric valerates, they are soluble in water.

Valeric acid is separated from butyric acid by *fractional saturation—i. e.* half saturating the mixture of the two acids with soda, and distilling, only sodic valerate being at first formed. Besides the form of valeric acid just described, two other modifications have been obtained—one by the oxidation of normal amylic alcohol, the other from tertiary butylic alcohol. The zincic valerate has received some application in medicine as a remedy in nervous affections. J. P. BATTERSHALL.

**Valerius Flaccus** (CAIUS). See FLACCUS (CAIUS VALERIUS).

**Vale'rius Max'imus,** the name of a compiler of a large collection of historical anecdotes, *De Factis Dictisque Memorabilibus Libri IX.*, which is still extant. During the Middle Ages the book, which is not without value to the student of history and antiquities, was much read and highly esteemed; there were fourteen distinct editions of it before 1490. Critical editions have been given by Hase (Paris, 1822), Kempf (Berlin, 1854), and Halm (Leipsic, 1865). There is an English translation by W. Speed (London, 1678).

**Valet'ta,** capital of the island of Malta, on a rocky promontory of the north-eastern coast which forms two large, deep, and safe harbors. These harbors, as the whole city, are strongly fortified by lines of works, mostly hewn into the rock, and defended by forts, of which St. Elmo, on the extremity of the promontory, is the most important and deemed impregnable. On account of its harbors and fortifications, Valetta has been made the station of the English fleet in the Mediterranean, and it is regularly visited by all steamers crossing this sea. Thus, it became a point of great military and commercial importance, and although it has no manufactures and no natural resources, it is still increasing. It was founded in 1566 by the grand-master Valette, and contains in the cathedral and palace many interesting monuments from the times of the Knights of St. John. Together with its four suburbs, it has about 90,000 inhabitants.

**Valette', de la** (JEAN PARISOT), b. in 1494 at Toulouse, France; entered very early the order of St. John, and distinguished himself so much that in 1557 he was chosen grand-master of the order. In this position he fought the Turks with great effect, and finally roused the

wrath of the sultan Solyman to such a pitch that he determined to annihilate the order. Accordingly, a magnificent Turkish armament, consisting of 180 vessels of war and 30,000 select troops, Janizaries and Spahis, appeared off the coast of Malta before the fortifications of Valetta on May 18, 1565, and a most memorable siege began. La Vallette had between 8000 and 9000 men, but of these only 700 were knights; the rest were militia, the inhabitants of the island. With this force he resisted the furious attacks of the Turks for several months. On Sept. 8 the number of his men had dwindled down to 600, but on this day the viceroy of Naples arrived with reinforcements. The Turks embarked; once more, however, they returned, but were completely routed and driven off in wild disorder. The result of this event was a most severe check to the Turkish progress. La Valette died three years afterward in Valetta, Aug. 21, 1568.

**Valguarne'ra Carope'pe,** town of Sicily, province of Caltanisetta, delightfully situated in the Val di Noti, about 8 miles from Piazza Armerina. Behind it rise, amphitheatre-like, some of the loftiest peaks of the island, and the outlook upon the sea, between two promontories, is very lovely. The whole neighborhood offers views of rare grandeur and beauty. The principal products are grain and vines. P. 9524.

**Valhalla,** or **Walhalla.** See SCANDINAVIAN MYTHOLOGY and WALHALLA.

**Valhermo'sa,** p.-v. and tp., Morgan co., Ala. P. 1037.

**Va'li,** in Scandinavian mythology, a son of Odin and brother to Vidar, was destined in the popular faith to reappear in the new heavens which the All-Father should create after the fall of Walhalla, but remained in other respects a vague name, and received no distinct form in the popular imagination.

**Val'la** (LAURENTIUS), b. at Rome about 1410; was ordained priest in 1431; taught rhetoric and philosophy at Pavia and Milan, but had bitter controversies with the scholastic philosophers of the Aristotelian school; went to Naples, where he was treated with great kindness by King Alfonso V.; returned to Rome in 1443, but provoked the wrath of Pope Eugenius IV. by his *De Falso Credita et Ementita Constantini Donatione Declamatio;* fled to Naples, where he established a school, but fell out with the priests; was accused of heresy, and saved from death in the dungeons of the Inquisition only by the exertions of the king, who, however, could not prevent his being publicly whipped by the monks; was reconciled to Pope Nicholas V., who restored him as canon of St. John Lateran, and d. in Rome about 1460. He was one of the earliest and most ardent revivers of classical studies. His translations into Latin of Herodotus and Thucydides were eagerly read, and his *Elegantiæ Sermonis Latini* was for centuries the norm and rule for writing the Latin language. His collected works were published at Bâle in 1543. Erasmus published an edition of his *Annotationes* to the New Testament, which were considered heretical, and Ulrich von Hutten published his above-mentioned work on the donation of Constantine, and dedicated it to the pope. (See Vahlen, *Lorenzo Valla*, 1864.)

**Valladolid,** the former name of COMAYAGUA (which see), Honduras.

**Valladolid',** town of Spain, capital of the province of the same name, on the Pisuerga, communicates by the Duero and a vast system of canals with the Atlantic and the interior. It was formerly the capital of the Spanish empire, and adorned by Charles V. and Philip II. with many magnificent buildings. But after the removal of the royal residence to Madrid at the close of the sixteenth century, it fell into decay, and many of its buildings were much damaged by the French soldiery under the occupation in 1810. Of late, however, it has given signs of revival. Its manufactures of silk, yarn, perfumery, earthenware, paper, and leather have been enlarged and its trade has increased. Its university was founded in 1346, and was in 1841 attended by 1300 students. It is celebrated as a school of jurisprudence. P. about 50,000.

**Valladolid,** the former name of MORELIA (which see), Mexico.

**Valladolid,** town of the Mexican confederation, state of Yucatan, is in a healthy and fertile district, very rich in cotton, and is laid out and built in a grand style, though now it looks a little decayed. In the vicinity are many interesting remains of Indian edifices, and even ruins of whole cities. P. 10,000.

**Vallancey'** (CHARLES), LL.D., originally VALLENCE, b. in England in 1721; entered the army, in which he ultimately became a general of engineers; was quartered several years at Gibraltar, where he aided in strengthening the celebrated fortifications; resided for most of his life on engineer duty in Ireland, of which country he made an elaborate survey, and devoted himself to Irish antiquities and the Irish language. D. at Dublin in Aug., 1812. Author of two treatises on military engineering, *Collectanea de Rebus Hibernicis* (6 vols., 1770–1804), *An Essay on the Antiquity of the Irish Language, etc.* (1772), *A Grammar of the Iberno-Celtic or Irish Language, with an Essay on the Celtic Language* (1773), *An Essay towards illustrating the Ancient History of the Britannic Isles* (1786), *The Ancient History of Ireland proved from the Sanscrit Books of the Bramins of India* (1797), and issued a *Prospectus of a Dictionary of the Language of the Aire Coti, or Ancient Irish, compared with the Language of the Cuti or Ancient Persians, with the Hindostanee, the Arabic, and Chaldean Languages* (1802), a work which was never completed. Gen. Vallancey was one of the most obstinate of the numerous school of etymological antiquarians who founded theories of vast scope upon the resemblances of words.

**Vallan'digham** (CLEMENT L.), b. at New Lisbon, O., in 1822; studied law, and was admitted to the bar in 1842, was member of the Ohio legislature 1845–46; edited the Dayton *Empire* 1847–49, after which he devoted himself especially to politics. He was elected a representative in Congress in 1857, and re-elected for two subsequent terms. He was especially active in opposing the measures of the national government in carrying on the civil war. Failing of re-election in 1863, he returned to Ohio, where at public gatherings he assailed the government with great vehemence; was arrested by order of Gen. Burnside, who commanded in the department of the Ohio; tried by court-martial and sentenced to close confinement during the war —a sentence which President Lincoln commuted to banishment beyond the lines. Dissatisfied with his reception by the Confederates, he made his way to Canada, and while there was nominated by the Democratic party as governor of Ohio, but was defeated by more than 100,000 votes. He soon returned to Ohio, was not molested, and in 1864 was an active member of the national Democratic convention at Chicago. D. at Lebanon, O., by the accidental discharge of a pistol in his own hands, June 17, 1871.

**Vallau'ri** (TOMMASO), b. at Chiusa of Cuneo about 1805; took his degree in the University of Turin, and after the death of Carlo Boucheron was called to succeed him in the chair of Latin rhetoric, which he occupied with distinction till 1843; he wrote and spoke the Latin language with remarkable elegance. Among his works the following deserve to be mentioned: *Storia della Poesia in Piemonte* (1841), *Storia delle Università in Piemonte* (1846), *Historia Critica Literarum Latinarum*, besides his many inaugural orations. He was elected deputy to the Subalpine Parliament by the extreme Right or clerical party.

**Valle,** tp., Jefferson co., Mo. P. 2816.

**Valledol'mo,** town of Sicily, province of Palermo, pleasantly situated in a fertile valley of the Nettunei chain, but not in a thriving condition, from lack of roads. P. 7000.

**Valle'jo,** city and seaport of Solano co., Cal., on California Pacific R. R. and on an arm of San Pablo Bay, in lat. 38° 6′, lon. 122° 15′, has a spacious harbor, 6 churches, excellent schools, water and gas works, 2 daily and 1 weekly newspaper, 2 banks, an orphan asylum, 1 street railway, several flouring-mills, shipyards, iron-foundries and machine-shops, and broom manufactories. Large quantities of grain are shipped from this point. P. 6391.

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**Vallejo,** tp., Sonoma co., Cal. P. 1114.

**Vallelun'ga Pratamen'to,** town of Sicily, province of Caltanisetta, on the central high-road of the island, about 30 miles N. W. of the town of Caltanisetta. The pasturage of the district is good, and wine and oil are exported. P. 5200.

**Valley.** See EARTH, by PROF. GUYOT, PH. D., LL.D.

**Val'ley,** county of Central Nebraska, intersected by Loup Fork; surface rolling, soil fertile, consisting mainly of prairie-land. Newly formed and not organized. Cap. Ord. Area, 576 sq. m.

**Valley,** tp., Madison co., Ark. P. 743.
**Valley,** tp., Van Buren co., Ark. P. 224.
**Valley,** tp., Stark co., Ill. P. 1061.
**Valley,** tp., Page co., Ia. P. 636.
**Valley,** tp., Polk co., Ia. P. 715.
**Valley,** tp., Linn co., Kan. P. 1096.
**Valley,** tp., Nemaha co., Kan. P. 777.
**Valley,** tp., Guernsey co., O. P. 834.
**Valley,** tp., Scioto co., O. P. 724.

**Valley,** tp., Armstrong co., Pa. P. 1821.

**Valley,** tp., Chester co., Pa. P. 1165.

**Valley,** tp., Montour co., Pa. P. 1061.

**Valley,** tp., Preston co., West Va. P. 1131.

**Valley Brook,** p.-v. and tp., Osage co., Kan. P. 1539.

**Valley Falls,** p.-v., Pittstown tp., Rensselaer co., N. Y. P. 600.

**Valley Falls,** p.-v., Providence co., R. I.

**Val'leyfield,** p. v., Beauharnois co., Quebec, Canada, on the S. shore of the St. Lawrence, 42 miles above Montreal, near the Beauharnois Canal, has a splendid water-power, large paper-mills, and manufactories of woollens, pumps, lumber, etc., and a good trade. P. about 2000.

**Valley Forge,** tp., Montgomery co., Pa. P. 119.

**Valley Town,** p.-v. and tp., Cherokee co., N. C. P. 1030.

**Vallière, La.** See La Vallière.

**Vallisne'ri,** or **Vallisnie'ri** (Antonio), b. at Tresilico, near Modena, Italy, May 3, 1661; studied medicine at Bologna, and began in 1688 to practise as a physician at Reggio, but was in 1700 appointed professor of medicine at Padua, where he d. Jan. 18, 1730. He was a zealous defender of the principle *omne vivum ex ovo,* and his complete works, published in 1733 in 3 vols. fol. at Venice, contain several original investigations and experiments relating to the subject.

**Vallisne'ria** [named in honor of *Antonio Vallisneri,* an Italian botanist (1661–1730)], a genus of plants of the order Hydrocharidaceæ. *V. spiralis,* a plant common in slow waters in the U. S. and in the S. of Europe, is remarkable for its curious process of fecundation. The fertile or pistillate plants put up long, spirally-twisted flower-stalks, which allow the flowers to float upon the surface. But the male flowers are held to the bottom by their short stems. Accordingly, when the proper time for fertilization comes, the sterile or staminate flowers break their stems, rise, float upon the surface, and shed their pollen around the fertile flowers. The spiral stems of the latter (which are from one to four feet long) now contract and draw the fertilized germ under water, where it is perfected. Upon its roots the canvas-back duck feeds. Other species are found in Australia, etc.

**Val'lo della Luca'nia,** town of Southern Italy, province of Salerno, pleasantly situated on a hill 56 miles from the city of Salerno, is, in general, a well-built town, and the municipal palace and the Dominican convent, now public property, are worthy of notice. It is also a place of some industry and traffic. Vallo della Lucania occupies the site of an old Samnite city. P. 5050.

**Vallombro'sa** ("shady valley"), a former Benedictine monastery in a valley of the Apennines, 18 miles from Florence. It was founded by St. John Gualbert in 1039. The present noble buildings were erected in 1638. This ancient and celebrated establishment acquired great wealth, but in 1869 it was suppressed by the Italian government, which converted the buildings into a royal school of forestry (*instituto forestale*).

**Vallo'nia,** b., Crawford co., Pa. P. 462.

**Valls,** town of Spain, province of Tarragona, on the Francoli, manufactures soap, leather, paper, brandy, and yarn. P. 12,655.

**Valmore'** (Marceline Felicité Joséphe Desbordes), b. at Douai, department of Nord, France, in 1787; was educated in Guadaloupe; made her début on the stage as a singer after her return to France; married the tragedian Valmore in 1817; left the stage subsequently, and devoted herself to literature. D. at Paris July 7, 1859. She published several volumes of poems—*Elegies et Romances* (1818), *Elegies* (1824), *Pleurs* (1833), *Pauvres Fleurs* (1839); also several novels—*L'Atelier d'un Peintre* (2 vols., 1833), *Le Salon de Lady Betty* (2 vols., 1836). (See Sainte-Beuve, *Madame Desbordes-Valmore* (1870; translated into English by Harriet W. Preston, Boston, 1872).)

**Valmy',** village of France, department of Marne, is famous as the place where in 1792 the republican armies of France, under Kellerman, won the first skirmish against the allied armies under the duke of Brunswick.

**Valmy,** Duke of. See Kellermann.

**Valognes',** town of France, department of Manche, on the Morderet, manufactures lace and trades in butter, honey, wax, poultry, and eggs. P. 5812.

**Valois',** a part of the former province of France, Ile de France, corresponding nearly to the present department of Oise, formed under the Capet dynasty a countship in the possession of the house of Vermandois, but was incorporated with the French crown by Philip II. Augustus on the extinction of this family in 1215. In 1285, Philip III. gave the county of Valois to his younger son, Charles (b. 1270, d. 1325), and when the direct line of the Capet dynasty died out in 1328 with Charles IV., the eldest son of this Charles of Valois ascended the French throne under the name of Philip VI., and founded the dynasty of Valois, which ruled France to 1589. In direct succession from father to son the crown was borne by John the Good (1350–64), Charles V. (1364–80), Charles VI. (1380–1422), Charles VII. (1422–61), Louis XI. (1461–83), and Charles VIII. (1483–98). Charles VIII. having no male heirs, the crown fell to Louis XII. (1498–1515), the representative of the nearest collateral line, a grandson of Duke Louis of Orleans, the younger brother of Charles VI. As Louis XII. also died without male issue, the succession devolved once more upon a collateral line, and Francis I., a great-grandson of Duke Louis of Orleans, through his younger son, Charles of Angoulême, ascended the throne (1515–47). He was succeeded by his son, Henry II. (1547–59), who was married to Catharine de' Medici, and he again by his three sons—Francis II. (1559–60), Charles IX. (1560–74), and Henry III. (1574–89), with whom all the male lines of the house of Valois died out, and the French crown fell to the house of Bourbon, descending from Robert, the younger brother of Philip III., and represented by Henry IV., king of Navarre. The most prominent events during the reign of the house of Valois were the succession wars with England, the wars of conquest in Italy, and finally the civil or religious wars. Philip VI. ascended the throne, according to Salic law, as the nearest male heir of the Capet family, but his right was disputed by the English king, Edward III., who claimed the French throne for himself as a son of Isabel, daughter of Philip IV., arguing that the Salic law, although it excluded females from the succession, did not prevent them from transmitting a legitimate claim to their male heirs. The wars lasted a whole century. Charles VII. finally succeeded in driving the English out of the country, but the English kings continued to bear the title of kings of France up to George III. The Italian wars began under Charles VIII. with his conquest of Naples in 1495. Charles of Valois, the founder of the family, was first married to Margaret of Anjou-Sicily, by whom he obtained the counties of Anjou and Maine, and some very slender claims on the kingdom of the Two Sicilies. As his second wife he married Catharine of Courtenay, by whom he obtained some still thinner claims on the Byzantine empire, and he actually assumed the title of emperor of Constantinople. On the basis of these claims, Charles VIII., two centuries later, invaded Naples, and meditated an attack upon the Turks from thence. It was the idea of a world-empire, the ghost of the Roman empire, which haunted him. The three last kings of the house of Valois, the sons of Catharine de' Medici, were ruined, bodily and mentally, by their mother, who hoped thus to secure the supreme power to herself. Henry III. was the greatest fool of whom there exists any record. But the civil and religious wars were not the work of the Valois; they originated in Rome and the Escurial. The Holy League, which under the leadership of the family of Guise began open war in 1588, was formed and fed by Philip II. (For further details see the biographical articles on the various kings.)

**Valois, de** (Charles). See Angoulême, d', Duke.

**Valo'nia** [It. *vallonia*], the acorn-cups of *Quercus Ægilops,* a large oak tree of the Levant. Valonia is of a light drab color, and is exceedingly rich in tannic acid. It is imported from Trieste, Greece, and Smyrna, and largely employed by tanners and dyers.

**Valparai'so,** town of Chili, South America, capital of a province of the same name, is in lat. 33° 1′ S., on a large bay of the Pacific, sheltered on all sides except the N. Although it has suffered several times severely from earthquakes, and still more from the bombardment of the Spainards (in 1866), when property to the value of about $15,000,000 was wantonly destroyed, and although it is situated on a small strip of lowland surrounded by steep, barren mountains, where no tree, hardly any grass, will grow, still it is steadily increasing. It had 52,413 inhabitants in 1854, and at present it has about 110,000, of whom about 75,000 are natives, 15,000 Germans, 6500 British, 3750 French, 1500 Italians, etc. But its position as a commercial place is very favorable, being the only good harbor along the American coast of the South Pacific, and forming the only outlet from a vast territory of rich and productive land. It is connected with Santiago by a railway, and communicates with Hamburg by a German line of steamers—with Panama by an English and a Chilian. Gold, copper, lead, hides, and tallow are the principal articles of export. In 1873–74 its port was entered by 1585 vessels, of 973,090 tons burden, of which

611 were British, 276 Chilian, 161 Nicaraguan, 103 German, 101 French, 99 Guatemalan, 87 American, 46 Italian, etc. The educational and benevolent institutions of the city have increased with its commercial prosperity. There is an English, French, and U. S. hospital, attended by resident physicians. The most prominent public buildings are the government palace, the government warehouses, the custom-house, etc. Since 1866 a chain of forts has been constructed to protect the harbor.

**Valparaiso,** p.-v., cap. of Porter co., Ind., at the junction of Pittsburg Fort Wayne and Chicago and Chicago and Lake Huron R. Rs., 44 miles E. of Chicago, contains 8 churches, the Northern Indiana Normal School, 2 banks and a broker's office, 2 weekly newspapers, 1 large paper-mill, a pin manufactory, iron-foundry and machine-shops, and 3 hotels. Principal business, manufacturing and farming. P. 2765.

E. ZIMMERMAN, ED. "MESSENGER."

**Val'py** (ABRAHAM JOHN), son of Dr. Richard, b. at Reading, England, about 1787; educated under his father and at Pembroke College, Oxford; commenced business in London as a publisher and bookseller about 1808; was the publisher of several of the works of his uncle Edward and of his brother Frederick; originated the *Classical Journal* (1810), and the *Museum* (1822–25); brought out Barker's edition of Stephens's *Thesaurus* (8 vols., 1815–25); edited the Delphin and Variorum classics (141 vols., 1819–30), the *Family Classical Library, a Series of English Translations*, etc. (52 vols., 1830–34), a magnificently illustrated *Shakspeare* (15 vols., 1832–34), and successfully conducted many other literary enterprises of considerable magnitude. D. at London Nov. 19, 1854.

**Valpy** (EDWARD), D. D., brother of Dr. Richard, b. in the island of Jersey in 1764; educated at Trinity College, Cambridge; took orders in the Church of England; was for many years assistant to his brother in the classical department of Reading School; became head-master of the grammar school at Norwich 1810; held the rectory of Thwaite and the vicarage of St. Mary's, Walsham, Norfolk. Under his management Norwich School attained a high degree of prosperity. D. at Yarmouth Apr. 15, 1832. He published *Elegantiæ Latinæ* (1803) and editions of the Greek Testament (3 vols., 1816), the Septuagint (1819), and Homer's *Iliad* (1819).

**Valpy** (RICHARD), D. D., F. R. S., b. in the island of Jersey Dec. 7, 1754; educated at the college of Valognes, Normandy, 1764–69, and at the Southampton grammar school; obtained one of the scholarships founded at Pembroke College, Oxford, for natives of Jersey and Guernsey; graduated there about 1776; took orders in the Church of England; held for several years a living at Bury St. Edmund's; became rector of Stradishall, Suffolk, 1787; and from 1781 to 1830 was the highly-successful head-master of the celebrated school founded at Reading by Henry VII., and composed for that institution Latin and Greek grammars and a series of classical textbooks which enjoyed a wide reputation. D. at Kensington, Mar. 28, 1836.—He was succeeded in the head-mastership by his youngest son, REV. FREDERICK E. J. VALPY, b. about 1805, a graduate of Trinity College, Cambridge, and author of numerous classical textbooks, among which are an *Etymological Dictionary of the Latin Language* (1828), and *Etymology of Words of the Greek Language in Alphabetical Order* (1860).

**Val'ue** [Fr. *valeur;* Sp. *valor*, from Lat. *valere*, to "be strong," to "have influence," to "be worth"]. In ordinary usage, the word expresses that quality of a thing which makes it desirable. But the term is here introduced as a technical term of modern political economy, and so to be considered. It holds so important a place in that science that political economy has been called the "*science of values.*" Ambiguity in the use of this term leads to much confusion of ideas on economical problems; hence the necessity of a strict definition, to be closely adhered to. Value is *purchasing power—i. e.* as applied to any object, *that which gives it power to command other objects in exchange.* It supposes always a comparison of two objects in view of an exchange actual or contemplated. Hence it is not, like weight, an absolute inherent quality of a substance. It cannot be discovered by examining an article by itself. Value is always a relative term, and the measure of it pertaining to anything can be expressed only by naming some other thing for which it can be exchanged—the *quid pro quo.* Thus, the value of a hat may be set down at four bushels of wheat or a quarter of an ounce of gold, because it will command so much of one or the other in exchange.

Value should be distinguished from *price.* Price is value with reference to a single article—viz. money. Value is the power to command commodities generally. Money is made the general standard of value, and so value may be indicated by a comparison of prices; but it is important to observe the distinction between the two terms. The value of a specific commodity may rise or fall. Thus, the hat, which brought four bushels of wheat last year, may bring but three this year. To discover which of the two has changed in value, the causes affecting one or the other must be inquired into. It may be that a failure of crops has enhanced the value of the wheat, or that some new invention, cheapening the process of manufacturing, has lessened the value of the hat. But there can be no general rise or fall of all values. There may be, however, a general rise or fall of prices in consequence of some cause, like an expansion or contraction of currency, which affects money, the one object with which all things are compared. (See MONEY.)

Value should also be distinguished from *utility.* Utility is simply adaptedness to satisfy a want or gratify a desire. Things that have value have always utility in the sense of capacity to gratify desire, without reference to the quality of the desire as right or wrong, wise or foolish. The power of a commodity in exchange is measured by its desirableness. But some things of the very highest utility have no value; as, for instance, air, sunlight, water. We cannot live without them, yet they have no value, no purchasing power, simply because the supply is so large and so free that whosoever will may take to his satisfaction without labor. They cost nothing, and they cannot ordinarily be appropriated in exclusive possession.

With these distinctions in mind it is plain that value may be resolved into two elements: (1) Utility—*i. e.* desirableness for gratification; (2) cost—*i. e.* difficulty of attainment, measured by the amount of labor necessary to secure the object. Recognizing the presence of these two elements, we have the limits of value defined. The *maximum limit* of value in any commodity is its utility; that is, its purchasing power is determined by the intensity of desire for its possession by the parties to the exchange. This will depend on a variety of circumstances, such as the taste of individuals, the fashion of the day, the emergency of the hour, and the like. The value may, and often does, fall short of this limit, but can never go beyond it. We seldom give for a loaf of bread an equivalent which expresses the measure of its utility to support life; and when a man is willing to give 10,000 bushels of wheat for a choice diamond, he expresses only the intensity of his desire for the glittering gem.

The minimum limit of value in any article, for any long time, is the cost—*i. e.* the exponent of the labor either actually expended in its production or which must be expended for its reproduction. When the market value of a commodity falls permanently below its cost, its production will be suspended. If, however, there is reason to believe that its value will rise again, it may be good economy to tide over the temporary depression by exchanging at a rate less than cost. In the last analysis, the comparison is of labor with labor, and it is true, as has been said, that "service for service, rather than commodity for commodity, is the rule of value and the law of exchange." Between these two limits there is room for a considerable variation, which is determined by the *law of supply and demand.* Concisely stated, the rule is, That value increases directly as the demand, and inversely as the supply. Monopolies artificially limit supply for the purpose of increasing value. Thus, it is said that the Dutch, who had a monopoly of the trade in pepper, once actually destroyed a part of an extraordinary crop rather than permit the market-price to be lowered. Reduced value extends demand, and enhanced value restricts demand, quite beyond the mere ratio of the change. A thousand people will use cotton cloth at 10 cents a yard, where a hundred would use it at 50 cents. When left free from artificial interference, demand and supply rush toward an equilibrium; and the condition of stable equilibrium is that things exchange for each other according to the cost of production, or, as some express it, according to their *natural value.* Formerly, a distinction was made between *exchangeable* value and *intrinsic* value. Strict adherence to our definition does away with that distinction, for it resolves real value always into power in exchange, and what was meant by intrinsic value is best expressed by the word *utility.*

The term *value* is applicable to services as well as to commodities; indeed, as we have seen, it always carries with it an idea of service or labor. But most commonly a contract for service is made with reference to some material objects to be produced which fitly represent the service. We must, however, recognize an exception in the case of certain immaterial products. An hour's service of song by a Nilsson or a Jenny Lind will command $1000—equal to more than a year's salary of many a hard-worked man—yet we have no tangible product to carry away from the

entertainment. Here the gratification is instantaneous, coincident with the service rendered, yet an object of intense desire with those who have a taste for music. Still, the standard of value is the cost, estimated not by the effort of the singer for the hour, but by the long labor of training which has perfected her wonderful capacity, and by the difficulty of finding another with equal power, natural and acquired, to impart the gratification. A. L. CHAPIN.

**Valve** [Lat. *valvæ*, "folding doors"], a cover to an aperture, so formed as to open communication in one direction and to close it in the other, by lifting, sliding, or turning. Among the varieties of valves employed in mechanics are the *slide* or *sluice valve*, where the orifice is opened by drawing up a plate; the *flap valve*, which opens and shuts like a door; the *pot-lid valve*, where the orifice is closed by shutting down upon it a disk of metal; the *ball valve*, where the orifice is closed by a ball; and the *throttle valve*, where a disk of metal turning on a spindle passing through its edge may be made to stand across a pipe, and so close the opening. (For descriptions of some valves see PUMP, PUMPING ENGINE, and STEAM-HAMMER. For safety-valve see STEAM-ENGINE. For the valves of the circulation, see HEART, HUMAN, and VEINS, ANATOMY OF.)

**Valver'de del Cami'no,** town of Spain, province of Huelva, situated among the spurs of the Sierra Morena, is the centre of a rich mining district. P. 5460.

**Vam'bery** (ARMINIUS (HERMAN)), b. at Szerdahély in the Danubian island of Schütt, near Presburg, Hungary, in 1832, of Jewish parentage; studied languages at Presburg, Vienna, and Pesth; went to Constantinople, where he supported himself by teaching French; published in 1858 a Turkish-German pocket dictionary; undertook in 1862, with the support of the Academy of Pesth, an extensive journey of exploration through Persia into Turkestan; visited Khiva, Bokhara, and Samarcand, and was appointed professor of Oriental languages at the University of Pesth in 1865. He wrote *Cagataische Sprachstudien* (1867), *Uigurische Sprachmonumente und das Kudatku-Bilik* (1870), *Magyartörök szohasonlatok* (1870), a comparison of Hungarian and Turkish words, besides a number of travelling sketches published simultaneously in German and English—*Travels in Central Asia* (1865), *Wanderings and Adventures in Persia* (1867), *Sketches of Central Asia* (1868), *History of Bokhara or Transoxiana* (1873), *Central Asia and the Anglo-Russian Frontier Question* (1874), and *The Islam in the Nineteenth Century* (1875).

**Vam'pire** [Fr.], according to a superstition still existing among the lower classes in Hungary, Servia, Romania, and the Christian population of the Balkan peninsula, a kind of ghost which during the night leaves the grave and maintains a semblance of life by sucking the warm blood of living men and women. It is probable that this superstition originated from the ancient myth of the *lamiæ*, beautiful women who enticed young men into their embrace, and then sucked their life-blood; but it was much strengthened by the belief, common in the Middle Ages all through the Greek Church, that the bodies of those who died under the ban of the Church were kept alive by the devil, and by him sent out to ruin their friends and relatives. In the first part of the eighteenth century a vampire panic fell over Servia and Hungary, and spread thence into Germany. Books were written *pro et contra*, and thousands of graves were opened, and corpses which looked suspicious were fastened with nails and bolts to the ground, that they should not wander any more. Among the Wallachs it is still customary to drive a nail through the head of the corpse into the bottom of the coffin.

**Vampire Bat.** See BAT.

**Van,** town of Asiatic Turkey, in Armenia, in lat. 38° 30′ N., lon. 43° 40′ E., on the shore of Lake Van, a large salt-water lake covering an area of about 1500 sq. m., and receiving several minor streams, though it has no outlet itself. The town is ill built and surrounded with dilapidated walls. Its bazaars, however, are well stocked with the products of the surrounding fertile plain, and it has some manufactures of coarse cotton fabrics. It also contains some interesting ruins with cuneiform inscriptions. P. estimated at from 12,000 to 35,000.

**Vana'dium,** one of the elements of matter, a very interesting metal, named after the Scandinavian myth *Vanadis*. It was first discovered in 1801 by the chemist Del Rio in a Mexican lead ore, now called *vanadinite*, and named by him *erythronium;* but erythronium was for twenty-nine years a doubtful element, being imagined by many chemists, *including its discoverer*, to be identical with *chromium*. In 1830, Sefström, however, found it again in some commercial metallic iron, and called it *vanadium*—a name which still stands, the original name having been, somewhat unaccountably, altogether abandoned. Wöhler first pointed out that Sefström's supposed new element was the erythronium of Del Rio. Just as happened in the case of URANIUM (which see), for a long time the lowest oxide of vanadium was mistaken for the metal itself, and it is only within a few years that the English chemist Roscoe discovered that this supposed metal was the protoxide $V_2O_2$—a discovery which changed the whole aspect of this element and of its chemical relations, developing the fact that vanadium is one of the relatives (chemically speaking) of phosphorus and arsenic, and, like these, is a *pentad* in its chemical equivalency with oxygen.

Vanadium occurs as an essential constituent of several mineral species, *dechenite* and *descloizite* being vanadates of lead, *vanadinite* being chloro-vanadate of lead, similar in constitution to *pyromorphite* and *apatite*, *volborthite* being a hydric vanadate of copper, *chileite* a vanadate of lead and copper, and others. An ochreous mineral has been found associated with the native copper of Lake Superior, which has been pronounced to be vanadic acid, $V_2O_5$, but this requires confirmation. Two new American localities of vanadium minerals have, within the year 1876, been announced by our eminent American chemist and mineralogist, Genth of Philadelphia. One is at Granite Creek, El Dorado co., Cal., in a gold-mine. Here Dr. James Blake of San Francisco found a dark-green *mica*, which he supposed to contain chromium largely, but Dr. Genth at once recognized the chromium as vanadium, and this new and interesting vanadic mica has hence been named *roscoelite*, by Dr. Blake its discoverer, after the chemist Roscoe. Dr. Genth found in it 20 to 23 per cent. of an oxide of vanadium, approaching to the composition $V_6O_{11}$, conjectured by Dr. Genth to be possibly $2V_2O_3.V_2O_5$. The other locality of Dr. Genth is at the Iron Rod Mine, Silver Star district, Mont., where a new hydric vanadate of lead and copper was recognized and analyzed by him, which he names *psittacinite*. Other Montana gold-mines furnish the same mineral. Recently, two other American chemists have announced important discoveries regarding vanadium and its distribution on this continent. Dr. A. A. Hayes of Boston claims to have detected this metal in waters and some common soils, and considers that its distribution may be found to be as wide and general as that of the related element phosphorus. Dr. Isidor Walz also announced very recently that he has discovered the presence of vanadium in almost all the magnetic iron ores of this country, and suggests that, like phosphorus, it may have an effect upon the qualities of the iron made therefrom. Dr. Walz announces that titanic acid and vanadic acid are generally concomitant in iron ores, and that Dr. König of the University of Pennsylvania has also observed this same fact.

Metallic vanadium was obtained by Roscoe by long-continued ignition of the dichloride $VCl_2$, in hydrogen gas, as a metallic powder of a grayish-white color. Its equivalent weight is cited by some as 51.2, by others 51.3. Roscoe's density for the metal at 15° C. is 5.5. The writer's new geometric law of condensation, with the molecular diameter 21 for vanadium, computes for the zero-density, with equivalent, 51. = 5.507, with equiv. 51.2 = 5.528, with equiv. 51.3 = 5.539, with equiv. 51.5 = 5.561. (See VOLUMES, MOLECULAR.) Though insoluble in muriatic acid, it decomposes boiling water. It burns splendidly in oxygen to vanadic pentoxide, $V_2O_5$. Nitric acid dissolves it readily to a blue solution.

*Compounds of Vanadium.*—It forms five oxides, in exact parallelism with those of nitrogen—$V_2O$, $V_2O_2$, $V_2O_3$, $V_2O_4$, $V_2O_5$. $V_2O$ is brown, formed by oxidation of the metal in air at dull redness. $V_2O_2$ is the compound which Berzelius, and all before Roscoe, thought to be the metal itself. It may be obtained by the reduction of higher oxides with potassium. It is a lustrous gray metalloidal powder, density at 20° = 3.64, according to Schafarik. $V_2O_3$ may be formed by igniting $V_2O_5$ in hydrogen; black and infusible; conducts electricity; pyrophoric when warmed, burning to pentoxide; insoluble in acids; density by Schafarik at 16° = 4.72. $V_2O_4$ may be formed, by slow spontaneous oxidation of the previous compound, in shining blue crystals. Density undetermined; soluble in acids with blue color, forming a corresponding series of salts called *vanadious* salts.

$V_2O_5$, *Vanadic Oxide, Divanadium Pentoxide.*—The native lead vanadates may be used for the preparation of this compound by solution in nitric acid, precipitation of lead and arsenic by sulphuretted hydrogen, filtering and evaporating the blue liquid (containing vanadious nitrate, produced by the reducing action of the $H_2S$) to dryness, during which $V_2O_5$ is reproduced, and may be dissolved out from the residue with ammonia. Solid sal-ammoniac added to this solution causes *ammonia-vanadate* to deposit as a white powder, insoluble in the sal-ammoniac. This on ignition leaves pure vanadic oxide. It has a reddish-yellow color, and is

slightly soluble in water—1000 times its weight—to a yellowish solution. Acids dissolve it, and some form with it crystalline compounds. It combines also with bases, forming vanadates. Its density, according to Schafarik, at 21° = 3.51. The new geometric law (equiv. V = 51.5) requires 3.525 at 0°. Vanadates exist, corresponding to the phosphates, of three or more different degrees of basicity (see under the head PHOSPHORIC ACIDS, by HENRY WURTZ), although the only hydrogen-salt or vanadic acid known is dibasic, or corresponds to metaphosphoric acid, being $O_6V_2H_2.H_2O$.

*Chlorides of Vanadium.*—$VCl_2$, $VCl_3$, and $VCl_4$ are known. The last is formed by the action of chlorine on the metal as a dark yellowish-brown liquid. Roscoe's density at 0° = 1.8584. The others are obtained from the tetrachloride, and are solid and crystalline, of much higher densities, that of $VCl_2$ being 3.23 at 18°, indicating entirely different molecular structure. (See VOLUMES, MOLECULAR.) There are several interesting oxychlorides and an oxybromide known, as in the case of phosphorus. Two sulphides of vanadium, $V_2S_4$ and $V_2S_5$, are known. Roscoe proposed to regard the vanadium compounds as containing a compound radical, VO, *vanadyl*, similar to the assumed *phosphoryl*, PO, of the hydroxyl school of chemical theorists. (See SALT-RADICALS.) This hypothesis remains to be fully tested by the only possible mode, investigation of relations of molecular-volumic condensation.

HENRY WURTZ.

**Vanbrugh'** (Sir JOHN), b. probably in Chester, England, in 1666, was of Flemish descent; received a liberal education, partly in France; entered the French army as ensign, and rose to the rank of captain; became in 1695 secretary to the commission for completing Greenwich Hospital; devoted himself to literature and to the profession of an architect; brought out with great success the comedies *The Relapse* (1697) and the *Provoked Wife* (1698), which exposed him to the charge of indecency and profanity strongly pressed by Jeremy Collier; wrote, in consequence, his highly moral comedy *Esop* (1699), afterward recast by Garrick; produced an adaptation of Fletcher's *Pilgrim* (1700); made in 1702 the architectural designs for Castle Howard, Yorkshire, the seat of the earl of Carlisle; became Clarencieux king-at-arms 1703; undertook, in connection with Congreve and the actor Betterton, the construction of a large theatre in the Haymarket (1705), which proved a failure from defective acoustic properties; was for a short time manager of the Haymarket; produced there, with indifferent success, his *Confederacy* (1705), a witty but highly immoral comedy, and three adaptations from Molière; was the architect of the palace of Blenheim, built by order of Parliament for the duke of Marlborough—a task which occupied him for several years (1706–15) and involved him in a quarrel with the duchess; built several edifices of minor importance; was knighted and made comptroller of the royal works 1714, and surveyor of the works at Greenwich Hospital 1716. D. at London Mar. 26, 1726. His last play, left unfinished, *The Journey to London*, was completed by Colley Cibber under the title *The Provoked Husband*. His plays are admitted to be well written and to contain life-like pictures of the times, but are ill adapted to modern ideas of decency. They were edited with a biographical notice by Leigh Hunt, in connection with the plays of Congreve, Wycherley, and Farquhar (London, 1840), a volume which gave occasion to Macaulay's characteristic essay on *The Comic Dramatists of the Restoration*.

**Van Bu'ren,** county of Central Arkansas, intersected by Little Red River; surface undulating and well timbered, soil fertile. Swine, cattle, and sheep are the chief live-stock. Staples, lumber, Indian corn, wool, and tobacco. Cap. Clinton. Area, 1260 sq. m. P. 5107.

**Van Buren,** county of S. W. Iowa, bordering on Missouri, intersected by Fox and Des Moines rivers, the latter being navigable by steamboats during the greater part of the year, and traversed by Des Moines Valley R. R.; surface level, timber-land and prairies alternating; soil very productive. Bituminous coal is abundant. There are woollen-mills and flour-mills, and manufactories of carriages, agricultural implements, stone and earthen ware, and paper. Sheep, cattle, horses, and swine are numerous. Staples, Indian corn, wheat, oats, wool, and dairy products. Cap. Keosauqua. Area, 468 sq. m. P. 17,672.

**Van Buren,** county of S. W. Michigan, bordering on Lake Michigan, drained by several rivers and traversed by Central Michigan and Chicago and Michigan Lake Shore R. Rs.; surface level, soil fertile and well timbered. There are saw-mills, flour-mills, wood-turning and carving establishments, tanneries and currying establishments, manufactories of carriages, pig iron, and iron castings. Live-stock of all kinds, especially sheep, is numerous. Staples, Indian corn, wheat, oats, potatoes, wool, lumber, and dairy products. Cap. Paw Paw. Area, 633 sq. m. P. 28,829.

**Van Buren,** county of Central Tennessee, drained by the Caney fork of Cumberland River; surface mountainous, soil moderately productive, abounding in bituminous coal. Swine are the principal live-stock. Staples, Indian corn, wool, tobacco. Cap. Spencer. Area, 350 sq. m. P. 2725.

**Van Buren,** p.-v. and tp., cap. of Crawford co., Ark., on Arkansas River and Little Rock and Fort Smith R. R., has a newspaper. P. of v. 985; of tp. 3296.

**Van Buren,** tp., Newton co., Ark. P. 319.
**Van Buren,** tp., Union co., Ark. P. 1032.
**Van Buren,** tp., Brown co., Ind. P. 2048.
**Van Buren,** tp., Clay co., Ind. P. 3323.
**Van Buren,** tp., Daviess co., Ind. P. 1172.
**Van Buren,** tp., Fountain co., Ind. P. 522.
**Van Buren,** p.-v. and tp., Grant co., Ind. P. 1110.
**Van Buren,** tp., Kosciusko co., Ind. P. 1467.
**Van Buren,** tp., La Grange co., Ind. P. 1347.
**Van Buren,** tp., Madison co., Ind. P. 874.
**Van Buren,** tp., Monroe co., Ind. P. 972.
**Van Buren,** tp., Pulaski co., Ind. P. 972.
**Van Buren,** tp., Shelby co., Ind. P. 1194.
**Van Buren,** p.-v. and tp., Jackson co., Ia. P. 1155.
**Van Buren,** tp., Keokuk co., Ia. P. 1031.
**Van Buren,** tp., Lee co., Ia. P. 956.
**Van Buren,** tp., Van Buren co., Ia. P. 2455.
**Van Buren,** tp., Wayne co., Mich. P. 1970.
**Van Buren,** p.-v., cap. of Carter co., Mo.
**Van Buren,** tp., Jackson co., Mo. P. 2036.
**Van Buren,** tp., Newton co., Mo. P. 1288.
**Van Buren,** p.-v. and tp., Onondaga co., N. Y. P. 3038.
**Van Buren,** tp., Darke co., O. P. 1212.
**Van Buren,** p.-v. and tp., Hancock co., O. P. 780.
**Van Buren,** tp., Montgomery co., O. P. 2600.
**Van Buren,** tp., Putnam co., O. P. 1350.
**Van Buren,** tp., Shelby co., O. P. 1381.
**Van Buren,** tp., Hardeman co., Tenn. P. 661.

**Van Buren** (JOHN), second son of Pres. Martin Van Buren, b. at Hudson, N. Y., Feb. 18, 1810; graduated at Yale College in 1828; studied law, and was admitted to the bar in 1830. In 1832 he attended his father, who had been appointed minister to England; was attorney-general of New York 1845–47, and in 1848 took an active part in the Presidential canvass, his father being an unsuccessful candidate for the Presidency. After this he devoted himself wholly to his profession. In May, 1866, he left New York for a European tour, travelling in Sweden, Norway, Russia, and Scotland. D. at sea, while on his way home, Oct. 13, 1866.

**Van Buren** (MARTIN), the eighth President of the U. S., b. at Kinderhook, N. Y., Dec. 5, 1782. He began the study of law at the age of fourteen, and took an active part in politics before he had reached the age of twenty; in 1812 was elected to the State senate; was attorney-general 1815–19, and in 1816 a State senator for a second time. In 1818 he became a member of a small clique of politicians known as the "Albany regency," which held control of the State for a score of years; the other most prominent members being Benjamin F. Butler, Edwin Croswell, and William L. Marcy. In 1821 he was chosen a member of the convention for revising the State constitution, in which he advocated an extension of the franchise, but opposed universal suffrage, and also favored the proposal that colored persons in order to vote should have freehold property to the amount of $250. In this year he was also elected U. S. Senator, and at the conclusion of his term, in 1827, was re-elected, but resigned in the following year, having been chosen governor of the State. In Mar., 1829, he was appointed by Pres. Jackson secretary of state, but resigned in Apr., 1831, and during the recess of Congress was appointed minister to England, whither he proceeded in September. The Senate, when convened in December, refused to ratify the appointment, mainly on the ground that Mr. Van Buren, while secretary of state, had foisted our domestic party questions into his foreign diplomacy. In May, 1832, he was nominated as the Democratic candidate for Vice-President, and elected in the following November. In 1836 he was elected President, receiving 170 electoral votes out of 283, Gen. W. H. Harrison receiving 73, Hugh L. White 26, and Daniel Webster 14. The opening of his administration was at a time of

severe financial difficulty, which resulted in the suspension of specie payments by the banks, and the President urged the adoption of the independent treasury system, which was twice passed in the Senate and defeated in the House, but finally became a law near the close of his administration. Another important measure was the passage of a pre-emption law, giving actual settlers the preference in the purchase of public lands. The question of slavery now began to assume great prominence in national politics, and after an elaborate anti-slavery speech by Mr. Slade of Vermont in the House of Representatives, the Southern members withdrew for a separate consultation, at which Mr. Rhett of South Carolina proposed to declare it expedient that the Union should be dissolved; but the matter was tided over by the passage of a resolution that no petitions or papers relating to slavery should be in any way considered or acted upon. In the Presidential election of 1840, Mr. Van Buren was nominated without opposition as the Democratic candidate, William H. Harrison being the candidate of the Whig party. The Democrats carried only seven States, and out of 294 electoral votes only 60 were for Mr. Van Buren, the remaining 234 being for his opponent. The Whig popular majority, however, was not large, the elections in many of the States being very close. In 1844, Mr. Van Buren was proposed as the Democratic candidate for the Presidency, and a majority of the delegates to the nominating convention were in his favor, but owing to his opposition to the proposed annexation of Texas he could not secure the requisite vote of two-thirds; his name was at length withdrawn by his friends, and Mr. Polk received the nomination, and was elected. In 1848, Mr. Cass was the regular Democratic candidate; a schism, however, sprang up in the party upon the question of the permission of slavery in the newly-acquired territory, and a portion of the party, taking the name of "Free-Soilers," nominated Mr. Van Buren; they drew away sufficient votes to secure the election of Gen. Taylor, the Whig candidate. After this, Mr. Van Buren retired to his estate at Kinderhook, where the remainder of his life was passed, with the exception of a European tour in 1853–55. D. at Kinderhook July 24, 1862. He left a MS., which was edited and published by his sons, entitled *An Inquiry into the Origin and Course of Political Parties in the United States* (1867).

A. H. GUERNSEY.

**Van Buren Plantation,** tp., Aroostook co., Me. P. 922.

**Vance,** tp., Vermilion co., Ill. P. 1542.

**Vance** (JOSEPH), b. in Washington co., Pa., Mar. 21, 1786; went at an early age, with his father, to Kentucky, and afterward to Urbana, O.; was successfully engaged in mercantile pursuits, and subsequently became a farmer and stock-raiser upon a large scale; was a member of the State legislature 1812–16; Representative in Congress 1821–35, and again 1843–47, serving as chairman of the committee on claims; and governor of Ohio 1836–38; was also major-general of militia. D. near Urbana, O., Aug. 24, 1852.

**Vance** (ZEBULON B.), b. in Buncombe co., N. C., May 13, 1830; received mainly a common-school education, although he spent a single year at the University of North Carolina; studied law, and was admitted to the bar in 1853; and in 1854 was elected to the State legislature; in 1858 was elected a Representative in Congress, to fill a vacancy occasioned by the resignation of Mr. T. L. Clingman, and was re-elected in 1859. He was governor of North Carolina at the time of its secession, to which he was originally opposed, although he afterward took an active part in it; in 1870 was elected to the U. S. Senate, and re-elected governor in Nov., 1876.

**Vance'boro Plantation,** tp., Washington co., Me. P. 329.

**Vance'burg,** p.-v., cap. of Lewis co., Ky., on Ohio River, 20 miles S. W. of Portsmouth (O.), has 3 churches, 2 seminaries, a fine court-house, 1 weekly newspaper, 3 manufactories of hubs, spokes, and staves, 1 flouring and feed mill, and an extensive tannery. It is an important shipping-point, and good timber abounds. P. 513.

SAMUEL J. PUGH, ED. "KENTUCKIAN."

**Vance's,** tp., Orangeburg co., S. C. P. 822.

**Van Cleve** (HORATIO PHILLIPS), b. at Princeton, N. J., Nov. 23, 1809; graduated at West Point in 1831; was appointed second lieutenant, but resigned in 1836, and became a farmer and civil engineer in Michigan, and afterward in Minnesota; in July, 1861, was made colonel of volunteers, led his regiment at the battle of Mill Spring, and was made brigadier-general Mar. 21, 1862; commanded a brigade at Corinth, and subsequently a division. He bore a distinguished part in the battle of Stone River, where he was wounded; was engaged in several other battles, notably at Chickamauga; was in command at Murfreesboro' 1863–65, and in 1866 was appointed adjutant-general of Minnesota.

**Van Cort'landt** (PHILIP), b. in New York Sept. 1, 1749; became a land-surveyor, and at the opening of the Revolutionary war was made lieutenant-colonel, and subsequently colonel. He served at the battle of Stillwater, and against the Indians on the frontier in 1778; commanded a regiment under La Fayette, and was made brigadier-general for gallant conduct at the siege of Yorktown. He was a member of the New York house of representatives 1788–90, of the State convention of 1788 by which the Constitution of the U. S. was adopted, State senator 1791–94, and Representative in Congress 1793–1809. The latter part of his life was spent at his manor in Westchester co., N. Y. He was appointed to accompany La Fayette in his tour through the U. S. in 1824. D. at Croton, Westchester co., N. Y., Nov. 5, 1831.

**Van Cortlandt** (PIERRE), brother of Philip, b. in 1720; was a member of the first provincial congress, and of the committee which framed the constitution of the State; president of the senate and the first lieutenant-governor of the State of New York 1797–1805. D. at Cortland, N. Y., May 1, 1814.

**Vancouver,** p.-v., cap. of Clarke co., Wash. Ter.

**Vancou'ver** (GEORGE), b. about 1758; entered the British navy as midshipman in 1771; was with Cook in his first and second voyages (1772–75 and 1776–80); was made first lieutenant in 1780, and served in the West Indies until 1789. In 1790 he was put in command of a small squadron sent to take possession of Nootka, being also charged to ascertain if there was between the parallels of 30° and 60° N. lat. any water-communication between the Pacific and Atlantic oceans. He sailed in the Discovery Apr. 1, 1791, and after touching at the Sandwich Islands, crossed in Mar., 1792, to the American coast; received from the Spanish commandant the formal surrender of Nootka, and passed the three summers of 1792–94 in surveying the coast as far N. as Cook's Inlet, lat. 58°–61°, wintering at the Sandwich Islands, and convinced himself that no N. W. passage existed. On his return voyage he surveyed most of the W. coast of South America, visiting the principal Spanish settlements, and reached England in 1795, greatly broken down in health. The rest of his life was spent in preparing for publication a narrative of his long voyage, which was nearly finished at the time of his death. The work was completed by his brother, and published at the expense of government (3 vols. 4to, 1798). He was made a post-captain in 1794, and Vancouver's Island was named after him. D. near London May 10, 1798.

**Vancouver's Island** [named from Capt. George Vancouver (1758–98), a British sailor], an island which forms a part of British Columbia and of the Dominion of Canada, lies between lat. 48° 20′ and 50° 55′ N., and between lon. 123° 10′ and 128° 20′ W. It is bounded W. by the Pacific Ocean, and occupies the greater part of the Gulf of Georgia, which it converts into a narrow sound, the northward continuation of Puget Sound. The Strait of San Juan de Fuca on the S. and Queen Charlotte's Sound on the N. afford communication between this sound and the open sea. The island is 300 miles long and from 30 to 70 miles wide. Area, 18,750 sq. m. It is mostly a mountain-region, and is in part a waste of rocks, with large tracts of heavily-timbered land and open grassy glades. The highest mountain, Mount Arrowsmith, is 5900 feet high. The western coast is precipitous and forbidding, and is deeply cut up by high-walled fiords called *canals*. The climate is much like that of Scotland, but is perhaps more rainy. Only one-fifth of the surface is fit for cultivation, but the arable soil is of the most productive character, well adapted for all ordinary crops except Indian corn. Wheat, apples, root-crops, oats, and barley are extensively produced. Gold and other metals are abundant. Coal of Tertiary origin, partly anthracite of good quality, is very abundant. The timber-trade and the fisheries are the most important industries.

*Population, etc.*—The Indians constitute the most numerous portion of the people, and number some 18,000. They are mostly tribes or bands which belong to the confederation known as the Ahts. The Roman Catholics maintain missions among them. Vancouver's Island constitutes a Roman Catholic diocese, with its see-town at Victoria. There are reported 3 convents, 1 seminary (St. Louis College), 3 academies, and a Roman Catholic population. (This diocese includes Alaska, but not the vicariate apostolic of British Columbia.) The Anglican churches of the island are under the bishop of British Columbia. The census of 1871 gives no separate returns for the island as distinct from the province. The chief town is Victoria, which is the capital of British Columbia.

*History.*—The island was named Quadra, and Vancouver's Island by Vancouver, who in 1792 negotiated with Quadra,

the Spanish commandant of the coast, for the surrender of the Nootka region to the British. In 1846 it was secured to the latter by the U. S. by the Oregon treaty. In 1846 and 1849 it was leased to the Hudson's Bay Co. It was (1863–65) a distinct British colony, but in the latter year was united to British Columbia.

**Vanda'lia,** p.-v. and tp., cap. of Fayette co., Ill., on Illinois Central and St. Louis Vandalia and Terre Haute R. Rs., 67 miles E. of St. Louis (Mo.). Vandalia was the former capital of the State (1820–40). It contains 6 churches, excellent graded schools, 2 weekly newspapers, 2 banks, waterworks, a woollen-factory, 1 foundry, 1 extensive plough-factory, several wagon and carriage manufactories, a tannery, 3 public halls, and 2 hotels. Excellent hard-wood timber abounds. P. of v. 1771; of tp. 2431.

CHARLES G. SMITH, ED. "FAYETTE DEMOCRAT."

**Vandalia,** p.-v., Cass co., Mich.

**Vandalia,** p.-v., Butler tp., Montgomery co., O. P. 313.

**Van'dals, The,** a barbaric tribe, probably of Germanic, though by some believed to be of Slavic or mixed, origin, were settled in the second century of our era on the eastern slopes of the Riesengebirge, which after them were called *Montes Vandalici*, and appeared in the wars of Marcus Aurelius as the allies of the Marcomanni and Quadi. In the third century they removed into the Roman province of Dacia, where they lived among the Goths and the Gepidæ, and in the fourth century were found in Pannonia as quiet and peaceable inhabitants. But in the beginning of the fifth century they suddenly arose, together with the Suevi, Alani, and other Germanic tribes, overran the southern part of Gaul, thronged through the passes of the Pyrenees into Spain, and formed here, in the southern part of the country, an independent empire, *Vandalitia*, the modern Andalusia. In 429, Bonifacius, governor of the Roman province of Africa, invited them to Africa in order to avenge himself on Valentinian III., and a horde of from 50,000 to 80,000 crossed the Strait of Gibraltar under the leadership of Genseric. The Vandals were Arians; in Africa they were immediately joined by the Donatists, and the most horrible cruelties were perpetrated against the orthodox Christians. Meanwhile, Bonifacius had become reconciled to the emperor, and now turned against the Vandals, but was completely defeated and shut up in Hippo. In 435 a peace was concluded between Valentinian III. and Genseric, and the largest part of the province of Africa was ceded to the Vandals; but in 439, Genseric broke the peace and conquered Sardinia and Sicily. In 455 he invaded Italy, captured and sacked Rome, which he plundered and devastated with wild wantonness, and spread horror into all countries along the Mediterranean shores. But the power of the Vandals was only of short duration. Genseric died in 477, and none of his successors—Guntamund (477–496), Thrasamund (496–523), Hilderic (523–530), and Gelimir (530–534)—were prominent men. Hilderic had been educated in Constantinople, and leaned toward the orthodox conception of Christianity. This caused a revolt, in which he was overthrown by Gelimir. But the Byzantine emperor now sent an army to Africa under Belisarius. Gelimir was captured and sent to Constantinople, and most of the Vandals were drafted into the Byzantine army to serve in the wars against Persia; the rest soon disappeared among the natives. (See Papencordt, *Geschichte der vandalischen Herrschaft in Afrika*, Berlin, 1837.)

**Vandamme'** (DOMINIQUE JOSEPH), COUNT, b. at Cassel, department of Nord, France, Nov. 5, 1770; entered the French army in 1788, and served in a regiment in Martinique, but returned in 1790, and organized in 1792 a volunteer regiment, the so-called *chasseurs de Vandamme*, at the head of which he distinguished himself so greatly that in 1793 he was made a brigadier-general. In 1799 he was made a general of division, fought with great distinction at Austerlitz and Eckmühl, and was made a count, but took no part in the Russian campaign of 1812 on account of a conflict with Jerome. In 1813 he commanded the corps which from Lower Saxony was destined to penetrate into Bohemia in pursuit of the allied army, which had been defeated at Dresden, Aug. 27, but at Kulm he was surrounded, defeated, and compelled to surrender with 10,000 men and 81 guns, Aug. 30. He was brought as a prisoner to Russia, but restored to liberty in 1814. During the Hundred Days he joined Napoleon, fought at Ligny and Wavre, and led the army back to the walls of Paris. During the second Restoration he was banished from France, lived in the U. S., returned to France in 1819, was reinstated in the army in 1820, retired into private life in 1825, and d. at Cassel July 15, 1830. (See P. E. Albert du Casse, *Le Général Vandamme et sa Correspondance*, 2 vols., Paris, 1870.)

**Vandemere,** p.-v., cap. of Pamlico co., N. C.

**Van den Eeckhout.** See EECKHOUT, VAN DEN.

**Van'denhoff** (GEORGE), b. in England about 1820; made his début upon the stage at Covent Garden Theatre in Oct., 1839; came to New York in 1842; continued to act until 1856; studied law and was admitted to the bar in 1858. He has given public readings and lessons in elocution in America and England, and has published *The Art of Elocution* (1846), *Dramatic Reminiscences* (1859), *Leaves from an Actor's Note-Book* (1860), *Clerical Assistant, an Elocutionary Guide* (1862), and a *Lady's Reader, with Rules for Reading Aloud* (1862).

**Van'derbilt** (CORNELIUS), b. at Staten Island, N. Y., May 27, 1794. His parents emigrated from Holland, and were among the early settlers of New York. He had a very meagre education, and at an early age devoted himself to sailing boats in New York Bay. At the age of sixteen he purchased a boat of his own, and ran it as a ferry between New York and Staten Island. During the war of 1812 he carried some officers from Fort Richmond during a perilous storm, being the only boatman in the harbor who would undertake the task—carrying them, as he said, "part of the way under water." In 1814 he carried government supplies to various posts about New York, and that year he built a small schooner for his increased business; in the year following he built a larger schooner for the coast-trade. In 1817, having accumulated $9000 from his harbor-trade, he entered the employ of Thomas Gibbons, and became captain of a small steamboat running between New York and New Brunswick, N. J., on the road to Philadelphia. He also took charge of a hotel at New Brunswick, where the passengers remained over night. He remained with Mr. Gibbons for twelve years, during which time the line of steamboats had grown to be one of great importance; at the end of that time he resigned his position and started out for himself; he built several small steamboats, and ran them to points on the Hudson River and other places near New York. In 1851 he established the route of steamships between New York and California by way of Nicaragua, which he managed for two years, when he sold out and acted as agent for a short time; subsequently, he was chosen president of the company. In May, 1853, having amassed immense wealth, he built the steamship North Star, and, taking his family on board, made a tour of Europe in it at his private expense. In Apr., 1855, he established an independent line of steamships between New York and Havre. In the spring of 1862 he presented the government with his finest steamship, the Vanderbilt, for which Congress passed a resolution of thanks to him. Subsequently, he withdrew his money from vessels and invested it in railroads. He was president of the New York Central and Hudson River R. R., the Harlem R. R., and the Lake Shore and Michigan Southern R. R., and was a director in the Western Union Telegraph Co. In 1870 he purchased the building known as the Mercer street Presbyterian church in New York City, and presented it to the Rev. Charles Force Deems, pastor of a free and independent church of Jesus Christ, organized in 1868 under the name of the Church of the Strangers, to be used by that society as a place of public worship. On Mar. 27, 1873, Mr. Vanderbilt presented the Methodist Episcopal Church, South, with $500,000, afterward increasing the amount to about $1,000,000, to be used in founding a university at Nashville, Tenn., for the education of the youth of the Church. The board of trust of the proposed institution voted to call it VANDERBILT UNIVERSITY (which see), after its chief founder, and it was opened Oct. 4, 1875. Mr. Vanderbilt had been twice married, and had thirteen children. D. at New York Jan. 4, 1877.—His son, WILLIAM HENRY, b. in New Brunswick, N. J., May 8, 1821. He received a common-school education, and in 1873 was elected vice-president of the Hudson River R. R. Co. J. B. BISHOP.

**Vanderbilt University,** an institution of learning at Nashville, Tenn., founded in 1872 under the name of Central University of the Methodist Episcopal Church, South, and received its present name in 1873 in consequence of a donation of $500,000 by Cornelius Vanderbilt of New York, subsequently increased to $1,000,000, of which $600,000 is to remain as a permanent invested endowment. By one of the conditions of the gift, Bishop Holland N. McTyeire was named as president of the board of trust, and the labor of organization chiefly devolved upon him. L. C. Garland, LL.D., was chosen chancellor, and Rev. Dr. Thomas O. Summers, dean of the theological faculty, is *ex-officio* vice-chancellor. The corner-stone was laid Apr. 28, 1874, in the western suburbs of Nashville in a plot of 75 acres of land purchased for the university, and the institution was opened for students Oct. 4, 1875. During the first academic year the total number of students was about 300. There are four departments, devoted respectively to theology, law, medicine, and phi-

losophy, science, and literature, the two latter having 11 professors each. The library, scientific apparatus, and cabinets are already valuable. The courses of study are elective, and tuition is free to theological students.

**Van'derburg,** county of S. W. Indiana, bordering upon Ohio River, and traversed by Wabash and Erie Canal and by several railroads centring at the county-seat; surface generally undulating, soil fertile. Bituminous coal is abundant. There are nearly 300 manufacturing establishments, including those of cotton and woollen goods, clothing, furniture, agricultural implements, saddlery, iron, machinery, and tobacco; saw-mills, planing-mills, tanneries, currying establishments, and breweries. Live-stock is not very numerous. Staples, manufactured articles, Indian corn, wheat, tobacco, lumber, and dairy products. Cap. Evansville. Area, 216 sq. m. P. 33,145.

**Van der Goes** (Hugo), a disciple of Van Eyck; flourished in the latter part of the fifteenth century; painted mostly religious subjects, and is said to have ended his life as a monk in the monastery of Rodendale, near Brussels. His most celebrated pictures are a *Birth of Christ*, in the church of Santa Maria Nuova in Florence, a *Crucifixion*, in the church of St. James in Bruges, and a *St. John*, in the Pinakothek of Munich, bearing his name and the date of 1472.

**Van der Hey'den** (Jan), b. at Gorkum, Holland, in 1637; lived mostly in Amsterdam; acquired great fame as a painter of landscapes and city prospects, and received a pension from the government for his improvements of street-lamps and fire-engines. D. at Amsterdam Sept. 28, 1712. His principal pictures are—*The Exchange of London, The Exchange of Amsterdam, The Village on the River-bank*, etc. The figures in his landscapes were often painted by Adrian Vandervelde.

**Van der Hoeven.** See Hoeven, Van der.

**Van'derlyn** (John), b. at Kingston, Ulster co., N. Y., Oct., 1776; at sixteen was employed as a blacksmith's assistant, when by accident one of his sketches of a horse's head made in charcoal upon a barn-door attracted the attention of Aaron Burr, who invited him to New York, and received him into his house. He received instruction from Stuart, and in 1796 went to Europe through the assistance of Burr, where he remained five years. He returned to Europe in 1803, remaining until 1815; made many admirable copies from the old masters; painted the picture of *Marius seated amid the Ruins of Carthage*, which gained the Louvre gold medal in 1808, *The Murder of Jane MacCree by the Indians*, and other original works, which gave him a high reputation. Returning to America, he painted the portraits of Calhoun, Clinton, Madison, Monroe, Jackson, and other distinguished men, and endeavored to introduce large panoramas into this country—an enterprise which was pecuniarily unsuccessful. In 1832 he was commissioned to paint a full-length portrait of Washington for the hall of the House of Representatives, and in 1839 was commissioned to paint the *Landing of Columbus* for the Rotunda of the Capitol. Among his best works is the *Ariadne*, which he sold to Durand to engrave for $600, who many years after sold it for $5000. The later years of Vanderlyn's life were passed in great poverty. D. at Kingston, N. Y., Sept. 23, 1852. He had some time before dictated to a friend a sort of *Autobiography*, but the MS. was, after his death, destroyed by a fire in the publishing-house to which it had been sent for publication. (See Tuckerman's *Book of the Artists.*)

**Van der Meer** (Jan), the Elder, b. at Haarlem about 1625; painted landscapes with animals and sea-pieces, and held various positions in the civil service. D. in Haarlem about 1685.—His son, Jan van der Meer, the Younger, b. at Haarlem about 1660; received instruction first from his father, afterward from Berghem, and acquired a great reputation as a painter of landscapes and marine battles, but is said to have led a very dissolute life. His best picture is a *View of the Rhine*. D. at Haarlem about 1704. Both his and his father's paintings are very rare outside of the Netherlands.

**Van der Meulen** (Antoine François), b. at Brussels 1634; received his first instruction in painting from Peter Snayers; was invited to France by Colbert through the influence of Lebrun, and appointed designer at the Gobelins manufactures; attracted attention by his talent for battle-pieces, and accompanied Louis XIV. in several campaigns; was elected a member of the Academy in 1673. D. at Paris Oct. 15, 1690. Among his most celebrated pictures are the *Entrance of Louis XIV. into Arras*, the *Siege of Maastricht*, etc.; he also painted hunting and genre scenes.

**Van der Neer.** See Neer, Van der.

**Van'derveer** (Ferdinand), b. in Butler co., O., Feb. 27, 1823; was educated at Farmers' College, O.; enlisted as a private in an Ohio regiment during the Mexican war; rose to be captain, and headed one of the assaulting columns at the capture of Monterey. He subsequently practised law, and became sheriff of Butler co.; at the beginning of the civil war was made colonel of an Ohio regiment; succeeded to the command of McCook's brigade; led it until the autumn of 1864, when he was made brigadier-general; was in the battle of Mill Spring, and distinguished himself at Chickamauga and Chattanooga.

**Vandervel'de** (Adrian), b. in Amsterdam in 1639; was celebrated as a figure-painter, and was often employed by other artists—Ruysdael, Hobbema, Van der Heyden—to paint figures as staffage in their landscapes. D. at Amsterdam in 1672.

**Vandervelde** (Willem), the Elder, b. at Leyden in 1610; was educated as a sailor, but early attracted great attention by his drawings of sea-views; was sent by the Dutch government to accompany Admiral de Ruyter, and acquired great reputation by his sketches of manœuvres, engagements, etc.; was invited to England in 1675 by Charles II., who made him court-painter of sea-fights, and gave him a pension of £100 a year. D. in London in 1693. Most of his productions were drawings, many of which were colored by his son, Willem Vandervelde, the Younger, b. at Amsterdam in 1633, who succeeded his father as marine-painter to the king of England, and attained great fame. Most of his pictures are in England, especially in the gallery at Bridgewater House. D. London Apr. 6, 1707.

**Van der Weyde** (P. H.). See Appendix.

**Vandi,** or **Bandy.** Constantly, when treating of Indian topics, we come across such words as "bandy," which simply means a common country vehicle, much used by Hindus. Had there been no *Calicut* in India, the term *calico* would never have arisen. To take the commonest instance of all, *mulligatawny* is simply the Europeanized pronunciation of *milagu-tunni—i. e.*, literally translated, "pepper-water." This *milagu-tunni* is a pure Tamil word. It is wholly and solely from Tamil-land that we have derived those hot-flavored soups which, under various forms, go by the name of "mulligatawny soups," and are generally best liked when their pungency is partially subdued by a little well-boiled rice—"Patna rice," as it is foolishly called in England, as if the best Indian rice was from Patna. When also, as all over India, our white kinsmen speak of "bandymen" and "bandies," the word thus anglicized is simply the old Tamilian one. We all know how readily *b* and *v* change places in other languages. F in Latin becomes *h* in Spanish with no greater facility. The framework of "bandies" is made of light wood, but of wood as strong as possible. Above it is spread a semicircular awning of bamboos supporting mats or cloth or canvas. The bandy is a cross-country vehicle, and, as a rule, possesses no springs of any kind. The conveyance is dragged by oxen. Some bandies of rajahs are drawn by huge oxen, standing as tall as "galloways," with silver bells round their necks, jewels plaited on their foreheads, their feet shod with brass, and their horns encased with massive gold. Several of the late gaikwar of Baroda's bandy-oxen used to have diamonds and pearls worth $1,000,000 or so dangling round their necks on festive occasions, when they bore his wives on important pilgrimages to famous temples. The wheel of the common Indian bandy has been so rudely constructed from time immemorial that numbers of pattern-wheels for bandies have not long since been despatched to India from America. The writer has seen several, and two in his possession, five years ago, were immediately copied, to the best of their ability, by native carpenters, who were astounded at being informed that the original wheels came over the "great wild black water," not only of the Indian Ocean, but of the stormy Atlantic itself. R. C. Caldwell.

**Van Diemen's Land.** See Tasmania.

**Van Dorn** (Earl), b. in Mississippi in 1821; graduated at West Point in 1842; served with distinction in the Mexican war, and was brevetted as captain and major for gallant conduct at Cerro Gordo, Contreras, and Chapultepec, and was wounded in the final assault upon the City of Mexico; was secretary of the military asylum at Pascagoula, Miss., 1853–55, was subsequently employed in scouting in Texas, led an expedition against the Comanches in 1858, and severely wounded at Washita Village, Ind. Ter., Oct. 1, 1858. In Jan., 1861, he threw up his commission of major 2d Cavalry, and entered the Confederate army as colonel, taking command of a regiment of Texan volunteers; early in 1861 he captured the steamer Star of the West at Indianola, and soon after received the surrender of Major Sibley and of Col. Reeve, with thirteen companies of U. S. infantry. He rose to the rank of major-general, and in Jan., 1862, was placed in command of the Trans-Mississippi district; was defeated at Pea Ridge; superseded by

Gen. Holmes, and transferred to the Army of the Mississippi; commanded at the battle of Corinth, where he was defeated and superseded by Gen. Pemberton. D. in Maury co., Tenn., May 8, 1863, having been shot by a Dr. Peters on account of a private grievance.

**Vandyke′,** or **Van Dyck** (Anthon), b. at Antwerp Mar. 22, 1599; received his first instruction in painting from Van Balen (1610–15), then from Rubens (1615–20), whose most illustrious pupil he became; travelled in Italy 1620–25, visiting Venice, Genoa, Florence, Rome, Palermo, and other cities; resided after his return partly in Antwerp, partly at the Hague; went in 1632 to England on the invitation of Charles I., was knighted, received a pension of £200 a year, and lived in great style in London, where he d. Dec. 9, 1641, and was buried in St. Paul's church. During the first period of his career the influence of Rubens is very apparent; but after his Italian journey, especially after a thorough study of the Venetian school, his own style became fully developed. A deep, pensive, sometimes almost melancholy, sentiment, and a subdued, refined, and elegant harmony of colors, took the place of the active, often violent passion, with its burst into brilliant colors, which characterizes Rubens. In this manner he has painted numerous *Holy Families, Crucifixions,* etc., now found principally in the galleries of Antwerp, the Louvre, Madrid, and Munich; the most celebrated is the altarpiece in the cathedral of Mechlin. But it was principally as a portrait-painter that Vandyke achieved his great fame, and there exist about 300 portraits by him. The most remarkable are those of Thomas Carignan in the gallery of Turin, of Gen. Moncada and Charles I. in the Louvre, of Marchese Brignoli in the Palace Brignoli at Genoa, of the children of Charles I. in the gallery of Windsor, and the series of 100 small portraits of contemporaneous artists, of which etchings have been made. Many of the portraits which he painted during his residence in England are excellent with respect to conception, but somewhat hasty, and even careless, in execution.

**Vane.** See Londonderry, Marquis of.

**Vane** (Sir Henry), b. at Hadlow, Kent, England, in 1612, son of Sir Henry (1589–1654), who was secretary of state to Charles I.; educated at Westminster School, and entered as gentleman commoner Magdalen College, Oxford, about 1628, but before matriculation renounced the Church of England and refused to take the oath of allegiance; travelled in France and Holland, and completed his education at Geneva, where he became a Puritan and a republican; determined to cast in his lot with the Massachusetts Colony, he arrived at Boston 1635; was received with great satisfaction on account of his high reputation and social position; was chosen governor for the year 1636, but having taken the part of Mrs. Hutchinson in a bitter religious controversy then existing, lost much of his popularity, and was not re-elected; was chosen a member of the general court, and published a pamphlet in reply to one by Winthrop; returned to England Aug., 1637; was knighted, elected to Parliament, and made joint-treasurer of the navy 1640; took part in the impeachment of Strafford; became sole treasurer of the navy 1642; was a zealous supporter of Parliament in the civil war; gave up to that body the fees of his office, at that time very lucrative; went in June, 1643, to Scotland as one of the joint commissioners to negotiate an alliance, and was influential in securing the adoption of the "Solemn League and Covenant;" enabled Roger Williams to obtain the Rhode Island charter 1643; was a promoter of the "Self-denying Ordinance" 1644; served during the war on important parliamentary commissions, especially those empowered to treat with the king or to accompany the army in an advisory capacity; opposed the terms of settlement offered by Charles in 1648; was a member of the Westminster Assembly and a leader of the Independents in Parliament, but disapproved of the interference of that body in military affairs; condemned the execution of Charles and the "purge" of Parliament effected by Cromwell; became in Feb., 1649, a member of the council of state, in which capacity he had the direction of the navy and ample powers in regard to the foreign wars then carrying on; enjoyed at this time the friendship of Milton, who addressed him one of the most notable of his sonnets; reported, as chairman of a committee, a bill for parliamentary reform; came into conflict with Cromwell in consequence of the forcible dissolution of the Long Parliament Apr., 1653; retired to his estate of Raby Castle, where he wrote religious treatises and political pamphlets, one of which led to an imprisonment of four months in Carisbrooke Castle by order of Cromwell Mar., 1656; remained in opposition until the death of the Protector, when he was chosen to Parliament; became the leader of the republican party, and endeavored without success to mould the Commonwealth to his ideas of government; was a member of the committee of safety and president of the council of state during the brief renewed existence of the Long Parliament 1659; was one of the twenty persons excepted from the act of general pardon and oblivion passed at the Restoration; was sent to the Tower, and afterward to other prisons, remaining two years in a castle in the Scilly Islands, occupied in theological studies and writing; was tried for high treason before the court of king's bench June 2, 1662; was unjustly convicted and sentenced to be hanged, and in violation of a promise made by Charles was beheaded on Tower Hill June 14, 1662. His theological writings are pitched in so high a strain of mysticism as to be almost unintelligible to ordinary readers, but are said by Sir James Mackintosh to "display astonishing powers;" and the same writer ranks Vane as "one of the most profound minds that ever existed—not inferior, perhaps, to Bacon." His religious views were millenarian, and gave rise to a small circle of disciples who were known as Vanists. His *Life* was written by Charles W. Upham in Sparks's series of biographies (1st series, vol. iv.). Porter C. Bliss.

**Van Effen.** See Effen.

**Van Et′ten,** tp., Chemung co., N. Y. P. 1533.

**Van Eyck.** See Eyck, Van.

**Van Helmont.** See Helmont, Van.

**Van Hornes′ville,** p.-v., Stark tp., Steuben co., N. Y. P. 169.

**Van Huysum.** See Huysum, Van.

**Vanil′la** [Fr. and Ger. *vanille*], the fruit of the *Vanilla planifolia* and of the *Vanilla aromatica,* which are climbing plants native in Mexico and Brazil and cultivated in the West Indies. The pods of the plant are from 6 to 8 inches in length, possess a very pleasant odor, and are often encrusted with needle-shaped crystals of *vanilline,* their aromatic constituent. They also contain an iron-greening tannin, a fatty oil, and a resin. *Vanilline* ($C_8H_8O_3$), the odorous principle of vanilla, was formerly considered identical with benzoic and cinnamic acids. Its individuality was first recognized by Bley in 1858, afterward by Stokkebye in 1864, who assigned to it the incorrect name *vanillic acid* and the composition $C_{17}H_{22}O_5$. It is obtained by mixing the alcoholic extract of vanilla with water until a fluid of a syrupy consistence is formed, agitating with ether, evaporating the ether, treating the residual mass with boiling water, again evaporating, and purifying the crystals formed by solution and filtration through animal charcoal. It forms long colorless prisms, which are nearly insoluble in cold water, but dissolve in hot water, in alcohol, and in ether, the alcoholic solution possessing a feeble acid reaction. Vanilline fuses at about 176° F., sublimes at above 300° F., and can be distilled with the vapor of water. Its synthetical preparation has recently been accomplished by submitting the glucoside of the cambium of the Coniferæ (*coniferine*) to the action of emulsine, whereby it is converted into glucose and a crystalline body fusing at about 160° F. Upon oxidizing this crystalline compound by treatment with sulphuric acid and potassic dichromate, ethylic aldehyde is at first produced, then an acid substance, which, upon separation by agitation with ether, and evaporation, possesses the odor of vanilline, and is indeed identical with that compound. The product of the fermentation of coniferine appears to be the ethylic ether of vanilline. When fused with caustic soda, vanilline is converted into protocatechuic (oxysalicylic) acid, with formation of carbonic acid and water; if treated with hydrochloric acid, methylic chloride and protocatechuic aldehyde are formed. These and other transformations of vanilline indicate that it is a compound of methylic aldehyde and protocatechuic acid. When treated with nascent hydrogen, vanilline is converted into *vanillyl alcohol. Vanillic acid* ($C_8H_8O_3$) has been obtained from coniferine by oxidation with potassic permanganate, also by removing one methyl group from dinæthyl-protocatechuic acid; it appears, therefore, to be monomethyl-protocatechuic acid. By heating a mixture of calcic vanillate and formate, vanilline—which is really the *aldehyde of vanillic acid*—is formed. When vanilline is treated with nitric acid, oxalic acid is produced. A good method for estimating quantitatively the amount of vanilline contained in vanilla consists in dissolving the latter in ether, and agitating the liquid with an aqueous solution of sodic hydrosulphite, when a solution of a compound consisting of vanilline and sodic hydrosulphite is obtained, from which the pure vanilline can be separated by decomposition with dilute sulphuric acid and extraction with ether. Vanilla is chiefly used for flavoring ice-cream, chocolate, etc., and, to a slight extent, in medicine. J. P. Battershall.

**Vani′ni** (Lucilio, or, as he afterward called himself in his writings, Julius Cæsar), b. at Taurisano, near Naples, about 1585; studied philosophy, theology, and natural sci-

ence at Rome and Padua; took holy orders; taught at Geneva, Paris, and Lyons; visited England; published in 1615 at Lyons his *Amphitheatrum Æternæ Providentiæ*, which, although an argument against atheism, made him suspected of being a free-thinker; published next year at Paris his dialogues, *De Admirandis Naturæ, Reginæ Deæque Mortalium, Arcanis*, which was burnt by order of the Sorbonne; removed to Toulouse, and began to teach, but was accused of atheism, sentenced to death by the Parliament, and burnt at the stake the same day the sentence was given, Feb. 19, 1619. (See David Durand, *La Vie et les Sentiments de L. Vanini* (Rotterdam, 1717), and *Œuvres philosophiques de Vanini*, by Rousselot (Paris, 1841).)

**Van'ishing Frac'tion** [Lat. *vanescere*, to "vanish"], a fraction that reduces to $\frac{0}{0}$ for a particular value of the variable which enters it. The fraction reduces to the anomalous form $\frac{0}{0}$ in consequence of the existence of a factor in both terms, which factor reduces to 0 in consequence of the particular hypothesis. In some cases this factor can be found and struck out, and then the true value of the fraction can be found by making the particular substitution. A more general method of treating such cases depends on a principle of the differential calculus. The rule is as follows: Differentiate the numerator of the fraction for a new numerator, and the denominator for a new denominator; then in the resulting fraction substitute the special value of the variable. If the result is $\frac{0}{0}$, repeat the operation, and continue the repetition till a result is found which does not reduce to $\frac{0}{0}$; the final result is the required value. This rule fails when the factor which reduces to 0 in both terms of the given fraction has fractional exponents, both of which are included between two consecutive whole numbers.

There is a species of vanishing fraction which reduces to the form $\frac{\infty}{\infty}$ for a particular value of the variable. The cause of this anomalous result is the existence of a factor in both terms which reduces to $\infty$ for the value in question. Fractions of this kind are freed of their anomalous forms by the process just considered. W. G. Peck.

**Vanishing Point.** See Perspective, by Prof. W. G. Peck, LL.D.

**Van Lennep.** See Lennep, Van.

**Vanloo',** the name of a family of painters of Flemish descent, but settled in France. The two most celebrated members of this family were the brothers Jean Baptiste and Charles André. The former, b. at Aix, Provence, Jan. 14, 1684; studied at Rome, supported by the prince of Carignano; settled in 1719 in Paris; enjoyed the patronage of the regent; became teacher at the Academy; visited England 1738–40, and d. in Paris Dec. 19, 1745. He painted mostly portraits. The latter, generally known under the name of Carle Vanloo, b. at Nice in 1705, and educated by his brother; became director of the Academy of Fine Arts in Paris in 1760, painter to the king in 1762, and d. in Paris 1765. He painted mostly historical pieces. Pictures by both of them are frequent in French and English galleries. Younger members of the family lived as court-painters in Madrid and Berlin.

**Van Meter,** p.-v. and tp., Dallas co., O. P. 1433.

**Van Mil'dert** (William), D. D., b. in London, in 1765, descended from a family of Dutch merchants; educated at Merchant Taylors' School and at Queen's College, Oxford; took orders in the Church of England; became curate of Sherbourne and Lewknor, Oxfordshire, 1788, rector of Bradden, Northamptonshire, 1795, and of St. Mary-le-Bow, London, 1796; gained a high reputation for pulpit eloquence by the Boyle lectures of 1802 and 1805; was chosen preacher of Lincoln's Inn 1812, and regius professor of divinity at Oxford 1813; was Bampton lecturer 1814; became bishop of Llandaff Mar., 1819, dean of St. Paul's, London, 1820, and bishop of Durham Mar., 1826. D. at the episcopal palace of Bishop-Auckland Feb. 21, 1836. Author of *An Historical View of the Rise and Progress of Infidelity* (2 vols., 1802–05; 5th ed. 1838), with copious and learned notes, being the Boyle lectures for the year of publication; *An Inquiry into the General Principles of Scripture Interpretation* (Oxford, 1815), being the Bampton lectures for the preceding year; *Fifty Sermons before the Honorable Society of Lincoln's Inn* (2 vols., 1812–19) and *Sermons on Several Occasions* (1838), preceded by a *Memoir* by Cornelius Ives. Bishop Van Mildert had edited the complete *Works of Daniel Waterland, D. D.* (10 vols., 1823), which were then first collected and arranged, and prefixed an elaborate *Review of the Author's Life and Writings* (1823).

**Vannes,** town of France, department of Morbihan, at the mouth of the Vannes, carries on a lively and varied manufacturing industry and an active trade in salt, butter, wax, honey, and cider. P. 14,690.

**Van Ness** (Cornelius Peter), LL.D., b. in Vermont Jan. 26, 1782; studied law; practised successfully in Burlington; was U. S. district attorney 1809–13; representative in the legislature 1818–21; commissioner for the settlement of the boundaries between the U. S. and Great Britain 1818–21; collector of the port of Burlington 1815–18; chief-justice of Vermont 1821–23; governor of the State 1823–26; minister to Spain 1829–39, and collector of the port of New York 1844–45. D. in Philadelphia Dec. 15, 1852.

**Vannucci.** See Perugino.

**Vannucci** (Atto), b. Dec. 1, 1808. Besides school editions of the classics, his principal works are—*Studii storici e morali intomo alla Letteratura Latina* (Turin, 1834), *I primi Tempi della Libertà Fiorentina* (Florence, 1853–61), *I Martiri della Libertà Italiana* (last edition Milan, 1873), *Storia dell Italia antica* (his most important work, many editions), *Ricordi della Vita e della Opere di S. B. Niccolini* (2 vols., Florence, 1866). Vannucci was for some years professor of Latin literature at Florence, and is now senator of the kingdom.

**Vannuchi** (Andrea). See Sarto, del.

**Van Oos'terzee** (Jan Jacob), b. in Rotterdam in 1807; studied theology at the University of Utrecht; was appointed minister of the principal Reformed church of Rotterdam in 1844, and professor of systematic and practical theology at the University of Utrecht in 1862. He is a celebrated preacher and a reputable author. He wrote for Lange's *Bibelwerk* commentaries on the Gospel of St. Luke, the Pastoral Epistles, and the Epistles to Philemon and of St. James, which have been translated into English, as well as his *Theology of the New Testament* (1870) and *Christian Dogmatics* (1874).

**Van Ostade.** See Ostade, Van.

**Van Reu'sselaer** (Cortland), D. D., son of Stephen Van Rensselaer, "the patroon," b. in Albany May 25, 1808; graduated at Yale College in 1827; studied law, and was admitted to the bar in 1830; afterward studied divinity at Princeton Theological Seminary; was ordained in 1835; preached for a short time in Virginia, and in 1837 became pastor of a Presbyterian church in Burlington, N. J. For a time he acted as agent for Princeton College, and succeeded in raising $100,000 for its endowment. He was the founder of the *Presbyterian Magazine*, to which he contributed largely. D. at Burlington, N. J., July 25, 1860. A volume of his *Essays and Discourses*, edited by his son, was published in 1861.

**Van Rensselaer** (Henry Killian), b. near Albany in 1744; commanded a New York regiment during the war of the Revolution; in July, 1777, was attacked near Fort Anne by a large body of the enemy, whom he repelled, but learning that the strong position of Ticonderoga had been abandoned by Gen. St. Clair, he withdrew. He was present at the engagements which in the following October led to the surrender of Burgoyne, in which he was severely wounded. Toward the close of the war serious disputes occurred between the authorities of New York and New Hampshire in respect to the jurisdiction of what were known as the "New Hampshire grants," and a mutiny broke out in Van Rensselaer's regiment, which was quelled only by the intervention of Washington. He afterward rose to the rank of general of militia. D. at Greenbush, N. Y., Sept. 9, 1816.

**Van Rensselaer** (Solomon), son of Henry Killian, b. in Rensselaer co., N. Y., Aug. 6, 1774; entered the army in 1792 as cornet of cavalry; was captain under Wayne at the battle of Miami, Aug. 20, 1794, where he was shot through the lungs. In 1801–10, and again in 1813, he acted as adjutant-general of the New York militia, and in the brilliant but unsuccessful assault upon Queenstown Heights, Oct. 13, 1812, being then lieutenant-colonel of volunteers, he bore a conspicuous part and received four wounds; was a Representative in Congress 1819–22, and postmaster at Albany 1822–39. In 1836 he published a *Narrative of the Affair at Queenstown*. D. in Albany Apr. 23, 1852.

**Van Rensselaer** (Stephen), LL.D., known as "the patroon," b. in New York Nov. 1, 1764, was the fifth in descent from Killian Van Rensselaer, the original patroon or proprietor of a tract of land granted by the States-General of Holland, 48 miles long by 24 miles broad, and comprising the greater part of Albany, Columbia, and Rensselaer cos.; graduated at Harvard College in 1782; was member of the assembly in 1789, of the State senate 1790–95; lieutenant-governor 1795–1801; member of the constitutional convention 1801; in 1810 was appointed one of the commissioners to explore the proposed line for a canal from Lake Erie to the Hudson, and to report upon the feasibility of its construction, and from 1816 to his death one of the canal commissioners. He was in command of the State militia at the commencement of the war

of 1812, and directed the unsuccessful assault upon Queenstown Heights. In 1819 he was chosen one of the regents of the New York University, of which he was subsequently chancellor; in 1821–23 instituted the geological surveys of New York, which were executed wholly at his cost by Prof. Eaton, and in 1824 established at Troy a scientific school for the instruction of teachers, which was two years afterward incorporated as the Rensselaer Institute, one-half the current expenses being for a long time defrayed by him. He was a Representative in Congress 1823–29, and it was by his casting vote in the New York delegation that John Quincy Adams was made President of the U. S. D. in Albany Jan. 26, 1839. He published *A Geological and Agricultural Survey of the District adjoining the Erie Canal* (1824).

**Van Sant'voord** (George), b. at Belleville, N. J., Dec. 8, 1819; graduated at Union College in 1841; studied law, and practised first in Indiana, then at Kinderhook, N. Y., and subsequently at Troy; was elected to the State assembly in 1852 and 1856, and in 1859 became district attorney for Rensselaer co. He contributed several historical papers to the *Democratic Review*, and published—*The Indiana Justice* (1845), *Life of Algernon Sidney* (1851), *Lives of the Chief-Justices of the United States* (1854), *Principles of Pleading in Civil Actions* (1852 and 1855), *Precedents of Pleading* (1858), and *Practice in the Supreme Court of New York in Equity Actions* (1860–62). D. at East Albany, N. Y., Mar. 6, 1863, being run over by a railway train.

**Van Schaack** (Peter), LL.D., b. at Kinderhook, N. Y., in Mar., 1747; graduated at Columbia College in 1768, was admitted to practise at the bar in 1769, and in 1773 was appointed to revise the statutes of New York. Being opposed to the principles of the Revolution, he went to England at the close of 1776, but returned to New York in 1785; resumed the practice of his profession, and also was a teacher of the science of law. He published—*Laws of the Colony of New York 1691–1773* (1773), and *Conductor Generalis, or the Duty and Authority of Justices, Sheriffs, Coroners, etc.* (1788). D. in New York Sept. 27, 1832. His *Diary, Journals, and Letters*, edited by Henry C. Van Schaack, were published in 1842.

**Van Schaick** (Gozen), b. at Albany in 1737; was appointed in 1756 a lieutenant in the expedition against Crown Point, and took part in the subsequent French and Indian war. Early in the Revolutionary war he was sent to Cherry Valley, in the interior of the State, to protect the settlers against the British and Indians; was present at the battle of Monmouth, and in 1779 was sent to destroy the settlements of the Onondaga Indians, for which and other services he received the thanks of Congress; was made brevet major-general in 1783. D. July 4, 1789.

**Vans'ville,** tp., Prince George's co., Md. P. 2273.

**Van Swieten.** See Swieten, Van.

**Vantal'lar,** tp., Licking co., O. P. 70.

**Van Tromp.** See Tromp, Van.

**Vanux'em** (Lardner), M. D., an eminent geologist of New York, of whose career no information is found in works of reference, is accredited by Dr. H. Charlton Bastian in his *Beginnings of Life* (2 vols., 1872) with the discovery and announcement of the doctrine of the correlation of forces, which was afterward independently discovered and demonstrated by Mayer and Joule.

**Van Veen** (Otho, also called Ottovenius), b. at Leyden about 1556; studied painting at Liege, then for eight years at Rome; settled at Brussels as painter to Alexander Farnese; removed afterward to Antwerp, where he established a school in which Rubens received his first instruction; returned finally to Brussels, where he d. as master of the mint about 1630. The most remarkable of his paintings are the portrait of Alexander Farnese and some religious pictures in Brussels and Antwerp.

**Vanvitel'li** (Luigi), b. at Naples in 1700, the son of a Dutch painter, Caspar van Witel, who had settled in Italy; studied first painting, afterward architecture; formed his style principally after Palladio and Vignola; executed many works in Rome and Naples, and d. in the latter place Mar. 1, 1773. His principal buildings are the Augustinian convent in Rome and the palace of Caserta near Naples. (See *Vita di Luigi Vanvitelli*, by L. Vanvitelli, Naples, 1823.)

**Van Wert,** county of N. W. Ohio, bordering on Indiana, drained by St. Mary's and other rivers, is touched on its E. border by Miami Canal, and traversed by Pittsburg Fort Wayne and Chicago R. R.; surface level and well timbered, soil a rich loam resting upon blue marl. There are saw-mills, flour-mills, tanneries, and some manufactories of iron and woollen goods. Horses, cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, wool, lumber, and dairy products. Cap. Van Wert. Area, 390 sq. m. P. 15,823.

**Van Wert,** p.-v., Pleasant tp., cap. of Van Wert co., O., on Pittsburg Fort Wayne and Chicago R. R., has a national bank, a State bank, 2 private banks, and 2 newspapers. P. 2625.

**Van Zandt,** county of N. E. Texas, bounded N. E. by Sabine River, and drained by affluents of the Sabine, Neches, and Trinity; surface undulating, a large portion being well timbered. Cattle and swine are very numerous. Staples, cotton, Indian corn, and sweet potatoes. Cap. Canton. Area, 875 sq. m. P. 6494.

**Vapereau'** (Louis Gustave), b. at Orleans, France, Apr. 4, 1819; was educated at the normal school of Paris; taught philosophy and German at the College of Tours 1843–52; settled in the latter year in Paris, and became in 1854 chief editor of the *Dictionnaire Universel des Contemporains*, of which editions appeared in 1858, 1861, 1865, and 1870. He also contributed occasionally to various periodicals.

**Va'pors and Vaporization.** Under Liquids, Chemical and Physical Nature of, the passage from the liquid to the gaseous or vaporous state is discussed, and the law of *latent heat of vaporization*, or gasefaction, stated. Regarding the nature of the change called vaporization, it may be further pointed out that it is legitimate for us to compare the phenomenon of the disappearance of *temperature* or *thermometric* heat in this case to the similar phenomena that occur during fusion, solution, and other chemical transformations accompanied by absorption of heat. Heat being always *motion*, as universally believed in recent times, the writer seeks here again to apply his views (see Temperature, Nature of) regarding the differences in nature and effects between *atomic* and *molecular* motion. He deems latent heat of gasefaction, like heat of liquefaction or fusion, to be *atomic* motion only, *intramolecular*, or inside the molecule, and that it is latent for the reason that it is expended in amplifying the atomic excursions or orbits. It follows that the molecules of a compound in gaseous form, besides being separated further, are *larger;* or it may be, more probably, that *there are more of them*, from the splitting up of more compound chemical molecules into simpler ones. Thus, we may suppose that *liquid* muriatic acid (liquefied by pressure) is $H_2Cl_2$ or $H_4Cl_4$, or generally $n$HCl, and that when it is gasefied it becomes simply HCl. Water in liquid form may be $H_{10}O_5$ or $n H_2O$, and in steam simple $H_2O$. By this hypothesis it will not be necessary to believe that the *intermolecular distances* in steam are twelve times those in water, the enormity of this latter deduction being very greatly mitigated. This view makes the relation between the liquid and gaseous conditions simply one of *polymerism* (see the sub-head *Polymeres* under Isomerism), the gaseous state being that in which chemical molecules have their simplest possible atomic form, or are reduced to their smallest possible number of constituent atoms.

The total space occupied in a gas, therefore, by the molecules themselves—apart from the intermolecular space—is greater than in a liquid, this increase representing the latent heat of gasefaction, which only appears again on reconversion into liquid. And the intermolecular distances and spaces, on the new polymeric hypothesis above stated, may have received no greater increase than is due to the mere increase of *temperature*, or motion of the molecule as a whole; the multiplied number of molecules accounting largely for the increase of volume. A still further increase of temperature leads, in the case of chemical compounds, to a further decomposition of the molecule into gaseous molecules of the elements themselves, composed each of a certain number as yet unknown—possibly unknowable—of elementary atoms; this being Dissociation. (See this article, by Prof. Joy.) Henry Wurtz.

**Vapors, Determination of the Density of.** Owing to the near relations which the atomic weight of the elements and the composition of compounds bear to the specific gravity of their vapors, the accurate determination of the latter at a known temperature and pressure, in comparison with that of an equal volume of air at the same temperature and pressure, possesses very great importance. Of the numerous methods proposed for this determination, those suggested by Gay-Lussac and by Dumas are most often employed; other processes proposed by Deville and Troost, Regnault and Hofmann, are also used for special purposes. In the determination of vapor-densities it is necessary that the substance be completely volatile without decomposition, that it be entirely free from bodies possessing lower or higher boiling-points, and that it be perfectly dry.

*Gay-Lussac's method* is employed in cases where the density of a liquid which boils at about 212° F. is to be

determined. In it a known weight of the substance is converted into vapor at a definite temperature, and its volume accurately measured. The density is then calculated by dividing the weight of the substance by the weight of an equal volume of air at the same temperature and pressure. The apparatus used consists of an iron bath containing mercury, on which a wide glass cylinder (open at both ends) rests; this is filled with water or melted spermaceti, the temperature of which is indicated by a thermometer dipping into the liquid, and encloses a smaller graduated cylinder, which is filled with dry mercury. A small bulb of thin glass is completely filled with the liquid whose vapor-density is to be determined, and sealed by fusing its orifice. Its weight when empty and when full is determined, the difference being, of course, the weight of the liquid used. The bulb is next introduced into the small graduated cylinder containing mercury, and this is immersed in the large cylinder filled with water or spermaceti, which is then heated to a temperature of about 60° F. above that of the boiling-point of the liquid in the bulb. Owing to the dilatation of the liquid, the bulb bursts, and the liquid becomes converted into vapor, causing a depression of the mercury. The volume of the vapor as indicated by the graduated tube is read off, the temperature being shown by the thermometer, and the barometric pressure by the difference between the height of the barometer at the time of the observation and the height of the mercurial column in the glass cylinder. It is, however, also necessary to determine the height of the column of water or spermaceti in the larger cylinder, and reduce it to the corresponding volume in millimètres of mercury, which is then added to the height of the barometer. It then remains to calculate the weight of a volume of air equal to that of the vapor under the same pressure and temperature, and to divide the weight of the vapor by that of the air. Thus, let $p$ be the weight of the vapor in grains, $v$ its volume in cubic inches, and $t$ its temperature; if H be the height of the barometer (to which has been added that of the column of water or spermaceti reduced to its equivalent volume of mercury), and $h$ that of the mercury in the graduated cylinder, $H - h$ will be the pressure on the vapor. The weight $p'$ of a volume of air $v$, at the temperature $t$ and the pressure $H - h$, is ascertained as follows: At zero, under the normal pressure of 760 millimètres, a cubic inch of air weighs 0.31 grains; therefore, under the same conditions, $v$ cubic inches will weigh $0.31\,v$ grains, and the weight of $v$ cubic inches of air at $t°$ and the pressure of 760 millimètres will be $\frac{0.31\,v}{1+at}$ grains, where $a$ = the coefficient of cubical expansion of air for 1 degree (= .00366); and, as the weight of a volume of air is proportional to the pressure, the above weight can be reduced to the pressure $H - h$ by multiplying by $\frac{H-h}{760}$, which gives $\frac{0.31\,v\,(H-h)}{(1+at)\,760}$ for the weight $p'$ of the volume of air $v$ at the pressure $H - h$ at $t°$; therefore $\frac{p}{p'} = \frac{p\,(1+at)\,760}{0.31\,v\,(H-h)} = D$, or the desired density of the vapor. The method just described cannot be employed for vapor-density determinations of liquids which boil much above 300° F., as the mercury vapors evolved at a greater temperature would be dangerous to the operator, and would also vitiate the result by increasing the tension of the vapor of the liquid.

*Dumas's method* can be employed up to the temperature of 750° F. (about the heat at which glass softens), but it involves the necessity of a considerable supply of substance. It is executed as follows: A thin glass globe, having a neck consisting of a fine capillary tube, is first carefully dried, internally and externally, and weighed, the temperature $t$ and the barometric pressure $h$ being noted; the weight W is that of the glass G added to that of the air contained, $p$. The globe is next slightly warmed, and its neck inserted in the liquid the vapor-density of which is to be determined. On cooling, a small quantity of the liquid rises into the globe. It is then immersed in a bath consisting of oil or fusible metal, according to the temperature desired, the temperature of which is indicated by a thermometer. The bath is now heated a little above the boiling-point of the liquid contained in the globe, the vapor of which expels the air, and finally fills the globe. As soon as the vapor ceases to escape from the capillary tube, the point of the latter is hermetically sealed, the temperature of the bath $t'$ and the barometric pressure $h'$ being observed. When cold, the globe is carefully cleaned, and again weighed. This second weight W′ represents that of the glass G and that of the vapor $p'$ which filled the globe at the temperature $t'$ and pressure $h'$, or $W' = G + p'$. In order to ascertain the weight of the glass when empty, the weight $p$ of air is found by dipping the capillary tube beneath mercury and breaking off its extremity; if the operation has been properly performed, a vacuum is formed by the condensation of the vapor, and the mercury enters the globe, entirely filling it. The metal is then measured by pouring it out into a graduated tube, from the result of which the volume of the globe at the temperature $t'$, and therefore the volume of the vapor, can be readily calculated. The weight $p$ of the air at $t$ and $h$ is also then easily obtained, which, if deducted from W, gives the weight of the glass G. The weight of the vapor $p'$ is $W' - G$; and, as we have now ascertained the weight $p'$ of a given volume of vapor at the temperature $t'$ and pressure $h'$, it only remains to calculate the weight $p''$ of an equal volume of air under the same conditions; which is easily done, when the quotient of $\frac{p'}{p''}$ will give the required vapor-density of the substance.

Deville and Troost have extended Dumas's method to the determination of vapor-densities of substances having a very high boiling-point, by employing a light porcelain vessel in place of the glass globe, and sealing the exit-tube by means of the oxyhydrogen blowpipe. The bath used is contained in an iron vessel, and consists of vapors of known and constant temperature; thus, boiling mercury furnishes a vapor-bath having a temperature of 662° F., sulphur one of 824° F., cadmium one of 1580° F., and zinc one of 1904° F. The temperature of the bath is best determined by means of a thermometer filled with iodine vapor, as it has about the same coefficient of dilatation as air, and possesses a heavy density.

Of the several methods proposed by Regnault, the following, which possesses great simplicity, and can be employed in the vapor-density determinations of substances which have a high boiling-point and are not affected by exposure to the air, merits mention: The vessels used are two cast-iron flasks of the same capacity and thickness, having their orifices partially closed by means of two metallic bullets. The volume of the flasks is first accurately determined by weighing the quantity of water necessary to fill them. Some mercury is then introduced into one flask, the substance experimented upon being placed in the other, and both are placed in a muffle and heated to a temperature above that at which the substance boils; whereby the mercury and substance are converted into vapor, which expels the air from the flasks. They are subsequently removed from the fire and allowed to cool, when the quantities of mercury and substance remaining in the flasks are determined by analysis. If P be the weight of the residual mercury, P′ that of the substance, and $\delta$ the density of mercury compared with that of the air under the same conditions of temperature and pressure that existed in the muffle when the flasks were removed, the density of the vapor $x$ will be $x = \delta\frac{P'}{P}$; but as the capacities of the flasks are never precisely the same, the following equation is more correct: $x = \delta\frac{P'}{P}\cdot\frac{v}{v'}$, where $v$ is the volume of the flask in which the mercury is placed, and $v'$ that of the flask containing the substance.

*Hofmann's method*, which is based upon that of Gay-Lussac, is as follows: A graduated glass tube is first completely filled with mercury, and then dipped in a mercury bath, when a barometric vacuum of several millimètres will be formed in the top; this portion of the tube is then enclosed within another tube which is drawn out at its upper extremity to a conducting tube having a moderate width and bent at a right angle. This tube connects with a copper or glass vessel in which water or other liquids can be boiled. The outer tube is closed at the bottom with a cork having two openings, in one of which the barometric tube is inserted, in the other an escape-tube. In this way a current of vapor of water or other volatile liquid (such as *aniline*) can be made to traverse the space between the two tubes, thus maintaining the upper part of the barometric tube at the temperature desired in the determination. The substance under examination is introduced into the barometric vacuum in a small glass tube provided with a ground-glass stopper, which is afterward forced out by the expansion of the vapor. In other respects the determination is made as in Gay-Lussac's method. The above method is very advantageous in that, under the very slight pressure to which the enclosed vapor is exposed, the determination may be made at a comparatively low temperature. The vapor-densities of liquids, for instance, which boil as high as 300° F., can be ascertained at the boiling-point of water. J. P. Battershall.

**Vapors, Latent Heat of.** See Vapors and Vaporization, by Henry Wurtz; also Liquids, Chemical and Physical Nature of, by the same.

**Var,** department of France, bordering S. and S. E. on the Mediterranean, comprises an area of 2384 sq. m., with

293,757 inhabitants. It is mountainous, covered with spurs of the Alps, and rich in forests and useful minerals, especially coal and iron. In the valleys wheat, wine, olive oil, and all kinds of fruit are produced in abundance, and a considerable manufacturing industry is carried on, comprising iron goods, perfumery, earthenware, and articles of marble. Of 35,380 children of school age, 9911 received no school education at all in 1857. Cap. Draguignan.

**Varal'lo,** small town of Italy, province of Novara, in the centre of the Val Sesia. In its immediate neighborhood is the Sacro Monte di Varallo, one of the most celebrated sanctuaries in the kingdom of Italy, and annually visited by many thousands of pilgrims. Here are more than 40 chapels, all adorned with plastic or pictorial groups representing scenes from the life of Christ. The modelled figures, which generally possess decided merit, are of baked clay, painted to resemble life; they are the work of some of the best artists of Northern Italy, among them the celebrated Gaudenzio Ferrari, whose house is still shown in the town. P. 3200.

**Varangian Guards** and **Varangians.** See NORMANS, by E. MUNROE SMITH.

**Varan'idæ** [from *Varanus*—the Latinized form of a native name—the typical genus], a family of reptiles of the order Sauria and sub-order Pleurodonta, confined to the Old World. The body has the typical lizard form; the scales are small, roundish, and disposed in transverse lines; the head is covered above with small scales or shields, and bony superorbital plates are developed; the mouth is well cleft; the teeth adnate to the inner side of the jaws; the tongue is elongate, slender, and bifid, and its base receivable in a membranous sheath; the legs are well developed, as are also the toes, which are five in number; the femora are destitute of pores. The skull offers a number of additional characters signalized by Cope: "the temporal bone superior plate developed beyond arched body; frontal underarching olfactory lobes; arches not complete; fossa not covered by dermo-ossification; articular and angular separate; dentary short, not developed posteriorly; Meckel's cartilage exposed in its groove; premaxillary single, suspensoria two;" the clavicle at its proximal end is simple; the sternum has an anchor-shaped mesosternum. The family includes some of the largest of known lizards; they are swift in their motions, and progress mostly in a somewhat serpentine manner; they feed chiefly on insects and the eggs of birds, reptiles, etc. The most noteworthy species is the monitor of Egypt (*Monitor niloticus*), so called because it was anciently supposed to give a warning or monitorial hissing or whistling noise on the approach of a crocodile. Modern Egyptians, it is said, believe that the species is a neglected young crocodile hatched on dry land. It is represented on ancient Egyptian monuments, and probably owed this commemoration to the fact that it devoured the eggs of the crocodile. It lives near the water, and attains a length of five or six feet.

THEODORE GILL.

**Varaz'ze** [Lat. *Vicus Virginis*], town of Italy, province of Genoa, on a bay near the mouth of the Teiro, about 7½ miles E. of Savona, is a walled and well-built town, and several towers of the old fortifications are still standing, but a large portion of the inhabitants now live in the suburbs outside the walls. In the church of S. Ambrosio, built in the twelfth century, restored in the sixteenth, and again in the seventeenth, there are some very fine marbles and good pictures, as also in some of the other churches. There is a very extensive dock here, and the chief occupation of the inhabitants is shipbuilding and the manufacture of all articles required for the outfit of vessels. Between 700 and 1000 men are employed in the construction of vessels, mostly for the Genoese mercantile service. Large paper-mills, one or two cotton-factories, etc., are also in operation. P. 9179.

**Var'döe,** island of Norway, in the Arctic Ocean, in lat. 70° 20′ N., lon. 31° 10′ E., and contains a town and fort, Vardöehuus, which is the northernmost inhabited place in Europe.

**Varec** (see KELP, by HENRY WURTZ), a French name for barilla or kelp, sea-weed ashes.

**Varennes',** a beautiful p.-v. of Verchères co., Quebec, on the S. shore of the river St. Lawrence, 15 miles below Montreal. It has in the vicinity saline and inflammable gas springs, a college, convent, and hospital. P. 561.

**Varennes,** tp., Anderson co., S. C. P. 1892.

**Vare'se,** town of Italy, province of Como, on one of the extreme spurs of the Rhætian Alps, about 35 miles N. of Milan. Its vicinity to Lago Maggiore and Switzerland has made it a place of considerable trade, as well as of much general activity, and the fine climate and scenery render it a very favorite summer residence for the Lombard nobility. The sanctuary known as S. Maria del Monte, on a lofty hill about 5 miles N. W. of the town, is an object of special attraction to the devout Roman Catholic on account of an image of the Virgin consecrated by St. Ambrose which is still preserved here, and to the lover of nature for the magnificent views to be obtained from this summit. Varese was a Roman town of some importance, and recent discoveries in the lakelets near it prove that it was inhabited in pre-historic times. P. 12,600.

**Vare'se Ligu're,** town of Italy, province of Genoa, once fortified, but the ancient castle, with its lofty tower built by the Fieschi, is all that remains of that period. The very scattered population of this commune numbers about 7000.

**Var'gas** (José), b. in Venezuela in 1786; was educated at the University of Caracas, and subsequently studied medicine in Edinburgh; after travelling in England, France, and Spain, entered upon practice in the island of Porto Rico, becoming the foremost surgeon in the West Indies. Returning to Venezuela, he became professor of anatomy, surgery, and chemistry in the University of Caracas, of which he was subsequently rector. His lectures, which were published, were the textbooks in the university, and he gathered the largest collection of plants and minerals, and the finest private library, in Venezuela. He also took an active part in public affairs; was a member of the first congress of the republic in 1821, president in 1834, and subsequently senator and councillor of state. D. in New York July 14, 1854.

**Vargas, de** (LUIS), b. at Seville, Spain, in 1502; studied painting in Italy, residing chiefly in Rome for nearly thirty years, after which he established himself in his native city, where he executed for the churches numerous large oil paintings and frescoes; was regarded as the chief of the Seville school, and hastened his end by his rigorous austerities, being accustomed, among other ascetic practices, to sleep in a coffin. D. at Seville in 1568. Among most admired paintings are *Adam and Eve*, *Jesus bearing his Cross*, and *La Generacion*, representing the parents and ancestry of Christ, all of which are preserved in Seville, and a portrait of the duchess of Alcalá, esteemed as equal to the similar works of Raphael.

**Va'riable** [Lat. *variare*, to "vary"]. Variables are quantities which admit of an infinite number of sets of values in the same equation. Thus, in the equation $y^2 = 2px$, $x$ and $y$ are variables, because there is an infinite number of sets of values of these quantities that satisfy the equation. If there are two or more variables in an equation, all but one may be regarded as *independent;* that is, we may assign values to them at pleasure, but the value of that one must be such as to satisfy the given equation. Because one variable always depends on the form of the equation, as well as on the values assigned to the others, it is called the *dependent* variable or the *function.* In the rectangular equation of lines, $x$, or the abscissa, is called the independent variable, and $y$, or the ordinate, is the function; in the rectangular equation of surfaces $x$ and $y$, or the abscissas, are taken as independent variables, and $z$, or the ordinate, is the function. In the polar equation of a line the radius vector is regarded as the function, and the corresponding angles are regarded as independent. This is the conventional rule, but any variable may be regarded as the function, the other varying elements being regarded as independent.

The difference between the variables and the arbitrary constants that enter an equation is this: the variables admit of an infinite number of sets of values in the same expression, whilst the arbitrary constants admit of but one out of an infinite number of sets of values. Thus, in the equation of a parabola, which is $y^2 = 2px$, $2p$ may have any arbitrary value, whilst $x$ and $y$ must have an infinite number of values for any assumed value of $2p$. W. G. PECK.

**Varia'tions** [It. *variazioni*], in music, certain ornamental changes or embellishments in the treatment of a theme during several successive repetitions. The simplest kind of variation is by the breaking of chords into triplets or quadruplets, etc., or by throwing them into some of the numerous forms of arpeggio, or by inserting passing notes into the melody, together with scale movements, and many similar devices. In simple variation the fundamental harmony usually remains unchanged, whatever may be the form of the structure built upon it. But in the more elaborate styles of variation new harmonies, rhythms, and melodic developments gradually appear, and are often so richly worked out as to display with brilliance the fertility of the writer's fancy. Variations of *chorals* consist chiefly of changes in the harmony, suspensions, syncopations, and passing notes, while the flow of the original melody is preserved intact. A strain of mere melody may be so varied as to convey the idea of three or four parts in harmony, as

when on a violin or flute each note is broken into an arpeggio movement on a supposed series of chords.

WILLIAM STAUNTON.

**Variations, Calculus of.** John Bernouilli proposed (1696) to the mathematicians of his day the following problem: "Datis in plano verticali duobus punctis A et B, assignare mobili, M viam A M B per quam gravitate sua descendens, et moveri incipiens a puncto A, brevissimo tempore perveniat ad alterum punctum B." (Given, two points, A and B, in a vertical plane, to find the path or curve by which a body under action of gravity will descend from A to B in the least possible time.) In this problem (since known as that of the *brachystocrone*—βραχύς, "short," and κρόνος, "time") was the germ of the subsequently-developed *calculus of variations*. The peculiarity of the problem lies in this, that a curve is to be found no element of which is given; no condition establishing *directly* a condition between its elements (or parameters); nor any relation governing the *relative* increments of its co-ordinates (*i. e.* determining *its law of growth*; see CALCULUS). It was thus removed out of the sphere of pure geometry, and was beyond the methods of the differential calculus; for the first needs data involving the integral elements; the second (besides perhaps these), data governing the law of growth (*i. e.* involving some one or more of the differential coefficients). Such were not the data of this new problem, but (regarding the required curve as to be expressed by a relation between Cartesian co-ordinates $y$ and $x$) to find that relation or *function* which should *fulfil a certain condition—i. e.* that it should be the minimum-*time* path of descent, by action of gravity, of a body falling from one of its *given* points to the other and lower *given* point. Solutions were given by the proposer and his brother, James Bernouilli, and by the Marquis de l'Hôpital, but they were special, and involved assumptions which are not always admissible. Subsequently, Euler took up the subject, and to him the modern calculus is greatly indebted. He developed what (in his predecessors) had been mere solutions of a particular problem into an almost complete science. But it remained for the illustrious Lagrange to separate the principles of the calculus of variations from the geometrical considerations from which his predecessors had derived them; to establish a pure analytic basis; to invent a simple and definite notation; and thus to open a new and extensive field for its future applications. To Lagrange, therefore, is usually attributed the calculus of variations as it is now presented.

It is not in place here to attempt to set forth its methods. Its problems all involve the condition of maximum or minimum, absolute or relative—*e. g.* in that of the brachystocrone the condition is *absolute*, inasmuch as no *other* condition is imposed; in that of a line of *given* length which shall be the perimeter of a *maximum area*, is that of *relative* maximum. The methods are analogous to those by which maxima and minima are derived by the differential calculus. If in the expression $y = f(x)$ ($y$ being any function depending for its value on that of $x$) there be a value, $x_m$, for which the corresponding value $y_m$ is greater (or less) than all others (*i. e.* a maximum or minimum), then (in general) an indefinitely small increment of $x_m$ will produce no change in $y_m$. In the language of the differential calculus, the differential of $y$ taken with respect to $x$ becomes *zero* for that value of $x$ which renders $y$ a maximum (or minimum). But if, *instead of varying* $x$ in the particular function, we slightly vary *the function f itself* (this may be done by slightly varying its parameters or slightly varying its analytic form), we should have, for every value of $x$, a slightly-varied value of $y$. The differences thus created may be called *variations*. Now, analogously to the above law of maxima in the differential calculus, if for some particular form $f(x)$ *some other quantity or derived function depending upon this particular form* (*e. g.* the *time of descent* by gravity from one point to another) be a *minimum*, then an infinitesimal variation (under restrictions which cannot here be explained) of the *function* will produce *no* change in that minimum. By this condition (subject to certain restrictions) the *calculus of variations* determines the form of $f(x)$—somewhat as in the differential calculus the particular value of $x$ which makes $y$ a maximum is determined. The simplest of its problems is that of the shortest path between two given points, by which it is shown to be a *straight line*. The *History of the Calculus of Variations* has been written by Todhunter, as also *Researches in the Calculus of Variations*. Strauch, a German author, is an authority; but the most exhaustive English treatise is that of Jellett (Dublin, 1850).

J. G. BARNARD.

**Var'ick,** p.-v. and tp., Seneca co., N. Y. P. 1741.

**Varick** (RICHARD), b. at Hackensack, N. J., Mar. 25, 1753; at the opening of the war of the Revolution was a lawyer in New York; entered the army as a captain; was secretary to Gen. Schuyler in the northern department, and after the discovery of Arnold's treason was inspector at West Point, and subsequently, with the rank of colonel, a member of the military family of Washington. In 1783 he became recorder of the city of New York, and was subsequently mayor for several years, ending in 1801. In 1786 he and Samuel Jones were appointed to revise the State laws, and the result of their labors, bearing their joint names, was published in 1789. He was one of the founders of the American Bible Society, and succeeded John Jay as its president. D. at Jersey City July 30, 1831.

**Var'icose Veins,** relaxation of the coats of the superficial veins, with increased calibre, occurring most frequently in the lower extremities. Gravitation, the weight of the venous blood-column above, and the difficulty of the ascent of blood from the feet to the body, determine the greater frequency of the disease in the veins of the legs. Varicose veins are common in aged men, the result of senile degeneration of the various tissues, including attenuation of the coats of vessels; less often it occurs in mid-life to robust men of the gouty habit, and who by vocation are constantly standing; walking does not favor the condition, since the movements of the superficial muscles and tension of the integument help to lift the blood upward. Even in youth violent exercise, as in the gymnasium, by unduly taxing the tension of the vascular system, causes a breaking down of the valves in the veins and venous dilatation or varicosity. In women the chief and not unfrequent cause is pregnancy. Women who have borne several children will often have marked varicose veins, the result of the pressure of the gravid uterus upon the veins in the pelvic cavity, and consequent detention of the venous blood in the lower extremities. Varicose veins occur exceptionally in other parts of the body—upon the scalp and side of the neck, and upon the abdomen in the region of the groin. Varicocele in the male is a local varicosity of the spermatic veins. Hæmorrhoids or piles are due to repeated passive congestions of the hæmorrhoidal veins at the verge of the anus; obstruction to the portal circulation is the primary cause, but if of frequent recurrence and long standing, the veins become varicose. Varicose veins, as seen in the lower extremities, are increased in diameter with inequalities of calibre, and present nodular enlargements or pouches at intervals; there are greater relaxations at the site of former valves or at the points of division of veins. The veins are also tortuous, since the longitudinal fibres of the coat are relaxed no less than the circular; the tortuosity accommodates the increased length of the vessel and favors the ascent of the blood. Varicose veins when appearing do not necessarily indicate debility or degeneration, but should warn the patient at once to abandon vocations involving violent exertion, to habitually regulate the diet and bowels, and neutralize and remove any rheumatic or gouty vice. The varicose limb may be benefited by daily friction, cold effusion, and salt bathing. But the extension of the disease is best checked, and the best prospect of cure ensured, by constant external support. This is secured by uniform bandaging, or by wearing an elastic stocking or laced leg-corset. The elastic stocking, made of rubber webbing, is of the greatest value to those who can afford the silk and rubber webbing, and keep them constantly renewed when stretched by wear. The inferior stocking by stretching at points leaves bands of circular constriction which aggravate the disease rather than give the intended benefit. The cheapest and most efficient appliance is a case or corset of strong jean fitted to the shape of the limb and lacing up in front. Varicose veins are radically cured by ligation and by hypodermic injection of a drop of liquor ferri pernitratis within the vein. Either process may result in local ulceration and failure. The latter method carefully performed may afford permanent relief, with the precaution to tightly bandage the part for several hours to prevent blood-clots from reaching the heart and vessels of the trunk. Arsenical preparations are thought to act well on varicose veins.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Vari'na,** tp., Henrico co., Va. P. 3210.

**Varinas,** or **Barinas.** See BARINOS.

**Varioloid.** See SMALL-POX and VACCINATION.

**Var'na,** in Bulgaria, on an inlet of the Black Sea, 180 miles N. W. of Constantinople, with which it is connected by a line of steamers (about 15 hours). It makes a good appearance as seen from the water, and has some importance on account of its fortifications; and although its harbor is safe only in summer, it carries on a considerable trade. A railway, owned in England, connects it with Roustchouk (140 miles N. W.) on the Danube. P. about 20,000.

**Varn'hagen von En'se** (KARL AUGUST), b. at Düsseldorf Feb. 21, 1785; was educated at Hamburg; studied

first medicine, then philosophy and literature at Berlin, Halle, and Tübingen, and published in 1804 a *Musenalmanach*, together with Chamisso. In 1809 he entered the Austrian army, fought in the battles of Aspern and Wagram, and accompanied, after the conclusion of peace, Gen. Prince Bentheim as adjutant on his diplomatic journeys to Prague and Paris. In 1812 he received a position in the Prussian civil service, but in 1813 entered the Russian army as a captain; served in Tettenborn's corps during its campaign from Hamburg to Paris, and wrote *Geschichte der Kriegszüge Tettenborns* (1814). After the fall of Paris, he accompanied Prince Hardenberg to the Congress of Vienna, and went in 1815 as Prussian minister to Carlsruhe; but removed in 1810 to Berlin, where he subsequently resided till his death, Oct. 10, 1858, devoting himself to literature. In 1814 he married Rahel Levin, a rich Jewess (b. in 1771), much noted for the chivalric homage which the late Prince Louis Ferdinand of Prussia (d. in 1807) had borne to her, and most remarkable for the power and brilliancy of her intellect and for the energy and nobleness of her character. In Berlin she formed the centre of a large circle encompassing all the greatest talents in art, literature, science, and politics, and after her death (in 1833) her husband published *Rahel, ein Buch des Andenkens für ihre Freunde* (3 vols., 1834), containing selections from her posthumous papers, and *Galerie von Bildnissen aus Rahel's Umgang* (2 vols., 1836), a series of literary sketches. This last kind of production, the biography, the literary portrait, was the true talent of Varnhagen von Ense, and his *Goethe in den Zeugnissen der Mitlebenden* (1823) and *Biographische Denkmale* (5 vols., 1824–30) are very interesting. After his death were published his *Tagebücher* (14 vols., 1861–72), *Blätter aus der preussischen Geschichte* (1868), *Biographische Porträts* (1871), *Briefe von Alexander von Humboldt 1827–58* (1860), etc., which works gave many surprising revelations with respect to characters and events of his time.

**Var'nish** [Lat. *vernix*; Ger. *Firniss*; Fr. *vernis*], a resinous solution which is employed for coating various objects in order to produce a thin, transparent, and hard surface, forming a protection against moisture and air. The principal resins employed are the gums copal, shellac, animé, mastic, and sandarac; the solvents being spirit of wine, wood-spirit, oil of turpentine, linseed and other drying oils. From the nature of the solvent used varnishes may be conveniently divided into four classes—viz. fixed oil, spirit, volatile oil, and ether varnishes.

*Fixed oil varnishes*, which possess great durability and lustre, are usually prepared from linseed oil, which, on being oxidized by the action of the air, is converted into a tough elastic substance termed *linoxine*, the change taking place more rapidly in a boiled oil, which possesses greater siccative power. In the preparation of the oil for the manufacture of varnish, it is boiled in a copper vessel in the presence of litharge, oxide of zinc, or peroxide of manganese, by the action of which the *linoleine* of the oil is partially converted into linoxine. The resin is then fused in a caldron, and the boiled oil, which is heated to about 300° F., gradually added, with constant stirring. As soon as a complete admixture between the resin and oil has been effected, the caldron is removed from the fire and allowed to partially cool, when heated oil of turpentine is added in a thin stream until the mixture acquires a proper consistence. The proper amount of linseed oil to be added to the resin can be determined by taking out a drop of the fluid every few moments and allowing it to cool on a glass plate, when, if the proportions of oil and resin are correct, it will remain limpid and wax-like; in case it becomes hard and brittle, more oil is required. It was formerly considered necessary to boil the mixture of linseed oil and resin before adding the oil of turpentine, but the only heat really requisite is that needful to melt the resin and cause it to become thoroughly miscible with the oil. The manufacture of varnish should be carried on in dry weather, as otherwise its transparency and drying qualities are liable to be impaired by the absorption of moisture; and, owing to the inflammability of the oil of turpentine, great caution is necessary to avoid danger of fire. When practicable, all heating should be done by means of a sand-bath. The quality of the linseed oil used is of importance; a pale limpid oil, which is prepared from full-grown and ripe seeds, and does not change the color of the varnish to any great extent, should be employed. The proportions by weight of the ingredients composing an ordinary oil-varnish are as follows: resin (copal, amber, etc.), 10; boiled linseed oil, 20 to 30; oil of turpentine, 15 to 18. As a rule, varnishes of this composition improve with age. An amber varnish, which possesses great durability, but dries slowly, has the following composition: resin (*amber colophonium*), 1 pound; boiled linseed oil, 10 ounces; oil of turpentine, 1 pint. A good carriage varnish is made from gum-animé, 8 pounds; boiled linseed oil, 3 gallons; camphor, ¼ pound; litharge, ¼ pound; oil of turpentine, 5½ gallons. A black asphaltic varnish, suitable for iron-work, can be made from asphalt, 3 parts by weight; boiled linseed oil, 4; oil of turpentine, 15 to 18; or from foreign asphalt, 45 pounds; linseed oil, 6 gallons; litharge, 6 pounds; boil, then add dark fused gum-amber, 8 pounds; hot linseed oil, 2 gallons; boil again, remove from the fire, and thin down with oil of turpentine, 25 gallons. A good wainscot or mahogany varnish is obtained from sorted gum-animé, 8 pounds; clarified linseed oil, 3 gallons; litharge, ¼ pound; dried sugar of lead, ¼ pound; oil of turpentine, 5½ gallons. The addition of India-rubber or gutta-percha to oil varnishes imparts further flexibility to the product.

*Spirit varnishes* (*lac varnishes*) differ from the preceding in being true solutions of resins. The solvents most employed are spirit of wine and wood-spirit. Acetone, benzole, etc., are also occasionally used. The gums chiefly employed are sandarac, mastic, shellac, and animé. Sandarac confers hardness on varnishes; mastic imparts a gloss. Shellac is rendered more soluble by being powdered and exposed to the air for a long time. The spirit used as the solvent should not be less than 95 per cent. in strength. In the preparation of spirit varnishes the resins, before being added to the solvent, should be well pulverized and mixed with sand or broken glass, in order to prevent the gum from agglutinating into lumps. The solution is accomplished in a still heated in a steam-bath, the varnish being filtered, first through silk, then through filter-paper. The tendency of the varnish to "chill" or give a rough surface is obviated by the addition of a little concentrated ammonia or gum-sandarac; excessive brittleness being remedied by the addition of Venice turpentine. Sandarac varnish is prepared by dissolving 10 parts of the gum and 1 part of Venice turpentine in 30 parts of spirit. Ordinary copal varnish is made by first melting the resin at a gentle heat, then pulverizing and mixing it with sand, dissolving in strong alcohol, and filtering. Elemi resin, or solution of turpentine, is sometimes added to give greater softness. A colorless copal varnish is prepared by dissolving 6 parts of pulverized and fused copal in 6 parts of strong alcohol in a closed vessel, and adding 4 parts of oil of turpentine and 1 part of ether. Colored spirit varnishes, or *lacquers*, are commonly used to impart a gold color to instruments made of brass and other base metals. As the coloring ingredients, tinctures of gummi-gutta, dragon's blood, gamboge, coralline, picric acid, turmeric, Martius yellow, annotto, etc., are separately prepared and added in the proportions necessary to give the required color to a varnish consisting of seed-lac, 2 parts; sandarac, 4 parts; elemi, 4 parts; alcohol, 40 parts. The following mixture furnishes a good gold lacquer for brass-work: seed-lac, 3 ounces; turmeric, 1 ounce; dragon's blood, ¼ ounce; alcohol, 1 pint. Recently, aniline colors have been employed to impart various tints to spirit varnishes, which are especially adapted to the coloring of glass, the "bronzing" of leather, etc.

*Volatile oil varnishes* are prepared in the same manner as the preceding, the solvent being oil of turpentine. They are more durable than spirit varnishes, and are less brittle, but require more time in drying; they also differ from the latter in improving by age, whereas spirit varnishes usually deteriorate in quality. The resins employed (gum-copal, gum-damar, Canada balsam, etc.) are commonly directly dissolved in the oil of turpentine, with or without previous fusion, the usual proportions being about 5 pounds of the resin to 7 pounds of the solvent.

*Ether varnishes* consist simply of an ethereal solution of a resin. They have a very limited application. The following is sometimes used for the repairing of jewelry: copal, 5 parts; ether, 2 parts. A varnish for photographers' use is prepared by dissolving 3 or 4 grains of amber in 1 ounce of chloroform.

Besides the varieties of varnish already mentioned, numerous other preparations are used for specific purposes which cannot well be classified under any of the above heads. A varnish consisting of 1 part gutta-percha dissolved in 5 parts oil of turpentine, to which 8 parts of hot linseed oil are added, does not scale, and is sometimes used for maps. Wax varnish, or milk of wax, is prepared by melting 1 pound of white wax at a low heat, adding 1 pint of warm spirit of wine (90 per cent.), mixing, and pouring the liquid out on a cold porphyry slab, on which it is ground with a muller to a smooth paste. An emulsion with water is then made and strained through muslin. This preparation is extensively employed as a protective coating for old paintings, upon which it is first allowed to dry, and then equally fused by passing a warm iron over it. A varnish for covering zinc is obtained by dissolving equal parts of chlorate of potassa and sulphate of copper in hot water, and immersing the zinc in the solution for a few seconds; a coating of oxide of copper is formed on the

metal, which when dry is washed and polished, when it acquires an indigo-blue color. The preparations used for varnishing guns, engravings, leather, etc., differ little from those described above, and do not require special mention. A process closely resembling varnishing is practised by the Japanese, and is for this reason termed *japanning*, in which the object coated is heated in an oven after every application of the varnish. The Japanese varnish appears to consist of the resin of the *Rhus vernix*. In China the sap of the *Augia sinensis* is frequently employed as a varnish, either in the crude state or after being mixed with various coloring-matters. J. P. BATTERSHALL.

**Var'nish-Tree,** a name given to *Rhus vernicifera* of Japan, *Melanorrhœa usitata* of India, *Stagmaria verniciflua* of the Malay Islands, *Semecarpus anacardium* of Sylhet, and other varnish-producing trees of the order Anacardiaceæ.

**Var'num** (JAMES MITCHELL), b. at Dracut, Mass., in 1749; graduated at Rhode Island College in 1769; studied law, and practised at East Greenwich, R. I.; in 1774 headed a company called the Kentish Guards which gave to the army more than thirty commissioned officers, among whom was Gen. Greene; rose to the rank of brigadier-general, and commanded the American troops on the Delaware when the British took possession of Philadelphia; was with the army during the winter at Valley Forge; took part in the battle of Monmouth, and afterward served under La Fayette in Rhode Island, leaving the army in 1779. He was twice elected to the old Congress, and in 1788 was appointed a judge of the supreme court of the North-west Territory. D. at Marietta, O., Jan. 10, 1789.

**Varnum** (JOSEPH BRADLEY), brother to James M., b. at Dracut, Mass., in 1750; after serving in the Revolutionary army was successively a member of both houses of the Massachusetts legislature, Representative in Congress 1795–1811, Speaker of the House 1807–11, and Senator 1811–17. D. Sept. 11, 1821.

**Varo'li** (COSTANZO), b. at Bologna about 1543; studied medicine at the university of his native city, and taught anatomy there for some time, but was invited to Rome by Pope Gregory XIII., and made his first physician. D. at Rome in 1575. He made comprehensive investigations concerning the human brain, of which one part still bears his name, *pons Varolii*, and wrote *De Nervis Opticis, nonnullisque aliis, præter communem Opinionem in Humano Capite observatis* (1573), and *De Resolutione Corporis humani*, not published until after his death (1591).

**Var'ro** (MARCUS TERENTIUS), b. B. C. 116 in the Sabine town of Reate, of ancient family of senatorial rank. He early devoted himself to antiquarian lore and to literature, but did not neglect his duties toward the state, and was often employed by Pompey on grave political occasions. When the civil war arose, he espoused the republican cause, but was reconciled to the victorious Cæsar, who made him librarian of his contemplated collection. He was an exceedingly prolific writer, and versatile as well in matter as in form. Though a devoted patriot, he availed himself of Greek culture, but in style he always remained uncouth and harsh. He was older than Cicero, who with sentiments of admiration and fear dedicated his *Academica* to him. He was styled by Cicero *homo πολυγραφώτατος* (*Ad Att.*, xiii. 18), and by Quintilian, *vir Romanorum eruditissimus* (x. 1); he was a great favorite with the Christian Fathers, and especially with St. Augustine, who says of him: "Tam multa legit, ut aliquid ei scribere vacasse miremur; tam multa scripsit quam multa vix quemquam legere potuisse credamus." (*De Civ. Dei*, vi. 2.) His writings amounted to 620 books on 74 different works, of which 170 books were in metrical form. His prose works embraced almost all branches of knowledge—grammar, rhetoric, geography, history, philosophy, jurisprudence, husbandry—but in his universal study he kept Rome and Roman interests always in view, and thus exerted an immense influence on his own and on subsequent times. D. B. C. 27. Of all his works, only two have come down to us: *De Lingua Latina* and *Rerum Rusticarum Libri III.* Of the original 25 books on the Latin language, only books 5–10 are extant, and these imperfect. His three books on husbandry we have complete, with the exception of a gap at the beginning of the second; this treatise is given in the form of a dialogue, like Cicero's philosophical writings, but with far more spirit and vigor. The other works of Varro do not appear to have been in existence beyond 600 A. D. CHARLES SHORT.

**Varu'na.** In the present day, when it is the fashion amongst certain scholars to doubt everything, it is doubted by some whether this word is at root identical with the Greek *Ouranos*. It certainly is. It is derived from the Sanskrit root *vri*, to "surround." *Varuna* is therefore "that which surrounds." Varuna is adored as a deity by Hindus. He is the greatest offspring of the Lord of Space, *Aditi*. More than most gods of the Hindu pantheon, Varuna is shrouded in mystery. He is worshipped, in a dim sort of way, together with Indra, Mitra, and Agni. Varuna is especially praised in Vedic hymns; yet even there he is a mysterious power, just as space is mysterious. He first takes his place in Oriental mythology as something indefinable. It is only in later times that he assumes a substantial personality. At first, Varuna was the hidden sun. He had set, but he would rise, Whilst hidden underneath the earth in the bosom of night, Sûrya, the sun, was "Varuna." No one knew aught of him; he was of all powers that power who did his deeds in secret, lived in darkness, and withdrew at the first flush of dawn. Mitra was the rising sun, Agni was the god of fire, but Varuna was the heavenly mystery. The golden light of the beautiful Mitra (dawn) precedes Varuna, who loves the dark shades of night, which are especially sacred to him. He gives coolness to the people who are faint with the ardent beams of Agni. Yet, though a night-god and a lover of cool winds and dews, Varuna is luminous as the moonbeams themselves. He is described as the guardian of immortality, the lover of truth, having in his hand a rope with many nooses, with which he seizes evil-doers by flinging the slip-knot round their necks; all-powerful and all-merciful. It is written: "No one rules for the twinkling of an eye without his permission and favor." He governs the great waters. He is the "lord of punishment." His grand Vedic emblem is the setting sun. He resides on *Pushpagiri*, the fabulous mountain clad with sweet-scented flowers. R. C. CALDWELL.

**Va'rus** (PUBLIUS QUINTILIUS), consul in 13 B. C., and afterward governor of Syria; was sent in 7 A. D. to Germany as governor. Augustus considered the moment favorable to introduce the regular administration of a Roman province in the regions between the Rhine and the Weser, which Drusus had conquered; and although Varus carried out the abolition of the old German law and the introduction of the Roman law, he experienced no open resistance; he did not even suspect any disaffection. A formidable conspiracy had nevertheless been formed under the lead of Hermann between the chieftains of the Cherusci, Marsi, Catti, and Bructeri. By the information of the insurrection of a distant German tribe, Varus was allured out of his fortified camp. His way to the place of the insurrection led through the *Saltus Teutoburgiensis*. He had hardly entered the pass, however, before he was attacked on all sides by the Germans lying in ambuscade. After three days' hard fighting, he finally succeeded in making his way through the passes, and emerged, much reduced in numbers and utterly exhausted, into the open country; but here he was met by the main force of the German tribes, and his army was completely annihilated. In despair, he killed himself. The impression which this defeat made in Rome was enormous, and the old emperor himself was almost driven to distraction by the loss of his legions.

**Va'sa,** p.-v. and tp., Goodhue co., Minn. P. 1218.

**Vasa, House of,** one of the most celebrated royal families of Europe, was founded by Gustav Ericsson Vasa in 1523, and ruled over Sweden till 1818. Thrice the succession passed into collateral female branches, the direct male having become extinct—namely, with (1) Charles X. (1654–60), son of John Casimir, prince-palatine of Deux Ponts, and Catharine, daughter of Charles IX. and sister of Gustavus Adolphus; (2) Ulrike Eleonore (1718), daughter of Charles XI., sister of Charles XII., and married to Frederick of Hesse-Cassel; (3) Adolphus Frederick (1751–71), grandson of Eleonore Sophia, the elder sister of Charles XII., and married to Frederick III. of Holstein-Gottorp. On the death of Charles XIII. (1818) the house of Vasa ceased to reign, and was succeeded by Marshal Bernadotte, though there was an heir, Prince Gustav of Vasa (b. in 1799), the son of Gustavus IV. Adolphus, who abdicated in 1809. He lives in Vienna, and his only child, Princess Caroline of Vasa, is married to Prince Albert of Saxony. The most celebrated members of the family were Gustavus Adolphus and Charles XII. Queen Christina and Gustavus III. were also interesting characters, if not great, and Charles IX., X., and XI., as well as the founder, were very energetic and able rulers. Eric XIV., who was mad; the Polish branch of the family, which was controlled by the Jesuits; and the two last rulers, Gustavus IV. Adolphus and Charles XIII., were weak-minded. (For further information see the biographies under the separate headings.)

**Vas'arhely,** or **Hold-Mezö-Vasarhely,** market-town of Hungary, on Lake Hold, has 49,153 inhabitants, mostly engaged in the rearing of cattle and cultivation of wine and tobacco. Its annual markets are well frequented.

**Vasa'ri** (GIORGIO), b. at Arezzo in Tuscany in 1512, belonged to a family of painters; studied art, architecture, and painting practically; became a pupil and friend of

Michael Angelo; was much employed by Pope Clement VII. in Rome, and by Alessandro and Cosmo de' Medici in Florence; built the church of Abbadia in Arezzo and the Palazzo degli Uffizi in Florence; painted several noted pictures in the Palazzo Vecchio in Florence and in the Scala Regia in the Vatican; became one of the founders of the Academy of Fine Arts in Florence, and d. there June 27, 1574. His fame, however, rests less on his artistic productions than on his writings on art. His celebrated work, *Vite de' piú eccellenti Pittori, Scultori ed Architetti*, appeared first in 1550; in 1568 he published an enlarged and revised edition, ornamented with the portraits of the artists; a recent edition appeared in Florence in 13 vols. (1846–57). As a work of history it contains invaluable information; as a work of criticism it rests on broad and sound views; its style is simple and unaffected, sometimes eloquent. It has been translated into English by Mrs. J. Forster (5 vols., London, 1850–52).

**Vasco da Gama.** See GAMA, DA.

**Vas'cular Tis'sue,** in plants, is in general made up of elongated cells, which usually have closed extremities, so that fluids passing from cell to cell have to be passed by osmosis, or other physical or vital forces, through the intervening walls. In many plants there is no distinction into separate vascular and woody tissues, the two being commingled, and many hollow tubular cells contain coiled or spiral rolls of fibre. Some distinguish laticiferous vessels also for containing the milky, gummy, or other peculiar principles of the species. These, in some instances, seem to be not cells, but cavities between bundles of cells.

**Vasisht'ha.** This was a celebrated Brahman sage and rishi. He comes before us chiefly as a champion of Brahmanic claims to supremacy. He is accredited with many of the Vedic hymns. In the epic period of Sanskrit poetry he is extolled in the *Mahâbhârata*. In Puranic times every poetical history, or nearly so, records some legend of the sage. The reader should consult the article on VISWÂMITRA. Vasishtha represented the true principle of exclusive Brahmanism. He was the greatest champion they ever had. Though not in fact, yet virtually, he conquered *Viswâmitra* even, at the end of a struggle lasting over many thousand years; for *Viswâmitra* could only become his equal, after prodigious ascetic exertions, by becoming born again as a Brahmanic rishi. Viswâmitra was of the royal or military class, the Kshattriya caste. For it he primarily contended, and opposed himself against Vasishtha, who at every point overcame him. It was only after the attainment to Brahmanic power and honor that Vasishtha endured his splendid defeat. But he was still the champion of Brahmanism, for had he not demonstrated that it was only a man who was born, or who had made himself, a Brahman, who could contest equal honors with him? Thus this legend of the struggles of Vasishtha and Viswâmitra is a very one-sided one, intensely interesting, but a myth concocted wholly by Brahmans for their own glorification. There is little doubt but that in early Aryan times there was constantly going on a struggle between the priestly and royal castes of Hindus. It appears that at one period the Brahmanic element rose to an undoubted ascendency. The legend records that the struggle lasted over cycles of time. This is of course simply the splendid exaggeration of the Eastern poet who first invented the nucleus of the myth. But all accounts agree in this, that at length the Kshattriya champion became the equal at least of his Brahman-born competitor. Though this was only effected after terrible exertions, yet we see in it a foreshadowing, as it were, of a custom now prevalent amongst the royal race of Travancore, that most exclusive of Brahman states under British protection in the present day. The Travancore kings are of the Sudra, or one of the lower castes. But each of these mahârâjahs, as he ascends the throne, has a cow made of his own weight in gold, through which, literally, he passes, after great display and ceremonial. The cow of gold is then broken up, and the pieces of the costly metal are distributed amongst the temple Brahmans. The râjah then is "twice-born." He is no longer a mere Sudra. He may actually enjoy the sacred felicity of *seeing* a Brahman eat. Here we have, it may be well believed, a reflection of the effects which the Vasishtha-Viswâmitra myth was primarily intended to produce. Even kings can only buy the efficacies of holy birth by gold, and ancient sages could only buy it by superhuman austerities. The true moral of the Vasishtha-Viswâmitra legend is the greater glory of birth to that of anything else, royalty included. Vasishtha is said to have been the emanation of the intellect of Urvasî; he is also called the offspring of Mitra and Varuna. He was endowed with wonderful knowledge of efficacious sacrifices, and possessed a cow of plenty, which not only gave him everything he desired, but also protected him from all machinations and assaults. (See article on VISWÂMITRA.) He could tell that which passed in the minds of the gods, and was possessed of divine power. Manu says that he was a son of Brahma, and the *Purânas* here and there echo this statement, which is a little contradictory to others made in them. He is said to have edited the *Vêdas* in the Dwapara age. He is said to have had two wives—*Urjâ* ("strength") and *Arundhati*, a star in the constellation of the Pleiades. He was one who, through the wonderful merits of his cow of plenty, could make barren women bear children. He aided King Dilîpa in this way. He also was a profound lawyer. But his chief characteristic was arrogance. Like the Turk, he would have no brother near his throne. *Aut Cæsar, aut nullus*, was in effect the motto of his life, which was one long struggle with Viswâmitra, and one long assertion of self and the unapproachable excellence of the Brahmanic caste. Fiery-tempered, strong in intellect as well as in the physical aids he could summon, he was, after all, strange to say, just the last man one would have imagined that subtle, luxurious, and effeminate Brahmandom would have chosen as its representative champion. But the fact remains, and we must suppose that ancient Brahmanic Aryans were different from the wily, sleek, and flaccid Hindu priests of the present day. The following are a few of the stanzas of the hymns ascribed to the Vasishtha in the Rig Veda [Mandala vii., Anuvaka i., Sûkta i. (see Prof. H. H. Wilson's translation of the *Rig Veda Sanhitâ;* edited by Prof. Cowell, 1866). The lines quoted are only a few of many hundreds]: "Men generate the excellent far-gleaming master of the mansion, the accessible Agni, present in the two sticks, by attrition with their fingers. The dwellers have placed in the mansion, for its constant protection, that visible Agni who has been from ever, who is to be honored in every house. Well-kindled, youthful Agni! shine before us with undecaying radiance. To thee abundant sacrificial viands proceed. . . . Consume, Agni, all thine enemies. . . . Eminent, holy, radiating, purifier, Agni, be present at the sacrifice of him who lights up thy blaze, and at ours who address thee with these praises. Let us not sit down, Agni, in an empty dwelling: let us not be without successors. . . . Shine with bright lustre, Agni, son of strength, thou who art earnestly invoked and art of a benignant aspect." It is needless to give further illustrations of Vasishtha's Vedic verses. They run smoothly enough. To this day they are popular amongst Brahmans.

R. C. CALDWELL.

**Vasquez' de Corona'do** (FRANCISCO), b. at Salamanca, Spain, about 1505; was an early settler in Mexico, where he served in several campaigns against the Indians; was given command of an expedition which left Culiacan, Sinaloa, Apr., 1540, with which he passed through Sonora northward, crossed the Gila, reached the Little Colorado River, and visited the famous "seven cities of Cibola," which he found to consist of vast communal houses, sometimes five stories high, but did not find the wealth of precious metals announced by the explorer of the previous year, Fray Marcos de Niza; drew up and sent to Spain a report of his observations, with drawings of the edifices; reached the city of Quivira, 170 miles N. E. of the present town of El Paso, and was the first European to give an account of the great Western prairies and of the buffalo. Returning in Mar., 1542, Vasquez fell from his horse at Tiguex, from the effect of which fall he lost his reason and soon died.

**Vas'salborough,** p.-v. and tp., Kennebec co., Me. P. 2219.

**Vas'sar,** p.-tp., cap. of Tuscola co., Mich., on Detroit and Bay City R. R. and on Cass River, 20 miles S. E. of the latter city, has 3 churches, a union school-house, 1 newspaper, 2 foundries and machine-shops, 1 woollen and 1 pump factory, several flouring and lumber mills, furniture and basket warehouses, and 3 hotels. P. 775.

ALEX. TROTTER, ED. "TUSCOLA CO. PIONEER."

**Vassar** (MATTHEW), b. at East Dereham, Norfolk, England, Apr. 29, 1792; was brought to the U. S. in 1796 by his father, who settled on a farm near Poughkeepsie and carried on an extensive brewery, and acquired a considerable fortune in the same business. D. at Poughkeepsie June 23, 1868. In 1861 he delivered to trustees the sum of $408,000 for the foundation of VASSAR COLLEGE at Poughkeepsie (which see), and by his will increased the amount to $800,000.

**Vassar College,** an institution of learning at Poughkeepsie, N. Y., founded by Matthew Vassar in 1861 for the advanced education of young ladies. A sum of $408,000 was delivered in February of that year to an incorporated board of trustees, and he also gave 200 acres of land, beautifully situated 2 miles E. of Poughkeepsie, where in accordance with his wishes, about $200,000 was expended in the erection of a fine brick edifice with blue freestone

trimmings, five stories in height, 500 feet in length, 200 feet in breadth at the centre, and 164 feet at the transverse wings. This building contains several independent residences for officers, a chapel, library, reading-room, recitation and lecture rooms, laboratories, and apartments for 400 students. There are besides, apart from the main building, an astronomical observatory and an extensive museum containing an art-gallery, cabinets of mineralogy and natural history, a hall for calisthenics, etc. The college was opened in Sept., 1865, with 8 professors and 20 other instructors, and 300 students, which number was augmented to 350 during the academic year. The organization of the institution was chiefly effected by Prof. Milo P. Jewett, who was chosen first president, and visited Europe for the promotion of its interests. Resigning in 1864, he was succeeded by John H. Raymond, LL.D., who still remains in that post (1877). Admission to the college must be preceded by examination. The course of studies is equivalent to that of other first-class colleges, and good facilities are given for literary, scientific, and artistic training outside the regular course, the studies of Junior and Senior year being elective within certain limits. The baccalaureate degree is given in regular course, and the degree of M. A. is conferred after examination upon studies equivalent to a post-graduate course of two years. The regular expenses are for board and tuition $400 for the academic year of 40 weeks, and provision is made for the remission of half that amount when necessary. The college has a library of 9000 volumes, is well equipped with scientific apparatus, and has a particularly fine collection of objects of natural history from South America. In 1876 there were 9 professors (3 women) and 22 female teachers, besides the president and lady principal, 202 collegiate and 168 preparatory students, and the alumni numbered 323.

**Vassilkov',** town of European Russia, government of Kiev, on the Stugna near its influx in the Dnieper, has large tobacco manufactures. P. 8972.

**Vas'to** [*Histonium*], town of Italy, province of Chieti, in the charming plain known as the Piano d'Aragona, connected by rail with Brindisi and Bologna. The aspect of the town itself is very agreeable, and the neighborhood is unusually rich in olives, but unfortunately brigandage is very common. After the fall of the Roman empire, Vasto suffered many disasters, was almost totally destroyed by an earthquake in 1456, and in 1816, after a season of extraordinary rain, a land-slide more than a mile in length, occasioned by the subterranean flow of water, carried a considerable part of the town into the sea. It is a curious fact that similar slides took place in ancient times, and Augustus endeavored to guard against their recurrence by an extensive underground canal of the most solid construction. This great aqueduct and the reservoirs connected with it have been partially cleared during the present century of the accumulated obstructions of ages, and the completion of this work would be in every way a great advantage to the town. P. 13,797.

**Va'ter** (Johann Severin), b. at Altenburg in the duchy of Saxe-Altenburg, Germany, May 27, 1771; studied theology and languages at Jena and Halle; was appointed professor of theology and Oriental languages at Jena in 1796, at Halle in 1800, at Königsberg in 1809, and returned in 1820 to Halle, where he d. Mar. 16, 1826. He gave a condensation and continuation of Henke's *Allgemeine Geschichte der christlichen Kirche* (1818–23) and *Synchronistische Tafeln der Kirchengeschichte,* which latter work was reprinted several times. But he is most widely known as a linguist by his grammars of the Hebrew (1797), Polish (1807), and Russian languages (1809); his *Handbuch der hebräischen, syrischen, chaldäischen und arabischen Grammatik* (1801), his continuation of Adelung's *Mithridates* (1806–17), and his *Literatur der Grammatiken, Lexika und Wörtersammlungen aller Sprachen der Erde* (1815).

**Vatican Codex.** See Codex Vaticanus, by Prof. Thomas Chase, A. M.

**Vat'ican Council,** the nineteenth and the last œcumenical council of the Roman Catholic Church, has its name from the Vatican Palace in Rome, where it was held. It marks the greatest event in the history of the Roman Catholic Church since the Council of Trent, and completes the doctrine of the papacy. It was called by Pope Pius IX. in the twenty-third year of his pontificate by an encyclical (*Æterni Patris unigenitus Filius*) June 29, 1868, and solemnly opened amid the sounding of innumerable bells and the cannon of St. Angelo, but under frowning skies and a pouring rain, on the festival of the Immaculate Conception of the Blessed Virgin, Dec. 8, 1869, in the basilica of the Vatican. It was adjourned and indefinitely postponed Oct. 20, 1870, in consequence of the Franco-German war, which broke out immediately after the passage of the Infallibility decree, and ended in the prostration of France and the destruction of the temporal power of the papacy. Whether it will ever be reconvened (like the twice-interrupted Council of Trent) to finish its work remains to be seen. But since the Vatican Council decreed the infallibility of the pope there is no serious work left for a future œcumenical council. The confirmation and solemn proclamation of infallible decrees of the pope would be a mere formality and expensive luxury. The attendance was larger than on any previous council, and presented an array of hierarchical dignity and power such as even the Eternal City never saw before, nor is likely ever to see again. It seems as if the Roman Church on this occasion summoned all its vast resources for an overwhelming assault upon its enemies. At the opening there were present 719 prelates from all parts of the globe, including 49 cardinals, 9 patriarchs, 4 primates, 121 archbishops, 479 bishops, 57 abbots and generals of monastic orders. This number gradually increased to 764, but after the outbreak of the war it dwindled down to less than 200. The occupation of Rome by the Italian troops and the disturbed state of Europe made the continuance impossible. The whole number of prelates who are entitled to a seat in an œcumenical council and were invited is 1037. Among the many nations represented, the Italians had a vast majority of 276, of whom 143 belonged to the former Papal States alone. The French and German bishops were least in number, but strongest in learning and intelligence and the extent and importance of the dioceses which they represented. The deliberations of the council were conducted in strict secrecy, but four public sessions were held for the solemn proclamation of the results. The stenographic reports of the proceedings are still locked up in the papal archives, but every fact of importance has been made known by reports and letters of outside observers from familiar intercourse with their friends in the council.

The subject-matter of the council was divided into four parts: faith, discipline, religious orders, and rites (including missions), and each part was assigned to a special commission (*congregatio* or *deputatio*) consisting of 26 prelates, with a presiding cardinal appointed by the pope. The decrees were prepared on the basis of *schemata* previously drawn up by learned divines and canonists, discussed, revised, adopted in secret sessions by the general congregations, and then solemnly proclaimed in public sessions in the presence and by the authority of the pope. The management was entirely in the hands of the pope and his cardinals and jesuitical advisers. The proceedings were, of course, entirely conducted in Latin, the official language of the Roman Church.

The chief object of the council was to protest against modern infidelity and to settle the vexed question of papal infallibility. Both objects were fully obtained. The Vatican Council rung the death-bell to Gallicanism and liberal Catholicism, and put the topstone to the pyramid of papal absolutism. But it also gave rise to the Old Catholic secession and to a serious conflict with the sovereignty of secular governments, especially in Germany. The results are embodied in two sets of decrees, the first against outside infidelity, the second against inside liberalism.

(1) "The decrees on the dogmatic constitution of the Catholic faith" were unanimously adopted in the third public session, Apr. 24, 1870. They are directed against modern rationalism, pantheism, materialism, and atheism, and set forth the orthodox doctrine of God, the creation, and the relation of faith to reason. The Roman *Civiltà Cattolica* praises these decrees as "a reflex of the wisdom of God," the Paris *Univers* as "a masterpiece of clearness and force," Cardinal Manning as "the broadest and boldest affirmation of the supernatural and spiritual order ever yet made in the face of the world." But during the discussion a Swiss prelate declared the *schema de fide* a work of supererogation, and said, "What boots it to condemn errors which have been long condemned and tempt no Catholic? The false beliefs of mankind are beyond the reach of your decrees. The best defence of Catholicism is religious science. Encourage sound learning, and prove by deeds as well as words that it is the mission of the Church to promote among the nations liberty, light, and true prosperity." Bishop Strossmayer from the Turkish frontier, the boldest and most liberal member of the council, attacked the preamble to the scheme which made Protestantism responsible for modern infidelity, and said, "Protestants abhor these errors as much as Catholics. The germ of rationalism existed in the Catholic Church before the Reformation, and bore its worst fruits in the midst of a Catholic nation at the time of Voltaire and the Encyclopedists. Catholics produced no better refutation of the errors to be condemned than Leibnitz and Guizot."

(2) Far more important are the "decrees on the dogmatic constitution of the Church of Christ," or the decrees of papal absolutism and papal infallibility, which agitated

the council for several months, and after a vigorous opposition and the departure of the anti-Infallibilist bishops, passed, with two dissenting votes, in the fourth public session, July 18, 1870. This is undoubtedly the crowning act of the council on which its historical significance rests. The question of vital moment to every Catholic, the question of jurisdiction and authority which had been left open by the Council of Trent, and kept up for 300 years an agitation between Gallicans and Ultramontanes, Jansenists and Jesuits, constitutional monarchists and absolute monarchists, was brought to final rest within that Church. Ultramontanism and Jesuitism achieved a complete triumph over a powerful minority of liberal bishops, who at last gave up in despair, left Rome before the final vote, and then gradually submitted to the decision of the council for the sake of unity and peace, which they esteemed higher than their personal conviction and the facts of history. Even Bishops Hefele, Kendrick, and Strossmayer submitted. The council decided that the Roman pontiff has an *ordinary* episcopal authority and *immediate* jurisdiction over all the Catholic churches and dioceses, that he is the bishop of bishops, and that all bishops are simply his vicars, as he is the vicar of Christ; moreover, that the Roman pontiff, whenever he speaks in his official capacity to the Catholic world on any question of faith or morals, is infallible, and that his decisions are irreformable—that is, absolutely final and irreversible in and of themselves, even without the consent of an œcumenical council. (On the history and literature of this dogma during and after the council see INFALLIBILITY.)

The literature on the Vatican Council is very extensive. Not to mention innumerable controversial pamphlets and reports which appeared on both sides (the Infallibilists and anti-Infallibilists) before and during the council, the reader is referred to the following works: (1) By Roman Catholics: *Acta et Decreta sacrosancti et œcumenici Concilii Vaticani* (Friburgi, 1872, in 2 parts); *Actes et Histoire du Concile œcuménique de Rome, premier du Vatican* (Paris, 1869 *seq.*, 6 vols.); Eugen Cecconi (canon at Florence), *Geschichte des vaticanischen Concils*, translated from the Italian by Dr. W. Molitor (Regensburg, 1873 *seq.*, several vols.); Cardinal Manning, *Petri Privilegium* (London, 1871); Bishop Fessler (secretary of the council), *Das vaticanische Concil, dessen äussere Bedeutung und innerer Verlauf* (Wien, 1871). (2) By Old Catholics: Joh. Friederich, *Documenta ad illustrandum Concilium Vaticanum* (Nördlingen, 1871); by the same, *Tagebuch während des vaticanischen Concils geführt* (Nördlingen, 1871); Janus (pseudonymous), *Der Papst und das Concil* (Leipsic, 1869, before the council); Quirinus, *Letters from Rome on the Council*, first in German (London, 1870); sundry pamphlets of Döllinger, Schulte, Reinkens, and Huber. (3) By Protestants: Emil Friedberg, *Sammlung der Actenstücke zum ersten vaticanischen Concil* (Tübingen, 1872); Th. Frommann, *Geschichte und Kritik des vaticanischen Concils* (Gotha, 1872); E. de Pressensé, *Le Concil du Vatican* (Paris, 1872); L. W. Bacon, *An Inside View of the Vatican Council* (New York, 1872); Gladstone's two pamphlets—*The Vatican Decrees* (London and New York, 1874) and *Vaticanism*, in reply to Newman and Manning (London and New York, 1875).

PHILIP SCHAFF.

**Vatican Decrees.** See VATICAN COUNCIL and INFALLIBILITY.

**Vatican Palace,** the principal residence of the pope, is in Rome, on the right bank of the Tiber, in the Leonine City, so called, and on the Vatican Hill. It is the largest palace in the world. It is reported to have been founded by Pope Symmachus about 300 A. D., and to have been at one time the residence of Charlemagne. It has several times fallen into decay and been restored. In 1450, Nicholas V. commenced the great work of making it what it now is, the noblest palace of Christendom. A long line of popes have added to its size and magnificence. At present the lowest estimate gives the number of rooms at 4422; some place it as high as 16,000 (Bädeker says 11,000 halls, saloons, chapels, and apartments, and 20 courts). It contains the finest existing collection of marbles, bronzes, frescoes, paintings, gems, and statues. It contains the Sistine Chapel (built by Sixtus IV., 1473, and adorned by the genius of Michael Angelo); the Pauline Chapel (by Paul III., 1540); the Loggie and Stanze of Raphael; the court of the Belvedere; the noble library, containing 24,000 MSS. and 50,000 printed volumes; and several rich museums of ancient and modern articles of vertu. Since the return of the popes from Avignon, the Vatican has been their principal residence, and since the conversion of Rome into the capital of Italy in 1870 it is their *only* residence. Before the residence at Avignon, the Lateran was their chief abode.

**Vattel', de** (EMMERIC), b. Aug. 25, 1714, at Couvet, Neufchâtel, Switzerland; studied theology and philosophy at Bâle and Geneva; published in 1741 his *Défense du Système Leibnitien*, which attracted considerable attention; went in the same year to Berlin to solicit a position in the Prussian diplomacy, Neufchâtel being at that time a Prussian possession; received in 1743 an office in the civil service of Saxony; went in 1746 as Saxon minister to Berne; returned in 1758 to Dresden, and d. on a journey at Neufchâtel Dec. 20, 1767. While residing at Berne he wrote, besides several minor works, *Mélanges de Littérature, de Morale, et de Politique, Loisirs philosophiques*, etc., his celebrated book, *Droit des Gens, ou Principes de la Loi naturelle appliqués à la Conduite et aux Affairs des Nations et des Souverains* (2 vols., 1758), which was translated into several foreign languages and often reprinted. A recent edition appeared at Paris in 3 vols. (1863); translated into English in 1797 by Joseph Chitty, *Law of Nations, or Principles of the Law of Nature applied to the Conduct and Affairs of Nations and Sovereigns*, which translation has been reprinted several times, both in England and America. Vattel's last work was *Questions de Droit naturel, et Observations sur le Traité du Droit de la Nature par M. le Baron de Wolf* (Berne, 1762).

**Vauban'** (SEBASTIAN LE PRESTRE), b. near Saulieu, Burgundy, France, May 15, 1633, one of the most celebrated of the military engineers of that country. To his inventive genius is due the creation or perfection of the bastioned system of fortification, or that modification of mediæval forms which the invention of gunpowder and the perfecting of artillery imposed. Errard of Bois-le-Duc, the Chevalier Antoine de Ville, and the Comte de Pagan were his predecessors in this; Vauban following up principles suggested by Pagan, and putting them extensively into practice. He constructed 33 new fortresses and repaired and improved about 100. He conducted 53 sieges, and shared in 140 battles and skirmishes; acquiring the fullest confidence of his sovereign, he attained, as marshal of France, the highest honor in the French army. Notwithstanding his eminence as an author and creator, almost, of the subsequent art of fortification, his success as engineer of sieges was even more marked. Engaged in the service of one of the most ambitious of monarchs, Louis XIV., it was on the *offensive* rather than the defensive that his services were called for. The inventor of "parallels" in sieges and of the "ricochet" fire, he developed that irresistible system of attack which has ever since been so successfully followed.*

This is not the place to discuss the principles and forms of fortification, nor to allude to the distinctions between the so-called *three* "Vauban" systems, or developments of Vauban's method, as they were successively practised by himself. Reference must be made to technical treatises and to his great work, *De l'Attaque et de la Défense des Places* (1736). He was eminent also as a civil engineer, and indeed the impress of his genius is still borne in the history of his country. The question of such vital interest to France in modern days, the *fortification of Paris*, was elaborately treated by him, and in the subsequent discussions which preceded and accompanied the execution under Louis Philippe of the actual system, he has been by all parties deferentially appealed to. (See works of Choumara and others.) Among other subjects not military to which he devoted himself, political economy may be mentioned. "Vauban," says Gen. Bardin (*Dict. de l'Armée*, etc.), "has enjoyed an unparalleled fame; for a century and a half himself and his works have been the theme and study of Europe. Never before had engineer been able to obtain such consideration or to acquire so much experience." Allent (*Histoire du Corps du Génie*) affirms he *wrote* nothing on the tracé of fortifications; hence works thus attributed must be regarded rather as commentaries or exhibits by others of his methods. His principal military writings (*Œuvres militaire de Vauban*) have been edited by Gen. Latour Foissac (1796), and De Chambray has published (1834) *Notice historique sur Vauban* (inserted in the "Plutarque français"), new ed. 1745. Vauban also left a voluminous work entitled *Mes Oisivetés.* He was made governor of Lisle 1663, commissary-general of the fortifications of France 1678, governor of the maritime ports of Flanders 1689, marshal of France 1703. D. at Paris Mar. 30, 1707.

J. G. BARNARD.

**Vaucanson', de** (JACQUES), b. at Grenoble, department of Isère, France, Feb. 24, 1709; d. in Paris Nov. 21, 1782; became noted as a mechanician, especially as an inventor of automata. His most famous works were his brass duck, which could fly, quack, eat, digest, and evacuate its bowels; his flute-player, etc. Cardinal Fleury

* It remains to be seen whether, with the more recent systems of fortification, and with recent inventions in firearms, by which their range and accuracy have been so much increased, the march of the attack shall be hereafter so absolutely "irresistible."

made him superintendent of silk manufactures, but his improvements of the machinery caused a riot among the workmen of Lyons; in order to avenge himself, he made an automaton ass which could weave flowered silks. His collection of automatons he bequeathed to the queen, but it subsequently became scattered. Several pieces fell into the hands of a certain Dumoulin, who exhibited them in Germany, and three of them were found in the possession of the noted charlatan Prof. Beireis, body physician to the duke of Brunswick.

**Vaucluse′,** department of South-eastern France, bordering W. on the Rhone and S. on the Durance, comprises an area of 1328 sq. m., with 263,451 inhabitants. The eastern part is covered with spurs of the Alps; the western, along the Rhone, consists of low plains. The soil is not very fertile, and produces insufficient grain for home consumption. Wine and fruits succeed well; bees and silkworms are extensively reared; some manufactures of silk, perfumery, and confectionery are carried on. Of 33,277 children of school age, 8206 received no school education at all in 1857. Cap. Avignon.

**Vaud,** or **Pays-de-Vaud** [Ger. *Waadt*], canton of Switzerland, bordering S. on Lake Geneva and bounded W. by France, comprises an area of 1185 sq. m., with 231,700 inhabitants, most of whom are Protestants and speak French. The surface is an elevated plateau between the Jura and the Bernese Alps, sloping S. toward Lake Geneva, N. toward Lake Neufchâtel. Near the mountains are regions of pasture-land where cattle-rearing and dairy-husbandry form the principal occupations. But the larger part of the plateau is under tillage, and very carefully cultivated. Wheat and wine are extensively cultivated, and the white wines of the canton are of superior quality. The manufacturing industry is insignificant. Salt, marble, coal, and sulphur are produced. Cap. Lausanne.

**Vaude′ville** [believed to be from *Les Vaux de Vire,* two valleys in the Bocage of Normandy, where dwelt Olivier Basselin in the fifteenth century], a name at first applied to satirical songs relating to current events, for the composition of which Olivier Basselin was famous. The name is now applied to light dramatic compositions interspersed with music, and having pleasant or satirical allusions to current topics of the day. They are mostly in French.

**Vaudois.** See WALDENSES.

**Vaudreuil′,** county of Quebec, Canada, bounded N. E. by Ottawa River. Grand Trunk Railway traverses the S. E. part of the county. Area, 330 sq. m. Cap. Vaudreuil. P. 11,003.

**Vaudreuil,** p.-v., cap. of Vaudreuil co., Quebec, Canada, on the river Ottawa and near the Grand Trunk Railway, 24 miles W. of Montreal. In the vicinity are fine beds of ochre, sandstone, blue earthy phosphate of iron, a good pigment, and bog-iron ore of good quality and in unlimited quantity. P. 494.

**Vaudreuil,** the title of a French family, several members of which are notable in Canadian history.—PHILIP DE RIGAUD, MARQUIS DE, b. in France about 1641; entered the military service; rose to be a brigadier-general; came to Canada in 1687; served in various expeditions against the Seneca, Onondaga, and Oneida Indians; was made governor of Montreal in 1698, and governor-general of Canada in 1703. His administration was vigorous and successful; he put a check to the influence of the English in the W., and, although unable to prevent the loss of Acadia, succeeded in thwarting a formidable naval expedition sent against Quebec. D. in Quebec, Oct. 10, 1725.—PIERRE DE RIGAUD, MARQUIS DE, fifth son of Philip, b. in Quebec Nov. 22, 1698; entered the French military service; was made governor of the Trois Rivières in 1733, of Louisiana in 1742, and having in 1748 succeeded by the death of his brothers to his father's title, became in 1755 governor-general of Canada. He made strenuous but unavailing efforts to avert the capture of Quebec by Wolfe, and afterward endeavored to recapture it; was successful in one engagement, but receiving no support from the mother-country, was obliged to capitulate. He returned to France, where an investigation was instituted, and his administration was fully justified. D. in Paris in 1564.—LOUIS PHILIPPE DE RIGAUD, MARQUIS DE, nephew of Pierre, b. at Rochefort, France, Oct. 28, 1724; entered the French navy, and commanded vessels in several important actions, notably in that between D'Estaing and Byron off Granada in 1779, and that between De Grasse and Graves off the capes of Chesapeake; in the action with Rodney, Apr. 12, 1782, he saved his own squadron of the French fleet, with which he succeeded in reaching the harbor of Boston. Returning to France, he became a member of the States General in 1789, and in October defended the royal family against the populace; made his escape to England during the Reign of Terror, returning after its close. D. in Paris Dec. 14, 1802.

**Vaughan** (BENJAMIN), LL.D., b. in Jamaica Apr. 19, 1751; educated at the University of Cambridge; studied law at the Temple, London, and medicine at the University of Edinburgh; was a Whig member of Parliament 1792–96; settled in the latter year at Hallowell, Me., where he cultivated a large farm, practised medicine gratuitously, and devoted himself to literary pursuits, aided by a fine library, part of which he gave to Bowdoin College. D. at Hallowell Dec. 8, 1835. Author of *The Rural Socrates* (1800), and translator of Poivre's *Travels of a Philosopher* (1797).—His brother CHARLES, b. in England June 30, 1759, came to the U. S. about 1785; became a distinguished merchant and scientific agriculturist. D. at Hallowell May 15, 1839.

**Vaughan** (CHARLES JOHN), D. D., b. at Leicester, England, in 1816; educated at Rugby School under Dr. Arnold; graduated at Trinity College, Cambridge, as senior classic and chancellor's medallist 1838; became a fellow of Trinity 1839; took orders in the Church of England; held the living of St. Martin's, Leicester (formerly his father's), 1841–44; was head-master of Harrow School 1844–59, raising that institution from a comparatively low ebb to great prosperity; refused the bishopric of Rochester 1860; was vicar of Doncaster 1861–69, since which he has been master of the Temple; is chancellor of York cathedral and chaplain in ordinary to the queen; is married to a sister of Dean A. P. Stanley, with whom he is popularly associated as one of the leaders of the "Broad Church," and enjoys a high reputation as a pulpit-orator and as a commentator, chiefly upon the Pauline Epistles. His published sermons and expository discourses exceed 40 vols.

**Vaughan** (HENRY), M. D., b. at Newton St. Bridget, Brecknockshire, South Wales, in 1621; studied, but did not graduate at Jesus College, Oxford; qualified himself for the practice of medicine at London; was imprisoned as a royalist during the civil war, after which he passed his remaining years at his native place, enjoying great repute as a physician. D. at Newton Apr. 23, 1693. He called himself "the Silurist," from the name of the ancient British tribe of South Wales. Author of *Poems, with the Tenth Satyre of Juvenal Englished* (1646), *Olor Iscanus, a Collection of some Select Poems and Translations* (1650), *Silex Scintillans, or Sacred Poems and Private Ejaculations* (2 parts, 1650–55), *The Mount of Olives, or Solitary Devotions* (1652), *Flores Solitudinis, or Certain Rare and Elegant Pieces* (1654), and *Thalia Rediviva, the Pastimes and Diversions of a Country Muse, in Divine Poems* (1678). A *Memoir* by Rev. H. F. Lyte appeared in 1847.—His twin-brother, THOMAS, was educated at and became a fellow of Jesus College, Oxford; was for some years rector at his native village, whence he was expelled as a royalist; afterward resided at Oxford; was also a "tolerable" poet; studied Oriental languages; became familiar as an alchemist and Rosicrucian, and wrote several works on occult sciences under the name of "Eugenius Philalethes." D. Feb. 27, 1665, in consequence of a rash experiment on the properties of mercury.

**Vaughan** (Sir JOHN), b. in England in 1738, was a son of the earl of Lisburne; entered the army 1746; served in Germany and the West Indies; was colonel of the 40th regiment in the war of the American Revolution; became major-general Jan. 28, 1777; took part in the battle of Long Island and in the storming of Fort Montgomery, which was renamed from him Fort Vaughan; destroyed Esopus Oct., 1777; captured Stony Point and Verplanck's-on-the-Hudson May, 1779; became commander-in-chief of the Leeward Islands Dec., 1779; was subsequently lieutenant-general and governor of Berwick. D. at Martinique June 30, 1795.

**Vaughan** (ROBERT), D. D., b. in Wales in 1795; educated for the Independent ministry at Bristol College; was pastor of churches at Worcester and Kensington; professor of ancient and modern history in London University 1830–42; president of, and professor of theology in, the Lancashire Independent college, Manchester, 1842–57; was for a time pastor of a church at Uxbridge; projected the *British Quarterly Review* as an organ of the Independents, and edited it from 1845 to 1865; visited the U. S. 1865, and spent his later years in London. D. at Torquay June 15, 1868. Author of *John de Wycliffe, D. D., a Monograph, with some Account of the Wycliffe MSS.* (1853), which was a revised edition of an earlier *Life* (2 vols., 1828), *Memorials of the Stuart Dynasty* (2 vols., 1831), *The Protectorate of Oliver Cromwell* (2 vols., 1838), *History of England under the House of Stuart* (2 vols., 1840), *Essays on History, Philosophy, and Theology* (2 vols., 1849), *Revolutions in English History* (3 vols., 1859–63), treating of changes of race, religion, and government, and a bi-centenary memorial

volume on *English Nonconformity* (1862), besides several works of theological controversy or exposition.

**Vaughan** (Robert Alfred), son of Dr. Robert, b. at Worcester, England, Mar. 18, 1823; graduated at London University 1842, and at the Lancashire Independent college 1846; studied theology at Halle 1846; visited Italy 1847; became an Independent minister; was colleague with Rev. William Jay as pastor of Argyle Chapel, Bath, 1848–50, and pastor of a church at Birmingham 1850–55. D. in London Oct. 26, 1857. Though but thirty-two years of age at his death, he had been considered for some years as one of the ablest divines of his denomination. Author of *The Witch of Endor, and other Poems* (1844), and of a remarkable work, *Hours with the Mystics, a Contribution to the History of Religious Opinions* (2 vols., 1856; revised ed. 1860). His *Essays and Remains* (2 vols., 1858) were edited, with an interesting *Memoir*, by his father. The *Memoir* was also issued separately in 1864.

**Vaughan** (Sir William), M. D., LL.D., b. at Golden Grove, Caermarthenshire, Wales, in 1577, brother of the first earl of Carbery, the patron of Jeremy Taylor; educated at Jesus College, Oxford, where he graduated in law; became a physician about 1625; was the founder of a settlement called Cambriol in Newfoundland, and wrote the praises of that colony in a quaint tract in prose and verse called *The Golden Fleece, divided into Three Parts, etc., by Orpheus Junior* (1626), written apparently to attract emigrants, and notable as the first volume of original poetry written in the British North American colonies. Vaughan returned to England, and d. about 1640. Author, among other works, of *Varia Poemata* (1589), *The Golden Grove* (1600), *The Newlander's Cure* (1630), in the introduction to which he gives an account of his American experience, and *The Church Militant* (1640), a labored production in verse.

**Vaughan** (William), b. at Portsmouth, N. H., Sept. 12, 1703, son of George (1676–1724), who was lieutenant-governor of New Hampshire 1715–17; graduated at Harvard 1722; settled at Damariscotta, Me.; became largely engaged in the Newfoundland fisheries; was the originator of the expedition against Louisburg under Pepperell, and as lieutenant-colonel of New Hampshire troops had command of the military operations leading to the capture of that fortress, June 16, 1745, but being overlooked in the distribution of ministerial rewards, he went to England to assert his claims, and d. at London Dec. 11, 1746.

**Vaughay,** the native name of a South Indian tree, probably a *Rhizophora*, the bark of which is much valued by fishermen for tanning their nets.

**Vaughn,** tp., Jefferson co., Ark. P. 4735.

**Vaulabelle′, de** (Achille Tenaille), b. at Châtel-Censoir, department of Yonne, France, in 1799; published in 1835 his *Histoire de l'Egypte moderne, de 1801 à 1833;* became editor of the *National* in 1835; published in 1844 *seq.* his *Histoire des Deux Restaurations* (8 vols.); was elected a member of the Constituent Assembly in 1848, and appointed minister of public education from July to Oct., 1849, in the government of Cavaignac, but retired from all participation in politics after Dec., 1851, and devoted himself to historical studies, preparing a *Histoire de la Monarchie de Juillet, de la deuxième Republic et du Second Empire.*

**Vault** [O. Fr. *vaulte*]. When an arch moves around its keystone, it produces a dome; when it moves along in a straight line on its springers, it produces a vault; whence it follows that there are as many kinds of domes and vaults as there are arches. (See Arch.) Wherever the arch was known, the vault was also known, and the only new element which it introduced into the history of architecture occurred when two vaults intersected each other, and consequently had to be groined.

**Vauquelin′** (Louis Nicolas), b. at St. André d'Hébertot, department of Calvados, France, May 16, 1763; was employed in a drug-store in Rouen; went in 1781 to Paris; studied pharmacy; gained the patronage of Fourcroy; was appointed chief pharmaceutist in the military hospital at Melun in 1793, professor of docimacy in the mining school of Paris in 1794, and subsequently professor of chemistry at the École Polytechnique, Jardin des Plantes, and Collége de France. D. at Paris Nov. 14, 1829. Besides a great number of *Mémoires* in scientific periodicals, he published a *Manuel de l'Essayeur* (1812). He undertook a great number of analyses, and was the discoverer of chromium, glucina, etc.

**Vautier′** (Benjamin), b. at Geneva in 1830; studied painting at Düsseldorf 1850–51, and acquired great celebrity as a genre painter. Among his most remarkable pictures are—*Devout Singers in a Church* (1858), the *Spinning-Woman* and the *Surprise* (1863), *A Sunday Afternoon in Suabia* and *Cats in a Criminal Case* (1864), the *Wake in the Bernese Highlands* (1866), the *First Dancing-Lesson* (1868), a *Village Funeral* (1871).

**Vaux** (Richard), son of Roberts, b. at Philadelphia, Pa., in 1817; became a lawyer in that city; was recorder 1842–47, mayor 1856–58; was a director of Girard College, member of the committee of correspondence of the Grand Lodge of Freemasons of Pennsylvania, and for more than thirty years from 1842 was an inspector of the State penitentiary. Author of some 30 *Annual Reports* of inspectors of the penitentiary, of *Reports of Criminal Cases* (1846) tried by him as recorder, and of addresses, lectures, papers on social science, critical and humorous essays.

**Vaux** (Roberts), b. in Philadelphia, Pa., Jan. 21, 1786; was a member of the Society of Friends; devoted himself at an early age to philanthropic pursuits, promoting general education, the maintenance and instruction of the blind, deaf, and dumb, the care of the insane, prison discipline, the relief and employment of the poor, and the reformation of the vicious; corresponded with De Witt Clinton on internal improvements, and with Edward Livingston on penal codification; took an interest in scientific agriculture; and served for a short time as an associate justice of the court of common pleas. D. at Philadelphia Jan. 7, 1836. Author of *Memoirs* of Benjamin Lay and Ralph Sandiford (1815) and of Anthony Benezet (1817), and of addresses, letters, and pamphlets on philanthropic subjects.

**Vaux** (Thomas), Baron Vaux, b. at Harrowden, England, about 1510; educated at Cambridge; attended Cardinal Wolsey in his embassy to Charles V., 1527; succeeded to the title, and took his seat in the House of 1530; accompanied Henry VIII. to Calais and Boulogne 1532; became a knight of the Bath and governor of the island of Jersey 1533. D. in Oct., 1556. Author of a number of admired poems in the collection called *The Paradise of Daynty Devises* (1576), of which the best are entitled *The Assault of Cupid* and *The Aged Lover renounceth Love.*

**Vaux** (William Sandys W.), F. R. S., b. in England in 1818; educated at Westminster School; graduated at Baliol College, Oxford, 1840; became an assistant in the department of antiquities at the British Museum 1841; was keeper of coins and medals 1861–70; is secretary of the Royal Society of Literature, president of the Numismatic Society, and co-editor of the *Numismatic Chronicle;* deciphered and edited for the trustees of the British Museum in 1863 a collection of 90 Phœnician inscriptions found at Carthage; is a high authority upon Oriental subjects; has contributed largely to the *Transactions* of the Royal Society of Literature and those of other learned associations, and to Dr. Smith's *Dictionary of Geography;* has published *Nineveh and Persepolis* (1850; 4th ed. 1855), *A Handbook to the Antiquities in the British Museum, being a Description of Greek, Assyrian, Egyptian, and Etruscan Art preserved there* (1851); edited for the Hakluyt Society, from the unpublished MS. of Chaplain Francis Fletcher, *The World encompassed by Sir Francis Drake, etc.* (1854); prepared for the Society of Biblical Archæology a manual of the *History of Persia from the Monuments* (1875), and drew up for the University of Oxford a *Catalogue of the Coins in the Bodleian Library.*

**Vâyu.** Vâyu is the Vedic god of wind, often confounded with Indra, god of heaven. Vâyu is sometimes classed, together with Indra, in Vedic mythologies, with *Agni*, fire, and *Sûrya*, the sun. The tradition is that Anjanâ was the wife of Vâyu, and that by her he had the monkey-god Hanumân. Vâyu is not much respected as a deity in India now; his glory is swallowed up by that of Indra. Whenever native painters represent Vâyu, they make him ride on a long-horned antelope, with a drawn sword in his right hand. In his left hand he generally is represented as holding his monkey-faced son and heir. The root-meaning of the name of this god is simply a "breath." The word is immediately derived from the Sanskrit *vâ*, to "blow." The god is therefore simply a spirit, or rather a ghost. He is an airy mystery, impalpable, indefinable, unascertainable, and even the sole specimen of his progeny, as in the case of Hanumân, is a *lusus naturæ*, for mythology declares this one monkey-faced boy to have been his only son. The father is spiritually abnormal, and his son is materially so. As the name of the god implies, so seems everything connected with him—dim, indistinct, ghostly. R. C. Caldwell.

**Veale,** tp., Daviess co., Ind. P. 893.

**Vea′sey,** tp., Drew co., Ark. P. 657.

**Vea′zie,** p.-v. and tp., Penobscot co., Me. P. 810.

**Veda.** See Sanskrit Language and Literature, by Porter C. Bliss, A. M.

**Vedanta.** See Hindu Philosophy, by Prof. John Dowson.

**Veddas.** See WEDDAHS.

**Ved'der** (ELIHU), b. in New York City in Feb., 1836; studied art with Matteson, and also in Europe; had for some years a studio in New York; took high rank among American *genre* painters, and subsequently became a resident of Italy.

**Vee'dersburg,** p.-v., Fountain co., Ind., on Indianapolis Bloomfield and Western and Indiana North and South R. Rs., 65 miles W. of Indianapolis, contains 1 church, high-school building, 1 bank, 1 mill and woollen-factory, 2 hotels, 2 bakeries, a large hall, 2 warehouses, 1 newspaper, and rich deposits of bituminous coal. P. about 500. GEORGE ROWLAND, ED. "REVIEW."

**Ve'ga,** tp., Jackson co., O. P. 65.

**Vega** (GARCILASO DE LA). See GARCILASO DE LA VEGA.

**Vega Carpio, de la** (LOPE FELIX), usually called **Lope de Vega,** b. at Madrid, Spain, Nov. 25, 1562; lost his father in early childhood; was placed at the Royal College of Madrid by his uncle, the inquisitor Miguel de Carpio, by whom he was destined for the Church; displayed at school extraordinary precocity and aptness for versification; served in a campaign against the Portuguese at the island of Terceira 1517, during an escapade from college, which lost him the patronage of his uncle; was taken under the protection of Geronimo Manrique, bishop of Avila, by whom he was sent to complete his studies at the University of Alcalá de Henares; entered the service of the younger duke of Alva as his secretary about 1585; composed for his new patron his first notable literary effort, a pastoral entitled *Arcadia;* married Isabel de Urbino, daughter of a king-at-arms at the court; was imprisoned and exiled to Valencia for having wounded a courtier in a duel; returned to Madrid about 1587; lost his wife soon after; served as a volunteer in the Invincible Armada sent against England 1588, during which expedition he composed a long poem, *La Hermosura de Angelica,* intended as a continuation of Ariosto's *Orlando Furioso;* became secretary to the marquis of Malpica about 1590, and subsequently to the marquis of Sarria, afterward celebrated as viceroy of Naples and as the patron of Calderon, under the title of count of Lemos; contracted a second marriage with Juana de Guardio about 1597; passed thereafter at Madrid several years of happiness, prosperity, and almost incredible literary activity, pouring forth innumerable plays, *autos sacramentales,* madrigals, and sonnets, often writing a whole drama in a day; was liberally patronized by the Church, the nobility, and the court; acquired a literary popularity unexampled in Spain; was deeply affected by the loss in quick succession of his son Carlos at the age of seven and of his wife, who died in childbirth, after which he concentrated his affections upon a natural daughter, Marcela, who ultimately became a nun; became in 1609 a priest of the Franciscan order; continued his literary activity without intermission, though his later productions were tinged with fanaticism and religious melancholy; obtained several ecclesiastical preferments, becoming in 1628 chief chaplain to his congregation at Madrid; underwent the severest self-imposed penances, and is supposed to have hastened his end by a terrible scourging which he inflicted upon himself, dying at Madrid Aug. 26, 1635. He bequeathed his manuscripts to the duke of Sessa, by whom he was given a sumptuous funeral, lasting nine days. In productiveness Lope de Vega appears to have surpassed every other writer, ancient or modern. The number of his plays is variously calculated at from 1500 to 1800; his *autos* numbered several hundreds, and his miscellaneous pieces of prose and verse baffle all attempts at exact statement. About 300 of his plays were printed in his *Works* during his life or shortly afterward (28 vols., 1604–47), besides many others not gathered into volumes. Of these, 112 have been deemed worthy of reproduction by J. E. Hartzenbusch in his *Biblioteca de Autores Españoles.* He was a complete master of versification, which in all his works is uniformly facile, correct, and brilliant. As may be inferred from his fecundity, his invention was marvellous, but he usually contented himself with very slight though always ingenious and usually pleasing plots. For the dramatic proprieties and "unities" he had little regard, and never hesitated to set chronology and moral verisimilitude at defiance. The very number of his plays has contributed to their oblivion *en masse,* since there are few that can be pronounced notably superior to the general average. Among these few may be mentioned *El Padre engañado,* probably the only one which has appeared on the English stage (*The Father Outwitted,* adapted by Thomas Holcroft), *La discreta Enamorada, La Fuerza lastimosa,* and *Los tres Diamantes,* the very titles of which give a sufficient idea of the melodious cadence of his verse. PORTER C. BLISS.

**Ve'ga, von** (GEORG), BARON, b. at Sagoritza, Carniola, in humble circumstances in 1756; studied at the lyceum of Laibach; taught mathematics in the school of navigation, then in the school of artillery; became professor of mathematics at the military academy; was made commander of a regiment of artillery, and fought with distinction in the wars against the Turks and the French; was ennobled in 1800, and murdered Sept. 26, 1802. His *Vorlesungen über die Mathematik* (4 vols.) have often been reprinted, and are still used as textbooks in mathematical instruction in many Austrian institutions. His *Logarithmentafeln* (2 vols., 1783) reached their 57th ed. in 1876. He also published *Logarithmisch-trigonometrisches Handbuch* (1793; often reprinted), *Thesaurus Logarithmorum Completus* (1794), *Anleitung zur Zeitkunde* (1801), and *Natürliches Mass-, Münz- und Gewichtssystem* (published after his death, in 1803).

**Vegetable Alkali.** See POTASH, by H. WURTZ, A. M.

**Vegetable Chemistry.** See ORGANIC CHEMISTRY, by H. WURTZ, A. M.

**Veg'etable Flan'nel** is woven in Germany from "fir-wool," called also *wald-wolle,* a fibre prepared from the leaves of *Pinus sylvestris* after the turpentine has been distilled off. The fabric is reputed to have useful medicinal properties, and is worn by rheumatic and other patients.

**Vegetable Histol'ogy** treats of the minute structure of plants. By mechanical and chemical appliances the vegetable fabric can be separated into pieces suitable for examination by the microscope. Such an examination reveals the fact that even those parts of plants which appear to the naked eye to consist of compact material are in reality honeycombed with cavities. But it is further shown that these cavities are not mere hollow places in a homogeneous substance; they are contiguous and conjoined structures known as *cells.* Plants are composed of such cells variously developed, modified, and arranged.

In one of its simple forms the vegetable cell is a minute globular body, consisting of a closed membrane investing certain contents. The cell-wall consists of *cellulose,* a firm, elastic substance which remains when the contents of the cells have disappeared, and which constitutes the permanent bulk of the vegetable fabric. Cellulose has the same chemical composition as starch ($C_{12}H_{20}O_{10}$). It is insoluble in water, dilute acids, or alkalies, and generally possesses a slight admixture of incombustible matter. A living vegetable cell contains within the wall of cellulose a soft, inelastic mass known as *protoplasm.* The vital properties of this substance will be considered under VEGETABLE PHYSIOLOGY; it is necessary now merely to describe its appearance under the microscope. Protoplasm is usually transparent or translucent, often finely granular, and sometimes opaque from the presence of other matter, and easily recognizable by the yellow-brown color which it takes with solution of iodine. Cells differ greatly in size. In the pith of elder they are about $\frac{1}{120}$th of an inch in diameter; in *Chara* they are often an inch or more in length. The spores or reproductive cells of some plants are only $\frac{1}{6000}$th of an inch in diameter. Cells differ in size in different parts of the same plant. They differ also very widely in shape. The more common forms are the sphere and its polyhedral modifications, caused by the pressure of contiguous cells; spheroids of different kinds; elongated and tubular varieties; flattened cells, and branched cells. Many of the forms are irregular, but most shapes can be referred to one of three types: (1) *parenchyma,* in which the diameters are nearly equal; (2) *prosenchyma,* or long cells; and (3) *tabular,* or flattened and short cells. By the obliteration of the partitions between contiguous cells they may be thrown into one, and many other forms are produced. The cells thus constitute, by their confluence, slender tubes and the like, known as *ducts* and *vessels.* The cell-wall varies greatly in thickness in different cells, and in different parts of the same cell. Long, slender cells, especially if their walls are thick and the size of the cavity is very much reduced, are called *fibres.*

Inequalities in the cell-wall give rise to different markings. Some of the more common sorts are *dots* or *pits,* which are thin places, either round or linear, often surrounded on the inner surface of the cell by an elevated border (bordered pits and discoid markings, the latter characteristic of the wood-cells of Coniferæ); spiral, annular, netted, and cross-line deposits on the interior of the cell-wall. In many cases of internal deposit the proper cell-wall gives way and the ring or spiral becomes free. This is often seen when the cells are ruptured during dissection. Deposits on the external surface of a cell are seen in the case of some pollen-grains, where they exist as slight protuberances or sculpturings of regular or irregular shape.

Coherent cells constitute *tissues.* In most cases the contiguous cells are joined together from the period of earliest

growth, and they possess a common wall. Between cells which are near each other, but not united at all parts, there are cellular interspaces. It is convenient to classify tissues under three heads—namely, fundamental tissue, fibro-vascular bundles, and epidermal tissue. *Fibro-vascular bundles* arise in fundamental tissue, and are composed of two classes of modified cells—namely, flexible fibres, termed *bast*, and *woody ducts*, distinguished chiefly by their position. The wood is made up of ducts or cells, which have regular or irregular deposits by which they become denser and lignified. These structural elements, *bast* and *wood*, are variously arranged in a fibro-vascular bundle. Cells less modified, generally parenchyma, are interposed between them. Sometimes these intermediate cells are capable of growth by division, and are then called *meristem*. Fundamental tissue, in the substance of which fibro-vascular bundles arise, is generally made up of polyhedral cells. It constitutes a packing tissue, which fills the spaces between the bundles. *Epidermal* or cortical tissue surrounds the whole. It is composed largely of tabular cells in close contact with each other, and is not always easily distinguishable from the fundamental tissue which lies within; all these tissues grade off into each other. Epidermal tissue clothes all the organs of the plant. In the root it is modified to form the protective *root-cap* and the *root-hairs;* that of the stem frequently produces *cork;* that of the leaves possesses peculiar organs termed *stomata*, by which the intercellular cavities are placed in communication with the outer air. The epidermal tissue may at any part give rise to *hairs*, which are simple cells or rows of cells, or branched cells. The exposed wall of epidermal cells, except at certain parts of the stomata, is covered with cuticle, a film capable of resisting the chemical agents which destroy the cell-wall. Modifications of the cuticle give rise to waxy, granular, or gritty glazings of the outer cells.

The cells and tissues are variously arranged in different plants. The simplest plants consist of single cells, either simple or branched; and although nearly all such plants are of minute size, a few attain a length of an inch or more. Cells are arranged in rows, as in some fresh-water Algæ, or in planes, as in many seaweeds, or in solid forms, as in ordinary stems, etc. In the higher plants the structure is more complex, and the three systems of tissues are disposed differently in the different organs.

*Arrangement of Tissues in the Stem.*—In the stem of monocotyledonous plants the fibro-vascular bundles are closed—that is, they have no provision for further growth of the bundles in thickness. New bundles may arise between the old ones, but the old ones no longer increase in size. The bundles in solid monocotyledonous stems run in curves, and they cross each other, forming a complicated network. The bast-elements and wood-elements in different bundles differ in their relative amount, in their character, and their distance apart. A cross-section of a solid stem of a monocotyledonous plant shows that the bundles are nearer together at the outside than toward the interior. The bundles start from the leaves, curve inward, and pass downward, and, coming out to the surface of the stem, lose wood-tissue, and consist chiefly of bast. Between all the bundles there is fundamental tissue. In the stems of dicotyledonous plants the bundles are generally wedge-shaped, the broader part of the wedge being outside, and the bundles are arranged radially, so that by their contiguity they form rings. The wood is toward the centre; then comes a layer of *meristem* called *cambium*, and then bast. The fundamental tissue in the middle, where the bundles do not reach the centre, is *pith;* on each side of the bundles it constitutes the medullary rays; outside the bast it comprises the cells in which leaf-green is held. Annual layers of new wood are added by the cambium, and form by their juxtaposition the rings of wood marking the growth of the year. The tissues outside the cambium are called collectively the *bark*. Slight increments of bast and other parts of the bark are made each year. The year's growth in a tree is indicated by a ring of new wood, or sap-wood, laid down on the outside of the older wood, or heart-wood, and therefore such stems have been called *exogenous*—that is, "growing on the outside." Stems of monocotyledonous plants by contradistinction are often termed *endogenous*, "growing on the inside."

*Arrangement of Tissues in Roots.*—The roots of monocotyledonous plants are slender and simple, and do not materially increase in size. Those of perennial dicotyledons are much like the stem in structure, but have rarely any pith. The epidermis of the older parts is rough and almost corky; that of the newer portions in most plants is clothed with root-hairs of extreme delicacy. The point of the root is covered by a cap of modified epidermis, which exfoliates at its surface, but is constantly renewed by meristem behind it. This meristem constitutes the *growing-point* by which new tissue is added to the root at its protected tip.

*Arrangement of Tissues in the Leaves.*—The framework consists of fibro-vascular bundles variously disposed. In monocotyledons they proceed without branching from base to apex, or else from the midrib to the edge of the leaf. In dicotyledons they branch very variously, and form a network. The fundamental tissue of leaves surrounds the bundles, usually being more compact above than below, and consequently possessing larger or smaller intercellular spaces on the under side. The epidermal tissue of the leaf possesses *stomata*, which consist of a group of cells so arranged as to form a sort of valve. The lateral cells are known as *guard-cells*, and form with the contiguous cells a mechanism which will be described when the function of the leaf is spoken of. It is sufficient to say at this point that the leaf is a structure fitted to expose a large amount of surface to the air. The intercellular spaces taken in the aggregate present a vast exposure of transpiring surface. This framework, and the cells upon it, are all connected directly or indirectly with the stem from which supplies are received.

Besides the three systems of tissues now described, there is a peculiar modification of cells which must be noticed separately. When the leaf of lettuce is wounded, there exudes a milky juice called *latex*. The cells which contain latex form the laticiferous tissue. Sometimes they are distinct, and course irregularly through interspaces, but often they appear to be mere modifications of some one of the three systems of tissues.

In addition to the protoplasm previously referred to, there are other cell-contents of interest in histology—namely, (1) *chlorophyl*, or leaf-green; (2) *starch*, easily detected by the blue color imparted by a solution of iodine; (3) *inuline*, which forms spheres having a radiate structure; (4) *crystalloids*, nitrogenous substances imitating crystalline shapes; (5) *crystals*, chiefly calcium oxalate in needles, prisms, or clusters. All of these are described under their respective heads, and with regard to their origin and office, see VEGETABLE PHYSIOLOGY. G. L. GOODALE.

**Vegetable Ivory,** a substance considerably resembling ivory, is the hardened kernel of the carrozo-nut, the fruit of *Phytelephas macrocarpa*, a South American tree assigned by some to the palms, which it closely resembles, and by others considered a palm-like member of the order Pandanaceæ or screw-pines. Vegetable ivory is extensively employed as a substitute for real ivory, which it sometimes, but not always, closely resembles. Some specimens have a translucency entirely wanting in ivory.

**Vegetable Physiology** treats of the phenomena of plant-life. It investigates the development, growth, and functions of vegetable organisms, and the relations of plants to their surroundings. It is obvious that this science must depend largely for its means of research upon chemistry and physics. Anterior to the application of the microscope to the examination of vegetable structure, and even in the first century of its use, most of the explanations which were offered to account for the vital phenomena of plants were extremely unphilosophical. Methods of investigation by experiment do not appear to have been much employed in vegetable physiology until the beginning of the last century. At that period many of the relations of plants to water were clearly made out, and some of the relations of plants to the air and light were set forth as plainly as the imperfect physics and chemistry of that day would allow. Without tracing the history of vegetable physiology further, it will suffice to say that the science is of comparatively recent development. In the present treatment of the subject it is proposed to speak first of the nutrition of plants; secondly, of their growth; thirdly, of their reproduction; fourthly, of their movements. These phenomena, considered generally, may be investigated in the simplest plant, a one-celled alga, and the more striking characteristics of nutrition, growth, reproduction, and motion examined. But it will be better for the present purpose to direct attention to these phenomena as they are exhibited in the higher plants, such as the herbs and shrubs and trees with which all are familiar; a consideration of these will prepare the way for a comparison of the life-processes throughout the vegetable kingdom.

*The Nutrition of Plants.*—Plants do not undergo so extensive metamorphoses of tissues as do animals. Although a part of the oxidizable substance must be consumed in various kinds of work, the material of the vegetable fabric, once organized, remains essentially unchanged. It is obvious, therefore, that the word "nutrition," here retained for convenience, has in the vegetable kingdom a restricted signification. Certain inorganic substances, taken in from the soil and air, furnish all requisite materials for the sustenance of plants. These substances we shall call the food

of the plant. We may discover in two ways what the essential materials of plant food are—first, by determining, through chemical analysis, what is the chemical composition of the plant itself; second, by direct experiments upon living plants, to which are given, or from which are withheld, certain substances. The chemical analysis, for the purpose of answering the question above submitted, may be ultimate or proximate. Ultimate analysis breaks the plant into its elements; proximate analysis stops just short of this, and separates from each other the complex substances found in the plant, such as water, various salts, etc. When a fresh green plant is exposed to a temperature of 212° F. a part of the water which it contains is expelled. At a temperature slightly above this it soon ceases to lose weight. The amount of water driven off varies very greatly in different plants and in different parts of the same plant. Some Fungi and Algæ contain 95 per cent. of water; red clover contains 80 per cent.; the grains of the cereals about 14 per cent. The amount of water varies widely in the same plant at different periods of its life and in different seasons of the year. When the dry mass, from which all the water has been expelled, is burned in the open air, it disappears in the form of gaseous compounds, chiefly carbon dioxide and water, leaving behind only a small residue of ash. The percentage of unconsumed matter left after combustion varies in different plants, in different parts of the same plant, and at different seasons. Dry pine-wood yields about 0.2 per cent., dry oak-wood 0.5 per cent., dry pine-bark 2.8 per cent. The combustible part of plants consists chiefly of the chemical elements carbon, oxygen, hydrogen, and nitrogen, variously combined. The ash invariably contains potassium, calcium, magnesium, sulphur, phosphorus, and iron. Besides the above, other elements are frequently found in plants—namely, sodium, silicon, chlorine, iodine, bromine, and more rarely zinc and lithium. A few other elements have been detected in exceptional cases. Some of these elements, combined, enter directly into the structure of the vegetable fabric; others appear to be accessory, although indispensable, and assist in various processes in the economy of the plant.

We are now to inquire as to the sources from which plants obtain the elements necessary for their growth and work. These elements may be said in a broad sense to constitute the food of plants. *Carbon*, which makes up about 45 per cent. of cellulose, is ultimately derived from the slight admixture of carbon dioxide—or, as it is better known, carbonic acid—in the atmosphere ($\frac{4}{100}$ths of 1 per cent.). *Oxygen*, a constituent of cellulose and many other organic compounds in the plant, comes in either combined as in carbon dioxide and water or in the free state from the atmosphere. *Hydrogen* is obtained from water taken in through the roots. *Nitrogen*, which is found in the albuminoids, is derived from compounds of nitrogen, chiefly the nitrates; these compounds may be ultimately referred back to the air, in which they may be produced in minute quantities and under peculiar conditions. *Sulphur*, a constituent of the albuminoids, is obtained, perhaps exclusively, from calcium sulphate, a sparingly soluble salt. Plants obtain the remaining elements, such as iron and potassium, from aqueous solutions of their salts. The relative values of the different elements of plant-food, and of their different modes of combination, have been carefully investigated, and are being still further examined by means of water-culture. Plants soon after germination are cultivated under special conditions, by which certain substances are furnished or withheld. The general results obtained by such a method of research may be summed up as follows: An ordinary green plant, when growing in the open air and supplied with a sufficient quantity of water, requires for its healthy growth the following substances: combined nitrogen, preferably a nitrate; an available phosphate; compounds from which the plant can obtain the elements calcium, potassium, sulphur, magnesium, iron, and possibly chlorine. A few other elements appear to be required by certain plants, but they need not be considered in this place. A fertile soil not only contains the elements mentioned above, but it possesses them in such a form and such proportions as to be readily used by the plant. The physical as well as the chemical properties of soil have a very important bearing upon the healthy growth of plants, but a detailed consideration of these lies too far from the present path.

How does a plant obtain its food? Part of the food, consisting of ash-constituents dissolved in water and the combined nitrogen, is absorbed through the roots; the remainder, by far the largest part, is taken in in the gaseous form through the leaves.

*Root-Absorption.*—In many of the lower plants absorption of dissolved mineral matter takes place through all the surface, but in the higher plants this work is performed wholly by the roots. The amount of root-surface possessed by plants varies greatly in different species. It is difficult to estimate accurately the quantity of roots in a plant, but the following figures from German observers may be received with confidence: The length of roots of a strong barley-plant is about 125 feet; a vigorous oat-plant has not far from 150 feet; and all this spread of roots can be packed away in less than 4 inches cube. In some interesting observations made at the Massachusetts Agricultural College in 1874 by Pres. Clarke a surprising development of roots of a squash-plant was noted: "The entire system of roots was cleaned and spread out upon the floor of a large room, where they were carefully measured. The main branches extended from 12 to 15 feet, and their total length, including branches, was more than 2000 feet. At every node or joint of the vine was also produced a root. One of these nodal roots was washed out, and found to be 4 feet long, and to have 480 branches, averaging, with their branchlets, a length of 30 inches, making a total of more than 1200 feet. As there were 70 nodal roots, there must have been more than 15 miles in length on the entire vine." (P. 10, *Report of College for 1874.*) The plant is said to have grown in a propagating-pit, 4 feet wide by 50 long, in soil 6 inches deep. Notwithstanding the vast extent of roots possessed by plants, only a comparatively small part of each has the power of absorption.

A short distance behind the growing and protected tips of ordinary roots the fibrils are clothed with slender hairs. These root-hairs are very short-lived. As the root-tip advances, new hairs are formed on the newer parts of the slender roots, while the hairs on the older parts die off. A few plants with soil-roots are said not to have any root-hairs—*Abies excelsa*, for instance. (*Schacht.*) They are absent in aërial roots, as in the case of many orchids and other plants, chiefly endogenous. The root-hairs are the efficient agents in absorption of crude liquids from the soil. It was formerly held that this work was performed by the very tip of the root, the so-called spongiole. This erroneous view is still perpetuated in some treatises on vegetable physiology. It was shown experimentally by Ohlerts in 1837 that after the very tip of the root has been cut off and the wound closed by varnish, absorption takes place as before; but if the root-hairs are kept out of contact with water or moist earth, absorption ceases. It may be said confidently that only the new surface, consisting of the root-hairs and the delicate epidermis, of which they are a part, just behind the tip of the root, constitute the apparatus by which dissolved inorganic matter is absorbed from the soil. The question to be asked is, In what way do the root-hairs absorb? They are living cells which have grown to their full size in the interstices of the soil, and they are in most intimate contact with the minute particles of earth. When a root is taken carefully from loose earth, the smaller rootlets are covered with a thick envelope of soil which clings to them. The apparatus of absorption, when reduced to its lowest terms, is merely a living cell in close contact with particles of soil, and constituting a part of the external tissues of the rootlet. The cell-wall is made up of cellulose, a substance shown by Hofmeister to possess extraordinary power of imbibing water and dilute solutions. When the young cell-wall is completely dried, its imbibing power is greatly impaired. To account for this and some analogous phenomena, Nägeli proposes an hypothesis which has met with much favor. He assumes that organized substances —of which we may now take cellulose of the root-hair as an example—are composed of arranged *structural molecules*, each of which, under ordinary conditions, is surrounded by a film of adherent water. Each molecule has its own film of water adherent to it, and this film may, within certain limits, be increased in thickness or diminished. When, however, the diminution is too great, the relations of the molecules are so much disturbed that they cannot again resume their former position. The hypothesis of Nägeli carries back one step—namely, to the structural molecule—the attraction known as *attraction of adhesion*. This is not the place to discuss the subjects of adhesion and capillarity, but attention must be here called to the fact that many organized substances imbibe water and dilute solutions with great force, and that imbibition appears to be a phase of the attractions just mentioned. The root-hair is lined with active protoplasm, itself a substance which possesses an enormous power of imbibition. When it is remembered that the contiguous living cells in the root, stem, and leaves have cellulose walls, and that these walls are lined with protoplasm, it is not difficult to believe that the removal of a portion of the liquid already held imbibed by a leaf-cell, or a cell in the stem, would produce an immediate effect upon the cells next adjacent, and thus indirectly upon those most remote. The ultimate effect upon the root-hair would be to cause imbibition of water to replace the loss. This must come from the soil.

The root-hairs are closely appressed to the particles of the soil. Water holding salts in solution may adhere to the particles, but in a form which cannot be detected by the touch. The soil may appear to be dry, and yet contain enough water, held by adhesion, for the immediate use of the root-hairs. The root-hairs absorb the water in part by imbibition. It is, however, well known that when two liquids of different densities, and miscible with each other, are separated by a film of membrane, there is a transfer through the membrane, called membrane-diffusion, or osmosis. Experiments upon this subject by Graham in 1862 showed that the nature of the membrane largely influences rapidity of diffusion through it. The substances, other than gases which are now left out of account, with which we meet in the plant or its food, may be divided into two classes—those which diffuse rapidly, and those which diffuse very slowly, if at all. The saline solutions in the soil may be placed in the first class, the protoplasm which lines the cells in the second. It has been shown that substances of the second class, although they do not themselves diffuse, assist in diffusion. The root-hair with its surroundings is an apparatus for osmosis; the protoplasmic lining of the cell-wall is a non-diffusible substance; the dilute saline solution in the soil furnishes the diffusible materials. Under the term "imbibition," which is used somewhat vaguely to indicate the active and forcible absorption of water by a membrane, and the term "osmose," which is used to signify diffusion through a membrane, may be brought the general phenomena of root-absorption of liquids. The roots of aquatic plants are surrounded with water or with a saturated soil, but they do not appear to differ in structure from the roots of plants which thrive in a moist but not wet soil. If Indian corn is transferred after germination upon moist tan or a damp sponge, to a vessel containing water or an aqueous solution, the roots alone coming in contact with the liquid, the plant will continue to grow, and if suitable food is given to it, it will flourish vigorously. This method of cultivating plants with their roots in aqueous solutions of various substances is termed water-culture. When a plant has thus developed its roots in water, earth can be carefully sifted around the delicate fibrils until the whole mass of roots is secured in a wet soil, after which the excess of water can be easily drained off and the soil left dry. Under such conditions the plant will continue to grow as before, but its new roots will speedily adapt themselves to the interstices of the soil, and minute particles will adhere closely to the new root-hairs.

The roots of many plants are aërial. They strike off above ground, and may or may not come in contact with soil. Large numbers of the tropical orchids have such roots. In what way true aërial roots absorb is not yet clear. Duchartre, who examined this subject with care, concludes that water in the state of vapor is not absorbed by such roots, but that the liquid water which moistens them is. He furthermore suggests that such roots make use of the soluble substances which alight on them as dust from the air, and which are dissolved in the water on their surface.

The roots of some plants are parasitic. These roots plunge more or less deeply into the tissues of living plants near them, and absorb the juices which their hosts had elaborated for themselves. The mechanism of such absorption can be understood when the transfer of elaborated matters in the stem is hereafter considered. It may here be noted that some of the roots of a few plants appear to be parasitic, while the remaining roots are ordinary roots, with hairs for absorption of crude matters. Such plants are termed partial parasites. Again, the roots of some plants thrive only in decaying vegetable or animal matter; such plants are called saprophytes.

It must now be asked, In what way are the crude matters absorbed by ordinary roots conveyed to and through the stem? and what are the phenomena which accompany the transfer? It is held that the liquids are carried in part from cell to cell by osmosis; in part, by the walls themselves, either in their very substance or as an extremely thin film covering the cellulose. This view, which of course is hypothetical, is now generally adopted. That the crude liquids are transferred, for the most part, through the wood there can be no doubt, but whether through the substance of the cellulose or by means of the capillary tubes and the cells is not clearly made out. It was stated in the article on vegetable histology that the stem of woody plants consists of fibro-vascular bundles variously arranged. The essential constituents of such bundles are wood and bast, with cells of roundish shape between these elements. The roots of woody plants have substantially the same structure. The transfer of crude liquids is now believed to be through the woody part of the bundle, chiefly through its newer portion, and in the manner previously detailed. The cavities of the woody vessels may contain the overflow, and those of smaller calibre may assist in the transfer by their capillarity. The larger ducts, however, generally contain air more or less modified. Crude liquids are transferred, under certain conditions, with great force. The pressure of sap has long been a favorite subject with experimenters in vegetable physiology. Some of the earliest observations were made by Rev. Stephen Hales in England in 1724. The more recent investigators have been Hofmeister, Sachs, and De Vries. Their results accord very closely with some made in this country at a later date. In 1873 a protracted series of experiments was carried out at the Massachusetts Agricultural College under favorable conditions as regards ingenuity in contriving and patience in employing apparatus. The experiments did not materially differ in their scope, or generally in their results, from Hofmeister's, just referred to, but they are more extensive in their range than any other published observations upon the subject. "Observations were made on one or more gauges several times daily, and occasionally every hour of the day and night from the 1st of April to the 20th of July. A gauge was attached to a sugar-maple Mar. 31, which was three days after the maximum flow of sap for this species, so that further observations are required earlier in the season to complete the record and determine with certainty the maximum pressure which it exhibits in the spring. Of the record made, the following facts are specially interesting: first, the mercury was subject to constant and singular oscillations, standing usually in the morning below zero, so that there was indicated a powerful suction into the tree, and rising rapidly with the sun until the outward pressure was sufficient to sustain a column of water many feet in height. Thus at 7 A. M., Apr. 21, there was a suction into the tree sufficient to raise a column of water 25.90 feet. As soon as the morning sun began to shine on the tree the mercury suddenly began to rise, so that at 9.15 A. M. the pressure outward was enough to sustain a column of water 18.47 feet high, a change represented by more than 44 feet of water. On the morning of Apr. 22 the change was still greater, requiring for its representation 47.42 feet of water. These extraordinary fluctuations were not attended by any peculiar state of the weather, and happened twelve days before there were any indications of growth to be detected in the buds." . . . "The maximum pressure of the sap for the season was observed at 10 A. M., Apr. 11, and was equal to sustaining a column of water 31.73 feet high. This was an excellent sap-day, considering the lateness of the season. There was noticed a general correspondence between the flow of sap in other maples and the pressure on the gauge. After Apr. 29 the mercury remained constantly below zero, day and night. During the month of May there was a uniform suction equal to about 8 feet of water, and the unaccountable feature of this fact is that, though apparently produced by exhalation from the expanding leaves, it remained the same, day and night, for several weeks. In June the suction gradually lessened, and finally disappeared, the mercury standing steadily at zero. On the 20th of April two gauges were attached to a large black birch, one at the ground, and the other 30 feet higher. The next morning at six o'clock the lower gauge indicated the astonishing pressure of 56.65 feet of water, and the upper one of 26.74 feet. The difference between the indications of the two gauges was thus 29.92 feet, while the actual distance between them was 30.20 feet, so that it corresponded almost exactly as if they were connected by a tube. In order to learn whether the same principle would prevail if the upper gauge was moved, it was raised 12 feet higher. The same correspondence continued through nearly all the observations of the season, notwithstanding the gauges were separated by 42.20 feet of close-grained birch-wood. At 12.30 P. M., Apr. 21, a hole was bored into the tree on the side opposite to the lower gauge, and at the same level. Both gauges at once began to show diminished pressure, while sap issued freely from the orifice. In fifteen minutes, 1 pound of sap having escaped, it was found that both gauges had fallen equal to 19.27 feet of water. Upon closing the hole the gauges rose in ten minutes to their previous level, showing that the rootlets had reabsorbed in that brief period the sap which had escaped from the tree, notwithstanding the enormous pressure already existing. A stopcock having been inserted in the hole opposite the lower gauge, it was found that the communication between it and the two gauges was almost instantaneous, which appears to prove that the tree was entirely filled with sap, exerting its pressure in all directions as freely as if standing in a cylindrical vessel more than 60 feet in height, as indicated by the lower gauge. The sap-pressure continued to increase until, on the 11th day of May, it represented a column of water 84.77 feet in height, which is believed to be the highest pressure of vegetable sap ever before recorded. The buds of the birch now began to expand, the pressure of the sap to diminish, and

the oscillations of the mercury to become more decided and regular than before. The upper gauge ceased to vary May 14, remaining stationary at zero. The lower one declined slowly and varied greatly, but did not fall below zero until May 18. On May 27 it also became stationary at zero. The suction manifested by the birch was very little, never exceeding 9 feet of water, and continued only for a few days."

One of the best modern authorities on this subject says, that "although the movements of water in plants have been copiously investigated and discussed for nearly 200 years, it is nevertheless still impossible to give a satisfactory and deductive account of the mode of operation of these movements in detail." (Sachs's *Lehrbuch*, Eng. trans., p. 601.)

The crude sap which makes its way from the roots consists, before admixture with the elaborated juices of the plant, of a dilute saline solution containing ash-constituents and some form of combined nitrogen. The combined nitrogen is believed to be absorbed generally in the form of a nitrate. Inasmuch as starch is generally found in the root-cap, where it could not have been originally produced, but must have been formed there from products of assimilation elsewhere, it is difficult to believe that crude sap exists in any part of the plant free from admixture with elaborated matter. What is called crude sap is a mixture of saline solutions and elaborated substances in varying amount. The transfer of crude liquids through woody tissue is hindered, or absolutely prevented, by allowing the tissue to dry. This is strikingly shown by a well-known experiment by De Vries (quoted in Sachs's *Lehrbuch*, Eng. trans., p. 606): "If rapidly-growing shoots of large-leaved plants are cut off at their lower part, which has become completely lignified, and are placed with the cut surface in water, they remain for some time perfectly fresh. But if the cut surface is exposed even for a short time to the air, the leaves will speedily droop." The crude sap is ultimately carried to green tissue composed of cells containing granules of chlorophyll. The green tissue occurs on young shoots and in leaves. The crude sap, brought into this tissue by the same process which carries it from the root into and through the stem, undergoes certain changes which require to be now examined in detail. It may be noticed, in passing, that the tissues of the leaves are continuous with those of the stem. Upon the framework of fibres and vessels the chlorophyll-bearing cells arranged, packed in general more closely on the upper than on the lower part of the leaf. Between many of the cells are interspaces which communicate with the external atmosphere through stomata or valve-like pores. Over the whole upper and under surface, except at certain points in the stomata themselves, there is a cuticular layer differing in thickness in different plants. The cuticle and the cellulose walls of the outer or epidermal cells are both so thin as to be transparent, and reveal through their substance the color of the chlorophyll-granules in the cells below. Into this apparatus the crude sap is conveyed, and is there concentrated by evaporation, or more properly *transpiration*. The dilute solution parts with a large portion of the water in the form of vapor, which escapes chiefly through the stomata. The rate of transpiration varies with the nature of the tissue and with certain external conditions. If the cortical tissue is thick, as in the bark of older stems, transpiration ceases. From structures which are highly cuticularized, as are many kinds of Cactaceæ, *Euphorbias*, and ice-plants, transpiration takes place very slowly. Plants having such structure are natives of dry climates. The number and size of the stomata vary greatly, and must directly affect the rate of transpiration. The number and size of the intercellular spaces influence the rate of evaporation. If they are abundant and large, transpiration from the tissue will be rapid. The intercellular spaces in the leaves of some Araceæ are exceedingly numerous and of great size; in some leaves, like the common pine, they are small. The flexure of stems and leaves by wind must mechanically influence the rate of transpiration. It may be added that the character of the crude sap has been thought to affect the rate of transpiration; and if the process was simply one of evaporation, this would be the case, for it is well known that solutions of salts evaporate more slowly than pure water, and under similar conditions the more slowly the more concentrated they are. But it is to be remembered that the solution in the present case must first give up the water by imbibition to the cell-walls surrounding the intercellular spaces, and it is from these surfaces that the water evaporates. The problem is therefore, so far as the plant itself is concerned, very difficult and complicated.

The external conditions which affect the rate of transpiration are the relative dryness and the temperature of the surrounding atmosphere. The rate increases with the dryness and with elevation of the temperature. It is still an unsettled question whether light (independently of the rise in temperature) affects the rate of transpiration, but there is reason to believe that increase in the amount of light increases transpiration by causing the stomata to open more widely and allow the aqueous vapor to escape more freely. The disputed point is, whether the effect produced upon some, if not most stomata, causing them to open widely with access of light, is itself caused by the light, or by the heat, or by the chemical transformations which take place under its influence. The amount of water transpired by plants is therefore dependent upon many and diverse conditions. The earliest methodical experiments were made by Rev. Stephen Hales in 1734. He found that a sunflower which exposed 39 square feet of foliage transpired on an average 1 pound 4 ounces of water in twelve hours of the day, the maximum amount being 1 pound 14 ounces.

Transpiration is doubtless one of the most efficient agents in causing the ascent of crude sap. The escape of water in the form of vapor from the tissues of the leaf and young shoots causes a deficiency there, which is to be supplied, sooner or later, from below. If the loss is not made good by absorption through the roots, the lower leaves droop and the fading proceeds steadily upward. If the loss of water is not too great, the freshness can be restored by furnishing water to the roots, but if the leaves have become dry, they will not regain their former condition. In droughts the leaves which fade during the day partially or wholly recover during the cooler nights, when there is dew, leading to the belief that the leaves absorb water, and thus become fresh. But experiments have shown that the partial or complete restoration is to be attributed not to absorption of water by the leaves, but to the fact that transpiration is hindered on account of the coolness of the night and the greater humidity of the atmosphere. It is now generally held that, except in a few cases yet doubtful, leaves in the air do not absorb water, either in the form of liquid or vapor. The experiments upon this subject have disclosed a curious fact which should be mentioned here—namely, that transpiration can actually take place in an atmosphere saturated with moisture. Transpiration is an active and not a passive process. Water frequently exudes in drops from the tips of tender leaves, and from their under side. This takes place very frequently in germinating grasses and in many endogens. The exudation is obviously caused by internal pressure at some point, which forces the water into the intercellular spaces and out through the stomata.

By transpiration the crude sap is concentrated. The green tissue in which the concentration takes place is permeable to gases by what is known as gaseous diffusion. By means of the diffusion of gases through the cell-walls of green tissue carbon dioxide—or, as it is better known, carbonic acid—is taken up from the air into the leaves. This gaseous substance is termed an impurity in the atmosphere, but it exists in nearly the same amount everywhere in the free air of the globe, averaging $\frac{1}{25}$th of 1 per cent. by bulk, and $\frac{1}{16}$th of 1 per cent. by weight. Under the influence of light this gas, taken in by diffusion from the air, and the elements of water taken up by absorption from the soil, are assimilated by the plant.

*Assimilation*—or, as it has been called, vegetable digestion—consists in the conversion of this mineral matter into vegetable matter. Assimilation takes place only in the cells which contain chlorophyll (or its physiological equivalent), and under certain conditions of illumination and temperature it is accompanied by evolution of oxygen. Hales in 1730 said: "We may therefore reasonably conclude that one great use of leaves is what has been long suspected by many—viz. to perform in some measure the same office for the support of the vegetable life that the lungs do for the support of the animal life, plants very probably drawing through their leaves some part of their nourishment from the air." (Hales's *Veg. Statics*, vol. i. p. 326.) Shortly after this, Bonnet of Geneva observed that on leaves of grapevine, placed in spring water and kept in the sun, bubbles of gas appeared, and more abundantly on the under side. He further noticed that this phenomenon ceased at night, and did not take place at all in water which had been boiled and cooled. He thought, therefore, that the bubbles of gas came from the water, and not from the leaves. Shortly after this, Priestley discovered that green leaves in sunlight purify air which has been vitiated by the breathing of animals, and appears to have shown that the gas which is seen on green leaves immersed in spring water and exposed to sunlight is oxygen ("dephlogisticated air," as it was then called). Ingenhousz showed a little later that under solar influence leaves evolved a gas which we now call oxygen, but at night emitted a pernicious gas (carbonic acid). Senebier proved

that the oxygen evolved by the leaves in sunlight came from the decomposition of carbonic acid. De Saussure determined the quantitative relations existing between the carbonic acid taken up by plants and the oxygen given off by their green foliage in the sunlight. Daubeny in 1836 showed that intense light is more active in causing the evolution of oxygen, and he experimented upon the relations of plants to different kinds of light and to varying amounts of carbonic acid in the air. In 1844, Dr. John C. Draper of New York demonstrated that the decomposition of carbonic acid by green leaves is due to the action of the rays which belong to the middle part of the solar spectrum; he further proved that the violet rays do not produce this effect. The subject has been further investigated by Sachs, Pfeffer, and others, and with confirmatory results, the most recent statement of which is as follows (transcribed from the English translation of Sachs's *Lehrbuch der Botanik*): "Only those rays of the spectrum which are visible to our eye have the power of decomposing carbon dioxide; and indeed, those which appear brightest to the eye, the yellow rays, are alone as efficacious in this process as all the others put together. The most refrangible rays of the visible spectrum, and those which act most energetically on silver chloride, etc., play a very subordinate part in assimilation."

Assimilation, as indicated by the evolution of oxygen, can take place at low temperatures—in the leaves of the European larch at 0.5°–2.5° C. (Boussingault); in the leaves of some grasses at 1.5°–3.5° C. In a water-weed (Vallisneria) the decomposition of carbon dioxide can begin at or near 6° C.; in Potamogeton, between 10° and 15° C. The organic substance formed from carbon dioxide and water by chlorophyll in sunlight is a carbhydrate, and in most cases is starch ($C_{12}H_{20}O_{10}$), in a few cases it is oil, having probably nearly the same chemical composition. It is unnecessary to assume, as is generally stated, that this carbhydrate is first formed in the chlorophyll grain as solid starch, and then made soluble for transport elsewhere. In active chlorophyll grains it is generally possible to demonstrate the presence of starch, and under some conditions the grain becomes full of starch. Assimilation is understood to comprise the formation of a carbhydrate by chlorophyll in the sunlight from carbonic acid and water, with evolution of oxygen. It is believed by some authorities that the albuminoids (protoplasm, etc.) in the plant are also produced by assimilation in green tissue, but of this there does not appear to be any clear proof. Others hold that the albuminoids are products of further elaboration, and are formed in active meristem-cells. Such elaboration and similar changes are now termed *metastasis*. Other products of elaboration are the sugars, glucosides, etc., etc. The dissolved or modified starch enters into the composition of elaborated sap, of which mention has previously been made, and is either at once consumed in work or growth, or it is stored up in some form for future use. The liquid form of stored material is characterized by the presence of sugar or of some soluble carbhydrate. It is found in all tissues, even in those which convey chiefly crude sap. The solid form is generally starch. This is lodged in the parenchyma of the plant, but may occur in any tissue. In plants of the order Compositæ it is replaced by inuline. In many seeds—for instance, Ricinus—oil is the form in which the stored material chiefly occurs. These kinds of stored material are believed to be physiological equivalents, since the plant can turn them equally well to account in work and growth.

When green organs are kept from the light for a long time the color becomes blanched, and returns only when the light is restored. It is now known that by exclusion of light the chlorophyll is first changed in form, then is absorbed, and finally disappears with the protoplasm from the parenchyma. On the access of light, especially diffused sunlight, the chlorophyll shortly reappears. It should here be noticed that while most seedlings grown in the dark are blanched, the cotyledons of pines are green even when the darkness has been complete.

Toward the close of summer the leaf becomes loaded with solid inorganic matter, and changes take place in the organic contents. The protoplasm is withdrawn into the branches and stem, the coloring-matter of the chlorophyll becomes modified, leaving only yellow granules in the parenchyma cells, and, finally, the leaf becomes detached at the point of articulation with the stem. The so-called evergreen leaves of coniferous plants are more slowly charged with mineral matter, and do not fall for two, three, or even many more years.

*Work and Growth.*—These subjects can be now considered together. Work in the plant demands the oxidation of an oxidizable substance, and this process is accompanied, therefore, by absorption of oxygen, the evolution of carbon dioxide, and an increase of temperature. Water must of course also be produced as a product of oxidation. The absorption of oxygen by plants, and the corresponding evolution of carbon dioxide, properly answer to respiration in animals, and may be called *vegetable respiration*. The evolution of carbon dioxide during growth can be easily and well shown by Sachs's experiment, in which seeds are made to germinate in a mass of moist cotton or sawdust upon a polished marble slab. The roots grow over the surface of the calcic carbonate, and by the evolution of carbon dioxide from them during growth, and the consequent localized action of an aqueous solution of carbon dioxide upon the marble, the marble is corroded wherever the roots go. The increase of temperature during oxidation can be easily demonstrated in the germination of barley in the manufacture of malt. In the space enclosed by the spathe or envelope of the so-called calla-lily the elevation of temperature during flowering is very considerable, and varies in general with the time of day, but has fluctuations dependent upon causes not as yet well understood.

*Growth* consists essentially in the production of new cells and in the increase of cells in size.

*Formation of New Cells.*—New cells are formed in various ways; but they have this in common—namely, a rearrangement of the protoplasm around one or more new points, which for convenience may be called centres, and the enveloping of this new mass, sooner or later, by a new cell-wall. The modes of formation are referred conveniently to three types, and this classification will be adopted here from Sachs's *Lehrbuch* (ed. 4, p. 8):

A. *Formation of Reproductive Cells.*—(1) Cell-formation by renewal, a new cell being produced from the whole of the protoplasm already existing. In this the whole contents of a cell contract, force out a part of the water of the cell-sap, the protoplasm changes its form, and, escaping from the old cell-wall, becomes after a while clothed with a new cell-wall. Here the material for the production of the cell-wall is doubtless held dissolved in the protoplasm. (2) Conjugation. In this the protoplasmic contents of two or even more cells coalesce to form a new common protoplasmic body, which, escaping from the old cell-walls, sooner or later becomes covered with cellulose. This is common among Algæ. (3) Free cell-formation is characterized by having new centres, around each of which a part of the protoplasm collects and forms a cell. But after the new cells have thus been formed within the old cell, there is still some protoplasm left, which survives for a time as the living contents of the old cell. (4) Formation of reproductive cells by division of the mother-cell. In this case, as in the last, new centres arise, but around each the protoplasm gathers, and the whole is thus used up in the production of new cells, instead of having some remain over. The new cell-wall may be produced only when the new cells are fully isolated from each other, or it may arise during the separation of the new cells. Another mode of cell-formation is characterized by a continuous chain-like succession of new cells, as in the case of the reproductive organs of certain Fungi. This may be regarded as a sort of gemmation or budding.

B. *Vegetative Cell-Formation.*—(1) In growing parts, while the protoplasm is dividing from without inward, a partition-wall is formed, thus intruding as a ring between the separating protoplasmic bodies. This is interesting as being the first of all processes of cell-formation that was accurately examined, having been described by Von Mohl in an alga (*Conferva glomerata*) in 1835. (2) The partition-wall arises simultaneously at all points of the boundary-surface as a thin cell-membrane. This is the commonest form of cell-formation in the growth of the higher plants. The relations of the nucleus to cell-formation are not fully made out. The most recent investigations upon the subject are by Strasburger.

*Growth of Cells in Size.*—When a new cell has been formed, it may increase in size and in thickness of the wall. The increase in size and in thickness results from the interstitial deposition of new cellulose—that is, new matter is placed between the molecules already existing. At first superficial increase is much more rapid relatively than growth in thickness, and it takes place in various directions, so that different forms are assumed by the new cells, depending upon their specific character or upon their surroundings. The growth is not uniform either in surface or in thickness, and hence arises the infinite variety of cell-forms and cell-markings already referred to under VEGETABLE HISTOLOGY. The new cells may be in rows, and give rise to filamentous forms, or on the same plane, producing flat sheets of tissue, or they may constitute masses of tissue, as in the higher plants.

The place of formation of new cells, and the conditions under which they arise, can be now specially considered. The root increases in length by the multiplication of cells, which lie just behind the protective root-cap. Roots and stems of exogens increase in thickness by the formation of

new cells of the cambium or meristem layer under the bast, the inner layer of the bark. Roots of endogens do not, as a general thing, increase in diameter after they are once formed. The stems of endogens increase in diameter by the formation of new fibro-vascular bundles among the older ones. Stems grow in length by the extension of the internodes. The growth of an internode ceases after the first year or sooner, and all further increase of stem or branches in length must be from the elongation of new internodes. The nodes and internodes of a branch are recognizable in the bud, where they exist in a rudimentary state. Leaves arise as minute papillæ upon the shortened stem within the bud, and always at a point some distance below the apex. The stipules and petioles are often formed at an early stage, and in the bud are generally larger than the rudimentary blade. The expansion of the blade after unfolding from the bud is extremely rapid.

The conditions under which growth of cells, tissues, and organs takes place have been examined by many investigators, of late chiefly with respect to what may be termed the physics of growth. Leaving out of sight the recognized fact that the parts of each plant have inherited tendencies to assume certain forms, the question is asked whether these forms may be modified by changes in the surroundings. *Light* appears to affect growth very slightly, if at all, when there is enough assimilated material present for the formation and enlargement of new cells. In simple structures, where assimilation takes place in light, cell-division occurs only, or mostly, at night or in darkness. From what has been previously said, it will be remembered that in the higher plants the points where new cells are formed, and where new cells increase in size, are for the most part protected from the light. It is not yet clear from experiments whether cell-division is favored or retarded by exposure to light. When seeds germinate in darkness, and the seedling plants are kept in the dark, the internodes become much elongated, the leaves of monocotyledonous plants becoming extremely long and slender, those of dicotyledonous plants remaining small and generally taking an abnormal shape. Flowers are not generally changed in shape or in color when they develop in darkness. It is well known that when growing stems and other organs are differently illuminated on different sides, they bend or curve toward the side where the light is most intense. It is stated by Sachs that this *heliotropic* curvature is caused by the slower growth in length of the illuminated side. This may be illustrated by a simple experiment: "If plants which show heliotropic properties are grown in a box which receives light from one side that has passed in one case through a solution of potassium bichromate (yellow), in another case through one of ammoniacal copper oxide (blue), the internodes of the first remain quite straight and lengthen considerably, as if they were in the dark, while those exposed to the mixed blue light grow less, and at the same time bend strongly toward the light. It follows from this that only rays of high refrangibility, the blue, violet, and ultra-violet, cause the curvature by retarding growth." (*Sachs.*) The stems and other parts of a few plants bend in the opposite direction—that is, away from the light. Such are known as *negatively heliotropic*.

*Heat* has a very decided influence on growth. The results of the observations of Sachs and others may be summed up as follows: The growth of a plant takes place with certain limits of temperature, and these upper and lower limits are different for different plants. The rapidity of growth generally increases with elevation of temperature above the lower limit until a certain maximum is reached; above this, which is called the *optimum*, the rapidity diminishes. Some of the results of the experiments by De Vries and Köppen are here given:

| Temp. | Root of *Lupinus albus.* | *Pisum.* | *Tea.* |
|---|---|---|---|
| 14.1 C. | 9.1 m. m. | 5. m. m. | |
| 18. | 11.6 | 8.3 | 1.1 m. m. |
| 23.5 | 31.0 | 30.0 | 10.8 |
| 26.6 | 54.1 | 53.9 | 29.6 |
| 28.5 | 50.1 | 40.4 | 26.5 |
| 30.2 | 43.8 | 38.5 | 64.6 |
| 33.5 | 14.2 | 23.0 | 69.5 |
| 36. | 12.6 | 8.7 | 20.7 |

| Temp. | *Cucumis melo.* | *Sinapis.* | *Lepidium.* | *Linum.* |
|---|---|---|---|---|
| 15.1 C. | ..... | 3.8 m. m. | 5.9 m. m. | 1.1 m. m. |
| 21.6 | ..... | 24.9 | 38.9 | 20.5 |
| 27.4 | 18.2 m. m | 52.0 | 71.9 | 44.8 |
| 30.6 | 27.1 | 44.1 | 44.6 | 39.9 |
| 33.9 | 38.6 | 30.2 | 26.9 | 28.1 |
| 37.2 | 70.3 | 10. | 0.0 | 9.2 |

In these experiments it was found that growth was most rapid when there were no sudden oscillations of temperature. All oscillations appeared to retard growth.

*Gravitation* was long since suspected by Knight of England to have a marked influence upon the direction of growth. Some organs can be proved by experiment to be dependent, as regards the direction of their growth, upon the action of gravitation. When an organ is thus influenced, it is said to be *geotropic*. Geotropism may be positive, as in roots, or negative, as in many stems. It was formerly explained by the presence of tension in the latter and the absence of it in the former; but this hypothesis has been abandoned, and no satisfactory suggestion has taken its place.

*Tension of tissues* is that condition produced by unequal growth in the different tissues, which gives rise to mutual pressure of the inner masses and the epidermis. When a thrifty internode which measures 100 units in length is separated with care into bark, wood, and pith, there are at once seen great differences in length of the isolated parts. The bark shrinks, the wood shortens or remains stationary, or in some cases lengthens, while the pith becomes considerably longer than before. It is plain that if the parts were again put together, it would bring about a condition of longitudinal tension. Measurements show also that there is a slight transverse tension as well. The following table, from Sachs, will exhibit these remarkable changes of length:

| Plant. | Number of internode counting from the youngest. | Change in length of the isolated tissue, in percentage of the entire internode. | | |
|---|---|---|---|---|
| | | Bark. | Wood. | Pith. |
| *Nicotiana tabacum.* | I.—IV. | −5.9 | −1.5 | +2.9 |
| | V.—VII. | −3.1 | −1.1 | +3.5 |
| | VIII.—IX. | −3.5 | −1.5 | +0.9 |
| | X.—XI. | −0.5 | −0.5 | +2.4 |

In some other plants the differences are as striking as those above given. It will be at once seen that a young shoot whose internodes are in such a state of tension is in a condition of unstable equilibrium, which may be disturbed by slight causes, such as changes of temperature, illumination, shock, etc. This tension of tissues is observable in all young organs, even leaves, and may be easily demonstrated by severing the different tissues from each other. While this tension is brought about by growth, it in turn affects growth. This can be shown by the effect produced by incisions in the bark of rapidly-growing plants; the growth becomes at once more active upon the side where the tension has been relieved. This subject has been studied chiefly by De Vries and Hofmeister. The tension may exist in a cell, a group of cells, or an organ, and disturbances of this tension will give rise to changes of form which can be recognized by change of position of the mass or the movements of parts.

The force exerted by growing cells is in many cases very great. Some of the most interesting facts respecting this subject have been brought out by Pres. Clark of the Massachusetts Agricultural College at Amherst, and a brief account is here given: A squash-vine was grown in rich earth in a plant-house under very favorable conditions for rapid development. A single fruit was selected for experiment. "On the 15th of August it measured 22 inches in circumference; on the 16th, 24 inches, and on the 17th, 27. Though the rind of the young fruit was very soft, it was now determined to confine it in such a way as to test its expansive power. In doing this, great care was taken to preserve the health and soundness of every part of the squash, and to expose at least one-half of its surface to the air and the light. The apparatus for testing its growing force consisted of a frame or bed of 7-inch boards, 1 foot long. These were arranged in a radial manner, like the spokes of the lower half of a wheel, their inner edges being turned toward the central axis. These pieces were held firmly in place by two end-boards 12 inches square, to the lower half of which they were secured by nails and iron rods. A hemi-ellipsoidal cavity, about 5 inches deep in the centre and 8 inches long, was cut from the inner edges of the seven boards, and in this the squash was carefully deposited, the stem and vine being carefully protected by blocks of wood from injury by compression. Over the squash was placed a semi-cylindrical harness or basket of strap iron firmly riveted together. The meshes between the bands, which crossed each other at right angles, were about 1½ inches square. The harness was 12 inches long and the same in width, so that when placed over the squash it just filled the space between the end-boards. Upon the top of the harness, and parallel with the axis of the cylinder and the squash, was fastened a bar of iron with a knife-edge to serve as the fulcrum of a lever to support the weights by which the expansive force was to be measured. At first, an iron bar, 1 inch square, was used for a lever, then a larger bar of steel, then a lever of chestnut plank, then one of seasoned white-oak plank, and, finally, one of chestnut, 5 by 6 inches square, and 9 feet long; but even this required to be strengthened by a plate of iron 4 inches wide by ½ an inch thick and 5 feet in length. The fulcrum for the lever was also renewed from time to time as the

weight was increased. The following table shows the weight of iron lifted by the squash in the course of its development:

| | | | | | |
|---|---|---|---|---|---|
| Aug. | 21 | 60 pounds. | Sept. | 14 | 1300 pounds. |
| " | 22 | 69 " | " | 15 | 1400 " |
| " | 23 | 91 " | " | 27 | 1700 " |
| " | 24 | 162 " | " | 30 | 2015 " |
| " | 25 | 225 " | Oct. | 3 | 2115 " |
| " | 26 | 277 " | " | 12 | 2500 " |
| " | 27 | 356 " | " | 18 | 3120 " |
| " | 31 | 500 " | " | 24 | 4120 " |
| Sept. | 11 | 1100 " | " | 31 | 5000 " |
| " | 13 | 1200 " | | | |

The last weight was not clearly raised, though it was carried ten days, on account of the failure of the harness-irons, which bent at the corners under the enormous pressure of 2½ tons, and consequently broke through the rind of the squash. It was not feasible to remove the harness and substitute for it a stouter one, on account of its being imbedded in the substance of the squash, which grew up through the meshes of the harness, forming protuberances 1½ inches high and overlying the iron bands. When, on the 7th of November, the harness was removed in order to take a plaster cast of the squash, it was necessary to cut the straps with a cold chisel, sometimes into several pieces, and draw them out endways. The growing squash adapted itself to whatever space it could find as readily as if it had been a mass of caoutchouc; nor did it ever show the slightest tendency to crack, except in the epidermis. This would often open in minute seams, from which a turbid mucilaginous fluid exuded. In the morning drops of this would frequently bedew the protuberances like drops of perspiration. In the sunshine these dried up and fell off as minute globules, resembling gum-arabic. The lifting power was greatest after midnight, when the growth of the vine and the exhalation from the foliage was least." Recent experiments have shown that the form of certain organs in very low plants may be considerably influenced by changes in the surroundings, but these observations, and those which relate to changes produced by pressure, are too technical for consideration here. They may be found described in *Arbeiten des botan. Inst. in Würzburg.*

*Parasitic Plants, etc.*—There are some plants which do not contain chlorophyl, and which require that their food should be prepared by other organisms. Fungi and some higher plants of very different families are parasitic. Growth and reproduction in such plants are identical with corresponding processes in the plants which contain chlorophyll. When they take food from living organisms, they are known as true *parasites*—when from dead organic matter, *saprophytes*. They differ from green plants chiefly in their total inability to assimilate inorganic matter. Some plants are partial parasites, deriving a portion but not all of their food from the soil and air. A few of the higher plants are suspected of being carnivorous, or at least under certain circumstances capable of absorbing animal matter. These have been fully described under INSECTIVOROUS PLANTS.

REPRODUCTION in plants may be conveniently divided into *vegetative* and *sexual*. The former is seen in the production of a new cell or new cells from a single old cell, without the intervention of a second cell. In some of the lower plants this is exhibited in a simple division of an old cell—in such cases an individual—to form two or more new ones, which become new individuals separate from that which produced them and from each other. In the higher plants the phyton (see BOTANY), or a group of them in a bud, may be separated spontaneously or artificially from the mother-plant and give rise to new individuals. Many of the processes of horticulture, such as propagating by cuttings, etc., are based upon the facility with which parts of plants can be made to live and reproduce the wanting parts when severed from the parent. These modes of reproduction by buds and the like are termed vegetative. In the life of the plant there comes a time when the contents of two cells combine to form a new cell or new cells. This is known as sexual reproduction. It is seen in its simplest form in the lower plants, when the contents of two cells, which are not distinguishable by any means in our power, blend by the process known as *conjugation*. The new mass formed of the contents of the two old cells escapes, becomes clothed sooner or later with cellulose, and leads an independent existence. When, however, any considerable difference exists between two cells which thus interact, it is observed that one is active, and loses its identity by blending with the second, which is inactive and generally larger. The first is known as the sperm-cell, or male element—the second the germ-cell, or female element. The union of the two is termed fertilization. The male cell varies greatly in form and in its activity during fertilization, sometimes moving free toward the germ-cell, in other cases becoming attached to the latter during its growth. The different modes of reproduction in the groups of lower plants have been sufficiently described under the separate heads, and it is necessary here to refer briefly only to the higher plants known as phænogamous. These are sexually reproduced by the action of pollen (the *germ*-cell) upon the ovule (containing the *sperm*-cell). When the ovule is unenclosed in any pistil, it is naked, and receives the pollen directly at the apex of the nucleus (as in the pines and allied plants). If, however, the ovule is enclosed in a pistil, the pollen falls first upon a portion of the envelope known as the stigma, and thus can act on the ovule only mediately. It sends down a slender tube or tubes, consisting of prolongations of the inner coat through the style, and this tube at last penetrates the cavity of the ovary, where the ovules are lodged. The tip of the tube advances to the ovule, and comes in contact with the enlarged cell at the upper part of the nucleus. This cell has been termed the embryonal sac, and it contains the embryonal vesicle, a mass of protoplasm which does not generally fill the entire cavity of the sac. After contact of the tip of the pollen tube with the embryonal sac, the contents of the latter become covered with a cellulose film, and begin the formation of new cells, usually arranged in a vertical row. This row is known as the suspensor, or pro-embryo, and its terminal cell is the commencement of the formation of the embryo. The subsequent production of new cells gives rise to the embryo, which may remain very rudimentary, or may attain a large size and assume the form of a small plant. The other parts of the ovule undergo concomitant changes, by which the coats increase in size, or may become changed in form, and by which the food for the embryo is stored away either in its substance or immediately around it. The ripened ovule is a seed. The ovary, which may contain one or many thousand ovules, ripens into a fruit. Usually, other contiguous parts are more or less affected during maturation, and may constitute part of what is popularly known as the fruit. In the strawberry the end of the flower-stalk, the receptacle, becomes pulpy and large, and carries on its surface the minute ripened ovaries or seed-like fruits. In the apple, part of the receptacle and the calyx ripen off with the fruit. Other similar cases are more fully described under their respective heads.

*Cross-Fertilization.*—It is now well known that the pollen which is most efficient to produce the changes above noticed comes not from the same flower in which the ovule to be fertilized is found, but from some other flower of the same or a different plant of the same species. This cross-fertilization is effected by the wind, which carries pollen from one flower to another, as in the case of many imperfect or separated flowers, or by the agency of insects. The study of the mechanism by which this is brought about through the intervention of insects forms one of the most interesting chapters in vegetable physiology, but it is a subject which needs to be treated at greater length than can here be allowed. It can be found explained in Darwin's *Fertilization of Orchids*, and in a popular manner by Prof. Gray in *How Plants Behave*.

*Hybridization.*—The pollen of one plant has generally no effect upon the ovules of another species. In a few cases, however, the ovules are fertilized, and *hybrids* are the result. These are usually infertile, the sterility being closely connected with proximity of relationship between the plants producing the hybrid. Plants raised from seeds do not always perpetuate the minor characteristics or peculiarities of the parent. This is well known in our cultivated pears, apples, and the like, the varieties of which are propagated only by budding or grafting. This tendency to vary, and the tendency to closely resemble the parent, may be said to be conflicting tendencies in every case. The variation which arises in one generation is generally slight, and may be usually kept down in any case by cross-fertilization. Hence the production of varieties is greatly hindered by the various means by which cross-fertilization through insect-agency or wind is secured. Varieties are sometimes fixed, so that they are perpetuable by seed. Such varieties are termed *races*. They are well illustrated in many of the choicer annuals and garden vegetables. Varieties desirable to florists and horticulturists are generally propagated by cuttings and the like. By care in the selection of seed from desirable varieties the variation may often be led farther and farther away from the ancestral form. To what extent this variation and the fixation of varieties take place in nature forms one of the most interesting fields of modern speculation.

During flowering, and probably during the maturation of the fruit, there is a constant consumption of oxygen by the ripening parts, and an evolution of carbon dioxide. This is accompanied by a marked elevation of temperature in the case of the flower. The temperature varies considerably during the day, and presents oscillations which are not yet understood.

The seed, or, in the case of indehiscent fruits, the fruit itself, is often provided with means for dissemination. These are hooks, wings, hairs, and the like, by which, through the agency of the wind or of animals, the seeds or fruits may be carried for some distance from the parent plant. Many fruits, like the violet, witch-hazel, etc., by a peculiar mechanism project the seeds; others are furnished with appliances by which they can become fastened in suitable soil.

*Germination.*—The conditions of germination of seeds are sufficient moisture, access of oxygen, and a proper temperature. Different seeds require different degrees of temperature, some, like water-cress, germinating in ice-cold water, others requiring 100° F. or even more. These conditions must coexist in order to ensure germination; but as soon as the seed has once fairly sprouted, oxygen can be withheld without injury. Van Tieghem has shown that the embryo of a seed may be mutilated even to complete separation of its parts, and yet possess the power of partial repair. The albumen of a seed like the four-o'clock can by replaced by a wholly different starch without impairing the power of speedy germination. It is still a disputed point how long seeds can retain their vitality. The widely-published accounts of the germination of wheat found with Egyptian mummies are all discredited by botanists, but that there are cases of greatly-prolonged viability there can be no doubt. (See SEEDS. For VEGETABLE METAMORPHOSIS and VEGETABLE MORPHOLOGY see METAMORPHOSIS, BOTANY, LEAF, and MORPHOLOGY (in botany), by PROF. ASA GRAY, M. D., LL.D.) G. L. GOODALE.

**Vegetable Tissue.** See BOTANY, by PROF. ASA GRAY, LL.D., and VEGETABLE HISTOLOGY, by PROF. G. L. GOODALE, A. M.

**Vegetable Wax,** the wax-like product of various plants, used to a considerable extent as a substitute for beeswax. (1) Myrtle wax, produced from the bayberry or wax-myrtle, *Myrica cerifera* of the U. S. It is of a greenish hue, and is sparingly used in pharmacy as an ingredient of cerates. Its candles emit a pleasant odor, but do not give a good light. (2) The wax of the Carnahuba palm, *Copernicia cerifera* of Brazil. It is used in Europe in candle-making and waxing floors and furniture. (3) That of *Ceroxylon andicola*, a fine palm tree of the Andes. It is abundant, but rather resinous, and for candles is mixed with tallow. (4) The Japan wax, produced by boiling the seeds of *Rhus succedanea*, a sumach tree. It is nearly equal to beeswax, and is used in candle-making. It should not be confounded with China wax, which is an insect product.

**Vegeta'rianism,** a view according to which vegetable substances ought to form the sole food of man, while the use of all animal substances, or at least of meat proper, ought to be avoided in the diet as something wrong, both physiologically and morally. Many of the ancient philosophers—as, for instance, Plato—encouraged a vegetable diet as the most suitable for the well-being of man, physically and morally; and some of them—as, for instance, Pythagoras—absolutely forbade the use of animal food. In modern times the view found eloquent advocates in Rousseau, Shelley, and others, and in 1847 a society was formed for the propagation of vegetarianism at Manchester, England, which published the *Vegetarian Messenger*, a monthly paper, up to 1861. A similar society was formed in the U. S. in 1850.

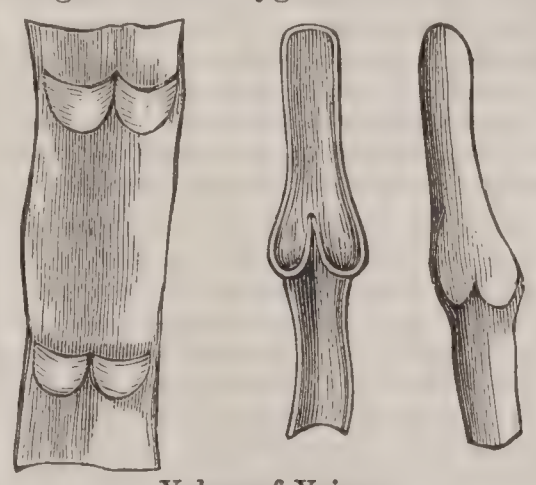
**Veg'etative Process, Chemistry of.** In the article BOTANY, by PROF. ASA GRAY, it has already been explained that the functions in nature of vegetation are to transform lifeless and stable bodies and compounds, such as make up the air, water, and soil, into organic matter, unstable, changeable, decomposable, oxidable, and full of chemical energy, which it evolves when decomposing or oxidating —matter fitted thus for the food of animals, whose life and movement it supports by supplying the energy necessary for animal heat and muscular motion. The methods and processes by which the plant accomplishes this fundamental vital function upon the earth constitute the subjects of a special branch of chemistry, which may be called *vegetable chemistry.* It is as yet but little cultivated, and but few things are known, even *superficially*, regarding the changes that occur in the conversion of mineral into organized matter. It is known that carbon, the binding element of organized bodies, is derived from the carbonic acid gas of the atmosphere. Hence this extremely minute constituent of the air, equal to only .0004 of its volume or .00061 of its weight, is the sole dependence of plant-life, and through this of animal life, upon the earth. Within the leaf of the plant resides the inscrutable vital influence which is able, with the assistance of the heat of the solar ray, to set up the most mysterious of chemical laboratories, where such substances as cellulose and starch (and through these sugars), with still more complex proteid bodies, are elaborated from the simple compounds carbonic acid and water. Generations may pass away at the present rate of progress of chemical investigation before any real insight will be gained into the chemistry of the plant-leaf. The writer is enabled to state, from his own new researches in volumic chemistry, a fact which has not been known in reference to this problem, and which is most impressive in its character. This fact is, that in the bodies formed in the plant-leaf *hydrogen* exists in a greater state of condensation than in any other class of compounds yet known. While in liquid water, according to his computations, liquid hydrogen exists with a density of .1561 only (water being 1), in cellulose, starch, and gum it has about twice this density, or .309, and in cane-sugar one higher still, .368. That this enormously-condensed condition of the hydrogen in these food-constituents is intimately connected with their nature as reservoirs of animal energy may be asserted without doubt, but the nature of this connection is yet to be elucidated by laborious chemical investigation. (See VEGETABLE PHYSIOLOGY and VEGETABLE HISTOLOGY.) HENRY WURTZ.

**Ve'glia,** an island of Austria, belonging to the government of Triest, in the Gulf of Quarnero, an inlet of the Adriatic, and separated from the mainland by the channel of Morlacca. It is 23 miles long, 12 miles broad, mountainous, and produces timber, wine, silk, marble, and salt. P. 15,000.

**Vehmic Court.** See FEHMIC COURT.

**Veh'se** (KARL EDUARD), b. at Freiberg, Saxony, Dec. 18, 1802; studied jurisprudence at Leipsic and Göttingen; was appointed assistant keeper of the royal archives of Dresden in 1825; published his *Geschichte Kaiser Otto's des Grossen* in 1828, and became chief of the archives in 1833. In 1838 he resigned his office and emigrated to America, but returned in 1839; lectured in Dresden and various other German cities; settled in 1853 in Berlin, but was arraigned for some passages in his *Geschichte der deutschen Höfe* (48 vols., 1851–58), condemned to six months' imprisonment, and banished from Prussia. In 1856 he went to Switzerland; settled at Sisach, near Bâle; was naturalized as a Swiss citizen; visited Italy twice, and d. at Dresden in 1870. The first 6 vols. of his *Geschichte der deutschen Höfe* treat of Prussia, the next 11 Austria, etc. He also wrote *Shakspeare als Politiker, Psycholog und Dichter* (2 vols., 1851).

**Veins, Anatomy of** [Lat. *vena*], the companion vessels to the arteries, distributed throughout the body for the purpose of returning the venous or impure blue blood from the extremities, surfaces, and viscera to the heart and lungs. The veins are membranous canals, essentially devoid of elasticity and without pulsation. They arise from venous capillaries which collect from the tissues the blood recently brought to them by the arterial capillaries, richly freighted with oxygen and nutritive matter. These venous capillaries unite to form ultimate veins, which still again unite, forming successively larger branches and trunks as they approach the centre of the circulation. The motion of venous blood is secured in part by the *vis a tergo*, or power of the capillary chemico-vital nutritive processes, in part by the pressure of the moving muscles and viscera between which the veins are imbedded, the veins being provided with valves which permit of blood-currents toward the heart, but not the reverse. Veins have three coats—internal, middle, and external. The veins are not uniform, symmetrical cylinders, like the arteries, but have pouches or sinuses adjacent to the valves, so that a vein distended resembles a bamboo stick with bulbous or knotted joints. The veins, like the arteries, have nutrient vessels, or *vasa vasorum*, in their walls. The veins of bones are termed sinuses, their outer coat being replaced by the endosteum or fibrous lining of the bone, as in the great sinuses of the skull. The venous blood returned by the veins from above the region of the heart is united in one great vein, the *vena cava superior*, all from below entering by the *vena cava inferior.* The *vena azygos* connects the two *venæ cavæ*, and receives a few veins from the region between them. The portal vein receives the venous blood from the intestines, and conveys it through the liver to the inferior vena cava. The pulmonary vein and branches go from the right side of the heart to the lungs, carrying the



Valves of Veins.

blood to the air-sacs to be revivified by the oxygen of inspired air.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Veins, Metallic and Mineral.** See Ore Deposits, by Prof. R. Pumpelly.

**Veit** (Philipp), b. at Berlin Feb. 13, 1793; was educated by Friedrich Schlegel, who became his stepfather, and exercised a decisive influence on the peculiar cast of his mind; made his first art-studies in Dresden; joined afterward Cornelius and Overbeck in Rome, and became one of the most vehement champions of the romantic school in painting. In 1830 he was appointed director of the Städel institute of art in Frankfort, but resigned this position in 1843 because the institute bought Lessing's picture of *Huss before the Council of Constance*, and removed his studio to Sachsenhausen, opposite Frankfort. He has painted both *al fresco* and in oil, mostly allegorical and biblical subjects. Among his most remarkable pictures are—the *Seven Years of Plenty*, in the Villa Bartholdy at Rome, *Christianity bringing the Fine Arts into Germany*, in the Städel institute of Frankfort, the *Assumption of the Virgin*, in the cathedral of Frankfort, and the *Egyptian Darkness*, for the king of Prussia.

**Veitch** (John), b. at Peebles, Scotland, Oct. 24, 1829; educated at the grammar school of that place and at the University of Edinburgh, where he graduated 1851 with honors in logic and moral philosophy; was assistant to Sir William Hamilton and to his successor, Prof. Fraser, in the chair of logic and metaphysics of that university 1855–60; became professor of logic, metaphysics, and rhetoric in the University of St. Andrew's 1860, and professor of logic and rhetoric in the University of Glasgow 1864. He translated Descartes' *Discourse on the Method of rightly conducting the Reason and Seeking Truth in the Sciences* (Edinburgh, 1850), and the same author's *Meditations and Selections from the Principles of Philosophy* (1853); prepared a *Memoir of Dugald Stewart* for the revised edition of the *Complete Works* of that philosopher (vol. x., 1858); was joint editor with the late Dean H. L. Mansell of Sir William Hamilton's *Lectures on Metaphysics and Logic* (Edinburgh and Boston, 4 vols., 1859–60), and has written a *Memoir of Sir William Hamilton, Bart.* (Edinburgh, 1869).

**Vejer' de la Fronte'ra,** town of Spain, province of Cadiz, on the declivity of a steep rock, is gloomy and dirty, but looks down on an exceedingly fertile plain along the river Barbate. P. 7662.

**Ve'la** (Vincenzo), b. in 1822 at Ligurnetto, canton of Ticino, Switzerland; was trained as a stone-cutter in the quarries of Viggio; went to Milan in 1836, where he studied drawing; worked in the studio of Cacciatori, and made models for the jewellers; removed in 1847 to Rome; won a prize in 1848 at Venice by his bas-relief, *Christ raising the Daughter of Jairus;* volunteered in the Italian war against Austria in 1848; settled permanently at Turin, and attracted general attention by his statues, *A Prayer* and *Spartacus*. Among his later works are *Harmony in Tears* (1855) for the monument of Donizetti at Bergamo; *France and Italy*, a group (1863), presented by the ladies of Milan to the empress Eugénie; *Columbus and America* and *Napoleon in St. Helena*, in the Metropolitan Museum of New York.

**Velas'quez** (Diego), b. in Spain about 1470; accompanied Columbus on his second voyage to America 1493; took a prominent part in the subjugation of St. Domingo, where he held several offices; was commissioned to conquer and colonize the island of Cuba, of which he became governor; founded Havana (1511) and other cities, and despatched to Mexico the expeditions of Grijalva, Cortez, and Narvaez. His last years were occupied by a controversy with the conquerors of Mexico about jurisdiction. D. 1523.

**Velasquez** (Diego **Rodriguez de Silva**), b. at Seville, Spain, in June, 1599, of Portuguese descent on the father's side; displayed in childhood such a fondness for drawing that he was placed in the school of Francisco de Herrera, the elder, and afterward in that of Francisco Pacheco, whose daughter he married; but was indebted for his style less to either of his masters than to his own resolute and untiring study of nature, by the aid of which he developed an intense realism, "adhering strictly to color, form, and outline of whatever he represented," and executing studies of the same model, a ragged peasant lad, in every possible attitude. He thus acquired wonderful skill in taking likenesses, as well as in his representation of still life. To this earliest period belong his celebrated *Water-Carrier*, at Apsley House, London, the *Adoration of the Shepherds* and *Beggar Boy*, at the Louvre, Paris, and a *Laughing Peasant*, in Vienna. In 1622 he made a short visit to Madrid to see the royal galleries, painted a portrait of Gongora the poet, and secured the friendship of powerful patrons; was invited to Madrid the following year (1623) to paint the portrait of Olivares, the prime minister of Philip IV.; was next employed by that monarch, and produced a portrait which at once established his reputation as the first artist of Spain; was appointed court-painter, with a regular salary in addition to handsome compensation for his separate works; made a portrait of Prince Charles of England during his secret visit to Madrid in 1623; gained great applause by his *Expulsion of the Moriscoes from Spain* (1627); became intimate with Rubens on the arrival of the latter at Madrid on a diplomatic mission (1628), but was not sensibly affected by his florid style; visited Italy 1629; was received with great honor by Pope Urban VIII., and assigned apartments in the Vatican; employed himself chiefly in copying the frescoes of Michael Angelo and Raphael, but considered Titian greater than either; returned to Madrid 1631; was given a painting-room in the palace, and became more than ever a royal favorite; went a second time to Italy to buy pictures and statuary for the royal gallery 1648–51, and was on his return appointed chief chamberlain of the court. D. at Madrid Aug. 7, 1660. He is generally regarded as the greatest of Spanish painters. An appreciative account of *Velasquez and his Works* (1855) has been written by Sir W. M. Stirling. Porter C. Bliss.

**Velde.** See Vandervelde.

**Ve'lez,** town of New Granada, in lat. 6° 10′ N., lon. 73° 50′ W., on the Suarez, has cotton manufactures. P. 7546.

**Ve'lez Mala'ga,** town of Spain, province of Malaga, on the river Velez, near its mouth in the Mediterranean, in a plain of the highest fertility, producing sugar, cotton, and rice, besides wine and fruits of superior quality. The town itself is old and somewhat decayed, but it is rich and carries on an important trade. It contains the ruins of a Moorish castle and two fine old churches. P. 15,000.

**Ve'lez Ru'bio,** town of Spain, province of Almeria, on a plain 2558 feet above the level of the sea, has some very efficacious chalybeate springs in the vicinity. P. 5148.

**Velia,** or **Elea,** a Greek city. See Elea.

**Veli'ki Ustjug',** town of European Russia, at the confluence of the Jug and the Suchona, manufactures leather, tallow, soap, and vinegar. P. 7763.

**Velish',** town of Russian Poland, government of Witebsk, on the Dwina, exports large quantities of corn, flax, and hemp to Riga. P. 9562.

**Velle'ia,** town of ancient Liguria, the present province of Parma, Italy, near the Nura, was founded under Tiberius, and was buried by a land-slide in the fourth century. It lay hidden and forgotten till 1760, when by chance it was discovered, and its forum, amphitheatre, baths, etc., were excavated. Singularly enough, Roman history does not contain the least hint of any such incident having taken place, but a comparison between the soil covering the city and that of the neighboring mountains makes the hypothesis of a land-slide very probable.

**Velleius Paterculus.** See Paterculus.

**Velle'tri** [anc. *Velitræ*], town of Italy, province of Rome, situated on a spur of Monte Artemisio, about 26 miles S. E. of the city of Rome. The walls, now very ruinous, are of the time of the Lower Empire; the cathedral and other churches contain ancient marbles, pictures, and other mediæval objects worthy of notice; but the Egyptian, Etruscan, and Roman antiquities formerly preserved here in the Museo Borgiano have been dispersed, as has also the important collection, likewise made by the Borgia family, of stone implements belonging to the age of the lake-dwellers. Velletri was one of the most conspicuous of the Volscian cities, and one of the most restless and rebellious under the Roman yoke. The Octavian family is said to have transferred itself from Velletri to Rome during the reign of Tarquinius Priscus, and to have been immediately admitted, as one of the chief heads of the Volsci, to the full rights of Roman citizenship. Velletri had to endure its share of suffering from the arms of the barbarians, and its mediæval life was no less turbulent than that of its neighbors. The modern town, notwithstanding its nearness to the Pontine Marshes, is said to be perfectly healthy. It is supplied with water by a subterranean aqueduct about 8 miles in length, constructed by Fontana. P. 16,500.

**Vellore',** a British fortress in the Arcot district of Southern India, is situated on the banks of the Pâlâr, or "river of milk," as the name of this picturesque stream signifies. The fort is surrounded by a deep moat excavated out of the solid rock. The European quarters of the town are airy and pleasant, but the town itself is overcrowded. Latterly, there have been severe floods in Vellore because of the sudden rise of the Pâlâr, and numbers of persons have perished. The town contains a fine temple to Vishnu, who is represented in his incarnation of Krishna, as divinely dallying

with and ravishing the thousand shepherdesses whom he so honored. Tippoo Sultan used to live a great part of each year (when he was not out on fighting expeditions) at this salubrious station. The railway now runs near the city, and it is likely to increase in size. As a fortress it is of considerable strategic importance even at this time. P. 51,500. R. C. CALDWELL.

**Vellum.** See PARCHMENT.

**Velocim'eter** [Lat. *velox*, "swift," and *μέτρον*, "measure"], an instrument for measuring with extreme accuracy the velocity of projectiles by means of electricity, was invented by Wheatstone in 1840, and has received ingenious improvements from Col. J. G. Benton of the U. S. ordnance department. A simpler form has recently been devised by Capt. Le Boulengé of Belgium.

**Veloc'ipede** [Lat. *velox*, "swift," and *pes*, "foot"], originally a vehicle invented in 1817 by M. Drais of Mannheim, consisting of a seat resting upon two wheels, one before the other. The rider sat astride the seat, and propelled the vehicle by striking the ground with his toes. More recently velocipedes are propelled by the action of the feet upon a crank attached to the axle of the forward wheel. Velocipedes are called bicycles, tricycles, or quadricycles, according to the number of wheels. Few things are more puzzling to the ordinary observer than the self-balancing or *self-sustenance* of the bicycle velocipede. If he makes the experiment, he finds his forebodings, founded upon the absence of *base* for *stable equilibrium* in the two wheels in the same fore-and-aft plane, but too well verified. The principle by which the skilled rider sustains himself is perhaps best illustrated by reference to the familiar experiment of balancing a long pole in a vertical position on the chin or end of the finger. The equilibrium of a pole thus balanced (supposing it to be perfectly so, which it never is) is *unstable;* but in its *almost* vertical (or balanced) position the motion of fall is extremely slow; the holder is easily able to detect it, and to move his finger (or chin) so as to counteract it. The process for the bicycle is not identical, but analogous; the experienced rider *feels* such incipient tendency of the vehicle to fall either way, and by an acquired habit, which becomes instinctive, checks it through the guiding-wheel, slightly varying his direction. The centrifugal force due to the *deflection* of his moving velocity thus brought into action counteracts each incipient falling tendency. Perhaps it would be more proper to say that what is, in statics (or *motionless*), a position of *unstable equilibrium* is made kinetically (*i. e. through motion*) stable. J. G. BARNARD.

**Velocity.** See MOTION, by PROF. W. P. TROWBRIDGE.

**Velpeau'** (ALFRED ARMAND LOUIS MARIE), b. at Brèche, department of Indre-et-Loire, France, May 18, 1795, the son of a common horse-leech; attracted attention by his passion for studies and his success in some cures he undertook in the neighborhood; went in 1816 to Tours, with some slender support from a friend, to study medicine; removed in 1821 to Paris, and became in 1830 surgeon in the Pitié Hospital in Paris, in 1835 professor of clinical surgery at the Academy of Medicine, and in 1842 at the Institute. D. at Paris Aug. 24, 1867. He wrote—*Traité de l'Anatomie chirurgicale* (2 vols., 1825), *Anatomie chirurgicale, générale et topographique* (2 vols., 1838), *Mémoire sur les Positions vicieuses du Fœtus* (1830), *Nouveaux Éléments de Médicine opératoire* (1832), *Embryologie ou Ovologie humaine* (1833), *Des Convulsions pendant la Grossesse, durant le Travail, ou après l'Accouchement* (1834), *Traité des Maladies du Sein et de la Région mammaire* (1853). His disciples, Jeanselme and Pavillon, collected and published his *Leçons orales de Clinique chirurgicale* (3 vols., 1840–41).

**Velvet.** See APPENDIX.

**Venan'go,** county of N. W. Pennsylvania, drained by Alleghany, Venango, and other rivers, and traversed by Lake Shore and Michigan, Atlantic and Great Western, and several branch railroads. The county forms the centre of the great oil-basin of Pennsylvania, and a large part of it is traversed by spurs of the Alleghany Mountains. Petroleum, bituminous coal, and iron ore are very abundant, and lumber is largely exported. The soil along the streams is fertile. There are manufactories of refined petroleum, machinery, carriages, woollen goods, and boots and shoes; flour-mills and saw-mills. Live-stock of all kinds is numerous. Staples, petroleum, coal, lumber, wool, oats, Indian corn, wheat, potatoes, and dairy products. Cap. Franklin. Area, 850 sq. m. P. 47,925.

**Venango,** tp., Butler co., Pa. P. 902.

**Venango,** p.-b. and tp., Crawford co., Pa. P. of b. 318; of tp. 623.

**Venango,** tp., Erie co., Pa. P. 1370.

**Venango,** city and b., Venango co., Pa. P. 1550.

**Venantius.** See FORTUNATUS (VENANTIUS).

**Vena'ria Rea'le,** town of Italy, province of Turin, near the torrent Stura, about 5 miles N. of the city of Turin. The castle, which was the royal summer residence of the house of Savoy during the last century, was so damaged in the course of the French occupation that it has never been repaired. The royal chapel, however, is still in good condition, and is much admired for its architecture and internal decoration. Venaria Reale is an active little town, and its large *piazza d'armi* is used as a place for artillery-practice. P. 5900.

**Venbâ Metre.** Every one knows of the Sanskrit *slôka*. Next in importance to it in India we must consider the *venbâ*. Millions and millions of Hindûs not only read and write it, but *sing* it alike. It is a most intricate alliterative measure, consisting usually of four lines, but sometimes, as in the *Kural* of Tiravalluvar, of two only. What the most involved and difficult versification of the Spenserian stanza, or the sonnet, is in English to the plain sober march of non-rhyming (called blank) verse, that is the venbâ to the slôka. The venbâ of four lines contains properly five alliterative rhymes and four or five alliterations simple. There is no need in this place further to dissect this strange Hindû metre, but the reader can easily consult Indian prosodies on the subject, where the venbâ, as it deserves, is treated of at great length. It is so extremely difficult a measure that it cannot be here treated of concisely. Probably, this is one reason why the word is to be found in no English cyclopædia. R. C. CALDWELL.

**Ven'dace,** the *Coregonus Willughbii*, a trout-like fish of the family Coregonidæ, found in Scottish and Swedish lakes, and probably in Pomerania also. Its introduction into Scotland is ascribed to Mary Queen of Scots. It is a fine prolific table-fish, and is caught in nets, since it never takes the hook.

**Vendée, La,** department of France, bordering W. on the Bay of Biscay, comprises an area of 2587 sq. m., with 401,446 inhabitants. The coast-land is either sandy or salt marshes, from which it has received the name of *Marais*. The northern part, the *Bocage*, is more elevated, but the ground is covered either with heath or with pine forest. The rest of the department, the *Plaine*, is fertile land, eminently well suited to agriculture. But in spite of all disadvantages, both the Marais and the Bocage are well peopled and carefully cultivated; flax, hemp, and vegetables are produced in the former, honey, fruit, and hops in the latter, and wine in both districts. In the Plaine large crops of wine, wheat, and fruits are raised, and many cattle fattened for the Paris market. Iron and coal are found. Of 54,003 children of school age, 18,234 received no school education in 1857. Cap. Napoléon-Vendée.

**Vendémiare'** ("wine month"), in the French revolutionary calendar, lasted from Sept. 23 to Oct. 21. It was the first month in the revolutionary year.

**Vendet'ta** [It.]. Before the administration of justice becomes a social institution, with authority to redress all injuries and power to enforce its authority, the idea of justice manifests itself in social life by the formation of customs which make vengeance one of the most sacred duties of the individual. When a man is slain, his son, his brother, or his nearest kinsman must avenge the blood by slaying the murderer, or the whole family will stand disgraced. In its gravest and most sublime form this custom existed among the ancient Scandinavians, but, as it denotes a certain stage of social development, it is found under some form in the history of every nation. Traces of it still occur among the Montenegrins, Albanians, Druses, Circassians, etc., and it flourishes among the Bedouins and in Corsica. In this last place it has received a most rigid and cruel form, and plays a most important part in social life. The name *vendetta* originated here. In his novel *Colomba*, Prosper Merimée has given a very striking and minutely true picture of the custom.

**Vendôme',** town of France, department of Loir-et-Cher, on the Loir, has a college, cavalry barracks, and manufactures of cotton hosiery, gloves, needles, and paper. P. 9938.

**Vendôme,** an ancient countship of France, corresponding nearly to the present department of Loir-et-Cher, was erected into a duchy by Francis I., and given to Charles of Bourbon. It returned to the Crown with the accession of Henry IV. in 1589, but in 1598 he bestowed it on his eldest son by Gabrielle d'Estrées, CÉSAR (b. in 1594, d. Oct. 22, 1665), from whom descended the house of Vendôme. César played a very conspicuous part in the intrigues and conspiracies against Richelieu and in the entanglements of the Fronde, and left two sons—LOUIS, duke de Vendôme (b. in 1612, d. Aug. 6, 1669), and FRANÇOIS DE VENDÔME, Duke de Beaufort (see BEAUFORT). Louis married Laura Mancini, one of Cardinal Mazarin's famous nieces, but be-

came a priest after her death in 1657; was made a cardinal, and left two sons—Louis Joseph, duke de Vendôme (b. in Paris July 1, 1654, d. at Tinaroz, Catalonia, June 11, 1712), and Philip of Vendôme, grand prior of the Knights Templar in France (b. Aug. 23, 1655, d. Jan. 24, 1727), with whom the family became extinct. Of all the members of the family, however, Louis Joseph was the only one who exhibited really great talents. He entered the army in 1672, and fought with distinction under Turenne in Germany and Alsace, and under Crequi in Flanders, to the Peace of Nymwegen (1678). He earned still greater renown in the following war (1688), under Luxembourg in the Low Countries, at the sieges of Mons and Namur, and in the battles of Leuze and Steenkerk, and under Catinat in Italy, where he commanded the left wing in the battle of Marsaglia (Oct. 4, 1693). But in spite of the brilliant energy he often displayed at the moment, and the coolness and inexhaustibleness of resources he evinced in an emergency, Louis XIV. still hesitated to entrust him with an independent command; for he was as careless as he was audacious, and his fits of energy were often succeeded by periods of indolence, during which he gave himself up to the grossest sensualities. Nevertheless, in 1695 he was placed in command of the army of Spain, and the result was a singularly rapid campaign, in which one brilliant success followed another; the whole finally was wound up with the capture of Barcelona, which enabled the king to negotiate the Peace of Ryswick (1697). In the Spanish war of succession he was sent in 1702 to supersede Villeroi in Italy. He was received with enthusiasm by the beaten and demoralized army, defeated the Austrians at Ustiano and San Vittorio, and drove Prince Eugene beyond the Mincio. His attempt to penetrate into Germany through the Tyrol failed, as the duke of Savoy rose in his rear; but with great alertness he turned round, defeated the Piedmontese completely, and gained new victories over Eugene at Cassano (1705) and over Reventlow at Calcinato (1706). However brilliant, his Italian campaign was not without its narrow escapes, caused by his carelessness, such as the battle of Luzzara (1702), and having been removed to the army of the Rhine once more to make amends for the blunders of Villeroi, he was completely defeated by Marlborough and Eugene at Oudenarde (July 11, 1708). The fault was perhaps not his. He commanded under the duke of Burgundy, a grandson of Louis XIV., and the hands of Madame de Maintenon, who hated him, were busy in his affairs. He left the army and retired in disgust to his estates. But in 1710 the situation of the French party in Spain became so desperate that Philip IV. implored his grandfather to send him Vendôme. Accordingly, Vendôme was sent to Spain, created an army, defeated the English at Brihuega and the Austrians at Villa Vicioso, carried the king back to Madrid, and finished the war in Spain. But as soon as the work was done, he immediately relapsed into his old indulgences, and died suddenly from "extraordinary gluttony."

**Vendôme, Column of.** See Paris.

**Vend'or's Lien** is an equitable lien for the unpaid purchase-money of land resulting to the vendor or grantor, although the purchaser has taken possession, and although the conveyance may acknowledge that the consideration has been paid. It attaches to the land in the hands of the vendee or grantee, and of all persons holding under him except purchasers for value without notice of its existence. It is in the nature of a mortgage, and is enforced by a foreclosure and sale of the land. If a higher security is taken for the price by the vendor, as a mortgage, and generally a collateral undertaking of a third person, the lien is waived, but no note, bond, or other personal security of the vendee will have this effect. Although this lien does not exist by the law of a few States, it is fully recognized in a large majority of the commonwealths. In several of the Western States it is of great practical importance, and seems to be very commonly relied upon as a security for the price of land. John Norton Pomeroy.

**Ve'nedey** (Jakob), b. at Cologne May 24, 1805; studied law at Bonn and Heidelberg, and began to practise as an advocate in his native city, but fled to France in 1832 on account of an injunction against his *Ueber Geschworenengerichte* and other conflicts with the Prussian police; settled in Paris, and began in 1835 to issue a monthly paper, *Der Geächtete;* was twice banished from Paris, but finally allowed to reside there by the intervention of Arago, Mignet, and others whose interest he had gained by his work, *Römerthum, Christenthum, Germanenthum* (1840); returned to Germany in 1848, and sat in the national assembly at Frankfort; was banished from Berlin and Breslau; went to Zurich in Switzerland, but settled finally in Oberweiler, Baden, where he d. Feb. 8, 1871. After a visit to England (1843–44), he wrote *Irland* (2 vols., 1844) and *England* (3 vols., 1845); he also wrote *Geschichte des deutschen Volks* (4 vols., 1854–62), besides a number of biographies and minor essays.

**Venedy,** p.-v., Washington co., Ill. P. 230.

**Veneer'ing** [Fr. *fournir*, to "furnish"], in cabinet-work, the art of laying thin leaves of some valuable wood or other material upon a foundation of inferior material. It was known to the Romans, and is referred to by Pliny as a novelty of his period. The plates were formerly sawn by hand, but in 1806, Brunel introduced a method of splitting them from straight-grained wood, and employed circular saws for carved and knotted wood. Veneers of ivory and bone are now largely used for some purposes. The finer processes are called Marquetry and Buhl-Work (which see).

**Venereal Ulcer.** See Appendix.

**Venesection.** See Bleeding.

**Venetian Architecture.** See Renaissance, by Clemens Petersen.

**Vene'tian Chalk,** the same as French chalk, a soft white talc used by tailors instead of chalk; also used in making pastels and cosmetics.

**Venezue'la, United States of,** a republic of South America, extends between lat. 1° 8′ and 12° 16′ N., and between lon. 60° and 73° 17′ W., bounded W. by the United States of Colombia, N. by the Caribbean Sea, E. by the Atlantic and British Guiana, and S. by Brazil, and comprises an area of 403,000 sq. m., with 1,784,194 inhabitants, of whom about 17,000 are pure whites, about 52,000 pure Indians, and the rest a mixture of Spaniards, Indians, and negroes. The language is Spanish; the religion is Roman Catholic, but other religions are tolerated; the constitution is a close imitation of that of the U. S. of North America. The union comprises the following twenty states, with one federal district and one territory:

| States. | Population in 1873. | Capitals. |
|---|---|---|
| Apure | 18,635 | San Fernando. |
| Barcelona | 101,396 | Barcelona. |
| Barquesimeto | 143,818 | Barquesimeto. |
| Bolivar | 129,143 | La Guayra. |
| Carabobo | 117,605 | Valencia. |
| Cojedes | 85,678 | San Carlos. |
| Cumaná | 55,476 | Cumaná. |
| Falcon or Coro | 99,920 | Coro. |
| Guárico | 191,000 | Calabozo. |
| Guayana | 34,053 | Ciudad Bolivar. |
| Guzman Blanco | 94,151. | Victoria. |
| Maturin | 47,863 | Maturin. |
| Mérida | 67,849 | Mérida. |
| Nueva Esparta (Margarita) | 30,983 | Asuncion. |
| Portuguesa | 79,934 | Guanare. |
| Táchira | 68,619 | San Cristobal. |
| Trujillo | 108,672 | Trujillo. |
| Yaracui | 71,689 | San Félipe. |
| Zamora | 59,449 | Barinas. |
| Zulia | 59.235 | Maracaybo. |
| Federal district | 60,010 | Carácas. |
| Territory of Amazonas | 23,048 | Carácas. |

The capital, Carácas, has 48,897 inhabitants; Valencia, 28,594; Barquesimeto, 25,664; Maracaybo, 21,954; Maturin, 12,944. The coast along the Atlantic is low, sandy, and mostly occupied by the delta of the Orinoco; along the Caribbean Sea, from the Gulf of Paria to that of Maracaybo, it is alternately low, swampy, and lined with lagoons, and bold and rocky, the cliffs rising wall-like against the sea, but forming many good harbors, such as those of La Guayra, Puerto Cabello, Cumaná, Barcelona, and Maracaybo. The interior comprises two different mountain-systems, N. and S. of the Orinoco. From Colombia the Andes enter this country, and at Pamplona, in lat. 7° 15′ N., lon. 73° W., they separate into two branches—the one running N., under the names of Sierra de Ocaña, Sierra de Perija, and the Oca Mountains, never rising above 5000 feet, and terminating in Cape Chichibacoa at the north-eastern extremity of the peninsula of Goajira; the other running first N. E., under the name of the Mérida Mountains, having an average altitude of 6000 feet, and rising in the two peaks of the Sierra Nevada to 15,000 feet, then more directly E., under the name of the Venezuela Coast Mountains, having a mean height of 4800 feet, and rising in the Silla de Carácas to 8547 feet, and in the Picacho de Naiquata even to 9100 feet. S. of the Orinoco stretches the Sierra Parima, consisting of many ranges, among which is the Sierra de Pacaraima, which forms the boundary between Venezuela and Brazil, but is generally very little known. Between these two mountain-systems extend along the banks of the Orinoco the Llanos, grassy plains of various elevation and of various surface-formation, those of Apure being so perfectly level that the waters of the Rio Apure and Rio Meta, which traverse them and enter the Orinoco, are turned by the least E. wind or by a swelling of the Orinoco and flow up-stream, while those of Carácas and Ca-

rabobo present low ranges of hills and groups of trees. The climate varies with the elevation. In the low regions, not rising beyond 2000 feet above the sea, it is very hot, the mean temperature being 80° and the thermometer often reaching 110°; these regions are by the natives called *tierras cálidas* ("hot lands"). At an elevation of from 2000 to 7000 feet, in the *tierras templadas* ("temperate lands"), the climate is delightful and healthy, the mean annual temperature ranging from 65° to 75°. Where the country rises above 7000 feet, in the *tierras frias* ("cold lands"), it generally becomes uninhabitable, not so much, however, on account of any excessive coldness as because of the perpetual mists which hang over these regions, and the terrible hail and snow storms which visit them. There is a dry and rainy season, but in many parts of the country —as, for instance, in Guayana—rains are frequent also in the dry season. The mean annual rainfall at Carácas is about 330 inches in eighty days. The country is everywhere well watered. Besides the Orinoco with its 400 navigable affluents, several hundred rivers, most of them navigable, enter the Caribbean Sea, and lakes and lagoons are numerous. The soil is generally exceedingly fertile, and the mineral wealth of the country seems to be very great, though its mining industry is as yet very little developed. Diamonds and precious stones are found in Nueva Esparta; gold, silver, and platinum in Bolivar and Guayana; copper, iron, tin, zinc, lead, and quicksilver in Falcon and Barcelona; alum, gypsum, saltpetre, asphaltum, petroleum, and sulphur abound; salt is produced in large quantities along the coast, and *urao* from the lagoon of Lagunilla in Mérida. Still richer is the vegetable kingdom. The primeval forests of Guayana contain excellent timber and fine cabinet woods, such as mahogany, satin-wood, ebony, etc. The cinchona occurs in large forests; also the caucho, or India-rubber tree, gum trees, dyewoods, among which the famous *divi-divi*, and medicinal plants. The cocoa, sago, wax, and royal palm abound in the low regions. The coffee tree, introduced in 1784, is extensively cultivated, and succeeds well at an elevation from 650 to 5500 feet. Cacao and cotton are also extensively cultivated. Sugar and indigo were formerly raised in larger quantities, but tobacco forms still a very important crop. The principal occupation, however, of the inhabitants is cattle-breeding. In 1873 the country possessed 1,389,802 head of horned cattle, 1,128,273 sheep and goats, 93,800 horses, 47,200 mules, 281,000 asses, and 362,597 swine. Excellent fish, beautiful birds, game, and barnyard fowls abound, but the lower regions are much infested by noxious insects, immense spiders, bats, and centipedes, venomous serpents and alligators; the boa constrictor reaches a length of 50 feet. The manufacturing industry is very little developed, but in spite of the lack of good roads and other proper means of communication, the commerce is considerable. In 1872–73 the total value of the exports amounted to $21,320,495; that of the imports to $11,264,976. The principal items of export were coffee, 23,998,585 pounds; cotton, 5,648,323; sugar, 5,017,469; cacao, 7,573,586; tobacco, 1,100,297; indigo, 182,976; hides, 130,000; skins, 150,000, etc. About 2200 vessels entered the ports of the country in 1874. In 1873–74 the revenue amounted to $5,570,401, the expenditure to $5,209,351; the home debt to $16,439,383, the foreign debt to $46,575,337.

The island of Margarita and the opposite coast of the mainland were discovered in 1498 by Columbus, and in the following year the whole northern coast of South America was traced by Ojeda and Vespucci as far as the Gulf of Maracaybo. At the entrance of the lake stood an Indian village built on piles in the water, and this aspect reminded the Spaniards so vividly of Venice that they called the place Venezuela ("Little Venice"), which name was afterward applied to the region around the lake, and finally to the whole country. The first permanent settlement was made in 1520 at Cumaná, and new colonies soon followed. Coro was founded in 1527, Tocuyo in 1545, Barquesimeto in 1552, Valencia in 1555, Carácas in 1567, etc. Of great consequence for the development of the country were the discovery of gold in the coast range in 1540, and the organization in 1700 of the Guipúzcoa Company in Spain for the encouragement of the cacao cultivation. In 1810 the country revolted against King Joseph, and (July 5, 1811) declared itself independent. In 1812 it was brought once more under Spanish authority, but in 1813 it again revolted. The republic of Colombia, comprising Venezuela, New Granada, and Ecuador, was organized in 1819, and its independence was recognized by Spain in 1823. In 1829 the republic dissolved into three republics, and in 1830, Venezuela adopted a new constitution. The transition from a monarchical and absolutist to a free republican government caused a total change in the ideas and customs of the people, and brought on a series of civil wars, in which much that was good and pleasant became lost, while confusion, disturbances, and degeneration seemed to take its place. Nevertheless, real progress, foreshadowing a higher development, was accomplished in many points. At present the government is carried on by Antonio Guzman Blanco, who was elected president of the republic in 1873 for four years, and with an almost dictatorial authority.

**Ve'nial Sin** [Lat. *venia*, "pardon"], a term used in Roman Catholic theology, denoting, in contradistinction to *mortal sin*, those sins which, although as transgressions of the law of God they divert more or less the end of the law from that which God intended, nevertheless are too small and insignificant to wholly subvert the law, and therefore pardonable. This class of sins is thus subdivided into objective venial sin, where the matter of the sin is very small, and subjective venial sin, where the sinner commits the transgression without full advertence or consent; but the whole set of distinctions is puerile in spirit and coarse in form, and it is furthermore so far below the aspirations of modern morals that when applied in practice it must be considered dangerous.

**Ven'ice** [It. *Venezia*], a celebrated city of Italy, once the magnificent capital of a rich and powerful republic, now the chief town of the province which bears its name. It is situated on, or rather in, the Adriatic, in lat. 45° 25′ N., lon. 12° 19′ E., and occupies a large number of small islands and shoals which lie between the mouth of the Piave on the N. and the Adige on the S. These islets, created by the deposits of the Brenta and other affluents of the Adriatic at this point, are connected by bridges (more than 300 in number) sufficiently raised to allow boats to pass freely under them; most of the houses and other edifices rest on piles, and there is generally a strip of artificial terra firma either in front or at the rear of every building. When these margins are very narrow, they are called *rive;* when broader, *fondamenti;* while the name of *campo* is given to every open space. By means of these and of the bridges a slender land-communication is kept up throughout the city, but most of the business and amusement of the town is carried on through the canals, which form not only the main highways, but interpenetrate every lane and alley of the floating town. The boats or *gondolas* used in Venice are too well known to require description here. The water of the canals is constantly changed by the tides, which, fortunately for the health of the city, rise higher here than at any other point in the Mediterranean, averaging some two or three feet. The shallow waters which separate Venice from the mainland, as well as those which flow between the city and the low, narrow, outlying islands, or *littorali*, to the E., are called *lagoons*, though the latter are generally meant when the singular, *lagoon*, is used. Between the *littorali*, which together form a gigantic breakwater against the full force of the Adriatic on the E., there are several more or less navigable passages from the open sea into the lagoon, but only three of these are now much frequented. The Porto del Lido, N. of the Lido, or Littorale of Malamocco, was once the main entrance, the proper port of Venice, but it is now much sanded up, and available only for small steamers and trading vessels. The Malamocco Pass, now the most commodious of all, is between the S. extremity of the *littorale* of the same name and the N. point of that of Palestrina. This channel has been deepened during the present century, at the suggestion of the distinguished engineer Paleocapa, by erecting two extensive dikes running E. (one from the S. point of Malamocco, the other from the N. of Palestrina) into the Adriatic for a distance of nearly 7000 feet. These dikes, by narrowing the width of the passage, have increased the force of the current, and thus enabled it to sweep all deposits farther out into the sea. Similar means have been successfully employed for the same purpose at the mouths of the Danube and the Mississippi. The third principal entrance is the Pass of Chioggia, between the S. extremity of Palestrina and the little sandbank on which stands the town of Sotto Marina, separated from Chioggia by an arm of the lagoon. This passage once admitted vessels of heavier tonnage than did the Malamocco, but now threatens to become shoaled up. This unfortunate change, which has also proved very injurious to the health of the town of Chioggia (20 miles S. of Venice), has been brought about by diverting an arm of the Brenta, which was producing most disastrous effects elsewhere, into the lagoon near this town. A large number of dredging-machines are constantly employed in clearing these channels, but the strength of man seems almost powerless to resist the natural forces here combined against him. North of the Porto del Lido, and about 5 miles from the city of Venice, lies the island of Torcello, probably the earliest settlement in the lagoons, as the town of Torcello had already passed its meridian in the eleventh century. Murano, which lies much nearer Venice, once contained

30,000 inhabitants, and its glass manufactures were the most celebrated in Europe. (For SAN LAZZARO see APPENDIX.) The island of Malamocco is now generally known as the Lido, and is a favorite bathing place. Since 1845 the city of Venice has been connected with the peninsula by a railway bridge, and is thus brought within an easy hour of Padua. This bridge begins about 2 miles E. of Mestre, is built on piles (more than 80,000 of which were used in its construction), consists of 222 circular arches of nearly 33 feet span each, and is 2⅓ miles in length. The water varies in depth from 3 to 13 feet, and about midway the length of the bridge there is an embankment 446 feet long and 98 feet wide, called the Ponte Maggiore, and intended for military purposes. For four and a half years, 1000 men, on an average, were employed on this gigantic work, at a cost of nearly $10,000,000. By an aqueduct just within the parapet fresh water is conducted into the city, though the supply is also in part furnished by artesian wells sunk below the bed of the sea, and in part brought in tanks from the main land. The approach to Venice by steam over this bridge may perhaps touch the fancy less than did the floating over the shallow lagoon in a gondola, but it cannot fail to impress the imagination most profoundly. The railway station is on the island of Santa Lucia, at the W. mouth of the Canal Grande, which runs through the heart of the city, nearly in the form of an inverted ∽, and divides it into two not very unequal parts. The famous bridge, the Rialto or Rivo Alto (1588), an eccentric-looking but very solid structure, crosses the Canal Grande at the most central point. It consists of a single arch over 90 feet in span, the crown of which is nearly 25 feet above the water, and it is divided longitudinally by two rows of shops into three passages, the middle and widest of which is about 22 feet. Only two other bridges, both of iron, cross this canal. There are naturally few squares or gardens in Venice; the Giardino Publico, at the E. extremity of the city, and the small grounds adjoining the royal palace are the only public gardens; the Piazza San Marco is the great square of Venice and the centre of its life. No adequate description, and indeed only a very imperfect catalogue, of the public edifices and private palaces of Venice, celebrated as they are throughout the world for the beauty of their architecture, can be given here, and the reader is referred for greater fulness to the works named at the end of this article. Some of the chief objects are in the immediate neighborhood of the Piazza San Marco, an open quadrilateral 576 feet in length and from 185 to 269 feet in width, on the Rivo Alto near the E. entrance of the Grand Canal. At the E. end of this piazza, where the Piazzetta joins it almost at a right angle, stands that wonderful monument of Oriental Greek architecture, the Basilica of San Marco, begun in 828 to receive the bones of St. Mark, which are believed to rest here. The façade of this church is composed of two tiers of round arches, five in each tier, the centre arch of both rows being larger than the others. These arches are supported by innumerable columns of great beauty; the spaces over the doorways, etc., are covered with rich mosaics and other most elaborate ornamentation; and above the central portal stand four copper horses, originally gilded, brought from Constantinople in 1204, and undoubtedly of Hellenic workmanship. The sides and rear of the basilica are also more or less highly adorned externally with curious works of art brought from the East, and the whole edifice is surmounted with pinnacles and domes so perfect in form and arrangement as to produce a finish of the most exquisite symmetry and fitness. Within, everything is worthy of the magnificent exterior. The vestibule is entered by five bronze doors of superb workmanship, is vaulted with mosaics from designs by Titian, and contains very interesting sepulchral monuments. Passing from the vestibule to the proper interior of the church, the effect of all the wealth of ornament gathered there is somewhat lessened by the want of sufficient light. By degrees, however, the eye becomes accustomed to the half twilight, and soon takes in with delight not only the general form of the Greek cross, with the great dome above the centre and a smaller one over each arm, but the splendid columns with their graceful capitals, the tessellated marble flooring with its rich patterns and quaint allegorical figures, the high altar, the pulpits, the screen, the candelabra, the reliefs, and all the countless objects of religious veneration and artistic value collected in the various chapels, in the sacristy, etc. The crypt (tenth century), long inaccessible, may now be seen, and the baptistery and the treasury are also of great interest. On the left, as you leave the church, stands the great campanile or bell-tower (begun 902), 42 feet square at the base and 323 feet in height, ornamented with arcades, statues, etc., and surmounted by a colossal angel. The view from the belfry is as magnificent as it is unique. On the right, but farther in the rear, rises the Torre dell' Orologio or *clock-tower* (1494), with its gorgeous dial-plate of blue and gold, above which stand the famous bronze Moors whose iron hammers have announced to Venice through ages of glory and of decay the flight of every passing hour. Directly in front of the church, and supported by highly-ornamented bronze pedestals, are the three masts from which once floated brilliant banners of silk and gold, emblematic of the republic and her proudest dependencies, Cyprus and the Morea. The following may be mentioned among the most noteworthy churches of different periods and different styles of architecture: The Chiesa de' Frari (1250) contains, besides exquisite pictures by G. Bellini, Titian, Pordenone, etc., several very remarkable sepulchral monuments, among them one of great artistic merit to the unfortunate doge F. Foscari, another to the doge N. Tron, and two modern erections, one in honor of Titian, ordered by the emperor of Austria (1853), a very grand work, the other in memory of Canova, less admirable. In the conventual buildings connected with this church are kept the archives of Venice, said to contain at least 14,000,000 documents of all dates from the ninth to the nineteenth century. The SS. Giovanni e Paolo, more commonly called San Zanipolo (1264), is very interesting architecturally, and contains many remarkable historical monuments of great excellence. The Santa Maria della Salute (1630) is very sumptuously decorated with pictures by Luca Giordano, Titian, Tintoretto, etc. San Giobbe is also very rich artistically; the Madonna dell' Orto is a fine Gothic church with admirable pictures; San Stefano Protomartire (1294) in charming Pointed style and abounding in curious monuments; San Giorgio de' Greci is for the Oriental ritual, and boasts of some very fine mosaics; San Giorgio Maggiore and San Giorgio dei Schiavoni both contain noteworthy pictures and statuary by eminent artists; San Giovanni in Bragola, San Giovanni Crisostomo, and San Giacomo on the site of the first church erected in Venice, all are rich in pictures by the great Venetian masters. Santa Maria Formosa, the church from which the brides of Venice are said to have been carried off by pirates, is now remarkable for the beautiful picture of Santa Barbara, perhaps the finest work of Palmavecchio; San Moïse, San Pantaleone, San Pietro di Castello, all contain pictures by Paul Veronese as well as by other great masters. The Redentore on the Giudecca, an island S. of the main city and separated from it by the Canal Giudecca, is regarded as Palladio's *chef-d'œuvre* in ecclesiastical architecture, and is splendidly adorned with pictures by some of the greatest names of the Venetian school. Adjoining the church of San Rocco is the famous Scuola di San Rocco, so rich in the works of Tintoretto. San Salvatore contains, among other celebrated monuments, that of Catharine Cornaro, queen of Cyprus. Santa Maria dei Scalzi abounds in the choicest marbles, and contains fine pictures by G. Bellini. San Sebastiano is the resting-place of Paul Veronese, and is magnificently adorned by his pencil. San Zaccaria (1456–1515) is of a mixed style of architecture, and is decorated with admirable pictures, carvings, etc. The Gesuiti is architecturally an extravagant and gaudy example of Jesuit bad taste, but contains some important historical memorials and some excellent pictures. The cathedral of Santa Maria at Murano (from the tenth to the twelfth century) is very noteworthy, and at Torcello the Duomo and the church of Santa Fosca (the former rebuilt in the beginning of the eleventh century, the latter little changed since the tenth) have very striking architectural features and are of great interest.

The secular edifices of Venice are not less remarkable than the ecclesiastical. The Palazzo Ducale or *doge's palace* (1354–55, 1420–71) stands almost adjoining the church of St. Mark. It extends to the Molo on the S., has the Piazzetta on the W., and the Bridge of Sighs, leading to the terrible prisons, on the E. The side next the Piazzetta and that on the Molo rest upon double tiers of pointed arches supported by columns of the greatest beauty, and above the upper tier runs a gallery with a screen of exquisite tracery. Over this is a flat wall composed of variously colored marbles disposed in regular patterns, and this wall is pierced by ungracefully broad Gothic windows, not all on the same line of elevation. The battlements are of stone, but by no means pleasing in form. Notwithstanding these undeniable architectural defects, the general design is so admirable, the decoration so rich and varied, and the historical associations connected with it are so thrilling, that few buildings in the world impress the imagination so powerfully. (For a description of the Porta della Carta, the Scala dei Giganti, the palace as seen from the court, and, indeed, of the whole wonderful interior with its untold wealth of pictures and other sumptuous adornment as well as historic memorials, the reader is again referred to the works at the end of this article.) E. of the ducal palace, and connected with it by the Bridge of Sighs, a covered footway over the canal, are the too famous *carceri* or pub-

lic prisons in a building rather handsome externally, and in themselves probably not worse than those in general use elsewhere at the time they were constructed. The buildings known as the Procuratie Vecchie, on the N. side of the Piazza San Marco, were originally intended for the use of the church-wardens, whose office was then one of great dignity and responsibility; they are now occupied as shops and for other business purposes, and the elegant Café Florian is here. The Procuratie Nuove, opposite the former, were built to furnish additional accommodation for the wardens; they now form a part, as does also the celebrated Libreria Vecchia (Sansovino, 1536), of the Palazzo Reale. This latter edifice, though very faulty in many respects, especially in the wing added in 1810 on the site of the church of San Geminiano (the masterpiece of Sansovino, and his sepulchre as well), which was destroyed to make room for it, is on the whole an extremely graceful structure. The Zecca or mint (Sansovino, 1536), immediately adjoining the library, is also a very admirable piece of architecture, and contains some superb pictures. The two granite columns (brought from the East in 1127) standing at the S. end of the Piazzetta, the one surmounted by a statue of St. Theodore, the other by the Lion of St. Mark, were considered as especially symbolic of the republic, and were copied in many of her dependent cities. The curious legend explaining why criminals were executed between these columns is well known. The number and beauty of the private palaces of Venice are such as to preclude any attempt to enumerate and describe them here. We may barely name the Palazzo Contarini Fasan (1360), the Ferso, the Fini, the Corner, the Giustiniani, the Foscari, the Rezzonico, the Balbi, the three Mocenigo palaces (in one of which Byron lived), the Trevisan or *Capello*, the Ca' d'Oro, the Giovanelli, etc.,—all of which are more or less remarkable for their architecture and their artistic treasures. The Palazzo Moro is interesting as the dwelling of Cristoforo Moro, the original of Shakspeare's Othello, and the Poli as that of the renowned traveller Marco Polo. The Accademia delle Belle Arti of Venice is one of the richest picture-galleries in the world. The first collection was placed here, by order of Napoleon I., in 1807. The picture-halls are on the first floor, are very conveniently arranged, and here the great masters of the gorgeous Venetian school are seen in all their splendor. The celebrated *Assumption of the Virgin* by Titian, the *Presentation of the Virgin in the Temple* by the same artist, the *St. Mark delivering the Slave* by Tintoretto, the *Tempest* by (probably) Giorgione, would alone make any gallery priceless, and yet these form but a small part of the wealth of this astonishing assemblage. There are several minor collections, but none of great importance. La Fenice is the principal theatre of Venice; the Malibran is used chiefly for *legerdemain* representations, and the Gallo is a second-class theatre.

*History.*—Though the principal islands now covered by the city of Venice were probably to some extent occupied by fishermen at an earlier date, yet the first regular settlements were no doubt made in the fifth century by fugitives from the violence of the Northern hordes, who repeatedly desolated the neighboring province during that period. Here they were secure from invasion, though of course subject to many privations, and the little colony throve so well that about the middle of the sixth century it was able to maintain something like an independent government, its rulers being called "maritime tribunes." Rivalries between the different islands, however, compelled them to elect a chief magistrate, who had authority over all the islands with the title of *dux* or *doge*. This election took place in 697, and the first person who received this honor was Pauluccio Anafesto, a man of ability, who fixed his seat on the island of Heraclia and maintained order and the public prosperity till his death in 717. In 737 the *avengo* or popular assembly declared itself weary of the doges, but in 742 returned permanently to that form of government, the ducal residence being then transferred to Malamocco. It was in 737 that Venice helped to reinstate the exarch of Ravenna, who had been driven out by the Lombards, and thus began the interesting relations which afterward existed between the two cities and the long career of Venetian enterprise which followed. The islanders, however, were divided in opinion as to the wisdom of siding generally with the Eastern empire or with the Lombards and Franks, and so violent were the factions that the most common fate of a doge was assassination or blinding or banishment. Early in the ninth century, the doge Obelerio having shown himself subservient to the Greeks, Pepin invaded the islands and overran several of them, while most of the inhabitants took refuge on the safest, the Rivo Alto, which Pepin vainly attempted to reach. The story of the great victory obtained over the Franks at the island of Albiola (809) is now given up as an exaggeration of later ages; but, at any rate, the Venetians gained such decided advantages that Pepin was glad to retire after concluding a peace very honorable to the little republic. The Rialto now became the fixed seat of the doge, the adjacent islands were united to it by wooden bridges, and the name *Venezia*, vaguely applied before, was formally given to the whole. The first doge elected after these changes was Agnello Partecipazio, under whom the new city advanced rapidly; but, like several of his successors, he was suspected, and probably justly, of the design of making the office of doge hereditary in his own family. In 828–829 the supposed body of St. Mark was surreptitiously taken from Alexandria in Egypt by two zealots and transported to Venice, where it was enthusiastically welcomed, and the apostle was at once raised to the dignity of patron saint of the republic; St. Theodore, who, it would seem, had hitherto performed the office, not without fidelity, being very unceremoniously set aside. It was to serve as a fitting monument for these relics that the first church of St. Mark was immediately designed and begun; this church was destroyed by fire in 976. In 991, Pietro Orseolo was placed in the ducal chair, and under his wise administration the internal disorders (which, however, had not prevented a rapid development of strength in the commonwealth) were quieted, piracy was repressed, the coasts of Istria and Dalmatia became a part of the Venetian territory (though the whole of these provinces was not ceded to the republic till 1085), and the doge received the additional title of duke of Dalmatia. It was also under this doge—according to many authorities, although others place it as late as 1177—that the ceremony known as the *sposalizio del mare* ("the espousals of the sea") was first instituted. In 1099, Venice sent out more than 200 vessels to aid the first crusade. But though in this and in the subsequent holy wars many brilliant deeds of arms were done by her sons, yet it must be confessed that they were rather inspired by policy than by piety, and the extension of her commerce was never made secondary to the liberation of the Sepulchre. In the early part of the twelfth century Venice obtained very important commercial concessions throughout almost every part of the Christian East, but the false and fickle policy of the Greek emperors soon threatened their loss, and these brave sons of the sea resolved to put forth all their naval strength to defend them, or at least to avenge themselves. They sent out a fleet, captured and overran Rhodes, Samos, and several other Greek islands, and even a considerable portion of the Morea. In 1177, Venice espoused the cause of the Church against F. Barbarossa, and won a brilliant victory over the Ghibellines, which was followed by the "Peace congress," during whose session Barbarossa made his famous submission to Pope Alexander III., allowing the latter, say some, to place his foot upon his neck, while others warmly deny that this humiliating ceremony (more disgraceful, if true, to the Vicar of Christ than to the emperor) ever took place. In 1204, Venice obtained fresh victories, possessions, and privileges in the East (see DANDOLO), and in 1260 was able to annul, in part at least, the immense influence acquired at Constantinople by her proud and powerful rival, Genoa, though the latter inflicted a severe blow in return at the terrible battle of Curzola (1298). Indeed, the "Queen of the Adriatic" was now at the height of her greatness abroad, but she had already lost much of her liberty at home. The election of the doge was less and less the act of the people, and at the end of the century Venice had really ceased to be a democracy, though the outward change in the form of the government was not great. The city, however, was a proverb for wealth and magnificence, for art and refinement. Churches and palaces rose on all sides as if by enchantment; her diplomacy was renowned throughout the world; and her enterprising and accomplished sons, such as Marco Polo, were bringing to light the mysteries of hitherto untrodden lands. But while so many liberalizing and progressive influences were at work, tyranny, temporal and spiritual, was not idle. The Inquisition, in a very mild form, it is true, had been established here as early as 1289, and in 1335, after the abortive attempt to return to more democratic usages known as the Quirini Tiepolo conspiracy, the famous Council of Ten declared itself permanent. This council, certainly at first, and perhaps always, more terrible to the nobility than to the commoners, has been the subject of the gravest historical discussion, and its true history is probably still unwritten; but it must be admitted on all hands that at least it preserved the external dignity and independence of the republic. Throughout nearly the whole of the fourteenth century Venice and Genoa were carrying on wars against each other, alternately disastrous to both. Andrea Dandolo, the accomplished statesman, scholar, and historian, was appointed doge in 1343. Not long after, a severe earthquake occurred, followed by extraordinary tides which threatened to submerge the whole city, and these terrible floods were succeeded by a still more awful pestilence

which swept away almost half the population. About the same time was discovered the conspiracy of Marino Faliero, the doge. Toward the close of the century, and only a few years after Genoa had boldly entered the Adriatic, defeated the Venetian fleet at Pola and seized Chioggia itself, the Ligurian republic placed herself under the protectorate of France, and Venice was once more at peace. Another short period of almost unparalleled prosperity followed. The argosies of the republic were upon every sea, her merchandise crowded every port, and was carried by caravans even far into Inner Asia. A successful war with Padua made her mistress not only of Padua itself, but of Verona, Vicenza, Bassano, Belluno, etc. Another war with Milan added Brescia, Bergamo, Crema, Cremona, Rovigo, and Treviso to the republic; but all this accession of territory by arms was at the cost of her commerce, which now began to decline. Unfortunately, in spite of the wise warnings of the doge, T. Mocenigo (1423), the same policy was pursued during the fifteenth and sixteenth centuries. Venice continued to take part in all the quarrels which divided the Peninsula, her government became more and more oligarchical, and every attempt on the part of the people to obtain a larger share in it failed. Though the most recent investigations seem to show that there has been great exaggeration in the pictures given of the despotism of the Council of Ten and of the dark and dreadful proceedings of the state inquisitors, yet it is certain that all power was in the hands of the aristocracy, and this aristocracy, though still capable of most brilliant achievements, was gradually wasting itself in idle and extravagant pleasures. The westward advance of the Turks, especially the fall of Constantinople (1453), was a cruel blow to the commerce of the republic, and the somewhat later exploits of the Portuguese navigators were not less damaging to it. Indeed, so well was Venice aware of her danger from these voyages that (as is proved by existing documents) she not only made every effort to induce Egypt to remove all restrictions upon commerce with the East through Cairo, but even projected, as early as 1504, that great work of the nineteenth century, the Suez Canal. The chivalric wars of the republic with the Porte, particularly that begun in 1645, in which Candia was most heroically defended by the Venetians during a siege of twenty-two years and at a cost in the single year 1668 of 4,392,000 ducats, are a sufficient evidence of the energy and the resources which still survived. Even in the eighteenth century the old maritime spirit was far from extinct, as was shown by the defence of Corfu (1716) and by the naval victories of Angelo Emo, who died in 1792. The final extinction of the republic of Venice by Napoleon Bonaparte (1797), and the means through which it was accomplished, are now familiarly known, but it is impossible to speak of this crime against humanity without characterizing it as one of the darkest of the many stains on a fame which has filled the world, but whose lustre is steadily waning before every new ray of light cast upon it by history. The story of Venice from the Treaty of Campo Formio (1797) to 1848 is a succession of secret conspiracies or open attempts at rebellion against Austrian domination. In 1848 a revolution broke out which was successful for a time, but in spite of the most heroic and masterly defence of the city by Manin and his brave companions-in-arms, Venice once more fell into the hands of her Northern lord. In 1866, however, as a consequence of the Austro-Prussian war, Venice and the so-called Venetian provinces became a part of the united kingdom of Italy, and in the autumn of that year the city welcomed her new sovereign with magnificent demonstrations of joy. Since then efforts have been made to revive the commerce and the manufacturing industry of Venice. Venetian glass and mosaics are once more found in all the markets of the world, the Venetian gold and silversmiths have a high reputation for certain styles of work, and the manufactures of silk and velvet are extensive. For a time, even the maritime trade of the city increased, but, owing to the physical difficulties already mentioned, it seems idle to hope that the merchant-fleets of Venice will ever again cover the seas as in the days when she was mistress of the commerce of the world. P. in 1875, 128,900.

(For the architecture of Venice see Ruskin's *Stones of Venice*, the works of Gwilt, Fergusson, etc.; for the Venetian school of painting, see also Ruskin, Kugler, Crowe, and Cavalcaselle; for modern life in Venice see George Sand's *Lettres d'un Voyageur*, Howell's *Venetian Life*. An adequate history of Venice still remains to be written, and it can therefore now be studied only fragmentarily, but the following are valuable sources of information on the subject: the *Chronicles* of Sagornino, Canale, Andrea Dandolo, Marin Sanuto; *Annals* of Malipiero; officially-appointed historians, R. Sabellico, Bembo, Paruta, Morosini, Contarini, Verdizzotti, Cappelletti. Romanin and Daru may also be named among the historians of Venice. Many interesting notices will be found in Sansovino, *Venezia;* in Filiasi, *Memorie Storiche;* in Muratori's Collection; also in Zannetti Girolomo, *Dell' Origine di alcune Arti;* Tafel and Thomas, *Urkunden*, etc. For the political relations of Venice see the *Correspondence of the Venetian Ambassadors*, published by Alberi (Florence).)

CAROLINE C. MARSH.

**Venice,** tp., Tulare co., Cal. P. 490.

**Venice,** tp., Shiawassee co., Mich. P. 986.

**Venice,** p.-v. and tp., Cayuga co., N. Y. P. 1880.

**Venice,** tp., Seneca co., O. P. 1781.

**Venice Turpentine.** See TURPENTINE, by J. P. BATTERSHALL.

**Veni' Crea'tor Spir'itus,** a hymn of the Roman Breviary, was probably composed by Pope Gregory I. (540–604), though it was once ascribed to Charlemagne. It is written in correct metre, according to the quantity of the syllables, and its Latinity is good. It is used in the ordinals of several of the Protestant churches. Dryden's translation of it is one of the best. This and the CREATOR SANCTI SPIRITUS (which see) are of the "seven great hymns of the mediæval Church." (See STABAT MATER.)

**Veni're** [Lat.]. At the common law the sheriff selected the jury from among the citizens of the county. The *venire*, or *venire facias* ("that you cause to come"), is a very ancient judicial writ directed to the sheriff, commanding him to select and summon from the body of the county before the court on a day named a specified number of qualified citizens to act as the jury at such court. The sheriff thereupon selects and summons the proper number, and returns their names with the writ. This mode and the writ are still retained in some of the U. S. In many of them, however, the whole common-law method has been abrogated. From lists of qualified persons made and kept by certain officials in each county the requisite number of jurymen for a court are drawn by lot; these names being certified to the sheriff, he summons them without a regular *venire* being issued to him. But even in these States a *venire* may be necessary when the sheriff is called upon to summon additional jurors in special cases, the original panel being exhausted. The term *venire de novo* is the old technical expression showing that a verdict has been set aside and a new trial ordered. J. N. POMEROY.

**Ve'ni Sanc'te Spir'itus,** a hymn of the Roman Missal, ascribed to King Robert II. of France (d. 1031 A. D.). It is in the mediæval Latin, is rhymed, and its metre is not according to quantity. It is a sequence in the mass for Whit-Sunday and its octave, and is one of the loveliest and most tender of the Latin hymns. (See VENI CREATOR SPIRITUS.)

**Venloo',** town of the Netherlands, province of Limburg, on the Meuse, is narrow and irregularly built, but surrounded by quite strong fortifications, and contains an arsenal, powder-mills, magazines, and hospitals. Its chief manufacture is cigars, and its principal trade is in swine. P. 7402.

**Venn** (HENRY), b. at Barnes, Surrey, England, in 1725; educated at Bristol and at Jesus College, Cambridge, where he graduated about 1745; took orders in the Church of England; became fellow of Queen's College, curate of Clapham, vicar of Huddersfield, Yorkshire, 1759, and rector of Yelling, Huntingdonshire, 1797. D. at Clapham in June, 1797. Author, among other works, of *The Compleat Duty of Man, or a System of Doctrinal and Practical Christianity* (1763), a Calvinistic work which obtained great popularity and was often republished. His *Life and Letters* were published in 1834; the *Memoirs* by his son John (1759–1813), edited by his grandson, Rev. Henry Venn.

**Ven'om** [Lat. *venenum*], the poisons elaborated by healthy animals as distinguished from *virus*, the virulent liquid product of disease in animals or man. Some insect stings are virulent, though as a rule they are mild and relieved by simple measures. Bees and wasps as a rule leave their sting in the wound they inflict; this should be extracted, the wound protected from the air or bathed in cooling and stimulating evaporating lotions; ammonia is a useful application. The scorpion is dangerously venomous in the tropical regions of the Indies and Africa, but in the milder climates it inhabits does little harm. Contrary to the fabulous accounts of the tarantula venom, it rarely causes death, and seldom causes alarming symptoms. In all countries there are venomous serpents, their number diminishing with increase of population and high cultivation of soil. Islands are comparatively free. Ireland is said to be quite free, and England has but one, the viper. The chief venomous serpents of the U. S. are the rattle-

snake, moccasin, and adder. The phoora of India and the cobra are exceedingly virulent. The venom of serpents is elaborated in special glandular apparatus adjacent to the mouth, stored in a sac or canal, and reserved for sudden voluntary ejection as a part of the reptile's means of self-defence. The effect of the poison upon man may be immediate, rapid, and speedily fatal, or slow and incomplete. The venom, which probably has definite living germs, a *contagium vivum*, is believed to rapidly multiply itself in the blood, and quickly pervades the entire body, vitiating the red corpuscles and the nutrition of the tissues. In some cases the nerve-centres are primarily attacked, various nervous phenomena being speedily followed by paralysis of the medulla oblongata, and death. More often a definite period, short or long, intervenes before death. A prickling, burning pain is felt in the wound, increases to intensity, and extends to adjacent parts. The limb or part swells and inflames; the veins often are inflamed (phlebitis), and as a result of obstructed circulation the part becomes speedily œdematous or dropsical, and assumes a variety of changed colors from disturbed circulation and the decomposed state of the blood—from dark red to livid white, to blue, purple, mottled, and leaden hue. The limb may become cold, and if life is not destroyed, in time slough away. These changes may extend over the entire body. The mind is anxious, depressed, often deranged. Breathing is embarrassed, there is profuse sweating, vomiting, and jaundice, and death occurs by paralysis of the nerve-centres or exhaustion.

Venomous wounds should at once be cleansed, encouraged to bleed freely by suction or excision, a ligature speedily placed on the limb, or the part sedulously rubbed *toward the wound* and *away from the centre of circulation*, to evacuate all contaminated blood. Bold and thorough cauterization is of value. Strength is to be kept up by the heroic use of alcohol, ammonia, and other stimulants. (See Poison of Serpents.)

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Veno'sa** [anc. *Venusium*], commune and city of the province of Basilicata in Southern Italy, celebrated as the birthplace of the poet Horace and as the scene of the defeat and death of the Roman consul Metellus in a battle with the Carthaginian troops under Hannibal. Venosa is mentioned by Diodorus and Dionysius as a town of great antiquity and importance, but we know nothing of the details of its early history, except that it belonged to the Samnites before its incorporation into the Roman state. It lies in a salubrious, fertile, and picturesque region, and now shares in the general material and moral improvement of renovated Italy. P. 7062.

**Ve'nous Blood,** the dark-colored fluid collected from every part of the system by the veins. It subsequently becomes mixed with the *chyle*, or nutritious portion of the blood, and is ultimately exposed to the modifying influences of the air as it passes through the lungs, whereby it is converted into bright-red arterial blood. (See Blood.) Besides the difference between venous and arterial blood in color, several distinctions in physical and chemical properties are presented. The specific gravity of venous blood is greater than that of arterial blood; it does not coagulate as rapidly, and contains more corpuscles, but less fibrine. Its serum contains less water and extractive matter, but more fat, than that of arterial blood. Corpuscles from venous blood contain 3.57 per cent. of fat; those from arterial blood contain but 1.84 per cent. The differences in color presented by the blood-corpuscles appear to be dependent, to a certain extent, upon their shape and upon the amount of *hæmatine* present. The florid color of arterial blood is probably due to oxidation of the hæmatine. Venous blood contains more carbonic acid, but less oxygen, than arterial. In 100 volumes there exist—nitrogen, 13; carbonic acid, 71.6; oxygen, 15.30: arterial blood containing nitrogen, 14.5; carbonic acid, 62.3; oxygen, 23.20. Venous blood does not evolve oxygen when placed in an atmosphere of nitrogen, as is the case with arterial blood.

J. P. Battershall.

**Ventilation.** See Warming and Ventilation.

**Ventimi'glia,** commune in the province of Porto Maurizio in Ligurian Italy, comprising several contiguous hamlets, with a total pop. of 6809 souls. It is a town of great antiquity, but it has little present interest except from its strategical importance as a strong and often-contested position on the coast near the Italo-French frontier, and as a striking point in the scenery on the Corniche road.

**Ventricles.** See Heart, Human, by Pres. A. Clark, M. D.

**Ventril'oquism,** the art of so managing the voice as to cause the illusion that its origin is from some other source than the vocal organs of the speaker or from a distant point, was undoubtedly known to the ancients. The word "ventriloquism" (*venter*, the "belly," and *loquor*, to "speak") indicates by its etymology the idea formerly entertained in relation to the nature of the performance. It is now, however, well known that the sound does not come from the abdomen. Again, it was conceived that the ventriloquist spoke during inspiration instead of expiration, and that thus illusions in regard to locality and distance were produced. But though it is undoubtedly true that modulated voice may be formed by inspiring air through the vocal organs, it is equally certain that the sounds which result have little or no analogy with those of the ventriloquist, and are not calculated to cause the deceptions which the accomplished performer so readily produces. In reality, the words uttered by the ventriloquist are formed in precisely the same manner as in ordinary articulation, the difference consisting mainly in the mode of respiration. A very full inspiration is taken, and then the air is expired slowly through a narrowed glottis, the diaphragm being kept in its depressed condition and the thoracic muscles alone being used to empty the lungs. At the same time, the lips are scarcely moved, and the deception is still further facilitated by the attention of the auditors being directed to the object which the performer wishes to be regarded as the source of the voice. This latter is no hard task, for it is at all times difficult to determine the source of sounds by the hearing alone, and the only means by which the unassisted ear can form an idea of the distance of a sound is by estimating its intensity.

William A. Hammond.

**Ventu'ra,** county of S. W. California, bordering on the Pacific Ocean, and drained by Buenaventura and Santa Clara rivers. The surface is generally mountainous, but the soil in the valleys is fertile, capable of producing grains and all kinds of semi-tropical fruits. There are large numbers of cattle and sheep. Cap. San Buenaventura. Area, about 2000 sq. m. P. not included in the census of 1870.

**Ventu'ra de Rau'lica** (Gioacchino), b. at Palermo Dec. 8, 1792; was educated by the Jesuits, but entered the order of the Theatines; became general of the order in 1824, and settled in Rome, where he enjoyed the confidence of Popes Leo XIII., Pius VIII., and Gregory XVI., and exercised considerable influence even on the diplomatic business of the papal government. He was a disciple of Lamennais. "The pope and the people" was his device; the establishment of free institutions under the tutelage of the Roman Catholic Church was his ideal. But in 1831 the disagreement between the pope and Lamennais became apparent, and in 1834, Lamennais burst into open rebellion against the Church. Ventura attempted to bring about a reconciliation, but failed, and was compelled by the intrigues of the Jesuits to retire from the papal court in 1836. For about ten years he lived almost in obscurity, devoting himself to studies, publishing 5 volumes of homilies, and preaching frequently in the church of S. Andrea della Valle. Here, however, his peculiar eloquence, characterized by a brilliant imagination and a strong flow of emotion, soon attracted great crowds, and the exertions of the Jesuits to disturb or annihilate the impression he made failed. With the accession of Pius IX. he returned to the court, and his influence, as well as his popularity, grew rapidly. In 1847 he made a funeral oration over O'Connell which astonished the whole world, and when, in 1848, the revolution against the Bourbons broke out in Sicily, he openly espoused the cause of his countrymen with great fervor, and wrote—*On the Independence of Sicily*, *On the Legitimacy of the Acts of the Sicilian Parliament*, and *Mensonges diplomatiques*. But with the revolution in Rome and the flight of Pius IX. to Gaeta his ideals disappeared in the air. On May 4, 1849, he fled from Rome; settled in Montpellier, and removed in 1851 to Paris, where he preached in French to large audiences in the imperial chapel in the Tuileries and in the Madeleine, and published many voluminous works—*Histoire de Virginie Bruni*, *Les Femmes de l'Évangile*, *La Raison philosophique et la Raison catholique*, *Sur l'Origine des Idées*, *La Femme catholique*, etc. As an author, however, he is not eloquent, and his knowledge is fragmentary as his reasoning is desultory. D. at Versailles Aug. 3, 1861.

**Ven'ue** [Lat. *visnetum* or *vicinetum*; Law Fr. *visne*, the "vicinity or neighborhood"] originally meant the place or neighborhood from which the jury were taken to try a cause. It finally came to designate the county in which a cause is to be tried, and this has for a long time been its signification. In England and in the U. S. all causes must be tried in some county, which must be indicated in the process or pleading. The place of trial is generally regulated by statute in the various States. In certain civil actions called "local" the venue must be the county where the cause of action arose or where the subject-matter—especially land—is situated. In others, called

"transitory," the venue, according to the prevailing rule, should be in a county where one of the parties resides. In criminal prosecutions it is a fundamental principle that the venue must be the county where the crime was committed, but in some instances of continuing offences there may be an election of counties. The venue may be changed in civil causes to prevent great inconvenience to witnesses, and in both civil and criminal causes to promote the ends of justice. The causes, occasions, and modes of change are regulated by statute in the various States.

JOHN NORTON POMEROY.

**Ve'nus,** the second planet in order of distance from the sun, and the next neighbor of the earth within her orbit. Venus travels at a mean distance from the sun of 66,134,000 miles, and the eccentricity of her orbit being only 0.00686, her greatest distance, 66,586,000 miles, exceeds her least distance, 65,682,000 miles, by only 904,000 miles. As the earth's mean distance from the sun varies by about 3 millions of miles—that is, 1½ millions on either side of its mean value, 91,430,000 miles—the distance of Venus when in inferior conjunction, or between the earth and the sun, depends more directly on the earth's position in her orbit than on that of Venus in hers. It varies from about 26½ to about 24 millions of miles. But Venus when nearest to the earth is invisible, being lost in the sun's rays, and she is most favorably placed for observation when near her elongations, when she appears like a half moon, or slightly gibbous or slightly horned. She lies then much farther from the sun's place in the heavens than Mercury when he is at his elongations, for the elongations of Venus range in extent from about 45° to about 47⅕°. Venus completes a sidereal revolution in 224.7008 days on a path inclined 3° 23½′ to the ecliptic, but her synodical revolution is much greater, amounting to 583.920 days, which is the mean interval between successive inferior conjunctions or between successive superior conjunctions. Half this period, or 291.960 days, is the interval between successive conjunctions, which are of course alternately inferior and superior. Between inferior conjunction and the next superior conjunction Venus is a morning star, while between superior conjunction and the next inferior conjunction she is an evening star. But for a considerable interval on either side of a conjunction of either sort she is invisible on account of her proximity to the sun's place in the heavens. It is also to be noticed that at equal intervals on either side of inferior conjunction she is much more conspicuous than at equal intervals on either side of superior conjunction. Venus has a diameter estimated at about 7500 miles; her volume is equal to about $\frac{171}{200}$ths of the earth. Her density is slightly greater than the earth's, insomuch that her mass is equal to about $\frac{177}{200}$ths of the earth. The telescopic study of this beautiful planet has not been attended by results so interesting as might have been expected from its proximity. Some astronomers, indeed, claim to have seen spots and markings upon the surface of Venus; but the best observers, using the most powerful telescopes, have uniformly failed to see what inferior observers have imagined they have discerned with relatively imperfect instruments. Sir John Herschel remarks that "the surface of Venus is not mottled over with permanent spots like the moon; we perceive in it neither mountains nor shadows, but a uniform brightness, in which we may indeed fancy obscurer portions, but can seldom or never rest fully satisfied of the fact. It is from some observations of this kind that both Venus and Mercury have been supposed to revolve on their axes in about the same time as the earth." Still, it is noteworthy that such observations have led to results tolerably accordant *inter se*. Thus, the elder Cassini deduced a period of 23 hours. Bianchini indeed inferred from his observations the monstrous rotation-period of 24 days 8 hours, but the younger Cassini showed that all Bianchini's observations could be reconciled with the elder Cassini's by taking for the rotation-period 23 hours 21 or 22 minutes; and as Bianchini's observations were not continued during several consecutive hours at each sitting, owing to the want of sky-room at his place of observation, this interpretation must be accepted as the more probable. Later, the industrious Schröter attacked the problem, and deduced the rotation-period 23 hours 21 minutes 19 seconds, while recently De Vico, by combining his own observations with those of Bianchini and Cassini, has deduced the rotation-period $23h.\ 21m.\ 15s.$ All the observers agree in assigning to the axis of Venus a considerable inclination from a perpendicular to the planet's orbit, but while some assign an inclination of 70°, others make the inclination no greater than 50°. Sir John Herschel considers that "the most natural conclusion from the rare appearance and want of permanence of the spots is that we do not see, as in the moon, the real surface of the planet, but only its atmosphere, much loaded with clouds, serving to mitigate the otherwise intense glare of their sunshine." It may be questioned, however, whether any such arrangement would render the planet habitable according to our ideas, if the actual inclination of the planet's equator be so great as 50°; for in this case the sun's annual range in declination (that is, in distance N. and S. of the equator) amounts to 100°, and the variations of the seasons must therefore be far greater than those we experience with a sun ranging only 23½° on either side of the equator. Take, for example, lat. 40° (N. or S.) on Venus. At a place having such latitude the sun's midday altitude in spring or autumn is 50°, while some time before midsummer the sun attains a midday altitude of 90°—that is, shines vertically down from the zenith—and thence to midsummer, and for as long an interval after midsummer, the sun crosses the meridian on the N. side of the zenith, and remains nearly all the day above the horizon (at midsummer *all* the day). This, with the tremendous sun of Venus, twice as large in appearance, and therefore giving out twice as much heat, as the sun we see, must involve an overpowering degree of heat. On the other hand, at the time of midwinter the sun does not rise above the horizon at all, unless raised by refraction for a few minutes at midday, and the cold must be as intense then as in our arctic winters. Such contrasts (and changes as great must occur in all latitudes) taking place in the short year of Venus, with only 112 days from the intensest heat of summer to the intensest cold of winter, would be altogether unendurable by the strongest race of men upon our earth. It has been found by means of spectroscopic analysis that the atmosphere of Venus contains aqueous vapor, so that in the important point of possessing water the planet is well provided for. In fact, if it were not for the very great obliquity assigned by observers to the equator of Venus we might not unreasonably assume that the planet is fit to be the abode of life.

Venus, like Mercury, transits the face of the sun, but at longer intervals. Her transits are much more important than those of Mercury, because, being nearer to us when in transit, her position on the sun is measurably different for observers differently placed on the earth. It thus becomes possible to determine how great a displacement of Venus arises for so many miles of distance between the observers on earth; and this is equivalent to determining the distance of Venus, precisely as the determination of the displacement of a distant terrestrial object, when viewed from either end of a measured base, is equivalent to determining the distance of the object. And when the distance of Venus is thus ascertained, the scale of the solar system is also determined, seeing that the proportions of the solar system are known from Kepler's third law. Accordingly, the transit of Venus on Dec. 9, 1874, was observed with great care at many stations on different parts of both hemispheres, and it is hoped that the results then obtained will lead to a more accurate knowledge than we have hitherto had of the distance of the sun. Transits of Venus occur only when she is in inferior conjunction near one of her nodes. These lie in longitudes 75° 19′ and 255° 19′, and the earth passes these longitudes respectively on or about Dec. 7 and June 6; so that transits can only occur near these dates. If a conjunction has occurred near the place for December transits, another will occur there 243 years later under very nearly the same conditions; but usually a pair of transits will occur near this date, separated by eight years, so that, for instance, we have a December transit in 1631 and another in 1639, followed by a transit like the first of the pair in 1874 (1631 + 243), and a transit like the second of the pair in 1882 (1639 + 243). In the interval between two pairs of December transits a pair of June transits or a single June transit will occur, but not quite in the middle of the interval, because neither the earth nor Venus moves quite uniformly. Thus, from Dec., 1631, to the 1st of the next June pair, in 1761, there elapsed 129½ years, whereas from the latter transit to the 1st of the next December pair in 1874 there elapsed only 113½ years; and of course the same intervals of 129½ years and 113½ years separate the second of the three pairs of transits in the seventeenth, eighteenth, and nineteenth centuries. But it is to be noticed that from the first or second of a June pair to the first or second of the next June pair there elapses the same period of 243 years that we have recognized in the case of December transits. Thus, between June, 1761, to June, 2004 (the next June transit), there are 243 years, and the same between June, 1769, and June, 2012 (the second transit of the next June pair).

R. A. PROCTOR.

**Venus,** in Roman mythology, the goddess of spring, generation, sensual love, etc., seems to have played no very prominent part in the oldest epoch of Roman civilization, but became afterward completely identified with Aphrodite, the Greek goddess of love, and appropriated to herself all the myths belonging to the Greek deity, without adding a single one of Roman origin—her birth from the foam of the sea, her coming from Cyprus or Cythera, her

marriage with Hephæstus (Vulcan), her amours with Ares (Mars), Hermes (Mercury), Adonis, Anchises, and others. Of special Roman interest was her adventure with Anchises, to whom she bore Æneas, the founder of Rome. Originally, however, Aphrodite was not a Greek creation either, but was introduced to Greece from Phœnicia, where she was worshipped under the name of Astarte. The myth of Adonis is also of Phœnician origin. The so-called Venus of Milo, in the Louvre, is one of the most celebrated antique statues which have come down to us.

**Venus's Flower-Basket,** the common name of *Euplectella speciosa*, a beautiful silicious sponge found chiefly in the Philippine Islands, consisting of a delicate lace-like skeleton or framework, which, when the enveloping gelatinous animal tissue is removed by immersion in chloride of lime, assumes the shape of a cornucopia twelve or fifteen inches in height by two inches in width. A hermit crab has sometimes been found imprisoned within. These baskets are properly regarded as great curiosities, and bring high prices.

**Venus's Fly-Trap.** See DIONÆA.

**Venus's Girdle.** See GIRDLE OF VENUS.

**Ve'ra,** town of Spain, province of Almeria, on the Almanzora, near its entrance into the Mediterranean, has a small harbor, through which it carries on some export and import trade. Its manufactures of nitre are important, and its fisheries quite considerable. P. 8470.

**Vera** (AUGUSTO), b. at Amelia in 1818; studied in France, where he was appointed associate professor of philosophy. He lectured on philosophy at Toulon, Rouen, Strasbourg, and London; was appointed to a professorship in that faculty at Turin by Mamiani in 1860, and afterward transferred to a similar post at Naples; has ably translated, annotated, and supplemented the works of Hegel. Most of his writings have appeared at Paris in French. He published in Latin *De Platonis, Aristotelis, et Hegelii de Medio Termino Doctrina.*

**Ve'ra Cruz,** state of Mexico, extending along the Gulf of Mexico from Tamaulipas to Tabasco, nearly 500 miles, in a narrow belt between the Sierra and the sea, is bounded inland by the states of San Luis Potosí, Hidalgo, Puebla, Oaxaca, and Chiapas; consists of a low sandy tract along the sea averaging 30 miles in width, and a mountainous inland region having several lofty peaks, among which are the snow-clad volcano of Orizaba or Citlaltepetl, 17,176 feet high, the Cofre de Perote, near Jalapa, 14,309 feet, and the volcano of Tuxtla, 9708 feet; has several extensive lagoons; is traversed by the large navigable rivers Pánuco, Papaloapam, and Goatzacoalcos; is hot and malarious along the sea-coast, which is frequently visited by yellow fever, but enjoys a salubrious temperature in the fertile *tierras templadas* of Jalapa, Orizaba, and Huatusco; produces a great variety of valuable staples, including sugar, cotton, tobacco, cacao, coffee, vanilla, the jalap-root, and many dyestuffs, as well as the cereals and fruits of both tropical and temperate climates, while cattle in vast numbers are pastured in the lowlands; is divided into 18 cantons; has several cotton and woollen factories; is well supplied with educational institutions, and traversed by two important railways, leading from the city of Vera Cruz to Mexico, and to Jalapa, the state capital. Area, 27,433 sq. m. P. 504,325.

**Vera Cruz,** city and the principal seaport of Mexico, state of the same name, of which it was formerly the capital, is situated on the coast of the Gulf of Mexico in lat. 19° 11′ 56″ N., lon. 96° 8′ 36″ W., 190 miles E. S. E. of the City of Mexico; is surrounded by strong walls with two redoubts, and defended by the famous castle of San Juan de Ulloa on the island of the same name, half a mile from the shore; is regularly and strongly built in the old Spanish style; has no regular harbor, but merely an exposed roadstead, but is nevertheless the entrepôt for more than half the foreign commerce of the republic, its imports and exports averaging each about $25,000,000, of which $2,000,000 are with the U. S.; has 16 churches, a municipal palace, a custom-house, a mole finished in 1875, several hospitals and seminaries, a library, and a theatre; has a horse railway and waterworks, and is lighted with gas. The city was founded by Cortés in 1519 upon its present site, to which it was brought back 1590, after having been for many years located at Antigua, some miles to the N., and received the city franchise 1615. The castle of Ulloa was held by the Spaniards until 1825, and both castle and city were bombarded and taken by the French in 1838. In Mar., 1847, Vera Cruz was besieged and captured by the army of the U. S. under Gen. Scott. (See BOMBARDMENT.) P. about 10,000.

**Vera Cruz,** v., cap. of Douglas co., Mo.

**Vera Cruz, Siege of.** See VERA CRUZ.

**Vera'gua,** or **Santiago de Veragua,** town of New Granada, on the river Soledad, near its mouth in the ocean, has 6121 inhabitants, mostly engaged in agriculture and the manufacture of mats and straw hats.

**Vera'tria,** a vegetable alkaloid used in medicine. It is obtained from cevadilla-seeds (fruit of *Asagræa officinalis* and *Veratrum sabadilla*). Pure veratria commonly occurs as a white powder, but can also be obtained in rhombic crystals. It has no smell, but has a bitter, acrid taste, and is very irritating to both tongue and nostrils. It is scarcely soluble in water, but dissolves in alcohol and ether. Upon the animal system veratria acts as an intense local irritant, and if taken internally produces also the same peculiar constitutional effects as *Veratrum viride.* (See VERATRUM.) Veratria is too irritating to warrant its use as an internal medicine, but is considerably employed externally as a local application for the relief of neuralgias. For such use it is made into an ointment with lard. EDWARD CURTIS.

**Veratrine.** See VERATRIA.

**Vera'trum,** a genus of plants of the natural order Melanthaceæ. The most important species are the following: *Veratrum viride*, or American hellebore, called also Indian poke, poke-root, swamp-hellebore. This is an indigenous plant, growing in damp soil from Canada to the Carolinas. It is an herbaceous perennial, with a thick fleshy root-stock, from which rises a round solid stem from three to six feet high, bearing bright green leaves, larger below than above, and surmounted by a panicle of greenish-yellow flowers. The root-stock is used in medicine, its activity residing in two alkaloids, *jervia* and *veratroidia.* It is a powerful drug, lowering the force and frequency of the heart-beats and respirations, and having a strong tendency to produce severe nausea and vomiting, with great muscular weakness and relaxation. In overdose it produces alarming prostration and feebleness of the heart, but, from the prompt vomiting which large doses occasion, cases of fatal poisoning are exceedingly rare. There is no antidote to the poison, and after evacuation of the dose from the stomach perfect rest on the back and the use of restorative means, such as alcoholics, ammonia, artificial respiration, etc., constitute the treatment. As a medicine, *Veratrum viride* is used to reduce the force and frequency of the pulse where the same is much above the normal standard, but like all remedies of its class its use requires caution. *Veratrum album*, white hellebore. This species is a native of Europe and Asia, and is closely allied to the foregoing in botanical characters. The root-stock contains the alkaloid jervia, like *Veratrum viride*, and has been commonly supposed to yield also the alkaloid *veratria*, found in cevadilla-seeds, but recent analyses make this doubtful. White hellebore affects the animal system much in the same manner as *Veratrum viride*, but is more violent and locally irritating, producing in overdose, in addition to the symptoms already described, severe pain in the abdomen, and even gastro-intestinal inflammation. On account of these objectionable properties, white hellebore-root is now almost wholly obsolete as a medicine with American physicians. *Veratrum sabadilla* is a native of Mexico, and is said to be one source of cevadilla-seeds. EDWARD CURTIS.

**Verazza'no,** or **Verrazano, da** (GIOVANNI), b. near Florence about 1480, of a noble family settled at Val di Greve, is alleged on doubtful evidence to have travelled in Egypt and Syria, engaged in traffic in spices, silks, and other Oriental productions; early entered the French maritime service; made a voyage to the East Indies in 1517 in a Portuguese vessel; became an expert navigator; was employed as a corsair or privateer by the French government in 1521 and the following years; took many prizes of Spanish vessels returning from the West Indies, and captured in 1523 the treasure-ship in which Cortés had sent from Mexico to Charles V. a large portion of the personal spoils of Montezuma, valued at $1,500,000. According to the authorities received without question until recently, he sailed from the Madeira Islands Jan. 17, 1524, on a voyage of exploration to North America; discovered land at a point near Cape Fear (or possibly near Little Egg Harbor, N. J.); coasted thence northward, discovering a bay, usually supposed to be that of New York, though others argue for Narragansett Bay; proceeded thence 150 leagues N. E. to lat. 50° N.; returned thence to France, and addressed a letter to King Francis I. from Dieppe July 8 (O. S.), 1524, claiming to have discovered 700 leagues of coast, of which he gave a confused description. Of his later history it is only known that he communicated to persons in England a map of his alleged discoveries, and signed in 1526, with Admiral Philipe Chabot, Jean Ango, merchant of Dieppe, and other partners, an agreement to undertake a voyage to the Indies for spices, with which was combined the purpose of capturing Spanish merchantmen. This voyage seems, however, to have been inter-

rupted by his capture on the southern coast of Spain, and he was executed as a pirate at the village of Pico, near Colmenar de Arenas, New Castile, in Nov., 1527. His exploits as a corsair, his capture and execution, are narrated by Pietro Martire d'Anghiera, Bernal Diaz, and other Spanish chroniclers, who call him Juan Florin or Florentin, and it was not till the eighteenth century that this corsair was identified with the navigator by Barcia. No evidence concerning his discoveries has been found in the French archives, and they rest entirely upon the letter mentioned above, which was published at Venice in an Italian version by Ramusio in 1556, no French original being known. In 1835, Mr. G. W. Greene discovered in the Strozzi Library at Florence a MS. copy of this letter, varying somewhat in text from the Ramusio version, and containing some additional paragraphs. This was published, with a translation, in the *Collections* of the New York Historical Society in 1841. In 1864 the genuineness of this letter was attacked by Mr. Buckingham Smith in a paper read before that society, and subsequently in other monographs. The letter, however, found an able defender in Mr. J. Carson Brevoort, who published an elaborate memoir entitled *Verrazano the Navigator* (1874), giving an account of a planisphere of the supposed date of 1529, found at Rome, signed by Hieronimo Verrazano, and containing a map of the coast discovered by Giovanni. Mr. Henry C. Murphy in his *Voyage of Verrazzano* (1875) has impugned the authority of this map, which he considers based upon the discoveries of Estevan Gomez in 1525. A document just discovered at Rouen (1876) proves that the navigator had a brother Hieronimo (Jerasme de Varasenne), to whom he executed a power of attorney May 11, 1526. The account of the voyage published by Ramusio, whether true or fictitious, may probably be traced to the efforts of this Hieronimo to popularize in Italy his brother's fame as a discoverer; and to him may be ascribed the statement given by Ramusio that Verazzano was killed by savages during another voyage to America. PORTER C. BLISS.

**Verb** [Lat. *verbum*, "word," "verb"], in grammar, a word or part of speech whose chief function is to assert or declare, and which in many languages, including those of the Aryan stock, such as Greek, Latin, Sanskrit, Russian, and English, presents many inflections which are classified under divisions named voices, moods, tenses, person, number, and others. In comparison with Latin, English has few inflections, and must therefore often employ circumlocutional phrases to indicate the meaning of single words in that language; and it is usual to assign to it divisions which do not belong to it, as in the following comparisons of Latin and English: Active voice, indicative mood, present tense, *amo*, "I love;" imperfect, *amabam*, "I did love;" perfect, *amavi*, "I have loved;" pluperfect, *amaveram*, "I had loved;" future, *amabo*, "I shall love." Subjunctive mood, pres. tense, *amem*, "I may love;" imperf., *amarem*, "I might love;" perf., *amaverim*, "I may have loved;" pluperf., *amavissem*, "I might have loved;" fut., *amavero*, "I shall have loved." In the passive voice, indicative mood, we have *amor*, "I am loved;" *amabar*, "I was loved," etc.; passive subjunctive present, *amer*, "I may be loved," etc. The root *am-* of these and the remaining forms means "love" in a general way, but it is neither a verb nor any other part of speech, because it is not used in this independent condition. Greek has a tense named *aorist* of several forms. That of the active voice indicative mood appears in ἔγραψα, "I wrote," which differs from the imperfect ἔγραφον, "I was writing," and from the perfect γέγραφα, "I have written," of which the two latter would be represented by the Latin active indic. perfect, *scripsi*.

An English subjunctive mood which was in use formerly is becoming obsolete, and mistakes are often made in attempting to retain it. Speaking of language, Max Müller says (*Sci. of Lan.*, lect. 1), "If it be a production of nature," etc., instead of the indicative form, "if it *is*," etc., because at the moment of speaking it is or it is not such a production. The subjunctive pertains to examples like —"If the tide *be* in when we arrive at Dover, we will go on board," but even in such cases the indicative is frequently used.

Some languages have a dual number, in which, besides the singular and plural forms, nouns, pronouns, adjectives, and verbs have inflections which may be used instead of the ordinary plural to indicate two objects and their action, including such as occur in pairs, as the hands or a pair of speakers, as *we* for "thou and I," excluding others who may be present. The dual of Sanskrit verbs is of the three persons; in Greek it is of the second and third; in Gothic of the first and second; and in Dakota of the first only, as in *mangka'*, "I am;" *ungyang'ka*, "we two (thou and I) are;" *ungyang'kapi*, "we are," where the plural is based on the dual. The Cri or Cree has forms like *ni miyosinân*, "we (I and he) are handsome;" *ki miyosinânow*, "we (I and thou) are handsome."

The most obvious division of verbs is into transitive and intransitive, the former indicative of passing to an object, as in "I wash dishes;" the latter independent of an object, as in "I work," "I wash daily." Forms like "I wash myself" are transitive, but when they are represented by special inflections, they are reflexive, as in Russian *myt'*, "to wash;" *myt'sya*, "to wash one's self." The same suffix represents reciprocal action, as in *obnimát'*, to "embrace;" *obnimát'sya*, to "embrace mutually." The Russian verb has but three tenses, the preterit, the present, and the future, but these are varied by certain inflectional and prepositional "aspects," which extend their functions and recall the Greek aorist tenses. In the singular number the Russian preterit indicates gender, as in *otrók zhevál*, "the boy chewed;" *otrokobítsa zhevála*, "the maid chewed;" *dityá zheválo*, "the child chewed;" pl. *zheváli*, "they (m., f., n.) chewed." The suffixed fragments of pronouns of the two Hebrew genders (m., f., also common) give gender forms to verbs in this language, going so far as to distinguish whether the suffixes for "thee" and "you" are masculine or feminine.

Latin deponent verbs are such as have a passive form and an active meaning, as *veneror* (for *venero*), which means "I revere," and not "I am revered." Latin inceptives (or inchoatives) are forms which represent the beginning of an action, as *liqvēre*, to "be liquid;" *liqvescĕre*, to "become liquid," to "deliquesce." Impersonal verbs are without a personal nominative, and are present in many languages, as in Gr. ὕει; Lat. *pluit;* Chippeway, *gimiwan;* Eng. "it rains;" Lat. *pluet*, "it will rain."

The Lĕnâpĕ or Delaware Indian is without the verbs to "be" and to "have," either separate or auxiliary, yet he is able to say *n'pawalessin*, "I am rich;" *nowikin*, "I have a house;" *wiku*, "he has a house;" *wikuwek*, "they have a house." He has but few adjectives, and supplies their place with verbs, as in English for "it is bright" we may say "it brightens." So in Lenâpe, *guneu*, "it is long;" *guneep*, "it was long;" *guneuchtschi*, "it will be long." (*Zeisberger.*) In fact, in languages of this Algonkin stock (Lenâpe, Chippeway, Cri or Cree, Potewâtomi, Otâwâ, etc., absurdly called "Algic" by Mr. Schoolcraft) almost any part of speech may be turned into a verb, so that the language mechanism depends to an unusual extent upon verbs, and these comprise a variety of minute details, including two genders, which are here independent of sex, being divided into animate and inanimate. (See INDIAN LANGUAGES, by J. HAMMOND TRUMBULL, LL.D.) Many of these languages are well adapted to the narrative style, there being none of that confusion present as in English in the use of "he" and "him" when an action between two persons or parties is described; but the persons of the narrative being indicated at the outset, the construction keeps them distinct to the end. (*Rev. Thomas Hurlburt.*)

The Basque, spoken in the vicinity of the Pyrenees, is in some features akin to the North American languages. It has four forms of the first person, as in *nuk*, "I am," used in addressing a male familiarly; *nun*, "I am," addressing a female familiarly; *nuzu*, "I am," speaking respectfully to either sex; *niz*, "I am," used without special regard to the person addressed; and similarly there are four forms for the 1st person plural, and for the 3d pers. sing. and pl. in most of the tenses. In Welsh the pronoun may precede or follow its verb, or be omitted unless required for emphasis. It has several forms, as *mi*, *fi*, "I, me;" *myfi*, "I or me myself," and others. Hence we may say "I love" in the various ways, *caraf*, *caraf fi*, *mi garaf*, *myfi garaf*, *mi garaf fi*. (*Pughe.*)

In the Chinese languages, words used as verbs (and other parts of speech) are without inflections; consequently, the function of a word depends on the syntax. (See CHINESE LANGUAGE, by ADDISON VAN NAME.) A few examples will exhibit its extreme simplicity: *twän*, "cease, discontinue;" *jin*, "man, men, people;" *twän jin*, "the population has ceased, dwindled away;" *ge*, "fish, fishes;" *ap*, "swallow, swallows;" *suy*, "water;" *ge ap suy*, "fishes swallow water;" *to mo yen nang chin lin* (word for word), "single tree how can make grove;" *neaou*, "bird;" *teang*, "swell, swollen, raise, stretch;" *ke*, "he, she, it, its, his, her, their;" *ek*, "wing;" *neaou teang ke ek*, "the bird stretches its wings;" *sip*, "ten;" *wuy*, "make;" *yit*, "one;" *pek*, "hundred;" *sip sip wuy yit pek*, "ten tens make one hundred;" *koé*, "ancient, distant, of old;" *cheá*, "that which, who, what, person;" *poê*, "take up in the hollow hand, as water;" *yim*, "drink;" *koé cheá poê yim*, "the ancients used to take up water in the hand and drink;" *kok*, "grain;" *che*, "of;" *se*, "begin-ing;" *seng*, "live, grow;" *wat*, "say, speak, assert;" *beaou* (a name); *kok che se seng*, *wat beaou*, "when grain is beginning; to grow, it is called beaou;" *be*, "not;"

*leng*, "be able, may, can;" *soo*, "affair, duty;" *jin*, "man, men;" *yëen*, "how;" *kwuy*, "ghost, spirit;" *be leng soo jin yëen, leng soo kwuy?* "(if) not able (if you) cannot (do your) duty (to) men, how (are you) able (to) serve spiritual beings?" The poverty of inflection in English gives its syntax some resemblance to that of Chinese, and in natural-history English we sometimes find a very condensed style, as in a description of a fish (1870): "Length from muzzle to pectoral equalling length from pectoral to ventral fin; depth less than length head; last dorsal ray more than half first; muzzle narrow. Brown above with brown cross-bars." S. S. HALDEMAN.

**Verbe'na** [Lat. for Eng. *vervain*], a genus of herbs and shrubs of the order Verbenaceæ, found in various warm and temperate regions. The U. S. have numerous species, some of them European also. One of the most interesting is *V. hastata*, the "simpler's joy," once highly prized in medicine and believed to possess magical virtues. The garden verbenas are fine border-plants of many varieties, belonging to *V. chamædrifolia* of the Argentine Republic, to *V. sororia* of Asia, and to *V. aubletia* of the U. S.

**Verboeck'hoven** (EUGENE JOSEPH), b. at Warneton, West Flanders, Belgium, June 8, 1799; was educated at Brussels, and received his first instruction in art, drawing, and modelling from his father, who was a sculptor, but devoted himself afterward to painting; attracted much attention in 1821 by his *Cattle-Market at Geneva*, and still more in 1834 by his *Herd of Cattle in an Autumn Landscape*. The most remarkable among his later works are—*A Herd of Sheep overtaken by a Storm* (1835), *Horses attacked by Wolves* (1836), *Cattle in the Roman Campagna* (1845). He also published several volumes of etchings.

**Vercel'li** [Lat. *Vercellæ*], a thriving and important town on the river Sesia, in the Piedmontese province of Novara in Northern Italy, about 50 miles N. E. from Turin, at an elevation of 428 feet above the sea. Vercelli has a certain notoriety as the town nearest to the field of Hannibal's first battle with the Romans in Italy; of the decisive defeat of the Cimbri (101 B. C.) by the Roman consuls Marius and Catullus; and of the battle of Palestro on May 30–31, 1859, in which the Austrians were defeated by the Piedmontese. To the stranger the interest of Vercelli lies principally in its churches, and in the libraries and artistic treasures in which they are rich. The cathedral is large, but not of great antiquity, suffered greatly during the French occupation, and has been restored with doubtful taste and judgment. Some of the MSS. in its library are of great value. Among them ranks perhaps first a copy of the Gospels written by the hand of Eusebius, bishop of Vercelli in the fourth century, in the ancient Italic version, older than the Vulgate, and probably the oldest existing copy of the Gospels in any language. Another MS. of great interest to English scholars is the Anglo-Saxon *Codex Vercellensis*, conjectured to have been brought to Vercelli by Cardinal Guala, papal legate in England in the time of John and of Henry III. The library contains also the *Leges Longobardicæ* in a MS. as old as the eighth century; an early *Epitome of the Constitutions of Justinian;* a *Capitulary of Hlodwig and Hlothair*, and the important *De Imitatione Christi*, a MS. ascribed to the thirteenth century, and confidently believed to be the work of John Gersen, a monk of Vercelli who lived two centuries before the time of Thomas à Kempis, the reputed author of that most celebrated work. The church of Sant' Andrea, founded by Cardinal Guala, is of interest as showing reminiscences of English ecclesiastical architecture, and that of St. Christopher is very noticeable for its fine frescoes by Gaudenzio Ferrari, who, as well as the more famous Bazzi (or Sodoma), was a native of Vercelli, though the greatest works of the latter were executed after his removal to Siena. The charitable and educational institutions of Vercelli are well endowed and highly respectable. P. 27,349.

**Verchères',** county of Quebec, Canada, bounded N. W. by the St. Lawrence and E. by the river Richelieu. Cap. Verchères. P. 12,717.

**Verchères,** p.-v., cap. of Verchères co., Quebec, Canada, on the S. shore of the St. Lawrence, 24 miles below Montreal. It has a college and convent. P. about 900.

**Verd, Cape.** See CAPE VERD.

**Verde Antique'** [Fr., "antique green," properly the name of the *ærugo nobilis*, or rust of bronze statues and coins], a fine dark-green stone, with patches of red, white, and sometimes black, highly prized in ancient and modern Italy. The name is sometimes applied to a marble, sometimes to a breccia, and again to a handsome porphyry. A marble called *verde antique* has been quarried at Milford, Conn. A kind of serpentine called *verde antique* has been quarried at Roxbury, Vt. It is a very handsome but brittle stone.

**Ver'den,** town of Prussia, province of Hanover, on the Aller, near its influx in the Weser, has a fine cathedral, large breweries, tobacco manufactures, and valuable fisheries. P. 5779.

**Ver'di** (GIUSEPPE), b. Oct. 9, 1814, at Busseto, near Parma. His first operatic production was *Oberto di San Bonifazio;* this was followed by an unsuccessful opera-buffa, *Un Giorno di Regno*. In 1842 he brought out with great success, at the La Scala in Milan, his *Nabucco;* in 1843, *I Lombardi;* in 1844–45, *Ernani, I due Foscari*, and *Giovanna d' Arco;* in 1846, *Attila;* in 1847, *Macbeth* and *I Masnadieri;* in 1848, *Il Corsaro* and *La Battaglia di Legnago;* in 1849, *Luisa Miller;* in 1850, *Stiffelio;* in 1851, *Rigoletto;* in 1853, *Il Trovatore;* in 1854, *La Traviata;* in 1855, *I Vespri Siciliani*. These were followed by *Araldo, Simone Boccanegra, Una Vendetta in Domino, Il Re Lear, Un Ballo in Maschera, La Forza del Destino, Don Carlos, Aïda*, and finally a *Requiem*. Verdi is a senator of the kingdom.

**Ver'dict** [Lat. *verè dictum*, "something said truly"], the decision of a jury as to the matters in issue submitted to them, and in respect of which they have sworn to find and declare the *truth*. A "general" verdict is one in which the jury render a complete decision on the facts in connection with the law applicable to them as laid down by the court. In a criminal prosecution the general verdict would be "not guilty" or "guilty;" in civil actions it would be "for the defendant" or "for the plaintiff," with such amount of damages or debt as had been found due. A "special" verdict is one by which the jury find the facts in a detailed manner and form, but do not apply the law to them by rendering a final decision in favor of either party. Upon the facts thus determined the court adjudicate. A verdict must be unanimous, and as a general rule it must be orally announced by the jury in open court and recorded by the clerk. If the jury agree upon their verdict after the adjournment of the court for the day, they are permitted to reduce it to writing, sign, and seal it up, and then separate. In such case they must be present at the reassembling of the court, when their verdict sealed will be opened and announced. After a verdict of guilty in criminal prosecutions, the jury may be "polled" by the prisoner—that is, each juryman may be asked by name if the verdict thus announced is his verdict. JOHN NORTON POMEROY.

**Verdiere,** tp., Colleton co., S. C. P. 3176.

**Ver'digris** [Fr. *vert-de-gris;* Ger. *Grünspan*]. Commercial verdigris, used as a pigment, is sometimes made by exposing the "marc" or "pomace" of grapes, left after pressing out the juice, spread on plates of copper. The plates become encrusted with a green crystalline matter, which is a mixture of several basic acetates, with some carbonate, of copper. Solution in warm water and spontaneous evaporation furnish a blue crystalline acetate, having the composition, according to some, $(C_4H_6CuO_4).(CuO.H_2O).5H_2O$. The insoluble residue left by the warm water, which has a green color, is considered to be $(C_4H_6CuO_4).2(CuO.H_2O).H_2O$. *Distilled verdigris* is the name given commercially to a preparation obtained by the use of so-called distilled or wood vinegar, sometimes by soaking cloths therein and applying them to plates of copper. HENRY WURTZ.

**Verdigris,** tp., Montgomery co., Kan. P. 1052.

**Verdigris,** tp., Wilson co., Kan. P. 687.

**Verdun'-sur-Meuse** [anc. *Verodunum*], town of France, department of Meuse, one of the numerous minor fortresses of the old system, the see of a bishop, the seat of a court of first resort and of an ecclesiastical seminary. P. 12,394. During the Franco-German war Verdun resisted a *coup-de-main* (Aug. 24, 1870) and an investment and bombardment (see SIEGE), surrendering Nov. 8, 1870.

**Vere** (Sir FRANCIS), b. in England in 1554, grandson of John de Vere, fifteenth earl of Oxford; served in the army in the Netherlands under the earl of Leicester 1585, and subsequently under Lord Willoughby; was knighted for gallantry at the defence of Berg-op-Zoom 1588; relieved the garrison at Berg on the Rhine 1589; contributed to the capture of Zutphen; was instrumental in the retaking of Deventer and in the defeat of the prince of Parma near Nymwegen 1591; was lord-marshal in the expedition against Cadiz 1596; distinguished himself at Turnhout, and became governor of the Brill 1597; was recalled to England during the threatened Spanish invasion 1599; was severely wounded at Nieuport, where he determined the victory for Prince Maurice, July 5, 1600, and successfully defended Ostend against great odds 1601–02. D. in England Aug. 28, 1608, and was buried in Westminster Abbey. His *Commentaries*, narrating his services in the Netherlands, were published in 1657.—His younger brother, HORATIO, b. at Kirby Hall, Essex, in 1565, distinguished himself

under his brother's command in the Netherlands, and commanded the English auxiliaries in Germany 1620–23; was created Baron Vere of Tilbury July 25, 1625, and became master of the ordnance 1619. D. in London May 2, 1635.

**Vere, de** (Sir AUBREY **Hunt**), BART., b. at Curragh Chase, co. Limerick, Ireland, Aug. 20, 1788, son and heir of Sir Vere Hunt, first baronet, to whose title he succeeded 1818, and subsequently took the name DE VERE, and was an enthusiastic disciple of Coleridge. D. July 5, 1846. Author of two dramatic poems, *Julian the Apostate* (1822) and *The Duke of Mercia* (1823), and of *A Song of Faith, Devout Exercises, and Sonnets* (1842). His works have frequently been ascribed to his son, AUBREY THOMAS (which see), and *vice versâ*.

**Vere, de** (AUBREY THOMAS), son of Sir Aubrey, b. at Curragh Chase, Ireland, Jan. 10, 1814; educated at Trinity College, Dublin; has published *The Waldenses, and other Poems* (1842), *The Search after Proserpine, etc.* (1843), *English Misrule and Irish Misdeeds* (1848), *Picturesque Sketches of Greece and Turkey* (2 vols., 1850), *Poems, Miscellaneous and Sacred* (1856), *May Carols* (1857), *The Sisters, etc.* (1861), *The Infant Bridal, etc.* (1864), *The Church Settlement of Ireland, or Hibernia Pacanda* (1866), *Irish Church Property, and the Right Use of it* (1867), *Pleas for Secularization* (1867), *Irish Odes, and other Poems* (1869), *The Legends of St. Patrick* (1872), *Alexander the Great, a Dramatic Poem* (1874), and a poem on the centenary of Daniel O'Connell (1875).

**Vere, de** (EDWARD), seventeenth earl of Oxford, b. in England about 1540; educated at St. John's College, Cambridge; was in high repute as a wit and a poet at the court of Queen Elizabeth, and was famous for the prodigality of his living; had a rencontre, not much to his credit, with Sir Philip Sidney; married Anne, the eldest daughter of William Cecil, Lord Burleigh; is alleged to have treated her inhumanly to revenge himself upon Burleigh for not interfering to save the life of his relative, Thomas Howard, duke of Norfolk (beheaded for treason 1572); was made lord high chamberlain, and in that capacity sat on the trials of Mary Queen of Scots (1586) and the earls of Arundel (1589), Essex and Southampton (1601), and held a command in the fleet sent against the Spanish Armada (1588). D. in London in July, 1604. He wrote a number of comedies, not extant, and contributed poems to Richard Edwards's *Paradise of Daynty Devises* (1576) and other collections of that period. His countess (d. June 6, 1588) also wrote verses, some of which are in John Southern's *Pandora* (1584).

**Vere, de** (JOHN), thirteenth earl of Oxford, b. in England about 1450, son of John, the twelfth earl, who took part as a Lancastrian in the wars of the Roses, and was beheaded in London Feb. 26, 1462, and descended from a long series of nobles dating from the Conquest, who had held high positions in the state; became a prominent Lancastrian leader; fought at Barnet 1471; joined the earl of Pembroke in Wales; was captured, imprisoned, and attainted 1474; took part with the earl of Richmond (Henry VII.), and commanded the van of his army at Bosworth 1485; contributed to the defeat of the insurgents on Blackheath June 22, 1497; was made lord high steward, and in that capacity pronounced sentence upon Edward Plantagenet, earl of Warwick, accused of conspiring with Perkin Warbeck 1499. D. in 1513. The last titled member of this proud family, which had become a synonym for long descent, was AUBREY DE VERE, twentieth earl, b. about 1620, styled by Macaulay "the noblest subject in England." He fought for Charles I. in the great rebellion, became lord lieutenant of Essex under Charles II., and was dismissed from that post by James II. 1687, because he refused to aid him in packing a Parliament.

**Vere, de** (MAXIMILIAN SCHELE). See DE VERE.

**Vere'ja,** town of European Russia, government of Moscow, on the Protva, has manufactures of tallow. It carries on a lively trade with the Don Cossacks. P. 5421.

**Vergennes',** tp., Kent co., Mich. P. 1342.

**Vergennes,** city of Addison co., Vt., chartered in 1783, on Central Vermont R. R., 6 miles from Lake Champlain, at the head of navigation, contains 5 churches, a public library, a graded school, 1 newspaper, a fire organization, and excellent waterworks. The State reform school is located here. MacDonough's fleet, with which he captured the British squadron off Plattsburg Sept. 11, 1814, was built here. It has steamboat communication with the lake-ports during the summer. P. 1570.

H. C. JOHNSON, ED. "VERMONTER."

**Vergennes, de** (CHARLES GRAVIER), COUNT, b. at Dijon, department of Côte-d'Or, France, Dec. 28, 1717; entered very early on the diplomatic career; was minister at Treves 1750–55, at Constantinople 1768, at Stockholm 1771, and became minister of foreign affairs in 1774. He concluded the treaty of alliance with the Swiss cantons in 1777, and with the American colonies in 1778, and negotiated the Peace of Teschen (May 13, 1779), which ended the Bavarian succession war, and the Peace of Versailles (Sept. 3, 1783). He was an adroit negotiator, but a very mediocre statesman, and his meddling with the finances became fatal to France; he drove Necker out and brought Calonne in. D. at Versailles Feb. 13, 1787.

**Vergier de Hauranne.** See DUVERGIER DE HAURANNE.

**Ver'gil** (POLYDORE), b. at Urbino, Italy, about 1470; became a priest and acquired a considerable literary reputation by his *Proverbiorum Libellus* (1498), several times reprinted in the sixteenth century, and by a treatise on the discovery of arts and sciences, *De Rerum Inventoribus* (1499); was sent by Pope Alexander VI. to England to collect the papal tribute called "Peter's pence" 1501, being the last to hold that office; remained in England for the most of his life; was made rector of Church Langton, Leicestershire, archdeacon of Wells, prebendary of Hereford and of Lincoln, all in 1507; exchanged the latter prebend for one in St. Paul's, London, 1513; was an intimate friend of Erasmus and the great scholars of the time; wrote, besides many miscellaneous treatises, a voluminous Latin history of England, *Historiæ Anglicæ Libri XXXVI.* (Bâle, folio, 1533; best ed. Leyden, 1651), and edited Gildas's *De Calamitate, Excidio et Conquestu Britanniæ* (1525). He returned to Italy in 1550, and d. probably at Urbino about 1555. Two volumes of an old English translation of his *Historiæ* were edited by Sir Henry Ellis for the Camden Society (1844–46), and a translation by John Langley of his *De Rerum Inventoribus* was edited for the Agathynian Club by Dr. W. A. Hammond, who prefixed an *Account of the Author and his Works* (New York, 1868).

**Vergil** (PUBLIUS VERGILIUS MARO), b. at Andes near Mantua B. C. 70 in humble circumstances, but received a careful education. His paternal estate was assigned (B. C. 41 and 40) to the veterans of Octavianus, but his application to the emperor effected a restoration of his lands or an indemnification for them. From this time Vergil lived partly in Rome, partly at Naples, always suffering from delicate health, but in the possession of sufficient means. He was himself a gentle and amiable character, and as a poet most successful in subjects which admit of genial treatment, as inanimate nature, one's native country, family ties, and love, but he allowed himself to be led on to subjects too grand for him; for, though pleasing in his episodes, he was hardly equal to majestic occasions. He collected his materials with great diligence, and polished his verse with extreme care; and this faithful labor won for him that elegance in style and correctness in metre which made him the standard of classicality in Roman poetry for a long period. Before the lapse of a century Vergil was used, as he is to this day, as a textbook in schools for learning Latin, and in subsequent times his writings were drawn upon for *centos*, superstition consulted them as an oracle, and in popular belief he was himself turned into a magician, upon whose name the nations of the West accumulated their fictions and legends in the Middle Ages. During the Renaissance his works exercised a great influence on Italian literature, and partly through that literature, but more by direct study, also on French and on English poets. He d. at Brundisium B. C. 19, and was buried near Naples, where his tomb is still shown.

Vergil's extant poems are (1) *Eclogæ*, ten bucolics, written B. C. 41–39, imitations, and to some extent translations, of Theocritus, but with an admixture of persons and events of his own time and country. Though Vergil can hardly be said to have improved on his original, yet these have always been regarded as very graceful and pleasing compositions, and themselves inspired one of the most brilliant and charming works of Pope, his *Pastorals*. (2) *Georgica*, in four books, composed B. C. 37–30, the first on agriculture, the second on the culture of trees, the third on domestic animals, and the fourth on bees. The prostrate condition of husbandry at the end of the civil wars induced Mæcenas, the influential favorite of Augustus, to propose husbandry to Vergil as the subject of a didactic poem. The task suited the taste of the poet, and he devoted himself to it with earnestness and enthusiasm. So successful was this attempt that in the *Georgics* we have confessedly the most perfect production of Roman art in this kind. In handling this theme Vergil could avail himself of his own personal experience in youth, but his studious bent would incline him also to consult and appropriate the works of others on this subject, which abounded in Greek and Latin, as of Hesiod, Aratus, and Xenophon, of Cato, Mago, and Varro. (3) *Æneis*, in twelve books, begun about B. C. 29,

but not finished when the poet died (B. C. 19), yet made public by his executors, L. Varius and Tucca, contrary to the express desire of the author. The *Æneid* turns on the fate of Æneas, the founder of a second Ilium and indirectly of Rome, and the ancestor of the Julian family. In this work Vergil in part had recourse to Greek sources and models, and in part relied on his own extensive study of Italian legends, history, and localities, thus blending Hellenic and Latin elements. According to Donatus (*Vit.* 46), Vergil read to Augustus books ii., iv., and vi., which, in the judgment of posterity, are, the two former the most real, and the latter the most curious and interesting of all. The style of the *Æneid* in general is rather sombre and unnatural, but always dignified; and we cannot but feel the fascination of its graceful and sonorous lines. Indeed, whatever faults criticism may have pointed out in this work, it has secured to its author an undisputed place among the few great epic poets the world has yet seen. Vergil derived from the Homeric poems the plan and style of the *Æneid*, as well as numerous details. Book vi. is quite in the manner of *Odyssey* xi., and the first half of the *Æneid* may be said to be in imitation of the *Odyssey*, as the rest is of the *Iliad;* the subject of book ii. is drawn from the Cyclic poets, and book iv. is imitated from Apollonius Rhodius. Of the Roman poets, Vergil has chiefly imitated Ennius (see *e. g.* vi. 846), as Servius and Macrobius remark. Aulus Gellius (i. 21) says: Non verba sola, sed versus prope totos et locos quoque Lucreti plurimos sectatum esse Vergilium; and Vergil himself in turn has been copied more or less by all the Latin epic and didactic poets, as Persius, Silius Italicus, Valerius Flaccus, Statius, Ausonius, Prudentius, and Paulinus Solanus.

Besides these great and genuine works of Vergil, certain minor poems have come down to us under his name: (1) *Culex*, a description of Hades. It is certain that Vergil in his youth wrote a brief epic of this name, but the general character of the poem which we have, especially its frequent imitations of the writings of Vergil, chiefly of the vi. *Ecl.* and the vi. *Æn.*, renders it probable that a new work, composed, however, soon after Vergil's death, occupies the place of the original. The extant poem, though puerile in composition, is masterly in metrical treatment. (2) *Ciris*, an account of the treacherous conduct of the Megarian princess Scylla against her father Nisus, and her transformation into the bird Ciris. This poem seems to have arisen in the circles of Messala, being dedicated to his son, who was consul A. U. C. 751. The author draws largely on Vergil, but also imitates Catullus, and reminds us here and there of Lucretius, Tibullus, and some of the Augustan poets. Metrically, this piece is less correct than Vergil, but in style it is more lively. (3) *Moretum*, a pleasing idyl, believed by Lachmann to belong to the time of Vergil, and perhaps translated by him from a Greek poem of Parthenius. It is vivid in description, amiable in spirit, and elaborate in form. (4) *Copa*, a short elegy of the best period, Vergilian in style, but more sprightly in tone. (5) *Catalecta*, fourteen poems in elegiac and iambic metre on various subjects. Only two are well attested as coming from Vergil, but two alone can be proved not to have come from him, and they all certainly belong to his period.

Of Vergil's prose, we know only of his correspondence with Augustus, which was probably published by the emperor's order. Seneca the Elder (*Exc. Controv.*, iii. 8) says of it: Vergilium illa felicitas ingenii in oratione soluta reliquit. Specimens of it are given in Donati *Vita Vergiliana*, and in Macrobius, i. 24.

As to the form of his name, the inscriptions of the time of the Republic and of the first centuries after Christ are in favor of *Vergilius*, and so the older MSS., as the Medicean. The Greeks also generally wrote Βεργίλιος or Οὐεργίλιος. The earliest dated instance of the form *Virgilius* is of the fifth century. In the Middle Ages, about the ninth century, this form began to be common, caused by fictitious derivations of the name (from *virgo* or *virga*), and in the fourteenth and fifteenth centuries it prevailed, though the Italian scholar Angelo Poliziano proved it to be wrong.

CHARLES SHORT.

**Vergniaud'** (PIERRE VICTURNIEN), b. at Limoges, department of Haute-Vienne, France, May 31, 1759; studied law in his native city and in Paris, and settled in 1781 as an advocate in Bordeaux. Elected a deputy to the Legislative Assembly of 1791 from the department of Gironde, he soon became the centre and leader of a great majority, the so-called Girondist party; Oct. 16 he was chosen vice-president, Oct. 31 president, of the Assembly. The decisive measures which the Girondists advocated in order to carry into effect the free constitution brought them into bitter conflicts with the royalists, and Mar. 24, 1792, the king dismissed the Girondist ministry. The negotiations which were carried on between the king and Vergniaud by Boze failed, and on Aug. 10 Vergniaud himself proposed the suspension of the royal power. But the approaching anarchy, whose first outbursts (Aug. 10 and Sept. 2–3) the Girondists had connived at, soon completely outgrew them. In the National Convention, opened Sept. 21, the Girondists still had the majority, but not the real power. In the trial of the king, Vergniaud supported by a brilliant speech the proposition of an appeal to the people; but when the proposition fell, he voted for the execution without delay (Jan. 30, 1793). In the terrible contest which now took place between the Girondists and the Jacobins, Vergniaud time after time swayed the whole assembly by the tremendous force of his eloquence, but he finally broke down before the argument which Marat used—the introduction of a yelling, howling, maddened mob into the very hall of the Convention. By this means the Jacobins finally succeeded (June 1) in carrying a decree for the arrest and trial of the Girondists. Oct. 24 the trial commenced, and Vergniaud, who for some time had fallen into a kind of mental insensibility, now rose once more to the full height of his genius, and actually caused the Jacobins to tremble by his speeches of defence. The trial was stopped, the sentence pronounced without scrutiny, and Vergniaud was guillotined Oct. 31, 1793. Several of his speeches are found in Barthe, *Les Orateurs français* (4 vols., Paris, 1820), and in *Choix de Rapports, Opinions et Discours* (Paris, 1818–25). (See also Touchard-Lafosse, *Histoire parliamentaire et Vie intime de Vergniaud* (Paris, 1848).)

**Veri'a, Verria,** or **Karaveria,** town of European Turkey, eyalet of Salonica, manufactures a peculiar kind of half-woollen, half-linen stuff much used for bathing-clothes. P. 10,000. It is the ancient town *Berœa* (*Berea*) alluded to in Acts xvii. 10. The principal occupation of the inhabitants is quarrying red marble from the neighboring mountain.

**Verifica'tion** (in law). (1) In the common-law system of pleading, whenever new matter is alleged by a party, he must conclude his averments by a statement that he is prepared to establish the truth of the facts thus set forth. This statement is called the "verification," and the following is its ordinary form: "And this he is ready to verify." A plea by way of traverse or mere denial does not require a verification. (2) The term also denotes the affidavit which, in equity pleading and in the reformed pleadings established by the American codes of procedure, a party may or must annex to his complaint or answer. The equity practice of swearing to the truth of the matters alleged in pleadings has been borrowed by the reformed procedure, and applied to legal actions. The pleading is then said to be "verified," and the affidavit wherein the party makes oath either on his own knowledge or upon his information and belief is called the "verification."

JOHN NORTON POMEROY.

**Verification** [Lat. *verus* and *facere*], the operation of testing. Thus, the verification of the roots of an equation is the operation of showing that these roots will satisfy the given equation.

**Ver'juice** [Fr. *verjus*], the juice of unripe grapes, an austere drink, much prized by the ancients and by peasants in parts of modern Europe. The vinegar of cider and the juice of sour crab-apples are sometimes called verjuice.

**Vermes.** See WORMS.

**Vermicelli.** See MACARONI.

**Ver'mifuges** [Lat. *vermis*, "worm," and *fugare*, to "cause to flee"], also termed **Anthelmintics** [Gr. ἀντί, "against," and ἕλμινς, "worm"], also **Helminthagogues** [Gr. ἕλμινς, "worm," and ἄγειν, to "lead" or "expel"], remedies intended to remove worms from the stomach and intestines, and prevent their recurrence by the destruction of their germs. Properly, they are to be distinguished as *vermicides*, or those which kill the worms, and *vermifuges*, those remedies which by moving the bowels violently or by their rough or irritating qualities dislodge and bring away the entozoa alive. The remedy that is destructive to the worm must at the same time be innocuous as regards the patient, and not injurious to the alimentary tract. Remedies which simply stupefy or destroy the worm must be followed by the exhibition of an efficient purgative to remove the destroyed parasite, as well as to demonstrate the success of their action. Pink-root (*Spigelia marilandica*) is well known, and for children much used in the form of fluid extract of spigelia and senna. The oil of wormseed (*Chenopodium anthelminticum*) is employed, as is *Spigelia*, against round worms. For the same purpose, and preferable, is santonine, the acid extract of *Santonica* or Levant wormseed (*Artemisia contra*). It is pleasantly administered in flavored lozenges; may be given at night, followed by cathartics in the morning. Cowhage (*Mucuna pruriens*) is less used than formerly. Thread-worms are usually in the lower bowel, and easily removed by enemata

of salt and water, aloes in milk, or any irritating or astringent material in solution. The removal of tapeworm is often difficult. Remedies should, as a rule, be preceded by free evacuation of the stomach and bowels by cathartics, and little food taken at the time. The best opportunity is thus given to dislodge the head, which adheres by tentacles or hooklets; for, though many yards of the worm be evacuated, except the head be obtained there is no cure. The chief remedies for tapeworm are pumpkin-seeds broken up and given in an electuary of sugar or emulsion of water or milk, followed by a purge; turpentine in emulsion of acacia mucilage and castor oil; decoction of pomegranate; the oil of male fern (*Filix mas*); and, preferably, kousso (the flowers and fruit of *Brayera anthelmintica*, a tree of Abyssinia). It is efficient, yet safe to the patient, and gives little inconvenience. Each morning half an ounce of the powdered flowers is taken in water, or 20 to 40 grains of the active extract, *kousine*, may be taken in a wafer. No purge is necessary; watery stools are produced, and the worm is discharged dead.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Vermi'gli** (Pietro Martire), generally known under the name of **Peter Martyr,** b. at Florence Sept. 8, 1500, entered the order of St. Augustine in 1516, and made a comprehensive study of theology and philosophy. While prior of the monastery of St. Peter ad Aram, near Naples, he became acquainted with several converts to the Reformed Church and with the writings of Luther and Zwingli, and in 1541, when removed to the monastery of San Frediano, near Lucca, began to preach openly the doctrines of the Reformed creed. The Roman Inquisition soon became aware of the movement which took place at Lucca, but Vermigli succeeded in escaping; fled to Switzerland in 1542, and was made professor of theology soon after at the University of Strasbourg. In 1547 he went to England on the invitation of Cranmer, and lectured on theology at Oxford, but on the accession of Queen Mary returned to Strasbourg; in 1556 was made professor of theology at Zurich, where he d. Nov. 12, 1562. He was considered one of the most learned theologians of his age, and besides giving commentaries on various parts of the Bible, especially the Old Testament, he took part largely in the theological controversies of his time. A selection of his works was published in 1575 by Robert Masson, and forms one of the principal sources of information concerning the theology of the Reformed Church of the sixteenth century.

**Vermilin'guia** [from Lat. *vermis*, "worm," and *lingua*, "tongue"], a sub-order of placentiferous mammals under the order Bruta or Edentata, containing the ant-eaters. The most prominent superficial characters in which the group contrasts with the other sub-orders in whole or part are the following: (1) The integumentary appendages are all developed as simple hairs; (2) the facial portion of the skull and snout are more or less elongated; (3) teeth are entirely wanting in both jaws; (4) they are adapted for an insectivorous diet, and especially for obtaining ants, and to this end have a long protrusible vermiform tongue, secreting a glutinous exudation which secures the insects for ingestion; the placenta is unknown. The only known representatives are the true ant-eaters of South America, forming the family Myrmecophagidæ (which see).

Theodore Gill.

**Vermil'ion** [Fr. *vermeil;* It. *vermiglione*], a pigment composed of mercuric sulphide, prepared by grinding red *cinnabar*, either the native mineral or generally an artificial product formed by subliming together sulphur and mercury. A very fine vermilion, of a deep color approaching to what is known in commerce as *Chinese vermilion*, is obtainable by agitating mercury and sulphur together for some hours with a warm solution of an alkaline sulphide. The mass first becomes black, and gradually changes to the vermilion color. (See Cinnabar.) Henry Wurtz.

**Vermilion,** county of E. Illinois, bordering on Indiana, drained by Vermilion and Little Vermilion rivers, and traversed by several railroads; surface level, soil very fertile. Bituminous coal is found in portions. There are flour-mills, woollen mills, and manufactories of carriages, furniture, iron castings, and machinery. Cattle, sheep, swine, horses, mules, and asses are very numerous. Staples, Indian corn, oats, wheat, potatoes, hay, wool, and dairy products. Cap. Danville. Area, about 1200 sq. m. P. 30,388.

**Vermilion,** p.-v., cap. of Clay co., Dakota Ter., on Missouri River at the mouth of the Vermilion River, about 35 miles N. W. of Sioux City, Ia., and 30 miles S. E. of Yankton, the capital of Dakota Territory. The Dakota Southern R. R. passes through Vermilion, making the town a ready market for farm-produce. Large quantities of wheat are shipped annually from this town by rail and by water. The Vermilion Valley and Northern Pacific R. R., which bids fair to be built at an early day, has been projected to connect Vermilion with the Northern Pacific R. R. by way of the valley of Vermilion River. The business portion of the town is built on the bottom-lands bordering Missouri and Vermilion rivers, and a portion of the residences have been built on a beautiful plateau of table-land overlooking the Missouri valley for miles. Good water is plenty. The first business-house was opened here in 1860, and Vermilion now contains 3 general merchandise houses, 2 hardware and tin stores, 3 drug stores, 2 meat-markets, 4 hotels, 2 churches, and 5 church societies, 2 clothing-houses, 1 steam flouring-mill, 1 steam saw-mill, 1 jeweller, 1 harness-shop, 4 blacksmith-shops, 2 wagon and repair shops, 1 photograph-gallery, 1 bakery, restaurant, news dépôt and fruit-store, 2 billiard-halls, 4 saloons, 2 schools, and a proportionate number of physicians, lawyers, tax-paying and insurance agents, etc. P. about 700.

Wm. L. H. Owens, Ed. "Clay Co. Register."

**Vermilion,** p.-v., Edgar co., Ill.

**Vermilion,** tp., La Salle co., Ill. P. 671.

**Vermilion,** p.-v. and tp., Dakota co., Minn. P. 652.

**Vermilion,** tp., Ashland co., O. P. 2087.

**Vermilion,** p.-v. and tp., Erie co., O. P. of v. 721; of tp. 1833.

**Vermilion River,** in Illinois and Indiana, is formed by three forks, the N., Middle, and S., which unite in Vermilion co., Ill. The river flows S. E., and joins the Wabash in Eugene tp., Vermillion co., Ind. It is navigable to Danville, Ill., for 30 miles, or almost its entire course.

**Vermilion River,** in Louisiana, rises in the vicinity of Opelousas, and flows S. into Vermilion Bay. It is navigable for 80 miles for steamboats, and traverses a fertile region.

**Vermil'ionville,** p.-v., cap. of Lafayette parish, La., junction of New Orleans and Texas and New Orleans and Shreveport R. Rs., contains 3 churches, a Roman Catholic convent, 4 schools (1 colored), Masonic hall, 1 newspaper, 1 carriage manufactory, and 3 hotels. Principal business, farming. P. 777.

W. B. Bailey, Ed. "Lafayette Advertiser."

**Vermillion,** county of W. Indiana, bordering on Illinois, bounded E. by the Wabash, intersected by Vermilion River, and traversed by Evansville Terre Haute and Chicago R. R.; surface generally level, much of it consisting of prairies; soil extremely fertile. Iron ore and bituminous coal abound. There are flour-mills, saw-mills, and woollen-mills. Live-stock is numerous. Staples, Indian corn, oats, wheat, potatoes, wool, hay, and dairy products. Cap. Newport. Area, 290 sq. m. P. 10,840.

**Vermillion,** parish of S. W. Louisiana, bordering on the Gulf of Mexico and intersected by Vermilion River, which is navigable by steamboats; surface level and often marshy. There are manufactures of carriages and of sugar and molasses. Cattle and horses are numerous. Staples, sugar, Indian corn, and rice. Cap. Abbeville. Area, about 1400 sq. m. P. 4528.

**Vermillion,** tp., Vermillion co., Ind. P. 2133.

**Vermilye** (Robert George), D. D., b. in New York City Mar. 3, 1813, of Huguenot ancestry; graduated at Columbia College 1831; was for several years a classical teacher in the college grammar school; was appointed adjunct professor (with Dr. Charles Anthon) of the Greek and Latin languages in Columbia College Dec., 1837; pursued meanwhile the study of theology; was licensed by the presbytery of New York Apr. 19, 1838; preached in the Duane street church 1838–39; was pastor of a Presbyterian church at German Valley, N. J., 1843–46, and of the Congregational church at Clinton, N. Y., 1846–57, taking an active interest in Hamilton College, located in that village; was a member of its board of trustees 1850–57, and in the latter year succeeded Dr. Bennet Tyler as professor of theology in the East Windsor Theological Institute; afterward removed to Hartford, Conn., and retained that position through life, supplying the pulpit at Newington, Conn., for several years. D. at Lyme, Conn., July 5, 1875. He published several sermons and addresses, and left in MS. his courses of theological lectures, as yet unpublished.

**Vermilye** (Thomas Edward), D. D., LL.D., brother of Robert George, b. in New York City Feb. 28, 1803; educated at Yale College, and studied theology at Princeton Seminary under Drs. Miller and Alexander, but did not graduate at either institution; was licensed and ordained by the presbytery of New York City; was for some years pastor of the Presbyterian church in Vandewater street, New York City, of the Congregational church at West Springfield, Mass., 1829–34, of a Reformed Dutch church at Albany, N. Y., 1834–39, and has been since 1839 pastor of the Collegiate Reformed church, New York City, having for

some years had a junior colleague in that post. He received the degrees of A. M. from Yale and Union, of D. D. from Rutgers and Union, and of LL.D. from Lafayette and Columbia colleges, the latter being in 1875. Author of a number of published sermons and discourses, including addresses before the St. Nicholas Society of New York and at the opening of the Roosevelt Hospital, a memorial discourse upon the life and services of Rev. Dr. De Witt before the New York Historical Society, and a bi-centennial discourse in commemoration of the organization of the town of West Springfield, Mar. 25, 1874.

**Vermont′,** one of the Eastern or New England States of the American Union, but not one of the original thirteen, is situated wholly inland, is of trapezoidal form, and is between the parallels of 42° 44′ and 45° N. lat., and the meridians of 71° 30′ and 73° 26′ W. lon. from Greenwich. It is bounded N. by the province of Quebec, Dominion of Canada; E. by New Hampshire, from which it is separated throughout its whole eastern line by the Connecticut River; S. by Massachusetts; and W. by New




The Seal of Vermont.

York, the line of division running through Lake Champlain, of which nearly two-thirds belong to Vermont, for about three-fifths of the distance. Its area, including the water-surface of Lake Champlain belonging to it, is 10,212 sq. m., or 6,535,680 acres. Its length from N. to S. is 157½ miles, its greatest breadth 85 miles, and its least 35 miles.

*Face of the Country.*—The Green Mountain range is continuous throughout the State, but above the 44th parallel it divides into two chains, one maintaining the same direction (N. by E.) with the lower portion, and extending into Canada; the other, turning N. E., extends to the New Hampshire line, and finally loses itself in the Canadian highlands on the western border of Maine. This last range, beginning at Killington Peak, forms the watershed between the affluents of the upper Connecticut and the streams flowing northward or westward into Lake Champlain, and the lower portion fulfils a similar office between the waters flowing into the Hudson and those tributary to the Connecticut. The Green Mountains are not granitic, at least in the surface-rocks, and their rounded, grassy summits afford a marked contrast to the sharp, cold, and bare summits of the White Mountains in the adjacent State. None of the summits attain the height of some of the White Mountains, and there is a considerable diversity of statement in regard to the actual height of the principal summits. Prof. Guyot gives the following figures in regard to the higher summits: Mount Mansfield, three summits, the "Chin" and "Nose," 4430 and 4094 feet; the "Forehead" or South Peak, 3934 feet; Killington Peak, 4221 feet; Killington Dome (Pico), 3954 feet; Camel's Hump, 4088 feet; Equinox Mountain, 3872 feet; Shrewsbury Peak, 3845 feet; Green Peak of Eolus Mountain, 3148 feet; Lincoln Mountain, 4078 feet; Mount Sterling, 3700 feet; Hogback Mountain, 3648 feet; Jay Peak, 4018 feet; Bald Mountain, 3124 feet. Mount Ascutney is a detached mountain 3320 feet high, and commands a noble landscape. The eastern part of the State is drained by the Connecticut River and its numerous affluents; the northern portion sends some small streams to Lake Memphremagog, but the principal rivers of the western part of the State, the Missisquoi, Lamoille, Winooski or Onion River, and Otter Creek, with their tributaries, are feeders of Lake Champlain, while Hubbardton Creek and Poultney River fall into the southern arm or extension of the lake. The Hoosac, Battenkill, and other small tributaries of the Hudson drain the S. W. corner of the State. There are numerous beautiful waterfalls in the Connecticut, Winooski, Lamoille, Clyde, Missisquoi, Passumpsic, and other rivers, and many interesting caves, natural bridges, etc.

*Lakes.*—Besides Lake Champlain, which forms so large a part of the western boundary of the State, and Lake Memphremagog, which is partly in Vermont and partly in Canada, there are nearly 100 smaller lakes or ponds, some of them of considerable size and great beauty, in the State. The principal are Willoughby, Seymour, Maidstone, Great Trout Pond, Dummer, Bombazine, and Austin.

*Islands.*—There are several large islands in Lake Champlain belonging to Vermont, and one county (Grand Isle) is composed wholly of these islands.

*Geology and Mineralogy.*—The Green Mountain range is usually considered as belonging to the Eozoic period, and its rocks are undoubtedly metamorphic, consisting largely of gneiss, but it is still a question whether they are Lower Silurian or Eozoic. On the E. side of the mountains the groups of the Silurian age are found, and, as the Connecticut River is approached, they give place to Devonian limestones, and these to strata of slate of excellent quality, which form a continuous bed along the river-bank, except at Bellows Falls, where there is an outcrop of granite. On the W. side of the mountains the Silurian system prevails, the sandstones belonging to the old red sandstone formations, though there is a difference of opinion as to their precise age. There are also some beds of crystalline limestone, called Eolian limestone, overlying the sandstones. Slates are found along Lake Champlain, which are regarded as Silurian. The whole State is overspread by the Drift formation, and in the river-valleys there are occasionally alluvial deposits of no great extent. The State is rich in minerals. Gold has been found, but not in veins which would repay the working. There are pyritous copper ores of considerable value. Lead ores, more or less argentiferous, occur at several localities; iron, in the form of chromic ores, hæmatite, magnetite, and bog ores, is found in almost every part of the State. Granite suitable for building purposes, black, white, and variegated marbles of excellent quality and great beauty, abound. Slates, both writing and roofing, as well as those used for mantels, bathing-tubs, etc., are quarried in great abundance. Porcelain clay or kaolin, steatite, fire-clay, talc, manganese, and limestone for burning are also among the mineral products of the State.

*Soil and Vegetation.*—The meadow and arable lands of the State are generally fertile, and, being largely underlaid with a disintegrating limestone, yield good crops to the careful tiller; the mountain-slopes, where not covered with timber, furnish rich and nutritious pasturage to the horses, cattle, and sheep, which are kept in large numbers and furnish a considerable share of the wealth of the State. The forest trees are the evergreens—hemlock, fir, and spruce, and some pine on the mountains; oak, hickory, beech, birch, elm, sugar, rock, and red maple, butternut, basswood, tulip tree, etc., on the lower slopes of the hills; and cedar and juniper in the swamps. The sugar maple is the most abundant of the forest trees of the State, and from its sap a larger quantity of maple sugar and syrup is made than in any other State in the Union. Four-fifths of the land in the State are in farms, and nearly three-fourths of this are under cultivation.

*Zoology.*—Of the larger wild animals in the State the number is diminishing. The moose, once abundant here, is now only found rarely around Lake Memphremagog. The elk is also rare; the black bear, panther, wild-cat, lynx, wolf, fox, and raccoon are still seen in considerable numbers, and deer are moderately plentiful. The smaller game, rabbits, squirrels, etc., are abundant. In the vicinity of Lakes Champlain and Memphremagog great numbers of aquatic birds make their appearance early in the season. The birds of prey and song-birds are those common to New England. Lake Champlain is remarkable for its excellent varieties of fish. The muscalonge is the largest and most highly prized, but its lake-trout, lake whitefish, pickerel, roach, and perch are abundant and of excellent quality. Among its reptiles is the proteus, which is not known to exist in any other waters so far N. The serpent tribe has only the species, either venomous or harmless, common to New England.

*Climate.*—The climate of Vermont is, in general, marked by wide extremes; the winters are cold and long, the summers short and, for a few days at a time, hot; but there are few more healthful climates in the U. S. The isothermal of 44° annual mean temperature intersects the State almost diagonally, entering from the N. W. corner and dipping down to near the central portion of the State on the E. In the N. E. the mean annual temperature is 40°; in the S. W. and S. it is about 46°. The following table gives meteorological data at three points in the State, representing the variations of temperature and rainfall:

| Places. | Mean annual temp. | Maximum temp. | Minimum temp. | Range. | Mean temp. of spring. | Max. temp. of spring. | Min. temp. of spring. | Range of spring temp. | Mean temp. of summer. | Max. temp. of summer. | Min. temp. of summer. | Range of summer temp. | Mean temp. of autumn. | Max. temp. of autumn. | Min. temp. of autumn. | Range of autumn temp. | Mean temp. of winter. | Max. temp. of winter. | Min. temp. of winter. | Range of winter temp. | Annual rainfall. | Rainfall of spring. | Rainfall of summer. | Rainfall of autumn. | Rainfall of winter. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | in. | in. | in. | in. | in. |
| Burlington, lat. 44° 29′, lon. 73° 15′; elevation, 223 feet. | 43.6 | 89 | −20.5 | 109.5 | 38.8 | 86 | 1 | 85 | 67.1 | 89 | 43 | 46 | 45.8 | 80 | 1 | 79 | 22.7 | 56 | −20.5 | 76.5 | 37.75 | 8.74 | 12.07 | 11.67 | 5.27 |
| Montpelier, lat. 44° 17′, lon. 72° 36′; elevation, 524 feet. | 42.1 | 84 | −8.5 | 92.5 | 41.6 | 85 | 2 | 83 | 60.6 | 84 | 41 | 43 | 45.2 | 74 | 3 | 71 | 23 | 54 | −8.5 | 62.5 | 41.05 | 9.21 | 13.72 | 11.80 | 6.32 |
| Woodstock, lat. 43° 38′, lon. 72° 30′; elevation, 400 feet. | 40.7 | 85 | −21 | 106 | 36.6 | 85 | −27 | 112 | 62.2 | 85 | 40 | 45 | 43.7 | 80 | 7 | 73 | 20.3 | 44 | −21 | 65 | 47.02 | 10.75 | 10.70 | 18.63 | 6.94 |

The average highest temperature of the State in 1869 was 91°, as the result of observations at eight stations; the average minimum, —29°; the average range, 120°; the average mean temperature, 42.9°; the average annual rainfall, 48.60 inches, the greatest amount falling in October.

*Agricultural Productions.* — In 1870, Vermont had 4,528,804 acres of land in farms, and of these 3,073,257 were under cultivation; the average size of the farms was 134 acres. The estimated value of the farms was $139,367,075; of farming implements and machinery, $5,250,279; the value of all farm products was $34,647,027; of animals slaughtered and sold for slaughter, $4,320,619; of home manufactures, $181,268; of forest products, $1,238,929; of market-garden products, $42,225; of orchard products, $682,241; of wages paid, $4,155,385. The number of bushels of wheat raised was 454,703; of rye, 73,346; of Indian corn, 1,699,882; of oats, 3,602,430; of barley, 117,333; of buckwheat, 415,096; of pounds of flax, 12,899; of pounds of wool, 3,102,137; of tons of hay, 1,020,669; of pounds of hops, 527,927; of pounds of tobacco, 72,671; of pounds of maple-sugar, 8,894,302; of gallons of maple-syrup, 12,023; of bushels of Irish potatoes, 5,157,428; of bushels of peas and beans, 95,242; of pounds of honey, 142,932, and 5235 pounds of wax; of domestic wine, 1038 gallons. The value of all live-stock in the State in 1870 was $23,888,835; it consisted of 69,015 horses, 252 mules and asses, 190,285 milch cows, 38,475 working oxen, and 117,741 other cattle, 580,347 sheep, and 46,345 swine. We have the later statistics of some of these items. The agricultural department in its report for the year 1874 estimates the crops of that year as follows: Indian corn, 1,660,000 bushels; wheat, 418,000; rye, 61,000; oats, 4,151,000; barley, 112,000; buckwheat, 372,000; potatoes, 4,782,000; tobacco, 105,000 pounds; hay, 973,500 tons. The value of these crops was estimated at $18,803,710. The estimate of the number and value of live-stock in Jan., 1875, was as follows: horses, 72,400; milch cows, 201,500; oxen and other cattle, 130,500; sheep, 516,400; swine, 52,400. The value of live-stock was estimated at $20,660,594. It is hardly necessary to say that the agricultural department almost invariably under-estimates both the crops and live-stock of the States.

*Manufactures.*—Vermont is essentially an agricultural State, and is far behind the other New England States in the amount of her manufactures, ranking in the census of 1870 as the twenty-first State in the Union in this respect. In 1870 there were reported 3270 manufacturing establishments, driven by engines or water-wheels of 51,322 horse-power, employing 18,686 hands (16,301 men, 1872 women, and 513 children), having a capital of $20,329,637, paying $6,264,581 wages, using $17,007,769 of raw material, and producing in 1869–70 goods and wares valued at $32,184,606. The largest manufacturing interest was lumber, of which, planed and sawed and manufactured as sash, doors, and blinds, the annual product in 403 mills was $6,186,660; of woollen goods, in 43 establishments, the value was $3,550,962; of flouring-mill products, in 81 mills, $2,571,594; of leather, tanned and curried, in 150 tanneries, $2,012,513; of scales and balances, in 2 factories, $1,629,000; of marble and stonework, in 29 establishments, $960,984; of machinery, in 37 shops, $756,080; of furniture, including chairs, in 80 factories, $895,606; of carriages and sleds, in 169 factories, $839,029; of hosiery, in 7 establishments, $551,129; of boots and shoes, in 20 shops, $547,789; of cotton goods, in 8 mills, $546,510; of agricultural implements, in 45 factories, $523,669; of tin, copper, and sheet-iron ware, in 97 shops, $505,005; 2 car-shops turn out $452,470 of cars; 28 cheese-factories make cheese to the value of $445,323; 26 iron-foundries make iron castings worth $491,520; 63 clothing-factories, $410,842 of clothing; 2 organ-factories make $348,999 of musical instruments and materials; and 123 saddlery and harness shops turn out $286,071 of goods.

*Railroads.*—In 1875, Vermont had 939.7 miles of railroad, costing for road equipment, etc., $45,108,722. Most of these roads are trunk-roads, forming parts of the route between Quebec, Montreal, and New York, or connecting with the Grand Trunk, the Boston, Portland, or White Mountain routes. The principal are the Connecticut and Passumpsic Rivers, 123.5 miles in the State; the Rutland R. R., 120 miles; the Vermont Central Railway, 193 miles, and its Rutland and western divisions, which together have about 263 miles more; the Rensselaer and Saratoga, 33 miles, and a portion of the Troy and Boston; the Harlem Extension, having about 61 miles in the State; the Montpelier and Wells River R. R., 38 miles; portions of the New London Northern, of which 21 miles are in the State, and of the South-eastern, which has 31 miles of its route in Vermont, and a number of short connecting routes.

*Finances.*—The sessions of the legislature being biennial, our latest financial statement is that presented to the legislature in Oct., 1876, for the year ending Aug. 1, 1875. The receipts of that year, including balance, were $830,606.93, and the payments, including instalments on the funded debt, $510,230.09, leaving a balance of $320,376.84 to be divided between the sinking fund and the general treasury surplus. The entire debt of the State at that date was $328,584.26, including the agricultural college fund, $135,500, not due till 1890, so that the surplus was very nearly sufficient to pay off the whole indebtedness of the State.

*Commerce.*—Vermont has but one customs district, known as Vermont. The foreign commerce of the State is mostly conducted through Lake Champlain and Richelieu and St. John's rivers, and Burlington is her principal port of entry, though officers of customs are stationed at Alburgh and other points along the northern border, and there is a considerable amount of smuggling. In the year ending June 30, 1875, the amount of imports in the Vermont district was $6,911,691, and of domestic exports $2,496,830; there were no foreign exports. The same year there were 89 American and 639 foreign vessels which entered the district; their aggregate tonnage was 97,798 tons, and the aggregate number of the crews, 3156; 59 American and 631 foreign vessels cleared the same year, having an aggregate tonnage of 95,120 tons, and crews numbering 3062 men. The number of registered, enrolled, and licensed vessels in the district was 23, and their tonnage 4630.71 tons.

*Banks and Savings Banks.*—There were in Nov., 1875, 46 national banks in operation in Vermont, having a capital of $8,618,700, with $7,755,000 bonds on deposit, and an outstanding circulation of $6,898,440. There were 4 or 5 private banking-houses. There were June 30, 1875, 20 savings banks in the State, with 27,677 depositors and aggregate deposits amounting to $7,590,599.

*Insurance.*—There were in Nov., 1875, 7 fire insurance companies, all mutual, 3 of which had aggregate assets of $5,881,170.20, and 3 life insurance companies (1 joint-stock and 2 mutual), 1 of which had assets to the amount of $1,732,769.

*Education.*—Public school education has received much attention in Vermont, and the condition of the schools, though not all that could be desired, is yet in advance of that in many of the States. In 1874 the legislature abolished its board of education, the secretary of which had been the executive school-officer, and established the office of superintendent of instruction, which it filled by the appointment of the principal of one of its normal schools. The following statistics show the condition of its public schools in 1876: Number of organized school districts, 2371, of fractional districts, 206; of common schools, 2519; average number of weeks of school in the year, 24.18; number of school population (5 to 20 years), 92,577; number enrolled, 72,093; number attending other schools, 6175; total average daily attendance, 39,474; average monthly salary of male teachers, $40.34, of female teachers, $24.35. *Receipts.*—From public money divided to schools, $107,031.95; tax on grand list of districts, $373,126.12; from other sources, $84,886.50; total, $565,044.57. *Expenditures.*—For sites of buildings and furniture, $89,788.55; for salaries of superintendents and teachers, $437,471.27; for miscellaneous or contingent expenses, $127,573.30; total, $565,044.57. Amount of school fund, $669,086.79.

There are 3 normal schools—at Randolph, Johnson, and Castleton. The total number of students who had graduated from these schools to 1876 was 683, of whom 610 were in the first course and 73 in the second. The whole number who had been connected with these schools was over 2000. The effort has recently been made to consolidate the three normal schools into one, and to use the very meagre appropriation of the State in supporting more generously the single school. Teachers' institutes are held twice a year in each county; about 1000 teachers attend them. There are 26 incorporated academies and seminaries, and 61 other schools of high grade, not connected with the public-school system. Between 7000 and 8000 pupils attend these schools, and nearly 300 teachers are employed in them. The following are the statistics of the institutions for higher instruction in 1874–75:

*Universities, Colleges, and Professional Schools.*

| Universities, Colleges, and Professional Schools. | Location. | When organized. | Under what control. | Professors and instructors. | Students. | | | | Value of buildings, grounds, and apparatus. | Amount of productive endowment. | Income from productive endowment. | Income from all sources. | Amount of scholarship funds. | No. of volumes in library. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Preparatory. | Collegiate. | Male. | Female. | | | | | | |
| *Colleges, etc.* | | | | | | | | | $ | $ | $ | $ | $ | |
| Middlebury College | Middlebury | 1795 | Congregational | 11 | .. | 52 | 52 | ... | 100,000 | 180,000 | 12,000 | 13,000 | 45,000 | 12,000 |
| Norwich University | Northfield | 1834 | Prot. Episcopal | 8 | 42 | 22 | 64 | ... | 20,000 | ..... | ..... | ..... | ..... | 3,700 |
| University of Vermont | Burlington | 1791 | State and Trustees | 9 | .. | 91 | 78 | 13 | 242,300 | 172,672 | 15,636 | 19,343 | 10,472 | 16,174 |
| Vermont Female College | Montpelier | 1869 | Methodist Episcopal | 11 | 52 | 200 | .. | 252 | 100,000 | ..... | ..... | 4,000 | ..... | 500 |
| *School of Science.* | | | | | | | | | | | | | | |
| State Agricultural College and State Univ. | Burlington | 1865 | State | 7 | .. | 37 | 32 | 5 | | | | | | |
| *School of Theology.* | | | | | | | | | | | | | | |
| Vermont Episcopal Institute | Burlington | 1860 | Prot. Episcopal | 7 | 38 | 12 | 50 | ... | 35,000 | ..... | ..... | 12,000 | ..... | 3,640 |
| *School of Medicine.* | | | | | | | | | | | | | | |
| Medical College of University of Vermont | Burlington | 1809 | Trustees | 10 | .. | 51 | 51 | ... | 12,000 | ..... | ..... | 3,500 | | |

*Special Education.*—Vermont provides for her indigent deaf mutes at the American Asylum at Hartford, Conn., and at the Clarke Institution at Northampton, Mass.; for the blind, at the Perkins Institution and Massachusetts Asylum for the Blind in South Boston, and for the feeble-minded and idiotic, to a limited extent at South Boston, Mass., and Lakeville, Conn.

*Population.*—The statistics are as follows:

*Population.*

| Year of census. | Total population. | Males. | Females. | White. | Colored. | Natives. | Foreigners. | Density. | Ratio of increase. | No. of families. | No. to a family. | No. of dwellings. | Persons to a dwelling. | Illiterate. | Of school age, 5 to 20 years. | Of military age, 18 to 45, males. | Of voting age, 21 years and upward, males. | Citizens, males. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1790 | 85,425 | 44,896 | 40,529 | 85,154 | 271 | ..... | ..... | 8.36 | | | | | | | | | | |
| 1800 | 154,465 | 79,628 | 74,837 | 153,908 | 557 | ..... | ..... | 15.12 | 80.84 | | | | | | | | | |
| 1810 | 217,895 | 109,981 | 107,732 | 217,145 | 750 | ..... | ..... | 21.33 | 40.95 | | | | | | | | | |
| 1820 | 235,981 | 117,755 | 118,009 | 235,063 | 903 | ..... | ..... | 23.10 | 8.29 | | | | | | | | | |
| 1830 | 280,652 | 140,422 | 140,230 | 279,771 | 881 | ..... | ..... | 27.48 | 19.04 | | | | | | | | | |
| 1840 | 291,948 | 146,742 | 145,206 | 291,218 | 730 | ..... | ..... | 28.59 | 4.02 | | | | | | | | | |
| 1850 | 314,120 | 160,033 | 154,087 | 313,402 | 718 | 280,055 | 33,715 | 30.76 | 7.59 | 58,573 | 5.36 | 56,421 | 5.57 | ‡6,240 | 108,647 | 62,735 | 83,289 | 68,104 |
| 1860 | 315,098 | 158,786 | 156,312 | 314,369 | *709 | 282,355 | 32,743 | 30.86 | 0.32 | 63,781 | 4.94 | 62,977 | 5.00 | ‡8,916 | 102,881 | 60,002 | 75,077 | 63,801 |
| 1870 | 330,551 | 165,721 | 164,830 | 329,613 | †924 | 283,396 | 47,155 | 32.37 | 4.90 | 70,462 | 4.69 | 66,145 | 5.00 | 17,706 | 103,107 | 62,459 | 90,806 | 74,867 |

*Charitable and Corrective Institutions.*—The Vermont asylum for the insane is at Brattleboro'. It was founded in 1834, and has an average of 473 patients; in 1874, 19 were discharged restored, 37 improved, 18 not improved; 26 died. The Providence orphan asylum and hospital at Burlington is a well-endowed institution, under the care of the Roman Catholic Sisters of Providence; it has 75 orphans. The Vermont reform school at Waterbury, founded in 1865, is a State institution. It had in 1874, 145 boys; 427 had been committed since its organization. It had a library of 300 vols. Its annual expenses were $21,843, of which the boys earned $9444. In Dec., 1874, its buildings were totally destroyed by fire. The legislature in Jan., 1875, appropriated money for its rebuilding, but removed the school to Vergennes. Girls are also to be committed hereafter to the school. The State prison is at Windsor. It was established in 1807. In July, 1874, it had 85 prisoners. Receipts from convict labor, $28,331; expenses, $25,080.90.

*Newspapers.*—Vermont had in 1870, 47 newspapers, having an aggregate circulation of 71,390 and an annual issue of 4,055,300 copies. Of these, 3 were dailies, with 3190 circulation; 43 weeklies, with 56,200 circulation; and 1 monthly, with 250 circulation. In 1876 the whole number had increased to 55, of which 7 were dailies, 1 semi-weekly, 42 weeklies, 1 semi-monthly, and 4 monthlies.

*Churches.*

| Denominations. | Church organizations, 1870. | Church edifices, 1870. | Sittings, 1870. | Church property, 1870. | Church organizations, 1875. | Church edifices, 1875. | Clergymen or ministers, 1875. | Communicants, 1875. | Adherent population, 1875. | Church property, 1875. |
|---|---|---|---|---|---|---|---|---|---|---|
| All denominations | 699 | 744 | 270,614 | $3,713,530 | 746 | 825 | 644 | 54,289 | 303,250 | $4,162,400 |
| Baptists (regular) | 115 | 114 | 37,935 | 462,200 | 112 | 114 | 87 | 8,250 | 41,000 | 490,000 |
| Free-Will Baptists, etc | 16 | 16 | 5,310 | 44,500 | 18 | 18 | 14 | 1,200 | 6,000 | 50,000 |
| Christian Connection | 14 | 14 | 4,350 | 31,200 | 14 | 14 | 12 | 840 | 4,100 | 33,000 |
| Congregationalists | 183 | 183 | 75,925 | 1,054,400 | 201 | 203 | 98 | 18,347 | 92,500 | 1,118,500 |
| Protestant Episcopalians | 33 | 34 | 11,223 | 348,100 | 40 | 36 | 31 | 2,846 | 15,400 | 390,000 |
| Friends | 5 | 5 | 1,280 | 6,100 | 5 | 5 | ..... | 410 | 2,000 | 7,500 |
| Methodists | 180 | 184 | 60,325 | 884,530 | 216 | 221 | 198 | 18,096 | 89,000 | 1,073,000 |
| Presbyterians (regular) | 7 | 7 | 2,706 | 20,200 | 7 | 7 | 7 | 350 | 1,750 | 21,500 |
| Presbyterians (other) | 2 | 2 | 650 | 5,000 | 2 | 2 | 2 | 100 | 500 | 6,400 |
| Roman Catholics | 40 | 40 | 25,000 | 401,500 | 61 | 57 | 29 | ..... | 34,000 | 503,500 |
| Second Adventists | 15 | 15 | 4,450 | 39,000 | 17 | 18 | 12 | 850 | 4,000 | 42,000 |
| Spiritualists | 1 | 1 | 300 | 2,500 | 1 | 1 | ..... | ..... | 300 | 2,800 |
| Unitarians | 4 | 4 | 1,900 | 53,000 | 4 | 4 | 4 | 360 | 1,500 | 55,000 |
| Universalists | 60 | 60 | 19,710 | 220,000 | 28 | 60 | 32 | 1,440 | 7,200 | 225,000 |
| Union | 24 | 65 | 19,550 | 141,300 | 20 | 65 | 18 | 1,000 | 4,000 | 145,000 |

*Constitution, Courts, Representatives in Congress.*—The constitution of the State provides for the meeting once in seven years of a council of censors, who propose, if they see fit, changes to the constitution, which are acted upon subsequently by a convention called by them. The first of these councils met in 1785, the thirteenth in 1869, and the fourteenth was to meet the present year (1876). By the last revision of the constitution it was prescribed that every man of twenty-one years of age, a native of any of the States of the Union or naturalized, who has resided in the State for one year next before an election, and who will take the prescribed freeman's oath, is entitled to the privileges of a freeman. The supreme executive of the State is the governor, or in his absence the lieutenant-governor. Both are chosen by ballot for two years, and must have resided in the State for four years next previous to their election. The treasurer is elected in the same way and for the same time. The secretary of state, auditor, superintendent of public instruction, and other State officers are elected by the legislature in joint ballot. The legislature consists of a senate of 30 members and a house of representatives

*Also 20 Indians. †Also 14 Indians.

‡The illiterate of 1850 and 1860 were persons 20 years old and over; of 1870, persons of 10 years and over.

of 241 members, both elected for two years. The legislature is styled "The General Assembly of the State of Vermont." The legislature holds biennial sessions. The judiciary of the State consists of a supreme court of 7 judges, having original jurisdiction, but being also a court of errors; of a chancery court, which the supreme court judges also hold; of a county court in each county, presided over by one of the supreme court judges and the two county judges, having original jurisdiction in divorce cases, in all civil actions for over $200, and in relation to real estate; of justices' courts in the several towns, and of probate courts in each probate district. The State under the apportionment of 1872 is entitled to 3 Representatives in Congress.

*Counties* (14).

| Counties. | Total pop., 1870. | Males, 1870. | Females, 1870. | Total pop., 1860. | True valuation, 1870. | Assessed valuation, 1870.* |
|---|---|---|---|---|---|---|
| Addison..... | 23,484 | 11,668 | 11,616 | 24,010 | $18,649,575 | $8,133,537 |
| Bennington.. | 21,325 | 10,678 | 10,647 | 19,436 | 13,927,385 | 5,732,586 |
| Caledonia.... | 22,235 | 11,283 | 10,952 | 21,698 | 18,092,569 | 7,397,995 |
| Chittenden... | 36,480 | 18,292 | 18,188 | 28,171 | 18,317,263 | 11,766,766 |
| Essex..... | 6,811 | 3,605 | 3,206 | 5,786 | 4,537,927 | 1,744,049 |
| Franklin..... | 30,291 | 15,160 | 15,131 | 27,231 | 14,913,887 | 8,680,912 |
| Grand Isle.... | 4,082 | 2,088 | 1,994 | 4,276 | 2,408,000 | 1,082,389 |
| Lamoille..... | 12,448 | 6,187 | 6,261 | 12,311 | 6,015,609 | 3,104,872 |
| Orange..... | 23,090 | 11,538 | 11,552 | 25,455 | 16,863,356 | 6,621,463 |
| Orleans..... | 21,035 | 10,724 | 10,311 | 18,981 | 12,570,640 | 5,421,080 |
| Rutland..... | 40,651 | 20,453 | 20,198 | 35,946 | 35,349,109 | 13,853,456 |
| Washington.. | 26,520 | 13,197 | 13,323 | 27,622 | 18,614,189 | 7,941,202 |
| Windham.... | 26,036 | 13,027 | 13,009 | 26,982 | 22,016,328 | 8,625,683 |
| Windsor..... | 36,063 | 17,821 | 18,242 | 37,193 | 33,073,716 | 12,442,518 |
| Total..... | 330,551 | 165,721 | 164,830 | 315,098 | $235,349,553 | $102,548,528 |

*Principal Towns.*—Montpelier, the capital, had 3023 inhabitants in 1870; Burlington, the largest town and only city, had 14,387 inhabitants; Rutland, the next largest town, 9834; St. Alban's, St. Johnsbury, and Brattleboro', between 4000 and 7500 each; Brandon, Colchester, Northfield, Middlebury, Woodstock, Poultney, Randolph, Swanton, Springfield, and Waterbury had between 2500 and 4000 each.

*History.*—Vermont was during the seventeenth century the battle-ground between the Algonkin tribes, and the New England tribes allied to them, and the Iroquois or Six Nations of New York. Champlain and his companions discovered it, and passed over the northern portion in 1609, but no attempt was made to effect a settlement within its present bounds till 1724, when Fort Dummer in the present town of Brattleboro' was erected by a party of settlers from Massachusetts, who supposed it to be within the bounds of that colony. In the French war of 1745 soldiers marched from this fort, and also from New Hampshire colony, against the French, who occupied points along Lake Champlain. The rich and fertile lands along Otter Creek, the Winooski and Lamoille rivers attracted the attention of these soldiers, who were farmers as well as soldiers, and after the French war of 1755–58 the emigrants began to come W. of the Connecticut River in large numbers. Gov. Wentworth of New Hampshire claimed that all this territory belonged to that colony, and between 1760 and 1768 granted 138 townships, reserving to himself, besides his fees, 500 acres of land in each township. It was only known at that time as the "New Hampshire grants." But about this time another claimant appeared, who was disposed to appropriate the title to the fee simple of these lands to his own benefit. This was the governor of the colony of New York, who made proclamation in Dec., 1763, that these lands belonged to New York under grants from Charles II. to the duke of York, and proceeded to order the sheriff to make returns of the names of all the settlers who had taken up lands W. of Connecticut River under titles from Gov. Wentworth. That magnate issued a counter-proclamation in Mar., 1764, maintaining his own jurisdiction. The matter went to England on an appeal to the king, and, Wentworth failing to put in an appearance, it was adjudged in favor of New York by default. But there was another party to the controversy. The settlers, under the leadership of Ethan Allen, were largely from Connecticut, and though they cared little personally for either claimant, they had paid Gov. Wentworth for the titles to their lands, and they had no intention of paying the New York governor for them a second time. They therefore resisted all attempts at ejection and dispossession, and flogged the New York officers with beechen rods without mercy. The controversy continued for ten years, and meantime the Revolutionary war came on, and the settlers in the "New Hampshire grants" took an active part in that struggle for liberty. In 1776 these settlers applied to the Continental Congress for admission into the Confederacy, but New York opposed, and they withdrew. In 1777 they formed a constitution and proclaimed themselves independent under the name of "New Connecticut," *alias* "Vermont." The British officers tried to intrigue with them, but they were true as steel to the cause of liberty. In 1781, Congress offered to admit them with smaller boundaries, giving a considerable tract to New York, but they refused and remained independent. In 1790, New York made new overtures for a settlement, and Vermont finally accepted them, paying New York $30,000 in satisfaction of all demands, and the State of Vermont was admitted into the Union in Mar., 1791. Vermont took an active part both in the Revolutionary war and the war of 1812; the capture of Ticonderoga, the battles near Bennington, and the actions on Lake Champlain in the former were all led by her sons; and in the latter they took an active part in the battle of Plattsburg and the naval action on Lake Champlain. In the Canadian troubles in 1837 and the Fenian raids since, the expeditions, though not of Vermont, started from her soil, and more than once during the late war rebel bands made a descent upon her northern towns from Canada. During the period from 1790 to 1840 her growth was rapid, but for the last thirty years her population has been almost stationary. During the late war her quota was always promptly filled, and her sons distinguished themselves in the field as well as in the national councils.

*Governors of Vermont.*

| | | | |
|---|---|---|---|
| Moses Robinson | 1789–90 | Carlos Coolidge | 1849–50 |
| Thomas Chittenden | 1790–97 | Charles K. Williams | 1850–52 |
| Isaac Tichenor | 1797–1807 | Erastus Fairbanks | 1852–53 |
| Israel Smith | 1807–08 | John S. Robinson | 1853–54 |
| Isaac Tichenor | 1808–09 | Stephen Royce | 1854–56 |
| Jonas Galusha | 1809–13 | Ryland Fletcher | 1856–58 |
| Martin Chittenden | 1813–15 | Hiland Hall | 1858–60 |
| Jonas Galusha | 1815–20 | Erastus Fairbanks | 1860–61 |
| Richard Skinner | 1820–23 | Frederick Holbrook | 1861–63 |
| Cornelius P. Van Ness | 1823–26 | John G. Smith | 1863–65 |
| Ezra Butler | 1826–28 | Paul Dillingham | 1865–67 |
| Samuel C. Crafts | 1828–31 | John B. Page | 1867–69 |
| William A. Palmer | 1831–35 | Peter T. Washburn | 1869–70 |
| Silas A. Jenison | 1835–41 | John W. Stewart | 1870–72 |
| Charles Paine | 1841–43 | Julius Converse | 1872–74 |
| John Mattocks | 1843–44 | Asahel Peck | 1874–76 |
| William Slade | 1844–46 | Horace Fairbanks | 1876– |
| Horace Eaton | 1846–49 | | |

*Electoral and Popular Votes for President and Vice-President.*

| Elect. year. | Candidates who received the electoral vote. | Elect. vote. | Elect. year. | Candidates who received the electoral vote. | Elect. vote. | Pop. vote. | Candidates of the opposition. | Pop. vote. | Third and fourth-party candidates. | Pop. vote. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1792 | George Washington P.... | 3 | 1824 | John Quincy Adams P.... | 7 | By legis. | Andrew Jackson P. | | Henry Clay P. | |
| | John Adams V.-P..... | | | John C. Calhoun V.-P.... | | | | | | |
| 1796 | John Adams P..... | 4 | 1828 | John Quincy Adams P.... | 7 | By legis. | Andrew Jackson P..... | | | |
| | Thomas Pinckney V.-P... | | | Richard Rush V.-P..... | | | John C. Calhoun V.-P... | | | |
| 1800 | John Adams P..... | 4 | 1832 | William Wirt P..... | 7 | By legis. | Andrew Jackson P..... | | Henry Clay P..... | |
| | C. C. Pinckney V.-P..... | | | Amos Ellmaker V.-P..... | | | Martin Van Buren V.-P.. | | John Sergeant V.-P..... | |
| 1804 | Thomas Jefferson P..... | 6 | 1836 | William H. Harrison P... | 7 | By legis. | Martin Van Buren P..... | | Daniel Webster P..... | |
| | George Clinton V.-P..... | | | Francis Granger V.-P.... | | | Richard M. Johnson V.-P. | | William Smith V.-P..... | |
| 1808 | James Madison P..... | 6 | 1840 | William H. Harrison P... | 7 | 32,440 | Martin Van Buren P..... | 18,009 | James G. Birney P..... | 319 |
| | John Langdon V.-P..... | | | John Tyler V.-P..... | | | Richard M. Johnson V.-P. | | Thomas Earle V.-P..... | |
| 1812 | James Madison P..... | 8 | 1844 | Henry Clay P..... | 6 | 26,770 | James K. Polk P..... | 18,041 | James G. Birney P..... | 3,954 |
| | Elbridge Gerry V.-P..... | | | T. Frelinghuysen V.-P.... | | | George M. Dallas V.-P... | | Thomas Morris V.-P..... | |
| 1816 | James Monroe P..... | 8 | 1848 | Zachary Taylor P..... | 6 | 23,122 | Lewis Cass P..... | 10,948 | Martin Van Buren P..... | 13,837 |
| | D. D. Tompkins V.-P..... | | | Millard Fillmore V.-P.... | | | William O. Butler V.-P.. | | C. Francis Adams V.-P.. | |
| 1820 | James Monroe P..... | 8 | 1852 | Winfield Scott P..... | 5 | 22,173 | Franklin Pierce P..... | 13,044 | John P. Hale P..... | 8,621 |
| | D. D. Tompkins V.-P..... | | | William A Graham V.-P.. | | | William R. King V.-P... | | George W. Julian V.-P... | |
| | | | 1856 | John C. Fremont P..... | 5 | 39,561 | James Buchanan P..... | 10,569 | Millard Fillmore P..... | 545 |
| | | | | William L. Dayton V.-P.. | | | J. C. Breckenridge V.-P.. | | A. J. Donelson V.-P..... | |
| | | | | | | | | | John Bell P..... | 1,969 |
| | | | 1860 | Abraham Lincoln P..... | 5 | 33,808 | Stephen A. Douglas P... | 6,849 | Edward Everett V.-P... | |
| | | | | Hannibal Hamlin V.-P... | | | H. V. Johnson V.-P..... | | John C. Breckenridge P. | 218 |
| | | | 1864 | Abraham Lincoln P..... | 5 | 42,419 | George B. McClellan P... | 13,321 | Joseph Lane V.-P..... | |
| | | | | Andrew Johnson V.-P.... | | | George H. Pendleton V.-P. | | | |
| | | | 1868 | Ulysses S. Grant P..... | 5 | 44,167 | Horatio Seymour P..... | 12,045 | | |
| | | | | Schuyler Colfax V.-P..... | | | Francis P. Blair, Jr., V.-P. | | | |
| | | | 1872 | Ulysses S. Grant P..... | 5 | 41,481 | Horace Greeley P..... | 10,927 | Charles O'Conor P..... | 593 |
| | | | | Henry Wilson V.-P..... | | | B. Gratz Brown V.-P.... | | | |
| | | | 1876 | Rutherford B. Hayes P.... | 5 | 44,092 | Samuel J. Tilden P..... | 20,254 | | |
| | | | | William A. Wheeler V.-P.. | | | Thos. A. Hendricks V.-P. | | | |

* In 1875 the assessed valuation was $99,493,526.

(The writer acknowledges his obligations to H. A. Huse, State librarian of Vermont, at Montpelier, for valuable documents.) L. P. Brockett.

**Vermont,** p.-v. and tp., Fulton co., Ill., has a private bank. P. 2289.

**Vermont,** tp., Dane co., Wis. P. 1244.

**Vermont, University of.** See Burlington, Vt.

**Vermont'ville,** p.-v. and tp., Eaton co., Mich., has a private bank. P. of v. 544; of tp. 1801.

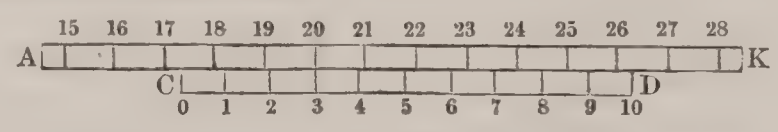
**Vermuy'den** (Sir Cornelius), b. in Zeeland, Holland, about 1590; was employed as an engineer in his native country in raising embankments against the sea; was invited to England 1621 to repair a breach in the embankment of the Thames at Dagenham; was engaged by James I. to drain Windsor Park; contracted with Charles I. to reclaim Hatfield Chase, an arduous task, which he successfully executed within three years, notwithstanding great opposition, employing a great number of Dutch, Flemish, and French laborers; was knighted Jan., 1629; contracted with the earl of Bedford and other great land-owners for draining the vast fens known as the "Bedford Level" 1630; was harassed by the opposition of the Fen-men, who did not like losing their commons, fish, and wild-fowl; failed in his first attempt, and also in the second, commenced in 1634, Oliver Cromwell, then a country squire, taking the lead in the local agitations against the project, which was interrupted for many years by the great rebellion; published *A Discourse touching the Drayning of the great Fennes lying within the severall Counties of Lincolne, Northampton, etc.* (London, 1642); served as a colonel in the Parliamentary forces; was a third time entrusted with the great drainage works 1649, and completed them 1653, when a solemn service in honor of the event was celebrated in Ely cathedral, Hugh Peters, the chaplain of Cromwell, preaching the sermon. Vermuyden was allotted considerable tracts of the reclaimed lands as his compensation, but his contract proved onerous, and he was obliged to sell his lands to pay his workmen. He applied to Parliament for redress in 1656, but seems not to have obtained any, and is supposed to have gone abroad and d. in obscurity, as no further data of his life are known. (See Donaldson's *Agricultural Biography*, 1854.) Porter C. Bliss.

**Vernal Grass.** See Anthoxanthum.

**Verne** (Jules), b. at Nantes, department of Seine-Inférieure, France, Feb. 8, 1828; studied law in Paris, and made his début in literature in 1850 with a comedy in verse, *Les Pailles rompues*, which was performed at the Gymnase Theatre in Paris; wrote subsequently several other plays, and struck in 1863, with his *Cinq Semaines en Ballon*, a vein of literary production which he has since pursued with great success. His most popular work is the *Tour du Monde en 80 Jours* ("Around the World in Eighty Days"), which was dramatized in 1874, and brought on the stage at the Porte Saint-Martin Theatre in Paris. He also wrote *A Journey to the Centre of the Earth, Twenty Thousand Leagues under the Sea, From the Earth to the Moon, Dropped from the Clouds, The Mysterious Island*, and an illustrated geography of France, with Théophile Lavallée (1867–68).

**Vernet'** (Jean Émile Horace), generally called Horace Vernet, b. in Paris June 30, 1789, descended from a celebrated family of painters. His grandfather, Joseph Vernet (Claude Joseph), (b. at Avignon Aug. 14, 1714; d. in Paris in Dec., 1789), was considered the greatest marine-painter of the age, and fifteen large pictures by him, representing French seaports and painted after the order of Louis XVI., are found in the gallery of the Louvre. His father, Carle Vernet (Antoine Charles Horace), (b. in Bordeaux Aug. 14, 1758; d. in Paris Nov. 28, 1836), was a painter of battle-pieces, and his *The Battle of Marengo, The Morning of Austerlitz, The Emperor giving Orders to his Marshals, The Bombardment of Madrid, The Battle of Rivoli*, and *The Battle of Wagram*, became immensely popular. It was intended that Horace should go to Rome to study painting, but, too much occupied by all kinds of outdoor sport and the practical study of nature, he failed to obtain the prize and travelling stipend of the Academy; he became a conscript; served in the army as a soldier; married, and began to paint battle-pictures entirely according to his own ideas. In 1810 he exhibited *The Capture of a Redoubt;* in 1811, *The Dog of the Regiment* and *The Halt of French Soldiers;* in 1812, *The Taking of an Intrenched Camp*, for which the Academy gave him a medal. The impression which these pictures produced was most extraordinary. Instead of the conventional manner in which the members of the school of David used to imagine a battle, Vernet painted war-scenes and soldiers exactly as he had seen them himself; and instead of the cold elegance which with the old classicists keeps the whole in a solemn attitude, this young romanticist inspired everything with a stirring, fiery passion which never fails to communicate itself in some magic way to the spectator. The result was almost immediately a boundless enthusiasm. The Bourbons gave the young painter large orders, and he filled them. But he continued all the while to paint the hero of the nation, and through engravings and the newly-invented art of lithography these enthusiastic representations of the grand army and its exploits, *The Death of Poniatowski, The Bridge of Arcola, The Soldier of Waterloo*, etc., passed into the hands of the humblest Frenchmen, and produced their effect. In 1822 his pictures were refused admittance to the exhibition of the Academy on account of their Bonapartistic tendency, but Vernet opened a private exhibition, and multitudes which under ordinary circumstances never dreamt of looking at a picture crowded his *salon*, and went away electrified. Charles X. became actually afraid of the painter, and sent him in 1827 to Rome as director of the French school there. In 1831 he returned to Paris, but his relation to Louis Philippe was, or soon became, very friendly. With great adroitness the king succeeded in alluring the artist's imagination to another subject—not relating to the emperor of the French, but to the king of France—namely, the conquest of Algeria. Vernet resided in Algeria from 1833–35, and visited it again in 1837, 1845, 1853, and oftener. He continued to paint Napoleon —the battles of Jena, Friedland, Wagram, etc.—but from 1836 to his death he chiefly treated subjects of the Algerian campaigns—*The Capture of the Smala, The Battle of Isly, The Siege of Constantineh*, etc.—whereby he afterward became almost as troublesome to Napoleon III. as he formerly had been to the Bourbons. Besides battle-pieces, he painted a number of excellent pictures, half genre and half history, such as *Rebecca at the Well, The School of Raphael, The Lion-Hunt*, etc.; several portraits, among which were those of Napoleon I., of Louis Philippe, of Napoleon III., etc.; and gave a great number of illustrations. D. in Paris Jan. 17, 1863. (See Durande, *Joseph, Carle et Horace Vernet*, Paris, 1845.) Clemens Petersen.

**Ver'nier** [named from the inventor, *P. Vernier*], a contrivance for measuring a fractional part of one of the equal divisions of a graduated scale or arc. It consists of an auxiliary graduated scale, the divisions of which differ from those of the primary scale. The vernier scale is formed by taking a space equal to an exact number of parts of the primary scale, and dividing it into a number of equal parts, either greater by 1 or less by 1 than the number that it covers on the primary scale. The former is the method of division usually adopted, and for that reason we shall explain the vernier as thus divided:




Let A K be a scale of equal parts, and let each part represent 1 foot; let C D be a parallel scale, such that it is exactly equal to 9 parts of the primary scale; suppose C D to be divided into 10 equal parts; then will each part represent .9 of 1 foot. By means of these scales we can measure distances to within .1 of 1 foot. Suppose the 0 of the vernier in the first instance to coincide with the division 17 of the primary scale; then is the distance from the 0 of the scale to the 0 of the vernier exactly 17 feet. If we suppose the vernier to slide along the primary scale till the division 1 coincides with 18, the distance from the 0 of the scale to the 0 of the vernier will obviously be equal to 17.1; if it slides along till the division 2 coincides with 19, the distance between the 0 of the scale and the 0 of the vernier is 17.2; and so on. In the present position of the vernier the reading is 17.3. This is obvious, for the distance from the 0 to the divisions which coincide is 20, and the distance from the 0 of the vernier to the same division is three times .9, or 2.7; hence, the difference is 17.3.

The difference between one space on the limb and one space on the vernier is called the *least count;* this is always equal to one space on the limb divided by the number of spaces on the vernier. To read an instrument by means of a vernier, we have the following rule: Read the principal scale up to the last division preceding the vernier, and call the result *the reading on the limb;* then look along the vernier for the division that coincides most nearly with a space on the limb, and multiply the number of that division by the least count; this result is called the *reading on the vernier;* then will the sum of the two readings be the *true reading* of the instrument. W. G. Peck.

**Vernon',** town of France, department of Eure, on the Seine, has some cotton manufactures and trade in wine and grain. P. 7410.

**Ver'non,** parish of S. W. Louisiana, separated from Texas by Sabine River, and drained by Bayou Lanacoco and affluents of Calcasieu River; surface level, soil gener-

ally fertile. Cattle are very numerous on the prairies. Staples, cotton, Indian corn, and sweet potatoes. Cap. Leesville. Area, about 1450 sq. m. Formed since the census of 1870. P. 4259.

**Vernon,** county of W. Missouri, bordering on Kansas, drained by Osage River and its affluents, and traversed by Missouri Kansas and Texas R. R.; surface undulating, soil fertile. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, potatoes, and wool. Cap. Nevada. Area, about 700 sq. m. P. 11,247.

**Vernon,** county of S. W. Wisconsin, separated from Iowa and Minnesota by Mississippi River, and drained by Raccoon and Kickapoo rivers; surface mostly of undulating prairie, soil fertile. There are saw-mills, flour-mills, cloth-dressing establishments, and manufactories of carriages. Cattle, horses, sheep, and swine are numerous. Staples, wheat, oats, Indian corn, potatoes, hops, hay, maple-sugar, wool, and dairy products. Cap. Viroqua. Area, about 800 sq. m. P. 18,645.

**Vernon,** p.-v., cap. of Sanford co., Ala.

**Vernon,** tp., Sutter co., Cal. P. 799.

**Vernon,** tp., Tolland co., Conn. P. 5446.

**Vernon,** p.-v., cap. of Washington co., Fla. P. 53.

**Vernon,** tp., Lake co., Ill. P. 1259.

**Vernon,** tp., Hancock co., Ind. P. 1963.

**Vernon,** tp., Jackson co., Ind. P. 1508.

**Vernon,** p.-v. and tp., cap. of Jennings co., Ind., on Vernon River and the Madison division of Jeffersonville Madison and Indianapolis R. R., has manufactures, trade in lime, and a newspaper. P. of v. 673; of tp. 2385.

**Vernon,** tp., Washington co., Ind. P. 1101.

**Vernon,** tp., Dubuque co., Ia. P. 1243.

**Vernon,** tp., Humboldt co., Ia. P. 393.

**Vernon,** p.-v. and tp., Van Buren co., Ia. P. 1474.

**Vernon,** tp., Wright co., Ia. P. 175.

**Vernon,** p.-v. and cap. of Jackson parish, La.

**Vernon,** tp., Isabella co., Mich. P. 383.

**Vernon,** p.-v. and tp., Shiawassee co., Mich. P. 1797.

**Vernon,** tp., Blue Earth co., Minn. P. 665.

**Vernon,** p.-v. and tp., Dodge co., Minn. P. 850.

**Vernon,** tp., Clarke co., Mo. P. 902.

**Vernon,** p.-v. and tp., Sussex co., N. J. P. 1979.

**Vernon,** p.-v. and tp., Oneida co., N. Y., has a national bank. P. of v. 391; of tp. 2840.

**Vernon,** tp., Clinton co., O. P. 1513.

**Vernon,** tp., Crawford co., O. P. 988.

**Vernon,** tp., Scioto co., O. P. 1924.

**Vernon,** p.-v. and tp., Trumbull co., O. P. 930.

**Vernon,** tp., Crawford co., Pa. P. 1615.

**Vernon,** p.-v. and tp., Windham co., Vt. P. 764.

**Vernon,** p.-v. and tp., Waukesha co., Wis. P. 1180.

**Vernon** (Edward), b. at Westminster, England, Nov. 12, 1684, son of James Vernon, secretary of state to William III.; educated at Westminster School and at the University of Oxford; received a commission in the navy 1702; was engaged in the destruction of the French and Spanish fleets off Vigo Oct. 12, 1702, in the capture of Gibraltar July 23, and in the sea-fight off Malaga Aug. 13, 1704; became rear-admiral 1708; was in active service until 1727, when he was elected to Parliament, in which body he sat with little intermission to the end of his life, distinguishing himself in the ranks of the opposition; declared in Parliament 1739 that Puerto Bello, on the Spanish Main, could be taken with six ships; was taken at his word by the ministry, and given the command of six men-of-war, with the rank of vice-admiral of the blue; took Puerto Bello Nov. 22, 1739, after an assault of one day, with a loss of only seven men—a success which procured him unbounded popularity, as evinced by hundreds of medals and signs of public houses; sailed from Jamaica in Jan., 1741, with 29 ships of the line, 80 smaller vessels, 12,000 troops, including several American regiments, and 15,000 sailors; appeared before Cartagena Mar. 4; was repulsed with great loss, which was augmented by a fearful pestilence; made in 1742 an unsuccessful expedition against Panama; was made admiral 1745, and charged to guard the coasts of Kent and Sussex against an expected attack by the Pretender, but was stricken from the list of admirals Apr. 11, 1746, in consequence of a quarrel with the admiralty. D. at Nacton, Suffolk, Oct. 29, 1757. He published *A New History of Jamaica, from the Earliest Account to the Taking of Porto Bello* (1740), *Original Papers relating to the Expedition to Panama* (1744), and several pamphlets on naval topics, which were the cause of his dismissal from the service. The expedition against Cartagena was graphically described, both in his *Roderick Random* and in his *History of England,* by Smollett, who was present as a surgeon's mate. Lawrence Washington, elder brother of George, also participated in the expedition, and testified his esteem and friendship for the admiral by the name, Mount Vernon, which he gave to his estate in Virginia, afterward the residence of Gen. Washington. *The Life of Admiral Vernon, by an Impartial Hand,* appeared in 1758, and a *Memorial from Contemporary Authorities* was printed for private circulation in 1861 by William F. Vernon. His memory also survives in the word *grog,* applied by the sailors of his fleet to their rations of watered rum, in allusion to the admiral's *grogram* breeches.

**Vernon** (George John Warren), fifth Baron **Vernon,** b. at Stapleford Hall, England, in 1803; succeeded to the title 1835, and gained great distinction as a student of mediæval literature, especially that relating to Dante. D. in 1866. He published at Florence in 1842 the first seven cantos of Dante's *Inferno,* in grammatical order with notes, edited the Latin text of a *Commentary on Dante* by Pietro Alighieri (1835), and two other ancient commentaries (1846–48), and issued a magnificent reproduction of the first four printed editions of Dante, *Le prime quattro Edizioni della Divina Commedia litteralmente ristampate, etc.* (London, folio, 1858), printed by Whittingham under the direction of Antonio Panizzi.

**Vernon** (Robert), F. S. A., b. in England in 1774; was at one time a dealer in horses; acquired in commercial pursuits a large fortune, which he expended in the purchase of pictures, chiefly by British artists, being a generous patron of artists and literary men of genius, and formed a vast collection of works of art at his country-seat of Ardington House, Berkshire, the best portion of which, comprising 162 pictures and several pieces of statuary (valued at £150,000), he presented to the nation Dec. 22, 1847, to be known as the "Vernon Gallery," which now forms the nucleus of the National Gallery of British Art at South Kensington Museum. D. in London May 22, 1849. A portrait of Mr. Vernon by Pickersgill and a bust by Behnes, the latter presented by the queen, are in the National Gallery.

**Vernon** (Thomas), b. in England about 1660; was for a time secretary to the duke of Monmouth; became an eminent lawyer, and sat in Parliament for Whitechurch. D. at Twickenham Park Aug. 22, 1726. He left in MS. his famous *Reports of Cases in Chancery,* which after a lawsuit were published under the editorial care of William Melmoth and William Peere Williams (2 vols. folio, 1726–28). The best edition is that of John Raithby (2 vols., 1806–07).

**Vernon Harcourt,** Sir. See Harcourt.

**Vernon Smith** (Robert). See Lyveden.

**Vernon Springs,** tp., Howard co., Ia. P. 1450.

**Ve'roli,** town of Italy, province of Rome, in the Hernican Mountains, not far from Frosinone, contains some very good churches, and was formerly the seat of several large convents—the Casa Mario (Benedictine, 1005), the S. Domenico di Sora (Cistercian), etc. Veroli is of ancient origin, was fortified by the Pelasgians, and was christianized at a very early period. P. 11,036.

**Veron'** (Louis Desiré), b. at Paris Apr. 5, 1798; was educated in the Imperial Lyceum, and studied medicine; served in various hospitals, and published *Observations sur les Maladies des Enfants* (1825); wrote absolutist-ultramontane articles in different papers, and was appointed physician at the Royal Museum in 1824; bought a large interest in a patent medicine, "Pâte Regnauld;" brought it by his connections with the papers into vast notoriety, and laid the foundation of a fortune; took firmer hold of the journalistic business, and founded in 1829 the *Revue de Paris,* which was devoted to the creation of new celebrities; became director of the grand opera in 1831, not as a superintending royal official, but as a privileged manager; brought out the opera *Robert le Diable* and the ballet *La Sylphide,* and retired in 1835 with a considerable fortune; bought in 1839 a controlling share of the *Constitutionnel,* the tottering organ of Thiers; became its sole proprietor in 1844; brought it into a most flourishing condition by publishing in its columns *The Wandering Jew,* by Eugene Sue, and was introduced in the highest circles of French society by Thiers, who was made minister in 1840; became the enthusiastic eulogizer of the *coup d'état* of Dec. 2, 1851; was elected to the Legislative Assemby as a candidate of the government, and sold the *Constitutionnel* at an enormous profit; endowed anonymously several second-rate literary associations in Paris with large sums, and published *Mémoires d'un Bourgeois de Paris* (6 vols., 1854), *Cinq-cent mille Francs de Rente* (2 vols., 1855), *Quatre ans*

*de Règne* (1857), and *Les Théâtres de Paris de 1806 à 1860* (1860). D. in Paris Sept. 27, 1867.

**Vero'na,** a very strongly-fortified town in the province of the same name in Northern Italy, picturesquely situated at the foot of the Alps, and traversed by the river Adige. Verona was a populous and important city of the Roman empire, and still retains many striking monuments of that as well as of the mediæval period. Foremost among these is the arena or amphitheatre, contemporaneous with the Flavian at Rome, the interior of which is well preserved, and in fact the whole structure appears to have suffered little except from earthquakes. Its interior dimensions are 511 by 404½ feet, and the highest remaining portion of the exterior wall measures 100 feet. There are also remains of a Roman theatre, and an arch, called the Porta de' Borsari, across one of the principal streets, of the time of Gallienus (third century), though parts of it may be older. This arch is remarkable for many of its architectural features, especially for its twisted or spirally-fluted columns, a form of which few other so ancient examples exist. Another Roman gateway, the Porta de' Leoni, is still preserved, and many fragments of the old town-walls have been incorporated into buildings for civil purposes or into fortifications of later date, of which Verona offers many examples of great interest in the history of military architecture. The palaces and public squares of Verona contain much to attract the notice of the stranger, and the group of monuments known as the Tombs of the Scaligers well deserves a careful examination. There is a picture-gallery containing some good works, but the collection as a whole does not rank with those of many other Italian cities. The Ponte del Castello, built of brick in the fourteenth century, one of the arches of which has a span of 161 feet, is perhaps the boldest structure of the kind of so early a date. The churches of Verona are numerous. The cathedral dates chiefly from the twelfth century, though the apse is believed to be older. It is decorated with many curious mediæval sculptures, and some of the chapels, of different ages, are of great richness. It contains an *Assumption* by Titian and other fine pictures. The baptistery belonging to the cathedral is of the twelfth century, and has a font ten feet in diameter, intended for baptism by immersion, hollowed out of a single block. The capitular library is among the most remarkable collections of MSS. in Italy. It contains parchments of the fourth and fifth centuries, including many palimpsests, among which is a Virgil, perhaps as ancient as the third century. It was here that were found the important *Institutes* of Gaius, re-written with the *Homilies* of St. Jerome. Sta. Anastasia is much admired for its architecture, paintings, and bas-reliefs, and the monument of Guglielmo da Castelbarco over the entrance to a detached chapel is described by Ruskin as "the most perfect Gothic sepulchral monument in the world." San Bernardino is remarkable chiefly for the Pellegrini chapel by Sanmicheli, a circular structure of exquisite beauty of design and most admirable delicacy of sculpture. San Fermo, of fine brickwork and with good pictures; San Giorgio Maggiore, excellent sculptures and paintings; Santa Maria in Organo and San Nazaro e Celso are remarkable for their works of art, and San Zenone, a large church of the twelfth century, built on the foundation of a more ancient structure, is surpassed in its design, its decorations, its monuments, and other appurtenances by few ecclesiastical edifices in Italy. The famous Sanmicheli enriched Verona with many fine palaces, still generally in good condition. The environs of the city are highly attractive, and among them the palæontologist will not fail to visit Monte Bolea, the most important deposit of fossil fishes yet discovered. During the Austrian occupation the garrison of Verona was always large, and the withdrawal of so considerable a part of the population after the war of 1866 was felt as a check to the industry and commerce of the town. Its material prosperity is now reviving from the establishment of manufactures of velvets and other silks, as well as various mechanical enterprises. The pop. at the latest enumeration was 67,080. Verona as a fortress constitutes with Peschiera, Mantua, and Legnano, the famous "quadrilateral."

**Verona,** tp., Hancock co., Me. P. 352.

**Verona,** tp., Huron co., Mich. P. 276.

**Verona,** tp., Faribault co., Minn. P. 607.

**Verona,** p.-v., Lee co., Miss.

**Verona,** p.-v., Spring River tp., Lawrence co., Mo. P. 240.

**Verona,** p.-v. and tp., Oneida co., N. Y., on New York Central R. R. P. of v. 229; of tp. 5757.

**Verona,** p.-v. and tp., Dane co., Wis. P. 1125.

**Veronese** (Paul). See Cagliari (Paoli).

**Verplanck'** (Gulian Crommelin), LL.D., b. in New York City Aug. 6, 1786; graduated at Columbia College 1801; studied law, and after being admitted to the bar spent two or three years in Europe; was in 1804 a candidate of the so-called "Malcontents" for the New York legislature, to which he was elected many years later, in 1820, when he took a prominent position and was chairman of the committee on education; became in 1822 professor of the evidences of Christianity in the General Protestant Episcopal Seminary, New York; was a member of Congress 1825–33; of the New York senate for several years, in the judicial duties of which he took a principal part; was one of the governors of the New York Hospital, vice-chancellor of the State University, president of the New York board of emigration commissioners 1846–61, and prepared nearly all the *Annual Reports* of the latter body. D. in New York Mar. 18, 1870. Author of *The Bucktail Bards* (1819), a political poem in satire of De Witt Clinton, *Evidences of Revealed Religion* (1824), *An Essay on the Doctrine of Contracts* (1825), *Discourses and Addresses* (1833), of nearly half the *Talisman* periodical, in which appeared his *Memoir* of Sands, of several college addresses, reports, speeches, and papers, and of numerous contributions to magazines. He edited *Shakspeare's Plays, with his Life* (3 vols., 1844–47).

**Verrazano, da** (Giovanni). See Verazzano.

**Ver'res,** notorious in the history of Rome as one of the most cruel, rapacious, and shameless officials which that city ever sent out to govern her provinces. In 73 B. C. he went to Sicily as governor, and after three years' administration returned to Rome loaded with plunder. Sicily was the wealthiest and most prosperous province of Rome, but Verres carried away every valuable work of art or public ornament, impoverished commerce and manufactures, and devastated the island worse than ever its own tyrants or the wars between Carthage and Rome had done. The Sicilians succeeded in bringing the robber to trial, though he had both wealth and powerful connections—the Scipios, Metelli, etc.—by which to defend himself. Cicero was his accuser, Hortensius his defender. But before the trial came to a close, Verres fled from Rome. He settled in Gaul, near Marseilles, and brought along with him enough of his wealth to live in luxury and opulence for the rest of his life, and even to excite the greed of Antony, by whose proscription he was put to death in 43 B. C.

**Verrill** (Addison Emery), A. M., S. B., b. at Greenwood, Me., Feb. 9, 1839; educated at the Lawrence Scientific School, Harvard University; since 1864 he has been professor of zoology in Yale College, and is a member of numerous scientific societies; has published largely upon zoology in American scientific periodicals.

**Versailles',** town of France, capital of the department of Seine-et-Oise, 11 miles S. W. of Paris, is regularly built, with broad and straight streets, and intersected by elegant avenues planted with trees. It has few manufactures and little trade. The chief attractions of the place are the palace and the park. The palace is an enormous pile, 1400 feet long. It was erected by Louis XIV., and was the residence of the French kings till 1792. In 1837, Louis Philippe transformed it into a kind of national museum, unique of its kind, and exceedingly interesting and instructive. The park, with its terraces, alleys, and fountains, is stiff, formal, and tiresome. P. 61,686.

**Versailles,** p.-v. and tp., Brown co., Ill. P. 1471.

**Versailles,** p.-v., cap. of Ripley co., Ind., 52 miles W. of Cincinnati and 5 miles S. of Ohio and Mississippi R. R., contains the usual churches, schools, and 1 newspaper. P. 495. J. A. Wayland, Ed. "Ripley Index."

**Versailles,** p.-v., cap. of Woodford co., Ky., 15 miles S. E. of Frankfort, laid out in 1794, and the centre of a wealthy agricultural district, has 8 churches, 2 banks, an excellent public school and private academy, 1 weekly newspaper, 1 large carriage-factory, 1 flouring-mill, 1 hotel, and an orphan asylum. P. 3268.
Dan. M. Bemnar, Ed. "Woodford Weekly."

**Versailles,** p.-v., cap. of Morgan co., Mo., on Missouri Pacific R. R., 20 miles S. of Tipton, and on the watershed between Osage and Missouri rivers, contains 1 church, 1 bank, an excellent high school, 1 newspaper, 2 lumber-yards, a court-house. Rich deposits of coal, lead, and iron underlie this whole section. P. 503.
John A. Hannay, Ed. "Gazette."

**Versailles,** p.-v., Darke co., O.

**Verse.** See Metre and Rhyme, by Prof. S. S. Haldeman, A. M., LL.D.; and Poetry.

**Ver'secz,** or **Werschetz,** town of Austria, Servian woiwodeschaft, has several educational institutions and some silk-spinning factories. Rice, wine, and silk are extensively cultivated in the neighborhood. P. 19,087.

**Ver'shire,** p.-v. and tp., Orange co., Vt. P. 1140.

**Versifiers.** See IMPROVISATION, by HON. G. P. MARSH, and POET-LAUREATE.

**Vertebra.** See SPINAL COLUMN, by E. DARWIN HUDSON, JR., M. D.

**Vertebral Column.** See SKELETON and SPINAL COLUMN, by E. DARWIN HUDSON, JR., M. D., and OSTEOLOGY, by PROF. E. D. COPE, A. M.

**Vertebratà.** See VERTEBRATES, in APPENDIX, by PROF. THEODORE GILL, A. M., M. D., Ph. D.

**Ver'tex** [Lat. *vertere*, to "turn"], a turning-point. A vertex of a polygon is a point at which two sides meet. The vertex of a cone or of a pyramid is its apex.

**Ver'tical,** a line perpendicular to the horizon. A *vertical line* is determined by a plumb-line. A vertical line at any point is always perpendicular to the free surface of a liquid at that point. A *vertical plane* is a plane through a vertical line, and any angle in such a plane is a *vertical angle*. A vertical line at any place passes very nearly through the centre of the earth; hence, vertical lines at different places on the surface of the earth are not parallel, but for places not far apart they are usually spoken of as parallel. In surveying, vertical lines are determined by means of the spirit-level.

**Ver'tigo** [Lat.], a subjective or apparent impairment of the equilibrium of the body. It assumes two principal forms: In one it appears to the subject as if the objects in his vicinity were whirling about him; in the other, he fancies that he is forced to fall in some definite direction, forward, backward, or to either side. Vertigo is rarely if ever continuous, but occurs in paroxysms provoked by some appreciable cause, as changing posture, eating, using the eyes, etc. The subjects of vertigo often stagger or fall in consequence of the sensation of motion. Vertigo is sometimes the expression of disease of the brain, or of interference with the circulation of blood in that organ, but more usually it is a sympathetic disorder, caused by indigestion, anæmia, sudden impairment of parallelism between the two eyes, disease of the internal organs of hearing, etc. Vertigo may be artificially produced by the administration of stimulants (alcohol), and by the application of galvanism to the head in a transverse direction or to the superior ganglion of the cervical sympathetic nerve. A variety of subjective unsteadiness, without definite direction to the apparent movement, is better designated as dizziness. The proper management of vertigo consists in the treatment of the disease causing it. E. C. SEGUIN.

**Vert'ner** (ROSA **Griffith**), formerly Mrs. JOHNSON, now Mrs. JEFFREY, b. near Natchez, Miss., about 1835, daughter of John Griffith (d. 1853), who was the author of several popular Indian tales; was adopted by a maternal aunt, Mrs. Vertner, whose name she took; passed her childhood at Burlington, her aunt's country-seat, near Port Gibson, Miss.; was educated in Bishop Smith's seminary at Lexington, Ky.; became in 1850 a contributor, chiefly of verses, to the *Louisville Journal*, and subsequently to the *Home Journal;* married at the age of seventeen, Claude M. Johnson, a wealthy gentleman of Louisiana; published a small volume of *Poems* (Boston, 1858), which were warmly received both North and South as indicative of "singular power and peculiar passionateness;" became by second marriage the wife of Alexander Jeffrey of Lexington, Ky., where she now resides (1876); has published *Woodburn, a Novel* (1864), and has written other novels.

**Vertoa',** town of France, department of Loire-Inférieure, has extensive manufactures of tiles, vinegar, soap, varnish, and gypsum. P. 6313.

**Vertot', de** (RENÉ AUBERT), b. at the château of Benetot, department of Eure, France, Nov. 25, 1655; became first a Capuchin, then a Premonstratensian monk, and was appointed secretary to the general of the latter order, but resigned this position afterward and became a secular priest in the neighborhood of Rouen; published in 1680 *Histoire des Révolutions de Portugal*, which attracted much attention, and in 1696 *Histoire des Révolutions de Suède* (2 vols.), which also proved a success; was elected a member of the Academy in 1701; removed to Paris; published in 1720 *Histoire des Révolutions dans le Gouvernement de la République romaine* (3 vols.); was chosen by the knights of St. John to become their historiographer, and received access to their archives; published in 1726 *Histoire des Chevaliers de Malte* (4 vols.). D. at Paris June 15, 1735. His first work is distinguished by a fluent and elegant style, the last rests on actual study of sources, but none of his works combine these two qualities.

**Ver'tue** (GEORGE), b. in Westminster, England, in 1684; became a distinguished engraver and antiquary; enjoyed the favor of Sir Godfrey Kneller and the patronage of Lord Somers and other wealthy nobles; was an original member of the Academy of Painting 1711; became engraver to the Society of Antiquaries 1717; made many journeys through England during forty years, taking drawings of churches, monuments, and ruins as materials for an intended history of the fine arts in England, for which he accumulated 13 folio vols. of MSS.; was a strict Roman Catholic and a man of singular piety, modesty, and artistic conscientiousness. D. in London July 24, 1756, and was buried in Westminster Abbey. Among his best-known works are sets of twelve *Portraits of Poets* (1730), ten *Portraits of Charles I. and his Friends*, and the series of kings of England in Rapin's *History*. His extensive materials fell into the hands of Horace Walpole, and a portion of them were published by him with little alteration under the title *Anecdotes of Painting in England*, etc. (Strawberry Hill, 5 vols. 4to, 1762–71; last ed. London, 3 vols. 8vo, 1862), to which was appended his *Catalogue of Engravers who have been Born or Resided in England*. The latter work was separately published, with an *Account* of Vertue's life and works (Strawberry Hill, 1763), by Walpole.

**Vertum'nus,** or **Vortumnus,** in Roman mythology, the god of the seasons, and, as the husband of Pomona, more especially the god of fruit. He was of genuine Italian origin, and derived his name from the Latin *vertere*, to "turn," "change." A feast, *Vertumnalia*, was celebrated in his honor on Aug. 23. By the artists he was generally represented as resembling Saturn.

**Verulam,** BARON. See BACON (FRANCIS).

**Verus** (LUCIUS). See ANTONINUS (MARCUS AURELIUS).

**Vervain.** See VERBENA.

**Verviers',** town of Belgium, province of Liege, on the Vesdre, is the centre of an extensive cloth-manufacturing industry which employs about 40,000 people in the city and adjacent district, and which annually produces cloth to the value of about $5,000,000. P. 38,875.

**Ver'wick,** town of Belgium, province of West Flanders, on the Lys, which separates Belgium from France, has manufactures of flax and tobacco. P. 7149.

**Ver'y** (JONES), b. at Salem, Mass., Aug. 28, 1813; made several voyages to Europe with his father, who was a sea-captain; graduated at Harvard 1836; was Greek tutor there 1836–38; published a volume of *Essays and Poems* (1839); was licensed as a preacher by the Cambridge (Unitarian) association 1843, but has never held pastoral charge, and has since lived a retired life at Salem, occasionally contributing to the Salem *Gazette* and to the religious organs of his denomination. His essays on *Epic Poetry*, *Shakspeare*, and *Hamlet* have been pronounced "fine specimens of learned and sympathetic criticism," and a high authority affirms that he "has written some of the best sonnets in our language."

**Vesa'lius** (ANDREAS), b. in Brussels Dec. 31, 1514; studied medicine at Louvain, Montpellier, and Paris; lectured on anatomy at Bâle, Pavia, Bologna, and Pisa; was appointed physician to Charles V. in 1544, and afterward to Philip II.; was accused of heresy by the Spanish Inquisition and condemned to death, but the sentence was commuted to a pilgrimage, and in 1563 he went to the Holy Land, returning from which he suffered shipwreck at Zante, and d. from starvation Oct. 15, 1564. His *De Corporis Humani Fabrica* first appeared at Bâle in 1543, and formed the foundation of the modern science of anatomy. It rests on actual observations made by dissection of the human body, and was received with the fiercest opposition by the Galenian school, who derived all their knowledge from dissections of the lower animals. His complete works appeared in 2 vols. fol. at Leyden in 1725.

**Ve'sicants** [Fr. *vésicant*], a term used in medicine to signify agents that produce blistering. Very many local irritants are capable of raising a blister, but many of these are too harsh and violent for medicinal use. For the ordinary purposes of blistering some preparation of cantharides (see CANTHARIS) is commonly used; but where haste is urgent, cotton soaked in water of ammonia may be employed or a hot iron momentarily applied to the skin. Both these means produce a blister, but they are painful and may cause severe inflammation, and are only used where a small blister is desired. Blistering, as a remedy, is far less employed nowadays than formerly, being at best a painful, distressing, and debilitating procedure. (For the management of the ordinary cantharidal blister see BLISTERS.) EDWARD CURTIS.

**Vesoul',** town of France, capital of the department of Haute-Saône, on the Drugeon, has some manufactures of calicoes, serges, and damasks, and a trade in grain, wine, and cattle. P. 7597.

**Vespa'sianus** (TITUS FLAVIUS SABINUS), b. at Reate, in the country of the Sabines, Nov. 17, 9 A. D., of a family

in mediocre circumstances; entered the army; held superior commands under Claudius in Germany and Britain; governed Africa as proconsul under Nero, and was sent by him in 66, at the head of a large army, to suppress the rebellion in Judæa. When, after the murder of Galba, the civil war broke out between Otho and Vitellius, Vespasian was proclaimed emperor (July 1, 69) by his own army, and shortly after was recognized by the whole eastern part of the empire. He left the final reduction of Judæa to his son Titus, and proceeded to Rome, where, after the murder of Vitellius, he was immediately recognized by the senate. A great change now took place in the government of the state. The new emperor was frugal and unostentatious in his personal habits, honest and open in his dealings with all persons, and parsimonious to niggardliness. The finances, which had been utterly disturbed by the wild prodigality of Caligula and Nero, were restored to order; the senate and the higher administration were purged, and the worst elements expelled; a firm discipline was established in the army. In his external policy he was also successful. Jerusalem, and with it the whole of Judæa, were taken in 70; an insurrection in Gaul was speedily suppressed; new conquests were made in Britain and Germany. For the city of Rome he did very much. He rebuilt the Capitol, which had been burnt down by the adherents of Vitellius; he erected a temple of peace, commenced the Colosseum, and encouraged the restoration and rebuilding of those parts of the city which had remained in ruins since the great conflagration under Nero. D. at Reate June 24, 79.

**Ves'pers** [Lat. *vesper*, "evening," the "evening star"], in the Roman Breviary, the last but one of the canonical hours, the one preceding compline and following the nones. It is celebrated in public in the churches, often with brilliant music. It occurs about the time of the lighting of the lamps.

**Vespertilion'idæ** [from *Vespertilio*—the ancient Latin name of the bats—the oldest established genus], a family of placentiferous mammals of the order Cheiroptera and sub-order Animalidora. They are destitute of complicated nasal appendages, and the nostrils open by simple crescentic or circular apertures at the end of the muzzle; the ears are moderate or large, mostly free, sometimes united, and each provided with a well-developed tragus; the teeth are normally developed, the molars with W-shaped ridges, the canines moderate, the incisors of the upper jaw in two groups separated by a median hiatus, in the lower jaw present all round; the wings are large; the middle finger generally provided with two phalanges, and with the first phalanx extended, in repose, in a line with the metacarpal bone; the stomach is sacciform, and the two extremities approximated; the premaxillary bones are small, and separated by a wide median interspace. The family is cosmopolitan in its range, and embraces most of the species flourishing in the northern temperate countries. Nearly twenty genera have been differentiated by modern systematists (*e. g.* Peters, Dobson, etc.), but almost, if not quite, the most comprehensive is *Vespertilio* itself. Most of the species found in the U. S. belong to the genera *Vespertilio, Scotophilus, Nycticejus, Atalapha, Corynorhinus*, and *Antrozous*. THEODORE GILL.

**Vespuc'ci** (AMERIGO), better known under the Latinized form AMERICUS VESPUCIUS, b. at Florence, Italy, Mar. 9, 1451; was educated by his uncle, Giorgio Antonio Vespucci, an eminent scholar; devoted himself to astronomy and cosmography; engaged in mercantile pursuits; settled at Seville, Spain, as an agent of the Medici family, about 1490; became acquainted with Columbus on his return from his earlier voyages; was concerned in fitting out four caravels for voyages of discovery in 1496; accompanied Alonso de Ojeda in his voyage of 1499–1500, in which he visited Cape Paria and explored several hundred miles of the coasts of South America; wrote an account of this voyage July 18, 1500, addressed to one of the Medicean family; made voyages to Brazil in the service of the king of Portugal 1501–02 and 1503–04; wrote to his friend at Florence two accounts of the second voyage, of which the later was published at Strasbourg 1505; was naturalized in Spain 1505; was appointed pilot-major Mar. 22, 1508, and was occupied for several years in examining pilots, constructing charts, and preparing descriptions of the newly-discovered regions. In a letter written from Lisbon in 1504 to René, duke of Lorraine, he gives an account of four voyages to the Indies, of which he says that the first sailed from Cadiz May 20, 1497, and returned in Oct., 1498. Other copies of the letter read 1494 instead of 1497, but neither of these dates is sufficiently corroborated by other evidence, and the reality of a voyage in either of those years has been denied by most historians, and Vespucci has been frequently accused of inventing voyages for the purpose of ascribing to himself the honor of the original discovery of the New World. The latter part of the charge is now generally admitted to be unfounded, as the name America was first applied, not by himself, but by the German geographer Martin Waldseemuller (Martinus Hylacomylus), who printed in 1507 at St. Die, Lorraine, a small volume, *Cosmographiæ Introductio, insuper quator Americi Vespucci Navigationes*, in which, on the strength of the Lisbon letter, the new continent was called *Americi Terra*. Vespucci d. at Seville Feb. 22, 1512. His letter concerning his earliest voyage was first published by Bandini in 1745, and that concerning the second voyage by Bartolozzi in 1789. The merits of his voyages, in none of which he seems to have held the chief command, have been exhaustively discussed by Humboldt in his *Examen critique*, and by Varnhagen, the historian of Brazil, in several publications. PORTER C. BLISS.

**Vessels, Spiral.** See SPIRAL DUCTS, by PROF. G. L. GOODALE, A. M.

**Ves'ta,** in Roman mythology, the goddess of the home or hearth, corresponding to the Greek Hestia. Very few and unimportant myths were formed on the idea of this deity, but the grave and sublime rites which her worship developed show that of the whole religious feeling which underlay the Roman mythology she formed the centre. She was not represented by any statue or image in her temples, but a perpetual fire burned on her altars, and each Italian city or community had raised an altar to her. The Vesta of the Roman empire had her temple at Lavinium, on the Via Appia, 20 miles from Rome, and hither the consuls and other high officials of the Republic went to offer up their sacrifice before entering on their duties. The Vesta of the city of Rome had her temple in the Forum, near that of the Penates, and here she was served by her own priestesses, the vestal virgins, and a festival, the *Vestalia*, was celebrated in her honor on June 9. The number of the vestal virgins was originally four, but afterward six. They were chosen by the pontifex maximus when between six and ten years old, and they served the goddess for thirty years, spending ten years in learning their duties, ten in the actual performance of them, and ten in teaching them to the novices. Their principal duty consisted simply in keeping alive the sacred fire on the altar of the goddess, but thereby the guardianship of the holiest which Roman life contained was entrusted to them; and although it has become impossible to us to discern clearly the whole bearing of this institution on the life of the community, numerous well-ascertained facts indicate the great importance ascribed to it. When a consul met one of the vestal virgins in the streets, he bowed with reverence, and the lictors lowered the fasces while she passed by. When a convict was seen by one of the virgins, he was immediately released if she demanded it. If the sacred fire went out from neglect, the priestess during whose watch it happened was stripped and scourged by the pontifex. If one of them committed adultery, she was buried alive and her seducer was flogged to death in the Forum.

**Ves'ta,** p.-v. and tp., Johnson co., Neb. P. 639.

**Ves'tal,** p.-v. and tp., Broome co., N. Y. P. 2221.

**Vestals,** or **Vestal Virgins.** See VESTA.

**Vest'ments, Ecclesiastical,** the dress appropriated to those who minister in the divine offices—viz. bishops, priests, deacons, sub-deacons, acolytes, servers, and choristers. The employment of vested choristers is a peculiarity of the English Church. In the papal chapels, and generally on the Continent, men are employed as singers, and in some of the French churches, and in the Roman Catholic churches in this country, the singers are of both sexes, but they are not reckoned among the ministers of the altar. In the English cathedrals, however, and in many parish churches, the singers, men and boys, are vested in cassock and surplice, and sit in a part of the church appropriated to their use, called the choir, between the presbytery, the place of the clergy, and the nave, the place of the people. The cassock (Fr. *sutane*) is a long coat reaching from the shoulders to the heels, with a low standing collar, and fastened through its entire length by a row of small buttons. The English cassock, however, is more properly made double-breasted and secured with hooks and eyes. A band around the waist, tied at the left side, called the cincture, serves to keep it in its place. The surplice is a linen garment hanging loose about the person and having large sleeves. The Anglo-Saxon surplice is large and full; it reaches nearly to the feet, and when it is properly made, without any opening in front, falls into ample and graceful folds. These surplices are still in use in the English Church, at least by the clergy. Choristers' surplices are generally made shorter and less full, approaching more nearly the form called *cotta* on the Continent. The Roman cottas are usually very small, reaching but little below the waist, and are sometimes made entirely of lace. The rochet and the alb are modifications of the surplice. The former is a

short, and the latter a long, surplice, with close sleeves. The rochet is commonly considered as the episcopal form of the surplice, but it is sometimes worn by acolytes. The alb is a eucharistic vestment. The surplice is worn by the clergy in the choir offices or daily services, and in the ministration of all rites and sacraments except the holy communion. On solemn occasions the principal minister wears also a cope and biretta. The cope is a cloak cut in such a way that when it is spread out the lower line forms half a circle, of which the front is the diameter. An opening, half an ellipse, is cut in the straight side for the head, and the garment is fastened in front by a large buckle called a morse. The cope is usually made of some valuable material, and is richly embroidered. One given by Queen Philippa (1328–69) to Durham cathedral is still kept there in excellent preservation. The biretta is a four-sided cap with a flat top, and ridges on it extending from the corners to the middle—four for doctors of divinity and three for ordinary clergymen. A ridgeless biretta appears to have been formerly common in England, and is often seen in old sculpture and in paintings. A stole is also worn at baptisms, marriages, and similar functions, but not, according to the old English rule, at the daily service. In the churches of the Roman obedience the public recital of the daily offices has so long been obsolete that the tradition seems to have been lost. The old rule, however, is probably the same as the English. This stole is 2½ inches wide and about 2½ feet long. It is usually made of silk, and is frequently embroidered.

The eucharistic vestments are the amice, the alb, the girdle, the maniple, the eucharistic stole, and the chasuble. The amice is a square piece of linen, embroidered on one side, which the priest rests for a moment on his head, and then spreads over his shoulders. It is seen as an embroidered collar above the alb. The alb is a long garment with close sleeves, secured about the waist with a girdle. It is commonly made of linen, but occasionally of lace, and it may have embroideries on the sleeves and lower part, called apparels. The Greek alb (*chitonion*) is sometimes made of richer materials, and is colored. The girdle is also of linen, and is made of strands of twisted cord. In the East a broad band (Gr. *zone*) is sometimes worn instead. The maniple (*sudarium;* Gr. *epimanikia*) was originally of linen, but is now made of the same materials and in the same form as the stole. It is worn upon the left wrist. The eucharistic stole (Gr. *orarion*) is three yards long and nearly three inches wide, sometimes widened at the ends to make room for embroidered crosses. It is crossed over the breast and secured by the girdle. The chasuble (Lat. *casula;* Gr. *phelonion;* in old English, "the vestment") is worn over all. It was originally, and is still sometimes in the Greek Church, cut in the form of a complete circle, in which form its ample folds are extremely graceful. It was at a later time made like an ellipse, or rather like the *vesica piscis*, which was a favorite shape in England. The modern Roman chasuble is very much cut away in front. In England, France, and Belgium a cross is commonly affixed to the back; in Italy and other Roman Catholic countries in the West, to the front of the chasuble. This is properly of the shape known as the Y-cross. The deacon (in England, "the gospeller") wears over his alb a dalmatic (Gr. *stoicharion*), and the sub-deacon (in England, "the epistoler") wears a tunicle, but no chasuble, which is reserved exclusively to the celebrant. The dalmatic is a coat partly open at the sides, with wide sleeves. The tunicle is a garment very similar to the last, but less highly ornamented. The deacon wears his stole over his left shoulder; the ends are brought together and fastened under his right arm. The sub-deacon wears no stole. In the Western churches acolytes at a high mass (in England, solemn service) wear albs and amices. At a low mass (plain service), where there are neither ministers nor choir, but only a single priest with a server, the latter wears a cotta or rochet over his cassock, which last is usually crimson. In the Greek Church servers and low masses are unknown. The priest is always attended by a deacon vested in alb and dalmatic. When a bishop is the celebrant, he wears a dalmatic in addition to the priestly vestments, to signify, it is said, that all the offices of the ministry are united in his person. The Western bishops also wear instead of the biretta a mitre, either plain or precious; the former is of white linen, the latter of gold and precious stones. The pall, pectoral cross, ring, gloves, sandals, and staff also appertain to the bishop.

In the churches now or formerly of the Roman obedience the color of the cassock is, for choristers, servers, or acolytes, crimson; for the principal acolyte, sometimes purple. Sub-deacons, deacons, and priests wear black, bishops purple, and cardinals crimson. The pope alone wears white. The surplice, cotta, rochet, alb, and amice are properly made of white linen, though in the West all except the last are sometimes made of lace. The maniple, stole, tunicle, dalmatic, and chasuble vary in their colors, following what is called the sequence of the seasons. The Roman sequence is now generally adopted in the West. This gives white for Christmas, Easter, and saints' days, purple for Advent and Lent, red for Pentecost and feasts of martyrs, black for Good-Friday, and green for ordinary days. The color for *ferias* or week-days usually follows that of the preceding Sunday. The English or Salisbury (Sarum) sequence differs from the Roman not only in the use of more colors—brown or gray being allowed instead of purple, blue instead of green, and yellow instead of white on the feasts of confessors—but also in the order in which the colors are used. According to this sequence, all Sundays at the festal seasons are white, and all other Sundays are red. White Sundays are followed by white ferias, but at the seasons of Advent and Lent the ferias are purple; at those of Epiphany, after the octave, and Trinity, they are blue or green. The old Sarum tradition, however, has been lost, and it has probably only been partially recovered. The Eastern calendars are numerous and complicated, and they do not appear to recognize any uniform sequence of colors.

This account includes all the vestments which are received by Catholic tradition, both in the Eastern and Western churches. There are, however, local variations, and there are other vestments which have been worn only at particular times and places. The Western mitre is unknown in the East, except among the Armenians; the Oriental bishops wear a peculiar cap. The patriarch of Alexandria wears a cap resembling a crown, which he never removes during the whole liturgy. The Eastern bishops wear attached to the stole a square ornament called the *epigonation*. This was originally merely a handkerchief, but it is now made of some stiff material like brocade, and richly decorated. The stole itself is joined together for nearly its entire length, and an opening is left at the top through which the head is put. Two maniples are worn instead of one. The Greek priest's cap is not square, but round. There are also local peculiarities in the West. The rochet and chimere worn by the English bishops are a modification of the daily dress, or perhaps the parliamentary robes, of their predecessors. The simple linen sleeves of the rochet have been superseded by lawn and the chimere of scarlet silk by one of black satin or velvet. The black gown is sometimes worn by English clergymen and Protestant ministers. The rival derivations of it from the gown worn by Calvin at Geneva or from the dresses of the mediæval monks may be dismissed as witty inventions. It is probably merely the academic gown which English clergymen were formerly accustomed to wear when they went about their parishes. A survival of this custom continued until nearly the middle of the present century. There are those yet living in New York who remember seeing the clergy of Trinity church and the Dutch dominies walking to church on Sunday mornings in gown and cassock. The square cap and the hood, much worn by the English clergy, are academic vestments. Hoods also form parts of several monastic dresses. As the latter, however, are for the most part modifications of the cassock, it is not necessary to describe them particularly. The amyss (which is not to be confounded with the amice) was at one time a favorite choir-vestment in Northern countries. It was in form not unlike a small chasuble, and was usually made of gray fur. It was only worn at the daily service.

Of the origin of the vestments little is certainly known. The linen ones have probably been inherited by Christians from the Hebrew Church. The others Dr. Rock believes to have been adopted from garments worn in daily life, retained by the Church after others had laid them aside, adorned and beautified and consecrated to sacred uses. Mr. Marriott states more specifically that they were dresses worn by persons of condition on state occasions, which were gradually adopted by the Church. This view is strengthened by the fact, alluded to by Mr. Planché, in his *Cyclopædia of Costume*, that emperors and kings were long allowed to wear the chasuble, and afterward the dalmatic and tunicle, at their coronations and when assisting at high mass. According to the view of Mr. Marriott, most of the vestments were introduced into the Church in the interval between the ninth and the twelfth centuries. Others, he thinks, can be traced back to the fourth, and some to the first century. He is also of the opinion that the color of all ecclesiastical vestments was originally white. As Mr. Marriott has made a careful study of the subject, the present writer thinks it fair to state his views, without, however, in all respects adopting them. The chief value of his work lies in the illustrations and in the elaborate quotations from ancient authors. The literature of the subject is extensive. Marriott's *Vestiarium Christianum*, Rock's *Hierurgia*, Neale's *Holy Eastern Church*, and Blunt's

*Annotated Book of Common Prayer* are perhaps the best modern authorities. They contain full references to the older writers. Dr. Schaff also has given, in his *Church History*, an article on the subject, with references to Bishop England, Bock, and Hefele. To sum up the whole matter, it is only necessary to add that the same vestments have been in use from time immemorial in both the Eastern and Western churches, and that, though they may have been, and doubtless were, introduced gradually in the way already mentioned, they varied from each other only in matters of detail or in bearing different names in different times and places. The idea of a dress peculiar to the ministers of religion at their ministrations is older than Christianity itself, and is recognized not only by Roman Catholics, but by several denominations of Protestants.

A word or two about the vestments of the altar will complete the subject. The stone slab (*mensa*) of the altar is first covered with a cere-cloth of waxed linen, fitting it closely to protect it from the damp. Over this is placed the superfrontal, hanging down about ten inches in front. Before the altar hangs the frontal, reaching nearly to the ground, and embroidered with two broad stripes called orphreys. Both superfrontal and frontal may have a rich fringe, and both are usually of the color of the season. The former, however, may with propriety be always red. Over all are placed three linen cloths. Two of these are of the exact size of the mensa, but the third is much longer, and hangs nearly to the ground at both ends. It is embroidered in a particular manner, and is usually adorned at the edges with lace. When the altar is not in use, a green covering of silk or baize or some similar material is laid upon it. B. R. Betts.

**Ves'tris,** a famous family of dancers, descending from Italy, but settled in Paris. The two most celebrated members of the family were—(1) Gaetano Apollino Baldassare Vestris, b. in 1729, d. Sept. 27, 1808, ballet-master and first dancer at the opera in Paris from 1749 to 1781; and (2) Marie Auguste Vestris-Allard, or Vestris II., b. Mar. 27, 1760, d. Dec. 6, 1842, a natural son of the preceding by the celebrated dancer Madame Allard (first dancer at the opera from 1780 to 1816), and professor at the Conservatory till 1828. The ballet compositions of the Vestris family were insignificant, but their style of ballet-dancing became predominant on all stages of Europe, and reigned for more than a century, largely influencing also the social dances of the higher classes.

**Vesunna.** See Périgueux.

**Vesu'vian,** or **Id'ocrase** [named from Vesuvius, in the lava of which it is often found], a hard silicate of lime and alumina, with iron and manganese, sometimes used as a gem, but not much esteemed, and is of various colors.

**Vesuvius.** See Volcanoes, by Prof. A. Guyot, LL.D.

**Vesz'prim,** town of Western Hungary, contains several handsome buildings and good educational institutions, manufactures salt, glass, and potash, and trades in grain, wine, and cattle, besides its own manufactures. P. 12,002.

**Vetch, Fitch,** or **Tare,** the name of several leguminous twining herbs of the genus *Vicia*. North America and Europe have each several species, some common to both continents. One of the most important is *Vicia sativa*, extensively cultivated in Europe as a forage-plant. The bitter vetches (*Orobus tuberosus*, etc.) are also leguminous forage-plants of Europe. The tubers of some sorts are used as food. Other so-called vetches are the genus *Lathyrus*, often called vetchlings.

**Vetch** (James), F. R. S., b. at Haddington, Scotland, May 13, 1789; educated in the cadet college at Great Marlow and in the Royal Military Academy at Woolwich; was engaged upon the trigonometrical survey of Berkshire 1806–07; served in the Peninsular war as an officer of engineers 1810–14; conducted the operations of the ordnance survey in the Orkney, Shetland, and Hebrides islands 1821–24; was for eleven years manager of the silver-mines of Real del Monte and Bolaños, Mexico, 1824–35, constructing in Mexico many roads and other public works, and collecting data for a map of Mexico; was afterward a commissioner for settling Irish boundaries; was engaged upon the reclamation of tide-lands in Ireland and Scotland; formed the plans for the drainage of Leeds, of Southwark, and of Windsor town, castle, park, and forest; became consulting engineer to the admiralty, conservator of harbors, metropolitan commissioner of sewers, royal commissioner of harbors of refuge, and suggested the means of improving the water-supply of London. D. Dec. 7, 1869. Author of many professional publications, one of which, *An Enquiry into the Means of Establishing a Ship-Navigation between the Mediterranean and the Red Sea* (1843), made important suggestions, utilized by Lesseps.

**Vet'eran,** tp., Chemung co., N. Y. P. 2479.

**Veteran Reserve Corps,** an organization created in the army of the U. S. during the civil war (1861–65), to avoid any weakening of the armies in the field by employing a portion of them in enforcing the laws for enrolling and drafting the national forces and arresting deserters, etc. Gen. J. B. Fry, provost-marshal-general, submitted Apr. 17, 1863, a plan proposing—(1) to retain the military services, for garrison, hospital, and provost duty, of that class of deserving officers and men who from wounds received in action or disease contracted in the service were unfit for further duty in the field, and who would otherwise be discharged, but were still able to perform light duty; (2) to bring back for like purpose those who had previously been discharged on similar grounds, were unfit for active service, and not liable to draft. The necessity for the action taken on this plan is apparent; for while an intelligent economy of the public strength demanded that some portion of the vast numbers of soldiers unfit for field service should be utilized, the enlistment or conscription of such men except under the extremest pressure of necessity would have been cruelty and folly. The plan of organization of the Invalid or Veteran Reserve Corps was announced in orders Apr. 28, 1863. The provost-marshal-general was charged with the execution of the order, and the troops raised under it were placed under his control. Stringent measures were adopted to secure the admission only of such disabled officers as were endorsed for good conduct in the field, and whose habits, education, and intelligence qualified them to make efficient officers and form an honorable and useful corps.

There were three sources from which the material for the formation of the corps could be drawn: (1) Men still in the field who had been disabled by wounds or by disease contracted in the line of duty; (2) men absent from their colors in hospitals or convalescent camps, etc.; (3) men who had been honorably discharged on account of wounds or other disability resulting from military service. Officers as well as soldiers were received from these three classes only. The material thus obtained from all the different arms of the service was organized into companies and battalions, and finally into regiments, of infantry. On May 31, 1865, the corps consisted of 762 commissioned officers and 29,852 enlisted men. Over 60,000 men entered the corps, and at one time it was twice as large as was the regular army at the commencement of the war. During its entire existence the corps was in the performanee of duties which would otherwise have been necessarily performed by as great a number of able-bodied troops detached from armies in the field. Its services, always valuable, were too varied to be enumerated here. As soon as the war was over, additions to the corps were discontinued. In the reduction of the vast volunteer army, all who desired it were granted a discharge from this corps, and by Dec. 31, 1865, it numbered less than 1000 men. By act of July 28, 1866, fixing the military peace establishment, Congress provided for four regiments, to be called the Veteran Reserve Corps, the officers to be appointed from among those wounded in the line of duty during the war, and the men enlisted under similar conditions. In the reduction of the army Mar. 3, 1869, this regimental organization was discontinued. James B. Fry.

**Veterinary Science.** See Appendix.

**Veth'ake** (Henry), LL.D., b. at Essequibo, Guiana, South America, in 1792; came to the U. S. in early childhood; graduated at Columbia College 1808; studied law; was instructor in mathematics and geography in Columbia College 1813, professor of mathematics and natural philosophy at Rutgers College 1813–17, at Princeton 1817–21 and 1829–32, at Dickinson College, Carlisle, Pa., 1821–29, and at the University of New York 1832–35; president of Washington College, Lexington, Va., 1835–36, professor of mathematics at the University of Pennsylvania 1836–54, vice-provost 1846–54, and provost of that institution and professor of moral and intellectual philosophy 1854–59, and became professor of the higher mathematics in the Philadelphia Polytechnic College 1859. D. at Philadelphia Dec. 16, 1866. He published a number of occasional addresses on education; contributed to periodicals; edited and wrote most of the articles of the *Supplementary Volume* (xiv., 1847) *of the Encyclopædia Americana;* edited, with large additions, J. R. McCulloch's *Dictionary of Commerce* (Philadelphia, 2 vols., 1843), and was author of *The Principles of Political Economy* (1838; 2d ed. 1844).

**Vet'iver,** a highly-fragrant substance used for making mats, fans, palanquin covers, and baskets, and often placed in linen for its strong and persistent perfume. It is brought from India, and consists of the dried roots of *Andropogon muricatus*, a grass of that country.

**Ve'to** [Lat., "I deny"], the power of the executive in constitutional governments to interfere in his official capacity, and to prevent an act passed by the legislature

from becoming a law. It may be absolute or qualified. It is absolute when the executive interposition of itself completely arrests the legislation; it is qualified when the arrest is only partial, and the legislature may, by an increased majority—for example, of two-thirds or three-fourths—enact the measure notwithstanding the objections. The veto power as it exists in the U. S. was borrowed in a modified form from the British constitution. The British Crown *nominally* possesses the absolute veto; practically, it possesses none. In pure theory, the imperial legislature consists of King, Lords, and Commons, the concurrence of all three branches being required to the enactment of a statute. After a bill has been passed through the two houses of Parliament the royal assent is indicated by the entry, "*Le roy le veult*" (Norman French, "The king so wills it"). If this assent should be withheld, the formula employed is, "*Le roy s'avisera*" ("The king will take it under advisement"). The royal veto was common enough in ancient times among the Tudor and the Stuart monarchs, but it has practically ceased to exist. No prime minister would dare advise the Crown to exercise the prerogative. The latest instances of its use were once in the reign of William III. (1692), when a bill for triennial Parliaments was vetoed, but was passed two years after; and once in the reign of Anne. Although the President of the U. S. possesses only a qualified veto, his power by its means to restrain and to shape the legislation of Congress is real, and is far greater than the shadowy authority of the British king. The U. S. Constitution provides (Art. I. Sect. vii.) that "Every bill which shall have passed the House of Representatives and the Senate shall, before it becomes a law, be presented to the President of the U. S. If he approve, he shall sign it; but if not, he shall return it, with his objections, to that house in which it shall have originated, who shall enter the objections at large on their journal, and proceed to reconsider it." After the veto, the measure can only become a law by a vote of two-thirds of each house. A subsequent clause applies the same rule to "every order, resolution, or vote to which the concurrence of the Senate and the House of Representatives may be necessary (except on a question of adjournment)." It is provided, however, that "if any bill shall not be returned by the President within ten days (Sundays excepted) after it shall have been presented to him, the same shall be a law in like manner as if he had signed it, unless the Congress by their adjournment prevent its return, in which case it shall not be a law." It has been settled by the legislative practice that proposed amendments of the Constitution, when duly passed by Congress, do not require the President's assent and are not subject to his veto. The Constitution places no limits on the nature of the objections which the President may interpose. He may refuse his assent because he thinks the measure unconstitutional or because he regards it as inexpedient or opposed to true legislative policy. The governors of the several States are generally clothed with the same qualified veto that is conferred upon the President. In a few commonwealths, however, the bill becomes a law if subsequently assented to by a majority vote of both houses. Under these latter circumstances it is plain that the executive act is in no true sense of the term a veto. Its only effect is to require a second consideration of the matter and a second vote by the legislature, but it opposes no obstacle to the exercise of their law-making function; it is simply argumentative. The mayors of many American cities have under their charters a veto upon the acts of the aldermen.

JOHN NORTON POMEROY.

**Vetral'la,** town of Italy, province of Rome, on a hill about 9 miles S. W. of Viterbo, commanding a remarkably fine view. It occupies the site of the ancient *Forum Cassii*, and traces of the Via Cassia are still seen near it. Vetralla was of some importance during the mediæval centuries, but its walls and towers have nearly disappeared, and it is now a place of no special interest. P. 6759.

**Veuillot'** (LOUIS), b. in 1813 at Boynes, department of Loiret, France, in humble circumstances; grew up in one of the Parisian suburbs amidst cheap wine, cheap theatres, and cheap romances; obtained in 1832, through a public labor bureau, a position as "man of all work" on one of the ministerial provincial papers; gained notoriety by his polemical aptitude and his readiness to fight duels; was advanced by the government from one paper to another, from one position to another, and became in 1843 editor of *L'Univers Religieux*. During a visit to Rome in 1838 he was suddenly converted from frivolity to fanaticism, and began to write religious romances—*Pierre Saintine* (1840), *L'Honnête Femme* (1843), etc.—and books of edification—*Les Pélerinages de Suisse* (1838), etc. His polemical talent, however, suffered nothing from his conversion, and many of his articles, collected in several volumes under the title *Mélanges religieux, historiques et littéraires*, and of his books, *Les Libres penseurs* (1848), *L'Esclave Vindex* (1849), *Le Parfum de Rome* (1865), *Les Odeurs de Paris* (1866), etc., in which he attacks every form of freedom and progress, and advocates a social order based on the monk and the soldier as its main supports, are conspicuous by their acridity.

**Vevay',** town of Switzerland, canton of Vaud, beautifully situated on the Lake of Geneva, at the mouth of the Vevayse, has manufactures of watches, jewelry, leather, and woollens, and a trade in wine. P. 7881.

**Vevay,** p.-v., cap. of Switzerland co., Ind., on Ohio River, equidistant from Cincinnati and Louisville, has 5 churches, good schools, 1 bank, 2 newspapers, 2 hotels, 2 furniture, 1 chair, and 2 cigar manufactories, and 1 flouring and 2 saw mills. Large quantities of honey, hay, and onions are shipped from this point. P. about 2100.

W. J. BAIRD, ED. "REVEILLE."

**Vevay,** tp., Ingham co., Mich. P. 2332.

**Viada'na,** town of Italy, province of Mantua, lying very near the Po, about 7 miles S. E. of Casalmaggiore. It had an ancient castle which was demolished in 1728, and other defences, and formed a part of the county or marquisate of Brescia. The house of Este, with its allies, the Pallavicini and the Malaspini, was master here at the close of the twelfth century. At the end of the thirteenth, Cavalcabò became marquis of Viadana, and its lordship remained in his family till the beginning of the fifteenth century, when the Gonzagas entered into possession, and they held it till it passed to Austria in 1707. Viadana was formerly a place of much industry; its manufactures of pottery, of leather, linen, silk, etc., were extensive and of a superior quality, but the town has not advanced in this respect during the present century. The principal streets of Viadana are flanked with porticoes; it contains 11 churches, a theatre, a gymnasium, and other public schools, and is not deficient in charitable institutions. P. 15,343.

**Vi'aduct** [Lat. *via*, a "way" or "road," and *ductus*, from *ducere*, to "lead"], the structure by which a way (or road of any kind) is carried over some break of continuity or gap in its wonted earth-bearings, as over a river, across a ravine, etc. A viaduct is therefore essentially *a bridge*. The modern development and extension of canals and railroads called for a new class of *way*-leading structures; and the name *viaduct* has been applied to some of the more important of them. For canals this distinguishing name might be very proper, but canal-*bridges* are more commonly called *aqueducts*, by which they are confounded with the real AQUEDUCT (which see) or water-*conducting* structure; whereas the canal structure simply *bears* the water-*way*—*i. e.* the canal. For railroads, while the word *bridge* has always been applied to its ordinary, and even its extraordinary, *river*-crossing structures, the word *viaduct* has been somewhat capriciously used when a structure of considerable magnitude spans a deep ravine, or a great valley in which the river or stream is relatively insignificant; *e. g.* the Carrollton viaduct of the Baltimore and Ohio R. R. (Washington branch), the Portage viaduct on the Erie R. R., etc.

J. G. BARNARD.

**Via'na,** town of Portugal, province of Minho, on the Lima near its mouth in the Atlantic, is well built and carries on a considerable fishing business. Its harbor is defended by a citadel, but much silted up. P. 9000.

**Viardot'** (LOUIS), b. at Dijon, department of Côte-d'Or, France, July 31, 1800; studied law in Paris; engaged in journalism; was manager of the grand opera from 1838 to 1841; founded in the latter year the *Revue Indépendante* in connection with George Sand and Pierre Leroux, and visited most of the European capitals in company with his wife, the celebrated singer, Pauline Viardot-Garcia (b. in Paris July 18, 1821), a daughter of Manuel Garcia and a sister of Madame Malibran. Besides numerous translations from the Spanish and Russian, he published *Études sur l'Histoire des Institutions et de la Littérature en Espagne* (1835), *Histoire des Arabes et des Maures d'Espagne* (2 vols., 1850), *Les Merveilles de la Peinture* (1868, *seq.*), of which a part, *Wonders of Italian Art*, was translated into English in 1870.

**Viareg'gio** [*Viaregium*], town of Italy, province of Lucca, lying on the seashore N. W. of Pisa. A century ago Viareggio was a small, unhealthy hamlet, containing about 300 inhabitants; now it is one of the most salubrious and frequented bathing-places of the Peninsula. This change is due to the hydraulic operations of the celebrated engineer Zendrini, who drained the stagnant pools which had so long poisoned the air of the neighborhood, and soon after its advantages as a place for sea-bathing attracted attention. The accommodations for visitors are now excellent, and the

constant agitation of the water at this point on the coast is believed to add to the efficacy of the baths. The Ospizio Marino is a charitable establishment intended for poor children of scrofulous constitutions, and it receives and provides for from 400 to 500 every season. There is considerable activity in the docks of Viareggio, but the land here is said to advance on the sea at the rate of 6 feet annually from the deposits of the Arno, Serchio, and Magra. P. 11,374.

**Viat'icum** [Lat., "provision for a journey"], in the Roman Catholic Church, the Eucharist as administered to a dying person. If life be prolonged, the viaticum may be repeated from time to time, if so desired by the sick person, provided the mental faculties are preserved. In the early Church the term was applied both to baptism and the Lord's Supper.

**Viat'ka,** government of European Russia, bounded S. by Nizhnee-Novgorod, comprises an area of 53,493 sq. m., with 2,406,024 inhabitants. The eastern part is occupied by spurs of the Ural Mountains, and covered with extensive forests of fir, pine, and birch; in the other parts the surface is level. The soil is not very fertile, except in the southern part, and here agriculture is successfully carried on; rye, barley, oats, and potatoes are raised, and a fine breed of horses is reared. The manufactures comprise iron, glass, and cotton; timber is largely exported. In the largest part of the country the climate is too cold for fruit to ripen.

**Viatka,** town of European Russia, capital of the government of the same name, on the Viatka, has several educational institutions, extensive ironworks, distilleries, and tanneries, and carries on a very active trade in timber, iron, and corn. P. 19,885.

**Viaz'ma,** town of European Russia, government of Smolensk, at the entrance of the Bebra into the Viazma, an affluent of the Dnieper, has many educational institutions and an extensive trade, as it forms the entrepôt for goods shipped to Riga and St. Petersburg. Gingerbread and dried and preserved fruits are largely manufactured here, and exported to all parts of the country. P. 10,853.

**Vi'borg,** one of the oldest towns of Denmark, on a small lake nearly in the centre of Jutland, carries on some manufacturing industry on a small scale and has a lively general trade. P. 8722.

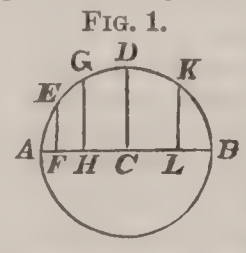
**Vibra'tion,** the reciprocating movement consequent upon the effort of a body, or of the parts of a body, disturbed from the position or figure of equilibrium, to recover that position or form again. Of the first kind of vibration a common pendulum affords the simplest example; of the second, a metallic spring fixed at one extremity and free at the other. When at rest, the pendulum or the spring is held in position by the equal action of opposing forces. When disturbed from this position, it acquires in returning to it a moment or living force which carries it as far beyond the point of equilibrium as the distance to which the original disturbance had removed it, after which its course is reversed and it retraces its path, returning as far to the side of the first disturbance again. This supposes the motion not to be in any manner resisted by the action of extraneous forces, in which case the reciprocating motion once established would continue for ever. But as such resistances are always present, the living force of the vibrating body is gradually absorbed by them, and the body finally assumes once more its original condition of rest.

The laws of vibratory motion lie at the foundation of the theories devised by modern science to account for the phenomena of acoustics and optics. Light and sound are supposed to be propagated through elastic media, of which the particles have to each other the same mechanical relations as if they possessed the property of mutual repulsion. These particles, in the condition of equilibrium, are assumed to be equidistant from each other; their absolute distances being very great compared with the magnitude of the particles themselves. If a slow movement be excited among these particles by the action of a foreign body, they will not sensibly alter their relative distances; but if any one particle or stratum of particles be driven toward those adjacent by a sudden impulse, then the intervening distance will be momentarily diminished, or there will occur a local compression of the medium at that place. The second particle, or stratum of particles, being therefore acted upon, on the side of the compression, by a greater repelling force than on the other, will be driven forward toward the third, which in its turn will be impelled toward the fourth, and so on indefinitely. A molecular movement is thus propagated throughout the medium. It is obvious that such a molecular disturbance can only be created by a body foreign to the medium, since in the nature of things it is impossible that an elastic fluid should unequally compress itself. Moreover, if the foreign body exerts but one impulse, and then remains at rest, only a single tremor will pass through the medium, and there will be no vibration. But if, after giving a forward impulse, the foreign body as suddenly recedes, the particle or stratum of particles in contact with it, being deprived of its support, will yield to the repulsive force on the opposite side, and the distance between the first and second particles or strata of particles will be diminished, or there will be a local dilatation at that place. The third particle or stratum will similarly move backward toward the second, the fourth toward the third, and so on, and a tremor by dilatation will pass through the medium. If such alternate impulses be persistently maintained, a vibratory movement will be imparted to all the particles of the medium to which their influence extends. But in order to this the foreign body which produces them must itself be in a state of vibration.

It is found experimentally in acoustics that the pitch of a sound depends on the number of vibrations of the sounding body accomplished in a unit of time, and that the intensity or loudness of a given sound depends not on the number, but upon the amplitude, of the vibrations—that is, upon the space passed over by the vibrating body in each alternate movement. Also, that variation of intensity produces no effect upon pitch; whence it follows that the vibrations of bodies producing musical sounds are strictly isochronous, whether the amplitude of vibration be great or small. It is hence inferred that the forces acting upon the vibrating body must be always proportional to the distance of displacement from the position of equilibrium. For as velocity, when time is constant, is proportional to force, and as space traversed is proportional to velocity, the condition of invariability of time requires an increase of force proportional to the amplitude of vibration.

The following propositions are of importance in their applications to the theory of undulation. (See UNDULATORY THEORY.) If a circle be described with the amplitude of displacement as radius, the centre of the circle being assumed as the point of equilibrium and any diameter as the path of the vibrating body, then the velocity of this body at any point of this path will be proportional to the perpendicular to the path drawn from such point and intercepted by the circumference of the circle. In the figure annexed AEDB is such a circle, C is the centre and point of repose, AB is the path of vibration, and CA or CB the amplitude of displacement. Then at the points F, H, C, L, the perpendiculars EF, GH, DC, and KL are proportional to the velocities which actuate the body when at these points respectively. For, if we make C the origin of co-ordinates, and put $CA = a$, CH, CF, or $CL = x$, employing $t$ to represent the time elapsed from the beginning of the movement, $v$ for the velocity, and $p^2$ for the force urging the body when at a distance from C equal to unity, then $dx$, the small space moved over in the small time $dt$, will be equal to $vdt$; or we shall have

FIG. 1.




$$vdt = dx.$$

Also, if $dv$ be the small increment (or decrement) of velocity in the time $dt$, we shall have this force, at the distance $x$, equal to $p^2x$, and hence, at that distance,

$$p^2xdt = -dv;$$

$dv$ having necessarily a sign contrary to that of $x$, as the velocity is diminishing when $x$ is increasing, and *vice versâ*. Whence we derive

$$vdv = -p^2xdx; \text{ and } v^2 = -p^2x^2 + C.$$

But when $v = 0$, $x = a$; consequently,

$$v^2 = p^2(a^2 - x^2); \text{ or } v = \pm p\sqrt{a^2 - x^2} = (\text{in the figure})$$
$$\pm p.\sqrt{CA^2 - CH^2} = p.GH; \qquad (1)$$

which proves that the velocity is always proportional to the ordinate in the circle drawn from the momentary place of the body in its path.

If in the first equation above we substitute for $v$, we have

$$\pm p\sqrt{a^2 - x^2}.dt = dx; \text{ or } dt = \frac{dx}{\pm p\sqrt{a^2 - x^2}};$$

$$\text{and } t = \frac{1}{p}\sin^{-1}\frac{x}{a} + C.$$

$$\text{If } t = 0,\ x = a; \text{ whence } t = \frac{1}{p}(90° - \sin^{-1}\frac{x}{a}) = \frac{1}{p}\cos^{-1}\frac{x}{a}. \qquad (2)$$

Now, putting $t + t'$ for the time later than $t$ at which another complete vibration shall have been accomplished, the arc expressed by $\cos^{-1}\frac{x}{a}$ will have been increased by one entire circumference, and the expression will become

$$t + t' = \frac{1}{p}(2\pi + \cos^{-1}\frac{x}{a});$$

from which, if the preceding equation be subtracted, member for member, there will remain, $t' = \frac{1}{p} 2\pi$, a constant quantity; which being independent of $a$, the amplitude, verifies the assumption that the time of vibration for all amplitudes is the same.

The common pendulum furnishes a familiar illustration of the case under consideration. When the pendulum is drawn out of the vertical, the force which urges it to return is very nearly proportional to its distance from the point of rest. If the pendulum be made to vibrate in a cycloid, this condition is strictly fulfilled. Its beats are therefore sensibly equal in time, whatever the length of arc through which it swings.

The movements of the pendulum are usually restricted to a single plane. If we suppose a pendulum, however, to be so suspended as to be equally free to swing in any direction, we may conceive it be acted on simultaneously or successively by impulses differently directed. Let it, for example, after having been set in motion along the line AB (Fig. 2), and just as it is passing the central point C, receive a second equal impulse in the direction CD at right angles to the first. By the law of the composition of forces, it will take the diagonal direction CM, and its subsequent vibrations will be performed along the line NM. It will be seen that the extent of its excursions in the directions AB and DP remain unaltered, but the actual amplitude of its vibrations is considerably increased. Suppose the second impulse to have been applied, however, not at C, but at A, where the body is momentarily at rest, and just as it is about commencing its return movement toward C. Its excursions in the two rectangular directions AB and DP will still be limited by the parallels RM and NQ, as before, but it will touch RM at D, and not at M, and NQ at P, and not at N. Apparently, the path described by it under these circumstances is a circle; and this may be shown to be so in fact. Take, for instance, in Fig. 3, $r$ to represent the radius vector of the body, and put $x$ and $y$ for the co-ordinates to the axes AB and DP respectively; we shall have

Fig. 2.

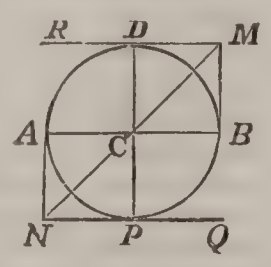
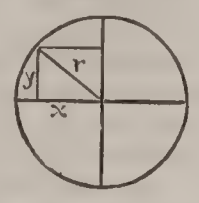



Fig. 3.




$$x^2 + y^2 = r^2; \text{ whence } x\,dx + y\,dy = r\,dr.$$

Now, by the law of velocities above given, if $a$ represent the maximum velocity, and $\phi$ be the measure of the angular movement of the radius vector from the axis of reference AB, the velocity in the direction of this axis will be $= a \sin \phi$, and that in the direction of CD will be $a \sin (\phi + 90°) = -a \cos \phi$. It should be observed that as the revolution is here supposed to be in the direction opposite to that usually assumed in trigonometry, the cosines are essentially negative in the first and fourth quadrants, and essentially positive in the second and third. Then, putting $t$ for time, we have

$$dx = a \sin \phi\, dt; \; dy = -a \cos \phi\, dt.$$

But, by construction, $x = r \cos \phi$, and $y = r \sin \phi$. Whence, by substitution,

$$ar \sin \phi \cos \phi\, dt - ar \sin \phi \cos \phi\, dt = r\,dr, \qquad (3)$$

or $\frac{dr}{dt} = 0$, and the radius vector is constant.

The orbit is therefore a circle. Moreover, the motion in the circle is uniform. For if $d\phi$ be the increment of the arc,

$$d\phi^2 = dx^2 + dy^2; \text{ or } d\phi^2 = a^2 \sin^2 \phi\, dt^2 + a^2 \cos^2 \phi\, dt^2 = a^2 dt^2, \qquad (4)$$

and $\frac{d\phi}{dt} = v = a$.

That is to say, the velocity in the circle will be uniform, and will be equal to the maximum velocity of the plane vibration. It hence follows that if, at the moment when a body vibrating in a rectilinear path leaves the limit of its excursion to return, a second body leaves the same point moving uniformly in the circumference of a circle described on the path of the first, and with a velocity equal to the maximum velocity of the first, the line joining these two bodies will move parallel to itself, and will always be perpendicular to the path of the plane vibration.

A convenient measure of the time after the beginning of vibration at which the body is at a given point of its path, as H, Fig. 1, may hence be deduced. The duration of a complete double vibration being taken as the unit of time, and the circumference of a circle whose radius is unity being represented by $2\pi$, the entire space passed over by a body making its revolutions in such a circle isochronously with the movements of the vibrating body will be expressed by the product $2\pi t$; and $t$ will then denote the entire number of vibrations, entire or fractional, which have taken place from the beginning. Every integral value of $t$ will indicate the return of the body to its original position, and every fractional excess will express a corresponding progress in a new vibration. Thus, if, in Fig. 1, the movement be supposed to have commenced from A, AG will be the fractional part of $2\pi t$ when the body is at H, and this arc will have the same ratio to the entire circle which the time of describing AH has to the total time of double vibration.

If the second impulse, applied as last supposed, is greater or less than the first, the orbit of the vibrating body will not be circular, but elliptical, having for its axes the amplitudes $a$ and $a'$, corresponding to the two supposed impulses. The velocities in the direction of $a$ will still be represented by $a \sin 2\pi t$; and those in the direction of $a'$ by $a' \cos 2\pi t$; the ordinates of the orbit will be $x = a \cos 2\pi t$, and $y = a' \sin 2\pi t$.

In case the second impulse, still normal to the first, is not applied at the limit nor at the middle of its path, the velocity in the original direction at the moment of application will be $a \sin 2\pi t$, where the value of $t$ is indeterminate. The velocity produced by the second impulse commences with the maximum—*i. e.* with the velocity belonging to the time $t = \frac{1}{4}$, and hence is $= a' \sin \frac{1}{2}\pi$, or $a' \sin 90°$. The difference of the two in respect to advancement in their respective vibrations—a difference called difference of phase—will therefore be $2\pi t - 90°$, or $90° - 2\pi t$, which difference put, for convenience, equal to $\theta$. After a further time, $t'$, the two velocities will be

1. $a \sin (2\pi t + 2\pi t') = a \sin (90° \pm \theta + 2\pi t') = a \cos (2\pi t' + \theta)$.
2. $a' \sin (90° + 2\pi t') = a' \cos 2\pi t'$.

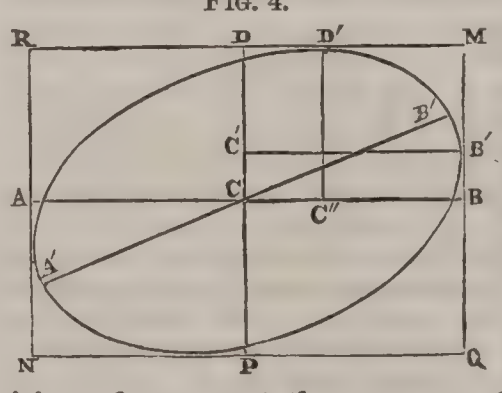
Hence, $x = a \sin (2\pi t' + \theta)$, and $y = a' \sin 2\pi t'$. And eliminating $2\pi t'$, there results the equation

$$a^2 y^2 + a'^2 x^2 - 2aa'xy \cos \theta = a^2 a'^2 \sin^2 \theta; \qquad (5)$$

which is the equation of the ellipse referred to its centre. It follows that any two impulses applied at right angles to each other with any interval between them to a body susceptible of vibration, will cause the body to describe an elliptical orbit.

We may determine the axes of this ellipse, and their angular position with respect to the directions of the impulses $a$ and $a'$, by considering that if a rectangle be constructed (Fig. 4) upon those directions with the adjacent sides, RM, RN, equal to $2a$ and $2a'$ respectively, the curve must touch the opposite sides of this rectangle in points of which the co-ordinates are $C'B' = a$, $BB' = a' \sin \theta$, and $C''D' = a'$, $DD' = a \cos \theta$; as also in corresponding points with the same co-ordinates taken negatively. Moreover, $a$ will be the perpendicular from the centre upon one of these tangents, and $a'$ the perpendicular upon the other. Also, the semi-diameter parallel to the tangent on which $a'$ falls, which is the distance of the body from the centre or position of repose at the moment of the second impulse, is evidently $= a \sin \theta$. Now, it is a property of the tangent that the rectangle of this diameter and perpendicular is equal to the rectangle of the axes. Hence, putting A and B to denote the semi-axes,

Fig. 4.




$$aa' \sin \theta = AB.$$

And from the necessary preservation of living force after impact, it is also true that

$$a^2 + a'^2 = A^2 + B^2.$$

From which we deduce

$$A = \tfrac{1}{2}\left(\sqrt{a^2 + a'^2 + 2aa' \sin \theta} + \sqrt{a^2 + a'^2 - 2aa' \sin \theta}\right); \text{ and}$$

$$B = \tfrac{1}{2}\left(\sqrt{a^2 + a'^2 + 2aa' \sin \theta} - \sqrt{a^2 + a'^2 - 2aa' \sin \theta}\right).$$

To find the angular position of A to $a$, or the relation of the resultant elliptic vibration in respect to phase to the original rectilinear vibration, we have, from the property of the ellipse (representing the inclination by $\psi$ and taking $a$ as the perpendicular upon the tangent),

$$a^2 = A^2 \cos^2 \psi + B^2 \sin^2 \psi.$$

Whence $\cos \psi = \pm \sqrt{\frac{a^2 - B^2}{A^2 - B^2}}$.

From which we infer that the elliptic revolution, assumed to commence at the extremity of the major axis, is virtually accelerated or retarded in its epoch by a time corresponding to $\psi$, according as the motion imparted by the second impulse is direct or retrograde, and according as the body

is advancing or returning, or is approaching or receding from the centre at the moment of application.

If the second impulse is in the same direction as the first, and is applied at the time $t$ after the beginning, the velocity ($= a \sin 2\pi t$) will be increased by the maximum amount, $a'$, which the second impulse is capable of separately imparting. If we then put A to represent the maximum velocity which, under the joint influence of these two forces, the body can receive, and assume,

$$a + a' \sin 2\pi t = \mathrm{A} \cos \psi \text{ ; and } a' \cos 2\pi t = \mathrm{A} \sin \psi,$$

by multiplying the first of these equations by $\sin 2\pi t$, and the second by $\cos 2\pi t$, and adding member for member, we shall obtain

$$a'(\sin^2 2\pi t + \cos^2 2\pi t) + a \sin 2\pi t = \mathrm{A}(\sin 2\pi t \cos \psi + \cos 2\pi t \sin \psi),$$

or,
$$a' + a \sin 2\pi t = \mathrm{A} \sin (2\pi t + \psi). \qquad (6)$$

The first member of this equation shows the velocity assumed by the body at the moment of application of the second impulse, and the second member shows that this same velocity would have existed in the body at the same instant, had it been impelled by a force capable of producing the maximum velocity A, applied earlier than $a$ by a time corresponding to $\psi$.

The foregoing conclusion is deducible by construction, as follows: Suppose (Fig. 5) the body under the original impulse $a = \mathrm{AC}$ to receive the additional impulse $a' = \mathrm{GG'}$ at the point H corresponding to the time $t$. The velocity $a \sin 2\pi t$ proper to H, represented by GH, will be increased by $a' = \mathrm{GG'}$, and will become $\mathrm{HG'} = \mathrm{A} \sin (2\pi t + \psi)$. The point of equilibrium, C, remains of course unaltered; hence, if CG′ be joined, CG′ is necessarily $= \mathrm{A}$; whence it directly follows that

$\mathrm{A} \sin(2\pi t + \psi) = \mathrm{GG'} + \mathrm{HG} = a' + a \sin 2\pi t$, as above.

The values of $\mathrm{A} \sin \psi$ and $\mathrm{A} \cos \psi$ give the equation

$$\mathrm{A}^2 = a^2 + a'^2 + 2aa' \sin 2\pi t \text{ ; and}$$

$$\mathrm{A} = \pm \sqrt{a^2 + a'^2 + 2aa' \sin 2\pi t}. \qquad (7)$$

If in these equations we substitute $\cos(2\pi t \pm 90°) = \cos \theta$ for $\sin 2\pi t$, they take a form analogous to those in the case foregoing—viz.

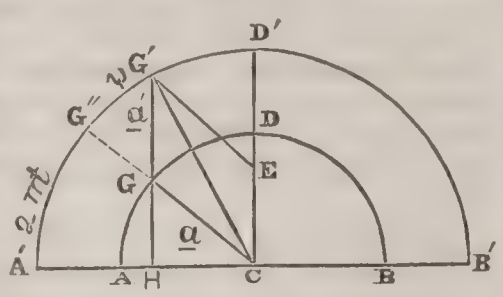
$$\mathrm{A}^2 = a^2 + a'^2 + 2aa' \cos \theta \text{ ; and}$$

$$\mathrm{A} = \pm \sqrt{a^2 + a'^2 + 2aa' \cos \theta}. \qquad (8)$$

It thus appears that the resultant maximum velocity of the body under the influence of the two impulses is the diagonal of a parallelogram of which the sides represent the component forces $a$ and $a'$, and their inclination $= 90° - 2\pi t$. This parallelogram in the figure is CGG′E.

Should the second impulse be neither coincident in direction with the first, nor normal to it, it may be decomposed into two components, one reinforcing $a$, and the other at right angles to $a$. Thus, if in any plane passing through AB (Fig. 5) the force $a'$ act upon the body at an inclination to $\mathrm{AB} = \phi$, the components will be $a' \cos \phi$, coincident with $a$, and $a' \sin \phi$, normal to $a$.

Fig. 5.




Put $a' \cos \phi = p$, and $a' \sin \phi = q$. Then in the original plane of vibration we shall have a resultant,

$$\mathrm{A} = \pm \sqrt{a^2 + p^2 + 2ap \sin 2\pi t};$$

while the velocity in the moment after impact will be

$$a \sin 2\pi t + p = \mathrm{A} \sin (2\pi t + \psi),$$

being that which would be produced by an impulse $= \mathrm{A}$, applied earlier than $t$ by a time corresponding to $\psi$. In equation (5), therefore, assume $\theta = 2\pi t + \psi - 90°$, or $90° - 2\pi t - \psi$, and substitute A for $a$, and $q$ for $a'$, and there will result the equation

$$\mathrm{A}^2 y^2 + q^2 x^2 - 2\mathrm{A}q \cos \theta = \mathrm{A}^2 q^2 \sin^2 \theta \text{ ; or, restoring values,}$$

$$(a^2 + a'^2 \cos^2 \phi + 2aa' \cos \phi \sin 2\pi t) y^2 + a'^2 \sin^2 \phi \, x^2 -$$

$$2\sqrt{a^2 + a'^2 \cos^2 \phi + 2aa' \cos \phi \sin 2\pi t}.a' \sin \phi \sin (2\pi t + \psi) xy$$

$$= (a^2 + a'^2 \cos^2 \phi + 2aa' \cos \phi \sin 2\pi t) a'^2 \sin^2 \phi \cos^2 (2\pi t + \psi). \quad (9)$$

The orbit will be an ellipse of which the axes will be A and $q$, and the commencement of the revolution will be earlier than $t$ by a time corresponding to $\psi$.

*Vibrations of Stretched Strings.*—When a cord firmly stretched between two fixed points is drawn aside at the middle from the position of rest, it is slightly elongated, and its molecules being more widely separated than in the condition of equilibrium endeavor to approach each other. Hence, when the cord is released, it returns to the position of rest, and in consequence of its inertia is carried beyond this position, and continues to vibrate until the resistance of the atmosphere and of its own rigidity brings it to rest once more. The number of vibrations performed by a stretched cord in a unit of time is dependent on the length, the tension or stretching weight, the thickness or diameter, and the density of the material.

(1) *As to Length.*—With a given tension, diameter, and density, the number of vibrations is inversely as the length. Thus, to double the number of vibrations per second, the cord must be taken half as long; to make the number threefold, one-third as long, and so on.

(2) *As to Tension.*—Other conditions remaining unaltered, the number of vibrations of a given cord is directly as the square root of the stretching weight, or the tensions are as the squares of the numbers of vibrations. That is, to triple the number of vibrations, the tension must be made nine-fold—to quadruple it, sixteen-fold.

(3) *As to Diameter.*—Material, length, tension, and density remaining the same, the number of vibrations is inversely as the diameter of the cord. A cord of double diameter will make but half the number of vibrations.

(4) *As to Density.*—Other things being equal, the number of vibrations is inversely as the square root of the density. A cord of fourfold density will make half the number of vibrations.

These last two propositions may be included under the single one, that when length and tension remain the same, the number of vibrations is inversely as the square root of the weight, or of the weight of a unit of length.

*Nodal Points.*—If a stretched cord be stopped by touching with the finger at a point distant from its extremity by any aliquot part of its length, and an impulse be suddenly applied half way between the extremity and the stopped point, the line will vibrate in sections, each being of the same aliquot part of the entire length, while the intermediate points will remain at rest. The successive vibrations separated by these points are in opposite phases, and the points themselves, which are called nodal points, may be likened to pivots round which the vibrating sections turn. With a long cord (Fig. 6) the nodes and the intervening swells are very perceptible to the eye; and the difference of condition of the different parts of the cord is strikingly shown by placing paper riders at intervals along it. Those which rest upon the nodes will remain motionless, but those which fall upon the vibrating portions will either be thrown off or be hurried along to the nearest node.

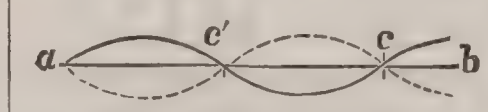
Fig. 6.




By the skilful application of the bow with the use of stops, a cord may be made to vibrate in its whole length and in sections at the same time. It may be made also to vibrate simultaneously in larger and in smaller sections. The sound produced by a string so vibrating will be composed of several tones of different pitch.

*Vibrations of Rods.*—Elastic rods vibrate laterally like cords when fixed by their extremities. Owing to their rigidity, however, they may be made to vibrate when fixed only at one extremity or at some nodal point. When a rod fixed at one end forms nodes, the free extremity is the middle of a vibrating section, and the distance from this free extremity to the first node is only half such a section, or half the distance between the first and second nodes. Thus, in Fig. 7, $a$ is the fixed and $b$ the free extremity. The free end $b$ is the middle of a swell, and the distance from $b$ to the first node $c$ is equal only to half the distance from $c$ to $c'$, the second node.

Fig. 7.



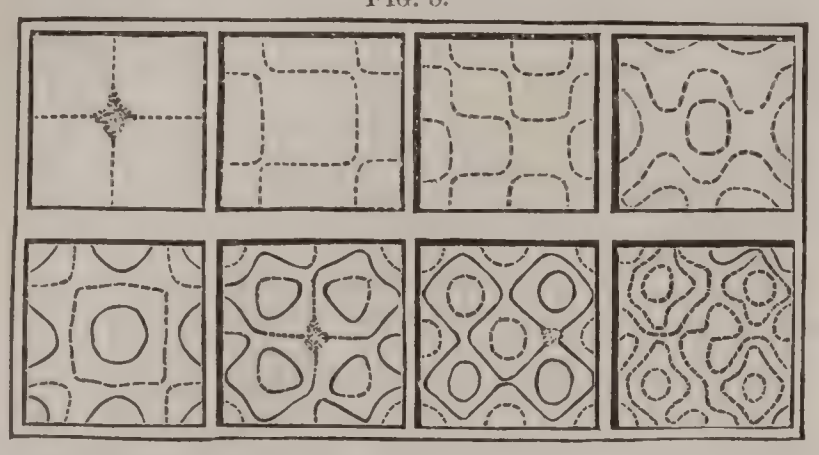

Both rods and stretched cords may be made to vibrate longitudinally by applying to them in the direction of their length an adhesive rubber. In rods or cords of the same material, the number of longitudinal vibrations is inversely as the length, and is unaffected by the area or form of the cross-section. Nodal points may be produced in longitudinal in like manner as in transverse vibration. Rods may also be made to vibrate by torsion; and in this case the number of vibrations per second is inversely as the length and directly as the thickness of the rods.

The paths described by the extremities of rods in vibration are often remarkably sinuous. An ingenious contrivance for observing them, employed by Prof. Wheatstone, consists in fixing to the extremity of the rod a polished bead which gives in a single point a bright reflection from a source of light. When the rod vibrates, the path described by this point, owing to the persistence of visual impressions upon the eye, appears as a brilliant curve more or less complicated, which is the resultant of the transverse vibrations of different lengths occurring simultaneously in the same rod.

*Vibrations of Plates.*—Elastic plates are easily made to vibrate, but their vibrations are seldom simple. They vibrate usually in segements, bounded and separated from each other by lines of repose, which lines are called nodal

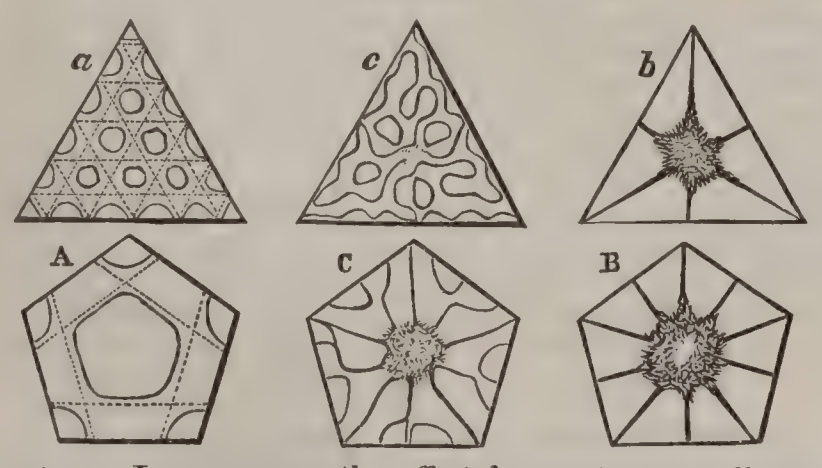
lines. The number and form of the vibrating sections are determined by the figure of the plate, the manner in which it is secured or "stopped," and the points of application of the exciting force. The plate is most conveniently excited by drawing the bow of a violoncello across its edge. The points which are firmly held by the immovable supports of the plate, and those whose movements are interfered with by stops, cannot, of course, participate in the vibration, and the segments must form themselves in reference to these. In order that the plate may vibrate freely, the stops must be placed so that lines drawn through them parallel to the principal linear dimensions or co-ordinate axes of the plate may be divided by them into parts having a simple numerical ratio to each other; and the exciting force must be applied at a point of the perimeter which is midway between two nodal lines. By varying the positions of the stops and the points of application of the exciting force, the nodal lines of any plate may be made to assume a great variety of configurations, and by employing plates of different forms this variety may be largely increased. These configurations become visible when the plate is lightly strewn with fine sand, the particles of which are driven by the vibration from the parts of the plate in motion and settle on the lines of repose. It is a curious fact that if a very light powder, like lycopodium,

FIG. 8.



be employed instead of sand, it will collect at the centres of the vibrating segments, and not on the nodal lines,—a paradoxical phenomenon which Mr. Faraday explained by showing it to be caused by the slight atmospheric currents produced by the vibration, which currents tend toward these

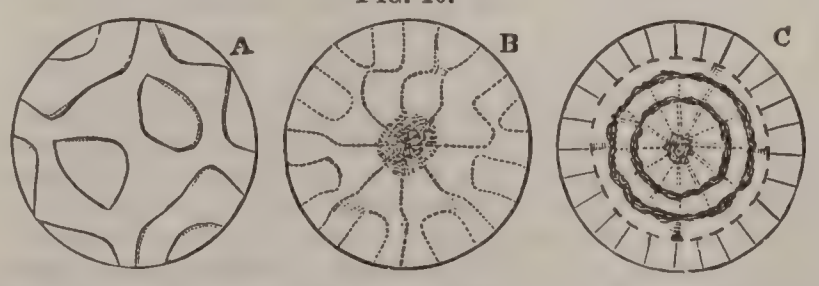
FIG. 9.




centres. In a vacuum the effect does not occur, all powders, whether light or heavy, going to the nodal lines.

The figures formed by the nodal lines are called acoustic figures. They are often so intricate as to be difficult of accurate delineation by the draftsman; on which account Savart, by whom they were first studied, made actual transfers of them to paper by pressing down upon the plate a

FIG. 10.




gummed surface to which the powder adhered. Photography, however, furnishes at the present time a much more expeditious as well as more effectual mode of making these copies. Figs. 8, 9, and 10 are examples.

When on superposing upon each other two acoustic figures formed by different modes of vibration of the same plate, the nodal lines are observed to have points of intersection; then by strewing the plate with sand, and causing it to vibrate successively in these two modes, it will be found, after a few alternations, that the sand will be chiefly accumulated upon these points of intersection, which may therefore be properly called nodal points.

The vibrations of plates obey the following laws: (1) When similarly secured and stopped, the number of vibrations performed by a plate in a unit of time is directly as the thickness of the plate. (2) In circular plates, or plates of regular geometrical figure capable of being circumscribed about a circle, the number is inversely as the square of the diameter. (3) In elongated plates the number is inversely as the square of the length, and is independent of the breadth.

*Vibrations of Membranes.*—As a plate may be regarded as a system of rods adhering to each other throughout their length, so any thin and flexible substance stretched upon a frame may be likened to a similar system of cords. Every such membrane has its own proper mode of vibration, which depends principally upon its tension, since the weight and thickness are small, but somewhat upon these also. It is easy to excite vibration in such a membrane by passing through it a thread knotted at one end and secured at the other to a steel diapason or tuning-fork, of which the mode of vibration is in harmony with it, fixed upon a stand. The thread being stretched, the membrane will be thrown into vibration whenever the fork is excited, and the acoustic figures formed by it will be shown, as in the case of plates, by loose sand. The thread may be attached at any point which is midway between the nodal lines of these acoustic figures.

*Sympathetic Vibrations.*—When a vibrating plate is brought near and parallel to a similar plate at rest, so supported as to be free to take on the same mode of vibration, it will excite vibration in the latter without contact, and the fact will be made evident by the appearance of acoustic figures. This is called vibration by sympathy. It is caused by the atmospheric pulsations which, excited by the vibrating plate, strike on the plate at rest at intervals coinciding with the period of its natural vibration, and in the parts where, when in vibration, it naturally tends to move. The energy of each of these impacts is very slight, but their number is very great, and as they so succeed in time as to reinforce each other, they produce presently a very sensible effect. If, however, the natural vibrations of the plate acted upon are not isochronous with those of the other, the successive impulses will be as often in conflict as in coincidence with its movements, and it will remain sensibly at rest.

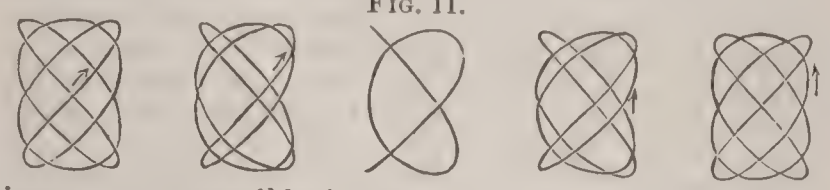
A membrane so lightly stretched upon its frame as to have no decided tendency to vibrate in a given time, will respond by sympathy to vibrations in other bodies of any description. On this principle is constructed an instrument called the *phonautograph*, designed to make a graphic record, upon a properly-prepared surface, of the aërial vibrations produced by the human voice. The pulsations are concentrated by a large hollow paraboloid open at the apex, but closed by a membrane, the middle point of which is connected with a tracer. The prepared surface upon which the tracer rests is carried by a slowly-revolving cylinder, and the record is an irregularly sinuous line produced by the varying character of the vibration. This instrument is more fully described under ACOUSTICS (which see).

*Composition of Vibratory Motions.*—Dr. Rudolph Kœnig of Paris has devised an ingenious mode of showing the path of a point affected by two vibrations, equal or unequal, at the same time. Two diapasons, or tuning-forks, with long and flexible limbs, are employed for this purpose, to a limb of one of which is attached a narrow plate of glass blackened with smoke, while a limb of the other carries a tracer resting on the glass. Both diapasons being excited, the one of them which carries the tracer is moved steadily in the direction of the length of the prepared plate, and the trace exhibits the resultant effect of the vibration. By varying the conditions of the experiment as to the relative directions and times of the component vibrations, a great variety of very curious and complicated curves may be produced.

In 1855, Prof. Lissajous of Paris communicated to the French Academy of Sciences an optical method of investigating the effects of compound vibrations which possesses considerable interest. It will be understood by supposing a small mirror to be attached to one limb of a fixed diapason in a dark room, into which a ray of sunlight is admitted through a small aperture. The ray is received upon the mirror and reflected upon a white screen, being passed first through a convex lens of long focus to give the image sharpness. When the diapason is excited, the slight vibratory movement of the mirror will be greatly magnified in the image on the screen; and, owing to the persistency of the impressions of vision, the point will be apparently transformed into a straight line. But if the reflecting ray be intercepted by a second mirror attached to another diapason, and both be put into vibration, the image, being received on a suitably-placed screen as before, will describe a path assuming a great variety of forms, according as the positions of the diapasons, and the times, amplitudes,

and respective initial phases of their vibrations are different. If the axes of the diapasons are parallel, the times and amplitudes equal, and the phases identical, the path will be a straight line of double the length of that produced by a single reflection; but if, the conditions remaining in other respects the same, the phases are opposite, the resultant is as if both diapasons were at rest, or is, in other words, a point merely. If the axes are at right angles, the resultant is a straight line inclined at an angle of 45° to the directions of the component vibrations. In this case, other conditions remaining unchanged, if one phase is one-fourth advanced on the other, the result will be a circle, or, if the amplitudes of vibration are unequal, an ellipse. With equal amplitudes and times, all relations of phase except that of one-quarter difference, and those of perfect identity or complete opposition, will give elliptical figures. When the times are different, the figures become complicated, and more so in proportion as the ratios of the

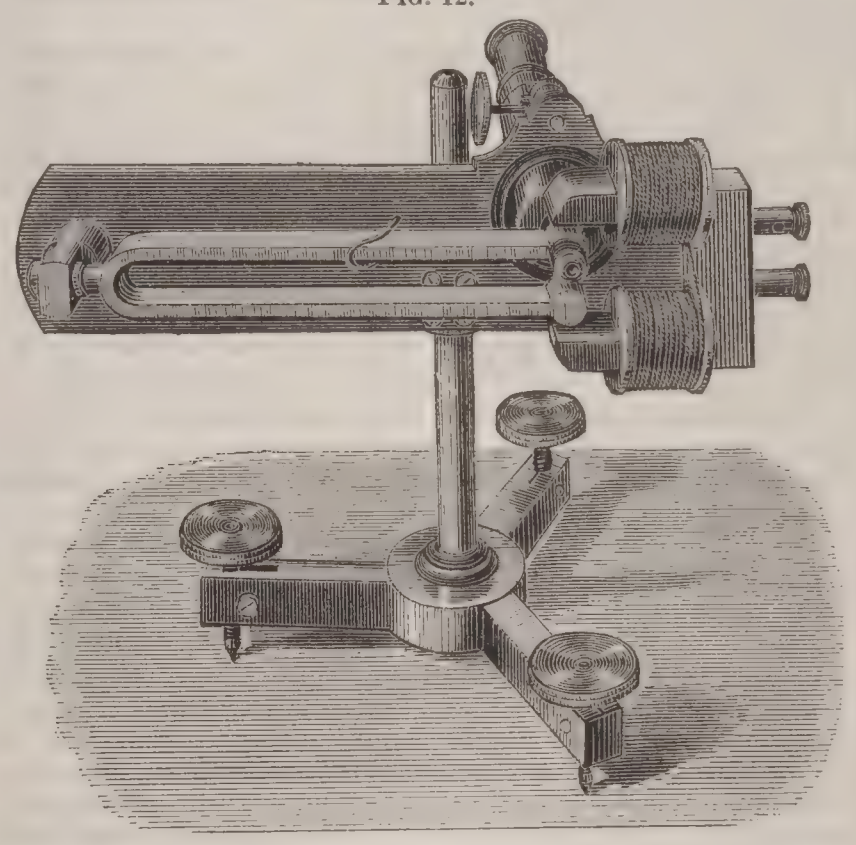
FIG. 11.



times are expressible in less and less simple numbers. Fig. 11 represents some of the figures obtained with two diapasons whose times are as 3 to 4, corresponding with the musical interval of a fourth. The first of these appears when the initial difference of phase is zero; the succeeding ones correspond to differences equal to the fractions $\frac{1}{24}$, $\frac{1}{12}$, $\frac{1}{8}$, and $\frac{1}{6}$ of the larger vibration, the shorter vibration beginning when the longer is advanced by such fraction of its length.

In order to study the vibrations of bodies to which mirrors cannot be attached—as, for example, of stretched strings—Prof. Lissajous made use of an ingenious apparatus which he called his comparator. This, which is represented in Fig. 12, consists of a diapason, to one limb of which is attached the object-glass of a compound micro-

FIG. 12.



scope, the body of the microscope being detached and supported by an independent stand. If the diapason be caused to vibrate, the image of any minute fixed object will seem to vibrate similarly, its motion being magnified by all the power of the instrument. But if the small object observed have itself a vibratory motion, its apparent path will be the resultant of the two vibrations, and figures will be produced resembling those above given, from the analysis of which the character of the vibration of the object observed may be deduced. When the vibrating body is a string, or other object without conspicuous points suitable to be used in the comparison, it is necessary in some manner to mark it. In order to avoid loading the body or altering its condition by adding coloring-matters, Mr. Lissajous, in the case of strings, employed a cylindrical lens to throw a sharp line of light across the object, thus creating a brilliant point which moves with the string without affecting its mode of vibration.

In order to maintain the vibration of the diapason for an indefinite length of time, without being under the necessity of exciting it mechanically, Mr. Lissajous introduced an electro-magnet to act intermittently on one of the limbs, the circuit being alternately closed and broken by an interrupter carried by the limb itself. The manner of making electric connection with the limb is shown in the figure, but the interrupter, which is a short bent wire attached to the end of the limb, does not appear. This expedient of Mr. Lissajous has since been made of extensive usefulness in arrangements of acoustic apparatus. (For the connection of vibration with undulation see ACOUSTICS and UNDULATORY THEORY OF LIGHT.) F. A. P. BARNARD.

**Vib'rio** [Lat., plu., *Vibriones*], a genus and a family (Vibrionidæ) of Infusoria having spindle-shaped bodies. Familiar examples are the so-called *eels* of vinegar and paste. Some few kinds, like the earcockle, which devours wheat (*Vibrio tritici*), attain the length of one-fourth of an inch, but others are microscopical. Vibriones are reported to have been found in unhealthy pus and in various diseased tissues (as in erysipelas), but whether as an essential element of disease is not settled. It is believed that "hay-fever" or autumnal asthma is caused by vibriones in the nostrils. (*Helmholz.*)

**Vi'broscope,** an instrument designed to enable an observer to make direct observation of the movements of a vibrating body. Mr. Wesselhoft of Riga in Russia has constructed an instrument of this kind, which he calls a universal vibroscope, as it is equally adapted to the observation of bodies of every description and under all circumstances. This instrument is founded upon the principle of the well-known optical toy called the phenakistoscope; that is to say, the essential part of it is a rotating disk, perforated near the circumference with equidistant sight-holes. Suppose, for instance, that an observer, with this disk before his eyes, directs his attention to a singing flame or a vibrating rod. If the duration of the vibration is just equal to the interval between the passages of the successive sight-holes before the eye, the aspect of the flame or of the rod will be unchanged. Thus, if the rod happen to be caught at the point of extreme flexure on one side of the mean position, it will appear to be a permanently bent rod; and if the flame should be on the point of extinction when first seen, it will seem to be a steadily faint flame. But such an exact coincidence of intervals could hardly occur. The object will therefore be seen at its successive reappearances in as many successive conditions; and owing to the persistence of impressions upon the eye it will not have been consciously lost sight of at all. The vibration, therefore, which is really rapid, will appear to be a motion comparatively deliberate, and the form of the path may be easily inferred. As it is necessary to give to the disk a high velocity of rotation, it should be made of light material. The inventor constructed it of aluminium blackened. Card-board in many cases would answer equally well. Some magnifying power is desirable. This is furnished by a small telescope mounted on an independent stand, and brought close to the revolving disk on the side opposite to the observer's eye. This instrument may serve as a means of determining the *rapidity* of vibration of the body observed. To this end it should be provided with a contrivance for regulating the velocity of rotation according to circumstances, and should have a register of its actual velocity during the time of observation. F. A. P. BARNARD.

*Extracted from my Report on the Paris Exposition.*

**Viburnum.** See CAPRIFOLIACEÆ.

**Vic'ar** [Lat. *vicarius*], in the Anglican Church, a clergyman who is the incumbent of a parish under a *rector*, the latter being the person who owns the great or rectorial titles, while to the vicar pertain the lesser tithes. A vicar is superior in rank to a curate, but in French parishes the *curé* is superior in rank to the *vicaire*. The latter usage of the terms was formerly prevalent in England.

**Vicar-Apostolic,** a person in episcopal orders, usually of some see *in partibus infidelium*, who holds from the pope episcopal authority over a district known as a vicariate-apostolic, usually an inchoate, new, and temporary, or a disordered and suppressed diocese. Missionary dioceses are usually vicariates-apostolic, and as such must report to the College of the Propaganda. In 1838 the difficulties between the king of Portugal and the pope with regard to the East Indian bishoprics led to the abolition of nearly all of them, and the substitution of vicariates-apostolic. So also the Scottish sees, suppressed by law, are represented by vicariates.

**Vicar-Capitular,** the administrator of a diocese, chosen by the chapter in case of a vacancy. He can perform acts for the government of the diocese, but has no episcopal authority.

**Vicar-Forane** [*vicarius foraneus*, "vicar out of doors"], the delegate of a bishop who exercises certain episcopal rights in a part only of the diocese. (See VICAR-GENERAL.) Not all dioceses possess such officers.

**Vicar-General,** an officer under a bishop, who as the representative of his superior exercises authority in all

parts of the diocese. Not all dioceses have a vicar-general, though many have two or more.

**Vic'ars** (JOHN), b. at London, England, in 1582; educated at Christ's Hospital, London, and Queen's College, Oxford; was for much of his life usher of Christ's Hospital, a Presbyterian preacher, and a violent writer on religious and political subjects. D. in 1652. Author of *Jehova Jireh, God in the Mount; or, England's Remembrancer* (1641), *God's Arke overtopping the World's Waves* (1646), and *The Burning Bush not Consumed* (1646), which were published together under the title of *Magnalia Dei Anglicani, or England's Parliamentary Chronicle* (1646), a curious book on *Prodigies and Apparitions* (1643), *England's Worthies* (1647), and other works.

**Vic'chio,** town of Italy, province of Florence, is composed of several fractions, the principal of which occupies a hill on the left bank of the Sieve, has its castle, and is surrounded by a wall. It became a part of the Florentine republic in 1324. P. 10,316.

**Vice-Admiral,** the second in rank of the officers in the U. S. navy, which has only one vice-admiral. The office was created in 1864. The vice-admiral's pay at sea is $9000 per annum, on shore duty, $8000, and while waiting orders, $6000. The British navy had in 1873, 15 active vice-admirals, besides 84 on the retired list. The old distinction into vice-admirals of the red, the white, and the blue has been abolished. (See ADMIRAL.)

**Vice-Consul,** in the U. S. service, an officer subordinate to a consul, is sometimes appointed to assist a consul or to perform a consul's duties in his absence, or, more frequently, to perform consular duties at ports of subordinate importance. Vice-consuls are appointed by the President or the secretary of state, and derive their pay from the consul under whom they serve.

**Vicente** (GIL). See GIL VICENTE.

**Vicen'za,** an ancient town in the province of the same name, in Northern Italy, on the torrent Bacchiglione and near Monti Berico. Vicenza is best known abroad for its palaces constructed by Palladio, which, though condemned by critics and now somewhat fallen into decay, are still justly admired for their proportions and the symmetry of their different members and decorations. The cathedral has pictures and terra-cottas, and is of fifteenth-century Gothic. San Lorenzo is a fine Gothic edifice lately restored. La Santa Corona, also Gothic, has a fine *Baptism in the Jordan* by G. Bellini, and other good paintings, as also remarkable sepulchral monuments. Besides the palaces erected by Palladio—the most conspicuous of which are the Barbarano, the Chienicati, Del Conte Porto, Colleoni Porto, and Orazio Porto, and the Teatró Olimpico—the houses of Palladio and Pigafatta, which latter, however, is perhaps by another architect, are very noticeable. There are several of similar style by Scamozzi, and some after the older Venetian manner. There is a good collection of pictures in the magnificent Pinacoteca Civica which contains works by Van Eyck, Antonella da Messina, Titian, Luini, and John Bellini. The sanctuary on Monte Berico is approached by an arcade of 168 arches, contains some good pictures, and is much resorted to for its extensive and beautiful view, which embraces a wide range of Alpine peak and fertile plain. At the foot of Monte Berico is the stripped and mutilated villa of Palladio, once one of the most splendid monuments of modern architectural art, and still retaining its fine proportions and most important features. Vicenza has a tasteful cemetery with some remarkable tombs. Vicenza is well provided with educational institutions. P. 37,686.

**Vicenza,** DUKE OF. See CAULAINCOURT, DE.

**Vice-President,** an officer of the U. S. government, chosen at the same time and in the same manner as the President. His only official duty is to act as president of the Senate. In case of a failure of the electors to choose a Vice-President, a majority of the votes of the Senators (a quorum of two-thirds being present) will elect him; or if there be no majority, he is chosen from the two candidates who have received the highest number of Senatorial votes. In case of a vacancy in the Presidency he becomes President of the U. S. As president of the Senate he has a casting vote in case of a tie. His salary is $8000 per annum.

**Vich,** or **Vique,** town of Spain, province of Barcelona, at the foot of the Pyrenees, has cotton and flax weaving factories, tanneries, potteries, and manufactures of combs, knives, and hats; its sausages are famous. P. 13,712.

**Vichy',** in Central France, department of Allier, on the Allier, is beautifully situated, nine hours by rail from Paris, and is celebrated for its hot mineral springs and elegant bathing establishments. The principal ingredients of the water are carbonate of soda and carbonic acid gas. The great celebrity of the place is somewhat recent. P. about 6028.

**Vicks'burg,** p.-v., Kalamazoo co., Mich., at the junction of Grand Rapids and Indiana and Chicago and Lake Huron R. Rs., 12 miles S. of Kalamazoo, has 2 churches, a union school, 1 newspaper, 4 hotels, and several mills. It is located in the centre of a rich farming section. P. about 1200. J. D. VAN BUREN, ED. "UNION."

**Vicksburg,** city and cap. of Warren co., Miss., on Mississippi River, midway between Memphis and New Orleans. It has a regular line of packets plying the Mississippi River to St. Louis, a weekly packet to Memphis, a tri-weekly mail line to New Orleans, and a large fleet of boats plying on the tributaries. Vicksburg and Meridian R. R. has its western terminus here, and Vicksburg and Shreveport R. R. its eastern terminus on the opposite side of the river. It is the first city in size and importance in the State of Mississippi, and the second port of importance on the Mississippi River between St. Louis and New Orleans. Vicksburg is built on a range of hills that skirts the Yazoo and Mississippi Valley from Memphis, and touches the river-bank here. It is therefore the outlet for the products of the Mississippi delta and the fertile valleys of the Yazoo, Sunflower, and tributary streams. The leading staple is cotton, and the commerce of the city depends mainly upon the success of the cotton-crop. Vicksburg has a merchants' and cotton exchange, 2 banks, 3 saw-mills, 2 window-sash and door factories, a cotton-seed oil-mill which ships a large amount of cotton-seed oil, oil-meal, and oil-cake to Europe, a shoe-factory, iron-foundry, carriage-factories, and 1 daily and 2 weekly newspapers. A short distance beyond the city limits is the national cemetery, in which are interred 17,000 Union soldiers, and between the cemetery and the city is a stone-quarry giving employment to 150 or 200 men. The "Anchor line" of St. Louis and Vicksburg packets, the New Orleans and Vicksburg mail line, and the "Parisot line" of Yazoo River steamers have their termini here. The city has a volunteer fire department, well equipped. There are 7 churches attended by white people, and 6 attended by colored people with colored pastors. Vicksburg was situated on the E. bank of the river, with a long, narrow neck of land forming a sort of peninsula opposite the city. During the siege of Vicksburg in 1863, Gen. Grant attempted to divert the channel of the river through the peninsula about 3 miles below the city, but failed. On Wednesday, April 26, 1876, the peninsula, which had been gradually wearing away for years, had narrowed to 153 feet width, and at 2.10 P. M. on that day the water broke through, forming a cut-off directly opposite the city; so that Vicksburg is now upon a lake with an island in front. P. 12,443. JAMES H. SULLIVAN, ED. "DAILY HERALD."

**Vicksburg, Siege of.** Early in the war the strategic importance of Vicksburg as the key to the southern Mississippi Valley was comprehended, and measures taken for its fortification, a battery having been planted there immediately after the passage of the Mississippi ordinance of secession in Jan., 1861. By the capture of New Orleans (Apr., 1862) and the previous successes of the flotilla under Com. Foote, Vicksburg remained the only fortified point on the river held by the Confederate forces, and they were rapidly strengthened. A demonstration was made by the appearance of some vessels from Farragut's fleet May 8, but hostilities were not commenced until June 28, when Gen. Williams with four regiments and eight field-pieces occupied the peninsula opposite Vicksburg, and began the work of cutting a canal across the neck of the peninsula, so as to change the course of the river and leave Vicksburg inland. The forces in that town were gradually increased to about 34,000, under Gen. John C. Pemberton, and in the autumn Gens. Grant and Sherman approached with an army of some 40,000 men. By direction of Gen. Grant an attempt was begun by Gen. Sherman (Dec. 25) to penetrate to the rear of Vicksburg through the Yazoo swamps, but they proved impassable, and the plan was abandoned Jan. 1, 1863. After some skirmishing, which involved an aggregate Union loss of nearly 2000 men, Sherman was superseded by McClernand (Jan. 4), and Gen. Grant, with all his forces, moved against Vicksburg. Several vain attempts were made to gain a passage by water to the S., but after two canals had proved failures, and an attack by Porter's gunboats upon Grand Gulf had been repulsed, Gen. Grant, with the main body of his army, marched from Bruinsburg inland upon Jackson, captured that place May 14, defeated Pemberton on the Big Black River May 16–18, and crossed that stream on floating bridges May 18, on which date the formal siege of Vicksburg may be considered to have begun. Gen. Sherman had meanwhile made feints from Milliken's Bend, and Pemberton soon abandoned his outside intrenchments on Haines's Bluff and con-

centrated within the city. Gen. J. E. Johnston, his superior in command, wrote to him to abandon the place as untenable and march to the N. E.; but Pemberton replied that it was neither possible nor desirable to withdraw, and solicited reinforcements. Grant made an experimental assault upon Pemberton's lines May 19, and, being repulsed, settled down to a regular siege. His forces were gradually increased to 70,000 men, while Pemberton had but 25,000 effective men, was deficient in ammunition, and had rations for only sixty days. The investment continued with an almost constant bombardment until July 3, when, having no hope of relief, Pemberton invited an interview with Grant, and surrendered the city upon honorable terms, which took effect the following day (July 4, 1863), which, being also the day of the final battle of Gettysburg, is justly considered the decisive crisis of the war. The prisoners numbered 27,000, the total previous loss of the Confederates being reckoned at 10,000, and the total Union loss 8575.

PORTER C. BLISS.

**Vi'co** (GIOVANNI BATTISTA), b. at Naples in 1668; was educated by the Jesuits; studied law; lived for several years in the house of the bishop of Ischia as tutor to one of his nephews; was afterward appointed professor of rhetoric at Naples, and in 1735 royal historiographer. D. at Naples Jan. 20, 1744. His great work, *Principj di una Scienza Nuova d'Interno alla Commune Natura delle Nazioni,* which is the first attempt to create a philosophy of history, appeared at Naples in 1725, and in enlarged editions in 1730 and 1745. It represents Divine Providence as the governing power in the history of mankind, and demonstrates the formation, development, and decay of nations as realizations of ideas pre-existing in the Divine Mind. It is often obscure, but it is as often bold and striking, anticipating the results of later researches; and it exercised great influence when, in the beginning of this century, it became thoroughly known in Europe, introduced in Germany by Weber, in France by Michelet. Complete editions of his works were given in 1818 by Villa Rosa, and in 1834 by Ferrari.

**Vi'co, de** (FRANCESCO), b. at Macerata, Naples, May 19, 1805; was educated in the Jesuit college of Urbino, and was appointed assistant superintendent in 1835, and director in 1839, of the observatory of Rome; discovered several comets, and acquired celebrity by his observations of the rings of Saturn and the spots of Venus; was expelled with the other Jesuits from Rome in 1848; was chosen to take charge of a new observatory to be established in New York, but d. in London Nov. 15, 1848.

**Vi'co del Garga'no,** town of Southern Italy, province of Foggia, at the foot of Monte Gargano and surrounded by charming hills. The pasturage of the district is excellent and the olive thrives luxuriantly. P. 7813.

**Vi'co Equen'se** [*Vicus Æquensis*], town of Southern Italy, province of Castellamare, about 4 miles S. W. of the town of Castellamare, on a rocky cliff which overlooks the Bay of Naples and commands magnificent views of Vesuvius, of the city of Naples, of the neighboring islands, etc. It was built by Charles of Anjou about 1300, and was afterward a favorite resort of the Aragonese princes, but the numerous remains of ancient constructions found near it prove that it was the seat of a dense Roman population. Vico Equense is remarkable for its superior wines and rich fruits; excellent fish abound on the coast. P. 11,208.

**Vicopisa'no** [formerly *Vico Anserissola*], town of Italy, province of Pisa, on a spur of Monte Pisano, is composed of several fractions, the largest of which is still walled, though the towers are demolished. This town belonged, for the most part, to Pisa from about 1100 till 1496, when it became the head-quarters of the emperor Maximilian I., and soon after this the commonwealth of Florence obtained permanent possession of it. The mineral waters of the neighborhood have considerable reputation. P. 7965.

**Vicq d'Azyr'** (FÉLIX), b. at Valognes, department of Manche, France, Apr. 28, 1748; studied medicine at Paris; began to lecture there on physiology in 1773; became perpetual secretary of the Royal Medical Society in 1776, and first physician to Marie Antoinette in 1789. D. in Paris June 20, 1794. He wrote—*La Médecine des Bêtes à Corne* (2 vols., 1781), *Système anatomique des Quadrupèdes, Système anatomique* (6 vols., 1791 *seq.*). A collected edition of his works was published by Moreau in 1805.

**Vic'tor,** tp., De Kalb co., Ill. P. 926.

**Victor,** p.-v., Iowa co., Ia., on Central R. R. of Iowa and Pacific R. R., contains several churches, excellent schools, 1 weekly newspaper, 2 elevators, 2 lumber-yards, 1 banking-house, and 2 hotels. It is surrounded by fine farming lands. P. about 700. MRS. H. M. CLAPP, ED. "INDEX."

**Victor,** p.-v. and tp., Clinton co., Mich. P. 940.

**Victor,** p.-v. and tp., Wright co., Minn. P. 596.

**Victor,** p.-v. and tp., Ontario co., N. Y., on the Syracuse and Rochester branch of New York Central R. R., has a private bank. P. of v. 506; of tp. 2437.

**Vic'tor Amade'us,** the name of three sovereigns of the house of Savoy, of whom the first bore the title of duke of Savoy, the two latter that of king of Sardinia. VICTOR AMADEUS I., b. in 1617, succeeded his father, Charles Emmanuel the Great, as duke of Savoy in 1630; was forced by Richelieu into an alliance with France against Austria and Spain; gained the victories of Fornavento and Montebaldone, but d. at Vercelli shortly after, Oct. 7, 1637.—VICTOR AMADEUS II., b. May 14, 1666, a grandson of the preceding, succeeded his father, Charles Emmanuel II., in 1675, and married in 1684 Anne Marie of Orleans, a niece of Louis XIV. Nevertheless, he allied himself with Austria, and although Catinat overran both Savoy and Piedmont after the battle of Marsaglia (Oct. 4, 1693), in which the duke lost 10,000 men, he still kept up the contest, and compelled Louis XIV. to buy him off by returning to him all his possessions and paying a handsome sum of money. After the peace his eldest daughter was married to the duke of Burgundy, by whom she became mother to Louis XV., and the younger to Philip of Anjou, soon after king of Spain. Nevertheless, in the Spanish war of succession the duke allied himself again with Austria. His country was the scene alternately of the exploits of EUGENE and VENDÔME (which see), but by the Peace of Utrecht (1713) he received Sicily and the title of king. In 1720 he exchanged Sicily for Sardinia, and on Sept. 2, 1730, abdicated. Next year he made an attempt to regain the royal power, but was imprisoned at the château of Moncalieri, where he d. Oct. 31, 1732.—VICTOR AMADEUS III., b. in 1727, a grandson of the preceding, succeeded his father, Charles Emmanuel III., in 1773; declared war against the French republic, but was compelled by Scherer and Bonaparte to accept the Peace of Paris (1796), by which he lost Savoy and Nice. D. in the same year.

**Victor** (AURELIUS). See AURELIUS VICTOR.

**Victor** (CLAUDE), duke of Belluno, b. at Lamarche, department of Vosges, France, Dec. 7, 1764; entered the army in 1781; was created a brigadier-general in 1795, general of division in 1797, marshal and duke after the battle of Friedland; commanded in Spain from 1809 to 1812, where he gained the victories of Uclés and Médellin, but was defeated at Talavera; fought with distinction in the Russian and German campaigns 1812–14; adhered to the Bourbons during the Hundred Days, and became afterward conspicuous on account of his harshness toward those generals who returned to Napoleon; was minister of war from 1821 to 1823; accompanied in the latter year the French army to Spain as commander under the duke of Angoulême, but was recalled on account of frauds in the administration of which he could not have been ignorant; was appointed minister to Vienna, but not accepted by that court, and lived afterward in retirement. D. at Paris Mar. 1, 1841.

**Victor** (ORVILLE JAMES), b. at Sandusky, O.; was editor of the Sandusky *Daily Register* 1852–56, of the *Cosmopolitan Art Journal* 1857–61, and of Beadle's "Dime" publications (1860–64), for which he wrote biographies of Garibaldi, Winfield Scott, Anthony Wayne, and John Paul Jones; contributed to magazines and to political papers in New York City, and was author of *Incidents and Anecdotes of the War* (1863), *History of American Conspiracies* (1864), and of a *History, Civil, Political, and Military, of the Southern Rebellion* (New York, vol. i., 1862; vol. ii., 1863; vols. iii. and iv., 1868).—In 1856 he married MISS METTA VICTORIA FULLER (b. at Erie, Pa., Mar. 2, 1831), a lady who became in 1847 a favorite contributor of poems to the *Home Journal,* has edited several periodicals, and published several volumes of poems, sketches, and novelettes. Among her books were *The Senator's Son, a Plea for the Maine Law* (1853), *The Two Mormon Wives* (1857), and *Miss Slimmens' Window, and other Papers* (1860).

**Vic'tor Emman'uel I.,** king of Sardinia (1802–21), b. July 24, 1759, the second son of Victor Amadeus III.; ascended the throne on the abdication of his brother, Charles Emmanuel IV., June 4, 1802, and resided at Cagliari till 1814, his possessions on the mainland being occupied by the French. By the Congress of Vienna not only his hereditary lands were restored to him, but the duchy of Genoa was added to his dominions; but the reactionary measures he introduced caused a violent revolution, and he abdicated Mar. 13, 1821. D. at Moncalieri Jan. 10, 1824.

**Victor Emmanuel II.,** king of Sardinia from 1849, and king of Italy from 1861, b. at Turin Mar. 14, 1820, the eldest son of Charles Albert; received an excellent education, both scientific and military; married (Apr. 12, 1842) Archduchess Adelheid of Austria; commanded the Savoy brigade in the campaigns against Austria in 1848–49, and

distinguished himself by his brilliant personal valor in the battles of Goito and Novara. On the very evening of the disastrous battle of Novara (Mar. 23, 1849) Charles Albert abdicated in favor of his son, and Victor Emmanuel ascended the throne under very critical circumstances. Peace had to be bought of Austria with great pecuniary sacrifices, and in the interior the state was divided into many contending political factions. The young king himself was as yet by no means popular. As the husband of an Austrian princess and a pupil of the Jesuits he had to earn the confidence of his subjects. Nevertheless, from the very first day of his reign the policy which he adopted, and which he invariably pursued, though at times it led him into very queer combinations, tended toward the establishment of the national unity of Italy and the elevation of the Italian people through free institutions. Supported by his celebrated minister Cavour, he succeeded in restoring the finances to order, reorganized the army, concluded commercial treaties with foreign powers, limited the privileges of the clergy, secularized the Church property, and established a new system of popular education independent of the control of the Church. The pope excommunicated him, but the thunderbolt proved cold, and the effect was simply that all intelligent men in Italy began to look on him as the coming liberator, the more so that he with great boldness gave all political refugees from the other Italian states an asylum in his dominions. By his participation in the Crimean war he made the kingdom of Sardinia a noticeable and noted part of the political system of Europe, and finally, in 1859, he was able to renew the contest with Austria by the aid of France. By the Treaty of Villafranca (July 11) and the Peace of Zurich (Nov. 10, 1859) Lombardy was added to his dominions. The aid of France he had to pay for by ceding Savoy and Nice; but at the same time Parma, Modena, Tuscany, and parts of the Papal States annexed themselves to Sardinia; and soon after, the campaign of Garibaldi in Sicily and Naples produced the same result with respect to the whole southern part of Italy. On Mar. 17, 1861, Victor Emmanuel assumed the title of king of Italy, and early in 1865 the royal residence was removed from Turin to Florence. Meanwhile, the situation continued to be very difficult. Venetia and Rome were still wanting, and their great success had at once made the Italian people very impatient and the relation to other powers, even to France, very delicate. As France was not likely to further support the Italian movement, Victor Emmanuel sought and found a new ally in Prussia; and although the Italians lost the battle of Custozza (June 24, 1866), by the Peace of Vienna (in October) Austria ceded Venetia; and when, during the Franco-German war, the French garrison was withdrawn from Rome, the city annexed itself by a popular vote to Italy, and on July 2, 1871, Victor Emmanuel entered the city and took up his residence in the Quirinal Palace. By his first wife, who died Jan. 20, 1855, he has two sons—Humbert, the crown prince, and Amadeus, for a time king of Spain; and two daughters—Clotilde, married to Prince Napoleon, and Pia, married to the king of Portugal. He has since married, morganatically, Rosa Vercellana, countess of Montefiore.

**Victoria,** city of HONG-KONG (which see).

**Victoria,** a British colony in Australia, formerly called **Australia Felix,** occupies the south-eastern part of the continent, comprises an area of 88,451 sq. m., and extends between lat. 34° and 39° S., and between lon. 140° and 150° E. The extent of its coast-line is nearly 600 miles. The principal harbor is Port Philip Bay, an inland sea of an extreme length of over 30 geographical miles from N. to S., and of about 35 geographical miles from E. to W. The entrance is about 2 miles across. Western Port is also of importance. The country is traversed throughout its whole length by a chain of hills completely dividing it into two parts, and thence called the Dividing Range. This range runs in an E. and W. direction, generally at a distance of 60 or 70 miles from the coast. The streams to the N. of it run toward the Murray, those to the S. of it toward the sea. There are also other ranges extending in different parts of the country, many of which are offshoots of the main chain. The highest peaks are the Bogong Range, 6508 feet; Cobberas, 6025; Cope, 6015; Feathertop, 6303; Hotham, 6100. The rivers are for the most part of inconsiderable size; many of them are liable to be partially dried up during the summer. With the exception of the Yarra, on the banks of which the metropolis, Melbourne, is situated, the Goulburn, which empties itself into the Murray about 8 miles to the eastward of Echuca, and the Murray itself, with perhaps some of the Gippsland streams, not one of them is navigable except by boats. As, however, they drain the watershed of large areas of country, they will ultimately be made feeders to permanent reservoirs for the purposes of irrigation, gold-washing, and manufactures. Of the numerous lakes which the country contains, and of which several are craters of extinct volcanoes, Lake Corangamite is the largest, and covers 76 sq. m. It is salt. Lake Colac covers 10 sq. m., Lake Burrumbeet 8½. The climate equals that of the most beautiful European countries; Melbourne has many of the advantages of Lisbon. The soil is fertile, offers excellent fields, meadows, pastures, and forests, and is rich in metals, especially in gold: 1,220,879 ounces were found in 1873; 1,155,972 in 1874. Since the discovery of gold in June, 1851, 44,414,177 ounces, worth £177,656,708, have been produced. Silver, copper, antimony, coal, iron, slate, etc., also abound.

*Population.*—The natives, whose number at the time when the first settlement was made comprised about 5000, have now become nearly extinct; there were 2693 in 1851, 1553 in 1875. The number of settlers amounted in 1851 to 77,345; in 1861, to 540,322; on Apr. 2, 1871, to 731,528. In 1874 the population was estimated at 808,437—namely, 439,159 males and 369,278 females. It increased in 1871 25,846; in 1872, 18,282; in 1873, 19,765; in 1874, 17,945. The excess of immigration over emigration amounted in 1871 to 8382, in 1872 to 1752, in 1873 to 3166, in 1874 to 3367. According to the census of 1871, 329,597 of the population were born in the colony, 28,669 in other parts of Australia, 164,287 in England, 52,210 in Scotland, 100,468 in Ireland, 1170 in France, 8995 in Germany, 6206 in other European countries, 2423 in the U. S. of America, 17,875 in China. With respect to creed, 257,835 belonged to the Church of England, 112,983 were Presbyterians, 170,620 Roman Catholics, 17,650 pagans. The number of houses returned in 1871 was 158,481, of which 6997 were unoccupied and 866 in course of construction; 33,461 were of brick or stone, 101,635 of wood or iron, and 21,155 were canvas tents. Melbourne, including the suburbs, comprised 206,780 inhabitants; Ballarat, 47,201; Sandhurst, 28,577; Geelong, 15,026. In all, there were 458 cities, towns, boroughs, and townships.

*Occupations.*—The principal occupations are agriculture and cattle-breeding. The land consists of—land alienated in fee-simple, 9,932,633 acres; land in process of alienation under deferred payments, 5,650,395 acres; roads, 779,157 acres; lands included in cities, towns, etc., 231,040 acres; reserves in connection with pastoral occupation, about 350,000 acres; auriferous lands, about 1,000,000 acres; state forests not included in unavailable mountain-ranges, 215,000 acres; timber reserves, 306,976 acres; unavailable mountain-ranges, lakes, lagoons, etc., about 23,000,000 acres. Area available for selection at the end of 1874, 14,981,419 acres. From the first settlement to the end of 1874 the amount realized by the sale of land has been £16,786,146, at the rate of £1 13*s.* 10*d.* per acre. The amount realized for lands sold during the year 1874 was £579,051, or an average of £1 1*s.* 9*d.* per acre.

*Land under Principal Crops in 1865, 1870, and 1875.*

| Crops. | 1865. Acres. | 1870. Acres. | 1875. Acres. |
|---|---|---|---|
| Wheat | 125,040 | 288,514 | 332,936 |
| Oats | 144,303 | 144,791 | 114,921 |
| Barley | 7,648 | 28,115 | 29,505 |
| Potatoes | 31,172 | 41,216 | 35,183 |
| Hay | 85,146 | 140,435 | 119,031 |
| Green forage | 40,061 | 102,530 | 254,329 |

*Gross Produce of Principal Crops in 1865, 1870, and 1875.*

| Crops. | 1865. | 1870. | 1875. |
|---|---|---|---|
| Wheat, bushels | 1,899,378 | 5,697,056 | 4,850,165 |
| Oats, " | 2,694,445 | 3,761,408 | 2,121,612 |
| Barley, " | 124,849 | 6,912,248 | 619,896 |
| Potatoes, tons | 59,828 | 127,645 | 124,310 |
| Hay, " | 97,731 | 224,816 | 157,261 |

Flax, hops, maize, mangel-wurzel, onions, peas, beans, millet, beets, carrots, parsnips, cabbage, rye, rye-grass for seed, tobacco, and vines were also cultivated, and 11,083 acres were occupied by gardens in 1874–75; 6317 by orchards. The value of wheat produced amounted in the same year to £1,071,078; of oats, £450,842; barley, £139,476; other cereals, £80,384; potatoes, £553,179; other green crops, £132,405; hay, £699,811; green forage, £762,987; wine, £115,498; garden and orchard produce, £348,000. Of live-stock there were—horses, 180,254; cattle, milch cows, 241,137, others, 717,521; sheep, 11,221,036; pigs, 137,941. The total value of pastoral produce was £9,840,562, of which that of milk and butter was £2,352,750; meat, £2,500,000; excess of exports over imports of wool, customs value, £4,347,199.

*Industry.*—There were 28,036 persons engaged in various kinds of manufacturing industry in 1874–75. The value of lands, buildings, machinery, etc., employed amounted to £6,798,820. There were 2109 manufacturing establishments—producing books and stationery, musical instruments, machines, tools, and implements, carriages and harness,

ships and boats, furniture, chemicals, textile fabrics, dress, fibrous materials, animal food, vegetable food, beverages and stimulants, coals, stone, clay, earthenware and glass, water, metals, etc. About 60,000 persons were engaged in gold-mining in 1874, and the value of the produce amounted to £4,659,341. The value of the produce of other metals and minerals amounted to £490,476.

*Commerce.*—The external commerce is very considerable. The discovery of gold in 1851 gave it at once a vigorous impulse.

| | Value of exports. | Imports. |
|---|---|---|
| 1851 | £1,422,909 | £1,056,437 |
| 1853 | 11,061,544 | 15,842,637 |
| 1861 | 13,828,606 | 13,532,452 |
| 1871 | 14,557,820 | 12,341,995 |
| 1874 | 15,441,109 | 16,953,985 |

The principal items of export are—apparel and ready-made clothing, gold, leather, live-stock, preserved provisions, specie (gold), sugar, tallow, tea, tobacco, wool. This last article is the most important of them all; its value amounted in 1874 to £6,373,676. The principal items of import are cotton, gold, grain of all kinds, hosiery, iron and steel, live-stock, spirits, sugar and molasses, wool, and woollens. According to value, nearly one-half of the imports is set down as the produce of the manufactures of the United Kingdom, and more than one-third of other British possessions. The navigation returns showed for 1874—entrances, 2100 vessels of 777,110 tons burden; clearances, 2122 vessels of 792,509 tons burden. Nearly three-fifths of the tonnage are colonial; about one-third is English. Of foreign vessels, 38 from the U. S. of America entered and 41 cleared; 23 from France entered and 26 cleared; 14 from Germany entered and 16 cleared. Of railways there were 457¼ miles in operation in 1874: between Melbourne and Sandhurst and Echuca; between Melbourne and Geelong and Ballarat, the Williamstown branch (6 miles) and the Melbourne and North-eastern road (187 miles); all of which are government lines. Of private lines there are only 17 miles, between Melbourne and Sandridge, St. Kilda, Windsor, Brighton, and Hawthorn. The postal department had in 1874, 802 stations, carried 15,738,888 letters, 6,866,918 newspapers, 1,269,822 packets, and had an income of £194,339, and an expenditure of £288,574. The telegraph had 148 stations and 4464 miles of wire, carried 701,080 despatches, and had an income of £42,825. The government of the colony consists of a governor and a council. According to the constitution of Nov. 23, 1855, the legislative council or upper house consists of 30, and the legislative assembly or lower house of 60 members, elected by the people. The financial returns for 1874 showed a revenue of £4,106,790, an expenditure of £4,177,388, and a public debt of £12,485,432. There were in that year 11 banks, with £8,503,033 paid-up capital, £20,456,852 assets, £14,105,460 liabilities; 157 saving banks, with 64,014 depositors and £1,617,301 in amount of balances. There were 2445 churches and chapels, 1721 schools, and 238,592 scholars. Melbourne has a university. Of charitable institutions, there were 32 general hospitals, 1 lying-in hospital, 1 blind asylum, 1 deaf and dumb asylum, 1 eye and ear hospital, 1 children's hospital, 5 benevolent asylums, etc.

*History.*—Capt. Cook was the first European who entered the country, Apr. 19, 1770. On Jan. 18, 1788, Capt. Philip landed at Botany Bay in order to establish a penal colony, but selected Port Jackson for the purpose Jan. 15, 1802. Port Philip Bay was discovered by Lieut. John Murray, and in 1803, Lieut.-Col. Collins founded a colony here. The place, however, was soon after given up on account of lack of good water, and for about twenty years this part of Australia lay forgotten. In 1824 the harbor of Geelong was discovered, and a settlement was attempted at Western Port, but also given up; a permanent settlement, however, was made in this year at Portland Bay. It was not until 1835 that John Batman founded a colony at Port Philip from Van Diemen's Land. More than half a million of acres were bought from the natives for a trifle, but the governor of New South Wales afterward declared the bargain invalid, and the land had to be bought again from the English crown. In 1839 the colony numbered 6000 inhabitants; in 1850 the population had increased to 76,000, and the colony had 52,000 acres of land under cultivation, 6,000,000 sheep, and 380,000 cattle; it was then separated from New South Wales and made independent. Shortly after, gold was discovered, and immediately the immigration increased immensely. AUGUST NIEMANN.

**Victoria,** town of Brazil, capital of the province of Espiritu Santo, on the bay of Espiritu Santo, has a good harbor and some coasting-trade. The vicinity produces much sugar. P. 5000.

**Victoria,** city, port of entry, and capital of British Columbia, at the S. E. extremity of Vancouver's Island, on the Strait of Fuca, in lat. 48° 27′ N., lon. 123° 25′ W., is beautifully situated and tolerably well built, having water and gas works, 2 banks, 2 daily and 2 weekly newspapers, 5 churches, a hospital, a theatre, an iron-foundry, a shipyard, 2 lumber-yards, 2 distilleries, and 4 breweries; has handsome buildings for the government, including Cary Castle, the residence of the governor; has a public park and a race-course; is a free port, with considerable commerce and fortnightly lines of steamers to New Westminster, Olympia, and San Francisco. The harbor is shallow, and large vessels can only ascend to Esquimalt, 3 miles distant, where the British naval station is located. The climate is very severe in winter. The earliest establishment here was a trading-fort of the Hudson's Bay Company (1843); it became the capital of the new colony of Vancouver's Island 1859, rose into importance on the discovery of gold in Columbia, and on the annexation to that colony in 1866 became its capital. It has been visited (Sept., 1876) by the earl of Dufferin, governor-general of Canada. P. in 1871, 4540.

**Victoria,** county of New Brunswick, bounded W. by Maine and N. W. by the province of Quebec, Canada. It is traversed by the river St. John, and is in great part a dense forest. P. 11,641.

**Victoria,** county of Cape Breton Island, province of Nova Scotia, Dominion of Canada. On the E. it is bounded by the Atlantic Ocean and by the Bras d'Or. Much of it is very fertile. Cap. Baddeck. P. 11,346.

**Victoria,** county of the central part of Ontario, Canada. Its N. portion is a wilderness, but the S. is fertile. The lumber interest is important. The county is traversed by Midland Railway and by various streams and chains of lakes navigable for steamboats. Cap. Lindsay. P. 30,200.

**Victoria,** county of S. Texas, intersected by Guadalupe River; surface low and level, soil fertile and well adapted for stock-raising. Herds of cattle and horses are very numerous. Staples, Indian corn, wool, and a little cotton. Cap. Victoria. Area, 925 sq. m. P. 4860.

**Victoria,** tp., Jefferson co., Ark. P. 1263.

**Victoria,** p.-v. and tp., Knox co., Ill. P. 1190.

**Victoria,** p.-v., cap. of Victoria co., Tex., has a private bank. P. 2534.

**Victoria Alexandrina,** queen of Great Britain and Ireland and empress of India, b. at Kensington Palace, London, May 24, 1819, only child of Edward, duke of Kent, fourth son of George III., and of his wife, Victoria Mary Louisa, daughter of the duke of Saxe-Coburg-Saalfeld, and sister of Leopold, king of the Belgians. Her father having died Jan. 23, 1820, she was educated under the care of her mother and of the duchess of Northumberland; became heiress-presumptive to the crown on the accession of William IV. in 1830, and on his death without issue (June 20, 1837) assumed the throne of Great Britain and Ireland, that of Hanover falling by the Salic law to her uncle, the duke of Cumberland. She was crowned in Westminster Abbey June 28, 1838; was directed in politics by Lord Melbourne, the head of a Whig administration, an eminent statesman, to whom she was personally and politically much attached; was married at St. James's Palace to her cousin, Prince Albert of Saxe-Coburg-Gotha, Feb. 10, 1840; has enjoyed a reign of peace and prosperity unexampled in the annals of England under the successive administrations of Sir Robert Peel (1841–46), Lord John Russell (1846–52), Earl Derby (1852, 1858–59, and 1866–68), Earl Aberdeen (1852–55), Lord Palmerston (1855–58 and 1859–65), Earl Russell (1865–66), Mr. Benjamin Disraeli (1868), Mr. W. E. Gladstone (1868–74), and Mr. Disraeli (now (1876) earl of Beaconsfield) again from 1874. The principal events of her reign have been the repeal of the corn laws (1845), the Irish famine and emigration to the U. S. (1847), the Chartist agitation (1848), the Crimean war (1853–55), the Indian mutiny (1857–58), the assumption of the direct government of India (1859), the "cotton famine" and the delicate relations with the American belligerents (1861–65), the Mexican intervention and its rupture (1861–62), the Reform bill of 1866, the confederation of British America, the disestablishment of the Irish Church, the abolition of religious tests at the universities and of the system of purchase in the army, the Alabama Claims Treaty (1871), the introduction of the ballot, the Abyssinian and Ashantee wars, the assumption of the title of empress of India (1876), and the creation, rapid growth, and organization of the colonies of Australia and New Zealand. In the autumn of 1876 the agitation upon the massacres in Bulgaria presaged important action upon the "Eastern question." The loss of her mother (Mar. 16) and of her husband, Prince Albert (Dec. 14, 1861), within a few months, affected her with such profound grief that,

although performing all the duties of sovereignty, she did not appear in public, as before, for nearly fifteen years, having spent much of the intervening time at her favorite residence, Balmoral Castle, in the Highlands of Scotland. She has had nine children, all of whom are living (1877), and by whom she has above twenty grandchildren. Queen Victoria is beloved for her admirable personal qualities, and has given evidence of literary culture by the publication of *Leaves from the Journal of Our Life in the Highlands* (1868), and by supervising two biographical sketches of Prince Albert, *The Early Days of his Royal Highness, the Prince-Consort* (1867), by Gen. C. Grey, and *The Life of the Prince-Consort* (1874), by Theodore Martin. The "Victorian period" bids fair to be chiefly remarkable for the material prosperity of the British people, and for the magnificent scientific discoveries which have changed the face of modern civilization. PORTER C. BLISS.

**Victoria Bridge,** in Canada. See BRIDGE, by GEN. J. G. BARNARD, A. M., LL.D.

**Victoria Falls.** See ZAMBESI.

**Victoria Land.** See ANTARCTIC OCEAN.

**Victoria Nyanza.** See NYANZA, by JUDGE C. P. DALY, LL.D.

**Victoria Regia,** a great water-lily of the rivers of tropical South America. It has huge floating circular leaves, often six feet across, and large and very fragrant flowers, white without and rose-colored within. The starchy seeds are eaten by the natives. It is successfully grown in green-houses.

**Vic'tory,** p.-v. and tp., Mason co., Mich. P. 314.

**Victory,** p.-v. and tp., Cayuga co., N. Y. P. of v. 170; of tp. 1898.

**Victory,** p.-v. and tp., Essex co., Vt. P. 263.

**Victory Mills,** p.-v., Saratoga tp., Saratoga co., N. Y. P. 870.

**Vicu'ña,** or **Vicugna,** the *Auchenia vicunna* (family Camelidæ), an extremely wild and active animal of the Andes, considerably smaller than the llama, and somewhat smaller than the alpaca. It is considered untamable. Its fine hair is even more valuable than that of the alpaca. It is obtained by hunting and killing the animal. Great numbers are annually slaughtered.

**Vi'da** (MARCO GIROLAMO), b. at Cremona, Italy, about 1485; studied theology at Padua and Bologna; became canon of St. John Lateran in Rome; acquired great fame by his Latin poems, and was made bishop in 1532 of Alba, where he d. Sept. 27, 1566. Of his epics, the *Christias*, in 6 books, is the most remarkable; of his didactic poems, his *De Arte Poetica*, both translated into English; his poem, *Scacchiæ Ludus*, was translated by Goldsmith.

**Vida'lia,** p.-v., cap. of Concordia parish, La.

**Vidar.** See ÆSIR.

**Vidaur'ri** (SANTIAGO), b. in the present state of Nuevo Leon, Mexico, about 1803; received a good education; became a lawyer; filled many minor offices; took part in several civil wars, in which he rose to the rank of general; became about 1853 governor of Nuevo Leon, to which he forcibly annexed (1856) the state of Coahuila; exercised for some years a species of dictatorship over the northern states of Mexico, where he was more than once suspected of intending to found the independent "republic of Sierra Madre;" aided in the campaign for the overthrow of Santa Anna 1854–55, though without political combination with Alvarez and Comonfort, his "plan" being distinct from that of Ayutla; was a candidate for the presidency at the junta of Cuernavaca Oct., 1855. He did not recognize the government of Comonfort until Nov., 1856; held the northern states against Zuloaga and Miramon during the "war of reform" 1857–60, and took part in the war against French intervention 1862–64, but was induced to recognize the "empire" of Maximilian, of whom he ultimately became a cabinet minister; was captured at the fall of the City of Mexico, and shot there as a traitor Aug. 8, 1867.

**Vid'ius,** or **Vidus** (GUIDO GUIDI), b. at Florence about 1500; was body-physician to Francis I., afterward to Cosmo de' Medici, and finally professor of medicine at the University of Pisa, where he d. May 26, 1569. He gave his name to the Vidian nerve, and wrote largely on hygienic, therapeutic, and anatomical topics. His works were collected and published in 3 vols. at Venice in 1614.

**Vidocq'** (EUGÈNE FRANÇOIS), b. at Arras, department of Pas de Calais, France, July 23, 1775; began life with a series of dissipations and crimes, which compelled him to flee from his home in disgrace; entered the army, but deserted to the Austrians; left them too, and served for some time as a French spy, but deserted once more; was caught at Arras and condemned to death, but was saved by a friend and by marrying the sister of the Terrorist Lebon, whom, however, he immediately left; entered once more the army, but was convicted of fraud and forgery, and condemned to the galleys; escaped after six years' imprisonment from the bagnio of Brest, and was employed in 1808 by the secret police of Paris; was made chief of the *brigade de sureté*, consisting of convicts and other notorious characters acting as spies, and fully pardoned in 1818; left the service of the police in 1828, and settled at St. Mondé, near Paris, as a paper manufacturer; failed in business, and opened a *bureau de renseignement* in Paris for the recovery of stolen goods, but came into conflict with the police, and was compelled to close his office; lived afterward in obscurity and poverty, and d. in Paris May 10, 1857. His *Mémoires* (4 vols., 1828; translated into English in the same year) are not without interest, but their contents are considered unreliable, and even their authorship is doubted. Several other works which appeared under his name are not by him.

**Viel-Castel', de** (LOUIS), BARON, b. Oct. 14, 1800; entered the French diplomatic service in 1818; was sent to Madrid in 1821 as secretary of legation, and removed in 1828 to Vienna in the same quality; returned in 1829 to Paris, where he held various positions in the office of the ministry of foreign affairs till the *coup d'état*, when he retired into private life. Besides a number of articles for the *Revue des Deux Mondes*, he has written a *Histoire de la Restauration*, of which 17 vols. have appeared (1860–76).—His elder brother, HORACE, COUNT DE VIEL-CASTEL, b. in 1797; d. Oct. 1, 1864, wrote romances, and published a *Collection de Costumes, Armes et Meubles* (3 vols., 1826), and several volumes of documents relating to the history of Marie Antoinette and the Reign of Terror.

**Vie'lé** (EGBERT L.), b. at Waterford, N. Y., June 17, 1825; graduated at the U. S. Military Academy July 1, 1847, when commissioned brevet second lieutenant of infantry, and ordered to the seat of war in Mexico, serving at the capital 1847–48; in campaign against Indians 1848–52. Resigned June 1, 1853, to enter upon the profession of civil engineering; was State engineer of New Jersey 1854–56; chief engineer of Central Park, New York, 1856–57; served in the civil war (1861–64) as captain of engineers 7th New York militia Aug., 1861, in which month appointed brigadier-general U. S. volunteers, and engaged in the Port Royal expedition, siege and capture of Fort Pulaski, Ga., capture of Norfolk, Va., and military governor of that city 1862–63. Resigned Oct., 1863, and resumed his profession at New York. Author of *Hand-Book of Active Service*, and various professional papers and reports on railways, water-supply, sewerage, etc.

**Vien** (JOSEPH MARIE), b. at Montpellier, France, June 18, 1716; studied painting; went in 1740 to Paris, in 1744 to Rome; returned in 1750 to Paris, where he formed a school in which he educated many celebrated pupils, among whom was David; made director of the French school of art in Rome in 1775, and of the Academy of Paris in 1781; was created a count by Louis XVI. and a senator by Napoleon I., and d. in Paris Mar. 27, 1807. His most celebrated pictures are—*Hector and Paris, Hector and Andromache, Briseïs in the Tent of Achilles, The Hermit*, and *St. Denis preaching to the Gauls.*

**Vien'na** [Ger. *Wien*], capital of Austria, with 1,020,770 inhabitants Apr. 15, 1875, is beautifully situated on the right bank of the Danube, traversed by the river Wien and an arm of the Danube, the Donaukanal. An immense engineering undertaking by which the course of the Danube was regulated was finished in 1875, and the stream now passes by the city in a new straight bed. Vienna is one of the most beautiful and interesting cities in Europe, and it has improved wonderfully of late by the construction of magnificent squares, streets, and buildings. In the period from 1866 to 1876 there have been erected a greater number of buildings of architectural consequence in Vienna than were ever erected in an equal space of time in any other city in the world, with perhaps the exception of Rome. The city is divided into ten wards—the Innere Stadt, or city proper, Leopoldstadt, Landstrasse, Wieden, Margarethen, Mariahilf, Neubau, Josephstadt, Alsergrund, and Favoriten. The Ring, the liveliest and most brilliant part of the city, consists of a series of broad streets planted with trees, surrounding, almost encircling, the Innere Stadt, and leading through numerous large and beautiful open places; it occupies the site of the former fortifications. To the N. W. the Donaukanal, with the Franz-Joseph quay, forms the boundary of the Innere Stadt, and connects the two ends of the Ring. On the Ring are situated the most important public squares of Vienna. First, the great place to the S. E. of the imperial palace, traversed by the Burgring, and consisting of various minor parts, which together form a magnificent whole. Next to the palace extends the Äussere

Burgplatz, with the palace-gate and the colossal equestrian statues of Archduke Charles and Prince Eugene. It communicates on the one side with the palace gardens, on the other with the city garden, and in front with the Museumsplatz, not yet finished, but to be surrounded by the buildings of the museum. Another magnificent public square, as yet called the Paradeplatz, is in process of construction close by, and will be formed by four monumental buildings —the parliament-house by Hansen, the city-hall by Schmidt, the university by Ferstl, and the new Burgtheatre by Semper. The Stadt-park, a lovely and much-frequented garden, is situated on the Parkring. Noteworthy among the other public squares are Stephansplatz, Hoher Markt, Neuer Markt, Am Hof, Franzens Platz, and Josephs Platz in the Innere Stadt, and in the other districts, Rudolfs Platz, Schwarzenberg Platz, Obstmarkt, the garden of the Belvedere, etc. The most remarkable streets, besides the Ring, are—Kärnthnerstrasse, Graben, Singerstrasse, Herrengasse, Wollzeile, and Rothenthurmstrasse, all in the Innere Stadt. Generally, the principal streets which traverse the exterior wards issue from the Innere Stadt as from a centre. The most important bridges crossing the Wien and the Donaukanal are the Aspernbrücke, Ferdinandsbrücke, Carls Kettensteg, Brigittabrücke, Franzensbrücke, Sophienbrücke, and Elizabethbrücke. The edifices are generally remarkable for their solidity, and many of them also for the purity of their style. Even the tenement-houses which have been erected on mere speculation show often a peculiar character which distinguishes them favorably from similar constructions in other cities. Numerous palaces belonging to the Austrian and Hungarian nobility or to rich burghers, and interesting partly by their age and art-collections, partly by their splendid modern architecture, adorn the city. The largest and most remarkable among them is the Burg, the residence of the emperor, erected at different times and in different styles. The principal part of the whole construction consists of four buildings—the Schweitzerhof, erected by Duke Leopold VII.; the Leopoldshof, finished in 1670; the Amalienhof, built by the emperor Rudolf II.; and the imperial chancellery, erected under Charles VI. after plans by Fischer von Erlach, and with an imposing entrance-gate, in front of which stand four colossal Hercules groups by Matthielli. These four buildings enclose the inner palace-court, called Franzensplatz, and connect with numerous other buildings—the Burgtheatre, erected in 1760; the riding-school, the stables, the ball-rooms, the magnificent imperial library, the zoological museum, etc. The imperial library contains over 300,000 volumes and about 20,000 manuscripts, among which many are very rare and interesting, and with it is connected a collection of about 300,000 engravings. The palace also contains a museum of natural history, a collection of minerals, a chamber of treasures, the richest and most interesting in Europe, and excellent collections of coins and antiquities. The most prominent among the other palaces are those of Archduke Albrecht, Prince August of Saxony, Prince Kinsky, Lobkowitz, Montenuovo, Count Harrach, Pallavicini, Hardegg, Schönborn, Schickh, Wimpfen, Czernin, Archduchess Elizabeth, the princess of Ligne, the countess of Erdödy, Archduke Wilhelm, Archduke Louis Victor, the prince of Würtemburg, Prince Schwarzenberg, Auersperg, Lichtenstein, Metternich, the duke of Modena, Prince Esterhazy, Dietrichstein, Schönburg, Sulkowski, etc. Several of these palaces were erected in the period of the rococo style, but are very graceful and elegant. Two palaces of that time, the Belvedere and the palace of Prince Lichtenstein, contain magnificent picture-galleries. The Belvedere was built in 1720 by Prince Eugene of Savoy, and consists of two palaces—the upper and lower Belvedere—between which stretches a large garden laid out in Italian style and adorned with numerous sphinxes of stone. The upper palace contains on the first floor pictures by Italian and Dutch, on the second by German, artists. The lower palace contains a collection of antiquities, the Egyptian museum, and the so-called Ambraser Museum, the most celebrated collection of armor and curiosities. Other remarkable edifices are—the opera-house, finished in 1869 by Siccardburg and Van der Nüll; the Heinrichshof, situated opposite the opera-house on the Operaring, a most original structure by Hansen, destined only for a tenement-house, but having its whole upper part gilded and covered with frescoes; the palaces of the ministries of foreign affairs, commerce, war, finance, and police; the Academy of Science; the Academy of Art; the Conservatory; the Polytechnic School; the Mercantile Academy; the building of the Horticultural Association; the Veterinary Institute, and the Austrian Museum. The last-mentioned building, erected in Renaissance style after plans by Ferstl, is especially interesting as an exhibition of Austrian manufactures. Furthermore, the city-hall; the Academy of Fine Arts, containing important collections, among which is a valuable picture-gallery; the Theresien Academy, with a large, beautiful garden; the Bank and Exchange, in Florentine style by Ferstl; the mint; the immense barracks on the Stubenring, etc. The arsenal is an immense establishment, forming a square 700 mètres long and 420 broad, and comprising a gun-factory, a cannon-foundry, several barracks, etc., and a museum of arms, a magnificent structure in rich Byzantine style, by Hansen, and containing many interesting trophies. The general hospital has 3000 beds, and is the largest institution of the kind in Europe. Of the churches, St. Stephan's cathedral, situated in the centre of the Innere Stadt, is the most interesting, built in Gothic style from 1300 to 1510, in the form of a Latin cross, 108 mètres long and with a tower 136 mètres high. It has beautiful chapels and choirs, celebrated sculptures, a magnificent pulpit, the work of Meister Pilgram (1512), many sarcophagi, and 34 subterranean vaults filled with bones. The Augustine church is the parish church of the court, and contains a celebrated monument by Canova; the hearts of the deceased members of the imperial family are preserved here in the Loretto chapel, erected in 1627; the church itself was built in 1339 and rebuilt in 1783. The church of St. Michael, begun in 1220 and rebuilt in the beginning of the fifteenth century, has valuable pictures. The church of St. Marie in Schnee, also called the church of the Minorites, was finished in 1330, and has a beautiful Gothic portal and a monument to Metastasio by Loccardi. The church of Marie Stiegen, belonging to the best period of the Gothic style, was restored in 1820, and has a tower 57 mètres high and ending in a calyx, a beautiful high altar, and good glass-paintings and sculptures. The parish church of St. Peter, built after the model of St. Peter's church in Rome in the beginning of the eighteenth century, by Fischer von Erlach, has a splendid portal and beautiful pictures. The church of St. Ruprecht is very small, but it is the oldest church of Vienna, and is said to have been built in the eighth century. The university church is a richly ornamented basilica, finished in 1631, and containing frescoes and altar-pieces by Pozzo. The church of the Capuchins, finished in 1632, contains the vault in which all the members of the imperial house have been interred since the emperor Matthias; the coffins of Maria Theresa and Francis I. are especially magnificent. The Innere Stadt contains, in all, 20 churches, besides chapels. The other parts of the city contain 35 large churches, of which the most important is the Carls church in Wieden, built under Charles VI. by Fischer von Erlach in Italian rococo style, with a high dome and a portal resting on six Corinthian columns and ornamented in the frontispiece with an interesting relief representing the effects of the plague. Remarkable are the two columns, 44 mètres high, inlaid with spiral reliefs representing the exploits of Cardinal Charles Borromeus, and terminating in two belfries. Very beautiful also is the Altlerchenfelder church, finished in 1853, after the plans by Müller, in mediæval Italian style, with an octagonal dome and magnificent interior decorations. Furthermore, the Elizabeth church in Wieden, built in 1866 by Bergmann in Gothic style; the evangelical church in Gumpendorf, finished in 1849 by Förster and Hansen; the church of the Visitation, finished in 1719, with a magnificent dome and richly decorated with gold, marble, and pictures; the votive church or church of the Saviour, a Gothic structure, begun in 1853 after plans by Ferstl, in commemoration of the escape of the emperor from assassination, with two tall towers of open-work, and richly decorated with statues; the church of St. Leopold, in Leopoldstadt, finished in 1728; the parish church of Marie Annunciation, finished in 1639 by Carlona; the parish church of St. Joseph, founded by Maria Theresa, etc. Of the non-Roman Catholic churches, that of the non-United Greeks, in the old meat-market, is a very interesting structure by Hansen in Byzantine style and richly decorated; also the Evangelical church, situated in Leopoldstadt, built by Förster and finished in 1849, is an imposing edifice. Of the two synagogues, the one in Moorish style, built by Förster and finished in 1849, is an interesting structure. The city has 25 monasteries and ecclesiastical orders. Of the educational institutions, the university is the most prominent, founded in 1365 by Rudolf IV., next to that of Paris the largest institution of the kind, and richly provided with all kinds of apparatus for scientific investigation. There are also various higher ecclesiastical seminaries; a polytechnic school which is richly endowed; a medico-chirurgical academy, which is one of the most celebrated institutions of the kind; an Oriental academy for the education of diplomatic agents in the Orient; an academy of fine arts; a military school; several gymnasiums and schools for commerce and industry, etc. Among the scientific institutions are an academy of science, a geological institute, a military-geographical academy, a

zoological and botanical association, etc. Besides the imperial library, the libraries of Archduke Albrecht, Prince Lichtenstein, and Prince Metternich are important. Of the benevolent institutions, the general hospital is the largest. The lunatic asylum is arranged on a grand scale. Furthermore, may be mentioned the hospitals of Wieden, of the Brothers of Mercy, of the Sisters of St. Elizabeth, and the asylums for children, for the blind, for the deaf and dumb, etc. Vienna is very rich in establishments of recreation and amusement. The Prater, a park and forest, E. of Leopoldstadt, was laid out by Joseph II., and is traversed by magnificent avenues, of which the principal one is the rendezvous of the elegant world, and is lined with crowded cafés, while another, the so-called Wurstel-prater, is filled with transportable museums, dancing establishments in the open air, etc. The World's Exhibition of 1873 took place in the Prater. The Angarten, to the N. of Leopoldstadt, is a large square of park and forest, traversed by straight avenues, and was opened to the public in 1775 by Joseph II. Among the theatres, the Burgtheatre, both for comedy and tragedy, occupies a very high rank.

The commerce and industry of the city are very important. Several branches of industry have been carried to a high degree of perfection, such as the manufacture of leather, carriages, furniture, meerschaum and amber goods, etc. The musical, mathematical, optical, and physical instruments made here enjoy a high reputation. The principal articles of commerce are wool, cotton, silk, fur, paper, leather, metal, and glass ware, objects of art, chemicals, spices, and colonial ware.

In ancient times Vienna was a Roman camp, called *Vindobona;* the emperor Marcus Aurelius died here. During the migration of nations, Huns, Longobards, Avars, and others successively fell upon the city. In 791, Charlemagne established a margrave here, and in the eleventh and twelfth centuries the margraves Leopold and Heinrich Jasomirgott did much for the prosperity of the city. In 1237 the German emperor Frederick II. made it a free city of the empire, and under Ferdinand I. it became the residence of the German emperor. In 1529 it was besieged by Sultan Solyman, but was victoriously defended. In 1640 the Swedes appeared before its gates, but without effect. In 1683 it was again besieged by the Turks, but saved by King John Sobieski of Poland. In 1704 a new line of fortifications was formed, including also the suburbs. During the wars with Napoleon the French twice occupied Vienna —Nov. 13, 1805, and May 13, 1809. In 1815 sat the famous congress. (See VIENNA, CONGRESS OF.) In 1848 it was the scene of several contests between the revolutionists and government, and suffered much. AUGUST NIEMANN.

**Vienna,** p.-v., Elgin co., Ont., Canada, 2 miles N. of Port Burwell, and on Big Otter Creek. The sawing of lumber is the chief business. A court sits here six times in the year. P. 593.

**Vienna,** tp., Madison co., Ala. P. 1660.

**Vienna,** tp., Pickens co., Ala. P. 1435.

**Vienna,** p.-v., cap. of Dooly co., Ga.

**Vienna,** tp., Grundy co., Ill. P. 900.

**Vienna,** p.-v. and tp., cap. of Johnson co., Ill., on Cairo and Vincennes R. R., 34 miles N. of the former city, has several churches, good schools, 2 newspapers, and is located in the fruit-producing belt of the state. P. of v. 550; of tp. 1496. A. J. ALDEN, ED. "JOHNSON CO. JOURNAL."

**Vienna,** p.-v. and tp., Scott co., Ind. P. of v. 166; of tp. 1510.

**Vienna,** p.-v. and tp., Marshall co., Ia. P. 905.

**Vienna,** p.-v. and tp., Pottawattamie co., Kan. P. 1288.

**Vienna,** p.-v., cap. of Lincoln parish, La.

**Vienna,** p.-v. and tp., Kennebec co., Me. P. 740.

**Vienna,** tp., Genesee co., Mich. P. 1916.

**Vienna,** p.-v., cap. of Maries co., Mo.

**Vienna,** p.-v. and tp., Oneida co., N. Y. P. of v. 156; of tp. 3180.

**Vienna,** p.-v. and tp., Forsyth co., N. C. P. 836.

**Vienna,** tp., Clark co., O. P. 239.

**Vienna,** p.-v. and tp., Trumbull co., O. P. 1132.

**Vienna,** tp., Dane co., Wis. P. 1176.

**Vienna, Congress of,** opened Oct. 3, 1814, and closed June 9, 1815. There were present the monarchs of Austria, Prussia, Russia, Denmark, Bavaria, and Würtemberg, besides a crowd of minor princes and diplomatic representatives of all European states except Turkey—Talleyrand from France, Castlereagh from England, Metternich from Austria, Nesselrode from Russia, Hardenberg from Prussia, Münster from Hanover, etc.—besides a multitude of diplomates without any distinct official character, such as Stein, Wilhelm von Humboldt, Pozzo di Borgo, etc. The congress assembled and carried on its work under a series of festivities whose sumptuousness and frivolity had never been equalled before—Austria alone spent 30,000,000 florins on dinners, balls, masquerades, illuminations, etc.—and the principal method of transacting business employed by the assembly was intrigue, often of the meanest and most infamous kind; as, for instance, in the case of the elector of Hesse, who only wanted to have the title of king bestowed on him. The members assembled with good-will toward each other, but Talleyrand soon succeeded in arousing all the slumbering jealousies and vanities, and one month had hardly elapsed before egotism, rapacity, pride, and envy were the ruling spirits of the assembly. A new general war seemed inevitable. Austria, Russia, Prussia, and even France, were arming, when, on Mar. 5, 1815, during a grand court-ball, a courier from Turin announced that Napoleon had left Elba and landed on the coast of Provence. The event proved most effective in bringing about an agreement between the carousing gentlemen. The task of the assembly was to restore to Europe that state of affairs which prevailed before the French revolution, and which Napoleon had almost entirely broken up. It was not possible to effect a complete restoration, but the congress did its best. The pope was reinstated in all his possessions, with the exception of Avignon and Venoissin, which were given to France, and some small Italian districts, which were given to Austria. These cessions, however insignificant, were nevertheless too much for His Holiness; he protested in a most solemn manner against the whole congress. The rest of Italy was again parcelled out in domains for French and Austrian princes. Austria was re-established in its old glory as an utterly artificial agglomeration of chips from seventeen different nationalities. A kingdom of Poland was erected, but the Polish provinces which Russia, Prussia, and Austria had seized twenty years before by open robbery were not returned to the new Polish crown, and the crown itself was tendered to the Russian czar; it looked like something, but it was nothing. Norway was taken from Denmark and added to Sweden, in order to pay Bernadotte for his treachery against Napoleon, and Denmark was paid with Lauenburg and other German districts. The Spanish Netherlands or Belgium were added to the Dutch Netherlands, and the whole formed into the kingdom of Holland, in spite of the absolute opposition which exists between these countries in language, religion, and economical interests; but it was the only way in which England could retain the Dutch colonies which she had conquered during the Napoleonic wars. To restore the German empire was found impossible, on account of the rivalry between Prussia and Austria, but, having restored as many of the petty princes as possible, the congress manufactured a *Bund*, which turned out to be simply a means of intrigue. The whole business transacted by the congress was simply a distribution of spoils, a division of the lands which had fallen out of the grasp of Napoleon, between a number of families which formerly had been *reigning* families, and thence inferred that they had a legal claim on a certain amount of land to reign over—a divine right, a right of *legitimacy*. To the aspirations of the nations, to their most apparent interests and most sacred instincts, no regard whatever was paid, and the history of Europe from 1815 up to our day, with all its bloody wars and terrible revolutions, is chiefly a series of attempts at correcting the blunders and crimes of the Congress of Vienna. (See *Acten des Wiener Congresses* (9 vols., Frankfort, 1815–35); *Uebersicht der diplomatischen Verhandlungen des Wiener Congresses* (Frankfort, 1816); Flassan, *Histoire du Congrès de Vienne* (3 vols., Paris, 1829); Lagarde, *Fêtes et Souvenirs du Congrès de Vienne* (2 vols., Paris, 1843).)

**Vienna Paste,** or **Vienna Caustic.** See LIME, MEDICINAL USES OF.

**Vienne',** an inland department of Western France, on both sides of the river Vienne, an affluent of the Loire, comprises an area of 2690 sq. m., with 320,598 inhabitants. The surface presents an elevated plain, with a general slope to the N. The soil is not very fertile, yet more wheat and wine are produced than necessary for home consumption. Hemp, flax, and chestnuts are also extensively raised, and good breeds of mules and horses are reared. Much iron is mined, and building-stone and lithographic stones are quarried. Of 43,778 children of school-age, 20,750 received no instruction in 1857.

**Vienne,** one of the most ancient towns of France, department of Isère, on the Gère, near its influx in the Rhone, contains many interesting remains of the Roman epoch, such as a triumphal arch, an amphitheatre, and a temple. Pilate is said to have been banished to this place. It was the cradle of Western Christianity. The fifteenth œcumenical council of the Roman Catholic Church met

here in 1311. Its vicinity contains rich silver and iron mines, and produces an excellent wine. Its manufactures comprise woollen and linen fabrics of different descriptions, cutlery and hardware, glass and leather. Its trade is brisk. P. 26,017.

**Vienne, Haute.** See HAUTE-VIENNE.

**Vier'sen,** town of Rhenish Prussia, has extensive manufactures of woollen, cotton, linen, and silk fabrics, ribbons, leather, tobacco, vinegar, soap, and straw hats. P. 18,550.

**Vierzon',** town of France, department of Cher, at the confluence of the Yèvre and Cher, has cannon-foundries, tanneries, slips for building river boats, and manufactures of linen, woollen, and silk fabrics, and porcelain. P. 7740.

**Vies'te,** town of Southern Italy, province of Foggia, at the foot of Monte Gargano, on the shore of the Adriatic, about 60 miles N. E. of the town of Foggia. It is washed by the sea on three sides, is surrounded by a wall, has a most fertile country behind it, and was once considered a place of strength. It was here that Pope Celestine was arrested by order of Boniface VIII. In the latter half of the sixteenth century Barbary pirates landed here, wasted the neighboring coast and country, and carried 7000 of the inhabitants into slavery. Vieste was for a time an episcopal see. P. 6595.

**Vie'ta,** or **Viète** (FRANÇOIS), b. at Fontenay-le-Comte, department of Vendée, France, in 1540; held various offices in the civil service of the French government during the reigns of Henry III. and Henry IV., and d. in Paris in 1603. It is, however, as a mathematician he has become known to the after-world, being the creator of modern algebra, which he developed into a purely symbolical science and applied to the extension of trigonometry. Most of his works were collected by Van Schooten and published at Leyden in 1646. His *Harmonicon Cœleste* and *Canon Mathematicus* were not discovered until quite recently.

**Vie'tri sul Ma're,** town of Southern Italy, province of Salerno, charmingly situated in a mountain-nook among dark crags which are reflected in the blue waters of the Gulf of Salerno. The climate is always extremely mild, the air of a delicious pureness, and the productions almost tropical. The town is not badly built, and not without some industry, there being several paper-factories, etc. Fragments of columns, mosaic pavements, vases, etc., have been found along the seashore, and there is a tradition that Vietri rose from the ruins of *Marcina*, which was destroyed by the Vandal Genseric in 455. P. 8441.

**Vieussens'** (RAYMOND), b. in the countship of Rouergue, present department of Gironde, France, in 1641; studied medicine in Paris; held for several years a position at the hospital of St. Eloi, Montpellier, and acquired great reputation for his investigations of the brain (the *valve of Vieussens*) and the spinal cord. D. at Montpellier in 1720. He wrote *Nevrographia Universalis* (1685) and *Traité des Liqueurs du Corps humain* (1715).

**Vieuxtemps'** (HENRI), b. at Verviers, Belgium, Feb. 20, 1820; made his first concert-tour as a virtuoso on the violin when only eight years old; studied afterward under Beriot and Rischa; resided from 1846 to 1852 in St. Petersburg, subsequently in Paris, but spent most of his time in concert-tours; visited America in 1843, 1855, and 1870, and published a considerable number of compositions for the violin and pianoforte. Both as a composer and as a performer he is more remarkable for correctness and elegance than for any original power of impression.

**Vie'yra** (ANTONIO), b. at Lisbon, Portugal, in 1608; became a Franciscan monk and the most celebrated Portuguese preacher of his age; was employed on public missions at the courts of Paris (1646), London, and Rome (1650), and spent his latter years as a missionary in Brazil, where he preached to the Indians in the Tapi or Guarani language and advocated the abolition of slavery. D. at Bahia in 1697. Sixteen volumes of his *Sermons* (1688–1754) and 3 of his *Letters* (1735–46) were printed mostly after his death, as was also his *History of the Future* (1718). He enjoys a distinguished place among Portuguese classics. Biographies were written by F. de Fonseca (1734) and A. de Barros (1746).

**Vigan', Le,** town of Southern France, department of Gard, has manufactures of silk, woollens, gloves, and leather. P. 5376.

**Viger'** (JAMES), b. at Montreal, Canada, May 7, 1787; served as an officer of militia in the war of 1812–15; filled several political offices; was the first mayor of Montreal, and a distinguished archæologist. D. at Montreal Dec. 12, 1858. Among his publications were *Le Petit Registre*, forming the groundwork for a history of the early settlers of Montreal, a *History of the Parishes of the Diocese of Montreal*, and a *History of the Lemoyne de Longueuil Family;* and he furnished all the documents which appeared in De Couray's *Servantes de Dieu en Canada.*

**Vige'vano** (*Vicus Veneris*), town of Italy, province of Pavia, in a healthful position on a rising ground above the banks of the Ticino. The adjacent country is very fertile, and has been famous for game since the days of King Arduin, who was very fond of hunting here, as was also Charles V. Vigevano is a well-built town, with churches and private palaces of some interest, and the castello, modified by Bramante under Ludovico il Moro, was a grand edifice, but is now used for military purposes. The Torre, designed by Bramante, has fine architectural features. The Piazza del Duomo, a large rectangular space flanked on three sides with porticoes supported by solid granite columns, the fourth being occupied by the cathedral, is also the work of Ludovico Sforza il Moro. Vigevano, originally settled by a race of Ligurians, after having passed under Roman, Lombard, Gothic, and Frankish rule, governed itself independently for several centuries, since which time, having been obliged to accept the Visconti and Sforza as lords, it has generally shared the fortunes of Milan. It is now an active town, with thriving manufactories of silk, velvet, linen, cotton, etc., and the agriculture of the vicinity is also very prosperous. The fish of the Ticino are a considerable source of income to Vigevano, and very pure gold, in small quantities, has been found in the bed of the river ever since the days of Queen Theodolinda, who, it is said, bestowed the privilege of collecting it upon the Biffignandi family, with whom it is still a monopoly. The educational and charitable provisions of Vigevano are excellent. The handsome school of arts and trades was recently established by a private legacy of $200,000. P. 18,436.

**Viggianel'lo,** town of Southern Italy, province of Potenza, about 32 miles from Lagonegro, without activity from want of roads. P. 5030.

**Viggia'no,** town of Southern Italy, province of Potenza, on a high rocky hill, at the foot of which flows a torrent on either side. The neighboring district is fertile in grain, vines, and olives, and the inhabitants are given to music, many of them gaining their livelihood as wandering harpists. P. 5242.

**Vig'il** [Lat. *vigilia*, a "watching"], in ecclesiastical language the evening before any church fast, festival, or other important day of the calendar. Special services are appointed in the Roman Catholic Church for the more important vigils. Vigils are retained in the English calendar, but no particular service is directed for any one of them.

**Vigil'ius,** POPE (540–555), a native of Rome; was appointed a deacon by Boniface II., and accompanied Agapetus to Constantinople in 536. Here the pope died in 537, and by the intrigues of Theodora, Vigilius was appointed pope by Justinian, on the condition that he should lend his authority to those measures by which the emperor hoped to reconcile the Monophysites with the orthodox Church. On his return to Rome, however, he found the papal see occupied by Sylverius; but partly by money, partly by the intrigues of Antonina, the wife of Belisarius, he obtained the aid of the Byzantine commander at Ravenna, and in 540 Sylverius was expelled. Vigilius was a rapacious and ambitious man, without talent or character, and probably also without convictions. Placed between the African and the Byzantine churches, with their diametrically opposite tendencies, he was alternately bought by the emperor and bullied by the bishops to make decisions which the next moment he retracted.

**Vignola, da** (GIACOMO BAROZZIO). See BAROZZO (JACOPO).

**Vigny', de** (ALFRED VICTOR), COUNT, b. at Loches, department of Indre-et-Loire, France, Mar. 27, 1799; entered the royal guard in 1816, but retired from military service in 1828, and devoted himself exclusively to literary pursuits. D. in Paris Sept. 18, 1863. His *Poëmes* (1822), among which are *Hélène, La Fille de Jephté, La Femme adultère*, etc., and his *Poëmes antiques et modernes* (1824–26), among which are *Moïse, Le Déluge, Dolorida*, etc., passed by almost unnoticed, though they belong to the best which the romantic school has produced in France. But in 1826 his historical novel, *Cinq-Mars* (2 vols.), attracted much attention, and was translated into various languages; and in 1835 his drama, *Chatterton*, made his name celebrated. He also wrote *Stello* (1832), *Servitude et Grandeur militaires* (1835), two novels; *Les Destinées*, a philosophical poem, published after his death, etc. A complete edition of his works appeared in 8 vols. in 1863–66.

**Vi'go,** town of North-western Spain, province of Pontevedra, is beautifully situated on a bay of the same

name, and has valuable sardine and tunny fisheries. It is irregularly built, and old but picturesque, and its beautiful surroundings abound in wine, oil, and fruits. P. 8214.

**Vigo,** county of W. Indiana, bordering on Illinois, drained by Wabash River and traversed by Wabash and Erie Canal and by several railroads centring at the county-seat; surface undulating, and diversified by forests and prairies; soil very fertile. Bituminous coal, limestone, and freestone abound. There are more than 200 manufacturing establishments, including saw-mills, flour-mills, woollen factories, iron, machinery, bricks, cooperage, carriages, railway cars, and wagon materials. There are large numbers of cattle, sheep, horses, and swine. Staples, manufactured articles, Indian corn, wheat, potatoes, wool, hay, lumber, and dairy products. Cap. Terre Haute. Area, about 400 sq. m. P. 33,549.

**Vigo,** tp., Knox co., Ind. P. 2426.

**Vigo'ne** [*Vicus Odonis*], town of Italy, province of Turin, in a mountainous region, about 9 miles S. E. of Pinerolo. It was formerly a walled town of considerable strength, but was ruined in the wars of the sixteenth century. Vigone has the honor of having maintained a public school in the fourteenth century, and primary instruction is now largely provided for. P. 6410.

**Vihāra** meant in post-Vedic times in India, first, pleasure, relaxation, and then a pleasure-ground or place of relaxation; and after the rise of Buddhism, it was applied to the Buddhist temples, these being at first only meeting-places for the Buddhist monks; but after images of Buddha began to be put up, and dwellings for the priests to be permanently erected round the image-house, the word *vihāra* was used, as it still is, to denote, first and more exactly, the temple itself, or, secondly and more generally, the whole monastic establishment. This usually consists, in all Buddhist countries alike, of one or more of the following buildings: (1) the *image-house* or temple, containing one or more figures of Buddha, represented standing, sitting cross-legged, or lying on his side; before these images, or before the dāgaba or before the bo-tree, the pious Buddhist goes through his simple worship, bowing with his palms placed together and raised to his forehead, repeating the creed or some moral sentences from the Buddhist books, and offering flowers; (2) the *dāgaba,* a solid bell-shaped dome, sometimes of enormous dimensions, under which some relic of Buddha is supposed to be buried; (3) *the sacred bo-tree* (*Ficus religiosa*), round which is raised a stone terrace; it is always supposed to be a descendant of the tree under which Buddha attained to Buddhahood, and holds the same position among the Buddhists as the cross does among Christians; (4) a *preaching-hall;* (5) an *assembly-hall* for the priests; and (6) their *sleeping apartments.* (See, for Ceylon, Davy's *Ceylon,* p. 220; Tennent's *Ceylon,* i. 347–349; for Siam, Pallegoix, *Annales de la Propagation de la Foi,* Jan., 1854; for Burmah, Bigaudet, *Legend of the Burmese Buddha,* p. 176; for Nepāl, Hodgson, *Sketch of Buddhism,* p. 241; for Thibet, Köppen, *Religion des Buddha,* ii. 258, and ch. i. 376.) Among the Southern Buddhists the word is always pronounced *Wihāra.*

T. W. Rhys Davids.

**Vi'king** [Norse, from *vik,* a "bay;" it has nothing to do with our word *king*], a name for the Norse pirates who formerly vexed and plundered the seas and coasts of Europe. The name is often incorrectly confounded with *sea-king.* The sea-kings were naval chieftains of royal blood, who were not necessarily pirates.

**Vilayets and Eyalets.** See Turkey, by Capt. A. Niemann.

**Vilkomir',** town of Russia, government of Kovno, on the Sventa, has some trade and manufactures. P. 7480.

**Villafran'ca de los Bar'ros,** town of Spain, province of Badajoz, has some trade in wheat and wine. P. 7575.

**Villafran'ca de Pana'des,** town of Spain, province of Barcelona, is old, gloomy, and uninteresting, but has a large trade in wine, oil, and fruits, especially figs. P. 6284.

**Villafran'ca di Vero'na,** commune in the province of Verona in Northern Italy, about 11 miles S. of that city and 12 miles N. of Mantua, consisting of eleven hamlets with a total population of 8344. The largest of these, which gives name to the commune, is a well-built and flourishing town, with a fine castle of the fourteenth century. It was at Villafranca that Napoleon III. terminated the war which he had commenced against Austria "to liberate Italy from the Alps to the Adriatic," by negotiating, without the participation or knowledge of his ally, King Victor Emmanuel, a peace with the emperor of Austria, in which the professed object of the campaign was ingloriously sacrificed.

**Vil'lage,** tp., Jackson co., Ark. P. 660.

**Village,** tp., Van Buren co., Ia. P. 1540.

**Village Springs,** p.-v. and tp., Blount co., Ala. P. 700.

**Villajoyo'sa,** town of Spain, province of Alicante, at the mouth of the river Orcheta, has a good harbor and a large trade. P. 9110.

**Villa'ni** (Giovanni), b. at Florence about 1280; occupied a prominent position in his native city, and held various offices, military and diplomatic, as a member of the Guelph party. D. at Florence by the plague in 1348. He wrote a chronicle of Florence, *Istorie Fiorentino,* in 12 books, from its origin to his own time, to which his brother Matteo added a thirteenth book, carrying the narrative down to 1363. According to the style of composition then reigning; this history of Florence is also a history of the world, but whenever the author speaks of Florence or of his own time, the book is considered to have great historical value. Its principal merits, however, are its simple and noble style and its pure language. It was first printed by Giuntini in 1562–87; last ed. in 7 vols. (Milan, 1848).

**Villanovanus** (Arnaldus). See Arnaldus Villanovanus.

**Villanue'va, de** (Joaquin Lorenzo), b. in Valencia, Spain, in 1757; became court-preacher at Madrid and confessor to the king; was elected to the Cortes 1810; took a prominent part as a liberal constitutionalist; was confined several years in a monastery on the return of Ferdinand VII.; went into exile on the overthrow of the constitution in 1823, and d. in Ireland in 1827. Author of *El Año Cristiano* (19 vols.), of a Latin dissertation on the Phœnician colonization of Ireland, of treatises on politics and in favor of the reading of the Bible in the modern languages in church services, and translated into Spanish Paley's *Natural Theology* and other English works.

**Villanue'va de Cor'dova,** town of Spain, province of Cordova, on the slope of the Sierra Morena, trades in cattle, horses, and hogs. P. 5535.

**Villanueva de la Sere'na,** town of Spain, province of Badajoz, in an exceedingly fertile plain called Serena, which is traversed by the Guadiana and encircled by high mountain-walls. P. 9630.

**Villa Real',** an old but handsome and regularly built town of Spain, province of Castellon, on the Mijares, near its mouth in the Mediterranean, has large distilleries and manufactures of woollen fabrics. P. 8207.

**Villa Ridge,** p.-v., Pulaski co., Ill.

**Vil'lari** (Pasquale), b. at Naples in 1827. Taking part with the university students in the movements of 1848 and 1849, he was obliged to emigrate; retired to Tuscany, where he devoted himself to historical researches, and especially to preparation for his great work, *Gerolamo Savonarola e i suoi Tempi,* one of the foremost historical writings of this century, published at Florence in 2 vols., 1859–61, which led to his appointment to the chair of modern history at Pisa, where he also had charge of the superior normal school. From Pisa he was transferred to a similar position in the Instituto di Studii Superiori at Florence. The *Life of Savonarola* was translated into French, English, and German. He has published also a volume on public instruction in England and Scotland, another of critical essays, and many articles in periodicals on public instruction and other subjects, among which his *Antiche Leggende e Tradizioni che illustrano La Divina Commedia,* published also separately at Pisa (1 vol. 4to, 1865), deserves notice. He has lately edited *Dispacci di Antonio Giustinian, Ambasciatore Veneto in Roma dal 1502 al 1505* (Firenze, 1876, 3 vols. 12mo), a hitherto unpublished but important contribution to the history of that period; and he is understood to be now engaged on a work on the life and times of Macchiavelli, which excites much expectation in Italy. For several years Villari has been a member of the superior council of public instruction and of the chamber of deputies in Parliament.

**Villaro'sa,** town of Sicily, province of Caltanisetta, about 28 miles from Piazza Armerina. The inhabitants are chiefly engaged in working the numerous and extensive sulphur-mines in the neighborhood, and the exportation of sulphur from this place is very large, as it is in railway communication with the nearest Sicilian ports. The district is also very rich in fruits and other agricultural products. P. 6879.

**Villars', de** (Claude Louis Hector), Duke, b. at Moulins, department of Allier, France, May 8, 1653; was educated as a page at the court of Louis XIV.; entered the army in 1672; fought with distinction under Turenne, Luxembourg, and Crequi; was also employed with great success in diplomatic negotiations, especially as ambassador to Vienna 1699–1701, and received in 1702, in the

Spanish war of succession, his first independent command. Oct. 14, 1702, he defeated Prince Louis of Baden at Friedlingen, and was made a marshal; next spring he penetrated through the passes of the Black Forest and joined the elector of Bavaria, but although, on Sept. 20, 1703, he won a new victory over the imperial forces under Styrum at Höchstädt, he nevertheless resigned his command and returned to France, disgusted at the follies of his ally, the elector. Having distinguished himself greatly at various points of the theatre of war as a commander of minor corps, he succeeded Vendôme in 1709 in the command of the grand army in the Netherlands, numbering 120,000 men, but was defeated and severely wounded at Malplaquet, Sept. 12, 1709. Having recovered, he again took command of the grand army, now the last which France was able to raise, and gained a brilliant victory over the allied English-Austrian force under the earl of Albemarle at Denain, July 24, 1712, which contributed much to the conclusion of the Peace of Utrecht. After a successful diversion against Prince Eugene, he finally negotiated and signed the Treaty of Rastadt (Mar. 6, 1714). During the regency and the reign of Louis XV. he continued to have much influence on the foreign policy and all military affairs, and when, in 1733, a new war with Austria broke out, he was placed in command of the army in Northern Italy and received the title of marshal-general. Although eighty-one years old, he still displayed remarkable energy; but disagreement with the king of Sardinia caused him to resign his command, and on his return to France he d. at Turin June 17, 1734. His *Mémoires*, published after his death, are only partially genuine. His biography has been written by Anquetil in 4 vols. (Paris, 1784).

**Villefranche′,** town of France, department of Aveyron, at the confluence of the Aveyron and the Alzon, has ironworks and manufactures of copper-ware. P. 10,172.

**Villefranche′-sur-Saône,** town of France, department of Rhone, on the Saône, manufactures cottons, linens, spirits, leather, and trades in corn and wine. P. 11,650.

**Villegagnon′, de** (Nicholas **Durand**), Chevalier, b. at or near Provins, France, in 1510, was a nephew of the grand master of the order of Malta, Villiers de l'Isle Adam; entered the naval service; commanded the vessel which conveyed Mary Queen of Scots to France 1548; became a knight of Malta and a commander of that order; distinguished himself at the sieges of Algiers and of Malta; was a scholar, a linguist, and a keen Protestant controversialist; engaged Admiral Coligny in the enterprise of founding a Protestant colony in Brazil, which he established in 1555 upon the island now bearing his name in the Bay of Rio de Janeiro; returned while there to the Church of Rome, and endeavored to compel the colonists to do the same; returned to France 1557, and engaged in a theological controversy with Calvin. His colony was soon abandoned, and he d. in 1571.

**Villegas, de** (Francisco). See Quevedo y Villegas.

**Ville′gas, de** (Esteban Manuel), b. at Nájera, Old Castile, in 1596; educated at Madrid and at the University of Salamanca; became a lawyer; wrote several dissertations on the classics and a work on the Theodosian code, and translated Boethius (1665), but is best known by his elegant amatory verses, *Las Eróticas* (1617), published when twenty-one years of age. D. at Nájera Sept. 3, 1669.

**Vil′lein,** or **Villain** [from Lat. *villa*, a "hamlet"], a feudal serf, the lowest order of "unfree" persons during the prevalence of the feudal system. In the feudal ages the class of serfs existed under different names throughout Western Europe. The Saxons possessed "theows." The "villains" in England after the Norman Conquest were partly the descendants of the ancient Britons, and partly the lower and poorer of the Saxons. Their condition was far different and far better than that of the Roman slaves (*servi*), or of the African slaves of modern times, and rather resembled the social position of the Roman *coloni*. The villains, in fact, possessed a double personal status. In respect to their owners or lords they had no rights, except that the latter might not kill or maim them or commit rape on the females. They could acquire or hold no property as against their lord; they were obliged to perform all the menial services which he might demand; and the cottages and plots of land which they possessed were held completely at his will. On the other hand, in respect to all other persons besides their lord they were absolutely free, with the rights and privileges of free men. Their condition was rendered the more endurable by the fundamental legal principle which made all possible presumptions in favor of freedom. The operation of these presumptions, and the gradual extinction of serfdom by their means, with little direct legislation as an aid, make one of the most interesting and instructive chapters in the English legal history. Villains were either *regardant* or *in gross*. The regardant were annexed to the soil, and belonged to a manor as fixtures, passing with it when it was conveyed or inherited; they could not be sold as persons separate from the land. Villains *in gross* were not thus affixed to a manor; they belonged personally to their lord, and could be transferred by him at will. Their condition was much inferior to that of the other class, but their number was very small. By far the greater part of the villains in England were annexed to the soil (*adscripti glebæ*). J. Norton Pomeroy.

**Villeinage.** See Villein.

**Villèle, de** (Jean Baptiste Séraphin Joseph), Count, b. at Toulouse, department of Haute-Garonne, France, Aug. 14, 1773; entered the navy in 1791; went to the West Indies, and remained there during the Revolution; returned in 1803 with a large fortune, and settled in his native city; was elected a member of the Chamber of Deputies in 1815, and became in a few years the leader of the ultra-royalist party. After the fall of Decazes in 1820 he entered the cabinet as minister without a portfolio, and became minister of finance in 1821, and president of the council in 1822. An able financier, he brought the finances of France into an orderly shape; but his reactionary measures made him very odious to the people, without fully satisfying the court. The principal events of his administration were the war with Spain for the reinstatement of Ferdinand VII., the indemnity of one milliard to the emigrants, the lowering of the interest on the public debt to 3 per cent., the prolongation of the electoral term for the Chamber of Deputies to seven years, the re-establishment of the right of primogeniture, the limitation of the freedom of the press, the law of sacrilege, and the dissolution of the national guard of Paris. In Jan., 1828, he was compelled to give way to the cabinet of Martignac. He was created a count when he entered the ministry, and a peer when he left it. After 1829 he lived in retirement in Toulouse, and d. there Mar. 13, 1854.

**Villemain′** (Abel François), b. in Paris June 9, 1790; studied first law, afterward literature and philosophy; was appointed professor of rhetoric at the Lycée Charlemagne in 1810; won the prize of the Academy three times between 1812 and 1816 for his *Éloge de Montaigne, Avantages et Inconvénients de la Critique*—which he read himself in a sitting Apr. 21, 1814, at which the emperor of Russia, the king of Prussia, and other prominent members of the alliance against Napoleon were present—and *Éloge de Montesquieu;* published in 1819 his *Histoire de Cromwell d'après les Mémoires du Temps et les Recueilles parlementaires* (2 vols.); received in 1820 a position in the department of the interior as *chef de l'imprimérie et de la librairie*, and was shortly after made *maître des requêtes* to the council of state. But his connection with politics soon carried him into the ranks of the opposition, and in 1827 the Academy, of which he had become a member in 1821, commissioned him, together with Lacretelle and Chateaubriand, to draw up its protest against the re-establishment of the censorship of the press. He now lost his position in the government, but his lectures at the Sorbonne gathered immense audiences, and greatly contributed, like those of Guizot and Cousin, to foment the movement which terminated with the Revolution of 1830. In 1831 he became a member of the council of public instruction; in 1832 was created a peer; in 1839–40 and 1840–44 was minister of public instruction. But of all the *doctrinaire* leaders he proved the one least fitted for actual government. Unable to take or to keep a firm position between the conflicting interests of the Church and the university, the liberals and the conservatives, etc., he resigned his office in 1844, and retired altogether from politics in 1848, devoting himself exclusively to literature. As a writer, however, both as a critic and as a narrator, he occupies a high rank. His principal works are *Cours de Littérature française* (last ed., 6 vols., 1864), *Discours et Mélanges littéraires* (last ed. 1860), *Études de Littérature ancienne et étrangère* (last ed. 1859), *Souvenirs contemporains d'Histoire et de Littérature* (2 vols., last ed. 1859–62), *La Tribune moderne* (2 vols., 1858), *Histoire de Grégoire VII.* (2 vols., 1872), etc. As he altered and enlarged his works very much, it is of consequence to have the last editions, published by himself. D. at Paris May 8, 1870.

**Villemont,** tp., Arkansas co., Ark. P. 407.

**Villemur′,** town of France, department of Haute-Garonne, on the Tarn, manufactures iron goods. P. 5304.

**Ville′na,** town of Spain, province of Alicante, on the Vinolapo, has distilleries, soapworks, and linen-weaving factories. P. 8350.

**Villena** (Enrique), Marquis, b. in Spain in 1384, was of royal descent; became celebrated at the Spanish courts for his erudition; translated Virgil and Dante into

Spanish, and wrote several original works, one of which was a treatise on the *Gaya Sciencia*, or art of poetry. D. in 1434.

**Villena, de** (Juan **Pacheco**), Marquis, b. in Spain about 1425; became the favorite and chief minister of the imbecile king of Castile, Henry IV., about 1454; was supplanted by Beltran de la Cueva, upon which he joined the confederacy of nobles which deposed Henry, and ultimately placed Isabella (the Catholic) on the throne. D. in 1474.

**Villeneuve'-sur-Lot,** town of France, department of Lot-et-Garonne, on the Lot, which here is crossed by a remarkable bridge spanning the river by one single arch, manufactures faïence, tiles, and bricks, and carries on a very brisk trade in corn, wine, prunes, and other products of the adjoining districts. P. 13,830.

**Villeneuve'-sur-Yonne,** town of France, department of Yonne, carries on a very varied manufacturing industry, and an active trade in wood, coal, and wine. P. 5018.

**Villeno'va,** tp., Chautauqua co., N. Y. P. 1401.

**Ville Platte,** p.-v. and tp., St. Landry parish, La. P. 135.

**Villers', de** (Charles François Dominique), b. at Boulay, Lorraine, Nov. 4, 1765; was educated at the school of artillery in Metz, and entered the army in 1782, but emigrated in 1793; served for a short time in the army of Condé; lived in various places in Germany, and settled in 1797 in Lubeck, devoting himself to literature. He published *La Philosophie de Kant* (2 vols., 1801), *Essai sur l'Esprit et l'Influence de la Réformation de Luther* (1804), which was translated, with notes, by James Mill (8vo, 1805), *Coup d'œil sur les Universités de Allemagne protestante* (1808); but his *Lettre à Madame la Comtesse Fanny de Beauharnais*, in which he made a report of the atrocities committed by the French soldiers at the storming of Lubeck in 1806, drew upon him the hatred of the French army, and exposed him to many persecutions. On the annexation of the Hanseatic cities to France in 1811, he removed to Göttingen, and thence to Leipsic, where he d. Feb. 26, 1815.

**Villiers.** See Clarendon, Earls of, and Clarendon (G. W. F. Villiers).

**Villiers** (George). See Buckingham, Duke of.

**Villis'ca,** p.-v., Montgomery co., Ia., on Burlington and Missouri and Brownsville and Nodaway Valley R. Rs., 66 miles E. of Council Bluffs, has 4 churches, a large school-building, a public reading-room, 1 bank, 1 newspaper, marble-works, 1 carriage manufactory, and several hotels. It is a prominent shipping-point for cattle, hogs, and grain. P. 457. C. K. Kennelly, Ed. "Review."

**Villoison', de** (Jean Baptiste Gaspard d'Ausse), b. at Corbeil-sur-Seine, present department of Seine-et-Oise, France, about 1750; acquired a great reputation as a Greek scholar; visited Venice, various places in Germany, Constantinople, and the islands of the Grecian Archipelago; was made professor at the National Institute of Paris, and d. there Apr. 26, 1805. His principal publications are—Apollonius's *Lexicon Græcum Iliadis et Odysseæ* (2 vols., 1773), Longus, *Pastoralia* (2 vols., 1778), *Anecdota Græca* (2 vols., 1781), *Epistolæ Vimarienses* (1785), and *Scholia Vineta* (1788), besides a number of essays in the *Mémoires de l'Académie des Inscriptions*.

**Vil'na,** or **Wilna,** government of Western Russia, bounded S. by the Niemen and W. by East Prussia, comprises an area of 16,434 sq. m., with 973,574 inhabitants. The surface is mostly flat, seldom broken by low hills of clay and sand, but often occupied by marshes and lakes or covered with extensive forests. The climate is mild and the soil generally fertile. Rye, barley, oats, potatoes, flax, hemp, and tobacco are largely cultivated and exported, together with timber, tar, potash, skins of elks, bears, wolves, and martens. The wild bull is found in these forests.

**Vilna,** or **Wilna,** town of Russia, capital of the government of Vilna, on the Wilia, is surrounded with old walls and mostly built of wood, for which reason it has several times suffered severely from fire. It contains, however, many fine buildings, both among its churches and its private residences, and has many good educational institutions, an observatory, a botanical garden, a chemical laboratory, and several museums. It has no manufactures, but an extensive trade in corn and timber. P. 79,265.

**Vilvoor'den,** town of Belgium, province of Brabant, on the Senne, has some cotton manufactures. P. 7602.

**Vimeur, de** (Donatien). See Rochambeau.

**Vi'nal Ha'ven,** tp., Knox co., Me. P. 1851.

**Vinaroz',** town of Spain, province of Castellon, on the Ebro, near the Mediterranean, is a well-built and enterprising place, with extensive fisheries, excellent wine-cultivation, and a brisk coasting-trade. P. 9795.

**Vinca.** See Periwinkle.

**Vince** (Samuel), F. R. S., b. at Fressingfield, Suffolk, England, about 1752; graduated at Caius College, Cambridge, 1775; became fellow of Sidney-Sussex College; took orders in the Church of England; held several ecclesiastical preferments, including the archdeaconry of Bedford, and was Plumian professor of astronomy and experimental philosophy at Cambridge from 1796 to his death, in Dec., 1821. His mathematical attainments were extraordinary. He published a series of textbooks, including *Elements of Conic Sections* (1781), *Principles of Natural Philosophy* (1793), and *A Complete System of Astronomy* (3 vols., 1797–1808); also *A Confutation of Atheism from the Laws and Constitution of the Heavenly Bodies* (1807).

**Vincennes',** a commune (or township) of France, adjoining Paris on the E., celebrated for its château and forest (Bois de Vincennes). The present château was commenced by Philip de Valois (1333), and finished by his successors. It constitutes a fortress, in form a parallelogram 1200 by 670 feet. An interior fort, "the donjon," was flanked by nine towers, all of which except one were removed in 1818 in remodelling the work, it having become the chief arsenal of Paris. The château of Vincennes was, up to the time of Louis XI., a royal residence. Subsequently, it became a state prison. The list of prisoners scarcely rivals that of the Tower of London, yet contains some of the greatest names of France. The unfortunate Duc d'Enghien (see Enghien, d') was shot here in the ditch at the S. E. angle, a locality still pointed out. The church (La Sainte Chapelle) where his remains are deposited contains a monument to his memory. There are extensive barracks and stables for cavalry; and, besides being a great arsenal, Vincennes comprises the École de Tir (firing school) where officers from all regiments are sent to learn the use of modern arms, and to which the regiments of the garrison of Paris and environs send their contingents for practice both with artillery and small-arms. The Bois de Vincennes (park) covers an area of nearly 4 sq. m., and is much resorted to by the middle classes of Paris. P. 17,064. J. G. Barnard.

**Vincennes,** city and tp., cap. of Knox co., Ind., on the E. bank of the river Wabash, 90 miles from its mouth, in lat. 38° 53′, lon. 87° 23′. It is built on a level, dry, sandy plain, and is entirely above overflow, behind which rises a beautiful plateau having an elevation of 100 feet above high-water mark, and occupied by well-tilled farms, vineyards, and gardens. Vincennes is an important railroad centre, having a direct connection with St. Louis and Cincinnati by Ohio and Mississippi R. R., with Indianapolis by Indianapolis and Vincennes R. R., with Cairo and Southern cities by Cairo and Vincennes, and with Evansville and Chicago by Evansville and Crawfordsville road. It has 10 churches, 3 banks, 3 high schools, and a public library, and has a Roman Catholic orphan asylum for boys. There are 3 weekly newspapers and 1 semi-weekly. The Vincennes University, a well-endowed school, chartered in 1807, is a prosperous institution of learning. Vincennes is the entrepôt for a rich agricultural region, in which there are vast quantities of valuable timber and coal of a superior quality. There are 5 flouring-mills, 1 producing annually 56,000 barrels of extra fine flour, an extensive factory for making starch and syrup from Indian corn, 2 woollen-mills, 3 iron-foundries, 1 hub and spoke factory, and extensive machine-shops for the railroads. There are 3 artificial earth-mounds standing upon the high land overlooking the city, representing an ancient civilization. There are about 800 of these mounds in Knox co., which are attracting considerable attention in certain scientific circles. The largest is 60 feet in height and covers an area of 4 acres. Human bones, broken pottery, and arrow-heads have been found in it. The town was settled by the French in 1702, and was the capital of the North-west and Indiana Territories until 1813. The inhabitants are Americans, Germans, and French, nearly equally divided. P. of city, 5440; of tp. 1426.

A. Patton, Ed. "Western Sun."

**Vincennes, de** (Jean Baptiste **Bissot**), Sieur, b. at Quebec, Canada, in Jan., 1688; was a near connection of Joliet; took part from childhood in expeditions to the Western country; was at Michilimackinac in 1698; entered the army as ensign; resided long among the Miami Indians, with whom he was a great favorite; rescued some Iroquois prisoners from the Ottawas 1704; came in collision with La Mothe Cadillac, the commander at Detroit; rendered valuable services against the Foxes near Detroit 1712; built soon afterward a fort and trading-post on the site of the present city of Vincennes, Ind., and in 1736 joined the expedition of D'Artaguette against the Chickasaws, by whom, after several victories, he was taken prisoner and burned alive, along with D'Artaguette, Père Senat, and several others.

**Vin'cent,** tp., Coosa co., Ala. P. 511.

**Vincent,** p.-v., Barlow tp., Washington co., O. P. 162.

**Vincent** (JOHN H.), D. D., b. at Tuscaloosa, Ala., Feb. 23, 1832; educated at Lewisburg Academy and Wesleyan Institute; entered the Methodist Episcopal ministry at an early age, and became distinguished by his efforts to improve the organization and the literature of Sunday-schools; in 1872 was placed by the General Conference at the head of its Sunday-School Union and Tract Society; founded the *Sunday-School Teacher* at Chicago, Ill., and has written and published on behalf of his special interest.

**Vincent** (WILLIAM), D. D., b. in London, England, Nov. 2, 1739; educated at Westminster School and at Trinity College, Cambridge, where he became a fellow 1761; took orders in the Church of England; was usher in Westminster School 1762–71, second master 1771–88, and headmaster 1788–1802; became rector of All-Hallows, London, 1778, prebendary of Westminster 1801, and dean of Westminster 1802. D. in London Dec. 21, 1815. Author of *The Greek Verb Analyzed* (1795), *The Voyage of Nearchus from the Indus to the Euphrates, etc.* (1797), from the original journal of Arrian, and *The Periplus of the Erythræan Sea* (2 parts, 1801–05), both of which latter works were republished as parts of *The History of the Commerce and Navigation of the Ancients in the Indian Ocean* (2 vols., 1807). He also wrote a *Defence of Public Education* (1802) and various other works, and a posthumous collection of *Sermons on Faith, Doctrines, and Public Duties* (2 vols., 1817) was preceded by a *Life* by Rev. Robert Nares.

**Vincent de Paul.** See PAUL, DE (VINCENT).

**Vincen'tians,** a congregation of secular Roman Catholic priests not under a monastic rule, but under special obligations to preach and hear confession among the poor, to assist in the education of clerics, and to further the annual devotion called the "ecclesiastical retreat."

**Vincent, St., Island of.** See SAINT VINCENT.

**Vin'centtown,** p.-v., Burlington co., N. J.

**Vin'ci,** town of Italy, province of Florence, on a hill 6 or 7 miles N. of Empoli, is distinguished as being the birthplace of the celebrated Leonardo da Vinci, who was born here in 1452. The Castello Vinci first appears in history in the eleventh century, and the famous captains Castruccio Castracani and Sir John Hawkwood both carried on military operations against it in the fourteenth century. P. 6576.

**Vinci, da** (LEONARDO). See APPENDIX.

**Vindhyas.** See INDIA, by R. C. CALDWELL.

**Vindobona.** See VIENNA.

**Vinds.** See SLOVENTZI.

**Vine.** See GRAPE, and VINE-CULTURE.

**Vine-Culture.** *History.*—The culture of the vine (*Vitis vinifera*) and the making of wine by the fermentation of the juice of the grape are among the most ancient industries of mankind. As the vine has accompanied the Aryan race to every congenial climate, its origin is usually referred to the same regions as that of its cultivators. It is said to attain its highest perfection in Persia, and in the forests of Mingrelia and Georgia it assumes proportions even more gigantic than do the American vines in our own. The Mosaic narrative mentions the planting of a vineyard by Noah, as well as his use and abuse of wine. The vine and its product are interwoven with the earliest myths of the Greeks and the Romans, and the estimation in which they were held by them is sufficiently indicated by the fact that the vine was the symbol and special attribute of one of their principal deities (Bacchus), whose service and feasts formed no small portion of their public religious ceremonies. In India wine was also known from the earliest times. Its use was interdicted to the Brahmans, as also to the kings of Egypt and to the Jewish priests when at the altar. In Carthage, Phœnicia, and most of Asia known to the ancients, wine was well known. Spain and Gaul doubtless received the vine from the Romans. From Gaul its culture extended into Germany, and later its character as a Christian symbol caused it to be carried by Christian missionaries to the remotest regions, from many of which it has since again disappeared. The advent of Mohammedanism checked vine-culture in the conquered countries; in China, where at one time it flourished, it was prohibited by law.

The early Norse discoverers of America were delighted to find the native vine on the coast of Southern New England. Wine is said to have been made in Florida from native grapes as early as 1564. The Spanish and Portuguese colonists carried the European grape to the temperate portions of South America at an early date; in 1602, some 2,000,000 vines were in bearing near the city of Asuncion in Paraguay. About 1620 the London Company sent French and Spanish vines to Virginia, and some time afterward French vine-dressers went out to take care of them, but failed of success. In 1648 vines trained on trees existed in Uvedale, now Delaware. In 1683, William Penn set out a vineyard near Philadelphia; this also failed. During nearly two centuries after these first attempts, the effort to establish the culture of the European vine on a large scale was often renewed, by colonies as well as individuals, in the Atlantic and Western States; and while sometimes attended with temporary success in favored localities, the uniform ultimate failure induced, at last, the cultivation and improvement of several native American species, now developed into numerous varieties. The first step in this direction that became of general importance was the bringing out of the *Catawba* grape by Major Adlum of Georgetown, D. C., about 1835. It seems to have been first planted on a large scale by Nicholas Longworth, near Cincinnati, and his success caused a rapid increase of vine-culture in that region. In 1858 the area of vine-culture near Cincinnati was estimated at 1200 acres; in 1867 it exceeded 2000. From Cincinnati the culture of the Catawba spread rapidly to the westward, especially to Illinois and Missouri, between 1845 and 1850. Heavy investments were made, both fruit and wine finding ready sale at high prices, and vine-culture in the Mississippi Valley seemed to be established upon a firm basis. Gradually, however, many failures began to be reported. Vineyards that had been in profitable bearing for several years began to be seriously affected by rot and mildew; in some even the vines languished and died, and viticulturists were getting to be seriously alarmed. Evidently, the Catawba had been too hastily accepted for general culture. Very soon, however, hardier and in many respects superior varieties were found or developed by culture. The success of *Norton's Virginia, Concord,* and other now well-known varieties revived the drooping spirits of the vine-growers, so that the total acreage of vines in 1867 was estimated by Mr. Husman at 2,000,000.

On the Pacific slope, in Northern Mexico, and California, vine-culture has had its independent history. About 1771 missionaries brought with them probably the seeds of Spanish grapes, which throve without any of the difficulties encountered on the Atlantic slope. Vineyards everywhere surrounded the missions, and wine for home consumption was abundant, though not, it would seem, of very choice quality, the mode of preparation being quite primitive. After the breaking up of the missions, the vineyards and orchards were neglected, but the "Mission grape" soon attracted the attention of the immigrants, after the first flush of the gold-fever had subsided; and after it was proved in 1858 that the vine could be grown in California without irrigation, its culture increased rapidly, the chief variety planted being the blue "Mission." The fiery and somewhat insipid character of the wines manufactured from this grape soon induced the introduction of other varieties, both of European and (quite lately) of the American stock; all of which seem to thrive in appropriate localities in the varied climates of California.

*Geographical Distribution.*—The culture of the vine on a large scale belongs to the warmer portions of the temperate zones. In the Old World, beginning at the mouth of the Loire, it reaches its extreme northern limits about the confluence of the Rhine and Moselle, 51° N. lat.; in the neighborhood of Berlin, 52° 30′ N. lat.; and about lat. 49° in Hungary. To the southward we find its outposts on the island of Ferro, lat. 27° 45′ N., and on that of Bahrein in the Persian Gulf, lat. 26° N. The production of palatable wines, however, usually falls far within these extreme limits, and is, moreover, largely controlled by local conditions of soil and climate. Farther N. the vine is still cultivated in favored localities or under glass for its fruit, which, however, fails to acquire sufficient sweetness and flavor for wine-making wherever the summer temperature falls below 18° to 20° C. (64.4° to 68° F.). In the tropics, on the other hand, the vine, while growing luxuriantly, bears but scantily, and the berries, when they ripen at all, are small, sweet, and insipid. Thus, we find the vine but sparingly cultivated on the southern slope of the Himalaya Mountains; in Southern Persia it already requires protection from the sun under lat. 29°, but in the northern and more elevated provinces of that country, as well as in Bokhara and the Caucasian region, its fruit is produced in the greatest profusion and perfection, with but little care on the part of cultivators.

The chief wine-producing countries of the Old World are, in the order of their commercial importance, France, Spain and Portugal, Germany (especially the valley of the Rhine), Austria (especially Hungary), and Italy. The vintages of Greece, Turkey in Europe, the Black Sea and Caucasian provinces of Russia, of Asia Minor, Syria, and Persia, are at present mainly of local importance, but the small raisin of the Greek islands—"currants," corrupted from *Corinth*—and the seedless "Sultana" raisins of Smyrna, are

everywhere known as articles of commerce. S. of the equator we find the vine in successful cultivation at the Cape of Good Hope, in lat. 32° S.; in South Australia, especially in the Hunter River region in New South Wales; and in New Zealand. On the South American continent it ranges nearer to the equator, partly, as in Peru, on account of the temperate climates produced by considerable elevation above the sea, partly because of the more rigorous climate of the southern continent. In North America also the zone of vine-culture lies nearer the equator than in the Old World, as might be presumed from the course of the isothermal lines. Although some of the more hardy varieties of the native stock thrive in the open air as far N. as Massachusetts, the northern limit of wine-production on a manufacturing scale is about lat. 42° N., in Southern New York, Pennsylvania, and the group of islands at the western extremity of Lake Erie. The culture of grapes chiefly for table use is extensively pursued on the eastern shore of Lake Michigan, about St. Joseph. Away from the tempering influence of the Great Lakes, however, we see little of vine-culture until we approach, to the southward, the wine-growing region of the Ohio River, Southern Illinois, and Missouri. Thence southward to the shores of the Gulf of Mexico and to the Rio Grande various species of vine flourish in the forests, and the European grape itself on the sandy shores of the Gulf. Thus far, vine-culture has been attempted on a limited scale only in the Southern States, but the results obtained render it highly probable that with a careful selection of varieties adapted to climatic and local circumstances good wines may be produced throughout this extensive region. Beyond the northern limit of wine-production the growing of grapes for table use, in favorable locations, on trellises on the sunny side of buildings, or finally in glass-covered graperies, is sometimes extensively pursued, as in Northern Germany, England, New England, and the Northern Middle States.

The vine is the type of the natural order Vitaceæ, which includes, besides, the Virginia creeper (*Ampelopsis*) and the numerous *Cissi* of the tropics. In the genus *Vitis* the calyx is minute, at the base of the petals; the latter, five in number (as are also the stamens), cohering at their points and detaching themselves at the base as the flower expands; style simple; ovary two-celled; the berried fruit 1 to 4-seeded. The flowers are polygamous—*i. e.* part of the plants obtained from seed are always sterile, the pistil being abortive, while the rest have perfect flowers, with both stamens and pistils, and bear fruit. The grapevines proper climb by tendrils placed opposite the leaves, mostly to two out of every three; the bunches of fruit occupy a corresponding position.

The main products of vine-culture, apart from the fresh fruit, of which enormous quantities are consumed, are *wine*, *brandy*, dried grapes or *raisins*, and *tartar*.

*Species and Varieties.*—The varieties of the vine heretofore almost exclusively planted in the Old World are all derived from the *Vitis vinifera*. As has been already stated, the culture of the latter on the North American continent has met with but very little success outside of California—whether, as some allege, from unsuitability of climate, or, as is believed by others, on account of its liability to the attacks of certain indigenous insect enemies and diseases, from which most of the varieties of native American grapes are comparatively exempt. The cultivated varieties of the latter are derived from four or five wild species, which may be briefly characterized as follows:

(1) *Vitis riparia* and *cordifolia*,* *or Frost Grape.*—Leaves three to five inches wide, more or less deeply 3-lobed, rather thin, glabrous, shining, rarely slightly hairy; lobes long and pointed, teeth acute; berries usually smaller than in the succeeding species, and usually with a bloom; one or two seeds in each; bunches loose, not very large; berries three to six lines in diameter. W. of the Alleghany range, from Canada to the Gulf of Mexico, on the banks of streams, often running over tall trees. Among the more important cultivated varieties of this species are the *Taylor*, *Clinton*, and perhaps the *Delaware*.

(2) *Vitis æstivalis, or Summer Grape.*—Leaves large, four to six inches wide, thicker and firmer in texture than the preceding, entire, or often more or less deeply and obtusely 3 to 5-lobed, sinus rounded, teeth short and broad; young leaves always very woolly or cottony, bright red or rusty; on maturity becoming smoothish, but dull, never shining; berries usually larger than in the preceding, with a distinct bloom, and two to three seeds; bunches usually compact, often so as to deform the berries. In the Middle and Southern States, on uplands, in open woods or thickets, not usually climbing as high as the preceding; fruit ripening in September; sweeter than the preceding, and of all natives the least foxy in taste. Exceedingly variable even in the wild state. The chief cultivated varieties are *Norton's Virginia*, *Cynthiana*, *Herbemont*, *Louisiana*.

(3) *Vitis vinifera*, of the Old World, is in many respects intermediate between the frost grape and the summer grape of the U. S. Its leaves are smoothish, and, when young, shining, bright green; more or less deeply 5- or even 7-lobed; lobes pointed and sharply toothed. The berries of most of the cultivated European grapes approach in size those of the two American species mentioned, and among the wild grapes of Italy, of the lower Danube, of the Caucasus, etc., the American species *riparia*, *cordifolia*, and *æstivalis* seem to be represented. While some regard these as varieties sprung from the cultivated vine, others incline to consider them as parent stocks from which, as in America, the cultivated varieties have gradually been produced. Of the numerous (some 2000) varieties of the European vine, but a few of the most prominent may find mention here. Of wine grapes, *Riesling*, *Traminer*, *Black Burgundy*, *Chasselas*, *Orleans*, *Rulander*, *Black Hamburg*, *Tokay of* Hungary, *Mission* of California. Of table and raisin grapes (more pulpy than the above), the *Spanish* or *Alexandrian Muscat* (from which the Malaga raisins are chiefly made), the *White Damascus*, *White Malvoisie*, *Black* and *White Gutedel*.

(4) *Vitis Labrusca, or Northern Fox Grape.*—Usually not very tall; leaves large, four to six inches, entire to deeply lobed, slightly dentate; covered when young with a thick, rusty, or sometimes whitish woolly down, which remains on the under side of the mature leaf; berries with three or four seeds as a rule, in small or middle-sized bunches; a tendril opposite each leaf, and as many as three or four bunches on each shoot; berries large, seven to ten lines in diameter. Native of the eastern slope of the Alleghanies from New England to South Carolina; not in the Mississippi Valley. The chiefly important cultivated varieties of this species are the *Catawba* (supposed to have originated on the Catawba River in North Carolina), *Isabella*, *Concord*, *Cunningham*, *Hartford Prolific*, *Delaware* (?). All possess to a greater or less extent the peculiar "foxy" flavor of their wild ancestor.

(5) *Vitis vulpina, or rotundifolia; Southern Muscadine, Bullace, Scuppernong.*—Bark, except of old trunks, not scaling off; stems casting aërial roots in damp places; tendrils not forked; leaves rounded, heart-shape, firm, glossy, smooth, or slightly hairy on under side, and with coarse and large teeth, 2 to 2.5 inches wide; berries few (6 to 20), in a rounded bunch, up to an inch in diameter, globular, thick-skinned, easily detached when ripe, strongly scented. Differs greatly in habit from all other cultivated species, and occurs only in the States S. of the 36th parallel. The mustang grape of Texas (*V. candicans*, Eng.) is probably a variety. Of cultivated varieties there are the black, red, and white *Scuppernong*.

Besides the varieties that may be considered as derived from the wild species by simple variation, a number of hybrids have been purposely bred, such as *Arnold's* (between foreign and *Clinton*) and *Rogers's* (foreign and *Labrusca*). Some of these give high promise of usefulness.

The *Soil* and *Location* of vineyards exert a very marked influence upon the kind and quality of their product, to an extent and in a manner often very difficult to explain. A southward (or at least eastward) slope is almost everywhere preferred; in the more northerly regions the value of the vintage depends very largely upon the increased warmth thus secured. The soils best adapted to the growth of the vine are light and even sandy loams, provided only that they be sufficiently rich in mineral plant-food, especially in potash. Hence the light soils resulting from the disintegration of feldspathic, and especially volcanic, rocks are everywhere among those producing the choicest vintages; on the Rhine, in Southern France, in Madeira, on the flanks of Mounts Etna and Vesuvius, in Sonoma co., Cal., and elsewhere. The American vines, moreover, both in the wild and cultivated condition, show a decided preference for calcareous soils. But there are local differences in soils, not understood, whose influence causes the market-value of vintages from contiguous and apparently exactly similar locations to vary as much as 200 per cent. Experience alone can determine questions of this kind. The soil of vineyards, moreover, should be deep and well drained. "Wet feet" are very generally considered injurious to the vine, and in heavy and badly-drained soils, as well as in wet seasons and damp climates, it is apt to become diseased. Its roots, however, will go far in search of moisture, and only extreme drought is seriously injurious. The vine resists the rainless summers of California and of the Med-

* It is doubtful whether the *V. cordifolia* of Michaux can properly be considered a distinct species from *V. riparia*, from which it differs only in the somewhat smaller and less deeply lobed leaves, and fruit sometimes fetidly aromatic, without bloom. Its habit is otherwise the same, and in the South-western States transitions from one to the other seem to occur frequently. In fruit catalogues both names are used indifferently.

iterranean region without irrigation; in some of the best vineyards of Malaga it is not unfrequently planted in cavities in the soft clay-slate rock. It has been found especially important to maintain in the soil of vineyards the supply of available potash, which is heavily drawn upon in the form of the tartar (bitartrate of potash) deposited in the fermentation of wines. Hence it should be made a rule to return to the vineyard all offal, such as prunings, pomace, stems, etc., as well as the lees not manufactured into tartar. Potassic manures have been found especially efficacious in strengthening the vine against the attacks of diseases and parasites.

*Propagation.*—Most grapevines root easily, hence propagation by cuttings (from the previous year's canes, three buds on each) is the mode generally used on a large scale. The varieties of *riparia* root most readily; those of *æstivalis* and *vulpina* with more difficulty; such may be rooted by layering of branches, and plants thus produced bear sooner. The rooting of single buds with only an inch or two of wood is extensively practised by nurserymen, but requires special care. The rooting of green shoots is also feasible, but seems to produce weakly plants. Grafting does not succeed as readily as with other fruits, but has been more extensively practised of late for the purpose of getting hardy roots for delicate varieties. Seedlings are grown in order to obtain new varieties, and some very valuable ones have been produced by hybridization.

*Culture, Training, etc.*—Since the natural climbing habit of grapevines would soon take them out of convenient reach and control, it has been usual from remote times to restrain it by pruning and training. Long culture has rendered the European vine capable of bearing the most severe pruning without seriously injuring its vitality, while all the American grapes must as yet be allowed a closer adherence to their natural habits. The varieties of *V. vulpina* will not, as a rule, bear pruning at all, but succeed best when allowed to form their natural arbors. The other kinds will also flourish when thus treated, but not with the best results as regards quality and quantity of fruit from a given area. The action of the direct rays of the sun upon the fruit, especially in its later stages, is of such importance, particularly in the more northerly regions, that all means must be used to secure that object; which of course cannot be done in arbor-training. Again, in restraining the excessive development of wood, and in bending the canes, we increase the tendency to bear fruit, and favor the improvement of its quality. The nearest approach to the natural arbor, that yet secures most of the advantages alluded to, is the open trellis or frame training. The trellis consists of stakes 6 to 10 feet apart, 3 to 6 feet high, connected by one to three horizontal "rails," upon which the canes are trained. Being from 6 to 9 feet apart in the row, these frames allow the sun and air free access on two sides. The expense of wood, as well as of repairs, rendering the trellis very costly for large culture in the chief vine-growing countries, it has to a considerable extent been superseded by the use of single stakes. This mode of training requires, of course, more severe pruning, but it admits of a larger number of vines to the same area. Finally, in the Mediterranean countries, where wood is and has been scarce for ages, even the stake is dispensed with, the main trunk of the vine being so shortened by cutting-back every year that it forms a mere stump or "stock"* 10 to 18 inches high, from the gnarled topknot or "head" of which the bearing wood annually springs; three or four spurs, with two or three buds each, having been left for the purpose from the previous year's canes. The climber is thus converted into a small but self-sustaining tree, with slender branches crowded with fruit; the latter thus being also somewhat shaded from excessive noonday heat. In the U. S. this mode of training, not being applicable to the native varieties, is confined to California and New Mexico, where the European vine is mainly cultivated. Frame- (and to some extent stake-) training prevails in the vine-growing regions of the Atlantic States.

*Diseases and Insect Enemies.*—The vine is subject to numerous diseases, affecting the stem, leaves, or fruit. Most of these, however, are of a sporadic character, and directly referable to local or temporary causes, especially want of proper drainage, unsuitable soil, excessive damp and cold, or very warm wet weather, especially if followed by hot sunshine; injudicious or excessive irrigation, incautious or excessive pruning, etc. Among these diseases are the "jaundice," "consumption," "blight," "dropsy," "cancer," etc. There is no record of the occurrence of diseases of a general or epidemic character up to the year 1845, when the vine-disease, commonly called *mildew* in this country, first made its appearance in Europe. It did not, however, excite general alarm until (in 1851) it broke out in its most virulent form in the island of Madeira, whose grape-crop it completely annihilated in 1852, after which it attacked and destroyed the vines themselves, so that since 1859 the wine-trade of Madeira has been practically extinct. The disease appeared in Spain and Portugal in 1853–54, and almost simultaneously in France and Germany, where at first it committed fearful ravages. The disease manifests itself by the development of a fungous parasite, covering the leaves or shoots, as well as the berries themselves, with a white, powdery-looking network of beaded fibres. Growth is soon arrested, and decay or drying-up follows. The fungus in its various phases has received a number of names, the best known of which is that of *Oïdium Tuckeri*. But it is doubtful whether it is anything more than one of the numerous forms of the zymotic fungus, of which the common mould is usually considered the typical or mature form. Among hundreds of remedies proposed for this disease, the one that has proved generally efficacious is to dust over the part affected flowers of sulphur. If this is carefully attended to early in the season, before the hibernating spores of the parasite have had time to multiply and spread, the disease may be arrested with comparatively little trouble.

Another fungous disease, especially fatal to certain varieties in the Western States, is the "black rot" of the *berries;* a similar disease affects chiefly the *leaves* of the vine in Europe.

Scarcely had the alarm consequent upon the *Oïdium* epidemic subsided on the discovery of a remedy in the application of sulphur, when (in 1865) a new alarm was sounded from certain districts of France. This time it was the "root rot" or *pourridie;* and its devastations and rapidity of progress threatened, for a time, to throw into the shade even the former plague. In 1868, Planchon showed it to be caused by the attacks of wingless lice upon the roots. These were ultimately proven to be the larvæ of a species of bark louse, having wings in its perfect state, and in some grape varieties feeding on the leaves only. To this insect, after many changes owing to a gradual acquisition of a knowledge of its most complicated natural history, the name of *Phylloxera vastatrix* has been affixed. (See PHYLLOXERA.) It is now almost beyond question that this insect is at home on the indigenous vines of the U. S., and has been introduced into Europe with them. It is especially fatal to the European vine, but hardly less so to the more delicate American varieties, particularly those of the *Labrusca* type; and it is exceedingly probable that most of the failures experienced in this country in the cultivation of the European vine have been owing to the attacks of this native American enemy, rather than to general unsuitability of climate. Of the numerous remedies proposed against the *Phylloxera*, but two thus far have proved effectual in eradicating the evil without material injury to the vine; and these, unfortunately, are difficult of universal application. One is, to submerge the vines for at least thirty days during winter; the other, to apply a very weak (1 in 8000) solution of the sulphocarbonate or xanthate of potash, in sufficient quantity to reach all the infested roots; 1 pound of the potash-salt being required for every 1000 to 1500 cubic feet of earth to be freed from insects. A most promising preventive is based upon the fact that the roots of some American varieties are practically *Phylloxera*-proof, and may therefore be used as stocks upon which to graft (above ground) the more susceptible varieties. Wet and sandy soils are the least favorable to the development of the *Phylloxera*. The *Phylloxera* has lately made its appearance among the European or *Mission* grapes of California, and locally with very fatal effect.

There are numerous other insects that infest the vine more or less, and if allowed to increase unchecked will at times become seriously injurious. Foremost among these are, in this country, the rose-chafer (*Melolontha macrodactylus*, Latr.), several species of leaf-rolling caterpillars, the green-plant louse (*Aphis*), and the red spider (*Acarus tellarius*). Timely attention to the early broods will generally keep these and other locally-injurious insects under control.

(For details of the manufactures connected with vine-culture see the articles on WINE, BRANDY, RAISIN, TARTAR.)

EUGENE W. HILGARD.

**Vine, Diseases and Insect Enemies of.** See PHYLLOXERA and VINE-CULTURE.

**Vin'egar** [Fr. *vin*, "wine," and *aigre*, "sour;" Ger. *Essig*], a dilute solution of ACETIC ACID (which see), mixed with small quantities of sugar and other organic and vegetable matters. It is produced by the oxidation of alcoholic solutions. In the oxidation of alcohol an intermediate compound, *aldehyde*, is at first formed, which by the continued action of oxygen is ultimately converted into

*Vine-growers distinguish in a growing vine the main trunk, or *stock;* its main subdivisions, or *arms;* the previous year's growth, or *canes;* and the current year's growth, or *shoots;* non-bearing side-shoots are *laterals;* a cane cut back to a few buds is a *spur*.

acetic acid. (See FERMENTATION, by PROF. C. F. CHANDLER.) A dilute solution of alcohol is not, however, oxidized to acetic acid by simple exposure to air or oxygen; it is usually necessary that a peculiar fungoid plant (*Mycoderma aceti*), which appears to contain a minute quantity of proteine compounds, in a state of activity which serves as the carrier of the oxygen of the air to the alcohol, should be present. This fungus, which is often developed in old casks that have been used for making vinegar for a long time, and is also termed *mother of vinegar*, forms a gelatinous mass, having the appearance of glue that has been soaked in cold water. Its surface becomes rapidly coated with a bluish mould (*Penicillium glaucum*), which is sometimes observed in old bread. Pasteur regards acetification as a product of the development of the *Mycoderma aceti*—*i. e.* as a physiological fermentation—but it appears probable that the process is rather one of oxidation, and that the fungus accelerates the change by condensing the oxygen upon its surface and delivering it to the alcohol, possibly in the form of ozone. Indeed, the process of vinegar-making takes place in the entire absence of the *Mycoderma aceti*, as when metallic platinum (spongy platinum or platinum black) is brought into contact with alcoholic solutions; and Buchner has quite recently examined shavings that had been in use in a vinegar-factory for over twenty-five years (see below, under *Quick Process*), and found them to be absolutely free from the fungus. The formation of vinegar occurs more readily when, in addition to the presence of the *Mycoderma*, the following conditions prevail: The alcoholic fluid should be sufficiently dilute, not containing more than 10 per cent. of alcohol; the temperature should not be much below 70° F.; air (oxygen) should be supplied in abundance, and come into intimate contact with the solution to be acetified. During the oxidation of alcohol to acetic acid an increase of the temperature and specific gravity of the liquid occurs. In France and Germany the greater part of the vinegar is made from inferior grades of wine; in England infusions of malt and soured beers are extensively employed; while in the U. S. cider and alcoholic liquors are largely used. The culture of the vine is increasing in importance in this country, and it is probable that at no very distant date vinegar will be obtained from this source.

*Wine vinegar* is manufactured in Paris by the following process: The wine is first mixed with wine-lees, and is then put into sacks, which are placed in a large vat and submitted to pressure from above. It is next introduced into large upright casks having an opening at the top, and allowed to acetify. The regulation of the temperature exerts an important influence upon the quality of the vinegar produced. In summer, when the casks are exposed to the heat of the sun, the oxidation is usually completed in two weeks, but in winter, when they are placed in a warmed chamber, a month's time is often required. The liquid is then run off into barrels containing shavings of birch-wood, in which it is allowed to remain for two weeks, when the vinegar will be clarified and ready for use. In Orléans, where the best vinegar is made, wine unfit for drinking is collected from all parts of the country. The casks, which have a capacity of about 400 pints, are placed in rows, one over the other. The wine used is preserved in a vat containing beech-shavings, by which it is separated from the lees and clarified. About 100 pints of boiling vinegar is first introduced into each cask, where it is allowed to remain for several days, after which a small quantity (10 pints) of the wine is gradually added until the casks are filled, when they are allowed to remain at rest for fifteen days. Half of the vinegar is then drawn off and stored, and more wine is added to the remainder in the same manner as before. In this way the process is continued uninterruptedly. In order to ascertain how the "mother of vinegar" is working, a spatula is dipped into the liquid at short intervals, and the quantity of fresh wine added regulated by the amount of froth shown. The "souring casks," as they are termed, often last for ten years, at the lapse of which time, however, a sediment of yeast, argol, etc., accumulates, rendering a cleansing of the entire vessel necessary. Although in the above operation no extensive contact between the wine and air is apparent, a change of the surface of the fluid is constantly taking place, owing to the greater density of the vinegar formed; a continuous circulation of air is also produced, as the air from which the oxygen has been absorbed acquires a lower specific gravity, and therefore rises upward through the casks. Usually, wines a year old furnish the best vinegar; those of a greater age, which have lost their extractive matter, are not suitable for use. Vinegar prepared from wine is either white or red according to the color of the wine from which it is made. It contains, in addition to acetic acid and water, small quantities of acetic ether, bitartrate of potash, and aldehyde; its specific gravity ranges from 1.014 to 1.022. The process just described is termed the *old method;* it is also occasionally used in the manufacture of vinegar from malt. *The Quick* or *German process* (*Schnellessigbereitung*), which is based upon the older method of Boerhaave (1720), and was first introduced by Schützenbach in 1823, effects the oxidation of the alcohol to acetic acid in the most rapid and complete manner possible by bringing an enlarged surface of the liquid into intimate contact with the air. This is accomplished by causing the alcoholic liquid to fall in drops and meet an ascending current of air. The vessel employed consists of a large vat—of which several are frequently in use at the same time—about 8 feet in height, and having a diameter of 3½ feet at the top and 3 feet at the bottom. About a foot from the real lower bottom it contains a false bottom, similar to a sieve in construction, which supports a layer of beech-shavings extending nearly to the top of the vat. Between the true and false bottom a row of air-holes half an inch in diameter is bored in a slanting direction from the outside downward. The beech-shavings are first boiled in water and dried; they are then "soured," or allowed to soak in warm vinegar for twenty-four hours, with which they become impregnated. The vinegar employed to acetify the shavings should not contain any mineral acid; it should also be free from essential oils and pyroligneous acid, the presence of which greatly retards acetification. At a short distance (8 inches) from the top of the vat a perforated wooden disk is fitted in, the perforations of which have about the diameter of a goose-quill (⅛ inch); this also has several larger orifices enclosing glass tubes which permit the escape of the air from below. The space about the disk is filled with cotton batting or yarn, which becomes swollen and penetrates through the holes, for a short distance, thus causing the liquid to trickle slowly upon the shavings. At the top of the vat is a closely-fitting wooden lid, having in its centre a circular hole through which the liquid is introduced. During the oxidation of the alcoholic liquid a large amount of heat is developed in the interior of the cask, whereby the air is made to ascend, and fresh air to enter at the lower air-holes, a constant circulation being thus produced, which is very essential to the success of the process. After the shavings have been "soured," the liquid to be converted into vinegar—usually diluted spirits—is poured into one vat, and, as it flows off, is introduced into a second. If not over 4 per cent. of alcohol were contained in the original liquid, that drawn off from the second vat will be converted into good vinegar. The vinegar, as it collects between the true and false bottoms of the vat, is removed by a tap, which is so constructed that its end dips in the lower stratum of the liquid (that is, in the strong vinegar), and has its exterior end raised so that the liquid cannot flow out until quite a layer has accumulated, the presence of which assists in the process of acetification by evolving acid vapors, which ascend to the upper part of the vat. The temperature of the vinegar-room should be from 75° to 85° F., that of the vat from 95° to 100° F. Occasionally, a layer of white sand is introduced just above the lower false bottom, which is then covered with a flannel cloth to prevent the holes from becoming obstructed. This arrangement assists in the clarification of the vinegar. The composition of the liquid to be acetified varies greatly. The following mixtures are frequently used: 60-per-cent. whisky, 50 gallons; beer or malt wort, 37 gallons (also employed to sour the beech-shavings): common whisky, 3 gallons; prepared vinegar, 4 gallons; pure water, 33 gallons: brandy, 20 parts; vinegar, 40 parts; water, 120 parts; to which an infusion of a mixture of bran and rye meal is first added in order to promote the formation of the *Mycoderma aceti*. It is usual to draw off four gallons of the vinegar every hour, the same quantity of one of the above mixtures being added, together with an additional quart to compensate for the waste in manufacture. The prepared vinegar is preserved in a large vat to which half a gallon of molasses is added every day, until a layer having a thickness of 2 to 3 inches is formed; in this way a fine color is imparted to the product. Owing to the development of heat in the vats, a loss of alcohol, aldehyde, and acetic acid by evaporation occurs in the above process, frequently amounting to 10 per cent. This objection is remedied in Singer's generator, which consists of a number of vessels, one placed above the other, connected by wooden tubes, through which the liquid slowly trickles from one vessel into the other, a longitudinal slit being cut in each tube, thus permitting a free circulation of the air. The quick method of vinegar-making has largely superseded all others, and is in general use in this country.

*Malt vinegar*, which is the variety chiefly used in England, is generally prepared by submitting the wort obtained by mashing malt or a mixture of malt and barley to vinous fermentation, and oxidizing the resulting alcoholic liquor. This latter process can be effected as in the preparation of

wine vinegar, or by repeatedly passing the liquid through vats containing beech-shavings as in the quick process. Singer's generator is also often employed. Dilute solutions of sugar, and even mixtures of starch with yeast, furnish good vinegar. A good article for domestic use can be made by adding ¼ pint of yeast to a solution of 1¼ pounds of sugar in 1 gallon of water, allowing the mixture to stand for three days at a temperature of 80° F., then drawing off into a ripening cask, and adding 1 ounce of bruised raisins and 1 ounce of crude tartar. Malt vinegar possesses a yellowish-red color, and an aromatic odor, which is imparted to it by the acetic and other ethers present. It is sold of four degrees of strength, known in the trade as Nos. 18, 20, 22, and 24. The last, which is the strongest and contains 5 per cent. of real acetic acid, is called *proof vinegar;* its sp. gr. is 1.019. The putrefactive fermentation of vinegar was formerly thought to be prevented by sulphuric acid, the addition of $\frac{1}{1000}$ part of which is allowed by law in England; but although this is now known to be unnecessary, the practice is still continued.

*Cider vinegar,* if made from good sweet and ripe apples, is perhaps the most agreeable variety in use; it is met with chiefly in this country. In its preparation fresh cider is allowed to ferment in barrels having the bungholes open, which are exposed either to the heat of the sun or to that of a warm cellar. It is well to allow several separate fermentations to take place, fresh quantities of cider being added to the barrels every two weeks; the acetification of the cider being also greatly accelerated by the addition of mother of vinegar. Cider vinegar contains, in addition to acetic acid, varying proportions of acetic ether and malic acid.

Pasteur has suggested a process of vinegar-making by the direct aid of the *Mycoderma aceti.* This fungus is first propagated in an aqueous solution containing 2 per cent. of alcohol, 1 per cent. of vinegar, and small amounts of phosphates of potash, lime, and magnesia. The plant soon spreads out, and ultimately covers the entire surface, the oxidation of the alcohol being at the same time gradually effected. When one-half of the alcohol has been acetified, small quantities of wine or alcohol, mixed with beer, are daily added, the complete conversion of the alcohol into vinegar being allowed to take place as soon as the acetification becomes weaker. The vinegar formed is then drawn off, and the plant again used in the same apparatus. The vessels employed are circular or rectangular shallow wooden tanks, into which the air is allowed access by means of two small apertures at the side, and are covered with lids. The alcoholic liquid is introduced through two gutta-percha tubes, which connect with the vessels at their bottoms. Wine or malt liquors can be directly converted into vinegar by this process; but when only alcohol is used, the addition of sulphate of ammonia and phosphates of potash and magnesia, and a little vinegar, is necessary in order to furnish the organic and inorganic food needful for the vinegar-plant.

A vinegar-making process in which the oxidation of the alcohol is effected with the aid of finely-divided platinum was first proposed by Döbereiner. Several shelves are arranged in a tall glass case, upon which are placed a number of porcelain capsules containing alcohol. Directly over each capsule is a tray supported on a tripod containing a little platinum black or spongy platinum. At the top and bottom of the case ventilators are so constructed that the access of air can be easily regulated. Upon heating the apparatus, by placing it in the sunshine or by means of a steam pipe, to about 85° F., the alcohol is slowly evaporated, and on coming in contact with the platinum is oxidized to acetic acid. So long as the ventilation is maintained, the platinum retains its property of conveying oxygen to the alcohol; when the acetification is completed, fresh air is admitted and the process recommenced. The vapors of alcohol and acetic acid carried off by the outgoing current of air can be collected by a condensing apparatus. Vinegar prepared from pure alcohol does not possess the pleasant flavor of that obtained from wine and cider, but the addition of a little acetic ether renders it more agreeable in taste. Small quantities of fusel oil, oil of cloves, or butyric ether are also occasionally added to the alcohol to be acetified in order to impart a fine aroma.

In countries where a high duty on alcoholic liquids exists, table vinegar is frequently prepared from wood vinegar or pyroligneous acid. For this purpose the crude acid is carefully purified, either by conversion into acetate of soda and distillation with sulphuric acid, or by saturation with lime, then adding hydrochloric acid, removing the tarry matters separated, and distilling. It is afterward further deodorized and purified by distillation with bichromate of potash and filtration through animal charcoal. Small quantities of acetic ether and burnt sugar are often used to impart flavor and color.

*Distilled vinegar*—which is generally employed for pharmaceutical purposes—is weaker than ordinary vinegar, since the boiling-point of concentrated acetic acid is above that of water. It is often contaminated with small quantities of alcohol, aldehyde, and empyreumatic substances. The quantity of acetic acid in vinegar differs greatly. The specific gravity is not an accurate indication of the strength, owing to the presence of foreign bodies. A preferable method consists in determining the amount of a standardized alkaline solution necessary to saturate the acetic acid present. (See VOLUMETRIC ANALYSIS.) The results given by this test are, however, not absolutely correct, as neutral alkaline acetates possess an alkaline reaction. The vinegar can also be supersaturated with a baryta solution, the excess of the salt eliminated by a current of carbonic acid, and the baryta salt in the filtrate precipitated as sulphate; from which the amount of acetic acid is calculated by multiplying by 0.515. Sulphuric acid, added to increase the acidity of vinegar or for other purposes, is best detected by boiling the suspected vinegar with a small quantity of potato-starch, and, after the *complete cooling,* adding a solution of iodine; if the vinegar be pure, the blue color of iodide of starch will become apparent; but if sulphuric (or hydrochloric) acid be present, the starch will be converted into dextrine by the boiling, and the blue coloration will fail to appear. Free sulphuric acid can also be detected by means of chloride of calcium, which causes a precipitation of sulphate of lime in presence of the free acid, but not in that of the minute quantities of sulphates generally present. Hydrochloric acid is indicated by a white precipitate with nitrate of silver; nitric acid can be detected by a yellow color when the vinegar is boiled with indigo, or by the deflagration of the residue obtained by evaporating with a little carbonate of soda. Such acrid substances as red pepper, mustard, etc., are recognized by evaporating the vinegar to an extract, which in their presence will possess a biting taste. Copper is detected by the formation of a brown precipitate upon addition of ferrocyanide of potassium; lead, by the black precipitate produced by sulphuretted hydrogen, and the yellow one given by iodide of potassium. J. P. BATTERSHALL.

**Vin'egar Hill,** tp., Jo Daviess co., Ill. P. 693.

**Vinegar-Plant.** See VINEGAR.

**Vine'land,** p.-v., Cumberland co., N. J., 34 miles S. of Philadelphia, on the direct line of West Jersey R. R. to Cape May, and 115 miles from New York, on the direct line of New Jersey Southern R. R. The town-plat is 1 mile square (the Vineland tract of 35,000 acres extends into Atlantic and Gloucester cos.), not closely built, except for a few blocks on the main avenue. The principal avenues are 100 feet wide; the remaining avenues and streets 60 feet in width. Outside the town-plat the tract is laid out in fruit-farms of from 5 to 25 acres, and there being few fences the appearance is that of an extended park. The place was founded by Charles K. Landis in 1861; is devoted mainly to the culture of small fruits, to which the soil is especially adapted; contains 10 churches, 18 district schools and a central high school, erected at a cost of over $25,000, several private schools, Kindergarten, bank, a variety of manufactories, including 8 shoe-factories, straw-sewing, paper-box, fruit-crate, carriage, wallet, button and glove factories, lumber-yards, steam flour and feed mills, machine-shops, etc. Vineland has 5 post-offices, 2 daily, 4 weekly, and 2 monthly newspapers, besides occasional publications, and 2 hotels. The temperance policy of the place, its mild and healthful climate, the abundance of superior fruit produced, and the general beauty of the town, serve to attract settlers here from all parts of the world. The shipping of fruit is an important industry, there having been shipped for the season of 1875, 345,791 quarts of berries, 23,794 crates of peaches and pears, and 1,210,188 pounds of grapes, besides which large quantities were disposed of in other ways. P. about 11,000.

MISS ESTELLE THOMSON, ED. "DAILY ADVERTISER."

**Vine Prairie,** tp., Crawford co., Ark. P. 338.

**Vi'ner** (CHARLES), b. at Aldershott, Hampshire, England, in 1680; became a lawyer; was employed above fifty years in the preparation of *A General Abridgment of Law and Equity* (23 vols., 1742–51), printed at his own house at Aldershott, to which an *Alphabetical Index* (London, 1758) was prepared by Robert Kelham. D. at Aldershott June 5, 1756. He bequeathed £12,000 to the University of Oxford to found the Vinerian professorship of common law, of which Sir William Blackstone was the first incumbent.

**Vines** (RICHARD), b. in England about 1580; received a medical education; was sent by Sir Ferdinando Gorges in 1614 or 1616 to act as his agent in planting a settlement on Saco Bay, Me.; spent there the winter of 1616–17, during the great pestilence which depopulated the New England Indians; gave them medical assistance; ascended the

Saco River in a canoe to Crawford's Notch 1617; was the first white man who visited and described the White Mountains, and received from the council of the Plymouth Company in 1630 a grant of land on the Saco River, where he founded the village of Biddeford.

**Vines** (Richard), b. at Blaston, Leicestershire, England, about 1590; educated at Magdalen College, Cambridge; became a celebrated Presbyterian preacher, expositor, and scholar; was rector of Weddington, Warwickshire, and subsequently minister of St. Clement Dane's and vicar of St. Lawrence Jewry, London; was one of the famous Westminster Assembly of Divines 1643–49, and became in 1645 master of Pembroke Hall, Cambridge, which post he resigned in 1650 on account of the Engagement. D. in 1655. He published a volume of *Sermons* (1644) and some single discourses. Four volumes of *Sermons* appeared after his death (1657–67).

**Vinet'** (Alexandre Rodolphe), b. at Ouchy, canton of Vaud, Switzerland, June 17, 1797; studied at Lausanne; was appointed professor of the French language and literature at Bâle in 1819; engaged with great energy in the Free Church movement going on at that time in several of the Swiss cantons, and was made professor of practical theology at Lausanne in 1837. D. at Clarens, on the Lake of Geneva, May 4, 1847. His theological writings, *Mémoire sur la Liberté des Cultes* (1823), *Discours sur quelques Sujets religieux, Essai sur la Manifestation des Convictions religieuses, Théologie pastorale*, etc., were often reprinted, and translated both into German and English. He also wrote *Histoire de la Littérature française au 18me siècle* and *Études sur la Littérature française au 19me siècle*, etc. His biography has been written by Scherer (Paris, 1853) and Rambert (Lausanne, 1875). (See also Sainte-Beuve's *Portraits contemporains.*)

**Vineur.** See Rochambeau.

**Vine'yard,** tp., Washington co., Ark. P. 887.

**Vineyard,** tp., Lawrence co., Mo. P. 1419.

**Vineyard Grove,** p.-v., Dukes co., Mass.

**Vineyard Haven,** p.-v., Dukes co., Mass.

**Vineyard Sound,** the passage between Martha's Vineyard and the Elizabeth Islands, on the S. coast of Massachusetts. It is 20 miles long and 6 broad, and is a great thoroughfare for coasting vessels.

**Vin'land** (the "wine-land"), the name which Leif the Lucky gave to those regions of North America—probably the coasts of Massachusetts and Rhode Island—which he visited in 1000 A. D. Leif was a son of Eric the Red, who had made the first settlement in Greenland, and it was on their road from Greenland to their home (Iceland) that these settlers discovered America. In 1003 came Thorvald, a brother of Leif, and in 1007, Thorfinn Karlsefne, his brother-in-law. But when Thorfinn, after three years' stay, returned to Iceland, no more attempts were made to explore and settle the new country. All facts relating to this early discovery of America—which, however, are few and not very interesting—have been collected by Rafn in his *Antiquitates Americanæ*, but another Danish antiquarian, the celebrated Finn Magnussen, has established the fact that Columbus visited Iceland in 1477, and this visit gives the old traditions of Vinland a curious interest.

**Vinland,** p.-v. and tp., Winnebago co., Wis. P. 1040.

**Vinnit'za,** town of Russia, government of Podolia, on the Bug, has 8991 inhabitants.

**Vinous Fermentation.** See Fermentation, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

**Vin'ton,** county of S. Ohio, drained by Salt and Raccoon creeks, and traversed by Marietta and Cincinnati R. R.; surface undulating, soil fertile. Iron ore and bituminous coal abound. There are saw-mills, flour-mills, tanneries, currying establishments, and manufactories of charcoal and pig lead. Cattle and sheep are numerous. Staples, Indian corn, oats, wheat, potatoes, tobacco, hay, and dairy products. Cap. McArthur. Area, 414 sq. m. P. 15,027.

**Vinton,** p.-v., cap. of Benton co., Ia., on Burlington Cedar Rapids and Minnesota R. R., and upon the S. bank of Cedar River, 25 miles N. W. of Cedar Rapids, has 6 churches, 1 academy, 3 banks, 2 newspapers, and 1 planing and 2 flouring mills. The State college for the blind is located here. P. 2460. J. W. Rich, Ed. "Eagle."

**Vinton,** p.-v., Gallia co., O., on Gallipolis McArthur and Columbus R. R., and on Raccoon River, 40 miles from its mouth, has several churches, excellent schools, 1 newspaper, and several mills. P. 137.

C. M. Holcomb, Ed. "Gallipolis Journal."

**Vinton,** p.-v. and tp., Vinton co., O. P. 656.

**Vinton** (Alexander Hamilton), M. D., D. D., b. at Providence, R. I., May 2, 1807; studied medicine at New Haven; practised as a physician 1828–32; pursued a theological course in the Protestant Episcopal Seminary at New York; was ordained 1835; was pastor of churches at Portland, Me., 1835–36, Providence, R. I., 1836–42, Boston, Mass., 1842–58, Philadelphia, Pa., 1858–61, and New York City 1861–70, since which time he has been rector of Emanuel church, Boston. He has published a volume of *Sermons* (1855) and several separate discourses and addresses.

**Vinton** (David H.), brother of following, b. in Providence, R. I., May 4, 1803; graduated at the U. S. Military Academy in 1822, and entered the 4th Artillery; transferred to the infantry in 1823. After a term of garrison and special duty, he was sent to Florida in 1836, where employed on quartermaster duty, and in 1837 made quartermaster-general of Florida. Continued in the same service until 1846, he was in that year made chief quartermaster on the staff of Gen. Wool, with rank of major, serving with the latter in Mexico; was chief quartermaster department of the West 1852–56, of the department of Texas 1857–61, and taken prisoner upon the surrender of Twiggs. Exchanged soon after, he was in Aug., 1861, made deputy quartermaster-general, and as chief quartermaster at New York during the civil war rendered valuable service. Promoted to be colonel in 1864, in 1866 he became assistant quartermaster-general, and the same year was placed on the retired list. For "faithful and meritorious services" he was brevetted colonel and brigadier-general. D. at Stamford, Conn., Feb. 21, 1873.

**Vinton** (Francis), brother of Alexander, b. at Providence, R. I., Aug. 29, 1809; graduated at West Point 1830; became second lieutenant of artillery; was stationed at Fort Independence, Boston harbor, during which time he studied law at Harvard Law School; acted as civil engineer to several railroads; was admitted to the bar at Portsmouth, N. H., 1834; served in the Creek war in Alabama and Georgia 1836; left the army in that year; studied theology in the Protestant Episcopal seminary, New York; was ordained 1838; was successively rector of churches at Providence and Newport, R. I. (1840–44), and Brooklyn, N. Y. (1844–55); declined the bishopric of Indiana 1847; became assistant minister of Trinity church, New York, 1855, and professor of ecclesiastical law and polity at the General Theological Seminary 1869. D. in Brooklyn Sept. 29, 1872. Author of *Arthur Tremaine, or Cadet Life* (1830), and a *Manual Commentary on the General Canon Law of the P. E. Church in the U. S.* (1870).

**Vinton** (Francis Laurens), nephew of Dr. Francis, b. at Fort Preble, Me., June 1, 1835; educated under the care of his uncle; graduated at West Point 1856; entered the 1st Cavalry, but soon resigned; studied metallurgy at the Imperial School of Mines, Paris; examined the mineral resources of Central America; was appointed captain of the 16th U. S. Infantry, 1861; became colonel of the 43d New York Vols.; was engaged in the Peninsular campaign in Hancock's brigade; was wounded at Fredericksburg; became brigadier-general of volunteers Mar. 13, 1863; resigned May 5, 1863; and has been professor of engineering in Columbia College since Sept., 1864.

**Vinton** (Frederick), b. at Boston, Mass., Oct. 9, 1817; graduated at Amherst 1837; studied divinity at New Haven, but was not ordained; taught at Nantucket, Mass., 1846–47, at Eastport, Me., 1847–48; librarian at St. Louis, Mo., 1851–55; assistant in the Public Library, Boston, Mass., 1857–65; in the Library of Congress 1865. Distinguished for bibliographical labors.

**Vinton** (John Adams), b. in Boston, Mass., Feb. 5, 1801; graduated at Dartmouth 1828, at Andover 1831; became a Congregational minister, and was settled over several churches in Maine, Vermont, and Massachusetts 1832–52. Author of *The Vinton Memorial* (Boston, 1858), *The Giles Memorial* (1864), and *The Sampson Family in America* (1864); edited a reprint of Deborah Sampson's *Female Review* (1866), and contributed to several religious and literary periodicals.

**Vinton** (John R.), b. at Providence, R. I., about 1795; graduated at the U. S. Military Academy in 1817, and entered the artillery; he served for three years on the northern boundary survey; in garrison and on special duty until 1836; in the Florida war 1837–42, and in the war with Mexico 1846–47, gaining the brevet of major for gallantry at Monterey. Transferred to the army of Gen. Scott, he was killed in front of Vera Cruz Mar. 22, 1847.

**Vio, de** (Thomas). See Cajetan.

**Vi'ola,** or **Tenor Violin,** a very large violin, having four strings, two of catgut alone and two wound with wire; it stands an octave above the violoncello, and is employed almost exclusively for playing the middle part in orchestral music.

**Vio'la,** tp., Lee co., Ill. P. 639.

**Viola,** p.-v., Green tp., Mercer co., Ill. P. 407.

**Viola,** p.-v. and tp., Olmsted co., Minn. P. 728.

**Viola,** p.-v., Warren co., Tenn. P. 944.

**Vi'olet,** tp., Fairfield co., O. P. 2087.

**Violet** [Lat. *viola*], a large genus (*Viola*) of exogenous herbs of the order Violaceæ. Of the 200 recorded species, most are natives of the N. temperate zone. Many varieties have resulted from cultivation. Among these are the sorts called pansies, heartsease, etc. The cultivated sorts are mostly of the Old-World species, *V. tricolor, V. odorata, V. grandiflora, V. altaica,* and their hybrids. One fine North American species, *V. pedata,* is becoming common in gardens, but most of our American violets are not very showy plants in culture. The successful culture of pansies of the better sorts requires skill and experience.

**Violin'** [It. *violino*], a musical instrument with four strings, played with a bow, anciently called a fiddle (Ang.-Sax. *fythel*), consists of three parts—the neck, the table, and the sounding-board; has at its side two S-shaped apertures of unequal size. Above these is a bridge, over which pass the strings from the lower extremity or tail-piece to the neck, where they are tightened or loosened by means of turning-pins. It is considered the most perfect of musical instruments, on account of its capabilities of fine tone and expression, and forms with its cognates, the viola, violoncello, and double-bass or bass-viol, the main element of all bands and orchestras. It is of considerable antiquity, being traced in England to the twelfth century. The most prized instruments are those made in the seventeenth and eighteenth centuries in Italy by the Amatis at Brescia, Stradivari and the Guarneris at Cremona, and Stainer in the Tyrol.

**Viollet-le-Duc'** (Eugène Emmanuel), b. in Paris Jan. 27, 1814; studied architecture under Leclère, afterward in Italy 1836–39; was employed after 1840 in the restoration of the principal mediæval architectural monuments of France, among which was the cathedral of Notre Dame in Paris, and was appointed professor of the history of art in 1863. His principal works are—*Dictionnaire raisonné de l'Architecture française du XI. au XVI. Siècle* (10 vols., 1853–68), *Dictionnaire raisonné du Mobilier français de l'Époque carlovingienne à la Renaissance* (1855–75), *Essai sur l'Architecture militaire au Moyen Age* (1854; translated into English by M. Macdermott, London, 1860), *Entrétiens sur l'Architecture* (2 vols., 1863–72), *Histoire d'un Maison* (1873), *Histoire d'une Fortresse* (1874), *Histoire de l'Habitation humaine* (1875); the four last have been translated into English by B. Bucknall.

**Violoncel'lo,** a bass violin with four strings tuned in fifths, A, D, G, and C, the two latter strings being wound with wire.

**Vioménil', de** (Antoine Charles **du Houx**), Viscount, b. at Fanconcourt, Lorraine, France, in 1728; entered the army at the age of seventeen; served in Holland, Hanover, and Corsica, gaining the rank of field-marshal; assisted the Polish confederation against Russia 1770, and captured the castle of Cracow; came to the U. S. in 1780 as second in command to Count Rochambeau; distinguished himself at the siege and capture of Yorktown 1781, where he led his troops in the storming of the redoubt; was promoted to a lieutenant-generalship; returned to France and became governor of La Rochelle 1782, and was so severely wounded while defending the king during the assault upon the Tuileries, Aug. 10, that he died a few weeks later, Nov. 9, 1792.—His brother, Charles Joseph Hyacinthe du Houx, Marquis de Viomenil, b. in 1734; served in Germany during the Seven Years' war; was a major-general under Rochambeau in the U. S. 1780–82, bearing the title of baron; was at Yorktown; was governor of Martinique 1789–90; emigrated from France as a royalist 1791; served under the prince of Condé 1791–97; became a peer 1814, a marshal of France July 3, 1816, and a marquis 1817. D. at Paris Mar. 5, 1827.

**Viper.** See Viperidæ.

**Viper'idæ** [from *Vipera*—the old Latin name—the typical genus of the group], a family of the order of serpents and the sub-order Solenoglypha, embracing the viper of Europe and related species. The form is typified by the common viper; the scales on the back and sides are oblong and imbricated, those on the abdomen transverse scutellæ; the head is well distinguished from the body, and depressed oval; the upper surface covered with plates or scales; the eyes have, mostly, elliptical pupils; no lachrymal fossæ are developed; the poison-fangs are truly solenoglyph, and destitute of external grooves. The family includes a number of poisonous serpents peculiar to the Old World, and is at first sight distinguishable from the Crotalidæ (rattlesnakes, etc.) by the want of the deep pits between the eyes and nostrils which so much enhance the vicious look of the latter. The most notable species are the viper of Europe (*Vipera berus*), the cobra de capello (*Naja tripudians*), and the Egyptian *Naja haje* and *Cerastes Hasselquistii,* each of which has been supposed by different writers to have been the asp fatal to Cleopatra. Theodore Gill.

**Vir'chow** (Rudolf), b. at Schivelbein, Pomerania, Oct. 13, 1821; studied medicine in Berlin; was appointed prosector at the Charité Hospital in 1843, and sent in 1848 by the Prussian government to Silesia to investigate a typhoid fever raging there; received in 1849 a professorship of pathological anatomy at the University of Würzburg, and was in 1852 sent by the Bavarian government to the Spessart to investigate a famine fever which had broken out there; returned to the University of Berlin in 1856, and acted as director of the hospitals during the campaigns of 1866 and 1870–71, taking part all the while with great energy in the political movements as a representative of the city of Berlin in the Prussian house of representatives. He is the creator of the cellular theory in pathology, which he has developed in *Die Cellularpathologie in ihrer Begründung auf physiologische und pathologische Gewebelehre* (1858), and in his *Archiv für pathologische Anatomie,* which he founded in 1844 in conjunction with Reinhardt. He also wrote *Handbuch der speciellen Pathologie und Therapie* (3 vols., 1854–62) and *Vorlesungen über Pathologie* (4 vols., 1862–67), besides a great number of minor essays on various subjects, among which are *Goethe als Natur-forscher* (1861), *Ueber Pfahlbauten und Hünengräber* (1866), *Ueber Erziehung des Weibes für seinen Beruf* (1865), *Die altnordische Schädel zu Kopenhagen* (1871), etc.

**Vir'den,** p.-v., Macoupin co., Ill., has a private bank.

**Vire,** town of France, department of Calvados, on the Vire, has large cloth and paper manufactures. P. 7647.

**Vireo.** See Vireonidæ.

**Vireon'idæ** [from *Vireo,* the generic name of the type], a family of birds of the group of Passeres, admitted by most recent ornithologists, although based on characters of dubious importance. It has been best defined by Baird in essentially the following terms: The general form is normal; the bill conical, much compressed, decurved at end and notched, but scarcely toothed; the gonys is more than half the length of lower jaw (from tip to angle of mouth), and usually longer than the width of the mouth, which is narrow; the nostrils are lateral and overhung by membrane; the frontal feathers are bristly and erect, or bent but slightly forward; the wings have mostly ten primaries, but the spurious one is wanting in certain *Vireos;* the tail is moderate; the tarsi have the lateral plates undivided, except at the extreme lower ends, and they are longer than the middle toes with the claws; the three anterior toes have their basal phalanges abbreviated, and the basal phalanx of the median toe is decidedly shorter than the basal of inner, or the two basal of outer, and adherent for its whole length on both sides to the lateral (*i. e.* not free at all); the outer claw reaches about halfway along middle claw. The family is peculiar to America, and according to Sclater and Salvia is represented by 7 genera and 50 species—viz. (1) *Vireosylvia,* with 9 species; (2) *Vireo,* with 10; (3) *Neochlæ,* with 1; (4) *Hylophilus,* with 16; (5) *Laletes,* with 1; (6) *Vireolanius,* with 4; and (7) *Cyclorhis,* with 9: 10 or 11 have since been described. In the U. S., according to Baird, Brewer, and Ridgway, are 14 species, belonging to *Vireosylvia* and *Vireo.* The species are all moderate or rather small-sized singing birds. According to Brewer they mostly build pensile nests of considerable architectural ingenuity and beauty. The eggs are usually five in number (sometimes not more than three), and, in *Vireo* at least, "of a brilliant crystal-white, sparingly spotted at the larger end with markings of dark brown, and others of a lighter shade" (*Brewer*). Theodore Gill.

**Virey'** (Julien Joseph), b. at Hortes, department of Haute-Marne, France, in 1775; studied medicine in Paris; was for some time first pharmaceutist to the military hospitals, and member of the superior council of health from 1831 to 1838. D. at Paris Mar. 29, 1846. His principal works are—*Histoire naturelle du Genre humain* (3 vols., 1801), *Art de perfectioner l'Homme* (2 vols., 1808), *De la Physiologie dans ses Rapports avec la Philosophie* (1814), *Histoire des Medicaments, des Aliments et des Poisons* (1820), and *Philosophie de l'Histoire naturelle* (1835).

**Virgil.** See Vergil.

**Vir'gil,** tp., Kane co., Ill. P. 1273.

**Virgil,** tp., Vernon co., Mo. P. 979.

**Virgil,** p.-v. and tp., Cortland co., N. Y. P. 1889.

**Virgil** (Polydore). See Vergil.

**Virgil City,** p.-v., Cedar co., Mo.

**Virgil'ia,** a genus of South African leguminous trees, to which the American yellow-wood (*V. lutea*) is ascribed by Michaux; and though Rafinesque denies the connec-

tion, calling it *Cladrastis tinctoria*, it is usually known in the U. S. by the former name. It is a beautiful tree, about forty feet in height, with flowers in loose pendent racemes twenty inches long; is much prized for lawn-planting, and is hardy and easily grown from the seed.

**Vir'ginals,** or **Pair of Virginals** [so called because it was designed to be played by young ladies], a sort of spinet; a small piano-shaped stringed and keyed instrument, long since obsolete.

**Virgin'ia,** one of the Middle Atlantic States of the American Union, and one of the original thirteen of the first Confederation, lying between the parallels of 36° 31′ and 39° 27′ N. lat., and between the meridians of 75° 13′ and 83° 37′ W. lon. from Greenwich. Maryland (from which it is separated by the Potomac River and Chesapeake Bay for 205 miles, and by a line of 25 miles across the Eastern Shore) forms its northern and north-eastern boundary; the Atlantic Ocean borders it for 125 miles on the E. and S. E.; on the S. it is bounded by North Carolina for 326 miles, and by Tennessee for 114; on the W. and N. W. Kentucky bounds it for 115 miles, and West Virginia for 450 miles more. The longest line in the State is from the Atlantic S. W. to the Kentucky line, 476 miles. The longest line from N. to S. is 192 miles. The area of the State, exclusive of tidal waters, bays, sounds, etc., is, according to

Obverse. Reverse.




The Seal of Virginia.

the census of 1870, 38,348 sq. m., or 20,062,720 acres; but Major J. Hotchkiss, whose *Geographical and Political Summary of Virginia* is just published by the State, reckoning all tidal waters, etc., as well as the mountains to their highest summits, estimates the area at 45,000 sq. m., or 27,201,000 acres. He arranges the State in six divisions, and assigns the following areas to each: Tidewater Virginia, 11,350 sq. m.; Middle Virginia, 12,470; Piedmont, 6680; Blue Ridge, 1230; the Valley, 7550; Appalachia, 5720 sq. m.

*Topography and Physical Geography.*—Tidewater Virginia is the alluvial and diluvial plain in the E. portion of the State, and is divided by Chesapeake Bay and the large tidal rivers which flow into it into nine primary and many subordinate peninsulas; among these is that portion of the Eastern Shore of the bay belonging to Virginia, and including the counties of Northampton and Accomac. It extends as far W. as Richmond. No part of this region is elevated more than 100 feet above the sea, and considerable tracts are low and marshy. Middle Virginia, a triangular tract extending from a N. and S. line running through Richmond to the foot-hills of South-west Mountain, is a wide undulating plain of no great elevation (perhaps an average of 400 feet), through which the many rivers which traverse it have cut their channels to a considerable depth and are bordered by alluvial bottom-lands. Its rocks belong to the Triassic and Jurassic systems, with occasional extensive outcrops of granite, gneiss, and other Eozoic groups. Piedmont includes both slopes of South-west Mountain, and an undulating plain, broken into valleys in some portions, extending to the foot-hills of the Blue Ridge. It has many small streams, and its hills are rounded and fertile. It occupies a belt of territory from 18 to 28 miles in width, and extending from N. E. to S. W. through the State. Its prevailing rocks are crumbling greenstone and granite. The Blue Ridge country is a still narrower belt, parallel with the preceding, including both slopes of the Blue Ridge Mountains, and forming the eastern wall of the Valley of Virginia. The summits of the Blue Ridge rise to a height of 2500 to 3000 feet; they are mostly dome-like, and between them stretch, especially in the S., broad plateaus. The Valley of Virginia is a part of the great Appalachian Valley, lying between the Blue Ridge on the E. and the Kittatinny or Endless Mountains on the W. It is a broad belt of rolling country, from 1200 to 1600 feet above the sea, diversified by hills and valleys, with many winding streams of water. Its soil, underlaid with disintegrating limestones, shales, slates, and clays, is very fertile, and it is sheltered by the mountains on either side from chilling winds. Appalachia is the region covered by that part of the Kittatinny Mountain range (which has here a score of local names) traversing Virginia. It is made up of a number of parallel mountain-chains, with trough-like valleys between them, the mountains often running 50 miles or more in an unbroken, single, straight, lofty ridge, with a narrow and equally uniform valley alongside; sometimes the mountains slope gently down and the valleys widen. Some of the sharp, bold ridges rise to a considerable height: Elliot's Knob is nearly 4200 feet, Warm Spring and Alleghany Mountain about 3500 each. Two points of the Blue Ridge are said to be still higher—the Balsam Mountain in Grayson co., 5700 feet, and a point near the Tennessee line, 5530 feet; the Peaks of Otter are 3993 feet, and Mount Marshall, near Front Royal, 3369 feet.

*Rivers and Lakes.*—Of the numerous rivers which drain the State, six-sevenths belong to the Atlantic system, and one-seventh to the Ohio and its tributaries; and of the latter, a part, as the Holston and Clinch, are affluents of the Tennessee; a part, as the Louisa, Russell, and Tug Forks, of the Big Sandy; while the Kanawha or New River flows into the Ohio directly. Of the streams flowing into Chesapeake Bay and the Atlantic, the principal are—the Potomac, with its large tributaries, the Shenandoah and South Branch, and the smaller ones, Potomac Creek, Occoquan River, Broad Run, Goose, Kittoctin, and Opequan creeks; the Rappahannock, with its principal affluent, the Rapidan, and numerous smaller ones; the Pianketank; the York, with its branches, the Pamunkey and Mattapony, as well as smaller tributaries; the James, one of the largest rivers in the State, which receives the Chickahominy, Elizabeth, Nansemond, Appomattox, Rivanna, Willis, Slate, Rockfish, Tye, Pedlar, South, Cowpasture, Jackson's, and other rivers and creeks. All these flow into Chesapeake Bay. The Chowan, with its affluents, the Blackwater, Nottoway, and Meherrin; the Roanoke, by its branches, the Dan, Otter, Pig, and other streams, fall into Albemarle Sound in North Carolina; and the Yadkin joins the Great Pedee and falls into the Atlantic in South Carolina. All these rivers drain the S. and S. E. portions of the State. Virginia is not a country of lakes. The largest in the State is Lake Drummond in Dismal Swamp; but, aside from the great Chesapeake Bay, which forms so large a portion of its coast-line, it has a number of small bays and extensive estuaries at the mouths of its rivers. There are a considerable number of islands belonging to Virginia in Chesapeake Bay and around the Eastern Shore.

*Geology and Mineralogy.*—We can only indicate in general terms the geological structure of the State. The Tidewater region is, along the shores of its estuaries, bays, and ocean-beach, Quaternary and Alluvial; the first step or terrace above this, the low plain of the Eastern Shore and Norfolk peninsulas, is Pliocene or Upper Tertiary; the next terrace, extending from this to about the 77th meridian, is Miocene or Middle Tertiary, mainly beds of sand, gravel, yellow and blue marl, and pebbles; from this line to the head of tidewater, a strip of about 15 miles in width, is Eocene or Lower Tertiary, a green sand-marl mingled with yellow and sulphur-colored clays, and yellowish-gray and blue marls, with many fossils. There are in the western portion of this region transported boulders of Triassic

or new red sandstone, and small outcrops of Azoic or Primary rocks. Middle Virginia is mostly Eozoic, the rocks mainly crystalline—gneiss, syenite, granite, with porcelain clays, micaceous, talcose, and argillaceous slates, and sandstones. The gold-belt runs through this section. At various points in this middle country are patches of greater or less extent of Triassic and Jurassic rocks, usually known as "brownstone," or geologically as new red sandstone. This is mostly a conglomerate, and includes some beautiful building-stones, such as the brecciated marble of the Potomac; many fossils are found in this formation, and in what is known as the Richmond coal-fields there are valuable beds of rich bituminous coal. The Piedmont region is also Eozoic, but the gneiss contains more talc or chlorite, hornblende, and iron pyrites, and near the base of the Blue Ridge belts of granite and micaceous and talcose slates. The eastern border of this region is largely composed of epidotic or greenstone rocks, with abundant crystals of epidote and quartz and bands of iron ores. The Blue Ridge is a transition region. On its eastern face the epidotic or greenstone rocks are very fully charged with crystals of epidote, and the granites; the rocks of the western slope are mostly of the Potsdam sandstone group, a close-grained white or light-gray sandstone, with beds of coarse conglomerate, brown sandstones, and olive-colored shales. Here are beds of specular iron ore and hæmatite. The Valley of Virginia is a limestone region, the limestones, slates, and shales ranging in geologic age from the Potsdam to the Hudson River group of the Cambrian and Lower Silurian ages. These formations are not only rich in mineral products—iron ores, umber, lead, zinc, etc.—but they invariably underlie a rich and fertile soil. A portion of the Appalachian country belongs politically to the Valley counties, and in this portion we have some of the formations of the Upper Silurian and Devonian systems, and fragments of the sub-Carboniferous formation, sometimes containing beds of semi-anthracite coal. The geological formations of Appalachia comprise a wide range. There are narrow outcrops of Lower Silurian; broader beds and tracts of Upper Silurian; mountains along whose sides the Corniferous, Hamilton, Chemung, and Catskill groups of the Devonian system, each in their turn, are exposed; the various formations of the sub-Carboniferous rocks, with their deposits of coal, gypsum, and rock-salt; and finally, in the S. W., the Carboniferous or true coal-bearing system, covering an area of 1000 sq. m., and yielding a good bituminous coal in thick workable seams.

*Minerals.*—We have already noticed some of these. Gold is found in the gold-belt of Middle Virginia, averaging in favorable localities from $10 to $24 to the ton of ore. Its working has not been found very profitable. Silver and copper are also found in the same region, the latter mostly in the form of sulphurets or copper pyrites. Plumbago of good quality occurs in Halifax, Amelia, and other counties. Iron is found in the forms of limonite, magnetite, hæmatite, specular ores, micaceous peroxides, chromates, sulphurets, etc., and the cheap and abundant coals of the State will cause its smelting in large quantities. Coal, as we have already said, abounds in several parts of the State. In the S. W. it is bituminous; in the Valley, semi-anthracite; in the Richmond and other Middle Virginia coal-fields, bituminous—an excellent coking coal, and accompanied by carbonite or natural coke of good quality. Gypsum (sulphate of lime) is found in extensive beds along the N. fork of Holston River, and so nearly pure that it yields within 1 per cent. of an absolutely pure sulphate. Rock-salt and salt springs of very strong brine are found in the same vicinity, and from the artesian salt wells at Saltville more than 1000 bushels of salt a day are now made. This salt is of great purity, surpassing in this respect any other known salt or brine. Lead and zinc ores are found in the Valley, and are shipped to other States for smelting. Umber exists in many places. There is a large deposit of kaolin in Augusta co., and barytes in Smyth and other counties. Manganese also occurs with hæmatite in Augusta co. Of building material—marble, breccia, limestone, freestone, Potsdam sandstone, slate, granite of excellent quality, brick and fire clays, etc.—there is a great abundance in all parts of the State except the Tidewater region; and of agricultural and fertilizing minerals—marls, greensand marls, gypsum, and the rich decomposed material of the epidotic rocks—the Tidewater region, S. W. Virginia, and even the Blue Ridge region, furnish unlimited quantities. Virginia is remarkable for its mineral springs, both sulphurous and chalybeate; they have been noted for their medicinal virtue for almost two centuries. There are many caves, natural bridges, rock-pillars, and other objects of interest in the State; among them, the Natural Bridge in Rockbridge co., so celebrated in song and story, Weir's, Madison's, and the Blowing Cave, Caudy's Castle, the Tea-Table, the Ice Mountain, etc.

*Soil and Vegetation.*—The soils of the first or alluvial bottoms deposited by the rivers and estuaries is of perpetual fertility. The second bottoms are of excellent quality, yielding large crops, but are improved by the use of marls or other fertilizers when they have been long cultivated. The Slope or third terrace, running back to the watershed or head of tide-water, is thinner and less fertile, but can be made very productive by the use of the marls and shells which are close at hand. The ridge-lands of the Tidewater region are always level and very poor, but by the use of manures can be made to produce fair crops. Middle Virginia has much good and fertile land, especially where the Triassic and Jurassic or new red sandstone belts come to the surface; but it has also much very poor and sterile soil. The soils of the Piedmont region, consisting largely of decomposed greenstone or epidotic rocks, are very fertile, as are also portions of the Blue Ridge country; but where the sandstones prevail on the western slope, they are sandy and poor. The greater part of the soils of the Valley of Virginia are very rich and productive. This has been called the "garden of America." In some portions of the Valley, however, stimulating manures are required, as the land is cold. It is generally a limestone region. The valleys in the Appalachian region are generally rich and productive, but many of the ridges and mountain-slopes are sterile. There are considerable alluvial tracts here which are very rich. The forest trees of Virginia are numerous, and differ on different soils. The Tidewater region has large forests of yellow pine, oak, cypress, cedar, and locust, and the usual shrubs of marsh and low lands. Middle Virginia has much hard pine, black, white, and other oaks, hickory, locust, persimmon, gum, cedar, holly, and other trees, and among the shrubs sassafras and sumach; the latter, indeed, is found all over the State, and is becoming a valuable article of commerce. Piedmont has many varieties of oak, hickory, tulip tree (*Liriodendron*), black walnut, locust, cedar, chestnut, butternut, and some pines. The Blue Ridge region is mostly covered with forests of white, black, red, rock, yellow, and black-jack oaks, hickory, chestnut, locust, birch, and some yellow pine. The Valley has nearly half its surface covered with oaks, hickories, locusts, black and white walnuts, yellow and other pines. Portions of Appalachia have forest trees, oaks, walnuts, white and yellow poplars, birches, beeches, locusts, wild cherries, sycamores, etc., of sound growth and immense size, but generally very few pines, firs, or hemlocks. In other sections the trees are small, but grow in thickets, and are only fit for charcoal. Wild fruits and nuts are abundant all over the State.

*Climate.*—The variety of surface and the great breadth of Virginia give it a varied climate. The mean annual temperature for the State ranges from 60° to 64° in the S. E. to 48° to 52° in the Valley and Appalachia, while the annual range from the severest cold of winter to the greatest heat of summer is not more than 86°. The following table represents the temperature and rainfall at nine different representative points in the State: it is compiled from Hotchkiss's *Summary* and the Signal Service reports:

| Meteorological Data. | Johnsontown, lat. 37° 23′, lon. 75° 55′; elevation, about 50 feet. | Hampton, lat. 37° 01′, lon. 76° 21′; elevation, 55 feet. | Zuni, lat. 36° 53′, lon. 76° 51′; elevation, about 60 feet. | Comorn, lat. 38° 17′, lon. 77° 18′; elevation, about 75 feet. | Vienna, lat. 38° 55′, lon. 77° 17′ 38″; elevation, 425 feet. | Lynchburg, lat. 37° 30′, lon. 79° 02′; elevation, 575 feet. | Staunton, lat. 38° 10′, lon. 79° 4′; elevation, 1400 feet. | Lexington, lat. 37° 44′, lon. 79° 25′; elevation, about 925 feet. | Wytheville, lat. 36° 56′, lon. 81°; elevation, 2300 feet. |
|---|---|---|---|---|---|---|---|---|---|
| *Temperature.* | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| Mean temp. of year... | 57.1 | 58.5 | 59.5 | 56.8 | 55.9 | 57.3 | 53.6 | 56.5 | 53.8 |
| Highest temp. of year | 95 | 100 | 104 | 104 | 93 | 95 | 93 | 104 | 95 |
| Lowest " " | 9 | 6 | −4 | 6 | 8 | 9 | 5 | −3 | −4 |
| Range of annual temp. | 86 | 94 | 108 | 98 | 85 | 86 | 88 | 107 | 99 |
| Mean temp. spring... | 52.4 | 54.7 | 57.1 | 54.1 | 54.2 | 55.6 | 51.3 | 54.8 | 51 |
| Highest temp. spring. | 87 | 96 | 96 | 92 | 86 | 84 | 84 | 92 | 85 |
| Lowest " " | 18 | 18 | 19 | 17 | 23 | 18 | 14 | 17 | −1 |
| Range spring temp... | 69 | 78 | 77 | 75 | 63 | 66 | 70 | 75 | 86 |
| Mean temp. summer.. | 76.3 | 78.6 | 81.2 | 77.3 | 75.4 | 76.1 | 73.7 | 77.1 | 71.5 |
| Highest temp. summer | 95 | 100 | 104 | 104 | 93 | 95 | 93 | 104 | 95 |
| Lowest " " | 57 | 60 | 60 | 52 | 57 | 55 | 56 | 52 | 49 |
| Range summer temp.. | 38 | 40 | 44 | 52 | 36 | 40 | 27 | 52 | 46 |
| Mean temp. autumn.. | 58.4 | 58.9 | 55.3 | 57.8 | 57.8 | 57.1 | 52.8 | 53.5 | 50.9 |
| Highest temp. autumn | 90 | 92 | 91 | 86 | 86 | 82 | 82 | 90 | 82 |
| Lowest " " | 27 | 25 | 20 | 28 | 27 | 29 | 28 | 18 | 18 |
| Range autumn temp.. | 63 | 67 | 71 | 58 | 59 | 53 | 54 | 72 | 64 |
| Mean temp. winter.... | 41.3 | 44.7 | 44.6 | 38.2 | 36.5 | 41.3 | 37 | 40.7 | 35.6 |
| Highest temp. winter. | 74 | 78 | 74 | 72 | 69 | 66 | 69 | 74 | 62 |
| Lowest " " | 9 | 6 | −4 | 6 | 8 | 9 | 5 | −3 | −4 |
| Range winter temp... | 65 | 72 | 78 | 66 | 61 | 57 | 64 | 77 | 66 |
| *Rainfall.* | in. | in. | in. | in. | in. | in. | in. | in. | in. |
| Annual amount..... | 33.16 | 40.15 | 42.97 | 29.27 | 48.51 | 44.74 | 41.99 | 48.58 | 35.10 |
| Rainfall of spring.. . | 10.69 | 11.35 | 14.81 | 7.81 | 13.90 | 11.62 | 12.15 | 12.77 | 8.95 |
| " of summer... | 7.45 | 12.60 | 8.80 | 7.32 | 13.90 | 14.30 | 8.78 | 8.23 | 11.05 |
| " of autumn... | 6.75 | 6.80 | 8.52 | 8.68 | 9.51 | 9.16 | 11.49 | 15.25 | 7.08 |
| " of winter.... | 8.27 | 9.40 | 10.84 | 5.46 | 11.20 | 9.66 | 9.57 | 12.33 | 8.02 |

*Zoology.*—The wild animals of Virginia are those common to the Atlantic States which have extensive forests—

the black bear, panther, wild-cat, and in some districts the wolf, the lynx, raccoon, red fox, opossum, ground-hog, rabbit, squirrels of several species, the Virginia deer, and possibly the elk; of birds, many species of ducks, teal, brant, wild-geese, swans, and the game-birds generally, especially wild-turkeys, grouse, pheasants, quail, partridges, pigeons, snipe, woodcock, etc. Song-birds and birds of prey are likewise very numerous. The fish are equally abundant, especially of edible species—the shad, herring, rockfish, bass, perch, sturgeon, sheepshead, chub, spot-fish, hog-fish, trout, tailor-fish, Spanish mackerel, etc. The Crustacea, crabs, lobsters, terrapins, turtles, tortoises, etc., are also well represented. Oysters of excellent quality abound in Chesapeake Bay; more than 15,000,000 bushels are taken annually from the beds in the Tidewater region.

*Agricultural Productions.*—The census of 1870 gives the amount of land in farms in Virginia that year as 18,145,911 acres, of which 8,165,040 acres were improved and 9,980,871 acres (55 per cent.) unimproved. The average size of farms was 246 acres, against 324 in 1860. The value of farms in 1870 was $213,020,845, and of farming implements, $4,924,036. The value of all farm productions of the year was $51,774,801; of animals slaughtered or sold for slaughter, $8,375,975; of home manufactures, $556,307; of forest products, $686,862; of market-garden products, $505,117; of orchard products, $891,231; of wages paid, $9,753,041. Of the cereals, 7,398,787 bushels of wheat were grown in 1869–70, 582,264 of rye, 17,649,304 of Indian corn, 6,857,555 of oats, 7259 of barley, and 45,075 of buckwheat. The State produced the same year 183 bales of cotton, 130,750 pounds of flax, 31 tons of hemp, 877,110 pounds of wool, 199,883 tons of hay, 10,999 pounds of hops, 37,086,364 pounds of tobacco, 245,093 pounds of maple-sugar, 329,155 gallons of sorghum and 11,400 gallons of maple molasses, 1,293,853 bushels of Irish potatoes, 865,882 of sweet potatoes, 162,102 of peas and beans, 26,438 pounds of beeswax and 505,239 pounds of honey, 26,283 gallons of domestic wine, 11,367 bushels of clover-seed, 9699 of flax-seed, and 12,709 of grass-seed, 6,979,269 pounds of butter, 71,743 pounds of cheese, 266,812 gallons of milk. The value of all live-stock in the State was estimated at $28,187,669; the number of horses, 168,938; of mules and asses, 26,903; of neat cattle, 573,152, of which 188,471 were milch cows; of sheep, 370,145; of swine, 674,670. Of some of these items we have later statistics. The report of the State assessors for the year ending Dec. 31, 1874, gives the total value of live-stock as $21,562,808; the number of horses, mules, asses, and jennets, 220,909; of cattle, 567,289; of sheep and goats (the latter not enumerated in the U. S. census), 362,627; and of swine, 571,779. The U. S. agricultural department in its report of Jan., 1875, makes a somewhat different showing. The value of live-stock is estimated at $31,937,662, and the numbers as follows: horses, 191,900; mules, 29,800; cattle, 626,800, including 229,300 milch cows; sheep (goats not estimated), 367,500; swine, 662,700. The same report gives the quantity of Indian corn grown in 1874 as 19,082,000 bushels; wheat, 5,672,000; rye, 460,000; oats, 4,587,000; barley, 6300; buckwheat, 40,000; Irish potatoes, 1,068,000; tobacco, 35,000,000 pounds; hay, 166,400 tons. These crops are valued at $29,415,437.

*Manufactures and Mining Products.*—Virginia is not largely engaged in manufacturing. In 1870 there were in the State 5933 manufacturing establishments, employing 26,974 hands (22,175 men, 2259 women, and 2540 children), reporting capital to the amount of $18,455,400, paying wages to the amount of $5,343,099, using raw material valued at $23,832,384, and producing manufactured articles to the value of $38,364,322. Of these, the most prominent were: Tobacco, chewing, smoking, and snuff, of which 94 establishments produced $6,935,249; flouring-mill products, of which 282 mills produced to the value of $6,581,396; iron as pig, cast, rolled, etc., in 85 establishments, $3,733,240; lumber sawed, 173 saw-mills produced $1,609,966; cotton goods, in 11 cotton-mills, were manufactured to the value of $1,435,800; 7 machine-shops made freight and passenger cars to the value of $613,036, and 26 other machine-shops produced machinery to the value of $511,485. No other industry in the State produced goods to the value of half a million dollars. Manufactures have materially increased since 1870, the manufactures of the city of Richmond alone amounting in 1874 to $17,746,720, or almost half of the entire product of the State in 1870. In 1870, 27 mining establishments employed 997 hands and $1,113,000 capital, paid wages to the amount of $248,270, used raw material valued at $31,067, and produced minerals valued at $409,914.

*Railways and Canals.*—There were Jan. 1, 1876, 1617 miles of completed railway in the State, aside from the horse-railroads of Richmond, Alexandria, and Norfolk. These roads cost, according to Poor's *Manual*, for road equipment, etc., $74,361,222. The most important of these roads were the Atlantic Mississippi and Ohio, and its branches, 427 miles in length; the Washington City Virginia Midland and Great Southern, with 2 branches, 315 miles; the Chesapeake and Ohio, with 2 branches, having 232 miles in Virginia; the Richmond and Danville, 141 miles in Virginia; the Richmond Fredericksburg and Potomac, 120 miles; the Richmond and Petersburg, with 3 branches, 108 miles; the Seaboard and Roanoke, 60 miles in the State; the Richmond York River and Chesapeake, 38 miles; the Washington and Ohio, 52 miles; the Valley R. R., 104 of its 207 miles in the State; and the Fredericksburg and Gordonsville, 20 miles. Eight of these lines are parts of trunk-roads. The James River and Kanawha Canal has been long in construction; 198 miles of it from Richmond to Buchanan are completed and in use; 32 miles more, between Buchanan and Clifton Forge, are in progress, and 15 miles of it will probably be finished within a year. It has also a branch 19¾ miles long. (See JAMES RIVER AND KANAHWA CANAL.) The Albemarle and Chesapeake Canal, with 2 cuts—one from the S. branch of Elizabeth River to the North Landing River, and the other from Norfolk to Albemarle Sound—is a ship-canal of great importance. The Dismal Swamp Canal connects the same waters by another route. There is also a canal from Alexandria to Georgetown, connecting with the Chesapeake and Ohio Canal, and a slackwater improvement on the Roanoke and Dan, owned by the Roanoke Navigation Co.

*Finances.*—The receipts of the fiscal year ending Sept. 30, 1875, including a balance of $192,394.79 on hand at the beginning of the year and $230,000 borrowed, were $2,840,184.84, and the expenditures for the same period, $2,814,614.32. The public debt of the State at that date was $29,514,426.38, aside from a sum of $15,239,370.74 which it is claimed should be settled by West Virginia. On the recognized public debt but 4 per cent. interest has been paid since July, 1874, and there are arrears on this. The whole interest due and unpaid Sept. 30, 1875, according to report of the second auditor, was $2,781,030.53, and the interest accruing annually $1,752,681.83. There is also a little more than $476,000 due for interest to the literary and sinking funds. The assessed value of real and personal estate for the year ending Sept. 30, 1875, was $336,484,466.

*Banks, Savings Banks, and Insurance Companies.*—There were in 1875, 20 national banks, having a paid-up capital of $3,590,000, bonds on deposit to the amount of $3,676,750, and outstanding circulation to the amount of $3,615,000. There were also 33 State banks, with an aggregate capital of $3,413,600; 13 savings banks, with capital and deposits amounting to $982,300; and 37 private and individual banking-houses. There were in 1876, 19 fire and marine insurance companies in the State, and 5 life insurance companies. Of the latter, 2 were mutual, and of the former 4. The assets of the fire insurance companies were in round numbers about $5,400,000, and of the life insurance companies about $2,800,000.

*Commerce, Navigation, and Immigration.*—Virginia has an extensive commerce, especially in the coastwise trade. The following table gives the statistics of her commerce, navigation, and direct immigration:

| Customs Districts. | Value of foreign imports for the year ending June 30, 1875. | Value of domestic exports for the year ending June 30, 1875. | Entrances of vessels into Virginia ports in year ending June 30, 1875. | | | Clearances of vessels from Virginia ports in year ending June 30, 1875. | | | Entrances and clearances of vessels engaged in the coasting trade and fisheries for year ending June 30, 1875. | | | Registered, enrolled, and licensed tonnage for year ending June 30, 1875. | | Immigrants landed in Virginia ports in 1871. | Immigrants landed in Virginia ports in 1872. | Immigrants landed in Virginia ports in 1873. | Immigrants landed in Virginia ports in 1874. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Number of vessels. | Tonnage. | Crews. | Number of vessels. | Tonnage. | Crews. | Number of vessels. | Tonnage. | Crews. | Vessels. | Tonnage. | | | | |
| | $ | $ | | | | | | | | | | | | | | | |
| Alexandria | 8,060 | ..... | 17 | 5,445 | 16 | .... | ..... | .... | 372 | 173,032 | 4,931 | 93 | 3,199 | | | | |
| Norfolk and Portsmouth | 18,929 | 5,243,986 | 24 | 13,299 | 301 | 106 | 49,332 | 1241 | 2219 | 2,044,797 | 54,503 | 380 | 13,977 | 79 | 664 | 1190 | 508 |
| Petersburg | 26,188 | 699 | 11 | 2,443 | 78 | 1 | 282 | 7 | 871 | 885,363 | 19,809 | 6 | 62 | | | | |
| Richmond | 433,905 | 2,944,642 | 44 | 10,775 | 352 | 103 | 29,144 | 885 | 1235 | 1,052,385 | 24,188 | 38 | 4,615 | | | | |
| Tappahannock | ..... | ..... | .. | ..... | .... | .... | ..... | .... | 240 | 188,216 | 5,949 | 78 | 1,809 | | | | |
| Cherrystone | ..... | ..... | .. | ..... | .... | .... | ..... | .... | .... | ..... | ..... | 363 | 5,925 | | | | |
| Yorktown | ..... | ..... | .. | ..... | .... | .... | ..... | .... | 426 | 412,886 | 12,416 | 114 | 2,289 | | | | |
| Totals | 487,082 | 8,189,327 | 96 | 31,962 | 747 | 210 | 78,758 | 2133 | 5363 | 4,756,679 | 121,796 | 1072 | 31,876 | 79 | 664 | 1190 | 508 |

*Population.*

| Census year. | Total population.* | Males. | Females. | White. | Free colored. | Slave. | Natives. | Foreigners. | Density. | Ratio of increase. | No. of families. | Persons in a family. | No. of dwellings. | Persons in a dwelling. | Illiteracy. | Of school age, 5 to 20. | Of military age, 18–45, males. | Of voting age, 21 and upward, males. | Citizens, males. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1790 | 691,737 | ..... | ..... | 391,524 | 7,586 | 292,617 | ..... | ..... | 18.05 | | | | | | | | | | |
| 1800 | 801,608 | ..... | ..... | 443,386 | 12,426 | 345,796 | ..... | ..... | 20.92 | 17.63 | | | | | | | | | |
| 1810 | 869,131 | ..... | ..... | 458,159 | 18,456 | 392,516 | ..... | ..... | 22.69 | 10.73 | | | | | | | | | |
| 1820 | 928,551 | ..... | ..... | 482,849 | 20,351 | 425,148 | ..... | ..... | 24.24 | 9.31 | | | | | | | | | |
| 1830 | 1,034,481 | ..... | ..... | 537,216 | 27,508 | 469,753 | ..... | ..... | 27.00 | 13.71 | | | | | | | | | |
| 1840 | 1,015,260 | ..... | ..... | 537,952 | 28,321 | 448,987 | ..... | ..... | 26.50 | 2.34 | | | | | | | | | |
| 1850 | 1,119,348 | 565,271 | 554,077 | 616,069 | 30,751 | 472,528 | 1,101,438 | 17,910 | 29.11 | 14.67 | 167,530 | 5.67 | 165,815 | 5.72 | 88,520† | 405,591 | 182,083 | 258,715 | |
| 1860 | 1,219,630 | 615,913 | 603,727 | 691,773 | 36,898 | 490,865 | 1,201,117 | 18,513 | 31.80 | 12.28 | 201,523 | 5.49 | 207,305 | 5.33 | 86,452† | 445,798 | 200,134 | 281,835 | |
| 1870 | 1,225,163 | 597,058 | 628,105 | 712,089 | 512,841 | ..... | 1,211,409 | 13,754 | 31.95 | .045 | 231,574 | 5.29 | 224,947 | 5.45 | 445,893 | 474,940 | 206,658 | 269,242 | 266,680 |

*Education.*—The present public-school system of Virginia is of recent origin, having been organized in 1870. Previously, the free schools had been of low grade, and had been regarded as intended only for the very poor whites, who often refused to avail themselves of their instruction. Under the new organization there is decided progress, though there is still room for a great advance, the amount of illiteracy being alarming. The statistics of public schools in the State in 1875 were as follows: Number of school population (between 5 and 21 years of age), 482,789, of whom 280,149 were white and 202,640 colored; number of pupils enrolled, 184,486 (38.2 per cent. of school population), of whom 129,545 were whites, 54,941 colored; average daily attendance, 103,927 (74,056 whites, 29,871 colored) —21.5 per cent. of school population; number of public schools, counting each grade of one teacher in a graded school as one school, 4185, of which 3121 were white and 1064 colored; average number of months taught, 5.59; number of graded schools, 155, of which 108 were white and 47 colored; number of schools yet needed, 953; whole cost of public education per month per pupil in average attendance, $1.58; number of teachers in the public schools, 4262, of whom 2360 were white males and 351 colored males, 1363 white females and 188 colored females; the average monthly wages of these teachers were—males, $33.52; females, $28.71; the number of school-houses used was 4561, of which 2101 were log, 1617 frame, 129 brick, 38 stone; the number built during the year was 292; of the whole number, only 1256 were owned by the districts; the value of school property owned by the districts was $757,181; the number of pupils of school age attending private schools was 23,285 (19,466 whites, 3819 colored); the number of teachers of private schools was 1319 (454 white males and 33 colored males, 775 white females and 57 colored females). The total amount received from all sources for school purposes was $1,021,396.68, of which $478,750.46 was from State funds, $465,414.09 from local taxation, $23,750 from the Peabody fund, and $53,482.13 from private donations.

*Special Instruction.*—The institution for the instruction of deaf mutes and the blind at Staunton had in Oct., 1875, 90 deaf-mute pupils and 37 blind; 13 mutes and 5 blind pupils had been received during the year, and 9 mutes and 5 blind discharged; 1 mute had died. The receipts of the year from all sources had been $49,949.14; the expenditures, $47,787.59.

The following table gives many particulars in regard to the universities, colleges, and professional schools of the State. It should be remarked that two of the State institutions, the University of Virginia and the Virginia Military Institute, are heavily embarrassed with debt, the former having a funded debt of $87,000, and an unfunded one of $6823.15; and the latter a bonded debt of $89,337.25, and other liabilities amounting to $97,666.30; against which are assets, not all now available, of $119,990.46, consisting mainly of bills receivable and dues by the cadets and the principal departments of the institute:

*Universities, Colleges, and Professional Schools.*

| Universities, Colleges, and Professional Schools. | Location. | Date of organization. | Under what control. | Professors and instructors. | Students. | | | | Value of buildings, grounds, apparatus, etc. | Amount of productive endowment. | Income from productive endowment. | Income from all sources. | Volumes in library. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | In preparatory department. | In collegiate department. | Male. | Female. | | | | | |
| *Universities and Colleges.* | | | | | | | | | | | | | |
| College of William and Mary | Williamsburg | 1693 | Prot. Episcopal | 7 | 15 | 50 | 65 | ... | 60,000 | 75,000 | 4,800 | ..... | 4,900 |
| Emory and Henry College | Emory | 1838 | M. E., South | 7 | 82 | 94 | 176 | ... | 125,000 | ..... | ..... | 7,534 | 13,580 |
| Hampden-Sidney College | Hampden-Sidney | 1775 | Presbyterian | 5 | ... | 82 | 82 | ... | 150,000 | 85,000 | 5,000 | ..... | 7,000 |
| Randolph-Macon College | Ashland | 1834 | M. E., South | 11 | ... | 215 | 215 | ... | 70,000 | 25,000 | 1.500 | 13,375 | 11,000 |
| Richmond College | Richmond | 1844 | Baptist | 7 | ... | 128 | 128 | ... | 180,000 | 75,000 | 4,500 | 12,500 | 5,700 |
| Roanoke College | Salem | 1853 | Lutheran | 8 | 55 | 112 | 167 | ... | 60,000 | ..... | ..... | 8,500 | 14,000 |
| University of Virginia | Near Charlottesville | 1825 | State | 18 | ... | 373 | 373 | ... | ..... | ..... | ..... | 36,779 | 40,000 |
| Washington and Lee University | Lexington | 1749 | Non-sectarian | 18 | ... | 196 | 196 | ... | 150,000 | 200,000 | ..... | ..... | 15,000 |
| *Schools of Science.* | | | | | | | | | | | | | |
| Virginia Military Institute | Lexington | 1839 | State | 20 | ... | 248 | 248 | ... | 350,000 | 40,000 | 2,200 | 37,200 | 6,000 |
| Virginia Agricultural and Mechanical College | Blacksburg | 1872 | State | 7 | ... | 222 | 222 | ... | 49,947 | 172,000 | 20,685 | 36,245 | 750 |
| Scientific department University of Virginia | Charlottesville | 1819 | Non-sectarian | Report with the classical department. | | | | | | | | | |
| Scientific depart. Washington and Lee Univ. | Lexington | 1782 | Non-sectarian | Report with the classical department. | | | | | | | | | |
| New Market Polytechnic Institute | New Market | 1870 | Trustees | 31 | ... | 71 | 71 | ... | 1,800 | | | | |
| Hampton Normal and Agricultural Institute | Hampton | 1872 | Am. Miss. Asso | 14 | 165 | 200 | 191 | 174 | 163,674 | 85,500 | 10,360 | ..... | 1,268 |
| *Schools of Theology.* | | | | | | | | | | | | | |
| St. John's College and Theological Seminary | Norfolk | 1869 | Roman Catholic | 9 | ... | 39 | 39 | | | | | | |
| Theological Seminary of General Synod of Evangelical Lutheran Church in N. A | Salem | 1831 | Lutheran | 3 | ... | 4 | 4 | ... | ..... | ..... | ..... | ..... | 400 |
| Theological Seminary Prot. Episcopal Church | Near Alexandria | 1823 | Prot. Episcopal | 5 | ... | 51 | 51 | ... | 100,000 | 115,000 | 7,500 | ..... | 10,000 |
| Union Theological Seminary of Gen. Assembly | Hampden-Sidney | 1823 | Presbyterian | 4 | ... | 76 | 76 | ... | 50.000 | 230,000 | 16,500 | ..... | 9,800 |
| Colver Institute | Richmond | 1867 | Baptist (colored) | 4 | 75 | ... | 70 | 5 | 60,000 | ..... | ..... | ..... | 1,800 |
| *Schools of Law.* | | | | | | | | | | | | | |
| Law School of Richmond College | Richmond | 1868 | Richmond College | 2 | ... | 16 | 16 | | | | | | |
| Law department University of Virginia | Charlottesville | 1825 | Univ. of Virginia. | 2 | ... | 110 | 110 | ... | ..... | ..... | ..... | 5,000 | 3,000 |
| Law department Washington and Lee Univ | Lexington | 1871 | Wash. and Lee Un. | 2 | ... | 25 | 25 | | | | | | |
| *Schools of Medicine.* | | | | | | | | | | | | | |
| Medical College of Virginia | Richmond | 1851 | Trustees | 14 | ... | 42 | 42 | ... | 60,000 | ..... | ..... | 5,000 | 1,200 |
| Medical department University of Virginia | Charlottesville | 1824 | Univ. of Virginia. | 5 | ... | 70 | 70 | | | | | | |

There are also 21 female collegiate schools and seminaries of high grade—5 under the control of the Presbyterians, 3 of the Baptists, 4 of the Protestant Episcopal Church, 4 of the Methodist Episcopal Church, South, 3 of the Roman Catholics, and 1 each of the Lutherans and Christian Connection. Most of these are endowed, and all are prosperous. There are also more than 40 academies or high schools of high grade for boys in the State. There are 2 normal schools for colored teachers—1 at Richmond and 1 at Hampton—and 1 has been projected, but not yet fully organized, for white teachers.

*Charitable, Corrective, and Penal Institutions.*—There are three insane hospitals, or, as they are generally called, lunatic asylums, in the State—viz. the Eastern Asylum at Williamsburg, said to be the oldest in America. On Oct. 1, 1875, this asylum had 305 patients (141 males, 164 females); 72 had been admitted during the year, and 61 discharged, of whom 19 died, 33 were recovered, 8 improved, and 1 stationary. The receipts of the year were $65,932.95, of which $60,000 was from the State; the disbursements, $65,094.28. The Central Asylum, at Richmond, exclusively for colored insane, which had 243 patients at the close of the year (109 males, 134 females); 80 had been admitted during the year, and 44 discharged, 12 by death; 30 recovered, and 2 improved. The receipts were $52,045.26, of which over $50,000 was from the State; the disbursements, $51,998.14. The Western Asylum, at Staunton, which had Oct. 1, 1875, 356 patients (198 males, 158 females), and during the two years previous had admitted 135 and discharged 113, 26 of

*The total population and the white, free colored, and slave and native and foreign populations for each decade are those of the counties now composing Virginia, the counties now in West Virginia being deducted.

†The illiterate in 1850 and 1860 are only those over twenty years of age, but they include West Virginia. The number of illiterates in 1870 includes all over ten years of age, but is confined to Virginia as now constituted.

them by death; 73 had recovered, 11 improved, and 3 not improved. The receipts of the year 1875 were $74,488.39, of which $60,000 was from the State, and the remainder, balance on hand, receipts from pay patients and from articles sold; the expenditures were $71,413.52. The State penitentiary at Richmond had Sept. 30, 1875, 942 prisoners (182 whites and 760 colored; 861 males, 81 females). Of these, 380 had been received during the year, and only 234 pardoned, discharged, escaped, and died. The prison was so crowded that not all the prisoners could be packed into it, and 367 were employed on contracts outside the prison under guard. These were all colored men. The whole expenditure of the prison was $77,778.91, of which all was paid in labor except $26,008.08 drawn from the State. There is a hospital, but no library, chaplain, religious services, or attempt at mental or moral culture. The jails of the Sttae are mostly in a deplorable condition.

*Newspapers.*—Virginia in 1870 had 114 newspapers, having a circulation of 143,840 and an annual issue of 13,319,578 copies; of these, 16 were dailies, with 24,099 circulation; 7 tri-weeklies, and 8 semi-weeklies; 69 weeklies, with 75,488 circulation; 4 semi-monthlies, 10 monthlies, and 1 quarterly. Four years later the whole number was 126, of which 17 were dailies, 8 tri-weeklies, 8 semi-weeklies, 78 weeklies, 4 semi-monthlies, 11 monthlies, and 1 quarterly.

*Churches.*

| Denominations. | Organizations, 1870. | Church edifices, 1870. | Sittings, 1870. | Church property, 1870. | Church organizations, 1875. | Church edifices, 1875. | Ministers, clergymen, or priests, 1875. | Church members or communicants, 1875. | Adherent population, 1875. | Church property, 1875. |
|---|---|---|---|---|---|---|---|---|---|---|
| All denominations* | 2582 | 2405 | 765,127 | $5,277,368 | 3166 | 2922 | 1805 | 285,279 | 1,169,500 | $6,327,700 |
| Baptists (regular) | 795 | 749 | 240,075 | 1,279,048 | 1172 | 1128 | 547 | 165,619 | 650,000 | 1,819.500 |
| Baptists (other) | 54 | 44 | 16,755 | 66,000 | 59 | 51 | 29 | 2,900 | 10,000 | 78,500 |
| Christian Connection and Disciples | 100 | 88 | 29,225 | 92,170 | 137 | 120 | 76 | 6,490 | 21,500 | 123,400 |
| Episcopalians (Protestant) | 185 | 177 | 60,105 | 843,210 | 160† | 161† | 139† | 11,925† | 40,000 | 900,000 |
| Friends | 12 | 13 | 4,925 | 35,625 | 14 | 14 | ..... | 1,000 | 4,000 | 45,500 |
| Jews | 8 | 7 | 1,890 | 35,300 | 9 | 8 | 8 | 500 | 1,500 | 48.000 |
| Lutherans | 80 | 73 | 25,350 | 160,800 | 121 | 109 | 53 | 7,219 | 28,150 | 209,300 |
| Methodists | 1011 | 901 | 270,617 | 1,449,565 | 1090 | 945 | 660 | 63,797 | 286,000 | 1,647,200 |
| Presbyterians | 204 | 200 | 70,065 | 837,450 | 217 | 212 | 176 | 17,719 | 76,000 | 945,000 |
| Reformed Church in U. S. (late Ger.) | 24 | 16 | 5,900 | 38,500 | 37 | 21 | 20 | 2,708 | 10,800 | 57,700 |
| New Jerusalem (Swedenborgian) | 3 | 3 | 550 | 2,200 | 4 | 4 | 3 | 175 | 650 | 3,100 |
| Roman Catholics | 19 | 17 | 9,800 | 343,750 | 45 | 25 | 27 | ..... | 18,500 | 561,000 |
| United Brethren in Christ | 42 | 30 | 7,700 | 23,300 | 59 | 44 | 36 | 3,127 | 12,400 | 39,500 |
| Union | 42 | 84 | 21,570 | 62,600 | 42 | 80 | 31 | 2.100 | 10,000 | 60.000 |

*Counties.*—There are ninety-nine organized counties, as follows:

| Counties. | Pop., 1870. | Males, 1870. | Females, 1870. | Pop., 1860. | Assessed valuation, 1870.‡ | True valuation according to census, 1870. |
|---|---|---|---|---|---|---|
| | | | | | $ | $ |
| Accomack | 20,409 | 10,099 | 10,310 | 18,586 | 4,033,435 | 4,033,435 |
| Albemarle | 27,544 | 13,441 | 14,103 | 26,625 | 10,886,680 | 13,242,985 |
| Alexandria | 16,755 | 7,819 | 8,936 | 12,652 | 6,082,337 | 6,082,337 |
| Alleghany | 3,674 | 1,870 | 1,804 | 6,765 | 1,391,005 | 1,391,005 |
| Amelia | 9,878 | 4,840 | 5,038 | 10,741 | 2,431,576 | 2,546,059 |
| Amherst | 14,900 | 7,365 | 7,535 | 13,742 | 2,670,461 | 2,697,891 |
| Appomattox | 8,950 | 4,384 | 4,566 | 8,889 | 1,478,767 | 1,478,767 |
| Augusta | 28,763 | 13,996 | 14,767 | 27,749 | 16,292,184 | 16,292,184 |
| Bath | 3,795 | 1,954 | 1,841 | 3,676 | 1,231,500 | 1,231,500 |
| Bedford | 25.327 | 12,422 | 12,905 | 25,068 | 5,473,365 | 5,712,936 |
| Bland | 4,000 | 1,955 | 2,045 | ..... | 797,432 | 797,432 |
| Botetourt | 11,329 | 5,444 | 5,885 | 11,516 | 3,744,317 | 3,744,317 |
| Brunswick | 13,427 | 6,506 | 6,921 | 14,809 | 1,694,550 | 1,877,603 |
| Buckingham | 13,371 | 6,558 | 6,813 | 15,212 | 2,358,394 | 2,358,394 |
| Buchanan | 3,777 | 1,938 | 1,839 | 2,793 | 455,457 | 455,457 |
| Campbell | 28,384 | 13,607 | 14,777 | 26,197 | 9,004,674 | 12,053,612 |
| Caroline | 15,128 | 7,094 | 8,034 | 18,464 | 3,896,160 | 5,510,230 |
| Carroll | 9,147 | 4,407 | 4,740 | 8,012 | 819,917 | 1,188,402 |
| Charles City | 4,975 | 2,517 | 2,458 | 5,609 | 904,594 | 1,057,545 |
| Charlotte | 14,513 | 6,992 | 7,521 | 14,471 | 3,112,863 | 3,500,000 |
| Chesterfield | 18,470 | 9,023 | 9,447 | 19,016 | 5,275,667 | 5,275,667 |
| Clarke | 6,670 | 3,305 | 3,365 | 7,146 | 3,674,914 | 4,307,215 |
| Craig | 2,942 | 1,427 | 1,515 | 3,553 | 831,619 | 1,258,382 |
| Culpeper | 12,227 | 6,053 | 6,174 | 12,063 | 4,403,046 | 4,403,046 |
| Cumberland | 8,142 | 3,948 | 4,194 | 9,961 | 2,047,042 | 2,047,042 |
| Dinwiddie | 30,702 | 14,325 | 16,377 | 30 198 | 11,265,579 | 12,664,915 |
| Elizabeth City | 8,303 | 4,258 | 4,045 | 5,798 | 1,194,358 | 1,194,358 |
| Essex | 9,927 | 4,678 | 5,249 | 10,469 | 1,518,317 | 2,199,761 |
| Fairfax | 12,952 | 6,730 | 6,222 | 11,834 | 5,568,284 | 8,244,307 |
| Fauquier | 19,690 | 9,698 | 9,992 | 21,706 | 11,724,455 | 12,490,980 |
| Floyd | 9,824 | 4,721 | 5,103 | 8,236 | 1,381,806 | 1,755,220 |
| Fluvanna | 9,875 | 4,774 | 5,101 | 10,353 | 2,301,231 | 2,460,918 |
| Franklin | 18,264 | 8,797 | 9,467 | 20,098 | 2,478,896 | 2,726,584 |
| Frederick | 16,596 | 8,104 | 8,492 | 16,546 | 8,025,565 | 9,100,000 |
| Giles | 5,875 | 2,899 | 2,976 | 6,883 | 1,478,312 | 1,656,369 |
| Gloucester | 10,211 | 5,006 | 5,205 | 10,956 | 2,040,136 | 2,040,136 |
| Goochland | 10,313 | 5,027 | 5,286 | 10,656 | 2,528,775 | 2,528,775 |
| Grayson | 9,587 | 4,667 | 4,920 | 8,252 | 1,061,891 | 1,643,831 |
| Greene | 4,634 | 2,231 | 2,403 | 5,022 | 1,067,147 | 1,100,777 |
| Greenville | 6,362 | 3,051 | 3,311 | 6,374 | 980,232 | 1,339,725 |
| Halifax | 27,828 | 13,511 | 14,317 | 26,520 | 5,431,795 | 5,785,610 |
| Hanover | 16,455 | 8,230 | 8,225 | 17,222 | 3,035,207 | 3,062,098 |
| Henrico | 66,179 | 31,351 | 34,828 | 61,616 | 41,310,061 | 41,310,061 |
| Henry | 12,303 | 5,912 | 6,391 | 12,105 | 1,388,640 | 1,773,108 |
| Highland | 4,151 | 2,045 | 2,106 | 4,319 | 1,579,573 | 1,900,000 |
| Isle of Wight | 8,320 | 4,092 | 4,228 | 9.977 | 1,630,461 | 1,735,481 |
| James City | 4,425 | 2,149 | 2,276 | 5,798 | 1,071,477 | 1,133,050 |
| King George | 5,742 | 2,820 | 2,922 | 6,571 | 1,511,329 | 1,511,329 |
| King and Queen | 9,709 | 4,565 | 5,144 | 10,328 | 1,466,660 | 1,916,713 |
| King William | 7,515 | 3,643 | 3,872 | 8,530 | 1,695,742 | 1,954,244 |
| Lancaster | 5,355 | 2,660 | 2,695 | 5,151 | 929,661 | 1,867,538 |
| Lee | 13,268 | 6,436 | 6,832 | 11,032 | 1,808,495 | 2,500,000 |
| Loudoun | 20,929 | 10,190 | 10,739 | 21.774 | 16,584,414 | 16,584,414 |
| Louisa | 16,332 | 7,905 | 8,427 | 16,701 | 3,653,300 | 3;653,300 |
| Lunenburg | 10,403 | 5,120 | 5,283 | 11,983 | 1,428,800 | 1,428,800 |
| Madison | 8,670 | 4,151 | 4,519 | 8,854 | 2,424,903 | 2,467,530 |
| Matthews | 6,200 | 3,979 | 3,221 | 7,091 | 968,326 | 968.326 |
| Mecklenburg | 21,318 | 10,273 | 11,045 | 20,096 | 2,855,779 | 6,090,785 |
| Middlesex | 4,981 | 2,477 | 2,504 | 4,364 | 905,396 | 1,005,170 |
| Montgomery | 12,556 | 6,164 | 6,392 | 10,617 | 3,314,183 | 4,703,030 |
| Nansemond | 11,576 | 5,638 | 5,938 | 13,693 | 2,195,619 | 2,195,619 |
| Nelson | 13,898 | 6,888 | 7,010 | 13,015 | 3,024.640 | 3,890,454 |
| New Kent | 4,381 | 2,210 | 2.171 | 5,884 | 11,091,774 | 1,091,774 |
| Norfolk | 46,702 | 22,277 | 24,425 | 36,227 | 8,045,487 | 20,512,605 |
| Northampton | 8,046 | 3,949 | 4,097 | 7,832 | 1.727,347 | 1,727,347 |
| Northumberland | 6,863 | 3,262 | 3,601 | 7,531 | 1,229,443 | 2,000,000 |
| Nottoway | 9,291 | 4,535 | 4,756 | 8,836 | 1,582,525 | 2,353,911 |
| Orange | 10,396 | 5,102 | 5,294 | 10,851 | 3,595,977 | 4,178,177 |
| Page | 8,462 | 4,116 | 4,346 | 8,109 | 2,912,764 | 3,503,840 |
| Patrick | 10,161 | 4,912 | 5,249 | 9,359 | 1,291,131 | 1,291,131 |
| Pittsylvania | 31,343 | 15,580 | 15,763 | 32,104 | 6,182,572 | 6,182,572 |
| Powhatan | 7,667 | 3,820 | 3,847 | 8,392 | 2,133,314 | 2,161,272 |
| Prince Edward | 12,004 | 5,812 | 6,192 | 11,844 | 2,440,025 | 2,827,982 |
| Prince George | 7,820 | 4,043 | 3,777 | 8,411 | 1,786,334 | 1,792,904 |
| Princess Anne | 8,273 | 4,263 | 4,010 | 7,714 | 2,055,203 | 2,055,203 |
| Prince William | 7,504 | 3,680 | 3,824 | 8,565 | 3,262,696 | 3,262,696 |
| Pulaski | 6,538 | 3,214 | 3,324 | 5.416 | 2,087,318 | 3,797,918 |
| Rappahannock | 8,261 | 4,030 | 4,231 | 8,850 | 2,795,840 | 3,200,000 |
| Richmond | 6,503 | 3,177 | 3,326 | 6,856 | 1,263,458 | 1,263,458 |
| Roanoke | 9,350 | 4,535 | 4,815 | 8,048 | 3,725,047 | 3,725,047 |
| Rockbridge | 16,058 | 8,140 | 7,918 | 17,248 | 7,258,604 | 7,258,604 |
| Rockingham | 23,668 | 11,567 | 12,101 | 23,408 | 10,136,588 | 13,443,160 |
| Russell | 11,103 | 5,491 | 5,612 | 10,280 | 1,896,159 | 2,129,922 |
| Scott | 13,036 | 6,359 | 6,677 | 12,072 | 1,700,294 | 1,700,294 |
| Shenandoah | 14,936 | 7,252 | 7,684 | 13,896 | 5.401,157 | 6,728,100 |
| Smyth | 8,898 | 4,403 | 4,495 | 8,952 | 2,796,768 | 2,810.080 |
| Southampton | 12,285 | 5,984 | 6,301 | 12,915 | 2,117,570 | 2,117,570 |
| Spottsylvania | 11,728 | 5,464 | 6,264 | 16,076 | 3,473,197 | 5,926,132 |
| Stafford | 6,420 | 3,123 | 3,297 | 8,555 | 1,749,545 | 2,000,000 |
| Surry | 5,585 | 2,886 | 2,699 | 6,133 | 1,153,934 | 1,153,934 |
| Sussex | 7,885 | 3,886 | 3,999 | 10,175 | 1,273,979 | 1,343,560 |
| Tazewell | 10,791 | 5,380 | 5,411 | 9,920 | 2,364.597 | 2,364.597 |
| Warren | 5,716 | 2,804 | 2,912 | 6,442 | 2,442,201 | 2,637,184 |
| Warwick | 1,672 | 849 | 823 | 1,740 | 494,289 | 494,289 |
| Washington | 16,816 | 8,325 | 8,491 | 16.892 | 5,172,190 | 5,899,881 |
| Westmoreland | 7,682 | 3,762 | 3,920 | 8,282 | 1,589,991 | 1,879,492 |
| Wise | 4,785 | 2,422 | 2,363 | 4,508 | 502,871 | 708,342 |
| Wythe | 11,611 | 5,712 | 5,899 | 12,305 | 3,989,602 | 4,041,571 |
| York | 7,198 | 3,603 | 3,595 | 4,949 | 896,725 | 896,725 |
| Total | 1,225,163 | 597,058 | 628,105 | 1,219,630 | 365,439,917 | 409,588,133 |

*Principal Towns.*—Richmond, the capital, is also the largest city in the State, having 51,038 inhabitants in 1870; Norfolk and Petersburg had between 18,500 and 20,000 inhabitants each; Alexandria and Portsmouth had from 10,500 to 14,000 each; Lynchburg, Staunton, Winchester, and Fredericksburg, from 4000 to 7000 each; Danville, Charlottesville, Lexington, Manchester, Hampton, and Harrisonburg, between 2000 and 3500 each; and Williamsburg, Culpeper, Wytheville, Farmville, Salem, Warrenton, Liberty, and Leesburg, from 1200 to 2000 each.

*Constitution, Government, Courts, and Congressional Representation.*—The present constitution of the State was adopted in July, 1869. The qualifications of a voter are that he shall be a male citizen of the U. S., twenty-one years old or upward, a resident of the State for one year or more, and of the county, city, or town where he offers to vote for three months next preceding any election, and is a registered voter and resident in the election district in which he offers to vote. Soldiers, sailors, and officers of the U. S. army and navy temporarily stationed in the State do not thereby acquire the right to vote. Idiots, lunatics, persons convicted of bribery or embezzlement, or of treason and felony, and any persons who since July 6, 1869, have taken part in a duel, are excluded. The governor is the

*There are included in this aggregate 1 Reformed Church in America (late Dutch), with 1 church edifice, 100 sittings, and $350 of church property; 1 Moravian (Unitas Fratrum) church, with 1 church edifice, 350 sittings, and $550 of church property; and 1 unknown (local mission), with 1 church edifice, 150 sittings, and $6000 of church property.

†These statistics include the parishes, clergymen, and communicants of West Virginia also.

‡The assessed valuation of 1870 is about $29,000,000 more than that of 1873 and 1875, owing, in part, to a different mode of assessing property for taxation.

chief executive officer of the State. He, as well as the lieutenant-governor, must have been a citizen of the U. S. for ten years (if not a native), must be thirty years of age, and for three years previous a citizen of the State. He is elected for four years, and at the close of his term is ineligible for the next four years. He possesses the pardoning power, and has a veto on the acts of the general assembly which can only be overridden by the vote of two thirds of the members of each house. The secretary of the commonwealth, treasurer, and auditor of public accounts are chosen for two years by the general assembly, and the superintendent of public instruction also by the general assembly for four years. The general assembly consists of a senate of 43 members, elected for four years, one-half at each biennial election, and of a house of delegates of 132 members, elected for two years. Its sessions are annual. The judiciary consists of a supreme court of five judges, chosen by the general assembly for twelve years; this court has appellate jurisdiction only, except in cases of *habeas corpus*, *mandamus*, and prohibition; 16 circuit courts, one for each judicial district, presided over by the same number (16) of judges, elected for eight years, having general jurisdiction in matters of law and chancery, and appellate jurisdiction from the county courts; and county courts for each county, the judges of which are elected by the general assembly for terms of six years. There are also justices' courts, and three justices of the peace are elected for each district (of which there are three or more to each county). There are special courts in the cities. The State is entitled to 9 members of Congress under the apportionment of 1872.

*History.*—Virginia was the earliest settled of the English colonies, preceding Plymouth by twelve or thirteen years, but the first attempts at planting a colony there well-nigh miscarried, from the improvidence and worthlessness of the colonists. On May 13, 1607, the first party of 105 colonists, sent out by the London Virginia Company, landed at what is now known as Old Jamestown, on the N. bank of the James or Powhatan River. They were mostly a company of needy adventurers; their president, Edward Wingfield, proved to be a knave, and the whole company would have perished but for the courage, enterprise, and shrewdness of Capt. John Smith, himself a noted adventurer, but the only sensible man of the party. Smith, after the escape of Wingfield and the failure of Ratcliffe, took command of the colonists, and held it until the officers appointed by the London Company, which had reorganized as the Virginia Company, should make their appearance. Nine vessels had been sent out by the company with 500 colonists, and the new governor, Lord De la Warr, being delayed for a time in England, the admiral, Sir George Somers, the vice-admiral, Christopher Newport, the lieutenant-governor, Sir Thomas Gates, and the high marshal, Sir Thomas Dale, all embarked with the fleet and on the same vessel; this vessel was wrecked on the Bermudas, but all the passengers were saved; one of the other vessels was lost, but the remaining seven arrived safely at Jamestown, but without any rulers. They were as worthless as their predecessors, and Smith had great trouble with them. Having been severely wounded by an accident, he was compelled to return to England for surgical treatment in Dec., 1609. He left 500 colonists, well supplied with all necessaries, and provided with a fort, storehouse, church, and 60 dwellings. Six months later, the number of colonists had dwindled to 60, and these on the verge of starvation. At this juncture (June, 1610) Newport, Gates, and Somers arrived at Jamestown, in vessels which they had built in the Bermudas, with 150 men and a moderate store of supplies; but finding the colonists in so sad a plight, they resolved to abandon Virginia and sail for Newfoundland with the remaining colonists, to seek further supplies and a passage home. As they descended the river, they met Lord De la Warr with three ships, bringing supplies and colonists. They then returned to Jamestown, and Lord De la Warr established a trading-post at Hampton, and punished the Indians for their barbarities to the previous colonists. Lord De la Warr's health failing, he returned to England, leaving Capt. George Percy as his deputy. Soon after, Sir Thomas Dale arrived with 300 more colonists and some cattle, and in Aug., 1611, Sir Thomas Gates with 350 more colonists. New settlements were made at Henrico and at what is now City Point, and the lands, which had previously been held in common, were divided among the colonists. The government of Gates, Dale, and their deputies was very stern, and gave much dissatisfaction. Lord De la Warr accordingly returned to resume the governorship, but died at the entrance of the bay which, with some modification, still bears his name. Sir George Yeardley, who succeeded him, was more popular. The culture of tobacco became profitable, and the number of colonists increased; new and more favorable laws were made; servants began to come into the colony in 1619 from two sources—felons or convicts sent over from English prisons and sold to the planters for a term of years, and negro slaves brought by Dutch vessels from the African coast. In the years that followed many redemptioners (*i. e.* persons who, being unable to pay for their passage, were sold as farm and house laborers for one or two years by the captains of the vessels for their passage-money) came over, and in most cases proved good citizens. In 1622, James I., then king of England, made strenuous efforts to introduce silk-culture to supersede tobacco-growing, but with no great success, though considerable silk was produced. In 1624–25 the Virginia Company was dissolved by writ of *quo warranto*, and the colony reverted to the Crown. The company had expended £150,000 more than they had received from the colony in their attempts to establish it. In 1632 the laws of the colony were revised and consolidated, and the colony was prosperous for the next twenty years. In 1649 there were 15,000 white inhabitants and 300 negro slaves, and the colonists had a large amount of live-stock. Tobacco was the colonial currency. In 1652 the colonists reluctantly submitted to the rule of Cromwell, but in 1660 they reaffirmed their loyalty to the Stuart dynasty. They had had since 1619 a house of burgesses or colonial legislature, which had exercised a considerable share of authority in the enactment of the colonial laws; and this during the Commonwealth made some addition to its powers which it never afterward relinquished. Suffrage, which had been almost universal, was restricted to freeholders and householders after 1670, in compliance with the wishes of the prominent aristocratic planters, and not from any considerable stress of the royal authority in that direction. The Church of England was again established by law, and persecuting laws passed against "nonconformists, Quakers, and Anabaptists." In 1671 the population was estimated at "40,000, including 2000 negro slaves and 6000 Christian servants (convicts and redemptioners), of whom about 1500 were imported yearly, principally English." The principal export was tobacco, of which 15,000 to 20,000 hogsheads were shipped to England yearly. There were no printing-presses or free schools in the colony at this time, the governor (Sir William Berkeley) opposing both with great vigor. "Bacon's rebellion" (see BACON, NATHANIEL), which occurred in 1676, was the result of the rapacity of this same Gov. Berkeley and two favorite courtiers of Charles II. (Arlington and Culpeper), to whom he had given a patent of the Virginia colony, and who were determined to squeeze all the money possible, in the way of taxes, out of the colonists. In 1681 a printing-press was set up in the colony, but was not long suffered to remain. In 1693, William and Mary College was founded. In 1689 the colony reluctantly acknowledged the accession of William and Mary. In 1698, Williamsburg became the capital of the colony. In 1736 the first newspaper, 6 by 12 inches in size, was established in the colony; it was enlarged in 1761. There were occasional conflicts with the Indians, but these were not serious until 1754, when the French war commenced. The French had established a line of military posts W. of the Alleghanies, and had induced many of the Indian tribes to become their allies. In this war Virginia troops were called into the field as a contingent to the regular British force, and Col. Washington commanded the colonial troops at Fort Necessity in 1754, and was Braddock's chief of staff in the disastrous battle of Fort du Quesne in 1755, and brought off the Virginia forces after Braddock's defeat and death. Virginia resented the levying of taxes by the mother-country without representation as warmly as did Massachusetts, and in 1765 adopted resolutions denying the right of any foreign body to levy such taxes. The colony was not a member of the first colonial congress of Oct., 1765, but approved its action, and asserted strongly, four years later, their rights and liberties. Thomas Jefferson was her spokesman for the first time in the discussion of the resolutions on this subject. A non-importation agreement was very generally signed by her merchants the same year. The imports of Virginia and Maryland from Great Britain at this time were $3,186,952. But it was not until the accession of Lord Dunmore as governor in 1772 that the opposition to the measures of the British ministry began to be generally manifested. Lord Dunmore aggravated the difficulties which his predecessor had striven to allay. He became at length so obnoxious to the people by his tyranny that he took refuge on board a British man-of-war off Yorktown, and in June, 1775, sailed down the river, and was declared by the general assembly to have abdicated his office. He subsequently attacked with a British and Tory force several of the towns along the coast, but was eventually driven S. with heavy losses. In the autumn of 1774 a battle occurred between the Indians, under Logan, Cornstalk, and other chiefs who were supposed to be under British influence, and a Virginian force of about

1200 men, at Point Pleasant on the Ohio River. The Indians were defeated, but the Virginians sustained considerable losses. In May, 1776, a convention of delegates met at Williamsburg, issued a declaration of rights, and on the 12th of June adopted a State constitution, said to have been the first permanent American constitution adopted for the government of an independent State. Committed thus to the cause of the Revolution, to which she contributed its commander-in-chief, Virginia was one of the theatres of the Revolutionary war, especially in its closing acts. Naval attacks were made on Norfolk, Portsmouth, and Gosport in 1779, and Benedict Arnold captured and burned Richmond in Jan., 1781. The battle of Jamestown was fought July 9, 1781, and the surrender of Cornwallis (the real close of the war) took place at Yorktown Oct. 19 of the same year. Virginia led the way in calling the national convention which framed the Constitution of the U. S., and ratified that Constitution June 25, 1788. In 1784 she ceded to the U. S. her claim to the lands lying N. W. of the Ohio. For thirty years or more after the Revolution the State maintained its pre-eminence in the national councils, and of the Presidents of the U. S., seven, whose united terms of service were more than thirty-eight years, were natives of the State, and five of them residents of it for most of their lives. After a time, however, the great States N. of the Potomac began to gain the ascendency in numbers, wealth, and political influence. In 1860 and 1861 the people of Virginia were divided in their views on the subject of secession. Many of them were strongly attached to the Union, while others sympathized heartily with the seceding States. Her convention, called Feb. 13, 1861, to consider the subject, was composed of three classes—unconditional Unionists, unconditional secessionists, and conditional Unionists; the latter were largely in the majority. There was a long discussion, but on Apr. 17, three days after the capture of Fort Sumter, the ordinance of secession was passed by 88 yeas to 55 nays. It was subsequently submitted to the people, and a majority of 94,000 was said to have declared in favor of secession. The western counties opposed it, and as a result the State of West Virginia was formed in October of the same year. (See WEST VIRGINIA.) Richmond became the capital of the Confederate States in the summer of 1861. The State was occupied by hostile armies during the whole of the civil war that followed. The battles of Bull Run, Carnifex Ferry, Ball's Bluff, Williamsburg, Winchester, Hanover Court-house, Seven Pines and Fair Oaks, "the seven days," June and July, 1862, Cross Keys and Port Republic, Cedar Mountain, Manassas, Fredericksburg, Chancellorsville, Hanover Junction, the series of battles from the Wilderness to Cold Harbor in May and June, 1864, Petersburg, Cedar Creek, Winchester, Fisher's Hill, the battles in the Valley, Lynchburg, Hatcher's Run, Five Forks, the capture of Petersburg, and the surrender at Appomattox, together with many less important actions, were all on Virginian soil. During a part of this time there were two State governments, the counties which were loyal and under Federal control having instituted a State government at Alexandria in 1863, and F. H. Pierpont being elected governor. The legislature of this State government called a convention, which met Feb. 13, 1864, and abolished slavery. After the close of the war, an attempt was made to convene the old Virginia legislature to restore the State to the Union, but there being evidence that that legislature would act in hostility to the government, its assembling was prohibited, the Pierpont government recognized by Pres. Johnson May 9, and Gov. Pierpont made provisional governor. The State remained under military control till Jan. 26, 1870, when it was restored to the Union by Congress under a constitution adopted by the people July, 1869, and compliance with the other provisions of the reconstruction acts. This constitution was the fifth adopted by the State. Recent measures adopted by the State give the promise of a more prosperous future.

### *Governors of Virginia.*

I. *Officers under the Virginia Company.*

Edward M. Wingfield, president.....1607–07
John Ratcliffe, pres.....1607–08
Capt. John Smith, pres..1608–09
Sir George Percy, pres...1609–09
Thos. West, Lord De la Warr, governor.....1609–11
Thos. Dale, high marshal.....1611–16
George Yeardley, lt.-gov.1616–17
Capt. Saml. Argall, lieutenant-governor.....1617–19
Sir Geo. Yeardley, gov...1619–21
Francis Wyatt.....1621–25

II. *Governors and Lieutenant-Governors under the Crown.*

Sir George Yeardley.....1626–27
Francis West.....1627–28
John Potts.....1628–29
John Hervey.....1629–35
John West.....1635–35
John Hervey.....1635–39
Francis Wyatt.....1639–41
Sir William Berkeley.....1641–45
Richard Kemp, lt.-gov...1645–45
Sir William Berkeley....1645–52

III. *Governors under the Commonwealth.*

Richard Bennett.....1652–56
Edward Digges.....1656–58
Samuel Matthews.....1658–60

IV. *Governors under the Crown.*

Sir William Berkeley.....1660–77
Herbert Jeffries, lt.-gov.1677–77
Herbert Jeffries, gov.....1677–78
Henry Chicheley..... 1678–79
Thomas, Lord Culpeper.1679–80
Henry Chicheley, lieut.-governor.....1680–84
Lord Howard of Effingham, governor.....1684–89
Nathaniel Bacon, lt.-gov.1689–90
Francis Nicholson, lieutenant-governor.....1690–92
Sir Edmund Andros, governor.....1692–98
Francis Nicholson, governor.....1698–1704
The earl of Orkney.....1704–05
Edward Nott, lt.-gov.....1705–06
Edmund Jennings, lieutenant-governor.....1706–10
Robert Hunter, lt.-gov...1710–10
Alexander Spotswood, lieut.-governor.....1710–22
Hugh Drysdale, lt.-gov..1722–26
Robert Carter, lt.-gov....1726–27
William Gooch, lt.-gov...1727–49
John Robinson, Sr., lieutenant-governor.....1749–49
Lord Albemarle, gov.....1749–50
Louis Burwell, lt.-gov....1750–52
Robert Dinwiddie, lieutenant-governor.....1752–58
John Blair, lt.-governor.1758–58
Francis Fauquier, gov...1758–68
John Blair, lt.-governor.1768–68
Norborne Berkeley, Lord de Botetourt, gov.....1768–70
William Nelson, lt.-gov..1770–72
John, Lord Dunmore, governor.....1772–76

V. *State Governors of the Revolutionary Period.*

Patrick Henry.....1776–79
Thomas Jefferson.....1779–81
Thomas Nelson.....1781–81
Benjamin Harrison.....1781–84
Patrick Henry.....1784–86
Edmund Randolph.....1786–88

VI. *Governors after adoption of U. S. Constitution.*

Beverly Randolph.....1788–91
Henry Lee.....1791–94
Robert Brooke.....1794–96
James Wood.....1796–99
James Monroe.....1799–1802
John Page.....1802–05
William H. Cabell.....1805–08
John Tyler.....1808–11
James Monroe.....1811–11
George W. Smith.....1811–12
James Barbour.....1812–14
Wilson C. Nicholas.....1814–16
James P. Preston.....1816–19
Thomas M. Randolph...1819–22
James Pleasant.....1822–25
John Tyler.....1825–27
William B. Giles.....1827–30
John Floyd.....1830–34
Littleton W. Tazewell...1834–36
Windham Robertson (acting).....1836–37
David Campbell.....1837–40
Thomas W. Gilmer.....1840–41
John Rutherford.....1841–42
John M. Gregory.....1842–43
James McDowell.....1843–46
William Smith.....1846–49
John B. Floyd.....1849–52
Joseph Johnson.....1852–56
Henry A. Wise.....1856–60
John Letcher.....1860–64
Francis H. Pierpont.....1864–68
Henry H. Wells.....1868–70
Gilbert C. Walker.....1870–74
James L. Kemper.....1874–78

### *Electoral and Popular Votes for President and Vice-President.*

| Elect. year. | Candidates who received the electoral vote. | Elect. vote. | Elect. year. | Candidates who received the electoral vote. | Elect. vote. | Pop. vote. | Opposition candidates. | Pop. vote. | Third-party candidates. | Pop. vote. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1788 | George Washington P..... | 10 | 1824 | William H. Crawford P... | 24 | 8,489 | John Quincy Adams P... | 3,189 | Andrew Jackson P..... | 2,861 |
| | John Adams V.-P..... | 5 | | Nathaniel Macon V.-P.... | | | John C. Calhoun V.-P... | | John C. Calhoun V.-P.. | |
| | John Jay V.-P..... | 7 | 1828 | Andrew Jackson P..... | 24 | 26,752 | John Quincy Adams P... | 12,101 | Henry Clay P..... | 416 |
| | John Hancock V.-P..... | 1 | | John C. Calhoun V.-P.... | | | Richard Rush V.-P..... | | | |
| | George Clinton V.-P..... | 3 | 1832 | Andrew Jackson P..... | 23 | 33,609 | Henry Clay P..... | 11,451 | John Floyd P..... | No report. |
| 1792 | George Washington P.... | 21 | | Martin Van Buren V.-P... | | | John Sergeant V.-P..... | | William Wirt P..... | No report. |
| | George Clinton V.-P..... | | 1836 | Martin Van Buren P..... | 23 | 30,261 | William H. Harrison P... | 23,368 | Hugh L. White..... | No report. |
| 1796 | Thomas Jefferson P..... | 20 | | William Smith V..P..... | | | Francis Granger V.-P.... | | John Tyler V.-P..... | |
| | John Adams P..... | 1 | 1840 | Martin Van Buren P..... | 23 | 43,893 | William H. Harrison P... | 42,501 | | |
| | Samuel Adams V.-P..... | 15 | | Richard M. Johnson V.-P... | 22 | | John Tyler V.-P..... | | | |
| | Thomas Pinckney V.-P..... | 1 | | James K. Polk V.-P..... | 1 | | | | | |
| | Aaron Burr V.-P..... | 1 | 1844 | James K. Polk P..... | 17 | 49,570 | Henry Clay P..... | 43,677 | | |
| | George Clinton V.-P..... | 3 | | George M. Dallas V.-P.... | | | T. Frelinghuysen V.-P... | | | |
| | George Washington V.-P.... | 1 | 1848 | Lewis Cass P..... | 17 | 46,963 | Zachary Taylor P..... | 45,439 | | |
| 1800 | Thomas Jefferson P..... | 21 | | Wm. O. Butler V.-P..... | | | Millard Fillmore V.-P.... | | | |
| | Aaron Burr V.-P..... | | 1852 | Franklin Pierce P..... | 15 | 73,858 | Winfield Scott P..... | 58,572 | | |
| 1804 | Thomas Jefferson P..... | 24 | | William R. King V.-P..... | | | Wm. A. Graham V.-P.... | | | |
| | George Clinton V.-P..... | | 1856 | James Buchanan P..... | 15 | 89,706 | Millard Fillmore P..... | 60,310 | John C. Fremont P..... | 291 |
| 1808 | James Madison P..... | 24 | | J. C. Breckenridge V.-P.. | | | A. J. Donelson V.-P..... | | William L. Dayton V.-P. | |
| | George Clinton V.-P..... | | 1860 | John Bell P..... | 15 | 74,681 | John C. Breckenridge P.. | 74,323 | Stephen A. Douglas P.. | 16,290 |
| 1812 | James Madison P..... | 25 | | Edward Everett V.-P..... | | | Joseph Lane V.-P..... | | H. V. Johnson V.-P.... | |
| | Elbridge Gerry V.-P..... | | 1864 | No vote. | | | | | Abraham Lincoln P.... | 1,929 |
| 1816 | James Monroe P..... | 25 | 1868 | No vote. | | | | | Hannibal Hamlin V.-P. | |
| | Daniel D. Tompkins V.-P. | | 1872 | Ulysses S. Grant P..... | 11 | 93,468 | Horace Greeley P..... | 91,654 | Charles O'Conor P..... | 42 |
| 1820 | James Monroe P..... | 25 | | Henry Wilson V.-P..... | | | Benj. Gratz Brown V.-P.. | | | |
| | Daniel D. Tompkins V.-P. | | 1876 | Samuel J. Tilden P..... | 11 | 139,670 | Rutherford B. Hayes P... | 95,558 | Peter Cooper P..... | No report. |
| | | | | Thos. A. Hendricks V.-P.. | | | Wm. A. Wheeler V.-P.... | | Samuel F. Cary V.-P.... | |

(The writer acknowledges his obligations to Hon. James MacDonald, secretary of state of Virginia, for documents. He has also made use of Hotchkiss's *Summary* to some extent.) L. P. BROCKETT.

**Virginia,** city and tp., cap. of Cass co., Ill., at the junction of Peoria Pekin and Jacksonville and Springfield and Illinois South-eastern R. Rs., 32 miles W. of Springfield, has 5 churches, graded schools, 2 banks, and 1 newspaper. It was laid out by H. H. Hall in 1836. P. of city, 954; of tp. 1789. W. M. SUMMERS, ED. "GAZETTE."

**Virginia,** tp., Warren co., Ia. P. 524.

**Virginia,** tp., Pemiscot co., Mo. P. 370.

**Virginia,** city and cap. of Storey co., Nev., on Central Pacific and Virginia and Truckee R. R., is the chief mining-centre of the Pacific coast, containing the famous Comstock Lode, yielding gold and silver ore to the amount (May, 1876) of $5,000,000 per month. The city is built at the eastern base of Mount Davidson, has several churches, good schools, 2 newspapers, 1 savings bank, and agencies of the Nevada Bank of San Francisco and Bank of California. The principal mines have machinery capable of pumping water and hoisting ore from a depth of 4000 feet. The greatest depth yet reached is about 2250 feet. P. 7048. D. E. MCCARTHY, ED. "EVENING CHRONICLE."

**Virginia,** tp., Coshocton co., O. P. 1014.

**Virginia,** or **Verginia,** a Roman maiden, daughter of Lucius Virginius, a patrician, and betrothed to Lucius Icilius, a popular democratic leader who had signalized himself in the office of tribune by procuring the passage of the law assigning the Aventine Mount to the plebeians. According to the ordinary histories—which, however, do not merit great confidence—the decemvir Appius Claudius, captivated by the beauty of the maiden, devised with one of his clients an infamous plot to obtain possession of her, under pretence that she was a slave; and when, in spite of all the efforts of the maiden's father and lover, the decemvir had in his magisterial capacity adjudged her to be the slave of his accomplice, Virginius plunged a knife into his daughter's breast in the midst of the Forum, and the people, excited by this tragedy, overthrew the government of the decemvirs, and Appius committed suicide in prison. The resemblances between this story and that of the fall of the Tarquins through the similarly tragic fate of Lucretia are too many and too minute to be casual, and as neither of the periods in question falls within the domain of well-authenticated history, it may be considered nearly certain that the same event, whatever it may have been, served as the foundation of the two narratives. That both the Lucretian and the Virginian myth were originally connected with the myth of the Horatii and Curiatii (one of whom slew his sister) may also be inferred from several indications, one of which consists in the facts that the names of these four families constantly recur in chronological connection with each other in the early *Fasti*, but no two of them ever appear as colleagues; that the Curiatian *gens* bore the surname of *Trigeminus*, the Virginian *gens* that of *Tricostus*, and the Lucretian *gens* those of *Trio* and *Triciptinus*, all evidently mere variations from the same original. The consuls who replace the fallen Tarquins are, according to the most plausible account, a Horatius and a Valerius, and the former obtains the honor of consecrating the Capitoline temple, from which the official chronology of Rome was reckoned. The consuls who replaced the decemvirs were also Horatius and Valerius, described as descendants of the earlier pair, but an inspection of the acts ascribed to them shows that they are the same persons appearing in another form of the legend. It may be remarked that the agnomen *Opiter*, which evidently has a religious significance, is found only in the Lucretian and Virginian families. P. C. BLISS.

**Virginia City,** city, cap. of Madison co., Mon., on the N. bank of the Alder Creek and on the E. slope of the Rocky Mountains, nearly 6000 feet above the sea, in the vicinity of the gold-mines of Alder Gulch, to which it owes its settlement in 1863, and which had yielded in 1876 above $40,000,000, has commodious county and public-school buildings, 3 churches, 2 weekly newspapers, 2 banks, a public library, and regular stage communication with Utah and with Helena, and was the capital of the Territory until Jan., 1875, when it was removed to Helena. P. 867; in 1875 estimated at 1200.

**Virginia Creepers.** See AMPELOPSIS.

**Virginia Deer,** a name given to the *Cariacus virginianus*, or common deer of the Eastern U. S. (See DEER.)

**Virginia Military Institute,** at Lexington, Va., established by Virginia in 1839 upon the basis of the U. S. Military Academy. (See MILITARY ACADEMIES.) A State arsenal, containing 30,000 stand of arms, was located here and guarded by a company of soldiers at an annual charge to the State of $6000. Through the earnest efforts of J. T. L. Preston, Esq. (who has been a professor in the institution since its organization), this appropriation was transferred to the support of the Virginia Military Institute, the cadets admitted by the State, free for board and tuition, doing duty as a guard in consideration therefor. The president of the first board of visitors appointed by the State was Col. Claude Crozet, an *élève* of the Polytechnic School of Paris, and a former professor of the U. S. Military Academy, while the superintendency of the Virginia Military Institute has been held since its organization by Gen. Francis H. Smith, LL.D., a graduate of West Point of the class of 1833. Besides the State cadets admitted upon the basis of free board and tuition, a large number of pay cadets are received each year, whose annual expenses are about $500. The departments of instruction embrace—(1) mathematics; (2) Latin and English; (3) practical engineering; (4) animal and vegetable physiology; (5) infantry, cavalry, and artillery tactics; (6) natural and experimental philosophy; (7) practical astronomy, physics, descriptive geography, and geodesy; (8) mineralogy, geology, and metallurgy; (9) general and applied chemistry; (10) modern languages, French and German; (11) civil and military engineering and applied mechanics. Each of these departments is under the charge of a professor, with assistant professors from the graduates as instructors. In its instruction it provides a carefully-arranged curriculum, which all are required to pursue, embracing the fundamental scientific branches with their applications, and the study of the Latin, French, and German languages, all auxiliary to the better knowledge of the structure of the mother tongue. When these are completed in the four years' academic course, provision is made for an extension of these studies in *special schools* of application, in which graduates and others may qualify themselves for their professional career in scientific or other practical pursuits. During the whole period of academic life the cadet is subjected to a rigid system of military discipline, the effect of which is to impart energy, system, subordination, and self-reliance to the youth, and to give to his education such a practical character as shall best qualify him for the active business of life.

During the late war the value of the military education given at this institution was prominently illustrated. The élèves of the Virginia Military Institute officered one-tenth of the armies of the South, and 170 of these fell in battle. In civil pursuits the departments of education, civil engineering, manufactures, agriculture, the bar, divinity, etc., have been supplied from its graduates, while the report of the late board of examiners, embracing the names of Prof. Charles Davies, Prof. D. H. Cochran, Gen. W. F. Barry, U. S. army, and Gen. J. W. Grigsby of Kentucky, closes with this strong testimonial: "In conclusion, your committee cannot too highly commend what has seemed to them the marked and distinguishing features of this institution—the happy combination of the military system of instruction with the departments of science and of literary culture, and the more ennobling culture of the heart and soul. Nowhere else have we seen this combination so complete and perfect. We cannot speak of it too highly. It is such a system as fits a pupil for life and for death. Under its guidance he is sure to tread always the path of duty, virtue, and honor." The State makes an annual appropriation of $15,000 toward its support, and this fund, with the income from tuition and from vested funds, secures a revenue of some $35,000. The buildings, library, apparatus, etc., were burned in 1864 by the order of Gen. D. Hunter, commanding the army of the U. S. in the Valley of Virginia, but all these buildings, which had been erected by the State at a cost of $250,000, have been restored by the institute itself. FRANCIS S. SMITH.

**Virginian Quail,** a name applied to the bob-white (*Ortyx virginianus*) of the Eastern U. S. (See ORTYGINÆ.)

**Virginian Snake-root.** See ARISTOLOCHIA.

**Virginia, University of,** an institution of learning near Charlottesville, Albemarle co., Va., chartered in 1819 through the influence of Thomas Jefferson, its first rector, who drew up all the statutory enactments relating to it, as well as its basis of organization, code of government, and plan of studies. It was opened in 1824, having among its faculty several young English professors, two of whom, George Long and Thomas Hewitt Key, subsequently achieved eminence in connection with the London University. Among the peculiar features which distinguish the University of Virginia from all other American institutions, the principal one is its division into separate schools, sixteen in number, each under the charge of a professor, who in several instances has assistant instructors. There is no general curriculum, but students select their schools,

usually three in number, for each year, and receive upon examination their respective degrees, which may be of six different kinds—namely, for proficiency in separate branches, for graduation in a single school, and the degrees of bachelor of letters, of science and of arts, and the degree of master of arts, reserved for those who have graduated in a sufficient number of the schools. There is no strictly academic head of the university, the faculty being presided over by a chairman annually chosen, and the government being vested in a board of visitors composed of a rector and eight members, appointed every fourth year by the governor of Virginia. The institution is under State patronage, having enjoyed from the beginning an annual appropriation of $15,000, a sum which in 1875 was increased to $30,000 on condition of free tuition for suitably-prepared students who may be natives. There are eleven competitive scholarships open to students from any State, and forty agricultural scholarships in connection with the department of agriculture founded in 1869 by Samuel Miller of Lynchburg with an endowment of $100,000. The discipline of the institution is largely left to the honor of the students. The library contains above 36,000 volumes; the number of alumni is about 15,000; and the number of students for the year 1876–77 about 330, under the tuition of 17 instructors. The office of rector since the death of Jefferson has been filled by James Madison, Chapman Johnson, J. C. Cabell, and R. G. H. Kean, the present incumbent (1877).

**Virgin Islands,** the name commonly given to a group of numerous small islands in the West Indies, situated between the Greater and Lesser Antilles. Three of these islands—namely, St. Thomas, St. Croix, and St. John—belong to Denmark; the rest, among which the most remarkable are Tortola, Virgin, Gorda, and Culebra, belong to Great Britain.

**Virgin Mary.** See IMMACULATE CONCEPTION OF THE VIRGIN MARY, by PROF. P. SCHAFF, PH. D., S. T. D.; MARY, THE BLESSED VIRGIN, by REV. W. F. BRAND, A. M.; and PURIFICATION OF THE VIRGIN.

**Virgin's Bower.** See CLEMATIS.

**Vir'ial** [Lat. *vis*], a term introduced by Prof. Clausius of Bonn to denote a particular form of energy for which an expression is needed in the dynamical theory of gases. Clausius has established by a simple mathematical process the following equation:

$$Vp = \tfrac{2}{3}T - \tfrac{2}{3}\Sigma\Sigma(\tfrac{1}{2}Rr);$$

in which $p$ denotes the presence of a gas, and V the volume of the containing vessel. At constant temperature, according to the law of Marriotte, $Vp$ is constant. T denotes the kinetic energy of the system, or that part of the energy which is due to the motion of its components. The kinetic energy of a particle is half the product of its mass into the square of its velocity, and the kinetic energy of the system is the sum of the kinetic energies of all its particles. The symbol $r$ represents the distance between any two particles, and R is the force of attraction or repulsion between them. Half the product of this force into this distance—viz. $\frac{1}{2}Rr$—is what Clausius calls the *virial*, which may be either positive or negative according as R is an attractive or a repulsive force. The virial of the system is the sum of the virials of all the pairs of particles which can be formed in the system; and is expressed by the double sum $\Sigma\Sigma(\frac{1}{2}Rr)$, which indicates that the value of $\frac{1}{2}Rr$ is to be found for every possible pair of particles, and the results added.

If there is neither attraction nor repulsion between the particles, there will be no virial, and the equation of Clausius becomes

$$Vp = \tfrac{2}{3}T, \text{ or } Vp = \tfrac{1}{3}Mc^2;$$

putting M for the entire mass, and $c^2$ for the mean square of the molecular velocity; and it is demonstrable that, in this case, assuming the mean square of the velocity of the moving particles to be dependent only on the temperature, which on the kinetic theory is capable of independent proof, $\frac{2}{3}T$ is constant, and this equation exactly represents the law of Marriotte.

If, on the other hand, the pressure of a gas arises wholly from the repulsion of the particles for each other considered as at rest, the kinetic energy must be zero, and the equation will become

$$Vp = -\tfrac{2}{3}\Sigma\Sigma(\tfrac{1}{2}Rr);$$

where R must be negative. In this expression, in order that $Vp$ may be constant, R must be inversely as $r$, or the repulsion must be inversely as the distance—a law which Newton proved to be inadmissible.

The kinetic theory must therefore be true; but inasmuch as most gases depart from the law of Marriotte, especially at low temperatures and great densities, it follows that the form of energy expressed by the virial must in general exist. Prof. Clerk-Maxwell has made the equation of Clausius the basis of very interesting investigations in molecular dynamics. F. A. P. BARNARD.

**Viri'athus,** a Lusitanian by birth and a herdsman by profession, became a leader in the guerilla war which was carried on in the middle of the second century B. C. on the border between Lusitania and the Roman province of Spain. In 147 he defeated the Roman proprætor, Vetilius, at Tribola, a town of Lusitania, S. of the Tagus, and invaded Spain. In 144 he was driven back into the Lusitanian mountains by the consul, Q. Fabius Æmilianus, but in 143 he utterly routed the proprætor, Q. Pompeius, and shut him up in Corduba in Andalusia. In 142, however, he was again driven back into Lusitania by the consul, Q. Fabius Servilianus, but in the following year he succeeded in alluring the consul into a mountain-pass, surrounded him on all sides, and compelled him to surrender himself and his whole army unconditionally. Peace was now concluded with the Romans, by which the Lusitanians were acknowledged as an independent nation and the allies of Rome. But in 140 the consul, Q. Servilius Cæpio, saw fit to invade Lusitania, bribed some persons to murder Viriathus while sleeping in his tent, and subjugated the country after a protracted but ineffectual resistance by the natives.

**Vir'idine** ($C_{12}H_{19}N$), a base of the pyridine series, is contained in the products of the distillation of coal, and is therefore present in coal-tar. (See GAS-LIGHTING, by PROF. C. F. CHANDLER.) It has a sp. gr. of 1.024, and boils at 450° F., is slightly soluble in water, and dissolves in alcohol and in ether. It forms mercuric and platinic salts. The properties of viridine and its compounds have been imperfectly investigated. J. P. BATTERSHALL.

**Viro'qua,** p.-v. and tp., cap. of Vernon co., Wis., 25 miles W. of Mississippi River, has an excellent graded school and 2 newspapers. The neighborhood is full of streams abounding in trout, and game of all kinds is to be found in season. P. 1988.

HENRY CASSON, ED. "THE CENSOR."

**Virtue.** See MORAL PHILOSOPHY, by PRES. NOAH PORTER, S. T. D., LL.D.

**Vi'rus** [Lat.], animal fluids produced in diseased conditions or by morbid processes, and capable of developing disease when transmitted to other animal bodies. Thus, man may be inoculated by the virus of human origin, small-pox, syphilis, etc., vaccinia of the cow, glanders of the horse, and rabies canina or hydrophobia. A minute amount of the virus gaining access to the body is sufficient, by self-multiplication, to infect the entire volume of the blood and contaminate every part of the body. Peculiar cells or germs, having temporary vitality and tendency to reproduce themselves (*contagium virum*), constitute the active elements of all viruses. (See GERM THEORY OF DISEASE.) Having gained entrance to the system, they for a time seem dormant, but are really multiplying, and this period is well designated as one of "incubation." Thus, small-pox appears twelve or more days after admission of virus, vaccinia within a week, hydrophobia on an average forty days. There are no specifics against the effects of viruses when once in the system. Hygienic and supporting measures may prepare the body to meet those effects and pass safely through. (See also VENOM.)

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Visa'lia,** p.-v. and tp., cap. of Tulare co., Cal., about 200 miles S. E. of San Francisco, contains 5 churches, excellent schools, 1 private bank, U. S. land-office, 4 hotels, and 3 restaurants. It is within the delta of Kaweah River, and is surrounded by groves of native oak. P. of v. 913; of tp. 1626. E. M. DEWEY, PROP. "WEEKLY DELTA."

**Viscacha,** or **Biscacha.** See LAGOSTOMINÆ and LAGOTIS.

**Viscai'no** (SEBASTIAN), b. in Spain about 1560; commanded an expedition sent from Acapulco in 1602 to the N. W. coast of America, and made an accurate chart of the coasts of the two Californias.

**Viscelli'nus** (SPURIUS CASSIUS), a Roman statesman and general of the earliest period of the Republic, who has received scant justice from the imperial annalists, but who, according to Niebuhr, deserves to be considered as the greatest and most illustrious historical figure of the Republic. He was consul with Opiter Virginius Tricostus, B. C. 502; triumphed over the Sabines; was *magister equitum* to the dictator I. Lartius Flavus 501; again consul with Post. Cominius Auruncus 493, when he negotiated the first great league with the Latins; was once more consul with Proculus Virginius Tricostus 486, when he made that league with the Hernicans which was the basis of Roman success for the century following; but having in the same year proposed and carried an "agrarian law"—*i. e.* an equi-

table division of the conquered lands—he was accused of aiming at kingly power, was put to death 485 B. C., his house razed to the ground, and his family degraded from the patriciate.

**Visch'er** (FRIEDRICH THEODOR), b. at Ludwigsburg, Würtemburg, June 30, 1807; studied theology at Tübingen, and entered an ecclesiastical career, but turned by degrees to the study of philosophy and æsthetics; travelled much (1839–43) in Italy and Greece; was appointed professor of æsthetics at Tübingen in 1844; removed to Zurich in 1855, but returned to Tübingen in 1866. His *Æsthetik* (3 vols., 1847–58) is the most complete representation which exists of the philosophy of the beautiful, and contains in its details many acute and striking analyses. The fundamental ideas of his system he set forth as early as 1837 in his *Ueber das Erhabene und Komische.* His *Kritische Gänge,* a collection of literary criticisms, is not of great consequence, but made a great sensation on account of its fierce attacks on all bigotry and pietism.

**Vischer** (PETER), b. at Nüremberg, Bavaria, in 1455; d. there Jan. 7, 1529. His father was a worker in bronze, and he himself, as well as his five sons, adopted the same profession. Of his personal life not much is known (see *Die Nürnberger Künstler, geschildert nach ihrem Leben und Werken,* 1831), but he attained a great fame as an artist and received orders both from Germany and foreign princes. Of his numerous works, the tomb of St. Sebaldus in the church of St. Sebaldus in Nüremberg is the most celebrated (1506–19), containing 72 figures, besides those of the apostles and prophets. Another famous work by him is the monument in the cathedral of Berlin over the elector John Cicero.

**Viscon'ti** [from the Lat. *vicecomites,* "viscounts"], a Lombard family, said to descend from King Desiderius, and in possession of large estates on Lakes Como and Maggiore, obtained in course of time the sovereignty of Milan and extended its power over the whole of Northern Italy, from Venice to Florence. One member of the family, OTTONE, is mentioned in 1078 as viscount of Milan, and another Ottone was appointed archbishop of Milan in 1262 by Pope Urban IV. This appointment by the pope, and not by the chapter, was considered an infringement on the rights of the people, and occasioned a popular rising under the leadership of the family of the Torriani or Della Torre. A civil war ensued, and was not brought to a final close until 1311, when the emperor Henry VII. expelled the Torrianis from the city, and not only confirmed MATTEO as viscount of Milan, but also made him imperial vicar in Lombardy. Between Matteo and Pope John XXII. a controversy arose regarding the appointment to the archiepiscopate of Milan. In 1322 the pope excommunicated the Viscontis, and in 1323 a crusade was preached against them. But by the aid of the emperor Louis of Bavaria, GALEAZZO I. succeeded in completely defeating the holy army at Vavrio on the Adda in 1324, and the excommunication was annulled. The power of the family now increased rapidly. Its members were conspicuous as shrewd politicians, able generals, and great patrons of literature and art; but they were generally unscrupulous and cruel, and conspiracies, depositions, and assassinations fill the pages of their history. With GIAN GALEAZZO (1378–1402) the power of the family culminated. He was a son of GALEAZZO II., the patron of Petrarca, the founder of the University of Pavia, and the inventor of the famous process of torturing called "Galeazzo's seat;" and the son evinced all the father's virtues and vices on a grand scale. He founded the library at Pavia, re-established the University at Piacenza, commenced the erection of the cathedral of Milan, built the Certosa and the bridge across the Ticino at Pavia, etc. He conquered Padua, Verona, Vicenza, etc., bought the title of duke of Milan from the emperor Wenceslas, and aspired to the royal crown of Italy, when he suddenly died from the plague. His daughter, Valentina, married Louis, duke of Orleans, and was the grandmother of Louis XII., king of France. On the death of his son, Filippo Maria, in 1447, the male line of the family became extinct, but his natural daughter, Bianca, married to Francesco Sforza, retained Milan and a large part of the family inheritance.

**Visconti** (GIOVANNI BATTISTA), b. at Sarzana, near Genoa, in 1722; settled in Rome, where he succeeded Winckelmann as superintendent of antiquities; organized the museum Pio-Clementinum in the Vatican, and undertook extensive excavations, by which the tomb of the Scipios was discovered. D. in Rome Sept. 2, 1784.—His son, ENNIO QUIRINO, b. at Rome Nov. 1, 1751, received a careful education, and was appointed sub-librarian of the Vatican in 1771, but lost subsequently this office, as he refused to take holy orders. Meanwhile, his archæological writings made his name famous, and in 1785 he was made director of the Museum Capitolinum. During the French occupation of Rome he was a member of the provisional government, and one of the five consuls during the period of the republic. But on the approach of the Neapolitan army in 1799 he left Rome and sought refuge in France, where he was made director of the collections of the Louvre and professor of archæology at the University of Paris, and d. Feb. 7, 1818. His principal works are—*Monumenti degli Scipioni* (1780), *Museo Pio-Clementino* (7 vols., 1782–1807), *Inscrizioni greche Tropee, ora Borghesiane* (1794), *Descriptions des Antiques du Musée national du Louvre* (1801), *Iconographie ancienne* (5 vols., 1808–20), *Illustrazioni di Monumenti scelti Borghesiani,* published after his death (1821). His complete works appeared at Milan in 12 vols. (1818–22).—His son, LOUIS TULLIUS JOACHIM, b. at Rome Feb. 11, 1791; studied at the School of Fine Arts in Paris, and was much employed as practical architect by Louis Philippe and Napoleon III. D. in Paris Dec. 29, 1853. He erected in Paris the fountains of Gaillon, Molière, Louvois, and St. Sulpice; the tomb of Napoleon I. in the Hôtel des Invalides, the Collet Palace on the Quai d'Orsay, and furnished the plans for the completion of the Louvre, which, however, he did not live to see executed.

**Viscon'ti-Venos'ta** (EMILIO), b. at Tirano, in the Valtelline, in 1828. He was carefully educated, wrote for various literary and political periodicals, and until about 1858 was in relation with Mazzini. In 1859, Cavour appointed him royal commissioner at the head-quarters of Garibaldi in Lombardy, and he acted in conjunction with the dictator Farini in measures for the annexation of Central Italy to Piedmont. In 1860 he was associated with Pepoli in a mission to Paris and London; on his return was elected to Parliament and appointed a member of the committee of contenzioso diplomatico in the ministry of foreign affairs; accompanied Farini to Naples, as legal and diplomatic counsellor, on the annexation of that kingdom to Italy; became minister of foreign affairs in 1863; was sent as minister of Italy to Constantinople; resumed the ministry of foreign affairs on his return, and remained in that position until Mar., 1876, when, with his colleagues of the Minghetti ministry, he resigned. In all these important positions he has shown marked ability.

**Viscosite,** or **Viscosine** [the first name is preferable, as in accordance with Dana's terminology in mineralogical nomenclature], a name conferred by the writer upon one of the constituents of the peculiar carbonaceous mineral *grahamite.* (See IRISITE.) Viscosite forms 15 to 20 per cent. of both the West Virginia and Colorado grahamites, also forming a small constituent of *albertite.* It appears to exist also in some crude Pennsylvania petroleums, and probably in coal-tar. Viscosite is obtained by digesting grahamite with ether or petroleum-naphtha—green fluorescent solutions resulting—and distilling off these solvents. It appears then as a translucent, dark-brown, very lustrous substance, of curious balsamic odor, very brittle when cold, and giving a light-brown powder. When warmed, it melts at a very low temperature, acquiring before melting a soft viscosity, like sealing-wax, so that threads of surprising length may be drawn out; hence its name. It has not been analyzed as yet, but appears to be a hydrocarbon free from oxygen, as its solutions in hydrocarbons preserve the lustre of *sodium* indefinitely. HENRY WURTZ.

**Viscos'ity** [Lat. *viscosus,* from *viscum,* "bird-lime"], a quality of liquid bodies, which, in some, causes them to flow with difficulty—an absence of *complete fluidity.* It has been referred to an *intermediate condition* between solidity and liquidity, but this is speculative and conveys no definite idea. At present it can only be said that it is probably a common quality of all liquids, in which they differ only in degree, some being very viscous or viscid, like strong syrup or mucilage, while others have a minimum of viscosity, like ether or chloroform. The chemist Dollfus invented an instrument called a *viscometer* to measure the degree of this quality by the time required for a given quantity of the liquid to pass through a given aperture under the same conditions. The rate of *transpiration* of a liquid is of course a function of its viscosity. (See *Transpiration,* under LIQUIDS, CHEMICAL AND PHYSICAL NATURE AND PROPERTIES OF.) HENRY WURTZ.

**Vis'count** [originally a *vice-count,* or earl's deputy] is at present, in the British peerage, the title of a nobleman higher in rank than a baron and lower than an earl. There is a corresponding title in the nobility of several other European nations.

**Viscum.** See MISTLETOE.

**Vi'seu,** town of Portugal, province of Beira, is old, ill built, dirty, and hot, but has a fine cathedral, many Roman remains, and a well-attended fair in September. P. 9160.

**Vish'nee-Volo'tchok,** town of Russia, government of Tver, on the Tsna, carries on an immense transit-trade, especially in grain, as it is situated on the canal which connects the Tsna with the Tvertsa, and thereby the Baltic with the Caspian Sea. P. 13,873.

**Vish'nu,** the second person of the Hindu Trimûrti. Whilst Brahma is said to create, and Siva to destroy, the chief function of Vishnu is said to be preservation. In tracing the history of the god, it can plainly be seen that the reason for nominating Vishnu as the Supreme Preserver lies in the fact that in his avatars he appears as an almighty Deliverer, the last succor of gods and men. Vaishn'avas consider him to be the greatest of gods, the embodiment of the supremest Supreme. Deriving their idea from the root-meaning of the word *Vishnu*, the Vaishn'ava Brahmans declare him to be the "Encompasser" and the "All-Penetrator." And not only so: as the supreme deity he formed heaven and earth. He is the Indefinable Omnipotent, and is the comrade of the gods of fire and the spacious firmament. It is he who reclines on the lotus; he is as fierce as the long-tusked boar; he is shaded and guarded by the hooded serpent of many heads; he is the lord of innumerable hosts of the monkey-warriors of Hanumân; he is the primal fish of the ocean of births; he is the eternal tortoise, and on his back he can bear all the weight of the universe; he is the man-lion; and he is the fulfiller of all space, who can at will take upon him the form of a dwarf. Brahma, with his four heads, springs into being from his navel. He is the husband of the peerless Sîtâ, who is so pure that even the flames of a furnace cannot take effect on her person. He loves dark blue, and dark-blue flowers are used in his worship. He is the hero of the *Râmayana*, and he is the matchless Krishna, with his hyacinthine complexion. He is lauded in the *Mahâbhârata* under a thousand names. He is Narâyana, the rester on the waters. He is the loved of the Gopîs, the thousand shepherdesses whom he divinely seduced. He is the sweet flute-player of heaven, and its nimble dancer. The lovely Laksmî, goddess of prosperity, sits at his feet and fondles her lord. Now he rides on Garuda, a creature partially man, partially bird. Now he wields the axe, or drives the plough, or sits on a throne. In a word, Vishnu is presented to us under almost innumerable aspects. If we are to believe his votaries and those who have written in praise of him, we are bound to confess that he stands alone, as the incomparable chief of the Hindû pantheon. But, unfortunately, zealous advocates of Saivism are as extravagant in the praise of their own pet deity, and declare that he is so potent that he is worshipped by Vishnu. As for Brahma, he is rather a venerated name that is encircled by shadowy awe, and which looms through the mists of tradition, than a living power to whom daily prayers and sacrifices must be offered up.

Vishnu in the *Vedas* is the sun. In the *Rig-Veda* he is represented as "stalking over the seven divisions of the globe with a threefold progression" (*i. e.* he shines everywhere in three ways—from the E., from the zenith, and from the W., at morn, noon, and eve). But at this period the worship of Vishnu was very restricted, and his praise not unboundedly expressed. He was considered but a third-rate power, after all, and inferior to Indra, whom he expressly worships. But when we come to the epic times of Sanskrit, to the *Mahâbhârata* and *Râmâyana*, then at once we find the sun-god of the Vedas leap up into sudden prominence, and become identified with the eternal Prime Essence itself. In the *Mahâbhârata*, however, although treated as one of the Triad, he is now and then spoken of as if he were not of equal honor with Siva. But the *Râmâyana* is wholly devoted to his praise. In that epic he is the chief of the gods, and his supremacy is in every way conspicuous and complete.

The most remarkable thing about Vishnu as a god is his avatars. It is his incarnations which present him to us as he is supposed to be, the champion of gods and men. Take away the idea of incarnations from the Vaishn'ava legends, and only the primal notions of Vedic triads are left. It is because that the grandeur—or at least picturesqueness—of many of the nine past avatars of Vishnu struck the Hindû fancy that Vishnu sprang up to popularity so suddenly, and has maintained his repute as a power so long. In the idea which lies at the root of many of these incarnations we catch a tone of Oriental chivalry much calculated to fire the Asiatic imagination. Then the *Râmâyana* burst on the world of Hinduism, and the obscure god of the sun was raised for all time to be the god of the gods of the East. He could do no evil. He ravished the Gopîs, but did he not create them? May not a potter put the vessels which he makes to any use which he sees fit? Brahmans will ask the Christian in words the latter reverences, "Shall not the Lord of all the earth do right?" Of course the reply is, if put as a query, "Who, then, is that Lord?" It must be acknowledged by any candid man who has read the *Purânas* that Brahma is represented as a liar who lusts after his own daughter, that Siva is an adulterer and abominably vicious and ferocious, and that Vishnu is a fornicator as well as a thief from his cradle. It is difficult for one to choose whom to worship in such a triad. But the Brahman triumphantly asks you to explain the authority by which you judge the gods by any mortal standard. As South Indian poets say—

"That good and ill's gods' play
Do not our sages say?
May they not what they make unmake again?
Mayhap, in 'sport divine'
They made your blood and mine;
May they not shed it, as they shed the rain?"

These lines embody one of the leading thoughts of Purânic philosophy. All mundane matters, good or evil, are only regarded as affording sport to the idle gods, who are, by virtue of their divinity, above all responsibility.

It will be most convenient if we now glance at the avatâras of Vishnu, taking them in the order in which they are generally commented on. First, then, we come to the incarnation in which Vishnu took the form of a fish. This is called the *Matsya avatâr*. In the *Matsya Purâna* we have a full account of it. There are many indications that the history of this avatar has some connection with that of the Hebraic account of the Deluge. With the story of this incarnation, too, is incorporated the name of the lawgiver Manu. In the *Mahâbhârata* the hero of this avatar is regarded to be not Vishnu, but Brahma. Even in the Vaishn'ava traditions Brahma plays an important part in the narrative. The origin of the avatar appears to have been the necessity for avenging the loss of the four *Vedas* which proceeded from Brahma's four mouths. The Vaishn'ava legend, which makes Vishnu to be the avenger of Brahma, necessarily implies the supremacy of Vishnu. Brahma, we are told, fell asleep, and a demon saw him thus unconscious. The demon's name was Hayagrîva, who took the opportunity to steal the *Vedas*. These *Vedas* had proceeded from the four mouths of Brahma. It will be remembered that, according to one legend, Brahma assumed a four-headed form for the purpose of looking to the four quarters of the globe, in order to catch his daughter *Tilôtumei*, whom he desired to ravish. (The reader will remember Milton's lines, "In Saturn's reign such mixture was not held a stain.") Out of the four mouths of the four heads, thus wantonly assumed, issued the holy *Vedas!* Hayagrîva succeeded in robbing Brahma, but was caught in the act and fact by the ever-watchful Vishnu, who determined to slay the doughty devil. But he appears to have taken a long time about it, and gone about his work in the most roundabout manner possible. Nor does it appear why Vishnu—who, when incarnate in his cradle, began to set an example to men by stealing a pot of butter—should be angry at the similar deed of Hayagrîva. Nor can the legends to the effect that Brahma sprang up in the perfection of power and person, four-headed and crowned, from the navel of Nârâyana, be easily reconciled with the tradition of the assumption of those heads in order to see whither his virgin daughter had fled from his incestuous embrace. But the fact is, the sacred books of the Hindûs are, as a whole, a contradictory jumble of wild legends. The Bible of Christendom stands alone as one harmonious whole, composed of many parts—a history written in all ages of the ancient world and by different men, but which, in no part of it, is self-contradictory. But in these legends of the avatars of Vishnu we must take only one and record it, and leave the rest to be recorded by others, whoso will. So we learn from the account we follow that Vishnu took the form of a fish. The sage Manu was performing his religious ablutions. The fish slipped into his hands, addressed the pious sage, and claimed protection from the larger fish. Manu consented, and placed it in his pitcher of water. But the fish grew so large that he placed it in a pond. Then the pond was found too small, and the fish was placed in a lake. Then nothing but the sea would contain the enormous creature; whereupon Manu became convinced of the divine character of the fish, although he surely might have become so aware long before when he heard the finny curiosity speak to him. Prof. Goldstücker thus writes: "Satyavrata now understood that the fish was none other than Nârâyana, and after he had paid his adoration to the god, Vishnu revealed to him the imminence of a deluge which would destroy the world, and told him that a large vessel would appear to him, in which he was to embark, together with the seven Rishis, taking with him all the plants and all the seeds of created things. Manu obeyed the behest of the god, and when the water covered the face of the earth, Vishnu again appeared to him in the shape of a golden fish, with a single horn ten thousand miles long, and to this horn Manu attached the vessel, Vishnu's serpent

serving as a cord. While thus floating in the vessel, Manu was instructed by the fish-god in the philosophical doctrines and the science of the Supreme Spirit; and after the deluge had subsided, the fish-god killed Hayagrîva, restored the *Vedas* to Brahman, and taught them to the Manu Satyavrata." There are surely in this legend particularly strange allusions to Noah and the ark, and even to the number of persons who escaped from destruction in the flood.

Next comes, in the usual order assigned, the tortoise avatar. This is in one way a remarkable incarnation, as, although the gods afterward fought with them and gained the victory, the demons were at first called into active alliance with all the powers of heaven. And yet they were summoned to aid toward encompassing their own downfall. For the gods had been growing weak; the demons were, if anything, growing stronger and stronger. Even the men on earth, by performing meritorious acts of austerity or by offering up extraordinary sacrifices, were getting stronger, and equal in strength with the gods themselves. So the gods, after solemn consultation, repaired to the omnipotent Vishnu, who directed them to churn the ocean of milk, with the mountain *Mandara* for their churning-stick. This was to be stuck down into the sea, cone downward, and the long serpent of Vishnu, *Vâsuki*, to be coiled round the mountain. The demons were to pull at the head of the snake, and the gods to pull at the tail, each alternately, so that the mountain should revolve in the sea of milk, and churn it. Vishnu himself, taking the form of a tortoise, descended to the bottom of the sea to support the mountain on his back whilst it revolved on the pivot of his scales. All this was done that the nectar of immortality, called *Amrita*, should be obtained for the gods, that their strength might be renewed and perfect invulnerability obtained. The *Amrita* was found of course. Then all kinds of the most miraculous creations suddenly sprang up from out of the milky waves. But the final close of this avatâra was—which is rather usual in these Vaishn'ava legends—a free fight in heaven. The Hindûs like noise and commotion only next to the mysterious and the wonderfully incredible in their divine histories. Any one who has read the *Râmâyana* will remember Hanuman's leap of ninety odd miles. And when gods and demons fight, the Hindû listens with rapture to the tale of how a mountain was used as a club, and a lightning-flash as a javelin!

We now come to the avatar in which Vishnu takes upon himself the form of a boar. As of the other incarnations, so of this, there are innumerable versions. That which the Saiva religionists chiefly patronize in Southern India is by no means flattering to any except Siva; for in that version of the legend—undoubtedly a late one, however—Brahma tries to reach the head of Siva, whilst Vishnu assumes the form of a boar, and, digging to the foundations of the earth, tries to arrive at the feet of the god. But he is the illimitable one. Brahma descends, and tries to make believe he has accomplished the feat he attempted, but is exposed and cursed by Siva. Vishnu ascends crestfallen, his tusks utterly worn out, without having been near the fulfilment of his purpose. But the *Varâha*, or boar-avatar, in the earliest phases of the legend, appears to point to its being an incarnation of one of the Trimûrti with the main object of saving the earth from a deluge which submerged it. But, according to some accounts, it was Brahma who, taking the form of a boar, tried to raise up the earth above the waters. Afterward, when the Varâha avatâra became associated with Vishnu, all kinds of strange symbolisms in connection with the incarnation were invented. The deluge was wickedness; the boar was the power of religious ceremonial. The *Vishnu-Purâna* is the storehouse of such idealization. It is impossible to conceive a greater mass of fanciful folly than that which we owe to Vaishn'avas of the Purânic period, who made this avatar their especial theme.

The *Vâmana-avatâra*, or incarnation in which Vishnu appears as a dwarf, is certainly one of the most poetical and pleasing of his many appearances amongst mortals. To the present day the Hindûs listen to any story about the Lord of Space who took three steps—one on earth, one on air, and one on heaven—and gained these three empires for himself. For it happened that King *Bali* was so powerful a monarch that he overcame *Indra* himself. He was lord of heaven, earth, and hell, and tyrannized over the greatest gods. By excessive austerities and unrivalled sacrifices he became so powerful that it was only by craft that the almighty Vishnu could himself overcome him. So, whilst Bali was performing on an extraordinary scale a sacrifice in honor of the gods, so that thereby he might acquire still more power by his meritorious action, and rule more despotically and supremely than ever, a dwarf approached him and did him reverence. Bali was pleased, and asked the little Brahman what he would like for a gift. The dwarf said, "Only as much ground as I can cover by taking three steps." This comical request was at once granted, when the god leapt up as the mightiest of the host of heaven, and, placing one foot on earth, one on the middle space, and one over heaven, gained to himself the three worlds, leaving only hell to Bali. But, on account of the pious and promise-keeping manner in which Bali submitted himself to Vishnu, he was told by the god that after death he should be born again as the eighth of the Manus.

In the next avatar Vishnu appears as a man-lion, and this incarnation is called *Nr'isinha-avatâra*. In it the Preserver is represented as saving the gods from the might, acquired by the most rigorous penances, of Hiran-ya-Ka'si-pu. This man could not die. He was lord of all the universe.

> "Supreme he stood:
> The merit of his sacrifice
> Was as a monsoon flood:
> His good deeds numberless—
> As in broad plains the laden ears of rice—
> That gods, who fain had shed his heart's red blood,
> Constrained by merit, were compelled to bless!"

He performed the omnipotent, god-overpowering horse-sacrifice. But even in his case the wily Vishnu was too much for him, and again upheld the might and supremacy of heaven.

Before proceeding further in our account of this typical avatar, it would be well to draw the attention of the reader briefly to the Hindus' idea of the peculiar efficacy of sacrifice. So it was an implanted theory in the breasts of every Semitic race. The Aryan imbibed it, or received it as a mental, instinctive axiom. As its ulterior object, Fate seemed to stand supreme. The gods were omnipotent, yet not purely and wholly so. A wicked and depraved mortal or inferior spirit could, by the practices of self-abnegation, austerity, sacrifice, and the rest, terrify the whole pantheon. Merit acquired became more potent than deity of the most exalted kind. And then the only remedy was—incarnation! How wonderfully, in a measure, run these grooves of thought collaterally with the later biblical revelations! We find in India the same seeds germinating, uprising, flowering, bearing fruit, and casting new seeds abroad which we find in the soil of sacred Palestine. The same instinctive notions are afloat in the human mind. And the Krishna is found by the Orientalist to be but a lower and more sensual estimation of the Christ.

*Hiran'yakas'ipu*, in consequence of his prolonged meritorious austerities and sacrifices, forced from Brahma the gift of a life which could not be destroyed by any created being—by neither man nor bird, reptile nor demon nor fish, at any time, or in any mode, or by any weapon. His motive was anger against Vishnu. The moment Hiran'-yakas'ipu obtained, through merit, this invulnerability, he began to molest the gods and to persecute the votaries of Vishnu. At length, Vishnu took upon himself to slay this demon without there being any need for Brahma's vow being broken. He came, therefore, *not* in the form of a being which had been "created," but as a new creation, a man-lion, and tore the heart of the demon from out of his breast with his sharp claws. It must be acknowledged that the trickery displayed in this avatar is not at all worthy of divinity. The word of the promise is only kept, not the spirit.

The *Parasu-Râma* avatar of Vishnu is not very interesting, as its glory is overshadowed by that of the great *Ramachandra Avatâra*. It was the liberation of the universe from Arjuna of the thousand arms which was accomplished under this incarnation. Here again, of course, we meet with this strange belief in "merit," for Arjuna acquired his malignant power wholly by deeds of unexampled piety. Arjuna was of the military class of Hindus, a Kshatriya, and Vishnu vowed to extirpate him and his whole caste. Using an axe or a bow, he did this; and it has been supposed that the legend is in essence historical, recording a great struggle in primeval times between Brahmans and Kshatriyas. The Arjuna of this avatar must be carefully distinguished from other heroes of his name.

The avatar of Vishnu as Rama is one of the most remarkable of Oriental myths, and is given in full in that magnificent epic, the *Râmâyana*. To this very day pious Vaishn'avas call out "Râma! Râma!" as the most potent of sacred exclamations or appeals for the immediate intervention of the deity who conquered the hosts of the ten-headed Râvana. And yet Râma was only the incarnation of *half* of the essential divinity of Vishnu. The whole history of this incarnation is one wild fight with demons and powers. It can scarcely be doubted that the myth is intimately connected with the inroad of South Indian Aryans into Ceylon. Such places as Adam's Bridge across the Palk Straits, Ramêswaram, Mahêndragiri, etc., are mentioned and minutely described. The monkey and bear

allies of Râma have been thought to be the Dravidian allies of the Brahman in his descent on Ceylon. The four leading personages in this avatar—which we must analyze in detail—are Râma, Râvana, Sîtâ, and Hanumân. But the whole story is full of clearly-defined characters, who grandly move through the divine drama; and finally all, in some way or other, combine to illustrate the omnipotence of Vishnu. (See RÂMÂYANA.)

The story of Râma's exploits may be thus sketched: Dasaratha, king of Ayodhyâ, had three wives and no sons, and to prolong his race (he was of the line of the Solar dynasty) he invoked the gods after solemnly performing the all-powerful horse-sacrifice. Then Vishnu appeared to him, and passed in the form of nectar into his three wives, one-half of his essence passing into *Kausalyâ*, one-quarter into *Sumitrâ*, and one-quarter into *Kaikeyî*. The result of this imbibing Narâyana was that the god was born in a threefold manner—as Râma (one-half Vishnu, son of Kausalyâ), as Lakshmana (one-quarter Vishnu), and as Bharata (also one-quarter Vishnu). It should also be mentioned that Lakshmana was a twin, and that his brother divided his quarter of divinity with him, but this does not affect the main current of the myth, wherein Lakshmana is more conspicuous than Bharata. At an early age the great sage *Vishwamitra* recognized in Râma the incarnation of Vishnu, and taking him with him to his secluded retreat in the jungle, got him to destroy the troublesome demons of the vicinity, who broke in upon the pious meditations of the sage and destroyed much of his peace of mind. This was the beginning of the war between Râma and the Râkshasas, or demons, which lasted all through the course of his history. They constantly polluted the sacrifices of the holy men, and Râma constantly pursued, fought with, and slew them. Under this head the *Râmâyana* gets to be positively wearisome. Râma always conquers, and is always bespattered with praise, and so on. Râma, in all his adventures, has Lakshmana at his side to share their dangers with him, and the friendship of the brothers is a delightful episode of ancient Hindu poetry. But the fairest creation of the Râma legend is the sweet and pure and loving Sîtâ. She was the daughter of *Janaka*, a potent monarch, who determined to give his daughter to the king most worthy of her, and who could perform the most wonderful martial exploits. A host of royalty presented itself to contend for the prize. Sîtâ was to be the bride of the man who could bend the enormous bow which only Siva, of gods and mortals, had ever bent before. The kings tried their best, but could not do so. Râma bent it like a willow wand, and flung it disdainfully away, and duly became the husband of the beautiful Sîtâ. In ancient Puranic legends, it may be mentioned in passing, we frequently come upon legendary accounts of strength being tested by the bow, and accuracy of aim, together with steadiness of the eye, by the arrow. Râma's first test of strength took place at Mithilâ. Râma's brethren married Sîtâ's sisters. Dasaratha, Râma's father, now grew old and imbecile, and installing Bharata, the third son, as his successor on the throne, banished his son Râma to live in the forests for fourteen years. Râma set out, honoring his father's mandate and preferring exile to disobedience to paternal authority. Soon after, Dasaratha died. Bharata now was proclaimed king of Ayodhyâ. Râma recommenced fighting the fiends. One of these was a she-devil, sister of the almighty demon of Ceylon. At the sight of Râma she became desperately enamored, but he repulsed her embraces. At last she became so importunate that her ears and nose had to be judicially removed, and they were carefully eliminated from her face by Râma's brother! Being naturally rather displeased, she hurried off to her brother Râvana, told him of Râma and his treatment, and then slyly played her trump card by telling the monstrous ogre of Ceylon that Râma possessed a wife who was simply peerless, and who could be easily carried off. Sîtâ was soon followed to the forest *Dandaka*, enticed from the home of Râma in the jungle whilst Râma himself was chasing a visionary deer, and carried away by the hideous Râvana to the central wilds of Ceylon. Râma, after a little lamentation, which forms a poetically touching episode, finds out to whom he owes the loss of his wife, and straightway sets off to make war against the demon of the "island" (*Lunka*). He collects a vast army of monkeys and other animals to aid him in his invasion. The son of the wind, *Hanumân*, leads the animal host. The rocks are torn down from the Himalayas and thrown into the strait between Râmêswaran and Ceylon, so as to form a bridge for the forces of the avenging avatar to cross over. Hanumân, however, crosses over to Ceylon in a more expeditious and agile way. He goes to Mâhêndragiri, a mountain about 5000 and 6000 feet above sea-level in the extreme S. of India, and takes a clear, clean leap from the top to Adam's Peak, the highest mountain in Ceylon. It appears that Hanumân, ere clearing this prodigious jump of 100 miles or so, leapt off with one foot, so as to alight on the other. So on the rocky tops of both the mountains we have alluded to, the traveller is shown by the simple natives the imprint in the hard rock of one huge foot. Râma of course proves victorious, destroys Râvana, and rescues Sîtâ, who is put into a furnace to test her purity after her rape by Râvana. Agni, the fire-god, sustains her through the ordeal, and her chastity is fully vindicated. Râma returns, after the expiration of the fourteen years' exile, to Ayodhyâ, and claims the kingdom from Bharata, who nobly abdicates. Everywhere, throughout Southern India at least, the two favorite names by which Vishnu is known are Râma and Krishna.

It is to the latter avatar that we now must come. It is extremely complex, and we cannot here devote great space to it. The fact is, that Krishna (together with Balarâma) was born a hero and champion of the great Pânduva kings in their wars against the Kurus. He is, as a god, simply the ideal personification of heroism, manliness of every kind, astuteness, and lust. He is of a deep-blue complexion, and is the perfection of manly beauty. He first comes to earth as the opponent of *Kausa*, the fiend-king, who terrorized over gods and men. To accomplish the end he had in view, and to annihilate Kausa, he, with Balarâma, determined to become incarnate, born of the seventh and eighth births of Devakî. Kausa had news of this, and killed every child born as soon as he could. But by means of stratagems and concealment Balarâma and Krishna escaped and grew up. When a few years old, they killed powerful demons and played all kinds of pranks with shepherds, uprooting trees, overturning heavy wagons, etc. But even this was an improvement on Krishna's prime achievements as an infant. He began his earthly career as an incarnate god by stealing butter! When seven years old, he killed a seven-headed snake-demon on the Jumna. A little time afterward he persuaded some votaries of Indra to worship the mountain *Govardhana*, rather than Vishnu himself. This greatly incensed the sky-god, who, to punish the land, sent down for a whole week a deluge of rain on the shepherds who had left off worshipping him; but these were not injured, for Krishna tore up by its roots the mountain Govardhana, and held it up, base upward, like an umbrella, over the heads of those who obeyed his behests! Finally, Indra worshipped Krishna as omnipotent. Vishnu now took to the wildest excesses of carnal lust. His dark-blue face and comely form at once produced an impression on the hearts of susceptible *Gôpis*, or shepherdesses, and led to a thousand of them being ravished by Krishna. Jayadêva, the poet of Kinduvilva, narrates that after a little Krishna became weary of, and penitent for, these worldly excesses, and married as his one wife the pure, saintly, ethereal, and intellectual Radha. However, if this be true, he soon got tired of his monogamy, for we find him marrying shortly afterward sixteen thousand one hundred virgins! Krishna and his brother at length slay their great enemy Kausa, after having killed two of his pugilists before thought to be invincible. Krishna was especially noted for lust and for thieving; so now we read of him stealing a miraculous tree from Indra's heaven. He died by an arrow from a hunter's bow. The hunter thought he was a deer, and wounded him in the sole of his foot. A strangely commonplace ending to the life of a god who had sixteen thousand one hundred wives! Krishna is one of the wildest of the creations of Oriental imagination. But he is thoroughly *typical*. He is dark of face in a land of dark complexions. He is handsome; and the Oriental loves the beautiful as much as most men do. He is deceitful, and wily, and shrewd, and unscrupulous; and the Asiatic has a great regard for these "virtues." He is lustful, but India is a land where wives are bought and sold, and where he that has most money indulges most in the pampering of his sexual passions. He steals; and the Hindû shrugs his shoulders, and only wishes he could steal the whole land, as perhaps some civilized nations have done in their quiet and eminently genteel and respectable way. He is brave; the timid Brahman delights in courage, with a vague sort of admiration for the inconceivable. Then Vishnu redresses wrongs. Never mind his faults, then, say they, if this be true. His wife is *Sri* or *Lakshmi*, the beautiful goddess of prosperity; and prosperity the Hindû fully appreciates. Vishnu is therefore a most popular god. He is not feared like Siva, but he is loved in a dim, fanatical kind of way. His idols—witness those of Srirangam—are covered with robes, and plates, and necklaces, and armlets, and rings, and anklets, and crowns, and overshadowed by umbrellas and seated on thrones, each and all ablaze with jewels of the largest size and first water—diamond, and ruby, and emerald, and topaz, and opal, and sapphire, and pearl. Much

more might be written of Vishnu, but we must conclude our remarks by a passing allusion to the *Buddha* avatar, the ninth. It is evidently a late invention of the Jaina sect, who tried (see JAINAS) to reconcile Brahmanism with Buddhism. The last avatar is yet to come, when the great god with the four hands will accomplish all things in the final *Kalki* avatar. R. C. CALDWELL.

**Visible Speech.** See DEAF AND DUMB, by HON. H. BARNARD, LL.D.; and VOICE, by PROF. R. R. RAYMOND, A.M.

**Visigoths.** See GOTHS, by PROF. CLEMENS PETERSEN.

**Vision.** See APPENDIX.

**Vision, Defects of.** See SIGHT, DEFECTS IN, in APPENDIX.

**Visitation,** in law. See CORPORATION (§ iv.), by PROF. T. W. DWIGHT, LL.D.

**Visita'tion Nuns,** first established in 1610 at Annecy, Savoy, by St. Francis de Sales and St. Jane Frances de Chantal; received papal approbation in 1626; introduced into the U. S. in 1808 by Teresa Lalor. The order has numerous convents in this country and in Europe.

**Viswâmitra.** *Viswâmitra* was a great sage of the Kshatriya caste. He is said to have lived many thousands of years, and to have performed constant austerities of an astonishing nature. He is represented as of kingly dignity, and the great foe of *Vasishtha*. Between Vasishtha and Viswâmitra there was a constant conflict for supremacy, the former being at first victorious, but finally the latter. The whole legend is in praise of the Brahman caste, in contradistinction to the warrior division of Hindû sects. It is indubitably an extremely ancient myth. Vasishtha seems to have been the personification of Brahmanism, and Viswâmitra the personification of the Kshatriya caste. When, after many thousands of years of austerities, Viswâmitra, by merit, becomes the equal or superior of Vasishtha, this is only accomplished by his becoming a Brahmarshi, or Brâhmana Rishi, a sage of a higher caste than that in which he was born. Thus, the Brahman element in the history of Viswâmitra is clearly traceable. This history is an extremely quaint and interesting one. It extends from the earliest Vedic times, through the epic to the Puranic. Its episodes, as given by various writers, are, however, extremely contradictory. We must give briefly a version or two of the acts of the life of this celebrated sage and ascetic, selecting as best we can the accounts most widely credited.

Viswâmitra traces his origin to the monarch *Purûravas*. His father was *Gâthin* or *Gâdhi*. The well-known character *Jamadagni* was said to be his nephew, who is connected with the *Parasu-râma avatâra* of Vishnu, which we have previously alluded to. Viswâmitra had a hundred sons, and could only be diverted from meritorious austerities and sacrifices by being snared by beautiful women. He wrote several of the hymns of the *Rig-Vêda*. The rivalry between Vasishtha and Viswâmitra is said to have begun about a question of sacrificial precedence. Afterward Viswâmitra visited Vasishtha, who had one of those miraculous cows of prosperity and plenty—a kind of living Aladdin's lamp, the owner of which could have pretty much what he liked—which is so frequently met with in Indian legends. Viswâmitra abused the sumptuous hospitality of his host, and tried to seize and carry away the wonderful cow. But the cow asserted its divine origin, and, emitting hosts of warriors, destroyed the hosts of Viswâmitra, who had to fly. He now became convinced of the invincibility of Brahmans when pitted against any other caste. So he determined to become a Brahman. Many thousand years passed before he attained his object, but he did finally become a pure Brahmanic sage. First, after a thousand years or so of penance, meditation, and deeds of holiness, austerity, and sacrificial rites and observances, he became a secular Rishi, then a Rishi pure and simple, then a chief of Rishis, and then, last of all, the goal of his desires, a Brahman Rishi, to whom Vasishtha himself had to yield precedence. So he became the "friend of all the gods," as his name in Sanskrit signifies. But before he attained the summit of his desires, he was often thwarted by the gods themselves, who were afraid that he would become too powerful. They consulted, and found out the weak point in the saint's character—the love of the fair sex. So they sent to him "her of the fish-bright eyes, the flowering tendril of the gods," *Menakâ*. Her dalliance quite turned the head of the sage. Then afterward a beautiful creature called *Rambhâ* did precisely the same thing. Amongst the miracles performed by Viswâmitra was that of causing a king to ascend bodily to heaven, and by an incantation to prevent the sacrificial immolation of a human victim. Whilst he raised himself to a higher caste, he by his power could lower a man's caste, and indeed did so in the case of fifty of his own sons. The splendid hymns in the third mandala of the *Rig-Vêda* are in most part ascribed to Viswâmitra. In them he confines his devotion to Agni, the deity of fire. He begins thus: "Render me vigorous, Agni, since thou hast made me the bearer of the Soma to offer it in the sacrifice: honoring the gods who are present, I take hold of the stone (to express the juice); I propitiate them; do thou, Agni, protect my person. We have performed, Agni, a successful sacrifice; may my praise magnify (thee) as worshipping thee with fuel and with reverence: (the gods) from heaven desire the adoration of the pious, who are anxious to praise the adorable and mighty Agni. The gods discovered the graceful Agni concealed amidst the waters of the flowing rivers for the purpose of (sacred) acts—Agni, who is intelligent, of purified vigor, and friendly; who from his birth bestowed happiness on earth and heaven." . . . "Spreading through the firmament with shining limbs, sanctifying the rite with intelligent and purifying energies, and clothed with radiance, he bestows upon the worshipper abundant food and great and undiminished prosperity." . . . "Son of strength, sustained by all, thou shinest, possessing bright and rapid rays. When the vigorous Agni is magnified by praise, then the showers of sweet rain descend." . . . "I, the institutor of the rite, worship thee with oblations. Desirous of thy favor, I implore thy friendship. Grant, together with the gods, protection to him who praises thee. Preserve us with thy well-regulated rays." (See H. H. Wilson's *Rig-Veda Sanhitâ*, vol. ii. p. 318, to vol. iii. p. 14.) The above will give a fair idea of the style of the Vedic hymns ascribed to Viswâmitra. R. C. CALDWELL.

**Vis'tula** [Pol. *Wisla;* Ger. *Weichsel*], river of Europe, rises in Austrian Silesia in the Carpathian Mountains, 2000 feet above the level of the sea, flows with a winding course, but generally in a northern direction, through Poland and East Prussia, and enters the Baltic through several mouths. Its entire course is 616 miles; at its entrance into Poland, after receiving the San, it is navigable for large vessels.

**Vita'ceæ** [from *Vitis*, the most important genus], a natural order of exogenous and mostly climbing woody plants. There are 260 recognized species, but the grapevines (*Vitis vinifera, V. labrusca*) are the only ones of economic value, although several others are planted for ornamental purposes.

**Vital** (ORDERIC). See ORDERICUS VITALIS.

**Vital Statistics.** See APPENDIX.

**Vitebsk',** government of Western Russia, on both sides of the Dwina, comprises an area of 17,336 sq. m., with 888,727 inhabitants. The surface is level, and covered with forests which yield excellent timber and mast; with lakes which are rich with fish; and with marshes which afford good pastures. Though the soil in general is not very fertile, much grain and flax are raised, and cattle and coarse-woolled sheep are reared.

**Vitebsk,** town of Russia, capital of the government of Vitebsk, on the Dwina, is mostly built of wood, and has no manufactures, but an active trade in corn, flax, hemp, and cattle. P. 28,944.

**Vit'elline** [Lat. *vitellus*, "yolk of egg"], the albuminoid or proteid constituent of the yolk of eggs. (See ALBUMINOIDS.) It has been ranked as a special compound of this class, but is now rather deemed by some to be merely a mixture of ordinary albumen and caseine. It is obtained by simple treatment of yelk with ether, which dissolves out the oily and coloring matters. H. WURTZ.

**Vitel'lius** (AULUS), b. in Rome Sept. 24, 15 A. D.; was a great favorite with Tiberius, Caligula, Claudius, and Nero, who bestowed the highest offices and greatest honors on him, although he was a sluggish glutton, generally drunk every day. Galba sent him to Germany in Dec., 68, as commander of the legions there—nobody understood why—and here he was proclaimed emperor by the soldiers Jan. 3, 69. His friends urged him forward, and fortune favored him. Galba was murdered Jan. 15, and Spain and Gallia recognized Vitellius. In Rome, Otho had assumed the imperial dignity, but he was defeated at Bedriacum by Vitellius's generals, and stabbed himself Apr. 15, 69. July 18, Vitellius entered Rome at the head of an army, or rather a loose band, of about 60,000 soldiers. He made very few confiscations or executions; he seemed bent only on eating and drinking, and for these purposes he spent fabulous sums. Meanwhile, VESPASIAN (which see) had been proclaimed emperor by the armies of the East, and his generals approached Italy. Vitellius now found nothing but indifference or treachery. He tried to negotiate, but failed. He offered to resign, but too late. He was found hiding in a corner of the deserted palace, dragged out into the Forum, and put to death by a common soldier Dec. 21, 69.

**Vitellus.** See EMBRYOLOGY, by PROF. J. C. DALTON, M.D.

**Viter'bo** [anc. *Viterbium*], a city and commune in the province of Rome, Central Italy, in a region fertile in a great variety of agricultural products, among which hemp

is particularly important, with rich pasturage and many valuable mineral deposits. From these sources is derived a great quantity of raw material, the elaboration of which furnishes employment to many laborers. Viterbo has also several mineral springs, very various in temperature and composition, which are beneficial in many diseases. Among these is the *Bulicame*, a large spring in continual ebullition, mentioned by Dante. With these great natural advantages Viterbo naturally became an important seat of industry and civilization at a very early period. The Etruscan cemeteries of Castel d'Asso, Norchia, and others are very striking testimonials to the wealth and culture of old Etruria, and there are in the town and neighborhood numerous interesting specimens of Roman and mediæval architectural art. It does not appear, however, that Viterbo or its environs was ever the site of any considerable Roman city, and, in fact, the town can scarcely be said to have a history. The cathedral is of early date, and contains a picture by Mantegna, and in the church of the Osservanti del Paradiso is a fresco ascribed to Leonardo da Vinci. The Santuario della Quercia, just without the town, is much admired for its architecture and for its sculptures and terra-cottas, among which latter are renowned works by Luca and Agostino della Robbia. The villa Lante della Rovere and that of Buen Retiro are celebrated, as is also a fountain called Fontana de' Mori. Many civil structures in Viterbo have architectural features of much merit. P. 26,237.

**Vitet'** (Louis), b. in Paris Oct. 18, 1802; was educated for a teacher, but engaged in journalism and literature; became a contributor to the *Globe*, and published with considerable success the dramatic poems *Les Barricades* (1826), *Les États de Blois* (1827), and *La Mort de Henri III.* (1829). From the revolution of July, 1830, to the *coup d'état*, Dec. 2, 1851, he held various offices in the civil service, but retired then into private life, and devoted himself exclusively to literature. D. in Paris June 5, 1873. His principal works are — *Eustache Lesueur* (1843), *Monographie de l'Église de Notre-Dame de Noyon* (1845), *Fragments et Mélanges* (2 vols., 1846), *Essais historiques et littéraires* (1862), *Études sur l'Histoire de l'Art* (1864), etc.

**Viticulture.** See Vine-Culture, by E. W. Hilgard.

**Viti Islands.** See Feejee Islands.

**Vitis.** See Grape, Vine-Culture, and Vitaceæ.

**Vito'ria,** town of Spain, capital of the province of Alava, consists of an old town, narrow, gloomy, and dirty, and a new town, open, airy, and elegant, with many fine buildings and beautiful promenades. Articles of brass, iron, and ebony, earthenware, candles, leather, and chocolate, are extensively manufactured, and a brisk trade in oil, wine, fruits, and corn is carried on. On June 21, 1813, the allied English and Spanish army under Wellington gained a victory here over the French under Jourdan. P. 18,700.

**Vitre',** town of France, department of Ille-et-Vilaine, on the Vilaine, is a curious old place, but interesting and lively. Its manufactures of leather and hosiery are extensive; has a brisk trade in wax, honey, and grain. P. 8900.

**Vitrification.** See Glass, by C. G. Leland, and Glass, American Manufacture of, by L. P. Brockett.

**Vit'rified Forts,** a remarkable class of pre-historic fortifications almost peculiar to Scotland and its islands. They are made of silicious stone, and the inside—in some cases the outside, or indeed the whole mass—has been vitrified by the action of fire and of wood-ashes, the stone being transformed into a kind of glass. Whether the vitrification was intentional or not, is a mooted question.

**Vitriol, Elixir of.** See Mineral Acids, Medicinal Uses of, by Prof. E. Curtis, M. D.

**Vitriol, Oil of.** See Sulphuric Acid, by H. Wurtz, A. M.

**Vit'riols** [Lat. *vitrum*, from the glassy character of the crystals], a generic name among the earlier chemists for the *sulphates*, often still applied in common language. Thus, ferrous sulphate is *green vitriol* or iron vitriol, cupric sulphate is *blue vitriol* or copper vitriol, zinc sulphate is *white vitriol* or zinc vitriol, and so on. Sulphuric acid was also called vitriolic acid, as forming vitriols or obtained from them, as in early times it was so obtained. H. Wurtz.

**Vitru'vius Pol'lio,** a Roman architect and author of a treatise on architecture in ten books, dedicated to the emperor Augustus. The place of his birth is uncertain, but it was Verona, if we may receive the testimony of an inscription found there. His work appears from internal evidence to have been composed about B. C. 14. In respect to its subject it is very important, as it is the only one of the kind that has come down to us, and it is expressly mentioned by Pliny as one of his authorities. Vitruvius discussed his art in its widest sense. In the first seven books he treats of architecture proper, ecclesiastical and private building; in the eighth, of water and aqueducts; in the ninth, of sun-dials; and in the tenth, of machines. His chief sources were Greek writers, but his knowledge of Greek seems deficient. Though he possessed varied learning and a philosophic turn, he appears to have been an unpractised author, and frequently fails to express himself intelligibly. Some things, indeed, are obscure from our own want of information on this complicated subject at this distance from the period of the writer; thus, his *modulus*, or unit employed in giving the proportions of an ancient temple, is maintained by Aurès to be the diameter of the column at its average vertical height, but by Reber to be the diameter of the lower end of the column proper. We have also an abridgment of the work by a very ancient but unknown author, who has preserved the arrangement of the original, but has limited the subject to private buildings. Vitruvius has been translated by Newton in 2 vols. fol., with 47 plates (London, 1771–91), and by Wilkins, also in 2 vols. fol. (London, 1813). Charles Short.

**Vitry-le-François',** town of France, department of Marne, on the Marne, is fortified, manufactures hats, hosiery, oil, and trades in wood, coal, corn, and iron. P. 7622.

**Vitto'ria,** town of Sicily, province of Syracuse, about 20 miles N. W. of Modica. In the neighboring plains are raised vast quantities of the soda-plant, the ashes of which are exported to Marseilles for the use of the soap-factories of that city. This town received its name from a victory obtained by Roger over the Arabs in 1092. P. 17,921.

**Vittoria Colonna.** See Colonna (Vittoria).

**Vitus's Dance, Saint.** See Saint Vitus's Dance, by A. M. Hamilton, M. D.

**Vivarium.** See Aquarium.

**Viver'ridæ** [from *Viverra*—an ancient name—the typical genus], a family of mammals of the order Feræ, containing the civets and allied types. The form is generally more or less elongated, and somewhat similar to that of the weasels; the head is elongate and terminates in a prominent snout; the feet are neither typically digitigrade, as in the cats and dogs, nor plantigrade, as in the bears, but rather intermediate, sometimes tending in one direction and sometimes in another; the toes are mostly well developed, the claws sharp; the tail more or less elongated; the teeth 36 to 40 in number, and moderate in size (M. $\frac{2}{2}$, rarely $\frac{1}{2}$; P. M. $\frac{4}{4}$, exceptionally $\frac{3}{3}$; C. $\frac{1}{1}$; I. $\frac{3}{3} \times 2$); the true molars of the upper and last of the lower jaw tubercular. The skull is of the "æluroid" (cat-like) type, the paroccipital processes being closely applied to the auditory bullæ; the mastoid processes small or obsolete, the external auditory meatus very short or imperfect; the carotid canals minute and superficial or obsolete; the condyloid foramina and foramina lacera postica debouching in common fossæ, and the glenoid foramina minute or null; the auditory bullæ are divided; the intestinal canal is generally provided with a cæcum; no prostate glands are developed; the os penis is rudimentary. These characters define a natural association of genera, and exclude several that have been approximated to the type by different naturalists. As thus limited, the family is peculiar to the Old World, and especially the tropical portions of Asia and Africa. The American genus, *Bassaris*, formerly referred to the family by most authors, is now proved, by the structure of the skull, to be most nearly related to the raccoons, and not at all to the viverrids. The genera and species are numerous, and have been grouped under eleven, or perhaps twelve, sub-families—viz. (1) Viverrinæ, (2) Prionodontinæ, (3) Galidiinæ, (4) Hemigaliinæ, (5) Paradoxurinæ, (6) Arctictidinæ, (7) Cynogalinæ, (8) Herpestinæ, (9) Cynictidinæ, (10) Rhinogalinæ, (11) Crossarchinæ, and perhaps (12) Euplerinæ. These, however, require confirmation, and more exact appreciation of their relations than they have yet received. The species are of small or moderate size, mostly ranging from the dimensions of a weasel to those of a dog. They are all carnivorous, preying on small animals of various kinds or their eggs, some attacking chiefly, by preference, birds, others serpents, others insects, and still others eggs; but they often fail to discriminate in this respect, and may take to either kind in the absence of a choice. The most noteworthy species are the civets (*Viverra civetta*, etc.), genets (*Genetta vulgaris*, etc.), paradoxures (*Paradoxurus typus*, etc.), binturong (*Arctictis binturong*), ichneumons or mungooses (*Herpestes ichneumon*, etc.), and suricate (*Suricata zenick*), the principal of which will be found noticed and illustrated under their respective names in this Cyclopædia. Theodore Gill.

**Vives'** (Juan Luis), D. C. L., b. at Valencia, Spain, in Mar., 1492; studied at the universities of Paris and Louvain, after which he visited England, and was chosen one of the first fellows of Corpus Christi College, Oxford, 1517;

was employed by Henry VIII. as tutor to the princess Mary (1523), for whose use he wrote his *De Ratione Studii Puerilis* and *De Institutione Fœminæ Christianæ;* was disgraced and imprisoned for having argued and written against the divorce of Queen Catharine of Aragon (1528), and afterward settled as a classical teacher at Bruges (1529), where he married and spent the remainder of his life; with his intimate friends, Erasmus and Budæus, formed a triumvirate to which was ascribed the leading part in the revival of literature. D. at Bruges May 6, 1540. His Latin *Works* were printed at Bâle (2 vols., 1555), not including, however, his most noted performance, the commentaries on St. Augustine's *De Civitate Dei*, which had appeared in 1522. Among his works were treatises *On the Truth of the Christian Faith, On the Soul and Life,* and *On the Causes of the Decline of the Arts.*

**Viv'ian,** p.-v. and tp., Waseca co., Minn. P. 305.

**Vivia'ni** (VINCENZO), b. in Florence Apr. 5, 1622; studied mathematics under Galileo and Torricelli; was member of the Florentine Academy, also of the French Academy after 1669; received a pension from Louis XIV., and d. at Florence Sept. 22, 1703. His principal works are—*Divinatio in quintum Conicorum Apollonii Pergæi* (1659) and *Divinatio in Aristæum* (1701).

**Vivisec'tion** [literally, the "opening of the living body" (*sectio vivi*), in contradistinction to that of the dead body (*sectio cadaveris*)]. The examination of the interior of the dead body, both in animals and in man, is resorted to for purposes of anatomical research, and also to ascertain the changes produced by disease. Vivisection, on the other hand, is employed for investigating, in the lower animals, the action of the organs during life. The term, however, though strictly applicable, in its etymological sense, only to cutting operations, is used to designate all experiments of a scientific nature performed upon living animals, whether they consist of division of the parts by cutting instruments, or their compression by ligatures, or the subjection of the animal to special conditions of food, temperature, or respiration, or to the action of drugs and medicines. In all these cases the object of the experimenter is to ascertain some fact in physiology or pathology which cannot be otherwise investigated.

The necessity for resorting to experiments upon living animals in physiology and the allied sciences depends upon the obvious fact that these sciences have to deal with the actions and phenomena of life; and consequently, in order to study them successfully, the necessary investigations must be made while life is going on. Examination of the dead body reveals the form and structure of the internal parts, but it does not yield a knowledge of their physiological actions, because these actions have ceased and the organs have relapsed into a quiescent condition. The physiologist, therefore, makes the living body the subject of his investigation for the same reason that the chemist experiments upon the reactions of chemical substances, or the student of electricity upon those which exhibit electrical phenomena. Where the necessary steps of an experiment are of a nature to cause pain to the animal, as in cutting operations, this is generally avoided by the use of ether or chloroform, in the same manner as when these anæsthetics are administered for surgical operations upon the human subject.

The results which have been attained by means of experiment upon the living body constitute nearly the whole of the actual knowledge possessed in physiology. The earliest investigator of note who employed this method was Galen, and his discovery of the true function of the *arteries,* about the year 150 of the Christian era, forms a striking illustration of its necessity and usefulness. Previously to that time the arteries were thought, as their name indicates, to be air-tubes for distributing throughout the body the air taken in at the lungs; while the veins were regarded as the only channels for the conveyance of blood. This conclusion was naturally derived from the appearance of the two sets of vessels in the dead body; for at the time of death the blood leaves the arteries in great measure and accumulates in the veins, and when the body is opened and the arteries cut across, they resume their tubular form, owing to the elasticity of their walls. Thus, the dissector of the dead body found the veins containing blood and the arteries containing air. When an artery was accidentally wounded during life and discharged blood, it was thought that it had first emptied itself of the air, and that the blood was afterward drawn into it from other parts. But Galen experimented upon this subject by exposing an artery in the living animal, and including a portion of it between two ligatures placed a certain distance apart. He then opened it between the ligatures, and showed that it discharged no air, but only blood. Consequently, it must have contained blood before-hand. This was the first demonstration of the important fact that the arteries are blood-vessels, and that there are in the body two kinds of blood—namely, venous blood in the veins, and arterial blood in the arteries. William Harvey in 1628 completed our fundamental knowledge of the circulation by his discovery that the blood, after passing from the heart outward through the arteries, returns again to the heart by the veins, thus moving in a continuous round through the vascular system. This discovery was also the fruit of experimentation on living animals; and it was by the same means that other eminent physicians of the time, who at first doubted Harvey's doctrine, were finally enabled to convince themselves of its truth. The real action of the *heart* as a propelling organ for the blood, and the true nature of the arterial *pulse,* were both parts of the same discovery, and were ascertained in a similar way.

The knowledge thus gained of the circulation was not only of the highest value in itself, but soon led to other important results, one of which was the possibility of the *transfusion of blood* from one animal to another. This was first demonstrated in 1665 by Richard Lower, who succeeded in transferring blood from the vessels of one dog into those of another, the second dog being allowed to bleed freely at the same time, but being kept alive by the blood received from the first. This showed that death from hæmorrhage might be prevented by the introduction of blood from another animal of the same species. After a variety of successes and failures in applying this operation to the human subject, the matter was again investigated experimentally by Dr. Blundell in 1824, and has been the subject of numerous later researches. They have resulted in improved methods of performing the operation, and in greater knowledge of its proper application as a remedy. It is now a recognized means of preserving life in cases of exhaustion from abundant or long-continued hæmorrhage.

The function of *respiration,* which is immediately essential to life, has come to be understood mainly through experiments upon animals. The first important knowledge in regard to it was obtained in 1670 by the Hon. Robert Boyle, who enclosed animals of various kinds in the receiver of the air-pump, then a recent invention. He demonstrated in this way not only that atmospheric air is necessary in all cases to the maintenance of life, but also that when confined in a limited space it becomes vitiated by continued respiration, and that in order to maintain life the vitiated air must be removed and replaced by a fresh supply. It was soon afterward found by Mayow that the air thus vitiated by the respiration of animals was also diminished in volume; and he concluded, accordingly, that something in it was consumed or used up by the process of respiration. Lavoisier in 1777 discovered, by experimenting with sparrows, that the respirable ingredient of the air could be removed by the calcination or oxidation of mercury; showing that the substance (oxygen) which combined with the metal was the same with that absorbed by animals in the process of breathing. But if he set free the oxygen from its metallic combination, and added it to the irrespirable residue of the air, the mixture again became respirable and capable of supporting life. He further proved that the animals in breathing not only consumed the oxygen of the atmospheric air, but at the same time exhaled another gas—namely, carbonic acid—which could be made to unite with lime-water and form carbonate of lime. In this manner it was ascertained that the process of respiration consists essentially in the absorption of oxygen and the exhalation of carbonic acid. Without the knowledge of such fundamental facts all further discovery in this direction would be impossible; but since the time of Lavoisier many important particulars have been, and are still being, added to physiology, as to the time, place, and quantity of the absorption and discharge of the gases of respiration, their relation to each other, the mode of their consumption and production in the body, and their influence upon the fitness of the air for breathing. The whole subject of ventilation and its practical application for the preservation of health depend upon a distinct knowledge of the composition of the air and its physiological properties in regard to respiration.

The functions of the *nervous system* have been the subject of experimental investigation from very early times. Galen showed that the nerves are the channels through which the commands of the will are conveyed to the muscles, and that the spinal cord is the conductor for voluntary impulses proceeding from the brain to the nerves of the body and limbs. The researches of modern physiologists have been directed to ascertain the special functions residing in particular nerves or nervous centres. The crossed action of the spinal cord in its communication with the brain, the different properties of the anterior and posterior roots of the spinal nerves—of which the former serve for motion and the latter for sensation—the distinction between the motor

and sensitive nerves of the face, the connection of the medulla oblongata with the function of respiration, and the influence of the pneumogastric nerve on the movements of the chest and the action of the heart,—are a few examples among many of the important discoveries effected in this way. A knowledge of these details is essential for the medical practitioner, since it is only by their aid that he can learn from the external nervous symptoms what is the nature of the internal injury or where it is located.

The natural mode of the *reproduction of bone* when a portion of its substance is destroyed or removed was discovered by a series of researches extending from 1740 to 1858, and conducted mainly by Duhamel, Hunter, Syme, and Ollier. When a bone is broken into small pieces, or when it is otherwise so injured that a considerable part of it must be removed, the remnants generally fail to unite with each other by solid tissue, and the limb, remaining permanently flexible at the point of fracture, is accordingly of no value for practical purposes. Formerly, such a limb was often amputated, in preference to leaving it as a useless incumbrance to the patient. But it was discovered by the experiments above mentioned that if the fibrous covering of the bone, or its "periosteum," were left behind in such cases, while the broken fragments were removed, new bony tissue would be produced and a solid union effected. This method of practice was consequently adopted in the treatment of fractures in the human subject, and has been the means of saving many limbs which would otherwise have been left in a state of deformity or wholly sacrificed.

The foregoing illustrations indicate the manner in which experimentation on animals has been rendered serviceable to physiological science and to practical medicine. It has also produced results of value in other directions, among which may be mentioned the practice and usefulness of *artificial respiration* in cases of drowning, hanging, and the suspended animation of newly-born infants; the improved surgical operation for the cure of *aneurism;* the successful study of the various *digestive secretions;* the investigation of *parasitic and contagious diseases;* the best treatment for *venomous wounds*, like those of the rattlesnake; and the action of *poisons, drugs, and medicines,* with their remedies and antidotes. J. C. DALTON.

**Vizagapatam′,** town of British India, presidency of Madras, the capital of a district of the same name, at the entrance of the Veragatam into the Bay of Bengal, in lat. 17° 41′ N., has a good harbor, sheltered by the Dolphin's Nose, a cliff about 1500 feet high, and is a military station, but is considered unhealthy for Europeans. P. 40,000.

**Vizier′** [Arab., "burden-bearer"], the title of many dignitaries in Mohammedan countries, first bestowed in 750 A. D. by Abul Abbas (Al Saffah), the first Abbaside caliph, upon his prime minister, whose duty it was to bear as far as possible the burdens of his master. At present the grand vizier of Turkey is the chief minister of state, and holds the most important position under the sultan. A great number of inferior dignitaries are called viziers.

**Vizzi′ni,** town of Sicily, province of Catania, in a healthy position on a hill near the source of the Dirillo. There are some respectable buildings here, and the neighborhood is fruitful and abounds in pasturage. The commune consists of several fractions, with a pop. of 14,942.

**Vlaar′dingen,** town of the Netherlands, province of South Holland, on the Meuse, has a good harbor and carries on an extensive herring fishery and some shipbuilding and shipping business. P. 8324.

**Vladimeer′,** government of Russia, nearly in the centre of the country, bounded S. W. by Moscow, comprises an area of 18,445 sq. m., with 1,239,051 inhabitants. The surface is level and the soil not fertile; less grain is produced than demanded for home consumption, but hemp is grown with success. Large forests of pine occur; also lakes rich in fish. Iron is found in several places and extensively worked. On account of the poverty of the soil manufacturing industry has been largely developed. Iron, glass, earthenware, cotton and linen goods are extensively manufactured. The iron-foundries alone employ over 6000 hands, and the value of its cotton manufactures amounts annually to about 13,000,000 rubles.

**Vladimeer,** town of Russia, capital of the government of Vladimeer, on the Kliasma, is beautifully situated, well built, and contains many remains from the time when it was the capital of Russia (thirteenth and fourteenth centuries). The inhabitants of the adjacent districts are celebrated as stone-workers, oven-builders, tilers, slaters, shinglers, and carpenters. P. 13,763.

**Vladimeer,** or **Wladimir,** town of European Russia, government of Volhynia, has 4 annual fairs and a trade in silk and salt. P. 5500.

**Vladimeer the Great.** See RUSSIA, by PROF. CLEMENS PETERSEN, A. M.

**Vladislaus.** See LADISLAS.

**Vliessingen.** See FLUSHING.

**Vocabulary.** See LEXICON, by HON. G. P. MARSH.

**Vode′na,** town of European Turkey, eyalet of Room-Elee, on the Vistritza, manufactures cotton and woollen fabrics. It occupies the site of the ancient EDESSA (which see) of Macedonia. P. 12,264.

**Vo′gel** (EDUARD), b. at Crefeld, Rhenish Prussia, Mar. 7, 1829; was educated at Leipsic; studied astronomy and natural science there and in Berlin under Encke; assisted Hind for two years in his labors at Bishop's observatory in London, and went in 1853 to Africa, with the support of the English government, to join the expedition of Clapperton, Barth, and Overweg. Feb. 20, 1853, he sailed from England to Tripolis; Aug. 5 he reached Moorzook, and Jan. 13, 1854, Kuka, the capital of Bornoo. From this place he undertook various expeditions to the adjacent countries; met Barth at Bundi Dec. 1, 1854; visited Yacoba, and returned to Kuka Dec. 1, 1855. At this date his own notes stop, but it was afterward ascertained that on Jan. 1, 1856, he started eastward, penetrated to Wara, the capital of Waday, and was assassinated there Feb. 8, 1856. As his fate was uncertain for a long time, several expeditions were fitted out to find him. His notes have been communicated by his sister, Elise Polko, in her *Erinnerungen an einen Verschollenen* (Leipsic, 1853).

**Voghe′ra** [*Iria*], town of Italy, province of Pavia, in the rich and highly-cultivated plain between the Po and the Apennines. The Via Emilia passes directly through the town, which is also connected by railway with Genoa, Milan, etc. The ancient castle with its four towers is still standing, but the walls and other defences are demolished. Several of the public buildings are noticeable, and the church of San Lorenzo, on the site of an older one of the same name, is a grand specimen of the Tuscan architecture of the seventeenth century. This church contains some curious monuments, relics, and reliquaries. The theatre is worthy of a large city. Public instruction is well cared for, and Voghera has the honor of being one of the first towns of Italy to practise the art of printing. The manufactories here are extensive; hempen, linen, and cotton fabrics are produced, and the hats of Voghera are largely exported, even to America. The agriculture of the vicinity is also very prosperous. Voghera was settled before the Roman period, and was a place of some importance when destroyed by the Northern invaders early in our era. Its mediæval history is closely connected with that of Milan and Genoa. Roman antiquities of interest are found in and near Voghera. P. 15,500.

**Vogt** (KARL), b. at Giessen, in Hesse-Darmstadt, July 5, 1817; studied medicine at the university of his native city, and worked a year and a half in the laboratory of Liebig; removed in 1835 to Berne, where he studied anatomy and physiology under Valentin; settled in 1839 at Neufchâtel, where for five years he assisted Agassiz in his various investigations; took part in editing the first two volumes of his *Histoire naturelle des Poissons d'Eau douce,* and published independently *Untersuchungen über die Entwickelung der Geburtshelferkröte* (1842) and *Im Gebirg und auf den Gletschern* (1843); resided from 1844 to 1846 in Paris, and published *Lehrbuch der Geologie und Petrefactenkunde* (2 vols., 1846) and *Physiologische Briefe* (1845–46); travelled in Italy, and was in 1847 appointed professor of natural history at Giessen. On account of his participation in the political movements of 1848 as one of the farthest-going radicals, he lost his chair in Giessen, and left Germany, but in 1852 was appointed professor of geology at Geneva, and in 1853 at Berne. Of his numerous writings, strictly scientific, popular, and polemical, the most remarkable are—*Ocean und Mittelmeer* (2 vols., 1848), *Untersuchungen über Thierstaaten* (1851), exceedingly satirical; *Bilder aus dem Thierleben* (1852), *Zoologische Briefe* (1851), one of his principal works; *Köhlerglaube und Wissenschaft* (1852), full of bitter scorn and sarcasm; *Die künstliche Fischzucht* (1859), *Grundriss der Geologie* (1860), *Vorlesungen über den Menschen* (1864), *Ueber die Mikrocephalen oder Affenmenschen* (1866), *Sechs Vorlesungen über die Darwinsche Theorie* (1868), *Politische Briefe an F. Kolb* (1870). As a writer, Karl Vogt is clear, rapid, and very entertaining, but his polemics against what he considers encroachments on the rights of science by superannuated superstitions is often crude.

**Vogüé, de** (CHARLES JEAN MELCHIOR), COUNT, b. about 1825; travelled in Syria and Palestine 1853–54; published *Les Églises de la Terre-Sainte* (1859), *Le Temple de Jérusalem* (1864), *L'Architecture civile et religieuse du I. au VII. Siècle dans la Syrie centrale* (1865–68); was sent as ambas-

sador to Constantinople in 1871, and thence transferred to Vienna in 1875.

**Voice** (in elocution). Voice, in the generic sense, is a property of all living animals which are structurally endowed with a capacity to produce certain sounds uttered from the mouth: articulate voice, the organ of language—which, as the vehicle of thought and feeling, is the divinely-ordered means of social intercourse and intellectual progress—belongs to man alone. The methods by which the intellectual attainments of any one member of the human family may thus become the possession of all are two—viz. *speaking* and *singing*.

These must have been almost coeval in their origin; for, as the deductions of reason assure us that the social necessities of the race must have very early given rise to spoken language, so a universal experience unites with remotest tradition in ascribing to every human being a religious impulse which finds its most adequate expression in song. The least-civilized tribes have always celebrated their festivals of worship with rude rhythmic chants, while the cultivated nations of all time have cherished music as the ethereal medium of poetry and a potent agent in the culture of the soul. For the musical side of vocal art science has already done much by defining its forms and improving its processes. Mathematics and physics have expounded the laws of sound; philosophers have discovered the immutable principles upon which melody, harmony, and rhythm depend; and the definite nature of the work to be accomplished in giving force and expression to the singing voice has made it possible to conduct that work on a well-ascertained scientific basis. But to the cultivation of speech, a faculty normally universal, and hence much more intimate and important in its relations to man—the minister of his highest social welfare and the agent of his noblest progress—its more complicated mechanical processes and the indefinable character of its melodic scale have hitherto presented the most formidable obstacles.

In many respects, however, what has been accomplished for one of these arts enures also to the benefit of the other. In both, the instrument, at least, is the same, though put to somewhat different uses. The important results of recent investigation in the domain of acoustics, though less obviously practical in their application to speaking than to singing, cannot but be, in the end, of great advantage to both, and that æsthetic culture by which all forms of art are inspired to their lofty purpose is essential alike to music and to elocution.

The limitations of this article require that these contributions of science and experience to the culture of the human voice shall be treated with exclusive reference to elocution. This may be done from a physiological, a physical, and a psychological point of view; in other words, we may consider the instrument, its mechanical uses and processes, and those intellectual laws by which it is made to convey thought and emotion to the human soul.

I. Of the physical apparatus employed in the production of voice the merest outline of description must suffice. Any good manual of anatomy will furnish the inquirer with the detailed discussion he may desire. If we begin to construct the mechanism of the voice as we would build an organ (to which it bears some analogy), we find at the base, in the human chest, the lungs, which perform the office of a bellows to furnish air for the instrument above. This air is forced by their action through bronchial tubes, which, extending upward through either lung, gradually converge until they meet in a single tube, called the *trachea*, or windpipe, consisting of incomplete cartilaginous rings lying horizontally one above the other. At the upper end of the trachea is a funnel-shaped piece of mechanism, enlarging upward and composed of various cartilages connected by ligaments, and moved by muscles. This is called the *larynx*. Through its centre, in continuation of the air-tube, runs a hollow passage, which terminates in a wide triangular opening. Across this are stretched two pairs of tense elastic membranes—the *chordæ vocales*—which have the power both of moving together and of playing into each other. Of these, however, only one pair is immediately concerned in the production of tone. These are called, therefore, the *true* vocal cords. Between their fine edges there is a narrow opening or chink, called the *glottis;* and as these cords are at will made more or less tense, the wind that is forced through the opening causes them to vibrate audibly with various degrees of force and pitch.

This is the genesis of voice: from this point the tone here generated undergoes only modifications of fulness and quality and such as combine to effect articulation. It now passes into the *pharynx*, a membranous bag which leads both into the mouth and into the nose, being separated from the former by the curtain of the palate, and from the latter by a very thin osseous partition. This, together with the two *false* vocal cords and the anterior cavity of the mouth, together with the frontal cavities over the eyes and in the cheek-bones, constitutes a resonance-apparatus, a species of sounding-board, by which the voice is modified in respect to fulness and quality. How it is further affected by the teeth, the tongue, the palate, and the other organs of articulation we are yet to consider.

II. Sound comes to our ears in two forms—as *tone* and as *noise*. Tone is sound caused by the regular periodic vibrations of the sounding body, such as is given out by musical instruments. Noise proceeds from irregular movements of the sounding body. The crash of thunder, the rattling of the streets, the discord which results from striking all the keys of a piano at once—these are noises. The sounds which we make in speaking consist of both tones and noises.

Prof. Helmholtz of Heidelberg, in his *Lehre von den Tonempfindungen*, has shown that for the production of every vowel-sound the cavity of the mouth is definitely tuned by the disposition of its various parts—the teeth, the tongue, the lips, the soft palate, the pharynx, etc. The air confined in the cavity of the mouth has, like any other body of confined air, its own rate of vibration, and hence its own pitch, which varies with the variation of the cavity. The vowel-sound, therefore, is independent of the musical tone produced by the larynx, and is always the same, whether in the mouth of a man, a woman, or a child. This is true also of some of the consonant sounds, while others are merely noises produced by the breath vibrating at points of resistance in partly-closed organs. Thus, every element of language has its own peculiar type—or *Klang*, as it is called by the Germans—which distinguishes it from all others. These characteristic sounds may be heard even in whispering. In speaking aloud they are combined with the noises (also formed in the mouth-cavity) and supported by the *tones* of the larynx. Speech thus results from the combined working of two very different actions of the vocal organs. The difference between singing and speaking is, that the first employs pure tones, modified only, *when words are used*, by those rapid and scarcely-observable discords caused by the striking of the air upon the interior parts of the mouth; while in speaking these *noises* predominate, and *tone* asserts itself only or mainly in the occasional prolongation of the vowel-sounds.

Tone has three properties—strength, pitch, and quality, called by the Germans *Klangfarbe* (tone-color), and by the French *timbre* (stamp). The latter term has come into very general use in English works upon the voice and its culture. The strength of a tone depends upon the amplitude, its pitch upon the rapidity, and its timbre upon the form, of the vibrations which produce it. As the strength of the tone depends upon the breadth of the sound-waves, this, in its turn, depends primarily upon the structure, and then upon the voluntary disposition or adjustment, of the vocal organs and of the resonance-apparatus. Much misdirected labor is sometimes expended in attempting to increase the power of the voice by harsh and straining exercise of its muscular organism, with a vague idea of imparting to them toughness and vigor. In view of the delicacy and tenderness of these ligaments, such a process must appear somewhat worse than useless. When once these parts are fully developed, it is not possible in this way to make a strong voice out of a weak one. Its tone may indeed be reinforced—first, by adding to the impulse which produces it through a greater exertion of the diaphragm and abdominal muscles; secondly, by a proper adjustment of the vocal cords and the management of the breath; and, thirdly, by the co-vibration of the chest, the mouth-cavities, and the bony parts of the head, so that whatever tends to give capacity to the one or firmness to the other contributes to this end. But when we come to consider the nature of timbre, and the ways of modifying it, we shall see that the processes which enter into that culture are nearly identical with what is necessary to this, and exactly adapted to impart to the voice not only a sweet and agreeable quality, but also that reach and ring which comprise all the best effects of power.

The pitch of a tone depends upon the number of the vibrations in a given time by which it is produced: the more rapid the vibrations the higher the pitch. The octave of a tone has exactly twice as many vibrations in the same time as the tone itself; the fifth above the first octave, three times; the major third above the second octave, five times; the fifth of the same octave, six times; and the minor seventh of the same, seven times as many. Variations of pitch in the human voice are due exclusively to the action of the glottis and the ligaments of the larynx, and are subject to the uniform laws by which the tones in hollow tubes ascend or descend according to the different lengths of the air-columns they contain, and in stringed instruments according to the greater or less tension, the extent, and the degree of vibrating surface in their strings. By means of

the LARYNGOSCOPE (which see) the various movements of the larynx and vocal cords which combine these two principles in the production of tone have been accurately inspected and recorded. It is found that in giving forth the lowest tones of what is called the *chest-voice* the windpipe is enlarged to its utmost capacity, the vocal cords are moved throughout their whole length with large, loose vibrations, which are communicated to all the interior parts of the larynx, and again, by resonance, to the confined air in the cavity of the chest. When to this is added a peculiar expansion of the pharyngeal cavity, that full, rich quality of the voice is produced to which Dr. Rush gave the name of *orotund* (from the *ore rotundo* of the Latin maxim), and to which the dramatic artist is indebted for some of his finest effects. As the scale is ascended the vocal cords swiftly meet and separate at each new tone, and are shortened and made more tense; as the strings of the violin are controlled by the fingers of the player. The tones of the *head-voice* (as it is usually styled) are produced by vibrations of the fine inner edges only of the *chordæ vocales*. This, however, is but a general and imperfect view of a very complicated process, and makes no account of the expansion and contraction of the trachea, with the consequent rise and fall of the larynx, and some other important modifications. For we are less concerned at present to give an accurate description of the physiological processes than to expound the physical laws relating to them, in obedience to which the phenomena of voice are produced.

The division of the vocal scale into registers (chest-voice, head-voice, falsetto, etc.), their points of transition, and the treatment of the singing voice with regard to them, about which a wide difference of opinion exists, are less important in elocution, because the scale employed is more limited, little beyond the lower and a part of the middle register requiring cultivation, and that of a simpler character. Men speak (normally) an octave lower than women, employing usually only the chest-tones, rarely the head-tones, and never the falsetto. The usual range of the male voice is from the low F to A. Women use mostly the upper part of the chest register and the lower part of the falsetto, ranging from A below the line to B in the treble clef. Little children speak entirely in the falsetto.

The upper part of the chest register—that is, the middle voice—is best adapted to public speaking, being most capable of inflection, farthest of reach, and most easily sustained. If the voice is pitched too high, when excitement supervenes it will tend to break into a scream, while for low-keyed voices it is usually very difficult to rise out of a tedious monotony. The middle voice gets all the advantage from chest-resonance, and at the same time has room to rise when emotion or occasion demands. The accomplished speaker should have full control over the pitch of his voice, and be able to modulate its key at will, so as to adapt it to all external circumstances.

The increase of the compass of the voice is not so important in elocutionary as in musical instruction. A judicious practice of the scale under the guidance of a skilful master will accomplish all that is necessary in this respect, and at the same time tend to improve the voice in flexibility and purity.

But the most important thing to be considered in the culture of the voice is timbre or quality. All bodies and instruments employed for producing musical sounds give forth, besides their fundamental tones, certain other tones due to higher orders of vibration. It is the intermixture of these with the fundamental tone which determines the *quality* of the sound, and distinguishes instruments from each other—a clarionet from a flute (for example), both these from a violin, all of them from the human voice, and different voices from one another. These are the *harmonics* of the fundamental tone—called by the German physicists the *harmonic overtones*. Though feeble in comparison with the primary tone, they may, with a little practice and attention, be heard when, for instance, one of the lower notes is struck upon a pianoforte. Above every tone of a determined pitch may be traced a whole series of "harmonic overtones," rising according to the "acoustic series" before indicated—viz. first, the octave, then the fifth, etc., etc.

The timbre of a tone, as we have said, depends on the *form* of the waves of vibration. As the surface of water is moved into waves of a different form according to the object which agitates it—whether a falling stone, a ruffling wind, or a dividing keel—so the movements of the air take different shapes according to the way in which they are excited, whether by the violin-string under the rasp of the bow, the harp-string plucked by the finger, or the reed of the clarionet vibrated by the breath. These varieties are infinitely numerous, and are distinguished by the different relations which they cause between the fundamental tone and the overtones. The most beautiful timbre is found to result from that form of the vibratory waves which produces the primary and its harmonics in the intervals of the major chord to the sixth above, the former sounding most loudly, and the latter gradually decreasing. As the overtones increase in strength in relation to the fundamental tone, the sound grows shrill; and if the higher overtones, which lie close together and are dissonant, overpower the fundamental, the quality of the sound becomes exceedingly harsh and disagreeable.

The timbre of the voice depends on the manner in which the tone begins, the management of the breath in producing it, the direction given to the column of air which carries it, and the disposition of the anterior cavities by which it is tuned for the various elements of speech. It has been found that the form of vibration most favorable to a pleasing as well as far-reaching quality of voice is a *round* form—*i. e.* one which sends the sound-waves out upon the air in such a way as to allow of their circulation in all directions with the least obstruction; and that this form is best produced by a light, elastic impulse, like that made by the sudden fall of a pebble into the smooth surface of a lake—with the difference that sound spreads out in the air like a sphere, while the waves of water extend only in circles. This is to be accomplished, first, by a careful adjustment of the vocal organs, so as to allow just the quantity of breath to escape which is necessary for the production of the tone. If too little breath is used, the vibrations will be feeble and the sound will lack strength; if too much, the vibrations will be distorted from the form most favorable to an agreeable and effective quality. An excessive pressure of the breath drives the sound-waves forth in a single direction, instead of allowing them to expand, and the low harmonic overtones disappear, while the high dissonant overtones disagreeably assert themselves. Every particle of the column of air expired should vibrate, or of course it is lost to sound; besides that, the escape of unvocalized along with the vibrating air makes itself manifest in a certain wheezing very detrimental to the purity of the tone. The first impulse of the voice, then, should be sudden, light, and made with a moderate expenditure of breath, which may be afterward reinforced. By this method the sound takes on a round and even form, which may be by due precautions maintained and the timbre kept always at its best; while the same process is most favorable also to the reach of the sound, as it is well known that more speed and power can be generated by a quick, elastic blow than by the steadier pressure of a heavy force.

Again, both theory and experience teach that, for purposes of purity in tone, the air-column from the larynx should be directed, both in speaking and singing, to the front of the mouth, and concentrated there above the upper teeth, whence it should rebound to form continuous vibrations in the various resonance-apparatus behind. If this rebound takes place farther back from any portion of the roof of the mouth, it is found that the inharmonic overtones become prominent, and various discordant qualities result. And here it may be remarked that most of those well-known faults of voice—such as nasality, gutturality, huskiness, thinness, strainedness, and excessive metallicity—which have usually been deemed organic and unalterable, may be traced (with the exception of rare instances of structural defect) to some violation of natural law in the use of the vocal apparatus, and may by proper treatment be greatly modified, and often, especially in the case of young children, entirely obviated.

Finally, the form given to the mouth-cavity, by which it is tuned for the elements of articulation, has not a little influence on the timbre of the voice. For, however excellent the tone may be in its origin, the form of the vibrations—on which, as we have seen, the quality depends—must be affected by the passages through which they proceed on their way to the lips. In the case of the vowels, and some of the consonants, the larger proportion of this air is employed in the generation of a proper musical tone with its regular vibrations, while the remainder, encountering various obstacles in its passage, breaks into *noise*, with irregular vibrations and dissonant overtones. With others of the consonants this proportion is reversed, and these derive their peculiar character from the predominance of noises, which cause the proper musical tones to become almost imperceptible. When both consonants and vowels are combined in syllables, the mouth is tuned and untuned for the vowel-sounds with great rapidity, while the swiftly-succeeding movements of its mechanism form the consonants. As a general rule, and one of far wider application than might at first be supposed, these elements should be formed far forward in the mouth; for when the necessary impulse is given farther back the sound is too tardy in striking the external air, and a dull and hollow quality is imparted to the voice. This is contrary to the practice of most teachers of elocution, who constantly inculcate the duty of producing the voice, as much as possible, from the

throat and chest, under a mistaken notion that it will thus acquire strength and fulness. Care must also be taken to give room in the mouth-cavity for the proper formation of the vowel, or the air in the nasal *fossæ* (which, in correct speaking, is mostly shut off by the soft palate) will be moved to vibration, and a nasal quality will be the result. The more room given in the mouth for the vowel-sounds, the more will musical tones predominate, and the richer, fuller, and sweeter will be the utterance. So true and so important are these injunctions that it has been said that the quality of a healthy voice has its origin in the mouth-cavities rather than in the vocal cords, as is commonly supposed.

Very careful and minute analyses of all the elements of speech, together with the various arrangement and movements of the organs in producing them, have been made by Helmholtz and others, but the subject can be barely indicated here. It is the office of the intelligent teacher, who would cultivate the human voice by methods in accordance with nature, to acquaint himself first with the physiology of the delicate and complicated instrument with which he assumes to deal, and then with the physical laws which are concerned in the production of the vocal sounds—the proper disposition of the vocal cords, and the management of the breath in originating and sustaining musical tones, the proper way of directing the air-column through the anterior passages, the right disposition of the mouth-cavities that the quality of the tone may not be impaired by improper obstructions, and the due adjustment of the teeth, tongue, lips, and palate to a pure articulation. Possessed of this knowledge, with the added resources of his own experience, he will be able not only to impart to the voices of his pupils those qualities of melody, reach, and resonance which enter into agreeable and effective speech, but to modify, and often completely remedy, vocal defects hitherto regarded as organic, and to treat successfully those widely-prevalent diseases which result from misuse of the sensitive vocal organs.

One of the most wonderful and interesting results of the system here outlined may be seen in what it has accomplished for the instruction of deaf mutes. The occasional attempts hitherto made by these unfortunates to utter speaking sounds have resulted only in discordant tones, entirely uncontrollable in the essential particulars of pitch and quality; but by many years of minute investigation and unwearied experiment, assisted by an ingenious system of diacritic symbols, Prof. A. Graham Bell of Boston has been enabled to teach them not only to produce all the sounds of speech, but to appreciate and to modify the quality of their voices, to sustain or to vary the pitch, and, in short, to fulfil all the conditions of a correct and pleasing utterance. The symbolic system alluded to was invented by Prof. A. Melville Bell, a distinguished elocutionist formerly of London. It is called "visible speech," and consists of a series of signs which indicate by their form (depending for the vowels on the shape of the wind-passages, and for the consonants on the disposition of the tongue and palate) the exact method by which all the sounds possible to human speech must be produced. (For these characters see DEAF AND DUMB.) A system of vocal culture in elocution based upon the best results of scientific investigation is faithfully pursued through a two years' course at the school of oratory of the Boston University, under the direction of Prof. Lewis B. Monroe. Of the faculty of this school Prof. A. Graham Bell also is a member.

III. With this cursory glance over the field of culture as regards the mechanical laws which govern the voice, we come to a still briefer consideration of speech as the medium of expression, the vehicle of thought and emotion. If we view the vocal elements combined in syllables and words and sentences as constituting the *form* of our art, we inquire now after the animating *spirit* which is to imbue that form with beauty and power. This influence is to be found, primarily and comprehensively, in the largest general culture—intellectual, æsthetic, moral. Cicero demanded for the orator the most consummate and various wisdom, and Quintilian contended that he should be also a *good* man; and even for the reader or the actor, who but embodies in his utterance the sentiments of another, it is clear that intelligence and sensibility to appreciate the language he employs is absolutely indispensable to the successful performance of his task. This psychological fitness makes itself immediately felt in an infinite variety of vocal inflections, some of them so minute as to defy analysis and almost to elude observation. These subtle phenomena the elementary writers, under the head of modulation, undertake to classify, and to formulate a system of *rules* by which they may be definitely produced and regulated. Yet, notwithstanding the nearness of the subject to all human interests, it is not to be denied that the formal study of elocution as a branch of education has never been popular except in ages and communities where mellifluous speech has been cultivated for its own sake—as an end rather than as a means. There is a latent suspicion in the common mind that the fine subtleties of thought and emotion, and the innumerable varieties of vocal inflection which are the exponents of these, are incapable, from the nature of the case, of analysis and classification and mechanical production; that they must result from the intuitive agency of the intellect and the heart; and that without this spontaneous energy no artificial system is competent to create them. Hence, there is much talk, even among intelligent advocates of the widest culture in every other department of art, of leaving the whole matter of rhetorical delivery to the spontaneous suggestions of nature.

This question may not be argued here: it is sufficient to say that there is truth on both sides of it. If the culture of delivery, according to the supposition of Archbishop Whately, the eminent formulator of the doctrine of *laissez aller* in this branch alone of rhetorical study, necessarily involved the careful attention of the speaker, *while in the act of speaking*, to rules of tone, emphasis, and inflection, the question would be answered in the statement of it. But the *technique* of this, as of all other arts, is to be taught and wrought into a *habit*, so that the learner comes to conform to its minutest requirements automatically. The test of excellence in this art, more than in any other, is the *celare artem*, and any disclosure by speaker or reader of his technical sub-processes is instantly fatal to success. On the other hand, it is not easy to see why this, more than any art, should be held as entirely independent of technical knowledge and skill. Notwithstanding the elaborate effort of the distinguished critic in question to show a difference between this and the art of composition, it appears to us that the analogy is complete, and that his objection holds equally good against the study of the numerous rules of grammar and rhetoric, which would doubtless prove mere impediments to the orator who should make conscious use of them in the pulpit or on the rostrum.

But, after all, it must be acknowledged that there has been a tendency in elocution, as usually taught, to fix the exclusive attention of the pupil upon a prescribed set of modulations, too apt to become mechanical, and so to shut the avenues of his soul against that infinite variety of delicate suggestions which nature is wont to make to cultured sensibility, and which can never be reduced to system. What distinction of grave, or acute, or circumflex, for example, can inspire the actor to the proper utterance of the *Et* TU, *Brute?* of the dying Cæsar, adopted from Plutarch by Shakspeare? Here is a single word, the just delivery of which all the systems of all the schools can never define. The *rules* that govern its utterance are indeed the simplest possible, yet the indescribable modulation which should adequately convey its infinite pathos of grief and despair can be generated only in the sympathies of a cultivated mind and heart. From this we may at least infer that no analysis of the voice in delivery can ever be exhaustive, or be allowed to supersede a constant fresh application to the oracles of nature for inspiration to the best utterance. Perhaps, indeed, we should be all the more jealous of systems when they claim to be exact and comprehensive.

Such, for example, are the attempts that have been made at different times, both in this country and in Europe, to define and regulate expression by intervals identical with those which exist in music, and to indicate the modulation by musical notation. One of the most eminent of these theorists was Dr. James Rush of Philadelphia, who published about fifty years ago the *Philosophy of the Human Voice*, and who deserves respectful mention, not only as an original and acute observer, and one of the first in this country to give impulse to the investigation of this subject, but for the many valuable contributions to the art of vocal culture which his work contains. This writer, having observed the diphthongal character of some of the vowels, gave the name of *radical* to the first, and of *vanish* to the latter of the two elements, and asserted that the voice spans the interval of a musical tone in passing from one to the other. From this he proceeded to construct the theory that all the intervals of speech may be determined by musical analogies; and he elaborated a system by which all the variations of the voice, in every phase of expression, may be measured by the degrees of the musical scale and marked by a quasi-musical notation. It is impossible here to discuss, or even more fully describe, this theory. It was advanced before the more thorough investigations of modern science had better explained some of the imperfectly-observed facts on which it rests; and probably its acute author, had he lived to our day, would have found reason to modify the tone of triumphant certainty with which it was introduced to the world. Its practical value may be estimated by the fact that not one of the notated phrases by which it is illustrated can be read by the musical symbols without

first appealing to the independent action of the mind for a key; and to the other fact, that of all the teachers who have professed to base their instruction upon the philosophy of Dr. Rush, not one (so far as we are aware) has ever made a serious and persistent attempt to carry this portion of it into practice. It is but just to add, however, that all through his rather voluminous work are scattered valuable suggestions of a general nature, and that his analysis of the vocal elements has been found useful for the acquisition of a correct and forcible utterance. Among the most conspicuous of his professed followers were Dr. Barber and Prof. Russell, who were eminent teachers in their day. The former published a *Grammar of Elocution*, in which a brief but ineffectual attempt was made to carry out the musico-rhetorical theory, and the latter an admirable selection of passages of English literature for purposes of voice-culture, entitled *Orthophony, or Vocal Culture*, arranged according to Rush's classification of the different qualities and uses of the voice, and distinguished by the employment of his terminology.

There is another system which is less open to the objection of artificiality, and which appears to be founded on correct principles and to be susceptible of a wider application to the multitudinous phases of expression. It is that which derives the law of delivery from the structure of the sentence. This idea was first advanced by Walker in his *Elements of Elocution*, but its fuller development was reserved for Dr. Mandeville of Hamilton College, New York. This gentleman carried out the principle of modulation based upon sentential structure (not forgetting the special influence of emphasis, of which he presents an acute and exhaustive discussion) through a very wide induction of sentences selected from English literature. This method of instruction, in causing the arts of composition and delivery to go hand in hand, restores elocution to its ancient dignified alliance with rhetoric. It obviates, too, the tendency of the learner to subordinate natural to mechanical methods in the vocal expression of his thought, by familiarizing him with the intellectual processes involved in its literary expression.

The result of a survey of the whole field is a conviction that the popular prejudice against this branch of education is not entirely without show of reason. It is quite natural to feel more hopeful in entrusting our youth, in this matter, to the "sure instincts of genius" than to systems which cast them in rigid mannerisms, professing to be founded on nature, but having only the effects of bad art, or to the guidance of instructors destitute of that liberal culture which alone can fit them to inspire a sense of the true and beautiful. Nevertheless, there can be no greater fallacy than to suppose that by declining to submit them to a true artistic training we but elect to leave them to the operation of that pure abstract beneficence which men fondly call "nature." Some one, pleading for the moral instruction of the children of the street, said, "Do not suppose that if we refuse this responsibility they will simply go untaught: if *we* do not teach them, you may be sure *the devil will.*" So, in the matter of a right rhetorical delivery, we may undervalue the importance of training Young America into good habits, but the influences which induce bad ones will none the less continue to swarm around him like the motes of the sunbeam, and he will take them in at every pore. Not nature, but *false art*, will be imbibed—by the child from the very family at home, by the youth from the very atmosphere of the school-room, by the adolescent from the hoary abuses of the college and the still more abominable traditions of the stage, and by them all from nearly every pulpit, forum, and hustings in the land.

The whole matter may be summed up in the well-worn maxim of Ovid: "The safest path lies midway of the extremes." The true doctrine is thus well expressed by another: "To be able to act upon the souls of men with an elevating and informing power, it is first of all necessary that an artist should cultivate the form of his art to its greatest possible perfection, and have such perfect command of it that the practical application of it is as natural to him as to breathe. For, empty and dead as all technical knowledge is unless it is animated with a soul, yet no product of art æsthetically beautiful is possible without a perfect *technique.*"

The inquirer who desires to pursue this subject in detail may be commended to Helmholtz's *Lehre von den Tonempfindungen*, Dr. Oscar Wolf's *Sprache und Ohr*, Carpenter's *Human Physiology*, and the writings of Max Müller, Czermak, Du Bois Raymond, etc. For popular reading we may refer to Tyndall's *Lectures on Sound*; to Mme. Emma Seiler's *The Voice in Singing* and *The Voice in Speaking*, which present the results of scientific investigation on the subject so far as practically valuable to the ordinary student; and to Dr. Mandeville's *The Elements of Reading and Oratory.*

ROBERT R. RAYMOND.

**Void** and **Voidable.** These two legal terms are often and very inaccurately used in common by text-writers in their treatises, by courts in their opinions, and even by legislatures in their statutes; but their true meanings are widely distinct and unlike. Much doubt and confusion are caused by the employment of the word "void" when the real thought intended to be conveyed is expressed by the word "voidable." *Void*, in its strict and only correct sense, denotes that a transaction, contract, conveyance, or other instrument is an absolute nullity, so ineffectual that no act or confirmation of the parties can cure it, and so completely nugatory that the defective quality can be asserted by any person at any time and in any proceeding. A marriage between a man and a woman, one of whom has a spouse known to be living, and a marriage between persons within the prohibited degrees, as in England between a man and the sister of his deceased wife, are thus void. No ratification would relate back and make the wedlock good; the children would be illegitimate, and in an action brought at any subsequent time a stranger might establish the illegality if his rights of recovery or of defence depended upon the proof of such fact. *Voidable*, on the other hand, denotes that a transaction, contract, conveyance, or other instrument is so tainted with imperfection or illegality that it may in some manner and by some method be avoided and rendered null, but also that the defect may be cured and the transaction or instrument made valid by the act and confirmation of the one who could interpose the objection. It was a general doctrine of the common law, applicable in most cases, that no person but an immediate party to the voidable transaction or relation, and his personal representatives, could object to its legality and render it, or procure it to be rendered, a nullity. Statutes have in certain instances modified this principle, and have extended the power of nullifying to others who have been made special representatives of the party for that purpose. The following examples will illustrate the nature of voidable transactions: A marriage procured by fraud or force is voidable. The wife whose consent was obtained under duress may annul the tie as soon as she regains her freedom of action, or she may ratify and make it valid from the beginning by voluntarily continuing to cohabit with her husband. Conveyances of land, transfers of personal property, and contracts executed through fraud, mistake, or duress, are voidable; they may be disaffirmed by the injured party, or they may be ratified by him, and thus made completely binding. Conveyances made with intent to defraud creditors, although declared by the statute to be void, are in fact voidable; the defrauded creditors may procure them to be adjudged null, or may certainly ratify and confirm them. The contracts of infants, except those which are essentially binding, are voidable, since the infant when he attains his majority may affirm them. The courts formerly spoke of certain contracts made by an infant as "void," and their number was gradually reduced. It is hardly possible at the present day that a person, after arriving at the age of twenty-one, would be prohibited from confirming, if he knowingly and deliberately chose to do so, any engagement which he had entered into during his minority. These examples are sufficient to exhibit the wide difference between the terms "void" and "voidable" when accurately used, and to show that in many instances where the word "void" is employed by legal writers, judges, and legislators, the word "voidable" should have been substituted in its place.

JOHN NORTON POMEROY.

**Voir Dire** [Fr., "to say the truth"], in law, is an ancient technical term derived from the Norman French, and denotes the preliminary examination of a witness on a judicial trial in order to ascertain whether he is competent. At the common law no person pecuniarily interested in the event of a suit was eligible as a witness on the side where his interest lay. If an individual was called on a trial and offered as a witness, the other party, suspecting him to be interested, might require that he should be specially sworn and examined touching his interest. This preliminary proceeding was called an examination on his *voir dire*, or simply the *voir dire*. By modern statutes in England and in most of the U. S. the incapacity resulting from interest has been abolished. The *voir dire* examination, therefore, if used at all, must be for the purpose of ascertaining other grounds of incompetency whenever and wherever any such exist.

JOHN NORTON POMEROY.

**Voiron'**, town of France, department of Isère, on the Morge, manufactures hempen cloth, paper, liqueurs, straw hats, gloves, iron and steel goods, and leather. P. 9637.

**Voiture'** (VINCENT), b. in 1598 at Amiens, department of Somme, France; was a very adroit man; crept into the court circles; received sinecures and pensions from Gaston of Orleans, Richelieu, Mazarin, and Louis XIV.; was one of the original members of the Academy, and one of the

most conspicuous figures of the Hôtel de Rambouillet; wrote the sonnet "Uranie," which was admired and imitated in Europe as much as the palace of Versailles. D. in 1648. His complete works, consisting of letters and poems in French, Latin, Spanish, and Italian, appeared with notes in 1856.

**Volatile** or **Essential Oils.** See OILS, by PROF. B. SILLIMAN, M. D.

**Volcano.** See VOLCANOES.

**Volca'no,** p.-v. and tp., Amador co., Cal. P. 1357.

**Volcano,** p.-v., Wood co., West Va.

**Volcanoes** [Lat. *vulcanus*]. *Nature and Formation of Volcanoes.*—A volcano is a mountain, generally of conical shape, with a circular cup-like opening or basin at its summit, called a *crater*. In the centre of that crater is the mouth of a perpendicular shaft or chimney, which emits clouds of hot vapor, gases, and, at times of greater activity, masses of ashes, hot fragments of rocks, and streams of fiery, liquid rocks, called *lava*, which flow down the slopes of the mountain. The gradual accumulation of these ejected materials around the mouth of the volcano forms a succession of concentric layers, which explains its conical form. These layers are distinctly visible on the inner walls of the crater, and as the same structure is found to exist in all volcanoes and in every part of their mass open to observation by crevices, it is probable that all such mountains are the result of a similar long-protracted accumulation. By this mode of formation and peculiar structure the volcanoes are quite distinct from the other mountains and mountain-chains which constitute the skeleton of the continents and smaller masses of land.

Volcanic activity, though it be continuous, differs very much in degree at different times. Nearly all the active volcanoes have times of relative repose, interrupted, often at great intervals, by periods of increased activity, which terminate in a violent ejection of incandescent matter from the interior. The volcano is then said to be in a state of *eruption*. The phenomena which characterize these various phases of volcanic activity may be best made clear by describing them as actually observed in Vesuvius, one of the more carefully studied and most active volcanoes of modern times. Vesuvius rises solitary from the midst of a highly-cultivated plain bordering the shores of the Bay of Naples to the height of nearly 4000 feet. Though the mountain is of a regular conical shape, two summits, almost equal in height, are visible from Naples—Monte Somma on the N., Vesuvius proper on the S. The first, however, is but the northern half of the crater-rim of the old Vesuvius, the southern half of which was destroyed by the first eruption of that volcano in historical time, in the year 79 after Christ. Vesuvius proper is the new cone, which gradually grew out of the old crater by the accumulation of the materials ejected during the subsequent eruptions to this day.

*State of Repose.*—After an eruption the energies of the volcano seem to be exhausted. It enters into a state of relative repose. After the great eruption of Oct., 1822, the crater of Vesuvius was emptied to the depth of 700 to 800 feet; its rim was broken and partially sunk on the S. several hundred feet. Of the dense clouds of smoke nothing remained but a few jets of vapor and gases, called *fumaroles* by the Italians, escaping from fissures in the walls and at the bottom of the crater. The lava, deeply sunk into the chimney, had almost disappeared from sight. Gradually, however, the volcano rallies; the fumaroles become again more active and more numerous, and their united vapors form the usual column which rises from the crater. The lava reappears in the chimney. On its boiling surface, exposed to the atmosphere, a crust is formed which bursts under the effort of the captive steam, sending into the air fragments of red-hot and melted lava, which fall back and accumulate around the chimney. This process is repeated every few minutes; a *cone of eruption* is thus built up around the mouth of the chimney—a cone within the main cone, as Vesuvius itself within the crater of the old Monte Somma. Such a one could be seen in the crater of Vesuvius in 1828. This cone grows more and more in dimensions. Occasional overflows of lava, and the materials which fall from the crumbling walls, help to fill the intervals, and the crater is once more full to the edge. The cone of eruption may grow even higher than the rim of the crater. This was the case in 1756. When the crater is thus full and its mouth choked, a great eruption is expected. Under the weight of these masses the expansive forces below accumulate, and the signs of an approaching eruption soon appear.

*Forebodings of the Eruption.*—In Vesuvius the usual forebodings of a great eruption are the drying up of the wells and springs, probably by the increasing heat of the ground, causing an internal evaporation and numerous fissures in which the underground waters are lost. Loud subterranean noises, like explosions of distant artillery, shocks of earthquake which shake the surroundings of the volcano, and the large increase of the volume of vapors which escape from the boiling lava in the crater, indicate the mighty struggle which is going on within the bowels of the mountain.

*Eruption.*—At last the eruption begins, generally with a tremendous burst, which seems to shake the mountain to its very foundations, and hurls into the air dense clouds of vapor and of pulverized lava or ashes. The explosions succeed each other with rapidity and increasing violence. Each sends upward a globular cloud of white steam, which is pressed up by the following one. That long array of fleecy clouds, accompanied by dark ashes, volcanic sand, and fragments of hot lava of all sizes, soon assumes the form of a stupendous column. Checked in its ascending motion by gravity, it expands, in a quiet atmosphere, into a dark circular cloud, which, with the pillar beneath, has the shape of an immense umbrella, or of the Italian pine, to which it has been often compared. In the eruption of 1822, remarkable for the abundance of ashes as well as for its violence, the height of the umbrella was estimated at over 7000 feet.

*Atmospheric Phenomena accompanying the Eruptions.*—The sudden condensation of such an enormous accumulation of hot vapors gives rise to striking atmospheric phenomena. Vivid flashes of lightning start from all parts of the column. Electricity rages also in the cloud above, and a local thunderstorm is often formed in the midst of the clear surrounding sky, and pours a heavy rain of warm water and ashes, running along the slopes of the mountain. These hot, destructive mud-torrents have often been mistaken for lava-streams.

*Appearance of the Sky.*—The majesty of the spectacle is increased at night. Though flames of burning gases are of rare occurrence, the clouds are strongly illuminated by the reflection of the white-hot lava in the crater. Red-hot fragments of lava, constantly thrown out, give the column the brilliancy of a gigantic piece of fireworks. The sky itself, far and wide, partakes of the same vivid coloring, and the whole scene resembles a vast conflagration.

*Emission of Lava.*—At last the boiling lava flows over the rim of the crater in fiery torrents along the slope of the cone, or, bursting the mountain itself by its weight, finds vent by some fissure far below on some point of its declivity. After the expulsion of lava, the volcano seems to be relieved, and the eruption is generally near its end.

*Period of Eruption.*—The eruption, however, does not necessarily terminate here. The alternate phases of outbursting steam, ashes, and lava may continue, with more or less violence, for weeks and months, until the volcano enters again into a slumbering state. A series of such eruptions, separated by short intervals of a few years, during which the signs of activity are still numerous, constitute a period of eruption. A short review of the history of Vesuvius will show a number of similar periods of activity followed by long seasons—nay, centuries—of almost absolute repose, during which the volcano seemed to be extinct.

*History of Vesuvius.*—At the time of Christ's birth Vesuvius was described by the Roman geographer Strabo as a burnt mountain, but it had never been known to show any sign of activity. Its crater, nearly full, was covered with a dense forest. In the year 63 after Christ several shocks of earthquake startled the numerous cities and villages which covered its delightful surroundings; and sixteen years after, in 79 A. D., during the reign of the emperor Titus, its first eruption took place. That eruption, graphically described by the Younger Pliny, was of fearful violence. The northern half of the mountain, now called Monte Somma, alone remained; the southern half was ground to powder; the rain of hot and wet ashes was so abundant as to cover the whole country with a deep layer of volcanic materials, under which were buried the flourishing cities of Pompeii and Herculaneum, recently exhumed from beneath several yards of consolidated volcanic tufa. No lava, however, is mentioned. From that time to the year 1036 only seven eruptions are recorded, when lava-streams are noticed for the first time. After two more eruptions, in 1049 and 1138, the volcano seemed to enter into a period of profound sleep, which lasted nearly 500 years. During that long interval only two slight eruptions are known to have occurred, in 1306 and 1500; but meanwhile the volcanic forces were finding vent in the neighboring region of the Phlegrean fields and the beautiful island of Ischia. In the latter, Mount Epomeo poured out destructive currents of lava in 1302. In the former, a new crater opened in 1538 on the shore of the Gulf of Baiæ in the Bay of Naples, and in a few days accumulated such a

mass of ashes and volcanic fragments as to raise a hill of 440 feet above the water in the gulf. That new mountain, still called Monte Nuovo, has a crater of over 400 feet in depth. In 1631, however, the whole activity of that volcanic district seemed again to concentrate in Vesuvius. The mountain had been so long dormant that it was forgotten that it had ever been in eruption. The walls of the crater were covered with forests harboring the wild-boar and other game; its bottom had grassy plains in which cattle quietly grazed; the slopes of the mountain were cultivated up to the foot of the cone. Suddenly, in the latter part of December of the same year, to the amazement and dismay of the inhabitants, began one of the most terrific eruptions recorded in the history of Vesuvius. After violent and repeated shocks of earthquakes, the volcano burst out with tremendous noise. The pine-shaped mass of vapors and ashes rose far above the clouds, and, spreading in every direction, covered a portion of Italy with a thick layer of volcanic sand and dust, destroying all vegetation. The rain of ashes extended beyond the Adriatic. Torrents of hot mud and seven streams of liquid lava, rushing with unusual rapidity from the crater and the foot of the cone to the sea, finished the work of destruction. The beautiful city of Torre del Greco, those of Torre del l'Annunziata, Resina, Portici, and others, were overwhelmed and almost entirely destroyed. During nearly three months Vesuvius raged continually, though with variable intensity, and only gradually settled down to a state of comparative repose. This great eruption was followed by a short rest of the volcano. But from the next eruption, in the year 1660, to this day, the eruptions have succeeded each other at intervals rarely exceeding ten years, and usually much shorter. Among the most remarkable by their magnitude are the eruption of 1698, which marks the beginning of an almost incessant activity of Vesuvius; that of 1737, which covered the city of Torre del Greco with torrents of lava; that of 1760, which again threatened the same city; that of 1779, noted for the height of the column of ashes and flames, which was estimated at 10,000 feet. The eruption of 1794 was the most destructive and the most grand since that of 1631. Rivers of lava, flowing from eight mouths, united into one large stream a mile wide, which rolled over Torre del Greco, and left in some of its streets a thickness of forty feet of lava. In 1822 the rain of ashes lasted from Oct. 26 to Nov. 16, ascending often in a majestic column to several times the height of the mountain. The eruptions of 1839, 1850, 1855, 1862 poured out again an unusual amount of lava, accompanied, in the latter year, by enormous quantities of ashes, betokening the unabated activity of that remarkable volcano.

The volcanic phenomena just described in Vesuvius may be considered as typical, for they are more or less common to all the true volcanoes of the earth. Each volcano, however, may differ in the relative abundance of the ashes and broken fragments compared to the liquid lava; in the violence or frequency of the eruptions; in the size and form of the crater; in the greater or less steepness of the cone; in the composition of its lavas, and other secondary circumstances. But, on the whole, the nature and course of the phenomena show everywhere a remarkable coincidence. Even the submarine volcanoes—and many such are known—do not seem to differ materially; only the arrangement of the ejected materials is no doubt modified in the formation of a submarine cone. The most important of these differences may be shown in a few striking examples.

*Etna.*—If Vesuvius is the most active, Etna, in the N. E. corner of Sicily, is by far the largest volcano of Europe. This noble mountain rises gently from a broad base, estimated at 80 geographical miles in circumference, to a height of nearly 11,000 feet (10,840 feet), into the region of perpetual snow. Its slopes, to an elevation of 2500 feet, are in a high state of cultivation, and are said to harbor 300,000 inhabitants in 65 cities and villages.

Though Etna has been active from an earlier historical date than Vesuvius, its eruptions are less frequent, but no less destructive. About eleven are mentioned or alluded to before Christ's birth, and sixty since, with an interruption of nearly five centuries between the third and eighth after Christ.

*Lateral Eruptions and Parasitic Cones.*—There is another marked difference between the two volcanoes in the number of the lateral eruptions. In Vesuvius the number of lateral and top eruptions is nearly equal. In Etna the ejection of materials, at least in the present condition of the volcano, takes place mostly along its slopes, forming small cones of ashes and scoriæ, with a crater at the top, from which, in many cases, lava flows abundantly. These are called *parasitic cones;* they are so numerous on Etna (over 200 having been counted) that they form a characteristic feature of the mountain. They are spread all around the main cone, but frequently in series on straight lines radiating from the main crater. It seems that the pressure of the column of lava in the chimney, combined with the expansive force of the gases, active in every eruption, bursts the mountain, causing deep fissures through which the lava and ashes escape. This view is confirmed by the influence that the height of the mountain seems to have upon the eruptions. In small volcanoes, like Stromboli, one of the Lipari Islands, N. of Sicily, less than 3000 feet high, the eruptions are constant, and have been so from the most remote historical times, but all are from the top. In Vesuvius, with 4000 feet of altitude, top and side eruptions are about equal. In Etna, 11,000 feet high, the lateral eruptions outweigh those from the crater. Therefore, the lower a volcano the more easy and frequent are its eruptions. The higher the column of lava the greater is the pressure on the sides of the chimney, and the more frequent the bursting of the mountain, the lateral eruptions, and parasitic cones. In the Andes, in which the altitude of many of the volcanic peaks exceeds 20,000 feet, it would seem that the eruptions should be all lateral; but the broad base of the Andes chain on which they rest is too massive to be burst, and the column of lava, unable to reach the crater, is tossed about in the chimney, and escapes from the top in the shape of ground ashes, but hardly ever of liquid lava.

*The volcanoes of Hawaii,* in the Sandwich Islands, are remarkable among all volcanoes of the globe by the great size of their craters, the absence of ashes, and the usually quiet overflow of their abundant lava, often unattended by earthquakes or explosive phenomena of any kind. Hawaii, the larger and the most southern of the group of Sandwich Islands, is an assemblage of three volcanic peaks close to each other—Mauna Kea, in the N., the highest, rising to 13,853 feet above the sea; Mauna Loa, in the S., the most active, 13,760 feet high; and Mauna Hualalai, in the W., 7822 feet. The first two probably exceed in altitude every other mountain in the islands of the broad ocean. On the S. E. slope of Mauna Loa, at 3970 feet above the sea and 16 miles from the main crater, another crater, called Kilauea, one of the most gigantic now in activity on our planet, forms a peculiar feature of that group. According to Prof. Dana, the summit crater of Mauna Loa is of elliptic form, measuring 13,000 feet in its longest diameter and 780 feet in depth. That of Kilauea is 16,000 feet in its greatest length, 7½ miles in circuit, nearly 4 square miles in area, and from 600 to 1000 feet deep. Its bottom, viewed from the brim, is a broad plain interspersed with lakes of boiling lava and jets of vapors. Notwithstanding their immense size, the liquid lava gradually fills them to the brim, and overflows, or, bursting their walls, escapes by large fissures on the slope of the mountain. As remarked, the eruptions from these large reservoirs are usually free from the commotions of the ground and the noisy explosions which attend the eruptions of Vesuvius. In 1840 a large eruption in Kilauea began noiselessly, and was first noticed by a fire in the woods, and the lava, breaking out successively at various points on the slope, reached the sea in a large stream nearly 40 miles from the crater. In Jan., 1843, a lava-stream flowed out of a fissure about 700 feet below the summit of Mauna Loa, and continued for 30 miles. Though one of the grandest eruptions, it broke out in silence and progressed without an earthquake. In Feb., 1852, a bright light at the summit, says Dana, announced another eruption; after three days it was continued by means of a second outbreak, 4000 feet lower, or 10,000 feet above the sea, which also was a quiet one. At this second opening, as described by Rev. T. Coan, the most faithful observer of the mountain for a long series of years, a fountain of fiery lavas 1000 feet broad, playing to a height at times of 700 feet, offered a spectacle of indescribable grandeur and brilliancy. There were rumblings and mutterings from the plunging flood, and explosions, but no earthquakes. Mr. Coan attributed the fountain to the hydrostatic pressure of the column of lava above. In Aug., 1855, another great eruption began, without noise and shakings, at an elevation of 12,000 feet, and for a year and a half the flood continued. The whole length of the stream was 60 miles. In Jan., 1859, still another eruption made its appearance near the summit of Mauna Loa in the same quiet manner, Kilauea remaining undisturbed. On the N. W. side of the mountain the lavas were thrown up "like the waters of a geyser" to the height of 400 to 500 feet, transforming the night into broad daylight, and the stream continued its winding way to the sea after a course of over 50 miles. In Mar., 1868, however, a mighty eruption took place, which proved an exception to the usual ways of the volcano. On the 27th, says Mr. T. Coan, a series of earthquakes commenced in the district of Hilo, and became more frequent and startling from day to day, until the succession became so rapid that the island quivered like the lid of a boiling pot. On the 28th, Mauna Loa

was seen to be on fire. Soon the southern slope of the mountain was rent open, and several streams of lava ran off in different directions, filling the valleys in their course. Suddenly all mountain-valves were closed. The fire, the smoke, the stream, disappeared together. But in Kilauea the action was intense. Earthquakes in rapid succession began to shake the ground, and on Apr. 2 culminated in fearful destruction. On the 7th, Mauna Loa was again rent open near its southern base; a great lava-stream poured into the sea, and the mountain, thus relieved, ceased to convulse the island.

*Form of the Volcanic Cones.*—The lavas of these islands are noted for their great liquidity. This circumstance, combined with the almost complete absence of ashes, explains the flattened form of these volcanic cones and the slight inclination of their slopes. Dana estimates the general slope of Mauna Loa to be only between 6° and 8°. A horizontal section 1800 feet below the summit would be nearly 20 miles broad, and at the top of the cone the traveller is surprised to find a large plain in which the crater is sunk, but so even that from this observatory, nearly 14,000 feet high, his eye cannot perceive the surrounding ocean. In volcanoes where the lavas are less liquid and ashes abound, as in Vesuvius and Etna, the slopes are more inclined, from 20° to 35°, and the form more conical. The volcanic peaks which emit nothing but ashes without lavas, as those of the Andes, are still more sharply pointed, as shown in the cones of Cotopaxi and Chimborazo. In the volcanoes of Iceland, whose lava is viscous and alternating with ashes, the usual shape is more that of a dome. The molecular condition of the ejected materials thus determines the shape of the mountain.

*Nature of Volcanic Products.—Ashes.*—The microscopic examination and chemical analysis of volcanic ashes prove them to be nothing but the pulverized lava, containing sometimes a large proportion of minute crystals. They bear, therefore, no analogy to the ashes of burnt wood. These fragments of lava are of all sizes. The most minute fragments, forming an impalpable powder suspended in the air, and often transported by the winds to a distance of hundreds of miles, are called ashes. Coarser materials take the name of volcanic sand. Larger fragments are called by the Italians *lapilli—i. e.* "small stones"—popularly pronounced *rapilli*. Still larger pieces of melted lava assume by cooling in their descent a pear-shape form. Others, exploding in their ascent, are called volcanic bombs. Irregular fragments of all sizes, large pieces of the walls of the crater, are also thrown out with great violence. Humboldt speaks of a mass of several tons' weight which was thrown to a distance of 7 miles from the crater in an eruption of Cotopaxi in the Andes.

*Lavas.*—Lavas, like nearly all rocks of undoubted igneous origin, are remarkable for an almost complete absence of quartz, which is so prevalent in most of the crystalline rocks of metamorphic origin. The lava-stream, when flowing from the crater white-hot, is not unlike a jet of melted iron escaping from the furnace. Moving at first with considerable rapidity, it soon cools on the surface, and is covered by a hard, black, and porous crust, the interior remaining in an incandescent state. Innumerable jets of vapor escape and nearly hide the surface. Enclosed, as in a sheath, by that hard covering, the stream rolls slowly upon itself, progressing at a rate which varies according to the slope and the liquidity of the lava. The cooling, though rapid at the surface, is very slow in the interior; if the stream is thick, the lava will be found still warm after ten or twenty years. This slow cooling allows the lava to crystallize into a compact rock much resembling granite or porphyry. Glassy lavas, like obsidian, reduced into foam by the action of hot vapors and cooled, give pumice-stone.

The amount of matter ejected by volcanoes, though an insignificant addition to the earth's crust, is, nevertheless, very great. The whole island of Hawaii seems but a huge accumulation of lava thrown out from the four craters above described. In a single eruption of Kilauea, that of 1823, the mass of lava was sufficient to have formed a cone 3000 feet high, with a still broader base. All the other high islands in the midst of the oceans, excluding the flat coral islands, are of the same nature. Iceland, with an area of 40,000 sq. m., is composed of a vast table-land, from 3000 to 5000 feet thick, of basaltic and trachytic rocks, similar to the lavas ejected by her numerous active volcanoes. One of the last, the Skaptar Jökul, in the south-eastern part of the island, broke out in 1783, and sent forth several streams of lava during more than a year. The main branch, 40 miles in length, filled the valley of the river Skapta to the brim with from 400 to 600 feet of rock, and expanded lower down into a breadth of 15 miles, forming a vast lake of fire 100 feet deep. The other branch, 50 miles in length and 5 miles broad, was no less imposing. Over twenty villages were destroyed and 9000 inhabitants perished. Prof. Bishoff calculated that the amount of liquid rock emitted in that single eruption was equivalent in bulk to Mont Blanc. The formation of the new volcano, Jorullo, in Mexico, in 1759, graphically described by Humboldt, is another example of the occasional magnitude of volcanic eruptions. From a fertile and highly-cultivated plain, surrounded by volcanic hills, over 100 miles from the sea and 2000 feet above it, the ground was rent, and along the fissure volcanic mouths poured out a stupendous amount of basaltic lavas and fragments, which accumulated in six volcanoes. The central one, Jorullo proper, rises to 1600 feet above the plain, and all rest on a sheet of volcanic rock studded with a multitude of small steaming cones and gently swelling toward the centre, where it has a thickness of 500 feet. This region, covering 4 sq. m., bears now the name of *Malpays*, or "bad land." (For the arrangement of volcanoes on the earth's surface, their distribution, the two great volcanic zones, and the heights of volcanoes, see EARTH.) A. GUYOT.

**Vole** [Fr.], the name given in England to species of the genus *Arvicola*, which is the type of the sub-family Arvicolinæ, belonging to the family Muridæ. The related species found in the U. S. are generally known under the name field-mice, but thus confounded with species of the sub-family Murinæ. (See MURIDÆ.)

**Vol'ga,** the largest river of Europe, rises in the government of Tver, Russia, in the Valdai Hills, at an elevation of 663 feet above the level of the Caspian Sea, flows southward with a winding and tortuous course, and enters the Caspian Sea through sixty or seventy mouths after a course of 2500 miles. It receives from the right the Oka and the Svora, and from the left the Tvertsa, Mologa, Sheksna, and Kama, and by canals is connected with the Dwina, Neva, and Dnieper, thus communicating with the Baltic and the White and Black seas. Between Nizhnee-Novgorod and Astrakhan it is navigable for the largest vessels; above Nizhnee-Novgorod only smaller crafts can ascend it; and below Astrakhan, and throughout the whole of its mouth, it is very shallow. At Nizhnee-Novgorod its breadth is 2069 feet, and it is immensely rich in fish, especially salmon and sturgeon.

**Volga,** tp., Clayton co., Ia. P. 1178.

**Volhy'nia,** government of Western Russia, bounded S. W. by Galicia, from which it is separated by the Bug, comprises an area of 27,742 sq. m., with 1,704,018 inhabitants. The northern and eastern parts of the country are flat, sandy, or marshy, little productive, but often covered with extensive forests of fir; the southern and western parts are hilly, partly occupied by spurs of the Carpathian Mountains, and contain the best agricultural land in Russia. Corn, timber, cattle, tallow, hides, tar, and potash are largely exported from this government. Cap. Zhitomeer.

**Voli'nia,** p.-v. and tp., Cass co., Mich. P. 1414.

**Volk'mann** (ALFRED WILHELM), b. in Leipsic July 1, 1801; studied medicine in his native city, in Paris, and in London, and was appointed professor of physiology at Leipsic in 1834, at Dorpat in 1837, and at Halle in 1843. The most remarkable of his writings are—*Anatomia Animalium* (1831–33), *Neue Beiträge zur Physiologie des Gesichtsinnes* (1836), *Die Lehre vom leiblichen Leben* (1837), *Die Selbständigkeit des sympathetischen Nervensystems* (1842), *Physiologische Untersuchungen im Gebiete der Optik* (1863–64).

**Vol'ney,** p.-v. and tp., Oswego co., N. Y., upon Oswego River. P. of v. 3507; of tp. 6565.

**Volney', de** (CONSTANTIN FRANÇOIS CHASSEBŒUF), COUNT, b. at Craon, department of Mayenne, France, Feb. 3, 1757; studied medicine and Oriental languages in Paris; spent subsequently several years in Egypt and Syria, and published after his return to France, *Voyage en Égypte et en Syrie* (2 vols., 1787; translated into English in the same year), which gave him a great reputation. Elected a deputy for Anjou to the States General of 1789, he advocated the ideas of the Revolution; published in 1791 *Les Ruines, ou Méditations sur les Révolutions des Empires* (translated into English, New York, 1796; London, 1827), and *La Loi naturelle, ou Catechisme du Citoyen français* (1793), but was, nevertheless, imprisoned as a royalist, and saved only by the fall of Robespierre. In 1794 he was appointed professor of history at the Normal School; travelled in the U. S. from 1795 to 1798; was made a senator in 1799, and published in 1803 *Tableau du Climat et du Sol des États-Unis d'Amérique* (2 vols.; translated into English by C. B. Brown, Philadelphia, 1804). After the establishment of the Empire, he retired from the senate, but Napoleon nevertheless made him a count in 1808, and Louis XVIII. a peer in 1814. In 1814–15 he published *Recherches nouvelles sur l'Histoire ancienne* (3 vols.; trans-

lated into English by Col. Corbet, London, 1819). His complete works appeared in 8 vols. (Paris, 1820–26). D. at Paris Apr. 25, 1820.

**Volog'da,** government of Russia, bounded N. W. by Archangel, comprises an area of 155,498 sq. m., with 1,003,039 inhabitants. The eastern part is covered with branches of the Ural Mountains, rising between 3000 and 4000 feet; the rest is an undulating plain. To the S. are some fertile agricultural districts, but the central and northern parts are little productive, and have a sandy or marshy soil, dotted with lakes and covered with almost impenetrable forests of fir and pine, and a very severe climate. The few inhabitants of these regions are of Finnish descent; they have their abodes along the rivers, and live as hunters. Fur, timber, salt, and iron are the exports.

**Vologda,** town of Russia, capital of the government of the same name, on the Vologda, has manufactures of soap, potash, candles, leather, cordage, and ropes, and carries on a brisk trade in its manufactures and in timber, tallow, and fur with Archangel and St. Petersburg. P. 18,984.

**Vol'sci,** an ancient people of Central Italy, inhabitants of the region directly E. of that of the Latini and W. of that of the Samnites. They were the hereditary enemies of the Latini and of the Romans, and allies of the Æqui. There are a few extant remains of their language, which seems to have been of the Oscan stock. The Volsci for many generations harassed Rome in a series of bloody wars, but about 338 B. C. they were finally subdued, and appear to have become *Latini* (in a legal sense), and subsequently full citizens of Rome.

**Volsinii,** town of Italy. See BOLSENA.

**Volsk,** town of European Russia, government of Saratov, on the right bank of the Volga, carries on an immense traffic on the river, exporting tallow, skins, and corn, and is celebrated for its gardens and orchards, in which large quantities of fine fruit are produced, which is exported to Nizhnee-Novgorod. Its fisheries are important. P. 26,853.

**Volt** [from *Volta*], in electrometry, the unit of tension or of electro-motive force. A million volts make one megavolt; one volt contains a million microvolts. A volt is to a daniell (that is, the tension of a Daniell's cell) as .9268 is to 1.079.

**Vol'ta** (ALESSANDRO), b. at Como Feb. 18, 1745; was first professor of physics at Como, and then in the University of Pavia, where he taught and studied for thirty years. In 1769 he published a dissertation, *De Vi attractivâ Ignis Electrici;* in 1775 invented the perpetual electrophore, in 1777 a lamp for inflammable gas, in 1782 the electric condenser, and finally arrived at the invention of the famous pile which bears his name, and was described by him in a letter to Sir Joseph Banks in the year 1800. Summoned to Paris by Napoleon I., he received the gold medal of the Institute, of which he became a member in 1802. Napoleon conferred upon him the title of count and the senatorship. The works of Volta were published at Florence in 9 vols. in 1816. D. Mar. 5, 1827.

**Voltaic Battery** and **Voltaic Electricity.** See ELECTRICITY, by PRES. H. MORTON, PH. D.

**Voltaire', de** (FRANÇOIS-MARIE AROUET), b. at Châtenay Feb. 20, 1694, the most brilliant French author, who by his genius and wit ruled as an absolute monarch in the kingdom of letters during the eighteenth century. He was a master-architect of ruin, and prepared the way for the mighty upheaving of society in France. He received his education in a Jesuit college; studied law; became secretary to the Marquis Châteauneuf (ambassador to the Hague); was dismissed on account of a love-intrigue; imprisoned in the Bastile for a satirical pamphlet on the decease of Louis XIV., which he hailed as a national deliverance; wrote the *Henriade* and *Œdipe,* which created much sensation and procured his liberty; was presented to the regent, who gave him 1000 crowns; changed his name from AROUET to VOLTAIRE; became the idol of fashionable and literary society; fell desperately in love with a lady of high rank, who gave him no encouragement; challenged the Chevalier de Rohan, who had insulted him, to duel; was arrested by the police and again sent to prison. Disgusted with the society and government of France, he accepted an invitation from Lord Bolingbroke to England Aug., 1726, and spent there nearly three years in friendship with the leading deists, whose opinions he adopted. He returned to Paris 1729; published *Brutus, Zaïre,* the *History of Charles XII.,* and *Letters on the English* (which gave great offence to the clergy and were condemned to be burnt); formed a *liaison* with Madame Gabrielle Châtelet 1735, which lasted till a year before her death (1749); wrote on the philosophy of Newton (1738), *Mahomet* (1741), and *Merope* (1743). On invitation of Frederick the Great, who admired his genius and sympathized with his infidelity, but after closer personal acquaintance despised his character, he spent three years in Berlin and Potsdam (July, 1750–53), but was dismissed in disgrace, and arrested on his return to Frankfort, and required to give up some of the king's poetry (which he called "a quantity of dirty linen"). He then settled with his niece at Ferney near Geneva 1755, where he spent the most tranquil and useful part of his life. He procured by untiring exertions the restoration of the good name of Jean Calas, who had been unjustly condemned to death at Toulouse by Romish bigotry (1762); composed or finished *La Pucelle* (1755), *Essay on the Manners of Nations,* a sort of philosophy of history (1756), *Candide* (1758), *Tancrède* (1768), and other works; and contributed to the famous *Encyclopédie* of Diderot and D'Alembert. In 1778 he once more visited Paris, and was received with extravagant demonstrations of enthusiasm, but he soon took sick, and died May 30 under great agonies of despair. He was buried with Rousseau in the Panthéon.

Voltaire was a man of sparkling genius, diversified talent, vast reading, untiring industry, quick wit, and unrivalled power of mockery; full of vanity, levity, petulance, avarice, malice, regardless of truth and charity—"half monkey, half tiger;" yet not without generous impulses and noble indignation against oppression, injustice, tyranny, and hypocrisy. His historical works (*Charles XII.* and *Siècle de Louis XIV.*) are models of clear, elegant, and lively narration. His poetic genius excels in tragedy (*Zaïre*) and epic (*Henriade*), but is destitute of heart and real pathos. His critical and satirical power is unsurpassed. He had a keen and bright intellect, a quick perception of defects, and could wield the dangerous weapons of irony and sarcasm with withering effect. "He had," says Carlyle, "the eye of a lynx, saw deeper at the first glance than any other man, but no second glance was given." He displayed his wit and power of ridicule at the expense of truth and justice, and he even uttered the most reckless falsehoods with unblushing assurance. Voltaire stands out as the bitterest enemy of Christianity in the last century, and contributed more than any one man to the French revolution and the temporary overthrow of religion in his native land. Much of his abuse was aimed at the Roman Catholic Church and her crying abuses at that time. He hated intolerance and bigotry which assumed the name of religion, and in the defence of Jean Calas he undoubtedly did good service to the cause of religious toleration. But he hated all forms of religion, Romanism, Jansenism, and Protestantism, alike, and assailed them most unscrupulously, without even taking the trouble to acquaint himself with the facts and arguments. He despised or hated the Bible as a barbarous book, and could not even appreciate its lofty poetry. We need not be surprised at this, for he also called Shakspeare "a great fool" and "an ugly ape." He went so far as to pronounce the fiendish blasphemy, "Crush the wretch!" (*Écrasez l'infâme!*), which refers either to Christ himself or rather (as Strauss explains it) to the Christian religion and Church. In his *Le Dîner du Comte de Boulinvilliers* (1767), which gives the best view of his religious opinions, he heaps contempt and ridicule on Judaism and Christianity alike, and concludes with the advice, "Expel all theologians and priests, who have flooded the earth with blood; throw away all mysteries of faith as useless trash; preach God and morals, and there will be more truth and happiness in the world." His arguments are borrowed from the English deists, and he is original only in his levity, wit, and never-failing power of satire. He was not an atheist, as is often asserted, but a deist. He said, "If there were no God, it would be necessary to invent one, but all nature cries aloud that he exists" (*mais toute la nature nous crie qu'il existe*). His dying confession to Wagnière, his secretary, was, "I die in the adoration of God, in love to my friends, without hatred of my enemies." He also confessed to a Romish priest (Abbé Gaultier), but this was merely an act of accommodation to the rules of society, that he might secure absolution and decent burial. "We must howl a little with the wolves," he said; "if I were on the banks of the Ganges, I would die with a cow's tail in my hand." He was a Mephistopheles who delighted in mischief, in ridicule and denial. Yet he was necessary in France, and had the mission to lay bare the rotten state of society in Church and State, and by destruction to prepare the way for reconstruction. His talents excite admiration, his character contempt. His only claim to our regard are his few acts of generosity and his services to the cause of religious toleration, although he aimed at freedom of infidelity rather than freedom of faith.

*Literature.—Œuvres* (Geneva and Paris, 1768–96, 45 vols.; Paris, 1802, 55 vols.; 1825, 66 vols.; 1827, 72 vols.; 1832, 95 vols.; 1834, by Beuchot, 70 vols. (Brunet calls this "la plus belle, du moins la plus complète et la mellieure edition").) English translation of his works by Smollett, Francklin, and others (London, 1776, 37 vols.). His *Henriade, Pucelle d'Orléans, Charles XII.,* and *Century of Louis*

*XIV.* have often been separately printed. Longchamp and Wagnière (his secretaries), *Mémoires sur Voltaire et sur ses Ouvrages* (Paris, 1825, 2 vols.); Villemain, *Tableau de la Littérature du Dix-huitième Siècle;* art. "Voltaire" in the *Nouvelle Biographie générale;* Lord Brougham, *Lives of Men of Letters and Science* (London, 1845); Carlyle's essay on *Voltaire;* Macaulay's essay on *Frederick the Great;* Schlosser's *History of the Eighteenth Century;* Bungener's *Voltaire;* David Friedr. Strauss, *Voltaire* (6 lectures, delivered before and dedicated to Princess Alice of Hesse, daughter of Queen Victoria, Leipsic, 1870); John Morley, *Voltaire* (London and New York, 1872). PHILIP SCHAFF.

**Voltameter.** See ELECTRICITY, by PRES. H. MORTON.

**Voltatype,** or **Electrotype.** See PRINTING, by W. S. PATERSON.

**Volter'ra,** an ancient town in the province of Pisa, in Northern Italy, on the summit of a steep hill at the height of 1800 feet above the sea, about 50 miles S. from Florence. Volterra was the largest of the twelve capital cities of Central Etruria, and sustained a long struggle against Rome, but the time of its final conquest is not known. During the Middle Ages, Volterra was alternately the spoil of popes and emperors. In the latter part of the fourteenth century Volterra fell into the hands of the Florentine republic, and, in spite of several more or less successful attempts at revolt, remained ever after a possession of Tuscany. Volterra still retains some of her ancient gates, and considerable fragments of the old Etruscan wall built of huge blocks of stone without cement, and much more extensive than the mediæval fortifications. The population is thought to be of more unmixed Etruscan blood than that of other old towns of that people, and many of the names read on the ancient sepulchral monuments are those of families still existing in the city and territory of Volterra. Its cemeteries have yielded rich contributions to Etruscan archæology, and the city museum—which, among many other interesting antiques, contains not less than 400 cinerary urns and sarcophagi, chiefly of alabaster enriched with sculptures—is among the most important existing repositories of Etruscan art. In the neighborhood of Volterra are valuable salt springs, called by an Arabic name, *le moje*, yielding annually about 7000 tons of salt. The Volterran quarries of alabaster are among the finest known deposits of that stone, and articles manufactured from it find a market all over the world. The cathedral, enlarged by Andrea Pisano in 1254, is a fine structure and contains good pictures. The pop., comprising the suburbs and some separate hamlets, is 13,702.

**Volterra, da** (DANIELE), whose true name was RICCIARELLI, b. at Volterra in 1509; was a friend and pupil of Michael Angelo, whose style he adopted with considerable success. His most famous pictures are a *Descent from the Cross*, in the church of Trinitá de' Monti, in Rome, and the *Massacre of the Innocents*, in Florence. D. at Rome about 1566. In the latter part of his life he devoted himself to sculpture, but left unfinished his two largest works, the statue of St. Michael of San Angelo and the equestrian statue of Henri II., king of France. He was generally nicknamed BRAGHETTONE, because he provided some of the naked figures in Michael Angelo's *Last Judgment* with breeches by order of Pope Paul IV.

**Vol'tri** [Med. Lat. *Ulterium*], town of Italy, province of Genoa, on the sea-shore between the Leira and the Cerusa, about 10 miles W. of the city of Genoa, with which, however, it is connected by an almost continuous line of houses. Voltri is a flourishing manufacturing town, has some fine churches, and near it are charming villas, the most striking of which is the Brignole-Sale, on a hill commanding an exquisite view of this most lovely coast. Voltri contains at least 125 paper-factories, and the sulphurous water employed in its manufacture is believed to protect the paper against the attacks of the *book-worm*, for which reason it is used, by regulation, in many of the public offices in England. It is also largely exported to America. The mechanical power of the two torrents is also further utilized in the manufacture of cotton, wool, hemp, linen, leather, etc. The mineral springs near Voltri, known as Acqua Santa and Acqua della Penna, are now much frequented. P. 13,250. CAROLINE C. MARSH.

**Voltum'na,** the tutelary goddess of the Etruscan confederation, at whose temple (*Fanum Voltumnæ*) the general meetings of the deputies from the twelve cantons were held, in the same manner as the assemblies of the Latin, Sabine, Hernican, and other leagues were held at the groves or fountains of Feronia or Ferentina, which, as well as Vertumnus or Vortumnus, Volumnus, Volumna, Vulturnus, and the Oscan Herentas (incorrectly represented as the goddess of love), are probably mere variations of the same name, of which the root, under the forms Val, Vel, Fal, Fel, Fer, Ver, appears in nearly all the tribal or civic names of the Pelasgic nations of Italy. The worship of Voltumna was doubtless anterior to the irruption of the Etruscans proper into the region called by their name. The site of the temple of Voltumna is placed by some at Castel d'Asso, by others at Viterbo, and by Mr. George Dennis (*Etruria*, vol. i. p. 516) at Monte Fiascone. PORTER C. BLISS.

**Voltur'no** [anc. *Vulturnus*], the principal river of Southern Italy, rises in Monte San Croce, near Castellone; flows first S. E., then W., through the plains of Campania, and enters the Gulf of Gaëta after a course of about 90 miles. Along the Volturno was fought a series of battles between Garibaldi and the royal Neapolitan troops, Sept. 19, 21, and Oct. 1, 1866.

**Volumenom'etry** [Lat. *volumen*, primarily a "roll"—whence we get our word "volume," meaning "bulk"—and *metari*, to "measure"]. A better term possibly is *stereometry* (Gr. στερεός or στερρός, "solid," and μετρεῖν, "to measure"). The term denotes the art of determining the volumes or spaces occupied by bodies, applied generally, however, only to solids, and not to liquids and gases, which latter are easily measured by means of graduated measures. In the case of solids, however, which have not the fluidity, and consequent homogeneity, of the other two conditions of matter, the measurement of the true volume is not so simple or direct, requiring contrivances and devices of a more or less elaborate kind. Almost all the methods of volumenometry or stereometry are founded upon the original method of Archimedes, who first discovered and made use of this art; which method was to measure the amount of water that flows over when the solid to be measured is plunged into a vessel filled to the brim. The exactitude of modern science requires, however, that several special precautions should be practised to eliminate certain sources of error.

The taking of specific gravities (see GRAVITY, SPECIFIC) involves one mode of volumenometry, the loss of weight in water being virtually the weight of a volume of water equal to the volume of the body, from which the volume of the body itself follows very simply. Instruments have, however, been constructed, known as *volumenometers* or *stereometers*, which indicate the volume of the immersed body directly by the rise of the liquid into a graduated tube. This plan was first used by Bishop Watson in 1770, who tried in this way to determine the increase of volume produced by the solution of salts in water. He used merely a matrass with a long narrow neck, filled with water up to the neck, and dropped the salt down through this neck, noting the rise in the latter. Playfair and Joule, about 1844, used an improved plan of a similar kind, this being a bulb with a long graduated stem, on the side of the bulb being a tubulure with a ground stopper. The bulb and stem, up to a certain mark, being filled with water, oil, or turpentine, or other suitable liquid, the instrument was so inclined that the stopper could be removed without escape of the liquid, and the weighed salt or other body whose volume was to be measured being introduced, the stopper was then replaced. On again placing the stem in vertical position, the new level of the liquid therein showed the increase of volume. The figures given of the work with this instrument by Playfair and Joule do not show very satisfactory accordances, and it seems probable that some important sources of error were not sufficiently eliminated. It would seem practicable so to use such an instrument as to obtain uniform and correct results.

Instruments have also been constructed to show the volume by measuring the *air* displaced, but these are so subject to sources of error as to be of little use. So far, the only reliable method of volumenometry in use is that referred to before—the careful determination of the density or specific gravity of the body, the volume being simply the reciprocal of the density, or 1 divided by the density. If instead of 1, the *equivalent weight* of a chemically homogeneous body be divided by the density, we get the *equivalent volume*. (See VOLUMES, MOLECULAR.)

HENRY WURTZ.

**Vol'umes, Molec'ular** or **Equivalent,** sometimes called **Atomic Volumes,** a term objectionable for several reasons, especially because it can apply, even hypothetically, only to elementary bodies, and not at all definitely to compounds; also sometimes called **Specific Volumes,** which is a still more mischievous term, as it likens them to *specific gravities*, to which they have no relation justifying a related term. "Equivalent volumes," or "*volumes of chemical equivalents*," is the most definitive term, as it involves no hypothesis whatever. The term "*molecular volume*" need not, however, be regarded as involving hypothesis if "molecule" and "equivalent" be merely viewed as synonymous in a chemical sense.

Under CHEMISTRY have been discussed the laws of *gaseous* combining volumes (called by some *molecular volumes*),

but the vast subject of *liquid* and *solid* combining volumes has there been left untouched. For one gaseous body that is known, however, *thousands* of equally important solids and liquids are known; and the branch of chemistry here to be treated has a commensurate significance, involving, indeed, in an essential manner, the whole future of the science, and the hope of future substantial progress therein. The argument upon which the writer bases this latter assertion is one which may be forcibly presented in but a few words. In the chemistry of solids and liquids the only laws of proportion and combination of elements hitherto successfully investigated and recognized are those which arise out of relations to the *attractive* or *centripetal* force or forces. The relations to the antagonistic *repulsive* or *centrifugal* force or forces (or resultants of forces, or of *motion*, as they may be deemed) which occasion the occupation of space by solids and liquids, are as yet unrecognized in the science. The writer claims—as many others have claimed before him—that these latter relations must be believed to be at least equally important with those that govern combining weights, and that any laws found to rule them must be admitted to have an essentiality comparable with that of the two laws of definite and multiple proportions by weight, or of the multiple volumic law of combination in gases.

Dr. Thomas Thomson of Glasgow first attempted, about 1830, to compute the relative volumes occupied in the solid and liquid states by equivalents of elements and compounds, and showed some striking approximations of volume between equivalents of some of the metals. The arithmetical method of obtaining equivalent volumes is simply to divide the equivalent weight by the specific gravity. (See Isosterism.) Subsequently, and at intervals since, the question has been taken up and studied by many distinguished chemists—with so little satisfactory success, however, that their generalizations are as yet little noticed in the text-books of the science. An *historical* discussion of this matter would go beyond our present scope, which must be limited to the brief setting forth of some *recently-discovered* relations and laws, which, it is believed, are so extensively supported by facts that they will command universal acceptation from all who are free from prejudice. These discoveries were presented by the present writer to the scientific world within the year 1876.*

The writer considered—as has been hinted under a previous head, Isosterism—that the simple *multiple* relations of volume (like those in gases) which have been sought to be established by other investigators between liquid and solid chemical molecules, were, in the nature of the case, not probable, or at least not probably essential, and that a *geometrical* ratio—or rather some simple ratio between geometrical dimensions, as, for example, between the *cube-roots* of the volumes—was much more likely to be found if sought for. He also considered that, whatever a molecule might be in shape or size, in a homogeneous collocation of equal molecules each one must needs occupy, *virtually*, an equal *cubical* space. He therefore directed his labors entirely to the comparison of the *cube-roots* of equivalent volumes at different temperatures. In due time he discovered that by multiplying the equivalent volumes by 1000—which amounts simply to assuming the equivalent weight of hydrogen as 1000 (instead of unity, which is the customary assumption)—these cube-roots of the volumes of equivalents presented, in many cases, close approximations to whole numbers. It was next found that this approximation was closest at the temperature of melting ice, or the Centigrade zero, the equivalent volume of ice itself being almost precisely the even cube of 27. Further, there appeared conclusive reason to believe that if the temperature be taken at which ice *begins* to melt or absorb latent heat, which is about 4° F. below the so-called freezing-point, the cube-root of the equivalent volume of ice would become 27, with mathematical exactness. This point of temperature, of initial fusion of ice, is therefore regarded by the writer as a standard temperature in nature; the more so as it is plainly the point at which all life and motion begin on the earth.

The following may be cited as some of the cases in which the probabilities are more or less great—in many of these cases very great—that at this temperature of initial ice-fusion the equivalent volume of the body would become an exact even cube of a whole number. For purposes of a symbolic *notation*, to convey at a glance this new relation, it will be a convenient device to place the number expressing the cube-root of the volume under the chemical symbol of the element. In the case of ice, which is only *one* of the even cubes that water or the compound $H_2O$ has been found to assume in different forms of combination, a new general symbol, Hδ, is used, founded on the Greek name of water, Ὕδωρ or *Hydor*. In all the following tables, when the temperature of the *experimental* density is not stated, it is to be understood that the experiment was made at about the *normal* temperature, 60° F. The *computed* densities are those corresponding to the new law of cubical molecular condensation, as well as to the new standard temperature of *initial* ice-fusion.

To explain the term *diametric*, as used in this table and throughout this article, it is only necessary to mention that the cube-root of any cubical space is its shortest *diameter*.

Table I.—*Elemental and Elementoid Molecules of Simplest Forms.*

| Bodies. | Diametric symbols. | Computed zero-densities. | Experimental densities. | Experimenters. |
|---|---|---|---|---|
| Diamond | C 15 | 3.5555+ | 3.55 | Pelouze, also Brisson. |
| Boron (adamantoid) | B 16 | 2.685 | 2.68 | Wöhler and Deville. |
| Ice | Hδ 27 | .9145 | .91674 | At 0° C., Bunsen. |
| Water of crystallization | Hδ 24 | 1.3021 | 1.3081 | Generalized by F. W. Clarke of Cincinnati, in an extended research. |
| Amorphous brick-red phosphorus | P 25 | 1.985 | 1.964 | Schrötter. |
| Orange-yellow phosphorus | P 24 | 2.243 | 2.23 | Brodie. |
| Crystallized native sulphur | S 25 | 2.048 | 2.05 | Karsten. |
| Selenium, crystallized from bisulphide of carbon | Se 26 | 4.495 | 4.46<br>4.509 | Mitscherlich. |
| Liquid bromine | Br 30 | 2.963 | 2.966 | Balard. |
| Liquid cyanogen | Cy 31 | .8728 | .866 | Faraday. |
| Silicon | Si 24 | 2.025 | 2.004 | Winkler. |
| Amorphous arsenic | As 25 | 4.8 | 4.716 | Bettendorff (compare red phosphorus). |
| Antimony | Sb 26 | 6.904 | 6.86 | Muschenbroek. |
| Bismuth | Bi 28 | 9.566 | 9.556 | Marchand and Scheerer (compressed). |
| Columbium | Cb 25 | 6.016 | 6. | Marignac. |
| Tantalum | Ta 26 | 10.355 | 10.43 | Rose. |
| Sodium | Na 29 | .943 | .935 | Davy. |
| Lithium | Li 23 | .575 | .578 | Bunsen. |
| Silver | Ag 22 | 10.143 | 10.1053 | Baudrimont (cast and slowly cooled). |
| Barium | Ba 33 | 3.812 | 3.75 | Sergius Kern. |
| Strontium | Sr 33 | 2.435 | 2.4 | Franz. |
| Tin | Sn 25 | 7.552 | 7.5565 | Herapath (cast). |
| Iron | Fe 19 | 8.164 | 8.14 | Smith (electrolytic iron). |
| | Fe 20 | 7. | 6.886 | Abel (minimum of hot-blast pig). |
| | | | 6.9551 | Mallet (minimum of hot-blast pig). |
| | Fe 21 | 6.047 | 6.03 | Stahlschmidt's soft allotrope. |
| Zinc | Zn 21 | 7.019 | 6.966 | Schiff. |
| | | | 6.975 | " |
| | | | 6.992 | Playfair and Joule. |
| | | | 7.03 | Bolley. |
| Manganese (hard.) | Mn 19 | 8.018 | 8.013 | John. |
| | | | 8.03 | Bachmann. |
| Manganese (soft.) | Mn 20 | 6.875 | 6.861 | Bergmann. |
| Nickel | Ni 19 | 8.456 | 8.402 | Tourte. |
| | | | 8.477 | Baumgartner. |
| Cobalt | Co 19 | 8.602 | 8.558 | T. H. Henry. |
| Platinum | Pt 21 | 21.272 | 21.267 | Marchand. |
| Palladium | Pd 21 | 11.5 | 11.4 | Deville and Debray. |
| Rhodium | Rd 21 | 11.262 | 11.2 | Cloud. |
| Ruthenium | Ru 21 | 11.251 | 11. | Deville and Debray. |
| Osmium | Os 21 | 21.488 | 21.4 | " |
| Vanadium | V 21 | 5.528 | 5.5 | Roscoe. |
| Tungsten | W 22 | 17.28 | 17.2 | Wöhler. |
| | | | 17.2 | Zettnow. |
| | | | 17.22 | Allen and Aiken. |
| | | | 17.3 | Bernouilli. |

A few other known cases may be added of elements which, *at their own points of fusion*, fall into one of these cubical volumes:

*Addenda to Table I.*

| Bodies. | Diametric symbols. | Computed zero-densities. | Experimental densities. | Experimenters. |
|---|---|---|---|---|
| Melted phosphorus | P 26 | 1.764 | 1.763 | Gladstone and Dale. |
| Melted sulphur | S 26 | 1.821 | 1.815 | Playfair and Joule. |
| Melted potassium | K 36 | .836 | .843 | " " |
| Melted lead | Pb 27 | 10.517 | 10.513 | " " |

The above cases are of necessity chiefly confined to elemental bodies, but the next tabulation to be given, of examples of molecules composed of two cubical volumes asso-

* See the *American Chemist* for Mar., 1876, pp. 321-346—"Introductory Memoir on Geometrical Chemistry, by Henry Wurtz"—memoir dated Jan. 1, 1876.

ciated together, having sometimes the same, but oftener *proximate* diameters, will contain both elements and binary compounds. It will be comprehended that the discovery of these double-cube molecules arose naturally out of—in fact, simultaneously with—that of the simpler cubical molecules tabulated above:

TABLE II.

| Bodies. | Volumic formulæ. | Computed zero-densities. | Experimental densities. | Experimenters. |
|---|---|---|---|---|
| Gas-carbon | C C 18 19 | 1.891 | 1.885 | Mené. |
| Common cast phosphorus | P P 24 25 | 2.105 | 2.09 | Playfair and Joule. |
| Iodine | I I 29 30 | 4.943 | 4.948 | Gay-Lussac. |
| Soft amorphous sulphur | S S 25 26 | 1.928 | 1.92 | Weber. |
| | | | 1.921 | Playfair and Joule. |
| | | | 1.926 | Weber. |
| | | | 1.927 | Weber. |
| | | | 1.927 | Bischof. |
| | | | 1.928 | C. Deville. |
| Arsenic, native metallic. | As As 23 24 | 5.771 | 5.763 | Stromeyer. |
| | | | 5.763 | Brisson. |
| | | | 5.766 | Mohs. |
| | | | and six others. | |
| Selenium, red, precipitated | Se Se 26 27 | 4.241 | 4.245 | Schaffgotsch. |
| Silver, native crystal. | Ag Ag 21 22 | 10.849 | 10.77 | Forbes. |
| Silver, in fusion | Ag Ag 22 23 | 9.468 | 9.4612 | Roberts. |
| Quicksilver | Hg Hg 24 25 | 13.583 | 13.56 | Karsten. |
| | | | 13.582 | At 5° C., Regnault. |
| | | | 13.5886 | Biot and Arago. |
| | | | 13.5886 | At 4°, Kupffer. |
| Cadmium | Cd Cd 23 24 | 8.619 | 8.604 | Stromeyer. |
| Indium | In In 21 22 | 7.434 | 7.421 | Winkler's heaviest. |
| Gold | Au Au 21 22 | 19.243 | 19.207 | Elliott (hammered). |
| Zinc, melted | Zn Zn 21 22 | 6.529 | 6.522 | Playfair and Joule. |
| Iron, native | Fe Fe 20 21 | 6.489 | 6.497 | Bahr (found in fossil wood). |
| Iron, pure | Fe Fe 19 20 | 7.537 | 7.5 | Poumaréde (reduced by Zn vapor). |
| Calcium | Ca Ca 29 30 | 1.556 | 1.55 | Liés-Bodart and Jobin. |
| Potassium | K K 35 36 | .871 | .87 | Sementini. |
| Chloride of iodine (solid) | Cl I 24 33 | 3.266 | 3.263 | At 0° C., Hannay. |
| Chloride of sulphur (liquid) | Cl S 28 26 | 1.708 | 1.7055 | At 0° C., Kopp. |
| Chloride of thallium | Cl Tl 24 27 | 7.148 | 7.02 | Lamy. |
| Chloride of sodium | Cl Na 24 23 | 2.251 | 2.24 | Filhol. |
| | | | 2.26 | Mohs. |
| Chloride of silver | Cl Ag 24 23 | 5.521 | 5.517 | Schiff (precipitated). |
| Liquid hydrofluoric acid | F H 22 21 | 1.0049 | .9922 | Gore. |
| Fluoride of silver | F Ag 18 25 | 5.919 | 5.852 | Gore. |
| Fluoride of potassium | F K 18 26 | 2.478 | 2.454 | Bödeker. |
| Bromide of potassium | Br K 28 28 | 2.717 | 2.69 | Schröder. |
| Bromide of sodium | Br Na 28 23 | 3.019 | 3.011 | Tschermak. |
| Bromide of silver | Br Ag 28 21 | 6.023 | 6.02 | Berthier (native). |
| Bromide of selenium | Br Se 28 28 | 3.621 | 3.604 | Schneider. |
| Iodide of potassium | I K 28 33 | 2.867 | 2.85 | Schiff. |
| Iodide of ammonium | I Am 28 33 | 2.505 | 2.498 | Bödeker. |
| Iodide of silver | I Ag 28 27 | 5.644 | 5.64 | Breithaupt (native). |
| Cyanide of silver | Cy Ag 24 27 | 3.999 | 3.943 | Giesecke. |
| Sulphide of manganese. | S Mn 24 20 | 3.987 | 3.95 | Leonhard (mineral *alabandite*). |
| Sulphide of zinc | S Zn 24 22 | 3.964 | 3.9235 | Karsten (lightest). |
| Sulphide of calcium | S Ca 24 24 | 2.604 | 2.58 | Maskelyne. |
| Sulphide of cadmium | S Cd 24 25 | 4.889 | 4.8 | Brooke. |
| Sulphide of mercury | S Hg 24 25 | 7.881 | 7.748 | Moore (black allotrope). |
| Sulphide of lead | S Pb 24 26 | 7.611 | 7.6 | Leonhard. |
| Selenide of mercury | Se Hg 24 29 | 7.301 | 7.274 | Dana's *Mineralogy*. |

Three tables are presented below, containing the molecular structures of such haloid salts as have had their densities determined. In many of these cases there is more than one allotropic form, but the one given here is generally that which is supported by the greater number of density-figures, the *dominant* form, as the writer prefers to call it. In several, however, of the bromides, and even of the iodides, there having been but one determination made, it remains in doubt as yet whether the form given is really the dominant one.

As yet these tabulations are far too imperfect—too many wide gaps remaining to be filled up, and too much uncertainty, as said before, regarding the true places of some important electro-positives—to justify much *generalization* from them. Chemists will observe, nevertheless, several striking cases of basic molecules brought into proximity or serial relations (see SERIES IN CHEMISTRY), both according to their *equivalencies*, and also according to certain known chemical parallelisms not depending always upon equivalence. Thus, for example, *lead* bromide with those of *silver* and *cuprosum; vanadium* and *chromium* chlorides; *hydrogen* with *magnesium* and *cupricum* chlorides; *lead* with *thallosum* and *mercurosum* chlorides; *ammonium* and *thallium* chlorides; and so on.

*Diametric Types.*—One feature of these tabulations is their illustration of *typical* diametric relations. *Six* of these types have appeared, marked by their dominant diametric figures forming a series of *multiples of 4*, these being 16, 20, 24, 28, 32, and 36. Higher ones may exist. These types are, provisionally, numbered from 1 to 6. Negative elements fall sharply into typical diameters, while positives usually only approximate thereto. Thus, *solid* chlorides are of Chloride-Type 3; solid bromides and iodides of Type 4; *liquid* chlorides are of Type 4. Similar differences of 4 are unmistakable among the positive elements. Thus, the diameters of the same metal show numerous cases like Ag 19, 23, 27; *cuprosum*, 20, 24, 28; Pb 23, 27, 31; Cd 24, 28, 33; Ca 25, 29; Sr 26, 30; Bi 30, 34; and so on. (See further under WATER OF CRYSTALLIZATION.)

TABLE III.—*Solid Anhydrous Haloid Bromides, arranged in the Order of the Diameters of the Electro-positive Molecules.*

| Bromide of— | Volumic formulæ. | Computed zero-densities. | Experimental densities. | Experimenters. |
|---|---|---|---|---|
| Argenticum | $2^{Br}_{28}.2^{Ag}_{19}$ | 6.525 | 6.425 | Schröder (*maximum*). |
| Cuprosum | $2^{Br}_{28}.2^{Cu}_{20}$ | 4.791 | 4.72 | Bödeker. |
| Lead | $4^{Br}_{28}.(^{Pb\ Pb}_{22\ 23})$ | 6.635 | 6.6302 | " |
| Sodium | $2^{Br}_{28}.2^{Na}_{23}$ | 3.019 | 3.011 | Tschermak. |
| Cadmium | $4^{Br}_{28}.(^{Cd\ Cd}_{23\ 24})$ | 4.781 | 4.712 | Bödeker and Giesecke. |
| Calcium | $4^{Br}_{28}.2^{Ca}_{25}$ | 3.359 | 3.32 | Bödeker. |
| Mercurosum | $2^{Br}_{28}.2^{Hg}_{25}$ | 7.451 | 7.307 | Karsten. |
| Mercuricum | $4^{Br}_{28}.(^{Hg\ Hg}_{25\ 26})$ | 5.95 | 5.9202 | " |
| Zinc | $4^{Br}_{28}.2^{Zn}_{26}$ | 3.659 | 3.643 | Bödeker. |
| Strontium | $4^{Br}_{28}.2^{Sr}_{26}$ | 4.025 | 3.985 | Favre and Valson. |
| Hydrogen | $2^{Br}_{28}.2^{H}_{27}$ | 1.9455 | ..... | Deduced from the hydrates. |
| Ammonium | $2^{Br}_{28}.(^{Am\ Am}_{28\ 27})$ | 2.291 | 2.266 | Bödeker. |
| Potassium | $2^{Br}_{28}.2^{K}_{28}$ | 2.717 | 2.672 | Playfair and Joule. |
| | | | 2.69 | Schröder. |
| Barium | $4^{Br}_{28}.(^{Ba\ Ba}_{29\ 30})$ | 4.267 | 4.23 | Schiff. |
| Aluminum | $6^{Br}_{28}.2^{Al}_{34}$ | 2.544 | 2.54 | Deville and Troost. |

TABLE IV.—*Solid Anhydrous Haloid Chlorides, arranged in the Order of the Diameters of the Electro-positive Molecules.*

| Chloride of— | Volumic formulæ. | Computed zero-densities. | Experimental densities. | Experimenters. |
|---|---|---|---|---|
| Lithium | $2^{Cl}_{24}.(^{Li\ Li}_{19\ 20})$ | 1.999 | 1.998 | Kremers. |
| Vanadium | $4^{Cl}_{24}.(^{V\ V}_{21\ 22})$ | 3.244 | 3.23 | Roscoe. |
| Vanadium | $6^{Cl}_{24}.2^{V}_{22}$ | 3.022 | 3.0 | Roscoe. |
| Chromium | $6^{Cl}_{24}.2^{Cr}_{22}$ | 3.051 | 3.03 | Schafarik (crystallized). |
| Argenticum | $2^{Cl}_{24}.(^{Ag\ Ag}_{23\ 22})$ | 5.687 | 5.595 | Schröder (*maximum*). |
| Sodium | $2^{Cl}_{24}.2^{Na}_{23}$ | 2.251 | 2.24 | Filhol. |
| Cuprosum | $2^{Cl}_{24}.(^{Cu\ Cu}_{23\ 24})$ | 3.692 | 3.678 | Karsten. |
| Hydrogen | $2^{Cl}_{24}.(^{H\ H}_{24\ 25})$ | 1.2785 | 1.27 | Watts's *Dictionary of Chemistry*. |
| Magnesium | $4^{Cl}_{24}.2^{Mg}_{25}$ | 2.195 | 2.179 | Playfair and Joule. |
| Cupricum | $4^{Cl}_{24}.2^{Cu}_{25}$ | 3.108 | 3.054 | " |
| Platinum | $4^{Cl}_{24}.2^{Pt}_{26}$ | 5.926 | 5.87 | Bödeker. |
| Mercurosum | $2^{Cl}_{24}.(^{Hg\ Hg}_{26\ 27})$ | 7.256 | 7.178 | Playfair and Joule. |
| Lead | $4^{Cl}_{24}.2^{Pb}_{27}$ | 5.873 | 5.805 | Stolba. |
| Thallosum | $2^{Cl}_{24}.2^{Tl}_{27}$ | 7.148 | 7.02 | Lamy. |
| Zinc | $4^{Cl}_{24}.(^{Zn\ Zn}_{27\ 28})$ | 2.806 | 2.753 | Bödeker. |
| Ammonium | $2^{Cl}_{24}.(^{Am\ Am}_{27\ 28})$ | 1.544 | 1.5443 | Wattson. |
| Thallium | $3^{Cl}_{24}.2^{Tl}_{28}$ | 6.026 | 5.9 | Lamy. |
| Cadmium | $4^{Cl}_{24}.2^{Cd}_{28}$ | 3.689 | 3.625 | Bödeker. |
| Mercuricum | $4^{Cl}_{24}.2^{Hg}_{28}$ | 5.464 | 5.448 | Schröder. |
| Ferrosum | $4^{Cl}_{24}.2^{Fe}_{28}$ | 2.56 | 2.528 | Filhol. |
| Calcium | $4^{Cl}_{24}.(^{Ca\ Ca}_{28\ 29})$ | 2.184 | 2.16 | Favre and Valson. |
| Potassium | $2^{Cl}_{24}.(^{K\ K}_{28\ 29})$ | 2.014 | 1.996 | Schröder. |
| Manganese | $4^{Cl}_{24}.(^{Mn\ Mn}_{28\ 29})$ | 2.4794 | 2.478 | " |
| Barium | $4^{Cl}_{24}.(^{Ba\ Ba}_{29\ 30})$ | 3.899 | 3.886 | " |
| Strontium | $4^{Cl}_{24}.(^{Sr\ Sr}_{29\ 30})$ | 2.971 | 2.96 | Filhol. |
| Bismuth | $6^{Cl}_{24}.2^{Bi}_{30}$ | 4.622 | 4.56 | Bödeker. |

TABLE V.—*Iodides, arranged in the Order of the Electro-positive Diameters.*

| Iodide of— | Volumic formulæ. | Computed zero-densities. | Experimental densities. | Experimenters. |
|---|---|---|---|---|
| Sodium..... | $2^{I}_{28}.\left(\begin{smallmatrix}Na & Na\\ 27 & 26\end{smallmatrix}\right)$ | 3.696 | 3.654 | Favre and Valson (*maximum*). |
| Argenticum..... | $2^{I}_{28}.\left(\begin{smallmatrix}Ag & Ag\\ 27 & 26\end{smallmatrix}\right)$ | 5.791 | 5.707 | Damour (native, *maximum*). |
| | | | 5.718 | Schröder. |
| | | | 5.807 | H. Deville (precipitated, at 0° C.). |
| Hydrogen..... | $2^{I}_{28}.2^{H}_{27}$ | 3.0743 | ..... | From its hydrates. |
| Cuprosum..... | $2^{I}_{28}.\left(\begin{smallmatrix}Cu & Cu\\ 28 & 27\end{smallmatrix}\right)$ | 4.454 | 4.41 | Schiff. |
| Mercurosum..... | $2^{I}_{28}.\left(\begin{smallmatrix}Hg & Hg\\ 28 & 27\end{smallmatrix}\right)$ | 7.646 | 7.6445 | Karsten. |
| Zinc..... | $4^{I}_{28}.\left(\begin{smallmatrix}Zn & Zn\\ 28 & 29\end{smallmatrix}\right)$ | 4.756 | 4.696 | Bödeker and Giesecke. |
| Mercuricum..... | $4^{I}_{28}.\left(\begin{smallmatrix}Hg & Hg\\ 30 & 31\end{smallmatrix}\right)$ | 6.279 | 6.25 | Filhol. |
| | | | 6.27 | Tschermak. |
| Potassium..... | $2^{I}_{28}.\left(\begin{smallmatrix}K & K\\ 31 & 32\end{smallmatrix}\right)$ | 3.118 | 3.11 | Boullay (*maximum*). |
| Lead..... | $4^{I}_{28}.\left(\begin{smallmatrix}Pb & Pb\\ 31 & 32\end{smallmatrix}\right)$ | 6.132 | 6.11 | " |
| Ferrosum (with crystal-water) | $4^{I}_{28}.2^{Fe}_{32}$ | 2.897 | 2.873 | Bödeker. |
| Strontium..... | $4^{I}_{28}.2^{Sr}_{32}$ | 4.464 | 4.415 | " |
| Barium..... | $4^{I}_{28}.2^{Ba}_{33}$ | 4.9 | 4.917 | Filhol. |
| Ammonium..... | $2^{I}_{28}.2^{Am}_{33}$ | 2.505 | 2.498 | Bödeker. |
| Cadmium..... | $4^{I}_{28}.2^{Cd}_{33}$ | 4.584 | 4.576 | " |
| Antimony..... | $6^{I}_{28}.\left(\begin{smallmatrix}Sb & Sb\\ 32 & 33\end{smallmatrix}\right)$ | 5.019 | 5.01 | " |
| Bismuth..... | $6^{I}_{28}.\left(\begin{smallmatrix}Bi & Bi\\ 33 & 34\end{smallmatrix}\right)$ | 5.711 | 5.652 | " |
| Arsenic..... | $6^{I}_{28}.\left(\begin{smallmatrix}As & As\\ 33 & 34\end{smallmatrix}\right)$ | 4.407 | 4.39 | " |
| Tin..... | $8^{I}_{28}.\left(\begin{smallmatrix}Su & Sn\\ 35 & 36\end{smallmatrix}\right)$ | 4.722 | 4.696 | " |
| Potassium (melted)..... | $2^{I}_{28}.\left(\begin{smallmatrix}K & K\\ 35 & 36\end{smallmatrix}\right)$ | 2.488 | 2.497 | At 666° C.—Braun. |
| Aluminum..... | $6^{I}_{28}.\left(\begin{smallmatrix}Al & Al\\ 44 & 45\end{smallmatrix}\right)$ | 2.652 | 2.63 | Deville and Troost. |

Divers cases of more complex combinations of cubical molecules will appear further on. The discovery of these cubical relations led the writer, through long and laborious researches and generalizations, to the establishment of certain general laws governing the chemical molecular constitution of matter. The chief of these has been expressed as follows: (1) *The Geometric Law of Molecular Condensation.—The volumes of all single chemical molecules, whether of elements or of radicals—with the one sole exception of oxygen—are expressible by quantities having, at the temperature of incipient ice-fusion, the relation of even cubes of a series of whole numbers, of which series the number pertaining to the molecule of ice at this temperature is 27.*

The tendency of further investigations and generalizations, still in progress, has been, however, toward the promise of a wider extension of the principle—to the effect that all definite chemical compounds, at *their own* points of fusion likewise, fall, when liquid, into definite simple or compound cubical volumes, according to the above law. This probable expansion of the law rests as yet, however, on but a limited number of cases.

THE OXYGEN-VOLUME.—It will be observed that a most important exceptional case is excluded from the law—namely, the great dominating element *oxygen*, the most electro-negative and acidic of known bodies. The mode of arriving, by induction, for the first time, at the true combining volume of oxygen in solids and liquids—a point arrived at early in these investigations, and one which was in reality fundamentally necessary to the success of even the earliest steps therein—must next be explained. It was discovered, after long courses of experiment with volumes that have heretofore been assumed, or supposed to be deduced, for oxygen, by previous workers in this field, and with a great number of volumes, either assumed as hypotheses or computed from various sources, that a volume obtained from that of the *peroxide of hydrogen* of Thénard—being merely the difference between the volume of its equivalent and that of the equivalent of water contained in it—yielded results consistent with each other and with those obtained from cases where oxygen was absent. The figure thus obtained, multiplied as in other cases by 1000, was closely 5184, this precise number ($=3\times12^3$) having been arrived at by a series of experimental approximations covering a great range of compounds; the unavoidable conclusion having been adopted that oxygen has but one *invariable* volume—a conclusion which follows necessarily from the general principle, induced from all the facts, that the tendency to variation of volume is in proportion to the *electro-positive* nature of an element, while oxygen is recognized as being the least electro-positive, or most electro-negative, of all.

Among the several other independent methods which have been discovered by the writer for approximating to the true oxygen-volume of 5184, it may be well to explain one more. Two oxides of nitrogen are known in *liquid* form, $N_2O$ and $N_2O_4$. Of each of these there is a *maximum* and a *minimum* density on record, differing so much as to make the existence clear of two allotropic modifications of each, the $N_2O$ densities having been determined at 0° C., and those of $N_2O_4$ at normal temperature. Admitting that an addition of 1 per cent. to the latter will bring the figures about to what they should be at zero, we find for the equivalent volumes at zero,

Of $N_2O$ = 46959 and 48867
Of $N_2O_4$ = 62777 and 64148
Differences = $O_3$ = 15818 and 15281

The sum of these differences divided by 6 = 5183.9 for the single oxygen-volume. The *extreme* closeness of this approximation is of course accidental, but this certainly does not detract from its value. It may be well to point out in addition, to those who may not incline to admit the existence of the two parallel modifications here assumed, that the averaging of the two determinations of each compound amounts in this case to the same thing. Other methods of verifying the new oxygen-volume have been found in the comparison of the volumes of certain metals and oxides, sulphides and sulphates, chlorides and chlorates, selenides and selenates, oxychlorides and oxybromides; also among some oxygenated organic compounds.

VOLUMES OF OXIDES.—Uniform geometric relations, even between related groups of compounds, can only be expected to come out *prominently* under *uniform* conditions of condensation and of influences modifying the same. But in no class of bodies is it more difficult to assure ourselves of uniformity of such conditions than in the case of anhydrous oxides. These are mostly solid, very often not crystalline, and only obtainable in crystals with much difficulty and under exceptional and variable temperatures and other conditions. The few which are soluble in water undergo profound transformations in contact with the latter, accompanied by great thermal disturbance, proving new stages of condensation, with the formation of entirely new classes of bodies. In considering, therefore, the following new facts regarding such anhydrous oxides as are known, due allowance should be made for such variations.

(1) *Oxides of Amphigens.—Liquid* $SO_2$ is $O_4.\left(\begin{smallmatrix}S & S\\ 32 & 33\end{smallmatrix}\right)$ = 1.431 (D'Andreeff, at 0° — 1.433). *Solid* $SO_3$ is $O_3.^{S}_{29}$ = 2.003 (Buff, at 25° — 1.908; Morveau, at 13° — 1.955; which compute at 0° to 2.005); four diameters below the larger sulphur-molecule in the liquid dioxide. In the combinations of these with bases the sulphur-molecule shrinks to $^{S}_{24}$, which is its diameter in all the sulphites and sulphates, including oil of vitriol and its hydrates. Dithionic oxide, $S_2O_5$, is not known as anhydrous oxide, but in dithionates we appear to have $\left(\begin{smallmatrix}S & S\\ 24 & 25\end{smallmatrix}\right)$, like the P in orthophosphates (see below). $SeO_2$ and $SeO_3$ are only known in their salts, in which we have always $^{Se}_{24}$. $TeO_2$, anhydrous, is $O_4.\left(\begin{smallmatrix}Te & Te\\ 25 & 26\end{smallmatrix}\right)$ = 5.933 (Schafarik, 5.93).

(2) *Oxides of Metallic Monads.*—Anhydrous soda is $O.\left(\begin{smallmatrix}Na & N\\ 20 & 21\end{smallmatrix}\right)$; anhydrous potash, $O.\left(\begin{smallmatrix}K & K\\ 24 & 25\end{smallmatrix}\right)$, differing four diameters; the sodium being condensed $4\times2$ diameters, and the potassium $4\times3$ diameters, below their *elemental* molecules. This difference of four diameters between corresponding sodium and potassium compounds is general, occurring exactly in the sulphates, nitrates, carbonates, chlorates, and other salts. The corresponding *argentosum* oxide, $Ag_2O$, is $O\left(\begin{smallmatrix}Ag & Ag\\ 22 & 23\end{smallmatrix}\right)$, containing the molecule of *melted silver;* found also in the sulphate, chromate, selenide, one chloride-allotrope, and in other compounds. In this group it is quite appropriate for us to include the *cuprosum* and *mercurosum* oxides: $O.2^{Cu}_{21}$ = 6.032 (Haidinger, 5.992) is clearly related closely to the group, but $O.\left(\begin{smallmatrix}Hg & Hg\\ 25 & 26\end{smallmatrix}\right)$ = 10.839 (Herapath, 10.69) not so directly. Of *thallosum* oxide, $Tl_2O$, the density does not seem to have been yet determined. (See also *plumbosum*-oxide below.)

(3) *Triadic and Pentadic Oxides.*—It happens that the densities of quite a number of these are known. Of the *nitrogen* oxides, previously referred to, we have that of liquid nitrous oxide, which is $O_2.2^{N}_{28}$ = .8964 (Wills, *minimum*, at 0° = .9004), and that of liquid nitric oxide, $O_4.2^{N}_{28}$ =1.423 (Mitscherlich, *minimum*, 1.42). In nitric acid and nitrates this diameter of nitrogen shrinks $4\times2$ units to $O_5.2^{N}_{20}$, which is also the ammonia-diameter of N.

"Phosphoric anhydride," $P_2O_5$, is $O_5.\left(\begin{smallmatrix}P & P\\ 25 & 26\end{smallmatrix}\right)$ = 2.402 (Brisson, 2.387), but in orthophosphates this shrinks to $O_5.\left(\begin{smallmatrix}P & P\\ 24 & 25\end{smallmatrix}\right)$, and in pyrophosphates dilates to $O_5.2^{P}_{26}$, the latter containing the molecule of *melted phosphorus*. The form in the

metaphosphates has not yet been discovered. There is another group of phosphates, first identified by this new method of volumic research, in which the P is condensed enormously, to $^{P}_{18}$ (about one-third of its volume in the pyrophosphates, and $4 \times 2$ diameters below the same); these being certain heavier mineral phosphates, including *dufrenites, wavellites, vivianites, hitchcockite, brushite* (of Julien), and several others.

Of *arsenic* we have $O_3.2^{As}_{26} = 3.905$ (Filhol, 3.884), $O_5.2^{As}_{26} = 3.766$ (Karsten, 3.7342), and $O_5.2^{As}_{25} = 4.023$ (Playfair and Joule, 4.023). $^{As}_{26}$ is Bettendorff's amorphous arsenic. In *arsenates* there is a shrinkage to $O_5.2^{As}_{24}$.

Of *vanadium* (which, as an element, is $^{V}_{21}$) we have $O_3.2^{V}_{20} = 4.773$ (Schafarik, 4.72), but in the pentoxide the V is about four diameters higher, $O_5.\left(^{V}_{23}\ ^{V}_{24}\right) = 3.518$ (Schafarik, 3.51). The orthovanadates, few only being known, have not yet been thoroughly investigated, but there is a probable parallelism with the orthophosphates.

Of *boron*, placed among the triads by some, boric oxide has the constitution $O_3.2^{B}_{23} = 1.755$ (Breithaupt, 1.75), but in borates it shrinks to $O_3.2^{B}_{20}$, comparable with the $^{N}_{20}$ of the nitrates (but also with the dyadic $^{C}_{20}$ of the carbonates), and four diameters above its elemental molecule $^{B}_{16}$ (diamond-boron).

Of *tantalum* we have two distinct forms of tantalic oxide, $O_5.2^{Ta}_{26} = 7.27$ (H. Rose's highest figure, 7.28), and $O_5.2^{Ta}_{24} = 8.288$, obtained by *ignition* (H. Rose, 8.26). $^{Ta}_{26}$ is the dominant *elemental* molecule.

Of *columbium* we have corresponding to the *minimum* densities, $O_5.2^{Cb}_{26} = 4.388$ (Marignac, 4.37; Kopp, 4.31), $^{Cb}_{25}$ being an elemental molecule of this metal, while among the *maximum* densities we find *ignited* $O_5.2^{Cb}_{20} = 6.393$ (H. Rose, 6.4) and $O_5.2^{Cb}_{19} = 6.761$ (H. Rose, 6.725), these last bringing it into parallelism with $^{N}_{20}$, $^{B}_{20}$, and $^{P}_{18}$, as above.

Of *iodine*, as a pentad, we have of "iodic anhydride" three definite allotropes:

$O_5.\left(^{I}_{29}\ ^{I}_{30}\right) = 4.32$ (Filhol, 4.25), containing *elemental iodine*. (See Table II.)

$O_5.2^{I}_{29} = 4.478$ (Ditte, at 0°, 4.487).

$O_5.\left(^{I}_{27}\ ^{I}_{28}\right) = 4.796$ (Kämmerer, 4.7987).

In iodates, however, the iodine molecules shrink, as in case of many other acidogenic elements, to $^{I}_{24}$, this being four diameters smaller than its molecule in the iodides, as shown in Table V. The chloric and bromic anhydrides are unknown, but in both chlorates and bromates we find $^{Cl}_{24}$ and $^{Br}_{24}$, corresponding to the iodine-molecule in iodates.

(4) *Oxides of Tetrads and Hexads.*—Of carbon we have liquid carbonic acid, $O_2.^{C}_{33} = .9502$ (D'Andreeff, at 0°, .9471), but in carbonates (also in hydrocarbons) always $^{C}_{20}$, a shrinkage of thirteen (nearly $4 \times 3$) diameters. In this connection it will be interesting to note that the *liquid* compound of carbon with sulphur is $4^{S}_{28}\left(^{C}_{24}\ ^{C}_{25}\right) = 1.2963$ (Buff, at 0°, 1.29858), both the sulphur and carbon being about four diameters higher than in *solid* sulphur and carbon compounds. The recently-discovered *solid* sulphide of carbon of Sidot has a nearly-related carbon-molecule, associated, however, with the usual *solid* sulphur-molecule $2^{S}_{24}\left(^{C}_{24}\ ^{C}_{23}\right) = 1.641$ (Sidot, 1.66).

Of *titanium* we have the trimorphs *rutile, brookite*, and *anatase*, the *maximum rutile* being $O_4.2^{Ti}_{20} = 4.464$ (Kopp, 4.42), like $CO_2$ in carbonates; the commonest *rutile*, however, being $O_4\left(^{Ti}_{20}\ ^{Ti}_{21}\right) = 4.316$ (Hautefeuille, 4.3); the dominant *brookite* (*arkansite*) being $O_4.2^{Ti}_{21} = 4.177$ (H. Rose, 4.166; Klaproth, 4.18); the dominant *anatase* being $O_4.2^{Ti}_{22} = 3.902$ (Hautefeuille, artificial crystals, 3.9; H. Rose, native, 3.912); while another *minimum anatase* is $O_4.\left(^{Ti}_{22}\ ^{Ti}_{23}\right) = 3.766$ (Boullay, 3.75).

Of *tin* we have also a similar series of *cassiterite* allotropes, ranging through three diametric units, as with titanium, but in a little higher range, beginning with $O_4.2^{Sn}_{22} = 7.047$ (Forbes, black, from Bolivia, 7.021)—the dominant form being $O_4.\left(^{Sn}_{22}\ ^{Sn}_{23}\right)$—and closing with an artificial crystalline form described by Leeds, $O_4\left(^{Sn}_{24}\ ^{Sn}_{25}\right) = 5.98$ (Leeds, 6.019). $^{Sn}_{25}$ is Herapath's cast tin.

Of *silicon*, of which one *elemental* form is $^{Si}_{24}$, we have quartz $O_2.^{Si}_{23} = 2.662$ (Deville, 2.663, and many others), and other allotropes less common, containing larger silicon molecules, *tridymite* being $O_2.^{Si}_{25}$, and quartz after fusion $O_4.\left(^{Si}_{25}\ ^{Si}_{26}\right)$.

[It thus appears that these four closely-related "tetrads" furnish us a *progressive series* in the dominant modifications of their oxides—$O_4.2^{C}_{20}$, $O_4\left(^{Ti}_{20}\ ^{Ti}_{21}\right)$, $O_4\left(^{Sn}_{22}\ ^{Sn}_{23}\right)$, and $O_4.2^{Si}_{23}$. (See SERIES, IN CHEMISTRY.)]

Of *lead* we have several oxides. In $Pb_2O$ (oxide of plumbosum), as well as in *minium*, we find the melted-lead molecule $^{Pb}_{27}$, as we found the melted-silver molecule in (argentosum-oxide) $Ag_2O : 0.2^{Pb}_{27} = 9.652$ (Playfair and Joule, 9.772) : $O_4.3^{Pb}_{27} = 8.586$ (Karsten, 8.62). In one *litharge* (the heaviest) we find the dominant metallic-lead molecule : $O_3.\left(2^{Pb}_{26}.\ ^{Pb}_{27}\right) = 9.505$ (Boullay, 9.5); while in one peroxide (the heaviest) the lead is condensed to $^{Pb}_{25} : O_2.^{Pb}_{25} = 9.195$ (Wernicke, 9.045).

Of *molybdenum* the dioxide gives us a parallelism with the "tetradic" sub-group above : $O_2.^{Mo}_{23} = 5.68$ (Bucholz, 5.67), like quartz; while the trioxide tends toward widely-different molecules, the lightest one being $O_6\left(^{Mo}_{29}\ ^{Mo}_{30}\right) = 3.491$ (Berzelius, 3.49).

Of *uranium* the only two oxides of known densities give us uranosum and uranicum molecules corresponding with the two extremes of the carbon-silicon group : $O.^{U}_{20} = 10.315$ (Ebelmen, 10.15), and $O_4.3^{U}_{23} = 7.408$ (Ebelmen, 7.31).

Of *aluminum* we find in the *corundums* a highly-condensed molecule, approaching $^{Al}_{17}$, but in large classes of aluminous silicates, including the *feldspars* and *zeolites*, it takes $^{Al}_{23}$, like silicon itself, and near its own elemental molecule. Curiously, the *kaolinites* and some other clays, derived from the feldspars, give us the Al *condensed* into its smaller corundum-molecule $^{Al}_{17}$, while in the *garnets*, the heavier *kyanites*, and some others it appears to shrink even to $^{Al}_{15}$. In the lighter *andalusites*, as *myeline*, we find $^{Al}_{23}$ and $^{Al}_{24}$, while normal (*dominant*) *andalusites* have $^{Al}_{19}$, and *sillimanite* has $^{Al}_{18}$.

Of *iron* three well-marked modifications of the sesquioxide (*hæmatites*) may be cited, containing molecules of elemental iron (*ferricum*), set forth in previous tables:

$O_3.\left(^{Fe}_{19}\ ^{Fe}_{20}\right) = 5.261$ (G. Rose, 5.23; Rammelsberg, 5.241; Mohs, 5.251; Breithaupt, 5.261; and others).

$O_3.2^{Fe}_{20} = 5.071$ (H. Rose, ignited, 5.037; Neumann, 5.079).

$O_3.2^{Fe}_{21} = 4.696$ (Playfair and Joule, 4.679).

Of the magnetic oxide one form is very distinct (curiously, containing *ferricum !*).

$O_4.3^{Fe}_{20} = 5.186$ (Kenngott, 5.168 and 5.18; Rammelsberg, 5.185; and others).

Of *cobalt*, which generally assumes a more condensed molecule than iron in the corresponding iron compounds, we may give a cobalticum oxide which contains the dominant elemental molecule:

$O_3.2^{Co}_{19} = 5.671$ (Boullay, the highest, 5.6).

(5) *Oxides of Dyadic Metals.*—Some of these may be given as follows:

*Magnesium* forms $O.^{Mg}_{18} = 3.631$ (Ebelmen, artificial crystals, 3.636).

*Cupricum* gives us a considerable series of allotropic forms of cupric oxide, three of which contain copper-molecules recognizable among the elemental densities. Cupricum, it will be observed, tends to a greater condensation than *cuprosum:*

$O_4.\left(3^{Cu.Cu}_{19\ 20}\right) = 6.45$ (Jenszch, artificial crystals, 6.451; and others).

$O_3.\left(2^{Cu.Cu}_{19\ 20}\right) = 6.399$ (Filhol, 6.322; Herapath, 6.4304).

$O_2.\left(^{Cu.Cu}_{19\ 20}\right) = 6.303$ Whitney, native, 6.25).

$O.^{Cu}_{20} = 6.042$ (Playfair and Joule, artificial, 5.9; Joy, native, 5.952).

*Zinc* forms $O.^{Zn}_{21} = 5.607$ (Boullay, 5.6; Brooks, 5.6067; Filhol, 5.612), this containing the dominant elemental zinc-molecule, found also in the sulphates, arsenates, silicates, and other compounds.

*Calcium* gives $O.^{Ca}_{23} = 3.222$ (Filhol, the highest, 3.184),

this being a *calcite* molecule, also found in *fluor-spar*, in the lightest *anhydrite*, in the two *gypsum* allotropes, in *scheelite*, in one *wollastonite*, in *bordite*, and other lime-compounds.

*Cadmium* gives us $O_2\binom{Cd\ Cd}{23\ 24} = 7.043$ (Karsten, 6.9502), this being the elemental molecule of cadmium, of Stromeyer.

*Mercuricum* forms $O.^{Hg}_{24} = 11.364$ (Playfair and Joule, the highest, 11.344), this being an elemental molecule of *solidified* mercury. *Mercurosum* (see above, under 2) is less condensed, as in the case of copper-oxides.

*Strontium* gives $O_2\binom{Sr\ Sr}{27\ 28} = 3.98$ (Karsten, 3.932), a strontium-molecule found also in the heaviest strontium-chloride crystallized with $6H_2O$; also in the heaviest nitrate.

*Barium* forms apparently several allotropic protoxides, the lightest one of which approaches closest to (the next diameter below) elemental barium : $O.^{Ba}_{32} = 4.031$ (Fourcroy, 4.). This is about four diameters above the strontium oxide. In the dioxide barium is more condensed, the heaviest being $O_4.\binom{Ba\ Ba}{28\ 29} = 5.032$ (Playfair and Joule, 4.958).

Under Isosterism it was remarked that there is no distinct similarity in the order of condensation of the volumes of compounds in different classes. This will be found confirmed on comparing the order of the above oxides of dyad metals with the order of the chlorides, bromides, and iodides in Tables III., IV., and V. The iodides approximate somewhat closely to the same order as the oxides, but it may not be quite the same.

Volumes of Water and of Hydrogen.—Out of these new researches have arisen several discoveries regarding the true nature and functions of water and hydrogen, which without any doubt must change the present face of the science of chemistry. The most important of these is the new fact that the compound $H_2O$, instead of performing the part of a metallic oxide, as has heretofore been conjectured, has in reality the function of a *compound radical*, and hence follows directly the law of simple cubical condensation, like an element. This is the reason why ice and crystal-water, as above shown, have the cubical molecules $H^{\delta}_{27}$ and $H^{\delta}_{24}$. Under Water of Crystallization this is further explained. When water combines (apparently) with oxides, both acidic and basic, it has been found that it is broken up (as to its *radical* constitution), the H and O becoming detached, and entering into the new compound as elements, the O with its unchanged volume, 5184, but the H in different cubical volumes. Such hydrogen is elemental or metalloidal (*"hydrogenium"*), and is *replaceable* by electro-positive metals in acids, and in bases by acidic oxides or electro-negative elements or radicals. (See further under Water of Crystallization.)

Volumes in Organic Chemistry.—Under this head comes a vast division of the subject, which might be carried far beyond the necessary limits of this article. The new general principles that have been arrived at, however, governing the chemistry of organic compounds, are exceedingly simple, and may be stated within a small space. The most important one of these new generalizations—one whose application is quite revolutionary in this field of science—is this : that all the great number and variety of hydrocarbon radicals, including the so-called "alcohol radicals," are reducible *to a single one*, $H_2C$, to which the name *Homologen* is given (with the symbol Hm), because its successive addition, in the same or proximate cubical molecules, gives rise to the universal serial relation known as Homology (which see). Under Homology it is shown that the alcohol radicals themselves constitute a series of homologues. The examples given here of such homologues, formulated upon the geometric law of condensation, must be confined to three series—one of coal-tar, and two of petroleum-derivatives :

Table VI.—*The Coal-Tar Hydrocarbons.*

| Hydrocarbons. | Volumic formulæ. | Computed densities. | Densities found at 0° C. | Authorities. |
|---|---|---|---|---|
| Benzenes, or Benzols..... | $C_6.4^{Hm}_{28}.2^{Hm}_{27}$ | .8906 | .8957 | Warren. |
| | $C_6.4^{Hm\ Hm\ Hm}_{28\ \cdot\ 27\ \cdot\ 26}$ | .9014 | .90122 | Adrieenz. |
| Toluene, or Toluol..... | $C_6.4^{Hm\ Hm}_{28\ \cdot\ 27}.3^{Hm}_{26}$ | .8837 | .8824 | Warren. |
| | | | .8841 | Longuinine. |
| Xylene, or Xylol ..... | $C_6.4^{Hm\ Hm}_{28\ \cdot\ 27}.5^{Hm}_{26}$ | .8711 | .877 | Longuinine. |
| | | | .878 | Warren. |
| Cumenes, or | $C_6.4^{Hm\ Hm}_{28\ \cdot\ 27}.7^{Hm}_{26}$ | .8617 | .8643 | Warren. |
| Cumols ..... | $C_6.4^{Hm\ Hm}_{28\ \cdot\ 27}.5^{Hm\ Hm\ Hm}_{26\ \cdot\ 25\ \cdot\ 24}$ | .8797 | .87976 | Pisati and Paterno. |
| Cymene, or Cymol ..... | $C_6.4^{Hm\ Hm}_{28\ \cdot\ 27}.7^{Hm\ Hm\ Hm}_{26\ \cdot\ 25\ \cdot\ 24}$ | .8702 | .8705 | Longuinine, from oil of cummin. |
| | | | .8707 | Pisati and Paterno, from oil of wormwood. |
| | | | .8708 | Beilstein and Kupffer, from oil of cummin. |
| | | | .8710 | Fittig, Köbrich, and Jilke. |
| | | | .87224 | Pisati and Paterno, from camphor. |
| | | | .87227 | " " from "cymyl-alcohol." |
| | | | .8732 | Longuinine, from camphor and $PCl_3$. |
| | | | .8732 | Beilstein and Kupffer, from camphor. |
| Laurene, or Laurol ..... | $C_6.4^{Hm\ Hm}_{28\ \cdot\ 27}.7^{Hm}_{26}.3^{Hm\ Hm}_{25\ \cdot\ 24}$ | .8726 | .8751 | Lippmann and Longuinine's "diethyl-toluol." |

The substantiation, by these discoveries, of Kekulé's *six-atom elemental-carbon nucleus* of the "aromatic series," is of extraordinary interest, though most of the hypotheses that have, with so much labor, been built upon this true basis, by the help of graphic atomistic formulation, seem likely to be of little further use.

Table VII.—*Mineral Hydrocarbons : the Alpha-Naphtha Series of Marsh-Gas Homologues.*

| Composition. | Pelouze and Cahours, Pennsylvania petroleum-products : densities. | | Cahours and Demarçay, artificial naphthas from fatty acids : densities. | | Different zero-densities, found for the same hydrocarbons. | | Volumic formulæ. | Computed densities, for melting ice. | Excesses of computed densities over means of experimental densities at normal temperatures. |
|---|---|---|---|---|---|---|---|---|---|
| | at | | at | | | | | | |
| $C_4H_{10}$ | 0° | .600 | .... | .... | .600 | Ronalds.... | $2^{H}_{25}.2^{Hm}_{26}.2^{Hm*}_{25}$ ..... | .5940 | |
| $C_5H_{12}$ | 18° | .628 | 14° | .626 | .640 | Warren .... | $2^{H}_{25}.2^{Hm}_{26}.3^{Hm}_{25}$ ..... | .6356 | .0086 |
| $C_6H_{14}$ | 16° | .669 | 13° | .667 | .676 | Warren .... | $2^{H}_{25}.2^{Hm}_{26}.3^{Hm\ Hm}_{25\ \cdot\ 24}$ ..... | .6766 | .0086 |
| $C_7H_{16}$ | 16° | .699 | 12° | .693 | .7085 | Warren and Storer.... | $2^{H}_{25}.2^{Hm}_{26}.4^{Hm\ Hm}_{25\ \cdot\ 24}$ ..... | .7007 | .0047 |
| $C_8H_{18}$ | 15° | .726 | 13° | .723 | .728 | A. Wurtz... | $2^{H}_{25}.2^{Hm}_{26}.4^{Hm}_{25}.2^{Hm}_{24}$ ..... | .7282 | .0037 |
| $C_9H_{20}$ | .... | .741 | 13° | .744 | .753 | A. Wurtz... | $2^{H}_{25}.2^{Hm}_{26}.4^{Hm}_{25}.3^{Hm}_{24}$ ..... | .7513 | .0088 |
| | | | | | .756 | Warren..... | | | |
| $C_{10}H_{22}$ | 16° | .757 | 14° | .758 | ..... | | $2^{H}_{25}.2^{Hm}_{26}.5^{Hm}_{25}.3^{Hm}_{24}$ ..... | .7635 | .0060 |
| $C_{11}H_{24}$ | .... | .766 | 14° | .770 | ..... | | $2^{H}_{25}.2^{Hm}_{26}.6^{Hm}_{25}.3^{Hm}_{24}$ ..... | .7737 | .0057 |
| $C_{12}H_{26}$ | 20° | .778 | 14° | .784 | ..... | | $2^{H}_{25}.2^{Hm}_{26}.6^{Hm}_{25}.4^{Hm}_{24}$ ..... | .7890 | .0080 |
| $C_{13}H_{28}$ | 17° | .796 | .... | .... | ..... | | $2^{H}_{25}.2^{Hm}_{26}.6^{Hm}_{25}.5^{Hm}_{24}$ ..... | .8025 | .0065 |
| $C_{14}H_{30}$ | 20° | .809 | .... | .... | ..... | | $2^{H}_{25}.2^{Hm}_{26}.6^{Hm}_{25}.6^{Hm}_{24}$ ..... | .8145 | .0055 |
| $C_{15}H_{32}$ | 19° | .825 | .... | .... | ..... | | $2^{H}_{25}.2^{Hm}_{26}.6^{Hm}_{25}.6^{Hm\ Hm}_{24\ \cdot\ 23}$ .... | .8305 | .0055 |
| $C_{16}H_{34}$ | .... | .... | 13° | .846 | ..... | | $2^{H}_{25}.2^{Hm}_{26}.6^{Hm}_{25}.6^{Hm}_{24}.^{Hm\ Hm}_{23\ \cdot\ 22}$ | .8499 | .0039 |

* In the memoir in the *American Chemist*, before referred to, this series was given in a slightly incorrect form, the error having arisen from the supposition that the density-determinations of Pelouze and Cahours were *all* (like their first one) *made at zero*. Reference made since to their original memoir has enabled the writer to recompute the series correctly, as now given. The figures as they stand above have been submitted to a mathematician of high rank, who has applied the Calculus of Probabilities, and finds the chances of the truth of the new law of condensation in this case to be 479,000,000 to 1.

TABLE VIII.—*Warren's Beta-Naphtha Series.*

| Composition. | Temperatures. | Densities. | Authorities. | Volumic formulæ. | Computed densities for melting ice. | Differences of experimental from computed densities. |
|---|---|---|---|---|---|---|
| $C_4H_{10}$ | 0.° | .611 | Warren..... | $2^{H}_{25}\cdot 2^{Hm\ Hm\ Hm}_{26\ \cdot\ 25\ \cdot\ 24}$ | .6051 | .0059+ |
| $C_5H_{12}$ | 11.2° / 0.° | .6413 / .645 | Frankland / Warren .... | $2^{H}_{25}\cdot 2^{Hm}_{26}\cdot 2^{Hm\ Hm}_{25\ \cdot\ 24}$ | .6459 | .0009− |
| $C_6H_{14}$ | 0.° | .689 | " | $2^{H}_{25}\cdot 2^{Hm}_{26}\cdot 2^{Hm}_{25}\cdot 2^{Hm}_{24}$ | .6863 | .0027+ |
| $C_7H_{16}$ | 0.° | .73 | " | $2^{H}_{25}\cdot 2^{Hm}_{26}\cdot 2^{Hm}_{25}\cdot 2^{Hm\ Hm}_{24\ \cdot\ 23}$ | .7275 | .0025+ |
| $C_8H_{18}$ | 0.° | .752 | " | $2^{H}_{25}\cdot 2^{Hm}_{26}\cdot 2^{Hm}_{25}\cdot 3^{Hm\ Hm}_{24\ \cdot\ 23}$ | .7535 | .0015+ |

In consequence of the two facts that *zero*-determinations of densities have been almost exclusively confined hitherto to *organic* compounds, and that among these also are by far the greater number of definite *liquid* compounds now known, it is necessarily among carbo-hydrogen compounds that *crucial tests* are chiefly to be found of the truth of the new law of molecular condensation. The above several organic series furnish good examples of these. Whenever we shall have, however, multitudes of careful zero-determinations of *inorganic* densities, we shall no doubt find among these correspondences quite as close and quite as great a degree of beauty and order.

Under WOOD-SPIRIT some account is given of the application of these new discoveries to the alcohols, etc.; and the reader may also be referred again for a few other series to the article in the *American Chemist* for Mar., 1876. The present article must close with a statement of two more molecular laws, which the writer has endeavored to define, as generalized from these new classes of relations: (2) *The Law of Molecular Engymmetry.**—*A molecule added to a congeries, tends to assume a diameter already present, or a diameter next below or above one, or between two, already present; in such manner that the tendency is more and more toward the formation of a succession of proximate or consecutive diameters, becoming more regular as the compound molecule becomes more complex.* (3) *The Law of Molecular Cratesis.*†—*The tendency of an elemental or elementoid molecule to vary, according to the diametric ratios, in combining with other elemental or elementoid molecules, is in proportion to its degree of basicity, or electro-positive attitude, relative to the other elemental or elementoid molecules present.*

HENRY WURTZ.

**Volumet'ric Anal'ysis,** a branch of quantitative chemical analysis (see CHEMICAL ANALYSIS), in which the substance to be estimated is subjected to characteristic reactions, solutions of known strength being employed for this purpose, from the quantity of which required, the substance sought can be determined, by aid of the fixed laws of equivalence. Volumetric processes usually require less time and less elaborate apparatus for their execution than the ordinary methods by weight; and as they afford equally, if not more accurate results, they are particularly well adapted for technical purposes, such as the valuation of commercial products. Gay-Lussac, who first suggested this method of analysis, was impressed with the advantage of estimating silver by the use of a solution of common salt (sodium chloride); and this process will serve to illustrate one of the more simple applications of volumetric analysis. In the ordinary method of analysis a known weight of the substance containing silver is first dissolved in nitric acid; then hydrochloric acid is added, whereby insoluble argentic chloride is precipitated, which is separated from the fluid by filtration, washed, dried, fused, and weighed; and as the composition of argentic chloride is known, the amount of silver contained in the precipitate, and therefore in the original substance, can be easily calculated. It is evident that the same result can be obtained by preparing a solution of sodium chloride of known strength, and ascertaining the quantity of this necessary to precipitate the silver completely as chloride from the nitric acid solution. This is done by slowly adding the salt solution to the silver solution, until a point is reached at which the precipitate ceases to form. The process is now stopped, and the exact number of divisions (grains or cubic centimètres) of the salt solution used ascertained by observing the graduated vessel from which it was taken; and as we know that 58.5 parts by weight of sodium chloride are exactly sufficient to convert 108 parts by weight of silver into silver chloride, and the strength of the salt solution is also known, the weight of the precipitated silver can be readily determined. The operation just described can be completed in less than half an hour, while a silver determination by the method first referred to would require at least half a day; while in regard to accuracy of result the volumetric process is also more advantageous. The liquids used in methods of this character are termed "standard solutions." The quantity of these solutions used in a determination can be ascertained either by weighing or by measuring, but the latter is usually resorted to. In order that a reaction may be applicable in volumetric determinations, it must take place quickly, and give rise to some change by which its termination can be readily detected by the eye, such as the appearance or disappearance of a color, a precipitate beginning or ceasing to form, etc. For this reason the number of processes available is limited, although many reactions that are useless in analysis by weight furnish valuable means for volumetric estimations. The apparatus used consists of a good chemical balance and several varieties of graduated glass vessels for the preparation and measuring of the solutions, in the use of which the French or metrical system of weights and measures is most advantageously employed. The measuring apparatus embraces pipettes, flasks, and burettes. The *pipette* is simply a glass tube, having an enlarged body and a narrow stem, on which a mark is placed indicating its capacity. It is used by filling to the mark, and allowing the liquid to escape by a displacement of the finger from the upper end. The flasks used are graduated for the capacity of from $\frac{1}{10}$th litre to 5 litres. The *burette*, which is employed for the measurement of standard solutions, and usually has a capacity of 50 or 100 cubic centimètres, consists of a long glass tube of uniform calibre, having throughout its length equal divisions (cubic centimètres and fractional parts thereof). The burette of Mohr has at its lower end a caoutchouc tube, which can be opened or closed by means of a spring-clamp; but as the rubber is not entirely without influence on some of the solutions used, it is in many instances advantageously replaced by a glass stopcock. In consequence of the curved surface or *meniscus* of the liquid, it is difficult to obtain a distinct level in the fluid to be measured; the best plan is to have the lowest point of the meniscus coincide with the graduation, when the reading will be proportionally correct, or to employ Erdmann's float. The preparation of the standard solutions is best effected on the atomic plan—*i. e* they are so prepared as to contain in each litre (1000 cubic centimètres) the whole or a fractional part of the atomic weight of the reagent employed, expressed in grammes. For instance, in preparing a standard or normal solution of the bivalent oxalic acid, the composition of which is $C_2O_4H_2$ = 126, one-half of its atomic weight, or 63 grammes, is dissolved in a litre of water; each cubic centimètre of this solution will contain $\frac{1}{2000}$th of the atomic weight of oxalic acid, and will exactly neutralize $\frac{1}{2000}$th of the atomic weight of an alkaline mono-carbonate, or $\frac{1}{1000}$th of the atomic weight of a caustic alkali. In the case of a substance like silver, it is more convenient to take $\frac{1}{10}$th of the atomic weight; that is, 10.8 grammes of silver are dissolved in nitric acid, and the solution is diluted to 1 litre; each c. c. of this liquid will then contain $\frac{1}{10000}$th of the atomic weight of silver (0.0108 gramme), and will precipitate $\frac{1}{10000}$th of the atomic weight of chlorine (0.00355 gramme) in the form of silver chloride. In the same way, normal solutions of the following acids and alkalies contain in a litre one-half or the whole of their atomic weight in grammes:

| | | | | |
|---|---|---|---|---|
| Sulphuric acid | 49. | gr. | per | litre. |
| Hydrochloric acid | 36.5 | " | " | " |
| Sodic carbonate | 53. | " | " | " |
| Sodic hydrate | 40. | " | " | " |

A great advantage of the above system is, that the solutions agree with each other, volume for volume; thus, 100 c. c. of any of the above acid solutions will exactly neutralize 100 c. c. of any one of the alkaline solutions. Its convenience will be readily perceived from the following illustration: Suppose it is necessary to determine the purity of a sample of soda-ash (impure sodic carbonate); if it were perfectly pure, 5.3 grammes would require 100 c. c. of one of the above normal acids for neutralization; and if this quantity is weighed out, dissolved in water, and the normal acid gradually added from a 100 c. c. burette until complete saturation takes place, the number of c. c. required will directly indicate the percentage of pure sodic carbonate present in the sample; thus, if 85 c. c. of the acid solution were necessary, the sample contained 85 per cent. of sodic

* *Engymmetry*, from ἐγγύς, "near," and μέτρον, "measure." This word is modelled, of course, after the word *symmetry*.

† From κράτησις, "rule," "sway," "mastery."

carbonate. It is, however, not always practicable to weigh out the substance composing the standard solution; in this case an approximately correct quantity is taken, and the exact strength of the solution determined by actual experiment. Besides the direct methods of volumetric analysis (which include those processes in which the substance is brought into direct contact with the standardized solution of a reagent which combines with or decomposes it, as in the estimations of alkalies by acids, silver by sodium chloride, iron by potassic permanganate, etc., and also those determinations in which the standard solution reacts upon the substance, causing the liberation of an equivalent quantity of a representative body, which is estimated instead of the substance itself—such as the valuation of manganese ores, in which, upon boiling the substance in hydrochloric acid, an amount of chlorine equivalent to the oxygen present is evolved and its quantity determined), *indirect* or *residual* processes are frequently employed, in which the amount of the substance to be analyzed is not directly estimated, but is calculated by using an excess of some agent of fixed strength, which decomposes or combines with it in a known proportion, and subsequently determining the excess used. Thus, if a weighed amount of an impure sample of calcic carbonate be dissolved in a known excess of nitric acid, it is possible, by determining the amount of pure acid remaining by titrating backward with a standard alkaline solution, to ascertain the proportion of pure calcic carbonate contained in the sample examined.

Having referred to the apparatus employed in, and some of the features of, volumetric analysis, it remains to mention more particularly a few of the processes most commonly used. These may be conveniently classified into analyses by saturation, by precipitation, and by oxidation or reduction, although this division fails to embrace all of the volumetric methods resorted to. *Analysis by saturation* includes the processes of alkalimetry and acidimetry.

*Alkalimetry*, or the determination of the amount of alkali contained in alkaline mixtures, such as the commercial products *potash* and *soda*, etc., by volumetric methods, is based upon the fact that the alkalies and their carbonates readily form neutral salts with the strong acids which do not affect the color of litmus; whereas the smallest excess of either the alkali or the acid imparts to it a blue or red coloration. Sulphuric, oxalic, or hydrochloric acid is usually employed in the preparation of the standard acid solutions, which are best made of the strength previously prescribed. In addition to the remarks already made concerning the determination of an alkali by means of a normal acid solution, a few details of the process should be added. A weighed quantity of the sample of alkali having been dissolved, the solution is distinctly colored blue by the addition of a few drops of solution of litmus. A burette is then filled to the zero-point with the standard acid, and this is allowed to flow into the solution until a red coloration begins to appear. Owing to the carbonic acid liberated, this will occur before all of the alkali is saturated, and it is necessary to boil the solution in order to remove this source of error, when the blue color will reappear. The acid is then cautiously added by drops, heat again applied, and a little more acid added, until a distinct pink-red color, which does not disappear on boiling, is produced. We now know that complete neutralization has taken place, and, as the strength of the acid solution is also known, the amount of real alkali contained in the sample is readily calculated from the number of cubic centimètres used. The inconvenience occasioned by the presence of carbonic acid in the above process can be avoided by adding more acid than is really required to neutralize the alkali, and then ascertaining the excess taken by means of a normal solution of caustic alkali, and deducting it from the amount of acid used. Caustic lime, baryta, and strontia, and their carbonates, can be estimated in the same manner, the standard acid employed being the hydrochloric.

*Acidimetry* can be accomplished by a method precisely the reverse of that used in alkalimetry, a normal alkaline liquid being added to the solution under examination until a blue color is imparted to the litmus. Caustic soda, either obtained directly in the pure state or prepared by the decomposition of sodic carbonate by means of lime, is usually employed as the normal alkaline solution; but a solution of 53 grms. of pure sodic carbonate in 1 litre of water is also often used. In special cases, as in the estimation of acetic acid (see VINEGAR), the salt formed does not possess a neutral reaction, and it is advisable to first prepare a solution of the acid of known strength, and then determine the quantity of the alkaline solution required to produce the change of color. The quantity of acid contained in numerous neutral salts, if the base is precipitated by an excess of caustic alkali or carbonate, can be estimated by first adding an excess of the standard alkaline solution, and then determining the excess used by titration with a normal acid; the amount of acid contained in many salts, the base of which is precipitated by sulphuretted hydrogen, can also be determined by titrating the filtrate from the precipitate with normal alkali.

Volumetric analysis *by precipitation* includes such determinations as that of silver, referred to in the beginning of this article. The end of reactions of this nature is frequently shown by the precipitate ceasing to form, but indications of greater precision and delicacy are often obtained by aid of a third body, with which a characteristic color is produced; thus, if in the estimation of chlorine or chlorides by a normal silver solution, a little potassic chromate be added, the completion of the process is indicated by the formation of an orange-yellow color, proceeding from argentic chromate produced by the first drop in excess of the silver solution, and in the precipitation of phosphoric acid by uranic nitrate or acetate, the end of the precipitation is indicated by a drop of the mixed solutions producing a brown color with yellow prussiate of potash. As bromine, iodine, and cyanogen likewise form insoluble precipitates with silver solutions, it is evident that they can be volumetrically determined in the same manner as chlorine. In the estimation of cyanogen, however, the process is often executed in the presence of an excess of alkali, and the standard solution added *until* a precipitate forms, as in this case argentic cyanide is not precipitated until all the cyanogen has formed a double salt with the alkali and silver. Mohr has suggested a method whereby alkalies, alkaline earths, or their carbonates, can be indirectly estimated through the precipitation of chlorine by silver, in which these bodies are first converted into chlorides, and the chlorine then determined by a standard silver solution. Owing to the fixed laws of chemical combination, the amount of chlorine found will be a measure of the base with which it was combined.

Analysis by *oxidation or reduction* comprises numerous volumetric methods, which give very accurate results, and have, to a great extent, replaced the older process by weight. In these, substances which readily take up oxygen are titrated with oxidizing agents of known power; or substances which give up oxygen are deoxidized by an excess of a reducing agent, the excess of which is afterward determined by residual titration with a standard oxidizing solution. The oxidizing bodies most employed are potassic permanganate and dichromate, and iodine; the reducing agents being sulphurous acid, sodic hyposulphite, arsenious anhydride, and oxalic acid. One of the most important estimations coming under this head is the volumetric determination of iron, which is based upon the fact that when a solution of potassic permanganate is added to an acid solution of a ferrous (protoxide) salt, the latter is oxidized to a ferric salt, the purple-red color of the permanganate solution being destroyed so long as any of the ferrous salt is present; but as soon as the oxidation is completed, the next additional drop of the solution imparts a distinct red coloration to the liquid. It is necessary first to reduce all iron contained in the substance examined to the ferrous state, which can be done by means of zinc and sulphuric acid. The strength or standard of the permanganate solution is also to be previously determined by reducing a known weight of pure iron to the ferrous state, and ascertaining the number of cubic centimètres of the solution required to oxidize it, the value of 1 c. c. being noted on the bottle in which the solution is preserved. It is then only necessary to multiply the number of c. c. employed in an analysis by the value, or oxidizing power, of 1 c. c., in order to ascertain the quantity of iron present in the substance taken. Potassic dichromate can also be employed as the oxidant, but in this case the termination of the process is not indicated in the liquid itself, but is shown by a drop of the mixture no longer producing a blue color when added to a solution of ferricyanide of potassium. Iodine often serves as an oxidizing agent by combining with the hydrogen of water to form hydriodic acid, while the oxygen liberated acts upon the oxidizable substances present, and, as the slightest excess of iodine imparts a blue color to starch, the reaction can be applied to the volumetric estimation of many bodies that readily take up oxygen, such as arsenious and sulphurous acids, etc. It is evident that these latter compounds can likewise be employed for the determination of free iodine. On the above reaction very accurate and important volumetric processes are based, such as the estimation of oxygen in peroxides, in which, however, an indirect method is employed. Many substances containing oxygen, when boiled with hydrochloric acid, liberate a quantity of chlorine corresponding to a part or all of the oxygen present. Upon conducting the chlorine so evolved into a solution of potassic iodide, an equivalent amount of iodine is set free, which can then be estimated by adding a solution of starch-paste and titrating with a solution of sodic hyposulphite of known

strength. The standard of the hyposulphite solution used is readily ascertained in the same manner by heating a *known quantity* of potassic dichromate with hydrochloric acid, conducting the evolved chlorine into a solution of potassic iodide, and estimating (in presence of starch) the number of cubic centimètres of the hyposulphite solution required to reduce the iodine set free; the termination of the reaction being indicated by the disappearance of the blue color of the iodide of starch. Processes similar to that just described receive frequent practical application in the valuation of numerous articles of commerce, such as manganese, bleaching-powder (see article on HYPOCHLOROUS ANHYDRIDE, by PROF. HENRY WURTZ), etc.

A method more curious than valuable, by which analytical determinations can be accomplished without the use of weights or standardized solutions, consists in taking a certain amount of the impure substance to be tested, balancing it with an equal weight of the pure substance, and submitting both to titration with a solution of unknown strength. It is easy to perceive that the impure substance will require for its decomposition a smaller quantity of the solution than the pure substance, and that the quantity required will be in proportion to its purity. The pure substance can, in some instances, be replaced by another of similar chemical activity (*e. g.* sodic carbonate by calcic carbonate, manganese dioxide by potassic dichromate, etc.). In addition to the examples cited above, volumetric processes, usually based upon the principles already mentioned, receive extensive application in the estimation of several metals (such as copper, zinc, tin, lead, and mercury) and numerous organic compounds (including sugar, tannic acid, alkaloids, the constituents of urine, water, wine, etc.). J. P. BATTERSHALL.

**Vol'untary** [Lat. *voluntarius*], in music. This term originally signified an extempore performance on the organ, usually before the opening or at the close of divine worship. In the pure voluntary the performer was unrestricted by any set form, rule, or style, but gave free scope to his imagination and to his skill in execution. In the present day the term "voluntary" is also applied to compositions of this class which are not extempore, but premeditated and carefully written. Large collections of them, composed by the best masters, have been published, and are extensively used under the names of organ-pieces, preludes, offertories, postludes, etc. WILLIAM STAUNTON.

**Voluntary Conveyance,** in law, denotes a deed of conveyance without the adequate consideration which the law deems valuable—that is, something upon which a pecuniary estimate can be placed. It is therefore a gift, and is frequently made to some near relative of the grantor, in which case the consideration is love and affection, which is regarded as "good," though not as "valuable." As such, it is entirely legal and valid as between the parties—except, of course, where obtained by fraud or undue influence—for the law permits gifts to be freely made so long as the creditors of the donor are not thereby defeated or delayed. The term voluntary conveyance is generally applied to such a deed of lands, but the same principles control all similar transfers of chattels and other forms of personal property. The peculiar legal interest connected with voluntary conveyances arises from their effect upon the rights of the creditors of the grantor or transferror, and all the modern law on that subject has practically originated from two statutes passed in the reign of Elizabeth and from subsequent legislation of the same import. The first (13 Eliz. ch. 5, 1570) enacted that every conveyance of lands, chattels, etc., made with intent to defraud creditors or others of their actions, debts, demands, etc., shall be deemed (only as against that person, his heirs, executors, administrators, or assigns, whose actions, debts, etc., are delayed or defrauded) void. The second (27 Eliz. ch. 4, § 2, 1584) enacted that every conveyance of lands made with intent to defraud any person who shall purchase the same shall be deemed (only as against that person, his heirs, etc.) void. These provisions include two distinct cases: (1) deeds and transfers, whatever may be their consideration, made with an intent, either express or which the law requires or permits to be inferred from all the circumstances, to defraud creditors or subsequent purchasers; (2) deeds and transfers made without a valuable and adequate consideration; and the question with regard to the latter class is, whether they are void or valid as against the creditors of the donor. Statutes designed to produce the same effect, and containing substantially the same provisions, but often with a greater amplitude and minuteness of detail, have been passed in all the States of the U. S. At a former time the rule was maintained by high authority that a conveyance made without consideration by a person indebted was absolutely void as against his then existing creditors, whose demands he should not otherwise have discharged. This is no longer the law. The doctrine is now settled, both in England and in a great majority of the States, that there must be an intent to defraud on the part of the grantor or transferror; that the existence of this intent is a question of fact; that the absence of an adequate valuable consideration, while it does not absolutely show the intent, raises a presumption that such fraudulent intent did in fact exist; and, finally, that this presumption is not conclusive, but is rebuttable, and circumstances may show that, notwithstanding the existing indebtedness and the absence of a valuable consideration, the conveyance was not made with intent to hinder, delay, or defraud the donor's creditors. To illustrate this doctrine: If the grantor at the time of executing a voluntary conveyance to his wife or children was somewhat indebted, but still retained in his hands other property amply sufficient to pay all his then existing debts in full, and those creditors delay in enforcing their demands until he becomes insolvent, and then attack the former deed on the ground that it was without consideration and fraudulent as against themselves, all these circumstances would be taken into account, and would show, or at least tend to show, the absence of any intent to defraud on his part. But if the conveyance by way of gift to his wife or children should have left the grantor without sufficient property to pay his then existing indebtedness, these circumstances would indicate the fraudulent intent condemned by the statute. That a conveyance may be void as against subsequent creditors of the grantor, an actual design to cheat them must be clearly shown by other evidence than the mere absence of a valuable consideration. The want of such consideration does not raise any presumption of fraud, although it may undoubtedly be a circumstance, in connection with other and more directly criminative proofs, from which the preconceived intent to defraud subsequent creditors may be inferred as a conclusion of fact. JOHN NORTON POMEROY.

**Voluntaryism.** See VOLUNTARY SYSTEM.

**Voluntary System,** in religion. We shall describe it as it appears both in theory and in practice. The theory, as its advocates contend, rests on Scripture, on history, and on considerations of social equity. They maintain that religion, even in the Old Testament, where it is enforced by divine law, presents a voluntary aspect as it respects obedience, willing submission to divine commands being essential to the performance of religious duty. And, turning to the New Testament, they find there that the whole movement of Christianity at the beginning was of the voluntary kind; that it had no state support and no state control; that it was left to its own spiritual power and the protection and blessing of Heaven; that appeal was made by the apostles to the willing hearts and hands of primitive believers; and that Christ's kingdom was declared by himself to be "not of this world," and therefore its being linked on to the secular government of a country, to be enriched and guided thereby, is entirely out of the question. Voluntaries also appeal to history, with the view of showing that Christianity was more truly (*i. e.* more spiritually) prosperous before it was endowed by the state than afterward; that Constantine's was a fatal gift; that the union between the Church and the Empire gave power to persecution; that now orthodoxy, and then heterodoxy, became established, and that each in turn oppressed the other through the enforcement of political laws; that during the Middle Ages the Church became miserably corrupted by its secular relations, and that some of the brightest spiritual lights of that long period are to be found amongst those who protested against the worldliness of the reigning religion, and promoted spiritual truth and life in voluntary ways. They assert that establishments in Europe have been instruments of persecution; that the use of the magistrate's sword in the service of religion has wounded conscience and cut many a good man to the heart; that the wealth of the Church, being in worldly hands, has been necessarily misapplied; that voluntary efforts have been repressed, and that the willinghood of nonconformists has not had fair play. It is further urged that a comprehensive Church supported by the state so as to become truly national is an impossibility, and that, therefore, every establishment is, and must be, more or less sectarian. It is the Church of a party, not of a united people, and hence the unendowed and unpatronized are placed on terms of inequality, and consequently suffer a social wrong. Men ought not to be taxed for the support of creeds and systems in which they do not believe, and all such taxation involves social injustice. It is the duty and the privilege of every Christian to give as the Lord has prospered him: he is a steward of the gifts of God, and is bound to act conscientiously, and all interference with him in this matter on the part of the civil power is unrighteous and impertinent. Civil society being mixed and changeful, the permanent support of par-

ticular religious bodies is a sort of prolonged usurpation, and inflicts an injury, and crosses the opinions, the prejudices, and passions of those unendowed, so as to foster discontent and division and strife. These and a number of other arguments, which we have not space to specify, are presented by voluntaries to the attention of their fellow-citizens with a great variety of illustration and with no little energy and zeal.

The voluntary principle was implied, if not distinctly asserted, in some of Wycliffe's writings; still more clearly by Leonard Busher, a London citizen and Baptist, in a tract published in 1614; but most of all, in his own day, by Roger Williams in his *Bloody Tenet of Persecution* (1644). Not that the voluntary support of religion was prominently maintained in these works, but phases of religious liberty were unfolded which lead to such a conclusion. The Quakers, too, were amongst the pioneers of voluntaryism, and so were all the men who during the Commonwealth asserted extreme views of individual independence of thought and action. The Puritans were not voluntaries in our sense of the word; the Presbyterians were not; many of the Independents and some of the Baptists were not, for they accepted livings and emoluments in the Establishment. The Pilgrim Fathers and the founders of Massachusetts did not avoid state complications. Such nonconformists as Watts and Doddridge based their nonconformity on other grounds than that of opposition to a legal establishment of religion.

The clear enunciation in England of the principle began about half a century ago, and has ever since been gaining ground. Pamphlets, lectures, and public meetings in favor of disestablishment have called public attention to the question, and some who do not care for it in its religious bearings have been drawn toward the cause by affinity to it on its political side. The Anti-State Church Association and the Liberation Society, conducted by earnest men, have been zealous in fighting this battle, and have appealed strongly for support to liberals throughout the kingdom. Of late the educational has become complicated with the voluntary controversy, and many oppose the combination of religious with secular instruction in schools supported by the nation on the same grounds as those adopted in opposing a national Church. Even the enforcement of observance of the Lord's Day as a day of rest has come to meet objections from the extreme wing of the army arrayed under the voluntary flag. The practice is to be distinguished from the theory. Nowhere is the practice exemplified as it is in America. Ever since the war of independence closed, and the U. S. became separated from England, religion has been left for its support to the willing offerings of Christian people. The establishments which once existed have disappeared. There is no established Congregationalism in New England, nor established Presbyterianism or Episcopalianism in New York or Virginia, or anywhere else. Magnificent churches, well-supported ministers, prosperous colleges, and religious societies of all descriptions attest the energy and power of voluntaryism. The ground was cleared for its unfettered action by the previous absence of wealthy endowments, dignified clerical positions, and any long interweaving of secular and spiritual interests, so as to create difficulties in the way of disentanglement.

The voluntary system has been at work in England by the side of the Establishment ever since nonconformity began. The practice preceded the theory. Before any definite ideas on the subject obtained, proscribed sects were, of necessity, thrown upon their internal resources. Tithes and church-rates were beyond their reach, had they wished for them. It is remarkable that practical voluntaries, in a small minority 200 years ago, have so multiplied and increased as now to vie with the endowed Church in activity and influence. The number of places of worship built, the number of ministers supported, and the number of colleges sustained by voluntary communities appear from recent statistics to be very large. Congregational churches in England alone amount to 1960, pastors to 1575, whilst there are 10 colleges for ministerial education. Methodists are far more numerous, and to these are to be added Baptists, Presbyterians, Roman Catholics, and other large bodies. In Wales also voluntaryism is putting forth energetic efforts.

The voluntary system in Scotland has been widely extended since the disruption of 1843. The Free Church, which exists all over Scotland, as well as the United Presbyterian and other unestablished religious bodies, is entirely dependent for support on contributions from members and friends.

Now that the Episcopal Church of Ireland has been disestablished, it is placed, except so far as old associations and distinctions linger around it, on the same footing as other communities, save that it is endowed with revenues arising from funds which were set apart for its support when it ceased to be, as it had been, the national Church. Presbyterian, Methodist, Congregational, and Baptist communities, not to mention others, are working side by side with it in voluntary endeavors, unaided, except in the case of certain Presbyterian ministers, by any reserve made for them out of the old national endowments.

And in estimating the voluntary principle in its practical working, account must be taken of what it does in established churches. In the churches of England, Wales, and Scotland there have been great voluntary exertions for church building and restorations, for the endowment of places of worship, and for the augmentation of poor livings. Whereas in London 50 new churches were built by act of Parliament after the fire of 1666, and 50 more were ordered in the reign of Queen Anne, and not more than 6 were reared under George III., the bishop of London fund in a few years has outstripped the previous operations of a whole century; and when the ecclesiastical commissioners challenged the Church, offering £150,000 to meet equal private benefactions, the result was the free subscription of £300,000 in a single year.

Turning to the colonies of Great Britain in Canada, Australia, New Zealand, and the Cape, not to mention others, we discover a large amount of free Church activity. There are 232 ministers in one colonial church section alone—the Congregationalist—and that by no means the most numerous. Then to all the foregoing indications of free-will effort in the cause of religion must be added the sum-total revenues of Bible, missionary, and other religious societies, Roman Catholic as well as Protestant, in Europe and America—indeed, in all the world. JOHN STOUGHTON.

**Volunteers.** See MILITIA, by COL. R. N. SCOTT.

**Vol'untown,** tp., Windham co., Conn. P. 1052.

**Volu'sia,** county of E. Florida, bordering on the Atlantic and bounded W. by St. John's River; surface level and often swampy. There are many cattle, but little other live-stock. Staples, Indian corn, sweet potatoes, and cotton. Cap. Enterprise. Area, 2196 sq. m. P. 1723.

**Volu'tidæ** [from *Voluta*, "volute," the generic name of the type], a family of gasteropod mollusks containing some of the most beautiful and esteemed of univalve shells. The animals have the normal gasteropod form; the mantle is often more than usually well developed; the siphonal extension is short and recurved (generally provided with auricle-like appendages at the base); the gills are normally developed; the head is large and proboscidiform; the tentacles mostly (in Volutinæ, etc.) far apart, and connected by a broad "veil" forming a hood over the head, sometimes (in *Volutomitra*) close together; the eyes sessile on the head, near the outer bases of the tentacles; the teeth of the lingual ribbon are in a single longitudinal row, but diversiform in the several groups; the foot is large or moderate; an operculum is sometimes developed, and sometimes wanting; the shell is convolute or turreted, with a linear or narrow aperture and an anterior notch, with the columella obliquely plaited anteriorly, and with an enlarged nucleus. Although the generally-recognized constituents of the family seem at first to be naturally associated in a group of the rank in question, on account of the similarity of the shell, they differ so decidedly in dentition as to render it doubtful whether the association is of the value assigned. (I.) Most of the species (Volutinæ) have broad teeth with three-lobed apices; of these, again, (1) some are ovoviviparous, and have a very large foot, closing over much of the shell in extension, and depositing a thin enamel-like layer over the under side of the shell, and the nucleus of the shell is large and irregular; such is the genus *Yetus*, or the "boat-shells" of some collectors, typifying the sub-family Yetina of Gray; (2) others are oviparous, and have a moderate foot, and the nucleus of the shell is moderate and spiral; these are the typical Volutinæ of Gray, and include the genera *Voluta, Lyria, Volutella*, etc. (II.) A few of the species (forming the sub-family Volutomitrinæ) have teeth with diverging bases and single acuminate apices; these differ much among themselves, (3) some (like the majority of the family) having the tentacles far apart, and connected by a veil as well as auricled siphons (genus *Scaphella* or *Amoria*), and (4) others having the tentacles close together and simple siphons (genus *Volutomitra*). The representatives of the family are mostly confined to the tropical seas, and there they attain the largest size and exhibit the most beautiful colors. A few, however, are found in the temperate and even cold seas; the most northern species is a small shell, the type of the genus *Volutomitra*, the *V. grœnlandica* of authors. In time they have ranged from the Cretaceous period to the present, and in the Miocene epoch typical forms of the family extended much farther N. in both hemispheres than at present. The species are carnivorous. THEODORE GILL.

**Volvulus,** another name for the iliac passion. See Ileus.

**Vo′mer** [Lat., a "ploughshare," from its shape in man], a bone of the face which in the human skeleton forms a part of the nasal septum. In transcendental anatomy it is considered the centrum of the first cephalic vertebra. It affords important characters in the classification of many fishes.

**Vom′iting** [Lat. *vomere;* see Indigestion]. Vomiting is a reflex contraction of the muscular coats of the stomach, ejecting its contents. It is an involuntary and spasmodic act, but when established may be aided by voluntary effort. The contraction of the stomach and vomiting may be the result of disease of the brain, of the pneumogastric nerve, of the walls of the stomach, of catarrh or inflammation of its mucous lining; it may be the result of indigestible food, bile or mucus in the cavity of the stomach, or a sympathetic reflex result of disease in other organs, as the uterus, ovaries, or liver. The vomiting of pregnancy and of uterine or ovarian disease, the peculiar morning nausea and vomiting of Bright's disease of the kidneys, bilious vomiting, vomiting of gastric catarrh, and the vomiting at the onset of acute fevers and eruptive diseases of children, and vomiting from surgical causes, as fracture at the base of the skull, concussion and inflammation of the brain, are to be distinguished, each from the other, in some instances, by peculiar features of the act of vomiting, but more often by observation of the associated symptoms. (See Stomach, Diseases of.) At the onset of vomiting the face may be deathly pale; the surface becomes cool and bathed with clammy sweat; the pulse small and feeble; and great prostration results. In some instances faintness occurs, or even fatal syncope. An occasional accident during vomiting is the impaction of solid food or artificial teeth in the larynx, causing suffocation. Robust persons, but little depressed by vomiting, become red in the face during the effort, and later are cool and slightly pale. The clothes should be loose when vomiting, fresh air in the room, water at hand for cold affusion to the face if needed. Stimulants may be needed to counteract collapse. Ice, carbonic acid water, creosote, oxalate of cerium, dilute hydrocyanic acid, are useful remedies to allay vomiting.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Von′del, van den** (Joost), b. at Cologne Nov. 17, 1587; was educated in Amsterdam, whither his parents removed, being Anabaptists; the son, however, subsequently joined the Arminians, and finally the Roman Catholic Church. His education was very insufficient, but his poetical genius was of superior rank. He translated the Psalms, Virgil, and Ovid into Dutch verses, and wrote satires and tragedies. The most famous of the latter is *Gysbrecht van Aemstel,* which was first brought on the stage Jan. 3, 1638, and is performed every year on the same day. The best edition of his complete works is that by Jan van Lennep, in 7 vols. (Amsterdam, 1850–61). D. Feb. 5, 1679; a statue in his honor was raised in Amsterdam Oct. 18, 1867.

**Voor′hees** (Daniel W.), b. in Fountain co., Ind., Sept. 26, 1828; graduated at Indiana Asbury University 1849; was admitted to the bar 1851; was U. S. district attorney for Indiana 1858–61; defended John E. Cook for participation in the Harper's Ferry raid 1859; was a Democratic member of Congress 1861–65 and 1869–71.

**Vor′men,** one of the principal rivers of Norway, rises under the name of Lougen in the Lessö-Verki-Vaud, at an elevation of more than 2000 feet, flows through the narrow, wild, but beautiful Gudbrandsdale, forms the Lake of Mjösen, receives then the name of Vormen, and joins the Glommen. Lake Mjösen, about 80 miles long and 8 miles broad, and situated at an elevation of between 500 and 600 feet, is the scene of a very brisk traffic, four steamers traversing it daily in various directions.

**Voronetz′,** government of Southern Russia, on both sides of the Don, comprises an area of 25,878 sq. m., with 2,152,696 inhabitants. The surface is an undulating plain, the soil very fertile, and the climate mild. Large crops of wheat, barley, oats, and tobacco are raised, and fine fruits, melons, and even vines, are cultivated with success. Cattle, sheep, and horses of good breeds are extensively reared. Corn, cattle, tallow, wool, fruit, skins, and horses are the principal articles of export.

**Voronetz,** town of Russia, capital of the government of Voronetz, on the Vorona near its influx in the Don, contains many fine buildings, among which are two cathedrals; it is the seat of many civil, ecclesiastical, and educational institutions. Its manufactures of tallow, soap, leather, and candles are quite extensive, and its trade brisk. P. 41,592.

**Vö′rösmarty** (Mihály), b. at Nyék, Hungary, Dec. 1, 1800; studied law in Pesth, but devoted himself subsequently entirely to literature, and wrote some of the finest epics—*Zalán futása* (1825), *Eger* (1827), and dramas, *King Salomon* (1821), *Kont* (1825)—of the Hungarian literature. Some of his minor poems also became very celebrated, as, for instance, the patriotic song, *Szózat* (1845). After the unfortunate issue of the Hungarian revolution of 1848–49, Vörösmarty retired broken-hearted to his country-seat; pen and ink were not found in his house. Subsequently, he recovered his spirits, and began a translation of Shakspeare, but d. Nov. 9, 1856, before finishing it. A complete edition of his works was published by Paul Gyulai in 10 vols. (1865–66).

**Vor′stius** (Conrad), b. in Cologne July 19, 1569; studied theology at Heidelberg; lectured in Geneva, and was in 1596 appointed professor of divinity at the gymnasium of Steinfurt. Meanwhile, his treatises, *De Prædestinatione, De Sancta Trinitate,* and *De Persona et Officio Christi,* made him suspected of Socinianism, and he was compelled in 1599 to go to Heidelberg and vindicate his orthodoxy. He was acquitted, and in 1610 he succeeded Arminius as professor of theology at Leyden, but here his treatise *De Deo* was attacked most violently by the Gomarists. James I. of England became interested in the case; *De Deo* was burnt by the hangman in London and Oxford; Vorstius was deposed in 1612, and solemnly condemned as a heretic by the Synod of Dort in 1619. He fled from Holland, and lived concealed until 1622, when the duke of Holstein offered the Arminians an asylum, but Vorstius d. shortly after at Tönningen, Sleswick, Sept. 29, 1622.

**Vos, de** (Martin), b. at Antwerp in 1530; studied painting in his native city under Francis Floris, and in Venice under Tintoretto; formed a school in Antwerp, and d. there in 1603. His best pictures, among which are *The Triumph of Christ, Cæsar's Penny, St. Luke painting the Portrait of the Virgin,* etc., are in the museum of Antwerp.

**Vosges,** department of Eastern France, comprises an area of 2266 sq. m., with 392,988 inhabitants. The eastern portion of the department is occupied by the Vosges Mountains, which are partly covered with forests of oak, beech, and fir, and partly afford excellent pastures, where large quantities of cheese of superior quality are produced. In the western portion, the Plaine, wheat, wine, and fruits, are extensively raised. Iron, copper, and silver are mined, and marble is quarried. Education is better cared for here than in any other department of France; of 52,152 children of school age, only 1103 received no school education in 1857.

**Vosges Mountains,** a range of mountains on the left bank of the Rhine, situated partly in North-eastern France, partly in South-western Germany, and running parallel with the Schwartzwald (or Black Forest) Mountains in Baden, which they resemble very much, not only in direction, but also in form and geological structure. By the depression between Montbéliard and Mühlhausen they are sharply separated from the Jura Mountains, and their eastern slopes toward the plain of the Rhine are steep and abrupt. But to the N. they connect with the Hardt in Rhenish Bavaria, and to the S. W. by the plateau of Langres through the hills of Faucilles. They are generally rounded and of a regular shape, whence they are called *ballons,* covered with forests of oak, beech, and fir on the sides, and affording excellent pastures on their tops during the six months of the year in which they have no snow. Their highest peaks rise between 4000 and 5000 feet. Ballon de Guebviller, the highest peak, reaches 4700 feet; Ballon d'Alsace and Ballon de Servance are not much lower. Mineral and thermal springs are numerous, and copper, iron, lead, and rock-salt abound. The Meurthe, Moselle, Saar, Ill, and Ognon descend from them.

**Vös′lau,** village of Lower Austria, has a palace with a beautiful park, a warm sulphur spring much used for bathing, and numerous elegant villas. The place is most famous, however, for its wine, the so-called *Vöslauer-Wein,* one of the finest wines of Austria, produced from a vine transplanted hither from Burgundy.

**Voss** (Johann Heinrich), b. at Sommersdorf, Mecklenburg, Feb. 20, 1751; had to struggle with many difficulties in order to finish his education, but was nevertheless possessed of comprehensive knowledge in classical and modern languages and literatures, and had formed valuable connections with many of the more prominent men in the German literature, when in 1778 he was appointed rector of the gymnasium at Ottendorf in Hanover. In 1782 he removed to Entin, near Lubeck, as rector of the gymnasium there. From 1802 to 1805 he resided in Jena, where he enjoyed a pension from the grand duke of Saxe-Weimar. In 1805 he accepted a chair in classical literature at the University of Heidelberg, and here he d. Mar. 29, 1826.

He had an uncommon mastership of the German language and a fine sense for the formal correctness of verses. His translation of Homer (4 vols., 1793) is fluent and elegant, and exercised considerable influence. His translation of Virgil's *Eclogæ* and *Georgica*, of Ovid's *Metamorphoses*, of Hesiod, Theocritus, Bion, Moschus, etc., were also much appreciated. But his power of imagination and emotion was not great. His translation of Shakspeare, finished by his son (9 vols., 1818–29), is unimpressive, and so are his own poems, collected in 4 vols. (1825), though one of them, the idyl *Luise*, became very popular. His critical works show the same character—his attack on Heyne, his polemics against Creuzer, *Mythologische Briefe* (2 vols., 1794), *Antisymbolik* (2 vols., 1824–26), etc. They are clear, and rest on solid knowledge, but they lack elevation and are singularly unsuggestive. A striking picture of the man's noble and open but somewhat circumscribed character is given in his *Wie ward Fritz Stolberg ein Unfreier* (1819), which he wrote when his friend Friedrich Stolberg was converted to Roman Catholicism. His letters were published by his son in 3 vols. (1829–33).

**Vos'sius** (Gerard Johannes), b. near Heidelberg in 1577 of Dutch descent; studied classical languages and literatures at Leyden and Dort, and was appointed professor of rhetoric at Leyden in 1618, but became entangled in the controversies between the Arminians and Gomarists by his *Historiæ Pelagianæ Libri IV.* (1618), and was for many years prohibited from teaching, though he was acknowledged to be one of the finest scholars of his age. Through Archbishop Laud he received a prebend in the cathedral of Canterbury, and in 1629 went to England, and was installed, but in 1633 returned to Holland, and was made professor of history at the College of Amsterdam, where he d. Mar. 17, 1649. The most remarkable of his works are—*Aristarchus sive de Arte Grammatica* (1635), *Etymologicum Linguæ Latinæ* (1662), *Commentariorum Rhetoricorum sive Oratoriarum Institutionum Libri VI.* (1606), *Ars Rhetorica* (1623), *De Historicis Græcis Libri IV.* (1624), *De Historicis Latinis Libri III.* (1627), etc. His complete works appeared at Amsterdam in 6 vols. (1695–1701). His letters were published in two collections (London, 1690, and Augsburg, 1691).—His six sons were all prominent men, but only the youngest, Isaac Vossius, survived him. He was born at Leyden in 1618, and received the instruction of his father. In 1648 he went to Stockholm on the invitation of Queen Christina, but fell out with Salmasius, and returned to Holland in 1658. In 1670 he removed to England, was made canon of Windsor in 1673 by Charles II., and d. there Feb. 21, 1689. His principal works are—*De Septuaginta Interpretibus eorumque Translatione et Chronologia* (1661), *De Poematum Cantu et Viribus Rhythmi* (1673), *Variarum Observationum Liber* (1685).

**Vote** [Lat. *votum*]. This term, both in the private and in the public law, denotes a suffrage—a statement of a choice by each individual among many having a like power, given and counted in order to express and obtain an opinion and decision upon some pending question in which all are interested, or to make a selection of a person for some representative or official position. Although "voting" and "votes" are frequently used in matters connected with the private law—as, for example, by the stockholders and directors of corporations—the terms are most frequently and significantly employed to describe the means and instruments by which many officials are chosen at public elections and measures are passed in legislative bodies. In England the voting for members of the House of Commons was for a long time *vivâ voce*. Each voter came up to the polling-place or booth, and cast his vote by naming aloud the candidate or candidates of his choice; and the names thus announced were immediately registered in the polling-book. This method was long upheld as being peculiarly in harmony with the English character, but it plainly subjected the lower classes, and especially the tenantry, to an enormous political pressure from their superiors and landlords. Parliament finally abolished the whole system, and introduced the ballot by the recent statute of 35 and 36 Vict. ch. 33, § 2 (1872), which goes to the very opposite extreme, and prescribes very minute and careful provisions for rendering the votes absolutely secret. At an early day after the adoption of the U. S. Constitution the *vivâ-voce* vote existed in a few of the States, but the ballot has long been established as a part of the American system, and now prevails in all elections, national, State, and municipal. While the statutes always require that the ballots shall be deposited unopened in the box by an inspector of the election, and often that they shall be printed upon plain white paper without any external marks except the name or title of the offices, no further safeguards are generally furnished for preserving the absolute secrecy which is obtained by the English statute. In one or two States, however, the law has permitted the vote to be enclosed in an envelope. Another common and important species of vote is that used for the determination of questions—and especially for the passage of bills—in legislative assemblies. In the British House of Commons, in the U. S. Congress, and in all the State legislatures the votes must be given by the members personally while present at a session, but in the British House of Lords votes by proxy are permitted. There are three forms of the legislative vote—by a rising and count, by a collective and simultaneous utterance of the *ay* or *no*, and by a call of the roll, each member responding "ay" or "no" when called, so that his name and response may be entered on the records. The American constitutions, statutes, and parliamentary rules contain special provisions by which the latter form may or must be resorted to in the decision of certain classes of questions, and especially in the final passage of bills. Stockholders of corporations are generally permitted to vote by proxy in the election of trustees or directors and in the determination of other matters left to them by the charters. (See also Proportional Representation.) John Norton Pomeroy.

**Vouch'er** [Law Fr. *vocher;* Lat. *vocatio*, "calling"]. (1) In the ancient common law the term denoted a peculiar proceeding in an action brought to recover land, whereby the defendant "vouched" or summoned his own grantor or lessor, who had warranted the title, to appear and defend his title against the attacks of the plaintiff. The defendant thus calling in his predecessor to defend the suit was also named the "voucher," while the party summoned was styled the "vouchee." This special process and the names belonging to it have been abrogated by the modern amendments made in the system of legal procedure. (2) The term also denotes—and this is now its ordinary signification—any written memorandum, receipt, discharge, or evidence of the payment of money, and also the books of account in which are entered such payments and receipts, used in actions or other proceedings for the judicial settlement of accounts. Every writing showing the payment of money by the person whose accounts are investigated, and which thereby strengthens or even supplies the place of the oral testimony, is a voucher.

John Norton Pomeroy.

**Vouet'** (Simon), b. in Paris Jan. 9, 1590; studied painting under his father, and afterward in Italy, where he formed his style principally after Paul Veronese and Caravaggio; acquired a great reputation, and was made president of the Academy of St. Luke at Rome in 1624; returned to Paris in 1627; received a pension from Louis XIII. and rooms in the Louvre, and d. there June 30, 1649. He is largely represented in the gallery of the Louvre, where, among others of his works, the celebrated *Presentation in the Temple* is found. Among his pupils were Eustache le Sueur, Pierre Mignard, and Charles Lebrun.

**Vourla,** or **Urghula,** town of Asia Minor, on the southern shore of the Gulf of Smyrna, occupies two hills, of which one is inhabited by the Turks, the other by the Greeks. The excellent harbor is formed by a row of islands in front of it, and is generally the station of the European men-of-war which visit Smyrna. The site of the city was in ancient times occupied by Clazomenæ, and the causeway which was built from the mainland to one of the islands when, on the approach of Alexander the Great, the city was removed to this island, is still extant. Between Vourla and Smyrna are numerous warm springs which are much used for bathing.

**Vow'el,** a vocal element composed of uninterrupted voice, varied by modifications chiefly of the mouth and pharynx. The ordinary *pure* vowels may be made *nasal*, of which examples exist in French, Portuguese, and Polish; they may be *whispered*, as in some of the North American languages; they occur *independent* (of expiration, inspiration, and voice), being vowel-effects succeeding a clack; and they are *glottal* when a vowel is accompanied by a scraping effect at the glottis, as in the Hebrew and Arabic *ain*. (See Haldeman, *Analytic Orthography*, 1860, p. 38.) The final element of diphthongs is usually accounted a vowel, but improperly, because two vowels must form two syllables. The final of a diphthong is a *way*-sound (as in *now, round*), or a *yay*-sound (as as *boy, aisle*), with less closure of the organs than these liquid consonants require, but more than the vowels of *ooze* and *eel*, forming intermediate *coalescents*, while they remain true consonants. In a succession like *by-you* or *bâyou*, the coalescent of *by* glides into the consonant of *you*. S. S. Haldeman.

**Voy'sey** (Charles), b. in London, England, Mar. 18, 1828; educated at Stockwell Grammar School; graduated at St. Edmund's Hall, Oxford, 1851; took orders in the Church of England; was curate of Hessle, near Hull, 1852–59, of Craigton, Jamaica, 1860–61; became incumbent of

St. Mark's, Whitechapel, London, 1861; was ejected in consequence of having preached a sermon against the doctrine of endless punishment; held for a short time the curacy of Victoria Dock parish, London, and became vicar of Healaugh, Yorkshire, 1864. He began in 1865 the publication of *The Sling and the Stone* in monthly parts, each consisting of two sermons, and continued the series until 1871. In consequence of these sermons containing sundry opinions upon the doctrines of atonement, justification, incarnation, and inspiration which were held to be inconsistent with the Thirty-nine Articles, Mr. Voysey was prosecuted in the chancery court of York minster by the secretary of the archbishop of York. Decision having been pronounced against him Dec. 1, 1869, he appealed to the judicial committee of the privy council, which confirmed the decision and sentenced the appellant to be deprived of his living and to pay the costs (Feb. 11, 1871), giving him, however, a week in which to retract his opinions. Since that date Mr. Voysey has preached and lectured upon his own responsibility in St. George's Hall, London, being supported by the "Voysey Establishment Fund," to which there were numerous and wealthy subscribers. His sermons, which are increasingly "heretical" in their tone, have been regularly printed every week in the *Eastern Post*. He has published some controversial pamphlets, and conducted for a few months in 1876 the *Langham Magazine*, an organ of free religious thought which had but a brief existence.

**Vra'na,** village of Dalmatia, formerly a strongly-fortified place belonging to the Knights of St. John, is on the shore of the Lake of Vrana, famous for its rich eel fisheries.

**Vukovar',** town of Austria, in Slavonia, at the influx of the Vuko in the Danube, has 6782 inhabitants, mostly engaged in silk-culture and silk manufactures.

**Vul'can** [Lat. *Vulcanus*], a planet supposed to be revolving around the sun, within the orbit of Mercury. About twenty years ago, Leverrier announced that certain perturbations in the orbit of Mercury could only be accounted for by the existence of another planet still nearer the sun, even as the perturbations of Saturn had enabled him to discover the planet Neptune. Within three years after Leverrier's announcement, Dr. Lescarbault detected the supposed planet in its transit across the sun's disk, but it has not been seen since. At the observatory in Paris, MM. Porro and Wolf of Zurich believe they found the stray planet during its transit in 1876. It is not known whether their observations are sufficient for the precise calculation of the elements of the planet. Kepler's law, however, would reduce the time of its revolution around the sun to about a month. It was not discovered during the watching for its transit in Oct., 1876.

**Vulcan,** in Roman mythology, the god of fire and of those arts which depend on the use of fire, became in course of time completely identified with the Greek Hephæstus, and was, like him, imagined to have his earthly abodes, his workshops, in the volcanoes, where he was served by the Cyclops. Numberless myths were formed in connection with Hephæstus and transferred to Vulcan, but most of them were of a humorous turn. He was a son of Zeus and Hera; but he was born lame, and so weak and feeble that Hera, disgusted with him, dropped him from Olympus. But Thetis caught him when falling, and brought him to a grotto, where he lived for nine years, kindly attended to by the Oceanides. During this period he made a magnificent throne-chair of gold, but so constructed that any person who sat down on it was held fast, and could not get free unless liberated by the workman himself. The chair was sent to Olympus; Hera sat down on it, and was entrapped. At first, all the summons of Zeus and all the supplications of Hera and the other gods were fruitless: the mother sat chained in Olympus, and the son lay laughing in his grotto. But finally a stratagem succeeded. Dionysus went to the grotto, and soon Hephæstus became tipsy. Crowning himself with flowers and wreaths, the lame and homely man joined the wild chorus of the satyrs, and without noticing what was going on he came dancing into Olympus, where the laughing gods took him captive and coaxed him to release Hera. He was married to Aphrodite, but his marriage was not altogether without troubles. (See *Od.*, viii. 266–358.) He was nevertheless fervently worshipped both in Athens and Rome, and festivals to his honor, the *Hephæstia* in Athens and the *Volcanalia* in Rome, were celebrated with great splendor.

**Vulcanite** and **Vulcanization.** See India-Rubber, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

**Vulca'no,** or **Volcano,** the southernmost of the Lipari or Æolian Islands, in the Mediterranean Sea, in lat. 38° 22′ N., lon. 14° 55′ E., 12 miles off the northern coast of Sicily, is 7 miles long and 3 miles broad, and contains nearly in the centre a crater over 1200 feet high and about one-fourth of a mile in circumference, which constantly emits smoke and vapors charged with sulphur, ammonia, vitriol, and alum. The southern part of the island is very fertile, and produces excellent corn, grapes, fruit, and flax. The interior is sterile, and on the northern side the island is connected by a row of low rocks with the Vulcanello, a minor crater, likewise emitting smoke and vapors.

**Vul'gate, The.** Latin translations of the Bible. The Latin is one of the three oldest versions of the Old Testament, the Greek, the Syriac, and the Latin, and one of the two oldest of the New Testament, the Syriac and the Latin. The history of its origin is lost, but it is certain that it was made in Africa, and in the second century. It would naturally be assumed that it was made in Rome, but at that period the Church in Rome was essentially Greek, the Roman bishops bore Greek names, the earliest Roman liturgy was Greek, and the few remains of Roman Christian literature are Greek. The same statements hold true of Gaul. The Church in Africa, however, seems to have spoken Latin from the first. At what exact time this Church was founded we know not, but at the close of the second century Christians were found there in all places and in every rank. Tertullian of Carthage, the first of the Latin Fathers, directly cites or alludes to every part of the New Testament which we now have, except the second and third Epistles of St. John, the second of St. Peter, and St. James. This version, the *Vetus Latina*, or *Old Latin*, was preserved generally unchanged in Northern Africa, but when introduced into cultured Italy its provincial rudeness would offend, and the familiarity of the leading bishops there with Greek would make the revision, so likely to take place, easy of accomplishment. Hence, in the fourth century a revision of the Gospels seems to have been made in Northern Italy, and to have been distinguished by the name *Itala, Italian.* This version St. Augustine recommends for its accuracy and perspicuity (*De Doctr. Christ.*, 15), and the text of the Gospels as quoted by him, on occasion, in his works bears out his representation; but in the other books the difference cannot be traced with exactness. The Latin version of the New Testament appears to have arisen from individual and successive efforts; for St. Augustine says that any one in the first ages of Christianity who gained possession of a Greek MS., and thought he had a fair knowledge of Greek and Latin, ventured to translate it. And as the LXX. about B. C. 250 furnished the mould in which the thoughts and expressions of the Greek Testament are cast, so the LXX. may have taken a Latin form for the Latin-speaking Jews, and thus may have made ready a dialect for the Latin version of the New Testament. But, however this may have been, there is found, in fact, a substantial similarity between the character of the Old Testament and the New Testament in Latin, and this justifies the belief that there was one Latin version of the Bible current in Africa in the last quarter of the second century.

The name Vulgate—that is *Vulgata editio*, the current text of Holy Scripture—originally answered to the designation of the Greek version of the Old Testament, the κοινὴ ἔκδοσις. As the *vetus versio* of the Old Testament was made from the LXX., and in substance identified with it, St. Jerome introduces Latin quotations from the Old Testament under the name of LXX. or *Vulgata editio* indifferently, and thus this term was transferred from the current Greek to the current Latin of the Old Testament. This use of the expression *Vulgata editio* continued to later times. It is found in St. Augustine, Ado of Vienne, and in Roger Bacon, and it is recognized even by Bellarmin. The Council of Trent, therefore, historically erred in styling St. Jerome's Bible *Vulgata editio*. The Latin Fathers themselves commonly spoke of St. Jerome's version as *nostra versio*, "our version," or *nostri codices*, "our books;" but the Tridentine prelates, like many later scholars, were misled by the associations of their own period, and gave this designation a wider range than it ever had in early times.

After the translation received a definite shape in Africa, it was jealously guarded by ecclesiastical use, and was retained there even when St. Jerome's version was almost universally received elsewhere; and the disturbance caused by an African bishop's attempt to introduce one of the changes of St. Jerome shows how carefully intentional alterations were avoided. But at the same time the text suffered by the natural corruptions of copying and by the interpolation of glosses, especially in the Gospels, and thus the different forms of the text became almost as numerous as the copies. The one remedy for this confusion was to go back to the first form in Greek.

St. Jerome had not long been in Rome (A. D. 383), when Pope Damasus consulted him on points of scriptural criticism. The answers the pope received may well have encouraged him to seek for greater services, and, apparently

in the same year, he applied to St. Jerome for a revision of the current Latin version of the New Testament by means of the Greek original. St. Jerome undertook it, and confined himself strictly to the labors of a reviser, and therefore when St. Augustine spoke of him as *translating the Gospel*, St. Jerome corrected him, saying that he had simply *emended it*. In the prosecution of his work he collated early Greek MSS. and introduced the necessary changes, but he preserved the old renderings where the sense was not injured by it. Some of his alterations were made purely on linguistic grounds, but it is impossible to ascertain on what rules he proceeded; others involved questions of interpretation; the greater number, however, consisted in the removal of the interpolations by which the first three Gospels especially were corrupted. These interpolations must have been far more numerous than are found in existing copies, but instances still occur to show the service he rendered in checking the perpetuation of apocryphal glosses and additions.

St. Jerome's Preface, addressed to Damasus, speaks only of a revision of *the Gospels*; and St. Augustine, writing to St. Jerome, alludes to *the Gospel*, and there is no preface to any other book such as is elsewhere found before St. Jerome's versions or editions. But this omission is probably due to the fact that the rest of the New Testament was preserved comparatively pure. For St. Jerome enumerates among his works his *Restoration of the New Testament to Harmony with the Greek*, using this general expression, and in writing to Marcella on the charges brought against him for introducing changes in the Gospels, he quotes three passages from the Epistles to show the superiority of his revision over the old version.

The old version of the Old Testament was made from the unrevised form of the LXX., and thus included many false readings and other imperfections. Therefore, about the same period in which St. Jerome revised the New Testament he put his hand to the Old Testament. He first undertook and accomplished a revision of the Psalter. This was done with the aid of the LXX., but not very thoroughly. It was called the *Roman Psalter*, probably because made for the use of the Church in Rome at the request of Damasus. Afterwards, urged by Paula and Eustochium, he made a new and more careful version, which became very popular, and which Gregory of Tours is said to have introduced into France, hence called the *Gallican Psalter*. From this work he proceeded to a revision of the rest of the Old Testament by means of the LXX., which he appears to have completed in four or five years. About the year 374 he began the study of Hebrew, which he zealously pursued for some years, and about 389 published several treatises connected with this study. These paved the way for his new version of the Old Testament direct from the Hebrew, which he now undertook and in 392 seems to have completed. Portions of this, as the books of Solomon, Judith, and Tobit, were done in great haste, but the greater part was accomplished successfully. This stupendous work is an enduring monument of his piety, his genius, and his learning, and has made his name as illustrious in the Western as the great Hexapla made the name of Origen in the Eastern Church.

The critical labors of St. Jerome were received with an outburst of reproach. He was accused, as other such laborers have been, of disturbing the peace of the Church and of undermining the foundations of the ancient faith. Acknowledged errors were looked upon as hallowed by usage, and few had either interest or courage to seek the purest text of Holy Scripture. Even St. Augustine was carried away by popular prejudice and endeavored to discourage St. Jerome from his presumptuous work, as it appeared to him; and to the last he himself adhered, as we have noticed above, to the *Versio Itala*, which he had first employed. But the improved translation gradually came into use side by side with the old, and at length supplanted it; and this it did without any direct ecclesiastical authority.

But the Latin Bible, which thus became current under the name of St. Jerome, was a composite work, containing elements that belonged to every period and form of the Latin version: (1) *Unrevised Old Latin*, Wisdom, Ecclus., 1 and 2 Maccabees, and Baruch; (2) *Old Latin revised from the LXX.*, the Psalter; (3) *St. Jerome's Translation from the original Greek*, Judith, Tobit; (4) *St. Jerome's translation from the original Hebrew*, the Old Testament except the Psalter; (5) *Old Latin revised from the Greek original*, the Gospels; (6) *Old Latin thus revised cursorily*, the rest of the New Testament.

The MS. remains of the *Old Latin text* of the Old Testament are very scanty. There still exist important MSS. of the New Testament: of the *African text*, *Codex Vercellensis*, at Vercelli, of the fourth century; *Cod. Claromontanus*, in the Vatican, of the fourth or fifth century; *Cod. Bobbiensis*, at Turin, of the fifth century, a remarkable revision of this text; of the *Italic text*, *Cod. Brixianus*, of the sixth century. Of *St. Jerome's text* we have *Cod. Amiatinus*, at Florence, of the sixth century; *Cod. Toletanus*, at Toledo, in Gothic letter, of about the eighth century; and *Cod. Fuldensis*, containing the New Testament merely.

At the invention of the art of printing, St. Jerome's Bible was the first book produced from movable types, about 1455. It was printed again and again by various hands and in various forms, but it was not until the heat of controversy in the sixteenth century exaggerated the differences in the text and in the interpretation that an authorized edition was determined on for the Church of Rome. This was undertaken by Pope Sixtus Quintus, and put forth in 1590. Though declared by the pontiff *authentical and in a manner absolutely perfect*, it contained such typographical and other errors as to compel the publication of a second and revised edition in 1592, of another in 1593, and still another in 1598, with a triple list of *errata*, one for each of the preceding editions. This is the standard of the *Vulgate*, or Roman Catholic Bible, of the present day.

The MS. form of St. Jerome's Bible—which, upon the whole, stands highest in the estimation of scholars—is the *Codex Amiatinus*, mentioned above. The editors employed by Pope Sixtus rightly valued this MS., and in some passages solely or chiefly followed its authority. The portion containing the New Testament has been repeatedly published, and is easily accessible, as ed. by Fleck (1840, 12mo), common text with the Amiatine variations; by Tischendorf (1854, roy. 8vo), Amiatine text with learned prolegomena.

We subjoin a specimen of the diction of the Vulgate, under different heads, extending over the first six or ten chapters of St. Matthew, employing the Greek and the Latin text of Prof. Tischendorf in his *N. T. Triglottum*, published in 1854: (1) *It preserves the exact order of the original in very many instances.* At the opening of the Gospel we find, *Liber generationis Jesu Christi filii David, filii Abraham. Abraham genuit Isaac, Isaac autem genuit Jacob.* This follows the Greek word by word: Βίβλος γενέσεως Ἰησοῦ Χριστοῦ υἱοῦ Δαυὶδ υἱοῦ Ἀβραάμ. Ἀβραὰμ ἐγέννησεν τὸν Ἰσαάκ, Ἰσαὰκ δὲ ἐγέννησεν τὸν Ἰακώβ. So in clauses and phrases: vi. 6, Σὺ δὲ ὅταν προσεύχῃ, *Tu autem cum orabis*; iv. 22, οἱ δέ, *illi autem.* The advantage of following the order of the Greek sometimes appears conspicuously, as in iv. 10, *Dominum Deum tuum adorabis et illi soli servies*—an order preserved in English only by the Rheims version, and far more forcible than the common order. In iii. 1, Ἐν δὲ ταῖς ἡμέραις ἐκείναις is given by *In diebus autem illis*: here (*a*) the postpositive particle *autem* stands for the postpositive δέ, but the Vulgate, faithful to Latin usage, puts it after the noun, not after the preposition, as in the Greek; and (*b*) the demonstrative follows its noun like the Greek; now, common as this order is in Greek, it is comparatively rare in Latin, though found in the best writers (Cicero, Livy). In τὸ σκότος πόσον, vi. 23, we find the interrogative (exclamatory) after its noun, and this position adopted by the Latin, *tenebræ quantæ erunt!* This secondary position of an interrogative is rather uncommon, but found both in prose and poetry (Cic., *Ad Fam.*, xvi. 18; Cæs., *B. G.*, vii. 4; Hor., *Sat.*, i. 5, 43). But we meet here and there with a departure from the arrangement of the Greek without apparent reason: in i. 12, Μετὰ δὲ τὴν μετοικεσίαν is given by *Et post transmigrationem*, instead of *Post transmigrationem autem*; and in ii. 5 and iv. 20, οἱ δέ is given by *At illi*, instead of *Illi autem*; and this is the more strange, as the stricter form is common in the Vulgate.

(2) *Many of its renderings are peculiarly exact in sense or form, or both, in reference to the Greek.* In i. 11, ἐπὶ τῆς μετοικεσίας Βαβυλῶνος, is given by *in transmigratione Babylonis*, which, though unclassical, as we shall presently see, preserves the euphemism of the Greek Testament and of the LXX. for "captivity," and of all our versions, Wycliffe and the Rheims alone have retained it. In ii. 19, Τελευτήσαντος δὲ τοῦ Ἡρώδου, the gen. abs. is exactly given by the abl. abs., *Defuncto autem Herode*, and so in vi. 3. In iii. 2, Μετανοεῖτε is given by *Pœnitentiam agite*, and this Latin was rendered by Wycliffe "Do penance," which the Rheims followed; but, though this English phrase has now, even to the Roman communion, come to mean rather mortification of the body than sorrow of mind, yet the Latin is a good classical equivalent of the Greek, and is actually found in Petronius, *Sat.*, 132, in Tacitus, *De Orat.*, 15, in Pliny, *Ep.*, vii. 10, and has the express sanction of Quintilian in a critical observation in ix. 3, 12. In iii. 9, μὴ δόξητε is given in form by *ne velitis*, and so in v. 42; vi. 13; vi. 25, while, as we shall see below, the freer and quite classic *noli* and *nolite* with the inf. prevails in the Vulgate. In iii. 15, Ἄφες ἄρτι is ingeniously rendered by *Sine modo*, and in iv.

17, Ἀπὸ τότε by *Exinde* (Plaut., Cic., Verg.), and vi. 25, Διὰ τοῦτο by *Ideo*. In iv. 16, ὁ λαὸς ὁ καθήμενος is nicely given by *qui sedebat*, "who were sitting," and viii. 24, ὥστε τὸ πλοῖον καλύπτεσθαι by *ita ut navicula operiretur*, "was being covered," while the A. V. has "sat," and "was covered." In viii. 16, δαιμονιζομένους is rightly rendered *dæmonia habentes*, "possessed with demons," while all our versions have here "devils," as if it were the plural of ὁ Διάβολος, "the devil;" but the plural in this sense nowhere occurs in Holy Scripture; and though "devils" is found also four times in our version of the Old Testament, the Vulgate has likewise *dæmonia* uniformly there.

(3) *Certain of its renderings seem more or less inexact or faulty.* In i. 20, Ταῦτα δὲ αὐτοῦ ἐνθυμηθέντος is given by *Hæc autem eo cogitante*, but this would be the proper rendering of the pres. participle, as is given by the Vulgate in Acts x. 19, while here the proper rendering would have been, *Cum autem hæc cogitavisset;* we also find the aor. part. of the Greek given by the pres. part. in the Vulgate in i. 24; ii. 3, 4, 8, 9, 10, 11 *bis*, 16 *bis*, 21, 22, 23; iii. 7; iv. 3, 9, 21; v. 1, 2, 24. These instances are enumerated in full, because there is an impression, even among scholars, that our loose use in English of the pres. part. is largely due to the influence of the A. V.; yet against these twenty cases of such loose use in the Vulgate only four can be adduced from the same portion of the A. V., and one of these (iii. 15) is logically right: Ἀποκριθεὶς δὲ ὁ Ἰησοῦς εἶπεν, "And Jesus answering said." In ii. 8 the diminutive παιδίον is given by *puer*, instead of the dim. *puellus*, by which the Vulgate always renders this elsewhere, except in Tobit i. 8, where it uses *puerulus*. In iv. 21, αὐτῶν—αὐτῶν, both reflexive, are rendered *eorum—sua* for *sua—sua*. In vi. 19, διορύσσουσιν is rendered *effodiunt* for *perfodiunt*, which the Vulgate rightly uses in xxiv. 13 and in Ezek. xii. 12. In vi. 24, ἑνὸς ἀνθέξεται is given by *unum sustinebit* instead of *uni adhærebit*, which the Vulgate employs in the parallel passage, Luke xvi. 13. In viii. 4, Ὅρα μηδενὶ εἴπῃς is given by *Vide nemini dixeris* for *Vide ne cui dixeris*.

(4) *Many of its renderings are strictly in accordance with Latin usage, even when this differs from the Greek.* We have the Greek part. given by *cum* and the subj.: (*a*) the aor. part., i. 18, Μνηστευθείσης γὰρ τῆς μητρός, *Cum esset desponsata mater*, and so ii. 1, 9, 13, 19; iv. 2, 12; v. 1; (*b*) the pres. part., i. 19, δίκαιος ὤν, *cum esset justus*. We have the Greek aor. part. given by the abl. abs.: καλέσας τοὺς μάγους, *vocatis magis;* so ii. 11, 12; iv. 13, 22; vi. 6. In i. 20, μὴ φοβηθῇς is given by the idiomatic *noli timere;* so v. 17; vi. 2, 7, 8, 19, 31, 34, but in iii. 9, as we have seen, and elsewhere, we find the Greek form imitated, *ne velitis*. In iv. 1 we have πειρασθῆναι, denoting a purpose, rendered by *ut temptaretur*, and in iii. 13, τοῦ βαπτισθῆναι by *ut baptizaretur*, though, as we shall see, the Greek inf. of purpose the Vulgate commonly gives by an inf., simply to preserve the form of expression.

(5) *It not unfrequently gives literal renderings from the Greek in violation of the Latin idiom.* In i. 11, ἐπὶ τῆς μετοικεσίας Βαβυλῶνος is given by *in transmigratione Babylonis*, for *cum Babylona commigrassent* (Liv.); iii. 8, ποιήσατε—καρπόν, *facite fructum*, for *edere, ferre fructum* (Cic., Quint.); iii. 12, συνάξει—εἰς τὴν ἀποθήκην, *congregabit—in horreum*, for *percipere, horreo condere* (Cic., Hor.); iii. 17, ἐν ᾧ εὐδόκησα, *in quo mihi complacui*, for *qui mihi complacuit* (this Greek was rendered literally only by the Vulgate and Wycliffe—"in whiche I have plesid to me"—and no one of our versions but Wycliffe's has here retained the past tense of the original); iv. 4, οὐκ ἐπ' ἄρτῳ μόνῳ—ἀλλ' ἐν παντὶ ῥήματι, *non in pane solo—sed in omni verbo*, for the simple abl., *pane—verbo;* so v. 13, 28; vi. 7; iv. 19, Δεῦτε ὀπίσω μου, *Venite post me*, for *Sequimini me;* iv. 24, ἀπῆλθεν ἡ ἀκοή, *abiit opinio*, for *exiit opinio* (Suet.); vi. 16, ἀφανίζουσιν τὰ πρόσωπα αὐτῶν, *exterminant facies suas*, for *vultus deformare, turpare*, or *fœdare* (Verg., Ov.); vi. 34, μεριμνήσει ἑαυτῆς, *sollicitus erit sibi*, for *pro se* (Cic.), or *de se* (Cic. and St. Jerome himself, *Adv. Jov.*, 113).

(6) *It employs some words, forms, and phrases of very unusual, but still of authorized Latin.* In i. 19 αὐτὴν δειγματίσαι, *eam traducere:* this verb is so used by Livy and Martial; ib. ἀπολῦσαι αὐτήν, *dimittere eam:* this is an early and late phrase, being found in Plautus and Suetonius; ii. 16, ἀπὸ διετοῦς, *a bimatu*: this noun is used by Varro and Pliny; v. 13, ἐὰν δὲ τὸ ἅλας μωρανθῇ, *si sal evanuerit:* Cic., in *Div.*, ii. 17, says, *salsamentum* (the brine) *vetustate evanuit;* v. 43, μισήσεις τὸν ἐχθρόν σου, *odio habebis inimicum tuum:* an early phrase used by Plautus; v. 45, ὅπως γένησθε, *ut sitis*, for *ut fiatis: esse* is found so used in Cic., *De Off.* i. 11, and elsewhere; vi. 12, ἄφες ἡμῖν τὰ ὀφειλήματα ἡμῶν, *dimittite nobis debita nostra:* compare *alicui tributa dimittere*, "to remit," Tac., *Hist.*, iii. 55.

(7) *It employs some words and phrases quite unexampled in Early or Classical Latin, and found only in Ecclesiastical and Later Latin.* In iii. 12, διακαθαριεῖ, *permundabit:* only Later Latin for *purgabit;* iv. 2, νηστεύσας, *cum jejunasset;* only ecclesiastical for *cum jejunus fuisset;* iv. 10, Ὕπαγε, *Vade:* only poetic and used in the sense of "Go!" for *Apage, Abi hinc;* v. 5, παρακληθήσονται, *consolabuntur:* here used as passive, a later usage (Justinian); v. 16, δοξάσωσιν, *glorificent:* only eccl. for *laude afficere, laudibus efferre;* vi. 9, ἁγιασθήτω, *sanctificetur;* only eccl. and later for *sanctum sit;* vi. 11, ἐπιούσιον, *supersubstantialem:* a word coined by St. Jerome for this place.

(8) *In the use of Particles it commonly follows classical usage, even in nice points.* In iii. 11, μέν—δέ, *quidem—autem:* employed by Cicero occasionally, and as if in imitation of the Greek formula; v. 13, ἐὰν δέ, *quod si:* used by the purest writers; δέ is regularly given by *autem*, and καί by *et*, but δέ, *resumptive*, in ii. 1 is well given by *ergo*.

(9) *Some of its uses of Particles are uncommon, others unexampled.* In v. 29, συμφέρει—σοὶ ἵνα—καὶ μή, *expedit tibi ut—quam*, as now and then in Tacitus, for *magis quam;* vi. 14, ἐάν—ἐὰν δέ, *si—si autem* for *si—sin* or *sin autem;* v. 12, Χαίρετε—ὅτι, *Gaudete—quoniam*, for *quod, quia*, or *cum;* vi. 29, οὐδὲ Σολομὼν, *nec Salamon*, for *ne Salamon quidem;* nor is the familiar classical *ne—quidem* known to the Vulgate New Testament any more than our familiar *not even* is known to the Authorized Version of the New Testament, except once in a question (1 Cor. xi. 14); *nec—quidem*, however, is found in 1 Cor. iii. 2, and *ne—quidem* in the Vulgate Old Testament. One of the most remarkable peculiarities of the diction of the Vulgate remains to be noticed under this head. It is well known that verbs of hearing, saying, thinking, etc., are construed in Greek sometimes with ὅτι, "that," and a finite verb, and sometimes with the acc. and the inf.; while in Latin the latter is the regular construction. But besides its objective meaning, "that," ὅτι has, according to its context, a causal force, "because." Now, the Vulgate, to preserve the exact form of the Greek, commonly construes these verbs with a particle, but, as if taking the wrong meaning of ὅτι, renders, for example, in ii. 22, ἀκούσας ὅτι by *audiens quia;* so v. 21, 27, 33, 38, 43; in ii. 16, ἰδὼν ὅτι by *videns quoniam;* in vi. 32, οἶδεν—ὅτι by *scit quia;* in iii. 9, λέγω ὅτι by *dico quoniam*, and so v. 20, 28; vi. 29; and by *dico quia* in v. 22, 32; in ii. 23, τὸ ῥηθέν—ὅτι by *quod dictum est—quoniam;* in iv. 6, γέγραπται ὅτι by *scriptum est quia*, and so v. 20, 22; in v. 23, μνησθῇς ὅτι by *recordatus fueris quia;* in v. 17, μὴ νομίσητε ὅτι by *nolite putare quoniam;* in vi. 7, δοκοῦσιν ὅτι by *putant quia;* in vi. 26, ἐμβλέψατε ὅτι by *respicite quoniam*. And in all this portion we find *quod* used only once in this relation, though at certain periods of the language and in certain cases this particle alone stood in such relation; that one instance is in iv. 12, where Ἀκούσας δὲ ὅτι is rendered *Cum audisset quod*.

(10) *In the use of the moods it generally conforms to classical usage.* Omitting illustrations of this conformity, we give the exceptions, which are as follows: in ii. 2, ἤλθομεν προσκυνῆσαι αὐτῷ, *venimus adorare eum:* only a poetic construction for *ut adoremus*, and so v. 17; viii. 29; ix. 13; x. 34, 35; in iii. 11, εἰμὶ ἱκανός—βαστάσαι, *sum dignus portare:* also poetic for *sum dignus qui portem;* in iv. 19, ποιήσω ὑμᾶς ἁλιεῖς ἀνθρώπων, *faciam vos fieri piscatores hominum:* rare, but found in Varro and Sallust for *faciam ut*, etc.; in a few instances, only three, the subjunctive is strangely used after certain particles: ii. 16, *videns quoniam inlusus esset;* ii. 22, *audiens quia regnaret;* and iv. 12, *Cum audisset quod Johannes traditus esset*. In vi. 28 we find the indicative in an indirect question: *Considerate lilia agri quomodo crescunt*, for *crescant;* but this usage is often found in Plautus and Terence, in a few instances in Cicero, and here and there in the later poets.

Such are some of the characteristics of the Vulgate appearing from an examination of a portion of one of the Gospels. Its excellences are great and marvellous, and even its defects, generally arising from a scrupulous desire to keep close to the side of the sacred original, often suggest or confirm points of the gravest importance. Prof. Lachmann, Prof. Tischendorf, and Dr. Tregelles, the three greatest names connected with the textual criticism of the Greek Testament in recent times, adopting the view of the learned Bentley, regarded the Latin in the purest and most ancient forms as the most important witness to the integrity of the New Testament next to the Greek MSS., nor did they fail to observe that the Latin, in some phases, goes back to a period which no Greek MS. now extant represents.

The Vulgate is, to a degree not generally understood, the venerable parent of our own translation, the Authorized Version. The history of our English Bible begins with Wycliffe, and the Wycliffite version, as it is now more strictly called, was made directly from the Vulgate. But while this great work was completed by Wycliffe and his coadjutors, a certain preparatory work had, in God's providence, already been done. Cædmon embodied the entire

history of the Bible in the alliterative Anglo-Saxon poetry; Aldhelm, bishop of Sherborne in the seventh century, translated the Psalter; Venerable Bede translated the Gospel of St. John; Alfred the Great translated the four chapters of Exodus xx.–xxiv. as the basis of his laws, rendered some of the Psalms and other portions of the Bible for the use of his own children, and an old tradition—though we cannot substantiate it now—makes him the translator of the entire Bible; there is an Anglo-Saxon version of the Gospels, interlinear with the Vulgate, the *Durham Book*, which belongs to the ninth or tenth century; there is another, called the *Rushworth Gloss*, of the same period in the Bodleian Library; there is another of a somewhat later date in the Bodleian and in Christ Church College, Cambridge; we have the famous *Ormulum*, a metrical paraphrase of the Gospels, assigned to the latter half of the twelfth century; there is a prose translation into Norman French of about 1260, which shows that there must have been a demand for the Holy Scriptures among the rich and refined, and perhaps in the court itself; three versions of the Psalms, that portion of the Bible which has always been most dear to the hearts of the English people, were made in these early days—one toward the close of the thirteenth century, another by Schorham about 1320, and the third by Rolle of Hampole about 1349. All these partial and preliminary versions also, it is to be remembered, were made directly from copies of the Vulgate.

The influence of the Wycliffite version, representing the whole Vulgate, has been great and constant on all the subsequent English versions and revisions, furnishing apt and established words and phrases, which the new translators and revisers were neither willing nor able to lay aside. When the Roman Catholic exiles in the reign of Elizabeth produced at Rheims an English version for their own brethren, it was professed, of course, to be made out of *the authentical Latin*, but the translators in innumerable cases, and most wisely, followed the previous English versions; and though the Rheims has defects which time has brought to light, yet it has such and so many good points, chiefly by exactly representing the original Greek in adhering closely to the faithful Latin forms, that any new and excellent revision of our English Bible must often follow in its steps, as the Rheims did in those of the Reformers.

We have spoken in general of our indebtedness to the Vulgate. To be more particular, when the Vulgate was turned into its earliest English form, the Anglo-Saxon version, it was hardly possible that this act should not have greatly modified our language by introducing new words, mostly religious, and by giving us new forms of construction; and again, this work would be carried further by the Wycliffite version, and was perhaps nearly consummated in the Rheims, the last great version that preceded our own. Our Christian nomenclature itself has thus in great measure been furnished to us by the Vulgate, and many of these precious words were either invented in Latin or there first used in their higher and spiritual sense; such as *regeneration, conversion, justification, sanctification, predestination, election, propitiation, reconciliation, Savior, salvation, Redeemer, redemption, Mediator, Spirit, cross, faith, grace, revelation, inspiration, Scripture, Testament, communion, orders, congregation;* some words are Greek, but given to us through the Latin, as *baptism, Paraclete,* and *presbyter* or *priest;* while some were coined in Latin to copy the Greek, as *transgress* from *transgredior*, in imitation of *παραβαίνω*.

If we say, as we may with truth, that Christianity in the first instance was received in the Greek language and through Greek thought, we may surely say that it was adopted in Europe chiefly in Latin forms; and the influence of the Vulgate upon the religious language, thought, and culture of Europe, and so also upon our own, can hardly be overestimated. (*The Vulgate,* Canon Westcott, in Smith's *Dictionary; Horne's Introduction to the Scriptures,* vol. iv., Dr. Tregelles; *N. T. Lat.*, Fleck (1840); *N. T. ex Cod. Amiatino,* Prof. Tischendorf (1854); *Two Letters on 1 John v. 7* (Discussion of N. African Latin), Card. Wiseman, *Essays* (vol. i., 1853); *Geschichte der Vulgata,* Kaulen (1868); *Itala und Vulgata,* Rönsch (1875); *Itala-fragmente,* Ziegler (1876).) CHARLES SHORT.

**Vulkoj,** town of Transylvania, circle of Carlsburg, forms the centre of several rich gold, silver, copper, and quicksilver mines, and is the seat of a considerable mining industry. Its mines form one of the very few places in which *tellurium* has been found in its elementary state. P. about 3000.

**Vul'pius** (CHRISTIAN AUGUST), b. at Weimar Jan. 23, 1762; studied at Jena and Erlangen; received an appointment at the library in Weimar in 1797, and d. there June 26, 1827. He wrote a great multitude of operas, romantic dramas, romances, tales, etc., and edited *Curiositäten der physisch-litterarisch-artistisch-historische Vor- und Mitwelt* (10 vols., 1810–23), and *Die Vorzeit* (4 vols., 1817–21), which contain some interesting materials. One of his original works became very famous—*Rinaldo Rinaldini, der Räuberhauptmann* (1797). It was republished over and over again, translated into many foreign languages, and imitated by all the scribblers of Europe. It is still of interest to the student, showing whither the imagination of that age liked to wander when it was unoccupied by real business and uncultivated by true art.—His sister, JOHANNA CHRISTIANA SOPHIE VULPIUS, born at Weimar June 1, 1765, met Goethe for the first time in the summer of 1788, when she addressed him in the park of Weimar in order to present a petition to him; removed shortly after into his house as a kind of stewardess; bore him a son, August von Goethe, Dec. 25, 1789, and was married to him Oct. 19, 1806, a few days after the battle of Jena. Goethe chose this time in order to attract as little attention to the affair as possible. She continued to address him as *Herr Geheimerath*, and he would sometimes say with a smile: "*Die Kleine kann gar keine Verse verstehen.*" Nevertheless, when she d. (June 6, 1816) Goethe mourned her sincerely, and she was spoken of with kindness and with respect by all his friends.

**Vul'ture** [from Lat. *Vultur*], a name applied to certain representatives of the group or sub-order (generally called order) Raptores or Ætomorphæ.

I. By almost all ornithologists until recently, and even by the latest monographer of the Raptores (Sharpe, in *Catalogue of the Accipitres or Diurnal Birds of Prey,* in 1874), the name, under its Latin form, Vulturidæ, was employed as a family name for all the diurnal raptorial birds distinguished by the "head naked or clothed with down; no *true feathers on crown* of head." The group thus defined embraced the typical vultures and allied forms of the Old World and the condor, turkey-buzzards, etc., of the New. But the researches of several modern authors—but first and especially of Prof. Huxley—have amply demonstrated that under this term two very distinct types of structure have been confounded, and that the superficial agreement between those types is a simple analogical one, and the absence of cephalic feathers has doubtless reference to their habits of feeding. It has been also shown, on the one hand, that the vultures of the Old World are closely related to the true Falconidæ, especially the buteonine forms, and that their separation from the latter as a distinct family can scarcely be justified; and, on the other hand, that the analogues of the New World are very distinct in several points of structure, and should therefore be isolated as an independent family. The two forms will, then, be considered under separate heads: (1) Falconidæ vulturinæ and (2) Cathartidæ.

(1) *Falconidæ vulturinæ, or Old-World Vultures.*—It is very doubtful whether even sub-family rank should be attributed to the group of Old-World vultures, and it is only in deference to general usage that the heading is preserved. The forms in question are simply Falconidæ without true feathers on the crown of the head, and, so far as known, have no other co-ordinated characters. Like the typical Falconidæ, the nostrils are not perforate. According to Sharpe, the group is divisible into six genera—viz. (1) *Vultur*, with 1 species; (2) *Gyps*, with 6; (3) *Pseudogyps*, with 2; (4) *Otogyps*, with 2; (5) *Lophogyps*, with 1; and (6) *Neophron*, with 4; to which some (*e. g.* G. R. Gray) add others—*Gypohierax* and *Gypoëtus*. These essentially agree in habits, living for the most part on dead animal matter, and even appearing to prefer that which is putrescent, although not confining themselves to such. When an animal has died the carcass is soon discovered by these birds, and they fly from all points of the compass, and in company share the banquet. They alight for this purpose, and stalk to the animal, pulling at the flesh and swallowing the torn piece, unless, indeed, it is pulled away by a neighbor, contests for possession of the dainty bits constantly going on. After eating to satiety, they rest in a lethargic manner near the remains of the carcass, and are scarcely able to fly, and when disturbed generally vomit their ingesta before they are able to take to wing. They are birds of bold flight, and soar high in the air, scanning the ground in search of food. This they seem to find as much by the sense of sight, if not more than by that of smell. The species, as might naturally be supposed, are mostly inhabitants of warm countries, especially Asia and Africa; several, however, inhabit Southern Europe, they being *Vultur monachus* (the typical vulture), *Gyps fulvus*, and *Otogyps auricularis*.

(2) *Cathartidæ, or New-World Vultures.*—These differ in many respects from their Old-World analogues, and contrast with them especially in the perforate internasal membrane, through which anything can be seen on the opposite side. These essentially agree in habits with the typical vultures. Their characteristics will be found under the head CATHARTIDÆ in APPENDIX. THEODORE GILL.

# W.

**W,** a letter composed of two V's or two U's, the U and V having been once interchangeable. W is either a vowel with the sound of *oo*, or more frequently it is a consonant, having almost the same vowel-sound, but partly suppressed by the closure of the lips, and on this account it is freely interchangeable with *b* and *v*. The English *w*-sound was represented by Latin *V*-consonant and a form of it in Anglo-Saxon, where it is often improperly written with *w*. W is the proper representative of a sound allied to English and French *v*, but made with the lips alone, and its earliest occurrence is said to be in the year 536 on coins, in the name *Witiges*. The corresponding voiceless sound is the Greek *phi*. W in chemistry designates tungsten (or wolfram). It is an abbreviation for west, and in martyrologies stands for *widow*.

**Waa'gen** (Gustav Friedrich), b. at Hamburg Feb. 11, 1794; was educated in Silesia, whither his father, a painter of some reputation, removed in 1807; made the campaigns of 1813–14 as a volunteer; studied art subsequently under the influence of Ludwig Tieck, a relative of his, at Breslau, Dresden, Heidelberg, and Munich; was appointed director of the picture-gallery of the Museum of Berlin in 1830; visited England and France; became professor of the history of art at the University of Berlin in 1844; visited Spain, St. Petersburg, etc. D. at Copenhagen July 15, 1868. His principal works are—*Kunstwerke und Künstler in England und Paris* (3 vols., 1837–39), of which a much enlarged edition of the English part, *Treasures of Art in Great Britain*, appeared in 3 vols. in 1854, and was followed by a supplement in 1857; *Kunstwerke und Künstler in Deutschland* (2 vols., 1843–45), *Die Gemäldesammlung in der kaiserlichen Eremitage in St. Petersburg* (1864), *Die vornehmsten Kunstdenkmäler in Wien* (2 vols., 1866–67).

**Waal, The,** river of the Netherlands, is one of the principal arms of the Rhine, joins the Maas, and receives the name of *Merwede*.

**Wa'bash,** county of S. E. Illinois, bordering on Indiana, watered by Wabash River and Bonpas Creek, and traversed by Cairo and Vincennes and Louisville New Albany and St. Louis R. Rs.; surface generally level, varied by forest and prairie; soil fertile. There are saw-mills, flour-mills, and manufactories of carriages, furniture, and sash, doors, and blinds. Sheep and swine are numerous. Staples, Indian corn, wheat, oats, hay, and dairy products. Cap. Mount Carmel. Area, 110 sq. m. P. 8841.

**Wabash,** county of N. E. Indiana, drained by Wabash, Salamonie, and Eel rivers, and traversed by Wabash and Erie Canal and Toledo Wabash and Western R. R.; surface varied and partly covered with forests, soil fertile. There are saw-mills, planing-mills, woollen-mills, tanneries, currying establishments, and manufactories of iron castings and linseed oil. Horses, cattle, sheep, and swine are numerous. Staples, wheat, Indian corn, flaxseed, tobacco, wool, hay, lumber, and dairy products. Cap. Wabash. Area, 420 sq. m. P. 21,305.

**Wabash,** tp., Clarke co., Ill. P. 2945.

**Wabash,** tp., Wabash co., Ill. P. 1120.

**Wabash,** tp., Adams co., Ind. P. 957.

**Wabash,** tp., Fountain co., Ind. P. 1284.

**Wabash,** tp., Gibson co., Ind. P. 442.

**Wabash,** tp., Jay co., Ind. P. 933.

**Wabash,** tp., Parke co., Ind. P. 781.

**Wabash,** tp., Tippecanoe co., Ind. P. 2129.

**Wabash,** p.-v., cap. of Wabash co., Ind., on Wabash River, at the junction of Toledo Wabash and Western and Cincinnati Wabash and Michigan R. Rs., 136 miles S. W. of Toledo, has 5 churches, an excellent high school, 2 weekly newspapers, repair and machine shops of Cincinnati Wabash and Michigan Railway, woollen, flouring, and oil mills, 2 furniture, 1 carriage, and 1 spoke factory, 2 banks, 2 hotels, 3 planing-mills, and 1 machine-shop. P. 4200.

John L. Knight, Ed. "Plain Dealer."

**Wabash,** tp., Darke co., O. P. 824.

**Wa'basha,** p.-v. and tp., cap. of Wabashaw co., Minn., on Milwaukee and St. Paul, Minnesota Midland, and a branch of Green Bay and Minnesota R. Rs., and upon the W. bank of Mississippi River, has 5 churches, fine high school, a foundry and machine-shops, 1 newspaper, 1 furniture-factory, a court-house, and several hotels. P. 1739.

W. S. Walton, Ed. "Herald."

**Wa'bashaw,** county of S. E. Minnesota, bounded E. by Mississippi River, which separates it from Wisconsin, intersected by Zumbro River, and having Lake Pepin on the E. border; surface undulatory, partly prairie; soil fertile. There are manufactories of carriages, agricultural implements, furniture, and lime. Horses, cattle, and sheep are numerous. Staples, wheat, oats, Indian corn, potatoes, hay, and dairy products. Cap. Wabasha. Area, about 570 sq. m. P. 15,859.

**Wabash City,** Wabash co., Ind. P. 2881.

**Wa'bash College,** an institution of learning at Crawfordsville, Ind., founded 1833 under Presbyterian management, has four college edifices, a cabinet of 30,000 specimens, and libraries of 30,000 volumes, and an average of nearly 100 students in the regular college course. The president from 1841 to 1861 was Rev. Charles White, D. D., who was succeeded by the present incumbent, Rev. Joseph F. Tuttle, D. D.

**Wabash River** rises in Mercer co., O., flows at first N. to Wabash City, where it receives Big Beaver River; turning N. W., it sweeps in a devious course across Indiana, and during the last 120 miles of its course forms the boundary between that State and Illinois. It is the largest northern tributary of the Ohio. It has been navigated at high water by steamboats as far as Lafayette, Ind.; and from Terre Haute to Huntington, Ind., it is followed by Wabash and Erie Canal. Length, 550 miles.

**Wabaun'see,** county of N. E. Kansas, drained by Kansas and other rivers; surface undulating, soil fertile. Cattle form the principal live-stock. Staples, Indian corn, wheat, and hay. Cap. Alma. Area, 804 sq. m. P. 3362.

**Wabaunsee,** p.-v. and tp., Wabaunsee co., Kan. P. 517.

**Wac'camaw,** tp., Brunswick co., N. C. P. 452.

**Waccamaw,** tp., Georgetown co., S. C. P. 4310.

**Waccamaw River** rises in Waccamaw Lake and in the marshes of Bladen, Columbus, and Brunswick cos., N. C., flows into South Carolina in a direction nearly parallel to the coast, and at Mount Gilead, S. C., unites with the Great Pedee, which indeed is usually called Waccamaw below the junction. It finally flows into Winyaw Bay. The Waccamaw proper is navigable to Conwayboro', S. C.

**Wace** (Richard or Robert), usually known as Master Wace, the name being a corruption of the Latin *Eustacius*, and otherwise written *Waice*, *Gace*, and *Gasse*, b. in the island of Jersey about 1115; was taken to Caen, Normandy, in childhood, and there educated; afterward resided in France, but returned to Caen; became a priest and reading-clerk in the royal chapel; was made canon of Bayeux by Henry II. of England about 1160. D. in England about 1180. He wrote while at Caen, and dedicated to Henry II. (about 1155), *Brut d'Angleterre*, a rhyming paraphrase, in Romance verse of above 15,000 lines, of Geoffrey of Monmouth's *British History*, and *Le Roman de Rou, et des Ducs de Normandie* (about 1170), a poem of nearly 17,000 lines, partly in alexandrine, partly in octosyllabic verse, forming a chronicle of the Norman dukes to his own time, including the conquest of England, and extremely valuable as the best monument of the Norman French language of that period. The latter work was printed for the first time in a complete form by Frédéric Pluquet (Rouen, 2 vols., 1827), and the former by Le Roux de Lincy (Rouen, 2 vols., 1836–38). The portion of the *Roman de Rou* relating to the conquest of England was translated into English prose by Edgar Taylor, with notes and illustrations, *Master Wace, his Chronicle of the Norman Conquest* (1837), and by Sir Alexander Malet, Bart., *The Conquest of England, from Wace's Poem, now first translated into English Rhyme* (London, 1860), including also the text, illustrated by photographs from the Bayeux tapestry. Four shorter poems are doubtfully attributed to Wace—a shorter chronicle of the dukes of Normandy (Caen, 1824), *L'Établissement de la Conception Notre Dame, dite la Fête aux Normands* (Caen, 1842), *La Vie de St. Nicholas* (Paris, 1820–34), and a romance about the Virgin, still in MS. Porter C. Bliss.

**Wachu'sett Mountain,** in the N. part of Princeton, Worcester co., Mass., reaches an elevation of 2016 feet. It is a detached peak, from whose top there is a wide and picturesque view.

**Wa'co,** city, cap. of McLennan co., Tex., on the W. bank of Brazos River, and at the W. terminus of the N. W. branch of Texas Central R. R., contains 10 churches, 1 university, a female college, 1 convent, and 4 select schools, 1 extensive cotton and woollen factory, 2 daily, 3 weekly, and 2 monthly newspapers, 2 iron and brass foundries, an ice manufactory, 2 flouring-mills, 1 lumber-mill, and various other industries. A wire suspension bridge (24 by 472 feet) spans the river at this place. P. about 10,000.

J. W. Downs, Prop. "Daily Examiner."

**Waco'nia,** p.-v. and tp., Carver co., Minn. P. 1097.

**Wacoo'chee,** tp., Lee co., Ala. P. 1179.

**Waco'ta,** p.-v. and tp., Goodhue co., Minn. P. 88.

**Wacous'ta,** tp., Humboldt co., Ia. P. 93.

**Wa'day,** country in the interior of Africa, and, next to Bornoo and Darfoor, the most powerful empire of Soodan, is bounded W. by Bagirmi, N. by Sahara, and E. by Darfoor. Its surface is a somewhat elevated plain, with a general inclination from E. to W., broken now and then by isolated groups of mountains, and traversed in its whole extent by two broad valleys. Copious streams flow through these valleys, and form in the eastern part of the country the large inland sea of Fittre, which is remarkably rich in fish. The soil is on the outskirts sandy and barren, but of a more productive quality in the central part; and as the land is reached by the tropical rains, its vegetation is luxuriant, especially in the southern regions. Rice, maize, durra, and all kinds of tropical fruits are raised; different kinds of palm, ebony, and sandal trees abound. The principal occupation, however, is not agriculture, but rearing of cattle and horses, of which latter the country possesses a very fine breed. In trading, horses or strips of cotton cloth are used as money. The inhabitants consist of Arabs and different tribes of negroes; no less than thirty different languages are in use. The ruling tribe and the Arabs are Mohammedans; the rest are pagans. The capital is Warra, but neither this nor any other town of the country has over 1000 houses. Manufacturing industry is almost unknown, or confined to articles of the coarsest kind, but the commerce of the country is quite considerable. Gums, ivory, ostrich-feathers, tamarinds, and skins are exchanged for armor, arms, cotton fabrics, and tobacco, and of late the sultan of Waday has succeeded in establishing a direct communication with Egypt, thus escaping the extortions of the Darfoorians.

**Wad'dams,** tp., Stephenson co., Ill. P. 1359.

**Waddell'** (James), D. D., b. at Newry, Ireland, in July, 1739; was brought to America in infancy by his parents, who settled on Whiteclay Creek, Pa.; studied under Dr. Finley at Nottingham; was an assistant to Pres. Smith at Hampden-Sidney College; studied theology under Samuel Davies; was licensed as a Presbyterian preacher 1761; ordained pastor of a church in Lancaster co. 1762; removed to Augusta co., Va., 1776, and to Hopewell 1785; lost his sight while there, but continued to preach, and became renowned for his oratory, which was graphically described by William Wirt in the *British Spy*. D. in Louisa co., Va., Sept. 17, 1805. A daughter married Rev. Dr. Archibald Alexander of New Jersey.

**Wad'dell** (James Iredell), b. July 13, 1824, at Pittsboro', Chatham co., N. C. Some of his ancestors settled in this State at its first colonization, and the family has always occupied a prominent position, socially and otherwise. One of his ancestors, Maj.-Gen. Hugh Waddell, was the ranking officer of the colony of North Carolina before the Revolution, at the beginning of which he died, and was the same person who with Gen. John Ashe resisted the landing of the British stamps at Old Brunswick in 1766, several years before the "Boston tea-party." Another paternal ancestor was Gen. Francis Nash, who was killed at the battle of Germantown in 1778. Another in the maternal line was Alfred Moore, one of the justices of the Supreme Court of the U. S. at the beginning of the present century. Capt. Waddell was educated at the Bingham School, Hillsboro', N. C., and entered the U. S. navy Sept. 10, 1841; became a passed midshipman in 1847 and a lieutenant in 1855. For his conduct during the time when the officers and crew of the supply-ship *Release* were all stricken down (except a man and a boy) by the Chagres fever, in relieving the vessel and taking her to Matanzas, Cuba, he was most honorably mentioned in a special report made by his commanding officer to the navy department. For his successful conduct of an expedition into the interior of China, while on that station in 1860, he was honorably mentioned in general orders, and was again commendably reported to the navy department. At the breaking out of the war in 1861, he resigned his commission and returned to his native State. He entered the Confederate navy as lieutenant Mar. 27, 1862; in April was ordered to burn the unfinished ram Mississippi at New Orleans; served as ordnance-officer at Drury's Bluff on James River, Va., where the Federal iron-clad fleet was repulsed; was sent to Europe on special service in 1863, and took charge of the Shenandoah on Oct. 19, 1864, on the N. side of the islands called Deserters near the island of Madeira. The name Shenandoah was given to this steamer on his taking command of her; the Sea-King was her previous name. She had been built at Glasgow in 1863 by a London firm for the China trade. In the fall of 1863 she set out on her first voyage, taking government troops to New Zealand, and returned with a cargo of tea in 1864. In September of this year she was sold by her owners to a merchant of Liverpool, and on Oct. 8 following she again left London on another voyage with British papers, but in the mean time was sold to an agent of the Confederate government, and turned over to the command of Lieut. Waddell at the time and place stated, where under her new name she set out on a cruise against the commerce of the U. S., with which the Confederate States were then at war. She first went to Melbourne, Australia, where she was detained for twenty odd days for repairs, the only port she visited in a cruise of thirteen months. During this cruise she was actively in service only eight months out of the thirteen. During this time she made 38 captures, valued at $1,152,000, though the demands of claimants amounted in the aggregate to $6,200,000. She destroyed 32 vessels, and released 6 on bonds. She visited every ocean except the Antarctic. She was the only vessel that carried the Confederate flag around the world, and bore it afloat, her commander not knowing the fact, six months after the surrender at Appomattox Court-house. The last gun fired from her deck was on June 22, 1865. She ran a distance in all of 58,000 statute miles, and met with no injury, although amidst icebergs a fourth part of her active service. Her anchors were on her bows for eight months. She never lost a chase. Com. Waddell having been informed at sea in Aug., 1865, by the master of the British bark Baracouta, of events in this country, desisted from all further belligerent acts, and proceeded to Liverpool with the Shenandoah, where by formal letter to the ministry on Nov. 5, 1865, she was turned over to the British government. After three days' detention, the British authorities took charge of the vessel, and Lieut. Waddell, after spending some time in Europe, returned to his native land. For the last few years (Mar., 1875) he has been engaged in the U. S. Pacific Mail Co.'s service as captain. A. H. Stephens.

**Waddell** (James Pleasants), A. M., oldest son of Rev. Moses, b. in Willington, S. C., Jan. 5, 1801; educated at Nassau Hall and University of Georgia; graduated at the latter institution 1822, and in which he was tutor of Latin for two years; resigned to take charge, as principal, of the Richmond Academy; in 1836 elected professor of belles lettres and oratory in the University of Georgia; in 1840 transferred to the chair of Greek; in 1846 chosen professor of Latin and Greek in that university, which office he filled for ten years. D. at Athens, Ga., May 28, 1867. Alexander H. Stephens.

**Waddell** (John Newton), D. D., LL.D., youngest son of Rev. Moses, b. Apr. 2, 1812, at Willington, S. C.; graduated at the University of Georgia 1829; entered the Presbyterian ministry in 1841; was chosen professor of Latin and Greek in the University of Mississippi in 1848; resigned in 1857 to occupy the like chair in La Grange College, Tenn.; was elected president of that college in 1860, which position he held till the place was occupied by the Federal army in 1862; then accepted the appointment of general superintendent of Presbyterian missions in the Western Confederate army; was chiefly instrumental in founding the charity for the benefit of orphans at Tuskegee, Ala.; in 1865 elected chancellor of the University of Mississippi; held that position nearly ten years, when he resigned to accept the appointment of secretary to the board of ministerial education of the Southern Presbyterian Church, the duties of which he still discharges.

Alexander H. Stephens.

**Waddell** (Rev. Moses), D. D., b. July 29, 1770, in that part of Rowan now cut off into Iredell co., N. C.; graduated at Hampden-Sidney College, Va., 1791; was ordained a Presbyterian minister in 1792, and soon became distinguished for his eloquence and theological learning. The degree of D. D. was conferred upon him by the College of South Carolina in 1807. His fame, however, rests more upon the extraordinary qualities exhibited by him in his eminent success as a teacher, instructor, and educator of youth than upon his displays in the pulpit. In his insight into the character of boys, the constitution of their minds,

and their capacities and aptitudes, and in drawing out and developing their faculties by proper training, discipline, and government, he had few if any superiors in the U. S. In this respect he is entitled to rank with Dr. Nott of Union College, Schenectady, N. Y., and Dr. Witherspoon of Princeton, N. J. In 1804 he established his classical boarding-school at Willington, S. C., from which he sent forth such men as Hugh S. Legaré, James L. Pettigru, Augustus B. Longstreet, George McDuffie, and John C. Calhoun, William H. Crawford, and many prominent jurists, legislators, and divines. In 1819 he was called to the presidency of the University of Georgia at Athens, which office he held until 1829, when he was compelled to resign in consequence of failing health. D. July 21, 1840. ALEXANDER H. STEPHENS.

**Wad'ding** (LUKE), b. at Waterford, Ireland, Oct. 16, 1588; studied theology in the Jesuit seminary at Lisbon and elsewhere in Portugal; joined the Franciscan order 1605; became professor of divinity at the University of Salamanca; accompanied as chaplain an embassy to Rome in 1618 for the settlement of the controversy relating to the doctrine of the Immaculate Conception, and wrote the history of the mission in Latin; remained at Rome; founded in 1625 the College of St. Isidore for Irish Franciscans; is said to have encouraged the Irish rebellion of 1641; was one of the papal councillors appointed in the settlement of the Jansenist controversy, in which his own opinions coincided with those of Jansen, but he retracted them upon the publication of the papal bull of condemnation; was procurator of his order at Rome 1630–34, and vice-commissary 1645–48, and refused a cardinal's hat. D. at Rome Nov. 18, 1657. He edited from the MS. the posthumous *Concordantiæ Bibliorum* of Marius de Calasio (4 vols. folio, 1621) and the works of Duns Scotus (12 vols., 1639), and wrote the history and bibliography of his order in the elaborate Latin works *Annales Ordinis Minorum* (Lyons, 8 vols. folio, 1625–40), of which a new edition, edited by J. M. Fonseca, appeared in 22 vols. (Rome, 1731–47), and *Scriptores Ordinis Minorum* (Rome, 1660; new ed. 1806).

**Wad'dington,** p.-v. and tp., St. Lawrence co., N. Y. P. of v. 710; of tp. 2599.

**Waddington** (GEORGE), D. D., b. in England in 1793; educated at the Charter-house and at Trinity College, Cambridge, where he obtained a fellowship; spent several years in Oriental travels; took orders in the Church of England; became vicar of Masham, Yorkshire, dean of Durham 1840, and warden of Durham University 1841. D. at Durham July 20, 1869. Author of *A Visit to Greece* (1825), *The Present Condition and Prospects of the Greek or Oriental Church* (1829), *History of the Church from the Earliest Ages to the Reformation* (1833), *History of the Reformation on the Continent* (3 vols., 1841), and *Lectures on National Education* (1845), and joint author with Barnard Hanbury of a *Journal of a Visit to some Parts of Ethiopia* (1822).

**Waddington** (WILLIAM HENRY), b. in Paris, France, in 1826, of English parentage; graduated at the University of Cambridge 1849; was naturalized in France; spent some time in archæological explorations in Asia Minor and Palestine; became in 1865 a member of the Academy of Inscriptions, and was elected to the Chamber of Deputies; was chosen to the National Assembly 1871 and 1876; was minister of public instruction under Thiers for a few days in May, 1873, and again filled that post under MacMahon in 1876, distinguishing himself by his projects for the reformation of national education by depriving the Roman Catholic Church of its commanding influence in the schools and universities. He married in 1875, as his second wife, Miss King of New York. Author of *Voyage en Asie mineure au Point de Vue numismatique* (1850), *Mélanges de Numismatique et de Philologie* (1861), *Édit de Dioclétien* (1864), and *Fastes des Provinces asiatiques de l'Empire romain dépuis leur Origine jusqu'au Règne de Dioclétien* (1872 *seq.*), and edited the Greek and Roman inscriptions in Le Bas's *Voyage archéologique* (1868).

**Wade,** tp., Jasper co., Ill. P. 1864.

**Wade** (BENJAMIN FRANKLIN), b. at Springfield, Mass., Oct. 27, 1800; worked on a farm during his early manhood, teaching district schools during the winters; settled in Ashtabula co., O., 1821; studied law; was admitted to the bar 1828; was elected prosecuting attorney 1835, to which post he was twice re-elected; State senator 1837; president judge of the third judicial district 1857; was U. S. Senator 1851–69; was a firm opponent of slavery, and voted in 1852 against the Fugitive Slave law; ardently opposed the Nebraska bill, the Lecompton constitution, the appropriation of $30,000,000 for the purchase of Cuba; and subsequent to Mr. Lincoln's election in 1860, on the question of compromise between the North and the South, he strongly opposed any concessions. The Homestead bill, which he had for many years advocated, finally passed the Senate in 1862; as chairman of the joint committee on the conduct of the war, he advocated the vigorous prosecution of the war, and favored the confiscation of property in slaves, and reported the bill for the abolition of slavery in the District of Columbia; became president of the Senate *pro tempore* and acting Vice-President of the U. S. on the assassination of Pres. Lincoln; and was one of the commission sent in 1871 to Santo Domingo to report upon the proposed acquisition of that island.

**Wade** (JOHN), b. in England about 1800; received a classical and legal education; practised at the bar in London; wrote largely in favor of reform 1829–32; became vice-president of the French Institut d'Afrique, and has received since 1862 a pension for valuable services to literature. Author of *A History of the Middle and Working Classes* (1833), *The Cabinet Lawyer* (24th ed. 1868), *British History chronologically arranged* (1839), *Unreformed Abuses in Church and State* (1849), and other works; revised Archdeacon Coxe's *Memoirs of the Duke of Marlborough* (3 vols., with atlas, 1848), and supervised a standard edition of *Junius's Letters* (2 vols., 1850).

**Wade'na,** county of Central Minnesota, drained by Crow Wing River; surface rolling, chiefly prairie-land. Cap. Wadena. Area, 540 sq. m. P. 6.

**Wadena,** p.-v., cap. of Wadena co., Minn.

**Wä'densweil,** town of Switzerland, canton of Zurich, on the southern shore of Lake Zurich, has the largest tanneries in Switzerland and important manufactures of silk and cotton fabrics, wax candles, soap, chemicals, and tobacco. P. 5980.

**Wade Plantation,** tp., Aroostook co., Me. P. 76.

**Wa'ders** (*Grallatores*), a group of birds distinguished by elongated legs and the exsertion of the inferior part of the crus (tibia and fibula) and its nakedness. It is an artificial physiological group, constituted by the groups (sub-orders or super-families) called (1) Limicolæ or Charadriomorphæ, (2) Alectorides or Geranomorphæ, (3) Phœnicopteri or Amphimorphæ, and (4) Herodiones or Pelargomorphæ. (See also GRALLATORES.) THEODORE GILL.

**Wades'boro',** p.-v. and tp., cap. of Anson co., N. C., on Carolina Central and Cheraw and Wadesboro' R. Rs., has 6 churches, 1 college, 1 bank, 3 newspapers, and 2 hotels. P. of v. 480; of tp. 2337.

JOHN T. PATRICK, PROP. "PEE DEE HERALD."

**Wad'leigh** (G. H.), U. S. N., b. Sept. 28, 1842, in New Hampshire; graduated at the Naval Academy in 1863; became lieutenant in 1866, lieutenant-commander in 1868; served in the Lackawanna at the battle of Mobile Bay, and commended for "undaunted bravery."

FOXHALL A. PARKER.

**Wad'malaw Island,** tp., Charleston co., S. C. P. 3826.

**Wads'worth,** p.-v. and tp., Washoe co., Nev. P. 253.

**Wadsworth,** p.-v. and tp., Medina co., O., on Atlantic and Great Western R. R., 37 miles S. of Cleveland, contains 4 churches, a Mennonite college, excellent schools, 1 bank, 3 newspapers, and several manufactories. P. of v. 949; of tp. 2283.

JOHN A. CLARK, PROP. "YOUNG FOLK'S GEM."

**Wadsworth** (BENJAMIN), D. D., son of Capt. Samuel, b. at Milton, Mass., 1669; graduated at Harvard 1690; was colleague with Mr. Foxcroft as pastor of the First church, Boston, from Feb. 8, 1696, until July 7, 1725, when he was inducted president of Harvard College. D. at Cambridge Mar. 16, 1737. He published many sermons and theological treatises.

**Wadsworth** (JAMES), b. at Durham, Conn., July 6, 1730; graduated at Yale College 1748; during the war of the Revolution was a member of the committee of safety and major-general of the State militia; was a judge of common pleas for New Haven county, a delegate to the Continental Congress 1783–86, and a member of the State council 1785–90, and was thirty years town-clerk of Durham, where he d. Sept. 22, 1817.

**Wadsworth** (JAMES), nephew of Gen. James, b. at Durham, Conn., Apr. 20, 1768; graduated at Yale College 1787; removed with his brother William to the Genesee country of Western New York 1790, purchasing a large tract of land in that valley; became by the rise of value of landed estates one of the richest proprietors in the State; took a very active interest in promoting common-school education, printing pamphlets on the subject, employing lecturers, and offering premiums to the towns that should first establish school libraries; advocated as early as 1811 the establishment of normal schools; procured in 1838 the enactment of the school-library law; stipulated in the titles to the lands he sold, for two tracts of land of 125 acres

each in every township, for the maintenance of schools and churches; founded and endowed a library and scientific institution at Geneseo, and disbursed in all nearly $100,000 for the promotion of the cause of popular education. D. at Geneseo June 8, 1844.

**Wadsworth** (James Samuel), b. at Geneseo, N. Y., Oct. 30, 1807; studied at Hamilton College and at Harvard University, but without graduating; studied law at Yale and in the office of Daniel Webster; was admitted to the bar, but never practised law as a profession, devoting his attention to assisting his father in the care of the large family estates, which, as increased by the property of William, who died in 1833, amounted to 15,000 acres of land, to the sole charge of the greater part of which he succeeded on the death of his father. Applying himself with enthusiasm and success to agricultural affairs, he was in 1842 elected president of the State society, in the prosperity of which he always manifested a lively interest. The cause of education and the interests of the community in which he lived were objects which he strove by every means to promote. In politics he took a special interest in the questions which affected his State and the nation. Of Federalist stock, he was a Democrat by conviction, but in the agitation of the slavery question in 1848 he supported the Free-Soil party, and thenceforward his efforts were in the same direction. In 1856 he was nominated a State elector by the Republicans, and in 1860 was chosen a district elector for Lincoln and Hamlin. In the events which succeeded he took an open and decided stand for the Union, and under appointment of the legislature of New York attended the Peace Conference in Feb., 1861, where he firmly opposed all measures tending to jeopardize the honor and independence of the Union. Upon the outbreak of war and interruption of railroad communication with the national capital, Wadsworth provisioned two vessels at New York, which he accompanied to Annapolis, where he superintended the delivery of the supplies. At the battle of Bull Run he served as volunteer aide to Gen. McDowell, displaying conspicuous bravery and rendering efficient aid. Commissioned a brigadier-general of volunteers in Aug., 1861, he commanded a brigade in front of Washington until Mar., 1862, when appointed military governor of Washington. While holding this command he received the Republican nomination for governor of New York, but was defeated by Horatio Seymour. Applying for service in the field, he was assigned to the 1st corps in Dec., 1862, participating in the battle of Fredericksburg. At Chancellorsville his corps was not engaged, but at Gettysburg, Wadsworth's division was the first to engage the enemy on the morning of July 1, 1863, and in the struggle that ensued that day his division lost 2400 out of 4000. During the second and third days' fighting he rendered conspicuous service in maintaining the heights on the right of the line, and also during the subsequent operations in the campaign of that year. Early in 1864 he made an extended tour on special service through the South and South-west. In Gen. Grant's Richmond campaign of 1864, Wadsworth commanded the 4th division of the 5th corps, composed in part of his old command, which crossed the Rapidan May 5. On the evening of the 5th he was engaged for several hours, sustaining severe loss. In the fighting which was renewed early next morning Wadsworth was at once engaged with the 2d corps, and the enemy was defeated; but at noon, after a lull in battle, the enemy, being reinforced, took up the offensive, and though Wadsworth made the most heroic efforts to stay the onset, his men finally gave way, and while endeavoring to rally them he was struck in the head by a bullet, and before he could be removed the enemy had gained possession of the ground where he lay. Although unconscious, his death did not occur until Sunday morning, May 8, 1864. It was said of him by a distinguished general that "in all these combats he literally *led* his men, who, inspired by his heroic bearing, continually renewed the contest which but for him they would have yielded."

George C. Simmons.

**Wadsworth** (Peleg), b. at Duxbury, Mass., May 6, 1748; graduated at Harvard 1769; taught school, and afterward went into commercial business at Plymouth, Mass.; entered the army at Roxbury Apr., 1775, as captain of minutemen; became aide to Gen. Ward and adjutant-general for Massachusetts; was present at the battle of Long Island, Aug., 1776; became brigadier-general of militia 1777; was second in command in the Penobscot expedition 1779; was taken prisoner Feb., 1781; escaped from the fort at Castine in June; settled at Portland, Me., 1784, as a land-surveyor; was elected a State senator 1792; sat in Congress 1793–1807; received in the latter year a large grant of land in Oxford co., Me., as a recognition of his Revolutionary services; settled upon it, and spent the remainder of his life in developing the resources of that region, enjoying the rank of major-general of Maine militia. D. at Hiram, Me., Nov. 18, 1829.

**Wae'reghem,** town of Belgium, province of West Flanders, has 7217 inhabitants, mostly engaged in flax cultivation and lace manufactures.

**Waes'münster,** town of Belgium, province of East Flanders, on the Darme, manufactures oil and pack cloth, and has 5492 inhabitants.

**Wa'fer** [O. Fr. *waufre*], the small circular disk of unleavened bread employed in the celebration of the Eucharist in the Roman Catholic Church. It is usually marked with emblematical figures.—Wafer, a disk of dried paste used for sealing letters. The paste is mixed with some non-poisonous coloring-matter. The wafer is formed in a hot wafer-iron shaped like a pair of pincers. This iron dries the wafer, and partly converts its starch into dextrine.

**Wafer** (Lionel), b. in London about 1645; made several voyages to the Pacific as surgeon; visited Bantam in the Malay Archipelago 1677; went to Jamaica 1679; practised his profession there for some years; became surgeon to two buccaneers, Cook and Lynch, and subsequently to Capt. William Dampier on his expedition across the Isthmus of Darien; quarrelled with Dampier, and was left in a wounded condition among the Indians of the Isthmus; sailed again with Dampier and Cook; was one of the first settlers of Philadelphia, Pa., and returned to England 1690. Author of *A New Voyage and Description of the Isthmus of America* (1699).

**Wa'geningen,** town of the Netherlands, province of Gelderland, on the Rhine, has many good educational institutions, some shipbuilding and manufactures of tiles and bricks, and a considerable trade in cattle. It has four well-attended fairs annually. P. 5326.

**Wa'ger,** an agreement between two or more persons that a specified sum of money or other thing of value shall be paid or transferred by one to the other upon the happening or not of a designated contingency *in which neither has any legal interest.* It implies at least two parties, and that each puts something at risk, which constitutes the stakes, which are to be delivered to the winner. These stakes are often, though not necessarily, deposited with a third person as the stakeholder to await the final decision. If the uncertain event is one in which the parties have a legal interest, the agreement belongs to the class of business contracts sometimes termed "aleatory," of which the insurance policy is the most familiar example. At the common law, wagers in general were valid and binding promises, and were enforced by the courts. Indeed, certain special judicial proceedings for the determination of disputed facts were anciently put into the form of actions upon fictitious bets. If, however, the subject-matter of a wager, or the contingency on which it turned, was illegal, or indecent, or opposed to public policy, or otherwise *contra bonos mores*, it was held to be improper and incapable of enforcement. By statutes of England and of the various States of the U. S. this common-law doctrine has been abrogated, and all wagers have been declared void. There is much diversity in the extent and effect of this legislation. The statute of New York may be taken as an example of the most sweeping and destructive. All wagers, bets, or stakes laid upon any game or upon any chance or unknown contingency are unlawful. All contracts for or on account of money or other property staked, lost, or won are null and void, even though the contracts are negotiable paper in the hands of *bona-fide* holders. Each party can recover his stake from the stakeholder; the loser who has paid can recover the sum back from the winner; and even when the stakeholder has surrendered up the stakes to the winner, he is still liable to the loser for the latter's portion of the deposit. These statutory rules are in direct opposition to the common-law doctrine concerning voluntary payments. The legislation of other States is of a somewhat milder type. It declares all wagers unlawful, and all contracts based upon them incapable of being enforced; but if the loser has voluntarily parted with his money to the winner, it does not empower him to recover it again. Of course, legitimate business agreements which depend upon contingent events, such as contracts of insurance, are excepted from the prohibitions of these statutes. Wagers upon the results of an election have generally been made the subject of special enactment; the penalty of forfeiting their right to vote at such election is visited upon the parties, while in some States their act is made a misdemeanor.

John Norton Pomeroy.

**Wa'ger-Policy,** in law, is an instrument having the form of a policy of insurance, but without any legal interest held by the assured in the subject-matter of the contract or in the risk insured against. It is, therefore, merely a

wager, according to the nature of the instrument, between the insurer and the assured that the contingent event referred to will or will not happen—that the ship will or will not perform her voyage, that the house will or will not burn, or that the person will or will not die, as the case may be. The assured puts at risk or stakes the premium paid, and bets that the uncertain event will take place, while the insurer puts at risk or stakes the sum insured, and bets that such event will not happen. Thus, a policy of marine insurance, where the assured has no interest in the ship, cargo, or freight, is nothing but a bet between him and the insurer upon the safety of the vessel, the premium and the sum insured being the stakes; a similar policy of fire insurance is merely a bet upon the safety of the house, one party risking his premium upon the chance that it does not burn within a year, the other risking the sum insured upon the chance that it does burn within the same period; finally, a policy of life insurance taken upon a life in which the assured has no interest is a bet by him that the person thus designated will die, and by the insurer that he will not die. Such bargains are plainly within the statute against wagers, and even at the common law they are against public policy, since they create a strong interest in the assured that the ship should be lost, the house should be burned, or the life should be ended. In order that a policy of insurance shall be a legal contract, and not a wager, the assured must have some legal interest in the subject-matter, and this interest must be shown upon the face of the instrument. It is not necessary that he should be the absolute owner of the ship, cargo, freight, or building, but he must at least hold some equitable or other inferior estate in them, or some specific claim upon them, as a mortgage, lien, or charge, whereby he would be pecuniarily damnified in case of their loss or injury. Every one has an interest in his own life, so that he may procure it to be insured. Creditors also have a legal interest in the lives of their debtors, and statutes have created an insurable interest in the lives of certain near relatives, as between husband and wife, parent and child. It is now a settled rule in reference to life policies that if they are valid in their inception, they may be assigned to parties who have no interest in the life assured, and they will continue to be valid in the hands of such assignees. This important distinction between life and other policies arises from the fact that they are not contracts of indemnity. Wager-policies are universally void, either by virtue of special statutes enacted against them or because the courts have held them to be within the general statutes concerning wagers. JOHN NORTON POMEROY.

**Wa′ges** [Lat. *vas, vadis*, "security"]. The theory of wages accepted by most political economists a generation ago was that the normal price of labor depends on the cost of the laborer's subsistence. In the words of David Ricardo, "The natural price of labor depends on the price of the food, necessaries, and conveniences required for the support of the laborer. With a rise in the price of food and necessaries the price of labor will rise; with a fall in their price the natural price of labor will fall." The acceptance of this doctrine by the majority of English economists is the more surprising that Adam Smith had clearly shown that the quantity and quality of the food and other commodities obtained by the laboring classes are the consequence, not the cause, of the amount of their wages. The food of the laborer in Scotland, he observed, was much inferior to that of his fellow in England—adding, "This difference, however, in the mode of their subsistence is not the cause, but the effect, of the difference in their wages, though by a strange misapprehension I have frequently heard it represented as the cause. It is not because one man keeps a coach, while his neighbor walks afoot, that the one is rich and the other poor; but because the one is rich he keeps a coach, and because the other is poor he walks afoot." Ricardo's doctrine, nevertheless, was generally accepted, not only by theoretical economists, but also by practical legislators and statesmen, and it led to the English corn laws; for the inference was that wages must rise with the price of food, so that taxes on corn cannot fall on the laborer; and down to the Irish famine Sir Robert Peel supported the duty on foreign corn under this conviction. It is singular that at the same time it was part of Ricardo's theory of wages, and of the general creed of economists, that the price of labor varies in different employments with the nature of the work. But if it adjusts itself to a certain standard of subsistence, and depends on the cost of the articles which laborers commonly consume, it is hard to see how it can also depend on the nature of their employment. Nor was this the only inconsistency in the received theory. It was likewise held that there is in each country a certain aggregate amount of wages, or "wages fund," formed by the accumulations of capitalists, the proportion of which to the number of laborers determines the general or average rate of wages, the rates in particular employments varying according to their difficulty, severity, etc. Here a new element—namely, the accumulation of capital—becomes the dominant factor; and it is evident that the rates of wages resulting from the amount of capital accumulated may have little or no relation to the cost of the laborer's living.

The foregoing doctrines were not only inconsistent with each other, but also with the actual rates of wages in every civilized country during the last 100 years, especially with the extraordinary diversity in the rates in different parts of the same country. A century ago Adam Smith drew attention to "the sudden and unaccountable differences in the wages of neighboring places in England;" and several generations later these differences, instead of disappearing, had greatly increased. Soon after the publication of the *Wealth of Nations*, Arthur Young collected statistics of agricultural wages in 26 English counties, and found that the highest rate then was 8*s*. 6*d*., the lowest 6*s*. In 1850, Mr. Caird traversed the same counties, and found that agricultural wages then varied from 6*s*. to 16*s*. In 1870 it was found that they varied from 7*s*. in Dorsetshire to 18*s*. and 20*s*. in Northumberland. Was the Dorsetshire or the Northumberland rate, then, it might be asked of Ricardo's followers, "the natural price of labor"? Or how could the general rate depend on the proportion between the total accumulation of capital and the total number of laborers in the country when such different rates prevailed in different parts of it? Again, if wages varied in accordance with the nature of the employment, how was it that they varied so widely in the same employment?

The truth is, that the doctrines of Ricardo and his followers are applicable only to a past state of society, or to what may be called the mediæval as distinguished from the modern industrial system. In the Middle Ages the laborer was commonly paid in commodities, or, if in money, the sum was adjusted to the cost of his subsistence, and the wages of common labor varied but little throughout each country. Scotland was much behind England in the seventeenth century, and this state of things still continued in the former in the time of Adam Smith. "In the last century," he says (the *Wealth of Nations* was published in 1776), "the most usual day-wages of common labor through the greater part of Scotland were sixpence in summer and fourpence in winter. Three shillings a week, the same price very nearly, still continues to be paid in the Highlands. Through the greater part of the low country the most usual wages of common labor are now eightpence a day; tenpence, sometimes a shilling, in the counties which border upon England, and in a few other places where there has lately been a considerable rise in the demand for labor, about Glasgow, etc." He adds that wages were considerably higher in England than in Scotland, and that they varied also considerably more from place to place, and remarks: "In England the improvement of agriculture, manufactures, and commerce began much earlier than in Scotland. The demand for labor, and consequently its price, must necessarily have increased with those improvements." In the same chapter Adam Smith states that wages were much higher in North America than in any part of England, although the price of provisions was everywhere in North America much lower. We have in these facts the principal key to the true law of wages in modern times. The natural sources of wealth, the fountains of wages and profits—mines, soils of uncommon fertility, sites especially adapted for manufactures and trade, natural resources and advantages—are unequally distributed, not only among the different countries, but also among the different parts of each country. Their development, too, has been unequal. Hence the rate of production, the returns to capital and labor together, and the demand for labor have varied in different countries, and in different localities in the same country. In the south-western counties of England, for example, agriculture has been the only employment, the landlord and the farmer the only employers, and land is neither plentiful nor very fertile; in the N. of England rich mines and flourishing manufactures have competed with farming for labor. Hence the rates of wages in the northern and southern counties have been very unequal, and the inferiority of the laborer in the latter is more the effect than the cause of inferior wages. In the American States, again, extraordinary natural resources have been developed with extraordinary enterprise and skill, and all the chief causes of high wages—a high rate of production, great demand for labor, and abundance of fertile land within the laborer's reach, diminishing the supply—have concurred. The value of the joint produce of capital and labor together determines the maximum price of the labor, and this maximum varies with the local resources and powers of production of different regions, as well as with the energy and skill of both capitalist and laborer. Given the maximum, the actual partition between employers and

laborers will depend on a variety of conditions which cannot be stated in a single proposition, although they are all consistent with the formula that wages depend on demand and supply. In one place, for instance, the laborers may have the choice of several employments on the spot, may have the means of removing easily to several other places, and may know all the circumstances of the market. In another place they may be tied to one spot by ignorance and poverty, and may compete with each other desperately for a bare living, although their employers could afford a much higher remuneration. Sometimes we find employers combining and laborers competing; sometimes employers compete and laborers combine. In some cases machinery, animals, and natural agents co-operate with labor, compete for it, and in both ways add to its value; in other cases they compete with it and supersede it. In some cases there is antagonism between labor and capital, each striving to diminish the share of the other; while elsewhere they co-operate amicably, and aim at augmenting the returns to both. So various being the conditions which determine the rates of wages in particular cases, it is evident that the aggregate amount of wages, instead of being the general cause which determines the rates in particular cases, is merely the result or arithmetical sum of the particular rates added together. In looking to the particular rates, both employers and workmen too often think too much of their respective shares, and too little of the total amount to be shared. A doctrine which has contributed to this error is laid down in some celebrated treatises of political economy—namely, that profit depends on wages, and therefore the lower the wages the higher the profit. But not only is the efficiency of labor a variable quantity, dependent in part upon the rate of its remuneration, but capitalists themselves have productive powers, as also have the instruments, the animal, and the natural agents they employ; and it is an error alike for laborers to assume that an increase of profit can be had only at their cost or by their exertions, and for capitalists to look only to keeping down wages for profit.

Another reflection which the subject calls for is, that the economic system of modern times must be admitted to have introduced two conditions unfavorable to labor, in the great uncertainty and fluctuations in trade, prices, demand for labor, and wages, on the one hand, and the disappearance of production on a small scale with the openings it afforded to the majority of workingmen to rise to the rank of small capitalists and masters, on the other hand. These drawbacks add greatly to the value of the avenue to independence which the facility of acquiring landed property offers to labor in America. (See LABOR, STRIKES, TRADES-UNIONS.) T. E. CLIFFE LESLIE.

**Waggoner,** tp., Mason co., West Va. P. 3324.

**Wag'horn** (THOMAS), b. at Chatham, England, in 1800; entered the navy as midshipman 1812; served many years in the East Indies, taking part in several campaigns by land and sea, and from about 1827 devoted himself to promoting steam communication between England and India *viâ* the Isthmus of Suez, in the interest of which project he made at his own expense elaborate surveys. He met with ill-success for many years, and exhausted his fortune in the undertaking. D. in London Jan. 7, 1850. His statue now occupies a conspicuous position on the route of the Suez Canal.

**Wag'ner,** p.-v. and tp., Clayton co., Ia. P. 988.

**Wagner** (JOHN), M. D., the first professor of pathological and surgical anatomy in the U. S., b. about the close of the last century; graduated A. B. in Yale College, Conn., 1812, and was made A. M. in the same institution 1815; went abroad that year, and through his preceptor, Dr. Post of New York, became a pupil of the celebrated Sir Astley Cooper for three years; on his return settled in Charleston, S. C., where he soon rose to eminence as a surgeon. He was elected professor of pathological and surgical anatomy in the South Carolina Medical College, said to have been the first of that department ever established in this country; in 1832 became Dr. Ramsey's successor in the chair of surgery. D. in Charleston, S. C., the scene of his great promise of usefulness, after a protracted and painful illness, May 22, 1841. PAUL F. EVE.

**Wagner** (RUDOLF), b. at Baireuth, Bavaria, June 30, 1805; studied medicine at Erlangen and Würzburg, and comparative anatomy in Paris under Cuvier; undertook various scientific journeys in France and Sardinia, and was appointed professor of zoology at the University of Erlangen in 1829, and in 1840 at the University of Göttingen, where he d. May 13, 1864. His principal works are —*Lehrbuch der vergleichenden Anatomie* (2 vols., 1834–35), *Icones physiologicæ* (1839), *Lehrbuch der Physiologie* (1839), *Handwörterbuch der Physiologie* (4 vols., 1842–53), *Neurologische Untersuchungen* (1854), which brought him into conflict with Karl Vogt and the materialistic school of scientists; *Vorstudien zu einer wissenschaftlichen Morphologie und Physiologie des menschlichen Gehirns als Seelenorgans* (2 vols., 1860–62).—His younger brother, MORITZ FRIEDRICH WAGNER, b. at Baireuth Oct. 3, 1813, was educated for business, but left this career in 1834; studied natural science at Erlangen and Munich; accompanied the French army in Algeria 1837–38 as a member of the scientific commission, and wrote *Reisen in der Regentschaft Algier* (3 vols., 1841); studied geology at Göttingen; undertook 1842–45, with the support of the Academy of Berlin, explorations in the regions of the Black Sea, Caucasus, Armenia, Koordistan, and Persia, and wrote—*Der Kaukasus und das Land der Kosacken* (2 vols., 1847), *Reise nach Kolchis* (1850), *Reise nach dem Ararat und dem Hochlande Armeniens* (1850), *Reise nach Persien und dem Lande der Kurden* (2 vols., 1852); travelled 1852–55, with Scherzer, extensively in North and Central America, and wrote, in connection with him, *Reisen in Nordamerika* (3 vols., 1854), *Die Republik Costa-Rica* (1856); undertook 1857–58, with the support of King Maximilian II. of Bavaria, explorations in Panama and Ecuador, the results of which were published in Petermann's *Mittheilungen*, and was appointed professor at the University of Munich in 1860. His *Travels in Persia, Georgia, and Koordistan* were translated into English in 3 vols. (London, 1854).

**Wagner** (RUDOLF JOHANNES), b. at Leipsic Feb. 13, 1823; studied chemistry and technology in his native city and at Paris; was appointed professor of chemistry at the Polytechnic School of Nuremberg in 1851, and in 1856 professor of technology at the University of Würzburg. In 1858 he was made inspector-general of technical studies in Bavaria. His principal works are—*Lehrbuch der Chemie* (1850), *Lehrbuch der chemischen Technologie* (1850), *Geschichte der Chemie* (1854), *Handbuch der Technologie* (4 vols., 1856–63), *Theorie und Praxis der Gewerbe* (5 vols., 1857–61), etc., most of which have gone through several editions and been translated into other languages. He is also the editor of *Jahresberichte über die Leistungen der chemischen Technologie* (started in 1856).

**Wagner** (WILHELM RICHARD), b. in Leipsic May 22, 1813, son of a police actuary, who died six months after his birth. His step-father, who was an actor and painter, wished to make a painter of him, but for that he showed no aptitude. The boy played tunes on the piano at the age of seven; at nine he entered the Dresden Kreutzschule, and studied hard—not music, which he cared little for, but Greek, Latin, ancient history, and mythology. He made verses, longed to be a poet, translated twelve books of the *Odyssey*, took up English, in his enthusiasm for Shakspeare projected a tragedy which was a compound of *Hamlet* and *Lear*. His passion for music was awakened by hearing Beethoven's music in Leipsic; he studied then in order to adapt his great tragedy for the lyric stage, but in a desultory and fitful way, which resulted in no solid attainment. He had no systematic instruction until his sixteenth year, and then his impetuous genius disdained rules; he preferred composing music to studying it. One of his boyish overtures was played in the Leipsic theatre. Less than six months with Theodor Weinlig, spent in the study of counterpoint, was his first equipment for his extraordinary career. He was then nineteen. An overture composed at this time, after the model of Beethoven, was played and well received, he tells us, at one of the Gewandhaus concerts; a symphony, composed after Beethoven and Mozart, was performed at the Conservatory in Vienna, and later at the Gewandhaus in Leipsic. At this period Wagner visited Vienna, Prague, Wurtzburg, making the acquaintance of music and musicians, all the while undergoing the intellectual fermentation which introduced his musical reform. At twenty-one he abandoned his model, Beethoven, and felt that a new era in music was about to dawn. In 1834 he accepted the position of musical director at the theatre of Magdeburg; completed and on ten days' notice presented an opera, *Das Liebesverbot*, and was not disheartened by its failure; went to Berlin with the *Liebesverbot*, but met with no practical encouragement at the royal opera; asked for and received the position of musical director at Königsberg; in Dresden was moved by reading Bulwer's *Rienzi* to write an opera with that title, which, after some delay, was brought out in Dresden in 1842; visited London, and, being driven by a storm into a Norwegian port, caught the legend of the "Flying Dutchman;" went to Paris, but found no welcome; in 1839–40 composed an overture to the first part of Goethe's *Faust* and several songs; suffered from want to the degree that he was compelled to arrange music for all sorts of instruments. In 1842 the success of *Rienzi* at Dresden secured his appointment to the post of Kapellmeister at the Dresden opera-house. Here he finished the *Flying Dutchman*, and composed *Tanhäuser*. In

1849 his revolutionary enthusiasm forced him to take refuge in Zurich. There he became director of the musical society and of the orchestra of the theatre; composed *Lohengrin*, and began the composition of the *Nibelungen;* in 1858 left Zurich, and resided for short periods in Italy, Paris, Vienna, Carlsruhe; attracted the attention of Ludwig, king of Bavaria; established himself in Munich, and entered on his fame. *Tristan und Isolde* appeared in 1865, *Die Meistersinger von Nürnberg* in 1868, and *Reingold*, the prelude to the *Nibelungen*, in 1869. At Munich was laid the plan, so brilliantly carried out at Baireuth in the summer of 1876, where, in a theatre of his own design, with an orchestra composed of the best material Germany could furnish, and singers he had himself selected, was produced, under royal patronage and imperial countenance, with the moral support of a large and distinguished public, the threefold opera of the *Nibelungen Ring*, in which his musical theories first found full expression. Wagner's musical reform is not technical; it embraces the whole field of conception and expression. Disgusted with the Italian and French school of opera, while persuaded more and more that opera was the highest form of musical expression, loathing the silly *libretti* and disdaining the practice of making music subservient to the convenience of pet singers, he contended that the theme of opera should be poetic in the purest, deepest sense; that the poetry should be married to fitting music, vocal and instrumental; and that the whole should be associated with the convictions and sympathies of humanity. Hence he took his themes from romance, legend, and popular myths, arranged his *libretti* himself, and in his musical adaptations consulted the intellectual demands of his theme, neglecting and even scorning the popular arts of song and melody which delight the ears of the opera-loving public. The phrase "music of the future," which is applied to his work, was bestowed in derision, though it was warranted by the title of one of his own essays. *The Flying Dutchman*, *Tanhäuser*, and *Lohengrin* were written, composed, and the two first performed, before the composition of his theoretical pieces, the first characteristic example whereof, the *Tristan und Isolde*, did not long precede the *Nibelungen*. In this opera he fully expressed himself, and by it is willing to be judged. Here, he says, "I moved with entire freedom and disregard of all theoretic scruples." Wagner resents the charge that his music is destitute of melody. "The one true form of music," he says, "is melody. Music that has no melody has no inspiration, no power over the feelings, no originality. But melody is something more than the fixed and narrow form that belongs to the childish stage of musical art—the dance form." "The wanderer in the wood becomes every moment more distinctly aware of endlessly-varied voices that are audible in the forest. They grow louder and louder, and the voices, the separate tunes, he hears are so many that the whole music seems to him one grand forest melody. Yet he cannot hum it over to himself; and to hear it again he must again go to the woods." Wagner is a copious writer; his collected works, critical, expository, controversial, fill nine octavo volumes, and abound in vigorous, ingenious, original ideas. His musical compositions are numerous. Besides the operas and overtures mentioned, there are overtures, songs, marches, poems with pianoforte accompaniment, a polonaise, a sonata, a mourning symphony for the funeral of C. M. von Weber, and smaller pieces that have not been catalogued. A complete list of his works, so far as known, may be found in *Art Life and Theories*, by E. L. Burlingame (New York, 1875). The same volume, which is devoted entirely to Wagner, contains a good sketch of his musical system, taken from his own writings. In Germany, where his works are known, Wagner has numerous and devoted disciples, in spite of bitter opposition. Out of Germany he is comparatively unknown and unappreciated. In America he is to the general public scarcely more than a name. *Lohengrin* has been handsomely presented in New York; *Tanhäuser* has been tolerably well produced. His characteristic pieces are brought out in fragments at concerts. Still, his admirers are neither few nor uninfluential. Some of the ablest critics are on his side. The most popular leader of orchestra is his adherent. Those that are best acquainted with him give him most praise. His home is in Baireuth, where he lives in a house of his own designing. His wife is a daughter of Franz Liszt, who is a believer in the genius and the mission of his son-in-law. Wagner calls himself a *pessimist*, but derives from that belief the privilege of enjoying the more heartily the good things that unexpectedly fall to his lot. Optimism, he says, made him complaining because he received so little; pessimism allows him to be grateful for small favors and patient under heavy trials. His ardor in the cause of human rights made him cheerfully consent to write the grand march for the American Centennial celebration of 1876. O. B. Frothingham.

**Wag'oner,** tp., Oconee co., S. C. P. 1982.

**Wagons.** See Carriages, by L. P. Brockett, A. M.

**Wa'gram,** village of Lower Austria, 12 miles N. E. of Vienna, and on the opposite or northern side of the Danube, famous for the victory which Napoleon gained here over the Austrians July 6, 1809.

**Wag'tail,** the name conferred in England on the species of passerine birds constituting the genera *Motacilla* and *Budytes;* these have the bill slender and conical, with the upper mandible slightly notched at the tip, and the culmen somewhat concave above the front of the nostrils; the wings are long and pointed, and have each nine primaries; the tail is longer than, or equal to, the wings, and the two central feathers are rather longer than the lateral; the feathers are mostly broadest at the middle, and thence taper to the tips; the tarsi are rather long, and scutellate in front only; of the toes, the inner is free almost to the base, and the outer adherent by the basal joint only; the hind claw is more or less curved. The name is given in allusion




The Gray Wagtail.

to their habit of "wagging" their tail in a fan-like manner. They are active birds, at home equally in the air and on land; they fly by short undulating courses, and frequently emit, while on the wing, chirping notes; on the ground they run by a rapid succession of steps. The species are quite numerous; according to Gray, there are 16 species of *Motacilla*, 14 of *Budytes*, 2 of *Calobates*, and 1 of *Limonidromus*. These are all naturally peculiar to the Old World and Australia, but the *Motacilla alba* and *Budytes flava* have been known to wander into North America. Theodore Gill.

**Wah.** See Ailurus Fulgens.

**Waha'bees,** or **Wahabites,** the name of a modern Mohammedan sect prevailing in Central and Eastern Arabia, but hardly known outside of the peninsula. It was founded in the middle of the eighteenth century by Abd-el-Wahab, who converted Saoud, the sultan of Nedjed, and from Deraijeh, the capital of Nedjed, in which Abd-el-Wahab lived and preached, his ideas spread so rapidly that before his death, in 1787, they predominated in the larger part of the peninsula. It was a moral reformation rather than a religious revival which Abd-el-Wahab preached, and with politics he did not interfere. The differences between the doctrines of the Wahabees and those of the orthodox Mohammedans are comparatively very small, though the Wahabees deny the inspiration of the Koran and the justness of worshipping Mohammed's tomb. A strict observance of all the precepts of the Koran, which had fallen into neglect throughout the whole Mohammedan world, and become very much mixed up with pagan practices among the Bedouins; a return to the old Arab frugality and chastity; a total abstinence from wine, opium, and tobacco; a strict administration of justice; and the renewal of the war against all other religions, were the points most characteristic of the new sect. The immediate result of these ideas was a revival of the old Mohammedan fanaticism, and Saoud used this circumstance to subdue his neighbors and extend his empire. His son, Abd-ul-

Aziz, took Mecca in 1803, and his grandson, Saoud II., Medina in 1804. The Wahabite cultus was introduced in the holy cities, and pilgrimages were stopped, partly because the pilgrims belonged to the Persian or Turkish rites, and consequently were considered heretics, partly because of the gross vices and crimes which these pilgrimages occasioned. The prevention of the pilgrimages to the holy cities caused a great commotion in the Mohammedan world, and in 1804 the sultan of Constantinople ordered Mehemet Ali to punish the Wahabees. After seven years' preparation, Mehemet Ali was ready to execute the order, and in 1811, Mecca and Medina were reconquered. In 1818, Ibrahim Pasha took and destroyed Deraijeh, and the power of the Wahabees seemed completely broken. Soon, however, other and more important affairs occupied the attention of the Egyptian rulers. The Egyptian governors were repeatedly expelled from Nedjed, the Wahabite kingdom was reorganized, and after the death of Mehemet Ali in 1849, Egypt retired altogether from the contest, and the Wahabees spread undisturbed. In 1863 they held 316 towns and villages and numbered 1,219,000. (See Corancez, *Histoire des Wahabites dépuis leur Origine jusqu'à l'an 1809* (Paris, 1810); W. G. Palgrave, *Narrative of a Year's Journey through Central and Eastern Arabia* (London, 1865); Burckhardt, *Notes on the Bedouins and the Wahabys* (London, 1830).)

**Wahee,** tp., Marion co., S. C. P. 1429.

**Wahkiak'um,** county of S. E. Washington Territory, bounded S. by Columbia River; surface rugged and mountainous, generally covered with dense forests. Lumber is the principal product. Cap. Cathlamet. Area, 225 sq. m. P. 270.

**Wahkon'sa,** tp., Webster co., Iowa. P. 921.

**Wahoo'.** (1) The *Euonymus atropurpureus,* a fine ornamental shrub of the U. S. belonging to the order Sapindaceæ, and often called burning bush and spindle tree. Its bark has considerable use in medicine as a diuretic, tonic, and alterative, with cathartic powers. (2) The winged elm, *Ulmus alata,* a small tree of the Southern U. S. Its wood is much valued for timber. Its branches have singular corky wings.

**Wahoo,** p.-v., cap. of Saunders co., Neb.

**Wahsatch Mountains.** See Utah.

**Wain'wright** (Jonathan Mayhew), D. D., D. C. L., b. at Liverpool, England, Feb. 24, 1792, of American parents, his mother being a daughter of Rev. Dr. Jonathan Mayhew of Boston; came with his parents to the U. S. 1803; graduated at Harvard 1812; was tutor there in rhetoric and oratory 1815–17; took orders in the Protestant Episcopal Church 1816; became rector of Christ church, Hartford, Conn., 1816; assistant minister of Trinity church, New York, 1819; rector of Grace church, New York, 1821, of Trinity church, Boston, Mass., 1834, and again assistant minister of Trinity church, New York, 1838, having especial charge of St. John's chapel; visited Europe and the East 1848–49, and Europe again in 1852, when the University of Oxford conferred upon him the doctorate of law; was many years secretary to the House of Bishops; was chosen provisional bishop of New York in October, and consecrated Nov. 10, 1852; was a ripe scholar, a fine musician, and an admired pulpit-orator. D. in New York City Sept. 21, 1854. He published a volume of chants (1819), *Music of the Church* (1828), *The Pathways and Abiding-places of our Lord* (illustrated, 1851), *The Land of Bondage, a Journal of a Tour in Egypt* (1852), several liturgical compilations, and, with Dr. W. A. Muhlenberg, *The Choir and Family Psalter* (1851), and edited the *Life of Bishop Heber, by his Widow* (2 vols., 1830), and the magnificently illustrated volume, *Our Saviour with Prophets and Apostles* (1850). A controversy between him and Rev. Dr. Potts on the possibility of "a Church without a bishop" was issued in a volume 1844. A *Memorial Volume* appeared in 1856, with a memoir by Bishop Doane, and another *Life,* by Rev. John N. Norton, in 1858.

**Waite** (Carlos A.), b. in New York City in 1800; entered the U. S. army as lieutenant of infantry 1820; became major of 8th Infantry Feb. 16, 1847; commanded that regiment in the Valley of Mexico; was brevetted for the battles of Churubusco and Molino del Rey; became full colonel of 1st Infantry June 3, 1860; served in that rank through the war of the rebellion until Feb., 1864, when he was retired, and was brevetted brigadier-general Mar. 13, 1865. D. at Plattsburg, N. Y., May 7, 1866.

**Waite** (Henry Matson), LL.D., b. at Lyme, Conn., Feb. 9, 1787; graduated at Yale College 1809; was admitted to the bar Dec., 1812; practised law at Lyme; was elected to the lower house of the legislature 1815; was a member of the State senate 1832–33, judge of the superior court and of the supreme court of errors 1834–54, and chief-justice 1854–57. D. at Lyme Dec. 14, 1869.

**Waite** (Henry Randall), Ph. D., b. at Copenhagen, N. Y., Dec. 16, 1846; graduated at Hamilton College 1868; became in that year literary editor of the Utica *Daily Herald;* subsequently studied theology at Union Seminary, N. Y., editing at the same time the *University Quarterly Review* and contributing to the press; resided in Europe in 1871–74; organized American (Union Evangelical) chapels at Rome and Geneva, and was chaplain at Rome; became in 1874 editor of the New Haven *Daily Evening Journal;* became in 1875 associate editor of the *International Review* at New York, and lecturer on political science to the University of Syracuse, and is president of the Political Science Association and of the National Reform League, both of which owe their existence to his efforts. Author of *Carmina Collegensia* (1868) and *Sermons from the Life of St. Paul in Rome* (1873); is preparing works upon *The History and Scenery of the St. Lawrence River* and upon *Higher Education,* the latter in conjunction with Dr. Karl M. Thordin of the University of Upsala, Sweden.

**Waite** (Morrison Remich), LL.D., son of Henry Matson, b. at Lyme, Conn., Nov. 29, 1816; graduated at Yale College 1837, in the same class with William M. Evarts and Edwards Pierrepont; studied law at Lyme with his father, then a judge of the supreme court of errors; settled at Maumee City, O.; was elected to the Ohio legislature 1849; removed to Toledo 1850; took a prominent place at the Ohio bar; declined repeated nominations to Congress and also a seat on the supreme bench of Ohio; distinguished himself as U. S. counsel at the Geneva tribunal of arbitration on the Alabama claims 1871; was president of the Ohio constitutional convention 1873, and became chief-justice of the Supreme Court of the U. S. Mar. 4, 1874.

**Waite Plantation,** tp., Washington co., Me. P. 122.

**Waites'burg,** p.-v., Walla Walla co., Wash. Ter.

**Waits** [Scottish *wate;* Ger. *Wacht,* a "watch"], a former class of watchmen in English and Scotch towns, who at certain fixed hours of the night played upon the pipe and other instruments. In London and many other places the waits were officially recognized until quite recently, if indeed they are not so at present in some places. At London there are still companies of men called waits who during the Advent season frequently serenade the citizens, and on Christmas morning call for a Christmas-box.

**Wait'sen,** town of Hungary, on the right bank of the Danube, is well built, and beautifully situated in a fertile district celebrated for its excellent wine. It has educational institutions and a large trade in cattle. P. 12,894.

**Waits'field,** p.-v. and tp., Washington co., Vt. P. 948.

**Waitz** (Georg), b. at Flensburg, duchy of Sleswick, Oct. 9, 1813; studied law and history at the universities of Kiel and Berlin; visited numerous cities in Germany, France, and Scandinavia, investigating their archives; was appointed professor of history at Kiel in 1842, at Göttingen in 1849, and removed in 1875 to Berlin as editor of the *Monumenta Germaniæ Historica.* His principal works are—*Deutsche Verfassungsgeschichte* (4 vols., 1843–61), *Die Schleswig-holsteinische Geschichte* (2 vols., 1851–54), *Lübeck unter Jürgen Wallenweber* (3 vols., 1855–56), *Grundzüge der Politik* (1862), besides numerous minor essays, monographs, and editions of documents relating to the history of Germany.

**Waitz** (Theodor), b. at Gotha, duchy of Saxe-Weimar, Mar. 17, 1821; studied philosophy and mathematics at Leipsic and Jena; travelled in 1842–43 in France and Italy; published in 1844–46 a critical edition of Aristotle's *Organon* in 2 vols., and was appointed professor of philosophy in 1848 at the University of Marburg, where he d. May 21, 1864. He wrote—*Grundlegung der Psychologie* (1846), *Lehrbuch der Psychologie als Naturwissenschaft* (1849), *Allgemeine Pädagogik* (1852); but his principal work is his *Die Anthropologie der Naturvölker* (5 vols., 1860–67; last volume edited by Gerland), vol. i. giving a general introduction; ii., treating of the negroes of Africa; iii.–iv., the aboriginal inhabitants of America; v., the Malayo-Polynesian nations. He also wrote *Die Indianer Nordamerikas* (1864).

**Waiv'er** [from *waif*]. This term, in its most comprehensive sense as a word of legal nomenclature, denotes the passing by, declining, or refusing by a person to accept of rights which may avail to him, or to take advantage of privileges which may exist in his favor, or to interpose objections which might be raised to the regularity or suffi-

ciency of proceedings instituted or pending against him. As a general principle, a person may thus waive all rights and privileges which affect him individually, so that no other one would be damnified by the act. When, however, the right or privilege is of a public nature, or grows out of circumstances which are required to be strictly regular and legal from considerations of public policy, a private person is not permitted to waive such right, and thus to derange or defeat a policy which affects large classes or perhaps the entire people of a State. A waiver may either be intentional and done in a direct and formal manner, or it may be unintentional and the consequence of negligence or a disregard of established methods. In the first case the intention to surrender a right must be clearly and unequivocally expressed; and in order both to remove all doubt and to furnish the highest evidence of the party's design, the law sometimes requires the act to be in writing. The second case furnishes the greatest variety of practical questions. In all judicial proceedings, criminal or civil, the law prescribes a greater or less number of steps to be taken in a certain manner, by certain forms, and at certain times; and if this established order is not accurately complied with, the adverse party may object to the irregularity; but if he, in turn, does not interpose his objection at the proper time or by the proper mode, he is considered as having waived it, and cannot be heard to urge it afterward, unless, indeed, the original fault was vital to the whole proceedings, and so tainted them with imperfection that a proper notice of it given at an earlier stage would not have enabled the opposite party to make a sufficient correction without actually commencing anew. The particular instances of this waiver through *laches* are almost as numerous as the possible irregularities which may happen and the possible objections which may be taken to them. Another common species of waiver is intentional, and is shown in the choice of legal remedies. On the occurrence of certain delicts or wrongs a double remedial right is given to the injured party for his election. For example, when the wrongdoer has taken and carried away or converted the goods of another, the owner may either treat the act as a tort, and may sue for the damages resulting therefrom, or he may waive the tort and the right of action springing from the tortious act, which often includes the power to have the defendant arrested, and may simply regard the transaction as a sale of the goods and bring an action on the contract for their price. Also, when a buyer has procured a sale to himself on credit by means of false and fraudulent representations, so that the vendor might rescind the contract and either retake the goods or recover damages for their wrongful conversion, he may waive the fraud and all of its remedial consequences, and sue directly for the price. In these and all similar cases the intention to waive is shown by the kind of action which the plaintiff commences. Another example is the waiver of the forfeiture arising from the breach of a condition in a lease or other conveyance. Such forfeitures are deemed harsh and inequitable, and the law requires great strictness and regularity in their enforcement. If, therefore, the lessor or other person claiming by virtue of the forfeiture does any act subsequent to the breach of the condition which recognizes the estate and the rights conferred by it as still continuing to exist, he thereby, as a general rule, waives the forfeiture, although that result may not have been intended by him. JOHN NORTON POMEROY.

**Wakan'da,** tp., Carroll co., Mo. P. 5342.

**Wakarusa,** p.-v., Elkhart co., Ind., about 58 miles N. W. of Fort Wayne; has good schools, 1 weekly newspaper, 1 machine-shop, 1 grist and 2 saw mills, and 5 stove-shops. P. 245. J. H. BRUBAKER, ED. "SUN."

**Wakaru'sa,** tp., Douglas co., Kan. P. 2401.

**Wake,** in old English usage, is the equivalent of VIGIL (which see), and in most instances where the term occurs in old books it is to be understood in this sense. In many English parishes the term and custom still survive in the "country wakes," ancient festivities which are kept up on the eves of certain saints' days. The *lyke-wake*, in which the neighbors of a deceased person hold a watch over the dead body, is a custom of entirely different character. It is found among the lower classes in several countries, notably among the Irish.

**Wake,** county of Central North Carolina, drained by Neuse and Little rivers, and traversed by North Carolina Raleigh and Gaston and Augusta R. Rs.; surface hilly, soil moderately fertile. Granite and plumbago are found. There are flour-mills, saw-mills, and manufactures of carriages, railway cars, iron castings, machinery, and paper. Cattle, sheep, and swine are the principal live-stock. Staples, cotton, Indian corn, sweet potatoes, and tobacco. Cap. Raleigh, which is also the capital of the State. Area, 1010 sq. m. P. 35,617.

**Wake** (WILLIAM), D. D., b. at Blandford, Dorsetshire, England, in 1657; graduated at Christ Church, Oxford, 1676; took orders in the Church of England; became chaplain to the English embassy in France; had a theological controversy with Bossuet, arising from what he claimed to be a misrepresentation of the doctrine of the Church of England, 1686–88; became preacher to Gray's Inn, canon of Christ Church 1689, chaplain to King William, rector of St. James, Westminster, 1693, dean of Exeter 1701, bishop of Lincoln 1705, archbishop of Canterbury 1716, and discussed with Dupin a project for the union of the English and Gallican churches 1718. D. Jan. 24, 1737. Author of several controversial publications against Bishop Atterbury, three volumes of *Sermons*, and a translation of the *Apostolical Fathers* (1693).

**Wake'field,** town of England, county of York, on the Calder, is well built, and has many educational and benevolent institutions. Its manufactures of cloth and yarn have declined, but its trade in corn, cattle, and coal is very considerable. P. 28,069.

**Wakefield,** p.-v., Clay co., Kan.

**Wakefield,** p.-v. and tp., Middlesex co., Mass., on Boston and Maine, Newburyport and Georgetown, and South Reading branch of Eastern R. Rs., 10 miles N. of Boston, contains 4 churches, a public library containing about 4500 volumes, a town-hall, 2 banks, 1 newspaper, and manufactories of rattan, stoves, and boots and shoes. P. 4135.

W. H. TWOMBLY, ED. "CITIZEN AND BANNER."

**Wakefield,** tp., Stearns co., Minn. P. 613.

**Wakefield,** p.-v. and tp., Carroll co., N. H. P. 1185.

**Wakefield,** p.-v., Washington co., R. I.

**Wakefield,** tp., Rappahannock co., Va. P. 1362.

**Wakefield,** tp., Sussex co., Va. P. 1063.

**Wakefield** (EDWARD GIBBON), b. in England about 1796; educated to the business of a land-surveyor; was brought into public notice in 1826 from having eloped to Gretna Green and there married a young heiress of fifteen; was tried and convicted of forcible abduction, the marriage being declared null by special act of Parliament, and imprisoned three years in Newgate; turned his experience to advantage by writing a book upon prison management; subsequently made minute inquiries upon the system of colonization by convicts in Australia, writing a volume of *Letters from Sydney* so full of local knowledge as to be generally accepted as a genuine book of travel; published *Tracts relating to the Punishment of Death in the Metropolis* (1831), and a careful work on *England and America, a Comparison of the Social and Political State of the Two Nations* (2 vols., 1833), and *A View of the Art of Colonization* (1833), in which he promulgated the "new colonization system," on which he gave evidence before a committee of the House of Commons; was a director of an association formed upon his system for the colonization of New Zealand and of South Australia; attacked the system of penal transportation, to which he gave the first effective blows, aided by Robert S. Rentoul and Sir William Molesworth; accompanied the earl of Durham to Canada as his private secretary, and rendered valuable service in the introduction of the new form of government; resided for some years in the S. of France, but subsequently removed to New Zealand, a colony which owed its existence largely to his efforts, and where his brother, Col. William, and his son, Edward Jerningham, had been (1839) pioneer settlers. D. at Wellington, New Zealand, May 16, 1862. The distinctive principle of the "Wakefield system" much resembles that of the American homestead and pre-emption legislation, consisting in selling the lands in small lots and at low prices to actual settlers, and employing the proceeds as a fund for the transportation of fresh emigrants. PORTER C. BLISS.

**Wakefield** (GILBERT), b. at Nottingham, England, Feb. 22, 1756; graduated at and became fellow of Jesus College, Cambridge, 1776; took orders; appointed curate of Stockport, Cheshire, and of St. Peter's, Liverpool, 1778; classical tutor in the dissenting academy at Warrington 1779–83; formally abandoned the Church of England 1786, becoming a "Socinian" or Unitarian, though without any church connection; was classical tutor at Hackney Academy 1790–91; published *Silva Critica* (5 parts, 8vo, Camb. and Lond., 1789–95) and a *Translation of the New Testament* (3 vols., 1791); attacked the practice of public worship in a pamphlet entitled *An Enquiry into the Expediency and Propriety of Social Worship* (1791); wrote his own *Memoirs* (1792), a volume of *Evidences of Christianity* (1793); edited several of the classics, especially *Lucretius* (3 vols., 1796–97); engaged in controversy with Porson and others on points of classical learning, on which subjects he corresponded at length with Charles James Fox; was imprisoned in Dorchester jail 1799–1801 for a "seditious libel" he had published in reply to Bishop Watson's *Address to the Peo-*

*ple of Great Britain.* His political friends presented him with £5000 as a token of their sympathy and esteem. D. at Hackney Sept. 7, 1801.

**Wakefield** (Priscilla **Trewman**), b. at Tottenham, near London, England, in 1751, of Quaker parents, was a descendant of Robert Barclay, the celebrated Quaker apologist; married Edward Wakefield 1771; wrote numerous works for the young, and established at Tottenham in 1798 the "Frugality Bank," which in 1804 was reorganized as the first savings bank in Great Britain. D. at Ipswich Sept. 12, 1832.

**Wakefield** (Robert), b. in the N. of England about 1480; educated at the University of Cambridge and on the Continent; became "the greatest linguist of his time;" taught Greek, Hebrew, Chaldaic, and Syriac in France and Germany; was for some years professor of Hebrew at the University of Louvain; returned to England 1519, and became chaplain to Dr. Richard Pace; rendered assistance to Henry VIII. in the matter of his divorce from Queen Catharine of Aragon; became lecturer in Greek at Cambridge 1524, professor of Hebrew at Oxford 1530; was a canon of Wolsey's new college 1532, and saved many Hebrew and Greek MSS. from destruction at the dissolution of the lesser monasteries 1536. D. in London Oct. 8, 1537. His *Oratio de Laudibus et Utilitate trium Linguarum Arabicæ, Chaldaicæ, et Hebraicæ*, etc. (London, 1524), printed by Wynkin de Worde, was the first book issued in London in which Hebrew and Arabic characters were employed, they having been specially cut in wood. Among his other works were a Latin paraphrase of *Koheleth* (Ecclesiastes) and a *Syntagma de Hebræorum Codicum Incorruptione*, the latter (*s. l. et a.* 4to) an extremely rare specimen from the press of De Worde.

**Wake Forest,** p.-v. and tp., Wake co., N. C. P. 3135.

**Wake'man,** p.-v. and tp., Huron co., O., beautifully situated on the banks of Vermilion River, 12 miles S. of Lake Erie, 45 miles W. of Cleveland, and 68 miles E. of Toledo, on Lake Shore and Michigan Southern R. R. The business of the village is in farm produce and the manufacture of oil barrels, pumps, flour, etc. It contains 4 churches, good schools, and 1 weekly newspaper. P. of v. about 500; of tp. 1216. F. M. Lewis, Ed. "Free Press."

**Wake-Robin,** a plant. See Arum.

**Wakesh'ma,** tp., Kalamazoo co., Mich. P. 1401.

**Wak'ley** (Thomas), M. D., b. at Manbury, Devonshire, England, in 1795; studied medicine and surgery in London, attending the lectures of Sir Astley Cooper 1815; practised some years as a surgeon in London; retired from active practice in 1823, when he founded the *Lancet*, a weekly medical journal, which he edited nearly forty years, and which was instrumental in promoting many reforms in surgery and medicine. Dr. Wakley was coroner for Middlesex 1839–62, and sat in Parliament 1835–52. D. in the island of Madeira May 2, 1862.

**Wakuafi,** a tribe of East African nomads, inhabiting a territory near the coast and traversed by the equator. They are heathens, but practise circumcision, and by their language seem to be of Arabian stock. Their manner of life is much like that of the Tartars. They are a warlike people, but are low in the scale of civilization.

**Wakul'la,** county of N. Florida, bordering on Appalachee Bay, bounded W. by Oclockonee River, and E. by the St. Mark's, and traversed by a branch of Jacksonville Pensacola and Mobile R. R.; surface level, soil fertile. Live-stock, principally cattle and swine. Staples, Indian corn and a little cotton and sugar. Cap. Crawfordville. Area, 504 sq. m. P. 2506.

**Wal'bridge** (Hiram), b. at Ithaca, N. Y., Feb. 22, 1821; graduated at Ohio University 1841; studied law at Toledo, O.; was admitted to the bar 1843; became brigadier-general of Ohio militia 1844; settled in New York City as a merchant 1847; was a Democratic member of Congress 1853–55; was a fluent speaker, an effective promoter of internal improvements, and an earnest supporter of the war for the Union, advocating early in 1861 the calling out of 600,000 volunteers; declined a seat in Mr. Lincoln's cabinet; was vice-president of the national commercial convention at Chicago, and president of similar bodies convened at Detroit and Louisville, and in 1869 was a national commissioner to examine and report on the Pacific R. R. D. in New York City Dec. 6, 1870.

**Walch** (Christian Wilhelm Franz), b. at Jena Dec. 25, 1726; studied theology and philosophy at the university of his native city, where his father was a professor of theology; travelled through Germany, Holland, France, Switzerland, and Italy, and was appointed professor of philosophy in 1750 at Jena, and in 1753 at Göttingen, where he subsequently became professor of theology, developed a great activity as a teacher, and d. in 1784. Of his works, which mostly relate to ecclesiastical history, the most remarkable are—*Historia Adoptianorum* (1755), *Historia Patropaschitarum* (1760), and *Entwurf einer vollständigen Historie der Ketzereien* (11 vols., 1762 *seq.*).

**Walch** (Johann Georg), b. at Meiningen in 1693; studied at Jena, and was appointed professor there, first in eloquence in 1719, then in theology in 1724. D. in 1775. The most remarkable of his writings are—*Philosophisches Lexicon* (2 vols., 1726), *Bibliotheca Theologia Selecta* (4 vols., 1757–65), and *Theologia Patristica* (1770; revised ed. 1834). He had three sons—Johann E. I. (1725–78), professor and writer on theology and mineralogy; Christian W. F. (which see); and Karl F. (1734–99), professor and writer on law.

**Wal'cheren,** island of the Netherlands, forming part of the province of Zealand, between the East and West Scheldt and the North Sea. It is 11 miles long and 10 miles broad, and has 45,000 inhabitants. It is low, and is protected against inundation partly by natural downs, partly by immense dykes, the rupture of which has on more than one occasion been most disastrous, but it is very fertile, and contains fine tracts both of meadow and arable land. The northern part of the island is well wooded. Walcheren is somewhat famous in military history for the disastrous expedition of the English under Lord Chatham and Admiral Strachan in 1809.

**Wal'ckenaër** (Charles Athanase), Baron, b. in Paris Dec. 25, 1771; was drafted into the army in 1793, and held some administrative position; attempted literature, both the philosophical essay and the romance; entered the civil service during the Restoration, and was appointed prefect of the department of Nièvre in 1824 and of that of Aisne in 1826; retired from public life in 1830, and devoted himself exclusively to science; was chosen perpetual secretary of the Academy of Inscriptions in 1840. D. at Paris Apr. 27, 1852. His most remarkable works are—*Faune parisienne des Insectes* (1805), *Tableau des Aranéides* (1805), *Histoire naturelle des Insectes aptères* (1837), *Le Monde maritime* (1819), *Géographie historique et comparée des Gaules* (1839), *Mémoires touchant la Vie et les Écrits de Mme. de Sévigné* (5 vols., 1842); he also published *Nouvelle Collection de Voyages* (21 vols., 1826–31).

**Wal'cott,** tp., Rice co., Minn. P. 599.

**Walcott** (Mackenzie Edward Charles), F. S. A., b. in England in 1822; educated at Winchester School; graduated at Exeter College, Oxford, 1844; took orders in the Church of England; was for some years curate of St. Margaret's, and subsequently of St. James's, Westminster; became precentor and prebendary of Chichester cathedral 1863; was minister of Berkeley chapel, Westminster, 1866–69; is a member of many learned societies, a distinguished authority upon archæology and architecture, and a contributor to numerous magazines and other periodicals. Author of *The History of St. Margaret's Church, Westminster* (1847), *Memorials of Westminster* (1849), *William of Wykeham and his Colleges* (1852), *The Cathedrals of the United Kingdom* (1859), *The Minsters and Abbey Ruins of the United Kingdom* (1859), *The South Coast of England* (1859), *The East Coast of England* (1861), *Guide to the Lakes, Mountains, and North-west Coast of England* (1860), *Cathedral Cities of England and Wales* (London, 6 vols., 1866), *Memorials of Canterbury* (1868), similar *Memorials* of Stamford, Carlisle, Exeter, Chichester, Worcester, and other cities (1865), *Sacred Archæology, a Popular Dictionary of Ecclesiastical Arts and Institutions* (1868), and numerous other works, including sermons and poems.

**Wald,** town of Rhenish Prussia, manufactures articles of brass, copper, iron, and steel. P. 5775.

**Wal'deck-Pyr'mont,** principality of North-western Germany, consists of two parts—Waldeck, situated between Rhenish Prussia and Hesse-Cassel, and comprising an area of 407 sq. m., with 51,824 inhabitants; and Pyrmont, situated between Hanover and Brunswick, and comprising an area of 25 sq. m., with 7319 inhabitants. Both districts are hilly, but fertile and well cultivated, rich in salt, iron, marble, and sandstone, and covered with fine forests. Agriculture and breeding of cattle are the principal occupations, and timber and mineral waters from the celebrated springs of Pyrmont form the two chief items of export.

**Wal'den,** p.-v., Montgomery tp., Orange co., N. Y., on Walkill Valley R. R., 73 miles N. of New York City, has 3 churches, excellent schools, 2 banks, 1 newspaper, foundry and machine-shops, 2 cutlery-works, a woollen-mill, soap-works, and 2 hotels. P. 1254.

Chauncey A. Reed, Ed. "Herald and Recorder."

**Walden,** p.-v. and tp., Caledonia co., Vt. P. 992.

**Wal'den,** or **Waldensis** (Thomas), whose family name was Netter, b. at Saffron-Walden, Essex, England, about 1380; educated at Oxford; entered the Carmelite order in

London, and was ordained sub-deacon 1395; was sent by Henry V. as his representative at the Council of Pisa 1409; became provincial of the English Carmelites 1414; attended in that capacity the Council of Constance 1415; went to Lithuania 1419; founded there several houses of his order, and negotiated a peace between the king of Poland and the Teutonic Knights; was confessor to Henry V., whom he attended on his deathbed 1422; took a prominent part in the persecution of the Lollards; accompanied Henry VI. to France, and d. at Rouen Nov. 2, 1430. Author of treatises, *Doctrinale antiquum Fidei Ecclesiæ Catholicæ* and *De Sacramentis*, and supposed to have been the writer of the series of tracts entitled *Fasciculi Zizaniorum Johannis Wyclif* ("Bundles of Wycliffe's Tares"), first edited by Dr. W. W. Shirley in the "Rolls Series" (1858).

**Walden's,** tp., Calhoun co., Ala. P. 1070.

**Walden'ses,** called also **Vallenses** or **Valdenses** [from *vallis*, "valley"], and **Vaudois** ["men of the valleys"], a Protestant sect and community in Italy, numbering in 1839 about 20,000, now numbering about 25,000, most of whom are in Piedmont, on the eastern slope of the Cottian Alps, from 25 to 40 or more miles S. W. of Turin, occupying a romantic district of about 22 by 18 miles. From 1686 to 1829 there were thirteen parishes—there are now sixteen—in the three valleys of Lucerna, Perosa, and San Martino. In 1814 the territory was reannexed to Sardinia. The original language of the people was a dialect of the old Provençal, which gave way largely to the French in consequence of the introduction, after the plague of 1630, of fifteen pastors from Geneva. But Italian is also spoken, and is now steadily gaining ground. Of four journals published in 1873, three were in Italian and one in French. The people are remarkably intelligent, industrious, honest, and hospitable. For 600 years they have claimed descent from a race which peopled the same valleys and professed the same faith in the first centuries of the Christian era. This claim, once generally allowed by Protestant historians, and still maintained by some, is no longer tenable. Vigilantius of the fourth century, and Claudius of Turin of the ninth, were not Waldenses. The name is probably derived from that of a wealthy merchant of Lyons in France, who is called Waldo, Waldus, Waldius, and even Waldensis. The earliest authority for Peter Waldo or Petrus Waldus is a manuscript of 1404 A. D.; the date of his birth is not known. The sudden death of one of his friends, an eminent citizen of Lyons, turned his attention to spiritual things. Two ecclesiastics were employed to prepare for him vernacular translations of the Gospels, with other portions of Scripture, and some passages of the Fathers topically arranged. About 1170—some say in 1173—he distributed his property to the poor, and, with several associates of both sexes who had joined him, began to preach in the streets of Lyons and of other places in the neighborhood. His aim was to revive the fervent, simple, self-denying piety of the early Church. He emphasized the right and duty of every Christian to study the Scriptures for himself, and held that laymen, if only truly regenerate, might properly preach and administer the sacraments. His followers styled themselves *Humiliati* ("the Poor"). Others called them *Leonistæ* (from *Leona* = Lyons) or *Sabotati* (from *sabot*, "wooden shoe"). The name *Waldenses* first occurs in 1194 in an edict of Ildephonsus, king of Aragon. Waldo was excommunicated by the archbishop of Lyons, but appealed to the pope (Alexander III.), and the third Lateran Council, then (1179) in session, failed to brand him as a heretic. Afterward, at Verona, under Lucius III., in 1184, he was condemned and driven into exile. He died in 1197, possibly in Bohemia, but probably in Northern Italy. His followers multiplied rapidly in several countries, but especially in Southern France, Northern Spain, and Northern Italy, whence, from the latter part of the thirteenth century, they gradually came together in the valleys of Piedmont and Savoy, and have remained there ever since, in spite of thirty-three bloody persecutions, some of which are among the bloodiest in history. One of these massacres (in 1655) called forth Milton's immortal sonnet beginning—

> "Avenge, O Lord! thy slaughtered saints, whose bones
> Lie scattered on the Alpine mountains cold."

Setting aside their claim to a high antiquity, recent writers recognize three periods in the history of the Waldenses: (1) When they differed but very little from the Roman Catholics except in regard to purity of life and the use of Scripture; (2) when they denounced Rome as Babylon and the pope as Antichrist; (3) since their reformation in doctrine, which began in the time of Huss of Bohemia (d. 1415), and was completed in the time of Luther and Calvin. As late, apparently, as 1520 or 1524 their form of government was still episcopal. They are now Presbyterians, each congregation having a pastor, elders, and deacons. The churches are all under a consistory called "The Table." Their present standard of doctrine is a confession (of 33 articles) dating from 1655, and probably composed by Jean Leger, then their moderator, afterward (1669) their historian. This confession is Calvinistic—indeed, is borrowed largely from the Gallic Confession of 1559, which, if not composed by Calvin himself, had both his inspiration and his approval. Their more ancient summary of doctrine, *The Noble Lesson*, which was formerly supposed to have come down from the twelfth century, is now assigned to the fifteenth. Great injustice is done them by those Roman Catholic writers who confound them with the Albigenses and Cathari. They were never tainted with the Manichæan heresy. Between them, however, and the Bohemian Brethren the connection was very close, although it is impossible to determine exactly the indebtedness of each to the other. A new era in their history dates from the visit of Dr. Gilly, canon of Durham, in 1823, whose *Narrative of an Excursion to the Mountains of Piedmont* (1824) recalled the attention of the Protestant world to this interesting people. Moved by this book, which he chanced to see in the library of the duke of Wellington, Col. Beckwith, who had lost a leg under Wellington at Waterloo, went among the Waldenses in 1827, and remained there, laboring earnestly for their improvement, with only occasional interruptions, till he died in 1862. A *Memoir* of Col. Beckwith, by J. P. Meille, Waldensian pastor at Turin, was published in 1873. Since 1848, when for the first time in all their heroic history full liberty of worship was granted them, the Waldenses have greatly flourished. In Turin they number 1500, have removed their theological seminary to Florence, are sending forth missionaries, and have established congregations in all parts of the Italian peninsula. They have hospitals and colleges (at La Tour and Pomaret) and excellent schools.

The literature of the subject is copious. Perrin, *Histoire des Vaudois* (1619); Morland, *History of the Evangelical Churches of the Valleys of Piedmont* (1658); Leger, *Histoire générale des Églises évangéliques des Vallées de Piemont ou Vaudoises* (1669); and Allix, *Some Remarks upon the Ecclesiastical History of the Ancient Churches of Piedmont* (1690; new ed. 1821); Maitland, *Tracts and Documents illustrative of the Doctrines and Rites of the Ancient Albigenses and Waldenses* (1832); Munston, *Histoire des Vaudois* (1834) and *L'Israël des Alpes* (1851, 4 vols.); Monastier, *Histoire de l'Église vaudoise* (1847, 2 vols.); Hahn, *Geschichte der Waldenser* (1847); Dieckhoff, *Die Waldenser im Mittelalter* (1851); Herzog, *Die romanischen Waldenser* (1853); Todd, *Books of the Vaudois* (1865); Palacky, *Verhältniss der Waldenser zu den böhmischen Secten* (1869); Schaff, *Creeds of Christendom* (1877, 3 vols.). R. D. Hitchcock.

**Wal'do,** county of S. Maine, bounded E. by Penobscot River and Bay, drained by St. George and Marsh rivers and affluents of the Sebasticook, and traversed by Maine Central R. R.; surface undulating, with considerable productive soil. It has a large export-trade in timber, staves, lime, etc., and a considerable cod and mackerel fishery. Principal live-stock, cattle and sheep. Staples, manufactured articles, lumber, potatoes, oats, hay, wool, and dairy products. Cap. Belfast. Area, 812 sq. m. P. 34,522.

**Waldo,** tp., Livingston co., Ill. P. 1051.

**Waldo,** p.-v. and tp., Waldo co., Me. P. 648.

**Waldo,** p.-v. and tp., Marion co., O. P. of v. 247; of tp. 1029.

**Waldo** (Daniel), b. at Windham, Conn., Sept. 10, 1762; was a soldier in the Revolution; taken prisoner at Horseneck and confined in the Sugar-house prison, New York; graduated at Yale College 1788; was a Congregational pastor at West Suffolk, Conn., 1792–1809; was afterward settled at Cambridgeport and Harvard, Mass., and at Exeter, R. I.; was a home missionary in Pennsylvania, New York, and Rhode Island; resided in New York; became chaplain to the House of Representatives 1855. D. at Syracuse, N. Y., July 30, 1864, at the age of 102 years.

**Waldo** (Peter). See Waldenses.

**Waldo** (Samuel), b. at Boston, Mass., in 1696; engaged in commerce at Falmouth, Me.; acquired a large fortune; crossed the ocean fifteen times; was an intimate friend of Sir William Pepperell, with whom he served in the Massachusetts council, and as brigadier-general and commander of a regiment at the capture of Louisburg, 1745, and spent a year with him in England upon public service. D. on Penobscot River, Me., May 23, 1759.

**Waldo** (Samuel), b. at Windham, Conn., in 1783; studied painting at Hartford, Conn.; went to London 1806; was there associated with Benjamin West, J. S. Copley, and Robert Fulton, and became a successful portrait-painter, which profession he exercised in New York City fifty-two years, from Jan., 1809, to his death, Feb. 16, 1861.

**Waldo** (SAMUEL PUTNAM), grandson of Gen. Israel Putnam, b. in Connecticut in 1780; author of *Lives* of Jackson, Decatur, Nicholas Biddle, Paul Jones, E. Preble, and A. Murray; of *Tour of James Monroe* (1818); prepared for publication Archibald Robbins's *Journal of the Loss of the Brig Commerce upon the Western Coast of Africa.* (See RILEY, JAMES.) D. at Hartford, Conn., Mar., 1826.

**Wal'doboro',** p.-v. and tp., Lincoln co., Me., on Knox and Lincoln R. R., at the head of tidewater on Medomak River, has 6 churches, good schools, 2 circulating libraries, 1 newspaper, and 2 banks; seat of U. S. customs district; incorporated 1773. Principal business, shipbuilding. P. 4174. S. L. MILLER, ED. "LINCOLN COUNTY NEWS."

**Wal'dron,** p.-v., cap. of Scott co., Ark., has good schools, 2 silversmiths, 2 furniture manufactories, 1 newspaper, 2 gins, 2 hotels, and 1 mill. P. 162.
R. A. ALLISON, ED. "REFORMER."

**Wald'wick,** tp., Iowa co., Wis. P. 935.

**Wales** was inhabited by the Cymries, a people of Celtic descent, at the time when the Romans first came to Britain. Conflicts soon arose between the Cymries and the Romans, and the latter repeatedly invaded Wales, though without conquering it. Against the Anglo-Saxons the Cymries succeeded also in vindicating their independence, but at the time of the Danish conquest of England, Wales had become divided between several princes who warred against each other, and the Cymries were finally compelled to pay tribute. The tribute, however, was refused to William the Conqueror, and he accordingly invaded the country and conquered it. The Welsh retained their own native princes, but they had to pay tribute, and their independence was gone. Rebellions and wars ensued, until, in 1282, LLEWELLYN AP GRIFFITH (which see) was defeated and slain, and Edward I. united the country with England by the statute of Rhuddlan (1284), and gave his son, afterward Edward II., who was born in the castle of Carnarvon Apr. 25, 1284, the title of prince of Wales. The country, however, still retained a kind of political independence, but as this gave rise to frequent controversies and new insurrections (see GLENDOWER), Henry VIII. finally merged the country completely into England in 1536. (For its geography, statistics, language, and literature see GREAT BRITAIN and WELSH LANGUAGE AND LITERATURE.)

**Wales,** p.-v. and tp., Androscoggin co., Me. P. 556.

**Wales,** p.-v. and tp., Hampden co., Mass. P. 831.

**Wales,** p.-v. and tp., St. Clair co., Mich. P. 1358.

**Wales,** p.-v. and tp., Erie co., N. Y. P. 1416.

**Wales, New South.** See NEW SOUTH WALES.

**Wales, Prince of.** See ALBERT EDWARD.

**Wales'ville,** p.-v., Whitestown tp., Oneida co., N. Y. P. 115.

**Walew'ski** (ALEXANDRE FLORIAN JOSEPH COLONNA), COUNT and DUKE, b. at Walewice, Poland, May 4, 1810, a son of Napoleon I. and the countess Walewska; was educated at Geneva; fought in the ranks of the Polish patriot army in 1830, and was sent in the same year to London to solicit an English intervention; went to France after the fall of Warsaw; entered the army as a captain, and was naturalized as a French citizen; gave up subsequently the military career and devoted himself to politics and literature; wrote *Un Mot sur la Question d'Afrique* (1837), *L'Alliance anglaise* (1838), also a drama, *L'École du Monde* (1840), and founded the *Messager*, which he sold in 1840 to Thiers; entered the diplomatic service, and was chargé d'affaires to Buenos Ayres at the outbreak of the Revolution of 1848; was sent in 1849 as ambassador to Florence, and in 1854 to London; was minister of foreign affairs May 7, 1855–Jan. 4, 1860, minister of state Nov. 24, 1860–June 23, 1863, and president of the Legislative Assembly Sept. 1, 1865–Apr. 2, 1867. D. at Strasbourg Oct. 27, 1868.

**Wal'ford** (EDWARD), b. at Hatfield Peverell, Essex, England, in 1823, is a great-grandson of Sir William Pepperell, Bart.; was educated at the Charter-house; graduated at Baliol College, Oxford, 1845; took orders in the Church of England, but being in sympathy with the "Tractarian" movement, soon seceded to the Roman Catholic Church; became assistant master of Tunbridge School 1846; afterward became a private tutor in preparing pupils for Oxford, and has written or edited numerous educational, biographical, genealogical, and literary works, and translated several volumes of the Greek ecclesiastical historians in "Bohn's Library." He was editor and proprietor of the *Court Circular* 1858–59, sub-editor of *Once a Week* from its beginning to 1863, editor of the *Gentleman's Magazine* 1865–68, and of the *Register* from July, 1869. Among his publications were the annual *Shilling Peerage, Shilling Baronetage*, etc. (1857 *seq.*), *Men of the Time* (1862), and *Representative Men in Literature, Science, and the Arts, with Photographic Portraits* (1867). He has written many biographies in Knight's *Cyclopædia*, and furnished for many years the obituaries of distinguished men to the *Times*, *Illustrated London News*, and other leading periodicals.

**Walhal'la,** in Northern mythology, the name of the magnificent palace, resting on spears and covered with shields, to which the warriors repaired when they fell on the battlefield fighting bravely. Those who were cowards and died in their beds from sickness or old age were sent to Niflheim, and that place was as dark and gloomy, as silent and shadowy, as Walhalla was bright, resplendent, and stirring with life. Every morning the Einheriars, the inhabitants of Walhalla, marched out at cock's crow from its 540 doors, through each of which 800 men could walk abreast. The day they spent to their hearts' delight in fighting furiously against each other, but toward sunset all the wounds healed up, and home they went to the banquet in Odin's hall, where roast pork, the favorite dish of the old Norsemen, was served, cut fresh every morning from the wild boar Sæhrimner, while Freya's maids handed round the strong mead in golden horns. The idea of a future life was much more vivid in the Scandinavian mythology than in any other pagan religion, and it had a direct bearing on man's conduct in this life, as his future state was wholly dependent on the deeds he achieved during his life on earth. But his moral ideas were extremely narrow, nearly confined to a mere distinction between bravery and cowardice, and his ideas of moral reward and punishment were extremely coarse, simply an exaggerated image of his earthly delights.

After the wars between Germany and France, which ended with the downfall of Napoleon I. in 1815, King Louis I. of Bavaria conceived the idea of erecting a temple of fame which should be called Walhalla, and in which busts and statues should be placed of all the great men Germany had produced. The temple was built 1830–42, and it is certainly one of the most remarkable edifices in Germany. It is a copy of the Parthenon, 232 feet long, 110 feet broad, and 63 feet high, built of a fine reddish marble, and situated at Donaustauf, on a hill on the Danube 250 feet above the river. The substructure and the surroundings are magnificent, and contribute largely to set off the building itself. The design was made by Leo von Klenze, the bas-reliefs, statues, and groups which adorn the edifice by Rauch, Schwanthaler, and I. M. Wagner. It is singular, however, that a German temple of fame should be a Greek building with a Scandinavian name; and German critics say that a similar confusion reigns with respect to the Einheriars who are selected for this Walhalla.
CLEMENS PETERSEN.

**Walhalla,** p.-v., cap. of Oconee co., S. C., the present terminus of Blue Ridge R. R., contains 4 churches, a college, 1 bank, 1 newspaper, 1 brewery, and 2 hotels. P. 716.
THOMPSON & KEITH, EDS. "KEOWEE COURIER."

**Walhon'ding River,** called also **White Woman's River** and **Mohican River,** is formed by several forks which unite in Ashland co., O. At Coshocton, O., the stream joins the Tuscarawas, and forms Muskingum River.

**Walke** (HENRY), U. S. N., b. in Virginia in 1809; entered the navy as midshipman Feb. 1, 1827; became lieutenant in 1839, commander in 1855, captain in 1862, commodore in 1866, rear-admiral in 1870; retired in 1871. Served with great gallantry during the civil war at Fort Henry, Fort Donelson, Island No. 10, Vicksburg, Grand Gulf, Memphis, and various other places on the Western waters, and was complimented in official despatches by the secretary of the navy, the general of the army, and Rear-Admirals Foote, Porter, and Davis. FOXHALL A. PARKER.

**Walk'er,** county of N. W. Alabama, drained by Blackwater and Gipsy rivers and affluents of the Black Warrior; surface hilly, soil in the valleys fertile. Bituminous coal is found, and timber is abundant. Live-stock, principally cattle and sheep. Staples, cotton, rye, sweet potatoes, and wool. Cap. Jasper. Area, 828 sq. m. P. 6543.

**Walker,** county of N. W. Georgia, drained by Chatooga and Chickamauga rivers, traversed by Taylor's ridge, and containing Lookout, White Oak, and Pigeon mountains; surface broken, soil rich along the streams. Bituminous coal, marble, limestone, and lead abound, and there are several fine mineral springs. Live-stock, principally cattle, sheep, and swine. Staples, cotton, Indian corn, wheat, wool, a little tobacco, and dairy products. Cap. Lafayette. Area, about 500 sq. m. P. 9925.

**Walker,** county of E. Texas, bounded N. E. by Trinity River and traversed by Houston and Great Northern R. R.; surface level, soil a rich alluvium. There are saw-mills and some manufactures of cotton and woollen. Principal live-stock, cattle and swine. Staples, cotton, Indian corn, and

sweet potatoes. Cap. Huntsville. Area, 854 sq. m. P. 9776.

**Walker,** tp., Conway co., Ark. P. 222.
**Walker,** tp., Hancock co., Ill. P. 1474.
**Walker,** tp., Jasper co., Ind. P. 281.
**Walker,** tp., Rush co., Ind. P. 1081.
**Walker,** tp., Anderson co., Kan. P. 891.
**Walker,** tp., Kent co., Mich. P. 1675.
**Walker,** tp., Moniteau co., Mo. P. 3492.
**Walker,** p.-v. and tp., Centre co., Pa. P. 1356.
**Walker,** tp., Huntingdon co., Pa. P. 978.
**Walker,** tp., Juniata co., Pa. P. 1608.
**Walker,** tp., Wise co., Va. P. 1036.
**Walker,** p.-v. and tp., Wood co., West Va. P. 1205.

**Walker** (Abraham Joseph), b. in 1818 near Nashville, Tenn.; graduated at Nashville University 1838; was admitted to legal practice 1841; settled at Jacksonville, Ala., 1842; became a successful lawyer and Democratic legislator; removed in 1852 to Talladega, and in 1854 became one of the State chancellors; was 1856–59 a judge of the State supreme court; chief-justice 1859–68. D. at Montgomery Apr. 25, 1872.

**Walker** (Amasa), LL.D., b. at Woodstock, Conn., May 4, 1799; educated in the common school at North Brookfield, Mass.; became a merchant at Boston 1825; was a prominent advocate of the construction of the Western R. R., an influential member of the early anti-slavery circles, and a leader in the cause of temperance; visited Europe 1843 and 1849 as delegate to peace conventions; was professor of political economy at Oberlin College, O., 1842–49; was a representative in the Massachusetts legislature 1848, member of the State senate 1849, secretary of state 1851–52; was chosen to the State constitutional convention 1853; was member of Congress 1862–63, and of the Philadelphia loyalists' convention 1866, and lecturer on political economy at Amherst College from 1861–66. D. at North Brookfield Oct. 29, 1875. Author of *The Science of Wealth* (1866; 7th ed. 1874), and one of the editors of the *Transactions* of the Agricultural Society of Massachusetts (7 vols., 1848–54).

**Walker** (Benjamin), b. in England in 1753; settled in New York at an early age; became a merchant; served in the Revolution as aide-de-camp to Gen. Steuben and to Washington 1781–82; was subsequently secretary to the governor of New York and a broker in New York City, where he was naval officer in Washington's administration; was a member of Congress 1801–03; became in 1797 agent for the vast landed estates of the earl of Bute in Central New York, and was identified with the growth and prosperity of Utica, where he d. Jan. 13, 1818.

**Walker** (Clement), b. at Cliffe, Dorsetshire, England, about 1595; educated at Christ Church, Oxford, but left without a degree; became usher to the exchequer; was originally a royalist and churchman, but having been chosen to the Long Parliament for Wells 1640, distinguished himself by his violence as a Presbyterian and promoter of the "Solemn League and Covenant," and by his hostility to the Independents, against whom he wrote his *Complete History of Independency* (1646–50), a work of great value for the annals of that stormy period; was imprisoned by Cromwell in the Tower 1649, where he d. Oct., 1651. He wrote there *The High Court of Justice, or Cromwell's New Slaughter-house.*

**Walker** (Dawson A.), b. in Grainger co., Tenn., Dec. 7, 1819; graduated at East Tennessee University at Knoxville in Aug., 1843; studied law and was admitted to the bar in Feb., 1845; moved to Georgia, and located at Spring Place in Mar., 1845; was appointed by the governor to fill a vacancy on the bench of the superior courts of the Cherokee circuit in Feb., 1860; was elected to the same place in Jan., 1861; was again appointed to the same position in Mar., 1865; in 1866 was elected by the legislature judge of the supreme court for six years, but lost this position under the reconstruction laws in 1868, as he was not renominated by Gov. Bullock. He was appointed by Pres. Grant one of the members of the civil service commission in 1871; in 1872 was the candidate of the Republican party for governor of the State. He is a lawyer of great distinction, and resides at Dalton. Alexander H. Stephens.

**Walker** (Francis Amasa), son of Amasa, b. at Boston, Mass., July 2, 1840; graduated at Amherst 1860; studied law under Judges Devens and Hoar at Worcester; entered the army 1861 as sergeant-major of Devens's regiment; became assistant adjutant-general of Couch's brigade Sept. 14, 1861, adjutant-general of Couch's division Aug. 11, 1862, colonel on the staff of the 2d army corps Dec. 23, 1863, and brevet brigadier-general 1865; was wounded at Chancellorsville; taken prisoner at Reams's Station, and confined in Libby prison, where his health was shattered; was a teacher at Williston Seminary, Easthampton, Mass., 1866–68; an editor of the Springfield *Republican* 1868–69; became chief of the bureau of statistics of the treasury department at Washington 1869; was superintendent of the ninth census of the U. S. 1870–71; commissioner of Indian affairs 1871–72, and has been since 1872 professor of political economy and history in the Sheffield Scientific School of Yale College. He edited three 4to volumes of *Census Reports*, compiled a *Statistical Atlas of the U. S.* (1874), and has published *The Indian Question* (Boston, 1873) and *The Wages Question* (New York, 1876).

**Walker** (Frederick), b. in London, England, in 1840; studied art at the Royal Academy; became a distinguished member of the Society of Painters in Water-Colors, and in 1871 an associate of the Academy. D. in London in 1876. Both his water-color and his oil paintings were deemed of great merit, and a collection of 200 of them was exhibited in London in 1876.

**Walker** (Freeman), b. Oct. 25, 1780, in Charles City co., Va.; went to Georgia in 1797, where, after a course of study, he was admitted to the bar, and commenced the practice of law in the city of Augusta in 1802; soon rose to eminence in his profession; in 1807 was a member of the State legislature, and in 1819 was elected a Senator of the U. S. In this body his talents shone with rare splendor. His speech on the Missouri question, it is said, "will ever remain a monument of his genius and patriotism." Richard Henry Wilde said of him that he was "generous, hospitable, and humane, of cheerful temper and familiar manners, idolized by his family, beloved by his friends, and admired by his countrymen." D. at his residence, in Richmond co., Ga., Sept. 23, 1827. Alex. H. Stephens.

**Walker** (George), D. D., b. in county Tyrone, Ireland, about 1650; educated at the University of Glasgow; took orders in the Church of England; was rector of Donoughmore, near Londonderry, Ireland, when James II. laid siege to that city 1689; raised a regiment, with which he gallantly defended Londonderry after it had been abandoned by its governor, and held out until the siege was raised, July 30, 1689. He received the thanks of the House of Commons, was nominated to the bishopric of Derry by William III., and was killed at the battle of the Boyne, July 1, 1690, "while exhorting the colonists of Ulster to play the man." He published *A True Account of the Siege of Londonderry* (1689) and a *Vindication.* His statue surmounts a lofty pillar at Londonderry.

**Walker** (Sir Hovenden), b. in Somersetshire, England, about 1660; entered the navy at an early age; became a captain 1692, rear-admiral of the red 1709, and of the white 1710; was knighted by Queen Anne 1711; commanded in that year the unfortunate naval expedition which sailed from Boston against Canada; lost half his vessels by shipwreck on the Isle aux Œufs, and had to abandon the enterprise; suffered the loss of his ship, the Edgar, which blew up at Spithead 1715, when he was dismissed the service; subsequently settled in South Carolina as a planter, and published *A Journal or Full Account of the Late Expedition to Canada* (London, 1720). D. at Dublin, Ireland, in Jan., 1726.

**Walker** (James), D. D., b. at Burlington (then Woburn), Mass., Aug. 16, 1794; graduated at Harvard College 1814; studied theology at Cambridge; was pastor of the Unitarian church in Charlestown, Mass, 1818–38; editor of the *Christian Examiner* 1831–39; Alford professor of moral and intellectual philosophy at Harvard 1838–53, and president of Harvard University 1853–60. D. at Cambridge Dec. 23, 1874. He left his valuable library and $15,000 in money to the university. Author of *Sermons preached in the Chapel of Harvard College* (1861), *A Memoir of Daniel Appleton White* (1863), *A Memoir of Josiah Quincy* (1867), and a posthumous volume of *Discourses* (1876); delivered three series of *Lectures on Natural Religion* and a course of Lowell lectures on the *Philosophy of Religion*; published a number of occasional sermons and addresses, and edited as college textbooks Dugald Stewart's *Philosophy of the Active and Moral Powers of Man* (Cambridge, 1849) and Dr. Thomas Reid's *Essays on the Intellectual Powers, abridged, with Notes and Illustrations from Sir William Hamilton and others* (Cambridge, 1850).

**Walker** (James Barr), D. D., b. at Philadelphia, Pa., July 29, 1805; became an operative in a factory at Pittsburg, and subsequently a printer; was clerk to Mordecai M. Noah in New York City, and principal of an academy at New Durham, N. J.; studied law at Ravenna, O.; graduated at Western Reserve College, Hudson, O., 1831; edited successively the *Ohio Observer* at Hudson, the *Watchman of the Valley* at Cincinnati, and the *Watchman of the Prairies* at Chicago, all religious newspapers; was also engaged in

the book-trade; studied theology, and was licensed to preach 1841, since which time he has resided at Mansfield, O., conducting a private orphan asylum and lecturing on the harmony between science and revealed religion at Oberlin College and Chicago Theological Seminary. Author of *The Philosophy of the Plan of Salvation* (Boston, 1855); a work published anonymously under the editorship of Prof. C. E. Stowe, but of which many thousands were quickly sold in the U. S. and in England, it being translated into five languages, including Hindostanee, *God Revealed in Nature and in Christ* (1855), intended as a refutation of the "development theory;" *Philosophy of Scepticism and Ultraism* (1857); *The Philosophy of the Divine Operation in the Redemption of Man* (London, 1862); and *The Living Questions of the Age* (Chicago, 1869).

**Walker** (John), b. at Colney-Hatch, near London, England, Mar. 18, 1732; was in early life engaged in mercantile pursuits, and was subsequently an actor; established in 1767 a school at Kensington, and from 1769 devoted himself to lecturing on elocution in England, Scotland, and Ireland, a profession in which he achieved great success. Author of several works on grammar and elocution, and of a *Critical Pronouncing Dictionary and Expositor of the English Language* (1791; 36th ed. 1862), which was long the standard work of its class, and still retains considerable value.

**Walker** (John J.), U. S. N., b. Nov. 20, 1835, in New Hampshire; graduated at the Naval Academy in 1856; became lieutenant in 1859, commander in 1866; served with distinguished gallantry at the taking of New Orleans and Vicksburg, and in almost all the battles on the Mississippi River and its tributaries during the years 1862 and 1863, and commanded the gunboat Saco at the taking of Wilmington, N. C., in 1865. Always commended for "coolness, sound judgment, and intrepidity."

Foxhall A. Parker.

**Walker** (Leroy Pope), b. in Alabama; early entered public life; was Speaker of the Alabama house 1847–50; a judge of the State circuit court 1850–53; became a prominent advocate of the internal improvement of the State and of the policy of secession; was Confederate secretary of war 1861–62; served afterward as a Confederate brigadier-general, and after the war resumed legal practice at Huntsville, Ala.

**Walker** (Robert James), b. at Northumberland, Pa., July 19, 1801, and was the youngest son of Judge Jonathan Hoge Walker, a learned jurist and an ardent philanthropist. Educated under his father's direction, Mr. Walker graduated at the University of Pennsylvania in 1819 with the highest honors, and in 1821 was admitted to the bar at Pittsburg; entered upon political life as a Democrat, and in 1823 first proposed Gen. Jackson as a candidate for the Presidency; in 1825 was married to Mary Bache, a great-granddaughter of Benjamin Franklin and a granddaughter of A. J. Dallas; in 1826 removed to Natchez, Miss., and entered into a successful law-partnership with his brother, Duncan S. Walker. He opposed the nullification movements of South Carolina (1833), and, heading the opposition to Hon. George Poindexter, was in 1836 elected to the U. S. Senate; and in that year brought forward, without success, the first Homestead bill. In the Senate he at once took a prominent position, which he thenceforth maintained, gaining rapidly a brilliant reputation in this country and abroad; in 1837 brought forward a bill for the recognition of the independence of Texas. His bust in marble, by Powers, was placed in the Texan capitol as a testimonial to his services to the young republic. In 1837 he ably advocated the Independent treasury bill; in 1841 originated the Pre-emption act, still unrepealed; in 1843 declined a nomination for the Vice-Presidency of the U. S. He exercised great influence during the Tyler administration, and in 1844 secured the nomination and election of James K. Polk to the Presidency. In 1844 he published a cogent letter in favor of the "reannexation" of Texas; in 1845 was appointed secretary of the treasury, an office which he filled with distinguished ability until 1849. The revenue tariff of 1846, the warehouse-system, the Independent treasury, and the establishment of the department of the interior were measures proposed by him. In Great Britain his opinions touching questions of political economy had great weight, and his report on free trade was reprinted by the British House of Commons. In 1853 he was appointed commissioner to open trade with Japan and China, but resigned the position; in 1857–58 he was, by appointment of Pres. Buchanan, governor of Kansas at a most difficult crisis. Here his management of public affairs reflected the greatest credit upon him as a patriot and statesman, though it lost him the friendship and esteem of a large number of lifelong political and social followers. On the breaking out of the civil war, he most efficiently sustained the Federal government, and in 1863–64 was financial agent of the U. S. in Europe, negotiating the sale of $250,000,000 in government bonds, and preventing the second $75,000,000 loan to the Confederacy. He afterward advocated the purchase of Alaska and the Danish West Indies, and opposed the radical party during the reconstruction measures of Congress under Pres. Johnson's administration. Mr. Walker was profoundly versed in civil and common law, a skilful advocate, an enthusiastic student of political economy, an earnest believer in free trade, in popular sovereignty, and in the American federal system. State rights and the Union of the States were to him equally dear. His knowledge of facts and his industry were alike wonderful. Full of generous, ardent, and kindly sympathies, he was himself tenderly loved by a large circle of friends; yet such was his strength and manliness that he repeatedly sacrificed many long-continued and highly-valued friendships by his devotion to what he regarded as the right. During a part of the war he conducted a monthly magazine with much ability, called *The Continental*, though at a heavy pecuniary loss. In 1867 he was counsel for the State of Mississippi, and made a masterly argument before the Supreme Court in a case brought to restrain the execution of the reconstruction acts. In the latter part of his life he was successfully engaged in the practice of law at Washington, D. C., where he d. Nov. 11, 1869.

Martha Walker Cook.

**Walker** (Sears Cook), b. at Wilmington, Mass., Mar. 28, 1805; graduated at Harvard 1825; taught school in Boston and Philadelphia 1828–36; built an observatory at the Philadelphia High School 1837; was actuary to an insurance company in Philadelphia 1836–45; was employed at the Washington Observatory 1845–47; identified the planet Neptune with a star discovered by Lalande in May, 1795, and had charge of the longitude department of the Coast Survey from 1847 to his death, at Cincinnati Jan. 30, 1853. His parallactic tables for computing the phases of an occultation (1834), his method of determining differences of longitude by telegraph (1849), and his various astronomical and mathematical papers exhibit great powers of mind.

**Walker** (Timothy), b. at Rumford (now Concord), N. H., June 26, 1737; graduated at Harvard 1756; studied theology, but was never ordained; became a lawyer in New Hampshire; commanded a regiment of minutemen at the siege of Boston 1775; was a member of the committee of safety 1776; served in the war as paymaster; was a member of the State constitutional convention and of both houses of the legislature, judge of the court of common pleas 1777–1804, and chief-justice of that court 1804–09. D. at Concord, N. H., May 5, 1822.

**Walker** (Timothy), LL.D., brother of Sears C., b. at Wilmington, Mass., Dec. 1, 1802; graduated at Harvard 1826; was a teacher of mathematics at Messrs. Bancroft & Cogswell's celebrated Round Hill School at Northampton 1826–29; studied at the Dane Law School 1829–30; went to Cincinnati, O., 1830; was there admitted to the bar 1831; established in 1833, in connection with Judge John C. Wright, the Cincinnati Law School, which in 1835 was united with Cincinnati College; was professor of law until 1844, having for some years the exclusive charge of the school; was president judge of Hamilton county court of common pleas 1842–43, and founded the *Western Law Journal* 1843, which he continued to edit for several years while practising at the Cincinnati bar. D. at Cincinnati Jan. 15, 1856. He translated Fischer's *Elements of Natural Philosophy* (Boston, 1827); wrote for the *North American Review;* published *Elements of Geometry* (1828) and an *Introduction to American Law, designed as a First Book for Students* (Philadelphia, 1837; 5th ed., revised by J. Bryant Walker, 1869), and delivered several admired discourses on anniversary occasions, among which were those *On the Dignity of the Law as a Profession* (1837), *On the History and General Character of the State of Ohio* (1838), *On the Reform Spirit of the Day* (1850) before the Phi Beta Kappa Society of Harvard, and memorial orations on John Quincy Adams (1848) and Daniel Webster (1852).

**Walker** (William), b. at Nashville, Tenn., May 8, 1824; studied medicine in Paris; travelled in Italy and Germany; was admitted to the bar at Nashville; resided several years at New Orleans, where he was connected with the *Crescent* newspaper; went to California 1850; became one of the editors of the San Francisco *Herald;* afterward practised law at Marysville; organized in July, 1853, an expedition for the conquest of Northern Mexico; set sail from San Francisco Oct. 15; landed at La Paz, Lower California, with a handful of followers; proclaimed himself president and made a liberal distribution of high offices; occupied two or three small towns; issued a proclamation annexing

Sonora to his dominions; received early in 1854 a reinforcement under Col. Watkins, raising his numbers to 100 men, with whom he set out for Sonora overland. The party, having suffered great privations on its march from want of food, gradually melted away, and Walker thought it expedient on nearing the U. S. frontier to surrender to the officials at San Diego, Cal.; was tried at San Francisco for violation of the neutrality laws, but acquitted May 15, 1854; was induced soon afterward by liberal offers from one of the parties to a civil war in Nicaragua to proceed thither, landing at Realejo with 62 followers June 11, 1855; was joined by 100 natives of the "liberal" party; won two sharp battles at Rivas (June 29) and at Virgin Bay, in consequence of which he augmented his forces, and after a short siege obtained possession of the city of Granada Oct. 15; made a treaty with Gen. Corral, designating Rivas as president and himself as minister of war and general-in-chief; quickly discovered, or alleged, a treacherous plot on the part of Corral, whom he tried by court-martial and caused to be shot Nov. 8; received numerous recruits from California; had to wage a war with Costa Rica; was defeated near Guanacaste Mar. 20, 1856, but won a battle at Rivas Apr. 11; engaged in a quarrel with the management of the (Vanderbilt) Transit Co., then in full operation in Southern Nicaragua; revoked the charter and confiscated its property for non-payment of his demands for money; went through the farce of ordering a presidential election June 25; took possession of the presidency; issued great quantities of worthless currency; re-established slavery by a decree of Sept. 25, and was recognized by the American minister resident and by the government of Pres. Pierce, but succumbed in the following spring to a general insurrection fomented by the agents of the steamship company and aided by forces of Costa Rica and Honduras. After having lost several desperate battles and burned the city of Granada, he surrendered at the port of San Juan del Sur, May 1, 1857, to Com. (afterward Admiral) Charles H. Davis of the U. S. sloop-of-war St. Mary's; was taken to Panama; went thence to New Orleans; was put under bonds to keep the peace, but soon organized another party, with which he sailed in the steamer Fashion and landed Nov. 25 at Punta Arenas, Nicaragua; was compelled, with 132 men, to surrender as a prisoner to Com. Paulding of the U. S. navy Dec. 8, and taken to New York; was liberated by order of Pres. Buchanan Jan., 1858; made another attempt in Oct., 1858, but was seized on board his steamer at the mouth of the Mississippi River; tried and acquitted in the U. S. court at New Orleans; spent the next few months in preparing a work entitled *The War in Nicaragua* (1860); professed himself a Roman Catholic; succeeded in fitting out another expedition, with which he landed at Truxillo, Honduras, June 27, 1860; held that town until Aug. 23, when an English man-of-war intervened, ordering him to evacuate the place; marched southward with 80 men; was captured Sept. 3; carried back to Truxillo, tried by court-martial, and shot Sept. 12, 1860. Walker was known as "the gray-eyed man of destiny;" he had a profound conviction of ultimate success, to which, though not deliberately cruel, he was prepared to sacrifice every other consideration. PORTER C. BLISS.

**Walker** (WILLIAM H. T.), b. in Georgia in 1817; graduated at the U. S. Military Academy July 1, 1837, when appointed brevet second lieutenant 6th Infantry, and second lieutenant July 31; ordered at once to the seat of war in Florida, was engaged in the battle of Okeechobee, Dec. 25, 1837, and three times wounded; brevetted first lieutenant, promoted to that rank Feb. 1, 1838, but resigned Oct. 31; in Nov., 1840, was reappointed; promoted to be captain Nov., 1845, he served in the war with Mexico in Gen. Scott's army from Vera Cruz to the battle of Molino del Rey, where so severely wounded as to compel him to remain absent from the army on sick leave for two years. For gallantry at Churubusco and Contreras he was brevetted major, and lieutenant-colonel for Molino del Rey. Returning to duty in 1849, he was forced again to go on sick leave 1850–51. In Dec., 1852, he was appointed deputy governor of the East Pascagoula Branch Military Asylum; transferred to West Point in July, 1854, as commandant of cadets. Promoted to a majority in the 10th Infantry in Mar., 1855, he was in 1856 relieved from duty at West Point and ordered to a Northern frontier post, but soon after, in the same year, went on sick leave, and remained absent until Dec. 20, 1860, when he resigned from the army. Entering the Confederate army, he rose to the rank of major-general, serving mostly in the South and West. In the sortie from Atlanta, Ga., he was killed July 22, 1864.

**Walker** (WILLIAM JOHNSON), M. D., b. at Charlestown, Mass., Mar. 15, 1790; graduated at Harvard 1810; became a skilful and highly-successful surgeon at Charlestown, and accumulated a large fortune. D. at Newport, R. I., Apr. 2, 1865. During his lifetime he distributed some $400,000 to objects of public utility, and by his will left nearly $1,000,000 to various institutions of learning.

**Walker** (WILLIAM SIDNEY), b. at Pembroke, Wales, Dec. 4, 1795; educated at Eton School; graduated at Trinity College, Cambridge, 1819; contributed to Charles Knight's *Quarterly Magazine;* was fellow there 1822–29, during which period he became blind; afterward gained a scanty subsistence by his pen in London, where, after years of suffering from strange hallucinations due to a painful disease, he d. Oct. 15, 1846. He enjoyed at college an immense reputation for talent and literary ability, scarcely justified by his desultory performances, and was well known as the intimate college friend of Praed, Derwent Coleridge, and John Moultrie, of whom the latter edited his *Poetical Remains with a Memoir* (1852). At the age of seventeen he published an epic poem, *Gustavus Vasa* (1813), translated while an undergraduate *Poems from the Danish* (1816), subsequently edited a *Corpus Poetarum Latinorum* (Cambridge and London, 1827; new ed. 1854), and left in MS. *Shakspeare's Versification and its Apparent Irregularities, explained by Examples from Early and Late English Writers* (1852; 3d ed. 1859), and *A Critical Examination of the Text of Shakspeare, etc.* (3 vols., 1859), both edited by W. N. Lettsom.

**Walker Creek,** tp., Lafayette co., Ark. P. 520.

**Walker Creek,** tp., Ellis co., Kan. P. 23.

**Walker's,** tp., Etowah co., Ala. P. 524.

**Walker's Creek,** tp., Rockbridge co., Va. P. 2467.

**Walker's Lake,** in Esmeralda co., Nev., is 45 miles long and 20 miles wide, and has an elevation of 4000 feet. It receives the waters of Walker's River, and has no outlet. Its waters afford fine trout, but are brackish and alkaline.

**Walker's River** rises in the Sierra Nevada of California by the E. and W. forks. The waters flow into Walker's Lake, Nev.

**Walk'erton,** p.-v., cap. of Bruce co., Ont., Canada, on Saugeen River, 30 miles from Saugeen (Southampton), and on Wellington Grey and Bruce Railway. It has 3 weekly newspapers. P. about 1200.

**Walkerton,** p.-v., St. Joseph co., Ind.

**Walk'erville,** tp., Greene co., Ill. P. 800.

**Walk'ing-Leaf,** the usual name of *Camptosorus rhizophyllus,* formerly classified in the genus *Asplenium,* a curious North American fern found in the Northern and Middle States of the U. S., derives both its common and its scientific name from the peculiarity of propagating by striking the tips of its leaves into the ground, where they take root and give origin to new plants.

**Walking-Stick,** a name given to insects of the family Phasmidæ, which belongs to the order Orthoptera. The body is elongated and often linear, and in some resembles a twig or dried stick, whence the name; the head is small and oblong; the antennæ filiform and moderate; the legs are long, slender, and gressorial, none being adapted for grasping or for leaping; the wings are rudimentary or wanting. The species are sluggish animals, chiefly found on twigs and leaves, and their resemblance to such parts is doubtless an adaptation for protective purposes. A species (*Diaphemora femorata*) is not uncommon in portions of the U. S.; its average size is between three and four inches. THEODORE GILL.

**Walky'ries** [Icelandic, *Valkyrjur;* Ang.-Sax. *Välcyrigear,* from *val,* the "battlefield," and *kjora,* to "choose"], one of the most sublime, but also one of the most terrible, creations of the Scandinavian mythology. They were beautiful young maids in the service of Odin; Hrist and Mist were his two cup-bearers, the former name signifying a black cloud, the latter a watery, floating, and trembling vapor, as, in general, ideas abstracted by observation of nature seem to be most curiously mixed in the conceptions of these superhuman beings. Clad in radiant armor, surrounded with the subdued brightness of an aurora borealis, and with light streaming from the points of their lances, they ride through the air, three and three, sent by Odin to attend to battles. In Njals Saga they sit on a hill overlooking the battle between Sigtryg with the silken beard and King Brian of Ireland, and while they sing their weird songs they weave the battle web, allotting death and victory according to the orders of Odin. Generally, however, they are imagined as hovering over battles, sometimes even as participating in the fight, marking with the point of their lance the heroes who shall die and whom they shall conduct to Walhalla. In some respects the idea of the Walkyries resembles that of the Norns or Destinies, though they never attain that lofty, stern, and inapproachable dignity which characterizes those mysterious deities, to whom Odin himself must bow. The Walkyries, although superhuman beings, are not goddesses. They fall in love

with men, and then they distribute death and victory in battle according to their own passions. Then Odin expels them from Walhalla, dooms them to marriage, or touches them with his magic rod, and drives them into a trance, in which they lie sleeping till the warrior comes who understands how to break the spell. This is the story of Brynhild and Sigurd, and in such cases the Walkyries of the Scandinavian mythology resemble the German swan-maidens, though they never show that tame sentimentality or that exaggerated wildness which characterizes the German fiction.

CLEMENS PETERSEN.

**Wall,** tp., Ford co., Ill. P. 588.

**Wall,** tp., Monmouth co., N. J. P. 2671.

**Wall** (GARRET D.), b. in Monmouth co., N. J., Mar. 10, 1783; was admitted to the bar 1807; was clerk of the supreme court 1812–17; quartermaster-general 1815–37; was appointed U. S. district attorney, and elected governor by the legislature 1829, but declined the latter office; was U. S. Senator 1835–41, and judge of the court of errors and appeals 1848–50. D. at Burlington Nov. 22, 1850.

**Wall** (CHARLES WILLIAM), D. D., b. early in the nineteenth century; educated at, and senior fellow of, Trinity College, Dublin; took orders in the Church of England, and became professor of Hebrew in the University of Dublin and vice-provost of Trinity College. Author of *An Examination of the Ancient Orthography of the Jews and the Original State of the Text of the Hebrew Bible* (1835) and *Proofs of the Interpolation of the Vowel Letters in the Text of the Hebrew Bible* (1857).

**Wall** (JAMES W.), son of Garret D., b. at Trenton, N. J., in 1820; graduated at Princeton 1839; became a lawyer at Trenton, and subsequently (1847) at Burlington; filled the posts of commissioner of bankruptcy and of mayor of Burlington; visited Europe 1854; wrote against the restrictions imposed upon the press at the outbreak of the civil war, for which he was imprisoned some weeks in Fort Lafayette as a sympathizer with the rebellion; was welcomed with demonstrations of enthusiasm by his political friends on his release; was elected U. S. Senator to fill an unexpired term Jan., 1863, and removed to Elizabeth 1869. D. at Elizabeth June 9, 1872. Author of various literary essays and addresses, and of *Foreign Etchings, or Outline Sketches of the Old World's Pleasant Places* (Burlington, 1855).

**Wall** (WILLIAM), D. D., b. in England in 1646; was for fifty-two years (1676–1728) vicar of Shoreham, Kent, where he d. in 1728. Author of a *History of Infant Baptism* (1705), which is considered the standard work in favor of such baptism, and was translated into Latin; of a *Defence* (1720) of that book, *Critical Notes on the Old Testament* (2 vols., 1734), and other theological writings.

**Wal'labout Bay,** in Brooklyn, N. Y., is a bight in the East River, opposite the S. E. angle of Manhattan Island. The Wallabout is separated by an island from the East River. The island and all the land abutting on the bay is the property of the U. S. government, and the whole constitutes the Brooklyn navy-yard. The Wallabout was the mooring-ground of the Jersey and other British prison-ships during the Revolution.

**Wallaby,** a kangaroo. See APPENDIX.

**Wal'lace,** county of W. Kansas, bordering on Colorado, drained by Smoky Hill River and its affluents, and traversed by Kansas Pacific R. R.; surface mostly elevated tableland. Cap. Wallace. Area, about 2000 sq. m. P. 538.

**Wallace,** tp., Independence co., Ark. P. 308.

**Wallace,** tp., La Salle co., Ill. P. 734.

**Wallace,** p.-v. and tp., cap. of Wallace co., Kan., on Kansas Pacific R. R., includes Fort Wallace, an important military post.

**Wallace,** p.-v. and tp., Chester co., Pa. P. 746.

**Wallace** (ALFRED RUSSEL), b. at Usk, Monmouthshire, England, Jan. 8, 1822; educated at the grammar school of Hertford; was articled to an elder brother as land-surveyor and architect; abandoned that profession to devote himself to natural history; undertook in 1848, with Mr. H. W. Bates, an exploration of Northern Brazil; resided some months at Pará; explored the Amazon and Negro rivers; obtained numerous vocabularies of Indian tribes; made extensive collections in ornithology and botany, which were mostly lost at sea; returned to England 1852; published *Travels on the Amazon and Rio Negro, with Remarks on the Vocabularies of the Amazonian Languages* (1853), aided in the linguistic part by Robert G. Latham, and *Palm Trees of the Amazon, and their Uses* (1853); spent eight years in exploring the vast islands of the East Indies, especially the Moluccas, Celebes, and New Guinea; arrived, independently of Mr. Darwin's researches, at a theory of natural selection, which he embodied in a paper sent to Sir Charles Lyell, *On the Tendency of Varieties to depart indefinitely from the Original Type,* and read before the Linnæan Society July 1, 1858, simultaneously with Mr. Darwin's paper *On the Tendency of Species to form Varieties,* etc., being the first public announcement of the so-called "Darwinian theory;" brought from the East Indies in 1862 more than 8000 birds and more than 100,000 entomological specimens; was occupied for several years in the study and classification of his vast collections; published *The Malay Archipelago, the Land of the Orang-utan and the Bird of Paradise, a Narrative of Travel 1854–62, with Studies of Man and Nature* (2 vols., 1869), accompanied by 9 maps and 50 illustrations; presented many papers to the *Transactions* of the Linnæan, Zoological, Ethnological, Anthropological, and Entomological societies, some of which were collected in a volume, *Contributions to the Theory of Natural Selection* (1870); was awarded in 1868 the royal medal of the Royal Society, and in 1870 the gold medal of the Geographical Society of Paris; has become noted for his investigations of spiritualism, in which he is a believer, as shown by his volume on *Miracles and Modern Spiritualism* (1875), and has lately issued, simultaneously in English, French, and German, an elaborate and important work, *On the Geographical Distribution of Animals* (2 vols., 1876). PORTER C. BLISS.

**Wallace** (DAVID), b. at Philadelphia, Pa., Apr. 4, 1799; graduated at West Point 1821; studied law in Brookville, Ind., where his family had settled in 1817; was several times elected to the State legislature; was a member of the Indiana constitutional convention; lieutenant-governor 1834–37, governor 1837–40, member of Congress 1841–43, and judge of common pleas for Marion co. 1856–59. D. at Indianapolis Sept. 4, 1859.

**Wallace** (HORACE BINNEY), b. at Philadelphia, Pa., Feb. 26, 1817, was the youngest son of John Bradford Wallace; studied for two years at the University of Pennsylvania; graduated at Princeton 1835; studied medicine, chemistry, and law, but never adopted a profession; contributed largely to literary periodicals; published anonymously a novel, *Stanley, or the Recollections of a Man of the World* (1838); edited, in conjunction with Judge Hare, *American Leading Cases in Law* (2 vols., 1847; 3d ed. 1852), *Smith's Leading Cases* (4th Amer. ed., 2 vols., 1852), and White and Tudor's *Leading Cases in Equity* (2d Amer. ed., 3 vols., 1852), all copiously annotated; aided R. W. Griswold in his *Napoleon and the Marshals of the Empire* (2 vols., 1847); travelled in Europe 1849–50, and again 1852, giving assiduous study to philosophical problems, and d. by his own hand at Paris, in consequence of an attack of brain disease, Dec. 16, 1852. Two posthumous volumes of his miscellaneous writings were published—*Art and Scenery in Europe, with other Papers* (1855), and *Literary Criticisms and other Papers* (1856).

**Wallace** (Sir JAMES), b. in Great Britain about 1730; became post-captain in the navy 1771, commanded the fleet on the Newport station 1775, and conducted the naval expedition up the Hudson River Oct., 1777, when Kingston was destroyed and several other towns laid waste; was captured in the Experiment by D'Estaing Sept. 24, 1779; commanded the Warrior in Rodney's victory over De Grasse, Apr. 12, 1782; was governor of Newfoundland 1793–95; became rear-admiral 1794, vice-admiral 1795, and rear-admiral of the blue Jan. 1, 1801. D. in London Mar. 6, 1803.

**Wallace** (JOHN BRADFORD), b. in Somerset co., N. J., Aug. 17, 1778; graduated at Princeton 1794; was admitted to the Pennsylvania bar 1797; wrote in defence of the Federal party, and practised with distinguished success in Philadelphia, where he d. Jan. 7, 1837. He edited *Reports of Cases Third Circuit Court* (1801), Abbot on *Shipping* (1802), and wrote *Remarks upon the Law of Bailment* (1840). A *Memoir* by his widow was privately printed (1848).

**Wallace** (JOHN WILLIAM), b. at Philadelphia, Pa., Feb. 17, 1815, son of John Bradford (1778–1837); graduated at the University of Pennsylvania 1833; studied law in Philadelphia and in London at the Inns; became master in chancery of the Pennsylvania supreme court; was reporter to the third circuit U. S. circuit court 1842–53; has been reporter of the U. S. Supreme Court since Mar. 21, 1864, and is president of the Historical Society of Pennsylvania. Author of *The Reporters, chronologically arranged, with Occasional Remarks upon their Respective Merits* (1843), and of several legal and historical discourses; editor of *Cases in U. S. Circuit Court* (2 vols., 1842–53) and *Cases argued and adjudged in the U. S. Supreme Court, etc.* (1864 *seq.*), *British Crown Cases Reserved* (6 vols., 1839–53), and *American Leading Cases* (2 vols., 1857), and after the death of his brother, Horace B., revised the 4th ed. of John William Smith's *Leading Cases in Law* (2 vols., 1857).

**Wallace** (Lewis), b. in Fountain co., Ind., about 1828; studied law and was admitted to the bar, but during the war with Mexico served as second lieutenant 1st Indiana Vols. Returning to Indiana and his profession, he was for one term a member of the State senate; early in 1861 became adjutant-general of Indiana, but in April took command of the 11th Indiana (3 months') Vols., which served in West Virginia, being engaged in the capture of Romney, etc. On the expiration of its term the regiment was reorganized in Aug., 1861, with Wallace again at its head, but Sept. 3 he was commissioned brigadier-general of volunteers, and stationed for a time in Kentucky. At the capture of Fort Donelson, where he commanded a division and the centre of the Union lines, he displayed such ability and courage that his commission as major-general of volunteers followed, Mar. 21, 1862. In the succeeding battle of Shiloh (which see), though not engaged the first day, he rendered efficient aid in the second day's fighting and subsequent advance upon Corinth; in Nov., 1862, was president of the court to inquire into the conduct of Gen. Buell; commanded Middle department and 8th corps 1864; defeated at Monocacy. Member of commission for trial of persons implicated in the murder of Pres. Lincoln and attempted assassination of Mr. Seward.

**Wallace** (Robert), D. D., b. in Perthshire, Scotland, in 1697; educated at the University of Edinburgh; became minister of Moffat 1723, and of Greyfriars' church, Edinburgh, 1733. D. in 1771. Author of *A Dissertation on the Numbers of Mankind in Ancient and Modern Times* (1753), *Characteristics of the Present Political State of Great Britain* (1758), and *Various Prospects of Mankind, Nature, and Providence* (1761).

**Wallace** (Robert), b. in Scotland about 1810; graduated at the University of Glasgow, and became collegiate tutor to the University of London. D. in London Nov. 16, 1858. Author of numerous geographical, mathematical, and mechanical textbooks, of *A Dissertation on the True Age of the World* (1844), *Anti-Trinitarian Biography* (3 vols., 1850), and *A History of the Steam-Engine* (new ed. 1859); was editor of the *Public Instructor* and other periodicals, and co-editor (with Profs. De Lolme and H. Bridgeman) of Cassell's *French Dictionary* (new ed. 1859).

**Wallace** (Robert), D. D., b. in the parish of St. Andrew's, Fifeshire, Scotland, June 24, 1831; educated at the universities of St. Andrew's and Edinburgh; took orders in the Scottish Church; became minister of Newton-upon-Ayr 1857, of Trinity College church, Edinburgh, 1860, and of Old Greyfriars, Edinburgh, 1868; examiner in philosophy at the University of St. Andrew's 1866, professor of divinity and church history at the University of Edinburgh 1872, and on the death of Alexander Russel in July, 1876, succeeded him as editor of the *Scotsman*, the leading daily newspaper of North Britain.

**Wallace** (R. R.), U. S. N., b. Nov. 7, 1835, in Tennessee; graduated at the Naval Academy in 1856; became lieutenant in 1861, commander in 1870; served in the Fort Jackson at both the Fort Fisher fights, and highly commended in the report of her commanding officer of Jan. 16, 1865. Foxhall A. Parker.

**Wallace,** or **Walleys** (William, usually but improperly called Sir William), b. in Scotland about 1270. Most of the events of his career are involved in great uncertainty, his true history being largely falsified by the rhyming chroniclers of the next generation. He appears to have been the younger son of Sir Malcolm Wallace of Ellerslie, Renfrewshire. According to one account, having quarrelled with the son of the English governor of Dundee Castle while a student at the high school of that city, he stabbed his antagonist, and fled to the Southern Highlands; according to another version, the event is represented as a duel which took place in 1295. He first appears in authentic history in 1297 as leader of a large band of insurgents against the authority of the English king, Edward I., who then attempted the conquest of Scotland. Emboldened by the success of several preliminary skirmishes, he attacked the town of Scone, where an English justiciary was holding court, killing or taking prisoners many of the English, while Sir William Douglas about the same time captured two of the English strongholds. Edward thereupon sent into Scotland a considerable force under the command of Sir Henry Percy and Sir Robert Clifford, who successfully repulsed a night-attack made by Wallace near Lochnaber, and drove him back into Ayrshire, and received, by a treaty at Irvine, the submission of most of the Scottish leaders. Wallace and Murray of Bothwell alone refused to lay down their arms, and withdrew to the Northern Highlands, where they organized large forces and captured the English garrisons at Aberdeen, Forfar, and Montrose. Wallace then advanced to the siege of Dundee, being now recognized as commander-in-chief of the national insurrection. Edward I. was at this time in Flanders, but his general, John de Warrenne, earl of Warrenne and Surrey, who in the previous year had been appointed guardian of Scotland, having gathered a powerful army and advanced toward Stirling, Wallace abandoned the siege and marched against him. After a vain attempt at negotiation, Earl Surrey was completely defeated at Cambuskenneth (or Stirling Bridge) Sept. 10, 1297, and pursued to Berwick. Wallace passed the border and ravaged Cumberland and Northumberland. The forces engaged are traditionally stated as respectively 50,000 English and 40,000 Scots, but these numbers are evidently exaggerated. On his return, Wallace was recognized in Scotland as guardian of the realm in the name of John Baliol, then a prisoner in the Tower of London. In the following year Edward proceeded to Scotland with a force numbering, according to Scottish accounts, 80,000 infantry and 7000 cavalry, and gained over Wallace a decisive victory at Falkirk July 22, by which the English rule in Scotland was re-established. The career of Wallace is involved in great obscurity for several years, but it is certain that he refused to submit, and carried on a guerilla warfare on a small scale for several years. At one time he went to France with a few followers to seek the aid of King Philip, and was thrown into prison by that monarch, but soon liberated and recommended to the pope, who vainly summoned Edward to evacuate Scotland in May, 1301. Wallace took part in the Scottish revolt of 1303, though not in any conspicuous capacity; was declared an outlaw on account of his refusal to respect the treaty between Edward and John Comyn, earl of Badenoch (Feb. 4, 1304), large rewards being offered for his capture; was betrayed by Sir John Menteith into the hands of the English near Glasgow early in 1305; was taken to London, tried for treason in Westminster Hall, condemned Aug. 23, 1305, and hanged, drawn, and quartered at West Smithfield the following day. His head was placed above London Bridge and his limbs sent to Newcastle, Berwick, Perth, and Stirling. (See the *Lives* by Carrick (1830), J. S. Watson (1862), Paterson, and Tytler, the *Histories of Scotland* of Tytler and Burton, and for the English version William Longman's *History of the Life and Times of Edward I.* (2 vols., 1869).) Porter C. Bliss.

**Wallace** (William), LL.D., b. at Dysart, Fifeshire, Scotland, Sept. 23, 1768; taught himself French, Latin, and mathematics while acting as bookbinder and shopman; obtained the post of assistant professor of mathematics at Perth Academy 1794; became mathematical master in the Royal Military College at Great Marlow, afterward at Sandhurst; lecturer on astronomy 1818, and was professor of mathematics in the University of Edinburgh 1819–38. D. at Edinburgh Apr. 28, 1843. He wrote largely on mathematics for scientific periodicals and for the *Encyclopædia Britannica;* prepared textbooks on conic sections and geometry; edited Playfair's *Elements,* and was author of a *New Book of Interest* (1794).

**Wallace** (William H. L.), b. at Urbana, O., July 8, 1821; removed to Illinois with his father in 1833; studied law, and was admitted to the bar in 1846, but the war with Mexico occurring, he enlisted in Col. Hardin's 1st Illinois Vols., of which he became adjutant, and was engaged in the battle of Buena Vista. Resuming his profession, he was in 1853 chosen district attorney for the ninth Illinois district. In May, 1861, he was appointed colonel 11th Illinois Vols., and at Fort Donelson (Feb., 1862) commanded a brigade in McClernand's division with conspicuous gallantry and ability, which led to his appointment as brigadier-general of volunteers in March. In the succeeding battle of Shiloh (which see) Wallace commanded Smith's old division, which withstood for nearly six hours the furious assaults of the enemy, and was the last to leave the field, Wallace falling mortally wounded in an ineffectual attempt to resist the overwhelming onslaught. D. at Savannah, Tenn., Apr. 10, 1862.

**Wallace** (William Ross), b. at Lexington, Ky., in 1819; educated in collegiate institutions at Bloomington and South Hanover, Ind.; studied law at Lexington; settled in New York City 1841, and has since resided there, chiefly engaged in literary pursuits. Author of several volumes of poems.

**Wallace** (William Vincent), b. at Waterford, Ireland, in 1814, son of a military band-master, from whom he inherited a genius for music and a taste for roving; obtained at the age of eighteen considerable reputation as a pianist and violinist; visited Australia, New Zealand, and the islands of Oceanica, where he is said to have had some very romantic adventures; also India, South America, and the U. S.; brought out at Drury Lane his successful opera, *Maritana* (1846), which was followed by *Matilda of Hungary, Lurline, The Amber Witch, The Maid of Zurich,*

*Love's Triumph, Gulnare, Olga, The Desert Flower*, and others, and was author of marches, polkas, fantasias, etc., and of many songs which have become popular favorites. D. at Château de Bayen (Haute-Garonne), France, Oct. 12, 1865. His remains were buried in Kensal Green Cemetery, near London. *Memoirs* were published (in French) by M. A. Pougin (Paris, 1866).

**Wal'laceburg,** p.-v., Kent co., Ont., Canada, on the navigable river Sydenham, 17 miles N. W. of Chatham. It has a weekly newspaper. P. about 600.

**Walla'chia,** the largest of the two Danubian principalities which form Romania, is bounded N. by Hungary, Transylvania, and Moldavia, and E., S., and W. by Turkey, from which it is separated by the Danube, and comprises an area of 27,930 sq. m., with 3,421,000 inhabitants. The surface is a large, unbroken plain sloping from the Carpathian Mountains to the Danube, along which are found large tracts of swamps and marshes. The climate is extreme; the winter is severe and long, snow covering the ground often for four months, and the summer is extremely hot and subject to long droughts. The whole plain is almost treeless, but the soil is very fertile, even rich, and though agriculture, the main occupation of the inhabitants, is in a very backward state, rich crops of wheat, maize, millet, wine, and fruits are gathered, and immense herds of cattle and horses reared. The inhabitants belong to the Greek Church and speak the Romanian language, a spoiled Latin, mixed with Gothic, Greek, Turkish, and Slavonian elements. The lower classes live in very abject circumstances, and a middle-class does not exist, as the country has no manufactures, and its trade is carried on by the Jews, who by the natives are considered as an inferior, and even as an odious, race. Cap. Bucharest. (See MOLDAVIA and ROMANIA.)

**Wal'lack** (JAMES WILLIAM), b. in London, England, Aug. 24, 1795, son of William, a comedian and vocalist, and of Elizabeth Field, who for several years played leading female characters with Garrick; made his first appearance on the London stage at the age of seven years; was engaged by Sheridan at Drury Lane; played with Edmund Kean in Shakspearean dramas; came to the U. S. 1818; appeared as Macbeth at the Park Theatre, New York, Sept. 7, 1818; became stage-manager at Drury Lane 1820; alternated between England and the U. S. for several years; opened in 1837 the National Theatre, New York, burned down in 1839; established in 1852 Wallack's Lyceum, afterward Wallack's Theatre, on the corner of Broadway and Broome street, rebuilt in 1861 at the corner of Broadway and Thirteenth street, and still a favorite place of amusement. He was a superior comedian and manager, owing much of his success to his care in the selection of competent supporters in his companies and to his regard for artistic proprieties in the details of stage costumes and scenery. D. in New York Dec. 25, 1864.—His son, JOHN LESTER, b. in New York Jan. 1, 1818, known for some time as J. W. LESTER, is now (1876) proprietor of the theatre, maintaining its reputation with success, and has adapted some French comedies to the American stage.

**Wal'lagrass Plantation,** tp., Aroostook co., Me. P. 297.

**Wallaroo,** a kangaroo. See APPENDIX.

**Wal'la Wal'la,** S. E. county of Washington Territory, bounded, in 1870, N. by Snake River, E. by Idaho, S. by Oregon, and W. by Columbia River, but in 1875 the new county of Columbia was formed from the E. portion of this county; surface variegated, usually well timbered, with many broad valleys and fertile plains. There are flour-mills, saw-mills, and breweries, and some manufactures of saddlery, sash, doors, and blinds, bagging, and tin, copper, and iron ware. Principal live-stock, cattle, horses, sheep, and swine. Staples, wheat, oats, wool, and lumber. Cap. Walla Walla. Former area, about 3500 sq. m. P. 5300.

**Walla Walla,** p.-v., cap. of Walla Walla co., Wash. Ter., on Walla Walla and Columbia River R. R., in the midst of a rich agricultural region, has 8 churches, 7 schools, 2 banks, 3 newspapers, 1 foundry and machine-shop, 3 flouring-mills, and 4 hotels. Principal business, farming and stock-raising. P. about 2500.

W. I. MAYFIELD, ED. "SPIRIT OF THE WEST."

**Walla Walla River,** a small stream of Washington Territory which flows into the Columbia at Wallulu, near old Fort Walla Walla.

**Wal'lenstein,** or **Waldstein, von** (ALBRECHT WENZEL EUSEBIUS), b. on the family estate of Hermanitz, Bohemia, Sept. 14, 1583; was educated in the Protestant faith, but came after the death of his parents under the guardianship of his uncle, Albrecht von Slavata, who sent him to the Jesuit academy of Olmütz, where he was converted to Romanism. After studying at the universities of Padua and Bologna, and travelling through Italy, Spain, France, and Holland, he served in Hungary against the Turks in the army of the emperor Rudolf, under Gen. Basta, and married in 1606 an old widow, by whose death in 1614 he inherited very extensive estates in Moravia. His uncle bequeathed to him fourteen estates in Bohemia, and he thus became one of the largest landed proprietors in Moravia and Bohemia. In 1616 he organized a regiment of dragoons at his own expense, and hastened to the rescue of the city of Gradisca, which was besieged by the Venetians. The emperor now made him a count, and by his marriage with the daughter of Count Harrach he obtained connections and influence at the court of Vienna. When the revolution which opened the Thirty Years' war broke out in Bohemia in 1618, he sided with the emperor, saved the imperial treasury containing a large sum from falling into the hands of the insurgents, equipped a new regiment of dragoons, and when, after the battle of the White Mountain—in which, however, he was not present—enormous confiscations took place in Bohemia, he bought of the emperor estates to the value of 7,290,228 florins. In 1623 the emperor created him prince, and in the following year hereditary duke of Friedland. With his success his ambition increased. In 1625, when the Protestant princes of Northern Germany, under the leadership of Christian IV. of Denmark, and in alliance with Bethlen Gabor of Transylvania, arose against the emperor, Wallenstein offered to organize an army of 50,000 men and lead it according to the orders of the emperor. After some negotiations the offer was accepted, and in an incredibly short time he actually created an effective army of about 40,000 men. Apr. 25, 1626, he defeated Count Mansfeld, one of the most famous generals of the time, at Dessau, and pursued him through Silesia into Hungary, where this part of the war ended by the dissolution of Mansfeld's army and an advantageous peace with Bethlen Gabor. Returning through Silesia, Wallenstein occupied Brandenburg and Pomerania, expelled the refractory dukes of Mecklenburg, penetrated through Holstein and Sleswick into Jutland, and compelled Christian IV. to conclude peace. In reward the emperor created him duke of Mecklenburg in 1629, and thus the obscure Bohemian nobleman had become a prince of the German empire. But at this moment his career received a severe check. He was haughty in his bearing and exacting in his demands. Many people complained of him, and his army, now numbering about 100,000 men and stationed at various points of Northern Germany, was felt as a very heavy burden. Moreover, there was something mystical in his character, which, while it attracted people below him, made him suspicious to the eyes of people above him, and the emperor could not fail to observe that such a man at the head of such an army was a great danger. In Sept., 1630, he was dismissed and his army dissolved. He retired to his estates in Bohemia, where he lived in royal splendor, occupied with the administration of his vast property, with astrological studies, and with schemes of the most daring ambition. When Gustavus Adolphus appeared successful in Germany, Wallenstein proposed to raise an army and attack the emperor in joint operation with him, but the Swedish king had no confidence in him, and dropped the negotiations. Meanwhile, after the defeat of Tilly and the annihilation of his army, when the Saxons invaded Bohemia and the Swedes penetrated into Bavaria, the situation of the emperor became almost desperate, and the reinstatement of Wallenstein in power seemed almost the only means of escape. The emperor made the humblest approaches and consented to the most humiliating conditions. Wallenstein received the supreme military authority in Germany, the right of appointing his own officers, the rights of confiscation, amnesty, and pardon—yea, even the right of negotiating peace. But two months after his appointment there was a new army ready for battle. In the spring of 1632 the Saxons were expelled from Bohemia, and Wallenstein occupied a strongly-fortified position at Nuremberg in front of the army of Gustavus Adolphus. The attempt of the Swedes at dislodging him (Sept. 3) failed. Both the armies moved into Saxony, and on Nov. 16, 1632, the battle of Lutzen took place. Gustavus Adolphus fell, but Wallenstein was defeated. He retreated into Bohemia, and here he remained inactive for over a year, in spite of the entreaties and positive orders of the emperor. He opened negotiations with the Swedes, the Saxon princes, and Richelieu. His plan was, by an alliance with these powers to compel the emperor to accept such a peace as they would grant him, and the special goal of his personal ambition seems to have been the acquisition of the Bohemian crown. He failed, however. Although he succeeded in concealing his schemes from the emperor, he failed to detect the intrigues of the court in his own army, and while he still hesitated, and had made no decisive step, some of his most important generals—Gallas, Piccolomini, Altringer, Marradas, and Colloredo—fell from him, and with

them the army. On Feb. 23, 1634, he fled from his headquarters at Pilsen to seek rescue and support by the Swedish corps which approached under Duke Bernhard, but two days afterward he was assassinated at Eger by one of his own followers, Col. Butler. His *Letters* have been published by F. Förster in 3 vols. (1828–29), and monographs on his life and character have been written by Förster (1834 and 1844), Aretin (1846), Hurter (1855), Dudik (1858), Fiedler (1860), Ranke (1869), Gindely (1875). The picture of Wallenstein in Schiller's tragedy is generally considered as striking as it is vivid and impressive.

**Wal'ler,** county of S. E. Texas, formed since the census of 1870, bounded E. by Brazos River, and traversed by Houston and Texas Central R. R.; surface undulating, soil productive. Cap. Hempstead. Area, 350 sq. m.

**Waller** (Edmund), b. at Coleshill, Hertfordshire, England, Mar. 3, 1606, of an ancient and wealthy family, was first cousin, through his mother, of John Hampden, and distantly related to Cromwell; educated at Eton and at King's College, Cambridge; inherited in boyhood an estate of £3500 a year; was chosen to Parliament for Agmondesham at the age of nineteen, on the accession of Charles I. (1625), and sat in that body much of the time for sixty years; married in 1631 a London heiress, who soon died; became noted as a writer of elegant and rhythmical verses, most of which were in praise of Sacharissa (Lady Dorothy Sidney) and Amoret (Lady Sophia Murray), to whom he unsuccessfully paid court; married Miss Mary Bresse, by whom he had thirteen children; was appointed after the battle of Edgehill (1642) one of the Parliamentary commissioners to negotiate with the king at Oxford; was gained over by the royalists, and entered into a conspiracy known as "Waller's plot" for the restoration of royal authority; but the plot having been discovered May 31, 1643, he was imprisoned for a year, fined £10,000, and banished the kingdom, only saving his life by abject humiliation before the House of Commons, confessing his guilt and incriminating his companions, three of whom were hanged; spent eight years of exile in France and Italy; was allowed to return about 1653, when he became a favorite with Cromwell, who several times visited his mother (a determined royalist), at Beaconsfield, where Waller now took up his abode; celebrated the praises of Cromwell in *A Panegyric to my Lord Protector* (1654), which contains some of his most effective stanzas; lamented his death in another poem, but welcomed the return of Charles II. by some indifferent verses *To the King upon his Majesty's Happy Return* (1660); was a general favorite with all parties on account of his wit and eminent social qualities; published a volume of his poems 1645, and again 1664, which ran through many editions, were highly admired and imitated. D. at Beaconsfield Oct. 21, 1687. Of the twenty-five or more editions of his poems, the most valued are that of 1711, edited by Bishop Atterbury, and containing two portraits of the poet, one in his twenty-third and one in his seventy-sixth year, and that of 1729, with a *Life* by Fenton and a portrait by Vertue. Some of the editions contain a number of Waller's parliamentary speeches. There are modern *Lives* by Bell (1853) and Gilfillan (1857) accompanying the latest editions of the *Poems.* Porter C. Bliss.

**Waller** (Edwin), b. in Spottsylvania co., Va., in 1800; became an alcalde in Texas; was the owner of the Sabine, a vessel which in 1832 sailed past the Mexican post of Velasco, the Mexican authorities having determined to levy a duty on the exportation of cotton, then a new branch of Texan commerce. This was the first overt act of resistance to the Mexican exactions in Texas. Mr. Waller was for some time imprisoned. His vessel brought back two cannon, which afterward did duty in the Texan navy. Waller became a leading spirit in the following war; was wounded at the capture of Velasco; helped form the provisional government; was a member of the convention of 1836, and assisted in framing the constitution of that year; selected Austin as the capital 1839; was president of the board of land commissioners; was the first mayor of Austin; postmaster-general of Texas; was long chief-justice of Austin co.; was the first to sign the ordinance of secession in 1861, his last political act.

**Waller** (John Francis), LL.D., b. in Limerick, Ireland, in 1810; graduated at Trinity College, Dublin, 1831; was called to the Irish bar 1833; became vice-president of the Royal Irish Academy 1864; was for many years editor of the *Dublin University Magazine;* editor of William Mackenzie's *Imperial Dictionary of Universal Biography* (Glasgow, 6 vols. imp. 8vo, 1866); contributed to Cassell's *Biographical Dictionary* (1869); edited the *Works* of Goldsmith, with a *Life* (1864), and is author of *The Slingsby Papers* (1852), *Poems* (1854), *The Dead Bridal* (1856), and other works.

**Waller** (Sir William), b. in Kent, England, in 1597; educated at Magdalen College and Hart Hall, Oxford, and at Paris; served in Germany during the early part of the Thirty Years' war as a volunteer in the army of the Protestant princes; was knighted by Charles I. on his return; was elected by the town of Andover to the Long Parliament (1640), in which he was a zealous member of the Presbyterian party; was appointed general and second in command of the Parliamentary forces under the earl of Essex 1642; took a leading part in the reduction of Portsmouth in that year; was defeated by the royalists at Lansdowne, near Bath, July 5, 1643, and again at Roundway Down, near Devizes, July 13, but gained a signal victory over Sir Ralph Hopton at Cheriton (or Cherrytown) Down, Alresford, near Winchester, Mar. 29, 1644; was defeated by Charles I. in person at Cropredy Bridge, near Banbury, Oxfordshire, July 29; joined the earl of Manchester in his march against Oxford, and took part in the indecisive engagement at Newbury, Berkshire, Oct. 27; was deprived of his military command by the "Self-denying Ordinance" Apr., 1645, but continued to be a leader of the Presbyterians in Parliament; was one of the eleven members of Parliament who were impeached of high treason by the army, June, 1647, and expelled and twice imprisoned, but was soon readmitted to his seat; was a second time expelled, together with all the Presbyterians, by Col. Pride, Dec., 1648; remained in retirement until the Restoration, when he sat as a member of the council of state Feb., 1660, and of the Convention Parliament Apr. to Dec., 1660. D. at Osterley Park, Middlesex, Sept. 19, 1688. Some of his immediate descendants settled in Maryland and Virginia. He left in MS. a *Vindication*, published in 1793, and *Divine Meditations*, printed in 1680. Porter C. Bliss.

**Wallette',** county of N. W. Dakota, bordering on Montana and British America, bounded on the S. by Missouri River and drained by its affluents; surface rolling, most of it constituting the Plateau du Couteau du Missouri. Area, about 3350 sq. m.

**Wall'-Flower,** the *Cheiranthus cheiri*, a European half-shrubby cruciferous plant, often growing on old walls, whence the name. It is a popular garden-flower, having blossoms single or double, of varied colors and of a rich fragrance. The Western wall-flower, or "yellow phlox" of the U. S., is *Erysimum asperum*, var. *Arkansanum*, a fine cruciferous plant.

**Wal'lich** (Nathaniel), M. D., b. at Copenhagen, Denmark, June 28, 1786; studied medicine; went to India 1807 in the employment of the Danish government at Serampore; devoted himself to botany, and after the transfer of the Danish possessions to England transferred his services to the East India Company, and was superintendent of the Calcutta botanic garden from 1815 to 1847, when he returned to Europe and settled in London; was elected vice-president of the Linnæan Society 1849, and d. in London Apr. 28, 1854. He contributed to the *Transactions* of the Asiatic Society of Calcutta and of the Linnæan Society, and to Sir W. J. Hooker's *Journal of Botany;* added a copious supplement to Drs. Roxburgh and Carey's *Flora Indica* (3 vols., 1832), and was author of *Tentamen Floræ Nepalensis Illustratæ* (Calcutta and Serampore, 1824–26), *A Numerical List of Dried Specimens of Plants in the East India Company's Museum* (1828), and *Plantæ Asiaticæ Rariores* (3 vols., 1830–32), with 300 colored plates.

**Wal'lingford,** p.-v. and tp., New Haven co., Conn., on Hartford and New Haven R. R., 12 miles from New Haven, contains 4 churches, excellent schools, 1 hotel, manufactories of britannia and silver ware, 1 newspaper, a book-making establishment, public Turkish bath, and a machine-shop. P. 3676. The Wallingford Community, a branch of the Oneida Community, founded in 1850 by John H. Noyes and Henry Allen, the original proprietor, is located here. The whole property is held by three persons in trust; the religion, social life, and government are the same as those of its head and parent community. The domain comprises 340 acres, 150 of which are covered by a valuable water-power belonging to the society. The principal business is agriculture, horticulture, job printing, and book-making in all its branches. The society numbers 60 members. (See Oneida Community.) Alfred Barron.

**Wallingford,** p.-v. and tp., Rutland co., Vt. P. 2023.

**Wallis,** Switzerland. See Valais.

**Wal'lis** (John), D. D., F. R. S., b. at Ashford, Kent, England, Nov. 23, 1616; educated at Felsted School and at Emmanuel College, Cambridge, where he graduated about 1636; became a fellow of Queen's College; took orders in the Church of England 1640; was chaplain to Sir Richard Darley and to Lady Vere; became an expert in discovering the keys to MSS. written in cipher, and was employed for that purpose by the Long Parliament; obtained the living

of St. Gabriel, Fenchurch street, London, which he exchanged for St. Martin's 1643; was secretary to the Westminster Assembly of Divines 1644; became Savilian professor of geometry at Oxford 1648, and keeper of the archives at Oxford 1658; was confirmed in those posts and made one of the royal chaplains at the Restoration 1660; was one of the founders of the Royal Society 1662; had a controversy with Hobbes, who pretended to have discovered the quadrature of the circle 1655–63; attracted notice by his success in teaching a deaf and dumb child to speak; was one of the revisers of the Book of Common Prayer 1661; edited the posthumous works of Jeremiah Horrox (1673), and maintained theological controversies with the Arians, Baptists, and Sabbatarians. D. at Oxford Oct. 28, 1703. Author of *Grammatica Linguæ Anglicanæ* (1653), *Arithmetica Infinitorum* (1655), *Mathesis Universalis* (1657), *De Æstu Maris Hypothesis Nova* (1668), *Mechanica, sive de Motu Tractatus Geometricus* (3 vols., 1669–71), *Observations concerning the Swiftness of Sound* (1673), *Claudii Ptolemæi Opus Harmonicum* (1680), *A Treatise of Algebra* (1685), *Institutio Logicæ ad Communes Usus accommodata* (1687), *Theological Discourses* (1692), and other minor works, which were collectively published as *Opera Mathematica et Miscellanea* (Oxford, 3 vols. folio, 1695–99), and a volume of his *Sermons, now first Printed from the Original MSS.*, appeared in 1791, with a *Memoir and Introduction* by Rev. C. E. de Coetlogon. His work on the *Arithmetic of Infinities* was of great service to (Sir) Isaac Newton in his mathematical studies, as suggesting new views in geometry, especially by foreshadowing Newton's brilliant discoveries of the binomial theorem and the method of fluxions.

**Wallis** (Severn Teackle), b. at Baltimore, Md., Sept. 8, 1816; graduated at St. Mary's College 1832; studied law with William Wirt; was admitted to the Baltimore bar 1837; published numerous pamphlets on legal and miscellaneous subjects; travelled in Europe 1847; served in the Maryland legislature; is a trustee of the Peabody Institute at Baltimore, and since 1870 provost of the University of Maryland. Author of *Glimpses of Spain* (1849), *Spain, her Institutions, Politics, and Public Men* (1853), and a *Discourse on the Life and Character of George Peabody* (1870).

**Wal'lisville,** p.-v., cap. of Chambers co., Tex. P. 27.

**Wall'kill,** tp., Orange co., N. Y., contains several villages, the largest of which is Middletown. P. 9477.

**Wallkill River** rises in Sussex co., N. J., and flows N. N. E. through Orange and Ulster cos., N. Y., its waters flowing into the Rondout. It furnishes considerable water-power. The Wallkill Valley is a famous dairy region.

**Wall Lake,** tp., Wright co., Ia. P. 199.

**Wallon'** (Henri Alexandre), b. at Valenciennes, department of Nord, France, Dec. 23, 1812; was educated in the Normal School of Paris, and became professor of modern history and geography at the Sorbonne in 1840; was elected a member of the Legislative Assembly of 1849, but resigned his seat in 1850 on account of the restrictions under which the Assembly placed the suffrage; was again elected a member of the National Assembly of 1871, and contributed much to the final establishment of the Republic; became minister of public education in 1875, and member of the senate in 1876. His principal works are—*De l'Esclavage de la Colonie* (1847), *Histoire de l'Esclavage dans l'Antiquité* (3 vols., 1847–48), *Jeanne d'Arc* (2 vols., 1860), *La Vie de Jésus et son nouvel Historien* (1864), against Renan; *Richard II., Épisode de la Rivalité de la France et de l'Angleterre* (2 vols., 1864), *La Terreur, Étude critique sur l'Histoire de la Révolution française* (1872).

**Walloom'scoik River** rises in Bennington co., Vt., flows past Bennington, and empties into the Hoosac in Rensselaer co., N. Y. It is also known as the Walloomsac River.

**Walloons'** [Dutch, *Walen*], a name applied to the inhabitants of certain provinces of Belgium and Holland—viz. Artois, Hainault, Namur, a portion of Flanders, Brabant, the country of Liege, Limburg, and Luxemburg. These speak the Walloon language or ancient French, which has Gaulish, Latin, and Teutonic elements. (See J. Sigart, *Dictionnaire du Wallon de Mons*, Bruxelles, 1870.) The Walloons are distinguished from the other Flemings and Brabançons not only by their idiom, but by their stature and fine bearing. The etymology of their name is the old German word *Wahle* (signifying "stranger," or, in the most restricted sense, *Gaul*), in Dutch, *Vaal*. Hence the appellation *Wœlschland*, applied to the N. of Italy (*Gallia Cisalpina*). A line beginning at Menin on the Lys (where the French and Belgian boundaries meet), running easterly, bending northward toward Brussels and Louvain, and then southward until it terminates on the Meuse between Maestricht and Liege, divides the Flemings to the N. from the Walloons to the S.

J. W. De Peyster.

**Walloostook River.** See St. John River (Maine and New Brunswick).

**Wall'pack,** tp., Sussex co., N. J. P. 647.

**Wall-Papers.** See Paper-Hangings.

**Wall'-Piece,** an arm having its stock like that for the musket, of larger calibre, and too heavy to be fired without a fixed support. It is therefore usually provided with a pivot-bolt which may rest in a socket on top of a wall or in the sole of an embrasure, and checks recoil while permitting free aiming. The earliest small-arms were wall-pieces. (See Small-Arms.)

**Wall'send,** a small town of England, county of Northumberland, is famous for the excellent coal which is raised in its collieries. P. 5721.

**Waln** (Robert), b. in Philadelphia, Pa., in 1797; received a liberal education, and devoted himself to literature; wrote *The Hermit in America on a Visit to Philadelphia* (1819), *American Bards, a Satire* (1820), a poem of nearly 1000 lines, praising Cliffton and Dwight, and condemning the verses of Barlow, Humphreys, and L. M. Sargent; *Sisyphi Opus, or Touches at the Times, with other Poems* (1820), and *The Hermit in Philadelphia, Second Series* (1821); made a voyage to China as supercargo; published in quarto numbers a *History of China* and a *Life of La Fayette* (1825), and edited after the third volume Sanderson's *Biography of the Signers of the Declaration of Independence* (7 vols., 1820–27), for which he wrote several of the lives. D. at Philadelphia July 4, 1825.

**Wal'nut** [signifying "foreign nut;" it was introduced into Europe from the East], the common name of trees and their fruit of the genus *Juglans* (order Juglandaceæ). In some localities the name is locally extended to the hickories, which are of an allied genus. The English walnut or madeira-nut of the shops is the fruit of *Juglans regia*, a stately tree producing excellent timber. The nuts are very good eating, and the kernels yield a fixed drying-oil much prized by artists and makers of choice varnishes. In the U. S. we have the black walnut, *J. nigra*, which produces a very valuable dark-colored timber, much used for furniture, joinery, gun-stocks, etc. The black walnut produces a strong and very oily nut, much relished by some persons. The white walnut, *J. cinerea*, called also oilnut and butternut, produces a useful timber. Its nuts are more palatable than those of the black walnut, and its inspissated sap, or a decoction of the bark of the root, is a useful cathartic.

**Walnut,** p.-v. and tp., Bureau co., Ill. P. 1187.
**Walnut,** p.-v. and tp., Marshall co., Ind. P. 1972.
**Walnut,** tp., Montgomery co., Ind. P. 1449.
**Walnut,** tp., Adair co., Ia. P. 213.
**Walnut,** p.-v. and tp., Appanoose co., Ia. P. 778.
**Walnut,** tp., Dallas co., Ia. P. 489.
**Walnut,** tp., Jefferson co., Ia. P. 1199.
**Walnut,** tp., Madison co., Ia. P. 869.
**Walnut,** tp., Polk co., Ia. P. 1231.
**Walnut,** tp., Wayne co., Ia. P. 674.
**Walnut,** tp., Atchison co., Kan. P. 1374.
**Walnut,** tp., Bourbon co., Kan. P. 289.
**Walnut,** p.-v. and tp., Butler co., Kan. P. 849.
**Walnut,** tp., Crawford co., Kan. P. 568.
**Walnut,** tp., Adair co., Mo. P. 495.
**Walnut,** tp., Fairfield co., O. P. 2072.
**Walnut,** tp., Gallia co., O. P. 1732.
**Walnut,** tp., Pickaway co., O. P. 1636.
**Walnut Creek,** p.-v. and tp., Pottawattamie co., Ia. P. 382.
**Walnut Creek,** tp., Brown co., Kan. P. 1561.
**Walnut Creek,** p.-v. and tp., Bates co., Mo. P. 1070.
**Walnut Creek,** tp., Macon co., Mo. P. 1304.
**Walnut Creek,** tp., Edgecombe co., N. C. P. 1008.
**Walnut Creek,** tp., Holmes co., O. P. 1321.
**Walnut Grove,** tp., Crittenden co., Ark. P. 160.
**Walnut Grove,** tp., Knox co., Ill. P. 1960.
**Walnut Grove,** p.-v. and tp., McDonough co., Ill. P. 1128.
**Walnut Grove,** tp., Neosho co., Kan. P. 686.
**Walnut Grove,** tp., Saline co., Kan. P. 912.
**Walnut Grove,** tp., Granville co., N. C. P. 1698.
**Walnut Grove,** tp., Wilkes co., N. C. P. 1005.

**Walnut Hill,** p.-v. and tp., Tallapoosa co., Ala. P. 762.

**Walnut Hill,** tp., Marion co., Ill. P. 721.

**Walnut Lake,** p.-v. and tp., Faribault co., Minn. P. 500.

**Wal'pole,** p.-v. and tp., Norfolk co., Mass. P. 2137.

**Walpole,** p.-v. and tp., Cheshire co., N. H. P. 1830.

**Walpole** (Horace), fourth Earl of **Orford,** third son of Sir Robert, b. in London, England, Oct. 5, 1717; educated at Eton and at King's College, Cambridge; received from his father several lucrative sinecures, which produced him about £4000 per annum; travelled on the Continent 1739–41, accompanied by the poet Gray, with whom he quarrelled at Reggio; had a seat in Parliament 1741–68, but took little part in politics; purchased an estate near Twickenham 1747; was occupied for many years in the erection and decoration of a strange, irregular Gothic mansion, which he called Strawberry Hill, and which he filled with a library and a museum of pictures, armor, antiquities, and miscellaneous objects; set up a private press 1757, on which, among others, he printed several of his own works, and succeeded his nephew as fourth earl of Orford 1791, but never took his seat in the House of Lords. D. in London Mar. 2, 1797. He was never married. Author of *A Catalogue of the Royal and Noble Authors of England* (1758), *The Castle of Otranto* (1765), a romance, *Historic Doubts on the Life and Reign of Richard III.* (1768), *Memoirs of the Last Ten Years of the Reign of George II.* (1822), and other works, but will be best remembered by his voluminous and interesting letters. His *Entire Correspondence* (9 vols., 1857–59) was edited by Peter Cunningham.

**Walpole** (Sir Robert), Earl of **Orford,** b. at Houghton, Norfolk, England, Aug. 26, 1676; educated at Eton and at King's College, Cambridge; was elected to Parliament for Castle Rising 1700, and for King's Lynn 1702; became secretary at war 1707, and treasurer of the navy 1709; managed as leader of the Whigs the parliamentary proceedings against Dr. Sacheverell 1710; was found guilty by the House of Commons of "a high breach of trust and notorious corruption;" was expelled the House and sent to the Tower Jan. 17, 1712, the condemnation being probably due to partisan animosity; was soon released and re-elected to Parliament, but not permitted to take his seat until the following year; became a privy councillor on the accession of George I.; procured the impeachment of Bolingbroke and the late Tory ministers; was appointed paymaster-general of the forces Sept., 1714, chancellor of the exchequer and first lord of the treasury, with the rank of prime minister, Oct. 10, 1715; resigned office in consequence of the intrigues of Sunderland Apr. 10, 1717; was the determined enemy of the South Sea scheme; became again paymaster-general June, 1720; returned to power as prime minister and first lord of the treasury Apr. 4, 1721, and was the virtual ruler of England for the ensuing twenty-one years, until Feb., 1742, when he resigned, having been created earl of Orford two days before. D. in London Mar. 18, 1745. The popular impression so long prevalent that he ruled by means of bribery was doubtless much exaggerated.

**Walpole** (Spencer Horatio), D. C. L., b. in Surrey, England, in 1806, is a great-grandson of Sir Robert; was educated at Eton and at Trinity College, Cambridge, where he obtained two first prizes for declamation and essay-writing; was called to the bar at Lincoln's Inn 1831; became a bencher there, a successful practitioner in the chancery courts, and a queen's counsel 1846; married a daughter of the premier, Spencer Perceval, 1835; sat in Parliament for Midhurst as a Conservative 1846–56; has represented the University of Cambridge since 1856; was secretary of state for the home department in Lord Derby's three administrations, 1852, 1858–59, and 1866–67; is chairman of the Great Western Railway; and was for some years commissioner of church estates, and is an excellent classical scholar.

**Walpur'gis-Night,** the evening before the first of May, the vigil of the old festival of St. Walpurgis, or Walburga, who died in 778, and is properly commemorated on Feb. 25. She was an Englishwoman of the royal blood of Wessex, the first abbess of Heidenheim, and a sister of SS. Willibald and Wunnibald. Walpurgis-Night is celebrated as the season of the supposed annual celebration of the "witches' sabbath" on Blocksberg in the Hartz. St. Walpurgis had no connection with this ancient superstition, except a partly accidental one. In fact, the old May-day festival was a heathen one, like midsummer (which became the feast of St. John), and the traditions with regard to Walpurgis-Night have a dim reference to the old heathen practices. (See Halloween.)

**Wal'rus** [Norse, *hval,* "whale," and *ros,* "horse"], the common English name of the species of *Rosmarus.* (See Morse and Rosmaridæ.)

**Wal'sall,** town of England, county of Stafford, on the Tame, has large brass and iron foundries and manufactures of cutlery and hardware. Its tanneries, malt-houses, and manufactures of harness and saddlery are also extensive. P. 46,452.

**Wal'senburg,** p.-v., cap. of Huerfano co., Col.

**Walsh** (Robert), LL.D., b. at Baltimore, Md., in 1784; educated in the Roman Catholic college at Baltimore and the Jesuit college at Georgetown, D. C.; spent several years in Europe, returning 1805; studied law under Robert Goodloe Harper, but abandoned that profession on account of deafness; became a writer for Dennie's *Portfolio;* published *A Letter on the Genius and Disposition of the French Government, including a View of the Taxation of the French Empire* (1810), which in six weeks ran through 12 editions in London, and contained much information new to English readers; conducted from 1811 to 1813 the first quarterly attempted in America, *The American Review of History and Politics,* in which most of the articles were from his pen; issued *Correspondence respecting Russia between R. G. Harper and Robert Walsh, Jr.* (1813), and an *Essay on the Future State of Europe* (1813); wrote biographical prefaces to an edition of the English poets in 50 small volumes, and *An Appeal from the Judgments of Great Britain respecting the United States of America* (1819); conducted *The American Register* (1817–18), a valuable statistical publication, *The Museum of Foreign Literature and Science* (1 vol., 1822), and *The American Quarterly Review* (22 vols., 1827–37), a resuscitation of his original *Review;* wrote biographical sketches for Delaplaine's *Repository* and for the *Encyclopædia Americana;* brought out the *Select Speeches* of George Canning (1835), William Windham, and William Huskisson (1841); and edited from 1821 to 1837 the *National Gazette,* a small daily newspaper, in which much attention was given to literature, and published *Didactics, Social, Literary, and Political* (2 vols., 1836), a selection of aphorisms from his newspaper articles and MSS. In 1837 he became U. S. consul at Paris, where he resided until his death, Feb. 7, 1859, acting as correspondent of the *National Intelligencer,* and subsequently of the *Journal of Commerce.*

**Walsh** (Robert), LL.D., b. in Ireland about 1785; educated at Dublin University; took orders in the Church of England; was joint author with John Warburton and Rev. James Whitelaw of a *History of the City of Dublin* (2 vols., 1818), and became chaplain to the British legations in Constantinople and Rio Janeiro. Author of *A Brief Notice of some Ancient Coins and Medals as illustrating the Progress of Christianity in the Early Ages* (1828; 3d ed. 1830), *Notices of Brazil* (2 vols., 1830), and *A Residence at Constantinople* (2 vols., 1836).

**Walsh'ville,** p.-v. and tp., Montgomery co., Ill. P. 1740.

**Wal'singham** (Sir Francis), b. at Chiselhurst, Kent, England, about 1536; studied at King's College, Cambridge; travelled on the Continent, and remained there during the reign of Mary; acquired the favor of Cecil, Lord Burleigh, by his political abilities and his knowledge of foreign languages; was sent three times on missions to the court of France, where he resided 1570–73; was on Cecil's recommendation knighted, sworn of the privy council, and made one of the principal secretaries of state 1573; was sent on important embassies to the Netherlands 1578, to France 1581, and to Scotland 1583; was a man of strict morals and undoubted integrity, addicted to religious meditation and to the Puritanic party in the state, but displayed as a statesman a consummate craftiness, bordering on duplicity; was said to have had in his pay in foreign countries 53 agents and 18 spies, through whom he was quickly informed of the secrets even of hostile courts; was an uncompromising political adversary, if not a personal enemy, of Mary Queen of Scots, whom for years he surrounded with spies and informers, who endeavored to inveigle her into real or pretended plots and conspiracies in order to intercept her letters; had in his pay a servant of the French ambassador Castelnau, and Gray, the envoy of the duke of Guise to the Scottish court, who was employed in managing the correspondence of Mary and James with their friends in France, thus discovering the so-called "Babington's plot" 1586; was a member of the commission for the trial of the queen of Scots at Fotheringay Oct., 1586; was charged by her with having forged the correspondence produced against her—a charge which he of course solemnly denied. About this time he was made chancellor of the duchy of Lancaster, and soon afterward withdrew from the management of public affairs. D. at Barn-Elms, near Lon-

don, Apr. 6, 1590, and was buried in St. Paul's cathedral. He was kept poor all his life by the niggardly policy of Elizabeth, and died in debt.—His daughter FRANCES was successively the wife of Sir Philip Sidney, of Robert Devereux, earl of Essex, and of Richard de Burgh, earl of Clanricarde. A tolerably full account of Walsingham's French embassy (1570–73) is given in Sir Dudley Digges's *Compleat Ambassador* (folio, 1655), and many of his letters may be found in the various collections of state papers. He was the chief patron of Richard Hakluyt in his colossal enterprise of collecting and publishing the voyages and discoveries of the sixteenth century. No biography of Walsingham seems ever to have been written, though the careers of few statesmen better deserve a detailed examination.

PORTER C. BLISS.

**Wal'singham** (THOMAS), a native of Walsingham, Norfolk, England, was about the year 1440 a monk of the Benedictine abbey of St. Alban's, and, as Bishop Nicolson suggests, "very probably regius professor of history in that monastery," and was afterward prior of Wymondham, Norfolk. He was author of two valuable Latin chronicles, *Historia Brevis, ab Edwardo Primo ad Henricum Quintum*, and *Ypodigma Neustriæ vel Normanniæ, ab Irruptione Normannorum usque ad Annum sextum Regni Henrici Quinti*, the former work being a continuation of that of Matthew Paris. Both were edited by Archbishop Parker in the same volume with Asser's *Ælfridi Regis Res Gestæ* (1574), and in Camden's *Anglica, etc., a Veteribus Scripta* (Frankfort, 1603). The *Historia Brevis* has recently been edited by H. T. Riley for the "Rolls Series" under the title *Chronica Monasterii S. Albani, Historia Anglicana* (2 vols., 1863–64).

**Wal'ter** (JOHN), b. in England in 1739; became a printer in London; bought in 1780 two patents issued to Henry Johnson for "logography, or the art of using entire words, their radices, and terminations, instead of single letters, in arranging and composing for printing;" endeavored to introduce that invention by the establishment of a newspaper, *The London Daily Universal Register*, of which the first number appeared Jan. 18, 1785. Though the system of printing proved a comparative failure, the newspaper itself prospered, especially after a change of title was made to *The Times* (Jan. 1, 1788), and it gradually rose to the rank it now holds of the leading periodical of the world. Mr. Walter acquired a considerable fortune, and d. at Teddington, Middlesex, Nov. 16, 1812.

**Walter** (JOHN), son of the above, b. in London, England, in 1784; became joint proprietor and sole manager of the *Times* 1803; raised its circulation in ten years from 1000 to 5000 copies; introduced improvements in the printing-press (see PRINTING), including the use of steam-power, first practically employed Nov. 27, 1814; sat in Parliament for Berkshire 1832–37, and was elected for Nottingham 1841. D. in London July 28, 1847. He left a large personal estate, and built and endowed a handsome church near his country-seat at Bearwood, near Reading, Berkshire.

**Walter** (JOHN), son of the above, b. in London, England, Oct. 8, 1818; educated at Eton and at Exeter College, Oxford; studied law; was called to the bar at Lincoln's Inn 1847; was an unsuccessful candidate for Parliament in the so-called "Liberal-Conservative interest" 1843, but was returned for that borough Aug., 1847; represented it until 1859, when he was elected for the county of Berkshire; was defeated in the general election of July, 1865, but again chosen for that county in 1868 and 1874. He became proprietor of the *Times* at his father's death, and has conducted that great exponent of English public opinion with great success, and is a deputy lieutenant for London and Berkshire. His name is attached to a "web-perfecting" printing-press. (See PRINTING.)

**Walter** (THOMAS USTICK), LL.D., b. at Philadelphia, Pa., Sept. 4, 1804; received a good education; became professor of architecture in the Franklin Institute, Philadelphia; designed the Philadelphia county prison (1831), Girard College (1833), the U. S. Capitol extension (1851–65), the new treasury building and the government hospital for the insane at Washington, and was one of the founders of the American Institute of Architects.

**Walter'borough,** p.-v., cap. of Colleton co., S. C., 50 miles S. W. of Charleston, has 6 churches, good schools, 3 hotels, and 1 newspaper. It is a resort for invalids during the winter months. P. about 1000.

A. C. SHAFFER, ED. "NEWS."

**Wal'tham,** tp., La Salle co., Ill. P. 1115.

**Waltham,** p.-v. and tp., Hancock co., Me. P. 366.

**Waltham,** p.-v. and tp., Middlesex co., Mass., on Boston and Fitchburg R. R. and on both sides of Charles River, about 9 miles W. of Boston, contains 7 churches, a free public library, excellent schools, 2 banks, 2 newspapers, a farmers' club, post of the Grand Army, with literary and Masonic organizations. The first cotton-mill on an extensive scale was erected here in 1814, and with its later additions of a bleachery and hosiery department is still in successful operation. The American Watch Co.'s factory situated here is the largest of the kind in the country, and it was here that watchmaking by machinery was first thoroughly introduced. It has abundant water-power. Waltham is connected with the city of Newton by a street railway. P. 9065. GEO. PHINNEY, ED. "FREE PRESS."

**Waltham,** tp., Mower co., Minn. P. 179.

**Waltham,** tp., Addison co., Vt. P. 249.

**Waltham Abbey,** or **Holy Cross,** town of Essex, England, on the river Lea and the Great Eastern Railway, 12 miles N. of London. It has government powder and flour mills, and Enfield Lock, where the royal small-arms factories are situated, is in the immediate vicinity of the town. The town took its name from the ancient monastery founded here by Harold Harefoot. P. 5197.

**Wal'thamville,** p.-v. and cap. of Liberty co., Ga.

**Wal'ther von der Vogelweide,** b. between 1165 and 1170 in Franconia or Austria, of a noble but poor family; learned the art of poetry from the elder Reinmar, and became a wandering minstrel; visited successively the courts of most of the German princes, charming people by his songs in praise of love and valor, and influencing them by his poems on political, social, and even religious subjects; received in 1215 a small fief from Frederick II. near Würzburg, where he d. about 1230, and was buried near the cathedral; a new monument was raised on his tomb in 1843. His poems have been edited by Lachmann (1827), Wackernagel and Rieger (1862), and Pfeiffer (1864). A glossary to his poems was published by Hornig in 1844, and a translation into modern German by Simrock (1833). His *Life* was written by Uhland (1822) and Menzel (1865).

**Walthourville,** p.-v., cap. of Liberty co., Ga., on Atlantic and Gulf R. R.

**Wal'ton,** county of N. W. Florida, bordering on Alabama, and intersected by Yellow Water River; surface level and partly covered by pine forests; soil fertile in the N. part, and poor in the S. Principal live-stock, cattle and swine. Staples, cotton, wool, Indian corn, and sweet potatoes. Cap. Euchee Anna. Area, 1480 sq. m. P. 3041.

**Walton,** county of N. Georgia, bounded N. E. by Appalachee River, drained by the head streams of the Ocmulgee and Oconee, and traversed by Georgia R. R.; surface elevated and undulating, soil moderately fertile. Iron ore and granite are abundant, and some gold has been found. Principal live-stock, cattle, sheep, and swine. Staples, cotton, Indian corn, and wool. Cap. Monroe. Area, 320 sq. m. P. 11,038.

**Walton,** tp., Labette co., Kan. P. 477.

**Walton,** tp., Eaton co., Mich. P. 1645.

**Walton,** p.-v. and tp., Delaware co., N. Y., on New York and Oswego R. R. at the junction of the Delhi branch, 17 miles W. of the latter place, contains 9 churches, a union school with academic department, 1 bank with savings department, 1 newspaper, 1 tannery, 2 grist-mills, a sash and door factory, and 1 hotel. Principal business, farming and dairying. P. of v. 866; of tp. 3216.

WM. A. WHITE, PROP. "CHRONICLE."

**Walton,** tp., Charlotte co., Va. P. 2778.

**Walton,** p.-v. and tp., Roane co., West Va. P. 1371.

**Walton** (BRIAN), D. D., b. at Seymour, in Cleveland, Yorkshire, England; educated at Magdalen College and Peterhouse, Cambridge, where he graduated 1619; took orders in the Church of England; was a curate in Suffolk and in London; was successively rector of St. Martin's, Ongar, London, of Sandon, Essex, and of St. Giles-in-the Fields, London; became prebendary of St. Paul's and chaplain to Charles I. 1639; espoused the side of the clergy in the London tithe dispute, publishing a *Treatise on the Payment of Tithes and Oblations in London* (1641); became thereby obnoxious to the Puritans, during whose ascendency he was summoned before Parliament, placed in custody, and his livings sequestrated (1642). He was forced to flee to Oxford, where he devoted himself for ten years during the civil war and the Protectorate to the preparation of his great work, the *Biblia Sacra Polyglotta* (London, 6 vols. folio, 1657), including the Hebrew original of the Old Testament, the Samaritan Pentateuch, the Chaldee, Syriac, Arabic, Persian, and Latin Vulgate, with various readings, notes, etc., constituting one of the chief monuments of Oriental scholarship in England, and still considered "the most complete biblical apparatus in any language." In its preparation Dr. Walton received aid from Archbishop Usher, John Selden, Samuel Clarke, Drs. Edmund Castell,

Thomas Hyde, Edward Pocock, and John Lightfoot, and several other noted Orientalists, and for its publication subscriptions to the amount of £9000 were made. He wrote in 1658 his *Dissertatio* on the antiquity and authority of his texts, usually styled in later editions the *Prolegomena*, and in reply to the attack made by the celebrated Dr. John Owen in his *Vindication of the Purity and Integrity of the Hebrew and Greek Texts, etc.* (1658), wrote his conclusive treatise, *The Considerator considered, etc.* (1659). Walton became chaplain to Charles II. at the Restoration, was consecrated bishop of Chester Dec. 2, 1660, and took part in the Savoy Conferences 1661. D. in London Nov. 29, 1661. *Memoirs of his Life and Writings* (2 vols., 1821) were written by Henry John Todd. PORTER C. BLISS.

**Walton** (GEORGE), b. in Frederick co., Va., in 1740; was apprenticed to a carpenter; acquired a tolerable education by private study; was admitted to the bar and settled in Savannah, Ga., 1774; was one of the four persons who called the first public meeting at Savannah (July 27, 1774) to concert measures for the defence of that colony; drew up the resolutions passed on that occasion; was a delegate to the Continental Congress 1776–81, and signed the Declaration of Independence and the Articles of Confederation; was colonel of militia in the defence of Savannah Dec., 1778, when he was dangerously wounded, and was a prisoner until Sept., 1779; was chosen governor of Georgia in Oct., 1779, and again 1789; became chief-justice of Georgia 1783, and judge of the State supreme court 1793; was appointed delegate to the Philadelphia convention for remodelling the Articles of Confederation and the formation of the present Constitution, but declined; and was U. S. Senator 1795–96. D. at Augusta, Ga., Feb. 2, 1804.

**Walton** (IZAAK), b. at Stafford, England, Aug. 9, 1593; became a linen-draper in Fleet street, London, 1624, in which business he acquired a competency, upon which he retired in 1644; sympathized with the royalist cause in the great rebellion, and from that time "lived mostly in the families of eminent clergymen of England, of whom he was much beloved," devoting himself to literature, the contemplation of nature, and the pleasures of the fishing-rod. D. in Winchester Dec. 15, 1683. He wrote *Lives* of Dr. John Donne (1640), Sir Henry Wotton (1651), Richard Hooker (1665), George Herbert (1670), and Dr. Robert Sanderson (1678), which have often been published together, and are known collectively as *Walton's Lives; The Compleat Angler, or the Contemplative Man's Recreation* (1653), one of the best-known works of the seventeenth century, and various minor productions. Walton was twice married—first in 1626 to Rachel Floud, a descendant of Archbishop Cranmer, who d. 1640; and secondly, about 1647, to Anne, half-sister of Bishop Ken, who d. 1662. He left a son Izaak, who became a clergyman. A *Life of Izaak Walton, including Notices of his Contemporaries* (1823), was published by Thomas Zouch, D. D.

**Walton** (WILLIAM), D. D. See APPENDIX.

**Waltz** [Ger. *walzen*, to "revolve"], a German round dance, probably of Slavic origin. It was originally in $\frac{3}{4}$ or $\frac{3}{8}$ time, but the *valse à deux temps* now prevails. It is performed by couples.

**Waltz,** p.-v. and tp., Wabash co., Ind. P. 2361.

**Wal'worth,** county of Central Dakota, bounded W. by Missouri River. Area, about 900 sq. m. Not included in the census of 1870.

**Walworth,** county of S. E. Wisconsin, bordering on Illinois, drained by affluents of Rock and Pishtaka rivers, and traversed by Western Union and other railroads; surface level, with alternating forest and prairie, and containing several small lakes; soil productive. There are flour-mills and manufactories of carriages, pumps, iron castings, and paper. Live-stock, especially sheep, is very numerous. Staples, wheat, Indian corn, oats, potatoes, hay, wool, lumber, and dairy products. Cap. Elkhorn. Area, 576 sq. m. P. 25,972.

**Walworth,** p.-v. and tp., Wayne co., N. Y. P. of v. 362; of tp. 2236.

**Walworth,** p.-v. and tp., Walworth co., Wis. P. 2291.

**Walworth** (MANSFIELD TRACY), son of Chancellor Reuben H., b. at Saratoga in 1830; graduated at Union College 1849; became a lawyer at Albany, and published several highly successful novels, among which were *Hotspur* (1864), *Stormcliff* (1866), and *Warwick, or the Lost Nationalities of America* (1869). He was killed by his son at the Sturtevant House, New York, June 3, 1873.

**Walworth** (REUBEN HYDE), LL.D., b. at Bozrah, Conn., Oct. 26, 1789; passed his early years on a farm at Hoosick, N. Y.; was for the most part self-educated; taught a district school at the age of sixteen; studied law at Troy; was admitted to the bar 1809; settled at Plattsburg; was an officer of volunteers 1812, and acting adjutant-general of New York militia during the British campaign against Plattsburg 1814; became master in chancery and county judge 1811; took a high position at the bar; removed to Saratoga; was a member of Congress 1821–23; was a circuit judge 1823–28; was chancellor of New York 1828–48, taking rank as one of the masters of equity jurisprudence; was prominent in connection with the temperance cause and a vice-president of the Bible and Tract societies. His decisions as circuit judge are in Cowen's *Reports* (9 vols., 1824–30); those pronounced as chancellor are contained in Paige and Barbour's *Reports* (14 vols., 1830–49), and his opinions delivered as an *ex-officio* member of the court for the correction of errors may be found in the *Reports* of Wendell, Hill, and Denio (38 vols., 1829–50). D. at Saratoga Nov. 21, 1867. Author of *Rules and Orders of the Court of Chancery of the State of New York* (Albany, 1829) and *The Hyde Genealogy, or the Descendants, in the Female as well as in the Male Line, from William Hyde of Norwich* (2 vols. 8vo, 1864, with 22 steel portraits), the most elaborate genealogical work which had at that time appeared in the U. S., and the first which fully brought down to a recent date the descendants in the female lines. He also contributed articles on the Delamater and Mason families to the *N. E. Genealogical Register*, vols. xiv. and xv.—His son CLARENCE, b. about 1828, graduated at Union College 1838, became a Roman Catholic, and a priest of the Paulist order at Albany. Author of *The Gentle Skeptic* (1863), a reply to Bishop Colenso.

**Wamego,** p.-v., Pottawattamie co., Kan., on Kansas Pacific R. R., 100 miles W. of Kansas City, has a fine school-house, 1 bank, 1 newspaper, and a furniture-factory. The round-house, machine-shops, and turn-table of Kansas Pacific R. R., are located here. A fine iron bridge, 960 feet in length, spans Kansas River here. P. about 1200.

R. CUNINGHAM, ED. "BLADE."

**Wam'pum** [from an Algonkin root signifying "white"], the strings and belts of beads used as money by some tribes of North American Indians. The shells of *Venus mercenaria*, the round clam, or quahaug, were the favorite material. These were drilled lengthwise and strung upon a thread. Wampum was either white or of a black or violet-purple color, the last being valued twice as highly as the first. The wampum-belt served not only as money, but as an ornament, and the beads seem to have been used as counters or aids to memory in such simple computations as the Indians made.

**Wanamin'go,** p.-v. and tp., Goodhue co., Minn. P. 1468.

**Wanatah,** p.-v., La Porte co., Ind.

**Wan'dering Jew, The,** is the hero of a legend which first appeared in the middle of the thirteenth century in the chronicle of Matthew of Paris, who professes to have received his information from the lips of an Armenian bishop, to whom the Wandering Jew himself had communicated the events. According to this version, he was a servant in the house of Pilate, by the name of Cartaphilus, and gave Christ a blow when he was dragged out of the palace to be executed. According to another version—probably of the fifteenth century and of German origin—he was a shoemaker by the name of Ahasuerus, and refused Christ permission to sit down and rest when, on his way to Golgotha, he passed by his house. All versions, however, agree with respect to the verdict of Christ, that he should remain wandering on the earth until the second coming, and consequently the myth-forming imagination immediately went to work to narrate his travels, now and then supported by actual fraud and impostures. In the sixteenth century Ahasuerus was seen in Hamburg and other German cities, and held long conferences with Dr. Paulus von Eizen, bishop of Sleswick. In the beginning of the eighteenth century Cartaphilus appeared in London in the higher circles, and communicated to the most learned professors of Oxford, who came to see him, anecdotes from his personal acquaintance with the apostles, Mohammed, Tamerlane, and others. In the nineteenth century he has not appeared personally, but he has figured very largely in works of fiction by Schubart, A. W. Schlegel, Julius Mosen, Lenau, Klingemann, Edgar Quinet, Béranger, Eugène Sue, H. C. Andersen, etc. (See Grässe, *Die Sage vom ewigen Juden*, 1844.)

**Wanderoo',** the name of several monkeys. See APPENDIX.

**Wanika,** a Caffre race of Eastern Africa, numbering perhaps 50,000 people. They are divided into twelve tribes, and live with the Suahili near the coast between lat. 2° and 6° S. They are indolent and morally corrupt, and are worshippers of fetiches and spirits, but have in part imbibed Mohammedan ideas.

**Wanklyn** (James Alfred), b. in England in 1834; received a thorough scientific education; studied chemistry at Heidelberg under Bunsen; made several important discoveries in chemistry, especially in settling the relation of the sugar group to the alcoholic series, and the ammonia process of water-analysis; became professor of chemistry at the London Institution, and public analyst for the county of Berks, and in 1871 conducted for the government the analysis of the milk supplied to the London workhouses. Author of treatises on *Water-Analysis* and *Milk-Analysis* (1873), and *On Tea, Coffee, and Cocoa* (1874).

**Wan'tage,** tp., Sussex co., N. J. P. 3636.

**Wapakone'ta,** p.-v., cap. of Auglaize co., O., on Dayton and Michigan R. R., 121 miles N. of Cincinnati and 84 miles S. of Toledo, contains 7 churches, a fine union school, 2 newspapers, and several manufacturing interests. The town was laid out in 1833, and was previously an ancient Indian capital. In Aug., 1831, treaties were signed here with the Senecas and Shawnees, by the terms of which they consented to give up their lands to the U. S. and remove to the Indian Territory. This was the last point in Ohio occupied by the Indians. The county is noted for its rich agricultural lands. P. 2150.

R. McMurray, Ed. "The Auglaize Democrat."

**Wapella,** p.-v. and tp., De Witt co., Ill. P. 1437.

**Wapel'lo,** county of S. E. Iowa, intersected by Des Moines River, and traversed by the Des Moines Valley, Burlington and Missouri River, and St. Louis Kansas City and Northern R. Rs.; surface undulating, soil fertile. Bituminous coal and limestone occur. There are flour-mills, saw-mills, pork-packing establishments, and manufactories of woollen goods, boots and shoes, agricultural implements, carriages, furniture, and brick. Live-stock of all kinds is numerous. Staples, Indian corn, wheat, oats, hay, wool, lumber, and dairy products. Cap. Ottumwa. Area, 432 sq. m. P. 22,346.

**Wapello,** p.-v. and tp., cap. of Louisa co., Ia., on Burlington Cedar Rapids and Minnesota R. R., 30 miles N. of Burlington, has 3 churches, excellent schools, 1 bank, 2 newspapers, 1 large flouring-mill, 1 woollen-factory, and 3 hotels. Principal business, farming and stock-raising. Iowa River affords immense water-power. P. of v. 870; of tp. 1870. L. W. Myers, Ed. "Republican."

**Wap'iti,** the *Cervus Canadensis*, a noble North American deer. (See Appendix.)

**Wappanoc'ca,** tp., Crittenden co., Ark. P. 320.

**Wap'pers** (Gustave), b. at Antwerp in 1803; studied painting in his native city and in Paris, and attracted general attention in 1830 by his *Devotions of the Burgomasters of Leyden;* became the first representative and the founder of the romantic school of painting in Belgium, and was made director of the Academy of Antwerp in 1840, and a baron in 1847. In 1853 he resigned his position in the academy, and in 1855 removed to Paris, where he d. Dec. 6, 1874. Of his pictures, chiefly consisting of historical pieces and portraits, some of the most remarkable are—*Charles I. taking Leave of his Children, Charles IX. on the Night of St. Bartholomew, Execution of Anne Boleyn, Defence of Rhodes by the Knights of St. John*, for Louis Philippe, now at Versailles; *The Great Fishery of Antwerp*, for Queen Victoria. His influence on the development of Belgian art was very considerable.

**Wap'pinger's Falls,** p.-v., Dutchess co., N. Y., 7 miles S. of Poughkeepsie, contains 5 churches, 2 public schools, 2 banks, a library and reading-room, 1 newspaper, 3 hotels, the Dutchess printworks, Franklindale cotton-mills, 2 large comb manufactories, a fine driving-park, and is a resort for summer tourists. P. 2263.

D. S. Dougherty, Ed. "Chronicle."

**Wapsin'onoc,** tp., Muscatine co., Ia. P. 1944.

**Wapsipin'icon River,** in Iowa, rises near the Minnesota line, and after a S. E. course of 200 miles reaches the Mississippi 25 miles above Davenport.

**War.** See International Law (Summary of its Principles), by Pres. T. D. Woolsey, S. T. D., LL.D.

**War.** *Permanence of the Institution of War.*—The history of war is the history of the human race. It is one of the natural functions of the savage, and the most honored profession of civilized society. The ancient Scandinavian looked forward to a perpetual state of war in paradise, and the enlightened American republic gives to its successful warrior the first place in its councils and its heart. All civilized men regard it as a great evil, yet some one of the leading nations of the world is nearly always engaged in it; and it may safely be said that the sun never sets upon a world wholly at peace. We have recently seen in our own land the philanthropist urging on a hesitating government, the minister of the Christian religion exchanging the gown for the sword, and the fairest and gentlest of "the sex" instilling energy into the uplifted arm. War must therefore be recognized as an instinct of humanity, of divine origin, not to be replaced, as idealists hope, by any human device like tribunals of arbitration or submissive trust in the generosity of competitors. At all events, its permanence is thoroughly believed in by all those most competent to judge, as will become evident by a brief review of the existing armies of civilized powers.

*Review of Existing Armies.*—The population of the leading powers, their peace forces, annual expenditure exclusive of interest on public debt, etc., are shown with sufficient approximation in the following table:

| | Population. | Army. | Navy. | No. of men in army and navy. | Per cent. of population. | Total annual expenditure. | Cost of army and navy. | Per cent. of annual expense. |
|---|---|---|---|---|---|---|---|---|
| Great Britain | 32,500,000 | 129,000 | 54,500 | 183,500 | .58 | $248,700,000 | $131,104,000 | 52.7 |
| Germany | 41,000,000 | 422,300 | 8,000 | 430,300 | 1.05 | 111,117,000 | 77,104,000 | 69.4 |
| Russia | 82,000,000 | 768,500 | 64,000 | 832,500 | 1.08 | 242,000,000 | 121,500,000 | 50.0 |
| France | 36,000,000 | 425,000 | 47,500 | 472,500 | 1.30 | 263,200,000 | 126,800,000 | 48.2 |
| Austria | 36,000,000 | 278,000 | 7,000 | 285,000 | .79 | 150,000,000 | 39,000,000 | 26.0 |
| United States | 38,500,000 | 27,489 | 10,442 | 37,931 | .10 | 178,600,000 | 46,000,000 | 26.0 |

A standing army drains the resources of a state in two ways—negatively, by withdrawing its numbers from industrial pursuits, and positively, by the expenditure necessary for its support. It is generally supposed that the maximum number of men which any state can keep permanently under arms is about 1 per cent. of its entire population. A glance at the table will show which nations have reached this limit, and which have passed it. Nevertheless, these figures indicate merely the number actually present with their colors in time of peace, and not the number of trained soldiers that can be called upon in time of war. All the nations, except Great Britain and the U. S., are at this time engaged in organizing and arming their entire able-bodied population. The system by which this is done was originated and perfected by Prussia. The other nations have based their organization upon hers, and have not yet completed it. Accordingly, an examination of the Prussian system as applied to the German empire will be most profitable, and will give a good general idea of the others in their present or future condition.

The Prussian system is based upon the theory that military service is not a trade or craft, to be followed by a portion of the population, but a duty owed by every male citizen to his country. Only members of the reigning or mediatized princely families are exempt, and *in time of peace* an only son of a widow or chief support of a family, an owner of a factory who would be unable to carry on his business, a sole assistant of a father in business, a property-holder whose property would suffer, and a student of theology. Every able-bodied man, with these exceptions, between the ages of 20 and 32, forms part of the army. No substitute or exemption by payment is permitted. All others between the ages of 17 and 42 are liable to be called out upon occasions of great emergency, but they are not regularly organized, although they are enrolled; they are called Landsturm. The standing army consists of the active army and the Landwehr. The active army comprises the field army and the reserves. Every man upon reaching the age of 20 must enter the active army, and serve with it seven years; he serves the first three years continuously in the field army, after which he becomes part of the reserves, and is placed on furlough for the remaining four years. While in the reserves he is bound to take part in not more than two manœuvres, neither of which is to exceed eight weeks; he is recalled to active service whenever an increase of the field army becomes necessary. At the expiration of his seven years in the active army he becomes part of the Landwehr, and so continues for five years, when at the age of 32 he is freed from liability to service except as part of the Landsturm. Students of medicine are allowed to enter the army as surgeons, apothecaries, or veterinary surgeons. Educated young men who provide their own equipment and subsistence are required to serve only one year in the field army, and they may postpone entering it until the age of 23, having been examined, however, at the age of 20. This exception is made on the supposition that superior talents render the acquisition of the necessary military training possible in

one year. These men furnish most of the officers of the Landwehr.

The whole army, including the Landwehr, is divided into 16 army corps, 1 of the guards and 15 of the line. The corps of the guards is somewhat larger than the others, and is recruited from the empire at large. Each of the other corps belongs to a particular province, where it is always kept. Thus, the 1st corps belongs to the province of Prussia, and the 15th to Alsace-Lorraine. The corps never leaves its province except for war, and then it draws all its reinforcements and recruits from it. These provinces are subdivided to correspond with the subdivisions of the army itself. Each corps in time of peace consists of 2 divisions; each division of 2 brigades of infantry and 1 of cavalry; each brigade of 2 to 4 regiments; each regiment of 3 battalions; each battalion of 4 companies; each company of 129 men. There are attached to each corps also 1 battalion of rifles, 1 battalion of pioneers, 1 battalion of military train, and 1 brigade of artillery. Each army corps district is divided into 4 brigade districts, corresponding to its 4 infantry brigades. Each brigade district is divided into Landwehr battalion districts, and these again into company or levying districts. In the states which are divided into circles each company district is composed of 1 circle, and in general the districts coincide with the civil divisions. Each regiment of the line receives its recruits from its own district, in which it is quartered and from which it is rarely moved; it has a *reserve* battalion, consisting of men who have served in its own ranks, upon which it relies to increase its strength to a war-footing. It also has its own Landwehr battalions attached to it, bearing the same number and provincial designation. As before stated, the Landwehr and reserve battalions are not kept under arms; the reserves are on furlough, and the Landwehr are something like our militia. Generally there are 2 Landwehr battalions to each regiment of the line. Each of these Landwehr battalion districts is provided with a permanent staff, consisting of 1 commander, 1 adjutant, 2 sergeants, 3 corporals, and 6 men as orderlies, with 1 sergeant and 1 corporal for each company district. It is the duty of this staff to keep the necessary clothing and equipments, and to have everything prepared in time of peace for the formation of the Landwehr battalions. Dépôts and magazines of arms and equipments for soldiers of the Landwehr are established at the head-quarters of the Landwehr battalion districts. Those of the reserves are at the head-quarters of the regiments of the line.

The field army in time of peace is always ready to take the field. It consists of 401,659 enlisted men. A part of this number, the non-commissioned officers, are encouraged to remain, but the greater portion, probably 90 per cent., is renewed every three years, and about 30 per cent. every year. The number of young men who reach the age of 20 each year is rather more than sufficient to recruit this force. Selection is made by lot, those not chosen being then considered as a special reserve, called the restoration (*ersatz*) reserve. The latter includes also those men who have claimed exemption on account of family circumstances, and those who have been exempted on account of *slight* bodily defects. The mobilization of the army, or placing it on a war-footing, consists of filling up the field troops to their war-strength, and the formation of dépôt troops and of garrison troops. The field troops are placed on a war-footing by increasing the strength of the regiments. For this purpose each infantry regiment calls in about 500 reserves per battalion; this absorbs most of the reserves, and what are left are employed as dépôt troops. Each cavalry regiment calls in about 40 reserves, the peace-strength of cavalry being nearly as great as the war-strength. The field artillery calls in all the reserves and many of the Landwehr. The dépôt troops are intended for filling up vacancies as they occur in the field army. In a year of war the infantry loses 40 per cent., and the cavalry, artillery, and pioneers 20 per cent., of their strength. Each infantry regiment forms a fourth battalion, which it leaves behind as a dépôt battalion; each cavalry regiment leaves a dépôt squadron; each field artillery regiment a dépôt division of four batteries; and each pioneer battalion a dépôt company. As soon as a regiment has lost one-tenth of its men, it calls for that number from its dépôt, and receives them thoroughly prepared for the field. Their places at the dépôt are at once filled by recruiting from the *ersatz* reserve, and, when that is exhausted, from the youngest men of the Landwehr. Should the fourth battalion be required to join the army, a fifth battalion is formed for the dépôt from the Landwehr. The troops required for the garrisons and for guarding the lines of communication are taken from among the Landwehr.

The officers of the field army are permanent, and are usually taken from the aristocratic class. (See MILITARY ACADEMIES.) Officers of the reserve are appointed from among officers who have left the field service, or from among very meritorious soldiers whose active service has expired. Officers of the Landwehr are obtained by transfer from the reserve and by promotion from the ranks. At the mobilization some officers of the field army are always transferred to each infantry and cavalry regiment of Landwehr, and each company receives two or three non-commissioned officers from the line.

By this system Germany can now put into the field within two weeks over 1,200,000 men, 700,000 of whom are in the highest state of instruction and discipline, and the balance are inferior only from being out of practice. After the expiration of twelve years from 1874, the date of the last reorganization, by which the system was extended to the recent additions to the empire, the number will be increased to 1,600,000, with the Landsturm to fall back upon in case of emergency. (For the manner in which this force can be applied see FRANCO-GERMAN WAR.)

The people of the U. S. and Great Britain resemble each other in their jealousy of large standing armies and their abhorrence of a system of universal service, as well as in their warlike spirit and self-sacrificing patriotism. Their military systems are explained in the article MILITIA. The result of such systems is that the army, having to compete with other employments for its recruits, is in time of peace much more expensive per man than that of continental powers, while the cost of carrying on war is enormously greater. It is safe to say that the civil war in America cost the North double what it would, had it had such an organization as Germany. The chance of a collision between the U. S. and a power so prepared is very remote, but not so with Great Britain. What would be the result of such a collision is a question which causes some anxiety to the friends of the latter. One certain result would be great waste of lives and money, and it can only be hoped that with these sacrifices the superior ingenuity, pertinacity, and composure of character of the race would enable her to retain her merited place at the head of the European family of nations.

The natural result of a perfect preparation for war is a less reluctance to enter upon it. Fortunately, these great preparations carry with them a restraining influence—viz. the increased cost of war. We have considered only the organization of the men or the *scale* upon which modern war is waged, but all the implements of war (see ARTILLERY, SMALL-ARMS, GATLING GUN, etc.) have increased in efficiency and expense in full proportion to the perfection of organization. The wars of Napoleon in thirteen years (1802–15) cost France about $1,000,000,000. The civil war in America cost the North in four years about $4,000,000,000, or thirteen times as much per year as Napoleon's, or, allowing one-half of the expense for waste, it cost more than six times as much per year as Napoleon's wars. The work of war is therefore accomplished in less time, and although the total amount of damage that nations inflict upon each other is probably about the same as formerly, there are more years of peace.

*Art of War.*—The art of war consists of rules for raising, arming, organizing, recruiting, administering, feeding, and fighting armies in the most efficient and economical manner. It includes, therefore, the fabrication and perfection of arms and equipments, the construction of fortifications, the establishment of military institutions, and the preparation of the soldier for duties in the field. These are the preparations for war, and have been more or less fully treated in the articles ARMY, ARTILLERY, BRIDGE (MILITARY), CAVALRY, COMMISSARY, ENGINEERS (CORPS OF), FORTIFICATION, INFANTRY, MILITARY ACADEMIES, MILITIA, SAPPERS, MINERS, AND PONTONIERS, SMALL-ARMS, TORPEDO, etc. We are here concerned with war itself, or the actual employment of armed forces. Some of its details have already been touched upon in BOMBARDMENT, ESCALADE, MINING ENGINEERING, SIEGE, TACTICS (MILITARY), etc.

"War," says Jomini, "far from being an exact science, is a terrible and passionate drama, subjected, it is true, to three or four general principles, but the result is subordinate to a multitude of moral and physical complications." Napoleon I. presents Achilles, born of a goddess and of a mortal, as the image of the genius of war. The divine part relates to moral considerations—to character, talent, the spirit of the soldier, who is strong and victorious or weak and beaten according as he thinks himself to be one or the other. The earthly part relates to arms, intrenchments, positions, orders of battle—all that pertains to the combination of material things. This poetic but accurate conception clearly indicates the imperfection of any theory of strategy. The problem is to direct and estimate the effect of forces the energies of which are only partially known, and the resistances to which are known still less. The data for its solution are obtained from military history.

Although it is not possible to establish rules to fit every case, nevertheless certain general principles underlie the operations of war, and these give rise to rules which are useful for pointing out the errors to be avoided, if for nothing else. These fundamental principles are—(1) that to ensure success we must bring the heaviest force to bear upon the weakest point of the enemy; and (2) that this force must act with the greatest possible velocity. It was one of Napoleon's maxims that the force of an army, like the quantity of motion in mechanics, is measured by the mass multiplied by the velocity.

An army in the field has constant wants which cannot be supplied from the enemy's country, such as ammunition, arms, recruits, medical stores, etc., and frequently also food and forage. It is essential to its existence that it should keep open communication with some part of its own country. That part immediately in rear of the army and covered by it is generally selected, and here are collected special dépôts for supplies. This strip of territory is the foundation of the army, or, as it is technically called, its *base*. The roads leading from the position of an army to its base are called *lines of communication*, or, simply, *communications*. They are the throat of the great machine, of which the base is the head and the army the body. An enemy with his hands upon the communications of an army can quickly choke the life out of it.

The great aim in war is such destruction of the enemy's military power as will compel him to peace. The defeat and dispersion of his troops is not always sufficient; it must generally be accompanied by the occupation of a portion of his country, thus cutting off his sources of recuperation and his power to raise new armies. And it is evident that such cutting off of resources before the dispersion of his troops will facilitate the latter operation. Accordingly, while the defeat of the enemy's army is the first consideration, effort is generally made at the same time to get possession of some important strategic point, such as his capital or great commercial centres. This point is called the *objective*. The line of direction of the objective from the base is called the *line of operations*. It it not a mathematical line, but it may include several parallel roads not farther apart than one or two days' march when they are employed by the different divisions of the same army. Lines of operation are *simple* when the army is not divided into large independent bodies; *double*, when two armies, either independent or commanded by the same general, proceeding from the same frontier, are widely separated for a long interval of time. Double lines are said to be *interior* when used by one or two armies against several hostile bodies, and having such direction that the masses can be concentrated in less time than the enemy would require to collect a greater force; *exterior*, when the army acts at the same time against both extremities of the enemy; *concentric* or *converging*, when, starting from widely-separated points, they meet at the same point; *diverging*, when, leaving a given point, they are directed upon several distinct points. The choice of the line of operations is the most important problem in strategy. The object sought for is to place the army where a victory will be decisive. This will be the case if the enemy's communications are seized, and this object must always be kept in view. At the same time, it must be remembered that the great advantage of the offensive lies in a sudden, unexpected attack—that wide détours are therefore out of place, and the shortest road to the enemy is, other things being equal, the best. In every case, except that of vastly preponderating forces, the line must be directed upon the centre or one of the extremities of the enemy, and not upon all at the same time. If the enemy's front is widely extended, the best direction will be upon the centre; otherwise, upon one of his flanks, and then upon his rear. The latter may expose the assailant's own communications, and he must take care to preserve a safe line of retreat either to the rear or to the right or left. A single line is preferable to double lines, and the latter are adopted only when the topography of the country makes it necessary, or when double lines have been adopted by the enemy and it has become necessary to oppose each of his masses; and then interior are preferable to exterior lines. In the case of converging lines care must be taken that the junction can be made before the armies are separately exposed to the combined masses of the enemy. Diverging lines may be usefully employed when the enemy's forces have been separated to increase the dispersion; they are then interior lines. All other things being equal, the richest provinces are selected to operate in, as facility of subsistence promotes rapidity of movement. Keeping the army concentrated and giving it a proper direction are not the only requisites for success. There must be no hesitation, no rest. The result of slow and hesitating movements is to find the enemy prepared at all points. No time must be lost in opening the campaign, and when a success is obtained it must be followed up with energy. Fortifications must be observed by detachments, and must not be allowed to check the main advance.

In presenting these simple rules of strategy the offensive has been principally considered, because that is the normal characteristic of war, and is the positive side of it. The defensive is the result of necessity, and is therefore negative. It is generally acknowledged that politically a defensive war is the only legitimate one, but a war politically defensive is not necessarily conducted by defensive campaigns. The offensive preserves the assailant's country from devastation and raises the *morale* of his army, while it is the direct road to the object of the war—viz. the destruction of the enemy's military power. On the other hand, the defensive has the advantage of fortifications, knowledge of the country, and facilities for obtaining information of the enemy's movements; and it is frequently assumed at the beginning of a campaign with a view to taking up the offensive as soon as the enemy shall have expended a part of his strength. As a rule, however, it is employed only in case of reverses or decided inferiority, and then it must not be passive. Minor points are neglected to concentrate upon the decisive ones. Fortifications being intended to occupy a considerable part of the enemy's army in their capture, advantage must be taken of this time to beat the other part. Accordingly, the fortifications with their defenders are left to draw off such portions of the enemy's force as they can, and battle is offered at a distance in rear, and not in front of them. Every effort must be made to strike the enemy's communications and compel him to retreat. "Retreats," says Napoleon, "cost many more men and much more material than the bloodiest battles, with this difference—that in a battle the enemy loses nearly as much, while in a retreat the loss is all on one side." But a simple repulse is not sufficient; for unless the blow is returned, the enemy may renew it, and the war being thus carried on at the expense of the defenders, they will in the end succumb.

The fundamental principles of war, concentration upon the decisive point and velocity, apply to battles (see TACTICS) as well as to strategy, but the resulting rules are modified by the differing circumstances, as one deals with the theatre of operations and the other with a battle-field. Good strategy attempts to place the force in the midst of the enemy's masses, but this does not place it in immediate contact with all of them; while in tactics it probably would, on account of the shorter distances involved and the difficulties of preserving secrecy. Hence, in the offensive battle effort is made to overwhelm one wing at a time only. The main force is concentrated upon this effort, while a few troops are employed to occupy the enemy at other points. A great success can only be obtained by depriving the enemy of his line of retreat. This can be attained by attacking his flank or his rear, but the first consideration is to beat him, for a vigorous pursuit can change an indecisive victory into a decisive one.

The application of these principles requires a knowledge of the topography of the country, a perfect familiarity with tactics, and experience in administering and feeding troops. These acquirements are within the reach of men of no extraordinary capacity. There have been many great generals who were not men of learning, or even men with great powers of understanding. The question at once suggests itself, Why is it, then, that there are so few great generals? A glance at some of the difficulties met with at every step in actual campaigning will give the answer. A complete list of them would not be practicable, but the following are given as examples: (1) There are comparatively few men whose minds are not somewhat clouded by the presence of danger; great moral and physical courage are therefore necessary. (2) We are in total or partial ignorance of the enemy's condition and intentions, and our information is contradictory. The natural anxiety as to the correctness of our conjectures upon these points leads, with an ordinary man, to hesitation and doubt, and these are fatal. Perfect self-reliance and calm adherence to original plans are here demanded. (3) There is nearly always some miscalculation in the difficulties of a road or the strength of a post. Expecting to reach a point at a given time, a commander finds himself a long distance from it. Great energy, strong will, even some severity to obtain the utmost exertions of the troops, are here necessary. (4) The movements of an enterprising enemy call constantly for new combinations, and these must be made and acted on without hesitation. This demands great decision of character. (5) To ensure the full support of troops, the general must be able to impress upon them his own spirit. This requires a deep knowledge of men. (6) There is always the element of chance; a sudden rainstorm or a fog may neutralize the greatest efforts.

The following are some of the principal maxims of war,

in addition to those already given: (1) Foresee everything that the enemy may do, and provide means to thwart him. (2) The forces employed must be proportionate to the obstacles to be overcome. (3) Debate well at the outset whether to assume the offensive or defensive; but the offensive having been selected, pursue it to the last extremity. The evils of retreats have been referred to above. (4) Be ready to meet the enemy at all hours of the day or night, whether on the march, at a halt, or in camp. (5) With an army inferior in numbers avoid a general battle, and supply the place of numbers by rapidity of marching. (6) The honor of his arms is a general's first consideration, the lives of his men secondary, though the two are entirely consistent with each other, for safety to the whole is found in audacity and persistency. (7) Never do what the enemy wishes you to, for the reason merely that he desires it. (8) When surprised by a superior enemy, a bold attack will generally disconcert him. (9) On the day of battle neglect no chance of success; a battalion sometimes decides the day.

*Laws of War.*—Besides the articles of war and laws relating to the internal government of armies and the establishment of martial law, there are certain usages generally recognized among civilized nations, and forming part of the general law of nations, which regulate the intercourse of belligerents with each other. The following is a brief synopsis of the more important of these usages.

The laws of war permit the destruction or capture of *armed* enemies, and the capture of any other enemy who is of importance to the hostile government, the destruction of property and of channels of traffic, the withholding sustenance from the enemy, and the appropriation of everything in the enemy's country necessary for the safety and subsistence of the army. They prohibit wounding except in fight, torture to extort confession, and all cruelty, the use of poison in any way, and all wanton devastation. They admit of deception, but not perfidy. It is lawful to starve the enemy, whether armed or unarmed, so that it leads to the speedier reduction of his army. Hence, noncombatants expelled from a besieged place may be driven back, so as to hasten the surrender. Warning of bombardment should usually be given a besieged place, but this may be omitted when a surprise is necessary. As soon as a capitulation is signed, the capitulator forfeits all right to injure the works, arms, or stores in his possession. The unarmed citizen is to be spared in person, property, and honor as much as the exigencies of war will permit. The subjects of the enemy are not to be forced into the service of the victors. Private property is to be protected, but an invader may levy taxes and forced loans, billet soldiers, and appropriate houses, boats, etc., for temporary use. Private property is to be seized only from necessity, and receipts are to be given to the owner to serve him in procuring indemnity. All pillage, even after taking a place by main force, all rape, all wounding of inhabitants, are strictly prohibited. All captures and booty belong to the government of the captor. A victorious army seizes all public money and public property, and sequesters all revenues of real property, the title to said property being in abeyance during military occupation. The property of churches, hospitals, and educational institutions may be used when necessary, but is to be protected from injury. Works of art, libraries, scientific collections, and precious instruments, like telescopes, are to be secured from injury. They may be removed for the benefit of the conquering nation, the ultimate ownership being settled by the treaty of peace, but in no case are they to be sold or given away or privately appropriated. Retaliation, the sternest feature of war, is sometimes necessary, but is only resorted to protectively, and after careful inquiry into the occurrence which requires it. Deserters who have entered the enemy's service, and are recaptured, suffer death. If the people of a district actually held by an army rise against it, they violate the laws of war, whether called upon by their government or not; but if the district is not yet occupied, there is no such violation in a general rising *en masse* under a duly-authorized levy. Chaplains, physicians, and nurses are not usually made prisoners. A prisoner of war is subject to no punishment for being a public enemy, and no revenge is to be wreaked upon him by the infliction of any suffering or disgrace; but he is answerable for any crime he may have committed against the captor's army or people before his capture, and he is subject to the infliction of retaliatory measures. A prisoner of war may be required to work, according to his rank and condition. If he escapes, he may be shot in his flight, but no punishment is to be inflicted for an attempt to escape. If, however, a conspiracy for the purpose of a general escape is discovered, the conspirators may be severely punished, even with death. Every wounded prisoner is to be medically treated, according to the ability of the medical staff. A resolution in hatred and revenge to give no quarter is illegal, but a commander may give such an order when in great straits and when his own salvation makes it *impossible* to cumber himself with prisoners. Troops who give no quarter receive none. Troops who give no quarter have no right to kill enemies already disabled on the ground or prisoners captured by other troops. Troops who fight in the uniform of their enemies without plainly distinguishing marks can expect no quarter. The use of the enemy's national flag or standard is an act of perfidy, by which the perpetrator forfeits the protection of the laws of war. Men who commit hostilities without belonging to the enemy's army are treated as pirates. A spy (see SPY) is punishable with death by hanging. The person of a bearer of a flag of truce is sacred, but firing is not required to cease on the appearance of a flag of truce in battle. The bearer is rarely admitted during an engagement, and if admitted he may be retained. It is customary to designate hospitals by special flags, so that the enemy may avoid firing on them, and these flags are respected if practicable. It is an act of infamy to deceive the enemy by such flags. Breaking a parole is punished with death. Proclaiming any subject of the hostile government an outlaw who may be slain without trial by any captor is illegal. Persons who violate the laws of war are no longer entitled to their protection.

(For naval warfare see NAVY, NAVAL TACTICS, etc.)

O. H. ERNST.

**Warasdin'**, town of Austria, in Croatia, on the Drave, is the seat of many civil, ecclesiastical, and educational institutions, and manufactures tobacco, liqueurs, rosoglio, and vinegar. P. 8978.

**War'beck** (PERKIN), a pretender to the crown of England who personated Richard, duke of York, younger brother of Edward V., with whom he is supposed to have been murdered in the Tower in 1483. He was said to have been the son of a Jew of Tournay, where he went in the above year. In 1490 he appeared at the court of Burgundy, where an extraordinary resemblance to Edward IV. was noted, and it is supposed that he was then instructed in the part he was to play on a future occasion. In 1492, in anticipation of the outbreak of hostilities between England and France, he landed at Cork, Ireland, and was joined by numerous partisans, but was soon obliged to fly to France, where he was acknowledged by Charles VIII. as duke of York, received a pension, and was assigned a body-guard. After the Peace of Etaples, however, he had to leave France; repaired again to Flanders 1493, where he was recognized by Margaret, the duchess-dowager (sister of Edward IV.), as her nephew. After being repulsed from the coast of Kent July, 1495, and from Ireland 1496, he proceeded to Scotland; was acknowledged by James IV., and married to Lady Catharine Gordon, daughter of the earl of Huntley; invaded England with Scottish forces Oct., 1496, and again in the spring of 1497, when he besieged Norham Castle; landed in Ireland July 30 of that year; proceeded thence to Cornwall, landing at Bodmin Sept. 7; assumed the title of Richard IV., and gathered around him 7000 men, with whom he besieged Exeter; was driven back to Taunton; being hard pressed by the royal forces, he took sanctuary in Beaulieu Abbey, Hampshire; was induced to give himself up by the promise of a pardon; confessed his imposture, and was committed to the Tower in October; escaped to the sanctuary at Sheen June 9, 1498; was retaken the following year, placed in the stocks at Westminster and at Cheapside, forced to read aloud his confession, and recommitted to the Tower, where, being soon afterward detected in another plan to escape, along with his fellow-prisoner, Edward, earl of Warwick, son of the duke of Clarence, he was hanged, drawn, and quartered at Tyburn Nov. 23, 1499, Warwick being beheaded five days later. Modern opinion favors the belief that he was really an illegitimate son of Edward IV., and that his pretended "confession" was forged by the agents of the court.

**War'blers,** the name of numerous birds. See APPENDIX.

**War'burton** (ELIOT BARTHOLOMEW GEORGE), b. at Aughrim, near Tullamore, county Galway, Ireland, in 1810; educated at Queen's and Trinity colleges, Cambridge; was called to the Irish bar, but soon relinquished that profession to devote himself to the care of his Irish estates, to country sports, literature, and foreign travel; was a genial member of society, and proved himself a generous landlord during the famine of 1846–47. He travelled in the East in 1843; published on his return *The Crescent and the Cross, or Romance and Realities of Eastern Travel* (2 vols., 1844), which obtained immense popularity; settled in London 1844; published *Memoirs of Prince Rupert and the Cavaliers* (3 vols., 1849), *Reginald Hastings* (3 vols., 1850), a

novel of the great rebellion, *Memoirs of Horace Walpole and his Contemporaries* (2 vols., 1851), and *Darien, or the Merchant Prince, an Historical Romance* (3 vols., 1851). He perished in the burning of the steamer Amazon off Land's End Jan. 4, 1852, being on a voyage to the West Indies.—His brother GEORGE was for some years a major in the British army in Canada; subsequently sat in Parliament for Harwich, and d. by suicide 1857. Author of *Hochelaga, or England in the New World* (2 vols., 1846), *The Conquest of Canada* (2 vols., 1849), both anonymous and edited by his brother Eliot, and *A Memoir of Charles Mordaunt, Earl of Peterborough* (3 vols., 1853).

**Warburton** (WILLIAM), D. D., an English prelate of great learning and ability, but paradoxical, dogmatic, and overbearing, b. Dec. 24, 1698, at Newark-upon-Trent, where his father was an attorney and town-clerk; attended school at Newark and Oakham; in 1719 began the practice of law at Newark, but in 1723 abandoned the law and took deacon's orders; in 1726 was ordained priest, and made vicar of Gryesly, Nottinghamshire; became rector of Brant Broughton, Lincolnshire, 1728; preacher to the society of Lincoln's Inn 1746; prebend of Gloucester 1753; king's chaplain in ordinary 1754; prebend of Durham 1755; dean of Bristol 1757, and in 1760 bishop of Gloucester, where he d. June 7, 1779. His spirited defence, in 1739–40, of Pope's *Essay on Man* against the charge of atheism made the poet his ardent and life-long friend. In 1741, Pope introduced him to his friend Allen of Prior Park, near Bath, and when he d. in 1744 bequeathed to him half his library and all his copyrights not otherwise disposed of. In 1746 he was married to Miss Gertrude Tucker, the favorite niece of Mr. Allen, and ultimately came into possession of Prior Park. He published *Miscellaneous Translations in Prose and Verse* (1723), *An Inquiry into the Causes of Prodigies and Miracles* (1727), *Alliance between Church and State* (1736), *Divine Legation of Moses* (his greatest work, 1738–41), a very poor edition of *Shakspeare* (1747), *Julian* (1750), an edition of *Pope's Works* (1751), *The Doctrine of Grace* (1762). His own works were published by his friend Bishop Hurd in 7 vols. 4to (1788), with a *Memoir* prefixed (1794). His *Letters* to Hurd appeared in 1808, and *Literary Remains* in 1841. A new *Life* of Warburton, by Rev. John Selby Watson, was published in 1863. R. D. HITCHCOCK.

**Ward,** in feudal law, means the heir of the king's tenant in capite during his nonage, but in general language the term is applied to all infants under the power of guardians. The guardian—that is, in law, he who has the custody of infants, or generally, of such persons as are incapable of directing themselves—may now be said, on the father's death, to belong to one of the following five classes: (1) testamentary, or appointed by will; (2) customary, or appointed by local usage; (3) *ad litem*, or appointed by a court in order to conduct legal proceedings; (4) by appointment of chancery; and (5) in tort, or by intrusion, as when a person wrongfully intrudes in the management of an infant's estate, he must account in chancery as if he had been a guardian. The old kinds of guardianship at common law are now nearly obsolete. In France, as in England, guardianship lasts until the full age of twenty-one, except in case of marriage or judicial emancipation. The court of wards and liveries, for cognizance of various matters relating to the king's prerogative, was established by Henry VIII., and abolished at the Restoration.

**Ward,** tp., Yell co., Ark. P. 359.

**Ward,** tp., Randolph co., Ind. P. 1614.

**Ward,** tp., Clarke co., Ia. P. 421.

**Ward,** tp., Allegany co., N. Y. P. 745.

**Ward,** tp., Hocking co., O. P. 1305.

**Ward,** tp., Tioga co., Pa. P. 285.

**Ward** (ADOLPHUS WILLIAM), b. in England about 1835; educated at and fellow of St. Peter's College, Cambridge, and became professor of history at Owen's College, Manchester. Author of *The House of Austria in the Thirty Years' War* (1869) and *Dramatic Literature of the Age of Elizabeth* (2 vols., 1875), translator of Curtius's *History of Greece* (5 vols., 1868–74), and editor of Pope's *Poems* (Globe edition, 1869).

**Ward** (ANDREW HENSHAW), b. at Shrewsbury, Mass., May 26, 1784; graduated at Harvard 1808; was admitted to the bar at Northampton 1811; practised law in his native town; was some years an officer of customs at Boston, and was a member of the State constitutional convention of 1853. D. at Newtonville, Mass., Feb. 18, 1864. Author of a *History of Shrewsbury* (1847) and of genealogies of the Ward family (1851) and the Rice family (1858).

**Ward** (ARTEMAS), b. at Shrewsbury, Mass., Nov. 27, 1727; graduated at Harvard 1748; became major of a Col. Williams's regiment 1755; took part in the campaigns against the French near Lake Champlain, attaining the rank of colonel; represented Shrewsbury in the legislature, and took an active part in political questions; was appointed a general officer by the Massachusetts provincial congress Oct. 27, 1774, and commander-in-chief of Massachusetts forces May 19, 1775; was in nominal command at the battle of Bunker Hill, though he remained at head-quarters at Cambridge, and had no actual share in determining the events of that day; was appointed by the Continental Congress first on the list of major-generals June 17, 1775; was in command of the forces besieging Boston until the arrival of Gen. Washington, after which he was second in command, with head-quarters at Roxbury; resigned Apr., 1776, in consequence of ill-health; was chief-justice of common pleas for Worcester co. 1776; president of the Massachusetts executive council 1777; sat in the legislature sixteen years; was Speaker of that body 1785, and member of Congress 1791–95. D. at Shrewsbury Oct. 27, 1800.

**Ward** (ARTEMUS). See BROWNE (CHARLES FARRAR).

**Ward** (EDWARD), generally known under the name of NED WARD, b. in Oxfordshire, England, about 1660; was a noted tavern-keeper and poet in London, and d. there in 1731. He published *The London Spy* (London, 1698), often reprinted, and containing his famous voyage to New England and description and character of Boston about 1690; *Hudibras Redivivus, or a Burlesque Poem on the Times* (2 vols., 1705–07), for which he was fined 40 marks and condemned to stand twice in the pillory; *Complete and Humorous Account of all the Remarkable Clubs and Societies in London and Westminster* (1709), *Vulgus Britannicus* (1710), *Nuptial Dialogues and Debates* (2 vols., 1710), *Life and Adventures of Don Quixote, merrily translated into Hudibrastick Verse* (2 vols., 1711–12), *History of the Grand Rebellion digested into Verse* (3 vols., 1713), and *The Whigs Unmasked*, 1713. (See Thomas Campbell's *Essay on English Poetry*.)

**Ward** (EDWARD MATTHEW), R. A., b. at London, England, in 1816, is a nephew on the mother's side of Horace and James Smith, authors of the *Rejected Addresses;* became in 1834 an art-student at the Royal Academy, where he enjoyed special instruction from Wilkie, and exhibited a decided talent for original composition and color; studied at Rome 1836–39, gaining the silver medal of the Academy of St. Luke 1838; pursued a course of fresco-painting under Cornelius at Munich; exhibited his first picture at the Royal Academy 1839; presented unsuccessfully his *Boadicea* in the cartoon competition at Westminster Hall 1843; was brought into favorable notice by his *Dr. Johnson reading the MS. of the Vicar of Wakefield* (1843), *Goldsmith as a Wandering Musician* (1844), and *Dr. Johnson in the Anteroom of Lord Chesterfield* (1845), the latter having been bought by Mr. Vernon; devoted himself successfully to the illustration of English and French history by a series of large pictures; was commissioned to paint eight pictures in oil for the corridor of the House of Commons 1852, three of which have since been reproduced in fresco and two in water-glass, and became an academician 1856. His numerous later pictures have placed him at the head of the historical school of British art.

**Ward** (FREDERICK TOWNSHEND), b. at Salem, Mass., in Nov., 1831; educated at the Salem High School; was a lieutenant in the French service during the Crimean war; was with Walker in Nicaragua; became admiral-general in the service of the emperor of China; trained the Chinese into good soldiers, and won many victories over the rebel Tae-Pings, but was killed in an engagement with them near Ningpo Oct. 7, 1862.

**Ward** (HENRY AUGUSTUS), b. at Rochester, N. Y., Mar. 9, 1834; educated at Williams College and at the Lawrence Scientific School of Harvard University, where he became assistant to Prof. Agassiz in the museum of comparative zoology; went to Europe 1854; studied zoology at Paris, and mineralogy at Freiberg; travelled in Palestine, Arabia, Egypt, Nubia, and the W. coast of Africa, ascending the Niger; subsequently visited the West Indies, Central America, and the Western Territories of the U. S. as a mining engineer; was professor of natural sciences at Rochester University 1861–66; established there a laboratory for the production of fac-similes of rare fossils; made an extensive collection of modern zoology, and was naturalist to the U. S. expedition to Santo Domingo 1871. The "Ward cabinets" of mineralogy and geology at the University of Rochester now fill fourteen rooms.

**Ward** (Sir HENRY GEORGE), son of Robert Plumer, b. in England about 1796; entered the diplomatic service 1816; married in 1824 a daughter of Admiral Sir John Edward

Swinburne; was chargé d'affaires in Mexico, where he made extensive travels 1825–27; sat in Parliament for St. Alban's 1832–37, and for Sheffield 1837–49; was secretary to the admiralty 1846–49; lord high commissioner of the Ionian Islands 1849–55; governor of Ceylon 1855–60; was transferred to Madras as successor of Sir Charles Trevelyan, and d. there of cholera a few days after his arrival, Aug. 2, 1860. He had been originator and editor of the *Weekly Chronicle;* was its proprietor until May, 1849, and was author of a valuable work, *Mexico in 1827* (2 vols., 1828), which in the 2d ed. bore the title *Travels in Mexico* (1829). It was illustrated by his wife, who also published two volumes of *Views of Towns in Mexico* (1829).

**Ward** (James), R. A., b. in London, England, Oct. 23, 1769; began life as an engraver; afterward turned his attention to painting; became noted for his exact imitations of Morland, and obtained such brilliant success as an animal painter as to be styled "the English Paul Potter." He also painted historical pieces, and became an academician in 1811. D. at Kensington Nov. 16, 1859.

**Ward** (John Elliott), b. in Sunberry, Liberty co., Ga., Oct. 2, 1814. His early education was partly at the Sunberry Academy and partly at Walthourville in the same county. He commenced a collegiate course at Amherst College, Mass., in 1830, but left before graduation in consequence of the excitement in that institution against Georgians because of the imprisonment of Wooster and Butler, Cherokee missionaries; on his return to his native State he studied law in the office of Hon. Matthew Hall McAllister in Savannah, and was admitted to the bar in Jan., 1835, by special act of the legislature, before he was twenty-one years of age; after this, before beginning practice, he attended law lectures at Dane Law School, Cambridge, Mass. In 1836 he opened an office in Savannah, and was soon appointed solicitor-general of the eastern judicial circuit of Georgia. He became U. S. district attorney for Georgia in 1838. This position he resigned in 1839, and became a member of the State legislature. In 1854 he was Speaker of the House; was afterward mayor of the city of Savannah, and in 1857–58 was State senator from the county of Chatham. During this term he was president of the senate, and thereby lieutenant-governor of the State. He was also president of the Cincinnati Democratic Presidential convention in 1856. Upon the resignation of Judge Berrien of the office of U. S. Senator from Georgia in 1851, his unexpired term was tendered to Mr. Ward, which, however, from private reasons, he declined to accept. In 1858, while president of the State senate, he was appointed U. S. minister to China, and was occupying this position when Georgia passed her ordinance of secession in 1861. On the receipt of this intelligence he resigned and returned to his native land and home in Savannah. While he was strongly opposed to the policy of secession, he did not, however, question the right. His fortunes were cast with those of the people of his State. After the war, he took no active part in politics or public affairs, but moved to the city of New York, where he opened a law-office, and has since, to this time (May, 1875), been eminently successful in the active prosecution of his profession. A. H. Stephens.

**Ward** (John Quincy Adams), b. at Urbana, O., June 29, 1830; studied medicine, but never practised; was engaged in the studio of H. K. Brown, the sculptor, 1850–56; resided two years at Washington, where he executed portrait-busts of several eminent men; settled in New York City 1861; has gained a high reputation by his bas-reliefs and groups; executed in bronze for the Central Park the famous *Indian Hunter,* the *Shakspeare,* and the *Private of the Seventh Regiment,* and was chosen in 1874 president of the National Academy of Design.

**Ward** (Nathaniel), b. at Haverhill, Suffolk, England, about 1570; graduated at Emmanuel College, Cambridge, 1603; was for some years a lawyer; travelled on the Continent upon commercial business; studied theology; became preacher at St. James's, Duke's Place, London, and afterward rector of Standon Massaye, Essex; became connected with the Massachusetts Company 1630; was brought before Bishop Laud for nonconformity 1631; was silenced 1633; sailed for Massachusetts Apr., 1634; immediately became pastor at Agawam or Ipswich, being colleague first of Thomas Parker, and afterward of John Norton; resigned his charge on account of ill-health Feb., 1637; took part in the settlement of Haverhill (named from his native place) May, 1640; was the author of the *Body of Liberties* adopted Dec., 1641, being the first code of laws established in New England; preached the election sermon 1641; was a member of a committee appointed to draw up new laws 1645; returned to England 1646; preached before the House of Commons June 30, 1647; took part as a pamphleteer in the great political struggle then going on; became pastor of Shenfield, Essex, 1648, and d. there in 1653. Author of *The Simple Cobler of Agawam* (1647), a quaint political satire, and *Mercurius Anti-Mechanicus, or the Simple Cobler's Boy, with his Lap full of Caveats* (1648). A *Memoir* by John Ward Dean was published at Albany in 1848.

**Ward** (Robert Plumer), b. in London, England, Mar. 19, 1765, son of a wealthy merchant resident at Gibraltar, where he spent his early years, his mother being a Spanish lady; educated at Walthamstow and at Christ Church, Oxford; was called to the bar at the Inner Temple 1790; went on the western circuit for some years; spent some time in Paris during the early period of the French revolution; was brought into favorable notice as a jurisconsult by his works written at the instance of Lord Eldon, *An Enquiry into the Foundation and History of the Law of Nations in Europe, from the Time of the Greeks and Romans to the Age of Grotius* (2 vols., 1795), *A Treatise of the Relative Rights and Duties of Belligerent and Neutral Powers in Maritime Affairs, etc.* (1801), and *An Essay on Contraband* (1801); declined an offer of a judgeship in the admiralty court of Nova Scotia; sat in Parliament for Cockermouth 1802–05, through the influence of Earl Mulgrave, who had married a sister of his wife, and of Pitt, to whom he had rendered services in the treason trials of 1794; was frequently employed in cases before the privy council; became under-secretary of foreign affairs 1805, Earl Mulgrave being his immediate superior; retired from office on the death of Pitt 1806; was member of Parliament for Haselmere 1807–20; became lord of the admiralty in the Portland administration 1807; was clerk of the ordnance from 1811–23, and auditor of the civil list from 1823 to 1831, when he retired from political life on a pension of £1000, and spent his remaining years in literary leisure. D. at Okeover Hall, Staffordshire, the residence of his father-in-law, Lieut.-Gen. Sir George Anson, Aug. 13, 1846. The name Plumer was first assumed in 1828, on his marriage with Mrs. Plumer Lewin. He published anonymously *Tremaine, or the Man of Refinement* (3 vols., 1825), and *De Vere, or the Man of Independence* (4 vols., 1827), novels which had extraordinary popularity as delineations of English society, and subsequently issued *De Clifford* (4 vols., 1841) and other novels, and *An Historical Essay on the Real Character and Amount of the Precedent of the Revolution of 1688* (2 vols., 1838). A portion of his diaries and correspondence was published by Hon. Edmund Phipps, accompanying the interesting *Memoirs of the Political and Literary Life of Robert Plumer Ward, Esq.* (2 vols., 1850). The diary extends from 1809 to 1820, the later portion being still unpublished. Porter C. Bliss.

**Ward** (Samuel), b. at Newport, R. I., May 27, 1725, son of Richard, who was secretary of Rhode Island 1714–33, and governor 1741–42; became a wealthy farmer at Westerly; was delegate to the Hartford military convention 1758; chief-justice of Rhode Island 1761, governor 1762 and 1765–67; was one of the founders of Rhode Island College (1764), afterward Brown University; a delegate to the Continental Congress 1774–76, and several times presided over that body when in committee of the whole. D. at Philadelphia Mar. 26, 1776. A *Life* by Prof. William Gammell was published in Sparks's *American Biography.*

**Ward** (Samuel), son of Gov. Samuel, b. at Westerly, R. I., Nov. 17, 1756; graduated at Rhode Island College 1771; was a captain under Arnold in the expedition against Quebec 1775; was taken prisoner, and not exchanged until late in 1776; took part in the defence of Red Bank, N. J., and in the Rhode Island campaign, attaining the rank of lieutenant-colonel; was subsequently for several years a wealthy merchant in New York City, and was a delegate from Rhode Island to the Hartford Convention 1814. D. in New York City Aug. 16, 1832.—His son Samuel, a banker in New York City and a liberal benefactor of the New York Historical Society and the Stuyvesant Institute, was father of the distinguished poetess, Mrs. Julia Ward Howe.

**Ward** (Seth), D. D., F. R. S., b. at Buntingford, Hertfordshire, England, in 1617; graduated at Sidney-Sussex College, Cambridge, about 1637; became fellow there 1640; was ejected from his fellowship for refusing to sign the Solemn League and Covenant 1643; became a private tutor; afterward went to Oxford, where he was Savilian professor of astronomy 1649–61; elected principal of Jesus College 1657, but did not receive possession, and president of Trinity College 1659; was obliged to resign the latter post at the Restoration 1660, receiving the vicarage of St. Lawrence, Jewry, London, and the precentorship of Exeter; was promoted to the deanery of Exeter 1661; became bishop of that diocese 1662, bishop of Salisbury 1667, chancellor of the order of the Garter 1671, prebendary of Salisbury 1672, archdeacon of Wilts 1675, prebendary of Winchester 1676, chancellor of Salisbury 1681,

and treasurer of Salisbury 1687; founded at that place a college for the widows of clergymen 1682, and lost his mental faculties about 1687. D. at Knightsbridge Jan. 6, 1689. He was a distinguished mathematician and natural philosopher, and was one of the founders of the Royal Society. Author of *A Philosophical Essay on the Being and Attributes of God, etc.* (1652), *Prælectio de Cometis* (1653), *Astronomia Geometrica* (1656), and other works.

**Ward** (THOMAS), b. at Danby Castle, Yorkshire, England, Apr. 13, 1652; became a Roman Catholic schoolmaster; served in the pope's guards and in a maritime war against the Turks; returned to England 1686; received a commission in the guards of James II., and retired to Flanders after the Revolution. D. at St. Germain's in 1708. Author of *The Errata of the Protestant Bible* (1687), *Monomachia* (1687), and a poem in Hudibrastic verse, *England's Reformation, from the time of King Henry VIII. to the End of Oates's Plot* (1710). He left in MS. a *History of England*, never published.

**Ward** (WILLIAM), b. at Derby, England, Oct. 20, 1769; learned the printer's trade; was licensed as a Baptist preacher; was sent in both capacities as a missionary to India 1799; settled at Serampore; printed numerous religious works in the Bengalee language; wrote *An Account of the Writings, Religion, and Manners of the Hindoos, including Translations from their Principal Works* (Serampore, 4 vols. 4to, 1811; 5th ed., Madras, 1863); visited England, Holland, and the U. S. 1819–21, delivering addresses upon the cause of missions, and printed *Farewell Letters to Friends in the U. S.* (1821). D. of cholera at Serampore Mar. 7, 1823. His *Account* was long a leading authority upon Indian matters, and may still be profitably consulted upon some points, although later works have revealed many inaccuracies in the description of native religions, and still more in the translations. A volume of *Memoirs* (1825) was prepared by Samuel Stennett, and a more adequate biography may be found in the *Life and Times of Carey, Marshman, and Ward, embracing the History of Serampore Mission* (2 vols., 1859; abridged ed., New York, 1867), by John Clark Marshman.

**Ward** (WILLIAM HAYES), D.D., b. at Abington, Mass., June 25, 1835; graduated at Amherst College 1856, at Andover Theological Seminary 1859, ordained in 1859, and became acting pastor of the Congregational churches of Oskaloosa and Grasshopper Falls, Kan.; in 1857–58 taught the natural sciences in Beloit College; in 1862 became teacher of sciences in the Utica Free Academy; in 1865 accepted the position of professor of Latin in Ripon College, Wis., which he left in 1868 to enter the editorial staff of the New York *Independent*, of which he became superintending editor in 1870, and has continued in that position to this date (1877). He is a member of the American Oriental Society, before which he has read various papers. He has published various articles in the *Bibliotheca Sacra* on biblical criticism and Assyriology. The second statement of the American Palestine Exploration Society contains a paper of his on the Hamath inscriptions.

**Ward-Burton Rifle.** See SMALL-ARMS, by GEN. P. V. HAGNER, U. S. A.

**Ward'en** (DAVID BAILLIE), M. D., b. in Ireland in 1778; came to the U. S. in youth; received a classical education; graduated at the New York Medical College; was appointed secretary of legation to France 1804, and resided at Paris forty years, filling most of the time the office of U. S. consul; was well known in literary circles, and formed two libraries of American books which were acquired respectively by Harvard College (1823) and by the New York State Library (about 1840). D. at Paris Oct. 9, 1845. Author of *A Statistical, Political, and Historical Account of the U. S. of North America* (Edinburgh, 3 vols., 1819); also published in French (Paris, 5 vols., 1820) and in German (Ilmenau, 1824), *L'Art de vérifier les Dates, Chronologie historique de l'Amérique* (Paris, 10 vols., 1826–44), *Bibliotheca Americana septentrionalis, etc.* (1820), and *Bibliotheca Americana* (1831), *Recherches sur les Antiquités de l'Amérique septentrionale* (Paris, 1827), which originally appeared in *Antiquitates Mexicanæ* (Paris, 2 vols. folio, 1834–36), and other minor publications.

**War Department of the U. S.** See SECRETARY OF WAR.

**Wardian Case** [named from W. B. Ward, its inventor, an Englishman], a box whose sides and top are of glass, containing at the bottom a layer of earth, and used for growing ferns and other plants in parlor-culture. Probably from the fact that the air within is highly charged with moisture, many beautiful plants thrive well in Wardian cases which cannot be grown in the open air.

**Ward'law** (RALPH), D. D., b. at Dalkeith, Midlothian, Scotland, Dec. 22, 1779; educated at the University of Glasgow and at the divinity school of the United Secession Church, for the ministry of which he was intended, but joined the Independent or Congregational Church; in 1803 was ordained pastor of the North Albion street chapel, Glasgow, where, and at the new chapel of the same congregation in West George street, he labored through life, filling also gratuitously from 1811 the professorship of systematic theology in the Independent theological academy of that city. He received his degree from Yale in 1818. In 1853 the fiftieth anniversary of his ministry was celebrated by a public meeting and the formation of a fund for the establishment of the "Wardlaw Jubilee School and Mission-house" at Dove Hill, Glasgow. He was for many years the recognized head of the Independent body, which through his influence was widely extended through Scotland. D. at Glasgow Dec. 17, 1853. Author of several treatises on the Socinian controversy, infant baptism, and Christian ethics, of *Expository Lectures on the Book of Ecclesiastes* (2 vols., 1821), *Lectures on Systematic Theology* (3 vols., 1856–57), and other works. His *Life* was written by Rev. Dr. W. L. Alexander (1856).

**Wards'borough,** p.-v. and tp., Windham co., Vt. P. 866.

**Ward's Grove,** tp., Jo Daviess co., Ill. P. 530.

**Ward's Island,** New York co., N. Y. P. 1760.

**Ward'ville,** p.-v., Bergen tp., Genesee co., N. Y. P. 788.

**Ware,** town of England, county of Herts, on the Lea, has large breweries, malting establishments, and manufactures of tiles. P. 5002.

**Ware,** county of S. E. Georgia, intersected by Satilla River, drained by its tributaries, and traversed by Atlantic and Gulf and Brunswick and Albany R. Rs. The surface is level, and frequently swampy, Okefinokee Swamp, which lies partly in this county, being 30 miles long and 17 miles wide. The soil is for the most part fertile, producing large quantities of oranges and figs. There is considerable livestock, especially cattle and swine. Staples, cotton, Indian corn, fruit, sweet potatoes, and wool. Cap. Waresborough. Area, about 850 sq. m. P. 2286.

**Ware,** p.-v. and tp., Hampshire co., Mass., on Ware River R. R., 25 miles N. E. of Springfield, contains 7 churches, a public library of 2000 vols., 2 banks, 2 newspapers, 2 hotels, 5 extensive cotton and woollen factories, and a beautiful cemetery, Aspen Grove. P. 4259.

W. L. DEMOND, ED. "STANDARD."

**Ware,** tp., Gloucester co., Va. P. 3013.

**Ware** (ASHUR), b. at Sherburne, Mass., Feb. 10, 1782; graduated at Harvard University in 1804, where he was engaged as tutor 1807–11, and professor of Greek 1811–15; practised law at Boston, and editor of *Boston Yankee* 1816; removed to Portland, Me., in 1817; was the first secretary of state for that State on its separation in 1820; was judge of the U. S. district court of Maine from 1822 until 1866. Author of *Reports of Cases U. S. District Court of Maine* (1822–39) and of articles on "Admiralty Jurisdiction," on the "Duty of Masters of Vessels," and on "Privileged Debts," in Bouvier's *Law Dictionary*.

**Ware** (HENRY), D. D., b. at Sherburne, Mass., Apr. 1, 1764; graduated at Harvard 1785; taught the town school at Cambridge while pursuing the study of theology 1785–87; was ordained pastor of the first church at Hingham, Mass., Oct. 24, 1787; was a leader in the direction of the Unitarian opinions then becoming prevalent among the Congregationalists of New England; precipitated the theological crisis by his acceptance of the Hollis professorship of divinity in Harvard University 1805, but took no part in the controversy thereby excited until some years later, when he published *Letters to Trinitarians and Calvinists, occasioned by Dr. Woods's Letters to Unitarians* (Cambridge, 1820), followed by *An Answer to Dr. Woods's Reply* (1822) and *A Postscript to an Answer, etc.* (1823); printed a number of single sermons, and issued in 1842 one of his courses of theological lectures with the title *An Inquiry into the Foundation, Evidences, and Truth of Religion* (Cambridge and London, 2 vols., 1842). In addition to his professorship, which he resigned 1840, he had charge of the Harvard Divinity School from its foundation in 1826 to his death at Cambridge, July 12, 1845. He had been totally blind for nearly eighteen years. With Drs. Noah Worcester, William E. Channing, and Andrews Norton he laid the foundation of what is now the conservative school of American Unitarianism.

**Ware** (HENRY), JR., D. D., son of the preceding, b. at Hingham, Mass., Apr. 21, 1794; was prepared for college by his cousin, Ashur Ware, and at Phillips Academy at Andover; graduated at Harvard 1812; taught at Phillips (Exeter) Academy 1812–14; studied theology under his father's direction; was ordained pastor of the Second

church (Unitarian) at Boston Jan. 1, 1817; took an active part in the formal organization of the Unitarian body, editing its organ, the *Christian Disciple*, which afterward became the *Christian Examiner;* visited Europe 1829–30; resigned his pastorate on account of ill-health 1830, and filled the Parkman professorship of pulpit eloquence in the Divinity School of Harvard University 1830–42. D. at Framingham, Mass., Sept. 22, 1843. Author of *Hints on Extemporaneous Preaching* (1824), *Recollections of Jotham Anderson, Minister of the Gospel* (about 1824), *On the Formation of the Christian Character* (1831), *Life of the Saviour* (1832; new ed., New York, 1868), *The Feast of the Tabernacles* (1837), a poem prepared for an oratorio, *Memoirs* of Rev. Dr. Parker (1834), Dr. Noah Worcester, Dr. Joseph Priestley, and of Oberlin, and *Scenes and Characters illustrating Christian Truth* (2 vols., 1837), besides miscellaneous poems and single sermons. A *Memoir* was published by his brother, John Ware, M. D. (1845). Four volumes of selections from his writings were edited by Rev. Dr. Chandler Robbins (1846–47).

**Ware** (Sir James), LL.D., b. at Dublin, Ireland, Nov. 26, 1594; educated at Dublin College; was knighted 1629; succeeded his father as auditor-general of Ireland 1632; became an eminent antiquarian; distinguished himself by his zeal in defence of the earl of Strafford; was deprived of his offices and committed to the Tower by the Parliamentary party; recovered the auditorship at the Restoration, when he was chosen a member of the Irish Parliament for the University of Dublin, and declined a baronetcy and a peerage. D. at Dublin Dec. 1, 1666. Author of *De Scriptoribus Hiberniæ* (1639), *De Hibernia et Antiquitatibus ejus Disquisitiones* (1654), and *Hibernia Sacra* (1717), which, with other treatises, were translated into English by his son Robert under the title *The Antiquities and History of Ireland* (London, folio, 1705). His *Whole Works* (3 vols., 1739–46), with a revision and continuation of the *Antiquities*, was subsequently edited by Walter Harris, who has married a descendant.

**Ware** (John), M. D., son of Dr. Henry, Sr., b. at Hingham, Mass., Dec. 19, 1795; graduated at Harvard 1813, and at Harvard Medical School 1816; began to practise at Duxbury; removed to Boston 1817; was professor of the theory and practice of medicine at Harvard 1832–58, and several years president of the Massachusetts Medical Society. D. at Boston Apr. 29, 1864. Author of several professional treatises, of many lectures on peace, temperance, etc., of occasional poems, and a biography of his brother Henry.

**Ware** (Nathaniel A.), b. in Massachusetts about 1789; graduated at Yale College; became a teacher in South Carolina, where he studied and practised law; removed to Natchez, Miss.; became a major of militia and secretary of the Territorial government; acquired a large fortune by judicious purchases of lands; travelled extensively; was noted for his wide attainments in literature, especially in geography, botany, and the natural sciences, and resided during his later years at Philadelphia and at Cincinnati, O., superintending the education of his daughters Catharine and Eleanor, who became known as poetesses. (See Lee, Eleanor Percy, and Warfield, Catharine A.) D. at Galveston, Tex., in 1854. Author of a small work on the Pestalozzian system of education, of *Views of the Federal Constitution*, and of a work on political economy.

C. G. Forshey.

**Ware** (William), son of Dr. Henry, Sr., b. at Hingham, Mass., Aug. 3, 1797; graduated at Harvard 1816; taught school at Hingham 1816–17; studied theology under his father's direction, graduating at Cambridge 1819; preached successively at Northborough, Mass., Brooklyn, Conn., and Burlington, Vt.; was pastor of the First Unitarian church in New York City from Dec. 18, 1821, to Oct. 19, 1836; preached at Brookline, Mass., 1836–37, at Waltham 1837–38; settled without pastoral charge at Jamaica Plains 1838, and at Cambridge 1839; was editor and proprietor of the *Christian Examiner* 1839–44; was pastor of a church at West Cambridge 1844–45; resigned on account of ill-health; settled again at Cambridge, where he occasionally preached; spent a year in Europe, chiefly in Italy, 1848–49, and delivered a course of lectures on European travel 1849–51. D. at Cambridge Feb. 19, 1852. Author of *Letters from Palmyra* (New York, 2 vols., 1837), which originally appeared in the *Knickerbocker Magazine* the previous year, and were subsequently republished in London and New York with the title *Zenobia, or the Fall of Palmyra* (new ed. 1868); *Probus, or Rome in the Third Century* (2 vols., 1838), subsequently republished as *Aurelian* (new ed. 1868); *Julian, or Scenes in Judea* (New York, 2 vols., 1841), *Sketches of European Capitals* (1851), *Lectures on the Works and Genius of Washington Allston* (1852), and a *Life of Nathaniel Bacon*, in Sparks's series, and editor of *American Unitarian Biography* (2 vols., 1850).

**War Eagle,** tp., Madison co., Ark. P. 1465.

**Ware Creek,** tp., New Kent co., Va. P. 1012.

**Ware'ham,** town of England, county of Dorset, between the Frome and the Piddle, is surrounded with old Roman walls, and has manufactures of various kinds, but on a small scale. P. 6532.

**Wareham,** p.-v. and tp., Plymouth co., Mass. P. 3098.

**Ware'house** is a building or other suitable place adapted to and used for the storage of goods and merchandise on behalf of their owners, and generally for hire. There are two distinct species, the public and the private. Public warehouses—or, as they are often called, "bonded warehouses"—form an important feature in the system for the collection of the customs revenue in the U. S. and in Great Britain, and their consideration does not belong to the present article. Private warehousing occupies a distinct position in the mercantile law, because, like the business of fowarding or of common carrying, with which it is sometimes connected, it is a separate species of bailment for hire. Private warehouses are designed to be convenient depositories of goods, which are received and kept in safety subject to the order of the owners, and delivered either to them or to the persons whom they designate. One particular form which has come into extensive use in many parts of the U. S. is called the "elevator," and is employed exclusively for the storage or transhipment of grain. The wheat, corn, or other grain, separated into various classes or grades, is raised by powerful machinery from the cars or vessels, and stored in bulk in vast bins, so that an owner who had delivered a certain quantity—say 10,000 bushels—of wheat of a particular grade, receives back not the identical grain which he deposited, but the same number of bushels of a like class. This business of "elevating," especially in the great grain-shipping ports of the West, as Chicago and Milwaukee, has grown to be one of enormous magnitude, involving a vast amount of capital; and some of the principal elevators themselves are among the largest business structures of the world. In ordinary warehouses the identical goods which are received from a particular owner are kept distinguished from others, and are delivered upon his order. In large commercial cities, and especially in the principal seaports which are the centres of an importing trade, the wholesale merchants and manufacturers do not always, nor perhaps generally, keep their goods in their own stores or places of business. Warehousing forms a distinct branch of mercantile traffic. The merchandise of a particular merchant, importer, or manufacturer is often placed at once in a warehouse, and the warehouse-man gives to the depositor a written instrument—known as a "warehouse-man's receipt"—which acknowledges the reception from the owner named of the goods as specified and described, and engages to keep the same in safety and to deliver them upon his order on payment of the fees and charges incident to the storage. These receipts are transferable, and although they are not regarded by the law as fully negotiable, like promissory notes and bills of exchange, yet in the practice of merchants they are treated, somewhat like bills of lading, as semi-negotiable, and merchandise in vast amounts is constantly sold and delivered by a simple endorsement and transfer of the warehouse-man's receipts. The merchant whose goods are thus in store usually transacts his business and negotiates his sales by means of samples, which he either keeps on hand or leaves with his broker, and the delivery of the articles thus purchased is effected either by an assignment of the warehouse-man's receipt or by giving an order on the warehouse-man for the specific articles bought in case they constitute a part only of those contained in the receipt. The assignment of the receipt or the giving the order is a delivery of the goods to the buyer, at least when the same has been presented to the warehouse-man, and he has assented to it by transferring the goods on his books into the name of the purchaser, and thus recognizing him as their owner and depositor. *A fortiori*, if he makes an actual delivery to the buyer, the sale is fully consummated. The warehouse-man has no right to refuse his assent to such transfer unless he has a lien on the goods for his charges which neither the original depositor nor the purchaser is willing to pay. The warehouse-man is a bailee for hire, and is therefore bound to exercise ordinary care, skill, and diligence in respect of the merchandise while it is under his control, and is liable for all losses and injuries resulting from his ordinary negligence or want of ordinary skill. He is bound to deliver the goods to the depositor or to his order upon being paid his lawful charges thereon; and as a security for such payment he has a lien upon the articles which are subject to the charges, but not a general lien for any balance due on account of prior transactions between himself and the depositor. (See the articles on Lien and Bailment.)

John Norton Pomeroy.

**Warehouseman.** See WAREHOUSE.

**Warehouse Point,** p.-v., Hartford co., Conn.

**Warehousing System.** See WAREHOUSE.

**Ware River,** is formed in Barre, Worcester co., Mass., by the union of several small streams. Its course is S. S. W., and it joins Chicopee River at Three Rivers, Mass. It furnishes valuable water-power.

**Wares'boro',** p.-v. and tp., cap. of Ware co., Ga. P. 819.

**War'field,** p.-v., cap. of Martin co., Ky.

**War'field** (CATHARINE ANNE **Ware**), b. at Natchez, Miss., about 1814, daughter of Major Nathaniel, and sister of Eleanor Percy Ware (afterward Mrs. Lee); educated at Philadelphia, at New Orleans, in France, and at Cincinnati, and in 1833 married Elisha Warfield of Lexington, Ky. From some early poetic compositions of the two sisters their father, without their knowledge, selected enough to form a volume entitled *The Wife of Leon, and other Poems, by Two Sisters of the West* (1843), which was received with favor, and was followed by another volume selected by the sisters themselves, entitled *The Indian Chamber, and other Poems* (1846). In 1855, Mrs. Warfield published *The Household of Bouverie* (new ed. 1875), a novel which attracted great attention for its originality and its striking dramatic effects. She has since issued *The Romance of Beauseincourt* (1867), *The Romance of the Green Seal* (1867), *Miriam Monfort* (1873), *A Double Wedding* (1875), *Hester Howard's Temptation* (1875), and other novels. C. G. FORSHEY.

**War'ham** (JOHN), b. in England about 1590; became a distinguished Puritan minister at Exeter; came to Massachusetts 1630 as colleague pastor with John Maverick of a church which removed thither from Plymouth, England; was settled at Dorchester until 1635, when he accompanied his church to Windsor, Conn., where he d. Apr. 1, 1670.

**Warham** (WILLIAM), D. D., LL.D., b. at Okely, Hampshire, England, about 1450; educated at Winchester School and at New College, Oxford, of which he became fellow 1475; was ordained priest; was a joint envoy to the duchess of Burgundy to complain of her countenance to the pretender Perkin Warbeck 1493; was master of the rolls 1494–1502; joint envoy to Maximilian of Burgundy 1501–02; became keeper of the great seal Aug. 11, 1502, lord chancellor Jan. 1, 1503, bishop of London 1503, archbishop of Canterbury Mar. 9, 1504, chancellor of Oxford University soon after; was an intimate friend of Erasmus, and a rival of Fox, bishop of Winchester, and later of Cardinal Wolsey, with whom he had sharp contentions about jurisdiction and precedency; opposed the marriage of Henry VIII. with Catharine of Aragon, but officiated at the ceremony June, 1509; resigned the great seal to Wolsey Dec. 22, 1515, and lent some support to the pretensions of the Nun of Kent. D. near Canterbury Aug. 23, 1532.

**Wa'ring** (GEORGE E.), b. at Middletown, Conn., July 21, 1833; was agricultural engineer of the Central Park, New York; in 1861 entered the volunteer service of the U. S., and became colonel of the 4th Missouri Cavalry; published *Draining for Profit and Health, Elements of Agriculture,* etc., and contributed to periodical literature.

**Warm-blooded Animals.** See APPENDIX.

**Warming and Ventilation.** See APPENDIX.

**War'minster,** tp., Bucks co., Pa. P. 840.

**Warm Springs,** p.-v., tp., Madison co., N. C. P. 498.

**Warm Springs,** cap. of Bath co., Va., known as BATH COURT-HOUSE (which see).

**Warm Springs,** tp., Bath co., Va. P. 890.

**War'ner,** tp., Chippewa co., Mich. P. 238.

**Warner,** p.-v. and tp., Merrimack co., N. H. P. 1667.

**Warner** (CHARLES DUDLEY), b. at Plainfield, Mass., Sept. 12, 1829; graduated at Hamilton College 1851; was a member of a surveying party in Missouri; studied law in New York; was admitted to the bar in Philadelphia 1856; practised in Chicago until 1860; became editor of the Hartford *Press and Courant,* and twice travelled in Europe and the East as correspondent of several American newspapers. He has contributed to the *Atlantic* and other magazines, and is author of *My Summer in a Garden* (1871), *Saunterings* (1872), *Back-Log Studies* (1872), *Mummies and Moslems* (1876), and joint author with Samuel L. Clemens of *The Gilded Age* (1873).

**Warner** (HIRAM), b. in Hampshire co., Mass., Oct. 29, 1802; moved to Georgia in 1819, and taught school for three years. Before leaving his native State he had acquired a pretty good common-school education, with some knowledge of the classics, and he was therefore well qualified to teach a Georgia country school at that time. With his earnings as teacher he laid up sufficient funds to enable him to study law, and was admitted to the bar in 1825, and opened an office first at Knoxville, Crawford co. From 1828 to 1831 he was a member of the general assembly of the State; in 1833 was elected by the legislature one of the judges of the superior courts of the State, and in 1836 was re-elected to the same position for another term of four years. In 1845, upon the organization of the supreme court of the State, he was elected one of its three judges, which position he held for eight years; then resigned, and was elected to Congress in 1855, but declined a re-election to the same body in 1857. In 1860 he was a member of the celebrated Charleston convention, where he exerted his utmost powers against the secession movement. In 1861 he was a member of the Georgia secession convention. He opposed the ordinance, but after it was passed pledged himself to sustain the cause of the State. After the war he accepted the situation, and sustained the first Reconstruction act of Congress, and was again, on the reorganization of the judiciary under the new constitution, appointed to the bench of the supreme court of the State, and in 1872 was appointed chief-justice of that court, which position he still holds (Sept., 1876) with great ability, dignity, and honor. ALEXANDER H. STEPHENS.

**Warner** (RICHARD), b. in England in 1763; was for twenty-three years curate of St. James's church, Bath, and subsequently rector of Chelwood, Somerset, and of Great Chalfield, Wiltshire. D. in 1857. Author of numerous works on local history and antiquities, among which were histories of the Isle of Wight (1795), of Hampshire (5 vols., 1795), of Bath (1801) and of Glastonbury (1826), *Walks through Wales* (2 vols., 1798–99), *A Tour through the Northern Counties of England* (2 vols., 1802), and *Illustrations of the Waverley Novels* (1823). He also published *Literary Recollections* (2 vols., 1830) and a poetical *Diary of an Aged Parson* (1848).

**Warner** (SETH), b. at Roxbury, Conn., May 17, 1743; settled at Bennington, Vt., 1765; was a leader of the "Green Mountain Boys" in the conflicts of jurisdiction with the New York authorities, by whom he was outlawed; was second in command to Ethan Allen at the capture of Ticonderoga and Crown Point 1775; was chosen colonel of Vermont troops July 27, 1775; took part in Montgomery's campaign in Canada; rendered good service in the retreat to Ticonderoga May, 1776; commanded in a sharp engagement at Hubbardton July 7, 1777; participated in the battle of Bennington, and continued in the service until 1782, when he retired from ill-health, and returned to Roxbury, Conn., where he d. Dec. 26, 1784. A *Memoir* by Daniel Chipman was published at Middlebury in 1848.

**Warner** (SUSAN), b. in New York in 1818, daughter of Henry W. Warner (d. 1875); has published *The Wide, Wide World* (1850), a novel which had great success both in England and the U. S., *Queechy* (2 vols., 1852), *The Hills of the Shatemuc* (1856), *Wych Hazel* (1876), and other works, in some of which she was aided by her sister ANNA, who has also written several novels.

**Warner** (WILLIAM), b. in Oxfordshire, England, about 1558; educated at Magdalen College, Oxford; became an attorney, and is supposed to have spent most of his life as business-agent of Henry Carey, Lord Hunsdon. D. at Amwell, Hertfordshire, Mar. 9, 1609. Author of *Pan, his Syrinx* (1584), a pastoral novel, and *Albion's England, a Continued History of the same Kingdom from the Originals of the First Inhabitants thereof,* etc. (1586), a long poem which enjoyed contemporary popularity, passing through 9 eds., the last of which was in Chalmers's series (1810).

**Warner's Ranch,** tp., San Diego co., Cal. P. 246.

**War of Succession.** See SUCCESSION WARS.

**Warped Surface,** sometimes called a **Twisted Surface,** a surface that may be generated by a straight line moving so that no two of its consecutive positions shall be in the same plane. Warped surfaces are divided into two classes—those having a *plane directer,* and those which have *no plane directer.* Every warped surface of the first class may be generated by a straight line moving so as to touch two given lines and continue parallel to a given plane. The moving line is called the *generatrix,* the lines which it touches are called *directrices,* and the plane to which the moving line is parallel is the *plane directer.* Any position of the generatrix is an *element* of the surface. Every warped surface of the second class may be generated by a straight line moving so as to touch three lines, which are called *directrices.* Warped surfaces may be generated in a great variety of ways, but all the methods of generation may be reduced to one of the two described.

If one of the directrices of the first class of surfaces is a straight line and the other a curve, the surface generated is a *conoid.* In this case the rectilineal directrix is called the *line of striction,* because the elements are nearer together

along this line than along any other line of the surface. If both directrices are straight lines, the surface is called an *hyperbolic paraboloid*. If two of the elements of such a surface are taken as directrices, and if a plane parallel to the original directrices is a plane directer, the corresponding surface will be identical with the given surface. As a consequence of this property, it follows that two straight lines of the surface may be drawn through any point of the surface, and it may be shown that only two such lines can be drawn. The surface is named from the fact that all its plane sections are either hyperbolas or parabolas. If the plane of any section is parallel to two right-lined elements which intersect, the section is an hyperbola, of which the two right lines constitute a particular case. All other sections are parabolas, of which one right line constitutes a particular case. From what has been said it is to be inferred that the hyperbolic paraboloid is a particular case of the conoid.

If all the directrices of a warped surface of the second order are straight lines, the surface is called an *hyperboloid of one nappe*, or, sometimes, an elliptical hyperboloid. All plane sections of such a surface are either ellipses or hyperbolas. If any three elements of an elliptical hyperboloid are taken as directrices, the corresponding surface is identical with the given surface. Hence, two right lines lying in the surface can always be drawn through any one of its points. All sections made by planes parallel to two such lines are hyperbolas, of which these lines constitute a particular case. All other plane sections are ellipses. If the three directrices are symmetrically situated with respect to a fourth line, the surface is an *hyperboloid of revolution of one nappe*. Such a surface may be generated by revolving a straight line about a second line to which it is neither parallel nor secant. It can also be generated by revolving an hyperbola about its conjugate axis. (For a more complete explanation of warped surfaces and their properties see Davies' *Descriptive Geometry*.) W. G. Peck.

**War'rant** (in law). This word is used in several different senses: (1) It denotes an order or writ issued by a court, judge, or magistrate having criminal or police jurisdiction, directed to a sheriff, constable, or police-officer, commanding him to arrest the person therein named, who is charged with committing some crime therein briefly described, and to bring him before a court, judge, or magistrate for examination, trial, or sentence, as the case may be. If issued by a court, it is called a "bench warrant," and when this form is used it is generally for the purpose of apprehending a criminal who is at large either on bail or otherwise after an examination, indictment, or trial, or who has committed an offence in presence of the court. Unless a statute has dispensed with the seal, a warrant must not only be signed by the judicial officer who issues it, but must also be sealed. If the offence was not done in open court in presence of the judge—as, for example, a manifest perjury by a witness testifying at a trial—the warrant must be preceded by and based upon an oath or affirmation of some person having sufficient knowledge of the crime that the facts contained in his deposition will constitute a probable cause for the charge and the arrest. The officer makes return of what he has done, either that he has arrested the party named and brought him before the court or magistrate as directed, or that he has been unable to find such person. As a general rule, offenders cannot be arrested unless by warrant. The common law admits of exceptions to this principle where the offence was committed in the sight of an officer, or even of a private citizen if it was felonious, and where the crime was recent and notorious, the criminal was known, and there was danger that he might escape. Statutes have frequently clothed policemen with much more ample powers of arresting without a warrant. In this connection see the article Search-Warrant. (2) *Warrant of attorney* is the name, now somewhat obsolete, synonymous with Power of Attorney (which see). (3) The verb "*to warrant*" signifies that a grantor, in and by his deed of conveyance, covenants that he will assure and defend the grantee in the title and the undisturbed possession of the lands conveyed. In other words, the grantor binds himself, his heirs, executors, and administrators, by a special covenant contained in the deed, that the title is good, and that the grantee shall not be disturbed by any one claiming under the grantor himself, or by virtue of a title paramount to his own. This clause in the deed is called the covenant of warranty. (See article Warranty.) John Norton Pomeroy.

**War'ranty** (in law). This name is given to a class of agreements which are always based upon and collateral to some other and principal contracts. There are three distinct species in common use to which the term is applied.

*Warranty on the Sale of Land.*—This is an express covenant contained in a deed of conveyance, whereby the grantor binds himself and his representatives to warrant and defend the grantee, his heirs and assigns, in the quiet and peaceable possession of the land conveyed against any one claiming the same by a title paramount to that of the grantor. Another form protects the grantee against persons only claiming under the grantor himself. This covenant does not purport to guard the grantee against the acts of mere trespassers, or of those who have no valid superior claim to the land; it becomes operative against the grantor only when the grantee or his assigns are evicted, either in fact or in contemplation of law, from the premises or a portion thereof, by virtue of a valid paramount title or outstanding prior incumbrance.

*Warranty on the Sale of Chattels.*—This is a collateral agreement by the vendor on the sale of chattels or other kinds of personal property, based upon the same consideration as the principal contract, and stipulating either as to the good quality and condition of the articles, or that the title of the seller is perfect. It may be either express or implied. If express, the agreement is made by the very language employed by the parties, and especially by the seller; if implied, it is inferred by the law from the fact of the sale without any express words to that effect. *First, Express Warranty.*—Of course the vendor may use the most formal language, such as, "I warrant," "I agree that the goods are," etc.; but this is by no means necessary. Every distinct affirmation made by the seller at the time of the sale of the existence of a fact in connection with the thing sold is a warranty, *provided it was so intended;* and whether so intended is a question of fact for the jury to decide. When the description of the article relates to a matter of opinion, it is not presumed of itself to be a warranty, but it may be if the vendor so intended it, and this is to be determined as a fact from the consideration of all the circumstances. When the description of the article relates to a matter of fact within the knowledge of the vendor, it is presumed to have been intended as a warranty. A *mere representation* is not actionable, unless intentionally false, and then not as a warranty, but on the ground of the deceit. The practical question is, In which of these three classes—the affirmation of a fact, the statement of an opinion, or a mere representation—does the language of the vendor fall? and this question is left to the jury for decision. It is a settled rule, however, that an express warranty is not broken if the defects in the article covered by it were at the time open, visible, and plain, so as to be seen or known by an ordinary observer, and there was no attempt to conceal them from the buyer. *Second, Implied Warranty.*—The general doctrine of the common law is *caveat emptor*—"Let the buyer take care." Warranties are not therefore generally implied on the sale of chattels, even from the payment of a full price. The English courts have lately shown a strong disposition to relax this rule, to hold sellers to a more rigid liability, and even to adopt the Roman-law doctrine, *caveat venditor*—"Let the seller take care." The American courts have not as yet sanctioned this innovation. To the general rule of the common law there are a few well-defined exceptions, as follows: I. *Of Title.*—When the vendor has the article in his possession at the time of the sale, a warranty of his title is implied, and if the thing should turn out to be another's, the buyer can recover its value which he has lost. But if the article was not at the time in the seller's possession, no such warranty arises. II. *Of Quality.*—(1) When provisions are sold for domestic use, there is an implied warranty that they are fit for consumption. (2) When a purchaser orders an article to be manufactured for a special purpose, or buys such an article from the manufacturer, the law implies a warranty by the manufacturer that it is reasonably fit for the purpose indicated. (3) Sales by sample. Although it has sometimes been said that the mere exhibition of a sample as the basis of a sale implies a warranty that the bulk of the goods corresponds therewith, it is the settled rule, in most of the U. S. at least, that the seller must in some manner agree that the commodity and the sample correspond. This renders the warranty an express and not an implied one. (4) When the vendor, though not a manufacturer, is told of the purpose for which the article is wanted, and the purchaser relies wholly on the seller's judgment to furnish such a commodity, which the seller undertakes to do, he warrants that the thing sold is reasonably fit for the object intended. (5) If, however, the buyer orders or purchases a certain ascertained article known in the market, there is no implied warranty that it shall be fit for the purpose designed. The distinction between this and the preceding case is, that here the buyer trusts to his own knowledge and judgment, while in the other he trusts to the knowledge and judgment of the seller. (6) Finally, in all executory contracts to sell—that is, in contracts to sell at a future time—the law implies a warranty that the article when delivered shall be of a fair merchant-

able quality. *The Remedy.*—It is the settled doctrine in England and in most of the States, that upon the breach of a warranty of quality, either express or implied, collateral to a sale, the buyer is entitled to recover his damages without any recission of the sale or return of the goods. If the price has been paid, the vendee may sue the vendor in a direct action for the damages. If the price has not been paid, and he is sued for it by the vendor, he may recoup or counterclaim his damages, and thus reduce, or perhaps prevent, a recovery against himself. In either case, the measure of damages is generally the difference between the value of the commodity, had it been of the quality as warranted, and the actual value in its inferior condition. In some special cases consequential damages have been allowed greatly exceeding the value of the goods. The law of a few States requires the vendee to rescind the sale, and to return, or offer to return, the thing bought before he can claim to recover his damages.

*Warranties in Policies of Insurance.*—These are stipulations by the assured which constitute the conditions upon which the policy is issued. They are express when incorporated into the instrument; implied when inferred by the law from the very contract of insurance, as, for example, in a marine policy, that the vessel shall be seaworthy at the commencement of the voyage. All such warranties must be literally complied with, or else the policy is avoided, although perhaps the risk may not have been increased, because the parties have expressly made these stipulations to be the conditions upon which the validity of the entire contract is rested. In marine policies the warranties generally relate to the character and condition of the vessel and the voyage upon which she is to sail; in fire policies, to the nature, position, ownership, occupation, and use of the building; and in life policies, to the health, physical condition, and habits of the person whose life is the subject of insurance. JOHN NORTON POMEROY.

**War'ren,** county of E. Georgia, bounded S. W. by Ogeechee River, and traversed by Georgia and Macon and Augusta R. Rs.; surface undulating, soil fertile. There are many cattle, sheep, and swine. Staples, cotton, Indian corn, and sweet potatoes. Cap. Warrenton. Area, 450 sq. m. P. 10,545.

**Warren,** county of W. Illinois, drained by Henderson River, and traversed by Chicago Burlington and Quincy and Rockford Rock Island and St. Louis R. Rs.; surface level, soil highly fertile. Bituminous coal and limestone are abundant. There are flour-mills, saw-mills, and manufactures of agricultural implements, carriages, iron castings, and woollen goods. Cattle and swine are very numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Monmouth. Area, 540 sq. m. P. 23,174.

**Warren,** county of W. Indiana, bordering on Illinois, bounded E. by Wabash River, and traversed by Wabash and Erie Canal and Toledo Wabash and Western R. R.; surface partly level prairie, and partly undulating, soil fertile. Live-stock is numerous. Staples, Indian corn, wheat, oats, hay, wool, and dairy products. Cap. Williamsport. Area, 360 sq. m. P. 10,204.

**Warren,** county of S. Iowa, intersected by South, Middle, and North rivers, drained by tributaries of the Des Moines, and penetrated by a branch of Chicago Rock Island and Pacific R. R., which terminates at the county-seat; surface diversified with prairie and woodland, and abounding in bituminous coal; soil fertile. There are saw-mills, flour-mills, and some woollen manufactures. Live-stock of all kinds is numerous. Staples, Indian corn, wheat, wool, hay, lumber, and dairy products. Cap. Indianola. Area, 482 sq. m. P. 17,980.

**Warren,** county of S. W. Kentucky, bounded N. by Green River, intersected by Big Barren River, and traversed by Louisville and Nashville R. R.; surface somewhat hilly, soil generally fertile. It contains several remarkable caves and a number of ancient monumental mounds. There are saw-mills, grist-mills, tanneries, and manufactures of carriages, woollen goods, and marble and stone work. Horses, mules, cattle, sheep, and swine are numerous. Staples, tobacco, hay, Indian corn, wheat, oats, and wool. Cap. Bowling Green. Area, 455 sq. m. P. 21,742.

**Warren,** county of W. Mississippi, separated from Louisiana by Mississippi River, bounded S. E. by Big Black River, intersected by the Yazoo and by Steel's Bayou, and traversed by Vicksburg and Meridian R. R. The surface is low and level along the rivers and bayous, which are navigable by steamboats, and hilly back from the water; soil generally fertile. There are some manufactures of railway cars, cotton-seed oil, machinery, and iron castings. Live-stock is not numerous. The chief staple is cotton, in which it is exceeded by only one county in the State; there are also Indian corn and sweet potatoes. Cap. Vicksburg. Area, 575 sq. m. P. 26,769.

**Warren,** county of E. Missouri, bounded S. by Missouri River and traversed by St. Louis Kansas City and Northern R. R.; surface varied, soil fertile along the river. There are flour-mills and some manufactures. Live-stock numerous. Staples, Indian corn, oats, wheat, wool, tobacco, and dairy products. Cap. Warrenton. Area, 350 sq. m. P. 9673.

**Warren,** county of N. W. New Jersey, separated from Pennsylvania by Delaware River, intersected by Paulinskill and Paquest rivers, and traversed by Morris Canal and by New Jersey Central, Morris and Essex, and Delaware Lackawanna and Western R. Rs. The surface is hilly in parts, but there are fertile valleys, and the elevated portions are well adapted for pasturage. Iron ore, zinc, manganese, marble, soapstone, and roofing-slate are found. There are numerous flour-mills, grist-mills, and tanneries, and manufactories of agricultural implements, carriages, furniture, clothing, lime, iron, and paper. Cattle, horses, sheep, and swine are numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Belvidere. Area, 550 sq. m. P. 34,336.

**Warren,** county of N. E. New York, partly bounded E. by Lake George and partly S. and W. by Hudson River, drained by Schroon River, and traversed by Adirondack and a branch of Rensselaer and Saratoga R. Rs. The surface is mountainous, hardly a third of the area being adapted for cultivation. Iron ore is abundant, and limestone, marl, and graphite abound. There are numerous saw-mills and tanneries, and some manufactures of boots and shoes and paper. Cattle and sheep form the principal part of the live-stock. Staples, hay, oats, wool, lumber, and dairy products. Cap. Lake George. Area, 912 sq. m. P. 22,592.

**Warren,** county of N. North Carolina, bordering on Virginia, intersected by Roanoke River, and traversed by Raleigh and Gaston R. R.; surface elevated and undulating, soil fertile; with several mineral springs. There are many saw-mills and grist-mills. Cattle and swine are the principal live-stock. Staples, cotton, tobacco, Indian corn, oats, and wool. Cap. Warrenton. Area, 391 sq. m. P. 17,768.

**Warren,** county of S. W. Ohio, intersected by Miami and Little Miami rivers, and traversed by Miami Canal and by several railroads, centring at Cincinnati; surface undulating, soil fertile. There are many ancient aboriginal mounds and an abundance of limestone. There are saw-mills, grist-mills, and manufactories of carriages and of malt. Horses, cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, barley, potatoes, wool, hay, and dairy products. Cap. Lebanon. Area, about 400 sq. m. P. 26,689.

**Warren,** county of N. W. Pennsylvania, bordering on New York, intersected by Alleghany River, drained by Conewango and Brokenstraw creeks, and traversed by Philadelphia and Erie, Atlantic and Great Western, Oil Creek and Alleghany River, and Dunkirk Alleghany Valley and Pittsburg R. Rs. The surface is hilly, with large forests of good timber and much iron ore. The soil is generally tolerably fertile. This county forms part of the great Pennsylvania oil-region. There are more than 100 saw-mills, planing-mills, flouring-mills, tanneries, oil-refineries, iron-foundries, and machine-shops. Cattle and sheep are the principal live-stock. Staples, petroleum, lumber, oats, potatoes, Indian corn, wool, hay, and dairy products. Cap. Warren. Area, 832 sq. m. P. 23,897.

**Warren,** county of Central Tennessee, bounded N. E. by the Caney fork of Cumberland River, drained by Collins River and its affluents, and traversed by McMinnville and Nashville R. R.; surface generally mountainous, soil tolerably fertile. There are flour-mills, saw-mills, cotton-mills, and tanneries. Cattle, sheep, and swine are numerous. Staples, Indian corn, a little cotton and tobacco, and wool. Cap. McMinnville. Area, 440 sq. m. P. 12,714.

**Warren,** county of N. Virginia, intersected by Shenandoah River, and having railroad connections with Washington. The surface is generally hilly, the Blue Ridge running along its S. E. border. The soil is generally good, and iron ore, copper, manganese, and limestone occur. Cattle and sheep are the principal live-stock. Staples, wheat, Indian corn, hay, and wool. Cap. Front Royal. Area, about 200 sq. m. P. 5716.

**Warren,** p.-v. and tp., cap. of Bradley co., Ark., at the head of navigation on Saline River, 45 miles S. of Pine Bluff, has 2 churches, excellent schools, a library, 1 gin, and corn and flouring mills. H. B. VAN VALKENBURGH.

**Warren,** tp., Columbia co., Ark. P. 524.

**Warren,** p.-v. and tp., Litchfield co., Conn. P. 673.

**Warren,** tp., Henderson co., Ill. P. 84.

**Warren,** p.-v. and tp., Jo Daviess co., Ill., on Illinois Central and Mineral Point R. Rs., has good schools, a free public library, 1 bank, 1 newspaper, 3 hotels, 3 halls, wood-carpet manufactory, and 1 grist-mill. Principal business, grain and stock-raising. P. of v. 1666; of tp. 1786.

HERST C. GANN, ED. "SENTINEL."

**Warren,** tp., Lake co., Ill. P. 1235.

**Warren,** tp., Clinton co., Ind. P. 1134.

**Warren,** p.-v. and tp., Huntington co., Ind. P. of v. 358; of tp. 951.

**Warren,** p.-v. and tp., Marion co., Ind. P. 2291.

**Warren,** tp., Putnam co., Ind. P. 1087.

**Warren,** tp., St. Joseph co., Ind. P. 760.

**Warren,** tp., Warren co., Ind. P. 1208.

**Warren,** tp., Bremer co., Ia. P. 927.

**Warren,** tp., Keokuk co., Ia. P. 799.

**Warren,** tp., Lucas co., Ia. P. 963.

**Warren,** tp., Poweshiek co., Ia. P. 1137.

**Warren,** tp., Wayne co., Ia. P. 514.

**Warren,** p.-v. and tp., Knox co., Me. P. 1974.

**Warren,** p.-v. and tp., Baltimore co., Md. P. 317.

**Warren,** p.-v. and tp., Worcester co., Mass. P. 2625.

**Warren,** p.-v. and tp., Macomb co., Mich. P. 1938.

**Warren,** tp., Winona co., Minn. P. 819.

**Warren,** tp., Camden co., Mo. P. 472.

**Warren,** p.-v. and tp., Marion co., Mo. P. 2425.

**Warren,** p.-v. and tp., Grafton co., N. H. P. 960.

**Warren,** tp., Somerset co., N. J. P. 2705.

**Warren,** p.-v. and tp., Herkimer co., N. Y. P. 1503.

**Warren,** p.-v., Haverstraw tp., Rockland co., N. Y. P. 3469.

**Warren,** tp., Belmont co., O. P. 4099.

**Warren,** tp., Jefferson co., O. P. 1637.

**Warren,** p.-v. and tp., cap. of Trumbull co., O., on Atlantic and Great Western, Cleveland and Mahoning, Ashtabula Youngstown and Pittsburg, and Painesville and Youngstown R. Rs., contains 6 churches, 6 fine brick school-houses, 4 banks, 2 newspapers, 3 foundries, 1 rolling-mill, a furnace, 3 machine-shops, a flax, straw, and jute mill for making cotton bagging, a flax-oil mill, 2 carriage-factories, a musical institute, an efficient fire department, gas, and paved streets, a fine park, and several hotels. It is contiguous to an extensive coal and iron district. P. of v. 3457; of tp. 1148. WM. RITEZEL, ED. "CHRONICLE."

**Warren,** tp., Tuscarawas co., O. P. 822.

**Warren,** tp., Washington co., O. P. 1604.

**Warren,** tp., Bradford co., Pa. P. 1421.

**Warren,** tp., Franklin co., Pa. P. 606.

**Warren,** p.-b., cap. of Warren co., Pa. P. 2014.

**Warren,** p.-v. and tp., Bristol co., R. I. P. 3008.

**Warren,** tp., Colleton co., S. C. P. 1631.

**Warren,** p.-v. and tp., Washington co., Vt. P. 1008.

**Warren,** tp., Upshur co., West Va. P. 1601.

**Warren,** p.-v. and tp., St. Croix co., Wis. P. 467.

**Warren,** tp., Waushara co., Wis. P. 632.

**Warren** (GOUVERNEUR KEMBLE), b. at Cold Spring, N. Y., Jan. 8, 1830; graduated at the U. S. Military Academy July 1, 1850, when appointed brevet second lieutenant in the corps of topographical engineers; was employed on surveys of the delta of the Mississippi River 1850–53; topographical engineer of Sioux expedition 1855; aided in Pacific R. R. explorations, and compiled a map and memoir of the territory W. of the Mississippi 1854–58, for vol. xi. *Pacific R. R. Reports;* in charge of surveys, and preparing reports and maps thereon, of Dakota and Nebraska Territories 1855–59; assistant professor of mathematics at West Point 1859–61; lieutenant-colonel of the 5th New York Vols. (Zouaves) May, 1861, which participated in the action at Big Bethel June 10; promoted colonel of his regiment in August, he served in the construction of the defences of Baltimore until the spring of 1862, when his command was united with the Army of the Potomac. In the Virginia Peninsular campaign of 1862 he commanded a brigade in Sykes's division of the 5th (Porter's) corps, and was brevetted lieutenant-colonel for gallantry at Gaines's Mill, where he was wounded. In the battle of Manassas his command was hotly engaged on Aug. 30, and participated in the battle of Antietam. He was commissioned brigadier-general of volunteers on Sept. 26, 1862, and continued to command a brigade in the 5th corps in the battle of Fredericksburg. Gen. Hooker appointed him chief topographical engineer, which position he held until after the battle of Chancellorsville, when he was made chief engineer of the Army of the Potomac. At the battle of Gettysburg he rendered conspicuous aid; was wounded, and brevetted colonel for gallant and meritorious services. He was now promoted major-general of volunteers to date from Chancellorsville, and Aug. 12 assigned to temporary command of the 2d corps, which gained a marked advantage over the enemy at Bristoe Station, Oct. 14, for which he was brevetted brigadier-general. In Mar., 1864, the 1st corps was united with the 5th corps, and Warren assigned to this command by the President, which he held through the campaign of 1864, and until the close of the battle of Five Forks, Apr. 1, 1865; was assigned Apr. 2 to the command of the troops between the Appomattox and James, and Apr. 3 placed in command of Petersburg. Ordered to command the department of the Mississippi May 14, he held this till May 27, when, the enemy having all laid down their arms, he resigned his volunteer commission; was brevetted major-general for gallant and meritorious service in the field; as major of engineers has charge of various harbor and river improvements, bridge constructions and investigations, and fortifications in course of construction and modification. Author of numerous military, exploration, and engineering reports, and of a pamphlet on the battle of Five Forks.

**Warren** (HENRY), b. in London, England, Sept. 24, 1798; studied sculpture under Nollekens along with Bonomi and Gibson; became a friend of Benjamin West, through whom he obtained access to the sculpture-room of the British Museum, where he practised drawing and modelling; studied painting at the Royal Academy; gave his especial attention to water-colors; was an original member of the Institute of Painters in Water-Colors 1835, of which body he was for thirty years president, and was chiefly instrumental in raising the English school of that branch of art to the importance it now enjoys. Author of *Artistic Anatomy, Water-Color Painting,* and other works.

**Warren** (JAMES), b. at Plymouth, Mass., Sept. 28, 1726; graduated at Harvard 1745; became a wealthy merchant at Plymouth; was high sheriff of the county 1757–75; became a member of the general court 1766; procured the appointment of committees of correspondence 1772; president of the provincial congress 1775; was paymaster-general of the army before Boston 1775–76; subsequently major-general of militia, Speaker of the Massachusetts house of representatives several years, and member of the navy board, and declined the offices of lieutenant-general and judge of the supreme court. D. at Plymouth Nov. 27, 1808.—He married MERCY OTIS, sister of James Otis.

**Warren** (JOHN), M. D., brother of Gen. Joseph, b. at Roxbury, Mass., July 27, 1753; graduated at Harvard 1771; studied medicine in the office of his brother Joseph; commenced practice at Salem 1777; became in June, 1775, senior surgeon to the military hospital at Cambridge; attended the wounded from the battle of Bunker's Hill; served in the campaigns of New York and New Jersey 1776–77, being present at the battles of Trenton and Princeton; was in charge of the military hospitals in Boston until the close of the war; accompanied Gen. Greene's expedition to Rhode Island 1778, and the campaign against the Shays insurrection 1786; gave a course of dissections to his surgical colleagues 1780; became professor of anatomy and surgery in the medical school established through his efforts in connection with Harvard University 1783; was for forty years the most distinguished surgeon of New England, introducing many operations previously unknown; delivered in 1773 the first of the series of Fourth of July orations at Boston; was grand master of the Freemasons, president of the agricultural and humane societies and of the Massachusetts Medical Society from 1804 to his death, at Boston Apr. 4, 1815. He published numerous professional papers and some miscellaneous addresses and essays.

**Warren** (Sir JOHN BORLASE), BART., b. at Stapleford, Nottinghamshire, England, in 1754; educated at Winchester School; entered the navy at an early age; subsequently studied at Cambridge; entered Parliament 1774; became a baronet 1778; returned to the navy; performed several gallant exploits during the French war 1778–83; took part in the expedition to Quiberon Bay 1795; captured a French squadron bound with troops for Ireland Oct. 11, 1798; became privy councillor and ambassador to Russia 1802, and full admiral 1810. D. at Greenwich Feb. 27, 1822.

**Warren** (JOHN COLLINS), M. D., son of Dr. John, b. at Boston, Mass., Aug. 1, 1778; graduated at Harvard 1797; studied medicine with his father, also at Edinburgh and in

the hospitals of London and Paris; began practice at Boston 1802; was assistant professor of anatomy and surgery in the Harvard Medical School 1806–15, and professor (as successor to his father) 1815–47, and emeritus professor 1847–56; was one of the founders of the Massachusetts General Hospital 1820, and of the McLean Asylum for the Insane; founder and editor of the Boston *Medical and Surgical Journal* (1828); president of the Massachusetts Medical Society 1832–36; president for many years of the Massachusetts Temperance Society and of the Boston Society of Natural History; visited Europe 1837 and 1852; carried into effect (1846) the successful application of ether in a surgical operation at the Massachusetts General Hospital, of which he was principal surgeon; was a member of the principal scientific societies of America and Europe, and made fine collections of comparative anatomy, osteology, and palæontology, including the most perfect known specimen of the mastodon. D. at Boston May 4, 1856. By his will he ordered his body to be given for examination to the medical school, and that his skeleton should be deposited in its museum. He contributed largely to medical and scientific journals; was one of the editors of the *Monthly Anthology and Boston Review* (1804) and of the *Gospel Advocate* (1821–22); published numerous and valuable professional monographs, a *Genealogy of Warren, with some Historical Sketches* (1854), and several addresses before scientific bodies. A *Life, chiefly compiled from his Autobiography and Journals* (Boston, 2 vols., 1860), was published by his brother, Edward Warren, M. D.

**Warren** (Jonathan Mason), M. D., son of Dr. John Collins, b. at Boston, Mass., in 1811; graduated in medicine at Cambridge 1832; studied surgery in London and Paris, and was for many years attending surgeon at the Massachusetts General Hospital. D. at Boston Aug. 19, 1867. Author of many professional papers, collected under the title *Surgical Observations, with Cases and Operations* (1867).

**Warren** (Joseph), b. at Roxbury, Mass., June 11, 1741; graduated at Harvard 1759; studied medicine under Dr. Lloyd; began practice at Boston 1762; delivered in 1772, and again in 1775, the civic oration on the anniversary of the "Boston Massacre;" was a member of the provincial committee of correspondence 1772; president of the Massachusetts congress and chairman of its committee of public safety 1774, being thus the virtual executive of a *de facto* government at the outbreak of hostilities with Great Britain; was efficient in organizing the volunteers after the battle of Lexington; was chosen major-general by the provincial congress June 14, and took an active part as a volunteer, declining the command, at the battle of Bunker's Hill, at which he was killed June 17, 1775, falling near the spot where the Bunker's Hill Monument now stands. A statue by Dexter was erected on Bunker's Hill June 17, 1857. A *Life* by A. H. Everett may be found in Sparks's *American Biography*, and another by Richard Frothingham was published at Boston in 1865.

**Warren** (Mercy **Otis**), sister of James Otis, b. at Barnstable, Mass., Sept. 25, 1728 (N. S.), married James Warren about 1754; became a zealous patriot; corresponded with Samuel and John Adams, Thomas Jefferson, and other leaders of the Revolution; wrote several dramatic and satirical poems against the royalists (1773–75), which, with two tragedies, were included in a volume of *Poems, Dramatic and Miscellaneous* (1790), and published *A History of the Rise, Progress, and Termination of the American Revolution, interspersed with Biographical, Political, and Moral Observations* (Boston, 3 vols., 1805). D. at Plymouth Oct. 19, 1814.

**Warren** (Sir Peter), b. in England in 1703; entered the navy 1727; was commodore of the squadron which conveyed Sir William Pepperell's expedition against Louisburg 1745; was made rear-admiral the same year, and vice-admiral 1747, when with Anson he defeated a French fleet off Cape Finisterre; was elected to Parliament for Westminster 1747; married Miss Susan de Lancey of New York, daughter of Stephen, and acquired a vast estate in the Mohawk Valley, which he placed in charge of his nephew, afterward celebrated as Sir William Johnson. D. in Ireland July 29, 1752.

**Warren** (Samuel), D. C. L., b. at Racre, Denbighshire, Wales, May 23, 1807; educated at the University of Edinburgh; commenced the study of medicine, but soon abandoned it for that of the law, which he pursued at the Inner Temple, London, 1828–30; contributed to *Blackwood's Magazine* his well-known *Passages from the Diary of a Late Physician* (1830–31); wrote several legal works; became queen's counsel 1851; was recorder of Hull 1854–74; sat in Parliament as a Conservative 1856–59, and was appointed master in lunacy Feb., 1859. He has published *Ten Thousand a Year* (1839), a successful novel, and *Now and Then* (1847), an unsuccessful one; has collected from the pages of *Blackwood* 2 vols. of *Miscellanies, Critical and Imaginative* (1854), and is author of various other literary productions.

**Warren** (William), b. in Philadelphia Nov. 17, 1812, and made his first appearance on the stage at the Arch Street Theatre as Young Norval Oct. 27, 1832; played an engagement at the Park Theatre in New York in 1841, and in 1845 appeared in London at the Strand Theatre; in Oct., 1846, appeared as Sir Lucius O'Trigger in *The Rivals* on the opening night of the Howard Athenæum, Boston, where he won an immediate success, which has continued for more than thirty years. In Aug., 1847, he became a member of the Boston Museum company, appearing Aug. 23 as Billy Lackaday. Since that time he has, with the exception of a brief interval, when he made a tour of the principal cities of the U. S., performed continuously at the Museum with unvarying popularity and success, representing probably in that time a greater variety of characters, and appearing a greater number of times, than any living actor. In the old English comedies he is unrivalled, while the number of hits he has made in special character parts are too numerous to mention.

**Warren** (William Fairfield), D. D., b. at Williamsburg, Mass., Mar. 13, 1833; graduated at Wesleyan University, Middletown, Conn., 1853; became a preacher in the N. E. Methodist conference 1855; subsequently studied theology at Andover, Berlin, and Halle; travelled in the East; became professor of systematic theology in the Methodist missionary institute at Bremen, Germany, 1861, and in the Boston Theological Seminary 1866, and was chosen president of Boston University 1873. Author of treatises on logic (1864) and on systematic theology (1865), both in German.

**War'rensburg,** p.-v. and tp., cap. of Johnson co., Mo., on Missouri Pacific R. R., 217 miles W. of St. Louis, contains 8 churches, 3 public-school buildings, the State normal school, 3 banks, a foundry and machine-shop, woollen-mills, 1 carriage and 2 wagon factories, 1 jewelry establishment, celebrated sandstone quarries, 3 newspapers, 4 flouring-mills, 1 elevator, and 2 hotels. P. of v. 2945; of tp. 4804. David Nation, Ed. "Journal."

**Warrensburg,** p.-v. and tp., Warren co., N. Y. P. of v. 715; of tp. 1579.

**Warren's Store,** tp., Hale co., Ala. P. 480.

**War'rensville,** p.-v. and tp., Cayahoga co., O. P. 1429.

**War'renton,** tp., Dallas co., Ala. P. 1057.

**Warrenton,** p.-v. and tp., Marshall co., Ala. P. of v. 60; of tp. 863.

**Warrenton,** p.-v., cap. of Warren co., Ga., on Macon and Augusta R. R., 54 miles from the latter city, contains 4 churches, 1 academy, 1 newspaper, and a wagon-factory. P. about 1000. C. E. McGregor, Ed. "Clipper."

**Warrenton,** p.-v., Warren co., Mo., on St. Louis Kansas City and Northern R. R., 58 miles N. W. of St. Louis, has 3 churches, a college and public school, 3 newspapers, 1 bank, an orphan asylum, 3 hotels, and 2 mills. P. 588. F. T. Williams, Pub. "Citizen."

**Warrenton,** p.-v. and tp., cap. of Warren co., N. C., 60 miles N. E. of Raleigh, has 6 churches, 1 academy and 2 seminaries, 1 bank, 1 newspaper, a tobacco-factory, 2 carriage-factories, an iron-foundry, 1 hotel, and a fire insurance company. The late Horace Greeley was married in the Episcopal church here. It is a resort for tourists and invalids during the winter months. P. of v. 941; of tp. 2886. H. A. Foote, Ed. "Gazette."

**Warrenton,** p.-v. and tp., Jefferson co., O. P. 241.

**Warrenton,** p.-v., Centre tp., cap. of Fauquier co., Va. P. 1256.

**War'rick,** county of S. W. Indiana, separated from Kentucky by Ohio River, intersected by Wabash and Erie Canal, and partially traversed by Lake Erie Evansville and South-western R. R.; surface undulating, soil fertile. Bituminous coal is found. Horses, cattle, sheep, and swine are numerous. Staples, tobacco, Indian corn, oats, hay, wool, and dairy products. Cap. Boonville. Area, 360 sq. m. P. 17,653.

**Warrick's Mill,** tp., Washington co., Ala. P. 863.

**War'rington,** town of England, county of Lancaster, on the Mersey, which here is navigable for vessels of 100 tons burden, manufactures fustians, twills, corduroy, and other cotton goods, glass, leather, soap, all kinds of tools, and ale. P. 32,083.

**Warrington,** p.-v., Escambia co., Fla.

**Warrington,** p.-v. and tp., Bucks co., Pa. P. 949.

**Warrington,** tp., York co., Pa. P. 1726.

**Warrington** (Lewis), b. at Williamsburg, Va., Nov. 3, 1782; graduated at William and Mary College 1798; became a midshipman in the navy 1800; served under Preble in the war with Tripoli; was a lieutenant on the Chesapeake in her engagement with the Leopard 1807; became master-commandant of the Peacock, and captured the sloop-of-war Epervier; took 14 British merchantmen 1814, and became captain in November of that year; proceeded to the East Indies; captured the Nautilus in the Straits of Sunda June 30, 1815; subsequently commanded a squadron on the West India station, and was a member of the board of navy commissioners 1827–30 and 1840–42, and chief of the bureau of ordnance from Sept., 1842, until his death, at Washington, D. C., Oct. 12, 1851.

**War'rior's Mark,** p.-v. and tp., Huntingdon co., Pa. P. 1209.

**Warrior Stand,** tp., Macon co., Ala. P. 2179.

**War'saw** [Polish, *Warszawa;* Ger. *Warschau;* Fr. *Varsovie*], the fortified capital of the former kingdom of Poland, with 279,502 inhabitants in 1873, of whom 86,000 were Jews, is on the left bank of the Vistula, on a hill which gradually loses itself in a vast flat plain, and consists of the old town, the new town, and several suburbs, of which the most important is Praga, on the right bank of the river, and connected with the city proper by an iron bridge. The location of Warsaw is of extraordinary commercial importance. The city is the entrepôt of the products of Northern Russia and Siberia, which hence reach Western Europe, and the opening of the Suez Canal has given it an opportunity of grasping the Chinese and East Indian traffic, which formerly passed through Nizhnee-Novgorod and Kiachta, and of making itself the centre of the Europo-Asiatic commerce. In architectural respects it still bears the character of being the capital of a country which is governed despotically, small and miserable huts alternating with large and magnificent palaces; but this contrast is diminishing every year, and the more recent parts of the city have a decidedly modern character. The principal public squares are the Saxon Square, Exchange Square, Theatre Square, Krasinski Square, and Sigismund Square, containing a column bearing the statue of Sigismund III., erected in 1643. The principal streets are Long street, Honey street, King street, Elector street, Marshal street, Senator street, Lescino street, and Cracow street, with the equestrian statue of Poniatowski by Thorwaldsen. The most remarkable of the public buildings are—the royal palace, situated on an elevation in the northern part of the city, built by Sigismund III., and containing many magnificent rooms, a library, and the archives; the Saxon palace and the palace of the vice-regent; the Krasinski and Brühl palaces, and numerous palaces belonging to the rich Polish nobility, the families of Potocki, Zamoyski, Lubienski, Raczynski, Sapieka, Branicki, etc.; the Belvedere, with a beautiful park; the Lazienki on an island in the centre of a lake; the city hall, the mint, the arsenal, and the theatre. The city has 85 churches, among which are 7 Greek Catholic, 1 Lutheran, and 1 Reformed. The most remarkable are—the Roman Catholic cathedral of St. John in the old town, connected with the royal palace, the Greek Catholic cathedral, the Lutheran church, the Alexander church, the church of the Holy Cross, with a magnificent front façade, and the church of the Capuchins, with a beautiful marble monument. The three dépôts belonging to the Warsaw-Vienna, Warsaw-Terespol, and Warsaw-St. Petersburg railways are connected by horse-railways. The scientific institutions of the city suffer very much because the Russian government suppresses all that has a national Polish character; thus, the largest part of the library of the university, founded in 1816, has been carried to St. Petersburg. There exist, however, good zoological and mineralogical collections, a botanical garden, an observatory, a picture-gallery, etc. There are also fine private art-collections belonging to the families of Assolinski, Potocki, Dombrowski, etc. The educational and benevolent institutions are numerous, and besides the theatre there are many and good establishments for amusement, as the Poles are very fond of dancing and singing. Manufacturing industry is flourishing. Cloth, carpets, woollen, cotton, and silk fabrics, hats, gloves, saddlery, gold and silver ware, carriages, furniture, etc., are manufactured, and extensive distilleries and breweries are in operation. In order to facilitate the enormous business of the city, there have recently been established several banks, besides the national Polish bank founded in 1830. In the vicinity of Warsaw are several beautiful palaces, such as the Wilanow, built in the seventeenth century in French style, the Krolikarnia, with a park, a menagerie, etc., the Marynout, and others.

Warsaw is said to have been founded in 1185 by King Casimir. In 1550 it became the residence of the Polish kings. At Wola, a village near Warsaw, the elections of the kings took place. In 1655 the Swedes took the city, and held it for a long time. Augustus II. and III. did much to beautify it. In 1764 the Russians captured it, but by the third division of Poland it fell to Prussia. By the Peace of Vienna it became definitely a Russian possession, and it has suffered much from the cruelties which the Russians perpetrated every time they succeeded in suppressing a Polish insurrection. It suffered most, however, in 1831, when it was stormed and taken by Paskevitch. Nevertheless, its favorable commercial location has always enabled it to recover, and even to increase. August Niemann.

**War'saw,** p.-v. and tp., Sumter co., Ala. P. 2080.

**Warsaw,** p.-v., Hancock co., Ill., the W. terminus of the Toledo Peoria and Wabash R. R., and upon Mississippi River, 5 miles below the lower rapids, contains 7 churches, a public library, 13 schools, 1 bank, 2 parks, 1 newspaper, a Masonic lodge, large woollen-mill, 3 hotels, wagon and plough factories, several flouring-mills and cooperage establishments, 1 foundry, and a lodge and encampment of I. O. O. F. P. 3583. F. M. Dallam, Ed. "Bulletin."

**Warsaw,** p.-v., cap. of Kosciusko co., Ind., on Pittsburg Fort Wayne and Chicago and Cincinnati Wabash and Michigan R. Rs., 109 miles E. of Chicago, has 4 churches, good schools, 2 banks, 2 newspapers, 4 hotels, and 2 large flouring-mills. P. 2206.

Williams & Hossler, Eds. "Northern Indianian."

**Warsaw,** p.-v., cap. of Gallatin co., Ky. P. 715.

**Warsaw,** tp., Goodhue co., Minn. P. 1027.

**Warsaw,** p.-v. and tp., Rice co., Minn. P. 1000.

**Warsaw,** p.-v., cap. of Benton co., Mo., on the N. bank of Osage River, has 2 churches, 2 places of worship for colored people, 1 bank, 2 newspapers, court-house, jail, 1 grist and 1 saw mill, 1 wagon-shop, and 2 hotels.

Sewall W. Smith, Ed. "Weekly Times."

**Warsaw,** p.-v. and tp., cap. of Wyoming co., N. Y., on New York and Erie R. R., 45 miles E. of Buffalo, in the beautiful Wyoming Valley, contains 6 churches, a fine union free-school building, water and gas works, 2 newspapers, a public library, 2 banks, 4 hotels, wagon and broom factories, an iron-foundry, and a map-roller manufactory. P. of v. 1631; of tp. 3143.

Wm. H. Merrill, Ed. "Western New Yorker."

**Warsaw,** p.-v. and tp., Duplin co., N. C. P. 1362.

**Warsaw,** p.-v. and tp., Jefferson co., Pa. P. 1122.

**Warsaw,** p.-v., cap. of Richmond co., Va.

**Warsaw Landing,** tp., Benton co., Mo. P. 498.

**Wars of Succession.** See Succession Wars, by Prof. Clemens Petersen, A. M.

**Wart.** See Warts.

**War'ta,** river of Europe, rises near Cracow, passes through Poland and Prussia, joins the Oder at Küstrin, province of Brandenburg, after a course of 450 miles, navigable for 220 miles, and through its chief affluent, the Netze, it communicates by canals with the Vistula.

**Wart'burg,** a castle situated in the heart of the Thuringian Forest, was founded in 1067 by Ludwig the Leaper, count of Thuringia, and was for several centuries the residence of his successors, who at times held a brilliant and widely-renowned court here. After passing through many vicissitudes—conflagrations by sieges and lightning, collapses by hurricanes and old age, remodellings after the demands of other times, etc.—it has recently been restored with great magnificence and exquisite taste by Charles Alexander, duke of Saxe-Weimar. It exercises, however, a much greater attraction by its historical remembrances than by its architectural merits. Here the famous contest between the Minnesingers took place in the time of Landgrave Hermann I., about 1206—an event whose historical and mythical elements cannot now be separated (see Lucas, 1838; Plötz, 1851), but which forms the subject of the singular epic, *Der Krieg von Wartburg,* probably written about 1300, edited by Ettmüller in 1830, and translated into modern German by Simrock in 1858. Here lived Elizabeth of Hungary (1207–31), the wife of Landgrave Louis II., and afterward one of the most renowned saints of the Roman Catholic Church; and here Luther was kept concealed May 4, 1521–Mar. 6, 1522, finishing his translation of the Bible. On Oct. 18, 1817, delegates from all the Protestant universities of Germany assembled here to celebrate the third centenary year of the Reformation and the recent liberation of the country from the French yoke. In the excitement of the moment the enthusiasm for liberty and Fatherland ran a little high. Some books which were considered illiberal and unpatriotic were burnt, and some plans were proposed for the reformation and elevation of the students' life at the universities, more especially for the abolition of the

old traditionary barriers which separated the students of various German countries from each other. The whole affair was noble and harmless, in spite of some exaggerations, but the German princes, alarmed by this attempt to revolutionize and republicanize Germany, made it the cause of numerous odious persecutions and chicaneries.

**Wartburg,** p.-v., cap. of Morgan co., Tenn.

**Wart-Hog.** See PHACOCHŒRIDÆ, by THEODORE GILL, PH. D.

**War'ton** (JOSEPH), D. D., brother of Thomas, b. at Dunsford, Surrey, England, in 1722, son of Thomas Warton, D. D. (d. 1746), vicar of Basingstoke, Hampshire, and of Cobham, Surrey, and professor of poetry at Oxford 1718–28; educated at Winchester School; graduated at Oriel College, Oxford, 1744; took orders in the Church of England; was curate to his father at Basingstoke 1744–46; curate at Chelsea 1746–48; became rector of Winslade, Hampshire, 1748; travelled on the Continent with his patron, the duke of Bolton, 1751; obtained the rectory of Tunworth 1754, that of Wickham 1782, and of Upham 1788; was second master of Winchester School 1755–66, and headmaster 1766–93; became chaplain to Sir George (afterward Lord) Lyttleton 1756, prebendary of St. Paul's, London, 1782, and of Winchester 1788. D. at Wickham, in Hampshire, Feb. 23, 1800. He published *Odes on Various Subjects* (1746), a poetical translation of the *Eclogues and Georgics of Virgil* (1753), an *Essay on the Genius and Writings of Pope* (2 vols., 1756–82); contributed 24 critical papers to *The Adventurer* (1753–56), and edited the works of Pope (9 vols., 1797) and Dryden, the latter completed after his death (4 vols., 1811). He was engaged upon and announced for publication (1784) a history of Greek, Roman, Italian, and French poetry, but it never appeared. A volume of *Biographical Memoirs* (1806) was published by Rev. John Wooll.

**Warton** (THOMAS), F. S. A., b. at Basingstoke, Hampshire, England, in 1728; graduated at Trinity College, Oxford, about 1747; became a fellow there 1751; took orders in the Church of England 1755; was professor of poetry in the university 1757–67; became Camden professor of ancient history and poet-laureate 1785; and obtained the livings of Kiddington 1771 and Hill Farrance 1782. D. at Oxford May 21, 1790, having resided for forty years in Trinity College. Author of *Observations on the Faerie Queene of Spenser* (1754), *The Life of Sir Thomas Pope* (1772), and of a valuable *History of English Poetry* (3 vols., 1774–81), intended to extend to the beginning of the eighteenth century, but never continued beyond the Elizabethan age. Revised editions were issued in 1824, 1840, and 1870. Warton edited the Greek *Anthology* (1766), the works of Theocritus (Oxford, 2 vols., 1770), and the *Minor Poems of Milton* (1785; 2d ed. 1791), and published several occasional poems, of which a collection appeared in 1777. His *Poetical Works* (1802) were edited, with a sketch of his life, by Richard Mant, D. D., bishop of Down. They have also been included in Chalmers's *British Poets* (1810).

**War'trace Dépôt,** p.-v., Bedford co., Tenn.

**Warts,** or **Verrucæ** [Lat. *verruca*, a "wart"], are developed by hypertrophy, abnormal growth, of the papillæ of the skin. They may be round and ovoid or conical, thread-like, or broad and flat. The so-called "seeds" or points of a dry wart correspond to the number of papillæ which have become elongated and thickened. Each papilla of the skin has an independent supply of blood by a little loop of capillary blood-vessels at its base. Hence, mere removal of the wart is followed by its renewal from the well-nourished base and remaining cells which have transmitted the tendency to excessive growth. Cases are often cited of warts communicated by the blood from other warts, but the best authorities deny them. Warts occur chiefly in children between the second and fourteenth year; their cause is uncertain. Their duration is indefinite; they sometimes disappear suddenly, probably by contraction of the vascular papillary base and casting off of the superabundant dry cells. When they are kept free from handling or irritation, the diet is corrected, and alteratives are given, they may slowly disappear. The common treatment is to snip them off and touch the base with nitric acid, glacial acetic acid, or lunar caustic; saturation with tincture of thujar or thuya (arbor vitæ) daily has the effect to speedily remove them in many cases.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Warville, de** (BRISSOT). See BRISSOT DE WARVILLE.

**War'wick,** or **Warwickshire,** county in the centre of England, watered by the Avon, comprises an area of 881 sq. m., with 633,902 inhabitants. The surface is elevated; in the northern part, which once was covered with the Forest of Arden, moor, heath, and forest alternate; in the southern part the soil is very fertile. Agriculture and dairy-farming are in an advanced state. Coal, chalk, lime, and marl are found; manufactures are extensive.

**Warwick,** town of England, capital of Warwickshire, on the Avon, an old and interesting place, contains several fine buildings, among which the most remarkable is the castle, many benevolent institutions, and some manufactures, though on a small scale. P. 11,001.

**Warwick,** county of S. E. Virginia, between York and James rivers; surface undulating, soil good. Staples, oysters, firewood, and Indian corn. Cap. Warwick Court-house. Area, 95 sq. m. P. 1672.

**Warwick,** p.-v. and tp., Bedford co., Md. P. 320.

**Warwick,** p.-v. and tp., Franklin co., Mass. P. 769.

**Warwick,** p.-v. and tp., Orange co., N. Y., on Warwick Valley and Pine Island R. Rs., has 13 churches, Seward and Warwick institutes, a public library, 1 bank, 1 newspaper, waterworks, an efficient fire department, graded streets, butter and cheese manufactories, and rich mines of iron ore and other minerals. P. of v. 938; of tp. 5736.
D. F. WELLING, ED. "ADVERTISER."

**Warwick,** tp., Tuscarawas co., O. P. 1387.

**Warwick,** tp., Bucks co., Pa. P. 775.

**Warwick,** p.-v. and tp., Chester co., Pa. P. 1266.

**Warwick,** tp., Lancaster co., Pa. P. 3345.

**Warwick,** p.-v. and tp., Kent co., R. I., on Stonington and Providence R. R. P. 10,453.

**Warwick** (GUY), EARL OF, a legendary Saxon hero who figures largely in early English metrical romances as a champion against the Danes, and especially noted for his victory over the giant Colbrand, alluded to in Shakspeare's *King John* and *Henry VIII.* He is usually assigned to the period of King Athelstan. *The Booke of the most victorious Prince Guy of Warwick,* a metrical romance of the earlier half of the fourteenth century, was printed before 1567, and a prose French romance on the same subject, printed in 1525, was edited by J. Zupitza for the Early English Text Society 1875–76.

**Warwick** (HENRY DE **Beauchamp**), DUKE OF, and king of the Isle of Wight, son of Richard, b. at Hanley Castle, Warwickshire, England, Mar. 22, 1424; succeeded to the earldom on the death of his father 1439; distinguished himself in the defence of Normandy 1442–44; was created duke of Warwick, to rank next the duke of Norfolk and before the duke of Buckingham—a provision which led to a controversy with the latter nobleman, which was settled by act of Parliament to the effect that the claimants should take precedence in alternate years; and received from Henry VI., who had been his companion in childhood, many honors, the most extraordinary being that he was crowned by that monarch as vassal king of the Isle of Wight early in 1445. He survived his advancement but a few months, dying without issue June 11, 1445.

**Warwick** (RICHARD DE **Beauchamp**), TWELFTH EARL OF, b. at Salwarpe, Worcestershire, Jan. 28, 1381, son of Thomas, who was condemned as a traitor in the reign of Richard II., but not executed; was made a knight of the Bath at the coronation of Henry IV. (1399); succeeded to the earldom 1401; fought against Owen Glendower 1401–02, and against the Percies 1403, taking part in the famous battle of Shrewsbury; made a pilgrimage to the Holy Sepulchre 1408; visited several European courts, where he distinguished himself at tournaments; was lord high steward at the coronation of Henry V. (1413), and in the same year commissioner to negotiate peace with France; headed an embassy to the Council of Constance 1414; was an energetic opponent of the Lollards or followers of Wycliffe; became in 1415 captain of Calais, where he entertained the emperor Sigismund with such grace as to receive from him authority to bear the title "father of courtesy;" aided in the siege and capture of Caen 1417; was ambassador to the duke of Burgundy 1418; was created about that period earl of Aumerle (otherwise Albemarle); attended Henry V. on his deathbed (1422); was regent of France 1425–28; directed for nine years the education of the young king, Henry VI., gaining the title "the good earl," and was again regent or lieutenant-general of France and Normandy from 1437 to his death at Rouen Apr. 30, 1439. He was buried and has a magnificent tomb in the church of St. Mary, Warwick. He was possessed of immense landed estates, was father of Anne, the wife of Richard Neville, subsequently earl of Warwick, and known as the "king-maker," and was author of some courtly verses preserved in MSS. in the British Museum.

**Warwick** (RICHARD **Neville**), EARL OF, known as "the king-maker," b. in England about 1420 (or 1428), was the eldest son of Richard Neville, earl of Salisbury, and Alice, daughter and heiress of Thomas de Montacute,

the previous earl of Salisbury; was first cousin of the earl of March, afterward Edward IV., through the marriage of his father's sister, Lady Cecily Neville, to Richard Plantagenet, duke of York; distinguished himself in an incursion across the Scottish Marches 1448; married Anne Neville, daughter and ultimate heiress of Richard de Beauchamp, earl of Warwick, which title was now conferred upon him 1449; became by this connection the most wealthy and powerful nobleman of the kingdom; fought along with his father in the "war of the Roses," which grew out of the claims of the duke of York to the throne; bore a leading part in the first battle, that of St. Alban's, May 22, 1455, which he decided in favor of the Yorkists by a daring charge into the town; was rewarded with the post of captain of Calais, then the most important in the gift of the king, and also received the command of the fleet for five years; fought in May, 1458, a successful naval battle with a Lubeck fleet of twenty-eight vessels, of which he captured six; joined his father at Ludlow Castle on the renewal of the civil war 1459; escaped to Calais with his cousin, the earl of March, on the dispersion of the Yorkists, Oct., 1459; was deprived of his naval command, but retained Calais by force of arms; fitted out there an expedition of 1500 men, with whom he landed in Kent June, 1460; marched upon and entered London, which opened its gates without a battle; augmented his troops to 40,000 men; defeated the queen's army near Northampton July 10, capturing the imbecile king, Henry VI., after which the duke of York laid formal claim and was recognized as heir to the throne Nov. 1. At the disastrous battle of Wakefield, however, Dec. 30, the pretender was killed, and the earl of Salisbury (Warwick's father) and twelve other Yorkist nobles were captured and beheaded at Pontefract (Jan. 1, 1461). Warwick suffered another defeat at Bernard's Heath, near St. Alban's, Feb. 17, but rallied his forces, effected a junction with the young duke of York, and marched upon London, where they were received with acclamations, and the duke was proclaimed king Mar. 4 under the title of Edward IV. Warwick next defeated the Lancastrians at the desperate battle of Towton (or Ferrybridge), near the city of York, Mar. 29, 1461, and again, three years later, at Hexham, May 15, 1464; captured the deposed king, Henry VI., 1465, and led him as a public spectacle through Cheapside, London, to the Tower June, 1465; was appointed to the offices of high admiral, warden of the West Marches, lord-chamberlain, lord lieutenant of Ireland, and governor of Dover and Calais, together with large grants of forfeited estates, his brother George being made archbishop of York and lord high chancellor, and his brother, Lord Montacute, warden of the East Marches of Scotland and earl of Northumberland. He had now a revenue from his offices alone of 80,000 crowns a year, and displayed a regal magnificence, keeping open house wherever he went and maintaining many thousands of servants or dependents. He was employed on missions to France, Burgundy, and Brittany, and took such deep offence at the king's marriage with Elizabeth Woodville (1464), while he was engaged in negotiating for him the hand of a French princess, that he began to be disaffected; gave his daughter in marriage to Edward's brother, George, duke of Clarence, without the royal permission, 1469, and, taking advantage of an insurrection against certain taxes in Yorkshire, placed himself, with Clarence, at the head of the rebellion; defeated the royal forces at Edgecote July 26, 1469, capturing the king and putting to death the queen's father and brother; had a brief reconciliation with the king; was again in arms against him in the following year (1470); was forced to flee to France; made at Amboise (July 15, 1470) a treaty with Queen Margaret for the restoration of Henry VI., the marriage of Prince Edward of Lancaster to his daughter Anna (August), and the recognition of his son-in-law Clarence as heir-presumptive to the latter. By this double marriage the crown seemed now assured to the descendants of Warwick, who, aided by Louis XI., landed with a body of exiles at Plymouth and Dartmouth Sept. 13, 1470, successfully marched upon London, restored Henry VI., and was reinstated in all his offices, with the addition of that of lord high admiral. The Lancastrian restoration, however, had lasted barely six months before Edward IV., who had escaped to Holland, obtained the aid of Charles the Bold, duke of Burgundy; landed at Ravenspur, near Hull, with 2000 men, English, Dutch, and Flemings, and Warwick, along with his brother Montacute (then earl of Northumberland), betrayed by his son-in-law Clarence, was defeated and killed at the battle of Barnet, Apr. 14, 1471. They were buried at Bisham Abbey, Berkshire. The capture of Queen Margaret and murder of Prince Edward at Tewksbury, May 4, and the murder of King Henry in the Tower in June, terminated the war of the Roses, in which all the members of the house of Neville for two generations perished by the sword, except George, archbishop of York, who d. June 8, 1476. Anne Neville, widow of Prince Edward of Lancaster, married in 1472 Richard, duke of Gloucester, afterward Richard III.; was crowned queen July 6, 1483; lost her only son Apr. 9, 1484, and d. Mar. 16, 1485. The widow of Warwick survived him many years, experiencing great vicissitudes, and was living reduced to poverty in 1490.

PORTER C. BLISS.

**Warwick** (ROBERT **Rich**), EARL OF, a descendant of Lord Chancellor Rich, b. in England about 1590; succeeded to the earldom 1618; became a prominent leader of the Puritan party; took an active part in promoting the colonization of New England, especially of Rhode Island; was an intimate friend and protector of Thomas Hooker, the celebrated founder of Connecticut, and of other Puritan clergymen, whom he protected during the ecclesiastical prosecutions of the reign of Charles I.; adhered to the cause of Parliament during the great rebellion; became lieutenant of the fleet under the earl of Northumberland 1642, and was a prominent supporter of Cromwell as Protector, and was appointed to bear the sword of state in the latter's presence 1657. D. in 1658.

**Warwick Court-house,** p.-v., cap. of Warwick co., Va. P. 21.

**Wa'satch,** county of N. E. Utah, intersected by Green River and its affluents; surface mostly desert. Cap. Heber. Area, about 10,000 sq. m. P. 1244.

**Wasatch** (or **Wahsatch**) **Mountains.** See UTAH.

**Was'co,** county of Central Oregon, bounded N. by Washington Territory, from which it is separated by Columbia River, and watered by Des Chutes and John Day's rivers; surface generally mountainous, soil better adapted to grazing than tillage. Live-stock numerous in proportion to the population. Staples, oats, Indian corn, potatoes, hay, and wool. Cap. The Dalles. Area, about 12,000 sq. m. P. 2509.

**Was'eca,** county of S. Minnesota, intersected by Le Sueur River and traversed by Winona and St. Peter R. R.; surface undulating and partly wooded, soil fertile. Live-stock numerous in proportion to the population. Staples, wheat, oats, hay, wool, and dairy products. Cap. Waseca. Area, 432 sq. m. P. 7854.

**Waseca,** p.-v. and tp., cap. of Waseca co., Minn. P. 551.

**Wash'burn,** tp., Scott co., Ark. P. 499.

**Washburn,** p.-v. and tp., Sebastian co., Ark. P. 478.

**Washburn,** p.-v., Woodford co., Ill., on the Western branch of Chicago and Alton R. R., 125 miles W. of the former place, has 5 churches, a fine school-building, 1 bank, 2 hotels, and 1 flouring-mill. P. 272.

N. V. MALONEY, ED. "REVEILLE."

**Washburn,** tp., Aroostook co., Me. P. 449.

**Washburn** (CADWALLADER COLDEN), LL.D., son of Israel Washburn, Sr., b. in Livermore, Me., Apr. 26, 1818; settled at Mineral Point, Wis., in 1841, as a lawyer, and had a large practice as counsel for the early settlers in securing their homes. In 1854 he was elected to Congress, and was re-elected for the two following terms, thus serving through the 34th, 35th, and 36th Congresses. He declined another election, but at the breaking out of the civil war volunteered, and entered the service as colonel of the 2d Wisconsin Cavalry in 1861; was commissioned brigadier-general by Pres. Lincoln in June, 1862, and was engaged in the Arkansas campaign during that year; was commissioned major-general in Nov., 1862; was engaged in the siege of Vicksburg, and at its close was ordered to the department of the Gulf in command of the 13th corps; was ordered to Texas in Nov., 1863, with a portion of the 13th corps, and captured Fort Esperanza, a strong casemated fortification at Pass Cavallo, guarding the entrance to Matagorda Bay; in Apr., 1864, relieved Gen. S. A. Hurlbut in command at Memphis of the district of West Tennessee. This command he held with a short interruption till the close of the war; resigned his commission as major-general June 1, 1865. In 1867 he was again elected to Congress, and re-elected in 1869; in Nov., 1871, was elected governor of Wisconsin for two years. He now resides at Madison, Wis., and is largely engaged in the manufacture of lumber at La Crosse, Wis., and of flour at Minneapolis, Minn.

**Washburn** (CHARLES AMES), son of Israel Washburn, Sr., b. at Livermore, Me., Mar. 16, 1822; graduated at Bowdoin College 1848; went to California in the spring of 1850; early connected himself with the press of San Francisco, first as editor, and afterward as editor and proprietor, of the *Alta California;* took an active part in the organization of the Republican party there, and his was the first newspaper on the Pacific coast to advocate the distinctive principles of that party; from 1858 to 1861 was

editor and proprietor of the San Francisco *Daily Times;* was chosen an elector at large 1860, and the next year was appointed by Pres. Lincoln minister to Paraguay, where he remained for seven years, and during most of the time of the war between that country and Brazil and its allies. His *History of Paraguay, with Notes of Personal Observations and Reminiscences of Diplomacy under Difficulties* (Boston, 2 vols., 1871), gives a startling account of a strange people who were almost exterminated under the rule of the younger Lopez. (See LOPEZ, FRANCISCO SOLANO.) His exertions to save the lives of his friends and diplomatic associates from the tyrant's indiscriminate rage involved him in the utmost personal danger, and in an accusation of complicity with the pretended "conspiracy" which gave occasion to the massacre of nearly all the Paraguayan and foreign residents above the humblest social position. The circumstances of the violence done to members of his legation (Sept., 1868), and their rescue from impending death through his efforts in compelling the intervention of an American squadron (Dec., 1868), are graphically related in his volumes. His disinterested course under these unparalleled circumstances brought him into collision with several high officers of the U. S. navy, and led to an investigation of the circumstances by the committee of foreign affairs of the House of Representatives, which resulted completely in his favor. He is also the author of several novels, and is the inventor of the "typograph" and several other ingenious machines. Since his return from Paraguay he has resided at Oakland, Cal., and more recently in New York City.

PORTER C. BLISS.

**Washburn** (EDWARD ABIEL), D. D., b. at Boston, Mass., Apr. 16, 1819; graduated at Harvard 1838; studied divinity at Andover and New Haven; was rector of St. Paul's (Episcopal) church, Newburyport, Mass., 1844–51; from 1851–53, after residing six months in China, travelled leisurely homeward through Asia, Egypt, and Europe; was rector of St. John's, Hartford, Conn., 1853–62, and at the same time professor of church polity in the Berkeley Divinity School, Middletown; was rector of St. Mark's, Philadelphia, 1862–65, when he succeeded Bishop Coxe as rector of Calvary church, New York, which position he still (1876) holds. Besides numerous sermons and review articles, he has published *The Social Law of God* (1874).

R. D. HITCHCOCK.

**Washburn** (EMORY), LL.D., b. at Leicester, Mass., Feb. 14, 1800; entered Williams College at the age of thirteen; graduated in 1817; after a course of three years' study at the Harvard Law School was admitted to the bar, and at the age of twenty-one commenced practice at Charlemont, Mass.; afterward removed to his native town of Leicester, and in 1828 settled in Worcester, where he resided for twenty-eight years. In 1825 and 1826 he represented Leicester in the Massachusetts general court, and Worcester in 1838. In 1841 and 1842 was a member of the State senate for Worcester co. He was also nominated for Congress at a time when his party, the Whig, had several thousand majority, but declined the nomination; in 1844 was appointed a judge of the court of common pleas, which office he resigned in 1847. During his absence in Europe in 1852 he was nominated and elected governor of Massachusetts, and was re-elected the ensuing year. The following year the Know-Nothing crusade swept over the State, after which the Whig party never rallied, and the record shows him as the last Whig governor of Massachusetts. He removed to Cambridge in 1856, having been appointed professor of law in the Harvard Law School, which position he held for twenty years, resigning Sept. 1, 1876. Gov. Washburn's published works are numerous, and all of a character showing much thoroughness and research. His *Lectures on the Study and Practice of the Law,* his work on *Easements and Servitudes,* and the more elaborate work in 3 vols. on *The Law of Real Property,* all of which have passed through several editions, are regarded as the highest standard authorities both in the law schools and the courts throughout the country. He has also published a *Judicial History of Massachusetts,* a work of 400 pp., and a *History of Leicester,* of 464 pp., besides many addresses of an historical and genealogical character. His published lectures, orations, and addresses, all evincing high scholarship and close research, would fill several large volumes, and of all the subjects on which he has treated it may be said "he touched nothing which he did not adorn." The comprehensive article in this work on HOMESTEAD LEGISLATION IN THE UNITED STATES was written by him.

**Washburn** (ISRAEL, SR.), b. in Raynham, Mass., Nov. 18, 1784; moved in 1806 to Maine, and in 1808, in company with Barzillai White, established himself at a point on the Kennebec River then called White's Landing, now Richmond, where he engaged in shipbuilding. In 1809 he established a trading-post at Livermore, Me., at what is now called The Norlands, and soon after moved there, where he settled and had a large family of children, some of whom have held high positions under the national government and by election of the people of their respective States. D. at Livermore Sept. 1, 1876.

**Washburn** (ISRAEL, JR.), LL.D., son of the preceding, b. at The Norlands, Livermore, Me., June 6, 1813; received a classical education, mostly from private tutors, and studied for the bar, to which he was admitted Oct., 1834; settled in December of that year at Orono, Penobscot co., where he soon had a large practice, which continued till his election to Congress in 1850; was again elected to the four succeeding Congresses. During the anxious and exciting period just preceding the civil war he took a prominent part in the discussions in Congress, being one of the first, boldest, and most influential in opposing the pretensions of the slave-power and in arousing the anti-slavery sentiment of the country to its duty. In 1860 he was elected governor of Maine, and re-elected in 1861, his term of office covering the most laborious and responsible period of the civil war. Declining another election, he was in 1863 appointed collector of customs for the port of Portland, an office which he has held to the present time (1876). He is president of the board of trustees of Tufts College, Mass., and was elected president of the college in 1875, a position he declined to accept. He is a member of several historical and genealogical societies, and in 1874 published *Notes, Historical, Descriptive, and Personal, of Livermore, Me.* Many of his addresses and speeches on important subjects have been published and widely circulated, and he has contributed liberally to the periodical literature of the country.

PORTER C. BLISS.

**Washburn** (SAMUEL BENJAMIN), son of Israel Washburn, Sr., b. at Livermore, Me., Jan. 1, 1824; was a shipmaster in the merchant marine, and was afterward in the lumber-trade in Wisconsin; volunteered for the naval service for the war, and was highly complimented for gallantry and skill by Admiral Rodgers after the battle of Fort Darling. He subsequently commanded a squadron in Berwick Bay, and took part in many engagements.

**Washburn** (WILLIAM BURRITT), LL.D., b. at Winchendon, Mass., Jan. 31, 1820; graduated at Yale College 1844; engaged in manufacturing in Greenfield, Mass., where he has since resided; was also engaged in banking, and in 1859 was chosen president of the Bank of Greenfield; was elected to the Massachusetts State senate 1850, and a member of the house of representatives 1854. He was nominated as the Republican candidate for Congress for his district in 1862, and had the unusual, if not unprecedented, honor of being elected by a unanimous vote; was re-elected to 39th, 40th, 41st, and 42d Congresses; in 1871 was elected governor of Massachusetts; resigned his seat in the 42d Congress Jan. 1, 1871, to be inaugurated as governor; was re-elected governor in 1872, which office he resigned Apr., 1874, having been elected U. S. Senator to fill the vacancy occasioned by the death of Charles Sumner. His term as Senator expired Mar. 3, 1875. He is now (1876) president of the First National Bank in Greenfield; one of the trustees of Yale College and of the Massachusetts Agricultural College; also a trustee of Smith College at Northampton, Mass., for the education of females, and a member of the board of overseers of Amherst College. The degree of LL.D. was conferred upon him by Harvard College in 1872.

**Washburn** (WILLIAM DREW), b. at Livermore, Me., Jan. 14, 1831; youngest son of Israel Washburn, Sr.; graduated at Bowdoin College 1854, and having studied law was admitted to the bar 1857; emigrated to Minnesota the same year, and in 1861 was appointed surveyor-general of that State, which office he held during the administration of Pres. Lincoln. Since then he has been one of the largest lumber-dealers and manufacturers in the North-west; is president of the Minneapolis and St. Louis R. R. Co.

**Washburne** (ELIHU BENJAMIN), b. at Livermore, Me., Sept. 23, 1816, the third son of Israel Washburn, Sr.; early learned the trade of a printer, but gave up type-setting at the age of eighteen and commenced the study of the classics, which he pursued at the academy at Kent's Hill, Readfield, Me.; afterward studied law in Hallowell and Boston and at the Harvard Law School; in 1840 went West, and settled in Galena, Ill., where he commenced the practice of law in company with Charles S. Hempstead, Esq.; in 1852 was elected to Congress, and continued to represent his district till Mar., 1869. At the time of his retirement he was by consecutive elections the oldest member, or, in Congressional parlance, the "father of the House." On the accession of Gen. Grant to the Presidency he was appointed secretary of state, but soon after resigned that position to accept that of minister plenipotentiary to France. He was serving in this capacity at the outbreak of the war between

France and Prussia, and remained at his post during the siege of Paris by the Prussians and the more terrible reign of the Commune, all the other foreign ministers having left their posts at this time, when their presence was most required to protect the lives and property of their respective countrymen. Mr. Washburne sturdily refused to leave, but gave shelter and protection as far as possible to all foreigners who had been abandoned by the ambassadors of their own governments. His firmness and resolution in protecting those unfortunate Germans who were unable to leave Paris won the admiration not only of all persons who were exposed to the trials and dangers of this protracted siege, but of all foreign governments. PORTER C. BLISS.

**Washing of Feet,** in supposed accordance with the Lord's example and mandate (John xiii. 5–14), is a practice insisted on by some Protestant Christians. In the Roman Catholic Church the pope himself and the bishops and priests of certain dioceses wash the feet of twelve pilgrims once a year on Maunday Thursday, after the celebration of a solemn mass.

**Wash'ington,** county of S. W. Alabama, bordering on Mississippi, bounded E. by Tombigbee River and traversed by Mobile and Ohio R. R.; surface uneven, soil usually sandy. Staples, cotton, Indian corn, sweet potatoes, and wool. Cap. St. Stephen's. Area, 940 sq. m. P. 3912.

**Washington,** county of N. W. Arkansas, bordering on the Indian Territory, and drained by the head-streams of Illinois and White rivers; surface varied, soil productive. Cattle, sheep, and swine numerous. Staples, Indian corn, wheat, tobacco, and wool. Cap. Fayetteville. Area, 870 sq. m. P. 17,266.

**Washington,** formerly a county of the District of Columbia. (See DISTRICT OF COLUMBIA.)

**Washington,** county of W. Florida, bordering on the Gulf of Mexico; surface undulating, soil poor on the coast, good in the interior. Live-oak abounds and is largely exported. Staples, Indian corn, sweet potatoes, tobacco, cotton, and sugar. Cap. Vernon. Area, about 1100 sq. m. P. 2302.

**Washington,** county of E. Georgia, lying between Oconee and Ogeechee rivers, and intersected by Georgia Central R. R.; surface diversified, soil fertile. Many fossils have been found in caves. Cattle and swine are numerous. Staples, cotton and Indian corn. Cap. Sandersville. Area, 760 sq. m. P. 15,842.

**Washington,** county of S. W. Illinois, drained by Kaskaskia River, and traversed by Illinois Central and St. Louis and South-eastern R. Rs.; surface level, with considerable woodland, soil fertile. There are flour-mills, saw-mills, and manufactories of carriages and agricultural implements. Live-stock numerous. Staples, Indian corn, wheat, oats, wool, and hay. Cap. Nashville. Area, 580 sq. m. P. 17,599.

**Washington,** county of S. Indiana, drained by Lost River, which runs for a considerable distance under ground, and Great Blue River, and traversed by Louisville New Albany and Chicago R. R.; surface generally undulating, but rising in the E. part to hills; soil fertile. There are flour-mills, saw-mills, tanneries, and manufactories of carriages, clothing, and furniture. Live-stock numerous. Staples, Indian corn, wheat, oats, leather, lumber, wool, and dairy products. Cap. Salem. Area, 510 sq. m. P. 18,495.

**Washington,** county of S. E. Iowa, drained by Iowa, Skunk, and Eagle rivers, and traversed by Chicago Rock Island and Pacific R. R.; surface level, with woodland and prairie, soil fertile. There are flour-mills and saw-mills, and manufactures of woollen goods, agricultural implements, furniture, and iron castings. Live-stock numerous. Staples, Indian corn, wheat, oats, hay, wool, and dairy products. Cap. Washington. Area, 556 sq. m. P. 18,952.

**Washington,** county of N. E. Kansas, bordering on Nebraska, and watered by Little Blue River; surface rolling prairie-land, with wooded river-bottoms; soil moderately fertile. Staples, Indian corn, wheat, and hay. Cap. Washington. Area, about 900 sq. m. P. 4081.

**Washington,** county of Central Kentucky, drained by Lick Creek; surface undulating, soil fertile. Live-stock numerous. Staples, Indian corn, wheat, oats, wool, hay, tobacco, and dairy products. Cap. Springfield. Area, 550 sq. m. P. 12,464.

**Washington,** parish of S. E. Louisiana, bordering upon Mississippi, from which it is separated by Pearl River; surface generally undulating, soil sandy and moderately fertile. Staples, cotton, Indian corn, sweet potatoes, and wool. Cap. Franklinton. Area, about 700 sq. m. P. 3330.

**Washington,** county of S. E. Maine, upon the Atlantic Ocean, separated from New Brunswick by St. Croix River, drained by the Machias and Schoodic rivers, and traversed by European and North American, St. Croix and Penobscot, and Whitneyville and Machiasport R. Rs. The surface is generally undulating, with numerous lakes, some of considerable size, and the coast-line, which is nearly 80 miles long, is indented by many bays and inlets. The soil in the interior is moderately fertile. There are more than 300 manufacturing establishments, including shipyards, saw-mills, tanneries, cooperage, carriages, fish-curing, iron, sails, and machinery. Cattle and sheep are numerous. Staples, manufactured articles, lumber, oats, potatoes, wool, hay, and dairy products. Cap. Machias. Area, about 2700 sq. m. P. 43,343.

**Washington,** county of N. W. Maryland, bordering on Pennsylvania and on Virginia, from which it is separated by the Potomac, intersected by Antietam and Licking creeks, and traversed by Chesapeake and Ohio Canal, Baltimore and Ohio, and Cumberland Valley and Western Maryland R. Rs.; surface hilly, soil in parts fertile. There are manufactures of agricultural implements, furniture, carriages, iron, tinware, paper, and cement; flour-mills, saw-mills, tanneries, and distilleries. Cattle, swine, sheep, and horses are numerous. Staples, wheat, Indian corn, oats, wool, leather, and dairy products. The battle of Antietam was fought in this county (Sept. 17, 1862) between the Union army under Gen. McClellan and the Confederates under Gen. Lee. Cap. Hagerstown. Area, 520 sq. m. P. 34,712.

**Washington,** county of E. Minnesota, bordering on Wisconsin, bounded S. by the Mississippi, and traversed by Lake Superior and Mississippi, North Wisconsin, and West Wisconsin R. Rs.; surface diversified, and containing many small lakes; soil fertile. There are saw-mills, flour-mills, and breweries. Live-stock not numerous. Staples, wheat, oats, and Indian corn. Cap. Stillwater. Area, 380 sq. m. P. 11,809.

**Washington,** county of W. Mississippi, separated from Arkansas by Mississippi River, and intersected by Sunflower River, Steele Bayou, and Deer Creek; surface low, liable to overflow, and containing many small ponds and lagoons; soil very fertile. Staples, cotton, Indian corn, and oats. Cap. Greenville. Area, 1220 sq. m. P. 14,569.

**Washington,** county of S. E. Missouri, lying between Big and Maramec rivers, and traversed by St. Louis and Iron Mountain R. R. The surface is hilly and rugged, and abounds in mineral wealth, Iron Mountain, near the S. W. corner, being a mass of magnetic iron ore; copper, lead, plumbago, and copperas are also found. There are saw-mills, lead-furnaces, and ironworks. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, and wool. Cap. Potosi. Area, 870 sq. m. P. 11,719.

**Washington,** county of E. Nebraska, separated from Iowa by Missouri River, and traversed by Omaha and North-western and Sioux City and Pacific R. Rs.; surface undulating, soil fertile, with timber along the streams. Staples, Indian corn, wheat, and oats. Cap. Blair. Area, about 400 sq. m. P. 4452.

**Washington,** county of E. New York, bordering on Vermont, from which it is partly separated by Lake Champlain, touching upon the Hudson River and Lake George, and traversed by Champlain Canal and Rensselaer and Saratoga R. R.; surface generally mountainous or hilly, containing iron ore, lead, marble, slate, and limestone. There are more than 400 manufacturing establishments, including agricultural implements, carriages, machinery, iron, woollen goods, marble and stone work, stone and earthen ware, flax, and paper; saw-mills, planing-mills, tanneries, and flour-mills. Cattle and sheep are very numerous. Staples, potatoes, oats, Indian corn, hay, flax, wool, and dairy products. Caps. Salem and Sandy Hill. Area, 850 sq. m. P. 49,568.

**Washington,** county of E. North Carolina, bordering on Albemarle Sound; surface level and swampy, abounding in valuable red cedar and cypress timber. Staples, lumber, Indian corn, cotton, and sweet potatoes. Cap. Plymouth. Area, 360 sq. m. P. 6516.

**Washington,** county of S. E. Ohio, separated from West Virginia by Ohio River, intersected by Muskingum River, and traversed by Marietta and Cincinnati and Marietta and Pittsburg R. Rs.; surface diversified, abounding in bituminous coal and iron ore; soil fertile. There are flour-mills, saw-mills, planing-mills, tanneries, and manufactories of boots and shoes, furniture, cooperage, iron, and woollen goods. Cattle, sheep, and swine are numerous. Staples, tobacco, Indian corn, wheat, oats, potatoes, hay, wool, and dairy products. Cap. Marietta. Area, 713 sq. m. P. 40,609.

**Washington,** county of N. W. Oregon, bounded E. by Willamette River, and bordering W. on the Coast Range,

watered by Tualatin and other rivers, and traversed by Oregon Central R. R.; surface diversified, with prairies and timber-land, and abounding in iron ore; soil usually fertile. Staples, wheat, oats, wool, and hay. Cap. Hillsborough. Area, 750 sq. m. P. 4261.

**Washington,** county of S. W. Pennsylvania, bordering on West Virginia, bounded E. by Monongahela River, and traversed by several railroads. The surface is generally hilly, and well adapted to grazing; soil in the valleys a rich dark loam. There are many manufactories, including those of carriages, furniture, saddlery, and woollen goods; flour-mills, saw-mills, planing-mills, tanneries, and distilleries. Live-stock, especially sheep, are very numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Washington. Area, 888 sq. m. P. 48,483.

**Washington,** county of S. Rhode Island, bounded E. by Narragansett Bay, S. by the Atlantic Ocean, drained by Charles River, and traversed by Stonington and Providence R. R.; surface hilly, soil tolerably productive. There are numerous manufactories of cotton and woollen goods. Staples, manufactured goods, with some potatoes, Indian corn, hay, wool, and dairy products. Cap. Kingston. Area, 367 sq. m. P. 20,097.

**Washington,** county of N. E. Tennessee, separated from North Carolina by Bald Mountain, drained by Watauga and Nolinchy rivers, and traversed by East Tennessee Virginia and Georgia R. R.; surface diversified by hills and valleys, abounding in iron ore, with traces of bituminous coal. There are many cattle, sheep, and swine. Staples, Indian corn, wheat, oats, tobacco, and hay. Cap. Jonesborough. Area, 430 sq. m. P. 16,317.

**Washington,** county of S. E. Texas, lying W. of Brazos River, and traversed by Houston and Texas Central R. R.; surface undulating, soil generally fertile, with much live oak and red cedar. Horses, cattle, and swine are numerous. Staples, cotton, Indian corn, and sweet potatoes. Cap. Brenham. Area, 726 sq. m. P. 23,104.

**Washington,** county of S. W. Utah, bordering on Nevada and Arizona, watered by Rio Virgin and Santa Clara rivers, and having the Wahsatch Mountains on the N. Surface varied, soil generally unproductive, but with some fertile lands along the streams. Some gold has been found. Cattle and sheep are the principal live-stock. Staples, wheat, Indian corn, and wool. Cap. St. George. Area, 1890 sq. m. P. 3064.

**Washington,** county of N. Vermont, drained by Onion River and its affluents, and traversed by Vermont Central R. R.; surface broken, and in parts mountainous, but well adapted to pasturage. There are many saw-mills, tanneries, manufactories of agricultural implements, carriages, saddlery, machinery, and woollen goods. Cattle and sheep are numerous. Staples, potatoes, oats, Indian corn, maple-sugar, hay, and dairy products. Cap. Montpelier, which is also the capital of the State. Area, 580 sq. m. P. 26,520.

**Washington,** county of S. W. Virginia, bordering on Tennessee, intersected by the forks of Holston River, and traversed by Atlantic Mississippi and Ohio R. R. The surface is hilly, with an abundance of bituminous coal, iron, and gypsum, and there are several valuable salt-wells. There are saw-mills, tanneries, wool-carding and pork-packing establishments, and manufactories of furniture and carriages. There are many cattle, sheep, and swine. Staples, Indian corn, wheat, oats, wool, tobacco, and dairy products. Cap. Abingdon. Area, 529 sq. m. P. 16,816.

**Washington,** county of S. E. Wisconsin, drained by Milwaukee and other rivers, and traversed by Milwaukee and St. Paul R. R.; surface generally level, with several small lakes, and abounding in limestone suitable for building, with some iron; soil very productive. There are saw-mills, flour-mills, and manufactories of agricultural implements, furniture, carriages, and saddlery. Live-stock numerous. Staples, wheat, oats, Indian corn, hay, wool, and dairy products. Cap. West Bend. Area, 432 sq. m. P. 23,919.

**Washington,** tp., Bradley co., Ark. P. 655.
**Washington,** tp., Conway co., Ark. P. 487.
**Washington,** p.-v., cap. of Hempstead co., Ark.
**Washington,** tp., Independence co., Ark. P. 869.
**Washington,** tp., Jefferson co., Ark. P. 231.
**Washington,** tp., Ouachita co., Ark. P. 401.
**Washington,** tp., Sevier co., Ark. P. 619.
**Washington,** tp., Sharpe co., Ark. P. 503.
**Washington,** tp., Van Buren co., Ark. P. 117.
**Washington,** tp., Alameda co., Cal. P. 3019.
**Washington,** p.-v. and tp., Nevada co., Cal. P. 638.
**Washington,** tp., Plumas co., Cal. P. 520.
**Washington,** tp., Sonoma co., Cal. P. 548.
**Washington,** tp., Stanislaus co., Cal. P. 281.
**Washington,** tp., Yolo co., Cal. P. 809.
**Washington,** p.-v. and tp., Litchfield co., Conn. P. 1563.
**Washington,** p.-v., cap. of Wilkes co., Ga., on a branch of Georgia R. R., has a newspaper. P. 1506.
**Washington,** p.-v., cap. of Idaho co., Id.
**Washington,** tp., Carroll co., Ill. P. 603.
**Washington,** p.-v. and tp., Tazewell co., Ill., on Toledo Peoria and Warsaw, western division of Chicago and Alton, and Chicago Pekin and South-western R. Rs., 12 miles E. of Peoria, contains 6 churches, 3 excellent graded schools, a library association, 2 banks, 3 large elevators, 7 wagon, carriage, and furniture establishments, 2 hotels, and 1 newspaper. P. of v. 1607; of tp. 3456.
THOMAS HANDSAKER, ED. "HERALD."
**Washington,** tp., Will co., Ill. P. 1564.
**Washington,** tp., Adams co., Ind. P. 1846.
**Washington,** tp., Allen co., Ind. P. 1628.
**Washington,** tp., Blackford co., Ind. P. 1008.
**Washington,** tp., Boone co., Ind. P. 1391.
**Washington,** tp., Brown co., Ind. P. 2187.
**Washington,** tp., Carroll co., Ind. P. 920.
**Washington,** tp., Cass co., Ind. P. 1220.
**Washington,** tp., Clarke co., Ind. P. 1357.
**Washington,** tp., Clay co., Ind. P. 1867.
**Washington,** tp., Clinton co., Ind. P. 1692.
**Washington,** city and tp., cap. of Daviess co., Ind., on Ohio and Mississippi R. R., equidistant from Cincinnati and St. Louis, contains 6 churches, good schools, and 2 newspapers. There are 7 extensive coal-mines worked here, and large quantities of cannel and bituminous coal, flour and small grains, besides numbers of cattle, horses, and hogs, are shipped from this point. P. of city, 2901; of tp. 4956.
S. F. HORRALL, ED. "GAZETTE."
**Washington,** tp., Dearborn co., Ind. P. 510.
**Washington,** tp., Decatur co., Ind. P. 4591.
**Washington,** tp., Delaware co., Ind. P. 1190.
**Washington,** tp., Elkhart co., Ind. P. 1391.
**Washington,** tp., Gibson co., Ind. P. 757.
**Washington,** tp., Grant co., Ind. P. 1139.
**Washington,** tp., Greene co., Ind. P. 640.
**Washington,** tp., Hamilton co., Ind. P. 3590.
**Washington,** tp., Harrison co., Ind. P. 1176.
**Washington,** tp., Hendricks co., Ind. P. 1502.
**Washington,** tp., Jackson co., Ind. P. 960.
**Washington,** tp., Knox co., Ind. P. 1537.
**Washington,** tp., Kosciusko co., Ind. P. 2288.
**Washington,** tp., Marion co., Ind. P. 2439.
**Washington,** tp., Miami co., Ind. P. 1306.
**Washington,** tp., Monroe co., Ind. P. 990.
**Washington,** tp., Morgan co., Ind. P. 3151.
**Washington,** tp., Newton co., Ind. P. 983.
**Washington,** tp., Noble co., Ind. P. 766.
**Washington,** tp., Owen co., Ind. P. 2547.
**Washington,** tp., Parke co., Ind. P. 1213.
**Washington,** tp., Pike co., Ind. P. 2363.
**Washington,** tp., Porter co., Ind. P. 647.
**Washington,** tp., Putnam co., Ind. P. 1843.
**Washington,** tp., Randolph co., Ind. P. 2051.
**Washington,** tp., Ripley co., Ind. P. 1206.
**Washington,** tp., Rush co., Ind. P. 1148.
**Washington,** tp., Shelby co., Ind. P. 1390.
**Washington,** tp., Starke co., Ind. P. 546.
**Washington,** tp., Tippecanoe co., Ind. P. 1376.
**Washington,** tp., Warren co., Ind. P. 1251.
**Washington,** tp., Washington co., Ind. P. 4172.
**Washington,** tp., Wayne co., Ind. P. 2040.
**Washington,** tp., Whitley co., Ind. P. 1246.
**Washington,** tp., Adair co., Ia. P. 495.
**Washington,** tp., Adams co., Ia. P. 535.
**Washington,** tp., Appanoose co., Ia. P. 1873.
**Washington,** tp., Black Hawk co., Ia. P. 548.
**Washington,** tp., Bremer co., Ia. P. 948.

**Washington,** tp., Buchanan co., Ia. P. 1259.
**Washington,** tp., Butler co., Ia. P. 402.
**Washington,** tp., Chickasaw co., Ia. P. 668.
**Washington,** tp., Clarke co., Ia. P. 594.
**Washington,** tp., Clinton co., Ia. P. 995.
**Washington,** tp., Dallas co., Ia. P. 468.
**Washington,** tp., Des Moines co., Ia. P. 1081.
**Washington,** tp., Dubuque co., Ia. P. 963.
**Washington,** tp., Franklin co., Ia. P. 1079.
**Washington,** tp., Greene co., Ia. P. 1411.
**Washington,** tp., Iowa co., Ia. P. 619.
**Washington,** tp., Jackson co., Ia. P. 1051.
**Washington,** tp., Jasper co., Ia. P. 498.
**Washington,** tp., Johnson co., Ia. P. 933.
**Washington,** tp., Jones co., Ia. P. 860.
**Washington,** tp., Keokuk co., Ia. P. 1467.
**Washington,** tp., Lee co., Ia. P. 1075.
**Washington,** tp., Linn co., Ia. P. 1483.
**Washington,** tp., Lucas co., Ia. P. 753.
**Washington,** tp., Marion co., Ia. P. 1285.
**Washington,** tp., Marshall co., Ia. P. 806.
**Washington,** tp., Montgomery co., Ia. P. 426.
**Washington,** tp., Page co., Ia. P. 606.
**Washington,** tp., Polk co., Ia. P. 640.
**Washington,** tp., Poweshiek co., Ia. P. 626.
**Washington,** tp., Ringgold co., Ia. P. 518.
**Washington,** tp., Story co., Ia. P. 1666.
**Washington,** tp., Taylor co., Ia. P. 401.
**Washington,** tp., Van Buren co., Ia. P. 1036.
**Washington,** tp., Wapello co., Ia. P. 1596.
**Washington,** tp., Warren co., Ia. P. 3379.

**Washington,** city and tp., cap. of Washington co., Ia., on Chicago and Rock Island and Chicago and Southwestern R. Rs., was settled in 1835, and contains 12 churches, an academy and high schools, 2 steam-elevators and flouring-mills, 2 newspapers, a conversational club and free home lectures, 2 woollen-mills, 2 foundries and machine-shops, and 2 carriage establishments. Business, chiefly agriculture. P. of city, 2575; of tp. 4043.
H. A. Burrell, Prop. "Washington County Press."

**Washington,** tp., Wayne co., Ia. P. 693.
**Washington,** tp., Webster co., Ia. P. 765.
**Washington,** tp., Winneshiek co., Ia. P. 1460.
**Washington,** tp., Anderson co., Kan. P. 427.
**Washington,** tp., Crawford co., Kan. P. 595.
**Washington,** tp., Doniphan co., Kan. P. 2513.
**Washington,** p.-v. and tp., cap. of Washington co., Kan. P. 1238.
**Washington,** p.-v., Mason co., Ky. P. 240.
**Washington,** p.-v., St. Landry parish, La. P. 907.
**Washington,** p.-v. and tp., Knox co., Me. P. 1276.
**Washington,** p.-v. and tp., Berkshire co., Mass. P. 694.
**Washington,** tp., Gratiot co., Mich. P. 551.
**Washington,** p.-v. and tp., Macomb co., Mich. P. 2057.
**Washington,** tp., Sanilac co., Mich. P. 370.
**Washington,** tp., Le Sueur co., Minn. P. 359.
**Washington,** tp., Buchanan co., Mo. P. 3042.
**Washington,** tp., Cedar co., Mo. P. 978.
**Washington,** tp., Clarke co., Mo. P. 1316.
**Washington,** tp., Clay co., Mo. P. 2609.
**Washington,** tp., Dallas co., Mo. P. 1470.
**Washington,** tp., Daviess co., Mo. P. 810.
**Washington,** tp., De Kalb co., Mo. P. 2029.
**Washington,** tp., Douglas co., Mo. P. 213.

**Washington,** p.-v. and tp., Franklin co., Mo., on the S. bank of Missouri River, 54 miles W. of St. Louis by Missouri Pacific R. R., which passes directly through the town, has 7 churches, including the Roman Catholic (St. Borgia's); a fine public school building, the Jeffries High School; a convent, with a school for young ladies within the building and under the charge of the sisters; a Roman Catholic parochial school; a free Lutheran school; 1 bank (savings institution), 2 weekly newspapers (German and English), 2 steam merchant flouring-mills (capacity of 200 barrels per day), 1 steam planing and saw mill, with door, sash, and blind factory attached, 1 tannery, 2 packing-houses (beef and pork), and 4 hotels and several boarding-houses. A steam-ferry plies across the Missouri River daily. There are two inexhaustible clay-banks adjoining the town of fire and potter's clay, large quantities of which are shipped to St. Louis. The site of the town proper is on a high ridge running parallel with the river, and is the healthiest locality in the State. The town is improving quite rapidly. The people are sociable, well educated, and fond of social amusements. The Turnvereins have a very roomy hall. The trade of the town is large, and it ships more produce than any other point on the railroad between St. Louis and Kansas City. P. 5614.
Edward N. Parker, Ed. "Franklin Co. Observer."

**Washington,** tp., Grundy co., Mo. P. 1014.
**Washington,** tp., Harrison co., Mo. P. 469.
**Washington,** tp., Jackson co., Mo. P. 2305.
**Washington,** tp., Johnson co., Mo. P. 2992.
**Washington,** tp., Lafayette co., Mo. P. 2533.
**Washington,** tp., Mercer co., Mo. P. 808.
**Washington,** tp., Monroe co., Mo. P. 1512.
**Washington,** tp., Nodaway co., Mo. P. 1058.
**Washington,** tp., Osage co., Mo. P. 1591.
**Washington,** tp., Pettis co., Mo. P. 1753.
**Washington,** tp., Ripley co., Mo. P. 680.
**Washington,** tp., St. Clair co., Mo. P. 599.
**Washington,** tp., Stone co., Mo. P. 506.
**Washington,** tp., Webster co., Mo. P. 1438.
**Washington,** tp., Nemaha co., Neb. P. 323.
**Washington,** p.-v. and tp., Sullivan co., N. H. P. 839.
**Washington,** tp., Bergen co., N. J. P. 2514.
**Washington,** tp., Burlington co., N. J. P. 609.
**Washington,** tp., Camden co., N. J. P. 1567.
**Washington,** tp., Mercer co., N. J. P. 1294.
**Washington,** tp., Morris co., N. J. P. 2484.
**Washington,** p.-b. and tp., Warren co., N. J. P. of b. 1880; of tp. 4040.
**Washington,** tp., Dutchess co., N. Y. P. 2792.

**Washington,** seaport, p.-v. and tp., cap. of Beaufort co., N. C., at the head of Pamlico River, about 80 miles from the ocean, contains 4 churches, excellent schools, 1 newspaper, 3 benevolent institutions, 1 bank, 2 hotels, 1 carriage-manufactory, 2 shipyards, 1 block and pump factory, 1 saw and 2 grist mills, and several fisheries. The town was nearly destroyed by fire during the late war. P. of v. 2094; of tp. 3304. Richard Granger, Ed. "Echo."

**Washington,** tp., Guilford co., N. C. P. 823.
**Washington,** tp., Nash co., N. C. P. 2139.
**Washington,** tp., Auglaize co., O. P. 840.
**Washington,** tp., Belmont co., O. P. 1367.
**Washington,** tp., Brown co., O. P. 1082.
**Washington,** tp., Carroll co., O. P. 740.
**Washington,** tp., Clermont co., O. P. 2818.
**Washington,** tp., Clinton co., O. P. 1250.
**Washington,** tp., Columbiana co., O. P. 2228.
**Washington,** tp., Coshocton co., O. P. 768.
**Washington,** tp., Darke co., O. P. 1537.
**Washington,** tp., Defiance co., O. P. 1016.
**Washington,** v., Fayette co., O. P. 2117.
**Washington,** tp., Franklin co., O. P. 1334.
**Washington,** tp., Guernsey co., O. P. 712.
**Washington,** tp., Hancock co., O. P. 1579.
**Washington,** tp., Hardin co., O. P. 883.
**Washington,** tp., Harrison co., O. P. 1098.
**Washington,** tp., Henry co., O. P. 1141.
**Washington,** tp., Highland co., O. P. 972.
**Washington,** tp., Hocking co., O. P. 1534.
**Washington,** tp., Holmes co., O. P. 1285.
**Washington,** tp., Jackson co., O. P. 1133.
**Washington,** tp., Lawrence co., O. P. 1446.
**Washington,** tp., Licking co., O. P. 1252.
**Washington,** tp., Logan co., O. P. 812.
**Washington,** tp., Lucas co., O. P. 1549.
**Washington,** tp., Mercer co., O. P. 1148.
**Washington,** tp., Miami co., O. P. 1305.
**Washington,** tp., Monroe co., O. P. 1720.
**Washington,** tp., Montgomery co., O. P. 1758.
**Washington,** tp., Morrow co., O. P. 916.

**Washington,** tp., Muskingum co., O. P. 1242.
**Washington,** tp., Paulding co., O. P. 957.
**Washington,** tp., Pickaway co., O. P. 996.
**Washington,** tp., Preble co., O. P. 3414.
**Washington,** tp., Richland co., O. P. 1496.
**Washington,** tp., Sandusky co., O. P. 2282.
**Washington,** tp., Scioto co., O. P. 1085.
**Washington,** tp., Shelby co., O. P. 1092.
**Washington,** tp., Stark co., O. P. 1980.
**Washington,** tp., Tuscarawas co., O. P. 1113.
**Washington,** tp., Union co., O. P. 819.
**Washington,** tp., Van Wert co., O. P. 2241.
**Washington,** tp., Warren co., O. P. 1229.
**Washington,** p.-v., Wills tp., Washington co., O. P. 554.
**Washington,** tp., Wood co., O. P. 1321.
**Washington,** tp., Armstrong co., Pa. P. 1180.
**Washington,** tp., Berks co., Pa. P. 1609.
**Washington,** tp., Butler co., Pa. P. 996.
**Washington,** tp., Cambria co., Pa. P. 1904.
**Washington,** tp., Clarion co., Pa. P. 1240.
**Washington,** tp., Dauphin co., Pa. P. 1255.
**Washington,** tp., Erie co., Pa. P. 1943.
**Washington,** tp., Fayette co., Pa. P. 1065.
**Washington,** tp., Franklin co., Pa. P. 2364.
**Washington,** tp., Greene co., Pa. P. 765.
**Washington,** tp., Indiana co., Pa. P. 1466.
**Washington,** tp., Jefferson co., Pa. P. 1124.
**Washington,** b., Lancaster co., Pa. P. 673.
**Washington,** tp., Lawrence co., Pa. P. 612.
**Washington,** tp., Lehigh co., Pa. P. 2464.
**Washington,** tp., Lycoming co., Pa. P. 1122.
**Washington,** tp., Northampton co., Pa. P. 801.
**Washington,** tp., Schuylkill co., Pa. P. 1313.
**Washington,** tp., Snyder co., Pa. P. 1541.

**Washington,** p.-b., South Strabane tp., cap. of Washington co., Pa., on Chartiers Creek and on Pittsburg Cincinnati and St. Louis (Chartiers branch) and Baltimore and Ohio R. Rs., has 11 churches, 2 banks, 3 weekly newspapers, 2 iron-foundries, woollen, coach, and other factories, a female seminary, and several schools, and is the seat of Washington and Jefferson College. P. 3571.

**Washington,** tp., Westmoreland co., Pa. P. 1416.
**Washington,** tp., Wyoming co., Pa. P. 793.
**Washington,** tp., York co., Pa. P. 1444.
**Washington,** tp., Edgefield co., S. C. P. 1025.
**Washington,** p.-v., cap. of Rhea co., Tenn. P. 223.
**Washington,** p.-v., Washington co., Ut.
**Washington,** p.-v. and tp., Orange co., Vt. P. 1113.
**Washington,** tp., Alexander co., Va. P. 555.
**Washington,** tp., Norfolk co., Va. P. 2124.
**Washington,** p.-v., cap. of Rappahannock co., Va.
**Washington,** tp., Richmond co., Va. P. 1760.
**Washington,** tp., Westmoreland co., Va. P. 2467.
**Washington,** tp., Boone co., West Va. P. 1015.
**Washington,** tp., Braxton co., West Va. P. 1395.
**Washington,** tp., Calhoun co., West Va. P. 582.
**Washington,** tp., Jackson co., West Va. P. 1449.
**Washington,** tp., Kanawha co., West Va. P. 1065.
**Washington,** tp., Lincoln co., West Va. P. 543.
**Washington,** tp., Marshall co., West Va. P. 993.
**Washington,** tp., Ohio co., West Va. P. 533.
**Washington,** tp., Pleasants co., West Va. P. 820.
**Washington,** tp., Upshur co., West Va. P. 1016.
**Washington,** tp., Door co., Wis. P. 384.
**Washington,** tp., Eau Claire co., Wis. P. 527.
**Washington,** tp., Green co., Wis. P. 901.
**Washington,** tp., La Crosse co., Wis. P. 870.
**Washington,** tp., Sauk co., Wis. P. 1042.
**Washington,** tp., Shawano co., Wis. P. 71.

**Washington** (Bushrod), LL.D., nephew of Gen. George, b. in Westmoreland co., Va., June 5, 1762; graduated at William and Mary College 1778; studied law with James Wilson at Philadelphia; commenced practice in his native county 1780; served as a private soldier at Yorktown 1781; was a member of the Virginia house of delegates 1787, of the Virginia convention to ratify the U. S. Constitution 1788; afterward practised law at Alexandria and at Richmond; was appointed by Pres. Adams an associate justice of the U. S. Supreme Court Dec. 20, 1798; inherited from his uncle the Mount Vernon estate 1799, and was the first president of the American Colonization Society. D. at Philadelphia Nov. 26, 1829. He published *Reports of the Virginia Court of Appeals 1790–96* (2 vols., 1798–99) and *Reports of the U. S. Circuit Court, Third Circuit, 1803–27* (4 vols., 1826–29), the latter being edited by R. Peters.

**Washington** (George), first President of the U. S., b. in Washington parish, Westmoreland co., Va., near the junction of Pope's Creek with the Potomac River, Feb. 22 (O. S. 11), 1732, being the son of Augustine Washington by his second wife, Mary Ball, daughter of Col. Ball of Lancaster co., Va. Of Washington's English ancestry, though much has been written, nothing is known with certainty, since recent researches have proved the defectiveness of the genealogies which were formerly thought to trace his lineal descent from the ancient family of the name at Washington Manor, Durham, or that at Sulgrave, Northampton. The first American ancestor, John Washington, came to Virginia about 1657, and became a prosperous planter in the "Northern Neck," or district between the Potomac and Rappahannock rivers. He served as a colonel in expeditions against the Indians, and married Ann Pope of the family which gave name to Pope's Creek, by whom he had two sons, Lawrence and John. Lawrence married Mildred Warner of Gloucester co., and had three children, John, Augustine, and Mildred. Augustine first married Jane Butler, who bore him four children, of whom two sons, Lawrence and Augustine, reached maturity. Of six children by the second marriage, George was the eldest, the others being Betty, Samuel, John Augustine, Charles, and Mildred, of whom the youngest died in infancy. Little is known of the early years of Washington, beyond the fact that the house in which he was born was burned during his early childhood, and that his father thereupon removed to another farm, inherited from his paternal ancestors, situated in Stafford co., on the N. bank of the Rappahannock, nearly opposite Fredericksburg, where he acted as agent of the Principio Ironworks in the immediate vicinity, and died there in 1743. The well-known anecdotes of Washington's boyhood in connection with his father's teachings cannot be accepted with any confidence, as they rest exclusively upon the statements of one biographer, the eccentric Mason L. Weems. Left an orphan at the age of twelve years, he inherited the paternal residence, while his elder half-brother, Lawrence, inherited the large estate on Hunting Creek, afterward known as Mount Vernon. The early education of George was somewhat defective, being confined to the elementary branches taught him by his mother and at a neighboring school. He developed, however, a fondness for mathematics, and enjoyed in that branch the instructions of a private teacher. On leaving school he resided for some months at Mount Vernon with his brother Lawrence, who acted as his guardian, and who had married a daughter of his neighbor at Belvoir on the Potomac, the wealthy William Fairfax, for some time president of the executive council of the colony. Both Fairfax and his son-in-law, Lawrence Washington, had served with distinction in 1740 as officers of an American battalion at the siege of Carthagena, and were friends and correspondents of Admiral Vernon, for whom the latter's residence on the Potomac had been named. George's inclinations were for a similar career, and a midshipman's warrant was procured for him, probably through the influence of the admiral, but, through the opposition of his mother, the project was abandoned. The family connection with the Fairfaxes, however, opened another career for the young man, who at the age of sixteen was appointed surveyor to the immense estates of the eccentric Lord Fairfax, the head of the family, who was then on a visit at Belvoir, and who shortly afterward established his baronial residence at Greenway Court, in the Shenandoah Valley. Three years were passed by young Washington in a rough frontier life, gaining experience which afterward proved very essential to him. In 1751, when the Virginia militia were put under training with a view to active service against France, Washington, though only nineteen years of age, was appointed adjutant with the rank of major. In September of that year the failing health of Lawrence Washington rendered it necessary for him to seek a milder climate, and George accompanied him in a voyage to Barbadoes. They returned early in 1752, and Lawrence shortly afterward died, leaving his large property to an infant daughter. George was named in his will as one of the executors and as eventual heir to Mount Vernon, and by the death of the infant niece soon succeeded to that estate. On the arrival of Robert Dinwiddie as lieutenant-governor of Virginia in 1752, the militia was reorganized, and the province divided into four military dis-

tricts. Washington was commissioned by Dinwiddie adjutant-general of the northern district in 1753, and in November of that year a most important as well as hazardous mission was assigned him. This was to proceed to the Canadian posts recently established on French Creek near Lake Erie (in North-western Pennsylvania) to demand, in the name of the king of England, the withdrawal of the French from a territory claimed by Virginia. This enterprise had been declined by more than one officer, since it involved a journey through an extensive and almost unexplored wilderness in the occupancy of savage Indian tribes, either hostile to the English or of doubtful attachment. Major Washington, however, accepted the commission with alacrity, and, accompanied by Capt. Gist, the pioneer settler on the Monongahela, he reached Fort Le Bœuf on French Creek, delivered his despatches, and received the reply; which, of course, was a polite refusal to surrender the posts. On their return, Washington and Gist narrowly escaped death through the treachery of an Indian guide, and again by the shattering of a raft in the ice in the Allegheny River near the present site of Pittsburg. Washington's journal of this perilous expedition, prepared for the information of Lieut.-Gov. Dinwiddie, was by him sent to London, where it was published, and deservedly raised its author in public esteem. The answer of the commander of the French posts near Lake Erie was of such a character as to induce the assembly of Virginia to authorize the executive to raise a regiment of 300 men for the purpose of maintaining the asserted rights of the British crown over the territory claimed. As Washington declined to be a candidate for that post, the command of this regiment was given to Col. Joshua Fry, professor of mathematics at William and Mary College, and Major Washington, at his own request, was commissioned lieutenant-colonel. On the march to the Ohio, while at head-quarters at the mouth of Will's Creek, Md. (afterwards the site of Fort Cumberland), news was received that a party previously sent to build a fort at the confluence of the Monongahela with the Ohio had been driven back (Apr. 7, 1754) by a considerable French force, which had completed the work there begun, and named it Fort Duquesne in honor of the marquis Duquesne, then governor of Canada. This was the beginning of the great "French and Indian war," which continued seven years. Washington was sent forward with 150 men to retrieve this loss, but, being unsupported by the promised reinforcements, was unable to make a formal attack upon the fort. Meanwhile, he succeeded to the command of the regiment by the death of Col. Fry, and had a successful engagement with an advanced party of French, but, being afterward surrounded by overwhelming numbers of French and Indians within a post he had thrown up on the "Great Meadows," and named "Fort Necessity," was at last obliged to sign a capitulation, surrendering his artillery (July 4, 1754), and returned thereafter to Virginia. In the course of the following winter orders were received "for settling the rank of His Majesty's forces when serving with the provincials in North America," which being deemed by Washington derogatory to the merits of the provincial officers, he indignantly resigned his commission and retired to Mount Vernon. In the spring of 1755, Gen. Edward Braddock arrived in Virginia with two British regiments as a nucleus for a formal campaign against the French on the Ohio; and that officer, being informed of the services of Col. Washington and his extensive knowledge of the destined theatre of operations, persuaded him to join his military family as a volunteer aide-de-camp. The well-known result of this campaign, and the distinguished part borne in it by Col. Washington in saving the shattered remnants of the army from the field where Braddock and all his chief officers had fallen (July 9, 1755), need no elaborate notice here. His conduct was the theme of general praise, and the Virginia assembly, having hastily directed the enlistment of a regiment of sixteen companies for the defence of the province, commissioned Washington as commander-in-chief of all the forces raised and to be raised in the colony, with authority to appoint his own officers. Soon after this, Lord Loudon, who was sent out from England as the commander-in-chief of the British forces in the colonies, visited Virginia. Washington submitted to him a detailed account of the late operations against the French on the Ohio, assigning the reasons of their failure. He urged an active campaign with increased forces. To impress more effectually his views upon Lord Loudon, he visited that nobleman during the ensuing winter at Philadelphia, where he had convened the governors of Pennsylvania, Maryland, and North Carolina and the lieutenant-governor of Virginia to consult with them in relation to the ensuing campaign. Washington was disappointed in his hope and object. Loudon determined to direct all his efforts against Canada. Instead of receiving assistance, Virginia was required to send aid to South Carolina against Indian outbreaks in that colony. Washington, however, did not abandon his object, and urged upon the Virginia authorities the importance not only of passing a more effective militia law, but of increasing the number of her regular troops. In this, however, he was again disappointed. He was compelled to do the best he could with the inadequate forces under his command in defence of an Indian frontier of about 400 miles. In the latter part of 1757, Lord Loudon returned to England, and Gen. Abercrombie succeeded to the command of the British forces in the colonies. The department of the middle and southern provinces was committed to Gen. Forbes, who to Washington's great gratification determined to undertake an expedition against Fort Duquesne. Washington urged a quick movement and an early campaign, but was disappointed in both respects, and also as to the route by which the general determined to advance. Instead of taking, as he should have done, the old Braddock road across the mountains, Forbes determined upon making a new one farther N. in Pennsylvania, which consumed months in its preparation, so that it was not until late in November that the army reached its rendezvous in the Allegheny Valley. Col. Washington led the front, and his forces took possession of the ruins of Fort Duquesne Nov. 25, 1758, the French having evacuated and burned that post the night before. The elder Pitt, the great war-minister of England, was now at the head of the British ministry. Washington therefore changed the name of this fortification from Fort Duquesne to Fort Pitt (now Pittsburg), and after detaching 200 men from his regiment as a garrison, he marched the others back to Winchester, where he left them and proceeded himself to Williamsburg to take his seat in the general assembly, of which he had been elected a member. A cessation of all Indian hostility on the frontier having followed the expulsion of the French from the Ohio, the object of Washington in accepting his last command was accomplished, and he therefore resigned his commission as commander-in-chief of the Virginia forces. Though much attached to the military service, he well knew that he could not receive a commission in the regular British service that would place him on an equal footing, in all respects, with native British officers of like grade, and therefore directed his views for the future to a purely civil career —a most fortunate event for Washington as well as for his country; for had he been in the British army when the colonial troubles came to a crisis in 1774, whatever might have been his conduct, he could not have been placed at the head of the American cause. Soon after resigning his commission and entering the legislature he married (Jan. 17, 1759) Mrs. Martha (Dandridge) Custis, a young and beautiful widow lady of great wealth, and devoted himself for the ensuing fifteen years to the quiet and peaceful pursuits of agriculture at his magnificent estate of Mount Vernon, which he greatly enlarged by purchases, interrupted only by his annual attendance in winter upon the sessions of the colonial legislature at Williamsburg, until summoned by his country to enter upon that other arena in which his fame was to become world-wide.

It is unnecessary here to trace the details of the struggle upon the question of local self-government which after ten years culminated in the closure by act of Parliament of the port of Boston. Throughout the length and breadth of the land the cry went up, "The cause of Boston is the cause of us all!" It was at the instance of Virginia that a Congress of all the colonies was called to meet at Philadelphia Sept. 5, 1774, to secure their common liberties—if possible by peaceful means. To this Congress Col. Washington was sent as a delegate. Its remonstrances and appeals exhibited the highest abilities as well as the loftiest patriotism. Lord Chatham said in the British Parliament of the papers issued by them, that "Though he had studied and admired the free states of antiquity, the master-spirits of the world, yet for solidity of reasoning, force of sagacity, and wisdom of conclusion no body of men could stand in preference to this Congress." On dissolving in October it recommended the colonies to send deputies to another Congress the following spring. In the mean time, several of the colonies felt impelled to raise local forces to repel insults and aggressions on the part of British troops, so that on the assembling of the next Congress, on May 10, 1775, the war-preparations of the mother-country were unmistakable. The battles of Concord and Lexington had been fought. Amongst the earliest acts, therefore, of the Congress was the selection of a commander-in-chief of the colonial forces. This high office was unanimously conferred upon Washington, still a member of the Congress. His commission was in the name of each colony separately. He accepted it on June 19, but upon the express condition that he should receive no salary. He would keep an exact account of his expenditures, and expect Congress to pay for them, and nothing more. He immediately repaired to

the vicinity of Boston, against which point the British ministry had concentrated their forces. As early as April, Gen. Gage had 3000 troops in and around this proscribed city. During the fall and winter the British policy clearly indicated a purpose to divide public sentiment and to build up a British party in several if not all of the colonies. Those who sided with the ministry in their schemes of effecting a general submission were stigmatized by the patriots as "Tories," while the patriots took to themselves the name of "Whigs." As early as Jan., 1776, many of the leading men and colonies had come to the conclusion that there was no hope except in separation and independence. In May, 1776, Washington wrote, from the head of the army in New York, "A reconciliation with Great Britain is impossible. . . . When I took command of the army, I abhorred the idea of independence, but I am now fully satisfied that nothing else will save us." The sentiment in favor of independence soon became universal. Most of the colonies instructed their delegates in Congress to vote for independence, and on July 4, 1776, the Declaration of Independence proclaimed to the world that "All governments derive their just powers from the consent of the governed." In making this Declaration, as upon all other questions since the first organization of the Congress, each colony had an equal vote, and the paper stands upon the record headed "In Congress, 4th of July, 1776. The Unanimous Declaration of the Thirteen United States of America."

It is not the object of this sketch to trace the military acts of the patriot hero to whose hands the fortunes and liberties of the people of the U. S. were confided during the seven years' bloody struggle that ensued until the treaty of 1783, in which England acknowledged the independence of each of the thirteen States, and negotiated with them, jointly, as separate sovereignties. (See article UNION, AMERICAN.) The merits of Washington as a military chieftain have been considerably discussed, especially by writers in his own country. During the war he was most bitterly assailed for incompetency, and great efforts were made to displace him; but he never for a moment lost the confidence of either the Congress or the people. On Dec. 4, 1783, the great commander took leave of his officers in most affectionate and patriotic terms, and went to Annapolis, Md., where the Congress of the States was in session, and to that body, when peace, quiet, and order prevailed everywhere, resigned his commission (Dec. 23), and, again in search of that repose ever so agreeable to him, retired to Mount Vernon. He had previously addressed a circular letter to the governors of the States, in which he urged several changes in "the constitution" under which they were then united. This constitution, to which he referred, was set forth in the Articles of Confederation reported to the Congress eight days after their Declaration of Independence. These Articles constituted what the Germans style a *Staaten-Bund* (see article UNION, AMERICAN), and, though a great war had been successfully conducted under them, yet they were found to be defective in a few particulars, chiefly in these—that the States in Congress assembled had no authority to regulate commerce with foreign nations, nor had they any authority to execute with their own machinery any of the numerous powers delegated to them. They could only recommend to the States necessary action to carry out the purposes of the union, which recommendation had to receive the sanction of the States before it became binding on the people. The States severally could alone act directly upon their own citizens, even in the matter of raising the taxes to make up the amount of the quota apportioned to the States by Congress. It was not till 1787 that these great changes were effected in the new Constitution which was agreed upon by the celebrated convention of the States which assembled that year in the old Independence Hall in the city of Philadelphia. The history of this convention it is not in the purview of this article to relate. Suffice it to say that it was called for a revision of the Articles of union between the States. It met May 14, 1787, and was unquestionably the ablest body of jurists, legislators, and statesmen that had ever assembled on the continent of America. Washington was a member of it as a delegate from the State of Virginia, and was unanimously chosen to preside over its deliberations. In this body, as in Congress up to this time, each State upon all questions had an equal vote, without reference to the number of its delegates. The proceedings of this body were with closed doors, and its sessions lasted till the 17th of September. The result of their proceedings was the present new Constitution, with the exception of subsequent amendments incorporated in it according to the terms of its own provisions. These revised Articles for a more perfect union of the States were submitted to the Congress of States, and by them were submitted to the several States for their ratification and adoption. It was to be binding "between" all the States that should ratify it, provided as many as nine did so. Washington in his letter to Congress earnestly recommended its ratification. It was to go into effect Mar. 4, 1789, in case the required number of States should in the mean time so ratify it. In point of fact, it was adopted and ratified by conventions duly called in all the States (except North Carolina and Rhode Island) before the close of the year 1788. No one took a deeper interest in the events passing during the interval than he who has been so justly styled "the father of his country." Neither his voice nor his pen was idle. Many of his most interesting letters were written upon this subject. (See Washington's *Writings*, pp. 278, 389, 390.) All eyes were now turned to the great military chief of the Revolution as the first civil executive of the new organization. The Constitution had not been framed by the convention nor adopted by the States without a close and bitter contest in every stage of its progress. In the convention that framed it two antagonistic parties developed themselves soon after their assembling. These were known as the Nationals and the Federalists. The Nationals were led by Gov. Randolph of Virginia, supported by Madison, Hamilton, King, and others, and the Federalists by Charles Pinckney of South Carolina, supported by Ellsworth, Ames, Yeates, and others. The former were for utterly disregarding the powers conferred upon them and the instructions under which they were to act, and were in favor of doing away entirely with the States and forming one single or consolidated republic. Their idea was to institute what the Germans style a *Bundes-Staat*, with the sovereignty of all the States merged in a consolidated union; while the other side unyieldingly contended for the maintenance of the federal system under the present form, preserving the equality of the States in one branch of the Congress of the States at least, without any regard to their respective size, population, or wealth. This point they ultimately carried, so that, under the new Constitution as under the old, no act or measure can become a law against the votes of a majority of the States in the Senate. The retention of the federative feature in the new Constitution caused most of the Nationals in the Philadelphia convention to oppose it in every stage of its progress in that body, but they espoused its adoption in the ratifying State conventions as a temporary expedient, and the best thing that could then be obtained on their line, in view of the prevailing popular sentiment at the time. The main opposition to it in the State conventions sprung from the new machinery introduced for the execution of all the delegated powers by the general government within its limited sphere, without awaiting the sanction of the several States for final valid action, and from the absence of an express reservation in the instrument to the States of all their sovereign powers not delegated by the Constitution to the U. S. This was the position of Patrick Henry and Mr. Monroe of Virginia and Samuel Adams and John Hancock of Massachusetts. This class were perfectly satisfied with the Constitution on the adoption of the Tenth Amendment, which they insisted upon, and which was soon unanimously adopted by the States, and is in the following words: "The powers not delegated to the U. S. by the Constitution nor prohibited by it to the States are reserved to the States respectively, or to the people." The new machinery, however, was by far the greatest and most important change in the new system. This ideal of a confederated republic seems to have emanated from the brain of Mr. Jefferson. The first intimation of it in the history of the country was given by him in a letter written to Mr. Madison from Paris in 1786, when the question of remodelling the then existing Articles of union between the States was agitating the public mind. It was in this letter he suggested the outlines of that new feature of the federal machinery to operate directly upon the citizens of the States within the limits of the specific and enumerated powers delegated to the general government, which has, in the language of De Tocqueville, effected such momentous results. His suggestion was, that in the Federal government, as in the State governments, there should be three separate and distinct departments—the executive, the legislative, and the judiciary; and in this way the U. S. would present to the world one nation as to all foreign and extra-State affairs, while among themselves they would remain separate and distinct nations as to all internal affairs and the exercise of all sovereign powers not delegated to the general government. How the parties of the time referred to subsequently developed and changed their names, as well as their policies, space will not allow us to trace in this article, even if it were otherwise pertinent to do so.

Washington, it was known, was devoted to the federative feature retained in the new system. That, besides his other eminent qualities of head and heart, secured him the unanimous voice of the friends of the new Constitution for the chief magistracy in putting it into operation.

He received every electoral vote cast in all the colleges of the States voting for the office of President. New York, the eleventh State ratifying the Constitution, did not cast any electoral vote in this election, because she had not time after her ratification, late in the fall of 1788, to provide for holding the election within the time prescribed. The 4th of Mar., 1789, was the time appointed for the government of the U. S. to begin its operations under its new organization; but several weeks elapsed after this time before quorums of both the newly-constituted houses of the Congress were assembled. The city of New York was the place where the Congress then met. Washington, having been duly notified of his election, left his home at Mount Vernon on the 16th of April to enter upon the discharge of his new duties. He set out with a purpose of travelling privately and without attracting any public attention; but this was impossible. Everywhere on his way he was met by thronging crowds, eager to see the man whom they regarded as the chief defender of their liberties, and everywhere he was hailed with those public manifestations of joy, regard, and love which spring spontaneously from the hearts of an affectionate and grateful people. His reception in New York was marked by a grandeur and an enthusiasm never before witnessed in that metropolis. The inauguration took place Apr. 30, in the presence of an immense multitude which had assembled to witness the new and imposing ceremony. The oath of office was administered by Robert R. Livingston, chancellor of the State. When this sacred pledge was given in the presence of his fellow-citizens, with an appeal to Heaven, "to the best of his ability," in the execution of the office of President, "to preserve, protect, and defend the Constitution of the U. S.," he retired with the other officials into the Senate chamber, where he delivered his inaugural address to both houses of the newly-constituted Congress in joint assembly.

In the manifold details of his civil administration, as previously in the direction of military operations, Washington proved himself equal to the requirements of his position. The greater portion of the first session of the first Congress was occupied in passing the necessary statutes for putting the new organization into complete operation. In the discussions brought up in the course of this legislation the nature and character of the new system came under general review. On no one of them did any decided antagonism of opinion arise. All held it to be a limited government, clothed only with specific powers conferred by delegation from the States. The Nationals now came warmly in support of the new system as it had been amended and enlarged. Failing in their object in the convention, they now accepted the new Constitution as the best thing they could obtain on their line, as before stated. It was admitted on all hands that the federative feature was retained in the new system. There was therefore no change in the name of the legislative department or of the style of the government. The former still remained "the Congress of the U. S. of America." There was no change in the original flag of the country, and none in the seal, which still remains with the Grecian escutcheon borne by the eagle, with other emblems, under the great and expressive motto, "*E Pluribus Unum.*" All friends of the new Constitution now assumed the name of Federalists. This state of things, however, did not last very long. The first division of parties arose upon the manner of construing the powers delegated, and they were first styled "*strict* constructionists" and "*latitudinarian* constructionists." The former were for confining the action of the government strictly within its specific and limited sphere, as clearly defined by the language of the Constitution, while the others were for enlarging its powers by inference and implication, thus securing by construction what the States in convention had expressly refused to confer. In the ranks of the latter class the old Nationals almost universally took position. They still adhered, however, to the popular name of Federalists, while the strict constructionists took the name of Republicans in some places, and of Democrats in others. Hamilton and Jefferson, both members of the first cabinet, were soon regarded as the chief leaders, respectively, of these rising antagonistic parties, which have existed, under different names, from that day to this. Washington was regarded as holding a neutral position between them, though, after mature deliberation, he vetoed the first apportionment bill (in 1790) passed by the party headed by Hamilton, which was based upon a principle constructively leading to centralization or consolidation. This principle was manifested in applying the ratio of representation under it to the entire population of all the States, as constituting one aggregate mass or nation, instead of applying it to the population of each State severally, as one distinct member of a confederative republic. The latter was the only way in which it could be made upon correct federal principles, as Mr. Jefferson insisted in a written cabinet opinion, notwithstanding large fractions of population in several of the States were left out by this mode of apportionment. This was the first exercise of the veto power under the present Constitution. In it Washington showed his devotion to the federative principle still retained in the new system. The veto created considerable excitement at the time in the ranks of the Nationals. Another bill was soon passed in pursuance of Mr. Jefferson's views, which has been adhered to in principle in every apportionment act passed since.

At the second session of the new Congress, Washington announced the gratifying fact of "the accession of North Carolina" to the Constitution of 1787; and on June 1 of the same year he announced by special message the like "accession of the State of Rhode Island," with his congratulations on the happy event which "united under the general government" all the States which were originally confederated. In 1792, at the second Presidential election, Washington was desirous to retire, but he yielded to the general wish of the country, and was again chosen President by the unanimous vote of every electoral college. At the third election (1796) he was again most urgently entreated to consent to remain in the executive chair. This he positively refused. In September, before the election, he gave to his countrymen his memorable *Farewell Address*, which in language, sentiment, and patriotism was a fitting and crowning glory of his illustrious life. After Mar. 4, 1797, he again retired to Mount Vernon for peace, quiet, and repose. His administration of the new system for two terms had been successful beyond the expectation and hopes of even the most sanguine of its friends. The finances of the country were no longer in an embarrassed condition, the public credit was fully restored, life was given to every department of industry, the workings of the new system in allowing Congress to raise revenue from duties on imports proved to be not only harmonious in its federal action, but astonishing in its results upon the trade and commerce of all the States. The exports from the Union increased from nineteen million to over fifty-six million dollars per annum, while the imports increased in about the same proportion. Three new members had been added to the Union; the progress of the States in their new career under their new organization thus far was exceedingly encouraging, not only to the friends of liberty within their own limits, but to their sympathizing allies in all climes and countries. Of the call again made on this illustrious chief to quit his repose at Mount Vernon and take command of all the U. S. forces, with the rank of lieutenant-general, when war was threatening with France in 1798, nothing need here be stated, except to note the fact as an unmistakable testimonial of the high regard in which he was still held by his countrymen of all shades of political opinion. He patriotically accepted this trust, but a treaty of peace put a stop to all action under it. He again retired to Mount Vernon, where, after a short and severe illness, he died Dec. 14, 1799, in the sixty-eighth year of his age. The whole country was filled with gloom by this sad intelligence. Men of all parties in politics and creeds in religion, in every State in the Union, united with Congress in "paying honor to the memory of the MAN, first in war, first in peace, and first in the hearts of his fellow-citizens." His remains were deposited in a family vault on the banks of the Potomac at Mount Vernon, where they still (1876) lie entombed. ALEX. H. STEPHENS.

**Washington** (WILLIAM AUGUSTINE), b. in Stafford co., Va., Feb. 28, 1752, was a distant relative of Gen. George Washington; received a good education; became a captain under Mercer in the Virginia line; fought at the battles of Long Island, Trenton, and Princeton; became lieutenant-colonel of Baylor's dragoons 1778; commanded a light corps of cavalry in the campaign of the Carolinas 1779–81, being distinguished at Cowpens, Guilford, Hobkirk's Hill, and at Eutaw Springs, where he was taken prisoner. He settled at Charleston, S. C.; was a member of the legislature, and became a brigadier-general and aide-de-camp to Gen. George Washington about 1798. D. at Charleston Mar. 6, 1810.

**Washington and Jefferson College,** Washington, Pa., is the result of the union of Washington College and Jefferson College, located respectively at Washington and Canonsburg, two villages 7 miles apart in Washington co., Pa. Jefferson College grew out of Canonsburg Academy, which was organized in 1791, and by act of the legislature in 1802 received college privileges under the name of Jefferson College. Its first president was Rev. John Watson, A. M., who was chosen principal Aug. 29, 1802; and d. Nov. 30, 1802. Until 1852 no funds were collected except for buildings and appliances, such as libraries and apparatus. In that year a plan of endowment was adopted by the trustees, under which $60,000 were raised, and the in-

stitution began operating under the system of giving free tuition to scholarship holders and supporting its faculty on the income of its endowment. By a general catalogue recently published its graduates are reported as ministers 921, lawyers 408, physicians 193, other occupations 368; total, 1890. Washington College grew out of an academy, and received its charter in 1806. Its first president was Rev. Matthew Brown, D. D., LL.D., elected Dec. 3, 1806; resigned Apr. 30, 1817. Until 1853 it was a close corporation. At that time a contract was entered into with the synod of Wheeling (O. S.) that on condition that they endowed it they should have the right to its trustees and faculty. This agreement took effect with the college year 1853–54. By a general catalogue lately published, the list of its alumni numbers 846—to wit, ministers 329, lawyers 205, physicians 109, other occupations 203.

Throughout nearly the whole history of these institutions efforts and plans for uniting them were proposed. With the cost of living increased by the war, their endowments, whose incomes furnished but a bare support before, became thereafter altogether inadequate. Under these circumstances the trustees of both institutions accepted the offer of Rev. C. C. Beatty, D. D., LL.D., of Steubenville, O., of $50,000 if they would unite, and in 1865 the enabling act passed the legislature. By that union the preparatory department, scientific department, and the freshman class of the classical department were located at Washington, the sophomore, junior, and senior classes at Canonsburg. This duplex arrangement proved undesirable, and application was made to the legislature for leave to consolidate the whole institution at one place; which request was granted, and the trustees under that authority located the whole at Washington, Pa. This being unacceptable to some, they brought suit to prevent it by an injunction. The case was tried both before the supreme court of Pennsylvania and the Supreme Court of the U. S., and unanimously decided by both courts in favor of the college. Its first president was Rev. Jonathan Edwards, D. D., LL.D., who was succeeded in 1870 by Rev. George P. Hays, D. D., who is still in office. Its present endowment fully supports its faculty of nine professors. New buildings are now erecting, which when completed will furnish ample room for all purposes. GEORGE P. HAYS.

**Washington and Lee University,** an institution of learning at Lexington, Va., derived its origin from the Augusta Academy at Greenville, which in 1776 took the name of Liberty Hall; was chartered in 1782; was removed to the vicinity of Lexington in 1785, and to its present grounds in 1803. It received from Gen. Washington, in 1796, 100 shares of stock in the James River Canal Co., which was commuted by the legislature to an interest-bearing fund of $50,000, and the name was changed to Washington College. It received in 1803 a fund of $25,000 from the Cincinnati Society, and in 1826 a bequest of $40,000 from Mr. John Robinson. On the death of Gen. Robert E. Lee in 1870 the name was changed to its present form. The institution resembles in plan of organization the UNIVERSITY OF VIRGINIA (which see), being divided into thirteen elective schools, including the applied sciences, engineering, and law. Scholarships are conferred upon students for the ministry, sons of clergymen, persons intending to become practical printers, journalists, or teachers, and upon the students ranking first in several academies and high schools. Degrees are conferred only upon examination in the courses of the several schools. The government is in the hands of a board of trustees, and is more immediately conducted by the president and faculty. Instruction was suspended during the civil war, when the college suffered by the destruction of its scientific apparatus during the occupation of the town by the national forces, but these losses have been more than compensated by liberal contributions. The institution was reorganized in 1865 under the presidency of Gen. Robert E. Lee, who was succeeded in 1871 by his son, Gen. G. W. Custis Lee. It has a library of 12,000 volumes, and an average of 300 students and 20 instructors.

**Washington City,** the capital of the United States of America, and the seat of the Federal government since 1800, is situated on the eastern bank of the Potomac River, 106 miles above its mouth, and 105 miles in a straight line W. of the Atlantic Ocean, in 38° 53′ 39″ N. lat. and 77° 2′ 48″ lon. W. of Greenwich. The population of the city in 1875 was 125,000 (estimated). The population at each decennial period was, by the census of 1800, 3210; 1810, 8208; 1820, 13,247; 1830, 18,826; 1840, 23,364; 1850, 40,001; 1860, 61,122; 1870, 109,199. Out of the population in 1870 there were—white, 73,731; colored, 35,455; Indian, 13; natives of the District of Columbia, 42,694; of other parts of the U. S., 52,748; of foreign birth, 13,757—viz. Great Britain, 8505; Germany, 4133; all other countries, 1119. Washington ranks as the twelfth city of the U. S. in number of inhabitants, containing, in 1870, 21,343 families and 19,545 dwelling-houses. (For facts regarding the climate, geology, natural history, agriculture, manufactures, commerce, education, and civil history of Washington, see DISTRICT OF COLUMBIA.)

Washington is almost alone among the capitals of great nations of modern times in the fact of its creation for the sole purpose of a seat of government, apart from any questions of commercial greatness or population. While London, Paris, Berlin, St. Petersburg, Vienna, and Madrid are respectively the commercial capitals and the most populous cities of the nations they represent, Washington never was, and probably will never be, the leading city of the U. S., or the great metropolis of a commercial and a manufacturing population. Although not isolated in position, and possessing some natural advantages in the water-power of the Potomac, the city has no natural harbor. Though located at the head of tide-water navigation, just below the Little Falls of the Potomac at Georgetown, it could not become a great shipping-point without the expenditure of many millions. In trade and manufactures it is overshadowed, no doubt permanently, by the neighboring great commercial capitals of Baltimore and Philadelphia, from which it is distant only 39 and 137 miles respectively, while New York is but 227 miles distant by railway.

The history of the selection of Washington as the seat of government shows that there was a protracted conflict in the Congress of the republic over the claims of rival localities, and that the confluence of the Potomac and Anacostia was finally selected as a compromise. After the settlement of the cession to the U. S. by Maryland and Virginia of a Federal district 10 miles square (elsewhere recorded), the site of the city and the location of the public squares and buildings were selected by Pres. Washington in person on the Maryland side of the Potomac, in accordance with the act of Congress of Mar. 30, 1791. At the time of this location the city was almost precisely in the geographical centre between the northern and the southern limits of the Union. On Apr. 15, 1791, the corner-stone of the Federal territory was laid by three commissioners appointed by the President, together with the officials of Alexandria, Va.; and in the following year the lines of boundary directed by the President's proclamation were permanently marked by square milestones. The place was called "the Federal City" by Washington and in the records of the time until Sept. 9, 1791, when the commissioners directed that the Federal district should be called "the Territory of Columbia," and the Federal city "the city of Washington." Major L'Enfant, a French engineer, prepared the topographical plan of Washington City under the direction of Pres. Washington and Thomas Jefferson, secretary of state. L'Enfant took as a basis for his design the topography of Versailles, the seat of the government of France, and introduced the scheme of broad transverse avenues intersecting the main streets of the city, with constantly-recurring squares, circles, and triangular reservations, which form at this day the main features of the plan of the city. Having determined upon the location of the Capitol as the initial point, a true meridian line was drawn through it, crossed by another due E. and W. line, by the accurate measurement of which the acute angles were determined, and the avenues and streets laid down by strict measurement. The ideas of the founders of the city proposed a seat of government of ample territorial proportions, and provided for the future wants of a swarming population, as well as for the embellishment of the fine natural features of the city by the aid of art. The grand scope of the superficial design, contrasted with the poverty of the results achieved in the shape of public improvements for many years, led to the proverbial designation of Washington as the "city of magnificent distances." Thus, the public streets throughout were projected on the scale of a width of 160 feet down to 70 feet, no street in the city being less than the latter width. The aggregate length of the streets and avenues is 264 miles, and they are wider than those of any other city in the world. There are 21 avenues in all, which bear the names of various States in the Union. Pennsylvania Avenue, the principal street of Washington, is a magnificent thoroughfare 160 feet wide, running from the Capitol to the Treasury Department, where it is deflected to the N. and continued past the President's House to Georgetown at the width of 130 feet. On the other side of the Capitol it runs 160 feet wide to the Anacostia River. This avenue was originally laid out in three roadways, with a double row of Lombardy poplars planted, at the instance of Mr. Jefferson, between the central or main street and that on each side. These trees were cut down in 1832, and the avenue thrown into one broad thoroughfare, now (1876) paved with smooth concrete, constituting the most splendid and attractive *corso* or driveway in the

country. Massachusetts Avenue is over 4½ miles long, running in an unbroken course 160 feet in width from the N. W. boundary of Washington at Twenty-second street to the Anacostia beyond Lincoln Park. The other avenues are named Maine, New Hampshire, Vermont, Connecticut, Rhode Island, New York, New Jersey, Maryland, Delaware, Virginia, North Carolina, South Carolina, Georgia, Louisiana, Missouri, Tennessee, Kentucky, Ohio, and Indiana. To these must be added the newly laid out Executive Avenue, which starts from Pennsylvania Avenue at the President's House and follows a serpentine course through the Washington Monument grounds, in full view of the Potomac, till it reaches the grounds of the department of agriculture, whence it passes through the Smithsonian reservation and the Mall to the Botanic Garden at the foot of the Capitol. Executive Avenue affords a fine drive about 2 miles in length, and will soon be adorned with shade trees through its whole extent, as it now is in the grounds of the Smithsonian Institution. The Mall, through which the drive runs, was originally covered with majestic oaks, which were cut down about 1820 under an unwise agreement of the commissioners of Washington with the proprietors, that they should be entitled to all the wood on the lands reserved by the U. S. East Capitol street, running at a uniform breadth of 160 feet from the E. front of the Capitol to Lincoln Park, was originally designed to be the chief street of the city, and has recently become one of the most attractive, many fine residences having been located upon it. K street, 148 feet wide, extending from Rock Creek, the Georgetown boundary, to the Anacostia, is one of the most splendid thoroughfares of the city. Sixteenth street, 160 feet wide, runs from La Fayette Square opposite the President's House due N. to the boundary, where it climbs the heights toward Columbian College, presenting a fine view of the city and environs. Boundary street, running along the northern limit of the city, is also a fine driveway or boulevard.

Every grand transverse avenue was laid out 160 feet wide. The crossings of the streets and avenues created opportunity for constant parks or reservations as centres of attraction, interspersed with business blocks and dwelling-houses. Besides these fractional reservations, there were set apart more extensive parks or squares, including the following: the Capitol grounds, 52 acres; President's grounds, 20 acres; La Fayette Square, 7 acres; the Park or Mall (not yet fully opened), about 100 acres; Judiciary Square, 19 acres; the Arsenal grounds, 44½ acres; the Navy-yard, 27 acres; Farragut Square, 1⅛ acres; McPherson Square, 1⅛ acres; Scott Circle, 1 acre; Franklin Square, 4 acres; Rawlins Square, 1¼ acres; Lincoln Park, Capitol Hill, 6¼ acres; Stanton Place, Capitol Hill, 3¼ acres. Besides these, are numerous smaller squares and several circular plots of ground, the most conspicuous of which are Washington Circle, midway between Washington and Georgetown, Fourteenth street Circle, at the corner of Massachusetts and Vermont avenues, and P street Circle, at the

FIG. 1.



The Capitol.

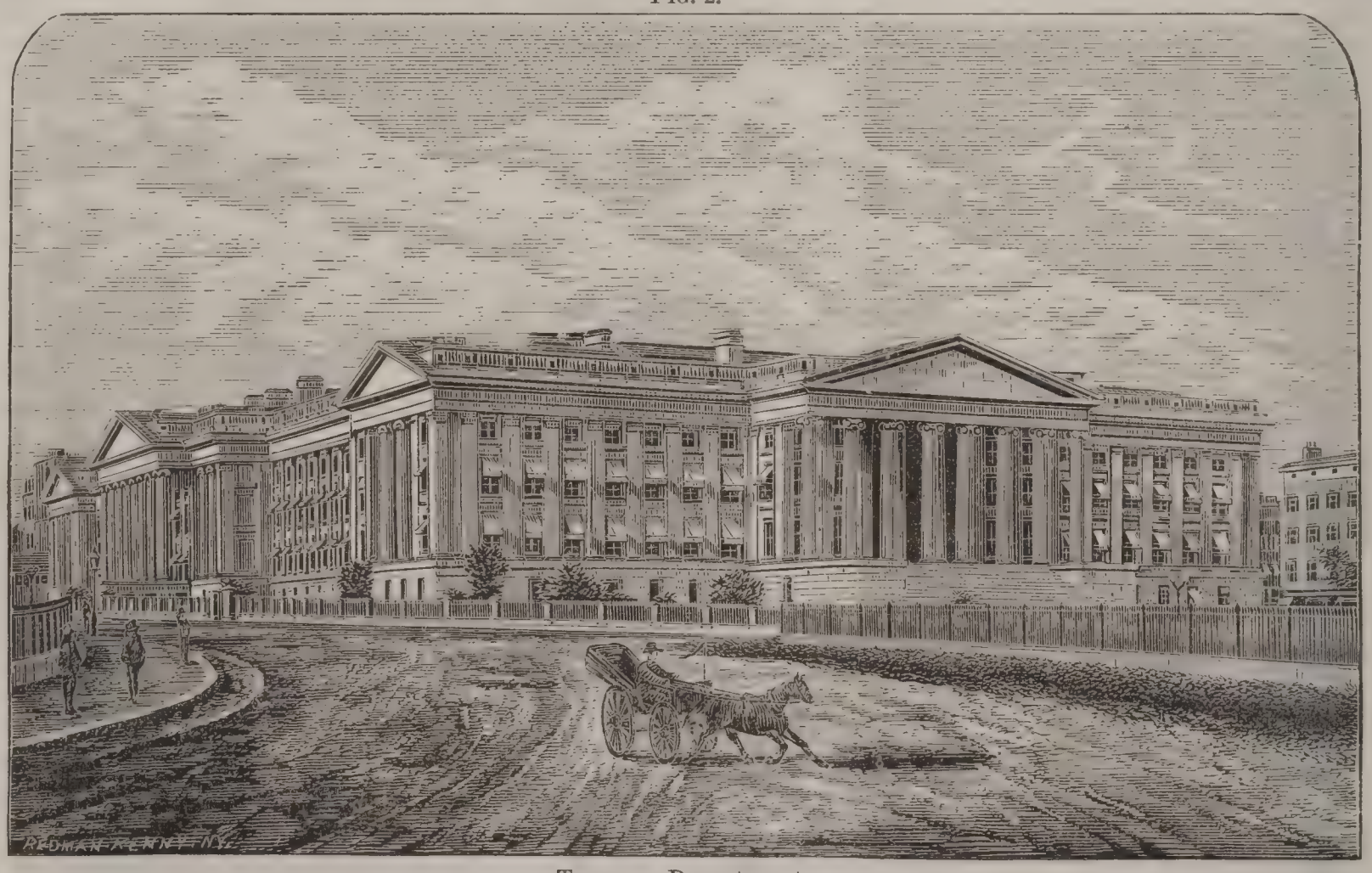
The Capitol.

intersection of Connecticut, Massachusetts, and Vermont avenues. Numerous triangular reservations at the intersections of streets and avenues have been enclosed and beautified with trees and shrubs.

Notwithstanding the magnitude and far-sightedness of the original plans for the laying out of the Federal capital, more than half a century was suffered to elapse before any portion of the city could be said to have assumed the beauty and attraction due alike to its natural advantages and to the liberality of the schemes for its adornment. The narrowest views of economy prevailed in Congress, and all attempts to expend even the smallest sums of public money upon making the Federal capital attractive, or even of contributing to its salubrity as a residence by draining its numerous marshes or rendering its muddy streets and avenues accessible by suitable pavements, were steadily defeated. The descriptions which have come down to us of the appearance of Washington in early days concur in representing it as a gigantic failure. Mrs. John Adams, the first occupant of the White House, has described, in letters familiar to the public, the rude and uncomfortable condition of the city when Congress first came to occupy the new capital. For ten years before the public offices were removed from Philadelphia, the area of the future capital embraced scarcely 500 inhabitants. Oliver Wolcott wrote in 1800, "The Capitol is situated on an eminence near the centre of the immense country here called the city. There is one good tavern about forty rods from the Capitol, and several other houses are built and erecting." John Cotton Smith, Congressman, wrote: "The Pennsylvania avenue was then nearly the whole distance a deep morass, covered with alder-bushes." The place was simply a backwoods town in the wilderness, and Senators and Representatives in Congress were for years in the habit of finding such comfort as they could in lodgings in Georgetown, 3 miles distant, though within the District of Columbia. Yet the nascent capital of the republic was not without its experiences of the soaring ambition of the early owners of land in the vicinity of the capital that was to arise in such magnitude out of the primitive swamps and forests which had so long occupied the site of Washington. When the bluff overlooking the Potomac was selected as the site for the Capitol, the owners of lots on the plateau facing eastward, where the edifice was to front, immediately put up the prices of their lots to 75 cents or $1 a square foot. The result was, that settlers in Washington, avoiding Capitol Hill, purchased land and erected their houses in the swampy district lying between the Capitol and the Potomac, where lots could be obtained at the low price of from 10 to 25 cents a square foot. Thus it came to pass that the broad plateau of Capitol Hill, the highest, most commanding, and most salubrious portion of Washington, remained unsettled for more than half a century, save by a small straggling population. The shops and residences of the citizens grew steadily in the north-western direction, following the valley, on either side of Pennsylvania Avenue, and extend-

ing slowly toward the northern limits of the city, as well as westward toward Georgetown. In 1839, George Combe, the English traveller, wrote of Washington: "The town looks like a large straggling village reared in a drained swamp." It was not until the year 1851 that anything was done toward laying out or adorning the numerous public parks and reservations contemplated by L'Enfant sixty years before. In that year A. J. Downing, the landscape-gardener, was employed by Pres. Fillmore, pursuant to a small appropriation by Congress, and his plans for roadways planted with a picturesque selection of trees were partially carried out in the park occupied by the Smithsonian Institution. The death of the artist in 1852, and the neglect of Congress, suspended these needed improvements for twenty years longer. All visitors to Washington before 1871 cannot fail to remember the crude and unkempt condition of the Capitol grounds, and the neglected aspect of the approaches to all the noble public buildings which adorn the capital. The streets and avenues were in a chronic state of neglect, the drifting of dust alternating with the deepest mud, and the thoroughfares of the city being at times almost impassable. At length in 1871, under the combined influence of a more liberal spirit in Congress, and the energetic determination of some of the private citizens, a new order of things was inaugurated. Congress having abolished the municipal governments of Washington and Georgetown, and created for the District of Columbia a Territorial government with a governor, legislature, and board of public works, the latter body became invested with exclusive power over the streets, sewers, and avenues of Washington and Georgetown, with authority to improve the same on a comprehensive plan. Endowed with these great powers, and the ability to raise money by tax and loan, the new government went vigorously into the business of improving the Federal city. An extensive system of sewerage and of street pavements was drawn up, through which the greater portion of the city was reclaimed from neglect and filth, the great ditch known as the Washington Canal was filled up, and about 160 miles of streets and avenues were paved with stone, wood, or concrete. Many streets were completely re-graded; the public squares were all fenced and planted with shade trees; while in the streets and avenues about 29,000 umbrageous trees have been set out. These comprise elm, maple, linden, tulip, ash, Carolina poplar, and other native forest trees. The magnitude and extent of these improvements, carried on with a vigor and rapidity almost without precedent in American municipal history, of course entailed a corresponding amount of extravagance. While the seat of government reaps solid and permanent benefit from some of these improvements, others, hastily executed, have already fallen into decay. Whatever may be the verdict of history upon the much-controverted acts of the Territorial government, during whose short reign of three years the city of Washington was so transformed, it cannot be doubted that a new era for the Federal capital

FIG. 2.



Treasury Department.

dates from these improvements. Coincident with them, the erection of an unprecedented number of public buildings and private residences has contributed to render the city at once more attractive and more habitable to residents old and new. The net result of the operations of the board of public works is the substantial completion of these vast improvements, and the creation of a public debt of more than $20,000,000, which still hangs over the city unadjusted by the legislation of Congress, while the interest thereon is paid partly by taxation of the property of the District and partly out of the public treasury.

The government of Washington was strictly municipal in character, with a mayor and city council, until 1871, when Congress created a Territorial government for the District of Columbia, repealing the charters of the cities of Washington and Georgetown, and merging them into the same government. This government was abolished by act of June 20, 1874, and a provisional government of three commissioners, appointed by the President and Senate, was constituted until Congress should devise a more permanent form. The affairs of the District, including those of Washington, still continue to be managed by these commissioners under the direct legislation of Congress for the levying and disbursement of taxes and for all public improvements. The financial operations of the government are administered directly by the treasury department. The assessed valuation of real estate in Washington in 1876 was a little less than 80 millions of dollars. The rate of tax levied that year was 1½ per cent., with the same amount on personal property. The government property in buildings and reservations has never been subjected to tax. Congress exercises, under the Constitution, the power of exclusive legislation.

Since the retrocession of Alexandria and the territory on the W. bank of the Potomac to Virginia in 1846, the city of Washington, together with the District of Columbia, embraces only 64 sq. m. The city extends 4½ miles in one direction by about 2½ in the other, and its circumference is 14 miles, having a water-front on the Potomac of 4 miles, and on the Anacostia of 3¼ miles. The city proper covers 6111 acres, being about 9½ sq. m.; and out of this territory the government reservations comprise 541 acres, while the avenues and streets embrace 2554 acres (or 3095 acres in all), leaving only 3016 acres to the squares on which private residences are built. There is thus a much larger proportion of land unbuilt upon in Washington than in any large city on the globe—a circumstance which conduces in the highest degree to the public health, securing as it does large open spaces and abundant ventilation in every quarter of the city. The returns of the board of health exhibit a death-rate of slightly less than 2 per cent. per annum, considerably below the average mortality of cities in all countries. The continuous heat of summer, though often intense, is mitigated by breezes which blow up the valley of the Potomac, while in winter snow seldom falls, and for many days together the thermometer rarely indicates a temperature below the freezing-point. By the original plan the city is divided into four sections, starting

from the Capitol as a centre, with N. and S. Capitol street as the dividing-line on one side, and E. and W. Capitol street (the latter not opened) on the other. The streets and avenues are numbered by what is known as the Philadelphia plan, 100 numbers to each square, and the streets running E. and W. are called by the letters of the alphabet from A to W inclusive, while those running N. and S. bear numerical names from First to Twenty-eighth street inclusive. This poverty of street-nomenclature will probably be superseded by more expressive designations.

The site of the city of Washington is admirably adapted by nature for the building up of an attractive and imposing city. Situated in part on the tongue of land lying at the confluence of two broad rivers, from which the ground rises in natural and not abrupt ridges into the expanded plateau of Capitol Hill, about 100 feet above the Potomac, the surface of the city presents a gentle undulation which gives variety and constant transition of prospect, without producing any obstructions to travel. The city proper is surrounded on the E., N., and W. by an amphitheatre of well-wooded hills, embracing in most cases the ancient forest-growth of tall timber, which was cut off or burned on the Maryland side (as on the Virginia) during the ravages of civil war. Viewed from the vantage-ground of the Capitol dome, or even the western portico, the environs of Washington present a landscape of rare beauty and picturesqueness. The near view includes the mass of the city, thickly covered with dwellings, stores, and shops, intersected by the two great arteries of Pennsylvania Avenue, running to the Treasury, and Maryland Avenue, running westward to the Potomac. At frequent intervals through the perspective of roofs rise the tall steeples of churches and the massive white marble edifices of the various government buildings. Turning westward, the bright broad current of the Potomac—nearly 1 mile wide opposite the Capitol—sweeps southward, while there comes in on the left, joining its broad stream at Greenleaf's Point (on which the government arsenal is situated), the deep current of the Anacostia, or Eastern Branch of the Potomac. To the S., on the heights beyond the Eastern Branch, is seen the long mass of the government insane asylum building. On the Virginia shore rises a long picturesque range of hills, amid which may be discerned Arlington Heights, with its pillared edifice erected by George Washington Parke Custis, now occupied by the government, and its National Cemetery or city of the dead, where 15,000 Union soldiers are interred, while the spire of Fairfax Seminary, 6 miles distant, rises above the horizon in the direction of Alexandria. The latter little city, with its houses, churches, and shipping lying along the harbor, is clearly visible, and the river is at almost all seasons dotted with the sails of river-craft and with steamers plying up and down. To the N. W., over the roofs of the Executive Mansion and the new State Department, rise the lofty and picturesque heights of Georgetown, attaining at the adjoining village of Tenallytown, just outside the borders of the District of Columbia, a height of some 400 feet above the level of the sea. To the N. are seen the buildings of Howard University crowning Seventh street hill, and beyond the tower of the Soldiers' Home, a free refuge for the disabled soldiers of the army, comprising a beautiful park of 500 acres in extent. It was this delightful and comprehensive view which drew from Baron von Humboldt the remark, as he stood on the western crest of Capitol Hill and surveyed the scene, "I have not seen a more charming panorama in all my travels."

FIG. 3.



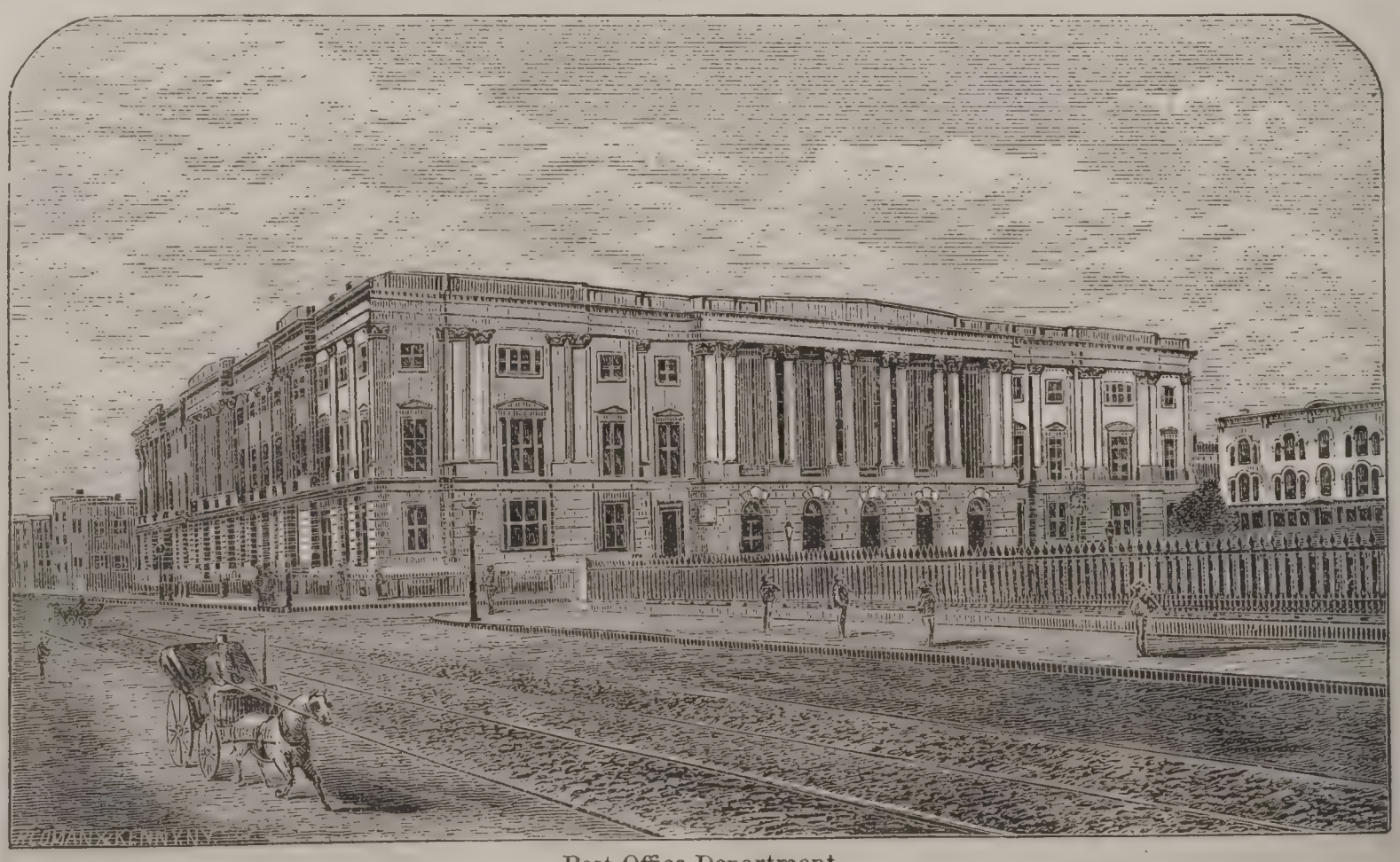

Interior Department (Patent Office).

The Capitol building, as the most conspicuous object in the scenery of Washington, its lofty white dome being visible from all directions for miles around the city, first merits a description. It is situated very nearly in the geographical centre of the city, the great plateau of Capitol Hill extending from the E. front about 1 mile, and gently sloping toward the Anacostia, while from the W. front the ground falls off by a partly abrupt and partly gradual decline to the level of the Potomac. This building, constructed in the purely classic style, with a centre and two projecting wings of great extent, is ornamented on the E. front with 68 Corinthian columns. The entire length of the building is 751 feet 4 inches, with a breadth of from 121 to 324 feet in the different portions. The whole edifice covers nearly 3½ acres. The height of the centre and wings from the ground to the roof is 70 feet. From the main or central building springs a lofty iron dome 135½ feet in diameter at its base, and containing 8,009,200 pounds, or 3575 tons, of cast and wrought iron. The apex of the dome is surmounted by a tholus or lantern 15 feet in diameter and 50 feet high, and this is crowned by a bronze statue of Freedom, designed by Crawford, facing the E., the height of which is 19½ feet. The total height from the eastern front of the Capitol to the crest of the statue of Freedom is 285½ feet. The advantageous position, great architectural mass, and harmonious and imposing effect of the Capitol seen from most points of view are such as to have secured for it the almost unanimous praise of the best judges of all countries as the most impressive modern edifice in the world. The material of the central building is Virginia freestone; that of the wings is white marble, from Massachusetts quarries; while the fluted marble columns are from the Cockeysville (Md.) quarries near Baltimore. The solidity and durability of the structure are in harmony with its character and cost. The total expenditure upon the Capitol for erection, extension, and repairs has been a little more than 13 millions of dollars. Owing to the fact that the main building

was constructed many years before the wings, there is some want of harmony between the older and newer portions, but this is more perceptible in the interior than the exterior. The chief want in the latter direction is a greater projection of the eastern and western fronts of the central building, so as to afford a more ample support to the enormous superincumbent weight and mass of the dome. The Capitol has had several superintending architects. The central building was designed chiefly by B. H. Latrobe, and the wings and dome by Thomas U. Walter. The present central structure dates from 1818 (completed 1827), and the extension or wings from 1851. The first Capitol building, erected on the same site, was commenced in 1793, the corner-stone having been laid by George Washington Sept. 18 of that year, seven years before the removal of Congress to Washington. Two wings were first constructed, the N. wing being occupied by Congress in 1800, and the S. wing, connected by a wooden passage, in 1811. Before the completion of this first Capitol building, the whole was destroyed by the British army at the invasion of Washington in Aug., 1814; after which Congress found temporary apartments in other buildings until the completion of the central portion of the present Capitol in 1827, which was surmounted by a wooden dome, afterward replaced (between 1855 and 1863) by the present one of iron. The corner-stone of the Capitol extension was laid July 4, 1851, and the new Hall of Representatives in the S. wing was occupied in 1857, and the Senate chamber in 1859. The work was continuously prosecuted during the civil war, the great dome rising foot by foot while hostile armies were struggling for the possession of the capital, until the great statue of Freedom crowned the summit on Dec. 12, 1863.

The rotunda forms the central attraction of the Capitol, and consists of a circular hall 96 feet in diameter, by 180 feet in height to the canopy above, on the concave interior of which is painted a mammoth fresco by Brumidi representing allegorical and historical subjects. The eight panels which surround the rotunda, nearly on a level with the spectator, are adorned by historical paintings, most of which have become familiar to all through their repeated multiplication by the art of the engraver. These comprise Col. Trumbull's four paintings, *The Declaration of Independence*, *The Surrender of Burgoyne*, *The Surrender of Cornwallis*, and *The Resignation of General Washington*; *The Landing of Columbus*, by Vanderlyn; *The Embarkation of the Pilgrims*, by Weir; *The Baptism of Pocahontas*, by Chapman; and *De Soto's Discovery of the Mississippi*, by Powell. The portico of the eastern front of the Capitol presents two sculptured groups on either side—one by Persico, representing the discovery of America by Columbus, the other by Greenough, being an allegorical representation of the first settlement of America. Neither group can be esteemed happy in conception or pleasing in treatment. In niches on the right and left of the main entrance-door are two colossal statues by Persico, representing Peace and War. But the best embodiment of the sculptor's art in the external decorations of the Capitol is the group by Thomas Crawford on the tympanum of the

FIG. 4.



Post-Office Department.

eastern front of the Senate wing. This represents the progress of civilization in the U. S. The great bronze doors by Randolph Rogers, which adorn the eastern front entrance of the Capitol, represent in sculptured *alto-rilievo* events in the discovery of America and life of Columbus, while the similar doors in bronze which constitute the main entrance to the Senate wing, designed by Thomas Crawford, represent Revolutionary battles and prominent civic events in the history of the country.

The Senate Chamber, occupying the centre of the N. wing, is 113 by 81 feet in dimensions, with seats for 76 Senators, the galleries furnishing accommodations for over 1000 spectators. The Senate Chamber is without artistic decoration except in the glass panels of the ceiling, which have symbolic designs. The most elaborate decorations in the Capitol are beneath the Senate Chamber in the corridors and connecting passages, where the vaulted ceilings and walls are completely covered with designs in fresco and distemper, representing natural scenery, birds, animals, flowers, and heads of historical characters in great variety of graceful combination. Several of the Senate committee-rooms are richly and elaborately frescoed—notably, the naval committee room, with its frescoes of sea-gods and goddesses and other nautical subjects, exquisitely painted in the style of some of the panels unearthed at Pompeii; and the military committee room, which has five paintings of Revolutionary battle-scenes, done in pure fresco by Brumidi. The grand staircase of white marble, ascending from the basement story to the Senate floor on the W., presents one of the finest gems of interior architecture in the world. The long apartment in the rear of the Senate Chamber known as the Marble Room is constructed wholly of marble, the ceiling resting upon four Corinthian columns of Italian marble, while the walls are wholly of variegated Tennessee marble highly polished. Adjoining the Marble Room is the President's Room, which presents a crowded assemblage of decorations too numerous and ornate for so small an apartment. On the opposite side is the room of the Vice-President, furnishing a contrast to the former, being furnished in severely simple though pleasing taste. The Senate post-office, just beyond, has a ceiling elaborately frescoed with emblematic designs.

The S. wing of the Capitol is occupied by the House of Representatives and its offices and committee-rooms. The hall of the House is the largest legislative chamber in the world, measuring 139 feet in length by 93 feet in width, and 36 feet in height. The galleries are capable of accommodating about 1500 persons, while the floor affords ample space for 300 members, each of whom is provided with a writing-desk. On the right of the Speaker's chair is Vanderlyn's full-length portrait of Washington, and on the left a fine portrait of La Fayette by Ary Scheffer, presented by that artist to Congress.

The Library of Congress occupies the whole western projection of the central building. It consists of three communicating halls, lined throughout with iron shelves and alcoves, finished in ornate but chaste and beautiful style. The floor is of black and white marble, and no wood has been used in any part of the construction of the library, which is thus impregnably fireproof. The library embraces

over 310,000 volumes, and a new building is proposed to contain its overflowing stores, together with the copyright bureau, which is attached by law to the office of the librarian of Congress. Copies of every work secured by copyright, including books, periodicals, musical compositions, prints, chromos, photographs, engravings, etc., must be deposited in this office, and hundreds of thousands of these publications are already gathered here, the number constantly increasing. The law department of the library is located in the basement of the Capitol, occupying the room formerly used by the Supreme Court of the U. S. It has 35,000 volumes. The vestibule or entrance to this library is marked by six columns of what may be styled an American order of architecture, being carved in imitation of Indian-corn stalks, while the capitals of the columns represent the silken corn in full ear. In like manner, the columns in the upper vestibule are crowned by capitals representing the flower and leaf of the tobacco-plant, instead of the traditional acanthus.

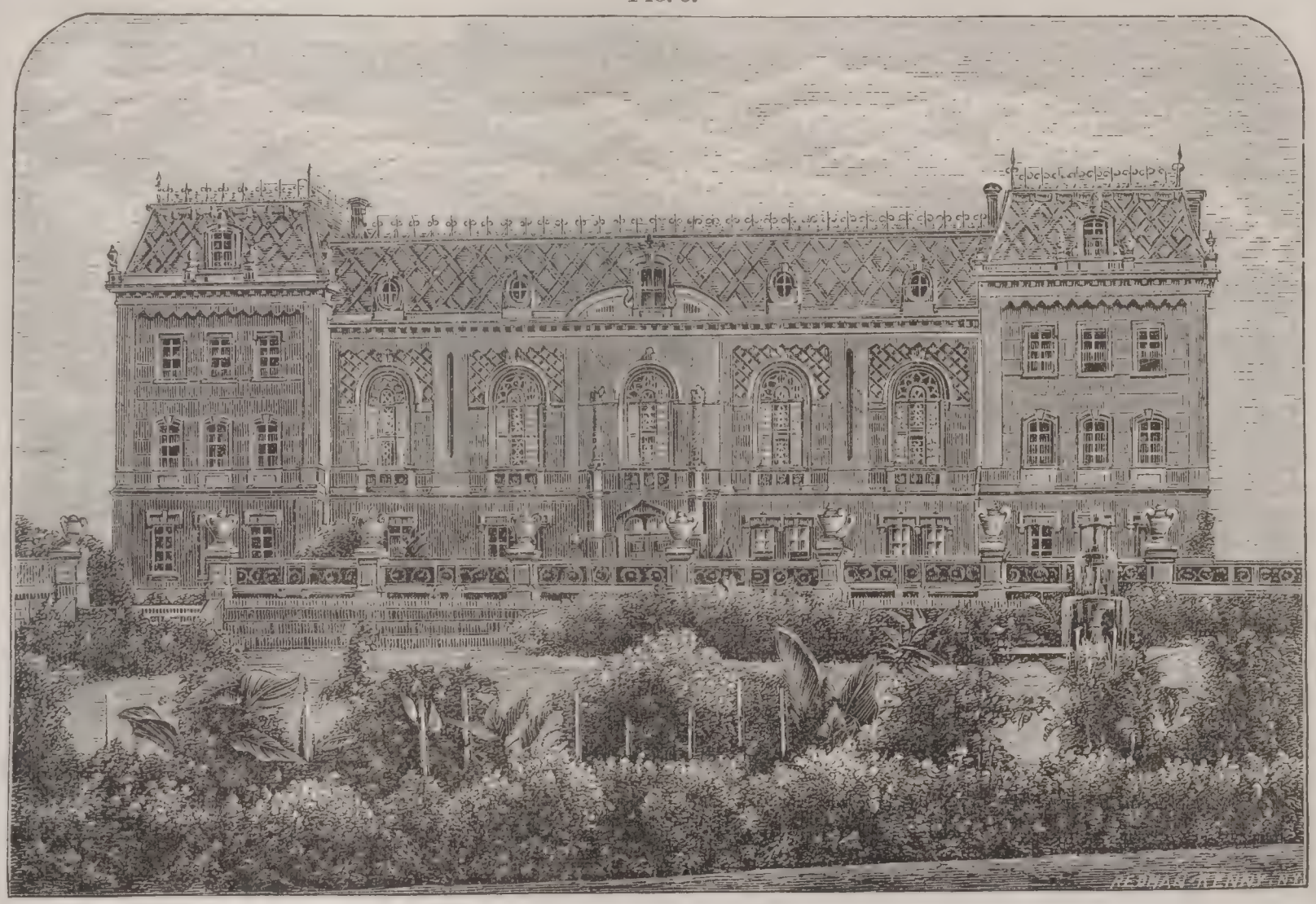
The Supreme Court room and offices occupy the old Senate Chamber in the central building and rooms adjacent. The court of claims, which has jurisdiction of cases involving claims on the government of the U. S., is located immediately beneath.

The old hall of the House of Representatives, through which one passes from the rotunda to reach the present hall of the House, is built in the form of a semicircle, surrounded by columns of variegated marble from the Potomac River. This hall was devoted by act of 1864 to the purposes of a national memorial hall, each State in the Union being invited to contribute statues of two of its most distinguished citizens in marble or bronze. As yet, only Rhode Island, Connecticut, Massachusetts, Vermont, New York, and New Jersey have sent contributions to this hall of fame. In this hall, too, is the exquisite piece of sculpture by Franzoni representing the Muse of History on the winged car of Time, with a clock recording the hours.

The Capitol contains, besides these, the historical paintings in the rotunda and the frescoes, a considerable number of works of art of various merit. At the head of the grand staircase W. of the House is Leutze's large painting representing an emigrant train crossing the Rocky Mountains. Powell's picture of *Perry's Victory on Lake Erie* is at the head of the eastern staircase in the Senate wing. Two paintings of American scenery on the Colorado and Yellowstone by Thomas Moran are in the corridor to the E. of the Senate gallery. Statues of Franklin and Jefferson by Powers, and of Hancock, Hamilton, and Baker by Horatio Stone, are among the decorations of the Capitol.

The Treasury Department, situated at the corner of Fifteenth street and Pennsylvania Avenue, is an imposing edifice in the pure Ionic style of architecture, with a stone balustrade running around the entire roof of the building.

FIG. 5.



Agricultural Department.

It has four fronts, the western of which, facing the city, represents the older part of the building, constructed 1836–41, and is of Virginia freestone. The other three fronts, built 1855–64, are of solid granite from the State of Maine. The monolithic columns in the S. front are among the largest in the world, being 31½ feet high and 4½ feet in diameter. The building measures 468 feet by 264, exclusive of porticoes and stairways, contains 195 rooms, exclusive of attic and sub-basement, and cost $6,000,000. It was designed by Robert Mills and T. U. Walter.

The great building of the state department, which when finished will accommodate the war and navy departments as well, is the latest erection among the public buildings of Washington, and is a massive piece of architecture in the Italian Renaissance style from designs by A. B. Mullett, surmounted by a Mansard roof. The material of the basement is Maine granite, and the entire superstructure is of granite from the quarries near Richmond, Va. The building was commenced in 1871, and the southern portion finished and occupied by the state department in 1875. The dimensions of the entire edifice will be 567 feet by 471, and it will have four façades, looking to the E., W., N., and S. respectively. The two buildings now occupied by the war department and navy department are situated on Seventeenth street, near the corner of Pennsylvania Avenue, and are plain edifices of brick, which will shortly give place to the magnificent new structure erected in part for their use, the total cost of which will approach $7,000,000.

The department of the interior, best known as the Patent Office building, is located near the centre of the city, occupying the entire square between F and G streets, and running from Seventh to Ninth. This splendid building is of severely simple though massive proportions, the architecture being pure Doric, the edifice measuring 453 by 331 feet, with an elevation of 75 feet. The older part of the structure, constructed 1837–42, and fronting on F street, is of freestone. The three remaining fronts, constructed 1850–64, are of Maryland marble, and the interior, fronting on a court in the centre, is of New England granite. The Parthenon at Athens furnished the model of the columns, capitals, and tympanum of this building; designed by W. P. Elliott. In it are located, besides the patent office, which occupies by far the larger portion of its 191 rooms, the Indian office, and the office of the public lands, together with the offices of the secretary of the interior and clerks. The patent business of the U. S. (treated elsewhere) is of enormous extent, and the models exhibited in this building number upward of 160,000, while the annual registry of new patents now averages about 15,000. The cost of the patent office building was $2,700,000.

The building of the post-office department is located immediately opposite the patent office, occupying the square embraced between Seventh and Eighth streets on one side,

and E and F streets on the other. It is constructed of Maryland marble. It is 300 feet long by 204 wide, with a central quadrangle 195 by 95 feet. The order of architecture is pure Corinthian. The building, erected about 1855, cost $1,700,000.

The department of agriculture occupies a large brick building with brownstone trimmings, in the Renaissance style, 170 by 61 feet, situated on a public reservation adjoining the Smithsonian Institution. It was erected in 1868, from designs by A. Cluss, at a cost of $140,000. Its appendages consist of greenhouses and graperies and experimental grounds covering about 10 acres, with terraces beautifully laid out in front and planted with beds of assorted flowers grouped in excellent taste. The business of the agricultural department is the distribution of seeds, plants, agricultural reports, and information, chiefly through members of Congress.

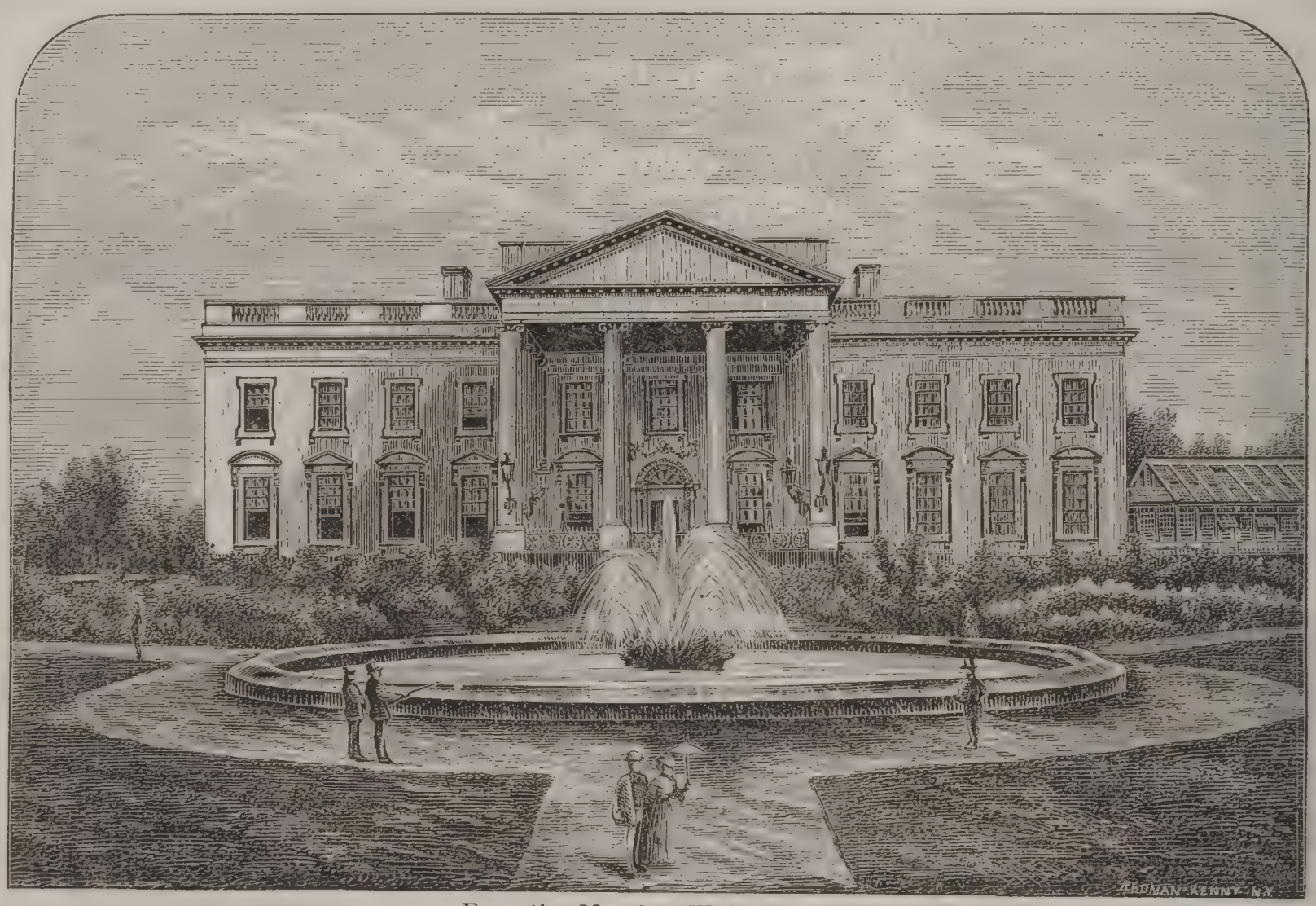
The Naval Observatory of the U. S. is situated on the banks of the Potomac, midway between Washington and Georgetown. The grounds occupy 19 acres. The main building of the observatory, erected in 1844, is surmounted by a dome, from the flagstaff of which a signal-ball, dropped daily at the hour of 12, indicates the hour of mean noon by electric wires to the telegraph company running to all parts of the U. S. Another domed edifice in the immediate vicinity of the observatory contains the great equatorial telescope, mounted in 1873, with an object-glass of 26 inches, made at a cost of $47,000. This is the largest refractor in the world.

The Army Medical Museum, formerly Ford's Theatre, is on Tenth street between E and F, and contains the hospital records of the U. S. army in over 10,000 MS. volumes and a vast assemblage of curious and instructive specimens representing the effects upon the human body of wounds, morbid conditions, surgical operations, etc. The microscopic section of this museum has been carried to a high point of perfection, and exhibits wonderful results, while the models assembled of hospitals, barracks, ambulances, surgical instruments, etc., constitute the finest museum of the kind in the world. The library of the surgeon-general's office, here deposited, embraces about 40,000 volumes, and is by far the most complete medical collection in the U. S.

The government printing-office and book-bindery occupy a plain brick building 300 by 175 feet at the corner of N. Capitol and H streets. This is the largest printing establishment in the world, and its equipment is very complete, as many as 1,000,000 volumes having been turned out in a single year.

The Washington Navy-yard, established 1804, occupies 27 acres on the Anacostia River at the foot of Eighth street, about 1 mile S. E. of the Capitol. It embraces two ship-houses, several boat-houses, and shops for the manufacture of ordnance, together with buildings for officers' quarters. This yard, though practically disused for the construction

FIG. 6.



Executive Mansion (White House).

of naval vessels, is an important dépôt for the manufacture of naval supplies. Above it are the extensive though not attractive buildings known as the Marine Barracks, the head-quarters of the marine corps of the U. S. navy.

The President's House, known also as the Executive Mansion, and popularly called the White House, stands on Pennsylvania Avenue, occupying a reservation of about 20 acres of ground midway between the Treasury and the departments of state, war, and navy. It is a plain edifice of freestone painted white, 170 feet long by 86 feet wide, with a colonnade of eight simple Ionic columns in front and a semicircular portico in the rear. The grounds are adorned with fountains, flowers, and shrubbery, and form a pleasing retreat in the midst of buildings and streets devoted to commercial and public business. The building is adorned by excellent portraits of the ex-Presidents of the U. S. The largest apartment, known as the East Room, is 80 by 40 feet in dimensions, and 22 feet high. The adjoining Blue Room, a beautiful apartment finished in blue and gold, is devoted to receptions, diplomatic and social. The Green Room and Red Room (so called from their furnishings) are each 30 by 20 feet. The rooms of the second floor are occupied by the executive office and the President's secretaries, together with apartments for the Presidential family. The first President's house, commenced in 1792, was occupied by Pres. Adams in 1800, and was burned by the British army in 1814. The present edifice was constructed 1818–29, and there have been appropriated for its erection and maintenance up to the present time about $1,800,000.

Besides the public buildings erected by the government, various public offices occupy rented buildings in different parts of the city. The department of justice is accommodated in the upper stories of the Freedman's Bank building, opposite the Treasury. The pension office and its valuable records occupy the upper portions of a fireproof building on the corner of Pennsylvania Avenue and Twelfth street. The bureau of statistics is on Fifteenth street, and the Coast Survey rents the fine buildings with fireproof store-rooms attached, erected especially for its use, on New Jersey Avenue near the Capitol. The large operations of the signal service of the army are conducted in two buildings on G street, W. of the War Department, and the army paymaster's office, commissary bureau, *Nautical Almanac* office, etc., are bestowed in hired apartments elsewhere.

The fine arts are not yet well represented in Washington, though numerous ambitious attempts have been made to decorate the city with statuary. The earliest executed of these, including the bronze equestrian statues of Gen. Jackson in La Fayette Square and of Washington in the circle on Pennsylvania Avenue, both by Clark Mills, belong to the grotesque and exaggerated style, which is gradually giving place to better models. H. K. Brown's fine equestrian statue of Gen. Winfield Scott in bronze, erected in 1874, occupies the circle at the intersection of Massachu-

setts and Rhode Island avenues on Sixteenth street. Rawlins Square is distinguished by a full-length statue in bronze of Gen. Rawlins, secretary of war in 1869, executed by Bailly in 1873. The Soldiers' Home is ornamented by a very superior work of art in bronze, being a colossal full-length statue of Gen. Scott by Launt Thompson. Ball's fine bronze statue, emblematic of Emancipation, erected in Lincoln Park in 1876, represents Abraham Lincoln freeing a slave in chains. Greenough's marble statue of Washington, classical in style and colossal in size, is situated immediately before the E. front of the Capitol.

The only public institution devoted exclusively to the fine arts is the Corcoran Gallery of Art, on the corner of Pennsylvania Avenue and Seventeenth street, erected in 1859 from designs by Renwick, and opened with a collection of paintings, statuary, bronzes, and casts from the antique in 1873. This gallery, founded by the liberality of W. W. Corcoran of Washington, is managed by a board of trustees, and is open to the public free during three days of the week, with an admission fee of 25 cents on Mondays, Wednesdays, and Fridays.

The Washington National Monument, so long a truncated column of 174 feet in height, was commenced in 1848 by an association incorporated by Congress. After an expenditure of $230,000, raised by voluntary subscription, the monument came to a stand-still for twenty years. By act of Congress passed in 1876, appropriating the sum of $200,000, this monument is to be finished, and will form a lofty and imposing plain obelisk, 70 feet square at the base and 470 feet high. It is constructed of great blocks of crystal Maryland marble, lined with blue gneiss stone, and while simple and majestic in form, without attempt at ornament, will constitute a mausoleum that will last for ages, erected by the people of the whole country to its greatest citizen on a scale worthy of the nation.

The cemeteries of Washington are not numerous. The Congressional Cemetery, located on the banks of the Anacostia 1 mile E. from the Capitol, embraces 30 acres. It has about 200 square cenotaphs of freestone erected to the memory of members of Congress who have died in Washington, and contains also the graves of many distinguished officials and citizens. Oak Hill Cemetery, on Georgetown Heights, is the most attractive and beautiful place of sepulture about Washington, occupying the undulating hills above Rock Creek, and thickly planted with noble forest trees and shrubbery. Glenwood Cemetery, at the extremity of Lincoln Avenue, N. of the city, and Rock Creek Cemetery, near the Soldiers' Home, with Mount Olivet, are the principal other cemeteries.

The Soldiers' Home, a national institution for the invalid soldiers of the regular army, was established in 1851 by a purchase of 200 acres 3 miles N. of the Capitol with a sum of money levied by Gen. Scott on the City of Mexico. It has been more than doubled in extent of grounds, and is kept up by a fund derived from retaining 12½ cents a month from the pay of each private in the army. The buildings are handsome and costly, and the grounds, laid out in meadows, groves, and lakes, afford 7 miles of beautiful drives, serving as a free public park for the city of Washington. At the Soldiers' Home, Pres. Lincoln and some of his predecessors were wont to find relaxation during the heated term of summer.

FIG. 7.



New State, War, and Navy Departments.

Of minor public buildings erected by the government may be mentioned the Naval Hospital, a handsome edifice at the corner of Ninth and Pennsylvania Avenue E.; the Columbia Institution for the Deaf and Dumb, founded 1857, with its picturesque semi-Gothic buildings, occupying 100 acres at Kendall Green, and accommodating 100 pupils; the government Hospital for the Insane (opened 1855), a commodious structure on the crest of hills on the E. bank of the Anacostia opposite Washington, with 419 acres and 600 patients, belonging to the army and navy and the District of Columbia; and the Reform School of the District of Columbia (150 acres), established in 1871, on the Bladensburg turnpike, 3 miles from the Capitol. The SMITHSONIAN INSTITUTION, one of the most important and attractive features of Washington, is fully treated under that head.

Charitable institutions abound in Washington, and many of them have received continuous or occasional aid from the treasury by act of Congress. The principal ones are Providence Hospital, a large edifice on Capitol Hill, accommodating 200 patients; the Louise Home, a fine building on Massachusetts Avenue, erected and endowed by W. W. Corcoran in 1871 for indigent gentlewomen; the Columbia Hospital for Women; the National Soldiers' and Sailors' Orphans' Home; the Washington Orphan Asylum; St. Joseph's and St. Vincent's orphan asylums; St. John's Hospital for Children; the Freedmen's Hospital and the Home for the Aged, under the care of the Little Sisters of the Poor.

The markets of Washington are profusely supplied with all the products of the soil and of the waters, the best qualities of meats, and the finest game at low rates. The two principal markets are the Central, erected in 1870, an ornate structure of brick on Pennsylvania Avenue between Seventh and Ninth streets, and the Northern Liberty Market, running from K to L streets on Fifth, erected in 1874.

The water-supply of Washington is brought by a capacious aqueduct from the Great Falls of the Potomac, 16 miles above the city. It affords a daily supply of 80,000,000 gallons to the reservoir, the consumption, however, only reaching 23,000,000 gallons per diem. The aqueduct cost $3,500,000. The public parks and squares are well supplied with fountains, none of which, however, are of remarkable size or artistic beauty.

Washington is connected with the Virginia shore by three bridges across the Potomac. The Long Bridge, which has a track for the Washington and Alexandria R. R. and a carriage-way for vehicles and pedestrians, is laid on piers. The Aqueduct Bridge at Georgetown is the only toll-bridge in the District. The Chain Bridge at Little Falls, 4 miles above, has given place to an iron truss bridge erected in 1874. Across the Eastern Branch or Anacostia runs the Navy-yard Bridge, an iron structure erected in 1875, and Ben-

ning's Bridge, of wood, lies about a mile above the navy-yard.

The schools of Washington are treated under the head of DISTRICT OF COLUMBIA. There are several colleges or universities, the chief of which are—Columbian University, with its law and medical department and preparatory school of over 100 pupils; Gonzaga College (Roman Catholic); Howard University for colored youth (see HOWARD UNIVERSITY); and the law school of the National University.

Five daily newspapers and 12 weekly periodicals, with several monthlies, are issued, but as yet the capital possesses no journal of first-rate power and importance to the country, the local papers being overshadowed by the keen competition of the metropolitan press.

As the political capital of the U. S., Washington enjoys a distinction to which no other metropolis, however extensive its population, commerce, shipping, or manufactures, can lay claim. The vast and varied interests connected with the legislation for a people of 45,000,000, now embracing 38 States and 9 Territories, draw to Washington an annually increasing number of citizens from motives of interest or curiosity, while its mild and salubrious climate in the winter season renders it an attractive resort for persons of wealth and leisure from all quarters. The society of Washington is marked by a degree of freedom and liberality of intercourse such as prevails in scarcely any other city of the Union. While the vast majority of the population is distinctively American, the presence of travellers and sojourners from all parts of the world, and the residence of the diplomatic corps representing foreign nations, render the society cosmopolitan in the best sense of the term. The opening of the fashionable season is nearly coincident with the opening of Congress on the first Monday in December. From that time until the Lenten holidays there is a constant succession of receptions, balls, dinners, etc., invitations to which are freely distributed, while the partly official, partly social receptions, termed levees, given by the President, the members of the cabinet, and the Speaker of the House of Representatives, are open to all comers. The President receives the calls of the public daily from 12 to 3 P. M., except on Sundays and cabinet days, Tuesdays and Fridays. New Year's reception at the White House is attended by foreign ministers in their official costumes, by the officers of the army and navy in full uniform, and by officers of the government, Senators and Representatives, and the public generally.

The chief places of amusement are Ford's Opera-house, corner of Louisiana Avenue and Ninth street, and the National Theatre. There are several public halls where concerts and lectures are of frequent occurrence during the season. The principal are Lincoln Hall, Masonic Temple, Odd Fellows' Hall, Willard's Hall, and Tallmadge Hall. The principal hotels are the Arlington, Ebbitt House, Willard's, Riggs House, the National, and the Metropolitan. Washington has 120 church edifices, few of which are

FIG. 8.



City Hall and Court-house.

remarkable for architectural beauty, divided between 15 different religious denominations. Nearly all parts of the city and of Georgetown are accessible by street cars, there being 10 street-railway companies and branches in active operation.

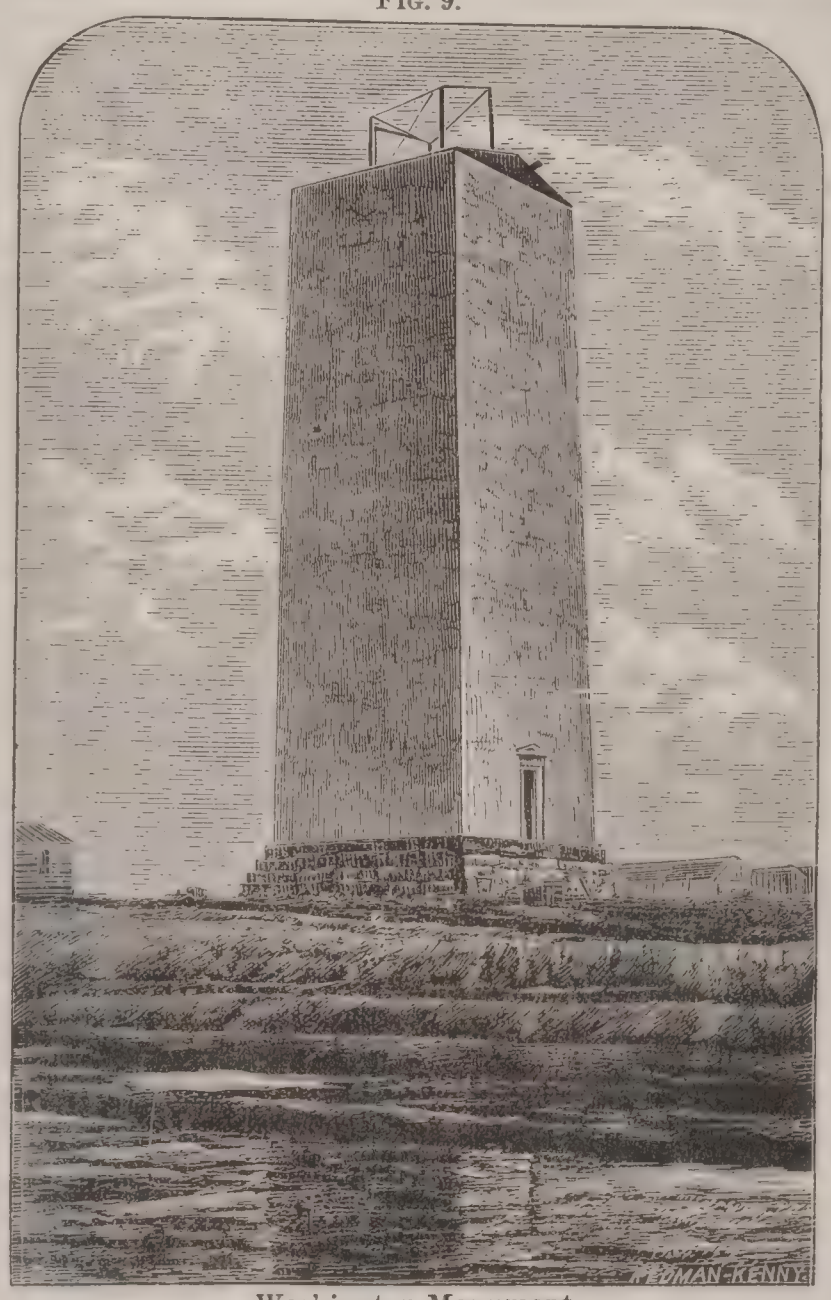
Washington is to a great extent a city of boarding-houses, and thousands of its citizens depend upon the rental of apartments, etc., for a portion of their incomes. The number of officers and clerks in government employ is nearly 5000, and as most of these have families, there is an extensive local market for goods and commodities of all kinds, which is met by a large and excellent variety of stores of merchandise.

During the civil war of 1861–65, Washington was the centre of military operations of prodigious magnitude. The city was fortified soon after the outbreak of hostilities by a cordon of strong earthworks or forts. These works, as finally completed, "consisted of 68 enclosed forts and batteries, having an aggregate perimeter of about 14 miles, and emplacements for 1120 guns, of which 807, besides 98 mortars, were mounted; of 93 unarmed batteries, having 401 emplacements; and of 20 miles of infantry trenches. The entire circuit of the line was, exclusive of the Chain Bridge works, and of the stretch across the Potomac from Fort Greble to Fort Lyon, 33 miles. Thirty-two miles of military roads, besides the existing roads and avenues of the District, afforded the means of communication from the interior to the periphery, or from point to point." (Draper's *Civil War in America.*) These works "exerted no small influence in saving Washington after the Bull Run defeat. They afforded a temporary shelter to the shattered national forces in Virginia after the disasters of the campaign of 1862, and they were again instrumental to the same result when Early marched on Washington—a third time saving the capital." (*Ibid.*) (See also *The Defences of Washington*, by Gen. Barnard.) Washington constituted throughout the war a great dépôt for military supplies of all kinds, and the rumble of the long trains of army-wagons moving to the front sometimes resounded all night long through its streets. Immense temporary hospitals were erected for sick and wounded soldiers sent in from the army in Virginia and elsewhere, and many churches and public institutions, including the Capitol building itself, were pressed into service as hospitals. Great depression prevailed during those critical years throughout the city. Property depreciated fearfully, and no new building was erected for years. Alternate seasons of profound gloom and of patriotic elation marked the varying fortunes of the war until the fall of Richmond and the surrender of Lee, followed by the unexampled catastrophe of the assassination of Pres. Lincoln, which threw the whole city into a panic on Apr. 14, 1865. On the return of peace and the assured restoration of the Union, confidence in the future revived, and Washington, which had been so long retarded by the incubus of war, began to extend its growth by the erection of multitudes of new buildings, and other evidences of prosperity. From this period may be said to date that new Washington which, with its magnificent pub-

lic improvements and multitude of private edifices of taste and elegance, has taken the place of the mean little village which but a few years ago appeared so unworthy the capital of a great nation. There were erected in 1875, 1400 new buildings, at a cost of about $3,500,000.

The environs of Washington abound in natural beauties which need only the hand of wealth and taste to render

FIG. 9.



Washington Monument.

them more attractive than those of any other American city. Favorite drives out of town take the visitor to Soldiers' Home, whence an enchanting view of city, river, and hilly landscape is unrolled; to Rock Creek Valley, notable for its picturesque wildness and wealth of flowers and forest trees; to the heights above Georgetown, by the splendid driveway of K street and Connecticut Avenue, climbing hills which command the widest and most impressive prospect in the District of Columbia; and to Arlington Heights, on the Virginia shore, with its city of the dead containing 15,000 Union soldiers' graves, and its lovely views down and across the Potomac to where the Capitol lifts its airy dome into the eastern sky.

The question whether it is good policy to build up a great city expressly for a seat of government is not now an open one. Washington has been built, and was laid out by the fathers of the republic on a scale of greatness commensurate with the permanent wants of a capital for a populous and powerful nation, destined to hold a front rank in civilization. The question of the removal of the seat of government westward, or nearer to the present or prospective centre of the country, is no longer agitated. The present capital, with its storied memories, founded by the first President, whose name it bears, is felt to be a worthy centre of the political union of a great people, symbolized by the inscription engraved on the dome of the Capitol—"*E pluribus unum.*"

A. R. SPOFFORD.

**Washington Court-house,** p.-v., and cap. of Fayette co., O.

**Washington Lake,** tp., Sibley co., Minn. P. 608.

**Washington Plantation,** tp., Franklin co., Me. P. 62.

**Washington Territory,** an organized portion of the Pacific domain of the U. S., lying between the parallels of 45° 32′ and 49° N. lat., and between the meridians of 117° and 124° 28′ W. lon. from Greenwich. It is bounded on the N. and N. W. by British Columbia, from which it is separated for nearly one-fourth of the distance by the Straits of San Juan de Fuca, the Canal de Haro, and the Gulf of Georgia; on the E. by Idaho Territory; on the S. by Oregon, the Columbia River forming the boundary for three-fourths of the distance; and W. by the Pacific Ocean. Its greatest length from E. to W. is about 360 miles, and its greatest breadth from N. to S. about 400. Its area, according to the U. S. land-office report, is 69,994 sq. m., or, including its water-surface, 79,128 sq. m.

*Topography.*—The Territory is divided by the Cascade Mountains and the Columbia River into Western Washington, lying W. of the Cascade Mountains, and extending to the Pacific; Central Washington, between the Cascade Mountains and the Columbia River; and Eastern Washington, E. of the Columbia. Western Washington, besides the Cascade Mountains, which form its eastern wall, has the Coast Range, extending in somewhat disorderly masses from the Coast Mountains of Oregon, and trending N. W. between Puget's Sound and the Pacific, and finally terminating in the bold and lofty headlands of Cape Flattery. The southern portion of this range is low, but W. of Hood's Canal, in Jefferson co., it rises to an elevation of 5000 feet, and in one of its summits, Mount Olympus (which gives its name to this part of the chain), to 8150 feet. The Pacific coast is generally abrupt and forbidding except the two harbors of Shoalwater Bay and Gray's Harbor, but the Straits of San Juan and the extensive inland sea known by the general name of Puget's Sound have some of the best harbors and roadsteads in the world. Puget's Sound, with its bays and inlets, known as Bellingham Bay, Hood's Canal, Admiralty Inlet, etc., covers 2000 sq. m., and has a coast-line of about 1600 miles. There are numerous islands in the Sound and Straits, some of them of large size. The Sound receives numerous rivers, among which are the Nesqually, Puyallup, White, Cedar, Snohomish, Snoqualmie, Stalukwamish (or Stillaguamish), Duwamish, Skokomish, Skagitt (or Skayit), and Nooksahk (or Lummi). The Chehalis falls into Gray's Harbor, and is navigable for 60 miles. It receives the Newaukum River. The Willopah empties into Shoalwater Bay. The Columbia River, of which we shall speak further on, has several small tributaries in Western Washington, the principal of which are Cowlitz, and its branches, Strong's and Gray's rivers. This western division of the Territory is much broken, but it is well watered and most of it very fertile, while the fine harbors and bays of its central valley make it readily accessible to commerce. Central Washington comprises the summits of the Cascade Mountains, the valley of the Yakima, and the plateau stretching to the Columbia River. The mountains on its western border form an unbroken range from 5000 to 8000 feet above the sea, and several lofty peaks rise from 2000 to 6000 feet higher. Thus, Mount Baker is said to be 11,100 feet in height; Mount Rainier, 14,444 feet; Mount Adams, over 9000 feet, and Mount St. Helen's, 9750 feet. Stretching eastward toward the Columbia River is a lofty plateau channelled by the valleys of the Yakima, Methow, Okinapum, and Nehoiatpugun rivers and their tributaries. The Blue Mountains, the summits of this plateau, rise to 8000 or 9000 feet, but near Walla Walla sink to 5000 feet. Its lands are barren, sterile, and dry; the river-valleys are very fertile. Much of the plateau is scantily wooded. Eastern Washington comprises the valley of the Columbia and its great affluents, the Clark's, Spokane, and Lewis (or Snake) rivers, and the Spokane plains or plateau—the latter elevated and sterile, and without forests; the former well watered, fertile, and containing a sufficiency of timber. Columbia River rises in British Columbia, and pursues a very devious course, receiving Clark's River, just as it enters the Territory, running S. to the mouth of the Spokane, thence W. to the point where it receives the Okinikane, and shortly afterward the Methow, Chelan, and several smaller streams, when it flows S. E. to the Oregon line, receiving the Yakima on one side and Snake River with its tributaries on the other; a few miles below it receives the Walla Walla, and then turns sharply to the W. and forms the boundary between Oregon and Washington for almost 300 miles. In this last course it has in Eastern or Central Washington no important tributary except the Klickatat. There are many lakes in Washington; some of them very beautiful. The most considerable are Quinault, American, Whatcom, Union, and Washington lakes in W. Washington; Lakes Natchess, and Kitchelus high up in the Cascade Mountains; Kleattam, Chelan, and Osoyoos in the central section; and Lakes Arnold and Silkatqua in E. Washington.

*Geology.*—The shore of the Pacific, the lower valley of the Columbia, and the great valley drained by Puget Sound are Tertiary and Quaternary; the islands W. of the Canal de Haro in the Gulf of Georgia are Cretaceous; the Coast Range is Eozoic; the Cascade Mountains to about 47° 40′, and the great plain of the Columbia River in Central and Eastern Washington S. of the Spokane River, are volcanic; Northern Washington is Eozoic, except two narrow and small outcrops of Silurian age in the extreme N. E.—one E., the other W. of Clark's Fork.

*Minerals.*—Coal of excellent quality has been mined near Bellingham Bay and Lake Whatcom, also back of Seattle, on Lake Washington, and in the Coast Range. Some of it probably belongs to the Tertiary coal-beds, but that in the N. is from the coal-measures. It is mostly bituminous, but it is claimed that deposits of anthracite coal have been found in Puyallup Valley and Green River. Gold has been found in the N. E., near the Columbia River. Iron is plentiful of different ores.

*Zoology.*—The wild animals are the same as are found in Oregon. Salmon are nearly as abundant as in Oregon, and form a profitable article of commerce.

*Population.**

| Census year. | Total population. | Male. | Female. | White. | Colored, including Chinese and Indians. | Native. | Foreign. | Density. | Ratio of increase. | Number of families. | Persons in a family. | Number of dwellings. | Persons to a dwelling. | Illiteracy. | Of school age, 5 to 20. | Of military age, 18–45, males. | Of voting age, 21 and upward, males. | Citizens, males. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1860 | 11,594 | 8,446 | 3148 | 11,138 | 456 | 8,450 | 3144 | 0.06 | ..... | 2798 | 4.14 | 3037 | 3.82 | 438 | 2279 | 5880 | 6166 | 4231 |
| 1870 | 23,955 | 14,990 | 8965 | 22,195 | 1760† | 18,931 | 5024 | 0.34 | 106.61 | 5673 | 4.22 | 6066 | 3.95 | 1307 | 7060 | 7835 | 9241 | 7902 |

*Soil, Vegetation, and Botany.*—The forest trees of Western Washington are unsurpassed in height and beauty except by the giant redwoods and sequoias of California. The white, red, and yellow pine, the red, black, and yellow fir, and the Oregon cedar, are from 175 to 350 feet in height and from 8 to 15 feet in diameter. The deciduous trees are principally maple, ash, laurel, and alder. There is less timber in Central and Eastern Washington; but wherever there is sufficient water, the plains yield immense crops. In Walla Walla, Whitman, and Stevens cos. large tracts have yielded 85 bushels of wheat to the acre, the wheat weighing 62 pounds to the bushel. Flax, sugar-beets, hops, and fruit of most kinds are raised in large quantities. The nutritious bunch-grass is abundant, and most of Central and Eastern Washington is admirably adapted for grazing. In the N. the nights are too cool for Indian corn.

*Climate.*—Western Washington has a climate similar to that of Oregon. The winters are mild, without much snow or ice. During sixteen successive years only three winters were so severe as to render it necessary to house and feed stock. The summers are delightful, the temperature seldom rising above 80°, and the nights cool and agreeable. The mean difference between the hottest and coldest month is but 26°. The mean annual temperature is 52°. In Eastern and Central Washington the winter corresponds with that of Pennsylvania; the summers are dry and hot. The rainfall near the Cascade Mountains is 36 inches; on and near the coast, from 100 to 130 inches; in Eastern Washington, 12 to 14 inches on the plains, and from 20 to 24 in the more elevated districts.

*Agricultural Productions.*—In 1870 only 649,139 acres had been taken up in farms—not quite $\frac{1}{100}$th of the area. Of this, 192,016 acres had been improved. There has been a considerable increase in the amount of improved land since 1870. The value of farms in 1870 was $3,978,341; of farming implements, etc., $280,551. The value of all farm products was $2,111,902; of animals slaughtered, etc., $292,280; of home manufactures, $28,890; of forest products, $19,705; of market-garden products, $74,462; of orchard products, $71,863; of wages paid, $215,522. The crops raised were—wheat, 217,043 bushels; Indian corn, 21,781; oats, 255,169; barley, 55,787; wool, 162,713 pounds; hay, 30,233 tons; hops, 6162 pounds (200,000 pounds in 1875); tobacco, 1682 pounds; potatoes, 281,144 bushels; peas and beans, 15,790; honey, 25,636 pounds; grass and clover seed, 1566 bushels; flaxseed, not reported in 1870, is now raised extensively in Eastern Washington; butter, 407,306 pounds; cheese, 17,465 pounds; milk sold, 21,060 gallons. The value of live-stock in the Territory in 1870 was $2,103,343; number of horses, 13,923; neat cattle, 51,979, of which 16,938 were milch cows; sheep, 44,063; swine, 17,491.

*Manufactures*, of course, are in their infancy, yet in 1870 there were 269 establishments, employing 1026 hands (all males but one), with a capital of $1,893,674, paying $574,936 wages, using $1,435,128 of raw material, and producing $2,851,052 of manufactured goods. Of these products, $1,872,310 was lumber, planed and sawed (in 1875 over 300,000,000 feet of lumber was sawed in the 60 saw-mills of the Territory); $282,728 flouring-mill products. In 3 mining establishments the same year there were employed 90 hands, $301,200 capital, and $209,064 was produced, mainly coal. The same year 17 fisheries, employing 234 hands and $165,565 capital, produced $289,746 of fishery products. This amount (which includes salmon, halibut, cod, and oysters) has since been very largely increased.

*Railroads.*—There were in Jan., 1875, 170.7 miles of railroad, costing $7,856,701 for road and equipment. This railway was a continuation of the Oregon and California line, sometimes called the western division of the Northern Pacific, to Olympia on Puget Sound and to Steilacoom.

*Finances, etc.*—The true valuation of real and personal estate in 1870 was $13,562,164. There was no Territorial debt, but county debts to the amount of $71,196, and town, city, etc., $17,631. The Territorial tax was $33,743, and all taxation not national, $163,992. There are no banks or savings banks or insurance companies in the Territory, and in 1875 there were but 2 private banking-houses.

*Commerce.*—Washington Territory has but one customs district, that of Puget Sound. The imports into this district in the year ending June 30, 1875, were $24,954, and the exports from it, all products of the Territory, $395,330.‡ During the same year 342 vessels of 115,215 tons burden and manned by 5241 men entered the ports of the district from foreign countries, of which 235 were ocean steamers, of 87,440 tons burden, and crews numbering 4617 men; 365 vessels, of 129,973 tons aggregate tonnage and 5587 men, cleared from the same ports, of which 239 were ocean steamers, of 92,760 tons and manned by 4808 men. In the coastwise trade and fisheries the number of vessels entered was 120, their tonnage 67,881, their crews 1706 men; the number cleared was 41, the tonnage 23,481, the crews 686; 103 registered, enrolled, and licensed vessels belonged to the district, and their tonnage 24,209 tons.

*Churches in 1870 and 1875.*

| Denominations. | Organizations, 1870. | Church edifices, 1870. | Sittings, 1870. | Church property, 1870. | Organizations, 1875. | Church edifices, 1875. | Ministers, etc., 1875. | Communicants or members, 1875. | Adherent population, 1875. | Church property, 1875. |
|---|---|---|---|---|---|---|---|---|---|---|
| All denominations | 51 | 36 | 6000 | $62,450 | 94 | 72 | 58 | 2398 | 21,465 | $105,700 |
| Baptists | 3 | 2 | ..... | ..... | 12 | 9 | 9 | 224 | 1,100 | 7,200 |
| Christian Connection | 4 | 1 | 250 | 600 | 5 | 2 | 2 | 120 | 600 | 1,500 |
| Congregationalists | 2 | 1 | 250 | 5,000 | 6 | 4 | 3 | 94 | 500 | 8,000 |
| Protestant Episcopalians | 4 | 3 | 500 | 7,650 | 9 | 7 | 6 | 215 | 1,200 | 10,500 |
| Methodists | 16 | 12 | 2200 | 21,650 | 24 | 14 | 10 | 1213 | 6,350 | 32,600 |
| Presbyterians | 3 | 3 | 600 | 5,500 | 7 | 6 | 5 | 121 | 690 | 10,200 |
| Roman Catholics | 11 | 12 | 1785 | 18,400 | 19 | 19 | 15 | ..... | 9,000 | 26,700 |
| Second Adventists | 1 | 1 | 40 | 150 | 1 | 1 | 1 | 30 | 150 | 250 |
| United Brethren in Christ | 7 | 2 | 400 | 3,200 | 10 | 9 | 6 | 306 | 1,500 | 8,150 |
| Union | ... | 1 | 100 | 300 | 1 | 1 | 1 | 75 | 375 | 600 |

*Education.*—The total receipts for school purposes in the Territory in 1874 were $39,294. The scholastic age is from four to twenty-one years, and the number of persons of scholastic age was about 11,937; the number enrolled during the school year was 7592; the average attendance is not given; school-rooms, 225; teachers necessary to supply the public schools, 117; the average duration of the school in days, 165. The schools of Olympia and Seattle are graded and of high character. There are 2 colleges. The Territorial University at Seattle, organized in 1872, had in 1874, 3 professors and 50 students (27 males and 23 females, all in the preparatory department), but having organized academic and collegiate departments, in which classes would soon be formed; the university had buildings and grounds

* Gov. Ferry estimates the population in 1875 at 36,000, aside from tribal Indians.

† Besides 13,477 Indians sustaining tribal relations on reservations in the Territory.

‡ Gov. Ferry (message Oct. 5, 1875) gives the exports of the year ending July 31, 1875, as $759,230, the imports as $49,125, and the foreign and coastwise commerce over $5,000,000.

valued at $50,000; endowment, $15,000; income from productive funds, $2000; volumes in library, 125. The Holy Angels' College at Vancouver City, a Roman Catholic institution, was organized in 1865. It has 3 professors and 56 students, and a library of 500 volumes. Provision is made for the insane in the Oregon hospital.

*Newspapers.*—In 1870 there were 14 newspapers in the Territory, having an aggregate circulation of 6785, and a total annual issue of 396,500 copies. Of these, 1 was a daily, with 460 circulation; 1 a tri-weekly, with 600 circulation; 10 weekly, with 4525 circulation; and 2 monthly, with 1500 circulation. In 1875 the number was 17, of which 3 were dailies, 1 semi-weekly, and 13 weekly.

*Government, Courts, etc.*—All male citizens of the U. S. who are qualified to vote elsewhere are voters. The President appoints the governor and secretary; the auditor and treasurer are chosen under Territorial authority. The legislative assembly, which convenes annually, is composed of a council of 9 members, elected for three years, and a house of representatives of 30 members, elected for one year. The judicial power (aside from U. S. district courts) is vested in a supreme court consisting of a chief-justice and two associate justices, who hold their offices for four years; in three district courts, one for each judicial district, in each of which one of the justices of the supreme court presides; and in justices' courts, held by justices of the peace. The Territory is represented in Congress by a delegate.

*Counties* (24).

| Counties. | Pop., 1870. | Males, 1870. | Females, 1870. | Pop., 1860. | Assessed valuation, 1875. | True valuation, 1870. |
|---|---|---|---|---|---|---|
| Chehalis | 401 | 238 | 163 | 285 | $301,799 | $202,829 |
| Clallam | 408 | 267 | 141 | 149 | 126,905 | 216,155 |
| Clarke | 3,081 | 1,725 | 1,356 | 2,384 | 679,008 | 803,029 |
| Columbia | New co. | | ..... | ..... | 800,000 | |
| Cowlitz | 730 | 432 | 298 | 406 | 644,259 | 354,566 |
| Island | 626 | 435 | 191 | 294 | 460,363 | 366,268 |
| Jefferson | 1,268 | 937 | 331 | 531 | 495,264 | 709,870 |
| King | 2,120 | 1,359 | 761 | 302 | 1,778,172 | 1,113,765 |
| Kitsap | 866 | 691 | 175 | 544 | 789,029 | 1,050,000 |
| Klikitat | 329 | 193 | 136 | 230 | 275,404 | 204,046 |
| Lewis | 888 | 516 | 372 | 384 | 1,155,650 | 626,125 |
| Mason | 289 | 212 | 77 | 162 | 178,510 | 196,000 |
| Pacific | 738 | 460 | 278 | 420 | 322,945 | 600,000 |
| Pierce | 1,409 | 810 | 599 | 1,115 | 1,123,063 | 505,607 |
| San Juan | New co. | | ..... | ..... | 732,848 | |
| Skamania | 133 | 96 | 37 | 173 | 124,911 | 158,439 |
| Snohomish | 599 | 448 | 151 | ..... | 239,629 | 138,570 |
| Stevens | 734 | 509 | 225 | 996 | 253,527 | 201,480 |
| Thurston | 2,246 | 1,372 | 874 | 1,507 | 1,358,537 | 2,183,650 |
| Wahkiakum | 270 | 190 | 80 | 42 | 172,761 | 375,000 |
| Walla Walla | 5,300 | 3,108 | 2,192 | 1,318 | 1,992,065 | 3,187,555 |
| Whatcom | 1,088 | 731 | 357 | 352 | 469,267 | 177,158 |
| Whitman | New co. | | ..... | ..... | 376,887 | |
| Yakima | 432 | 261 | 171 | ..... | 413,167 | 192,052 |
| Totals | 23,955 | 14,990 | 8,965 | 11,594 | $14,569,156 | $13,562,164 |

*Principal Towns.*—Olympia, the capital, had, in 1870, 1203 inhabitants; Walla Walla, 1394; Seattle, 1107; while Steilacoom, Port Townsend, and Vancouver were places of some importance.

*History.*—The region about Puget Sound was a favorite resort for the Indian tribes for centuries. In 1840 there were 25,000 Indians who claimed the Puget Sound region as their home. The number has been greatly reduced since that time. The Straits of San Juan de Fuca were first entered in 1592 by a Greek navigator of that name in the Spanish service; the coast was revisited in 1775 by Heceta, a Spanish navigator, and in 1787 and 1788, Capts. Berkeley and Meares, Englishmen, successively entered the straits, and the latter revived the name of the old Greek discoverer. An American, Capt. Gray, discovered Gray's Harbor in 1791, and Lewis and Clark penetrated to it in 1815. The Hudson's Bay Company attempted to take possession of it from 1828 to 1841, but the U. S. claimed it by a double title—from the Spanish and from Gray's discovery—and American settlers occupied it from 1845. After a long controversy the American claims were admitted, but the islands in the Gulf of Georgia were not adjudged to them till 1873. The Territory was organized in 1853, had a severe Indian war in 1855, comprised most of Idaho Territory from 1859 to 1863, since which time it has had its present boundaries.

*Governors of the Territory.*

| | | | |
|---|---|---|---|
| Isaac J. Stevens | 1853–57 | Marshall F. Moore | 1867–69 |
| J. Patton Anderson | 1857–57 | Alvin Flanders | 1869–70 |
| Fayette McMullen | 1857–61 | Edward S. Salomon | 1870–71 |
| Richard D. Gholson | 1861–61 | James F. Legate | 1871–72 |
| William H. Wallace | 1861–61 | Elisha P. Ferry | 1872–77 |
| William Pickering | 1861–67 | | |

(The writer acknowledges the receipt of valuable documents and statistics from His Excellency, Hon. Elisha P. Ferry, governor of the Territory.) L. P. Brockett.

**Washington Territory, University of,** was chartered in 1860, when most of the lands granted by Congress were sold to prepare the grounds in Seattle, King co., and to erect buildings. The school was first organized as a graded school with regular courses of study in the autumn of 1872, by Pres. E. K. Hill. The courses of study include a preparatory department and an academic department, containing academical, classical, scientific, and English courses of four years each.

**Washington University,** an institution of learning at St. Louis, Mo., incorporated in 1852, consisting of an academy, a female seminary, a polytechnic institute (1857), and a law school (1867), besides the college proper, which was organized 1859. The entire number of students averages 700, and of instructors 58, but of these only 30 students and 5 professors are assigned to the college proper. The latter has a library of 5500 volumes, and the O'Fallon Polytechnic School one of 30,000 volumes. The president of the university is Rev. W. G. Eliot, D. D.

**Wash'ingtonville,** v., Columbiana co., O. P. 517.

**Washingtonville,** v., Mahoning co., O. P. 232.

**Washingtonville,** b., Montour co., Pa. P. 172.

**Washita.** See Ouachita.

**Wash'ita River** (frequently spelled **Ouachita**) rises by its Brushy Fork in Polk co., Ark., and flows first E. and then S., crossing the Louisiana State line, and finally discharges its waters into Red River. It is navigable by steamboats throughout the year to Camden, Ark., and for two-thirds of the year to Arkadelphia, Ark. It is 600 miles long, and flows through a rich corn and cotton region. Its navigation is extensive and important.—Another Washita, called also the False Washita, traverses the Indian Territory between the S. fork of the Canadian and Red River, and falls into the latter stream at Washita Bend, above Preston, Tex. (See Red River.)

**Wash'oe,** county of N. W. Nevada, bordering on California, traversed along the S. border by Central Pacific R. R. The N. part is mainly a desert; in the S. part is Truckee Lake and several other considerable bodies of water. Gold, silver, and copper have been found, but not in any great quantities, and there are large forests in the mountains which border the Truckee Valley, in which there is a tract of arable land. Staples, hay and a little barley, oats, and potatoes. Cap. Reno. Area, 2316 sq. m. P. 3091.

**Washoe City,** p.-v., Washoe co., Nev. P. 552.

**Wash'tenaw,** county of S. E. Michigan, drained by Huron and Raisin rivers, and traversed by Michigan Central and Michigan Southern R. Rs.; surface undulating, interspersed with prairie and woodland and several small lakes; soil a rich sandy loam. There are saw-mills, planing-mills, flour-mills, tanneries, and more than 500 manufacturing establishments, among which are those of agricultural implements, carriages, saddlery, cooperage, furniture, clothing, boots and shoes, paper, and woollen goods. Live-stock, especially sheep, very numerous. Staples, wheat, Indian corn, oats, potatoes, wool, hay, and dairy products. Cap. Ann Arbor. Area, 720 sq. m. P. 41,434.

**Wasioja,** p.-v. and tp., Dodge co., Minn. P. of v. 324; of tp. 1134.

**Wasp** [Ang.-Sax. *wüsp;* Lat. *vespa*], a name popularly applied to hymenopterous insects of the families Vespidæ, Crabronidæ, Nyssonidæ, Larridæ, Sphegidæ, and Pompilidæ, which essentially agree in form, but properly applicable to the Vespidæ alone as a family designation. This family is typified by the paper-wasp and hornet, and the physiognomy in all is nearly alike; the prothorax is extended backward as far as the origin of the wings; the abdomen sessile or pedicellate, composed of seven segments in the males and of six in the females, and terminated by a retractile sting; the mandibles are variable; the lip is mostly quadrifid or quadrilobed, sometimes only bifid; labial palpi 4-jointed; maxillary 6-jointed; the antennæ are geniculate, 13-jointed in the males, 12-jointed in the females; the eyes are generally emarginate; the wings are folded longitudinally when at rest, and have two recurrent nervures, and three or four cubital cells; they are developed in both sexes; the legs are slender and hairless. Such are in substance the characters of the family given by its latest monographer, De Saussure. The species are numerous, not far from 1000 being known, and are quite widely distributed. The North American representatives are many, among which are 53 species of *Zethus*, 53 of *Eumenes*, and 156 of *Odynerus*. The species differ considerably in habits, and these, being co-ordinated with structural characteristics, have furnished the basis on which De Saussure has differentiated the family into three sub-families—viz. (1) Masarinæ, or parasitic wasps; (2) Eumeninæ or Odynerinæ, or solitary wasps; and (3) Vespinæ, or social wasps. The first of these is only represented in the U. S. by three known species, the others by very many. The social wasps are the ones most generally known, and to this category

belong the common species framing papery cells (*e. g. Vespa maculata, Vespa arenaria*), the hornet (*Vespa crabro*), and the species which form the silky nests, with the mouths of the cells downward, which are found attached to bushes, etc. (*Polistes annularis, Polistes canadensis*, etc.). The typical wasps are quite omnivorous in their diet, attacking fruits and berries, as well as other insects and raw meat. In their assaults on insects they use almost solely their jaws, and not their stings. The common honey-bees frequently fall victims to their rapacity, and after being dismembered their abdomen is devoured by their destroyers. The American solitary wasps are described in vol. i. of a *Synopsis of American Wasps*, by Dr. Henri de Saussure of Geneva, recently (Dec., 1875) published by the Smithsonian Institution. (See also Entomology and Hornet.)

Theodore Gill.

**Wasson** (David Atwood). See Appendix.

**Waste** (in law). When a tenant for years or for life, either through actual misconduct or through negligence, does or suffers permanent damage to the land in his possession—technically, to the inheritance—so that the rights of the ultimate owner, the reversioner, heir, or remainderman are prejudiced, such injury is termed "waste," and the tenant is responsible therefor to the party who stands behind him, and to whom the land will finally come. Waste may be voluntary or permissive. It is voluntary when caused by the intentional act of the tenant, by his doing what he ought not to have done. It is permissive when it results from his negligence, from his not doing what he ought to have done. As examples of the first are the cutting down of trees more than may be needed for actual use for firewood or for repairing buildings, fences, or agricultural instruments, and especially the cutting down timber trees, fruit trees, or ornamental trees; the changing the nature and use of fields; the opening of new mines, quarries, etc.; the tearing down or altering houses; and the like. Some of the strict common-law rules concerning the use of farming land have been considerably modified in the U. S., and the tenant is permitted here to do all such acts which would be regarded as a proper and husbandlike treatment of the land in the neighborhood. Examples of permissive waste are the suffering buildings to become dilapidated or ruinous, or fences to become out of repair, or orchards to become decayed, or fields to become overrun with weeds and briers from lack of proper cultivation. When acts of waste are committed by a stranger, the tenant is liable therefor, since it is his duty to protect the possession against all trespassers. The remedies which the reversioner may have for waste are three: (1) An action at law to recover the damages already done; (2) a suit in equity, wherein the tenant will be enjoined from committing any further injury, and will be compelled to account for and pay the damages which have accrued: as this remedy is the most effective, it is the one generally used; (3) ancient English statutes, which have been enacted in many of the States, give the reversioner an action for treble damages, and also enable him to recover the land on which the waste is actually committed. In England life estates are frequently created and conferred by will or family settlement "without impeachment of waste." While this clause enables the tenant to do most acts which the law would treat as waste, equity will not suffer him to do acts of wanton injury, such as pulling down or dilapidating houses, cutting down ornamental trees, destroying pleasure-grounds, and the like. The object of the provision is to permit the tenant to use the land in such a manner as to make it profitable. John Norton Pomeroy.

**Wa'tab,** p.-v. and tp., Benton co., Minn. P. of v. 22; of tp. 58.

**Wa'taga,** p.-v. and tp., Knox co., Ill. P. 1205.

**Watau'ga,** county of N. W. North Carolina, bordering on Tennessee, and drained by Watauga and New rivers. The surface is generally mountainous, containing some iron ore, with fertile valleys. Staples, Indian corn, oats, and rye. Cap. Boone. Area, 550 sq. m. P. 5287.

**Watauga,** tp., Watauga co., N. C. P. 556.

**Watauga River** rises in Watauga co., N. C., and passes through a mountain-region into Tennessee, flowing into Holston River (S. fork). It is navigated to a point 6 miles above Elizabethton, Tenn. It affords fine water-power.

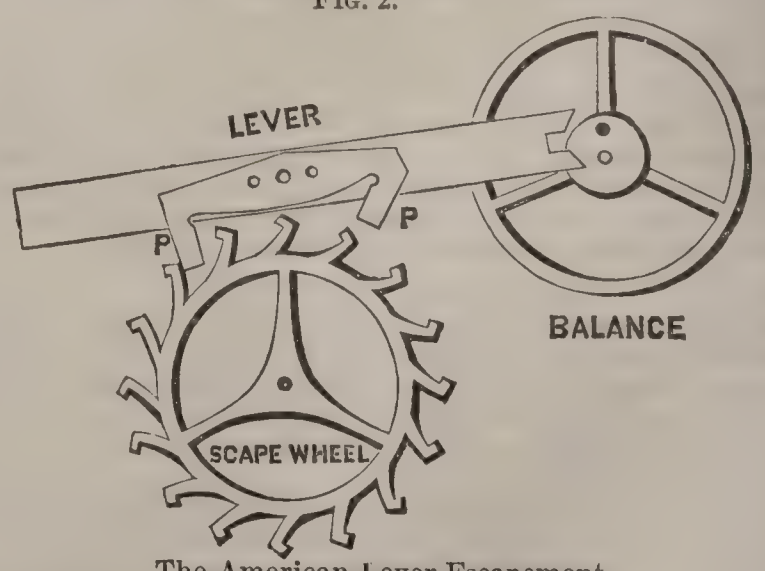
**Watches.** The name "watch," as applied to a pocket timepiece, is not so old as the thing itself. In the article Clocks (which see) we have given a condensed history of the slow processes by which the civilized world attained to an accurate measurement of time. The clock was the mother of the watch. The means of producing motion were substantially the same; for in the early part of the fifteenth century it had been discovered that "clockwork" could be set in motion as well by the gradual uncoiling of a spring as by the running down of weights, and that these motions could be made isochronous either by the swing of a pendulum attached to the escapement or by a balance-wheel acting upon the escapement. Yet the pocket-clock, or "Nuremberg animated egg," was not made till 1477 by Peter Helé, a clockmaker of that city, and was reckoned one of the wonders of the world. Its production cost a year's labor; it varied nearly an hour a day from the true time; it required winding up twice a day, and the price put upon it and its fellows by the inventor was equal to $1500 in gold at the present time. It was egg-shaped, and its size was about that of a goose-egg. The hair-spring was not then invented, but Helé did probably invent the *fusee*. The main-spring was enclosed in a small brass box called the "barrel," the inner end being attached to a "pinion" or movable stem in the centre of the barrel, by the turning of which the spring was drawn up, while the outer end passed through a small slit in the barrel, and was attached to the barrel; the other end was fastened to the base of a conical wheel, the pinion of which was armed with teeth: as the spring uncoiled, the chain was wound up on this conical fusee, whose decreasing diameter aided in regulating the relaxation of the spring, and producing that uniformity of motion considered necessary in an instrument which was to measure time with accuracy. For the first 125 years or more, the fusee-chain was made of catgut, a material peculiarly susceptible to atmospheric changes. A watch in the library of the American Watch Co. at Waltham, which bears the date of 1600, has this catgut chain. Not long after, some watchmaker, probably in England, substituted for this the metallic fusee-chain, composed of several hundred minute and highly-finished steel links—a great improvement, but liable to break or become unfastened. As yet, the balance was only the old balance-wheel of De Vick (see Clocks), the principal weight being concentrated in the rim, to correspond to the weights suspended on the horizontal lever; but this proved unsatisfactory. The application of the coiled hair-spring—or pendulum-spring, as the old watchmakers called it—to the balance, and the discovery that within certain limits the vibrations of this spring are isochronous, were the most important improvements made in the watch. The hair-spring is claimed both by Dr. Robert Hooke and the astronomer Huyghens, but Hooke's claim (of having applied it in 1658 or 1659) seems to be the best substantiated; Huyghens's earliest date is 1674. For 100 years after this great improvement was introduced, the ingenuity of watchmakers was expended on the escapement, but with very meagre results: the scape-wheel has its teeth a little different in form, the pallets are changed somewhat, and the "lever" is attached to a moving bar; but beyond these changes, mostly in form, and also to some extent in greater efficiency of action, there is but a slight difference between Dr. Hooke's escapement of 1666 and the "patent lever," "detached lever," or "detached escapement" now in use in the best English, Swiss, and American watches. In the latter the lever has a nick or slot in it, which catches a pin in the balance, and is thrown to the right or left; this raises the pallet, which, immediately falling again, catches the next tooth of the scape-wheel, stops the train, and so releases or *detaches* the balance from the lever for a single half-revolution, when the pin again falls into the

Fig. 1.



De Vick's Escapement.

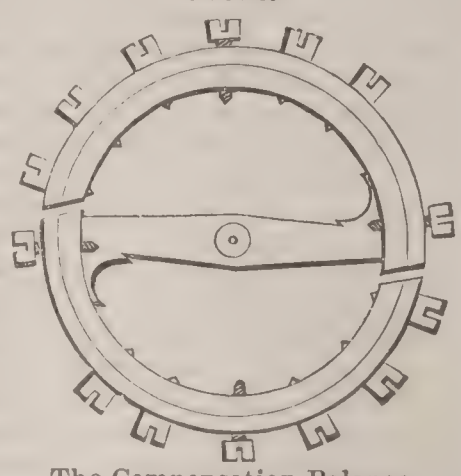
Fig. 2.




The American Lever Escapement.

slot of the lever, and the same results follow in reversed action. This isochronous swing of the balance acts like the pendulum of the clock, and determines the rate of movement of the train. The next improvement in the construction of the watch was made about 1700, and consisted in the use of jewels for the bearings of the pivots. These had previously run on metallic bearings; but it was found that after a moderate period they became so worn that the watch would no longer keep good time. For these bearings, minute jewels of ruby, sapphire, chrysolite, garnet, or agate, each shaped in a diamond-armed lathe and drilled by a diamond-pointed drill, were substituted. In some of the cheapest and least serviceable of Swiss watches the harder descriptions of glass are used for jewels, but these do not wear well. The next improvement was not discovered till 1767; it was the compensation balance, invented by John Harrison. The cut illustrates this compensation balance. The circumference is divided into two sections, the opposite ends of which are fastened to the cross-bar of steel; the outer rim of the balance is of brass; the inner rim, which is soldered to it, of steel, and each half of the circle has one end free, while the different contractility or expansibility of the two metals compensate each other.

Fig. 3.



The Compensation Balance.

With these improvements the English watch attained its highest development. It was, it is true, thick and clumsy, justifying the slang names, "bull's eye," "turnip," etc., often applied to it. A more delicate manipulation and finer, lighter wheels and pinions reduced its thickness somewhat, though it was always a heavy, thick watch, but was regarded by the English people and some others as the more valuable and durable for its solidity. It was made almost entirely by hand, and the different parts by different workmen, so that the mere work of putting it together was no small labor. In no instance could the wheels, pinions, fusees, barrels, escapements, or compensation balances of two watches be produced exactly alike, and there was a great deal of difficult work necessary in adapting and adjusting the different parts to each other, so that they would work together harmoniously without serious friction or wear. When this was accomplished, the price of the watch was necessarily high; and though, when the watch was well made, the substantial character of the work ensured its lasting longer than the continental watches, yet when repairs were needed they were necessarily very costly. Any portion of the watch-movement which was broken or destroyed could only be replaced by making another as nearly like it as possible; and as workmen differed in skill and in capacity to adapt their work to that which was still sound in the watch, it often happened that a watch which had been injured when put into the hands of even a tolerably skilful workman for repairs was rendered worthless as a timekeeper. Still, the English watches of the celebrated makers Reid, Arnold, Earnshaw, Frodsham, Tobias, etc., had a high reputation for many years. The French and Swiss watchmakers very early abandoned two features of the English watch as unnecessary, and as increasing the size and cost of the watch—viz. the fusee and chain and the vertical escapement. In their watches the great wheel which had been attached by the English watchmakers to the base of the fusee was transferred to the base of the barrel which held the main-spring, and set in motion the centre wheel and pinion, which in turn imparted motion to the third wheel and pinion, and this to the contrate wheel and pinion, which connected directly with the balance and escapement, which by their alternate motions regulated and compelled isochronous action in the uncoiling of the main-spring. More than 600 of the 800 parts of the English watch were thus thrown out, and at the same time the capacity of the watch as a timekeeper was rather increased than impaired. The Swiss, who for the last forty years have been the principal watchmakers of Europe, carried the division of labor so far that most of their workmen made only a single piece of the watch through life; they used some machinery for this purpose, but the workmen worked at their own homes, and the watches were afterward put together by workmen who made this their sole business. So low were the wages of labor in that country that they were able to undersell other countries, and for the past fifteen or twenty years the greater part of the pieces which go to make up an English watch have been imported from Switzerland, and English workmen have found their occupation gone. Yet this cheap labor had its disadvantages; there was a large amount of poor and imperfect work. It is stated on high authority that one-third of all the pieces made are rejected by the best watchmakers; but it has been the practice of less conscientious dealers to buy them up, put them together, and, covering them with showy cases, send them to distant markets—the U. S., South America, Australia, etc.—and sell them at low prices as Swiss watches. For a long time our markets were flooded with these worthless watches, but for reasons which will subsequently appear we are now rid of them. The better class of Swiss watches were, and are, really very good timekeepers, and are perhaps the best made wholly or mainly by hand-labor.

The manufacture of watches in the U. S. is not yet (1876) twenty-five years old. There had been, it is true, for more than sixty years isolated cases where ingenious workmen, who had imported the springs, the jewels, the escapements, and the fusee-chain, had supplied the remainder of the parts of a watch-movement and set it up, so as to make a very serviceable watch; there were numerous instances where watchmakers, having imported all the parts of a watch-movement, had put them together and made cases for them; but this was not watchmaking. In 1852, Mr. A. L. Dennison, a watchmaker of Boston, conceived the idea that by gathering all the machines used in Switzerland for making the parts of a watch under one roof, operating them by the same steam or water power, and supplementing them by other machines of American invention and by such hand-labor as might be necessary, it would be possible to create a manufactory which would turn out ten watches a day. His friends thought the man insane, but he succeeded in persuading three other watchmakers, Edward Howard, David P. Davis, and Samuel Curtis, to join him, and the four erected a watch-factory in Roxbury, Mass. Difficulties surrounded them from the start. The Swiss authorities prohibited, under severe penalties, the exportation of either machines, models, or drawings, and prevented, as far as possible, the migration to this country of any of their skilled workmen; the pioneers were therefore compelled to invent and construct their own machines, and after a year of hard, and at times almost hopeless, labor they completed their first watch in 1853. It was by no means as elegant as many timepieces they have since made, but it was, and is, an excellent timekeeper. They were now met by an unexpected obstacle to their success; the soil of that part of Roxbury immediately surrounding their factory is a fine clay, and in dry weather an almost inpalpable dust rises from it which they found fatal to the more delicate operations required in the manufacture of a watch. Nothing daunted, however, they removed to a site on the banks of Charles River, a little above the village of Waltham, where other partners soon came in and the manufactory was organized at first as the Boston Watch Co., and some years later as the American Watch Co. In their new location their growth has been rapid but steady. They now have a capital of $1,500,000, a manufactory covering nearly 2 acres, with a park in front, an extensive enclosed flower-garden, cottages and other dwellings for their employés, and when running at full time employ about 900 hands, half of them women, paying for all their work by the piece, but at such prices that the wages average $1.40 per day for women and $2.75 per day for men. They can turn out 350 watch-movements a day, and produce 5000 silver watch-cases monthly. Their gold cases are made in New York by Messrs. Robbins & Appleton, the general agents of the company, who also own the large building they occupy there. Their actual production ranges from 60,000 to 100,000 watches per annum. They have sold in this and other countries, in the twenty-two years since they began work at Waltham, over 1,000,000 watches, and have now a large demand for export, as well as an ample home-market. Their sales average about $1,500,000 a year. It was to be expected that this success would have induced others to enter the field as competitors. In all, there have been eight or nine watch manufactories started in the U. S., most of them since 1860. The first was, we believe, that of Mr. Edward Howard, one of the original members of the American Watch Co., who withdrew from it at an early date and established himself in Roxbury, Mass., in the manufacture of watches, chronometers, regulator clocks, and tower clocks. Mr. Howard has not attempted to produce so large a number of watches as some of the others, his production ranging from 25 to 50 watches a day, and employing about 200 or 250 men, but his watches, like all his timepieces, are of excellent quality, and all of them of the higher grades. In 1864–65 several companies were organized. The most prominent and successful of these was the National Watch Co., established at Elgin, Ill., and now gen-

erally known as the Elgin National Co. The capital as well as the enterprise which originated this company came from Chicago. Their works are extensive, employing a large number of hands, more than half of them women, and turning out many thousand watch-movements per annum of sixteen grades. They make no cases, the competition in the manufacture of watch-cases having, they affirm, reduced this part of the business below a living profit. They have agencies in Europe, export their watch-movements largely, and at the same time absorb a fair share of the home-trade. They are, next to the American Watch Co., much the largest manufacturers of watches in the U. S. The United States Watch Co., at Marion, N. J., and the New York Watch Co., at Springfield, Mass., were organized in 1866 or 1867. The former has met with many misfortunes, and after changing its corporate title to the Marion Watch Co., and finally to the Empire Watch Co., is doing a moderate business at Marion. The New York Watch Co. (Springfield, Mass.) has recently been reorganized as the New York Watch Manufacturing Co. under very favorable circumstances. They have facilities for producing 90 to 100 watches *per diem* with a force of from 200 to 225 hands, but are now (Oct., 1876) producing about 60 watches daily with a force of from 150 to 175 hands. They manufacture sixteen different grades, some of them stem-winders. The watches of this company have always borne a high reputation for perfection of finish and excellence as timekeepers. The Cornell Watch Co., first started at Newark, N. J., was transferred from thence to Chicago, and finally to San Francisco, where the banker Ralston became interested in it, connected it with some of his land speculations, and finally, on his sudden death, left it in an embarrassed condition, from which it is now emerging. The Springfield (Ill.) Watch Co., organized in 1869 or 1870, is in some sense an offshoot from the National, and several of the former employés of that company are now among its leading men. It has facilities for making 90 to 100 watch-movements a day of eleven grades, and can employ about 250 hands. At present it is turning out about 50 watches a day and employs 125 hands. It makes no cases. There are, or were recently, small watch-factories at Rockford, Ill., Lancaster, Pa., and Washington, D. C., but we have no definite information concerning them.

And now let us attempt to describe what an American watch is; for, though differing in some minor details, the American watches are all substantially alike. The foundation of the watch is what is technically called the plate (or rather two plates, an upper and under, between which the train or running-gear except the balance-wheel and hair-spring are placed). In these plates are drilled the twenty-one holes for the jewels on which the axles of the wheels revolve, and for the tiny screws which hold the jewels in place. These plates, which are of hardened brass, or, in the higher-priced movements, of nickel, are drilled, and if of brass are gilded, and then sent to the engraving-room for such lettering as is to be placed upon them. The jewels—which have been already described, and which in American watches are always of ruby, sapphire, or garnet, and finished with great care—the pivot-holes or perforations for the axles of the wheels, which vary, according to the size of the watch-movement, from $\frac{1}{300}$ to $\frac{1}{1200}$ of an inch in diameter. The finest movement made by the American manufacturers has nineteen jewels, the cheapest has seven. The jewels having been inserted and fastened in their places by the tiniest screws, some of them weighing 150,000 to the pound, the axles of the wheels of the train are inserted in these minute pivot-holes, and the wheels being geared to each other, the watch-movement is "set up." The American watch-movement has no fusee or chain; its main-spring and going-barrel store the power which is to move the wheels of the watch; the escapement and compensating balance let out this power in regular motion; and thus regulated, it is distributed to the hands of the watch through the toothed wheels and the pinions that fit them. We have already described and illustrated the present form of the escapement-wheel and the compensating balance. All the wheels of the American watch-movement are stamped out in blanks and the teeth cut by machinery in quantities of thirty to fifty at a time; but this, which is a very simple matter in the ordinary regularly-formed toothed wheels, is much more difficult in the escapement, which is of steel, and has, as our illustration shows, teeth peculiarly formed and of a curiously-hooked shape. There are fourteen of these teeth, and the cutting of each involves six different operations. The machine which does this work is a very ingenious one. Thirty of the blanks are slipped upon a rod and screwed in a firm, compact mass, and then put into the escapement-wheel machine. On the cylindrical face of the machine are six revolving cutters, each pointed with sapphire; and as the rod with the blanks upon it passes automatically along the cylinder, one of these cutters ploughs through the thirty wheels, making a deep furrow; as the rod comes back, the cylindrical face has turned one-sixth round, and a second cutter is ready to do its work at a different angle from the first, and so on till each of the six cutters has performed its part and one tooth is finished. The process is repeated (the blanks being turned automatically one-fourteenth round each time) till the whole fourteen teeth are cut, when the machine throws itself out of gear, and waits for another set of blanks to be fed to it. The balance-wheel goes through the same number of operations, though in an entirely different machine. The number of parts of an American watch range from 156 to 162. The minor differences are mainly in the form of the pivots, in the dust-rings or excluders, the form of the centre pinions, the methods of removing the barrel, etc. One of the most striking peculiarities of the American watch-movements, and one which gives them an immense advantage over all hand-made watches, is that every part, even to the infinitesimally-small screws, is exactly duplicated thousands of times, so that any broken or defective parts can be sent by mail to any part of the world if the number of the watch is known. There is one modification, however, which the larger companies have been slow in adopting, but which is now in use in most of the best watches, and in about one-half of all that are made. This is the stem-winding and stem-setting attachment. The objection to it has been that the complicated gearing required for both purposes increased the liability of the movement to get out of order. The advantages were manifold. There was no necessity for a key, which was always liable to be lost; the arrangement was much more convenient for the owner of the watch; and there was no need of opening the watch except when it required cleaning, so that dust and everything which would obstruct its action could be completely excluded. Some of the foreign as well as a few of the American manufacturers attempted to surmount the difficulty by making the watches stem-winding, but not stem-setting, as the gearing for the former purpose was less complicated than for the latter. Others have adopted a variety of devices which accomplish both results with much less elaborate machinery than the foreign gearing. The perfection to which the higher grades of American watches have attained as timekeepers is simply marvellous. The adjusted and carefully-regulated watches of the American, Howard, National, and New York Watch Cos. have been known to run for several months together with a variation not exceeding two seconds per month. Of course, such a rate is exceptional, but one of ten to fifteen seconds per month is often maintained in the best grades of most American watches.

For some years the larger companies were greatly annoyed by the tricks of unscrupulous importers, who brought over large quantities of inferior and nearly worthless Swiss watches marked with the names of their best movements, or names so nearly like them as readily to deceive unwary purchasers. This was a double fraud: it passed off a worthless watch upon the purchaser, and it damaged the reputation of genuine American watches. The rigorous application of the trade-mark law finally broke up this swindle. But our markets have been for some years past flooded with watches, the rejected movements of the Swiss watchmakers put in showy but cheap and often base-metal cases, which have been sold at very low prices, but were dear at any price. The American watch companies resolved to put an end to this imposition also upon the public. They have therefore manufactured a variety of cheap but substantial movements—good timekeepers, but not full-jewelled, and so not as imperishable as the best—which they furnish at prices as low as the worthless Swiss watches, and have already stopped the importation of those watches in American markets. At the same time, the American companies, except the Howard, have, as a result of their complete adaptation of machinery to watchmaking and their increased facilities for doing work on a large scale, reduced the prices of all grades of their watches from 33⅓ to 40 per cent., and thus have greatly enlarged their market, making what was a few years ago an article of luxury a necessity for all classes.

The manufacture of watch-cases has greatly expanded within the past ten or fifteen years, and they are now made of as exquisite workmanship as in Europe, and at a much lower price.

A *chronometer* is a watch adjusted to the variations of temperature, and fitted with all the contrivances which experience has shown to be conducive to accurate timekeeping. The marine chronometers are larger than an ordinary watch, and are set in gimbals—an arrangement by which they maintain a horizontal position whatever the motion of the vessel. Their escapement also differs from those of other watches or clocks, and is only valuable when the chro-

nometer is kept in a horizontal position. The pocket chronometer, or chronometer watch, as now made, is a carefully-adjusted watch which has been tested at certain intervals by a regulator clock which is kept at absolutely correct time by daily comparison with the observations made with a transit instrument. Many of these chronometer watches made by American watch companies, though none of them have the chronometer escapement, have proved as accurate as any timepieces ever made. Repeating watches were very popular in the early part of this century, but very few are now made. They require a separate train and main-spring, as well as a spring or bell on which to strike, and are too bulky and inconvenient to be in demand at the present day. The horse-timers or racing watches are also very complicated in their construction, and liable to derangement of their action. Neither of these descriptions of watches is made in this country. L. P. Brockett.

**Watch Hill,** p.-v., Washington co., R. I.

**Watch Hill Point,** the south-westernmost point of the State of Rhode Island, is in the town of Westerly. It is a favorite place of summer resort. It has a granite light-house 40 feet high, showing a fixed white light 62 feet above the sea; lat. 41° 18′ 11″ N., lon. 71° 51′ 11″ W.

**Watchmaking.** See Watches.

**Wa′ter** [Sax. *wæter;* Ger. *Wasser;* Fr. *eau;* Lat. *aqua;* Gr. ὕδωρ], hydrogen oxide or protoxide, $H_2O$.

*Occurrence.*—In the liquid form it constitutes the ocean, seas, lakes, rivers, springs, etc., covering three-fourths of the earth's surface. It also occurs disseminated throughout the rocky strata which constitute the earth's crust. In the solid state it covers the polar regions and high mountainous districts permanently, and the temperate regions periodically, appearing as snow, ice, glacier, and iceberg. In the state of vapor it is always contained in the atmosphere, and gives rise to clouds, fog, mist, rain, dew, snow, hail, etc. It is a constituent of many minerals, as water of crystallization; gypsum contains 20 per cent., alum 45. It occurs in all plants in quantities reaching sometimes 99 per cent. Air-dried wood contains 20 per cent. In animals it is always present in considerable quantities. An average man weighing 154 pounds contains about 116 pounds of water, or three-fourths his weight.

*Composition.*—The Hindoos and the Egyptians considered water the element from which all other bodies were formed. Among the Greeks the idea was maintained that water was the first or fontal element; that from it all other substances were produced; that even plants and animals owed their origin to it. Aristotle regarded water as one of four elements, and this idea was maintained for more than 1000 years, though the old idea that water was the primal element seems to have been mingled with this idea; for it was supposed that these four elements, fire, earth, air, and water, were mutually convertible. Heat converted water into invisible air; repeated evaporation, they said, converted water into earth, so that there seems to have been an original idea that water was the only sole element. Lavoisier in 1770 tested experimentally the question of the conversion of water into earth. It had long been known that when water was placed in a glass retort or alembic, and distilled, there remained behind a small quantity of earthy matter, and if the water was returned to the alembic and distilled again, the quantity of earthy matter increased, and it continued to increase as often as the water was distilled from it. It was supposed, therefore, that the water was gradually converted into earth. Lavoisier distilled 3 pounds of water again and again in an alembic provided with a condenser, the whole apparatus being hermetically sealed, that not a particle of water should be lost. At the close of the experiment he found that while the quantity of water had not diminished in the least, he had a residue of 20 grains of earthy matter in the alembic. As the water had not diminished, he justly concluded that it had not come from the water; it must then have been derived from the alembic itself. On cleansing the alembic and condenser, and weighing them, it was found that they had lost 17 grains; 17 grains of the earthy matter had therefore been produced by the action of the boiling water on the glass. The remaining 3 grains were attributed by Lavoisier to the natural impurities of the water. Scheele tested the same question, and not only proved that the earthy matter was derived from the glass, but analyzed it and found it to consist of the same constituents, potash, lime, and silica. Dalberg repeated the experiment in a silver vessel and obtained no earthy matter. So the conversion of water into earth was proved to be a fallacy due to the action of the water upon the glass vessel. In 1781, Cavendish and Watt proved its composition by synthesis. In 1805, Humboldt and Gay-Lussac determined the ratio of its constituents, hydrogen and oxygen, to be as 2 : 1, and Berzelius and Dulong proved the ratio by weight to be as 1 : 8. Their method of investigation consisted in passing pure and dry hydrogen gas over red-hot oxide of copper. The oxide gives up its oxygen to form water with the hydrogen. This water is collected in a receiver and chloride-of-calcium tubes. By comparing the weight of the water produced with the weight of the oxygen given up by the oxide of copper, its loss in weight, the composition of the water is determined. It is—

| Molecular weight. | | Calculated. | Berzelius and Dulong. | Dumas. |
|---|---|---|---|---|
| $H_2$ | 2 | 11.111 + | 11.1 | 11.11 |
| O | 16 | 88.888 + | 88.9 | 88.89 |
| $H_2O$ | 18 | 100. | 100. | 100. |

1 U. S. gallon (231 cu. in.) of water contains about 620 gallons of oxygen and 1240 of hydrogen.

*Decomposition.*—Water may be decomposed (1) with liberation of both constituents (*disassociation*) by (*a*) heat, first noticed by Grove (see *Am. Chemist,* vi. 126); (*b*) by electricity, as when the poles of a galvanic battery are placed in water slightly acidulated with sulphuric acid to increase its conducting power. (2) With liberation of one constituent only: (*a*) by the metals of the alkalies and alkaline earths at ordinary temperatures, $H_2O + Na = NaOH + H$; by iron and some other metals at high temperatures; by zinc and some other metals in the presence of an alkali; the oxygen is always taken into combination by the metal, while the hydrogen is liberated; (*b*) carbon decomposes steam at a red heat, yielding hydrogen and carbonic oxide, with a little carburetted hydrogen (see Water-Gas); (*c*) some lower oxides decompose water or water-vapor, with evolution of hydrogen, as hydrated silicious oxide, carbonic oxide, etc.; (*d*) chlorine decomposes water with the liberation of oxygen under the influence of light, or watery vapor at a red heat. Bromine vapor produces the same decomposition at a red heat; iodine does not. (3) With combination of both constituents: (*a*) phosphorus in the presence of an alkali forms phosphuretted hydrogen and an hyposphite; (*b*) Schönbein says that when boiled in contact with nitrogen (air) water is converted into ammonic nitrite, $2H_2O + 2N = NH_4NO_2$; (*c*) many chlorides decompose water, $PCl_5 + 4H_2O = H_3PO_4 + 5HCl$; (*d*) arsenious and sulphurous oxides decompose water in the presence of chlorine, $SO_2 + 2H_2O + 2Cl = H_2SO_4 + 2HCl$; (*e*) certain oxides decompose water, or at least combine both its constituents in a new state:

$$SO_3 + H_2O = H_2SO_4$$
$$CaO + H_2O = Ca(OH)_2.$$

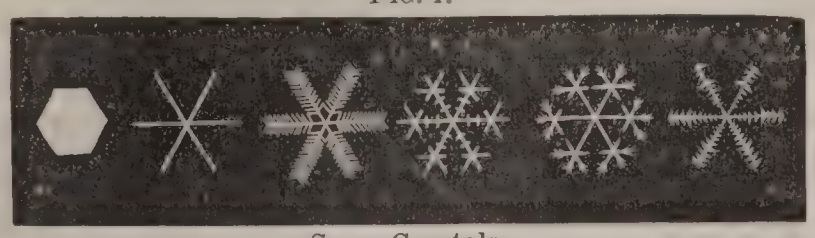
(See Hydrates and Hydroxyl.)

*Formation.*—Water is formed whenever hydrogen or combustible bodies containing hydrogen are burned in oxygen, atmospheric air, or any gas capable of supplying oxygen. It is one of the products of most forms of combustion for heating and lighting purposes, also of the combustion which occurs in animal life, fermentation, etc. It is also produced in many cases when bodies containing hydrogen are heated with easily-reducible metallic oxides or salts capable of yielding oxygen under these conditions.

*Properties.*—Between 32° and 212° F., under the ordinary atmospheric pressure, water is a limpid liquid. When pure, it is entirely free from smell and taste, and has neither an acid nor an alkaline reaction. It is colorless in small quantities—blue when viewed in mass. The impurities in large bodies of water often produce decided colors, as the mud in rivers, the red microscopic plants seen at times in the Red Sea, etc. The density of water in the liquid state is about 770 times that of the atmosphere, and is greatest at about 4° C. (39.2° F.). Taking the density of water at 4° C. as unity, it is 0.999877 at 0° C. (32° F.) and 0.999107 at 15.5° C. (60° F.). The density of water is always taken as the standard unit for comparing the densities of all other liquids and of solids—on the Continent at 4° C., in Great Britain and the U. S. at 60° F. (15.5° C.). Its density or specific gravity is therefore 1.000. (See Gravity, Specific.) A cubic centimètre of water at 4° C., under a barometric column of 760 millimètres of mercury (29.922 inches), weighs 15.432349 grains, or 1 gramme, which is the unit of weight in the metric system. As 1000 grammes make a *kilogramme,* and 1000 cubic centimètres a *litre,* the litre of water at 4° C. weighs 1 kilogramme. A cubic inch of water at 62° F. weighs 252.458 grains, equivalent to 16.386 grammes. A cubic foot of water weighs 62.355 pounds avoirdupois, 436,495 grains, 28,315 grammes. Our U. S. or wine gallon (231 cu. in.) of water at 60° F. weighs 58,318 grains or 8.331 pounds avoirdupois. The imperial gallon, used only in Great Britain, weighs 70,000 grains or 10 pounds avoirdupois. (See Gallon; also *Am. Chemist,* i. 318, 398.) Water is slightly elastic; an increased pressure of 1 atmosphere reduces its volume .000045 (*Oersted*) or .000047 (*Regnault*); 200 atmospheres reduces its volume $\frac{1}{12}$th (*Perkins*). Taking the volume of water at 0° C. as 100, it expands to 104.2986 when heated to 212° F. = 100° C. (*Kopp*), and to

110.16 when heated to 314.24° F. = 156.8° C. (*Mendelejeff*). The specific heat of water is greater than that of any other substance; that is, it requires more heat to raise a given weight a given number of degrees in temperature. Its specific heat is taken as the standard of unity. It is a very poor conductor of heat and of electricity. At 32° F. or 0° C. water becomes solid, freezes, crystallizes, expanding considerably at the same time. Pressure lowers the freezing-point. The crystallized form of ice is hexagonal. Snow, which is ice produced by the freezing of aqueous vapor in the air, consists of minute compound crystals.

Fig. 1.



Snow-Crystals.

Ice is colorless, or in masses blue when pure. Its density is less than that of water at 32° F. (0° C.), being about 0.920. Ice always floats on the surface of water; and as water attains its maximum density—is heaviest—at 39.2° F. (4° C.), it follows that water cooled below this temperature expands, becomes lighter, and remains on the surface of lakes, rivers, etc., where it may finally be converted into ice, while the water below remains at 39.2° F. The bursting of pipes and other vessels by the freezing of water is due to the almost irresistible expansion which accompanies the act of freezing, and which amounts to nearly $\frac{1}{11}$th the volume of the water. Freezing water is a powerful agent in the disintegration of rocks. In order to convert water into ice, it is necessary to deprive it of considerable heat after it has been cooled to 32°; and to convert ice into water, it is necessary to add considerable heat. A pound of water at 174.56° contains just enough heat to melt a pound of ice at 32°, the resulting 2 pounds of water exhibiting a temperature of 32°. 174.56 − 32 = 142.56 degrees of heat are required to melt the ice without affecting the sensible temperature; they become latent in the resulting water. To convert the water into ice, this latent heat must be withdrawn. Water evaporates at all temperatures when in contact with air or other gases. The higher the temperature, the dryer the air, and the more rapid the air-currents, the greater will be the evaporation. Water boils at 212° F. (100° C.) under the ordinary atmospheric pressure, equivalent to a column of mercury of 29.922 inches or 760 m. m., and yields more than 1700 volumes of vapor. When the pressure is reduced, the boiling-point is lowered. Vacuum-pans are constructed for the purpose of boiling sugar solutions, milk, glue, etc., at low temperatures to prevent decomposition. If the pressure is increased, the boiling-point rises. The following table is given by Arago and Dulong (*Ann. Chim. Phys.*, 2 ser., xliii. 74):

| Pressure in atmospheres. | Boiling-point. | |
|---|---|---|
| | Centigrade. | Fahrenheit. |
| 1. | 100° | 212° |
| 1.5 | 112.2 | 233.96 |
| 2. | 121.4 | 250.52 |
| 3. | 135.1 | 275.18 |
| 4. | 145.4 | 293.72 |
| 5. | 153.1 | 307.58 |
| 6. | 160.2 | 320.36 |
| 7. | 166.5 | 331.70 |
| 8. | 172.1 | 341.78 |
| 10. | 181.6 | 358.88 |
| 12. | 190. | 374.00 |
| 14. | 197.2 | 386.96 |
| 16. | 203.6 | 398.48 |
| 18. | 209.4 | 408.92 |
| 20. | 214.7 | 418.46 |
| 25. | 226.3 | 439.34 |
| 30. | 236.2 | 457.16 |
| 35. | 244.8 | 472.64 |
| 40. | 252.5 | 486.50 |
| 45. | 265.9 | 510.62 |

The boiling-point of water is influenced slightly by the nature of the vessel. In clean smooth vessels of glass it boils one or two degrees higher than in rough metallic vessels. Vapor of water is colorless and transparent, and becomes visible only when partially condensed, as when steam escapes into the air. At 212° the specific gravity of the vapor is 0.622 compared with air at the same temperature, or 0.455 compared with air at 32° F. A large amount of heat is rendered latent in the conversion of water into vapor—5.37 times as much as is required to raise it from 32° F. to 212° F.; that is, 180 × 5.37 = 966.6 degrees. The latent heat of steam is exactly 966.06 (*Regnault*), 964.386 (*Favre* and *Silberman*), 964.62 (*Andrews*). 966.6 + 180 = 1146.6 degrees represent the amount of heat necessary to convert water at 32° F. into vapor, no matter what the temperature at which the evaporation occurs.

To condense the vapor back to water this latent heat must be withdrawn. One pound of steam at 212° F. is therefore capable of heating 5.37 pounds of water from 32° to 212° F.; and if the steam is passed directly into the water, the result will be 6.37 pounds of water at 212° F. On account of the large quantities of heat which water is capable of absorbing in passing from the solid to the liquid or vapor state, and of liberating when the order is reversed, as well as on account of its great capacity for heat (specific heat), it is the great regulator of temperature. Climate is largely influenced by its presence or absence, and the temperature of plants and animals is largely controlled by it. Evaporation from the lungs and skin preserves the normal temperature of 98° F. in the human body. Water is a very general solvent for solids, liquids, and gases; many substances, as sugar, salt, etc., are very soluble, others but slightly soluble. Thus $MgSO_4$ requires 3.278 parts of water (*Gay-Lussac*); $CaSO_4$, 429.14 (*Poggiale*); $SrSO_4$, 6895 (*Fresenius*); $BaSO_4$, 806,451 (*Calvert*). (See Storer, *Dictionary of Chemical Solubilities.*) Certain substances, as metals, resins, carbon, sulphur, fat-oils, etc., are practically insoluble. With a few exceptions, calcic hydrate, calcic sulphate, thoric sulphate, etc., heat increases the solubility of solid substances in water, while it diminishes the solubility of gases. Hot saturated solutions generally deposit crystals on cooling. Carbonic acid increases the solubility of many substances. It converts the almost insoluble carbonates of lime, magnesia, iron, etc., into soluble acid- or bi-carbonates ($CaH_2(CO_3)_2$), and basic tricalcic-ortho-phosphate, $Ca_3(PO_4)_2$, into soluble mono-calcic-ortho-phosphate, $CaH_4(PO_4)_2$. Some salts and other compounds increase, some diminish, the solubility of bodies in water. Solutions of solids and of many gases are heavier than water. Some solutions, as that of ammoniacal gas, are lighter than water. The specific gravity of the solution is in most cases a measure of the degree of concentration of the solution.

The freezing-point of saline solutions is lower than that of pure water, and the ice formed is free from the saline body, except as it is entangled mechanically. A 10-percent. solution of common salt freezes at 21.2° F. (−6° C.), a saturated solution of calcic chloride at −5.8° F. (−21° C.). The boiling-point of saline solutions is higher than that of pure water. Liquids and gases sometimes raise, sometimes lower the boiling-point. Pressure, by raising the boiling-point of water, generally increases its solvent power, often to a remarkable degree. The solution of solids in water generally results in a lowering of the temperature, due to the absorption of the heat of liquefaction by the solid. The most notable case is that of ammonic sulphocyanide. According to Phipson, 35 grammes of this salt dissolved in 35 c. c. of water at 73.4° F. lowered the temperature to 14° F. (See Rüdorff, *Ber. Duct. Chem. Gesel.*, 1869.) According to Raoult (*Compt. rend.*, Oct., 1869), electricity is developed when salts are dissolved in water. He says the dissolution of a salt in water is a complex phenomenon, whereby we distinguish—1st, the *fusion* (melting) or *disintegration* of the salt, whereby heat is absorbed; 2d, the *diffusion* of saline molecules in water, which also absorbs heat; 3d, the *combination* of the salt with water, whereby heat is set free. The author then states that the conditions alluded to under Nos. 1 and 2 do not produce any electricity, but that, on the other hand, the combination of a salt with water certainly does give rise to an electric current, to prove which the author records a series of experimental results. Pressure increases the solubility of gases in water. (See further article "Solution" in Watts's *Dict.*, and I. Walz, "Theory of Solubility," *Am. Chem.*, v. 279.) Water combines in several other ways with bodies. In some of the compounds formed it exists as water, and may be expelled by heat; in others its elements appear to have entered into new combinations. (See Hydrates.) Bodies which attract water from the atmosphere and form solutions with it are said to be *deliquescent*. Crystallized bodies which lose water by exposure to the air, and crumble to powder, are said to be *efflorescent*.

Natural Waters.—Water, being a great solvent, dissolves to some extent whatever it comes into contact with.

I. Atmospheric Waters.—Even atmospheric waters, the rain and melted snow, are not pure. Rain, as it falls through the air, washes out the solid particles of dust and the germs of animals and plants. In addition to these, it dissolves the oxygen, nitrogen, carbonic acid, and ammonia of the atmosphere, but a greater proportion of the oxygen than of the nitrogen. The air which is dissolved in water is much richer in oxygen than ordinary atmospheric air. This seems to be a special provision of nature for the fishes. They extract the small quantity of oxygen which

is dissolved by the water from the air. The quantity is very small: 25 cubic feet of water take up only 1 cubic foot of oxygen. But this quantity is sufficient for the maintenance of life in the fishes; their gills enable them to absorb it, and they die without it.

Water which is collected from roofs in the city is never pure. It contains gases which are only developed in cities, sulphur compounds, products of the combustion of coal. After thunderstorms the rain-water is always found to contain minute quantities of nitric acid, produced by the electric sparks, which cause the oxygen and nitrogen of the air to unite. Rain-water almost always contains a little organic matter, causing it to become putrid when kept for some time. "Boussingault found .004 grm. per litre in rain-water collected in Paris, and in that collected in the country only .00079 grm. per litre. Dew he found to contain from .001 to .006 grm. per litre. In water condensed from fog he found .0497 grm., and on another occasion in Paris .1378 grm. per litre. Barral found from .002 to .003 grm. per litre in rain-water collected in Paris." (*Ann. Ch. Phys.* [3], xxxix. 257; xl. 129.) In rain-water collected at Lyons, Bineau found as much as .03 grm. per litre. The amount of ammonia in rain is also much larger in summer than in winter.

*Nitric acid* is commonly present in rain-water, chiefly in combination with ammonia. The amount varies considerably, and is greater in rain falling during thunderstorms. Boussingault estimated the average amount at .0002 grm. per litre. In rain-water, collected during a hailstorm in Paris, he found .055 grm. per litre, and in the melted hail .083 grm. per litre; on other occasions from .0004 to .0021 grm. per litre in rain-water, from .0003 to .004 grm. per litre in snow-water collected in Paris, and in water condensed from fog .0101 grm. per litre. In the country (Alsace) he found in rain-water from .00004 to .00028 grm. per litre; in that collected during a thunderstorm .0021 grm. per litre; and in water condensed from fog, from .0004 to .0018 grm. per litre. Barral found from .002 to .036 grm. per litre in rain-water collected in Paris. The amount is less after rain has continued for some time, and it is generally greater in summer than in winter. (*Compt. rend.*, xxxiv. 283, 824; xxxv. 427; xlvi. 1123, 1175.)

*Nitrous acid* is also present in rain-water, and, according to Schönbein, ammonia-nitrite is formed by the direct combination of nitrogen with water. Lawes, Gilbert, and Way estimate the average amount of nitrogen contained in rain-water, as ammonia, nitrous and nitric acid, at about .985 grm. per litre. (See *Report of the Brit. Assoc.* for 1854.)

Rain water perhaps always contains a small amount of *organic substance*, in consequence of which it readily becomes putrid when kept some time. Angus Smith found .01 grm., Marchand .024 grm., and Chatin .05 grm. per litre.

*Sulphuric acid* is often found in the rain-water falling in towns, and near factories where sulphurous gas is generated and discharged into the atmosphere. A. Smith found .1 grm. per litre in rain water collected at Manchester.

Rain-water sometimes contains a very small amount of *hydrochloric acid, sodic or calcic chlorides*, and other *saline substances*. Barral found the rain-water collected in Paris gave, on evaporation to dryness, a residue amounting to .022 grm. per litre, and that collected in the neighborhood of Paris .0078 grm. per litre. A. Smith also found a minute quantity of coal-ash in rain-water collected in Manchester.

Rain-water is stated by some observers to contain *iodine*. (Chatin, *Compt. rend.*, xlvi. 399; l. 420; li. 496; Marchand, *ibid.*, xlvi. 806; De Luca, *ibid.*, xlvii. 644; xlix. 170; li. 177.)—*Watts's Dict.*

The accompanying engravings, showing the residues ob-

Fig. 2.



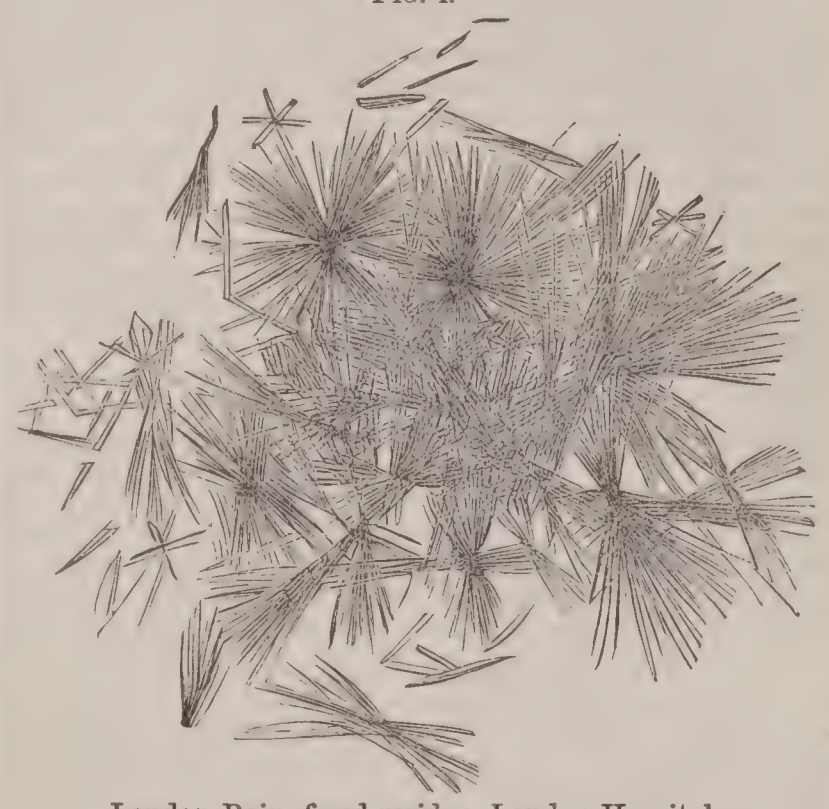
Newcastle Rain.

Fig. 3.



Manchester Rain.

Fig. 4.



London Rain, fixed residue, London Hospital.

tained by evaporating rain-water, are taken from R. Angus Smith's *Air and Rain*.

II. Spring Waters.—Terrestrial waters are always impure. Rain falling upon the earth's surface is absorbed by the porous soil, and the materials of which the soil is composed, being to a greater or less extent soluble, the water becomes contaminated with mineral matter. The character of spring water, therefore, depends upon the character of the soil through which it has passed before it issues as a spring. In New England, where the rocks are granitic, and the minerals chiefly quartz, feldspar, and mica, water is nearly pure. But in limestone countries, where carbonate of lime and magnesia abound, we find the spring waters largely contaminated with these substances. These carbonates are rendered much more soluble in water by the carbonic acid present, which forms bicarbonates with them. To such solutions of bicarbonate of lime are due many curious phenomena in nature. Where they trickle down from the roofs of caves, the evaporation of a portion of the carbonic acid causes the separation of an equivalent quantity of carbonate of lime. Each drop, as it hangs for a moment and then falls, leaves behind a thin pellicle of solid spar, and finally, in years of dripping, a stalactite is formed. Where the drops strike the floor of the cave, corresponding stalagmites gradually spring up, often meeting the stalactites at last, and forming columns of glistening stone. Sometimes where the water falls from a crevice, a series or row of columns is produced, which finally becomes a solid wall or partition of calcareous spar. On boiling solutions of bicarbonate of lime and magnesia, the excess of carbonic acid is expelled, and the carbonates, having no longer a solvent, are precipitated. In this way incrustations are formed in tea-kettles and steam-boilers.

*Spring-Waters.*

| Grains in 1 U. S. gallon. | Spring in Massachusetts. | Clyde, N. Y. | Weedsport, N. Y. |
|---|---|---|---|
| Chloride of potassium | ..... | 0.14 | 0.26 |
| Chloride of sodium | 0.264 | ..... | 0.02 |
| Sulphate of potassa | 0.156 | 0.18 | |
| Sulphate of soda | ..... | 0.45 | 0.69 |
| Sulphate of lime | ..... | ..... | 7.94 |
| Carbonate of soda | 0.133 | | |
| Carbonate of lime | 1.229 | 9.66 | 6.30 |
| Carbonate of magnesia | 0.541 | 4.41 | 4.79 |
| Alumina and oxide of iron | trace. | trace. | 0.07 |
| Silica | 1.120 | 1.58 | 0.36 |
| Organic and volatile | 0.233 | 2.16 | 0.75 |
| Total | 3.676 | 17.58 | 21.18 |

Spring water is generally very clear, although it may be quite impure. It holds its impurities in solution. The soil through which it has passed, although it has conferred upon it its impurities, has at the same time filtered it, and thus rendered it clear and sparkling. As it comes from below the surface, it is generally cool. For these reasons spring water has always been highly prized.

Ordinary open wells are supplied partly by springs and partly by surface-drainage. The water usually contains the alkaline and alkaline earthy salts of spring water, the total quantity of mineral matter and the relative proportions of the various salts depending upon the nature of the soil. In the neighborhood of dwellings the proportion of chloride of sodium or common salt is generally increased by the drainage of house-refuse, which also leads to the contamination of the water with the products of the decomposition of animal matters, such as salts of ammonia, nitrites, and nitrates. In many cases, from the proximity of cesspools and privy-vaults, the water becomes contaminated with filtered sewage-matters, which, while they hardly affect the taste or smell of the water, have nevertheless the power to create the most deadly disturbances in the persons who use the waters. In the neighborhood of graveyards the water of wells is often impregnated with animal matters from the recently-filled graves. As long ago as 1808 it was decreed in France that no one should dig a well within 100 mètres of any cemetery. (See article by Jules Lefort in *American Chemist*, vol. ii. p. 448.) The water of driven wells does not differ in any respect from that of open wells in the same localities, except in cases where there is near the surface a bed of clay or "hard pan" impervious to water. When such a stratum is penetrated by the tube, and the water is drawn from beneath it, the well is somewhat protected from surface-drainage.

*Well-Waters.*

| Grains in 1 U. S. gallon. | Brooklyn, N. Y. | Rochester, N. Y. | New York City. |
|---|---|---|---|
| Chloride of potassium | trace. | 0.96 | |
| Chloride of sodium | 0.557 | 4.82 | 9.655 |
| Chloride of magnesium | ..... | 1.53 | 1.968 |
| Sulphate of potassa | ..... | ..... | 2.103 |
| Sulphate of soda | 0.414 | | |
| Sulphate of lime | ..... | 6.46 | 6.239 |
| Carbonate of soda | 0.193 | | |
| Carbonate of lime | 3.770 | 16.92 | 9.368 |
| Carbonate of magnesia | 1.714 | 8.88 | 17.770 |
| Alumina and oxide of iron | 0.198 | 0.10 | 0.321 |
| Silica | 1.137 | 0.90 | 1.166 |
| Organic and volatile | 0.116 | 1.60 | 8.059 |
| Total | 8.099 | 42.17 | 56.649 |

*Artesian Wells.*—Occasionally wells are sunk to great depths by boring, Such wells are called artesian wells, from the district in France where they were first bored. (See ARTESIAN WELLS.) The earth's crust consists in many localities of strata of gravel, sand, or clay, resting upon sandstones, limestones, or shales. In many cases these strata are in basins, and their edges often come to the surface at the margin of the basins. Some of these strata, which are porous, constitute reservoirs of water, and by boring down to them this water is reached. It may rise above the surface and overflow if the strata rise elsewhere to higher levels; otherwise it must be pumped. Often the pressure of gases forces the water above the surface. At Grenelle, near Paris, an artesian well was bored down 1798 feet, or about one-third of a mile. The water rises 80 feet above the surface, and flows at the rate of 90 cubic feet per minute. Coming from so great a depth, it is very warm, and must be stored in a reservoir to cool. At Rochefort, in France, is a well 2676 feet deep, or more than half a mile. This is the deepest well in Europe. Some of the deepest artesian wells have been put down in this country. At Louisville, Ky., there is one 2086 feet deep, the water of which has a temperature of 82° F. But instead of being suitable for domestic purposes, the water proved to be heavily charged with saline compounds, which gave it a medicinal value. At Charleston, S. C., there is a well 1250 feet deep, yielding similar mineral water. At Columbus, O., an artesian well at the depth of 180 feet yielded sulphur water, but it proved to be hard water. At the depth of 675 feet salt water was obtained. As fresh water was required, the well was pushed down a half-mile, or 2575 feet, but no water was obtained of a satisfactory quality. At St. Louis a well was bored to the depth of 3881 feet, or two-thirds of a mile, but no water of any consequence was obtained, and the well is a failure. Artesian wells are in some localities of the greatest economic and sanitary importance, yielding water where it could not otherwise be obtained at all, or pure water when the shallow surface-wells are too impure for domestic use. The former case is illustrated in the Libyan desert, where there are no rivers or springs, and upon which rain never falls; the latter case in the city of London, where the surface-wells are contaminated by sewage, while the artesian wells 400 or 500 feet deep bring up from the chalk-beds below a very pure water. In many instances water which rises in artesian wells comes from great distances. At Tours, in France, the well is sometimes obstructed, and when the obstruction is removed, it is found that the leaves which come to the surface, and which caused the obstruction, do not grow within 100 miles of Tours, showing that there is some subterranean communication by which the leaves, as well as the water, are brought from a distance.

*Ordinary Spring-Waters* (fresh waters, as they are generally called) contain salts of the alkalies and alkaline earths—chlorides, sulphates, and bicarbonates of potassa, soda, lime, and magnesia. The most common salts are the chlorides of potassium and sodium, the sulphates of soda and lime, and the bicarbonates of lime and magnesia. Besides these alkaline and earthy salts, we almost invariably find silica, the substance of quartz, to the amount of a grain or less in a gallon. In wells which receive drainage-waters in the neighborhood of dwellings we generally find nitrates, nitrites, and ammonia salts, derived from decomposing animal matter in the soil. The total quantity of dissolved impurities in ordinary spring waters varies from 1 or 2 grains to 80 or 90 grains in a U. S. gallon of 231 cubic inches.

*Hard and Soft Waters.*—Lime salts in water are the cause of what is called *hardness*. They decompose the soap used in washing, forming a flocculent insoluble compound and destroying its detergent properties. In Glasgow the saving to the people in soap, due to the introduction of the pure water of Loch Katrine in place of the hard well waters previously used, is said to amount to $180,000 per annum. Soap is an excellent reagent for testing water—a fact which is well known, though but few persons understand that it indicates the lime compounds only. As bicarbonate of lime is destroyed by boiling, with the formation of insoluble carbonate of lime, which does not act on soap, it is said to produce *temporary hardness*, while sulphate of lime, which is not affected by boiling, produces *permanent hardness*.

*Organic matters* of various kinds are always present in natural waters. They are derived from the decomposition of plants and animals, chiefly the former. They are both nitrogenous (*albuminoid*) and non-nitrogenous. Several of them have been identified as crenic and apocrenic acids (see article HUMUS), but most of them are of unknown nature.

*Pond, lake, and river waters* are generally purer than spring water, for the reason that while those bodies of water receive the waters of springs, they also receive a considerable quantity of water which has simply run *over* the surface of the earth. When a shower comes up, a portion of the water goes through the soil and issues as a spring, but a large portion of it runs over the soil, and goes into the lakes and rivers without taking with it much mineral matter. For this reason the waters of lakes and ponds are much purer than those of the springs in the same locality. One of the purest waters known is the

*River-Waters.*

| Grains in 1 U. S. gallon. | Croton, N. Y. | Genesee, Rochester, N. Y. | Hudson, Albany, N. Y. | Mohawk, Utica, N. Y. |
|---|---|---|---|---|
| Chloride of potassium | ..... | 0.28 | ..... | 0.12 |
| Chloride of sodium | 0.402 | 0.05 | 0.361 | 0.17 |
| Chloride of magnesium | ..... | ..... | 0.157 | |
| Sulphate of potassa | 0.179 | ..... | 0.076 | |
| Sulphate of soda | 0.260 | 0.85 | ..... | 0.57 |
| Sulphate of lime | 0.158 | 3.16 | 0.980 | 1.31 |
| Carbonate of lime | 1.648 | 4.64 | 2.571 | 4.60 |
| Carbonate of magnesia | 1.100 | 2.06 | 0.803 | 1.71 |
| Alumina and oxide of iron. | trace. | 0.09 | 0.070 | 0.09 |
| Silica | 0.621 | 0.90 | 0.408 | 0.47 |
| Organic and volatile | 0.670 | 1.64 | 0.699 | 1.64 |
| Total | 5.038 | 13.67 | 6.125 | 10.68 |

water of the river Loka in Sweden, which contains only $\frac{1}{20}$th of a grain of impurities in a gallon. Rivers are more likely to be charged with *suspended impurities*, for the reason that their waters, which have not been filtered through the soil, carry with them a certain quantity of mud and organic matter. That is what we see in Potomac water; it has had no opportunity to settle, and has not been filtered out. When water flows into lakes and the sediment subsides, it becomes clear; but in streams where the water runs rapidly it has no opportunity to deposit its sediments, and it often appears very turbid. The water of the Mississippi contains 40 grains of mud per gallon, and it is estimated that this river carries 400,000,000 tons of sediment per annum into the Gulf of Mexico; the Ganges is said to carry down 6,368,000,000 cubic feet annually. This transportation of mud in suspension has produced large deposits at the mouths of these rivers. All of the State of Louisiana, and considerable portions of other States which border upon the lower Mississippi, have been formed by the deposition of these sediments brought from higher levels. This mud is rich in plant-food, and the land which it produces is very fertile. The Mohawk Flats are famous for their fertility, and the annual overflow of the Nile is the chief reliance of the poor Egyptians who cultivate the fields enriched by its sediments.

Rivers flowing through populous districts and receiving the drainage of the towns on their banks often become contaminated with sewage to such a degree as to make them positively offensive, and dangerous to those who drink their water.

The waters of ponds are more largely supplied by springs; they are generally clearer than those of rivers, as the suspended impurities subside. They often exhibit more or less color, due to peaty matters held in solution. This is specially the case in the Dismal Swamp and in new reservoirs; such matters are entirely harmless.

*Living Organisms in Water.*—In addition to the soluble and suspended impurities already mentioned, we find

FIG. 5.



Organisms in Croton Water.

living organisms in water—animals and plants. Figs. 5 and 6 show some of the most common forms of the Croton and Ridgewood waters. They were prepared by Dr. William B. Lewis for the metropolitan board of health.

These animals when magnified by the microscope are very frightful in their appearance and motions, but they are not really objectionable. The plants even exercise a purifying influence on the water. It is stated by a celebrated English author that the providential spread of the American weed *Anacharis alsinastrum* has saved thousands of lives by the purifying influence which it has exerted on the watercourses in certain districts in England. These plants liberate oxygen, which attacks poisonous dead organic matter and destroys it, thus ridding the water of its most dangerous impurities. It occasionally happens, however, owing perhaps to some peculiarity of the season, that microscopic animals or plants multiply to such an unusual extent in the waters of lakes or rivers as to produce serious annoyance. This occurred some years ago in the Croton Lake. The subject was investigated by Dr. John Torrey, who reported the presence of myriads of minute plants (*Nostoc*), which by their death and decomposition communicated to

FIG. 6.



Organisms in Ridgewood Water.

the water a disagreeable taste and odor. It may be considered as fully established that the ova of entozoa (the eggs or embryos of parasitic worms) gain sometimes entrance to the body by the water we drink. We have no reason to believe, however, that the animalcula in the Croton, Ridgewood, and other city waters of the U. S. are such embryos, or, in fact, that they are in any way objectionable. In Iceland, however, it is stated that one-sixth of the deaths are caused by hydatids in the liver. These are the larval forms of the tænia or tapeworm of the dog. Young leeches, contained in drinking-water, sometimes fix themselves on the pharynx. In a march of the French in Algiers 400 men were in the hospital at one time from this cause. (See F. Cohn, *Microskop. Analyse der Brunnenwässer, Beit.* 3; *Biol. d. Pflanze*, i. 108; James Bell, *Microscopical Examination of Water for Domestic Use, Monthly Micros. J.*, Apr., 1871, p. 163; C. F. Gissler, *Contributions to the Fauna of the Croton Water*, New York, 1872.)

III. SEA-WATER.—The ocean is the great and final receptacle of all waters which escape evaporation, and it consequently receives the mineral and other impurities which the rivers and smaller streams carry along in solution or suspension. From the surface of the ocean the water evaporates, rising into the atmosphere to fall again in the form of rain.

*Analysis of Sea-Water, by Von Bibra.*

| | Atlantic Ocean. | Dead Sea. |
|---|---|---|
| Specific gravity | 1.0275 | 1.17205 |
| Chloride of sodium | 1671.34 | 6702.73 |
| Chloride of potassium | ..... | 682.63 |
| Chloride of ammonium | ..... | 3.35 |
| Chloride of calcium | ..... | 1376.75 |
| Chloride of magnesium | 199.66 | 4457.23 |
| Chloride of aluminum | ..... | 31.37 |
| Chloride of iron | trace. | 1.50 |
| Chloride of manganese | ..... | 3.35 |
| Bromide of sodium | 31.16 | 156.53 |
| Iodide of sodium | trace. | trace. |
| Sulphate of potassa | 108.46 | |
| Sulphate of magnesia | 34.99 | |
| Sulphate of lime | 93.30 | 38.07 |
| Phosphate of soda | trace. | |
| Carbonate of lime | trace. | trace. |
| Silver | trace. | |
| Copper | trace. | |
| Lead | trace. | |
| Arsenic | trace. | |
| Silica | trace. | trace. |
| Organic matter | trace. | 34.59 |
| Bitumen | ..... | trace. |
| Total in 1 U. S. gallon | 2138.91 grs. | 13488.10 grs. |
| Percentage by weight | 3.569 | 19.733 |
| Water | 96.431 | 80.267 |
| | 100. | 100. |
| Weight of 1 gallon | 59922. grs. | 68352. grs. |

Entering the soil, it again issues in the form of springs, with a fresh quantity of dissolved mineral matters, which it bears onward to the ocean. Thus, again and again, the raindrops have performed the voyage to the sea, each time laden with the little cargo of dissolved salts. In this manner the ocean has become very saline; it is the receptacle for the soluble matters which are washed out of the earth's crust. The foregoing analysis of sea-water was made by Von Bibra. The numbers represent grains in 1 U. S. gallon of 231 cubic inches. The analysis of the water of the Dead Sea was made by the Herepaths.

"In addition to the substances already mentioned, sea-water contains about .3 grm. per litre of *bromine*, and very minute amounts of *iodine* and *fluorine;* also *silica, phosphoric acid* (Voelcker, *Chem. Gaz.*, viii. 346), *calcic* and *magnesic carbonates* in small proportions. The amount of carbonates is largest near the land, and is very small in the water of the ocean (J. Davy, *Ed. New Phil. Journ.*, xlvii. 320). *Silver, lead, copper*, and *arsenic* have been detected either in sea-water, the ashes of marine plants or animals, or in the deposit formed inside the boilers of ocean steamers (Malaguti, Durocher, Sarzeaud, *Ann. Chim. Phys.* [3], xxviii. 122; Field, *Chem. Gaz.*, 1857, p. 93; Daubree, *Compt. rend.*, xxxii. 827). In fact, since the ocean is the common recipient of by far the greater part of the water discharged from springs and constituting rivers, most of the material abstracted by their water from the interior and surface of the earth passes into it, and all substances which exist in spring-water may be expected to exist, to some extent, in sea-water. The gaseous contents of sea-water are nitrogen, oxygen, and carbonic anhydride, amounting altogether to from 10 to 30 c. c. per litre, according to different observers. The amount appears to be greater at a depth of about 2000 feet than near the surface, but at about 4000 feet the water contains scarcely any dissolved gases. The relative proportions of the gases have not been estimated with much accuracy. Carbonic anhydride is stated to vary from 2 to nearly 40 c. c. per litre, oxygen from about 1 to 3 c. c. per litre, and nitrogen from 12 to 17 c. c. per litre. (Aimé, *Pogg. Ann.*, lx. 404; Hayes, *Sill. Am. J.*, 1851, 421; *Compt. rend.*, vi. 616; Lewy, *Ann. Chim. Phys.*, ii. 535; viii. 425; xii. 5; Bischof, *Chem. Phys. Geol.*, i. 113; Thorpe, *Chem. Soc. J.* [2], v. 189.)"—*Watts's Dict.*

The question arises, If these saline substances are being carried to the sea, is it not becoming much salter? A calculation has been made, by which it appears that about 36 cubic miles of water are poured into the ocean daily by the rivers. But then this vast quantity of water is so small in comparison with the amount of water in the ocean that it would take 30,000 years for all the water in the ocean to rise as vapor, fall as rain, and make one trip back to the ocean again.

*Inland Seas.*—Where evaporation is rapid, inland seas and lakes which drain considerable areas become even more salt than the ocean. The Dead Sea and the Great Salt Lake are examples. The Dead Sea receives the waters of the Jordan, which drains the surrounding country. There are no outlets to this lake, and evaporation is rapid. Thus, in the course of time, the Dead Sea has come to contain a large quantity of salt. The above analysis of this water by the Herepaths shows that it contains nearly 31 ounces of saline matter in a gallon, while the water of the Atlantic contains less than 5 ounces. The following table gives a comparison of the waters of some other inland seas with that of the ocean:

| | Density. | Grains of saline matter in 1 gallon. | Ounces of saline matter in 1 gallon. |
|---|---|---|---|
| The Atlantic Ocean | 1.027 | 2139 | 4.89 |
| The Dead Sea | 1.172 | 13488 | 30.86 |
| The Great Salt Lake | 1.170 | 15203 | 34.72 |
| Lake Oroomiah, in Persia. | 1.188 | 18209 | 41.60 |

The difference in the character of the salts contained in the Dead Sea water and in the water of the ocean is not surprising. The ocean receives the saline matters washed out of all the continents, while these inland seas are local in their sources of supply. They receive the washings of limited areas, and the salts they contain must necessarily partake of the character of those particular countries in which they are situated.

IV. MINERAL WATERS.—Waters which contain unusually large quantities of any of the ordinary impurities, or which are characterized by unusual constituents, are known as mineral waters. Such waters may be valuable for their medicinal properties or as sources of the special substances which they contain. As examples of medicinal waters we have sulphur springs, which contain sulphuretted hydrogen; chalybeate springs, which contain iron, etc.; while brines and borax-waters are valuable for the extraction of salt and borax.

*Sulphur Waters.*—Waters containing sulphuretted hydrogen gas are found in many parts of the world. Those of Harrowgate, Croft, and Aix-la-Chapelle are renowned in Europe, while we have in the U. S. numerous examples, among which are the White, Red, and Salt Sulphur springs of Virginia, the White Sulphur springs of Ohio, and the Richfield, Sharon, Chittenango, and Florida springs of New York State. The sulphuretted hydrogen gives these waters a sweet taste and a very peculiar odor, which some consider offensive. These waters have the property of blackening silver; persons who visited these springs in the earlier days of the republic, when specie was current, noticed a gradual darkening of their "change," which finally became quite black, owing to the formation of a black sulphide of silver. The following analyses by the writer show the composition of such waters:

| In 1 U. S. gallon of 231 cubic inches. | Chittenango, Madison co., N. Y. | | | Florida, Montgomery co., N. Y. |
|---|---|---|---|---|
| | White Sulphur Spring. | Cave Spring. | Magnesia Spring. | Florida Spring. |
| | Grains. | Grains. | Grains. | Grains. |
| Hydrosulphate of sodium (NaS,HS) | 0.117 | 0.386 | 0.757 | 2.008 |
| Hydrosulphate of calcium (CaS,HS) | ..... | 1.123 | 0.929 | |
| Sulphate of potassa | ..... | ..... | ..... | 1.390 |
| Sulphate of soda | 0.213 | | | |
| Sulphate of lime | 81.420 | 106.126 | 115.085 | |
| Sulphate of strontia | trace. | trace. | trace. | |
| Sulphate of magnesia | 1.953 | 7.589 | 12.718 | |
| Hyposulphite of soda | ..... | 0.257 | 0.020 | 0.711 |
| Bicarbonate of soda ($NaO,HO,2CO_2$) | ..... | ..... | ..... | 22.143 |
| Bicarbonate of lime | ..... | ..... | ..... | 8.317 |
| Bicarbonate of magnesia | 22.017 | 23.973 | 20.779 | 6.972 |
| Bicarbonate of iron | 0.078 | 0.156 | 0.325 | |
| Chloride of potassium | 0.156 | 0.233 | 0.333 | |
| Chloride of sodium | 1.037 | 1.569 | 1.833 | 5.880 |
| Chloride of lithium | trace. | trace. | trace. | |
| Alumina | 0.082 | 0.222 | trace. | trace. |
| Silica | 0.286 | 0.519 | 0.577 | 0.793 |
| Sulphur (in suspension) | trace. | | | |
| Sulphide of iron (in suspension) | ..... | ..... | ..... | 0.176 |
| Total solid contents per gallon | 107.359 | 142.113 | 153.356 | 43.390 |
| Total sulphur in the metallic sulphides and sulphuretted hydrogen | 0.339 | 1.397 | 2.4 | 1.91654 |
| *Cubic Inches of Gas per Gallon.* | | | | |
| Sulphuretted hydrogen gas | 0.884 | 2.754 | 5.623 | 3.765 |
| Carbonic acid gas | 20.480 | 15.934 | 19.436 | 32.169 |

With the exception of the following compounds, the substances found in these waters are not essentially different from those contained in most spring-waters:

| | |
|---|---|
| Hydrosulphate of sodium | (NaS,HS). |
| Hydrosulphate of calcium | (CaS,HS). |
| Hyposulphite of soda | ($NaO,S_2O_2$). |
| Sulphur | (S). |
| Sulphide of iron | (FeS). |
| Sulphuretted hydrogen gas | (HS). |

To the last-mentioned substance the peculiar odor of the water is due, while by the free sulphur, which is formed by the action of the oxygen of the air on this gas, the white milky turbidity is produced.

*Saline Waters.*—The chlorides of sodium, calcium, and magnesium often occur in spring waters in such quantities as to cause a decided saline taste—agreeable in the case of the first-mentioned salt, if not too intense, but bitter and disagreeable when caused by either of the others. Sulphate of soda (Glauber salt) or of magnesia (Epsom salt) may also be the cause of a saline taste. Brines, which are important sources of national wealth in many countries, belong to the first-mentioned class. Nearly all the salt manufactured in the U. S. is obtained from salt springs or wells. This table exhibits analyses of some of the brines of Michigan and New York, made by Dr. C. A. Goessmann of the Massachusetts Agricultural College:

*Analyses of Brines.*

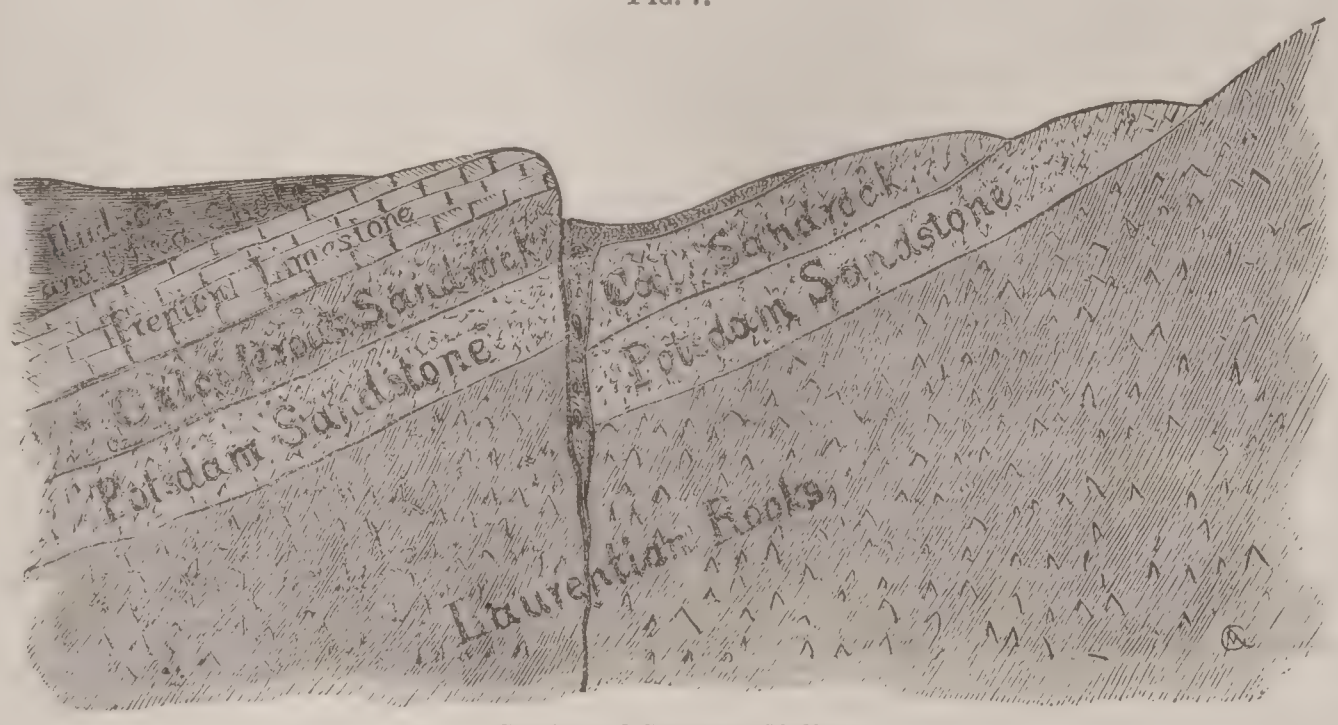
| | Michigan. | | New York. | |
|---|---|---|---|---|
| | East Saginaw Co.'s well. | Bangor Co.'s well. | Syracuse. | Salina. |
| Chloride of sodium | 16.86 | 19.86 | 15.36 | 14.94 |
| Chloride of magnesium | 0.96 | 1.26 | 0.14 | 0.13 |
| Chloride of calcium | 2.27 | 2.96 | 0.08 | 0.08 |
| Sulphate of lime | 0.15 | 0.07 | 0.57 | 0.59 |
| Total saline matter | 20.24 | 24.15 | 16.15 | 15.74 |
| Water | 79.76 | 75.85 | 83.85 | 84.26 |
| | 100.00 | 100.00 | 100.00 | 100.00 |

Similar brines occur in Kansas, Ohio, West Virginia, and other States. Over 9,000,000 bushels of salt have been

manufactured in the neighborhood of Syracuse in a single season. The brine is here pumped up through artesian wells from a depth of 400 or 500 feet. It is undoubtedly derived from beds of rock-salt, such beds having been already discovered in Canada, not very far distant. The famous St. Catharine's Spring in Canada contains large quantities of the chlorides of calcium and magnesium, which give its water a bitter taste. The Kissingen bitter water illustrates the class of waters that owe their peculiar qualities to the sulphates of soda and magnesia.

*Acidulous Springs.*—Waters charged with such quantities of carbonic acid as to cause them to sparkle and effervesce as they flow from the spring are called *acidulous*. Owing to the solvent power of this acid upon limestones and some other rocks, such waters generally hold considerable quantities of lime, magnesia, and iron in solution in the form of bicarbonates; when the latter is present in quantities of a grain or more to the gallon, the spring is called a *chalybeate*, from the name of an ancient people who worked in iron at an early day, the *Chalybes*. These waters often contain considerable quantities of chloride of sodium, and frequently bromide and iodide of sodium, as well as bicarbonates of soda and lithia. Such is the character of the most celebrated mineral waters in this country, the well-known springs of Saratoga and Ballston in New York. Fig. 7 is a section of the Saratoga valley, which shows you the position of the rocky strata there:

Fig. 7.




Section of Saratoga Valley.

Beginning with the uppermost, the rocks of Saratoga county are: (1) the Hudson River and Utica shales and slates; (2) the Trenton limestone; (3) the Calciferous sandrock, which is a silicious limestone; (4) the Potsdam sandstone; and (5) the Laurentian formation of gneiss and granite of unknown thickness. The northern half of the county is occupied by the elevated ranges of Laurentian rocks; flanking these occur the Potsdam, Calciferous, and Trenton beds, which appear in succession in parallel bands through the central part of the county. These are covered in the southern half of the county by the Utica and Hudson River slates and shales. The most remarkable feature is, however, the break or vertical fissure which occurs in the Saratoga valley, which is indicated in the diagram. The strata on one side of the fissure have been elevated above their original position, so that the Potsdam sandstone on the left meets the edges of the Calciferous sandrock, and even the Trenton limestone, on the right. It is in the line of this fissure, or *fault*, in the towns of Saratoga and Ballston, that the springs occur. The Laurentian rocks, consisting of highly crystalline gneiss, granite, and syenite, are almost impervious, while the overlying Potsdam sandstone is very porous, and capable of holding large quantities of water. In this rock the mineral springs of Saratoga probably have their origin. The surface-waters of the Laurentian hills, flowing down over the exposed edges of the Potsdam beds, penetrate the porous sandstones, become saturated with mineral matter, partly derived, perhaps, from the limestones above, and are forced to the surface at a lower level by hydrostatic pressure. The valley in which the springs all occur indicates the line of a fault or fracture in the rocky crust, the strata on the W. side of which are hundreds of feet above the corresponding strata on the E. The mineral waters probably underlie the southern half of the entire county, many hundred feet below the surface, the accident of the fault determining their appearance as springs in the valley of Saratoga Springs, where, by virtue of the greater elevation of their distant source, they reach the surface through crevices in the rocks produced by the fracture. Their common origin is also shown by analysis; all the springs contain the same constituents in essentially the same order of abundance; they differ in the degree of concentration merely. Those from the deepest strata are the most concentrated. The constituents to which the taste of the water and its most immediate medicinal effects are due are—chloride of sodium, bicarbonate of lime, bicarbonate of magnesia, bicarbonate of soda, and free carbonic acid. Other important though less speedily active constituents are—bicarbonate of iron, bicarbonate of lithia, iodide of sodium, and bromide of sodium. Besides the natural springs, several artesian wells have been bored to depths reaching in some cases 651 feet. All these have been successful in bringing up very concentrated waters of the same chemical character as the natural springs. It is probable, therefore, that water can be obtained anywhere in the southern portions of the county by tapping the underlying Potsdam sandstone. In all of these wells the water rises to and above the surface. Down in the rocky reservoir the water is charged with gases under great pressure. As the water is forced to the surface the pressure diminishes, and a portion of gas escapes with effervescence. The wells deliver, therefore, enormous volumes of gas with the water—a perfect suds of water, carbonic acid, and carburetted hydrogen.

The High Rock Spring was the first to attract attention. It was well known to the Indians, who highly prized the medicinal virtues of its waters. The Indian name Saraghtoga means "place of salt." In 1767 they brought Sir William Johnson to the spring on a litter. The spring rises in a little mound of stone three or four feet high, which appears like a miniature volcano, except that sparkling water instead of melted lava flows from its little crater. When Sir William Johnson visited the spring, and in fact until quite recently, the water did not overflow the mound, but came to within a few inches of the summit, some other hidden outlet permitting it to escape. The Indians had a tradition, however, which was undoubtedly true, that the water formerly flowed over the rim of the opening. A few years ago the property changed hands, and the new owners, convinced that by stopping the lateral outlet they could cause the water again to issue from the mouth of the rock, employed a number of men to undermine the mound, and with a powerful hoisting-derrick to lift it off and set it one side, that the spring might be explored.

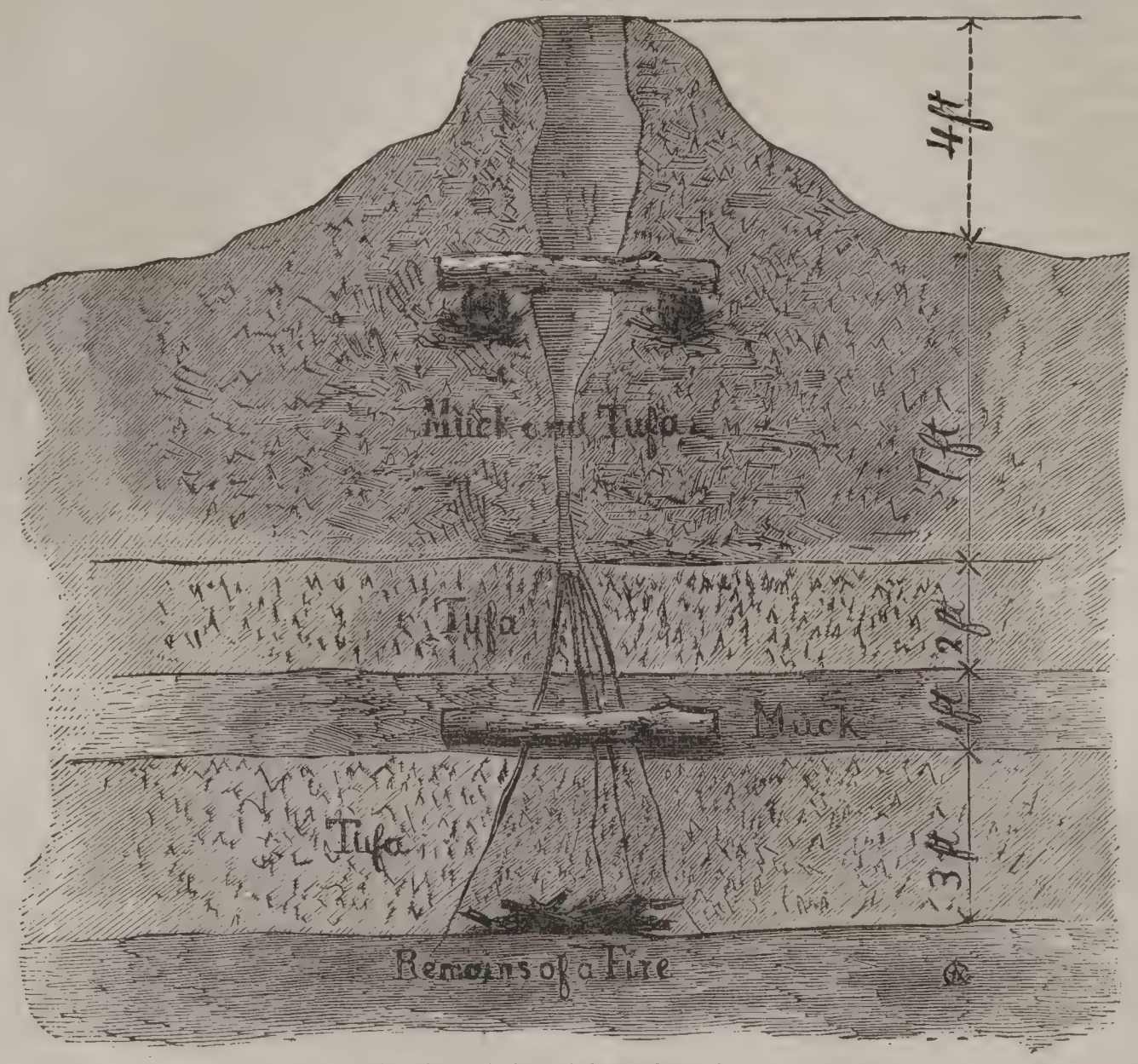
*Analysis of a Fragment of the High Rock.*

| | |
|---|---|
| Carbonate of lime | 95.17 |
| Carbonate of magnesia | 2.49 |
| Sesquioxide of iron | 0.07 |
| Alumina | 0.22 |
| Sand and clay | 0.09 |
| Organic matter | 1.11 |
| Moisture | 0.39 |
| Undetermined and loss | 0.46 |
| | 100.00 |

Just below the mound were found four logs, two of which rested upon the other two at right angles, forming a curb. Under the logs were bundles of twigs resting upon the dark brown or black soil of a previous swamp. Evidently some ancient seekers after health had found the spring in the swamp, and to make it more convenient to secure the water had piled brush around it and then laid down the logs as a curb. The rock was formed by the water. It is composed of tufa, carbonate of lime, and was formed in the same manner as stalactites and stalagmites were formed. As the water flowed over the logs, the evaporation of a portion of the carbonic acid caused the separation of an equivalent quantity of insoluble carbonate of lime, which, layer by layer, built up the mound. Below the rock the workmen followed the spring through 4 feet of tufa and muck. Then they came to a layer of solid tufa 2 feet thick, then 1 foot of muck, in which they found another log. Below this were 3 feet of tufa; and there, 17 feet below the apex of the mound, they found the embers and charcoal of an ancient fire. The Indian tradition went back only to the time when the water overflowed the rock: how many centuries may have elapsed since even the logs were

placed in position? There are springs in the Auvergne, in France, in which the peasantry are in the habit of suspending little wire baskets containing egg-shells, or crawfishes, or medallions, which become thickly incrusted with tufa in a few days. The table below gives the writer's analyses of several of these springs. Thus, there are

FIG. 8.




Section of the High Rock Spring.

springs to suit all tastes, from the concentrated artesian waters to the mild Saratoga Seltzer, which is used with wines, as the original Seltzer (Selters) from the spring of the late grand duke of Nassau has long been used. Hathorn's Spring is the strongest natural spring yet discovered in the county, while the Ballston Artesian Lithia Spring fur-

*Analyses of some of the Springs and Artesian Wells of Saratoga Co., N. Y.*

| Compounds as they exist in solution in the waters. | In Saratoga. | | | | | | | | | | | In Ballston. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Star Spring. | High Rock Spring. | Seltzer Spring. | Pavilion Spring. | United States Spring. | Hathorn Spring. | Crystal Spring. | Congress Spring. | Empire Spring. | Geyser spouting well. | Glacier spouting well. | Ballston Artesian Lithia well. | Franklin Artesian well. | Condedentonian well. |
| Chloride of sodium | 398.361 | 390.127 | 134.291 | 459.903 | 141.872 | 509.968 | 328.468 | 400 444 | 506.630 | 562.080 | 702.239 | 750.030 | 659.344 | 645.481 |
| Chloride of potassium | 9.695 | 8.974 | 1.335 | 7.660 | 8.624 | 9.597 | 8.327 | 8.049 | 4.292 | 24.634 | 40.446 | 33.276 | 33.930 | 9.232 |
| Bromide of sodium | 0.571 | 0.731 | 0.630 | 0.987 | 0.844 | 1.534 | 0.414 | 8.559 | 0.266 | 2.212 | 3.579 | 3.643 | 4.665 | 2.368 |
| Iodide of sodium | 0.126 | 0.086 | 0.031 | 0.071 | 0.047 | 0.198 | 0.066 | 0.138 | 0.606 | 0.248 | 0.234 | 0.124 | 0.235 | 0.225 |
| Fluoride of calcium | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. |
| Bicarbonate of lithia | 1.586 | 1.967 | 0.899 | 9.486 | 4.847 | 11.447 | 4.326 | 4.761 | 2.080 | 7.004 | 6.247 | 7.750 | 6.777 | 10.514 |
| Bicarbonate of soda | 12.662 | 34.888 | 29.428 | 3.764 | 4.666 | 4.288 | 10.064 | 10.775 | 9.022 | 71.232 | 17.624 | 11.928 | 94.604 | 34.400 |
| Bicarbonate of magnesia | 61.912 | 54.924 | 40.339 | 76.267 | 72.883 | 176.463 | 75.161 | 121.757 | 42.953 | 149.343 | 193.972 | 180.602 | 177.868 | 158.348 |
| Bicarbonate of lime | 124.459 | 131.739 | 89.869 | 120.169 | 93.119 | 170.646 | 101.881 | 143.399 | 109.656 | 170.392 | 227.070 | 238.156 | 202.332 | 178.484 |
| Bicarbonate of strontia | trace. | trace. | trace. | trace. | 0.018 | trace. | trace. | trace. | trace. | 0.425 | 0.082 | 0.867 | 0.002 | 0.189 |
| Bicarbonate of baryta | 0.096 | 0.494 | trace. | 0.875 | 0.909 | 1.737 | 0.726 | 0.928 | 0.070 | 2.014 | 2.083 | 3.881 | 1.231 | 4.739 |
| Bicarbonate of iron | 1.213 | 1.478 | 1.703 | 2.570 | 0.714 | 1.128 | 2.038 | 0.340 | 0.793 | 0.979 | 0.647 | 1.581 | 1.609 | 2.296 |
| Sulphate of potassa | 5.400 | 1.608 | 0.557 | 2.032 | trace. | trace. | 2.158 | 0.889 | 2.769 | 0.318 | 0.252 | 0.520 | 0.762 | trace. |
| Phosphate of soda | trace. | trace. | trace. | 0.007 | 0.016 | 0.006 | 0.009 | 0.016 | 0.023 | trace. | 0.010 | 0.050 | 0.011 | 0.003 |
| Biborate of soda | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. |
| Alumina | trace. | 1.223 | 0.374 | 0.329 | 0.094 | 0.131 | 0.305 | trace. | 0.418 | trace. | 0.458 | 0.077 | 0.263 | 0.395 |
| Silica | 1.283 | 2.260 | 2.561 | 3.155 | 3.184 | 1.260 | 3.213 | 0.840 | 1.458 | 0.665 | 0.699 | 0.761 | 0.735 | 1.026 |
| Organic matter | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. |
| Total per U. S. gal., 231 cu. in. | 617.367 | 630.500 | 302.017 | 687.275 | 331.837 | 888.403 | 537.155 | 700.895 | 680.436 | 991.546 | 1,195.582 | 1,233.246 | 1,184.368 | 1,047.700 |
| Carbonic acid gas | 407.650 | 409.458 | 324.080 | 332.458 | 245.734 | 375.747 | 317.452 | 392.289 | 344.669 | 454.082 | 465.458 | 426.114 | 460.066 | 358.345 |
| Density | 1.0091 | 1.0092 | 1.0034 | 1.0095 | 1.0035 | 1.0115 | 1.0060 | 1.096 | ..... | 1.0120 | ..... | 1.0159 | 1.0135 | 1.0125 |
| Temperature | 52° F. | 52° F. | 50° F. | ..... | ..... | ..... | 50° F. | 52° F. | ..... | 46° F. | ..... | 52° F. | 52° F. | 49° F. |
| *Bases and Acids, as actually found in the Analysis, uncombined.* | | | | | | | | | | | | | | |
| Potassium | 7.496 | 5.419 | 0.949 | 4.931 | 4.515 | 5.024 | 5.326 | 4.611 | ..... | 13.039 | ..... | 17.653 | 18.104 | 4.833 |
| Sodium | 160.239 | 163.216 | 61.003 | 182.084 | 57.259 | 202.058 | 132.006 | 162.324 | ..... | 251.031 | ..... | 299.005 | 286.221 | 263.769 |
| Lithium | 0.163 | 0.202 | 0.093 | 0.976 | 0.499 | 1.179 | 0.445 | 0.490 | ..... | 0.720 | ..... | 0.798 | 0.698 | 1.082 |
| Lime | 43.024 | 45.540 | 31.066 | 41.540 | 32.189 | 58.989 | 35.218 | 49.569 | ..... | 58.901 | ..... | 82.326 | 69.942 | 61.698 |
| Strontia | trace. | trace. | trace. | trace. | 0.009 | trace. | trace. | trace. | ..... | 0.211 | ..... | 0.430 | 0.001 | 0.094 |
| Baryta | 0.056 | 0.292 | trace. | 0.517 | 0.537 | 1.026 | 0.429 | 0.549 | ..... | 1.190 | ..... | 2.292 | 0.727 | 2.799 |
| Magnesia | 16.992 | 15.048 | 11.051 | 20.895 | 19.968 | 48.346 | 20.592 | 33.358 | ..... | 40.915 | ..... | 49.480 | 48.731 | 43.383 |
| Protoiyde of iron | 0.491 | 0.598 | 0.689 | 1.040 | 0.289 | 0.456 | 0.824 | 0.137 | ..... | 0.396 | ..... | 0.639 | 0.651 | 0.929 |
| Alumina | trace. | 1.223 | 0.374 | 0.329 | 0.094 | 0.131 | 0.305 | trace. | ..... | trace. | ..... | 0.077 | 0.263 | 0.395 |
| Chlorine | 246.357 | 241.017 | 82.128 | 282.723 | 90.201 | 314.037 | 203.292 | 246.834 | ..... | 352.825 | ..... | 470.997 | 416.278 | 396.096 |
| Bromine | 0.443 | 0.568 | 0.489 | 0.767 | 0.656 | 1.188 | 0.322 | 6.645 | ..... | 1.718 | ..... | 2.829 | 3.623 | 1.839 |
| Iodine | 0.106 | 0.072 | 0.026 | 0.060 | 0.039 | 0.166 | 0.055 | 0.117 | ..... | 0.208 | ..... | 0.104 | 0.197 | 0.189 |
| Fluorine | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | ..... | trace. | ..... | trace. | trace. | trace. |
| Sulphuric acid | 2.483 | 0.739 | 0.256 | 0.934 | trace. | trace. | 0.992 | 0.409 | ..... | 0.146 | ..... | 0.239 | 0.350 | trace. |
| Phosphoric acid | trace. | trace. | trace. | 0.004 | 0.008 | 0.003 | 0.004 | 0.008 | ..... | trace. | ..... | 0.025 | 0.006 | 0.002 |
| Boracic acid | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | ..... | trace. | ..... | trace. | trace. | trace. |
| Carbonic acid in carbonates | 56.606 | 62.555 | 44.984 | 60.461 | 50.380 | 104.928 | 54.984 | 80.249 | ..... | 112.880 | ..... | 125.973 | 136.133 | 110.019 |
| Carbonic acid, for bicarbonates | 56.606 | 62.555 | 44.984 | 60.461 | 50.380 | 104.928 | 54.984 | 80.249 | ..... | 112.880 | ..... | 125.973 | 136.133 | 110.019 |
| Silica | 1.283 | 2.260 | 2.561 | 3.155 | 3.184 | 1.260 | 3.213 | 0.840 | ..... | 0.665 | ..... | 0.761 | 0.735 | 1.026 |
| Organic matter | trace. | trace. | trace. | trace. | trace. | trace. | trace. | trace. | ..... | trace. | ..... | trace. | trace. | trace. |
| Water in bicarbonates | 23.160 | 25.591 | 18.405 | 24.736 | 20.613 | 42.929 | 22.496 | 33.828 | ..... | 46.183 | ..... | 51.543 | 55.696 | 45.013 |
| Oxygen in $KO(SO_3)$ | 0.496 | 0.148 | 0.051 | 0.187 | ..... | ..... | 0.199 | 0.082 | ..... | 0.029 | ..... | 0.018 | 0.070 | |
| Oxygen in $LiO(HO2CO_2)$ | 0.187 | 0.232 | 0.105 | 1.116 | 0.570 | 1.347 | 0.509 | 0.560 | ..... | 0.824 | ..... | 0.911 | 0.797 | 1.237 |
| Oxygen in $NaO(HO2CO_2)$ | 1.206 | 3.323 | 2.803 | 0.358 | 0.444 | 0.408 | 0.959 | 1.024 | ..... | 6.785 | ..... | 1.136 | 9.011 | 3.277 |
| Oxygen in $2NaO(HO,PO_5)$ | ..... | ..... | ..... | 0.001 | 0.002 | 0.001 | ..... | 0.002 | ..... | ..... | ..... | 0.006 | 0.001 | trace. |
| Total per U. S. gal., 231 cu. in. | 617.367 | 630.500 | 302.007 | 687.275 | 331.837 | 888.403 | 537.155 | 700.895 | ..... | 991.546 | ..... | 1,233.246 | 1,184.368 | 1,047.700 |
| Total residue by evaporation | 537.600 | 542.350 | 238.970 | 602.080 | 260.840 | 740.550 | 459.670 | 588.818 | ..... | 832.483 | ..... | 1,055.730 | 992.540 | 892.670 |

nishes from its artesian tube the most concentrated water yet obtained. The peculiar excellence of the Congress Spring is due to the fact that it contains very much less iron than any other spring, and that it contains in the most desirable proportions those substances which produce its agreeable flavor and satisfactory medicinal effects; neither holding them in excess nor lacking in anything that is desirable in this class of waters.

In the following table are some partial analyses of nearly all the mineral springs of the county, which are sufficiently complete for comparison. The numbers represent grains in 1 U. S. gallon of 231 cubic inches:

*Table showing the Total Quantities of Mineral Matter left by evaporation, and of some of the more important Constituents.*

| Spring. | Total solids as left by evaporation. | Chlorides of sodium and potassium. | All other solids left by evaporation; carbonates of lime, magnesia, etc. | Bicarbonate of lime ($CaO,HO,2CO_2$). | Bicarb. of magnesia ($MgO,HO,2CO_2$). | Bicarbonate of iron ($FeO,HO,2CO_2$). |
|---|---|---|---|---|---|---|
| Ballston Artesian Lithia Well | 1,055.74 | 783.30 | 272.43 | 238.16 | 180.60 | 1.58 |
| Franklin Artesian Well | 992.54 | 693.27 | 299.27 | 202.33 | 177.87 | 1.61 |
| Conde-Dentonian Well | 892.67 | 654.70 | 237.97 | 178.48 | 158.35 | 2.29 |
| Geyser Spouting Well. | 832.48 | 586.71 | 245.77 | 170.39 | 149.34 | 0.98 |
| Hathorn's Spring | 740.55 | 519.55 | 221.00 | 170.65 | 176.46 | 1.13 |
| Hamilton Spring | 611.71 | 411.00 | 200.71 | 144.84 | 104.80 | 1.80 |
| Congress Spring | 588.82 | 408.49 | 180.33 | 143.40 | 121.76 | 0.34 |
| High Rock Spring | 542.35 | 399.10 | 143.25 | 131.74 | 54.92 | 1.48 |
| Washington Spring | 353.23 | 215.00 | 138.23 | 110.23 | 40.56 | 2.40 |
| Excelsior Spring | 611.05 | 473.00 | 138.05 | 90.38 | 72.27 | 2.84 |
| Pavilion Spring | 602.08 | 467.56 | 134.51 | 120.17 | 76.73 | 2.57 |
| Putnam Spring | 354.79 | 220.50 | 134.27 | 110.72 | 60.01 | 3.97 |
| Columbian Spring | 353.08 | 219.00 | 134.08 | 104.89 | 78.05 | 3.26 |
| Star Spring | 537.60 | 408.05 | 129.55 | 124.46 | 61.91 | 1.21 |
| Crystal Spring | 459.67 | 336.79 | 122.88 | 101.88 | 75.16 | 2.04 |
| Eureka Spring | 280.16 | 171.00 | 119.16 | 94.02 | 63.75 | 3.36 |
| United States Spring | 260.84 | 150.49 | 110.35 | 93.12 | 72.88 | 0.71 |
| Empire Spring | 460.32 | 355.16 | 105.16 | 113.54 | 48.10 | 1.34 |
| Seltzer Spring | 238.97 | 135.62 | 103.35 | 89.87 | 40.34 | 1.70 |
| Red Spring | 155.53 | 73.50 | 82.03 | 79.80 | 27.84 | 2.51 |
| Village Spring, Ballston | 153.09 | 75.00 | 78.09 | 65.08 | 21.59 | 2.00 |

*Chalybeates.*—Almost all natural waters contain minute quantities of iron, generally in the form of bicarbonate. In the above analyses of the Saratoga waters are recorded from $\frac{1}{3}$ of a grain to 3 grains of this compound of iron per gallon. All these waters are therefore chalybeates, but the properties of the iron are masked to a greater or less extent by the much larger quantities of other materials. Pliny employed tannic acid in the form of nutgall tincture, which forms ink with the iron, in testing mineral waters before the destruction of Pompeii and Herculaneum. In fact, these ferruginous waters are characterized by a styptic or inky taste, due to the iron which they contain.

*Acid Waters.*—It occasionally happens that springs are characterized by the presence of free mineral acids, such as sulphuric and hydrochloric. The Rio Vinagre, in South America, is supplied by such springs; and it is stated that this stream carries to the ocean daily an amount of acid equal to 82,720 pounds of oil of vitriol and 69,638 pounds of concentrated muriatic acid. There is a celebrated spring of this character in New York State, known as the Oak Orchard Acid Spring, an analysis of which is here presented:

*Analysis of the Oak Orchard Acid Water, by Prof. Porter.*

1 gallon contains:

| | |
|---|---|
| Sulphuric acid | 133.312 |
| Proto-sulphate of iron | 32.216 |
| Sulphate of magnesia | 8.491 |
| Sulphate of lime | 13.724 |
| Sulphate of alumina | 6.413 |
| Sulphate of potash | 2.479 |
| Sulphate of soda | 3.162 |
| Chloride of sodium | 1.432 |
| Silicic acid | 3.324 |
| Organic matter | 6.654 |
| Total grains | 211.207 |

*Alum Waters.*—In several localities waters occur charged to a greater or less extent with alum, which is a double sulphate of alumina and potassa. These waters frequently contain free sulphuric acid, and it is probable that they were all first charged with this acid, which, acting on feldspathic rocks or slates, has dissolved the alumina, potash, etc., forming the sulphates found in them as they issue at the surface. The Rockbridge Alum Spring and the Church Hill Alum Spring, in Virginia, are examples of this class.

*Silicious Waters.*—Almost all natural waters contain small quantities of silica, in the neighborhood of 1 grain in a gallon; but the waters of hot springs, especially those which contain alkaline carbonates, are largely charged with silica, and in the neighborhood of their outlets large masses of silicious tufa are formed. The water of the famous Geyser in Iceland contains 24 grains of silica in the gallon. There are wonderful geysers in California, and quite recently a region in Montana, on the Upper Yellowstone, has been explored in which from 1000 to 1500 hot springs occur. One of these, the Grant Geyser, throws a column of hot water 8 feet in diameter to a height of over 200 feet at regular intervals of thirty-two hours, while others are in almost constant operation.

*Borax Waters.*—Minute quantities of borax (biborate of soda) are found in many mineral waters—as, for instance, the waters of Saratoga—but in a few localities waters occur so heavily charged with this salt as to make it worth while to extract it for manufacturing purposes. Instead, however, of evaporating the waters to extract the borax which they contain, the borax-gatherers content themselves with collecting the crystals formed by natural evaporation along the margins and on the muddy beds of the borax lakes. For many years considerable quantities of borax, called tincal, were brought from a salt lake in Thibet. More recently California has been found to contain borax lakes of great size, in which occur enormous quantities of this valuable salt. No complete analysis of the waters of these lakes has yet been published, but according to G. E. Moore the water contains 535 grains of borax per gallon. Near the borax lake is situated a wonderful hot spring, from which, and perhaps from others of similar character, the borax of the lake has been derived. It is astonishingly rich in ammonia.

*Analysis of a Borax Spring, California, by G. E. Moore.*

| | Grains in a gallon. |
|---|---|
| Chloride of potassium | trace. |
| Chloride of sodium | 84.62 |
| Iodide of magnesium | 0.09 |
| Bromide of magnesium | trace. |
| Bicarbonate of soda | 76.96 |
| Bicarbonate of ammonia, $NH_4O,2CO_2$ | 107.76 |
| Biborate of soda, $NaO,2BO_3$ | 103.29 |
| Sulphate of lime | trace. |
| Alumina | 1.26 |
| Carbonic acid (free) | 36.37 |
| Silicic acid | 8.23 |
| Total grains in 1 U. S. gallon | 418.58 |

V. Water for Manufacturing Purposes.—For manufacturing purposes pond or river water is generally selected, not only because it can generally be obtained in unlimited quantities, but also because it is generally softer than spring-water. For many purposes the impurities of waters are often seriously objectionable. When used in stationary or locomotive boilers, impure water produces incrustations which often form a complete lining. As much as 1300 pounds of calcareous incrustation have been taken from the boiler of a single locomotive on the New York Central R. R. These incrustations are very poor conductors of heat. Their presence in boilers causes, therefore, a great waste of fuel. It is estimated by the French engineers that 45 per cent. of the fuel burned under locomotive boilers is lost owing to the non-conducting power of the incrustations. Furthermore, these scales prevent the contact of the water with the plates of the boiler, the metal becomes therefore overheated, and is rapidly burned out, making frequent repairs necessary. Boiler explosions are sometimes attributed to the presence of incrustations; the metal becoming very much overheated, causes the scale to crack, which permits the water to come in contact with the hot metal; a great quantity of steam being at once generated, the boiler is burst. These incrustations vary somewhat in character with the impurities of the waters by which they are produced. Their chief constituents are carbonate of lime, carbonate of magnesia, and sulphate of lime. The analyses on the following page of incrustations from locomotives on the New York Central R. R. were made by the writer.

Various substances are employed to prevent the formation of these incrustations in boilers, some of which are very effective. Amylaceous, saccharine, and extractive matters tend to prevent the carbonates of lime and magnesia from forming a hard scale, causing them to separate as a loose mud, which can be easily washed from the boiler at convenient intervals. Potatoes, molasses, extractive matters, or substances which yield them, as logwood sawdust, are consequently employed with varying success. Astringent substances, which contain tannic acid, have a similar action. To this class belong catechu extract, oak sawdust, tan bark, etc. Solid particles, as sawdust, clay, chopped straw, etc., serve to diminish the formation of hard scale by presenting nuclei upon which the earthy carbonates are deposited. For the decomposition of sulphate of lime carbonate of soda or chloride of barium is employed. Sal-ammoniac is sometimes employed to convert the car-

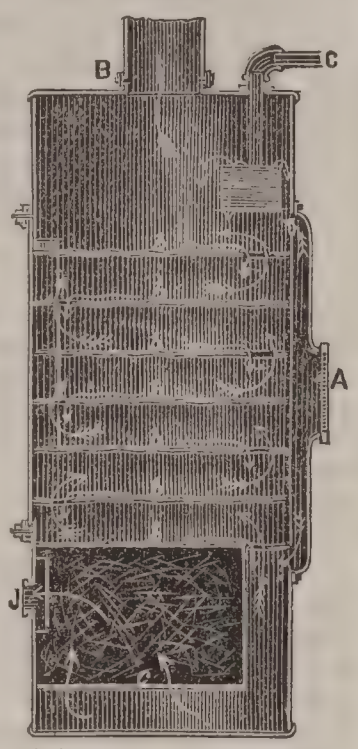
*Analysis of Boiler Incrustations.*

| Source. | Structure. | Thickness. | Sulphate of lime. | Carbonate of lime. | Basic carbonate of magnesia. | Oxide of iron and alumina. | Water. | Organic matter. | Silica. | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Stationary engine, boiler-shop, Syracuse, hydrant water | Compact and crystalline. | 3-16ths inch. | 74.07 | 14.78 | 9.19 | 0.08 | 1.14 | undet. | 0.65 | 99.91 | |
| 2. *Stationary engine, machine-shop, Rochester, 10 mos., canal water, well water, 2 mos. | " | 2 inches. | 71.37 | ..... | ..... | ‰ 26.87 | ..... | ..... | 1.76 | 100.00 | Fair, average representatives of the usual incrustations. |
| 3. Locomotive, No. 211, frt., both roads, Syracuse | " | 1-32d inch. | 62.86 | 12.62 | 18.95 | 0.92 | 1.28 | undet. | 2.60 | 99.23 | |
| 4. Locomotive, surrounding a brace | " | 1-4th to 1-3d in. | 53.05 | ..... | ..... | ‰ 42.16 | ..... | ..... | 4.79 | 100.00 | |
| 5. Locomotive, No. 127, frt., both roads, Syracuse | " | 1-32d inch. | 46.83 | ..... | ..... | ‰ 47.85 | ..... | ..... | 5.32 | 100.00 | |
| 6. Locomotive, No. 202, frt., both roads, Syracuse | " | 1-4th inch. | 30.80 | 26.93 | 31.17 | 1.08 | 2.44 | undet. | 7.75 | 100.17 | |
| Average | ..... | ..... | 56.49 | 18.11 | 19.77 | 0.69 | 1.62 | undet. | 3.81 | | |
| 7. †Stationary engine, Niagara Falls, river water | Friable and gran. | 2 inches. | 4.95 | 86.25 | 2.16 | 1.03 | 0.63 | undet. | 2.07 | 97.54 | |
| 8. ‡Stationary engine, Townsend's Furnace, Albany. | " | 1¼ inches. | 0.88 | 93.19 | 2.84 | 0.36 | 0.15 | 1.96 | 0.62 | 100.00 | Exceptional incrustations, the only ones of their kind analyzed. |
| 9. Locomotive, No. 122, Rochester to Buffalo | Powder. | ..... | 4.81 | ..... | ..... | ‰ 92.27 | ..... | ..... | 2.92 | 100.00 | |
| 10. Stationary engine, Barhydt and Greenhalgh, Schenectady | " | ..... | 30.07 | ..... | ..... | ‰ 61.69 | ..... | ..... | 8.24 | 100.00 | |

bonate of lime into soluble chloride of calcium, and thereby prevent its being deposited. The substances which I have enumerated are placed in the boiler from time to time and allowed to act there. An English chemist, Mr. Clark, proposed purifying the water beforehand by adding lime-water, on the principle of *similia similibus curantur*. The carbonate of lime in the water is held in solution by carbonic acid as a bicarbonate. The lime which Mr. Clark adds takes this extra carbonic acid, forming an insoluble carbonate, and at the same time precipitating the lime of the bicarbonate as insoluble carbonate. The magnesia present is also precipitated by the lime-water; but the sulphate of lime, which forms the hardest and most crystalline incrustations, is not removed by this process. The real objection to this process arises from the vast quantities of water required in practice. A locomotive consumes on the average about 45 gallons of water for every mile that it runs, and on the New York Central R. R. alone about 300 locomotives are employed. As at least twenty-four hours are required to enable the precipitated lime to settle from the water, enormous reservoirs or tanks would be required to contain a sufficient supply for a railroad. Dr. Frankland stated in his examination before the parliamentary committee on the London water bill that all the water supplied to Canterbury, Tring, and to the military hospital at Woolwich is purified by this process, at a cost of about $3 per million gallons for the lime.

An excellent device has been patented by Stillwell to be used in connection with stationary boilers. It is simply a box containing a great number of horizontal shelves. The water for supplying the boiler passes through this, and the exhaust steam from the engine is also admitted to it. The exhaust steam causes the water to boil, and most of the lime which it contains in the form of bicarbonate separates as insoluble carbonate, lodging on the shelves or being caught by a filter of straw at the bottom of the box.

Fig. 9.




Stillwell's Heater and Lime-Catcher.

A, steam enters the heater, and is divided into two currents; *B*, steam escapes from the heater; *C*, cold water enters; *F*, cock with which to regulate supply of cold water; *H*, door of heater; *J*, hot water leaves heater; *L*, glass water-gauge; *a*, overflow cup suspended on the end of cold water pipe; *b b b b*, removable shelves or depositing surfaces; *c*, filtering chamber, to be filled with any suitable filtering material. The feathered arrows indicate the course of the steam, and the plain arrows the course of the water. The bottom of the heater is provided with an opening for drawing off sediment collected there.

Great annoyance was formerly experienced by marine engineers whose boilers were fed with sea-water. Not only was there formed a very hard, strong scale of sulphate of lime, often an inch or more in thickness, but even the salt separated, sometimes entirely filling the spaces between the tubes. By noting the density of the water in the boiler with a hydrometer, and blowing out a portion of the concentrated sea-water from time to time, the engineer was able to prevent the separation of salt, but the separation of sulphate of lime could not be prevented. This became so great an evil, causing the very rapid destruction of the boilers, that the use of sea-water had to be abandoned. Marine boilers are now provided with condensers, by which the steam, after doing its work in the cylinder, is condensed to water again and returned to the boiler. A supply of fresh water is taken on board before leaving port, and is used over and over again until the vessel reaches her destination.

Often for washing or for cleaning cotton, wool, or other fabrics the impurities of water are a great objection; they destroy soap, and affect colors in dyeing; for sugar-refineries and in brewing the character of the water is of great importance. In fact, the highly-prized flavor of some of the English ales is attributed facetiously to the impurities in the water used.

*Filtering Water.*—Filtration is one of the simplest methods for purifying waters; its action is limited to the suspended impurities, such as mud, animal and vegetable substances, etc. Any porous material may be employed in the construction of a filter, the selection being generally governed by the magnitude of the operation. For city supplies, reservoirs are constructed which are provided with porous partitions, or so arranged that the water is obliged to percolate through beds of sand and gravel.

In many European cities filtering basins of great size are employed for filtering the entire water-supply. Filtering beds are constructed many feet thick, consisting of layers of large stones at the bottom, smaller stones above, and finally coarse sand at the top. Galleries arched with brick serve to receive the filtered water, which is then ready for distribution. The river-waters supplied to London, Liverpool, York, Dublin, Edinburgh, Lyons, Marseilles, Genoa, Leghorn, Berlin, etc., are thus purified. In this country the system of filtering river-water is being now introduced at St. Louis, Schenectady, and elsewhere. Many families now make use of rain-water, which is received in a cistern provided with a filtering partition.

Fig. 10.



The Triple Filter.

The sponge filter (Fig. 10) is a very simple filter, which has recently been devised for domestic use. It contains, in the first place, a little cup filled with coarse charcoal and sand, and provided with a network of wire gauze. Above that is

* A mass weighing 21 ounces, which had apparently filled the space between three tubes.

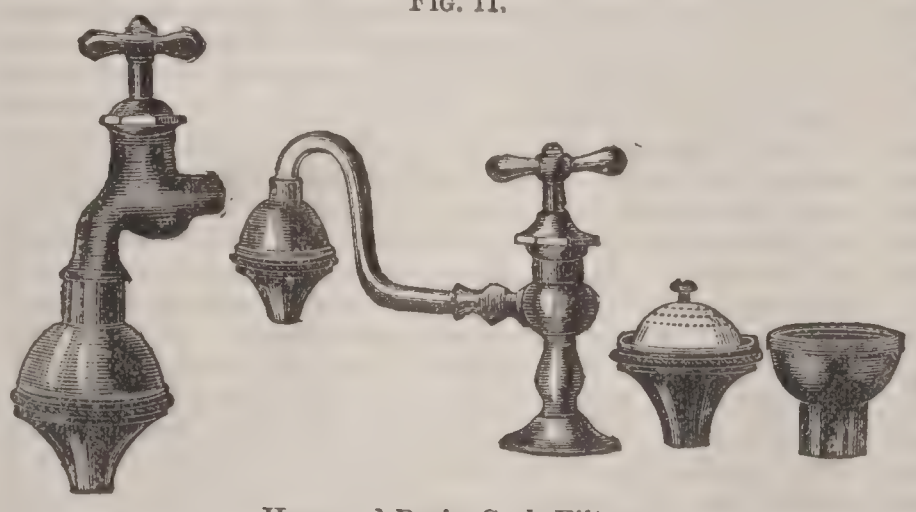
† A mass weighing 14 ounces, evidently detached from a tube.

‡ A mass weighing 16 ounces, evidently detached from a tube.

‰ This number includes those belonging to the two preceding and the two following columns, as obtained by difference.

placed a common sponge, pressed firmly into its place, so that it entirely fills the space. This is encased in a little perforated cup and is placed over the charcoal vessel. The water which passes through this is therefore obliged to pass through the sponge, and then through the charcoal. Although it acts as a perfect filter, it does not seriously interrupt the flow. The advantage of this filter is, that when it becomes clogged and the flow of the water is impeded by the impurities separated, it is merely necessary to open it and take out the sponge, wash it, and return it to its place, and reverse the charcoal cup. Fig. 11 is a house filter without the sand and charcoal cup, containing the sponge only.

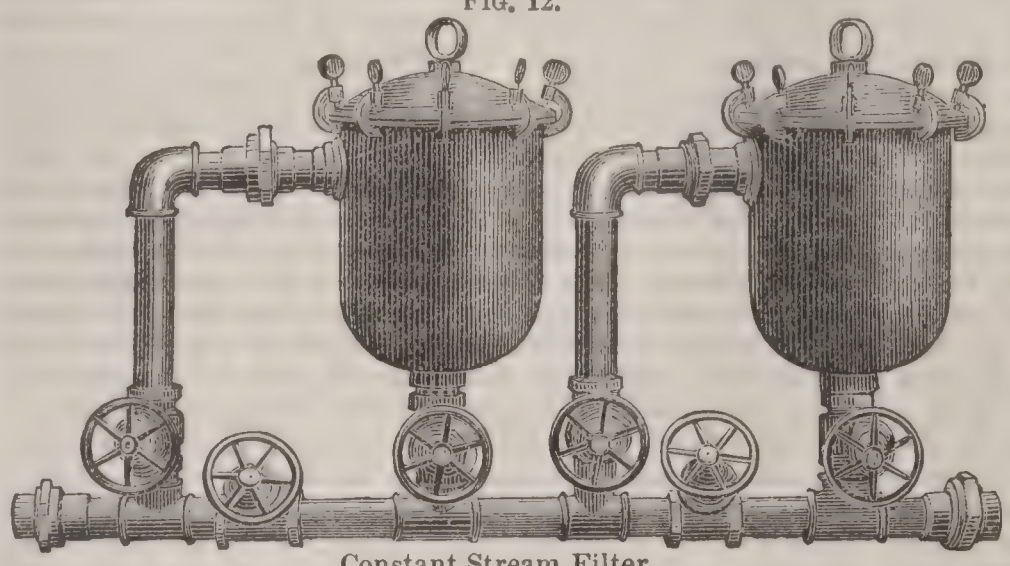
FIG. 11.



Hose and Basin-Cock Filters.

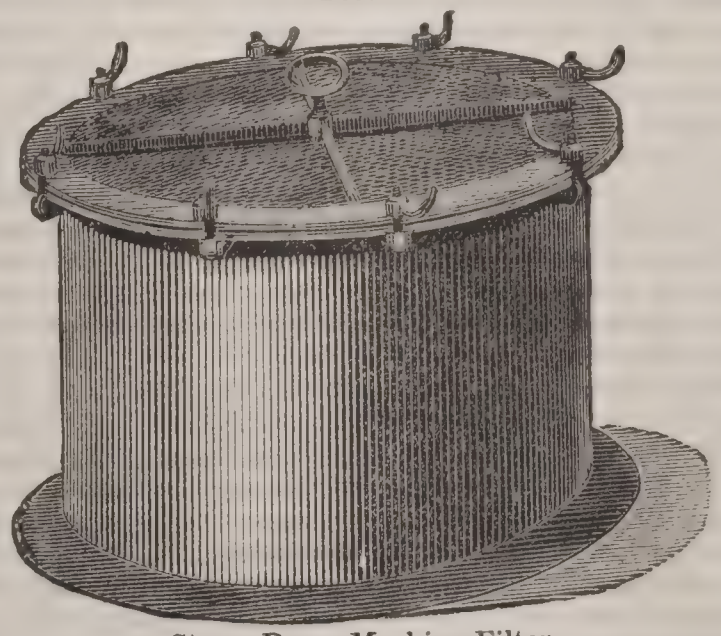
Filters are constructed on the same principle for use in manufacturing establishments. Fig. 12 represents one suitable for a large factory or hotel. As there are really two filters, either one may be cleansed without interfering with the flow of water through the other, as is seen by the arrangement of the cocks. Fig. 13 is a much larger filter, containing six chambers for holding sponges, each 6 inches in diameter, which is designed for paper-factories, where large quantities of water are used. Still larger filters are constructed upon the same principle, up to a capacity of 300 gallons of water per minute. The sponges in every case completely remove the animal, vegetable, and other suspended impurities. Another filter which is often attached to faucets in houses is the common sand filter. It is attached in the same way as the sponge filter, Fig. 11, and by and by, when it becomes clogged, it is merely necessary to reverse it, when the first glass of water passing through cleanses it. This does not permit so free a flow of water as the sponge filter, and, moreover, it is liable to become permanently obstructed by impurities.

FIG. 12.



Constant Stream Filter.

FIG. 13.



Steam Paper-Machine Filter.

*Boiling Water.*—Impurities of animal and vegetable origin are often rendered inert and harmless by simple boiling, and travellers in malarious countries consider this simple precaution a very efficient protection against some of the diseases peculiar to the localities.

*Distillation.*—Distillation is really the most effective method for purifying water, but it is only applicable in special cases. The analytical chemist, the photographer, and sometimes the pharmaceutist, are compelled to resort to distillation to obtain water sufficiently pure for certain of the operations incident to their respective professions. Almost all vessels are now provided with an apparatus by which sea water may be distilled for drinking purposes in case of a long voyage and deficient supply of fresh water. Distilled water must be thoroughly aërated to render it palatable and wholesome.

*Other Methods of Purifying Water.*—Charcoal has the property of purifying water contaminated by organic matters. On this account, water-casks are generally charred on the inside to the depth of an eighth of an inch or so, and it is a common practice, when rain-water cisterns become foul, to throw in a bushel or two of fresh charcoal. Permanganate of potassa, commonly called chameleon salt, is very effective in destroying organic matter in water. Travellers are advised to carry with them a small vial of the crystallized salt. A small particle added to a glass of water renders it pure, as in a few moments it oxidizes or burns up the impurities, which taken into the system might produce fever or dysentery. Running streams undergo purification by the oxygen which they absorb from the air. Very impure waters, when placed in casks on shipboard, frequently undergo a kind of fermentation by which the impurities are worked off and the waters rendered sweet and wholesome. This phenomenon has been noticed in the case of Thames water. Contact with iron, as when water is stored in iron tanks, effects a speedy purification. Filtration over magnetic oxide of iron is said to purify water very rapidly.

VI. WATER FOR DOMESTIC PURPOSES.—For domestic purposes the water of springs is generally selected, because it is cool and clear, having undergone a natural underground filtration; but, as already shown, spring water generally contains a larger quantity of dissolved impurities, hence it is generally harder than river or pond water. Ordinarily, wells receive their supply of water partly from springs and partly by drainage. They are therefore very liable to be contaminated with the soluble impurities of sewage, and frequently serve to disseminate special diseases, such as cholera and typhoid fever. Deep artesian wells, which bring water from deep-lying strata supplied from a distance, are free from organic impurities, though they often contain so much mineral matter as to give them medicinal qualities. This is the case with Dupont's artesian well in Kentucky. One of the most celebrated fresh-water artesian wells is that at Grenelle, a suburb of Paris. It is 1798 feet deep, cost $72,500, and supplies nearly 900,000 gallons daily. The water is received in a reservoir near the Pantheon, and distributed to the adjacent parts of the city. Numerous wells of this character have been bored in London into the chalk-beds, which are from 350 to 550 feet deep, and furnish very wholesome water. Recently, the tube or drive well has become quite popular. A simple iron tube or pipe is driven down through the soil, and in some cases a continual flow of water is obtained; otherwise, a pump is applied, but of course drainage water is obtained, though not to the same extent as in an open well. The drive well is, I believe, an American invention; it was extensively employed by the British army in Abyssinia. For the supply of waterworks of cities and large towns, ponds or rivers are resorted to as furnishing the purest water in sufficient quantities, though in a few cases artesian wells have been relied upon.

*Characteristics of a Good Drinking Water.*—The characteristics of a good drinking water may be enumerated as follows: Its temperature should be at least 10° lower than the temperature of the atmosphere, but it should not be much lower than 45° F. It should be free from taste, except, perhaps, a slight pungency from oxygen and carbonic acid, which is an advantage. Taste is, however, a poor guide. When one becomes accustomed to a certain water, pure water tastes flat by comparison; 50 grains of chloride of sodium in a gallon would hardly affect the taste perceptibly. A third requirement is freedom from smell. A smell should not be perceptible, even when a bottle is half filled with water, placed in a warm place for a few hours, and then shaken. It should be transparent; though it is not necessarily injurious if not transparent. Sometimes water

may contain peaty matter from swamps or vegetable matter from new reservoirs, which is not necessarily unwholesome. With regard to the total quantity of impurities admissible in good drinking water, the sanitary congress which met at Brussels decided that water containing more than 35 grains of impurity in 1 gallon is not wholesome, and that there should not be much more than 1 grain of organic matter. Thirty-five grains is a large quantity for city water, though well waters frequently contain more.

Effect of the Impurities contained in Water.—(1) *Mineral Impurities.*—The quality of the impurities is more important than the quantity. It is found that 5 or 6 grains of lime or magnesia render water unfit for the cooking of leguminous vegetables. On the other hand, it is a great advantage in making tea or coffee to use water of about 5 degrees of hardness—that is, containing about 5 grains of carbonate of lime or its equivalent in the gallon. A person of very nice taste can tell the difference in tea or coffee made with water in which the difference is not more than 2 to 3 grains of lime or magnesia to the gallon. It is on this account that certain wells have a great reputation as "tea wells." In olden times there were two or three such wells in New York. The fine flavor of the tea made with such water is due to the fact that the 5 or 6 grains of carbonate of lime prevent the water from dissolving the astringent matter contained in the tea, without interfering with the extraction of the theine and the other desirable constituents of the leaf. Magnesia in large quantities is objectionable, as are also lime salts. They are liable to cause dyspepsia. It is said that horses acquire a rough coat if supplied with water containing a large quantity of sulphate of lime. Goitre and cretinism are attributed to these impurities in the water; at least, the facts observed make this reference extremely probable. The goitre appeared in the Durham jail, afflicting a large proportion of the convicts. The spring water with which they were supplied was analyzed, and found to contain 77 grains of lime and magnesia salts per gallon. On substituting for this a water containing only 18 grains of these salts, it was found that the old cases rapidly improved, while no new cases made their appearance. In the limestone districts of England, Switzerland, and Central New York this goitre has been traced over considerable areas. At Goruckpoor in India, where the waters are quite calcareous, 10 per cent. of the adults are afflicted with goitre, and many of the children are cretins. Even the cats and dogs are said to be afflicted with cretinism, which is a kind of idiotic insanity. It is a curious fact that in Ireland, on the Waterford side of the Suir, where sandstones and slates prevail, goitre and cretinism are almost unknown, while on the Kilkenny side, where limestones abound, goitre is not uncommon. More recent investigations have shown that moderate quantities of these compounds are actually desirable; at least this is claimed by some of the most distinguished authorities in England, where the subject of water-supply for cities has been most carefully studied. Dr. Letheby has carefully examined the connection between the quantities of lime and magnesia salts contained in the waters used in 65 English and Scotch cities and towns and the average rates of mortality. For convenience of comparison the waters are rated according to their hardness, represented in grains per gallon of carbonate of lime or its equivalent in soap-destroying compounds:

*Table showing Hardness of the Water-Supply, and the Death-Rate.*

| Hardness. | No. of towns. | Average death-rate per 1000. | Average hardness. |
|---|---|---|---|
| Over 10°..... | 25 | 21.9 | 16. |
| 10° to 6°..... | 17 | 24.9 | 8. |
| 6° to 2°..... | 15 | 26.3 | 3.8 |
| 2° and under..... | 8 | 28.5 | 1.3 |

It would certainly appear from these figures that waters containing earthy salts in considerable quantities are preferable to very soft waters. Even if this generalization of Dr. Letheby is not fully sustained, the old theory, which demanded the softest water possible, can hardly stand in opposition to these facts.

(2) *Organic Matter.*—The organic matter of a purely vegetable origin, such as occurs to the extent of 1, 2, or 3 grains per gallon in country springs and wells or in ponds and rivers, even when it contributes a tint of yellow to the water, is entirely harmless and unobjectionable. The nitrates, nitrites, and ammonia salts found in wells in densely-peopled towns are themselves harmless, but their presence proves the contamination of the water with the products of decomposition of animal refuse, and should always be viewed in the light of a warning of the presence of impending danger.

(3) *Animal Excreta.*—The product of the decomposition of animal matter in water is, however, by far the most objectionable impurity. Organic matters, produced by the decomposition of vegetable substances, are not especially dangerous, but the products of decomposing animal substances are highly dangerous, even when in minute quantities. These impurities do not make themselves apparent to the taste. On the contrary, such waters are frequently considered unusually fine in flavor, and persons go a great distance to procure them. Nevertheless, they contain an active poison. Many diseases of the most fatal character are now traced to the use of water poisoned with the soakage from soils charged with sewage and excremental matters. Sudden outbreaks of disease of a dysenteric character are often caused by an irruption of sewage into wells, either from a break in the sewer or cesspool or from some peculiarity of the season. Such contamination of the water is not indicated by any perceptible change in the appearance of the water. The filtered sewage, clear and transparent, carries with it the germs of the disease. At a convent in Munich 31 out of 121 of the inmates were affected with typhoid fever. It was found upon investigation that the well was polluted by sewage, and the disease disappeared as soon as the proper repairs were made. At Pittsfield, Mass., typhoid fever suddenly broke out in a large boarding-school for young ladies. The water was found to be contaminated with sewage owing to a leak in the cesspool. At Edgewater, on Staten Island, in 1866, the inmates of a small block of houses were afflicted with typhoid fever, several deaths occurring. On making investigation, the health officers found that a neighbor, through whose land the underground drain passed, had taken the liberty of closing up the drain, thus sending its contents back upon this block of houses, contaminating the well, and thus actually murdering the unfortunate victims with sewer poison. Dr. Stephen Smith describes an interesting case that came to his knowledge. He visited an old schoolmate, a clergyman, in the country, and in the course of conversation his friend told him of a family in which typhoid fever had made its appearance, five members having already died, while another was then fatally sick. The physician called the attention of his friend to the fact that typhoid fever is now attributed to the poisoning of the water by animal refuse. This was new to his friend, the clergyman, who had not thought of attributing it to anything else than to the visitation of Providence. They went together to visit the locality, and found the house situated on an elevation, with all its surroundings admirably arranged for health. One readily believed the statement that there had not been a case of sickness in the house for twelve years. A few weeks before the fever appeared, when the laborers on the farm were busy taking in the crops, one of the valves of the pump got out of order. Being unable to get their usual supply of water, and being too busy to send for the pump-maker, they sent a man down to a neighboring spring to draw water, who, finding that it was not easy to dip the water of the spring from the shallowness of the pool, drew his supply from a brook near by. From this source the family was supplied for two or three weeks. This stream, higher up, ran through several farmyards and received the surface drainage. The first symptoms of poison by this water were a slight nausea and mild diarrhœa; after several days, typhoid fever in its worst form was ushered in. Of the entire family but two escaped an attack, and they did not use the water. It is a common saying in villages and towns that "There was health in the old houses, while there is death in the new." This is owing to the fact that when villages were first settled the houses were supplied with water from the springs on the hillside, while, as the dwellings multiplied in number, these sources of supply proving insufficient or too distant, wells were sunk in the valley, which of course received the drainage of the locality. Hence diseases such as typhoid and typhus fevers, diphtheria, etc., which were unknown to the early settlers, ultimately became prevalent. New York City, during the last century, and before the introduction of sewers or the Croton water, was ravaged every few years by deadly epidemics, which are now believed to have been favored and invited by the defilement of the wells then in use by sewage and fæcal soakage. No such visitation has occurred since the introduction of the Croton water and the completion of the very perfect system of sewers. Cholera, though it does not originate from polluted water, is disseminated chiefly by the aid of wells and other impure water-supplies. At Exeter, England, in 1832, 1000 deaths occurred from cholera. A purer supply of water was then introduced from a locality 2 miles higher up the river, above the point at which it received the sewage of the town. When the cholera again invaded the city in 1849, only 44 cases occurred, and in the cholera season of 1854 there was hardly a case. In London, in 1854, the water

supplied by the Southwark Co. contained much sewage, while that supplied by the Lambeth Co. was very pure. Both companies had pipes in the same streets, supplying water indiscriminately on both sides. Among those who used the Southwark water the deaths amounted to 130 in 10,000, while among those who drank the Lambeth water they amounted to only 37 in 10,000; 2500 persons were destroyed by the Southwark water in one season. On the previous visitation of 1848–49 the case was the reverse; the deaths from the Lambeth amounted to 125, while those from the Southwark amounted to 118 in 10,000. At that time the Lambeth Co. took their water from a point lower down the river. Another very striking instance occurred in London. The famous Broad street pump supplied water in one of the most fashionable localities of the West End. During the visitation of 1848–49 this pump killed 500 persons in a single week by disseminating cholera. The wealthy people of the West End went to Brompton, a fashionable summer resort, about 5 miles up the Thames, and soon the cholera broke out among them there. The health officers soon discovered, on investigation, that these people had been in the habit of sending to the Broad street pump for tea water, and had brought the cholera with it. A curious case was that of an old spinster who had moved to Hampstead, 3 miles from the pump, but who sent her maid daily for a kettle of the highly-prized tea water. She and her maid were the only persons who suffered from cholera at Hampstead. A similar story might be told of an outbreak of cholera in a shanty village W. of Central Park, and another in a shanty village on the heights across the river. In both cases it was clearly shown that the cholera germs were distributed among the unfortunate squatters by the waters of the single well in each village. There is a famous pump in the 12th ward of Brooklyn, at the corner of Van Brunt street, from which over fifty families obtained their water-supply. In 1866 cholera broke out in five or six of these families, but the spread of the disease was prevented by the prompt action of the health officer, who removed the pump-handle. From these facts it is seen that water aids in disseminating two of the most fatal diseases which affect the human race—the typhoid fever and the deadly cholera. During the ten years from 1856 to 1866 there were 21,000 deaths from cholera in England and Wales, and 150,000 deaths from typhoid fever. There is every reason to believe that at least three-fourths of these deaths might have been prevented had proper attention been paid to the purity of the water-supply. This poisoning by bad water is now fully established, and must awaken communities to the vital importance of securing a pure and unfailing supply of this indispensable beverage.

The Spontaneous Purification of River Water.—While the animal matters which find their way into wells from cesspools and privies are capable of producing the fatal results to which we have called attention, it is now well settled that such matters are speedily oxidized and destroyed, and thus rendered harmless, when they flow into running streams, by the oxygen held in solution in the water. Dr. Alfred Taylor stated before the parliamentary commission that "organic matter in water is only offensive while in process of decay. When this operation is completed, it ceases to be offensive." Sewage which would poison an ordinary well becomes harmless in the running stream; and while the well is always open to suspicion, the river, though it drain populous districts, will nevertheless supply wholesome water. This subject has been most carefully studied in connection with the water-supply of London, and the following facts have been obtained from the official reports on the subject: The area of the Thames watershed, above the point at which the water companies take their supply, is 3676 sq. m., or 2,352,640 acres, while the population is about 1,000,000. There are three large cities, Oxford, Aylesbury, and Reading, each with a population of over 25,000. The cities next in size are Windsor, Guildford, and St. Alban's, containing from 7600 to 9500 inhabitants. Besides these there are thirty other towns, containing from 2000 to 7000 inhabitants each. The average for the entire area is 1 person to about 2⅓ acres, or 272 to each sq. m. The rainfall in this area averages 27.2 inches, and it is estimated that one-third of this quantity flows down the Thames at Kingston. The average flow at Kingston for five years was 1,350,000,000 gallons daily, equivalent to 9 inches of rainfall. In very dry seasons the flow is reduced to 350,000,000 gallons.

There have always been alarmists who have excited the fears of the people of London with regard to the condition of the water-supply, and there are still those who believe that it is not safe to drink it. From time to time Parliament has caused committees to examine into its condition, and a royal commission has had the matter under consideration for several years. A few quotations from the reports of these bodies and from other sources will serve to show the opinions of those who are most entitled to respect. A special committee of the House of Commons considered the report of the royal commission of 1850 on the water-supply, and employed three of the most distinguished chemists of England to aid them in their investigation—Prof. Graham, master of the mint, Prof. W. Allen Miller, and Prof. Hoffman. The final verdict of the committee is embodied in the following sentence: "The Thames water is perfectly wholesome, palatable, and agreeable; uniform, plentiful, and safe in use." The chemical commission, composed of the chemists above mentioned, reported as follows: "As the main drain of a large and populous district, the Thames becomes at all seasons polluted by the sewage of several considerable towns and by the surface-drainage of manured and ploughed land; at the same time, we doubt whether the existence of organic contamination from town-drainage is at present perceptible in the Thames above the reach of the tidal flow (*i. e.* above London), or amounts to a sensible evil. The indefinite dilution of such matters in the vast volume of the well-aërated stream is likely to lead to their destruction by oxidation, and to cause their disappearance. The river may reasonably be supposed to possess, in its self-purifying power, the means of recovery from an amount of contaminating injury equal to what it is at present exposed to in its higher section (*i. e.* above London)." In 1867 another committee of the House of Commons inquired into the water question. After listening to the testimony of a number of the most competent experts they declared that "they were satisfied with both the quantity and quality of the water supplied by the river Thames." The water of the Lea they found "naturally not only wholesome, but comparing favorably with that supplied to other places."

While these extracts represent the general verdict in favor of the Thames water, there were still, and there are even now, a few who dissent from this opinion. The most prominent of these is Dr. Frankland, professor of chemistry at the Royal Institution. Dr. H. Letheby, the medical officer of health for the city of London, thus criticises his opinion: "In reply to your letter of the 5th instant I have to state that I cannot agree with Dr. Frankland that the water of the Thames, after receiving defecated sewage-water, is unfit for domestic use; for, after a large practical acquaintance with the subject as it is observed in the principal streams and rivers of England, I have arrived at a very decided conclusion that sewage, when it is mixed with twenty times its volume of running water, and has flowed a distance of 10 or 12 miles, is absolutely destroyed; the agents of destruction being infusorial animals, aquatic plants and fish, and chemical oxidation." Dr. Frankland seems to contradict himself; for in an article in the *Quarterly Journal of Science* of 1867, he says: "The population in the basin of the Thames above where water is taken is 1,000,000, the drainage of some 600,000 of whom is poured into the river; the sewage is so thoroughly oxidized that no trace of it can be detected in an unoxidized state. The average flow of the river at the point where the companies take their supply is 800,000,000 gallons daily. The sewage contained would be $\frac{2250}{1000000}$."

*Report of the Royal Commission.*—In 1869 the royal commission on the water-supply of the metropolis made their last report, which was published in a folio volume of 128 pp., and was accompanied by a volume of minutes of evidence of 488 folio pp. and an appendix of 144 pp., with numerous maps, etc. In this report they say: "But though for these reasons we believe that the organic contamination of the Thames is much less than is commonly imagined, still it would be sufficient to do great mischief were it not for a most beneficial provision of nature for effecting spontaneously the purification of the streams. Some of the noxious matter is removed by fish and other animal life, and a further quantity is absorbed by the growth of aquatic vegetation; but, in addition to these abstractions, important changes are effected by chemical action. The organic compounds, dissolved in water, appear to be of very unstable constitution and to be very easily decomposed, the great agent in this decomposition being oxygen, and the process being considerably hastened by the motion of the water. Now, as such waters always contain much air dissolved in them, the decomposing agent is ready at hand to exert its influence the moment the matter is received into the water; in addition to which the motion causes a further action by the exposure to the atmosphere, and when (as in the Thames) the water falls frequently over weirs, passes through locks, etc., causing further agitation and aëration, the process must go on more speedily and more effectually. The effect of the action of oxygen on these organic matters, when complete, is to break them up, to destroy all their peculiar organic constitution, and to rearrange their elements into permanent inorganic forms, innocuous and free

from any deleterious quality. This purifying process is not a mere theoretical speculation. We have abundant practical evidence of its real action in the Thames and other rivers."

*Extracts from the Testimony before the Commission.*—Testimony of Sir Benjamin Brodie, professor of chemistry in the University of Oxford: "Oxidization is constantly going on in the soil and in the river, and therefore there must be some point at which the perfect destruction or oxidation of its animal matter must take place. What I think is much more important still is another point—namely, the great dilution of the material; and I should rely upon the dilution quite as much, and more, than upon the destruction of the injurious matter. Supposing the sewerage of a large town, as Oxford, pouring into the river, there are numerous feeders and tributary streams to the river which effectively dilute the sewerage. The sewerage is gradually getting less and less, and therefore its noxious character diminishes, and ultimately disappears."

Testimony of Dr. Odling, professor of chemistry at the Royal Institution and at St. Bartholomew's Hospital: *Q.* "Has your attention been directed to the important principles of the self-purifying processes which are going on in the rivers running at a given velocity?' *A.* "Yes, it has." *Q.* "You will understand my question is not referring to sluggish waters, but to the rivers where the body of water would become exposed to the action of the atmosphere as it passes along?" *A.* "You may see in many rivers, even sluggish rivers, having sewerage discharged into them, that for a mile or two the appearance of the river is affected by the sewerage, but beyond a certain distance there is no recognizable effect at all; the weeds are perfectly clear and perfectly healthy."

Testimony of Dr. Miller, professor of chemistry in King's College, London: *Q.* "Are you of the opinion that water once contaminated with sewerage can never be considered a safe water afterward?" *A.* "I think experience is quite against that; I think it is safe; evidence shows that it is safe in the majority of instances. There may be cases in which danger is produced." *Q.* "Have you made any experiments upon the power of water, in a given course, to oxidize organic matter?" *A.* "I ascertained a remarkable result in 1859 upon the river. I took specimens of the water at Kingston, at Hammersmith, at Somerset House, at Greenwich, at Woolwich, and at Erith on the same day, and I examined the quantity of oxygen which the water contained at all those different points. I found the quantity of oxygen at Kingston was the normal or ordinary proportion; at Somerset House it was much diminished; at Greenwich the whole of the oxygen had disappeared; at Woolwich it was in much the same condition; at Erith it was very much improved, showing that this diminution of oxygen had been produced by the action of the water contaminated with the sewerage of the London district, and that as it passed lower down the oxygen was again absorbed from the air. And, again, it became diluted with a large volume of water from below, from other sources, the Lea, the Ravensbourne, and other tributaries, and in this manner the water had again become oxidized. I look upon this as a direct proof of the effect of oxygen in destroying those organic contaminations which are thrown into the river."

Testimony of Dr. Parkes, professor of military hygiene of the Army Military School at Netley: *Q.* "Have you observed in a case where sewerage has been discharged into a river that after running 3 or 4 miles the effect of the sewerage has been destroyed?" *A.* "Yes, we have that in the case of the Southampton water-supply. Some sewerage passes into the Itchen River, but it is quite destroyed by the time the water is distributed in Southampton; at least there is no detectable quantity." *Q.* "What is the distance?" *A.* "The distance is 6 or 8 miles. I could not undertake to state the distance in which water would purify itself in that way, but there is no doubt that it does purify itself, although in what distance, or in what time, or under what precise circumstances, I could not say."

Testimony of Mr. Leach, engineer to the Thames conservancy board: *Q.* "How soon, in your observation, is the effect of sewerage destroyed by its flow and admixture with the waters?" *A.* "At Windsor it is discharged into a most unfavorable point in the river, where there is little or no stream at ordinary times. The matter which is passed out of the drain floats about in the river there to a very great and very disgusting extent. Two miles, or even a mile below, I could see no traces whatever of the sewerage."

Testimony of Mr. Hawksley, vice-president of the Institute of Civil Engineers: "The great complaint of London water is not the quality of the water itself, so much as the polluted district through which it passes. That, I think, there is the greatest possible amount of misconception upon. There is a great deal of prejudice—not unnatural at all, but still amounting to prejudice—upon that question. I believe—in fact, I know—that the water of the Thames at Hampton is a very excellent water—very pure, very free from organic matter, and that what little organic matter there is, is of a very innocuous character." *Q.* "What quantity of water, as compared with the volume of sewerage, is necessary for the purpose of breaking up into its original elements the sewerage which has been discharged into it?" *A.* "Generally about 20 to 1. If the water flows rapidly and is very much disturbed, so as to be continually receiving fresh oxygen, a smaller quantity, even 12 to 1, will effect the process; if it proceeds very tardily, it may take a little more, but usually 20 to 1 is perfectly abundant." *Q.* "You remember, do you not, the original condition of the river at Leicester after receiving all the sewage of the town into it?" *A.* "Yes, perfectly well. At Leicester the water was as black as this ink; I do not mean to say that it was absolutely so thick, but looking at it in a mass it was as black as ink; nothing would live in it, and the smell was abominable; but by the time it got to Loughborough, 12 miles below, it was entirely restored to its pristine condition; you could stand on the bridge there and see the fish swimming among the beautiful reedy and other plants growing in the water, just as in the purest stream; you could see every pebble at the bottom. That is an instance of the effect of oxidation." *Q.* "The water has symptoms of returning purity, has it not, within 4 miles of Leicester?" *A.* "Yes, but not to the same extent as at Loughborough; the water was perceptibly impure, at the driest period of the year, down as far as Barrow; it could be just perceived there, but at Loughborough it was perfectly restored." "There is no such thing as a particle of fæcal matter put into the Thames at Oxford finding its way down to Hampton Court. It is all burnt up, in fact, by the combustion set up by the oxygen."

*The Cholera Question.*—It having been established, with some considerable degree of probability, that the wells in certain parts of London had aided in disseminating the cholera poison during the successive visitations of that disease to the metropolis, an opinion had gained credence that the water of the Thames had contributed in no small measure to swell the awful list of victims who died from that disease, especially the water supplied by the East London waterworks. Considerable testimony was therefore taken upon this point, the most important of which we will quote. Testimony of Dr. Robert Angus Smith, government inspector of alkali-works: "If the germs pass into the rivers, we do not know how far they may be carried. On the other hand, we do not know that they ever can be carried in pure water; the dissolved oxygen may destroy them, as it unquestionably does putrescent matters. A positive proof of their transmission in otherwise pure water is wanting. One might ask if a cholera germ in the water at Oxford would produce disease in London; and one might answer by asking if one cholera germ passing into the air at Woolwich would produce disease in Pimlico. This we do not know, but it seems probable that disease cannot be carried far by pure air, nor by water with much oxygen in it, which is equal to pure air. We are informed that the atmosphere is full of germs, but the evidence seems to be that it requires an unusual excess to attack us successfully; it seems to be a question of quantity."

Testimony of Dr. Letheby, medical officer of health to the corporation of London: *Q.* "Taking the case of the cholera disease and the discharges from the human body being mixed up with the sewage, do you consider that any germs of that disease would be carried down in water?" *A.* "At the present moment, we do not know what the germs of disease are; if the germs of the disease be decomposing matter, then I do not think that they would exist in the water; but if the germs of the disease be living matter, then it is possible that they may exist in the water; but as nobody, as far as I am informed, can tell us what the germs of cholera are, it would be premature for me or anybody to theorize as to the probability or the possibility of their existing in the water." *Q.* "You are aware that it has been alleged that the main cause of the cholera in the E. end of London was due to the water-supply; do you entertain that opinion? *A.* "No; I entertain the opposite opinion. It was a matter of duty with me to investigate the whole of the circumstances connected with the East London supply; in the first place, it was supplied to the hospital to which I am attached; in the next place, it was supplied to the eastern division of the city, where as officer of health it was my duty to look well into the matter; and in the third place, I had a general interest in it scientifically, apart from any official connection with the subject, and I was very desirous to ascertain whether or not the water had been in any way concerned in the propagation of the disease; I therefore investigated it very fully."

*Q.* "Do you think the present supply of water to the London people is wholesome water?" *A.* "I do—a thoroughly wholesome water."

In his report on the sanitary condition of the city of London for the years 1866–67, Dr. Letheby is much more explicit in his discussion of the cholera epidemic of 1866. He says on p. 26 *seq.*: "But difficult as the problem is, to determine the exact value of the several circumstances which influence the severity of the disease, and especially those which give to it its marked local intensities, enough has been ascertained to indicate its general habits, and to show that it fixes itself at low levels in proximity to tidal rivers, among dense populations that are living in ill-constructed houses that are filthy, badly ventilated, badly drained, and generally defective of sanitary provisions; and the inference is, that the actual agent of cholera, be it what it may, can only find congenial conditions for its full development in damp and impure air. The theory of Pettenkofer is, that the essential conditions for the active manifestations of the disease are a porous soil, charged with excrementitious matter, and having a certain degree of hydration, as happens when the subsoil water is just drawn off or is slowly retiring. All these conditions were singularly coincident with the localization of the disease in the eastern districts of London, for the soil is gravelly, and therefore very porous to air and water, and it is largely charged with excrementitious matters derived from the local tide-locked sewers. It is also remarkable that for some months before the outbreak of the disease the subsoil water had been gradually sinking in consequence of the drainage operations that were necessary for the construction of the main low-level sewer and its branch to the Isle of Dogs. Now, according to Pettenkofer, it is exactly under these circumstances that a district is most liable to choleraic infection. Another theory which has been advanced to account for the local character of the outbreak is, that the water distributed to the infected districts was charged with choleraic matter; but, looking at all the facts of the case, it is clearly evident that while none of them are discordant with Pettenkofer's theory, a large number are in open and direct antagonism to the water hypothesis. In point of fact, it is necessary for the acceptance of such a speculation not only that some clear proof should be given of the actual pollution of the water with choleraic matter, but also that the time of the outbreak throughout the infected district was coincident with the distribution of such water, and that it did not notably fail to produce the disease wherever it was sent. It is likewise necessary to show that the disease was strictly confined to the area of such distribution, and that the use of other water was not accompanied with like severe results. The alleged pollution of the water rests upon a series of assumptions, many of which are in the highest degree improbable. Apart, however, from the improbabilities of these assumptions, it is a fact that the water which is said to have been thus polluted did not produce its effects in the several districts to which it was distributed in anything like uniformity of time or force. Suppose, by way of illustration, that alcohol or arsenic had become mixed with the water, and that on a certain day it was distributed to the public; we should expect to find that the action of the poison was not only manifested at the same time over the whole district of supply, but that it was confined to that district. Not so, however, with the water in question, for although it is not alleged to have been more than once polluted, yet the first effects in the several districts occurred at long intervals; and there were many places to which it was distributed where there was no sign of the disease, while others which did not receive the water were seriously affected. The dates of the outbreak of the disease in the districts supplied with the East London water were as follows: Bromley, June 27; Poplar and Bethnal Green, June 30; Shoreditch and Mile End, July 7; Whitechapel, Stepney, and St. George's-in-the-East, July 14; and the East London Union, July 28. A month, therefore, elapsed between the first outbreak of the disease in the several districts. It is, moreover, remarkable that, while it was so violent in many of the districts of supply, it was absolutely powerless in others. The death-rate, for example, of Bethnal Green was 63 per 10,000 of the population; Whitechapel, 78; Poplar, 85; and St. George's-in-the-East, 93; whereas the districts of Stamford Hill, Upper Clapton, Walthamstow, Woodford, Wanstead, Leytonstone, Buckhurst Hill, North Woolwich, and Silvertown were absolutely untouched by the disease, notwithstanding that they received the same water and at the same time. More remarkable still, there were places in the very heart of the cholera-field, and others close adjoining it, where the residents received the same suspected water and used it freely without suffering in the least degree. In the Limehouse School, around which the cholera was frightfully fatal, there were 400 children who drank the same water as their neighbors, and yet there was not even a case of diarrhœa among them. In the London Hospital, which is also in the heart of the cholera-field—for it is surrounded by the districts of Whitechapel, Bethnal Green, Mile End, Old Town, and St. George's-in-the-East—there was an average resident population of 463 persons, and, although they drank freely of the unfiltered East London water, yet there was not a case of illness among them. Again, in the eastern division of the city of London, which adjoins the cholera-field, the suspected water was supplied to 161 houses, with a population of about 1732 persons, but except in one of these houses (20 Somerset street), which is on the boundary of Whitechapel, there was not a single death from cholera; and to verify this, I have obtained the addresses of all the persons who died in the cholera ward in Bishopsgate street. But, besides this, the disease was singularly fatal in places where the suspected water was never used. In Crown Court, Blue Anchor Yard, Whitechapel, where the water-supply is from the New River, the mortality was at the rate of 284 per 10,000. In Boar's Head Yard, of the same district, which is also supplied by the New River, the death-rate was 193 per 10,000; and indeed there are eighteen courts in Whitechapel where none of the East London water was used, and yet, out of an aggregate population of 4351 persons, there were 30 deaths from cholera, the mortality being at the rate of 69 per 10,000; that of the whole district being but 77. So that, on carefully examining the facts in their relation to the water theory, we find—(1) That there is no proof whatever of choleraic pollution of the water; (2) that there was no coincidence of time in the appearance of the disease in the several districts supplied with the suspected water; (3) that numerous districts receiving the same water, but situated at high level or placed beyond the cholera-field, were entirely exempt from the disease; (4) that even in the very heart of the cholera-field, there were places receiving and using the suspected water with impunity; (5) that other places not supplied with the water, but situated within the infected area, suffered equally with the neighborhood.

"I am far from wishing it to be thought that choleraic matter diffused through water will not produce disease—there is abundant evidence to show that it is often a prolific source of it—but I am anxious, in dealing with a question of so much public importance as the origin of the late epidemic, that none of the facts should be perverted, and that no hasty or ingenious hypothesis, without solid foundation, should take possession of the public mind. In the conduct of inquiries like this there should be a calm, a full, and a candid examination of the facts; we should endeavor to study the phenomena in a philosophical spirit, and apply to them the tests of sound induction; we should strive also to deduce from them such laws as will not only expose the nature of the malady, but will at the same time enable us to treat it successfully. Rash opinions, boldly asserted and tenaciously held, though they may force themselves on public attention, rarely lead to useful results; and while they have their hold on the popular mind they seriously hinder the progress of real knowledge."

These extracts are sufficient to indicate the opinions of the most eminent medical officers, chemists, and engineers who have considered the fitness of the waters of the Thames for supplying the people of London with wholesome water. The verdict of the commissioners, after carefully and conscientiously weighing all the testimony presented, is as follows: "The only point raised against the Thames water on the ground of organic contamination is of less positive character; it is said that water which has once been contaminated with sewage may still contain undecomposed organic matter, which, though inappreciable by the most delicate chemical tests, may still exercise prejudicial effects on the human system. The strongest form of this objection has reference to some opinions now prevalent, that certain forms of disease, such as cholera and typhoid fever, are propagated by germs contained in excremental matter; and it is conceived possible that when matter of this kind once gets into streams, these germs may escape destruction and long preserve their dangerous character. It is said that no process is known by which such noxious material can be removed from water, and therefore it is argued that water which has at any time been contaminated by sewage is henceforth unsuitable for domestic use. These opinions have been advanced by many eminent men of science; they are worthy of respectful attention, and ought to operate as a constant stimulus to the most searching examination of the state of the water, to the improvement of the modes and means of scientific analysis, and to the diligent collection of medical data as to the effect of the waters upon the public health. But we cannot admit them as sufficiently well established to form any conclusive argument for abandoning an otherwise unobjectionable source of water-supply; we are of opinion that there is no

evidence to lead us to believe that the water now supplied by the companies is not generally good and wholesome." This report was made in 1869, and has been before the British public in an accessible form, in all its details, nearly seven years, and its conclusions have been generally accepted. The most recent opinion is contained in a voluntary communication made by Dr. Alfred S. Taylor, the distinguished writer on chemistry, toxicology, and medical jurisprudence, to the secretary of the West Middlesex Water Co., under date of Mar. 7, 1872. He says, "Having during the last twenty-one years made analyses of the water supplied to my house by the West Middlesex Co., and compared it with numerous waters derived from rivers, springs, and lakes in England and Scotland, I can confirm Dr. Whitmore's general conclusion that the water is good in quality and perfectly wholesome. This opinion is not based merely on chemical analysis, but on twenty-one years' experience derived from its use for all domestic purposes."

The water of the Thames has been selected as the basis of discussion, not only because it had been more carefully studied than any other source of city supply, but because it may be considered an extreme case. Notwithstanding the fact that one-half the supply of London, a city of considerably more than 3,000,000 inhabitants, is obtained from it, while the river Lea furnishes nearly all the rest, London was said by Dr. Edwin Lankester, coroner of Middlesex, to be the *healthiest city in the United Kingdom*. Tours is supplied from the Cher; Lyons from the Rhone; Toulouse from the Garonne; Angers and Nantes from the Loire; Paris from the Seine, the Canal d'Ourcq, and the Marne; Berlin from the Spree; Hamburg and Altona from the Elbe. The last-named city, which is a suburb of Hamburg, takes its supply from a point 8 miles below, when the water has received the drainage of 230,000 people. Most of the above-mentioned rivers are among the largest streams in France and Germany, and flow through extensive and densely-inhabited districts, yet we have no reason to believe that there is any *permanent* defilement of the waters.

That there is generally no fear on the part of engineers and those having charge of water-supply in American cities is fully shown by the fact that many of our largest cities take water from rivers. Jersey City and Trenton and Hoboken are supplied from the Passaic; Philadelphia from the Delaware and Schuylkill; Washington from the Potomac; Cincinnati and Louisville from the Ohio; and St. Louis, New Orleans, and many other cities from the Mississippi.

The Pollution of Streams by the Refuse from Factories.—It is often suggested that the waters of our rivers are liable to become polluted to a dangerous degree by refuse chemicals from paper-factories, woollen mills, printworks, and chemical works. While this may undoubtedly be true in some densely-populated portions of England, where the factories are numerous and the streams very small, it is not probable that for years to come this source of pollution need be feared in this country. Our rivers are too large and our factories too much scattered, and the importance of turning all waste products to account is made imperatively necessary by the sharp competition which prevails among manufacturers. This latter point is well illustrated by our gas companies, who now derive an important revenue from the sale of their coal-tar and ammonia-water, offensive products which they formerly allowed to run to waste. The waste products of our most important industries are entirely harmless when diluted with large volumes of water. They consist chiefly of sulphuric and hydrochloric acids, lime, potash, soda, iron and alumina salts, chloride of lime, exhausted dyewoods, and soapsuds used in scouring wool. The more powerful form, when mingled, harmless salts, carbonates, sulphates, and chlorides, which are normal constituents of all river waters. The action of many of these products, if appreciable at all, will be to purify the waters by oxidizing or precipitating the matters derived from sewage. Salts of iron and alumina are especially efficacious in purifying waters. Alum is often used in the West for clarifying the muddy waters of the streams, a pinch being added to a barrel of the water, which on standing a few hours becomes clear and limpid. The possibility of objectionable pollution will depend in each case upon the ratio of the refuse matters to the quantity of water in the stream. Dr. Edward Smith, in his *Manual for Medical Officers of Health*, states that the contamination of streams by the refuse of factories prevails exceedingly in Yorkshire and Lancashire. The waters of the river Irwell, a small stream, present the differences in composition at their source and below Manchester shown in the preceding table.

*Grains of Impurities in 1 Imperial Gallon.*

| Impurities. | At source. | Below Manchester. |
|---|---|---|
| Organic carbon | 0.1009 | 0.8211 |
| Organic nitrogen | 0.0175 | 0.2324 |
| Total nitrogen | 0.0343 | 1.1536 |
| Chlorine | 0.8050 | 6.7410 |
| Hardness | 2.6040 | 16.0440 |
| Total solids | 5.4600 | 39.0600 |

The examination by the rivers pollution commission of fifteen samples of waters contaminated by the cotton and woollen mills in Yorkshire showed the following quantities in 1 imperial gallon which were thrown into the waters of the rivers:

*Grains of Impurities thrown into each Imperial Gallon.*

| | |
|---|---|
| Organic carbon | 45.3481 |
| Organic nitrogen | 7.2198 |
| Nitrogen as nitrates and nitrites | 0.0287 |
| Ammonia | 8.1529 |
| Total combined nitrogen | 14.0105 |
| Chlorine | 15.3580 |
| Arsenic (computed as metal) | 0.0077 |
| Mineral matters * | 332.3880 |
| Total solids * | 235.9000 |

"The commission gave a page in their report of 1871 to a fac-simile of a letter written with the water of the river Calder at Wakefield, which equals in depth of color that from a watered ink; and similar examples might have been made from the river water at Bradford."

A clearer idea can be obtained of the influence of factory refuse on river waters by comparing the quantities of chemicals used with the quantities naturally contained in the streams. The Croton water contains in 1 U. S. gallon of 231 cubic inches the following *normal* impurities:

*Grains in 1 U. S. Gallon.*

| | |
|---|---|
| Soda | 0.326 |
| Potassa | 0.097 |
| Lime | 0.988 |
| Magnesia | 0.524 |
| Chlorine | 0.243 |
| Sulphuric acid ($SO_3$) | 0.322 |
| Silica | 0.621 |
| Carbonic acid | 2.604 |
| Organic and volatile matter | 0.670 |
| Total | 6.395 |

One hundred million gallons of this water are used daily in New York, in which are contained the following quantities of the above-mentioned substances in pounds and in tons of 2000 pounds:

*Impurities in 100,000,000 gallons of Croton Water.*

| Impurities. | Pounds. | Tons. |
|---|---|---|
| Soda | 4,657 | 2.319 |
| Potassa | 1,385 | 0.692 |
| Lime | 14,114 | 7.038 |
| Magnesia | 7,485 | 3.742 |
| Chlorine | 3,471 | 1.735 |
| Sulphuric acid | 4,600 | 2.300 |
| Silica | 8.858 | 4.429 |
| Carbonic acid | 37,200 | 18.600 |
| Organic and volatile matter | 9,571 | 4.785 |
| | 91,341 | 45.640 |

As the average flow of the Croton River is 400,000,000 gallons daily, there are 365,428 pounds, or nearly 183 tons, of impurities carried to the ocean daily by a stream which does not receive any refuse from factories. The Thames at Kingston has an average flow of 1,250,000,000 gallons (imperial) daily, and the water contains—

| | |
|---|---|
| Inorganic impurities | 19.00 grains. |
| Organic and volatile impurities | 1.68 " |
| Total per gallon | 20.68 grains. |

This is equivalent to 3,364,286 pounds, or 1682 tons of 2000 pounds, of inorganic matter daily; of this two-thirds, or 1121 tons, are carbonate of lime, and 271 tons are sulphate of lime.

At the Arnold Printworks, at North Adams, Mass., on the S. branch of the Hoosac, the following quantities of the most common chemicals were used daily: lime, 1¼ barrels; soda-ash, 200 pounds; sulphuric acid ($H_2SO_4$), 320 pounds. There were contained in the 43,200,000 gallons of water that flowed daily down the stream—

| | Pounds. | Tons. |
|---|---|---|
| Lime | 10,793 | 5.396 |
| Soda (NaO) | 2,050 | 1.025 |
| Sulphuric acid ($H_2SO_4$) | 1,715 | 0.857 |

Or, as combined—

| | Pounds. | Tons. |
|---|---|---|
| Carbonate of lime | 18,852 | 9.476 |
| Carbonate of magnesia | 10,342 | 5.171 |
| Sulphate of lime | 574 | 0.243 |

The Valley Bleachery on the Woonasquatucket River at Providence, R. I., consumed daily, sulphuric acid, 17 pounds; soda-ash, 3000; bleaching-powder, 1500.

The following table gives the most complete exhibit of

* These numbers are incredible, and can hardly be accepted as presented without further explanation.—C. F. C.

the character and quantities of chemicals, etc., consumed in a large factory; it shows the average daily consumption of materials of all kinds at the Atlantic De Laine Works at Providence, R. I., for the ten months from Jan. 1, 1870, to Oct. 29, 1870. The quantity of wool washed amounted to 1926 pounds per day. The flow of the stream was 36,000,000 gallons in twenty-four hours.

*Daily Consumption of Chemicals at the Atlantic De Laine Works.*

| Chemicals. | Pounds consumed. | Grains per gallon of water in river. |
|---|---|---|
| Sumac | 291.41 | 0.05665 |
| Hypernic wood | 43.99 | 0.00855 |
| Turmeric | 73.33 | 0.01425 |
| Logwood | 144.05 | 0.02800 |
| Fustic-wood | 66.04 | 0.01283 |
| Cudbear | 63.91 | 0.01242 |
| Madder | 10.53 | 0.00204 |
| Aniline colors | 1.17 | 0.00022 |
| Sulphate of iron | 4.04 | 0.00078 |
| Nitrate of iron | 88.56 | 0.01721 |
| Muriate of tin | 29.09 | 0.00565 |
| Stannate of soda | 43.68 | 0.00849 |
| Sulphate of copper | 90.12 | 0.01751 |
| Sulphate of soda | 43.75 | 0.00850 |
| Alum | 23.74 | 0.00461 |
| Cream of tartar | 9.91 | 0.00192 |
| Prussiate of potash | 14.13 | 0.00274 |
| Bichromate of potash | 8.44 | 0.00164 |
| Sulphuric acid | 136.39 | 0.02651 |
| Soap | 90.12 | 0.01751 |
| Total | 1209.75 | 0.23508 |

Supposing all the materials used to have been allowed to run into this little stream, less than one-tenth the size of the Croton, the entire pollution would have amounted to less than $\frac{1}{4}$th grain per gallon. As a matter of fact, a large portion of these substances were fixed upon the goods and sent to market, while one-half the entire quantity consisted of dyewoods, which are chiefly composed of insoluble cellulose (sawdust and chips). It is not probable that the refuse from this factory added .05 of a grain per gallon to the water of the stream.

During the war it was feared that some attempt might be made to poison the Croton supply of New York. The following figures show how difficult the task would have been. To poison the 100,000,000 gallons supplied to the city in a single day with strychnine, supposing each pint of water to have received the smallest fatal dose of this alkaloid, $\frac{1}{16}$th grain, would have required 7285 pounds, or $3\frac{1}{2}$ tons, of strychnine—a quantity not to be found in all the markets of the world. To procure such a quantity it would be necessary to order an extra supply of *Nux vomica* beans from the East Indies three or four years in advance to secure their collection by the natives. Supposing arsenic to have been selected, at the rate of 2 grains (the fatal dose) to the pint, 114 tons would have been required, with special means to secure its solution in the water.

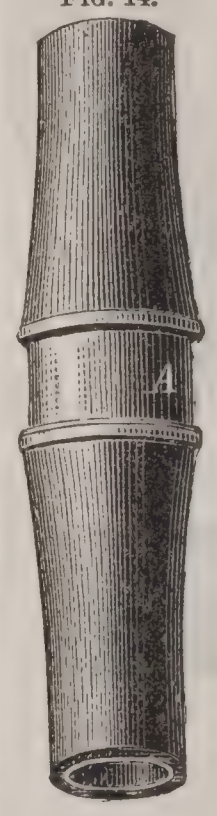
Metallic Impregnations.—Water is frequently rendered impure by the metallic tubes used to conduct it. Organic matter, nitrates, nitrites, chlorides, etc., and in some cases even pure water, attack certain metals, causing them to dissolve.

*Copper.*—Cases of sickness have occurred caused by water drawn through copper pumps, copper having been actually detected in the water.

*Lead.*—Lead is by far the most common material used in the construction of service-pipes for water, and this metal is the one which is the most easily dissolved by water, and at the same time most poisonous in minute quantities, being a cumulative poison. A celebrated case occurred in the royal family of France at Claremont, where one-third of the persons who drank of the water were affected. This water contained only $\frac{1}{10}$th of a grain of lead in a gallon. As little as $\frac{1}{100}$th of a grain of lead to the gallon has been known to produce palsy in persons who habitually drank it. It is a great pity that the peculiar advantages of lead as a material for the manufacture of water-pipes are more than counterbalanced by the danger of lead-poisoning. When the Croton water was first introduced into New York, it contained considerable lime derived from the mortar of the recently-constructed aqueduct. This prevented, to a considerable extent, the action of the water on the lead pipes, and it was stated at that time that no lead was taken up by the Croton water; but as the lime of the mortar became carbonated, the water ceased to dissolve it and began to act upon the lead pipes. Examinations have recently been made of Croton water which had been in contact with lead for different lengths of time, under usually-occurring circumstances, of which the following are the results: (1) A gallon of Croton water from a lead-lined cistern, in which it had stood several weeks, was found to contain 0.06 grain of metallic lead. (2) A gallon of water which had remained six hours in the lead pipes of a private residence yielded 0.11 grain metallic lead, a considerable portion of which was visible to the eye in the form of minute white spangles of the hydrated oxycarbonate ($PbO,HO + PbO,CO_2$). (3) Water drawn from one of the hydrants of the School of Mines laboratory in the middle of the day, when the water was in constant motion, yielded traces of lead. This water reaches the school through about 100 to 150 feet of lead pipe. These results indicate the source of many hitherto unaccountable cases of lead-poisoning, and are of a character to alarm the residents of New York, and to lead them to adopt precautionary measures for protection against this insidious cause of disease. Certainly, no pains should be spared to impress upon servants the importance of allowing the water to run for a few minutes before taking it for drinking or cooking purposes, especially early in the morning, after the water has stood all night in the pipes. The habit of filling the kettle from the boiler, or of using water from the boiler for any purpose except washing, is very dangerous. The following case recently occurred in New York: An elderly gentleman was completely prostrated with paralysis or palsy. His physician at once suspected lead-poisoning from his symptoms, and instituted inquiries which developed the fact that the patient had been using wheaten grits for dyspepsia, and that the first duty of the cook in the morning had been to soak them preparatory to boiling them. She had therefore used daily the water which had stood all night in the pipes. The occurrence of a considerable portion of the lead in experiment No. 2 in suspension, instead of solution, is an additional argument for the use of filters, though it will of course be useless to employ them unless they are frequently reversed, that they may be cleansed.

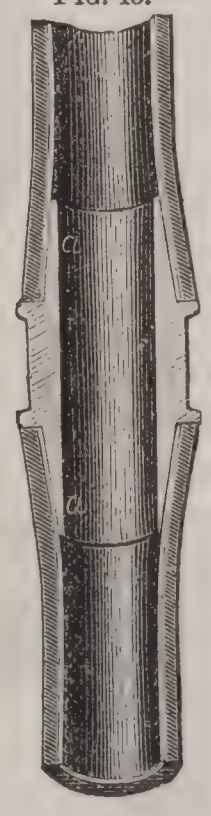
*Substitutes for Lead.*—Various substitutes have been suggested for lead, as, for instance, wrought iron, which generally makes the water rusty; galvanized iron, which is said to be objectionable on account of the zinc, which is readily taken up by the water, rendering it unwholesome, numerous cases of zinc-poisoning by these pipes having occurred in New England, where this pipe is much used; gutta-percha has been suggested, but it is not durable; brass is used to some extent, but is dangerous: Prof. Appleton of Brown University has found both copper and zinc in water supplied through a brass pipe; glass, porcelain, etc., have also been tried. None of these substances possess the peculiar flexibility, softness, and other desirable qualities of lead, which makes it so easy to cut and bend, and join and fit pipes of this metal. The problem, therefore, is to provide a pipe which shall possess all the good qualities of lead, and be free from the one great objection—namely, the danger of lead-poisoning from its use. This has been achieved by the invention of the *lead-encased block-tin pipe* or *tin-lined lead pipe.* This is essentially a pipe of pure tin surrounded by a lead pipe, to which it is firmly and perfectly united by an intervening alloy or solder composed of the two metals. The water comes in contact with the pure tin surface only, and cannot therefore be contaminated with lead. That tin is harmless it is hardly necessary to argue, as vessels covered with this metal are extensively used for culinary purposes throughout the civilized world. It has been argued that commercial tin contains arsenic; but if we can consume daily, with impunity, food which has been boiled and stewed in tin pans, notwithstanding the arsenic contained in the tin coating, we need have little fear of poisoning from the trace of arsenic which may possibly be present in the tin lining of this sanitary pipe. The tin-lined pipe fully realizes all that is desired as a service pipe for aqueduct water. Tested side by side with ordinary lead pipe, waters which take up from $\frac{1}{10}$th to $\frac{2}{10}$ths of a grain of lead per gallon from the lead pipe are not perceptibly affected by remaining for considerable lengths of time in the tin-lined pipe. It was at first thought that the expense of the tin would interfere with the introduction of this pipe, but it is

Fig. 14.




Joint with the Pipe attached.

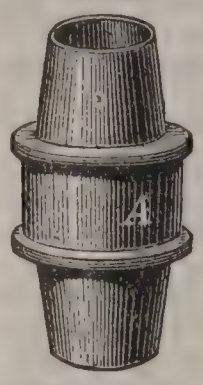
Fig. 15.




Section of Jointed Pipe.

found in practice that the great strength of the tin makes it possible to reduce very materially the thickness of the

Fig. 16.




The Joint.

Fig. 17.



The Soldering Tongs.

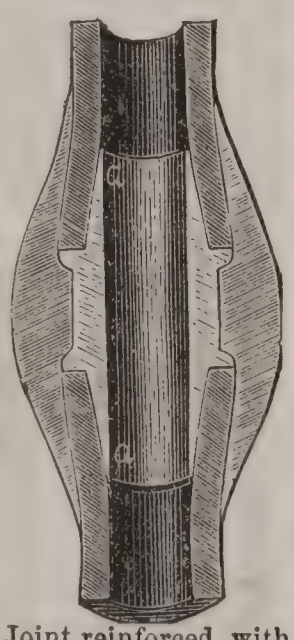
Fig. 18.




The Expander.

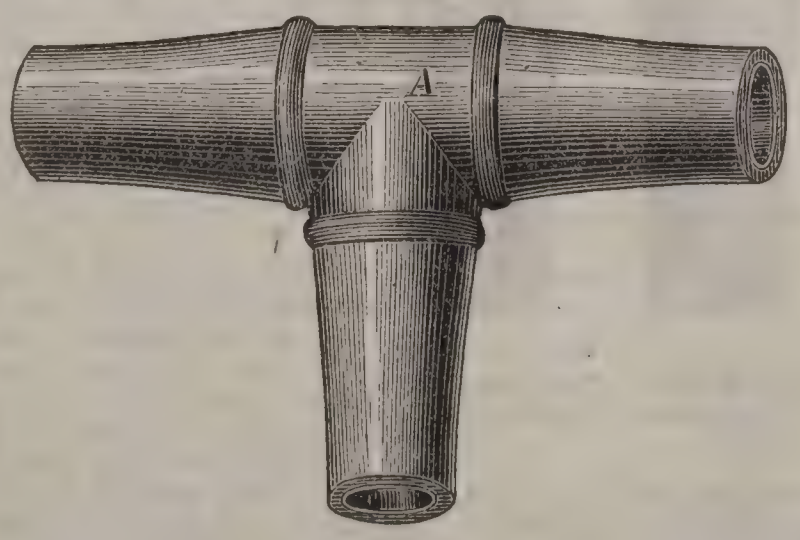
pipe, so that the tin-lined lead pipe need not weigh more than half as much to the cubic foot as lead pipe of the same calibre in order to possess an equal degree of strength. It has been stated that on exposing this pipe to water, galvanic action would take place, by which rapid corrosion would be produced; but Mr. Cassamajor has shown that as a matter of fact no such galvanic action occurs. When this pipe is used for bringing water from a well, it is of course important not to allow it to pass into the water, as the exterior pipe of lead would contaminate it as readily as though the tin were absent. In such case a few feet of block tin pipe should be used in the well to deliver the water to the tin-lined pipe. This pipe is not well adapted for hot water, as tin is very sensitive to heat. This is no objection, as the hot water from boilers should not be used for any purpose save washing. Some difficulty was at first experienced in making joints on this pipe; the plumbers were careless and heated the solder hotter than was necessary, and thereby melted the lining in the pipe. This difficulty has been obviated by the tinned brass joints which the foregoing figures illustrate. Fig. 16 is a joint ready for use, before the pipes are attached. It is composed of brass, heavily tinned within and without. The ends of the pipe are enlarged on the expander, Fig. 18, and after they have been carefully forced upon the conical ends of the joint, a union of the solder is effected by the application of the hot copper tongs shown in Fig. 17. Thus a simple, expeditious method has been devised for joining this pipe, which meets all the objections raised by the plumbers, except perhaps that they will have no excuse for charging for several pounds of solder for every joint. If one fears this joint is not sufficiently strong, it is very easy to cover it with a "wiped joint," as shown in Fig. 19. Fig. 20 is a T-joint with the pipe attached:

Fig. 19.



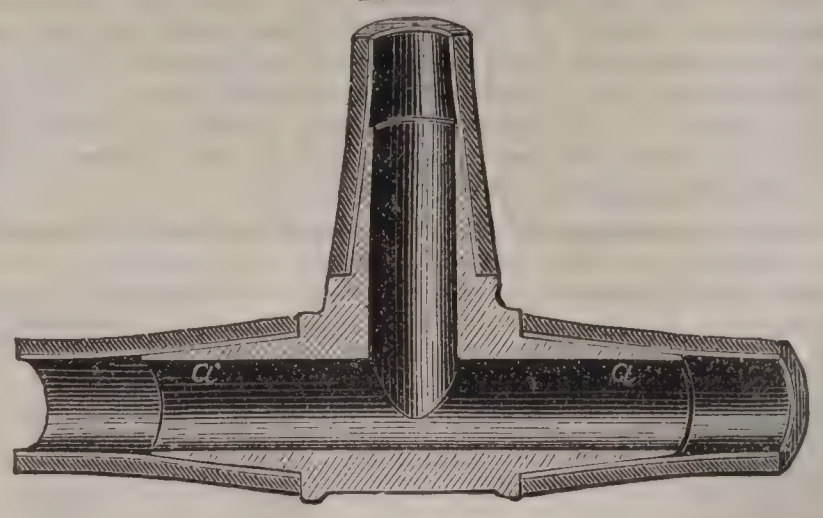
Joint reinforced with Solder.

Fig. 20.




T-joint with Pipe attached.

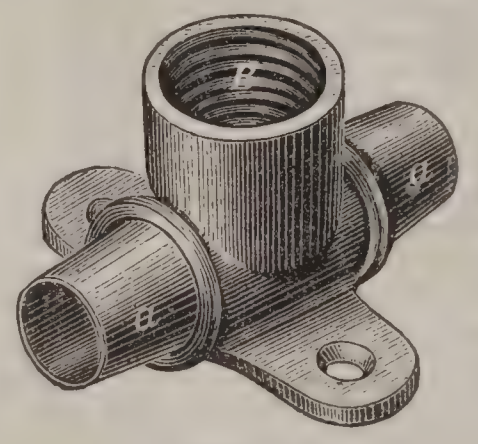
Fig. 21.




Section of a T-joint with Pipe attached.

Fig. 22 is a joint for the attachment of a faucet:

Fig. 22.




A Faucet Joint.

Every difficulty seems thus to have been met, so that we have reason to believe that the poisonous lead pipe will soon be generally replaced by this sanitary pipe, which possesses all its advantages without its dangers.

VII. Purity of City Waters.—*Impurities contained in 1 Wine Gallon of 231 Cubic Inches, expressed in Grains.*

| City. | Source. | Inorganic matter. | Organic and volatile matter. | Total solids. |
|---|---|---|---|---|
| New York..... | Croton, average for 13 weeks, 1867 (C. F. Chandler) | 3.90 | 0.66 | 4.56 |
| New York..... | Croton, average for 3 months, 1868 (C. F. Chandler) | 3.31 | 1.14 | 4.45 |
| New York..... | Croton, average for 6 months, 1869 (C. F. Chandler) | 4.11 | 0.67 | 4.78 |
| New York..... | Croton, May 11, 1871 (C. F. Chandler) | 2.799 | 0.875 | 3.674 |
| New York..... | Croton, average for 5 months, winter 1871–72 (E. Waller) | 3.934 | 0.508 | 4.442 |
| New York..... | Well, W. of Central Park (C. F. Chandler) | 38.95 | 4.55 | 43.50 |
| Brooklyn..... | Ridgewood, average for 3 months, 1869 (C. F. Chandler) | 3.37 | 0.59 | 3.92 |
| Boston..... | Cochituate (E. N. Horsford) | 2.40 | 0.71 | 3.11 |
| Philadelphia... | Fairmount, Schuylkill (E. N. Horsford) | 2.30 | 1.20 | 3.50 |
| Philadelphia... | Delaware (H. Wurtz) | 2.93 | 0.55 | 3.48 |
| Albany..... | Hydrant (E. N. Horsford) | 8.47 | 2.31 | 10.78 |
| Troy..... | Hydrant (W. Elderhorst) | 6.09 | 1.34 | 7.43 |
| Utica..... | Hydrant (C. F. Chandler) | 5.50 | 0.96 | 6.46 |
| Syracuse..... | New reservoir (C. F. Chandler) | 12.13 | 1.80 | 13.93 |
| Cleveland..... | Lake Erie (J. L. Cassels) | 4.74 | 1.53 | 6.27 |
| Chicago..... | Lake Michigan (J. V. Q. Blaney) | 5.62 | 1.06 | 6.68 |
| Rochester..... | Genesee River (C. F. Chandler) | 12.02 | 1.23 | 13.25 |
| Schenectady.... | State street well (C. F. Chandler) | 46.88 | 2.33 | 49.21 |
| Newark..... Jersey City... Hoboken..... Hudson City.. | Passaic River (E. N. Horsford) | 4.58 | 2.86 | 7.44 |
| Trenton..... | Delaware River (H. Wurtz) | 2.93 | 0.55 | 3.48 |
| London..... | Thames (Dr. H. Letheby) | 15.55 | 0.83 | 16.38 |
| London..... | Well, Leadenhall street (Dr. H. Letheby) | 90.38 | 9.59 | 99.97 |
| Dublin..... | Lough Vartry, new supply (Apjohn and others) | 1.77 | 1.34 | 3.11 |
| Paris..... | Seine, above the city (Bussey, Wurtz, and Ville) | 7.83 | 1.00 | 8.83 |
| Amsterdam.... | River Vecht (V. Baumhauer and Van Moorsel) | 14.45 | 2.13 | 16.58 |
| Amsterdam.... | Deep well at the Keisergracht | 64.55 | 4.38 | 68.93 |

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C. F. Chandler.

**Water, Arrangement of, on the Earth's Surface.** See Cataracts, Earth, and Lake, by Prof. A. Guyot, LL.D., and Rivers, by Elisée Reclus.

**Wa'ter-Bed,** a device invented by Neil Arnott, M. D., F. R. S., physician extraordinary to Queen Victoria, for the prevention of bed-sores upon the persons of bed-ridden patients. It is an ordinary bed, resting upon an under-bed of India-rubber cloth filled with water, and is in many cases extremely useful.

**Wa'ter-Beetle,** a name given to the representatives of two families of beetles which live in fresh waters—the Dytiscidæ and Gyrinidæ. These two families are very distinct from each other, and agree chiefly in that they have the body oval and depressed, the first ventral segments visible only at the sides, the legs of the second and third pairs flattened and fitted for swimming.

I. The Dytiscidæ have "the prothorax, with the epimera and the episterna, distinct; the prosternum compressed, produced behind, and fitting into a cleft or emargination of the metasternum;" the abdomen provided with only six ventral segments; the eyes two in number; and the "antennæ inserted under the front, behind the base of the mandibles, glabrous, polished, usually filiform," and 11- (rarely 10-) jointed; the legs all moderate and normally proportioned, ciliated with long hairs, and the posterior usually compressed, elongated, and formed for swimming; "posterior coxæ very large, usually oblique, contiguous at the inner margin. The insects thus distinguished are carnivorous, and are related to the Carabidæ, from which they differ almost only in the form of the posterior coxæ and the natatorial legs. The species, from their habits, are known under the name of diving beetles. The larvæ are long and cylindrical, and have large and flattened heads "armed with scissor-like jaws, by which they seize other insects or snip off the tails of tadpoles, while they are even known to attack young fishes, sucking their blood." They moult several times before attaining the pupa condition. "The body ends in a pair of long respiratory tubes, which they protrude into the air, though eight pairs of spiracles exist." They undergo their transformation on land, on which they creep preparatory to metamorphosis. The species are quite numerous: those of North America have been combined, by Dr. Leconte, under eighteen genera, which have been segregated into two sub-families—Haliplidæ and Dytiscidæ.

II. The Gyrinidæ are beetles "of an oval form, somewhat attenuated at their end, usually of a brilliant bluish-black color above, with the punctures reflecting a golden tint;" the prothorax has the prosternum short and carinated, and the episterna and epimera are distinct; the abdomen has seven segments; the eyes are four, and the upper and lower are both rounded; the antennæ are inserted under the sides of the front, behind the base of the mandibles, and are short and thick, with the third joint auriculate, the following ones indistinct, and the last elongate; the coxæ are small and globular; the "anterior legs very long, and received in oblique grooves of the pro- and mesosternal segments; tibiæ slender, with one terminal spur;" the middle and posterior legs are short, broad, and much compressed, with the tibiæ spurless; and the middle legs have the first joint large and triangular. The beetles of this family associate in groups, and are more generally known by their peculiar habits. In the proper season and place they abound, and move rapidly in whirl-like motion on the surface of the water, and, if disturbed, suddenly dive to the bottom. This habit of gyrating has obtained for them the name of "whirligigs." The larvæ have considerable resemblance to centipedes, having long respiratory filaments upon the sides of each segment which strikingly simulate feet. They undergo their transformation on land, as do the Dytiscidæ. (See Leconte's *Classification of the Coleoptera of North America*, etc.)

Theodore Gill.

**Water-Boatmen.** See Appendix.

**Wa'terboro',** v., Colleton, S. C. P. 636.

**Wa'terborough,** p.-v. and tp., York co., Me. P. 1548.

**Wa'ter-Buck,** the *Kobus ellipsiprymnus*, a large and handsome antelope of South Africa, always found near rivers. It is a good swimmer and is exceedingly timid. It emits an intolerable odor, and its flesh is uneatable.

**Wa'ter-Bug,** the popular name of insects of the order Hemiptera. See Entomology, by Prof. S. Tenney, A. M.

**Wa'terbury,** city and tp., New Haven co., Conn., on Naugatuck R. R., about 88 miles N. E. of New York, at its junction with New York and New England R. R., which has for the present its western terminus here. It is mostly built in a valley, through which flow Naugatuck and Mad rivers and several smaller streams, which furnish a large and well-developed water-power. Although a marketing centre for a great part of the surrounding country, a large portion of its capital is invested in manufacturing. Large quantities of rolled and sheet brass, tubing, lamp-burners and trimmings, silver-plated ware, pins, brass kettles, percussion-caps, clocks, buttons, suspenders, machinery, and almost every variety of article manufactured from metals, are produced here, and furnished to the mar-

kets of the country. There are 30 joint-stock corporations located here, with a united capital exceeding $6,000,000. Waterbury has 7 churches, 4 chapels, 2 national banks and 4 other banking institutions, a fine city hall containing court-rooms and offices for the town and city officials, a hall for public amusements capable of seating 1400 people, a free public library containing 18,000 volumes, with a fund of $200,000—a bequest to the city by the late Silas Bronson of New York, whose name it bears—several good hotels, a number of mercantile houses, and a large number of handsome private residences. The waterworks by which the city is supplied are among the finest in New England. It has an excellent fire department, a handsome park, abounds in pleasant drives, and has a beautiful cemetery (Riverside), located on the banks of the Naugatuck River about 1 mile from the city. It is well supplied with institutions of learning, among which are the high school, St. Margaret's (a diocesan school for young ladies), the Academy of Notre Dame (convent school), and the Waterbury English and Classical School for boys. It has 1 daily and 2 weekly newspapers, and is the fifth city in size and importance in the State. P. of city 10,826; of tp. 13,106.

ED. "AMERICAN."

**Waterbury,** p.-v. and tp., Washington co., Vt. P. 2633.

**Wa'ter-Chestnut** and **Water Chinquapin,** names for the SINGHARA NUT (which see) and for the seeds of other species of *Trapa;* also for the tubers of *Scirpus tuberosus,* a club-rush (Cyperaceæ) of China, much cultivated in tanks; also for the great seeds of various species of NELUMBIUM (which see). The above plants grow in the water, and several of them furnish considerable food-supplies in the countries where they are grown.

**Water-Clock.** See CLEPSYDRA.

**Water-Closet.** See PLUMBING, by DAVID PATERSON, and SEWER, by GEN. Q. A. GILLMORE.

**Wa'ter-Color Painting.** The substitution of water for oil as a medium of applying color to surfaces is not a modern discovery. In fresco-painting the principle was adopted as a method of applying color to plastered walls—an art that was practised by eminent Italian artists of the fifteenth century, and probably dates back to antiquity. In modern water-color the ordinary white drawing-paper is used, without chemical or other preparation. The pigments are the same as are employed in oil-painting, and are prepared in the same manner, only they are more manageable, and are capable, in some instances, of being made more effective; indigo and gamboge, for instance, being more brilliant and permanent under the water treatment. In the early stages of this art the solid cakes, being mixed with gum, hardened, and did not lend themselves to facile manipulation. The admixture of honey and glycerine with the colors, by keeping them soft, meets the requirement of the artist better. The use of moist colors, and of "Chinese white" as an opaque body-color, marks the chief difference between the older and the newer schools. The light is due to the whiteness of the paper, which, shining through the transparent colors, produces a mild brilliancy of effect. The artist in water-color needs in every respect the same training as the artist in oil, the only difference between them being that one uses water, the other oil, as a vehicle. In fact, the artist in water-color requires greater swiftness and certainty of touch, for the water dries immediately, and mistakes in drawing cannot be corrected or covered over, as on canvas: the lines and processes stand revealed. The artist is unable to slight or slur his work. The ease with which the painter in water-color throws off sketches and produces startling effects with a few masses of light and shade, or a few bold gradations of tone, deludes many into the belief that this is a light and trifling branch of art. The method, in fact, is remarkably well suited to sketching, owing to the lightness of the materials and the rapidity with which the paper dries; the luminousness of the paper likewise greatly assists the immediate, superficial effect. But finished painting in water-color demands skill of a very high order; great works come only from masters, and no master has exhausted, or even severely taxed, the resources of the method. The water-colorist claims for his branch of the art that while it is, equally with oils, adapted to all subjects—landscape, marine views, composition pictures, historical themes, architectural elevations, portrait—it offers peculiar advantage in depicting clouds and atmospheric effects. Another advantage he claims in the distinctness and separateness of the colors, which in oil-painting have a tendency to run together. This advantage also is due to the rapid drying of the colors, which fixes each before another can be applied. Greater care is needed on this account to prevent apparent roughness on the one hand and slovenliness on the other. From the old process, which consisted merely in staining paper, through the intermediate stage of excessive, opaque body-color, to the present point of the art, is a great stride. There is no reason to doubt that in course of time, with proper study, water-color painting will be held equally in esteem with oil. Its permanency seems to be unquestionable, though perhaps it is too early to pronounce a decided opinion on this point. The oldest paintings in oil, as we learn on good authority, date back no further than the time of John Van Eyck, who died in 1440. Not many are as old, and these, we are assured, will not bear comparison in brilliancy with the paintings executed in missals on parchment; therefore much earlier. Water-color paintings, not tinted drawings—which are very different things—have been known to retain their freshness and brilliancy for the space of ninety years, giving then no indications of weakness. The darkening of the paper on long exposure to the air may be avoided by protecting the surface with glass. This danger being averted, the colors in other respects may be trusted to hold their own with even more certainty than is the case with canvas painting. The authority quoted above (Fielding) says: "It is not, in our opinion, presuming too much to affirm that the water-colors of the present day, in which water only is used as a solvent, may, and most probably will, endure much longer than works done in oil according to our present mode, when the requisite care is given to them." The liability of paper to be torn renders the water-color painting less durable than the work on canvas, but this disadvantage reflects no disparagement on the method of applying color. True gems of art receive the greater care from being committed to fragile materials. The work that Vibert, Meissonier, Fortuny, do on paper will acquire additional value from the circumstance that it must be tenderly kept, and cannot be rolled up like canvas and thrown into a lumber-room. And this care will be bestowed the more readily as it is a peculiar property of the paper on which water-color pictures are painted to retain and give back light, as may be observed by the luminousness of water-colors at dusk, when oiled canvas rapidly darkens. But this fine quality of painting is secured only by great study, by repeated washings on and washings off, in order that the tints may partake of the granular surface of the paper. The process of water-color is in common use by sketchers, whose finished works are in oil. But as the capacities of it are understood, it is preferred by artists to oil-painting, many feeling what Michael Angelo expressed in regard to fresco-painting, that in comparison with it oil-painting was work for women and children. Societies of artists in water-color hold now a distinguished place among the schools of painting. The Belgian association, under the patronage of the king, is by some ranked first. In England there are two. The Society of Painters in Water-Colors, instituted in 1804, gave its eighty-sixth exhibition in 1876. Its president is Sir John Gilbert, A. R. A.; among its honorary members are W. E. Gladstone and John Ruskin; its membership includes names famous in oil-painting, and in the list of its associate exhibitors is Holman Hunt. The Institute of Painters in Water-Colors gave the same year its forty-second exhibition. Its membership comprises artists of distinguished merit; in the number of its honorary members we find Rosa Bonheur and John Millais, both of whom have done work, though not eminent, in water-color; of the thirteen lady members, one, Mrs. E. Murray, is well known here by her Spanish subjects, and Miss Elizabeth Thompson is famous as the painter of the *Charge at Balaclava* and *Quatre-Bras.* The variety in the subjects presented at the last exhibitions demonstrates the capacity of the style. The French have paid less attention to water-color than the English, though individual artists owe their fame to it—Vibert and Detaille, for example. Artists of the Spanish school find it admirably adapted to produce the gorgeous effects they aim at. In New York the American Society of Painters in Water-Colors was formed in 1867, and is already an established institution. Each annual exhibition shows advance on its predecessor in variety and quality of work. Artists of reputation are devoting themselves exclusively to it. The price of finished water-color pictures is rising as the demand for them increases.

O. B. FROTHINGHAM.

**Water-Colors.** See PAINT, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Wa'tercourse,** in law, denotes any natural stream of water which flows in a constant current and between defined banks. It is distinguished, on the one side, from a mere torrent, whereby the accumulation of surface-water is carried off, perhaps always through the same channel or bed, but which soon becomes exhausted, and remains dry until the next supply from the rain or melting snow; and, on the other side, from a mere percolation of water through the substance of the soil, without being collected into a

distinct current running between ascertained banks, although such process may perhaps be constant. Watercourses are either navigable or not navigable. At the common law a navigable watercourse is one in which, and as far as, the tide ebbs and flows; all others are legally unnavigable. This rule arose from the fact that in England the tidal streams were the only ones actually navigable. In the U. S. the physical geography of the country is so different that a more reasonable doctrine has been established. Every stream which, in its natural condition or with no further artificial improvement than the removal of temporary obstructions, can be navigated by vessels adapted to commercial purposes, is legally navigable. The bed and stream of a navigable watercourse are under the control of the State and U. S. governments, subject to the common public right of fishing and transportation. If the river runs between or through two or more States, the final authority over it belongs to Congress by virtue of its power to regulate commerce among the States. If the river lies wholly within the territory of a single State, the jurisdiction over it, at least in the first instance, is held by the State government. The owners of land bordering upon a navigable watercourse do not own its bed, nor have they any greater rights to the stream than those possessed by the public at large, unless special privileges have been conferred by the State or the national government; as, for example, the building of wharves, the grant of a ferry franchise, or the right to erect a bridge. On the great navigable rivers flowing between or through two or more States, as the Ohio and the Mississippi, it seems to be settled that the authority to erect bridges must be obtained from Congress, since these structures, much more than ferries or wharves, tend to interfere with inter-State commerce. The law concerning unnavigable watercourses is very different. They are necessarily private property. The beds, as a general rule, belong to the adjacent riparian proprietors, who have also a right to use the water while flowing within their respective territories, but have not individually an actual property in it. The stream itself, in its natural flow and to its natural amount, is subject to a right of *user* by all the riparian owners as it passes by or through their several premises. If the same person owns the land abutting on both sides of such a watercourse, he owns also the entire bed lying between his opposite banks. When, however, the opposite lands are held by different riparian proprietors, their rights extend to the middle line or thread of the stream, each owning the half of the bed adjacent to his bank. This thread is determined by supposing a series of straight lines to be drawn across the stream always perpendicular to the opposite banks, and then causing each of these transverse lines to be bisected by another line which, following the sinuosities of the two banks, would always be found at the middle of the watercourse. If an island should form wholly on one side of this thread, it would belong to the proprietor or proprietors of the nearest bank opposite to whose lands it was situated; if it should form so as to be intersected by the thread of the stream, it would belong to the owners of the two opposite banks, the thread being the boundary separating their respective portions; and the same principle would apply if it should form opposite the lands of two or more adjacent owners lying upon the same side of the stream. If the stream should slowly change its course—that is, if the soil washed away from one side should be imperceptibly added to the other—the owner of the land thus augmented would acquire full property in the accumulation—which is technically termed "alluvion"—and his title would follow the gradual alteration in the bed and in the thread of the watercourse. A deed of land bounded upon one side or bank of an unnavigable stream conveys the bed to the middle line, unless the grantor by a special description limits the conveyance to the bank itself. It is of course possible for a riparian proprietor, owning the half or the whole of the adjacent bed, to sell and convey the upland without the bed, or the bed without the upland, but in such a case the description must clearly indicate the intent. (The other rights and powers of the riparian proprietors, and especially those relating to the use of the water for milling and other purposes, will be found in the article on RIPARIAN RIGHTS.) JOHN NORTON POMEROY.

**Water-Cress.** See CRESS.

**Water-Cure.** See HYDROPATHY, by R. T. TRALL, M. D.

**Wa'terdown,** p.-v., Wentworth co., Ont., Canada, 6 miles N. of Hamilton. Waterdown Station, on the Great Western R. R., is 2 miles distant. P. about 1000.

**Wateree',** tp., Kershaw co., S. C. P. 3657.

**Wateree River** is called **Catawba** in North Carolina above the mouth of Fishing Creek. In South Carolina it joins the Congaree, and forms the Santee River. It is navigable for steamboats to Camden, S. C.

**Waterfall.** See CATARACTS AND RAPIDS.

**Water-Flea,** a name given sometimes to species of ENTOMOSTRACA (which see).

**Wa'terford,** county of Ireland, province of Munster, bordering S. on the Atlantic, comprises an area of 721 sq. m., with 123,252 inhabitants, of whom 44,842 can neither read nor write; since 1851, 61,051 persons have emigrated. The surface is mountainous, several ranges from 2000 to 3000 feet high traversing it. Pasturage and dairy-farming are the principal occupations. Coal, iron, lead, copper, and marble are found. Copper-mines and marble-quarries are worked with success.

**Waterford,** town of Ireland, capital of the county of Waterford, on the Suir, near its mouth in the Atlantic, has a good harbor, with shipbuilding docks and a fine quay, to which vessels of 2000 tons burden can ascend and unload. It contains several fine streets, but also many wretched ones; has some good educational and benevolent institutions; manufactures glass, soap, ale, and spirits, and carries on a considerable trade with England, exporting large quantities of agricultural produce. P. 23,349.

**Waterford,** p.-v., Norfolk co., Ont., Canada, 8 miles N. of Simcoe, on the Canada Southern R. R., has a weekly newspaper and some manufactures. P. about 900.

**Waterford,** p.-v. and tp., New London co., Conn. P. 2482.

**Waterford,** tp., Fulton co., Ill. P. 454.

**Waterford,** tp., Clinton co., Ia. P. 1160.

**Waterford,** p.-v. and tp., Oxford co., Me. P. 1286.

**Waterford,** p.-v. and tp., Oakland co., Mich. P. 1362.

**Waterford,** p.-v. and tp., Dakota co., Minn. P. 331.

**Waterford,** p.-v., Marshall co., Miss. P. 40.

**Waterford,** tp., Camden co., N. J. P. 2071.

**Waterford,** p.-v. and tp., Saratoga co., N. Y., at the junction of Mohawk and Hudson rivers, on Champlain Canal and the Delaware and Hudson Canal Co.'s R. R. and Rensselaer and Saratoga R. R., and connects with Troy, 4 miles distant, by horse railroad and steam-ferry, and with Lake Champlain, 63 miles distant, by State canal. It has abundant water-power, and is a manufacturing point of some consequence. It has a bank, 1 newspaper, high schools, 5 churches, 5 hotels, paper-mill, flouring-mills, 3 knitting-mills, 2 stock-and-die factories, steam fire-engine works, Globe Ironworks, 2 straw-board mills, valve fire-hydrant and Dodge press works, soap and candle works, lampblack factory, veneering mills, brush-factories, nut-works, machine-shops, etc., besides numerous establishments on a small scale, the whole employing capital to the amount of $3,000,000. It has a volunteer fire department with 2 steam fire-engines. P. of v. 3071; of tp. 3631.
LEWIS CAULDWELL, ED. "ADVERTISER."

**Waterford,** p.-v. and tp., Washington co., O. P. 2046.

**Waterford,** p.-b. and tp., Erie co., Pa. P. of b. 790; of tp. 1884.

**Waterford,** p.-v. and tp., Caledonia co., Vt. P. 879.

**Waterford,** p.-v., Loudon co., Va. P. 419.

**Waterford,** p.-v. and tp., Racine co., Wis. P. of v. 545; of tp. 1580.

**Water-Gas.** See APPENDIX.

**Wa'ter-Glass,** the soluble silicate of soda or of potash, or of both, prepared for use by boiling silica with a caustic alkali under great pressure. It is used in fresco-painting, in dyeing cloth, and in making certain kinds of artificial stone and cement. It is sometimes used in surgery in making immovable bandages as a substitute for dextrine. It is also used in making cotton and linen goods fireproof. (See also GLASS.)

**Water-Hen.** See GALLINULE.

**Water-Hog.** See HYDROCHŒRIDÆ and CAPYBARA.

**Wa'terhouse** (BENJAMIN), M. D., b. at Newport, R. I., Mar. 4, 1754; studied medicine at London, Edinburgh, and Leyden, where he graduated 1780; began practice as a physician at Newport; was professor of the theory and practice of physic at Harvard 1783–1812; was at the same time professor of natural history at Brown University, Providence; from 1784 was the first lecturer on natural history in an American college; also introduced the study of mineralogy; obtained from Dr. Lettsom a valuable collection of minerals, and procured the establishment of a botanic garden; tested in his own family as early as 1799 Dr. Jenner's discovery of vaccination, and vindicated its value for several years by his writings, in opposition to public prejudice; was a frequent writer for the press in support of the doctrines of Jefferson; was appointed hospital surgeon U. S. army June 29, 1813; became post surgeon 1818, and was medical supervisor of the U. S. military

posts in New England 1812–25. D. at Cambridge, Mass., Oct. 2, 1846. Author of *Lectures on the Theory and Practice of Medicine* (1786), *Lectures on Natural History* (1810), *The Botanist* (1811), a novel, *The Journal of a Young Man of Massachusetts* (1816), an *Essay on Junius and his Letters* (1831), supporting the claims of Lord Chatham, and several other works.

**Wa'terland** (DANIEL), D. D., b. at Wasely, Lincolnshire, England, Feb. 14, 1683; graduated at Magdalen College, Cambridge, about 1703; became a fellow (1704) and master (1713) of that college; took orders in the Church of England; was appointed chaplain to George I. 1714; preached the Lady Moyer lectures at St. Paul's, London, 1720; became rector of Ellingham 1713, and of the united parishes of St. Austin and St. Faith, London, 1720; chancellor of York 1723; canon of Windsor 1727; vicar of Twickenham and archdeacon of Middlesex 1730; was highly distinguished as a Trinitarian controversialist. D. in London Dec. 23, 1740. He has been called "the last of the great patristic scholars of England," but his extensive knowledge of the texts of the Fathers was not sufficiently critical to have been of any avail in the great patristic controversies of the present century. Among his writings were controversial treatises on the *Divinity of Christ*, against Drs. Whitby and Samuel Clarke (1718–24), in vindication of the authority of Scripture, against Middleton and Tindal, and on the doctrines of the Eucharist and baptismal regeneration, against the laxer divines of the Anglican body; and a critical essay on the Athanasian Creed, which he traces to Hilary of Arles. Modern researches assign it to a much later period. A complete edition of his *Works*, accompanied by a *Memoir*, was published by Bishop Van Mildert (Oxford, 11 vols., 1823–28; 3d ed., 6 vols., 1856).

**Wa'ter-Lil'y,** a name appropriate to the beautiful blossoms of the water-plants of the genus *Nymphæa*, and also extended to *Nuphar* and *Nelumbium*. (See LOTUS.) One of the finest anywhere is the *Nymphæa odorata* of the U. S., often called pond lily.

**Waterloo',** village of Belgium, province of South Brabant, on the road from Charleroi to Brussels, at the southern outskirts of the Forest of Soignies, with 2935 inhabitants in 1871. Here and in the vicinity was fought, on June 18, 1815, the battle between the French under Napoleon on the one side, and on the other an allied English-Dutch-German army under Wellington and a Prussian army under Blücher, the loss of which battle finally broke Napoleon's power. With excellent skill Napoleon prevented the junction of the two armies, and on the 16th, while he attacked Blücher at Ligny and completely defeated him after five hours' fight, Ney engaged the nearest point of Wellington's position, Quatre-Bras, 7 miles distant from Ligny, and occupied by a division under the command of the prince of Orange. After despatching a corps of 34,000 men and 90 guns under Grouchy in pursuit of Blücher, who retreated northward, not eastward, Napoleon joined Ney at Quatre-Bras, which was still held by Wellington, but on learning the defeat of Blücher and his line of retreat, Wellington on the 17th drew back his whole army from the line of Quatre-Bras to that of Waterloo, followed by Napoleon, who, however, was prevented by the lateness of the hour and by the rain which poured in torrents from attacking him. On the morning of the 18th the two armies stood facing each other in battle-array, and occupying the two ridges running nearly parallel, and separated by a valley from 500 to 800 yards broad. The allied army numbered 70,000 men, with 13,500 cavalry and 159 guns—25,000 English, 17,500 Dutch, and the rest Brunswickers and Hanoverians. The French army numbered 72,000 men, with 15,000 cavalry and 240 guns. The salient points of the position of Wellington were, on the right wing, the château and forest of Hougomont; in the centre, the village of Mont St. Jean and the farm-house of La Haye Sainte; on the left wing, the farm-houses of La Haye and Papelotte. Wellington's head-quarters were at Waterloo, just behind Mont St. Jean, and Napoleon's nearly opposite, at Belle Alliance. At 11½ o'clock A. M. the battle was opened by the divisions of Jerome Bonaparte, Foy, and Bacheln attacking Hougomont. The forest was taken, but the buildings were still held by the English guard at 2 o'clock P. M. A little after noon the tips of the Prussian army began to show on the right flank of the French. Napoleon believed that he had completely incapacitated this army, and felt sure that, at all events, Grouchy's co-operation would keep him safe on this side. Nevertheless, at 1 o'clock P. M. he despatched Lobau with 10,000 men from his centre to operate against the Prussians. At 1½ o'clock he ordered Ney to break through the enemy's centre. Moving across the valley, or rather the ravine, Ney took La Haye Sainte, but was driven back with fearful slaughter by the English heavy cavalry under Picton and Ponsonby; he formed again behind the lines of Milhaud's cuirassiers, who massacred the English dragoons in the ravine, and retook the place at 3 o'clock. An attempt by Wellington, at 4 o'clock, to dislodge him he repelled, and, reinforced by the light cavalry of Milhaud and the heavy cavalry of Kellermann, he now threw himself on the lines of the English infantry, which he several times caused to waver, but which he could not break without the support of infantry. At the same time La Haye and Papelotte had been taken by the French on the left wing, and Lobau had driven the Prussians out of Planchenoit. At 7 o'clock, Napoleon ordered the guard to advance to the final attack on the enemy's centre, but at nearly the same moment the Prussians broke forth in great force from the Forest of Soignies, Wellington ordered his whole line to advance, and the French army, somewhat loose in its strategical disposition and hard pressed both in front and on the right flank, was thrown into disorder, repulsed with great slaughter at the principal points, seized by a panic, and finally driven into a wild flight. At 9½ o'clock, Wellington and Blücher met each other at Maison du Roi, in rear of Belle Alliance. The French loss was 30,000 men and 227 pieces; that of the allies about 23,000 men. CLEMENS PETERSEN.

**Waterloo,** county of the S. W. central part of Ontario, Canada. It is fertile and well cultivated, and is traversed by Grand Trunk Railway and several of its branches. Cap. Berlin. P. 40,251.

**Waterloo,** a suburb of Berlin, the county-seat of Waterloo co., Ont., Canada, has a large trade, good water-power, thriving manufactures, and 2 weekly newspapers. P. 1594.

**Waterloo,** p.-v., cap. of Shefford co., Quebec, Canada, on Stanstead Shefford and Chambly Railway, 42 miles N. W. of Stanstead Plain. It is the terminus of a wooden railway to the Huntington copper-mine, and copper and iron ores abound. It has a foundry, tannery, branch bank, and a weekly newspaper. P. 1240.

**Waterloo,** p.-v. and tp., Lauderdale co., Ala. P. 1186.

**Waterloo,** p.-v., cap. of Monroe co., Ill., on Cairo and St. Louis R. R., 22 miles S. of the latter city, has 4 churches, a fine public-school building, 2 newspapers, 2 denominational schools, 2 literary societies, 1 flouring-mill (the largest in the State), 2 lumber-yards, and 3 hotels. The county is strictly agricultural. The village is well paved, and the buildings mostly of brick. P. 1537.

J. F. GOTSHALL, ED. "ADVOCATE."

**Waterloo,** p.-v., De Kalb co., Ind., at the junction of Lake Shore and Fort Wayne Jackson and Saginaw R. Rs., has 7 churches, an elegant school building, 1 newspaper, and fine fair grounds. P. 1259.

C. K. BAXTER, ED. "PRESS."

**Waterloo,** tp., Fayette co., Ind. P. 671.

**Waterloo,** tp., Allamakee co., Ia. P. 747.

**Waterloo,** city and tp., cap. of Black Hawk co., Ia., on the Iowa division of Illinois Central and Burlington Cedar Rapids and Minnesota R. Rs., 93 miles W. of Dubuque, contains 13 churches, 3 public and 2 private schools, 2 banks and a private banking-house, 1 woollen and 3 large flouring mills, an agricultural-implement factory, several foundries, 1 cracker, 1 soap, and 2 carriage factories, 3 newspapers, and excellent water-power afforded by Cedar River, which runs through the place. P. of city, 4337; of tp. 458. MATT. PARROTT, ED. "IOWA STATE REPORTER."

**Waterloo,** tp., Lyon co., Kan. P. 657.

**Waterloo,** p.-v. and tp., Jackson co., Mich. P. 1229.

**Waterloo,** p.-v., cap. of Clarke co., Mo.

**Waterloo,** p.-v. and tp., cap. of Seneca co., N. Y., on the Auburn division of New York Central R. R., and on both sides of Cayuga and Seneca Canal, 58 miles E. of Rochester, has good schools, 1 bank, 2 newspapers, 2 woollen factories, an extensive yeast-factory, planing, saw, and grist mills, and 4 hotels. P. of v. 4086; of tp. 4469.

W. A. BURTON, ED. "OBSERVER."

**Waterloo,** tp., Athens co., O. P. 1695.

**Waterloo,** v., Violet tp., Fairfield co., O. P. 85.

**Waterloo,** v., Madison tp., Fayette co., O. P. 120.

**Waterloo,** p.-v. and tp., Laurens co., S. C. P. 2158.

**Waterloo,** tp., Grant co., Wis. P. 951.

**Waterloo,** p.-v. and tp., Jefferson co., Wis., on Milwaukee and St. Paul R. R., 25 miles E. of Madison, contains 5 churches, an academy, 1 newspaper, 3 hotels, 1 machine-shop, and 2 large flouring-mills. Principal business, farming and dairying. P. of v. 727; of tp. 1818.

E. F. CONKLIN, PROP. "JOURNAL."

**Waterloo** (Antoni), b. at Amsterdam in 1618; lived at Maarsen and Breukelen, near Utrecht, and died, poor and miserable, in the hospital of St. Hiob at Utrecht in 1662. His pictures, mostly landscapes, are few, but much valued for the truth and simplicity with which they represent nature. More widely known and as highly estimated are his drawings and engravings, 136 in number.

**Wa'terman** (Thomas Whitney), b. at Binghamton, N. Y., in 1821; studied at Yale College; travelled in Europe 1842–44, and was admitted to the bar in New York City 1848. Author of *Civil Jurisdiction of Justices of the Peace* (1849), *American Chancery Digest* (3d ed., 3 vols., 1853), *Principles of Law and Equity in the Granting of New Trials* (2 vols., 1855), *Digest of Decisions of Superior Court of Connecticut* (1858), and other legal treatises.

**Wa'termelon,** the fruit of *Citrullus vulgaris*, a trailing annual vine of the order Cucurbitaceæ, a native of Asia and Africa, extensively found wild on the plains of the latter continent, where some varieties or specimens of its fruit are bitter and poisonous. In this country, if the watermelon is grown near the colocynth, it will hybridize and acquire a bitter taste and poisonous qualities. Watermelons are largely grown in the U. S. for their cooling, watery pulp; many varieties are known. In warm climates sugar has been profitably made from watermelons.

**Wa'ter-Meter,** an automatic device for measuring and registering the flow of water. In populous districts, when the municipal authority assumes the duty of furnishing water to the inhabitants, it is usually supplied *ad libitum*, a certain rental being charged for the privilege of drawing all that is required. This system usually works very well for a few years; but the prudent habits prevailing when the supply is drawn from wells and cisterns soon disappear, and are often succeeded by habits of wanton and reckless wastefulness. When the Croton waterworks were undertaken, the quantity of water to be supplied was fixed, after elaborate calculation and inquiry, at 36 gallons per day for each inhabitant—an allowance which, at the present time, would, with reasonable economy, be found ample for all legitimate purposes. Nevertheless, the consumption of New York City now exceeds 90 gallons per day for each inhabitant. Most other great cities have had a similar experience, and the necessity of restraining this enormous waste by charges based upon the quantity of water actually used is daily becoming more apparent to all concerned in works for the supply of water.

Such a system of water-rates requires accurate means of determining the quantity drawn by each consumer. The device made use of must be capable of registering the smallest as well as the largest quantity deliverable. It must work under all pressures, from a few feet up to 200 or more. It must work for long periods without attention. It must not leak. It must be capable of standing idle, and even of remaining dry for longer or shorter periods, without losing its efficiency. It must offer but slight resistance to the flow of water. And, finally, since it must be applied in great numbers, must be furnished at a moderate cost. These requisites involve a combination of qualities not readily secured. About 200 patents are on record in the U. S. for water-meters, and an equal number in England, and although some of these are successful in a mechanical point of view, it must be admitted that a water-meter combining all that is essential to its general introduction is yet to be produced. The difficulty does not appear to lie in a lack of ingenuity to conceive of suitable combinations of mechanism; it lies rather in the lack, on the part of inventors, of mechanical skill, perseverance, and resources to pursue the idea to its consummation.

With a few unimportant exceptions all water-meters may be classed under the four following heads: (1) *Piston meters*, in which the water propels a piston in a cylinder, the piston by suitable connections opening and closing the valves and moving the registering mechanism. (2) *Fly meters*, in which the water acts by impulse upon vanes or floats attached to a wheel, the revolutions of which are registered by a train of clockwork. The quantity of water corresponding to a turn of the wheel is determined by experiment. (3) *Diaphragm meters*, in which the water is admitted alternately to the opposite sides of a flexible diaphragm. (4) *Rotary meters*, in which a series of vanes attached to an axis move in a corresponding circular chamber, fitting it as a piston does a cylinder.

Figs. 1, 2, 3, and 4 represent in detail a meter of the first-named type, made by Mr. H. R. Worthington of New York. It has two pistons or plungers, *a*, *b*, moving in separate cylinders. The piston *a* works the valve for the piston *b*, and *vice versâ*. Fig. 1 is a cross-section of the instrument; Fig. 2 a longitudinal section, showing the piston *a* with its cylinder and valve; Fig. 3 shows the valve worked by the piston *b*; Fig. 4 shows the connection which operates the registering mechanism. It will be noticed that the central part of each piston is diminished in diameter, and passes through a common chamber A. The water enters the meter at *c*, Fig. 1, and leaves it at *d*. In the bottom of the meter there are passages, sometimes crossing each other, leading from the valve of *a* to the cylinder of *b*—that is, each passage shown in Fig. 2 communicates with a passage marked by the same letter in Fig. 3. As drawn, the piston *b* has completed its stroke to the left, and moved its valve *w*. The water from the chamber A enters through the cylinder of *a* through the passages *g*, *g*, Figs. 2 and 3, and forces the piston *a* to the right. From the right of *a* the water escapes through the passage *k k* to the exhaust-passage *h*. The piston *b* rests till *a* has completed its stroke and moved its valve, opening communication between the chamber A and the left of *b* through the passage *m m*, and putting the right of *b* in communication with the exhaust by the passage *l l*. *o* is a circular

Fig. 1.

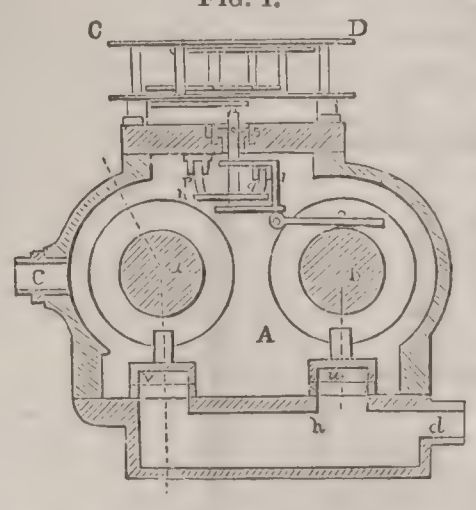
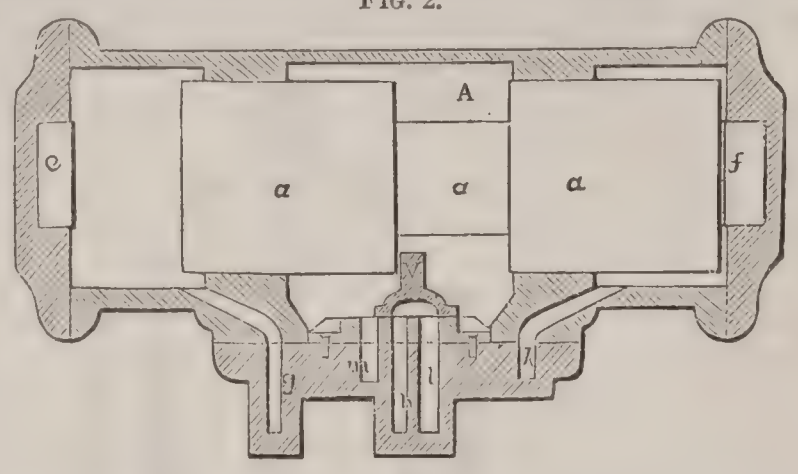



Fig. 2.




disk resting between the shoulders of the piston *b*. It is connected with a frame *r*, which hangs upon a pivot *s*, without being rigidly fixed to it. *n* is a ratchet-wheel fixed upon the same pivot. Every second stroke of the piston *b* advances this wheel one tooth by means of the pawl *q*. P is a pawl which prevents the ratchet-wheel from moving backward. The pivot *s* passes through a stuffing-box, and gives motion to a train of clockwork which shows the quantity of water consumed by means of hands on a dial-plate C D. *e* and *f* are rubber buffers which arrest the movement of the piston at each stroke. This machine is founded upon a sound mechanical principle, and has met with as large a measure of success as any meter yet introduced. Its cost is too high to warrant its general introduction. A great many different piston-meters have been constructed. They are generally provided with two pistons. Meters with a single piston have never worked satisfactorily. There is the same necessity for two that there is for an auxiliary piston in the direct-acting steam-pump.

Fig. 3.

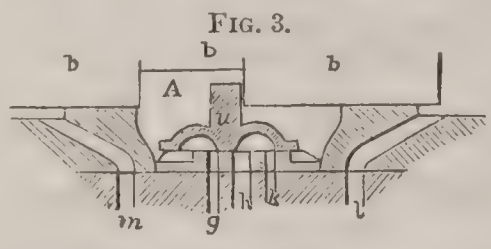



Fig. 4.

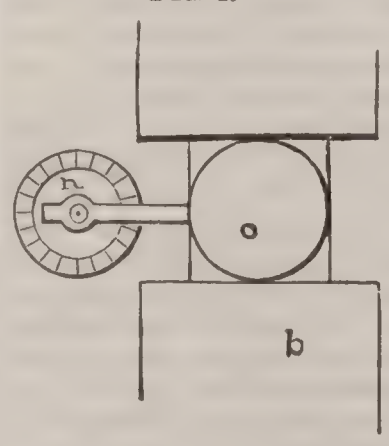



Fig. 5 is an example of the second type of water-meter. The figure represents an invention of James Boyle of Brooklyn, N. Y. A wheel with spiral vanes is turned by the direct impulse of the water, and gives motion to a train of clockwork by means of an endless screw. This style of meter is very simple and capable of being cheaply constructed—advantages which have led to considerable demand for it. Its operation, however, is not sufficiently certain. It does not positively measure the quantity of water, but gives indications which enable it to be inferred with more or less certainty. A very slight obstruction to its movement materially alters its indications. In fact, it may cease to register entirely without affecting the quantity of water delivered. The train of wheelwork necessarily moves in water, since a stuffing-box would cause too much resistance. It is consequently liable

to obstruction from anything floating in the water. The dial-plate must be observed through glass, and its indications are liable to be obscured by deposits.

FIG. 5.

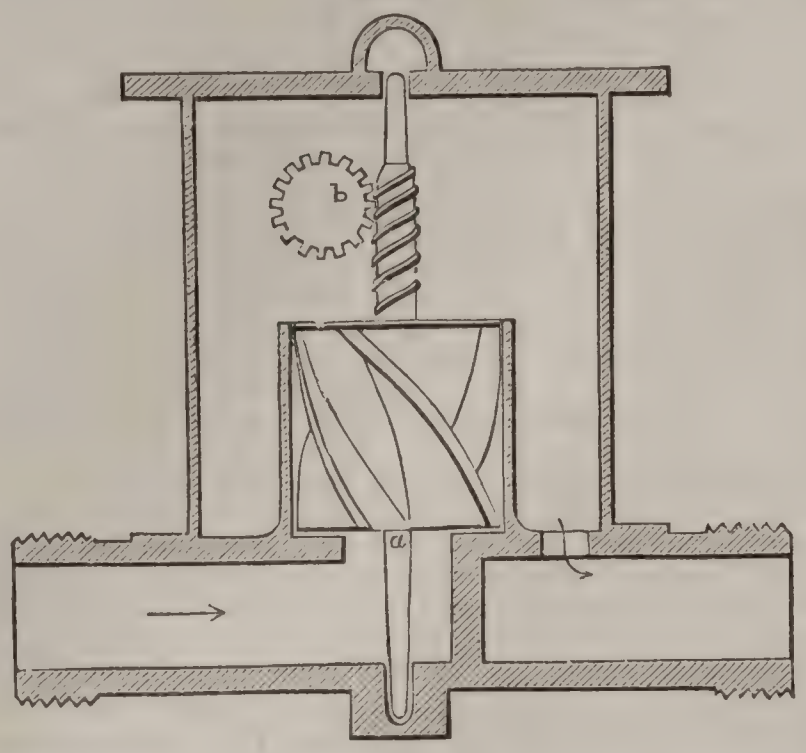
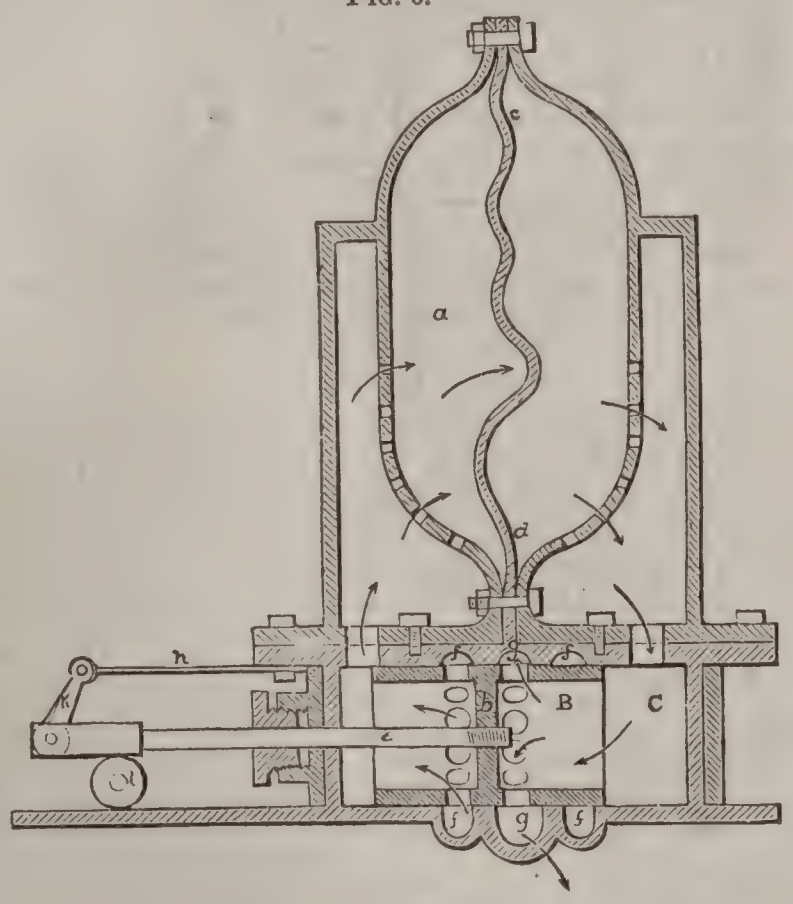



Fig. 6, a recent invention of Mr. Guthrie of Chicago, is one of the diaphragm meters. The water is measured in a

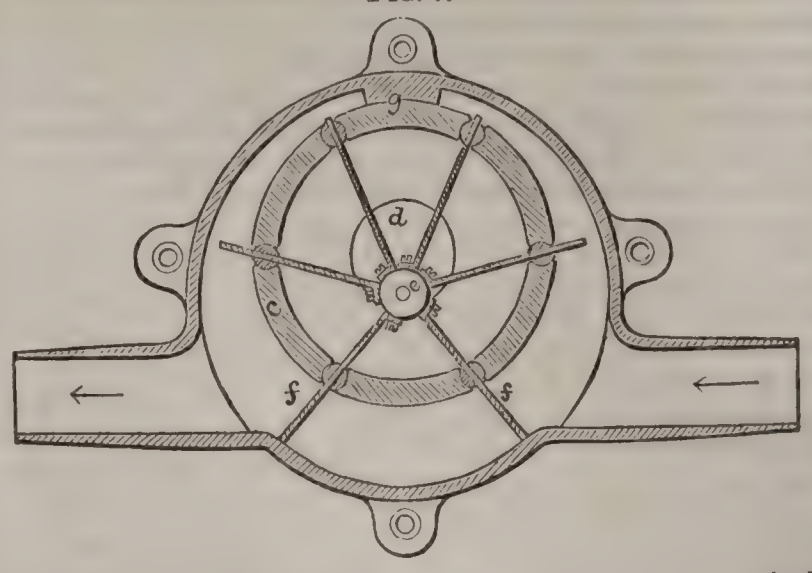
FIG. 6.




chamber *a*. The valve B is a hollow piston fitting a cylinder C. It is divided into two parts by a partition at the centre, *b*. It has a rod *e* passing through a stuffing-box, and giving motion to the registering mechanism, which is not shown. It is provided with a "knuckle-joint," consisting of the arm *k*, the spring *h*, and the roller *l*. The purpose of this arrangement is to ensure a sufficient travel of the valve. Around the interior of the cylinder C are three annular passages or grooves. Two of them, *f f*, *f f*, communicate with the supply-pipe; the other, *g g*, with the delivery-pipe. The valve contains two rows of orifices, as shown. The operation is as follows: The water is shown entering through the orifices in the left side of the valve from the passage *f f*, and passing into the chamber *a*. It moves the diaphragm *c d* to the right, causing the water to escape into the passage *g g*, as indicated by the arrows. When the chamber *a* is filled, the diaphragm being in contact with its right side, the pressure on the right of the valve in the chamber C ceases, and the valve moves to the right, bringing the right-hand orifices into communication with the supply, the left with the delivery. The reverse action then takes place, the water entering the chamber *a* from the right side, and passing to the delivery-pipe from the left. The defect most commonly met with in this class of meters is the rapid destruction of the diaphragm.

We come, finally, to meters of the fourth class, an example of which is given at Fig. 7. This particular form was patented in England about twenty years ago. It consists of a cylindrical drum *c* with vanes *f f*, the drum and vanes revolving on different centres. The drum revolves in contact with the chamber at *g*, and the vanes act as

FIG. 7.




pistons on a certain part of the circumference, entirely closing the passage. The vanes are attached to a series of small collars *c* on a spindle, an arrangement which admits of their moving with reference to one another. One of the collars is fixed to the spindle, which passes through a stuffing-box and moves the registering mechanism. The circle *d* is the hub on which the drum revolves. A kind of swivel-joint is introduced where the vanes pass through the drum. Many patents have been granted for rotary meters. In some cases the vanes are hinged to the drum, folding against it at the point of contact between the drum and its chamber, and being extended at other parts of the circumference. In some forms the vanes turn on pivots moving flatwise during a part of their revolution, and passing edgewise through a narrow passage during the remainder. No rotary meter has hitherto proved successful.

J. P. FRIZELL.

**Water-Mill.** See BARKER'S MILL.

**Water-Mole,** a name given by the Australian colonists to the ORNITHORHYNCHIDÆ (which see).

**Water of Crystallization and of Constitution,** in chemistry. Chemical changes may be divided into those which take place in the internal substance of a *homogeneous* body, with new distribution of the molecules and development or absorption of heat, and those which take place between two bodies, or within a *heterogeneous* mixture. The latter class always requires the intervention of some fluid medium which is capable of dissolving at least one of the two bodies and bringing it into chemical contact with the other. *Water* was ordained as the great natural promoter of such action upon the surface of our earth, being the medium of most of the chemical changes that are necessary to the progress and perpetuation of life of every kind, as well as that of the most numerous and important of the merely mineral transformations that have heretofore occurred, and that are now in progress, upon and within the earth's crust. In the course of the infinite variety of these chemical transformations, organic and mineral, it is found that a portion of the water concerned remains very often, in certain forms of combination, in the dry solid products, furnishing a class of chemical problems which have largely exercised investigators in this science, and with the correct solution of which, indeed, its hope of establishment as an exact science is closely knit up. Especially, as there can be no hesitation in asserting, is their solution entirely essential to the right understanding of the subjects of *saline constitution, acidity* and *basicity*, and *crystalline relations*.

It has long been the universal belief among all reasoning chemists that water which enters thus into combination with other bodies in chemical reactions does this in two distinct ways, being in one class of cases combined in such a way as to retain in a measure its identity and to remain susceptible of easy separation by heat, sometimes heat of a very gentle degree; this being what is usually known as *crystal-water*, or *water of crystallization*, because innumerable saline and other substances are liable to take it up into their crystals, and on losing it by heat these crystals often fall to powder, losing their previous crystalline structure. The other class of cases is that in which water enters into combination in such ways as manifestly to lose its identity altogether, and to become sometimes incapable of recovery again in the form of water by any direct or simple operation. Those who adhere to the idea that such water still retains, nevertheless, the $H_2O$ molecule, have called it, in these cases, *water of constitution* or *constitutional water*. Such instances are characterized by great development of heat during the reaction, and usually either contraction or expansion of volume. The slaking of quicklime and the mixture of anhydrous sulphuric oxide with an equivalent of water are familiar examples of this heat-development; but in the first of these cases change

of volume is at least doubtful. (Taking Filhol's density-figures for both quicklime and slaked lime, the volume remains almost unchanged during the combination.) In the combination of anhydrous potash and baryta with water there appears to be expansion, and in the cases of soda and strontia, contraction; in all these cases, however, the temperature rising nearly or quite to incandescence.

In the instances just cited, of the compounds formed between *basic oxides* and water, many chemists have long believed that the water does not retain, in the compound, any trace of its original constitution—that there is no longer, in fact, any water present. The special school of speculative theorists, whose views chiefly prevail in the schoolbooks of the present day, regard this class of compounds as containing *hydroxyl*, OH, and must give to *slaked lime*, for example, the constitution $Ca(OH)_2$, while they arbitrarily split in two the molecules of the potash and soda compounds, calling them K(OH) and Na(OH).

The term "water of constitution," and the vague—indeed, entirely undefined—idea attached to it, have been widely applied also to water contained in acids, called also by some "basic water," this being the form into which water is supposed to pass when it combines with acidic oxides, the so-called "anhydrides." The case of sulphuric oxide above is one example, others being phosphoric pentoxide, arsenic pentoxide, selenious oxide, etc. In the case of phosphoric pentoxide it is a matter of *temperature* whether one molecule or three of water pass into the form of so-called "constitutional" or "basic" water; that is, whether monobasic or tribasic "phosphate of water" is formed. (See PHOSPHORIC ACIDS.) The hydroxyl school, in these cases also, imagine hydroxyl compounds to be formed. (See SALT-RADICALS.)

Of late years many attempts have been made by chemists of great eminence—conscious of the obscure state of our views on the subject of the condition of water in salts and so-called "hydrates"—to arrive at some knowledge which might clear up these questions. These inquiries have generally been directed to the search for some law governing the *thermic* changes that occur during reactions with water. Few have paid any attention to the other striking phenomena that occur—namely, the changes of *volume*. Among these few, however, has been an American chemist, F. W. Clarke of Cincinnati, who in 1874 made the first successful generalization regarding the volume of the water-molecule in the form of water of crystallization. (*Am. Jour. of Science*, 3, vol. viii. p. 428.) From the mean of the volumes of this constituent in 31 hydrated salts computed by him, Prof. Clarke found 13.76 for the molecular volume of crystal-water. The present writer finds that two of these cases (doubtfully low) being omitted, the remaining 29 give 13.829, which, multiplied by 1000, is manifestly the even cube of 24 = 13824. (See VOLUMES, MOLECULAR.) This fact, with a great multitude of others discovered by the present writer, has led him to the new view regarding crystal-water—that it is water which performs the part, in chemical combination, of a *compound radical* or elementoid group, and that it comes, therefore, directly under his new law of cubical condensation, which is explained in the article VOLUMES, MOLECULAR. The *molecular diameter* of crystal-water is therefore 24, and it may have the symbol $H^{\delta}_{24}$. A few cases may be cited here—including some not in the list of Prof. F. W. Clarke—of salts which contain water of crystallization in this volume, 13.824 (or when multiplied by $1000 = 24^3$), to add some further precision and strength to the generalization under the new aspect it assumes in connection with the geometric law of condensation. (For explanation of the special formulation and symbols here used reference must be had to VOLUMES, MOLECULAR.)

| | | Computed densities. | Experimental densities. |
|---|---|---|---|
| Borax, anhydrous | $O_7.4^{B}_{20}.2^{Na}_{20}$ | = 2.397 | Favre and Valson, at 20°.....2.371 |
| " crystals | $O_7.4^{B}_{20}.2^{Na}_{20}.10^{H\delta}_{24}$ | = 1.7166 | Favre and Valson, at 20°.....1.711; Stolba.....1.7156; Mohs.....1.716 |
| Lithium sulphate, anhydrous | $O_4.^{S}_{24}.(^{Li\ Li}_{19\ 20})$ | = 2.226 | (Kremers, 2.21). |
| Lithium sulphate, crystals | $O_4.^{S}_{24}.(^{Li\ Li}_{19\ 20}).^{H\delta}_{24}$ | = 2.024 | (Troost, 2.02). |
| Ammonium sulphate, anhydrous | $O_4.^{S}_{24}.2^{Am}_{27}$ | = 1.786 | Schröder, 1.771; Kopp, 1.78 |
| *Mascagnite*, native crystals | $O_4.^{S}_{24}.2^{Am}_{27}.^{H\delta}_{24}$ | = 1.71 | Dana's *Mineralogy*, lowest, 1.72 |
| *Kupfferite*, mineral | $O_6.2^{Si}_{23}.2^{Mg}_{17}$ | = 3.065 | (Dana's *Mineralogy*, 3.08). |
| Picrosmine, " | $O_6.2^{Si}_{23}.2^{Mg}_{17}.^{H\delta}_{24}$ | = 2.756 | Dana's *Mineralogy*, cleavable, 2.66 |
| Zinc sulphate, anhyd. | $O_4.^{S\ Zn}_{24\cdot 21}$ | = 3.674 | Playfair and Joule, 3.681 |
| " " crystals | $O_4.^{S\ Zn}_{24\cdot 21}.7^{H\delta}_{24}$ | = 2.041 | Filhol, 2.036; Mohs, 2.036 |
| *Willemite*, mineral | $O_4.^{Si}_{23}.2^{Zn}_{22}$ | = 4.004 | Vanuxem and Keating, New Jersey, 4.0 |
| *Calamine*, " | $O_4.^{Si}_{23}.2^{Zn}_{22}.^{H\delta}_{24}$ | = 3.528 | Dana's *Mineralogy*, Altenberg, 3.49 |

| | | Computed densities. | Experimental densities. |
|---|---|---|---|
| Iron sulphate, anhyd. | $O_4.^{S\ Fe}_{24\cdot 24}$ | = 3.142 | Playfair and Joule, 3.138 |
| " " crystals | $O_4.^{S\ Fe}_{24\cdot 24}.7^{H\delta}_{24}$ | = 1.915 | Buignet, 1.902; Filhol, 1.904 |
| Manganese sulphate, anhyd. | $O_4.^{S\ Mn}_{24\cdot 24}$ | = 3.121 | (Bödeker, at 14°, 3.1). |
| Manganese sulphate, crystals | $O_4.^{S\ Mn}_{24\cdot 24}.5^{H\delta}_{24}$ | = 2.051 | (Pape, 2.059). |
| Lime sulphate (*anhydrite*) | $O_4.^{S\ Ca}_{24\cdot 23}$ | = 2.911 | (Fuchs, 2.92). |
| Lime sulphate (*gypsum*) | $O_4.^{S\ Ca}_{24\cdot 23}.2^{H\delta}_{24}$ | = 2.313 | Mohs, 2.31; Kenngott, mean of 15, 2.317 |

Instances are not very abundant, however, like these, in which a *precise* comparison can be made between the corresponding saline molecules, with and without crystal-water, for two reasons—one being that the number of cases in which densities have been determined of salts in these two forms is comparatively trifling; but another and much more influential reason is, that in dehydrating a crystalline salt a temperature is used sufficiently high, *as a general thing*, to produce a definite (allotropic) change in the diameter of the electro-positive molecule.

Cases like the following are exceedingly numerous:

| | | |
|---|---|---|
| Chromium trisulphate, anhydrous | $O_{12}.3^{S}_{24}.2^{Cr}_{27}$ | = 2.747 (Favre and Valson, 2.743). |
| Chromium trisulphate, crystals | $O_{12}.3^{S}_{24}.2^{Cr}_{28}.15^{H\delta}_{24}$ | = 1.868 (Favre and Valson, 1.867). |

The two chromium-molecules each shrinking one diameter during the application of heat.

It will be seen, therefore, that the study of molecular volumes lets in a surprising light upon the nature and functions of water of crystallization. Even more remarkable are the explanations it gives us of the nature of so-called "constitutional" and "basic water."

The new developments, while justifying the ideas of those who have doubted that water exists any longer, as such, in combination with both acidic and basic oxides in the so-called "hydrates," give no support to the hydroxyl-hypothesis. In the classes of compounds referred to (which should no longer be called *hydrates*) the radical molecule $H_2O$ (which the writer proposes to call *hydor*) is broken up into its elements, and while the oxygen retains, as an elemental molecule, its unchangeable volume, 5184, the hydrogen also enters into the new compound on the same footing as the other elements present, assuming a cubical volume, and such hydrogen is basylic and *metalloidal*, being susceptible of replacement by a basylic metal. The new system, it should be remarked, involves also the conclusion that metallic oxides no longer exist, as such, in their saline compounds—a view which has also been held, speculatively, by the older school of salt-radicalists. (See SALT-RADICALS.) It is found, however, that there are no such radicals in existence as were held by that school under the names of *oxysulphion*, $SO_4$, *oxyphosphion*, $P_2O_6$, etc.; nor is there found any proof of the existence of the radicals invented by the more recent salt-radicalists, called *sulphuryl*, $SO_2$, *phosphoryl*, PO, *nitrosyl*, *nitryl*, etc. Indeed, the disproof of the existence of all these is positive if the geometric law of condensation be admitted, as it must be from the overwhelming mass of facts explainable only by this law. Examples will now be given of the true molecular structure of those few of the miscalled "hydrates," both *basic* and *acidic*, whose densities are as yet known. Though but a very meagre number of the basic class is known, yet these few exhibit remarkable parallelisms. They seem divisible into three *types*, characterizable by the diameters of their metal-molecules, which latter, by the *law of cratesis* (see VOLUMES, MOLECULAR), rule, in this case, the more electro-positive hydrogen-molecules:

TABLE II.—*Basic (so-called) "Hydrates."*

*Type 1 (these are all native mineral species).*

| | | | |
|---|---|---|---|
| *Diaspore*: Dihydrogen dialuminum tetroxide. | $O_4.(^{H\ H}_{14\ 15}).2^{Al}_{17}$ | = 3.299 | Shepard, Trumbull, Conn., 3.29. |
| *Gibbsite*: Hexahydrogen dialuminum hexoxide. | $O_6.6^{H}_{16}.2^{Al}_{17}$ | = 2.397 | B. Silliman, Richmond, 2.387. $^{Al}_{17}$ is the corundum molecule. |
| *Brucite*: Dihydrogen magnesium dioxide. | $O_2.(^{H\ H}_{16\ 17}).^{Mg}_{17}$ | = 2.388 | Hermann, 2.36; Beck, 2.376 |
| *Manganite*: Dihydrogen dimanganese tetroxide. | $O_4.2^{H}_{17}.2^{Mn}_{17}$ | = 4.358 | (Rammelsberg, 4.335). |
| *Limonite*: | $O_9.6^{H}_{17}.4^{Fe}_{17}$ | = 3.905 | (Bergemann, 3.908). |
| *Goethite*: Dihydrogen di-iron tetroxide. | $O_4.2^{H}_{18}.2^{Fe}_{17}$ | = 4.215 | (Yorke, fibrous, 4.19). |

*Type 2.*

| | | | |
|---|---|---|---|
| *Caustic soda*: Disodium dihydrogen dioxide. | $O_2.2^{H}_{17}.(^{Na\ Na}_{20\ 21})$ | = 2.136 | (Filhol, 2.13). |
| *Limonite*, mineral species: Trihydrogen iron trioxide. | $O_3.3^{H\ Fe}_{17\cdot 21}$ | = 2.708 | (Church, 2.69). |
| Dihydrogen zinc dioxide | $O_2.(^{H\ H}_{18\ 19}).^{Zn}_{21}$ | = 3.063 | (Filhol, 3.053). |
| Dihydrogen strontium dioxide. | $O_2.2^{H\ Sr}_{19\cdot 21}$ | = 3.644 | (Filhol, 3.625). |
| Dihydrogen lead trioxide | $O_3.2^{H\ Pb}_{20\cdot 21}$ | = 6.297 | (Wernicke, 2.267). |

*Slaked lime:* Dihydrogen calcium dioxide. ... $O_2.2^{H\ Ca}_{20\cdot 21}$ = 2.077 (Filhol, 2.078).

Dihydrogen dimanganese trioxide. ... $O_3.2^{H\ Mn}_{20\cdot 21}$ = 2.573 (Wernicke, 2.564).

Tetrahydrogen dinickel pentoxide. ... $O_5.2\binom{H\ H}{20\ 21}.2^{Ni}_{21}$ = 2.761 (Wernicke, 2.744).

Dihydrogen diantimony pentoxide. ... $O_5.\binom{H\ H}{20\ 21}.2^{Sb}_{21}$ = 5.283 (Blum and Delffs, 5.28).

Tetrahydrogen dicobalt pentoxide. ... $O_5.4^{H}_{21}.2^{Co}_{21}$ = 2.48 (Wernicke, 2.483).

Dihydrogen barium dioxide. ... $O_2.2^{H\ Ba}_{21\cdot 21}$ = 4.482 (Filhol, 4.495).

Dihydrogen bismuth trioxide. ... $O_3.2^{H\ Bi}_{22\cdot 21}$ = 5.639 (Wernicke, 5.571).

*Type 3.*—Only one compound is as yet known of this type, this being—

*Caustic potash* $O_2\cdot\binom{H\ H}{19\ 20}\cdot\binom{K\ K}{24\ 25}$ = 2.048 (Filhol, 2.044).

It will be observed that the metal-molecules of Type 2 are four diameters larger than those of Type 1, while in the only known member of Type 3, K is also four diameters larger than Na of Type 2. Indeed, as remarked under VOLUMES, MOLECULAR, this difference of 4 or $4n$ diameters between corresponding K and Na compounds is general, these two alkali-metals, in almost all their compounds with the same elements, falling into different volumic types, the K-compound usually one type above the Na-compound.

*Acidic (so-called) "Hydrates."*—Meagre as is the list of the hydrogenated oxides of basylic metals, of known densities, that of the like compounds of acidogenic elements is even still more fragmentary, the number being but about ten in all, so few that little can be done in the way of satisfactory generalization from them. They may, however, so far as they go, be assigned likewise to two *types*, and each of these arranged in the order of the diameters of the basic hydrogen. Of Type 1 none are known; *carbon* and *boron*, which, in *elemental* crystals, belong to this most condensed type, expanding in their saline compounds four diameters up to Type 2.

TABLE III.—*Examples of Acidic Structure.*

*Acids of Type 2.*

Dihydrogen oxalate ..... $O_4.2^{H}_{16}.2^{C}_{20}$ = 2.003 (Husemann, at 9°, 2.0).

Hexahydrogen borate..... $O_6.6^{H}_{18}.2^{B}_{20}$ = 1.514 {Favre and Valson, at 20°, 1.493}

Dihydrogen uranate..... $O_4.\binom{H\ H}{19\ 20}.2^{U}_{20}$ = 5.931 {Gmelin's *Handbuch*, 5.926}

Tetrahydrogen diselenite.. $O_8.2\binom{H\ H}{20\ 21}.2^{Se}_{20}$ = 3.16 {Topsöe, 3.123. This one a little doubtful.}

Dihydrogen nitrate..... $O_6.\binom{H\ H}{25\ 26}.2^{N}_{20}$ = 1.569 {Watts's *Dictionary*, 1.56}

*Acids of Type 3.*

*Orthophosphoric acid:* Hexahydrogen phosphate ..... $O_6.6^{H}_{17}.\binom{P\ P}{24\ 25}$ = 1.9 {Schiff, 1.88; Thomsen, 1.884}

Hexahydrogen hypophosphite ..... $O_4.6^{H}_{19}.\binom{P\ P}{23\ 24}$ = 1.502 (Thomsen, at 18.8°, 1.493).

Hexahydrogen phosphite.. $O_6.6^{H}_{19}.\binom{P\ P}{23\ 24}$ = 1.669 (Thomsen, at 21.2°, 1.651).

Dihydrogen iodate..... $O_6.2^{H}_{19}.2^{I}_{24}$ = 4.857 (Ditté, at 0°, 4.869).

*Oil of vitriol:* Tetrahydrogen disulphate ..... $O_8.4^{H}_{21}.2^{S}_{24}$ = 1.846 (Marignac, at 0°, 1.853).

Tetrahydrogen diselenate. $O_8.2\binom{H\ H}{22\ 23}.2^{Se}_{24}$ = 2.527 (Mitscherlich, 2.524).

To Type 3 may be added hydrochloric acid, which, in liquefied form, is

Dihydrogen dichloride..... $2^{Cl}_{24}\binom{H\ H}{24\ 25}$ = 1.2785 (Watts's *Dct.*, at 10°, 1.27).

These are very nearly or quite all the *inorganic* acids whose densities in pure state are even approximately known as yet. Of the *organic acids*, those which contain homologen—at least those based upon one or more molecules of elemental carbon—may probably be regarded as belonging, to that extent, to Type 2. The molecule of *succinic acid*, one of the homologues of oxalic acid, may be constructed from its known density. It is—

Dihydrogen succinate.. $O_4.\binom{H\ H}{15\ 16}.2^{C}_{20}.2^{Hm}_{25}$ = 1.564 {Richter, 1.55; Husemann, crystals, at 9°, 1.552}

This special succinic acid, it will be seen, varies in its hydrogen from the oxalic acid given above, belonging therefore to another series of isomeres.

One series of organic acids, the *fatty acids*, is well known, and some of the lower members of the *dominant* series of isomeres are constituted as follows:

Dihydrogen formate. $O_4.^{C}_{20}.\binom{H\ H}{24\ 25}.^{Hm}_{26}$ = 1.2143 (Kopp, at 0°, 1.2227).

" acetate..... $O_4.^{C}_{20}.\binom{H\ H}{24\ 25}.^{Hm}_{3\ 26}$ = 1.0819 (Kopp, at 0°, 1.08005).

" propionate. $O_4.^{C}_{20}.\binom{H\ H}{24\ 25}.^{Hm}_{5\ 26}$ = 1.0133 {Pierre and Puchot, at 0°, 1.0143}

" butyrate... $O_4.^{C}_{20}.\binom{H\ H}{24\ 25}.^{Hm\ Hm}_{6\ 26\cdot 25}$ = .9818 {Pierre, at 0°, .98165; Kopp, " .9886}

" valerate.... $O_4.^{C}_{20}.\binom{H\ H}{24\ 25}.^{Hm\ Hm}_{8\ 26\cdot 25}$ = .9514 (Kopp, at 0°, .9555).

" caproate... $O_4.^{C}_{20}.\binom{H\ H}{24\ 25}.^{Hm}_{9\ 26}.2^{Hm}_{25}$ = .9444 {Lieben, .9438; Lieben and Rossi, .9449}

Four more members of the series of fatty acids have likewise been computed.

One more acid, of organic origin, may be added; this is—

Dihydrogen sulphovinate.. $O_8.4^{H}_{21}.2^{S}_{24}.2\binom{Hm\ Hm}{27\ 28}$ = 1.33 {Watts's *Dict.*, at 16°, 1.317}

It may be observed that this contains the same hydrogen-molecules as oil of vitriol, being really a direct compound of the latter with *dihomologen* (ethylene), as before suspected, but now for the first time proved.

*Relations of Water with Sulphuric Oxide.*—The purposes of this article will be well met by a volumic discussion of the series of compounds formed by the addition of successive equivalents of $H_2O$ to anhydrous sulphuric trioxide, $SO_3$, which will illustrate most of the principles above set forth:

(1) $S_2O_6 : \left(O_3.^{S}_{29}\right)^2$ = 2.003 {Buff, at 25°, 1.90814; Morveau, at 13°, 1.9546; Computing, at 0°, 2.005}

This is doubling the usually-assumed number of atoms in the trioxide—a proceeding which is, however, otherwise called for. Thus, for example, this brings the compound into series with the other oxides of sulphur:

$S_2O_2$...Hyposulphurous oxide.

$S_2O_3$...Unknown.

$S_2O_4$...Sulphurous oxide. {See VOLUMES, MOLECULAR. *Liquid*, it is $O_4.\binom{S\ S}{32\ 33}$}

$S_2O_5$...Dithionic oxide.

$S_2O_6$...Sulphuric oxide.

(2) Adding one $H_2O$, we get fuming or Nordhausen sulphuric acid, which is—

$\left(O_3.^{S}_{29}\right)\cdot\left(O_4.^{S}_{24}.2^{H}_{21}\right)$ = 1.913 (Watts's *Dictionary*, 1.9).

The molecular changes here are the collapse of one $^{S}_{29}$ to $^{S}_{24}$, and the expansion of $H_2$ (in water) to $2^{H}_{21}$, the general resultant being a contraction of volume from 97882 to 93022, about 5 per cent. The reaction is violently explosive, and the heat reaches incandescence.

(3) Adding $2H_2O$, we get oil of vitriol, which is $O_8.4^{H}_{21}.2^{S}_{24}$, as shown in Table III. above, among acids of Type 3. This, which again contains double the number of atoms usually supposed, is in accordance with several of the best-known sulphates of dyadic metals. Thus, Filhol's heaviest density-figure for *gypsum* requires the molecular formula—

$O_8.2^{S}_{24}.4^{H\delta}_{24}.\binom{Ca\ Ca}{23\ 22}$ = 2.337 (Filhol, 2.331).

*Cœlestine* is—

$O_8.2^{S}_{24}.\binom{Sr\ Sr}{23\ 22}$ = 3.992 {Beudant, 3.96; Sterry Hunt, 3.96; Kopp, 3.962; Breithaupt, 3.973}

The heaviest *heavy spar* is—

$O_8.2^{S}_{24}.\binom{Ba\ Ba}{25\ 26}$ = 4.554 (G. Rose, 4.5271).

One *anglesite* is—

$O_8.2^{S}_{24}.\binom{Pb\ Pb}{24\ 23}$ = 6.309 {Mohs, 6.298; Filhol, 6.3}

*Silver-sulphate* contains the *melted-silver molecule*, being—

$O_8.2^{S}_{24}.\binom{Ag\ Ag}{23\ 22}$ = 5.438 {Filhol, 5.41; Schröder, 5.425}

The only *cadmium-sulphate* yet known is—

$O_8.2^{S}_{24}.2^{H\delta}_{24}.\binom{Cd\ Cd}{30\ 31}$ = 2.949 (Buignet, 2.939);

and so on; showing that the usual formulæ of all sulphates must be doubled, in correspondence with the above view of sulphate of hydrogen.

(4) The next compound which is found definitely determinable is the *crystallizable*, or "glacial sulphuric acid," obtained by adding $4H_2O$ to $S_2O_6$, or $2H_2O$ to oil of vitriol. Its density when crystallized appears unknown, but when liquid it is—

$O_8.4^{H}_{21}.^{H\delta}_{22}.^{H\delta}_{23}.2^{S}_{24}$ = 1.799 {Watts's *Dictionary*, 1.78; Otto, at 15°, 1.782; Kolb, 1.784; Wackenröder, at 8°, 1.784}

Two points are here illustrated. One is the fulfilment of the *law of engymmetry* (see VOLUMES, MOLECULAR), the two added hydor-molecules falling in between the H and the S molecules, into *plesymmetry** therewith. Another is that the contraction from the hydor-molecules in liquid water $\left(\text{which is } 4^{H\delta}_{26}.^{H\delta}_{27}\right)$ is *four diameters*. The condensation in the formation of this compound is 10.22 per cent. It seems probable that when the density of the glacial acid *in solid form* shall be determined, it may be found to correspond to $O_8.4^{H}_{21}.2^{S}_{24}.2^{H\delta}_{24} = 1.669$, at 28° F.

(5) Adding $2H_2O$ more, or $6H_2O$ altogether, we get

$O_8.4^{H}_{21}.^{H\delta}_{22}.^{H\delta}_{23}.2^{S}_{24}.2^{H\delta}_{25}$ = 1.673 {Kolb, 1.652; Otto, at 15°, 1.652}

The plesymmetry is here carried to another step. The condensation from oil of vitriol is about 8 per cent.

(6) $2H_2O$ more give us—

$O_8.4^{H}_{21}.^{H\delta}_{22}.^{H\delta}_{23}.2^{S}_{24}.2^{H\delta}_{25}.2^{H\delta}_{26}$ = 1.556 (Kolb, 1.543);

still another plesymmetrical addition to the compound molecule.

---

* *Plesymmetry*, from πλησίος, "next," σύν, "with," and μέτρον, "measure."

(7) The next $2H_2O$ are found to assume $^{H\delta H\delta}_{25\ 26}$, giving us—

$$O_8.4^{H\ H\delta\ H\delta\ H\delta}_{22\cdot 22\cdot 23\cdot 24}.2^{S}.3^{H\delta}_{25}.3^{H\delta}_{26} \quad 1.488 \left\{ \begin{matrix} \text{Kolb, } 1.476 \\ \text{Otto, } 1.4764 \end{matrix} \right\}$$

(8) With another $2H_2O$—

$$O_8.4^{H\ H\delta\ H\delta\ H\delta}_{21\cdot 22\cdot 23\cdot 24}.2^{S}.3^{H\delta}_{25}.5^{H\delta}_{26} = 1.426 \text{ (Kolb, 1.407).}$$

(9) With another $2H_2O$—

$$O_8.4^{H\ H\delta\ H\delta\ H\delta}_{21\cdot 22\cdot 23\cdot 24}.2^{S}.5^{H\delta}_{25}.5^{H\delta}_{26} = 1.397 \text{ (Kolb, 1.386).}$$

Above this point, so far as computations have been carried —which is up to $50H_2O$ in all—the condensation is always to $^{H\delta}_{26}$. As it is a known fact that up to $60H_2O$ heat is still evolved, no doubt it is not until about this latter degree of combination with hydor that the cratetic influence of this compound of sulphur and oxygen upon hydor-molecules ceases, and further intermixed water begins to retain its free volume of 18000, instead of condensing to 17576, that of $^{H\delta}_{26}$.

*Acidity, Basicity, and Salinity.*—The range of new volumic facts above set forth puts in a clear light some things previously obscure regarding the relations of acids, bases, and salts. The well-understood fact that no distinct line can be drawn between acids and bases becomes theoretically far more intelligible. Acidity and basicity are only relative terms. All the so-called "hydrates" alike contain replaceable hydrogen. Thus, zinc dissolves in solutions of caustic soda, replacing and expelling its elemental or metalloidal hydrogen, exactly as it does in dilute sulphuric acid. In one case we have—

$$Zn_2 + O_2.H_2.Na_2 = O_2.Zn_2.Na_2 + H_2;$$

in the other case—

$$Zn_2 + O_8.H_4.S_2 = O_8.Zn_2.S_2 + H_4.$$

It may also be remarked that oxygen-salts—and in one mode of derivation also haloid salts—are products of a species of *double decomposition* between two hydrogenated oxides; the radical or hydor-molecules, which were broken up in the formation of these hydrogenated oxides, being reconstructed again, simultaneously with the saline molecule. Thus, sulphuric acid and caustic soda react as follows:

$$O_8.H_4.S_2 + O_4.H_4.Na_4 = O_8.Na_4.S_2 + 4H_2O;$$

and the two so-called "basic hydrates" of sodium and zinc thus react:

$$O_2.H_2.Na_2 + O_2.H_2.Zn = O_2.Zn.Na_2 + 2H_2O.$$

To take a somewhat less simple case of the latter kind, in the solution of *gibbsite* in caustic soda:

$$O_6.H_6.Al_2 + O_2.H_2.Na_2 = O_4.Na_2.Al_2 + 4H_2O.$$

Finally, taking a case of two "hydrates," generally both ranked as acidic, the *oxalates* and *uranates* of hydrogen, we have, in the formation of uranic oxalate, the following reaction:

$$O_4.H_2.C_2 + O_4.H_2.U_2 + H_2O = O_6.C_2.U_2.3H_2O.$$

As Ebelmen has given us the *density* of the resulting compound in this case, we may write this reaction in volumic notation:

$$O_4.2^{H}_{16}.2^{C}_{20} + O_4.\left(^{H\ H}_{19\ 20}\right).2^{U}_{20} + H_2O = O_6.2^{C}_{20}.3^{H\delta}_{24}.2^{U}_{29} = 3.013$$
(Ebelmen, 2.98).

(The expansion of volume during this transformation being enormous—*20 per cent.* of the initial volume—it is interesting to inquire whether any peculiar phenomena were observed. Reference to Ebelmen's original paper shows that this salt was precipitated from boiling concentrated solutions, and appeared first as a *viscous magma*, which *gradually* changed into sulphur-yellow granular crystals. The *time* required for this transformation proves either absorption or loss of internal energy, quite in accordance with the great volumic change. The expansion of the uranicum molecule through nine diameters—from Type 2 to Type 4 —will be better understood when it is stated that in both the carbonate and the nitrate uranicum appears also to be of Type 4. The nitrate is—

$$O_8.2^{N}_{20}.6^{H\delta}_{24}.\left(^{U\ U}_{26\ 27}\right) = 2.837 \text{ (Bödeker, at 13°, 2.807).}$$

The carbonate is known only as a double salt with ammonium, which appears to have the molecule

$$O_{11}.3^{C}_{20}.\left(^{Am\ Am}_{27\ \ 28}\right).\left(^{U\ U}_{29\ 30}\right) = 2.804 \text{ (Husemann, 2.773);}$$

bringing it into serial relation with the oxalate above.)

(There is still another mode of combination of water (or the radical hydor) occurring in large classes of chemical compounds, differing, in typical character at least, from those of crystal-water, which will be found explained under the head of Wood-Spirit.) Henry Wurtz.

**Wa'ter-Ouzel,** a name given to birds of the genus *Cinclus*, family Cinclidæ, formerly classed as Turdidæ or thrushes, and often called dippers. The European water-ouzel is *C. aquaticus* (or *Hydrobates cinclus*). North America affords a species, *C. mexicanus*, found chiefly in the Rocky Mountains. These remarkable little birds are excellent divers, and feed at the bottom of streams. It is commonly said that they have the power of walking upon the bottom of streams under water, but some good observers state that they do not in fact walk, but swim under water.

**Water Plants.** See Aquatic Plants.

**Wa'ter-Power.** The term water-power implies not only the existence of certain topographical features by which a continuous supply of water falling from one level to another is obtained, but also the employment of motors known as *water-wheels* and *water-engines*, through the medium of which the energy of the falling water is transformed into useful work.

Water-privileges, as they are commonly called, exist on nearly all streams of any considerable magnitude, and in settled countries, where they have become developed or utilized by the construction of dams or otherwise, they are regarded as a kind of property having special value, depending on the quantity of water available and the height of fall. The quantity of water which flows yearly through a stream at a given point depends on the drainage-area of the stream above that point and the yearly rainfall over this area. Inasmuch as the rainfall is seldom the same in any two years, and is never distributed through the year in the same proportions in any two years, the quantity of flow of all streams varies not only in different days, weeks, and months of the same year, but also varies greatly in different years. Two methods of ascertaining approximately the average flow of a stream in different months may be followed. One is to determine its drainage-area from accurate maps or surveys, and then from recorded observations of the rainfall of the region to estimate the quantity of water which reaches the stream daily during each month. It will be found generally that the total amount which flows away from a watershed is 50 to 70 per cent. of the rainfall for the year, while the minimum *daily flow* for a month is many times less than the *average*, and the maximum many times greater. The least minimum, or minimum for one day, and the greatest maximum, are separated widely apart in quantity. Another, and perhaps the most usual, method of determining the flow of streams is by gauging. This ought to be done in such a way that the probable maximum and minimum flow for each week or month may be ascertained, and also the mean daily flow for the year. In either case it is usually found, especially in small streams, that on account of these variations of flow a storage-reservoir is necessary for water-powers, and a certain proportion between the capacity of such a reservoir and the number of square miles in the watershed is necessary if the full average daily flow for the year is to be secured. This proportion is seldom realized, on account of the expense attending the establishment of reservoirs; and the consequence is, that a vast majority of the improved water-powers of a country are subject to great fluctuations of supply. In wet seasons a large quantity of water runs to waste over the dams, and in dry seasons the supply is deficient, often requiring the stopping of mill machinery.

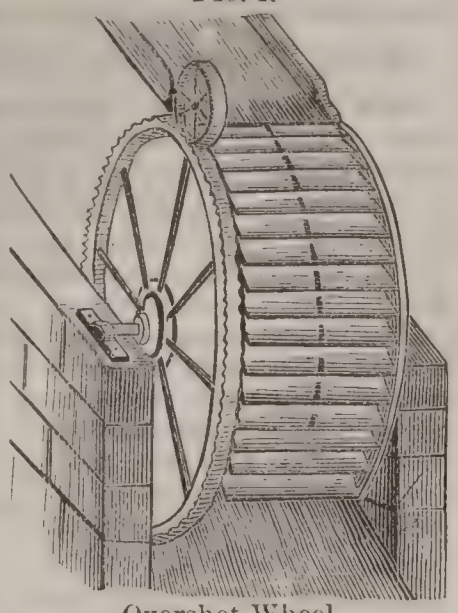
The quantity of power which any *privilege* will furnish depends not only on the quantity of water, but also directly on the available fall. When the available head and the quantity of water which flows are determined, the total *theoretical* energy of the water for a given time is found by multiplying the quantity of water in pounds which flows during this time by the available fall. This will give the energy expended in foot-pounds. If the time be 1 minute, and the number thus obtained be divided by 33,000, the theoretical horse-power of the waterfall will be given. Since no motor will realize a perfect efficiency, however, the actual horse-power is less than the theoretical. If we suppose the motor to utilize 75 per cent. of the available energy, the horse-power will be found by dividing the product of the height and weight of water which flows in 1 minute (in feet and pounds) by 41,000. It is very difficult, however, to estimate the horse-power of a water-privilege with exactness, as it must vary with the varying flow of water; nothing, in fact, being fixed but the fall. An approximate mean value only can be assumed.

The motors employed in connection with water-powers are known as water-wheels and water-engines; the latter being used, however, only for small powers and to a limited extent. Water-wheels are classed as over-shot wheels, breast wheels, undershot wheels, and turbines, the latter forming a distinct class of modern development, which has superseded to a great extent the other classes. The figures on the next page represent respectively the first three classes of water-wheels in their most perfect development.

The overshot wheel, though fast disappearing from use, has been one of the most valuable, as well as the most efficient, of water-wheels. It is applicable to all falls, from 12 to 60 feet. Its disadvantages are its large size where large power is developed; it must be protected or

housed in winter to prevent ice forming in the buckets; and the slow motion of the wheel and its great weight involve increased friction. It must be constructed generally on the spot where it is to be used.

FIG. 1.

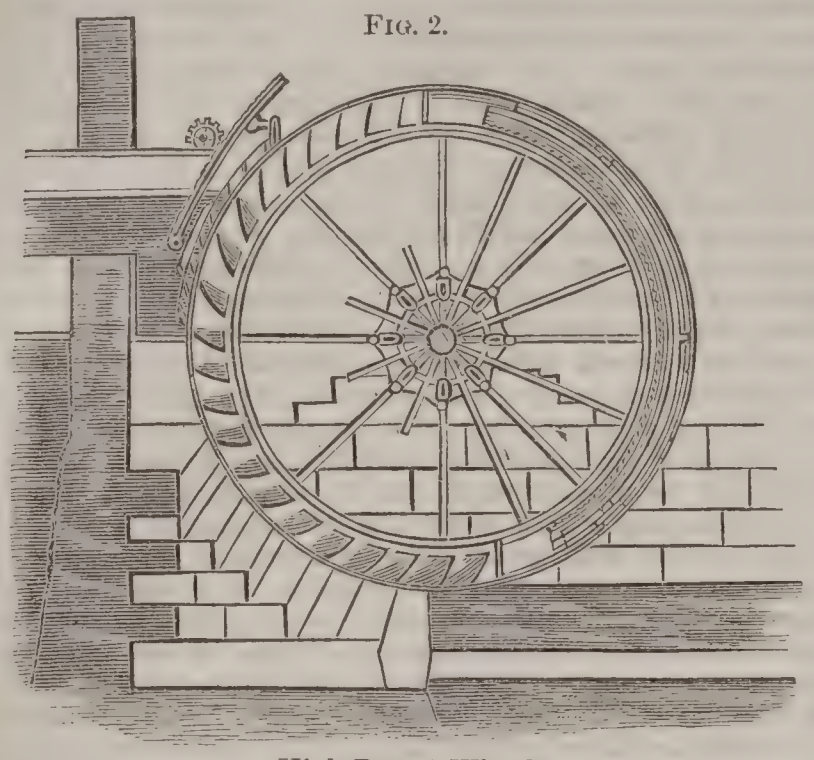


Overshot Wheel.

The breast wheel has advantages over the overshot wheel, especially for low falls, although many of the disadvantages hold true with respect to it, in its general features, that are found in the overshot wheel. The breast wheel is perhaps better adapted to varying streams, and is applicable to low falls, to which it would be impracticable to apply the overshot wheel.

Undershot wheels are adaptable to situations and circumstances where the mere force of a running current is to be made effective, and until they were improved by

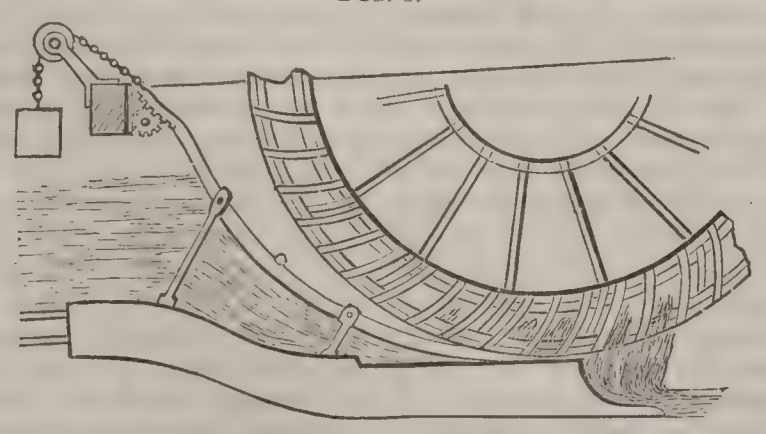
FIG. 2.



High Breast-Wheel.

Poncelet they were the most inefficient of all wheels. Poncelet introduced the curved buckets, by which a reactionary force is exerted on the wheel as well as an impulse, the

FIG. 3.



Poncelet's Undershot Wheel.

water entering the buckets without shock, and falling out with little horizontal velocity.

The efficiencies of these wheels, when constructed properly and under the most favorable conditions, are for the overshot wheel 7 to 8 per cent., for the breast wheel 7 per cent., and for the undershot wheel 6 per cent.

The *turbine* wheel is an old form of water-wheel, but its modern usefulness has been developed since Fourneyron invented the famous wheel which is still the type of one class of turbines. The distinguishing characteristic of all turbines is that the water before reaching the wheel proper is forced by the form of the casing or by fixed guiding channels into a whirling or vortex motion. Issuing from these fixed channels in nearly a tangential direction, it strikes the buckets or floats of the wheel, which revolve in the same direction, but which are curved backward with respect to the motion, so that if the *wheel* were also fixed as well as the guiding channels, the water would return on itself in direction, and would issue from the wheel in nearly a tangential direction, but with an opposite whirling motion from that which is given to it by the guide-blades. Owing to the rapid motion of the wheel, however, the water really leaves it in a direction perpendicular to the direction of its motion as it leaves the guide-blades. Nearly the whole of its living force having been imparted to the wheel, the water falls into the wheel-pit with little velocity, and is carried away by the tail-race. The water thus acts upon the wheel both by impulse and reaction. (For a description of turbine wheels see TURBINE.)

The great water-powers of Holyoke, Lowell, Lawrence, Manchester, and Birmingham in this country may be referred to as illustrative on a grand scale of the value of improved water-powers, while the mills scattered throughout nearly every populous district of civilized communities furnish examples on smaller scales everywhere. And yet the unoccupied and unimproved sites for valuable water-powers which still remain show that, compared with what may still be accomplished, a beginning only has been made in such improvements. W. P. TROWBRIDGE.

**Waterproof Garments.** See WATERPROOFING.

**Wa'terproofing,** the art of rendering textile fabrics, paper, and other substances impervious to water. This result is usually obtained either by applying an insoluble coating upon the surface, or by causing the formation of a compound that exerts a repellent action toward water in the pores of the article, often by means of double decomposition. The application of oil to leather and cloth, and of tar to tarpaulins, are familiar examples of waterproofing. One of the most important branches of this art is the application of India-rubber in the preparation of "mackintoshes" and other waterproof wearing apparel, in the manufacture of which a thick solution is made by treating the caoutchouc with spirits of turpentine, coal-tar, benzole, bisulphide of carbon, etc., which is spread out upon the fabric, and the whole passed between rollers, the coating and pressing being repeated until a layer of proper thickness and uniformity is obtained. (See INDIA-RUBBER, by PROF. C. F. CHANDLER.) In double waterproof fabrics two pieces of the cloth that has been treated in this manner are cemented together by passing them face to face between wooden rollers. A mixture of the flock of silk, cotton, or wool with liquefied caoutchouc is also applied to cloth that has previously been saturated with an ordinary waterproofing solution. In Sievier's process (patented 1835) a solution of India-rubber is first spread over the cloth, which is next treated with the same solution mixed with acetate of lead, litharge, sulphate of zinc, and gum-mastic. Nap is then fixed on the fabric by placing wool upon it and passing it between rollers. Another varnish for waterproofing goods is made by dissolving ¼ pound of India-rubber in ½ pound of oil of turpentine, and adding 6 pounds of boiled linseed oil and 1 pound of litharge. The disagreeable smell often adhering to fabrics treated by the preceding processes is removed by exposing them to the fumes of aromatic essences, such as lavender, verbena-root, etc. Potter's patent process (1835) for rendering cloth impervious to water consists in applying a solution of gelatine, alum, and soap on the wrong side of the fabric by means of a brush, and afterward washing and drying it. A similar but more recent method is to dissolve gelatine, castor-oil soap, and gum-lac in water, to add alum, and to apply the solution thus obtained. In Townsend's process two solutions are made by dissolving 20 pounds of British gum in 8 gallons of water, and 10 pounds of white soap in 8 gallons of boiling water; the solutions are next mixed; 1 pint of logwood-liquor is added, and the mixture boiled; 3 pounds of alum, dissolved in 1 gallon of water, are now added, and after being again boiled the preparation is applied to the cloth. The same inventor prepares waterproof fabrics by successively immersing them in a solution of 6 pounds of sulphate of zinc in 9 gallons of boiling water, then in the preceding mixture of gum and soap. Woollen and other goods are also rendered waterproof by first saturating them with a solution of soap, then with a solution of alum, or by successive immersions in solutions of gelatine and galls (tannic acid), whereby the same compound that is formed in the tanning of leather is produced. Ballard's process for waterproof clothing consists in simply impregnating the cloth with a mixture of solutions of acetate of lead and sulphate of alumina. In a similar process 2½ pounds of alum and sugar of lead are separately dissolved in 10 gallons of water, and the solutions mixed; the fabric is then immersed in the liquid, washed, and dried; for tweed cloaks one-half of this quantity of sugar of lead is sufficient, and the cloth is immersed separately in each solution. In another method, 8 pounds of oleic acid is dissolved in 6 quarts of alcohol, and 20 pounds of sulphate of alumina gradually added. The mixture is allowed to settle for twenty-four hours, and the supernatant liquid decanted; the sediment is then pressed into cakes, dried, and ground to a powder. When used for waterproofing silk or linen goods, 1¼ pounds of the powder is dissolved in 20 gallons of water, and the cloth dipped in the solution; for woollen goods, 1 pound of the

powder, dissolved in 20 gallons of water, is employed. Linen, canvas, etc., can also be made impervious to water by first dissolving 1 part of alum-cake in 10 parts of water, then boiling 1 part of resin and 1 part of soda-crystals with 10 parts of water, separating the soap formed by adding ⅓ part of chloride of sodium, mixing it with an equal quantity of palm-oil soap, and dissolving the mixture in 30 parts of water; the fabric is immersed successively in the alum and soap solutions, and, after being rinsed in pure water, is dried. Berlin waterproof cloth is said to be prepared by saturating the fabric in a solution of sulphates of alumina and copper, and then dipping it successively in solutions of water-glass and resin soap. Cooley's process consists in rubbing the wrong side of the fabric with white wax until it acquires a slightly gray or white appearance. In France waterproof belting is made by first preparing a homogeneous paste of India-rubber 106 parts, sifted saw-dust 175 parts, powdered sulphur 10 parts, slaked lime 25 parts, sulphate of alumina 125 parts, sulphate of iron 125 parts, and hemp tow 10 parts. This mixture is dried, and then dissolved in 4½ parts of spirits of turpentine or benzine, and the solution applied to the fabric, which, when dry, is passed between rollers, and is finally exposed for some time to the heat of a steam-bath. A metallic soap, adapted to the waterproofing of tents, etc., is made by dissolving ordinary soft soap in water, and adding a solution of sulphate of iron; the iron soap formed is washed, dried, and mixed with linseed oil. The qualities of this mixture are improved by the addition of India-rubber. Most of the above methods accomplish the waterproofing without destroying perviousness to air. Gloves, hats, umbrellas, etc., can be rendered impervious to water by coating them with a solution of 1 part of paraffine in 10 to 15 parts of naphtha or benzine. A process for protecting the fleece of live sheep from the action of water consists in first impregnating the fleece with a solution of alum, then treating it with a solution of soft soap; after this treatment the wool is said to remain perfectly dry, and to be improved for manufacturing purposes. Paper is rendered impervious to grease and water by immersing it, when unsized, in a solution of shellac in borax. The product obtained in this manner somewhat resembles parchment paper. The Japanese are said to prepare waterproof paper for the manufacture of umbrellas by treating it separately with solutions of bichromate of potassa and glue, the gelatine being thus rendered insoluble. The following preparations are employed in the waterproofing of leather, the ingredients being usually melted together and applied hot: Boiled linseed oil, mutton suet, beeswax, and resin; linseed oil, resin, white vitriol, sawdust, and spirits of turpentine; beeswax, burgundy pitch, linseed oil, and turpentine; tallow, copaiba balsam, and naphtha; caoutchouc boiled with linseed or neat's-foot oil. According to Hager, a preparation made by dissolving 1 part of India-rubber in 5 parts of petroleum, and adding 20 parts of paraffine, 5 parts of oil, and 5 parts of tallow to the solution, also furnishes a good waterproof dressing for leather.

J. P. Battershall.

**Water-Ram.** See Hydraulic Ram, by J. P. Frizell.

**Wa'ter-Rat,** or **Beaver-Rat,** the common name of the *Hydromys chrysogaster* of Tasmania, an animal resembling the muskrat in many particulars, and deriving its scientific name from the golden-yellow color of its belly, while the back is of a dark rich brown. It is an expert swimmer, frequents both salt and fresh water, is nocturnal in habit, and when eating supports itself upon the hind legs and tail.

**Water-Rice.** See Rice, Indian.

**Wa'tershed.** This word, like the science of physical geography, to which it belongs, is of German origin, and has been recently borrowed from the compound *Wasserscheide,* "division of the waters," though it might legitimately have been formed from the English elements, "water" and "shed," which originally meant to "divide." In fact, some geographers still use "divide" instead of "watershed." The latter word is preferable, because it is more specific, while at the same time it is quite as truly English as "divide," which we owe to a Latin source. The Romans employed *divergium* and *divortium* (generally in the plural) *aquarum.* Innocentius, an engineer of the time of Constantine, introduced *aquivergium,* and *aquiversium* is found in some mediæval authors. According to Marca (Marc. *Hisp.,* p. 64), *aiguebes,* derived from one of these words, was used in the Limousin dialect, and the same writer gives *eauversant* as the proper French equivalent of *aquivergium. Eauversant,* if ever known, is now obsolete, and this great feature of geographical surface wanted a specific designation in scientific nomenclature until the recognition of the importance of flowing water as a formative geological agent led to the introduction of *Wasserscheide* and *watershed* into German and English, and of their equivalents *acquapenda, displuvio,* and *spartiacqua* or *spartiacque* into Italian. *Versant* is used in French for watershed, but is wanting in precision.

A watershed is a boundary of a hydrographical basin, or an imaginary line which runs along the ridge of separation between adjacent seas, lakes or river-valleys, and represents the limit from which the water of precipitation naturally flows in opposite directions into different basins. The watershed in perhaps most instances follows the line of highest elevation between the waters of whose basins it forms the drainage-limit, but to this rule the exceptions are numerous. The flow of water is determined at every point by the configuration and character of the ground *below,* not *above,* its own level, and it follows a descending surface wherever it finds it. The contour of a peak or a ridge higher than any other part of the chain to which it belongs may be such as to carry the drainage of its western slope, for example, around its flanks or its base to a point of discharge on its eastern side; the precipitation on the northern slope of a mountain-chain may be carried off to the S. by a transverse valley, as in S. E. Transylvania, where a territory of several thousand square miles, including the entire N. scarf of the Eastern Carpathians, is drained into the Danube by the Olto through the Rothenthurm Pass, which cleaves the Carpathians to their base; the rocky strata of a mountain whose external slope is to the S. may be inclined in the opposite direction, and may be so permeable by water as to absorb the rains of summer and conduct them by hidden interstratal channels to an outlet on the northern side; while the same surface in a frozen condition may send off to the S. the rains and melting snows of the winter season. The precipitation on extensive districts, too, is sometimes almost wholly received by caverns or porous and bibulous strata, which discharge into basins not superficially connected with those in which the waters have fallen. Thus, much of the Austrian province of Carniola is drained by cave-rivers which pass beneath the coast-range of mountains and empty into the Adriatic. In like manner the upper valleys of tributaries of the Tiber and the Garigliano send the excess of their rainfall into the Pontine Marshes by hidden channels passing under the Lepini chain, and feed springs which in wet weather gush in great volume from the S. W. flank of those mountains and swell the annual delivery of the Badino, the general emissary of the marshes, to 50 per cent. above the total precipitation in its geographical basin. Important systems of rivers not unfrequently originate in great plateaus lying far from any very lofty mountains, as in North America and in Africa, and the flow of such rivers may be so variable from inundations and other irregularly acting influences that a permanent and well-defined watershed can hardly be said to exist within their precincts. Especially is this the case in the marshes which often form in *cluses* or transverse mountain-valleys, where earth-slides, the deposits brought down by torrents, ice, beaver-dams, the growth of aquatic vegetation, or other local causes, may obstruct a watercourse, reverse its flow, and consequently displace a watershed. Like effects are sometimes produced by human action, as in the case of Barton Pond, of the Val di Chiana, and partially, but most signally, in the construction of the great Illinois Canal, which now serves as a new emissary for a portion of the waters of Lake Michigan. Indeed, almost all canals and aqueducts involve more or less derangement of natural watersheds. The hydraulic operations now going on at the Lake of Bienne in Switzerland have resulted in curious discoveries respecting ancient artificial interference with the discharge *régime* of that basin. The Romans had lowered the level of the lake by drawing off a portion of its waters into the river Aar by means of a tunnel half a mile long through the ridge on the eastern side which separated it from the valley of that river. This tunnel had been choked up and forgotten. The engineers of the present day have reversed the process, and by a deep cut, accidentally almost exactly coinciding with the line of the tunnel, turned the Aar into the lake, at the same time lowering the outlet of the latter, so as to depress the surface to the desired level, and recover much valuable land from the beds of the river and the lake.

The question whether a lake can have more than one natural outlet, which has been much discussed of late, is connected with this subject. Cases of this sort are certainly not frequent, and where they occur must generally be due to temporary causes, but the bifurcation of great rivers, and even their division at the heads of their deltas, which may often be regarded as substantially permanent in character, are analogous phenomena, as is also the dividing of glaciers, or rivers in congelation, several branches of which often issue from a single great snow-field through different valleys, and of course have separate

discharges. The Gries glacier, which fills and overtops a depression along the Gries *col*, sends streams, even without a division of its ice-current, to the Rhone on one side, and through Lago Maggiore to the Po on the other.

GEORGE P. MARSH.

**Watershed of the Gulf of Mexico.** This includes the entire portion of North America that slopes toward the basin at its foot and discharges its waters into the Gulf. Its boundary is convex from the Florida capes to the Isthmus of Yucatan, except the indentation made by the delta of the Mississippi. The Gulf is bounded N. by the U. S., lat. 30° 30′ N. being its most northerly extreme; E. by the Florida peninsula and straits and Cape Sable to Cardenas in Cuba, lon. 81° 20′ W.; S. by the Isle of Cuba to Cape San Antonio and the Caribbean Sea to Cape Catoche in lat. 21° 35′; thence it is bounded by the state of Mexico to the Rio Grande. Its most southerly point is 17° 32′ N., and its most westerly extreme is 97° 50′ W. The length of the basin is 1000 miles; its breadth from the mouth of the Mississippi to Cape Catoche is 535 miles, and from Matagorda or Corpus Christi to Tabasco is 750 miles. The total area covered by the Gulf is 590,000 sq. m., and, including all its bays, it may be reckoned at 600,000 sq. m. Into this basin there is poured the drainage of an area of 2,000,348 sq. m., computed, according to the most recent surveys, as follows:

| | | |
|---|---|---|
| The valley of the Mississippi | = | 1,317,690 sq. m. |
| East of the same | = | 139,999 " |
| West Louisiana and Texas | = | 232,458 " |
| In the states of Mexico and Guatemala | = | 310,200 " |
| | | 2,000,348 sq. m. |

The valley of the Mississippi River occupies two-thirds of the watershed of the basin, lying almost wholly within the territory of the U. S. Indeed, the states of Mexico and Guatemala embrace only 310,200 miles, or about $\frac{1}{64}$th of the watershed, and a very small portion near the northern sweep of the Missouri River, where the Milk River touches the British possessions, lies beyond the dominion of the U. S. The delineated boundaries may be given as follows: Commencing at Cape Sable, the most southerly point of Florida, and passing through the Everglades to the E. of Lake Okechobee, and thence by nearly a right line, N. 20 W., for a distance of 540 miles, through Florida to Atlanta in the State of Georgia; and thence by a line, with a few deviations, bearing N. 47 E. 342 miles, along the divide between Tennessee and North Carolina, to Newbern in Virginia; and thence, with a very slight deviation to the westward, it follows the mountain-summit and boundary between Virginia and West Virginia, to Frostburg on the Maryland and Pennsylvania lines; and onward 240 miles to Gallatin near Altoona on the Pennsylvania Central R. R.; and thence, with a very zigzag line, it runs between the heads of the Alleghany and the Genesee and Cattaraugus till it touches within 10 miles of Lake Erie at Dunkirk; and thence to Erie in the N. W. angle of Pennsylvania; thence its trend is S. 70 W. 240 miles to Marion in Ohio, heading the Cuyahoga and Sandusky on the N. and the Muskingum and Scioto on the S.; thence the boundary trends W. about 70 miles to New Bremen and Fryburg in Ohio; thence, with a deflection to the N., to head the Wabash and Maumee; the course of the divide is N. 50 W. 150 miles to Carlisle, on the N. boundary of Indiana; thence nearly W., inclining S., the boundary nearly touches the S. end of Lake Michigan, heading off the two Chicago rivers, and hugs the shore of Lake Michigan up to Kenosha; thence with a northern bend, N. 21 W. 90 miles N. of Lake Horicon, and S. of Fond du Lac, in Wisconsin; thence W. 48 miles to Packwatree, in Marquette co., touching the waters of the Wisconsin River; thence N. 10 E. and then 10 W. 165 miles, with slight deviations, to the northern boundary of Wisconsin at Deer Lake; thence, with a bearing about 30 miles from and parallel to Lake Superior, N. 87 W. 138 miles to Elkton, S. W. of the S. W. extreme of the lake at Duluth; thence N. 17 W. 98 miles, between the St. Louis River, passing into Lake Superior, and the Mississippi, running S., and the Little Fork of Rainy River, emptying northward into the Lake of the Woods. This touches the most northerly waters of the Mississippi at Lake Pemidji; and thence, turning abruptly S. 75 W., its trend continues 100 miles to Red Lake and Wild Rice River, that run into the Red River of the North; thence, with a course S. 30 W. and deflections of 20 miles to W. and E., the watershed boundary continues 180 miles to the divide or portage between Lake Traverse and Big Stone Lake. This point is the head alike of the Red River of the North and the Minnesota, running S. into the Mississippi.

Here we find traces unmistakable of another state of relative level about the waters of the divide. These show that an enormous stream once swept through this gorge and emptied its waters through the Minnesota Valley. At an elevation of 40 to 60 feet from the present level of these small lakes and the marshes between them there are water-marshes on the cliffs of drifting currents running southward, worn into the rocks that rise 130 to 150 feet on either side of the lakes. These indicate a lifting up of the entire region, and the disruption of the barriers that made a lake of all the region N., W., and E. of them, and the discharge of the waters through the Mississippi River, perhaps at the expense of the Niagara and St. Lawrence. Lake Winnipeg and its attributes in the region round its basin were then an extensive fresh-water sea, now laid bare by the modern level and present geological dispositions. (See Gen. G. K. Warren's essay and report to the war department, 1874.) That the lake-region is tributary to the Gulf of Mexico is evident over all the extent of the lake-front down to Dunkirk on Lake Erie; in the proximity of the watershed boundary to the lakes and the lowness of the barrier.

To resume: Starting from the S. end of Lake Traverse, at an elevation of about 1000 feet above the sea, and with a bearing N. 54 W., it reaches the head of the Shyenne River at Fort Totten, about 180 miles. Fort Totten is on the Minni-wau-ke Lake, 5 miles N. of the Shyenne, which empties into the Red River. The watershed keeps S. of it, and runs thence W. 90 miles, and thence N. 47 W., 72 W., to the northern boundary of the U. S. near the source of the Mouse River, a tributary of Assiniboine—and White Earth and Muddy, running into the Missouri; thence from the Dakota line, keeping along the parallel of 49° for a distance of 210 miles, to where it deflects N. for 25 miles, to head the Milk River, a tributary of the Missouri; and it returns again at 170 miles farther on, where lat. 49° reaches the summit of the Rocky Mountains, 8574 feet above the sea. Its most northerly point is in lon. 112° W., and the most westerly point is in lon. 113° 50′. Here we bound the northernmost drainage of the watershed and the extreme western spring of the great valley of the Mississippi River. Thence the trend of the boundary is southward along the summit of the mountain, with a general course S. 20 E. 356 miles, taking in three great deflections—one W., the other E., and the third W., and a circuit of 200 miles to include the Wisdom River sources and the sources of Jefferson River, to Henry's Lake at the head of Red Rock fork of Jefferson River; thence, with a détour to the E., S., and N., to include Madison, the head of the Missouri, and exclude the Shoshone Lake, and include the great part of the National Park and the Yellowstone Lake. The boundary starts S. 40 E., and continues down the Wind River Range 370 miles to Long's Peak, 14,056 feet in elevation. This sweep heads the Yellowstone and Wind River and the waters of the Platte, running into the Missouri, into Mississippi River, into the Gulf, and the Snake River, running into the Columbia and the Pacific, and the Green River into the Colorado, drifting to the Gulf of California. Thence the course of the divide turns S. 12 W. 175 miles to Fort Plummer, on the S. border of Colorado. At the San Luis Park, on this line, 60 miles inside of the State of Colorado, the divergence takes place from the Mississippi Valley to the divide between the waters of the Colorado of the West and the Rio Grande. The San Luis is the name of the stream which heads the Rio Grande. The Arkansas departs from the same park and runs E., and the three rivers thence depart in widely different destinations. From Fort Plummer the boundary runs S. 35 W. through New Mexico, 145 miles to Fort Winnebago, in the Zuni Mountains; thence 16 E. to the Mimbres Mountains, and S. with the Mimbres to the southern line of New Mexico, to the San Florida Mountains. This point is 66 miles W. of El Paso, in lat. 31° 48′ N., T. 29–30, R. III. W.; thence the boundary leaves the United States S. 25 E. 348 miles through the arid regions of Chihuahua; thence S. 58 E. 210 miles through the deserts of Coahuila; thence S. 78 miles through Lac del Muerto and to Lake Parras; thence E., still in Coahuila, along parallel 25° N. to the line of Nuevo Leon—thus far, at least, the country is chiefly a desert from Middle New Mexico; thence S. 200 miles through Zacatecas, and, with a S. E. trend, 75 miles along the line between San Luis Potosi and Guanajuato; thence S. 12 W. 160 miles through the central portions of Mexico; thence E. 85 miles, still in the State of Mexico; thence S. 165 miles through Puebla into the centre of Oaxaca; thence S. 87 E. 240 miles to the boundary between Oaxaca and Chiapas; thence S. 45 E. 250 miles to the centre of Guatemala, and only 25 miles from the Pacific Ocean, and thence N. 24 E. through Guatemala, Campeachy, and Yucatan, 265 miles, to Cape Catoche on the Yucatan Channel or straits. The Gulf is bounded by running the line to Cape San Antonio, on the W. of Cuba, and with the watershed of that island to Cardenas, and thence across the Florida Straits to Cape Sable, the point of departure. These are the boundaries of the watershed of the Gulf of Mexico.

The *meteorology* and *physical features* of the watershed

are varied through all the extremes in this long boundary and this extensive area. Commencing at the Gulf itself, the precipitation of rain (in the absence of observations), varying with the latitude, must be taken as indicated by the observations upon the neighboring shores. We shall therefore assume the rainfall upon the Florida peninsula and the circuit of the Gulf—at Punta Rassa, 44.45 inches; at Jacksonville, 56.59; at Mobile, 54.50; at New Orleans, 68; at Galveston, 54.49; at Indianola, 45.32 inches—as the index to the rainfall upon the Gulf in their vicinity in 1873. Assuming this as a fair mean, we have 54 inches or 4.5 feet for the rainfall upon the Gulf. This reaches the vast sum of 75,270,680,000,000 cubic feet. Unlike the rainfall upon the land, no part of this contribution is absorbed, but it is re-evaporated perhaps more than once before the winds bear it to the shore. This total is nearly equal to the entire amount discharged upon the Mississippi Valley, according to Humphreys and Abbot, though the area it falls on is less than one-half of that valley. And now let us examine into the causes of this deficit and the difference between the rainfall on different portions of the watershed. Attributing to the latitude and temperature all due influence, there is still an unexplained cause for the difference of precipitation on the land to the westward and northward of the Gulf of Mexico. If we draw a line from the western fundus of the Gulf across the watershed to the Red River of the north, about lon. 97° W., and take 50 miles of territory on either side of said line, we shall describe an area that bounds two distinct climates. That on the E. we shall denominate the *humid* or *fertile climate*, and that on the W. the *dry climate*. "The animals typical of their clime do not cross the boundary to reside E. of it. The mule-eared rabbit, the civet-cat, the Mexican hog among quadrupeds; the Mexican buzzard, the scissor-tail flycatcher, the prairie-hawk among birds; the cutting ant, the devouring grasshopper among insects; the spreading adder, the joint snake, the coachwhip snake, the tarantula, and the scorpion among reptiles,—these reside on the W. side of the line; while the trees are all of stunted growth except those growing upon the streams; the mesquite and cactus and the agave or American aloes grow in abundance." (Forshey's *Climate of Texas*, in the *Texas Almanac* for 1860.) The W. of this line is characterized by drouths and the necessity of irrigation to agriculture. In many districts farther W. the want of rain makes a positive desert; and this characteristic marks most of the watershed on the western border, through the U. S. and through the Mexican dominions down to Nuevo Leon in lat. 25°. The climate E. of the dry line is characterized by an abundance of rain and corresponding growth of vegetation. The forest trees are indicative of the exuberance of other growths—tall and of gigantic proportions. The Gulf is undoubtedly the grand reservoir and the S. wind the Aquarius for the watering of all North America to the N. and E. of the Gulf. The climates, dry and humid, are fixed by these dispositions. The rainfall is the result of the supply from the reservoir, and the supply depends on the reservoir and the transporting winds.

*Table showing the Climates of North America and the Line of Demarcation along lon. 97°.*

| | Places. | Lon. | Lat. | Rain, inches. |
|---|---|---|---|---|
| | | ° ′ | ° ′ | |
| Lat. 30±. | Savannah | 81 08 | 32 02 | 63.14 |
| | New Orleans | 90 07 | 30 00 | 68.00 |
| | Galveston | 94 50 | 29 18 | 54.50 |
| | Indianola | 96 38 | 28 32 | 45.32 |
| | Corpus Christi | 97 27 | 27 47 | 30.82 |
| | Fort McKavitt | 100 00 | 30 50 | 23.27 |
| Lat. 35±. | Huntsville | 87 00 | 35 00 | 54.00 |
| | Memphis | 90 07 | 35 07 | 49.39 |
| | Fort Smith | 94 29 | 35 23 | 42.10 |
| | Fort Arbuckle | 97 09 | 34 27 | 38.57 |
| | Santa Fé | 106 10 | 35 41 | 19.83 |
| Lat. 40±. | Morgantown | 79 52 | 39 36 | 47.04 |
| | Indianapolis | 86 06 | 39 47 | 46.26 |
| | Jefferson Barracks | 90 15 | 38 28 | 41.95 |
| | Fort Laramie | 104 47 | 42 12 | 19.98 |
| Lat. 45±. | Milwaukee | 87 00 | 43 03 | 32.00 |
| | Fort Ripley | 93 00 | 45 00 | 27.00 |
| | Fort Gaimes | 94 00 | 46 19 | 29.00 |
| | Pembina | 97 00 | 49 00 | 12.39 |
| | Fort Benton | 110 00 | 47 00 | 9.88 |

The basin of the Gulf charges the reciprocal of the trade winds, and sends them N. and E. to water all the earth. They obey a law which inclines them in the direction indicated, without mountain or other vicissitude obvious to man; and they sweep the entire Gulf front and the larger portion of the valley of the Mississippi, and spread in width to 1650 miles before they reach the northern limit of the watershed. They yield their burden of water and produce a fertility that will always sustain a dense population. No country is blessed with a more exuberant soil, or a more extended area of well-watered territory.

The dry region, supposing it limited by 25° N. lat., contains an area of 933,000 sq. m.; and while this area too is watered by the Gulf, its supply is so limited, away from the immediate coast, as to show in its vegetation less and less of moisture to the farther summits of the mountains and to the positive arid deserts. The humidity was obtained in the region observed by the army meteorological observations prior to 1860; by the Smithsonian registers kept thence to the establishment of the signal service, and by the signal stations since 1872, together with many private observations. Taking ten of these stations, the average depth of rain is 18 inches over the entire dry region. The palpable falling off along the line of division, as at Leavenworth (lon. 95°), 35 inches of rain, Denver (lon. 105°), 14 inches, Breckenridge (lon. 96°), 28 inches, and Cheyenne (lon. 104°), 8.60 inches, is in proof of the hypothesis. The humid or fertile region contains about 1,067,151 sq. m. of territory, and the rainfall, as indicated by the mean of observations at twenty stations, is 47.5 inches, varying from 33 to 65 inches, according to latitude.

It follows from these views and observed facts that the rivers of the dry region have their mere freshets in the season of rains, and then run nearly dry in the summer season. Thus, the Rio Grande, the upper Red River, and the sources of the Arkansas and the Missouri in the summer season send but little water to the rivers that discharge into the Gulf. They are largely absorbed by the sandbars and drifts or evaporated by the sun. The corresponding rivers of the Mississippi Valley of the eastern slope keep flush during the whole season and furnish abundant supplies to the discharging river; so that the Mississippi River at Carrollton (upper New Orleans) discharges one-fourth its maximum delivery when it is within 3 feet of low-water mark. This is true of the rivers that feed the eastern Gulf, and so with the rivers of Texas that belong properly to the humid region. The discharge of the Mississippi River, as shown in the delta survey, by actual measurement, gives 19.5 trillions of cubic feet annually, omitting the Red River. This is but about 25 per cent. of the rainfall on the whole valley. The rest must be in part re-evaporated and carried by the winds beyond the valley, and in part absorbed. What portion of this water finds its way to the reservoir under the earth will never be known. But the fact that the geological strata dip toward the basin in nearly every part of the watershed, and that there exist subterranean streams wherever the earth has been penetrated, make it highly probable that a very large portion reaches the basin by these channels. An indefinite but large proportion of the surface of the earth is covered by the drift beds, and wherever these are cut by streams or accident or design, they are found pervaded by springs or streams of water, that persistently find their way down to the Gulf. This is particularly true of the whole Gulf-front E. of the Sabine River. The reservoir receives large acquisitions from recent rainfalls near the Gulf-front, both above and beneath the surface of the earth. This well accounts for the low degree of salt-saturation of the hither portions of the Gulf.

The Gulf of Mexico receives from the Caribbean Sea about as much as it discharges through the straits of Florida to the Atlantic Ocean. This is determined by the cross-sections and velocities of the straits of Yucatan and the straits of Florida. Hence, the Mississippi and other streams, visible and invisible, which enter the reservoir are therefore left to supply evaporation. The S. wind, as observed above, is the water-carrier for the whole area watered by the Gulf. This is manifestly much greater than the watershed, and yet the chief supply is to the lands that slope toward the basin, and this reciprocity is kept up through the centuries. This economy is nowhere on earth better balanced and preserved, and nowhere are its blessings more abundantly felt or more thoroughly appreciated.

C. G. Forshey.

**Wa′tershield,** a general name for the Cabombaceæ or Cabombeæ, a group of exogenous water-plants variously regarded as a separate natural order or as a sub-order of Nympheaceæ. The common species of the U. S. are *Brasenia peltata* and *Cabomba caroliniana*. The former has an extensive range in America, Asia, Australia, and even Africa.

**Wa′ter-Spaniel,** a name given to several breeds of the spaniel, distinguished by fondness for swimming. Water-spaniels have rather long, curled hair, which has an oily feel and turns water very well. They have often a peculiarly strong, unpleasant odor. They are extremely intelligent and affectionate, but are often slow and inactive, except when at work. Their chief use is as retrievers in shooting water-fowl. Comparatively few are of pure breed.

**Waterspout.** See Storms, by Prof. A. Guyot, Ph. D., LL.D.

**Waterstaat** [literally, "disposition of the waters;" Fr. *état des eaux*] is the name of the corps of royal civil engineers of Holland—"engineers of the waterstaat." The corps, as organized in 1849, and partly reorganized since, consists of 2 inspectors, 5 engineers-in-chief of the first class, 6 engineers-in-chief of the second class, 13 engineers of the first, 15 engineers of the second, and 8 engineers of the third class, with 6 aspirant- (under-) engineers. The engineers of the waterstaat are originally selected by competitive examination from the civil engineers who, having made their studies at the Polytechnic School at Delft, are in possession of a certificate delivered by a commission of examination appointed by government. The corps has charge of the national hydraulic works; the protection of the country against the inundations and encroachments of the sea and the rivers; the improvement of rivers, harbors, canals, and dikes; the maintenance of highways and bridges; restoration by drainage of submerged areas (see Haarlem Lake, Inundations); and the construction of railroads. The waterstaat is placed under the superintendence of the secretary of state for the interior (*minister van rinnenlandsche zaben*). The state budget for the works of the waterstaat of Holland for 1876 amounts to 16,000,000 "gulden" (nearly $6,500,000). P. Caland,
*Inspector of the Waterstaat.*

**Waterston** (Robert Cassie), b. in Kennebunk, Me., in 1812; studied theology at Cambridge under Drs. Henry Ware and J. G. Palfrey; for five years had charge of a sailors' Sunday school; for six years was minister at large in Boston; for seven years was pastor of the church of the Saviour there; is author of a volume on *Moral and Spiritual Culture* (1842), which was republished in England and Ireland; of articles in the *North American Review;* of discourses, addresses, poems, and papers on questions of reform and education—subjects in which he took a cordial and intelligent interest. Was made an A. M. by Harvard College in 1844. O. B. Frothingham.

**Water-Supply.** See Water, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

**Wa'terton** (Charles), b. at Walton Hall, near Wakefield, Yorkshire, England, of an ancient and wealthy Roman Catholic family descended from Sir Thomas More; was educated at Stonyhurst College; displayed great fondness for natural history; spent many years in travels in Spain, Italy, the West Indies, and North and South America, visiting several times Demerara, British Guiana, where he had estates; published *Wanderings in South America*, etc. (1825), and *Essays on Natural History, chiefly Ornithology* (2 series, 1838–44), accompanied by his *Autobiography* with a view of Walton Hall, where he resided many years in the midst of a wood, where by prohibiting the use of firearms many rare birds and animals became domiciled. D. at Walton Hall May 26, 1865, and at his own desire was buried in his own wood with an imposing funeral ceremony devised by himself. *Lives* of Waterton have been published by Dr. Richard Hobson (1865) and Norman Moore (1871).

**Wa'tertown,** p.-v. and tp., Litchfield co., Conn. P. 1698.

**Watertown,** p.-tp., Middlesex co., Mass., on the Watertown branch of Fitchburg R. R. and upon Charles River, about 6 miles W. of Boston, contains several religious societies, a free public library, good schools, 1 bank, 1 newspaper, a street railway, an iron-foundry, and 1 paper-bag manufactory. Mount Auburn Cemetery is partly located within the limits of the town, and here is also an important U. S. arsenal. P. 4326. Geo. Phinney, Ed. "Press."

**Watertown,** tp., Clinton co., Mich. P. 1297.

**Watertown,** tp., Sanilac co., Mich. P. 49.

**Watertown,** p.-v. and tp., Tuscola co., Mich. P. 684.

**Watertown,** p.-v. and tp., Carver co., Minn. P. 1241.

**Watertown,** city and tp., cap. of Jefferson co., N. Y., on Black River, a few miles from its entrance into Black River Bay in Lake Ontario, and on Rome Watertown and Ogdensburg R. R., is the terminus of two other branch railroads. The river, here 60 yards wide, is crossed by several bridges, and has here a fall of 24 feet, with a succession of rapids below, affording immense water-power, which is largely utilized for manufactories of woollen goods, paper, flour, machinery, iron utensils, farming implements, leather, and lumber. The city contains a U. S. arsenal, court-house, several fine churches, 3 national banks, and 5 newspapers. P. of city, 9336; of tp. 1373.

**Watertown,** v., partly lying in Trenton tp., Dodge co., and partly in Watertown tp., Jefferson co., Wis. P. of the part in Dodge co. 2186.

**Watertown,** city and tp., Jefferson co., Wis., was first settled in Dec., 1836. The territory within the corporate limits is about equally divided into two parts by Rock River, furnishing a valuable water-power, which runs a large amount of machinery. It is at the junction of Chicago and Northwestern R. R., extending north-eastward from that city to Marquette, Mich., with Chicago Milwaukee and St. Paul R. R., reaching north-westward from Chicago to Duluth. This makes the city the most convenient and important railway centre in Wisconsin. Its educational facilities are among the best and most liberal in the State. A graded system of union schools has for several years been in successful operation, with 4 large and commodious buildings, suitably furnished, in the different wards. Here is located the North-western University, a Lutheran institution, in a flourishing condition. More recently has been commenced the College of our Lady of the Sacred Heart, a Roman Catholic Seminary, well attended. It has 3 weekly papers—2 printed in the English language and 1 in the German. To sustain a population of nearly 10,000, and that rapidly increasing, a large amount of manufactures, all kinds of domestic industries, the usual mercantile business, the different trades, the mechanical and useful arts, and the learned professions must be carried on extensively, and this is the case, without going into an enumeration of particulars. The location of the city is beautiful, the ground gently undulating, and the place remarkably healthy. It is surrounded by one of the most thickly-settled, best-cultivated, and most fertile agricultural regions in the State—the rich garden of Rock River Valley. P. of city 5364; of tp., exclusive of city, 2222.
D. W. Ballou, Ed. "Democrat."

**Water Valley,** p.-v., Yalabusha co., Miss.

**Wa'terville,** p.-v. and tp., Marshall co., Kan., on the Central branch of Union Pacific R. R. and on the S. bank of Blue River, 100 miles W. of Missouri River, has 3 churches, an excellent graded school, 1 newspaper, 1 wagon and carriage and 1 soap factory, 1 bank, 2 fine water-powers, 2 grist and flouring mills, and 2 hardware stores. P. 1584. W. P. Campbell, Ed. "Telegraph."

**Waterville,** p.-v., Kennebec co., Me., on Maine Central R. R. and on Kennebec River, 18 miles above Augusta, has 6 churches, a college and a classical institute, 4 banks, 1 newspaper, 2 hotels, a large cotton-mill, 1 door, sash, and blind factory, 1 lumber-mill, 1 shirt-factory, and 1 furniture establishment. P. 4852.
Maxham & Wing, Eds. "Waterville Mail."

**Waterville,** p.-v. and tp., Le Sueur co., Minn. P. 798.

**Waterville,** tp., Grafton co., N. H. P. 33.

**Waterville,** p.-v., Sangerfield tp., Oneida co., N. Y. P. 1182.

**Waterville,** p.-v. and tp., Lucas co., O. P. 1609.

**Waterville,** p.-v. and tp., Lamoille co., Vt. P. 573.

**Waterville,** tp., Pepin co., Wis. P. 835.

**Waterville School District,** v., Waterbury tp., New Haven co., Conn. P. 426.

**Wa'tervliet,** p.-v. and tp., Berrian co., Mich. P. 1674.

**Watervliet,** tp., Albany co., N. Y. P. 22,609. It contains several large villages, the most important of which are West Troy and Green Island (which see).

**Water-Wheel.** See Water-Power, by Prof. W. P. Trowbridge, A. M.

**Wa'terworks.** Though the term *waterworks* is ordinarily understood to refer to constructions and appliances, it is proposed here to include under that head the entire subject of the collection, preservation, and distribution of water for domestic purposes.

The sources of water are discussed in Water and Rains. To obtain more than the minimum flow of a stream, storage reservoirs must be constructed of a capacity proportioned to the quantity desired. To ascertain the capacity of the reservoirs, it is desirable to have a record of the rainfall at the locality, or sufficiently near it, embracing a long series of years. Then, having ascertained by experiment what portion of the rainfall may be expected to reach the streams, we can compute the total yield of the drainage-basin for each year, and, deducting the quantity to be consumed, we find the greatest quantity that must be in store at any time in order that there may be no deficiency in the driest seasons. Such a calculation for a series of past years may be applied with confidence to the future. It is possible to provide storage sufficient to utilize the entire yield of the drainage-basin, but the excessive cost and the lack of suitable sites for such reservoirs usually make this impracticable. The most that is ordinarily attempted is to utilize a quantity equal to the average flow of the driest year. Experience has shown that to accomplish this the reservoirs must be capable of containing about four months' supply.

That is, suppose we find the minimum yield for a sufficiently long series of years to be 14.68 inches of water, which is equivalent to about 700,000 gallons per day per square mile, the reservoirs should be sufficient to deliver 700,000 gallons per day for each square mile of drainage-ground during a period of about five months. This is a reservoir capacity of 85 million gallons per square mile of drainage-ground. In some European systems of waterworks an attempt is made to economize the flow of the three driest known consecutive years. For this purpose the reservoir capacity must be equal to about six months' supply. The average rainfall of the three driest consecutive years of a long series is usually represented very closely by the general average rainfall diminished by one-sixth. Where, for instance, the average rainfall of a series of years, thirty or more, is 48 inches, the average of the three driest consecutive years will be about 40 inches. Assuming 20 inches collectible, this would be about 952,000 gallons daily per square mile. The reservoirs must be sufficient to contain six months' supply at this rate—viz. about 174 million gallons per square mile of drainage-ground. To economize the total yield of the drainage-ground, we should require a reservoir capacity equal to the average flow of from nine to eighteen months—that is, in the case just supposed, from 313 to 627 million gallons per square mile of drainage-ground. The reservoir capacity of several British systems of waterworks is given below in millions of gallons per square mile of drainage-ground. The facts are given in Mr. Bateman's evidence before the London water-supply commission, report of 1868–69: Manchester, 117; Liverpool, 233; Dublin, 123; Glasgow, Loch Katrine district, 145; Glasgow, Gorbal's district, 252. The gallon spoken of in this paper, unless otherwise stated, is the U. S. standard gallon, 231 cubic inches, being 58,373 Troy grains at the maximum density. A cubic foot contains 7.48 gallons.

Considerable amounts of water are sometimes obtained from deep wells by pumping. A considerable part of the supply at Liverpool is pumped from wells in the sandstone formation underlying the region. The entire supply of the neighboring city of Birkenhead, which contains over 50,000 inhabitants, is, or was recently, obtained in that way. The Kent Company, supplying a part of London, obtains its entire supply, and the New River Company a part of its supply, from deep wells in the limestone. The Liverpool wells in some cases communicate with tunnels for collecting the water. According to Mr. Thomas Duncan, engineer to the Liverpool waterworks, there were four wells in use there in 1868, furnishing from 35 to 43 million imperial gallons per week. There were formerly seven, from which about the same quantity was pumped. He affirms that the hardness of the water increases with pumping. The Green Lane well when first opened (about 1855) showed 4½° of hardness; in 1868, 7°. The yield of this well had diminished about one-tenth. Mr. G. F. Deacon, borough and water engineer of Liverpool, says in his report for 1875 that the quantity of water derivable from each well without lowering its level is decreasing at the rate of about 2 per cent. per annum. He says: "Near Bootle an additional well was sunk, and the yield of that station was increased from 621,660 to 1,462,000 gallons per day. But in consequence of this increase the level of a well 3½ miles off fell off 4 feet, and its yield diminished." The depths of the wells belonging to the New River Water Co. are given as follows by Mr. James Muir, their engineer: Depth of the well and bore together at Amwell End, about 390 feet; the Amwell Hill well, 260 feet; the Cheshunt well, 172; the Hampstead Heath well, 458; and the Hampstead Road well, 237. He gives the yield of the Amwell Hill well as 2,400,000, and the Amwell End well 2,500,000, imperial gallons per day.

*Consumption.*—The purpose to which the water-supply of towns is applied may be embraced under three general heads—viz. (1) Watering, including the sprinkling of streets and grounds, the extinguishing of fires, and the flushing of sewers where this is practised; (2) manufactures; (3) domestic uses. In large cities the first item rarely amounts to more than 5 per cent. of the total consumption. It is greater in suburban districts, being sometimes as high as 20 per cent. during the hot weather. The second item is from 5 to 20 per cent. of the total in commercial cities, and may be as much as 33 per cent. in towns devoted mainly to manufacturing. In English manufacturing towns it is said to be from one-fourth to three-sevenths of the total consumption. The third division embraces the manifold uses and waste of water in the domiciles of the people. The following table, showing the present consumption of the principal American cities, is taken from the Cincinnati waterworks report for 1875, being compiled by the engineer, Mr. Americus Warden. It is believed to be correct, though it is not clear in every case what kind of gallons is intended. New York gallons are generally used by towns in the State of New York. There are 7.8125 New York gallons in a cubic foot. The consumption is given in gallons per day per inhabitant:

TABLE I.

| | | | |
|---|---|---|---|
| New York | 90 | St. Louis | 60 |
| Detroit, Mich | 88 | Boston | 60 |
| Chicago | 80 | Philadelphia | 56 |
| Hartford, Conn | 80 | Toledo, O | 54 |
| Reading, Pa | 75 | Cincinnati | 53 |
| New Haven, Conn | 75 | Baltimore | 50 |
| Albany, N. Y | 70 | Lowell, Mass | 44 |
| Springfield, Mass | 66 | Cleveland, O | 43 |
| Buffalo, N. Y | 63 | Providence, R. I | 30 |
| Brooklyn, N. Y | 60 | Milwaukee, Wis | 25 |

The consumption of St. Louis for 1875 is given by the engineer, Mr. Whitman, as 42 U. S. gallons; that of Chicago for same year, by Mr. Chesbrough, as about 90 U. S. gallons. The consumption of Lowell in 1875 was 34 gallons per head daily. Mr. Warden's figures refer to an earlier year. Table II. gives some facts as to the consumption in several British towns. The consumption of some other European cities at a late date was as follows: Berlin, 26 U. S. gallons per head daily; Hamburg, 24½; Paris (1867), 34; Bordeaux, 45.6; Marseilles, 49; Lyons, 22; Dijon, 62¾. Probably the greatest consumption of water on record in modern times was reached in Boston in 1860, being 97

TABLE II.

| Town. | Population supplied in 1868. | Consumption in U. S. gallons per head. | |
|---|---|---|---|
| | | Total. | Domestic. |
| Glasgow | 511,000 | 63.6 | 54. |
| Manchester | 600,000 | 27.0 | 18. |
| Edinburgh | 206,117 | 43.2 | 36. |
| Liverpool | 600,000 | 31.2 | 24.9 |
| Bradford | 203,000 | 36. | |
| Newcastle-on-Tyne | 200,000 | 33.6 | 25.2 |
| Wolverhampton | 60,000 | 22.8 | 20.4 |
| Halifax | 50,000 | 54. | |
| Birkenhead | 52,826 | 40.8 | 37.8 |
| Chester | 31,301 (1866) | 30.7 | 28.9 |
| Parts of London | 2,827,660 (1875) | 37.6 | |
| Parts of Liverpool | 234,000 | ..... | 19¾ |

gallons. According to Rozat de Mandres (see *Annales des Ponts et Chaussées*, 1858, ii. semestre), the quantity supplied to ancient Rome amounted, at one time, to nearly 400 U. S. gallons per day for each inhabitant. The enormous discrepancies in the daily consumption, varying as it does from 20 to near 100 gallons, reveal one of the most serious evils in the administration of waterworks—viz. the wanton waste of water. How much water is really necessary for all rational household purposes it is perhaps not easy to say, though undoubtedly the lowest amount given above is ample. A very careful investigation of this subject was made in 1852 by the medical officers of London. The following quantities, excluding waste, were found to be ample: for houses with good cisternage, water-closets, and baths, containing 15 or 20 rooms, 15 or 16 U. S. gallons daily per head; for second-class houses, 9 gallons; the poorest class of houses, 5 gallons; workhouses, 4 to 7. Although the supply was intermittent, water being discharged at certain hours of each day into reservoirs provided by the consumers, it cannot be supposed that these quantities were less than necessary for health and reasonable convenience. The principal causes of waste of water are defective fittings, mains, and reservoirs, carelessness of consumers, and imperfect protection of pipes from frost, which in cold weather necessitates great waste to prevent freezing. Observations are often made to ascertain the quantity of water wasted, by noting the flow in the latter part of the night, when no legitimate consumption is taking place. Observations of this kind recently made at Cincinnati indicate a loss of one-third the total supply. The city engineer of Quebec states in his report for 1872–73 that he has observed seven-eighths as much water flowing to the city at three o'clock in the morning as at noon. The engineer of the Liverpool waterworks states that where no measures are taken to prevent waste, it is no uncommon thing for 70 gallons to be wasted out of every 100 supplied, leaving but 30 applicable to the legitimate uses of the consumer. Similar statements are made by most officers of waterworks who give their attention to this subject.

In America the tendency is to accept this waste as inevitable, and to increase the supply as fast as the consumption overtakes it. In some English towns determined efforts have been made to restrain waste, and these efforts have been attended with such success as to show that the evil is by no means beyond control. In the city of Norwich, which is supplied by a private company, the daily consumption was some 40 imperial gallons per head. In 1859 the company obtained an act of Parliament authorizing them to prescribe the nature in detail of all fittings and pipes, and the work in connection therewith, and to

interdict the use of any existing fittings and pipes which in their judgment might tend to waste. In a few years, by stringent enforcement of these provisions, the daily consumption was reduced to 15 imperial gallons per head with constant service. The imperial gallon contains 10 pounds of water at 62° F., being 6.23 gallons to the cubic foot. The low rate of consumption in Manchester, as given in Table II., is due to the enforcement of similar regulations. The low consumption of parts of Liverpool in 1875 was brought about also by a rigorous system of inspection and enforcement of ordinances concerning waste. Mr. G. F. Deacon, borough and water engineer of Liverpool, has prepared a very interesting paper, which is printed in the minutes of proceedings of the Institution of Civil Engineers for 1875, in which he details the measures taken to restrain waste. The city has been divided into a number of districts, in each of which the aggregate consumption is measured by meters. The nightly indications of these meters show which districts are most in need of inspection. No premises are entered unless waste is observed. Inspections to detect waste are made at night after all legitimate consumption has ceased. The inspector applies his wrench or key to the street stopcock controlling the service-pipe which supplies the premises, and nearly closes the cock. Then, applying his ear to the key, the passage of a very minute quantity of water can be detected. If waste is observed, the house is entered in the daytime, the fittings carefully inspected and defects pointed out, which the owner is required to remedy. Previous to the adoption of these measures the city had been on intermittent service. At one time in 1865 water was only furnished for three hours per day. Constant service was restored for a short time in 1873 as an experiment. It appeared that its maintenance would require a daily supply of 33½ imperial gallons per head. The results of these inspections were surprising. In a large district the consumption was reduced to 12 imperial gallons per head. In a district containing 2134 persons it was reduced to 6 or 7. In 1875 the constant service had been restored to nearly the entire town, with a consumption much less than had formerly been required with intermittent service. It is conceded that only the most stringent legal provisions, and the most ample authority on the part of water-officers for their enforcement, can avail to restrain the wasteful tendencies of consumers.

I have dwelt somewhat fully upon this point, as it appears to me that cities sometimes commit an error in projecting and executing great works for additional supplies of water—well knowing that of every three gallons, two are destined to be wasted, and knowing also that the existing supply is ample for all the legitimate uses of the next generation—instead of addressing themselves to the less ambitious and agreeable task of restraining waste.

*Constructions.*—The multifarious applications of water in a city require a considerable pressure in the distributing pipes. This is secured in two ways: (1) by adopting a natural source of water at a sufficient elevation; (2) by pumping. The most obvious classification of the systems of water-supply is that of gravitation systems and pumping systems. The configuration of the ground is rarely such as to furnish a source sufficiently elevated and sufficiently near capable of supplying the requisite quantity at all seasons of the year. Gravitation systems, therefore, commonly involve storage reservoirs. Where pumping is resorted to, recourse can usually be had to sources whose minimum yield is sufficient. Such a source, however, is liable to be highly charged with sediment in times of flood, and also to contamination from sewage and other sources. We accordingly find that pumping systems commonly involve arrangements for purification. The principal elements of a gravitation system are—(1) the drainage-grounds; (2) the storage reservoirs; (3) the conduit; (4) the distributing or service reservoirs; (5) the distributing pipes. The pumping system commonly lacks the feature of storage reservoirs, and has in addition the pumping establishment and force main, and ordinarily arrangements for filtering or otherwise purifying the water. There are, however, pumping systems with storage reservoirs, of which Brooklyn, N. Y., is an example, and there are gravitation systems in which the water is subjected to filtration, as in the case of Dublin, Ireland. There is also a system recently applied in many small cities and villages which dispenses with service reservoirs. Storage reservoirs are described under RESERVOIR.

The conduit or aqueduct conveys the water from the source to the distributing reservoir in or near the city. In extensive works it is ordinarily of masonry, not being intended to be entirely filled. It is built to a nearly level grade, having only sufficient inclination to give motion to the water. Intervening ridges are cut down or pierced by tunnels. Valleys are crossed by embankments of earth or earth and masonry combined, or by rows of arches. In crossing deep valleys or rivers the masonry of the aqueduct is sometimes interrupted, and the water flows in iron pipes, which descend into the valley and rise and re-enter the aqueduct on the opposite side. In the ancient aqueducts, where, from the limited knowledge of iron-working, such expedients could not be adopted, these crossings required ranges of arches supported by piers of enormous height, constituting the most remarkable monuments of ancient civilization. (See AQUEDUCT.) Small conduits are often made of earthenware pipe. The best earthenware pipes, and particularly the celebrated Scotch pipes, are made from very pure clay mined at great depths, the clays found near the surface of the ground not being found so suitable. The pieces are moulded by hydraulic pressure, and are covered with a vitreous glazing which renders them impermeable to water. The glazing is applied during the burning of the pipe by covering the fires with a layer of common salt moistened with water. The salt is volatilized, and the moisture contained in it is vaporized by the intense heat. The chlorine of the salt combines with the hydrogen of the vapor, and passes off as chlorohydric acid. The sodium of the salt combines with the oxygen of the vapor, becoming soda, which enters into chemical combination with the material of the pipe at the surface, forming a silicate of soda and alumina. These pipes are made in lengths of 2 or 3 feet. The smaller sizes are put together with sockets. Each piece has an enlargement at one end into which the next piece enters, and the joint is made tight by hydraulic cement. The larger sizes are put together with sleeves, which are narrow rings encircling the pipe at each joint, the space between the inside of the sleeve and the outside of the pipe being filled with hydraulic cement. The thickness of earthenware pipes should be about one-twelfth of the diameter. Such pipes have been made as large as 48 inches in diameter. Conduits have been made of wood, but such are not to be recommended. For the first year or two they impart a disagreeable taste to the water, and if not entirely filled with water at all times they decay rapidly. The portions of a conduit subjected to pressure are sometimes made of wrought iron lined with brickwork or cement.

A long and large aqueduct should be provided with gates and discharge-sluices at intervals of a few miles, in order that any section may be emptied for repairs without wasting the entire contents of the aqueduct. It is stated that access to the Croton aqueduct for repairs involves the wasting of some 220 million gallons of water.

A pumping system usually has a conduit, not essentially different in construction from that required in a gravitation supply, though it ordinarily forms a much less important feature of the system. Its purpose is to convey the water from the source to the pump-well, which can usually be located so as not to require a great length of conduit. In waterworks for cities located on the shores of the great lakes, and drawing their supply therefrom, the conduit forms a very important feature. The water cannot be taken from any point near the shore, as it is there liable to be contaminated by sewage and turbid from the action of waves. To procure water free from the latter source of impurity, the conduit must extend a long distance into the lake, as it is only in water of considerable depth that the waves cease to act upon the bottom. A solid structure built into the lake would require the strength and solidity of a breakwater, and even in that case would not be sufficiently permanent and free from settlement to serve as the foundation of an aqueduct. The method adopted at Chicago and other lake cities has been to extend a tunnel under the bottom of the lake to the desired point. The tunnel recently finished for the supply of Cleveland, O., is 6660 feet long and about 5 feet diameter inside. It has a lining of brick about 8 inches thick. It extends from a shaft 67 feet deep sunk at the margin of the lake to a shaft 90 feet deep, from the surface of the water, at a point in the lake where the water is about 36 feet deep. In order to sink the latter shaft, an enormous crib of timber was floated into the proper position, and sunk upon the bottom by loading it with stone. The crib was of pentagonal form, measuring 54 feet on each side, and rising about 12 feet above the surface of the water. It is surmounted by a beacon and a keeper's dwelling. Through an opening in the centre of this crib a large iron tube was let down, and its extremity forced into the bottom. The water was then pumped from the tube, and the earth excavated from the inside, the tube being sunk or extended as the work proceeded. From the bottom of this shaft the tunnel was commenced, and continued toward the shore till it met a similar tunnel excavated from the shore shaft. Great difficulties were encountered in the prosecution of this work. Volumes of inflammable gas sometimes entered the tunnel, driving out the workmen and endangering their lives by

explosions. Several lives were lost from that cause. On different occasions strata of quicksand and other treacherous material were encountered, necessitating the abandonment of portions of the completed tunnel and its reconstruction in more secure ground. The work was commenced in Aug., 1869, and completed in Mar., 1874, at a cost of about $320,000, which is a little more than $48 per linear foot.

The first tunnel built in this country for the supply of water was the one at Chicago, made in 1864 to 1867, under the direction of Mr. E. S. Chesbrough, the engineer for the city, who may be regarded as the originator of this method of procuring a supply of water from lakes. This tunnel is about 2 miles long, and was excavated substantially as above described, though from the more uniform character of the bottom fewer difficulties were encountered than in the Cleveland tunnel. (See TUNNEL, CHICAGO.) A similar tunnel has recently been completed at Buffalo, N. Y. For Milwaukee, Wis., the supply is drawn through a flexible iron pipe 3 feet in diameter, extending about two-fifths of a mile into Lake Michigan, to a point where the water is 18 feet deep. A crib of pilework protects the mouth of the pipe, and a pilework bridge extends from the crib along the line of pipe to the shore.

*Distributing or Service Reservoirs.*—The supply of water is liable to too many contingencies to be entrusted to a pipe or conduit reaching from the source of supply to the point of consumption. It is always considered judicious, where the topographical conformation admits of it, to provide a reservoir at an elevation corresponding to the pressure required in the distributing pipes. At this reservoir the works of supply terminate and the works of distribution commence. Its contents constitute a reserve to be drawn upon in the event of an interruption of the supply from accident or for repairs. The height of the reservoir above the general level of the town is not always subject to control. The points suitable for such a structure are usually limited in number, and their acquisition is often beset with difficulties. An elevation of from 100 to 150 feet is usually sufficient for all purposes of domestic supply; and a greater height than 150 feet is not desirable, unless all fittings are made to conform to the increased pressure, as the leakage is increased, and the velocity with which the water moves in the service-pipes often causes them to burst when outlets are suddenly closed. Where fire-engines are to be dispensed with, a greater elevation is necessary, as will be noticed further on. Many towns situated on undulating ground have more than one reservoir—a low one for the lower districts, and a high one for the higher. The town of Brighton, England, has four "zones of distribution," with a reservoir for each, the highest being 480 feet above the level of the sea.

In localities where land is not too expensive, reservoirs are usually built entirely of earth. The most suitable site for the construction of a reservoir is an eminence composed of gravel containing such a proportion of clay as to admit of being consolidated by pressure. This is called "binding gravel." The embankments forming the sides of the reservoir are formed of this material very carefully compacted by heavy rollers and by the wheels of vehicles. Such embankments ought to have a slope of 2 base to 1 perpendicular, so that an embankment 25 feet high, assuming it to be 15 feet wide on the top, should be 115 feet wide at the bottom. They are further secured from filtration by a central core or an inner lining of puddle, which is an artificially-prepared mixture of clay and gravel in such proportions as to be impermeable to water without being liable to crack when dry. Ledges and abandoned stone-quarries have sometimes been chosen as sites for reservoirs, with usually very unsatisfactory results. The rock should always be covered with a thick layer of puddle. The inner slopes of the embankments are usually paved with heavy stone resting on a layer of pebbles or broken stone. This is necessary on account of the waves to which all bodies of water are liable, which would otherwise injure the banks and render the water turbid. Reservoirs in thickly-settled parts of towns are generally built of masonry, and are sometimes covered to prevent contamination of the water by dust and smoke. All reservoirs in London within five miles of St. Paul's are required by law to be covered, unless the water is subjected to filtration after leaving the reservoir. In open reservoirs the water should not be less than 20 feet deep when full, as vegetation is active at a depth much less than this when exposed to the sun. Impurities sometimes affect the surface, while the water remains good at the bottom, and *vice versâ*, for which reason engineers are accustomed to construct reservoirs so that the water can be drawn from the bottom or otherwise at pleasure. They should also be so arranged that the water will have a circulation through the whole extent of the reservoir, the outlet being at the opposite side from the inlet.

In a pumping system the pipe leading from the pumps to the reservoir is called the force-main. It is usually made a little stronger than other pipes sustaining the same pressure, under the impression that it is liable to greater shocks from the pulsations due to the action of the pumps, though, in reality, there is probably no part of the system of pipes liable to less violent pulsations than the force-main, especially where, as is the universal practice, it is in free communication with an air-chamber.

Where, from lack of a suitable eminence or from economical considerations, no reservoir is constructed and the water passes from the pump directly into the distributing pipes, a stand-pipe is often employed to prevent the pulsations due to the action of the pumps from extending to all parts of the distributing system. A stand-pipe is simply a vertical pipe communicating with the force-main, and rising to a height greater than that corresponding to the pressure in the distributing pipes. It sometimes consists of two pipes communicating with one another at their summits. In this case the pump acts under a constant pressure, the water being all raised to the same height and flowing from one pipe to the other. In the case of a single pipe the water oscillates according to the varying consumption and speed of the pumps. To support the pipe and protect it from frost, a tower of masonry is constructed which forms usually a very striking feature of the works. The tower sometimes serves also as the chimney of the engine-house. The works lately completed at Milwaukee, Wis., contain both a reservoir and stand-pipe. The motive which led to the construction of the latter I have not been able to learn.

A system of waterworks recently introduced into many small cities, and strongly pressed upon the attention of all towns contemplating the construction of waterworks, may, with propriety, be noticed in this place. It dispenses with both stand-pipes and reservoirs. An automatic device regulates the speed of the pumping machinery according to the pressure in the mains. It is called the "Holly System," from Mr. B. Holly of Lockport, N. Y., the patentee of this and other appliances, and an officer of the company which manufactures the pumping machinery. It is claimed that this system maintains a pressure sufficient for domestic purposes at all times, and on the occurrence of a fire the pressure can in a few minutes be raised to a point which will enable the latter to be controlled by streams from the hydrants without the use of fire-engines. In fact, many towns, upon the adoption of this system, have disposed of their movable engines and rely altogether upon hydrants for controlling fires. A fire-alarm, to give notice at the pump-house of the occurrence of a fire, is a part of the system. The maintenance of a pressure in the distributing pipes sufficient to deal with fires without the use of movable engines is no new thing. Mr. J. F. Bateman, an eminent hydraulic engineer of England, says in evidence before the commission of 1867 on the water-supply of London: "Where you have pressure enough, you can do without fire-engines." Again: "In almost all cases where I am engineer the fire-engine has been discontinued. The water is obtained direct from the mains almost instantaneously, and the fire-engines are only used as omnibuses to carry the men and their apparatus." And again, in answer to the question, "And with a system of constant supply do you see any difficulty in introducing a system like that in London?" he answers, "None whatever." Mr. B. thinks 200 feet a sufficient pressure to allow of the disuse of fire-engines; Capt. Shaw, chief of the London fire brigade, would have 300 feet. At Brighton, England, there are no engines and no fire department. Fires are there managed entirely by the police. In none of these places, however, so far as I can learn, are reservoirs dispensed with. It is claimed for the Holly system, as an advantage over reservoirs sufficiently elevated to deal with fires, that it works under the high pressure only so long as the fire lasts, while for ordinary purposes it works under a very moderate pressure. This would certainly be a substantial advantage if the pumps worked with the same relative economy in the one case as in the other. This system recommends itself by its low first cost as compared with a reservoir system, and by the prospect which it offers of dispensing with fire-engines. Many disadvantages, however, generally become apparent in the course of a few years. The necessity of keeping the machinery in readiness for fires at all hours of the day and night, with the requisite number of men in attendance, makes the pumping much more expensive than in the reservoir system. A committee of the municipal government of Yonkers, N. Y., who visited several towns in 1871–72 to ascertain the relative merits of pumping machinery, report the cost of pumping at Columbus, O., by the Holly system at $67.60 per million gallons pumped under a pressure equivalent to something less than 100 feet head. A committee of the American Society of Civil Engineers, who collected data of the cost of

pumping in 1875, report the cost by the Holly system at from $14.10 to $39.81 per million gallons raised 100 feet, the average being $27.04. At Kalamazoo, Mich., the cost is said to have amounted to the enormous sum of $109.56. It is but fair to state that the trustees of the waterworks at Columbus, O., in their report for 1875, put the cost of pumping at $15.04 per million gallons—a surprising reduction from the former figures. The average cost of pumping 1,000,000 U. S. gallons 100 feet high by the ordinary methods in New England is about $12. In this figure, as well as those given by the New York Society of Engineers, interest on the cost of machinery is not included.

The omission of a reservoir from a system of water-supply is at variance with the practice of mankind in all analogous cases. No great permanent demand is supplied without reservoirs and dépôts of supply. The demand for food, merchandise, and necessaries of all kinds requires elevators, magazines, and warehouses. Financial wants require banks and treasuries, which are reservoirs of money. The demand for learning cannot be satisfied without colleges and libraries, which are reservoirs of knowledge. No commodity passes directly from its source to its ultimate destination. Such a supply is exposed to too many contingencies. Simplicity and efficiency require the business of collection and transmission to be separate from the business of distribution, that the former may not be under the necessity of accommodating itself to all the capricious fluctuations of the latter. In applying the direct system in connection with a filtering gallery, the latter will require to be considerably larger than would otherwise be necessary, in order to meet the extraordinary demands of a fire. In such a case it will usually be found that nothing is gained in first cost by the omission of a reservoir. Where it is desired to provide for an increased pressure in the event of a fire, with a moderate pressure at other times, it will usually be found preferable to construct a small reservoir at a great elevation, to be put in communication with the distributing system during fires, and shut off at other times. There are, nevertheless, circumstances—such as abundant supply of good water near at hand, lack of suitable elevations for reservoirs, and high rate of interest—which might justify the adoption of the direct system.

*The distributing system* embraces the network of pipes through which the water is conveyed from the reservoir or other central point to all parts of the town. The pipes lying in the common streets and thoroughfares are called mains; those leading from the latter to the premises of consumers are called service-pipes. Distributing mains of wood, lead, stone, earthenware, and asphaltum have been used at various times. The water of London was once distributed in wooden and lead pipes. The water from Jamaica Pond was distributed in Boston in wooden pipes before the introduction of the supply from Lake Cochituate. Fragments of these wooden pipes are now often met with in excavating the streets. Wooden pipes, formed of the trunks of straight trees, bored through from end to end, are still employed for conveying water under slight pressure, as in the supply of farm-buildings. Pipes formed of natural stone, artificially hollowed out, were laid down in considerable quantity in London, and also in Manchester, England, in the early part of the present century. The result in each case was a disastrous failure. A pipe of sheet iron, coated internally and externally with hydraulic cement, has been extensively used in America within the last fifteen years. The cement, while it remains intact, preserves the iron very effectually from rusting. These pipes are joined together by means of sleeves of the same material, the void spaces being filled with cement. The cement used in these joints gives such a degree of rigidity to the line of pipes that any settlement of the ground causes cracks. The separation of the cement from the iron at any point is followed by a rapid corrosion of the pipe. This kind of pipe has, in many cases, given satisfaction, though it cannot be said to have justified the expectations once entertained of it. It has frequently failed in connection with the Holly system of pumping. This is notably the case at Canton, O., and Binghamton, N. Y. Cast iron, notwithstanding grave defects, is by far the most reliable and satisfactory material for distributing mains. The most serious defect of cast-iron pipe is the facility with which the metal is acted on by water. The inner surface becomes covered with tubercles or protuberances, sometimes of such size as to diminish the effective diameter of the pipe by as much as an inch and a half, or even two inches. In small pipes this action sometimes goes to the extent of closing them entirely. A 3-inch pipe is often so choked that one cannot see through it from end to end. Wrought iron is attacked more energetically than cast. The gray variety of cast iron is more readily oxidated than the white. A large proportion of carbon or graphite in the iron accelerates the action. The development of tubercles proceeds most rapidly in the softest and purest waters, the Boston pipes being more rapidly fouled than those of Philadelphia or New York. No method of preventing this action has been discovered, but it may be delayed for many years by a process commonly ascribed to Dr. R. Angus Smith. This consists in immersing the pipe in a bath of coal-tar, both the pipe and tar being heated to a temperature of from 300 to 500° F. The pipe remains in the tar some thirty minutes, and on being removed and allowed to cool a very fine coating is found on the surface of the pipe. This resists the action of the water for a long time, but the tubercles usually appear in the course of ten or twelve years, sometimes much sooner. Pipe thus prepared imparts a slightly tarry taste to the water at first, but it disappears in a year or two. Cast-iron pipes are also liable to another kind of deterioration in certain soils, arising from the action of matters contained in the soil upon the exterior of the pipe. The iron undergoes a remarkable change, being reduced to a substance resembling plumbago. The mud of salt-water marshes has this action upon iron in a remarkable degree. Long lines of pipe laid in this material in Boston have been entirely destroyed in the course of fifteen or twenty years. In some places a crowbar, or even a knife, could be thrust through the pipe, and it could be cut with a knife. After exposure to the air for some time it becomes harder. The pitch coating is thought to be a protection against this kind of decay, but for greater security the pipe should be imbedded and covered with unobjectionable material. Cast-iron pipes are made in lengths of from 9 to 12 feet. For the purpose of joining them together, one end of each pipe has an enlargement called the bell; the unenlarged end is called the spigot. The inside diameter of the bell is some three-fourths of an inch greater than the outside diameter of the spigot. The spigot of each pipe enters the bell of the preceding pipe to the depth of three or four inches, and the void space is filled with melted lead, which, as it shrinks somewhat in cooling, is tightened by a hammer and calking-iron.

Pipes are usually cast in vertical moulds with the bell downward. A more uniform thickness is thus secured than by casting them horizontally. Pieces of peculiar form, called branches, are required where two lines of pipe communicate with one another. Curved pieces are required for changes of direction in a line of pipe. Pipes usually communicate at all street-crossings. This intercommunication gives a great number of routes by which the water may approach any point in case of fire. Hydrants are inserted at intervals of some 200 feet in the more compact parts of towns, 300 or 400 feet apart in the more sparsely-peopled districts. Valves or stop-gates are introduced, so as to divide the whole system into a great number of small sections, any one of which can be isolated from the rest for the purpose of repairs without interrupting the supply to other districts. Rivers and other bodies of water are crossed by pipe provided with a sort of ball-and-socket joint, by means of which the pipe adapts itself to the inequalities of the bottom.

Lines of pipe which cross summits of ground are provided at such points with air-cocks, to allow the air enclosed at the summit to escape. Air lodges at such points when the pipe is filled after having been emptied for any cause. Air is also, under some circumstances, disengaged from the water itself, and accumulates at the summits of pipes. Natural water always contains a certain quantity of air, or rather of the gases constituting air. A cubic foot of water in contact with air, at any pressure whatever, is capable of absorbing $\frac{46}{1000}$ths of the oxygen and $\frac{25}{1000}$ths of the nitrogen contained in a cubic foot of the air. In a steam-pump air is often drawn into the suction-pipe by accident or design, and the water takes up a larger portion of the gases than it can contain at a diminished pressure. These are accordingly disengaged as the water rises in the force-main. In the Holly system of pumping, in which every pipe is a force-main, the summits are very liable to be filled with air.

The depth to which pipes are covered varies with the climate. In different parts of England from 2 to 3 feet is considered to afford sufficient protection from frost. Regulation No. 10 of the Metropolitan water act of 1871 is: "Every pipe hereafter laid, etc., . . . shall, when laid in open ground, be laid at least 2½ feet below the surface." At Manchester, Eng., 3 feet is the prescribed depth. In the severe climate of the Northern States much greater depths are required. In Boston pipes are now covered to a depth of 5 feet. In New England generally the depth is from 4½ to 6 feet, and this latter is not always sufficient. The winter of 1874–75 was a very severe test of water-pipes. Upward of 2½ miles of pipe, 4 to 20 inches in diameter, were frozen in Boston; more than 1000 service-pipes were frozen. At Buffalo, N. Y., 3½ miles of street-mains were

destroyed by frost; they were relaid in trenches 6 feet deep, which was thought sufficient; the reports do not indicate the depth at which they were frozen. At Dayton, O., where, as in many Western towns, waterworks were constructed without much regard to past experience, the pipes were covered to a depth of only 3 and 3½ feet. The effect of frost during the winter named was such as to seriously threaten the total cessation of the water-supply; many streets were cut off from water. Says the report of 1875: "Long lines of pipe were met with where scarcely a joint was found perfect, and to repair such required the uncovering of the entire pipe." "From the 13th to the 25th of Feb. at least 200 fire hydrants, out of the 272 in use, were frozen up." Also: "The damage done to the pipe-work was no larger in proportion than that experienced by our sister cities." In St. Paul, Minn., 7 and 7½ feet are found sufficient. In the adjacent city of Minneapolis, which has a very loose gravelly soil, the pipes are laid 8 feet deep, and give great trouble from freezing. In Montreal the authorities are content with a depth of 6 feet, though much trouble is experienced from frost. We find from the reports that during the winter of 1873–74, 362 service-pipes were frozen, and there were 397 cases of the freezing of hydrants. In Quebec the pipes are laid 8 and 10 feet deep.

For conveying the water from the mains to the premises of consumers another order of pipes is required, called service-pipes. These are generally from ½ to 1½ inches in diameter. They are most commonly composed of lead, or of wrought iron prepared in various ways to resist corrosion. In a mechanical point of view lead pipe has peculiar fitness for this use. It is procurable in any desired length, easily attached to mains and fittings, easily divided and bent to suit the various situations. These advantages have led to its employment for service-pipes more than any other material, notwithstanding the oft-repeated warnings of chemists that it is liable to impart poisonous qualities to the water. Concerning the extent to which lead pipe may be used for this purpose without danger the opinions of chemists are conflicting. It is generally conceded that the softest waters act with greatest vigor upon lead. Hard waters acquire the power of corroding it when containing organic impurities. This explains why the most frequent cases of lead-poisoning have occurred with well waters. The action of water on lead is thought to be accelerated by the access of air. Pipes which are filled and emptied alternately are considered more liable to corrosion than when kept constantly full. For pipes not exceeding 100 feet in length it is probable that lead may be used, under almost any conditions, with but a very remote chance of injury; the danger increases with the length. For conveying water from a spring or pond to buildings at a distance lead should not be employed. A service-pipe of wrought iron, lined internally with hydraulic cement, has been much used of late, and appears to be eminently well fitted for the purpose. The most important precaution to be observed in the introduction of service-pipes is to secure protection from frost. The pipe usually passes from the main directly into the cellar. In houses having open areas, it is hardly possible to secure sufficient depth. The pipe is usually provided with a cock just inside the cellar wall, by which the water can be shut off and discharged from the portion within the cellar, as city cellars are rarely frost-proof. Freezing usually takes place at or near the cellar wall. For this reason the pipe is often so made that it can be separated at this point and thawed out by injecting hot water through a long small pipe. A service-pipe should, by preference, enter at the sunny side of a house, as the ground freezes less deeply there. (See also PLUMBING and SEWER.) J. P. FRIZELL.

**Wathena,** p.-v., Doniphan co., Kan.

**Wat'kin** (Sir EDWARD WILLIAM), b. at Manchester, England, about 1815; was trained to the mercantile business by his father, with whom he became a partner; was one of the directors of the Manchester Athenæum 1839–40, and organized its celebrated literary soirees in Free Trade Hall; was one of the founders of the Manchester *Examiner* 1845; became director and manager of several important railroads, especially the Intercolonial of Canada; visited the U. S. and Canada on railway business 1851 and 1861; became president of the Grand Trunk Railway of Canada; was influential in securing the confederation of British North America, for which he was knighted 1868; and has been prominent in Parliament as a supporter of reforms in financial legislation.

**Wat'kins,** tp., Dent co., Mo. P. 816.

**Watkins,** p.-v., cap. of Schuyler co., N. Y., at the head of Seneca Lake, on Northern Central and Syracuse Geneva and Corning R. Rs., 22 miles N. of Elmira, has 5 churches, an academy, 2 public libraries, 2 newspapers, 2 banks, 3 iron-foundries, 2 carriage-factories, 1 flouring and 2 planing mills, and 6 hotels. It is chiefly noted for its famous Watkins Glen, a great scenic wonder which is visited by tourists from all parts of the country. It has also fine mineral springs. P. 2639. L. M. GANO, ED. "EXPRESS."

**Watkins** (TOBIAS), M. D., b. in Maryland in 1780; graduated at St. John's College 1798, and at the Philadelphia Medical College 1802; commenced practice at Havre de Grace, Md.; removed to Baltimore, where he edited the *Medical and Physical Recorder* 1809; was surgeon in the army during the war of 1812–15; edited at Philadelphia, with his brother-in-law, Stephen Simpson, the *Portico* (4 vols., 1816–20); was assistant surgeon-general of the U. S. 1818–21, and fourth auditor of the treasury 1824–29. D. at Washington, D. C., Nov. 14, 1855. He translated from the French Bichat's *Physiological Researches upon Life and Death* (Philadelphia, 1809), and from the Spanish Louis de Onis's *Memoir upon the Negotiations between Spain and the U. S. which led to the Treaty of 1818* (Baltimore, 1822).

**Watkins Glen,** one of the most picturesque spots in America, is a ravine extending several miles S. W. from the head of Seneca Lake, in the township of Dix, Schuyler co., N. Y., deriving its name from the neighboring village of Watkins, the county-seat. It is bordered by perpendicular rocks from 200 to 300 feet high, through which a small stream has formed its channel, falling over several lofty and wildly-beautiful cascades. Among the principal objects of interests are Glen Alpha, the Cathedral, the Well, and Rainbow Fall, which have become extensively known through stereoscopic pictures and articles in illustrated periodicals, and are annually visited by from 30,000 to 50,000 visitors.

**Wat'kinson** (DAVID), b. at Lavenham, Suffolk, England, Jan. 17, 1778; educated under the direction of the celebrated Mrs. Barbauld; came to the U. S. with his parents, and settled at Middletown, Conn., 1795; was trained to commercial pursuits at New York; commenced business as a merchant in partnership with his brother William at Hartford 1800, and retired with a handsome fortune 1841. D. at Hartford Dec. 13, 1847. By his will he gave $40,000 to the Hartford Hospital, an equal sum for the establishment of a juvenile asylum, and $100,000 to the Connecticut Historical Society for the formation of a library now known as the Watkinson Library. Several other public charities also received handsome bequests.

**Wat'kinsville,** p.-v., Clarke co., Ga. P. 643.

**Watkinsville,** p.-v., cap. of Oconee co., Ga.

**Wat'ling's Island,** one of the Bahamas, in the West Indies, in lat. 23° 56′ N., lon. 74° 28′ W. It is uncertain whether San Salvador or Watling's Island was the first land in the New World seen by Columbus.

**Wat'onwan,** county of S. Minnesota, drained by Watonwan River and traversed by St. Paul and Sioux City R. R.; surface rolling, soil productive. Staples, wheat, oats, and hay. Cap. Madelia. Area, 432 sq. m. P. 2426.

**Wato'pa,** tp., Wabashaw co., Minn. P. 460.

**Wat'rousville,** p.-v., Juniata tp., Tuscola co., Mich. P. 213.

**Watse'ka,** p.-v., cap. of Iroquois co., Ill., at the junction of Chicago Danville and Vincennes and Toledo Peoria and Warsaw R. Rs., 82 miles S. of Chicago, has excellent schools, 2 newspapers, 2 banks, and 2 mills. P. 1551.
OTTO H. WANGELIN, ED. "IROQUOIS TIMES."

**Wat'son,** p.-v. and tp., Effingham co., Ill. P. 1066.

**Watson,** tp., Allegan co., Mich. P. 1220.

**Watson,** p.-v., Nishnabatona tp., Atchison co., Mo. P. 75.

**Watson,** p.-v. and tp., Lewis co., N. Y. P. 1146.

**Watson,** tp., Lycoming co., Pa. P. 280.

**Watson** (ELKANAH), b. at Plymouth, Mass., Jan. 22, 1758; was apprenticed to John Brown, the distinguished merchant of Providence, by whom he was sent to Cambridge in 1775 with a supply of powder for the American army; was entrusted in 1777 with a considerable sum of money to be invested in the Southern States in cargoes for European markets; kept a journal of his travels to the South, which is valuable as containing the best extant account of the principal American cities at that period; went to France Aug., 1779, as bearer of despatches to Franklin; opened a commercial house at Nantes; lost most of his property 1782; visited England, Holland, and Flanders; passed four years in North Carolina, and settled at Albany, N. Y., in 1789, where he resided until 1807; was an active promoter of education, agriculture, and the improvement of the Hudson navigation; conceived the project of the interior canals of New York; resided at

Pittsfield, Mass., 1807–16; founded there the Berkshire Agricultural Society; returned to Albany 1816, in which year he organized the first agricultural society in New York; visited Michigan, and descended the St. Lawrence to Montreal with a view to the projected canal to unite the lake region with the seaboard; made another visit to Europe, and settled in 1828 at Port Kent, Essex co., where he d. Dec. 5, 1842. He was a frequent contributor to periodicals on agricultural and other topics, and published *A Tour in Holland in 1784* (Worcester, 1790), *History of the Rise, Progress, and Existing Condition of the Western Canals in the State of New York, Sept., 1788–1819* (Albany, 1820), and *Rise, Progress, and Existing State of Modern Agricultural Societies* (1820); and his son, Winslow Cossoul Watson, edited in 1856 a very valuable autobiographical work, *Men and Times of the Revolution, or Memoirs of Elkanah Watson*, etc. A pamphlet was published by Col. Robert Troup as *A Vindication of the Claim of Elkanah Watson to the Merit of projecting the Lake Canal Policy* (Geneva, 1821).

**Watson** (Henry C.), b. at Baltimore, Md., in 1831; early removed to Philadelphia, where he was editorially connected with the *North American*, the *Evening Journal*, and other newspapers; edited Hugh Murray's *The United States of America*, with additions and corrections; wrote several volumes of hunting adventures; assisted John Frost in some of his historical works, and ultimately settled in California, where he became editor of the Sacramento *Union*. D. at Sacramento in 1869. Author of *Camp-Fires of the Revolution* (1851), *Nights in a Blockhouse* (1852), *The Old Bell of Independence, or Philadelphia in 1776* (1852), *The Yankee Tea-Party, or Boston in 1773* (1853), *Lives of the Presidents of the U. S.* (1853), *Heroic Women of History* (1853), *The Camp-Fires of Napoleon* (1856), and various other historical compilations.

**Watson** (Henry Cood), b. in London, England, in 1816; belonged to a family of musical celebrity, his father being the leader of the orchestra at Covent Garden Theatre, and his sisters being well-known oratorio-singers; inherited a fine voice, and displayed as a child great musical ability; made his *début* at the first performance of Weber's opera *Oberon* at the Covent Garden Theatre in Nov., 1829; subsequently achieved considerable success in London as a composer and musical critic; came to the U. S. 1840; became art-critic on the staff of the *New World*, in which he published some notable poems; became connected with the *Musical Chronicle* 1843; contributed to the *Ladies' Glee-Book* and the *Masonic Manual;* wrote on general subjects for the columns of the *Evening Mirror* and the *New Family Magazine;* became art and musical critic to the New York *Albion* 1844; was associated with Charles F. Briggs and Edgar A. Poe in founding the *Broadway Journal* 1845, a short-lived but brilliant and ably-conducted periodical; was the chief founder of the New York Philharmonic Society, of the American Musical Fund Association, and of the Vocal Society, afterward called the Mendelssohn Union; was associated with William Vincent Wallace and Carlos D. Stuart in organizing the famous Mendelssohn concert at Castle Garden; wrote the libretto for Wallace's opera *Lurline* (1854); started in 1855 *The Musical Guest*, a monthly magazine, separate editions of which were devoted respectively to sacred and to operatic music; published in its columns many of his own compositions; was for several years previous to 1861 editor-in-chief of Frank Leslie's *Illustrated Newspaper* and *Ladies' Magazine;* founded in 1862 the *Art Journal*, and became in 1863 the successor of William Henry Fry as musical critic of the New York *Tribune*, both which positions he filled with eminent versatility, extent of knowledge, and critical acumen until his death, in New York City Dec. 2, 1875. He was buried in Greenwood Cemetery. H. L. Stuart.

**Watson** (Hewett Cottrell), b. in England in May, 1804; educated at the University of Edinburgh; became an intimate friend of George and Andrew Combe; edited for several years the *Phrenological Journal*, and subsequently devoted himself to British botany. In an early pamphlet, *The Statistics of Phrenology* (1836), he substantially anticipated Darwin's theory of the origin of species. Author of *Outlines of the Geographical Distribution of British Plants* (1832; new ed. 1835), *The New Botanist's Guide to the Localities of the Rarer Plants of Great Britain* (2 vols., 1835–37), *The London Catalogue of British Plants* (6th ed. 1867), *Cybele Britannica, or British Plants and their Geographical Relations* (4 vols., 1847–59), and of a *Supplement* (1863) and a *Compendium* (1870) of the same work.

**Watson** (James Craig), b. in Elgin co., Canada West, Jan. 28, 1838, of American parents, who soon afterward settled in Michigan; graduated at the University of Michigan, 1857; became teacher of mathematics there, and assistant at the observatory; was appointed professor of astronomy 1859, of physics and mathematics 1860; has been director of the observatory since 1863; has discovered eighteen asteroids; went to Iowa 1869, and to Sicily 1870, to observe eclipses of the sun, and in 1874 was the head of the very successful American expedition which observed the transit of Venus at Peking, China. For his various astronomical discoveries he was in 1870 awarded the gold medal of the French Academy of Sciences. He has contributed to many scientific journals, has prepared various astronomical charts, and is author of *A Popular Treatise on Comets* (1860) and *Theoretical Astronomy, relating to the Motions of the Heavenly Bodies revolving around the Sun in accordance with the Law of Universal Gravitation, with Numerical Examples and Auxiliary Tables* (1868).

**Watson** (J. C.), U. S. N., b. Aug. 24, 1842, in Kentucky; graduated at the Naval Academy in 1860; became lieutenant in 1862, commander in 1874; served in the flagship Hartford at the battles of New Orleans and Mobile Bay, and at the passage of the Vicksburg, Port Hudson, and Grand Gulf batteries, and handsomely mentioned in the official despatches. Foxhall A. Parker.

**Watson** (John), M. D., b. at Londonderry, Ireland, Apr. 16, 1807; came to the U. S. in childhood 1810; settled in New York City 1818; graduated in medicine at the New York College of Physicians and Surgeons 1832; was on the surgical staff of New York Hospital 1832–33; was a physician of the New York Dispensary 1833–35; was an attending surgeon there 1839–62; founded with Dr. H. D. Bulkley an infirmary for cutaneous diseases, known as the Broome Street School of Medicine, 1836; was one of the founders of the New York Medical and Surgical Society, the American Medical Association, and the New York Academy of Medicine, of which latter he was several years president. Author of several professional treatises.

**Watson** (John Dawson), b. at Sedburgh, Yorkshire, England, May 20, 1832; studied art at the Manchester School of Design and at the Royal Academy, London; obtained distinction as an illustrator of books and magazines and by his water-color paintings illustrative of British life and character.

**Watson** (John Fanning), b. in Burlington co., N. J., June 13, 1779; was trained to the mercantile business in Philadelphia; became a clerk in the war department 1798; was afterward engaged in business in New Orleans, where in 1804 he was contractor of subsistence for the U. S. troops; was for several years thereafter a bookseller in Philadelphia; was cashier of a bank at Germantown 1814–47; afterward treasurer of a railway company, and was an indefatigable collector of antiquarian and historical data concerning the city of Philadelphia. D. at Germantown Dec. 23, 1860. Author of *Annals of Philadelphia* (1830), revised and enlarged in the 4th ed. with an *Appendix* to 1857 (20 Nos. in 2 vols., 1857–58), *Historic Tales of Olden Time concerning the Early Settlement and Advancement of New York City and State* (1832), *Historic Tales of Olden Time concerning the Early Settlement and Progress of Philadelphia and Pennsylvania* (1833), and *Annals and Occurrences of New York City and State in the Olden Time* (1846). He was engaged upon a new edition of the latter work (left unpublished) at the time of his death. A *Memoir* by Rev. Dr. Benjamin Dorr was read to the Historical Society of Pennsylvania Feb. 11, 1861.

**Watson** (John Forbes), M. D., b. in England about 1830; received a careful scientific and medical education; became a surgeon in the Bombay army; was appointed reporter to the Indian government on the products of India; is a member of many scientific societies in India and in England; has contributed largely to their *Transactions* and to periodicals, and is a leading authority upon Oriental ethnology and natural history. Author of *A Classified List of Contributions from the Indian Museum, London, to the New Zealand Exhibition* (1865), *Textile Manufacture and the Costume of the People of India* (1867), *An Index to the Native and Scientific Names of Indian and other Eastern Economic Plants* (1868), *The Food-Grains of India, Food and its Influence on Man*, and with John William Kaye is editor of a valuable series of photographs entitled *The People of India* (vols. i. and ii. 1868), to consist of 8 vols.

**Watson** (John Selby), b. in England about 1815; graduated at Trinity College, Dublin, 1838; took orders in the Church of England 1839; held several parochial charges, and was for many years head-master of the proprietary grammar school at Stockwell, Surrey. Author of *Lives* of George Fox (1860), Richard Porson (1861), Sir William Wallace (1861), Bishop Warburton (1863), and

John Wilkes and William Cobbett (1870); published 2 vols. of poems (1844 and 1861); edited *Sallust* (2 vols., 1865–66) and the *Prometheus Vinctus* of Æschylus (1870), and translated for Bohn's "Classical Library" Lucretius, Sallust, Florus, Velleius, Paterculus, Justin, Cornelius Nepos, Eutropius, Xenophon, Quintilian, and portions of Cicero.

**Watson** (Malbone F.), b. at New York June, 1840; graduated at the U. S. Military Academy May 6, 1861, when appointed second lieutenant of 1st Cavalry; transferred to the 5th Artillery May 14; served with his battery throughout the Virginia Peninsular campaign, also at Manassas and Antietam, and at Fredericksburg, Chancellorsville, and Gettysburg in command of battery, losing his right leg at the latter battle. For gallantry at Gaines's Mill he was brevetted captain, and major for Gettysburg. In Nov., 1863, he was assigned to duty at West Point as assistant professor of French, and in Sept., 1868, was placed on the retired list.

**Watson** (Musgrave Lewthwaite), b. at Hawkdale, near Carlisle, England, 1804; educated at Raughton School; spent several years in a law-office; went to London 1824; studied sculpture in private, aided by the friendly counsel of Flaxman; spent several years (1825–28) at Rome; became an assistant to Chantrey, whom he soon left on account of his haughty manners, and to Behnes, whom he aided in his statue of Dr. Babington; was employed by New College, Oxford, to execute from Chantrey's models the fine group of Chancellors Eldon and Stowell now in the library of University College; made statues of Queen Elizabeth (for the Royal Exchange), Flaxman, Allan Cunningham, Nelson, *Hebe and Iris*, a bas-relief of the *Burial of Sarpedon*, a statuette of Chaucer, and the model for the bas-relief of the battle of St. Vincent for the Nelson Column in Trafalgar Square, London. D. in London Oct. 28, 1847. Unsuccessful in winning fortune or fame during life through his sturdy independence of character, his works have since been admitted to rank high in British art. (See his *Life and Works* (1866), by Dr. H. Lonsdale, with photographic illustrations.)

**Watson** (Richard), D. D., F. R. S., b. at Heversham, near Kendal, Westmoreland, England, in Aug., 1737; received his early education from his father, who was master of a grammar school at that place; graduated at Trinity College, Cambridge, 1759; obtained a fellowship there 1760; took orders in the Church of England; became professor of chemistry 1764; one of the head-tutors of Trinity 1767; regius professor of divinity at Cambridge, and rector of Somersham 1771; prebendary of Ely 1774; archdeacon of Ely and rector of Northwold, Norfolk, 1780; rector of Knaptoft, Leicestershire, and bishop of Llandaff 1782. D. at Calgarth Park, Westmoreland, July 4, 1816. Author of *An Apology for Christianity* (1776) and *An Apology for the Bible* (1796), in the form of letters addressed respectively to Edward Gibbon and to Thomas Paine, and distinguished by courtesy, candor, and no small learning, though written from a point of view long since substantially abandoned by writers on Christian evidences. He also published *Chemical Essays* (5 vols., 1781–87; 7th ed. 1800), *Sermons on Public Occasions* (1788), *Miscellaneous Tracts on Religious, Political, and Agricultural Subjects* (2 vols., 1815), and other works; edited a *Collection of Theological Tracts, selected from Various Authors* (6 vols., 1785; 2d ed. 1791), which were thought to favor Socinian opinions, and left an interesting autobiography, published by his son (1817).

**Watson** (Richard), b. at Barton-upon-Humber, Lincolnshire, England, Feb. 22, 1781; acquired a good knowledge of Latin and Greek in childhood; was apprenticed to a carpenter at the age of fourteen; joined the Methodists at the age of fifteen; was by them authorized to preach, and, having been released from his indentures, devoted himself to the ministry; printed at the age of nineteen an *Apology for the People called Methodists;* was ordained 1800; soon afterward joined the Methodists of the New Connection, but returned to the Wesleyan body 1812, and became secretary of its missionary society 1817. D. in London Jan. 8, 1833. He was for some time editor of the Liverpool *Courier*, and was author of *Theological Institutes* (6 parts, 1823–28), *The Life of the Rev. John Wesley* (1831), *A Biblical and Theological Dictionary* (1831), *An Exposition of the Gospels of Matthew and Mark* (1833), and other theological treatises, collectively republished, accompanied by *Memoirs of his Life and Writings* (13 vols., 1834–37) by Rev. Thomas Jackson. His *Institutes, Dictionary, Sermons, Catechisms*, and *Life of Wesley*, which are esteemed standard authorities among the Methodists, were edited with notes, etc., by Rev. Dr. Summers at Nashville, Tenn., and the *Institutes* were also edited, with an *Analysis*, by Rev. John McClintock.

**Watson** (Robert), LL.D., b. at St. Andrew's, Scotland, about 1730; educated at the universities of St. Andrew's, Glasgow, and Edinburgh; became a minister of the Church of Scotland; professor of logic, rhetoric, and belles-lettres in the college of St. Salvador at St. Andrew's, and in Nov., 1777, principal of the united college of St. Leonard and St. Salvador, and minister of the church and parish of St. Leonard's. D. at St. Andrew's Mar. 31, 1781. Author of a *History of the Reign of Philip II., King of Spain* (London, 2 vols., 1777; 8th ed. 1839), a work designed as a continuation as well as an imitation of Robertson's *Charles V.*, and translated into French, Dutch, and German, but become obsolete since the publication of Prescott's book on the same subject. He also left an unfinished *History of the Reign of Philip III.* (1783), which was completed for the benefit of his family by William Thomson, LL.D. Both works have been republished in the U. S. (New York, 1818).

**Watson** (Thomas), D. D., b. in England about 1520; educated at St. John's College, Cambridge, of which he became fellow and master 1553; took orders in the Church of England; was appointed dean of Durham 1553, and bishop of Lincoln 1557; was preacher to Queen Mary; refused to take the oath of supremacy to Elizabeth, identifying himself thenceforward with the Church of Rome, and was imprisoned many years until his death, at Wisbeach Castle Sept. 25, 1582. He was regarded as "the chief superior of the English Roman Catholic clergy." Author of an admired but unpublished Latin tragedy entitled *Absolon*, of *Two Notable Sermons before the Quenes Highnes concerning the Reall Presence* (1554), and *Holsome and Catholyke Doctryne concerninge the Seven Sacramentes* (1558).

**Watson** (Thomas), b. in London, England, about 1557; educated at Oxford University, where he was distinguished for his Latin and English verses; studied law in London, probably at one of the inns of court; spent some time in Paris with members of the Walsingham family; settled in London, and acquired a high reputation by his pastoral and amatory poems, which rivalled in popularity those of his friends Spenser and Sidney, and was a favorite with the aristocratic literary circles around Queen Elizabeth. D. in 1592. Author of a translation of Sophocles' *Antigone* into Latin (1581), *Ekatompathia, or Passionate Centurie of Love* (1582), *Melibœus, sive Ecloga in Obitum Domini Francisci Walsinghami* (1590), *The Tears of Fancie, or Love Disdained* (1593), and many other poetical works, some of which have utterly perished. The three last named were carefully edited by Edward Arber in his *English Reprints* (1870), with an introduction in which he claims for Watson a very high place among English poets, notwithstanding the oblivion into which he had fallen.

**Watson** (Thomas Henry), b. in England Nov. 1, 1839; gained three silver medals of the Royal Academy for architectural designs 1860, and the gold medal 1861 for his design of an exchange; was awarded the first annual travelling studentship of the Royal Academy Dec., 1863, and the Soame medallion of the Royal Institute of British Architects Mar., 1864. In 1871 he was chosen president of the Architectural Association.

**Watson** (Sir William), M. D., F. R. S., b. in London, England, in 1715; educated at Merchant Taylors' School; was apprenticed to an apothecary; became eminent for his attainments in botany, physics, and chemistry, and especially for his researches upon electricity, for which he obtained the Copley medal and received honorary degrees from two German universities; was chosen one of the physicians of the Foundling Hospital 1762, and was knighted 1786. D. in London May 10, 1787. He contributed to the medical and scientific periodicals, and published *Experiments and Observations on Electricity* (1745), *Electricity applied to Tetanus* (1763), *An Account of Experiments in Inoculating the Small-Pox* (1768), and other works.

**Watson** (Winslow Cossoul), son of Elkanah, b. at Albany, N. Y., Dec. 22, 1803; was author of *A General View and Agricultural Survey of the County of Essex, a Treatise on Practical Husbandry* (1854), *A Pioneer History of the Champlain Valley* (1863), and a *History of Essex County and Military Annals of Ticonderoga and Crown Point, etc.* (1869), besides occasional addresses and contributions to religious and other periodicals.

**Wat'sontown,** p.-v., Northumberland co., Pa., on Philadelphia and Erie R. R. and on the W. branch of Susquehanna River, 22 miles S. of Williamsport, contains 4 churches, 1 bank, a town-hall, 1 newspaper, 1 tannery, car manufactory, 3 hotels, 2 saw and 2 planing mills, and a match-factory. P. about 2500.

John J. Auten, Ed. "Record."

**Wat'sonville,** p.-v., Pajaro tp., Santa Cruz co., Cal. P. 1151.

**Watt** (Gregory), son of James, b. at Birmingham, England, in 1777; educated at the University of Glasgow; went for his health to Cornwall, where he resided in the house of the mother of Humphry Davy, then a youth, with whom he formed a warm friendship; was admitted at an early age as a partner in the Soho firm; was engaged in scientific researches on the Continent 1801–02, and published an account of his remarkable experiments upon the laws of crystallization as exemplified in the cooling of 700 pounds of melted basalt. D. Oct. 16, 1804.

**Watt** (James), LL.D., F. R. S., b. at Greenock, Scotland, Jan. 19, 1736; manifested in childhood great mechanical ingenuity, having constructed an electrical machine at the age of fourteen; spent some time at Glasgow 1754–55, learning to make mathematical instruments; practised this trade at London 1755–56; returned to Glasgow; was appointed instrument-maker to the university; studied French, German, and music; constructed an organ; obtained the friendship of Adam Smith and other eminent men; began about 1758 a series of experiments on steam as a motive-power, along with his friend Robison, afterward professor of natural philosophy in Glasgow; constructed a model high-pressure steam-engine 1761, a second much-improved model 1765, a third 1768; took out a patent Jan., 1769 (see Steam-Engine); occupied himself for some years with land-surveying, the engineering of the Forth and Clyde and the Caledonian canals, building bridges, improving the navigation of the Clyde and the harbors of Glasgow and Greenock; became in 1773 a partner with Matthew Boulton, founder of the famous Soho works, near Birmingham, where in 1775 they began the manufacture of steam-engines, which were rapidly improved by the addition of new features; invented also a micrometer, the copying-press, and a method of warming houses by steam; visited Paris 1786; introduced into England on his return Berthollet's process of bleaching with chlorine; obtained, after long years of vexatious litigation, the recognition of his title to his principal inventions; acquired a comfortable competence; purchased an estate at Heathfield 1790; trained up his two sons to the business of the Soho firm, of which they became members; retired from business 1800; invented a flexible iron pipe for carrying water across the Clyde; was chosen a fellow of several learned societies, corresponding member of the Institute of France, and foreign associate of the French Academy of Sciences, and spent his closing years in prosperity, surrounded by friends to whom he was endeared by his admirable moral, social, and intellectual qualities. D. at Heathfield Aug. 25, 1819. He was buried beside Boulton in Handsworth church, a statue by Chantrey was erected in Westminster Abbey by national subscription, and a copy in bronze stands in front of the Manchester Infirmary. (See J. P. Muirhead's *Origin and Progress of the Mechanical Inventions of James Watt* (3 vols., 1854) and *Lives* by Muirhead (1858), Smiles, and Lord Brougham.)

Porter C. Bliss.

**Watt** (James, Jr.), b. at Glasgow, Scotland, Feb. 5, 1769; became proficient in the natural sciences; was secretary of the Manchester Literary and Philosophical Society; resided at Paris several years from 1789; manifested his sympathy with the French revolution until the excesses of the Jacobins changed his sentiments, when he was denounced as an enemy and obliged to flee to Italy; returned to England 1794; became a partner in his father's manufacturing firm, of which he ultimately became the head, and made important improvements in steam-engines to adapt them to the requirements of ocean navigation. D. at Aston Hall, near Birmingham, June 2, 1848.

**Watt** (Robert), M. D., b. in Ayrshire, Scotland, in 1774; was in early life a farm-laborer and cabinetmaker; studied at Glasgow University 1793–97; was licensed to practise surgery and pharmacy 1799; resided as a surgeon at Paisley 1799–1810; removed to Glasgow in the latter year, and lectured there on surgery with great success, becoming physician to the Glasgow Infirmary and president of the faculty of physicians and surgeons of that city. D. at Glasgow Mar. 12, 1819. Author of several medical treatises and of an important work, *Bibliotheca Britannica, or a General Index to British and Foreign Literature* (Edinburgh, 4 vols. 4to, 1821–24), published after his death by his two sons, who had aided him in the work—John, who d. 1821 at the age of twenty, and James, who d. 1829, aged twenty-six. The work was purchased by Archibald Constable & Co. for £2000, for which bills were given, but the failure of that great publishing-house deprived the family of Dr. Watt of its whole fortune, and Miss Watt, the last surviving child of the bibliographer, died at Glasgow in a workhouse in 1864.

**Watteau'** (Antoine), b. in Valenciennes in 1684; struggled with poverty in youth; practised scene-painting, coarse engraving, and designing; was roused to emulation by paintings by Rubens in the Luxembourg; attempted historical art, but was soon led by natural genius to the field where he made himself distinguished. Possessing a light touch, an eye for brilliant and harmonious color, a graceful fancy, and a refined taste, he described court and popular life in the reign of Louis XIV., balls, masquerades, *fêtes champêtres*, pastoral scenes, with landscapes, gardens, groups of people and animals, with admirable freshness, brilliancy, and point. The popularity of his style created many imitators, who, however, came far short of his excellence. Though his health was broken and he died young (in 1721), he left numerous pieces, which are preserved, for the most part, in Paris. O. B. Frothingham.

**Wat'tensac,** tp., Prairie co., Ark. P. 660.

**Wat'terson** (Henry), b. in Washington, D. C., Feb. 16, 1840; owing to his defective eyesight was educated almost entirely at home; began his journalistic career at a very early age as a dramatic and musical critic; in 1858 became editor of the *Democratic Review*, and at the same time contributed to the *States*, a journal of liberal opinions published at Washington; went in 1861 to Tennessee, and drifted into the rebellion, doing casual duty in the Confederate army till the close of the war, except a year spent in editing the *Rebel* at Chattanooga; when the war closed, assumed the editorship of the Nashville *Banner*, remaining there until a year later, when he succeeded George D. Prentice as editor of the Louisville *Journal;* in 1868 the *Journal* was consolidated with two other newspapers, and became the *Courier-Journal*, with Mr. Watterson as part owner and editor-in-chief. He is married and has a family. He was in 1876 elected to Congress. J. B. Bishop.

**Wat'terstown,** tp., Grant co., Wis. P. 580.

**Wat'tle-Bird,** the *Anthochæra carunculata*, so named from the large wattles on its neck. It is a honey-eater of Southern Australia, of large size and bold, active habits, living on the honey and insects it obtains from the flowers of the *Banksias*, which cover the waste lands of that region. It has a loud, disagreeable note. The yellow wattle-bird, *A. inauris*, is a gregarious bird of that continent, of some importance for the excellent oil which it abundantly affords.

**Wat'tle-Tur'key,** a name sometimes applied to the brush-turkey or *Tallegalla Lathami* of Australia. (See Brush-Turkey and Megapodidæ.)

**Wattrelos',** town of France, department of Nord, has large oil-mills and cotton-spinning factories. P. 12,315.

**Watts,** tp., Perry co., Pa. P. 725.

**Watts** (Alaric Alexander), b. in London, England, Mar. 16, 1799; became a teacher at Putney and at Manchester; published a successful volume of *Poetical Sketches* (1822); was successively editor of the Leeds *Intelligencer*, the Manchester *Courier*, and the London *Standard;* founded and conducted for ten years the *United Service Gazette* 1833–43; consumed his property by six chancery suits with his partner in that enterprise; edited a series of annual volumes, *The Literary Souvenir* (1825–35); published his selected poems, *Lyrics of the Heart* (1851), and received in 1853 a pension of £100 per annum. D. at Kensington Apr. 5, 1864.—His wife, a sister of B. B. and J. H. Wiffen, was a poetess of some repute.

**Watts** (Frederick), b. at Carlisle, Pa., May 9, 1801; graduated at Dickinson College 1819; was admitted to the bar 1824; was reporter of the supreme court of Pennsylvania 1831–45, publishing 20 vols.; became president of the Cumberland Valley R. R. 1845; was appointed president-judge of the ninth district 1849; was distinguished as a scientific farmer; was one of the projectors of the Agricultural College of Pennsylvania and president of its first board of trustees 1854, and became in 1871 commissioner of the department of agriculture at Washington.

**Watts** (George Frederick), R. A., b. in London, England, in 1820; early achieved considerable success as a portrait and historical painter; gained at the Westminster Hall competition of 1843 one of the three highest prizes of £300 by his cartoon of *Caractacus;* studied in Italy 1844–46; obtained in the Westminster Hall competition of 1845 a prize of £500 for his *Echo* and *Alfred the Great*, which were purchased for the new Houses of Parliament, in which he was subsequently commissioned to execute the fresco *St. George overcoming the Dragon*, from Spenser (1853); painted at the W. end of the new hall at Lincoln's Inn a large design in fresco representing the great lawgivers of ancient and modern times (1861), but has of late years confined himself chiefly to portrait-painting, rarely exhibiting at the Royal Academy.

**Watts** (Henry), F. R. S., b. in England about 1825; received a thorough scientific education, partly in Germany; became a professional chemist at London, where he has lec-

tured on that subject; translated Gmelin's *Handbook of Chemistry* (9 vols., 1848–55) and A. Wurtz's *History of Chemical Theory from the Age of Lavoisier to the Present Time* (1869); is editor of the *Quarterly Journal* of the Chemical Society and of the standard *Dictionary of Chemistry* (5 vols., 1863–68), to which two *Supplements* have since been added (1871 and 1875).

**Watts** (Henry M.), b. at Carlisle, Pa., Oct. 10, 1805; graduated at Dickinson College; was admitted to the bar at Pittsburg 1827; served as deputy attorney-general, and subsequently as U. S. district-attorney, at Philadelphia; sat some years in the legislature; took an active part in politics, and was minister to Austria 1868–69.

**Watts** (Isaac), D. D., b. at Southampton, England, July 14, 1674, son of a nonconformist schoolmaster, by whom his early education was directed; studied at the Southampton free school and at Rev. Thomas Rowe's dissenting academy in London; became a private tutor at Stoke Newington 1696; was assistant minister 1698 and pastor 1702 of the Mark Lane Independent congregation, London; was forced by ill-health in 1712 to retire from the active work of the ministry, and having gone on a visit to his friend, Sir Thomas Abney, at Theobald's, Newington, was persuaded to remain there indefinitely as a guest, and so continued for thirty-six years until his death, Nov. 25, 1748. He was buried in Bunhill Fields, was of diminutive size and somewhat deformed in person, and was never married. He had a high reputation as a preacher, and was much beloved for his cheerfulness, his wit, and his truly philosophical traits of character. Author of *Logic, or the Right Use of Reason in the Inquiry after Truth* (1725), *The Improvement of the Mind* (1741), and many volumes of religious and educational treatises, but is best remembered by his *Psalms and Hymns*, which have ever since contributed largely to the services of song in nearly all branches of English-speaking Protestant denominations. "He was," says Montgomery, "almost the inventor of hymns in our language." Monuments have been erected to his memory in Abney Park and Westminster Abbey, a statue by Chantrey was dedicated at Southampton 1861, and the foundation of a memorial hall was laid there May 6, 1875. His *Complete Works* were edited by Drs. Jennings and Doddridge (6 vols., 1754), and biographical sketches have been written by Dr. Johnson, Milner, and Southey.

**Watts** (John), b. in New York City Apr. 5, 1715; was one of the wealthiest land-proprietors of the colony; married Ann, daughter of Stephen De Lancey, July, 1742; was for many years a representative in the assembly and a member of the council 1757–75; was one of the original founders and trustees of the New York Society Library 1754; presented its first clock to the New York Exchange 1760; was the first president of the New York City Hospital 1760; was the most trusted adviser of his brother-in-law, Gov. James De Lancey, and in 1775 withdrew to England on account of his loyalty to the Crown. D. in Wales in Aug., 1789. His property was confiscated, but a considerable portion was granted to his sons Robert and John July 1, 1784.—His daughter Ann married Capt. Kennedy, who became earl of Cassilis.

**Watts** (John), son of the preceding, b. in New York City in 1749; was the last royal recorder of New York City; was three times Speaker of the New York assembly; member of Congress 1793–96; judge of Westchester co. 1802–08; was the chief founder of the Leake and Watts Orphan House, New York, to which he made a munificent donation. D. in New York Sept. 3, 1836. He married his cousin, Jane De Lancey, and was grandfather of Gens. Philip Kearny and John Watts de Peyster.

**Watts** (John S.), b. in Boone co., Ky., Jan. 19, 1816; graduated at Indiana University; studied law, and was admitted to the bar in Indiana; was twice elected a prosecuting attorney; served in the legislature; was appointed by Pres. Fillmore associate justice of New Mexico; subsequently practised his profession in that Territory; was elected a delegate in Congress 1860; took an active part in raising troops for the Union armies, and was appointed by Pres. Johnson in 1868 chief-justice of the supreme court of New Mexico.

**Watts** (Robert), M. D., b. at Fordham, N. Y., in 1812; graduated at Columbia College 1831, and in medicine at the New York College of Physicians and Surgeons 1835; was appointed, while still an undergraduate, lecturer on anatomy at the Vermont Medical College; became in 1838 professor of anatomy there, and also in the medical college at Pittsfield, Mass.; occupied the chair of anatomy in the New York College of Physicians and Surgeons from 1839 until his death; was one of the founders of the New York Pathological Society, and for several years its presiding officer, and was from 1859 an attending physician of the Nursery and Child's Hospital. D. at Paris, France, Sept. 8, 1857. He edited Harrison's *Manual of Anatomy*, and contributed largely to medical periodicals.

**Watts** (Thomas), b. in London, England, in 1811; manifested in childhood a wonderful aptitude for the mastery of languages; was conversant at the age of twenty with Russian, Hungarian, and several Slavonic and Scandinavian tongues; visited the British Museum to prosecute researches in the literatures of those languages; found no books in Russian or Hungarian, and but few in the Scandinavian tongues; drew attention to this deficiency in articles published in the *Mechanic's Magazine* (1836–37); was appointed in 1837 an assistant in the library of the British Museum; became assistant keeper of the printed books and superintendent of the new reading-room 1857, and was keeper of the printed books from Aug., 1866, to his death, at London Sept. 9, 1869. Under his auspices the Museum collections of Slavonic and Scandinavian literature became the largest outside the several countries where the languages are spoken, and the collections of Americana and of foreign literature generally were raised from insignificance to comparative completeness. Mr. Watts left no great publication as a monument of his surprising abilities, and was best known as the author of contributions to the quarterlies and to the *Transactions* of learned societies, and of some 150 biographies of Scandinavian, Hungarian, Russian, and Polish celebrities in Knight's *Cyclopædia*, and of the *Sketch of the History of the Welsh Language and Literature* (1861) in the same work.

**Watts** (Thomas Hill), b. in Butler co., Ala., about 1820; was member of the State legislature 1842–45; moved to the city of Montgomery, and was again elected to the legislature 1851–53; was now regarded as among the most prominent of the leaders of the Whig party in his State, and was run as a candidate for the office of Presidential elector on the Bell-Everett ticket in 1860; was strongly opposed to the policy of secession, but when Alabama passed her ordinance withdrawing from the Union, he cast his fortunes with her people; first entered the Confederate military service as colonel of a regiment, but after the battle of Shiloh (Apr., 1862), where he greatly distinguished himself, resigned to take the position of attorney-general in Pres. Davis's cabinet. This position he also resigned in 1863, to fill the office of governor of his State, to which he had been elected; was deposed from this office, which he filled with great ability, under the Reconstruction policy of the Federal government. He still (1876) resides in Montgomery, pursuing the practice of law.

Alexander H. Stephens.

**Watts** (William), b. in England in 1753; became an eminent line engraver. D. Dec. 7, 1851. He published *The Seats of the Nobility and Gentry, in a Collection of the most Interesting and Picturesque Views* (84 plates, 1779–86), *A Collection of Colored Views in the Turkish Provinces, with Descriptions in French and English* (1801–05), and a fine collection of views of the city of Bath.

**Watts'burg,** p.-b., Erie co., Pa. P. 286.

**Wat Tyler's Insurrection,** a celebrated episode of the reign of Richard II., king of England. During the minority of that monarch the government was in the hands of his ambitious uncles, the dukes of Lancaster and of Cambridge, both married to Spanish princesses, through whom they laid claim to the crown of Castile. The expenses attending their foreign projects and the lingering war with France having exhausted the ordinary revenues, the Parliament assembled at Northampton imposed a poll or capitation tax (Nov. 5, 1380) on each male or female above the age of fifteen years; which was rigorously enforced, and became the occasion of disturbances in several places. At Dartford, in Kent, a laboring-man, one Walter or Wat, known as "the Tiler" from his occupation, struck dead a tax-collector, whom he accused of gross insult to his daughter, early in June, 1381, and calling his neighbors to shield him from punishment, soon found himself at the head of a considerable multitude; and the excitement spreading over the nine south-eastern counties, a march against London was determined on for the redress of grievances. A vast mob, usually said to have numbered 100,000, reached Blackheath, near London, June 12, 1381, took possession of the southern portion of London, burned the duke of Lancaster's palace (June 13), plundered a portion of the city, seized the Tower, put to death the lord treasurer, Sir Robert Hales, and the archbishop of Canterbury (June 14), destroyed the Savoy Palace, the archbishop's palace, and the priory of St. John's, Clerkenwell, and advanced to Smithfield (June 15), where they were met by some of the authorities, with the young king at their head. In the parley which ensued the arrogance of Wat was so great that Sir William Walworth rushed upon him, and killed him on the spot. Richard displayed great presence

of mind in a situation of great danger; he declared to the excited mob that he would be their leader, and actually conducted them out of the city. On the following day they were attacked by Sir William Knollys, dispersed, and their leaders mercilessly punished.

**Wau'beck,** p.-v., Maine tp., Linn co., Ia. P. 222.

**Waubeck,** p.-v. and tp., Pepin co., Wis. P. 360.

**Waucon'da,** p.-v. and tp., Lake co., Ill. P. 1120.

**Waucul'la,** tp., Sedgwick co., Kan. P. 209.

**Waugh** (Alexander), D. D., b. at East Gordon, Berwickshire, Scotland, in 1754; received a good education; was an influential minister of the Scotch Secession Church, officiating at its principal London church in Wells street from 1782 until his death, Dec. 14, 1827. A *Memoir, with Selections from his Epistolary Correspondence, Pulpit Recollections, etc.* (1830), was published by Rev. James Hay and Rev. Henry Belfrage, D. D.

**Waugh** (Edwin), b. at Rochdale, Lancashire, England, Jan. 29, 1817; educated at the commercial academy of that place; was apprenticed to a bookseller and printer; worked at his trade as a journeyman nearly ten years; was then appointed secretary to the Lancashire public school association for the promotion of a national plan of secular education; filled that post five years, and has since devoted himself entirely to literature, having by his cultivation of the dialect of his native county won the designation of "the Lancashire poet." Author of *Sketches of Lancashire Life and Localities* (1855; 4th ed. 1869), *Poems and Lancashire Songs* (1859; new ed. 1870), *Rambles in the Lake Country and its Borders* (1862), *Tufts of Heather from the Lancashire Moors* (1864), *Home Life of the Lancashire Factory-Folk* (1866), and other works. A selection from his poems appeared under the title *Poesies frome a Country Garden* (2 vols., 1865).

**Waukec'hon,** p.-v. and tp., Shawanee co., Wis. P. 315.

**Wauke'gan,** city and tp., cap. of Lake co., Ill., on Chicago and North-western R. R., 35 miles N. of Chicago, on a bluff 80 feet above and overlooking Lake Michigan, with a wide beach separating the town from the lake. Waukegan is the location of valuable mineral springs; among the most celebrated are the Glen Flora, the Magnesia, and the McAllister group. The natural beauty of its location, its springs, its salubrity, its nearness to Chicago, and convenient railroad facilities have made it a favorite place of residence for many Chicago business-men, and a pleasure resort for many families. The lumber, brick, tanning, flour, and fishing interests are considerable. The town contains a national bank, 2 weekly newspapers, 9 churches, public schools, a commercial college, St. Albertus Academy, 4 hotels, society libraries, a public park, waterworks supplied from an artesian well, and a volunteer fire department. Its principal manufacturing establishments are a pump-factory, scaleworks, agricultural works, a woollen-factory, machine-shops, a wood-working establishment, 1 sash and blind factory, 1 brewery, 4 carriage-factories, and a table-factory. Waukegan was settled in 1838. Pop. of city, 4507; of tp. 507. Partridge Bros., Pubs. "Gazette."

**Wauke'sha,** county of S. E. Wisconsin, drained by Fox and Bark rivers, and traversed by Chicago Milwaukee and St. Paul R. R.; surface level, with alternate prairie and woodland, and numerous small lakes; soil fertile. There are flour-mills, saw-mills, limekilns, and manufactories of agricultural implements, carriages, and saddlery. Live-stock, especially sheep, numerous. Staples, wheat, Indian corn, oats, hay, wool, and dairy products. Cap. Waukesha. Area, 576 sq. m. P. 28,274.

**Waukesha,** p.-v. and tp., cap. of Waukesha co., Wis., on Chicago Milwaukee and St. Paul R. R., 20 miles W. of Milwaukee, is the principal watering-place in Wisconsin, and is noted for the efficacy of its springs for kidney and liver complaints. Waukesha contains the Wisconsin State industrial school for boys, also Carroll College, 2 banks, 3 newspapers, 6 hotels, an iron-foundry, 1 woollen manufactory, extensive lime and building-stone quarries, flouring-mills, 1 brewery, and a boot and shoe manufactory. Pop. of v. 2633; of tp. 3877. H. M. Youmans, Ed. "Freeman."

**Wau'kon,** p.-v., cap. of Allamakee co., Ia., 18 miles from Mississippi River, in the centre of a rich farming district, contains 5 churches, an excellent graded school, 1 newspaper, several wagon-factories, a public library, 2 hotels, 1 fanning-mill, 1 bank, and a narrow-gauge railway. Principal business, farming and trade in agricultural machinery. P. 809. E. M. Hancock, Ed. "Standard."

**Wauman'da,** p.-v. and tp., Buffalo co., Wis. P. 1138.

**Waupac'a,** county of Central Wisconsin, intersected by Waupaca and Embarras rivers, having Weyauwegan Lake in its S. part, and traversed by Wisconsin Central and Green Bay and Lake Pepin R. Rs.; surface undulating, much of it being covered with dense forests, which furnish large quantities of lumber. There are flour-mills, saw-mills, tanneries, and manufactories of agricultural implements, carriages, iron castings, and woollen goods. Staples, lumber, wheat, Indian corn, oats, and wool. Cap. Waupaca. Area, 648 sq. m. P. 15,539.

**Waupaca,** city, cap. of Waupaca co., Wis., on Wisconsin Central R. R., 135 miles S. W. of Milwaukee, has 5 churches, good schools, excellent water-power, several mills, factories, and foundries, and 1 newspaper; city chartered in 1875. P. 2042. C. M. Bright, Ed. "Republican."

**Waupon'see,** tp., Grundy co., Ill. P. 720.

**Wau'pun,** v., partly in Dodge co., Wis. P. of part of v. in this co. 1101.

**Waupun,** p.-v. and tp., Fond du Lac co., Wis., 68 miles N. W. of Milwaukee, on Chicago Milwaukee and St. Paul R. R., has 6 churches, 2 banks, 2 newspapers, 4 hotels, 2 carriage-factories, and pump and windmill works. It is surrounded by a fine farming country, and is connected with the Chicago and North-western R. R., 2½ miles distant, by two lines of stages. P. of v. 924; of tp. 2161.
J. W. Oliver, Ed. "Leader."

**Waure'gan,** p.-v., Windham co., Conn.

**Wau'sau,** p.-v. and tp., cap. of Marathon co., Wis., on Wisconsin Valley R. R. and on Wisconsin River, has 6 churches, a fine school-house, 2 public halls, 2 banks, 3 newspapers, 2 wooden-ware factories, 2 machine-shops, several hotels, and 5 large saw-mills. Principal business, lumbering and farming. P. of v. 1349; of tp. 1797.
V. Ringle, Ed. "Wisconsin River Pilot."

**Wau'seon,** p.-v., Clinton tp., and cap. of Fulton co., O. P. 1474.

**Wausha'ra,** county of Central Wisconsin, drained by Fox, Pine, and White rivers; surface undulating and well wooded, soil fertile. Staples, wheat, Indian corn, oats, lumber, wool, and dairy products. Cap. Wautoma. Area, 648 sq. m. P. 11,279.

**Wauto'ma,** p.-v. and tp., cap. of Waushara co., Wis., 22 miles from Berlin, the nearest railroad station, has 2 churches, a graded school, 1 newspaper, 2 hotels, 3 wagon-shops, and 1 flouring-mill. P. 801.
W. S. Monroe, Ed. "Waushara Argus."

**Wauwato'sa,** p.-v. and tp., Milwaukee co., Wis. P. 3689.

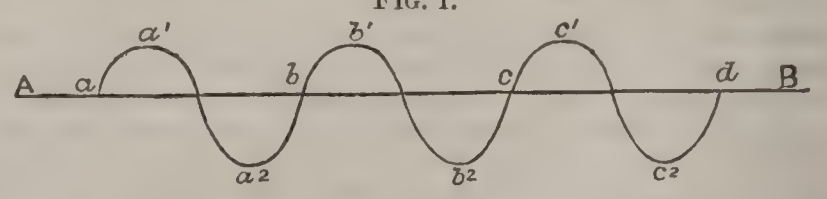
**Wauze'ka,** p.-v. and tp., Crawford co., Wis. P. 923.

**Wave.** See Waves, by J. P. Frizell, C. E.

**Wave'land,** p.-v., Montgomery co., Ind., on Logansport Crawfordsville and South-western R. R., 37 miles N. E. of Terre Haute, has 3 churches, 1 college and a graded school, 1 bank, 2 newspapers, 2 hotels, and 1 mill. Principal business, farming and stock-raising. P. about 1300.
M. C. McCormick, Ed. "News."

**Wave-Lengths.** In the undulatory theory, light is supposed to be propagated in space by means of waves. A particular ray of light may be considered as perfectly defined when its state of polarization, its wave-length, and its intensity are known. The simplest case is that of a ray consisting of a succession of plane waves—that is, of waves in which the vibrations of the particles of the ether take place in the same plane. Such a ray is said to be plane-polarized, and in such a ray the length of a wave is defined to be the distance measured along the axis of the ray between two nearest successive particles which at any given instant are in the same states of displacement and motion. Thus, in Fig. 1, A B represents the axis of a ray—that

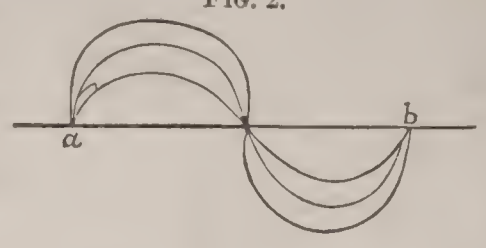
Fig. 1.




is to say, the direction in space in which the light moves. The plane of the paper is the plane of vibration. Particles $a$ and $b$ are in the same states of *displacement* with reference to the axis A B, since both are *on* the axis. They are also in the same states of *motion*, since $b$ is just beginning to execute its $n$th vibration when $a$ has completed its $(n+1)$th vibration, and the two are moving in the same direction: $a_1 b_1$, $b_1 c_1$, $a_2 b_2$, $b_2 c_2$ are in like manner, by definition, wave-lengths. Our definition also applies to the cases of elliptically and circularly polarized rays. In these the particles of the ether revolve in ellipses or in circles, the planes of which are at right angles to the axis of the ray. It is easy to see that a ray might pass from one state of polarization to another without changing the lengths of its

component waves. The intensity of the light at any point depends upon the extent of the vibrations of each particle of the ether at that point. This extent is termed the *amplitude* of the vibration, and the intensity corresponding to a given wave is proportional to the square of the amplitude of the vibrations. Thus, in Fig. 2 we have with the same wave-length several different degrees of intensity.

Fig. 2.




From the above it appears that the wave-length is the only invariable characteristic of a ray of light, since it is not affected by changes in the intensity or in the state of polarization. It has become usual to denote the wave-length by the letter λ, and to express it in decimals of a millimètre, the millionth of a millimètre forming a convenient unit. When a ray of light passes from an optically less to an optically more dense medium, the wave-lengths of the component elementary rays are shortened. If the elementary rays differ in wave-length, the waves will be shortened in precisely the same ratio. In like manner, the waves are lengthened in the same ratio when the rays pass from a more to a less dense medium. Hence, it is necessary to define optically the medium in which the light is moving, and for this purpose it is theoretically best to give the wave-length when referred to motion *in vacuo*. But in practice the wave-length in air is usually given as more convenient, small changes in the pressure and temperature of the air having an insensible influence in changing the lengths of the waves. (For the method of determining wave-lengths experimentally we must refer to the article Undulatory Theory of Light.) The earliest accurate measurements are those of Fraunhofer. More recently, elaborate measurements have been made by Ditscheiner, Van der Willigen, Mascart, and Ångström. The results of the last-named observer are the most numerous and most entitled to confidence. When the wave-lengths of a sufficient number of standard spectral lines have been determined with precision, those of intermediate lines may be determined by interpolation. Thalen has employed for this purpose the method of comparison first given by the writer of this article, and has in this manner very greatly extended the results of Ångström. Normal maps of the spectrum are those in which each characteristic ray is laid down upon a scale according to its wave-length. The first extended map of this kind was given by the writer in 1867. It contained 108 spectral lines, and was based partly upon the measurements of Ditscheiner and partly on the older measurements of Ångström. The splendid map of Ångström appeared in 1869. It contains about 800 lines, and is the now universally-recognized standard.

The most accurate information which we possess at present in regard to the wave-lengths of the spectral lines of the elements is contained in the following tables. Table I. contains the results of Ångström's direct and absolute measures, but the unit is taken as the millionth instead of the ten-millionth of a millimètre, and only two decimals are given. In addition, the writer has completed, as far as possible, the comparison with Kirchhoff's well-known chart by filling up the numbers in Column 1, left very incomplete by Ångström. Column K. contains, therefore, the number of the spectral line upon Kirchhoff's chart; Column λ the corresponding wave-length; Column S. the symbol of the element of which the line is characteristic; and Column R. remarks as to the character of the lines. Telluric lines are represented by the symbol Aq.

The wave-lengths of the ultra-violet rays have been determined by Mascart. The corresponding spectral lines have not yet been identified with those of any of the elements, and they consequently possess but little interest. The shortest wave-length accurately measured is that of the line R in the ultra-violet portion of the spectrum. For this we have λ = 317.75 millionths of a millimètre, but rays of shorter wave-length have by special artifices been rendered visible. The longest wave yet measured is that corresponding to the limit of sensible rays of heat; for this we have, according to Fizeau, λ = 0.001940.

Table I.

| K. | λ. | S. | R. | K. | λ. | S. | R. | K. | λ. | S. | R. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 760.40 | Aq | | 1352.7 | 544.44 | Fe | | | 476.17 | Mn | |
| *a* | 718.47 | Aq | | 1362.9 | 542.90 | Fe and Ti | | | 475.35 | Mn | |
| | 718.25 | | | 1389.4 | 540.49 | Fe | | | 472.67 | Fe | |
| B | 686.71 | Aq | | 1390.9 | 540.33 | Fe and Ti | | 2249.7 | 471.38 | Ni | |
| 641.0 | 671.72 | Ca | | 1421.5 | 537.06 | Fe | Very strong. | 2264 | 470.24 | ..... | Unknown. |
| C | 656.21 | H | | 1397.5 | 536.91 | Fe | Strong. | | 466.72 | Fe and | |
| | 651.58 | Aq | | 1451.8 | 533.93 | Fe | Double. | | 466.64 | Ti | |
| | 649.51 | Aq | | 1462.8 | 532.74 | Fe | Double. | | 465.41 | Cr | |
| | 649.42 | Fe | | 1466.8 | 532.35 | Fe | | | 461.28 | ..... | Unknown. |
| 731.7 | 646.20 | Ca | | | 529.67 | Ti | | | 461.08 | Fe | |
| 736.9 | 644.93 | Ca | | E | 526.96 | Ca and Fe | | | 458.09 | Ca | |
| 740.9 | 643.84 | Ca | | E | 526.87 | Fe | | | 457.16 | Ti | |
| | 643.01 | Fe | | 1527.7 | 526.59 | Fe | | | 456.49 | ..... | Unknown —double. |
| | 641.06 | Fe | | 1528.7 | 526.47 | Ca | | | | | |
| 756.9 | 639.93 | Fe | Very strong. | 1569.6 | 523.22 | Fe | Triple—very strong. | 2467.0 | 454.90 | Ti | |
| | 633.62 | Fe | | 1577.2 | 522.64 | Fe and Ti | | | 453.56 | Ti and Ca | Double. |
| | 627.71 | Aq | | 1601.4 | 520.78 | Cr | | | 453.33 | Fe and Ti | |
| | 627.63 | Aq | | 1604.4 | 520.54 | Cr | | | 452.81 | Fe | |
| 815.0 | 626.43 | Fe | | 1606.4 | 520.39 | Cr Fe | | | 452.21 | Ti | |
| | 624.56 | Fe | | | 520.18 | Fe | | | 450.05 | Ti | |
| 831 | 622.99 | Fe | | $b_1$ | 518.31 | Mg | | | 449.38 | Fe | Strong. |
| 849.7 | 619.07 | Fe | | $b_2$ | 517.22 | Mg | | 2606.5 | 445.41 | Ca Mn | |
| 860.2 | 616.85 | Ca | | $b_3$ | 516.85 | Ni and Fe | | 2638.5 | 443.46 | Ca | |
| 863.9 | 616.14 | Ca | | $b_4$ | 516.69 | Mg and Fe | | 2653.0 | 442.51 | Ca | |
| 874.3 | 614.08 | Ba | | 1693.8 | 513.88 | Fe | | 2670.0 | 441.48 | Fe Mn | |
| 876.5 | 613.68 | Fe | | | 510.72 | Fe | | 2686.4 | 440.43 | Fe | Strong. |
| 877 | 613.58 | Fe | | 1748.9 | 509.92 | Ni | Double. | 2721.0 | 438.28 | Fe | Very strong. |
| 884.9 | 612.13 | Ca | | 1749.6 | | | | | 434.01 | H | |
| 894.9 | 610.19 | Ca | | 1752.6? | 509.83 | Fe | | | 432.52 | Fe | |
| | 607.78 | Fe | | 1775.8 | | | | G | 430.73 | Fe | |
| | 606.47 | Fe Ti | | 1776.5 | 507.93 | Fe Ni | Four rays. | | 427.13 | Fe | Very strong —double. |
| 931.4 | 602.32 | Fe | | 1777.5 | | | | | 426.00 | Fe | |
| | 602.09 | Mn | | 1778.5 | | | | | 425.05 | Fe | |
| | 601.93 | Fe | | | 506.45 | Fe Ti | | | 424.98 | | |
| | 597.48 | Fe | | 1833.5 | 504.13 | Ca Fe | | *g* | 422.64 | Ca | Very strong. |
| | 591.33 | Fe | | 1834.5 | 504.03 | Ca Fe | | | 420.16 | Fe | |
| $D_2$ | 589.51 | Na | | | 501.78 | Fe | | | 419.80 | Fe | Double. |
| $D_1$ | 588.91 | Na | | | 501.16 | Fe | | | 419.11 | Fe | |
| 1029.4 | 585.66 | Ca | | | 500.51 | Fe | Double. | | 418.67 | Fe | Double. |
| 1096 | 576.20 | Fe | | 1961 | 495.69 | Fe | Very strong —double. | | 415.57 | Fe | |
| | 570.85 | Fe | | | | | | | 415.38 | Fe | |
| | 568.15 | Na and Fe | | 1989.5 | 493.35 | Fe Ba | Double. | | 414.31 | Fe | Double. |
| 1174.2 | 565.77 | Fe | | 1990 | | | | | 413.39 | Fe | Several rays. |
| | 562.34 | Fe | | 2005.2 | 491.99 | Fe | | | 413.15 | | |
| 1207.3 | 561.46 | Fe | Strong. | 2007.2 | 491.82 | Fe | | *h* | 410.12 | H | Very strong. |
| 1217.8 | 560.18 | Fe | | 2041.3 | 489.10 | Fe | | | 407.67 | One Ca | Double. |
| 1221.6 | 559.77 | Fe | | 2042.2 | 489.02 | Fe | | | 407.10 | | |
| 1221.7 | 559.36 | Ca | | 2058 | 487.76 | Ca | | | 406.29 | Fe | Very strong. |
| 1231.5 | 558.57 | Fe | | 2066.2 | 487.14 | Fe | | | 404.51 | | |
| | 557.18 | Fe | | 2067.1 | 487.06 | Fe | | | 403.29 | Mn | Three rays. |
| 1280 | 552.75 | Mg | Strong. | F | 486.07 | H | | | 402.95 | Mn | |
| | 550.06 | Fe | | | 482.29 | Mn | | | 400.49 | Fe | Strong. |
| 1337.0 | 546.24 | Fe | | 2157 | 479.18 | Co Ti | | H | 396.81 | Ca and | Very broad. |
| 1343.5 | 545.48 | Fe | Very strong. | | 478.27 | Mn | | $H_1$ | 393.30 | Fe | |
| 1351.1 | 544.61 | Fe and Ti | | | | | | | | | |

TABLE II.—*Wave-Lengths of the Metallic Lines according to Thalen.*

In these tables the first column, headed "Color," gives the colored space in which the line is found. Column λ gives the wave-lengths in millionths of a millimètre. Column I. gives the intensity of the line upon a scale of 5, the number 1 indicating the greatest intensity. Under column R. the character of the ray is given, *b* signifying a broad line; *bb*, a very broad line; *n*, a nebulous line; *bn*, a line which is broad and nebulous, etc. The limits of the colors are those assigned by Listing. The following metals were examined in the metallic state: K, Na, Mg, Al, G, Co, Ni, Zn, Cd, Pb, Tl, Bi, Cu, Hg, Ag, Au, Sn, Pt, Pd, Os, Sb, As, Te, In. The other metals were examined, for the most part, in the form of chlorides. Column K. gives the corresponding number of the line on Kirchhoff's scale, as determined by the writer of this article.

### POTASSIUM.

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Yellow.. | 582.9 | 1 | | |
| | 580.2 | 1 | | |
| | 578.25 | 1 | | |
| | 535.35 | 2 | *b* | |
| Green... | 533.85 | 2 | *b* | |
| | 532.25 | 2 | | |
| Blue..... | 482.70 | 3 | *b* | |
| Indigo.. | 430.95 | 4 | | |

### SODIUM.

| | | | | |
|---|---|---|---|---|
| Orange. | 616.00 | 2 | | |
| | 615.42 | 2 | | |
| | 589.50 | 1 | $D_2$ | 1002.8 |
| | 588.90 | 1 | $D_1$ | 1006.8 |
| Yellow.. | 568.72 | 3 | | |
| | 568.14 | 3 | | |
| Green... | 515.48 | 3 | | |
| | 515.25 | 3 | | |
| | 498.25 | 4 | *n* | |

### LITHIUM.

| | | | | |
|---|---|---|---|---|
| Red..... | 670.52 | 1 | | |
| Orange. | 610.20 | 3 | | |
| Blue..... | 460.27 | 1 | *b* | |

### CÆSIUM.

| | | | | |
|---|---|---|---|---|
| Green... | 497.15 | 1 | | |

### RUBIDIUM.

| | | | | |
|---|---|---|---|---|
| Orange. | 629.65 | 1 | | |
| | 620.40 | 2 | | |
| | 616.00 | 3 | | |
| | 607.00 | 3 | | |
| Blue..... | 477.60 | 4 | | |
| | 456.95 | 5 | | |
| Indigo.. | 455.10 | 5 | | |
| Violet... | 420.20 | 2 | *b* | |

### BARIUM.

| | | | | |
|---|---|---|---|---|
| Red..... | 652.60 | 3 | | |
| | 649.60 | 1 | ..... | 718.7 |
| | 648.30 | 3 | | |
| Orange. | 644.90 | 3 | | |
| | 634.30 | 3 | | |
| | 614.06 | 1 | ..... | 874.3 |
| | 610.99 | 3 | ..... | 890.2 |
| | 606.20 | 3 | | |
| | 601.80 | 3 | | |
| | 599.15 | 3 | | |
| | 597.10 | 3 | ..... | 964.5 |
| | 590.45 | 5 | | |
| Yellow. | 585.25 | 1 | ..... | 1031.8 |
| | 582.70 | 3 | ..... | 1050 |
| | 580.85 | 5 | | |
| | 580.35 | 5 | | |
| | 577.95 | 3 | ..... | 1083 |
| | 553.42 | 1 | ..... | 1274.2 |
| | 551.84 | 3 | ..... | 1287.5 |
| | 542.50 | 3 | ..... | 1371.4? |
| Green... | 493.34 | 1 | ..... | 1989.5 |
| Blue..... | 489.93 | 2 | ..... | 2031.1 |
| Indigo.. | 455.34 | 1 | *b* | |
| | 452.44 | 3 | | |
| Violet... | 416.55 | 2 | | |
| | 413.05 | 1 | *b* | |

### STRONTIUM.

| | | | | |
|---|---|---|---|---|
| Red..... | 655.00 | 4 | | |
| | 650.15 | 2 | ..... | 717.5 |
| Orange. | 640.70 | 1 | ..... | 753.8? |
| | 638.70 | 3 | | |
| | 638.00 | 4 | | |
| | 597.05 | 5 | | |
| Yellow. | 585.00 | 5 | | |
| | 554.00 | 3 | ..... | 1269.5 |
| | 553.35 | 2 | ..... | 1274.7 |
| | 552.25 | 2 | ..... | 1286.0 |
| | 550.35 | 2 | ..... | 1301 |
| | 548.50 | 3 | ..... | 1317 |
| | 548.00 | 1 | ..... | 1320.6 |
| Green... | 525.60 | 2 | ..... | 1539 |
| | 523.85 | 1 | ..... | 1562 |
| | 522.85 | 3 | ..... | 1578.5 |
| | 522.55 | 3 | ..... | 1582 |
| | 522.35 | 3 | | |
| | 496.75 | 4 | | |
| | 496.15 | 2 | | |
| Blue..... | 487.60 | 3 | | |
| | 487.20 | 3 | | |
| | 483.15 | 3 | | |
| | 481.20 | 3 | | |
| | 478.35 | 3 | | |
| | 474.05 | 3 | | |
| | 472.10 | 3 | | |
| | 460.75 | 1 | *b* | |

### STRONTIUM (continued).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Indigo.. | 430.53 | 1 | *b* | |
| Violet... | 422.63 | 3 | | |
| | 421.53 | 1 | *bb* | |
| | 416.10 | 3 | | |
| | 407.85 | 1 | *b* | |

### CALCIUM.

| | | | | |
|---|---|---|---|---|
| Red..... | 649.80 | 2 | ..... | 717.8 |
| | 649.21 | 1 | ..... | 720.1 |
| Orange. | 646.85 | 2 | ..... | 731.7 |
| | 646.17 | 1 | | |
| | 644.90 | 2 | ..... | 736.9 |
| | 643.81 | 1 | ..... | 740.9 |
| | 616.83 | 2 | ..... | 863.9 |
| | 616.12 | 1 | | |
| | 612.12 | 1 | ..... | 884.9 |
| | 610.17 | 2 | ..... | 891.9 |
| | 585.65 | 3 | ..... | 1029.3 |
| Yellow.. | 560.17 | 4 | ..... | 1217.8 |
| | 560.02 | 3 | ..... | 1219.2 |
| | 559.72 | 3 | | |
| | 559.34 | 2 | ..... | 1224.9 |
| | 558.90 | 4 | ..... | 1235 |
| | 558.76 | 1 | | |
| | 588.08 | 4 | | |
| | 534.86 | 2 | ..... | 1443.5 |
| Green... | 526.94 | 2 | E | 1522.7 |
| | 526.45 | 3 | ..... | 1528.7 |
| | 526.34 | 4 | ..... | 1530.2 |
| | 526.12 | 5 | ..... | 1532.5 |
| | 526.08 | 5 | ..... | 1533.1 |
| | 518.82 | 3 | ..... | 1627.2 |
| | 504.12 | 2 | ..... | 1832.8 |
| Blue..... | 487.74 | 3 | ..... | 2058? |
| | 484.81 | 4 | | |
| | 483.18 | 5 | | |
| | 481.16 | 4 | | |
| | 460.75 | 4 | | |
| | 458.53 | 4 | | |
| | 458.08 | 4 | | |
| | 457.83 | 4 | | |
| Indigo.. | 453.55 | 5 | | |
| | 453.42 | 5 | | |
| | 453.21 | 5 | | |
| | 445.52 | 5 | ..... | 2606.5 |
| | 445.40 | 1 | | |
| | 443.53 | 5 | ..... | 2653 |
| | 443.45 | 1 | | |
| | 442.50 | 1 | | |
| | 440.77 | 5 | | |
| | 440.70 | 5 | | |
| | 440.57 | 5 | | |
| | 439.30 | 4 | | |
| | 438.94 | 4 | | |
| | 438.47 | 4 | | |
| | 437.91 | 4 | | |
| | 431.80 | 2 | ..... | 2855.2? |
| | 430.65 | 3 | | |
| | 430.23 | 1 | ..... | 2864.7 |
| | 429.85 | 3 | ..... | 2869.7 |
| | 428.94 | 2 | | |
| | 428.25 | 2 | | |
| | 427.45 | 5 | | |
| | 427.15 | 5 | | |
| | 425.39 | 5 | | |
| | 424.98 | 4 | | |
| | 424.75 | 5 | | |
| Violet... | 423.75 | 5 | | |
| | 423.30 | 5 | | |
| | 422.63 | 1 | *bbb* | |
| | 421.53 | 2 | | |
| | 419.25 | 5 | | |
| | 418.85 | 4 | | |
| | 414.30 | 4 | | |
| | 413.15 | 4 | | |
| | 409.80 | 5 | | |
| | 409.55 | 5 | | |
| | 409.18 | 5 | | |
| | 407.70 | 3 | $H_1$ | |
| | 396.80 | 1 | $H_2$ | |
| Ultra violet | 393.28 | 1 | | |

### MAGNESIUM.

| | | | | |
|---|---|---|---|---|
| Yellow.. | 552.74 | 1 | | |
| Green... | 518.30 | 1 | $b_1$ | 1634.1 |
| | 517.20 | 1 | $b_2$ | 1649 |
| | 516.67 | 1 | $b_4$ | 1655.9 |
| Blue..... | 470.35 | 3 | *bn* | |
| | 458.65 | 3 | *bn* | |
| Indigo.. | 448.10 | 3 | *bn* | |

### ALUMINUM.

| | | | | |
|---|---|---|---|---|
| Orange. | 637.10 | 3 | | |
| | 634.45 | 3 | | |
| | 624.40 | 2 | *b* | |

### ALUMINUM (continued).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Orange. | 623.40 | 2 | *b* | |
| Yellow.. | 572.25 | 1 | | |
| | 569.55 | 1 | | |
| | 559.25 | 4 | *n* | |
| Green... | 505.65 | 1 | | |
| Blue..... | 466.20 | 1 | | |
| Indigo.. | 452.95 | 3 | *b.n* | |
| | 451.10 | 3 | *b.n* | |
| | 547.85 | 4 | *b.n* | |
| Ultra violet | 396.10 | 2 | *b* | |
| | 394.30 | 2 | *b* | |

### GLUCINUM.

| | | | | |
|---|---|---|---|---|
| Blue..... | 457.20 | 3 | | |
| Indigo.. | 448.85 | 3 | | |

### ZIRCONIUM.

| | | | | |
|---|---|---|---|---|
| Orange. | 634.35 | 3 | | |
| | 631.00 | 3 | | |
| | 614.05 | 1 | | |
| | 613.25 | 3 | | |
| | 612.70 | 1 | | |
| Yellow.. | 538.45 | 4 | | |
| | 534.95 | 3 | | |
| Green... | 519.05 | 3 | | |
| Blue..... | 481.50 | 1 | | |
| | 477.10 | 1 | | |
| | 473.85 | 1 | | |
| | 470.95 | 1 | | |
| | 468.65 | 1 | | |
| Indigo.. | 449.75 | 4 | | |
| | 449.45 | 4 | | |
| | 444.30 | 4 | | |
| | 438.00 | 4 | | |
| | 437.00 | 4 | | |
| | 436.00 | 4 | | |
| | 424.20 | 4 | | |
| | 424.15 | 4 | | |
| Violet... | 422.85 | 4 | | |
| | 420.95 | 4 | | |
| | 420.90 | 4 | | |
| | 415.50 | 2 | | |
| | 414.90 | 2 | | |

### YTTRIUM AND ERBIUM.

| | | | | |
|---|---|---|---|---|
| Orange. | 643.40 | 2 | | |
| | 623.55 | 5 | | |
| | 622.35 | 5 | | |
| | 621.80 | 2 | Er | |
| | 619.90 | 4 | | |
| | 619.00 | 2 | | |
| | 617.90 | 3 | | |
| | 616.40 | 3 | | |
| | 614.80 | 2 | Er& | |
| | 613.15 | 1 | Yt | |
| | 611.25 | 5 | | |
| | 610.60 | 5 | | |
| | 609.40 | 5 | | |
| | 608.80 | 5 | | |
| | 607.15 | 4 | | |
| | 605.30 | 4 | | |
| | 603.80 | 3 | | |
| | 601.90 | 3 | | |
| | 600.30 | 2 | Er& | |
| | 598.80 | 2 | Yt | |
| | 598.25 | 4 | Er | |
| | 597.10 | 1 | Er& Yt | |
| Yellow.. | 570.65 | 4 | | |
| | 566.10 | 1 | *b* | |
| | 564.60 | 4 | | |
| | 564.15 | 4 | | |
| | 562.95 | 2 | | |
| | 560.40 | 4 | | |
| | 559.40 | 4 | | |
| | 558.80 | 4 | | |
| | 558.05 | 2 | | |
| | 557.60 | 4 | | |
| | 556.75 | 4 | | |
| | 555.55 | 3 | Er | |
| | 554.40 | 3 | | |
| | 554.25 | 3 | | |
| | 552.70 | 1 | | |
| | 552.20 | 4 | | |
| | 550.90 | 3 | | |
| | 550.20 | 4 | | |
| | 549.65 | 2 | | |
| | 547.90 | 4 | | |
| | 547.75 | 5 | | |
| | 547.60 | 2 | Er | |
| | 547.35 | 4 | | |
| | 546.80 | 5 | | |
| | 546.55 | 1 | | |
| | 543.70 | 4 | | |
| | 540.15 | 1 | | |

### YTTRIUM AND ERBIUM (c.).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Yellow.. | 535.25 | 4 | Er | |
| Green... | 534.55 | 4 | Er | |
| | 533.50 | 3 | Er | |
| | 528.75 | 4 | | |
| | 566.90 | 4 | | |
| | 526.40 | 4 | | |
| | 526.10 | 4 | | |
| | 523.90 | 4 | | |
| | 520.50 | 2 | Er& | |
| | 520.00 | 2 | Yt | |
| | 519.50 | 4 | | |
| | 513.45 | 5 | | |
| | 512.65 | 4 | | |
| | 512.10 | 2 | | |
| | 511.75 | 3 | | |
| | 508.70 | 1 | Er & Y | |
| | 498.15 | 4 | | |
| | 497.10 | 4 | | |
| | 493.50 | 4 | Er *b* | |
| Blue..... | 490.00 | 1 | Er& | |
| | 488.25 | 1 | Yt | |
| | 485.40 | 1 | | |
| | 484.50 | 5 | | |
| | 484.20 | 5 | | |
| | 483.90 | 5 | | |
| | 482.20 | 4 | | |
| | 478.50 | 3 | Er | |
| | 476.05 | 4 | | |
| | 467.40 | 4 | | |
| | 464.30 | 2 | | |
| Indigo.. | 450.50 | 4 | | |
| | 442.20 | 2 | | |
| | 439.70 | 4 | | |
| | 437.40 | 1 | Er& Yt *b* | |
| | 435.75 | 3 | | |
| | 430.95 | 1 | *b* | |
| Violet... | 423.65 | 3 | | |
| | 422.70 | 5 | | |
| | 417.65 | 2 | *b* | |
| | 416.70 | 3 | | |
| | 414.25 | 3 | | |
| | 412.70 | 3 | | |
| | 410.25 | 3 | | |

### THORIUM.

| | | | | |
|---|---|---|---|---|
| | 569.85 | 5 | | |
| | 564.00 | 5 | | |
| | 553.70 | 3 | | |
| | 544.60 | 3 | | |
| | 537.45 | 3 | | |
| | 491.90 | 3 | | |
| | 486.35 | 3 | | |
| | 439.25 | 3 | | |
| | 438.15 | 1 | | |
| | 428.10 | 1 | | |
| | 427.75 | 2 | | |
| | 427.25 | 3 | | |

### IRON.

| | | | | |
|---|---|---|---|---|
| Red..... | 648.98 | 3 | ..... | 721.1 |
| Orange. | 639.90 | 1 | ..... | 756.9 |
| | 630.03 | 3 | ..... | 798.5 |
| | 624.54 | 2 | | |
| | 622.97 | 2 | | |
| | 619.05 | 2 | ..... | 849.7 |
| | 613.56 | 2 | ..... | 877 |
| | 606.45 | 2 | ..... | 912.1? |
| | 602.30 | 3 | | |
| | 601.91 | 4 | | |
| | 600.75 | 4 | | |
| | 600.21 | 4 | | |
| | 598.62 | 4 | | |
| | 598.42 | 4 | | |
| | 598.28 | 4 | | |
| | 597.61 | 4 | | |
| | 597.46 | 4 | | |
| Yellow.. | 576.19 | 3 | ..... | 1096.1 |
| | 570.83 | 3 | | |
| | 568.14 | 3 | | |
| | 566.15 | 3 | | |
| | 565.76 | 1 | | |
| | 565.44 | 3 | | |
| | 562.32 | 3 | ..... | 1200.6 |
| | 561.45 | 1 | ..... | 1207.3 |
| | 560.17 | 1 | ..... | 1217.8 |
| | 559.72 | 1 | | |
| | 559.12 | 2 | | |
| | 558.56 | 1 | ..... | 1231.3 |
| | 557.49 | 2 | ..... | 1239.9 |
| | 557.17 | 1 | ..... | 1242.6 |
| | 556.85 | 2 | ..... | 1245.1 |
| | 550.59 | 3 | | |
| | 550.05 | 3 | | |
| | 549.66 | 3 | | |
| | 548.68 | 4 | | |

### IRON (continued).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Yellow.. | 545.47 | 1 | ..... | 1343.5 |
| | 544.59 | 1 | ..... | 1352.7 |
| | 542.88 | 1 | ..... | 1367 |
| | 540.48 | 2 | ..... | 1389.4 |
| | 540.31 | 2 | ..... | 1390.9 |
| | 539.61 | 2 | ..... | 1397.5 |
| | 539.23 | 3 | ..... | 1401.6 |
| | 538.23 | 3 | ..... | 1410.5 |
| | 537.05 | 1 | ..... | 1421.5 |
| | 536.90 | 3 | ..... | 1423 |
| | 536.65 | 3 | ..... | 1425.4 |
| | 536.40 | 3 | ..... | 1428.2 |
| | 536.19 | 4 | | |
| | 535.24 | 4 | | |
| | 534.86 | 4 | | |
| Green... | 534.02 | 2 | ..... | 1450.8 |
| | 533.92 | 2 | ..... | 1449.4 |
| | 532.73 | 1 | | |
| | 532.34 | 2 | ..... | 1466.8 |
| | 531.59 | 2 | ..... | 1473.9 |
| | 530.65 | 3 | | |
| | 530.15 | 3 | ..... | 1487.7 |
| | 528.26 | 2 | ..... | 1506.3 |
| | 528.09 | 3 | ..... | 1508.6 |
| | 526.95 | 1 | E | 1522.7 |
| | 526.85 | 1 | E | 1523.7 |
| | 526.58 | 2 | ..... | 1527.7 |
| | 526.24 | 4 | | |
| | 523.21 | 1 | ..... | 1569.6 |
| | 522.62 | 1 | ..... | 1577.2 |
| | 520.76 | 3 | | |
| | 520.37 | 3 | | |
| | 520.15 | 4 | | |
| | 519.41 | 3 | | |
| | 519.17 | 2 | ..... | 6222.3 |
| | 519.05 | 4 | ..... | 1623.4 |
| | 517.11 | 4 | ..... | 1650.3 |
| | 516.83 | 3 | $b_3$ | 1653.7 |
| | 516.67 | 2 | $b_4$ | 1655.6 |
| | 516.16 | 4 | ..... | 1662.8 |
| | 513.86 | 2 | ..... | 1693.8 |
| | 510.70 | 3 | | |
| | 506.44 | 4 | | |
| | 505.10 | 2 | | |
| | 504.94 | 2 | ..... | 1867.1 |
| | 504.12 | 3 | | |
| | 504.01 | 3 | | |
| | 500.52 | 4 | | |
| | 500.20 | 5 | | |
| | 499.33 | 5 | | |
| | 499.03 | 4 | | |
| | 498.83 | 5 | | |
| | 495.67 | 1 | *s* | 1961.2 |
| | 492.31 | 3 | ..... | 2001.6 |
| | 491.98 | 1 | ..... | 2005.2 |
| Blue ..... | 491.82 | 2 | ..... | 2007.2 |
| | 489.04 | 1 | ..... | 2041.3 |
| | 487.74 | 3 | ..... | 2058 |
| | 487.13 | 2 | ..... | 2066.2 |
| | 487.05 | 2 | ..... | 2067.1 |
| | 485.92 | 4 | ..... | 2082 |
| | 478.86 | 5 | | |
| | 478.58 | 5 | | |
| | 470.94 | 5 | | |
| | 470.83 | 5 | | |
| | 470.65 | 5 | | |
| | 469.08 | 3 | | |
| | 465.34 | 3 | | |
| | 463.20 | 3 | | |
| | 461.06 | 3 | | |
| | 460.26 | 4 | | |
| | 459.19 | 3 | | |
| Indigo.. | 452.80 | 3 | | |
| | 441.47 | 1 | *ss* | 2670 |
| | 440.42 | 1 | *ss* | 2686.4 |
| | 438.28 | 1 | *ss* | 2721 |
| | 434.31 | 3 | | |
| | 432.52 | 1 | *s* | |
| | 431.46 | 3 | | |
| | 430.72 | 1 | G | 2854.7 |
| | 429.85 | 4 | | |
| | 429.39 | 4 | | |
| | 428.60 | 4 | | |
| | 427.13 | 1 | | |
| | 426.00 | 2 | | |
| | 425.05 | 1 | | |
| | 424.98 | 1 | | |
| | 424.75 | 4 | | |
| Violet... | 423.55 | 3 | | |
| | 423.30 | 3 | | |
| | 422.68 | 5 | | |
| | 422.17 | 5 | | |
| | 421.83 | 5 | | |
| | 420.99 | 5 | | |
| | 420.35 | 2 | | |
| | 419.80 | 1 | | |
| | 419.12 | 2 | | |
| | 418.72 | 1 | | |
| | 418.67 | 1 | | |
| | 418.13 | 4 | | |
| | 417.70 | 4 | | |
| | 415.38 | 3 | | |
| | 415.15 | 4 | | |
| | 414.86 | 4 | | |
| | 414.31 | 1 | | |

### IRON (continued).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Violet.. | 413.39 | 2 | | |
| | 413.15 | 1 | | |
| | 411.78 | 2 | | |
| | 407.10 | 1 | | |
| | 406.29 | 1 | | |
| | 404.50 | 1 | | |
| | 400.47 | 3 | | |

### MANGANESE.

| | | | | |
|---|---|---|---|---|
| Orange | 602.07 | 1 | | |
| | 601.56 | 1 | | |
| | 601.25 | 1 | | |
| Yellow. | 551.56 | 5 | | |
| | 544.30 | 5 | | |
| | 541.95 | 3 | | |
| | 541.24 | 3 | | |
| | 540.65 | 5 | | |
| | 539.96 | 4 | | |
| | 539.35 | 4 | | |
| | 537.66 | 3 | | |
| | 535.90 | 4 | | |
| Green.. | 534.02 | 3 | | |
| | 525.41 | 4 | | |
| | 523.36 | 4 | | |
| | 519.52 | 4 | | |
| Blue .... | 482.28 | 1 | | |
| | 478.26 | 1 | | |
| | 476.58 | 5 | | |
| | 476.47 | 1 | | |
| | 476.15 | 1 | | |
| | 476.07 | 5 | | |
| | 475.34 | 1 | | |
| | 473.80 | 3 | | |
| | 472.90 | 3 | | |
| | 472.60 | 3 | | |
| | 470.87 | 3 | | |
| Indigo. | 450.35 | 5 | | |
| | 450.12 | 2 | | |
| | 449.82 | 2 | | |
| | 449.52 | 5 | | |
| | 449.10 | 5 | | |
| | 448.95 | 3 | | |
| | 447.89 | 5 | | |
| | 447.24 | 2 | | |
| | 447.05 | 2 | | |
| | 446.40 | 3 | | |
| | 446.15 | 3 | | |
| | 446.10 | 3 | | |
| | 445.98 | 5 | | |
| | 445.77 | 3 | | |
| | 445.73 | 4 | | |
| | 445.70 | 5 | | |
| | 445.55 | 5 | | |
| | 445.62 | 4 | | |
| | 445.52 | 3 | | |
| | 445.20 | 5 | | |
| | 445.04 | 3 | | |
| | 443.64 | 3 | | |
| | 443.53 | 5 | | |
| | 441.47 | 2 | | |
| | 428.05 | 3 | | |
| | 426.50 | 3 | | |
| | 425.82 | 3 | | |
| Violet.. | 423.48 | 1 | | |
| | 422.70 | 1 | | |
| | 408.35 | 3 | | |
| | 408.30 | 5 | | |
| | 407.96 | 3 | | |
| | 406.29 | 5 | | |
| | 405.44 | 3 | | |
| | 404.81 | 3 | | |
| | 404.05 | 3 | | |
| | 403.39 | 5 | | |
| | 403.28 | 5 | | |
| | 403.17 | 3 | | |
| | 402.94 | 2 | | |
| | 398.80 | 5 | | |

### CHROMIUM.

| | | | | |
|---|---|---|---|---|
| Yellow. | 540.90 | 2 | ..... | 1385.7 |
| Green .. | 534.25 | 5 | | |
| | 534.10 | 5 | | |
| | 531.80 | 5 | | |
| | 531.30 | 5 | | |
| | 529.66 | 5 | | |
| | 529.61 | 5 | | |
| | 527.43 | 4 | | |
| | 526.34 | 4 | | |
| | 525.41 | 4 | | |
| | 524.63 | 4 | | |
| | 520.76 | 1 | ..... | 1601.4 |
| | 520.52 | 1 | ..... | 1604.4 |
| | 520.37 | 1 | ..... | 1606.4 |
| | 492.40 | 4 | | |
| Blue .... | 465.39 | 4 | | |
| | 464.64 | 4 | | |
| Indigo. | 449.52 | 4 | | |
| | 438.18 | 4 | | |
| | 436.92 | 4 | | |
| | 435.91 | 4 | | |
| | 435.18 | 2 | | |
| | 434.44 | 2 | | |
| | 433.82 | 2 | | |
| | 433.75 | 2 | | |

### CHROMIUM (continued).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Indigo. | 433.68 | 3 | | |
| | 428.94 | 1 | | |
| | 427.46 | 1 | | |
| | 425.39 | 1 | | |

### COBALT.

| | | | | |
|---|---|---|---|---|
| Orange | 614.25 | 3 | ..... | 873 |
| | 612.12 | 3 | ..... | 884.9 |
| | 600.35 | 2 | *b* | |
| Yellow. | 548.24 | 4 | | |
| | 545.20 | 3 | ..... | 1346 |
| | 544.30 | 3 | ..... | 1354.5 |
| | 536.80 | 3 | ..... | 1424 |
| | 536.25 | 5 | ..... | 1429.8 |
| | 535.95 | 5 | ..... | 1433 |
| | 535.24 | 3 | ..... | 1438.9 |
| | 535.12 | 3 | ..... | 1440.2 |
| Green... | 534.26 | 5 | ..... | 1448.7 |
| | 534.21 | 5 | ..... | 1449.4 |
| | 527.96 | 3 | *d* | 1510.3 |
| | 526.72 | 5 | ..... | 1525 |
| | 526.58 | 3 | *d* | 1527.7 |
| | 523.44 | 5 | ..... | 1566.5 |
| | 523.00 | 5 | ..... | 1572 |
| | 521.20 | 5 | ..... | 1596 |
| Blue..... | 486.70 | 1 | ..... | 2071.3 |
| | 483.90 | 1 | ..... | 2103.3 |
| | 481.35 | 1 | ..... | 2132.3 |
| | 479.17 | 1 | ..... | 2157 |
| | 477.87 | 1 | ..... | 2171.5 |
| | 474.85 | 4 | | |
| | 458.08 | 4 | | |
| Violet... | 453.05 | 4 | ..... | 2493.6 |

### NICKEL.

| | | | | |
|---|---|---|---|---|
| Orange | 617.57 | 3 | *b* | 856.8 |
| | 611.53 | 4 | | |
| | 610.75 | 4 | ..... | 891.7 |
| | 589.20 | 1 | ..... | 1005 |
| | 585.65 | 4 | ..... | 1029.3 |
| Yellow. | 547.59 | 3 | ..... | 1324.8 |
| Green... | 517.56 | 5 | ..... | 1643 |
| | 516.83 | 5 | ..... | 1653.7 |
| | 515.51 | 5 | ..... | 1672.2 |
| | 514.57 | 5 | ..... | 1684? |
| | 514.20 | 5 | ..... | 1690 |
| | 513.68 | 5 | ..... | 1697 ? |
| | 511.49 | 5 | ..... | 1727.3 |
| | 509.97 | 5 | ..... | 1748.9 |
| | 509.85 | 5 | ..... | 1749.6 |
| | 508.06 | 5 | ..... | 1775.8 |
| | 507.97 | 5 | ..... | 1776.5 |
| | 503.46 | 3 | ..... | 1842.2 |
| | 501.65 | 3 | ..... | 1868.4 |
| | 498.33 | 5 | ..... | 1920.2 |
| | 497.96 | 5 | ..... | 1925.8 |
| | 493.51 | 3 | ..... | 1987.5 |
| Blue .... | 491.76 | 3 | ..... | 2008.1 |
| | 490.39 | 3 | | |
| | 487.29 | 1 | ..... | 2064.7 |
| | 486.53 | 1 | ..... | 2073.5 |
| | 485.47 | 1 | ..... | 2086.9 |
| | 483.02 | 5 | ..... | 2115.0 |
| | 482.84 | 5 | | |
| | 478.58 | 2 | ..... | 2164 |
| | 475.50 | 5 | ..... | 2199.2 |
| | 471.37 | 1 | | |
| | 464.70 | 5 | | |
| Indigo. | 440.17 | 5 | | |

### ZINC.

| | | | | |
|---|---|---|---|---|
| Yellow. | 636.25 | 1 | ..... | 771.8 |
| | 610.20 | 1 | ..... | 896 |
| | 602.25 | 2 | | |
| | 589.35 | 2 | ..... | 1004 |
| | 581.60 | 4 | | |
| | 575.60 | 5 | | |
| | 574.50 | 5 | | |
| | 560.80 | 4 | | |
| Green.. | 557.75 | 4 | | |
| | 556.30 | 4 | | |
| | 546.55 | 4 | | |
| | 543.60 | 5 | | |
| | 533.60 | 5 | | |
| | 524.95 | 4 | | |
| | 523.30 | 4 | | |
| | 515.85 | 4 | | |
| | 512.10 | 4 | | |
| | 507.40 | 4 | | |
| | 504.80 | 4 | | |
| | 497.10 | 4 | | |
| | 492.38 | 1 | *b.b.n* | 2000.5 |
| Blue .... | 491.12 | 1 | *b.b.n* | 2018? |
| | 487.80 | 5 | | |
| | 486.50 | 5 | | |
| | 480.97 | 1 | | |
| | 472.14 | 1 | ..... | 2240? |
| | 467.95 | 1 | ..... | 2291.8? |

### CADMIUM.

| | | | | |
|---|---|---|---|---|
| Orange | 646.60 | 3 | *b* | 730.5? |
| | 643.80 | 1 | ..... | 740.9? |
| | 605.65 | 5 | | |
| | 600.35 | 5 | | |

### CADMIUM (continued).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Orange | 595.75 | 5 | *n* | |
| | 591.30 | 5 | *n* | |
| Yellow. | 579.00 | 5 | | |
| | 568.70 | 4 | | |
| | 548.90 | 5 | | |
| | 547.10 | 4 | | |
| | 537.80 | 1 | | |
| Green... | 533.75 | 1 | | |
| | 530.45 | 5 | | |
| | 515.30 | 4 | | |
| | 508.50 | 1 | ..... | 1769.5 |
| Blue..... | 479.90 | 1 | ..... | 2148 |
| | 467.68 | 1 | ..... | 2294.5 |
| Indigo. | 441.55 | 2 | ..... | 2667.7 |

### LEAD.

| | | | | |
|---|---|---|---|---|
| Red..... | 665.60 | 1 | | |
| Orange | 645.20 | 3 | ..... | 735? |
| | 605.90 | 5 | | |
| | 604.00 | 3 | *b* | |
| | 600.90 | 5 | ..... | 944 |
| | 600.15 | 3 | *b* | |
| | 589.50 | 5 | | |
| | 587.40 | 3 | *b* | |
| | 585.65 | 4 | | |
| Yellow. | 577.90 | 5 | | |
| | 560.70 | 1 | *b* | 1213 |
| | 554.60 | 2 | *b* | 1266 |
| | 552.35 | 4 | | |
| | 537.20 | 1 | *b* | 1419.5 |
| Green... | 527.45 | 5 | | |
| | 520.65 | 5 | | |
| | 520.10 | 3 | | |
| | 518.90 | 5 | | |
| | 516.30 | 4 | | |
| | 504.50 | 2 | *b* | 1826 |
| | 500.45 | 3 | | |
| Blue .... | 480.20 | 5 | *n* | |
| | 479.65 | 5 | *n* | |
| | 476.00 | 4 | *b* | |
| | 457.30 | 5 | | |
| Indigo. | 440.15 | 5 | | |
| | 438.65 | 1 | *b* | 2714 |
| | 424.60 | 1 | *b* | |

### THALLIUM.

| | | | | |
|---|---|---|---|---|
| Orange | 594.75 | 3 | | |
| Yellow | 560.80 | 5 | | |
| | 549.00 | 5 | | |
| | 541.25 | 4 | *n* | |
| | 536.00 | 4 | | |
| | 534.95 | 1 | *b* | |
| Green.. | 515.25 | 2 | *n* | |
| | 508.50 | 4 | | |
| | 507.85 | 3 | *n* | |
| | 505.30 | 3 | | |
| | 498.15 | 3 | *n* | |
| | 494.55 | 4 | | |
| Blue..... | 489.20 | 4 | | |
| | 473.55 | 3 | *b* | |

### BISMUTH.

| | | | | |
|---|---|---|---|---|
| Orange | 659.90 | 4 | | |
| | 649.25 | 3 | | |
| | 612.90 | 2 | | |
| | 605.65 | 2 | | |
| | 605.00 | 4 | | |
| | 603.85 | 4 | | |
| | 586.15 | 2 | | |
| Yellow. | 581.60 | 3 | | |
| | 571.65 | 2 | | |
| | 565.50 | 4 | | |
| | 555.30 | 4 | | |
| | 545.00 | 2 | *b* | |
| | 539.65 | 4 | | |
| Green... | 527.00 | 2 | *b* | |
| | 520.80 | 1 | *b* | |
| | 520.10 | 4 | *n* | |
| | 514.35 | 1 | *b* | |
| | 512.35 | 1 | *b* | |
| | 509.00 | 5 | *n* | |
| | 507.75 | 4 | *n* | |
| | 499.30 | 1 | | |
| | 497.00 | 5 | | |
| Blue .... | 490.50 | 4 | | |
| | 479.65 | 4 | | |
| | 475.25 | 5 | | |
| | 473.00 | 5 | | |
| | 472.20 | 1 | | |
| | 470.50 | 5 | | |
| | 469.15 | 4 | | |
| | 456.00 | 2 | | |
| Indigo. | 433.95 | 4 | | |
| | 432.75 | 4 | | |
| | 430.20 | 3 | *b* | |
| | 425.95 | 2 | *b* | |
| Violet... | 411.90 | 4 | *b* | |
| | 408.45 | 4 | *b* | |

### COPPER.

| | | | | |
|---|---|---|---|---|
| Orange | 637.97 | 2 | | |
| | 621.83 | 5 | | |
| Yellow. | 578.13 | 2 | ..... | 1081.8 |
| | 570.04 | 1 | | |

### COPPER (continued).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Yellow.. | 529.20 | 2 | ..... | 1497.3 |
| | 521.71 | 1 | ..... | 1588.3 |
| | 515.26 | 1 | | |
| | 510.49 | 1 | | |
| | 501.14 | 4 | | |
| | 495.55 | 3 | *n* | |
| | 493.25 | 3 | *n* | |
| | 491.15 | 3 | *n* | |
| | 470.30 | 3 | | |
| | 465.07 | 3 | ..... | 2329.5 |
| | 427.50 | 3 | | |

### MERCURY.

| | | | | |
|---|---|---|---|---|
| Orange. | 615.10 | 1 | | |
| | 588.80 | 2 | | |
| | 587.10 | 4 | ..... | 869.2 |
| Yellow.. | 578.95 | 1 | | |
| | 576.80 | 1 | ..... | 1092.5? |
| | 567.80 | 2 | ..... | 1157 |
| | 559.50 | 3 | | |
| | 546.05 | 1 | *b* | 1338 |
| | 542.60 | 2 | ..... | 1369 |
| | 536.45 | 4 | *n* | |
| Green... | 527.85 | 5 | *n* | |
| | 521.70 | 5 | *n* | |
| | 520.60 | 4 | *n* | |
| | 513.10 | 4 | *n* | |
| | 495.80 | 3 | | |
| Blue ..... | 491.60 | 4 | | |
| | 435.80 | 1 | *b* | |
| Violet... | 407.85 | 3 | | |
| | 404.70 | 3 | | |
| | 398.20 | 4 | | |

### SILVER.

| | | | | |
|---|---|---|---|---|
| Orange. | 603.60 | 5 | *n* | |
| Yellow.. | 565.60 | 4 | *n* | |
| | 564.50 | 4 | *n* | |
| | 562.55 | 4 | *n* | |
| | 562.25 | 2 | *b* | |
| | 561.05 | 4 | *n* | |
| | 559.00 | 4 | *n* | |
| | 556.80 | 4 | *n* | |
| | 555.65 | 5 | *n* | |
| | 555.15 | 2 | | |
| | 552.20 | 4 | *n* | |
| | 548.65 | 5 | *n* | |
| | 547.00 | 2 | ..... | 1330 |
| | 546.40 | 1 | ..... | 1335 |
| | 542.35 | 3 | *n* | |
| | 541.10 | 5 | *n* | |
| | 540.15 | 2 | *b* | |
| Green... | 529.90 | 3 | | |
| | 520.87 | 1 | ..... | 1600 |
| Blue ..... | 487.40 | 2 | | |
| | 466.65 | 4 | | |
| Indigo.. | 447.50 | 4 | | |

### GOLD.

| | | | | |
|---|---|---|---|---|
| Orange. | 627.65 | 2 | ..... | 809.5 |
| | 596.00 | 3 | ..... | 967.0 |
| | 595.50 | 3 | ..... | 969.6 |
| Yellow.. | 583.60 | 1 | ..... | 1042.5 |
| Green... | 523.00 | 1 | ..... | 1572 |
| Blue ..... | 479.20 | 3 | ..... | 2157 |

### TIN.

| | | | | |
|---|---|---|---|---|
| Orange. | 645.20 | 1 | *b* | 736 |
| Yellow.. | 579.80 | 1 | *b* | |
| | 563.00 | 2 | | |
| | 558.85 | 1 | *b* | |
| | 556.25 | 1 | *b* | 1250 |
| | 536.85 | 5 | | |
| | 534.75 | 4 | | |
| Green... | 533.20 | 2 | *b* | |
| | 528.95 | 5 | | |
| | 522.40 | 4 | | |
| | 510.05 | 3 | ..... | 1748 |
| | 502.10 | 5 | | |
| | 492.30 | 4 | | |
| Blue ..... | 485.80 | 3 | | |
| | 458.45 | 2 | | |
| Indigo.. | 452.40 | 1 | *b* | |

### PLATINUM.

| | | | | |
|---|---|---|---|---|
| Orange | 652.20 | 3 | ..... | 709.3 |
| red. | 596.35 | 3 | ..... | 965.5 |
| Yellow.. | 584.50 | 4 | | |
| | 583.70 | 4 | | |
| | 580.60 | 4 | | |
| | 547.80 | 4 | | |
| | 547.55 | 4 | ..... | 1325.7 |
| | 538.95 | 3 | | |
| | 536.75 | 2 | | |
| | 530.15 | 1 | ..... | 1488.2 |
| | 522.60 | 2 | ..... | 1576.8 |
| | 519.80 | 4 | | |
| | 505.95 | 2 | ..... | 1806.1 |
| Blue ..... | 487.90 | 4 | ..... | 2057? |
| | 485.15 | 4 | | |
| | 480.30 | 4 | | |
| Indigo.. | 455.18 | 2 | *b* | |
| | 449.82 | 2 | | |
| | 444.20 | 4 | | |
| | 438.94 | 4 | | |
| | 432.70 | 4 | | |

### PALLADIUM.

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Orange | 612.90 | 5 | | |
| Yellow. | 569.40 | 3 | ..... | 1146.2 |
| | 566.80 | 3 | ..... | 1164.9 |
| | 565.10 | 4 | | |
| | 564.00 | 4 | ..... | 1185.6 |
| | 561.80 | 3 | | |
| | 554.60 | 3 | ..... | 1264.6 |
| | 554.20 | 3 | ..... | 1269? |
| | 539.40 | 2 | ..... | 1407 |
| | 536.15 | 4 | ..... | 1430.1 |
| Green.. | 534.50 | 4 | ..... | 1447 |
| | 531.20 | 4 | ..... | 1477 |
| | 529.50 | 1 | | |
| | 525.70 | 4 | | |
| | 523.35 | 2 | ..... | 1566.5 |
| | 520.80 | 4 | ..... | 1601.4 |
| | 516.30 | 1 | ..... | 1660 |
| | 511.65 | 2 | | |
| | 511.00 | 2 | ..... | 1732.9 |
| Blue..... | 487.45 | 3 | ..... | 2062 |
| | 481.70 | 3 | | |
| | 478.70 | 3 | ..... | 2162 |
| Indigo. | 447.35 | 3 | | |
| | 427.80 | 5 | *b* | |
| Violet.. | 421.25 | 2 | | |

### CERIUM.

| | | | | |
|---|---|---|---|---|
| Yellow. | 565.40 | 5 | | |
| | 560.00 | 5 | | |
| | 556.40 | 5 | ..... | 1249.9 |
| | 551.10 | 2 | | |
| | 547.20 | 3 | ..... | 1329.1 |
| | 546.70 | 4 | ..... | 1332.4 |
| | 546.30 | 5 | ..... | 1336.2 |
| | 540.85 | 2 | ..... | 1385 |
| | 539.25 | 2 | ..... | 1401.7 |
| | 535.20 | 1 | ..... | 1438.9 |
| Green.. | 533.00 | 3 | ..... | 1460.9 |
| | 527.30 | 1 | ..... | 1517.9 |
| | 519.05 | 4 | ..... | 1623.1 |
| | 518.70 | 3 | ..... | 1629.2 |
| | 516.10 | 5 | | |
| | 507.90 | 3 | ..... | 1775.5 |
| | 507.20 | 4 | ..... | 1784.5 |
| | 497.00 | 5 | ..... | 1938.8 |
| Blue..... | 471.35 | 2 | *b* | |
| | 462.80 | 1 | | |
| | 462.40 | 5 | | |
| | 460.55 | 5 | | |
| | 459.40 | 3 | | |
| | 458.25 | 5 | | |
| | 457.85 | 5 | | |
| | 457.25 | 1 | | |
| | 456.45 | 5 | | |
| | 456.20 | 1 | | |
| | 456.05 | 2 | *b* | |
| Indigo. | 453.95 | 2 | | |
| | 452.75 | 2 | *b* | |
| | 452.65 | 1 | | |
| | 452.30 | 2 | | |
| | 448.60 | 5 | | |
| | 448.25 | 5 | | |
| | 447.90 | 5 | | |
| | 447.15 | 2 | | |
| | 446.70 | 5 | | |
| | 446.25 | 5 | | |
| | 445.95 | 1 | *b* | |
| | 444.85 | 3 | *b* | |
| | 444.35 | 3 | | |
| | 442.80 | 2 | | |
| | 441.90 | 2 | | |
| | 441.00 | 5 | | |
| | 439.85 | 5 | | |
| | 439.15 | 2 | | |
| | 438.55 | 2 | | |
| | 438.20 | 2 | | |
| | 436.50 | 5 | | |
| | 429.60 | 1 | *b* | |
| | 428.90 | 1 | *b* | |
| | 418.55 | 3 | *b* | |
| | 416.50 | 4 | *b* | |
| | 414.90 | 4 | *b* | |
| | 413.65 | 4 | | |
| | 413.25 | 4 | | |
| | 412.70 | 5 | | |
| | 412.40 | 5 | | |

### DIDYMIUM AND LANTHANUM.

| | | | | |
|---|---|---|---|---|
| Orange | 634.60 | 5 | Di | |
| | 629.25 | 5 | Di La | |
| | 597.35 | 5 | | |
| | 596.35 | 5 | | |
| Yellow. | 580.55 | 5 | ..... | 1064.5 |
| | 579.70 | 5 | | |
| | 579.00 | 4 | ..... | 1075.6 |
| | 576.80 | 5 | ..... | 1092.1 |
| | 550.00 | 3 | ..... | 1303.4 |
| | 545.40 | 2 | | |
| | 538.10 | 3 | | |
| | 537.65 | 3 | | |
| Green.. | 533.90 | 4 | | |
| | 533.75 | 3 | | |

### DIDYMIUM AND LANTHANUM (continued).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Green... | 530.30 | 2 | *b* | 1486.8 |
| | Di & La | | | |
| | 527.00 | 4 | *b* | 1519.4 |
| | 525.75 | 5 | | |
| | 525.20 | 4 | Di | 1541.4 |
| | 523.35 | 4 | | |
| | 522.50 | 5 | | |
| | 521.10 | 4 | | |
| | 520.35 | 4 | | |
| | 518.75 | 1 | | |
| | 518.20 | 1 | | |
| | 517.70 | 4 | | |
| | 515.70 | 4 | | |
| | 514.40 | 4 | | |
| | 513.05 | 3 | Di | |
| | 512.25 | 3 | ..... | 1716.6 |
| | 511.40 | 3 | ..... | 1728.8 |
| | 505.55 | 5 | | |
| | 499.95 | 4 | ..... | 1895.2 |
| | 496.80 | 4 | | |
| | 495.00 | 4 | | |
| | 493.40 | 4 | ..... | 1988.6 |
| | 492.00 | 1 | ..... | 2003.8 |
| Blue..... | 490.00 | 1 | ..... | 2031? |
| | 488.25 | 1 | Di& La | |
| | 486.00 | 4 | ..... | 2081 |
| | 485.75 | 4 | | |
| | 482.30 | 4 | | |
| | 481.10 | 4 | ..... | 2136.8 |
| | 480.20 | 4 | | |
| | 474.70 | 3 | | |
| | 474.15 | 3 | ..... | 2214.5 |
| | 473.90 | 5 | ..... | 2217.8 |
| | 470.25 | 3 | | |
| | 469.10 | 1 | | |
| | 467.10 | 2 | | |
| | 466.80 | 2 | | |
| | 466.35 | 1 | | |
| | 466.10 | 2 | *b* | |
| | 465.45 | 1 | *b* | |
| | 461.95 | 1 | | |
| | 461.35 | 2 | | |
| | 455.90 | 2 | *b* | |
| Indigo. | 452.50 | 2 | Di& La | |
| | 452.15 | 1 | | |
| | 443.00 | 1 | *b*, Di& La | 2646.2? |
| | 435.45 | 4 | | |
| | 433.50 | 1 | | |
| | 429.55 | 2 | *b*, Di& La | |
| | 428.75 | 2 | | |
| | 426.80 | 2 | Di& La | |
| | 426.25 | 1 | | |
| Violet.. | 423.70 | 1 | | |
| | 421.70 | 4 | | |
| | 419.60 | 4 | | |
| | 419.25 | 4 | | |
| | 414.15 | 4 | | |
| | 412.35 | 4 | | |

### URANIUM.

| | | | | |
|---|---|---|---|---|
| Orange | 591.30 | 3 | | |
| Yellow. | 561.90 | 3 | | |
| | 557.90 | 3 | | |
| | 556.25 | 3 | | |
| | 552.70 | 1 | | |
| | 550.90 | 3 | | |
| | 549.35 | 1 | | |
| | 548.15 | 1 | | |
| | 547.95 | 1 | | |
| | 547.70 | 1 | | |
| | 547.45 | 1 | | |
| | 538.40 | 3 | | |
| Green... | 502.70 | 3 | | |
| Blue..... | 473.10 | 3 | | |
| | 472.30 | 3 | | |
| Indigo. | 454.30 | 2 | | |
| | 447.25 | 1 | | |
| | 439.35 | 3 | | |
| | 437.40 | 3 | | |
| | 436.20 | 1 | | |
| | 434.05 | 1 | | |

### TITANIUM.

| | | | | |
|---|---|---|---|---|
| Orange | 655.57 | 4 | | |
| | 654.28 | 5 | | |
| | 626.02 | 2 | | |
| | 625.74 | 1 | *b* | |
| | 622.09 | 3 | | |
| | 621.41 | 3 | | |
| | 612.52 | 2 | | |
| | 609.74 | 3 | | |
| | 609.04 | 2 | | |
| | 608.32 | 3 | | |
| | 606.45 | 2 | | |
| | 599.87 | 2 | | |
| | 597.80 | 1 | | |
| | 596.53 | 1 | | |
| | 595.18 | 1 | | |
| | 592.15 | 3 | | |

### TITANIUM (continued).

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Orange | 591.89 | 3 | | |
| | 589.90 | 1 | | |
| | 586.53 | 1 | | |
| Yellow. | 573.80 | 3 | | |
| | 571.40 | 4 | | |
| | 570.15 | 5 | *n* | |
| | 568.85 | 2 | | |
| | 567.90 | 3 | | |
| | 567.44 | 1 | | |
| | 566.15 | 1 | | |
| | 564.70 | 4 | | |
| | 564.30 | 1 | | |
| | 562.90 | 5 | *n* | |
| | 559.72 | 5 | *n* | |
| | 556.46 | 3 | | |
| | 551.34 | 1 | | |
| | 551.18 | 1 | | |
| | 550.28 | 2 | | |
| | 548.89 | 2 | | |
| | 548.68 | 3 | | |
| | 548.02 | 2 | | |
| | 547.65 | 3 | | |
| | 547.33 | 3 | | |
| | 547.05 | 4 | | |
| | 544.80 | 3 | | |
| | 544.58 | 4 | | |
| | 542.86 | 2 | | |
| | 542.50 | 3 | | |
| | 541.79 | 4 | | |
| | 540.86 | 2 | | |
| | 540.31 | 3 | | |
| | 539.61 | 2 | | |
| | 538.02 | 3 | *b* | |
| | 536.88 | 2 | | |
| | 535.05 | 2 | | |
| Green... | 533.68 | 1 | | |
| | 529.85 | 3 | | |
| | 529.67 | 1 | | |
| | 529.55 | 3 | | |
| | 528.78 | 4 | | |
| | 528.28 | 1 | | |
| | 527.15 | 4 | | |
| | 526.72 | 4 | | |
| | 526.50 | 2 | | |
| | 526.29 | 4 | | |
| | 525.96 | 4 | | |
| | 525.50 | 4 | | |
| | 525.10 | 4 | | |
| | 524.63 | 2 | *b* | |
| | 523.85 | 2 | *b* | |
| | 522.60 | 3 | | |
| | 522.30 | 1 | *b* | |
| | 521.75 | 4 | | |
| | 520.95 | 1 | *b* | |
| | 520.55 | 3 | | |
| | 520.05 | 3 | | |
| | 519.23 | 1 | | |
| | 518.83 | 2 | | |
| | 518.51 | 3 | | |
| | 517.30 | 2 | | |
| | 515.32 | 3 | | |
| | 515.12 | 2 | | |
| | 514 70 | 3 | | |
| | 514.45 | 2 | | |
| | 512.86 | 1 | | |
| | 512.66 | 4 | | |
| | 511.99 | 1 | | |
| | 511.30 | 2 | | |
| | 510.86 | 4 | | |
| | 510.24 | 4 | *b* | |
| | 508.65 | 2 | *b* | |
| | 507.65 | 4 | *b* | |
| | 507.18 | 4 | *b* | |
| | 506.55 | 4 | | |
| | 506.44 | 1 | | |
| | 506.13 | 3 | | |
| | 505.23 | 3 | | |
| | 504.34 | 3 | | |
| | 503.92 | 2 | | |
| | 503.80 | 2 | | |
| | 503.56 | 1 | | |
| | 502.48 | 3 | | |
| | 502.38 | 3 | | |
| | 502.12 | 3 | | |
| | 501.94 | 2 | | |
| | 501.53 | 2 | | |
| | 501.33 | 1 | | |
| | 501.22 | 4 | | |
| | 500.66 | 1 | | |
| | 500.10 | 4 | | |
| | 499.88 | 1 | | |
| | 499.03 | 1 | | |
| | 498.83 | 3 | | |
| | 498.10 | 1 | | |
| | 497.78 | 3 | | |
| | 497.52 | 4 | | |
| | 497.22 | 5 | | |
| | 496.77 | 5 | | |
| | 496.45 | 5 | | |
| | 494.70 | 5 | | |
| | 493.72 | 2 | | |
| | 492.75 | 2 | | |
| | 492.50 | 4 | | |
| | 492.08 | 3 | | |
| | 491.90 | 3 | | |

**TITANIUM (continued).**

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Blue..... | 491.32 | 3 | | |
| | 491.13 | 3 | | |
| | 490.39 | 4 | | |
| | 489.93 | 2 | | |
| | 488.45 | 1 | | |
| | 487.30 | 4 | | |
| | 486.90 | 2 | | |
| | 486.75 | 2 | | |
| | 485.50 | 2 | | |
| | 484.80 | 3 | | |
| | 484.00 | 2 | | |
| | 483.50 | 4 | | |
| | 481.95 | 2 | *b* | |
| | 480.43 | 1 | | |
| | 479.75 | 4 | | |
| | 479.16 | 2 | | |
| | 477.90 | 3 | | |
| | 475.85 | 1 | | |
| | 475.70 | 1 | | |
| | 474.18 | 2 | | |
| | 472.28 | 2 | | |
| | 470.90 | 2 | | |
| | 469.80 | 2 | | |
| | 469.06 | 2 | | |
| | 468.15 | 2 | | |
| | 466.65 | 2 | | |
| | 465.60 | 1 | *b* | |
| | 464.40 | 4 | | |
| | 463.88 | 1 | *b* | |
| | 462.90 | 3 | | |
| | 462.30 | 2 | | |
| | 461.67 | 2 | | |
| | 457.15 | 1 | *b* | |
| | 456.32 | 2 | | |
| | 455.53 | 3 | | |
| Indigo.. | 455.18 | 3 | | |
| | 454.89 | 1 | *b* | |
| | 454.35 | 3 | | |
| | 453.55 | 1 | *bb* | |
| | 453.20 | 1 | *bb* | |
| | 452.61 | 1 | | |
| | 452.19 | 3 | | |
| | 451.75 | 3 | | |
| | 451.15 | 3 | | |
| | 450.07 | 1 | *b* | |
| | 449.61 | 2 | *b* | |
| | 448.10 | 3 | *b* | |
| | 446.85 | 1 | | |
| | 445.75 | 2 | | |
| | 445.50 | 2 | | |
| | 445.25 | 2 | | |
| | 444.95 | 2 | | |
| | 444.65 | 2 | | |
| | 444.30 | 1 | *b* | |
| | 442.68 | 1 | *b* | |
| | 441.78 | 2 | *b* | |
| | 441.10 | 3 | | |
| | 440.30 | 3 | | |
| | 439.85 | 3 | | |
| | 439.30 | 1 | *b* | |
| | 433.75 | 1 | | |
| | 432.35 | 2 | *b* | |
| | 432.00 | 5 | | |
| | 431.80 | 5 | | |
| | 431.35 | 5 | | |
| | 431.25 | 5 | | |
| | 430.75 | 5 | | |
| | 430.50 | 2 | | |
| | 429.90 | 1 | *b* | |
| | 429.50 | 5 | | |
| | 429.38 | 5 | | |
| | 429.07 | 2 | *b* | |
| | 428.70 | 5 | | |
| | 428.20 | 5 | | |
| | 427.30 | 5 | | |
| | 426.30 | 2 | | |
| Violet... | 423.65 | 2 | | |
| | 418.50 | 3 | | |
| | 417.10 | 1 | *b* | |
| | 416.30 | 1 | *b* | |

**TUNGSTEN.**

| | | | | |
|---|---|---|---|---|
| Yellow.. | 580.50 | 4 | | |
| | 573.30 | 3 | | |
| | 564.80 | 4 | | |
| | 563.15 | 5 | | |
| | 551.30 | 1 | | |
| | 549.15 | 2 | | |
| Green... | 522.30 | 1 | | |
| | 507.05 | 3 | | |
| | 506.80 | 3 | | |

**TUNGSTEN (continued).**

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Green.. | 505.30 | 1 | | |
| | 501.40 | 3 | | |
| | 500.70 | 3 | | |
| | 498.10 | 4 | | |
| Blue..... | 488.75 | 2 | | |
| | 484.20 | 1 | | |
| | 468.05 | 5 | | |
| | 466.05 | 5 | | |
| | 465.95 | 5 | | |
| Violet.. | 430.20 | 3 | | |
| | 429.50 | 3 | | |
| | 426.90 | 3 | | |

**MOLYBDENUM.**

| | | | | |
|---|---|---|---|---|
| Orange | 602.90 | 1 | | |
| | 588.75 | 1 | | |
| | 585.65 | 2 | | |
| Yellow. | 579.10 | 3 | | |
| | 575.00 | 3 | | |
| | 568.75 | 3 | | |
| | 564.90 | 4 | | |
| | 563.10 | 4 | | |
| | 556.90 | 1 | | |
| | 554.00 | 5 | | |
| | 553.15 | 1 | | |
| | 550.50 | 1 | | |
| | 536.00 | 4 | *b* | |
| Green.. | 497.90 | 5 | | |
| Blue..... | 486.75 | 4 | *b* | |
| | 482.95 | | | |
| | 481.80 | | | |
| | 475.75 | | | |
| | 473.05 | | | |
| | 470.65 | | | |
| Indigo. | 453.60 | 4 | | |
| | 447.50 | 4 | | |
| | 443.35 | 4 | | |
| | 441.15 | 4 | | |
| | 438.05 | 4 | | |
| | 432.60 | 4 | | |
| | 427.75 | 3 | *b* | |

**VANADIUM.**

| | | | | |
|---|---|---|---|---|
| Orange | 624.05 | 3 | | |
| | 613.44 | 4 | | |
| | 611.90 | 1 | | |
| | 610.95 | 4 | | |
| | 608.90 | 1 | | |
| | 608.00 | 4 | | |
| | 603.90 | 1 | | |
| Yellow. | 578.60 | 4 | | |
| | 572.50 | 1 | | |
| | 570.60 | 4 | | |
| | 570.25 | 3 | | |
| | 569.75 | 2 | | |
| | 566.80 | 3 | | |
| | 562.60 | 3 | | |
| | 562.25 | 3 | | |
| | 541.40 | 3 | | |
| | 540.10 | 4 | | |
| Green.. | 524.00 | 3 | | |
| | 523.30 | 3 | | |
| | 519.50 | 4 | | |
| Blue..... | 519.15 | 4 | | |
| | 488.10 | 3 | | |
| | 487.45 | 3 | | |
| | 486.40 | 4 | | |
| | 485.10 | 5 | | |
| | 484.30 | 3 | | |
| | 483.15 | 5 | | |
| | 459.30 | 3 | | |
| | 458.50 | 4 | | |
| | 457.90 | 5 | | |
| | 457.60 | 5 | | |
| Indigo. | 445.90 | 2 | *b* | |
| | 440.75 | 1 | *b* | |
| | 440.60 | 4 | | |
| | 440.05 | 5 | | |
| | 439.50 | 3 | | |
| | 438.90 | 2 | | |
| | 438.40 | 1 | | |
| | 437.90 | 1 | *b* | |
| | 435.25 | 5 | | |
| | 434.05 | 5 | | |
| | 433.25 | 5 | | |
| | 432.95 | 5 | | |
| | 431.00 | 5 | | |
| | 429.70 | 4 | | |
| | 429.25 | 5 | | |
| | 428.35 | 5 | | |

**VANADIUM (continued).**

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Indigo. | 427.70 | 5 | | |
| | 427.20 | 4 | | |
| | 426.85 | 4 | | |
| Violet.. | 410.00 | 3 | | |

**OSMIUM.**

| | | | | |
|---|---|---|---|---|
| Indigo. | 442.20 | 4 | | |

**ANTIMONY.**

| | | | | |
|---|---|---|---|---|
| Orange | 630.15 | 2 | ..... | 798.1 |
| | 624.45 | 4 | | |
| | 620.90 | 4 | | |
| | 619.30 | 4 | | |
| | 615.50 | 4 | | |
| | 612.85 | 1 | | |
| | 607.80 | 1 | | |
| | 605.10 | 4 | | |
| | 600.35 | 1 | | |
| | 597.95 | 4 | ..... | 957.2 |
| | 590.90 | 2 | *b* | 994? |
| | 589.35 | 2 | *b* | 997.1? |
| Yellow. | 579.15 | 4 | | |
| | 563.80 | 2 | ..... | 1189.0? |
| | 560.70 | 5 | | |
| | 556.70 | 2 | *b* | 1247 |
| | 546.35 | 3 | *b* | 1334 |
| | 537.90 | 3 | *b* | |
| | 537.15 | 5 | | |
| | 535.25 | 5 | *n* | |
| Green.. | 524.15 | 3 | *b* | |
| | 520.80 | 5 | | |
| | 517.70 | 3 | *n* | |
| | 514.10 | 4 | *n* | |
| | 511.25 | 4 | *n* | |
| | 503.60 | 5 | | |
| | 494.85 | 2 | *b* | |
| Blue..... | 487.75 | 3 | *b* | |
| | 483.50 | 4 | *n* | |
| | 478.60 | 4 | *n* | |
| | 493.45 | 4 | | |
| | 471.10 | 2 | *b* | 2252? |
| | 469.10 | 3 | ..... | 2254? |
| | 459.15 | 3 | *b* | |
| Indigo. | 435.20 | 2 | *b* | |
| | 426.50 | 3 | *b* | |

**ARSENIC.**

| | | | | |
|---|---|---|---|---|
| Orange | 616.95 | 2 | | |
| | 611.00 | 2 | *b* | 890.5 |
| | 602.15 | 4 | | |
| Yellow. | 565.10 | 2 | *b* | |
| | 555.80 | 2 | *b* | |
| | 549.80 | 3 | *b* | 1304.5 |
| Green .. | 533.15 | 3 | *b* | 1460.5 |

**TELLURIUM.**

| | | | | |
|---|---|---|---|---|
| Orange | 643.70 | 1 | | |
| | 604.60 | 3 | | |
| | 601.25 | 3 | | |
| | 597.30 | 1 | | |
| | 593.50 | 2 | | |
| | 585.65 | 4 | | |
| Yellow. | 585.20 | 4 | | |
| | 582.50 | 4 | *n* | |
| | 580.55 | 4 | *n* | |
| | 578.10 | 3 | | |
| | 575.50 | 1 | | |
| | 574.10 | 5 | | |
| | 570.65 | 1 | | |
| | 564.70 | 1 | | |
| | 561.60 | 4 | | |
| | 557.40 | 2 | | |
| | 548.80 | 3 | | |
| | 547.75 | 3 | | |
| | 544.75 | 2 | | |
| | 540.85 | 4 | | |
| | 536.60 | 3 | | |
| Green.. | 531.00 | 3 | | |
| | 529.90 | 5 | | |
| | 521.70 | 2 | | |
| | 517.20 | 5 | | |
| | 515.20 | 3 | | |
| | 513.30 | 5 | *n* | |
| | 510.45 | 3 | | |
| | 503.50 | 4 | | |
| Blue.... | 489.50 | 5 | *n* | |
| | 486.65 | 4 | *n* | |
| | 483.20 | 5 | *n* | |
| | 478.50 | 5 | *n* | |
| | 460.35 | 4 | | |

**INDIUM.**

| Color. | λ. | I. | R. | K. |
|---|---|---|---|---|
| Indigo. | 453.15 | 2 | *bbn* | |
| | 450.95 | 1 | | |
| Violet.. | 410.10 | 1 | *b* | |

**AIR.**

| | | | | |
|---|---|---|---|---|
| Red..... | 660.20 | 3 | | |
| | 656.18 | 1 | *c* | |
| | 647.95 | 3 | | |
| Orange | 617.05 | 3 | *b* | |
| | 594.90 | 4 | | |
| | 594.15 | 1 | *b* | |
| | 593.20 | 1 | | |
| | 592.95 | 4 | | |
| Yellow. | 576.70 | 4 | | |
| | 574.50 | 4 | | |
| | 571.10 | 3 | | |
| | 568.55 | 3 | *b* | |
| | 567.80 | 1 | | |
| | 567.45 | 3 | | |
| | 566.60 | 1 | | |
| | 554.90 | 4 | | |
| | 554.10 | 3 | | |
| | 553.40 | 1 | | |
| | 553.00 | 3 | | |
| | 549.50 | 2 | | |
| | 547.90 | 3 | | |
| | 546.15 | 4 | | |
| | 545.30 | 4 | | |
| | 535.10 | 5 | | |
| Green.. | 533.95 | 5 | | |
| | 532.00 | 5 | | |
| | 518.95 | 4 | | |
| | 518.45 | 5 | | |
| | 517.80 | 4 | | |
| | 517.20 | 5 | | |
| | 504.50 | 1 | *b* | |
| | 502.50 | 2 | | |
| | 501.60 | 3 | | |
| | 501.00 | 3 | | |
| | 500.65 | 4 | | |
| | 500.50 | 1 | *b* | |
| | 500.20 | 1 | *b* | |
| | 499.35 | 3 | | |
| | 498.70 | 3 | | |
| | 494.10 | 4 | | |
| | 492.40 | 4 | | |
| Blue..... | 490.60 | 4 | | |
| | 489.55 | 4 | | |
| | 480.30 | 1 | | |
| | 478.80 | 1 | | |
| | 477.90 | 1 | | |
| | 471.20 | 4 | | |
| | 470.65 | 2 | | |
| | 469.80 | 2 | | |
| | 467.50 | 4 | | |
| | 466.15 | 4 | | |
| | 464.90 | 2 | | |
| | 464.20 | 1 | | |
| | 464.00 | 3 | | |
| | 463.05 | 1 | *b* | |
| | 462.10 | 2 | | |
| | 461.30 | 2 | | |
| | 460.65 | 2 | | |
| | 460.10 | 2 | | |
| | 459.60 | 3 | | |
| | 459.05 | 3 | | |
| Indigo. | 444.65 | 1 | *b* | |
| | 443.20 | 3 | *bn* | |
| | 441.80 | 1 | | |
| | 441.45 | 1 | | |
| | 436.80 | 4 | *n* | |
| | 435.05 | 3 | | |
| | 434.75 | 1 | | |
| | 434.60 | 3 | | |
| | 433.30 | 3 | *bn* | |
| | 431.90 | 2 | | |
| | 431.65 | 2 | | |
| Violet.. | 423.00 | 2 | *bn* | |
| | 418.95 | 3 | | |
| | 418.45 | 3 | | |
| | 415.50 | 5 | *n* | |
| | 414.90 | 5 | *n* | |
| | 413.70 | 4 | *bn* | |
| | 412.30 | 3 | | |
| | 407.55 | 3 | | |
| | 407.40 | 3 | *n* | |
| | 407.15 | 3 | *n* | |
| | 406.95 | 3 | *n* | |
| | 404.00 | 4 | | |
| | 399.50 | 4 | | |

W. GIBBS.

**Wave-Line.** See WAVES.

**Wa'vellite,** an interesting mineral species, a *hydric alumina-phosphate,* named after its discoverer, Dr. Wavell, who first recognized it in Devonshire, England, at the beginning of this century. It occurs near Bellows Falls, N. H., at the Washington Mine, Davidson co., N. C., and in York and Chester cos., Pa. It is found usually in radiated spheroidal masses; of white or light colors; translucent; harder than calcite, approaching fluor; crystal-system, right-rhombic. Dana assigns to it the formula $O_{19}P_4Al_6.12H_2O$. The density of the Devonshire mineral, according to Haidinger, is 2.337. Städeler, however, analyzed a Hungarian variety, which gave D. = 2.356 and composition $O_{19}P_4Al_6.11H_2O$. Wavellite is one of the phosphates, having so small a molecular volume that the writer argues from this the existence of a type of ortho-phosphates with an enormously-condensed phosphorus-molecule. (See VOLUMES, MOLECULAR.) Wavellite does not, however, present such convincing evidence of this as several other species, such as *pseudomalachite, plumbo-gummite, hitchcockite,* the *vivianites,* the *turquoises,* and others.

HENRY WURTZ.

**Waverley Novels.** See SCOTT (Sir WALTER).

**Wa'verly,** p.-v. and tp., Morgan co., Ill., on Jacksonville North-western and South-eastern R. R., 30 miles S. W. of Springfield, contains 6 churches, an excellent graded school, 2 banks, and 1 newspaper. P. 2463.

W. T. LAKIN, ED. "TIMES."

**Waverly,** p.-v., Washington tp., cap. of Bremer co., Ia. P. 2291.

**Waverly,** p.-v. Baltimore co., Md.

**Waverly,** p.-v. and tp., Van Buren co., Mich. P. 1234.

**Waverly,** p.-v. and tp., Martin co., Minn. P. 253.

**Waverly,** p.-v., Middleton tp., Lafayette co., Mo. P. 887.

**Waverly,** tp., Lincoln co., Mo. P. 1339.

**Waverly,** p.-v., Tioga co., N. Y., on Erie R. R., 256 miles W. of New York City, and near the junction of Lehigh Valley, Geneva Ithaca and Athens, and Southern Central R. Rs. with the Erie, contains 6 churches, a union high school, 3 banks, an opera-house, 3 newspapers, 5 hotels, and several manufacturing establishments. Large quantities of butter and grain are marketed here. P. 2239.

O. H. P. KINNEY, ED. "ADVOCATE."

**Waverly,** p.-v., cap. of Pike co., O., 29 miles N. of Portsmouth, on Ohio Canal, was laid out in 1829, and contains 5 churches, a large union school-house, 2 banking-houses, 2 newspapers, 2 saw, 2 planing, and 2 flouring mills, 2 furniture factories, 1 tannery, and a brickyard. Principal business, farming and stock-raising. P. 1202.

S. F. WETMORE, ED. "REPUBLICAN."

**Waverly,** p.-v., Luzerne co., Pa., on the Delaware Lackawanna and Western R. R., 9 miles from Scranton, Pa.

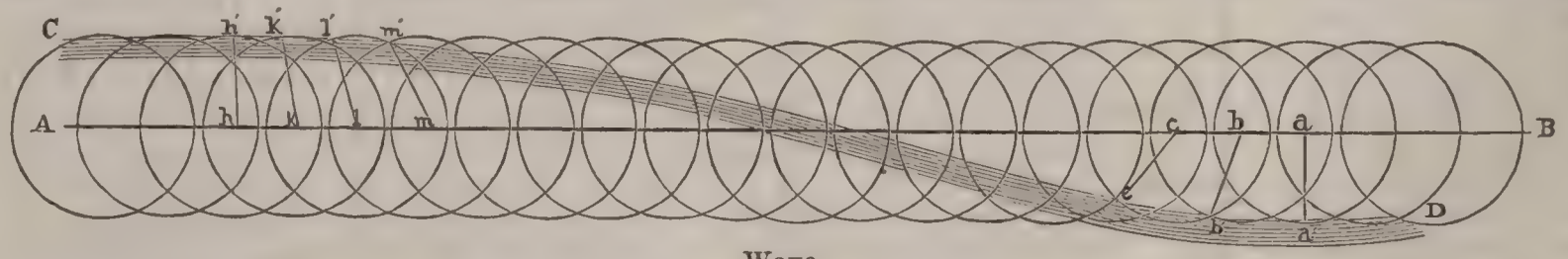
**Waverly,** p.-v., cap. of Humphreys co., Tenn. P. 207.

**Waverly,** tp., Sussex co., Va. P. 945.

**Waves.** Water is distinguished from solid bodies by its mobility—that is, by the freedom with which its elementary particles move with reference to one another. It results from this mobility that a disturbance communicated to particles of water at any point becomes the occasion of disturbance to contiguous particles, and through these to particles more remote, propagating itself in this manner to great distances in the form of oscillatory movements called *waves*.

The physical characters of waves are familiar to all. A stone dropped into standing water is followed by a series of circular ridges, spreading till they reach the shore or become so indistinct as to escape observation. We never remain long near any extended body of water without observing its surface ruffled by a series of ridges and furrows in rapid motion, usually toward the shore. Upon the great ocean the phenomenon presents itself on a grander scale. The crests of the waves attain at times a height of 30 feet, and thus move with the velocity of a railroad passenger train. During our first sea-voyage, upon observing such liquid hills approaching the vessel with such a velocity, it is difficult to divest ourselves of the impression that the latter is in danger of being shattered to fragments. Yet it receives but a moderate shock, and is lifted with a movement which, to the voyager who is accustomed to it, is not even unpleasant. Were the mass of water moving with the velocity of the wave, the effect upon vessels would be disastrous, as is readily seen in the rapidity with which a stranded vessel is broken up when exposed to the full force of the waves. The character of the wave is here so changed by the shelving ground that the water has a rapid movement. In a body of water the movement of any particle is controlled by the proximity of other particles. No particle can move without occasioning a movement of other particles, and it can only move in such a manner as is consistent with the movement of the entire mass. This condition determines the path in which each particle moves. It moves in a closed orbit around its position of rest, returning to the same position at regular intervals. Of this fact we may satisfy ourselves by observation. If we note the effect of waves upon a small body floating in the water, we shall see that the latter is not carried along by the wave. On the contrary, its position is but slightly altered. When the crest of the wave passes the body, it moves a short distance in the direction of the wave-motion; when it is in the hollow of the wave, it moves slightly in the opposite direction. If we observe a float which gradually sinks in the water, we shall find that these movements are not confined to the surface, but extend as deep as our observation reaches. The particles of water move forward rising and sinking, and return sinking and rising, describing a closed orbit; but whether this orbit is circular or elliptical cannot be learned by observation. Mathematicians who have investigated this subject find that in water of very great depth the orbit of each elementary particle is an exact circle whose centre is in the position occupied by the particle when at rest. These circular orbits are greatest at the surface of the water, being there equal in diameter to the height of the wave. They diminish rapidly farther down, so that when the water at the surface has a movement of 20 feet, causing waves 20 feet high from trough to crest, it has at a depth of 50 feet a movement of only 7 feet, and at a depth of 200 feet a movement of not more than 4 inches.

The figure below shows how the circular movements of the different particles of water conspire to produce the undulations of the surface which we call waves. A B is the surface




Wave.

of the water when at rest. The circles are the orbits of the particles at the surface, which are supposed to be in motion in a direction opposite that of the hands of a clock. The particle $h'$, whose position of rest is $h$, is at the highest point of its orbit; the next particle to the right, $k'$, whose position of rest is $k$, is slightly past the summit of its orbit, and farther to the right each particle is in a little more advanced position than the one preceding. The particle $a'$, whose position of rest is $a$, is at the lowest point of its orbit. The surface of the water at the instant under consideration is represented by the curved line C D, $h'$ being the highest point or crest of the wave, $a'$ the lowest point or trough of the wave. The motion continuing, the crest advances toward the left, and when the particle $h'$ has reached the lowest point of its orbit, that point becomes the trough of the wave, and $a'$, having then reached the highest point of its orbit, is the crest of the succeeding wave. The horizontal distance between the crests of two consecutive waves is called the length of the wave. If we consider the particles of water which, when at rest, lie all in the same vertical line, constituting a vertical filament of water, these all arrive, during wave-motion, at the summits of their orbits at the same instant. The orbits diminish in diameter downward, so that at a depth of a few hundred feet the movement practically ceases. The lower part of the filament remains immovable, and its upper part bends like a stalk of wheat in a field under the action of the wind. When the crest of the wave coincides with the filament, the latter is erect and elongated. It then bends in the direction of the wave's motion, and returns to its erect position when the trough of the wave passes. It is then shortened and thickened. It then bends in the direction opposite to that of the wave's motion, and so on.

The form of the wave is cycloidal, but it is not the common cycloid, which is a curve traced by a point on the circumference of a circle rolling upon a straight line. Were this the case, the height of the wave would bear the same proportion to its length that the diameter of a circle bears to its circumference; whereas there is not necessarily any definite relation between the height and length of the wave. In the same system of waves we always find the same relation between the height and the length. But a slight change in the direction or intensity of the wind gives rise to a different system in which a different relation exists. Different systems of waves often occur at the same time. It is a matter of common observation at the seashore that at intervals a wave occurs much higher than the preceding. This arises from the coincidence of two waves belonging to different systems. To the same cause is due the "seas" which break over the decks of vessels, carrying away everything not securely fastened.

The velocity of a wave depends upon its length. To find this velocity when the length is known, we first find the radius of a circle whose circumference is the length of the wave. Designate this radius by $r$, the velocity is the same that a heavy body would acquire in falling freely through a height equal to one-half $r$. To find the radius of the orbit of a particle at a given depth below the surface, divide the given depth by $r$, and find the number of which this quotient is the natural logarithm. Divide $r$ by this number, and the quotient will be the radius sought. Waves in deep water usually arise from the action of the

wind, and their motion when unobstructed is in the same direction as the wind to which they owe their origin. How powerfully the wind acts in acceleration of the molecular movements to which waves are due will appear upon a little reflection. The elevated part of the wave is fully exposed to the action of the wind, and here the particles of water are moving in the same direction as the wind. The trough of the wave, in which the particles are moving in the opposite direction, is mainly screened from the action of the wind by the neighboring crest. When the wind begins to blow while the water is smooth, it might appear difficult to understand how it can originate waves, since the wind would seem to exert a uniform pressure upon all parts of the surface. The wind, however, never acts with a perfectly uniform and steady pressure. There is always enough of inequality to cause a ruffling of the surface, and the minute waves, once formed so as to present a surface to the direct action of the wind, are rapidly increased in magnitude. They continue to increase until they have attained a velocity nearly equal to that of the wind.

The tendency of waves is to form in long lines at right angles to the direction of the wind. This tendency is the more marked in proportion as the expanse of water is unlimited and the wind unvarying in force and direction. We rarely, however, have an opportunity to observe the phenomenon of waves in its entire simplicity. Under the most favorable circumstances the eye can follow the wave longitudinally but a very short distance. Neither, if we fix our eye upon the crest of a wave and endeavor to follow its movement, can we trace it to any great distance before it disappears and a new wave arises. The more common case is a system of waves caused by a local wind, crossed in different directions by other systems originating in distant parts of the ocean, and by waves reflected from the shore, the whole often forming a tumultuous commotion of waters, in which scarcely any law of movement can be recognized. This shows that different simple movements of the elementary particles may coincide and superpose themselves upon one another in all conceivable ways.

The preceding refers to waves in deep water—that is, water so deep that the bottom exerts no influence upon the movements of the elementary particles. These move in precisely the same manner as though the depth were infinite. Hence, the preceding is called, for distinction, the theory of waves in water of infinite depth. In water of moderate depth the proximity of the bottom exerts an influence the more marked in proportion as the depth is less. Where the depth is considerable, this influence manifests itself in a slight horizontal movement of the water at the bottom. As the depth diminishes, this horizontal movement increases, until finally, at slight depths, the particles have the same horizontal movement at the bottom as at the surface, while the vertical movement is greatest at the surface and diminishes to nothing at the bottom. The particles thus move in orbits which are often nearly circular at the surface, and become more and more flattened toward the bottom, where they are simply straight horizontal lines. The movements of the elementary particles in shallow water were very attentively studied by Hayen. He used for this purpose a trough about 4 inches in width and height and 12 feet long. He inserted glass plates in the sides to enable him to observe the movements of small visible particles suspended in the water. The waves were created by the movement of a metallic plate nearly equal in size to the cross-section of the trough, placed at one end of the latter and moved by clockwork. It was adjusted so that the movement of the top could be greater than that of the bottom in any desired proportion, from the case in which the bottom was stationary to that in which it had the same movement as the top. He found that whatever movement was communicated to the water, no difference was discernible between the horizontal movements of the particles at the top and those at the bottom at a distance of 4 feet from the plate. The most important difference between waves in infinite depth and those in finite depth is, that in the former the velocity with which the wave travels appears to have no relation to the depth, depending solely upon the magnitude of the wave; whereas in the latter the velocity depends upon the depth, being, according to the most trustworthy observations, equal to that velocity which a heavy body acquires by falling freely a height equal to half the depth, measured from the top of the wave.

J. Scott Russell, an English marine engineer, made very extended and valuable researches upon the subject of waves. These researches were undertaken at the instance of the British Association for the Advancement of Science, and the results are detailed in a provisional report made to the Association in 1837, and published in its *Transactions* for 1837, and a more complete report in 1844. The following is given as summary of results in the report of 1837: (1) The existence of a *great primary wave* of fluid, differing in its origin, its phenomena, and its laws from the undulatory and oscillatory waves which alone had been investigated previous to the researches of Mr. Russell, has been confirmed and established. (2) The velocity of this wave in channels of uniform depth is independent of the breadth of the fluid, and equal to the velocity acquired by a heavy body falling freely by gravity through a height equal to half the depth of the fluid, reckoned from the top of the wave to the bottom of the channel. (3) The velocity of this primary wave is not affected by the velocity of impulse with which the wave has been originally generated; neither does its form or velocity appear to be derived in any way from the form of the generating body. (4) This wave has been found to differ from every other species of wave in the motion which is given to the individual particles of fluid through which the wave is propagated. By the transit of the wave the particles of the fluid are raised from their places, transferred forward in the direction of the motion of the wave, and permanently deposited at rest in a new place at a considerable distance from their original position. There is no retrogradation, no oscillation; the motion is all in the same direction, and the extent of the transference is equal throughout the whole depth. Hence, this wave may be descriptively designated *the great primary wave of translation.* The motion of translation commences when the anterior surface of the wave is vertically over a given series of particles; it increases in velocity until the crest of the wave has come to be vertically above them; and from this moment the motion of translation is retarded, and the particles are left in a condition of perfect rest at the instant when the posterior surface of the wave has terminated its transit through the vertical plane in which they lie. This phenomenon has been verified up to depths of five feet. (5) The elementary form of the wave is cycloidal; when the height of the wave is small in proportion to its length, the curve is the prolate cycloid; and as the height of the wave increases, the form approaches that of the common cycloid, becoming more and more cusped until at last it becomes exactly that of the common cycloid with a cusped summit; and if by any means the height be increased beyond this, the curve becomes the curtate cycloid, the summit assumes a form of unstable equilibrium, the summit totters, and, falling over on one side, forms a crested wave or breaking surge. (6) A wave is possible in forms of channel where the depth is not uniform throughout the whole breadth. The full consideration of this subject is reserved for the next report. It appears, however, that when the difference between the depth of the sides is considerable, one part of the wave will continue during the whole period of propagation in the act of breaking, so as to show that in these circumstances a continuous wave is impossible. In other cases the ridge of the wave rises so much higher on the shallower part of the fluid as to produce a given velocity without exceeding the limits of equilibrium; and in these cases the wave becomes possible, and the velocity appears to coincide closely with that which we obtain by supposing the wave resolved into vertical elements, each having the velocity due to the depth, and then integrating. . . . In the sloping or triangular channel the velocity is that due to one-third of the greatest depth. In a parabolic channel the velocity is that due to three-eighths or three-tenths of the greatest depth, according as the channel is convex or concave. (7) The height of a wave may be indefinitely increased by propagation into a channel which becomes narrower in the form of a wedge, the increased height being nearly in the inverse ratio of the square root of the breadth. (8) If waves be propagated in a channel whose depth diminishes uniformly, the waves will break when their height above the surface of the level fluid becomes equal to the depth at the bottom below the surface. (9) The great waves of translation are reflected from surfaces at right angles to the direction of their motion, without suffering any change but that of direction. (10) The great primary waves of translation cross each other without change of any kind, in the same manner as the small oscillations produced on the surface of a pool by a falling stone. (11) *The waves of the sea* are not of the first order; they belong to the *second or oscillatory order* of waves. They are partial displacements at the surface, which do not extend to considerable depths, and are therefore totally different in character from the great waves of translation, in which the motion of displacement of the particles is uniform to the greatest depth. The displacement of the particles of the fluid in the waves of the sea is greatest at the surface, and diminishes rapidly downward. There are generally on the surface of the sea several co-existent classes of oscillations of varying direction and magnitude, which by their union give the surface an appearance of irregularity which does not exist in nature. (12) When waves of the sea approach a shore or come into shallow water, they become waves of translation, and, obey-

ing the laws already mentioned, always break when the depth of the water is not greater than their height above the level. (13) Waves of the sea do not move with the velocity due to the whole depth of the fluid. . . . (14) A circumstance frequently observed when the waves break on the shore has been satisfactorily accounted for by the examination of the constitution of the waves of the sea. It has been frequently observed that a certain wave is the largest of a series, and that these large waves occur periodically at equal intervals, so that sometimes every third wave, every seventh, or every ninth wave is the largest. Now, as there are almost always several co-existent series of waves, and as one of these is a long gentle "underswell," propagated to the shore from the deep sea in the distance, while the others are short and more superficial waves generated by a temporary breeze of [or] reflections from a neighboring shore, so it will follow that when the smaller waves are one-third, or one-seventh, or one-ninth, or in any other given ratio to the length of longer ones, those waves in which the ridges of the two series are coincident will be the periodical large waves; and if there be three systems of coexistent waves, or any greater number, their coincidences will give periodical large recurring waves, having maxima and minima of various orders. (15) *The tide-wave* appears to be the only wave of the ocean which belongs to the first order, and appears to be identical with the great primary wave of translation; its velocity diminishes and increases with the depth of the fluid, and appears to approximate closely to the velocity due to half the depth of the fluid in the rectangular channel, and to a certain mean depth, which is that of the centre of gravity of the section of the channel. It is, however, difficult to determine the limits within which the tide-wave retains its unity; where portions of the same channel differ much in depth at points remote from each other, the tide-waves appear to separate. (16) The tide appears to be a compound wave, one elementary wave bringing the first part of flood tide, another the high water, and so on; these move with different velocities according to the depth. On approaching shallow shores, the anterior tide-waves move more slowly in the shallow water, while the posterior waves, moving more rapidly, diminish the distance between successive waves. The tide becomes thus dislocated, its anterior surface rising more rapidly and its posterior surface descending more slowly than in deep water. (17) A tidal bore is formed when the water is so shallow at low water that the first waves of flood tide move with a velocity so much less than that due to the succeeding part of the tidal wave as to be overtaken by the subsequent waves, or wherever the tide rises so rapidly, and the water on the shore or in the river is so shallow, that the height of the first wave of the tide is greater than the depth of the fluid at that place. Hence, in deep water vessels are safe from the waves of rivers which injure those on shore. (18) The identity of the tide-wave and of the great wave of translation shows the nature of certain variations in the establishment of ports situated on tidal rivers. Any change in the depth of the rivers produces a corresponding change on the interval between the moon's transit and the high water immediately succeeding. It appears from the observations in this report that the mean time of high water has been rendered 37 minutes earlier than formerly by deepening a portion of about 12 miles in the channel of a tidal river, so that a tide-wave which formerly travelled at the rate of 10 miles an hour now travels at the rate of nearly 15 miles an hour. (19) It also appears that a large wave, or a wave of high water of spring tides, travels faster than a wave of high water of neap tides, showing that there is a variation on the establishment, or on the interval between the moon's transit and the succeeding high water, due to the depth of the fluid at high water, and which should, of course, enter as an element into the calculation of tide tables for an inland port derived from those of a port on the seashore. The variation of the interval will vary with the square root of mean depth of the channel at high water.

J. Scott Russell's completed report was published in the report of the British Association for 1844. He states that he had in the interim devoted his available time to these researches, and had confirmed and extended the results previously published. He had extended his inquiries to what he calls the negative wave of translation, being a wave which is propagated not as a ridge, but as a cavity in the surface of the water. He gives the following summary of his conclusions on this subject:

"The characteristics of this species of wave of the first order are—(1) That it is negative or wholly below the level of repose. (2) That it is a wave of translation, the direction of which is opposite to the direction of transmission. In other words, the movement of the fluid particles is in one direction, that of the wave in another. (3) That its anterior form is that of the positive wave reversed. (4) That the path of translation is nearly that of the positive wave reversed. (5) That its velocity is, in considerable depths, sensibly less than that due by gravity to half the depth reckoned from the lowest point, or the velocity of a positive wave being the same total height. (6) That it is not solitary, but always carries a train of secondary waves.

"It is important to notice that the positive and negative waves do not stand to each other in the relation of companion phenomena. They cannot be considered in any case as the positive and negative portions of the same phenomena, for the following reasons: (1) If an attempt be made to generate or propagate them in such a manner that the one shall be companion to the other, they will not continue together, but immediately and spontaneously separate. (2) If a positive wave be generated in a given channel, and a negative wave behind it, the positive wave, moving with the greater velocity, rapidly separates itself from the other, leaving it far behind. (3) If a positive wave be generated and transmitted behind a negative wave, it will overtake and pass it. (4) Waves of the secondary class, which consist of companion halves, one part positive and the other negative, have this peculiarity, that the positive and negative parts may be transmitted across and over each other without preventing in any way their permanence or their continued propagation. It is not so with the positive and negative waves of the first order. (5) If a positive and negative wave of equal volume meet in opposite directions, they neutralize each other, and both cease to exist. (6) If a positive wave overtake a negative wave of equal volume, they also neutralize each other and cease to exist. (7) If either be larger, the remainder is propagated as a wave of the larger class. (8) Thus, it is nowhere to be observed that the positive and negative wave coexist as companion phenomena.

"These observations are of importance for this reason, that it has been supposed by a distinguished philosopher that the positive and negative waves might be corresponding halves of some given or supposed wave."

The following results of observations obtained by Mr. Walker, the harbor-master at Plymouth, are given by Scott Russell:

| No. | Wave-length, feet. | Velocity, feet per second. | Velocity, miles per hour. | Height, feet. | Remarks. |
|---|---|---|---|---|---|
| I. | 110.5 | 20.2 | 11.9 | 2¾ | A fresh breeze blowing. |
| II. | 175. | 34.3 | 20.3 | 2½ | Waves not easily traced. |
| III. | 302. | 37. | 21.9 | 4 | High seas overtake small ones. |
| IV. | 345. | 37. | 21.9 | 4½ | These waves came down channel. |
| V. | 306. | 37. | 21.9 | 4½ | Long, low swell. |
| VI. | 408. | 41.2 | 24.2 | 4½ | Small waves merged in large ones. |
| VII. | 442. | 41.8 | 24.7 | 27 | Height of waves correctly measured; they break in 5 and 6 fathoms of water. |
| VIII. | 450. | 44.7 | 26.5 | ? | Strong S. W. wind. |
| IX. | 460. | 46. | 27.2 | ? | Waves running high and breaking. |
| X. | 345. | 46. | 27.2 | 5 | Long, low swell. |
| XI. | 394. | 38.3 | 22.7 | 5 | Waves generated by wind of preceding day. |
| XII. | 345. | 41.5 | 24.5 | 4 | Waves crowd near the beach. |
| XIII. | 306. | 36.8 | 21.6 | Irregular. | Shifting wind. |
| XIV. | 460. | 42.5 | 25.2 | Regular. | Easterly winds. |

The above results apply to a depth of 40 to 50 feet. Russell also found in a depth of—

50 to 60 fathoms, a velocity of 13.5 miles per hour.
53 " " 20 " "
60 to 70 " " 17 " "
34 to 40 " " 17½ " "

In a depth of 51 fathoms the waves produced by a steam vessel had a height of about 20 inches, were 12 feet apart from crest to crest, and moved at the rate of a little less than 3 miles an hour. These results show that in waves which do not affect the water to the bottom the velocity has no relation to the depth. The following are the velocities with which the tide-wave was found to ascend the Frith and river Clyde:

In a depth of 240 to 360 feet, 80 miles per hour.
" " " 25 " 20 " "
" " " 5 " 8.1 " "
" " " 15 " 15 " "

In these results the velocities are approximately proportional to the square roots of the depths.

A series of experiments upon waves was made in 1859 by M. Bazin, an officer of the French corps of engineers. This officer had previously been entrusted with the duty of investigating some of the laws of flowing water, and upon the termination of that task extended his researches to the subject of waves, availing himself of the arrangements provided for his preceding experiments. He had a perfectly straight and regular channel about 6½ feet wide, in which he was able to observe the movement of the wave for any desired length. The bottom was inclined at the rate of about 1½ feet in 1000; which gave him an opportunity of observing the effect of the diminishing depth upon the velocity and form of the wave. For the case of isolated waves, stations were established at distances of 60 to 65

feet, at which the time of the passage of the wave was noted. A few results of these observations are given below. They refer to positive waves—that is, to those which are wholly above the general water-level. These were generated by the sudden admission of a certain volume of water into the canal.

| No. of points of observation. | Depth of water before the passage of the wave, feet. | Height of the wave, feet. | Velocity of the wave, feet per second. | | Remarks. |
|---|---|---|---|---|---|
| | | | Observed. | Calculated. | |
| 1 | 2.24 | 0.39 | | | |
| 2 | 2.16 | 0.30 | 8.70 | 9.04 | |
| 3 | 2.04 | 0.30 | 8.88 | 8.77 | |
| 4 | 1.95 | 0.30 | 8.26 | 8.58 | |
| 5 | 1.85 | 0.33 | 8.67 | 8.44 | |
| 6 | 1.75 | 0.36 | 8.68 | 8.30 | |
| 7 | 1.64 | 0.36 | 8.32 | 8.13 | |
| 8 | 1.55 | 0.36 | 8.12 | 7.93 | |
| 9 | 1.46 | 0.39 | 7.80 | 7.78 | The wave did |
| 10 | 1.35 | 0.39 | 7.85 | 7.60 | not break until |
| 11 | 1.45 | 0.39 | 7.54 | 7.59 | a little past the |
| 12 | 1.12 | 0.43 | 7.46 | 7.38 | 13th point of ob- |
| 13 | 0.80 | 0.52 | 6.69 | 6.80 | servation. |

| No. of points of observation. | Depth of water before the passage of the wave, feet. | Height of the wave, feet. | Velocity of the wave, feet per second. | | Remarks. |
|---|---|---|---|---|---|
| | | | Observed. | Calculated. | |
| 1 | 2.08 | 0.39 | | | |
| 2 | 2.00 | 0.46 | 8.81 | 8.90 | |
| 3 | 1.88 | 0.52 | 8.64 | 8.84 | |
| 4 | 1.79 | 0.62 | 9.43 | 8.80 | |
| 5 | 1.69 | 0.62 | 8.04 | 8.73 | |
| 6 | 1.59 | 0.62 | 7.62 | 8.53 | |
| 7 | 1.48 | 0.62 | 9.00 | 8.33 | |
| 8 | 1.39 | 0.62 | 7.65 | 8.13 | |
| 9 | 1.30 | 0.62 | 7.99 | 7.95 | |
| 10 | 1.19 | 0.62 | 7.57 | 7.74 | The wave broke |
| 11 | 1.29 | 0.56 | 7.46 | 7.66 | between the 12th |
| 12 | 0.96 | 0.62 | 7.46 | 7.41 | and 13th points of |
| 13 | 0.64 | 0.36 | 7.13 | 6.51 | observation. |

The wave travelled about 100 feet before passing the first point of observation. Here it moved as a perfectly symmetrical undulation, unaccompanied by any other wave. As the depth diminished, the height of the wave increased, and its velocity diminished as indicated by the figures; the front of the wave became steeper, till finally it broke into a mass of foam, and, resolving itself into a number of smaller waves, pursued its course. It generally broke before the depth became equal to the height of the wave, not fully verifying Scott Russell's law in that respect. The velocity of the wave is computed according to the law announced by Scott Russell, and agrees very well with observation. If too much water was admitted, the entire mass did not continue together as a single wave. The superfluous water was thrown off, and formed one or more separate waves. Experiments were made upon negative waves, generated by suddenly withdrawing a quantity of water from the channel. This differed from the positive wave in this respect—it could not be generated singly. It was always accompanied by a series of oscillatory waves. Its velocity, however, contrary to the view expressed by Scott Russell, was very nearly the same as that acquired by a heavy body in falling freely a height equal to one-half the depth of water reckoned from the lowest point of the wave. Bazin found that these waves were propagated according to the same law in moving as in still water, due allowance being made for the velocity of the current. The negative wave diminishes and decays much more rapidly in still water than the positive wave; which latter has, according to Scott Russell, a remarkable longevity. This observer found that a wave of this description 6 inches in height was only diminished 1 inch by travelling 700 feet. Another, starting with a height of 6 inches, was 2 inches high after a journey of 3200 feet. Both the negative and positive waves diminish much more rapidly in moving than in still water.

The *breaking* of a wave occurs when the conditions under which it finds itself do not admit of the necessary movements of the fluid particles. The movement of a wave in water of diminishing depth is the most common case. Another is the case above noticed of the solitary wave, which, when formed of a magnitude greater than corresponds to the depth of the channel, spontaneously separates itself into two or more smaller waves. When a wave originating in deep water rolls toward a shoaling beach, the water constituting the top of the wave is moving, at any given instant, toward the shore—that at the bottom in the opposite direction. This results from the circular movement of the fluid particles. This movement ceases at the instant of breaking, and the upper part of the wave moves forward toward the shore, while the lower part moves backward. This movement extends nearly to the shore, the great volume of water set in motion by the breaking waves moving toward the shore upon the surface, and returning at the bottom. This action constitutes the "under-tow" which often proves dangerous to surf-bathers.

Waves always approach the shore in a direction nearly at right angles to the general line of the shore, whatever be the direction of the wind. This arises from the fact that if the wave approach in a direction inclined to the shore, the end nearest to the shore moving in shallow water is retarded, tending to swing the wave round into a direction at right angles to the shore. At a distance of 2 or 3 miles from the shore the waves usually move in the direction of the wind.

When the shore rises perpendicularly out of deep water, the waves do not break. They simply oscillate, rising a little higher at the shore than elsewhere, and are reflected, forming a new system of waves running in the opposite direction. It is said that vessels can lie off such a shore in the heaviest storms without danger. This fact is sometimes turned to account in the construction of breakwaters, which have latterly been made as perpendicular walls. In water so deep that the waves do not break, this form is well calculated to withstand their action. In shallow water, or where, as sometimes happens, the action of the waves and shore-currents is such as to deposit a bank of gravel or sand at the foot of the breakwater, causing the waves to break, their action is very destructive.

Earthquakes are sometimes accompanied by waves of formidable proportions, inundating shores ordinarily high above the reach of the tide. During the earthquake which destroyed the city of Lisbon in 1755 a wave 40 feet high rolled upon the shore. An Englishman residing there named Chase records in his journal that shortly after this wave, ships at anchor in the deep river Tagus were observed resting on the ground. The wave was followed by two others of nearly the same height. A wave 60 feet in height reached Cadiz on the same occasion. The sea rose 20 feet in the Antilles, where the tide rarely exceeds 2 feet. Similar phenomena have been observed to accompany South American earthquakes. Humboldt relates that at Callao he saw a series of waves 10 or 14 feet high in the midst of a dead calm, which he supposed to originate in submarine earthquakes.

The force of waves as they break upon a shelving beach, and the circular movement of the water is transformed into a forward movement, is terrific. Constructions designed to withstand the force of waves tax to the utmost the resources of engineering. Thomas Stevenson relates that during the construction of the lighthouse at Barra Head, one of the Hebrides Islands, he saw the waves move a stone measuring 500 cubic feet. The breakwater at the French port of Cherbourg is composed of an immense bank of loose stone, protected in parts by blocks of concrete measuring 700 cubic feet each. The bank is surmounted by a wall about twenty feet high. During the storm of Dec. 25, 1836, stones weighing nearly 7000 pounds were thrown over the top of this wall, while many of the enormous concrete blocks were moved, some of them as much as 60 feet, and two of them were turned over. Hagen relates that in the harbor of Cette, during the storm of Aug. 20, 1857, a block of concrete measuring 2500 cubic feet, which must have weighed 125 U. S. tons, was moved upon its bed something over 3 feet. Thomas Stevenson constructed an instrument for the direct measurement of the force of waves. He found that during the heaviest storms the force exerted by the waves of the Atlantic upon a solid surface exposed to their action is upon an average 611 pounds per square foot during the summer months, and 2086 pounds during the winter months. The greatest pressure observed was 6083 pounds per square foot.

A remarkable phase of wave-movement, alluded to by Scott Russell as the "tidal bore," is occasionally presented upon tidal rivers. The advent of the flood tide is preceded and announced by a wave, sometimes of formidable dimensions, which runs up the river. The French book of sailing directions for the Indian Seas (*Instructions nautiques sur les Mers de l'Inde*) gives the following description of this phenomenon upon the Hoogly, one of the mouths of the Ganges: "The bore is first perceived at Diamond Bank, below the port of the same name; it afterward becomes more apparent at the point of Hoogly, several leagues farther up, where it encounters a strong resistance on account of the sudden turn of the river toward the W.; thence it ascends past all the principal sandbanks as far as the city of Hoogly, which is 70 miles farther up, and it occupies four hours in traversing this distance; ordinarily, it moves at the rate of 20 miles an hour. Upon the sandbanks contiguous to the shores of the river the bore occasions an elevation of the water amounting sometimes to 12 or 15 feet, and advances with a great noise, announcing the commencement of the flood. It sweeps away all floating

bodies which it encounters on its passage, and swamps any small craft found in shoal water. By day it is visible at a great distance. Its approach is indicated at night by the noise; then all boats lying in shoal water move promptly to attain a greater depth, where they are safe. Where the wave does not break, it simply causes an agitation of the water. At Calcutta there is a good depth near the shore, and all craft do not leave the shore when the bore approaches. Those on board throw a line ashore, and haul their craft as high as possible when lifted by the bore, which has been seen to attain in a single instant the height of an ordinary tide. Europeans should be prudent in crossing the river at night at low tide near the period of the moon's conjunction, this being the epoch at which the bore most commonly arrives. They should keep in deep water, as, if it should arrive while they are stranded or in shoal water, they incur the greatest dangers."

Says Bazin: "The mascaret (bore) occurs with great violence upon the river Amazon. According to La Condamine, it is between Matupa and the North Cape, in that part where the channel of the river is choked with islands, and principally opposite the mouth of the Awawary, which enters the Amazon on the N. side, that the phenomenon manifests itself with the greatest power. During the three days nearest the full and new moon the tide, instead of requiring six hours to attain its full height, reaches it in a few minutes; not unaccompanied, however, with accidents which deserve notice. Afar off, at a distance of 1 or 2 leagues, a great noise is heard, which announces the approach of the *pororoca*, the name by which this impetuous wave is known to the Indians. As it approaches, the noise augments, and then an enormous wave appears 12 or 15 feet in height; afterward a second, then a third, sometimes also a fourth, which follow each other without interruption, and which occupy the entire width of the channel. This wave advances with prodigious rapidity, overturning everything which it encounters. La Condamine has observed it overturn tall trees and great masses of earth. . . . The canoes of the Indians and other vessels must remain in deep water as the only means of escaping the fury of the bore. . . . La Condamine, without going into great details with regard to the bore, says that he has observed it in many places, and finds that it is only accompanied with destructive effects when, confined in a narrow channel, it encounters upon its passage a sandbank or an elevation of the bottom which presents an obstacle, and never under other circumstances, and that it ceases immediately beyond the bank when the channel becomes deeper or considerably enlarged."

The bore also occurs upon the Seine and the Dordogne in France, where it is known as the *mascaret*. It is also recognizable by close inspection upon several smaller rivers. It has been observed with great interest upon the Seine by the French engineer officers. It only occurs at the period of high or spring tides. The first wave has a height of 7 or 8 feet. It is followed in rapid succession by four or five smaller waves, and after their passage the water is found to have risen 4 or 5 feet above low tide. Those who have studied the subject give the following explanation of this remarkable phenomenon: At the period of dead low water the river is very low, and is flowing rapidly toward the sea. To better understand what occurs, we may conceive the rise of the tide to take place by a series of sudden jumps at regular intervals. That is, instead of supposing the tide to rise uniformly at the rate of say 1 foot in 12 minutes, let us consider what would take place if it were to rise suddenly 1 inch each minute. The first rise would move up the stream as a kind of wave, leaving a little deeper water behind than before it. The second would move a little faster than the first, both on account of the increased depth, and also by reason of the slightly-diminished current. It accordingly very soon joins the first, and both advance as a single wave. Every successive wave, for the same reason, moves a little faster than the preceding, and all join the initial wave. Now, though the rise of the tide does not take place by perceptible sudden jumps, as supposed, it nevertheless does consist of a great number of very small increments of depth, and the influence of each successive increment of depth moves up the river faster than that of the preceding, so that all are concentrated into one grand wave. Where there is sufficient depth for the development of wave-motion, the bore does not break. In shoal water it breaks continually, and it does not, like other waves, exhaust itself by breaking, as its power is continually renewed.

For the convenience of those who would like to pursue the subject of waves further the following sources of information are indicated. The labors of Newton, Laplace, Bernouilli, and La Grange need not be particularized. They are interesting only as a part of the history of the subject. To Franz Gerstner is due the credit of having first solved the problem of wave-movement upon the assumption of a finite displacement of the fluid particles. His essay is contained in the *Transactions* of the Royal Bohemian Scientific Society (*Abhandlungen der kgl. Gesellschaft der Wissenschaften*) for 1802. It was also separately printed at Prague in 1804, and is likewise contained in Gilbert's *Annalen*, vol. xxxii., as well as in Webers' *Wellenlehre*. This latter was published by the brothers Ernst Heinrich Weber and Wilhelm Weber at Leipsic in 1825. It is entitled *Wellenlehre auf Experiment gegrundet* ("Theory of Waves founded upon Experiment"). Scott Russell's researches, as already mentioned, are contained in the *Reports* of the British Association for 1837 and 1844. The most complete theoretical exposition of the subject is Prof. G. B. Airey's essay entitled *Tides and Waves*, contained in the *Encyclopædia Metropolitana*, vol. v. of "Mixed Sciences." It is here treated in a thoroughly scientific manner and in the utmost generality, presupposing very high mathematical attainments on the part of the reader. Prof. Airey affirms that his formulas agree as well as could be expected with the results of Scott Russell's experiments, but this assertion is emphatically denied by the latter. Hagen's researches upon this subject are contained in the *Transactions* of the Royal Academy of Sciences of Berlin (*Abhandlungen der königl. Akademie der Wissenschaften zu Berlin*) for 1861. They are also embodied in substance in his great work, *Handbuch der Wasserbaukunst* ("Handbook of Hydraulic Architecture"), part 3, vol. i. He extends and verifies Franz Gerstner's theory of waves in deep water, and presents a theory of his own for waves in shoal water, founded upon the experimental studies already spoken of. Hagen is at once an engineer of extensive experience and observation, a skilful experimenter, and an acute mathematician. These qualities are nowhere more conspicuous than in his treatise on waves. His conclusions as to waves in shallow water are somewhat at variance with those of Scott Russell and other experimenters. The memoir of Bazin, from which the preceding citations are made, is contained in the *Mémoires présentés par divers Savants à l'Institut Impérial de France* (Paris, 1865). The work is in two parts, the first relating to the flow of water in channels, the second to waves.

J. P. FRIZELL.

**Wavre,** town of Belgium, province of Brabant, on the Dyle, has some breweries, tanneries, paper-mills, and cotton-spinning factories. P. 6083.

**Wawagan'da,** tp., Orange co., N. Y. P. 1900.

**Wawa'ka,** tp., Noble co., Ind. P. 252.

**Wa'warsing,** tp., Ulster co., N. Y. P. 8151.

**Wax** [Ger. *Wachs;* Fr. *cire;* Lat. *cera*]. Wax is a generic term given to several substances chemically unlike, but resembling each other in the physical properties so familiar in the wax of bees. We speak of animal wax, vegetable wax, and mineral wax, although the last-named substance is chiefly paraffine. The vegetable world furnishes numberless wax-like bodies, only a few of which have been carefully examined, almost every plant, in fact, secreting a wax-like substance, especially in the seeds or in the fruit. The animal kingdom furnishes (1) the typical beeswax; (2) a kind of insect wax from the Orinoco and Amazon valleys, known as Andaquies wax; (3) Chinese wax, formerly supposed of vegetable origin; and (4) SPERMACETI (which see).

*Beeswax.*—This is the wax of which bees form their cells. It is an animal secretion, formed by bees even when confined to a diet of pure sugar. Formerly, it was believed that the bee found the wax ready formed in plants, and merely elaborated it. This opinion is not sustained by the facts. Common beeswax is of a yellow color, has an agreeable and peculiar smell, feels a little greasy, but more sticky, and moulds readily under the warmth of the fingers. Light bleaches it if exposed in thin sheets. It then becomes white wax, and is somewhat less fusible than before. A mixture of potassium bichromate and sulphuric acid also bleaches wax. Nitric acid and chlorine also bleach it, but the substitution-product formed by the action of chlorine gives off irritating vapors of hydrochloric acid in burning the candles formed of such wax. If wax is agitated with dilute sulphuric acid—2 parts of water to 1 of acid—in presence of some fragments of nitrate of sodium, enough nitric acid is set free to destroy the feeble yellow color of the wax, and thus bleach it without injury. It is worth remembering, in this connection, that Gay-Lussac in his attempts to bleach wax by chlorine discovered one of the important laws of modern chemistry—that of *substitution*—by virtue of which chlorine, etc., may replace hydrogen in the constitution of organic bodies without a change of the typical form. What we find is often better than what we seek. Beeswax is formed from honey and adhering impurities by melting and

stirring with water, which dissolves the traces of honey; the heavy solids fall to the bottom, and the wax forms a cake on the top of the water.

Bleached wax fuses at about 145° F. It is insoluble in water, but dissolves readily in oils, fats, and essences. By Lewy's analysis it contains carbon 80.2 per cent., oxygen 6.4 per cent., and hydrogen 13.4 per cent. It consists essentially of three substances, separable from each other by alcohol—(1) *myricine*, insoluble in boiling alcohol, and consisting chiefly of myricyl palmitate, $C_{16}H_{31}(C_{30}H_{61})O_2$; (2) *cerotic acid*, which is dissolved by boiling alcohol, but crystallizes out again on cooling; this was formerly called cerine when obtained in an impure state, $C_{27}H_{54}O_2$; (3) *ceroline*, which remains in solution in cold alcohol. The proportions of myricine and cerotic acid differ considerably in wax from different places. A wax from Ceylon, Brodie found quite free from cerotic acid, while in a wax from Surrey in England he found 22 per cent. of this acid. Myricine, the portion of beeswax insoluble in boiling alcohol, is the source of myricyl alcohol, $C_{30}H_{62}O=C_{30}H_{61}.(OH)$, the highest known member of the series, $C_nH_{2n+2}O$. Pure myricylic alcohol is a crystalline substance having a silky lustre. When heated, it partly sublimes unaltered, and is partly resolved into water and melene, $C_{30}H_{60}$.

By destructive distillation, alone or with lime, beeswax gives off a little water, with acetic acid, propionic acid, and then a body known as *wax-butter*, which forms on cooling a white buttery mass composed mainly of solid hydrocarbons, cerotene, and melipene. By further heat a more fluid oil is obtained, called wax-oil, leaving behind a coaly residue. Hydrocarbon gases and carbon dioxide are given off during this distillation, but no acroleine. By long boiling with potash or soda imperfect saponification of the acids of wax ensues, the soapy body floating on the water, and being decomposed by acids, with liberation of myricine.

The uses for wax are numerous and important. Its property of preserving tissues and preventing mould or mildew were well known to the ancients, who used cerecloth for embalming, and wax for encaustic painting, as in the wall-pictures of Pompeii. Wax candles and tapers play an important part in the processions and ceremonies of the Roman Catholic Church. Wax is used by the manufacturers of glazed ornamental and wall papers and on paper collars and cuffs for polishing the surfaces. It is used in varnishes and paints, and for the "stuffing" of wood which is to be polished, as for pianos, coachwork, fine furniture, and parquette floors. Electrotypers and plasterers use wax in forming their moulds. Wax is an important ingredient in preparations for covering surfaces of polished iron and steel to prevent rust. Combined with tallow, it forms the coating of canvas and cordage to prevent mildew, as in sails, awnings, etc. Artificial flowers consume much wax, and, despite the introduction of paraffine, ceresine, and mineral wax, its use appears to be extending.

The product of wax in the U. S. is stated by Mr. N. M. Hoge of New York (communication to the writer) to be 20,000,000 pounds annually, and increasing, worth in money at least $6,000,000. Of this, about $700,000 are exported, and about $1,200,000 worth of honey also goes abroad. About 70,000 persons in the U. S. cultivate bees, the average number of hives to each cultivator being 28, or about 2,000,000 hives in all. Each hive yields a surplus of about 22 pounds of honey. The total product of honey and wax is worth at present in the U. S. nearly $15,000,000. The invention of the movable-comb hives by Rev. S. L. Langstroth in 1852; of the honey-extracting machine, which throws the honey from the cells by centrifugal force, leaving the comb in a condition to be used again by the bees; and, lastly, the ingenious production of artificial combs in a machine constructed by Dr. John Long, that turns out combs with cells rivalling, if not excelling, the natural product, are all important American improvements in apiarian culture which add largely to the economy of this industry, yet in its infancy. As the honey-bee is said to consume three-fourths of its time in producing comb at the very time when the honey-harvest is at its best, it is evident that Dr. Long's invention of artificial combs must be a great economy in the collection and storing of honey; but it is not so clear how the stock of wax is to be kept up unless man deceives the bee by using "mineral wax" in the formation of the artificial comb; and this product, as we shall presently see, is not true wax, but a natural paraffine. There is no wax imported into the U. S. The U. S. duty on foreign wax is 20 per cent.

Under Stearic Acid, wax candles were referred to Wax. A word or two may suffice for this industry. To form wax candles, wicks of twisted (not plaited) Turkey cotton are suspended from a ring or hook over the caldron of melted wax, and the workman pours over them a stream of wax from a ladle, revolving each in succession to equalize the flow of the wax over the surface, until about one-third the intended size is obtained, when, after cooling, the same operation is repeated until the candles are about half size. While still warm they are then removed from the hooks, and rolled between two marble slabs to give them a cylindrical form and straightness. The upper end of the candle is now formed by cutting down the wax to a metal tag which covered one end of the wick. The candles are then suspended again on the hook, changing ends, and the operation of basting and rolling repeated until the desired size is attained. The lower ends are then cut off to an even length. Large wax candles, used at church altars, are formed up from thin slabs of wax by rolling them over the wick and finishing as before. Wax tapers are made by a sort of wire-drawing process, the wicks, wound on a drum, being drawn through the molten wax at a regulated temperature, passing through graduated holes to size the tapers, and thence to a cooling drum.

*Andaquies Wax* (*cera de los Andaquies*) is a peculiar wax produced by a little bee called *caveja* by the Tamas Indians, of the Rio Coquetta on the plains of Orinoco, above the Magdalena River. These insects build on the same tree numerous combs, each of which yields from 100 to 250 grammes of yellow wax, about 3 to 8 oz. Troy, which, purified by boiling water, has a slightly yellowish color and melts at about 170° F. It contains C. 81.66, H. 13.55, O. 4.78 = 99.99. Lewy found in it three different bodies—viz. myricyl palmitate, about 50 per cent., fusible at about 162° F.; cerosine, fusible at 176° F., about 45 per cent.; and an oily matter, about 5 per cent. These principles are separated by alcohol as in case of ordinary beeswax.

*Vegetable Wax.*—The most familiar body of this class is the "bayberry wax," so called, from *Myrica cerifera*, a very abundant American species, the wax of which was carefully investigated by Moore (*Sill. Jour.* (2), xxxiii. 313), as already referred to in a former article. Other species of *Myrica* or *Myristica* furnish like products; *e. g.* in French Guiana the *M. ocoba*, *M. officinalis*, and *M. sebifera* furnish the *ocuba wax*, which, according to Sigaud (*Comptes rend. de l'Acad.*, xxii. 1321), grows on a fruit the size of a musket-ball, the nut covered with a thick crimson skin which dyes water of a fine purple. The wax is separated by boiling water, and swims on the surface. It is used for candles in the country where it is found; 3 parts by weight of this wax are obtained from 16 parts of the nuts. *Bicuiba Wax* is another body of the same sort from *M. bicuhyba*, of the origin of which little appears to be known. The composition of these two varieties of wax is C. 74.16, H. 11.25, O. 14.58 = 100. Both dissolve in boiling alcohol, and melt at 98.7° and 95° F., respectively.

*Carnahuba Wax* is the product of a palm (*Corypha cerifera*) growing in N. Brazil, and especially in the province of Ceara, forming a thin layer on the surface of the leaves. It scales off easily from the cut leaves when dried in the shade, and is readily fused and moulded into candles. It is soluble in boiling alcohol and in ether, and on cooling shows a crystalline structure. It melts at 185° F., and is very brittle and readily powdered. It contains, according to Lewy, C. 80.33, H. 13.07, C. 6.60 = 100.00. *Chinese Wax* is a dazzling white wax produced by the sting of *Coccus* on the leaves of certain plants. It crystallizes like spermaceti, which it resembles; melts at 180° F.; dissolves in alcohol, and yields cerotic acid and cerylene, $C_{27}H_{54}$, by dry distillation. It is used in China to make candles. *Japan Wax* is palmatine. Bleached carnahuba wax is employed for tempering other candle-stock of a lower melting-point, and was exhibited by Wagenmann of Vienna in the Austrian department of the Philadelphia Exposition as prepared for that purpose.

*Fossil Wax* (*Ceresine*). Under the so-called "fossil wax" are several distinct mineral hydrocarbons of the general formula $C_nH_{2n}$, belonging to the ethylene series—one especially of which (ozocerite) has lately assumed considerable economic importance as a substitute for beeswax, which in many physical properties it much resembles. The fossil paraffines are—(1) *Urpethite*, from Urpeth colliery (*Johnston*), melting at 102° F., sp. gr. 0.885, and soluble in cold ether; adheres to the fingers and stains paper. (2) *Hatchettite*, from Scotland (*Johnston*), a soft wax, sp. gr. 916–983, pearly, glistening, yellowish in color, greasy to the feel; melts at 115° F., dissolves very sparingly in cold ether and boiling alcohol, crystallizing as it cools from the hot ethereal solution. (3) *Ozocerite* (ozokerite); the original mineral was from Slanik in Moldavia, and was wholly soluble in ether; that from Boryslav in Galicia is insoluble in cold ether, but largely so in hot ether. Its sp. gr. is 0.944, and melting-point 140° F. (4) *Zietrisikite*, like the last named in nearly all physical characters, as hard as beeswax or harder; melts at 194° F., has a density of 0.9–0.946, and is distinctly separated from ozocerite by its almost complete insolubility in ether. It occurs at Zietrisika in Moldavia in large masses. Taking a mean differ-

ence in the melting-points of these several natural products as 57° F., and commencing with a variety of paraffine distilled from bituminous shale of Autun, as examined by M. Laurent, which melted at 91.4° F., was very soluble in ether and insoluble in alcohol, and consisted of C. 85.745, H. 14.200, and including an intermediate product obtained from the Urpeth mineral by Johnston, and which we call "Johnston's *third*," we shall have the following melting-points for the series—viz. urpethite, 91.4°; hatchettite, 116.6°; ozocerite, 141.8°; Johnston's *third*, 167°; zietrisikite, 192.2° F. The boiling-points of ozocerite and zietrisikite are respectively above 400° and 572° F.

It is asserted by some chemists that this series of fossil wax does not afford paraffine, as found in nature, but that this body is a product of transformation of the native hydrocarbons in the process of manufacture, just as petroleum is changed in part to paraffine during the process of distillation of the crude oil.

It is evident that there are great possibilities connected with this series for very important application in the arts of a class of substances resembling beeswax in many physical properties, and surpassing it in the range of temperature and permanence of constitution. The so-called "ceresine wax"—a senseless tautology—is a trade-term applied to the purified ozocerite (named from ὄζειν, to "smell," and κηρός, "wax," in allusion to its odor) from Drohobicz and Boryslav in Galicia, and at Gresten in Austria. Since 1872 deposits of this mineral, in connection with the coal-measures, have been extensively explored, and the ozocerite industry has attained already large proportions. In the Centennial Exposition (1876) were four exhibitors of the products of this industry—Messrs. Paul Dobel, engineer at Boryslav; the chartered first Austrian ceresine manufactory, H. Ujhely & Co. at Stockerau near Vienna (represented by Messrs. Thurber & Co., New York); Gustavus Wagenmann, Vienna, and J. C. & J. Field, London. All these show the crude and melted mineral as brought into commerce, with purified product in white blocks, candles, wreath-tapers, Christmas-lights, cobbler's wax, thread wax, floor wax, etc., in interesting variety and great beauty. The establishment of Wagenmann has three buildings devoted to ozocerite manufacture, and is capable of working up 2,500,000 kilogrammes (nearly 6,000,000 pounds) of raw wax. In the establishment of Messrs. Ujhely & Co. are 400 persons occupied in various departments of the ceresine manufacture, aided by five steam-engines. The crude product, freed by fusion from sand, clay, and other impurities, is of a deep-brown color, with a greenish tint, has a sp. gr. of 0.940 to 0.990, exhales a naphtha-like odor, and in hardness, fracture, and plasticity greatly resembles beeswax. It is very combustible, burning with a pure rich flame of high illuminating power. It dissolves with difficulty in oil of turpentine. It is purified and bleached by means of Nordhausen sulphuric acid, which attacks only the foreign bodies in the ozocerite, leaving the colorless hydrocarbon untouched. It is used for all purposes for which beeswax is employed, and by its higher melting-point is capable of uses to which the former is not adapted. It is said not only to retard, but entirely prevent, rancidity in ointments—a most valuable quality. We have already suggested in the former part of this article that it may be used perhaps in Dr. Long's apparatus for producing artificial comb-cells for bees' use. No deposit of ozocerite has yet been found in the U. S. If zietrisikite, with its high melting-point, could be found in abundance, it has capabilities which have never yet been available in any hydrocarbon. Possibly we may find in ozocerite or zietrisikite the long-sought material for a standard candle for photometric measurement, which no existing candle has yet supplied. B. Silliman.

**Waxahatch'ie,** p.-v. and tp., cap. of Ellis co., Tex. P. 2478.

**Wax Figures** were held in high repute at Rome from an early period, owing to their employment in the religious ceremonies in honor of ancestors, images of those who had filled curule offices being placed in the vestibules of their descendants. From about 300 B. C. these images were cast from moulds, and gradually took high rank as works of art. This employment of wax, on the decay of the Roman religion, was transferred to the worship of the saints, and the industry has flourished in Italy to the present time, the most celebrated artists having been Verrochio and Orsino.

**Wax'haw,** p.-v. and tp., Lancaster co., S. C. P. 960.

**Wax Modelling** is a branch of plastic art at present in low esteem, yet in former times Michael Angelo and other artists of the first rank in Germany and Italy produced excellent ceroplastic figures, many of which still exist. In some cases the wax was covered with clay or plaster, and then melted out, the mould thus formed being used in casting a bronze figure—technically, *cire perdue*.

**Wax-Myrtle.** See Bayberry.

**Wax'-Palm,** a name given to various wax-producing palms, especially to *Copernicia cerifera* (see Carnahuba Palm and Wax), and *Ceroxylon andicola* of the Andes.

**Wax'-Plant,** the popular name of *Hoya carnosa*, a climbing greenhouse shrub of the Asclepiadaceæ or milkweed family, a native of the East Indies, deriving its name from the wax-like appearance of its clustering white flowers.

**Wax'wing,** an English name for the species of the genus *Ampelis*, and so applied because the wings have their tertial and secondary feathers provided with small plummet-like red appendages simulating red sealing-wax. The genus belongs to the great passerine group, and by most recent authors has been taken as the type of a peculiar family (Ampelidæ). The bill is rather short, depressed at base, with the culmen decurved at tip; the nostrils linear, and partially concealed by the extension of the frontal feathers; the head has a well-developed crest of soft blended feathers; the wings are long and narrowed, the tail even; the predominant color is a silky brownish, which grades into "vinaceous" anteriorly and ashy posteriorly above; the head has on each side a black stripe extending from the nasal region through the eye backward beneath the crest, and a black patch on the chin, with a white streak between them on the side of the lower jaw. Three species are known: (1) the *Ampelis garrulus* (Northern or Bohemian waxwing), of the northern parts of both continents; (2) the *Ampelis cedrodum* (common cedar-bird), of the U. S. and North America generally; and (3) the *Ampelis phœnicopterum*, of North-eastern Asia. The species appear to prefer as food berries of various kinds, but they also devour worms and insects, and in confinement the cedar-bird is "very fond of apples, bread soaked in milk, and almost any kind of soft food." (*Brewer.*) Theodore Gill.

**Waxwork,** a plant. See Celastraceæ.

**Waxy Degeneration,** a diseased condition of the tissues of the living body, in which parts of organs are changed into the substance known as lardaceine, or "animal amyloid," a peculiar albuminoid substance, which some have tried to identify with the glycogene of the liver. Though an albuminoid, it has reactions somewhat like those of starch. It takes a deep-brown red from iodine, dissolves in warm water, cannot be melted, swells but does not dissolve in sulphuric acid, and does not dissolve in ether. It is apparently isomeric with albumen (*Friedrich* and *Kekulé*). It has often been confounded with true starch, with which it is sometimes associated. Organs seriously affected by waxy degeneration, when cut, have a half-transparent look. It has been detected in the brain, nerves, spleen, liver, kidneys, muscles, arteries, bones, glands, adventitious tissues, cancers, and in various other situations. Rickets, syphilis, pulmonary consumption, diabetes, chronic kidney disease, and malarial and mercurial poisoning are among the conditions with which it is associated. It is seldom or never detected during life. The treatment naturally is for the disease with which it is associated. Some cases of obscure and undiagnosticated ill-health doubtless arise from this degeneration. Not much that is definite can as yet be said of the causes and treatment. In suspected cases the patient is to be put into the best hygienic conditions, and untoward symptoms should receive attention. This degeneration was first recognized in 1854 by Gairdner and Sanders of Edinburgh, and soon after, quite independently, by Virchow.

**Way** [Ang.-Sax. *weg*], in law, is classed among the incorporeal hereditaments as a servitude or easement, and is the right held by one or more individuals of passing and repassing in a given direction between fixed termini over the land belonging to another private owner. Although the term is sometimes applied to a highway, this is an incorrect use of it; for while a "highway" is the space along and over which the entire public may travel, and is always under the control of the public authorities, a "way" is the private *right* enjoyed by particular persons, and the burden thereby resting on the land of some proprietor, rather than the path or course along which the right must be exercised. A right of way may exist in three different forms: (1) It may be, and generally is, an easement—that is, it is annexed or appurtenant to one specific tract called the dominant estate, and is exercised over another defined parcel of land termed the servient estate. (For a full description of easements see the article Easement.) (2) It may be enjoyed by the inhabitants of a particular village or hamlet to go and come to and from a designated point. This species is quite frequent in England, but can hardly be said to exist in the U. S., unless perhaps in connection with some of the oldest New England villages. (3) It may be an entirely personal servitude, conferred upon some particular individual, not by virtue of his owning land, but as a privilege belonging to himself alone, which cannot be

transferred, and which necessarily must end at his death. (See article SERVITUDE.) In respect to the nature and amount of the use permitted, the Roman law divided the general right into three grades—*iter*, for foot passengers only; *actus*, for passage on foot, with horses, vehicles, or cattle; and *via*, which included all the former uses, together with that of drawing heavy burdens, and also involved the notion of a distinct path or roadway of ascertained width. Although these names are not found in our law, the right may exist in these several degrees. A way may be acquired in three different modes.—(1) By the express terms of a deed, as when the owner of the servient estate by means of a grant charges his land with the easement, and also when an owner conveys a part of his land, and reserves a right of way over it in favor of the tract which he retains. (2) By prescription, or a long-continued user under a claim of right, the period having generally been fixed by statute at twenty years. (See article PRESCRIPTION.) (3) Of necessity. A way of necessity arises when A, being owner of land, conveys a portion thereof to B, so surrounded by other tracts that B is entirely cut off from access to any highway. Under such circumstances B has of necessity a right of way appurtenant to his parcel over the remaining land of A to a convenient highway, although the deed of conveyance was silent upon the subject. J. N. POMEROY.

**Way** (ALBERT), F. S. A., b. at Bath, England, in 1805, son of a wealthy and philanthropic clergyman, Rev. Gregory Lewis Way of Stanstead Park, Surrey; received his early education at home; graduated at Trinity College, Cambridge, about 1826; settled at London; devoted himself to archæological pursuits; became in 1843 president of the Society of Antiquaries, to whose *Proceedings* he contributed largely; seceded from that society, with a number of others, on account of differences among its members, and founded the Archæological Institute of Great Britain and Ireland, to whose interests he devoted his subsequent efforts, and was an efficient promoter of local antiquarian societies. He married in 1844 his cousin Emmeline, youngest daughter of the first Lord Stanley of Alderley. He edited for the Camden Society the *Promptuarium Parvulorum sive Clericorum; Lexicon Anglo-Latinum Princeps* (3 vols., 1843), valuable as supplying the most authentic record of the English of the fifteenth century, and corrected, enlarged, and brought out Sir S. R. Meyrick's work on *Ancient Armor* (2d ed., 3 vols., 1844). D. at Cannes, France, Mar. 22, 1874.

**Way Cross,** p.-v., cap. of Ware co., Ga.

**Way'land,** p.-v. and tp., Middlesex co., Mass., on Massachusetts Central R. R., 16 miles W. of Boston, has 4 churches, good schools, several boot and shoe factories, 1 newspaper, and a public library. The first free public library in the U. S. was established here. P. 1240.

T. A. MERRILL, ED. "NEWS."

**Wayland,** p.-v. and tp., Allegan co., Mich. P. of v. 585; of tp. 1963.

**Wayland,** tp., Chariton co., Mo. P. 674.

**Wayland,** tp., Steuben co., N. Y. P. 2553.

**Wayland** (FRANCIS), D. D., LL.D., b. in New York City Mar. 11, 1796, of English parents; graduated at Union College 1813; studied medicine and commenced practice at Troy, but having joined the Baptist church 1816, devoted himself to the ministry; studied theology one year at Andover; was tutor in Union College 1817–21; pastor of the First Baptist church at Boston, Mass., 1821–26; became president of Brown University Feb., 1827, having previously filled for some months the professorship of mathematics and natural history in Union College; retired from the presidency 1855, and was for two or three years pastor of the First Baptist church at Providence, and was highly distinguished as a pulpit orator. D. at Providence Sept. 26, 1865. Author of several volumes of sermons and addresses, *Elements of Moral Science* (1835), *Elements of Political Economy* (1837), *Limitations of Human Reason* (1840), *Thoughts on the Collegiate System of the U. S.* (1842), a work which led to the adoption of the voluntary system at Brown University in 1849; *Christianity and Slavery* (1845), being a discussion by correspondence with Dr. Richard Fuller; *Elements of Intellectual Philosophy* (1854), *Life of Rev. Adoniram Judson, D. D.* (2 vols., 1853), *Notes on the Principles and Practices of Baptists* (1856), *Letters on the Ministry* (1863), and other works. His *Life* was written by his sons Francis and H. L. Wayland (2 vols., 1867).

**Wayland Dépôt,** p.-v., Steuben co., N. Y.

**Wayles'burg,** tp., Bartholomew co., Ind. P. 101.

**Waymansville,** p.-v., Jackson tp., Bartholomew co., Ind. P. 55.

**Way'mart,** p.-b., Wayne co., Pa. P. 567.

**Way'mouth,** or **Weymouth** (GEORGE), b. in England about 1570; became distinguished as a navigator, and explored the Atlantic coasts of North America in the employ of Sir Ferdinando Gorges; entered the Penobscot and Kennebec rivers, and carried to England several Indians from that region.

**Wayne,** county of E. Georgia, bounded N. E. by Altamaha River, intersected by the Santilla, and traversed by Atlantic and Gulf, Brunswick and Albany, and Macon and Brunswick R. Rs.; surface level, soil sandy, with large pine forests. Staples, Indian corn, sweet potatoes, and rice. Cap. Jesup. Area, 594 sq. m. P. 2177.

**Wayne,** county of S. E. Illinois, intersected by Little Wabash River, and traversed by Springfield and Illinois South-eastern R. R.; surface generally level, soil fertile. There are flour-mills, saw-mills, woollen-mills, and carriage factories. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, hay, tobacco, wool, and dairy products. Cap. Fairfield. Area, 720 sq. m. P. 19,758.

**Wayne,** county of E. Indiana, bordering on Ohio, drained by Whitewater River and its affluents, and traversed by the Whitewater Canal and several railroads; surface undulating, soil fertile. There are saw-mills, flour-mills, tanneries, and manufactories of agricultural implements, carriages, iron castings, machinery, and linseed oil. Live-stock numerous. Staples, Indian corn, wheat, oats, tobacco, wool, and dairy products. Cap. Richmond. Area, 420 sq. m. P. 34,048.

**Wayne,** county of S. Iowa, bordering on Missouri and drained by the S. fork of Chariton River; surface undulating, soil fertile. Cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, hay, wool, and dairy products. Cap. Corydon. Area, 510 sq. m. P. 11,287.

**Wayne,** county of S. Kentucky, bordering on Tennessee, and bounded N. and E. by forks of the Cumberland River; surface hilly, with much bituminous coal and iron; soil along the streams fertile. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, tobacco, and wool. Cap. Monticello. Area, 570 sq. m. P. 10,602.

**Wayne,** county of S. E. Michigan, bordering on Lakes Erie and St. Clair, drained by Rouge and Huron rivers and their branches, and traversed by several railroads, which centre at Detroit. The surface is level or gently undulating; soil very fertile, with excellent limestone and several sulphur springs. There are more than 1000 manufacturing establishments of various kinds, the greater portion being in Detroit. (See DETROIT.) Live-stock is abundant on the farms outside of the city. Staples, manufactured articles, Indian corn, oats, wheat, wool, and garden and dairy products. Cap. Detroit. Area, 600 sq. m. P. 119,038.

**Wayne,** county of S. E. Mississippi, bordering on Alabama, intersected by Chickasawha River, and traversed by Mobile and Ohio R. R.; surface undulating, soil sandy. Staples, cotton, Indian corn, and sweet potatoes. Cap. Waynesborough. Area, 790 sq. m. P. 4206.

**Wayne,** county of S. E. Missouri, watered by Bigwater, Castor, and St. Francis rivers; surface undulating; soil tolerably fertile in some parts, swampy in others, but scantily timbered. Swine and sheep are the principal live-stock. Staples, Indian corn, tobacco, and wool. Cap. Greenville. Area, 750 sq. m. P. 6068.

**Wayne,** county of N. E. Nebraska, drained by affluents of Elkhorn River; surface undulating, soil fertile. Cap. La Porte. Area, about 450 sq. m. P. 182.

**Wayne,** county of N. W. New York, lying on Lake Ontario, intersected by Clyde River, and traversed by Erie Canal, and by New York Central, Lake Ontario Shore, and other railroads; surface undulating, soil generally fertile. Iron ore and gypsum abound, and there are several saline and sulphur springs. There are about 600 manufacturing establishments, among which are flour-mills, saw-mills, planing-mills, tanneries, agricultural implements, carriages, cooperage, iron castings, machinery, and essential oils and essences, especially of peppermint. Live-stock, especially cattle and sheep, numerous. Staples, oats, Indian corn, wheat, barley, potatoes, wool, hay, and dairy products. Cap. Lyons. Area, 572 sq. m. P. 47,710.

**Wayne,** county of E. North Carolina, intersected by Neuse River, and traversed by North Carolina, Atlantic and North Carolina, and Weldon and Wilmington R. Rs. The surface is level, much of it being covered by pine forests; soil sandy. Swine are the chief live-stock. Staples, cotton, lumber, tar, pitch, and turpentine, Indian corn, and sweet potatoes. Cap. Goldsborough. Area, 720 sq. m. P. 18,144.

**Wayne,** county of N. E. Ohio, drained by Walhonding River and other streams, and traversed by Pittsburg Fort

Wayne and Chicago, Cleveland Mount Vernon and Delaware, and Atlantic and Great Western R. Rs.; surface undulating, soil very fertile. There are saw-mills, planing-mills, flour-mills, tanneries and currying establishments, and manufactories of agricultural implements, carriages, iron castings, machinery, and woollen goods. Horses, cattle, sheep, and swine are numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Wooster. Area, 660 sq. m. P. 35,116.

**Wayne,** county of N. E. Pennsylvania, bordering on New York, bounded E. by Delaware River, drained by the Lackawaxen and other streams, and traversed by Delaware and Hudson Canal and by Erie R. R. The surface is hilly, in some parts mountainous, and not well adapted for tillage. There are many tanneries and saw-mills, and manufactories of agricultural implements, carriages, and iron castings. Cattle and sheep are numerous. Staples, hay, wool, oats, potatoes, and dairy products. Cap. Honesdale. Area, 720 sq. m. P. 33,188.

**Wayne,** county of S. W. Tennessee, bordering on Alabama, bounded N. W. by Tennessee River and drained by Buffalo River and other streams; surface hilly, soil fertile, and abounding in iron ore. There are saw-mills, flour-mills, and many tanneries and currying establishments. Swine and cattle are the chief live-stock. Staples, cotton, Indian corn, wool, tobacco, and dairy products. Cap. Waynesborough. Area, about 700 sq. m. P. 10,209.

**Wayne,** county of S. W. West Virginia, bordering on Kentucky and on Ohio, from which it is separated by Ohio River. The surface is hilly, mostly covered by forests, with much bituminous coal and iron ore. Sheep and swine are the chief live-stock. Staples, Indian corn, tobacco, and wool. Cap. Wayne Court-house. Area, 415 sq. m. P. 7852.

**Wayne,** p.-v. and tp., Du Page co., Ill. P. 1019.
**Wayne,** tp., Allen co., Ind. P. 1742.
**Wayne,** tp., Bartholomew co., Ind. P. 1836.
**Wayne,** tp., Fulton co., Ind. P. 1131.
**Wayne,** tp., Hamilton co., Ind. P. 1398.
**Wayne,** tp., Henry co., Ind. P. 3318.
**Wayne,** tp., Huntington co., Ind. P. 804.
**Wayne,** tp., Jay co., Ind. P. 1526.
**Wayne,** tp., Kosciusko co., Ind. P. 3664.
**Wayne,** tp., Marion co., Ind. P. 3738.
**Wayne,** tp., Montgomery co., Ind. P. 1418.
**Wayne,** tp., Noble co., Ind. P. 1236.
**Wayne,** tp., Owen co., Ind. P. 1333.
**Wayne,** tp., Randolph co., Ind. P. 3220.
**Wayne,** tp., Starke co., Ind. P. 606.
**Wayne,** tp., Tippecanoe co., Ind. P. 1801.
**Wayne,** tp., Wayne co., Ind. P. 3734.
**Wayne,** p.-v. and tp., Henry co., Ia. P. 1258.
**Wayne,** tp., Jones co., Ia. P. 1178.
**Wayne,** tp., Mitchell co., Ia. P. 305.
**Wayne,** tp., Monroe co., Ia. P. 655.
**Wayne,** tp., Doniphan co., Kan. P. 2070.
**Wayne,** p.-v. and tp., Kennebec co., Me. P. 938.
**Wayne,** tp., Cass co., Mich. P. 999.
**Wayne,** p.-v., Wayne co., Mich. P. 833.
**Wayne,** tp., Bollinger co., Mo. P. 630.
**Wayne,** tp., Buchanan co., Mo. P. 803.
**Wayne,** tp., Passaic co., N. J. P. 1521.
**Wayne,** tp., Steuben co., N. Y. P. 891.
**Wayne,** tp., Adams co., O. P. 1169.
**Wayne,** tp., Ashtabula co., O. P. 817.
**Wayne,** tp., Auglaize co., O. P. 1011.
**Wayne,** tp., Belmont co., O. P. 1700.
**Wayne,** tp., Butler co., O. P. 1694.
**Wayne,** tp., Champaign co., O. P. 1729.
**Wayne,** tp., Clermont co., O. P. 1690.
**Wayne,** tp., Clinton co., O. P. 1267.
**Wayne,** tp., Columbiana co., O. P. 766.
**Wayne,** tp., Darke co., O. P. 1983.
**Wayne,** tp., Fayette co., O. P. 1336.
**Wayne,** tp., Jefferson co., O. P. 1564.
**Wayne,** tp., Knox co., O. P. 1658.
**Wayne,** tp., Monroe co., O. P. 1252.
**Wayne,** tp., Montgomery co., O. P. 1160.
**Wayne,** tp., Muskingum co., O. P. 1508.
**Wayne,** tp., Noble co., O. P. 796.
**Wayne,** tp., Pickaway co., O. P. 790.
**Wayne,** tp., Tuscarawas co., O. P. 1132.
**Wayne,** tp., Warren co., O. P. 2905.
**Wayne,** p.-v. and tp., Wayne co., O. P. 1714.
**Wayne,** tp., Armstrong co., Pa. P. 2028.
**Wayne,** tp., Clinton co., Pa. P. 701.
**Wayne,** tp., Crawford co., Pa. P. 1464.
**Wayne,** p.-v. and tp., Erie co., Pa. P. 1295.
**Wayne,** tp., Greene co., Pa. P. 1563.
**Wayne,** tp., Lawrence co., Pa. P. 1040.
**Wayne,** tp., Mifflin co., Pa. P. 1453.
**Wayne,** tp., Schuylkill co., Pa. P. 1546.
**Wayne,** b., Wayne co., Pa. P. 476.
**Wayne,** tp., Lafayette co., Wis. P. 1056.
**Wayne,** p.-v. and tp., Washington co., Wis. P. 1710.

**Wayne** (Anthony), b. at East Town, Chester co., Pa., Jan. 1, 1745; educated at the Philadelphia Academy; became a surveyor and an intimate friend of Franklin; was agent of a land company in Nova Scotia 1765–66; married and settled on a farm in Chester county 1767; was elected to various county offices; was a member of the Pennsylvania convention and of the legislature of 1774; served on the committee of safety 1775; raised in September of that year a regiment with which he took part in the campaign against Canada; became colonel Jan. 3, 1776; was wounded at the battle of Trois Rivières, at which he was highly distinguished; was afterward in command of the fortresses of Ticonderoga and Mount Independence, garrisoned by five regiments, until May, 1777; was commissioned brigadier-general Feb. 21, 1777; joined Washington in New Jersey; commanded a division at the battle of Brandywine, Sept. 11, being stationed at Chadd's Ford to oppose the passage of the river by Knyphausen; fought all day and effected a successful retrèat at sunset; took command of a flying detachment of 1500 men for the purpose of harassing the British rear, but was surprised at Paoli (close to his own homestead) by superior numbers on the night of Sept. 20, and lost 53 men; was acquitted of blame by a court-martial held at his own request; led the American right wing at the battle of Germantown, Oct. 4; made a raid within the British lines in the winter of 1777–78, capturing numerous horses and cattle and abundance of forage; contributed by his skilful manœuvres to the victory of Monmouth June 28, 1778; led the attack at the storming of Stony Point on the night of July 15–16, 1779, considered the most brilliant feat of arms of the whole war (see Stony Point); was wounded in the head; received from Congress a vote of thanks and a gold medal; acquired the sobriquet of "Mad Anthony Wayne," and became the favorite popular hero; exhibited much address in suppressing a mutiny of the Pennsylvania line at Morristown Jan., 1781; joined La Fayette in Virginia Jan. 7; made with a part of a brigade a daring attack upon the whole British army at Green Spring or Jamestown Ford July 6, and by a bayonet-charge disconcerted a projected manœuvre against La Fayette; was present at the surrender of Cornwallis; defeated the British and Indians in Georgia May and June, 1782; took possession of Charleston, S. C., after its evacuation Dec. 14; retired to his farm in Pennsylvania after the war; served in the Pennsylvania assembly 1784–85, and in the convention that ratified the U. S. Constitution; was appointed major-general Apr. 2, 1792, and took command of an expedition against the Western Indians, whom he defeated at Fallen Timbers, or Maumee Rapids, Aug. 20, 1794; concluded with them the treaty of Greenville 1795, and while on his return homeward d. at Presque Isle (now Erie, Pa.) Dec. 15, 1796. His remains were removed in 1809 to Radnor church, near Waynesborough, Pa., where a monument was erected by the Pennsylvania Society of Cincinnati July 4, 1809. His *Life*, by Gen. John Armstrong, is in Sparks's series, and his *Regimental Orderly Book* was printed at Albany in 1859.

Porter C. Bliss.

**Wayne** (James Moore), LL.D., b. at Savannah, Ga., in 1790; graduated at Princeton 1808; became a lawyer and politician at Savannah; sat in the legislature; presided over two constitutional conventions; was mayor of that city 1823, judge of the superior court of Georgia 1824–29, member of Congress 1829–35; was an efficient debater, an advocate of free trade, and an active supporter of the policy of Pres. Jackson, by whom he was appointed an associate justice of the Supreme Court of the U. S. Jan. 9, 1835, and gave especial attention to admiralty jurisprudence. D. at Washington, D. C., July 5, 1867.

**Wayne Court-house,** p.-v., cap. of Wayne co., West Va.

**Waynes'boro',** p.-b., Franklin co., Pa., about 50 miles S. W. of Harrisburg, has 7 churches, a graded school, steam-engine and boiler works, grain-separator works, 1 sash and door factory, 2 hotels, 1 tannery, a medicine manufactory, and 1 newspaper. P. 1345.

W. Blair, Ed. "Village Record."

**Waynesboro',** p.-v., cap. of Wayne co., Tenn., about 100 miles S. W. of Nashville, contains 1 church, good schools, 1 newspaper, and 2 hotels. Large deposits of iron ore exist in the county. Principal business, farming. P. about 350.

Thos. F. Warren, Ed. "Wayne Co. Citizen."

**Waynesborough,** p.-v., cap. of Burke co., Ga.

**Waynesborough,** p.-v., cap. of Wayne co., Miss.

**Waynesborough,** p.-v., South River tp., Augusta co., Va. P. 536.

**Waynes'burg,** v., Auburn tp., Crawford co., O. P. 63.

**Waynesburg,** p.-v., Sandy tp., Stark co., O. P. 425.

**Waynesburg,** p.-b., cap. of Greene co., Pa., on Waynesburg and Washington R. R., 45 miles S. of Pittsburg, contains 7 churches, Waynesburg College, a fine town-hall, 1 bank, 3 weekly newspapers, 1 extensive carriage-factory, 1 foundry, 2 lodges of Masons and 1 of Independent Order of Odd Fellows, and several planing and flouring mills. The town was laid out in 1796. P. 1272.

W. T. H. Pauley, Ed. "Messenger."

**Waynes'field,** tp., Lucas co., O. P. 2045.

**Waynes'ville,** p.-v., cap. of Wayne co., Ga.

**Waynesville,** p.-v. and tp., De Witt co., Ill. P. 970.

**Waynesville,** p.-v., Wayne tp., Bartholomew co., Ind. P. 104.

**Waynesville,** p.-v., cap. of Pulaski co., Mo.

**Waynesville,** p.-v. and tp., cap. of Haywood co., N. C. P. 1543.

**Waynesville,** p.-v., Warren co., O., on Little Miami R. R. and River, 38 miles E. of Cincinnati, has 6 churches, an excellent graded school, 2 banks, 1 newspaper, a town-hall, fine water-power, and several mills. P. 745.

Drew Sweet, Ed. "Gazette."

**Wayn'flete,** or **Wainfleet** (William of), otherwise called **William Patten** or **Barbour,** b. at Waynflete, Lincolnshire, England, about 1405; educated at Winchester and at Oxford University; became head-master of Wykeham's school at Winchester 1429; was appointed by King Henry VI. first master of his newly-founded college at Eton 1442; became provost of Eton Dec., 1443; succeeded Cardinal Beaufort in the bishopric of Winchester 1447; founded Magdalen Hall, Oxford, 1448; converted it into a college with a liberal endowment 1456; also founded a free school in his native town; was lord high chancellor to Henry VI. during the disastrous years 1456–60, resigning three days before the battle of Northampton, and was generously treated by the victorious Yorkists. D. Aug. 11, 1486, and was buried in a magnificent chapel in Winchester cathedral.

**Waywode,** a Slavic word meaning "leader in war," was first applied simply to the military commanders, but afterward also to the governors of the provinces, and used in Poland, Hungary, Transylvania, Moldavia, and Wallachia. It has since been superseded by another title, also of Slavic origin—*hospodar*.

**Wayzeta,** p.-v., Hennepin co., Minn.

**Wea,** p.-v. and tp., Tippecanoe co., Ind. P. 1251.

**Wea,** p.-v. and tp., Miami co., Kan. P. 1324.

**Weak'-Fish,** a name given to the *Cynoscion regalis* (*Otolithus regalis* of old writers), one of the most common fishes along the eastern coast of the U. S. It belongs to the family Sciænidæ, and has as associates several other species, mostly peculiar to the southern coast of the U. S.—viz. *C. thalassinus, C. nothus,* and *C. carolinensis.* These species are all distinguished by their elongated subfusiform shape, the prominence of the lower jaw, and the armature of the upper one with canine teeth; the dorsal fin has nine or ten spines, and the anal fin one small spine. The weak-fish is distinguished by its color, which above is pale-brownish, with a decided greenish tinge, and grading below into silvery; on the back and sides are irregular vermicular blotches disposed in an oblique direction, tending forward and downward; the ventral and anal fins are yellowish, the others neutral. It generally averages between one and two feet in length, and is found along the entire eastern coast S. of Cape Cod, but is most common in the warmer waters. It confines its habitat to the sea, and does not ascend into the fresh waters. It is rather a voracious fish, and readily seizes the hook, but its mouth is easily torn, and to this characteristic (weakness of mouth) the name refers.

Theodore Gill.

**Weak'ley,** county of N. W. Tennessee, bordering on Kentucky, drained by tributaries of Obion River, and traversed by Nashville Chattanooga and St. Louis R. R.; surface level, soil fertile. Swine are the chief live-stock. Staples, tobacco, Indian corn, and wheat. Cap. Dresden. Area, 550 sq. m. P. 20,755.

**Weale** (John), b. in England in 1791; was for forty years a publisher in London, and issued the three valuable series of textbooks—rudimentary, educational, and classical—now published by Messrs. Virtue, and edited some of the works in question. D. at Canterbury Villas, London, Dec. 18, 1862. Author of *A Catalogue of Works on Architecture and the Fine Arts* (1823), *A Rudimentary Dictionary of Terms used in Architecture, Building, Engineering, etc.* (2 parts, 1849–50), *London Exhibited in 1851* (1851), and other works, and editor of *Quarterly Papers on Architecture and Archæology* (4 vols., 1843–46), *Quarterly Papers on Engineering* (6 vols.), and *Divers Works of Early Masters in Christian Decoration* (2 vols., imperial folio, 1846).

**Wealth** [Ang.-Sax. *wela;* Ger. *Wohl;* Dan. *vel,* supposed by some to have the same root with Lat. *valeo,* to "be strong"], a collective term for riches, material possessions in all their variety. The chief subject of political economy is wealth, and hence that science is sometimes called "the science of wealth." As a technical term of science, wealth embraces all and only such objects as both have utility—*i. e.* fitness to gratify human desire—and can be appropriated in exclusive possession, and therefore exchanged; in other words, all objects of *value.* (See Value.) It was formerly a popular notion that only money is real wealth. The idea still lingers in many minds in a way to confuse and complicate problems of both private and public finance. Money, though it measures all values, forms but a small part of the sum of wealth, and is desirable not for itself, but for the wealth in other forms which it can purchase. The term *wealth* does not properly include human beings, nor their capacities and qualities, such as strength, skill, genius, judgment, fidelity, etc. These are of highest consequence as means for the production and security of wealth, but it is only the products of their active employment which can be counted in the category of wealth. Nor does the term, in its generic sense, properly include evidences of debt, such as mortgages, bonds, stocks, etc. These things only indicate a title to possession and a mode in which real wealth is distributed. A mortgage on a farm given for borrowed money or as a part of the purchase price simply indicates that the mortgagor and the mortgagee are for the time, till the fulfilment of certain conditions, joint owners of the farm. The wealth is in the farm. It is not increased one whit by the mortgage itself. The issue of bonds by the U. S. government adds nothing directly to the wealth of the country. Each bond for $1000 gives its holder simply a lien on the wealth of the nation, at some time or other to be brought under control of the government by taxation. Many a mischievous illusion comes from mistaken views of these things. In the estimate of his personal property one may count in all he possesses of these evidences of debt, but the amount thus set down to his advantage is to be subtracted from some other man's wealth or from the common wealth of the country. In themselves they add nothing to the real wealth of a people or of the world, though they render an important service in bringing the wealth of a community into productive use. They are always symbols, not substance.

Wealth is produced only through the development of the resources of nature by human labor. The prime source of all utilities is the free bounty of God in nature, and the basis of the right of possession is the labor put forth to bring out the properties of nature in form and place to meet the desires of man. To accumulate wealth, labor must be continued beyond what is essential to meet immediate necessities, and the check of forethought and abstinence must be laid on the immediate consumption of the products of labor. Hence, *industry* and *frugality* are the indispensable conditions of the production and increase of wealth. These are characteristics which distinguish civilized from savage men, and thus wealth becomes a sign of civilization. At the same time, it is to be noted that wealth is maintained only by a continual process of reproduction. It must be perpetually renewed or it disappears. Values in one form are consumed that new values may appear, and the increase of wealth is as the value in the new form is greater than the value destroyed. Mill says, "The greater part of England's wealth to-day was produced within the last twelvemonth." (For other aspects of the subject see Political Economy.)

A. L. Chapin.

**Weare,** p.-v. and tp., Hillsborough co., N. H. P. 2092.

**Weare** (Meshech), b. at Hampton, N. H., June 16, 1713; graduated at Harvard 1735; studied and practised law; sat several years in the legislature; was Speaker 1752; commissioner to the colonial congress at Albany 1754; be-

came a justice of the supreme court and chief-justice 1777; was councillor from Rockingham county and chairman of the committee of safety 1775; was chosen president of the State 1776, and annually re-elected during the war, in which he rendered great services to the defence of the Northern colonies from Burgoyne's invasion, raising and equipping the forces sent to the frontier under Gen. Stark; and was again chosen president under the new constitution 1784. D. Jan. 14, 1786.

**Wea'sel** [Ang.-Sax. *wesle*], a name employed for representatives of the family Mustelidæ and the sub-family Mustelinæ, and more especially restricted to the species of the genus *Putorius*. These are especially distinguished by the small number of molars, there being only 34 teeth in all—viz. M. $\frac{1}{2}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$, I. $\frac{3}{3}$; the lower suctorial molar tooth has no inner tubercle; the body is very slender and elongated, especially in the small species, and so much so as to have obtained the name vermiform; the tail is moderate; the feet are essentially digitigrade. The species are among the boldest and most bloodthirsty of carnivorous animals, and especially destructive to poultry, which they generally seize by the neck, and, after sucking their blood, proceed to devour the carcasses leisurely, or perhaps leave, satisfied with quenching their thirst for blood alone. The species are mostly confined to cold and temperate regions, although a few extend into tropical countries. The generally-recognized species in North America are the *Putorius vulgaris*, or common little weasel; the *P. longicauda*, nearly related to the former, found in the upper Missouri and Platte countries; the *P. frenata*, or bridled weasel, of the south-western portions of the U. S.; the *P. visor*, or common mink; and the *P. nigripes*, or black-footed ferret of the Western plains. In Europe and Northern Asia are found a number of other species more or less closely related to those of North America. THEODORE GILL.

**Wea'ther** [Ang.-Sax. *weder*], the condition of the atmosphere prevailing at any moment over any region of the earth. This term is therefore to be carefully distinguished from *climate*, since the latter refers to the average condition of the weather for a considerable period; as, for instance, a month or year. The weather is in most portions of the earth exceedingly variable, but the climate is sensibly constant; the climates of the inhabited countries appear to have undergone only slight changes during the entire period over which history extends, notwithstanding occasional local exceptions, due, probably, to the drainage of lakes and marshes, the improved cultivation of the ground, or a slow change in the elevation of the land. On the other hand, decided changes in local climates seem to have taken place in those remote periods contemplated in the study of geology, so that it has been possible for strata to accumulate in which are found fossil animals and plants such as are supposed, but not known, to require very different climates from those now prevailing in the respective localities. One of the most recent of these geological periods is that known as the Glacial, during which greater quantities of snow, and possibly more intense cold or longer winters, prevailed than now. A large part, if not the whole, of these slow general changes in climate may be explained as due to changes in the distribution of land and water or of high land and low land; which changes are still going on throughout the entire earth. The sufficiency of the subsidence and elevation of land to account for these climatic changes has been maintained by many. Probably the most comprehensive and satisfactory view of the subject is given by Sartorius von Waltershausen in *Untersuchungen der Klimat der Gegenwart und der Vorwelt* (*Nat. Verh. Haarlem*, 2d series, vol. xxiii., 1865). In this mode of viewing the subject of permanency of climate all extreme assumptions seem to be avoided, and it is seen to be unnecessary to assume variations in solar radiation, or in the earth's orbit, or in its axis of rotation, or in the constitution of the atmosphere, or in the temperature of those portions of space through which the solar system has moved.

The terms applied to the different sorts of weather are also applicable to climate; thus, the combination of hot, moist air without wind forms sultry weather; cold, moist air with wind forms raw weather. The terms *damp* and *dry* have somewhat different significations in various parts of the world, but usually when the relative humidity is above 90 per cent. the air is called damp, while a humidity of 60 per cent. or less is dry weather; at 30 or 40 per cent. the air becomes very dry, and at less than 20 uncomfortable except to those who are accustomed to the very dry air of the interior of the continents, where relative humidities of 10 and 20 per cent. frequently occur. The expression *dull* weather applies when the sun is obscured by cloud or fog and haze, so that a twilight darkness seems to brood over the earth.

As the characteristic constant features of the climate of any region are shown by tables of appropriate monthly and seasonal averages, so the varying features of the weather are shown by tables of appropriate extreme values. An ingenious attempt has been made by J. W. Osborne of Washington to devise some single number or curve that should represent at a glance the combined influence of temperature, moisture, and wind upon the human body; this he seeks to do by determining the rate of cooling of a mass of water at a temperature of blood-heat contained in a porous vessel and exposed to the open air. (See *Proceedings Amer. Assoc. Adv. Sci.*, 1875.) In the absence of data furnished by such apparatus, which would afford a simple means of comparing the weather in different countries and on different days, we give the following approximate estimates based on the ordinary registers of meteorological observations:

| | New York. | Toronto. | St. Paul. | New Orleans. |
|---|---|---|---|---|
| Greatest daily range of temperature | 35 | 45 | 40 | 25 |
| Greatest daily rainfall | 6 | 3½ | 3 | 9 |
| Greatest daily range of relative humidity | 30 | 30 | 25 | 20 |

The variability of the weather is also seen by tabulating the frequency with which any phenomenon occurs. Thus, the number of days in each month on which rain or snow fell at Toronto was, according to the records for thirty years, as follows:

| Month. | Average. | | Maximum. | | Minimum. | |
|---|---|---|---|---|---|---|
| | Rain. | Snow. | Rain. | Snow. | Rain. | Snow. |
| Jan | 4.6 | 14.0 | 10 | 23 | 0 | 5 |
| Feb | 4.0 | 12.6 | 11 | 21 | 0 | 4 |
| Mar | 6.2 | 10.0 | 15 | 18 | 0 | 3 |
| Apr | 10.0 | 3.6 | 17 | 11 | 3 | 1 |
| May | 11.8 | 0.4 | 18 | 2 | 5 | 0 |
| June | 11.9 | 0.1 | 22 | 2 | 5 | 0 |
| July | 10.7 | 0.0 | 16 | 0 | 4 | 0 |
| Aug | 10.8 | 0.0 | 17 | 0 | 4 | 0 |
| Sept | 11.1 | 0.0 | 17 | 0 | 4 | 0 |
| Oct | 12.5 | 1.8 | 22 | 7 | 6 | 0 |
| Nov | 10.0 | 6.9 | 15 | 18 | 5 | 1 |
| Dec | 5.7 | 13.6 | 11 | 23 | 1 | 5 |

*Weather Predictions.*—The rapid changes that are continually taking place in the weather of the countries beyond the tropics have from time immemorial made it desirable to know the probable character of the weather a few days in advance. The predictions made by the ancients and by the majority of persons at present depend generally on local rules founded upon personal experience or tradition. Many of these are of the value of myths, in that they have descended to us from most ancient times, and were brought to us from distant countries, where alone they could have any applicability. Others of these rules have a foundation in a more correct philosophy: thus, the colors of the sky at sunset and sunrise depend on the moisture then present, and give a hint as to the prospect of cloudy or clear weather; thus, also, the behavior of plants and hygroscopic substances depends on the quantity of moisture, and shows whether the air is dry or nearly saturated; the aspects of the clouds, the direction of the wind, the audibility of distant sounds, etc., etc., are all more or less reliable indications of the weather that is to be experienced within a few hours. Those predictions of the weather that are based upon astronomical phenomena, especially the phases of the moon, and which are even still published in popular almanacs, and are as current among the ignorant to-day as they were 3000 years ago, must be looked upon as the outgrowth of ancient systems of astrology; a careful comparison of these predictions with the weather will show that they are no better than they would be if all reference to the celestial bodies was omitted. Some meteorologists have, however, compiled for certain localities tables for weather prediction founded on the assumed natural constancy of climates, and which may be illustrated by an example. Thus, if 100 years of observation at New York show that during the first ten days of September only one is rainy and only three cloudy, then the prediction "clear weather" for any one of those days would have been verified seven times out of ten. This same principle has been skilfully applied to the climate of the Barbadoes by Gov. Rawson, who has tabulated the chances that a rainy season will follow a given dry one, or *vice versâ*, and whose tables, based on thirty years of experience, enable him to attain a very satisfactory degree of precision in his official predictions, which, however, must be regarded as belonging to climatology rather than to the weather. Another interesting question is as to the chance of a change in the weather from day to day. Thus, the permanency of the weather in a portion of the U. S. is such that if we should always predict for to-morrow the same weather that we are experiencing to-day, we should come out right in about six cases out of ten; on the Pacific coast we should come right in about nine cases out of ten.

In so far as weather predictions are based upon the principle of the general uniformity of climate, they can, however, scarcely be said to be the application of scientific meteorology. The predictions published by the meteorological offices of many civilized nations, among which is the U. S., are based upon a very different course of reasoning. In these offices there is being developed a system of rational deductive meteorology in which certain fundamental physical laws are applied to the condition of the atmosphere at any moment as given by observations and weather-charts. It is essential to the successful application of this mode of prediction that the weather-charts should cover a very large extent of territory, since certain atmospheric changes are propagated with great rapidity to great distances; and again, the region for which predictions are to be made should be centrally located with reference to the surrounding stations, since the winds, moisture, and barometric pressure, etc., are liable to advance from the N., S., or E., although most frequently coming from the W. So extensive are these changes that we must view the atmosphere as a whole; and it will readily be granted that only by the study of weather-maps of the entire globe can deductive meteorology attain the completeness toward which it must ever approach. The progress already made, however, warrants the conclusion that in this as in every other department of nature a few inexorable laws are at work producing their results with unerring certainty, and without any of that mysterious chance which is so often spoken of as characteristic of the weather. (See METEOROLOGY and SIGNAL SERVICE.)

C. ABBE.

**Wea'therford,** p.-v., cap. of Parker co., Tex.

**Weatherford** (WILLIAM), b. in Alabama about 1770, was the son of a Seminole woman by a white trader; became a skilful hunter and warrior and the leading chief of his tribe; was the commander in the war of 1813–14 against the U. S.; surrendered to Gen. Jackson Apr., 1814; lived thenceforth peaceably on his plantation at Little River, Monroe co., Ala., where he d. in 1824.

**Weather-Glass.** See BAROMETER, by PRES. F. A. P. BARNARD, and HYGROMETRY, by JOSEPH HENRY, LL.D.

**Weather-Glass, Poor Man's.** See PIMPERNEL.

**Wea'therly,** p.-b., Lausanne tp., Carbon co., Pa. P. 1076.

**Wea'thersfield,** tp., Trumbull co., O. P. 5184.

**Weathersfield,** p.-v. and tp., Windsor co., Vt. P. 1557.

**Weat'land,** p.-v., Clinton co., Ia., on Chicago and North-western and Davenport and St. Paul R. Rs., has 3 churches, 1 graded school, a library, 1 newspaper, Masonic lodge, and 1 hotel. P. 788.

FRANK L. DENNIS, ED. "NEWS."

**Wea'ver** (A. W.), U. S. N., b. July 1, 1832, in the District of Columbia; entered the navy as midshipman May 10, 1848; became lieutenant in 1855, commander in 1866, captain in 1876; served in the Susquehanna at the capture of Forts Hatteras and Clark, and at the battle of Port Royal in 1861; commanded the gunboat Wivern in some sharp battles and skirmishes on the Mississippi River in 1862 and 1863, and in 1865 commanded the iron-clad Mahopac in the last Fort Fisher fight. Favorably mentioned by Rear-Admirals Farragut, Porter, and Lardner.

FOXHALL A. PARKER.

**Wea'ver-Bird,** a common name for the Ploceinæ, a sub-family of the finches, remarkable for their curious nests. They belong to the genera *Ploceus, Euplectes, Textor, Hyphantornis, Philetærus,* etc. Comparatively little is known of these birds, as they are mostly African, although a few are Asiatic, but their remarkable nests, constructed so as to protect the eggs and young from snakes and monkeys, have long been objects of curiosity.

**Wea'ver's Mill,** tp., Morgan co., Ala. P. 494.

**Wea'verville,** p.-v. and tp., cap. of Trinity co., Cal. P. of v. 816; of tp. 1399.

**Weav'ing,** the operation of producing cloth or other textile fabrics by means of a loom from the combination of threads or filaments. The art was rudely practised in the infancy of civilization, was brought to considerable perfection in Egypt, India, and Greece, and has assumed, by the great inventions of modern times, a foremost rank among mechanical industries. (See LOOM, by PROF. W. E. A. AXON.)

**Webb,** county of S. Texas, bounded W. by the Rio Grande, which separates it from Mexico. Stock-raising is the chief industry, and cattle and sheep are numerous. Cap. Laredo. Area, about 1200 sq. m. P. 2615.

**Webb,** tp., Reynolds co., Mo. P. 634.

**Webb** (ALEXANDER S.), son of James Watson, b. in New York Feb. 15, 1835; graduated at West Point July, 1855, when commissioned brevet second lieutenant of 2d Artillery; served with his regiment in Florida and on frontier duty 1855–57; as assistant professor of mathematics at West Point 1857–61. Returning to duty with his regiment, he served in the defence of Fort Pickens Apr.–July, 1861; appointed captain 11th Infantry May 14, 1861, and engaged in the battle of Bull Run, July 21. As major 1st Rhode Island Vol. Artillery, he served in the defences of Washington Sept., 1861–Apr., 1862, and with the Army of the Potomac in the Virginia Peninsular campaign Apr.–Aug., 1862; commissioned lieutenant-colonel and assistant inspector-general Aug. 20, 1862; was chief of staff 5th corps until November, when assigned to duty at Washington as inspector of artillery at Camp Barry. Returning to duty in the field Jan., 1863, he served as assistant inspector-general 5th corps until June 23, when appointed a brigadier-general of volunteers and assigned to the 2d corps. At Gettysburg his brigade met the assault of the third day, where Gen. Webb displayed conspicuous bravery, was wounded, and brevetted major for gallantry. In the subsequent operations of the campaign he commanded a division (2d corps), gaining the brevet of lieutenant-colonel for gallantry at Bristoe Station, Oct. 11, 1863. In the Richmond campaign of 1864 he led a brigade in the battles of the Wilderness and Spottsylvania, being severely wounded in the last day's fight (May 12), and disabled from active service until Jan., 1865, when, returning to duty, he served as chief of staff to Gen. Meade, commanding the Army of the Potomac, during the remainder of the campaign resulting in the surrender of Gen. Lee, and subsequently, until Feb., 1866, as acting inspector-general of the military division of the Atlantic, having been mustered out of the volunteer service the month previous. In July, 1866, he was appointed lieutenant-colonel 44th Infantry, and served at West Point until 1868. In 1871 he accepted the presidency of the College of the City of New York. For gallantry at Gettysburg and Bristoe Station he was brevetted major-general U. S. volunteers, and colonel, brigadier-general, and major-general U. S. A. for gallantry at Spottsylvania and for gallant and meritorious services during the rebellion.

**Webb** (CHARLES HENRY), b. at Rouse's Point, N. Y., about 1835; was founder and editor of the *Californian* newspaper; wrote for other San Francisco papers and for the Eastern magazines; became a well-known humorous correspondent of the New York *Tribune* and other papers under the signature of "John Paul," and travelled in Europe in that capacity 1876. He is the inventor of an adding-machine, and author of several burlesque dramas and travesties.

**Webb** (EDWARD BRAINERD), b. in England in 1820; became an eminent civil and railway engineer; constructed the Londonderry and Coleraine Railway, conducting successfully the great blasting operation at the Downhill Tunnels June 6, 1846; went to Brazil 1852; built there the first railway on the eastern coast of South America; was instrumental in effecting telegraphic communication with Europe and with the distant coast-provinces of Brazil by means of submarine cables, and directed other important works; afterward constructed the first railway in Colombia, and is now (1876) chief engineer to two railways in the Argentine Republic. Author of *Our Iron Breakwaters and Piers* (1862) and other professional works.

**Webb** (GEORGE JAMES), b. in Massachusetts about 1805; was many years professor in the Boston Academy of Music; prepared, with T. B. Hayward, *The Musical Cabinet* (1832), with William Mason *The Melodist;* contributed to William Russell's *Orthophony* (24th ed. 1864), and was author of *The American Glee-Book, The Common-School Songster, The Vocal Class-Book for Schools, The Massachusetts Collection of Psalmody,* and other musical works.

**Webb** (HENRY LIVINGSTON), son of Gen. Samuel B., brother of Gen. James Watson Webb, b. at Claverack, N. Y., Feb. 6, 1795; settled in Southern Illinois in 1817; was repeatedly a member of both branches of the legislature; was a major of volunteers in the Black Hawk war, colonel of the 18th regiment U. S. infantry in the Mexican war, and subsequently general of Illinois militia. D. at Macanda, Ill., Oct. 5, 1876.

**Webb** (JAMES WATSON), son of Gen. Samuel B., b. at Claverack, N. Y., Feb. 8, 1802; entered the U. S. army as 2d lieutenant of Artillery Aug., 1819; became adjutant 3d Infantry 1825; was stationed in 1820 at Chicago, twelve years before even the first house was erected where that flourishing city now exists; was promoted to a first lieutenancy in 1823, and the next year was made assistant commissary of subsistence; in 1827 resigned his commission, and took charge of the *Morning Courier,* which had been established in New York in May of that year;

in 1829 purchased the *Enquirer*, and united the two under the name of *The Morning Courier and New York Enquirer*, and became sole editor, and the next year sole proprietor—a position he held for thirty-four years. This journal was at an early period identified with the interests of the Whig party, and was an able advocate of its principles. In 1851, Gov. Hunt of New York appointed him an engineer-in-chief of the State of New York, with the rank of brigadier-general. In 1849 he was appointed minister to Austria, and to Constantinople in 1861. The same year he was appointed by Pres. Lincoln envoy extraordinary and minister to Brazil, where he served two terms of four years each. Being in Paris in 1865, he negotiated a secret treaty with the emperor Napoleon for the removal of the French troops from Mexico. Gen. Webb resigned the mission to Brazil in 1869, before the inauguration of Pres. Grant, and has since resided in New York City.

**Webb** (Philip Cartaret), b. in England in 1700; became an attorney-at-law, an eminent antiquary, and a member of Parliament, and was a joint solicitor of the treasury 1756–65. D. in 1770. Author of a reply to Warburton's *Divine Legation*, of several forensic publications, of *A Short Account of Domesday Book* (1756), and of *A Short Account of Danegeld* (1756).

**Webb** (Samuel Blatchford), b. at Wethersfield, Conn., Dec. 15, 1753, was the sixth in descent from Richard Webb of Gloucestershire, England, who was made a freeman of Boston 1632, and accompanied Rev. Thomas Hooker in the settlement of Hartford, Conn., 1635, driving away the Dutch, who were settled on the spot subsequently known as Webb's Point. Being a step-son and private secretary of Silas Deane, young Webb took part at an early age in the movements preliminary to American independence, and on hearing of the battle of Lexington promptly left Wethersfield for Boston in command of Capt. Chester's company of light infantry; took part in the battle of Bunker's Hill, where he was wounded; was commended in general orders for gallantry, and wrote to Mr. Deane an account of the battle, now on file in the library of the Connecticut Historical Society. He was soon appointed aide-de-camp to Gen. Putnam; became private secretary and aide-de-camp to Gen. Washington, with the rank of lieutenant-colonel, June 21, 1776; was the writer of the order for promulgating the Declaration of Independence in New York City July 9, 1776; was associated with Col. Joseph Reed a few days later in refusing to receive a letter from Lord Howe addressed to "George Washington, Esq.;" was engaged in the battle of Long Island; was wounded at White Plains and at Trenton; was engaged at Brandywine; raised, and organized almost entirely with his own funds, the 3d Connecticut regiment, of which he took command 1777; was captured with his regiment by the British fleet in Gen. Parsons's unfortunate expedition to Long Island, Dec. 16, 1777, and not exchanged until 1780, when he succeeded Baron Steuben in the command of the light infantry, with the brevet rank of brigadier-general; arranged, by request, the meeting between Washington and Count Rochambeau in the house in which he was born, at Wethersfield, Conn., May 19, 1781; was an intimate and trusted friend of Washington throughout the war, and subsequently was one of the sixteen officers who founded the Society of Cincinnati at Newburg-on-the Hudson June 19, 1783, and was selected to hold for Washington the Bible on which he took the oath of office as first President of the U. S. at New York City 1789. In that year he married Catharine Hogeboom of Claverack, Columbia co., N. Y., where he passed the remainder of his life, and d. Dec. 3, 1807. He kept a diary of his experiences throughout the war, portions of which were printed in 1876.

**Webb** (Thomas Smith), b. in Rhode Island about 1770; became grand master of the (Masonic) grand lodge of Rhode Island; composed Masonic poetry and music; was one of the compilers of the rituals now in use in the U. S., and published *The Free Mason's Monitor, or Illustrations of Masonry* (1797), which is still in high repute, and was edited by E. T. Carson (1865). D. in 1819.

**Webb** (William H.), b. in New York City June 19, 1816; educated in the grammar-schools of New York; learned the art of shipbuilding under his father, Isaac Webb, after whose death, in 1840, he carried on that business, and constructed many vessels of great speed and capacity upon original plans. Among them have been vessels of war for the Russian, Italian, and other foreign governments, and the iron-clad ram Dunderberg for the U. S. navy.

**Webbe** (Edward), b. in London, England, in 1554, son of Richard Webbe, master-gunner of England; resided at Moscow in the service of Capt. Anthony Jenkinson, ambassador to Russia, 1566–68; returned to Moscow in the Russian fleet of 1570; was taken prisoner by the Crim Tartars in their capture of Moscow, May 24, 1571; was taken as a slave to the Crimea, and ransomed the following year; served under Don John of Austria at the capture of Tunis, Oct., 1572; was master-gunner on board the ship Henry when it was captured by the Turks after a fight of two days, 1573; was made a galley-slave; served as a gunner for the Turks in their war against the Persians 1580–82; was afterward taken to Syria, Egypt, India, and Toorkistan, and again to Constantinople, where he was imprisoned in chains with 2000 other Christian slaves; was ransomed 1588; went to Italy; was tried for heresy at Padua; was imprisoned for the same cause at Rome, and also at Naples on suspicion of being a spy; became gunner to the king of Naples; escaped to England 1589; went to France, and was appointed chief master-gunner to Henry IV., but returned to England the following year, when he printed his curious and entertaining book, *The Rare and most Wonderful Things which Edward Webbe, an Englishman borne, hath seene and passed in his troublesome Travailes*, etc. (1590), of which a careful reprint was edited by Edward Arber in 1868. Webbe's subsequent career is unknown.

**Webbe** (George), D. D., b. at Bromham, Wiltshire, England, in 1581; graduated at Corpus Christi College, took orders in the Church of England; became minister of Steeple Aston, Wiltshire, rector at Bath 1621, and bishop of Limerick 1634. D. in 1641. Author of *God's Controversie with England* (1609), *A Posie of Spiritual Flowers* (1610), *The Practice of Quietness* (10th ed. 1705), and other works, and printed many sermons, being "accounted the best preacher in his time in the royal court, and the smoothest writer of sermons that were then published."

**Webbe** (Samuel), son of a government officer, b. in 1740 in Minorca, which then belonged to England; after his father's death came to London; was apprenticed to a cabinet-maker, his mother having become reduced in her circumstances; afterward became a copier of music; learned the principles of composition from a German organist, and published a large number of glees, catches, canons, masses, anthems, and songs, some of which were highly esteemed. He studied Latin, French, Italian, and German, and is said also to have had some knowledge of Hebrew. D. in London May 25, 1816.—He had a son of the same name, b. in London about 1770, who was also a distinguished composer.

**Webbe** (William), b. in England about the middle of the sixteenth century; graduated at one of the universities; translated Virgil's *Georgics* into English hexameters, and published *A Discourse of English Poetrie, together with the Author's Judgment touching the Reformation of our English Verse* (London, 1586), republished in vol. ii. of Haslewood's *Ancient Critical Essays upon English Poets and Poetry* (2 vols., 1811–15), and recently edited by Edward Arber in vol. xi. of his *English Reprints* (1870), and wrote *Tancred and Gismund, a Tragedy* (1592). His later career is unknown.

**Web'ber** (Charles Wilkins), b. at Russellville, Ky., May 29, 1819; was a grand-nephew of Hon. William Wilkins of Pittsburg and nephew of Wilkins Tannehill, a distinguished Western writer; went in 1838 to Texas, then struggling for independence; was for several years connected with the famous Texan Rangers, seeing much of wild and adventurous life on the frontier, which afterward furnished the material for several books; returned to Kentucky and studied medicine; afterward entered Princeton Theological Seminary with a view to the Presbyterian ministry, but soon abandoned that purpose, and settled in New York as a writer for literary periodicals, especially the *New World*, the *Democratic Review*, and the *Sunday Despatch*; was associate editor and joint proprietor of the *Whig Review*; projected with the two sons of his friend Audubon the naturalist a monthly magazine of mammoth size to be illustrated with copper-plate colored engravings by Audubon, but published only the first number; was engaged in an unsuccessful attempt to lead an exploring and mining expedition to the region of the Colorado and Gila rivers 1849, and in 1855 went to Central America, where he joined the filibuster Walker in Nicaragua, and was killed in a skirmish the following year (1856). Author of *Old Hicks the Guide, or Adventures in the Camanche Country in Search of a Gold-Mine* (1848), *The Gold-Mines of the Gila* (1849), *The Hunter Naturalist, etc.* (1851), with 40 engravings from original drawings by Mrs. Webber; *Wild Scenes and Song-Birds* (1854), with 20 colored illustrations from drawings by Mrs. Webber; *Tales of the Southern Border* (1852), *Spiritual Vampirism* (1853), *Shot in the Eye, and Adventures with the Texan Rifle Rangers* (1853), and other works.

**Webber** (Samuel), D. D., b. at Byfield, Mass., in 1759; graduated at Harvard College 1784; became a Con-

gregational minister; was professor of mathematics and natural philosophy in that institution 1789–1806, and president from May 6, 1806, until his death, at Cambridge July 17, 1810. He was one of the commissioners employed by the U. S. government to determine the N. E. boundary, and published a textbook of mathematics (1801).

**Web'berville,** p.-v., Travis co., Tex. P. 330.

**Webb's Mill,** tp., Clarke co., Ala. P. 799.

**We'ber,** county of N. Utah, lying on the Great Salt Lake, intersected by Weber River and traversed by Central and Union Pacific and Utah Central R. Rs. The surface in the centre is mountainous, and the streams flowing thence toward Salt Lake irrigate and fertilize a considerable tract. Cattle and sheep are the chief live-stock. Staples, wheat, Indian corn, and potatoes. Cap. Ogden City. Area, 540 sq. m. P. 7858.

**Weber,** a river which rises in the Wahsatch Mountains, in Summit co., Ut., and after passing through cañons remarkable for their noble and strange scenery, its waters at last reach Great Salt Lake. It is a small stream, but is important as affording a route for the Union Pacific R. R. It abounds in fine trout.

**Weber** (Albrecht Friedrich), b. at Breslau Feb. 17, 1825; studied classical and Oriental philology in his native city, in Bonn, and in Berlin under Bopp; visited England and France in 1846, and was appointed professor of ancient Indian languages and literature at the University of Berlin in 1856. His principal works are his edition of *White Yajurveda* (3 vols., 1849–59) and *Indische Studien* (10 vols., 1849–67), containing many valuable essays on subjects relating to Indian language, literature, and antiquities. He also wrote—*Vorlesungen über indische Literaturgeschichte* (1852), *Die vedischen Nachrichten von den Naxatra* (2 vols., 1860–61), *Ueber das Râmâyana* (1870), *Ueber ein zum weissen Yajus gehöriges phonetisches Compendium des Pratijnâsûtra* (1872).

**Weber** (Ernst Heinrich), b. at Wittenberg June 24, 1795; studied medicine at Leipsic, and was appointed professor there of comparative anatomy in 1818; in 1840 also in physiology. His principal works are—*Anatomia Comparata Nervi Sympathici* (1817), *De Aure et Auditu Hominis et Animalium* (1820), *Lehre vom Bau und von der Verrichtung der Geschlechtsorgane* (1846), and a number of minor essays and monographs collected in 1851 under the title *Annotationes Anatomicæ et Physiologicæ.*—His brother, Wilhelm Eduard Weber, b. at Wittenberg Oct. 24, 1804, studied natural science at Halle; was appointed professor of physics at Göttingen in 1831, but dismissed in 1837 for political reasons; accepted a chair in 1843 at Leipsic, but returned in 1849 to Göttingen. In connection with his brother, Ernst Heinrich, he published in 1825 *Die Wellenlehre,* and in 1840, in connection with Gauss, *Resultate aus den Beobachtungen des magnetischen Vereins,* with an *Atlas des Erdmagnetismus.* From 1846 to 1867 he also published a series of essays on the connection between electricity and magnetism under the title *Elektrodynamische Massbestimmungen.* — The third brother, Eduard Friedrich Weber, b. at Wittenberg Mar. 10, 1806; studied medicine at Leipsic and Halle; was appointed professor of medicine at Leipsic in 1835, and d. there May 18, 1871. In connection with his brother, Wilhelm Eduard, he wrote *Mechanik der menschlichen Gewerkzeuge* (1836).

**Weber, von** (Karl Maria Friedrich Ernst), Baron, b. at Eutin, near Lubeck, Dec. 18, 1786; showed very early great talent for art, especially for music, but received a somewhat forced and desultory education, as his father, an unstable character and a man of very various fortune—successively a soldier, a financial agent, a chapel-master, and now the leader of a band of strolling actors—wished to make him a musical prodigy, such as Mozart had been. Wandering about from place to place, young Weber published in 1798 his first composition, six fughettis for the piano, and wrote his first opera, *Die Macht der Liebe und des Weins.* The result, however, did not answer the expectations, and for a couple of years father and son devoted themselves to the improvement of the recent invention of lithography by Senefelder. In 1800 their enthusiasm and means of subsistence were spent. Young Weber returned to his art, and produced the opera *Das Waldmädchen,* which was performed at Chemnitz, and in the following year *Peter Schmoll und seine Nachbarn,* which was performed in 1802 at Augsburg; neither of these works, however, produced any great effect. In 1803 he went to Vienna, where he studied under the celebrated Abbé Vogler, a spirited and peculiarly-gifted teacher of music, and by his recommendation he received in 1804 a place as director of music at the theatre of Breslau. Here he began to compose a great opera, *Rübezahl,* which he never finished, and of which only the overture exists in a much altered form, *Zum Beherrscher der Geister;* but the situation did not agree with his tastes, and in 1806 he accepted a position as private secretary to Duke Louis of Würtemberg. At this the most dissolute court in Europe he spent four years in idleness and dissipation. Like his father, he had a taste for "high life," but no talent for it; in 1810 he left Ludwigsburg morally and bodily impaired, in debt, and in disgrace. Once more he met with Abbé Vogler in Darmstadt, and under the influence of the atmosphere which he breathed here he again took up music, composed the cantata, *Der erste Ton,* several sonatas, overtures, etc., transformed the *Waldmädchen* into the *Sylvana,* which was performed with some success at Frankfort, and wrote the operetta *Abu Hassan.* After travelling in Germany and Switzerland, he settled in 1813 in Prague as director of the opera, and remained here till 1816, doing good service and establishing for himself a wide reputation. He possessed great ability as an operatic manager, and his music (in 1814) to Körner's war-songs, among which were *Lützow's wilde Jagd, Schwertlied,* etc., and his great cantata *Kampf und Sieg* after the battle of Waterloo, were true revelations of his genius, and spread his fame all over Germany. In 1816 he went to Dresden as director of the royal opera, and here he remained till his death. The position was not without difficulties. The Italian opera was the pet of the court, and the great work of Weber's life was to drive the Italian opera out of Germany. Not one of his great operas was first brought on the stage in Dresden. *Preciosa* and *Freischütz* were first performed at Berlin Mar. 15 and June 18, 1821, *Euryanthe* at Vienna Oct. 25, 1823, and *Oberon* at London Apr. 12, 1826. The success of *Freischütz,* however, was instantaneous and very great. In Berlin it completely annihilated the influence of Spontini. It became a favorite on the operatic stage of Northern and Central Europe; it exercised a decided influence on Marschner and Mendelssohn, on Meyerbeer and Auber, on the whole modern music, even on Richard Wagner; and as it was the first, it is still one of the freshest, musical embodiments of the romantic spirit. Weber conducted in person the first performance of *Oberon,* and d. shortly after, June 5, 1826, at London. He was buried in Moorfields chapel, but in 1844 his remains were brought to Dresden, where in 1860 a fine statue of him by Rietschel was raised in front of the theatre. His *Autobiography* and other writings were edited in 1828 in 3 vols. by Theodor Hell, and his life was elaborately described by his son (in 3 vols., 1864). Clemens Petersen.

**Web'ster,** county of S. W. Georgia, drained by affluents of Chattahoochee and Flint rivers; surface undulating, soil fertile. Staples, cotton, Indian corn, and sweet potatoes. Cap. Preston. Area, 325 sq. m. P. 4677.

**Webster,** county of Central Iowa, drained by Des Moines and Lizard rivers, and traversed by Des Moines Valley and Illinois Central R. Rs.; surface undulating, with alternate prairie and woodland; soil moderately productive. Staples, Indian corn, wheat, hay, and wool. Cap. Fort Dodge. Area, 1080 sq. m. P. 10,484.

**Webster,** county of N. W. Kentucky, drained by Green River and its affluents, and traversed by St. Louis and South-eastern R. R.; surface rolling, soil productive. Swine and sheep are the chief live-stock. Staples, tobacco, Indian corn, and wool. Cap. Dixon. Area, 290 sq. m. P. 10,937.

**Webster,** parish of N. W. Louisiana, bordering on Arkansas, formed since the census of 1870; surface rolling, soil productive. Cap. Minden. Area, 550 sq. m. P. 9522.

**Webster,** county of S. W. Missouri, drained by branches of Gasconade and White rivers and traversed by Atlantic and Pacific R. R.; surface undulating, with much iron ore; soil fertile. Swine, sheep, and cattle are the principal live-stock. Staples, Indian corn, wheat, oats, tobacco, and wool. Cap. Marshfield. Area, 575 sq. m. P. 10,434.

**Webster,** county of S. Nebraska, bordering on Kansas, and intersected by Republican River; surface undulating, soil fertile. Cap. Red Cloud. Area, 576 sq. m. P. 2590.

**Webster,** county of Central West Virginia, drained by Elk and Gauley rivers; surface hilly, with much bituminous coal and iron ore. Staples, Indian corn, wool, and tobacco. Cap. Webster Court-house. Area, about 400 sq. m. P. 1730.

**Webster,** tp., Fayette co., Ala. P. 647.

**Webster,** tp., Harrison co., Ind. P. 1025.

**Webster,** v., Tippecanoe tp., Kosciusko co., Ind. P. 87.

**Webster,** tp., Hamilton co., Ia. P. 811.

**Webster,** tp., Madison co., Ia. P. 486.

**Webster,** tp., Webster co., Ia. P. 560.

**Webster,** p.-v. and tp., Androscoggin co., Me. P. 939.

**Webster,** p.-v. and tp., Worcester co., Mass., at the junction of Norwich and Worcester and Southbridge branch of New York and New England R. Rs., 16 miles S. of Worcester, contains 7 churches, excellent public schools, 1 bank, a library association, 1 newspaper, several iron and brass foundries, a straw-factory, and 1 woollen, cotton, and linen mill. The Norwich line of steamers to New York City has its terminus here. P. 4763. JOHN CORT, ED. "TIMES."

**Webster,** tp., Houghton co., Mich. P. 876.

**Webster,** p.-v. and tp., Washtenaw co., Mich. P. 974.

**Webster,** tp., Rice co., Minn. P. 414.

**Webster,** p.-v. and tp., Merrimack co., N. H. P. 689.

**Webster,** p.-v. and tp., Monroe co., N. Y. P. of v. 291; of tp. 2749.

**Webster,** p.-v. and tp., cap. of Jackson co., N. C. P. 1407.

**Webster,** tp., Scioto co., O. P. 200.

**Webster,** tp., Wood co., O. P. 922.

**Webster,** tp., Marshall co., West Va. P. 1143.

**Webster,** p.-v. and tp., Taylor co., West Va. P. 955.

**Webster,** tp., Vernon co., Wis. P. 812.

**Webster** (BENJAMIN), b. at Bath, England, Sept. 3, 1800; educated for the navy, and afterward for the musical profession, but ultimately became an actor in 1825; maintained a high popularity during an artistic career of half a century; became manager of the Haymarket Theatre 1837; employed Bulwer-Lytton, J. S. Knowles, Douglas Jerrold, and Bayle Bernard, and many other dramatists, paying annually some £2000 for original plays, which were brought out by Macready, Wallack, Strickland, Matthews, and their compeers; built the New Adelphi 1858, and became lessee of the Olympic 1866, both of which theatres are still (1876) under his management, and is president of the new Dramatic College.

**Webster** (DANIEL), LL.D., b. at Salisbury (now Franklin), N. H., Jan. 18, 1782, being the second son of Ebenezer Webster by his second wife, Abigail Eastman; enjoyed but limited educational advantages in childhood, and was indebted for his earliest instruction to his mother; spent a few months in 1797 at Phillips Exeter Academy under Benjamin Abbot; completed his preparation for college in the family of Rev. Samuel Wood at Boscawen; entered Dartmouth College in the autumn of 1797; supported himself in great part by teaching school during the winters; was considered the foremost scholar of his class, being decidedly proficient in the classics and in English literature; was distinguished in the debates of the college societies, before which he delivered several addresses which found their way into print; graduated 1801; entered the law-office of Hon. Thomas W. Thompson (afterward U. S. Senator) at Salisbury; continued his legal studies in 1802 at Fryeburg, Me., where he was principal of the academy, and acted as copyist in the office of the registrar of deeds; completed his studies in the office of Christopher Gore, Boston, 1804–05, at which time he was assiduous in preparing reports of cases decided by the supreme and circuit courts; was admitted to the Suffolk bar in the spring of 1805; commenced practice at Boscawen, N. H.; removed to Portsmouth 1807; soon rose to eminence at a bar where Samuel Dexter, Joseph Story, and Jeremiah Mason were at the height of their fame; married Grace Fletcher of Hopkinton, N. H., June, 1808; became known as a decided Federalist, but did not at first court political honors; attracted notice by his eloquence in opposing the declaration of war against Great Britain; was consequently nominated and elected to Congress by the Federalists 1812; took his seat in the special session of May, 1813; was appointed to the committee on foreign affairs; made his maiden speech June 10, 1813, in support of a series of resolutions moved by himself in condemnation of the Berlin and Milan decrees; took a prominent part in the debates on the war and the finances, advocating the increase of the navy and the repeal of the embargo; effected the defeat of the proposal for a new U. S. bank by means of a speech exhibiting great mastery of economical subjects; was re-elected 1814; supported the charter of the Bank of the U. S. Apr., 1816, and secured the passage of a resolution for a return to specie payments at the Federal custom-houses; was admitted to practice at the bar of the Supreme Court at Washington; removed to Boston, Mass., 1816; devoted himself with great assiduity to the practice of his profession for seven years; gained by his argument in the celebrated Dartmouth College case, carried by appeal to Washington in 1817, a rank among the most distinguished jurists of the country (Mar. 10, 1818); was thenceforth retained in nearly all the leading cases before the Federal Supreme Court; was chosen in 1820 a member of the convention for revising the constitution of Massachusetts, in which task he bore a leading part; delivered at Plymouth, Dec. 22, 1820, his celebrated discourse on the 200th anniversary of the landing of the Pilgrims, which was the pioneer of those great efforts which placed him in the front rank of orators; declined about this time a nomination as U. S. Senator; was elected a Representative in Congress from the city of Boston 1822; took his seat Dec., 1823; made early in the session (Jan., 1824) his celebrated speech on the Greek revolution, which established his reputation as one of the first statesmen of the age; opposed the increase of protective duties, and as chairman of the judiciary committee reported and carried through a complete revision of the laws of the U. S.; was almost unanimously re-elected in the autumn of 1824, when he supported the candidacy of John Quincy Adams, of whose administration he became the leading Congressional champion, advocating in a notable speech the convocation of the congress of Panama for the consolidation of the independence of the Spanish American republics; added to his fame as a popular orator by his magnificent address at the laying of the corner-stone of the Bunker Hill Monument June 17, 1825, and by his eulogy of Adams and Jefferson delivered at Faneuil Hall, Boston, Aug., 1826; was re-elected to Congress in the latter year, but transferred to the Senate in 1827 to fill the unexpired term of Elijah H. Mills, who resigned from ill-health; retained his seat in that body by successive re-elections until 1841; made his début in the Senate by an elaborate argument in favor of moderation in the proposed augmentation of the duties on foreign woollens, but nevertheless gave his vote for the protective tariff of 1828; lost his wife in January of that year; married Caroline Bayard Le Roy of New York City Dec., 1829; made what is generally regarded as the ablest of his parliamentary efforts in his second speech (Jan. 26–27, 1830) in reply to Robert Y. Hayne of South Carolina, who in the famous debate which incidentally arose upon a resolution offered by Senator Samuel A. Foot of Connecticut, in relation to a survey of the public lands, had bitterly attacked the Eastern States, and had affirmed for the first time the doctrine of nullification; and, though opposed to the financial policy of Gen. Jackson, gave him a cordial support in his measures for the defence of the Union against the anarchical policy proclaimed by John C. Calhoun; made a notable speech in May, 1832, in favor of the renewal of the charter of the U. S. Bank; supported Henry Clay for the Presidency in that year, but opposed his Compromise tariff bill, and voted for the "Force bill" of the administration in the great nullification crisis of 1833, when he victoriously measured his forces in debate with Calhoun; united with him, nevertheless, in securing the passage of the famous resolutions condemning Jackson's course on the removal of the deposits Sept., 1833; purchased about this time an estate by the seaside at Marshfield, Mass., which he made his summer residence; was recognized as the chief Northern leader of the Whig party, organized about 1834, upon the general break-up of the earlier party issues; received the electoral vote of Massachusetts for the Presidency 1836; opposed the Sub-Treasury bill in Sept., 1837, in a speech reputed the most effective of all his arguments on the subject of finance; made a brief visit to Europe in 1839, being received in the court-circles of England and France with the attention due to his character and talents; took an active part in the Presidential campaign of 1840 in favor of Gen. Harrison, whose success he facilitated by his eloquence no less than by the prompt withdrawal of his own proposed candidacy for the second place on the ticket; was appointed secretary of state by Pres. Harrison Mar., 1841, and continued in office by Pres. Tyler; displayed consummate diplomatic ability in the negotiation of the "Ashburton treaty" of Aug. 9, 1842, which terminated in a favorable manner long-pending questions upon the impressment of seamen and the N. E. boundary of the U. S.; remained in office, at a great sacrifice of personal interest and inclination, after the disruption of the cabinet by the defection of Pres. Tyler from Whig interests, through a patriotic desire of completing these and other important diplomatic negotiations; resigned his post May, 1843; resumed with energy, for a short time, the practice of his profession at Boston, declining the offer of a seat in the Senate; delivered a splendid oration on the completion of the Bunker Hill Monument 1843; was pressed by his friends for the Presidential nomination in 1844, when with great earnestness he supported Mr. Clay and opposed the annexation of Texas; resumed his seat in the Senate as the successor of Rufus Choate Dec., 1845; combated the admission of Texas as a slave State and the prosecution of the Mexican war (in which, nevertheless, his second son, Edward, took part as major of Massachusetts volunteers, and died in the City of Mexico); contributed in an unofficial way to the solution of the Oregon question with Great Britain 1847; was dis-

appointed in his well-founded expectation of receiving the Whig nomination for the Presidency 1848; was profoundly affected by the magnitude of the legislative issues which arose in the session of 1849–50 from the recent annexation of Mexican territory and the discovery of gold in California, and, though retaining his anti-slavery convictions, was induced by a controlling desire for peace to support Clay's "Compromise measures," including the Fugitive Slave law, in a famous speech of Mar. 7, 1850, which lost him the confidence and support of the majority of the Whig party, and thereby contributed to its disorganization and extinction; became secretary of state under Pres. Fillmore on the death of Gen. Taylor, July, 1850; displayed all his wonted energy and ability in the famous correspondence with Chevalier Hulsemann, the Austrian minister (Dec., 1850), upon the reception accorded to Kossuth and the Hungarian exiles; in the measures taken to repress filibustering expeditions against Cuba, and afterward to obtain the pardon of the followers of Narciso Lopez, who had been deported to Spain; in the collision with British pretensions relative to Central America and to the fisheries; and in the negotiation of a treaty securing reciprocity with the Canadian provinces; delivered a magnificent address at the laying of the corner-stone of the Capitol extension at Washington July 4, 1851; made his last forensic argument in the celebrated Goodyear patent case at Trenton, N. J., Jan., 1852; was thrown from his carriage and seriously injured near Plymouth, Mass., May, 1852; was defeated by Gen. Scott in the contest for the Presidential nomination at the Baltimore Whig convention of that year, receiving only 32 votes; made a brief visit to Washington in August, and tendered his resignation on account of failing health, but was prevailed upon to remain in office in the vain hope of a recovery. He d. at Marshfield Oct. 24, 1852, and was buried in the family tomb erected by himself in the cemetery of that town.—He left but one surviving child, FLETCHER, b. at Portsmouth, N. H., July 23, 1813, who graduated at Harvard 1833; became a lawyer and private secretary to his father; was secretary of legation to China 1843; surveyor of the port at Boston 1850–61; entered the Union service as colonel of the 12th Massachusetts Vols., and was killed at the battle of Bull Run, Va., Aug. 30, 1862.—In person, Mr. Webster was of imposing stature, with a head and brain of unusual size, a dark complexion, and large, dark, lustrous eyes, and has been well represented in numerous portraits and in a magnificent bust by Hiram Powers. He possessed great strength; was from his youth passionately fond of athletic sports, hunting, and fishing; paid much attention to scientific agriculture and to the improvement of stock on his celebrated Marshfield estate; was of genial and convivial habits, and sometimes imprudent in the latter particular; was generous and improvident in money-matters, which had to be managed for him by a self-constituted committee of his lifelong supporters, the "solid men of Boston;" was devoted to his family and his friends; abounded in gayety and humor in his conversation; was the supreme representative of American eloquence in its argumentative and logical aspect, being master of a pure vigorous English style, cultivated by close and long-continued study of the English classics; and in grasp of intellect has been excelled by few of his age or country. Early in life he joined the Congregational Church, and, though he did not remain actively identified with any religious body, was a diligent student of the Bible, and caused a statement of his firm belief in Christianity to be inscribed upon his tomb. By his will he appointed as his literary executors Edward Everett, George Ticknor, Cornelius C. Felton, and George Ticknor Curtis. Many partial collections of his speeches have been made. An authoritative edition of his works appeared under the title *The Speeches, Forensic Arguments, and Diplomatic Papers of Daniel Webster* (6 vols., 1851; 12th ed. 1864), preceded by a *Notice of his Life and Writings* by Edward Everett. Two volumes of his *Private Correspondence* were published by his son Fletcher (1857; 5th ed. 1864). Several popular biographies have appeared, including one by the present writer (*The Private Life, etc.*, 1853), and an elaborate *Life* was written by George Ticknor Curtis (New York, 2 vols., 1869). A work on *Daniel Webster and his Contemporaries*, by Hon. C. W. Marsh, has appeared in New York in the present year (1876). CHARLES LANMAN.

**Webster** (EBENEZER), father of Daniel, b. at Kingston, N. H., in 1739; served under Gen. Jeffrey Amherst in the French war; was one of the original settlers of Salisbury (now Franklin), N. H., 1761, that town being then the most northern settlement in New England; kept a country inn; was captain of the Salisbury militia at the siege of Boston 1775; served at White Plains and at Bennington; was at West Point at the time of the treason of Arnold; attained the rank of colonel of militia; sat in both branches of the State legislature; was judge of common pleas of Hillsborough county from 1791 until his death, and was reputed a man of great natural endowments and force of character. D. at Salisbury in 1806.

**Webster** (EZEKIEL), brother of Daniel, b. at Salisbury, N. H., Mar. 11, 1780; graduated at Dartmouth College 1804; studied law; attained considerable eminence at the New Hampshire bar, and served in the State legislature. D. at Concord, N. H., Apr. 10, 1829.

**Webster** (HORACE), b. in Hartford, Vt., Sept. 21, 1794; graduated at the U. S. Military Academy July, 1818, when appointed 2d lieutenant of infantry, but retained at West Point as assistant professor of mathematics until Oct., 1825, at the close of which year he resigned his commission of first lieutenant, having accepted the appointment of professor of mathematics and philosophy in Geneva (now Hobart) College. In 1848 was appointed principal of the Free Academy then organizing in the city of New York, plans of organization of which he prepared. From 1852, in addition to his duties as president, he was also professor of moral, intellectual, and political philosophy until 1869, when he retired from the presidency and accepted the place of emeritus professor. Under his able administration the institution over which he so long presided became justly celebrated, and is now known as the College of the City of New York. D. at Geneva, N. Y., July 12, 1871.

**Webster** (JOHN), b. in England toward the close of the sixteenth century; was associated with Dekker, Chettle, Drayton, Marston, Rowley, Middleton, Munday, Heywood, and Wentworth Smith in writing some of their plays, and ultimately became an author on his own account. Of his personal history nothing is known. Among his dramas are *The White Devil* (1612), *The Duchess of Malfy* (1623), and *Appius and Virginia* (1624). The two former have greater resemblances to Shakspeare than the productions of any of his contemporaries. Webster's dramatic works have been edited by Dyce (4 vols., 1830) and by Hazlitt (4 vols., 1857–58).

**Webster** (JOHN), b. in England about 1590; was one of the principal settlers of Hartford, Conn., 1636; was a magistrate 1639–55, deputy governor 1655, and governor 1656, and in 1659 was associated with Rev. Mr. Russell and others in purchasing and settling the territory now forming the towns of Hadley, Hatfield, Granby, and Amherst, Mass. D. at Hadley Apr. 5, 1661.

**Webster** (JOSEPH DANA), b. at Hampton, N. H., Aug. 25, 1811; graduated at Dartmouth College in 1832; appointed second lieutenant in the corps of topographical engineers July, 1838, in which he attained a captaincy in 1853; resigned Apr., 1854, and removed to Chicago, where he was president of the commission on sewerage which perfected the remarkable system of sewerage for that city; also planned and executed the raising of the grade of Chicago. In the civil war he became colonel 1st Illinois Heavy Artillery; was Gen. Grant's chief of staff at the battle of SHILOH (which see), where at the close of the first day's fight by great energy he occupied the ridge covering Pittsburg Landing with all the remaining artillery, by which means the hitherto victorious enemy were checked. Commissioned brigadier-general Nov. 29, 1862, and for a time military governor of Memphis; chief of staff to Gen. Grant during the Vicksburg campaign, and to Gen. Sherman from 1864 to close of the war. Assessor of internal revenue at Chicago 1869–72; assistant U. S. treasurer at Chicago until July, 1872, when appointed collector U. S. revenue. D. at Chicago Mar. 12, 1876.

**Webster** (NOAH), LL.D., b. at West Hartford, Conn., Oct. 16, 1758, a descendant of Gov. John Webster, and on the mother's side of Gov. William Bradford of Plymouth; graduated at Yale College 1778; pursued the study of the law while teaching school at Hartford; was admitted to the bar 1781; taught a classical school at Goshen, Orange co., N. Y., 1782–83; prepared there his spelling-book, grammar, and reader, printed under the title *A Grammatical Institute of the English Language, etc., in Three Parts* (Hartford, 1783–85), a work so successful that the sale of the spelling-book had in 1876 exceeded 40,000,000; printed an edition of Gov. Winthrop's *Journal;* wrote political articles for the Hartford *Courant* 1784; published *Sketches of American Policy* (1785), advocating the formation of a Federal Constitution; travelled in the Southern States the same year, visiting Washington at Mount Vernon; delivered a course of lectures on the English language in the principal Atlantic cities 1786; taught an Episcopal academy at Philadelphia 1787, in which year he issued a pamphlet, *An Examination of the Leading Principles of the Federal Constitution;* edited in New York Dec., 1787, to Nov., 1788, the *American Magazine*, an unsuccessful enterprise; practised law at Hartford 1789–93; married a daughter of William Greenleaf of Boston 1789; returned to New York,

and founded Nov., 1793, a daily paper, the *Minerva*, to which was soon added a semi-weekly edition entitled the *Herald*, papers which still exist (1876) under the names *Commercial Advertiser* and *New York Spectator;* published in his paper, over the signature of "Curtius," an elaborate defence of Jay's treaty; settled in New Haven 1798; published *A Brief History of Epidemics* (2 vols., 1799), *Rights of Neutral Nations in Time of War* (1802), a *Compendious Dictionary of the English Language* (1806), and a *Philosophical and Practical Grammar of the English Language* (1807); devoted himself thenceforth to the great labor of his life, the preparation of the *American Dictionary of the English Language* (2 vols. 4to, 1828), having formed for his own use a *Synopsis of Words in Twenty Languages*, which remains unpublished; resided at Amherst, Mass., 1812–22; was influential in the establishment of Amherst College, and was president of its first board of trustees; returned to New Haven 1822; visited Europe 1824–25, pursuing his philological studies at the Bibliothèque du Roi, Paris, and completing his dictionary by the aid of the libraries of the University of Cambridge 1825, and devoted his leisure for the remainder of his life to the revision of that work and of his schoolbooks, and to the preparation of a series of intermediate dictionaries. He was for several years a member of the legislatures of Massachusetts and Connecticut, judge of one of the State courts of Connecticut, and took a prominent part in scientific and literary associations which were grouped around Amherst and Yale colleges, being assisted in the preparation of his dictionary by several members of the faculty of the latter institution. From 1808 he was a member of the Congregational Church, and was universally beloved for the simplicity, uprightness, and kindliness of his character. D. in New Haven May 28, 1843. He had superintended in 1840 the publication of the 2d ed. of his *Dictionary* (1840–41), carefully revised and with the addition of several thousands of words. A 3d ed. was edited by his son-in-law, Prof. Chauncey A. Goodrich, D. D. (1847), as also the 4th ed. (pictorial, 1859), the latter containing 99,798 words. A 5th ed., with 114,000 words, 3000 illustrations, and extensive revisions in every branch, but especially in etymology, was brought out in 1864 by Prof. Noah Porter, D. D., now president of Yale College. A 6th ed. is understood to be in preparation, to which the labors of several years will be devoted. Among the many minor publications of Dr. Webster were *Dissertations on the English Language* (1789), *A Collection of Essays* (1790), *The Revolution in France* (1794), *Political Progress of Britain* (1795), *Letters to Dr. Priestley* (1800), *Banking Institutions and Insurance Offices* (1802), *Origin, History, and Connection of the Languages of Western Asia and of Europe; Letters to a Young Gentleman on commencing his Education* (1823), *A History of the U. S.* (revised ed., 1838), and *A Collection of Papers on Political, Literary, and Moral Subjects* (1843), including reprints of some of the preceding. He also published editions of the Bible (1833) and of the New Testament (1839), "with amendments of the language." PORTER C. BLISS.

**Webster** (PELATIAH), b. at Lebanon, Conn., in 1725; graduated at Yale College 1746; studied theology; preached at Greenwich, Mass., 1748–49; became a wealthy merchant at Philadelphia; was an active promoter of independence, both by his pen and his purse, for which he suffered imprisonment in the city jail by the British authorities 1778, and was an able writer upon finance and politics. D. at Philadelphia in Sept., 1795. Author of *An Essay on Free Trade and Finance* (1779–80), *A Dissertation on the Political Union and Constitution of the Thirteen United States of North America* (1783), *An Essay on Credit, in which the Doctrine of Banks is considered* (1786), *Political Essays on the Nature and Operation of Money, Public Finances, etc.* (1791), and other treatises of similar character, chiefly contributed to the periodicals of Philadelphia.

**Webster** (THOMAS), b. in the Orkney Islands about 1773; was educated as an architect; became an assistant to Count Rumford in his researches in domestic economy; subsequently devoted himself to scientific pursuits, especially geology; became keeper of the museum of the London Geological Society, and its draftsman 1814; house secretary and curator 1826, and professor of geology in University College, London, 1840. D. in London Dec. 26, 1844. Author of several geological monographs, and, with Mrs. Frances Byerley Parkes, of the well-known and valuable *Encyclopædia of Domestic Economy* (1844).

**Webster** (THOMAS), R. A., b. in London, England, Mar. 20, 1800, son of a musician of the royal establishment at Windsor; became in boyhood a member of the choir at the chapel royal, St. James; studied painting at the Royal Academy, where he exhibited a portrait-group 1823; has been since 1835 one of the best-known English painters of domestic scenes, which usually abound in "character, expression, and quiet humor," and was elected to the Academy 1846. Among his best efforts are the exquisite *Dame's School* (1845) in the Vernon Gallery, *A Village Choir* (1848), and *Dotheboys Hall* (1848).

**Webster City,** p.-v., Boone tp., cap. of Hamilton co., Ia., has 2 newspapers. P. 1339.

**Webster Court-house,** p.-v., cap. of Webster co., West Va.

**Webster Groves,** p.-v., St. Louis co., Mo.

**Webster's Plantation,** tp., Penobscot co., Me. P. 28.

**Weddahs** (*Veddas*), the name of a primitive hill-tribe in Ceylon. The pronunciation of the name of the community in regard to the *first* letter is one which is not clearly distinguishable. It is somewhat between the sound of *v* and *w*. The same difficulty exists in English. We see some poets of great rhythmic power rhyming *love* with *of, enough, prove*, and *rough*. Thus "Weddah" might be written "Veddah." As the word is pronounced in Ceylon it would perhaps be most accurately written as "*Vweddha*." The terminal *h* is customary, not needful. Take in English the case of the virtually silent *f* (as in the name *Ffoulkes*) or the hardly-pronounceable *D* in Dnieper or Dniester of the Russian, or the *kee*-sound in the Spanish Guadal*qui*vir. By these analogies, so near at home, one may see a glimpse of the difficulties of Oriental transliteration. Some Weddahs themselves pronounce the name of their tribe and caste *H'hed*, seemingly a short, sharp, aspirated ejection of tone, with "*ed*" for the base; the *d* being *hard*, produced by the excessive curling of the tongue during the act of pronunciation.

The Weddahs are confined to Ceylon. They occupy a small territory, 90 miles long, 40 broad. They were especially brought to the notice of the prince of Wales during his royal tour through India, and executed before him some curious antics—"dances" they could scarcely be called. Some are jungle Weddahs, and some are half civilized. The latter live in rude villages. The former, living in the highlands of Uva and Medamahanuwara, are wilder, and shift their habitations. They clear out a piece of jungle and plant such roots as tapioca upon it, feed on honey and fruits, and monkeys, etc., shot by their arrows, and after a year's sojourn in small reed huts constructed by their clearings, they remove to another locality, and open out more jungle to cultivate the virgin soil. The village Weddahs are more settled, but the instinct of the whole tribe is nomadic. There are not more than 1000 primitive, pure-blooded Weddahs living now, but the very rarity of the caste makes a study of it valuable. Diamonds would not be precious unless they were rare. It is said that the Weddahs of the primeval forests of Ceylon never build any kind of hut or dwelling by which they may be protected from climatic influences. This is, at least, scarcely probable. They often in their wanderings make shift for themselves, but their reed huts are known to many inland Ceylon coffee-cultivators. They are fond of chasing deer and trapping the porcupine. They always *cook* their food before they eat it. They are fond of iguanas. They have good packs of hunting-dogs. Water is, with honey and palm-wine, their exclusive drink. They are only lately beginning to learn to smoke. They sometimes chew betel and the bark of various trees. They are generally "left-handed," as the saying is; and though the tallest Weddah known is not more than 5 feet 4½ inches high, they are wiry and capable of great exertion. In Mr. Hartshorne's essay on the Weddahs in the *Fortnightly Review* for Mar., 1876, we have the clearest and most precise information on the subject. They draw bows 6 feet high with a pull up to 56 pounds. The arrows are generally about 3 feet 6 inches long. Mr. Hartshorne says: "One of them, Latty, was able to hold his bow drawn to its full length for upward of two minutes, without the slightest tremor of the left arm. They are, as a rule, good shots, and upon one occasion, in Feb., 1872, I saw a Weddah bring down a pariah dog at the distance of 35 yards when it was running away. He took very deliberate aim, and the arrow passed through nearly the whole length of the animal, entering at the hinder quarter, and coming out through the fore shoulder." Weddahs are tolerably good axe-men. They are experts in the art of making fire by rubbing two pieces of wood together, but recently they have acquired the knowledge of flint and steel. Beads for the neck and empty cartridge-cases as ear-rings placed in the distended lobes of the ears are highly prized as ornaments amongst Weddah women. Clothing is considered a superfluity as a rule, unless a gay-colored handkerchief wrapped round the head and a dozen silk strings round the waist may be considered clothing. They are very partial to a kind of curry or thick mulligatawny broth made out of flying-ants at the commencement of the rainy season, and seasoned with green ginger. They

very rarely wash, as they consider bathing deleterious to health. It is untrue that they never laugh, though it is true that not one out of a thousand has ever seen them laugh. But they are prone to tears. Laughter in others only provokes disgust in the Weddah. By nature he is certainly morose. But to say he *cannot* laugh is, *a priori*, an improbability. He were then not human. Repression of feeling on the part of a Spartan of old did not signify that he could not feel. The barbarous Weddah is a hard-worked animal, with his emotions blunted. What should he laugh at? He must gather the honey for his mid-day meal; he must tear the succulent root from its crevice in the rock; he must cut down the hard-wooded palm for a taste of its edible pith; he has to feed many hungry mouths; his meat for weeks depends on the accuracy of his aim whilst a spotted deer glances by him through the *shôla* at lightning speed. He may weep: he knows sorrow. He may frown: he knows disappointment. He may bear a wrinkled brow: he knows care. And he *might* laugh if he only knew what pleasure and luxury were.

The Weddahs appear to have no religion. They do not even know of the name of the being so popular in the worship of Ceylon—*Buddha*. Attempts have recently been made to christianize the tribe, but this is difficult, as few of the primitive and pure Weddahs can even count above six. Each Weddah is his own doctor; his only medicines and surgical instruments are green ginger, castor-oil berries, and sharp arrow-heads of flint or of steel. When a wife is confined, the husband attends her. The dead of the Weddahs are buried; deer-skin, if obtainable, is used as the coffin. At burials no females are present. The general belief of Weddahs is, that departed spirits become devils and must be propitiated; so offerings are nearly always made after funerals to the ghost of the departed. The language of the people seems to be one of the roughest of Aryan dialects. Some have said that the Weddahs are the only savages who now speak a dialect of the Aryan. This is a mistake. Many savages of the Assam frontier speak dialects which must be affiliated with Aryan. But this is only *one* example. The subject cannot here be exhaustively entered into. The Weddah is one of the great types of the primeval man. He is a child of seclusion; his home is the secluded forest; what he can kill he eats; what he can dig is his own. The mountain is his home, the shady trees are his shelter; he drinks of the running brook; the hollow of his palm is his cup. His knowledge is small, but so are his needs.

R. C. Caldwell.

**Wed'derburn** (Alexander), earl of Rosslyn and Baron Loughborough, b. at Chester Hall, East Lothian, Scotland, Feb. 13, 1733; studied law in Edinburgh and at the Inner Temple, London; was called to the bar 1757; was made king's counsel 1763; entered Parliament; became solicitor-general Jan. 26, 1771; conducted the defence of Lord Clive; was appointed attorney-general June, 1773; defended Govs. Hutchinson and Oliver of Massachusetts before the privy council and denounced Franklin Jan., 1774; was a strong advocate of the war-measures of Lord North; became privy councillor, chief-justice of the common pleas, and Baron Loughborough 1780, first commissioner of the great seal Apr., 1783, and lord chancellor Jan. 27, 1793, and retired with the title of earl of Rosslyn Apr., 1801. D. in Berkshire Jan. 3, 1805.

**Wedderburn** (David), b. in Scotland about 1570; received a careful classical education, and became distinguished as a writer of Latin, both prose and verse; was master of Aberdeen grammar school 1602–40; became teacher of the "high class" in Aberdeen University 1614, and professor in Marischal College 1619. D. about 1652. Author of several poems in the *Deliciæ Poetarum Scotorum*, of *Institutiones Grammaticæ* (1633), *Persius Enucleatus* (1664), and other works.

**Wedderburn** (Sir David), Bart., a descendant of the preceding, b. at Musselburgh, Scotland, Dec. 20, 1835; graduated at the University of Cambridge; became an advocate at the Scottish bar and an active politician; sat in Parliament for South Ayrshire 1868–74; has travelled in the U. S., and is a contributor to the British magazines, especially the *Fortnightly Review*, in which he published in 1876 a notable account of *Mormon History from a Mormon Point of View*.

**Wedderburn** (James), b. at Dundee, Scotland, about 1500; edited with his brother Robert *Ane Compendious Buike of Godly and Spirituall Sangs, collectit out of Sundrie Partes of the Scripture, wyth sundrie of uther Ballates changed out of Prophane Sangs, for avoyding of Sinne and Harlotrie* (printed at Edinburgh about 1548), and which was the principal psalm-book used in Scotland. He was also the reputed author of *The Complaynt of Scotland* (1548), "the only classic work in old Scottish prose." D. in England about 1564.

**Wedding and Wedlock.** See Marriage, by J. N. Pomeroy, LL.D.

**Wedge** [Ang.-Sax. *wecg*], in geometry, a volume bounded by a quadrilateral called the *back*, by two quadrilaterals called *faces*, and by two triangles called *ends*; the faces meet in a straight line called the *edge*.

**Wedge,** one of the so-called mechanical powers, is a modification of the inclined plane. In the ordinary wedge, as well as in knives, nails, and all cutting and pointed instruments, this mechanical power is practically used.

**Wedgwood** (Hensleigh), grandson of Josiah, b. in Dorsetshire, England, about 1805; graduated at, and became fellow of, Christ College, Cambridge; is a barrister-at-law in London, and married his cousin Frances, daughter of Sir James Mackintosh the historian. Author of *Principles of Geometrical Demonstration, deduced from the Original Conception of Space and Form* (1844), *The Development of the Understanding* (1848), *The Geometry of the First Three Books of Euclid* (1856), *On the Origin of Language* (1866), and *A Dictionary of English Etymology* (3 parts, 1859–67; new ed. 1876), and has contributed valuable papers to the *Proceedings* and *Transactions* of the Philological Society.

**Wedgwood** (Josiah), F. R. S., b. at Burslem, Staffordshire, England, July 12, 1730, was the younger son of a potter in easy circumstances, and descended from a family identified for several generations with the ceramic art; lost his father at the age of nine years; was apprenticed to his brother Thomas in 1744; worked at the potter's wheel several years; was lame from his sixteenth year as the result of a severe attack of small-pox; was thus led to devote himself rather to the artistic development than to the manual operations of his profession; received a somewhat limited early education, but ultimately corrected its defects; entered into business for himself with a partner named Harrison at Stoke in 1752, manufacturing the ordinary cheap wares then in demand, to which, however, his careful superintendence gave an artistic finish previously unknown; was from 1754 to 1759 partner of Thomas Wheildon, the most eminent potter of his day; devoted himself for many months to a careful study of, and experiments upon, the fictile materials then in use, resulting in the invention of a new green "tortoise-shell" earthenware, having the smoothness and brilliant appearance of glass, from which he made toilet vessels, services of dessert, knife-handles, and articles of *virtu*, which were highly appreciated by the jewellers of London and Bath; established himself in business at his native place in 1759; perfected in 1761 a fine cream-colored ware, specimens of which, being presented to the new queen, Charlotte of Mecklenburg, obtained him the title of queen's potter and permission to entitle his new art-product "queensware;" rapidly acquired a considerable fortune, of which he made a liberal use; married his cousin, Sarah Wedgwood, Jan. 25, 1764; was the most efficient promoter of Brindley's Grand Trunk Canal, to which he subscribed £1000, and for which he cut the first sod at Burslem July 26, 1766; adapted the engine-lathe to the uses of his art; produced in 1766 his fine black "basaltes" or "Egyptian" ware, and shortly afterward his celebrated jasper-ware; began building the celebrated establishment which he named Etruria in 1767; formed a partnership in 1768 with Thomas Bentley of Liverpool, a man of fortune and artistic tastes, who contributed largely to the success of his plans; made experiments in the qualities of many kinds of clays, importing from Ayoree in the Cherokee district of South Carolina a fine porcelain clay; opened his works at Etruria June 13, 1769; began about this time to produce beautiful copies of classical vases and other ancient masterpieces, chiefly from the engravings in Sir William Hamilton's *Antiquities;* opened in 1770, at Chelsea, a branch establishment for the painting and finishing of his wares; opened in London soon afterward a salesroom of his own, which became a fashionable resort of the nobility; received orders of immense amount from the Continent, especially from Queen Catharine II. of Russia, for whom he executed a service of many hundreds of pieces, each representing a different English landscape; was elected to the Royal Society and to the Society of Antiquaries; invented the pyrometer; contributed several papers to the *Transactions* of scientific societies; erected a magnificent mansion at Etruria; employed Flaxman and other great artists as his modellers; executed magnificent copies of the famous Barberini or Portland Vase 1790; admitted his three sons and his nephew, Thomas Byerly, to partnership the same year; was a liberal patron of education, literature, and the arts; was highly esteemed by the royal family; enjoyed the intimate friendship of the duke of Bridgwater, Earl Gower, and other prominent noblemen, and was regarded as the father of his art in modern times. D.

at Etruria Jan. 3, 1795.—His sons JOHN and JOSIAH, and their descendants, have continued his business to the present day. By his daughter Susanna he was grandfather of the celebrated naturalist Charles Darwin, and other descendants have been prominent in literature or science. His statue by Davis has been erected at Stoke-upon-Trent, and a memorial institute was opened at Burslem Oct. 26, 1863. His biography has been written by Llewellyn Jewett (1865) and by Miss Eliza Meteyard (2 vols., 1865–66), who is also authoress of *Memorials of Wedgwood* (1875) and *Wedgwood Handbook* (1875). PORTER C. BLISS.

**Wedgwood** (RALPH), son of Thomas, a cousin and partner of Josiah, b. in Staffordshire, England, about 1766; was educated as a chemist; became proprietor of a pottery at Burslem, and afterward at Ferrybridge, Yorkshire, but did not succeed; taught chemistry in schools in the central counties; invented a "penna-polygraph" for writing with several pens attached to one handle; patented in 1806 a "pocket secretary" or "manifold writer," which came into general use, and spent several years (1806–14) in fruitless endeavors to induce the admiralty to adopt a scheme for his "fulguri-polygraph," an electric telegraph, which he had devised. D. at Chelsea in 1837. Author of *The Book of Remembrance*, etc. (1814), and of a pamphlet on his telegraphic project (1815).

**Wedgwood** (THOMAS), youngest son of Josiah, b. at Etruria, Staffordshire, England, in May, 1771; educated at the High School and University of Edinburgh, and at home under the tutorship of John Leslie, afterward the celebrated professor; studied chemistry under the direction of his father; became expert in physical and mathematical science; made ingenious experiments in optics, the results of which were published in two papers on the *Production of Light from Different Bodies* in the *Philosophical Transactions* for 1792; invented an imperfect process of photography, by means of which he took the first heliotype about 1793; was an intimate friend of the most prominent literary men of the time, and a liberal benefactor to Coleridge, Wordsworth, Mackintosh, and Leslie, and would undoubtedly have achieved distinction as a psychologist had it not been for a painful disease which he suffered for years previous to his death, which occurred June 10, 1805. Mackintosh and Coleridge undertook to write his biography, but never fulfilled their trust, and a volume of *Metaphysical Essays*, committed to the former as editor, never saw the light. An ingenious paper on *The Origin of our Notion of Distance* in the *Quarterly Journal of Science and Arts*, vol. iii., is the best remaining specimen of his philosophical studies. (See *The Younger Wedgwoods and their Friends* (1871), by Eliza Meteyard.)

**Wedgwood Ware.** See POTTERY AND PORCELAIN MANUFACTURE, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

**Wednes'bury** (wenz'bere), town of England, county of Stafford, near the sources of the Tame, in the centre of a very rich mining district, has extensive manufactures of ironware of almost every description. P. 15,298.

**Wednes'day** (wenz'dy), ["Odin's day;" Ger. *Mittwoch*, "mid-week;" Fr. *Mercredi;* Late Lat. *dies Mercurii*, "Mercury's day"], the fourth day of the week, so named in consequence of an identification of the Northern god Odin with the Roman Mercurius.

**Wedow'ee,** p.-v. and tp., cap. of Randolph co., Ala., on Wedowee Creek, about 4 miles from Tallapoosa River, contains 1 church, 2 schools, a Masonic lodge, 1 hotel, 2 newspapers, and 1 grist and 2 saw mills. P. of v. 130; of tp. 1791.

JAMES M. K. GUINN, ED. "RANDOLPH ENTERPRISE."

**Weed,** or **Shot of Grease,** an inflammation of the lymphatics in the hind legs, or more rarely the fore legs, of horses. Overwork, overfeeding, and exposure to cold are among the causes. Foment the parts thoroughly, give 5 drops of tincture of aconite every two hours, let the horse have a smart dose of aloes, and if he is in good condition bleed him. Afterward give him a few weeks' rest and pasturage, with shelter in rainy weather.

**Weed** (STEPHEN H.), b. in New York in 1834; graduated at the New York Free Academy 1850, and from the U. S. Military Academy July, 1854, when appointed brevet second lieutenant of artillery; served on the Texan frontier and in the Florida war 1855–57, and the Utah expedition 1858–61, being engaged in the actions at Egan Cañon and Deep Creek, Aug.–Sept., 1860. Appointed captain 5th Artillery May 14, 1861, he was engaged at regimental head-quarters and on recruiting duty August to November, and at Camp Greble, Pa., Nov., 1861, to Mar., 1862, when, joining the Army of the Potomac, he commanded his battery throughout the Peninsular campaign of 1862, as at Manassas, Antietam, and Chancellorsville, in all of which battles he displayed great bravery and ability. After Chancellorsville he was placed in command of the artillery brigade 5th corps, and June 6 was appointed a brigadier-general of volunteers. At Gettysburg he commanded a brigade of regulars 5th corps, and in the terrible struggle of July 2, 1863, for the possession of Little Round Top he was instantly killed at the head of his command.

**Weed** (THURLOW), b. at Cairo, Greene co., N. Y., Nov. 15, 1797; became a cabin-boy on a Hudson River vessel when ten years of age; entered a printing-office at Catskill two years later; worked in several villages in the interior of New York; was a volunteer on the northern frontier of New York in the war of 1812–15, serving as quartermaster-sergeant; established in 1818 the *Agriculturist* newspaper at Norwich, Chenango co., N. Y.; edited several other papers during the ensuing ten years, among which was the *Anti-Masonic Inquirer* at Rochester 1826–27; took an active part in the controversy arising from the disappearance of William Morgan, with the details of which he was familiar, as he also was with the origin of the Mormon imposture in the same region; was twice elected to the New York assembly 1826–30; contributed largely to the election of De Witt Clinton as governor 1826; settled at Albany in 1830; founded there the *Evening Journal*, a newspaper established in the interests of the party then being formed in opposition equally to the administration of Pres. Jackson, as represented by the "Albany Regency," and to the nullification policy of Calhoun; was an original leader of the Whig party; contributed largely to the election of Gov. Seward in 1838 and 1840, to the nomination of Harrison in 1836 and 1840, and to his election on the latter occasion; became known as the most adroit of party managers; wielded an immense influence in legislation and in the distribution of executive appointments, but declined to accept any public office; was active in promoting the nomination of Gen. Taylor in 1848 and of Gen. Scott in 1852; exerted his influence in 1856 and 1860 in favor of the nomination of William H. Seward, but rendered cordial support to Fremont and Lincoln; was an advocate of the energetic prosecution of the war 1861–65; visited Europe at the request of Pres. Lincoln Nov., 1861, remaining abroad until June, 1862, and exerted an important influence upon English opinion through his personal relations with leading statesmen; withdrew from the *Evening Journal* in 1862; settled in New York City 1865, and was for some time editor of the *Commercial Advertiser;* retired from active journalism in 1868, but continued throughout the administration of Pres. Grant, and especially during the grave constitutional crisis ensuing upon the election of 1876, to exert a powerful influence upon the counsels of his party, and was a frequent contributor over his own signature to the columns of the political journals. He has published *Letters from Europe and the West Indies* (Albany, 1866), collected from the *Evening Journal;* has published some interesting chapters of *Reminiscences* in the *Atlantic Monthly* (1870) and in other periodicals, and is understood to be engaged in the preparation for the press of an autobiography and of portions of an extensive correspondence which will doubtless prove valuable materials for the political history of the U. S., and especially of New York, during the half century in which (with his friends Seward and Greeley) he was the arbiter of Whig and Republican policy. PORTER C. BLISS.

**Wee'don** (GEORGE), an innkeeper and postmaster of Fredericksburg, Va., when the Revolutionary war broke out, was made a lieutenant-colonel of the 3d Virginia regiment Feb. 13, 1776, colonel of the 1st Virginia regiment Aug. 12, and a brigadier-general Feb. 24, 1777. In the battle of Brandywine he commanded the brigade of Greene's division which stopped the British pursuit and saved the routed army. Having resigned on account of some misunderstanding, he resumed command in 1780, and fought at the siege of Yorktown, Oct., 1781.

**Weeds'port,** p.-v., Cayuga co., N. Y., at the junction of New York Central and Southern Central R. Rs., and upon Erie Canal, has 5 churches, a union school, 2 banks, 1 newspaper, 1 foundry, and 3 hotels. Large quantities of coal are transhipped here. P. 1348.

GEO. R. NASH & CO., PUBS. "SENTINEL."

**Wee'hawken,** p.-v., Hudson co., N. J.

**Week** [Ang.-Sax. *weoc*], a period of seven days, forming a subdivision of the lunar month, corresponding to the four quarters of the moon, or about $7\frac{3}{8}$ days. It was in common use among the ancient Hebrews, who in Ex. xx. 11 referred its origin to the creation of the world, and in Deut. v. 15 to the exodus from Egypt. It was not a Hebrew invention, however, as may be seen from Josephus, Philo Judæus, Clemens of Alexandria, and others. It was found as a civil institution in the very earliest times among the Hindoos, Persians, Assyrians, and Egyptians.

But the Jews were the only nation with which the week had a religious signification. With the Egyptians, Assyrians, etc., the seventh day was simply a day of recreation; with the Jews it was the day of worship, the sabbath. The Greeks divided the month into three periods of ten days (*decades*), and the Romans gathered the days into periods of eight days (*nundinæ*); with both, the first day of the period was the market-day, on which country people came to town and stirred up both business and public life. The period of seven days, the week proper, was introduced to the Romans and Greeks partly by Christianity (which may be inferred from the fact that the term *sabbath* was adopted), partly by the Egyptian astronomy and astrology. It recommended itself to the practical Romans as peculiarly convenient by its relation both to the lunar month and to the solar year. Among the Jews the days of the week had no names; they were simply counted. But the Egyptians named them after the seven planets then known, and in the following way: they arranged the planets according to their distance from the earth, beginning with the most distant; ascribed a planet to each hour, and named the day after the planet which reigned over its first hour. This method of appellation was adopted by the Romans, so that when Saturn presided over the first hour of the first day, which consequently became *Saturday*, the first hour of the second day would fall to the sun, etc. (For further details see the special articles on the days.)

**Weekes** (Henry), R. A., b. at Canterbury, England, in 1807; studied sculpture under Behnes and at the Royal Academy, where he entered 1823; was many years the principal assistant of Chantrey, whom he succeeded in his studio at Pimlico 1841; was elected to the Academy 1863, and became professor of sculpture there May 16, 1873. He executed the first bust of Queen Victoria (1837), statues of Cranmer, Latimer, Ridley, Wellesley, Bacon, Hunter, Harvey, Charles II., and many others, and gained a gold medal for the best treatise on the fine-art section of the Great Exhibition of 1851.

**Weeks** (John M.), b. at Litchfield, Conn., May 22, 1788; was educated at Salisbury, Vt., whither his parents removed in 1789; invented the "Vermont beehive," and was a contributor to agricultural journals. D. at Salisbury Sept. 1, 1858. He wrote *A Manual on Bees* (1854), also a posthumous *History of Salisbury, Vt.* (1860), edited, with a *Memoir of the Author*, by G. A. Weeks, and left in MS. a *History of the Five Nations*, still unpublished (1876).

**Weeks, Feast of.** See Pentecost and Easter.

**Weems** (Mason L.), b. at Dumfries, Va., about 1760; studied divinity in London; took orders in the Episcopal Church; was for several years rector of Pohick church, near Mount Vernon, Gen. Washington being one of his parishioners, and was subsequently famous for his success and his eccentricities as a book-agent for Matthew Carey, travelling through the Southern States, canvassing chiefly for his own books, of which the most celebrated were the *Lives* of Washington (1810) and of Marion (about 1805), to which were subsequently added those of Franklin (1817) and Penn (1819). The *Life* of Marion was written from data furnished by Gen. Horry, but the latter disavowed all responsibility for the manner in which his materials had been used. Several of the most widely-circulated anecdotes of the youthful days of Washington, such as the famous story of the "little hatchet," rest upon the questionable authority of Weems, who seems not to have shared his hero's conspicuous devotion to truth. D. at Beaufort, S. C., May 23, 1825.

**Wee'nix** (Jan Baptist), the Elder, b. at Amsterdam in 1621; received his first instruction in the art of painting from Abraham Bloomaert and Nicholas Moojaert; resided for several years in Italy; settled after his return in Utrecht, and d. there in 1660. He painted mostly landscapes and seaport scenes.—His son, Jan Weenix, the Younger (b. at Amsterdam in 1644, d. there in 1719), studied under his father, and acquired a great reputation as a painter of animals and hunting-scenes. There are numerous pictures by him in the galleries of Amsterdam, Munich, and Dresden.

**Weep'ing** [Ang.-Sax. *wêpan*]. Weeping is a physical expression of certain mental emotions by shedding tears, accompanied, especially in children, by facial distortion and involuntary muscular contractions in other parts of the body. For the purpose of secreting the tears there is a special apparatus placed within the orbit at its upper part, consisting of a body called the lachrymal gland; of a reservoir, the lachrymal sac, and of certain canals, the ducta lachrymalia, which collect the tears from the inner angle and convey them to the lachrymal sac; and of a tube, the lachrymal duct, by which the secretion is carried from the sac into the nose. Aside from the office of the tears in, as we have said, expressing certain emotions, they serve to lubricate and keep moist the lining membrane of the eyelids and external coat of the eyeball, the conjunctiva. The secretion of tears, whether for emotional or ordinary physiological purposes, is effected through the intermediation of the fifth pair and the sympathetic nerves. In emotional weeping the action is probably mainly induced through the sympathetic. In the lachrymation which is for the purpose of lubricating the ocular surfaces, or which is the result of irritating applications to them or to the neighboring mucous surfaces, the fifth is the channel of communication with the brain.

Weeping is probably originally the expression of physical pain only. And yet, as is well known, very young infants, whose crying is in every instance due to physical uneasiness, do not shed tears. But, as Darwin noticed in the case of one of his own children, this is not the result of any inability of the lachrymal gland to secrete tears; for having accidentally brushed the open eye of the infant when seventy-one days old with the cuff of his coat, that eye watered freely, but the other did not weep, though the child screamed violently. As the individual advances toward adult life, tears are less apt to be shed as an expression of physical pain, until when fully grown it is exceedingly rare to find a man or woman, however much the countenance may be distorted and the body writhe, weep from bodily suffering.

Weeping is excited by anger, sorrow, fear, joy, and in some cases by sympathy with others in their sorrows or joys, and again by intense interest in the highly-wrought and exalted actions of those in whom we are interested; and still, again, by musical compositions—more by singing than by instrumental performances—which, in a manner not easily explained, awaken in us the emotional excitement that leads to tears. The minor key has most influence in this direction. Funeral marches are almost invariably composed in it. I have known highly-intellectual men and women who could listen to female voices without being moved till a certain note was sounded, generally one in the lower register, when tears would trickle down their cheeks. Contralto voices are, in my experience, more emotional than soprano. Diseases of the brain tending to diminish the functional activity of the organ increase the disposition to shed tears, and in some cases this is carried to an extent that would be ridiculous were it not a morbid phenomenon. The writer had a patient, a gentleman who had an organic disease of the brain, who could not see a funeral without weeping, and another who could not read the obituary column in a newspaper without shedding tears profusely. The insane are much more easily affected to tears than sane persons, and they weep disproportionately to the exciting cause.

Sobbing, which is a species of weeping, appears to result in part from the attempt to restrain the emotions, and from a cause analogous to that which induces sighing—namely, the demand of the system for additional aëration of the blood—a process which intense emotion serves to disturb.

*Bibliography.*—Sir Charles Bell, *The Anatomy of Expression* (London, 1844); Lavater, *L'Art de connaitre les Hommes par la Physionomie* (Paris, 1820); Lemoine, *De la Physionomie et de la Parole* (Paris, 1865); Piderit, *Wissenschaftliches System der Mimik und Physiognomik* (1867); Duchenne, *Mécanisme de la Physionomie humaine* (Paris, 1862); Bain, *The Emotions and the Will* (3d ed., London, 1875); Darwin, *The Expression of the Emotions in Man and Animals* (London, 1872); Pfluger, *Die Endigungen der Absonderungsnerven in der Speicheldrüse* (Bonn, 1866); Demetschenko, *Zur Innervation der Thränendrüse* (*Pfluger's Archiv*, Bonn, 1872).

William A. Hammond.

**Weeping Water,** p.-v. and tp., Cass co., Neb. P. 481.

**Weerselo',** town of the Netherlands, province of Overyssel, has some manufactures of woollen and cotton fabrics. P. 5445.

**Weert,** town of the Netherlands, province of Luisburg, has some breweries, tanneries, distilleries, and manufactures of tobacco. P. 6788.

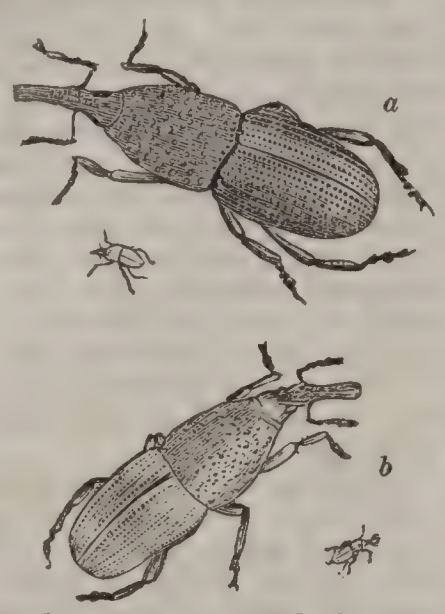
**Wee'saw,** tp., Berrien co., Mich. P. 1243.

**Weever.** See Trachinidæ, and also Great Weever.

**Weever,** or **Weaver** (John), b. in Lancashire, England, in 1576; educated at Queen's College, Cambridge; travelled on the Continent and throughout the British isles in quest of antiquities, and published a valuable work, *The Ancient Funeral Monuments within the United Monarchy of Great Britain*, etc. (London, folio, 1631), of which a 3d ed., with addenda and an index by Rev. William Tooke, appeared in 1767. D. in London in 1632.—He is not to be confounded with another John Weever, his contemporary (b. 1576), who was author of *Epigrammes in the Oldest Cut and Newest Fashion* (1599), and of a quaint

poem, *The Mirror of Martyrs, or the Life and Death of that Thrice-valiant Capitaine and most Godly Martyre, Sir John Oldcastle, Knight, Lord Cobham* (1601).

**Wee'vil** [Ang.-Sax. *wifel*], a term which, when compounded with some other word, is properly applied to many snout-beetles (Curculionidæ), but more particularly to the insects belonging to the genus *Bruchus* of Linnæus, formerly included among the Rhynchophora, but now placed in a family (Bruchidæ) which connects the snout-beetles with the leaf-beetles (Chrysomelidæ), and has greatest affinities with these last. The snout-beetles are characterized by the extension of the head into a snout or proboscis, at the tip of which the jaws are placed. By means of this snout the eggs are inserted where the larva is destined to live. Their larvæ are, with few exceptions, footless, clumsy grubs, with a horny head, and live within the blossoms, fruits, seeds, stems, or roots of plants. Some few even live within leaves. There are over 400 described North American species of the Curculionidæ proper, distributed among nearly 100 genera. The following are among the more notable in their larval habits: *Conotrachelus nenuphar*, Herbst, the plum-weevil (see Curculio), works, as larva, in the flesh of stone fruit, and transforms in the ground; *C. cratægi*, Walsh, infests the pear and quince; *Anthonomus prunicida*, Walsh, works in the stones of plums, and transforms therein; *A. suturalis*, Lec., is inquilinous in *Phylloxera*, hickory galls; *A. quadrigibbus*, Say, works in apples and other pip fruit; *Cœliodes inæqualis*, Say, works in grapes; *Analcis fragariæ*, Riley, injures the crown and root of the strawberry; *Baridius trinotatus*, Say, the potato-stalk weevil, bores the stems of the potato; *Ithycerus novaeboracensis*, Forster, the New York weevil, breeds in the twigs of oaks; *Pissodes strobi*, Peck, burrows in the tips of pines; *Hylobius pales*, Herbst, in the stems and roots of *Pinus sylvestris*; *Magdalis armicollis*, Say, works under the bark of elms; *Dorytomus mucidus*, Say, breeds in the blossoms of cottonwoods and willows; *Phytonomus comptus*, Say, feeds on the leaves of *Polygonum*, and constructs a silken mesh-like cocoon in which to transform; *Prionomerus calceatus*, Say (= *carbonarius*, Gyll.), lives between the leaf-cuticles, and also makes a cocoon on the magnolia or tulip tree; *Otidocephalus lævicollis*, Horn, which resembles a wingless gall-fly, is inquilinous in the gall of *Cynips q. globulus*. The species of the genus *Attelabus* breed in thimble-shaped rolls of the leaves of oak, hickory, rose, sumach, etc. *Balaninus* comprises species with very long snouts, and known as "nut-weevils," different species infesting different nuts, as *caryæ*, Horn, hickory nuts; *Sayi*, Gyll., chestnuts; *uniformis*, Lec., and *quercus*, Horn, acorns. *Rhynchophorus Zimmermanni*, Fahrs., our largest species, breeds in the palmetto palm; *Spenosphorus zeæ*, Walsh, breeds in moist, rotting wood; *S. pulchellus*, Schh., in stems of cockle-bur and other herbaceous plants. The grain-weevils are more particularly referred to at the end.



*a, Calandra granaria; b, C. oryzæ.* (The small outlines show the natural size.)

The Bruchidæ, or weevils proper, mostly breed in the seeds of leguminous plants; their larvæ are fat, clumsy, wrinkled grubs, and in some instances are provided with short legs. Their eggs are not inserted in the pods, as has been heretofore asserted by authorities, but are invariably glued to the outside of the pod; they are elongate, generally smooth, but sometimes beautifully reticulate. The new-born larva eats directly through the pod and into the seed, the hole of entrance effectually closing up if the pod is yet green. The pea-weevil (*Bruchus pisi*, L.) affects peas, one individual appropriating the contents of one pea; the eggs are laid while the pod is forming. The bean-weevil (*Bruchus fabæ*, Riley) infests beans, several individuals developing in the same bean; *Bruchus bivulneratus*, Horn, breeds in the seeds of *Cassia marilandica*, and its eggs, which are reticulate and fastened by two filaments anteriorly and one posteriorly, are laid on the mature pod; the honey-locust seed-weevil (*Spermophagus robiniæ*, Schh.) has distinct thoracic legs, and spins from the mouth a cocoon of silk, mixed with excrement, in which to undergo its transformations.

Though the term "weevil," when used alone, is often very loosely and incorrectly applied by farmers to several insects that affect wheat, and particularly to the wheat-midge (*Cecidomyia tritici*)—a little orange, dipterous maggot that affects the growing ear—it strictly belongs to the grain-weevil (*Sitophilus granarius*, L.), which is the greatest pest to stored grain, and frequently reduces a lot of wheat to mere husks before its presence is noticed. The beetle is about one-eighth of an inch long, of a deep chestnut-brown color, with nine deeply-punctured striæ along each elytron, and without wings. The female with her snout makes an oblique puncture just under the skin of the stored grain, and lays an egg therein, from which egg there hatches a whitish grub that devours the substance of the kernel and undergoes its transformations within the hull. In from forty to fifty days from hatching the perfect weevil eats its way out. Several generations are produced each year, and when once the species is established it increases at an alarming rate, more particularly in warm climates. There is a closely-allied form, known as the rice-weevil, and generally considered a distinct species (*Sitophilus oryzæ*, L.), which differs principally in being somewhat smaller, and in having wings, and four pale or reddish spots on the elytra. The habits of the two are similar. Both infest most kinds of dry grain, including maize, and both are widespread over the world, having been introduced from one part to another. The remedies employed against these weevils are principally kiln-drying, sulphur fumes, and the sprinkling of air-slaked lime among the grain. The best antidote, however, is cleanliness. All rubbish that the weevils can harbor under should be burned, cracks filled up, the walls whitewashed, and a general supervision had over the grain, which should be kept as cool as possible, and well aired.

C. V. Riley.

**Wegatch'ie,** p.-v., Rossie tp., St. Lawrence co., N. Y. P. 201.

**Wegefarth,** an unorganized county of N. W. Texas, in the "Panhandle" W. of the Indian Territory, is watered by the forks of Red River, is hilly in the W. and undulating in the E., and is uninhabited except by nomadic Indians.

**Weige'la,** a shrub found in China by the celebrated naturalist Dr. Robert Fortune, by whom it was introduced into England and named *W. rosea*, but afterward found to be identical with *Diervilla*, a genus introduced into Europe from Canada in the eighteenth century. In the U. S., where there are two species, it is familiarly known as "bush honeysuckle."

**Weigh'ing, Chemical.** (See also Weights, Chemical.) The accurate determination of the weight of a substance is of special importance in quantitative analysis (see Chemical Analysis) and in other chemical processes. In order to arrive at true results in this operation the balance and weights employed must be correct, and certain precautions observed in their use. The chemical balance, in its most approved form, consists of a light but strong brass beam, which is suspended at its centre on an agate or steel knife-edge, resting on a smooth agate plane fixed on a brass column. At each extremity of the beam is a steel or agate prism supporting an agate plane, from which the pans are suspended by means of bent wires. Except when in use, the weight of the beam and pans does not rest upon the agate surfaces, but is supported by a brass frame which is operated by means of an eccentric extending outside of the balance-case. A second attachment is often added, which supports the weight of the pans and prevents their oscillation. The movements of the beam are indicated by a long index-needle extending below and passing over a small ivory scale. The beam is often graduated into tenths, the smaller weights (milligrammes and fractional parts thereof) being estimated by means of a bent wire centigramme weight, termed the *rider*, which is placed upon the divisions of the beam by means of a rod operated from the exterior of the case. The balance is maintained in a horizontal position by the aid of levelling-screws and a circular spirit-level. The stability of the beam is regulated by having a movable weight placed above its point of suspension; its equilibrium can be adjusted by means of movable vanes or by screws attached to its extremities. The entire instrument must always be protected from the influence of currents of air, dust, etc., by a glass case provided with suitable windows. The balance used in Assaying (which see) is particularly adapted for accurately weighing small amounts of material with *rapidity*; it is smaller than the ordinary chemical balance, and is provided with loose scale-pans. In order that a chemical balance may be accurate, the point on which the beam rests must be above the centre of gravity of the balance; the point of suspension of the scales must be in a line absolutely horizontal with the fulcrum; the beam must be of sufficient strength to support the weights used without bending; and the arms of the beam must possess equal length. The greatest sensibility is attained when the friction of the edges upon the supporting planes is as small as possible, when the beams

are of the slightest possible weight, and when the centre of gravity lies as near as possible to the fulcrum or point on which the beam rests. A good chemical balance should stand the following tests: When the pans are empty, the index-needle should point to the zero of the scale, or make equal and slow excursions on either side; if the pans are removed, the beam should be in equilibrium, and remain so when it is turned round from right to left if its construction permits of this change; on equally loading the pans, the beam should also be in equilibrium, and resume its orginal position when its oscillations are suddenly arrested; it should bear a load of 75 grammes on each pan, and indicate a weight of 1 milligramme; in its ordinary condition the addition of $\frac{1}{10}$th milligramme should cause the beam to turn distinctly. A chemical balance should be moved as little as possible, and be carefully protected from moisture and acid fumes. Presence of moisture is best prevented by placing in the balance-case a dish containing chloride of calcium or quicklime. The parts of the balance should never be removed or cleaned without adequate cause.

Weighings may be executed either *directly* or *by substitution*. By the former mode the substance is placed upon one scale and the weights upon the other. It is advisable always to place the substance to be weighed upon the same pan—most conveniently the left—although in assaying the reverse is practised. Much time is saved in determining the weight of a substance if a systematic plan in using the weights is adopted, and they are added in their proper order, as 20, 10, 5, 2, 1, etc., the rider being employed for the milligrammes. As soon as equilibrium is nearly attained, the increase or decrease of weight required will be indicated by the rapidity and extent of the oscillations of the index-needle. Errors in reading off the result of a weighing are often avoided by counting first from the vacant spaces left in the weight-box, and then removing the weights from the pan while again counting them. The body to be weighed is seldom or never placed directly upon the pan, but is introduced into a vessel of platinum, porcelain, or glass which has been weighed when empty. It is then weighed with the substance, and its weight when empty subtracted, or the weight of the vessel and substance is first determined, a portion of the latter taken out, and the weighing repeated, the quantity of substance removed being then the decrease in weight. Bodies that rapidly absorb moisture must invariably be weighed in closed vessels, and those that possess a higher temperature than the surrounding air should be allowed to cool in a vessel containing chloride of calcium or concentrated sulphuric acid, in order to avoid the condensation of moisture upon their surfaces; besides, if a substance is weighed when hot, the current of heated air produced in the balance-case always affects the movements of the beam, causing it also to expand slightly, thus vitiating the accuracy of the weighing. As the specific gravities of the substances weighed are not the same as that of the weights used, *absolutely correct* results are obtained only when the process is performed *in vacuo*, or when corrections are made by adding the weights of the volumes of air corresponding to the volume of the substance and weights. This refinement, however, is seldom necessary, as the density of the air is very small compared with that of the solids involved.

The method of weighing by substitution, which affords exceedingly accurate results even if the beams are unequal in length and are not in exact equipoise, is often employed in the determination of the atomic weight of an element. It is executed by placing the substance to be weighed in one pan, restoring the equilibrium of the balance by adding weights to the other pan, removing then the substance, and again counterpoising by substituting the necessary weights in its place; or it can be accomplished also by first placing a *tare*, consisting of shot or wire, and having a greater weight than the substance, in one pan, and balancing it with the proper weights; the weights are then removed and the substances to be weighed put in their place, together with the smaller weights required to counterpoise the tare, and the weights added deducted from the known weight of the tare, the difference being the weight of the substance.

Weighing by reversal—*i. e.* repeatedly changing the substances weighed from one pan to the other, and restoring equilibrium to the beam by means of a small and constant weight—is advantageously employed in comparing nearly equal weights. The same result is obtained by causing the beam to oscillate slowly and observing the extent of each excursion. For this purpose, a small scale, divided into spaces of $\frac{1}{100}$th of an inch, is fixed to one end of the beam, and the length of each oscillation determined by viewing the scale through a fixed compound microscope provided with a horizontal wire in the focus of the eyepiece, or by having a small mirror attached to the beam, in which the image of the scale is observed by means of a fixed telescope.

Good chemical balances are manufactured by Becker (New York and Brussels), Oertling (London and Berlin), Fortin (Paris), Staudinger (Giessen), Steinheil (Munich), and Sacré (Brussels). J. P. Battershall.

**Weigh'ing-Machines.** Weighing is the direct and accurate comparison of a body, the potential gravity of which is not known, with another body, the gravity of which has been previously ascertained, and which is taken as a standard, as a pound in this country, a gram in France, a tale in China, or a cattie in Japan. If, for example, we take one of these weights, or any other, and arrange in relation therewith and under identical conditions another body which counteracts or balances the gravity of the weight, we know that the second is exactly equal to the first. These conditions are fulfilled in the simplest and oldest form of weighing-machines, the common balance. This is simply a lever having its fulcrum in the centre and its arms of equal weight and length. The standard weight being placed at one end of the lever, and the article to be weighed at the opposite end, and equidistant from the fulcrum or point of suspension, the lever will be horizontal or balanced when the article to be weighed is brought exactly to the same weight as the standard of weight. The term "balance" is therefore applied to this variety of weighing apparatus. Furthermore, this balancing of the unknown potential gravity of a body against force the degree of which is known is the essential principle of all weighing. If, instead of having the arms of the lever of equal length, we make one of the arms two, three, four, or more times the length of the other, it follows that one unit of the standard weight on the long arm will balance two, three, four, or more units, as the case may be, on the short arm, and the calculation as to the weight on the latter is therefore readily made. This last-indicated apparatus is the common steelyard, the standard weight being adjustable at any required point along the length of the long arm of the lever, which arm is marked with a scale or index to indicate the distance from the fulcrum at which the movable weight will counterbalance the body attached to the short arm. Although this scale in reality indicates the relative distance from the fulcrum of the standard weight and the body weighed (which is nothing more than indicating the ratio between the standard weight and that of the body weighed), these distances are commonly marked in the units of weight; for instance, the pound and the conventional fractions thereof. If we vary the construction, and instead of causing the body to be weighed to bear against the known potential gravity of another or standard weight, we substitute in place of the latter a spring, the power to compress which to any requisite degree is known, we have the same result; for the resistance of the spring to compression up to a certain point being equal, say, to one, five, or ten pounds, a body applied to the spring weighing one, five, or ten pounds will of course compress it; and this degree of compression in proportion to the weight being marked upon a scale, the force or potential gravity exerted upon the article weighed is ascertained in the same manner as if the scale was applied to a lever indicating the position at which the movable or standard weight would balance a body having a certain ratio to such standard weight. If in place of the spring we substitute any other means of exerting a force that is measured and known, we can in like manner ascertain the weight or potential gravity of the body placed to bear in opposition to it. No matter what the construction of the apparatus, or what the character of the measured or standard force, this is the *modus operandi* of all weighing apparatus, from the largest railroad scale down to the delicate torsion apparatus used in weighing, so to speak, the tension of any part of an electrically-excited body.

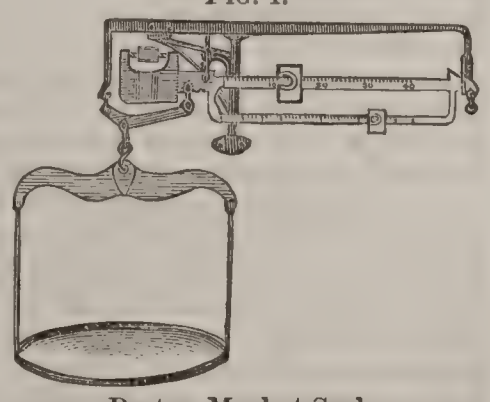
The production of accurate weighing apparatus, however, is beset with many difficulties in practice. To avoid friction, to reduce the construction to the simplest form consistent with perfect utility, and to adapt the apparatus to the myriad uses to which it is applied in arts, industry, and scientific research, are problems that have only been approximately solved. The most delicate and perfectly-constructed weighing apparatus are those employed by chemists, a full description of which, together with the extraordinary care and skill required in their use, may be found in any standard treatise on chemical manipulation. Foreign manufacturers greatly excel Americans in the production of these balances, while the Americans are unequalled in the large and heavy scales required in traffic. A Howe railroad scale capable of weighing up to twenty tons has been made so perfect in working and adjustment that its beam was turned by the weight of a quarter dollar laid upon its platform. In all weighing-machines involving the principle of the lever balance the fulcra or points of suspension are made with knife edges in order to reduce friction to the lowest point. The bringing of the beam or lever to a free suspension horizontally between two limits

of movement is the common indication that the standard weight or poise is balanced by the weight of the body weighed; the scale or index of the beam indicating the ascertained weight of the latter. This bringing of the beam to a place of rest, as just mentioned, is sufficiently accurate for all commercial or industrial purposes, but in balances of chemists, jewellers, and the like, another means is resorted to. The balance-beam or lever has projecting down from its centre a long arm which swings in front of a horizontal scale, the zero-point of which is in a vertical line with the central pivot or fulcrum of the lever. When the point, therefore, of the arm is opposite the zero-mark, the lever is balanced, and the standard weights are counterpoised by the article to be weighed. Inasmuch, however, as the perfect cessation of motion of the beam would require a long time, the balance of the lever is taken for granted when the arm swings regularly to and fro with a sweep of equal length on each side of the zero-mark.

One curious and very old form of balance depends for its utility upon the increasing resistance of a body swung from a vertical to a horizontal position. In this the article to be weighed is suspended from the upper short arm of a lever, while the long arm, loaded to the requisite degree, swings along an index or scale formed on an arc attached to the standard to which the lever is pivoted; only a small weight is required to move the long arm in the lower part of the arc or scale, but the resistance of the long arm increases in proportion as it is moved upward, its place in relation to the scale of course indicating the potential gravity of the article suspended from the short arm. It would not be impossible to construct a weighing-machine in which the article weighed should force upward a column of mercury or other liquid, the rise of the liquid in its tube of course indicating the degree of potential gravity or weight exerted upon it. If the liquid should be forced upward into a tube closed at its upper end to provide a vacuum above the liquid, we should have simply the principle of the barometer, for in this the atmosphere is just as much weighed as a sack of potatoes or a bushel of corn is weighed upon a pair of standard scales.

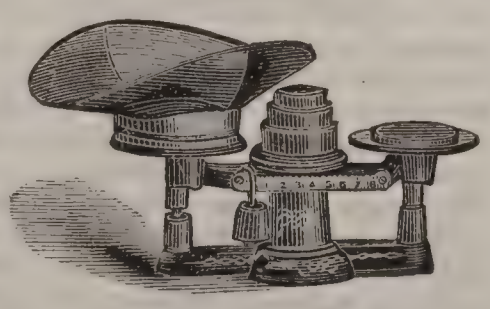
The spring balance comprises an oblong metallic shell having a hook at the upper end, by which it can be suspended from the hand or attached to a fixed support, and having a scale upon its face. A rod extends through the spiral spring, and is attached to the latter at its upper end, and carries a hook at its lower extremity, to which the article to be weighed is attached, the degree of compression, and consequently the force expressed in pounds or other units of weight, being indicated by a small pointer attached to the rod and passing through a slot in the face of the shell in proper relation with the scale. This is a common and convenient appliance, but cannot be relied upon for any degree of accuracy. A far better device is the improved Boston market scale, which operates on much the principle of the steelyard, but with greater accuracy, the heavier weights being indicated on a major scale, and the smaller ones on a minor scale, both forming parts of the same beam. The pan which holds the article to be weighed, instead of being attached directly to the short arm of the lever, is connected by a secondary lever, an adjustable counterpoise being arranged to balance the weight of the beam or long arm of the lever. The common balance for weighing small quantities—as, for example, household supplies, coffee, sugar, tea, etc.—is provided at one end with a pan for holding the article, and the other with a plate for holding the various weights. These are technically termed "even balances," and sometimes have, besides the weight, a scale or side beam attached to the lever or beam, and are sometimes constructed to be used indifferently with weights on one end of the beam, or with a supplemental beam having an adjustable poise.

FIG. 1.



Boston Market Scale.

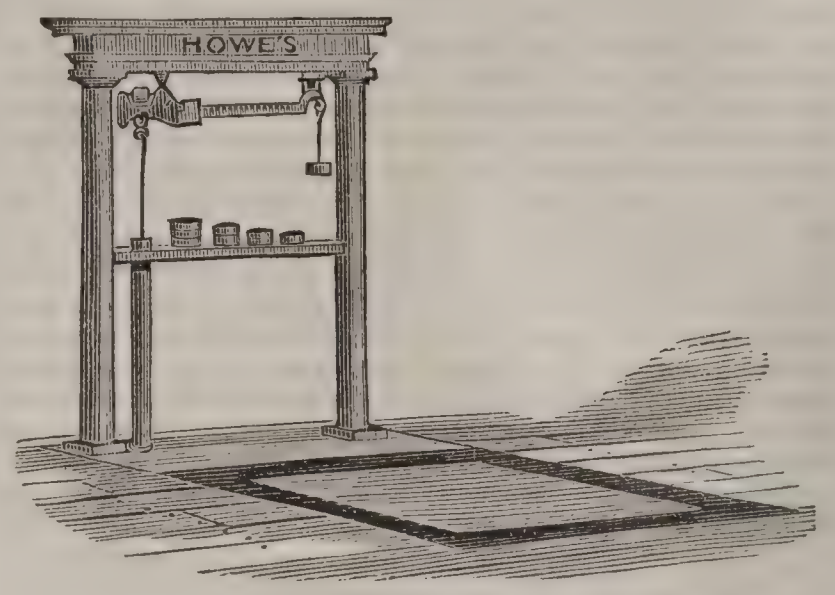
FIG. 2.



Even Balance, with side scale or beam.

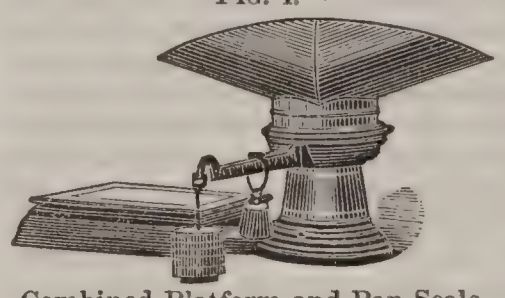
If, instead of suspending the body to be weighed directly to one arm of the lever, we extend a rod from the one arm —as, for example, the short arm when the principle of the steelyard is employed—downward to a frame capable of a downward movement by weight or pressure applied thereto, taking care to properly balance the platform against the beam, we have the same relation of the article weighed to the beam carrying the standard weight. By this means the apparatus is rendered capable of use under many circumstances where the simpler balances or steelyards could not be employed. This arrangement is in fact that of a common platform scale. Sometimes these platform scales are made so small as to be used on counters in retail grocery stores and markets; sometimes of a size sufficient to weigh a loaded railroad car. A good example of this class is the railroad dépôt scale. The credit of the invention of the platform scale appears to be due to James Edgell, an English inventor, whose patent is dated 1774. He calls it a compound "ballance" or engine. He describes it as comprising a platform placed nearly level with the surface of the ground or floor, and supported by four pillars resting on four different points of suspension of the short brachia or arms of an equal balance, whose longer arms at the points of application thereof meet and are combined or coupled together under the large scale or platform. Several levers or unequal balance-beams are inserted between the balance-beam just mentioned and the scale or basin that receives the weights; the shorter arm of the one being applied to and acting on the longer arm of the other. If a scale be hung to the longer arm of the last balance-beam, a small weight will equiponderate with a large weight on the large platform.

FIG. 3.




Dépôt Scales.

FIG. 4.

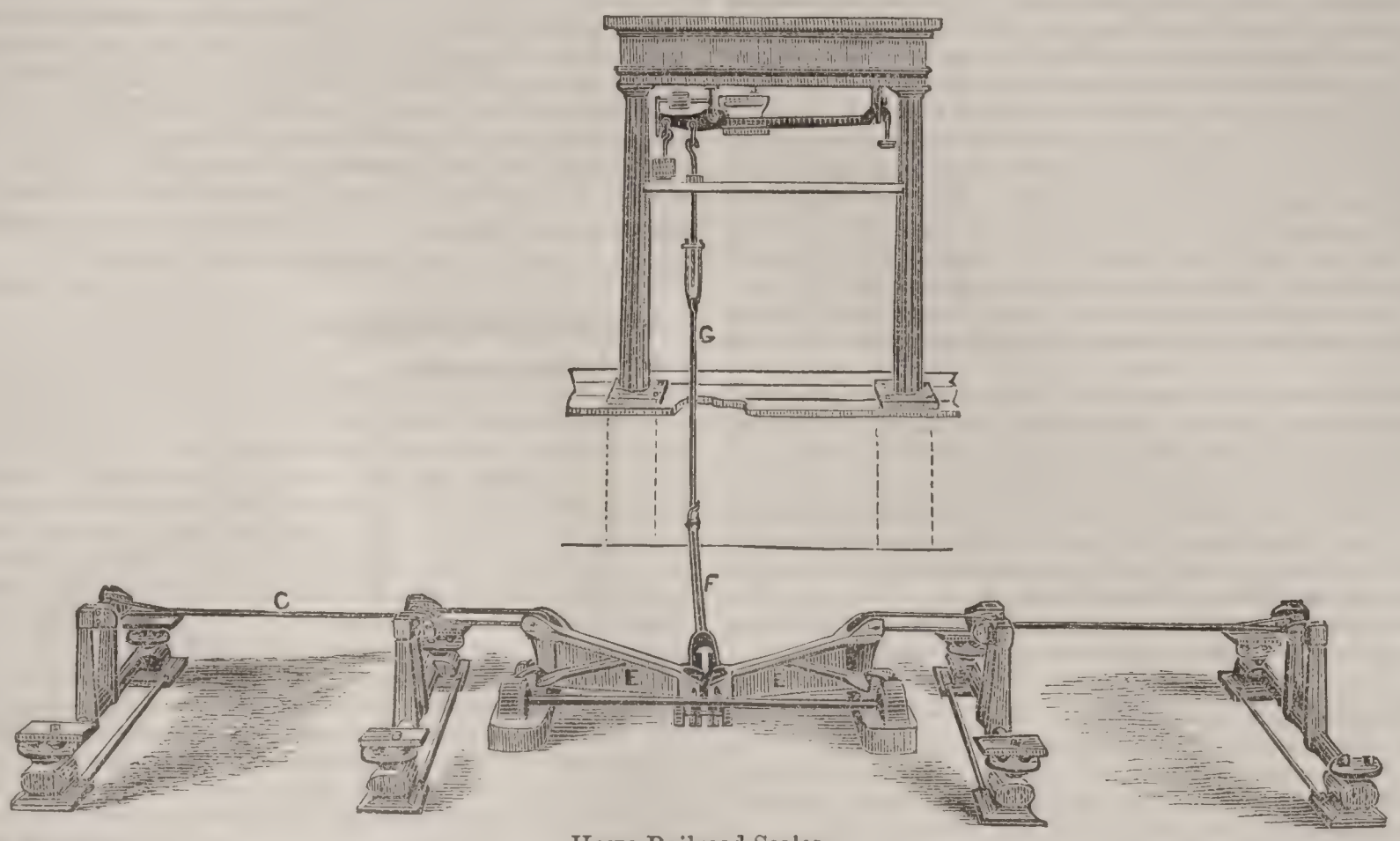


Combined Platform and Pan Scale.

There is of course a vast difference between this initial machine of 100 years ago and the apparatus of the present day. But although forty-three British patents on platform scales were granted between the date above given and the year 1866, the most approved mechanism for weighing heavy bodies is of American invention and manufacture. The pioneer in this movement was Thaddeus Fairbanks, who forty-five years ago (June 13, 1831), in conjunction with E. Fairbanks, secured a patent on apparatus for weighing heavy bodies; the next year the same parties obtained another patent in the same class, and three years later two more; and afterward (Feb. 10, 1837) five others. Fairbanks's scales were a great advance upon others previously in use, although since excelled by more recent inventions and improvements. These latter relate, among other things, to a reduction of friction, the avoidance of injury to the pivot-bearings, and the general simplification of the mechanism by which the movement of the platform is communicated to the beam. In the larger sizes of old-fashioned platform scales—as, for example, a hay-scale—the platform is supported upon levers which have their points of suspension at the four corners of the platform, as shown in the illustration of Fairbanks's four-ton scale, the platform itself resting upon the knife-edges provided near the pivoted outer extremities of the levers. In still larger or railway scales the points of suspension are necessarily more numerous, being at intervals of about ten feet around the periphery of the platform. It is of course essential to the perfect operation of the scale that the levers which sustain the platform should be subjected to as little friction upon their bearings or points of suspension as the beam upon its knife-edge or fulcrum. The arrangement of the levers underneath the platform, and the manner in which they are suspended and arranged

in the old-fashioned type of large scales—for example, the four-ton scale—is illustrated in the figure of Fairbanks's platform bearings. Each lever F is provided at its extremity with knife-edged bearings placed in a stirrup depending from the fixed frame timber A surrounding the pit in which the platform and its adjuncts are arranged.

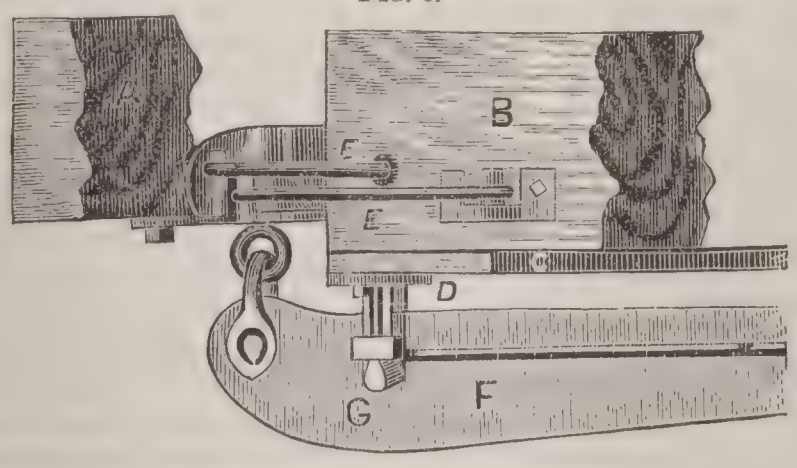
Fig. 5.




Howe Railroad Scales.

At a suitable distance from the just-mentioned extremity of the lever are knife-edged bearings G; an iron casting D extends downward from the platform B, and, passing astride of the lever F, rests on the knife-edges G at each side of said lever. If, now, the load to be weighed could be dropped vertically upon the platform B, this arrangement would be sufficient; but in practice the load is drawn in wagons or cars, as the case may be, upon the platform, and on striking the edge of the latter gives it a positive lateral movement which tends to make the casting D scrape upon the knife-edges G; and this dulls the knife-edges and impairs the accuracy of the apparatus. In order to prevent this lateral movement of the platform B, check-rods E are extended from the fixed frame timber A to the platform, and are designed to resist the lateral strain exerted thereon by the passage of the load thereto. If these check-rods by the swelling of the timber or the rusting of the rods themselves should be deranged in any way, they are liable to bind and impair the reliability of the scale. In the Howe scale the check-rods are dispensed with, and perfect freedom secured to the platform without involving the frictional movement or scraping of the casting D upon the knife-edge. This is done, as shown in the figure of Howe's platform bearing and railroad scale by

Fig. 6.

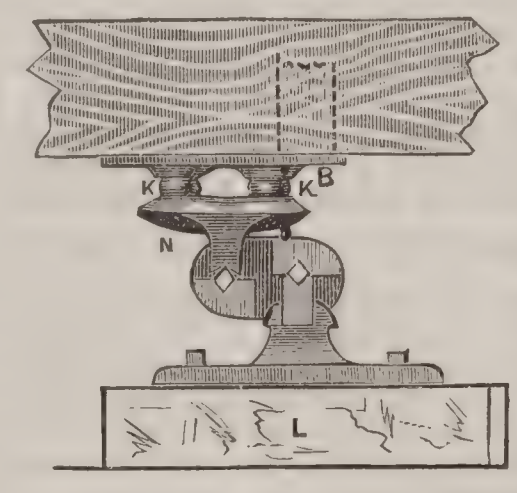



Fairbanks Platform Bearing.

making the main levers A of elbow shape, their upper ends connecting by rods with the centre levers E, from which, through a supplemental lever F and rods G, motion is communicated to the beam. The lower ends of the elbow-levers A (the form of which is shown in the larger view) have knife-edges resting on chilled iron blocks, these knife-edges forming the fulcra of the said levers. The short arms of these levers have knife-edges, which receive the bearings of the casting N. In the upper side of the casting N are two shallow cup-shaped recesses which receive the balls or spheres K, and on these rest the cupped bearings B, fastened to the timber of the platform. The centre levers, E, of course work on knife-edges. When the load strikes the edge of the platform, the movement of the latter simply causes it to sway slightly on the spheres, and this is immediately corrected by the gravity of the platform itself, there being absolutely no grating of the knife-edges on their bearings, inasmuch as the lateral motion of the platform cannot be transmitted to them, all need of check-rods, as herein just mentioned, being dispensed with. By the peculiar arrangement, moreover, of the levers, the number of knife-edges is reduced from eighty to thirty-nine.

The modifications of weighing apparatus to suit the exigencies of various branches of traffic are very many—some in practical and every-day use, others as yet only theoretical. Among the former is the common weigh-master's frame, in which an ordinary scale or steelyard is suspended on a portable frame from the short arm of a lever, by which the scale can be lowered bodily for adjustment to a cask or other article to be weighed, and then lifted clear of the floor to permit the weighing operation. A recent invention for use in charging blast furnaces, and designed to permit the employment of the most illiterate operatives, is made with a beam having three separate scales or indexes, one for coal, one for ore, and one for the flux; the adjustable poises of each scale are capable of being fixed at any desired point along the same; and to each scale, or to the poise thereof, is attached a sample of the material which that particular scale or index of the beam is designed for weighing; thus a piece of ore is suspended from the scale for weighing ore, from the fuel scale a piece of coal, and from the flux scale a lump of lime, these being held in suitable holders depending from the scales, which latter form parts of one beam. Cranes for lifting and subsequently weighing ponderous bodies have been made, and appear to have been first proposed by two English projectors about forty years ago. Various contrivances for the automatic weigh-

Fig. 7.




Howe Platform Bearing.

Fig. 8.



Weighmaster's Frame for Steelyard Scale.

ing of materials passing through the apparatus have been projected, but none, so far as the writer knows, have come into any extended use. Among these was an English invention for automatically weighing cotton as it comes from the openers or scutchers preparatory to spinning, the cotton being carried by an endless belt, and thence between rollers which conduct it to a receptacle mounted on levers arranged as part of a weighing-machine; when the accumulated cotton reached a certain limit of weight, its action upon the levers was calculated to bring into operation mechanism for stopping the supply until the receptacle was emptied. Another automatic weighing-machine, which embraces the principle of the well-known gravity water-meter, is intended for automatically weighing grain, the grain passing to a box or hopper, which as soon as a certain weight is reached tilts and empties the box into a conduit which conducts it to the bin.

Previous to the year 1875, 119 different weighing-machines were patented in the U. S., the earliest of which was granted May 10, 1811, to F. Armat of Philadelphia for an apparatus for weighing hay, live cattle, etc. On Jan. 6, 1830, E. Cady secured a patent on a machine for weighing a boat and cargo; this was called a tonnage-meter, and the following year D. Loring patented a machine for weighing canal-boats, loaded wagons, etc. Among other curiosities may be mentioned one patented in 1858 which comprises a weighing mechanism for coal-carts.

JAMES A. WHITNEY.

**Weightman** (ROGER C.), b. at Alexandria, Va., in 1786; became a printer at Washington, D. C., and was at one time Congressional printer; served as an officer of cavalry in the war of 1812–15; became a general of District of Columbia militia; was mayor of Washington 1824–27; became cashier of the Bank of Washington 1827; was for many years librarian of the patent office, and during the civil war had command of the troops quartered in that edifice. D. at Washington Feb. 2, 1876.

**Weight of a Body,** the resultant action of the force of gravity on all of its particles.

**Weight of Observations.** If several observations are made for the purpose of determining the value of a required quantity, it may happen that some of these are more reliable than others, in which case they are said to have greater *weight*. The weight of an observation is a number which expresses the degree of its reliability. Let us suppose that $n$ observations are made, giving results that may be denoted by $a$, $a'$, $a''$, etc., and let the corresponding weights be represented by the numbers $c$, $c'$, $c''$, etc. If we now take the symbol $\Sigma$ to denote *the algebraic sum of homologous quantities*, it may be shown that the expression $\frac{\Sigma(ca)}{\Sigma(c)}$ is more likely to be the true value of the quantity sought than the result obtained by the ordinary method of average. The numbers $c$, $c'$, etc. are often assigned by the observer at the moment of observation, and are intended to express the relative degree of confidence which he has in the several observations. This method of weighting observations is purely arbitrary, and should be employed with great caution.

The term *weight* is also applied to a function which is often used in computing the *probable error* of a result obtained by combining several observations. This function depends on the theory of probabilities. In accordance with this theory, the weight is equal to *the square of the number of observations divided by twice the sum of the squares of the residual errors.* The residual errors are found by subtracting each result of the group from the arithmetical mean of all the results. The probable error is equal to the number .476936 divided by the square root of the weight. By the term *probable error* we mean a quantity such that there is the same probability of *the difference between the result obtained and the true result* exceeding or falling short of it. Thus, if 31 observations have been made for the determination of the longitude of a place, giving a mean result equal to $2m.\ 43.49s.$, and if it is an even chance that the error of this result (either in excess or in defect) is less than $0.029s.$, then the probable error is $0.029s.$, and the result is written $2m.\ 43.49s. \pm 0.029s.$

The method of computing the weight and the probable error of the arithmetical mean may be illustrated by an example taken from Brunnow's *Spherical Astronomy*, p. 53: On the 21st of May the difference of longitude between the observatory at Ann Arbor and the Lake Survey station was determined by telegraph, 31 stars being observed at both stations. The mean value of the longitude thus obtained was $2m.\ 43.49s.$; the sum of the squares of the differences between this result and each of the individual results was found to be 1.77. From these data we find the weight of the mean result equal to $\frac{31}{2\times 1.77}$, or to 271.47, and the probable error equal to $\frac{0.476936}{\sqrt{271.47}}$, or to $0.029s.$ The weight of the result of a single observation of a group is equal to the weight of the mean results *divided* by the square root of the number of observations, and the probable error of the result of a single observation is equal to the probable error of the mean result *multiplied* by the square root of the number of observations. Thus, the weight of the result of a single observation in the case just considered is $271.47 \div \sqrt{31}$, or 48.48, and the probable error of a single result is $0.029s. \times \sqrt{31}$, or $0.16s.$

W. G. PECK.

**Weights and Measures.** See APPENDIX.

**Weights, Atomic.** Those proportions of different chemical species of matter which enter definitely into chemical reactions and combinations—which, chemically speaking, saturate each other or are *equivalent* to each other—are found to have definite *centripetal* tendencies or weights. Dalton originated the hypothesis—upon his noble discovery, made in the first years of the nineteenth century, of the law of multiple combining proportions—that these definite centripetal tendencies of chemical equivalents were simply those of the *atoms of matter*, and that, therefore, each chemical element must have a certain numerical ratio representing the proportional force with which its atom tends to the centre of the universe, which he called its *atomic weight.* The Daltonian hypothesis is among the grandest generalizations of the human intellect, and its author's name is written among the highest upon the rolls of science. (See CHEMISTRY for some account of Dalton's discoveries.)

HENRY WURTZ.

**Weights, Chemical.** In chemical operations the use of the French or metric system of weights (see GRAMME and METRIC SYSTEM) is almost exclusively adopted. For ordinary analytical purposes a set of weights extending from 1 milligramme to 50 grammes is sufficient. The series commonly met with comprises the following weights: three *riders* (see WEIGHING, CHEMICAL), three of .001, one of .002, one .005, two of .01, one of .02, one of .05, three of .1, one of .2, one of .5, three of 1., one of 2., one of 5., two of 10., one of 20., and one of 50. The weights above 1. gramme are made of brass, preferably, plated with gold; those below are usually formed of flat squares of platinum, bent up at one corner. With the exception of the milligrammes, each weight has its value indicated upon it. The entire set is preserved from the action of acids and the air by being enclosed in a small wooden case, the platinum weights being also protected by a glass cover. Notwithstanding this precaution, weights invariably become somewhat tarnished in time, but the error caused by this fact is too slight to seriously affect their accuracy, and is, moreover, more than equalized by the loss proceeding from wear. The weights should never be touched with the fingers, but always taken from the case with a small ivory-tipped forceps, and all cleaning should be confined to dusting them with a camel's-hair brush. A new set of weights should always be carefully tested by weighing against each other; thus, a 2. grm. weight should exactly counterbalance two 1. grm.; a 5. grm., one 2. grm. and three 1. grm., etc.; or one 1. grm. is exactly balanced by a *tare* of tin-foil, and then successively replaced by the other simple gramme weights and their equivalents of the smaller denominations. In ASSAYING (which see) a system of weights especially adapted to the results required—expressing the value of the alloy tested in thousandths of the arbitrary weight taken—is usually employed.

J. P. BATTERSHALL.

**Weights, Measures, and Moneys, Metric System of.** See METRIC SYSTEM, by PRES. F. A. P. BARNARD.

**Weil** (GUSTAV), b. at Sulzburg, Baden, Apr. 24, 1808, of Jewish parentage; studied first Jewish theology at Metz, then classical and Oriental philology at Heidelberg and Paris; resided 1830–36 in Algeria, Constantinople, and Cairo; was appointed assistant librarian at the University of Heidelberg in 1836, and professor of Oriental languages in 1845. He translated into German the *Arabian Nights* (4 vols., 1837–41) and the *Life of Mohammed* by Abd-el Malik ibn Hischam (2 vols., 1864), and wrote—*Mohammed der Prophet* (1843), *Historisch-kritische Einleitung in den Koran* (1844), *Geschichte der Khalifen* (5 vols., 1846–62), and *Geschichte der islamitischen Völker von Mohammed bis zur Zeit des Sultans Selim* (1866).

**Wei'len** (JOSEPH), b. at Tetin, Bohemia, Dec. 28, 1828; studied at Prague and Vienna; served in the Austrian army in Hungary in 1848, and was appointed professor of history and geography at the engineering academy of Znaim in 1852, professor of the German language and lit-

erature at the military academy in Vienna, and custodian at the imperial library in 1861. His poems, *Phantasien und Lieder* (1853) and *Männer vom Schwerte* (1854), attracted some attention, and several of his dramas had still more success—*Tristan* (1860), *Edda* (1865), *Drahomira* (1867), *Graf Horn* (1870), and *Der neue Achilles* (1872).

**Wei'mar,** town of Germany, capital of the grand duchy of Saxe-Weimar, on the Ilm, is a quiet, neat, and friendly place, though rather indifferently built, and not containing any eminent edifices. It has no manufactures and no trade, but several good educational and scientific institutions, and the whole atmosphere is, so to speak, impregnated with the remembrance of Goethe, Schiller, Herder, and Wieland, and the life the town witnessed when these men resided here; and this, its old fame, and the monuments and relics which it contains, attract annually a great number of visitors. P. 15,998.

**Weimar,** DUKE OF. See BERNHARD.

**Wein'heim,** town of Germany, grand duchy of Baden, is celebrated for its leather manufactures and its excellent wine. P. 6130.

**Weins'berg,** small town of Würtemberg, formerly a fine imperial city, on the Neckar, in the centre of a beautiful valley, and surrounded with vineyards and orchards, is famous for the siege which Count Welf (or Guelph) sustained here in 1140. Irritated by the desperate resistance which he had met from the besieged, the emperor Conrad III. ordered that all the men in the town should be put to death, and only the women were allowed to leave the place with what property they could carry along with them. On the day of surrender the women then marched out carrying their husbands on their backs. In the parish church is a picture of 1659 representing the event. P. about 3000.

**Weir** (HARRISON WILLIAM), b. at Lewes, England, May 5, 1824; was apprenticed to a wood-engraver at London; gave great attention to natural history and studied water-color painting; was one of the original members of the Society of Painters in Water-Colors; became noted for his wood-engravings of animals in the *Illustrated London News*, the *Children's Friend*, and the *Band-of-Hope Review*, and by his illustrations to several books on natural history, and is author of *The Poetry of Nature* (1865), *Funny Dogs with Funny Tales*, *The Adventures of a Bear*, and other highly-successful juvenile works illustrated by himself.

**Weir** (ROBERT WALTER), b. at New Rochelle, N. Y., June 18, 1803; became a successful painter at the age of nineteen; studied three years in Italy, returning 1827; was professor of perspective in the National Academy of Design 1830–34; succeeded Charles R. Leslie as instructor in drawing at West Point 1834, and has been full professor there since 1846. Among his best-known works are the *Embarkation of the Pilgrims*, in the rotunda of the Capitol at Washington; *Indian Captives*, in the Athenæum at Boston; *View of the Hudson from West Point*, *Pæstum by Moonlight*, *The Landing of Hendrick Hudson*, and *Columbus before the Council of Salamanca*.—His son, JOHN FERGUSON WEIR, has been since 1869 professor of painting and design in the Yale College School of Fine Arts.

**Weis'bach** (JULIUS), b. near Annaberg, Saxony, Aug. 10, 1806; studied at Freiberg, Göttingen, and Vienna; travelled much in the Austrian countries to investigate their mines, and was appointed professor of mathematics in 1833 at the academy of Freiberg, where he d. Feb. 24, 1871. His *Versuche über den Ausfluss des Wassers durch Schieber, Hähne, Klappen und Ventile* (1842), and *Versuche über die unvollkommenen Contraction des Wassers beim Ausfluss desselben aus Röhren und Gefässen* (1843) were of great importance for the science of hydraulics. His *Lehrbuch der Ingenieur- und Maschinen-mechanik* (3 vols., 1845–54) has been translated into English by L. Gordon (London, 1847–48) and by W. R. Johnson (Philadelphia, 1849). He also wrote *Handbuch der Bergmaschinen-mechanik* (2 vols., 1835–36), *Die neue Markscheidekunst* (2 vols., 1850–59), *Der Ingenieur* (1848; often republished), and *Experimentalhydraulik* (1855).

**Weis'haupt** (ADAM), b. at Ingolstadt, Bavaria, Feb. 6, 1748; studied law in his native city, and was appointed professor there in 1772. He acquired great reputation as a teacher, but came into controversy with the Jesuits, and was dismissed from his office in 1785; went to Gotha, and d. there Nov. 18, 1830. He was the founder of the society of the ILLUMINATI (which see), and most of his writings relate to this subject: *Apologie der Illuminaten* (1786), *Das verbesserte System der Illuminaten* (1787), *Pythagoras oder Betrachtung über die geheime Welt- und Regierungskunst* (1790), *Materialien zur Beförderung der Welt- und Menschenkunde* (3 vols., 1810), *Ueber Staatsausgaben* (1820), *Ueber das Besteuerungssystem* (1820).

**Weiss** (JOHN), b. in Boston, Mass., June 28, 1818; was taught at Chauncy Hall School and Framingham Academy; graduated from Harvard College in 1837; taught at Chauncy Hall and Jamaica Plain; entered the Cambridge Divinity School in 1840; passed the winter of 1842–43 in Heidelberg, Germany; was graduated from the Divinity School, and settled in Watertown in 1843; withdrew on account of strong anti-slavery opinions, and went in 1847 to New Bedford; left soon by reason of ill-health; spent some years in repose, quiet study, and travel; was minister again in Watertown 1859–70; retired in order to devote himself to literature; published in 1845 a translation of Schiller's philosophical and æsthetic essays, *Æsthetic Prose*, preface to an American edition of Smith's *Memoir of Fichte* (1846), *Life and Correspondence of Theodore Parker* (1864), *American Religion* (1871); has written and delivered courses of lectures on Greek religious ideas, humor in Shakspeare, Shakspeare's women; and is author of numerous magazine articles, reviews, lectures, sermons, discourses, literary, biographical, social, political — all stamped with singular originality of thought, intense feeling, and humanity of purpose. Mr. Weiss was one of the leading disciples of the Transcendental philosophy, an ardent abolitionist in the days of slavery, and is now an ardent champion in the cause of woman's political emancipation and an apostle of rationalism in religion. Resides in Boston, Mass. O. B. FROTHINGHAM.

**Weis'senburg,** town of Alsace-Lorraine, at the foot of the Vosges, 32 miles N. E. of Strasbourg. While under French dominion it was strongly fortified, but it was taken by the Germans Aug. 4, 1870, and its fortifications were razed. P. 5886.

**Weissenburg,** p.-v. and tp., Lehigh co., Pa. P. 1644.

**Weis'senfels,** town of Prussia, province of Saxony, on the Saale, in a beautiful district rich in vineyards, has several cotton-spinning and weaving factories, and manufactures tobacco, porcelain, and articles of silver and gold. In one of its churches are the remains of Gustavus Adolphus. P. 15,443.

**Weiss'kirchen,** town of Austria, Military Frontier, is beautifully situated on the Nera, surrounded with orchards and vineyards, and has several silk-throwing and spinning factories. P. 6587.

**Weisskirchen,** town of Austria, in Moravia, has large dyeworks, cloth manufactures, and trade in wool. P. 5970.

**Weiss'port,** p.-b., Carbon co., Pa. P. 359.

**Weit'zel** (GODFREY), b. at Cincinnati, O., Nov. 1, 1835; graduated at the U. S. Military Academy July, 1855, when appointed brevet second lieutenant of engineers; as assistant to Capt. Beauregard he was employed in the construction and repairs of fortifications about New Orleans until 1859, when transferred to West Point as assistant professor of engineering; in Jan., 1861, was ordered to duty with Co. A, Engineers; served in the defence of Fort Pickens Apr.–Sept., 1861; was chief engineer department of the Ohio Oct.–Dec., 1861. In the organization of Gen. Butler's expedition to New Orleans, Weitzel, being familiar with the forts and surrounding country, was selected as chief engineer. He planned the capture of New Orleans, and on its fall was appointed acting military commander and mayor of the city. Commissioned brigadier-general of volunteers Sept. 16, 1862, he cleared the enemy from the La Fourche district, the battle of Labadieville occurring Oct. 27. Remained in possession of the district until Apr., 1863, when, dispersing the enemy, he joined his force to that besieging Port Hudson, and during the siege was in command of a division, and upon its surrender was placed in command of the 1st division of the 19th corps and ordered to Donaldsonville; engaged in the expedition to Sabine Pass. In Apr., 1864, he was ordered to Virginia, and made chief engineer of the Army of the James, as such constructing the defences of Bermuda Hundred and Deep Bottom, and in command of 2d division of 18th corps was engaged in the various operations of that army, including the actions near Drury's Bluff; in command 18th corps in the repulse of the enemy at Fort Harrison. In Nov., 1864, he was promoted to major-general, and in December was placed in command of the 25th corps. In that month he accompanied Butler's unsuccessful expedition to Fort Fisher as second in command. The troops N. of the Appomattox were assigned to his command in Mar., 1865, and on the morning of Apr. 3 he took possession of the city of Richmond. Commanded a military district in Texas Apr., 1865, to Mar., 1866, when mustered out of the volunteer service. Brevet major for gallantry at Thibodeaux; lieutenant-colonel for Port Hudson; colonel for Fort Harrison; brigadier and major general for gallant and meritorious services during the rebellion. Returning to duty with his corps, in which he attained a majority Aug., 1866, he has

since been engaged on important engineering work in connection with the Louisville and Portland Canal, St. Mary's Falls Canal, improvement of the falls of the Ohio, etc., and on lighthouse construction.

**Wel'born,** tp., Conway co., Ark. P. 1275.

**Wel'by** (Amelia B. **Coppuck**), b. at St. Michael's, Md., Feb. 3, 1819; removed with her parents to Kentucky in childhood; resided at Lexington and at Louisville; was married to a merchant of the latter city, Mr. George B. Welby, in 1838; began in 1837 to contribute poems to the Louisville *Journal* over the signature of "Amelia," which were highly praised by Prentice and Griswold, and obtained for her a considerable reputation. They were collected into a volume which was published at Boston 1844, passed through several editions, and was issued at New York (1850), with illustrations by R. W. Weir. D. in Louisville, Ky., May 3, 1852.

**Welch,** tp., Cape Girardeau co., Mo. P. 589.

**Welch** (Moses Cook), D. D., b. at Mansfield, Conn., 1754; graduated at Yale College 1772; was at first a teacher; studied law, and afterward theology; served in the army of the Revolution, and was minister of Mansfield from June 2, 1784, until his death, Apr. 21, 1824. He was associated with (Rev. Dr.) Samuel Nott in the early part of the Revolution in making saltpetre for the supply of the army with powder, and a pioneer explorer of Western New York; was the teacher of Eleazar Williams (called the dauphin of France), and a very effective preacher. He published many single sermons.

**Welches,** tp., Macon co., N. C. P. 546.

**Welches Creek,** tp., Columbus co., N. C. P. 818.

**Weld, Wold,** or **Dyer's Weed** [Lat. *Reseda luteola;* Fr. *gande;* Ger. *Gelbkraut* or *Wau*], an annual herbaceous plant, often growing wild, which is a native of the southern parts of Europe, but has been naturalized in the U. S. It contains a yellow coloring-matter termed luteoline ($C_{20}H_{14}O_8$) which is highly esteemed for its durability, and ranks among the vegetable dyes next to the Persian berry. Luteoline is extracted from the plant by treatment with boiling water; it is more soluble in alcohol and in ether; when heated it sublimes and condenses in yellow needles; it furnishes yellow lakes with plumbic acetate, alum, and stannous chloride, and is extensively used for imparting a gold color to silks and for paper-staining. The entire plant is also employed for dyeing purposes in Europe, including England (especially in Kent), but its consumption has greatly diminished since the introduction of quercitron. In preparing baths from weld the exhausted plant should be removed from the liquid, and the latter used as soon as possible, as its decoction speedily undergoes decomposition on exposure to the air. J. P. Battershall.

**Weld,** county of N. E. Colorado, bordering on Nebraska and Wyoming, watered by the South Platte and its affluents, and crossed in the W. part by Denver Pacific R. R. The surface is an elevated plain, scantily wooded, but with much coal and iron ore; soil very productive when irrigated. Sheep and cattle are the principal live-stock. Staples, oats, Indian corn, wheat, hay, and wool. Cap. Greeley. Area, about 11,000 sq. m. P. 1636.

**Weld,** p.-v. and tp., Franklin co., Me. P. 1130.

**Weld** (Angelina Emily **Grimké**), wife of Theodore Dwight Weld, and sister of Thomas Smith and Sarah Moore Grimké, b. at Charleston, S. C., Feb. 20, 1805; became a resident of Philadelphia, where, with her sister Sarah, she joined the Society of Friends 1828, and emancipated a number of slaves whom they inherited from their parents 1836; was also associated with her sister in delivering public addresses against slavery in New England and New York, and achieved great success by her eloquence, which was then a novelty in the U. S., and had an important bearing upon the rise of the "woman's rights" movement, and was joint authoress, with Sarah, of *An Appeal to the Christian Women of the South* on the subject of slavery. She was married to Theodore D. Weld May 14, 1838.—Her sister, Sarah Moore Grimké, b. at Charleston, S. C., Nov. 26, 1792; d. at Hyde Park, Mass., Dec. 23, 1873.

**Weld** (Charles Richard), b. at Windsor, England, in 1818; educated at Dublin; studied law at the Middle Temple; was called to the bar 1844; was assistant secretary to the Royal Society 1845–61, district superintendent of the International Exhibition of 1862, assistant British commissioner to the Paris Exposition 1867, partner with Lovell Reeve in the publishing business since 1861; was a friend and literary assistant of Sir John Franklin, and brother-in-law of the poet Tennyson. D. at Bath Jan. 15, 1869. Author of a *History of the Royal Society, with Memoirs of the Presidents* (2 vols., 1848), *A Vacation Tour in the U. S. and Canada* (1855), and other similar *Tours* in Ireland, Scotland, Brittany, Burgundy, and Italy; also of various other works.

**Weld** (Horatio Hastings), b. at Boston, Mass., in 1811; became a practical printer; edited newspapers in Lowell, Boston, New York, and Philadelphia, and took orders in the Protestant Episcopal Church 1845. Author of *Corrected Proofs, a Volume of Sketches* (1837), *Life of Christ* (1850), *Scripture Quotations* (1851), and *Sacred Poetical Quotations* (1851), and edited Franklin's *Autobiography* (1849), *The Sacred Annual* (1851), *The Women of the Scriptures, Scenes in the Lives of the Apostles,* and *Scenes in the Lives of the Patriarchs and Prophets.*

**Weld** (Isaac), brother of Charles Richard, b. at Dublin in 1774; travelled extensively in Europe and America, and was for many years secretary and vice-president of the Royal Dublin Society. D. in 1856. Author of *Travels through the States of North America,* etc. (1799), a work which was translated into several languages, and was long regarded as of standard authority; *Illustrations of the Scenery of Killarney* (1807), and *A Statistical Survey of the County of Roscommon* (1832).

**Weld** (Lewis), b. in Hampton, Conn., Oct. 17, 1796; graduated at Yale College in 1818, when he became teacher in the American asylum for the education of the deaf and dumb; in 1830, upon the resignation of Mr. Gallaudet, was appointed his successor; as chief executive officer sustained himself in the performance of its varied responsibilities with honor to himself and to the satisfaction of the board of directors for nearly twenty-three years. During a few of the last years of his life he was oppressed with chronic infirmities. D. Dec. 30, 1853.

**Weld** (Theodore Dwight), b. at Hampton, Conn., Nov. 3, 1803; educated at Hamilton College; studied theology at Lane Seminary, Cincinnati, O.; headed the secession of most of the students of that institution to Oberlin on account of the suppression of an anti-slavery society by the board of trustees; became an anti-slavery lecturer, but losing his voice in 1836, took the post of editor of the publications of the American Anti-Slavery Society; wrote many pamphlets against slavery, and several volumes, among which were *The Bible against Slavery, Slavery as it Is,* and *The Power of Congress over the District of Columbia;* spent several sessions at Washington 1841–43, working in connection with the anti-slavery members of Congress; established in 1854 a school of a high class at Eagleswood, N. J., in which colored pupils received especial attention, and in 1864 removed to Hyde Park, near Boston, where he has since resided, devoting himself chiefly to lecturing.

**Weld** (Thomas), b. in London, England, Jan. 22, 1773; was the eldest son of Thomas Weld, a wealthy Roman Catholic who was the founder of Stonyhurst College, Lancashire; succeeded in 1810 to the ancestral estates at Lullworth, Dorsetshire; lost his wife 1815; became a Roman Catholic priest 1821, giving up the family estates to his next brother; was employed at Chelsea and Hammersmith; was created coadjutor bishop of Kingston, Upper Canada, and bishop of Amyclæ *in partibus infidelium* Aug. 6, 1826, but never proceeded to Canada; went to Rome with his daughter, Lady de Clifford, 1829; was created a cardinal by Pope Pius VIII., and d. at Rome Apr. 19, 1837. (See Cardinal Wiseman's *Recollections of the Last Four Popes.*)

**Welde** (Thomas), b. in England about 1590; graduated at Trinity College, Cambridge, 1613; took orders in the Church of England; was for some years minister of a church at Farling, Essex; being molested as a Puritan by the ecclesiastical authorities, emigrated to New England; arrived at Boston June 5, 1632; was ordained the following month as first minister of the church of Roxbury; received in November as a colleague the celebrated John Eliot; took a prominent part at the trial of Mrs. Anne Hutchinson as an opponent of her peculiar doctrines 1637; was associated with Eliot and Richard Mather in 1639 in making the translation of the Psalms known as the "Bay Psalm-Book" (*The Whole Book of Psalms faithfully translated into English Metre,* Cambridge, 1640), which was the first volume printed in New England; was sent with Hugh Peters to England in 1641 as agent for the colony—a post he filled until 1646, when he was dismissed and requested to return, but remained in England; was afterward pastor of a church at Gateshead, near Newcastle-upon-Tyne; accompanied Lord Forbes to Ireland, and resided there some time; subsequently returned to England, and was ejected from his living for nonconformity 1662. D. Mar. 23, 1662. He published *A Short Story of the Rise, Reign, and Ruin of the Antinomians, Familists, and Libertines that infected the Churches of New England* (London, 1644; 2d ed. 1692), a celebrated tract of which another shorter version, *Antinomians and Familists condemned,* etc. (1644), appeared about the

same time, leaving it doubtful which is the original edition, and whether Gov. John Winthrop may not have been the chief author, as maintained by several antiquaries. It was answered by Rev. John Wheelwright in his *Mercurius Americanus*, etc. (1645). Welde also wrote a controversial tract, *An Answer to W. R. his Narrative of the Opinions and Practices of Churches lately erected in New England* (1644). —One of his sons, THOMAS, remained in New England (d. Jan. 17, 1683).—His grandson, THOMAS, b. in 1652, graduated at Harvard 1671, and was minister of Dunstable, Mass., from 1685 to his death, June 19, 1702. The latter was father of HABIJAH, b. at Dunstable Sept. 2, 1702, graduated at Harvard 1723, was settled as pastor at Attleborough Oct. 1, 1727, was a notable preacher, and who survived until May 14, 1782.

**Weld'ing,** a term applied to a phenomenon exhibited by *iron*, *platinum*, and probably some other metals, consisting in the assumption at a certain temperature of a glutinous cohesion between surfaces, accompanied, in the case of iron, with a considerable degree of plasticity and viscosity. It is doubtful whether this character as manifested in iron differs in nature from the same character as assumed by semi-fused shellac or sealing-wax. It is one of the most important properties, in a practical sense, of both iron and platinum, for without it neither of these valuable metals could be readily or cheaply obtained in large homogeneous masses. The process of puddling iron is founded on the welding cohesiveness produced at the heat of the puddling-hearth as the iron gradually loses its carbon and other contaminating impurities. The tool of the operative causes the particles of iron, as they gradually "come to nature," to cohere together gradually into a ball. The same remark applies to the processes of obtaining soft iron direct from the ore in bloomeries or Catalan forges. (See IRON.) Platinum is obtained in masses by forming it into sponge by chemical means, then compressing this into a cylinder, which, when heated highly and hammered, *welds* into a compact homogeneity. HENRY WURTZ.

**Wel'don,** tp., Benzie co., Mich. P. 74.

**Weldon,** p.-v., Halifax co., N. C., at the head of navigation on Roanoke River and on Petersburg Raleigh and Gaston, Seaboard and Roanoke, and Wilmington and Weldon R. Rs., 97 miles E. of Raleigh, contains good schools, 1 semi-weekly newspaper, and fine water-power. P. 208. MANNING BROS., EDS. "ROANOKE NEWS."

**Weldon** (Sir ANTHONY), BART., b. in England about 1590, became clerk of the kitchen to James I., whom he accompanied in his "progress" through Scotland in 1617, when he wrote a description of Scotland and its people which gave so much offence that he was dismissed from office with a pension. He survived until after 1655. He published *The Court and Character of King James* (1650) and *The Court of King Charles* (1651), both of which have been several times republished, and exhibit those monarchs in no favorable light. He left in MS. a *Brief History of the Kings of England, particularly those of the Royal House of Stuart* (1755).

**Weldon** (JOHN), b. at Chichester, England, about 1670; was a pupil of Henry Purcell in sacred music; was for some time organist of New College, Oxford; was appointed gentleman extraordinary of the chapel royal 1701, organist of the same 1708, and second composer to the court 1715; was at the same time organist of St. Bride's and of St. Martin-in-the-Fields; wrote several fine anthems, some pleasing songs, and part of the music to Congreve's *Judgment of Paris*. D. in 1736. His anthems *Hear my Crying* and *In Thee, O Lord!* are still favorites.

**Wel'haven** (JOHAN SEBASTIAN CAMMERMEIER), b. at Bergen, Norway, Dec. 22, 1807; studied at the University of Christiania; began to lecture on philosophy in 1840; was appointed professor in 1846, and d. Nov. 8, 1872. In 1832 he published *Henrik Wergelands Digtekunst og Character*, and thereby opened that memorable controversy which forms the introduction to the Norwegian literature. (See NORWEGIAN LANGUAGE AND LITERATURE.) In 1833 he founded the *Vidar*, a weekly paper, which in 1836 was transformed into a daily paper, the *Constitutionelle*, and in 1834 he published that book which became the centre of the whole contest, *Norges Dæmring*, a collection of poems, in which he attacked the prejudices and narrow tendencies of the awakening national spirit with merciless sarcasm, and unfolded his own wider views and loftier ideas. Another collection of poems, without any polemic tendency, appeared in 1851, and a third in 1863. He also wrote several valuable essays on the elder Danish-Norwegian literature. His collected works were published in 8 vols. in Copenhagen (1868).

**Welker** (MARTIN), b. in Knox co., O., Apr. 25, 1819; was admitted to the bar 1840; was clerk of Holmes co. court 1846–51 and judge of common pleas for the 6th district 1851–56; settled at Wooster, and was elected lieutenant-governor as a Republican 1857; served in the early part of the civil war as judge-advocate; was assistant adjutant-general of Ohio 1862, and superintended the draft in that State; was a delegate to the Philadelphia Loyalists' convention 1866; sat in Congress 1865–71, and was appointed in 1873 U. S. judge for the northern district of Ohio.

**Well** [Ang.-Sax. *weallan*, to "gush out"]. *Well*, like the German *Brunnen*, originally signified a natural flowing spring, and some mineral springs are still called wells. Living springs were the only sources of drinkable water known to primitive man, and though excavated wells are among the most ancient of human permanent constructions, they are too laborious, too costly, and require too great an amount of mechanical skill to have been executed until the arts had made a considerable progress, and social institutions were so far organized as to secure to individuals, or at least families or tribes, long enjoyment of the fields and the pastures of which they had taken possession. In pastoral life, and especially in the climates in which pastoral industry appears to have been first largely practised, water is the first requisite for the establishment of a camp or the temporary occupancy of feeding-grounds for cattle. The nomad Bedouins now rarely if ever dig wells. For their small herds the slender threads of living water found here and there in the desert, cisterns and pools accumulated from the winter rains, suffice, and in many of their habitual routes of travel they still find a supply of water in wells excavated, like those of Jacob and of Beersheba, in the patriarchal ages. Ancient writers speak of wells in the North African desert several hundred feet deep, and their accounts have been confirmed by modern travellers; but in a large part of that waste a continuous sheet of water exists at depths so moderate as to be easily reached by cutting through the bed of indurated sand which overlies it. The wells of the Sahara are square excavations, not walled up with stone, but lined with a framework of palm-trunks, and they yield an abundant supply of water for cattle and for irrigating the small gardens which Arab industry finds it convenient to till. The water often rises to the surface, and pours over like that in an artesian boring, and the wells are choked in a few years by fine sand brought up by the flow. The removal of the sand is a difficult and dangerous operation, as the work must be performed under water, and it is the special vocation of a sort of guild or corporation.

In the East, wells are generally round, but sometimes square, and when not cut through solid rock are generally stoned, as in Europe. In their present condition they are usually without a curb, the orifice being closed by a flat stone, and they are unprovided with any apparatus for raising the water, the traveller being expected to furnish his own rope and bucket. The Greek and Roman wells were provided with curbs, and it appears that these were used long before the general employment of sweeps or of pulleys for hoisting the bucket, for the edges of the most ancient curbs are everywhere cut into channels by the friction of the rope drawn over them, which would not be the case if the water-vessels had been attached to a sweep or to a rope passing over a pulley suspended from above.

In Europe, several apartments, sometimes fifteen or more, in different stories in the same house, often draw water from a common well in the court by the aid of an ingenious mechanical contrivance. Over the centre of the well, and two or three feet above it, a stout iron ring, of a diameter considerably smaller than the orifice of the well, is suspended by strong wires running from the ring to a window in each apartment to be supplied. A bucket is attached to a double pulley or block running on the wire, which carries it down to the ring, whence it is lowered into the water by slackening, and drawn up by hauling in the rope over the lower sheave, with very little labor.

The economical and sanitary value of water, and the frequent difficulty and expense of procuring it, gave wells great importance in the eyes of the ancient world, and those distinguished for purity or abundance of water were regarded with almost idolatrous reverence. Hence great care was bestowed upon their construction and preservation, and they were often sumptuously decorated and provided with many useful as well as ornamental accessories. Many ancient well-curbs of fine material and workmanship are found in museums of ancient art, and some of those in the Vatican—particularly one of marble, thought to be Etruscan—are among the most admirable works of sculpture in that great museum. In India, too, valuable wells are considered and treated almost as temples. Grant Duff, in his recent *Notes of an Indian Journey*, p. 33, speaks of "a famous well" at Ahmedabad, "an exquisite combination of galleries, pillars, and deep cool pools sunk beneath the soil." Of remarkable wells we may mention that in

the citadel at Cairo, traditionally ascribed to the patriarch Joseph. This is several hundred feet in depth, and is surrounded by a double winding ramp by which beasts of burden can descend and bring up water. There is a very similar well, though not of very ancient construction, at Orvieto. Among the most extraordinary, as well as deepest, excavated wells known is that at Scarpa, not far from Tivoli. According to Nibby and other writers, this well, which is in solid rock, circular and about nine feet in diameter, is above 1700 feet deep, but has seldom more than 18 feet of water in it. At what period it was excavated is quite unknown, and as it does not appear to be connected with any mining gallery or with any aqueduct, it is not easy to conjecture the purpose for which it was executed.

Persons of acute observation acquire by long practice a wonderful skill in detecting the *indicia* which point to the existence of water at accessible depths beneath the surface of the earth. Paramelle, a French priest of the last generation, though often at fault in his geology, is declared by high scientific authorities to have been infallible in practice; and he claims to have discovered and revealed more than 10,000 subterranean fountains in the course of a few years. (See Paramelle, *Quellenkunde* (12mo), and on ancient wells, Smith, *Dictionary of Greek and Roman Antiquities*, article "Puteal.") The ingenious and simple method of obtaining water by what is called the American well, consisting in driving a small iron tube, provided with a perforated hollow conical point of steel, a few feet into the ground and applying a hand-pump to the orifice, deserves special notice as an economical and speedy process which in many cases obviates the necessity of common wells altogether. (See WELLS.) GEORGE P. MARSH.

**Wel'land,** river of Ontario, Canada, an affluent of the Niagara, which it joins above the Falls after a course of about 60 miles, forms part of the Welland Canal, which connects Lake Erie with Lake Ontario.

**Welland,** county of Ontario, Canada, bounded S. by Lake Erie and E. by the river Niagara. It is level, and very productive of wheat and all kinds of farm products. It is traversed by various railroads and the Welland Canal. Cap. Welland. P. 20,572.

**Welland,** p.-v., cap. of Welland co., Ont., Canada, on Welland River, Railway, and Canal, and on Canada Southern Railway, 12 miles S. of St. Catharine's, has a fine water-power and 2 weekly newspapers. (Formerly called MERRITTSVILLE.) P. 1110.

**Wellbeloved** (CHARLES), D. D., b. at York, England, about 1770; became a Unitarian minister at his native place, and was noted for his philological and archæological attainments. D. at York in 1858. Author, among other works, of *Eboracum, or York under the Romans* (1842), and a translation of the Old Testament, of which the first portion (Genesis to Solomon's Song) appeared in 1838 (2 vols.), and again, along with other translations by Rev. George Vance Smith and Rev. John Scott Porter, under the title *The Holy Scriptures of the Old Covenant, in a Revised Translation* (3 vols., 1859–62). A *Memoir* (1860) was written by Rev. John Kenrick.

**Wel'ler,** tp., Henry co., Ill. P. 1560.

**Weller,** tp., Richland co., O. P. 1140.

**Weller** (JOHN B.), b. in Ohio about 1812; was a Democratic member of Congress 1839–45; was lieutenant-colonel of Morgan's Ohio regiment in the Mexican war, and became its commander on the death of Col. Morgan at the battle of Monterey; was the first commissioner to Mexico under the Treaty of Guadalupe Hidalgo 1848; settled in California 1849; was U. S. Senator 1851–57, governor of California 1858–60, minister to Mexico 1860–61, and delegate to the national Democratic convention at Chicago 1864. D. at New Orleans, La., Aug. 17, 1875.

**Wellersburg,** p.-b., Somerset co., Pa. P. 290.

**Welles** (EDWARD R.), D. D., b. at Waterloo, N. Y., about 1834; graduated at Hobart College; studied theology under Rev. Dr. Wilson; took orders in the Protestant Episcopal Church about 1857; was many years minister of the Episcopal church at Red Wing, Minn., the most important parish of the State; was long an active member of General Conventions, and was consecrated bishop of Wisconsin Oct. 25, 1874.

**Welles** (GIDEON), b. at Glastonbury, Conn., July 1, 1802; educated at the Episcopal academy at Cheshire and at Norwich University; studied law under Judges Williams and Ellsworth; editor and proprietor of the Hartford *Times*, a Democratic paper, 1826–37; supported the candidacy of Gen. Jackson for the Presidency; was a member of the legislature 1827–35; postmaster of Hartford 1836–41; State comptroller 1842–46, and chief of a bureau in the navy department 1846–49; was an original member of the Republican party, and chairman of the Connecticut delegation at the Chicago convention, where he was influential in securing the nomination of Lincoln for the Presidency; was secretary of the navy through the administrations of Lincoln and Johnson; has written largely for the press, and has contributed a valuable series of war-memoirs to the *Galaxy* magazine (1875–76).

**Welles** (NOAH), D. D., b. at Colchester, Conn., Jan. 23, 1718; graduated at Yale College 1741; taught a school at Hartford several years; was tutor at Yale 1745–46; studied theology; was ordained pastor of the Congregational church at Stamford, Conn., Dec. 31, 1746; took an active part in the polemic concerning the validity of non-episcopal ordination 1763, publishing three pamphlets on the subject, and printed other single sermons and addresses. D. at Stamford Dec. 31, 1776.

**Welles'ley,** p.-v., Norfolk co., Mass.

**Wellesley** (ARTHUR). See WELLINGTON.

**Wellesley** (HENRY), D. D., F. S. A., b. in 1792, son of the Marquis Wellesley by his first wife, Mlle. Hyacinthe Gabrielle Roland (d. 1825), but deemed illegitimate in English law because born before the marriage of his parents; graduated at Christ Church, Oxford, 1816; took orders in the Church of England; became rector of Woodmancote, Hurstmonceaux, Sussex, 1838, and principal of New Inn Hall, Oxford, 1837, and was subsequently select preacher to the University of Oxford, curator of the Bodleian Library, of the university galleries, and of the Taylor Institution; was an accomplished scholar in the classical and modern languages, also in the fine arts and archæology, having been a member of the Sussex Archæological Society from its formation, and a leading contributor to its volumes. D. at Oxford Jan. 11, 1866. Author of *Anthologia Polyglotta, or a Selection of Versions in Various Languages, chiefly from the Greek Anthology* (1849), *Stray Notes on Shakspeare* (1865), and of the part relating to Italian and majolica ware in Marryat's *History of Pottery and Porcelain* (1851).

**Wellesley** (RICHARD COLLEY), MARQUIS WELLESLEY, K. G., D. C. L., and earl of Mornington, brother of the first duke of Wellington, b. at Dublin, Ireland, June 20, 1760; educated at Eton and at Christ Church, Oxford; distinguished himself in oratory and in Latin versification; succeeded, on the death of his father in 1781, to the titles of Viscount Wellesley and earl of Mornington, and took his seat in the Irish House of Peers; was obliged to sell the family estates to discharge the pecuniary obligations of his father; was one of the original knights of St. Patrick 1783; was elected to the British House of Commons for Beeralston 1785, and for Saltash 1786, but was unseated on petition in the latter year; advocated in the Irish Parliament, during the regency debate of 1789, the restriction of the powers of the prince during the malady of the king; became, in consequence, a favorite of George III.; obtained an election from Windsor; was made one of the lords of the treasury, a member of the Irish, and subsequently (1793) of the British, privy council; gave especial attention to the affairs of India; was appointed an unpaid member of the board of control 1795; was raised to the House of Lords as Baron Wellesley, and appointed governor-general of India, Oct. 4, 1797; arrived at Calcutta May, 1798; found the native powers of India ripe for a struggle against British ascendency, to which they were incited by Bonaparte, who was then in possession of Egypt, was meditating an expedition to India, and had formed an alliance with the celebrated Tippoo, sultan of Mysore; sent a small British force into the territories of the nizam, ordering him to disband his levies and to surrender 124 French officers; despatched Gen. Harris with an army of only 20,000 men against the capital of Mysore Feb. 3, 1799, coming himself to Madras to superintend the operations, which resulted in the storming of Seringapatam and the death of Tippoo May 4; divided the territories of Mysore with the nizam, and made his brother, Col. Arthur Wellesley, governor of Seringapatam, July, 1799; was created Marquis Wellesley in the peerage of Ireland Dec. 2, 1799; received the thanks of Parliament, and refused £100,000 of prize-money offered by the East India Company; directed his attention with great success to the commercial interests and the internal organization of the British empire in India; made treaties with the nizam and the sultan of Muscat; took quiet possession of the territories of the nabob of the Carnatic in consequence of the treachery of that prince; effected the occupation by the British of the frontier provinces of Oude; concluded a treaty with the shah of Persia, which resulted in the fall of the celebrated Afghan conqueror Zemaum Shah, who had for years disturbed the W. of India by his formidable hordes; sent in 1801 a force of 7000 men, under Gen. Baird, up the Red Sea to co-operate with Gen. Sir Ralph Abercromby against the French in

Egypt; had a quarrel with the board of directors and tendered his resignation 1802, but was induced to withdraw it; engaged in a desperate but brilliant and victorious struggle with the Mahrattas 1803–05, signalized by the triumph of his brother at Assaye and of Lord Lake at Laswaree, the conquest of the whole country between the Jumna and the Ganges, the humiliation of Scindia and Holkar, and the submission of the rajah of Berar; built the viceregal palace at Calcutta; founded a college for the cultivation of Indian literature; inaugurated surveys of the country upon a vast scale and effected great financial reforms, making his administration the most memorable in Anglo-Indian history; returned to England Aug., 1805; was received with honor by the government and the East India Company, which conferred upon him an annuity of £5000, but was annoyed by the presentation in the House of Commons of articles of impeachment, which, however, were almost unanimously rejected; was ambassador in Spain 1808–09; secretary of state from Dec., 1809, to Jan., 1812; was designated as prime minister on the assassination of Mr. Perceval, May, 1812, but was unable to form a satisfactory cabinet; remained in opposition for the ensuing ten years, but rendered invaluable parliamentary support to his brother during the campaigns of the Peninsula and of Waterloo; accepted the office of lord lieutenant of Ireland under Canning Dec., 1821; was an advocate of the Roman Catholic claims, and attempted a policy of conciliation, but was obliged to have recourse to energetic measures to repress violent outbreaks; was recalled on the accession of his brother to the premiership 1828, owing to a difference of opinion between them on the "Catholic question;" was lord steward of the household under the Liberal government of Earl Grey 1830–31; a second time lord lieutenant of Ireland 1833–34, and lord chamberlain 1835, but resigned from public life the same year on account of advanced age and straitened circumstances, and was the recipent of a testimonial of £20,000 from the East India Company. D. at Kingston House, Knightsbridge, London, Sept. 26, 1842, and was buried, in compliance with his will, in the vault at Eton College chapel. Statues have been erected in London and at Calcutta. He was twice married, the second time Oct. 29, 1825, to Mrs. Patterson, an American lady (daughter of Richard Caton of Maryland, and granddaughter of Charles Carroll of Carrollton), but left no legitimate issue, and the marquisate became extinct at his death. The earldom went to his next brother, but afterward reverted to the duke of Wellington. He published several political pamphlets shortly before his death, and privately printed a small volume of poems in English, Latin, and Greek, entitled *Primitiæ et Reliquiæ* (1840; 2d issue 1841). His *Despatches, Minutes, and Correspondence, etc., during his Administration in India* (5 vols., 1836–37), and his *Despatches and Correspondence during his Mission to Spain* (1838), were edited by R. Montgomery Martin, and his *Memoirs and Correspondence* (3 vols., 1846) by Robert R. Pearce.

PORTER C. BLISS.

**Well'fleet,** p.-v. and tp., Barnstable co., Mass. P. 2135.

**Welling** (JAMES C.), LL.D., b. at Trenton, N. J., July 14, 1825; graduated at Princeton 1844; settled in New York 1848; was for some years correspondent and literary editor of the *National Intelligencer*, its associate editor 1855–65, and its principal conductor during the war; visited Europe for his health 1866; was president of St. John's College, Annapolis, Md., 1867–70, professor of belles-lettres at Princeton 1870–71, and became president of Columbian College, Washington, D. C., Nov. 6, 1871. He has been a contributor to the *North American Review* and to other literary periodicals.

**Wel'lington,** city of New Zealand, capital of the province of the same name, and, since 1865, of the whole colony, is on an inlet of Cook's Strait, has an excellent harbor, and is connected by railway with Upper Hutt. It is well built, carries on a considerable trade, exporting wool, tallow, and gum, and had 10,507 inhabitants in 1857.

**Wellington,** town of England, Shropshire, has large smelting-furnaces, nailworks, and malt-houses. P. 5576.

**Wellington,** county of the W. central part of Ontario, Canada, has a soil generally fertile and well cultivated, and the manufacturing interests are thriving. It is traversed by divisions of the Grand Trunk and Great Western railways. Cap. Guelph. P. 68,289.

**Wellington,** port of entry of Prince Edward co., Ont., on a bay of Lake Ontario called West Lake, the seat of important fisheries. P. 517.

**Wellington,** p.-v., cap. of Sumner co., Kan., on the N. bank of Slate Creek, 12 miles W. of Arkansas River, has excellent schools, 1 bank, and 1 newspaper. The soil is adapted to the growth of wheat. The village was laid out in 1871. P. about 600.

JOHN H. FOLKS, ED. "SUMNER COUNTY PRESS."

**Wellington,** p.-v. and tp., Piscataquis co., Me. P. 681.

**Wellington,** p.-v., Lafayette co., Mo.

**Wellington,** p.-v. and tp., Lorain co., O., on Cleveland Columbus Cincinnati and Indianapolis R. R., 35 miles S. of Cleveland, has 3 churches, a fine union school building, 1 bank, 1 newspaper, several large mills, and 2 hotels; it is the principal market for dairy products in Ohio, the shipment of cheese alone amounting to 10,000,000 pounds annually. P. of v. 1281; of tp. 1891.

J. C. ARTZ, ED. "ENTERPRISE."

**Wellington,** tp., Monroe co., Wis. P. 502.

**Wellington** (ARTHUR **Wellesley**), K. G., DUKE OF, b. at Dangan Castle, county Meath, Ireland, in Apr., 1769 (or, as some biographers allege, at Merrion Square, Dublin, May 1), was the third son of Garrett Wellesley or Wesley (as the name was then spelled), first Viscount Wellesley and earl of Mornington (d. 1781), who attained some distinction as a musical composer, his mother being Anne Hill Trevor, oldest daughter of Arthur, first Viscount Dungannon; received his earlier education at Eton College; spent six years (1781–87) in the military seminary at Angers, France, then under the direction of the celebrated engineer Pignerol; was rapidly pushed by family influence through the lower grades of the service, entering the army as ensign of the 73d Foot Mar. 7, 1787; was appointed lieutenant in the 76th Dec. 25, captain of the 58th Foot June 30, 1791, exchanged into the 18th Light Dragoons Oct., 1792, was promoted to major Apr. 30, and lieutenant-colonel of the 33d Foot Sept. 30, 1793; was elected to the Irish Parliament for the borough of Trim, where his family possessed preponderating influence, in the summer of 1790; was appointed aide-de-camp to the earl of Westmoreland, lord lieutenant of Ireland, 1791; saw his first field-service under the duke of York in the Netherlands in 1794, when, having obtained through his brother's influence the command of the 33d regiment, he embarked at Cork for Ostend (May); joined the main body of the army at Antwerp; commanded three battalions during the disastrous retreat of the British army through Holland Jan., 1795, conducting himself with credit in several sharp skirmishes with the French; was commissioned colonel May, 1796; embarked for India with his regiment the same year, arriving at Calcutta Feb., 1797; was placed in command of the subsidiary forces furnished by the nizam for the campaign against Tippoo Sultan 1799; bore a prominent part in the victory of Mallavelly; commanded the reserves in the trenches at the assault and capture of Seringapatam, May 4; was appointed governor of Mysore by his brother, the governor-general (see WELLESLEY, MARQUIS OF); waged a campaign against a celebrated Mahratta freebooter, Dhoondia Waugh, self-styled "the king of the two worlds," whom he defeated and killed Sept. 10, 1800; was named second in command to the expedition sent to Egypt 1801, but was prevented from embarking by illness; became major-general Apr., 1802; commanded the expedition against the Mahrattas, and restored the peishwa Apr.–May, 1803; besieged and took Ahmednuggur Aug. 8–12; entered Aurungabad Aug. 29; defeated Scindia at the decisive battle of Assaye, Sept. 23, and again at Argaum, Nov. 29; took the great fort of Gawilghur in December; concluded a treaty with Scindia Dec. 30, imposing upon him stringent conditions; was knighted and received the thanks of the king and Parliament 1804; arrived in England Sept., 1805; took part in Lord Cathcart's expedition to Hanover in November; married Lady Catharine Pakenham, second daughter of the third earl of Longford, Apr. 10, 1806; was elected to the British Parliament for Newport, Isle of Wight; became chief secretary for Ireland under the duke of Richmond Apr., 1807; had a command under Lord Cathcart in the expedition against Copenhagen, and negotiated the capitulation of that city Sept. 7, 1807; became lieutenant-general Apr. 25, 1808, and commander-in-chief of the forces sent to the Peninsula in June; sailed from Cork, and landed at Coruña in July, offering his aid to the Galicians for the expulsion of the French, but the offer being declined, he re-embarked; landed at Mondego Bay, Portugal, Aug. 1, and defeated Gen. Laborde at Roliça Aug. 17; was superseded in the chief command by Sir Harry Burrard Aug. 20; gained over Junot the brilliant victory of Vimeira Aug. 21; signed the armistice which led to the convention of Cintra Aug. 31; returned to England at the close of the year, and received the thanks of Parliament for Vimeira; resumed his seat in Parliament Jan., 1809; was again appointed to the chief command of the army in the Peninsula on the death of Sir John Moore, and arrived at Lisbon Apr. 22, 1809; succeeded in passing the Douro

in the face of the French army, and entered Oporto May 12; was appointed by the prince regent marshal-general of the Portuguese army the same month; defeated the French under Marshals Victor and Sebastiani in the great battle of Talavera, July 27–28, but was compelled by the non-co-operation of the Spanish army to fall back on Badajoz, crossing the Tagus at Arzobispo Aug. 4; received the thanks of Parliament; was created Baron Douro of Wellesley and Viscount Wellington of Talavera, with a pension of £2000, Sept. 4, 1809; fortified his famous triple lines of intrenchments, 30 miles in length, between the Tagus and the Atlantic, at Torres Vedras; repulsed Marshal Massena at Busaco Sept. 27, 1810; again occupied the lines of Torres Vedras Oct. 10; pursued the French along the line of the Mondego in their retreat upon Santarem; received the thanks of Parliament for the liberation of Portugal Apr. 11, 1811; gained the victory of Fuentes de Onoro May 3–5; took Almeida and invested Badajoz May 19, but retreated June 10 within the frontiers of Portugal; carried Ciudad Rodrigo by assault Jan. 19, 1812, for which he was made by the Spanish regency duke of Ciudad Rodrigo and a grandee of Spain (January), and by his own government created earl of Wellington with a further pension of £2000; reinvested Badajoz Mar. 16; took it by storm Apr. 6; routed Marshal Marmont with great slaughter at Salamanca July 22, and occupied Madrid Aug. 12; was made generalissimo of the Spanish armies, created marquis of Wellington Oct. 3, and granted £100,000 by Parliament; laid fruitless siege to Burgos Sept. 19 to Oct. 21; retreated to Portugal; visited Cadiz and Lisbon, and was received as a deliverer; received heavy reinforcements during the winter; entered Spain in two columns with 200,000 men in the spring of 1813; obtained a signal victory over King Joseph and Marshal Jourdan at Vitoria June 21, capturing 150 cannon and driving the French into the Pyrenees; was made field-marshal of England July 3, and duke of Vitoria in Spain; laid siege to San Sebastian and Pamplona, but was repulsed in an attempt to storm the former July 25; gained a series of battles in the Pyrenees July 27–31; carried San Sebastian by assault Aug. 31; crossed the river Bidassoa into France Oct. 7; received the capitulation of Pamplona Oct. 31; took up his head-quarters at St. Jean de Luz Nov. 10; crossed the Nivelle and the Nive, and repulsed Marshal Soult Dec. 10–18; left two divisions to blockade Bayonne, and pursued Soult, whom he defeated at Orthez Feb. 27, 1814, and at Toulouse Apr. 10, and occupied that city Apr. 12, having meanwhile sent Gen. Beresford to take possession of Bordeaux; learned of the occupation of Paris by the allies, and proceeded thither; was made marquis of Douro and duke of Wellington May 11; arrived at London June 23, and took his seat for the first time in the House of Lords June 28; received (as a matter of course) the thanks of Parliament and a further pension; went to Paris as ambassador to the restored monarch, Louis XVIII., in August; attended the Congress of Vienna Jan., 1815; took command of the British army in Flanders in April on the return of Napoleon from Elba; repulsed Marshal Ney at Quatre Bras June 16; gained, with the Prussian marshal Blücher, the decisive battle of WATERLOO (which see), June 18; crossed the French frontier and marched upon Paris June 21; was commander-in-chief of the allied army of occupation in France 1815 to Nov., 1818; received £60,000 as Waterloo prize-money; was made prince of Waterloo by the king of the Netherlands; was presented by the British nation with the estate of Strathfieldsaye, Hampshire, costing £263,000; attended the Congress of Aix-la-Chapelle for the evacuation of France, and was created field-marshal of Austria, Russia, and Prussia Oct., 1818; was appointed master-general of the ordnance, giving him a seat in the cabinet, Jan. 1, 1819; became governor of Plymouth Oct., 1819; attended the Congress of Verona 1822; was ambassador to Russia, and appointed constable of the Tower 1826; became commander-in-chief Jan., 1827, governor of Dover Castle and lord warden of the Cinque Ports Jan., 1829; was prime minister in the Tory interest from Jan. 8, 1828, to Nov. 15, 1830, steadily opposing Roman Catholic emancipation and all projects of parliamentary reform, on which account he was hooted in the streets of London, the windows of Apsley House, his town residence, broken by the mob, and an attempt made to burn his country residence June, 1832; was appointed chancellor of Oxford University Jan. 29, 1834; was secretary of state for foreign affairs Dec., 1834, to Apr. 8, 1835; became a member of the cabinet without a portfolio 1841; was visited by Queen Victoria at Walmer Castle 1842; was a second time appointed commander-in-chief Dec., 1842; gave a reluctant support to the free-trade measures of Sir Robert Peel, and was president of the privy council 1845–46, after which he declined further political honors on account of advanced age, though he continued to attend the House of Lords and was assiduous in the discharge of his duties at the court of the youthful queen. He died of apoplexy at his official residence as lord warden of the Cinque Ports, Walmer Castle, Kent, Sept. 22, 1852; received a magnificent funeral, and was buried in St. Paul's cathedral, London, Nov. 9. In person he was of middle size, but strongly built, and his capacity for enduring fatigue gave him the familiar title of "the Iron Duke." His leading characteristics as a soldier were invincible resolution and singleness of purpose, combined with a full measure of caution. His political, social, religious, and literary instincts were pre-eminently conservative—a fact which brought him into unpopularity during the unquiet agitations for reform, but did not detract from the affectionate pride and veneration with which he was regarded by his countrymen during the protracted evening of his life. Numerous statues and memorials have been erected to his memory, and works illustrative of his military exploits are naturally abundant. The most notable personal biographies are those of Maxwell (3 vols., 1839–41), Stocqueler (2 vols., 1852–53), Brialmont (3 vols., 1856–57), and C. D. Yonge (2 vols., 1860). His *Despatches* (2 series, 25 vols., 1834–65), edited by Col. John Gurwood, and his *Supplementary Despatches and Memoranda* (17 vols., 1858–73), edited by his son Arthur Richard, the present duke, exhibit him in a most favorable light, and constitute invaluable materials for history. Other volumes of selections from the vast mass of his correspondence are promised (1876).

PORTER C. BLISS.

**Wellingtonia Gigantea.** See SEQUOIA.

**Wells.** See ARTESIAN WELLS, by PROF. E. W. HILGARD, PH. D.; GAS-WELLS, in GAS-LIGHTING, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.; OIL-WELLS, in PETROLEUM, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D., and in PETROLEUM, GEOLOGY OF, by PROF. J. S. NEWBERRY, M. D., LL.D.; TUBE-WELL and WELL, in WELL, by HON. G. P. MARSH.

**Wells,** county of N. E. Indiana, intersected by Wabash River, and traversed by Fort Wayne Muncie and Cincinnati R. R.; surface rolling, with much good timber-land; soil fertile. Live-stock abundant. Staples, wheat, Indian corn, wool, lumber, and dairy products. Cap. Bluffton. Area, 372 sq. m. P. 13,585.

**Wells,** tp., Appanoose co., Ia. P. 953.

**Wells,** p.-v. and tp., York co., Me. P. 2773.

**Wells,** tp., Tuscola co., Mich. P. 194.

**Wells,** p.-v., Faribault co., Minn.

**Wells,** tp., Rice co., Minn. P. 1153.

**Wells,** p.-v. and tp., Hamilton co., N. Y. P. 817.

**Wells,** tp., Jefferson co., O. P. 1414.

**Wells,** p.-v. and tp., Bradford co., Pa. P. 1207.

**Wells,** tp., Fulton co., Pa. P. 589.

**Wells,** p.-v. and tp., Rutland co., Vt. P. 483.

**Wells** (C. H.), U. S. N., b. Apr. 3, 1822, in Pennsylvania; entered the navy as a midshipman Sept. 25, 1840; became lieutenant in 1855, commander in 1866, captain in 1871; served on the E. coast of Mexico during our war with that country, and participated in the capture of Tuspan and Tampico; was executive officer of the Susquehanna at the capture of Port Royal, and commanded the Galena in the battle of Mobile Bay. Favorably mentioned by Rear-Admiral Farragut and Capt. Lardner.

FOXHALL A. PARKER.

**Wells** (CHARLES), b. in England about 1798, was an early and intimate friend of the poet Keats, who introduced his name in one of his best-known sonnets; published anonymously a prose volume of *Stories after Nature* (1822) and *Joseph and his Brethren, a Scriptural Drama* (1824), under the pseudonym of "H. L. Howard," both of which were received by the critics with such utter indifference that, accepting their verdict as decisive, he published nothing more, and his very existence as a literary man was forgotten until his poem fell into the hands of the "new school" of Swinburne and the Rossettis, by whom it has been pronounced second in dramatic merit to Shakspeare alone. This opinion was first made public by William M. Rossetti in a supplementary chapter to Gilchrist's *Life of Blake* (1863), and was occasionally re-echoed in various review articles until 1876, when Mr. Swinburne published an edition of the poem, preceded by a critical *Introduction*, in which an eminent place among English poets was claimed for Wells, and this verdict has been in great measure confirmed by recent critics. Mr. Wells is still living (1876), but the facts of his career have not been made known.

**Wells** (CHARLOTTE **Fowler**), sister of Orson Squire and Lorenzo Niles Fowler, b. at Cohocton, Steuben co., N. Y., Aug. 14, 1814; educated at the Franklin Academy, Plattsburg, but was largely self-taught; became, like her

brothers, interested in phrenology about 1833; studied the writings of Spurzheim, in which she became proficient; taught a class in phrenology as early as 1835; joined her brothers in 1837 in establishing in New York City the famous phrenological partnership subsequently known as "Fowlers & Wells;" married, in 1844, Mr. Samuel R. Wells, who in 1845 became a partner in the house, of which he ultimately became the head; rendered very efficient support to her brothers and her husband in all departments of their business, being endowed with rare executive abilities, and since the death of her husband in 1875 has been the sole proprietor and director of the establishment, including the widely-known *Phrenological Journal*, which retains its prosperity under her management, and is engaged in an earnest effort to found a permanent institution for the instruction of students in phrenology.

SUSAN B. ANTHONY.

**Wells** (DAVID AMES), D. C. L., b. at Springfield, Mass., June 17, 1828; graduated at Williams College 1847, and at the Lawrence Scientific School, Cambridge, 1851; was assistant professor there 1851–52; was associated with Dr. A. A. Hayes as a practical chemist at Boston 1853–55; patented in 1856 several improvements in bleaching; was a member of the publishing-house of G. P. Putnam & Co., New York, 1857–58; was associate editor of the Springfield *Republican* 1858; settled at Norwich, Conn.; visited Europe on commissions of the U. S. government 1862 and 1867; was U. S. special commissioner on revenue 1866–70; produced on that subject fifteen important reports; became university lecturer on political economy at Yale College 1872; visited Europe 1873; delivered in that year an address before the Cobden Club in London; was chosen a foreign associate of the French Academy of Political Sciences, in the place of John Stuart Mill, deceased, 1874; received in the same year the degree of D. C. L. from Oxford University; has been since 1867 a strong advocate of free trade; has taken considerable part in recent efforts for civil-service reform, and was an unsuccessful Democratic candidate for Congress at the special election of Apr., 1876. He edited the *Annual of Scientific Discovery* (Boston, 16 vols., 1850–65), Charles Knight's *Knowledge is Power* (1856), Timbs's *Things not Generally Known* (1857), Brodie's *Psychological Inquiries* (1857), and an abridgment of Burton's *Pilgrimage to El-Medinah and Mecca* (1857), and is author of *The Year-Book of Agriculture* (1856), *Familiar Science* (1856), *The Science of Common Things* (1857), *Elements of Natural Philosophy* (1857), *Principles and Applications of Chemistry* (1858), *First Principles of Geology* (1861), *Our Burden and our Strength* (1864), of which 7 editions, amounting to above 50,000 copies, were printed in that year; was joint author with S. H. Davis of a *History and Sketches of Williams College* (1847; new ed. 1859); has published numerous pamphlets on agriculture, science, and revenue, and contributed to the *Transactions* of several societies.

**Wells** (EDWARD), D. D., b. in England about 1665; graduated at Christ Church, Oxford; took orders in the Church of England; became rector of Blechley, Buckinghamshire, and in 1719 of Cotlesbuch, Leicestershire, where he d. in 1727. Author of *A Treatise of Ancient and Present Geography* (1701), *Historical Geography of the New Testament* (1708), *Historical Geography of the Old Testament* (1711–12), and other works; edited the works of Xenophon (5 vols., 1703) and Dionysius (1704), and published a revised translation of the Bible, with notes, prefaces, a paraphrase, and the Greek text of the New Testament (21 parts, 1709–28).

**Wells** (HENRY H.), b. at Rochester, N. Y., Sept. 17, 1823; educated at the Romeo Academy, Mich.; studied and practised law at Detroit; sat in the legislature 1854–56; served in the war, attaining the rank of brigadier-general of volunteers; settled in Virginia 1865; was military governor of Virginia 1868–69; was the Republican candidate for governor of Virginia at its reorganization in 1869, but defeated by Gilbert C. Walker; was U. S. district attorney for Virginia 1869–72, and appointed district attorney for the District of Columbia Sept., 1875.

**Wells** (HENRY TANWORTH), R. A., b. in London, England, in Dec., 1828; became distinguished first as a miniature and subsequently as a *genre* painter in oil; began to exhibit at the Royal Academy in 1845; was chosen an academician 1870, and is noted for the strict fidelity of his portraits.

**Wells** (HORACE), b. in Hartford, Windsor co., Vt., Jan. 21, 1815; received a good English education, and at the age of nineteen (1834) began the study of dentistry in Boston, and in 1836 he opened an office in Hartford, Conn., to practise his profession. His mind was early turned to the subject of the possibility of preventing pain in the extraction of teeth. In Aug., 1840, Dr. Brockett of Brooklyn, then a medical student, went to Wells to have a molar tooth extracted; the operation was difficult, and so painful that Wells said that there ought to be some method of mitigating such suffering, and that he thought a man might be made so drunk by the inhalation of nitrous oxide gas as to prevent the pain of dental and other operations. This was four years before the discovery of anæsthesia, and it shows how deeply impressed this subject was upon the mind of Wells at that early day. On Dec. 10, 1844, Mr. G. T. Colton delivered a lecture in Hartford, Conn., on "laughing gas," and after the lecture he administered the gas to Wells and several other gentlemen. One of them (Mr. Cooley), while under its influence, fell over some benches, and was evidently badly injured; when he returned to consciousness, Wells rushed up to him and inquired if he was hurt. He replied, "No." Wells then said, "You must have been hurt, for you struck your legs against the benches." The young man then, at Wells's suggestion, pulled up his pantaloons; the blood was running down his legs and his knees were badly injured. When again questioned by Wells he said, "I did not feel any pain at the time." Wells then turned to a friend (Mr. David Clarke), who was near by, and an eyewitness of all this, and remarked, "I believe a man by taking that gas could have a tooth extracted or a limb amputated and not feel the pain." So thoroughly was Wells convinced of this fact that he told his wife on their way home that he intended to take the gas the next day and have a tooth extracted. On arriving home, he left his wife and went to see his friend, Dr. Riggs, to announce his great discovery, and his intention to take the gas for the extraction of a tooth. Riggs tried to dissuade him from it, but his mind was made up, and he said, "As the young man did not feel pain at the time he was hurt, why cannot the gas be used in the extraction of teeth?" Early next morning (Dec. 11) Wells called on Colton and engaged him to go to his office at ten o'clock and give him the gas. He did so, and Dr. Riggs extracted a large molar tooth. Wells did not seem to feel any pain. He remained unconscious for a few moments, and on coming to he exclaimed, "A new era in tooth-pulling! It did not hurt me more than the prick of a pin. It is the greatest discovery ever made."

From that moment Wells's enthusiasm was unbounded. He immediately began the administration of the gas, and daily extracted teeth under its influence; and other dentists in Hartford adopted the same practice with like success. Dr. Marcy, then of Hartford, on witnessing Wells's operations, told him that when a student at Amherst College he with other students had for amusement often inhaled nitrous oxide gas and also the vapor of sulphuric ether, and that the effects of the two were identical; and he suggested to Wells to try ether as a substitute for the gas. On this hint Wells did try it. He inhaled it himself, and he says, "I found it very difficult to inhale the vapor of ether, in consequence of the choking sensation. For this reason, and for the reason that Dr. Marcy and myself came to the conclusion that nitrous oxide gas was not so liable to do injury, I resolved to adhere to this alone."

About a month after the discovery of anæsthesia by Wells, Dr. Marcy (Jan., 1845) gave the vapor of sulphuric ether to a sailor for the extirpation of a small wen on the side of his head. The patient was insensible and the operation successful, but Marcy after this experiment still advised Wells to stick to the gas, as being more agreeable and perhaps safer than ether. Wells continued the use of the gas, and the dentists (Riggs, Terry, Braddock, and Crowfoot) and the doctors in Hartford were all convinced of its value as an anæsthetic. But Wells felt that his great discovery should be laid more broadly before the profession and the world, and early in 1845 went to Boston for this purpose. Through his former pupil and partner, Dr. Morton, dentist, he was introduced to Dr. John C. Warren, Dr. Charles T. Jackson, Dr. Hayward, and others. Dr. Warren received him kindly, and Wells remained in Boston several days with the expectation of giving the gas to a man who was to submit to an amputation at the hands of Dr. Warren. For some cause the operation was postponed. Wells was then invited to address the class at the medical college on the subject. He did so at some length, and then administered the gas for the extraction of a tooth. Unfortunately, the gas-bag was removed too soon; the patient was not sufficiently anæsthetized; the operation was therefore a failure; the patient screamed out, and said he felt the pain of extraction. Wells was hooted at, and unfeelingly hissed out of the amphitheatre by the thoughtless young men present, and he was pronounced a charlatan and his anæsthetic a humbug. He returned home greatly mortified at his failure, was taken suddenly ill, and did not recover his health for many weeks.

In 1841–42, Morton was a pupil of Wells. In 1843, Wells established Morton in Boston, and for a while was his partner. In 1845–46, after Wells's discovery of anæsthesia, they

had frequent interviews, sometimes in Boston and sometimes in Hartford. After Wells's unfortunate visit to Boston, Morton became greatly interested in the subject of anæsthesia. Notwithstanding Wells's failure in Boston, Morton witnessed his continued success with the gas in Hartford, and was anxious to try it again in Boston. During one of his visits to Wells in Hartford in 1846, Morton asked Wells to show him how to make the gas. Wells told him to ask Dr. Charles T. Jackson to make it for him, as he was a chemist. On returning home, Morton called on Jackson. Jackson told Morton that the manufacture of nitrous oxide gas required some nicety of manipulation, that there was some danger of his getting nitric instead of nitrous oxide, and that he was too busy at that time to make it for him. Morton explained that he wished to use it to render patients insensible for the extraction of teeth. Jackson then told him to use the vapor of sulphuric ether, saying that it was perfectly safe, and that the students at Cambridge often inhaled it for amusement.

On the evening of the day (Sept. 30, 1846) that Morton had this interview with Jackson he gave the ether to a patient and extracted a tooth without pain; and on Oct. 16 he gave it in the Massachusetts General Hospital to a patient who had a tumor exsected from the neck by Dr. John C. Warren. On the next day (Oct. 17) he gave it to another patient for Dr. Hayward, who exsected a tumor from the arm; and from that time it came rapidly into use by the whole profession throughout the civilized world. On Oct. 27, 1846, Jackson and Morton published to the world, by letters patent, the discovery of *letheon* as an anæsthetic, but it was seen at once that their letheon was nothing more or less than pure sulphuric ether. Jackson resigned his interest in the patent to Morton, and soon sent a communication to the French Institute claiming the honor of the discovery of anæsthesia by ether. Morton then set up his claim as the real discoverer, giving Jackson credit only for some unimportant suggestions. While Jackson and Morton were sending bulletins to the Institute of France, Wells sailed for Europe in Dec., 1846, to lay his claims before the French Institute as the real discoverer of anæsthesia. His mission was a failure, and he returned home in Mar., 1847, to prepare the documents upon which his claim was to be presented to the Institute. And thus this tripartite war was waged with great fury, Morton and Jackson denying everything to Wells, and denying everything to each other. They denied that nitrous oxide gas had any anæsthetic properties. Wells brought forward his Hartford experience, and he gave the gas for surgeons in general practice, proving that prolonged operations could be performed under its influence. Dr. Marcy exsected a large gland, the patient being under the gas for fifteen minutes; Dr. Ellsworth amputated a thigh; and Dr. Berresford exsected a large tumor under its influence—all in Hartford. But notwithstanding all this, Wells saw nitrous oxide gas supplanted by sulphuric ether as an anæsthetic—ether which he had tried and rejected. He saw his claims as the great discoverer of anæsthesia unrecognized abroad, disputed and set aside at home, and he was disappointed and dispirited. He then went to New York to lay his claims as the discoverer of anæsthesia before the profession of the great metropolis. Soon after his arrival in New York, he showed signs of mental aberration, and on Jan. 14, 1848, in a fit of madness he ended his life with his own hands.

A few years after the death of Wells, Morton applied to Congress for a grant of money for the discovery of anæsthesia. The friends of Wells opposed the grant on the ground that Wells was the real discoverer. If Morton had claimed remuneration for the introduction of sulphuric ether as an anæsthetic, he might have carried his point; this would have been honor enough. But he and his friends were not satisfied with this, and they claimed all the glory of the great discovery of anæsthesia. They admitted that Wells tried to make the discovery, but asserted that he failed, because nitrous oxide gas could not produce insensibility to pain. They even attempted to prove this before a Congressional committee appointed for this purpose. Morton declared that nitrous oxide gas never had, and never could, produce the effect claimed by Wells. Wells was dead, and there was no one to controvert him. The world had accepted ether and chloroform, and no one cared to inquire into the steps by which this was brought about.

If nitrous oxide gas can produce insensibility to pain, as Wells claimed, then Wells was the first to demonstrate the fact that anæsthesia can be produced by the inhalation of gases and vapors. But if it does not possess this property, as asserted by Morton, then Morton was the real discoverer by giving us ether. Let us see how curiously, how providentially, this question has been settled, and settled to the satisfaction of all unprejudiced minds. Colton seems to have been incidentally an important agent in establishing the truth. We have seen how Wells's discovery grew out of Colton's lecture in Hartford in Dec., 1844. Colton continued his popular lectures on this subject for many years after this. In 1862 he lectured in the town of New Britain, Conn., and, as usual, related how the great discovery of anæsthesia was made, giving Wells all the honor. An old lady present wished to have some teeth extracted: she was afraid to take ether or chloroform, and she requested her dentist, Dr. Dunham, to get Colton to give her the gas for their extraction. He did so, and taught Dr. Dunham how to make the gas. One year after this (1863) Colton returned to New Britain on his usual annual lecture-tour, and he found Dunham extensively engaged in extracting teeth under the influence of the gas. Colton and Dunham then went to New Haven, with the understanding that Colton was to give the gas and Dunham to extract teeth. After the first day, Dunham returned home, and Dr. Smith of New Haven took his place, and in a few weeks people came by thousands to take the gas and get teeth extracted. Colton, then seeing that it could be made a good business, went to New York and opened the Colton Dental Institute, where since 1863 he or his agents have given the gas to 93,000 persons without an accident.

All this disproves the assertion made by Morton and his adherents. If nitrous oxide gas produces anæthesia today in the hands of Colton and others, it did it in the hands of Wells in 1844, and Wells was therefore the discoverer of anæsthesia. The fact that other anæsthetics are cheaper and easier of administration does not in the least invalidate his claims. It has been used in general surgery by many eminent surgeons in New York, Philadelphia, Baltimore, and elsewhere. The writer has used it in difficult and prolonged operations (ovariotomy), requiring 30, 40, 57, and 60 minutes, and in one case an hour and 50 minutes, and always with the most satisfactory results. All this goes to prove that to Wells is due all the honor of the great discovery of anæsthesia by nitrous oxide gas—in 1844.

To Morton and Jackson is due the credit of introducing ether as an anæsthetic—in 1846; to Sir James Y. Simpson is due the imperishable honor of introducing chloroform as an anæsthetic—in 1847; and to Dr. B. W. Richardson of London is due the credit of introducing the bi-chloride of mytheline for the same purpose at a later period. Morton's labors do not invalidate Wells's claims; Simpson's do not invalidate Morton's; Richardson's do not invalidate Simpson's. They are all good in their way; but Wells was the original discoverer of the principle upon which they all act.

In Boston, Mass., a monument has been erected to the discoverer of anæsthesia, but no man is designated thereon by name. The citizens of Hartford, Conn., have erected a bronze statue of Wells (by Bartlett) in their Capitol Park, claiming for him the discovery of anæsthesia, the greatest boon that medical science has given to humanity since the immortal discovery of Jenner.

But long before the day of Horace Wells we were on the eve of the discovery of anæsthesia. In 1790, Priestley discovered nitrous oxide gas. In 1799, Sir Humphry Davy experimented with it, and in 1800 he published his *Researches, Chemical and Philosophical, chiefly concerning Nitrous Oxide Gas and its Respiration*, in which he distinctly announced his belief that it might be used as an anæsthetic in surgical operations. But no one acted upon his suggestion, and this grand idea was lost to the world till its resuscitation by Wells. But prior to Wells ether was used as an anæsthetic by Dr. Crawford W. Long of Athens, Ga. It is well known that sulphuric ether was used sportively ever since the beginning of this century by the young men in all our New England colleges; and in certain sections of the South its use as an excitant was at one time very common. Dr. Wilhite of South Carolina informed the writer that "ether frolics" were the fashion forty years ago in some portions of Georgia; that boys and girls, meeting at quiltings and other parties, often wound up the evening's entertainment with an ether frolic; and that the effects of the ether, carried only to the stage of intoxication, were identical with those of nitrous oxide gas, such as laughing, dancing, speaking, fighting, etc. In 1842, Dr. Crawford W. Long practised medicine in Jefferson, Jackson co., Ga. He had four students at the time —viz. P. A. Wilhite, D. I. Long, H. R. P. Long, and John S. Groves. They all occasionally indulged in "ether frolics." On several occasions Dr. Long became furiously excited under the influence of the ether, and could not be controlled. After recovering from the intoxication he often noticed that his arms were badly bruised, and he was not conscious of having felt any pain at the time. From this fact he inferred that it might be used as an anæsthetic in surgery. Accordingly, for this purpose he administered the ether to a Mr. Venables, putting him profoundly under its influence,

and then exsected a tumor from Mr. V.'s head. The operation, entirely painless, was witnessed by the four medical students above named and by others. Dr. Long performed other operations under ether. The first one was on Mar. 30, 1842. His operations were known to medical men in the neighborhood. But Dr. Long did not communicate his discovery to any scientific body, nor did he write it out for any medical journal till the year 1849, when he sent it to the *Southern Medical and Surgical Journal*, which was long after the labors of Wells, Morton, Jackson, and Simpson in this direction were fully recognized. In a communication by Dr. Charles T. Jackson to the *Boston Medical Journal*, Apr. 11, 1861, he says he visited Dr. Long at Athens, Ga., on Mar. 8, 1854, to examine into Dr. Long's claims to being the first to use sulphuric ether as an anæsthetic in surgery, and he further says: "From the documents shown me by Dr. Long it appears that he employed sulphuric ether as an anæsthetic agent—First, on Mar. 30, 1842, when he extirpated a small glandular tumor from the neck of James W. Venable, a boy [Mr. Venable was twenty years old when the operation was performed—J. M. S.], in Jefferson, Ga., now dead. Second, on July 3, 1842, in the amputation of the toe of a negro boy belonging to Mrs. Hemphill of Jackson, Ga. Third, on Sept. 9, 1843, in the extirpation of a tumor from the head of Mary Vincent of Jackson, Ga. Fourth, on Jan. 8, 1845, in the amputation of a finger of a negro boy belonging to Ralph Bailey of Jackson, Ga. Copies of the letters and depositions proving these operations with ether were all shown me by Dr. Long. He also referred me to physicians in Jefferson who knew of the operations at the time."

From these facts it is clear that Dr. Crawford W. Long was really the first man who ever performed an operation under an anæsthetic. His operations were witnessed by medical students, known and talked of by medical men in the community, but, unfortunately, he procrastinated their publication till the great discovery of anæsthesia was made by others. J. Marion Sims.

**Wells** (Samuel Roberts), b. at W. Hartford, Conn., Apr. 4, 1820; became a partner in the publishing-house of Fowler & Wells, New York, 1844; travelled extensively in the U. S., Canada, and Europe, lecturing on phrenology; edited the *Water-Cure Journal* (1850–62), the *Phrenological Journal* (1863–75), and the *Illustrated Annual of Phrenology and Physiognomy* (1865–75), and was author of *The New Physiognomy, or Signs of Character* (1866), *How to Read Character* (1869), and *Wedlock, or the Right Relations of the Sexes* (1869). D. in New York Apr. 13, 1875.

**Wells** (William), Ph. D., b. in New York City in 1820; graduated at Williams College, Mass.; studied in Europe, and was professor of modern languages in Genesee College, N. Y., from 1852 to 1865, then of the same at Union College, Schenectady, N. Y. He has been a contributor to periodicals and reviews.

**Wells** (William Charles). See Appendix.

**Wells** (William Harvey). See Appendix.

**Wells** (William Vincent), great-grandson of Samuel Adams, b. at Boston, Mass., Jan. 2, 1826; educated in the Boston schools; became a captain in the merchant service, and was four times wrecked; visited South America and Europe; went to California 1849; built and commanded the first steamboat seen on the interior waters of California; edited several papers at San Francisco; travelled in Central America, exploring the gold-regions of Honduras; was influential in promoting the expedition of Walker to Nicaragua, and became consul-general in Honduras. Author of *Walker's Expedition to Nicaragua* (1856), *Explorations and Adventures in Honduras* (1857), and *The Life and Public Services of Samuel Adams*, etc. (Boston, 3 vols., 1865).

**Wells'boro',** p.-b., cap. of Tioga co., Pa., on Corning Cowanesque and Antrim R. R., contains 4 churches, good schools, 1 bank, 2 newspapers, several saw and planing mills, 2 tanneries, carriage and marble shops, and 5 hotels. It is surrounded by a rich dairy and farming section. P. 1465. A. F. Barnes, Ed. "Agitator."

**Wells'burg,** p.-v., Ashland tp., Chemung co., N. Y. P. 542.

**Wellsburg,** p.-v. and tp., cap. of Brooke co., West Va. P. 1366.

**Wells Dépôt,** p.-v., York co., Me.

**Wells River,** p.-v., Orange co., Vt.

**Wells'ville,** p.-v., Montgomery co., Mo.

**Wellsville,** p.-v. and tp., Allegany co., N. Y. P. of v. 2034; of tp. 3781.

**Wellsville,** p.-v., Yellow Creek tp., Columbiana co., O. P. 2313.

**Wellsville,** p.-v., Cache co., Ut.

**Wellwood** (Sir Henry **Moncreiff**), Bart., D. D., b. at Blackford, Perthshire, Scotland, Feb. 6, 1750, being eldest son of Rev. Sir William Moncreiff; educated at Glasgow and Edinburgh universities; was ordained a minister of the Church of Scotland 1771; was for some time his father's successor as minister at Blackford; became pastor of St. Cuthbert's, Edinburgh, 1775, and moderator of the General Assembly 1785; was a popular preacher; "succeeded Dr. John Erskine in the chieftainship of the Whig party in the Kirk of Scotland;" took an active part in the ecclesiastical controversies of his time, and late in life assumed the name of Wellwood. D. at Edinburgh June 14, 1827. Author of *Discourses on the Evidence of the Jewish and Christian Revelations* (1815), *An Account of the Life and Writings of John Erskine, D. D.* (1818), of many pamphlets on ecclesiastical topics, and of several volumes of *Sermons*. His *Posthumous Sermons* (3 vols., 1829–31) were selected by Dr. Andrew Thomson, and edited, with an *Account of the Author's Life*, by his son, Sir James Wellwood Moncreiff, Bart. (1776–1851), who became a judge of session and a lord justiciary, known by the courtesy title of Lord Moncreiff.—James Moncreiff, son of the latter, b. at Edinburgh Nov. 29, 1811, was an eminent advocate and member of Parliament, and was created Baron Moncreiff of Tulliebole Jan. 1, 1874.

**Wels'by** (William Newland), b. in Cheshire, England, about 1803; graduated at St. John's College, Cambridge, 1823; was called to the bar at the Middle Temple; became an eminent barrister-at-law, and was many years recorder of Chester, where he d. July 1, 1864. He published, with several associates, *Reports of the Decisions of the Court of Exchequer from 1836 to 1856* (27 vols.); edited, with Edward J. Beavan, Chitty's *Collection of Statutes of Practical Utility* (4 vols., 1851–54) and Sir Christopher Rawlinson's *Municipal Corporation Acts* (2d ed. 1849), and was author of *Lives of Eminent English Judges of the Seventeenth and Eighteenth Centuries* (1846).

**Wels'ford** (Henry), b. in England about 1810; is author of *The Origin and Ramifications of the English Language*, etc. (1845), *Mithridates Minor, or an Essay on Language* (1848), *Lights and Shadows of Spiritual Life* (1855), and other works.

**Welsh** (David). See Appendix.

**Welsh** (John), of Scotland. See Appendix.

**Welsh** (John), F. R. S., b. at Boreland, Kirkcudbrightshire, Scotland, Sept. 27, 1824; educated at the University of Edinburgh with a view to the profession of an engineer; became a proficient in physics and astronomy; was engaged by Sir Thomas Brisbane as observer in his magnetical and meteorologieal observatory at Makerstown; became assistant in 1850, and subsequently superintendent, at the Kew Observatory; made four balloon ascents for scientific purposes in 1852; made several inventions for the purpose of giving greater precision to the observations of magnetic dip and force, and made several valuable reports on meteorology to the British Association, for which body he undertook the Scottish division of the magnetic survey of Great Britain. D. at Falmouth May 11, 1859.

**Welsh** (William). See Appendix.

**Welsh Language and Literature.** Hitherto it has been usual to divide the Welsh language, historically considered, into three periods—namely, those of Old, Middle, and Modern Welsh. This answered very fairly at a time when the student of the Celtic languages knew but little about the early inscribed stones of Wales and Cornwall, which mark out one or two previous periods in the history of the language. To these, in default of a better, the term Early Welsh may be applied, which, however, renders that of Middle Welsh inadmissible; but in order to disturb the old terminology as little as possible, the adjective *Mediæval* may be used instead of *Middle*. The whole range of the past existence of the language admits of being parcelled out as follows:

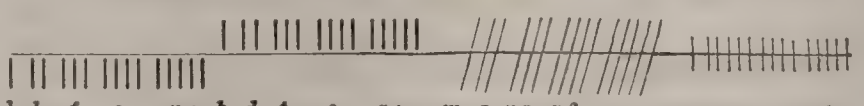
(1) *Pre-historic Welsh*, ranging from the time when the ancestors of the Welsh and the Irish ceased to form one nation, or to speak one and the same language, to the subjugation of the Britons by Julius Agricola; or, let us say, to the end of the first century. (2) *Early Welsh*, of the time of the Roman occupation down to the departure of the Romans in the beginning of the fifth century. (3) *Early Welsh*, of what is called the Brit-Welsh period, from that time to the eighth century. (4) *Old Welsh*, from then to the coming of the Normans into Wales, in the latter part of the eleventh century. (5) *Mediæval Welsh*, thence to the Reformation. (6) *Modern Welsh*, from that epoch to the present day.

This would be the order to follow if one were not stinted in materials to serve as specimens of the earlier stages; but that being the case, it will be preferable here to proceed backward, from the known to the less known. Modern Welsh, accordingly, takes the lead, and of this two kinds may be distinguished—namely, biblical and journalistic Welsh, whereof the latter is the vernacular of the Welsh of the present day, and is to be met with, more or less touched up, in Welsh periodicals and newspapers, of which there are no less than thirty published in Wales and America. Journalistic Welsh is characterized, as might be expected, by a growing tendency to copy English idioms, which is the result, no doubt, of continual contact with that language and of frequently translating from it. Biblical Welsh, as the term indicates, is the language of the Welsh translations of the Bible and a number of other books, mostly theological, of the time of the Reformation and later. This is still the language of the best authors, and the supposed model of all. We are unable to give any statistics as to the yearly yield of the Welsh press, but it is certain that it is fast increasing; it comprises works on theology, history, poetry, and biography, as well as grammars, dictionaries, and encyclopædias, not to mention a considerable number of English books which are translated for the use of the reading public in Wales and the U. S. of America. Among these last may be mentioned, for instance, plays of Shakspeare and a work on shorthand.

Passing beyond the time of the Reformation, we come to the Mediæval Welsh of the *Bruts* or chronicles, so called from their commonly beginning with an account of Brutus or Brytus, a fictitious personage postulated as the first colonizer of Albion for the sake of accounting for its being called Britain. He was held to be a son of Æneas, and so were the Welsh made out to be of Trojan descent. It is right, however, to state that inventions of this kind were not by any means peculiar to the Welsh, and it is even probable that the Brutus tale is of English rather than Welsh origin. The same kind of Welsh also prevails in the romances called the *Mabinogion*, which consists mostly of tales about Arthur and the Knights of the Round Table. A number of these *Mabinogions* were published in 1849 by Lady Charlotte Guest, but they have been some time out of print, and a new edition of them is a decided desideratum. In point of quaintness of style, vividness of description, and comic exaggeration they are not surpassed by any other literature of the same kind and date; nor is there any other which can boast of having directly or indirectly exercised so much influence on European thought in the Middle Ages. To the earlier part of this period belong also the *Laws of Wales*, the Venedotian version of which is found in a manuscript which has been assigned to the twelfth century: three versions were edited by Mr. Aneurin Owen for the English record office in 2 large 8vo vols. in 1841. The form in which they are known to us dates from the reign of Howell the Good, in the tenth century, but in point of substance they are the growth of laws and customs which were the common inheritance of all the Aryan nations, modified, of course, by the coloring which the special history and surroundings of the Welsh could not help giving them. The mediæval period was highly productive of Welsh poetry; among the leading Welsh poets of the time may be mentioned Dafydd ab Gwilym, who lived in the fourteenth century. He boasts having sung seven score and seven odes to Morfudd, the lady he loved; and some of his compositions are admitted to possess great merit and beauty. But more interesting, however, to the philologist are the contents of a manuscript called the *Black Book of Carmarthen*, which dates from the twelfth century, and has been published in Skene's *Four Ancient Books of Wales* (Edinburgh, 1868). It contains the oldest version extant of a considerable portion of the poems, which it has been the habit of some writers to attribute to the sixth century. As to the language of these poems, it is hardly older, on the whole, than the manuscript containing them; and even supposing that they are substantially compositions of the sixth century, or rather that some of them are such, linguistically they are of the twelfth or the eleventh century. This difficulty is bridged over by assuming that successive minstrels and reciters unconsciously changed the form of the words they used into harmony with the pronunciation of their own time. This must be to a certain extent admitted, but even then the leap from the twelfth to the sixth century is a very long one; and Mr. Skene, making the best of the archaisms they contain, the historical allusions in them, and the metrical peculiarities of some of them, has only succeeded in making it appear probable that some of them date, though not exactly in their extant form, as early as the ninth, or perhaps the preceding century. Besides Mr. Skene's book, Stephens's *Literature of the Kymry* (London, 1849) and Nash's *Taliesin* may be consulted on this question and others nearly allied with it.

Thus far, the student of Welsh has abundance of literature at his command; but when he passes the threshold of the twelfth century it ceases to be so, his only materials for the study of Old Welsh being inscriptions and glosses, together with a few other scraps in the blank spaces of Latin manuscripts. The inscriptions of this period are written in letters which archæologists are wont to term Hiberno-Saxon, and are far less numerous than those of an earlier period, owing, probably, to their having become, in consequence of the prayers in them, objects of the iconoclastic rage of later times. An instance or two will show this more clearly, and also that the Welsh they contain is confined to proper names. In Gwnnws churchyard in Cardiganshire, preceded by a sort of cross meant to do duty also as the monogram of Christ, we read *Quicunque explicauerit hoc nomen det benedixionem pro anima Hiroidil filius Carotinn;* and in the wall of a chapel on Caldy Isle, off the coast of Tenby, there is a stone with an illegible Ogam on its edges and an inscribed cross on its face, followed in Hiberno-Saxon letters by the legend, *Et singno crucis in illam fingsi; rogo omnibus ibi ammulantibus exorent pro anima Catuoconi.* As to the manuscript portion of the materials just mentioned, a Welshman reading a Latin work sometimes wrote the Welsh equivalents of Latin words which gave him trouble between the lines or in the margin, and thus arose the Welsh glosses, as they are called. Their date is ascertained by experts, and none of them are now admitted to be older than the ninth century. As they contain but few complete sentences, they teach us very little as to the syntax of Old Welsh. On the other hand, they enable one to ascertain what phonological changes have taken place in the language since the ninth century; and, among other things, they afford us the means of watching the rise and growth of that system of consonantal mutation which has been carried out with such persistence in Welsh that it has often been supposed to be peculiar to it and as old as the Kymric race. As a matter of fact, it is a species of phonetic decay which is not wholly unknown in most languages, and has very exact parallels in some of the Italian dialects, especially that of Sassari in the island of Sardinia. This was first pointed out by Prince L. L. Bonaparte in his introduction to the Gospel of St. Matthew, translated into the Sardo-Sassarese dialect by the Canon G. Spano (London, 1866). Since then Prof. Hugo Schuchardt of Halle has written on the same subject in the journal called the *Romania*.

The next step backward lands us in the Brit-Welsh period of the language, for the study of which our materials are very slender. They may be said to be of two kinds—namely, inscriptional and manuscript. Those of the former kind consist mostly of very simple epitaphs written in Latin, but containing Kymric names. Somewhat over 100 such inscriptions, by far the greater number of which still exist, are known, scattered over Wales, Devonshire, and Cornwall, not to mention a few in Scotland from Luce Bay to Edinburgh. They are written in Roman capitals more or less debased: toward the end of the period the capitals are found interspersed with minuscules of the Hiberno-Saxon type, so called, owing to the fact that it is customary to write and print Irish in this character, and that it was also the character used formerly by the English. More correctly speaking, letters of this kind are neither Irish nor English, but Kymric or Welsh, and the inscriptions in question supply all the successive gradations whereby Roman capitals assumed this form, of which the modern Irish alphabet will serve as a specimen (for the characters of which see IRISH LANGUAGE AND LITERATURE). However, both the Irish and the Welsh had an alphabet of their own of a very peculiar nature, known as the Ogam or Ogham, from its Irish inventor, a mythical personage called *Oghma*, nearly related, probably, to Ogmios, the Hercules of the Gauls. Most of the early monuments of Ireland are written in Ogam, and over twenty of those of Wales, Devonshire, and Cornwall are partly, and one or two wholly, in Ogam: they cover the country from Ruthin in Denbighshire to South Devonshire. In Wales the Ogam grew out of use as early as the eighth or ninth century, whereas in Ireland it has come down in manuscript—a fact which has not left room for genius to distinguish itself by discovering the key to it. The following is the Irish Ogam, with the traditional values of the letters:



*b, l, f, s, n; h, d, t, c, q; m, g, ng, z? r; a, o, u, e, i.*

But for Early Welsh, and probably Early Irish also, the values of the Ogams must have been rather the following, in the same order: *b, l, w, s, n; ch, d, t, c, qu; m, g, ng, z, r; a, o, u, e, i.* It is to be noticed that the Ogam is not

written on the face of a stone, but along the edges, which are here represented by the continued line from which the digits hang: the vowels consist of notches. Lastly, the clumsiness of such an alphabet precludes the probability of its having been either invented or introduced into Britain after the Romans had introduced their letters: as to its origin, it could be shown to be based on the Phœnician alphabet, but the proof could not here be entered upon. But to return to the inscriptions themselves. We can best give the reader an idea of them by quoting an instance or two: At St. Dogmel's, near Cardigan, there is a stone which reads in Roman capitals, *Sagrani Fili Cunatami*, and in Ogam, *Sagramni Maqui Cunatami: Cunatami* is now *Cyndaf*. At Cilgernam in the same neighborhood there is a stone which reads, *Trenegussi Fili Macutreni*, and in Ogam, *Trenagusu Maqvi Maqvitreni*. A tombstone at Penmachno, in Carnarvonshire, reads in Roman capitals, *Cantiori Hic Jacit Venedotis Cive Fuit Consobrino Magli Magistrati*. The other kind of materials mentioned consists of a few proper names used by Gildas and others who wrote during this period. They are exceedingly few, but very important as helping us to some precision as to the inscriptions and to the assigning their approximate date.

As to the early Welsh of the time of the Roman occupation, we have still less to go upon: there are a few inscriptions of the period containing Celtic names, which are presumably of Kymric origin. Besides these, a few names of men and places are handed down in the writings of Tacitus, Ptolemy, and others. Beyond this lies the prehistoric period of the language. What it was then like is entirely a matter of inference, by no means wanting in ethnological interest, but far too difficult a question to be disposed of in a few words. Suffice it to say that in all probability much of that which distinguishes the Celtic languages—and among them Welsh—from the other Aryan tongues, and from one another, is to be ascribed to the Aryan settlers in the British Isles having in the course of time and conquest absorbed other races speaking languages very different from their own. Such an absorption could not happen to a very great extent without the dying language of the vanquished producing a lasting effect on that of the dominant race.

*Race and Language.*—The Celtic languages still spoken are Welsh, Breton, Gaelic in Ireland and the Scotch Highlands, and Manx in the interior of the Isle of Man. Among the dead ones are Old Cornish, which lingered on into the last century, Pictish, and Gaulish. Of these, Cornish has left behind it a considerable quantity of literature, while the Pictish words extant may perhaps be counted on one's fingers; the Gauls have left us a number of monuments, from which, together with other sources, a fair number of their proper names and a few other specimens of their vocabulary have been collected—enough, in fact, to enable one to assign the Gauls their proper place in the Celtic family. Now, as to the modern Celts of the British Isles and Brittany, all are agreed that they divide themselves naturally into two branches, the one Kymric and the other Goidelic. To the latter belong the Irish and the Gaels of Scotland, together with the Manx: to the former, the Welsh, the Cornish, and the Bretons. Then as to the ancient Gaels, it is usual to range them with the Kymric nations, so that the entire Celtic family is commonly spoken of as consisting of Goidelic nations on the one hand, and Gallo-British ones on the other. A word as to the terms *Goidelic* and *Kymric*. The former is derived from the Old Irish *Goidel* or *Gaedel*, "an Irishman or Gael;" in modern Irish it is spelled *Gaoidheal*, with a silent *dh*, which has led to the simplified spelling *Gael*. The latter is from the Welsh word *Cymro*, "a Welshman," plural *Cymry*, to which may be added *Cymraes*, "a Welshwoman," which are supposed to represent earlier and longer forms, Combroc-s, from Combrag-i, Combrag-issa: compare the Gaulish tribe-name, *Allobrox*, *Allobroges*. In any case, the Welsh national name has nothing whatever to do with either Cimbri or Cimmerii.

The foregoing classification of the Celts, however, is to be rejected as resting on a bad foundation—namely, the following: The Welsh and the Gauls belong, it is argued, to the same Celtic branch, because Welsh agrees with Gaulish in changing *qu* into *p*, whereas Irish has *c*. Thus, the Old Irish word for *four* was *cethir*, while in Welsh it is *pedwar*; and the Gauls called a kind of carriage in use among them *petorritum*, a form which is supposed to involve the Gaulish word for *four:* the Latin, it is needless to add, was *quatuor* or *quattuor*, and the Aryan original was probably *qvatvar*. Now, a glance at the equivalents of *qu* will serve to convince one that this is not the kind of argument to base an ethnological theory upon. For there were Greeks who called *four* πίσυρες, and Italians who said *petus* for *quatuor;* not to mention the Romanians, who have made the Latin words *aqua* and *equa* into *ape* and *eape* respectively; but will anybody assert that this proves the Welsh and the nations alluded to to be nearly related? The change of *qu* into *p* is a phenomenon which it is the business of the phonologist to explain, but the physiological law underlying it knows no racial boundary. Moreover, to be of any use as an argument, the *p* coincidence between Welsh and Gaulish ought to involve coincidence of time—that is to say, Gauls and Welsh should have made *qu* into *p* at the same time, so as to admit of the supposition that they were as yet one nation, speaking one and the same language; but it is not so. The Gauls had replaced *qu* by *p* some time before we have any history of them, whereas the early Welsh do not seem to have done so before the sixth century. It happens that Aryan *p* simple was lost in the Celtic languages at a very early date. So, previous to the passage of *qu* into *p*, the latter sound was in all probability unknown to the Kymric race, as well as to the Irish; accordingly, we find that the Ogam alphabet made no provision for it, and that, when the Welsh at length borrowed names with *p* from the Romans, they were unable to write them in Ogam without inventing a non-Ogamic symbol. In the two instances which occur the symbols used are different, so that the scribes may be said to have extemporized them without agreeing on a common one. The names with *p* are very scarce in Kymric inscriptions; the first native one is *Porius*, which occurs on a stone near Trawsfynydd, in Merionethshire: it is probably of the same origin and date as the *Vortipori* (vocative) of Gildas, who wrote about the middle of the sixth century. On the other hand, *qu* occurs more frequently on the monuments of Wales and Cornwall; and especially noticeable is the genitive *maqui* of the word for *son*. *Maqui* is common also on early Irish monuments: in Old Welsh it is always *map*, now *mab*, and in Old Irish it is reduced to *macc* or *mac*. And, among the other instances, may be mentioned the name *Quenvendani* on a stone in Pembrokeshire: the first part *Quenvend*, is now *penwyn;* Irish, *Cennfinn*, "whitehead or white-headed," and the Gaulish equivalent occurs on a coin in De Saulcy's collection in the form ΠΕΝΝΟΟΥΙΝΔΟC—*i. e. Pennovindos*.

As it appears that there is no reason for dividing the Celts into Goidelic and Gallo-British nations, we are at liberty to classify them more in harmony with geography into continental and insular Celts, and to subdivide the latter group into Goidelic and Kymric. In other words, the insular Celts may be regarded as forming one nation long after they migrated from the continent of Europe to the British Isles; and it was only after some of them crossed over to Ireland and settled there that the well-known differences of language between the Welsh and the Irish grew up in the course of many centuries of separation by the Irish Sea. As a matter of fact, the linguistic divergences usually relied upon by the advocates of the Gallo-British theory as proving the existence of a profound primeval difference between them, may, like the *p-qu* instance, be shown to date after the beginning of the fifth century. This, however, cannot be entered upon here, as it would be requisite to survey more or less minutely the entire field of Celtic phonology. JOHN RHYS.

**Welsh Onion,** another name for the CIBOL (which see).

**Wel'ton,** p.-v. and tp., Clinton co., Ia. P. 956.

**Welton,** tp., Mineral co., West Va. P. 627.

**Wel'witsch** (FREDERICK), M. D., b. in Holland about 1810; became an eminent botanist; spent eighteen years in the Portuguese possessions of Western Africa, where he collected above 40,000 specimens of plants, which he brought to England, and published several works on African botany and on natural history. D. in London Oct. 20, 1872. In 1863 he discovered at Mossamedes, West Africa, a remarkable plant which was named by Dr. J. D. Hooker *Welwitschia mirabilis*. It is placed among the Gnetaceæ, a family nearly allied to the conifers; is never above a foot high, though its trunk is sometimes six feet in diameter; is found only in an elevated rainless, stony plateau; attains an estimated age of above a century; produces flower-stalks twelve inches high, cones two inches long, and cotyledons six feet long, which extend in all directions.

**Wel'wood** (JAMES), M. D., b. near Edinburgh, Scotland, in 1652; educated at the universities of Glasgow and Leyden; accompanied William III. to England 1689; became one of the royal physicians for Scotland, and practised with great reputation at Edinburgh, where he d. in 1716. Author of a *Vindication of the Revolution in England* (1689) and of *Memoirs of the Most Material Transactions in England for the Hundred Years preceding the Revolution* (1700), often reprinted, commended by the earl of Chatham, and edited in 1820 by Baron Maseres.

**Wen** [Ang.-Sax. *wenn*], a cystic tumor occurring upon the surface of the body, especially frequent on the scalp. It originates by the occlusion of a follicle of the skin or

scalp, and the subsequent slow accumulation of sebaceous matter secreted by the lining of the steadily-increasing cyst. The tumor, therefore, is round and symmetrical, and, causing a distension of the overlying skin or scalp, is smooth and shiny. It may be soft, semi-solid, or indurated, according as its contained sebaceous matter is fluid, rich in pultaceous fatty granules, or has had its fluid elements absorbed, leaving only inspissated and calcific substance. The wen is a harmless, non-malignant tumor. Whether single or present in large numbers, its removal is easy and harmless. The overlying tissues are to be incised, without cutting into the wen, when with the handle of a scalpel or a small ivory paper-cutter the round, ball-like cyst may be pried or peeled out. If the cyst has been cut into and the cheesy contents evacuated, the membranous sac must be seized with forceps and gently drawn out, for if left it will refill. Once properly removed, it cannot return.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Wen'ceslas,** or **Wenzel,** emperor of Germany (1378–1400), b. at Nuremberg Feb. 26, 1361, a son of the emperor Charles IV., of the house of Luxemburg. He was a weak, violent, and cruel character, and spent most of his time in dissipation. In order to get money he annulled all debts due to Jews on condition that the creditors should pay from 15 to 30 per cent. into the imperial treasury; and when the mob of Prague fell upon the Jews and killed 3000 of them, he simply confiscated the property of the victims. In Bohemia, which was his hereditary dominion, and of which he had been crowned king when only three years old, he ruled with the highest degree of arbitrariness and cruelty. John Nepomuk he tortured with his own hand, and threw him, hands and feet tied together, into the Moldau. But in 1393 the Bohemian nobles, who hated him for the partiality he showed toward the Germans, formed a conspiracy against him, headed by his own brother, Sigismund, king of Hungary, seized him, and held him a prisoner at Prague for a long time. He was finally restored to liberty, but his power was henceforward much circumscribed in Bohemia. In Germany, where his influence never had been great, he finally lost all authority, and when he allied himself with France for the purpose of ending the papal schism by deposing both Boniface IX. and Benedict XIII., the electors of Mentz, Cologne, Treves, and the Palatinate assembled at Oberlahnstein and formally deposed him (Aug. 20, 1400). Ruprecht of the Palatinate, who was elected emperor in his stead, was never generally acknowledged, but when, after the death of Ruprecht in 1410, Sigismund of Hungary was elected emperor, Wenceslas renounced his claims on the German crown, though he continued to bear the title till his death, Aug. 16, 1419.

**Wen'dell,** p.-v. and tp., Franklin co., Mass. P. 539.

**Wendell** (John L.), b. in New York City in 1784; became a member of the Albany bar, and was for many years reporter of the supreme court of New York. D. at Hartford, Conn., in 1861. His *Reports of Cases* (26 vols., 1829–42) and *Digest of Cases* (1836) are well known to the profession; he also edited Starkie's *Law of Slander* (Albany, 2 vols., 1843) and Blackstone's *Commentaries* (New York, 4 vols., 1847).

**Wends,** or **Vends** (*i. e.* "wanderers"), a Slavic race of Germany, considered by some as identical in race with the Vandals (who are generally thought to have been of Teutonic stock), and, with more probability, considered by others as the same as the Venedi, or old Venetians. They anciently inhabited a large part of Northern and Northeastern Germany, and figure much in the accounts of the early and mediæval wars of the Scandinavians and Germans, by whom they were finally overcome. Some of their tribes were exterminated, and the remainder were cruelly oppressed. At present the number of Wends (*i. e.* people speaking the Wendish language, exclusive of the large numbers who are Germanized) is put at 140,000, of whom 83,000 are in Prussia (Liegnitz and Frankfort), and Saxony (the kingdom) has (1871) 52,097 Wends, mostly in the district of Bautzen. It is to be noted that the Sloventzi of Austria (1,260,000 in number) are called Vinds also, and their language is called the Vindish. They are also of the Slavic race. The Wendish language resembles the Czechic. There are several dialects—the Upper Lusatian, the Evangelical or Protestant, and the Catholic. There are some collections of Sorabian-Wendish songs and ballads, and several good grammars of the language.

**We'ner, Lake,** the largest lake of the Scandinavian peninsula, in the southern part of Sweden, 30 miles from the Cattegat, at an elevation of 105 feet, covers an area of 2005 feet. It receives the Clara-elv, and sends its waters to the Cattegat through the Götha-elv. It is connected with Lake Wetter by canals, and thus an inland communication is established between the Baltic and the Cattegat.

**Wen'ham,** p.-v. and tp., Essex co., Mass. P. 985.

**Weno'na,** p.-v., Marshall co., Ill., on Chicago and Alton and Illinois Central R. Rs., 100 miles S. W. of Chicago, has 5 churches, 1 bank, a good school system, 1 newspaper, foundry and stoveworks, and planing and flouring mills. The Wenona Union fair is held here, and is second in importance only to the State fair. P. about 2000.

Cadet Taylor, Ed. "Index."

**Wenona,** p.-v., Bay co., Mich.

**Wens'leydale** (James **Parke**), Baron, b. at Highfield, near Liverpool, England, Mar. 22, 1782; graduated at Trinity College, Cambridge, 1803; became a fellow there 1804; was called to the bar at the Inner Temple 1813; became a puisne judge in the court of king's bench 1828, baron of the exchequer and privy councillor 1834; retired, and was created a peer for life under the title of Baron Wensleydale, Jan. 16, 1856, thereby giving occasion to animated discussions on the part of the House of Lords upon the validity of this innovation, resulting in a report by the committee of privileges (Feb. 25) against the patent, and the grant of a new patent in the ordinary form as Baron Wensleydale of Walton, Yorkshire, with remainder to himself and his issue male. D. at Ampthill Park, Bedfordshire, Feb. 25, 1868, leaving no issue, and the title thereby became extinct.

**Wen'tletrap** [Ger. *Wendeltreppe*, "winding stair"], a popular name for the shells of the gasteropods of the genus *Scalaria*, family Turritellidæ. There are about 100 living and as many more extinct species. The finest are from the warm seas. *S. pretiosa*, from China, is very fine and lustrous, and a single shell has been sold for $1000 (200 guineas), but its price is now moderate. *S. grœnlandica* is abundant in the North Atlantic, and is devoured by the codfish. These creatures emit a purple juice, like many other shell-fish.

**Went'worth,** county of Ontario, Canada, W. of the head of Lake Ontario. Area, 454 sq. m. It is a fertile and well-cultivated region, and is traversed by various railways, centring at Hamilton, the capital. P. 57,599.

**Wentworth,** p.-v. and tp., Grafton co., N. H. P. 971.

**Wentworth,** p.-v. and tp., cap. of Rockingham co., N. C. P. 1767.

**Wentworth** (Anne Isabella **Milbanke**), Baroness and Lady Byron, b. in England May 17, 1792, was the only child of Sir Ralph Milbanke and his wife Judith, sister of Thomas Noel, Viscount Wentworth, of whose large estates she became the heiress; married Lord Byron, the celebrated poet, Jan. 2, 1815, but separated from him in Feb., 1816, after the birth of their only child; devoted her large income to charitable objects, especially industrial schools and reformatory institutions, and inherited the title of Baroness Wentworth 1856. D. May 16, 1860.—Her daughter, Ada Augusta, b. in London Dec. 10, 1815; married, in 1835, William, Lord King, now earl of Lovelace, and d. Nov. 27, 1852. The title of Baron Wentworth was inherited by her eldest son, Byron Noel (b. May 12, 1836), from 1856 until his death, Sept. 1, 1862, since which time it has been borne by her only surviving son, Ralph Gordon Noel (b. July 2, 1839), who is known by the courtesy title of Viscount Ockham, and has several children.

**Wentworth** (Benning), b. at Portsmouth, N. H., July 24, 1696; graduated at Harvard 1715; became a merchant; was frequently elected to the assembly; was appointed a member of the council 1734; was royal governor from 1734 to 1767; made grants of land in Southern Vermont, occasioning a famous conflict with New York concerning jurisdiction, and gave to Dartmouth College 500 acres of land, on which its buildings were erected. D. at Portsmouth Oct. 14, 1770. The town of Bennington, Vt., was named in his honor.

**Wentworth** (Charles Watson). See Rockingham, Marquis of.

**Wentworth** (John), grandson of William, b. at Portsmouth, N. H., Jan. 16, 1671; became a captain in the merchant marine; was appointed by Queen Anne a councillor for New Hampshire 1711; became justice of common pleas 1713, and lieutenant-governor of New Hampshire 1717, the province being then dependent on Massachusetts. D. at Portsmouth Dec. 12, 1730.

**Wentworth** (John), b. at Dover, N. H., Mar. 30, 1719; became a lawyer and a colonel of New Hampshire militia; was a member of the legislature 1768–75, and Speaker 1771; was chairman of the Revolutionary committee of correspondence and president of the first convention 1774, state councillor 1776–81, judge of common pleas for Strafford co. 1773–76, and judge of the supreme court 1776–81. D. May 17, 1781.

**Wentworth** (Sir John), Bart., LL.D., nephew of Gov. Benning, b. at Portsmouth, N. H., Aug. 9, 1737; gradu-

ated at Harvard 1755; went to England as agent of the province 1765; obtained through the marquis of Rockingham the appointments of surveyor of the king's woods in America and that of governor of New Hampshire, which he held from 1767 to 1775; gave its charter to Dartmouth College; encouraged agriculture and promoted the settlement of the colony; went to England at the outbreak of the Revolution (1775); was lieutenant-governor of Nova Scotia 1792–1808, and was created a baronet 1795. D. at Halifax, N. S., Apr. 8, 1820.

**Wentworth** (John), son of Col. John (1719–81), b. at Dover July 17, 1745; graduated at Harvard 1768; was a member of the committee of safety during the Revolution; sat in the legislature 1776–80; was a delegate to the Continental Congress 1778–79, and a signer of the Articles of Confederation; councillor 1780–84, and State senator 1784–87. D. at Dover Jan. 10, 1787.

**Wentworth** (John), nephew of Sir John, b. at Portsmouth, N. H., in 1768; was taken to England about 1775; educated as a lawyer; became a barrister at the Inner Temple; published a *Complete System of Pleading* (London, 10 vols., 1797–99); was appointed attorney-general of Prince Edward's Island; resided some years at Portsmouth, where he married his cousin, a daughter of Col. Michael Wentworth, and returned in 1816 to London, where he d. soon afterward.

**Wentworth** (John), LL.D., grandson of John, Jr. (1745–87), b. at Sandwich, N. H., Mar. 5, 1815; graduated at Dartmouth College 1836; settled in Illinois 1836; studied law at Cambridge Law School, and was admitted to the bar 1841; sat in Congress as a Democrat 1843–51 and 1853–55, and as a Republican 1865–67; was mayor of Chicago 1857; took a leading part in the Illinois constitutional convention of 1861, and edited the Chicago *Democrat* for many years previous to 1861. Author of a *History of the Family of Wentworth* (2 vols., 1870), which is perhaps the most elaborate of all American genealogical works.

**Wentworth** (Tappan), b. at Dover, N. H., Feb. 24, 1802; became a lawyer at Lowell, Mass.; was president of the common council of that city 1842; served four years in the Massachusetts senate and eight years in the assembly; was a member of Congress 1853–55, and a delegate to the Loyalists' convention at Philadelphia 1866. D. at Lowell June 12, 1875.

**Wentworth** (Thomas). See Strafford, Earl of.

**Wentworth** (William), b. at Alford, Lincolnshire, England, in 1615; came to Massachusetts in 1636 with Rev. John Wheelwright; was associated with that clergyman in his difficulties with the Massachusetts government respecting the "Antinomian" opinions attributed to him and to Mrs. Hutchinson; took part in the settlement of Exeter, N. H., 1639; removed thence to Wells, Me., and ultimately settled at Dover, N. H., where he was a ruling elder in the church and often preached. In 1689 he was instrumental in saving Heard's garrison from destruction by the Indians. D. at Dover Mar. 16, 1697. From him are descended all persons of the name in the U. S.

**Wentworth Location,** p.-v., Stratford tp., Coos co., N. H. P. 38.

**Wentz'ville,** p.-v., St. Charles co., Mo.

**Weogufka,** p.-v. and tp., Coosa co., Ala. P. 404.

**Wer'dau,** town of Germany, kingdom of Saxony, on the Pleisse, has several dyeing establishments and manufactures of cloth and yarn. P. 10,326.

**Wer'den,** town of Rhenish Prussia, on the Ruhr, manufactures woollen, linen, cotton, and silk fabrics, alum, and copperware. P. 6264.

**Werden** (Reed), U. S. N., b. Feb. 28, 1818, in Pennsylvania; entered the navy as midshipman Jan. 9, 1834; became lieutenant in 1847, commander in 1862, captain in 1866, commodore in 1871, rear-admiral in 1875; commanded the steamer Stars and Stripes in the fight at Roanoke Island and at the capture of Newberne, and for "gallant service" commended by Rear-Admiral Goldsborough.

Foxhall A. Parker.

**Wer'der, von** (August), b. Sept. 12, 1808; entered the Prussian army in 1825; took part in the Russian campaigns in the Caucasus in 1842–43, and was severely wounded; became a member of the staff in 1846; received the command of the 4th battalion of chasseurs in 1856; that of the 4th guard infantry brigade in 1863, with the title of major-general; that of the 3d infantry division in 1866, with the title of lieutenant-general, and led this division with distinction in the campaign against Austria in 1866. In the war against France in 1870 he was a member of the staff of the crown prince, but soon received the command of the Baden-Würtemberg army corps, which he led at Wörth, Aug. 6, 1870. He conducted the siege of Strasbourg; was made a general of infantry after the capitulation of the fortress, and repulsed victoriously (Jan. 15–17, 1871) the attack of Bourbaki at Belfort, which success made him very popular in Southern Germany, where an invasion by the army of Bourbaki was generally anticipated. His statue was raised at Freiburg.

August Niemann.

**Wer'geland** (Henrik Arnold), b. at Christiansand, Norway, June 17, 1808; studied theology at the University of Christiania; received in 1836 an appointment at the library; became keeper of the archives of the state in 1840, and d. Aug. 12, 1845. His collected works (Christiania, 9 vols., 1852–57) contain a large philosophical or religious poem, *The Creation, Man, and the Messiah*, several tragedies, dramas, vaudevilles, and farces or dramatic satires, which in their time attracted much attention; but the best of his productions are his lyrical poems and fairy-tales. His influence, however, on Norwegian literature and civilization can by no means be measured by the æsthetic worth of his works. (See Norwegian Language and Literature.) A good selection of his works appeared in 1859 in 1 vol. (See Lassen, *Henrik Wergeland og hans Samtid*, Christiania, 1867.)

**Wer'ner** (Abraham Gottlob), b. Sept. 25, 1750, at Wehrau, Upper Lusatia, where his father was director of smelting-works; studied at the mining academy of Freiberg and at the University of Leipsic, and was appointed professor of mineralogy in 1815 at Freiberg, where he d. June 30, 1817. His writings are not numerous, comprising only a few minor books, or rather pamphlets—*Ueber die äussern Kennzeichen der Fossilien* (1774; translated into English by Weaver, Edinburgh, 1849), *Kurze Klassification und Beschreibung der Gebirgsarten* (1787), and *Neue Theorie über Entstehung der Gänge* (1791; translated into English by Charles Anderson, Edinburgh, 1809). But by his lectures, to which students from all European countries gathered, he gained many disciples, and his theory, the so-called Neptunian, forms a most important chapter in the history of geology. In 1845 the Wernerian Society was founded in Edinburgh by one of his disciples, Robert Jameson.

**Werner** (Friedrich Ludwig Zacharias), b. at Königsberg Nov. 18, 1768; studied law at the university of his native city, and entered the Prussian civil service in 1793, holding office first in Warsaw till 1805, then in Berlin. While in Warsaw he wrote in 1800 his first drama, *Söhnen des Thals*, inspired by his enthusiasm for the Freemasons, and in 1804, the *Kreuz an der Ostsee*, to which Hoffmann composed the music. In Berlin he wrote *Martin Luther, oder die Weihe der Kraft*, and *Der 24ste Februar*. This last drama is a representation of Fate as the absolute ruler of human destiny—not the Mohammedan fate, which may fill the heart with fanatical enthusiasm, but a peculiar, mystic, and fantastic power, merely fit to strike the imagination with terror. The whole play is, like his other dramas, the outburst of an ill-regulated imagination, rather than the product of any genuine dramatic or poetic talent, but it is by no means without power. It made a great sensation, and called forth scores of imitations. In 1807 he resigned his office in the Prussian service; travelled in Germany, Switzerland, and France; visited Goethe at Weimar and Madame de Staël at Coppet; went in 1809 to Rome; joined the Roman Catholic Church Apr. 19, 1811; was ordained a priest in 1814; preached in Vienna during the Congress, and made an enormous sensation by the peculiar blending, in his sermons, of coarseness and real power. He spent 1816–17 in Podolia in the house of Count Choloniewski, but in the latter year he returned to Vienna, where he continued to preach with great effect till his death, Jan. 18, 1823. His *Sämmtliche Werke*, with a biography by Schütz, were published in 14 vols. (1839–41), and contain, besides the above dramas, the tragedies *Attila, Wanda, Kunegunde*, and *Die Mutter der Makkabäer* (1820), lyrical poems, hymns, sermons, etc.

Clemens Petersen.

**Werner** (Karl), b. at Weimar Oct. 4, 1808; studied painting at the academies of Leipsic and Münich; resided in Italy from 1833 to 1853; visited Spain in 1857, and the Orient twice, in 1862 and 1867. He devoted himself to water-colors, and paints mostly landscapes and architecture, subjects from Munich, Prague, Venice, Palermo, Granada, and the Orient. His most celebrated works are—*The Triumphal Procession of Doge Contarini*, five feet high; *The Zisa Hall in Palermo, The Lions' Court of the Alhambra*, and *Jerusalem and the Holy Land*, comprising 30 designs, published with colored plates and text at London (1866–67).

**Werner, von** (Anton), b. at Frankfort-on-the-Oder May 9, 1843; studied painting at the Academy of Berlin and in Carlsruhe under Adolph Schröder; won a prize for his *Luther before Cajetan* (1865) and *Conradin of Hohenstaufen and Frederick of Baden hearing the Sentence of Death* (1866); painted for the University of Kiel, in 1870,

*Luther before the Diet of Worms* and *The National Uprising of 1813;* accompanied the German head-quarters during the Franco-German war, and received orders from the emperor for the execution of several large frescoes in the triumphal monument in the Königsplatz in Berlin.

**Wernigero'de,** town of Prussia, province of Saxony, on the Holzemme, has manufactures of woollen and linen fabrics, bricks, and tiles. P. 6925.

**We'sel,** town of Rhenish Prussia, on the Rhine, is strongly fortified, and has a good harbor, from which steamboats ply to Amsterdam, manufactures of nails, paper, tobacco, chemicals, and woollen fabrics, and an active trade. P. 18,519.

**We'ser,** river of Europe, is formed by the junction of the Fulda and Werra at Minden, Hanover, whence it flows northward, and enters the North Sea after a course of 250 miles. It is navigable for vessels drawing 7 feet of water up to Bremen, but large ships ascend no farther than Bremerhafen, at its mouth, and the river is not of much consequence as a road of traffic.

**Wes'ley,** tp., Will co., Ill. P. 924.

**Wesley,** p.-v. and tp., Washington co., Me. P. 336.

**Wesley,** p.-v. and tp., Washington co., O. P. 1450.

**Wesley** (Bartholomew), the great-grandfather of John and Charles Wesley. As his name was written *Westley,* it is not improbable that he was a descendant of the family represented by John Westley, bachelor in degrees, rector of Langton Matravers, Dorset, England, 1481. *Lea* means a "field," and Hutchins, the historian of Dorset, speaks of a place in that county called *West Leas;* this may have originated the family name. Bartholomew Wesley was the son of Sir Herbert Wesley, or Wellesley (which see). He was born about 1595. He married the daughter of Sir Henry Colley of Kildare, Ireland. Dr. Calamy states that when at the university (perhaps Oxford) he studied physic as well as divinity. He was rector of Catherston and Charmouth, two villages in Dorset, in 1650, and was ejected from both by the Act of Uniformity in 1662. After his ejectment he practised physic for a living, and preached among the nonconformists "as the times would permit." Dr. A. Clarke says: "He was so affected by the premature death of his son John, who was also a minister, that his health rapidly declined, and he did not long survive him. This must have been some time after 1678." Calamy says: "He was, when an old man and the vigor of life was gone, as tender-hearted and affectionate as he had been pious and prudent." T. O. Summers.

**Wesley** (Charles), M. A., youngest son of the Rev. Samuel Wesley, rector of Epworth, and Susannah Wesley, b. at Epworth Dec. 18, 1708, O. S. (Dec. 29, N. S.). In 1716 he was sent to Westminster School, under his elder brother, Samuel Wesley (which see). Whitehead says: "When he had been some years at school, Mr. R. Wesley, a gentleman of large fortune in Ireland, wrote to his father and asked if he had any son named Charles; if so, he would make him his heir. Accordingly, a gentleman in London brought money for his education several years. But one year another gentleman called—probably Mr. Wesley himself—talked largely with him, and asked him if he was willing to go with him to Ireland. Mr. Charles desired to write to his father, who answered immediately, and referred it to his own choice. He chose to stay in England." Southey says: "Mr. John Wesley, in his account of his brother, calls this a fair escape. The fact is more remarkable than he was aware of, for the person who inherited the property intended for Charles Wesley, and who took the name of Wesley or Wellesley in consequence, was the first earl of Mornington, grandfather of Marquis Wellesley and the duke of Wellington." In 1721, Charles was admitted king's scholar at St. Peter's College, Westminster; in 1726 was elected to Christ Church College, Oxford. While there he became so serious, devout, and zealous that the wits at Oxford called him and his godly companions "Methodists"—a title which had been given derisively to rigidly religious persons a century before. When, with his brother John, he was about to embark for America with Oglethorpe in 1735, he was ordained deacon by Dr. Potter, bishop of Oxford, and the next Sunday presbyter by Dr. Gibson, bishop of London. After preaching with little success in Frederica, Ga., he returned to England, reaching his native land Dec. 3, 1736. On Whitsunday, May 21, 1737, he experienced the "witness of adoption," by which he was raised to a higher plane in the divine life—an event which he commemorated in an immortal hymn, beginning, "Oh! for a thousand tongues to sing!" so popular among Methodists and others. Being excluded from the churches of the Establishment because of his "Methodism," despite his High-Church proclivities, he began at once to co-operate with his brother in his great work of evangelization. As far as his health and family circumstances would admit, he travelled extensively in England and Wales, and was very successful as a preacher. But he is chiefly renowned as "the poet of Methodism." He wrote thousands of hymns on every religious theme, versifying large portions of the Scriptures, including most of the Psalms, which beautiful paraphrases have been published in *The Wesleyan Psalter,* edited by the present writer. His hymns constitute the staple of the Methodist hymnals, and are too well known and too highly esteemed to require further notice in this place. D. in London Mar. 29, 1788. At the conference which followed his death John Wesley answered the question "Who died this year?" thus tersely: "Charles Wesley, who after spending fourscore years with much sorrow and pain, quietly retired into Abraham's bosom. He had no disease, but after a gradual decay of some months 'the weary wheels of life at last stood still.' His least praise was his talent for poetry, although Dr. Watts did not scruple to say that that single poem, 'Wrestling Jacob,' was worth all the verses he himself had written." The last lines which he composed were dictated to his wife when he could scarcely articulate:

"In age and feebleness extreme,
Who shall a sinful worm redeem?
Jesus, my only hope thou art,
Strength of my failing flesh and heart;
Oh! could I catch a smile from thee,
And drop into eternity!"

He composed on horseback, in bed, anywhere, on every occasion, and wrote his compositions as soon as he could get pen and paper. Some of his manuscripts have fallen into our possession: they are written in a neat, unique hand, in the style of chirography prevalent in the Wesley family. Charles Wesley was married in 1749 to an excellent woman, Miss Sarah Gwynne of Wales, who after his death was supported principally by his brother John. By her he had eight children, three of whom, two sons and a daughter, lived to a good old age. The daughter, Miss Sarah Wesley, was a woman of fine parts. Her correspondence with Dr. A. Clarke in regard to a ludicrous anecdote of her grandfather and his clerk at Epworth may be found in Tyerman's *History of S. Wesley,* pp. 453, 454. Charles, her eldest brother, was b. Sept., 1757. He inherited the musical genius of his mother and an infant brother, who died before he was born, and who sang a tune and beat time before he was a year old. In his third year Charles learned from his mother to play on the harpsichord. In his fourth year his father introduced him to Dr. Boyce, a leading musician in London, where his astonishing precocity in music led to the proposal that he should be one of the king's singing boys in the chapel royal—an offer his father declined. For half a century, till his death in 1834, he had no rival at the organ, unless it was his brother Samuel. He was b. Feb., 1776. At the age of three he played "God save great George, our king!" Fischer's minuet, which he had caught from street organs. When his brother was playing he would scrape on his little fiddle and beat time to the music. The best organists in London took pleasure in teaching them gratuitously, as they could learn anything and play the hardest music at sight. Samuel became the foremost composer and performer of his age. He composed a high mass for the chapel of Pope Pius VI., who thanked him in a Latin letter written to the apostolic vicar in London. He d. in that city in 1837. The service of music performed at his funeral was grand and impressive beyond precedent. Charles was never married; Samuel was married twice. By his first wife he had three children —Charles Wesley, D. D., late chaplain to Queen Victoria and sub-dean of the chapel royal of St. James's Palace; Emma, who married an artist, and is dead; and the late John William, who for some years was a clerk at the Wesleyan Mission-house, London. By his second wife Samuel had seven children. The first of these was Dr. Samuel Sebastian Wesley, late organist of Gloucester cathedral, and the greatest musical genius in England. He d. Apr. 19, 1876. The other five of Charles Wesley's children, named, respectively, John, Martha Maria, Susannah, Selina, John James, died in infancy. We have a list of 51 of his living descendants, bearing the names of Wesley, Dennis, Newenham, Glenn, Simmonds, Martin, and Bayley. (See *Life of Charles Wesley,* by Thos. Jackson, and Stevenson's *Memorials of the Wesley Family.*) The poetical works of Charles Wesley have been recently edited, in a series of 13 vols., by Dr. Osborn, London.

T. O. Summers.

**Wesley** (Sir Herbert). Two branches of the Wesley family preserve genealogical tables of their respective ancestry dating back to 1350. From one of those branches sprang Sir Herbert Wesley (or Wellesley) of Westleigh, Devon, who married a relative, Elizabeth Wellesley of Dangan, Ireland. From her branch of the family came Arthur,

the famous duke of Wellington. Sir Herbert and his wife Elizabeth had three children—WILLIAM, HARPHAN, and BARTHOLOMEW. William married the daughter of John Eden of West Duckland. They had three children—ARTHUR, BRIDGET, and WILLIAM. Arthur died without issue; Bridget married Sir Francis Pulpre; William married Ann, daughter of Sir Thomas Pigott. They had four children—THOMAS, GEORGE, FREDERICK, and MARY. Nothing is known of three of them. George was born in the early part of the eighteenth century. He married first Miss Pelham, who died without issue. His descendants assert that he then married a daughter of Samuel Wesley, rector of Epworth, but without proof. Two sons were the issue of this second marriage—FRANCIS and HENRY, who died unmarried. Francis was born in 1764, and married Miss Bamfylde. They had two sons—WILLIAM, who died without issue, and FRANCIS, who died in 1854. His son ALFRED married Anne Lillie. They had five sons, who are all living, or were recently—to wit, ERNEST GEORGE, LEWIS HERBERT, CHARLES, HENRY, and EDWARD. Ernest George has been for some years in the U. S. He was for a while a preacher of the M. E. Church in New Jersey. He has contributed some poetical pieces to the Nashville *Christian Advocate*, and corresponded with the editor, the present writer, affirming his descent from the rector of Epworth, but through which of his daughters he could not say; nor could his brother Lewis Herbert, when interrogated by Mr. George J. Stevenson of London, from whom we have received much of our information concerning the Wesley family; so that they are probably in error in regard to that intermarriage. Ernest George has recently left the M. E. Church for the Baptist. Lewis Herbert Wesley is an advanced ritualist, a "missioner," in England. Another of the brothers was some time since seeking an alliance with the Wesley family in the person of a daughter of the late Rev. Dr. Charles Wesley, chaplain in ordinary to the queen, and grandson of the poet of Methodism, who d. in 1859. T. O. SUMMERS.

**Wesley** (JOHN), son of Bartholomew Wesley (or Westley), and grandfather of the founder of Methodism, b. about 1636; educated at New Inn Hall, Oxford, where he was distinguished for piety and diligence and the successful study of the Oriental tongues. After taking his degree, he became a member of a "particular church at Melcombe in Dorsetshire," by which he was sent to preach among the seamen and at Radipole, near Weymouth, though not as a pastor, but a kind of lay-preacher. In 1658 he became the minister of Winterborne Whitchurch, Dorset, by the appointment of the trustees and the approval of the "triers"—persons appointed by Cromwell to authorize men to preach. After the Restoration, he was brought before Gilbert Ironside, bishop of Bristol, who interrogated him concerning his ministry, but dismissed him, saying, "I will not meddle with you. Farewell, good Mr. Westley." But he was subsequently twice imprisoned, and after the passage of the Bartholomew act in 1661 ejected from his living, and persecuted from place to place, till finally he found shelter in Preston; and being called to preach to a society in Poole, he officiated there as pastor, but still resided in Preston to avoid coming under the Five-mile act, Poole being a corporate town. He was several times apprehended, and four times imprisoned. He d. about 1670. Application was made to bury him in the church at Preston, but the vicar would not suffer it. He had a numerous family, but nothing is known of any of them except his two sons, MATTHEW and SAMUEL (which see). His widow survived him about half a century. T. O. SUMMERS.

**Wesley** (JOHN), A. M., son of the Rev. SAMUEL WESLEY and SUSANNAH WESLEY (which see), b. at Epworth, Lincolnshire, Eng., June 17, 1703, O. S. (June 28, N. S.). When nearly six years of age he narrowly escaped burning to death in the fire which consumed the Epworth parsonage. He received his early training principally from his incomparable mother. At the age of eleven he was sent to the Charter-house School, London, where he made great attainments; at the age of sixteen was elected to Christ Church, Oxford. Here he acquired extraordinary proficiency in all kinds of learning, especially in the classics, logic, and theology. He was ordained deacon by Bishop Potter Sept. 19, 1725, and presbyter Sept. 22, 1728; obtained a fellowship in Lincoln College, Oxford, Mar. 17, 1726; during that year assisted his father at Epworth; was made Greek lecturer and moderator of the classics Nov. 7, 1726; took his M. A. degree in Feb., 1727, and in that year he became his father's curate at Epworth and Wroote, but as it was necessary for him to reside at Oxford, he resigned the curacy and returned to Oxford Nov., 1729. He then became the head of the society at Oxford composed of Charles Wesley, Mr. Morgan, and Mr. Kirkman, who were derisively called "Methodists" because they were so methodical in their lives and strict in the performance of religious duties. Messrs. Ingham, Broughton, Clayton, Hervey, Whitefield, and others subsequently joined their society. In 1735 the two brothers accompanied Oglethorpe to Georgia—John to be a missionary to the Indians, and Charles to be secretary to the governor and a clergyman in the colony. The way was not opened for the mission to the Indians; and as the colonists would not endure the rigid, ascetic discipline which the Wesleys wished to enforce (being then of the extreme High-Church party), they returned to England, Charles in 1736, and John in 1738. While he was at Savannah, he paid his addresses to a Miss Hopkey, but was fortunately unsuccessful: if he had married her, he would have been very "unequally yoked." On his voyage, in Georgia, and on his return to England he became acquainted with some Moravians, whose experience in regard to justification by faith and the assurance of pardon led him to exclaim, "I, who went to America to convert others, was never myself converted to God." He used the word "converted" in a peculiar sense. He was all the time a sincere and devout Christian, full of good works, but he had not a clear sense of pardon by the witness of the Spirit, as he subsequently had. He says: "In the evening (of May 24, 1738) I went very unwillingly to a society in Aldersgate street (London), where one was reading Luther's preface to the Epistle to the Romans. About a quarter before nine, while he was describing the change which He works in the heart through faith in Christ, I felt my heart strangely warmed. I felt that I did trust in Christ, Christ alone, for salvation; and an assurance was given me that he had taken away my sins, even mine, and saved me from the law of sin and death." While he was seeking this experience—viz. May 1, 1738—he formed the first Methodist "society," in Fetter Lane, London. The following summer he visited Count Zinzendorf and the Moravians in Germany to study their discipline and to intensify his spiritual life. On his return from Germany, being excluded from the churches of the Establishment because of his "Methodism," he imitated Whitefield, preaching in the fields and in private houses, wherever occasion served. The foundation-stone of his first chapel was laid in Bristol May 12, 1739. An old foundry in Moorfields, London, was purchased, and opened for preaching Nov. 11, 1739. Wesley says: "In the latter end of the year 1739 eight or ten persons came to me in London and desired that I would spend some time with them in prayer, and advise them how to flee from the wrath to come: this was the rise of the *united society*." From that period to the close of his life he was incessantly engaged in preaching, forming societies, governing them, providing them spiritual help. As their members increased rapidly in various parts of the kingdom, and as few clergymen would co-operate with him, while some repelled his followers from their churches, he was led to employ laymen to preach, though not to administer the sacraments. The first whom he employed was Thomas Maxfield, in 1741. Wesley would have silenced him at first, but his mother remonstrated, telling him, "He is as surely called of God to preach as you are." John Nelson, a stone-mason of Birstall, and others, soon followed. In 1742, Wesley instituted *class-meetings*—first at Bristol, where they were originated for the purpose of paying a debt on the chapel, but as they were found admirably adapted to maintain godly discipline and Christian fellowship, they became an important and permanent feature of Methodism. He held his first *conference* at the Foundry in London June 25, 1744, when there were present four clergymen, besides himself and his brother Charles, and four lay-preachers—ten in all. In Aug., 1744, he preached his last sermon before the University of Oxford. At the next conference (Aug. 1, 1745) only one clergyman besides himself and brother were present, the other seven being lay-preachers. The third conference was held at Bristol May 12, 1746. It was attended by John and Charles Wesley, John Hodges, and six lay-preachers. The work was then systematically arranged and divided into "circuits"—seven in England and Wales, none as yet in Scotland and Ireland—and the call and qualifications of preachers were defined substantially as in the present Methodist Discipline. Twelve "assistants" were then recognized. Thus originated the great Wesleyan system of *itinerancy*. In June, 1748, he opened Kingswood School, near Bristol, an institution designed for the education of preachers' sons and others. This was the nucleus of the vast system of literary and theological institutions which now obtains among the Methodists. In 1753, supposing that he was going to die, he wrote his own epitaph: "Here lieth the body of John Wesley, a brand plucked out of the burning; who died of a consumption in the fifty-first year of his age: not leaving, after his debts are paid, ten pounds behind him; praying, God be merciful to me an unprofitable servant!" His friend Whitefield, supposing him to be near the grave, wrote him a touching letter, concluding

thus: "*Ego sequar, etsi non passibus æquis.* My heart is too big, tears trickle down too fast, and you are, I fear, too weak for me to enlarge. Underneath you may there be Christ's everlasting arms! I commend you to his never-failing mercy, and am, revered and very dear sir, your most affectionate, sympathizing, and afflicted younger brother in the gospel of our common Lord." But Wesley lived to preach the funeral sermon of Whitefield, Nov. 18, 1770. At the twenty-seventh conference, held Aug. 7, 1770, "minutes" were adopted which led to a more formal and permanent separation from the Calvinistic Methodists, who were in connection with Whitefield and Lady Huntingdon. A sharp and prolonged controversy took place, in which the saintly Fletcher of Madeley came to the help of Wesley and defended his evangelical Arminianism against the fierce attacks of Toplady, Richard and Rowland Hill, and others. The result is too well known to be here recorded. The Wesleyan Methodists have never since "leaned toward Calvinism." When he was fourscore years of age, naturally looking forward to his death, and being desirous to perpetuate the work of God wrought through his instrumentality, he had "the Deed of Declaration" executed, Feb. 24, 1784, by which the government of the connection was assigned legally to the conference, consisting of 100 preachers and their successors for ever. This fixed the *status* of British Wesleyan Methodism with regard to both doctrine and discipline. In 1766 two Irish local preachers, Embury and Strawbridge, began to preach in New York and Maryland; and at the conference in 1769, Wesley sent to America two travelling preachers, Boardman and Pilmoor, to take charge of the societies they had formed. In 1770 he set down in the appointments, "No. 50, America." In 1771 he sent over Francis Asbury and Richard Wright, and in 1773, Messrs. Rankin and Shadford. As the work increased so rapidly in America, as the colonial Church of England, to which the Methodists generally had looked for the sacraments (their own preachers not being empowered to administer them), was virtually extinct, as the English bishops would not ordain ministers for America, and as Wesley had long before repudiated the theory of prelatical succession, recognizing the parity of bishops and presbyters as to order—being importuned by the American societies, he provided them with an ordained ministry. He was a staunch Episcopalian; so he ordained Richard Whatcoat and Thomas Vasey as elders, or presbyters, and the Rev. Thomas Coke, LL.D., a clergyman of the Church of England, as superintendent, or bishop. At a conference in Baltimore Dec., 1784, Bishop Coke, assisted by the Rev. Mr. Otterbein of the German Reformed Church and others, consecrated Francis Asbury bishop, and ordained others as elders, or presbyters, and deacons. Thus originated Methodist *episcopacy*. At first, Wesley, being intensely loyal, wrote against the American "rebellion;" but when he saw the hand of God in it, he wrote a powerful letter to Lord North, imploring the government to stop the war. When, therefore, the colonies had acquired their independence, Wesley was fully prepared to take this important step. Speaking of the American brethren, he said: "We judge it best that they should stand fast in that liberty wherewith God has so strangely made them free." He abridged and modified the liturgy, offices, ordinal, and Articles of the Church of England for the M. E. Church in America, as, with some changes, they are used by that Church to this day. This was the crowning act of his life. He ordained a few ministers for special service in England and Scotland, and he would have ordained more of them, but he wished to keep his connection, as far as possible, within the pale of the national establishment. But for this he would have organized his societies in Great Britain and Ireland into an Episcopal Church, like the M. E. Church in America. Wesley's constant prayer was to lay down his body with his charge "and cease at once to work and live." His prayer was answered, for he labored on to the last. It has been well said of him: No man perhaps ever accomplished so much. He rode, chiefly on horseback, 5000 miles, and preached 500 sermons every year for nearly fifty years; arranged and governed his societies, which numbered before his death some 80,000 members; carried on an immense correspondence; read every work of note as it came from the press; wrote commentaries on the Bible, grammars of the Hebrew, Greek, Latin, and French languages, works on logic and philosophy, controversial treatises, journals, sermons, etc., and abridged over 100 volumes for "A Christian Library." He was never in a hurry—always cheerful, deferential to women, and fond of children. His generosity was limited only by his means. He acted upon the principle he laid down for others: Make all you can by industry; save all you can by economy; give all you can by liberality. When a young man he walked from London to Epworth (160 miles) that he might have more to give away. In after life, though he realized £20,000 by his writings, his personal expenses did not average £100 a year, and he left nothing at his death. His life was often in danger from the fury of mobs, and his delicate mind felt keenly the contempt of the higher classes, his equals, yet he could say, None of these things move me. He lived in constant activity, cheerfulness, and trust in God. A lady once asked him, "Mr. Wesley, supposing that you knew that you were to die at twelve o'clock to-morrow night, how would you spend the intervening time?" "How, madam?" he replied; "why, just as I intend to spend it now. I should preach this evening at Gloucester, and again at five to-morrow morning. After that, I should ride to Tewkesbury, preach in the afternoon, and meet the societies in the evening. I should then repair to friend Martin's house, who expects to entertain me, converse and pray with the family as usual, retire to my room at ten o'clock, commend myself to my heavenly Father, lie down to rest, and wake up in glory." Like the rest of the Wesley family, he was fond of music and poetry. He published several volumes of tunes for the organ and voice, and quite a library of hymns and poems. He wrote elegant hymns himself, and is accredited with the admirable translations from the German, French, and Spanish found in his hymn-books. He was a keen and judicious critic, and many of the hymns of his brother Charles, Dr. Watts, Herbert, and others were greatly improved by his pruning and correction. He lived long enough to see the tongue of slander hushed and the hand of persecution stayed, except in rare instances, and to win golden tributes from Dr. Samuel Johnson, Alexander Knox, and other distinguished men of the age. Knox closes an exquisite eulogy of him with this sentence: "I never was so happy as while with him, and scarcely ever felt more poignant regret than at parting from him; for well I knew 'I ne'er should look upon his like again.'" His person is thus described: "The figure of Mr. Wesley is remarkable. His stature was low; his habit of body, in every period of life, the reverse of corpulent, and expressive of strict temperance and continual exercise; and, notwithstanding his small size, his step was firm and his appearance, till within a few years of his death, vigorous and muscular. His face, for an old man, was one of the finest we have seen. A clear, smooth forehead, an aquiline nose, an eye the brightest and most piercing that can be conceived, and a freshness of complexion scarcely ever to be found at his years, and expressive of the most perfect health, conspired to render him a venerable and interesting figure. Few have seen him without being struck with his appearance, and many who had been greatly prejudiced against him have been known to change their opinion the moment they were introduced into his presence. In his countenance and demeanor there was a cheerfulness mingled with gravity—a sprightliness which was the natural result of an unusual flow of spirits, and yet was accompanied with every mark of the most serene tranquillity. His aspect, particularly in profile, had a strong character of acuteness and penetration. In dress he was a pattern of neatness and simplicity. A narrow plaited stock, a coat with a small upright collar, no buckles at his knees, no silk or velvet in any part of his apparel, and a head as white as snow, gave an idea of something primitive and apostolic, while an air of neatness and cleanliness was diffused over his whole person." He was two or three times "crossed in love," but, considering it his duty to enter the conjugal state, he married, in 1757, Mrs. Mary Vizelle, a woman of cultivation and apparent piety, but she proved a very vixen, who did all in her power to ruin him. He bore her treatment with marvellous forbearance till she finally robbed him of important papers and left him for ever, whereupon he calmly said, *Non eam reliqui, non dimisi, non revocabo.* She died in 1781, leaving him a ring. He died in London Mar. 2, 1791, surrounded by some of his preachers and other friends, exclaiming, "The best of all is, God is with us." He was buried Mar. 9 at City Road chapel, where a marble tablet commemorates his life and labors. On Mar. 30, 1876, a marble tablet to the memory of John and Charles Wesley, showing their profiles, and also representing John Wesley preaching on his father's tomb at Epworth, where he was excluded from the church, was unveiled in Westminster Abbey by Dean Stanley in the presence of the president of the conference, Dr. Jobson, who designed the tablet, and others, who took part in the impressive ceremony. Time works great changes. (See *Life of John Wesley*, by John Hampson, by Dr. Coke and Henry Moore, Dr. John Whitehead, Robert Southey (with notes by Dr. Curry), Richard Watson (with "Observations on Southey's Life of Wesley," and notes by the present writer); *Vie du Révérend Jean Wesley* (a French translation of Watson's *Life of Wesley*, with notes, etc.); Isaac Taylor's *Wesley and Methodism;* Tyerman's *Life of Wesley;* Dr. Rigg's *Living Wesley; Journal of John Wesley*, in his *Works*, 7 vols.)

T. O. SUMMERS.

**Wesley** (Matthew), eldest son of John Wesley, who was ejected from the vicarage of Whitchurch, and uncle of the founder of Methodism, b. about 1662. He settled as a physician in London, and was eminent in his profession, making a large fortune. He contributed to the support of the dependent family of his brother Samuel, whose wife gives an interesting account of a visit he made to Epworth in 1731. An elegy on his death may be found in the *Gentleman's Magazine*, June, 1737. He had a son who was educated at Oxford, but who shortened his life by intemperance. Charles Wesley used to say, "This young man was a profligate, and the only drunkard in the family." D. in June, 1737. (See A. Clarke's *Wesley Family*, and Tyerman's *Life of the Rev. Sam. Wesley, Sr.*)
T. O. Summers.

**Wesley** (Samuel, Sr.), son of John and grandson of Bartholomew Wesley, or Westley (which see), and father of the founder of Methodism. B. at Winterborn-Whitchurch, Dorset, 1662. His education began at the free school in Dorchester conducted by Henry Dolling. At fifteen he went to an academy in London, where he remained till Aug., 1683; was thence transferred to the Stepney academy, conducted by the learned nonconformist divine Edward Veal, one of the Bartholomew sufferers. At the end of about two years that academy was broken up in consequence of the persecution of the magistrates, and Wesley was sent to the famous academy of Charles Morton, Newington Green, where he had De Foe for a schoolmate. Here he remained till the summer of 1683. During all this period he was expected to enter the ministry among the nonconformists, and he wrote satires, lampoons, etc. against the Episcopal clergy, encouraged thereto by the nonconformist ministers. But after more carefully examining the subject, he renounced nonconformity and entered as a *servitor* and *pauper scholaris* in Exeter College, Oxford, in 1683, and remained there till 1688. He eked out his subsistence at the university by his pen. He took his degree of B. A. June 19, 1688, and seven weeks after was ordained deacon at Bromley by Dr. Sprat, bishop of Rochester. He was first appointed to a curacy, with an income of £28 a year. At the end of one year he was appointed chaplain on board a man-of-war, with £70 a year. He held this office one year, during which he began his *Life of Christ*. He then held for two years a curacy in London, with £30 a year, which he raised to £60 by his pen. At this time he married Susannah, daughter of the eminent ejected nonconformist divine, Dr. Samuel Annesley. In 1691 he was appointed to the parish of South Ormsby in Lincolnshire, where he also acted as domestic chaplain to the marquis of Normandy, who desired him to be raised to an Irish episcopate, but William and Mary and Archbishop Tillotson favored it not. As Wesley could not tolerate the immoralities of the earl of Castleton, who kept a mistress in his parish, he had to leave South Ormsby. Having dedicated his *Life of Christ* to Queen Mary, she presented him with the living of Epworth in Lincolnshire, of which he was rector thirty-nine years, and where he d. Apr. 22, 1735. For four or five years he had also the rectory of Wroote, a little village near Epworth, which, however, hardly paid his curate. In 1734 he resigned it to his son-in-law, John Whitelamb. As he was the father of nineteen children (some of them twins), had to assist poor relations (including his widowed mother), met with many reverses, and never had more than £200 a year for his salary, it is no wonder that he sometimes complained of the *res angusta domi*. When censured by his brother for not getting along better in the world, he referred to "eight children born and buried, ten living brought up and educated," three sons having the best education he could get for them in England. "He can struggle with the world, but not with Providence; nor can he resist sickness, fires, and inundations." He was a man of great learning, of large benevolence, loyal, devout, and conscientious in the exercise of his sacred functions. He is frequently described as a Tory and a High Churchman, but he was no Jacobite or bigot. He was the eulogist of William and Mary and Tillotson, who headed the Low-Church party. He rejoiced when he learned what his sons John and Charles were doing at Oxford, which gained for them the name of "Methodists" and "The Holy Club." He wrote (Dec. 1, 1730): "I hear my son John has the honor of being styled the 'father of the Holy Club.' If it be so, I must be the grandfather of it; and I need not say that I had rather any of my sons should be so dignified and distinguished than to have the title of His Holiness." He was a prolific author. His first volume of poems, called *Maggots*, was published in 1685; it consists of humorous and satirical pieces on various subjects. He was the principal contributor to the *Athenian Gazette* and the author of numerous pamphlets. But his great works were *The Life of Christ, an Heroic Poem, Dissertations on the Book of Job*, in Latin, and *Eupolis's Hymn to the Creator*. As an author he is best known to the present age by his two elegant hymns, found in Methodist hymnals, "Behold the Saviour of mankind," and "O Thou who when I did complain." (See *Life and Times of the Rev. Samuel Wesley*, by Tyerman, in which will be found a full account of the mysterious noises which disturbed the Epworth parsonage in 1716–17, considered by some preternatural; A. Clarke's *Wesley Family*; and the various *Lives* of John and Charles Wesley.) T. O. Summers.

**Wesley** (Samuel, Jr.), A. M., eldest son of the Rev. Samuel and Susannah Wesley, and brother of John and Charles Wesley (which see), b. in London Feb. 10, 1690. His brother John states that he had the mark of a mulberry on his neck: "Every spring it was small and white; it then grew larger, exactly as real mulberries do, being greenish, then red, then a deep purple, as large and of as deep a purple as any real mulberry on the tree." He made no attempt to speak till he was nearly five years old, when, being missed by his mother, who called for him loudly by name, he cried out from under a table, "Here am I, mother." She then taught him to read, and laid the foundation of his exalted intellectual and moral character. In 1704 he was sent to Westminster School, where he was admitted king's scholar in 1707. He there attracted the attention of Dr. Sprat, bishop of Rochester, who took him to his seat at Bromley to read to him at night, which the youth did not much relish, as he was hoarse and purblind. In 1711 he was elected to Christ Church, Oxford. After taking his A. M. degree, he went to officiate as usher in his old school at Westminster, and soon, by the advice of his friend Bishop Atterbury, entered into holy orders. He became familiar with Lord Oxford, Pope, Swift, Prior, and other Tory poets and statesmen, though he associated also with Addison and others of his class. He was the uncompromising friend of Atterbury, and this probably kept him from preferment in the Church. In 1732 he became headmaster of Blundell's free grammar school at Tiverton, where he remained till his death, Nov. 6, 1739. He was buried in Tiverton churchyard, where his tombstone bears an inscription which describes him as a man of uncommon wit and learning, eminent for piety and benevolence, and an excellent preacher. He was one of the founders of the first infirmary set up at Westminster, now St. George's Hospital. He belonged to the old High-Church school, and did not co-operate with his Methodist brothers. Like them, he was greatly gifted in poetry. He began writing charity hymns when he was about twenty years of age. The first edition of his poems was published in quarto in 1736; a second, with additions, was published in 12mo in 1743. A new edition was published, with a *Life* of the author, by William Nichols in 1862. They consist of odes, epigrams, epitaphs, epithalamiums, translations, hymns, etc., and are characterized by great classical elegance, genial humor, sparkling wit, and sometimes withering satire. He will be best known to posterity by his hymns in the Methodist hymnbook on the Passion, Easter, to God, the Father, Son, and Holy Ghost, and an exquisite piece on the death of a young lady: "The morning flowers display their sweets." T. O. Summers.

**Wesley** (Susannah), wife of the Rev. Samuel Wesley, Sr. (which see), was the youngest daughter of the famous ejected nonconformist divine, Dr. Annesley, b. Jan. 20, 1669. Before she was thirteen years old she conformed to the Church of England, and in 1689 became the wife of Samuel Wesley, to whom she bore nineteen children. Her method of teaching her children was peculiar and successful. It is detailed in a letter to her son John dated July 24, 1732. They were not taught to read till they were five years old, when they learned the alphabet in a day or two, and began to spell and read, first a line, and then a verse, mastering it perfectly. She was a model *materfamilias*, and her famous sons owed much to her wise and godly counsels. After her husband's death and a short sojourn with her daughter Emilia, she resided with her son John in London, and became his judicious adviser in carrying on his great work. She was the true matriarch of Methodism. She encouraged her son to employ lay-preachers, and she was profited by their ministry. Her writings show that she had a superior intellect and a devout spirit. In her last days her experience was rich and ripe, and she spoke clearly of the assurance of pardon, on which she had previously been reserved, though she appears to have been a true Christian all her days. D. in London July 23, 1742. "We stood around her bed," said her son John, "and fulfilled her last request, uttered a little before she lost her speech, 'Children, as soon as I am released sing a psalm of praise to God.'" An immense multitude attended her burial in Bunhill Fields, Aug. 1, when her son John de-

livered a solemn discourse. Her tomb has been reconstructed, and an appropriate epitaph perpetuates her memory. Dr. A. Clarke says the names of only thirteen of her nineteen children have been recovered: SAMUEL, JOHN, CHARLES (see the foregoing articles); SUSANNAH, b. Mar. 31, 1691; d. Apr. 17, 1693; EMILIA, b. 1692, married an apothecary at Epworth, named Harper, who left her a widow. She taught school at Leicester and Gainsborough, as she was a good scholar. For many years before her death (about 1770) she resided at the preachers' house in West street, London. She was a poet, and her brother John said, "My sister Harper was the best reader of Milton I ever heard." She was a constant attendant at her brother's chapel, the old Foundry. ANNESLEY and JEDEDIAH (twins), b. 1694; d. in infancy. SUSANNAH (the second so named), b. 1695. She was highly cultivated, but unequally yoked to Richard Ellison, who proved "little inferior to the apostate angels in wickedness," so that she was forced to separate from him. She had four children—JOHN, who lived and died at Bristol; he left two daughters and a son—ELIZABETH, who was unfortunate in life, and was often relieved by John Wesley; PATIENCE, who married at Bristol, and became a devout dissenter; JOHN was a respectable man, who resided in Bristol. ANN, Susannah's second child, married Pierre le Lièvre, a French Protestant refugee. He left a son, Peter le Lièvre, who was educated at Kingswood School, took orders in the Church of England, and died at his living in Lutterworth. He left a son who became a clergyman of good character. Ann married a second time—a gentleman named Gaunt, who soon left her again a widow. It was at the house of this Mrs. Gaunt, in London, that her mother, formerly Susannah Wesley, died. DEBORAH ELLISON, married Pierre Collet, another French refugee, and, like the former, a silk-weaver. RICHARD ANNESLEY ELLISON died at twenty-seven, leaving two daughters—one, Mrs. VOYSEY, wife of a dissenting minister, who had four children, all respectable; MARY WESLEY, b. 1696; married her father's curate at Wroote, John Whitelamb, and died in childbed. She was somewhat deformed in body, but exquisitely beautiful in countenance and angelic in disposition; MEHETABEL WESLEY, b. at Epworth 1697; d. Mar. 21, 1751. She could read the Greek Testament when eight years old. She had a fine poetic genius, and was full of sprightliness and wit, but she was unequally yoked to a plumber and glazier named William Wright, who treated her badly and broke her heart. For several years before her death she enjoyed the ministrations of her brothers, and in association with the Methodists closed her life in triumph. ANNA WESLEY, b. at Epworth 1702; she married John Lambert, a surveyor of Epworth; MARTHA WESLEY, b. at Epworth 1707, in 1735 married the Rev. Wesley Hall, who became an apostate, an adulterer, a monster of wickedness, whose demon-like conduct she bore with superhuman patience. She had ten children; nine died at Salisbury, and the survivor, WESLEY, while being educated at the expense of his uncles, died at the age of fourteen. Martha (Mrs. Hall) was a great favorite with Dr. Samuel Johnson and other learned men. She died in triumph July 12, 1791, shortly after the death of her brother John, whom she resembled in body and mind. KEZIAH WESLEY, b. at Epworth 1710; d. at the house of her sister, Mrs. Hall, Mar. 9, 1741. She was a teacher for some time in a boarding school at Lincoln. Like every other member of the Wesley family, she possessed a fine mind (though afflicted in body), and died the death of the righteous.

T. O. SUMMERS.

**Wesleyan Female College,** located at Macon, Ga., was founded in 1836, and, it is believed, was the first female college in the world that was chartered with full powers to confer upon females the usual degrees conferred by other colleges upon males. It is well endowed, and has been in a prosperous condition for forty years, under the control of the Methodist Episcopal Church, South.

A. H. STEPHENS.

**Wesleyan Methodists.** See METHODISM, by ABEL STEVENS, A. M., LL.D.

**Wesleyans, Primitive.** See METHODISM, by ABEL STEVENS, A. M., LL.D.

**Wesleyan University,** located at Middletown, Conn., is the oldest of the colleges under the control of the Methodist Episcopal Church. About the close of the first quarter of the present century the leading minds of that Church became convinced of the need of some institution of collegiate rank in New England or New York which should be under the auspices of their own denomination. Accordingly, in the spring of 1829 a joint committee appointed by the New York and New England conferences issued proposals inviting the several towns within a specified region to compete for the location of the proposed college by the offer of subscriptions. In response to these proposals, two large stone buildings in the city of Middletown, erected five years before for the American Literary, Scientific, and Military Academy, but recently vacated by the removal of that institution to Norwich, Vt., were now offered to this committee as a gift, on the condition that an endowment fund of $40,000 should be raised for the new college. This offer, accompanied by a subscription of $18,000 from the citizens of Middletown, was at once accepted; the remainder of the $40,000 was soon raised, and the college organized and chartered under the name of the Wesleyan University. Its first class, numbering 6, was graduated in 1833. At present (1876), the faculty comprises 16 professors and instructors; the students number 176. Some three years since the curriculum was judiciously modified in accordance with modern educational theories, and expanded by the introduction of a considerable number of elective studies. The college now offers three courses of study of four years each. The classical course is substantially the same as that of other New England colleges; the Latin-scientific course omits Greek, and the scientific course both Latin and Greek, in order to give time for more thorough attention to the modern languages and to physical science. Nine-tenths of the students now take the classical course. In 1872 the doors of the college were opened to ladies. Within the last decade the material interests of the college have greatly advanced. Three elegant buildings have been erected—a library, the gift of Isaac Rich, Esq.; the memorial chapel, which commemorates the 18 alumni and students who fell in the late war; and the Orange Judd hall of natural science, the gift of the gentleman whose name it bears. The total value of the buildings and grounds of the college, as given in the last report of the treasurer (1875), is $400,000. During the current year a vigorous and hopeful effort is making to secure a generous enlargement of the endowment of the college. The library numbers about 27,000 volumes; the observatory contains a 12-inch refracting telescope by Alvan Clarke & Sons; finely-appointed laboratories, with ample chemical and physical apparatus and extensive cabinets illustrating the departments of geology and natural history, furnish the undergraduate with unusual facilities for the study of physical science. The presidents of the college have been—Wilbur Fisk, D. D., 1831–39; Stephen Olin, D. D., LL.D., 1839–41; Nathan Bangs, D. D., 1841–42; Stephen Olin, D. D., LL.D., second term, 1842–51; Augustus William Smith, LL.D., 1851–57; Joseph Cummings, D. D., LL.D., 1857–75; and Cyrus D. Foss, D. D. The whole number of graduates of the college is 1138, of whom about 950 are now living.

C. T. WINCHESTER.

*Revised and approved by Cyrus D. Foss, D. D., President of Wesleyan University.*

**Wesleyan University,** an institution of learning at Delaware, O., chartered in 1843, and organized in 1844 under the auspices of the Ohio and North Ohio conferences of the M. E. Church; has fine grounds and above 800 varieties of trees and shrubs, the site having formerly been a noted watering-place called the Sulphur Springs; has an endowment fund of $250,000, and has sold large numbers of cheap scholarships, and is well provided with cabinets of natural history. The presidents have been Rev. Edward Thomson, D. D. (subsequently bishop), 1846–60; Rev. Frederick Merrick, D. D., 1860–73; Rev. Lorenzo D. McCabe, 1873–76; and Rev. Charles H. Payne, D. D., inaugurated June, 1876.

**Wesobul'ga,** tp., Clay co., Ala. P. 907.

**Wes'sel** (JOHANN), also called **Gansfort** (the name of a village from which his family probably came), b. at Gröningen, Holland, about 1420; was educated in the school of Zwolle, then under the leadership of the celebrated Gerhard Groot, and enjoyed the friendship of Thomas à Kempis, who was sub-prior of the neighboring monastery of Mount St. Agnes; went to Cologne, where he learned Greek and Hebrew and studied Plato; resided for many years at Paris, where he took part with great energy in the controversy between nominalism and realism, and began to teach, having Reuchlin and Agricola among his pupils; visited Rome, and stayed for some time at Heidelberg, teaching philosophy, but turned more and more decidedly away from the whole scholastic method based on Aristotle, and began to be suspected of holding heretical views; retired finally to his native city, and d. there Oct. 4, 1489. According to Ullmann, he was pre-eminently the *theological* forerunner of the Reformation. Martin Luther said of him, "If I had read Wessel before I began, my opponents would have imagined that Luther derived everything from Wessel, so do we agree in spirit." Personally, he escaped persecutions, but his writings, by which he belongs to the Reformers before the Reformation, were partly burnt by the monks. The remaining works were first published by Luther in 1522 under the title *Farrago Rerum*

*Theologicarum;* afterward by Johann Lydius (1617). His *Life* has been written by Ullmann (1834) and Bähring (1846). (See also Ullmann's *Reformatoren vor der Reformation,* 2d vol. (1842; English translation 1855).)

**Wes'sells** (HENRY WALTON), b. at Litchfield, Conn., Feb. 20, 1809; graduated at the U. S. Military Academy July, 1833, when appointed brevet second lieutenant of 2d Infantry. Mainly on duty in garrison until 1837, he then served for five years in Florida against the hostile Seminoles; again in garrison until 1846, he was ordered in that year to Mexico; promoted captain Feb., 1847, he led his company in the operations of Gen. Scott's army from Vera Cruz to the City of Mexico; was wounded at Contreras, and brevetted major for gallantry on that occasion and at Churubusco; served on the Pacific coast 1849–54, and on the N. W. frontier 1855–61, being engaged in the Sioux expedition of 1855. In Aug., 1861, he was appointed colonel of the 8th Kansas Vols., and engaged on the Missouri border until Feb., 1862. Commissioned brigadier-general of volunteers Apr. 25, 1862, he was engaged before Yorktown and at the battle of Fair Oaks, where wounded; in the defence of Suffolk, Va., Sept.–Dec., 1862, when transferred to North Carolina, and engaged in the actions at Kinston and Goldsboro' during that month, and in subsequent defence of Newberne until May, 1863, when assigned to the defence of Plymouth, which place he was compelled to surrender Apr. 20, 1864, after a fight of four days, and was himself held a prisoner until August, when exchanged, and in November appointed commissary of prisoners. In charge of the draft rendezvous at Hart's Island Feb., 1865, until mustered out of the volunteer service, Jan., 1866. In Feb., 1865, he had attained a lieutenant-colonelcy in the 18th regular infantry, with which he served on the N. W. frontier until 1869. Brevet colonel and brigadier-general for gallant and meritorious services during the war. Retired Jan. 1, 1871.

**Wessex.** See HEPTARCHY.

**West,** tp., Effingham co., Ill. P. 859.

**West,** tp., McLean co., Ill. P. 941.

**West,** tp., Marshall co., Ind. P. 1489.

**West,** tp., Montgomery co., Ia. P. 432.

**West,** tp., Columbiana co., O. P. 1985.

**West,** tp., Huntington co., Pa. P. 1367.

**West** (BENJAMIN), LL.D., b. at Rehoboth, Mass., in Mar., 1730; was a bookseller at Providence, R. I., during the Revolution, and a manufacturer of clothing for the Continental soldiers; pursued mathematical and scientific studies; published an almanac 1763–93; furnished the Royal Society with his observations on the transit of Venus 1769; taught mathematics in the Episcopal seminary at Philadelphia 1784–86; was professor in Brown University 1786–99, and postmaster at Providence 1812–13. D. at Providence Aug. 13, 1813.

**West** (BENJAMIN), R. A., b. at Springfield, Pa., Oct. 10, 1738, of Quaker parents; displayed great artistic precocity in childhood; studied painting at Philadelphia 1757; practised his art in that city and the surrounding towns, and also in New York; resided and studied in Italy 1760–63; settled at London 1763; married there Miss Elizabeth Shewell, an American lady, 1765; soon acquired a high reputation by his portraits; enjoyed the friendship of Reynolds and of many distinguished men, and the patronage of the nobility and of George III., for whom he executed a large number of religious pieces and pictures from early English history; was elected to the Royal Academy 1768; was its president 1792–1802, and again from 1803 until his death; enjoyed a career of great prosperity, and produced above 400 pictures. D. in London Mar. 11, 1820, and was buried in St. Paul's cathedral. His best-known pictures were *The Battle of La Hogue, The Death of Wolfe* (1771), *Christ Healing the Sick* (1802), and *Death on the Pale Horse.* A *Life* (1816) was published by John Galt.

**West** (GILBERT), LL.D., b. in England in 1706; educated at Eton and Oxford; was for some time an officer of cavalry; became clerk of the privy council (1729) and under-treasurer of Chelsea Hospital, and was an intimate friend of William Pitt and of Lord Lyttelton, who was his cousin. D. at Wickham, Kent, Mar. 26, 1756. Author of *Observations on the History and Evidences of the Resurrection of Jesus Christ* (1747) and of a translation of the *Odes of Pindar* (1749).

**West** (J. RODMAN), b. at New Orleans Sept. 19, 1822; studied at the University of Pennsylvania, but without graduating; captain of volunteers in the Mexican war; emigrated to California in 1849, where engaged in commercial pursuits until the outbreak of civil war, at which date he was publisher of the San Francisco *Price Current;* as lieutenant-colonel of the 1st California Vols. he served in New Mexico and the South-west. Returning to New Orleans soon after the close of war, he served as chief deputy U. S. marshal, auditor of customs, and auditor of improvements. In 1871 he was chosen U. S. Senator from Louisiana.

**West** (NATHANIEL), D. D., b. in Ireland in 1794; studied theology in Scotland under Dr. Chalmers; came to the U. S. 1834; was pastor of churches at Meadville, Pittsburg, and Philadelphia, and chaplain of the Satterlee U. S. General Hospital at West Philadelphia from 1862 until his death, Sept. 2, 1864. Author of *A Complete Analysis of the Holy Bible,* etc. (1853).

**West** (SAMUEL), D. D., b. at Yarmouth, Mass., Mar. 4, 1730; graduated at Harvard 1754; was ordained 1764; was many years pastor at New Bedford, teaching the doctrines subsequently known as Unitarian; was an active Whig writer during the Revolution; deciphered the treasonable letter of Dr. Benjamin Church, and was a member of the Massachusetts constitutional convention. D. at Tiverton, R. I., Sept. 24, 1807. Author of an ingenious treatise, *Essays on Liberty and Necessity* (2 parts, 1793–95), in reply to Edwards *On the Will.*

**West** (SAMUEL), D. D., b. on the island of Martha's Vineyard, Mass., Nov. 19, 1738; graduated at Harvard 1771; was appointed chaplain at Fort Pownall in Penobscot; was ordained minister of Needham 1764, and pastor of the Hollis street church, Boston, 1789, and in the later portion of his career embraced the doctrines now known as Unitarian. D. at Boston Apr. 10, 1808. Author of *Essays* signed "An Old Man" in the *Columbian Centinel* (1806–07), and of several published sermons.

**West** (STEPHEN), D. D., b. at Tolland, Conn., Nov. 13, 1735; graduated at Yale College 1755; studied theology while teaching school at Hatfield, Mass.; became chaplain of Hoosick Fort 1757; succeeded Jonathan Edwards as missionary to the Stockbridge Indians 1758; was pastor of the Congregational church at Stockbridge 1759–1818, having resigned the charge of the Indian mission 1770, at which date he adopted the Hopkinsian theological opinions, having previously been an Arminian. D. at Stockbridge May 15, 1819. Author of *An Essay on Moral Agency, Remarks on Edwards's Enquiry on Freedom of the Will* (New Haven, 1772; enlarged 1794), *The Duty and Obligation of Christians to Marry only in the Lord* (1779), *An Essay on the Scripture Doctrine of the Atonement* (1785), *An Inquiry into the Ground and Import of Infant Baptism* (1794), *The Life of Rev. Samuel Hopkins, D. D.* (1805), and *The Evidences of the Divinity of Christ* (1816).

**West Ac'ton,** p.-v., Middlesex co., Mass.

**West Al'bany,** p.-v. and tp., Wabashaw co., Minn. P. 793.

**West Alexan'der,** p.-v., Washington co., Pa.

**West Alexan'dria,** p.-v., Preble co., O. P. 455.

**West'all** (RICHARD), R. A., b. at Hertford, England, in 1765; was apprenticed to an heraldic engraver in London; took evening lessons in drawing at the Royal Academy; became noted as a water-color painter; was an intimate friend of Lawrence, with whom he occupied a house in Soho Square, and produced several highly-finished pictures of historical and poetical subjects, but is best known by his numerous illustrations of books, especially of Boydell's superb editions of Milton and Shakspeare. He was teacher of drawing and painting to the princess Victoria, now queen. D. in London Dec. 4, 1836. Author of *A Day in Spring, and other Poems* (1808).

**Westall** (WILLIAM), brother of Richard, b. at Hertford, England, Oct. 12, 1781; studied at the Royal Academy; accompanied as artist Capt. M. Flinders in his voyage around the world 1801; exhibited in Brook street, London, his collection of views in China and the East Indies, and was subsequently employed in making drawings for engravings. D. in London Jan. 22, 1850. Among his publications were—*Views in Madeira* (folio, 1811–14), *Views of the Caves in Yorkshire* (1818), *Views on the Thames, Britannia Depicta,* and *Views in London* (1825).

**West Al'mond,** p.-v. and tp., Allegany co., N. Y. P. 799.

**West Ames'bury,** p.-v., Essex co., Mass.

**West Am'well,** tp., Hunterdon co., N. J. P. 4872.

**West Bal'timore,** p.-v., Clay tp., Montgomery co., O. P. 69.

**West Ban'gor,** p.-v., York co., Pa.

**West Bath,** tp., Sagadahoc co., Me. P. 373.

**West Bat'on Rouge,** parish of S. E. Louisiana, lying between Mississippi River and Bayou Fordoche, and traversed by Baton Rouge Grosse Tête and Opelousas R. R.; surface low, and exposed to inundation; soil fertile.

Staples, cotton, sugar, and Indian corn. Cap. Allain. Area, 225 sq. m. P. 5114.

**West Baton Rouge,** v., West Baton Rouge parish, La., on the W. bank of Mississippi River, contains 2 churches, several public schools, and 1 newspaper. Large quantities of cotton and sugar-cane are grown in the vicinity. P. 7140. H. J. HYAMS, ED. "SUGAR-PLANTER."

**West Bear River,** tp., Yuba co., Cal. P. 407.

**West Bea'ver,** tp., Snyder co., Pa. P. 1131.

**West Bed'ford,** p.-v., Bedford tp., Coshocton co., O. P. 152.

**West Belle'ville,** p.-v., St. Clair co., Ill. P. 1679.

**West Bend,** p.-v. and tp., Palo Alto co., Ia. P. 232.

**West Bend,** p.-v. and tp., cap. of Washington co., Wis., on Fond du Lac Air-Line R. R., a branch of Northwestern R. R., 34 miles N. of Milwaukee, contains 6 churches, 2 public schools and several private schools, 2 newspapers, 1 saw and 2 grist mills, a court-house, 4 hotels, 1 marble-factory, 1 bank, 3 furniture establishments, and 2 grain-elevators. P. of v. 1058; of tp. 2014.
WILLIAM GEORGE, ED. "REPUBLICAN."

**West Berne,** p.-v., Berne tp., Albany co., N. Y. P. 100.

**West Beth'lehem,** tp., Washington co., Pa. P. 1964.

**West Black'stock,** tp., Chester co., S. C. P. 1278.

**West Bloom'field,** tp., Oakland co., Mich. P. 1143.

**West Bloomfield,** p.-v. and tp., Ontario co., N. Y. P. 1651.

**West Blue River,** tp., Hamilton co., Neb. P. 89.

**West'boro',** p.-v., Jefferson tp., Clinton co., O. P. 237.

**Westborough,** p.-v. and tp., Worcester co., Mass., on Boston and Albany R. R., 32 miles W. of Boston, has excellent schools, 2 banks, 1 newspaper, 3 extensive boot and shoe manufactories, and 2 straw-goods establishments. The milk business is carried on extensively. P. 3601.
HOLTON & THURSTON, EDS. "CHRONOTYPE."

**West Boyls'ton,** p.-v. and tp., Worcester co., Mass. P. 2862.

**West Brad'ford,** tp., Chester co., Pa. P. 1536.

**West Branch,** p.-v., Cedar co., Ia.

**West Branch,** p.-v. and tp., Potter co., Pa. P. 302.

**West Bran'dywine,** tp., Chester co., Pa. P. 933.

**West Brat'tleboro',** p.-v., Windham co., Vt.

**West Bridge'water,** p.-v. and tp., Plymouth co., Mass. P. 1803.

**West Brom'wich,** town of England, county of Stafford, in the centre of a rich mining district, has large manufactures of glass, gas, and iron goods, firearms, swords, cutlery, and agricultural implements. P. 17,024.

**West'brook,** p.-v. and tp., Middlesex co., Conn. P. 987.

**Westbrook,** tp., Cumberland co., Me. P. 6583.

**West Brook'field,** p.-v. and tp., Worcester co., Mass. P. 1842.

**West Brookfield,** p.-v., Stark co., O.

**West'brooks,** tp., Sampson co., N. C. P. 1449.

**West Browns'ville,** p.-b., Washington co., Pa. P. 547.

**West Bruns'wick,** tp., Schuylkill co., Pa. P. 1163.

**West Buf'falo,** tp., Union co., Pa. P. 1046.

**West'burg,** tp., Buchanan co., Ia. P. 519.

**West Burke,** p.-v., Caledonia co., Vt.

**West Bur'lington,** p.-v. and tp., Bradford co., Pa. P. 896.

**West'bury,** town of England, county of Wilts, has 6395 inhabitants, who are mostly engaged in cloth manufactures and iron-mining.

**Westbury,** p.-v., Victory tp., Cayuga co., N. Y. P. 152.

**Westbury** (RICHARD **Bethell**), BARON, b. at Bradford-on-the-Avon, Wiltshire, England, June 30, 1800; graduated with high honors at Wadham College, Oxford, 1818; became a fellow there and resident private tutor; was called to the bar at the Middle Temple 1823; entered Parliament 1832; became a distinguished practitioner in the equity courts; was made queen's counsel 1840; was knighted and appointed solicitor-general Dec., 1852; carried through the House of Lords the Succession-Duty bill, the Oxford University Reform bill, the bill for the abolition of ecclesiastical courts, and other important measures; was attorney-general under Lord Palmerston Nov., 1856, to Feb., 1858; carried, after a formidable struggle, measures for the abolition of the ecclesiastical testamentary courts and the establishment of the divorce and probate court, the judgeship of which was offered him, but declined; was a second time attorney-general, from June, 1859, until June 27, 1861, when he was raised to the chancellorship under the title of Baron Westbury; carried important measures of law reform relating to bankruptcy, landed estates, and professional education, and resigned the great seal July 4, 1865. D. July 20, 1873.

**West Bux'ton,** p.-v., York co., Me.

**West Caln,** tp., Chester co., Pa. P. 1398.

**West Carlisle',** p.-v., Pike tp., Coshocton co., O. P. 175.

**West Charles'ton,** p.-v., Orleans co., Vt.

**West Cha'zy,** p.-v., Clinton co., N. Y.

**West Chesh'ire,** p.-v., New Haven co., Conn.

**West'chester,** county of S. E. New York, bordering on Connecticut and on Long Island Sound, bounded W. by Hudson River, drained by Bronx and Croton rivers, and traversed by Hudson River, Harlem, and New York and New Haven R. Rs. The surface is generally level or rolling, but it is crossed by several ridges of hills, and contains valuable marble-quarries. In 1870 the county contained about 525 sq. m., with a pop. of 131,348, but in 1873 a portion of the county lying immediately contiguous to New York City was annexed to the city, of which it now forms a part. A considerable part of the present county is practically a suburb of New York. Stock-raising, gardening, fruit-culture, and manufacturing form the chief occupations of the people. There are nearly 600 manufacturing establishments, among the most important of which are those for iron, brick, carriages, furniture, clothing, saddlery, sash, doors, and blinds, sewing-machines, machinery, cutlery, carpets, and breweries. Horses and milch cows form the chief part of the live-stock. Staples, garden and dairy products, fruit, and hay. Caps. Bedford and White Plains. Area, about 500 sq. m. P. 131,348.

**West Ches'ter,** tp., Porter co., Ind. P. 1364.

**West'chester,** p.-v. and tp., Westchester co., N. Y. P. 6015.

**West Ches'ter,** p.-v., Union tp., Butler co., O. P. 257.

**West'chester,** v., Perry tp., Tuscarawas co., O. P. 198.

**West Chester,** p.-b., cap. of Chester co., Pa. P. 5630.

**West Ches'ter,** tp., Chester co., S. C. P. 2795.

**West Cocalico,** tp., Lancaster co., Pa. P. 2140.

**West Colum'bia,** p.-v., Waggoner tp., Mason co., West Va. P. 778.

**West Con'cord,** p.-v., Essex co., Vt.

**West Corn'wall,** p.-v., Litchfield co., Conn.

**West'cott** (BROOKE FOSS), D. D., b. near Birmingham, England, in Jan., 1825; was successively scholar and fellow of Trinity College, Cambridge, where he graduated 1848, having carried off high honors and several medals and prizes both in classics and mathematics; took orders in the Church of England 1851; was assistant master at Harrow School 1852–69; became preacher to the University of Cambridge 1859; examining chaplain to the bishop of Peterborough 1868, canon of Peterborough cathedral 1869, regius professor of divinity at Cambridge Nov. 1, 1870, and honorary chaplain to the queen Apr., 1875. Author of *Elements of the Gospel Harmony* (1851), being the Norrisian prize essay for the previous year, *A History of the Canon of the New Testament during the first Four Centuries* (1855; 4th ed. 1875), *Characteristics of the Gospel Miracles*, being sermons preached before the University of Cambridge, *An Introduction to the Study of the Gospels, with Historical and Explanatory Notes* (1860; 4th ed. 1872), *The Bible in the Church, a Popular Account of the Collection and Reception of the Holy Scriptures in the Christian Churches* (1864; 3d ed. 1872), *The Gospel of the Resurrection, Thoughts on its Relation to Reason and History* (1866; 3d ed. 1874), *A General View of the History of the English Bible* (1868), and *The Christian Life Manifold and One, Six Sermons* (1870). Prof. Westcott contributed several articles (including the important one on the canon) to Smith's *Dictionary of the Bible*, and is one of the New Testament revision company.

**Westcott** (THOMPSON), b. at Philadelphia, Pa., June 5, 1820; studied law; was admitted to the Philadelphia bar 1841; has been since its commencement in 1848 editor of the Philadelphia *Sunday Dispatch;* conducted the Philadelphia *Inquirer* 1863–75, and was a contributing editor of the Philadelphia *Commercial List* 1863–70. He has published a *Life of John Fitch, Inventor of the Steamboat* (1857), *The Tax-Payer's Guide* (1864), *Names of Persons who took the Oath of Allegiance to the State of Pennsylvania*

*1777–89, with a History of the Test Laws of Pennsylvania* (1865), *Chronicles of the Great Rebellion* (1867), extracted from the *Old Franklin Almanac*, which he edited 1860–72, as also the *Public Ledger Almanac* since 1873, *A Guide to Philadelphia and Vicinity* (1876), *The Centennial Portfolio* (1876), and has been publishing since Jan. 6, 1867, in weekly instalments in the *Sunday Dispatch*, an elaborate *History of Philadelphia*, embodying a vast amount of local information, the result of thirty years of patient labor and research. He has never held a public office of any kind.

**West Creek,** p.-v. and tp., Lake co., Ind. P. 1158.

**West Deer,** tp., Allegheny co., Pa. P. 1299.

**West Del'phi,** v., Deer Creek tp., Carroll co., Ind. P. 253.

**West Den'nis,** p.-v., Barnstable co., Mass.

**West Depere',** p.-v. and tp., Brown co., Wis. P. 875.

**West Don'egal,** tp., Lancaster co., Pa. P. 1136.

**West Earl,** p.-v. and tp., Lancaster co., Pa. P. 1893.

**West Ea'ton,** p.-v., Madison co., N. Y.

**West Eau Claire,** tp., Eau Claire co., Wis. P. 2452.

**West Eliz'abeth,** p.-b., Allegheny co., Pa. P. 590.

**West Elk'ton,** p.-v., Gratis tp., Preble co., O. P. 156.

**Wes'terlo,** p.-v. and tp., Albany co., N. Y. P. 2384.

**West'erly,** p.-v. and tp., Washington co., R. I., on Pawcatuck River, 5 miles from Long Island Sound, and on Stonington and Providence R. R., 44 miles from Providence, has 4 national banks, 3 savings banks, 6 woollen-mills, 2 cotton-mills, 2 machine-shops (1 with foundry, building printing-presses), several granite-quarries, 8 churches, a graded and high school with 12 teachers and 500 scholars, a public library, 1 weekly newspaper, gasworks, lighted streets, police department, town-hall and lock-up, steam and hand fire-engines, 2 military companies with armory, lodges of Freemasons and Odd Fellows, 2 hotels in village, 7 at Watch Hill seaside, 5 miles by steamboat. P. (1876) 5708. The village lies on both sides of the river, having 500 houses on the Rhode Island side and 350 on the Connecticut side. P. (1870) 4709.

GEO. B. UTTER, ED. "NARRAGANSETT WEEKLY."

**West'ern,** p.-v., Linn co., Ia., 8 miles S. of Cedar Rapids and 16 miles N. of Iowa City, contains 2 churches, WESTERN COLLEGE (which see), and 1 school, 2 newspapers, and 1 flouring-mill. P. about 500.

W. H. SHUEY, ED. "GAZETTE."

**Western,** tp., Henry co., Ill. P. 1372.

**Western,** tp., Oneida co., N. Y. P. 2423.

**West'ern Austra'lia,** a British colony, comprising the whole western portion of the Australian continent from the 129th meridian, and containing an area of 978,000 sq. m., with 24,785 inhabitants. (For a description of this immense territory and its climate see the article on AUSTRALIA.) The colony was first established in 1829 under the name of the "Swan River Settlement." It had 1540 inhabitants in 1832, 4622 in 1848, 8711 in 1852. Its growth has been very slow, and if a gold-field or some such thing is not discovered, there is little prospect of a more rapid progress. The only source of wealth peculiar to the colony which hitherto has been discovered are some forests which are said to contain large quantities of timber suited for ship- and house-building, but of this timber nothing has as yet appeared in the market, and the sandal-wood which at one time was exported from the colony was entirely exhausted in five years.

**Western Branch,** tp., Norfolk co., Va. P. 5100.

**Western College** was founded in 1856, and is under the control of the Church of the United Brethren in Christ. It is located at Western, Linn co., Ia., 8 miles S. of Cedar Rapids. It is supported by five annual conferences, and is the educational centre of the United Brethren Church in the North-west. These co-operating conferences are—in Iowa, the Iowa, East Des Moines, and West Des Moines; in Minnesota, the Minnesota; in Illinois, the Rock River. The buildings are three in number, all brick. The chapel building is 36 by 62 feet, and three stories in height. In it are five recitation-rooms, two society-halls, a library, laboratory, and cabinet-rooms; also the chapel. Neidig Hall is 30 by 40 feet, and two stories in height. This building is designed for the accommodation of ladies desiring to board themselves. Lain Hall is a three-story building, besides basement, and is 35 by 62 feet in size. It is the boarding-hall of the college, and contains 22 dormitories for students, steward's rooms, reception-room, music-room, and the ladies' society-hall. The faculty, headed by Rev. Ezekiel B. Kephart, A. M., as president, consists of a president, professors, and principal of the ladies' department. Tutors and teachers are employed in the subordinate departments. The courses of study are the classical and scientific, and as the institution was founded on the basis of co-education, these courses are open to any student, either lady or gentleman, who is prepared to enter. There is also a complete commercial department under the patronage of the college, which is an important auxiliary. Its graduates number 43, 38 of whom have graduated within the past eight years. It has an endowment of $16,000.

E. B. KEPHART.

**West'ern Empire, The.** When Theodosius the Great died (in 395) the Roman empire was divided, according to his will, into the Eastern or Byzantine empire, consisting of Greece, Macedonia, Mœsia, Thrace, Asia Minor, Pontus, Syria, and Egypt, with Constantinople for its capital; and the Western empire, consisting of Italy, Africa, Spain, Gaul, Pannonia, Dalmatia, and Illyricum, with Rome for its capital. There had been earlier divisions. (See DIOCLETIAN and VALENTINIAN.) But this of 395 became the decisive one by which a Western and an Eastern empire were finally established. Theodosius's oldest son, Arcadius, became the ruler of the Eastern empire—the younger, Honorius, of the Western; but, although it seems to have been Theodosius's idea that the two brothers should rule the two empires in community, a sharp and even hostile separation very soon took place between East and West, and the intrigues and treacheries of the Byzantine court played no inconsiderable part in the fearful devastation and final overthrow of the Western empire by the barbarians. Its existence was very short. In 476 its last emperor, Romulus Augustus (whom the Romans called Augustulus), was deposed by the barbarian chief Odoacer, and as he would not accept either the title or the power of emperor, the Roman senate addressed the Byzantine emperor, Zeno, expressing the wish that there should be only one sole monarch, consenting to the transference of the seat of government from Rome to Constantinople, and asking as a favor that Odoacer might be made general or military governor of Rome. From 395 to 476 the Western empire was ruled over by twelve emperors—namely, Honorius (423), Joannes (425), Valentinian III. (455), Maximus (455), Avitus (457), Majorian (461), Severus (465), Anthemius (472), Olybrius (472), Glycerius (473), Julius Nepos (474), and Romulus Augustus. But the general characteristic of the imperial government was, that the emperor had no power. His position was a name, his existence that of a shadow. The real power was in the hands of the generals, foreign and native, who commanded the armies, and it rested with them only as long as they were victorious; when defeated, they became shadows themselves. Thus, Stilicho ruled the empire under Honorius, Aëtius under Valentinian III., and Ricimer under Majorian, Severus, and Anthemius. The history of the empire during this period is the history of the intrigues between the generals, who were put into power by the fears of the emperor or the whims of the empress, and of the battles between their armies, which flew over the country whither the wind blew, alighting like a swarm of grasshoppers wherever they found a green spot. The provinces fell off, and established themselves in a sort of independence. In 418 the Goths founded an empire consisting of the southern part of Gaul and the northern part of Spain, with Toulouse for its capital. In 451, Britain was completely abandoned. In 427 the Vandals, called in from Spain by the Roman governor, Bonifacius, against his rival, Aëtius, conquered Africa, and twenty years later they conquered, under Genseric, both Sardinia and Sicily. In 465, Marcellinus separated Dalmatia from the empire, and made himself master of the Adriatic, and about the same time Ægidius ruled Gaul entirely independent of Rome. Indeed, when, in 476, the Roman senate pretended to reunite the Western with the Eastern empire, the Western empire consisted only of a corrupted, seven times sacked, and half-destroyed city, and so much territory as Odoacer's army could sweep over, and nothing more; the grand original building had literally fallen to pieces. (For detailed information concerning these matters see the special articles under the different names mentioned.)

CLEMENS PETERSEN.

**West'ernville,** p.-v., Western tp., Oneida co., N. Y. P. 235.

**West'erville,** p.-v., Franklin co., O., on Cleveland Mount Vernon and Columbus R. R. and on Alum Creek, 12 miles N. of Columbus, has 3 churches, Otterbein University, 1 newspaper, 1 foundry, flouring and saw mills, several lumber and coal yards, and 1 planing mill. P. about 1400.

S. R. GRAYBILL, ED. "BANNER."

**West Fair'lee,** p.-v. and tp., Orange co., Vt. P. 833.

**West Fair'view,** p.-v., Cumberland co., Pa.

**West'fall,** tp., Pike co., Pa. P. 960.

**West Fal'lowfield,** tp., Chester co., Pa. P. 1159.

**West Fallowfield,** tp., Crawford co., Pa. P. 503.

**West Far'mington,** p.-v., Trumbull co., O.

**West Farms,** p.-v. and tp., Westchester co., N. Y. P. of v. 1761; of tp. 9372.

**West Farn'ham,** p.-v., Missisquoi co., Quebec, Canada, at the junction of Stanstead Shefford and Chambly and South-eastern Counties railways, 41 miles S. E. of Montreal. Lumber, tubs, woollens, etc., are manufactured. The village has an academy. P. 1317.

**West Felicia'na,** parish of Central Louisiana, bordering on Mississippi, lying on the E. bank of Mississippi River, and traversed by West Feliciana R. R. Surface level, soil fertile. Staples, cotton, sugar, and Indian corn. Cap. St. Francisville. Area, 350 sq. m. P. 10,499.

**West'field,** tp., Bureau co., Ill. P. 1396.

**Westfield,** p.-v. and tp., Clark co., Ill. P. 1166.

**Westfield,** p.-v., Washington tp., Hamilton co., Ind. P. 608.

**Westfield,** tp., Fayette co., Ia. P. 1708.

**Westfield,** p.-v. and tp., Hampden co., Mass., on Boston and Albany R. R., at its junction with New Haven and Northampton R. R., 9 miles W. of Springfield. The village is beautifully situated in a valley excavated by geological agencies, 30 or 40 feet below the surrounding plain, 3 or 4 miles from the foot of the eastern slope of the range of hills which form the southern continuation of the Green Mountains. The bluffs which reach the limits of the village on the N. W. and S. W., and the rich alluvial soil of the valley, utilized for farms where not required for building purposes, make Westfield one of the most beautiful rural villages in Western New England. P. in 1875, 8492. Westfield contains 9 churches, 2 national banks, 2 institutions for savings, 1 public library, 1 State normal school, 1 public high school, 2 public grammar schools, and 1 weekly newspaper. The village is supplied with water from hills to the N. W. by a system of waterworks completed in Oct., 1874, at a cost of $243,810, having a storage capacity in the reservoirs of 1885 million gallons. The distributing reservoir is 292 feet above the village, delivering the water at an average pressure of 126 pounds to the inch. The public library and free reading-room was incorporated in 1866, and founded by the gift of the Athenæum building to the library association by one of the citizens. Other citizens provided for the care of the library, and furnished its shelves with books and its tables with current literature. It was opened to the public Jan. 1, 1868, and contained in Apr., 1876, 8400 vols. Prominent among the industries of Westfield is the manufacture of whips, of which $800,000 worth are produced annually. More whips are made here than in all the country besides. The American Whip Co. have the largest whip-shop in the world, own $70,000 worth of patents on styles of whips, process of making, or machinery used, and produce $450,000 worth of whips per annum. The manufacture of cigars is another of its most prominent industries, the total production in 1875 aggregating 18,046,000, requiring for their production about 340 tons of tobacco, a considerable portion of which is grown in the Connecticut Valley. Three paper-mills, 2 producing fine writing papers and 1 manila paper, form a part of the town's industries. At the Japanese mill, besides fine ledger paper, there is manufactured from all new-linen stock a kind of thick, tough material impervious to water, resembling raw hide, used for making racing-boats, machine-belting, pails, baskets, trunks, and a variety of domestic utensils. The church-organ works, established in 1844, have built 475 organs. Another church-organ manufactory has its works here; also steam-heating apparatus, flavoring extracts, and piano-leg establishments. Ratio of increase in valuation during the last ten years, 117 per cent.; in population, 49.3 per cent. P. in 1870, 6519. A. E. Gibbs.

**Westfield,** tp., Dodge co., Minn. P. 342.

**Westfield,** p.-v. and tp., Union co., N. J. P. 2753.

**Westfield,** city and tp., Chautauqua co., N. Y., on Lake Shore R. R., 59 miles W. of Buffalo, contains 5 churches, an academy, 2 banks, 1 newspaper, the Westfield lockworks, 1 steam reaper, 1 handle and 3 carriage factories, 4 hotels, 1 paper-mill, mower and reaper factory, 3 grist-mills, water and gas works, and an efficient fire department. The surrounding country is devoted to mixed farming and grazing. P. of city, 3000; of tp. 3645.

F. A. Hall, Ed. "Republican."

**Westfield,** tp., Richmond co., N. Y. P. 4905.

**Westfield,** tp., Surry co., N. C. P. 800.

**Westfield,** tp., Medina co., O. P. 1023.

**Westfield,** p.-v. and tp., Morrow co., O. P. 1322.

**Westfield,** p.-b. and tp., Tioga co., Pa. P. of v. 370; of tp. 912.

**Westfield,** p.-v. and tp., Orleans co., Vt. P. 721.

**Westfield,** p.-v. and tp., Marquette co., Wis. P. 534.

**Westfield,** tp., Sauk co., Wis. P. 1230.

**Westfield Plantation,** tp., Aroostook co., Me. P. 76.

**Westfield River,** in Massachusetts, rises by three branches (the N., Middle, and W. branch) in the Green Mountains and their foot-hills in Berkshire and Hampshire cos., Mass. The main stream commences at Huntington, Mass. Throughout most of its course it is a wild, turbulent stream, affording good water-power. It joins the Connecticut opposite Springfield, Mass. In its lower course it is often called the *Agawam*.

**West Fin'ley,** p.-v. and tp., Washington co., Pa. P. 1471.

**West Fitch'burg,** p.-v., Worcester co., Mass.

**West'ford,** p.-v. and tp., Middlesex co., Mass. P. 1803.

**Westford,** p.-v. and tp., Otsego co., N. Y. P. 1300.

**Westford,** p.-v. and tp., Chittenden co., Vt. P. 1237.

**Westford,** tp., Dodge co., Wis. P. 1341.

**Westford,** p.-v. and tp., Richland co., Wis. P. 801.

**West Fork,** p.-v. and tp., Washington co., Ark. P. 1243.

**West Fork,** tp., Franklin co., Ia. P. 285.

**West Fork,** tp., Monona co., Ia. P. 54.

**West Fork of Ivy,** tp., Madison co., N. C. P. 746.

**West Forks Plantation,** tp., Somerset co., Me. P. 73.

**West Frank'lin,** tp., Armstrong co., Pa. P. 1098.

**West Gale'na,** tp., Jo Daviess co., Ill. P. 591.

**West Gar'diner,** p.-v. and tp., Kennebec co., Me. P. 1044.

**West Go'shen,** tp., Chester co., Pa. P. 944.

**West Green'wich,** p.-v. and tp., Kent co., R. I. P. 1133.

**West Grove Station,** p.-v., Chester co., Pa.

**Westhamp'ton,** p.-v. and tp., Hampshire co., Mass. P. 587.

**Westhampton,** tp., Burlington co., N. J. P. 1369.

**West Hamp'ton,** p.-v., Southampton tp., Suffolk co., N. Y. P. 439.

**West Han'over,** p.-v. and tp., Dauphin co., Pa. P. 1044.

**West Hart'ford,** p.-v. and tp., Hartford co., Conn. P. 1533.

**West Ha'ven,** p.-b., New Haven co., Conn., on New Haven Bay and on New York and New Haven R. R., 2½ miles S. W. of New Haven, has 3 churches, an academy, seminary, and graded school, a street railway, 1 newspaper, 4 hotels, Masonic lodge, carriage-pole factory, 1 planing-mill, coal- and ship-yards. P. 1852.

H. I. Thompson, Ed. "Journal."

**West Haven,** p.-v., Shiawassee co., Mich.

**West Haven,** p.-v. and tp., Rutland co., Vt. P. 713.

**West Hem'lock,** tp., Montour co., Pa. P. 396.

**West Hemp'field,** tp., Lancaster co., Pa. P. 3688.

**West Ho'boken,** p.-v. and tp., Hudson co., N. J., on the heights 160 feet above tide-water, 1½ miles W. of Hoboken ferry at Hudson River, directly opposite New York City, has 7 churches, a monastery of the Passionist Fathers, 1 newspaper, a large silk-hat factory, a street railway, and about 20 florists, who furnish an immense quantity of flowers for the New York market. St. Michael's church, connected with the monastery, is a handsome stone building, one of the largest churches in the U. S. P. 4132.

Alfred E. Gregory, Ed. "Palisade News."

**West In'dian Planta'tion,** tp., Penobscot co., Me. P. 13.

**West In'dies,** the common name of that archipelago which extends from the southern extremity of the peninsula of Florida to the northern coast of Venezuela. It consists of four groups of islands—the Bahama Islands, the Greater Antilles, the Virgin Islands, and the Lesser Antilles—and is described under these separate heads.

**West Jef'ferson,** p.-v., Madison co., O.

**West Jer'sey,** p.-v. and tp., Stark co., Ill. P. 1315.

**West Kil'lingly,** p.-v., Windham co., Conn.

**West Lam'peter,** tp., Lancaster co., Pa. P. 1760.

**West'land,** tp., Guernsey co., O. P. 889.

**West Las Animas,** p.-v., cap. of Bent co., Col., the S. W. terminus of Kansas Pacific R. R., and at the junction of Purgatoire and Arkansas rivers, has good schools, 1

newspaper, and 3 hotels. Principal business, cattle, sheep, wool, and hides. It is the forwarding-point for New Mexico and Arizona. Slaughtering and shipping fresh beef are extensively carried on.

CHAS. W. BOWMAN, ED. "LAS ANIMAS LEADER."

**West Leb'anon,** p.-v., Warren co., Ind., on Toledo Wabash and Western R. R., 29 miles S. W. of Lafayette and 90 miles S. of Chicago, has 3 churches, 1 newspaper, 2 hotels, 2 mills, and good schools. P. 1053.

H. R. GREGORY, ED. "WARREN TIMES."

**West Lebanon,** p.-v., Grafton co., N. H.

**West Lebanon,** p.-v., Paint tp., Wayne co., O. P. 164.

**West Lib'erty,** p.-v., Muscatine co., Ia., at the crossing of Chicago Rock Island and Pacific and Burlington Cedar Rapids and Minnesota R. Rs., contains 5 churches, good schools, 1 newspaper, 1 flouring-mill, and 4 hotels. It is the centre for fine cattle in the West. P. 1500.

J. W. MCELRAVY, ED. "ENTERPRISE."

**West Liberty,** p.-v., cap. of Morgan co., Ky. P. 142.

**West Liberty,** p.-v., Liberty tp., Logan co., O. P. 741.

**West Liberty,** v., Liberty co., Tex. P. 230.

**West Liberty,** p.-v., Liberty tp., Ohio co., West Va. P. 251.

**West Lin'coln,** tp., Logan co., Ill. P. 3053.

**West Lo'gan,** v., Jefferson tp., Cass co., Ind. P. 978.

**West Mac'edon,** p.-v., Wayne co., N. Y.

**West'macott** (Sir RICHARD), R. A., b. in London, England, in 1775, son of a sculptor of some eminence, from whom he learned the rudiments of his art; studied under Canova at Rome 1793–97; obtained the first premium from the Academy of Florence 1794; made himself familiar with the best remains of ancient art in Italy; became an associate of the Royal Academy 1805, and an academician 1816; succeeded Flaxman as professor of sculpture at the Royal Academy 1827, and was knighted 1837. D. in London Sept. 1, 1856. Among his most noted statues are those of Addison, Pitt, Fox, Erskine, Nelson, the dukes of Bedford and York, that of Achilles in Hyde Park and of George III. at Windsor, and those of Cupid and Psyche in the possession of the duke of Bedford. Other admired works are an alto-relievo, *The Dream of Horace,* numerous monuments in St. Paul's cathedral and Westminster Abbey, and the groups of sculpture on the marble arch at Cumberland Gate and the pediment of the British Museum. Several of his academic lectures on sculpture were published in the *Athenæum* (1843).

**Westmacott** (RICHARD), R. A., F. R. S., son of Sir Richard, b. in London, England, in 1799; studied sculpture under his father; was in Italy 1820–26; was in general an imitator of his father's style, but with a preference for mythological and religious compositions; was elected associate 1838, and academician 1849, and succeeded his father as professor of sculpture 1857. D. in London Apr. 19, 1872. Among his best ideal works are—*Venus and Ascanius, The Cymbal-Player, A Girl and Fawn, Venus instructing Cupid, Paolo and Francesca,* the bas-reliefs *The Blue Bell, Go and Sin no More, The Angel Watching,* on a monument of the Ashburton family, recumbent monumental figures of Archbishop Howley and the earl of Hardwick, and the group of figures on the pediment of the Royal Exchange. He contributed articles on sculpture to several journals and to the *Encyclopædia Britannica* (8th ed. 1859), published several of his academic lectures either separately or in the *Athenæum* (1856), and was author of a *Handbook of Sculpture, Ancient and Modern* (Edinburgh, 1864), and an essay *On Coloring Statues.*

**West Maho'ning,** tp., Indiana co., Pa. P. 1131.

**West Man'chester,** p.-v. and tp., York co., Pa. P. 1824.

**West Man'heim,** tp., York co., Pa. P. 1147.

**West Marl'borough,** tp., Chester co., Pa. P. 1189.

**West'meath,** an inland county of Ireland, province of Leinster, bordering on the Shannon, comprises an area of 708 sq. m., with 78,416 inhabitants, of whom 30,158 are unable to read and write. The surface is hilly, especially in the northern part, and much diversified by lakes, rivers, and forests. The soil is fertile, but only a small part of it is under tillage. Oats and potatoes are the common crops, and breeding and fattening of cattle the principal occupation. Since 1851, 31,683 persons have emigrated from this county. Principal town, Mullingar, one of the largest military dépôts in Ireland.

**West Med'ford,** p.-v., Middlesex co., Mass.

**West Med'way,** p.-v., Norfolk co., Mass.

**West Mer'iden,** railway station and principal post-office in the city of Meriden, New Haven co., Conn., on New York New Haven and Springfield R. R., 17 miles N. of New Haven and 17 miles S. of Hartford, on Middletown and Waterbury turnpike, and geographically near the centre of the State. Area of the city, 2400 acres; of the town, 24 sq. m. P. of city in 1876, about 9000; of town, about 16,000. Meriden is exceedingly picturesque, being skirted with mountains on the N. and E., known as the Hanging Hills, embracing the famous Cat-Hole Pass, with Washington's Face, and Mount Lamentation, the whole being the southern terminus of a range of trap-rock extending through Massachusetts into New Hampshire. Quinnipiac River has its source in the Meriden Mountains. The city is built principally on high hills, in every direction overlooking a broad valley through which lies the railway and a prominent stream having its source in the East Mountains and called Harbor Brook, from its swamps and marginal bushes having given refuge to the pursued regicides in the early days of the colony. The town embraces three post-offices—namely, Meriden, West Meriden, and South Meriden—and four distinct villages—namely, Meriden, West Meriden, Prattsville, and Hanover; all but the last are embraced within the city limits; also 12 churches, 13 school districts and 44 public schools, 3 national and 2 savings banks, 2 fire insurance companies, 3 daily and 2 weekly newspapers, a public library and reading-room; is the seat of the State reform school, numbering 450 pupils; has a gentlemen's club, 2 hotels, a turners' society and hall, 3 lodges of Masons (1 each of chapter, council, and commandery), 3 lodges of Odd Fellows, an encampment, a post of the Grand Army, a lodge of Knights of Pythias. The grand list of the town in 1876 was $8,715,701. There was invested in manufacturing $1,405,325; in merchandise and trade, $351,380; in banks and insurance, $868,007; there were 1887 dwellings and 171 mills, stores, and manufactories. Meriden derives its importance chiefly from the manufacture of silver-plated ware, malleable iron and bronze goods, lamp-burners, carriage and other hardware, pocket and table cutlery, woollen goods, machinery, piano stools, carriages, firearms. It has a paid fire department, one of the finest waterworks in the country, a gas-light company, 2 trotting parks, a beautiful cemetery, a fine public hall, 2 private halls, an imposing police building; and the railroad dépôt is one of the finest edifices on the line of the road.

LUTHER G. RIGGS, ED. "MERIDEN DAILY RECORDER."

**West Mid'dlesex,** p.-b., Mercer co., Pa. P. 888.

**West Mid'dletown,** p.-b., Washington co., Pa. P. 346.

**West Mil'bury,** p.-v., Worcester co., Mass.

**West Mil'ford,** p.-v. and tp., Passaic co., N. J. P. 2660.

**West Mil'ton,** p.-v., Miami co., O.

**West'minster,** city and tp., cap. of Carroll co., Md., on Western Maryland R. R., 28 miles N. W. of Baltimore, contains 8 churches, the Western Maryland College, 4 public schools and several private academies, 4 banks, 2 machine-shops, 6 hotels, gasworks, a shoe-factory, and 2 newspapers. It is a resort for city people during the heated term. P. of city, 2310; of tp. 5227. W. H. RIPPARD, ED. "SENTINEL."

**Westminster,** p.-v. and tp., Worcester co., Mass. P. 1770.

**Westminster,** p.-v. and tp., Windham co., Vt. P. 1238.

**Westminster** (HUGH LUPUS **Grosvenor**), K. G., FIRST DUKE and THIRD MARQUIS OF, EARL GROSVENOR and BARON BELGRAVE, son of Richard, the second marquis, by his wife, Elizabeth Mary, daughter of the first duke of Sutherland, b. in London, England, Oct. 13, 1825; was member of Parliament for Chester 1847–69; succeeded to the marquisate on the death of his father, Oct. 31, 1869, and was created a duke 1874. He is married to his cousin, Constance Gertrude, daughter of the second duke of Sutherland, and is reputed the wealthiest nobleman in Europe.

**Westminster** (RICHARD **Grosvenor**), SECOND MARQUIS OF, b. in England in 1795; was known in early life as Viscount Belgrave; educated at Christ Church College, Oxford; sat in Parliament for the county of Chester as a Whig 1818–35; succeeded to the peerage on the death of his father, Richard, the first marquis (1767–1845); was lord steward of the queen's household under the Russell ministry 1850–52, a member of the privy council, and possessed of real estate, mostly in London and Westminster, valued at £21,000,000. D. in London Oct. 31, 1869.

**Westminster Abbey,** dedicated to St. Peter. The architecture, the historical associations, and the monuments of this remarkable edifice, which may be regarded pre-eminently as the national church of England, require

separate notice and a larger space than can be allotted to it in a work of this description.

(1) Its architecture runs back to an ancient period, but long before any portion of the present building was in existence there stood upon the same spot a Saxon church. That church, built within what was called Thorney Isle, from its being covered with brushwood, was connected long before the Conquest with a monastic body of the Benedictine order, who named the place of their abode the "Western Monastery," or Westminster, to distinguish it, some say, from St. Paul's in London, which was called East Minster. The first church here of which, architecturally considered, we possess any accurate knowledge, was that built by Edward the Confessor, and consecrated Dec. 28, Holy Innocents' Day, 1065. Though built by a Saxon king, it was in the Norman style, cruciform in shape, and exceeding in magnificence any sacred building at that time in England; and there still remains, under what is called the pyx-house, a noble crypt pertaining to the Norman structure. Henry III. rebuilt the greater part of the abbey church in the style denominated Early English; and it is his work we continue to behold in the transepts and the choir, which worthily call forth the admiration of all visitors whether of the Old or the New World. He had previously raised a Lady chapel at the E. end; and then, when he erected the new choir and transepts, he transferred the high altar to the place it now occupies, and reared behind—between it and the Lady chapel—a lofty shrine, to which he removed the body of Edward the Confessor. That shrine, somewhat mutilated, still remains. The Norman nave was not removed until the middle of the fourteenth century, when the present nave and aisles were commenced in a style corresponding with the architecture of Henry III.'s abbey. The W. front and its grand window, as well as the completion of the nave and aisles, belong to the latter part of the fifteenth century. Henry VII. pulled down the Lady chapel, and built that which now bears his name, a charming specimen of the florid architecture of the period—*i. e.* Late Perpendicular—with richly-mullioned windows and elaborately groined and fretted roof. The gates are a beautiful specimen of metal-work. Sir Christopher Wren was the architect of the upper part of the western towers, which are by no means in keeping with the rest of the glorious pile. The extreme length of the whole is 511 feet, and the width across the transepts 203. The width of the nave and aisles is 79 feet; of the choir, 38; and of Henry VII.'s chapel, 70. The height of the roof is 102 feet, an unusual elevation in England. There were cloisters to the Norman abbey, but those which now afford such a pleasant shade on a hot summer's day were built in the thirteenth and fourteenth centuries. The chapter-house is an architectural gem, lately restored after long neglect, and, when the stained glass is inserted in the windows, will defy comparison with all other edifices of the same description. The exquisitely-carved screen at the back of the altar was erected recently. The architecture of the abbey has of late engaged the attention of well-skilled archæologists, and the results of their study are well preserved in a volume of *Gleanings* edited by Gilbert Scott and published in 1863.

(2) The historical associations of the Abbey can be but imperfectly specified in this work; they can be best studied in Dr. Stanley's *Memorials*. Westminster is the place where the sovereigns of England have been crowned ever since the Conquest; therefore, the grandest pageants of the kingdom have been exhibited before multitudes of spectators within the time-honored walls. The coronation-stone brought from Scotland by Edward I. may still be seen under the coronation-chair used by Richard II., which ever since, there is reason to believe, has been occupied by the English sovereigns during the solemnity of their inauguration. The funerals of kings and queens have also taken place in the minster. The remains of Oliver Cromwell, who never wore the crown, were for a time deposited in a vault under Henry VII.'s chapel with a pomp which royalty could not exceed. In the chapter-house the Commons met when that body became an assembly distinct from the Lords, and repeated their sittings there as late as the end of the reign of Henry VIII. The history of the abbey is interwoven with that of the English Reformation. One of the Protestant martyrs, Thomas Bilney, was arraigned before Cardinal Wolsey in the Westminster chapter-house. The abbey fell at the time of the dissolution of the monasteries, and the abbot was succeeded by a dean. For a short time Westminster had a bishop, but the experiment proved unsuccessful. In Queen Mary's time the abbey was restored, but after Elizabeth's accession the present institution of dean and chapter was established. Convocations were transferred to Westminster in the time of Henry VIII. That which acknowledged the royal supremacy was held here. In the time of Elizabeth the bishops met in Henry VII.'s chapel. In Charles I.'s reign both houses were gathered together under its beautiful roof to hear a speech from Archbishop Laud. In the Jerusalem chamber we find the bishops debating the final alterations made in the Book of Common Prayer in 1662; and afterward some of the most exciting scenes connected with the history of Convocation in the reigns of William III. and Anne occurred in the chamber itself, or in that part of the abbey where the lower house had been convened. The fortunes of the abbey have followed those of the nation, and therefore the Westminster Assembly was held in the Jerusalem chamber, and during the civil wars and Commonwealth, Episcopalian worship was interrupted, Presbyterians and Independents occupied the pulpit; and with the restoration of Charles II. worship began to flow back into the former channels. Since the Act of Uniformity the Book of Common Prayer has of course been the formulary of devotion used by the clergy in this ancient edifice. But since the present respected dean, Dr. Stanley, has occupied his post, proceedings have occurred in the abbey of national interest, and in harmony with that catholic spirit which ought to preside over the religious offices conducted in a national temple. Sermons on Sunday evenings have been preached to vast audiences; and for the last three years (written in 1875) on the evening of St. Andrew's Day, Nov. 30, set apart for intercession on behalf of missions, a layman professor, Max Müller, a Presbyterian clergyman, Dr. Caird, and a Congregational missionary, Dr. Moffat, have delivered lectures from the lectern in the centre of the nave.

(3) The tombs and monuments in the abbey are exceedingly numerous, and the life-stories of those who are buried under the pavement or commemorated on the walls would form a national biography. Some of the principal are grouped together according to the grounds on which history builds their fame. Sovereigns and members of royal families have graves and tombs in the chapels of Edward the Confessor and Henry VII. Edward himself slumbers under the shrine which bears his name, and which is curious as a work of art belonging to the age of Henry III. On the N. side that king sleeps, and next to him Edward I. On the S. side lie Edward III. and Richard II., and to the E. Henry V. in the beautiful chantry named after him. In the midst of Henry VII.'s chapel the founder and his wife repose side by side; at the W. end is the sepulchre of Edward VI. In the N. aisle are Queen Elizabeth and her sister Mary; in the opposite aisle is Mary Queen of Scots. Close to the tomb of Henry VII. we meet with the grave of King James; Charles II. is buried at the E. end of the N. aisle. His grave is unmarked; so is that of William III. Queen Anne was laid next her sister Mary in the southern aisle. George II. was the last of the kings interred in the abbey. The interment was in Henry's chapel. Some of the buried sovereigns have monuments. Several members of the royal families lie near their relatives. The N. transept is distinguished as the resting-place of eminent statesmen—Pitt, Fox, Wilberforce, Canning, Peel, Palmerston. The S. transept is marked by the world-known "Poets' Corner," perhaps the most attractive part of the whole building. Here lie Chaucer, Spenser, Beaumont, Ben Jonson, Cowley, Dryden, Addison; also hard by are monuments to Shakspeare, Milton, Isaac Watts, Goldsmith, and Johnson. Numbers of generals, admirals, courtiers, divines, men of letters, and other distinguished personages are covered by the marble pavement or have memorials of them by the pillars or on the walls. Two slabs on the central floor of the nave, lately inserted, mark the last home of George Stephenson and David Livingstone. It may be added that some of the monuments are much more remarkable on account of their sculpture than from interest attaching to the names they bear. JOHN STOUGHTON.

**Westminster Assembly.** This famous Assembly, if it does not form a landmark in the history of Protestantism, has exercised a great and lasting influence on the history and development of American as well as of British Presbyterianism, and its symbolical books are still regarded with veneration by almost all English-speaking Presbyterian churches throughout the world. After some unsuccessful attempts to obtain the sanction of the king, it was summoned by ordinance of the two houses of the English Parliament. It was intended that it should include among its members adherents of all the chief parties among English-speaking Protestants with the exception of that of Archbishop Laud, whose innovations and despotic tendencies had been one main cause of the troubles in Church and State. Almost all the clerical members were in episcopal orders, three or four were bishops, five afterward rose to be so, and several were known to be favorable to the continuance of episcopacy and to side with the king rather than with the Parliament. A place was found for some of the ministers of the French churches in England, for one or two

representatives of the Church of Ireland, and for some who had been pastors of the English churches in Holland; while invitations to send commissioners were addressed to the Church of Scotland, and, it is said, also to the churches of New England. The Assembly, as originally constituted by the ordinance, consisted of 121 divines and of 30 lay assessors, of whom 10 were peers and 20 commoners. Additions were made from time to time, chiefly to supply the places of those who had failed to attend or had been removed by death. The purposes for which, according to the ordinance, the Assembly was convoked were to vindicate the doctrine of the Church of England from all calumnies and false aspersions, and to recommend such further reformation of her discipline, liturgy, and government as might "be agreeable to God's holy word, and most apt to procure and preserve the peace of the Church at home, and nearer agreement with the Church of Scotland and other Reformed churches abroad." But when the Parliament, feeling their need of Scottish aid, acceded to the Solemn League and Covenant and urged the Scotch to send deputies to the Assembly, its objects were extended; and to promote the covenanted uniformity it was empowered to prepare a new confession of faith and catechism, as well as directories for public worship and church government which might be adopted by the churches of the three kingdoms. It retained to the last, however, that advisory character which has made some question whether it was properly an ecclesiastical synod at all, though in this respect it only resembled an ordinary English convocation, and in those respects in which it differed from that body it may claim the benefit of what is said in chap. xxxi. sec. ii. of its Confession.

It was on Saturday, July 1, 1643, that the divines, with the two Houses and a great congregation, met in Westminster Abbey, and after sermon by Dr. William Twisse, who had been named as prolocutor, the Assembly was constituted in the chapel of Henry VII., in which, only three years before, Laud's unfortunate convocation had been held. On the names being read over, it was found that "threescore and nine" had obeyed the summons of the Parliament. Bishop Brownrigg sent an excuse for his absence; Bishop Westfield and a few other royalists and conformists were actually present, and by the retention of their canonical habits seemed, as Fuller says, "the only nonconformists." The most of the divines came not in canonicals, "but in black coat or cloak and bands, in imitation of the foreign Protestants," and probably a more correct idea of the appearance of the Assembly may be formed from the plate of the French synod prefixed to the first volume of Quick's *Synodicon* than from the plate of the Assembly so common in England. The meetings continued to be held in the chapel of Henry VII. till after the arrival of the Scottish commissioners, and were chiefly occupied with the revision of the first fifteen of the English Articles. Soon after, the Covenant was subscribed by the Assembly and the House of Commons, and the last remaining royalist, Dr. Featley of Lambeth, was expelled for opposing it, and for revealing the proceedings to Ussher, then in the king's quarters at Oxford. The Assembly was now authorized by the houses to treat of the questions of church government and worship; and about the same time, that it might have the benefit of a fire, it removed from Henry VII.'s chapel to the Jerusalem chamber, which since that time has generally been the meeting-place of the upper house of Convocation. Baillie, one of the Scotch commissioners, has left us the following graphic account of the Assembly at this early date: "The like of that Assembly I did never see, and, as we hear say, the like was never in England, nor anywhere is shortly like to be. They did sit in Henry the 7th's chapel, in the place of the convocation; but since the weather grew cold, they did go to Jerusalem chamber, a fair room in the abbey of Westminster, about the bounds of the college fore-hall, but wider. At the one end, nearest the door, and both sides, are stages of seats as in the new assembly-house at Edinburgh, but not so high; for there will be room but for five or six score. At the upmost end there is a chair set on a frame, a foot from the earth, for the Mr. Prolocutor, Dr. Twisse. Before it on the ground stand two chairs for the two Mr. Assessors, Dr. Burgess and Mr. White. Before these two chairs, through the length of the room, stands a table at which sit the two scribes, Mr. Byfield and Mr. Roborough. The house is all well hung, and has a good fire, which is some *daintise* at London. Foranent the table, upon the prolocutor's right hand, there are three or four ranks of forms. On the lowest we five do sit. Upon the other, at our backs, the members of Parliament deputed to the Assembly. On the forms foranent us, on the prolocutor's left hand, going from the upper end of the house to the chimney, and at the other end of the house, and backside of the table, till it come about to our seats, are four or five stages of forms, whereupon their divines sit as they please; albeit commonly they keep the same place. From the chimney to the door there are no seats, but a void for passage. The lords of Parliament use to sit on chairs, in that void, about the fire. We meet every day of the week but Saturday. We sit commonly from nine to one or two afternoon. . . . Ordinarily, there will be present above threescore of their divines. These are divided into three committees; in one whereof every man is a member. No man is excluded who pleases to come to any of the three. Every committee, as the Parliament gives order in writing to take any purpose into consideration, takes a portion, and in their afternoon meeting prepares matters for the Assembly, sets down their mind in distinct propositions, backs their propositions with texts of Scripture. After the prayer, Mr. Byfield, the scribe, reads the proposition and Scriptures, whereupon the Assembly debates in a most grave and orderly way. No man is called up to speak; but who stands up of his own accord, he speaks, so long as he will, without interruption. . . . They harangue long and very learnedly. They study the questions well beforehand, and prepare their speeches, but withal the men are exceedingly prompt and well-spoken. I do marvel at the very accurate and extemporal replies that many of them usually make."

The debates on the subject of church government were keen and protracted, and unexpected obstacles arose which for a time retarded a settlement. Twisse, Gataker, Palmer, Temple, and several other learned divines who were cordially on the side of the Parliament were inclined toward what they termed primitive episcopacy, under which the presbyters and their president governed the churches in common. They were not able all at once to reconcile themselves to various details of the Presbyterian system, though ultimately they agreed to acquiesce in it as affording the only chance of constituting a comprehensive national Church, with such reasonable powers of self-government as would prevent the recurrence of the oppressive despotism under which they had so long groaned. The Scotch commissioners and their more thorough-going associates, the Puritans of the school of Cartwright, had for the sake of union occasionally to forego the claim of a *jus divinum* for the details of their polity, and to rest contented with the phrase "lawful and agreeable to the word of God," instead of "expressly instituted or commanded." The Independents, though fewer in number than either of the other parties, yet, backed up by their political friends outside, proved more unyielding, and in the end resolved rather to seek for toleration outside the national Church than for comprehension within it if it were not to be constituted more in accordance with their system than the majority of the Assembly were willing to allow. It was therefore agreed to lay aside the discussion of these topics for a time, and proceed to take up subjects on which there was likely to be a greater amount of harmony. Baillie seems to represent this as a mere matter of policy, but one cannot doubt that such men as Twisse, Henderson, Gillespie, Gataker, Tuckney, and Arrowsmith were actuated by more praiseworthy motives, nor refuse to admit that at a considerably later period the majority of the Assembly labored honestly and earnestly to retain the Independents within the national Church.

The subjects on which least disagreement was expected were those relating to the form of public worship and the statement of doctrines. Early in 1644 the Assembly remitted each of these to a small committee to prepare materials for the decision of them, and to bring these first before the large committees, and then before the Assembly. In this way the *Directory for Public Worship* was prepared in 1644, considerable progress was made with a practical *Directory for Church Government* in 1644–45, though the printing of it was delayed till 1647, and in 1645–46 the *Confession of Faith* was elaborated, and finally put into the shape in which it is still printed in Scotland. In the two following years the Assembly elaborated the *Catechisms*, and prepared the Scripture proofs for them as well as for the *Confession of Faith*. It spent part of the time also in attempting to complete its answers to the famous Erastian *Queries* of the House of Commons, and gave its sanction to certain papers in answer to the Independents, formerly drawn up by its grand committee. These last appeared ultimately in the volume entitled *The Grand Debate concerning Presbytery and Independency*. The former were never completed and published, but it is said that the substance of them is given in the preface to the *Jus Regiminis Ecclesiastici Divinum*, prepared by the London ministers. After 1648 the Assembly occupied itself almost exclusively with the examination of those appointed to ecclesiastical charges or desiring license as expectants or probationers, and it was only occasionally that the full quorum of forty could be brought together. The 1163d session was held Feb. 22, 1648–49. The subsequent sessions are not numbered, but the last of which an entry is made in the minutes took place on Mar. 25, 1652. These minutes, which are pro-

nounced by competent judges to be almost entirely in the handwriting of Adoniram Byfield, are still preserved in Dr. Williams's library, Grafton street, London. The whole of them were recently transcribed at the expense of the Church of Scotland, and the more important portion of them has been published by the Messrs. Blackwood, Edinburgh. The Assembly was not formally dissolved, but, as Fuller says, "it dwindled by degrees," and "vanished with the Parliament" which gave it birth.

The most various estimates have been formed of the merits of this Assembly from the time it met down to our own day. Clarendon has spoken of its members and their work with great contempt, and others have "damned them with faint praise;" but Baxter, perhaps as competent as any among their contemporaries to give an impartial verdict, did not hesitate to affirm that "the divines there congregated were men of eminent learning and godliness, and ministerial abilities and fidelity; and being not worthy to be one of them myself, I may the more freely speak that truth which I know even in the face of malice and envy, that, as far as I am able to judge by the information of all history, . . . the Christian world since the days of the apostles had never a synod of more excellent divines." "This," as Dr. Stoughton, one of the most competent judges in our own day, observes, "is high praise, but it comes nearer the truth than the condemnatory verdicts pronounced by some others. The Westminster divines had learning, scriptural, patristic, scholastical, and modern, enough and to spare, all solid, substantial, and ready for use." Hence, their work has stood the test of time, and is still valued and honored. Almost all of them were graduates of the universities of Oxford and Cambridge. Several of them had been honored to suffer in defence of the truths they taught, and many of them had the courage afterward to brave suffering, insult, and poverty rather than renounce their creed or abandon their views of church polity and discipline. Twisse, the prolocutor of the Assembly, was a man not only of subtle and speculative genius, but also of profound learning. He was esteemed one of the most influential theologians of the day, and held in honor by all the Reformed churches. Herle, who succeeded him as prolocutor, was, according to Fuller, "so much Christian, scholar, and gentleman that he could unite in affection with those who were disjoined in judgment from him." White and Burgess, the two assessors, were both men of acknowledged eminence. The former, surnamed, from his high standing in his parish, the "patriarch of Dorchester," was the maternal great-grandfather of the Wesleys. The latter was a most accomplished debater and public speaker, and proved a warm friend of the Scotch and one of the most valiant defenders of Presbytery. Reynolds was a divine "eloquent, learned, cautious," and at the Restoration was made bishop of Norwich. Calamy was a more cautious and liberal Calvinist still, and he too was offered but declined a bishopric. Arrowsmith, "the man with the glass eye," and Tuckney, the friend of Whichcot, successively professors of divinity at Cambridge, were men of high scholarship, extensive theological attainments, and considerable mental breadth. Staunton was a "walking concordance;" Seaman, "an invincible disputant;" Lightfoot, Coleman, and Gataker were all distinguished Oriental scholars; and the last named, after Ussher and Selden (who also had been invited to the Assembly), was accounted the most learned man in England. The age is acknowledged to have been an age of great preachers, and in the first rank among these fall to be numbered the following members: Gouge, on whose preaching Ussher and other scholars then congregated in the metropolis did not disdain at times to attend; Manton, in whom "clear judgment, rich fancy, and happy eloquence met;" Marshall, whose yet more impressive oratory is said to have secured for him greater influence with the Parliament than ever Laud enjoyed with the court; Calamy, who "delighted in that experimental strain of discourse which ever touches the hearts of men;" Burroughs and Greenhill, "the morning and evening stars" of Stepney; Hoyle, the friend of Ussher and professor of divinity in Dublin and Oxford, who was profound in patristic lore, and "reigned both in the schools and in the pulpit;" Palmer—"gracious, learned, little Palmer," as Baillie somewhat familiarly but kindly terms him—who could preach ably and attractively in French as well as in English; Caryl, long popular with the learned audience of Lincoln's Inn; and Goodwin, one of the most successful expository preachers of the age. With these were associated the very *élite* of the Scottish ministers and elders—Henderson, whose learning and culture even royalists acknowledged; Rutherford, twice invited to a professorship in Holland; Gillespie, the prince of disputants, who "with the fire of youth had the wisdom of age;" and Baillie, who has embalmed in graphic narrative their debates and gossip; together with Johnstone of Warriston and the "great marquis" of Argyll, who both suffered afterward on account of their principles; Loudon, the chancellor at once of the kingdom and of its most ancient university; and the engaging but versatile and unscrupulous Lord Maitland.

*Literature.*—*Minutes of the Sessions of the Westminster Assembly of Divines*, edited by Alexander F. Mitchell and John Struthers (Edinburgh, 1874); Lightfoot's *Journal of the Proceedings of the Assembly of Divines*, vol. xiii. of *Works* (London, 1824), Gillespie's *Notes of the Proceedings of the Assembly of Divines*, in vol. ii. of *Works* (Edinburgh, 1844); *Journals of the House of Lords and of the House of Commons from 1643 to 1649* (London); Baillie's *Letters;* Rutherford's *Letters;* Hanbury's *Historical Memorials of the Independents;* Rushworth's *Historical Collections;* Whitlock's *Memorials;* Fuller's *Church History* and *Worthies of England;* Clarendon's and Collier's *Histories;* Palmer's *Nonconformists' Memorial;* Calamy's and Sylvester's *Life and Times of Baxter;* Neal's *History of the Puritans;* Price's *History of Protestant Nonconformity;* Brook's *Lives of the Puritans;* Reed's *Lives of the Westminster Divines;* Smith's *Lives of English and Scottish Divines;* Wood's *Athenæ Oxonienses;* Hetherington's *History of the Westminster Assembly;* Marsden's *Early and Later Puritans;* Stoughton's *Ecclesiastical History of England;* Lee and Cunningham's *Histories of the Church of Scotland;* McCrie's *Annals of English Presbytery;* Stanley's *Memorials of Westminster Abbey;* Masson's *Life of Milton.*

ALEX. F. MITCHELL.

**Westminster City and Liberties,** so constituted by royal charter, extend as far as Kensington and Chelsea westward, Temple Bar eastward, Marylebone northward, and the Thames southward. The district is governed by a high steward elected by the dean and chapter, and by a high bailiff elected by the dean alone. It returns two members to Parliament, and the election in the days of Fox and Burdett produced immense excitement. Westminster includes several parishes, and the church of one of them, dedicated to St. Margaret, is close to the abbey. St. Margaret's church is the church of the House of Commons, and during the Commonwealth many fast-day sermons were preached from its pulpit. Sir Walter Raleigh is buried there, and at the Restoration, Oliver Cromwell's mother and other notabilities were dug out of their graves in the abbey and thrown into a pit opened in St. Margaret's churchyard. The last population-return for Westminster which we have seen gives 246,616; it is probably now 250,000.

JOHN STOUGHTON.

**Westminster Confession of Faith and Catechisms.** See WESTMINSTER STANDARDS.

**Westminster Hall** was originally built by William Rufus, but a new one arose in the reign of Richard II., when the old walls were raised higher, the windows enlarged, and a stately porch and noble roof of timber constructed. Parliaments were held in ancient times within this vast apartment; and it is a curious fact that the first meeting of a Parliament under its beautifully-carved beams of oak ended in the deposition of the king who built the edifice. Happily, the hall escaped the conflagration in 1834, and has been carefully restored and skilfully adapted as an immense vestibule to the Houses of Parliament, which can be approached by spacious flights of steps at the S. end. It has been the scene of many stirring events. Here Sir William Wallace of Scotland, Sir Thomas More, and the Protector Somerset were tried and condemned. Not to mention other trials, King Charles I. here appeared before the High Court of Justice, while the banners of Naseby hung over his head. Here the seven bishops just before the Revolution were acquitted, Dr. Sacheverell and the rebel lords of '45 were convicted, and Warren Hastings passed through that ordeal which has been rendered so famous by the eloquence of Burke and Sheridan and by the most brilliant assemblage, perhaps, ever seen in a court of justice. It must be also mentioned that here Oliver Cromwell was inaugurated as Lord Protector of England. Nor can some now living forget how in their youth, at the coronation of George IV., Westminster Hall witnessed a coronation banquet, and at the same time the challenge of the king's champion on horseback in complete armor.

Westminster Hall was long the centre of the English law courts; abutting on it were the court of chancery, the court of king's or queen's bench, the court of common pleas, and the court of exchequer. Originally they were held within the hall, in parts partitioned off for the purpose. These law courts were constructed outside, with entrances into them leading out of the hall. Great changes have been going on in the history of the legal profession. "When I entered the profession," says Mr. Foss in *Old London* (p. 223), "about the beginning of this century, there were only twelve judges in the three courts of

common law. This number was deemed one of peculiar sanctity, and it was considered a sort of sacrilege to suggest any increase, as if that had been the number ever since the institution. And yet that number had only been the regular staff of the courts from the reign of Edward VI. (1547), and it had been entirely forgotten that in all the previous reigns the number of judges had constantly varied, sometimes extending to nine in one court, eight in another, and six or five in a third, and sometimes being reduced to three, and even to two. James I., indeed, added one judge to the four judges then acting in each of the courts, but the increase was discontinued before the end of the reign, and from that time till the reign of William IV. (except during the Commonwealth) the number of judges continued to be twelve. But in 1830 the accumulation of business was at last met by an additional judge in each court, and ever since that date the common-law bench has consisted of fifteen judges."

The hall of old was blocked up with shops and stalls of divers descriptions. Booksellers, law-stationers, and sempstresses here plied their respective trades, while on both sides the building there was a display of banners taken at Blenheim and other battle-fields where Marlborough won his victories. It is curious to notice that in Queen Mary's time the floor was flooded, so that when the lord mayor of London came to present the sheriffs to the barons of the exchequer the place was full of water; and in the reign of Henry III. boats might have been rowed up and down, and no one could get in but upon horseback. But the old legal associations of the buildings, except in history, have now (1875) disappeared, as well as the shops and stalls, and, like the floods, are things of the past. By the legal reforms just effected the old courts are abolished, and instead of them we have a blending of law and equity in the high court of justice in its different divisions. When the new law courts are completed, they will absorb the supreme administration of justice, and gather round them in the future historical associations of English jurisprudence as Westminster Hall has done in the past.

JOHN STOUGHTON.

**Westminster Palace,** a name originating with the ancient royal residence close to Westminster Abbey, and still applied to the group of buildings used for the meetings of Parliament and other state purposes.

(1) A palace was built on what had been called Thorney Isle by Edward the Confessor, if not by some earlier Saxon monarch. Documentary evidence is preserved of the progress of domestic architectural works, and payments for the same, during the reigns of Henry II., Richard I., John, Henry III., Edward I., Edward II., Edward III., and Henry VI. Extracts of this kind may be found in great number and variety in Britton and Brayley's *History of the Ancient Palace at Westminster*, showing the nature and value of the materials used and the artisans engaged. The palace was partly burnt in the year 1263, and was also damaged by insurgents in 1269. The expenses of the royal household also appear from another set of accounts pertaining to the last two reigns just enumerated. Henry VIII. erected a new palace at York Place and St. James, in the neighborhood, but at some distance from the old buildings occupied by his predecessors. Whitehall was the name given to the new palatial abode, and the former one, deserted by the royal family and household, came to be employed for public business. The Houses of Lords and Commons assembled within the old walls. The former met in a portion of the building which underwent changes and received different names. The latter began to meet in St. Stephen's chapel in the reign of Edward VI. St. Edward's, or the Painted Chamber, was used by the Lords and Commons when they came together for conferences. In the year 1834 a terrible fire destroyed the whole pile, so long interwoven with the royal and national history of England. We well remember the occurrence of that immense conflagration, and the excitement it produced throughout the country. Immediately afterward temporary accommodation was provided for the legislature, and the carrying on of affairs connected with it, and in 1840 the first stone of the new houses was laid.

(2) The new palace of Westminster occupies the site of the old one, and is the most magnificent pile of buildings for legislative purposes in the whole world. It has four fronts. The E. or river front, which is the principal, presents a façade of 900 feet, divided into compartments, panelled with tracery and decorated with statuary and coats-of-arms. The other fronts are in the same style, and exhibit the same profusion of ornament. Three principal towers crown the outspread edifice—the Royal Victoria tower, the central tower, and the clock tower. The first is 340, the second 300, and the third 320 feet in height. The present chambers occupied by the two houses are richly decorated, and all the appurtenances are of a harmonious description. The royal entrance, the royal gallery, the central hall, the passages and the libraries, are all on a scale of the greatest magnificence, and wherever it is appropriate the walls are adorned with statues and frescoes. Of course the new houses far surpass in architecture, sculpture, and painting the previous buildings, but of necessity the new lack the glories thrown around the old by the battles for liberty fought for three centuries in St. Stephen's chapel.

JOHN STOUGHTON.

**Westminster School,** as it now exists, was founded by Queen Elizabeth in 1560, but there was an abbey school long before. The establishment is called St. Peter's College, consisting of the dean of Westminster, 12 prebendaries, 12 almsmen, and 40 scholars, with a master and usher. But to the 40 royal scholars many more have since been added, and the masters have multiplied on a corresponding scale. The boys on the foundation, however, used to be separated from the rest by a bar or curtain. The school-room was a dormitory of the abbey, and the college hall was the abbot's refectory, built by Abbot Litlington under Edward III. The dormitory was built by the earl of Burlington in 1722. According to an old custom, the boys at Christmas still perform one of Terence's plays, with a prologue and epilogue written for the occasion and suited to the times. Westminster School can boast of distinguished men amongst its masters and pupils. Of the former, were Camden the antiquary, and Busby of wonderful fame as a schoolmaster, who would not take off his hat in the king's presence before the school, lest he should diminish his authority with the boys. The scholars include *poets*—Ben Jonson, George Herbert, Giles Fletcher, Cowley, Dryden, Prior, Churchhill, Cowper, Southey; *statesmen*—Sir Harry Vane, Halifax, Warren Hastings, marquis of Lansdowne, Burdett, Graham, and Earl Russell; *warriors*—marquis of Anglesey, Lord Combermere, Lord Raglan; and other *celebrated men*—Locke, South, Christopher Wren, Atterbury, Gibbon.

JOHN STOUGHTON.

**Westminster Standards.** Under this title are sometimes comprehended all the church books drawn up by the Westminster Assembly, at others only those relating to doctrine; and accordingly, though these were drawn up last, we proceed to treat of them first.

(1) *Confession of Faith.*—A committee was appointed by the Assembly "to prepare matter for a joint confession of faith" as early as Aug. 20, 1644. It consisted of Drs. Gouge, Temple, and Hoyle, Messrs. Gataker, Arrowsmith, Burroughs, Burgess, Vines, and Goodwin, together with the Scotch commissioners. A fortnight later, Dr. Smith and Messrs. Palmer, Newcomen, Herle, Reynolds, Wilson, Tuckney, Young, Ley, and Sedgewick were added to the committee. In all probability, the material afterward embodied in the Confession was in part, at least, prepared by this committee. But the digesting of the matter into a formal "draught" was, on May 12, 1645, entrusted to a small committee consisting, apparently, of Drs. Temple and Hoyle, Messrs. Gataker, Harris, Burgess, Reynolds, Herle, and the Scotch commissioners. On July 7, 1645, Dr. Temple "made report of that part of the Confession of Faith touching the Scriptures," and it was read and debated. The following day Messrs. Reynolds, Herle, and Newcomen (to whom were afterward added Messrs. Tuckney and Whitaker) were appointed a committee to "take care of the wording of the Confession," as its articles should be voted in the several sessions. On July 16 report was made from the committee of the heads of the Confession, and these were distributed among the three large committees of the Assembly, to be by them elaborated and prepared for more formal discussion. All were repeatedly read and debated, paragraph by paragraph, and sometimes word by word, in the Assembly. On Sept. 25, 1646, the first nineteen chapters, and on Dec. 4 of that year the whole Confession, were finally passed, and then presented to the Houses of Lords and Commons. They gave orders that 600 copies should be printed for the use of members of Parliament and of the Assembly, and that Scripture proofs should be added to the Confession, which was accordingly done. In 1647 the Confession was approved by the Church of Scotland in the form in which it had passed the Assembly, and it was subsequently ratified by the Scottish Parliament. In 1648, under the title of "Articles of Christian Religion," and with certain changes, most of which were afterward adopted by the Savoy Conference, it was passed by the English Parliament.

*Sources and Character of the Confession.*—It has been maintained that the Assembly's Confession was derived mainly from foreign sources, and even that it "bears unmistakably the stamp of the Dutch theology in the sharp distinctions, logical forms, and juridical terms into which the Reformed doctrine had gradually moulded itself under

the red heat of the Arminian and Socinian controversies." But there is conclusive evidence that in its general plan, and in the tenor and very words of its more important articles, it was derived not from foreign but from native sources. It may confidently be traced up to those confessedly Calvinistic or Augustinian Articles which are supposed to have been prepared by Ussher, and in 1615 were adopted by the convocation of the Irish Church. This was before the Synod of Dort had met, or the bitterness and heat which the debate of the Arminian controversies occasioned had extended to Britain. In these Articles I am satisfied we have the main sources of the Assembly's Confession of Faith, and almost its exact prototype in its statement of all the more important and essential doctrines of Christianity. In the order and titles of many of its chapters, as well as in the language of whole sections or subdivisions of chapters, and in many single phrases, and *voces signatæ* occurring throughout their Confession, the Westminster divines appear to me to have followed very closely in the footsteps of Ussher and his Irish brethren. I do not venture to assert that in no case do they determine points which the Irish convocation had left open. But I do say that these points are not many nor important, and that it is clear the Assembly took the greatest possible pains to express its views in such a way as to obviate objections which had been, or might have been, taken either to the words or to the matter of the Irish Articles. The minutes clearly show that the attempt to determine questions left open by the Synod of Dort was seldom made, and that when it was made it was strenuously resisted by the pupils and successors of the English divines, who claimed to have moderated the conclusions of that synod. With respect to the doctrine of the covenants, and the juridical phraseology which some assert were imported into England through Cocceius (whose chief work on the subject, however, was not published till after the Confession had been framed), there is nothing taught by the Westminster divines which had not in substance been found by Rollock in Scotland and Cartwright in England half a century before, while there is an advance on what is taught in the Dutch *Synopsis Purioris Theologiæ* of 1642. In regard to the important chapters on "The Holy Scripture," on "God's Eternal Decree," on "Christ the Mediator," and on "The Lord's Supper," which so largely determine the character of the Confession, the resemblance to the Irish Articles both in language and arrangement is so close that hardly a doubt can be entertained either of the sources from which it was derived or of the design of its framers in following in the footsteps of Ussher. They meant their Confession to be in harmony with the *consensus* of the Reformed churches; they desired it to be a bond of union, not a cause of strife, among those who adhere to the sum and substance of the doctrine of the Reformed churches.

The Confession, under the title of *The Humble Advice of the Assembly of Divines now by authority of Parliament sitting at Westminster concerning a Confession of Faith*, etc., was printed at London in Dec., 1646, without proofs, and in May, 1647, with proofs, for the use of the Houses of Parliament and the Assembly. A copy of this last edition was taken to Scotland by the commissioners, and from it 300 copies were printed for the use of the General Assembly there. After being approved by that body, it was *published* in Scotland with the title *The Confession of Faith agreed upon by the Assembly of Divines*, etc., and, to the indignation of the House of Commons (which had not yet approved of it), this was reprinted by a London bookseller in 1648. In the same year it was, with the omission of part of chapters xx. and xxiv., and the whole of chapters xxx. and xxxi., and with some minute verbal alterations, approved by the two houses, and published under the title *Articles of Christian Religion, approved and passed by both Houses of Parliament after advice had with the Assembly of Divines*, etc. But in this instance the Assembly proved too strong for the Parliament, even though the Savoy Conference sided with the latter; and the Confession continues to be printed in Britain in the form in which it was drawn up by the Assembly and approved by the Church of Scotland. Under the title of *Truth's Victory over Error*, Dickson, professor of divinity in Edinburgh, published a brief catechetical exposition of the Confession in 1649. Admirable expositions of it have been published in our own day by Dr. Shaw of Whitburn, Scotland, and Dr. Hodge of Allegheny, U. S.

(2) *Catechisms.*—The catechism which Baillie reports to have been drawn up and nearly agreed to in the end of 1644 was probably that which had been almost completed, and to a considerable extent had been passed, by the Assembly while still occupied with its Confession of Faith. But on Jan. 14, 1646–47, "upon a motion made by Mr. Vines, it was ordered, That the committee for the Catechism do prepare a draught of two catechisms, one more large, and another more brief, in which they are to have an eye to the Confession of Faith and to the matter of the Catechism already begun." The Larger Catechism was first proceeded with. This appears distinctly from the minutes of the Assembly, though the opposite view is still sometimes maintained. It may be admitted that the Shorter one at times embodies more of the materials of the original Catechism, and seems to be less directly drawn from the Confession of Faith, but it was not cast into its present shape till after the Larger one was completed, and all the Scotch commissioners except Rutherford had left the Assembly. Tradition attributes to Gillespie the answer given in it to the question, What is God? but so far as can be ascertained from the minutes the answer to that question, even in the Larger Catechism, was not moulded into its present shape till after Gillespie returned to Scotland, but remained somewhat of the same form as it bears in the original draught and in the catechisms of Ussher and Cartwright. Some suppose that the Smaller Catechism of Cartwright was a good deal followed by the Assembly's committee; but no accurate comparison, so far as I know, has yet been instituted between the Assembly's catechisms and those which had previously appeared in England, especially during the years immediately preceding. Tuckney had the chief share in digesting the Larger Catechism into its present form, and he was also convener of the committee which prepared the Shorter, though some think that in its more concise and severely logical answers they discern traces of the handiwork of Wallis, the mathematician. Both catechisms, as has been well observed by the younger M'Crie, "are inimitable as theological summaries; though when it is considered that to comprehend them would imply an acquaintance with the whole circle of dogmatic and controversial divinity, it may be doubted whether either of them is adapted to the capacity of childhood. But if too little regard has been paid in former days to the *intelligent* training of our youth in such catechisms, . . . experience has shown that few who have been carefully instructed in our Shorter Catechism have failed to discover the advantage of becoming acquainted in early life, even as a task, with that admirable 'form of sound words.'"

Ridgley's *Body of Divinity* is virtually an exposition of the Larger Catechism. Alleine, Vincent, and Flavel in England, and Fisher, Willison, and several others in Scotland, have published expositions of the Shorter Catechism.

(3) *Directory of Public Worship.*—This occupied the attention of the Assembly during the greater part of the year 1644, and received the sanction of the English houses of Parliament on Jan. 3, 1644–45, though one or two alterations were made in March following to meet the views of the Scotch. It was approved by the Scotch General Assembly and Parliament in Feb., 1645, with one reservation. The first English edition bears the date of 1644, but was really published in what, according to our reckoning, would be Mar., 1645. The first Scotch edition bears the date of 1645, and has been recently reprinted by the Messrs. Blackwood with an historical introduction and notes by Dr. Leishman of Linton. From the preface, as well as from the testimony of those engaged in framing it, we may clearly infer that the Directory was not intended to form a new liturgy, the very words of which might be turned by the minister into a fixed and unvarying form of prayer. The meaning of its framers, as themselves tell us, only was that there might be "a consent of all the churches in those things that contain the substance of the service and worship of God," and that the ministers might, "if need be, have *some help and furniture*, and yet so as they become not hereby slothful and negligent in stirring up the gifts of Christ in them, but that each, by taking heed to himself and the flock of God committed to him, and by wise observing the ways of Divine Providence, may be careful to furnish his *heart and tongue* with *further or other* material of prayer and exhortation as shall be needful on all occasions." Its minuter directions have never been regarded as rigidly binding, but it were much to be wished that more heed were given to these wise and weighty counsels.

(4) *Church Government and Discipline.*—Two treatises on these subjects proceeded from the Westminster Assembly. The preparation of the former, to which it set itself shortly after subscribing the Covenant, was attended with many difficulties. It was entitled by its framers *Propositions concerning Church Government*, but it is now generally known as the *Form of Church Government*, and under this title it is still printed, along with Scotch editions of the Confession of Faith. The greater part of it had been drawn up before Feb., 1645, and the same month was presented apparently in manuscript to the Scotch Assembly, which approved of it as far as then completed, with certain reservations, and agreed to carry it out in practice as soon as it should be ratified without substantial alteration by the English Parliament. It never was so ratified. The

best friends of Presbytery in England became satisfied that they must be contented to get the assent of their countrymen to their system as one that was lawful and agreeable to the word of God, and that could be justified by considerations of reason and expediency in many details for which divine warrant could not be claimed. Urged by these and the friends of comprehension generally, the Assembly set itself in 1645 to prepare its "Directory for Church Government" and discipline. Henderson took special interest in the preparation of this, and furnished, in part at least, its materials, and all the Scotch commissioners assented to it. To a large extent it was adopted by the English Parliament in 1648 in their "Ordinance as to the Form of Church Government." It was printed in Scotland in 1647, and reprinted, along with Henderson's *Form and Order of the Government of the Church of Scotland*, in 1690, and use was made of it in drawing up the *Form of Process* in the Church of Scotland in 1707, but it was never formally approved of, nor is it so well known as it deserves to be.

ALEX. F. MITCHELL.

**West Mitch'ell,** p.-v., Mitchell co., Ia.

**West Monroe',** p.-v. and tp., Oswego co., N. Y. P. 1304.

**West'more,** p.-v. and tp., Orleans co., Vt. P. 412.

**West'moreland,** county in the northern part of England, comprises an area of 758 sq. m., with 65,005 inhabitants. The surface is mountainous, the mountains, of which some rise over 3000 feet, alternating with moorland, heath, and lakes. Useful minerals abound, and coal, lead, and copper mines are worked. Agriculture is in a backward state and of small consequence; the rearing of sheep and geese is one of the principal occupations. Manufactures of woollens are carried on.

**Westmoreland,** the easternmost county of New Brunswick, bounded N. E. by Northumberland Strait, and on the S. E. reaching to Chignecto Bay. It is generally very fertile and well cultivated, and is traversed by Intercolonial Railway. Cap. Dorchester. P. 29,335.

**Westmore'land,** county of S. W. Pennsylvania, bounded N. W. by Alleghany River, watered by many of its affluents, skirted along its N. border by Pennsylvania Canal, and traversed by Pennsylvania, Pittsburg Washington and Baltimore, and Alleghany Valley R. Rs. The S. E. part is mountainous, with an unproductive soil; the other parts are hilly, but fertile. Bituminous coal, iron ore, and salt are plentiful throughout. There are flour-mills, saw-mills, planing-mills, numerous tanneries and currying establishments, distilleries, and manufactories of agricultural implements, carriages, saddlery, iron castings, railway cars, brick, paper, and woollen goods. Horses, cattle, and sheep are very numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Greensburg. Area, 1040 sq. m. P. 58,719.

**Westmoreland,** county of E. Virginia, separated from Maryland by Potomac River, and occupying a part of the peninsula between the Potomac and the Rappahannock. The surface is diversified by hills and valleys, and the soil along the streams is very fertile. In this county were born many men noted in American history, among whom are George Washington, James Monroe, and the entire Lee family of Virginia, including Robert E. Lee, the Confederate commander in the civil war. Staples, Indian corn, wheat, oats. Cap. Montross. Area, 316 sq. m. P. 7682.

**Westmoreland,** p.-v. and tp., Cheshire co., N. H. P. 1256.

**Westmoreland,** p.-v. and tp., Oneida co., N. Y. P. 2952.

**Westmoreland** (JOHN **Fane**), D. C. L., ELEVENTH EARL OF, and BARON BURGHERSH, b. in England Feb. 3, 1784, son of John, the tenth earl (1759–1841), who was lord lieutenant of Ireland 1790–95 and lord privy seal 1798–1806; entered the army 1803; participated in the passage of the Dardanelles by Admiral Duckworth 1806, and in the storming of Rosetta, Egypt, 1807; joined the army in the Peninsula 1808; was at the battles of Vimeira and Talavera; served as aide-de-camp to Wellington and as military commissioner to the head-quarters of the allies Sept., 1813; took part in the invasion of France 1814; was minister at Florence Aug., 1814; served in the campaign against Naples 1815; became a privy councillor 1822; minister at Berlin 1841, and at Vienna 1851; was raised to the full rank of general 1854, and was special plenipotentiary at the Congress of Vienna for the consideration of the "Eastern question," Feb. to Nov., 1855. D. at Apthorpe House, London, Oct. 16, 1859. He left in MS. a work on *The Great European Congresses.*

**Westmoreland** (RALPH **Neville**), FIRST EARL OF, b. in England about the middle of the fourteenth century; was an able military commander and a shrewd politician, displaying great dexterity in maintaining himself in power in a time of frequent revolutions; promoted the downfall of the duke of Gloucester, and was created earl by Richard II. 1397; joined Henry of Lancaster (Henry IV.) July, 1399, and was by him made earl-marshal of England and governor of the Tower of London; was subsequently lord warden of the Scotch Marches; filled other high offices of state, and was captor of Mowbray, earl of Nottingham, and of Scrope, archbishop of York, May, 1405. D. Oct. 21, 1425.—His second son, RICHARD (b. 1400), became earl of Salisbury 1442; was the most prominent of the early Yorkist leaders, and was beheaded at Pontefract after the battle of Wakefield (Jan. 1, 1461); and his grandson, RICHARD, was the celebrated "Kingmaker." (See WARWICK, EARL OF.)—CHARLES NEVILLE, head of the family in the time of Queen Elizabeth, was associated with the earl of Northumberland in his attempted insurrection of 1569 in favor of the queen of Scots.

**West Mount Ver'non,** v., East Chester tp., Westchester co., N. Y. P. 1200.

**West Nant'meal,** tp., Chester co., Pa. P. 1070.

**West New Brigh'ton,** p.-v., Richmond co., N. Y., on the S. side of Kill Van Kull, opposite Bergen Point, N. J., contains 4 churches, good schools, a paper-hanging factory, the New York dyeing and printing establishment, the largest of its kind in the U. S.; the New York fancy dyeing establishment, 1 newspaper, and 1 horse-railway.

J. J. CLUTE, ED. "NORTH SHORE ADVOCATE."

**West New'bury,** p.-v. and tp., Essex co., Mass. P. 2006.

**West New'ton,** p.-v., Middlesex co., Mass.

**West Newton,** p.-v. and tp., Nicollet co., Minn. P. 703.

**West Newton,** p.-b., Westmoreland co., Pa. P. 992.

**West North'field,** p.-v., Franklin co., Mass.

**West Not'tingham,** tp., Chester co., Pa. P. 879.

**West'on,** p.-v., York co., Ont., Canada, on Grand Trunk, Canada Northern, and Toronto Grey and Bruce railways, 9 miles W. of Toronto, has a large grain-trade. P. about 1300.

**Weston,** p.-v. and tp., Fairfield co., Conn. P. 1054.

**Weston,** v., Webster co., Ga. P. 66.

**Weston,** p.-v., McLean co., Ill., on Toledo Peoria and Warsaw R. R., has 4 churches, good schools, and 3 grain warehouses. The neighboring section is well adapted to the cultivation of corn. P. 250.

R. M. SPURGIN, ED. "YE LOCAL."

**Weston,** p.-v. and tp., Aroostook co., Me. P. 394.

**Weston,** p.-v. and tp., Middlesex co., Mass. P. 1261.

**Weston,** p.-v. and tp., Platte co., Mo., on Kansas City St. Joseph and Council Bluffs R. R., and on Missouri River, 3 miles from Fort Leavenworth, contains 9 churches, a handsome public school, 1 newspaper, 1 furniture-factory, 1 brewery, a pork-packing establishment, 2 banks, 3 saw-mills, and excellent water-power. P. of v. 1614; of tp. 2453.

**Weston,** tp., Johnson co., Neb. P. 192.

**Weston,** p.-v. and tp., Wood co., O. P. 1833.

**Weston,** p.-v., Collin co., Tex. P. 157.

**Weston,** p.-v. and tp., Windsor co., Vt. P. 931.

**Weston,** p.-v., cap. of Lewis co., West Va., 81 miles from Charlestown, has 4 churches, 1 academy, 1 bank, 1 newspaper, a hospital, and 4 hotels. Business, mechanical pursuits. P. 1111. J. W. WOFFINDIN, ED. "DEMOCRAT."

**Weston,** tp., Clark co., Wis. P. 500.

**Weston,** p.-v. and tp., Dunn co., Wis. P. 339.

**Weston,** tp., Marathon co., Wis. P. 265.

**Weston** (HENRY G.), D. D., b. Sept. 11, 1820, at Lynn, Mass.; graduated at Brown University in 1840; entered the Baptist ministry; preached in Peoria, Ill., and in New York City, and has been since 1868 president of Crozer Theological Seminary, Upland, Pa, and editor of *Baptist Quarterly Review.*

**Weston** (Sir RICHARD), b. at Sutton, Surrey co., England, about 1580, was sent by James I. as ambassador to the elector-palatine and king of Bohemia 1619, and by his example and his pen "laid the foundation of the improved agriculture of Britain." D. about 1650. Author of *The Discourse of Husbandry used in Brabant and Flanders* (1645), published under the name of "Samuel Hartlib," and of *Brief Discoveries of Ways and Means for Manuring and Improving Land* (1646).

**Weston** (STEPHEN), b. at Exeter, England, in 1747; educated at Eton and at Exeter College, Oxford, of which

he became a fellow; took orders in the Church of England, and held the livings of Mamhead (1777–90) and Little Hempston, Devonshire (1786–90), after which he devoted himself to travels on the Continent and to literature, being distinguished as a classical and Oriental scholar. D. in London Jan. 8, 1830. He published translations from the Chinese and Persian, *Specimen of the Conformity of the European with the Oriental Languages* (1802), *Specimen of a Chinese Dictionary* (1812), and several works of travel and biblical criticism.

**Weston** (THOMAS), b. in England about 1575; became a merchant in London; advanced £500 to the agents of the Leyden Pilgrims 1620 when fitting out the Mayflower expedition, but soon abandoned his connection with them as unprofitable, and personally commenced in 1622 another settlement at Wessagussett under a grant given by the king to Sir Ferdinando Gorges. His settlers were improvident, and soon had to be supported by the Pilgrims at Plymouth, and most of them, like Weston himself, soon returned to England.

**Weston** (WILLIAM), b. in England about 1700; graduated at and became fellow of St. John's College, Cambridge; took orders in the Church of England, and was many years rector of Campden, Gloucestershire, England, where he d. in 1760. Author of a learned work, *An Enquiry into the Rejection of the Christian Miracles by the Heathens* (Cambridge, 1746), which involved him in a polemic with Richard Hurd; of *Dissertations on some of the Most Remarkable Wonders of Antiquity* (1748), and other treatises.

**West Or'ange,** tp., Essex co., N. J. P. 2106.

**West'over,** p.-v., Somerset co., Md.

**West Penn,** p.-v. and tp., Schuylkill co., Pa. P. 1980.

**West Penns'borough,** tp., Cumberland co., Pa. P. 2180.

**West Per'ry,** tp., Snyder co., Pa. P. 585.

**Westpha'lia,** province of Prussia, bounded by Rhenish Prussia, Holland, Hanover, Brunswick, Hesse, and Nassau, comprises an area of 7848 sq. m., with 1,775,175 inhabitants, of whom 806,464 are Protestants and 949,118 Roman Catholics. The surface is a low plain in the eastern part of the province, more elevated and hilly toward the N. and W. The soil is fertile and very well cultivated. Wheat, rye, barley, oats, potatoes, and excellent flax, hemp, and hops are raised; coal, iron, lead, copper, and salt are produced, and an important manufacturing industry carried on, especially in articles of iron, steel, flax, and wool. It became a Prussian province in 1815 at the Congress of Vienna.

**Westphalia,** p.-v. and tp., Clinton co., Mich. P. 1499.

**Westphalia,** p.-v., Osage co., Mo.

**Westphalia, Treaty of,** in 1648, put an end to the THIRTY YEARS' WAR (which see).

**West Pike'land,** p.-v. and tp., Chester co., Pa. P. 1201.

**West Pike Run,** tp., Washington co., Pa. P. 1252.

**West Pitts'ton,** b., Luzerne co., Pa. P. 1416.

**West Plains,** p.-v., Howell tp., cap. of Howell co., Mo. P. 130.

**West Point,** p.-v., Troup co., Ga. P. 1405.

**West Point,** tp., Stephenson co., Ill. P. 2602.

**West Point,** p.-v., Wayne tp., Tippecanoe co., Ind. P. 246.

**West Point,** tp., White co., Ind. P. 611.

**West Point,** tp., Butler co., Ia. P. 320.

**West Point,** p.-v. and tp., Lee co., Ia. P. of v. 794; of tp. 1894.

**West Point,** p.-v., Hardin co., Ky. P. 206.

**West Point,** p.-v., cap. of Colfax co., Miss., on Mobile and Ohio R. R., has 5 churches, fine public buildings, 2 colleges, 1 bank, 1 newspaper, 2 hotels, 1 wagon and carriage factory, and 2 large mills. Principal business outside of village, cotton-growing. P. about 2500.

D. L. LOVE, ED. "SOUTHERN ADVERTISER."

**West Point,** p.-v., cap. of Cuming co., Neb., on Sioux City and Pacific R. R., contains good schools, 2 banking-houses, 1 newspaper, woollen, paper, and grist mills, 1 foundry, a furniture-factory, 2 carriage establishments, 2 lumber-yards, 1 brewery, an elevator, stock-yards, and 3 hotels. P. 520. C. F. BAYHA, ED. "REPUBLICAN."

**West Point,** v., Rio Virgin tp., Lincoln co., Nev. P. 138.

**West Point,** a military post and the seat of the U. S. Military Academy, is on the W. bank of the Hudson River, between the towns of Highlands and Cornwall, Orange co., N. Y., 52 miles from New York City and 94 miles from Albany. The river, bending a little at Newburg, thence flows nearly due S. through a gorge between abrupt and lofty hills for about 8 miles, then turns suddenly to the E. for about one-fourth of a mile, and as suddenly resumes its southward course, leaving West Point in the southern angle of the bend and in the midst of the Highlands of the Hudson. The eastern side of the Point is a nearly straight, precipitous shore, while the northern side, curving so as to form a bay at its western extremity, has a comparatively gentle slope, and commands a fine view up the river. On the north-western part of this slope is Camp Town, containing barracks for soldiers, storehouses, etc. Farther N., at the extremity of a plain called the German Flats, is the cemetery, the burial-place of many distinguished officers of the army, including Gen. Scott; and still a little to the N. is Washington's Valley, where stood the house occupied by Washington in 1779. The Military Academy is situated on a level plateau 160 feet above the river, flanked on the W. by rocky heights, of which that on which stand the ruins of Fort Putnam is the nearest and most prominent. On the S. the heights approach the river, leaving only room for a road southward, leading to the village of Highland Falls and to Forts Montgomery and Clinton. A road westward over the mountains leads to Newburg and the surrounding country. The principal buildings of the Academy are at the southern end of the plateau; the quarters of the officers and professors are on the W. side and along the roads leading southward and westward. In the northern angle of the bend, opposite the Point, is Constitution Island, a rocky mass rising 130 feet above the river, connected by a broad marsh with the E. bank. Just N. of the island are the West Point Foundry and the village of Cold Spring; farther N. rises the lofty Bull Hill, with Breakneck in the distance. N. W. of the Point, on the W. side of the river, are Crow Nest and Butter Hill, and beyond is the town of Newburg at the extremity of the upper reach of the river, which viewed from West Point appears like a mountain-lake. On the same side of the river, 1½ miles S. of the Point, is the village of Highland Falls, and 4½ miles farther S., on Pooplopen's Creek, are the ruins of Forts Montgomery and Clinton. Six miles still farther S. is the memorable Stony Point. E. of West Point, on the opposite bank, is a high, narrow, nearly level plain, from which there is a gradual rise to the hills beyond. Near the southern end of this plain, about 2 miles below the Point, still stands the Robinson House, Arnold's head-quarters. Just beyond is Sugar-loaf Hill, and farther to the S., projecting into the river, Anthony's Nose. One mile S. of the Nose was Fort Independence. Verplanck's Point is nearly opposite Stony Point, with which it is connected by King's Ferry.

The government tract of land at West Point contains about 2100 acres, most of which was purchased in 1790 from the son of one of the original patentees; the rest was purchased in 1824. Jurisdiction was ceded by New York to the U. S. over a part of the tract in 1826, and over the remainder in 1875.

In the war of the Revolution, to obtain control of the navigation of the Hudson, which gave a very important line of communication from New York City to Canada and Western New York, and thereby to separate the eastern part of New York and the whole of New England from the rest of the colonies, was a favorite project of the British. To thwart this project by obstructing the navigation of the river, and retaining the control of at least a portion of it, was the object which the colonies sought to attain by strongly fortifying and occupying the Highlands through which the river flows for several miles. The importance of West Point as a military position for this purpose, at first not appreciated, eventually became capital. The first fortifications were commenced on Constitution Island and at Forts Montgomery and Clinton on Pooplopen's Creek in 1775. These were taken and demolished by the British advancing from New York City in 1777, but were abandoned by them after the surrender of Burgoyne's army. The subject of again fortifying the Highlands received immediate attention, and West Point having been recommended by a commission as the best place to obstruct the navigation of the river, fortifications were here commenced early in 1778 under the supervision of Gen. Putnam, with Lieut.-Col. Radière as engineer. From this time forward great exertions were made to complete and strengthen the works. The Polish hero Kosciusko relieved Radière as engineer at this place Mar. 26, 1778. At the time of Arnold's treason in 1780 these works, though unfinished, had cost more than two years' labor of the army and $3,000,000. The place was esteemed of great strength, secure against any army the British were able to bring against it. The fortifications were never fully completed, although work upon them was continued until 1794. The principal of

these were Fort Putnam, commanding the plateau and the other works; Forts Webb, Wyllis, and Meigs, on eminences nearer the river; and Fort Clinton, at the north-eastern angle of the plateau. There were also several additional redoubts and batteries at various important points, and a strong boom and chain stretched across the river from the Point to Constitution Island. Both sides of the river were occupied by the army. To the command of this most important post some of the most distinguished officers were at different times assigned; among whom were Gens. Clinton, Putnam, Parsons, McDougall, Heath, Howe, Greene, and Knox. Washington himself established his head-quarters here in 1779, and with La Fayette and other officers often visited the place. He was here present at the celebration of the birth of the dauphin of France, May 31, 1782. Arnold took command Aug. 5, 1780, and continued negotiations already commenced with the British to betray his trust. It is quite probable that the success of the plot, and consequent loss of West Point, would have been fatal to the cause of the colonies. The interview between Arnold and André to arrange the details of the plot took place Sept. 22, 1780, on the W. bank, about 2½ miles below Stony Point. André was captured the next day on the E. bank, while attempting to return to New York. He was taken to West Point on the 26th, where he remained until the 28th. On the morning of the 25th, Arnold, while seated at the breakfast-table at the Robinson House, with two of Washington's aides who had been sent forward to announce the arrival of the chief, received the note announcing the capture of André. Feigning a pretext, he at once left the table and the house, dashed down the river-bank, and taking a boat succeeded in reaching the British war-vessel, the Vulture.

The ruins of the principal fortifications are still to be seen. Fort Clinton has been partially restored; Fort Putnam, though in ruins, still looks down upon the river and plain beneath, and from its summit may be had an extensive view of this interesting locality. Within the parapet of Fort Clinton stands a monument sacred to Kosciusko, and on the E. side of the plain, a secluded spot, a shelf of the precipice, known as Kosciusko's Garden, is said to have been his favorite resort while engineer of the works at this place. Placed in the midst of attractive scenery, comparatively isolated from the surrounding country, and favorably situated for retirement and study, hallowed by the footsteps of Washington, La Fayette, and other heroes of our Revolution, associated with some of the most stirring events of our national history, West Point may well be the place consecrated to training the youth of the nation for the military service of their country. (For further information see Boynton's *History of West Point.*) (See MILITARY ACADEMIES.)

GEORGE L. ANDREWS.

**West Point,** p.-v., Cornwall tp., Orange co., N. Y., on Hudson River, 49 miles N. of New York, is the seat of the U. S. Military Academy. P. 942.

**West Point,** p.-v. and tp., King William co., Va., on Richmond York River and Chesapeake R. R., 38 miles E. of Richmond, and 35 miles from Chesapeake Bay, has good schools, 1 newspaper, a steamboat line to Baltimore, 2 hotels, 1 mill. P. 2193.

S. ROSZEL DONOHOE, ED. "STAR."

**West Point,** p.-v. and tp., Columbia co., Wis. P. 949.

**West'port,** p.-v. and tp., Fairfield co., Conn. P. 3361.

**Westport,** p.-v. and tp., Lincoln co., Me. P. 699.

**Westport,** p.-v. and tp., Bristol co., Mass. P. 2724.

**Westport,** tp., Pope co., Minn. P. 238.

**Westport,** city and tp., Jackson co., Mo. P. of city, 1095; of tp., exclusive of city, 1051.

**Westport,** p.-v. and tp., Essex co., N. Y. P. 1577.

**Westport,** tp., Dane co., Wis. P. 1589.

**West Prov'idence,** tp., Bedford co., Pa. P. 970.

**Westra'lia,** v. and tp., Montgomery co., Kan. P. of v. 104; of tp. 1117.

**West Ran'dolph,** p.-v., Orange co., Vt., on Central Vermont R. R., 25 miles S. of Montpelier, has 10 churches, an academy and normal school, 1 bank, 1 newspaper, and 4 hotels. P. 3000.

LEWIS P. THAYER, ED. "GREEN MOUNTAIN HERALD."

**West Ridg'way,** v., Boke's Creek tp., Logan co., O. P. 100.

**West Riv'er,** tp., Randolph co., Ind. P. 1612.

**West River,** p.-v., Anne Arundel co., Md.

**Wes'tropp** (HODDER M.), b. in England about 1825; studied art in Italy, giving especial attention to religious archæology; is author of *Epochs of Painted Vases, an Introduction to their Study* (1856), of *A Handbook of Archæology, Egyptian, Greek, Etruscan, and Roman* (1867), and, with C. Staniland Wake, of *Ancient Symbol-Worship—Influence of the Phallic Idea in the Religions of Antiquity* (London, 1873), which was edited in New York, with an *Introduction, Additional Notes, and an Appendix* (1874), by Alexander Wilder, M. D.

**West Rox'bury,** formerly a township in Norfolk co., Mass., but in 1873 annexed to Boston. P. 8683.

**West Rush'ville,** p.-v., Richland tp., Fairfield co., O. P. 185.

**West Rut'land,** p.-v., Rutland co., Vt.

**West St. Paul,** p.-v. and tp., Dakota co., Minn. P. 1103.

**West Salaman'ca,** p.-v., Cattaraugus co., N. Y.

**West Sa'lem,** p.-v., Wayne co., O., on Atlantic and Great Western R. R., has 4 churches, a fine school building, 1 bank, 1 newspaper, flax and grist mills, 2 brickyards, 1 grain-elevator, 1 tannery, a foundry, a lumber-yard, and 2 hotels. Principal business, farming, dairying, stock-raising. P. 713. F. G. MCCAULEY, ED. "BUCKEYE FARMER."

**West Salem,** tp., Mercer co., Pa. P. 2082.

**West Salem,** p.-v., La Crosse co., Wis.

**West Sand Lake,** p.-v., Rensselaer co., N. Y. P. 315.

**West Sen'eca,** p.-v. and tp., Erie co., N. Y. P. 3196.

**West Shenan'go,** tp., Crawford co., Pa. P. 357.

**West Spar'ta,** tp., Livingston co., N. Y. P. 1244.

**West Spring'field,** p.-v. and tp., Hampden co., Mass. P. 2606.

**West Stock'bridge,** p.-v. and tp., Berkshire co., Mass. P. 1924.

**West Swan'zey,** p.-v., Cheshire co., N. H.

**West'town,** tp., Chester co., Pa. P. 818.

**West Town'send,** p.-v., Middlesex co., Mass.

**West Town'ship,** p.-v., Albany co., N. Y.

**West Troy,** p.-v., Albany co., N. Y., on Hudson River, opposite Troy, with which it is connected by an iron bridge and two steam-ferries, and on Rensselaer and Saratoga R. R., 6 miles N. of Albany. It is at one of the entrances of the Erie and Champlain canals into the Hudson, at the head of navigation, and connected by river and canals with Lakes Erie, Ontario, and Champlain. It is wholly built on the bottom-lands of the Hudson, extending back nearly a mile from the river to a slight elevation, on which are situated some of the most beautiful residences in the town. Its streets are finely laid out, and a company has been formed with a capital of $200,000 to supply the village with water from the Mohawk River. West Troy has 9 churches, a national bank, and 1 newspaper. A tract of land near the centre of the village has been appropriated for the erection of buildings suitable for a public market, which will be erected during the summer of 1876. It is the largest village in New York, and several attempts have been made to obtain a city charter, annexing to it the neighboring village of Green Island, but they have all signally failed through the opposition of the citizens of the two towns. Its principal business is in lumber, which is brought from Michigan by way of the lakes and Erie Canal. Its citizens are also extensively engaged in the manufacture of bells, patent car-boxes, Scotch woollen shawls, butts and hinges, horse cars, lime and cement, stoves and hollow-ware, and many other manufacturing interests. The Watervliet U. S. arsenal and grounds, established in 1807 by a grant of the land by the State to the U. S. government, containing 105 acres, is situated here. The grounds are finely laid out, and contain many fine buildings, including the officers' residences, magazines, the arsenal building, iron and artillery storehouses. The village has a very efficient fire department. The Watervliet horse-car railroad connects it with Albany. P. 10,693.

ALLEN COREY, ED. "ALBANY COUNTY DEMOCRAT."

**West Tu'rin,** tp., Lewis co., N. Y. P. 2111.

**West U'nion,** p.-v. and tp., cap. of Fayette co., Ia., on Milwaukee division of Burlington Cedar Rapids and Minnesota R. R., has 5 churches, 1 bank, a good school, 2 newspapers, 1 flouring-mill, 1 wagon-factory, and 3 hotels. Excellent farming and grazing country. P. of v. 1489; of tp. 2032. C. H. TALMADGE, ED. "GAZETTE."

**West Union,** p.-v. and tp., Todd co., Minn. P. 307.

**West Union,** p.-v. and tp., Steuben co., N. Y. P. 1264.

**West Union,** p.-v., Tiffin tp., cap. of Adams co., O. P. 486.

**West Union,** p.-v. and tp., cap. of Doddridge co., West Va., on Parkersburg branch of Baltimore and Ohio R. R., 54 miles E. of Parkersburg, contains 3 churches, a graded school, court-house, jail, 2 weekly newspapers, 1

flouring and 1 saw mill, and 1 hotel. Principal trade, lumber, staves, hoops, coal, and country produce. P. 1128.
DAVID GOSORN, ED. "BAPTIST MESSENGER."

**West U'nity,** p.-v., Brady tp., Williams co., O. P. 537.

**West Up'ton,** p.-v., Worcester co., Mass.

**West Vien'na,** p.-v., Oneida co., N. Y. P. 113.

**West'ville,** p.-v., Pictou co., N. S., 14 miles S. from Pictou, has extensive and valuable coal-mines. Coal-Mines R. R. Station is 2 miles distant. P. about 1000.

**Westville,** tp., Dale co., Ala. P. 1014.

**Westville,** p.-v., New Haven co., Conn.

**Westville,** p.-v., Laporte co., Ind.

**Westville,** p.-v., cap. of Simpson co., Miss., 13 miles from Pearl River, has 1 church, 2 schools, fine court-house, 1 newspaper, 1 tannery, 1 hotel, and 2 mills. Principal business, farming. P. 100. J. L. MEADE, ED. "NEWS."

**Westville,** tp., Franklin co., N. Y. P. 1658.

**Westville,** tp., Matthews co., Va. P. 2476.

**Westville City,** p.-v., Laporte co., Ind. P. 640.

**West Vin'cent,** p.-v. and tp., Chester co., Pa. P. 1256.

**West Virgin'ia,** one of the central States of the American Union, set off from Virginia in 1863, including a portion of the Appalachian Valley, the western slope of the Appalachian range, and a part of the upper valley of the

Obverse.




Reverse.




The Seal of West Virginia.

Ohio. It lies between the meridians of 77° 40′ and 82° 35′ W. lon. from Greenwich, and, including the "Panhandle," between the parallels of 37° 6′ and 40° 40′ N. lat. It is the most irregular State in form in the Union, and is thought, perhaps fancifully, to bear a rude resemblance to a tortoise, the "Panhandle" being the stiffly-projecting tail, McDowell co. the rounded head, and the counties lying on and near the Potomac its hind feet and claws. It is bounded on the N. W. by Ohio; on the N., N. E., and E. N. E. by Pennsylvania and Maryland; on the E., S. E., and S. by Virginia; and on the S. W. by Virginia and Kentucky. Its area is estimated at 23,000 sq. m., or 14,720,000 acres.

*Topography and Physical Geography.*—The counties lying on the Potomac River, especially Berkeley and Jefferson, form a part of the Shenandoah Valley or Valley of Virginia, somewhat elevated, but very fertile, and drained by the Shenandoah, Opequan Creek, and other smaller affluents of the Potomac. W. of these, Morgan, Hampshire, Mineral, Grant, Hardy, and Pendleton cos. are all drained by tributaries of the Potomac, but form portions of the "Appalachian Country" described under Virginia. They consist of high mountain-ridges, with narrow but fertile valleys between, sloping to the N. E., and belonging strictly to the Potomac River system. W. of these, but adjacent to them, and extending in a narrow belt S. W. to the Big Sandy River, lies what the West Virginia geologists call "the Mountain Region," forming the western ridges of the Appalachian chain, the mountains lying in nearly parallel folds, capped originally with a hard sandstone, but having softer and more easily-eroded rocks beneath. So sharp were some of these anticlinals that the sandstone at the summit was rent and fissured, and the torrents of rain and snow, forcing their way through, dissolved and broke down the underlying shales and limestones, and carved for themselves deep cañons, through which they forced their way to the larger streams emptying into Monongahela and Cheat rivers. Some of these cañons are nearly 1000 feet deep. From the western border of this Mountain Region stretches to the Ohio a much wider tract, called by the geologists "the Hilly Region," though some of its summits are higher than any in the Mountain Region, except Panther Knob in Pendleton co., which is said to be 4000 feet, and Haystack Knob, near the line of Pocahontas and Randolph cos., which is 3800 feet. More than twenty of the summits of the so-called Hilly Region rise from 2200 to 3700 feet. In this region the streams flow from E. to W., and carry their waters directly to the Ohio. The hills and river-valleys have generally an E. to W. direction, and where they do not, the rivers cross them in deeply-eroded valleys and cañons. One of these, the cañon of New River, is nearly 500 feet deep. Many of these valleys have sharp, abrupt, almost perpendicular sides, and no alluvial bottom-lands; others slope more gently, with a considerable breadth of alluvium at their bases, and the summits are flat-topped, gently-undulating plains. This region slopes moderately to the Ohio River, and along its banks has an elevation of from 550 to 700 feet above tide-water. This region is drained by Fishing Creek, Middle Island Creek, the Little Kanawha, the Great Kanawha, the Guyandotte, the Big Sandy and its eastern branch, the Tug Fork. There are no considerable lakes in West Virginia, but its cañons, its deeply-eroded valleys, and its undermined strata make the State attractive to travellers from its numerous objects of interest.

*Geology and Mineralogy.*—The only Eozoic rocks in the State are those on the eastern edge of Jefferson co., the most eastern county of the State. Next to these, both in geological order and in the order of its occurrence, are the Lower Silurian limestone, and the Hudson River shales which overlie it in Jefferson and Berkeley cos. This is followed by the Medina sandstone, the hard and massive sandstone which forms the crowning summit-rocks of the Mountain Region, and which produces the arches and natural bridges of that region by the erosion of the softer strata beneath it. The Clinton and Onondaga groups, soft slates and shaly sandstones, come next in order, are easily disintegrated, and form the surface-rocks of Hampshire and Hardy cos. The Lower Helderberg limestone overlies the last-mentioned groups in several counties, and furnishes the needed element of lime to the soils. The Oriskany sandstone, another hard and firm sandstone, forming some of the arches and natural bridges, like those at the Hanging Rocks near Romney, is the crowning rock of the summits of the western ridges of the Mountain Region, while the Hamilton and Portage groups, soft shales and clay-slates, overlie the sandstone on the mountain-slopes and valleys, the region about the White Sulphur Springs in Greenbrier co. and for some distance N. being mainly composed of them. They are the normal deposits for mineral springs from the amount of iron pyrites, carbonaceous and other salts which they contain, as well as from their contorted and broken condition. Next above these come the Chemung and Catskill groups, soft sandstones and shales, the Chemung group predominating in West Virginia. Leaving with these the Devonian system, we come to the sub-Carboniferous, which is developed here, according to Prof. Rogers's nomenclature, in the Vespertine and Umbral strata, the former consisting of coarse sandstone and conglomerates, of a finer and harder sandstone, and of red crumbling shales; the latter of a dark bluish limestone and clayey sandstones and shales of a deep-red color. These strata occupy a narrow tract in the N., and spread out in the lower counties into a broad area, overspreading most of Greenbrier, Pocahontas, Summers, Mercer, and Monroe cos. The Umbral strata when broken down produce an excellent soil. The next formation, the Carboniferous, overspreads all the remainder of the State, the Appalachian coal-field covering 16,000 sq. m. in the State. The river-bottoms are, indeed, generally diluvial or alluvial, but high

up the steep cliffs and cañons which line their banks the coal in bands of from 8 to 16 feet in thickness crops out. This Appalachian coal-field forms an immense basin, of which West Virginia comprises more than half the breadth, and Ohio and Eastern Kentucky about two-fifths, the Ohio River passing through the basin a little W. of its middle line, and finally penetrating its western edge. In this basin (and within the limits of West Virginia) are found every one of the coal-deposits except anthracite lying between the conglomerate which underlies the lower coal-measures, and the Permian rocks which cap the upper coal-measures. Among these are every quality of cannel, splint, coking, block, and bituminous coals yet discovered, and all of them in thick and easily-worked veins. Throughout this whole region iron ores, red and brown hæmatite, black manganiferous carbonates, black band, red and brown oxides, protocarbonate or Olyphant blue lump, and other ores abound in veins easily worked, and accompanied by limestone and other fluxes, which make the production of iron very much cheaper than elsewhere. Salt also, a usual deposit in the coal-measures, is found here in springs of great strength and purity of brine, and at numerous points on the Great Kanawha, Little Kanawha, New, Big Sandy, and Elk rivers and Otter Creek there are saltworks, some of them of great extent. The Kanawha salt has the very highest reputation in the market, being more free from sulphate of lime, more pungent and penetrating in its action, and from its greater strength more economical, than any other salt. The production has ranged for many years past at from 1,000,000 to 3,000,000 bushels per year. Petroleum, both the light and heavy oils, is largely produced in the State, there being 292 producing wells of the former, and over 100 of the latter. Common tufa, hydraulic, and building limestones of great beauty, and other building-stones, especially the Mahoning sandstone, a beautiful gray and fine sand or free stone, fire-clay, potter's clay, glass-sand, ochre, barytes, black oxide of manganese, saltpetre are found abundantly, and zinc, copper, and lead in moderate but not profitable working quantities. The mineral springs of West Virginia include the larger portion of the Virginia springs which have been so famous for more than a hundred years, as well as several new springs of considerable merit. They comprise sulphur waters of differing composition—chalybeates simple and compound, acidulous or carbonated, saline and aluminated chalybeates. Several of them are thermal waters, the highest having a temperature of about 107° F. They are situated in Morgan, Jefferson, Hampshire, Monroe, Fayette, and Greenbrier cos., by far the larger number being in the last-named county.

*Soil, Vegetation, and Botany.*—The soils of the State may be classed as *clay soils*, containing 75 per cent. or more of clay, stiff, and not very productive, found in limited areas in the eastern and southern portions of the State; *sandy soils*, containing 75 per cent. or more of sand, not productive, and occurring mainly in the N. E. mountain counties; *loams*, containing about equal quantities of clay and sand, and 25 per cent. or more of humus or vegetable matters; these are very productive and often enriched by the disintegration of the shales or limestones which crop out from the surface; the greater part of the coal-measures are covered by these soils; *calcareous soils*, in which lime forms a large constituent; these are excellent soils, and are found on the mountain-slopes and in some of the higher valleys; *stream and upland alluviums*, found in the river-bottoms and in the valleys and on the gentler slopes of the mountains; these possess wonderful fertility and yield immense crops, or, where they are covered with forests, the most gigantic trees. The principal forest trees are the white, black, or water, blue, green, and mountain ash (the latter not really an ash at all); the aspen, beech, water-beech, black and red birch, fetid and sweet buckeye; cedar, wild-cherry, chestnut, Kentucky coffee tree, cottonwood, cucumber tree, dogwood, negundo or box elder, red or slippery, white, and witch elm; black and southern balsam, fir, and the hemlock spruce; the black or sour gum and the sweet gum or liquid-amber; three species of hickory; the white, red, and bitter nut; the holly, hackberry, and ironwood or hop hornbeam; the red, green, white, and honey locust; the linden; the sugar, silver, and red maple; red mulberry; twelve species of oak, three of pine; the poplar or tulip tree; the red-bud, the sassafras, sour-wood, and sycamore; black walnut and butternut; the mountain and smooth alder; crab-apple, chinquapin, elder, persimmon, magnolia, haw, mountain-laurel, rhododendron, shadbush, spice-wood, and all the species of sumach, and the bush or shrub willows and osiers. West Virginia abounds in medicinal plants, some of them not found elsewhere. Over 9,000,000 acres of land in the State are in the original forest.

*Zoology.*—The wild animals of the State are those common to the Appalachian range of mountains. They include the panther, wild-cat, lynx, wolf, black bear, raccoon, opossum, ground-hog, etc.; the elk, deer, rabbit, and hare; squirrels of several species, and the smaller rodents; the beaver, mink, and muskrat, weasel, skunk, etc.; and among game-birds the wild-turkey, two or three species of grouse, snipe, woodcock, etc.

*Climate.*

| Meteorological Data. | Wheeling, lat. 40° 4.1′, lon. 80° 43′ 6″; elev., 675 feet. | Kanawha Salines, lat. 38° 16′, lon. 81° 33′30″; elev., abt. 570 feet. | Lewisburg, lat. 37° 50′, lon. 80° 27′; elev., abt. 2234 feet. | Morgantown, lat. 39° 36′, lon. 79° 52′; elev., 991.23 ft. | Marietta, Ohio, lat. 39° 24′ 30″, lon. 81° 29′; elev., abt. 580 feet. |
|---|---|---|---|---|---|
| *Temperature.* | ° | ° | ° | ° | ° |
| Mean annual temp.... | 52.08 | 54.72 | 52.22 | 52.70 | 52.46 |
| Highest temp. of year | 104 | 99 | 98 | 97 | 102 |
| Lowest " " | −15 | −4 | −5 | −1 | −23 |
| Range of " " | 119 | 103 | 103 | 98 | 125 |
| Mean temp. of spring | 51.00 | 53.77 | 51.79 | 50.23 | 52.88 |
| " " summer | 71.54 | 72.94 | 71.78 | 71.43 | 71.51 |
| " " autumn | 52.72 | 54.87 | 52.57 | 52.03 | 52.78 |
| " " winter.. | 32.08 | 37.29 | 32.75 | 34.63 | 33.01 |
| *Rainfall.* | Inches. | Inches. | Inches. | Inches. | Inches. |
| Average an. rainfall.. | 41.95 | 55.84 | 35.75 | 49.22 | 42.56 |
| Rainfall of spring.... | 10.90 | 12.92 | 7.39 | 10.71 | 10.52 |
| " " summer... | 12.93 | 12.03 | 9.21 | 15.97 | 13.05 |
| " " autumn... | 9.57 | 16.18 | 9 60 | 11.86 | 9 75 |
| " " winter.... | 9.36 | 14.71 | 9.55 | 10.68 | 9.24 |
| *Winds, prev. direction.* | | | | | |
| In spring..... | S. W., N. W., N., W. | S. W., W., N. W., N. | W., N.W., N., S. W., S. E. | W., S. W., N. W., S. W. | N., S. W., S., W., N. W., S. E., E. |
| In summer..... | S. W., N. W., N., S. S. E. | S. W., S., N. W., W. | S. W., N., W., N.W., S. E. | S. W., S., W., N. W. | S. W., N., S., W., S. E., E. |
| In autumn..... | S. W., N. W., W., N., S. | S. W., N. W., N., N. E., W. | N., N. W., S. W., S. E., S. | S., W., S. W. to N. W. | N., S. W., S., W., S. E., N. W., E., N. E. |
| In winter..... | N. W., S. W., N., W., S. E., E. | N. W., N., W., S. W., S., E. | N., N. W., N. E., S. E., S. W., W. | S., W., S. W., W. | S. W., N., W., S., N. W., S. E., E., N. E. |

The mean annual temperature of the State, as deduced from forty years' observations, is that of Marietta, O., which is in the latitude of the middle of the State, and only separated from it by the Ohio River. It is 52° 46′. The warm season is long, but the heat is not intense. Ploughing and planting begin, except in the most mountainous districts, from Mar. 15 to Apr. 1, and the first white frosts occur from Oct. 1 to 15, but cattle are not housed or fed from Mar. 15 to Nov. 15.

*Agricultural Productions.*—According to the census of 1870, there were 8,528,394 acres of land in farms in the State, of which 2,580,254 acres only were improved lands. The total value of farms was $101,604,381, and of farming implements and machinery, $2,112,937. The value of farm products was $23,379,692; of animals slaughtered or sold for slaughter, $4,914,792; of home manufactures, $615,412; of forest products, $363,668 (evidently an under-estimate, as single counties sent to market tan-bark, slippery elm bark, timber, charcoal, and ashes in larger amounts than this); market-garden products, $69,974; orchard products, $848,773 (an under-estimate); wages paid, $1,903,788. Of the crops, wheat was grown to the amount of 2,483,543 bushels; rye, 277,746; Indian corn, 8,197,865; oats, 2,413,749; buckwheat, 82,916 (the production of Preston co. alone was 95,857 bushels a year or two earlier); cotton, 2 bales; hemp, 37 tons; flax, 82,276 pounds; hops, 1031 pounds; wool, 1,593,541 pounds; hay, 224,164 tons; tobacco, 2,046,452 pounds (in 1873, 13,500,000 pounds were sent to market from West Virginia); Irish potatoes, 1,053,507 bushels; sweet potatoes, 46,984 bushels (both these amounts are under-estimates); maple-sugar, 490,606 pounds; maple-syrup, 20,209 gallons (both under-estimates; at least one-third too low); sorghum-syrup, 780,829 gallons; honey, 376,997 pounds; beeswax, 9917 pounds; domestic wine, 6093 gallons (an under-estimate, as the wine from the vineyards of Ohio, Wood, Ritchie, and Doddridge cos. in 1874 was valued at nearly $200,000). The dairy products in 1870 were—5,044,475 pounds of butter, 32,429 pounds of cheese, 144,895 gallons of milk sold. The value of live-stock in 1870 was stated at $17,175,420; the number of horses at 99,362; of mules and asses at 2139; of neat cattle at 337,881, of which 104,434 were reported as milch cows; of sheep at 552,327; and of swine at 268,031. At the close of 1874 there were reported 116,877 horses, mules, asses, etc., in the State; the number of neat cattle was 361,900, of which 124,300 were milch cows; of sheep, 539,200; and of swine, 310,600; and the entire value of live-stock (partly estimated) was $18,948,283. The report of the agricultural department for the year 1874 gives the principal crops of the State as follows: Indian corn, 8,803,000 bushels; wheat, 3,268,000; rye, 268,000; oats, 1,684,000; barley, 50,000; buckwheat, 62,000 (an under-estimate); Irish potatoes, 782,000; tobacco, 1,690,000 pounds (a blunder); hay, 167,800 tons.

*Manufactures.*—The latest accessible statistics are those of the census of 1870, but the manufactures of the State,

which even then were inadequately reported, have since increased with great rapidity. There were in that year 2444 manufactories reported, employing 11,672 hands (10,728 men, 287 women, and 657 children), having an estimated capital of $11,084,520, paying $4,322,164 wages, using $14,503,701 worth of raw material, and producing manufactures valued at $24,102,201. Of this amount more than one-third was in some form of iron production—pig, forged and rolled, castings, nails and spikes, etc.; 46 establishments produced to the amount of $9,833,892. Next in order were flouring-mill products, 68 mills producing $2,239,799; lumber, 144 saw-mills producing $1,344,512; 18 saltworks, $1,507,605; leather tanned and curried, in 178 tanneries, to the amount of $840,245. The census reports but 1 glassworks, manufacturing glass worth $200,000. At that very time there were 4 glass-factories in the city of Wheeling, besides others in the State. Cooperage, in 101 shops, produced $488,476. Coal-oil rectifying-works, ready-made clothing establishments, woollen-factories, carriage-shops, and tobacco and cigar factories were the other principal industries; the last named has greatly increased since 1870.

*Mining.*—In 1870 there were reported 185 mines, quarries, etc., in the State, employing 1527 hands (1430 men, 97 boys), with a capital of $2,554,499, and producing annually $2,538,531, mainly coal and iron ores. These industries have since greatly increased.

*Railroads.*—Until 1870, West Virginia had no important railway except the Baltimore and Ohio, which, with its Parkersburg branch, traversed 263 miles of her territory; the completion of the Chesapeake and Ohio to Huntington brought the central and southern counties into connection with Eastern and Western markets; there are also several trunk-roads crossing or traversing the Panhandle and the counties lying on the Potomac. There are two or three projected roads, partly finished, of considerable importance. One of these starts from the Pittsburg Cincinnati and St. Louis road at Holliday's Cove in Hancock co., and passes down the E. bank of the Ohio to the Kentucky line, developing all the Ohio River counties. Others are intended to develop the resources of the Guyandotte and Big Sandy rivers. Poor's *Manual* reports 629 miles of railway as in operation in 1875, but not more than 575 are yet completed.

*Finances, Commerce, etc.*—The balance in the treasury Oct. 1, 1874, was $282,364.12, the receipts from all sources during the year, $547,426.26, making a total of $829,790.38; and the disbursements of the year were $576,171.97, leaving a balance in the treasury Oct. 1, 1875, of $253,618.41, besides a very considerable sum in arrears from the county officers. Since its organization the State has contracted no debt, but the State of Virginia claims that it should assume somewhat more than one-third of the general debt of that State before the separation. West Virginia acknowledges a measure of obligation, but contends that as almost the entire debt was incurred for the benefit of the eastern counties she should not be required to assume so large a share of it. On what basis it will eventually be settled is as yet uncertain. West Virginia being wholly an inland State, its commerce is conducted wholly by its railways and navigable rivers. The amount is large and increasing.

*Banks, Savings Banks, and Insurance Companies.*—In 1875 there were 17 national banks in operation in the State, having an aggregate paid-up capital of $2,145,000, bonds on deposit to the amount of $2,093,600, and outstanding circulation to the amount of $2,385,430; there were 10 State banks, reporting an aggregate capital of $975,000; 7 other banks, not reporting their capital or assets; 2 savings banks, with a capital of $100,000. There were on Jan. 1, 1875, 14 fire and marine insurance companies (one of them having also a life insurance charter) in the State, having an aggregate paid-up capital of $1,438,450, and reporting assets amounting to $2,321,858.96. Seven of the number reported liabilities amounting to $111,516.58. There are no distinctive life insurance companies chartered by the State.

*Population of West Virginia, and of the Counties which now constitute the State, in former censuses.*

| Census year. | Total population. | Males. | Females. | Whites. | Free colored. | Slave. | Natives. | Foreign. | Density. | Ratio of increase. | Number of families. | Persons to a family. | Number of dwellings. | Persons to a dwelling. | Illiteracy. | Of school age, 5 to 20. | Of military age, 18–45, males. | Of voting age, 21 and upward, males. | Citizens, males. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1790 | 55,873 | ..... | ..... | 50,593 | 612 | 4,668 | ..... | ..... | 2.43 | | | | | | | | | | |
| 1800 | 78,592 | ..... | ..... | 70,894 | 526 | 7,172 | ..... | ..... | 3.42 | 40.68 | | | | | | | | | |
| 1810 | 105,469 | ..... | ..... | 93,355 | 1,278 | 10,836 | ..... | ..... | 4.58 | 34.19 | | | | | | | | | |
| 1820 | 136,808 | ..... | ..... | 120,236 | 1,413 | 15.119 | ..... | ..... | 5.95 | 30.65 | | | | | | | | | |
| 1830 | 176,924 | ..... | ..... | 157,084 | 2,167 | 17,673 | ..... | ..... | 7.69 | 29.32 | | | | | | | | | |
| 1840 | 224,537 | ..... | ..... | 203,016 | 3,033 | 18,488 | ..... | ..... | 9.76 | 26.94 | | | | | | | | | |
| 1850 | 302,313 | ..... | ..... | 278,731 | 3,082 | 20,500 | ..... | ..... | 13.14 | 34.63 | ..... | .... | ..... | .... | ..... | 115,886 | 52,542 | 65,779 | |
| 1860 | 376,688 | ..... | ..... | 355,526 | 2,733 | 18,371 | 360,143 | 16,545 | 16.37 | 24.60 | ..... | .... | ..... | .... | ..... | 144,393 | 65,468 | 81,214 | |
| 1870 | 442,014 | 222,843 | 219,171 | 424,033 | 17,980 | ..... | 424,923 | 17,091 | 19.22 | 17.34 | 78,474 | 5.63 | 78,854 | 5.61 | 81,490 | 169,428 | 76,832 | 95,317 | 93,435 |

*Education.*—The free-school system of the State, though of recent origin, seems to be in very efficient operation. For school purposes each county is divided into districts (corresponding with the townships in other States), and each of these into sub-districts. Each district is controlled by a board of education consisting of a president and two commissioners, and each sub-district is under the management of one trustee. These officers are chosen by the electors of the district every two years. On Sept. 1, 1875, the permanent school fund amounted to $325,243.34, the current teachers' fund to $541,358.83, the current building fund to $255,233.29, and the aggregate amount expended for school purposes for that year to $796,592.12. The scholastic age in the State is from six to twenty-one years, and 179,897 youth between those ages were enrolled. The attendance on the free schools is about 49 per cent. of this number; the general average daily attendance in 1874 was 61,244, and was said to have been considerably greater in 1875. The whole number of schools in 1875 was 3231; of school-houses, 2959; of teachers, 3461; the value of school property was $1,605,627. In all these particulars the increase within ten years had been from ten to thirty fold. The State apportionment for school purposes from the tax was $214,791.32; about $500,000 is raised by district levies, and the remainder from other sources. The average duration of schools was about four and a half months; average wages of teachers, males $35.70, females $29.55; average cost of pupil for tuition per year, $7.03.

*Normal Schools.*—The West Virginia State Normal School, or Marshall College, is at Huntington, Cabell co., and had a high reputation as Marshall Academy before its transfer to the State for a normal school in Feb., 1867. There are 5 branch normal schools in the State, all connected with the parent institution—viz. Fairmont, Marion co.; West Liberty, Ohio co.; Glenville, Gilmer co.; Shepherdstown, Jefferson co.; and Concord in Mercer co. These schools have graduated about 175 teachers, and probably four times that number of their pupils have been engaged continuously in teaching. The number of teachers in attendance in 1875 was about 625. The value of the State's property in them is somewhat more than $100,000, but tuition is required, and the legislature has withheld appropriations in aid of them for some years. Teachers' institutes are held in different parts of the State, under the encouragement and aid of the Peabody Fund. This fund in 1874 apportioned to West Virginia, for the support of teachers, $14,600. There are a considerable number of private schools, some of them of high grade, in the State. The Centennial commissioners enumerate 15 of these, having an aggregate of about 2500 pupils.

*Higher Education.*

| Colleges, Universities, and Professional Schools. | Location. | Date of organization. | No. of professors and instructors. | Students. | | | | Under what control. | Value of buildings, grounds, apparatus, etc. | Amount of productive endowment. | Income from endowment. | Income from all sources. | Amount of scholarship funds. | Volumes in library. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Preparatory. | Collegiate. | Male. | Female. | | | | | | | |
| Bethany College | Bethany, Brooke co. | 1841 | 9 | .. | 123 | 123 | .. | Disciples | $250,000 | $60,000 | $4,500 | $6,500 | $ | 3,500 |
| West Virginia College | Flemington | 1868 | 5 | 61 | 7 | 55 | 15 | Free-Will Baptists | 15,000 | ..... | ..... | ..... | .... | 537 |
| West Virginia University | Morgantown | 1867 | 12 | 50 | 76 | 126 | .. | State | 150,000 | 110,000 | 6,600 | 31,828 | .... | 3,500 |
| *School of Science.* | | | | | | | | | | | | | | |
| Agricultural dept. of West Virginia Univ. | Morgantown | 1867 | .. | 23 | 24 | 47 | .. | State | With the University. | | | | | |
| *School of Theology.* | | | | | | | | | | | | | | |
| St. Vincent's College | Wheeling | 1865 | 3 | .. | 43 | 43 | .. | Roman Catholic | 20,000 | ..... | ..... | ..... | .... | 3,000 |

*Charitable Institutions.*—The West Virginia institution for the deaf and dumb and the blind is located at Romney. It has 7 professors and instructors, and 7 other employés, and had in Nov., 1875, 106 pupils—about 80 deaf mutes and 26 blind. Its current expenses are a little more than $25,000, and it has been adding to its buildings. The West Virginia hospital for the insane at Weston has 2 medical and 4 other officers and employés, and had Oct. 1, 1875, 349 patients, its daily average being 351. It reported 18 discharged cured during the year. Its current expenses are $56,160 per year, aside from transportation of patients.

*Prisons.*—The West Virginia penitentiary is at Moundsville. It seems to be well conducted, but is not yet self-sustaining, though efforts are making to secure that result. There were Oct. 1, 1875, 105 convicts in the prison; 31 had been discharged, 2 pardoned, and 2 died; there had been no escapes. Strict attention is paid to the moral and religious instruction of the convicts. The county jails are much like those of other States, a few well managed, but most of them needing radical improvement.

*Newspapers.*—In 1870 there were 59 newspapers in the State, having an aggregate circulation of 54,432, and an annual issue of 4,012,400 copies. Of these, 4 were dailies, 2 tri-weeklies, 48 weeklies, 2 semi-monthly, and 3 monthly. In 1876 the number had increased to 72, of which 5 were daily, 2 tri-weekly, 63 weekly, and 2 monthly.

*Churches.*

| Denominations. | Organizations, 1870. | Church edifices, 1870. | Sittings, 1870. | Church property, 1870. | Organizations, 1875. | Church edifices, 1875. | Ministers, 1875. | Church members or communicants, 1875. | Adherent population, 1875. | Church property, 1875. |
|---|---|---|---|---|---|---|---|---|---|---|
| All denominations* | 1529 | 1018 | 297,315 | $1,835,720 | 1666 | 1296 | 841 | 93,264 | 428,960 | $2,349,600 |
| Baptists (regular) | 302 | 205 | 58,400 | 191,805 | 339 | 287 | 206 | 25,638 | 120,000 | 274,300 |
| Baptists (other) | 23 | 18 | 4,450 | 9,050 | 30 | 24 | 20 | 1,856 | 9,000 | 12,800 |
| Christian Connection and Disciples | 36 | 23 | 6,400 | 37,550 | 51 | 35 | 27 | 3,124 | 15,700 | 61,400 |
| Protestant Episcopalians | 21 | 19 | 7,355 | 166,500 | 25 | 21 | 20 | 1,987 | 9,300 | 190,600 |
| Evangelical Association | 2 | 1 | 300 | 1,000 | 4 | 3 | 2 | 240 | 1,200 | 2,500 |
| Lutherans | 22 | 21 | 7,300 | 93,300 | 30 | 26 | 17 | 1,525 | 7,500 | 112,500 |
| Methodists | 879 | 552 | 152,865 | 723,015 | 983 | 677 | 398 | 45,620 | 187,500 | 956,000 |
| Presbyterians | 87 | 76 | 27,320 | 328,050 | 118 | 98 | 65 | 8,083 | 40,500 | 499,500 |
| Reformed (late German) | 2 | 2 | 600 | 15,000 | 5 | 4 | 3 | 400 | 2,000 | 23,400 |
| Roman Catholics | 40 | 37 | 16,800 | 221,950 | 45 | 42 | 30 | ..... | 16,000 | 250,000 |
| United Brethren in Christ | 94 | 52 | 13,800 | 42,450 | 124 | 66 | 42 | 4,236 | 18,000 | 59,400 |
| Universalists | 4 | 1 | 300 | 1,000 | 2 | 2 | 3 | 55 | 260 | 2,000 |
| Union | 11 | 11 | 1,425 | 5,050 | 10 | 11 | 8 | 500 | 2,000 | 5,200 |

*Counties.*—There are fifty-four counties, as follows:

| Counties. | Total pop., 1870. | Males, 1870. | Females, 1870. | Total pop., 1860. | True valuation, 1870. | Assessed valuation, 1874. |
|---|---|---|---|---|---|---|
| Barbour | 10,312 | 5,197 | 5,115 | 8,958 | $3,882,280 | $2,020,801 |
| Berkeley | 14,900 | 7,411 | 7,489 | 12,525 | 7,373,664 | 6,142,387 |
| Boone | 4,553 | 2,343 | 2,210 | 4,840 | 810,419 | 595,732 |
| Braxton | 6,480 | 3,316 | 3,164 | 4,992 | 2,000,000 | 1,472,916 |
| Brooke | 5,464 | 2,685 | 2,779 | 5,494 | 8,980,134 | 2,739,773 |
| Cabell | 6,429 | 3,290 | 3,139 | 8,020 | 2,048,420 | 2,902,466 |
| Calhoun | 2,939 | 1,510 | 1,429 | 2,502 | 577,791 | 513,972 |
| Clay | 2,196 | 1,149 | 1,047 | 1,787 | 347,689 | 399,880 |
| Doddridge | 7,076 | 3,617 | 3,459 | 5,203 | 2,567,851 | 1,406,560 |
| Fayette | 6,647 | 3,357 | 3,290 | 5,997 | 1,643,242 | 1,440,840 |
| Gilmer | 4,338 | 2,188 | 2,150 | 3,759 | 919,133 | 856,174 |
| Grant | 4,467 | 2,277 | 2,190 | ..... | 2,436,000 | 1,835,533 |
| Greenbrier | 11,417 | 5,675 | 5,742 | 12,211 | 5,741,404 | 4,524,563 |
| Hampshire | 7,643 | 3,816 | 3,827 | 13,913 | 2,531,198 | 2,542,409 |
| Hancock | 4,363 | 2,183 | 2,180 | 4,445 | 4,060,127 | 2,052,676 |
| Hardy | 5,518 | 2,746 | 2,772 | 9,864 | 3,057,547 | 2,312,194 |
| Harrison | 16,714 | 8,333 | 8,381 | 13,790 | 8,500,000 | 7,331,486 |
| Jackson | 10,300 | 5,254 | 5,046 | 8,306 | 2,514,026 | 2,342,559 |
| Jefferson | 13,219 | 6,546 | 6,673 | 14,535 | 12,206,135 | 7,434,310 |
| Kanawha | 22,349 | 11,497 | 10,852 | 16,150 | 7,953,876 | 6,430,051 |
| Lewis | 10,175 | 5,120 | 5,055 | 7,999 | 3,327,800 | 2,616,650 |
| Lincoln | 5,053 | 2,546 | 2,507 | ..... | 1,848,390 | 1,073,901 |
| Logan | 5,124 | 2,640 | 2,484 | 4,938 | 827,414 | 604,851 |
| Marion | 12,107 | 6,080 | 6,027 | 12,722 | 5,280,000 | 4,169,099 |
| Marshall | 14,941 | 7,662 | 7,279 | 12,937 | 7,543,945 | 4,363,713 |
| Mason | 15,978 | 8,077 | 7,901 | 9,173 | 7,900,000 | 6,207,711 |
| McDowell | 1,952 | 968 | 984 | 1,535 | 196,754 | 303,878 |
| Mercer | 7,064 | 3,516 | 3,548 | 6,819 | 1,370,861 | 660,895 |
| Mineral | 6,332 | 3,216 | 3,116 | ..... | 3,798,256 | 2,463,435 |
| Monongalia | 13,547 | 6,698 | 6,849 | 13,048 | 4,445,727 | 4,597,207 |
| Monroe | 11,124 | 5,428 | 5,696 | 10,757 | 4,854,509 | 2,891,953 |
| Morgan | 4,315 | 2,254 | 2,061 | 3,732 | 1,922,698 | 1,082,355 |
| Nicholas | 4,458 | 2,301 | 2,157 | 4,627 | 1,054,391 | 990,847 |
| Ohio | 28,831 | 14,029 | 14,802 | 22,422 | 17,535,518 | 15,104,740 |
| Pendleton | 6,455 | 3,222 | 3,233 | 6,164 | 2,099,950 | 1,559,436 |
| Pleasants | 3,012 | 1,590 | 1,442 | 2,945 | 794,399 | 784,842 |
| Pocahontas | 4,069 | 2,056 | 2,013 | 3,958 | 1,721,080 | 1,405,463 |
| Preston | 14,555 | 7,338 | 7,217 | 13,312 | 5,871,378 | 3,106,778 |
| Putnam | 7,794 | 3,981 | 3,813 | 6,301 | 2,223,890 | 1,823,624 |
| Raleigh | 3,673 | 1,839 | 1,834 | 3,367 | 663,208 | 730,862 |
| Randolph | 5,563 | 2,872 | 2,691 | 4,990 | 2,062,602 | 1,561,101 |
| Ritchie | 9,055 | 4,673 | 4,382 | 6,847 | 2,454,267 | 1,981,650 |
| Roane | 7,232 | 3,685 | 3,547 | 5,381 | 1,469,196 | 1,022,767 |
| Summers | New | county. | ..... | ..... | ..... | 752,711 |
| Taylor | 9,367 | 4,720 | 4,647 | 7,463 | 7,230,818 | 4,058,763 |
| Tucker | 1,907 | 990 | 917 | 1,428 | 505,285 | 377,111 |
| Tyler | 7,832 | 3,950 | 3,882 | 6,517 | 2,287,738 | 1,838,126 |
| Upshur | 8,023 | 4,027 | 3,996 | 7,292 | 2,990,595 | 2,353,009 |
| Wayne | 7,852 | 4,016 | 3,836 | 6,747 | 1,874,318 | 1,965,714 |
| Webster | 1,730 | 880 | 850 | 1,555 | 551,005 | 543,192 |
| Wetzel | 8,595 | 4,376 | 4,219 | 6,703 | 1,857,159 | 1,633,764 |
| Wirt | 4,804 | 2,532 | 2,272 | 3,751 | 1,064,379 | 1,035,798 |
| Wood | 19,000 | 9,544 | 9,456 | 11,046 | 10,000,000 | 6,959,263 |
| Wyoming | 3,171 | 1,627 | 1,544 | 2,861 | 873,025 | 955,378 |
| Totals | 442,014 | 222,843 | 219,171 | 376,688 | $190,651,491 | $141,867,819 |

*Principal Towns.*—Wheeling, now the capital of the State, in 1870 had 19,280 inhabitants; a local census taken in 1876 gives it a little more than 30,000. Parkersburg in 1870 had 5546 inhabitants, and is now (1876) estimated as exceeding 8000; Martinsburg had 4863 in 1870; Charleston, 3162; South Wheeling, Huntington, Grafton, and Morgantown are thriving towns of from 2000 to 4000 inhabitants.

*Constitution, Courts, Government, Representatives in Congress.*—The first constitution of the State was adopted in May, 1862; it was modified to some extent prior to the admission of the State into the Union, and the modifications ratified in Apr., 1863. A new constitution was adopted and ratified in 1872. By this constitution all male citizens are entitled to vote at all elections who have resided in the State one year and in the county in which they offer to vote sixty days next preceding an election. The legislative power is vested in the legislature of West Virginia, which consists of a senate of 24 members, elected for four years. and a house of delegates of 65 members, elected for two years. The executive department consists of a governor, secretary of state, State superintendent of free schools, auditor, treasurer, and attorney-general, who is also *ex-officio* reporter of the court of appeals. All these are elected by the legal voters of the State for four years, commencing on the 4th of March next after their election. The judicial power is vested in (1) a supreme court of appeals, consisting of four judges, elected by the voters of the State for twelve years; it has both original and appellate jurisdiction; (2) in nine circuit courts, one for each circuit district, each presided over by a judge elected for eight years by the voters of the district, and having original jurisdiction in all except petty causes, and appellate jurisdiction from the inferior courts; (3) in county courts, 54 in number, each presided over by a president and two justices of the peace. The president is elected by the voters of the county for four years, and the justices of the peace for the same time by the voters of the several districts of the county which they represent. These courts hold six sessions a year. West Virginia is entitled under the apportionment of 1872 to 3 members of Congress.

*History.*—West Virginia formed the W. and N. W. portion of the commonwealth of Virginia until the latter seceded from the Union in 1861, but three-fourths of the population being in the eastern counties, the western had been constantly outvoted and denied any participation in the improvements of railroads and canals for which the State pledged its credit. In June, 1861, delegates assembled from Wheeling from thirty-nine of these western counties to protest against the secession ordinance and to form a provisional government. Another convention met in Aug., 1861, and ordered an election in October of that year to decide upon the question of organizing a new State embracing these 39 counties, to be called the "State of Kanawha." Their vote was substantially unanimous, and a constitution was prepared and ratified by the people in May, 1862. Before they could be admitted to the Union it was necessary that the consent of Virginia, as a loyal State, to the division should be obtained. There were at this time two governments in Virginia—a loyal one, having its capital and holding its legislative sessions at Alexandria, and the disloyal one, which then held Richmond as its capital. The loyal legislature consented to the separation, and after the passage of certain amendments required by Congress—among others the change of name to West Virginia—West Virginia came into the Union June 20, 1863. The energies of the State, so long repressed, immediately manifested themselves. The young State sent 26,540 men to the Union armies out of a total enrolment

*There are also included in this enumeration 3 Second Advent, 2 Cumberland Presbyterian, and 1 Jewish society, of which there is no further information as to church edifices, sittings, or church property.

of 33,744. In Jan., 1866, the counties of Jefferson and Berkeley, lying on the Potomac, were added to the State, which had previously consisted of 50 counties. The progress of the State in education, commercial enterprise, and railroad development, and its moral and religious advancement, have been very remarkable since the date of its admission to the Union.

*Governors of West Virginia.*

| | | | |
|---|---|---|---|
| Arthur J. Boreman..... | 1863–69 | John J. Jacob..... | 1871–77 |
| William E. Stevenson | 1869–71 | Henry M. Matthews.... | 1877– |

*Electoral and Popular Vote for President and Vice-President.*

| Elect. year. | Candidates who received the electoral vote. | Elect. vote. | Pop. vote. | Opposition candidates. | Pop. vote. | Third-party candidates. | Pop. vote. |
|---|---|---|---|---|---|---|---|
| 1864 | Abraham Lincoln P.....<br>Andrew Johnson V.-P..... | 5 | 23,152 | George B. McClellan P....<br>Geo. H. Pendleton V.-P... | 10,438 | | |
| 1868 | Ulysses S. Grant P.....<br>Schuyler Colfax V.-P..... | 5 | 29,175 | Horatio Seymour P.....<br>Francis P. Blair, Jr., V.-P. | 20,306 | | |
| 1872 | Ulysses S. Grant P.....<br>Henry Wilson V.-P..... | 5 | 32,103 | Horace Greeley P.....<br>Benj. Gratz Brown V.-P.. | 29,453 | Charles O'Conor P..... | 600 |
| 1876 | Samuel J. Tilden P.....<br>Thos. A. Hendricks V.-P.. | 5 | 17,911 | Rutherford B. Hayes P...<br>William A. Wheeler V.-P. | 16,076 | Peter Cooper P.....<br>Samuel F. Cary V.-P..... | 576 |

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**West War'ren,** p.-v., Worcester co., Mass.

**West Wa'terville,** p.-v., Kennebec co., Me.

**West Wheat'field,** tp., Indiana co., Pa. P. 1318.

**West Wheel'ing,** v., Pultney tp., Belmont co., O. P. 407.

**West White'land,** p.-v. and tp., Chester co., Pa. P. 1177.

**West Wind'sor,** tp., Mercer co., N. J. P. 1428.

**West Windsor,** tp., Windsor co., Vt. P. 708.

**West Win'field,** p.-v., Herkimer co., N. Y., on Delaware Lackawanna and Western R. R., 21 miles S. of Utica, contains 3 churches, an academy and normal business institute, 1 newspaper, 1 bank, 1 grist and 2 planing and saw mills, and 2 hotels. Principal business, farming and dairying. P. 640. R. W. Ackerman, Ed. "Standard."

**West Win'sted,** p.-v., Litchfield co., Conn.

**West'wood** (John Obadiah), F. S. A., b. at Sheffield, England, in 1805; educated at Lichfield; devoted himself to natural history and archæology; was long secretary, and subsequently president, of the Entomological Society of London, and has been since 1861 Hope professor of zoology at Oxford. Author of numerous publications on entomology, of *Palæographia Sacra Pictoria* (1845), *Illuminated Illustrations of the Bible* (1849), and *The Miniatures and Ornaments of Anglo-Saxon and Irish Manuscripts* (1868).

**Westwood** (Thomas), b. at Enfield, Middlesex, England, Nov. 26, 1814; has been for twenty-five years director of a railway company in Belgium; has been a frequent contributor of verse to the London *Athenæum* and *Gentleman's Magazine;* is author of several volumes of poems, *Beads from a Rosary* (1843), *The Burden of the Bell, and other Lyrics* (1850), *Berries and Blossoms, a Verse-Book for Young People* (1855), *Foxglove-Bells, a Book of Sonnets* (1856), and *The Quest of the Sancgreall* (1868); also of *Bibliotheca Piscatoria* (1861) and *The Chronicle of the "Compleat Angler" of Izaak Walton and Charles Cotton, being a Bibliographical Record of its various Phases and Mutations, Editions and Illustrations* (1864).

**West Zanes'ville,** p.-v., Falls tp., Muskingum co., O. P. 1744.

**Weth'erall** (Sir George Augustus), G. C. B., b. in England in 1788, son of Gen. Sir F. Wetherall; educated at Hyde Abbey School and at the Royal Military College, Farnham; entered the army 1803; served at the Cape of Good Hope and at the conquest of Java, where he acted as aide-de-camp to his father; was military secretary to the commander-in-chief at Madras 1822–25; became deputy judge-advocate-general in India 1826; served as lieutenant colonel of the 1st Foot in India, and afterward in Canada, where he aided in suppressing the rebellion of 1837–38; was deputy adjutant-general in Canada 1843–50, and in England 1850–54; was appointed adjutant-general in the latter year; filled that post through the Crimean war and the Indian mutiny, rendering services for which he was knighted 1856; resigned in 1860, when he was appointed to the command of the northern district; attained the rank of full general and colonel of the 84th Foot Oct. 23, 1863, and was appointed in Aug., 1866, governor of the Royal Military College at Sandhurst, where he d. Apr. 8, 1868.

**Weth'erell** (Sir Charles), D. C. L., b. in England in 1770; graduated in 1790 at University College, Oxford (of which his father was master for more than half a century); was called to the bar at the Inner Temple 1794; practised for many years with eminent success at the common-law bar; entered Parliament for Shaftesbury 1818; sat for Oxford 1820–26; was knighted and made solicitor-general Jan., 1824; was attorney-general 1826–27, and again under the duke of Wellington from Jan., 1828, to May, 1829, distinguishing himself by inveterate hostility to Roman Catholic emancipation and to parliamentary reform; was recorder of Bristol, and there assaulted by a mob at Michaelmas session 1831, being rescued with difficulty by the authorities, and sat in Parliament for Boroughbridge 1830–32, until that village was disfranchised by the Reform act (June, 1832), when, "amidst a torrent of eloquence, learning, drollery, and enthusiasm, he closed his senatorial life, exclaiming, 'This is the last dying speech and confession of the member for Boroughbridge.'" D. at Preston Hall, Kent, Aug. 17, 1846.

**Weth'ersfield,** p.-v. and tp., Hartford co., Conn. P. 2693.

**Wethersfield,** p.-v. and tp., Henry co., Ill. P. 1247.

**Wethersfield,** p.-v. and tp., Wyoming co., N. Y. P. of v. 170; of tp. 1219.

**Wet'more,** county of E. Dakota, formed since the census of 1870. Area, about 700 sq. m.

**Wetmore,** tp., McKean co., Pa. P. 721.

**Wetmore** (James), b. in Connecticut about 1690; graduated at Yale College 1714; studied divinity; was ordained the first Congregational minister of North Haven Nov., 1718; became converted to Episcopalian sentiments Sept., 1722; went to England to obtain orders in the Church of England 1723; returned the following year as a missionary of the Society for Propagating the Gospel in Foreign Parts, and was rector of a church at Rye, N. Y., from 1726 until his death, May 14, 1760. Author of *A Vindication of the Professors of the Church of England in Connecticut* (1747), and other polemical treatises, chiefly in reply to Rev. Noah Hobart.

**Wetmore** (Prosper Montgomery), b. at Stratford, Conn., Feb. 14, 1798; removed in childhood to New York City, where he entered a counting-room; became a merchant; began to write for the magazines 1816; published a volume of poems 1830; was associated with the literary and dramatic circles of the city; also with the cause of education and several philanthropic enterprises, having been chosen a regent of the University of New York 1833; was a member of the legislature and chairman of the committee on colleges and academies 1834–35; was president and a prominent supporter of the American Art-Union, a member of the New York Chamber of Commerce, a director of the institution for the deaf and dumb, an active member of the New York Historical Society, and many years paymaster-general of the State militia. In 1838 he edited the poems of James Nack, with biographical notice, and in 1847 published *Observations on the Origin and Conduct of the War with Mexico.* D. at Great Neck, L. I., Mar. 16, 1876.

**Wet'stein** (Johann Jacob), b. at Bâle Mar. 5, 1693; studied theology; was appointed field-preacher to a Swiss regiment in the Dutch service, and in 1717 dean in the Reformed church of his native city. From this office he was dismissed in 1730 on account of deviations from the accepted Reformed creed, and went in 1733, as professor of church history, to Amsterdam, where he d. Mar. 23, 1754. His principal works are *Prolegomena ad Novi Testamenti Græci Editionem accuratissimam* (1730) and a critical edition of the New Testament (2 vols., Leyden, 1751–52).

**Wette, de** (Wilhelm Martin Leberecht). See De Wette.

**Wet'ter,** the second largest lake of Sweden, is 80 miles long, 13 miles broad, and covers an area of 850 sq. m. It is 275 feet above the sea, and sends its surplus water to the Baltic through the Motala. It is connected with Lake Wener by canal, and is of great commercial consequence, as it forms the inland communication between the Baltic and the Cattegat.

**Wet'teren,** town of Belgium, province of West Flanders, has oil and powder mills, breweries, and manufactures of lace and different kinds of linen fabrics. P. 9463.

**Wetump'ka,** p.-v. and tp., cap. of Elmore co., Ala., on Coosa River, 14 miles from Montgomery, contains 3 churches, 3 schools, 1 newspaper, 1 hotel, and the State prison. It has fine facilities for manufacturing. P. of v. 1137; of tp. 3820. J. L. Birch, Ed. "Constitution."

**Wet'zel,** county of N. West Virginia, bordering on Pennsylvania, bounded N. and W. by Ohio River, and traversed by Baltimore and Ohio R. R.; surface hilly, with much iron ore, bituminous coal, and limestone. Staples, Indian corn, oats, wheat, tobacco, and wool. Cap. New Martinsville. Area, 360 sq. m. P. 8595.

**Wetz'lar,** town of Rhenish Prussia, on the Lahn, has breweries, distilleries, and linen-weaving factories. P. 5204.

**Wex'ford,** county of Ireland, province of Leinster, bordering E. on St. George's Channel and S. on the Atlantic, comprises an area of 900 sq. m., with 132,666 inhabitants, of whom 51,689 are unable to read and write. In the northern part the surface is elevated, and rises in Mount Leinster and Blackstairs, but from this ridge it gradually slopes down into a level plain, which along the coast is fringed with swamps and marshes. The soil is fertile, and better cultivated than in most parts of Ireland. Good crops of wheat, barley, oats, and potatoes are gathered, and cattle-breeding, dairy-farming, and fishing are carried on with success. Since 1851, 47,051 persons have emigrated from this county.

**Wexford,** town of Ireland, capital of the county of Wexford, on the right bank of the Slaney, which here is lined with a handsome quay, 85 miles S. of Dublin. Its harbor is shallow, and accessible only for small craft, still its export-trade in agricultural and dairy produce is important, and so are its shipbuilding and fishing. P. 12,077. It was an early and important Danish settlement, and was also one of the earliest landing-places of the Anglo-Norman invaders.

**Wexford,** county of N. W. Michigan, drained by Manistee River and its affluents. The surface consists of alternate prairie and woodland, interspersed with several small lakes. Staples, Indian corn, wheat, and potatoes. Cap. Sherman. Area, 625 sq. m. P. 650.

**Wexford,** p.-v. and tp., Wexford co., Mich. P. 259.

**Weyauwe'ga,** p.-v. and tp., Waupaca co., Wis., on Wisconsin Central R. R. and on Wolf River, 40 miles N. W. of Oshkosh, is surrounded by an excellent grain and fruit-growing country, and contains 5 churches, a large school-house, public library, fine water-power, 1 newspaper, an exchange bank, several charitable institutions, 1 tannery, flouring, lumber, and shingle mills, 1 foundry and machine-shop, plough-factory, 1 paper-mill, a pottery, and 2 breweries. An extensive lumbering-business is carried on. P. 1243.

F. W. Sackett, Ed. "Times."

**Wey'bridge,** tp., Addison co., Vt. P. 627.

**Weyer's Cave,** a stalactitic cavern in the north-eastern part of Augusta co., Va., in a low spur of the Blue Ridge Mountains, contains several beautiful apartments, of which the so-called Washington Hall is the largest and most remarkable—about 250 feet long, and 90 feet high. It was discovered in 1804 by Bernard Weyer, from whom it received its name.

**Wey'mouth,** p.-v., Digby co., N. S., on St. Mary's Bay, at the mouth of Sissiboo River, 20 miles S. of Digby. This place and Weymouth Bridge, near by, do a large business in shipbuilding and exporting to the U. S. and West Indies. P. of sub-district, 1440.

**Weymouth,** p.-v. and tp., Norfolk co., Mass., on South Shore R. R., 11 miles S. of Boston, is the second oldest settlement in the State (1626), and contains a hygienic institute, 2 national and 3 savings banks, 1 newspaper, 6 printing establishments, ironworks, good schools, drug, box, and saw mills, and 1 boot and shoe manufactory. P. 9010.

C. G. Easterbrook, Ed. "Gazette."

**Weymouth,** p.-v. and tp., Atlantic co., N. J. P. 810.

**Whale** [Ang.-Sax. *hwäl*], a name given to large Cetaceans, representing several different families, and even different sub-orders. The only character shared in common by them, independent of those characteristic of the order, is the large size. The families to which the forms thus distinguished belong are, of the whalebone whales or Mysticete, the families Balænopteridæ and Balænidæ; and of the toothed-whales, the families Physeteridæ and Ziphiidæ. The large species of Delphinidæ are also known as whales—*e. g. Delphinapterus beluga,* called the white whale, and the species of *Globicephalus,* generally designated as blackfish, etc. (See also Whalebone Whales.)

Theodore Gill.

**Whale'bone** [*baleen;* Fr. *baleine;* Ger. *Fischbein*], the horny, elastic laminæ obtained from the mouth of the whale, especially of *Balæna mysticetus,* to which it serves the purpose of teeth, forming a sort of filter through which the water passes as it is expelled from the jaws, the small fish, etc., which comprise the food of the animal being thus retained. Its fibres have very little lateral cohesion, and can easily be removed in the form of long filaments; the blades, 300 of which are sometimes present on each side of the mouth, are arranged in parallel series, resembling somewhat the roof of a house in shape; they are usually about 12 feet in length, 10 to 12 inches in breadth, and ½ inch in thickness. In the manufacture of useful articles from whalebone the blade is first cut in parallel prismatic slips, which are then dried and levelled by planing, the shavings being sometimes utilized as a stuffing for mattresses. When heated by steam, it softens, and can then be bent or moulded in forms which it retains if allowed to become cool under pressure. The essential constituent of whalebone appears to be albumen, its hardness being probably increased by the small proportion of phosphate of lime. According to Frémy, the composition of the organic part is—C. 50.8, H. 7.4, N. 16.5, S., O., etc., 25.3. Whalebone has been employed for the ribs of umbrellas and parasols, stiffening of stays, framework of hats, and in the manufacture of whips, canes, ramrods, archery bows, fans, screens, etc.; but steel rods have been substituted for it for several of these purposes of late years, with improved results.

J. P. Battershall.

**Whalebone Whales,** whales distinguished by the possession of whalebone. This substance is a peculiar epidermal development arising from each side of the median line of the roof of the mouth, and may be looked upon as modified hair. Teeth are existent in a rudimentary condition in the fœtus, but are not functionally developed, and are absorbed and disappear before birth; the supramaxillary bones are not extended backward over the frontal bones, but are produced outward in front of the orbits; the olfactory organ is distinctly developed, and the nasal bones project forward, and are not overlapped at their distal ends; the lower jaw has its rami bowed out, and connected at their simphyses by fibrous tissue, and not by suture. In external appearance the animals are pisciform, and are distinguished from the toothed whales chiefly in that the head is more depressed above toward the margin of the jaw, the eyes situated nearly above the angle of the mouth, and the lower jaw and throat more bag-like. The forms thus combined exhibit two primary modifications of structure, which by some are considered as of family value, but by others as indicative of only sub-family rank:

(1) The typical whalebone whales (Balænidæ) have the skull greatly arched at the maxillary region, and the rostrum narrow and compressed at the base; the frontals have the orbital processes prolonged, and extremely narrow and rounded on the upper surface; the supramaxillary bones are entire at their posterior margins; the tympanic bones large and ovoid; the lower jaw has the coronoid processes almost obsolete; the cervical vertebræ are coalesced together; and the manus is comparatively broad, and has five fully-developed fingers.

(2) The finback, humpback, and scrogg whales (Balænopteridæ) have the skull but slightly arched at the maxillary region; and the rostrum broad at the base, depressed, and gradually tapering; the frontals have the orbital processes moderately prolonged, broad, and flat on the upper surface; the supramaxillary bones are deeply excavated at their posterior margins; the tympanic bones elongated and ovoid; the lower jaw has the coronoid processes more or less developed; the cervical vertebræ in whole or in part separated; and the manus is narrow, and only four digits are developed, the first being wanting.

To the family Balænidæ belongs the bowhead or Greenland whale, and several distantly-related species inhabiting warmer and Antarctic waters, which have been differentiated, but probably on insufficient grounds, into as many as six genera. The bowhead is the most valuable of all the whales in a commercial point of view, and is the species especially hunted by the whalemen fitted out for the Arctic seas. Although not the longest, it is the stoutest of known species; its head is proportionately larger and more ungainly than any other of the sub-order, and forms about one-third of the animal's entire length. Individuals occasionally reach a length of sixty or seventy feet, although not often found much exceeding fifty. In proportion to its size, it is the richest in oil-giving characters; individuals have been known to yield nearly 300 barrels. Its whalebone, which is of a black color, and developed in strips gradually attenuated toward the end, is also the most esteemed of any, and 3500 pounds or more have been obtained from a single individual. It is a timid animal, and rarely turns upon its pursuers, as do some of the spe-

cies of Balænopteridæ. "Sometimes, when engaged in feeding, it remains down for twenty-five minutes or more. The depth to which the animal descends when pursued is not accurately known, for, as a general rule, it has been captured 'on soundings' in the Arctic Ocean and Behring Sea, as well as in the Sea of Okhotsk, where the depths in places do not exceed 100 fathoms, and from that to less than 50. Sometimes it has been taken in very shallow water; yet this animal when in deep water has been known to 'sound out' a line, in its descent and return, equal to a mile in length." (*Scammon.*) The species is now sought for chiefly in Behring Sea, and in the Arctic Ocean N. of it. According to Scammon, "the bowheads of the Arctic may be classed as follows: 1st class—the largest whales, of a brown color; average yield of oil, 200 barrels; 2d class—smaller, color black; yield of oil, 100 barrels; 3d class—the smallest, color black; yield of oil, 75 barrels. Those belonging to the last-named class are generally found among the broken floes, the first of the season, and they have been known to break through ice three inches in thickness that had been formed over water between the floes. They do this by coming up under and striking it with the arched portion of their heads." "Hence they have been called 'ice-breakers.'" The whalers strive to be on their hunting-grounds in the early summer, and they frequently reach the latitude of 72° N., and sometimes, in open seas, even beyond.

The family of Balænopteridæ is much richer in forms and decided contrasts than the Balænidæ. There are three primary types. In the Balænopterinæ the throat is longitudinally plicated; a high, erect, and more or less falcate dorsal fin exists; the frontal bones have orbital processes nearly as broad at the outer extremity as the base, and somewhat narrowed; the manus is moderate, and has four digits, none of which have more than six phalanges. These are mostly very large whales, which have been grouped under the generic names *Balænoptera*, *Physalus*, *Sibbaldius*, and *Rudolphius*. The Megapterinæ have also the throat longitudinally plicated, but the dorsal fin developed as a mere hump; the manus is very long, and the digits are segmented into many phalanges; these are the humpback whales, which have been grouped under the genera *Megaptera*, *Poescopia*, and *Eschrichtius*. Finally, the Agaphelinæ are characterized by the plications of the throat being obsolete, and not more than two in number, and by the dorsal fin being entirely undeveloped. To this group belong the genera *Agaphelus* of the Atlantic Ocean and *Rhachianectes* of the Pacific. The most gigantic of known cetaceans belong to this family and to the genera *Physalus* and *Sibbaldius*. The *Sibbaldius sulfureus* of the western coast of America has been reported to reach an equally great length. The body in these animals is relatively slender, and they are capable of very great speed. Fourteen species are found on the American coasts. On the eastern coast are eight—viz. of the family Balænidæ, (1) *Eubalæna cisarctica*, the right whale, and (2) *Balæna mysticetus*, the bowhead whale; of the family Balænopteridæ, (3) *Balænoptera rostrata*, the grampus, (4) *Sibbaldius borealis*, the sulphur-bottom whale, (5) *S. tuberosus*, the finback whale, (6) *Eschrichtius robustus*, the Gräsö whale, (7) *Megaptera osphyia*, the humpback whale, and (8) *Agaphelus gibbosus*, the scragg whale. On the western coast are six—viz. of the family Balænidæ, (1) *Eubalæna cullamach*, the right whale; of the family Balænopteridæ, (2) *Balænoptera Davidsonii*, the sharp-headed finner whale, (3) *B. velifera*, finback whale, or Oregon finner, (4) *Sibbaldius sulfureus*, the sulphur-bottom whale, (5) *Megaptera versabilis*, the humpback whale, and (6) *Rhachianectes glaucus*, the gray whale. THEODORE GILL.

**Whale Fishery,** an old and, at one time, a flourishing industry. The increasing scarcity of the animal, however, and the extensive use of gas and mineral oils, have now made it less remunerative, and caused it to be abandoned by nations which formerly pursued it as one of the principal branches of their trade; the U. S. is the only nation which still carries it on with vigor. As early as the twelfth century there existed a whale fishery in the Biscayan Sea, and in the thirteenth and fourteenth centuries it became of considerable importance; but it was a smaller species of whale which was caught here, and in the fifteenth and sixteenth centuries this animal became extinct or left the grounds, and the industry died out. By the Dutch explorations of the northern seas in the latter part of the sixteenth century extensive whaling-grounds were discovered near Spitzbergen. The Dutch founded a village called Smeerenberg on the island, whither the blubber was brought for boiling, and a considerable trade sprang up. Soon, however, the whales were driven off, and betook themselves to the coasts of Greenland. The Dutch followed; the blubber was brought to Holland for boiling, and the Dutch oil-trade flourished for more than a century. In 1680, 260 Dutch ships and about 14,000 sailors were engaged in the whale fishery, but from that period the industry began to decline in Holland, and in the present century it has been given up altogether. The English followed in the track of the Dutch, but they never developed this trade to any high degree of prosperity, and they are now about abandoning it. In 1815 they had 164 ships; in 1833 only 129 engaged in the fishery; in 1842 the number sank to 75, and at present it is hardly 20. The industry was taken up early by the New England colonies, and at first the fishery was prosecuted by boats from the shore. In the first part of the eighteenth century, however, the whales had been driven off, and vessels were now fitted out for their pursuit from Nantucket, Cape Cod, Martha's Vineyard, New Bedford, etc. In 1854 the traffic reached its culmination. In 1830 there were 102,000 tons of shipping engaged in the trade, and this amount increased in 1840 to 137,000 tons, in 1850 to 171,484, and in 1854 to 208,399. But then began the decline. The amount of shipping decreased in 1860 to 176,842 tons, in 1865 to 79,690, in 1870 to 73,137, and in 1876 to 38,883. New Bedford is the principal place from which the fishery is now carried on; it sent out 110 vessels of 31,691 tons in 1876.

**Whale-Louse,** a popular name for the sessile-eyed crustaceans of the genus *Cyamus*, parasitic organisms which infest the whales, the mackerels, etc. They are placed in a family, Cyamidæ, which is by some considered to form a separate order, Læmodipoda. They have the abdomen very small indeed, and the head fused with the thorax.

**Whale Oil** [Ger. *Wallfischthran*], the liquid portion of the fat of the common whale, differing from that obtained from the *Physeter macrocephalus* (sperm oil) in possessing a darker color and more disagreeable odor. It possesses a sp. gr. of 0.927, contains small quantities of spermaceti, and does not become solid above 32° F., while sperm oil has a sp. gr. of 0.868, and remains semi-solid at 44.6° F. Whale oil can be deodorized by agitation with chloride of lime (bleaching-powder) (see HYPOCHLOROUS ANHYDRIDE), about 112 pounds of the oil requiring 1 pound of the salt, mixed with 12 pounds of water.

J. P. BATTERSHALL.

**Whale's Back, The,** a small island or ledge on the N. E. side of the entrance to Portsmouth harbor, N. H. It has a lighthouse of stone rising 69 feet, and another stone tower with a fog-bell. Lat. 43° 3′ 30″ N., lon. 70° 41′ 28″ W.

**Wha'leysville,** p.-v., Berlin tp., Worcester co., Md. P. 150.

**Whal'ley** (GEORGE HAMMOND), b. at Gloucester, England, in 1813; was called to the bar 1836; settled in Wales; was high sheriff of Carnarvonshire 1852; is a magistrate for Montgomeryshire and Denbighshire, and deputy lieutenant for the latter county; was elected to Parliament for Peterborough as a Liberal 1852, and still (1876) represents that borough, being noted in Parliament for his hostility to Roman Catholicism. He has published some legal treatises.

**Whang-Hai.** See YELLOW SEA.

**Wharf and Wharfing.** A wharf is a broad plain space or surface resting upon the shore of a harbor or a navigable stream, and generally projecting out beyond the lowest ebb of the tide, so that vessels may moor at its sides or end. Its purpose is to afford a convenient place at which vessels may load and unload—that is, on which goods may be deposited when taken out of a ship or preparatory to being put on board a ship. In the U. S. wharves are generally constructed by driving piles into the bed of the harbor or river, and covering them with a flooring of timberwork and plank; but they are sometimes built of stone upon abutments and piers. It is plain that a wharf must necessarily abut upon the space where the tide ebbs and flows, and that it may extend beyond that space. It is a settled doctrine of the common law that this portion of land between high and low tide, called the "shore," belongs to the government, and that the harbor or river beyond the lowest ebb is under the exclusive control of the government. A wharf, therefore, built without governmental authority would be a public nuisance. In Great Britain the Crown, in the U. S. the States, hold the power to authorize and regulate the construction and use of wharves. As a matter of fact, this authority has been frequently ceded away, either to municipal corporations or to private persons. The State of New York has granted the shore of Manhattan Island to New York City, and that city owns the wharves which fringe its territory, and which it leases to individual occupants. In other States the shore and the right to construct wharves thereon have often been conveyed to the proprietors of the adjacent uplands.

*Wharfing* is the business carried on by the occupant of a

wharf, either owner or lessee, who is termed a wharfinger. He is a bailee for hire, for he receives and keeps the goods placed in his custody. He is entitled to demand a compensation, called wharfage, for the privilege of mooring a vessel at his wharf, and there receiving or discharging her cargo, and for the storage of goods. The amount of these fees, since the business is one of a quasi-public nature, is often regulated by statute. The wharfinger is bound to exercise ordinary care and diligence in respect of the goods placed in his custody—that is, deposited on his wharf—and is responsible for losses caused by ordinary negligence. Unlike the warehouseman and most other bailees, he has a general lien on the goods of a customer for any balance due him on account. (See LIEN.) JOHN NORTON POMEROY.

**Wharfingers.** See WHARF AND WHARFING.

**Wharn'cliffe** (JAMES ARCHIBALD **Stuart-Wortley Mackenzie**), BARON, b. in England Oct. 6, 1776; served in the army 1791–1801; entered Parliament 1797; was created Baron Wharncliffe, July 12, 1826; was lord privy seal Dec. 15, 1834, to Apr., 1835, and became president of the council 1841. D. in London Dec. 19, 1845. He was a great-grandson of the celebrated Lady Mary Wortley Montagu, whose *Letters and Works* (5 vols., 1837) he edited.—His son, JOHN STUART WORTLEY, second baron, b. in 1801, published several pamphlets on political and agricultural topics, and translated and edited Guizot's *Memoirs of George Monk, Duke of Albemarle* (1838). D. Oct. 22, 1855.

**Whar'ton,** county of S. E. Texas, bounded N. E. by San Bernard River, intersected by the Colorado, and crossed in the N. part by Galveston Harrisburg and San Antonio R. R.; surface generally level, soil fertile. Staples, cotton, Indian corn, and sweet potatoes. Cap. Wharton. Area, 1094 sq. m. P. 3426.

**Wharton,** tp., Fayette co., Pa. P. 1478.

**Wharton,** p.-v. and tp., Potter co., Pa. P. 287.

**Wharton,** p.-v., cap. of Wharton co., Tex.

**Wharton** (CHARLES HENRY), D. D., b. in St. Mary's co., Md., June 5, 1748; educated at the Jesuit colleges at St. Omer and Bruges; became a tutor at Liege; was ordained priest 1772; officiated several years as chaplain at Worcester, England; returned to Maryland 1783; professed himself a Protestant, and printed a *Letter to the Roman Catholics of the City of Worcester* (1784), explaining his change of creed; was pastor of Episcopal churches at Newcastle and Wilmington, Del., and became in 1798 rector of St. Mary's at Burlington, N. J., retaining that post until his death, July 22, 1833. He was chosen president of Columbia College, New York, in 1800, but declined that office. Author of *An Inquiry into the Proofs of the Divinity of Jesus Christ* (1796), *A Concise View of the Principal Points of Controversy between the Protestant and Roman Churches* (1817), and other miscellaneous theological writings, chiefly in a *Quarterly Theological Magazine*, which he edited at Burlington and Philadelphia (3 vols., 1813–14). His *Remains* (2 vols., 1834) were edited, with a *Memoir*, by Rev. Dr. G. W. Doane.

**Wharton** (FRANCIS), D. D., LL.D., son of Thomas I., b. at Philadelphia, Pa., in 1820; graduated at Yale College 1839; practised law many years in Philadelphia; was professor of logic and rhetoric in Kenyon College, O., 1856–63; was ordained in the Protestant Episcopal Church as rector of St. Paul's, Brookline, Mass., 1863, and became professor in the Cambridge (Episcopal) Divinity School 1866. Author of *A Treatise on the Criminal Law of the U. S.* (Philadelphia, 1846; 6th ed., 3 vols., 1868), *State Trials of the U. S. during the Administrations of Washington and Adams* (1849), *Precedents of Indictments and Pleas*, etc. (1849), *A Treatise on the Law of Homicide in the U. S.* (1855), *A Treatise on Theism and Modern Skeptical Theories* (1859), *The Silence of Scripture, a Series of Lectures* (1867), *A Treatise on the Conflict of Laws* (1872), and *The Law of Agency and Agents* (1876); was joint author with Dr. Moreton Stillé of *A Treatise on Medical Jurisprudence* (1855; revised ed. 1860); was for a time co-editor of the *Episcopal Recorder;* wrote for many magazines and periodicals, and edited several volumes of law reports.

**Wharton** (GRACE and PHILIP). See THOMSON (KATHARINE BYERLEY).

**Wharton** (HENRY), b. at Worstead, Norfolk, England, Nov. 9, 1664; graduated as senior wrangler at Caius College, Cambridge, 1684; was a favorite pupil of Newton; took orders in the Church of England 1687; became chaplain to Archbishop Sancroft Sept., 1688; was assistant to Dr. William Cave in the preparation of his *Scriptorum Ecclesiasticorum Historia Literaria* (2 vols., 1688–89); was patronized by Archbishop Tenison, who made him vicar of Minster Thanet and rector of Chartham 1689. D. of excessive literary work at Newton, Cambridgeshire, Mar. 5, 1695. Author of *A Treatise of the Celibacy of the Clergy* (1688), *Anglia Sacra, etc.* (2 vols., folio, 1691), being biographies of English prelates, and *A Defence of Pluralities, etc.* (1692); aided in the preparation of many other works; edited the works of Reginald Peacock (1688), Bede (1693), the *Remains of Laud* (1695), Beccatelli's *Vita Reginaldi Poli* (1696), and left important MSS., preserved in the archiepiscopal library at Lambeth, including a Latin *Life* of Capt. John Smith. His *Historia Episcopis et Decanis Londinensibus* (1695) was posthumously published, as also *Sermons preached in Lambeth Chapel, with an Account of the Author's Life* (2 vols., 1698–99). Considering the age at which he died (thirty years), the vast amount of his labors, and the extent of his acquisitions, he was justly considered a prodigy, and his death was deplored as an irreparable loss to letters.

**Wharton** (PHILIP), DUKE OF **Wharton,** son of Thomas, the first marquis, b. in Dec., 1698; made a secret marriage at the age of sixteen; succeeded to the marquisate Apr., 1715; studied under a strict Calvinistic tutor at Geneva 1716, but ran away to Avignon, where he recognized the Pretender and received the title of duke of Northumberland; proceeded to Paris; borrowed £2000 from the queen-dowager, widow of James II.; took a seat in the Irish House of Peers 1716; distinguished himself in debate; was made duke of Wharton in the English peerage Jan. 28, 1718; entered the British House of Lords 1720; distinguished himself against the ministry; soon impoverished himself by his extravagance; edited a semi-weekly paper, *The True Briton*, 1724; went to Vienna, and thence to Madrid, 1726; took service under the Pretender; was aide-de-camp to the count of Torres at the siege of Gibraltar; was made colonel of an Irish regiment in the Spanish service; was attainted of treason in England, and his property confiscated; visited Rome, Paris, and other parts of Europe, and d. in poverty at Tarragona, Spain, May 31, 1731. His *Life and Writings* appeared in the following year (2 vols., 1732). His *Poems* had been published in 1727.

**Wharton** (THOMAS), D. C. L., MARQUIS OF **Wharton,** b. in England about 1640, eldest son of Philip, fourth Baron Wharton; entered Parliament soon after the Restoration; took a prominent part in the opposition to Charles II.; was sent to the Tower for joining in the complaint against the long prorogation of Parliament Feb. 17, 1677; was one of the first to join the prince of Orange 1688; was appointed comptroller of the royal household and privy councillor Feb., 1689; succeeded to the family title 1696; was made chief-justice in eyre 1697; fought a duel with Viscount Cheyney 1697; was commissioner to negotiate the union with Scotland, for which service he was rewarded with the titles of Viscount Winchendon and Earl Wharton Dec. 23, 1706; was lord lieutenant of Ireland 1708–10, with the Irish titles of Earl Rathfarnum and Marquis Catherlogh, and had Addison for his secretary, and became privy seal on the accession of George I., Sept., 1714, and marquis of Wharton and Malmesbury Feb. 15, 1715, having been a zealous Whig and supporter of the Hanoverian succession, and a skilful party manager, though notorious for immorality. D. in London Apr. 12, 1715. He was the reputed author of the famous Irish ballad "Lillibulero."

**Wharton** (THOMAS, JR.), b. in Philadelphia in 1735; became a merchant; was president of Pennsylvania 1777–78. D. at Lancaster, Pa., May 23, 1778.

**Wharton** (THOMAS I.), b. at Philadelphia, Pa., in 1791; was many years a distinguished member of the Philadelphia bar and reporter of the Pennsylvania supreme court. D. at Philadelphia Apr. 9, 1856. Author of *A Digest of Cases in the Circuit Court of the U. S., Third District, etc.* (1822; 6th ed., 2 vols., 1853), *A Digested Index to the Reported Decisions of the Several Courts of Law in the Western and Southern States* (1824), *Reports of Cases in the Supreme Court of Pennsylvania, Eastern District* (6 vols., 1836–41), of several historical or anniversary discourses, and a *Memoir of William Rawle, LL.D.* (1840); was associated with Thomas Sergeant and others in the editorship of the *Law Library* (1833), and with Henry Wheaton in editing the 5th American ed. of Selwyn's *Abridgment of the Law of Nisi Prius* (1839); edited with copious notes the reissue of A. J. Dallas's *Reports*, and wrote a number of biographical sketches, which were republished in the volume of *Eminent Philadelphians* (1859).

**Wharton's Creek,** tp., Madison co., Ark. P. 84.

**What'com,** county of N. W. Washington Territory, bounded N. by British Columbia, W. by Washington Sound, lying between the Gulf of Georgia and Fuca Strait. The interior is covered with dense forests, and is crossed in the E. part by high, rugged mountains, the culminating point of which is Mount Baker, about 10,000 feet above the sea.

Lumber is as yet the principal product, although much of the soil is adapted for tillage. Cap. Whatcom. Area, about 4000 sq. m. P. 534.

**Whatcom,** p.-v., cap. of Whatcom co., Wash. Ter.

**Whate'ly,** p.-v. and tp., Franklin co., Mass. P. 1068.

**Whately** (Richard), D. D., b. in London, England, Feb. 1, 1787; graduated at Oriel College, Oxford, 1808; became a fellow there 1811; took orders in the Church of England; was intimately associated at Oriel with Keble, Arnold, Pusey, John Henry Newman, and others destined to become innovators in British theology; was noted for his wit, his freedom of thought and action, and fondness for debate; was Bampton lecturer 1822; rector of Halesworth, Sussex, 1822–25; principal of St. Alban's Hall, Oxford, 1825–30; professor of political economy in the University of Oxford 1830–31, and was appointed by Earl Grey archbishop of Dublin 1831, in which capacity he was charged with the difficult task of carrying out, in the details of social, political, and religious life, the principles embodied in the recent Roman Catholic Relief act. He was for twenty years the leading member of the Irish national board of education, for which he wrote several educational books; endowed the professorship of political economy in the University of Dublin; promoted the extension of the "national system" of unsectarian education in Ireland; won the confidence and co-operation of the Roman Catholic archbishop Murray, but resigned his seat at the board in 1853 from inability to work in harmony with the new archbishop (now cardinal), Cullen, and from the covert opposition of illiberal clergymen of the Church of England. He filled the posts of bishop of Kildare, visitor of Trinity College, president of the Royal Irish Academy, and chancellor of the order of St. Patrick. His family, which had been educated by the celebrated Joseph Blanco White 1832–35, took an active part in the promotion of Irish church missions, ragged schools, refuges, and other charitable institutions. Archbishop Whately was regarded as one of the founders of the "Broad Church" party, and was distinguished for "large munificence, genial hospitality, ever-ready wit, and solid common sense." D. at Dublin Oct. 8, 1863. Among his numerous works are—*Historic Doubts relative to Napoleon Bonaparte* (1819), *The Use and Abuse of Party Feeling in Matters of Religion* (Oxford, 1822), being the Bampton lectures for that year, *Essays on some of the Peculiarities of the Christian Religion* (1825), *Elements of Logic* (1826), *Elements of Rhetoric* (1828), *Essays on some of the Difficulties in the Writings of the Apostle Paul, and in other Parts of the New Testament* (1828), *View of the Scripture Revelations concerning a Future State* (1829), *The Errors of Romanism traced to their Origin in Human Nature* (1830), *Introductory Lectures on Political Economy* (1831), *Essay on the Omission of Creeds, Liturgies, and Codes of Ecclesiastical Canons in the New Testament* (1831), *Essays on some of the Dangers to Christian Faith which may arise from the Teaching or Conduct of its Professors* (1839), *The Kingdom of Christ delineated* (1841), *Introductory Lessons on Christian Evidences* (1841), *Introductory Lessons on the Study of St. Paul's Epistles* (1849), *Scripture Revelations concerning Good and Evil Angels* (1851), *English Synonyms* (1851), *Cautions for the Times* (1853), *Bacon's Essays, with Annotations* (1856), *Introductory Lessons on Morals* (new ed. 1860), *Introductory Lessons on Mind* (1859), *Introductory Lessons on the British Constitution* (1859), *Lectures on some of the Parables* (1859), *Lectures on Prayer* (1860), *Thoughts on the Proposed Revision of the Liturgy* (1860), *A General View of the Rise, Progress, and Corruptions of Christianity* (1860), and *Miscellaneous Lectures and Reviews* (1861). Since his death have appeared *Miscellaneous Remains* (1864) and *Earlier Remains* (1864), both edited by his daughter, Miss E. Jane Whately, who has also published her father's *Life and Correspondence* (2 vols., 1866). Two volumes of *Memoirs* (1864) were published by William J. Fitzpatrick.

Porter C. Bliss.

**Wheare** (Degory), b. at Jacobstow, Cornwall, England, in 1573; educated at Broadgate Hall, Oxford; took orders in the Church of England; became fellow of Exeter College 1602, and Camden professor of ancient history at Oxford 1622, and was principal of Gloucester Hall (afterward Worcester College) from Apr., 1626, until his death, Aug. 1, 1647. Author of *Lectiones Hiemales, de Ratione et Methodo Legendi Historias Civiles et Ecclesiasticas* (1623; 5th ed. 1684; translated into English by Edward Bohun, 1685; 3d ed. 1698), and other works.

**Wheat** [Ang.-Sax. *hwæte*], the most valuable and, next to maize, the most productive of all the cereal grasses, belongs to the genus *Triticum*, and is distinguished by a spike with many-flowered spikelets seated on opposite sides of a hollow and jointed stem, which rises zigzag and forms notches at each joint; by awned or awnless palets; and by grains with a longitudinal furrow on one side, turgid on the other, and hairy at the top. It is not known in a wild state, but most botanists are inclined to believe that it had its home in the central parts of Asia. It was very early cultivated, and has formed the principal breadstuff of all civilized nations since long before the historical era. The Bible and the Egyptian and the Chinese records testify to the antiquity of its cultivation. In proportionate altitude it may be cultivated very near the equator, but the proper limit for its cultivation is between lat. 20° and 25°. The lowest mean temperature in which it will ripen is 57.2°. The principal wheat-exporting countries are the U. S., Russia, Hungary, Denmark, Turkey, and Chili: 309,102,700 bushels were produced in the U. S. in 1874 from 24,967,027 acres, averaging 12.3 bushels to the acre. In England the average yield of an acre is 33½ bushels; in Denmark, 27½. This difference, however, does not refer to any difference in climate and soil—which, generally speaking, are much more favorable to the cultivation of wheat in the U. S. than in any of the two above-mentioned countries—but to a difference in the agricultural systems which are pursued. In the State of New York land which fifty years ago yielded from 20 to 30 bushels to an acre yields now only from 5 to 7; and the same fact has been observed in Ohio. The explanation is, that in such places the soil has become exhausted, no fertilizers having been applied to it; and generally the farmer has moved farther West in order to occupy fresh and hitherto uncultivated soil. The production of the chief wheat-growing States was in 1873—Iowa, 34,600,000 bushels; Illinois, 28,417,000; Minnesota, 28,056,000; Wisconsin, 26,322,000; California, 21,504,000; Indiana, 20,832,000; Ohio, 18,567,000; Pennsylvania, 15,548,000; Michigan, 14,214,000; Missouri, 11,927,000; Tennessee, 7,414,000; Kentucky, 7,225,000; New York, 7,047,000; Virginia, 5,788,000; Maryland, 5,262,000; Kansas, 4,330,000; Nebraska, 3.584,000; Oregon, 3,127,000; North Carolina, 2,795,000; West Virginia, 2,657,000; Georgia, 2,176,000; and New Jersey, 1,948,000.

**Wheat, Chemistry of.** See Flour, by Prof. E. N. Horsford, M. D., and Bread, by Prof C. F. Chandler, Ph. D., M. D., LL.D.

**Wheat'ear,** or **Fallowchat,** the *Saxicola œnanthe*, a European bird of the family Sylviadæ, allied to the Chat (which see), ranges from Africa in winter to the N. of Europe in summer, is six and a half inches in length, generally colored ash-brown and buff, marked with white and black, and is easily trapped as a delicacy for the table. It feeds on worms and insects, and the male sings well in confinement.

**Wheat'field,** tp., Jasper co., Ind. P. 103.

**Wheatfield,** tp., Ingham co., Mich. P. 781.

**Wheatfield,** tp., Niagara co., N. Y. P. 3406.

**Wheatfield,** tp., Perry co., Pa. P. 780.

**Wheat-Fly.** See Midge.

**Wheat'head,** tp., Will co., Ill. P. 1133.

**Wheat'land,** tp., Bureau co., Ill. P. 492.

**Wheatland,** tp., Fayette co., Ill. P. 871.

**Wheatland,** tp., Macon co., Ill. P. 1336.

**Wheatland,** p.-v., Spring Rock tp., Clinton co., Ia., at the junction of Chicago and North-western and Davenport and St. Paul R. Rs., has 3 churches, a graded school, library, hotel, and 1 newspaper. P. 788.

Frank L. Dennis, Pub. "Weekly News."

**Wheatland,** tp., Hillsdale co., Mich. P. 1513.

**Wheatland,** tp., Mecosta co., Mich. P. 400.

**Wheatland,** p.-v. and tp., Rice co., Minn. P. 681.

**Wheatland,** p.-v., Montgomery tp., Hickory co., Mo. P. 80.

**Wheatland,** tp., Monroe co., N. Y. P. 2565.

**Wheatland,** p.-v., Mercer co., Pa.

**Wheatland,** p.-v. and tp., Kenosha co., Wis. P. 843.

**Wheatland,** tp., Vernon co., Wis. P. 697.

**Wheatland** (Henry), M. D., b. at Salem, Mass., Jan. 11, 1812; graduated at Harvard 1832; studied medicine, but never practised; was an original member of the American Association for the Advancement of Science; one of the founders of the Essex Natural History Society and of the Essex Institute; is president of the latter body, vice-president of the Peabody Academy of Science, and director of the Salem Public Library, which has owed much of its prosperity to his efforts.

**Wheat'ley** (Henry B.), b. in England about 1835; is honorary secretary of the Early English Text Society, for which he has edited, from the original MS., Alexander Hume's quaint treatise, *Of the Orthographie and Congruitie*

*of the Britan Tongue* (1865), *Merlin, or The Early History of King Arthur, a Prose Romance* (part i., 1866), and Peter Levins's *Manipulus Vocabulorum, a Rhyming Dictionary* (1868); has compiled a *General Index to the Works of Thomas de Quincey* (1863); is author of a curious essay entitled *Of Anagrams, a Monograph treating of their History from the Earliest Ages to the Present Time, etc.* (Hertford, 1862), and of *Round About Piccadilly and Pall Mall, or a Ramble from the Haymarket to Hyde Park, a Retrospect of the Various Changes that have occurred in the Court End of London* (1870).

**Wheatley** (PHILLIS), a negro poetess, b. in Africa about 1750; was brought as a slave to Boston 1761; was taught to read by the family of her master, Mr. John Wheatley; made rapid progress in letters; soon displayed so much poetical talent, stimulated by the reading of Pope's *Homer*, that a volume of her verses was printed in London 1773, with a copper-plate portrait and a dedication to the countess of Huntingdon. She visited England in that year; wrote some notable verses to Gen. Washington, whom she visited at his head-quarters at Cambridge; was treated by him with great politeness, writing her a letter dated Feb. 2, 1776, and her poem was printed by his direction in the *Pennsylvania Magazine* for Apr., 1776. She married a colored man named John Peters, who seems to have fallen into great poverty during the Revolution. D. at Boston Dec. 5, 1784. Her *Letters* were privately printed in 1864.

**Wheat'ly** (CHARLES), b. in London, England, in 1686; educated at Merchant Taylors' School and at St. John's College, Oxford, of which he became fellow; took orders in the Church of England; was lecturer of St. Mildred's, London, and afterward vicar of Brent and Furneaux Pelham, Hertfordshire, where he d. May 13, 1742. Author of *The Church of England Man's Companion, being an Illustration of the Book of Common Prayer* (Oxford, 1710), subsequently enlarged and published as *A Rational Illustration of the Book of Common Prayer* (1714), *The Nicene and Athanasian Creeds, etc.* (1738), *Fifty Sermons* (3 vols., 1746), and other theological writings.

**Wheat'-Moths.** There are several lepidopterous insects which devour grain in the bin. Of these the best known is *Tinea granella*, an insect closely allied to the ordinary clothes-moth. Its larva devours the flour out of kernels of wheat, and covers the shells with its thick web. Thorough cleanliness, whitewashing, and the use of coal oil tend to prevent its ravages, and the grain should be frequently shovelled over. An open lamp will also allure many of the flying moths to their own destruction. The Angoumois grain-moth (*Gelechia cerealella*) is another similar insect of the same family.

**Whea'ton,** p.-v., cap. of Du Page co., Ill., on Chicago and North-western R. R., 25 miles from Chicago, contains 4 churches, Wheaton College, a public school, 1 bank, 1 newspaper, and 3 hotels. Principal business, farming and dairying. P. 998. J. RUSSELL SMITH, ED. "ILLINOIAN."

**Wheaton,** v., Wayne tp., Tippecanoe co., Ind. P. 87.

**Wheaton,** tp., Chippewa co., Wis. P. 799.

**Wheaton** (HENRY), LL.D., b. at Providence, R. I., Nov. 27, 1785; graduated at Rhode Island College (now Brown University) 1802; studied law; was admitted to the bar 1805; spent eighteen months at the law school at Poictiers, France, 1805–06; studied some months at London 1807; practised law at Providence 1807–12; settled in New York in 1812; edited the *National Advocate*, the organ of the administration party, 1812–15, in which he published some notable articles on the question of neutral rights in connection with the then existing war with England; became division judge-advocate of the army Oct. 26, 1814; was justice of the marine court of the city of New York May, 1815–July, 1819; reporter of the Supreme Court of the U. S. 1816–27; delegate to the convention for forming a new constitution for New York 1821; member of the New York assembly 1823; was associated with Benjamin F. Butler and John Duer in a commission for revising the statute law of New York 1825; was U. S. chargé d'affaires to Denmark 1825–37; displayed great diplomatic skill in the settlement of the vexed question of the Sound dues, and acquired a high reputation by his researches into Scandinavian history, languages, and literature; was appointed minister resident at the court of Prussia 1835; was soon promoted to minister plenipotentiary 1837, filling that post until 1846, during which period he became honorably distinguished by his writings on international law and by his settlement of the questions relating to the Scheldt dues, the tolls on the Elbe, and the rights of American naturalized citizens; was chosen a corresponding member of the French Institute 1843, and a foreign member of the Royal Academy of Science at Berlin 1846; signed an important treaty with Germany (1844), which was rejected by the U. S. Senate for political reasons, but has served as the basis of later treaties, and was requested to resign in 1846 by Pres. Polk, much to the "astonishment and indignation of both parties at home and all parties abroad;" was complimented with public dinners in New York and Philadelphia on his return to the U. S. 1847, and was immediately chosen lecturer on international law at Harvard University. D. at Dorchester, Mass., Mar. 11, 1848. Author of *A Digest of the Law of Maritime Captures and Prizes* (1815), *Reports of Cases Argued and Adjudged in the Supreme Court of the U. S. 1816–27* (New York and Philadelphia, 12 vols., 1826–27), *A Digest of the Decisions of the Supreme Court of the U. S. from its Establishment in 1789 to 1820* (2 vols., 1820–29), *The Life of William Pinkney* (1826), *A History of the Northmen, or Danes and Normans, from the Earliest Times to the Conquest of England by William of Normandy* (London, 1831), *The Elements of International Law, with a Sketch of the History of the Science* (Philadelphia, 1836; London, 2 vols., 1836), *Histoire du Progrès du Droit des Gens en Europe depuis la Paix de Westphalie jusqu'au Congrès de Vienne, avec un Précis historique du Droit des Gens européens avant la Paix de Westphalie* (Leipsic, 1841), written in unsuccessful competition for a prize offered by the French Institute, and translated into English by William B. Lawrence under the title *A History of the Law of Nations in Europe and America from the Earliest Times to the Treaty of Washington* (New York, 1845); *An Inquiry into the Validity of the British Claim to a Right of Visitation and Search of American Vessels suspected to be engaged in the Slave-Trade* (1842); contributed to Dr. Andrew Crichton's *History of Scandinavia* (1838), and published many articles in the *North American Review* and other periodicals, and numerous historical, political, and literary addresses or essays, of all which a collective edition in 3 or 4 vols. was contemplated by Mr. Wheaton, but has never appeared. His great work on *International Law* has become a recognized standard in the English language, and has been edited by rival commentators, Mr. William Beach Lawrence (1855) and Mr. Richard H. Dana, Jr. (1866). The former gentleman added a *Biography* of Mr. Wheaton, and has since published in French a *Commentaire* on this work (Leipsic, 1868 *seq.*). PORTER C. BLISS.

**Wheaton** (NATHANIEL SHELDON), D. D., b. at Washington, Conn., Aug. 20, 1792; graduated at Yale College 1814; took orders in the Protestant Episcopal Church; was rector of Christ church, Hartford, 1818–31, president of Trinity College 1831–37, and rector of Christ church, New Orleans, 1837–44, and visited Europe 1823–24, and again 1844. D. at Washington, Conn., Mar. 18, 1862. He was one of the chief founders of Trinity College, for the endowment of which he raised $40,000, and bequeathed to it $20,000 more. Author of a *Journal of a Residence in London, etc.* (1830), and of several religious publications.

**Wheaton College,** in Wheaton, Ill., 25 miles W. of Chicago, on the Galena division of the North-western R. R., was founded in 1850 by the Illinois annual conference of the Wesleyan Methodists. The first trustees were appointed in 1851, and in 1853 a school was opened in the lower story of an unfinished stone building, under the care of Rev. John Cross. In 1855 the Rev. L. C. Matlack was chosen the first president of what was then called the "Illinois Institute." On account of a pecuniary crisis, the founders proposed to the Congregationalists that they should take the control of the institution, and in 1860 the Rev. J. Blanchard was chosen president of what is now called "Wheaton College." In the same year the first class of seven young men graduated. The college is now in possession of a commodious and beautiful stone edifice, and of property to the value of $100,000 above its liabilities. Its faculty consists of 11 members, besides assistant teachers, and the number of its students is 230. All the benefits of the regular college course are extended to both sexes. O. F. LUMRY.

**Wheat'stone** (Sir CHARLES), F. R. S., LL.D., b. at Gloucester, England, in 1802; was in early life a manufacturer of musical instruments; was led by his profession to investigate the laws of sound and their application to music—subjects on which he published papers in the *Annals of Philosophy* (1823 *seq.*) and the *Quarterly Journal of Science;* contributed papers to the *Philosophical Transactions* on Chladni's figures (1833) and *An Account of some Experiments to measure the Velocity of Electricity and the Duration of Electric Light* (1834); became in the latter year professor of experimental philosophy in King's College, London; was chosen a fellow of the Royal Society 1836; read to that body his *Contributions to the Physiology of Vision*, as a consequence of which researches he soon afterward (1838) invented the stereoscope; began in June,

1836, with Mr. William Fothergill Cooke, a series of successful experiments in electro-magnetism, with a view to the transmission of intelligence over copper wires; took out, along with Cooke, in May, 1837, a patent for a magnetic telegraph, which was not, however, practically operated until after that of Morse; invented also an electro-magnetic alarum and various instruments for registering thermometrical and barometrical indications and transit observations in astronomy; was one of the jurors in the class for health, light, and electricity at the Paris Universal Exposition of 1855; received from Napoleon III. the cross of the Legion of Honor; was awarded Ampère's medal by the French Society for the Encouragement of National Industry; was knighted by Queen Victoria 1868; received in the same year the Copley medal of the Royal Society for his researches in acoustics, optics, electricity, and magnetism; was made LL.D. by the University of Edinburgh Apr. 12, 1869, and elected foreign associate of the French Academy of Sciences June 30, 1873, to fill the vacancy caused by the death of Baron Liebig. D. at Paris Oct. 19, 1875. An English official commission, consisting of Sir Mark I. Brunel and J. F. Daniell, declared under date of Apr. 27, 1841, that Mr. Wheatstone was the person to whose scientific researches the practical application of the telegraph was due. He was author of papers on *The Physiology of Vision* (1852), *The Binocular Microscope* (1853), *Fessil's Gyroscope* (1854), *Powers for Arithmetical Progression* (1854–55), and *Automatic Telegraphy* (1859).

PORTER C. BLISS.

**Whe'don** (DANIEL DENISON), D. D., LL.D., b. at Onondaga, N. Y., Mar. 20, 1808; graduated at Hamilton College 1828; studied law; was professor of ancient languages at Wesleyan University, Middletown, Conn., 1832–43; became a preacher of the M. E. Church 1836; was professor of rhetoric, logic, and history at the University of Michigan 1845–53, and became in 1856 editor of the *Methodist Quarterly Review* and general editor of the publications of the Methodist Book Concern, New York. Author of *Public Addresses, Collegiate and Popular* (1856), *A Commentary on Matthew and Mark* (1860), *The Freedom of the Will as a Basis of Human Responsibility, etc.* (1864), and a *Commentary on the New Testament* (5 vols., 1866 *seq.*) of a strongly anti-Calvinistic character.

**Wheel.** See WHEEL-AND-AXLE and WHEELWORK.

**Wheel,** an instrument of torture and death, was used in Germany before 1400, and was employed in Prussia as late as 1841. The prisoner was bound upon a large wheel, with his arms and legs extended, and each limb was fractured as the wheel revolved by the blows of an iron rod, both above and below the knees and elbows. In France, *coups de grace*, or merciful blows, were often administered upon the head and chest, so as to shorten life; but frequently the victim was allowed to lie upon the wheel and die of pain and neglect. This punishment was introduced into France by Francis I. Persons so punished were usually traitors, parricides, etc. Hence the term *roué* ("broken on the wheel") applied to persons guilty of odious practices by which their energies are exhausted.

**Wheel-and-Axle,** one of the so-called mechanical powers, is an application of the principle of the lever. There are two cylinders with a common axis, with differing radii—the smaller being termed the *axle*, the larger the *wheel*. Suppose a cord is wound around the wheel in one direction, and another cord around the axle in the contrary direction. The condition of equilibrium of weights attached to these cords is that the product of each of the weights into their respective radii should be equal.

**Wheel-Animalcule.** See ROTIFERA.

**Wheel'er,** p.-v. and tp., Gratiot co., Mich. P. 231.

**Wheeler,** p.-v. and tp., Steuben co., N. Y. P. 1330.

**Wheeler,** or **Wheler** (Sir GEORGE), D. D., b. at Breda, Holland, in 1650, of English parentage; settled in Kent, England, in childhood; was educated at Lincoln College, Oxford; travelled on the Continent with Dr. James Spon of Lyons, extending their tour to Dalmatia, Greece, and Asia Minor 1675–76; presented to the University of Oxford a valuable collection of MSS.; was knighted, and took orders in the Church of England 1683; became prebendary of Durham 1684, and subsequently vicar of Basingstoke, Hampshire, and rector of Houghton-le-Spring, where he d. Feb. 18, 1724. Author of *A Journey into Greece* (1682), which was translated into French, *An Account of the Churches or Places of Assembly of the Primitive Christians* (1689), and *The Protestant Monastery, or Christian Œconomics* (1698).

**Wheeler** (JOHN H.), b. at Murfreesboro', N. C., in 1806; graduated at Columbian College, Washington, 1826; became a lawyer, member of the North Carolina Assembly, and a prominent Democratic politician; was appointed by Pres. Jackson superintendent of the U. S. mint at Charlotte 1836; was treasurer of North Carolina 1842–44; minister resident of the U. S. in Nicaragua 1854–57, where he hastened to recognize the presidency of William Walker; was in 1859–61 employed in the statistical department of the ministry of the interior at Washington; took part in the rebellion, and has since been a resident of that city, engaged in condensing and collating the debates of Congress, and also employed in statistical labors. Author of *Historical Sketches of North Carolina* (1851) and *A Legislative Manual for North Carolina* (1874), and editor of Col. David Fanning's *Autobiography, etc.* (Richmond, 1861).

**Wheeler** (NATHANIEL), b. in Watertown, Conn., in 1820. After receiving a good public-school education, he began life as a manufacturer in a small way, and in 1850 made the acquaintance of Mr. Allen B. Wilson, who was engaged in perfecting a sewing-machine, but needed aid in patenting his invention and introducing it to the public. After a careful examination of its merits, Mr. Wheeler joined him in the enterprise, and, enlisting the interest of others in it, the machine was patented in 1852 (see SEWING-MACHINES), and the firm of Wheeler, Wilson & Co. (changed a year later to "The Wheeler and Wilson Manufacturing Co.") was founded. Mr. Wheeler's thorough knowledge of machinery and his remarkable ability as an organizer enabled him to expand the sewing-machine manufacture from its small beginnings in the little factory which could turn out one machine a day to the vast establishment which has facilities for producing 600 per diem. But he has, since 1850, as president of the Wheeler and Wilson Manufacturing Co., also accomplished the much more difficult work of creating a market for more than 1,200,000 sewing-machines, and demonstrating that the sewing-machine is a prime necessity in every household.

L. P. BROCKETT.

**Wheeler** (RAYALL T.), b. in New Hampshire in 1810; was educated at Kenyon College, O.; taught school and an academy; studied law in Kentucky, and graduated B. L. in the Cincinnati Law School Mar. 27, 1837; went to Arkansas, and there practised his profession and married; in 1839 removed to Texas; became judge in 1845, and rose to the supreme bench. D. Nov. 8, 1864.

**Wheeler** (WILLIAM A.), b. June 30, 1819, in Malone, Franklin co., N. Y.; entered the University of Vermont in the class which graduated in 1842, but the sudden death of his father compelled him to leave his collegiate course uncompleted. He commenced the study of law with Col. Asa Hascall, and was at different times employed as a school-teacher. Soon after his admission to the bar he rose rapidly in the legal profession, and was made district attorney for Franklin county, holding the position until he declined to retain it longer. For several years he was superintendent of schools for Franklin county. In 1850 and 1851, Mr. Wheeler represented Franklin county in the New York house of assembly; was a member of the senate of New York in 1858 and 1859, and president *pro tem.* of that body. He was a member and the president of the New York constitutional convention in 1867–68; was elected a Representative in Congress to the 37th, 41st, 42d, 43d, and 44th Congresses, and in June, 1876, was unanimously nominated for the Vice-Presidency of the U. S. by the Republican national convention at Cincinnati. For several years he was much engaged in banking and railroad affairs. He was one of the organizers of the bank of Malone, and held the position of cashier and chief managing director. He was trustee of the Northern New York Railway Co. In the political complications which arose in Louisiana during the session of the 43d Congress, Mr. Wheeler was conspicuous, he having been chairman of the special committee of the House of Representatives that visited Louisiana, and finally adjusted the difficulties existing there on the basis of what is known as "the Wheeler compromise."

Z. K. PANGBORN.

**Wheeler** (WILLIAM ADOLPHUS), b. at Leicester, Mass., Nov. 14, 1833; graduated at Bowdoin College 1853; was an assistant to Dr. Joseph E. Worcester in the preparation of his quarto *Dictionary* (1856–59); contributed to the new illustrated edition of Webster's *Dictionary* (1864), published separately, *A Dictionary of the Noted Names of Fiction, etc.* (Boston, 1865), edited a *Dickens's Dictionary* and Hole's *Brief Biographical Dictionary* (1866); began a *Shakspearian Cyclopædia;* aided Richard Soulé, Jr., in his manuals of spelling and reading; became in 1867 assistant superintendent of the Boston Public Library. D. at Roxbury Oct. 28, 1875. He left unfinished an index to anonymous literature, entitled *Who Wrote It?*

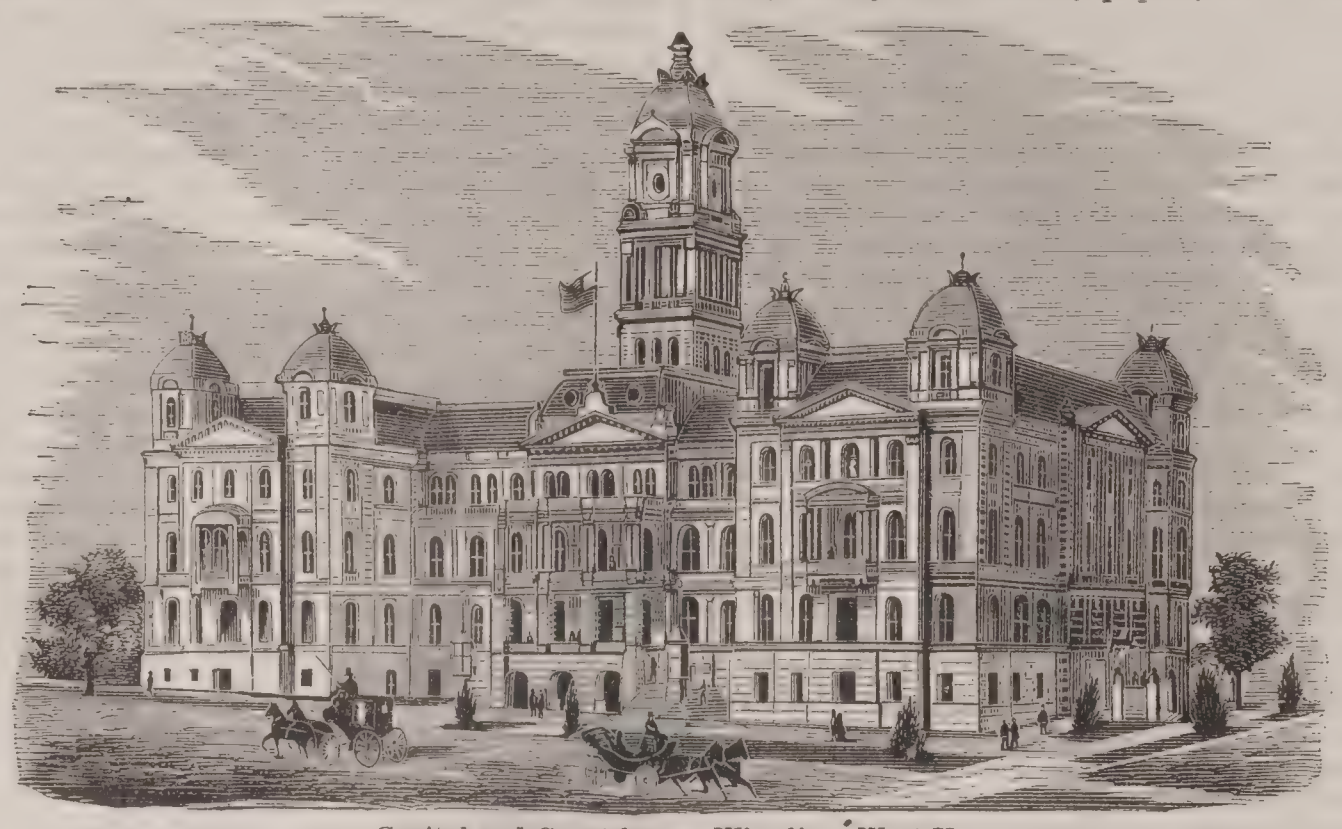
**Wheele'ra Eb'enus,** a West Indian leguminous tree, whose dark-green, heavy, handsome wood is much used by joiners under the incorrect name of West India ebony.

**Wheel'ersburg,** p.-v., Porter tp., Scioto co., O. P. 358.

**Wheel'ing,** p.-v. and tp., Cook co., Ill. P. 1835.
**Wheeling,** p.-v. and tp., Rice co., Minn. P. 864.
**Wheeling,** p.-v. and tp., Livingston co., Mo. P. 249.
**Wheeling,** tp., Belmont co., O. P. 1240.
**Wheeling,** p.-v. and tp., Guernsey co., O. P. 1090.

**Wheeling,** city and port of entry, cap. of West Virginia and seat of justice of Ohio co. in that State, on both sides of Wheeling Creek, on the eastern bank of Ohio River, on the Baltimore and Ohio R. R., and on the Hempfield connection of this road and its Connellsville branch, 92 miles below Pittsburg, Pa. The city is principally a manufacturing place, the surrounding country containing enormous deposits of bituminous coal; 7 nail-factories, 5 blast furnaces, a rail-mill, bar and sheet iron mill, several glass-factories, 2 paper-mills, a number of foundries and machine-shops, 1 hinge and 1 tack factory, and several other manufacturing establishments are in operation. The trade, however, carried on by way of the river and the railway lines is very considerable. During the year ending June 30, 1875, 11 steamers of 2067 tons and 17 barges of 13,336 tons were built, and the total shipping belonging to the port amounted on that date to 73 steamers of 8508 tons and 128 barges of 1383 tons. The city is divided into eight wards, but the division most commonly known is that into North, East, Centre, and South Wheeling, and Zane's Island, which is more than a mile long, contains 400 acres, and is connected with the city by a fine suspension bridge. Each ward has a public school, in which both German and English are taught. The city also contains 2 seminaries, 21 churches, a public library with reading-room, 3 daily and 5 weekly papers, etc. Among its public buildings the most noteworthy are the custom-house, the new court-house, the theatre, etc. Wheeling was settled in 1774, incorporated in 1806, made the capital of West Virginia in 1863, and again in 1875. It had 11,435 inhabitants in 1850, 14,083 in 1860, 19,280 in 1870; and 30,000 in 1876, according to local estimation.

A. W. CAMPBELL, ED. "INTELLIGENCER."



Capitol and Court-house, Wheeling, West Va.

**Whee'lock** (ELEAZAR), D. D., b. at Windham, Conn., Apr. 22, 1711; graduated at Yale College 1733; was ordained pastor of the Second Congregational church at Lebanon, Conn., Mar., 1735, remaining there thirty-five years; established a school 1754; had as a pupil an Indian boy, Samson Occom (see OCCOM, SAMSON), whose proficiency led to the establishment of Moor's Indian Charity School, which grew into DARTMOUTH COLLEGE (which see), for which he obtained a large tract of land in New Hampshire, and removed thither as first president of the college Aug., 1770. One of his pupils at Lebanon was the celebrated Joseph Brandt. D. at Hanover, N. H., Apr. 24, 1779. He published several *Narratives of the Indian Charity School* (1762–75), together with an abstract of McClure and Frisbie's mission to the Delaware Indians W. of the Ohio, and some sermons. A *Memoir* by Rev. Drs. Elijah Parish and David McClure appeared in 1810.

**Wheelock** (JOHN), D. D., LL.D., son of Dr. Eleazar, b. at Lebanon, Conn., Jan. 28, 1754; entered Yale College 1767; went to Hanover, N. H., with his father 1770, and graduated with the first class at Dartmouth College 1771; was tutor there 1772–74; represented Hanover in the legislature 1775; served as major and lieutenant-colonel in the army of the Revolution, and was a member of Gen. Gates's staff; was chosen successor to his father as president of Dartmouth College 1779, though only twenty-five years of age; visited England to raise funds 1783; was partially successful, but lost the money and papers by shipwreck off Cape Cod; was removed from office 1815 in consequence of an ecclesiastical controversy, but restored 1817. D. at Hanover Apr. 4, 1817, leaving half his estate to Princeton Seminary. Author of a *Eulogy on Prof. John Smith, D. D.* (1809), and *Sketches of Dartmouth College* (1816).—His only daughter, MARIA MALLEVILLE WHEELOCK, married Pres. William Allen of Bowdoin College.

**Wheelocke, or Whelock** (ABRAHAM), b. at Loppington, Shropshire, England, about 1592; educated at Trinity College, Cambridge; became a fellow at Clare Hall; was appointed first professor of Arabic, and also of Anglo-Saxon, at Cambridge 1632; was minister of St. Sepulchre's 1622–42, and was, by presentation of Sir Henry Spelman, vicar of Middleton, Norfolk. D. in London in Sept., 1653. He edited and translated Bede's *Ecclesiastical History* (1644), Lambarde's *Old Saxon Laws* (1644), the *Anglo-Saxon Chronicle* (1644); printed the Gospels in Persian and Latin (1657), and labored on Walton's *Polyglot.*

**Wheel'work, or Gearing.** These terms are applied to trains of toothed wheels, a common arrangement of mechanism by which continuous rotation is communicated from one revolving axis to another. It is not even necessary for the communication of motion that the wheels should be supplied with teeth, frictional gearing being that kind of wheelwork in which motion is transmitted from one wheel to another by the mere contact of the rims of the wheels. This requires, however, that the smooth edges of the wheels shall be constantly pressed together, circular V-shaped grooves and projections being generally provided to make the friction more effective. Teeth are generally provided, however, which, by interlocking, render the slipping of one circumference upon another impossible. Wheelwork usually receives a special designation, depending on the relative positions of the axes of the wheels. When the axes are parallel, it is called *spur-gearing;* when the axes intersect, *bevel-gearing;* and when the axes are not parallel, and do not intersect, *skew-bevel* and *screw-gearing.*

One of the most important requirements in wheelwork is that smooth and continuous motion shall be communicated from the driver to the follower. In frictional gearing this always takes place, but in toothed gearing a constant ratio of the angular velocities of the two wheels in gear, without shocks, can only be attained by special forms of teeth; the investigations for the development of these forms of teeth have occupied geometricians for a long period. The forms of cross-section which have been found to produce a constant ratio of the angular motions are found generally by the rolling of curves on the pitch-circles of the wheels, tracing points in the rolling curves producing epicycloidal forms of teeth, which remain in contact with a limited amount of sliding between the curved faces of the teeth. These forms are also often involutes of the circles which form the bases of the teeth; the difference between involute teeth and epicycloidal teeth being that the curves of the former are single continuous curves, forming the entire sides of the teeth, while in epicycloidal teeth the curve of a tooth is made up of two separate curves joined at the pitch-circle.

In common gearing, where great accuracy is not required, the curves of the teeth are often composed of arcs of cir-

cles drawn according to special geometric rules, these resulting curves being a sufficient approximation to the epicycloids which are traced in the more exact constructions. The ratio of the angular velocities in spur and bevel gearing is always inversely proportional to the radii of the pitch-circles of the wheels or to the numbers of teeth in the wheels. In skew-bevel gearing this ratio is inversely proportioned to the radii at the throats or smallest parts of the hyperboloids which form the bases of the wheels; and in screw-gearing the angular velocities are inversely proportional to the number of threads. In two wheels which work continuously together during a complete revolution the pitch of the teeth in both wheels must be the same. The pitch must also be an aliquot part of the circumference of each; hence the ratio of the numbers of revolutions in a given time must be expressible in whole numbers. In screw-gearing the normal pitch—*i. e.* the pitch as measured on a helix of the screw cylinder which cuts the teeth at right angles—must be the same in both wheels. The screw and worm wheel is an example of screw-gearing in which the axes are at right angles, the diameter of the screw being much smaller than that of the wheel.

In a train of wheelwork where spur-wheels are employed and the axes parallel, the ratio of the numbers of revolutions of the first and last wheels may be found by multiplying the numbers of teeth in all the drivers for a numerator, and of all the followers for a denominator. The resulting ratio will be that of the number of revolutions of the first wheel divided by the number of revolutions of the last wheel.

The subject of wheelwork is fully developed in Willis's *Principles of Mechanism*, in Rankine's *Machinery and Millwork*, and in other works on mechanism.

W. P. Trowbridge.

**Wheel'wright** (John), b. in Lincolnshire, England, in 1594; graduated at Cambridge as a classmate of Oliver Cromwell 1614; took orders in the Church of England; was vicar of Bilsby, near Alford, 1623–31; was silenced for nonconformity by Archbishop Laud; came to Massachusetts 1636; was chosen pastor of a church at Braintree; was a brother-in-law of the celebrated Anne Hutchinson, whose religious opinions he defended, on which account, though supported by Gov. Vane, he came into sharp collision with Rev. John Wilson, pastor of the Boston church, especially in consequence of a sermon preached at Boston on Fast Day, 1637, which was declared seditious by the general court; was banished from Massachusetts 1638; removed with his partisans to New Hampshire; founded Exeter on the Squamscott, organizing a church there, and that territory being subsequently claimed by Massachusetts, located with a part of his church at Wells, Me., 1643; was allowed to return to Massachusetts 1646; resided at Hampton 1646–54; was in England 1657–60, and was settled in 1662 as pastor at Salisbury, N. H., where he d. Nov. 15, 1679. He published in 1645, in answer to Thomas Weld, *Mercurius Americanus, or Observations on a Paper entitled Of the Rise, Reign, and Ruin of the Familists, Libertines, etc. in New England;* and in 1654 printed a *Vindication.* The genuineness of an Indian deed to him, covering a large tract of land in New Hampshire, has been the occasion of much controversy, on which subject see Savage's edition of Winthrop's *History*, also Savage's *Genealogical Dictionary.*

**Wheelwright** (William), b. at Newburyport, Mass., in 1798; was brought up to seafaring pursuits; commanded a trading-vessel on the W. coast of South America as early as 1823; established in 1829 a line of passenger-vessels between Valparaiso and Cobija; planned in 1835 the line of steamers on the W. coast, now running 54 steamers; built the first telegraph-line in South America; suggested in 1842 the railroad from Santiago to Valparaiso, which he subsequently built, as also that from Caldera to Copiapo and Tres Puntos 1849–52; planned a railroad from Caldera across the Andes to Rosario on the Paraná; obtained a concession for the Central Argentine R. R., which he built from Rosario to Cordova 1863–70; finished in 1872 a road from Buenos Ayres to Ensenada, and was identified with many other public works in Chili, Peru, and the Argentine Republic. D. at London Sept. 26, 1873, and was buried at Newburyport. His bust was placed many years before in the Chamber of Commerce at Santiago, Chili. His *Life and Industrial Achievements in South America*, by J. B. Alberdi, was published (in Spanish) at Paris in 1876.

**Whe'lan** (Richard Vincent), D. D., b. at Baltimore Jan. 29, 1809; educated at Mount St. Mary's College, Emmittsburg, Md., where he became a teacher and was "prefect of studies;" graduated in theology and philosophy at the seminary of St. Sulpice, Paris, 1831; was ordained to the priesthood at Versailles the same year; was professor at St. Mary's College 1832–35; performed mission-work at Harper's Ferry, Martinsburg, and other towns of Virginia and Maryland 1835–40; was consecrated bishop of Richmond Mar., 1850; took the title of bishop of Wheeling on the division of the diocese in 1851; settled at Wheeling, where he built up a seminary for young ladies and a convent at Mount de Chantal, and was active in promoting the interests of his Church; was a member of the Vatican Council of 1869–70, and opposed the dogma of infallibility, but gave in his adhesion after its promulgation. D. at Wheeling July 7, 1874.

**Whelk** [Ang.-Sax. *hwylca*], a name popularly applied in a vague manner to species of gasteropod mollusks belonging principally to the families Buccinidæ and Muricidæ, but more especially to the former, the type of that family (*Buccinum undatum*) being the common whelk of England. The species of the two families agree in having shells whose body-whorls are inflated, whose spire is moderately exserted, while the aperture is notched and more or less produced forward or canaliculated. The animals have elongated filiform tentacles; the eyes placed outside the tentacles; the odontophore or lingual ribbon long and straight, and armed with three longitudinal rows of teeth; and the foot comparatively short. The representatives of the two families are distinguished by differences in the dentition of the odontophore. In the Buccinidæ the median or rhachidian tooth is flat and lamelliform, and generally armed at its anterior margin with denticles arising directly therefrom, and the lateral teeth are broad and armed with a strong external and at least a weaker internal dentiform lobe. In the Muricidæ the rhachidian tooth is thick, solid, and somewhat prismatic, and armed with denticles which project from its anterior edge over the convexity of the outer surface, and the lateral teeth are comparatively narrow at the base, and have each but a single dentiform lobe arising therefrom. No conchological characters are coordinated with these, and the systematic position of the various genera have therefore to be determined each on its own merits. The most noteworthy species of whelks are those of the genera (1) *Buccinum* (and especially *Buccinum undatum*), (2) *Chrysodomus* or *Neptunea*, (3) *Fulgur* or *Busycon*, (4) *Sycotypus*, and (5) *Purpura*, the first four of which are Buccinidæ, and the last Muricidæ. (1) *Buccinum undatum* and some related species are very common in the colder seas, and form one of the chief elements of the food of the codfishes. In England it is a staple article of food, and sold largely in the markets. According to Jeffries, "Evidence was given before a select committee of the House of Commons in the session of 1866, on the 'Whitstable Oyster-fishery Extension bill,' that the whelk fishery on a sandy flat in that bay yielded £12,000 a year, part of the produce being disposed of in the London market for food, and the rest sent to the codfishing banks for bait." Unless sold the day after they are caught in the summer, they are boiled, and may be then kept for some time. (2) The shell of the almond or red whelk (*Chrysodomus antiquus*) of the market is used in the Shetland Islands and some other places for a lamp, being suspended, mouth upward, by a string around the middle or toward the ends, from a nail in the wall or roof. (3–4) The species of *Fulgur* and *Sycotypus* are common to the Atlantic shores of North America, and are the common large univalve shells of the coasts. (5) *Purpura lapillus* is a very abundant species in the northern seas, and may be found in large numbers clinging to the rocks between tidemarks, as well as lower down, and especially where seaweed is abundant. It secretes a purplish fluid, similar to that of the true purple-bearing mollusks which afforded the ancient Tyrian dye, and hence the generic name applied to it.

Theodore Gill.

**Whe'lock,** p.-v. and tp., Caledonia co., Vt. P. 822.

**Whet'stone,** tp., Crawford co., O. P. 1490.

**Whew'ell** (William), D. D., F. R. S., b. in Lancaster, England, May 24, 1794; graduated at Trinity College, Cambridge, 1816; became a fellow there; took orders in the Church of England; was for many years a highly successful tutor; was professor of mineralogy 1828–32, of moral theology or casuistry 1838–55; was master of Trinity College from 1841, and vice-chancellor of Cambridge University from 1855 to his death, at Cambridge Mar. 5, 1866. He long enjoyed the reputation of possessing more universal information than any other man in England. Author of several textbooks on mathematics, mechanics, and dynamics; *Astronomy and General Physics considered with Reference to Natural Theology* (1833), being the third Bridgewater treatise; *A History of the Inductive Sciences from the Earliest to the Present Time* (3 vols., 1837; 3d ed. 1857); *The Philosophy of the Inductive Sciences* (2 vols., 1849; remodelled in 3 parts, 1858–60); *Lectures on the History of Moral Philosophy in England* (1852); *Of the Plurality of Worlds, an Essay* (1853); *Lectures on Political Economy* (1863), and *The Platonic Dialogues for English*

*Readers* (3 vols., 1859–61), besides many minor works, translations, essays, reviews, and papers in the *Transactions* of learned societies. An account of his writings, with selections from his correspondence, by Prof. Isaac Todhunter, appeared in 1876.

**Whey** [Ang.-Sax. *hwæg;* D. *wei* or *hui;* Ger. *Molken*], the serum of MILK (which see), obtained when the caseine of milk is coagulated by means of rennet or acids, as in the manufacture of cheese. It forms a clear, straw-colored liquid, and contains the water and sugar (lactose) of the milk.

J. P. BATTERSHALL.

**Which'cote** (BENJAMIN), D. D., b. in Shropshire, England, Mar. 11, 1610; graduated at Emanuel College, Cambridge, 1629; became a fellow there 1633; became distinguished as a tutor; took orders in the Church of England 1636; was appointed Sunday lecturer at Trinity church and preacher to the university; became incumbent of North Cadbury, Somersetshire, 1643, provost of King's College 1644, and rector of Milton, Cambridgeshire, 1649; favored the Puritans during the great rebellion and the protectorate; was deprived of his provostship at the Restoration 1661, but obtained the living of St. Anne's, Blackfriars, 1662, and the vicarage of St. Lawrence, Jewry, 1668. D. at Cambridge in May, 1683. He was regarded as "one of the heads, if not the chief founder, of the latitudinarian school of English divines," and enjoyed great fame as a preacher. He published nothing during his lifetime, but his friend, the earl of Shaftesbury, whose genius was kindred to his own, edited his *Observations and Apophthegms* (1688) and his *Sermons* (1698); and Dr. John Jeffery edited his *Moral and Religious Aphorisms* (1703) and his *Discourses* (3 vols., 1701–03), to which Dr. Samuel Clarke added a 4th (1707). An edition of *Sermons* (4 vols., 1751) was accompanied by a *Life* by Drs. Campbell and Gerard.

**Whidaw-Finch.** See WIDOW-BIRD.

**Whiff, Sail-Fluke, Marysole,** or **Carter** (*Lepidorhombus megastema*), a fish of the flatfish family (Pleuronectidæ), related to the turbot of the northern European coasts. The body is rather elongated, the height being contained two and two-thirds times in the total length, without including caudal; the scales are small and pectinated; the lateral line describes a semicircular curve above the pectoral; the eyes are on the left side, and close together; the teeth in a band on the jaws, and present also on the vomer, but not on the palatines; the dorsal commences on the snout in advance of the eyes; the ventrals have a long base, but are free from the anal—D. 85–87, A. 67–67. The species does not seem to be a very abundant fish anywhere, although, according to Mr. Couch, it is "well known to the Cornish fishermen, who apply the name of 'carter' to it. It keeps on sandy ground at no great distance from land, and takes a bait, so that it is caught as often as any of the salt-water flatfishes, but is not so highly esteemed for the table, chiefly from being so thin." Its nearest representative on the American coast is the *Citharicthys microstomus* of the sandy shores of the Middle States. THEO. GILL.

**Whig** [a contraction of *Whiggamore,* a local expression which in South-western Scotland denoted a drover] was first introduced into public use in 1648, when a party of Covenanters from that part of the country attacked Edinburgh. From that time all who opposed the court were called *Whiggs,* and in 1679, during the debate on the bill for the exclusion of the duke of York from the succession, the term came into common use in English politics. (See TORY.) During the Revolution the American patriots called themselves Whigs, and later (1832–54) there existed a Whig party in American politics. (See UNITED STATES and REPUBLICAN PARTY.)

**Whim'brel** [from *whimper*], a species of the genus *Numenius* (*N. phæophus*), related to the common curlew (*N. arquata*), but considerably smaller, and hence also called half-curlew and jack-curlew in England. It is found not only in Europe, but also, in the winter season of the northern hemisphere, in Africa and Asia.

**Whin.** See DYERS' BROOM.

**Whin'chat,** or **Furzechat,** the *Saxicola* (or *Pratincola*) *rubetra,* a little European bird of the family Sylviadæ. It considerably resembles the stonechat, but is smaller, and is also considerably less than the wheatear. Like the latter, it is highly prized for the table, and is trapped in great numbers in the autumn, when fat. It is an excellent song-bird in confinement. (See CHAT.)

**Whip'ple** (ABRAHAM), b. at Providence, R. I., Sept. 16, 1733; in early life commanded a merchant-vessel in the West Indies trade; was captain of the privateer Game Cock during the French war 1759–60, capturing in a single cruise 23 French prizes; headed in June, 1772, the expedition which burned the British revenue-schooner Gaspe in Narragansett Bay; was made commodore of two armed vessels fitted out by the colony of Rhode Island June, 1775; became commander of the Columbus Dec., 1775, and afterward of the schooner Providence, which captured more British prizes than any other vessel, but was itself finally taken by the British; was placed in command of the new frigate Providence, with which he adroitly escaped from the blockade of Narragansett Bay; captured 10 richly-laden vessels from the Jamaica fleet 1779, and attempted with a squadron to relieve Charleston, S. C., when besieged by the British, but was captured and held a prisoner until the close of the war. He was subsequently a farmer at Cranston, R. I., until 1788, when he became connected with the Ohio Company, and settled at Marietta, O., where he d. May 29, 1819.

**Whipple** (AMIEL W.), b. at Greenwich, Mass., 1817; graduated at the U. S. Military Academy July, 1841, and commissioned second lieutenant of artillery; transferred to the corps of topographical engineers in September, he served in the survey of various rivers and harbors until 1844; as assistant astronomer of the commission to determine the N. E. boundary between the U. S. and the British provinces 1844–49; and in the same capacity on the Mexican boundary survey 1849–53. In the latter year he took charge of the party authorized by Congress to make the explorations and surveys necessary to ascertain a railroad route from the Mississippi to the Pacific Ocean, upon which he was engaged until 1856; thence to 1861 employed in the improvement of the St. Clair Flats and St. Mary's River, Mich., performing during the same period the duties of lighthouse engineer. As chief topographical engineer he served on the staff of Gen. McDowell until Apr., 1862, when appointed brigadier-general of volunteers, and commanded a brigade in the defences of Washington until September, in which month he was assigned to command of a division of the 3d corps, Army of the Potomac, which he led at Fredericksburg and at Chancellorsville. On the second day of the latter battle he was fatally wounded. D. at Washington May 7, 1863. Brevet lieutenant-colonel, colonel, brigadier, and major general for gallantry.

**Whipple** (EDWIN PERCY), b. at Gloucester, Mass., Mar. 8, 1819; educated in the public schools of Salem, where at the age of fourteen he began to write for a newspaper; was for some time a clerk in a bank at Salem; entered a Boston banking-house 1837; became its chief clerk; took an active part in the debates of the Mercantile Library Association, and was superintendent of the reading-room of the Merchants' Exchange from its foundation until 1860, since which time he has devoted himself exclusively to literature, being a frequent contributor to the principal reviews and magazines, and a popular lecturer before lyceums and collegiate literary societies, and enjoying a considerable reputation as a critic. Author of *Essays and Reviews* (2 vols., 1848–49), *Lectures on Subjects connected with Literature and Life* (1849), *Character and Characteristic Men* (1867), *The Literature of the Age of Elizabeth* (1869), originally delivered as lectures before the Lowell Institute, *Success and its Conditions* (1871), and a biographical sketch of Macaulay, prefixed to an edition of his *Essays* (New York, 6 vols., 1860). A complete edition of his works appeared in 6 vols. (1871).

**Whipple** (HENRY BENJAMIN), D. D., b. at Adams, Jefferson co., N. Y., Feb. 15, 1822; was bred a merchant and took an active part in politics; in 1847 became a candidate for holy orders, and pursued his theological studies with Rev. W. D. Wilson, D. D., now professor in Cornell University; was ordained deacon Aug. 17, 1849, in Trinity church, Geneva, N. Y., by Rt. Rev. W. H. de Lancey, D. D.; took charge of Zion church, Rome, N. Y., Dec. 1, 1849; was ordained priest July 16, 1850, in Sackett's Harbor by Bishop de Lancey; became rector of the church of the Holy Communion, Chicago, Easter, 1857; was chosen bishop of Minnesota June 30, 1859; was consecrated in St. James's church, Richmond, Va., Oct. 13, 1859; Bishops Kemper, De Lancey, Burgess, Whitehouse, Cobb, Scott, H. W. Lee, Clark, and Bowman united in the imposition of hands. In 1860, Bishop Whipple, with Revs. I. L. Breck, S. W. Mauncey, and E. S. Peake, organized the Bishop Seabury mission, out of which has grown the cathedral of Our Merciful Saviour, the Seabury Divinity School, Shattuck School, and St. Mary's Hall, which have made Faribault one of the educational centres of the Northwest. The bishop has been the friend and defender of the North American Indians, and has planted successful missions among them. He is a warm advocate of free churches, and all but four of the churches in the diocese are free.

R. W. LOWRIE.

**Whipple** (WILLIAM), b. at Kittery, Me., Jan. 14, 1730; was in early life a sea-captain in the West India trade; subsequently a merchant at Portsmouth, N. H., where he acquired a considerable fortune; was a member of the pro-

vincial congress 1775, of the Continental Congress 1776; signed the Declaration of Independence; was brigadier-general of New Hampshire troops at Saratoga 1777; co-operated with Sullivan at the siege of Newport 1778; was again a member of Congress 1778–79; was financial receiver of the State of New Hampshire 1782–84, and judge of the superior court from 1782 to his death, at Portsmouth Nov. 28, 1785.

**Whip'-poor-will,** the common designation in the U. S. of species of birds of the genus *Antrostomus* of the family Caprimulgidæ. These are characterized by the bill being very small; the nostrils shortly tubular; the gape furnished with long, stiff, and sometimes pectinated bristles, which project beyond the end of the bill; the wings broad, rounded, and with the first quill shorter than the third; the tail broad and rounded; and the tarsi moderate and partly feathered above. The chief distinctive characters, in contrast with the night-hawks, are found in the bristled gape and the form of the tail, and in this respect, as well as others, the species agree with those of the genus *Caprimulgus*, or the typical goatsuckers of the Old World, to which they are, indeed, very closely related. "The common species, and presumably the others, are nocturnal in their habits, remaining silent and keeping within the shady recesses of the forests during the daytime. As soon as the sun has disappeared and the night-insects are in motion" they leave their retreats for exercise and in search of food. In the early part of the evening, and then for only a brief period, they emit the peculiar cry which is intended to be expressed by the popular name. These notes are repeated with great rapidity, but with clearness and power, six or seven times in as many seconds. They are to be heard, however, chiefly in clear weather, and not during rain. In the daytime their haunts are deep ravines, shady swamps, and extensive pine-groves. Their flight is effected "by easy flapping of the wings, with occasional sailings and curving sweeps," and they repeatedly pass and repass over the same area in their search for insects. They lay their eggs upon the ground, generally in the midst of fallen leaves, and make no regular nest. Their eggs are usually two in number, and are white and more or less spotted. By Baird, Brewer, and Ridgway four species are recognized as inhabitants of North America—viz. (1) *A. carolinensis*, inhabiting the Louisianian region of the U. S.; (2) *A. vociferus*, occurring in the eastern provinces generally of North America; and (3) *A. Nuttallii*, representing the genus in the western portions of the U. S. from the Plains to the Pacific; while (4) a species closely related to the *A. vociferus* is the *A. macromystax* of Mexico (variety *Macromystax*) and Cuba (variety *Cubanensis*). THEODORE GILL.

**Whirl'wind,** the general term applied to such storms as are specifically known as hurricanes, cyclones, typhoons, etc., and whose miniatures are found in the tornado and waterspout. In these storms the air over a large region of the earth is in a state of rotation about a central space within which comparative calm exists. While very many violent storms occur without being well-developed whirlwinds, yet the existence of the latter class of storms is well established. The formulæ connecting the barometric pressure and the velocity of the wind have been given by Ferrel (1861 and 1874), and by Colding (1872) and Hann (1875). The resemblance between these whirlwinds and the movements of water in whirlpools has been dwelt upon by Colding, but the latter are generally so small in extent that the rotation of the earth has but little influence upon them, while it is quite perceptible in the case of the whirlwind. The smaller whirlwinds, such as waterspouts, etc., revolve in either direction with equal frequency; the larger ones, however (the cyclones, etc.), invariably revolve from E. through the N. in the northern hemisphere, and from E. through the S. in the southern hemisphere. These, which are the whirlwinds *par excellence*, usually begin within the tropics, and after moving slowly westward and away from the equator for several days, turn in their course, and advance eastward, still moving away from the equator. The progress of one and the same storm has thus been traced for fifteen consecutive days, though usually they are only traceable for from seven to twelve days. These storms require for their initial development a large area of warm, moist, quiet air and the formation of cloud or rain; and if not fed by currents of moist air, they die out; they are therefore most frequent in the hottest months of the year—*i. e.* from July to November in the North Atlantic, and from January to March in the South Pacific. Extensive catalogues of hurricanes have been compiled by Poey for the Atlantic, and by Meldrum for the Indian Ocean, from which it would appear that a maximum and minimum number of storms occur in those years in which the sunspots have respectively the greatest and the least frequency; this may be an accidental coincidence. If, however, it be a law of nature, it may possibly be explained as due to the greater or less amount of moisture evaporated by the sun's heat, which is perhaps variable to a slight extent. The diameter of the mass of air affected by a rotatory movement about the centre of a whirlwind is occasionally, in an extreme case, 3000 miles at the close of its course, having grown to this dimension from an initial diameter of 50 or 100 miles. After attaining its maximum dimensions, a whirlwind is ordinarily broken up into several smaller storms, owing, generally, to the fact that the winds on its circumference, as they encounter continents and mountains or masses of cold air, are raised up, and by condensation of their moisture give rise to new independent storm-centres. The tornadoes and waterspouts frequently are observed attending large whirlwinds, and usually on the equatorial side of the main storm; both of these seem to have their origin and principal development in the lowest stratum of clouds, and only occasionally set the air below them in motion so as to reach down to the earth. Sandstorms and the whirls that form over extensive fires, on the other hand, originate in the heated air ascending from the surface of the ground. It is probable that a mass of cold air descending nearly vertically and quite uniformly would acquire a rotatory motion; indeed, it is maintained by Faye that this is the general type of summer hailstorms, but this theory has not yet been generally received. It is, however, not denied that downward currents form an important feature in all summer thunderstorms: when heavy falls of rain take place in such storms, the falling rain and hail mechanically carry down with them a considerable amount of cool damp air, but it does not seem certain that any rotatory motion results therefrom. The theory of Faye seems to have been suggested by the phenomena of the solar spots (see SUN), which he attributes to whirlwinds on the solar surface.

The direction of motion of a whirlwind depends, if it be a small one, upon the general movement of the current of air in which it is found, and to a less extent upon the supply of moisture and the process of condensation. In large whirlwinds the conditions are reversed, and the storm as a whole moves toward the region whose topography, winds, relative humidity, and temperature are so related that the condensation is going on most rapidly, or where the greatest condensation is about to be. This principle, announced at Cincinnati in 1869, has been also independently arrived at by Mohn (1871), and is, in fact, a simple consequence of the laws whose discovery is due to Espy (1841, etc.) and Ferrel (1860). According to these, the liberation of latent heat that takes place on the formation of cloud and rain is the motive-power that maintains the air in its motion, while the condensation of the vapor into cloud and rain is a consequence of the mechanical cooling of the air due to its expansion when it is forced or drawn up to greater elevations. By following as closely as our imperfect means will allow the complicated process of evaporation, ascent, cooling, condensation, and evolution of latent heat through which the aqueous vapor of the air circulates in a ceaseless round, we are able to approximately explain from day to day the path of storms as is required in weather-predictions. The latest work explanatory of the whirlwinds and other movements of the atmosphere is an important memoir by Profs. Guldberg and Mohn of Christiania, Norway, entitled *Études sur les Mouvements de l'Atmosphere* (Christiania, 1876). (See also STORMS.) C. ABBE.

**Whis'ky,** or **Whiskey** [Gaelic and Irish, *uisge*, "water," whence *uisge-beatha*, commonly written *usquebaugh*, "water of life"], the spirituous liquor obtained by distilling fermented infusions of barley, rye, wheat, corn, oats, etc. According to some authorities, the art of distillation was first introduced in England in the reign of Henry II., but it is more probable that it was known and practised in Ireland previous to this date, having been acquired by the inhabitants of that country from India. Directions for preparing *usquebaugh* or *aqua vitæ* are contained in the *Red Book of Ossory*, compiled about 500 years since, at which time it was chiefly used as a medicine, being considered a panacea for all diseases. The term "whisky" appears to have been first confined to the liquor obtained in the Highlands of Scotland from barley, its general application being of a more recent date. Spirits that contain over 60 per cent. of alcohol are termed "high-wines" or common spirits; those containing 90 per cent. of alcohol are known as "cologne spirits," the name whisky being usually given to the product of a former distillation containing about 50 per cent. by weight of alcohol. In Great Britain the largest amount of whisky is made in Scotland and Ireland; in this country the principal supply comes from Illinois, Ohio, Indiana, Kentucky (termed Bourbon whisky, from Bourbon co., Ky.), Pennsylvania (Monongahela co.), and New York, a smaller quantity being manufactured in Tennessee, Missouri, and California; large quantities of whisky

are also made in Canada, near Toronto. The grains used vary greatly in composition. In Scotland and Ireland malted barley is extensively employed, but a mixture of malted barley with raw grains (rye, oats, etc.) is also very largely used. In the preparation of Bourbon whisky a mixture of 50 to 60 per cent. of Indian corn with 40 to 50 per cent. of small grain (containing about 10 per cent. malt, the balance being rye), is taken; for Monongahela whisky only rye is used, it being mixed with 10 per cent. of malt; while in Canada a mixture of rye, wheat, or corn with 5 per cent. of malted barley is chiefly employed. The quantity of alcohol afforded by the different grains is influenced by the proportion of starch, including the small amount of sugar, they contain; 2 pounds of starch will give a quart of spirit containing 30 per cent. of alcohol, or 100 pounds of starch will give 35 pounds of alcohol, equal to 4.375 imperial gallons. One hundred pounds of the following grains afford the following quantities of a spirit containing 45 per cent. of alcohol: Wheat, 40 to 45 pounds; rye, 36 to 42 pounds; barley, 40 pounds; oats, 36 pounds; buckwheat, 40 pounds; maize, 40 pounds. In the manufacture of whisky the starch of the grain is first changed into dextrine and glucose in the process of *mashing*, chiefly by the action of the *diastase* (a peculiar nitrogenous substance formed by the germination of the grain), which, although it exists in malt only in the very small proportion of 0.003 per cent., must be present in order that the conversion shall take place rapidly. Yeast is next added to the saccharine liquid to induce fermentation, by which the sugar is converted into alcohol and carbonic acid; and the alcohol is finally concentrated by distillation. The essential features of the process of whisky-making are therefore the preparation of the vinous mash and the distillation of the alcohol.

*Preparation of the Mash.*—A quantity of water of a temperature of 150° F. is first run into the mash-tub, which is best made of circular cast-iron plates, and then the ground mixture of malt and grain is added, the intimate mixture of the two being effected by briskly stirring with wooden oars, which, in large establishments, are operated by machinery. The malt used should be lightly kiln-dried by the heat of steam to avoid imparting an empyreumatic smell to the product, although this flavor is agreeable to some persons, and was formerly purposely given to whisky (notably to the famous "poteen whisky" of Ireland) by drying the malt by means of burning turf. During the process of mashing the liquid gradually acquires a sweet taste and a greater specific gravity. When it has attained its maximum density, it is drawn off, and more water, of a temperature of 190° F., added to the residual grain and allowed to infuse with it for one to two hours. This second wort is added to the first, and a third quantity of boiling water poured over the remaining mixture, which is afterward used for the first liquor in the mashing of fresh meal and malt. In beer-making (see BEER, by PROF. C. F. CHANDLER), the brewer does not require complete saccharification, some dextrine being necessary; but the distiller desires to obtain the greatest amount of sugar possible. The mash is next cooled down to the proper temperature for fermentation (70° F.) by passing it through a series of pipes surrounded by cold water, and it is then introduced into the fermentation-vat. Formerly, 4 per cent. of yeast was added to the wort, but at present not over 1 to 1½ per cent. is used, three-fourths of which is added directly, the remainder only after the second day of the process. As fermentation advances, the temperature of the wort increases about 20° F., but it should not be allowed to attain to over 95° F., in order to avoid acetification, which can be detected by an increased density of the wort and by the odor of acetic acid. The time occupied in the process of fermentation varies from three to nine days. Owing to the disappearance of the sugar and the formation of carbonic acid and alcohol, the specific gravity of the liquid decreases, the operation being considered finished when the greatest degree of attenuation has been reached. Distillers strive to reduce the density of the wort to that of water, but even then a considerable quantity of sugar remains undecomposed, sometimes amounting to one-fifth of the entire saccharine matter. This difficulty is due to the fact that the alcohol first formed tends to prevent the further decomposition of the remaining wort into sugar, and can be remedied by removing the alcohol as soon as it is produced by diminishing the pressure in the fermentation-vat with an air-pump, which enables the alcohol to be distilled off at the low temperature of 125° F. In England, however, the use of this device is prevented by the excise law, which prohibits the simultaneous carrying on of fermentation and distillation. When, instead of a mixture of raw grain and malt, only the latter is taken, the process employed is slightly different. Five hundred bushels of the ground malt are first mashed with 9000 gallons of water having a temperature of 160° F., and as soon as saccharification has taken place, 6000 gallons of the wort are drawn off and cooled to 60° F., after which it is run into the fermentation-vat and a mixture of London-porter yeast and quick Scotch barm added. The fermentation is usually completed at the end of two or three days, when 1 pound of soap is added for every 100 gallons of the mash, and the mixture introduced into the still. In malt-whisky distilleries 1 bushel of malt should yield 2 to 2½ gallons of proof spirits. In localities where potatoes abound, this root is occasionally employed for the preparation of a vinous mash. The dry substances of potatoes constitute about 28 per cent., three-fourths of which is starch. The conversion of this starch into glucose can be effected either by the action of malt or by that of dilute sulphuric acid. In the former case, the potatoes, after cleansing, are cut into small pieces and thoroughly incorporated with boiling water, malt (generally a mixture of malted rye and barley) then being added, and the process of mashing and cooling conducted as described above. The proportion of malt used is variable, but 5 per cent. is the average amount employed. In the preparation of the mash by the use of sulphuric acid, the raw potatoes are first converted into a pulp, which is thrown into a large vat containing water. When the starch has settled to the bottom of the vessel, the supernatant liquid, which contains the albumen of the potatoes, is removed by means of a siphon, and the residue transformed into glucose by boiling with a very diluted sulphuric acid for about five hours, the point of complete conversion of the starch being ascertained by the iodine test. The fluid is next run through a wooden strainer, in order to remove the cellular tissue present, and the free acid is neutralized by the addition of chalk. The precipitated gypsum is then allowed to settle, the clear liquid being now ready for the fermentation-vat. The fermentation of potato-mash is carried on in a manner similar to that employed with malt, 4 per cent. of yeast being added, and from sixty to seventy hours required for the operation. One hundred pounds of potatoes afford about 16 pounds by measure of proof spirits. In Germany and Holland, where the sugar-beet is extensively cultivated, the poorer grades of a crop are often converted into spirits by fermentation and distillation, the process of mashing being omitted, as the sugar exists ready formed in the beet-root. Spirits can also be obtained from horse-chestnuts, acorns, etc., by proper treatment; 100 pounds of the former can be made to yield 34 pounds of a spirit containing 36 per cent. of alcohol In the preparation of alcohol from this source the addition of 10 per cent. of barley malt is advisable. During the fermentation of the mash in the preceding operations it is customary to expose the vats to the action of the atmosphere for the first few days, after which time they are tightly closed, in order to prevent the escape of the carbonic acid and the formation of acetic acid. The products of the fermentation of saccharine solutions include, in addition to carbonic acid and alcohol, small proportions of glycerine ($C_3H_8O_3$) and succinic acid ($C_4H_6O_4$).

*Distillation of the Mash.*—The fermented wort consists of volatile and non-volatile substances, the former comprising water, alcohol, fusel oil (a mixture of amylic, butylic, and propylic alcohols), small amounts of acetic acid, etc., the latter being vegetable fibre, decomposed and undecomposed yeast, malt, grain, salts, and small quantities of lactic and succinic acids and glycerine. Upon heating it to boiling in a still (see DISTILLATION) these bodies are separated, the vapors given off consisting essentially of alcohol and water. The boiling-point of the mixture is intermediate between that of alcohol and water (173° and 212° F.), but as the process of distillation advances it becomes higher and the proportion of water carried over increases. In Great Britain the fermented mash is removed from the residual grain contained in the fermentation-vat before its introduction into the still; but in this country the entire mash is often taken, by which mode it is asserted that a larger yield of alcohol is furnished. The first distillate from the mash is termed "low-wines" or "singlings" which on redistillation constitute the "faints," the term whisky being usually applied to the spirit obtained by the distillation of the "faints," although diversity exists in the method of separating, purifying, and naming the different grades of spirit. It is not possible by simple distillation to completely separate the water from the alcohol, the purest spirit that can be obtained in this way still containing 11 per cent. of water. By carrying on the distillation to the farthest point, in order to obtain the greatest possible quantity of alcohol, a danger of promoting the formation of fusel oil is incurred, as this mixture boils at a much higher temperature than alcohol. Fusel oil has an unpleasant fiery and nauseous flavor, which is communicated to spirits containing it. Its complete removal can be effected by diluting the contaminated alcohol with water and redistilling, only the first part of the distillate being collected;

but owing to the great expense thus incurred, this is seldom resorted to. Fusel oil is chiefly contained in spirits prepared from potatoes, although it is also often present in that obtained from grain, especially when the solid substances introduced into the still have been allowed to become strongly heated, and undergo destructive distillation. The very numerous improved stills employed at present in the manufacture of spirits effect the separation of the alcohol and water either by causing the mixtures of alcoholic and aqueous vapors to pass through the alcohol at first distilled, by which heat is generated and a secondary evaporation of the alcohol induced, or by cooling the mixed vapors to such a degree that only the water and fusel oil are condensed and returned to the body of the liquid. Coffey's still, which is extensively used in Great Britain, is based upon the latter principle. Whisky-distilleries are frequently of a very large size; at Banagher, Kings co., Ireland, an establishment capable of producing over half a million gallons per annum has lately been erected. The manufacturer of whisky seldom purifies the spirit he obtains, but disposes of it to the rectifying distiller, who frees it from the fusel oil and other noxious impurities present. The nauseous smell and taste of bad whisky are often removed by filtration through, or distillation from, charcoal. Fusel oil can also be removed by oxidation with manganic acid (Attwood's process), by agitating the contaminated spirit with olive oil, or by distilling it from "gray salt" (caustic potash or soda) and "white salt" (pearl-ash); likewise by agitating 665 parts of the spirit with 1 part of bleaching-powder, when a flavor resembling that of brandy is imparted to the product. A very large proportion of the whisky consumed in this country and elsewhere is artificially prepared by reducing the raw products of the distillation of malt or potato spirits with water, and adding certain substances to give a desired flavor. Creosote, for instance, is sometimes added to impart a whisky-flavor to inferior grades of spirit; methylic alcohol is also used, but probably to a less extent. The following are examples of some of the *least harmful* mixtures employed in the fabrication of whisky: For Bourbon whisky, proof spirits, 40 gallons; peach flavoring, ½ gallon; hickory-nut flavoring, ½ gallon; brandy, ½ gallon; wine vinegar, 1 pint; glycerine, 1 pint. For copper-distilled Bourbon whisky, sulphate of copper dissolved in water, 1 drachm; proof spirit, 40 gallons; peach flavor, 1 gallon; brandy flavor, 1 gallon; wine vinegar, 1 pint; glycerine, 1 pound; oil of cognac (a mixture of fusel oil and œnanthic ether), dissolved in alcohol, 12 drops; color with caramel. For rye whisky, proof spirit, 40 gallons; peach flavoring, 2 gallons; white vinegar, 1 pint; oil of cognac, 12 drops. A large amount of inferior whisky is exported to Holland and France, and returned in the form of "gin" and "brandy." The last-named liquors are extensively prepared from the following recipes: For brandy, dilute alcohol to proof, and to every 100 pounds add ½ to 1 pound argol dissolved in water; then add some French raisins and good cognac, and distil (the addition of argol and cognac introduces "œnanthic ether" or ethylic pelargonate), and if a little acetic acid be also added, the characteristic flavor of genuine cognac brandy is obtained; the mixture is then colored by burned sugar, astringency being imparted by means of tannic acid. For gin, add to 900 gallons spirits juniper-berries 95 pounds, coriander seeds 95 pounds, crushed almond-cake 47 pounds, angelica-root 2 pounds, liquorice powder 2 pounds, and distil. Upon adding caustic potash to a sample of whisky that has been prepared from potato spirit, distilling, and treating the residue with sulphuric acid, a disgusting odor is emitted; whisky made by the distillation of fermented grain gives, under the same treatment, a doughy smell. The presence of fusel oil in a liquor will often become apparent on simply removing the alcohol by evaporation; it is also detected by distilling the sample and adding sulphuric acid to the portion that distils between 230° and 240° F., when a red color will be produced; or by treating this portion of the distillate with sulphuric and acetic acids, when amylic acetate will be evolved; likewise by oxidation with bichromate of potash and sulphuric acid, by which the characteristic odor of valerianic acid will be engendered. If a small quantity of nitrate of silver is added to a spirit containing fusel oil, this latter compound separates in the form of a black powder on allowing the mixture to stand exposed to the sunlight for a short time. The presence of creosote can often be detected by its imparting a blue color to ferric chloride. Pure whisky, when recently prepared, is nearly colorless, but if preserved in casks it gradually acquires a brownish color. It contains minute quantities of acetic, butyric, and valerianic acids, and, if distilled from a copper still, traces of this metal may also be present. It has a sp. gr. ranging between 0.922 and 0.94, and should contain from 48 to 56 per cent. (by weight) of absolute alcohol.

In Great Britain and in this country the excise on whisky has for many years been so great a source of revenue to the government that there is no doubt of the fact of this and other spirits being consumed in a much larger quantity than is consistent with health and morality. In the U. S. an excise was first imposed on spirits in 1791. This was removed shortly afterward, but was again restored in 1812. Since then the amount of tax has varied greatly; in 1862 it was 20 cents per proof gallon; in 1864 it ranged from 60 cents to $2; in 1868 it was 50 cents; in 1872, 70 cents; and at present it is 90 cents. During the year ending June, 1875, over 61 million gallons of distilled spirits were manufactured in this country, of which 130,460 gallons were exported. The state of Illinois furnishes the largest amount of the spirits made in the U. S. The following is the value of the production of several States during the year 1875:

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|---|---|
| Illinois | $14,111,398 |
| Ohio | 9,958,116 |
| Kentucky | 7,002,786 |
| Indiana | 3,954,340 |
| New York | 3,237,570 |
| Pennsylvania | 1,894,282 |

Besides its consumption as a beverage, whisky is extensively employed in the preparation of alcohol, which in this country is exclusively obtained from this source. It is also used to some extent in medicine as a substitute for brandy, and if pure it is doubtless to be preferred to the grades of this latter liquor most commonly met with in the U. S.

J. P. Battershall.

**Whis'ky Run,** tp., Crawford co., Ind. P. 1127.

**Whist,** a famous and perhaps the most intellectual of all the games played at cards. Its existence in its primitive form is recognized by unmistakable data in English literature for several centuries past, but, like all matters of art and science, its history is traced and marked by many steps in the progress of its development, both in its name and the elementary powers of its combinations. The present name of the game and the country of its origin have both been disputed, but, according to the best authorities, both are due to England. The old English word "whist," meaning silence, eminently distinguishes the character of the game, and furnished a most fitting name for it. One of its fundamental rules is, that there shall be no talking at the table between the parties engaged in the play. The only language there expressed, according to strict rule, is that of the cards as they are exhibited in the order of their presentation. To understand and correctly interpret this language, and act promptly upon its true meaning and import, calls into exercise several of the highest qualities of the human mind, especially those fitting one for the bar. Edgar A. Poe well said: "It is a game of circumstantial evidence."

It is not the object of this article to go into a history of the game, or to give any instructions to novices. It is intended only for those who are well acquainted with the fundamental terms and definitions, as well as the usual rules now prevailing in its practice, and to cite the entirely uninformed to those authorities from which the best information as to minutiæ can be obtained. Suffice it on these points here barely to say that for several centuries whist, under different names, had been slowly developing in its progress in England, as stated, when, for the first time in 1733, it was regularly systematized and actually taught as a science by Edmund Hoyle. This new system, in which he gave lessons as a teacher or professor, was published in 1743, and was eagerly sought after everywhere. It soon passed through many editions, was translated into French and other European languages, and at an early day after its publication found its way into several of the royal courts of the Continent as well as the court of England. Lord Byron truly said that "Troy owes to Homer what whist owes to Hoyle." Several British writers succeeded Hoyle in publications upon the same subject during the first century after the publication of his great work. Of these, Thomas Matthews, Esq., was the chief. In the mean time several books were written upon the same subject in France, where the new game was enthusiastically espoused. It was a great favorite with Louis XV. "The nobles," says a French writer, "had gone to England to learn to think, and they brought back the thinking game with them." Talleyrand, it has been said, was the great player in France in his day. A remark imputed to him has become famous: "You do not know whist, young man? What a sad old age you are preparing for yourself!" None of the works, however, published either in England or France during the period referred to, materially changed or modified the system established by Hoyle. They were all built upon it, and only suggested improvements in practice. But the greatest stride in the progress of the development of the game since the days of Hoyle

has been within the last quarter of a century. This originated, says an able writer in the *London Quarterly Review* for Jan., 1871, with "a knot of young men at Cambridge of considerable ability, who had at first taken up whist for amusement, and found it offer such a field for intellectual study that they continued its practice more systematically with a view to its complete scientific investigation. The result of the labors of this club was the three great modern works upon whist—those of Cavendish, Clay, and Pole. "Taken together, these books (which ought to be combined in one volume)," says the reviewer referred to above, "furnish a complete epitome of the game, presenting it, both theoretically and practically, in the perfect state at which it has now arrived by continued study and practice during the two centuries which have elapsed since it first assumed a definite shape and took its present name." This system, which is now styled in England "the modern scientific game of whist," differs in no essential from that of Hoyle. It is indeed nothing but an improvement on his. Its chief feature is the bringing the two hands of the partners respectively into co-operation with each other, so that they may act in concert as two divisions of an army. This co-operation is brought about by certain signals known as "the language of cards," as stated before, and of close observation of the cards which fall from the hands of their adversaries respectively. To establish this co-operation effectually requires that both partners shall act upon the same general basis in the beginning and progress of the game. The "long-suit" system is adopted as the general basis in the beginning. The first lead, therefore, of any player is an indication to his partner that he holds more cards of that suit than of any other. The first lead of the opposite partner, whether he takes the trick or not, is not to return his partner's lead, but in like manner to indicate *his* longest suit. The joint object now, then, between them both is to get trumps out of the way and bring both their long suits into play. In this system the proper use of trumps is of the utmost importance. On that point Pole should be especially consulted. One point only will here be stated, and that is the signal of one party to the other calling for trumps. This consists in throwing first a higher card upon a lead of a card that cannot be taken, and a lower one upon the next similar lead. For instance, if a right-hand adversary leads an ace, and the second player throws a six upon it, and the first player follows with the king of the same suit, and the second player throws a three upon it, this is an indication to his partner to lead trumps as soon as possible. (For further explanation the student must refer to the authorities above stated.)

Our space will barely allow us to present in succinct form the general rules which govern the system, as set forth by the reviewer referred to. These are as follows: (1) Lead from your most numerous suit. Begin with the lowest, unless you have several high cards, as mentioned in the text.* (2) Lead your own long suit before you return your partner's, *unless he leads trumps*, which return immediately. (3) In returning your partner's suit, if you have only two left, return the *highest;* if more, the lowest. (4) But in any position, if you hold the best card, play it the second round. (5) *Holding five trumps, lead them* or call for them. (6) Look out for your partner's call for trumps, especially if weak in them yourself. If he calls, and you hold not more than three trumps, lead the *highest;* if more, the lowest. (7) Second hand, generally play your lowest. (8) Do not trump a doubtful trick, second hand, if you hold more than three trumps; with three or less, trump fearlessly. (9) Do not force your partner if you hold less than four trumps yourself, but force a strong *adverse* trump hand whenever you can. (10) Discard from your weakest suit. (11) If not leading, always play the lowest of a sequence. (12) Be very careful in the play of even your smallest cards, every one of which will convey information to your partner.

This system applies as well to what is known as long whist as short whist. In long whist the game consists in securing and scoring ten points, and in these points *honors*, as they are styled, enter as an important element in the count. The honors are the four face-cards of the trump suit. If two partners happen to hold all these between them, they score four for "honors," besides the odd tricks they make; that is, all over six, which constitute what is called "the book." If they hold three only between them, then they score two. If each set of partners holds two between them, then honors are said to be "easy," and neither side scores anything for honors. Honors are not counted by either side which has already reached a score of nine. Either side at a score of eight may call for honors; that is, one partner holding two may call upon his copartner "Have you an honor?" or "Can you one?" If he can, or has an honor, the game is ended; but if this call is not made at the proper time—that is, just before the partner calling makes his first lead—then the honors so held avail nothing if the adversary party make their score of ten on that hand by tricks.

In 1800 what is known as "short whist" was introduced into England. In it the game consists of five points instead of ten, and no honors are counted. In this country short whist has been extended to seven points, without counting honors in the score. This is perhaps the most interesting form in which the game is now played in the U. S. The Germans have introduced another modification of whist, which is exceedingly entertaining and interesting. Under this system the old score of ten points for game is retained, without counting the honors. An important feature under their system is that the trump card is not determined by the deal. The partner of the dealer has the right first to name the trump. If he fails to name it, then the dealer has the right to name it, and if he fails to do so, then the left-hand adversary has the right to name it. If he fails, then there is a new deal, as it becomes evident that the fourth hand has most of the controlling cards of some suit. Another important feature of this system is, that if the party making the trump fail to make at least one odd trick—that is, one trick over what is called "the book," which, as stated, consists of six tricks in all forms of whist—then they subject themselves to the following forfeitures: to wit, their adversaries will be entitled to score two points for every trick they make over the book. If they make one odd trick, as it is called, they score two points; if two, four; if three, six, etc. This feature requires great caution as well as sound judgment in making the trump, and adds a great deal to the interest of this form of the game.

ALEXANDER H. STEPHENS.

*In the reviewer's text he had stated that in case the long suit contained two or more high cards, such as ace and king or king and queen, etc., then the high cards should be led first.

**Whist'ler** (GEORGE WASHINGTON), b. at Fort Wayne, Ind., May 19, 1800; graduated at West Point 1819; served on the northern boundary commission 1822–28 as a member of the engineer corps, from which he resigned 1833; was constructing engineer of Baltimore and Ohio and Susquehanna and Western R. Rs., and became in 1842 chief engineer of St. Petersburg and Moscow R. R., Russia, where the rails, locomotives, and cars were constructed under his supervision; and employed in the construction of extensive dockyards and in the improvement of Russian rivers and harbors. D. at St. Petersburg Apr. 7, 1849. —His son, GEORGE WILLIAM, b. at New London, Conn., in 1822, under his father became civil engineer 1840; was connected with railroads in the U. S.; superintendent of the Erie and New York and New Haven R. R.; had considerable knowledge of railway machinery and the management of railways; in 1856 went to Russia, and took charge of and completed the railroad of which his father had been engineer. D. at Brighton, England, Dec. 24, 1869.

**Whis'ton** (WILLIAM), b. at Norton, Leicestershire, England, Dec. 9, 1667; educated at Tamworth School; graduated at Clare Hall, Cambridge, 1690; obtained a fellowship there, and became a mathematical tutor; took orders in the Church of England 1693; was chaplain to Dr. Moore, bishop of Norwich, 1694–98, and vicar of Lowestoft 1698–1701; became deputy to Sir Isaac Newton in the Lucasian professorship of mathematics at Cambridge 1701, and succeeded to that chair on the resignation of Newton 1703, but was deprived of it and expelled from the university Oct. 30, 1710, in consequence of having expressed Arian views in the Boyle lectures; was pronounced a heretic by the convocation of 1711; was pardoned by an "act of grace" 1715; removed to London, where he gave private lectures on astronomy and natural philosophy; was an active writer on theological subjects; became a Baptist and a Millenarian, and gathered a congregation in his own house to which he expounded "primitive Christianity" and predicted the advent of the millennium and the restoration of the Jews to Palestine in 1766. D. in London Aug. 22, 1752. Author of *A New Theory of the Earth* (1696), *The Accomplishment of Scripture Prophecies* (1708), *Prælectiones Physico-Mathematicæ* (1710), *Primitive Christianity Revived* (5 vols., 1711–12), *A Brief History of the Revival of the Arian Heresy in England* (1711), *Athanasius convicted of Forgery* (1712), *Three Essays on Trinitarianism* (1713), *A Vindication of the Sibylline Oracles, to which are added the Genuine Oracles themselves* (1715), *Astronomical Lectures* (1715), *St. Clement's and St. Irenæus's Vindication of the Apostolical Constitutions, etc.* (1816), *Sir Isaac Newton's Mathematical Philosophy demonstrated* (1716), *Astronomical Principles of Religion, Natural and Revealed* (1717), *A Letter to the Earl of Nottingham concerning the Eternity of the Son of God and of the Holy Spirit* (1719), *The True Origin of the Sabellian and Athanasian Doctrines of the Trinity* (1720), *An Essay towards Restoring the True Text of the Old and New Testa-*

*ment* (1722), containing translations of the passages in which the Samaritan Pentateuch differs from the Hebrew; *The Literal Accomplishment of Scripture Prophecies* (1724), *A Collection of Authentic Records belonging to the Old and New Testament, translated into English* (2 vols., 1727–28), *Historical Memoirs of the Life and Writings of Dr. Samuel Clarke* (1730), *The Primitive Eucharist Revived* (1736), *The Eternity of Hell Torments considered* (1740), *The Primitive New Testament* (1745), *The Sacred History of the Old and New Testament* (6 vols., 1745), *Memoirs of the Life and Writings of Mr. William Whiston, etc., written by himself* (2 vols., 1749–50), and numerous minor works; edited in Latin Moses of Chorene's *Historiæ Armenicæ* (1736), and made a translation of the *Works* of Josephus (folio, 1737), which, though very inaccurate, has not yet been superseded, except in part.

**Whit'aker** (Alexander), b. in England about 1585, son of Rev. William Whitaker, D. D., master of St. John's College, Cambridge; graduated at that university; took orders in the Church of England; was for a time minister of a parish in the north of England; settled at Henrico, Va., in 1611; built there a church and parsonage; baptized Pocahontas and married her to John Rolfe. Author of *Good Newes from Virginia* (London, 1613), one of the first works written in Virginia.

**Whitaker** (Daniel K.), LL.D., grandson of Rev. Nathaniel Whitaker, D. D., and second son of Rev. Jonathan Whitaker, was b. at Sharon, Mass., Apr. 13, 1801; educated at Harvard University, where he obtained the Boylston and Bowdoin prizes for English composition and oratory, and graduated in the class of 1820, distinguished for its eminent scholars; studied law, and moved to South Carolina, where he was received as a partner in the profession by ex-Gov. John Lyde Wilson of that State. His success at the bar was eminent, but his taste was for letters, and he became the founder and editor of several periodicals, among which was the *Southern Literary Journal, Whitaker's Magazine*, both monthlies, and the *Southern Quarterly Review*, commenced in 1841, and published in Charleston, S. C. This review maintained a high position until the beginning of the late war. In 1866 he moved to New Orleans, La., where he is now (Sept., 1875) in full intellectual vigor, engaged in editing the New Orleans *Monthly Review*, a periodical established by him, and the only one of the kind in the South-west. He is also corresponding secretary of the New Orleans Academy of Sciences. A. H. Stephens.

**Whitaker** (John), b. at Manchester, England, about 1730; educated at Oxford, where he became fellow of Corpus Christi College 1753; took orders in the Church of England; was curate of Bray, and subsequently of Newton; was for a short time morning preacher at Berkeley chapel, London, 1773, and became in 1778 rector of Ruan Langhorne, where he d. Oct. 30, 1808. Author of a *History of Manchester* (1771; new ed., 3 vols., 1775), *The Genuine History of the Britons* (1772), *Mary Queen of Scots vindicated* (3 vols., 1787), *The Origin of Arianism disclosed* (1791), *The Course of Hannibal over the Alps ascertained* (2 vols., 1794), *The Ancient Cathedral of Cornwall historically surveyed* (2 vols., 1804), *The Life of St. Neot, the eldest Brother of King Alfred* (1809), a *Review* of Gibbon's *History*, and other works.

**Whitaker** (Joseph), b. at London, England, May 4, 1820; brought up to the business of a bookseller; edited for J. W. Parker the *Morning and Evening Church Services* (2 vols., 1843); projected and edited *Tracts for the Christian Seasons* (2 series, 4 vols., 1849–51) and *Tracts for Parochial Use* (7 vols., 1849–51); founded *The Penny Post* (1849), a Church magazine, *The Educational Register* (1850–53), and *Whitaker's Clergyman's Diary* (1851–53); edited the *Gentleman's Magazine* (new series, vols. i.–vii., 1856–59); commenced in 1858 his valuable bibliographical journal, *The Bookseller*, and in 1868 *Whitaker's Almanac*, a useful annual.

**Whitaker** (Mrs. Mary Scrimgeour), b. in Beaufort district, S. C., Feb. 22, 1820, daughter of Rev. Samuel Furman, D. D., a distinguished Baptist divine of South Carolina, and wife of Dr. Daniel K. Whitaker. On the mother's side she is a descendant in a direct line from the illustrious houses of Scrimgeour, Montrose, and Dundee. At an early age she was sent to Edinburgh, where she completed her education; in 1850 a volume of her poems was published, which elicited high encomiums from the best American writers; in 1867, *Albert Hastings*, a novel of great merit, made its appearance. From early life she has been devoted to letters, and besides the two works mentioned has contributed largely to the periodical literature of the day. A. H. Stephens.

**Whitaker** (Rev. Nathaniel), D. D., grandfather of Daniel K. Whitaker, LL.D., was b. at Long Island, N. Y., Feb. 22, 1732; graduated at Princeton College during the presidency of Dr. Burr; entered the ministry, and took charge of a church at Norwich, Conn., where he remained until 1766, when he was deputed by the Scotch Society for the Advancement of Learning (of which there was a branch in Connecticut) to visit Scotland, England, and Wales for the purpose of obtaining donations for the establishment of an institution of learning in America for the education and christianization of the North American Indians. He carried with him Rev. Samson Occom (which see), an educated Indian of the Mohegan tribe, who had been licensed to preach by the Presbyterian denomination. The General Assembly of the Church of Scotland received the visitors with open arms, and warmly sympathized with their plans and purposes. In England the mission also met with favor. The earl of Dartmouth, then secretary of American affairs, received the strangers with great kindness, and generously promoted their object by his benefactions. The king, George III., it is said, contributed £400 to the cause. From different sources there was contributed to the fund, during the two years of Dr. Whitaker's visit to Europe, the sum of £11,000, to which considerable additions were afterward made before the outbreak of the American Revolution. With an endowment so obtained, Dartmouth College at Hanover, N. H., was founded, and was originally organized for the education of the Indian tribes of North America. It bore the name of *Dartmouth*, in honor of the distinguished nobleman who had so liberally contributed to its first endowment. Very few Indians, however, were successfully educated at this institution, and of those that were, Rev. Ebenezer Wheelock, its first president, feelingly lamented the return of most to the primeval habits of savage life. On his return home from Europe, Dr. Whitaker was called to the charge of the Presbyterian church at Salem, Mass., and officiated for a number of years with great distinction for piety, learning, and eloquence in what was known as the "Tabernacle church," built and owned by himself. Many of his sermons were published and extensively circulated throughout New England. He was an ardent Whig, and zealously supported the cause of the colonies in their struggle for independence in 1776. D. in 1794. A. H. Stephens.

**Whitaker** (Ozi William), D. D., b. May 10, 1830, at New Salem, Mass.; graduated from Middlebury College in 1856; was principal of the North Brookfield (Mass.) High School for four years; graduated from the General Theological Seminary of the Protestant Episcopal Church in 1863; was ordained deacon in Boston in July, and priest in August of the same year; was rector of St. John's church, Gold Hill, Nev., from Oct., 1863, to July, 1865; was rector of St. Paul's, Eaglewood, N. J., from Oct., 1865, to Feb., 1867; became rector of St. Paul's, Virginia City, Nev., in Apr., 1867; was elected missionary bishop of Nevada and Arizona in 1868, and consecrated in New York Oct., 1869.

**Whitaker** (Thomas Dunham), LL.D., b. at Rainham, Norfolk, England, June 8, 1759; educated at St. John's College, Cambridge; took orders in the Church of England 1785; became perpetual curate of Holme, Lancashire, 1797, vicar of Whalley 1809, and of Blackburn 1818. D. at Blackburn Dec. 18, 1821. Author of a *History of the Original Parish of Whalley and Honour of Clitheroe in the Counties of Lancaster and York* (Blackburn, 4to, 1801), *History and Antiquities of the Deanery of Craven* (1805), *Lordis and Elmete, or an Attempt to Illustrate the Districts described in those Words by Bede* (1816), and a *History of Richmondshire* (2 vols., 1823); edited the *Sermons of Archbishop Sandys, with a Life of the Author* (1812), the *Vision of Piers Plowman* (1810), the *Life and Correspondence of Sir George Radcliffe* (1810), and Ralph Thoresby's *Ducatus Leodensis* (1816). Dr. Whitaker was one of the most popular of modern English topographers. A magnificent edition of his *History of Whalley*, annotated and enlarged by John Gough Nichols, appeared in 1871.

**Whitaker** (William), D. D., b. at Holme, Lancashire, England, in 1548; educated at St. Paul's School, under his uncle, Dean Alexander Nowell; graduated at Trinity College, Cambridge, where he became a fellow; was appointed regius professor of divinity at Cambridge 1579, chancellor of St. Paul's 1580, and master of St. John's College, Cambridge, 1586; was an able Calvinistic writer, and considered the most learned English champion of Protestantism of his time, having won the admiration of his antagonists, Bellarmine and Stapleton. D. at Cambridge Dec. 4, 1595. He translated the Liturgy into Greek and Latin (1569), and Dean Nowell's Catechism into Latin (1571); wrote Latin refutations of Drs. Nicholas Sanders (1583), William Rainoldes (1585), and the Jesuit Campian (1581), and many other controversial works, and maintained against Bellarmine and Stapleton a famous *Disputation on Sacred Scripture*, published in Latin (1588) and in English (1849). A

collection of his *Opera Theologica* was published at Geneva (2 vols. folio, 1610).

**Whitaker's,** p.-v., Edgecombe co., N. C.

**Whit'bread** (SAMUEL), b. in London, England, in 1758, son of Samuel, a very wealthy brewer, who had married a daughter of the first Earl Cornwallis; was educated at Eton and at St. John's College, Cambridge; travelled on the Continent, accompanied by Archdeacon Coxe, the historian, as his tutor; married Lady Elizabeth, daughter of Sir Charles Grey, 1789; entered Parliament 1790; was a close friend of Fox and a vigorous assailant of Pitt, and conducted the impeachment of Lord Melville 1805–06, and, losing heavily by the burning of Drury Lane Theatre, committed suicide July 6, 1815. To him the memory of Milton was indebted for a monument in the church of St. Giles, Cripplegate.

**Whit'by,** town of England, county of York, at the mouth of the Esk in the North Sea, has a good harbor, protected by two piers 1000 feet long jutting out into the sea; drydocks for building and repairing ships; manufactures of sailcloth and cordage, and an extensive trade. Jet, alum, and ironstone are exported. P. 13,082.

**Whitby,** p.-v., cap. of Ontario co., Ont., Canada, on Lake Ontario, and on Grand Trunk and Port Whitby and Port Perry railways. It has a good harbor, 30 miles N. E. of Toronto. It is an important grain and produce market, and has 2 weekly papers. P. exclusive of tp. 2732.

**Whitby** (DANIEL), D. D., b. at Rushden, Northamptonshire, England, in 1638; graduated at Trinity College, Oxford, about 1657; obtained a fellowship there 1664; took orders in the Church of England; became prebendary (1668) and precentor of Salisbury cathedral (1672), and rector of St. Edmund's church, Salisbury, about the same time; was a distinguished commentator, and an ardent controversial writer against Arianism and Roman Catholicism, but was censured for his *Protestant Reconciler* (1683); ultimately became an Arian by the reading of Dr. Clarke's *Scripture Doctrine*, and engaged in a polemic with Dr. Waterland. D. at Salisbury Mar. 24, 1726. Among his numerous books the most important was a *Paraphrase and Commentary on the New Testament* (2 vols., 1703).

**Whit'comb** (JAMES), b. at Stockbridge, Vt., Dec. 1, 1791; removed with his father to Ohio 1806; graduated at Transylvania University, Ky.; studied law; began practice at Bloomington, Ind., 1824; became prosecuting attorney for the district 1826; was a Democratic State senator 1830–35; became commissioner of the general land-office 1836; resumed the practice of law at Terre Haute 1841; was governor of Indiana 1843–48; became U. S. Senator 1849, and was vice-president of the American Bible Society. D. in New York City Oct. 4, 1852.

**Whitcomb** (JOHN), b. at Lancaster, Mass., about 1720; was colonel of Massachusetts troops in the campaign against Crown Point 1755; led a regiment to Boston after the battle of Lexington; was appointed by the provincial congress a brigadier-general; was chosen brigadier-general on the Continental establishment June 5, and advanced to major-general in the Massachusetts service June 13, but soon resigned on account of advanced age. D. in 1812.

**White.** See COLOR.

**White,** county of Central Arkansas, lying E. of White River, intersected by Little Red River and Bayou des Arc, and traversed by Cairo and Fulton R. R. The surface is undulating, much of it being covered by dense forests, which furnish large quantities of lumber. Swine and cattle are the principal live-stock. Staples, cotton, Indian corn, lumber. Cap. Searcy. Area, 1044 sq. m. P. 10,347.

**White,** county of Northern Georgia, drained by the head-waters of Chattahoochee River; surface undulating, soil moderately fertile. Staples, Indian corn, wool, and tobacco. Cap. Cleveland. Area. 250 sq. m. P. 4606.

**White,** county of S. E. Illinois, separated from Indiana by Wabash River, intersected by the Little Wabash, and traversed by Cairo and Vincennes, Springfield and Illinois South-eastern, and St. Louis and South-eastern R. Rs.; surface prairie and woodland, soil fertile. Live-stock considerable. Staples, Indian corn, wheat, oats, tobacco, wool, and lumber. Cap. Carmi. Area, 480 sq. m. P. 16,846.

**White,** county of N. W. Indiana, intersected by Tippecanoe River, and traversed by Louisville New Albany and Chicago and the Pittsburg Cincinnati and St. Louis R. R.; surface generally level, soil fertile. Cattle and sheep numerous. Staples, corn, wheat, oats, hay, and dairy products. Cap. Monticello. Area, 504 sq. m. P. 10,554.

**White,** county of Central Tennessee, lying upon Caney fork of Cumberland River; surface hilly and wooded. Cattle, sheep, and swine numerous. Staples, Indian corn, tobacco, wool. Cap. Sparta. Area, 672 sq. m. P. 9375.

**White,** tp., Ashley co., Ark. P. 442.

**White,** tp., Newton co., Ark. P. 615.

**White,** tp., Pike co., Ark. P. 401.

**White,** tp., Polk co., Ark. P. 293.

**White,** tp., Benton co., Mo. P. 1993.

**White,** tp., Cambria co., Pa. P. 969.

**White,** tp., Indiana co., Pa. P. 2124.

**White** (ALBERT S.), b. at Blooming Grove, N. Y., Oct. 24, 1803; graduated at Union College 1822; was admitted to the bar at Newburg 1825; removed to Indiana 1829; was several years clerk of the Indiana house of representatives; member of Congress 1837–39, U. S. Senator 1839–45; was a leading promoter of the Wabash and Erie Canal; became president of the Wabash and Indianapolis and Lake Erie Wabash and Indianapolis R. R. Cos.; was again a member of Congress 1861–63; became commissioner of claims against the Sioux Indians 1863, and was appointed district judge of Indiana Jan., 1864. D. at Stockwell, Ind., Sept. 4, 1864.

**White** (ALEXANDER), b. at Franklin, Tenn., Oct. 16, 1816; removed to Talladega, Ala., when five years of age; studied at Jackson College and at the University of Tennessee at Nashville; studied law under his father, Judge John White; was admitted to the bar 1838; practised at Talladega as the associate of his father, and subsequently (1841–55) as partner of Hon. Lewis E. Parsons; was elected to Congress for the term 1851–53 on the Union platform, after an exciting contest in a district overwhelmingly Democratic; settled at Selma 1856; supported Bell and Everett in 1860, and earnestly opposed secession, but acted with his State during the civil war; was a leading member of the Alabama State convention of 1865, and of that of June, 1866, which chose delegates to the Loyalists' convention at Philadelphia; sat in the general assembly of 1872; was again a member of Congress 1873–75; was distinguished for oratorical powers and skill as a debater, and was U. S. associate justice for Utah 1875.

**White** (ANDREW DICKSON), LL.D., b. at Homer, N. Y., Nov. 7, 1832; removed in childhood to Syracuse; graduated at Yale College 1853; travelled in Europe; was for several months an attaché of the U. S. legation in Russia; studied at the University of Berlin 1854–55; was professor of history and English literature at the University of Michigan 1857–62; visited England 1863; returned to Syracuse; was State senator 1863–66; introduced the bills which codified the school laws, created the new system of normal schools, and incorporated Cornell University; was chosen first president of that institution 1866; visited Europe to purchase for it books and apparatus and to study modern educational methods; has been a liberal contributor to the funds for the foundation of the university, in which, besides the presidency, he fills the chair of modern history; was one of the commissioners sent by Pres. Grant to Santo Domingo to study the question of annexation 1871, and has taken a prominent part as a Republican in the recent politics of New York. Author of *Lectures on Mediæval and Modern History* (Detroit, 1861), *A Word from the North-west* (1863), in reply to Dr. W. H. Russell; *The Plan of Organization for Cornell University* (1868), *The New Education* (1868), being his inaugural address; a *Report on the Co-education of the Sexes* (1871), *The Warfare of Science* (1876), and miscellaneous addresses and essays.

**White** (CHARLES), D. D., b. at Randolph, Vt., Dec. 28, 1795; graduated at Dartmouth College 1821; studied two years at Andover (1821–23); was settled at Thetford, Vt. (Congregational), 1825–29; at Cazenovia, N. Y. (Presbyterian), 1829–33; wrote for the *National Preacher*, the *Biblical Repository*, and the *Bibliotheca Sacra* at Oswego, N. Y., 1834–41; and from 1841 to 1861 was president of Wabash College, Crawfordsville, Ind., where he d. Oct. 29, 1861. Author of *Essays in Literature and Ethics* (1853).

**White** (CHARLES J.), D. D., b. at Baltimore, Md., in 1807; graduated at St. Mary's College 1823; became a Roman Catholic priest; edited the *Catholic Almanac* (1834–57); founded and edited the *Religious Cabinet* (1842), a monthly magazine which was soon replaced by the *U. S. Catholic Magazine* (1843–49), and this by the *Catholic Mirror* (1849), a weekly paper; translated and edited Balmes's *Protestantism and Catholicity compared in their Effects on the Civilization of Europe* (1850) and Chateaubriand's *Genius of Christianity* (1856), and is author of a *Life of Mrs. Eliza A. Seton*, (1853; 5th ed. 1865).

**White** (DANIEL APPLETON), LL.D., b. at Lawrence (then a part of Methuen), Mass., June 7, 1776; graduated at Harvard 1797; was teacher of the Medford grammar school 1797–99, Latin tutor in Harvard 1799–1803; studied law; was admitted to the bar 1804; began practice at Newburyport; sat in the Massachusetts legislature 1810–15; was elected to Congress, but declined the office 1814; be-

came judge of probate for Essex co. 1815; settled at Salem 1817, and was for many years a leading member of the Essex Institute and of the Massachusetts Historical Society, by both of which bodies he was regarded with peculiar attachment on account of his rare social qualities. D. at Salem Mar. 30, 1861. Author of eulogies on Washington (1800), Nathaniel Bowditch (1838), and John Pickering (1846), *A View of the Jurisdiction of the Court of Probate in Massachusetts* (1822), *New England Congregationalism in its Origin and Purity* (1861), of several occasional addresses and other pamphlets, and aided John Pickering in preparing his edition of Sallust (1805). Biographical memoirs were prepared by Pres. James Walker (1863) for the Massachusetts Historical Society, and by Hon. George W. Briggs (1864) for the Essex Institute, to which institution he gave 8000 volumes.

**White** (Fortune C.), b. at Whitestown, Oneida co., N. Y., in 1787, grandson of Judge Hugh White, the pioneer settler of that county and region, for whom the town (then embracing most of Western New York) received its name; received a classical education; was admitted to the bar at an early age; was captain, and afterward an aide-de-camp to the general-in-chief 1812–14; was many years a leading lawyer of Central New York; was chief judge of common pleas and quarter sessions for Oneida county 1837–43, and was for more than forty years a brigadier-general of State militia. D. at Whitestown Aug. 27, 1866.

**White** (G. B.), U. S. N., b. Nov. 29, 1836, in Pennsylvania; graduated at the Naval Academy in 1858; became lieutenant in 1861, commander in 1872; served in the Ottawa at the battle of Port Royal, and commended for "coolness and gallantry." Foxhall A. Parker.

**White** (Gilbert), b. at Selborne, Hampshire, England, July 18, 1720; educated at Basingstoke School and at Oriel College, Oxford, where he graduated 1743; became a fellow there 1744, retaining that position through life; became senior proctor of the university 1752; took orders in the Church of England, but declined ecclesiastical preferment, though officiating as curate at his native village, where he spent most of his life upon his paternal estate, chiefly occupied in those minute observations in natural history on which his fame is based. D. at Selborne June 26, 1793. Author of *The Natural History and Antiquities of Selborne in the County of Southampton* (1789) and *The Naturalist's Calendar, with Observations in Various Branches of Natural History* (1795), a posthumous work made up from his papers by Dr. John Aikin. Among the numerous naturalists who have published annotated editions of these two works (usually published together) may be mentioned Sir W. Jardine (1833), J. Rennie (1833), Capt. Thomas Brown (1835), Edward T. Bennett (1837), Blyth and Mudie (1850), Edward Jesse (1850), and Rev. J. G. Wood (1854). The last and best edition is that by Frank Buckland (London, 1875). A volume of his inedited *Letters* was issued by J. E. Harting (1876).

**White** (Henry Clay), b. in Baltimore, Md., Dec. 30, 1848; graduated at the University of Virginia June 29, 1870, as bachelor of science and civil and mining engineer; professor of St. John's College, Annapolis, Md., 1871–72, and since that time is professor of chemistry and geology in the University of Georgia at Athens. Author of various scientific addresses, reports on *Chemistry of the Cotton-plant*, on *Commercial Fertilizers*, and co-author with W. G. McAdoo of *Elementary Geology of Tennessee*.

**White** (Henry Kirke), b. at Nottingham, England, Mar. 21, 1785; was apprenticed to a stocking-weaver, and afterward to an attorney, in whose office he found time to study the classics and several modern languages, as well as English literature, drawing, and music; began to write verses for magazines in his fifteenth year; gained several prizes offered by publishers of periodicals; printed a volume, *Clifton Grove, a Sketch in Verse, with other Poems* (1803), which won for him the high regard of Southey and other men of letters, by whom he was encouraged to study for the ministry; obtained a sizarship at St. John's College, Cambridge, 1804; was for two years at the head of his class, and became a tutor in mathematics, but destroyed his health by excessive study, and died of consumption at Cambridge Oct. 19, 1806. His papers were placed in the hands of Southey, who published his *Remains, etc., with an Account of his Life* (2 vols., 1807; vol. iii. 1822), which obtained for him a permanent place in English literature. A tablet to his memory by Chantrey was placed in All Saints' church, Cambridge, by Francis Boott of Boston, Mass. Among the numerous republications of his *Poetical Works*, the "Globe edition" (London and New York, 1869) deserves notice.

**White** (Hugh Lawson), b. in Iredell co., N. C., Oct. 30, 1773, son of Gen. James (1759–1821), a pioneer settler of Knoxville, Tenn., where he removed 1786; was a volunteer soldier against the Indians 1792; studied at Philadelphia 1794–96; read law at Lancaster, Pa.; began practice at Nashville 1796; was judge of the State supreme court 1801–07 and 1809–15; became U. S. district attorney 1807, State senator 1809 and 1817, president of the State Bank of Tennessee 1815, and commissioner of Spanish claims 1820; was U. S. Senator 1825–35 and 1836–39; president *pro tem.* of that body 1832; received the electoral votes of Georgia and Tennessee for President of the U. S. at the election of 1836, and resigned his seat in the Senate 1839, in consequence of having received from the legislature instructions to vote against his judgment. D. at Knoxville, Tenn., Apr. 4, 1840. A *Memoir, with Selections from his Speeches and Correspondence* (Philadelphia, 1856), was prepared by Nancy N. Scott, one of his descendants.

**White** (James), b. near Edinburgh, Scotland, about 1804; educated at Glasgow and at Oxford; took orders in the Church of England; was presented by Lord Brougham with a living in Suffolk, which he exchanged for the vicarage of Loxly, Warwickshire, and after inheriting a fortune retired from the ministry to devote himself to literature, writing frequently for *Blackwood's Magazine*. D. at Bonchurch, Isle of Wight, Mar. 26, 1862. Author of three historical dramas, *Feudal Times* (1845), *The Earl of Gowrie, a Tragedy* (1846), and *The King of the Commons* (1846); *Landmarks of the History of England* (1855), *Landmarks of the History of Greece* (1856), *The Eighteen Christian Centuries* (1857), *Robert Burns, a Memoir* (1859), *The History of France from the Earliest Times to 1848* (1859), and *The History of England from the Earliest Times to 1858* (1860). Most of his books were republished in the U. S.

**White** (John), b. at Stanton, St. John, Oxfordshire, England, in 1574; educated at Oxford; became perpetual fellow of New College 1595, and rector of Trinity church, Dorchester, 1606; was one of the most efficient promoters of the colonization of New England, and especially of Dorchester and Gloucester, Mass., both by his pen and by his personal influence; was known as "the patriarch of Dorchester," and was a member of the Westminster Assembly of divines. D. at Dorchester in 1648. Author of *The Planter's Plea, or the Grounds of Plantations Examined and Usual Objections Answered* (London, 1630), *A Commentary on the Three First Chapters of Genesis* (1656), and other religious publications.

**White** (John), b. in Kentucky in 1805; was a member of Congress 1835–45; Speaker of the 27th Congress (1841–43), and subsequently judge of the U. S. district court. D. by his own hand at Richmond, Ky., Sept. 22, 1845.

**White** (John T.), D. D., grand-nephew of Gilbert, b. in England about 1820; educated at Corpus Christi College, Oxford, where he became a fellow; took orders in the Church of England, and is rector of St. Martin's church, Ludgate, London, and head-master of the Latin school of Christ's Hospital. He has edited with English notes Xenophon's *Expedition of Cyrus* (1848) and the *Germania* and *Agricola* of Tacitus (1850); published a series of grammatical textbooks in Latin, and is author, with Rev. Joseph Esmond Riddle, of *A Latin-English Dictionary* (1862), based on Andrews's translation of Freund.

**White** (Joseph), D. D., b. at Stroud, Gloucestershire, in 1746, son of a weaver; graduated at Wadham College, Oxford, about 1770; became fellow there 1774; was chosen Laudian professor of Arabic 1775; was a highly-successful Bampton lecturer 1785, being aided in the composition of his sermons by Dr. Parr and Mr. Badcock; became prebendary of Gloucester (1788) and of Oxford (1802); regius professor of Hebrew at Oxford 1802, and subsequently canon of Christ church. D. May 22, 1814. Author of *A View of Christianity and Mohammedanism* (Bampton lectures, 1784), *Diatessaron* (1799), being a Greek Harmony of the Gospels, and *Ægyptiaca* (1801); editor of Griesbach's *Greek Testament* and of the Philoxenian Syriac Testament (1778).

**White** (Joseph Blanco), b. at Seville, Spain, July 11, 1775, of an Irish Catholic family settled for several generations in Spain; was known in Spain as José Maria Blanco y Crespo; was destined for a mercantile career, but left his father's counting-house to study for the Church; was ordained a priest 1799; was endowed with an inquiring mind, and, devoting himself to the study of religious systems, soon lost confidence in Roman Catholicism, though continuing in its priesthood until 1810, when, in consequence of the political crisis in Spain, he proceeded to England; was patronized by Lord Holland, in whose family he became a tutor, and through whom he became known to an influential literary and political circle, to which his religious experiences were an object of interest; wrote several works against Roman Catholicism; conducted

for several years a monthly Spanish paper, *El Español*, rendering services to the cause of Spanish independence which were rewarded by the English government with a life-pension of £250; gave his adhesion at first to the Anglican Church, to the ministry of which he intended to devote himself, but was ultimately prevented by doubts in respect to some of its doctrines; resided in London as a man of letters, contributing to leading reviews and periodicals and producing several works in Spanish and English, all bearing more or less directly either upon Spain or upon religious questions; conducted for three years (1822–25) another Spanish journal, *Las Variedades*, and was editor of the short-lived *London Review* (1829); was tutor in the family of Archbishop Whately at Dublin 1832–35, after which he avowed himself a Unitarian; settled at Liverpool, where he joined the society to which Rev. John Hamilton Thom was pastor, and resided there, suffering much from an incurable disease, aggravated by religious melancholy, until his death, May 20, 1841. He was never married. Among his publications were *Letters from Spain, by Leocadio Doblado* (1822), *Practical and Internal Evidence against Catholicism* (1825), *The Poor Man's Preservative against Popery* (1825), *Second Travels of an Irish Gentleman in Search of a Religion* (1833), and an instructive autobiography in the form of letters, addressed chiefly to Archbishop Whately, edited by Rev. J. H. Thom as a part of *Life and Correspondence* (3 vols., 1845). Blanco White's *Sonnet to Night* was called by Coleridge the finest in the English language. PORTER C. BLISS.

**White** (JOSEPH M.), b. in Franklin co., Ky., about 1790; received a good education, becoming familiar with French and Spanish; was for some years a lawyer in Florida Territory, where he was noted for eloquence, and was Territorial delegate in Congress 1823–37. D. at St. Louis, Mo., Oct. 18, 1839. Author of a valuable work, *A New Collection of Laws, Charters, etc., of Great Britain, France, and Spain relating to Concessions of Land, with the Laws of Mexico and Texas on the same Subject* (Philadelphia, 2 vols., 1839).

**White** (PEREGRINE), celebrated as the first child of English parentage born in New England; was the son of William White and his wife Susanna, passengers in the Mayflower, and was born on that vessel in the harbor of Cape Cod about Nov. 20, 1620; became a citizen of Marshfield; was "vigorous and of a comely aspect;" filled various civil and military offices, and reached a good old age, dying at Marshfield July 22, 1704. His father died during the first winter at Plymouth, and his mother married Gov. Edward Winslow, theirs being the first marriage in New England.

**White** (PLINY HOLTON), b. at Springfield, Vt., Oct. 6, 1822; was admitted to the bar of Windham co. 1843; was editor of the Brattleborough *Eagle* 1851–52, and of the *Express* at Amherst, Mass., 1857–58; was ordained minister at Coventry, Vt., Feb., 1859; sat in the Vermont legislature 1862–63; was chaplain of the senate 1864–66, and for several years president of the Vermont Historical Society. D. at Coventry Apr. 24, 1869. Author of a *History of Coventry* (1858), and a frequent contributor to magazines.

**White** (RICHARD GRANT), b. in New York City May 22, 1822; graduated at the New York Free Academy (now College of the City of New York) 1839; studied medicine and law; was admitted to the bar 1845; founded a short-lived paper entitled *The Alleghanian;* was associated with Evert A. Duyckinck as editor of *Yankee Doodle* (1846–47); was associate editor of the New York *Courier and Enquirer* 1851–58; and subsequently of the *World;* has written largely for numerous magazines and periodicals, more especially on grammatical and philological subjects; was American correspondent of the London *Spectator* 1863–67, and has for many years held an office in the New York custom-house. Author among other works of *Shakespeare's Scholar* (1854), *The Authorship of the Three Parts of Henry VI.* (1859), *National Hymns, how they are Written and how they are not Written, a Lyrical and National Study for the Times* (1861), *The New Gospel of Peace, according to St. Benjamin* (4 parts, 1863–66), an anonymous political satire which acquired great celebrity; *Memoirs of the Life of William Shakespeare, with an Essay toward the Expression of his Genius, etc.* (1865), which also formed part of the first volume of his splendid annotated variorum edition of Shakspeare (12 vols., 1857–65), and *Words and their Uses* (1870), being essays on the English language, from the *Galaxy* magazine, to which he is still (1876) contributing similar disquisitions, and edited J. H. Burton's *Book-Hunter* (1863) and a volume of selected *Poetry, Lyrical, Narrative, and Satirical, of the Civil War* (1866).

**White** (ROBERT MEADOWS), D. D., b. in England about 1798; graduated at Magdalen College, Oxford, 1819; took orders in the Church of England 1821; became tutor 1832, and Rawlinson professor of Anglo-Saxon at Oxford 1834; visited Denmark for philological purposes 1837; was chosen vice-president of Magdalen 1838; was noted as a local antiquary, as the annalist of his college, and as a leading authority in English philology, in which branch he was intimately associated with Dr. Bosworth, Benjamin Thorpe, and Richard Garnett, and, besides many miscellaneous philological and antiquarian papers, devoted much of his time for twenty years to the careful editing of *The Ormulum, Semi-Saxon Homilies in Verse, now first edited from the Original MSS., with Notes and Glossary* (Oxford, 2 vols., 1852). During the latter portion of his life he was rector of Slimbridge, Gloucestershire, where he d. Jan. 31, 1865.

**White** (Sir THOMAS), b. at Reading, England, in 1492; became a wealthy London merchant; was lord mayor of London 1553; was knighted 1554 for his services in maintaining the peace of the city during Wyatt's rebellion; and acquired a title to remembrance by the foundation of St. John's College, Oxford, in 1555, and by other liberal benefactions. D. in London Feb. 11, 1566.

**White** (THOMAS), D. D., b. at Bristol, England, about 1550; graduated at Magdalen Hall, Oxford, about 1570; took orders in the Church of England; became incumbent of St. Gregory's and vicar of St. Dunstan's-in-the-West, London; prebendary of St. Paul's, London, 1588; treasurer of Salisbury cathedral 1590; canon of Christ church 1591, and of Windsor 1593. D. Mar. 1, 1624. By his will he founded Sion College, London.

**White** (WILLIAM), D. D., b. in Philadelphia, Pa., Apr. 4, 1748; graduated at Philadelphia College 1765; studied theology in England; took orders in the Church of England 1770; became rector of Christ church and St. Peter's church, Philadelphia; was chaplain to Congress when in session at York, Pa., 1777; was at that time the only Episcopal clergyman in Pennsylvania; was a friend and pastor of Washington; presided at the first Episcopal convention held in America, Sept. and Oct., 1785; wrote the constitution of the Church then adopted; was chosen bishop of the diocese of Pennsylvania 1786; proceeded to England with his fellow-bishop (of New York), Dr. Samuel Provoost; was consecrated at Lambeth Palace by the archbishop of Canterbury Feb. 4, 1787; was president of the first Bible society established in the U. S., and of several charitable institutions, and with Bishop Seabury of Connecticut revised the *Book of Common Prayer* for the use of the American Episcopal Church. D. at Philadelphia July 17, 1836. Author of *The Case of the Episcopal Churches in the U. S. considered* (1782), *Lectures on the Catechism* (1813), *Memoirs of the Protestant Episcopal Church in the U. S.* (1820), and other works. A *Memoir* by Rev. Dr. Bird Wilson appeared in 1839.

**White Ants.** See TERMITES, by MRS. S. B. HERRICK.

**Whitebait.** See APPENDIX.

**White Bear.** See BEAR and URSIDÆ.

**White Bear,** tp., Ramsey co., Minn. P. 430.

**White Bear Lake,** tp., Pope co., Minn. P. 262.

**White Breast,** p.-v. and tp., Lucas co., Ia. P. 590.

**White Breast,** tp., Warren co., Ia. P. 1016.

**White Chap'el,** tp., Lancaster co., Va. P. 1669.

**White Clay Creek,** hd., New Castle co., Del. P. 2620.

**White Cloud,** p.-v. and tp., Mills co., Ia. P. 562.

**White Cloud,** p.-v., Iowa tp., Doniphan co., Kan. P. 843.

**White Cloud,** tp., Nodaway co., Mo. P. 994.

**White Copper,** an alloy; also called **Packfong.** See NICKEL and PACKFONG.

**White Creek,** p.-v. and tp., Washington co., N. Y. P. 2881.

**White Creek,** p.-v. and tp., Adams co., Wis. P. 206.

**White Deer,** tp., Union co., Pa. P. 1676.

**White Eyes,** tp., Coshocton co., O. P. 923.

**White'field,** tp., Marshall co., Ill. P. 1205.

**Whitefield,** p.-v. and tp., Lincoln co., Me. P. 1594.

**Whitefield,** tp., Kandiyohi co., Minn. P. 77.

**Whitefield,** p.-v. and tp., Coos co., N. H. P. 1196.

**Whitefield** (GEORGE), b. in the Bull Inn at Gloucester, Eng., Dec. 16, 1714; in St. Mary's grammar school acquired the rudiments of learning, and there gave indications of extraordinary talent for public speaking in the pieces which he repeated on festivals before the corporation of his native city, and in the skill with which he acted characters assigned to him when dramatic performances took place at

school. The old inn, too, is particularly associated with his early days, inasmuch as in his fifteenth year he went to assist his mother in the performance of her duties as hostess. One day an Oxonian, a servitor of Pembroke, tarried at the inn, and told the landlady how he obtained enough by his services to pay his expenses. "This will do for my son," she exclaimed; and turning to George asked, "Will you go to Oxford?" "With all my heart, mother," he replied. This ended in his entering the university in his eighteenth year as a Pembroke servitor. Having become intimate with the Oxford Methodists, as certain pious students were called, and having undergone a great moral change, he resolved to devote himself to the ministry of the gospel heart and soul. In the choir of Gloucester cathedral he was ordained on Sunday, June 20, 1736, and the following week he preached his first sermon in the church where he had been baptized. On that Sunday there commenced a new era in the history of Whitefield's life and in the history of the English pulpit. That life became devoted to preaching, and that pulpit became filled with new power.

He went to London, at first to read prayers in the Tower chapel, but having begun to preach at Bishopsgate church, his fame soon spread over the city, and shortly he was engaged four times on a single Sunday in addressing audiences of enormous magnitude. Having addressed multitudes in other parts of his native county, he spent some weeks in Bristol, and there the people hung upon the rails, climbed up the leads of the churches, and with their breath made the steam run down the pillars and walls like drops of rain. He sailed for Georgia in a ship full of sailors, who counted him an impostor, but he overcame their prejudices and explained the Scriptures to them twice a day. In Savannah he expounded at five in the morning, at ten read prayers and preached, at three held another service, and at seven in the evening expounded the catechism. Returning to England, the ship was once more turned into a church. And again in the city of Bristol, pondering what a man had said to him there some time before—"What need of going abroad? Have we not Indians enough at home? If you have a mind to convert Indians, there are colliers enough in Kingswood"—he resolved to go amongst that neglected class. "I hasted," he says, "to Kingswood. At a moderate computation there were about 10,000 people. The trees and hedges were full; all was hush when I began. To behold such crowds standing together in such awful silence, and to hear the echo of their singing run from one end of them to the other, was very solemn and striking. As the scene was new, and I had just begun to be an extempore preacher, it often occasioned many inward conflicts. Sometimes, when 20,000 people were before me, I had not, in my own apprehension, a word to say either to God or them; but I was never totally deserted, and frequently (for to deny it would be to sin against God) so assisted that I knew by happy experience what our Lord meant by saying, 'Out of his belly shall flow rivers of living water.' The first discovery of their being affected was to see the *white gutters* made by their tears, which plentifully fell down their black faces—black as they came out of the coal-pits. Hundreds and hundreds of them were soon brought under deep conviction, which, as the event proved, ended in a sound and thorough conversion." Then he visited Wales with Howel Harris, and, beginning at Cardiff, proceeded from town to town, laboring in every place with all his accustomed ardor. The effects produced were very striking, and an excitable people, as were the inhabitants of the principality, yielded to the force of the preacher's appeal and to the power of those divine truths which he proclaimed.

At length a dispute arose between Whitefield and Wesley. The tide for a time turned against the former, "and at Kennington Common," he says, "I had not above a hundred to hear me." He had to begin his work afresh, and was encouraged by Beza's words: "Calvin is turned out of Geneva, but, behold, a new Church arises!" On a common near Braintree he preached to 10,000. Then he went to Scotland, but the churches would not hold the congregations. He continued preaching, always twice, often thrice, and once seven times, a day. We find him in Gloucestershire, and again in Wales, and once more in London. He preached in Moorfield, with little boys and girls sitting round the stand and handing up people's notes, and weeping as they saw the eggs and dirt thrown at him. He returned to Scotland, caused a wonderful revival at Cambuslang, and then reappeared in London, having traversed the country, preaching where he went.

In 1744 he sailed to America for the third time. After untiring labors he recrossed the Atlantic, and was sent for by the countess of Huntingdon to preach in her drawing-room to the nobility, among whom were Chesterfield and Bolingbroke. Scotland was revisited; so was the west of England. From Bristol he writes: "Yesterday God brought me here after having carried me a circuit of about 800 miles, and enabled me to preach to upward of 100,000 souls." Immense consternation was caused in London by the shock of an earthquake in Mar., 1750; people thought the world was coming to an end. Thousands on thousands assembled in Hyde Park and stayed there till midnight. Whitefield went to them, lifted up his clear voice under the clear stars to that dense, awestruck multitude, and told them God's true prophecy of the world's end. Afterward he visited Ireland and Scotland, and then a fourth time crossed the ocean. We find him in England again before the year's end, and, after preaching there, hasting once more to the other side of the Tweed. The Tabernacle and Tottenham Court chapels were built in 1753 and 1756, and there he gathered crowded congregations, hundreds often being turned away from the doors because there was no room to enter. Again and again he repeated his visits to Scotland, filling up the intervals with home engagements. He went to America a fifth, a sixth, and a seventh time. He preached every day at Boston from the 17th to the 20th of Sept., 1770; then travelled to Portsmouth, and preached daily till the 29th. On Saturday morning, the 29th, he set out on his return to Boston, preached at Exeter in the open air, continued his discourse nearly two hours, went to bed on Saturday night complaining of an oppression of the lungs, and on Sunday morning at six o'clock expired in a fit of asthma. An astonishing circumstance in connection with his death is related in Stevens's *History of Methodism*. The hall of the house in which he died was crowded with people as he was going up to bed the last night of his life. Reluctantly leaving them, saying he could not speak a word, he paused at the top of the staircase and delivered a most solemn address. "His voice flowed on until the candle which he held in his hand burned away and went out in its socket." This incident, not related in any of the memoirs of Whitefield, was communicated to Mr. Stevens by the daughter of the Rev. Mr. Parsons, in whose house he died.

Whitefield's dramatic power was amazing. "Aye, sure," said an old man who heard him, "he was a jolly brave man; and what a look he had as he put out his right hand to rebuke a disturber who tried to stop him under a pear tree! The man had been threatening and noisy, but he could not stand the look. Off he rode, and Whitefield said, 'There he goes: empty barrels make most din.'" His voice was marvellously varied, and he ever had it at command—an organ, a flute, a harp, all in one. His intellectual powers were not of a high order, but he had an abundance of that ready talent which makes the popular preacher; and beyond all natural endowments there was in his ministry the power of evangelical truth, and, as his converts believed, the presence of the Spirit of God.

His works have been published in 6 vols. (1771). Dr. Gillies wrote memoirs of his life and character (1772); the Rev. Robert Philip wrote another biography of him in 1837; and in 1866 a book appeared by I. R. Andrews, under the title of *George Whitefield, a Light rising in Obscurity*. The best description of Whitefield's personal peculiarities will be found in the Rev. W. Jay's *Memoirs of Cornelius Winter*. On Sept. 30, 1870, there was a centennial anniversary of Whitefield's death at Newburyport, Mass., when an elaborate commemorative discourse was delivered by the Rev. Dr. Stearns; a public meeting was subsequently held, and several relics of the great preacher were exhibited on the occasion. JOHN STOUGHTON.

**Whitefield** (JAMES), D. D., b. at Liverpool, England, Nov. 3, 1770; received a good education; was for some time engaged in mercantile pursuits; studied divinity with Ambroise Maréchal; became a Roman Catholic priest 1809; settled at Baltimore, Md., 1817, as minister of St. Peter's church, and succeeded Archbishop Maréchal May 25, 1828. D. at Baltimore Oct. 19, 1834.

**Whitefish.** See APPENDIX.

**White Flux.** See FLUX.

**White'ford,** tp., Monroe co., Mich. P. 1427.

**White Fri'ars,** an ancient precinct in London, Eng., between Fleet street and the Thames, deriving its name from the church of the Carmelite monks, or "White Friars," founded by Sir Richard Grey in 1241. Salisbury Court, Whitefriars (see ALSATIA), enjoyed for centuries the privileges of a sanctuary—at first for criminals, and subsequently for debtors only—until 1697. Whitefriars Theatre was a flourishing institution during most of the dramatic career of Shakspeare (1580–1613), but was pulled down at the latter date.

**White Gun'powder,** a compound of chlorate of potash 3 parts, ferrocyanide of potassium 1 part, and white sugar 1 part, each pulverized and carefully mixed. It ex-

plodes from percussion, friction, the touch of a minute quantity of sulphuric acid or of a red-hot iron. It is very violent in its effects, and its preparation is dangerous. It is of no industrial value.

**White Hall,** p.-v. and tp., Greene co., Ill. P. of v. 1200; of tp. 1600.

**White'hall,** p.-v., Muskegon co., Mich., on Chicago and Michigan Lake Shore R. R., and on the E. shore of White Lake, 5 miles from Lake Michigan, contains 5 churches, a graded public school, 1 bank, 2 hotels, 1 newspaper, 1 tannery, a wagon-factory, and a number of shingle and lath mills. The village was incorporated in 1867. P. 842. C. P. NEARPASS, ED. "FORUM."

**Whitehall,** p.-v. and tp., Washington co., N. Y., at the head of Champlain Canal, and on Rensselaer and Saratoga and New York and Canada R. Rs., at the S. end of Lake Champlain, contains 5 churches, an excellent graded school, fine water-power, 4 banks, 2 newspapers, 4 transportation companies, an opera-house, gasworks, 3 hotels, 9 lumber-yards, 3 saw-mills, 1 door and 1 moulding factory, 8 shipyards, 2 grist-mills, and waterworks (proposed). The village owes its prosperity to the transportation by lake and canal, boatbuilding, and lumber-trade. P. of v. 4322; of tp. 5564. W. A. WILKINS, ED. "TIMES."

**Whitehall,** tp., Lehigh co., Pa. P. 3318.

**Whitehall,** tp., Abbeville co., S. C. P. 1516.

**Whitehall,** tp., Albemarle co., Va. P. 4749.

**White'haven,** town of England, county of Cumberland, on the Irish Sea, near the entrance of the Solway Frith, is well built, finely situated, and has a good harbor, with slips and drydocks for building and repairing ships. It has manufactures of sailcloth and cordage, iron-smelting works and foundries, and exports large quantities of coal from the rich collieries in its neighborhood. P. 18,446.

**White Ha'ven,** p.-b., Luzerne co., Pa. P. 1321.

**White'head** (WILLIAM), b. at Cambridge, England, in 1715; educated at Winchester School and at Clare Hall, Cambridge, where he became fellow 1742; wrote the tragedies *The Roman Father* (1750) and *Creusa, King of Athens* (1754), a comedy, *The School for Lovers* (1762), a farce, *The Trip to Scotland* (1770), and a number of poems now forgotten, but which procured him the honor of being appointed poet-laureate on the death of Cibber (1757). He resided many years in the family of Lord and Lady Jersey, first as tutor to their son, whom he accompanied 1754–56 on a European tour, and obtained in 1755, through Lady Jersey, the post of secretary and registrar of the order of the Bath. D. Apr. 14, 1785.

**Whitehead** (WILLIAM), U. S. N., b. June 12, 1840, in Pennsylvania; graduated at the Naval Academy in 1860; became lieutenant in 1862, commander in 1874; served on the iron-clad Passaic in many fights with the forts and batteries defending Charleston harbor in 1863 and 1864, and commended in official despatches.

FOXHALL A. PARKER.

**Whitehead** (WILLIAM ADEE), b. at Newark, N. J., Feb. 19, 1810; was collector of customs at Key West, Fla., 1830–38; has since been an officer of the New Jersey R. R. Co. and other railroad enterprises; is a resident of Newark, where he is an officer of an insurance company, and has been since 1871 president of the trustees of the New Jersey normal school. Author of *East Jersey under the Proprietary Governments* (1846), *Early History of Perth Amboy* (1856), of papers in the *Proceedings* of the New Jersey Historical Society on the northern and eastern boundary-lines of New Jersey, on the settlement of Elizabeth, the biography of Gov. William Franklin, and other topics of local history; edited *The Papers of Lewis Morris, Governor of New Jersey 1738 to 1746,* with a memoir (New York, 1852), and prepared an *Index to the New Jersey Colonial Documents.*

**White House,** the residence of the President of the U. S. (See WASHINGTON CITY.)

**White House,** p.-v., Hunterdon co., N. J., on Central R. R. of New Jersey, 45 miles W. of New York City, has 2 churches, good schools, 1 newspaper, 2 hotels, horn goods factory, marble-works, and 1 furniture manufactory. Large numbers of live-stock are shipped from this place annually. A. J. SHAMPANORE, ED. "FAMILY CASKET."

**White House,** tp., Robeson co., N. C. P. 684.

**White'house** (HENRY JOHN), D. D., D. C. L., b. in New York City in Aug., 1803; graduated at Columbia College 1821, and at the (Episcopal) General Theological Seminary, New York, 1824; took orders 1824; was rector of St. Luke's church, Rochester, 1829–44, and of St. Thomas's, New York, 1844–51; consecrated assistant bishop of Illinois Nov. 20, 1851; succeeded to that see on the death of Bishop Chase 1852, and preached the sermon before the Pan-Anglican Council, London, 1867. D. Aug. 10, 1874.

**White'hurst** (JOHN), F. R. S., b. at Congleton, Cheshire, England, in 1713, son of a watchmaker; became an ingenious mechanician at Derby, where he manufactured thermometers, barometers, and hydraulic machines; removed to London 1775, and became stamper of the money-weights at the mint; visited the Giant's Causeway 1783, and wrote treatises on various branches of mechanical science, one of which was *An Inquiry into the Original State and Formation of the Earth* (1778). D. in London Feb. 13, 1788.

**White Lake,** p.-v. and tp., Oakland co., Mich. P. 1180.

**White Lead,** the basic carbonate of lead, largely used in the composition of white oil paint, and to some extent in the manufacture of cements. It is made by precipitation, for which purpose carbonic acid is employed to decompose a soluble salt, or by exposing plates of cast lead to the joint action of the vapor of acetic acid, air, and carbonic acid.

**White'ly,** p.-v. and tp., Greene co., Pa. P. 977.

**White'locke** (BULSTRODE), b. in London, England, Aug. 2, 1605, son of Sir James (1570–1632), who became a justice of the king's bench; educated at Merchant Taylors' School and at St. John's College, Oxford, but left without a degree; studied law at the Middle Temple; was employed in a subordinate legal capacity at the impeachment of the duke of Buckingham 1626; was elected to the Long Parliament 1640; was chairman of the committee for conducting the impeachment of the earl of Strafford 1640–41, and drew up the charges upon which it was based; was a Parliamentary commissioner to treat with Charles I. at Oxford 1641–42; was deputy lieutenant of Buckinghamshire and Oxfordshire; aided Hampden in dispersing the commissioners of array at Watlington, and took part in the defence of Brentford 1642; was a member of the Westminster Assembly of divines 1643, and opposed the adoption of the Presbyterian doctrine and discipline; became governor of Windsor 1644; rescued from dispersion the royal library and cabinet of medals; opposed the Self-Denying ordinance; was a commissioner of admiralty 1645; was a member of the commission sent to Uxbridge to negotiate a treaty of peace 1645; was one of the commissioners of the great seal 1649, but refused to take part in the trial of the king, which he disapproved; was appointed ambassador to negotiate a treaty with Queen Christina of Sweden Sept., 1653; was created by her a knight of the order of Amartha (whence he is sometimes called Sir); became a commissioner of the treasury 1655, Speaker of the House of Commons 1656, and one of Cromwell's lords Dec., 1657; was commissioner of the great seal to Richard Cromwell, whom he assisted in dethroning; president of the council of state during the interregnum, and retired at the Restoration to his estate at Chilton Park, Wiltshire, where he d. Jan. 28, 1676. He left in MS. an autobiography and several other works. Of these there were printed his *Memorials of English Affairs, or an Historical Account of what passed from the Beginning of the Reign of King Charles I. to the Restoration of King Charles II.* (1682; new ed. 1732; last ed., Oxford, 4 vols., 1852), a *Journal of the Swedish Embassy* (2 vols., 1772; new ed., 2 vols., 1845), and other historical and juridical treatises.

**White Marsh,** p.-v. and tp., Montgomery co., Pa. P. 3151.

**White Moun'tains,** a group of peaks in the counties of Coos, Carroll, and Grafton, N. H., usually regarded as a part of the Appalachian system. They stand on a plateau whence flow the Saco, Pemigewasset, Ammonoosuc, and other rivers. The western portion of the group is known as the FRANCONIA MOUNTAINS (which see). The White Mountains proper culminate in Mount Washington, the highest peak in the U. S. east of the Mississippi River, excepting Mitchell's High Dome in North Carolina. Its height is 6288 feet. Mount Jefferson reaches 5794 feet; Mount Adams, 5714; Mount Madison, 5365; Mount Clay, 5553; Mount Monroe, 5384, besides many others of lesser height. Of the Franconia group, the only one exceeding 5000 feet is Mount La Fayette, 5290 feet high. The area of the whole is more than 800 sq. m. The White Mountains constitute a favorite summer resort, and are remarkable for their wild and varied scenery. They are readily accessible by several railroad routes, and are well provided with hotels and roads. Not the least remarkable of the sights of this region is the railway by which a locomotive climbs Mount Washington, rising 3625 feet in 3 miles.

**White Oak,** tp., Franklin co., Ark. P. 2160.

**White Oak,** tp., Jefferson co., Ark. P. 210.

**White Oak,** tp., El Dorado co., Cal. P. 751.

**White Oak,** tp., McLean co., Ill. P. 532.
**White Oak,** p.-v. and tp., Mahaska co., Ia. P. 1032.
**White Oak,** tp., Warren co., Ia. P. 685.
**White Oak,** p.-v. and tp., Ingham co., Mich. P. 979.
**White Oak,** tp., Harrison co., Mo. P. 872.
**White Oak,** tp., Henry co., Mo. P. 1357.
**White Oak,** p.-v. and tp., Bladen co., N. C. P. 1265.
**White Oak,** tp., Carteret co., N. C. P. 842.
**White Oak,** tp., Jones co., N. C. P. 959.
**White Oak,** tp., Wake co., N. C. P. 1680.
**White Oak,** tp., Highland co., O. P. 1052.
**White Oaks,** tp., Onslow co., N. C. P. 1280.
**White Oak Springs,** p.-v. and tp., Lafayette co., Wis. P. 540.
**White Pig'eon,** p.-v. and tp., St. Joseph co., Mich. P. of v. 922; of tp. 1833.

**White Pine,** county of E. Nevada, bordering on Utah. The surface is a high plateau, crossed N. and S. by hills and valleys. The mountains are rich in minerals, especially in silver; some of the soil is arable, and much of it adapted for pasturage. Staples, hay, potatoes, and wool. Up to 1870 the silver-mines were largely worked, since which time they have been partially abandoned, and the population decreased by nearly two-thirds between 1870 and 1875. Cap. Hamilton. Area, 6720 sq. m. P. in 1870, 7189.

**White Plain,** tp., Spartanburg co., S. C. P. 1342.
**White Plains,** p.-v., Greene co., Ga. P. 374.

**White Plains,** p.-v. and tp., semi-cap. of Westchester co., N. Y., on Harlem R. R., 25 miles N. E. of New York City, has 2 banks, 4 schools, 6 churches, and 2 weekly newspapers, and was the scene of one of the battles of the American Revolution, in which the British under Gen. Howe drove the Americans from Chatterton Hill, W. of Bronx River, with a loss to the latter of 180 killed, wounded, and prisoners, Oct. 28, 1776. The centennial anniversary was celebrated in 1876. P. 2630.

**White Post,** tp., Pulaski co., Ind. P. 785.
**White Post,** p.-v., Greenway tp., Clarke co., Va. P. 192.

**White Riv'er** rises by several heads in the Ozark Hills of Washington and Madison cos., Ark., takes a circuit of 100 miles in Missouri, returns to Arkansas, and after a course of some 900 miles reaches the Mississippi River at a point 15 miles above the mouth of the Arkansas, into which a part of its waters are discharged. It is navigable by large steamboats to Batesville, Ark., 380 miles.

**White River,** in Indiana, rises by two forks. The E. or Driftwood fork (called also Blue River), flowing from Henry co., is 250 miles long, and is navigated to Rockford. The W. fork, the longer arm, rises in Randolph co., and crosses the State. It is 300 miles long, and is navigable at high water 150 miles to Martinsville. The main stream is 50 miles long, and flows into the Wabash opposite Mount Carmel, Ill.

**White River,** in Michigan, rises in Newaygo co., and after a S. W. course reaches White Lake, which extends eastward from Lake Michigan like an estuary or bay.

**White River,** in Vermont, rises in Addison co., and after a devious course falls into the Connecticut River at White River Junction. This stream and its branches afford fine water-power.

**White River,** tp., Benton co., Ark. P. 1315.
**White River,** tp., Independence co., Ark. P. 1472.
**White River,** tp., Izard co., Ark. P. 366.
**White River,** tp., Prairie co., Ark. P. 997.
**White River,** tp., Washington co., Ark. P. 1545.
**White River,** tp., White co., Ark. P. 60.
**White River,** Woodruff co., Ark. P. 944.
**White River,** p.-v. and tp., Tulare co., Cal. P. 120.
**White River,** tp., Gibson co., Ind. P. 2174.
**White River,** tp., Hamilton co., Ind. P. 2047.
**White River,** tp., Johnson co., Ind. P. 1755.
**White River,** tp., Randolph co., Ind. P. 4069.
**White River,** p.-v. and tp., Muskegon co., Mich. P. 1452.
**White River,** tp., Barry co., Mo. P. 756.
**White River Junction,** p.-v., Windsor co., Vt.
**White Rock,** tp., Franklin co., Ark. P. 280.
**White Rock,** p.-v. and tp., Ogle co., Ill. P. 999.
**White Rock,** p.-v. and tp., Huron co., Mich. P. 270.
**White Rock,** tp., McDonald co., Mo. P. 344.
**White's,** tp., Blount co., Ala. P. 252.
**White's,** tp., Bertie co., N. C. P. 1025.
**Whites'boro',** v., Whitestown tp., Oneida co., N. Y. P. 964.
**Whites'borough,** p.-v., Grayson co., Tex.
**Whites'burg,** p.-v. and tp., Madison co., Ala. P. 2937.
**Whitesburg,** p.-v., cap. of Letcher co., Ky.
**White's Creek,** tp., Bladen co., N. C. P. 1440.

**White Sea,** a large inlet of the Arctic Ocean, penetrates into European Russia for a distance of 380 miles, with a breadth of from 30 to 150 miles. It is frozen from October to May, and is rich in herring and codfish.

**White Shoals,** p.-v. and tp., Lee co., Va. P. 2750.

**White'side** (James), LL.D., b. at Delagny, county Wicklow, Ireland, in 1806; educated at Trinity College, Dublin; was called to the Irish bar 1830; became queen's counsel 1842; was counsel for Daniel O'Connell 1843, and for Smith O'Brien and Thomas F. Meagher 1848; represented Enniskillen in Parliament 1851–59; was subsequently chosen for the University of Dublin 1859–66; was solicitor-general for Ireland in the Derby cabinet, and a bencher of the King's Inns 1852; attorney-general and privy councillor in the second Derby cabinet 1858–59, and also in the third 1865–66, and became lord chief-justice of Ireland 1866. Author of *The Law of Nisi Prius* (1840), *Italy in the Nineteenth Century* (3 vols., 1848), *The Vicissitudes of the Eternal City* (1849), *The Life and Death of the Irish Parliament* (1863), and *Essays and Lectures, Historical and Literary* (1869).

**White'sides,** county of N. W. Illinois, separated from Iowa by Mississippi River, intersected by Rock River, and traversed by Chicago and North-western and Rockford Rock Island and St. Louis R. Rs. The surface is level, with considerable woodland; soil fertile. There are saw-mills, planing-mills, flour-mills, and manufactures of agricultural implements, carriages, furniture, gloves, and woollen goods. Horses, cattle, and swine are very numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Morrison. Area, 730 sq. m. P. 27,503.

**White's School'house,** tp., Lee co., Ala. P. 120.
**White's Store,** p.-v. and tp., Anson co., N. C. P. 1358.

**White'stone,** p.-v., Queens co., N. Y., on the N. end of Long Island, 14 miles N. E. of New York City, has 4 churches, 4 good schools, savings bank, several tinware manufactories, hotels, an excellent harbor, and in its immediate vicinity are the U. S. fortifications at Willett's Point and (Fort Schuyler) on Throgg's Point, commanding the eastern entrance to New York harbor. P. 1907.

Chas. W. Smith, Ed. "Herald."

**Whitestone,** tp., Lancaster co., Va. P. 2078.
**Whites'town,** p.-v., Boone co., Ind.
**Whitestown,** p.-v. and tp., Oneida co., N. Y. P. 4339.
**Whitestown,** tp., Vernon co., Wis. P. 637.
**White Sul'phur,** tp., Greenbrier co., W. Va. P. 976.

**White Sulphur Springs,** p.-v., Greenbrier co., West Va., on Howard's Creek and on Chesapeake and Ohio R. R., 227 miles W. of Richmond, is a celebrated summer resort on account of a mineral spring, the waters having been employed medicinally since 1778. There are hotels capable of accommodating 1500 guests, and the place is conveniently located for access to the Red, Salt, and Blue Sulphur Springs, which are distant from 20 to 40 miles.

**Whites'ville,** p.-v., Daviess co., Ky. P. 257.

**White Swell'ing,** the popular name for a chronic inflammation of the joints (for which see Scrofula).

**White'throat,** the *Sylvia undata*, or *Curruca cinerea*, a very abundant European warbler whose song is rather sweet and very energetic. It is a favorite cage-bird, five and a half inches in length, colored reddish and whitish-brown, with a throat of pure white. There are several other warblers called whitethroat in England.

**White'ville,** tp., Jefferson co., Ark. P. 613.
**Whiteville,** tp., Marion co., Ark. P. 314.
**Whiteville,** v., Union tp., Montgomery co., Ind. P. 129.
**Whiteville,** p.-v. and tp., cap. of Columbus co., N. C. P. of v. 104; of tp. 2026.
**Whiteville,** v., Hardeman co., Tenn. P. 80.

**White'wash,** a preparation of slaked lime, thinned to a milky consistence, and used for whitening walls. Skimmed milk, glue, zinc-sulphate, tallow, and various pigments are sometimes added. Some of them form insoluble compounds with lime, and thus add to the permanency of the wash.

**White'water,** tp., Franklin co., Ind. P. 1467.

**White Water,** p.-v., Franklin tp., Wayne co., Ind. P. 144.

**Whitewater,** tp., Dubuque co., Ia. P. 1160.

**Whitewater,** tp., Grand Traverse co., Mich. P. 510.

**Whitewater,** tp., Winona co., Minn. P. 435.

**Whitewater,** tp., Cape Girardeau co., Mo. P. 1226.

**Whitewater,** tp., Hamilton co., O. P. 1609.

**Whitewater,** tp., Oconee co., S. C. P. 526.

**Whitewater,** p.-v. and tp., Walworth co., Wis., on Whitewater River and Chicago Milwaukee and St. Paul R. R., 51 miles S. W. of Milwaukee, contains 11 churches, the State normal school, 1 bank, 9 cheese-factories, a reaper manufactory, 1 paper-mill, a wagon-factory, 1 newspaper, furniture and sash and door factories. Principal business, wheat- and stock-raising. P. 4285.

E. D. Coe, Ed. "Register."

**Whitewater River,** in Indiana, is formed by two forks (the E. and W.), which unite at Brookville. The stream enters Ohio, and joins the Great Miami 6 miles from its mouth. Length to remotest source, 100 miles.

**Whitewater River,** in the S. E. of Missouri and the N. E. of Arkansas, originates in Cape Girardeau co., Mo., flows southward and joins the complicated lake and river system of the S. E. of that State, and after a course of 250 miles its waters are for the most part discharged into St. Francis River in Arkansas.

**White Whale,** the popular English designation for the Delphinidæ of the genus *Delphinapterus*, which is itself the type of a peculiar sub-family, represented by itself and the quite dissimilar genus *Monodon*. It is doubtful whether there is more than one species (*Delphinapterus beluga*), although some authors (*e. g.* Cope) have differentiated several. The type, whether generic or specific, is common to all the northern seas, and on the eastern coast of North America extends southward at least as far as the Gulf of St. Lawrence, where it is tolerably abundant. The form is essentially similar to that of the common porpoise, but the head is rounded forward and the cervical region has somewhat of a contraction: the teeth in the adult are generally about 22 in the upper and 8 in the lower jaw ($\frac{11}{8} \times 2$); no dorsal fin is developed, and hence the name *Delphinapterus—i. e.* "porpoise without a fin;" the color is a spotless white, and to this peculiarity the popular name alludes. Specimens sometimes attain a length of twenty feet, or even more, but the average is perhaps about thirteen feet. The animals frequently ascend a considerable distance up large rivers (*e. g.* the St. Lawrence). They often associate together in troops, but are also observed "in lines of seldom more than two or three abreast, or more frequently in single file, spouting irregularly," and showing little of the form above water. "When undulating along in this manner" they often make "a noise at the moment of coming to the surface to respire which may be likened to the faint lowing of an ox, but the strain is not so prolonged." (*Scammon.*) They are captured with harpoons and lances, as in ordinary whaling, as well as in nets. On the north-western coast of America "large numbers are captured by the natives of those coasts, and the oil obtained is to them a valuable article of commerce. In winter the fat of the white whale is considered a luxurious dish for the table, and the lean flesh supplies ample food for the sledge-dogs." (*Scammon.*)

Theodore Gill.

**White'wood,** a name given in the U. S. to the wood of the Tulip Tree (which see). The bark of *Canella alba* (see Canella Alba) is called whitewood bark. Other whitewoods are *Pittosporum bicolor*, of Australia, etc., *Oreodaphne leucoxylon*, *Lagunaria Pattersoni*, *Tecoma leucoxylon*, and many other trees, mostly tropical.

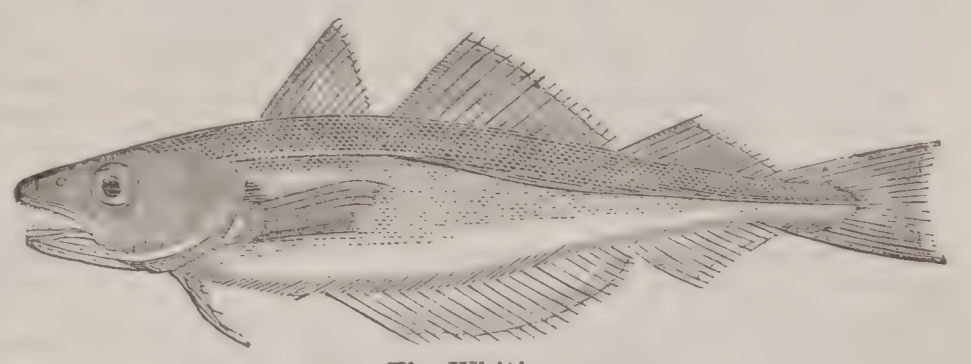
**Whit'field,** county of N. W. Georgia, bordering on Tennessee, bounded E. by Conasauga River, and traversed by Selma Rome and Dalton, Western and Atlantic, and East Tennessee Virginia and Georgia R. Rs.; surface hilly, but with some fertile valleys. Staples, Indian corn, wheat, and wool. Cap. Dalton. Area, 286 sq. m. P. 10,117.

**Whitfield** (Henry), b. in England in 1597; son of an eminent lawyer, received a university education, and studied law at one of the inns of court; took orders in the Church of England; was minister of Ockley, Surrey, where he sheltered a number of Puritan ministers during the persecution by Archbishop Laud, from which he ultimately suffered himself, in consequence of his refusal to read in church the *Book of Sports;* came to New Haven 1637; was one of the founders of Guilford, Conn. (1639), where his house, one of the oldest in the U. S., is still standing (1876); made a liberal use of a handsome fortune, and was esteemed one of the chief founders of New Haven colony; returned to England 1650, and became minister at Winchester, where he d. soon afterward. Author of *Helps to Stir up to Christian Duties* (1634), *The Light Appearing more and more towards the Perfect Day, or A Farther Discovery of the Present State of the Indians in New England, etc.* (1651; new ed., New York, 1865), and *Strength out of Weakness, or A Glorious Manifestation of the Further Progresse of the Gospel among the Indians in New England* (1652; new ed., New York, 1865).

**Whit'gift** (John), D. D., b. at Great Grimsby, Lincolnshire, England, about 1530; educated at Queen's College and at Pembroke Hall, Cambridge, under Ridley and Bradford; was chosen a fellow of Peterhouse 1555; favored the Reformation unobtrusively; took orders in the Church of England; became chaplain to Cox, bishop of Ely, and rector of Feversham, Cambridgeshire, 1560; was appointed Lady Margaret professor of divinity 1563, regius professor of divinity, master of Pembroke Hall and of Trinity College, Cambridge, all in 1567; became chaplain to Queen Elizabeth, prebendary of Ely 1568, vice-chancellor of Cambridge 1570, dean of Lincoln 1571, prebendary of Lincoln 1572, bishop of Worcester and vice-president of the Marches of Wales 1577; succeeded Edmund Grindall as archbishop of Canterbury 1583; showed himself intolerant both of Roman Catholicism and of Puritanism, insisting on new articles of subscription, suspending the clergy who refused them, and managing the Star-Chamber prosecutions with great rigor; obtained a decree against liberty of printing June, 1585; became privy councillor 1586; founded a magnificent hospital and grammar school at Croydon 1595, and took part in the conferences at Hampton Court Jan., 1604. D. at Lambeth Palace Feb. 29, 1604. His theological *Works* were edited for the Parker Society (Cambridge, 3 vols., 1851–54) by Rev. John Ayre. His *Life* was written by Sir George Paule (1612) and by John Strype (1718).

**Whit'ing,** or **Prepared Chalk,** chalk freed from impurities by elutriation, or pulverization and suspension of the finer and purer particles in water, from which they separate on standing; used as a water-color pigment and for coating paper, also as a polishing-powder for soft metals, like silver and brass.

**Whiting,** a European fish of the family Gadidæ and genus *Merlangus*, related to the true codfishes. As in them, the body is moderately elongated and covered with small scales; the head conic; the mouth deeply cleft; the upper jaw longest; the teeth in bands in the upper and lower jaw and on the vomer, but absent on the palatines; the dorsals three and the anals two; it differs from the



The Whiting.

true codfishes especially in that no barbel is developed at the chin; the color above is very dark and almost black, and below grayish; a black spot is developed in the axil of the pectoral fin. The species is esteemed for the excellence of its flesh, which is said to surpass in delicacy that of any other representative of the family. "The pearly whiteness of its flaky muscles, added to its extreme lightness as an article of food, recommends it particularly to invalids who are unable to digest more solid nutriment." (*Yarrell.*) It is quite common in the seas of Northern Europe, and is fished for throughout almost the entire year, but is more abundant in winter, when it approaches the shore—it is believed, to spawn. Its average size is about twelve or sixteen inches, with a weight of a pound and a half, although it sometimes attains a weight of three or four pounds. It is a voracious fish, and "seizes indiscriminately any of the Mollusca, worms, small Crustaceæ, and young fishes." "It appears to prefer sandy banks, but shifts its ground frequently in the pursuit of the various fry of other fishes, upon which it principally subsists." (*Yarrell.*) Although repeatedly claimed to be an inhabitant of the American coast, it has not yet been found thereon, the hake (*Merlucius bilinearis*) having been mistaken for it. On some parts of the coast the name "whiting" is also applied to the *Menticirrus nebulosus*, more generally known as the Kingfish (which see).

Theodore Gill.

**Whiting,** p.-v. and tp., Washington co., Me. P. 414.

**Whiting,** p.-v. and tp., Addison co., Vt. P. 430.

**Whiting** (Henry), b. at Lancaster, Mass., about 1790; entered the U. S. army as cornet of dragoons 1808; was chief quartermaster of Gen. Taylor's army in Northern Mexico, and was brevetted brigadier-general for services at Buena Vista Feb. 23, 1847. D. at St. Louis, Mo., Sept. 16, 1851. Author of poems, *Ontway, the Son of the Forest* (1822), and *Sannillac* (1831); co-author of *Historical and Scientific Sketches of Michigan* (Detroit, 1834), and wrote the *Life of Z. M. Pike* for Sparks's series of American biography.

**Whiting** (James R.), b. at Brooklyn, N. Y., Apr. 20, 1803; was admitted to the New York bar 1824; soon became distinguished in his profession, and also in politics; was early elected alderman; was district attorney for the county of New York several years from 1836; displayed great ability in the celebrated trials of John C. Colt and Monroe Edwards; served a few months as a judge of the supreme court of New York; returned to the practice of law as counsellor, seldom appearing in court; was defeated as an independent candidate for mayor, and accumulated a fortune of $2,000,000, gained in great part from a street-cleaning contract. D. at Spuyten Duyvil Mar. 16, 1872.

**Whiting** (John), b. at Naylsey, England, in 1655; became a Quaker leader; resided many years at Wrington, Somersetshire, and subsequently at London, where he d. in 1722. Author of many books in defence of Quakerism, including vigorous replies to George Keith (1701) and Cotton Mather (1702), and of *A Catalogue of Friends' Books* (1708), republished and enlarged by Joseph Smith (1867).

**Whiting** (Samuel), b. in Boston, England, Nov. 20, 1597, son of John Whiting, mayor of that town; educated at Cambridge University; became a Puritan minister; emigrated to New England, arriving at Boston, Mass., May 26, 1636, and was ordained first minister of Lynn, Nov. 8 of the same year, remaining there forty-three years until his death, Dec. 11, 1679. Author of a Latin oration pronounced at Harvard College 1649, a *Treatise on the Last Judgment* (1664), and of several published sermons.

**Whiting** (W. H.), U. S. N., b. July 8, 1843, in New York; graduated at the Naval Academy in 1863; became lieutenant in 1867, lieutenant-commander in 1868; served in the Monongahela at the battle of Mobile Bay, and commended for "gallantry." Foxhall A. Parker.

**Whiting** (William), a descendant of Rev. Samuel, b. at Concord, Mass., Mar. 3, 1813; graduated at Harvard 1833, and at the Cambridge Law School 1838; became an eminent lawyer at Boston; was soliciter of the U. S. war department 1862–65, and five years president of the New England Historico-Genealogical Society. Author of several legal pamphlets, a *Memoir of Rev. Joseph Harrington* (1854), and of a very important and well-written treatise on *The War-Powers of the President and the Legislative Powers of Congress in Relation to Rebellion, Treason, and Slavery* (1862), which soon passed through 27 eds. (revised and augmented 1863), and was credited with having had great influence upon the management of the war department and with some important steps taken by Pres. Lincoln. He was elected to Congress 1872. D. at Boston June 29, 1873.

**Whiting** (William D.), U. S. N., b. May 1, 1823, in Massachusetts; entered the navy as midshipman Mar. 1, 1841; became a lieutenant in 1855, commander in 1866, captain in 1872; served as executive officer of the Vandalia in the battle of Port Royal; in Sept., 1861, and in 1863 commanded the Ottawa in many of the fights with the forts defending the harbor of Charleston. Commended for "skill, fine bearing, and superior judgment." Foxhall A. Parker.

**Whiting** (William H. C.), b. in Mississippi 1825; graduated at the U. S. Military Academy at the head of his class July 1, 1845, when appointed second lieutenant in the corps of engineers. Until 1853 he was engaged as assistant in the construction of the defences of Pensacola harbor, Fla., and in the improvement of rivers and harbors in Texas, of the defences of San Francisco 1853–55; was in charge of the construction and repair of fortifications on the South Atlantic coast, and the improvement of various rivers and harbors in that section, including Cape Fear and Savannah rivers, 1856–61. He resigned his commission of captain of engineers Feb. 20, 1861, to join the Southern Confederacy, in whose service he became a major-general, and commanded a division in Jackson's corps in 1863. Fort Fisher, at the mouth of Cape Fear River, was planned and constructed by him, and in defence of that work (Jan., 1865) he was severely wounded and taken prisoner. Removed to Governor's Island, New York harbor, where his death occurred Mar. 10, 1865.

**Whi'tingham,** p.-v. and tp., Windham co., Vt. P. 1263.

**Whiting Pout.** See Bib.

**Whi'tinsville,** p.-v., Worcester co., Mass.

**Whit'ley,** county of N. E. Indiana, intersected by Eel River, and traversed by Pittsburg Fort Wayne and Chicago R. R.; surface generally undulating, soil fertile. There are many saw-mills and carriage-factories. Cattle and sheep are the chief live-stock. Staples, wheat, Indian corn, wool, and dairy products. Cap. Columbia City. Area, 324 sq. m. P. 14,399.

**Whitley,** county of S. E. Kentucky, bordering on Tennessee, and intersected by Cumberland River, the falls of which are in this county. The surface is hilly and broken, and there is an abundance of bituminous coal and iron ore. Swine, cattle, and sheep are the chief live-stock. Staples, Indian corn, oats, tobacco, and wool. Cap. Whitley Court-house. Area, 450 sq. m. P. 8278.

**Whitley Court-house,** p.-v., cap. of Whitley co., Ky.

**Whitley's,** tp., Moultrie co., Ill. P. 1280.

**Whit'low,** better known as **Felon,** a painful inflammation of the fingers and toes, more often affecting the last joint of the fingers. The felon may arise from a local bruise; more often it is the result of disturbed and deteriorated states of the blood. From the latter causes a number of felons may develop successively. A point of local tenderness and hardness is observed; swelling and induration increase, with persistent, deep-seated pain, at first dull, later more severe, with sense of tension, and ultimately lancinating and throbbing. The felon involves the periosteum, or fibrous sheath of the bone, and the unusual pain attending this condition is due to the dense and unyielding structure of the part and the degeneration of the inflammatory exudation into pus. The periosteum is usually separated from the bone by the burrowing pus, giving rise to the sense of tension; the bone, so deprived of its sheath and nutritive vessels, is liable to die, dead bone being a frequent sequel of felon. The constitutional disturbance is marked, the result of great suffering, the local injury, and the absorption of pent-up pus into the blood. When detected early, a felon may sometimes be dissipated by an ice-pack or by a small blister; more often it will progress. An early and efficient incision of the point of induration may avert further suffering and prevent the formation of much pus. Poulticing is a slower and painful means of bringing the pus to the surface; it should be evacuated with the knife as soon as detected. Dead bone and stiff joints need never follow felon if opened early. In severe cases anodynes may be needed to secure sleep and allay pain; quinine to sustain the strength; and sulphites to correct the blood in recurring felon.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Whit'man,** county of Washington Territory, bordering on Idaho. It has been formed since the census of 1870. Cap. Colfax. Area, about 3000 sq. m.

**Whitman** (Bernard), b. at East Bridgewater, Mass., in 1796; educated at Harvard, and became pastor of the Second (Unitarian) church at Waltham, Mass., 1826. D. at Waltham in 1834. He took an active part in the "Unitarian controversy," publishing *Two Letters on Religious Liberty* (1830), *Village Sermons* (1832), *Friendly Letters to a Universalist on Divine Rewards and Punishments* (1833), and many single sermons and addresses.

**Whitman** (Ezekiel), b. at East Bridgewater, Mass., Mar. 9, 1776; graduated at Brown University 1795; settled in Maine as a lawyer 1799, residing at Portland from 1807; was a member of Congress 1809–11, 1817–21, and 1821–23, of the executive council 1815–16, and of the constitutional convention 1819; chief-justice of common pleas 1822–41, and of the superior court 1841–48. D. at East Bridgewater, Mass., Aug. 1, 1866. Author of *A Genealogy of the Descendants of John Whitman* (1832).

**Whitman** (Jason), brother of Bernard, b. at Bridgewater, Mass., in 1799; graduated at Harvard 1825; studied theology; was pastor of Unitarian churches at Saco, Me., 1830–34, at Portland 1835–45, and at Lexington, Mass., 1845–48, and was general secretary of the American Unitarian Association 1834–45. D. at Lexington Jan. 25, 1848. Author of a *Memoir* of his brother Bernard (1837) and of their father, Deacon John Whitman (1843), and of several devotional, moral, and religious treatises, chiefly for the young.

**Whitman** (Sarah Helen **Power**), b. at Providence, R. I., in 1803; married in 1828 John Winslow Whitman, a lawyer at Boston, who died in 1833, since which time she has resided at Providence. Author of *Hours of Life, and other Poems* (1853), *Edgar Allan Poe and his Critics* (1860), and, with her sister, Anna Marsh Power, of a volume of *Fairy Ballads* (revised ed. 1867–68).

**Whitman** (Walt), b. at West Hills, Long Island, N. Y., May 31, 1819; educated in the public schools of Brooklyn and New York City; learned the printing and

subsequently the carpenter's trade; taught school; made extended pedestrian tours through the U. S. and Canada 1847–48; edited for brief periods newspapers at New Orleans and at Huntington, L. I.; was a volunteer nurse in the hospitals at Washington and in Virginia 1862–65; held clerkships in the government offices at Washington most of the time from 1865 to 1874; since which time, being partially disabled by paralysis, he has resided at Camden, N. J. Author of *Leaves of Grass* (1855), *Drum-Taps* (1865), and *Two Rivulets* (1873).

**Whit'marsh** (Caroline Snowden), b. at Boston, Mass., in 1827; is authoress of many works for the young of a religious, moral, or educational character; has contributed to the *Christian Examiner* and other magazines; was joint editor (with Mrs. Anne E. Guild) of an interesting and valuable collection, *Hymns of the Ages* (3 series, 1859–64), and sole editor of *Prayers of the Ages* (1867).

**Whit'more,** tp., Macon co., Ill. P. 1111.

**Whitmore** (William Henry), b. at Dorchester, Mass., Sept. 6, 1836; educated in the Boston public schools; was associated with Mr. John Ward Dean in founding the *Historical Magazine;* has been editor of the *New England Genealogical Register* and of the *Heraldic Journal*, a contributor to several magazines, chiefly on genealogical and historical subjects, and is a prominent officer of the New England Historico-Genealogical Society. Author of *A Register of Families settled at the Town of Medford, Mass.* (1855), *A Hand-Book of American Genealogy* (1862), *The Cavalier Dismounted, an Essay on the Origin of the Founders of the Thirteen Colonies* (Salem, 1865), *A Brief Genealogy of the Descendants of William Hutchinson and Thomas Oliver* (1865), *The Elements of Heraldry* (1866), *The American Genealogist, being a Catalogue of Family Histories and Publications containing Genealogical Information issued in the U. S., arranged chronologically* (Albany, 1868; new ed. 1874), and many brief genealogies issued separately, among which are those of the families Hall, Whitmore, Temple, Bowdoin, Lane, Reyner, Whipple, Quincy, Norton, Winthrop, and Ayres. He has edited for the Prince Society *The Hutchinson Papers* (2 vols., 1865) and *The Massachusetts Civil List 1636–1774* (1871), and supervised an edition of the *Poems* of W. M. Praed (1860).

**Whit'ney** (Adeline D. **Train**), b. at Boston, Mass., in 1824; married Seth D. Whitney of Milton, Mass.; has long been a favorite contributor to magazines, especially those for the young. Author of *Footsteps on the Seas, a Poem* (1857), *Mother Goose for Grown Folks* (1860), *The Boys at Chequasset* (1862), *Faith Gartney's Girlhood* (1863), *The Gayworthys, a Story of Threads and Thrums* (1865), *A Summer in Leslie Goldthwaite's Life* (1866), *Patience Strong's Outings* (1868), *Hitherto, a Story of Yesterday* (1869), *Real Folks* (1872), and other works.

**Whitney** (Asa), b. in Townsend, Mass., Dec. 1, 1791. His early advantages of education were limited, and at fourteen years of age he sought employment in Boston; after some months returned home, and after attending school for a time entered his father's blacksmith-shop, and, having learned the trade, worked in Swansea, N. H., on cotton-mill machinery for two years or more; in 1813 removed to Brattleboro', Vt., and engaged in the same business, but was burned out and lost all his savings; removed to Brownsville, Jefferson co., N. Y., and for the next twelve years, in company with Mr. U. Walton, manufactured cotton machinery, nails, etc.; in 1826–30 made the machinery for a cotton-mill and engaged in the manufacture of cotton goods, but was unsuccessful; in 1830 was appointed master-machinist in the Mohawk and Hudson R. R. shops, and from 1833 to 1836 was superintendent of the road; in 1836 took charge of a foundry for making cast steel in Orange co., but was recalled the next year to the superintendency of the railroad; in 1839 resigned from impaired health; was appointed a canal commissioner of the State of New York the same year, and served two years, having charge of the Champlain Canal and the eastern division of the Erie Canal; his reputation as a railroad engineer was at this time so high that he was consulted on the question of the gauge of the Erie Railway, then building; gave an elaborate opinion in favor of the 4 foot 8½-inch gauge, which, had it been adopted then (it has been recently), would have saved the railway many millions of dollars; in 1842 removed to Philadelphia, and became a partner with Matthew Baldwin in the manufacture of locomotives; four years later devoted his energies to the work of perfecting of car-wheels by a new process; was delayed for a year or two by his duties as president of the Morris Canal Co., and it was not until 1848 that he commenced the manufacture of car-wheels on a large scale. Using only the best qualities of iron, testing the wheels at every stage, and annealing them thoroughly by a process of his own invention, it was soon found that these car-wheels were not liable to breakage, and were practically indestructible. The manufacture constantly increased, and for some years previous to his death about 75,000 wheels were produced annually. D. in Philadelphia June 4, 1874. Mr. Whitney was a man of great benevolence, giving liberally through life, and at his death left $50,000 to found a chair of dynamical engineering in the University of Pennsylvania, and about $40,000 to other charitable purposes.

L. P. Brockett.

**Whitney** (Asa), b. about 1797; became a merchant in New York City, and was the first person who suggested a railroad to the Pacific, a project which he urged for many years upon Congress and upon the public by means of personal influence, speeches, newspaper articles, and pamphlets, and was instrumental in securing the survey of several routes. D. at Washington, D. C., in Aug., 1872. Among his publications were *A Project for a Railroad to the Pacific* (New York, 1849) and *A Plan for a Direct Communication between the Great Centres of the Populations of Europe and Asia* (London, 1851).

**Whitney** (Eli), b. in Westborough, Mass., Dec. 8, 1765; graduated at Yale College 1792; went to Georgia; studied law while residing in the family of the widow of Gen. Nathanael Greene, by whom he was stimulated to devise a machine for cleaning seed-cotton, in which he succeeded, having invented the cotton-gin; suffered much from violence and fraud, the idea of his invention having been stolen by others, but formed a partnership with a Mr. Miller and commenced the manufacture of the machines near the town of Washington, Ga., in 1795; was voted by the legislature of South Carolina a sum of $50,000 for his invention, which he succeeded in collecting only after many years of litigation; received a percentage for five years upon the use of his gins from the State of North Carolina, and was promised the same by Tennessee, but without results; turned his attention to the manufacture of firearms, entering into a contract with the U. S. government 1798, and reaped a fortune from his various improvements in their manufacture, which rapidly increased and became the origin of the flourishing village of Whitneyville, Conn. D. at New Haven Jan. 8, 1825.

**Whitney** (Frederick Augustus), b. at Quincy, Mass., Sept. 13, 1812; graduated at Harvard 1833, and at the Cambridge Divinity School 1838; was pastor of the Unitarian church at Brighton, Mass., 1843–58. Author of *An Historical Sketch of the Old Church at Quincy, Mass.* (1864), *A Biography of James Holton, Founder of the Holton Library, Brighton, Mass.* (1865), and of various published sermons, orations, hymns, Sunday-school reports, and articles in periodicals.

**Whitney** (Geffrey), b. at Nantwich, Cheshire, England, about 1550; educated at Oxford University; resided several years at Leyden, Holland, where he published a curious and exceedingly rare volume, *A Choice of Emblemes, and other Devises, for the moste parte gathered out of Sundrie Writers, Englished and Moralized and Divers Newly Devised, etc.* (2d ed. 1586), and settled soon afterward at Ryle's Green, Cheshire, where he d. 1602 or 1603. A photo-lithographic reprint of his *Emblemes* (1866) was edited by Rev. Henry Green of Knutsford, Cheshire.

**Whitney** (George), b. at Quincy, Mass., in 1804; graduated at Harvard 1824, and at Cambridge Theological School 1829, and was pastor successively of the Second and Third churches at Roxbury, Mass., where he d. in 1842. Author of several published sermons and addresses, and of *Some Account of the Early History and Present State of the Town of Quincy, Mass.* (1827).

**Whitney** (Henry Austin), b. at Boston, Mass., about 1835; is a banker in that city, but a resident of Hingham, and is a member of the Massachusetts Historical Society. He has privately printed *A Brief Account of the Descendants of John and Elinor Whitney* (1857) and *Incidents in the Life of Samuel Whitney* (1860), and has reproduced in fac-simile Cushing's *Account of the First Settlers of Hingham, Mass.*

**Whitney** (James Amaziah), M. A., LL.B., b. June 30, 1839, at Rochester, N. Y.; was in youth a farmer in the township of Maryland, Otsego co., N. Y., and received a common-school education; from 1860 to 1865 devoted himself without assistance to the study of chemistry, mechanics, and engineering; acquired by practice the trades of pattern and model maker, machinist, and draftsman; in 1865 came to New York City, and entered the office of a firm of patent solicitors as a writer of specifications; in 1868 became editor of the *American Artisan*, a weekly technical journal; in the same year took a leading part in organizing the New York Society of Practical Engineering, and was elected its president, which position he still holds; in 1869 became prominent in the New York Farmers' Club,

and was elected professor of agricultural chemistry of the American Institute; in 1872 established himself as a solicitor of U. S. and foreign patents, and in 1876 was admitted to practice as attorney and counsellor at law in the circuit courts of the U. S. He is the author of numerous essays on the law of patents, etc., on agricultural chemistry, applied mechanics, and engineering. He is now writing a textbook on the law of patents for inventions, and another work, involving long and laborious research, on the relations of the law of patents to industrial, social, and intellectual progress, from the inception of the system in the early part of the seventeenth century to the present time.

**Whitney** (Josiah Dwight), brother of Prof. Wm. D., LL.D., b. at Northampton, Mass., Nov. 23, 1819; graduated at Yale College 1839; was for many years employed on State and national geological surveys, including Ohio, the Lake Superior region, Mississippi, and California, where he has been for many years State geologist; has been since 1865 Sturgis-Hooper professor of geology in Harvard University, and is a prominent member of the American Association and of the National Academy of Science. Author of *The Metallic Wealth of the U. S.* (Philadelphia, 1854), *A Report on the Upper Mississippi Lead Region* (1862), *The Geological Survey of California* (vol. i., 1864), and *The Yosemite Guide-Book* (1864); translated *Berzelius on the Blowpipe* (1845); was joint author with Prof. John W. Foster of a *Report on the Geology of the Lake Superior Land District* (1851–52), and with Prof. James Hall of a *Geological Report on Ohio* (1858).

**Whitney** (Peter), b. at Petersham, Mass., in 1744; graduated at Harvard 1762, and was pastor of the church at Northborough from 1767 until his death, in 1815. Author of several occasional addresses and scientific papers, and of a *History of the County of Worcester* (1793).

**Whitney** (Thomas R.), b. in New York City in 1804; became editor of the *Republic* and the New York *Sunday Times*, and wrote for other periodicals; served two years in the New York assembly, and was member of Congress 1855–57. D. Apr. 12, 1858. Author of *The Ambuscade, an Historical Poem* (1845), and of *A Defence of the American Policy as opposed to the Encroachments of Foreign Influence, etc.* (1856).

**Whitney** (William Collins), b. at Conway, Mass., July 5, 1841, son of Gen. James S. Whitney, a distinguished Democratic leader; was prepared for college at the Williston Seminary, Easthampton, Mass.; graduated at Yale College 1863; studied law at the Harvard Law School, Cambridge, Mass.; commenced practice in New York City in 1865; soon obtained an extensive business, and became prominent in city politics, and was appointed in 1875 to the post of corporation counsel.

**Whitney** (William Dwight), b. at Northampton, Mass., Feb. 9, 1827; graduated at Williams College 1845; was several years clerk in a bank; in 1849–50 studied Sanskrit at New Haven; 1850–53 studied in Germany at Berlin and Tübingen, especially with Profs. Weber and Roth; planned with the latter an edition of the *Atharva-Veda*, and copied and collated all the MSS. then in Europe, visiting Paris, Oxford, and London on the way home for that purpose in the summer of 1853. A volume of the text appeared in 1856–57 (only one yet published); notes, translation, indexes, etc., are now in preparation. He became a member of the American Oriental Society in 1849, librarian from 1855–73, corresponding secretary since 1857, much occupied with labors for it and contributions to its journal; vols. v.–ix. were more than half written by him; principal contributions, translation with notes, etc. of *Sûrya-Siddhânta*, astronomical treatise (1860); text, notes, etc., of *Atharva-Veda-Prâtiçâkhya* (1862), and text, native comment, version, and notes of *Tâittirîya-Prâtiçâkhya* (1871); these two being Hindoo grammatical treatises. The *Tâittirîya-Prâtiçâkhya* received the Bopp prize from the Berlin Academy as the most important Sanskrit publication of the three years then ending. Prof. Whitney at this time was engaged in other discussions of Asiatic astronomy, relating especially to the "lunar zodiac," or division of the ecliptic into twenty-seven or twenty-eight lunar stations, of which he shows the origin to be undetermined, as against the arguments of Biot and others; also discussions of Lepsius's standard alphabet and other phonetic works. He was made professor of Sanskrit in Yale College in 1854, and of comparative philology in 1870; was first president of the American Philological Association; delivered in 1864 a series of lectures on the study of languages at the Smithsonian Institution, Washington; repeated, in extended form, the same at Lowell Institute, Boston; published these lectures in New York and London (1867). They were translated into German by Dr. J. Jolly in 1874. A volume on the *Life and Growth of Language* in "International Scientific Series" was issued in 1875, which was also translated into German and French in the following year. His views of language, taken and defended, may be gathered from his articles on Language in this work. Mr. Whitney has made numerous contributions to journals and reviews, mostly in America, also in England and Germany. From these, 2 vols. of *Oriental and Linguistic Studies* were collected and published in 1872–74. He contributed aid to the editors of the great Sanskrit lexicon of St. Petersburg (1852–75). In addition to these literary labors, Prof. Whitney has been now for many years an instructor in modern languages in Yale College, and in 1869 he published a *Compendious German Grammar*, and in 1873 a *Reader*, with notes and a vocabulary, on a somewhat new plan, with a view to derivations and English-German correspondences. He has in preparation a fuller dictionary, and a series of annotated German dramas. He has also in preparation an English school grammar and Sanskrit grammar for a German publisher. Prof. Whitney's reputation as a scholar is due to labor in several fields. He has established his position as one of the leading Sanskritists of the day by his above-mentioned editions of Sanskrit works. His grammatical textbooks for the study of German, aside from their practical merits, deserve high recognition for their scientific statements of general grammatical doctrine. His most conspicuous services, however, have probably been in his contributions to the science of language, of which, in the judgment of many, he is the most successful systematizer and expositor. His original and suggestive characterization of language as an *institution* has put the real character of language in a new light. In contrast with some, he regards language not as inseparable from thought or spontaneously generated in the mind, but as conventional signs agreed upon among men; giving great efficacy in the beginnings of speech to the principle of onomatopœia. He thus views language as a development of human forces in a highly-endowed nature. His latest work, entitled *Life and Growth of Language*, is perhaps the most complete and consistent exhibition of the leading principles of linguistic science that is anywhere to be found. James M. Hoppin.

**Whitney Ridge,** tp., Penobscot co., Me. P. 18.

**Whit'ney's Point,** p.-v., Triangle tp., Broome co., N. Y. P. 480.

**Whit'neyville,** tp., Washington co., Me. P. 569.

**Whi'ton** (James Morris), b. at Boston, Mass., in 1833; graduated at Yale College 1853; was for some years rector of the Hopkins Grammar School at New Haven, Conn. Author of *A Handbook of Exercises and Reading Lessons for beginners in Latin* (1860; new ed. 1864), *First Lessons in Greek* (1861), and *Exercises in Latin Prose Composition* (1863).

**Whiton** (John Milton), D. D., b. at Winchendon, Mass., Aug. 1, 1785; graduated at Yale College 1805, and was pastor of the Presbyterian church at Antrim, N. H., 1808–53. D. at Antrim Sept. 28, 1856. Author of *Brief Notices of the Town of Antrim* in the *Collections* of the New Hampshire Historical Society (vol. iv., 1852), of a statistical account of the Congregational and Presbyterian ministers of Hillsborough county in the *New Hampshire Repository* (1846), and of *Sketches of the History of New Hampshire 1623–1833* (Concord, 1834). He left incomplete a *History of Presbyterianism in New Hampshire.*

**Whit'paine,** tp., Montgomery co., Pa. P. 1330.

**Whitsunday,** or **Whitsuntide.** See Pentecost.

**Whit'taker** (John William), D. D., b. at Manchester, England, in 1790; educated at, and became fellow of, St. John's College, Oxford; took orders in the Church of England; was vicar of St. Mary's, Blackburn, and honorary canon of Manchester. D. Aug. 3, 1854. Author of *An Historical and Critical Enquiry into the Interpretation of the Hebrew Scriptures* (1819) and a *Supplement* (1820), of several volumes of sermons and religious treatises, and contributed to various periodicals.

**Whit'taker's,** p.-v., Edgecombe co., N. C.

**Whit'telsey** (Chauncy), son of Rev. Samuel, b. at Wallingford, Conn., Oct. 28, 1717; graduated at Yale College 1738; was a distinguished tutor there 1739–45; was a merchant at New Haven 1745–55; preached occasionally, having been licensed in 1740; was ordained pastor of a church in New Haven, as colleague with Rev. Joseph Noyes, Mar. 1, 1758, and became sole pastor 1761. D. at New Haven July 24, 1787. Five of his *Sermons* were printed.

**Whittelsey** (Samuel), b. at Saybrook, Conn., in 1686; graduated at the college, then established at Saybrook, afterward known as Yale, 1705; commenced preaching at Wallingford, Conn., 1709; was ordained colleague to Rev. Samuel Street, pastor at that place, May, 1710; married

Sarah Chauncy, granddaughter of Pres. Chauncy, July, 1712, and was a fellow of Yale College from 1732 until his death, at Wallingford Aug. 15, 1752. Four of his *Sermons* were printed.—His eldest son, SAMUEL, b. Nov., 1714, graduated at Yale College 1729; was tutor there 1732–38, and was pastor of Milford, Conn., from 1738 until his death, Oct. 22, 1768.

**Whitte'more,** tp., Darlington co., S. C. P. 1986.

**Whittemore** (AMOS), b. at Cambridge, Mass., Apr. 19, 1759; was brought up as a farmer; worked some years as a gunsmith; became a manufacturer of cotton and wool cards, and invented a machine for puncturing the leather and setting the wires, patented 1797. This invention was afterward sold for $150,000, though he was unsuccessful in an effort to secure a patent in England. One of its leading features occurred to the inventor in a dream. He was employed during his later years in devising an orrery in which each planet should describe its own orbit, but never completed it. D. at West Cambridge Mar. 27, 1828.

**Whittemore** (THOMAS), D. D., b. at Boston Jan. 1, 1800; was successively apprenticed to a morocco-dresser, a brass-founder, and a boot-maker; studied theology under Rev. Hosea Ballou; preached to Universalist churches in Milford 1821, and Cambridgeport 1822–31; settled at Cambridge; was joint editor of the *Universalist Magazine*, sole editor and proprietor for nearly thirty years from 1828 of its successor, *The Trumpet;* sat repeatedly in the Massachusetts legislature, and was president of the Vermont and Massachusetts R. R. D. at Cambridge Mar. 21, 1861. Author of *The Modern History of Universalism* (1830; enlarged ed. 1860), *Notes and Illustrations of the Parables of the New Testament* (1832), *Songs of Zion* (1836), *A Commentary on the Revelation of St. John* (1838), *A Plain Guide to Universalism* (1839), *The Gospel Harmonist* (1841), *Conference Hymns* (1842), *Sunday-school Choir* (1844), *Life of Walter Balfour* (1853), *Life of Rev. Hosea Ballou* (4 vols., 1854–55), and an *Autobiography* (1859); wrote a number of tracts in favor of Universalism, and edited Dr. Southwood Smith's *Illustrations of the Divine Government* (1831), with an *Appendix.*

**Whit'ten's,** tp., Lee co., Ala. P. 2019.

**Whit'tier** (JOHN GREENLEAF), b. at Haverhill, Mass., Dec. 17, 1807, of Quaker parentage; received a common-school education; spent his boyhood on a farm, learning also the trade of a shoemaker; began when eighteen years of age to write verses for the Haverhill *Gazette;* spent two years thereafter at the Haverhill Academy; became in 1829 editor of the *American Manufacturer,* a newspaper at Boston; succeeded George D. Prentice (who in 1830 went South to write the life of Henry Clay) as editor of the *New England Weekly Review,* which had been founded by J. G. C. Brainerd, at Hartford, Conn.; returned to Haverhill 1831, and engaged in farming for several years; edited, however, the *Gazette* 1832 and 1836; was a member of the legislature 1835–36; became secretary of the American Anti-Slavery Society at Philadelphia 1836; edited the *Pennsylvania Freeman* 1838–39, his office being sacked and burned by a mob; settled at Amesbury, Mass., 1840; became corresponding editor of the *National Era,* an anti-slavery paper published at Washington, D. C., by Dr. Gamaliel Bailey, 1847; contributed to its columns many of his anti-slavery and other favorite lyrics, and has lived in literary retirement of Quaker simplicity for many years, publishing frequent volumes of poetry, which have procured him a prominent place among American authors and the love and admiration of his countrymen. He has never married. In 1876 he took up his residence at Peabody (formerly South Danvers), Mass. Several collective editions of his poems have appeared, the best being the "Centennial edition" of 1876. His prose writings are *Legends of New England* (Hartford, 1831), *Justice and Expediency, or Slavery considered with a View to its Abolition* (1833), *The Stranger in Lowell* (1845), *Supernaturalism in New England* (1847), *Leaves from Margaret Smith's Journal* (1849), *Old Portraits and Modern Sketches* (1850), and *Literary Sketches* (1854). He has published no extended poem. (For the characteristics of his poetry see ENGLISH LANGUAGE AND LITERATURE, by RICHARD GRANT WHITE.) PORTER C. BLISS.

**Whit'tingham** (Sir SAMUEL FORD), b. in England about 1782; entered the army as lieutenant 1803; served in the Peninsular war as deputy assistant quartermaster-general 1809–10; became major Mar., 1810; was aide-de-camp to Gen. Castaños and to the duke of Albuquerque; took part in the battles of Baylen, Talavera, and Barossa; raised and disciplined a large corps of Spanish troops; took command of them with the rank of major-general; was commander of a division under Sir John Murray, and subsequently under Lord William Bentinck; was appointed aide-de-camp to the prince regent 1814; knighted May 3, 1815; became governor of Dominica 1819; quartermaster-general in India 1822; took part in the famous siege of Bhurtpoor 1825–26, and was appointed major-general; was commander-in-chief in the Windward and Leeward islands 1835–39, and at Madras as lieutenant-general from 1840 until his death, Jan. 19, 1841. His son, Major-Gen. Ferdinand Whittingham, has published his biography.

**Whittingham** (WILLIAM), b. at Chester, England, in 1524; educated at Brasenose College, Oxford; subsequently studied divinity at Orleans, France, where he married a sister of John Calvin; settled at Geneva, where he was ordained pastor of the church of English exiles (1556) as the successor of John Knox in the ministry, and took part, with others, in the translation of the Bible called by his name, which was published by C. Badius at Geneva (1557). He also made metrical translations of the Ten Commandments and of some of the Psalms. In 1563 he became dean of Durham, England, where he d. in 1589. His widow and children emigrated to New England, and a son graduated at Harvard College and married a daughter of Rev. William Hubbard, the historian. A granddaughter by this marriage became the wife of Gov. Gurdon Saltonstall of Connecticut.

**Whittingham** (WILLIAM ROLLINSON), b. of devout English parents in New York City Dec. 2, 1805. His father, while actively engaged in business, found time for the pursuits of a scholar. His mother, a woman of strong mind, with a view to educating her son, made herself, under the instruction of her husband, proficient in the learned languages; such were her attainments that she at one time gave lessons in Hebrew to theological students. The young Whittingham, who at a very early age showed that aptitude for learning and devotion to study which has characterized him, had no other instructor until he became a student at the General Theological Seminary. Whatever the benefits of such home-training, it may yet be doubted whether it be the best for one who is to be the guide and ruler of other men. He was graduated a year in advance of the canonical age for ordination. When made deacon by Bishop Hobart, he was sent as a missionary to Orange, N. J., and the adjoining villages, and within the year was advanced to the priesthood. His zeal for parochial work was as intense as had been his application as a student. In 1835 he was nominated to the professorship of ecclesiastical history in the General Theological Seminary by Mr. Stuyvesant, who had lately endowed the chair. While engaged in labors so congenial he was (in 1840) chosen bishop of Maryland. His success as a professor had been so marked, and his influence over the future teachers of the Church so great, that many regretted his abandoning this work even for that to which he was called. He was elected after warm and long-continued party contests. It cannot be pretended that party spirit ceased on his becoming bishop, but yet from his access the diocese rapidly advanced in all that belongs to Church improvement, and his personal influence with both clergy and laity could be rightly described only in terms of seeming exaggeration. This popularity he with pain sacrificed, to a great extent, during the troubles which followed secession, for his sense of duty separated him from the sympathies of the larger number of his people; but by this very cause for regret he was the better enabled, after the close of the war, to prevent obstacles to the return to unity in the Church. By the request of the House of Bishops, and as their representative, he attended the Bonn conference of the Old Catholics in Sept., 1872. While yet a student he, jointly with Dr. Turner, translated and prepared for the press Jahn's *Introduction,* and he has from time to time edited various Church works, but he has given to the world but little of his own. When seeking to influence men for their good, it seems not to have occurred to him that he could best do this by drawing on his own stores; to "esteem others better than himself" belongs to his nature. The esteem in which he is held by others cannot be better shown than by words spoken in convocation of the province of Canterbury during the current year by the bishop of Lichfield (Selwyn): "At the forthcoming meeting of bishops of the Anglican communion, if it be said that the whole of the Anglican bishops of the world could add very little to the learning that is to be found among the English bishops, I quite admit it; but there is one man in the American Church who, I believe, could take his part with credit, and that is Bishop Whittingham of Maryland." (*Guardian,* Feb., 1876.)

W. F. BRAND.

**Whit'tington** (Sir RICHARD), b. at Pauntley, Gloucestershire, England, about 1350, younger son of Sir William de Whityngdon, lord of the manor of Pauntley, who d. 1360; was obliged to seek his living, and, according to a well-known legend, walked to London; was apprenticed there to a merchant, from whom at one time he started to

run away, but while seated at the foot of Highgate Hill seemed to hear in the chime of Bow Bells—

"Turn again, Whittington,
Thrice lord mayor of London;"

obeyed the summons; married Alice Fitzwarren, daughter of his employer; became a wealthy merchant, his first capital having been derived from the consignment of a cat to an Eastern market; was lord mayor of London 1397, 1406, and 1419; carried on the business of a mercer; made loans to Henry IV. and Henry V.; bought on the Continent the wedding trousseaux for the princesses Blanche and Philippa, of which the invoices are still in existence, and d. in 1423. Having no children, he left his large estate to public or charitable objects, among which were the rebuilding of Newgate prison, the founding of a college and of the libraries at Guildhall and of the Grey Friars, the repair of St. Bartholomew's Hospital, etc. He shared with Richard Harweden the expense of rebuilding the nave of Westminster Abbey, and during his magistracy ordered the compilation of a sort of directory of the city of London, containing curious and valuable accounts of its mediæval customs and privileges. This work, called the *Liber Albus* (or "White Book"), was written in 1419, in Latin and Anglo-Norman, by John Carpenter, common clerk of the city, and was first translated by Henry T. Riley for the rolls commission 1862. Interesting particulars respecting Whittington are given by Mr. Riley in the preface to the above work, and his memory as an historical character has been vindicated by Rev. Samuel Lysons in his entertaining book, *The Model Merchant of the Middle Ages, exemplified in the Story of Whittington and his Cat, being an Attempt to rescue that interesting story from the region of Fable, and to place it in its proper position in the Legitimate History of this Country* (London, 1860).

PORTER C. BLISS.

**Whittington,** or **Whitynton** (ROBERT), b. at Lichfield, England, about 1480; began to teach a grammar school about 1501; was a secular priest; became famous as a Greek and Latin scholar and as a Latin poet; was honored with the last rhetorical degree conferred at Oxford 1512, and was author of very numerous grammatical treatises published by Wynkin de Worde. D. about 1535.

**Whit'tlesey** (ABIGAIL **Goodrich**), sister of Samuel G. and Charles A. Goodrich, b. at Ridgefield, Conn., about 1795; founded and conducted the well-known and useful periodicals *The Mother's Magazine* (1833 *seq.*) and *The Mother's and Daughter's Magazine.* (See Mrs. S. J. Hale's *Woman's Record.*)

**Whittlesey** (CHARLES), b. at Southington, Conn., Oct. 5, 1808; removed to Ohio in 1813 with his parents; graduated at the U. S. Military Academy July, 1831, when appointed brevet second lieutenant of infantry. After a year's service, he resigned to study law, upon the practice of which profession he entered in 1835 at Cleveland, O., but became editor of the Cleveland *Herald* in 1836, which paper he conducted for a year; turning his attention now to engineering pursuits, he was employed upon the geological surveys of Ohio and Wisconsin; conducted mineralogical surveys in Michigan, Minnesota, and Wisconsin, and engaged as mining engineer in the Lake Superior region. In the civil war he served as chief engineer of Ohio troops in the West Virginia campaign July–Aug., 1861, when appointed colonel 20th Ohio Vols., but employed as chief engineer of the department of the Ohio until December of that year. In Feb., 1862, he was engaged at Fort Donelson, and at Shiloh in April, on the 19th of which month ill-health compelled his resignation. Among his writings are the *Life of John Fitch* in Sparks's *American Biography, Ancient Mining on Lake Superior, Early History of Cleveland,* and, as a Smithsonian contribution, a paper on the *Glacial Drift of the North-western States.*

**Whittlesey** (ELISHA), b. at Washington, Conn., Oct. 19, 1783; received an academical education; studied law; settled in the Western Reserve of Ohio 1806; served in the war of 1812–15 as aide-de-camp to Gen. Wadsworth; was for sixteen years prosecuting attorney of his district; sat in the Ohio legislature 1820–21; was a member of Congress 1823–39; was one of the founders of the Whig party; was appointed by Pres. Harrison auditor for the post-office department, and by Pres. Taylor first comptroller of the treasury—a post which he held until 1857, and again under Pres. Lincoln from 1861 until his death, at Washington Jan. 7, 1863. He was a conspicuous example of ability and integrity in long and arduous public service.

**Whittlesey** (FREDERICK), b. at Washington, Conn., June 12, 1799; graduated at Yale College 1818; studied law; was admitted to the bar at Utica, N. Y., 1821; settled at Rochester 1822; conducted an anti-Masonic political newspaper in the campaign of 1828; was a member of Congress 1831–35; vice-chancellor of the eighth judicial district 1839–47; judge of the supreme court of New York 1847–48, and professor of law in Geneva College 1850–51. D. at Rochester Sept. 19, 1851. He published an *Address* delivered at Rochester July 4, 1842.

**Whittlesey** (SARAH J. C.), b. at Williamston, Martin co., N. C., about 1832; has written serial tales and verses for several periodicals, and published a volume of miscellaneous poems, *Heart-Drops from Memory's Urn* (1852), and 2 vols. of novelettes (1860 and 1867).

**Whit'tredge** (WORTHINGTON), b. in Ohio in 1820; became a painter of portraits and of landscapes at Cincinnati; resided in Europe 1849–59; settled in New York City 1860; became prominent among the artists of that city, and in 1876 was president of the National Academy of Design. Among his most admired productions are—*Twilight on the Shawangunk Mountains, The Ruins of Tusculum, The Roman Campagna, The Old Kentucky Home,* and *The Coast of Rhode Island.*

**Whit'worth** (CHARLES), BARON, b. at Aldboston, Staffordshire, England, about 1670; entered the diplomatic service as attaché to Mr. Stepney, whom he attended at several courts; was secretary of legation at Vienna; became resident to the German Diet at Ratisbon 1702, envoy to Russia 1704, and again 1710, plenipotentiary to the Diets of Augsburg and Ratisbon 1714, envoy to Prussia 1716 and 1719, to the States-General of Holland 1717, and plenipotentiary at the Congress of Cambray 1722, having in the preceding year been made Baron Whitworth of Galway. D. in London in 1725. His papers fell into the hands of the Walpole family, and Horace Walpole printed at Strawberry Hill his *Account of Russia as it was in 1710* (1758).

**Whitworth** (CHARLES), EARL **Whitworth,** b. at Laybourne Grange, Kent, England, in 1754; educated at Tunbridge School; became an officer in the Guards; was British minister to Poland 1786–88, to Russia 1788–1800, to Denmark 1800–02, and to France after the Treaty of Amiens (1802–03), the signal for the renewal of the war having been given by Napoleon in a celebrated interview (Mar. 13, 1803) with the British minister, who comported himself with dignity on the occasion. He had been made an Irish peer in 1800; was made a viscount June 14, 1813, and an earl Nov. 25, 1815, and served as viceroy of Ireland 1813–17. D. at Knowle May 13, 1825.

**Whitworth** (Sir JOSEPH), BART., F. R. S., b. at Stockport, England, in 1803; was trained to mechanical and manufacturing pursuits at Manchester, where he established an important manufacturing business; invented some improvements in planing-machines and other tools which attracted attention at the Great Exhibition of 1851: was a commissioner to the Exhibition at New York 1853, and began in 1854 the manufacture of the breech-loading rifles, cannons, and other firearms by which his name is widely known. (See ARTILLERY.) He founded in 1868 the "Whitworth scholarships" in mechanical science, thirty in number, of the annual value of £100; was made a baronet Oct., 1869, and has written several treatises on mechanics.

**Whitworth Guns.** See ARTILLERY, by MAJOR-GEN. W. F. BARRY.

**Whoop'ing Cough,** a disease generally occurring but once in the life of an individual, and usually during infancy or childhood, is characterized by paroxysms of convulsive coughing, followed by a long ringing inspiration, whence the name. It is the chin-cough of early English physicians, the *pertussis* of Sydenham, and the *coqueluche* of French authorities, and was formerly confounded with the catarrhal affections, which it much resembles in its symptoms and earlier diagnosis. The simple disease is rarely if ever fatal, but when complicated with pulmonary or cerebral disease it is extremely dangerous.

**Whor'tleberry, Hurtleberry,** or **Huckleberry,** a well-known American edible berry, being the fruit of the genera *Gaylussacia* and *Vaccinium,* constituting a sub-order of the ERICACEÆ, or heath family (which see).

**Whyd'ah,** town of Western Africa, in a district of the same name, on the Slave Coast of Guinea, on the Atlantic, in lat. 6° 18′ N. It was quite a considerable place, exporting palm oil, ivory, gold-dust, and salt, and the chief seat of the slave-trade. But it was almost entirely destroyed by fire in 1852, and has not yet recovered.

**Whydah-Bird.** See WIDOW-BIRD.

**Whym'per** (EDWARD), b. in London, England, Apr. 27, 1840; educated at Clarendon House School; became a draftsman on wood; made a series of journeys on the Continent, in one of which, in 1861, he ascended Mont Pelvoux, reputed the highest mountain in France; discovered from its summit another peak, the Pointe des

Écrins, 500 feet higher, which was subsequently ascended (1864); was chosen a member of the Alpine Club 1861; made for several years a series of bold ascents of Alpine summits before considered inaccessible, culminating in that of the Matterhorn July 14, 1865, when four of his companions lost their lives; travelled in N. W. Greenland, collecting fossiliferous deposits for the British Museum, and made a second visit to Greenland for a similar purpose in 1872. Author of *Swiss Pictures, drawn with Pen and Pencil* (1866), and *Scrambles among the Alps 1860–69* (1869).—His relative, FREDERICK WHYMPER, is author of *Travel and Adventure in Alaska* (1868) and *The Heroes of the Arctic and their Adventures* (1875).

**Whyte** (WILLIAM PINCKNEY), b. at Baltimore, Md., in 1824, is grandson of William Pinckney, a signer of the Declaration of Independence; received a classical education; became a merchant; studied law at Cambridge, Mass.; was admitted to the bar at Baltimore 1846; was elected to the Maryland house of deputies 1847, and State comptroller 1853; was appointed U. S. Senator for an unexpired term 1868, and has twice been elected to the same post.

**Whytt** (ROBERT), M. D., F. R. S., b. at Edinburgh, Scotland, in 1714; studied medicine at Edinburgh, London, Paris, and Leyden, besides taking a medical degree at Rheims and at St. Andrew's 1736; became a fellow of the Edinburgh Royal College of Physicians 1738, professor of the institutes of medicine at Edinburgh 1746, first physician to the king in Scotland 1761, and president of the Royal College of Physicians 1764. D. at Edinburgh Apr. 15, 1766. Author of *An Essay on the Vital and other Involuntary Motions of Animals* (1751), *Physiological Essays* (1755), *Observations on Nervous Disorders* (1765), and other professional treatises, which were collectively published as his *Works* (1768).

**Wich'ern** (JOHANN HEINRICH), b. in Hamburg Apr. 21, 1808; studied theology at Göttingen and Berlin, and opened in 1833 at Hort, near Hamburg, the *Rauhes Haus*, a reformatory for vagrant children, the beneficent effects of which institution were so great that it was soon imitated not only in various places in Germany, but also in France, Holland, and England. In 1848 the Protestant Ecclesiastical Assembly at Wittenberg combined, for the purpose of united action, all the inner missions under one central committee, at the head of which Wichern was placed, and finally in 1858 the Prussian government appointed him superintendent of all penal and correctional institutions of the country. Since 1844 he has issued the monthly *Fliegende Blätter des Rauhen Hauses*, and in 1849 he published *Die Innere Mission der deutsch-evangelischen Kirche*.

**Wichi'ta,** unorganized county of W. Kansas. Area, about 720 sq. m.

**Wichita,** unorganized county of N. W. Texas, bounded N. by Red River, and drained by the Wichita and other streams. Area, about 650 sq. m.

**Wichita,** p.-v. and tp., cap. of Sedgwick co., Kan., the terminus of Atchison Topeka and Santa Fé R. R., has 4 churches, good schools, 3 banks, 2 weekly and 2 monthly newspapers, 6 hotels, and 1 sash and 1 wagon manufactory. P. 689. R. P. MURDOCK, MAN. "EAGLE."

**Wick** [Ang.-Sax. *wecce*], the central porous material which by its capillary attraction affords a passage for the oil of lamps and candles to ascend to the flame. The pith of rushes is used by the peasantry in parts of Europe, moss and lichens are employed in Arctic regions, and in most civilized regions cotton, usually plaited or braided, is employed. In candles of the best quality many ingenious devices are used to obviate the necessity of snuffing. (See *Wicks* in STEARIC ACID.)

**Wick,** town of Scotland, capital of the county of Caithness, at the mouth of the Wick, consists of Wick proper, on the northern bank of the river, and Pulteney, on the southern. Herring fishing, shipbuilding, and trade in wool and cattle are carried on with great energy. P. 8132.

**Wickacanee',** tp., Northampton co., N. C. P. 1641.

**Wick'er's,** tp., Clay co., Ala. P. 770.

**Wick'ersham** (JAMES PYLE), LL.D., b. in Chester co., Pa., in 1825; educated at Unionville Academy; taught school several years; became principal of an academy at Marietta, O., 1846, and of the Pennsylvania State Normal School at Millersville 1855–66, and in the latter year became State superintendent of public schools. Author of *School Economy* (1864), *Methods of Instruction* (1865), *Methods of Culture*, and a *History of Education*.

**Wick'ford,** p.-v., Washington co., R. I.

**Wick'ham,** tp., Limestone co., Ala. P. 882.

**Wick'liffe** (CHARLES A.), b. at Bardstown, Ky., June 8, 1788; educated at the Bardstown grammar school; was admitted to the bar 1811; became a prominent lawyer; was aide to Gen. Caldwell at the battle of the Thames, Oct. 5, 1813; was a member of the legislature 1812–23, of Congress 1823–33, Speaker of the legislature 1834; was elected lieutenant-governor 1836; became acting governor 1839; was postmaster-general in the administration of Pres. Tyler 1841–45; was sent by Pres. Polk on a secret mission to Texas 1845; was a member of the State constitutional convention 1849, of the Peace Congress of Feb., 1861, of the U. S. Congress 1861–63, and delegate to the Chicago convention of 1864; was blind during his later years, but continued to practise at the bar. D. in Howard co., Md., Oct. 31, 1869.

**Wickliffe** (JOHN). See WYCLIFFE.

**Wick'low,** county of Ireland, bordering E. on the Irish Sea, comprises an area of 782 sq. m., with 78,509 inhabitants, of whom over 28,500 are unable to read or write. The surface rises in the middle in a group of mountains 3000 feet high, sometimes well wooded and picturesque, sometimes barren and wild. On the slopes of these mountains are good pastures and tracts of fertile soil. Crops of oats, potatoes, and some wheat are gathered; dairy-farming much attended to, and copper and lead mines worked. Chief town, Wicklow. Since 1851, 17,925 persons have emigrated from this county.

**Wicom'ico,** county of S. E. Maryland, bordering on Delaware, drained by the Pocomoke, Nanticoke, Wicomico, and other streams, and traversed by Eastern Shore and Wicomico and Pocomoke R. Rs.; surface generally low and level, soil tolerably fertile. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn and wool. Cap. Salisbury. Area, 350 sq. m. P. 15,802.

**Wicomico,** p.-v. and tp., Northumberland co., Va. P. 1445.

**Wicomico River** rises by several head-streams in Sussex co., Del., and flows south-westward into Maryland, and its waters at least reach Ellis and Monie bays, arms of Chesapeake Bay. It is navigable to Salisbury, Md., and is an important channel of trade.

**Wiconis'co,** p.-v. and tp., Dauphin co., Pa. P. 2993.

**Wic'opy,** the popular name of *Dirca palustris*, a shrub of the mezereum family or Thymelaceæ, found in the eastern forests of the U. S. from Maine to Florida. The name is of Algonkin Indian origin, and the plant is better known under the names of "leatherwood" and "moosewood," being remarkable for the toughness of its bark, which is employed for thongs, and also for baskets.

**Wid'der Station** (THEDFORD P. O.), v., Lampton co., Ont., Canada, on Grand Trunk Railway, 32 miles N. E. of Sarnia, has a woollen-factory and a weekly newspaper. P. about 500.

**Wid'din,** town of European Turkey, in Bulgaria, near the Serbian frontier, on the Danube, is wretchedly built, dirty, and filthy, but strongly fortified, surrounded by morasses, and defended by walls and citadels. At high tide large ships from the Black Sea can ascend to its harbor, and the trade which it carries on in corn, wine, and rock-salt is very important; leather and arms are manufactured. P. about 25,000.

**Widg'eon** [Fr. *vingeon*], the vernacular English name for the ducks of the genus *Mareca*. These are characterized by the bill being shorter than the head (about equal to the claw of the inner toe), rather high, with its sides parallel nearly to its end, the end somewhat obtusely pointed, and the nail at the tip a third as broad as the bill itself; "the upper lateral angle at the base not prominent, nor extending as far back as the lower edge;" the tail is pointed, and less than half the length of the wings. Four species are known, two of which are inhabitants of the northern hemisphere, and two of the southern one. The northern species are closely related, both, according to Baird, agreeing in having "the upper parts finely waved transversely with black and gray or reddish-brown, the under parts, with the usual exceptions, snowy white. The top of the head is uniform white or cream-color, the neck more or less spotted. The middle and greater coverts are white, the latter tipped with black. The speculum is green, encircled by black. The tertials are black on the outer web, edged with hoary white; the entire outer web of one of them hoary." The related species are, on the whole, representatives of each other in their respective colonies, but both wander sometimes beyond their natural limits. The European widgeon (*M. penelope*) has the head and neck reddish-brown or cinnamon, with the feathers of the former slightly spotted with dusky, and those of the latter nearly uniform; the head is further diversified by cream-color on the top, and by green in a band around the eye and in a few spots behind it. The American widgeon (*M. americana*) is distin-

guished by the head and neck being in the main grayish, with the feathers of the former thickly spotted, and of the latter banded with black; the head is also relieved by white on the top, and by green in a broad and continuous patch around and behind the eye. The species remain farther to the southward than many of their kindred; the American form, for example, breeding "in abundance in Northern Dakota and Montana, and along the banks of the streams and pools," according to Dr. Coues, who found a young widgeon "still unable to fly even as late as the middle of September, at a time when all the other ducks observed were well on the wing." The species are moderately good as food-birds. THEODORE GILL.

**Wid'ner,** tp., Knox co., Ind. P. 1704.

**Widow.** See DOWER, by PROF. T. W. DWIGHT, LL.D., and MARRIAGE, by J. N. POMEROY, LL.D.

**Wid'ow-Bird** [a corruption of *whidah-* or *whydah-bird*, the latter name having reference to its habitat in Whydah, on the western coast of Africa], a name given to species of *Vidua* and related genera, and placed by most modern ornithologists in a "family," Ploceidæ or "weavers;" the scientific name is a translation of the vernacular one first given—*i. e.* widow-bird. The species have the bill conic, but with the culmen more or less arched and advancing on the forehead in a point, while the sides are compressed toward the tip; the lateral margins are sinuate and straight, and the gonys lengthened and ascending; the wings are moderate, "with the first quill spurious; the second nearly as long as the third; the third, fourth, and fifth nearly equally long;" the tail is variable, but in the males some of the coverts and tail-feathers are usually greatly developed; the tarsi are slender, shorter than the middle toe, and covered in front with large plates; the toes are rather slender, and the hind one especially so, being as long as the inner; the claws are all long and moderately curved, and the hindermost developed. The species are peculiar to Africa. They chiefly feed upon grains. Their nest is generally complex and elaborately woven. The excessive development of the plumage, and especially the tail-feathers, of the males is peculiar to the breeding season. About sixteen or seventeen species are known, the most familiar of which is the *Vidua principalis*. THEO. GILL.

**Wie'land** (CHRISTOPH MARTIN), b. at Oberholzheim, Würtemberg, Sept. 5, 1733; received a careful education from his father, in the school of Klosterbergen, near Magdeburg, under a private tutor at Erfurt, and finally at the University of Tübingen, where he studied law, modern languages, and belles-lettres. His literary instinct, with its appetites and its talents, awakened very early. He devoured all kinds of books, and wrote Latin and German verses when he was only twelve years old, and before he had finished his law-studies he went to Switzerland, where he resided from 1752 to 1760, partly in Zurich, in the house of Bodmer, as his guest and as his literary assistant; partly in Berne, as a private tutor, deeply engaged all the while in various kinds of literary production, though without any remarkable result. From 1760 to 1769 he lived at Biberach, a free imperial city not far from his birthplace, where he held an office in the civil service, and here, or rather at the residence of Count von Stadion in the neighboring Warthausen, he came in contact with the German nobility, whose life, half sentimental and half frivolous, agreed very well with his own nature, and whose education, half English and half French, corresponded exactly with his taste. In this period he produced *Don Sylvio de Rosalva* (1764), *Komische Erzählungen* (1766), *Agathon* (1767), all of a very captivating but rather doubtful character; the didactic poem *Musarion* (1768), very elegant in its form, and in those days very startling in its ideas; and a prose translation of Shakspeare in 8 vols. (1762–66), which was the first introduction of the English poet to the German public. In 1767 he received a chair of philosophy in Erfurt, and held it to 1772, in which year he published, among other things, *Combabus*, a disgusting tale, and *Der neue Amadis*, a comic poem in 18 songs. In 1772 he was called to Weimar as tutor to the young duke, and he remained there till his death, Jan. 20, 1813, residing partly in the city itself, partly at his estate in the neighborhood, Osmannstedt, where he was buried in the garden. With Goethe, Schiller, and Herder he lived very intimately and very friendly, though the enormous literary activity which he developed followed other courses and sometimes occasioned collisions. He edited *Deutscher Mercur* (1773–95), *Attisches Museum* (1796–1804), and *Neues Attisches Museum* (1805–09); translated and annotated the epistles and satires of Horace (1788–89), all the works of Lucian, and Cicero's letters (5 vols., 1808–12); wrote *Oberon* (1780), his best and most celebrated work, a romantic epic, translated into English by W. Sotheby (London, 1826), *Neuen Göttergespräche* and *Geheime Geschichte des Philosophen Peregrinus Proteus* (1791), imitations after Lucian; *Geschichte der Abderiten* (1774; translated into English by H. Christmas under the title *The Republic of Fools, being the History of the State and People of Abdera in Thrace*, 2 vols., London, 1861); *Aristipp und einige seiner Zeitgenossen* (1800–01), his last romance. The first collected edition of his works was published by himself in 42 vols. (1794–1802), the second by Gruber in 50 vols. (1818–28); subsequently several other more or less complete editions have appeared. Of his letters there exist three collections—*Ausgewählte Briefe* (4 vols., 1815), *Auswahl denkwürdiger Briefe* (2 vols., 1815), and *Briefe au Sophie La-Roche* (1820). His biography was written by Gruber (4 vols., 1827) and Löbell (Brunswick, 1858). Considered by themselves, simply as productions of art, Wieland's works have lost somewhat of their interest. The frivolity of his humor, the sensuality of his imagination, are covered, but not always redeemed, by the sprightliness of his wit and by the quickness and compass of his sensibility. His style and manner of composition have become somewhat old-fashioned. But considered in their connection with the development of German literature as historical influences they will always be of the highest interest. After Luther, Wieland is the first poet in the German literature to whom verse was a natural form of speech—natural as the song to the lark—and beneath the elegance and refinement of form, which he learned partly from the French and partly from the Greek literature, there moves in all his works a native grace, a genuine spirit of sweetness and cheerfulness, which will never become stale. By these qualities he made German fiction respected and attractive to the upper classes of German society, which had hitherto scorned and neglected it, and became a most important element, the model of naturalness, in the education of Goethe. Many important issues in modern literature in Germany—the worship of Shakspeare, the enthusiasm for the Middle Ages, etc.—can be traced back to him as their source, or found in him one of their most effective supporters. His statue by Gasser was raised in Weimar Sept. 4, 1857.

CLEMENS PETERSEN.

**Wielicz'ka,** town of Austria, in Galicia, contains the largest and richest salt-mines in the world. They were accidentally discovered in 1233 by a shepherd, Wielicz, and have been worked uninterruptedly since that time. They now extend under the town—9590 feet in one direction, 3600 feet in the other, and 1780 feet in depth. They employ about 1500 men, and yield annually 55,000 tons of salt. They seem to be inexhaustible, and contain many curious features, as, for instance, the lake, the Gothic chapel hewn out in the salt, etc.

**Wien.** See VIENNA.

**Wien,** tp., Marathon co., Wis. P. 109.

**Wieniaws'ki** (HENRI), b. at Lublin, Poland, July 10, 1835; entered the Conservatory of Paris as a pupil in 1843, and received instruction on the violin by Clavel and Massart, and in harmony by Colet; gave his first concert in 1852; visited most of the great cities of Europe and the U. S. in 1872, and was appointed professor at the Conservatory of Brussels in 1876.

**Wiertz** (ANTOINE JOSEPH), b. at Dinant, Belgium, Feb. 22, 1806, in humble circumstances; was admitted as a pupil in the art school of Antwerp in 1820; won the great prize in 1834; studied for some years in Rome, and settled after his return at Brussels, where he d. June 18, 1865. The first period of his artistic career (1834–48) is characterized by colossal representations of mythological or biblical subjects—*Contending for the Body of Patroclus* (1835), 20 by 30 feet; the *Revolt of the Angels*, the *Flight from Egypt*, the *Triumph of Christ* (1848), 50 by 30 feet—and by very fierce polemics against certain features of modern art-life. He refused to sell any of his pictures; exhibited a *Carotte peinte au patientiotype;* offered his *Patroclus* as a prize to him who could show thoroughly the mischievous influence of journalism on art; forged his name on a picture by Rubens, sent it to the committee of the Paris Exhibition, and made the unfortunate judges the laughing-stock of Europe when they rejected it. In 1847 the Belgian government built him a large studio after his own designs, and between 1848 and 1853 he succeeded in perfecting the discovery of a new method of painting, which he called *peinture mate*, and which combines the qualities of fresco and oil painting. In the later period of his life (1853–65) his polemical temper developed into an exquisite though often somewhat grotesque humor, and his pictures became less pretentious in size and richer both in conception and execution: *The Last Cannon, A Second after Death, Napoleon in Hell, Precipitate Inhumation, Visions of a Head cut off*, etc. He bequeathed all his pictures to the state, and they are now exhibited in the so-called Wiertz Museum, his former studio. He also wrote *Éloge de Rubens* (1840) and *L'École*

*flamande de Peinture* (1863), both of which were crowned by the Belgian Academy. (See Labarre, *Antoine Wiertz*, Brussels, 1866.)

**Wies'baden,** town of Prussia, province of Nassau, is beautifully situated at the foot of Mount Taunus, on the Salzbach, an affluent of the Rhine, neatly built, and one of the most popular watering-places of Germany. It contains fourteen hot saline springs, of which the principal has a temperature of 156° and is very copious. These springs, which are considered very efficacious in cases of gout and rheumatism, were known to the Romans (*Aquæ Mattiacæ*), and they are now generally used by over 20,000 persons each season. P. 35,463.

**Wife.** See MARRIAGE, by J. N. POMEROY, LL.D.

**Wif'fen** (BENJAMIN BARRON), b. at Woburn, Bedfordshire, England, in 1794, of a Quaker family; wrote for several periodicals, and devoted himself to the study of Spanish literature, and especially of the Spanish Reformers of the sixteenth century, whose numerous writings he rescued from long neglect by the publication, with the assistance of Don Luis de Uroz i Rios, of a series of volumes entitled *Reformistas Antiguos Españoles, or the Works of Spanish Reformers reprinted and edited* (29 vols., 1848–69), with biographical and bibliographical notices. He rediscovered and published the *Alfabeto Christiano* of Juan de Valdés. D. at Woburn Mar. 18, 1867.

**Wiffen** (JEREMIAH HOLME), brother of Benjamin, b. near Woburn, England, in 1792; was for some years a schoolmaster, and subsequently librarian to the duke of Bedford at Woburn Abbey, retaining that position until his death, May 2, 1836. Author of esteemed poetical translations of Garcilaso de la Vega (1823), of Tasso's *Jerusalem Delivered* (2 vols., 1824–25), and of *Historical Memoirs of the House of Russell from the Norman Conquest* (2 vols., 1833), besides several volumes of original verse. He contributed poems to the annuals, and made some translations from the Welsh *Triads*.

**Wig** [shortened from *periwig;* Fr. *perruque*], a covering of hair for the head used to conceal baldness; it has been also, at some periods, fashionable as a means of decoration only. Horse-hair wigs are a part of the paraphernalia of British judges and barristers. Wigs also sometimes appear in the livery of servants for great occasions, and are of great value on the stage. The wearing of wigs is of great antiquity, and prevails among some savage races.

**Wig'an,** town of England, county of Lancaster, on the Douglas, is rather indifferently built, but is in the centre of a rich coal-field, and carries on an extensive manufacturing industry. It has iron and brass foundries, paper-mills, cotton-spinning factories, and manufactures of cotton goods, nails, edge tools, and chemicals. P. 39,160.

**Wigeon.** See WIDGEON.

**Wig'fall** (LEWIS T.), b. in South Carolina about 1824; settled in Texas as a lawyer; represented that State in the U. S. Senate from 1859 until its secession in 1861, when he was expelled for disloyalty, and became a brigadier-general of the Confederate army. D. at Galveston Feb. 21, 1874.

**Wig'glesworth** (EDWARD), D. D., b. at Malden, Mass., in 1693; graduated at Harvard 1710, and was the first Hollis professor of divinity in that institution, from Oct. 24, 1722, until his death, Jan. 16, 1765. Author of various published lectures, sermons, and controversial essays.

**Wigglesworth** (EDWARD), D. D., son of the preceding, b. at Cambridge, Mass., Feb. 7, 1732; graduated at Harvard with the first honors 1749; became tutor there 1764; succeeded his father as Hollis professor of divinity 1765, and was emeritus professor from 1791 to his death, at Cambridge June 17, 1794. Author of *Calculations on American Population* (1775), *The Authority of Tradition considered, etc.* (1777), being the Dudleian lecture for that year, and a discourse on *The Hope of Immortality* (1779).

**Wigglesworth** (EDWARD), grandson of Rev. Michael, b. at Ipswich, Mass., Jan. 3, 1742; graduated at Harvard 1761; was commissioned colonel by the Massachusetts provincial congress June 24, 1776; third in command of Arnold's flotilla on Lake Champlain Sept. 5, 1776, and colonel of the 13th Massachusetts regiment Nov. 6, 1776; resigned Mar. 10, 1779, and was appointed by Pres. Washington collector of Newburyport, where he d. Dec. 8, 1826.

**Wigglesworth** (EDWARD), a descendant of Rev. Edward, b. at Boston, Mass., about 1800; was associate editor (with Dr. Francis Lieber) of the *Encyclopædia Americana* (Philadelphia, 13 vols., 1828–32), and contributed to the *North American Review* and other literary periodicals. D. at Boston Oct. 16, 1876.

**Wigglesworth** (MICHAEL), b. in England Oct. 18, 1631; was brought to New Haven, Conn., and thence to Charlestown, Mass., by his father 1638; graduated at Harvard 1651; became tutor and fellow there; studied divinity; was ordained minister of the church at Malden 1656; had some skill as a physician, and was offered the presidency of Harvard 1684, but declined on account of ill-health, being "a little feeble shadow of a man." He preached the election sermon 1686, and the artillery election sermon 1696. D. at Malden June 10, 1715. Author of *The Day of Doom, or a Poetical Description of the Great and Last Judgment, with a short Discourse about Eternity* (1662), which went through 9 eds. in America and 2 in England, and was long one of the most popular books in New England. In it occurs the famous passage assigning to infants "the easiest room in hell." Another small volume, "intended for poetry" (*Allibone*), was entitled *Meat out of the Eater, or Meditations concerning the Necessity, End, and Usefulness of Afflictions unto God's Children, all tending to Prepare them for and Comfort them under the Cross* (1669; 5th ed. 1717). He left in MS. a poem entitled *God's Controversy with New England*, printed in the *Proceedings* of the Massachusetts Historical Society 1871. An edition of his *Day of Doom*, with the addition of other poems and a *Memoir*, has been issued by William H. Burr (New York, 1867), and Mr. John Ward Dean published a *Sketch of his Life, with a Fragment of his Autobiography, some of his Letters, and a Catalogue of his Library* (Albany, 1863; new ed. 1871).

**Wight** (MOSES), b. at Boston, Mass., Apr. 2, 1827; began to paint portraits at the age of eighteen; studied in Italy three years, after which he practised his art in Boston until 1860, when he spent some time in Paris studying *genre* painting under Couture, and made another visit to Europe 1865–67. He has executed portraits of Humboldt, Quincy, Everett, Agassiz, Sumner, and other eminent men, two large ideals, *The Sleeping Beauty* and *Eve at the Fountain*, and a number of cabinet, figure, and interior subjects, among which are *Le Seizième Siècle, Les Confidants, The Old Cuirassier*, and *John Alden and Priscilla*.

**Wight** (ORLANDO WILLIAMS), b. at Centreville, N. Y., Feb. 19, 1824; educated at Westfield Academy and at Rochester Collegiate Institute; travelled in Europe, and settled as a literary man at Brooklyn, N. Y. Author of *Lives and Letters of Abelard and Heloise* (1853; new ed. 1861); edited *The Philosophy of Sir William Hamilton* (1853), 12 vols. of *Standard French Classics* (1859 *seq.*), and *The Household Library* (1859 *seq.*); translated Victor Cousin's *Course of the History of Modern Philosophy* (2 vols., 1852) and *Lectures on the True, the Beautiful, and the Good* (1854); aided Miss Mary L. Booth in her translation of Henri Martin's *History of France*, and is understood to have in preparation a *Dictionary of Philosophical Science*.

**Wight** (PETER BONNETT), b. in New York City Aug. 1, 1838; studied architecture under Thomas R. Jackson; drew up the plans for the New York Academy of Design 1862, and has since built the Yale School of Fine Arts at New Haven, Conn., the Mercantile Library building in Brooklyn, and several important public edifices in Chicago, Ill., where he now (1876) resides.

**Wight, Isle of,** an island in the English Channel, belonging to the county of Hampshire, England, from which it is separated by the famous *roadstead* of Spithead, comprises an area of 136 sq. m., with 55,182 inhabitants. It is traversed from E. to W. by a range of chalk downs rising between 600 and 700 feet, which presents a great variety of fine scenery. The soil is very fertile, and the climate remarkably mild and equable; on the southern side the myrtle and fuchsia grow without any protection. Wheat, vegetables, and fruits are extensively cultivated, and a fine breed of sheep is reared on the downs. The island is much resorted to as a bathing-place, and by people who suffer from consumption. Cap. Newport. Near the town of Cowes is Osborne House, where Charles I. was imprisoned for a short time, and which is a favorite residence of Queen Victoria.

**Wight'man** (WILLIAM MAY), D. D., LL.D., b. in Charleston, S. C., Jan. 8, 1808; in 1827 graduated at Charleston College, and in 1828 joined the South Carolina conference of the M. E. Church; he filled important appointments in the pastoral work till 1834, when he was made agent for Randolph-Macon College in Virginia, in which capacity he served for three years, when he took the chair of English literature in that institution; in 1839 became presiding elder of the Cokesbury district, S. C., conference, and at the General Conference of 1840, of which he was a member, he was made editor of the *Southern Christian Advocate*, published in Charleston; was a member of the General Conference of 1844, which took measures for the division of the Church, and of the Louisville convention of 1845, which organized the M. E. Church, South, and of the General Conferences of 1846, 1850, 1854, 1858 (1862 not held), and 1866. In 1854 he became president of Wofford College, Spartanburg, S. C., where he remained

till he was made chancellor of the Southern University, Greensboro', Ala., 1859, when he also joined the Alabama conference. In all these positions he displayed eminent ability. His learning is extensive, his eloquence fervid and ornate, and he is abundant in labors. He has written much for the periodical press, and is the author of the *Life of Bishop Capers* (1858), his devoted friend, and of various published sermons and addresses. He was elected bishop at the General Conference of 1866, since which time he has resided in Charleston, S. C. T. O. SUMMERS.

**Wigram** (GEORGE VICESIMUS), b. at Walthamstow, England, about 1805, son of Sir Robert Wigram, Bart.; educated at Trinity College, Cambridge, and became a distinguished member of the sect of Plymouth Brethren. Author of *The Englishman's Greek Concordance to the New Testament* (1839) and *The Englishman's Hebrew and Chaldee Concordance of the Old Testament* (2 vols., 1843).

**Wigram** (Sir JAMES), brother of George V., b. at Walthamstow, England, in 1793; educated at Trinity College, Cambridge, where he became a fellow; was called to the bar at Lincoln's Inn 1819; entered Parliament for Leominster 1841, and was second vice-chancellor from Oct., 1841, until 1850, when he retired on a pension of £3500. D. July 29, 1866. Author of *An Examination of the Rules of Law respecting the Admission of Extrinsic Evidence in Aid of the Interpretation of Wills* (2d ed. 1835), of which the 2d American edition was annotated by Theodore W. Dwight, LL.D., and of *Points in the Law of Discovery* (2d ed. 1840).

**Wigram** (JOSEPH COTTON), D. D., brother of George V. and Sir James, b. in England Dec. 26, 1798; graduated at Trinity College, Cambridge, 1819; took orders in the Church of England 1823; became assistant preacher at St. James's, Westminster, 1827; was secretary of the National Society for Promoting the Education of the Poor in the Principles of the Established Church 1827–39; rector of East Tisted, Hampshire, 1839–50; became archdeacon of Winchester 1845, rector of St. Mary's, Southampton, and canon of Winchester, 1850, and bishop of Rochester 1860, and was notable for his "evangelical" views and his reproval of his clergy for wearing beards and for playing cricket. Author of *Practical Hints on Sunday-Schools* (1833), *The Geography of the Holy Land* (2d ed. 1836), and of many published sermons, charges, and pamphlets.

**Wig'ton,** or **Wigtown,** county of Scotland, occupying the south-western corner of the country, and bordering S. on the Irish Sea and W. on the North Channel, comprises an area of 451 sq. m., with 38,830 inhabitants. The surface is undulating, and gradually rises toward the N. to a height of 1500 feet. It consists to a great extent of moorland, interspersed with small lakes, but it contains some fine pastures where an excellent breed of cattle is reared, and some tracts of good soil where agriculture is carried on to a high degree of perfection.

**Wil'berforce** (EDWARD), son of Archdeacon Robert Isaac, b. in England about 1832; served some years in the British navy; conducted for a short time in 1856 a periodical entitled *The Idler;* has travelled extensively, given much attention to music and the fine arts, and married in 1860 an American lady. Author of *Brazil viewed through a Naval Glass, with Notes on Slavery and the Slave-Trade* (1855), *Social Life in Munich* (1863), *One with Another, a Novel* (1865), *Franz Schubert, a Musical Biography* (1866), *The Duke's Honor* (3 vols., 1870), a volume of *Poems* (1857), and other publications.

**Wilberforce** (HENRY WILLIAM), youngest son of William, b. at Clapham, England, in 1809; graduated with high honors at Oriel College, Oxford, 1830; took orders in the Church of England; was for some time curate of Bransgore, Hampshire; became vicar of East Farleigh, Kent, 1843; became a Roman Catholic 1850; was proprietor and editor of the *Weekly Register* and a magistrate for the county of Galway. D. Apr. 23, 1873. Author of *The Parochial System, an Appeal to English Churchmen* (1838), which gained a prize of £200 offered by the Christian Influence Society.

**Wilberforce** (ROBERT ISAAC), son of William, b. at Broomfield House, near Clapham Common, England, Dec. 19, 1802; graduated at Oriel College, Oxford, 1823; became fellow, tutor, and examiner there; took orders in the Church of England; was for some years vicar of East Farleigh, Kent, and of Burton Agnes, 1840; became archdeacon of the East Riding of Yorkshire Jan. 14, 1841, and prebendary of York Feb. 8 of the same year; resigned these preferments 1854 on being received into the Roman Catholic Church at Paris, and entered an ecclesiastical academy at Rome with a view to the priesthood. D. at Albano, near Rome, Feb. 3, 1857, being attended in his last illness by Dr. (now Cardinal) Manning. He was a joint author of his father's *Life,* and author of *The Five Empires, an Outline of Ancient History* (1840), *Rutilius and Lucius, or Stories of the Third Age* (1842), *Church Courts and Church Discipline* (1843), *The Doctrine of the Incarnation* (1848), *The Doctrine of Holy Baptism* (1849), *A Sketch of the History of Erastianism* (1851), *The Doctrine of the Holy Eucharist* (1853), 2 vols. of *Sermons* (1850–54), and *An Inquiry into the Principles of Church Authority, or Reasons for Recalling my Subscription to the Royal Supremacy* (1854).

**Wilberforce** (SAMUEL), D. D., son of William, b. at Clapham, England, Sept. 7, 1805; graduated with honors at Oriel College, Oxford, 1826; took orders in the Church of England; became curate of Chickendon, Oxfordshire, 1828, rector of Brixton (Brightstone), Isle of Wight, 1830, select preacher before the University of Oxford 1837, and again 1845, rector of Alverstoke, Hampshire, archdeacon of Surrey and chaplain to Prince Albert 1839, canon of Winchester cathedral 1840, sub-almoner to the queen 1844, dean of Westminster 1845, bishop of Oxford and *ex-officio* chancellor of the order of the Garter Nov., 1845, lord high almoner to the queen Nov., 1847, and bishop of Winchester Oct., 1869. He was a leader of the High-Church party, but an opponent of ritualism; was distinguished for skill as a debater in convocation and in the House of Lords, and for his versatility of opinions received the sobriquet of "Slippery Sam," by which he was popularly known; was a great favorite in the highest society, and was an influential advocate of free trade. He was killed by a fall from his horse, while riding with Earl Granville, near Dorking, Surrey, England, July 19, 1873. Author of *Note-Book of a Country Clergyman* (1833), *Eucharistica* (1839), *Sermons preached before the University of Oxford* (2 series, 1839–62), of several other volumes of sermons, *A History of the Protestant Episcopal Church in America* (1844), and many miscellaneous publications.

**Wilberforce** (WILLIAM), the third of four children and only son of Robert and Elisabeth Wilberforce, b. at Hull, England, Aug. 24, 1759. On the death of his father, in 1768, he went to live with an uncle in Wimbledon, near London, but at the age of twelve returned to his mother's house in Hull. During these early years he is spoken of as a boy whose activity and spirit made up for deficiency in bodily strength, with a love of letters and eloquence already developed, with a strong memory, warm affections, and a marked hatred of injustice and oppression. When not much more than seven years old, he was sent to the grammar-school of Hull, then under the charge of Joseph and Isaac Milner, and "even then," says the younger Milner, "his elocution was so remarkable that we used to set him upon a table and make him read aloud as an example to the other boys." In Oct., 1776, he entered St. John's College, Cambridge, and being the master of an independent fortune, of a genial temper, self-indulgent, playful, and witty, and thrown without restraint into the society of "as licentious a set of men as could well be conceived" (to use his own words), the risk to his health, his morals, and his general welfare was extreme. Happily, he was not long in becoming aware of his peril, and after the first year contrived to shake off these men, and for the last two years of college life was the centre of a higher circle. With his ample means and his free social nature it is not surprising that he was a universal favorite. Notwithstanding his temptations to idleness, he became a good classic and creditably passed the college examinations. Mathematical studies he was tempted to neglect, and in later life never ceased to regret the lack of this early discipline, to which he ascribed a certain want of mental regularity of which he was conscious. At Cambridge he formed an acquaintance with William Pitt, which afterward ripened into intimacy. Having determined to enter public life, he offered himself for Hull (in 1780), and after a sharp contest was elected to Parliament at a personal expense of between £8000 and £9000. He had just come of age, and was at once brought into the gayest and most seductive society of London, was chosen member of the leading clubs, became immersed in politics and fashion, and entered eagerly into play. From this dangerous amusement, however, he broke away, like Pitt, on seeing the hazard not only to himself, but to others who could ill afford to lose. In 1784 he was elected to represent the great county of York, a success which seemed to open before him the most gratifying prospects. The years 1785–86 witnessed a change in his religious convictions which modified the whole course of his future life. This change was consequent, mainly, upon a careful reading of the New Testament, to which he was led, during a tour upon the Continent, by his travelling companion, Rev. Isaac Milner. The result of this was that he began in 1787 a series of efforts for the reformation of manners, and especially for abolishing the African slave-trade. The latter subject was brought into Parliament, and

after overcoming many obstacles he opened the debate against the traffic on May 12, 1789, in a speech of great beauty and power. In this philanthropic effort he was supported by Burke, Pitt, and Fox. Although defeated, he renewed the effort whenever there seemed a chance of success, and finally, in 1807, after a struggle of nearly twenty years, had the joy of seeing the bill passed by both houses. It received the royal assent on Mar. 25, and became the law of the land. In 1797, Mr. Wilberforce published his book entitled *A Practical View of the Prevailing Religious System of Professed Christians in the Higher and Middle Classes, contrasted with Real Christianity.* The publisher thought that, since the author's name was given, 500 copies might be disposed of. Within six months 7500 were sold, and it was subsequently translated into the leading languages of Europe. In fact, few religious books have been read more widely or more generally approved. During the same year (1797) he married Barbara Ann, eldest daughter of Isaac Spooner of Elmdon Hall, Warwickshire. Four sons and two daughters were the result of this union. In 1825, Mr. Wilberforce retired from Parliament after a continuous service of nearly forty-six years, during which his labors had been conspicuous and unceasing for every measure, public or private, tending to ameliorate suffering, to relieve the oppressed, and to elevate the moral and religious condition of the kingdom. Among the most important of these were his efforts in behalf of the Bible and missionary societies, for Roman Catholic emancipation, against the war with America, for christianizing India, and for abolishing the slave-trade and slavery. In consequence of these philanthropic labors, and the spirit with which he conducted them, his name became known throughout the civilized world, and no one in the kingdom was more highly venerated and beloved.

Mr. Wilberforce was remarkable for many personal qualities. Madame de Staël spoke of him as the best converser she had met with in England. Pitt pronounced him to possess, of all men he had known, the greatest natural eloquence. Of a slight frame, his voice was uncommonly sweet and musical, and capable of great variety and richness of modulation. Sir Samuel Romilly declared him to be the most efficient speaker in the House of Commons. Lord Brougham speaks of his power of rebuke and invective as of the highest order. On one occasion, when a member sneeringly referred to him as "the honorable and religious gentleman," he turned upon him with a severity of dignified rebuke which was overwhelming, so that his friends hardly knew which most to admire, his remarkable power of sarcasm or the restraint under which he so generally held it. Sir James Mackintosh speaks of him as "the very model of a reformer—ardent without turbulence, mild without timidity or coldness, . . . patient and meek, yet intrepid, . . . just and charitable even to his most malignant enemies, unwearied in every experiment to disarm the prejudices of his more rational and disinterested opponents, and supporting the zeal without dangerously exciting the passions of his adherents."

After leaving Parliament, he retired almost altogether from public life, and went to live upon a small estate which he had purchased at Highwood near London. This, however, on account of a loss of property, he was obliged to relinquish in 1831, after which he lived with his sons in Kent and the Isle of Wight. His health gradually failed from about this time to the end. Three days before his death he had the intense pleasure of learning that the House of Commons had passed to its second reading the bill for the abolition of slavery. "Thank God," he exclaimed, "that I should have lived to witness a day in which England is willing to give twenty millions sterling for the abolition of slavery!" Held in great honor during all his later years, he died in Cadogan Place, London, July 29, 1833, and, in accordance with the wishes of the nation, was buried in Westminster Abbey, "side by side with Canning, at the feet of Pitt, and within two steps of Fox and Grattan." His daughters died before their father; four sons survived him, three of whom attained ecclesiastical or literary distinction.—The *Life of William Wilberforce*, 5 vols. 8vo, was written by his sons, Robert Isaac and Samuel. S. G. Brown.

**Wil'braham,** p.-v. and tp., Hampden co., Mass. P. 2330.

**Wil'brord,** or **Willibrod** (Saint), called "the apostle of the Frisians," b. in the Saxon kingdom of Northumbria about 657, his father's name being Widgils; was placed in childhood in the monastery of Ripon, then governed by (Saint) Wilfrid; embraced the monastic profession while very young; spent twelve years in Ireland, studying under the care of (Saint) Egbert and the monk Wybert or Wigbert, who had preached in Friesland; was ordained a priest about 689; went to Friesland in 690 or 691, landing near Utrecht, and was joined there by (Saint) Swidbert and ten or eleven other English monks; was well received by Pepin the Big, the Franconian ruler of Friesland; is said to have visited Denmark; made a visit to Rome 692; obtained ecclesiastical authority from Pope Sergius, and during a second visit (695) was ordained bishop of the Frisians under the name of Clemens; converted large numbers of the natives by his preaching, enjoying the patronage of Charles Martel; is claimed as the founder of the see of Utrecht, where he built the church of Saint Saviour, and spent his last years at a monastery he had established (698) at Echtemach, near Treves, where he d. in 738. His festival is celebrated Nov. 7. Considerable uncertainty exists respecting the events of his career.

**Wil'bur** (Hervey), D. D., b. at Wendell, Mass., in 1787; was minister of his native place 1817–23, and subsequently presided over several female seminaries. D. at Newburyport in 1852. He published a *Reference Bible* (1828), *Elements of Astronomy* (1829), *A Lexicon of Useful Knowledge* (1830), and a *Reference Testament for Bible-Classes* (1831).

**Wilbur** (Hervey Backus), M. D., son of Rev. Dr. Hervey, b. at Wendell, Mass., Aug. 18, 1820; graduated at Amherst College 1838; taught school some months; studied engineering, and afterward medicine, which he practised at Lowell and at Barre, Mass.; was so impressed by the perusal of an account of Dr. Seguin's school for idiots at Paris that he received several idiot pupils into his own house at Barre July, 1848; prevailed upon the legislature of New York to establish in 1851 an experimental school at Albany, which under his direction was so successful as to be fully organized in 1854 as the State asylum for idiots at Syracuse. Dr. Wilbur has continued in charge of this philanthropic institution, and has published various *Reports* and other papers on idiocy.

**Wilbur** (John), b. at Hopkinton, R. I., in 1774; became a minister of the Society of Friends; opposed the introduction of religious views at variance with the original doctrines of that society; was accused in 1838 by several members of Rhode Island yearly meeting of circulating in his conversation and writings opinions and statements derogatory to the character of the celebrated Joseph John Gurney, then (1837–40) visiting the U. S.; was sustained by a large majority in his own monthly meeting (that of South Kingston), but that body having been dissolved and its members added to the Greenwich meeting, he was formally disowned by the latter body Jan., 1843, and its action was confirmed by the quarterly meeting and the Rhode Island yearly meeting. His supporters were, however, sufficiently numerous in Rhode Island and other parts of New England to form an independent yearly meeting, the members of which were known as "Wilburites." D. in 1856. He published some polemical pamphlets, and his *Journal and Correspondence* (Providence, 1859) have appeared since his death.

**Wil'burger,** county of Texas, returned in the census of 1870 as having no population.

**Wil'burton,** tp., Fayette co., Ill. P. 1509.

**Wil'bye** (John), a famous composer of music who flourished in England at the close of the seventeenth century, of whom all that is positively known, his works excepted, is that in 1598 he was a teacher of music in Austin Friars, London. In that year he published *The First Set of English Madrigals to 3, 4, 5, and 6 Voices*, and a second book of the same in 1609. Both have been reprinted for the Musical Antiquarian Society, the former edited by James Turle (1841), the latter by G. W. Budd (1846). They are said to include "some of the most lovely and, at the same time, the most scientific compositions that, in this department, the art ever produced."

**Wil'cocks** (Alexander), M. D., b. at Philadelphia, Pa., in 1817; graduated at Jefferson Medical College 1844; contributed papers to the *Medical Examiner* and to the *American Journal of Medical Science*, and is author of *An Essay on the Tides* (1855), *Reflections upon the Nature of the Temporary Star of the Year 1572, an Application of the Nebular Hypothesis* (1860), *Thoughts on the Influence of Ether in the Solar System* (1864), and other scientific essays.

**Wil'cox,** county of S. W. Alabama, intersected by Alabama River, and traversed in the E. part by Selma and Gulf R. R.; surface undulating, soil generally fertile. Swine, cattle, and mules are the chief live-stock. Staples, cotton, Indian corn, and sweet potatoes. Cap. Camden. Area, about 900 sq. m. P. 28,377.

**Wilcox,** county of Central Georgia, lying upon Ocmulgee River; surface undulating, soil productive. Cattle, sheep, and swine are the chief live-stock. Staples, cotton, Indian corn, and wool. Cap. Abbeville. Area, about 500 sq. m. P. 2439.

**Wilcox,** tp., Hancock co., Ill. P. 4058.

**Wilcox,** p.-v., Elk co., Pa.

**Wilcox** (Cadmus M.), b. in North Carolina about 1825; graduated at the U. S. Military Academy, and commissioned brevet second lieutenant of infantry July, 1846; served in the war with Mexico from Vera Cruz to the City of Mexico, for the greater part of the time on the staff of Gen. Quitman, and brevetted first lieutenant for gallantry at Chapultepec; subsequently on frontier until June 8, 1861, when he resigned his commission of captain. In July he was commissioned colonel of the 9th Alabama regiment, and in October appointed a brigadier-general in the Confederate army. In Virginia he commanded a brigade in Longstreet's corps, as at the second battle of Bull Run, Fredericksburg, Chancellorsville, Salem Heights, Gettysburg, etc.; promoted to major-general Aug., 1863, and commanded a division in the Mine Run campaign and throughout the campaign of 1864–65, ending with the surrender at Appomattox Court-house. Author of *Rifles and Rifle Practice* and a translation of *Austrian Infantry Evolutions of the Line.*

**Wilcox** (Carlos), b. at Newport, N. H., Oct. 22, 1794; removed to Orwell, Vt., in childhood; graduated with valedictory honors at Middlebury College 1813, and at Andover Seminary 1817; was ordained to the Congregational ministry, and began to preach at Hartford, Conn., in 1818, but was soon obliged by ill-health to desist; travelled through New England; resided at Salisbury, Conn., where he published a poem, *The Age of Benevolence* (1822); delivered before the Phi Beta Kappa Society of Yale College his poem *The Religion of Taste* (1824); was pastor of the North church, Hartford, 1824–26; travelled in Europe 1826, and on his return accepted the pastorate of a church at Danbury, Conn., where he d. May 29, 1827. His *Remains*, consisting of poems and sermons, were published in 1828. Some of the descriptions of scenery have been highly commended.

**Wild** (Henry), known as the "learned tailor," b. at Norwich, England, about 1684; acquired some knowledge of Greek and Latin at the grammar school of that town, after which he served a seven years' apprenticeship to a tailor; worked seven years more as a journeyman, and had nearly forgotten his early classical acquisitions when, during a long period of sickness, he amused himself by reading some volumes of controversial theology abounding in quotations from the Bible in the original Hebrew; devoted his spare time for several years to the study, first, of Hebrew, and afterward of Chaldee, Syriac, Arabic, and Persian. His proficiency accidentally became known in 1614 to the celebrated Dean Prideaux and to Rev. Dr. Turner of Norwich, who were instrumental in raising a subscription in his behalf, and procured him a situation in the Bodleian Library at Oxford, where he was employed in classifying and indexing Oriental MSS., from which he made some translations. About 1720 he left Oxford and settled in London, where he was patronized by Dr. Richard Mead, and is supposed to have died before 1734, in which year his only publication appeared, a translation from the Koran of *Mahomet's Journey to Heaven.*

**Wild-Cat.** See Cat.

**Wild Cat,** tp., Tipton co., Ind. P. 1547.

**Wild Cherry** (*Cerasus serotina*, De Cand.). The wild cherry is a very common tree throughout America, growing in all parts of the U. S. In the Western States it may attain a height of from 80 to 100 feet, but in the Atlantic States it is usually much smaller. The fruit is small, about the size of a large pea, and when ripe is of a shining blackish-purple color. The wood of the wild cherry is much prized by cabinetmakers for its fine grain, handsome tint, and susceptibility to high polish. The inner bark, taken from all parts of the tree, furnishes the drug known as "wild cherry." By a mistake, the Latin officinal designation of this drug is *Prunus virginiana*, which is properly the botanical name of the choke-cherry, a different tree. Wild cherry bark is in pieces of various sizes, without epidermis, and of a light cinnamon color. It has the odor of peach-leaves and an agreeable aromatic taste, with a flavor of bitter almonds. The important ingredients of the bark are tannin and the peculiar principles *amygdaline* and *emulsine*, which by mutual reaction in the presence of water develop a volatile oil containing a small percentage of hydrocyanic acid. Preparations of wild cherry bark were formerly supposed to possess remarkable medicinal virtues, but they are now regarded as feeble, and are principally employed for the purposes of a mild and agreeable stomachic tonic, a gentle calmative in bronchial affections with an irritative cough, and to impart the pleasant flavor of the bark to compound medicinal preparations. E. Curtis.

**Wilde** (James Plaisted), **Baron Penzance,** brother of Baron Truro, late lord chancellor, b. in London, England, in 1816; studied at Winchester School; graduated at Trinity College, Cambridge, 1838; was called to the bar at the Inner Temple 1839; was appointed junior counsel to the excise and customs 1840, queen's counsel 1855, counsel to the duchy of Lancaster 1859, and a baron of the exchequer Apr., 1860, on which occasion he was knighted; was judge of the court of probate and divorce 1863–72; was sworn of the privy council 1864, and created a peer by the title of Baron Penzance Apr. 6, 1869.

**Wilde** (Richard Henry), b. in Dublin, Ireland, Sept. 24, 1789. His parents migrated to the U. S., and settled in Baltimore while he was an infant. His father soon died, and during his childhood he was dependent mainly upon his mother for the rudiments of an English education. In his eleventh year he was placed as a clerk in a store, and when he was thirteen his mother moved to Augusta, Ga., where they obtained a living by merchandising in a small way, the boy devoting all his leisure to books. Under many difficulties he studied law; was admitted to the bar, and soon rose to high distinction in his profession. He became attorney-general of the State; in 1815 was elected to Congress. This position he held for a number of years, and took rank among the ablest and most accomplished orators of that body. On retiring from Congress in 1835 he visited Europe, and spent several years in literary pursuits. Several productions of great merit came from his pen; several of these appeared before he went abroad, and several after. Those which will live longest, perhaps, are, first, his famous lyric entitled "My life is like a summer rose," and the second his *Life of Tasso.* After his return from Europe in 1843, he moved to New Orleans, when he renewed the practice of law with unusual success, and was elected professor of constitutional law in the University of Louisiana. D. of yellow fever in New Orleans Sept. 10, 1847. Alexander H. Stephens.

**Wilde** (Samuel Sumner), LL.D., b. at Taunton, Mass., Feb. 5, 1771; graduated at Dartmouth College 1789; was admitted to the bar 1792; practised successively at Waldoborough, Warren, and Hallowell, Me.; was a member of the legislature and of the executive council; was a delegate to the Hartford Convention 1814, and judge of the Massachusetts supreme court 1815–50; removed to Newburyport, Mass., 1820, and to Boston 1831; sat in the Massachusetts constitutional convention 1820; was a member of the American Academy of Arts and Sciences, and was noted for learning and integrity as a judge, being especially an authority in *nisi prius* cases. D. at Boston June 22, 1855.

**Wilde** (Sir William Robert Wills), M. D., b. at Castlerea, county Roscommon, Ireland, about 1810; became a distinguished surgeon; was director of St. Mark's Ophthalmic and Aural Hospital, Dublin, is surgeon oculist to the queen for Ireland, and vice-president of the Royal Irish Academy; is distinguished as a traveller, antiquary, and statistician, having twice superintended the Irish census, for which services he was knighted 1864. Author of *A Voyage along the Shores of the Mediterranean* (2 vols., 1840), *Austria, its Literary, Scientific, and Medical Institutions, etc.* (1843), *Irish Popular Superstitions* (1852), *Aural Surgery* (1853), *Catalogue of the Antiquities in the Museum of the Royal Irish Academy* (1857–62), *Malformations and Diseases of the Organs of Sight* (1862), and other works.

**Wildebeest.** See Gnu.

**Wild'er** (Alexander), M. D., b. at Verona, Oneida co., N. Y., May 13, 1823; is self-educated; was for some years a teacher; edited the Syracuse *Star* 1852, and the *Journal* 1853; was employed in the State department of public instruction 1854–55; became editor of the *New York Teacher* 1855, and of the *College Review* 1856; was a staff contributor to the *Anglo-American*, the *New Church Repository*, the New York *Evening Post* 1858–71; also to the *Medical Review* and the *Medical Eclectic;* practised in New York City as an eclectic physician; was president of the Eclectic Medical Society of New York 1869–70, and is secretary of the National Eclectic Medical Association; edited 2 vols. of *Transactions* (1869–70) of the former and a volume of *Proceedings* of the latter society, and has been since 1867 president of the Eclectic Medical College of the City of New York, and lecturer on physiology and physiological medicine. Author of an English grammar, of *The Secret of Immortality Revealed*, of a *City Directory*, of treatises on *The Eclectics of Alexandria* (1869), *The Intermarriage of Kindred* (1870), *The Medical Education of Women* (1874), *A Protest against Vaccination* (1876), and *The Worship of the Serpent* (1877); has edited Westropp's *Ancient Symbol-Worship* (1873), Taylor's *Eleusinian and Bacchic Mysteries* (1875), and R. Payne Knight's *Symbolical Language of Ancient Art and Mythology* (1876), and has prepared a translation of Iamblichus *On the Mysteries.*

**Wilder** (Marshall Pinckney), b. at Rindge, N. H., Sept. 22, 1798; educated at common schools and at the

Ipswich Academy; worked on his father's farm; afterward engaged in commercial pursuits, and in 1825 established himself as a merchant at Boston; was prominent in the organization of the State board of agriculture and the establishment of the State Agricultural College; was president of the Massachusetts Horticultural Society 1840–48, of the American Pomological Society from 1848, of the U. S. Agricultural Society 1852–58, and of the New England Historico-Genealogical Society from 1869; has sat in both houses of the legislature and in the executive council, and was president of the senate 1850, besides having held many other important trusts. Author of numerous speeches, addresses, and essays in horticultural journals.

**Wil'derness,** tp., Nicholas co., West Va. P. 824.

**Wilderness, Battles of the,** fought between the United States and Confederate States armies. The general character of the section of the country in which this battle was fought is that of a wilderness, by which name it is locally known. Though containing but moderate hills, the underlying rocks are quartzite, and in places gold-bearing, and to aid in reducing the gold the primitive forests had been cut down for fuel, leaving the site to be again covered by the thick and tangled growth that succeeds such an operation. Thickets of pine and other trees occupied a soil composed of sand and clay, unfavorable to agriculture and very swampy when wet. Two good roads pass through this region from Orange Court-house to Fredericksburg, uniting at the place called Chancellorsville; but on both sides of them the country is a very difficult one in which to control the movements of a large army. During the winter of 1863–64 the U. S. forces, under command of Gen. Meade, were encamped along the line of the Orange and Alexandria R. R., extending from Bull Run to the Rapidan. The opposing army, under Gen. Lee, occupied a strong line, partly intrenched, on the S. bank of the Rapidan, extending from Mine Run westward to Orange Court-house and Gordonsville, covering Richmond, and threatening Washington if the Union army uncovered it by a flank movement. In Mar., 1864, Gen. Grant, then commander of all the Union armies, took up his headquarters with Gen. Meade's army. Gen. Meade broke camp at midnight May 3–4, and commenced moving toward the Rapidan, the right, consisting of the 5th corps (Warren's) and the 6th corps (Sedgwick's), to cross at Germanna Ford; the left, comprising the cavalry (Sheridan's) and the 2d corps (Hancock's), to cross at Ely's Ford, 6 miles below. Before sunset Meade's army was established with but slight opposition in the Wilderness, with the 5th corps and a division of cavalry on the right, next the enemy. Gen. Grant, at 6 P. M. on the 4th, ordered an advance toward Lee next morning. Lee, however, had determined to give battle in the Wilderness, which, familiar to his soldiers, was but partially known to their opponents, and had also set his army in motion to meet his adversary. Accordingly, on the morning of May 5, the 5th corps and the advance of Lee's army met, a fierce encounter between some 25,000 men opening this bloody campaign. At intervals during the day others of the opposing columns met, and engaged with much valor and loss of life on both sides. The evening of May 5 found both armies face to face, and an inevitable and momentous conflict impending on the morrow. The 9th corps (Burnside's) and that of Longstreet on the other side had not yet reached the field, toward which they marched that night. At dawn of day on May 6 the battle was renewed along all the opposing lines, and continued with unceasing movements and attacks, with much loss of life, until dark. The day closed with the two armies holding substantially the positions of the night before. On the morning of May 7 both armies were behind intrenched lines, each too much exhausted to renew the fight. Gen. Grant then determined to move to his left, thus securing a short base of operations by way of Fredericksburg and the Potomac River, and threatening Lee's communications with Richmond. This was begun after dark on the 7th, the 5th corps having the advance toward Spottsylvania Court-house. Gen. Lee, however, anticipated this, and having a shorter road, his main force reached there first, and the battles of Spottsylvania followed, which for convenience to the reader are herewith described, although the "Wilderness" battles proper are considered by the army to have ended with the movement of May 7:

Spottsylvania, Battles of, May 8–21.—The advance cavalry of the Union army occupied this place early in the morning of May 8, but were compelled to withdraw before their enemy's advancing infantry. The 5th corps forced the enemy back until it found itself confronting the corps of Longstreet, and severe fighting followed. During the day the 6th corps joined the 5th, and a combined attack was made by them at dark, but without result. The other corps of both armies continued to arrive and take up positions, attended with constant fighting and severe loss of life. The 9th, 10th, and 11th of May were passed in movements and bloody conflicts, without being decisive. These actions include the fights at Laurel Hill—a name borne upon the records of many regiments—and near this Gen. Sedgwick was killed, and the command of the 6th corps was assigned to Gen. Wright. Early on the morning of the 12th a general assault was made by Gen. Grant upon Lee's position. The 2d corps (Hancock's) carried a salient, capturing nearly a division and twenty cannon, but the subsequent resistance was so obstinate that no decisive result was obtained. The 13th to the 18th was spent in demonstrations, conflicts, and reorganization while awaiting reinforcements. Unable to force the position at Spottsylvania, Gen. Grant issued orders for a movement toward North Anna River, around the right of Gen. Lee. The latter delayed this movement until the 21st by moving out a heavy force on the afternoon of the 19th, which attacked Gen. Grant's right, but after a sharp conflict it was driven back. Lee began to move as soon as his adversary did, and established his forces on the S. bank of the North Anna, where the battles were again renewed.

North Anna, Battles of.—The 5th corps reached the North Anna on the afternoon of the 23d, closely followed by the 6th corps, the 2d and 9th coming up about the same time. Gen. Warren effected a crossing the same afternoon without much opposition. Soon after getting into position he was violently attacked, but repulsed the enemy with great loss. Hancock on the left effected a crossing after some fighting. On the 24th the 6th corps crossed, taking position on Warren's right. The attempt of Burnside, on the centre, was repulsed. Finding the enemy's position on the North Anna stronger than either of his previous ones, Gen. Grant withdrew on the night of the 26th to the N. bank, and moved to turn the enemy's position by his right. The battle of Cold Harbor (which see) was the next serious engagement between the two armies. The official report of Gen. Meade states his losses May 5–31 at 41,398, of which 33,948 were killed and wounded, not including Burnside's loss, whose corps was not formally united to Meade's command until May 24. The Confederate loss is not officially reported, but, though large, was much less than that sustained by Gen. Meade.

**Wild'ers,** tp., Johnston co., N. C. P. 1203.

**Wild'erspin** (Samuel), b. in England about 1792; was founder and master of the London Central Infant School, the first institution of its kind, and was prominent in the Pestalozzian movement for the reform of the methods of instruction. D. in London Mar. 10, 1866. Author of the *Infant System of Education* (1823), *Early Discipline illustrated* (3d ed. 1840), *A System of Education for the Young* (1840), and, with T. J. Terrington, of *A Manual of Instruction for Young Children* (1845).

**Wil'dey** (Thomas), b. in England Jan. 15, 1783; came to the U. S. 1817; settled at Baltimore as a coach-spring maker, and there instituted in 1819 the first lodge of Odd Fellows in America. He was grand sire of that order from 1825 to 1833. D. at Baltimore Oct. 19, 1861. His funeral (Oct. 22) was attended by delegations of Odd Fellows from the principal Eastern cities, and a monument to his memory has been erected by that order. (See Odd Fellows.)

**Wild-Goose.** See Canada Goose.

**Wild'man** (Richard), b. at Chiltham Castle, Kent, England, in 1802; was called to the bar 1829; became a sergeant-at-law; is recorder of Nottingham and a circuit judge, and a high authority upon the law of nations. Author of *Institutes of International Law in Time of Peace or War* (2 vols., 1849–50; republished at Philadelphia 1850), *Directions for Naval Officers regarding the Law of Prizes* (1854), and *Considerations on the Chinese Coalition* (1857).

**Wild Service.** See Sorb Tree.

**Wild'wood,** tp., Craven co., N. C. P. 2241.

**Wi'ley** (Calvin Henderson), b. in Guilford co., N. C., Feb. 3, 1819; studied at Caldwell Institute, Greensboro'; graduated at the University of North Carolina 1840; studied law, and was admitted to the bar 1841; was a member of the North Carolina legislature 1850 and 1852; became State superintendent of common schools Dec., 1852; was six times re-elected for terms of two years by an almost unanimous vote; rendered great services to the cause of education, and kept in regular operation the schools of North Carolina during the civil war; was licensed to preach by the Orange presbytery 1856, and regularly ordained to the ministry 1866; contributed to *Sartain's* and other magazines; founded and edited the *Southern Weekly Post* at Raleigh; was editor and proprietor of the Oxford *Mercury;* was instrumental in founding a State educational association, and was one of the editors of its journal; procured

during the civil war the establishment at Greensboro', N. C., of a publishing-house to supply the State with textbooks, and took a prominent part in organizing at Columbia, S. C., the Educational Association of the C. S. A., and has been since 1869 agent of the American Bible Society in Tennessee. Author of many addresses, of some religious, political, and educational pamphlets, of two historical novels upon North Carolina subjects—*Alamance, or the Great and Final Experiment* (1847), and *Roanoke, or Where is Utopia?* (1850; new ed. 1866); *Life in the South, a Companion to Uncle Tom's Cabin* (1852), *The North Carolina Reader* (1863), embodying a popular history of North Carolina, *Elocution and Oratory, a Treatise on the Arts of Reading and Speaking* (1869), and other works.

**Wiley** (Isaac William), D. D., b. in Pennsylvania Mar. 29, 1825; graduated in medicine, afterward studied theology, and joined the Philadelphia Methodist Episcopal conference in 1849; the next year he was sent as missionary to China, where he continued four years. On his return he spent four years in the pastorate, and then became principal of the Pennington Seminary in New Jersey. In 1864 he was appointed editor of the *Ladies' Repository*, a monthly publication of his Church at Cincinnati, which he conducted till 1872, when he was elected bishop. He is author of *Fallen Heroes in Foo-Chow* and *Religion in the Family*.

**Wi'ley's Cove,** p.-v. and tp., Searcy co., Ark. P. 663.

**Wil'ford** (Francis), b. in Hanover about 1760; went to India in the military service of the East India Company 1781; devoted himself to Sanskrit studies, and wrote numerous memoirs in the *Asiatic Researches*, which at the time attracted great attention in Europe, as proving from Hindoo records the accounts of the Creation and the early history of mankind found in the book of Genesis. For some years the name of Lieut. Wilford figured largely in the writings of biblical commentators, but it subsequently appeared that he had been imposed upon by a Hindoo pundit, who had palmed upon him a series of forgeries. He attained the rank of lieutenant-colonel, and d. at Benares Sept. 4, 1822.

**Wil'frid,** or **Wilfred** (Saint), b. in the Saxon kingdom of Bernicia (Northumberland) about 634, of a noble family; studied at Lindisfarne Abbey, where he became a monk; travelled in France and Italy, residing some time at Rome; built a monastery at Ripon 663; was commissioned by King Alcfrid to regulate the usages of the Northumbrian Church upon the time of celebrating Easter, on which subject a famous council was held at Whitby (664) in the royal presence; was appointed by the king bishop of York, and consecrated as such at Paris, but was opposed by Ceadda (St. Chad), who had taken possession of the see in his absence; retired to his monastery for three years; was put in possession of the bishopric 669; was ejected by King Egfrid, who divided the diocese into three bishoprics; visited Rome for redress, and obtained the papal decision in his favor, but was imprisoned nine months on his return, and never recovered possession of his see. D. at the monastery of Oundle Apr. 24, 709.

**Wil'helm** (Karl), b. at Smalcald, Prussian province of Hesse; lived for many years as a teacher of music in Crefeld, and d. there Aug. 26, 1873. In 1854 he composed the music to *Die Wacht am Rhein*, and when this song became so immensely popular during the Franco-German war the Prussian government gave him a pension, and a monument was erected at Smalcald.

**Wilhelmshaven.** See Jade.

**Wilhelmshöhe.** See Cassel.

**Wilk.** See Whelk.

**Wilkes,** county of N. E. Georgia, drained by Broad River and Little River, and partially traversed by a branch of Georgia R. R., which terminates at the county-seat. Surface undulating, with considerable iron ore; soil generally unproductive. Staples, cotton and Indian corn. Cap. Washington. Area, 550 sq. m. P. 11,796.

**Wilkes,** county of N. W. North Carolina, intersected by Yadkin River, and having the Blue Ridge along the N. W. border; surface alternating hills and valleys; soil in the valleys fertile, in the mountains well adapted to pasturage. Swine and cattle are the chief live-stock. Staples, Indian corn and tobacco. Cap. Wilkesborough. Area, 864 sq. m. P. 15,539.

**Wilkes** (Charles), b. at New York in 1801; entered the naval service of the U. S. as midshipman Jan. 1, 1818; became lieutenant 1826, commander 1843, captain 1855, commodore 1862. He conducted the U. S. expedition (1838–42) to explore the Southern and Pacific oceans, a narrative of which he published, and of the detailed report of the expedition, giving the scientific results obtained, he contributed the volume on meteorology. In 1861 he was ordered to the West Indies in command of the frigate San Jacinto to search for the Confederate cruiser Sumter. Learning that the Confederate commissioners Slidell and Mason were on their way to Europe in the British mail-steamer Trent, he intercepted that vessel and took from her those men, whom he conveyed to Boston. This act met the approval of his department and of Congress, and the commissioners were for a time held as prisoners in Fort Warren, but subsequently surrendered by our government to Great Britain. In 1862 he was placed in command of the Potomac flotilla to co-operate with the Army of the Potomac, but on the withdrawal of that army from the Virginia peninsula, was ordered to command the flying squadron organized for the purpose of breaking up the blockade-running between the Southern States and the West Indies. Many captures were made. In July, 1866, he was promoted rear-admiral, and shortly after placed on the retired list. Among his published works, other than those above mentioned, are *Western America, including California and Oregon* (1849), *The Theory of the Wind*, with maps and charts (1856), etc. The London Geographical Society awarded him the gold medal in 1848. D. at Washington, D. C., Feb. 8, 1877.

**Wilkes** (George), b. in New York about 1820; became a journalist; wrote a *History of California* (1845) and *Europe in a Hurry* (1852); became in 1858 co-editor, with William T. Porter, of the *Spirit of the Times*, and subsequently proprietor of that paper; is well known as a politician, and has repeatedly travelled in Europe.

**Wilkes** (John), b. at Clerkenwell, London, England, Oct. 17, 1727, son of a wealthy distiller; educated at Hertford and Aylesbury schools and at the University of Leyden, where he acquired a taste for classical literature which he retained through life; travelled on the Continent; married in 1749 Miss Mead, a lady of fortune ten years his senior, from whom he was separated after the birth of one daughter; settled in Buckinghamshire; became colonel of the militia and high sheriff of that county; was elected to Parliament from Aylesbury 1757; commenced in June, 1762, the publication of a weekly paper, *The North Briton*, in opposition to the administration of Lord Bute; printed in his No. 45 (Apr. 23, 1763) a violent attack upon the king, which led to the issue of a "general warrant" for his arrest and the seizure of his papers; was committed to the Tower Apr. 30, but was soon released by order of Chief-Justice Pratt of the common pleas, who decided that general warrants were "unconstitutional, illegal, and also absolutely void." The House of Commons, however, declared No. 45 of the *North Briton* to be a "seditious libel," caused it to be burned by the hangman Nov., 1763, notwithstanding a popular commotion, and passed a special law for the prosecution of its author. Wilkes meanwhile won a suit against the under-secretary of state for seizure of his papers, being awarded £1000 damages, but was expelled from the House of Commons Jan. 19, 1764; was prosecuted at the instance of the House of Peers before Lord Mansfield on the charge of republishing No. 45, and also for printing and publishing an obscene poem called *An Essay on Woman*, and was found guilty of both charges by the court of king's bench Feb. 21, 1764, when, having previously fled to France, he was outlawed; returned to England in 1768; was chosen to Parliament for the county of Middlesex (including the city of London); surrendered himself to the court of king's bench; was rearrested, rescued by the mob, but went voluntarily into confinement; was the occasion, on the meeting of Parliament, of a riot in St. George's Fields May 10, 1768, in which several lives were lost, and was sentenced for his former offence to pay £1000 fine and to imprisonment for twenty-two months. His outlawry was reversed by Lord Mansfield, but he was expelled from the House of Commons for the new offence of libelling Lord Weymouth, but was returned without opposition at the new election. Though declared by Parliament incapable of a seat, he was three times chosen by his constituency, until, on the ground of illegality of votes cast for him, an opponent who had received but few votes was declared elected. These events caused great commotion in England; Wilkes became the idol of the people at large, being considered a martyr to the cause of liberty, received costly presents, extricated himself from bankruptcy by the aid of a subscription of £20,000, and was awarded £4000 damages from Lord Hardwick for false imprisonment (Nov., 1769). In Apr., 1770, he was set at liberty, was chosen alderman of London, and took his seat in Parliament, where a vain attempt was made to force him to appear at the bar in the capacity of alderman. He was elected sheriff of London 1771, lord mayor 1774, in which year he was re-elected to Parliament; had the resolutions of the House on the elections expunged May, 1782, and was chamberlain of London from 1779 to his death, in that city Dec. 27, 1797. He published many

political speeches and pamphlets, including a correspondence with "Junius," edited *Catullus* (1788) and *Theophrastus* (1790), and left a large *Correspondence*, which was edited by Almon, with a *Memoir* (5 vols., 1805). Among his numerous biographies, the latest and best are those of J. S. Watson (1870) and W. F. Rae (1870).

PORTER C. BLISS.

**Wilkes'barre,** city and tp., cap. of Luzerne co., Pa., in the beautiful valley of Wyoming, on the E. bank of the N. branch of Susquehanna River, near the 41st parallel. It is connected with the W. bank of the river by a fine double-track bridge. The township was surveyed under a Connecticut claim in 1770, and named after John Wilkes and Col. Isaac Barré for their efforts as members of the British Parliament in the cause of liberty. The town in 1772 contained four white women; incorporated a borough under Pennsylvania in 1806; has 13 banks, 3 national, 4 savings, with others incorporated or private for deposits and discount under State laws; 23 churches and chapels, some of them very fine buildings; 3 large iron-foundries and machine-shops, engaged in supplying the mining operations of the Wyoming coal-field, of which it is the centre; 3 large school buildings of creditable architecture, and an historical and geological society having a fine collection of coins and natural curiosities. The last appraisement shows 260 mercantile establishments. Incorporated by act of assembly as a city May 4, 1871, it is lighted with gas and is supplied with pure mountain-water by two companies. Kingston and Plymouth on the W. side of the river are populous boroughs, and several boroughs on the E. side, all properly suburbs of the city, swelling the population of which it is the centre by many thousands. Twelve million tons of coal are taken to market annually from the county. Lehigh and Susquehanna and Lehigh Valley R. Rs. afford direct facilities for communication N. and S. by connection with Philadelphia and New York at Allentown, Bethlehem, and Easton on the Lehigh, and N. to the lakes and St. Lawrence by Erie, Albany and Susquehanna, and other roads. North Branch Canal affords water-communication S., and Lackawanna and Bloomsburg R. R. runs through Kingston and Plymouth N. and S. on the W. side from Scranton to Northumberland, where it connects with Northern Central road. Two horse railroads connect it with neighboring towns. A paid fire department has two steam-engines with hose-carriages and other engines. One daily paper and 2 English and 2 German weekly papers are published here. A driving-park with half-mile track has regular races. P. of city, 10,174; of tp., exclusive of city, 7090. The population of the city is now (1876) over 20,000.

W. P. MINER, ED. "RECORD OF THE TIMES."

**Wilkes'boro',** p.-v. and tp., cap. of Wilkes co., N. C. P. 1300.

**Wilkes'ville,** p.-v. and tp., Vinton co., O. P. 1472.

**Wil'kie** (Sir DAVID), b. at Cults, Fifeshire, Scotland, Nov. 18, 1785; studied painting in the Trustees' Academy, Edinburgh, and at the Royal Academy, London, where in 1806 he exhibited his celebrated *Village Politicians*, quickly followed by *The Blind Fiddler* (1807), *The Card-Players* (1808), *Rent Day* (1809), and *Village Festival* (1811), which obtained him great popularity; was chosen an associate of the Royal Academy 1809, and an academician 1811; visited Paris with Haydon 1814; produced during the ensuing twelve years many notable pictures, including a group of *Sir Walter Scott and his Family* (1817), the *Chelsea Pensioners reading the Gazette of the Battle of Waterloo* (1822), executed for the duke of Wellington; spent three years (1825–28) on the Continent on account of ill-health, visiting Italy and Spain; was made painter in ordinary to George IV. Jan., 1830; was knighted by William IV. 1836; made portraits of those sovereigns and of Queen Victoria; executed a fine painting of the *First Council of Queen Victoria;* went to Constantinople for the express purpose of painting a portrait of the sultan 1840; visited Palestine and Egypt. D. at sea near Gibraltar on his homeward voyage, June 1, 1841. Several volumes of engravings of his best works have been issued, including *Oriental Sketches* (1843), *The Wilkie Gallery* (1850), and *The Great Works of Sir David Wilkie* (1867), with a *Memoir* by Mrs. C. Heaton. His *Life, Journals, and Correspondence* (3 vols., 1843) were published by his friend, Allan Cunningham.

**Wilkie** (WILLIAM), D. D., b. at Dalmeny, West Lothian, Scotland, Oct. 5, 1721; educated at the University of Edinburgh; became a successful farmer; was ordained minister of the Scottish Kirk at Ratho 1753, and became professor of natural philosophy in the University of St. Andrew's 1759. D. Oct. 10, 1772. Author of *The Epigoniad, a Poem in Nine Books* (1757; 2d ed. 1759), an epic upon the taking of Thebes, which procured for its author the title of the "Scottish Homer," and a volume of *Fables* (1768) after the manner of Gay.

**Wil'kin,** county of W. Minnesota, separated from Dakota by Bois de Sioux and Red rivers, and traversed by St. Paul and Pacific R. R.; surface uneven, soil generally fertile. Cap. Breckenridge. Area, 900 sq. m. P. 295.

**Wil'kins,** tp., Allegheny co., Pa. P. 3455.

**Wilkins** (Sir CHARLES), D. C. L., F. R. S., b. at Frome, Somersetshire, England, in 1749; went to Bengal in the civil service 1770; resided in India sixteen years, during which time he acquired a knowledge not only of Bengali, Arabic, and Persian, but also of Sanskrit, which language he was the first to make known to European scholars; made with his own hands the matrices of the first Bengali and Persian types employed in Bengal, with which he printed at Hoogly, N. B. Halhed's *Grammar of the Bengal Language* (1778); founded, in conjunction with Sir William Jones, the Literary Society of Calcutta, which subsequently became the Royal Asiatic Society of Calcutta; published a translation from the Sanskrit of *The Bhagvat Geta, or Dialogues of Kreeshna and Arjoon* (London, 1785; reprinted New York, 1867), to which Warren Hastings prefixed *Introductory Observations;* returned to England 1785, but continued his Oriental studies; became librarian of the East India Company 1801, and visitor of the company's colleges at Haileybury and Addiscombe; was made a knight of the Guelphic order 1823; chosen a member of the French Institute, and honored as the "father of Sanskrit literature." D. in London May 13, 1836. He edited Richardson's *Arabic and Persian Dictionary* (2 vols., 1806–10), published translations of the *Hitopadesa* (Bath, 1787), *The Story of Dooshwanta and Sakoontala* (1795), and was author of a *Grammar of the Sanskrita Language* (1808) and a treatise on *The Radicals of the Sanskrita Language* (1815).

**Wilkins** (DAVID), D. D., b. in Switzerland in 1685; studied theology; became keeper of the archiepiscopal library at Lambeth Palace 1715; drew up a catalogue of all the MSS. and printed books in that collection; became rector of Mongham Parva, Kent, 1716, of Great Chart, Kent, and Hadleigh, Essex, 1719, subsequently of Monks-Ely and of Bocking; prebendary of Canterbury 1720, and archdeacon of Suffolk 1724. D. Sept. 6, 1745. He published editions of the Pentateuch (1731) and of the New Testament in Coptic (1716); edited the *Leges Anglo-Saxonicæ* (1721), the *Works* of Selden (1726), and the *Concilia Magnæ Britanniæ et Hiberniæ* (4 vols. folio, 1736–37). He is also considered the author of a work published in the name of "J. Chamberlayne," *Oratio Dominica in diversas omnium fere Gentium Linguas versa, etc.* (Amsterdam, 1715), being the first attempt to present the *Pater-Noster* in many languages for philological purposes.

**Wilkins** (HENRY MUSGRAVE), b. in England about 1822; graduated at, and became fellow of, Merton College, Oxford, and took orders in the Church of England. Author of *Notes for Latin Lyrics* (1851), *Progressive Greek Delectus* (1859), *Progressive Latin Delectus* (1867), *Progressive Greek Anthology* (1861), *Progressive Latin Anthology* (1864), *Scriptores Attici* (1866), *Speeches from Thucydides* (1870), and other valuable classical textbooks.

**Wilkins** (JOHN), D. D., b. in 1614 at Fawsley, Northamptonshire, England, at the house of his maternal grandfather, the Puritan divine John Dod, "the Decalogist;" educated at New Inn and Magdalen halls, Oxford, graduating at the latter about 1632; took orders in the Church of England 1635; was successively chaplain to Lord Say and Sele, Lord Berkeley, and Charles, count-palatine of the Rhine; was a zealous adherent of Parliament during the great rebellion, and took the Solemn League and Covenant; was chiefly instrumental in forming at London in 1645 the club of scientists which became the nucleus of the Royal Society; became warden of Wadham College Apr. 13, 1648; married the widow of Dr. French, a sister of the Protector, Oliver Cromwell, 1656; was appointed by Richard Cromwell master of Trinity College, Cambridge, 1659; was ejected at the Restoration 1660; became prebendary of York 1660; obtained the favor of Charles II., who made him rector of St. Lawrence, Jewry, London, 1662; became preacher to Gray's Inn; was one of the charter members and councillors of the Royal Society 1663, and became bishop of Chester 1668. He was the inventor of the perambulator or measuring-wheel; was an excellent mathematician and physicist, a skilful mechanician, untiring in his experiments, a philologist of great erudition, and a noted theologian and pulpit-orator. D. in London Nov. 19, 1672. Author of *Discovery of a New World* (1638), treating of the habitableness of the moon and the possibility of a passage thither; *Mercury, or the Secret and Swift Messenger, showing how a Man may with Privacy and Speed communicate his Thoughts to a Friend at any*

*Distance* (1641); *Mathematical Magick, or the Wonders that may be performed by Mechanical Geometry* (1641); *An Essay towards a Real Character and a Philosophical Language, with an Alphabetical Dictionary* (folio, 1668), an ambitious and ingenious attempt to form a universal language; *Ecclesiastes, or a Discourse concerning the Gift of Preaching as it falls under the Rules of Art* (1646), and of various other religious treatises. His *Mathematical and Philosophical Works* were published collectively (1708; new ed., 2 vols., 1802), with a *Life of the Author and an Account of his Works;* and Archbishop Tillotson, his literary executor, who married his step-daughter, edited a posthumous volume of *Sermons* (1675) and a treatise on *The Principles and Duties of Natural Religion* (1675), which was many times reprinted. PORTER C. BLISS.

**Wilkins** (Ross), b. in Pennsylvania about 1805; became a lawyer; was appointed by Pres. Jackson a Federal judge for the Territory of Michigan; became in 1837 a regent of the State university; presided over the first war-meeting held in Detroit in 1861, and was many years a circuit judge, resigning that post in 1870.

**Wilkins** (WILLIAM), R. A., F. S. A., b. at Norwich, England, Aug. 31, 1778; graduated at Caius and Gonville College, Cambridge, 1800; became a fellow there 1805; devoted himself to the study of classic architecture; became architect to the East India Company and professor of architecture at the Royal Academy 1837. He designed the University Club House, St. George's Hospital, the London University 1827, the National Gallery, London, 1832–38, Corpus Christi and Downing colleges, Cambridge, the Nelson pillars at Dublin and Great Yarmouth, the additions to Trinity and King's colleges, Cambridge, and several other important public buildings; contributed to the *Archæologia;* translated *The Civil Architecture of Vitruvius* (2 parts, 1812–17); edited several works for the Dilettanti Society, and restored the mutilated Greek inscriptions on public edifices at Athens with great learning and ingenuity. D. at Cambridge Aug. 31, 1839. Among his works were—*The Antiquities of Magna Græcia* (1807), *Atheniensia, or Remarks on the Topography and Buildings of Athens* (1816), and *Prolusiones Architectonicæ, or Essays on Greek and Roman Architecture* (part i., 1837).

**Wilkins** (WILLIAM), b. in Eastern Pennsylvania in 1779, son of Gen. John (1762–1814), a Revolutionary officer and early settler at Pittsburg; received a good education; became in 1810 president of the Pittsburg Manufacturing Company, subsequently transformed into the Bank of Pittsburg; was elected in 1819 to the legislature, where he became noted for knowledge of business details and for skill in debate; was U. S. Senator 1831–34, minister to Russia 1834–36, member of Congress 1843–44, secretary of war under Pres. Tyler 1844–45; was co-founder (with Thomas Bakewell and John Harper) of the Western Pennsylvania Hospital 1847, and was subsequently judge of the U. S. district court for Western Pennsylvania. D. at Homewood, near Pittsburg, June 23, 1865.

**Wil'kinsburg,** p.-v., Allegheny co., Pa.

**Wil'kinson,** county of Central Georgia, lying on Oconee River, drained by its affluents, and traversed by Georgia Central and Milledgeville and Eatonton R. Rs.; surface undulating, partially wooded, with chalybeate and sulphur springs; soil moderately fertile. Swine and cattle are the chief live-stock. Staples, cotton and Indian corn. Cap. Irwinton. Area, 430 sq. m. P. 9383.

**Wilkinson,** county of S. W. Mississippi, bordering on Louisiana, bounded W. by Mississippi River and intersected by West Feliciana R. R. Cattle and swine are the chief live-stock. Staples, cotton and Indian corn. Cap. Woodville. Area, 580 sq. m. P. 12,705.

**Wilkinson,** tp., Desha co., Ark. P. 569.

**Wilkinson** (JAMES), b. in Maryland in 1757; studied medicine in Philadelphia, but after the battle of Bunker Hill repaired to Cambridge, and was soon appointed a captain in Reed's New Hampshire regiment, serving as such with Arnold in the Northern army; promoted brigade-major July, 1776, and lieutenant-colonel Jan. 12, 1777; bearer of despatches to Gen. Washington from Gen. Gates Dec., 1776, he participated in the battles of Trenton and Princeton. Upon Gates's accession to command of the Northern army, Wilkinson was made his adjutant-general May, 1777, and upon the surrender of Burgoyne he conveyed the official despatches to Congress. Brevetted brigadier-general in November, he was in Jan., 1778, appointed secretary of the board of war, of which Gates was president. A quarrel arising with the latter at the time of the Conway cabal, Wilkinson resigned his secretaryship, and in July, 1779, was appointed clothier-general of the army. Settled in Kentucky after the peace, and engaged in mercantile affairs. Appointed lieutenant-colonel 2d Infantry Nov., 1791, and conducted an expedition against the Wabash Indians 1791–92; promoted to be brigadier-general Mar., 1792, and commanded right wing of Wayne's army at Maumee Rapids, and in Dec., 1796, became general-in-chief of the army, serving on the Western frontier; one of the commissioners to receive Louisiana from the French in 1803, he was governor of that Territory 1805–06; ordered to command on the Mississippi Dec., 1808, he was recalled to Washington in 1810, and tried by court-martial in 1811 on charges of corruptly receiving money from Spain and being in complicity with Aaron Burr. The court acquitted him with credit, and he returned to the Southern department. In 1813 he was appointed major-general, and transferred to the Northern frontier. Owing to the failure of Hampton to co-operate with him, his plans for the occupation of Canada totally failed. He was superseded in command, and a court of inquiry ordered in 1815, which acquitted him of all blame. On the reorganization of the army in 1815, he was discharged, and passed the later years of his life upon his estates in Mexico. In 1816 he published *Memoirs of My Own Times* (3 vols. 8vo, 1800). D. near City of Mexico Dec. 28, 1825.

**Wilkinson** (JEMIMA), b. at Cumberland, R. I., about 1753; educated as a Quaker; recovered from a severe fever, attended by an apparent suspension of life, 1773, after which she asserted that she had been raised from the dead to instruct mankind, professed to work miracles, and made a few proselytes, with whom she settled on a tract of land in the present town of Torrey, Yates co., N. Y., where a village named Jerusalem was built, and resided there until her death, July 1, 1819. At her death the sect was entirely broken up.

**Wilkinson** (Sir JOHN GARDNER), D. C. L., F. R. S., b. at Haxendale, Westmoreland, England, Oct. 5, 1797, son of Rev. John Wilkinson by a daughter of Rev. Richard Gardner; educated at Harrow School and at Exeter College, Oxford; resided twelve years in Egypt, engaged in a careful study of the ancient history, geography, ethnography, and architectural remains of that country, making by his publications important additions to the existing knowledge, for which he was knighted 1839; travelled extensively in Europe; revisited Egypt 1855–56; presented his collections of Egyptian, Greek, and other antiquities to Harrow School for the purpose of forming a museum, to which he added in 1874 his valuable collection of coins and medals, and was an influential member and officer of the leading British scientific associations. D. Oct. 29, 1875. Author of *Materia Hieroglyphica* (Malta, 1828), *The Topography of Thebes and General View of Egypt* (1835), *The Manners and Customs of the Ancient Egyptians* (2 series, 6 vols., 1837–41; 3d ed., 5 vols., 1847), *Modern Egypt and Thebes* (2 vols., 1843), republished as Murray's *Handbook for Travellers in Egypt* (1847; new ed. 1857), *Dalmatia and Montenegro* (2 vols., 1848), *The Architecture of Ancient Egypt* (1850), *The Fragments of the Hieratic Papyrus at Turin* (1851), *The Egyptians in the Time of the Pharaohs* (1857), a treatise *On Colour* (1857); prepared an abridgment of his chief work as *A Popular Account of the Ancient Egyptians* (2 vols., 1853), and contributed a dissertation on Egypt to Prof. George Rawlinson's translation of *Herodotus* (4 vols., 1858–60; 3d ed., revised, 1876). A new edition of his *Manners and Customs* was prepared by Dr. Samuel Birch (1876), and a *Memoir* (1876) has been written by his widow.

PORTER C. BLISS.

**Wilkinson** (JOHN JAMES GARTH), M. D., b. in London in 1812; became a homœopathic physician, and has published *Swedenborg, a Biography* (1849), *The Human Body, and its Connection with Man* (1851), *The Ministry of Health* (1857), *Improvisations from the Spirit* (1857), and *Methods of Human Science and of Divine Revelation* (1876), and translated from the Latin several of the scientific works of Swedenborg.

**Wilkinson** (MORTON S.), b. at Skaneateles, N.Y., Jan. 22, 1819; received an academical education; settled in Illinois 1837; returned to Skaneateles to study law 1839; settled at Eaton Rapids, Mich.; went to Minnesota Territory 1847; was elected to the legislature 1849, and drew up the code of laws then enacted; was a Republican U. S. Senator 1859–65, a delegate to the Baltimore convention of 1864, and to the Loyalists' convention of 1866, and a member of Congress 1869–71, serving on the committees on foreign affairs and on the census.

**Wilks** (MARK), b. in England about 1765; was appointed a cadet in the East India service 1782; rose to the rank of lieutenant-colonel 1808, and brevet colonel 1814; was political resident at Mysore 1803–08; was governor of St. Helena 1812–16, embracing the first year of Napoleon's captivity in that island, and was placed on the retired list 1818. D. in England Sept. 19, 1831. Author of *A Report on the Interior Administration of the Government*

*of Mysoor* (1805) and *Historical Sketches of the South of India in an Attempt to Trace the History of Mysoor, etc.* (London, 3 vols. 4to, 1810–17).

**Wilks** (WASHINGTON), grandson of Mark, b. in England in 1826; became a Liberal journalist and politician in London; was co-editor of the *Morning Star;* published *The Half Century, its History, Political and Social* (1852), *Turk, Greek, and Russian—their Past, Present, and Probable Future* (1853), *Edward Irving, a Biography* (1854), and *The Three Archbishops of Canterbury, Lanfranc, Anselm, A Becket* (1858). D. suddenly of apoplexy while addressing a meeting on parliamentary reform at London June 27, 1864.

**Will** is one of the three forms under which the human mind becomes conscious of itself, thought and feeling being the two others. From its lowest phase, as an entirely unconscious correlation between action and reaction—as, for instance, when the hand is involuntarily moved back when touching something very hot—to its highest phase as the pursuit of an aim exclusively for its moral worth and regardless of its relations to the natural individual, the will runs through a great number of stages, appearing first as instinct, impulse, appetite, passion, etc., before it submits to the government of the moral ideas, and thereby enters into the sphere of freedom; and its definition varies according to the stages in which it is considered. In modern times Schopenhauer has made it the fundamental element of all existence, and his observations, though sometimes mystical and sometimes materialistic in their tendencies, have thrown much new light on all questions relating to the will.

**Will** (in law). The testament of the Roman law consisted essentially in the naming of an heir or heirs, who succeeded, as representatives of the defunct, to his entire inheritance, including not only his property, but his liabilities; while the legacies, if any, were in the nature of charges upon the succession, to be paid by the heir. It was a fundamental principle of that jurisprudence that no person (except a military man in active service, in whose favor many rules were relaxed) could die partly testate and partly intestate. This doctrine was first modified by Justinian in one of the *Novels* issued after the great codification which bears his name. (See TESTAMENT.) The will of the American and English law is radically different in its conception, form, and effect from the Roman testament. The recipients of the testator's bounty under it are not thereby his heirs; they do not succeed to his entire inheritance as such, but to such specific gifts or separate amounts as he bestows upon them individually; they do not become liable for his debts, but the personal estate devolves primarily upon the executor, who by its means discharges all the outstanding claims, and if it is not sufficient, recourse is had to the real estate; the legatees of personal property derive their title not directly from the deceased, but from the executor, while the devisees of lands take immediately under the will; finally, the will need not embrace all of the testator's estate, but he may die partly testate and partly intestate. Anciently, in England, "testament" was sometimes said to be a gift of personal property alone, and to require the appointment of an executor, while "will" was properly confined to a devise of lands; these distinctions, however, have long disappeared, and even statutes have enacted that the two words should be synonymous. A will may therefore be defined as the disposition in whole or in part of the testator's estate, real and personal, executed in the manner and form required by the law during his lifetime, but taking effect only at his death. Every will is "ambulatory" as long as the testator lives; that is, it is an inchoate act, remaining under his complete control; he may change or annul it at any time if he retains a disposing faculty of mind. Strictly speaking, "devise" refers to land, "legacy" to personal property, while "give," "bequeath," and "bequest" are applied indiscriminately to both. But the accurate use of these words is not necessary, and the will will be perfectly valid if the intent of the testator can be ascertained from his language. For example, a "devise of $1000" or "a legacy of" a certain farm, though improper expressions, could leave no doubt as to the meaning.

*What may be given by Will.*—From the most remote periods of the English law, personal property could be bequeathed. The customs and doctrines of feudalism long prevented lands from being devisable. After the introduction of uses, those peculiar estates could be bequeathed (see USE); at length the statute of wills (32 Hen. VIII. ch. 1, and 34 and 35 Hen. VIII. ch. 5) removed nearly all the existing restrictions, and rendered lands devisable as a general rule. By virtue of the existing legislation all property, real and personal, with a few special exceptions, may be disposed of by will to whatever persons or recipients of his bounty the testator chooses. The most important of these exceptions are those created by the statutes of mortmain, which prohibit a gift of lands to corporations unless they are expressly empowered by statute to receive devises—those created by statutes in England and in many of the American States, which in various forms and with much diversity of detail limit the power of testators in respect to the time and amount of their testamentary gifts to religious or charitable institutions and for distinctly religious or charitable purposes; and that—by far the most important one in the U. S.—which prevents a husband from depriving his widow of her dower or its equivalent.

*In whose favor Wills may be made.*—Beyond the excepted classes last enumerated, the law places no limitation upon the capacity to receive testamentary gifts. Wills may be made in favor of, and property real and personal may be bequeathed to, all persons, whatever may be their disabilities to perform any positive act which shall be legally binding, including married women, infants, lunatics, idiots, persons of unsound mind, and the like, as well as all those in the full possession of their mental faculties and in the enjoyment of all the legal rights belonging to manhood.

*By whom Wills may be made.*—As a general proposition, all persons are empowered to make a valid will except those disqualified through lack of the requisite age, through coverture, or through mental incapacity. (1) *Age.*—The statutory rule is almost universal that a person must have attained the age of twenty-one years before he or she can make a will of lands, and the same age is frequently, and perhaps generally, required for a will solely of personal property. In New York males of eighteen and females of sixteen are competent to bequeath personal estate. In Connecticut, California, and Nevada both males and females, and in Vermont, Maryland, and Illinois the females, acquire the full testamentary capacity in respect of lands as well as chattels at the age of eighteen. (For the peculiar rule of the law concerning the precise time when a person actually reaches any given age, as twenty-one, eighteen, or sixteen, consult the article YEAR AND A DAY.) (2) *Married Women.*—The ancient law denied to married women any testamentary power over lands, and admitted only a partial authority in the bequest of personal estate. The recent legislation in the U. S. has to a very great extent removed these restrictions, and has clothed married women with the same power to devise and bequeath their separate property as that held by single women. (See MARRIAGE AND MARRIED WOMEN.) (3) *Mental Incapacity.*—It is a fundamental doctrine that a sufficient mental capacity in the testator—that is, sound and disposing mind and memory—is essential to the validity of any will. This rule excludes idiots, lunatics—unless the instrument is executed during a lucid interval—persons completely intoxicated at the time of the execution, and persons of unsound or weak mind to such a degree that they are unable without assistance to call up to their memory the property which they possess or the individuals who would naturally be the recipients of their bounty, or to comprehend without prompting the nature of the act in which they are engaged while making a testamentary disposition. It is almost impossible to form an accurate and comprehensive definition which shall embrace all the instances of mere mental unsoundness, and each case must to a considerable extent depend upon its own circumstances. A will is also invalid when procured by fraud, or by undue influence exerted upon a testator of enfeebled mind and memory, even though he might possess a sufficient testamentary capacity if left to exercise his own judgment unforced by the external pressure.

*The Form and Execution of Wills.*—The existing legislation, both in the U. S. and in England, concerning the form and execution of wills is constructed upon the same model, applies alike to those of real and of personal property, and differs only in minor points of detail. All wills, except in the single case to be mentioned hereafter, must be in writing. The following formalities must be observed in order that the execution—the *factum*—may be complete: (1) The instrument must be subscribed or signed at the end by the testator, or by some one in his presence and by his direction. In some of the States the statutory language still remains "signed," and this, it has been decided, is complied with wherever in the instrument the signature appears, even at the commencement. (2) The signature must either be affixed, or must be acknowledged by the testator to be his own, in the presence of each of the witnesses. (3) The testator must declare the instrument to be his last will in the presence of each of the witnesses. This step, which is technically termed the "publication," is of the utmost importance, and was borrowed directly from the Roman mode of execution. (4) There must be a certain number of witnesses, who act as such in all that they do at the request of the testator, which request may

be made by him personally or by some one in his presence. In most of the States the required number is two, but in some it is three. (5) These witnesses must all sign the will at the end thereof in the presence of the testator; some of the statutes add that this signing must also be in the presence of each other. If the testator's name is written by an amanuensis, it is often required that he should be one of the attesting witnesses. While all these five steps are necessary to the validity of a will, a substantial compliance is sufficient. A *codicil* is an appendix annexed to the main will after its execution, whereby the testator makes some change in or addition to his former dispositions, and it must be signed, published, and attested in the same manner as the original. Verbal or *nuncupative* wills are, by the existing legislation in England and in a great majority of the American States, permitted to be made only by soldiers in active service during war and by sailors while at sea; in a very few States, however, the privilege is extended to all persons *in extremis* in respect to a limited amount of property. The statutes authorizing nuncupative wills contain various provisions intended to prevent imposition or mistake, by requiring a certain number of witnesses, and frequently that the testator's declaration should be reduced to writing and attested within a short time after his death —generally thirty days—and that the will itself must be offered for probate before the expiration of a limited period from its execution, often fixed at six months.

*Revocation.*—The revocation of a will may be express or implied. (1) *Express.*—As the statutory law requires that the intent of the testator in the execution shall be manifested by a compliance with certain fixed formalities, so it demands that the contrary act shall be done in a manner which leaves no doubt as to his real purpose. An express revocation may be effected by a subsequent will, which in plain and absolute terms annuls any and all former ones, or which, without such formal clause, disposes of all the estate in manner inconsistent with the prior bequests. It may also be made by the destruction or cancellation of the instrument, if done by the testator himself or under his direction with the intent thereby to revoke—*animo revocandi*. The statutes often enumerate the modes, as burning, tearing, obliterating, cancelling, and destroying. (2) *Implied.*—An implied revocation is wrought by the subsequent marriage of the testator and the birth of children, or by either. A will made by a single woman is annulled by her marriage. In the greater number of the American States the will of a man is revoked by his subsequent marriage and the birth of children for whom it makes no provision. In England and in a portion of the States the same effect is produced by the marriage alone. In a very few States the implied revocation results from the subsequent birth of a child or children who are left unprovided for by the testator. As a general rule, however, such children receive the portions to which they would have been entitled had their father died intestate, and the will stands, subject to the necessary deduction from its bequests. (For the rules concerning the construction and interpretation of wills, see the article on INTERPRETATION. In connection with the general subject of wills the reader may also consult the articles on PROBATE, SUCCESSION, EXECUTOR, LEGACY.) JOHN NORTON POMEROY.

**Will,** county of N. E. Illinois, bordering on Indiana, intersected by Des Plaines and Kankakee rivers, which unite near the S. W. border and form the Illinois, and traversed by Illinois and Michigan Canal, Illinois Central, Chicago and Alton, Chicago Rock Island and Pacific, and Chicago Danville and Vincennes R. Rs.; surface mostly level prairie-land, soil generally productive. There are flour-mills, planing-mills, tanneries, breweries, and manufactories of agricultural implements, carriages, saddlery, iron castings, machinery, bricks, and woollen goods. Live-stock, especially horses and cattle, very numerous. Staples, Indian corn, oats, hay, wool, and dairy products. Cap. Joliet. Area, 828 sq. m. P. 43,013.

**Will,** tp., Will co., Ill. P. 911.

**Willa'mette River,** a branch of the Columbia, rises in the Cascade Mountains in Oregon, and flows first N. W. and then N. through a beautiful region, extremely fertile and now well settled. It is navigable for ships to Portland, 15 miles. Twenty-five miles from its mouth are the Willamette Falls, at Oregon City. The river here falls 40 feet perpendicularly, but a canal and locks have been constructed at a cost of over $500,000, so that small steamboats for two-thirds of the year can pass from the mouth of the river to Eugene City, more than 130 miles. At Oregon City the river furnishes a noble water-power.

**Wil'lan** (ROBERT), M. D., F. S. A., b. at Hill, near Sedburgh, Yorkshire, England, Nov. 12, 1757; graduated in medicine at Edinburgh 1780; settled at Darlington, Yorkshire, 1781, and soon afterward at London, where he was physician of the Corey street Dispensary 1783–1803, and also physician of the Finsbury Dispensary, and was eminent as a specialist upon cutaneous diseases. D. at Madeira Apr. 7, 1812. Author of *The History of the Ministry of Jesus Christ, combined from the Narrative of it in the Four Evangelists* (1782), entitled in the 3d ed. *The United Gospel* (1806), and *The Description and Treatment of Cutaneous Diseases* (3 orders, 4 parts, 1798–1808), a work which was left unfinished, but was completed by his eminent pupil and successor, Dr. Thomas Bateman. Dr. Willan contributed to several medical journals, read several papers before the Antiquarian Society, and left valuable MSS., from which, and from his printed monographs, was prepared a volume of his *Miscellaneous Works* (1821), edited by Dr. Ashby Smith. A *Memoir* by Dr. Bateman was published in the Edinburgh *Surgical Journal.*

**Wil'lard** (CHARLES W.), b. at Lyndon, Vt., June 18, 1827; graduated at Dartmouth College 1851; was admitted to the bar at Montpelier 1853; was elected secretary of state 1855, and declined a re-election; was chosen State senator 1860; became editor of the *Green Mountain Freeman* 1861, and was a member of Congress 1869–73, serving on the committee of foreign affairs and as chairman of that on Revolutionary pensions.

**Willard** (EMMA C. **Hart**), b. in Worthington parish, Berlin, Conn., Feb. 23, 1787, descended on the paternal side from Rev. Thomas Hooker, the first minister of Hartford, and from Stephen Hart, the deacon of his church, was the youngest but one of a family of seventeen children; educated at the village academy; became a district school-teacher at the age of sixteen; taught a select school the following year; was at different times preceptress in academies at Berlin, Westfield, Mass., and Middlebury, Vt.; married Dr. John Willard at Middlebury, Vt., Aug., 1809; opened at that place a boarding-school for girls 1814; introduced several new studies and many improvements upon the ordinary methods of instruction; wrote *A Plan for improving Female Education* (1819), which was submitted in MS. to Gov. De Witt Clinton of New York; obtained his encouragement for her project, and by a special act a portion of the State fund for academies; opened a school under his patronage at Waterford, N. Y., 1819; removed the school to Troy, May, 1821, that town having tendered her a building; lost her husband 1825; wrote several school histories and other educational books; superintended the seminary with great success until 1838, when she resigned it to her son and his wife; visited Europe 1830; published on her return her *Journal and Letters from France and Great Britain* (1833), devoting the profits (about $1100) to the assistance of a school for women in Athens, Greece, which owed its origin to her; settled at Hartford, Conn., 1838; directed her energies for several years to the revision of her numerous school-books and to public labors in the cause of higher education, visiting the Western and Southern States and addressing teachers' conventions, being received by many of her former pupils with the utmost affection. D. at Troy Apr. 15, 1870. Among her numerous publications were—*A History of the U. S.* (1828), *Universal History* (1835), *Ancient Geography,* a volume of *Poems* (1830), *The Motive Powers which produce the Circulation of the Blood* (1846), *Respiration and its Effects* (1842), *Last Leaves of American History* (1849), and *Morals for the Young* (1857). A biography by John Lord, LL.D., was published in 1874. PORTER C. BLISS.

**Willard** (ERASTUS), b. at Lancaster, Mass., July 4, 1800; graduated at Waterville College, Me., about 1824; was for some years a teacher; studied theology at the Newton Seminary; was ordained pastor of a Baptist church at Grafton, Vt., Oct., 1833; went to France as a missionary teacher Aug., 1835; was eminently successful as an instructor of French candidates for the Protestant ministry; returned from France 1856; was missionary to the Ottawa Indians 1856–59, pastor of a church at Salem, N. Y., 1859–65, and subsequently settled at Newport, R. I., where he d. Dec. 30, 1871. He was an excellent Hebrew scholar, and familiar with the modern languages and literature of Europe.

**Willard** (FRANCES E.), b. near Rochester, N. Y., Sept. 28, 1839; graduated at the North-western Female College 1858; was a successful teacher in several Western towns; became directress of the Genesee Wesleyan Seminary at Lima, N. Y., 1867, and was chosen (Feb. 14, 1871) president of the Evanston College for ladies, established in connection with the North-western University. In 1869–71 she travelled in Europe, Egypt, and Palestine, and on her return delivered lectures at Chicago. Author of a biographical sketch of a deceased sister which appeared in a volume (1864), and has contributed to various periodicals.

**Willard** (GEORGE), b. at Bolton, Vt., Mar. 20, 1824; received a liberal education; removed to Michigan in early manhood; was two years professor in Kalamazoo College;

member of the board of education 1857–63; became regent of the university 1863; was a member of the State constitutional convention; a delegate to the national Republican convention of 1872; was for several years editor and proprietor of the Battle Creek *Journal*, and a member of Congress 1873–77.

**Willard** (John), b. in New York in 1792; became a prominent Democratic lawyer; was appointed by Gov. Marcy in 1836 judge and vice-chancellor of the 4th circuit court of New York, which post he filled until the adoption of the constitution of 1846; was a justice of the supreme court of New York 1847–55; was elected to the State senate by a unanimous vote 1861; served on the judiciary committee and prepared the act of 1862 restoring the death penalty and repealing all former statutes on that subject. D. at Saratoga Sept. 1, 1862.

**Willard** (John Dwight), LL.D., b. at Lancaster, Mass., Nov. 4, 1799; graduated at Dartmouth College 1819; was admitted to the New York bar about 1823; began practice at Troy, N. Y., 1826; was for some years editor of the Troy *Sentinel;* member of the State senate and judge of the circuit court of New York. D. at Troy Oct. 16, 1864. He left a legacy of $10,000 to Dartmouth College. Author of *A Treatise on Equity Jurisprudence* (Albany, 1855), *A Treatise on the Law of Executors, Administrators, and Guardians* (1859), and *A Treatise on the Law of Real Estate, and the Mode of Alienation thereof* (1861).

**Willard** (Joseph), D. D., LL.D., great-grandson of Pres. Samuel, b. at Biddeford, Me., Dec. 28, 1738; went to sea at an early age, and made several coasting-voyages; graduated at Harvard 1765; was tutor there 1766–72; became colleague pastor of the Congregational church at Beverly, Mass., Nov. 25, 1772, and was president of Harvard College from Dec. 19, 1781, until his death, at New Bedford, Mass., Sept. 25, 1804. He published several sermons, a Latin address on the death of Washington, prefixed to Rev. Dr. David Tappan's *Discourse* (1800); contributed mathematical and astronomical papers to the *Memoirs* of the American Academy and to the *Philosophical Transactions;* was a good Greek scholar, and left in MS. a Greek grammar.

**Willard** (Joseph), son of Pres. Joseph, b. at Cambridge, Mass., Mar. 14, 1798; studied at Phillips Academy; graduated at Harvard 1816; studied law at Amherst, N. H.; practised for some years at Waltham, and afterward at Lancaster, Mass.; settled at Boston about 1829; was corresponding secretary of the Massachusetts Historical Society 1829–64; became a master in chancery 1838; was appointed joint clerk of the courts of Suffolk co. (supreme and common pleas), which post he held until 1856, when, those offices becoming elective, he was chosen clerk of the superior court for five years; was re-elected for a like term 1861, and was for some years a trustee of the old Boston Library. Author of *Topographical and Historical Sketches of the Town of Lancaster* (Worcester, 1826), *The Willard Memoir, or Life and Times of Major Simon Willard, etc.* (1858), *An Address in Commemoration of the 200th Anniversary of the Incorporation of Lancaster* (1853), and of other addresses and pamphlets; edited Mrs. Rowlandson's *Narrative of Captivity, etc.* (5th ed., Lancaster, 1828); contributed to numerous historical and literary periodicals, and left incomplete a *Life* of Gen. Henry Knox.—His son, Sidney, b. at Lancaster Feb. 3, 1831, graduated at Harvard 1852; was noted at college as an oarsman, and subsequently for skill in athletic sports, on which subject he wrote for the *Atlantic Monthly;* became a lawyer at Boston; served in the civil war as major of the 35th Massachusetts regiment, and was killed at Fredericksburg, Va., Dec. 13, 1862.

**Willard** (Samuel), son of Major Simon, b. at Concord, Mass., Jan. 31, 1640; graduated at Harvard 1659; studied divinity; was minister of Groton from 1663 until driven away during King Philip's war, 1676; became colleague pastor with Rev. Thomas Thacher over the Old South church, Boston, Apr. 10, 1678; succeeded to the pastorate in the same year; opposed the witchcraft delusion of 1692, and was vice-president (exercising full powers as president) of Harvard College, as successor to Pres. Mather, from 1701 until his death, at Boston Sept. 12, 1707. He was twice married and had twenty children; author of *A Complete Body of Divinity* (1726), posthumously published in a folio volume under the editorship of Joseph Sewall and Thomas Prince, and of various minor religious treatises.

**Willard** (Samuel), D. D., nephew of Pres. Joseph, b. at Petersham, Mass., Apr. 19, 1776; graduated at Harvard 1803; was tutor in Bowdoin College 1804–05, and pastor of the Congregational church at Deerfield, Mass., from Sept. 3, 1807, to Sept., 1829, when he resigned on account of total loss of sight. D. at Deerfield Oct. 8, 1859. Author of *The Deerfield Collection of Sacred Music* (1808), *Original Hymns* (1823), *An Index to the Bible* (1826), *An Improved Reader* (1827), *The General Class-Book* (1828), *Sacred Poetry and Music Reconciled, a Collection of Hymns* (1830), *An Introduction to the Latin Language* (1835), and other works, some being anonymous schoolbooks, and left other works in MS.

**Willard** (Sidney), son of Pres. Joseph, b. at Beverly, Mass., Sept. 19, 1780; graduated at Harvard 1798; was librarian there 1800–05; studied theology, and sometimes preached, though he never held a pastoral charge; was a member of the famous Anthology Club; was Hancock professor of Hebrew and Oriental languages at Harvard 1807–31, filling also the chair of English literature, and for some years that of Latin; was frequently a member of the Massachusetts legislature, and once of the executive council, and was mayor of Cambridge 1848–50. Author of a *Hebrew Grammar* (1817), *Memories of Youth and Manhood* (2 vols., 1855); was one of the founders of and a contributor to the *Literary Miscellany;* also founder and editor of the *American Monthly Review* (4 vols., 1832–33); wrote largely for the *Monthly Anthology*, the *North American Review* (18 papers, 1816 *seq.*), the *General Repository*, and the *Christian Examiner*.

**Willard** (Simon), b. in Kent, England, in Apr., 1605; came to Massachusetts in 1634; was one of the chief founders of Concord; afterward lived in Lancaster, Groton, and Salem; held various civil offices; was major of militia during King Philip's war; became a magistrate, and d. at Charlestown, where he was holding a court, Apr. 24, 1676. He was ancestor of most of the name in the U. S. (See the *Willard Memoir* (1858), by his descendant, Joseph Willard.)

**Willard** (Simon), b. at Roxbury, Mass., Jan. 9, 1795; graduated at the U. S. Military Academy Mar. 2, 1815; promoted to the army as third lieutenant of ordnance, and ordered to the Pittsburg arsenal, crossing the Alleghany Mountains on foot; resigned May 1, 1816. After an unsuccessful business career of seven years, he entered his father's clockmaking establishment, but at the end of two years apprenticed himself to Mr. D. Eggert, an ingenious mechanician in New York, to learn the watchmaking and chronometer business. He soon became expert, and in 1828 returned to Boston, where he embarked in business for himself, and for forty-two years occupied the premises where he commenced business, during which time he attained a very distinguished reputation in his profession and acquired a handsome fortune. At the outset of his later venture in Boston he constructed an astronomical clock that was for forty years the standard of time for that section. D. at Boston Aug. 24, 1874.

**Willard** (Sylvester D.), M. D., b. at Wilton, Conn., in 1825; graduated at the Albany Medical College 1848; became a distinguished physician at Albany, an active member and officer of the State and county medical societies, and contributed to medical periodicals. Author of *Biographical Memoirs of Physicians of Albany Co.* (1857), *Annals of the Medical Society of Albany 1800–51* (1864), and other works.

**Willcox** (Orlando Bolivar), b. at Detroit, Mich., Apr. 16, 1823; graduated at the U. S. Military Academy, and appointed second lieutenant of artillery July, 1847; served in garrison and on frontier duty until 1857, when he resigned and commenced the practice of law at Detroit. On the outbreak of war in 1861 he took command of the 1st Michigan Vols., which he led at Bull Run, where wounded, taken prisoner, and not released until Aug., 1862. His commission of brigadier-general of volunteers was dated from the day of his capture, and at South Mountain and Antietam he commanded a division of the 9th corps, and at Fredericksburg was in command of that corps. During the riots arising from the enforcement of the draft in Indiana in 1863, Gen. Willcox was placed in command there; was engaged in East Tennessee from Sept., 1863, until Mar., 1864, when transferred to the Army of the Potomac, and in the Richmond campaign of that year commanded a division of the 9th corps, through the Wilderness battles to Petersburg, participating in the capture of that city; subsequently commanded various military districts until Jan., 1866, when mustered out. Resuming his profession at Detroit, he was also U. S. assessor of internal revenue until July, 1866, when reappointed into the army as colonel of the 29th Infantry; transferred to the 12th Infantry in 1869. Brevet brigadier and major general for gallantry at Spottsylvania and capture of Petersburg.

**Willehad,** or **Wilhead** (Saint), b. in Northumbria, England, early in the eighth century; was educated at York; became a priest; went as a missionary to the pagans of Friesland shortly after the martyrdom of (Saint) Boni-

face; was supported by Pope Adrian I. and by Charlemagne; became bishop of "Wigmodia" (afterward Bremen) 787; built there a noble cathedral, and had great success in the conversion of both Frieslanders and Saxons. D. in 789. He was canonized in the Roman Catholic Church, his festival being Nov. 8. Author of a *Commentary on the Epistles of Paul* and of several works still in MSS.

**Wil'lement** (Thomas), b. in England about 1790; became heraldic artist to George IV.; executed many fine works in stained glass, and was author of *Royal Heraldry, the Armorial Insignia of the Kings and Queens of England, from Coeval Authorities* (1821), *Heraldic Notices of Canterbury Cathedral* (1827), *Rolls of Arms of the Peers* (2 vols., 1829–33), *An Account of the Restoration of the Collegiate Chapel of St. George's, Windsor* (1844), *Insignia of the Orders of Knighthood of the United Kingdom*, and other works.

**Wil'lemite,** or **Wilhelmite** [named after Wilhelm I., king of the Netherlands, by the mineralogist Levy; also called *troostite* (the New Jersey ore)], a native silicate of zinc, of composition $O_4SiZn_2$; rhombohedral in crystallization; generally yellowish, greenish, or salmon-colored; generally opaque, but sometimes translucent, or even transparent; hardness somewhat below feldspar. Willemite, which in European localities is not common, occurs at some American localities in New Jersey—about Franklin and Stirling—almost in rock-masses, constituting a very valuable and important zinc ore. It contains (in New Jersey) about 60 per cent. of zinc oxide, equal to 48 per cent. of metallic zinc. The molecular structure of willemite is—

$$O_4 \overset{Si}{\cdot}_{23} \cdot \left(\overset{Zn\ Zn}{22\ \ 21}\right) = 4.203 \left\{\begin{array}{l}\text{Levy, from Moresnet, Belgium, 4.18.}\\ \text{Monheim, from Stolberg, 4.18.}\end{array}\right.$$

Henry Wurtz.

**Wil'lems** (Florent), b. at Liege, Belgium, about 1812; studied at the Academy of Mechlin; settled in 1839 in Paris, and acquired a great reputation as a genre painter. Among his most celebrated works are—*L'Après-diner sous Louis XV.*, *Une Partie du Music* (1844), *Visite de Marie de Médicis à Rubens*, *Les Adieux* (1847), *Au Roi!* (1861), *La Sortie* (1864), etc.

**Willems** (Jan Franz), b. at Bouchout, near Antwerp, Belgium, Mar. 11, 1793; was educated at Lierre, where he was trained in music and singing, and afterward at Antwerp, where he studied in the office of a notary; won in 1811 a prize by his poem on the battle of Friedland, and published in 1818 *Aen de Belgen*, an ode which became immensely popular, and in 1819 *De Nederduytsche Tael au Letterkunde*, which placed him at the head of the Flemish movement. Alternately coaxed or slighted by the Dutch and the Belgian governments, according as the anti-Dutch or the anti-French tendency of the Flemish movement could be used, he died as keeper of the archives of Ghent June 24, 1846, but by his quarterly review, *Belgisch Museum*, and by his poems and editions of old Flemish poems, he gave the whole movement scientific interest and literary importance.

**Willes** (Sir James Shaw), LL.D., b. at Cork, Ireland, in 1814; graduated at Trinity College, Dublin, 1836; was called to the bar at the Inner Temple 1840; was appointed a commissioner of common-law procedure 1850; was the chief author of the acts on that subject passed in 1852, 1854, and 1860, and was knighted and appointed a judge of common pleas 1855. D. by his own hand, during a paroxysm of insanity, at Otterspool, Hertfordshire, Oct. 2, 1872. With Sir Henry S. Keating he edited Smith's *Leading Cases* (2 vols., 1849).

**Willes** (Sir John), b. in England in 1685; educated at Trinity College, Oxford; was called to the bar 1707; was a commissioner for the prosecution of the Scottish rebels 1715; entered Parliament 1722; was appointed attorney-general and chief-justice of Chester 1733; chief-justice of the common pleas 1737, and missed the chancellorship only by "holding out for the promise of a peerage in addition." D. Dec. 16, 1761. Author of *The Present Constitution and the Protestant Succession vindicated* (1714) and of *Reports of Adjudged Cases in the Common Pleas* (1799).

**Wil'let,** or **Stone Curlew,** the *Symphemia semipalmata*, a bird of the snipe family, found in North and South America. It is a fine game-bird, and its eggs and flesh are prized as food. It is named from its note, "pilt-will-willet."

**Willet** (Andrew), D. D., b. at Ely, England, in 1562; educated at Peterhouse and at Christ's College, Cambridge, where he became a fellow; took orders in the Church of England; was appointed rector of Childerley, prebendary of Ely 1584, and rector in 1597 of Little Grantesden, which he exchanged for the living of Barley. D. in 1621. Author of *Synopsis Papismi* (1593), *Tetrastylon Papisticum* (1593), *A Catholicon, that is, a Generall Preservative or Remedie against the Pseudo-Catholyke Religion* (1602), of *Hexapla, or "Sixfold Commentaries"* on Genesis (1605), Exodus (1608), Leviticus (1631), Daniel (1610), and Romans (1611), of *Harmonies* of the First (1607) and Second Books of Samuel (1614), and numerous other works. His *Life and Death*, by his son-in-law, Peter Smith, D. D., was prefixed to the 5th ed. of the *Synopsis* (1634).

**Willet** (Thomas), b. in England in 1610; was a distinguished merchant in Plymouth Colony; settled at New York at the time of its capture from the Dutch; was the first mayor of that city, and subsequently resided in Seekonk, Mass., where he d. "August ye 4th, 1674," as attested by the rude inscription on his dilapidated headstone, still visible "on a lonely and barren heath at a place seldom visited by the footsteps of man."

**Wil'lett,** p.-v. and tp., Cortland co., N. Y. P. of v. 120; of tp. 889.

**Willett** (Marinus), b. at Jamaica, L. I., July 31, 1740; was a lieutenant in Delancey's regiment during the French war, and was distinguished at the unsuccessful assault upon Fort Ticonderoga; served in Col. Bradstreet's expedition against Fort Frontenac; was a captain under Montgomery in the Canada campaign of 1775–76; became lieutenant-colonel of the 3d New York regiment 1776; defended Fort Stanwix against the regulars, Tories, and Indians commanded by St. Leger Aug., 1777; made a successful sally as a diversion in favor of Gen. Herkimer; held the fort until its relief by Arnold; joined the army in New Jersey June, 1778; was present at Monmouth; accompanied Sullivan in his campaign against the Six Nations; was sheriff of New York 1784–92; declined the post of brigadier-general in the expedition sent against the Western Indians 1792, and was mayor of New York 1807. D. in New York Aug. 22, 1830. He left an autobiography, from which *A Narrative of the Military Actions of Col. Marinus Willett, etc.* (New York, 1831), was prepared and edited by his son, William M. Willett.

**Willett** (Ralph), F. S. A., b. in England in 1720; purchased in 1751 the property of Merly, Dorsetshire, where he built a fine country-seat and gathered a library famous for bibliographical rarities and for their luxurious red morocco bindings. D. at Merly in 1795. He printed *A Description of the Library at Merly House* (1776; new ed., in English and French, folio, with plates, 1785), *A Catalogue of the Books in the Library at Merly* (1790), and contributed to the *Archæologia* (vol. xi.) *A Memoir on the Origin of Printing* (1818), and to vol. viii. *Observations on the Origin of Printing* (1819). The sale of the 2906 lots comprising this celebrated library (in 1813) was a great event in the bibliographical world, giving rise to many spirited contests and realizing the sum of £13,508 4*s*. His collections of prints were sold in 1813 and 1814. (See Dr. T. F. Dibdin's *Bibliographical Decameron*.)

**Wil'ley,** tp., Lewis co., West Va. P. 2515.

**Willey** (Henry), b. in Geneseo, N. Y., July 19, 1824; educated at the academy in that town and the Bridgewater (Mass.) Normal School; was for several years a teacher, and since 1856 has been editor of the *Daily Evening Standard* of New Bedford, Mass. As a botanist has occupied himself especially with North American lichens, and has published the following: *List of North American Lichens* (New Bedford, 1873); *Statistics and Distribution of North American Lichens*, in *Bulletin* of Buffalo (N. Y.) Natural History Society (1873); *Lichens of the Yellowstone*, in *U. S. Geological Survey of the Territories* (Washington, 1873); *Lichens of Colorado*, in *Synopsis of the Flora of Colorado* (Washington, 1874); *American Lichenography*, in *Proceedings* of the Essex Institute (Salem, Mass., 1867); *Lichens under the Microscope*, in *American Naturalist* (1871); and the article on Lichens in the present work.

**Wil'liam,** the name of three kings of the Netherlands, not descending from William the Silent of Orange-Nassau, but from his brother, Count Johann of Dillenburg, through his youngest son, Ernst Casimir of Nassau-Dietz. William III. of England, the last of the house of Orange-Nassau, bequeathed the Orange estates and the stadtholdership of Holland to Johann Wilhelm Friso of Nassau-Dietz, stadtholder of Friesland. Johann Wilhelm Friso's son, William IV., was stadtholder of Holland, Friesland, Groningen, Geldern, Zutphen, etc. William I. (1815–40), b. at the Hague Aug. 24, 1772, the eldest son of William V., prince of Orange-Nassau and stadtholder of the Dutch republic, and married Oct. 1, 1791, Friederike Luise Wilhelmine, a daughter of Friederich Wilhelm II. of Prussia. When the National Convention of France declared war against the republic (Feb. 1, 1793), William assumed the command of the Dutch army, but on Jan. 18, 1795, he embarked with his father and the rest of the family at Scheveningen, and went to England. Aug. 29, 1802, he received the principality of Fulda, together with Corvey, Dortmund, and Weingarten, which had been given to his

father in compensation for the Netherlands, and he now resided for several years at Fulda. On his father's death (Apr. 9, 1806), he also came into possession of the hereditary estates of the family, Nassau-Dietz, but having allied himself with Prussia and accepted a command in the Prussian army, he was taken prisoner at Jena by the French, and all his possessions were confiscated by Napoleon. He was soon released from his captivity, and fought against the French at Wagram, but lived subsequently in retirement at Berlin until after the battle of Leipsic. The Hollanders now rose against the French, and on Nov. 29, 1813, William landed at Scheveningen, and was hailed by the people as their sovereign. By the Congress of Vienna the kingdom of the Netherlands, consisting of Holland and Belgium, was formed, and on Mar. 16, 1815, William I. was proclaimed king at the Hague. In compensation for his hereditary possessions, which were given partly to Prussia, partly to Nassau, he received the grand duchy of Luxemburg. The combination of Holland and Belgium proved a blunder. By the revolution of 1830, Belgium seceded, and was recognized as an independent kingdom by the grand powers at the conference in London Dec. 20, 1830. William I., however, would not submit to this decision, but continued his protest and resistance up to 1839 in a foolish and very expensive manner. This and other circumstances also spoiled his relation to his Dutch subjects, and on Oct. 7, 1840, he found it advisable to abdicate in favor of his son. He went to Berlin with an almost fabulous fortune, and d. there Dec. 12, 1843.—WILLIAM II. (1840–49), b. at the Hague Dec. 6, 1792, the eldest son of William I., was educated in the military academy of Berlin and the University of Oxford; served in the Spanish and English armies against the French, and distinguished himself at Quatre-Bras and Waterloo, where he was wounded. On Feb. 21, 1816, he married the grand duchess Anna Paulowna, a sister of Alexander I. of Russia. As king, he restored order to the finances, which had fallen into utter confusion during the reign of his father, but showed himself very unwilling to enter on any political reforms. Nevertheless, when, in 1848, the fermentation became dangerous in the country, he consented to a thorough reorganization of the government, but d. before the new constitution could be established, Mar. 17, 1849.—WILLIAM III., b. at the Hague Feb. 19, 1817, the eldest son of William II.; married June 18, 1839, Sophie, a daughter of King William of Würtemberg, and succeeded to the throne on the death of his father, Mar. 17, 1849. When the German union was dissolved in 1866, he succeeded in separating Limburg and Luxemburg from all connection with Germany, and annexed the former completely to the Netherlands. Concerning the latter, negotiations were opened by Napoleon III., who wanted to buy it, but these negotiations were frustrated by Bismarck, and Luxemburg was declared neutral under the sovereignty of the house of Orange-Nassau by the treaty of May 11, 1867. In the interior his government has proved very successful.

**William,** the name of four kings of England. (1) WILLIAM I., THE CONQUEROR, king of England (1066–87), b. at Falaise, Normandy, in 1027, the bastard son of Robert the Devil, duke of Normandy, by the beautiful Arletta, a tanner's daughter of Falaise; was educated at the court of King Henry I. of France; succeeded by his aid to the ducal throne of Normandy on the death of his father in 1035, and married, in 1053, Mathilde, a daughter of Count Baldwin V. of Flanders. In his numberless feuds with his vassals and neighbors, and with the king of France, he showed himself a man of superior talents, and his ambition was fully on a par with his power. As the English king, Edward the Confessor, had no children, William laid claims to the succession, his grandmother, Emma, being a sister to Edward; and it is said that the king himself acknowledged the claim. Nevertheless, when Edward died (Jan. 5, 1066), Harold was elected king by the Anglo-Saxon nobles, and William now gathered an immense armament—700 vessels and 60,000 men—in the harbor of St. Valéry, at the mouth of the Somme, crossed the Channel, and landed at Hastings Sept. 29. Here, Oct. 14, the battle was fought between him and Harold; the Anglo-Saxons were completely routed, Harold fell, and, Dec. 25, William was crowned king of England at Westminster. His government was at first mild and conciliatory, but as one insurrection followed another, and found support both from the Scots and the Danes, it soon changed its character and became a most formidable tyranny. The Danes, who landed under Asbjörn at the mouth of the Humber and perpetrated fearful depredations, were bought off; Scotland was successfully invaded, and Malcolm III. was compelled to declare himself a vassal of William; the whole country between the Tees and the Humber was laid waste, and every Saxon was expelled from his position in the administration, the courts, and the Church, and supplanted with a Norman. The estates of the fallen or banished Saxon nobles were partitioned out to the Norman lords, and a network of military stations was spread over the whole country—strongly-fortified castles, from which the feudal Norman kept the Saxon population in absolute submission. In 1068 the curfew-bell was introduced, at the sound of which every light and fire in the country should be extinguished, and between 1080 and 1086 a survey was taken of the Conquest and the division of the spoil—the so-called Doomsday Book. Besides the establishment and consolidation of his power in England, William also carried on a series of wars on the Continent, with his son, with Brittany, with the king of France, etc., which, however, were of less importance. In a campaign against Paris he was thrown from his horse at Mantes-sur-Seine, and hurt severely. He was brought to Rouen, and d. there Sept. 9, 1087. He was buried in the church of St. Stephen at Caen. (See Thierry, *Histoire de la Conquête de l'Angleterre par les Normands* (1825); Freeman, *History of the Norman Conquest of England* (1867).)—(2) WILLIAM II., RUFUS ("the red-haired"), king of England (1087–1100), b. in Normandy in 1056, the second son of William the Conqueror, was educated in England by Lanfranc, and succeeded to the throne of England on the death of his father, while his elder brother, Robert, took possession of Normandy. He carried on a long series of wars with his brother, with Scotland, etc., and came finally into possession of Normandy when, in 1096, Robert went to the Holy Land and sold the country to him for £10,000. He made a similar bargain in 1100 with the count of Poitiers; but before he could take possession of this new dominion he was shot by Walter Tyrrel while hunting in the New Forest, Aug. 2, 1100. He built London Bridge and completed London Tower and Westminster Hall.—(3) WILLIAM III., king of Great Britain and Ireland (1689–1702) and stadtholder of the Netherlands (1672–1702), a son of William II., prince of Orange and stadtholder of the Netherlands, and Mary, the eldest daughter of Charles I., king of England, b. at the Hague Nov. 4, 1650, ten days after the death of his father, and grew up under rather gloomy circumstances. His mother died in 1661; Louis XIV. took possession of the family estate of Orange; Oliver Cromwell persecuted him as a Stuart; and in the Netherlands, where his father had exerted himself to make the stadtholdership hereditary in the family of Orange, Jan de Witt carried through a law which prevented any one person from being at the same time stadtholder and commander-in-chief of the military forces of the republic. Nevertheless, in 1672, when France and England attacked the Netherlands, and Jan de Witt had been murdered, William was made stadtholder and commander-in-chief, and by his military and diplomatic talents he freed the country from the grasp of Louis XIV. much in the same way as his ancestor had wrenched it from the grip of Philip II. He succeeded in detaching England from France, and the Peace of Nymwegen (1678) was at least honorable to the republic. In 1677 he married his cousin Mary, eldest daughter of James, duke of York and heir presumptive to the English crown, and in the contest between the king and the people, which became almost desperate as soon as James ascended the throne, he naturally became the centre of the opposition. In 1688 he was invited by a large number of the most prominent men in England to interfere, and on Nov. 5 of the same year he landed at Torbay with an army of 15,000 men. James fled to France, deserted by all, and on Feb. 13, 1689, was deposed by Parliament, and William and Mary were established on the throne. James afterward went to Ireland, where the Roman Catholic population rose in favor of him, but he was completely defeated in the battle of the Boyne, and in Ireland, as well as in Scotland, all Jacobite movements were successfully suppressed. England now joined the great coalition against France which William had formed between Austria, Spain, and the Netherlands, and war was declared May 7, 1689. From 1691, William himself commanded the allied army in the Netherlands, and although he was defeated at Steenkerke (Aug. 3, 1692) and at Neerwinden (July 29, 1693), he nevertheless prevented France from making any progress. At La Hogue the French fleet was nearly annihilated in 1692, and by the Peace of Ryswick (1697) England and the Netherlands lost nothing and France was utterly exhausted. Louis XIV., however, had by no means given up his ambitious plans, and England had just determined and publicly announced that it would take part in the Spanish war of succession when William d. Mar. 8, 1702, in consequence of a violent fall from his horse. In England he was not loved, and his position was often very difficult, especially after the death of Mary (Dec. 28, 1694). He was entirely destitute of all those small arts by which a man in a superior position so easily wins the confidence,

good-will, and enthusiasm of his inferiors; but the soundness and elevation of his political views, and the sagacity and self-sacrificing energy with which he carried them out, have probably never been doubted. His great task was to resist Louis XIV., and in him political absolutism and religious intolerance; and he fulfilled it. (See Trevor, *Life and Times of William III.* (1835); Vernon, *Court and Times of William III.* (1841); and Macaulay's *History of England.*)—(4) WILLIAM IV., king of Great Britain, Ireland, and Hanover (1830–37), b. in London Aug. 21, 1765, the third son of George III.; was educated for the navy; became a lieutenant in 1785, an admiral in 1801, and lord high admiral in 1827; was created duke of Clarence in 1789, with an income of £12,000, and became heir presumptive to the crown in 1827, with an income of £40,000; entered in 1790 into a connection with an actress, Dora Jordans, with whom he lived twenty years and had ten children, but in the belief that he could get his appanage increased by a legitimate marriage, he left Dora Jordans in 1811, and she died in poverty and misery in 1815. In 1818 he married a German princess, but he was succeeded in Hanover by his brother, and in England by his niece. (What took place during his reign is related in the articles on his ministers, LORD GREY, LORD MELBOURNE, and SIR ROBERT PEEL.)

**William I.,** emperor of Germany, b. Mar. 22, 1797, the second son of King Frederick William III. and Queen Luise, a princess of Mecklenburg. He grew up with the humiliating impressions of the defeat of Jena, and under the melancholy consequences of this disaster, but distinguished himself, though as yet very young, in the campaigns of 1813–14, which terminated with the overthrow of Napoleon and the restoration of Prussia. All his life through he has been an enthusiastic soldier, indefatigable in the military service, even in its minutest details. When his father died (in 1840), and his elder brother, Frederick William IV., became king, he received the title of prince of Prussia as heir presumptive, but many years passed away before his name acquired any prominence in political affairs. He was considered an absolutist, and for this reason, as well as on account of his military inclinations, he was very unpopular. On the outbreak of the revolution in 1848 he was compelled to leave the country and go to England. In the spring of 1849 he took command of the military force sent against the South German insurgents, and suppressed the revolution in the Palatinate and Baden. Later, when the supremacy of the Austrian policy in German affairs was felt with much regret in Prussia, public opinion underwent a change concerning the prince, and people began to look at the strength and firmness of his character as a support of the greatness of Prussia. He was, nevertheless, by no means popular, and frequent collisions arose between him and the people when he came to the head of the government as regent Oct. 9, 1858, and as king Jan. 2, 1861. It was especially the reorganization of the army which perpetually irritated the people. The king considered this measure as the most effective means of elevating the Prussian state, and was consequently most anxious to carry it; while the people looked at it as an instrument of oppression. On Oct. 18, 1861, he was crowned at Königsberg, and his peculiar taste for ceremonious magnificence became very apparent on that occasion, as did also his high pride in his royal dignity and in his family—qualities which, however, with him are connected with the greatest personal simplicity, with temperance, perfect conscientiousness, and great industry. The relation between the king and the people remained cold, and it became even difficult after the appointment of Bismarck as president of the cabinet. But suddenly a complete change took place in this respect. In the war with Denmark (1864) the army proved able and effective. The people felt elated, and the king began to be popular. Still more apparent became this change in 1866, when, under the personal leadership of the king, brilliant victories were won over Austria and her German allies. At the opening of the war the liberal party condemned unanimously the policy of the government, but when the result of this policy became an accomplished fact, a storm of enthusiasm arose for the king and his most intimate councillors, Bismarck, Von Moltke, and Roon. After the war the king hesitated long before he decided to annex Hanover, Hesse, and Nassau, and thereby give the principle of legitimacy its death-blow; but finally the conviction of the statesman superseded the hesitation of the king. By the *publicandum* issued from Ems July 26, 1867, he placed himself at the head of the newly-formed North German union, and assumed for himself and his successors to the Prussian crown the rights and duties connected with this new dignity. But the greatest glory was gained by the king for his crown in the war with France (1870–71). By a peculiar combination of circumstances the final decision of the question of war or peace came to depend solely on him and his personal character, and in the crisis which preceded the war—the negotiations with the French ambassador, Benedetti, in Ems July, 1870—his presence of mind, his firm courage, and his proud consciousness of his dignity showed themselves in an imposing manner. From this moment he became the admired representative of the whole German people, and the enthusiasm for him increased every day as the German army under his leadership pushed farther and farther into France and gained one victory after another. It was simply just, however, that this should be so, for it must be remembered that the principal part of the success was actually due to the king. He created the army; he selected the leaders; he gave the undebatable decision in cases in which opinions differed; and in the bloodiest battles he exposed himself with the greatest valor and bravery to the bullets of the enemy. Moved partly by the brilliancy of the victory, partly by the personality of the victor, the German princes, so long divided, finally agreed in offering the imperial crown of Germany to King William, and he accepted it at Versailles Jan. 18, 1871. On Mar. 15, 1871, he returned to Berlin under an indescribable enthusiasm of the people. Here, however, a new contest awaited him—a contest which probably proved much more difficult to him than the war, as by nature he is a man of piety, leaning toward conservative views. The interior state of Germany, especially on the ecclesiastical field, needed a development in a liberal direction, and the policy of Bismarck soon brought about a conflict which must principally be fought out with the Roman curia, but which will necessarily also engage the Evangelical Church and the conservative party. In this conflict the emperor assumed a firm and decided position, guarding the rights of the State and the Crown against the encroachments not only of the Church, but also of that party which was generally considered the main support of the Prussian throne—a position which could not fail to surprise any one who knew the past life of the prince and the traditions of the Prussian state. But it is evident from this, as from many other important events of the emperor's life, that he is a man of sound and elevated understanding, steady, calm, energetic, always prepared for great decisions, willingly listening to the counsels of wise men, without jealousy of the fame of his servants and friends, and endowed with a happy faculty of recognizing such characters and talents as might be useful to his plans. In personal appearance he is tall and dignified, with a kind expression and a winning address.

AUGUST NIEMANN.

**William I. and II.,** electors of Hesse-Cassel. See HESSE.

**William of Champeaux** (GUILLIELMUS CAMPELLENSIS), b. at Champeaux, a village in the present department of Seine-et-Marne, France, in the latter half of the eleventh century; studied at Paris under Anselm of Laon; became archdeacon of Notre Dame, and taught philosophy in the school of the cathedral. Among his pupils was Abelard, and one day the disciple outwitted the master in a philosophical debate. William retired to one of the suburbs of Paris, and founded in 1113 the abbey of St. Victor, where he opened a new school and taught in opposition to Abelard, until he subsequently was made bishop of Châlons-sur-Marne. D. in 1121. Two treatises by him—*Moralia Abbreviata* and *De Origine Animæ*—are published in Martenne's *Thesaurus*, vol. v.

**William of Malmesbury.** See MALMESBURY, WILLIAM OF.

**William of Nassau.** See WILLIAM THE SILENT.

**William of Orange.** See WILLIAM III. of England.

**William of Wykeham.** See WYKEHAM, WILLIAM OF.

**William and Mary College.** This college is, next to Harvard, the oldest in the U. S. It was chartered by King William and Queen Mary in 1693. Its germ was planted at a much earlier period—in 1619, before the Pilgrims saw Plymouth Rock. This was destroyed in the Indian massacre of 1622. In 1660 grants were again made to establish a college in the colony of Virginia. Nothing important was effected till 1693, when the commissary of the bishop of London, the Rev. Dr. James Blair, sought and obtained from the sovereigns, William and Mary, a charter and a valuable endowment. It is believed to be the only college in the U. S. that received a royal charter. The college was made surveyor-general of the territory of Virginia, and was entitled by its charter to a duty of a penny a pound on tobacco exported from Virginia and Maryland. In 1776 these fees and duties were worth upward of $5000 per annum, and were steadily increasing. The Revolution of 1776 and the adoption of our Constitution deprived the institution of these sources of wealth. For these losses it has received no compensation, from State or national gov-

ernment. It received, with Harvard, until 1776, the annual proceeds of a fund left for educational and other purposes by the distinguished Christian and philosopher, the Hon. Robert Boyle. The services of William and Mary College to the country are well known. "As an offspring of the revolution of 1688, its sons were the warm and enthusiastic advocates of that of 1776." George Washington, after an attendance and examination in its halls, was made one of its deputy surveyors. Benjamin Harrison, Carter Braxton, Thomas Nelson, and George Wythe, signers of the Declaration; Peyton Randolph, president of the first American Congress; Edmund Randolph, secretary of state; John Marshall, chief-justice; Thomas Jefferson and James Monroe, Presidents of the U. S.; Gov. John Tyler, John Taylor of Caroline, the Nelsons, the Blands, the Pages, the Carters, the Harrisons, the Nicholases, the Braxtons, the Grymeses, the Burwells, the Lewises, the Lyonses, the Mercers, the Cockes, the Bollings, the Nicholsons, the Carringtons, and many others known to fame were among those educated at William and Mary before 1776. In 1775 the Phi Beta Kappa Society was founded at this college. Since 1776 it has educated John Tyler, President of the U. S.; Tazewell, Giles, Randolph of Roanoke, the Roanes, Bushrod Washington, the Breckenridges, the Stewarts, the Prestons, the Bibbs, the Barrys, the Fitzhughs, the Barbours, the Johnsons, the Leighs, the Cabells, the Joneses, the Nelsons, the Lennoxes, William S. Archer, Crittenden, Winfield Scott, William C. Rives, the Harrisons, the Randolphs, the Carters, the Pages, and a host besides. Besides its losses by war, that of 1776 and the late civil war, it has lost its buildings by fire three times—in 1705, in 1859, and in 1862. It is endeavoring to maintain itself in spite of obstacles, with an abiding faith in the future. B. S. EWELL.

**Wil'liams,** county of N. W. Dakota, bounded N. E. by Missouri River, and intersected by Big Knife and Little Missouri rivers. Formed since the census of 1870. Area, about 2500 sq. m.

**Williams,** county of N. W. Ohio, bordering on Indiana and Michigan, intersected by St. Joseph's and Tiffin rivers, and traversed by Lake Shore and Michigan Southern R. R.; surface generally undulating, soil productive. There are saw-mills, tanneries, and manufactories of agricultural implements, carriages, and woollen goods. Live-stock, especially cattle and sheep, numerous. Staples, wool, hay, wheat, Indian corn, oats, and dairy products. Cap. Bryan. Area, about 600 sq. m. P. 20,991.

**Williams,** tp., Sangamon co., Ill. P. 1279.

**Williams,** tp., Bay co., Mich. P. 445.

**Williams,** tp., Benton co., Mo. P. 2277.

**Williams,** tp., Stone co., Mo. P. 332.

**Williams,** tp., Columbus co., N. C. P. 905.

**Williams,** tp., Dauphin co., Pa. P. 1451.

**Williams,** tp., Northampton co., Pa. P. 2248.

**Williams,** tp., Wood co., West Va. P. 1486.

**Williams** (ALPHEUS STARKEY), b. at Saybrook, Conn., Sept. 20, 1810; graduated at Yale College 1831, but continued his studies in the law school there two years longer; in 1836 removed to Michigan, and took up his residence in Detroit, where he began to practise law; was chosen alderman of that city in 1843, city recorder in 1844, and from 1840 to 1844 was judge of probate of Wayne co. In 1843 he became proprietor of the Detroit *Daily Advertiser*, of which he was also editor until 1848. In the war with Mexico he served as lieutenant-colonel of the 1st Michigan Vols., and was postmaster of Detroit 1849–53. On the outbreak of civil war he was early (May 17, 1861) appointed a brigadier-general of volunteers, and afterward commanded a division in the Shenandoah; succeeded to the temporary command of the 12th corps in 1862, which he led at South Mountain, at Antietam (after the fall of Mansfield), and until Apr., 1863; in temporary command of corps at Gettysburg; transferred with his corps to Tennessee in October, and engaged at Lookout Mountain. In Sherman's Atlanta campaign of 1864 he commanded a division of the 20th corps, succeeding to the command of that corps Nov. 11, which he held during the march to the sea and subsequent campaign in the Carolinas. Mustered out of service in Jan., 1866, he served in August of that year in the adjustment of the military claims of Missouri; was U. S. minister to Salvador 1866–69; member 44th and 45th Congress 1875–79.

**Williams** (Mrs. CATHARINE R.), b. at Providence, R. I., in 1790; author of *Original Poems* (1828), *Tales, National and Revolutionary* (2 series, 1830–35), *Fall River, an Authentic Narrative* (1833), *Lives of Gen. William Barton and Capt. Stephen Olney* (1839), *The Neutral French, or the Exiles of Nova Scotia* (2 vols., 1841), and other works.

**Williams** (CHARLES KILBOURNE), LL.D., son of Prof. Samuel, b. at Cambridge, Mass., Jan. 24, 1782; removed to Rutland, Vt., in childhood; graduated at Williams College 1800; practised law at Rutland; was a member of the legislature, State attorney 1814–15, collector of customs for the district of Vermont 1825–29, judge of the supreme court 1822–24 and 1829–42, chief-justice and *ex-officio* chancellor 1842–46, president of the council of censors 1847, and governor 1850–52. D. at Rutland Mar. 9, 1853. A brief *Memoir* was published by Hon. Isaac F. Redfield.

**Williams** (DAVID), b. near Cardigan, Wales, in 1738; was a dissenting minister successively at Frome, Somersetshire, at Exeter, and at Highgate; opened in 1776, at Margaret street, Cavendish Square, London, a chapel for public worship on a purely theistic basis; abandoned the experiment for lack of success 1780; became a private tutor; published a splendid edition of Hume's *History of England;* translated works of Voltaire; wrote several theological treatises, and *Letters on Political Liberty* (1782), which procured him an invitation from the leaders of the French revolution to assist in the formation of a constitution, and was the founder of the Royal Literary Fund (1802), by which he was supported during his later years. D. in London June 29, 1816.

**Williams** (EDWARD), better known by his bardic name of IOLO MORGANWG, b. in the parish of Llancarvan, Glamorganshire, Wales, in 1745; was associated with Owen Jones and William Owen Pughe in the editorship of the great collection of ancient Welsh literature known as the *Myvyrian Archaiology* (3 vols., 1801–07); published *The Fair Pilgrim, a Poem translated from the Welsh* (1792), and *Poems, Lyrical and Pastoral* (2 vols., 1794), in the former of which appeared *An Ode on the Mythology of the Ancient British Bards, in the manner of Taliesin,* accompanied by notes and specimens of "Triads" containing the metaphysical and religious doctrines of the old Druidical bards, alleged to have been copied from the MS. of a Welsh poet of the sixteenth century. This publication gave rise to a controversy as to the genuineness of these "Triads," and the alleged MS. was never produced. Williams was a friend of Southey, and was recognized as the best Welsh writer of his time. D. at Flemingstone, Wales, Dec. 17, 1826. His posthumous Welsh work, *Secrets of the Bards of the Isle of Britain* (1829), was edited by his son, Taliesin Williams. An amusing volume, *Recollections and Anecdotes of Edward Williams* (1850), was published by Elijah Waring.

**Williams** (EDWARD), D. D., b. at Glanclwyd, Wales, in 1750; became a dissenting minister at Ross, Hertfordshire, 1776, at Oswestry 1777, and at Birmingham 1792, and was superintendent of the Independent academy at Rotherham from 1792 until his death in 1813. Author of several theological treatises and of *The Christian Preacher* (1800; 5th ed. 1843), which has been extensively used as a manual for the choice of evangelical books. His *Life* (1825) was written by Rev. Joseph Gilbert.

**Williams** (EDWIN), b. at Norwich, Conn., in 1797, son of Gen. Joseph, a Revolutionary officer; resided many years in New York City, where he was a constant contributor to periodicals; was many years secretary to the American Institute, an active member of the Historical and Geographical societies and of the Mechanics' Institute, and was noted for the extent of his statistical researches, and was one of the editors of the *New York Herald.* D. in New York Oct. 21, 1854. Author of the *New York Annual Register* (10 vols., 1830–45), *The Politician's Manual* (1832), *The New Universal Gazetteer* (4th ed. 1833), *The Book of the Constitution* (1833), *New York as it is in 1833, et seq.*, *The Political Manual* (1834), *The Statesman's Manual* (1838), *The Political History of Ireland* (1843), *The Statistical Companion* (1846), *The Presidents of the U. S.* (1849), and various other works; was joint author, with C. Edwards Lester, of *The Napoleon Dynasty, etc.* (1852), under the pseudonym of "the Berkeley Men," and furnished historical and statistical data to Benson J. Lossing's *National History of the U. S.* (2 vols., 1855). The latter gentleman has edited the *Statesman's Manual* (4 vols., 1854; new ed. 1859) since the author's death.

**Williams** (ELEAZAR), b. at Caughnawaga, N. Y., about 1787, son of Thomas Williams, a chief of the Caughnawaga or St. Regis Indians, who was a grandson of Eunice, daughter of Rev. John Williams of Deerfield, Mass., known as "the redeemed captive." He was educated at Longmeadow, Mass.; served in the American army in the war of 1812–15, being wounded at Plattsburg; became a missionary of the Protestant Episcopal Church among the Oneida and St. Regis Indians, and subsequently among the tribes at Green Bay, Wis. About 1842 the claim was made that he was the dauphin of France, son of Louis XVI. and Marie Antoinette, and a narrative of his having

been rescued from prison at Paris and brought to the U. S. gradually gathered form, and was embellished with all necessary details, including the total loss of memory by the young prince in consequence of his sufferings in prison. The story was brought before the public by Rev. J. H. Hanson in a famous article in *Putnam's Magazine—Have we a Bourbon among us?* in 1853, expanded the following year into a volume entitled *The Lost Prince.* Belief in this story was much aided by a remarkable personal resemblance to the Bourbon type. Williams d. at Hogansburg, N. Y., Aug. 28, 1858. Author of an *Iroquois Spelling-Book* (1813), a translation of the *Book of Common Prayer* into Mohawk (1853), a political tract against the British (1815), and a *Life of Thomas Williams* (1859).

**Williams** (Elisha), b. at Hatfield, Mass., Aug. 26, 1694; graduated at Harvard 1711; became minister of Newington, Conn., 1722, and subsequently of Wethersfield; was "rector" or president of Yale College 1726–39; resigned on account of ill-health; returned to Wethersfield; was elected to the legislature; served as judge of the superior court; was chaplain of the Connecticut regiment sent against Cape Breton 1745; was appointed colonel of a regiment destined for an expedition against Canada, but never sent, and went to England to collect the pay due his regiment, remaining there until 1752. D. at Wethersfield July 25, 1755.

**Williams** (Ephraim), b. at Newton, Mass., Feb. 24, 1715; was bred to the sea, and made several voyages to Europe; served in Canada against the French in the war of 1740–48, attaining the rank of captain; received from the Massachusetts legislature a grant of 200 acres of land in the present townships of Adams and Williamstown, upon which he erected Fort Massachusetts, 1751, and was made commander of the whole line of frontier posts W. of the Connecticut River, and on the renewal of war with the French in 1755 led a regiment of Massachusetts troops to join Sir William Johnson in his projected invasion of Canada; made his will while on the march, leaving his property to found a free school at Williamstown (see Williams College); fell in an ambuscade of French and Indians near the head of Fort George, N. Y., and was killed at the first fire, Sept. 8, 1755. He was never married. On the spot where he fell a monument was erected in 1854 by the alumni of Williams College.

**Williams** (Frederick Dickinson), b. at Boston, Mass., Aug. 27, 1828; studied at the Boston Latin School; graduated at Harvard 1850; was teacher of drawing at the Boston Latin and High schools 1850–57; afterward devoted himself successfully to landscape-painting, especially of New England scenery.

**Williams** (George), b. in Wales in 1814; educated at Eton; graduated at King's College, Cambridge, where he became a fellow 1836; took orders in the Church of England 1837; was chaplain to Bishop Alexander at Jerusalem 1841–45; was warden of St. Columba's College 1850–55, and vice-provost of King's College 1854–56, where he has been for some years senior fellow. Author of *The Holy City, or Historical and Topographical Notices of Jerusalem, etc.* (1845), of which a second edition (2 vols., 1845) contained *An Architectural History of the Church of the Holy Sepulchre,* by Prof. Robert Willis; *An Historical and Descriptive Memoir of Jerusalem, with Plan* (1849); *Dr. Pierotti and his Assailants, or a Defence of Jerusalem Explored, etc.* (1864); *The Orthodox Church of the East in the Eighteenth Century, etc.* (1868), and contributed articles on Oriental geography to Dr. William Smith's *Dictionaries.* In them, as well as in his larger works, Mr. Williams defends the genuineness of the traditional sacred sites in Palestine against the objections of Dr. Robinson and other recent geographers.

**Williams** (George H.), b. in Columbia co., N. Y., Mar. 23, 1823; educated at an academy in Onondaga co.; was admitted to the bar 1844; settled in Iowa; was elected judge of the first judicial district 1847; was chief-justice of Oregon Territory 1853–57; was a member of the Oregon constitutional convention 1857; was a Republican U. S. Senator 1865–71; was a member of the commission which signed the Treaty of Washington for settling the "Alabama claims" 1871; appointed attorney-general in Pres. Grant's cabinet 1872; was nominated chief-justice of the U. S. Supreme Court 1873, but not confirmed by the Senate; resigned his seat in the cabinet May, 1875.

**Williams** (Helen Maria), b. near Berwick, England, in 1762. After publishing several volumes of verse which obtained her some literary fame, she became a resident of Paris shortly before the Revolution; was imprisoned in the Temple on account of her writings in favor of the Girondins; was released on the fall of Robespierre; returned to Paris 1796; was again temporarily imprisoned after the Peace of Amiens on suspicion of being a spy; subsequently wrote in favor of the Bourbons and against the Revolution. D. at Paris in Dec., 1827. Among her writings were several volumes of *Letters from France* (1790–94), which contain graphic accounts of the scenes of the Revolution; *A Tour in Switzerland* (2 vols., 1798); *Sketches of the State of Manners and Opinions in the French Republic toward the Close of the Eighteenth Century* (2 vols., 1801); *Narrative of Events in France* (1815); *Letters on Events in France since the Restoration* (1819), and the portions of the *Annual Register* relating to France during several years. She translated St. Pierre's *Paul and Virginia* (1796) and Humboldt's *Personal Narrative* (7 vols., 1814–29), and wrote the hymn "While thee I seek, protecting Power."

**Williams** (Hugh W.), b. in Wales about 1790; became an eminent landscape painter; travelled some years in Italy and Greece, and settled at Edinburgh 1819. He published *Travels in Italy, Greece, and the Ionian Islands* (2 vols., 1820) and *Views in Greece* (2 vols. imp. 8vo, 1825–29), a series of 64 exquisitely beautiful line engravings by Horsburgh, Miller, and other distinguished artists, after drawings by Mr. Williams and Mr. Charles R. Cockerell.

**Williams** (Isaac), b. in Wales in 1802; graduated at Trinity College, Oxford, 1826; took orders in the Church of England 1831; became a fellow of Trinity 1832; was curate successively of Windrush, St. Mary the Virgin's, Oxford, and Bisley; was associated with Keble, Newman, and Pusey in the "Tractarian" movement, having written the tracts Nos. 80, 86, and 87, and was a successful imitator of Keble as a sacred poet; was defeated by Mr. Garbett in his candidacy for the professorship of poetry at Oxford 1842; was a contributor to the *Lyra Apostolica;* wrote numerous theological treatises imbued with a vein of mysticism and symbolism, and spent his later years in complete retirement at Stinchcombe, Gloucestershire, where he d. May 1, 1865. Author of *The Cathedral* (1838), *Hymns* (1839), *Thoughts in Past Years* (1842), *Harmony and Commentary on the Whole Gospel Narrative* (8 vols., 1842–45), *The Baptistery* (4 parts, 1842–44); *The Christian Scholar* (1849), *The Altar* (1849), *The Seven Days, or the Old and the New Creation* (1850), *The Apocalypse* (1852), *The Beginning of the Book of Genesis* (1861), *The Psalms interpreted of Christ* (3 vols., 1864–65), and other works.

**Williams** (Isaiah Thornton), b. at New Ipswich, N. H., Feb. 12, 1819; educated mainly under private tutelage, but received the degree of A. M. from Williams College; studied law under the tuition of the late Pres. Fillmore at Buffalo, where he practised his profession till 1854, when he removed to the city of New York, and at once entered upon an extensive practice, being for a time the partner of the late B. F. Cutting, and engaged as counsel for the late Mr. Greeley in his most important libel suits. Excessive labor broke down his health, and in 1867 he accepted the office of register in bankruptcy, which office he still holds.

**Williams** (James), b. in Granville co., N. C., about 1730; emigrated to Little River, Laurens district, S. C., 1773; was a member of the provincial congress of South Carolina Jan., 1775; became colonel of militia Apr., 1779; commanded a detachment at the battle of Stono, June 20, 1779; defeated the British and Tories at Musgrove's Mills Aug. 18, 1780, and led one of the attacking columns at the battle of King's Mountain, where he was killed, Oct. 8, 1780.

**Williams** (James D.), b. in Pickaway co., O., Jan. 8, 1808; settled in Knox co., Ind., in childhood; received a common-school education; became a farmer and stock-raiser; was frequently elected as a Democrat to the lower house of the legislature; was State senator 1859–67 and 1871–75; chosen member of Congress 1874, serving as chairman of the committee on accounts; was a member of the State board of agriculture seventeen years, and its president four years, and was chosen governor of Indiana over Gen. Benjamin Harrison at the election of Oct., 1876, after one of the most exciting contests in the political history of the U. S. He is widely known by the sobriquet of "Blue Jeans," given him by his supporters on account of the farmer's costume which he ordinarily wore.

**Williams** (Jesse L.), b. in Stokes co., N. C., May 6, 1807. His parents removed to Cincinnati, O., during his childhood; the impaired means of his father compelled him to avail himself of the aid of his son upon the farm, the latter being thus denied the privileges of obtaining an education other than such as the limited advantages of the town afforded during the brief intervals of time he was able to devote even to these. Following the inclination of his mind, however, at the age of seventeen he accepted the position of rodman in the surveying-party for the proposed Miami and Erie Canal. He was, however, soon advanced as assistant engineer, and during a portion of the time was called upon to direct the progress of the whole

work. In 1832 he accepted the position of chief engineer of the contemplated Wabash and Erie Canal; in 1835 was placed in charge of other new works, and a year later was appointed chief engineer of the entire system of canals throughout Indiana; in 1837 the railroads and turnpikes then in progress were added to his charge, and continued under his supervision as State engineer until 1841, during which time he was *ex-officio* a member of the board of internal improvement; after a suspension of five years upon the public works in Indiana, Mr. Williams was in 1847 reappointed chief engineer of the Wabash and Erie Canal. He was chief engineer of the Fort Wayne and Chicago R. R. 1854–56; a government director of the Union Pacific R. R. during its construction 1864–69; receiver of the Grand Rapids and Indiana R. R. 1869–71, during which time he completed 200 miles of that road; chief engineer of the Cincinnati Richmond and Fort Wayne R. R. 1871–72; has been a director of the Pittsburg Fort Wayne and Chicago R. R. since 1856.

**Williams** (John), D. D., b. at Aber-Conway, Carnarvonshire, Wales, Mar. 25, 1582; educated at Ruthin School; graduated at St. John's College, Cambridge, 1603; became a fellow there, distinguishing himself for the vast range of his studies; took orders in the Church of England 1609; was appointed chaplain to Lord Chancellor Egerton, Baron Ellesmere, 1611, and soon afterward to King James I.; was favored by that monarch on account of his learning and his absolutist opinions; became prebendary of Hereford 1612, of Lincoln 1613, and of Peterborough 1616; was made dean of Salisbury 1619, and of Westminster July 12, 1620; was successor to Bacon as lord keeper of the great seal July 10, 1621, to Oct. 25, 1626; was consecrated bishop of Lincoln Nov. 11, 1621; had a large share in the negotiation of the Spanish marriages 1622–23, thereby making a bitter enemy of Buckingham; used his court influence against monopolies and illegal exactions, and displayed moderation in the management of the Star-Chamber tribunal; preached the funeral sermon of James I. 1625; offended the new sovereign, by whom he was dismissed from the keepership the following year; supported the Petition of Right 1628; was three times prosecuted by Archbishop Laud before the Star Chamber on a charge of betraying the king's secrets; was condemned, after eight years' legal proceedings, to imprisonment, suspension from his bishopric, and successive fines of £10,000 and £8000; was confined four years in the Tower 1636–40, until released by the Long Parliament and restored to his diocese; caused the withdrawal of the bishops from the House of Lords on the occasion of the impeachment of Strafford; advised the king to assent to the execution of that minister; became archbishop of York Dec. 4, 1641; was soon afterward sent to the Tower with eleven other bishops for protesting against the validity of acts passed during their enforced absence from the House of Lords; was released 1643; was a firm supporter of the king during the great rebellion, and fortified and held Conway Castle. D. at Aber-Conway Mar. 25, 1650. He wrote a treatise in opposition to Laud's innovations in church ceremonies. His *Life* (1693) was written by Bishop John Hacket.

**Williams** (John), D. D., b. in Northamptonshire, England, in 1634; educated at Magdalen Hall, Oxford; took orders in the Church of England; became rector of St. Mildred's, London, 1673, prebendary of St. Paul's, London, 1683, of Canterbury 1692, and bishop of Chichester 1696. D. in 1709. He was one of the commissioners on the liturgy and canons in 1689; kept a curious diary of their proceedings, which was printed by order of the House of Commons in 1854; was author of a *History of the Gunpowder Treason* (1679), *A Brief Exposition of the Church Catechism* (1690), of a volume of Boyle lectures, preached in 1695–96, and of many pamphlets against Roman Catholics and dissenters.

**Williams** (John), b. at Roxbury, Mass., Dec. 10, 1644; graduated at Harvard 1683; became pastor of the church at Deerfield, Mass., 1686; was carried away captive to Montreal with his family by the Indians 1704; was returned to Boston 1706, and in 1710 was a commissioner in Col. Stoddard's expedition to Canada. D. at Deerfield June 12, 1729. His personal narrative, *The Redeemed Captive returning to Zion* (Boston, 1707), passed through many editions.—His daughter, Eunice, b. at Deerfield Sept. 17, 1696, was detained by her Indian captors, with whom she lived thirty-eight years; married John de Rogers, and was grandmother of Rev. Eleazar, the so-called "Bourbon prince."—His eldest son, Eleazar, b. at Deerfield July 1, 1688, graduated at Harvard 1708, and was minister of Mansfield, Conn., from 1710 until his death, Sept. 21, 1742. He published several sermons.

**Williams** (John), LL.D., b. at Lampeter, Cardiganshire, Wales, in 1726; became an Independent minister of Socinian views; was noted for classical scholarship, and was pastor of a dissenting congregation at Sydenham, Kent, from 1758 to his death, at Islington in 1798. Author of *A Concordance to the Greek Testament, etc.* (1767), *A Free Inquiry into the Authenticity of the First and Second Chapters of St. Matthew's Gospel* (1771), *An Enquiry into the Truth of the Tradition concerning the Discovery of America by Prince Madog ab Owen Gwynedd about the Year 1170* (1791), *A Farther Observation, etc., with an Account of a Welsh Tribe of Indians* (1792), and other works, chiefly theological.

**Williams** (John), b. in Surry co., N. C., Jan. 29, 1778; settled at Knoxville, Tenn., as a lawyer 1803; raised a regiment of volunteers 1812, and marched against Florida; was appointed colonel of the 39th U. S. Infantry June 18, 1813; served at the battle of Horseshoe Bend; was U. S. Senator 1815–23, being chairman of the military committee; was minister to Central America 1825–27, and subsequently a member of the State senate. D. near Knoxville Aug. 10, 1837.

**Williams** (John), b. at Ystradmeirig, Cardiganshire, Wales, in 1792; educated at Baliol College, Oxford; took orders in the Church of England; was classical instructor at Winchester College and at Hyde Abbey School; was incumbent of Lampeter, Wales, several years; was appointed, by the influence of Sir Walter Scott, rector of the New Edinburgh Academy; preached the funeral sermon of Scott; was on intimate terms with the celebrated authors then residing at Edinburgh, and became archdeacon of Cardigan 1833. D. at Bushey Heath, Hertfordshire, Dec. 27, 1858. Author of *The Life and Actions of Alexander the Great* (1829; 3d ed. 1860), *Two Essays on the Geography of Ancient Asia* (1829), *Homerus* (1842), *Claudia and Pudens, an Attempt to show that Claudia, mentioned in St. Paul's Second Epistle to Timothy, was a British Princess* (Llandovery, 1848), *Gomer, or a Brief Analysis of the Language and Knowledge of the Ancient Cymry* (2 parts, 1854), *A Life of Julius Cæsar* (1854), and *Essays on Various Subjects, etc., connected with the Pre-historical Records of the Civilized Nations of Ancient Europe, especially of that Race which first occupied Great Britain* (1858).

**Williams** (John), b. at Tottenham, near London, England, June 29, 1796; was apprenticed to an ironmonger, and acquired great skill in mechanical arts; was ordained a minister 1816, and sent by the London Missionary Society to the South Pacific islands; labored several years in the Society Islands with great success, acquiring the native languages; visited the Hervey Islands, and founded a mission at Raratonga 1823; built with his own hands a vessel 60 feet long, with which for four years he explored the neighboring groups of islands, including the Samoan; returned to England 1834; superintended the publication of the New Testament in the Raratongan language; raised £4000 for the purchase and outfit of a missionary ship, with which, accompanied by other missionaries, he returned to Polynesia 1838; renewed his explorations, and reached the New Hebrides, where he was about to plant a mission when he was killed and eaten by the cannibals of Erromanga Nov. 20, 1839. Author of *A Narrative of Missionary Enterprises in the South Sea Islands* (London and New York, 1837). Several memoirs were published, the most complete being that by Rev. E. Prout (1843).

**Williams** (John), called Ab Ithel, b. at Llangyhafel, Denbighshire, North Wales, in 1811; graduated at Jesus College, Oxford, 1834; took orders in the Church of England, and was successively incumbent of Llanfor, Nerquis, Llanymowddwy, and Llanenddwyn, Merionethshire, where he d. Aug. 27, 1861. He was editor of the *Cambrian Journal*, a quarterly commenced in 1854; edited for the Welsh MSS. Society an *Ancient Welsh Grammar* (1856), *The Medical Practice of Rhinwallon* (1856), and *Barddas, or Bardism, a Collection of Original Documents, etc.* (1862), and for the Rolls Series *The Chronicle of the Princes* (1860) and the *Annales Cambriæ;* translated Aneurin's celebrated poem, *The Gododin* (1858), and was author of *The Ecclesiastical Antiquities of the Cymry* (1844) and other works.

**Williams** (John), D. D., b. at Deerfield, Mass., Aug. 30, 1817; graduated at Trinity College 1835; studied divinity, and was ordained in the Protestant Episcopal Church 1838; was rector of St. George's, Schenectady, N. Y., 1842–48; president of Trinity College 1848–53; became assistant bishop of Connecticut 1861, and sole bishop Jan., 1865. Author of *Ancient Hymns of the Holy Church, Thoughts on the Gospel Miracles,* and other religious publications.

**Williams** (John Mason), LL.D., b. at Taunton, Mass., in June, 1780; graduated at Brown University 1801; was admitted to the bar at New Bedford 1803; was associate justice of the court of common pleas 1821–39, chief-justice of the same 1839–44, and commissioner of insolvency

1844–56. D. at New Bedford Dec. 28, 1868. Author of numerous addresses and legal and political arguments, and contributor to literary and educational periodicals.

**Williams** (Jonathan), b. at Boston, Mass., 1750, received a good education; was employed in the office of a commercial house in Boston; made frequent business-voyages to the West Indies and to England. On various occasions during his visits to England he was entrusted by his grand-uncle, Benjamin Franklin, with important political despatches and documents to his party in America. During Dr. Franklin's residence in France as U. S. ambassador, Williams was employed by him as secretary, performing also during a portion of the same time the duties of U. S. commercial agent. While here he studied the military sciences, and made himself acquainted with the standard works on fortification. Returning with his relative in 1785, he resided near Philadelphia, where he was for several years a judge of the court of common pleas. On Feb. 6, 1801, he accepted an appointment in the army as major of the 2d regiment of artillerists and engineers. In December he was appointed inspector of fortifications, and on the 4th of that month took command of the post of West Point and the duties of instruction of the artillerists and engineers. The act of Mar. 16, 1802, fixing the military peace establishment, separated the two corps and provided for the present Military Academy, of which the "principal engineer" should have the superintendency. Under this act Williams was retained as major of engineers (Apr. 15, 1802), and at once assumed the duties of superintendent at West Point, where he continued until June 20, 1803, when on a question of rank Major Williams resigned from the army. An adjustment of the point at issue was arranged, however, and Apr. 19, 1805, Williams, at the request of Pres. Jefferson, returned to the army as chief engineer, with the rank of lieutenant-colonel, resuming also the superintendency of the Military Academy. While exercising the latter duty he devoted himself personally to the fortifications of New York harbor and most of the forts which constitute its inner line of defence. Fort Columbus, Castles Williams and Clinton (Castle Garden), and a work similar to the last named (Fort Gansevoort) located 2 or 3 miles higher up the river were planned by him and built under his immediate supervision. Castle Williams was the first "casemated" battery erected in this country (built 1807–10), and was planned after the system of Montalembert, with which Col. Williams had made himself acquainted in France. Upon the declaration of war with Great Britain in 1812 he was at Castle Williams, and being the senior officer present claimed command of that work. The authorities at Washington, however, assigned the command to another, whereupon Col. Williams resigned July 31, 1812. Returning to Philadelphia, he was chosen to Congress in 1814, devoting his leisure to literary pursuits; was vice-president American Philosophical Society; author of a *Memoir on the Use of the Thermometer in Navigation* (1799), *Elements of Fortification* (translation, 1801), *Kosciusko's Movements for Horse Artillery* (1808), of numerous military and philosophical works, and translator of several works on military science. He was an officer of decided merit, and justly styled the "father of the corps of engineers." D. at Philadelphia, Pa., May 20, 1815.

**Williams** (Lewis), b. in Surry co., N. C., about 1783; graduated at the University of North Carolina 1808; was a member of the State legislature 1813–15, and a member of Congress for twenty-nine years, from 1815 until his death, at Washington, D. C., Feb. 23, 1842. He was for fifteen years chairman of the committee on claims, and was known as the "father of the House," from his term of service being the longest on record.

**Williams** (Marmaduke), b. in Caswell co., N. C., Apr. 6, 1772; became a lawyer; was a member of Congress from North Carolina 1803–09; settled in Madison co., Ala., 1810, and in Tuscaloosa co. 1818; was a member of the convention that framed the State constitution 1819, and was an unsuccessful candidate for governor against William W. Bibb at the first State election; was eleven times chosen to the legislature between 1821 and 1840; was a commissioner to adjust the unsettled accounts between Alabama and Mississippi 1826, and judge of the county court from 1832 until 1842, when he retired on account of having reached the age of seventy years. D. at Tuscaloosa Oct. 29, 1850.

**Williams** (Mary **Bushnell**), b. at Baton Rouge, La., in 1826; educated under the care of Prof. Alexander Dimitry; became proficient in modern languages and literature; married Mr. Josiah P. Williams of the parish of Rapides, La.; lost her husband during the civil war; has since resided in New Orleans, and has written much for the press, both in prose and verse. Her poem, *The Serfs of Châteney*, has received high praise from cautious critics.

**Williams** (Monier), b. at Bombay, India, in 1819; studied at King's College, London, and at the East India Company's College at Haileybury; graduated at Baliol College, Oxford, 1844; became Boden Sanskrit scholar 1843; professor of Sanskrit at Haileybury 1844–58, and at Cheltenham College 1858–60; was chosen Boden professor of Sanskrit at Oxford Dec., 1860, and visited India 1875–76. Author of a *Sanskrit Grammar* (1846; 2d ed. 1857), an *English-Sanskrit Dictionary* (1851), textbooks in Persian (1858) and Hindostani (1859), *Original Papers illustrating the History of the Application of the Roman Alphabet to the Languages of India* (1859), *Indian Epic Poetry* (1863), *A Sanskrit and English Dictionary* (1872), and *Indian Wisdom* (1875).

**Williams** (Otho Holland), b. in Prince George's co., Md., in Mar., 1749; entered the Revolutionary army before Boston 1775 as lieutenant of a rifle company under Col. Michael Cresap; became major of a rifle regiment 1776, and was distinguished at Fort Washington, N. Y., where he was wounded and taken prisoner, but soon exchanged; became colonel of the 6th Maryland regiment, with which he accompanied Gen. De Kalb to South Carolina; was adjutant-general of the Southern army under Gens. Gates and Greene from 1780 until the end of the war; rendered efficient service at the battle of Camden and during Greene's retreat, when he commanded a light corps which acted as a rear-guard; took an active part, commanding the Maryland brigade, at the battles of Guilford and Hobkirk Hill; decided the victory by a brilliant charge at Eutaw Springs; was made brigadier-general May, 1782, and was collector of customs for the State of Maryland from 1783 to his death, July 16, 1794. He wrote a *Narrative of the Campaigns of 1780*, and a *Sketch* of his life was published by Osmond Tiffany (Baltimore, 1851).

**Williams** (Reuel), LL.D., b. at Hallowell (now Augusta), Me., June 2, 1783; received an academic education; studied law; was admitted to the bar 1802; took a high rank in his profession; was a member of the legislature 1822–26, and again 1829–32; of the State senate 1827–28; was a Presidential elector 1836, U. S. Senator 1837–43, a trustee of Bowdoin College, and a promoter, and for twelve years manager, of the railroad uniting Augusta with Boston. D. at Augusta July 25, 1862.

**Williams** (Robert), brother of Marmaduke, b. in Caswell co., N. C., about 1765; received a good education; became a lawyer, and adjutant-general of North Carolina; represented that State in Congress from 1795 until 1803, when he was appointed commissioner of land-titles for Mississippi Territory; was governor of that Territory 1805–09; settled in Tennessee some years later, and d. in Louisiana.

**Williams** (Robert), b. in Wales about 1800; was educated at Christ Church, Oxford; became a curate in Denbighshire, and a distinguished authority on Welsh history and literature. Author of *A Biographical Sketch of the most Eminent Welshmen* (1836), *Enwagion Cymru, a Dictionary of Eminent Welshmen from the Earliest Times* (Llandovery, in Nos., 1843–52), and *Lexicon Cornu-Britannicum, a Dictionary of the Ancient Celtic Language of Cornwall, etc.* (1865), a work containing also the synonyms in the cognate dialects, Welsh, Armoric, Irish, Gaelic, and Manx.

**Williams** (Robert Folkestone), b. in England about 1805; was for many years professor of ancient and modern history at the Cavalry College, Richmond, and was editor of Colburn's *New Monthly Magazine*. Author, among other works, of *Rhymes and Rhapsodies* (1833), *The Youth of Shakespeare* (3 vols., 1838), *Shakespeare and his Friends* (3 vols., 1838), *The Secret Passion* (3 vols., 1844), *Lives of the Princes of Wales* (1843), *Memoirs of Sophia Dorothea, Consort of George I.* (2d ed., 2 vols., 1848), *Strawberry Hill, an Historical Novel* (3 vols., 1847), *Domestic Memoirs of the Royal Family and of the Court of England, chiefly at Shene and Richmond* (3 vols., 1860), *Lives of the English Cardinals* (2 vols., 1868), and *Memoirs and Correspondence of Francis Atterbury, D. D., Bishop of Rochester* (2 vols., 1868), edited from the MS. collections of Dr. Thomas Birch in the British Museum; *The Court and Times of James I.* (2 vols., 1848) and *The Court and Times of Charles I.* (2 vols., 1848), and completed Capt. Marryat's *The Little Savage* (2 vols., 1848) and Theodore Hook's *Fathers and Sons* (3 vols., 1841), left unfinished at the death of their respective authors.

**Williams** (Roger), b. in Wales about 1599; resided in London during his youth; was apparently destined for the law; made reports in shorthand of the proceedings before the court of Star Chamber, which gained him the patronage of Sir Edward Coke, through whose influence he was elected a scholar of Sutton's Hospital (now the Charter-house) July 5, 1621; obtained an "exhibition" there July 19, 1624; was admitted to Pembroke College, Cambridge, Feb.

8, 1623; was matriculated a pensioner July 17, 1625; graduated there as B. A. Jan., 1627; took orders in the Church of England; obtained a benefice in Lincolnshire; became a nonconformist or "Separatist," holding very decided views; embarked for New England at Bristol Dec. 11, 1630, with his wife Mary, on board the ship Lyon; arrived off Nantasket, Mass., Feb. 15, 1631; was immediately chosen "teacher," and invited to supply the place of John Wilson, minister of Boston, during the contemplated visit of the latter to England, but declined on the ground that the members of that church were "an unseparated people;" made known some "novel opinions" denying the right of magistrates to punish a breach of the Sabbath or other offences against God, coming thereby into collision with the authorities of the infant colony; was invited to Salem as assistant pastor to Mr. Skelton Apr. 22, but in consequence of the remonstrance of the Massachusetts court soon went to Plymouth; labored there as assistant pastor to Rev. Ralph Smith, whose opinions were also "leavened with the humors of the Rigid Separation;" supported himself by manual labor, engaging also in trade in a very limited way; made a vigorous effort to acquire the Indian language, in which he ultimately succeeded; left Plymouth with a number of adherents in 1633, on account of the church having refused to sanction "divers of his singular opinions;" proceeded anew to Salem, where he assisted Mr. Skelton in the care of the church, though without any formal ordination; wrote a treatise attacking the validity of the title of the Massachusetts Company to its lands, as derived from the royal patent, which he sent to Gov. Winthrop at the latter's request, and which was submitted to the examination of the governor and assistants Jan. 6, 1634, resulting in a vote of censure; was nevertheless settled as pastor of Salem church on the death of Mr. Skelton, Aug., 1634; preached against the custom of women appearing in public without veils; influenced Mr. Endecott, the assistant governor at Salem, to cut out from the flag of England the red cross, as being "a superstitious thing and a relique of Anti-Christ" (Oct., 1634), for which act Endecott was disabled for a year from bearing office; refused to take either the freeman's or the resident's oath, preaching against the latter, which was instituted Apr. 10, 1635; was cited before the general court, held July 18, to answer complaints made against him, when he maintained his opinions in a protracted debate; drew up letters of admonition to the churches of Massachusetts, charging all the magistrates with "heinous sin" in postponing action upon a petition of the Salem settlers for the assignment to them of lands at Marblehead, and demanding that the magistrates should be subjected to "the discipline of admonition therefor;" withdrew his communion from the churches of Massachusetts by letter of Aug. 25, 1635, and from his own church in consequence of its declining to follow his guidance in the matter; held a separate Sunday service in his own house for his few adherents; appeared upon summons before the general court at Newtown (Cambridge), Oct. 18, 1635, on which occasion the pastors of nearly all the fifteen churches of Massachusetts were present by special invitation; was called upon to meet the charge of teaching various doctrines considered as subversive of authority; maintained his opinions in formal debate with Rev. Thomas Hooker, who represented the general court; was ordered by vote of the court of the following day (Oct. 19) to depart out of the jurisdiction of Massachusetts within six weeks, on account of having "broached and divulged divers new and dangerous opinions against the authority of magistrates, as also writ letters of defamation both of the magistrates and churches;" was allowed by the authorities to remain at Salem until spring, on condition that he should not "go about to draw others to his opinions;" was charged with having broken this condition in Jan., 1636, when it was determined by the general court to send him to England; left Salem with four companions about the middle of January; proceeded to the residence of his friend, the Indian "king," Massasoit, at Sowams (now Warren, R. I.); purchased of the chieftain Ousamequin a tract of land on the eastern shore of Seekonk River, where he commenced a clearing in April; soon removed to the other side of the river, in order to be beyond the jurisdiction of Plymouth Colony; founded with a few associates the town of Providence about May 29, designing it as "a shelter for persons distressed for conscience;" made a "covenant of peaceful neighborhood" with the surrounding Indian sachems; drew up articles of agreement signed by all the settlers at Providence to subject themselves to the will of the majority "only in civil things;" embraced the principles of the Baptists; was baptized with some ten associates, and formed a church Mar., 1639, but withdrew from it four months later, and was never again connected with any church; visited England in 1643, having sailed from New Amsterdam (now New York); obtained a charter for his plantation through the influence of Sir Henry Vane; printed in London his *Key into the Language of America, or an Help to the Language of the Natives in that Part of America called New England; together with Brief Observations of the Customs, Manners, and Worships, etc., of the Aforesaid Natives in Peace and Warre, in Life and Death, etc.* (1643; new ed. by John Pickering, Providence, 1827), and two controversial treatises, *Mr. Cotton's Letter, lately printed, Examined and Answered* (1644), and *The Bloudy Tenent of Persecution for Cause of Conscience discussed, in a Conference betweene Truth and Peace, etc.* (1644), which elicited replies from Cotton and others; returned to Providence 1644, landing at Boston in September; refused to act as governor of the colony; again visited England to secure a confirmation of the charter 1651; remained in London nearly three years; was for some time a teacher of the Hebrew, Greek, Latin, French, and Dutch languages, employing the conversational method of instruction; became acquainted with Cromwell and Milton; was intimate with Sir Henry Vane, and had a curious correspondence with Mrs. Anne Sadleir, daughter of his early patron, Sir Edward Coke; published *The Bloody Tenent yet more Bloody, by Cotton's Endeavour to Wash it White in the Blood of the Lambe, etc.* (1652), *The Hireling Ministry none of Christ's, or a Discourse touching the Propagating the Gospel of Jesus Christ, etc.* (1652), and *Experiments of Spiritual Life and Health, and their Preservatives* (1652); returned to Providence early in 1654; was president of the colony 1654–57; rendered important services to the colonies by his influence with the Indians and by giving warning of impending hostilities; refused to sanction in 1672 the proposed exclusion of Quakers from Rhode Island, but engaged in public debate, both at Newport and at Providence, with three Quaker preachers (Stubbs, Burnet, and Edmundson), and published *George Fox digg'd out of his Burrowes, or an Offer of Disputation on Fourteen Proposalls made this Last Summer 1652 unto G. Fox, then present on Rode Island in New England* (Boston, 1676), which elicited Fox's violent rejoinder, *A New England Fire-Brand Quenched, etc.* (1679). D. at Providence in Apr., 1683. He was buried on his own estate, where a monument has been erected by his descendants, and a statue has been placed by Rhode Island in the Capitol at Washington, D. C. His *Letters* to the two Govs. Winthrop (65 in number) were printed by the Massachusetts Historical Society (1863), and the Narragansett Club has published a careful edition of his works (6 vols., 1866–75), under the supervision of Reuben Aldridge Guild. There are biographies by J. D. Knowles (1833), Prof. William Gammell (1846), and Romeo Elton (London, 1852). (See also Samuel G. Arnold's *History of Rhode Island* (vol. i., 1860), and Rev. Henry M. Dexter's *As to Roger Williams and his Banishment from the Massachusetts Plantation* (Boston, 1876).)

PORTER C. BLISS.

**Williams** (ROWLAND), D. D., b. at Halkyn, Flintshire, Wales, Aug. 16, 1817; educated at Eton; graduated at King's College, Cambridge, 1841; became fellow and tutor there; took orders in the Church of England, identifying himself with the "Broad-Church" movement headed by Arnold and Maurice; was prominent in connection with university reform; became chaplain to the bishop of Llandaff; vice-principal and professor of Hebrew at St. David's College, Lampeter, 1850; was select preacher to the University of Cambridge 1854; became vicar of Broad Chalk, Wiltshire, 1859; was prosecuted before the court of arches for having contributed to the famous volume of *Essays and Reviews*, and was condemned Dec., 1862, but obtained a reversal of judgment from the privy council Feb., 1864; resigned his professorship 1862, and resided thenceforth at his vicarage of Broad Chalk, near Salisbury, where he d. Jan. 18, 1870. Author of *Rational Godliness* (1855), *Christianity and Hinduism* (1856), *A Letter to the Lord Bishop of St. David's* (1860), *The Hebrew Prophets, a New Translation* (2 vols., 1868–71), *Broad Chalk Sermons* (1867), *Owen Glendower* (1870), and *Psalms and Litanies* (1872). His *Life and Letters* (2 vols., 1874) have been published by his widow.

**Williams** (SAMUEL), LL.D., b. at Waltham, Mass., Apr. 23, 1743, son of Rev. Warham and grandson of Rev. John of Deerfield; graduated at Harvard 1761; was distinguished in mathematical and philosophical studies; accompanied Prof. John Winthrop to Newfoundland to observe the transit of Venus of June 6, 1761; taught a school at Bradford while pursuing theological studies 1761–63; was licensed to preach Oct. 11, 1763; was ordained minister of Bradford Nov. 20, 1765; instructed several young men in theology; gave lessons in natural philosophy to the celebrated Benjamin Thompson, who was for a time an inmate of his family, and maintained a scientific correspondence with him in later years; was Hollis professor of mathematics and natural philosophy in Harvard College 1780–88; lec-

tured on astronomy to the senior class 1785–88; surveyed the western boundary of Massachusetts at the request of the colonial government 1786; visited Penobscot Bay with Prof. Stephen Sewall in the galley Lincoln, in behalf of the American Academy of Arts and Sciences and the corporation of Harvard College, to observe the total eclipse of the sun of Oct. 20, 1786; resigned his professorship and removed to Rutland, Vt., 1788; preached there 1789–95; subsequently preached two years at Burlington, Vt.; was for some years editor and proprietor of the Rutland *Herald;* surveyed the western boundary of Vermont 1805, by appointment of Gov. Tichenor, and delivered a course of lectures on astronomy and natural philosophy in the University of Vermont shortly after its establishment. D. at Rutland Jan. 2, 1817. Author of various printed sermons and scientific memoirs, and of many more left in MS., and of *The Natural and Civil History of Vermont* (Walpole, N. H., 1794; 2d ed., Burlington, Vt., 2 vols., 1809).

**Williams** (Samuel), b. at Colchester, England, Feb. 23, 1788; was apprenticed to a printer in his native town; applied his spare time in learning and practising the art of designing and engraving on wood; subsequently started in business as an engraver, first at Colchester and afterward at London; became known by his 300 excellent illustrations to Crosby's *Natural History;* was employed to illustrate Whittingham's *Robinson Crusoe,* Hone's *Every-Day Book,* Wiffen's *Tasso,* Thomson's *Seasons,* Britton's *Cathedral Antiquities,* Howett's *Rural Life,* Scrope's *Salmon-Fishing* and *Deer-Stalking, The Boy's Treasury of Sports,* and other works; contributed much by the spirit and vigor of his style to the improvement of wood-engraving in England, and made some successful essays as a painter in oil-colors. D. Sept. 19, 1853.

**Williams** (Samuel Wells), LL.D, b. at Utica, N. Y., Sept. 22, 1812; graduated at the Rensselaer Polytechnic Institute at Troy, N. Y., 1832; went to Canton, China, as printer to the American mission 1833; assisted in editing the *Chinese Repository;* completed at Macao the printing of Medhurst's *Dictionary;* visited Japan to return some shipwrecked sailors 1837; learned the Japanese language, into which he translated the books of Genesis and Matthew; aided Dr. Bridgman in preparing his *Chinese Chrestomathy;* published *Easy Lessons in Chinese* (Macao, 1842), *The Chinese Commercial Guide* (1844), and *An English and Chinese Vocabulary in the Court Dialect* (1844); visited the U. S. 1845, delivering lectures on China, and procuring from Berlin a new font of Chinese type; published *The Middle Kingdom, a Survey of the Geography, Government, Education, Social Life, Arts, Religion, etc., of the Chinese Empire and its Inhabitants* (2 vols., 1848; 3d ed. 1857), which is still considered the best work of the kind on that country; returned to China 1848; edited the *Chinese Repository* until 1851, when it was discontinued; accompanied Commodore Perry as interpreter on his expedition to Japan 1853–54; was appointed secretary and interpreter of the U. S. legation in Japan, of which he had charge until the arrival of the first minister; published a *Tonic Dictionary of the Chinese Language in the Canton Dialect* (1856), of which most of the copies were burned in December of same year, along with the mission-press at Macao; aided Hon. William B. Reed in the negotiation of the Treaty of Tientsin 1858; accompanied Mr. Ward to Peking to exchange the ratifications of 1859; revisited the U. S. 1860–61; went to reside at Peking as secretary of the U. S. legation 1862, then first established in the capital of China; published a 5th ed. of the *Commercial Guide* (1863), nearly rewritten; completed and brought out the great work of his life, *The Syllabic Dictionary of the Chinese Language* (4to, Shanghai, 1874); returned to the U. S. in 1875, and settled at New Haven, Conn., where he has been appointed lecturer on Chinese at Yale College. A new edition of his *Tonic Dictionary,* revised by Dr. Eitel, has been published by the English authorities (Hong-Kong, 1876).

**Williams** (Seth), b. at Augusta, Me., Mar. 22, 1822; graduated at West Point 1842; served as lieutenant of artillery and aide-de-camp to Gen. Patterson in the Mexican war; was brevetted captain for gallantry at Cerro Gordo; was adjutant of the Military Academy 1850–53; was appointed brigadier-general of volunteers Sept. 23, 1861; was adjutant-general to Gen. McClellan in Western Virginia and in the Army of the Potomac; was brevetted colonel U. S. A. for gallantry at Gettysburg, became acting inspector-general on the staff of Gen. Grant May 10, 1864, became major-general of volunteers Aug. 1, 1864, and subsequently brigadier and major general U. S. A., and rendered very valuable services in the organization of the army. D. at Boston Mar. 23, 1866.

**Williams** (Solomon), D. D., son of Rev. William of Hatfield, and grandson of Rev. Solomon Stoddard of Northampton, b. at Hatfield, Mass., June 4, 1700; graduated at Harvard 1719, and was minister of Lebanon, Conn., from Dec. 5, 1722, until his death, Feb. 29, 1776. He held a prominent place among the New England clergy; maintained polemics with Rev. Andrew Croswell "on the nature of justifying faith" (1746), and with his cousin, Jonathan Edwards, "on the qualifications necessary to lawful communion in the Christian sacraments" (1751). He published many funeral and anniversary sermons, of which one of the most notable was that preached at Mansfield, Conn., in 1741, on the occasion of the visit of his relative, the celebrated Eunice Williams, the Deerfield captive.

**Williams** (Stephen), D. D., son of Rev. John, the "redeemed captive," b. at Deerfield, Mass., May 14, 1693; was carried captive with his family to Canada by the Indians Mar., 1704 (see Williams, Rev. John); was bought of the Indians by the French governor of Canada, and sent to Boston before the rest of his family, arriving there Nov. 21, 1705; not long afterward wrote a minute narrative of his experiences in captivity; graduated at Harvard 1713; taught school at Hadley 1713–14; was ordained minister of Longmeadow, Mass., Oct. 17, 1716; was chaplain to a regiment in Sir William Pepperell's expedition against Louisburg 1745, to Col. Ephraim Williams's regiment in the expedition to Lake George 1755, and to Col. Thomas Williams's regiment in the campaign of 1756; visited the Housatonic Indians at Stockbridge, Mass., 1734, and was instrumental in the establishment of a mission among them. D. at Longmeadow June 10, 1782, in the sixty-sixth year of his ministry. Three of his sons, Stephen, Warham, and Nathan, were respectively ministers of Woodstock, Northford, and Tolland, Conn.

**Williams** (Stephen West), M. D., b. at Deerfield, Mass., Mar. 27, 1790, son of Dr. W. S. Williams of Deerfield, and descended from Rev. John, the "redeemed captive;" became a distinguished physician and contributor to medical periodicals, and settled in 1852 in Laona, Ill., where he d. July 6, 1855. Author of *A Catechism of Medical Jurisprudence* (Northampton, 1835), *A Biographical Memoir of the Rev. John Williams, etc., with an Appendix containing the Journal of the Rev. Dr. Stephen Williams of Longmeadow during his Captivity* (Greenfield, 1837; 3d ed., Northampton, 1853), *American Medical Biography* (Greenfield, 1845), and *The Genealogy and History of the Family of Williams in America, more particularly of the Descendants of Robert Williams of Roxbury* (1847).

**Williams** (Taliesin), called Ab Iolo, son of Edward, known as Iolo Morganwg (1745–1826), b. in Glamorganshire, Wales, about 1775; was his father's associate in his labors upon the Welsh literature and antiquities; edited his posthumous *Iolo Manuscripts* (Llandovery, 1848), and was author of a *Prize Essay on the Bardic Alphabet* (1840), in Welsh, and other writings. D. at Merthyr Tydvil in 1847.

**Williams** (Thomas), b. in New York in 1815; graduated at the U. S. Military Academy July, 1837, when appointed second lieutenant of artillery. After a two years' campaign in Florida, he was chiefly in garrison and on frontier duty until 1844, in which year he was attached to the staff of Gen. Scott as aide-de-camp, in which capacity he served throughout the Mexican war, gaining the brevet of captain for gallantry at Contreras and Churubusco, and of major for Chapultepec, and retained as A. D. C. until 1850, when again on frontier duty and in garrison until 1861, in May of which year he attained a majority in the 5th Artillery. During the early days of the civil war he was inspector-general of the department of Virginia; appointed brigadier-general of volunteers Sept. 28, 1861, he was in command of Fort Hatteras, N. C., until Mar., 1862, when placed in command of a brigade in the Ship Island expedition and capture of New Orleans. In the first unsuccessful attempt to capture Vicksburg (June–July, 1862) he was in command of the land forces. Upon the abandonment of the attempt he was entrusted with the defence of Baton Rouge, La., which post he gallantly defended against the attack of the Confederates under Gen. Breckenridge, and where, at the moment of victory, placing himself at the head of an Indiana regiment whose field officers had fallen, he was instantly killed, Aug. 5, 1862.

**Williams** (Thomas Scott), LL.D., b. at Wethersfield, Conn., June 26, 1777; graduated at Yale College 1794; studied law at Litchfield, Conn., under Judge Tapping Reeve; was admitted to the bar Feb., 1799; commenced practice at Mansfield; removed to Hartford 1803; became attorney of the board of managers of the school fund 1809; represented Hartford in the general assembly seven years, between 1813 and 1829; was a member of Congress 1817–19; associate judge of the supreme court of errors 1829–34, chief-justice of the same 1834–47; mayor of Hartford 1831–35; president of the deaf and dumb asylum at Hart-

ford twenty years; vice-president of the insane retreat and of the American Board of Foreign Missions, and subsequently president of the American Tract Society. D. at Hartford Dec. 15, 1861. He bequeathed $28,000 to charitable institutions.

**Williams** (WILLIAM), b. at Newtown, Mass., Feb. 2, 1665, son of Deacon Isaac, and grandson of Robert Williams of Roxbury; graduated at Harvard 1683, in the same class (consisting of only three persons) with his cousin John, afterward celebrated as the "redeemed captive," and was minister at Hatfield, Mass., from 1685 until his death, Aug. 29, 1741, in the fifty-sixth year of his ministry. His first wife was Eliza, daughter of Rev. Seaborn Cotton of Hampton, N. H., and his second was a daughter of Rev. Solomon Stoddard of Northampton, Mass. He published a number of sermons. He preached a half-century sermon from his ordination, as did his son, Dr. Solomon, of Lebanon, Conn., his grandson, Dr. Eliphalet, at East Hartford (b. at Lebanon Feb. 21, 1727; graduated at Yale College 1743; d. at East Hartford, Conn., June 29, 1803), and his great-grandson, Solomon, of Northampton, Mass., who was b. at East Hartford, Conn., in 1752; graduated at Yale College 1770; was tutor there 1773–75; and d. at Northampton, Mass., Nov. 9, 1834, in the fifty-fifth year of his ministry. He published a considerable number of sermons.

**Williams** (WILLIAM), son of Rev. Solomon, b. at Lebanon, Conn., Apr. 18, 1731; graduated at Harvard 1751; served on the staff of his relative, Col. Ephraim Williams, in the expedition to Lake George 1755; became a merchant at Windham; was long the town-clerk and justice of the peace; many times elected to the provincial assembly, serving often as clerk of that body; was a member of the Connecticut committee of correspondence 1773, Speaker of the house of representatives 1775, afterward a member of the council, of the committee of safety, and of the Continental Congress 1776–77 and 1783–84; was a signer of the Declaration of Independence, and contributed by his pen and his estate to the cause of independence, lending his "last mite" to the Continental treasury in 1779. He married a daughter of Gov. Trumbull.

**Williams** (WILLIAM), b. at Norwich, Conn., in 1788; became an eminent shipping merchant and a general of Connecticut militia; was one of the founders of the Norwich Free Academy, to which he liberally contributed, and served many years as president of its board of trustees; maintained for seventeen years by his personal efforts a Sabbath service among the Mohegan Indians, acting as a Sunday-school teacher; was very active as an officer of the American Seamen's Friend Society and a benefactor of missionary and Bible societies. D. at Norwich Oct. 28, 1870.

**Williams** (Sir WILLIAM FENWICK), b. in Nova Scotia Dec. 4, 1800; entered the royal artillery in 1825, and in 1868 attained the rank of general in the British army. Having been much employed in Turkey prior to 1848, he was in June of that year appointed English commissioner for the settlement of the Turco-Persian boundary, and in 1854 was made British commissioner with the Turkish army in the East, with the local rank of brigadier-general. His gallant defence of Kars in 1855 won him the promotion to major-general, and he was created a baronet and knight of the Bath. The order of the Medjidie and the grand cross of the Legion of Honor of France were also bestowed on him. Was a member of Parliament for Calne 1856–59; from 1859 to 1865 was in command of the troops in Canada, and in 1870 was appointed governor and commander-in-chief of Gibraltar.

**Williams** (WILLIAM R.), D. D., b. in New York City Oct. 14, 1804, son of Rev. John Williams (1767–1825), pastor of the Fayette street Baptist church; graduated with the highest honors at Columbia College 1822; studied law with Peter Jay, and practised that profession one year; entered the Baptist ministry 1831, and became in that year pastor of the Amity street Baptist church at its formation, and still retains (1876) that post; made three visits to Europe, and collected a theological library of unusual extent and excellence. Author of *Miscellanies* (1850; 3d ed. 1860), *Religious Progress, Discourses on the Development of Christian Character* (1850), *Lectures on the Lord's Prayer* (1851); has published many single sermons and addresses; has edited several religious works, and has announced for publication a *History of the Baptists*.

**Wil'liamsboro',** tp., Rockingham co., N. C. P. 2340.

**Wil'liam's Bridge,** v., West Farms tp., Westchester co., N. Y. P. 144.

**Wil'liamsburg,** county of E. South Carolina, lying on Great Pedee and Santee rivers, drained by Black River, and traversed by North-eastern R. R.; surface level, with numerous pine forests; soil moderately productive. Swine and cattle are the principal live-stock. Staples, cotton, tar, pitch and turpentine, rice, and Indian corn. Cap. Kingstree. Area, about 1200 sq. m. P. 15,489.

**Williamsburg,** p.-v., Jefferson co., Fla. P. 253.

**Williamsburg,** p.-v., Green tp., Wayne co., Ind. P. 248.

**Williamsburg,** v., Whitley co., Ky. P. 139.

**Williamsburg,** tp., Piscataquis co., Me. P. 176.

**Williamsburg,** p.-v. and tp., Dorchester co., Md. P. 1247.

**Williamsburg,** p.-v. and tp., Hampshire co., Mass. P. 2159.

**Williamsburg,** p.-v., cap. of Covington co., Miss.

**Williamsburg,** p.-v., Kings co., N. Y. Since 1874 forming a part of the city of BROOKLYN (which see).

**Williamsburg,** p.-v. and tp., Clermont co., O. P. of v. 773; of tp. 2383.

**Williamsburg,** v., Beaver tp., Noble co., O. P. 213.

**Williamsburg,** p.-v., Woodbury tp., Blair co., Pa. P. 821.

**Williamsburg,** p.-v. and tp., cap. of James City co., Va., on an elevated plateau between James and York rivers, about equidistant from either stream. The town was first settled in 1632, is the oldest incorporated town in the State, and abounds in historic interest. Prior to the Revolution it was the seat of the royal government, and subsequently, until 1799, the capital of the State. The capitol was destroyed by fire in 1748, and rebuilt; the latter building was also burned about 1830. The Eastern lunatic asylum, located here, authorized in 1769 and opened in 1773, is the oldest institution of the kind in this country. It is also the seat of WILLIAM AND MARY COLLEGE (which see), the oldest educational institution, except Harvard University, in the U. S., having been incorporated in 1692. There are public schools for both white and colored youth in the town; also Methodist, Baptist, and Episcopal churches, the latter building having stood since 1678, and is still in good condition. P. in 1870, 1392.

The immediate vicinity of this town was the scene of the first serious engagement in the Peninsular campaign of 1862. The siege of Yorktown was so far advanced that the Union batteries would have been ready to open on that city by May 6, when on the morning of the 4th it was found that the enemy had evacuated that city and abandoned their lines. All the available cavalry force, with four batteries of artillery, under Gen. Stoneman, was ordered in immediate pursuit. The infantry divisions of Hooker and Smith were ordered to proceed in support of Stoneman, and these were followed by the divisions of Couch, Kearny, and Casey. The immediate charge of these operations was given to Gen. Sumner. Stoneman, moving promptly, met with but little opposition until arriving in front of the enemy's works about 2 miles E. of Williamsburg, where he took up a defensive position to await the arrival of the infantry. The division of Smith arrived during the afternoon, and Hooker during the night; but an order for the former body to attack that evening was abandoned, and a heavy rain setting in, the roads became almost impassable by the morning of the 5th. The Confederate commander, Johnston, perceiving the pursuit to be serious, hastily recalled his troops to the works previously prepared in front of Williamsburg. Hooker began the attack at 7½ on the morning of the 5th, and for a while silenced the guns of Fort Magruder and cleared the ground in his front; but the enemy, being constantly reinforced, made attack after attack upon his left, which were gallantly resisted until about 4½ P. M., when, just as his ammunition was about exhausted, Kearny, who had succeeded by great exertion in pushing to the front through the mud, arrived, and at once gallantly attacked, driving the enemy back and allowing Hooker to withdraw his wearied troops. Peck's brigade (Couch's division), which had arrived about 1 P. M., was posted on Hooker's right, and the attacks of the enemy at that point were repulsed. Meanwhile, about 11 o'clock, Gen. Sumner ordered Hancock's brigade (Smith's division) to take possession of an unoccupied work on the enemy's left, which was successfully accomplished, and finding a second one vacated, he occupied that also, and sent back for reinforcements to enable him to advance farther and take the next redoubt, which commanded the plain between him and Fort Magruder. The enemy's attention being now attracted to his position on their flank, they soon showed in force in Hancock's front, threatening his rear right flank. To his repeated calls for reinforcements, Hancock was ordered back to his first position. Delaying as long as possible giving up the advantage he had gained, but being confronted with a superior force, he feigned to retreat slowly, awaiting their onset, until they were close upon him, when, after some

terrific volleys of musketry, he ordered a bayonet charge, which routed and dispersed their whole force. This brilliant engagement was not surpassed during the war, and put an end to the battle that day, for Hancock was now reinforced in his position, and during the night the enemy withdrew. The loss on the Union side was 2228, all told, of which Hooker lost 1575. The Confederate loss was probably about equal in numbers.

**Williamsburg,** p.-v. and tp., Greenbrier co., West Va. P. 1012.

**Williams College** is beautifully located in Williamstown, Berkshire co., Mass. It owes its origin and name to Col. Ephraim Williams, who fell in 1755 near Lake George in the French and Indian war. On his way to the field of battle, at the city of Albany, he made his will, devoting the bulk of his property to the founding of an institution of learning, which in 1793 was chartered as Williams College. Rev. Ebenezer Fitch, D. D., who had been the principal of the school up to the time of its incorporation as a college, became its first president, and continued such till 1815. The catalogue published in 1795 contained 77 names; the largest number of students under Pres. Fitch was 144. Rev. Zephaniah Swift Moore succeeded him, resigning in 1821. Rev. Edward Dorr Griffin, D. D., followed, and held the office with distinguished success till 1836. During his administration a society of alumni was formed "for the promotion," as they state it, "of literature and good-fellowship among ourselves, and the better to advance the reputation and interests of our alma mater." What is now known as Griffin Hall was then built, and funds were raised for the library, for the aid of indigent students, and other general purposes of the college. After him came Rev. Mark Hopkins, D. D., LL.D., who after a remarkably long and successful presidency of thirty-six years resigned in 1872. During this period the college grounds were greatly extended, most of its present buildings erected, its corps of instructors enlarged, and its main endowment secured. The present head of the college is Hon. Paul A. Chadbourne, LL.D., formerly president of the State University of Wisconsin. Though the resources of the institution have always been small, and its position in former years isolated, yet in all the great interests of humanity, whether religious or scientific, it has always wrought in the front rank. Here originated in 1808 the whole series of American missions in connection with Samuel J. Mills and his associates. Here, under Prof. Hopkins, was erected the first astronomical observatory on this continent. Here also, under Profs. Emmons and Hopkins, originated the first of those college scientific expeditions now so common, followed in later years by others to Labrador, Greenland, Florida, South America, and Central America. The number of its graduates is 2500. The condition of the college at present is highly prosperous; its libraries contain 25,000 vols. Its cabinet, recitation-room, appliances, and apparatus are of the best order; it has 13 professors; its funds and securities amount to $300,000; a college hall has been erected where board is furnished at cost or even less. This, with the scholarships already founded and an ample charitable fund, has enabled the trustees to assume the ground that no young man of merit shall be obliged to intermit his studies in this institution on account of inability to pay his college fees.

N. H. Griffin.

**Wil'liamsfield,** p.-v. and tp., Ashtabula co., O. P. 892.

**Wil'liamson,** county of S. Illinois, drained by Big Muddy River, and traversed by Carbondale and Shawneetown R. R., which terminates at the county-seat; surface alternate prairie and woodland, with much bituminous coal; soil fertile. Live-stock numerous. Staples, Indian corn, tobacco, wheat, and wool. Cap. Marion. Area, 432 sq. m. P. 17,329.

**Williamson,** county of Central Tennessee, drained by the head-streams of Harpeth River, and traversed by Louisville Nashville and Great Southern R. R.; surface generally hilly, soil fertile. There are saw-mills, flour-mills, and carriage-factories. Horses, mules, cattle, sheep, and swine are numerous. Staples, Indian corn, cotton, and wheat. Cap. Franklin. Area, 476 sq. m. P. 25,328.

**Williamson,** county of Central Texas, drained by San Gabriel River and its affluents; surface level, with alternate prairie and woodland; soil fertile. Cattle, horses, and sheep are numerous. Staples, Indian corn, cotton, and wool. Cap. Georgetown. Area, 1100 sq. m. P. 6368.

**Williamson,** p.-v. and tp., Wayne co., N. Y. P. 2430.

**Williamson,** tp., Richmond co., N. C. P. 2044.

**Williamson** (Hugh), M. D., LL.D., b. at West Nottingham, Pa., Dec. 5, 1735; graduated at the University of Pennsylvania 1757; studied theology and occasionally preached; was professor of mathematics in the University of Pennsylvania 1760–63; studied medicine at Edinburgh and Utrecht, where he took his degree; practised at Philadelphia; observed the transits of Venus and of Mercury for the Philosophical Society 1769; visited the West Indies 1772; was in London 1774, and was examined before the privy council on the subject of the destruction of tea; spent two years on the Continent 1774–76; engaged in mercantile business at Charleston, S. C., 1777; subsequently settled and practised medicine at Edenton, N. C.; was a surgeon in the Continental service 1781–82; was a member of the North Carolina legislature, a delegate to the Continental Congress 1782–85 and 1787–88, and to the Federal constitutional convention 1787, and a member of Congress 1790–93; removed afterward to New York, and was one of the founders of the Literary and Philosophical Society in 1814. D. at New York May 22, 1819. Author of various medical and scientific treatises, and of a very defective *History of North Carolina* (2 vols., 1812).

**Williamson** (Isaac Dowd), D. D., b. Apr. 4, 1807, in Pomfret, Vt. Beginning to preach as a Universalist in Oct., 1828, was pastor at Albany, N. Y., from 1830 to 1837; since then in Baltimore, Md., New York City, Philadelphia, Pa., Mobile, Ala., Lowell, Mass., Louisville, Ky., and Cincinnati, O. (1873). He has been a voluminous author of works upon Universalism, besides contributing largely to the press of his denomination. He has also labored earnestly in the spread of Odd Fellowship in the U. S.

**Williamson** (Isaac H.), LL.D., b. at Elizabethtown, N. J., in 1769; was admitted to the bar 1791; soon became prosecuting attorney for Morris county, and rose to the head of the New Jersey bar; was chosen to the assembly 1817; was governor and chancellor of the State 1817–29, and president of the State constitutional convention of 1844. D. at Elizabethtown July 10, 1844.

**Williamson** (Robert S.), b. in New York about 1825; graduated at the U. S. Military Academy July, 1848, and appointed a brevet second lieutenant in the corps of topographical engineers, serving on the Pacific coast in surveying railroad routes in California and Oregon until 1856; thence, until 1861, on the staff of the general commanding the department of the Pacific, and conducting (1858–61) meteorological observations and barometric experiments. In the civil war he served as chief topographical engineer at the capture of Newberne and Fort Macon, N. C. (Mar.–Apr., 1862), gaining the brevet of lieutenant-colonel for gallantry at the siege of Fort Macon; subsequently engaged in fortifying Newberne until August, when transferred to the Army of the Potomac. Ordered to the Pacific coast in 1863 (in May of which year he attained a majority in the corps of engineers), he was for a short time chief topographical engineer of the department, and retained on the staff of the general commanding until Dec., 1865. Since Feb., 1863, he has performed the duties of lighthouse engineer, besides having charge at times of the improvement of rivers and harbors on the Pacific coast and of surveys in California and Oregon. In 1868 he published a valuable work *On the Use of the Barometer in Surveys and Reconnoissances.*

**Williamson** (Thomas), b. in Maryland Aug. 1, 1791; received his degree in medicine from the University of Pennsylvania; commissioned surgeon's mate May, 1813, and passed through all the grades up to the highest; was conspicuously noted for his fearlessness, disregarding even yellow fever; Napoleon III. presented him a gold medal for services rendered to a French steamer having this disease on board. D. at Norfolk, Va., Jan. 12, 1859.

Paul F. Eve.

**Williamson** (William Durkee), b. at Canterbury, Conn., July 31, 1779; graduated at Brown University 1804; settled as a lawyer at Bangor, Me., 1807; was attorney for Hancock county 1808–16; State senator 1816–20; president of the first senate of the new State of Maine and acting governor 1821; member of Congress 1821–23, and judge of probate 1824–40. D. at Bangor May 27, 1846. Author of *A History of the State of Maine* (Hallowell, 2 vols., 1832; new ed. 1839), and contributor to the collections of the Massachusetts Historical Society.

**Wil'liamsport,** p.-v., cap. of Warren co., Ind., on the W. bank of Wabash River, and on Toledo Wabash and Western R. R., equidistant from Lafayette and Danville, Ill., contains 3 churches, a fine school building, 1 newspaper, 1 woollen-factory, handsome court-house, 2 hotels, jail, and an extensive grist-mill and warehouse. P. 988.

J. Gregory, Ed. "Republican."

**Williamsport,** tp., Shawnee co., Kan. P. 566.

**Williamsport,** p.-v. and tp., Washington co., Md., on Potomac River and on Western Maryland and Cumberland Valley R. Rs., has an extensive coal and grain trade, good schools, several flouring mills, 2 sash and door

factories, 1 newspaper, and a fine hotel. The village was founded in 1787. Gen. Lee's army crossed into Maryland at this point during the late war. P. of v. 1283; of tp. 3123.
ALPHEUS A. TOWNSEND, ED. "PILOT."

**Williamsport,** p.-v., Deer Creek tp., Pickaway co., O. P. 514.

**Williamsport,** city, cap. of Lycoming co., Pa., on the left (N.) bank of the W. branch of Susquehanna River, 202 miles N. W. of Philadelphia; lat. 41° 14′, lon. 77° 2′ W. It is the northern terminus of Philadelphia and Reading R. R., and a station on Philadelphia and Erie and Northern Central R. Rs., and on Pennsylvania Canal. Selected as county-seat in 1795, when the county was organized, and chartered as a city in 1861. Built on a plain along the river at the base of hills, regularly laid out, supplied with abundance of excellent water from two mountain-springs conducted in pipes under Susquehanna River; lighted with gas; has excellent markets. Williamsport contains 32 churches, 1 savings and 6 national banks, 10 public school-houses and Dickinson Seminary, 1 gas and 2 water companies, and 12 incorporated companies. It has a paid fire department with 3 steamers, 2 daily and 6 weekly newspapers, and 1 monthly magazine; Y. M. C. A. and library, and Woman's Christian Home, 2 Masonic lodges, a chapter, commandery, and a council, 5 Odd Fellows' lodges, 4 lodges Good Templars, 2 of I. O. Red Men, 3 of Knights of Pythias, 3 of United Order American Mechanics, 4 camps of P. O. S. of A., and 1 post of G. A. R. It has 1 horse railroad, 28 saw and 2 grist mills, 8 sash, door, and blind factories, an extensive rubber manufactory, 1 iron-furnace, 2 furniture-factories, 1 paint, 2 soap, and 1 glue works, 3 public parks, 2 race-courses, and agricultural society grounds, a number of manufactories of wood-working machinery, several extensive foundries and boiler-works, and 4 factories of carriages and wagons. It derives its prosperity and importance from its lumber manufacture. The Susquehanna boom, costing upward of $1,000,000, is here located, catching all logs cut from the vast forests of pine and hemlock on the W. Branch and its tributaries. From 1862 to 1875 there were rafted out of the boom 11,938,815 logs, which when sawed made 2,302,685,182 feet of lumber, at an average value of $18 per M. The manufacture of pickets, lath, and shingles is very extensive. Streets paved with Nicholson and stone, and a large number of elegant residences. P. 16,030.
C. E. FRITCHER, MAN. "GAZETTE AND BULLETIN."

**Wil'liamston,** p.-v., Ingham co., Mich., on Detroit Lansing and Lake Michigan R. R., 71 miles W. of Detroit, has 3 churches, 1 bank, excellent schools, 1 newspaper, 3 hotels, 2 foundries, 2 flouring and 2 saw mills, fine water-power, a coal-mine, and a stave-factory. P. 1237.
EBER S. ANDREWS, ED. "ENTERPRISE."

**Williamston,** p.-v. and tp., cap. of Martin co., N. C. P. of v. 520; of tp. 3160.

**Williamston,** p.-v. and tp., Anderson co., S. C. P. 1426.

**Wil'liamstown,** v., Posey tp., Clay co., Ind. P. 65.

**Williamstown,** p.-v., cap. of Grant co., Ky., on Cincinnati Southern R. R., 36 miles S. of Cincinnati, O., has 2 churches, 1 academy and 1 school building, 1 newspaper, Odd Fellows' lodge, 2 hotels, and 2 flouring-mills. Principal business, corn and tobacco-raising. P. 281.
E. H. EYER, ED. "SENTINEL."

**Williamstown,** p.-v. and tp., Berkshire co., Mass., on Troy and Boston R. R., 42 miles E. of Troy, contains Williams College and Greylock Institute, the latter located at South Williamstown, 4 woollen manufactories, 1 newspaper, fine water-power from Hoosac River, several saw-mills, and 2 large hotels. It is a summer resort for tourists. P. 3559.
FRANK TERRIS, ED. "WILLIAMS ATHENÆUM."

**Williamstown,** p.-v. and tp., Lewis co., Mo. P. 180.

**Williamstown,** p.-v. and tp., Oswego co., N. Y. P. 1833.

**Williamstown,** p.-v., Dauphin co., Pa.

**Williamstown,** p.-v. and tp., Orange co., Vt. P. 1236.

**Williamstown,** p.-v., Williams tp., Wood co., West Va. P. 282.

**Williamstown,** tp., Dodge co., Wis. P. 2305.

**Williams Valley,** v., Porter tp., Schuylkill co., Pa. P. 425.

**Wil'liamsville,** p.-v., Sangamon co., Ill.

**Williamsville,** p.-v., Amherst tp., Erie co., N. Y. P. 912.

**Williamsville,** p.-v. and tp., Bath co., Va. P. 998.

**William the Silent,** b. at Dillenburg, Nassau, Apr. 16, 1533, was the eldest son of Count William of Nassau-Dillenburg and his second wife, Juliane von Stolberg, both of whom were Protestants. In 1544 he inherited from his cousin, Renatus of Nassau, the principality of Orange in Provence, whence he derived the title of prince of Orange, and extensive estates in the Low Countries, and he was now sent to Brussels, where he was educated at the court of the queen-regent, Mary of Hungary, in the Roman Catholic faith. When he was fifteen years old he became a page to Charles V., and the emperor showed him from the very first a most extraordinary attention. He employed him, while still a young man of twenty years, in the highest military and diplomatic positions, and on his abdication (1555) recommended him in the strongest terms to his son and successor. In the beginning, Philip II. also seemed inclined, if not to put confidence in him, at least to use him. He held high offices in the provinces; he negotiated the Peace of Cateau-Cambrésis, Apr. 3, 1559; and he was one of the four hostages—the duke of Alva was another—which Spain sent to France as a guaranty for the fulfilment of the treaty. While here the French king, Henry II., one day told him that there existed a secret treaty between him and Philip II. for the purpose of exterminating by fire and sword all Protestants within their dominions; but although this communication must have affected him like a flash of lightning, revealing in hideous nakedness the main-springs of the policy of his royal master, and changing with dreadful suddenness all his own plans and aspirations, yet such was his self-possession and presence of mind that the news was received as carelessly as it was given. Afterward, when people began to realize what must have taken place in the young man's mind in that moment, they called him "the Silent," and there was something in his character and bearing which soon made the surname popular. He was too early and too intensely engaged in business to have any time either for the frivolous gossip of the camp and the court or for the long-winded eloquence of his time, and he hated from the very bottom of his heart those duplicities and lies which in the sixteenth century formed the principal characteristic of the great invention of Ferdinand of Aragon—the diplomatists. Thus, it was quite natural that he should make an impression of taciturnity, though in every-day life his talk was pleasant and cordial, and though in the council-chamber he gave his advice more freely and more forcibly than any one else, and never left the least doubt as to how he would act. As a young man he was even gay, kept a magnificent household, and exercised a most generous hospitality. Soon, however, after his conversation with Henry II., he found other use for his money, for he rose immediately in opposition to Philip II., and never, as long as he lived, gave up his resistance for one moment. As governor of Holland and Zealand he refused in 1564 to allow the establishment of the Spanish Inquisition in these provinces; and although he had not signed the compromise which the *Gueux* presented to the regent, Margaret of Parma, in 1566, yet he supported their demands at the court. When, finally, Philip II. decided to send the duke of Alva as governor-general to the Netherlands with a large Spanish army, William resigned all his offices and retired with his family to Germany. As soon as Alva arrived, the most arbitrary measures for the religious and political suppression of the provinces were carried out, often with incredible atrocity. William was summoned to appear before the council which had condemned Egmont and Horn, and his eldest son, a boy of thirteen years, who studied at the University of Louvain, was seized and carried to Spain, where he was held in captivity for twenty-eight years. He now raised an army by his own funds, and invaded the country in 1569, but although he gained some advantages, he was unable either to rouse the population to a general revolt or to bring Alva to a decisive battle; and he was soon compelled by lack of money to disband his army. In 1572 he made a new attempt, and with greater effect. In 1570 he had issued letters of marque to privateers, and these *Gueux of the Sea* inflicted great damages on Spanish commerce, especially since they early in 1572 had come into possession of Briel and Flushing, which formed a solid basis for their operations and commanded the navigation of the Scheldt and the Meuse. Thus, war with Spain appeared to be a remunerative trade, while obedience had proved to be utter desolation and ruin, and, consequently, on the approach of William with a new army, the province of Holland rose in open rebellion, and its states chose William stadtholder in July, 1572. Gelders, Overyssel, Zealand, and Utrecht immediately joined, and although William again was compelled to disband his army from lack of money, war, nevertheless, now began to be carried on in a regular manner against the Spaniards. The military successes which the Hollanders achieved under the leadership of William were not very remarkable, though many events—such as the defence of Leyden—show a circumspection in the formation of the

plan and a heroism in its execution which are most admirable. But it soon became apparent that the provinces under Spanish rule were impoverished and fallen to ruin, while the provinces under William's administration prospered and gathered wealth. By degrees, the hatred to the Spaniards became universal also throughout the southern provinces, even among the Roman Catholics, and in Oct., 1576, William brought about the so-called "Pacification of Ghent," by which all the provinces united for the purpose of driving the foreign soldiers out of the country and establishing religious toleration. The southern provinces, however, soon separated from the league, and returned under the rule of Alexander Farnese. They were Roman Catholics, and the prince of Orange had now openly joined the Calvinists. Religious liberty and toleration were ideas which the people of that age seemed incapable of comprehending fully and practising sincerely. Meanwhile, on Jan. 23, 1579, the "Union of Utrecht" was signed, by which Philip II. was formally deposed, and it was agreed to confer the sovereignty on some other prince—Archduke Mathias, the duke of Anjou, the queen of England, etc.—who might be able to vindicate himself against the Spaniards. On Mar. 15, 1580, Philip II. put a price of 25,000 crowns on William's head, and after several attempts which failed, one Balthazar Gerard finally succeeded in shooting him, at Delft, July 10, 1584. He had been four times married, and left twelve children, of whom the two sons, Maurice and Frederick Henry, became very celebrated. (See Klose, *Wilhelm I. von Oranien* (1864); Herrmann, *Wilhelm von Oranien* (1873); Motley, *The Rise of the Dutch Republic* (3 vols., 1856).) CLEMENS PETERSEN.

**Willibrod.** See WILBRORD (SAINT).

**Wil'limansett,** p.-v., Hampden co., Mass.

**Williman'tic,** p.-b., Windham co., Conn., about 30 miles E. of Hartford, contains 4 churches, 2 savings banks, 2 trust companies, 100 stores, markets, etc., and 3 hotels. It has 1 weekly newspaper and 1 monthly, and is the business centre for miles around. Willimantic is the most extensive railroad centre in Eastern Connecticut, being the junction of Hartford Providence and Fishkill, New London Northern, New Haven Middletown and Willimantic, and New York and New England R. Rs.; 52 trains arrive and depart from the station daily. The principal industries of the place are the manufacture of silk, cotton thread, print cloths, cotton warps, and machinery. The factories of the Willimantic Linen Co., whose thread has a world-wide reputation, are located here and give employment to a large number of people. It has fine schools, broad streets, concrete sidewalks, gasworks, a fire department, and a portion of the streets supplied with water-pipes. For the last few years its growth has been rapid, and for business thrift and enterprise it stands at the head of the list in this section of the State. Its unequalled railroad facilities, convenience to tide-water, light taxes, and other advantages enumerated above combine to make it one of the most attractive and best points in New England for manufacturing or other business purposes.

H. L. HALL, ED. "JOURNAL."

**Wil'ling,** tp., Allegany co., N. Y. P. 1199.

**Willing** (THOMAS), b. at Philadelphia, Pa., Dec. 19, 1731; studied law at the Temple, London; became the head of the mercantile house of Willing & Morris at Philadelphia, one of the most important commercial establishments in the country, who were agents of Congress during the Revolution for the supply of naval and military stores; became mayor of Philadelphia, judge of the supreme court, and representative in the general assembly; was chairman of one of the earliest popular meetings in behalf of resistance to Great Britain, June, 1774; president of the provincial congress of Pennsylvania; delegate to the Continental Congress 1775–76; president of the first chartered bank in America, and of the first Bank of the United States. D. at Philadelphia Jan. 19, 1821.

**Wil'lingborough,** tp., Burlington co., N. J. P. 750.

**Wil'lington,** p.-v. and tp., Tolland co., Conn. P. 942.

**Wil'link,** p.-v., Erie co., N. Y.

**Wil'lis** (BENJAMIN A.), b. at Roslyn, L. I., in 1840; graduated at Union College 1861; was admitted to the bar the same year; entered the army as captain of a company raised at his own expense 1862; was at Chancellorsville, Gettysburg, and Lookout Mountain, and was twice promoted; commenced the practice of law in New York City 1864; was one of the leaders of the Reform Democrats in overthrowing the leadership of Tammany Hall; was elected to Congress 1874, and re-elected 1876.

**Willis** (BROWNE), LL.D., F. S. A., grandson of Dr. Thomas, b. at Blandford, Dorsetshire, England, in 1682; educated at Westminster School and Christ Church, Oxford; entered Parliament for Buckinghamshire 1705; possessed an ample estate, and devoted his life to philanthropy and antiquarian pursuits. D. at his seat, Whaddon Hall, Bucks, Feb. 5, 1760. He was one of the leading members of the Society of Antiquaries at its revival in 1707; presented his valuable cabinet of coins to the University of Oxford, and gave many MSS. to the Bodleian Library. Author of *Notitia Parliamentaria, or A History of the Counties, Cities, and Boroughs in England and Wales* (vol. i. 1715; ii. 1716; and iii. 1750), *Surveys of the Welsh Cathedrals* (4 parts, 1717–21), *History of the Mitred Parliamentary Abbeys and Conventual Churches* (2 vols., 1718–19), *Survey of the (Fourteen Northern English) Cathedrals* (3 vols., 1727–30), *Parochiale Anglicanum* (1733), *Table of the Gold Coins of the Kings of England* (1733), and *The History and Antiquities of the Town, Hundred, and Deanery of Buckingham* (1755); contributed to S. Gale's *Winchester Cathedral,* to Leland's *Itinerary,* and to the *Archæologia.*

**Willis** (FRANCIS), M. D., b. at Greatford, Lincolnshire, England, about 1718; graduated at, and became a fellow of, Brasenose College, Oxford; took orders in the Church of England 1740; was presented by his college with the living of St. John's, Wapping; paid much attention to mental diseases, as his grandfather had done before him; conducted at Greatford a private lunatic asylum, which fact brought upon him the enmity of the medical faculty, to obviate which he took his degree in medicine; was consulted with other physicians, on the occasion of the first attack of insanity experienced by George III. in 1786; was the only one who predicted his recovery; was in consequence entrusted with the principal care of that monarch for many years; received a parliamentary reward of £1500 for twenty-one years, and was summoned to attend the queen of Portugal in a similar case, but without much success, though he gained a fee of £20,000. D. at Greatford Dec. 5, 1807.—His son, DR. ROBERT DARLING WILLIS, succeeded him as attendant physician to George III.

**Willis** (NATHANIEL), b. at Boston June 6, 1780, his father and grandfather being printers; established at Portland, Me., the *Eastern Argus* 1803, and at Boston in 1816 the *Boston Recorder,* the first religious newspaper in America, which he conducted until 1843, and founded in 1827 the *Youth's Companion,* the first American juvenile paper, of which he was editor and proprietor until 1857. D. at Boston May 26, 1870.

**Willis** (NATHANIEL PARKER), son of Nathaniel, b. at Portland, Me., Jan. 20, 1807; studied at the Boston Latin School and at Phillips Academy, Andover; graduated at Yale College 1827; gained while an undergraduate a prize of $50, offered by the *Album* for the best poem, and wrote for his father's paper, the *Boston Recorder,* some religious poems which were (and still are) much admired, and were reprinted by S. G. Goodrich under the title *Sketches* (Boston, 1827); edited for Mr. Goodrich ("Peter Parley") two annuals, *The Legendary* (1828) and *The Token* (1829); founded and conducted *The American Monthly Magazine* (1829–31) until it was merged in the New York *Mirror* (1823–42), of which he became associate editor with George P. Morris; travelled in Europe and Asia Minor 1831–37, seeing much of the best literary society, which he described with abundance of personal details in letters to the *Mirror,* collected under the title *Pencillings by the Way* (3 vols., 1835); married in England in 1835 Miss Mary Leighton Stace, daughter of Commissary-General William Stace of the royal arsenal, Woolwich; wrote for numerous English magazines; returned to the U. S. 1837; settled on a beautiful estate on the Susquehanna, near Owego, N. Y., which he called "Glen Mary;" founded, with Dr. T. A. Porter in 1839, a short-lived weekly literary paper, *The Corsair;* revisited Europe in 1839; discontinued the *Mirror* Dec. 31, 1842; conducted, with Gen. Morris, two daily papers, *The New Mirror* (Apr. 8, 1843, to Sept. 28, 1844) and *The Evening Mirror* (Oct. 7, 1844, to end of 1845); lost his wife, and went to Europe for his health 1844–46; published numerous volumes of European correspondence; married Miss Grinnell of New Bedford 1846, and established a new home at "Idlewild," near Newburg, on the Hudson; published in that place a complete edition of his writings in a large volume, and joined his friend Morris in the editorship of a new weekly paper, the *Home Journal,* upon which he continued to be occupied until his death, at Idlewild Jan. 21, 1867. Among his numerous works were—*Inklings of Adventure* (3 vols., 1836), *Loiterings of Travel* (3 vols., 1840), *Letters from under a Bridge* (1840), *People I have Met* (1850), *Hurry-Graphs* (1851), *A Health-Trip to the Tropics* (1853), *Famous Persons and Places* (1854), *The Convalescent, his Rambles and Adventures* (1859), and a volume of *Poems,* which appeared in many editions, some of them richly illustrated. PORTER C. BLISS.

**Willis** (RICHARD STORRS), son of Nathaniel, b. at Boston Feb. 10, 1819; graduated at Yale College 1841; con-

tributed to various periodicals; edited the New York *Musical World* and *Once a Week*, and is author of *Church Chorals and Choir Studies, Our Church Music, a Book for Pastors and People* (1855), and *Carols and Music Poems* (15 Nos., 1860–61).

**Willis** (Robert), F. R. S., b. in London, England, in 1800; graduated at Caius College, Cambridge, 1826; became a fellow there; took orders in the Church of England; was early distinguished for his attainments in several departments of natural science, and especially for his acoustical researches upon the mechanism of the larynx; invented the lyophone, the odontograph, and a tabulo-scriptive engine to facilitate the graphical representation of the results of the application of analysis to physics; was one of the original members of the British Association; made an architectural tour in France, Germany, and Italy 1832–33; became widely known as the most profound architectural historian of England; was a member of many scientific societies, before which he delivered many addresses; was on the foundation of the London School of Mines, appointed lecturer on applied mechanics, and was Jacksonian professor of natural and experimental philosophy at Cambridge from 1837 until his death, at that place Feb. 28, 1875. As a lecturer on mechanics, statics, and dynamics, with their practical application to manufactures and the steam-engine, he was unrivalled; "the power, the clearness, the vividness with which he brought forward every point left absolutely nothing to be wished for." Author, among other works, of *Remarks on the Architecture of the Middle Ages, especially of Italy* (Cambridge, 1835), *Principles of Mechanism for Students* (1841), *Architectural History of Canterbury Cathedral* (1845), of similar works upon the cathedrals of Winchester (1845), York (1846), Chichester (1862), the church of the Holy Sepulchre at Jerusalem (1849), and Glastonbury Abbey (1866), and contributed many learned papers to archæological and other scientific journals.

**Willis** (Robert), M. D., b. in England about 1810; received a careful classical and medical education, and has been for many years physician to the Royal Infirmary for Children at London. Author of *Benedict de Spinoza, his Ethics, Life, Letters, and Influence on Modern Religious Thought* (1870), and of many professional treatises.

**Willis** (Thomas), M. D., F. R. S., b. at Great Bedwin, Wiltshire, England, Jan. 27, 1621; graduated at Christ Church, Oxford, 1639, and in medicine 1642; served in the royalist ranks during the great rebellion; practised his profession at Oxford; became Sedleian professor of natural philosophy in the university at the Restoration; afterward settled in London; was one of the founders of the Royal Society; became physician to Charles II. 1666, and was considered for many years "the most famous physician of his time." He published several medical works, written in good Latin, of which the most important were—*Cerebri Anatome, cui accessit Nervorum Descriptio et Usus* (1664), *Pathologiæ Cerebri et Nervosi Generis Specimina* (1667), and *De Anima Brutorum* (1672). His complete works were posthumously collected in Latin (2 vols., 1676) and in English, translated by Roger l'Estrange (folio, 1679). They also appeared under other titles, such as *Dr. Willis's Practice of Physic, being the Whole Works of that Renowned Physician* (1681; translated by Samuel Pordage), and *The London Practice of Physic, etc.* (1685).

**Willis** (William), b. Haverhill, Mass., Aug. 31, 1794; graduated at Harvard University 1813; studied law, and admitted to the bar in Boston 1817; removed to Portland in 1819, and for twenty years was the law-partner of William P. Fessenden; was chosen to the State senate in 1855, and mayor of Portland 1857; was for many years president of the Maine Historical Society and vice-president of the New England Genealogical Society; was the author of a *History of Portland* (2 vols., 1831–33; new ed. 1865), *McKinstry Genealogy* (1866), *Books and Pamphlets relating to Maine* (1859), *History of the Law, the Courts, and the Lawyers of Maine* (1863), and edited the *Journals of Smith and Deane, Maine Historical Collections*, Dr. Kohl's *Discovery of Maine*, etc. etc. D. at Portland Feb. 17, 1870.

**Willis River,** in Virginia, rises in Buckingham co., and near Cartersville flows into the river James. It is navigable for bateaux 30 miles to Curdsville.

**Wil'liston,** tp., Barnwell co., S. C. P. 1379.

**Williston,** p.-v. and tp., Chittenden co., Vt. P. 1441.

**Williston** (Payson), D. D., b. at West Haven, Conn., in 1763, son of Rev. Noah, minister of that parish (b. at Springfield, Mass., July, 1733; graduated at Yale College 1757; d. Nov. 10, 1811); graduated at Yale College 1783; studied divinity at New Haven; was ordained pastor of the Congregational church at Easthampton, Mass., 1789, and occupied the pulpit until 1833. D. at Easthampton Jan. 30, 1856. He published some occasional *Sermons*, and contributed some interesting personal reminiscences of Connecticut ministers of the eighteenth century to Rev. Dr. W. B. Sprague's *Annals of the American Pulpit* (vols. i. and ii., 1857).

**Williston** (Samuel), son of Rev. Dr. Payson, b. at Easthampton, Mass., June 17, 1795; began classical studies at Phillips Academy, Andover, with a view to the ministry, but discontinued it from weakness of the eyes; gained a large fortune by the manufacture of buttons; established at Easthampton in 1840 the Williston Seminary, to which at different times he gave $250,000; endowed professorships in Amherst College by gifts of $125,000, 1858–59; gave liberally to the Mount Holyoke Female Seminary, and three times erected a church at Easthampton, which was twice burned. His entire gifts and bequests amounted to above $1,500,000. D. in July, 1874.

**Wil'listown,** tp., Chester co., Pa. P. 1552.

**Will'mar,** p.-v. and tp., cap. of Kandiyohi co., Minn. P. 449.

**Will'more** (James Tibbits), b. at Handsworth, Staffordshire, England, Sept. 15, 1800; became one of the most eminent of the landscape engravers who distinguished themselves by their beautiful reproductions of the masterpieces of Turner, and was chosen an associate of the Royal Academy 1843. D. Mar. 12, 1863. Among his prints of Turner are *Mercury and Argus, The Fighting Téméraire,* and *Ancient Italy.* He also engraved several notable pictures by Eastlake, Landseer, Stanfield, and Creswick.

**Will'mott** (Robert Aris), b. at Great Bradford, Wiltshire, England, in 1809; educated at Merchant Taylors' and Harrow schools, and at Trinity College, Cambridge; was for several years a private tutor in Suffolk; took orders in the Church of England 1842; was curate of St. James's church, Ratcliffe, 1842–44, and rector of St. Catharine's church, Bear Wood, Hampshire, from 1846 to 1862, when he retired on account of ill-health, receiving a pension from his generous patron, Mr. John Walter of the London *Times*, and d. at Nettlebed, Oxfordshire, May 27, 1863. Author of a biography of Jeremy Taylor (1846); edited the works of Herbert (1854), Gray (1854), Cowper (1854), Burns (1858), Wordsworth, Goldsmith, and Montgomery (1859); compiled *The Poets of the Nineteenth Century* (1856), and published a volume of original poems (1849).

**Wil'loughby,** p.-v. and tp., Lake co., O. P. of v. 867; of tp. 2516.

**Willoughby** (Sir Hugh), supposed to have been born at Risby, Derbyshire, England, about 1500; acquired military experience in the continental wars; was chosen commander of an expedition fitted out by the Merchants Adventurers at the instance of Sebastian Cabot, and received from Edward VI. a "license to discover strange countries;" fitted out three vessels, one of them under the command of Richard Chancellor; sailed from Deptford May 10, 1553; proceeded to the Arctic regions by the coasts of Norway, and his vessel, having become separated from the others, was detained in the ice somewhere upon the northern coast of Lapland, and its whole company perished, but the circumstances are unknown. By a journal, supposed to be his, which was recovered from the Russians, it appeared that his company was living in Jan., 1554, but when his vessel, the Bona Speranza, was discovered in the spring of 1554, all the inmates were dead. Richard Chancellor, with his vessel, the Edward Bonaventura, discovered the port of Archangel, and thus gave rise to direct commerce with Russia, which did not then extend to the Baltic. A journal of Sir Hugh's voyage to Sept., 1553, is printed in Hakluyt, from a MS. in the handwriting of Michael Lok.

**Willoughby Lake,** v. on the lake of the same name in the town of Westmore, Orleans co., Vt. The lake is some 7 miles long, and is very deep. It is an attractive place of summer resort. On either side is a high peak. Willoughby Mountain, the taller of these peaks, is a famous resort for botanists, many rare species of plants being found upon it. The view from this mountain is very fine.

**Wil'low** [Ang.-Sax. *wilig*], the trees and shrubs of the *Salix*, of which there are over 160 well-recognized species, besides innumerable varieties. Many of the long-leaved, shrubby sorts are used in basket-making (see Osier), and the larger kinds, short-leaved, and called *sallows*, are in Europe raised in copses for hoop-poles; for charcoal, to be used in gunpowder-making; for fence-poles, which when peeled and dried are very durable; for vine-props, hoe-handles, and the like. Willow-wood is also used for steamboat paddles, cricket-bats, and surgeons' splints. It is light, tough, and stands exposure in water very well. Salicine, an active principle from willow-bark, is very useful in medicine. The *S. babylonica*, or weeping willow, has

long been an emblem of grief. It is much planted as an ornamental tree. The U. S. have about 60 willows, and Europe nearly as many more.

**Willow,** tp., Cherokee co., Ia. P. 278.

**Willow,** tp., Richland co., Wis. P. 667.

**Willow Branch,** tp., Piatt co., Ill. P. 1438.

**Willow Creek,** tp., Lee co., Ill. P. 1019.

**Willow Fork,** tp., Moniteau co., Mo. P. 2242.

**Willow Grouse,** or **Ptarmigan,** a name of the *Lagopus albus*, a species found in the northern regions of the Old and New Worlds. (See PTARMIGAN.)

**Willow Hill,** p.-v. and tp., Jasper co., Ill. P. 1552.

**Willow Springs,** p.-v. and tp., Douglas co., Kan. P. 1163.

**Willow Springs,** p.-v. and tp., Howell co., Mo. P. 608.

**Willow Springs,** v., Erath co., Tex. P. 238.

**Willow Springs,** tp., Lafayette co., Wis. P. 1117.

**Wills,** tp., Saline co., Ark. P. 351.

**Wills,** tp., La Porte co., Ind. P. 884.

**Wills,** tp., Guernsey co., O. P. 1670.

**Wills** (DAVID), D. D., b. in South Carolina in 1825; graduated at the State college in Columbia in 1847, and at the theological seminary at the same place in 1850; in 1851 was called to the pastorate of a church in Laurens district; in 1860 to the Presbyterian church in Macon, Ga.; in 1870 elected president of Oglethorpe University at Atlanta, Ga.; in 1875 received and accepted a call to the pastorate of a Presbyterian church in Washington City, which position he still holds (Oct., 1876). Dr. Wills is distinguished not only for his high scholarly attainments, but for the peculiar and rare power of his eloquence.

A. H. STEPHENS.

**Wills** (WILLIAM GORHAM), b. in county Kilkenny, Ireland, in 1828; educated at Trinity College, Dublin; studied art at the Royal Irish Academy; became a portrait-painter at Dublin and in London; is author of *Notice to Quit* (3 vols., 1861) and *The Wife's Evidence* (3 vols., 1863), both republished in the U. S., and of several successful dramas, among which are *Charles the First* (1872), which had a run of 200 nights at the Lyceum, *Eugene Aram* (1873), and *Marie Stuart* (1874).

**Wills** (WILLIAM HENRY), b. at Plymouth, England, Jan. 13, 1810; devoted himself to literary pursuits at London in connection with the Messrs. Chambers, whose sister he married; contributed to the *Penny* and *Saturday Magazines;* was one of the original editors of *Punch;* became working editor and part proprietor of *Household Words* (1850) and *All the Year Round* (1859–69), in connection with Charles Dickens, and has also been an editor of *Chambers's Journal* and the *Daily News.* He published *Old Leaves gathered from Household Words* (1860), and edited *Sir Roger de Coverley* (1850) and *Poets' Wit and Humor, Selected* (1860).

**Wills** (WILLIAM JOHN), b. at Totnes, Devonshire, England, Jan. 5, 1834; educated at the Ashburton grammar school; was apprenticed to his father, Dr. William Wills; pursued his medical studies also in London; emigrated to Australia Oct., 1852; was joined there in the following year by his father, with whom he practised medicine at Ballarat; became a surveyor; was appointed assistant in the magnetic observatory at Melbourne Nov., 1858; joined the expedition headed by O'Hara Burke for the exploration of the interior of the continent, leaving Melbourne Aug. 20, 1860; crossed the entire continent northward through the deserts, reaching the Gulf of Carpentaria in Jan., 1861, but on their return both Burke and Wills died of starvation near Cooper's Creek about July 1, 1861. The journal kept by the latter was recovered and published by his father, *A Successful Exploration from Melbourne to the Gulf of Carpentaria, from the Journals and Letters of William John Wills* (1863), with portrait and map.

**Wills'borough,** p.-v. and tp., Essex co., N. Y. P. 1719.

**Will'shire,** p.-v. and tp., Van Wert co., O. P. of v. 268; of tp. 1644.

**Willshire** (Sir THOMAS), BART., b. at Halifax, Nova Scotia, Aug. 24, 1789, son of a paymaster; was appointed a lieutenant in the British army when six years of age; educated at Lynn and at Kensington; served in the West Indies, in Whitelock's expedition against Buenos Ayres July, 1807, in the Peninsular war 1808–09, in the Walcheren expedition 1809; returned to Spain 1812; was wounded at Salamanca; distinguished himself at the assault upon San Sebastian; had actual command of a regiment, with which he saw four years' hard service on the frontiers of Kaffraria, South Africa, 1818–22; annexed the territory on Great Fish River; served in India against the Mahrattas 1822; was appointed lieutenant-colonel 1827; distinguished himself in the Afghan war, especially at the siege of Ghuznee and the capture of Khelat 1839, for which exploits he was first knighted, and soon afterward made a baronet, receiving the thanks of Parliament; returned to England 1840; was commander of Chatham 1842–47, and became major-general 1847. D. at Hillhouse, near Windsor, May 31, 1862.

**Will'son** (JAMES M.), D. D., b. in Pennsylvania in 1809; received a good education; became a minister of the Reformed Presbyterian Church; was an eminent scholar, preacher, and professor in the Covenanters' theological seminary at Allegheny City, Pa., where he d. Aug. 31, 1866.

**Willson** (JAMES RENWICK), D. D., b. near Pittsburg, Pa., in 1780; graduated at Jefferson College 1805, and was licensed as a preacher of the Reformed Presbyterian Church 1807. D. in 1853. Author of *An Historical Sketch of Opinions on the Atonement* (1817), *Alphabetical Writing and Printing* (1826), *Prince Messiah's Claim to Dominion, etc.* (1832), *The Written Law* (1840), and of several single sermons and addresses.

**Willson** (MARCIUS), b. at West Stockbridge, Mass., in 1813; graduated at Union College 1836; became a teacher in New York City and Brooklyn; prepared a very successful series of readers and histories published by the Harpers, and is author of *Civil and Political Economy* (1838), *An Atlas of Perspective, Architectural, and Landscape Drawing* (1839), *Theoretical Arithmetic* (1842), *Object Lessons* (1862), and (with N. A. Calkins) of *School and Family Charts* (22 Nos., 1862).

**Willson** (ROBERT), D. D., b. in Lincolnshire, England, in 1795; educated at the Roman Catholic seminary at Orcott; was ordained priest by Bishop Milner 1825; was stationed several years at Nottingham, where he became noted for his services during the cholera epidemic of 1832, and for his labors for ameliorating the treatment of the insane, and procured the erection, after designs by Pugin, of the church of St. Barnabas, commenced in 1840, one of the finest as well as earliest architectural monuments of the new Gothic revival; was appointed by Pope Gregory XVI. bishop of Tasmania 1842; returned to England 1847, and communicated to the government facts proving the barbarous treatment of convicts in Tasmania and on Norfolk Island, which through his efforts was speedily remedied; returned to Tasmania 1848; resigned his bishopric from ill-health 1865; was seized with paralysis on the voyage to England, and d. at Nottingham June 30, 1866.

**Wil'lughby** (FRANCIS), b. at Wollaton Hall, Nottinghamshire, England, in 1635; graduated at Trinity College, Cambridge, about 1656; became a pupil of John Ray in natural history; resided some time at Oxford; travelled extensively on the Continent with Ray, making valuable collections for a work on natural history, and contemplated a voyage to America. D. July 3, 1672. He left many Latin MSS. upon natural history, which were translated, digested, and extended by Ray, who made them the basis of his own extensive labors. (See RAY, JOHN.) It is claimed for Willughby that he was the most accomplished zoologist of his time, and that he was the author of the system of classification in zoology which was adopted by Linnæus.

**Wil'mer** (WILLIAM HOLLAND), D. D., b. in Kent co., Md., in 1782; graduated at Washington College; was for some time engaged in mercantile pursuits; took orders in the Protestant Episcopal Church 1808; was minister of Chester parish 1808–12, rector of St. Paul's, Alexandria, 1812–16, first rector of St. John's, Washington, D. C., 1816, and editor of the Washington *Theological Repertory* 1819–26; became professor of theology in Alexandria seminary 1823, and president of William and Mary College and rector of the church at Williamsburg, Va., 1826. D. at Williamsburg July 24, 1827. Author of *The Episcopal Manual* (1815), of which an enlarged edition was prepared by John Coleman, D. D. (1841), of a controversial pamphlet against Father Baxter, a Jesuit priest (1818), and of several printed sermons and addresses.

**Wil'mington,** p.-v. and b., Union co., Ark. P. 320.

**Wilmington,** p.-v. and tp., Los Angeles co., Cal. P. 942.

**Wilmington,** city of New Castle co., Del., on the Delaware River, and at the junction of its affluents, Brandywine and Christiana creeks, 28 miles S. W. of Philadelphia and 70 miles N. E. of Baltimore, on Philadelphia Wilmington and Baltimore R. R., is the terminus of several other lines of railway, and has communication by steamers with Philadelphia and New York. It is built mainly upon elevated ground between the two creeks, about 1½ miles from Delaware River. The houses are generally of brick; the prin-

cipal streets are paved with stone, lighted with gas, and traversed by horse-cars. Brandywine Creek has within a distance of four miles a fall of 120 feet, furnishing immense water-power, which is largely utilized for manufacturing purposes. In 1873 the total capital invested in manufactures was $12,725,000, and the product for the year was more than $21,000,000. The principal manufactures were —machine-work, $2,200,000; morocco and other leather, $2,050,000; foundry-work and car-wheels, $2,000,000; railroad cars, $2,000,000; carriages and wagons, $1,400,000; iron, $1,300,000; iron ship-building, $1,200,000; paper, $1,200,000; powder and chemicals, $1,200,000; flour and meal, $1,200,000; cotton goods, $1,100,000. Besides these, there are large manufactures of tobacco, fertilizers, brick, sashes and blinds, and boots and shoes. There are about 50 churches, among which are 15 Methodist, 8 Episcopal, 7 Presbyterian, 5 Baptist, 5 Roman Catholic, and 2 Friends. Within the limits of the city is the old Swedes' church, built of stone in 1698, and still in a good state of preservation. The principal public buildings are the city hall, almshouse, custom-house, post-office, opera-house, public library, and the Wilmington Institute. There are several charitable institutions, numerous public and private schools, a mechanics' institute, 5 daily and 8 weekly newspapers, 4 national banks, 1 State bank, 2 savings banks, 3 fire insurance companies, and more than 20 building and loan associations. P. in 1870, 30,841; in 1876, including the suburbs, about 43,000.

**Wilmington,** p.-v. and tp., Will co., Ill. P. of v. 1828; of tp. 2766.

**Wilmington,** p.-v., Hogan tp., Dearborn co., Ind. P. 301.

**Wilmington,** tp., De Kalb co., Ind. P. 2296.

**Wilmington,** tp., Wabaunsee co., Kan. P. 662.

**Wilmington,** p.-v. and tp., Middlesex co., Mass. P. 866.

**Wilmington,** p.-v. and tp., Houston co., Minn. P. 1200.

**Wilmington,** p.-v. and tp., Essex co., N. Y. P. 794.

**Wilmington,** city, cap. of New Hanover co., N. C., the principal seaport and largest city in the State, on the E. bank of Cape Fear River, 30 miles from the ocean. It is the terminus of Wilmington and Weldon and Wilmington Columbia and Augusta R. Rs., which connect with other railroads running N. and S.; also the terminus of Carolina Central Railway, running through the southern portion of the State to its western border. Lines of steamers ply to Baltimore, Philadelphia, and New York, and there is an extensive commerce by sailing vessels with all parts of the world. At present vessels drawing 16 feet can load here, and when the bar improvements, now in progress, are completed, the depth of water will be materially increased. It has communication with the Sound, a place of summer residence, 7 miles distant by turnpike; has a street railway running through the principal streets to the railroad dépôts and to Oakdale Cemetery; has a city hall, a theatre, court-house, 3 banks, 22 churches, 12 academies and schools, 1 library, 5 newspapers (3 daily), seamen's home, marine hospital, marine railways, 1 cotton-factory, 1 cotton compress company, 5 steam saw and planing mills, 1 steam rice-mill, 4 steam grist and flour mills, 9 turpentine distilleries running 29 stills, 1 iron-foundry, 1 sash and blind factory. The principal exports of the place consist of naval stores, lumber, shingles, and cotton. This has long been the leading naval-store market of the world. Exports for 1875, about $10,000,000, of which about one-half has gone to foreign ports. P. (1870), 13,446. (For the engagement against this place during the civil war see Fort Fisher.) W. H. Bernard, Ed. "Morning Star."

**Wilmington,** p.-v. and tp., cap. of Clinton co., O., on Cincinnati and Muskingum Valley R. R., 55 miles N. E. of the former city, has 6 churches, Friends' college and excellent public schools, 2 banks, a building and loan association, 2 newspapers, 2 extensive pork-packing establishments, 2 hotels, and several mills. The neighborhood is well adapted for agriculture and grazing. P. 2023.

Frank Browning, Ed. "Clinton Republican."

**Wilmington,** tp., Lawrence co., Pa. P. 1634.

**Wilmington,** tp., Mercer co., Pa. P. 548.

**Wilmington,** p.-v. and tp., Windham co., Vt. P. 1246.

**Wilmington** (Spencer **Compton**), Earl of, b. in England about 1675; sat in Parliament many years; was Speaker of the House of Commons from Mar., 1714, until 1727, when he resigned; was created Baron Wilmington Jan. 8, 1728, lord president of the council and earl of Wilmington May, 1730, and became prime minister under the title of first lord of the treasury Feb. 17, 1742. D. July 26, 1743. As he left no male issue, his titles became extinct at his death.

**Wil'more,** p.-v. and b., Cambria co., Pa. P. 393.

**Wil'mot,** p.-v. and tp., Merrimack co., N. H. P. 1072.

**Wilmot,** p.-v. and tp., Bradford co., Pa. P. 1365.

**Wilmot** (David), b. at Bethany, Pa., Jan. 20, 1814; educated at the academies of Bethany and of Aurora (Cayuga co.), N. Y.; studied law, was admitted to the bar, and commenced practice at Wilkesbarre, Pa., 1834; soon removed to Towanda; sat in Congress as a Democrat 1845–51, and moved on Aug. 8, 1846, an amendment to a bill appropriating $2,000,000 for the purchase of Mexican territory, which became celebrated under the name "the Wilmot proviso"—"That, as an express and fundamental condition to the acquisition of any territory from the republic of Mexico by the U. S., . . . neither slavery nor involuntary servitude shall ever exist in any part of the said territory." This proviso was adopted by the House, but rejected by the Senate, and became the starting-point for the "Free-Soil" movement of 1848. Mr. Wilmot was president judge of the 13th district of Pennsylvania 1853–61, was a delegate to the Republican national conventions of 1856 and 1860, acting as the temporary chairman of the latter; an unsuccessful candidate for governor of Pennsylvania 1857; was U. S. Senator to fill a vacancy 1861–63, and was appointed a judge of the U. S. court of claims by Pres. Lincoln 1863. D. at Towanda, Pa., Mar. 16, 1868.

**Wilmot** (John). See Rochester, Earl of.

**Wilmot** (Sir John Eardley), b. at Derby, England, Aug. 16, 1709; educated at Lichfield and Westminster schools, and at Trinity College, Cambridge; was called to the bar at the Inner Temple 1732; was a judge of the court of king's bench 1755–66, and chief-justice of common pleas 1766–71. D. Feb. 5, 1792. His *Notes of Opinions and Judgments* (1802) were posthumously edited, and a biographical sketch by his son appeared in 1802.

**Wilmot** (John Eardley), son of the above, b. at Derby, England, in 1748; educated at Westminster School and University College, Oxford; became a fellow of All Souls; studied law; became a master in chancery 1783; was commissioner for settling the claims of American loyalists; long a member of Parliament, and author of several works. D. at Tottenham June 23, 1815.

**Wilmot** (Sir John Eardley), Bart., b. in England in 1810; graduated at Baliol College, Oxford, 1832; studied and practised law; became recorder of Warwick 1852; was judge of Bristol county court 1854–71; a deputy lieutenant for Warwickshire, and sat in Parliament for South Warwickshire. Author of *An Abridgment of Blackstone's Commentaries* (3d ed. 1855), *Lord Brougham's Acts and Bills* (1857), and several other legal books.

**Wilmot** (Robert Duncan), b. at Fredericton, New Brunswick, Oct. 16, 1809; educated at St. John's; became a lawyer; was chosen a member of the provincial legislature 1846–64; was surveyor-general, with a seat in the cabinet, 1851–54; provincial secretary 1856–57; member of the cabinet without a portfolio 1865–66, having co-operated as a delegate in effecting the confederation of the various provinces now constituting the Dominion of Canada, and was for some years mayor of St. John's. Author of various treatises on the currency, which have exercised a considerable political influence.

**Wilmot Proviso.** See Wilmot (David).

**Wil'murt,** p.-v. and tp., Herkimer co., N. Y. P. 191.

**Wilna.** See Vilna.

**Wil'na,** p.-v. and tp., Jefferson co., N. Y. P. 4060.

**Wil'son,** county of S. E. Kansas, intersected by Fall and Verdigris rivers; surface variegated, with fertile river-bottoms, upland pasturage, and woodland, with beds of coal and salt springs. Cattle and sheep are the chief live-stock. Staples, Indian corn, hay, wheat, oats, and wool. Cap. Fredonia. Area, 576 sq. m. P. 6694.

**Wilson,** county of N. E. North Carolina, drained by Mackason River, and traversed by Wilmington and Weldon R. R.; surface undulating, soil fertile. Staples, cotton, Indian corn, and sweet potatoes. Cap. Wilson. Area, 550 sq. m. P. 12,258.

**Wilson,** county of N. Tennessee, lying on Cumberland River and traversed by Tennessee and Pacific R. R., which terminates at the county-seat; surface somewhat hilly, soil fertile. There are saw-mills, flour-mills, and manufactories of carriages, furniture, and woollen goods. Horses, mules, cattle, sheep, and swine are very numerous. Staples, Indian corn, wheat, oats, cotton, tobacco, and wool. Cap. Lebanon. Area, about 500 sq. m. P. 25,881.

**Wilson,** county of S. Texas, drained by San Antonio River and Cibola Creek; surface hilly, with little timber except along the streams; soil fertile. Cattle and horses are numerous. Cap. Floresville. Area, 670 sq. m. P. 2556.

**Wilson,** tp., De Witt co., Ill. P. 640.

**Wilson,** p.-v. and tp., Winona co., Minn. P. 1016.

**Wilson,** p.-v. and tp., Adair co., Mo. P. of v. 32; of tp. 1119.

**Wilson,** tp., Audrain co., Mo. P. 1740.

**Wilson,** tp., Greene co., Mo. P. 1053.

**Wilson,** p.-v. and tp., Niagara co., N. Y. P. of v. 661; of tp. 2912.

**Wilson,** p.-v. and tp., cap. of Wilson co., N. C., on Wilmington and Weldon R. R., contains 2 colleges, 1 bank, and 4 newspapers. An extensive business in cotton is carried on. P. of v. 1036; of tp. 3170.

H. G. & J. A. Williams, Eds. "Advance."

**Wilson,** tp., Clinton co., O. P. 1157.

**Wilson,** tp., Sheboygan co., Wis. P. 1277.

**Wilson** (Alexander), b. at Paisley, Scotland, July 6, 1766; was trained as a weaver; engaged in peddling; published a volume of poems in 1790, and was sentenced in 1793 for a lampoon, after which event he emigrated, and landed at New Castle, Del., July 14, 1794. He worked for some time as a weaver, and then as a peddler; taught school in various places—in 1802 at Kingsessing on the Schuylkill—and was afterward employed in Philadelphia as editor of the American edition of Rees's *Cyclopædia*. During his wanderings as a peddler he always took a great interest in observing the life of birds; and this interest was further developed during his residence at Kingsessing by his acquaintance with William Bartram. He determined to make a collection of American birds, and wrote an American ornithology. He learned drawing, coloring, and etching, and began to make excursions for his special purpose —the first in 1804 to the wilderness of Western New York, which he described in a poem, *The Foresters*, published in the *Port Folio*. In 1808 the first volume of his *Ornithology* appeared; the second in 1810; at his death, in Philadelphia Aug. 23, 1813, seven volumes had been published; the eighth and ninth were edited after his death by George Ord, and a continuation of his work was given by Charles Lucien Bonaparte (Philadelphia, 4 vols., 1825–33). He was buried in Old Swedes' churchyard in Philadelphia—in a spot where, as he expressed it, "the birds might sing over his grave." His poems were published at Paisley in 1816, and at Belfast in 1857, and his statue was raised at Paisley in 1874. (See C. Lucy Brightwell, *Difficulties Overcome, Scenes in the Life of Alexander Wilson, the Ornithologist* (London, 1860); Allan Park Patton, *Alexander Wilson the Ornithologist, a New Chapter of his Life* (1863); and a volume of verse, prose sketches, notes, etc., published by A. B. Grosart, Paisley, 1874.)

**Wilson** (Allen B.), b. in Central New York in 1827; learned the trade of a cabinet-maker. In 1849, at Pittsfield, Mass., he built a shuttle sewing-machine, containing a horizontal table to sustain the material, and a feeding device consisting of two plates, between which the material was held, but not rigidly. One plate was smooth and stationary, the other was roughened and moved forward, carrying the material with it when the needle was out of the material, and back while the needle was through the material, which held it at the point to which the feed had carried it. He never saw or heard of a sewing-machine before his own. A description of this machine was published in the Berkshire *Culturist* Apr. 18, 1849. This was the first machine by which an endless seam could be sewed capable of being turned upon any curve or at any angle at the pleasure of the operator while the seam was being formed. This feed he improved in 1850 by giving the roughened bar four motions, so that it retreated preparatory to feeding the length of the next stitch out of contact with the material, permitting it to remain at rest whether the needle was in or out. This feeding device went into universal use, and became, without substantial modification or change, the feeding device of the world for all kinds of machines except the small class, which fed by the needle. In 1850, Mr. Wilson also invented the rotary hook and stationary bobbin of the "Wheeler & Wilson" sewing-machine, by which was obtained a double-thread machine of the greatest speed, with the least expenditure of power and waste of thread, with the smallest wear of parts, adapted to a range of practical articles and fabrics reaching from the lightest want of a family to the heaviest necessity of stitch manufacture. L. P. Brockett.

**Wilson** (Sir Archdale), Bart. of Delhi, b. at Didlington, Norfolk, England, in 1803; entered the military service of the East India Company 1819 as an officer of artillery; was distinguished at the siege of Bhurtpore 1825–26; participated in the Sikh war 1848–49; became colonel 1854; was brigadier-general of artillery at Meerut at the outbreak of the Sepoy rebellion May, 1857; was the first British officer to encounter the mutineers in the field, defeating them May 30–31; effected a junction with the Delhi field force under Sir Henry Barnard; succeeded to the command of that force on the death of Barnard in July; maintained his position before Delhi until Sept. 14, when the city was stormed and taken after six days' hard fighting in the streets, for which service he was made a baronet; received the thanks of both houses of Parliament and a pension of £1000 from the East India Company; was promoted to major-general Sept., 1857, and lieutenant-general Mar., 1858, and took part as commander of the Royal Horse Artillery in the siege and capture of Lucknow, 1858, for which he was again thanked by Parliament. D. in London May 9, 1874.

**Wilson** (Benjamin), b. in England in 1722; became an eminent artist; was appointed master-painter to the board of trade at London 1773, and made valuable researches upon electricity. D. in London June 6, 1788. Author of *An Essay on Electricity* (1746), *Observations upon Lightning, etc.* (1773), *An Account of Experiments on Conductors for Lightning, etc.* (1778), and various papers on the same subject in the *Philosophical Transactions* 1753–72.

**Wilson** (Bird), D. D., LL.D., son of James (1742–98), b. at Carlisle, Pa., in 1777; graduated at Philadelphia College 1792; studied law; became president judge of the court of common pleas for the 7th circuit 1802; took orders in the Protestant Episcopal Church 1819; was rector of St. John's church, Norristown, Pa., 1819–21; professor of systematic divinity in the General Theological (Episcopal) Seminary, New York, 1821–50, and emeritus professor from 1850 until his death, in New York City Apr. 14, 1859. He edited his father's *Works* (3 vols., 1803–04), Matthew Bacon's *Abridgment of the Law* (7 vols., 1811–13), and wrote *Memoirs of the Life of Bishop William White* (1839; 2d ed. 1856). A *Memorial* (1864) of his life was prepared by W. White Bronson.

**Wilson** (Byron), U. S. N., b. July 7, 1836, in New York; graduated at the Naval Academy in 1857; became lieutenant in 1861, commander in 1872; served in the Richmond at the passage of the Vicksburg and Grand Gulf batteries, and highly commended in official dispatches.

Foxhall A. Parker.

**Wilson** (Caroline **Fry**), b. at Tunbridge Wells, England, in 1787; edited for several years (1823 *seq.*) an educational publication, from the columns of which she issued separately *The Listener* (2 vols., 1832; 13th ed. 1863), which had a wide circulation both in England and America, as well as some later religious works, *Christ our Example* (3d ed. 1834), *Christ our Law* (1842), and *The Scripture Reader's Guide* (16th ed. 1849). D. in 1846. Her *Autobiography, Letters, and Remains* (1848) were edited by her husband.

**Wilson** (Charles Henry), b. in England in 1756; received a classical education; was called to the bar at the Inner Temple; edited the *Gazette;* was for several years the reporter of the parliamentary debates; published translations from the Icelandic, Danish, and other languages, and was author of several anecdotical works. D. in London in 1808.

**Wilson** (Daniel), D. D., b. at Spitalfields, England, July 2, 1778; educated at St. Edmund's Hall, Oxford; took orders in the Church of England; became vicar of Chobham 1801, curate of Worton 1803–09, was tutor and vice-principal at St. Edmund's Hall 1807–12, curate of St. John's chapel, Bloomsbury, 1812–24, vicar of St. Mary's, Islington, 1824–32, and lord bishop of Calcutta and metropolitan of India from Mar. 27, 1832, until his death, at Calcutta Jan. 2, 1858. He was a zealous member of the "evangelical school" of theology and opponent of the Tractarian movement, and administered his diocese with great energy and efficiency. Author of several volumes of *Sermons* and *Charges*, of *Lectures on the Evidences of Christianity* (2 vols., 1828–30; 4th ed. 1860), *Lectures on Confirmation* (last ed. 1861), *Lectures on Colossians* (1845; 3d ed. 1853), and various other works. His *Life, with Extracts from his Journals and Correspondence* (2 vols., 1860), was prepared by his son-in-law and chaplain, Rev. Josiah Bateman.

**Wilson** (Daniel), LL.D., b. at Edinburgh in 1816; educated at the University of Edinburgh; was for some years secretary to the Royal Society of Antiquaries in Scotland; became professor of history and English literature in the University of Toronto, Canada, 1853; was president of the Canadian Institute 1859–60, and edited for several years the *Canadian Journal*. Author of *Memorials of Edinburgh in the Olden Time* (2 vols., 1846–48), *Oliver Cromwell and the Protectorate* (1848), *The Archæology and Pre-historic Annals of Scotland* (1851, with 200 illustrations; enlarged ed., 2 vols., 1863), *Pre-historic Man, Researches into the Origin of Civilization in the Old and the New World* (2 vols., 1862; revised ed. 1865; 3d ed., rewritten, 1876,

with numerous illustrations), *Chatterton, a Biographical Study* (1869), *Caliban, the Missing Link* (1873), and *Spring Wild Flowers* (2d ed. 1875), a volume of poems. Dr. Wilson wrote the elaborate article on "Archæology" in the 8th ed. of the *Encyclopædia Britannica*.

**Wilson** (Erasmus), F. R. S., b. in England in 1809; studied medicine; became lecturer on anatomy and physiology at the Middlesex Hospital Medical School, consulting surgeon to St. John's Hospital, London, a fellow by election of the Royal College of Surgeons 1843, and a member of its council 1870; gave special attention to diseases of the skin, in which branch he is the leading English authority; founded in 1869 in the College of Surgeons a museum and a professorship of dermatology, and was chosen the first occupant of that chair. Author of *Practical and Surgical Anatomy* (1838), *The Anatomist's Vade-Mecum, a System of Human Anatomy* (1842), *Diseases of the Skin* (1842), *Healthy Skin* (1845), *History of the Middlesex Hospital* (1845), *Ringworm, its Causes, Pathology, and Treatment* (1847), *On Syphilis, Constitutional and Hereditary* (1852), *The Eastern or Turkish Bath* (1861), *On Food as a Means of Prevention of Disease* (1865), and other professional works; contributed largely to medical journals and to cyclopædias, and edited the *Quarterly Journal of Cutaneous Medicine*. Most of his works have been reprinted, and had a large circulation in the U. S.

**Wilson** (Florence), known only by the Latinized form of his name as Florentius Volusenus, b. near Elgin, Morayshire, Scotland, about 1500; educated at the universities of Aberdeen and Paris; became a member of the households of Cardinals Du Bellay and Sadolet, master of the Latin and Greek school at Carpentras, and an eminent scholar and Roman Catholic theologian. D. at Vienne in 1547. Author of *Commentatio quædam Theologica quæ eadem Precatio est in Aphorismos dissecta* (Lyons, 1539), *De Animi Tranquillitate* (1543; several times reprinted at Edinburgh, the best edition being that of Thomas Ruddiman, 1707), and *Poemata* (London, 1619). His death was commemorated by George Buchanan in sonorous Latin verses, and a *Life* was written by Dr. Lettice.

**Wilson** (George), M. D., brother of Daniel, b. at Edinburgh, Scotland; educated at the Edinburgh High School; was apprenticed at the age of fifteen in the laboratory of the Royal Infirmary; subsequently pursued chemical researches under Profs. Christison and Graham; graduated at Edinburgh as surgeon 1837, and as physician 1839, but devoted himself entirely to chemistry, in which branch he became lecturer in the extra-academical school of Edinburgh 1840, and in the School of Arts and Veterinary College 1845; was a member of the Maga Club and president of the Physical Society, and was director of the Scottish Industrial Museum and regius professor of technology in the University of Edinburgh from 1855 until his death, Nov. 22, 1859. Amid great physical suffering, protracted through many years, he cherished an ardent love of science and of literature; made valuable experimental discoveries, and for his eminent personal and social qualities was beloved as few men have been by a wide circle of friends. Author of the textbook of *Chemistry* (1850) in Chambers's "Educational Course," of *Lives* of Dalton, Wollaston, and Boyle in the *British Quarterly Review*, *The Life of Henry Cavendish, including Abstracts of his more Important Scientific Papers, and a Critical Inquiry into the Claims of all the Alleged Discoverers of the Composition of Water* (Cavendish Society, iii., London, 1851), *Life of Dr. John Reid* (1852), *Electricity and the Electric Telegraph* and *The Chemistry of the Stars* (1852), *The Grievance of the University Tests* (1852), *Researches on Color-Blindness* (1855), *The Five Gateways of Knowledge* (1856), *The Progress of the Telegraph* (1859), and posthumous works, *Religio Chemici* (1862) and *Counsels of an Invalid* (1862). He left unfinished a *Memoir of Edward Forbes*, which was completed by Archibald Geikie (1861). He contributed to periodicals and scientific journals many articles and papers, including poetical pieces in *Blackwood's* and *Macmillan's Magazines*. His *Memoir*, by his sister, Miss Jessie Aitken Wilson (1860), is a work of unusual interest, of which a condensed edition appeared in 1866.

**Wilson** (George), b. at Hathersage, Derbyshire, England, in 1808; became a merchant at Manchester; took an active part in the numerous free-trade and other radical and political agitations of that city; became a member of the council of the Anti-Corn Law League Jan., 1839, its chairman in April of the same year, and spent most of his time in its management for the ensuing seven years, until the repeal of the corn laws 1846, when his services were acknowledged by a public testimonial of £10,000. He was afterward president of the National Reform Union, and took an active part in electoral matters and in the direction and management of railways and telegraphs. D. suddenly in a railway train near Liverpool Dec. 29, 1870.

**Wilson** (Henry), LL.D., b. at Farmingham, N. H., Feb. 16, 1812. When but ten years old, in consequence of the extreme poverty of his parents, he was bound an apprentice to a neighboring farmer until twenty-one years of age. After serving out his full time, he received for his eleven years of hard labor, in addition to the privilege of one month's schooling in a year, a sum of about $80. With this he commenced his life as a freeman, taking up his residence in Natick, Mass., where he ever after lived. In 1836 he visited Washington, where his first sight of slavery and the domestic slave-trade produced an impression so profound on his mind that he made a solemn resolve to devote his life to the cause of emancipation. In 1840 he was elected a member of the lower branch of the State legislature; in 1844 and 1845 he was a member of the State senate; in 1848 was a member of the national convention of the Whig party. In this body, on the nomination of Gen. Taylor on a platform unpledged against slavery extension, he openly renounced his connection with the Whig party, and gave his support to the Free-Soil organization. In 1850 he was again elected to the State senate, and was made president of that body. He failed of an election as governor of the State in 1853, but two years after he was chosen a Senator of the U. S. in the place of Edward Everett, resigned. To this high position he brought an accurate knowledge of the political history of the country, a sagacity unequalled in estimating the drift of popular sentiment, a vigorous, earnest eloquence, a firm reliance upon justice and truth as the great forces of action in human affairs, and that intense abhorrence of slavery in all its forms which had marked his whole life. When his colleague, Charles Sumner, was stricken down at his desk in the Senate chamber by blows from a bludgeon in the hands of a Representative of South Carolina, he denounced the outrage in terms of fitting indignation, although threatened himself with personal violence. Challenged to mortal combat, he pronounced the duel a survival of barbarous ages, but declared that he was ready to defend himself whenever and wherever assailed. During the war of the rebellion, following the election of Pres. Lincoln, he manifested some of the highest qualities of statesmanship. His name is associated with nearly all the important legislation of the period. As chairman of the committee on military affairs he lifted himself to the level of the great occasions of the national crisis. Measures of the greatest importance relating to the raising and equipment of vast armies were reported from his committee with surprising rapidity, and almost all were passed nearly in the form reported. At the close of the short session of Congress in the summer of 1861, Gen. Scott said: "Senator Wilson has done more work in this short session than all the chairmen of the military committees have done for the last twenty years." At the close of the war he applied himself to the work of union, conciliation, and reconstruction. In 1872 he was elected to the honorable position of Vice-President of the U. S. In the "snatched leisure" of the last years of his life he prepared his great literary work, *The Rise and Fall of the Slave Power*, two volumes of which were published before his death, the third and last being left nearly completed in manuscript. Of his large executive ability, his fidelity to his convictions, his patriotism, moral and physical courage, his hearty sympathy with the poor and wronged, and the purity of his public and private life, there is no divided opinion among his countrymen. Holding for nearly a quarter of a century positions where mercenary inducements abounded, he kept himself spotless, and left the world as poor as he entered it. He died in the Vice-President's apartments in the Capitol at Washington Nov. 22, 1875. John G. Whittier.

**Wilson** (Henry Bristow), b. in London, England, in 1803; educated at Merchant Taylors' School, of which his father, Rev. Harry B. Wilson, D. D. (1774–1853), was a master and the historian; graduated with high classical honors at St. John's College, Oxford, 1825; became a fellow and tutor there; took orders in the Church of England; was one of the four resident tutors at Oxford who in 1841 issued a joint protest and remonstrance to the editor of *Tracts for the Times* on account of their Romanizing interpretation of the XXXIX Articles; was successively a select preacher, public examiner, professor of Anglo-Saxon, and Bampton lecturer (1850) at Oxford; became vicar of Great Stoughton, Huntingdonshire, 1851, and was one of the seven clergymen of the Church of England who in 1860 published the famous volume of *Essays and Reviews*, to which his contribution was an essay on *The National Church*; was tried for heresy before the court of arches, and sentenced to a year's suspension from his benefice 1862, but obtained a reversal on appeal to the privy council; is

author of *The Communion of Saints, an Attempt to Illustrate the True Principles of Christian Union* (1851); was a contributor to the *Oxford Essays*, and has published a number of sermons and pamphlets on university and theological questions.

**Wilson** (Horace Hayman), F. R. S., b. in London, England, in 1786; educated for the medical profession; went to India in 1808 as assistant surgeon in the Bengal service of the East India Company; gave his attention to chemistry; obtained an appointment in the Calcutta mint as assistant to Dr. Leyden, the celebrated Orientalist; became assay-master and secretary; applied himself with great diligence to the study of Sanskrit literature; was appointed secretary of the Asiatic Society of Bengal on the death of Dr. William Hunter 1811; became secretary to the public instruction committee at Calcutta, and director of studies of the Hindoo college at Benares 1819; rendered great service in encouraging the progress of education among the natives of Bengal, and in stimulating by his publications the cultivation by Europeans of Oriental philology; was a great favorite in Calcutta society for his musical skill and his talents as an amateur actor; received on several occasions the thanks of the government of India for reforms in the coinage and other public services; was a trusted counsellor upon all questions relating to the history, customs, and welfare of the people of India; returned to England in 1832 to occupy the lucrative Boden professorship of Sanskrit at Oxford University, to which he had been elected over several distinguished competitors; was appointed librarian at the East India House on the death of Sir Charles Wilkins 1836, and retained both offices until his death, in London May 8, 1860. He married in 1832 a granddaughter of the celebrated actress, Mrs. Siddons, and soon afterward became a director of the East India Company. Among his numerous works were a *Sanskrit and English Dictionary* (Calcutta, 1819; 2d ed., enlarged, London, 1832), a *Sanskrit Grammar* (1841; 2d ed., Oxford, 1847), *A Descriptive Catalogue of the Oriental MSS. and other Articles illustrative of the Literature of the South of India, collected by Col. Colin Mackenzie* (Calcutta, 2 vols., 1828), *A History of British India from 1805 to 1835* (3 vols., 1844–48), *Ariana Antiqua, a Descriptive Account of the Antiquities and Coins of Afghanistan* (1841), *A Sketch of the Religious Sects of the Hindus* (Calcutta, 1846), *A Glossary of Judicial and Revenue Terms, etc., in Arabic, Persian, Hindustani, Sanskrit, Bengali, Uriya, Marthi, Guzurathi, Telugu, Karnata, Tamil, Malayalam, and other Languages* (1855), and many translations in verse or prose of classical works from the Sanskrit, including *The Megha-Dùta, or Cloud Messenger* (1813; new ed., with vocabulary, 1869), *Select Specimens of the Theatre of the Hindus* (Calcutta, 3 vols., 1827; 2d ed., 2 vols., 1835), the *Vishnu Purana* (1840; new ed., 6 vols., 1867–70), and *The Rig-Veda Sanhita* (3 vols., 1850–57), comprising about one-half of the hymns of that ancient collection. A collective edition of his miscellaneous *Works*, in 17 vols., has been commenced under the editorship of Dr. Reinhold Rost and Dr. Fitzedward Hall, of which 11 vols. appeared 1864–70.

Porter C. Bliss.

**Wilson** (James), LL.D., b. near St. Andrew's, Scotland, in 1742; educated at the universities of Glasgow, St. Andrew's, and Edinburgh; emigrated to Pennsylvania 1766; was a tutor in the College and Academy of Philadelphia; studied law in the office of John Dickinson; was admitted to the bar 1768; practised at Reading, Carlisle, and Annapolis, Md.; was a member of the Pennsylvania provincial convention 1774, and of the Continental Congress 1775–77, and again 1782–83 and 1785–87; signed the Declaration of Independence, and wrote several pamphlets on political questions; was commissioned a colonel at the outbreak of hostilities, but did not serve in the field; settled at Philadelphia 1778; was advocate-general of France in the U. S. 1779–83; was a member of the committee which drafted the Federal Constitution 1787, of the Pennsylvania convention which ratified it, and of the convention which amended the State constitution of Pennsylvania in 1790; was appointed in Sept., 1789, one of the first judges of the U. S. Supreme Court, and became in 1790 the first professor of law in the College of Philadelphia. D. at Edenton, N. C., Aug. 28, 1798. His *Works* (3 vols., 1803–04), consisting chiefly of legal lectures, speeches, and orations, were edited by his son, Bird Wilson.

**Wilson** (James), brother of Prof. John (1785–1854), b. at Paisley, Scotland, in 1795; studied but never practised law; travelled on the Continent in 1816, 1819, and 1820–21; settled at Woodville, near Edinburgh, 1824, and d. there May 18, 1856. Author of *Illustrations of Zoology* (9 parts, 1826–32), *A Treatise on Insects* (1835), *The Natural History of Quadrupeds and Whales* (1838), *The Natural History of Fishes* (1838), *The Natural History of Birds* (1839), *A Voyage round the Coasts of Scotland and the Isles* (2 vols., 1842), and *Illustrations of Scripture, by an Animal Painter;* aided Hugh Murray in his works on Africa, North America, and India, and Patrick Fraser Tytler in his *Progress of Discovery on the Northern Coasts of America* (1832); was joint author with James Duncan of *Entomologia Edinensis* (1834); contributed largely to *Blackwood* and the quarterly reviews, and wrote the articles on natural history in the 7th and 8th eds. of the *Encyclopædia Britannica*, to which he also contributed a biography of Prof. Edward Forbes. His *Memoirs* (1859) were written by James Hamilton, D. D.

**Wilson** (James), b. at Hawick, Roxburghshire, Scotland, June 3, 1805; was for a time a hatter, and subsequently a tradesman at Hawick, London, and Newcastle, in which business he repeatedly failed; founded at London in 1843 the *Economist* newspaper, of which he was for many years chief editor and sole proprietor; was elected to Parliament 1847, 1852, and 1857; was secretary to the board of control 1848–52, financial secretary to the treasury 1852–56; became vice-president of the board of trade 1859, but in the same year accepted the position of financial member of the council of India; sailed for Calcutta Oct. 20, 1859, and after a brief but eminently successful administration of Indian finances, d. at Calcutta Aug. 11, 1860. His statue has been erected in that city. Author of *The Influence of the Corn Laws* (1839), *The Fluctuations of Currency* (1840), *Capital, Currency, and Banking* (1847), and other works on political economy, of which science he was one of the ablest modern expositors.

**Wilson** (James F.), b. at Newark, O., Oct. 19, 1828; received a good education, and studied law; settled in Iowa 1853; was elected to the convention for revising the State constitution 1856; sat in both houses of the legislature; was president of the senate 1861; was a member of Congress 1861–69, serving as chairman of the judiciary committee and as one of the managers of the impeachment of Pres. Johnson, and in 1869 was appointed a commissioner for the Pacific R. R.

**Wilson** (James Grant), b. at Edinburgh, Scotland, 1832; came to America in infancy with his father, William Wilson (1801–60); served in the civil war in the Southwest under Gens. Grant and Banks. Prior to 1861 he had been engaged in the book business with his father in Chicago; removed to New York at the close of the war. Author of *Illinois Officers in the Rebellion* (1863), *Life of Gen. Grant* (1868), *Mr. Secretary Pepys and his Diary* (1869), *Life and Letters of Fitz Greene Halleck* (1869), *Sketches of Illustrious Soldiers, Poets and Poetry of Scotland, History of Chicago*, etc.

**Wilson** (James Harrison), b. in Illinois about 1838; graduated at West Point 1860; became first lieutenant of topographical engineers Sept. 9, 1861, and captain May 7, 1863; served in the Port Royal expedition and at the capture of Fort Pulaski, Ga., for which he was brevetted major Apr. 11, 1862; was aide-de-camp to Gen. McClellan at South Mountain and Antietam; became staff lieutenant-colonel of volunteers Nov. 8, 1862; was assistant engineer and inspector-general of the Army of the Tennessee in the campaign against Vicksburg; was made brigadier-general of volunteers Oct. 31; brevetted lieutenant-colonel U. S. A. Nov. 24, 1863, for gallantry at Chattanooga; commanded the 3d cavalry division of the Army of the Potomac May to Aug., 1864; was brevetted colonel May 5 for the battle of the Wilderness; took part in the ensuing battles of that campaign, and in the Shenandoah Valley Aug. and Sept., 1864; commanded the cavalry of the division of the Mississippi from Oct., 1864, to July, 1865; took part in Gen. Thomas's campaign in Tennessee, being distinguished at the battles of Franklin and Nashville, and in a cavalry raid into Alabama and Georgia Mar. and Apr., 1865; was brevetted brigadier and major general U. S. A. Mar. 13, 1865, for the battle of Nashville and the capture of Selma, Ala., respectively; took Montgomery, Columbus, and Macon; was made major-general of volunteers Apr. 20; captured Jefferson Davis May 10, 1865; became lieutenant-colonel of 35th Infantry July 28, 1866; left the army Dec. 31, 1870, and has since been engaged upon railroad enterprises in the Western States, having his residence in New York City. Author of many articles in periodicals and contributor to Appletons' *Cyclopædia*.

**Wilson** (James Patriot), D. D., b. at Lewes, Sussex co., Del., in 1769; graduated at the University of Pennsylvania 1788; was admitted to the bar 1790; studied theology, and was pastor of the First Presbyterian church in Philadelphia from 1806 until his death, in Bucks co., Pa., Dec. 9, 1830. Author of *Lectures on the Parables* (1810), *An Easy Introduction to Hebrew* (1812), *Common Objections to Christianity* (1829), *The Primitive Government of Christian Churches*, etc. (1833), and other works.

**Wilson** (John), b. at Windsor, England, in 1588, third son of William Wilson, D. D., prebendary of St. Paul's, of Rochester, and of Windsor, and rector of Cliff, in Kent, who had been chaplain to Edmund Grindall, archbishop of Canterbury, and married one of his nieces, and grand-nephew of Sir Thomas Wilson, secretary of state to Queen Elizabeth; educated at Eton School (1598–1602), where he was chosen to make a Latin oration on the occasion of the visit of the French ambassador, the duke of Biron; entered King's College, Cambridge, 1602; graduated about 1606; obtained a fellowship; studied law three years at one of the inns of court; took orders in the Church of England; became conspicuous for his Puritanical leanings, derived from his intimacy with the celebrated Dr. William Ames and Richard Rogers of Wethersfield; was chaplain to Lady Scudamore and in other distinguished families; preached successively at Mortlake, Henley, Bumsted, Stoke, Clare, and Candish; was for some years minister of Sudbury, Essex, where he was several times suspended or silenced by the bishop's court, and was befriended by Robert Rich, earl of Warwick; married Elizabeth (d. 1659), daughter of Sir John Mansfield, surveyor to Queen Elizabeth, and master of the Minories, a relative of Dr. John Dod, the "Decalogist;" took part in the project of the colonization of Massachusetts; embarked at the Isle of Wight Apr. 8, 1630, in the great fleet with Winthrop and his associates of the Massachusetts Company; landed at Salem June 12; removed soon afterward to Charlestown, where he preached under a tree, and instituted (July 30) what was afterward the first church of Boston, consisting of himself, Gov. Winthrop, Isaac Johnson, and Deputy-Gov. Thomas Dudley; was ordained "teacher" of that church Aug. 27 by imposition of hands of the members thereof; sailed for England Apr. 1, 1631, returning May 26, 1632; took the freeman's oath July 3; was ordained "pastor" of the church Nov. 22, 1632; visited England again in the autumn of 1634, returning with his wife Oct. 3, 1635, along with the celebrated Hugh Peters; took a prominent part in the Antinomian controversy as the chief ally of Gov. Winthrop against the party headed by Wheelwright and Mrs. Hutchinson; was chaplain to the Massachusetts forces sent to Connecticut against the Pequots 1636, for which service he afterward received a grant of 1000 acres of land in the present town of Quincy; accompanied the "apostle" John Eliot on his visit to the Indian settlements, and labored for their interests; lost his colleagues Cotton (1652) and Norton (1663); was noted for benevolence, hospitality, and readiness in improvising verses, being esteemed by Mather "the greatest anagrammatist since the days of Adam." D. at Boston Aug. 7, 1667. Biographies were written by Cotton Mather in his *Magnalia* (1702) and by Rev. Dr. A. W. McClure in the *Lives of the Chief Fathers of New England* (6 vols., 1846 *seq.*). Poetical epitaphs on Mr. Wilson were written by Jonathan Mitchell, Cotton Mather, and others. He published in England a theological treatise, *Some Helps to Faith* (1625); a poem, *Famous Deliverances of the English Nation* (1626; new ed., Boston, 1680); a Latin poem to the memory of John Harvard; and a tract, *The Day Breaking, if not the Sun Rising, of the Gospel with the Indians in New England* (1647; new ed., New York, 1865), besides many other occasional productions, the titles of which are unknown.—His son John, b. in Sudbury, England, in July, 1621; graduated in the first class at Harvard 1642; was two years colleague with Richard Mather at Dorchester; married a daughter of Rev. Thomas Hooker, and was pastor of Medfield above forty years, until his death, Aug. 23, 1691.

Porter C. Bliss.

**Wilson** (John), more generally known by his pseudonym Christopher North, b. at Paisley, Scotland, May 19, 1785; was educated at the universities of Glasgow and Oxford, where he won the Newdegate prize for English poetry in 1803 by a poem on *The Study of Greek and Roman Architecture*, and graduated in 1807. In 1808 he bought the estate of Elleray, on Lake Windermere, in Westmoreland, where he lived in intimate intercourse with Wordsworth, Coleridge, and Southey, and published in 1812 the poem *The Isle of Palms*. In 1815 he sold Elleray, removed to Edinburgh, and was admitted to the bar; published in 1816 the dramatic poem, *The City of the Plague;* became one of the chief contributors to *Blackwood's Magazine*, founded in 1817, and was appointed professor of morals in 1820 at the University of Edinburgh, in preference to Sir William Hamilton. In 1822 he published *Lights and Shadows of Scottish Life;* in 1823, *The Trials of Margaret Lindsay;* in 1824, *The Foresters;* in 1841, *Essay on the Genius and Character of Burns;* but his most popular productions were his contributions to *Blackwood's Magazine* under the pseudonym of "Christopher North:" *Noctes Ambrosianæ* (1822–35), *Dies Boreales, or Christopher under Canvas* (1849–52), etc. In 1851 he resigned his chair at the university, and d. in Edinburgh Apr. 3, 1854. A collected edition of his works has been published in 12 vols. by his son-in-law, Prof. Ferrier; his *Life* has been written by his daughter, Mrs. Gordon, in 2 vols.; and a bronze statue of him has been raised in Edinburgh.

**Wilson** (John), D. D., b. in Scotland about 1800; was for many years a missionary of the Free Church of Scotland at Bombay, India. Author of *An Exposure of the Hindu Religion* (1832), *The Doctrine of Jehovah, addressed to the Parsis* (1839), *The Parsi Religion Unfolded, Refuted, and Contrasted with Christianity* (1843), *The Lands of the Bible Visited and Described* (2 vols., 1847), *The Evangelization of India* (1849), and *The History of the Suppression of Infanticide in Western India* (1855).—His son, Andrew, b. in Bombay about 1835; was employed by the East India Company; visited China; travelled in Western Thibet; is a distinguished professor in England, and author of *The Ever-Victorious Army*, a narrative of the suppression of the Tai-ping rebellion in China, and of *The Abode of Snow* (1875), an account of his travels in the Himalayas, which first appeared in *Blackwood's Magazine*.

**Wilson** (John), b. at Glasgow, Scotland, in 1802; became a printer and publisher at Boston, Mass., 1843, and was noted for the carefulness and elegance of the productions of his press. D. at Boston Aug. 3, 1868. Author of *Scripture Proofs and Scripture Illustrations of Unitarianism* (1833), *The Concessions of Trinitarians* (1842), *A Treatise on Grammatical Punctuation* (1844), *The Elements of Punctuation* (1856), and *Unitarian Principles confirmed by Trinitarian Testimonies* (1855).

**Wilson** (John), b. in Ireland in 1808; came to the U. S. in childhood; settled at Washington, D. C.; was for many years a clerk in the post-office and treasury departments; was commissioner of the general land office 1852–56, third auditor of the treasury several years from 1864; was for some time engaged in railroad business in Illinois, but subsequently returned to Washington, where he practised as an attorney until his death, in Jan., 1866.—His brother, Joseph S., was successively messenger and clerk in the treasury department; became on the organization of the interior department chief clerk of the general land-office, of which he was appointed commissioner 1860, and again 1866. D. at Washington about 1871.

**Wilson** (John G.), b. at New Leeds, Cecil co., Md., in 1809; became a Methodist preacher, and subsequently a minister of the so-called "Church of God," the peculiar views of which in regard to prophecy and the "second advent" he expounded in various periodicals, especially in the *Homiletic Magazine and Repository of Pastoral Theology* (1843–44), founded and conducted by him, and published *Discourses on Prophecy* (1850), *A Vindication of the Scheme of Redemption* (1858), *Writings in Prose and Verse on Various Subjects* (1860), *The Gospel of the Epiphany*, and *The Branch of David* (1867).

**Wilson** (John Leighton), D. D., b. in Sumter district, S. C., in 1809; graduated at Union College 1829; studied theology at Columbia, S. C.; went as a missionary to Africa 1833; labored eight years at Cape Palmas and twelve years at Gaboon; repeatedly visited all parts of the coast; mastered and reduced to writing the Grebo and Mpongwe languages, translating into them portions of the Bible, and composing grammars and dictionaries; and on his return to the U. S. became one of the secretaries of the Presbyterian Board of Foreign Missions. Author of *Western Africa, its History, Condition, and Prospects* (1856), and of various tracts on Africa, and has contributed papers to the *Bibliotheca Sacra* and to the *Journal* of the American Oriental Society.

**Wilson** (John Mackay), b. in Scotland about 1775; was for some years editor of the Berwick *Advertiser*. D. at Berwick-on-Tweed Oct. 2, 1835. He was the editor and principal author of an important work, of which 150,000 copies have been sold—*Tales of the Borders, Historical, Traditionary, and Imaginative* (6 vols., 1835–40), intended as a companion to the *Waverley Novels*. The last edition, revised and enlarged by Alexander Leighton, appeared in 24 vols. (Edinburgh, 1869).

**Wilson** (Peter), LL.D., b. at Banff, in the N. of Scotland, Nov. 23, 1746; pursued his studies in the University of Aberdeen, devoting himself especially to classical literature; removed to New York in 1763, where he began his labors as teacher; was soon called to be principal of Hackensack Academy; in 1775 threw himself with zeal into the measures leading to the Revolution and the independence of the colonies; from 1777 to 1783 served in the New Jersey legislature; in the latter year was appointed to revise and compile the laws of his adopted State, which work he satisfactorily completed; in 1789 was elected professor of the Greek and Latin languages in Columbia College, New

York; resigned in 1792, and became principal of Erasmus Hall, Flatbush, Long Island; received the degree of LL.D. from Union College 1793; was recalled in 1797 to Columbia College as professor of Greek and Latin and of Greek and Roman antiquities, which office he retained till 1820, when he retired on a liberal pension from the trustees. Published treatises on *Latin Prosody* (New York, 1810), *Greek Prosody* (1817), an edition of Sallust, Longinus, the Greek Testament, and a revision of Adam's *Roman Antiquities* (1826). D. Aug. 1, 1825. H. Drisler.

**Wilson** (Richard), b. in Montgomeryshire, England, in 1713 or 1714; painted portraits in London; went in 1749 to Rome, where he became acquainted with Joseph Vernet, and changed from portraits to landscapes; returned in 1755 to London; became one of the founders of the Royal Academy, and for several years its librarian. D. at Llanferras, Denbighshire, in 1782. Among his most celebrated pictures are *Destruction of Niobe's Children, View of Baiæ, Carnarvon Castle, Pembroke Castle*, etc.

**Wilson** (Robert Anderson), b. at Cooperstown, N. Y., in 1812; resided some years in California, where he was a judge in the Sacramento mining district 1851–54; travelled in Mexico and Central America, and was for some years a clerk in the state department at Washington, D. C. Author of *Mexico and its Religion* (1855) and of *A New History of the Conquest of Mexico* (1859), in which he pronounces most of the accounts of the conquest heretofore received to be unreliable, and that the boasted civilization of the Aztecs was a myth.

**Wilson** (Sir Robert Thomas), son of Benjamin, b. in Bloomsbury, London, England, in 1777; educated at Westminster and Winchester schools, and had commenced the study of law when he received from the duke of York a commission in the army; took part as a volunteer in the campaign in Flanders 1793–94; was on the staff in Ireland during the rebellion of 1798; served in Holland 1799, in Egypt under Abercromby 1800; accompanied Sir D. Baird to Brazil and the Cape of Good Hope 1805; went with Lord Hutchinson on a secret mission to the allied armies on the Russian frontier 1806–07; served in Portugal and Spain 1808–10, in command of the Lusitanian Legion, and afterward of a Spanish brigade; was British military correspondent at the Russian head-quarters during the memorable campaign in Germany and France 1812–14; received decorations from the allied emperors; aided in effecting the escape of Count Lavalette at Paris Jan., 1815; incurred the displeasure of the prince regent by espousing the cause of Queen Caroline; was in consequence dismissed from the army 1821, but was indemnified by a public subscription, and a few years later was restored to his rank; sat in Parliament as a Liberal 1818–31; attained the full rank of general 1841, and was governor of Gibraltar 1842–49. D. in London May 9, 1849. Author of *A History of the British Expedition to Egypt* (1802), *An Inquiry into the Present State of the Military Force of Britain* (1804), *A Sketch of the Campaigns in Poland in 1806–07* (1810), *A Sketch of the Military and Political Power of Russia* (1817), and translated Regnier's *Account of the Campaign in Egypt* (1802). Since his death have appeared his *Narrative of Events during the Invasion of Russia by Napoleon Bonaparte and the Retreat of the French Army* (1860), and his *Private Diary of Travels, Personal Services, and Public Events during Missions and Employment with the European Armies in the Campaigns of 1812–13–14, from the Invasion of Russia to the Capture of Paris* (2 vols., 1861), both edited by his nephew and son-in-law, Rev. Herbert Randolph, who also published a *Life* (2 vols., 1863) prepared from autobiographical memoirs, journals, and correspondence.

**Wilson** (Samuel Farmer), b. in New York in 1805; graduated at Columbia College 1822; was admitted to the New York bar; wrote about 1830 a small *History of the American Revolution* (new ed. 1869), which has been often reprinted; settled in New Orleans as a lawyer; became editor of the *True Delta* in conjunction with William Walker, and was subsequently editor and proprietor of the *Picayune*.

**Wilson** (Theodore D.), b. in Brooklyn, N. Y., May 11, 1840; served his apprenticeship as shipwright at the navy-yard, Brooklyn; served for three months at the outbreak of the rebellion with the 13th N. Y. S. M. as a non-commissioned officer; on the return of the regiment was appointed a carpenter in the navy; served about two years afloat; was in the fight with the Merrimack in Hampton Roads; was ordered to duty with Rear-Admiral F. H. Gregory in 1863 as an inspector of the building and repairing of vessels in private establishments in New York and vicinity; was examined for, passed, and appointed an assistant naval constructor May 17, 1866; served as such in the navy-yards at Pensacola, Philadelphia, and Washington; served four years as instructor in naval architecture and shipbuilding at the U. S. Naval Academy; promoted to naval constructor July 1, 1873; member of the Institution of Naval Architects of England. Author of *Shipbuilding, Theoretical and Practical*, used as a textbook at the Naval School and by the profession in this country generally.

**Wilson** (Sir Thomas), LL.D., b. at Stroby, Lincolnshire, England, about 1524, son of Thomas Wilson by his wife Anne, daughter of Roger Comberworth; educated at Eton under the celebrated Udal; was sent on an Eton scholarship to King's College, Cambridge, where he graduated 1546; took orders in the Church of England; became tutor to Henry and Charles Brandon, sons of the duke of Suffolk by Mary, the ex-queen of France, both of whom, however, soon died; wrote the biographies of his pupils in a rare Latin volume, *Vita et Obitus Duorum Fratrum Suffolcensium Henrici et Caroli Brandoni Ducum illustrissimorum, Duabus Epistolis explicata, adduntur Epitaphia, etc.* (1551); published *The Rule of Reason, conteinyng the Arte of Logique set forth in Englishe* (1551; 9th ed. 1580), and *The Arte of Rhetorike for the Use of all Suche as are Studious of Eloquence, sette forthe in Englishe* (1553; 9th ed. 1585), said to be the first critical treatises on logic and rhetoric in English, and incidentally to give the author a title to rank as the founder of English philology, the latter work having been referred to by Shakspeare, and having exerted a powerful influence to purify the English language from foreign idioms; withdrew to the Continent on the accession of Mary 1553; took the degree of LL.D. at the University of Ferrara; was imprisoned by the Inquisition at Rome on charges said to have been based on his published works; was put to the torture; obtained his liberty at the death of Pope Paul IV. 1555, when the populace broke open the prison of the Inquisition; returned to England soon after the accession of Elizabeth, to whom he became private secretary 1558, acting also as her instructor in various branches of learning; was made master of requests and master of St. Katherine's Hospital, near the Tower; published a translation of *The Three Orations of Demosthenes, Chief Orator among the Grecians, in Favor of the Olynthians, with those his fower Orations against King Philip of Macedon* (1570; 2d ed. 1572), a work which greatly pleased Queen Elizabeth by the obvious analogies it suggested between Philip of Macedon and Philip II. of Spain; issued *A Discourse upon Usury by way of Dialogue and Orations* (1572; 3d ed. 1584); went as ambassador to the Netherlands 1576; succeeded Sir Thomas Smith as secretary of state and colleague of Sir Francis Walsingham 1577, and became dean of Durham 1579. D. in London June 16, 1581. He married Anne, daughter of Sir William Winter of Lidney, Gloucestershire, and left a son, Nicholas, and two daughters. Many facts concerning him may be found in Strype's *Annals*, apparently based upon MS. documents. Porter C. Bliss.

**Wilson** (Thomas), D. D., LL.D., b. at Burton, Cheshire, England, in 1663; educated at Trinity College, Dublin; took orders in the Church of England; became curate of Winwick, Lancashire, 1686, domestic chaplain to the earl of Derby 1692; travelled with that nobleman's son, Lord Strange, on the Continent 1694–97, and was bishop of Sodor and Man fifty-seven years, from Jan. 16, 1698, until his death, Mar. 7, 1755. He was "held in the most exalted reputation for apostolic piety and unquenchable zeal in good works," and is even yet prominent in the writings of Matthew Arnold, Ruskin, and their followers as an exemplar of their doctrine of "sweetness and light." Author of *The Principles and Duties of Christianity* (1699), in English and Manx (being the first book printed in the language of the Isle of Man), *Short and Plain Instructions for the Better Understanding of the Lord's Supper* (1736), *The Knowledge and Practice of Christianity made easy to the Meanest Capacities, or an Essay towards an Instruction for the Indians* (1740), *Sacra Privata* (1800), several volumes of *Sermons*, and other treatises. His *Works* (Bath, 2 vols., 1781) were edited with a *Life* by Rev. C. Crutwell.

**Wilson** (Thomas B.), M. D., b. at Philadelphia, Pa., about 1800; received an academical education; studied medicine, which he practised in Philadelphia, accumulating a handsome fortune; became eminent as a zoologist; was a leading member of the Pennsylvania Academy of Natural Sciences, of which he became president, and to which he was a munificent benefactor, its library and its splendid collection of birds being mainly his gift. D. at Newark, Del., Mar. 15, 1865.

**Wilson** (Walter), b. in England in 1781; studied law at the Inner Temple; became a bookseller in London, where he accumulated a fortune, and subsequently resided for many years at Bath, where he d. in 1847. Author of *The History and Antiquities of Dissenting Churches and Meet-*

*ing-Houses in London, Westminster, and Southwark, including the Lives of their Ministers, from the Rise of Nonconformity to the Present Time, and an Appendix on the Origin, Progress, and Present State of Christianity in Britain* (London, 4 vols., 1808–14), and *Memoirs of the Life and Times of Daniel Defoe* (3 vols., 1830).

**Wilson** (WILLIAM), b. in Perthshire, Scotland, in 1801; was editor of the Dundee *Review* (1821–23) and of the *Literary Olio* (1824), for which he wrote many poems; resided afterward in Edinburgh as a writer for the press; was intimate with the brothers Chambers; came to the U. S. 1833; established himself as a bookseller at Poughkeepsie, N. Y., 1834; wrote under the signatures of "Allan Grant" and "Alpin" for *Blackwood's Magazine, Chambers's Journal,* the *Knickerbocker,* the *Albion,* and other Scottish and American periodicals; became a partner with his son, James Grant Wilson, in the bookselling and publishing business at Chicago, Ill., 1860; edited the *Scottish Songs, Ballads, and Poems* (New York, 1855) of Hew Ainslie, and some other volumes, and left unfinished a collection of the *Poets and Poetry of Scotland,* since completed by his son. D. Aug. 25, 1860. A volume of his *Poems* (Poughkeepsie, 1870) was edited by Benson J. Lossing.

**Wilson** (WILLIAM), b. in England in 1822; came to the U. S. in childhood; became a ticket and passenger agent for steamers at New York; was afterward in the real-estate business; was noted for great strength, which he several times exhibited in the prize ring; was a noted Democratic politician; filled various municipal offices, including that of alderman (1856), and at the outbreak of the civil war raised and commanded the famous 6th regiment of New York Vols., composed chiefly of the "roughs" of New York City, and known as "Billy Wilson's Zouaves." In 1864 he became colonel of the 69th regiment. D. at New York Nov. 13, 1874.

**Wilson** (WILLIAM DEXTER), D. D., LL.D., L. H. D., b. in Stoddard, N. H., Feb. 28, 1816. Having spent a short time at the Walpole (N. H.) Academy and several years in private study, in 1835 he entered the theological department of Harvard University; in 1842 was ordained to the ministry of the Protestant Episcopal Church, and soon after published *The Constitution of the Christian Church,* enlarged and republished in 1846 as *A Manual of Church Principles;* in 1847 edited Bishop Mant *On the Rubrics,* with additional matter, expounding the rubrics of the American Church, and in 1848 published a *History of the Reformation in England;* in 1848–49 wrote a series of articles entitled *The Church Identified,* afterward collected, published in a volume, and enlarged and republished in 1850, and reissued in various editions to the present time; in 1849 received the degree of D. D. from Geneva College, and in 1850 became professor of history and moral and intellectual philosophy in that institution; in 1856 published an *Elementary Treatise on Logic;* in 1868 received the degree of LL.D., and at the opening of the Cornell University became professor of intellectual and moral philosophy in that institution; soon after published *Lectures on Psychology, Comparative and Human,* and a new textbook on logic; in 1872 received the degree of L. H. D. from the regents of the University of the State of New York, and soon after published an *Introduction to the Study of Metaphysics and Intellectual Philosophy,* and a work on *Political Economy;* has also written many important monographs on mathematical and metaphysical subjects, which may be found in the reviews and in *Reports of the Proceedings of the University Convocation of the State of New York.* He is now engaged on a work on the *History of Philosophy.* In his philosophical works he proposes a new account of the origin and nature of knowledge, between and differing from the old theories of idealism and sensualism. He believes in an *insight* into the nature of things cognized, which accounts for the element of knowledge in dispute between the two old schools. He makes logic a science of things, and regards words as mere representatives of things. In ontology he recognizes no causes as *causæ veræ* except those denoted by concrete terms. On this he bases a *transcendental* logic which is a new method of investigating ontological questions.

**Wilson Creek,** tp., Grayson co., Va. P. 3231.

**Wil'son's,** tp., Sanford co., Ala. P. 957.

**Wil'sonville,** p.-v. and tp., Shelby co., Ala. P. 560.

**Wil'ton,** p.-v. and tp., Fairfield co., Conn. P. 1994.

**Wilton,** tp., Will co., Ill. P. 1118.

**Wilton,** p.-v. and tp., Muscatine co., Ia., on Chicago Rock Island and Pacific R. R., 24 miles from Davenport, has 7 churches, Wilton Collegiate Institute, 2 private banks, 2 newspapers, 2 elevators, 3 hotels, and 1 grist-mill. P. 2345. J. E. STEVENSON, ED. "HERALD."

**Wilton,** p.-v. and tp., Franklin co., Me. P. 1906.

**Wilton,** p.-v. and tp., Waseca co., Minn. P. 668.

**Wilton,** p.-v. and tp., Hillsborough co., N. H. P. 1974.

**Wilton,** p.-v. and tp., Saratoga co., N. Y. P. 1204.

**Wilton,** p.-v. and tp., Monroe co., Wis. P. 818.

**Wilton** (JOSEPH), R. A., b. in London, England, in 1722; studied sculpture at Brabant, at Paris, and at Rome, where he gained the jubilee gold medal of Pope Benedict XIV.; spent eight years in Italy, chiefly occupied in copying ancient statues, after which he returned to England with Cipriani, Chambers the architect, and a clever modeller named Capizzoldi; became director of the duke of Richmond's art-gallery in Spring Gardens; became the most popular sculptor in England; acquired a handsome fortune; lived in great style; was a friend and patron of Richard Wilson the painter and of Baretti the lexicographer, and was one of the founders of the Royal Academy. D. in London in 1803. Among his best-known works were busts of Bacon, Cromwell, Newton, Swift, Wolfe, Chatham, and Chesterfield, and the monuments of Wolfe, Admiral Holmes, and Stephen Hales.

**Wilton Junction,** p.-v., Wilton tp., Muscatine co., Ia. P. 1317.

**Wilts,** or **Wiltshire,** an inland county in the southwestern part of England, comprises an area of 1352 sq. m., with 257,202 inhabitants. In the northern part are extensive plains well suited to agriculture and dairy-farming, which are carried on with great energy. Many hogs are reared here, and Wilton bacon and Wilton cheese are famous. The southern part is hilly, and on the bleak downs a great number of sheep of a fine breed is reared. Woollen stuffs are extensively manufactured; also some cotton, silk, and iron manufactures are carried on.

**Wiltse** (G. C.), U. S. N., b. Nov. 29, 1838, in New York; graduated at the Naval Academy in 1859; became lieutenant in 1861, commander in 1873; served in the Cumberland when she was destroyed by the Merrimack, and commended for "courageously performing his duty."

FOXHALL A. PARKER.

**Wilt'shire** (THOMAS **Boleyn**), EARL OF, b. in England about 1480; was created Viscount Rochford June 18, 1525, having gained the royal patronage through Henry's passion for his daughter Anne, the celebrated and unfortunate queen; was sent as ambassador to France 1527 and to the emperor Charles V. Mar., 1530, and was created earl of Ormond and of Wiltshire 1529. D. in 1538.

**Wimpffen', de** (EMANUEL FELIX), b. at Laon, department of Aisne, France, Sept. 13, 1811; began his military career in Algeria; was made a brigadier-general in the imperial guard in 1855; distinguished himself both in the Crimean and in the Italian wars; was made a general of division in 1859; commanded at Lyons, and was subsequently made governor, first of the province of Algeria, then of that of Oran. In the Franco-German war he received the command, first of the 12th, then of the 5th army corps, and during the battle of Sedan, after MacMahon had been wounded, he assumed the command of the whole army, and signed as such the capitulation of Sedan. While residing in Stuttgart he published several letters concerning the catastrophe. After the peace he retired into private life and settled in Algeria. AUGUST NIEMANN.

**Win'amac,** p.-v., Monroe tp., cap. of Pulaski co. Ind. P. 906.

**Wi'nans** (JAMES J.), b. at Maysville, Ky., June 7, 1818; removed in infancy to Xenia, O.; received a common-school education; was admitted to the bar 1841; was clerk of the court of common pleas in Greene co. 1845–51; was elected to the State senate 1857, and to the assembly 1863; was chosen judge of common pleas 1864; re-elected for five years 1866, and was a Republican member of Congress 1869–71, serving on the committees on public lands and on Revolutionary pensions.

**Winans** (WILLIAM), D. D., b. in Pennsylvania Nov. 3, 1788; joined the Western conference in 1808; after two years volunteered to go to the Natchez country; in this pioneer work endured great hardships and performed prodigious services in Mississippi and Louisiana; rose to great eminence in his conference and in the connection; was alike powerful in the pulpit and on the conference floor. He took a prominent part in the organization of the Methodist Episcopal Church, South; was singularly methodical in his habits, plain in his attire, a close student and a correct writer; published a volume of discourses, which are perspicuous in style and forcible in argument, but severely plain. D. in Mississippi Aug. 31, 1857. T. O. SUMMERS.

**Wi'nant's Kill,** v., North Greenbush tp., Rensselaer co., N. Y. P. 140.

**Winch'ell** (ALEXANDER), LL.D., b. at North East, Dutchess co., N. Y., Dec. 31, 1824; graduated at the Wes-

leyan University, Middletown, Conn., 1847; was teacher of natural sciences at Amenia Seminary, N. Y., 1848–51, and at Mesopotamia Female Seminary, Ala., 1851–53; was president of the Masonic Female University at Selma, Ala., 1853; became professor of physics and civil engineering at the University of Michigan 1853, and of geology, zoology, and botany 1855; was president of the Michigan Teachers' Association 1859; State geologist of Michigan 1859–62; professor of geology in the Kentucky University 1866–69; director of the geological survey of Michigan 1869, and of that of Minnesota 1870; was chancellor of Syracuse University 1872–74, and is now (1876) professor of geology and zoology in that institution, and lecturer in Vanderbilt University, Nashville, Tenn. Author of *The First Biennial Report of the Geological Survey of Michigan* (1861), *The Grand Traverse Region* (1866), *Genealogy of the Family of Winchell in America* (1869), *Geological Map of Michigan* (1865), *Geological Chart of New York* (1870), *Sketches of Creation* (1870), *Geology of the Stars* (1872), *The Doctrine of Evolution* (1874), *Lay Theology* (1876), and of above 200 scientific memoirs, and has described 300 new species and genera, mostly fossil.

**Winch'endon,** p.-v. and tp., Worcester co., Mass., on Miller's River, and on Cheshire, Boston Barre and Gardner, Monadnock, and Ware River R. Rs., contains 7 churches, good schools, a library, an efficient fire department, the New England Home for orphan and destitute children, 1 Odd Fellows and 2 Masonic lodges, 1 veteran soldiers' society, 2 hotels, and several large manufactories of wooden ware. P. 3398.

GEO. W. DAVIES, ED. "JOURNAL."

**Win'chester,** town of England, capital of Hampshire, on the Itchin, is the *Caer-Gwent* of the Britons and the *Venta Belgarum* of the Romans. After being taken in 495 by the Saxons, it received its present name, and was for several centuries the capital of England and the residence of its kings. But in the thirteenth century it lost its trade, and since that time it has gradually declined. Its cathedral, built in the eleventh century, is a vast but heavy structure, containing many interesting monuments. P. 14,705.

**Winchester,** tp., Litchfield co., Conn. P. 4096.

**Winchester,** p.-v. and tp., cap. of Scott co., Ill., on Rockford Rock Island and St. Louis R. R., 100 miles N. of the latter place, has 6 large churches, 3 banks, an excellent high school, 2 newspapers, 3 grain-elevators, 1 packing establishment, 1 saw and 2 flouring mills, and 1 plough and 1 furniture factory. P. 1661.

T. H. FLYNN, ED. "INDEPENDENT."

**Winchester,** p.-v., White River tp., cap. of Randolph co., Ind. P. 1456.

**Winchester,** p.-v., Jefferson co., Kan.

**Winchester,** p.-v., cap. of Clark co., Ky. P. 1616.

**Winchester,** p.-v. and tp., Middlesex co., Mass. P. 2645.

**Winchester,** p.-v., Wayne co., Miss. P. 14.

**Winchester,** p.-v. and tp., Cheshire co., N. H. P. 2097.

**Winchester,** v. and tp., Adams co., O. P. of v. 416; of tp. 1475.

**Winchester,** v., Knox tp., Columbiana co., O. P. 235.

**Winchester,** v., Madison tp., Franklin co., O. P. 633.

**Winchester,** p.-v., Madison tp., Guernsey co., O. P. 179.

**Winchester,** v., Bloomfield tp., Jackson co., O. P. 89.

**Winchester,** v., Gratis tp., Preble co., O. P. 430.

**Winchester,** p.-v., cap. of Franklin co., Tenn., on Winchester and Alabama R. R., near the foot of the Cumberland Mountains, is the site of the University of the South, and contains good schools, 1 newspaper, 2 carriage-factories, several flouring-mills, and 3 tanneries. It is a favorite resort for invalids. P. about 1800.

W. J. SLATTER, ED. "HOME JOURNAL."

**Winchester,** city and cap. of Frederick co., Va., on Winchester Potomac and Strasburg division of Baltimore and Ohio R. R., contains a court-house and jail, 15 churches of different denominations, 2 banks, 6 free public schools, 4 female seminaries, a male high school, 2 weekly newspapers, 2 iron-foundries, 5 tanneries, and manufactories of soap, gloves, and agricultural implements. P. 4477. The place is the key to the valley of the Shenandoah, and during the civil war it was repeatedly occupied by the forces on either side, and in its vicinity were fought several battles. (See CEDAR CREEK.)

**Winchester,** p.-v. and tp., Winnebago co., Wis. P. 1439.

**Winchester** (ELHANAN), b. at Brookline, Mass., Sept. 30, 1751; began preaching to a Baptist church at Newton 1769; was pastor of a church at Rehoboth 1771, but excommunicated in consequence of his views on close communion; went to South Carolina 1774; preached to the negroes on the plantations on the Pedee River; became pastor of the First Baptist church at Philadelphia 1780, and, having adopted the doctrine of universal salvation, founded there a Universalist church 1781, after which he traversed several States to propagate his new doctrines, and preached in England 1787–94. D. at Hartford, Conn., Apr. 18, 1797. He was one of the precursors of the modern system of Universalism, his doctrines being very similar to those preached by his contemporary, Rev. Dr. Charles Chauncy. Author of numerous religious treatises, pamphlets, sermons, and addresses, and of several volumes of verse.

**Winchester** (JAMES), b. in Maryland in 1756; served in the war of the Revolution; settled in Tennessee; was appointed a brigadier-general Mar. 27, 1812; was defeated by the British and Indians on the river Raisin, Mich., Jan. 23, 1813, and resigned from the army Mar. 21, 1815. D. in Tennessee July 27, 1826.

**Winchester** (WILLIAM **Paulet** or **Poulet**), K. G., MARQUIS OF, b. in Hampshire, England, about 1475; dissipated large estates in youth; entered the personal service of Henry VII.; became comptroller and afterward (1536) treasurer of the household to Henry VIII.; was made Baron St. John Nov., 1537; received from Henry VIII. the order of the Garter; was appointed treasurer to Edward VI. 1549; made earl 1550 and marquis of Winchester Oct., 1551; presided at the trial of Somerset Dec., 1551, in the capacity of lord high treasurer, which post he managed to retain under Mary and Elizabeth, and, according to the testimony of Fuller, "trafficked so wisely and prospered so well that he got, spent, and left more than any subject since the Conquest," the secret of his prosperity being given by himself in the words, "No oak, but an osier." He built a magnificent mansion in Hampshire called Basing House, afterward celebrated for its siege by Cromwell; entertained Elizabeth there 1560, and d. there Mar. 10, 1572. He left 103 descendants. A volume entitled *The Lord Marques' Idleness, containing Manifold Matters of Acceptable Devise, as Sage Sentences, Prudent Precepts, Moral Examples, Sweet Similitudes, etc.*, was printed in 1586.

**Winck'elmann** (JOHANN JOACHIM), b. at Stendal, Prussian province of Brandenburg, Dec. 9, 1717, in humble circumstances; struggled hard with poverty and manifold other hinderances to reach into an atmosphere congenial to his mind; studied theology at Halle, medicine at Jena; lived for several years as tutor in a private family, and from 1743 to 1748 as co-rector at the school of Seehausen in Brandenburg, and came finally in 1748 to Dresden as librarian and secretary to Count Heinrich von Bünau. Here, under the influence of the picture-gallery, the intercourse with the painter Oeser, and other favorable circumstances, his enthusiasm for art awakened and his study of classical archæology began. Here he also published his first work, *Gedanken über die Nachahmung der griechischen Werke in Malerei und Bildhauerkunst* (1755). In this latter year he went to Rome, having joined the Roman Catholic Church, and received a pension of $200. In Rome he lived in intimate intercourse with Raphael Mengs, and his connection with the Cardinals Archinto, Passionei, and Albani afforded him unrivalled opportunities and materials for his archæological and artistic studies. Soon, also, the original and striking views which resulted from his researches attracted great attention, and in 1763 he was appointed prefect over the antiquities of Rome, and received also a position in the Vatican Library. He visited Florence, where he published *Description des Pierres gravées du feu Baron de Stosch* (1760); Naples, Herculaneum, and Pompeii, whence he sent to Dresden *Sendschreiben von den herculanischen Entdeckungen* (1762) and *Nachricht von den Neuesten herculanischen Entdeckungen* (1764); and from Rome he contributed many minor essays to various German periodicals, such as *Von der Grazie, Von der Fähigkeit der Empfindung des Schönen*, etc. In 1764 appeared his principal work, *Geschichte der Kunst des Alterthums*, and in 1767 his *Monumenti antichi inediti*. In 1768 he started on a visit to his native country, but hardly had he left Italian soil before he was overtaken by a peculiar uneasiness and restlessness, which at moments grew into a kind of mental disturbance. Arrived at Vienna, he determined to proceed no farther, but on his return to Rome he was murdered at Trieste, June 8, 1768, by a professional thief who attempted to steal some rare gold coins from him. A collected edition of his works was published in 8 vols. (Dresden, 1808–20). His *Life* was written by K. Justi (1866), and there exist various collections of his letters. By his works he founded the science of archæology and exercised a decisive influence on nearly all fields of literature and art. In his time the

Greek tragedy, the Greek temple, the Greek statue, etc., were acknowledged without dispute not only as the highest productions of art, but as the highest models of beauty. They were studied, they were imitated, but they were sorely misunderstood, and the loosest vagaries were often taken for legitimate developments of the classical art-ideal. Winckelmann now undertook to analyze the actual works of Greek art and to point out the qualities which constitute their excellence; and the result was that Greek art once more arose unveiled before the eyes of mankind, while narrow prejudices, vicious instincts, and frivolous caprices fell back ashamed and hid themselves in darkness. Only a few years elapsed, and most beneficent effects became visible in literature and art, in moral and political ideas, in manners and dress, in the principles and in the trifles of life.

CLEMENS PETERSEN.

**Wind.** See WINDS, by PROF. A. GUYOT, PH. D., LL.D.

**Wind'age of a Missile.** Formerly, it was customary for military surgeons to ascribe certain severe and even dangerous contusions without rupture of the surface to the "windage" of shot, the opinion prevailing that if a large missile at a high rate of speed passed near a person, he might be dangerously injured or killed outright by the rush of air. This opinion is now exploded, and it is known that shots striking at a very acute angle will produce the effects formerly ascribed to windage. In gunnery the space between the bore of the gun and the shot is called the windage.

**Win'der** (WILLIAM H.), b. in Somerset co., Md., Feb. 18, 1775; graduated at the University of Pennsylvania, and became a member of the Baltimore bar 1798. In Mar., 1812, he was appointed a lieutenant-colonel of the 14th Infantry, and colonel in July; commanded a successful expedition to the Canada shore from Black Rock Nov. 28, 1812; promoted to be brigadier-general Mar., 1813, he was taken prisoner at Stony Creek June 6. In May, 1814, he was appointed adjutant and inspector-general, and was in command of the 10th district when the British forces under Gen. Ross landed below Washington. He was placed in command of the militia summoned to defend the capital; he was defeated at the battle of Bladensburg, and was unable to prevent the occupation of Washington by the enemy. Returned to his profession in Maryland, in which he became distinguished, as well as the State senate, of which he was a member.—His son, JOHN H., b. in Maryland 1800; graduated at West Point in 1820; was brevetted major and lieutenant-colonel for gallantry in the Mexican war; resigned his commission of major of artillery Apr. 27, 1861, and joined the Confederate army, in which he became a brigadier-general; was the commandant of Libby Prison, Belle Isle, and Andersonville. D. at Branchville, S. C., Feb. 9, 1865.

**Win'dermere,** or **Winandermere,** the largest lake of England, 14 miles long and 1 mile broad, lies in Lancashire, and is celebrated for the rich beauty of its shores.

**Win'desheim,** in Holland, between Deventer and Zwolle, the seat of a monastery founded in 1386 by Florentius Radewini, a disciple of Gerard Groot, for Brethren of the Common Lot. It was the most famous of all their monasteries, and the seat of the general chapter of the order, which played an important part in preparing the way for the Protestant Reformation.

R. D. HITCHCOCK.

**Wind-Flower.** See ANEMONE.

**Wind'galls,** in horses, are the same as synovial ganglia or "weeping sinews" in man. Tight bandaging, irritant ointments, and rest may apparently cure them, but they are liable to reappear.

**Wind'ham,** county of N. E. Connecticut, bordering on Massachusetts and Rhode Island, drained by Natchaug, Quinnebaug, Shetucket, and Willimantic rivers, and traversed by Norwich and Worcester, Hartford Providence and Fishkill, New London Northern, and New York and New England R. Rs.; surface broken; soil generally poor, but fertile along the streams. There are nearly 500 manufacturing establishments, including saw-mills, flour-mills, cotton-mills, woollen-mills, carriages, boots and shoes, clothing, bricks, iron castings, machinery, sewing silk, glassware, paper, and shoddy. Cattle and sheep are the chief live-stock. Staples, manufactured articles, hay, dairy and garden products, potatoes, Indian corn, oats, and wool. Cap. Brooklyn. Area, 620 sq. m. P. 38,518.

**Windham,** county of S. E. Vermont, bordering on Massachusetts, separated from New Hampshire by Connecticut River, and traversed by Vermont Central and Connecticut River R. Rs.; surface hilly, soil generally fertile. There are nearly 300 manufacturing establishments, including saw-mills, woollen-mills, flour-mills, tanneries, machinery, furniture, carriages, hardware, paper, and organs. Cattle and sheep are the chief live-stock. Staples, manufactured articles, hay, maple-sugar, potatoes, Indian corn, oats, wool, and dairy products. Cap. Fayetteville. Area, 780 sq. m. P. 26,036.

**Windham,** p.-v. and tp., Windham co., Conn. P. 5412.

**Windham,** tp., Cumberland co., Me. P. 2428.

**Windham,** p.-v. and tp., Rockingham co., N. H. P. 753.

**Windham,** p.-v. and tp., Greene co., N. Y., 25 miles W. of Catskill, contains good schools, 1 newspaper, 2 hotels, a cabinet-warehouse, and several mills. It is a favorite resort for summer tourists. Principal business, farming and dairying. P. 1485.

COLE & HITCHCOCK, "WINDHAM JOURNAL."

**Windham,** p.-v. and tp., Portage co., O. P. 865.

**Windham,** p.-v. and tp., Bradford co., Pa. P. 1188.

**Windham,** tp., Wyoming co., Pa. P. 660.

**Windham,** p.-v. and tp., Windham co., Vt. P. 544.

**Windham** (Sir CHARLES ASHE), b. in Norfolk, England, in 1810; entered the British army 1826; served in Canada during the "patriot war" 1837–39; became colonel June 20, 1854; was assistant quartermaster-general in the Crimean war; distinguished himself at Inkermann Nov. 5, 1854; led the attack on the Redan Sept. 8, 1855, for which he was promoted to major-general; was made chief of staff of the Eastern army Nov., 1855; was chosen a member of Parliament for East Norfolk Mar., 1857; bore a distinguished part in the Sepoy war, especially by his defence of Cawnpore 1857; was made lieutenant-general 1863, and knighted 1865. D. in London Feb. 7, 1870.

**Windham** (JOSEPH), b. at Twickenham, England, in 1739; educated at Eton and at Christ's College, Cambridge; visited Rome, and made drawings of the principal monuments of antiquity; assisted Stuart in his *Athens;* wrote most of the letter-press for Cameron's *Baths of the Romans,* and for vol. ii. of the *Ionian Antiquities,* published by the Dilettanti Society, and contributed to various antiquarian publications, especially to the *Archæologia,* for which he wrote an important memoir on the temple of Diana at Ephesus. D. at Earsham House, Norfolk, Sept. 21, 1810.

**Windham** (WILLIAM), D. C. L., b. in London, England, May 3, 1750; educated at Eton, at Glasgow University, and at University College, Oxford; travelled on the Continent; became a member of Dr. Johnson's Literary Club and a friend of Burke and Fox, with whom he co-operated in denouncing the American war; entered Parliament for Norwich 1781; distinguished himself as an orator; was principal secretary to Lord Northington, lord lieutenant of Ireland, 1783; was one of the managers of the impeachment of Warren Hastings 1787; was a strenuous opponent of the French revolution and advocate of war with France; was secretary at war in Pitt's cabinet 1794–1801; bitterly opposed the Peace of Amiens 1802; was again secretary at war, and also for the colonies, in the Grenville administration 1806–07; after which, declining a peerage, he remained in opposition and denounced the Copenhagen and Walcheren expeditions. D. in London June 3, 1810. He had a great reputation for oratory, and was conspicuous for brilliant conversational powers, though his love for paradox fastened upon him the nickname of "the Weathercock." His *Diary* from 1784 to 1810 was published by Mrs. Henry Baring in 1866, and a *Life* by Thomas Amyot was prefixed to an edition of his *Speeches in Parliament* (3 vols., 1812). His *Select Speeches* (Philadelphia, 1837) were edited in the U. S. by Robert Walsh, who wrote a biographical sketch.

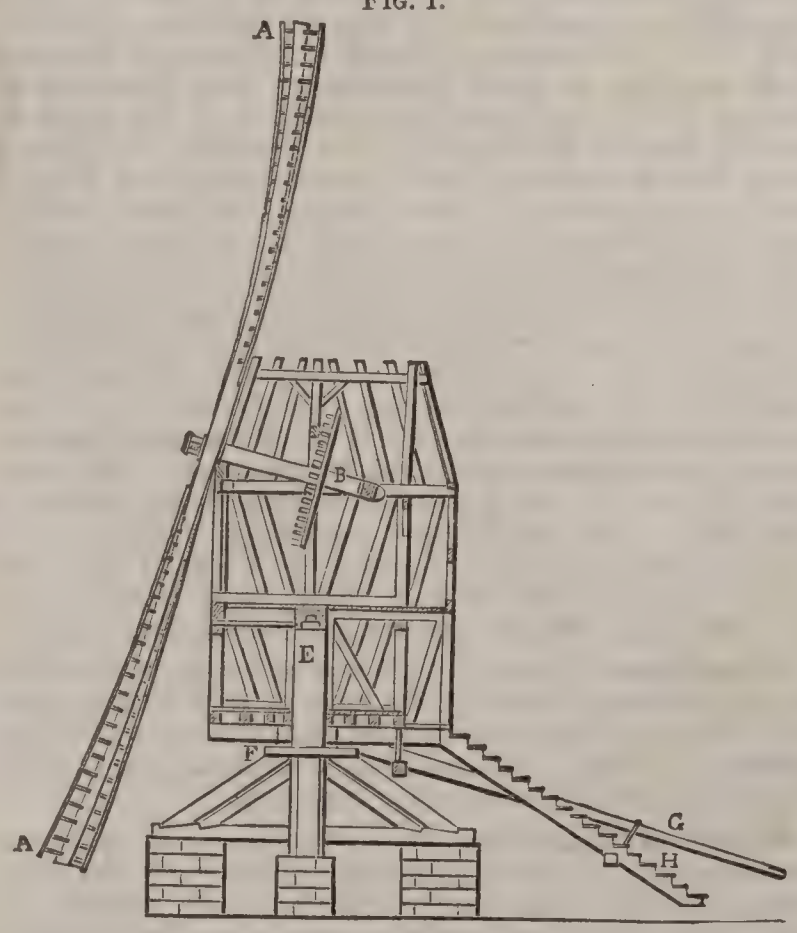
**Wind'lass,** a form of the wheel and axle, in which the axle is horizontal, while in the capstan it is usually vertical. The axle is made to revolve either by means of handspikes or a winch. The mathematical principles involved are precisely those of the wheel and axle.

**Wind'mill,** a mechanical prime-mover, in which the motive-power is derived from the currents of the atmosphere. In its ordinary form the windmill presents the appearance of a turret with a conical or hemispherical dome, from which projects a nearly horizontal shaft, carrying at its extremity four or more radiating arms at right angles to it, which support sails designed to receive the force of the wind. The windmill was probably the earliest form of mechanism used by man for making a force of nature subservient to the uses of industry. The original type was very simple in construction; and, though modern ingenuity has devised a variety of more efficient forms, this type, substantially unaltered, continues still to be most frequently met with in countries where this motor is in general use. The radiating arms of this early type of windmill are four in number, and the sails are formed of canvas. The canvas is stretched and supported by a kind of latticework constructed as follows: the arms, called the whips,

which are 30 or 40 feet long and 8 or 10 inches in diameter, are perforated through their axes at intervals of about 15 inches throughout their length, beginning at about 6 feet from the centre of motion, the perforations being at right angles to the axes, but inclined to the plane of rotation, the inclination being from 18° to 30° nearest the centre, and diminishing down to between 6° and 12°, or less, at the outer extremities. Through these perforations are passed stiff rods, which extend some 3 feet on each side the whip, but which are often made of gradually-increasing lengths from the centre outward. The ends of these rods on each side are connected and secured by longitudinal pieces, which make of the whole a sort of frame or lattice on which the canvas of the sail is to be extended. The sail is therefore not plane, but is what is called in mathematics a warped surface. This form is that which, supposing the sail to offer no resistance to rotation, whether of inertia or friction, would be necessary in order that it might nowhere obstruct the progress of the wind; and this form is therefore best for utilizing the force of the wind. In some windmills the lattice-work is wholly on one side of the whip. The central shaft, or axis, carrying sails of this magnitude, requires to be thick. In French and Dutch windmills it is 20 or more inches in diameter. It is inclined about 10° to the horizontal, experience having shown this to be a position more favorable than the truly horizontal. The plane of rotation of the sails is therefore equally inclined to the vertical. The shaft turns in a socket in the side of the dome, and is pivoted at its extremity in a strong bearing connected in the interior with the frame. If, as is usually the case, the mill is to be used for grinding or for driving any rotatory machinery, a face-geared or bevel-geared wheel upon the shaft connects with a pinion on a vertical spindle, to which it thus transmits the motion; but if it is to be employed for pumping, an eccentric or crank takes the place of the geared wheel; and in this case it is preferable that the shaft be truly horizontal.

As the direction of the wind is variable, and as the efficiency of the machine depends on the presentation of the plane of rotation of the sails at right angles to it, the dome or the entire turret must be capable of being turned about a central pivot. In general, the dome only turns, and is provided with rollers or wheels which run on circular ways; but in the ruder constructions it turns by sliding, and requires considerable force to move it. Fig. 1 shows one of the forms not infrequent in France, in which the whole

FIG. 1.




structure is pivoted on a stout mast or upright, about which it is turned by means of the lever G. The face-gear wheel is here shown, but not the grinding machinery. The lever G affords a partial support to the flight of steps H, which must not touch the ground, as it revolves with the mill. With heavy constructions of this kind it is necessary to employ a portable windlass or capstan to turn the mill. To assist in the operation, a set of posts are fixed in the ground in a circle around the mill, to which the windlass may be attached, while a rope extended from it is fastened to the lever G. It is more usual, however, to make only the dome rotary; and then this may be turned by means similar to those employed in giving rotation to the domes of astronomical observatories. A large wind-vane on the side of the tower opposite the sails is sometimes employed to make the mill adjust itself automatically; but this is not effectual except with light structures. Another contrivance of a good deal of ingenuity, designed for the same purpose by Sir William Cubitt, consists in a pair of small lateral windmills or flyers on a common axis placed at the extremity of a framework projecting out behind the dome, with their planes of rotation perpendicular to that of the sails. These, when the mill is in true adjustment, present their edges to the wind and remain at rest; but if the wind changes it strikes them on one side or the other, and sets them into rotation; and as their axis is connected by gearing with a mechanism for revolving the dome, this movement presently brings about again a true adjustment. A different and simpler mode still of effecting this adjustment was devised in 1830 by Mr. Amédée Durand of France, which consists in making the structure which sustains the horizontal shaft a completely open frame, through which the wind may freely blow, and causing the wind to take the sails from the rear, and not from the front, by which means it becomes necessarily self-adjusting. This plan serves very well in windmills used for pumping, but with grinding mills it necessitates the raising of the motor entirely above the building containing the machinery—a construction endangering its security in case of storms. In order to stop the mill, a friction-brake is used which embraces the gear-wheel on the shaft.

The extent of surface which the sails can advantageously spread to the wind does not exceed, according to Smeaton, seven-eighths of the area of the circle described by the sails in their revolution. The same authority says that the velocity of revolution, when the sails are revolving disconnected from the machinery, is to that with which they move when doing the maximum of work, in the ratio of 3 to 2; and that the useful effect varies with the square of the wind's velocity, and in sails of similar form is proportional to the cube of the length of the whip. Windmills for grinding will not work if the velocity of the wind is below 4 mètres, or about 13 feet, per second, and will not work advantageously if it is above 8 mètres, or 27 feet. Experience has consequently shown that such mills do not perform during the year more than about one-third as much useful work as they would if continually operating with the wind at mean velocity. At this velocity a mill with 12-mètre or 40-foot sails exerts an effective energy of 65,000 foot-pounds per minute, which is about equivalent to 2 horse-power.

In order to make the mill available under larger variations of wind, contrivances have been devised for varying the inclination of the sails in accordance with such changes. In a mill of six sails, introduced into France by M. Mahoudou of St. Épain, the sails, which are on one side only of the whip, are held in position by an elastic arm at the extremity of the whip, stiff enough to resist the ordinary pressure of the wind, but yielding under a greater, so as to reduce the amount of surface exposed. Another contrivance, employed by M. Formis of Montpellier in a mill of eight sails, is to hinge the sail to the whip, and from the extreme free angle of each sail to carry a cord to the top of the next following whip, whence, after passing over a pulley, it is continued down the whip to the shaft or axis of rotation, and through that shaft (which is hollow) lengthwise to the opposite extremity, where the whole system of cords is united, and, by means of a suitable joint and lever, is connected with a weight, which acts as a governor. The windmill of Thirion of Belgium, in which the sails are from twelve to twenty in number, and comparatively narrow, has a kind of circular framework to sustain them, the outer circumference being at half-sail length from the centre. At this point, and also at the inner extremity, each sail is hinged, while each is also attached at middle by its opposite edge to a second circumference or rigid ring, which is movable, and in its movement changes the inclination of all the sails. It may be set in the beginning at any inclination, which afterward cannot be diminished during the action of the machine; but in case the wind becomes violent, the inclination will be increased by the effect of a centrifugal-force governor acting on the movable circle.

For pumping windmills, an ingenious contrivance has been devised by M. Amédée Durand, which makes the machine available not only at high velocities of the wind, but also at those low velocities where grinding mills will not operate. This is to make the course of the pump-piston, or the length of stroke, variable with the variations of the force of the wind. In order to accomplish this, the pump-piston is worked through a lever, one end of which, being moved by an eccentric on the main shaft, has a constant range, while, by making the fulcrum movable, the course of the other end, and therefore of the piston, is made variable. A centrifugal-force governor is employed to change the position of the fulcrum as the velocity of rotation varies. The work done being thus proportioned to the force of the

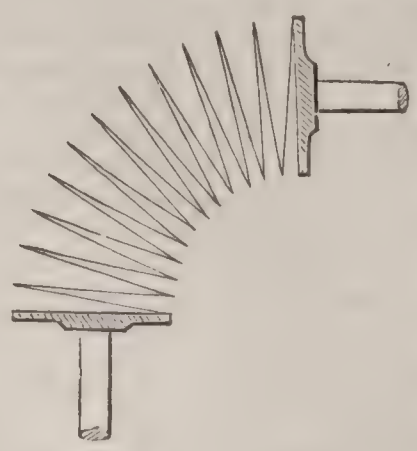
wind, the mill will operate under all atmospheric conditions when it is safe to spread the sails at all.

Thirion's windmill, above mentioned, has a noticeable peculiarity in the manner of transmitting rotatory motion between shafts whose axes are not parallel. A flat spiral

FIG. 2.



FIG. 3.



of steel is attached by its extremities to the ends of the two shafts, as shown in Figs. 2 and 3. The diameter of the spiral, in order to secure strength, is made considerably larger than that of the shaft, and the attachment to the shaft is made by means of a cast-iron cap, having on one side a socket for the shaft, and on the other a flat surface to receive the spiral. The diameter and breadth of the spiral will vary with the power of the mill or the maximum spread of sail, but the thickness cannot be indefinitely increased, since the cross-strain upon the metal would be too great. The thickness commonly used is about a quarter of an inch; the diameter, for mills of moderate power, one foot; and the breadth about an inch and a half. These joints operate very well, and are very durable.

The disadvantage attendant on a change of direction of the axis of rotation, by whatever means the transmission of movement is effected, has led to the use, in some cases, of horizontal windmills, in which the sails are placed at the extremities of arms radiating horizontally from a vertical shaft. By employing a cylindrical frame so as to secure the sails at both extremities, any vertical dimensions may be given them that may be desired; but if the sails are plane and immovable, and coincide in direction with the radii, the machine will not rotate unless one-half of it is screened from the wind. If the sails are hemispherical cups or cones, with the concavities set in a common direction along the circumference, the effective pressure of the wind will be more than twice as great on the concave as on the convex sides, and rotation will take place. But this form of sail is not of simple construction, and is not used for windmills, though we see it in anemometers. There were formerly in New York City two or three horizontal windmills, in which the sails were plane panels of wood hinged to a light cylindrical frame by a vertical edge, and free to swing through an arc of 180°. In passing the point of the revolution opposite the direction of the wind, the sail swung outward, and presented its edge to the wind during the succeeding half revolution; in consequence of which it was made gradually to swing inward, so that in passing the point toward the wind it was pressed against the radii of the frame and held in proper position to be effective. A more recent form of horizontal windmill with plane sails was patented in 1861 by Mr. A. Giraudat of New York, in which the sails, after being effective for a half revolution, are brought to a horizontal position during the other half. These sails are hinged by a horizontal edge. Sir David Brewster computes that, for equal numbers of sails, the power of a horizontal windmill is only about one-third or one-fourth that of a vertical mill.

The best form of horizontal windmill, however, is one in which the sails are numerous and fixed at a certain inclina-

FIG. 4.

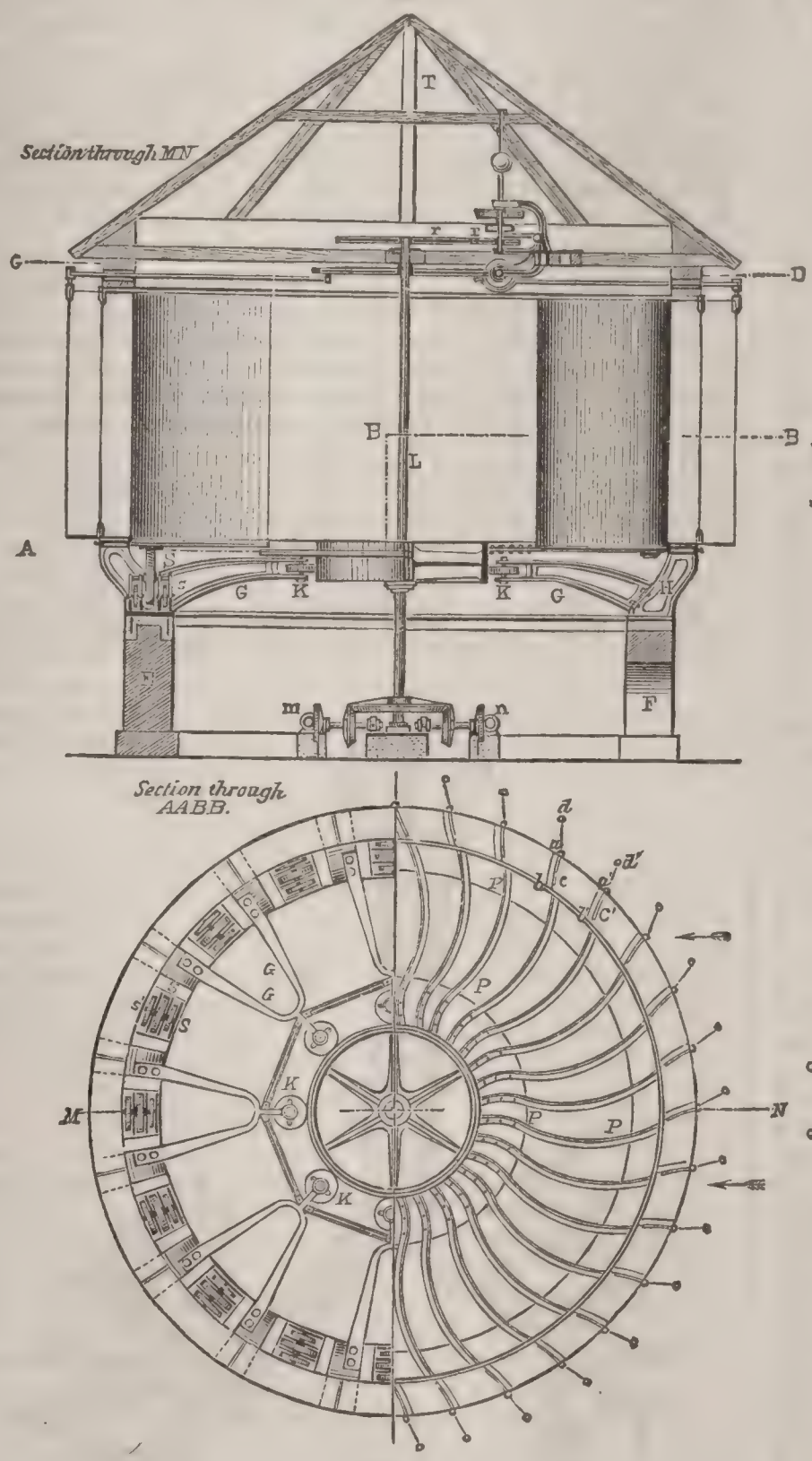
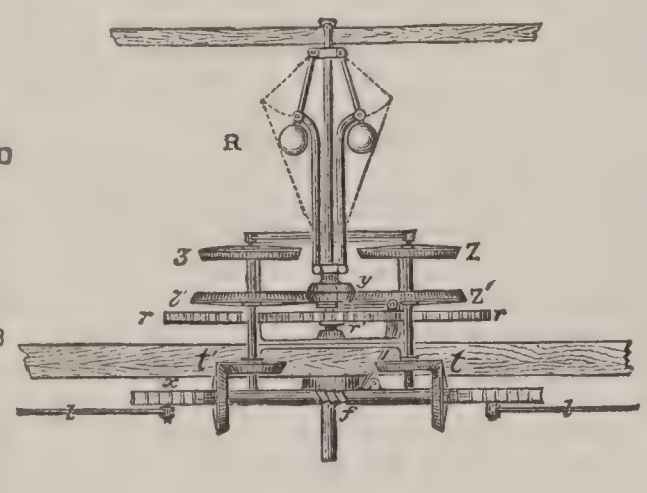



FIG. 5.

FIG. 6.



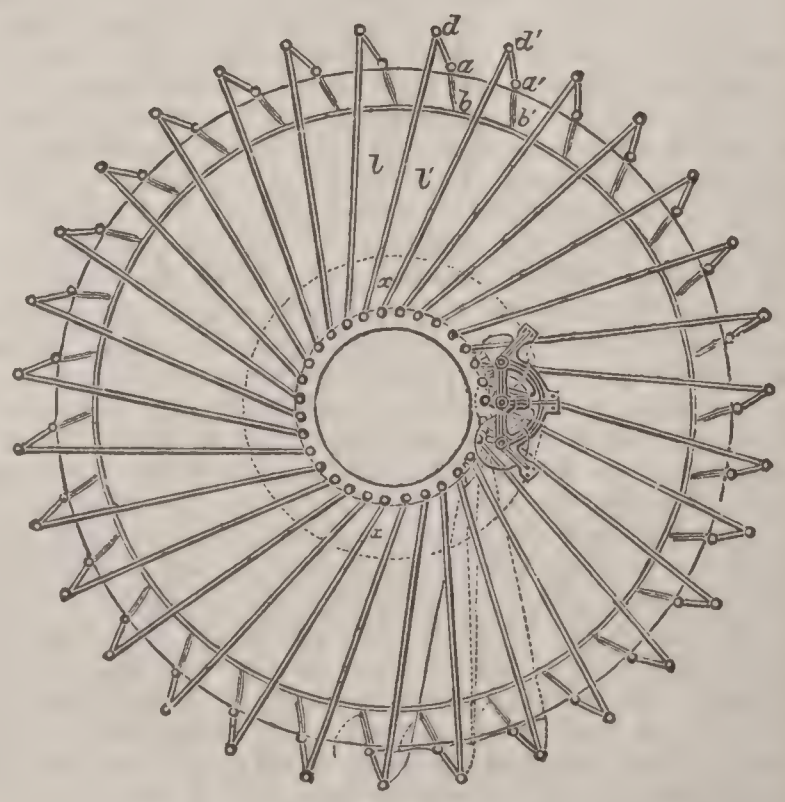




FIG. 7.

tion to the radii, the whole rotating frame being then enclosed within a similar fixed structure, which the wind enters through openings between boards set at an obliquity contrary to that of the sails or floats. With this construction the mill is effective from whatever direction the wind may blow. The best form of windmill of this construction is that of Moerath of Vienna, Austria, which, from the peculiar form of its sails, may be called an aërial turbine. This is shown in Figs. 4, 5, 6, and 7, Fig. 4 being an elevation representing the interior of a circular structure designed to enclose the frame or wheel carrying the sails. The rotation takes place about the central axis L. The form of the sails is exhibited in Fig. 5, which also shows, in plan, a series of fixed directrices, *ab*, *a'b'*, by which the currents of the air, coming in the direction indicated by the arrows, are deflected upon the sails. These sails are of canvas, for the sake of lightness, but their form is determined by the iron arms or frames to which they are attached. These frames are secured at top and bottom to two circular plates which are fixed to the axis. Beneath the whole there is also attached to the axis a pulley which, by means of guide-rollers, represented at K (Figs. 4 and 5), maintains it in position. The weight is sustained and the level more truly preserved by means of the rollers S, Fig. 4, themselves resting by their axes upon the smaller friction-rollers *s s'*. The guiding wheels K are sustained by brackets from the frame, shown at G in both figures. The power is applied through conical gearing, as shown at *m* or *n*, or in any other way.

The structure on which the motor rests may be of wood, brick, or stone; but the chamber in which the wheel is placed is designed to be constructed of iron, except the roof. Its base H (Fig. 4) forms a cast-iron crown, to which are bolted the brackets G, and from which rise vertically, at regular intervals, a series of rolled iron plates, which form the directrices for the wind, and also the support for the superstructure. It will be seen, by comparing the positions of the directrices in the plan with the directions of the arrows, that on the side on which the wind and wheel move in harmony, the wind can enter until its direction becomes tangential to the structure; while on the other side it is cut off from entering at all by the overlapping of the borders of the directrices, up to the point where it becomes capable of such a deflection as to favor rotation. A very ingenious provision is made for guarding against excessive velocity of movement in the case of high winds. To every one of the directrices there is attached, on the outside, a shutter wide enough to close entirely one of the openings, but pivoted by the middle points of its extremities, so that instead of closing one opening entirely, it closes the adjacent halves of the two between which it is placed. Thus, when all the shutters are closed, they meet each other halfway, like the blinds of windows. In the plan, Fig. 5, these shutters are seen at *cd*, *c'd'*. In calm or in light winds they stand in the positions in which the figure represents them. But when the velocity of movement begins to rise above what is designed to be the limit, they are closed to a greater or less extent by the effect of a self-acting apparatus represented in Fig. 4, and on an enlarged scale in Fig. 6, and through a system of connecting-rods shown in Fig. 7. The main axis of rotation L carries a gear-wheel *r*, which acts on the governor, Fig. 6, through the smaller wheel *r'*, secured to the vertical axis of the governor. By the divergence of the arms of the governor the doubly-conical friction-wheel *y* is raised, and is brought at length to the point where its upper conical surface is in contact with the conical wheels Z and *z*. The wheel Z is fixed to its shaft and operates the conical gear-wheels *t*. The wheel *z* is idle, its use being merely to equilibrate the pressure. The vertical conical wheel *t* turns the tangent screw *f*, which rests on the perimeter of a large wheel, seen dotted in the plan of this part of the machine, Fig. 7. To this wheel *x* are attached a number of rods *l*, equal to the number of shutters; and these rods, by their opposite extremities, are fastened by hinge-joints to the outer extremities of the shutters, severally. An examination of the plan will show that if the wheel *x* be turned from right to left, the shutters will be drawn inward, and if the movement be sufficiently continued, they will be closed entirely. The action of the wheel Z upon the wheel *x* through the tangent screw turns it from right to left, and thus by the automatic action of the machine itself the shutters are partially closed and the impelling force diminished. The velocity diminishing, the friction-wheel *y* will descend, and Z will cease to act. If, in consequence of the reduction of the driving force, the retardation is in excess, the friction-wheel *y* will descend until it comes into contact with Z' and *z'*, of which the first is now idle, and the second turns the bevel-wheel *t'*, reversing the motion of the gear-wheel *x*, and to a greater or less extent reopening the air-passages. There may thus take place a succession of oscillations of the bevel-wheel *y*, diminishing in extent if the breeze remains steady, until a permanent adjustment is attained. But if the wind varies, whether by an increase or a diminution of its mean velocity, the bevel-wheel *y* will act anew and effect a new adjustment corresponding to the changed velocity. It is not to be understood that the wheel *x* will be acted upon in response to every momentary lull or gust, since the bevel-wheel *y* has a sufficient freedom of movement between Z and Z' to accommodate itself to these, so long as the average strength of the wind remains unchanged. But if there is a permanent increase or diminution of the wind-force, the necessary correction will be made with infallible certainty.

The governor can be thrown out of gear with the machine; and if it is desired to leave the mill at rest, the wheel *x*, after detaching the governor, may be turned by hand so as to close the shutters entirely. It is an important recommendation in favor of this form of windmill that it is not liable to damage by the most violent storms.

There are large portions of our country in which windmills are almost unknown. There are other portions, as in California, where they are extensively used, and where objects of this class frequently strike the attention of the traveller. They would be undoubtedly much more generally introduced if, in their ordinary forms, they were less rude and more efficient. They adapt themselves admirably to the circumstances of sparse settlements, in prairie districts and low alluvial regions, where streams are few and sluggish, where fuel is costly, and where the population, chiefly engaged in the cultivation of the soil and living in comparative isolation from each other, find the conversion of their grains into flour and meal for domestic uses a serious tax upon both their time and their means. To such, a mill like that just described would be very useful for the elevation of water, for drainage, for grinding, and for many of the other exigencies of rural life. F. A. P. Barnard.

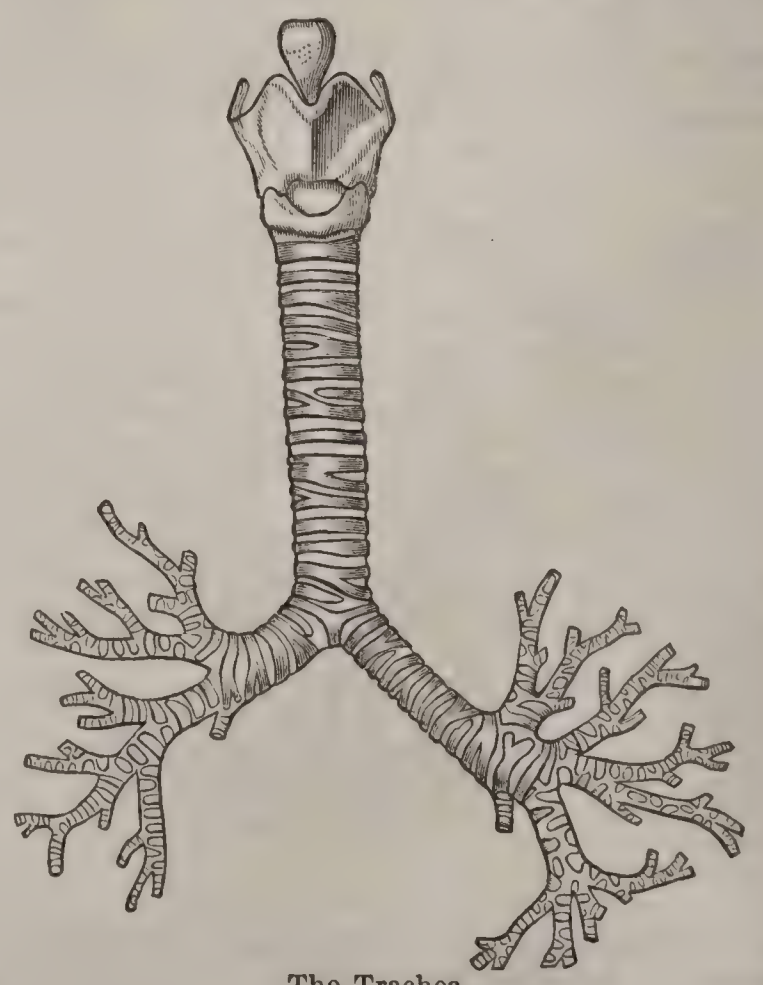
**Win'dom,** p.-v., Cottonwood co., Minn., on Sioux City and St. Paul R. R., 150 miles from St. Paul, has 3 churches, a handsome park, 1 newspaper, fine water-power, large graded-school building, and 1 butter-packing establishment. It is the centre of a large dairying and farming community. P. 500. E. C. Huntington, Ed. "Reporter."

**Windom,** tp., Mower co., Minn. P. 404.

**Windom** (William), b. in Belmont co., O., May 10, 1827; studied law, and entered upon the practice of his profession in Ohio; removed to Minnesota in 1855; member of Congress 1858–68; appointed U. S. Senator July, 1870, to fill a vacancy, and elected Senator for the full term 1871–77; re-elected in 1876 for term expiring in 1883.

**Win'dow-pane,** a name given on certain parts of the North American coast to the *Lophopsetta maculata*, which is most nearly related, among American fishes, to the turbot of Europe. This is so called on account of its thin, transparent body. Theodore Gill.

**Wind'pipe,** or **Air-Passage,** the popular name of the *trachea*, so called from its roughness [Gr. τραχύς, "rough"], a cylindrical tube of cartilage and membrane, 4½ inches long and from ¾ to 1 inch in diameter, extending



The Trachea.

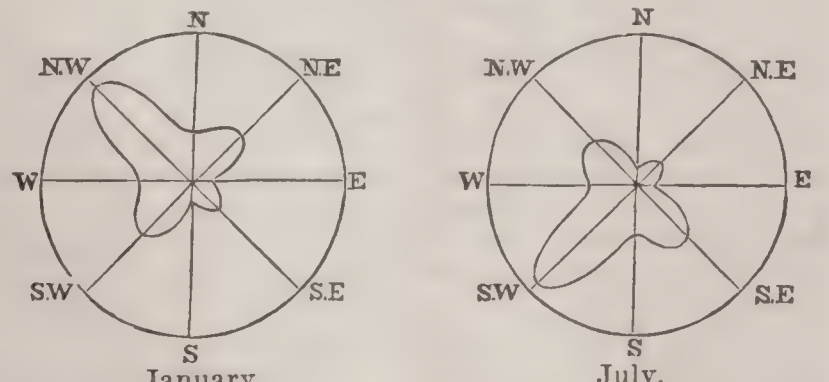
from the larynx (see LARYNX) downward to the origin of the two primary bronchial tubes. These branch off from the trachea opposite to the third dorsal vertebra, one going to each lung. The ancients termed the trachea *aspera arteria*, the great artery or channel by which the vital air was inspired; air was supposed to fill the arteries and veins, the nutritive agency of the blood being unknown and its circulation undiscovered. The trachea is an open tube, its collapse being prevented by its cartilaginous circular bodies or rings. These are incomplete, the posterior wall of the trachea being membranous, flaccid, and flat. This soft surface rests against the œsophagus, the food-passage, and facilitates the ingestion of food. The trachea is often the seat of catarrh and acute inflammation, during the progress of colds, influenza, and the incipient stages of bronchitis, from the mucous membrane of the nose and throat to the lungs. The trachea is occasionally the seat of croupous membrane (see CROUP and TRACHEOTOMY), of foreign bodies, polypus, cancer.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Winds,** or **Vinds.** See SLOVENTZI.

**Winds.** *Wind* is air in motion. The word is usually applied to currents of air more or less horizontal, though vertical or slanting currents of air, whether ascending or descending, equally deserve the name. Winds are named from the quarter of the horizon from which they come. Thus a wind blowing from E. to W. is an E. wind; one moving from N. to S. is a N. wind. The direction of the surface-winds can easily be taken from a wind-vane so located as to be free from all surrounding obstacles. For the direction of the winds in the upper part of the atmosphere, which is often very different from that of the surface-winds, we have to look to the course of the clouds. The winds from the four cardinal points, north, east, south, and west, and those from the intermediate directions, designated as north-east, south-east, south-west, and north-west, are the eight principal winds usually noted in meteorological journals, and are indicated simply by their initials. Further intermediate directions give eight more winds—viz. north-north-west and north-north-east on either side of north; south-south-west and south-south-east on either side of south; west-north-west and west-south-west on either side of west; and east-north-east and east-south-east on either side of east. For the use of mariners the divisions are carried to thirty-two winds. (See COMPASS.) When greater accuracy is needed, however, it is more convenient to use the division of the circle of the azimuth compass, and, starting from one of the cardinal points, note how many degrees from it, on either side, the radius passes which indicates the direction of the wind; as, for instance, north 25° east, south 15° east, and so on. A diagram constructed like the mariner's compass, bearing the name of the winds, is called the wind-rose. By giving to the radius representing each wind a length proportional to the length of time and the velocity with which it has blown at a given place during a stated period, such as a year or a month, a wind-rose may be traced which will present at a glance the peculiar condition of this important element of climate at that place. In the two following diagrams, for instance, which represent in this way the average duration of winds in January and July in Maryland, the eye seizes at once

FIG. 1.




January. July.

the great prevalence of the north-westerly winds in winter and of the south-westerly in summer which is characteristic of the climate of the Atlantic coast. Prof. Dove of Berlin has used a similar method for showing graphically the average condition of the barometric pressure, thermometer, and hygrometer which accompanies the different winds, and calls such diagrams the barometric, thermic, and atmic (hygrometric) wind-roses of the places considered.

The velocity and force of winds vary from an almost inappreciable breath of air to the furious hurricane which sweeps everything before it. It is measured by means of the anemometer ("wind-measure"), an instrument of which various kinds have been invented. (See ANEMOMETER.) Some give the pressure exerted by the wind upon a spring, like those of Osler and Jelineck, or on a liquid contained in a glass tube having the shape of a siphon, like that of Lind; others derive the velocity from the number of revolutions of a self-registering rod set in motion either by a vertical wheel composed of oblique plates, like that of a windmill, as in the anemometers of Wolfe and Whewell, or by four hemispherical cups placed horizontally, catching the wind, as in that of Robinson. The last form has been adopted by the Smithsonian Institution and the U. S. Signal Service. In all these instruments the velocity has to be computed by formulas based on previous experiments. It is on such trials that the various scales proposed to express the force and velocity of winds are founded. The scale adopted by the Smithsonian Institution, which is almost identical with that used by the U. S. Signal Service, distinguishes 10 grades, the names of which, with the corresponding pressures and velocities, are as follows:

| Grade. | Velocity in English miles and per hour. | Pressure in pounds avoirdupois on each square foot. | Name. |
|---|---|---|---|
| 0 | 0 | 0.00 | Calm. |
| 1 | 2 | 0.02 | Very light breeze. |
| 2 | 4 | 0.08 | Gentle breeze. |
| 3 | 12 | 0.75 | Fresh wind. |
| 4 | 25 | 3.00 | Strong wind. |
| 5 | 35 | 6 | High wind. |
| 6 | 45 | 10 | Gale. |
| 7 | 60 | 18 | Strong gale. |
| 8 | 75 | ..... | Violent gale. |
| 9 | 90 | ..... | Hurricane. |
| 10 | 100 | ..... | Most violent hurricane. |

Winds may be grouped in three classes—namely, *constant, periodical,* and *variable winds;* the first two are mainly tropical, the other characterizes the temperate and cold latitudes. To understand the cause of these differences and the general circulation of the winds we must inquire into their cause.

Winds are the consequence of a disturbance of equilibrium in the layers of the atmosphere, and the tendency of their motion is to restore the equilibrium which has been destroyed; as soon as that is accomplished the movement ceases and everything settles into a calm. One of the chief conditions of this equilibrium of the atmosphere is, that any level layer should have the same density at all points; otherwise the denser portions flow under the less dense, while the lighter rise to the top. Now this occurs when the different parts of the layer are unequally heated. At the point of greater warmth the air expands, becomes lighter; then, pressed by the neighboring layers, which have remained colder and heavier, it rises into the higher layers, until it reaches a stratum of equal density with itself. The result of this process is an ascending current, and lateral currents rushing from all sides toward the spot where the temperature is higher. This is well exemplified in a heated stove. The warm and light air ascending in the pipe is replaced by a steady horizontal current of cold air rushing in from the surrounding atmosphere.

Differences in the moisture of the air will have a similar effect, for moist air is lighter than dry air of the same temperature, and will cause an ascending current, or increase the ascending power of one already in progress. Moreover, when the moisture is condensed into rain, its latent heat, becoming free, adds to the buoyancy of the air.

*Land and Sea Breezes.*—As an example from nature, let us see what takes place on an island alone in the midst of the ocean, remembering that the land is heated more readily than the sea. In proportion as the sun rises above the horizon, the island becomes warmer than the neighboring sea. Their respective atmospheres participate in these unequal temperatures; the fresh air of the sea rushes from all directions in the form of a *sea breeze,* which makes itself felt along the whole coast, and the warmer and lighter air of the island will ascend into the atmosphere. During the night it is the reverse. The island loses heat by radiation, and cools quicker than the sea. Its atmosphere, having become heavier, flows into that of the sea in the form of a *land breeze;* and this interchange lasts until the temperature, and consequently the density, of the two atmospheres have again become the same. This is the phenomenon observed almost daily on nearly all the seaboards.

The same again takes place on a great scale between an entire continent and the ocean, between the tropical regions and the temperate and polar regions. Southern Africa is fiercely heated by the rays of a summer sun, while the seas of India and Asia experience the low temperature of the winter. The temperature of the tropics is almost always the same, and constantly higher than that of the rest of the globe. To each of these differences of temperature, unequal in duration and amount, particular atmospheric currents, which are their consequence, correspond—to the difference of temperature between day and night, the diurnal breezes, whether along the coasts or in the interior of the continent at the foot of the mountains; to the difference of temperature between the extreme seasons, the monsoons,

which one might call the season breezes; to the difference of temperature between the tropics and the poles, the trade-winds, which are the great annual breeze, and the constancy of which is only the expression of the permanent inequality of the distribution of solar heat between the great atmospherical regions of our globe.

The general (or trade) winds are the consequence of the general form of the globe, and their direction is given by its rotatory motion. The monsoons and the breezes depend on the form and the relative situation of the lands and the seas, which govern their intensity and direction. The variable winds are due to the same causes, and to the conflict between the general opposite currents.

*General Circulation of the Winds.*—The regions near the equator having a higher temperature, and the heat gradually diminishing as we advance toward the poles, the atmosphere of the tropical zone is more dilated and constantly lighter than that of the temperate and polar regions. As a consequence, the denser air of the colder regions presses that of the hot on two sides, the N. and the S.; the warmer portion of the tropical atmosphere, the equatorial, rises, and two lower currents are established from the poles to the equator, and two upper currents, which carry back the air from the equator toward the poles, to commence again the same rotation.

We ought, then, to find in the northern hemisphere a general wind coming from the N., and in the southern hemisphere a wind coming from the S. But the rotation of the earth from W. to E. exercises an influence upon the direction of these currents, which causes them to deviate from their original direction. The speed of rotation, which is almost nothing in the neighborhood of the poles, gradually increases with every parallel to the equator, where it is over 1000 miles an hour. The masses of air which rush toward the equator have an acquired speed less than that of the regions toward which they go. At each step they are obliged to assume a greater rapidity of rotation; but as, in virtue of the law of inertia, a certain time is necessary for this to take place, they find themselves at every step a little behindhand, or a little farther toward the W. than would otherwise be the case. These successive retardations accumulating, gradually deflect the polar currents toward the W., changing them into a N. E. wind in the northern hemisphere, and a S. E. wind in the southern hemisphere. These two polar currents, entering the tropical zone, become those permanent winds blowing nearly from the E. which are called *trade-winds*. Approaching the equatorial zone, these masses of air, strongly heated by the rays of a vertical sun, ascend, forming there a broad *zone of calms*, and return, as upper currents, toward the poles to supply the constant outflow from the polar regions.

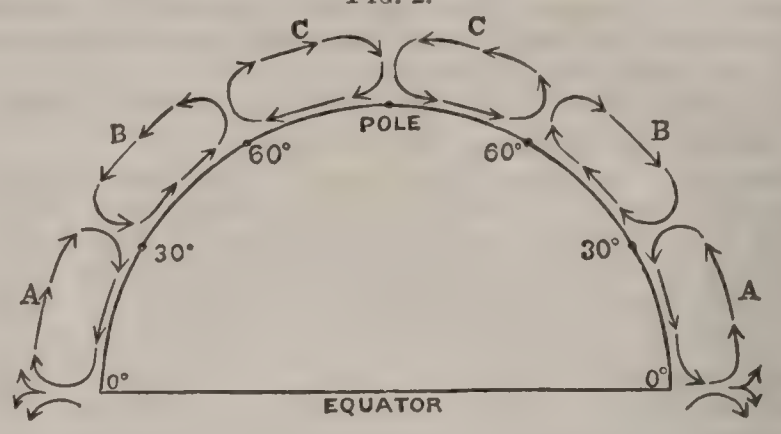
The same cause makes the upper currents, which set from the equator toward the poles, swerve, but in the opposite way. They arrive successively in the higher latitudes, with a velocity of rotation greater than that of the parallel which they enter, and are always a little in advance of the earth's motion in each place—that is, always more and more to the E. Thus, the returning equatorial currents, when descending to the surface of the earth, become the S. W. winds, so prevailing in the northern hemisphere, and the N. W. winds in the southern hemisphere.

The diagram of the normal circulation of the winds at the bottom of Map VII. shows the great wind-zones. The arrows point in the direction toward which the wind blows. We see—1st, the equatorial zone of calms, or the region of the ascending atmosphere; 2d, on both sides the zones of constant winds, or of the N. E. and S. E. trade-winds; 3d, two small zones of calms about the tropics of Cancer and Capricorn, which separate the zones of the constant from those of the variable winds; 4th, the broad zones of the variable winds in the middle latitudes, from the 30th degree to the 60th degree, with prevailing westerly winds; 5th, the zones of polar winds, with prevailing north-easterly winds. (See accompanying map.)

This circulation, arising from constant differences of density and pressure in different parts of the atmosphere, has its counterpart in permanent differences in the average height of the barometer at the level of the sea in various latitudes. In the equatorial regions the overflowing of the air from the ascending current toward the poles causes a diminution of its mass, and consequently a low barometer; while its descent about lat. 30° and the encounter of the extra-tropical air produce in that latitude an accumulation and a belt of high barometer. The constant flow of the cold air from the polar regions is manifested by a greater barometric depression within the Arctic circle. Accordingly, in the equatorial belt the mean pressure is only 29.9 inches; it rises to 30.1 and over about lat. 30°; decreases gradually to lat. 60° and 65°, where it hardly reaches 29.9; and is lowest in the polar regions, where it falls to 29.6. Whether there is a continuous belt of low barometer about lat. 60° to 65°, beyond which the barometer rises again toward the poles, as has been assumed from the record of a few cases, still remains a matter of doubt, the observations being too few, especially on the continents, to decide this question.

Our most distinguished physicist, Prof. J. Henry, accounts for the phenomena which characterize the three main zones of winds in a somewhat different manner. He assumes three distinct systems of circulation, each complete in itself, as shown in the following diagram: A, the tropical, with upper winds flowing toward the poles, descending at lat. 30°, and reappearing as surface-winds in the easterly trades; B, that of the temperate latitudes, from 30° to 60°, with prevailing south-westerly surface-winds,

FIG. 2.




fed by a portion of the returning equatorial air, rising again about lat. 60°, and returning thence as upper currents to the regions whence they came; C, the polar, with north-easterly surface-winds, rising at the contact with the preceding system, at about lat. 60°, and returning thence toward the pole. The belts of low barometer, at the equator and lat. 60°, indicate the regions of the ascending currents; that of the high barometer, in lat. 30°, marks the place of the descending ones. This view is in accordance with the theoretical deductions of Ferrel concerning the course of atmospheric currents moving on a sphere, and explains many important phenomena. More numerous and extensive observations, especially on the upper currents of the atmosphere, and the measure of influence which can be attributed to moisture in these movements, may clear up the difficulties which are still in the way of a complete adoption of this very plausible theory.

The general circulation of the atmosphere would doubtless show great regularity if the surface of the globe were a uniform sheet of water; but the presence of the continents and their arrangement modify the normal winds in many ways, as we shall see in examining more closely the systems of winds peculiar to each of the great climatic zones. In all cases, however, the law of the winds, as expressed by Buys-Ballot, holds good—viz. the wind blows from a region of high pressure toward one of low pressure, and, owing to the rotation of the earth, is deflected to the right in the northern hemisphere, and to the left in the southern.

*Winds of the Tropical Regions.*—The accompanying map shows that the all-prevailing currents of air between the tropics are the trade-winds, which blow the whole year round in the same direction, and occupy the greater part of the zone. These are the gentle and constant winds which wafted Columbus across the Atlantic to discover a New World, and carried Magellan, the first navigator whose ship made a voyage round the world, across the vast ocean which he named from them the Pacific. Wherever they blow the sky is cloudless and serene, the temperature even and moderate, and the atmosphere without tempests. The trade-winds occupy from 20 to 22 degrees of latitude on each side of the equator, forming two belts—the N. E. and the S. E. trade-wind. They blow with entire regularity only on the open sea, their course and character elsewhere being modified by continental relief and other local influences. The continents partially interrupt the general atmospheric currents, and being more heated than the adjacent oceans, they modify, or even overcome, the trades in their vicinity. Owing to this disturbing influence, the trades, both in the Atlantic and Pacific, begin to blow regularly only at a considerable distance W. of the continents. Thence they sweep without interruption over the ocean-basins at a nearly uniform rate of from 15 to 18 miles per day. In the northern half of the Indian Ocean the trades are suspended entirely during the northern summer, but resume their sway in winter.

*Zone of Equatorial Calms.*—The width of this zone of calms, which separates the two great bodies of the N. E. and S. E. trade-winds, is not uniform, but varies on an average from 4° to 6° in latitude. It is wider in the eastern part of the three oceans, probably because the force of

the trade-winds is broken by the neighboring continents. It is wider again during the northern summer, especially in the Atlantic, owing to the higher temperature of the extensive continental surfaces, which draws the polar limit of the trades up to the 30th parallel. To this predominance of land over water in the northern hemisphere the fact has to be referred that in the Atlantic, as well as in the Pacific, this central zone is not on the equator, but somewhat N. of it, so that a ship sailing in the northern hemisphere encounters the S. E. trade before crossing the equator. The mean position of this zone is, in the Atlantic, between 3° and 9° N. lat.; in the Pacific, between 4° and 8° N. In the continents it is usually found between 3° S. and 4° N. lat.

It would be an error to suppose that the air in the region of calms is without motion; the horizontal trade-wind is only changed into an upward current, which appears, at the surface, like a calm. The mixture of this warm current with the colder air of the upper atmosphere causes frequent descending variable winds, and often sudden squalls, and those tremendous tornadoes (or doldrums, as they are called on the W. coast of Guinea) which are the terror of the navigator. The zone of calms, unlike the serene region of the trade-winds, has an almost daily accumulation of clouds, which soon after mid-day burst in torrents of rain, accompanied by terrific thunder and lightning. The cause of these phenomena is easily understood. The mass of warm air, charged with moisture, ascends into regions of less pressure, expands, and cools both by expanding and coming into contact with colder layers. The temperature of the dew-point is soon reached, and the moisture is condensed into clouds and rains. The upward current being strongest in the warmest part of the day, the storm takes place soon after mid-day.

The calms of the tropics of Cancer and Capricorn are probably caused by a portion of the upper returning current descending to the surface and re-entering the general trade-winds, while the other portion continues its way toward the temperate latitudes. Light but variable winds and absence of rain characterize these regions; for descending, like ascending, air prevents the development of horizontal winds, and the moisture contained in air descending from upper and colder regions into lower and warmer ones has no chance to be condensed. In the Atlantic this belt of calm is called by the American mariners the *horse latitudes*.

All these zones of tropical winds move bodily to and fro with the vertical sun—northward during our summer, southward during our winter season—as shown in the diagram indicating the limits of the trade-winds at various periods of the year. In the summer-time the trade-winds are already reached N. of the Canary Islands in the 30th, and the zone of calms in the 12th degree of latitude.

These oscillations determine the seasons of the tropics, for a place may be alternately in the region of trade-winds and have a dry season, and in that of the calms, and have abundant rains.

*Monsoons.*—The influence of the lands is already marked in the Pacific and Atlantic by the broader extent of the trade-wind zone in their neighborhood, but it is still more perceptible in the Indian Ocean. Here the regular trade-wind only exists in the southern half. In the northern half it is completely broken and changed into season winds called *monsoons*, which blow alternately six months from the N. E. and six months from the S. W. The region of calms is mostly S. of the equator, and quite undefined, if found at all. The disturbing effect of the land-masses is evident. During the northern summer the great continent of Asia is overheated, while the southern part of Africa has winter. The colder air, therefore, rushes toward the continent of Asia, making the S. W. monsoon, which blows from April to October. The cold winter air of Asia flowing into the warm summer air of Africa causes a N. E. monsoon, blowing from October to April. The time of the change from one monsoon to the other is marked by high winds and great tempests.

Similar monsoons play between the continents of Asia and Australia, also all along the eastern coast of Asia, from Southern China to Japan and Mantchooria, between the overheated continent of Asia and the cooler adjacent ocean, bringing with them summer rains. Others, perhaps less marked, are found along the coast of Brazil and the western coast of South America, of Mexico, and Central America.

*Winds of the Temperate Regions.*—If the tropical zone is that of constant and periodical winds, the temperate regions are those of *variable* winds, for all the year round they blow alternately, without apparent rule, from every quarter of the horizon. Two winds, however, in our hemisphere—the N. E. and S. W.—are more steady, and so prevailing that they may be called the normal winds of the middle latitudes. The N. E., cold and dry, is the polar wind deflected by the earth's rotation; the S. W., warm and moist, is the returning upper equatorial current, which gradually descends and reaches the surface about the 30th degree of latitude, blowing from the S. W. The polar or equatorial winds, flowing side by side, or one above the other, but in contrary directions, encounter each other, each constantly struggling for the mastery. Their fierce battles are our never-ceasing storms; our latitudes their battle-field. They control the weather. The S. W. equatorial brings us heat, cloudiness, and rain; the polar winds, clear sky, dry, cold, bracing air, and sunshine. The science of the winds is the science of the weather.

When these variable winds succeed each other, it is, as demonstrated by Dove, in a regular order, called by him the law of the rotation of the winds. In the northern hemisphere, when the S. W. blows, and the N. E. is to succeed, the wind turns rapidly, first to the W., then by N. W. to the N. and N. E., when it becomes settled. When the S. W. in its turn is to prevail, the wind first turns to the E., then to the S. E., and finally settles to the S. W. The other winds from intermediate points of the compass, therefore, are mere transition winds. The order is reversed in the southern hemisphere. The N. W. is the warm equatorial, the S. E. the cold polar wind.

The diagram in Map VII. exhibits the normal succession of winds and their influence on the meteorological instruments.

When the S. W. wind blows, the air being warm, moist, and light, the thermometer is highest and the barometer lowest. When the wind turns toward the N. E., the thermometer falls and the barometer rises. The wind turning again toward the S. W., the thermometer rises, the barometer falls, and the weather becomes once more cloudy and rainy. These constant changes of the winds are the cause of the variability so characteristic of temperate climates.

The position of the continents, however, somewhat modifies the course of the polar winds. A great extent of land being more liable to become cold by radiation than the sea, the average course of polar currents is rather along the continents, and that of the returning equatorial winds along the oceans. This accounts for the lower temperature of the interior of the continents in the middle latitudes compared with that of the oceans, marked by the course of the annual isothermal lines, and for the high barometric pressure on the continents and the low barometer in the adjacent oceans.

The northern parts of Asia and North America, with their vast radiating plains and high barometric pressure in winter, are the centres of greatest cold, and also the starting-points of the polar winds, which therefore blow from the N. W. on the eastern coasts of Asia and North America.

*Influence of Winds and Marine Currents on Isothermal Lines.*—The circulation of the winds just explained, together with that of the great marine currents, warm and cold, equatorial and polar, which follow the same general course, and add their influence, enable us fully to understand the remarkable deviations of the isothermal lines from the parallels pointed out in Map VI. (see under CLIMATE), and the great difference in the temperature of places situated in similar latitudes.

In the northern hemisphere all heating influences, winds and waters coming from the equatorial regions, take their course toward the N. E., and benefit the western coasts of Europe and America, which are the warm coasts. All cooling influences, winds and waters from the polar regions, are directed to the S. W., and cool the eastern coasts of Asia and North America, which are the cold coasts.

In the Atlantic the S. W. equatorial winds and the Gulf Stream travel together toward the N. E., and along their path the isothermals are pushed far to the N. Moving on the warm surface of the Gulf Stream, the winds take up a part of its heat and spread it, with their own, over Western Europe. They add thus, from this double source, a large share to the temperature due to its latitude, and make Europe the warmest continent of the temperate latitudes.

In the Pacific Ocean, the warm Asiatic Gulf Stream or Japanese Current is so far removed that it has lost its heat when its waters, after a long circuit, return from the N. and glide along the coasts of North America. As the equatorial winds alone have an influence, the increase of temperature is only one-half of what it is in Europe.

In the interior of the continents, removed from these warming influences, the isothermal lines bend again toward the equator.

In the southern hemisphere, the domain of the waters, the marine currents have the greatest sway. In the Atlantic, the S. branch of the Equatorial Current, running along the coast of Brazil, carries a tropical temperature far beyond the tropics, while the cold Antarctic current reduces the heat of the Peruvian coast down to that of the temperate latitudes. The same phenomenon is repeated in Southern Africa. The warm equatorial current of Mozambique

gives to the coast of Natal a tropical temperature, while the Antarctic waters in their northward course cool the western coast of the Cape Land. (For storms, etc., see STORMS, HURRICANES, AND CYCLONES.) A. GUYOT.

**Wind'sor,** town of England, in Berkshire, on the right bank of the Thames, is an ancient borough, but has undergone much alteration of late years, owing to the improvement of the castle. One side of Thames street has been pulled down, the castle hill has lost its ancient identity, and picturesque old houses have been swept away for the sake of making wider and more convenient thoroughfares. High street is the best part of the town, in which are situated the parish church, a modern structure of late much improved, and the town-hall, covering a railed-in space used as a corn-market, and consisting of a quaint chamber of the time of Queen Anne, and other apartments for municipal purposes. A public-house—the Duke's Head—at the bottom of Peascod street, is said to have belonged to the duke of Buckingham. The inn of the Star and Garter, in the same street, claims connection with the famous hostelry of Shakspeare's day. Herne's Oak has disappeared from the park, but the river-side suggests a picture of Sir John Falstaff in the clothes-basket. Not far from the spot which Shakspeare must have been thinking of when he wrote his play is Traven College, consisting of a row of comfortable houses occupied by naval officers, who receive, in addition to their residence, some allowance from funds bequeathed by the founder, whose name the foundation preserves. P. 11,769. (See WINDSOR CASTLE.) JOHN STOUGHTON.

**Windsor,** seaport, cap. of Hants co., N. S., on the river Avon, at the head of the Basin of Minas and at the junction of Windsor and Annapolis and Nova Scotia railways, 45 miles N. W. of Halifax; shipbuilding and the mining and exportation of gypsum are leading industries. The town has a weekly newspaper, a bank, 6 churches, gasworks, and several manufactories. It is the seat of King's College, founded in 1787. P. of sub-district, 2715.

**Windsor,** p.-v., Essex co., Ontario, Canada, on Detroit River, directly opposite Detroit, Mich., and just above Sandwich, the county-seat. Windsor is in Sandwich township. It is the W. terminus of Great Western Railway, 229 miles W. of Niagara Falls. It has a weekly newspaper, a dispensary, and a Roman Catholic academy, and is connected by ferry with Detroit. P. 4253.

**Windsor,** county of S. E. Vermont, separated from New Hampshire by Connecticut River, and traversed by Vermont Central and Connecticut and Passumpsic Rivers R. Rs.; surface mountainous in the W. part, hilly elsewhere; soil generally fertile. There are nearly 500 manufacturing establishments, including saw-mills, flour-mills, cotton-mills, woollen-mills, ironworks, tanneries, agricultural implements, carriages, saddlery, furniture, wooden ware, shoe-pegs, and lime. Sheep, cattle, and horses are very numerous. Staples, manufactured articles, hay, wool, maple-sugar, potatoes, Indian corn, oats, and dairy products. Cap. Woodstock. Area, about 900 sq. m. P. 36,063.

**Windsor,** p.-v. and tp., Hartford co., Conn. P. 2873.

**Windsor,** p.-v. and tp., Shelby co., Ill. P. of v. 518; of tp. 1593.

**Windsor,** p.-v. and tp., Fayette co., Ia. P. 800.

**Windsor,** p.-v. and tp., Kennebec co., Me. P. 1266.

**Windsor,** p.-v. and tp., Berkshire co., Mass. P. 686.

**Windsor,** tp., Eaton co., Mich. P. 1222.

**Windsor,** p.-v., Henry co., Mo.

**Windsor,** tp., Hillsborough co., N. H. P. 81.

**Windsor,** p.-v. and tp., Broome co., N. Y. P. of v. 325; of tp. 2958.

**Windsor,** p.-v. and tp., cap. of Bertie co., N. C. P. of v. 427; of tp. 3732.

**Windsor,** p.-v. and tp., Ashtabula co., O. P. 871.

**Windsor,** tp., Lawrence co., O. P. 1943.

**Windsor,** tp., Morgan co., O. P. 2251.

**Windsor,** tp., Berks co., Pa. P. 1211.

**Windsor,** tp., Barnwell co., S. C. P. 1021.

**Windsor,** p.-v. and tp., Windsor co., Vt., on Connecticut River and Central Vermont R. R., contains 4 churches, a library, 2 parks, an excellent high school, 2 newspapers, an iron-foundry, 2 banks, and manufactories of print-cloths, scythe-snathes, and shoes. The State prison is here. P. 1699. FRANKLIN BUTLER, ED. "VERMONT JOURNAL."

**Windsor,** tp., Isle of Wight co., Va. P. 2243.

**Windsor,** p.-v. and tp., Dane co., Wis. P. 1256.

**Windsor Castle** is built upon a chalk hill near the river Thames, about 22 miles from London, and commands a magnificent prospect in a northerly direction. The terrace on that side is a broad, long platform constructed on a level with the base of the building, and is described in a manuscript of the seventeenth century as "borne up and sustained by arches and buttresses of stone and timber." William the Conqueror built a Norman edifice on the spot, but no part of the existing castle can be identified as coeval with his time. The most ancient portions are the Garter and Cæsar towers, the latter of which forms a bastion of the castle-wall, and abuts upon the winding street called Thames street. It is one of the most curious antiquities in the whole building. These towers were erected in the reigns of Henry I., II., and III. To the same period belong the S. ambulatory of the Dean's Cloister, a door behind the altar in St. George's chapel, and the remains of Domus Regis in the N. of the chapel. The Norman gateway near the keep, the groining of the Devil's Tower and King John's Tower, and the Dean's Cloister pertain to the time of Edward III. St. George's chapel was built by Edward IV.; the choir roof by Henry VII.; the outer gateway of the lower ward by Henry VIII.; and the buildings from the Norman gate to the state apartments, including the library, were raised by Queen Elizabeth. Thus, some materials are here afforded for illustrating the history of castellated architecture in England from the thirteenth to the sixteenth century. But the castle, as it now appears, is almost entirely the creation of George IV.'s reign, when about a million sterling was spent upon the place. The architect, Sir Jeffrey Wyatville, preserving somewhat the character of an ancient fortress, transformed it into a royal residence replete with all the accessories of modern luxury and splendor. Towers were raised to a greater height, especially the round tower in the middle; the windows were altered; much of the masonry renewed; so that the external appearance became very different from what it had been under George III., when much of the Gothic architecture appeared obliterated through alterations made under Charles II. The courts, the terrace, the gardens, the slopes, and the parks, all underwent great change and much improvement; so that old inhabitants who remember it sixty years ago scarcely recognize the castle of their childhood. The internal changes are even more striking than the external. Suites of rooms decorated and furnished with the utmost magnificence, the corridor which runs round two sides of the quadrangle, and the grand staircases, immensely surpass what was to be seen in the castle a little more than half a century since. Changes have been made in the pictures, some of the old ones having been sent away and others introduced; a splendid museum of curiosities has been arranged in a small gallery on the N. side; the library has been wonderfully improved; the plate-closet, containing silver and silver-gilt services and rare table ornaments of pure gold, is the wonder of all spectators; but the engravings, the miniatures, and the drawings in rooms under the library surpass in value and in interest all the treasures of precious metal, bedecked though some of these are with precious stones.

The history of the castle is, to a large extent, the history of the successive kings, royal families, and courts of England. Here lived Henry I., II., and III. amidst their domestic troubles. Here John took refuge from his barons, and Edward III. entertained the knights of the Round Table and founded the order of the Garter. Here Henry VI. was born; and Henry VII. and Henry VIII. received noble visitors. Elizabeth walked on the terrace and hunted in the forest. The story of the Stuarts is entwined about the building. Under the Norman gate the headless body of Charles I. was carried in a snowstorm. Oliver Cromwell and his family occasionally resided in this palace of English sovereigns. Queen Anne was sitting over a cup of tea with the duchess of Marlborough, in a little closet now part of the library, when the news of the victory of Blenheim arrived. The first two Georges had little or nothing to do with Windsor. George III. and his queen lived here, and made a building at the top of Castle Hill a nursery for their children. The castle was the favorite residence of William IV., but her present majesty only occasionally occupies it. Here, however, she came on the evening of her wedding-day amidst rejoicings never to be forgotten. The writer of this article well remembers seeing her in the bloom of youth taking a drive with her consort in a little pony phaeton a day or two afterward. The surroundings of the castle and the roads in the park have been much altered since then. St. George's chapel is within the castle precincts, and is partly an ecclesiastical and partly a military foundation. The architecture is a choice specimen of the age of Edward IV. and Henry VI. The external walls, buttresses, windows, parapets, and the aisles, chapels, choir, knights' stalls, numerous monuments, and mural paintings, are interesting archæological objects. Henry VI., Edward IV. and

his queen, Elizabeth Woodville, Henry VIII. and Jane Seymour, and Charles I., are all buried in St. George's chapel. The grave of the last-mentioned monarch was opened many years ago, when a relative of the writer being present recognized the resemblance in the face to Vandyke's portrait of him. George III. and Queen Charlotte, William IV. and Queen Adelaide, the duke of Kent, father of Queen Victoria, and the duke of York, the Princess Charlotte, and other members of the Brunswick family, are buried in the royal vault. Over that vault is what used to be called Wolsey chapel, from its having been granted to him by Henry VIII. Mass was performed in it when James II. was king. This led to a riot, and the building remained neglected for many years. It has recently undergone a costly restoration. The floor is of rich marble, the walls are decorated with exquisite designs in engraved marble, emblematically illustrative of the life and virtues of the prince-consort. The buildings connected with the chapel have been much altered of late years, and the Horseshoe cloisters, as they are called, at the W. end, have been almost wholly rebuilt, yet so as to preserve their former character and to retain some of the ancient timbers.

Within a short distance of the castle is Frogmore House, forming part of the royal demesne, and inhabited by Prince and Princess Christian. In the garden are two mausoleums—one containing the remains of the duchess of Kent; the other, on which wealth and skill have been richly expended by Queen Victoria, covering the dust of her husband, Albert the Good. JOHN STOUGHTON.

**Windsor Locks,** p.-v. and tp., Hartford co., Conn. P. 2154.

**Windsor Mills,** p.-v., Richmond co., Quebec, Canada, on Grand Trunk Railway, 62 miles N. of Island Pond, Vt. Windsor Brook and St. Francis River furnish admirable water-power. Lumber, paper, and gunpowder are here manufactured. The village has a substantial brick town-hall. P. about 325.

**Windward Islands.** See ANTILLES.

**Wine and Wine-Making.** By *wine* is usually understood the fermented juice of the grape, although the name is occasionally applied also to fermented beverages derived from other fruits. Its preparation dates from the most ancient times. (See VINE-CULTURE.) The wines of the ancients, however, were very generally modified by the addition of spices and other condiments to suit the taste of the consumers—a habit still largely prevalent among their descendants on the Mediterranean shores. The taste and demand for strictly pure wines are of comparatively modern date, and their prevalence accounts in part for the decline of the reputation of some of the wines, anciently most esteemed, of Italy, Greece, Asia Minor, and Persia. Wine-making is a complex and difficult art when the best possible results are to be achieved, and owes much to the progress of modern science.

Grapes to be used in wine-making should be fully ripe; when this is not the case, the juice is deficient in quantity as well as quality, and especially poor in sugar. Should the natural conditions fail to bring about the full ripening, the defect is sought to be remedied by various devices, such as spreading the bunches on mats or straw in the sun or in warmed rooms; placing them in large vats, in mass, for several days; causing them to freeze or steaming them moderately. When the weather permits, the grapes are often allowed to become over-ripe to such extent as to make them appear to be wilted; they then yield less, but sweeter wine (*Ausbruch-wein*, Ger.). Finally, in southern countries (Spain, Italy, Greece) wine is frequently made from grapes fully dried, or raisins, the requisite water being added in crushing and pressing. In vineyards whose product is very valuable, all unripe and decayed berries are carefully handpicked from the bunches, and the latter, or even their berries, assorted as to quality.

*Stemming and Crushing.*—In the making of white wines, the berries are mostly either picked off by hand or separated by means of an implement resembling a coarse comb. The berries are then crushed by passing them between ribbed rollers, set so as to avoid crushing any kernels. In the manufacture of red or tinted wines the bunches themselves are fed on the crushing-mill, or are crushed by treading with clogs or sandals or pounding with wooden pestles. The "first run," or juice flowing off spontaneously after gentle crushing, is often kept apart as yielding a higher quality of wine.

*Pressing.*—This is effected by means of presses of every variety of pattern, from the primitive lever and wedge press to the hydraulic; and even the centrifugal process has been successfully used. When the "first run" has been separately received, the pressed juice constitutes the "second run," while the pressed residue is the "pomace," which is thereafter utilized for the production of inferior wine, vinegar, or brandy. The average amount of juice obtained usually ranges from 60 to 70 per cent. of the weight of the berries. When *raisins* are used in wine-making, they are subjected to the treading process with the addition of water, and then pressed.

*Composition of Grapes and Must.*—The grape-berries, according to the analyses of Fresenius and Schlieper, contain from 12.6 to 22.9 per cent. of soluble matters, 2.5 to 7.0 of insoluble matters, and from 70.0 to 85.0 of water. The mineral (ash) ingredients range between 0.4 and 0.5 per cent., of which three-fourths or more are soluble, and therefore pass into the must. Berthier's analyses of grapes in the bunch give nearly the same ash-percentage, the soluble portion varying from one-half to two-thirds of the whole. The ash of must varies from 0.25 to 0.4 per cent. of its weight; from 80 to 85 per cent. of this ash consists of alkali (chiefly potash); $P_2O_5$ about 4.1. Kernels contain as much as 20 per cent. of ash, chiefly earthy phosphates and carbonates.

The *proximate ingredients* of must may be briefly stated as follows: *sugar*, in the form of grape-sugar or glucose; *gum and dextrine; vegetable acids*—tartaric (sometimes racemic), malic, citric; *albuminoids; tannin; coloring-matter; volatile aroma*, pre-existing chiefly in the husks of some kind of grapes, distinct from the wine flavor and "bouquet;" *ash ingredients*—potash, soda, lime, magnesia, alumina, iron, phosphoric and sulphuric acids, chlorine, silica.

*Grape-sugar* may be considered the most important ingredient of must, its amount, together with that of the vegetable acids, being usually the index to the commercial value of the product. Of all known fruit-juices, grape-must contains the largest amount of sugar, ranging, according to Mulder, from 13 to 30 per cent., and probably even higher. In fermentation the sugar is partially or wholly transformed into about half its weight of alcohol, the rest being given off in the shape of carbonic dioxide (carbonic acid). Besides common alcohol, there are formed succinic acid, glycerine, and a number of aromatic ethereal compounds, whose presence and quantity materially influence the quality of the wine. Since, moreover, a liquid containing over 12.5 per cent. of alcohol ferments slowly or not at all, any excess of sugar of over 25 per cent. will remain undecomposed and sweeten the wine. Wines containing less than 12 per cent. of alcohol seem to owe their sweetness chiefly to glycerine produced in fermentation. The determination of the amount of sugar is usually made by ascertaining the density of the juice by means of a hydrometer (Oechsle's and Massonfour's scales, Balling's saccharimeter), upon the supposition—in most cases practically nearly correct—that the specific gravity is sensibly proportional to the amount of sugar present. The polariscope and the copper-reduction test are also sometimes employed.

The *acids* of must rank next in importance to sugar. Their amount varies from 0.5 to 1.02 per cent., to a certain extent in inverse ratio to the sugar present, since during the later stages of ripening the acids undergo a rapid transformation into sugar; and as on their presence depends, to a large extent, the formation of the peculiar ethereal wine-flavors in fermentation, one cause of the lack of flavor observed in wines of southern countries is obvious. The sum-total of acids is determined, according to Pasteur, by neutralizing the juice with lime-water of known strength.

Of the special nature of the *albuminoids* of must we know but little. Their amount varies from 0.24 to 0.83 per cent., and their presence exerts a most important influence upon the fermentation and keeping qualities of wine. Being essential to the formation of yeast, an inadequate supply of these substances causes incomplete fermentation, while an over-supply, though partially precipitated in the lees, renders the wine liable to spoiling.

*Tannin* is not present in the pure juice, but occurs largely in the husks of some kinds of grapes, as well as in the stems and kernels. Hence, close crushing and pressing, and still more the presence of the whole pomace during fermentation, cause the wine to be rich in tannin. Under the same circumstances the coloring-matter of the husks and the acid and tannin of the stems find their way into the wine in larger quantities, thus producing the more acid and astringent qualities of red wines.

*Fermentation and Ripening of Wine.*—The process of fermentation naturally subdivides into two periods—(1) That of violent fermentation, during which the temperature rises considerably (from 10° to 20° C.), a lively evolution of gas takes place, and most of the sugar is converted into alcohol. Its duration is from twenty-four hours to as many days—usually ten to fourteen. (2) The after-fermentation of the cleared liquid, without perceptible elevation of temperature, and without a very definite limit, lasting through

three or four months, during which the action is completed and a further deposition of lees takes place. Freshly-pressed must is clear or but slightly turbid. Under the influence of atmospheric oxygen, and of the germs afloat in the air or adherent to the berries, it becomes turbid after a period varying, according to temperature, from a few hours to several days. Gas-bubbles begin to rise, and soon bring up with them particles of yeast. If the fermentation be violent and the temperature high (15° to 25° C.), the yeast forms a dense layer on the surface of the liquid (top fermentation); if the temperature be low (between 5° and 15° C.), the yeast remains largely at the bottom, and the process is slower (bottom fermentation). The latter process, as a rule, produces wine of higher and more delicate flavor, and of better keeping qualities; hence the use of deep, cool cellars when the external temperature is high. The want of these accounts in part for the lack of aroma in the wines of southern countries, and the frequent necessity of the addition of spirit to make them keep. In the preparation of red wines the pomace is allowed to ferment with the must for a certain length of time, and is carried to the surface with the yeast. As the porous mass thus raised is liable to souring, it is best to keep it submerged by means of perforated covers.

As regards the exclusion of air during violent fermentation, practice varies widely. While too much access is unquestionably injurious, in causing the formation of vinegar, it seems also to be well proven that a total exclusion is unfavorable to the development of the finest aroma. From casks closed by means of a hydrostatic valve, through which the gas escapes, but air cannot enter, we have all degrees of transition to the open tank, which is liable to many objections. In tanks provided with floating covers, leaving an annular space all around for the escape of gas and limited access of air, we have perhaps the arrangement applicable to the majority of cases, and capable of such adjustment as experience may determine to be best in each case. Upon the subsidence of the violent fermentation, the yeast (with more or less of tartar, gummy matter, and albuminoids) settles to the bottom, the liquid clears, and is then carefully racked off into casks, to undergo the

*After-Fermentation.* (See above.)—During this process great care must be taken to prevent excessive access of air by refilling the casks, yet without closing them so as to incur the risk of bursting. The lees of the after-fermentation consist largely of crystalline tartar, with some yeast, and more or less of gummy and albuminous substances. At the end of this period the young wine is once more racked off into casks (usually of smaller size), in which the ripening or aging is to take place. This process, as Pasteur has definitely shown, depends essentially on the gradual action of the atmospheric oxygen, which enters through the pores of the casks. The wine again becomes slightly turbid or "muddy," and forms a deposit consisting partly of products of oxidation, partly of fungous vegetation, of which the greater part remains suspended in the wine. The problem of preserving the latter turns mainly on the suppression of this parasitic vegetation, which otherwise gives rise to a variety of "diseases." According to circumstances, the wine may incline to turn sour, forming vinegar, or it may acquire a bitter taste; it may remain permanently turbid (this may usually be remedied by aëration), or become stale in taste and apparently gummy or "ropy" (remedied by the addition of tannin), etc. The racking-off often needs to be repeated several times in order to preserve or improve the flavor; and very usually young wines are cleared from a remnant of yeasty particles by the addition of gelatine, or some other substance ("finings"), which may then be curdled and carries with it all mechanical impurities. Filtration under pressure is also resorted to. Of late, two processes have been used as preventive of these difficulties, as well as for the acceleration of the "aging" of wines. One is the heating of the young wine to a temperature of from 60° to 63° C., recommended by Pasteur; the other is the "air-treatment" of D'Heureuse, which may also be applied to must. Of these, the former has been attended with such success that it is now extensively practised in France. The principle underlying the air-treatment is carried into practice in the manufacture of the aromatic "shovel wine" of Lorraine, and in the successful use of the centrifugal press.

When, finally, after the lapse of from two to four, and even eight years, the wine remains clear when bottled, it is "bottle-ripe," and is considered finished. Most wines, however, continue to improve by age in flavor for a length of time differing for each kind. In the end, even bottled wines become too harsh and acid to be palatable.

*Sparkling Wines.*—Ordinary "still" wines retain only so much of the gas generated in fermentation as to impart to them a refreshing quality, which soon vanishes on exposure to the air: the wine becomes "flat." Sparkling wines, of which champagne is the type, effervesce on account of an excess of carbonic acid gas contained in them under pressure. This gas is generated in a second fermentation produced in the young wine, subsequent to after-fermentation, by the addition of sugar and (when necessary) yeast-forming matter (gelatine). This is effected in strong bottles tightly corked, and when the fermentation is completed the sediment of yeast is ejected from the mouth of the inverted bottle by dexterous manipulation. Of all wines, champagne is perhaps the most extensively imitated, partly by forcing into sweetened still wines, or even cider, such gas as is used in the preparation of soda-water, and partly by adding to the bottled wine gas-generating powders.

*"Doctoring" of Wines.*—Few wines reach the consumer as they result from the processes above detailed. It is the general practice to adapt the various kinds and qualities of wines to the taste of the consumers by the intermixture of such as will improve each other. To this practice no reasonable objection can be made, since from beginning to end intelligent management influences the nature of wine nearly as much as its origin, and it would be difficult to define just what should be understood by "natural wine." When, however, outside additions are made to the juice of the grape, the aspect of the question is changed. So long as these additions merely make up for deficiencies in what might be considered the normal composition of must (as is done in adding grape-sugar to vintages that have suffered from unfavorable weather), it is questionable whether the consumer has reason to complain; and hence this practice ("chaptalizing") is very general, and made no secret of. The simultaneous addition of water ("gallizing") might claim equal immunity when made on similar grounds, and not for the fraudulent increase of quantity. The manufacture of a wine-like beverage from the pomace, by extraction with sugar-water to such extent as will secure for the resulting juice a proportion of constituents similar to that of natural must ("petiotizing"), while not intrinsically objectionable, is liable to great abuse, though vastly preferable to the compounding of so-called wines from materials to which the grape is a stranger, and whose manufacture has to a great extent been supplanted by that of cheap "petiotized" wines.

Among still wines, those most commonly imitated are the heavy, sweet wines of southern countries, which are to a great extent themselves the result of a compounding process, and whose general wine-flavor it is comparatively easy to reproduce.

*Classification of Wines.*—The wines of commerce may in a general way be divided into—(1) *dry* wines, not obviously sweet, but possessing a more or less distinctive and high flavor—"bouquet;" (2) *liqueur* or sweet wines, permanently and decidedly sweet, and rich in alcohol, with but little aroma, mostly from southern climates. Between these two classes there are of course all degrees of transition, and a third class may be formed out of those not prominently characterized by either aroma or sweetness. In all these classes we find both white and red or tinted wines.

*Wines of France.*—France produces an especial abundance and variety of red wines (clarets), of which those most highly esteemed are grown in the Bordelais and in Burgundy, as well as in Dauphiné. The Bordeaux wines have a full, agreeable bouquet, a good deal of body, are spirited yet not heady, with a pleasant astringency: first-class are Château Lafitte, Château Latour, Château Margaux, Haut Brion. The Burgundy wines are rather heavy, oily, less astringent, with a fine, peculiar aroma; such as Chambertin, Clos Vougeot, etc. Second-class clarets are those of St. Julien, St. Estephe, Cantenac of the Bordelais, those of the Champagne, the Lyonnais, and Dauphiné. *Petits vins,* or *vin ordinaire,* is produced in all but 8 out of 86 departments. The white wines of France are more fiery and have more body than the Rhenish wines: first-class are those of Champagne (Sillery), the Burgundy white, and Château d'Yquem of the Bordelais, with Sauterne, Barsac, etc., as second-class. Superior dry wines are also produced in the S. of France, but most prominent are the *liqueur* wines of Perpignan, Languedoc (Frontignan, Lunel), Roussillon, and the "straw wines" of Dauphiné and Northern France.

Foremost among the wines of *Germany* are the high-flavored, dry Rhenish wines, grown from Alsace down to Coblence, in the valley of the Rhine and its tributaries. Of the white wines (known in England under the collective name of "hock," a corruption of Hochheim), those of Hochheim, Rüdesheim, Johannisberg, Forst, the Niersteiner, Marcobrunner; and among the red wines, the Affenthaler and Asmannshäuser are best known. The Moselle wines resemble those of the Rhine in flavor, but are light and acid. The same, to a less degree, is true of the wines of Franco-

nia. The wines of Northern Germany (Grünberg) are very acid.

Among the wines of *Switzerland*, those of the Jura region (Vaud, Neufchâtel, Geneva) are esteemed best. Almost all have a somewhat harsh and earthy taste, and are not exported. That of the Val Tellin has some reputation as a stomachic and tonic.

*Austria* is second to France in the amount of wine produced, but only the wines of Hungary and some of the liqueur wines of the Adriatic provinces are somewhat widely known in commerce, and the aggregate export is quite small. The sweet, fiery, and aromatic wine of Tokay in Hungary is by some esteemed even above that of Johannisberg on the Rhine. Many other excellent wines are in high local repute.

*Italy* produces abundance of wine, largely of the liqueur class; of these, the wines of Asti, Monte Pulciano, and Fiascone, and the Lachrymæ Christi—of the many excellent wines of Sicily, that of Marsala—are best known. Much good material is spoiled by bad management in wine-making.

The wine-production of the *Spanish Peninsula* is very extensive and of considerable commercial importance. Among the wines exported, the best known are those of Jerez ("sherry"), Malaga, and Oporto ("port"). The latter is essentially a dry wine, mixed to suit the English market. The wines of Malaga and Jerez are both of the dry and liqueur class, the latter being sweetened with grape-syrup, and all are strengthened by the addition of spirit. Of the same general character are the wines of Madeira, now scarcely found genuine in commerce.

Few of the wines of *Greece* enjoy a general reputation at present, although the wines of Cyprus and Chios are still praised. They, as well as those of *Turkey* in Europe and Asia, and *Persia*, suffer for want of care in preparation, and from the nature of the vessels (goat- or hog-skins, rendered waterproof by pitch) in which they are too commonly kept or conveyed.

Of *American* wines, those of California approach most nearly those of the Mediterranean countries, being, thus far, mostly fiery, sweet, and heady, but somewhat deficient in flavor. To a certain degree these defects can, and doubtless will, be remedied by judicious selection of grape varieties and appropriate treatment. The wines of the States E. of the Rocky Mountains, made from American grapes (see VINE-CULTURE) bid fair to rival those of France and Germany, from which they differ, on the whole, in possessing more or less of the "foxy" flavor of the berries, to which the European palate has not yet become accustomed.

The following table gives the volume-percentages of alcohol contained in some of the best-known wines, varying greatly of course from year to year:

| | |
|---|---|
| Rhenish and Moselle wines | 9.0 to 11.0 |
| Grünberger, Naumburger | 6.5 |
| Burgundy, red | 7.5 to 9.0 |
| Bordeaux, first class | 9.0 to 11.5 |
| Catawba, Concord, etc | 8.5 to 10.5 |
| California wines | 10.5 to 14.0 |
| Port | 18. to 23. |
| Sherry | 17. to 21. |
| Madeira | 17. to 19. |
| Tokay | 12. to 20. |
| Greek and Syrian wines | 14. to 18. |

The total wine-production of the U. S. is given by the U. S. census of 1870 at 3,092,330 gallons, of which California is credited with 1,814,656; the *American Encyclopædia* (ed. of 1873) gives 20,000,000, upon data derived from private sources, and credits California with 5,000,000 gallons. The wine-crop of the latter State is claimed by the San Francisco *Market Review* to have been 8,000,000 gallons in 1875.

E. W. HILGARD.

**Wine'brenner** (JOHN), b. in Frederick co., Md., Mar. 25, 1797; became a minister of the German Reformed Church at Harrisburg, Pa., but in consequence of a difference of views in regard to revivals seceded from that Church in Oct., 1830, and established a new denomination under the title of "The Church of God," now more generally known as "Winebrennerians," and embracing 400 ministers and 40,000 members in 1873, their distinctive ordinances being baptism by immersion, the washing of feet, and the Lord's Supper. Mr. Winebrenner edited the *Church Advocate* of his sect for several years and published a number of books. D. at Harrisburg Sept. 12, 1860.

**Winebrennerians.** See CHURCH OF GOD.

**Wine, Physiological Relations of.** Under this heading will be discussed the relations to animal physiology of alcoholic drinks in general. As the most important properties of these beverages are due to the alcohol they contain, the effects of this fluid will first be treated of, and the individual properties of the different beverages pointed out afterward. The first point is to know what is the career of the alcohol itself within the animal system. Alcohol is a fluid of high diffusive power, and when swallowed passes at once, unchanged, into the circulation by absorption through the gastric walls. From the blood it also passes, in all probability, into the tissues by transudation through the walls of the blood-vessels. It finally suffers decomposition within the body, being probably oxidized into carbonic acid and water. Here a word of comment is necessary, since the reverse of the latter statement has been affirmed and extensively believed. The history of the matter is briefly this: It used to be supposed, upon theoretical grounds, that alcohol would naturally be oxidized within the body, and such was generally believed to be the case until the year 1860. In that year three Frenchmen, MM. Lallemand, Perrin, and Duroy, published the results of some investigations of theirs, by which they claimed to have proved that, instead of being oxidized within the body, alcohol is, on the contrary, always wholly excreted unchanged. This statement, being apparently supported by the results of experiment, was very generally accepted by the medical profession and widely circulated among the laity. But not many years after this publication, fallacies were found in the method of experimentation relied upon by the French observers, and the whole subject was reinvestigated by several scientists independently (Baudot, Anstie, Dupré, Schulinus, Thudichum, Binz). Improved methods and a more rigid guarding against possible errors were adopted, and the result has been that exactly the opposite of what was asserted by MM. Lallemand, Perrin, and Duroy turns out to be the truth. In moderate quantity (up to 1½ ounces daily) alcohol wholly disappears as such within the body, and even in grossly-intoxicating doses but a minute fraction—less than 1 per cent.—escapes unchanged through the excretory organs. This point has now been so often and so overwhelmingly proven by different experimenters that it must be accepted as an established fact. The nature and seat of the transformation of alcohol are not known, but many considerations make it probable that the fluid is finally completely oxidized into carbonic acid and water, just as it is when burned in a spirit lamp. (*Binz.*) An objection to this supposition, urged by some, is that in such case the body-temperature ought to rise after ingestion of alcohol, whereas in fact it is either stationary or actually falls. But the objection is not valid. The temperature of the body is a resultant of three factors—namely, the total quantity of oxidizable matter of all kinds oxidized in a given time within the body, the quantity of life-work (muscular action, etc.) done within the same period, and the quantity of heat at the same time lost from the skin and lungs. And the whole tendency of the economy is to such a mutual adjustment of these three determining influences as that the resulting body-temperature shall be nearly constant. Hence, in general, neither physical exercise, exposure to cold or heat (within moderate limits), *nor the ingestion of food* sensibly affects body-temperature. Since fat, then, is oxidized within the system without sensibly raising body-heat, there is no reason why the same should not be the case with alcohol, whose thermotic equivalent is lower than that of fat.

Turning next to the effects of alcohol-drinking, we find that they are highly complicated, and are apparently due to a number of independent influences exercised by alcohol upon different parts and functions of the body. Some are obviously the result of actions of the alcohol itself upon the solids and fluids with which it comes into contact; others are seemingly the mere physiological consequences of the final oxidation of the fluid, and others still probably have their cause in both these agencies combined. A point of obviously-important bearing is that the several effects of alcohol are not developed with equal readiness, so that the *general resultants*—to borrow a convenient technical phrase—of different doses differ not only in degree of effect, but even in kind; as where certain effects following small doses are actually reversed with large, or where certain prominent phenomena, as those of intoxication, which are produced by large doses, are wholly wanting if the potion be small. Of equal importance, again, is the additional fact that even the resultant of a given dose is by no means invariable, circumstances often greatly modifying the usual relative intensity of the different effects. Alcohol, in short, acts very differently in different cases, the determining influences being personal idiosyncrasy, age, sex, habit of indulgence, and, above all, state of the system as regards disease. Thus, with excitable women the susceptibility to intoxication is disproportionately high, while with habitual topers the same is low, the other alcohol-effects being meanwhile as usual. In fever, again, the power of alcohol to reduce body-temperature is greater than normal, while at the same time the intoxicating power is decidedly less. A third point, still, is that circumstances of administration will greatly affect the result of drinking

a given quantity of alcohol. Most of the effects depend upon absorption of the fluid into the blood, and, other things being equal, are proportionate to the percentage of alcohol actually present in the circulation at a given moment. This is determined by the whole amount of alcohol taken, and by the relative rates of absorption on the one hand, and destruction by oxidation on the other. Now, alcohol is pretty quickly disposed of within the system, so that any cause which delays absorption will proportionately diminish the effect of the dose. Hence, a given potion produces much less effect if taken upon a full stomach than upon an empty one, and likewise if taken in divided doses rather than at a single draught. Thus, 4 ounces of whisky, which would be decidedly intoxicating to most persons if swallowed all at once, can generally be taken in small broken doses, distributed throughout the day, with very little disturbance. The several effects of alcohol, in the order of their appearance with progressively increased dosage, are as follows: There is always a local effect in the stomach, differing in kind according to the dose and its alcoholic concentration. Small dilute doses tend to quicken digestion and promote appetite, while large and strong ones produce the reverse effect, irritating and disordering the stomach, and even inducing nausea and vomiting. The next organ affected is the heart, which is impelled to more vigorous action than before. In health, both the frequency and strength of the beats are increased, but in cardiac exhaustion, where the pulse is at the same time rapid and feeble, alcohol diminishes its excessive frequency while increasing its force. The action of alcohol upon the heart is one of the earliest and most constant of its manifestations. Its intensity increases with the dose so long as the heart retains power to respond to the excitation. In Parkes's experiments a daily allowance of 1 fluidounce of alcohol (about equal to 2 fluidounces of strong brandy), superadded to an already sufficient food-ration, increased the work done by an adult heart 4 per cent., and an allowance of 8 fluidounces (equal to a pint of brandy) increased the same over 25 per cent. The next effect is a dilatation of the capillary blood-vessels, seen externally by flushing of the face and neck and suffusion of the eyes, but also general throughout the internal organs, as the brain and lungs. Associated with this effect, and dependent upon it, are a feeling of fulness of the head and of general heat, and, in warm weather, a tendency to perspire. This dilatation of the capillaries requires a relatively larger amount of alcohol to produce it to appreciable degree than does the heart affection, nor is it so constant an effect as the latter, different persons varying greatly in their susceptibility to it. Like the heart effect, its intensity progressively increases with the dose. Next in order come the well-known phenomena of intoxication, consisting of failure of power to co-ordinate muscular action, as shown by the thick speech and staggering gait, and a peculiar intellectual disturbance. In severe degree, stupor, with sensory and motor paralysis, supervenes, and death even may occur from failure of respiration. (See INTOXICATION.) During intoxication the already-described affections of the heart and capillaries persist, producing the well-known bloated red face and eyes and the throbbing arteries of the drunkard. Intoxication is commonly followed by a heavy sleep, and upon awakening there are more or less mental and physical feebleness and languor, headache, thirst, loss of appetite, nausea, and sometimes vomiting. These effects, though they vary in intensity with different persons, seem in general more related to the quantity of alcohol drunk than to the mere degree of intoxication produced. Intoxication only occurs when the dose of alcohol is comparatively large—larger than is required to affect the heart and capillaries. With fully-developed males (over twenty-five years) alcohol taken in divided doses throughout the day generally begins to affect the brain when the daily allowance reaches somewhere between 1½ and 2 ounces. (*Parkes.*) But of all the properties of alcohol, this of intoxicating is the one most profoundly affected by the circumstances of the drinker. Women, as a class, are made drunk more easily than men, but in both sexes individual susceptibility varies greatly. Habitual indulgence deadens the susceptibility, so that the confirmed toper, though otherwise suffering from his deep potations, may show but little or no intoxication. But most extraordinary is the influence of certain morbid states of the system in the same direction. For in the prostration following great loss of blood, and in the low stage of severe fevers, enormous doses of alcohol can often be taken without the slightest sign of intoxication, although the other alcohol-effects are produced in due order. Besides the foregoing, there are other effects of alcohol, which, from not being immediately apparent to the senses, are not so well known. One of these is a tendency to a reduction of body-temperature. Under ordinary circumstances this only occurs to an appreciable extent when the potation verges on the intoxicating, and even with a dangerously poisonous dose the fall does not exceed from 3° to 5° F. According to its extent, it lasts from half an hour to several hours. In fever, where the temperature is abnormally high, the reduction by alcohol is proportionately greater than in health, but with habitual drinkers, on the contrary, it is less. When the body is exposed to severe cold, it is again in all probability greater than usual, for, though thermometrical observations are wanting, theoretical considerations, and the fact that spirit-drinkers succumb to cold far more readily than teetotallers, make it all but certain that the alcoholic fall of temperature here is excessive. Hand in hand with the reduction of body-temperature, and varying in extent under the same circumstances, is a tendency of alcohol to lessen the quantity of urea and carbonic acid excreted. Finally, alcohol, within certain limits, avails for the support of life after the manner of ordinary food. If to an insufficient dietary, where the body is losing weight, a little alcohol be added, not only may the loss of weight cease, but there may even be a gain. (*Hammond.*) It is a matter of common observation, also, that those who habitually drink alcohol, even in moderation, eat less than teetotallers, and those who take it in excess often subsist on a food-allowance utterly insufficient by itself to support life. Again, in persons desperately ill of fever, where the stomach is absolutely unable to digest ordinary food, life may be supported for many days, and sometimes even weeks, on alcohol alone.

Secondary consequences from habitual drinking seldom appear unless considerable quantities of alcohol are daily consumed. Here, again, there is great difference in individual susceptibility, and also in the organs affected. In general, those who lead sedentary lives suffer more readily than those who do hard physical work in the open air. These secondary consequences of hard drinking, like the sickness following a single debauch, are more related to the quantity of alcohol consumed and the concentration of the draughts than to the degree of drunkenness. Hence, although a certain daily allowance of alcohol may not intoxicate, it by no means follows that the same is therefore innocent. Probably 1½ ounces of alcohol are as much as can be taken daily with safety, but for obvious reasons exact scientific observations on this head are wanting. (For the individual diseases which hard drinking may induce see INEBRIETY.)

Such being the physiological effects of alcohol, so far as known, the next point is to analyze them and see how they are caused. As already noted, we have with alcohol to deal with a twofold influence—namely, the action of alcohol itself while present in the system as such, and also the dynamic outcome of its final oxidation. Pure alcohol is a highly-diffusible fluid, miscible both with watery and oily matters. It is powerfully hygroscopic, speedily desiccating moist tissues immersed in it, and it coagulates albumen. It is an intense irritant, and acts strongly upon living protoplasm, a small percentage added to a fluid containing living protoplasmatic organisms arresting those movements of the latter which are the measure of their vital activity. Alcohol also arrests or prevents putrefaction and fermentation. With these powerful affinities, therefore, it is not surprising that anything beyond a small percentage of free alcohol circulating in the blood and tissues should make disturbance. But not less striking are the consequences of the final oxidation of alcohol. Physiologists are now pretty much agreed that the greater part of the "energy" (using the word in the technical sense) which appears in animal dynamics as body-heat, muscular, nervous, glandular, and vital action in general, comes directly from oxidation within the system of non-nitrogenous food-substances, such as fat and sugar. Now, alcohol is also a non-nitrogenous substance, closely allied to fat in chemical composition, and, like it, is also oxidized within the body. Hence, since all oxidation is equally attended by conversion of "potential" into "actual" energy (using the terms always in the technical sense), it follows that the oxidation of alcohol must have the same kind of influence as that of fat or sugar. And since, moreover, the dynamic equivalent of alcohol is very nearly as high as that of fat, it is plain that where much alcohol is taken the dynamic result must be considerable. Even so small a quantity as 1½ ounces of absolute alcohol liberates by oxidation a quantity of "actual energy" equal to one-sixth of the whole amount required for the average daily vital needs of an adult man.

Bearing in mind, then, these two ways by which the ingestion of alcohol may affect the economy, we may proceed to analyze the effects already described. The effect upon *digestion* is obviously due to a direct local action, and is the same as that of irritants generally within the stomach, digestion being quickened when the irritation is feeble, and arrested and disordered when it is intense. Large and strong alcoholic draughts also probably coagulate the albu-

minous elements of the food and gastric juice, and thus still further impede digestion. The effect upon the *heart* may be in small part a reflex consequence of the gastric irritation, but is probably mainly a result of a direct action of the alcohol, after absorption, upon the nerves controlling the contractions of the heart. The *dilatation of the capillaries* is doubtless wholly due to direct action of the alcohol, and is the result of paralysis of the nerves whose influence normally maintains contraction of the walls of the blood-vessels against the outward pressure of the blood. The accompanying *sensation of heat* results from circulation of an unusual quantity of hot blood, direct from the interior, in the skin, where the nerves of feeling are distributed. The affections of the *general nervous system* are complex in character, and probably also in causation. The earliest manifestation—namely, a sense of general well-being, with abatement of feelings of physical or mental exhaustion and of small aches and pains—is probably in part a reflex consequence of the gastric irritation, since something of the same effect follows the swallowing of any substance that will cause a glow in the stomach, and in part a result of the alcohol-quickened circulation and capillary fulness, which, by augmenting the blood-supply in the tired nerves and muscles, tend directly to restore vigor to the same. The *exhilaration of spirits* that accompanies this general *bien-aise* is probably also produced by the same causes; for a hearty meal, and all influences that quicken the circulation, such as a cold bath, brisk exercise, or the breathing of the very pure air of the mountains or the sea, notoriously tend to produce the same result. But with slight increase of dose this simple exhilaration merges into the peculiar one-sided excitement of *intoxication*. The phenomena of this latter state are apparently wholly due to a direct action of the alcohol upon the substance of the brain and spinal cord, except that some of the coma in profound drunkenness may be a simple consequence of brain congestion. In the early stages intoxication consists of progressive failure of power to co-ordinate muscular movements, and, mentally, of unnatural excitation of the fancy, the passions, and emotions, with simultaneous unnatural enfeeblement of the reasoning faculty, judgment, moral sense, memory, and will. Alcohol thus shows the singular property of irritating some and paralyzing other parts of the brain and spinal cord at one and the same time. This double and opposite action, though curious and inexplicable, is comparatively common among nerve-poisons, opium and belladonna exercising it in fully as striking a manner as alcohol. In the latter stage of intoxication, even those centres which at first suffered excitement finally join in the general paralysis, until in "dead" drunkenness all nervous action is suspended except that concerned in maintaining the function of the heart and lungs. In overwhelming doses the respiratory centre also may finally succumb to the paralyzing influence, and the drinker die from arrest of breathing. An erroneous common belief is that in the earlier stage of intoxication the *intellectual* faculties are "stimulated"—that is, are aroused to an unwonted display of functional activity. Precisely the reverse is the case, and the error has arisen from the confounding of two entirely different things. It is true that a carefully-adjusted wholly *non-intoxicating* alcoholic draught will, like a bowl of hot beef-tea, a cup of coffee, or a snatch of sleep, temporarily restore to a tired brain something of its wonted vigor, probably through the increased blood-supply to the brain resulting from the action of alcohol on the heart. But an entirely different thing is to take a healthy person, in full intellectual vigor, and ply him with wine till his eye glistens and his cheek flushes with incipient intoxication; for now there is a specific mental disturbance, and though the imagination and the emotions do indeed run riot, yet *intellectual power* proper—the faculty of doing real "brain-work"—is simply in process of extinction from the very first. Thus, for instance, the usually grave lawyer, who under the influence of wine keeps the dinner-table in a roar with unwonted wit and mirth, is at the very moment less instead of better fitted for real intellectual work. Let him in the midst of his best story be suddenly called upon to deal with some important professional matter, and he will find that those qualities of large grasp of mind, deep penetration, shrewd forecasting, and ready application of knowledge which have made his fame at the bar, have now sadly deserted him. In precisely the same way the feeling of increased muscular power in the earlier stage of intoxication is wholly delusive. Careful experiments have shown that a well-fed man can accomplish more physical work and with less fatigue when sober than when continuously kept *consciously* affected by drink. But it will be observed that this is a different matter again from the addition of a wholly non-intoxicating alcohol-ration to an otherwise insufficient daily dietary. The next alcohol-effects—lessening of excreta and reduction of body-temperature—are, the former wholly and the latter mainly, mere consequences of a single effect—namely, diminished oxidation. For urea and carbonic acid, the excreta affected by alcohol, are simply the refuse products—the ashes, as it were—of the oxidation constantly going on within the system both of the food-derivatives in the blood, and, so far as they suffer change, of the tissues themselves. Diminished ashes therefore necessarily mean and prove diminished combustion. As to the reduction of temperature, since the animal heat is wholly maintained by the heat derived from these same oxidation-processes, repression of the latter necessarily tends to fall of the former. How the retarding of oxidation by alcohol is brought about is not wholly clear. It has been proved by ingeniously-contrived experiments upon animals to be entirely independent of any influence through the nervous system (*Binz*), and is probably largely due to direct interference with the function of the red blood-corpuscles in fixing and delivering oxygen. In the matter of reduction of temperature, besides the above-described influence of diminished oxidation, there is undoubtedly another factor—namely, the active determination of blood to the surface of the body, caused by the alcoholic quickening of the heart's action and dilatation of the capillaries. For now, an unwonted quantity of hot blood from the interior being distributed through the exposed tissues of the skin and lungs, the loss of body-heat by radiation from those surfaces, which is continually going on, will obviously be increased. Of course, the degree of effect thus produced will vary with the temperature of the air by which the body is surrounded, and while probably but slight under ordinary circumstances, it can yet readily be imagined to be considerable during exposure to severe cold. And that the latter is really the case is made likely by the well-known fact that alcohol-drinking, even in moderation, vastly lessens the power of the body to resist external cold; for travellers in arctic regions who indulge in spirits almost invariably succumb to the effects of the low temperature before those of their comrades who abstain. The effect of alcohol in supplementing an insufficient dietary—stopping loss of weight, removing the effects of inanition, and even, in fever, temporarily supporting life by itself alone—is probably again the resultant of two factors. One of these is undoubtedly the property of alcohol of itself fulfilling a very important food-function—that, namely, of being oxidized in the system, and thus serving as fuel to supply the needs of physiological dynamics. The other factor can be conceived to be the same repression of oxidation just discussed. For where this effect obtains, the food is, as it were, less wastefully consumed within the system, and the tissues are saved from unnecessary disintegration. But as this retarding of oxidation is only appreciable where the dose of alcohol is large, it can have but little influence in the ordinary dietetic use of alcoholic drinks in health. But in fever, where the waste of tissue and rate of oxidation generally are excessive, and alcohol is given in considerable quantities, the decided repression of oxidation that now takes place has undoubtedly a powerful influence in helping to support life. Alcohol in fever thus presents the singular picture of retarding the rate of oxidation generally, while itself falling a victim to the process at the same time. In a double way, therefore, it here economizes the system's store of fuel. The *organic diseases* attributable to habitual hard drinking are obscure in their causation, but are probably the result of the direct physico-chemical action of alcohol upon the tissues of the affected organs. Thus, the chronic catarrh of the stomach so common with drunkards is undoubtedly due to direct local irritation.

Alcoholic drinks are used as ordinary beverages in health and as medicines in disease. In all cases, in the determining of dosage, regard must be had to the varying general physiological resultant under different conditions. Where an alcoholic beverage is made an item of the regular dietary in health, the ration should be so limited as that the drinker is not appreciably affected by any of the specific alcohol-disturbances, and at the same time no risk is run of secondary injurious effects. From the great difference in individual susceptibility to the different alcohol-effects, and from the lack of exact knowledge concerning the conditions under which secondary diseases appear, it is impossible to put a definite figure to the above limit, especially one that shall be applicable to all cases. But for the striking of a general average we have the following data: With adults, when the daily ration contains not more than 1½ ounces of absolute alcohol, and is taken in portions equally divided with the later meals of the day, and in a beverage whose alcoholic strength is not higher than 10 per cent., all the alcohol is disposed of within the system, none appearing in the excretions, and, with the average of males at least, none of the specific alcohol-disturbances are produced beyond a trifling and very temporary quickening of the heart's action, and possibly a slight dilatation of the capillaries. Vital statistics, moreover, fail to show that

such a limited allowance is commonly followed by any injury to health. But if the above limit be exceeded, a trace of free alcohol appears in the excretions, showing that more is taken than the system can utilize; and, though intoxication may not be produced, yet now the heart and capillaries are affected to an injurious degree, oxidation is unduly interfered with, and secondary consequences may slowly declare themselves, such as dyspepsia with loss of appetite, short-windedness, easily-fatigued brain and muscles, unnatural fattening, and permanent congestions, perhaps followed by organic disease. It may therefore be said that a daily allowance of 1½ ounces of absolute alcohol represents for all persons the extreme physiologically safe limit for habitual alcoholic indulgence, while any quantity, no matter how small, which induces conscious alcohol-disturbance is for the individual so affected too much. Even this ration, moreover, should only be taken at the times and under the conditions set forth. Among ordinary alcoholic beverages this quantity of 1½ ounces of absolute alcohol is represented by from 3 to 3½ ounces of spirituous liquors (40 to 50 per cent.); about 9 of the weaker fortified wines, such as sherry, madeira, or port (17 per cent.), or 6 of the stronger (25 per cent.); 15 of the light wines, such as claret, hock, and champagne (average 10 per cent.); about 19 of strong ale (8 per cent.); and 30 of average beer (5 per cent.). But it must never be forgotten that these beverages are not simple alcoholic solutions, but contain other ingredients whose specific effects may often require the above allowance to be still further reduced. The effects of alcohol, when the dosage is confined to the foregoing limits, are simply such as result from gentle irritation of the stomach, slight quickening of the heart's action, and the *food-rôle* played by the alcohol in its final oxidation. That is, appetite is increased and digestion promoted; functional vigor generally tends to be restored from the quickened circulation in the fatigued organs; the feeling of comfort, refreshment, and general well-being, physical and mental, which ordinarily follows a wholesome and sufficient meal is hastened and enhanced; and less solid food has to be taken to satisfy hunger and keep up the weight of the body than on a teetotal dietary. All the effects due to dilatation of the capillaries, retardation of oxidation, *decided* acceleration of the heart, and specific action on the functions of the brain and spinal cord, are now practically wholly absent. The question of the wisdom of making alcohol part of the usual dietary involves many considerations besides the physiological, and is therefore beyond the scope of the present article. From the purely physiological point of view, with which alone we are here concerned, the foregoing analysis clearly shows that to a typically healthy and vigorous man, who is not overworked, and who can command a sufficiency of wholesome and appetizing food, alcohol is wholly superfluous. But it is equally apparent that in the condition so common among sedentary workers, of feeble digestion, sluggish circulation, and constant overtaxing of the nervous system, the property of a limited alcohol-ration of quickening digestive and circulatory activity, and furnishing a promptly and easily assimilated fuel-food, is, in itself considered, advantageous.

Medicinally, alcohol is of varied use. In primary failure of the heart's action it is one of the most powerful restoratives known. After exposure to cold, when there is danger of internal congestion or inflammation from the blood being driven from the surface, an alcoholic draught, by equalizing the circulation and forcibly determining the blood back again to the skin, may avert the threatened mischief. But *during* exposure to cold, unless the same be very brief, alcohol is best avoided for reasons already given, and in prolonged exposure to intense cold, as in arctic expeditions, it should be scrupulously abstained from as in the highest degree dangerous. In exhausting fevers alcohol may be of quadruple benefit, at once sustaining and strengthening the enfeebled heart, supporting life through the outcome of its oxidation when ordinary food cannot be taken, and tending both to check the disastrous disintegration of living tissue and to moderate the dangerously high fever-temperature. But its use requires judgment, and it is by no means always necessary, or even of benefit. Other uses are to relieve trivial spasmodic seizures; to temporarily invigorate in circumstances of exhaustion where a quickly-acting restorative is necessary; to calm nervous irritability and procure sleep; and to improve appetite and digestive power. In all cases where alcoholic drinks are used medicinally, though large amounts may be sometimes required, yet the production of intoxication is to be carefully avoided.

The *special effects of different alcoholic beverages* depend on the strength of the liquor in alcohol and on the presence of various other ingredients. Draughts of high alcoholic percentage irritate the stomach, impede and disorder digestion, and, by charging the blood quickly with a considerable volume of alcohol, are especially prone to intoxicate and poison. Hence, spirit-drinkers are peculiarly apt to suffer from dyspepsia, chronic gastric catarrh, and organic disease of the liver, and communities where spirits and strong wines are common drinks show more drunkenness than those where the lighter wines and beers are consumed.

Of the other ingredients of alcoholic beverages the most important are amylic alcohol, volatile ethers, tartaric and allied organic acids, carbonic and tannic acids, sugar, various salts, and the bitter and narcotic principles of malt liquors. *Amylic alcohol* occurs in spirits containing fusel oil. Its properties are generally the same in kind as those of common or ethylic alcohol, but the specific alcoholic effects are more intense and prolonged, and more easily induced. Spirits containing fusel oil are therefore especially deleterious. *Volatile ethers* develop in wines and spirits by keeping, and tend to make the liquor less apt to disorder the stomach and produce headache, and give it greater power in strengthening the action of the heart. Old wines and spirits are therefore valuable, not merely because of their more agreeable flavor, but also for being really more wholesome than new. *Free organic acids* occur in wines and malt liquors, tartaric being the principal acid of the former and acetic of the latter. The lighter wines contain a greater quantity than the stronger. These acids are wholesome, and tend to quench thirst and promote appetite and digestion. *Sugar* is present in varying quantity in malt liquors, in liqueurs and cordials, in most wines, and is sometimes added by the manufacturer to certain of the ardent spirits, as gin. Among wines those that contain the most sugar are the fortified wines, such as sherry, madeira and port, and champagne. The lighter hocks and clarets contain very much less, and sometimes even none at all. Saccharine alcoholic beverages are decidedly more trying to the digestion than the non-saccharine, the sugar being apt to ferment and breed acidity, flatulence, and nausea. They are especially obnoxious in the diseases *diabetes* and *gout*. Various *salts* are present in wines and malt liquors; those of vegetable acids are antiscorbutic. Free *carbonic acid* occurs in all effervescing beverages. It is thirst-quenching, stomachic, and tends to repress and remove nausea. Champagne, therefore, if very dry, can sometimes be retained by an irritable stomach when all other alcoholic fluids are rejected. *Tannic acid* (tannin) is present in appreciable quantity only in red wines, and as it precipitates slowly when the wine is kept, an old wine contains less of it than a new. Tannin is astringent, and in small quantity not unwholesome. A high percentage, however, such as is found in new red wines, is apt to disorder the stomach, and also gives the wine a rough, harsh, "puckery" taste. The *bitter principle* of malt liquors, derived from the hop, is in small quantity thirst-quenching and appetizing, but in large amount induces dyspepsia and diarrhœa. The hop also gives malt liquors a decided somniferous effect.

EDWARD CURTIS.

**Wines** (ENOCH COBB), D. D., LL.D., b. at Hanover, N. J., Feb. 17, 1806; graduated at Middlebury College 1827; was a teacher at St. Alban's, Vt., Alexandria, Va., Washington, D. C., and on board the U. S. man-of-war Constellation, in which he made a voyage to the Mediterranean 1829–32; took charge of the Edge Hill School, Princeton, N. J., 1833; became professor of languages in the Central High School at Philadelphia 1838; conducted a boarding school at Burlington, N. J., 1844–48; was licensed as a Congregational preacher 1849; was pastor of churches at Cornwall, Vt., and Easthampton, L. I.; became professor of ancient languages in Washington College, Pa., 1853; became president of the City University of St. Louis, Mo., 1859; secretary of the New York Prison Association 1862; founded the National Prison Association 1870, of which he became secretary; went to Europe as a representative of the U. S. government 1871; succeeded in convening representatives of twenty-six governments at the first International Penitentiary Congress at London, July 4, 1872, when he was appointed chairman of a commission which met at Brussels 1874 and at Bruchsal 1875, and has called a second international congress to meet at Stockholm 1877. Author of *Commentaries on the Laws of the Ancient Hebrews* (1853), and of several treatises on educational, economic, and religious topics.

**Wines'burg,** p.-v., Paint tp., Holmes co., O. P. 260.

**Win'field,** p.-v. and tp., Du Page co., Ill. P. 2211.

**Winfield,** p.-v. and tp., Lake co., Ind. P. 516.

**Winfield,** tp., Scott co., Ia. P. 991.

**Winfield,** p.-v. and tp., cap. of Cowley co., Kan., on Walnut River, 2 miles E. of Arkansas River, contains good schools, fine court-house and jail, 3 newspapers, 3 hotels, 2 grist-mills, and 2 banks. It is the principal trading-point for a large region. P. 472.

V. B. BECKETT, ED. "COURIER."

**Winfield,** p.-v., cap. of Winn parish, La. P. 94.

**Winfield,** tp., Montcalm co., Mich. P. 326.

**Winfield,** p.-v. and tp., Herkimer co., N. Y. P. 1561.

**Winfield,** p.-v., Dover tp., Tuscarawas co., O. P. 126.

**Winfield,** tp., Butler co., Pa. P. 1121.

**Winfield,** p.-v. and tp., Marion co., West Va. P. of v. 47; of tp. 1353.

**Winfield,** p.-v., cap. of Putnam co., West Va.

**Winfield,** tp., Sauk co., Wis. P. 758.

**Wing** (of an army). See ALA.

**Wing** (of birds). See BIRDS, by PROF. J. S. NEWBERRY, M. D., LL.D.

**Wing** (VINCENT), b. in England early in the seventeenth century, a mathematician and astronomer of considerable reputation, was author of *A Dreadful Prognostication* (1649), *Harmonicon Cœleste* (1651), *Astronomia Britannica* (1652), *Ephemerides from 1652 to 1658* (1652), *Ephemerides for Twenty Years, 1652–74* (1658), *Examen Astronomiæ Carolinæ Thomæ Streetii* (1665), *Ephemeris for Thirty Years, with Computatio Catholica* (1669), *The Art of Surveying* (1700), edited by John Wing, called "Philomath," probably his son; of a book and a sheet almanac published annually for the Stationers' Company, the latter of which is still continued under his name; and (with William Leybourn) of *Urania Practica* (1649) and *Ens Fictum Shakerlæi* (1649). D. in 1669 or 1670. (See *Vincent Wing, by J. G.* (1670), perhaps by James Gregory.)

**Win'gate** (CHARLES FREDERICK), b. at Harlem, N. Y., Mar. 5, 1847; educated in the public schools of New York; travelled in Europe 1866–67; adopted the career of a journalist, which he has since pursued, serving in all its branches, from reporting upward; was for five years the New York correspondent of the Springfield *Republican* over the signature "Carlfried;" has been a contributor to various literary periodicals; founded in 1872 (with Howard Lockwood) *The Paper-Trade Journal*, in 1873 *The American Stationer*, and in 1875 *The Housekeeper*, a monthly magazine, of which he is editor and proprietor; published in 1876 a series of four articles in the *North American Review* on the history of the "Tammany Ring," and is author of *Views and Interviews on Journalism* (1875).

**Wingate** (EDMUND), b. in Yorkshire, England, in 1593; graduated at Queen's College, Oxford, about 1614; studied law at Gray's Inn, cultivating at the same time mathematical researches; spent some years in France from 1624; taught English to the princess Henrietta Maria (afterward queen of England) and to some of the ladies of her suite, and also taught mathematics at the French court; inherited a landed estate in Bedfordshire, where at the commencement of the great rebellion he was a justice of the peace and recorder of Bedford; took the Covenant; sat in Parliament for the county; took about 1650 the oath called the "Engagement;" became a supporter and friend of Cromwell when Protector, and served as a commissioner for ejecting "scandalous" ministers from their benefices. D. in London in Dec., 1656. Author of *The Use of Proportional Rules in Arithmetic and Geometry* (in French, Paris, 1624; in English, London, 1626), *Arithmetic Made Easy* (1630), *Construction and Use of the Logarithmetical Tables* (1635), of other mathematical works and legal treatises.

**Wingate** (PAINE), b. at Amesbury, Mass., May 14, 1739; graduated at Harvard 1759; was ordained Congregational minister at Hampton Falls, N. H., Dec. 14, 1763; removed to Stratham, and became a farmer 1771; was a member of Congress under the Confederation 1787; U. S. Senator 1789–93; member of Congress 1793–95, and judge of the superior court of New Hampshire 1798–1809, and was the last survivor of the original members of the Senate, and was for some years the oldest graduate of Harvard. D. at Stratham, N. H., Mar. 7, 1838.

**Wing'field** (EDWIN MARIA), b. in England about 1570, of an opulent family; became a merchant in London; took part in the enterprise of colonizing Virginia under the patent of Apr. 10, 1606; sailed with the first company of emigrants Dec. 19, 1606; was named president of the colony by the sealed instructions opened on shipboard, but quarrelled with his associates, especially with Capt. John Smith; was deposed and replaced by Ratcliff, and returned to England in 1608, after which no further details of his life are known. His memory has been rehabilitated by the discovery of his *Discourse of Virginia* (Boston, 1860), edited in the *Transactions* of the American Antiquarian Society, vol. iv., from the original manuscript by Charles Deane of Boston.

**Wing'ham,** p.-v., Huron co., Ont., Can., on Great Western R. R., at the forks of the river Maitland, has extensive water-power and large manufactures. P. about 700.

**Wing'ville,** tp., Grant co., Wis. P. 1031.

**Win'hall,** p.-v. and tp., Bennington co., Vt. P. 842.

**Wink'elried, von** (ARNOLD STRUTH), native of the canton of Unterwalden, Switzerland; decided by his patriotic self-sacrifice the battle of Sempach, July 9, 1386, in which a small Swiss force was engaged with a large Austrian army under Archduke Leopold. By gathering the lances of Austrian halberdiers into his body and bearing them down to the ground, he effected a breach in the Austrian line, through which the Swiss made the attack. A monument was raised to him at Stanz, in Unterwalden, Sept. 3, 1865. (See Kleissner, *Die Quellen zur Sempacher Schlacht und die Winkelried Sage*, Göttingen, 1873.)

**Wink'worth** (CATHARINE), b. in England about 1825; has translated from the German *Lyra Germanica* (1855; 6th ed., illustrated, 1860; second series, 1858; new ed. 1862), *The Life of Amelia Wilhelmina Sieveking* (1863), *The Christian Singers of Germany* (1866), and *Palm-Leaves, Sacred Poems by Karl Gerok* (1871).

**Winkworth** (SUSANNA), sister of Catharine, b. in England about 1820; has translated from the German *The Life and Letters of Barthold Georg Niebuhr, with Essays by Bunsen, Brandis, and Loebel* (3 vols., 1851–52), *Theologia Germanica* (1854), Bunsen's *Signs of the Times* (1856) and *God in History, or the Progress of Man's Faith* (3 vols., 1868–70), *The History and Life of the Rev. John Tauler, with Twenty-five of his Sermons* (1857), and *German Love, from the Papers of an Alien* (1857), and completed, after the death of Archdeacon Julius Charles Hare, his *Life of Luther, in Forty-eight Historical Engravings by Gustav Koenig, with Explanations* (1855).

**Win'lock** (JOSEPH), LL.D., b. at Shelbyville, Ky., Feb. 6, 1826; graduated at Shelby College 1845; became professor of mathematics and astronomy in that institution; was employed at the observatory at Cambridge, Mass., as one of the computers of the *Nautical Almanac* 1852; became professor of mathematics in the U. S. navy 1857; was employed at the Naval Observatory at Washington, D. C., and at the Naval Academy at Annapolis, Md.; became director of the observatory at Cambridge, Mass., and Phillips professor of astronomy in Harvard University 1865; conducted expeditions to Kentucky to observe the solar eclipse of Aug., 1869, and to Spain to observe that of Dec., 1870, and made several improvements in the equipment of the observatory which have been generally adopted in similar institutions. D. at Cambridge June 11, 1875.

**Winn,** parish of N. Louisiana, bounded W. by Saline Bayou, and intersected by Dugdemona River; surface level, with many small lakes; soil fertile. Swine and cattle are the chief live-stock. Staples, cotton, Indian corn, and sweet potatoes. Cap. Winfield. Area, about 1000 sq. m. P. 4954.

**Winn,** p.-v. and tp., Penobscot co., Me. P. 714.

**Winneba'go,** county of N. Illinois, bordering on Wisconsin, drained by Pecatonia and Rock rivers, and connected by railway with Chicago; surface for the most part prairie, soil fertile. There are flour-mills, cotton-mills, paper-mills, and manufactories of agricultural implements, carriages, clothing, iron castings, machinery, and sashes, doors, and blinds. Horses, cattle, sheep, and swine are numerous. Staples, Indian corn, oats, wheat, rye, potatoes, wool, and dairy products. Cap. Rockford. Area, 508 sq. m. P. 29,301.

**Winnebago,** county of N. Iowa, bordering on Minnesota; surface rolling prairie-land, soil fertile. Staples, hay, wheat, oats, and Indian corn. Cap. Forest City. Area, 432 sq. m. P. 1562.

**Winnebago,** county of E. Wisconsin, lying on Lake Winnebago, drained by Fox and Wolf rivers, and having railroad connection with Milwaukee; surface level, soil fertile. There are numerous saw-mills, planing-mills, flour-mills, tanneries and breweries, manufactories of agricultural implements, carriages, furniture, boots and shoes, wagon materials, iron castings, machinery, sashes, doors, and blinds, matches, paper, and woollen goods. Sheep, cattle, and horses are numerous. Staples, manufactured articles, hay, wheat, oats, corn, hops, wool, and dairy products. Cap. Oshkosh. Area, 450 sq. m. P. 37,279.

**Winnebago,** p.-v. and tp., Winnebago co., Ill. P. 1427.

**Winnebago,** tp., Houston co., Minn. P. 804.

**Winnebago City,** p.-v. and tp., Faribault co., Minn. P. of v. 326; of tp. 780.

**Winnebago Indians,** a tribe of the Dakota stock, called by themselves *Hochungara* ("trout-eaters"), and by the Hurons *Awentsiwaen*, but named *Winnebago* ("men of the fetid or salt water") by the Algonkin tribes; were first found on the W. shore of Lake Michigan, surrounded by hostile Algonkin tribes. The Winnebagoes were formerly enemies of the whites, until after the Black Hawk

war, in which they took some part; were removed (in 1848) to Minnesota, where they settled on Blue Earth River, in a fine region, and prospered until 1863, when their removal was demanded by their white neighbors in consequence of unjust suspicions of their connection with the Sioux outbreak. They were then removed to Crow Creek, Dak., whence in the following year they were sent to a reservation of 128,000 acres in Nebraska, near that of the Omahas, 80 miles N. of Omaha City. Notwithstanding the ill-treatment and suffering they have endured, they are on the whole progressing. In 1874 they numbered 1445 souls in Nebraska, and several hundreds in Wood, Juneau, and Adams cos., Wis. The latter are self-supporting. Roman Catholic and Presbyterian missions have been established among them, with but little result.

**Winnebago Lake,** the largest lake entirely within the limits of Wisconsin, is traversed by the navigable Fox River. It is 26 miles long, and has a maximum breadth of 10 miles. Area, 212 sq. m. It is navigated by steamboats, and abounds in fish of various species. A part of its eastern shore has been curiously walled with stones by the action of the ice.

**Winnecon'ne,** p.-v. and tp., Winnebago co., Wis. P. of v. 1159; of tp. 2155.

**Winnemuc'ca,** p.-v., cap. of Humboldt co., Nev.

**Win'nepegoose,** or **Little Winnipeg Lake,** a lake 125 miles long and 25 miles wide, which lies some 50 miles W. of Lake Winnipeg, and nearly parallel to it. Its waters, with those of Lake Manitoba, flow into Lake Winnipeg.

**Win'neshiek,** county of N. E. Iowa, bordering on Minnesota, intersected by Upper Iowa and Turkey rivers, and traversed by Milwaukee and St. Paul R. R.; surface rolling prairies and woodland; soil fertile. There are flour-mills, saw-mills, woollen-mills, breweries, and manufactories of agricultural implements, carriages, iron castings, and machinery. Horses, cattle, and swine are numerous. Staples, Indian corn, oats, hay, and dairy products. Cap. Decorah. Area, 720 sq. m. P. 23,570.

**Win'nipauk,** p.-v., Fairfield co., Conn.

**Winnipeg,** cap. of Manitoba, Can.; also known as Fort Garry (which see).

**Win'nipeg Lake,** of British North America, between lat. 50° and 54° N. and lon. 96° and 99° W., the great reservoir of the Saskatchewan, is 280 miles long, varying in width from 60 miles in the N. part to 3 miles at the narrows toward its S. end. It receives at its S. end Red River, upward of 750 miles long by its very tortuous course. Toward its S. end the river Winnipeg enters, coming from the E. S. E. Lake Winnipeg is apparently about 9000 sq. m. in area, or nearly one-half larger than Lake Ontario. By recent surveys it is found to be 710 feet above the sea, or 112 feet higher than Lake Superior. It is very shallow at its S. end, toward the mouth of Red River. Its E. coast from the mouth of the river Winnipeg northward is a rugged Laurentian country, from which it receives Berens River, 160 miles long, and Jack River, 150, besides lesser tributaries. Southward and along its W. coast throughout is the level Silurian plain country, where a tract adjoining the province of Manitoba has been selected by a party of Icelandic settlers for the site of a national colony. The soil is very fertile, wooded, but interspersed with rich extensive meadows, and the fisheries of the lake are very rich. From the lake south-eastward the river Winnipeg, for 250 miles, up to and through the Lake of the Woods, and about 10 miles beyond it, is the boundary between the Laurentian and Silurian formations. The small but rapidly-increasing city of Winnipeg, the capital of the province of Manitoba, is situated 40 miles up from the lake on the W. side of Red River, immediately below the mouth of the river Assiniboin.

A. J. Russell.

**Winnipeg River** has its source in the outlets of Lake Sal and Lake of the Woods, and flows circuitously in a N. W. direction, entering Lake Winnipeg toward its S. E. extremity. Though only about 520 miles in length, it drains a wide area of high, humid, and wooded country, and delivers about as much water into Lake Winnipeg as the Saskatchewan, though not draining half the area, having about three times the volume of the Red River. Lac des Milles Lacs (in connection with Lake Shebandowan on a tributary of Lake Superior) and other lakes, upper waters of the river Winnipeg—with Rainy Lake and the Lake of the Woods, 73 miles long, into which they flow by the large and navigable reach of the Winnipeg called Rainy River, 80 miles long, and the lower reach from the Lake of the Woods to Lake Winnipeg, which, though obstructed with rapids on parts, can be made navigable—offer a line of navigation of great capacity as an outlet of the Saskatchewan Valley. It is now partly used by a line of steamers. On its lower course the Winnipeg receives English River, about 310 miles long. On the W. side of the middle of Lake Winnipeg it receives, through Little Saskatchewan River, the waters of Lake Manitoba, 135 miles long, and Lake Winnepegoose, 118 miles, forming with Red Deer River, which enters the upper part of the latter, a tributary 514 miles long, presenting an interior extent of navigation of considerable value.

A. J. Russell.

**Winnipiseog'ee Lake,** lies between Carroll and Belknap cos., N. H. It is of irregular outline, and has an extreme length of 25 miles and a breadth varying from 1 to 10 miles. It is studded with picturesque islands, and is much visited in summer for its charming scenery. Area, 175 sq. m.; elevation, 472 feet. It is navigated by steamboats, and discharges its clear waters by the Winnepiseogee River, one of the head-streams of the Merrimack.

**Winns'borough,** p.-v., cap. of Franklin parish, La.

**Winnsborough,** p.-v. and tp., cap. of Fairfield co., S. C. P. 1124.

**Wino'na,** county of S. E. Minnesota, bordering on Mississippi River, which separates it from Wisconsin, drained by Whitewater River, and traversed by Winona and St. Peter and Milwaukee and St. Paul R. Rs.; surface mostly rolling prairie, interspersed with woodland; soil fertile. There are railway repair-shops, flour-mills, saw-mills, planing-mills, breweries, and manufactories of agricultural implements, carriages, iron castings, sash, doors, and blinds, and lightning-rods. Cattle and horses are the chief live-stock. Staples, wheat, oats, corn, hay, and dairy products. Cap. Winona. Area, 638 sq. m. P. 22,319.

**Winona,** city and tp., cap. of Winona co., Minn., on a beautiful plateau on the W. bank of Mississippi River. The railroad system of the city embraces Winona and St. Peter, St. Paul and Chicago, Madison and Winona extension of Chicago and North-western, connected with Winona and St. Peter by a handsome iron bridge across the Mississippi, Green Bay and Minnesota R. Rs. Two other important lines—one to Central Iowa, and the other to the lumber-producing region of the Chippewa Valley in Wisconsin—are contemplated. The completion of these enterprises will, it is believed, make Winona the largest and most important commercial centre between St. Paul and St. Louis. The first white settlement made in this place was in 1851; in 1857 a city government was organized. Since that period the growth of the place has been steady and permanent. Winona is noted for the natural beauty of its site and surroundings, for its healthfulness, for the air of taste, comfort, and culture which pervades its residences, for its excellent system of graded schools, which rank among the highest of their class in the North-west, and generally for its thrift, energy, and commercial activity. It is the seat of the soldiers' orphans' home, a State institution, and also of the first State normal school of Minnesota, an exceedingly well-conducted and successful institution for the training of teachers. The normal school building is a symmetrical and imposing edifice, erected by the State at a cost of $145,000. The high school, a very handsome structure erected by the city, cost $55,000. A second public school building, completed in 1875, cost $35,000. There are in the city 15 organized churches, a well-selected public library of 5000 volumes, and 1 daily and 3 weekly newspapers. Among the business and manufacturing establishments are 3 national banks of issue and 1 savings bank, 3 wholesale grocery stores, 8 clothing stores, 5 boot and shoe establishments, 1 saddlery hardware store, 3 large saw-mills, 5 sash and door factories, 7 flouring-mills, 2 wheat-elevators, 2 foundries, several factories of agricultural implements, ploughs, etc., 6 carriage and wagon manufactories, 1 of which employs about 40 men, and is the largest W. of Lake Michigan; 1 blank-book manufactory, 1 confectionery and vinegar manufacturing establishment, gas manufactory, a tannery, a cracker-factory, 3 steam barrel-factories. The business portion of the town is compactly and substantially built of brick and stone, the streets are wide and regularly laid out, and the whole appearance of the place betokens business activity and prosperity. Lumber and grain are among the leading staples of trade, the sales of manufactured lumber in 1874 amounting to $1,500,000, and the exports of wheat (including flour) during the same year reaching 5,500,000 bushels, thus placing Winona at the head of wheat-exporting towns in the Mississippi Valley. P. of city, 7192; of tp., exclusive of city, 487.

D. Sinclair, Ed. "Daily Republican."

**Winona,** p.-v., cap. of Montgomery co., Miss., on New Orleans St. Louis and Chicago R. R., 271 miles N. of the former city, contains 3 churches, 4 schools, 1 newspaper, grist and planing mills, 1 sash and door factory, 3 hotels, court-house and jail, and fair-grounds. Cotton is the principal staple. P. 2200. Jones & Money, Eds. "Advance."

**Winooski.** See WINOOSKI FALLS.

**Winoos'ki Falls,** p.-o. in the v. of Winooski, in the tps. of Colchester and Burlington, Chittenden co., Vt., on both sides of Winooski River, which here makes a fall of 20 feet, supplying a water-power which is largely utilized for manufacturing purposes, is on Vermont Central R. R., 2 miles N. W. of Burlington, and includes the cemetery in the latter tp., in which is a lofty granite monument over the remains of Gen. Ethan Allen.

**Winooski** (or **Onion**) **River** rises in Caledonia co., Vt., and takes a south-westerly and afterward a north-westerly direction, flowing into Lake Champlain at a point 5 miles N. W. of Burlington. It has numerous falls, of which those at Middlesex and those at Winooski Falls, near Burlington, may be noticed.

**Wins'low,** p.-v. and tp., Stephenson co., Ill. P. 929.

**Winslow,** p.-v. and tp., Kennebec co., Me. P. 1437.

**Winslow,** p.-v. and tp., Camden co., N. J. P. 2050.

**Winslow,** tp., Jefferson co., Pa. P. 1320.

**Winslow** (BENJAMIN DAVIS), b. in Boston, Mass., in 1815; graduated at Harvard 1835, and at the (Episcopal) General Theological Seminary, N. Y., 1838; became assistant in the same year to Rev. Dr. (afterward Bishop) G. W. Doane in the pastorate of St. Mary's church, Burlington, N. J., and d. at Burlington Nov. 21, 1839. He is said to have been an accomplished preacher and a graceful poet. His *Sermons and Poetical Remains* (1841) were edited by Rev. Dr. G. W. Doane, who prefixed a biographical eulogy entitled *The True Catholic Churchman in his Life and in his Death.*

**Winslow** (CHARLES FREDERICK), M. D., b. at Nantucket, Mass., in 1811; graduated in medicine at Harvard 1834; contributed to scientific and literary periodicals; was U. S. consul at Payta, Peru, several years from 1862; visited the Sandwich Islands and other foreign countries, and was long a resident of California. Author of *Cosmography, or Philosophical Views of the Universe* (1853), *The Preparation of the Earth for the Intellectual Races* (1854), *The Cooling Globe, or the Mechanics of Geology* (1865), and *Force and Nature, etc.* (1869).

**Winslow** (EDWARD), b. at Droitwich, Worcestershire, England, Oct. 19, 1595, son of Edward Winslow, Esq., a member of a family of considerable note in that county; received a good education; became imbued with the doctrines of Puritanism, and having, while travelling on the Continent, made the acquaintance of Rev. John Robinson, pastor of the "Pilgrim" church at Leyden, joined his congregation 1617, and married there; embarked in the Mayflower with his wife and his brother Gilbert 1620; was one of the party in the shallop which explored the coasts of Cape Cod and discovered the port of Plymouth; lost his wife during the first winter; married Mrs. Susannah White, being the first marriage in New England; took an active part in public affairs; offered himself as a hostage to Massasoit, and paid two visits to the residence of that chieftain two days' journey inland, curing him of a severe illness on the second occasion (1623), thereby gaining his confidence and assuring his friendship; was followed to Massachusetts by three other brothers, two being Kenelm and Josiah; wrote a narrative of his visit to the Indians, which appeared in George Morton's *Relation* (1622); made a voyage to England as agent of the colony 1623, returning with a supply of necessaries and the first cattle; was chosen a magistrate 1624; made a second voyage to England, returning 1625; was chosen governor 1633; went to England again 1635, when he appeared before the council and succeeded in disconcerting a plot for abolishing the self-government enjoyed by the colonists; was thrown into the Fleet prison for seventeen weeks by order of Archbishop Laud, on complaint of Thomas Morton, for having at Plymouth taught in the church, being a layman, and having performed the ceremony of marriage as a magistrate; was again governor 1636, and a third time 1644; went to England for the last time 1649, when he was influential in the formation of the "Society for Propagating the Gospel among the Indians of New England;" remained in England during the Protectorate, being employed in several public capacities, and in 1655 was one of three commissioners sent by Cromwell to direct an expedition against the Spanish settlements in the West Indies. D. at sea of a fever, between Santo Domingo and Jamaica, May 8, 1655, and was buried at sea. A portrait, said to be by Vandyke, is preserved in Memorial Hall, Plymouth, where are also his chair and other relics. Author of *Good Newes from New England, or a True Relation of Things very Remarkable at the Plantation of Plimouth in N. England; together with a Relation of Customes among the Indians* (1624), *Hypocrisie Unmasked, a True Relation of the Proceedings of the Governeur and Company of the Massachusetts against Samuel Gorton, etc.* (1646), reissued as *The Danger of Tolerating Levellers in a Civill State, etc.* (1649), *New England's Salamander, etc.* (1647), *The Glorious Progress of the Gospel among the Indians in New England, with Appendix* (1649), and *A Platform of Church Discipline in New England* (1653), several of which have been republished by the Massachusetts Historical Society. An elaborate *Genealogy* of the descendants of Gov. Winslow and his brothers has been prepared by Dr. David Parsons Holton of New York. PORTER C. BLISS.

**Winslow** (FORBES BENIGNUS), M. D., D. C. L., b. in London, England, in Aug., 1810, son of Capt. Thomas Winslow of the 47th regiment, and a descendant of the Massachusetts Winslows; studied in private schools in Scotland and at Manchester; came to the U. S. in early life; commenced the study of medicine at New York; graduated at the College of Surgeons, London, 1835; took his degree of M. D. at Aberdeen; commenced practice in London; was for some time Parliamentary reporter for the *Times;* gave special attention to insanity; was Lettsomian lecturer to the Medical Society of London 1837; opened a private asylum at Sussex House, Hammersmith, and subsequently another in London; founded in 1848 the *Quarterly Journal of Psychological Medicine and Mental Pathology,* which he conducted until 1865; became in 1857 president of the association of medical officers of hospitals and asylums for the insane, and in 1859 a commissioner of lunacy; founded *The Medical Critic* 1861; was chosen vice-president of the Juridical Society and president of the Medical Society of London 1853; was frequently examined as an expert in criminal trials involving the question of the insanity of the prisoner, and was a firm upholder of the doctrine of "moral insanity;" was a member of the leading scientific societies, "an indefatigable worker, a genial philanthropist, a good talker, and a hospitable host, and highly esteemed by a large circle of friends." D. at Brighton Mar. 3, 1874. Author of *The Application of the Principles of Phrenology to the Elucidation and Cure of Insanity* (1831), *A Manual of Osteology, A Manual of Practical Midwifery, Physic and Physicians* (2 vols., 1839), *The Anatomy of Suicide* (1840), *On the Preservation of the Health of the Body and Mind* (1842), *The Plea of Insanity in Criminal Cases* (1843), *Notes on the Lunacy Act* (1845), *On Softening of the Brain, arising from Anxiety and Undue Mental Exercise* (1849), *The Lettsomian Lectures on Insanity* (1854), *On Obscure Diseases of the Brain and Disorders of the Mind* (1860; 4th ed. 1868), *Light, its Influence on Life and Health* (1867), and other professional treatises, and was a frequent contributor to medical journals and to the London *Times* and *Pall Mall Gazette.*

**Winslow** (GORDON), M. D., D. D., brother of Drs. Hubbard and Miron, b. at Williston, Vt., in 1804; became an Episcopal clergyman; was rector of churches at Troy, N. Y., Annapolis, Md., and Staten Island; served as chaplain of the Duryee Zouaves 1861, and inspector of the Army of the Potomac for the Sanitary Commission 1863, and was drowned in the Potomac June 7, 1864. Author of various pamphlets and a contributor to several periodicals.—His son, CLEVELAND, b. in 1836, became colonel of volunteers in the Army of the Potomac, and d. of wounds received at the battle of Mechanicsville, Va., July 7, 1864.

**Winslow** (HUBBARD), D. D., brother of Drs. Gordon and Miron, b. at Williston, Vt., Oct. 30, 1799, son of Nathaniel, a distinguished instructor (1752–1832), and a descendant of Kenelm of the Mayflower; studied at Phillips Academy, Andover, Mass.; graduated with honors at Yale College 1825; studied theology under Dr. N. W. Taylor at New Haven; preached at Litchfield, Conn., 1827–28; was pastor of the First church at Dover, N. H., 1828–31, and of the Bowdoin street church, Boston, Mass., 1832–44, in which he was eminently successful; travelled in Europe; was principal of Mount Vernon (Boston) institute for young ladies 1844–53; took an active part in the discussion of educational questions; was an examiner at Harvard and a trustee of several colleges; visited Europe to inspect educational institutions 1853; edited the *Religious Magazine* and wrote for numerous periodicals; defended the doctrines of his former instructor, Dr. Taylor, against the attacks of Dr. Bennet Tyler, gaining great repute as a polemical theologian; delivered lectures on scientific, religious, educational, literary, and practical topics, including the duties of citizens; preached to the First Presbyterian church at Geneva, N. Y., 1857–59, and became pastor of the Fiftieth street Presbyterian church, New York City, 1861. D. at Williston, Vt., Aug. 13, 1864. Author, among other works, of *Controversial Theology* (1832), *The Doctrine of the Trinity* (1834), *The Young Man's Aid to Knowledge* (1836), *Woman as She Should Be* (1838), *Elements of Intellectual Philosophy* (1851), *Elements of Moral Philosophy* (1856), and *The Hidden Life* (1862).

**Winslow** (Jacques Bénigne), b. at Odense, Denmark, in 1669, was probably a descendant of the English Puritan family of the name at Leyden, Holland; studied medicine at Paris, where he settled; became in 1743 professor of anatomy and physiology at the Jardin du Roi; made important discoveries in anatomy, of which a memorial remains in the name "foramen of Winslow" borne by an opening in the gastro-splenic omentum. D. at Paris in 1760. Author of *Exposition anatomique de la Structure du Corps humain* (Paris, 1732), which was translated into English, German, Italian, and Latin.

**Winslow** (James), b. at Albany, N. Y., in 1814; passed his early business life in the hardware store of Erastus Corning in that city; subsequently came to New York, and entered the banking firm of Winslow, Lanier & Co., which had been established by his father, and which rose from modest proportions to a position of financial influence, and rendered important services to the government of Pres. Lincoln in connection with the war-loans. Mr. Winslow was identified with the rise of national banks, of several of which he was an officer. D. in New York City July 18, 1874.

**Winslow** (John), grandson of Gov. Josiah, b. at Marshfield, Mass., May 27, 1702; was a captain in the unfortunate British expedition against Cuba 1740; was prominent in the Kennebec and Acadian expeditions, being the principal actor in the expulsion of the Acadians from their homes in 1755; commander at Fort William Henry 1756; took part as major-general in the expedition against Canada 1758–59; became judge of common pleas for Plymouth co. 1762; was the founder of the town of Winslow in the district of Maine 1766, and was a member of the Massachusetts legislature and of the provincial council during the Stamp-Act difficulties. D. at Hingham, Mass., Apr. 17, 1774. Most of his family were loyalists, and settled in Nova Scotia during the Revolution.

**Winslow** (John A.), U. S. N., b. Nov. 9, 1811, in North Carolina; entered the navy as a midshipman Feb. 1, 1827; became lieutenant in 1839, commander in 1855, captain in 1862, commodore in 1864, rear-admiral in 1866. Served on the E. coast of Mexico during our war with that country, and participated in the capture of Tuspan; but the service which placed his name on the roll of fame was that performed by him on June 19, 1864, when, in command of the Kearsarge, he sent to the bottom, after an hour's action, the Confederate steamer Alabama, which had made such havoc among American merchantmen. The fight was about as fair a one as has ever been fought at sea, "the vessels being well matched in size, speed, armament, and crew," and the honorable secretary of the navy but expressed the public sentiment when, in his dispatch of July 6, 1864, he wrote: "The battle was so brief, the victory so decisive, and the comparative results so striking, that the country will be reminded of the brilliant actions of our infant navy which have been repeated and illustrated in this engagement." A story which was for some time current, that the Kearsarge was an "iron-clad," had its foundation, most probably, in the fact that her executive officer had had her sheet cables "stopped up and down her sides, so as to cover her midship section;" and as this expedient had often been resorted to before by Union naval officers for the protection of one of the vital parts of a ship (her motive-power) from projectiles, it seems somewhat singular that it should not have suggested itself to any one on board the Alabama. D. Sept. 29, 1873. Foxhall A. Parker.

**Winslow** (Josiah), son of Gov. Edward, b. at Marshfield, Mass., in 1629; became commander of the Marshfield military company 1652; captured Alexander, the son of Massasoit, 1656, thereby probably averting a meditated attack upon Plymouth Colony; became major and commander-in-chief of the colonial forces 1658; was chosen deputy 1657, and one of the commissioners of the united colonies 1658, to which post he was annually re-elected until 1670; served several years as assistant governor, and was governor from 1673 until his death, including the trying period of King Philip's war, when he was both *ex-officio* and by virtue of his military rank the general-in-chief of all the forces of the united colonies. D. at Marshfield Dec. 18, 1680. He was the first native-born governor of Plymouth Colony.

**Winslow** (Miron), D. D., LL.D., brother of Drs. Gordon and Hubbard, b. at Williston, Vt., Dec. 11, 1789; graduated as valedictorian at Middlebury College 1815, and at Andover Theological Seminary 1818; married Miss Harriet Wadsworth Lathrop; sailed for Ceylon as a missionary of the A. B. C. F. M. June, 1819; arrived at Jaffna Feb., 1820; labored there and at Oodoville seventeen years; lost his wife at the latter place Jan. 14, 1833; founded the Madras mission 1837; was president of the important native college established at that city in 1840; translated the Bible into Tamil (finished about 1835); published educational and religious books in that language; supervised the mission press; wrote largely for the *Missionary Herald* and other European and American periodicals; prepared a *Memoir of Mrs. Harriet Winslow* (New York, 1835), which was widely read for many years, republished in England, and translated into French and Turkish, and devoted three or four hours daily for nearly thirty years to the preparation of his great work, *A Comprehensive Tamil and English Dictionary of High and Low Tamil* (Madras, 1862), partly based upon MS. materials left by the Rev. Joseph Knight—a work of a highly original character, containing over 67,000 Tamil words, and constituting one of the noblest of the many contributions of American missionaries to comparative philology. D. at the Cape of Good Hope when on a voyage to America, Oct. 22, 1864. By his second wife, Anne Spiers (d. 1844), daughter of a physician of the Madras service, he had two sons—Charles, b. at Madras June 5, 1839; educated in England, also at Yale and Williams colleges, and in medicine at the University of Pennsylvania; was a surgeon in the civil war, and at its close settled and married at Ciudad Guerrero, Mexico; and Miron, b. at Madras Aug. 28, 1840; educated at Yale College; served as officer of a New York regiment in the Army of the Potomac; graduated at Columbia College Law School 1864, and practises his profession in New York.

**Winslow** (Octavius), D. D., b. in England about 1815; received a good education; studied theology, and became a prominent Baptist minister in London.—His mother, Mrs. Mary Winslow, was a deeply religious lady, who has become well known through her biography, entitled *Life in Jesus* (1855), by her son, Dr. Winslow, who is also author of *Views of the Atonement* (1839; 8th ed. 1861), *Midnight Harmonies* (1851), *Human Sympathy* (1853), *Morning Thoughts* (1856), *Evening Thoughts* (1857), *Hidden Life* (1857), *Helps Heavenward* (1860), and many other devotional treatises.

**Winslow** (Stephen N.), b. in 1826; has been since 1844 one of the editors of the Philadelphia *Commercial List* and *Inquirer;* has written largely for other periodicals, and is author of *Biographies of Successful Philadelphia Merchants* (1864).

**Win'sor** (Justin), b. at Boston, Mass., Jan. 2, 1831; educated at Cambridge, Paris, and Heidelberg; contributed to the *Christian Examiner*, the *Knickerbocker Magazine*, and other periodicals; has been since Feb., 1868, superintendent of the Boston Public Library, and has much advanced the interests of students by his series of carefully-prepared special catalogues of that institution. Author of *A History of the Town of Duxbury* (1849); editor of Joseph Ware's *Journal of an Expedition against Quebec in 1775* (1852), and co-editor with Rev. George H. Hepworth of *Songs of the Unity* (1859). He has in preparation *The Life and Times of David Garrick, a View of the Eighteenth Century in England, in its Social, Literary, and Dramatic Relations, and their Influence upon Continental Life and Letters.*

**Win'stanley** (Henry), b. at Lettlebury, England, about 1650; became an eminent architect, designer, and engraver; published two volumes of architectural sketches of the royal palace of Audley End, and built (1696–1700) the first Eddystone lighthouse, where he perished during the storm in which it was swept away, Nov. 26, 1703.

**Win'sted,** p.-b. (incorporated), Litchfield co., Conn., at the northern terminus of Naugatuck R. R., 62 miles by rail from Bridgeport, and 26 miles W. of Hartford; Connecticut Western R. R. (Hartford to Millerton, N. Y.) intersects with the Naugatuck at this point. The borough contains the two villages of Winsted and West Winsted, each having a post-office (about 1 mile apart), the villages being connected by one continuous Main street, about 3 miles in length, following the winding course of Mad River (a branch of the Farmington), which furnishes an excellent water-power. The geography of Winsted is wonderfully diversified and remarkably picturesque. The business portion is mainly along the river-bank, while private residences peep out from its many sloping hillsides. Near the western limit of the borough is Long Lake, a natural body of water artificially strengthened, whose surface is about 150 feet above Main street, covering an area of about 400 acres. In addition to the superior water-power furnished by this lake, the two villages are supplied with water in pipes, the pressure being sufficient to force water over any building on Main street. A volunteer fire department is amply supplied with hose-carriages. The growth of Winsted is due to her manufacturing interests. The chief products of her manufactories are clocks, scythes, book leather, pocket and table cutlery, pins, wagon, carriage, and car axles, wagon springs, coffin trimmings, carriage bolts, planters' hoes, sewing silk, shelf

hardware, etc. Within the limits of the borough are 5 churches, excellent schools, a convent, an opera-house, 3 hotels, 3 weekly newspapers, gasworks, 1 national and 2 savings banks, and a well-endowed Beardsley (public) Library. P. 4000. J. H. VAILL, ED. "HERALD."

**Winsted,** tp., McLeod co., Minn. P. 638.

**Win'ston,** county of N. Alabama, watered by affluents of Black Warrior River; surface rolling table-land, soil fertile. Swine are the chief live-stock. Staples, Indian corn, cotton, and sweet potatoes. Cap. Houston. Area, about 900 sq. m. P. 4155.

**Winston,** county of Central Mississippi, drained by the head-waters of Pearl River; surface undulating, soil fertile. Swine and cattle are the chief live-stock. Staples, cotton and corn. Cap. Louisville. Area, 720 sq. m. P. 8984.

**Winston,** p.-v. and tp., cap. of Forsyth co., N. C., on North-western North Carolina R. R., 120 miles N. W. of Raleigh, has good schools, 2 newspapers, 3 tobacco warehouses, 10 tobacco manufactories, 1 spoke and handle factory, and 2 wagon and carriage establishments. An extensive traffic is carried on in the fruit line. P. of v. 443; of tp. 1693. GEO. M. MATHES, ED. "SENTINEL."

**Winston** (CHARLES), F. S. A., b. in England in 1814; studied law at the Inner Temple; practised as a special pleader from about 1835 until called to the bar in 1845, and was a learned and zealous artist and antiquary. D. in London Oct. 3, 1864. He bequeathed his 800 drawings from ancient stained glass to the British Museum. Author of *An Inquiry into the Difference of Style observable in Ancient Painted Glass, with Hints on Glass-Painting* (Oxford, 2 vols., 1847), *An Introduction to the Study of Painted Glass* (1849), and of a posthumous work, *Memoirs illustrative of the Art of Glass-Painting* (1865), edited by Philip H. Delamotte, and illustrated with 40 engravings from the author's original drawings. Mr. Delamotte has since (1868) issued a new edition, similarly illustrated, of the *Inquiry*.

**Winston** (JOHN ANTHONY), b. in Madison co., Ala., in 1812; educated at Lagrange College and at the University of Nashville; settled in 1834 in Sumter co., where he established a large plantation; was a member of the assembly 1839–40, and again 1842, and of the senate 1843–52, being president of the latter body 1845–48; engaged in mercantile business at Mobile 1844; was an influential member of the Baltimore convention of 1848, where he was the acknowledged leader of the Alabama Democracy; was the first native-born governor of Alabama 1853–56; gained the name of the "veto governor" by his conflicts with the legislature; was delegate to the Charleston convention of 1860, and was placed on the Douglas electoral ticket; went as a commissioner to Louisiana in 1861; raised the 8th Alabama infantry in the Confederate service; commanded it as colonel at Yorktown and on the Peninsula, being distinguished at Seven Pines, but was soon forced to retire through infirm health; was chosen to the State constitutional convention 1865, and elected in 1866 U. S. Senator, but not admitted to a seat. D. at Mobile Dec. 21, 1871.

**Winston** (JOSEPH), b. in Virginia in 1746; joined a company of rangers and marched to the W. frontier against the Indians 1760; was twice wounded in a battle on Greenbrier River, and was granted a pension for his gallantry; removed to Stokes co., N. C., 1766; took an active part in the Revolution; raised a regiment, of which he was commissioned major, 1766; marched against the Cherokee Indians, with whom he made a treaty 1777; had various actions with the Tories of North Carolina; commanded the American right wing at the battle of King's Mountain; had a sword voted him by the legislature, in which he frequently served; was a member of Congress 1793–95, and again 1803–07. D. near Germantown, N. C., in 1814.

**Win'ter,** that season of the year which begins with the shortest day, Dec. 21, and ends with the vernal equinox, Mar. 21. In the southern hemisphere the winter months are June, July, and August, and in the tropical zone the rainy season corresponds to the winter.

**Winter** (WILLIAM), b. at Gloucester, Mass., July 15, 1836; was educated in Boston; graduated at the Harvard Law School and admitted to the Suffolk bar; began to write both verse and prose at an early age; published a volume of poems at Boston in Dec., 1854; in 1856 lectured in and around Boston on literary subjects; published a second volume of poems, entitled *Queen's Domain*, at Boston in 1858; went to New York City in 1859, and was employed as book reviewer on the *Saturday Press* for one year; wrote for *Vanity Fair* irregularly for a long time; was dramatic critic for the New York *Albion* from 1861 to 1866, and also assistant editor and literary critic; for five years was managing editor and literary and dramatic critic of the New York *Weekly Review;* in 1865 became dramatic critic of the New York *Tribune;* published a third volume of poems, entitled *My Witness*, in Sept., 1871; published *Life of Edwin Booth* (Boston, 1872). J. B. BISHOP.

**Winter, von** (PETER), b. in 1755 at Manheim, Baden; entered, when eleven years old, the court-orchestra of his native city as a violinist; was appointed director of orchestra in 1776, and chapel-master in 1788 at the court of Munich. D. there Oct. 17, 1825. He visited Vienna in 1783 and 1794–96, Italy in 1791 and 1816, London in 1803–05, and Paris in 1805–07, bringing on the stage, with considerable success, his own operas, of which he wrote about 50. He was also an excellent singing-master, and his great *Gesangschule* (Mentz, 1824) is still used.

**Win'terberry,** a name applied to several American shrubs, forming a sub-genus of the *Ilex* or holly, and more particularly designating the black alder (*Ilex verticillata*), which ranges from five to twelve feet in height, grows on the edges of swamps, and bears in November and December an abundance of brilliant crimson berries, sometimes employed in domestic medicine as a bitter tonic.

**Win'terbottom** (THOMAS MASTERMAN), M. D., b. in England in 1765; became physician to the African colony of Sierra Leone; was one of the earliest anti-slavery advocates, and founder of several charitable funds. D. at Westoe, Durham, July 8, 1859. Author of *Medical Directions for the Use of Navigators and Settlers in Hot Climates* (2d ed. 1803) and *An Account of the Native Africans in the Neighborhood of Sierra Leone* (2 vols., 1803).

**Wintergreen.** See GAULTHERIA.

**Wintergreen, Oil of,** or **Oil of Gaultheria,** an aromatic liquid contained in the leaves of *Gaultheria procumbens* (partridge-berry, wintergreen, deer-berry, tea-berry, mountain tea), also in *Betula lenta* (sweet birch), and probably in the roots of *Polygala paucifolia, Spiræa ulmaria, Spiræa lobata,* and *Gaultheria hispidula.* It is colorless when freshly prepared, but gradually acquires a yellowish or reddish hue; possesses a peculiar sweetish taste and a characteristic and very agreeable odor; has a greater density than any other of the essential oils (1.173), and boils at 412° F. Wintergreen oil contains about 90 per cent. of methyl-salicylic acid (gaultheric acid), ($C_8H_8O_3$), and 10 per cent. of a terpene termed *gaultherilene,* isomeric with oil of turpentine. (See TURPENTINE.) The former compound, which is an isomere of anisic acid, is obtained in the distillation of the oil by allowing the boiling-point to rise to 432° F., and then collecting the portion that distils over; it can also be prepared artificially by distilling a mixture of 2 parts of crystallized salicylic acid, 2 parts of wood-spirit, and 1 part of sulphuric acid (sp. gr. 1.66), or by treating wood-spirit with salicylic chlorohydrate. Methyl-salicylic acid has a sp. gr. of 1.18, boils at 431° F., and possesses the taste and odor of the oil from which it is prepared. It is slightly soluble in water, dissolves readily in alcohol and in ether, and unites with bases, forming crystalline salts. Its aqueous solution is colored violet upon addition of a ferric salt. The purity of commercial wintergreen oil can be ascertained by means of this reaction, as well as by its very high specific gravity. It is often employed to disguise the taste of disagreeable medicines, and largely in confectionery. J. P. BATTERSHALL.

**Win'terhalter** (FRANZ XAVIER), b. at Blasica, Baden, Germany, Apr. 20, 1806; studied art at Munich and at Rome; took up his residence at Paris 1834; became distinguished as a portrait and genre painter; "belonged to the modern French school of art, which believes in intensity of color;" was distinguished for accuracy of drawing, grace of position, and the vividness and perfection of light and shade; was in great demand as portrait-painter to royal and princely houses, visiting nearly all the European capitals; first visited London 1842, and was well received at court; painted in 1848 a group of Queen Victoria, Prince Albert, and their children, which is well known by Cousens's engraving; subsequently made several other portraits of the English royal family, also of Louis Philippe and his queen, Napoleon III. and the empress Eugénie, etc.; received the grand cross of the Legion of Honor, many other decorations, and several medals. D. at London July 8, 1873. Among his genre pictures, the most noted are *Maternal Love* (1836), *The Decameron* and *The Young Daughter of Aricia* (1838), and *Florinda and Roderick the Goth* (1852), purchased for the royal collection.

**Win'terport,** p.-v. and tp., Waldo co., Me. P. 2744.

**Win'ter's Bark** [named from Capt. John Winter, who first brought it from the Straits of Magellan in 1579], the bark of *Drimys Winteri,* a magnoliaceous evergreen shrub which grows from Southern Chili S. to Cape Horn. It is a pleasant aromatic, tasting and smelling somewhat like cinnamon. It was once considerably employed in medicine as a stimulant tonic, but is now but little used.

**Win'terset,** p.-v., cap. of Madison co., Ia., on Chicago Rock Island and Pacific R. R., 42 miles from Des Moines, was incorporated in 1857, and contains a fine court-house, excellent schools, 2 banks, 2 weekly newspapers, 1 woollen-factory, several flouring-mills, and good building-stone quarries. P. 1485.

CUMMINGS & SPRINGER, EDS. "MADISONIAN."

**Win'tersville,** p.-v., Cross Creek tp., Jefferson co., O. P. 113.

**Win'terswyk,** town of the Netherlands, province of Gelderland, near the Prussian frontier, is neatly built, and manufactures cotton and linen stuffs and tiles. P. 7377.

**Win'terthur,** town of Switzerland, canton of Zurich, on the Enlach, is surrounded with vineyards, and has large breweries, tanneries, foundries, soapworks, and manufactures of cotton, linen, and chemicals. P. 9404.

**Win'throp,** p.-v., Buchanan co., Ia.

**Winthrop,** p.-v. and tp., Kennebec co., Me. P. 2229.

**Winthrop,** p.-v. and tp., Suffolk co., Mass. P. 532.

**Winthrop** (FITZ-JOHN), F. R. S., eldest son of Gov. John of Connecticut, b. at Ipswich, Mass., Mar. 14, 1638; resided in childhood at New London, Conn.; was educated in England; held a commission under the Protector Richard Cromwell 1658; returned to Connecticut about 1670; was elected to the assembly 1671; served as major in King Philip's war; was one of the council of Gov. Andros 1686; became a magistrate in Connecticut 1689; was major-general of the expedition against Quebec 1690; was a highly-efficient agent of Connecticut in London 1693–98, and governor of Connecticut from 1698 until his death, at Boston Nov. 27, 1707. Like his father, he was well versed in natural philosophy.

**Winthrop** (JAMES), LL.D., son of Prof. John, b. at Cambridge, Mass., in 1752; graduated at Harvard 1769; was librarian there 1772–87; participated in the battle of Bunker's Hill, where he was wounded, 1775; was for some years chief-justice of the Massachusetts court of common pleas and register of probate. D. at Cambridge Sept. 26, 1821. He bequeathed his valuable library to Alleghany College, Meadville, Pa. Author of *An Attempt to Translate the Prophetic Part of the Apocalypse of St. John into Familiar Language* (1794), *A Systematic Arrangement of several Scriptural Prophecies relating to Antichrist* (1795), and *An Attempt to Arrange, in the Order of Time, Scripture Prophecies yet to be Fulfilled* (1803). He contributed scientific papers to the *Memoirs* of the American Academy, and was a frequent writer for the *Literary Miscellany.*

**Winthrop** (JOHN), b. at Groton, Suffolk, England, Jan. 12, 1587 (O. S.), son of Adam (1548–1623), a London lawyer of ancient lineage and good education, who inherited the lordship of the manor of Groton; was educated at Trinity College, Cambridge, graduating about 1605; studied law; was appointed a justice of the peace at the age of eighteen years; married a daughter of Mr. Forth of Much Stambridge, Essex, and acquired such influence among the Puritans of the eastern counties and the capitalists of the "Company of the Massachusetts Bay in New England" that he was chosen governor of that body Oct. 20, 1629; was the leader of the great emigration of the following year, when, having sold his Suffolk estates, he sailed from Yarmouth Apr. 7, 1630, in the Arbella, accompanied by Isaac Johnson and his lady, daughter of the earl of Lincoln (for whom the vessel was named), Thomas Dudley and Simon Bradstreet, late stewards of that nobleman's estates, Sir Richard Saltonstall, Rev. John Wilson, and other distinguished men, with some 900 colonists, in a fleet of seventeen vessels; wrote on board the Arbella his treatise *A Modell of Christian Charity;* landed at Salem June 12, 1630; soon removed to Charlestown, where he was one of the four original members of Mr. Wilson's church; selected the peninsula of Shawmut (now Boston) as the site of the capital town of the colony, and settled there Sept. 7, 1630; visited Plymouth with Mr. Wilson, and established a good understanding with the government of that colony; acquired in the same year the island in Boston harbor known as Governor's Island, and still owned by his descendants; was annually re-elected governor until 1635, when he was replaced by John Haynes, thereby escaping the chief responsibility for the proceedings against Roger Williams, in which he nevertheless shared as an assistant; was again defeated at the election of 1636 by the young Henry Vane, then recently arrived, who was put forward as the champion of the "Antinomian and Familist" party directed by Wheelwright and Mrs. Hutchinson; was chosen governor uninterruptedly 1637–40; had a controversy with Vane and his party, terminated by the withdrawal of the former to England and the banishment of the heads of the latter, and was again governor 1641–43, deputy governor 1644–45, and governor from 1646 until his death, at Boston Mar. 26, 1649. After the death of his first wife, by whom he had one son, John, who became governor of Connecticut, he married a daughter of William Clopton of London, who soon died, and as his third wife a daughter of Sir John Tyndal, by whom he had four sons. He was a devout, charitable man, of enlightened principles, tolerant by nature, though a vigorous asserter of the rights of authority; was a good scholar, especially on theological questions, and left an interesting and valuable body of correspondence, given in his *Life and Letters* (2 vols., 1864–67) by his descendant, Robert C. Winthrop, and a copious *Journal,* which was edited, from the original MSS., with notes, by James Savage, under the title *The History of New England from 1630 to 1649* (2 vols., Boston, 1825–26; 2d ed. 1853). The first part had already been published by Noah Webster at Hartford (1790). Many of the *Winthrop Papers* were printed in the *Collections* of the Massachusetts Historical Society (3d series, vols. ix. and x.). The facts concerning his ancestry and early life may be found in William H. Whitmore's *Notes on the Winthrop Family and its English Connections* (Albany, 1864). His statue was presented to the U. S. government by the State of Massachusetts, and was placed in the Federal Capitol in 1876.

PORTER C. BLISS.

**Winthrop** (JOHN), F. R. S., son of the preceding, b. at Groton, Suffolk, England, Feb. 12, 1606; graduated at Trinity College, Dublin, 1625; studied law at the Inner Temple, London; obtained a commission in the army; participated in the expedition for the relief of the Huguenot garrison at La Rochelle, France, 1627; visited Turkey as an attaché of the British embassy 1628; came to Massachusetts 1631; was chosen a magistrate 1633, and settled at Ipswich Mar., 1633; went to England the same year; obtained a commission under the grant to Robert Rich, earl of Warwick, by virtue of which he founded a settlement at Saybrook, at the mouth of Connecticut River, Nov., 1635; built a fort there and acted as governor; removed his family from Boston to Pequot Harbor 1645, and founded New London; was chosen a magistrate of Connecticut 1651, after the union of Saybrook to that colony; was chosen governor of Connecticut 1657, and annually re-elected through life; went to England 1661; obtained from Charles II. a charter uniting Connecticut and New Haven in one colony, under himself as governor; was an early member of the Royal Society (founded 1662), and a contributor to its *Transactions,* being well versed in chemistry and physics; represented Connecticut at Boston 1676 and the congress of the united colonies, and d. there Apr. 5, 1676. He married Elizabeth, daughter of the celebrated Hugh Peters.

**Winthrop** (JOHN), LL.D., F. R. S., a great-grandson of Gov. John, b. at Boston Dec. 19, 1714; graduated at Harvard 1732; was Hollis professor of mathematics and natural philosophy in that institution from 1738 until his death; was a profound mathematician and well versed in scholastic discussions; made accurate observations of the transit of Mercury 1740, and that of Venus Jan. 6, 1761, making for the purpose on the latter occasion a voyage to St. John's, Newfoundland; was several years judge of probate for Middlesex co.; declined the presidency of Harvard 1769, and again 1774; was a member of the executive council 1773–74, and a firm advocate of political liberty. D. at Cambridge May 3, 1779. Author of *A Lecture on Earthquakes* (1755), *Two Lectures on Comets* (1759), *Relation of a Voyage from Boston to Newfoundland for the Observation of the Transit of Venus* (1761), *Two Lectures on the Parallax and Distance of the Sun, as deducible from the Transit of Venus* (1769), *Cogitata de Cometes* (1766), communicated by Dr. Franklin to the Royal Society, and contributed various papers to *Philosophical Transactions.*

**Winthrop** (ROBERT CHARLES), LL.D., son of Thomas Lindall, b. at Boston, Mass., May 12, 1809; is a descendant in the sixth generation of Gov. John Winthrop, a grandson of Sir John Temple, Bart. (1731–98), and a great-grandson of Gov. James Bowdoin; graduated at Harvard 1828; studied law with Daniel Webster 1828–31; was a Whig member of the Massachusetts legislature 1836–40, and Speaker of the House 1838–40; a member of Congress 1841–42 and 1843–50; was Speaker of the 30th Congress 1847–49, distinguishing himself through a critical period by his tact as a presiding officer, no less than by his graceful eloquence on the floor and his skill in debate; visited Europe 1847, and again some years later; became at an early age a member of many literary, scientific, and philanthropic associations; delivered an address before the New England Society of New York City 1840, and the official oration at Washington at the laying of the corner-stone of the Washington Monument, July 4, 1848; was president of the Massachusetts college of electors 1848; U. S. Senator, by ex-

ecutive appointment, to fill the unexpired term of Daniel Webster 1850–51; received a large plurality of popular votes for governor of Massachusetts 1851, but was defeated in the legislature; delivered at Boston, Nov. 23, 1853, an oration on *Archimedes and Franklin*, which gave rise to the statue of Franklin in that city; was the orator on the occasion of the inauguration of that monument Sept. 17, 1856, as he had been at the inauguration of the Boston Public Library 1855, as president of the city library commissioners; has been for many years the efficient president of the Massachusetts Historical Society, being also the senior member of that body; and, possessing an ample estate, has long devoted his leisure to the cause of historical literature, taking little part in recent political questions, his residence being at Brookline, near Boston. His speeches in Congress appeared in a volume of *Addresses and Speeches on Various Occasions* (1853), and a second volume, published in 1867, contained, among other notable orations, his eulogies upon William H. Prescott (Feb., 1859), Josiah Quincy (July, 1864), and Edward Everett (Jan., 1865). He has since delivered the *Introductory Lecture* (1869) to the course on the early history of Massachusetts by members of the Massachusetts Historical Society at the Lowell Institute, and an oration at the bi-centennial celebration (Dec. 21, 1870) of the landing of the Pilgrims at Plymouth. He has contributed to the *North American Review* and other periodicals, and is author of a *Memoir of Hon. Nathan Appleton, LL.D.* (1861), of the *Life and Letters of John Winthrop, etc.* (2 vols., 1864–67), and of a volume entitled *Washington, Bowdoin, and Franklin, with a Few Brief Pieces on Kindred Topics* (1876).

PORTER C. BLISS.

**Winthrop** (THEODORE), b. at New Haven, Conn., Sept. 22, 1828; graduated with honors at Yale College 1848; travelled in Europe 1849–51 as tutor to a son of William H. Aspinwall; resided two years at Panama in the employ of the Pacific Mail Steamship Co.; accompanied Lieut. Strain's expedition and made other explorations of South and Central America; studied law at St. Louis, Mo.; was admitted to the New York bar 1855; joined the famous 7th regiment of New York on its entering the national service Apr., 1861; was commissioned major in the New York volunteers; became a member of the staff of Gen. B. F. Butler as his military secretary, and was killed at the head of an assaulting column in the earliest formal engagement of the war, at Great Bethel, Va., June 10, 1861. In the *Atlantic Magazine* from June to September of that year were published several spirited sketches of early war-scenes, which attracted great attention, and he was found to have left ready for the press the materials of five volumes of novels and essays, several editions of which were immediately sold. They were *Cecil Dreeme* (Oct., 1861; 17th ed. 1864), *John Brent* (Jan., 1862; 14th ed. 1864), *Edwin Brothertoft* (July, 1862), *The Canoe and the Saddle* (Nov., 1862), and *Life in the Open Air and other Papers* (1863), with a portrait.

**Winthrop** (THOMAS LINDALL), LL.D., b. at New London, Conn., Mar. 6, 1760; was great-grandson of Gov. John Winthrop, Jr. (1606–76); graduated at Harvard 1784; married in 1786 the eldest daughter of Sir John Temple, Bart., of New York, agent and consul-general of Great Britain to the U. S.; settled at Boston; became a successful merchant and a scientific agriculturist; was a member of many literary and scientific societies; president of the Massachusetts Agricultural Society, the Massachusetts Historical Society, and the American Antiquarian Society, and was lieutenant-governor of Massachusetts 1826–32. D. at Boston Feb. 22, 1841.

**Winthrop** (WAITSTILL), son of Gov. John of Connecticut, b. at Boston, Mass., Feb. 27, 1642; become a member of Gov. Andros's council and of that of 1692; major-general of Massachusetts militia; judge of admiralty and chief-justice of the superior court of Massachusetts. D. at Boston Nov. 7, 1717.

**Win'ton,** p.-v. and tp., cap. of Hertford co., N. C. P. 2240.

**Winwood** (Sir RALPH), b. at Aynho, Northamptonshire, England, about 1565; graduated at Magdalen College, Oxford, 1582, and in law 1590; became fellow there and proctor of the university; spent some years in foreign travel; was knighted 1607; served on embassies to France, Holland, and other countries, and was secretary of state from 1614 until his death, Oct. 27, 1617. His *Memorials of Affairs of State* (3 vols., 1725) were edited by Edmund Sawyer.

**Win'yaw Bay,** in Georgetown co., S. C., receives the waters of Waccamaw, Pedee, and Black rivers. It is 14 miles long and 2 miles in average breadth. Large vessels ascend to Georgetown. The main entrance to the bay, called Georgetown Entrance, has a brick lighthouse on the N. side; lat. 33° 13′ 21″ N., lon. 79° 6′ 44″ W., called Georgetown Light.

**Wio'ta,** p.-v. and tp., Lafayette co., Wis. P. 1699.

**Wire and Wire-Drawing.** The manufacture of wire depends upon the ductility of metals—that is to say, upon their property of being drawn out into attenuated form. This property is quite different from a capacity for working under the hammer—copper, which is third among the metals in the order of its malleability, being sixth in ductility. Gold, however, stands first in both properties, and silver stands second in both. So far as our knowledge extends, these were the first metals from which wire was made. The first wire was fabricated by beating the metal into thin sheets, then cutting these into narrow strips or slivers, which were afterward rounded by hammering or filing, one or both. It was in this manner that the wires of the fabled net of Vulcan are said to have been made. Such wire was woven into fabrics with an admixture of textile material—literally, the cloth of gold. The grave of the wife of the emperor Honorius, discovered and opened at Rome about the year 1544, disclosed a mouldering raiment of this golden cloth, which weighed thirty-six pounds of the precious metal. The date when silver was first made into wire is uncertain, the earliest that can be fixed being the time of the later Grecian emperors. The period when the shears, the hammer, and the file gave way to the draw-plate with graduated holes or dies is not known. The terms "wire-smiths," applied to those who made wire with the hammer, and "wire-drawers" and "wire-millers," applied to those who made it with the die-plate, occur simultaneously in German records in the middle of the fourteenth century; and it was doubtless at this time that the draw-plate, which still remains, and probably always will remain, the chief appliance in the manufacture of wire, was first invented or brought into use. As the most important use for wire drawn of the precious metals was for purposes of ornamentation, the discovery that by flattening it a given weight could be wound around three times the length of textile fibre was an important step forward, this being the method in which for many purposes gold and silver is applied in ornamentation for tassels, fringe, etc., to this day. Wire was at first manufactured with the draw-plate entirely by hand, but at an uncertain date, probably before the year 1400, a machine, the inventor of which is unknown, was made to operate by water-power. In this, it is said, a lever moved a pair of pincers that opened as they came in contact with one side of the draw-plate, laid hold of the wire, drew it through the hole or die, and after drawing it a certain distance retraced their path, taking a new hold, and repeating the operation. This mechanism, or mechanism substantially the same, was in use in France for making certain kinds of wire until within the past half-century, such wire being known by indentations at intervals of about two inches along its length where the gripping pincers had taken hold. Nuremberg, so flourishing during the later portions of the Middle Ages in its arts and its manufactures, seems to have been the centre from which the art of manufacturing wire extended over Europe, although it is said to have been carried on with very great success in France and Italy. The prosperity of the manufacture in the German city was due to the system of encouraging manufactures by granting exclusive patents, sometimes given by the emperor, sometimes by the council of the city. One of these patentees, Frederick Hagelsheimer, received in 1592 a patent of fifteen years for the making of fine gold and silver wire. At the expiration of this term it was extended for fifteen years more, and the following year his patent was broadened to cover the manufacture of copper wire gilt or silvered. This patent appears to have been more than once confirmed, and when it expired in June, 1621, this same manufacturer entered into an agreement with the wire-drawers of the place, and this covenant was confirmed by still another patent granted in September of the same year, which was to continue through a period of fifteen years more. The following year this was transformed into a fief or continual privilege to the heirs male of his family. The flattening of wire appears to have been a most important branch of the manufacture; this being done by passing it between rollers. In England wire was made by hand until after the middle of the sixteenth century, and then the art making use of machinery was introduced by foreigners. The curious in this art may turn to the article "Wire-Drawing" in Beckmann's *History of Inventions* (from which I have largely drawn in the preceding portion of this sketch) for many items quaint and interesting.

Wire for industrial purposes is for the most part made of iron of the best quality. Steel, brass, and copper wire are also largely made, the methods of the manufacture being

substantially the same as with iron. But before referring to these we may refer briefly to the modern methods of making wire of the precious metals, which still forms an important though inferior branch of the art. What is known in later days as gold wire has an exterior of gold and a core of silver, being made by forming a cylindric ingot of silver and coating the latter with gold. This compound ingot is gradually reduced in size by means of the draw-plate—that is to say, by passing it through a succession of holes or dies in a hardened steel plate—first, through one only slightly smaller than the original diameter of the ingot; then through another still smaller, and so on until the requisite reduced diameter is reached. The finest wire ever made (that substituted for the spider-web lines of telescope micrometers) is made by first covering a platinum wire with solid silver. This compound wire, platinum within and silver without, is then reduced in diameter in the same manner as the gold wire with the silver core just referred to. This compound wire may be thus brought down to a diameter of about $\frac{1}{300}$th part of an inch. Assuming a platinum core to be one-tenth the whole diameter, this core will be attenuated to the $\frac{1}{3000}$th part of an inch. This fine compound wire being then dipped into hot nitric acid, the silver is dissolved and the inner core of platinum remains. Platinum wire was made by this means by the inventor, Dr. Wollaston, as fine as the $\frac{1}{18000}$th of an inch in diameter.

In the manufacture of iron wire, rods of the requisite tough quality of metal are rolled into rods at the rolling-mills; these rods are bent in coils, and these are placed in large tumbling boxes or rotating cylinders with water and gravel, in order that the abrading action exerted thereby may detach the scale from the rods. The rods are then passed through the successively diminishing holes of the draw-plate—for example, ten, fifteen, thirty, or more times, according to the degree of attenuation required. The constant compression of the molecules of metal upon each other hardens the wire, so that it has to be repeatedly annealed during the successive drawings. This is performed by placing the wire in kilns, which are first heated to redness and then allowed to cool gradually. Twenty-four hours is the time ordinarily required for annealing the smaller grades of wire. Six or eight different annealings are necessary; very small wire requires more. A scale is formed upon the wire at each annealing, and this is removed by pickling in some acid, preferably dilute oil of vitriol. Wire is sold in coils, and those of the more rigid and stiffer kinds are straightened for use by being passed alternately back and forth on two rows of alternating pins placed a slight distance apart. The wire is thus made to pass in a zigzag course through the device, which is termed a riddle, and comes out straight. Considerable skill is required in guiding the wire as it issues from the device, or the object of the operation is defeated. Cast-steel wire is made from steel rods hammered to about one-quarter of an inch square by a tilt-hammer, and afterward made round on the anvil. A spurious gold wire, called "gold wire of Lyons," is manufactured by heating copper to a red heat and exposing it to the fumes of zinc, which converts the external portion of the metal into brass. Brass wire loses its strength when exposed to the fumes of acid, and even by long exposure to a damp atmosphere. Zinc wire is flexible, and at first as strong as copper, but resumes the original crystalline state of the metal when subjected to the action of boiling water. The uses and applications of wire are too many to be noted; they range from the construction of suspension bridges to the manufacture of teeth for carding machinery, and from this down to pins and hooks and eyes, and from these, again, to the fabrication of the finest needles. One of the most unique is the production of surfaces for printing calico, in which copper wires are imbedded in the block, then filed down to a flat surface, and thus form the slightly-raised figures upon which the pattern is printed.

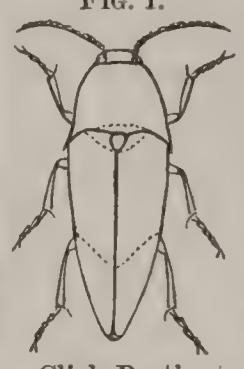
Of course, in wire-making, as in all other branches of manufacture, many improvements, some real, some futile, have been proposed. In 1856 an English projector claimed to "improve the tone in strings or wire used for musical purposes" by gilding the same, depositing "the gold by chemical means or coating by any process in which such covering can be produced." The English experiments extend back to 1768, when it was proposed to fold silver around a copper wire with borax between, and then draw the compound strip thus formed through a draw-plate to unite the metals. Silver was to be covered with a layer of gold and drawn in a similar way. Drawing zinc wire at a temperature of from 210° to 310° F. was patented in 1805. In 1852 the coating of wire with molten metal by drawing it through a bath thereof was described in a patent which also showed a method of excluding air from the bath. Among American inventions, one for which much was claimed a few years ago, was a combined telegraph wire, comprising a steel core and copper exterior, which was asserted to possess greater conductivity and strength in proportion to its weight and cost than the wire commonly used for such purposes. But probably the most valuable improvement in wire manufacture was that patented in Aug., 1858, by Henry Waterman, and which reduced the cost of tempering flat steel crinoline wire from $3 a pound to three cents. Previous to this the tempering of such wire was done by winding it in volute coils kept apart by interlaced iron wires, the coils being heated to the requisite degree in a furnace, and then plunged in a hardening bath. In the improved process the wire was drawn through the fire of a furnace, and guided directly from the fire into the hardening bath. This method of tempering is now universally applied in the production of tempered steel wire for all the purposes for which this is required. It is somewhat remarkable that among the 146,119 patents granted in the U. S. previous to the close of the year 1873, there were but five relating to the manufacture of wire, while in the following year, 1874, there were twelve American patents issued relating to this branch of manufacture.

JAMES A. WHITNEY.

**Wire-Rope.** See ROPE-MAKING, by CAPT. S. B. LUCE.

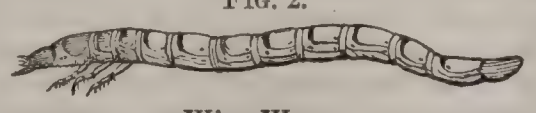
**Wire′-Worm,** a term applied to certain myriapods and to the larvæ of various beetles, but properly restricted to the tough, light-brown, cylindrical larvæ of various species of elaters, family Elateridæ. These beetles are well known to most persons under the popular names of "spring-beetles," "click-beetles," "skip-jacks," "snapping-bugs," etc.—names having reference to the peculiar power which the insects have of jumping with a clicking noise when placed on their backs upon any hard surface. These beetles are elongated in form, and have the posterior angles of the prothorax produced into an acute spine, so as to prevent all lateral movement. The back is convex and the legs short, so that without the peculiar jumping power they would be unable to recover the natural position when once laid on the back. If carefully examined beneath, an acute spine is found to proceed from the fore breast (prosternum), and to be received at will into a groove in the middle breast (mesosternum). Placed on the back, the insect lowers the head till this comes in contact with the surface upon which it lies, and the spine is entirely thrown out of its groove; then by suddenly jerking the head upward the spine is thrown back into the groove with a clicking noise and sufficient violence to cause the elastic body to rebound. The family comprises a number of genera, and many species which vary much in size, though averaging about one-third of an inch. The prevailing color is brown, but a few are jet black and others speckled with white. The South American *Pyrophorus noctilucus* (Linn.), whose larva is injurious to the sugar-cane, is luminous, as are also several other species of the genus. The larvæ of some of the larger species, as of *Alaus oculatus* (Linn.), are more or less flattened and predaceous, inhabiting the burrows and feeding upon the larvæ of lamellicorns. Others, again, as the large black *Melanactes piceus*, are luminous and feed upon soft-bodied animals in damp places. Still others feed upon decaying vegetation and rotten wood, but a larger number feed upon the roots of living plants, and are known by the name of wire-worms. These possess very similar habits, and they all look much alike, though a careful examination will show specific differences, especially in the structure of the terminal joint of the body. The eggs from which these worms hatch are soft, pale, and broadly oval. They are generally laid loosely in the ground, and the newly-hatched worm is invariably pale. The worms are from one to three years attaining full growth, according to the species, and undergo a larger number of moults than are necessary to most insects. According to the Swedish naturalist Bjerkauder, who carefully studied these worms in that country, some of the species in that latitude remain even five years in the larval state. The head is somewhat flattened, and there are six true legs near it; the body consists of thirteen joints, and the last generally has at its base, beneath, a retractile proleg. When full grown they descend deeper into the earth, and go through their transformations within an oval cavity, most of them issuing as beetles in early summer.

FIG. 1.



Click-Beetle.

FIG. 2.



Wire-Worm.

The wire-worms are about the greatest insect pests of the farmer, doing more or less damage to all the grasses and cereals, and often eating into and ruining potatoes,

onions, turnips, and injuring various other root-crops and bulbous flowers. In Europe most of the injurious species that have been traced through their transformations belong to the genus *Agriotes*. Fitch, who, in his eleventh report as State entomologist of New York, has given the fullest account of these wire-worms yet published in America, connects two species with the perfect beetle—the one the *Melanotus communis* (Gyll.), the other *Agriotes truncatus* (Melsh.). Another, the common wheat wire-worm of Canada, has been proved by Mr. J. Pettit of Grimsby to be the *Agriotes mancus*, Say (see *Can. Entomologist*, vol. iv. p. 3), a species closely allied to, if not identical with, *truncatus*. The writer has proved by breeding that one of the commonest species in the cornfields and meadows of the West is the same *Melanotus communis* which Fitch found to be common in the East, and many of our other wire-worms doubtless belong to this last genus, which is more richly represented in America than *Agriotes*. Wire-worms are always abundant in meadows, and crops grown on pasture or meadow land recently broken suffer most from them. In this country the crops most affected are wheat and Indian corn. The remedies proposed and adopted to counteract their injuries are innumerable. They may be divided into preventive and remedial. As wire-worms cannot subsist on the soil, as does the earth-worm, and as they mostly require about three years to come to full growth, one of the most effectual ways to prevent their injuries is to fallow the land for one year, but in order to be effectual the fallow must be thorough and the ground ploughed often enough in summer to keep down the weeds. In a small plot of ground they may be trapped by strewing on the surface sliced potatoes, turnips, lettuce, or other succulent vegetables. Being unusually fond of these, the worms eat into them, and while doing so may be collected and destroyed. Fall ploughing, by which the worms are exposed to their natural enemies, especially birds, at a time when most insect-life is sluggish, and submersion where feasible, are two of the most practicable ways of destroying them on a large scale. Corn soaked over night in copperas-water before planting is generally left untouched by them. Nitrate of soda, salt, and lime each have their advocates as wire-worm destroyers, and while the use of lime is generally beneficial in invigorating the crop, it is probable that all these substances have acquired their reputation from confounding the *post quod* with the *propter quod*. When the worms were noticed to be most troublesome during the last year of their existence as such, and when they were naturally just on the point of going through their final transformations to the beetle state, and of leaving the soil, the applications have been made, when, *presto!* we have a sure remedy. It has been found that wire-worms will live in soil pretty well impregnated with these minerals, so long as they have proper food; and the Hon. A. B. Dickenson of New York wrote in 1855: "I have heard it stated that 5 bushels of salt to the acre, or 100 bushels of lime, would destroy wire-worms. I have tried both, and have sowed 10 bushels of salt to the acre, and they only laughed at my folly; I tried 100 bushels of lime, as recommended, and they fattened on my bounty." The impression is very strong among farmers—and perhaps well founded—that white mustard and buckwheat are obnoxious, and that a crop of either cleans the ground from the pests. Rape-cake was very strongly recommended in England thirty years ago. The worms have a great partiality for it, and are supposed to die from eating it. While I consider that this last opinion is founded on incorrect observation, the cake may be made to kill them by being mixed with Paris green. Thus poisoned and spread in lumps over a field from which domestic animals can be excluded, it will probably prove the best of all the remedies, and act at the same time as a manure. C. V. Riley.

**Wirt,** county of Central West Virginia, intersected by Little Kanawha River; surface hilly, with much iron ore and bituminous coal; soil in the valleys fertile. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, oats, and tobacco. Cap. Wirt Court-house. Area, 298 sq. m. P. 4804.

**Wirt,** tp., Allegany co., N. Y. P. 1204.

**Wirt** (William), LL.D., b. at Bladensburg, Md., Nov. 8, 1772, his father being a Swiss, his mother a German; was left an orphan at the age of eight years, and brought up by an uncle; was educated at the grammar school of Rev. James Hunt of Montgomery co.; was afterward tutor nearly two years in the family of Benjamin Edwards of Maryland, father of Gov. Ninian Edwards of Illinois; studied law; commenced practice in Culpeper and Albemarle cos., Va., 1792; married and settled at Pen Park, near Charlottesville, Va., 1795; lost his wife, and removed to Richmond 1799; served three years as clerk to the house of delegates; became chancellor to the Eastern Shore of Virginia, and married a second time 1802; settled as a lawyer at Norfolk 1803, and published in the *Virginia Argus* his celebrated *Letters of a British Spy*, which have passed through 12 eds.; wrote for the *Richmond Enquirer* a series of essays entitled *The Rainbow* 1804; returned to Richmond 1806; was an assistant in the prosecution of Aaron Burr 1807; sat in the house of delegates 1807–08; wrote the collection of essays entitled *The Old Bachelor*, which originally appeared in the *Enquirer* in 1812; was appointed U. S. attorney for the district of Virginia 1816; was attorney-general of the U. S. for three full terms during the administrations of Monroe and John Quincy Adams 1817–29; delivered at Washington a discourse commemorative of the death of Adams and Jefferson Oct. 19, 1826; settled at Baltimore 1830, and was the anti-Masonic candidate for the Presidency of the U. S. 1832, and received for that office the electoral vote of Vermont. D. at Washington, D. C., Feb. 18, 1834. His chief work was *Sketches of the Life and Character of Patrick Henry* (Philadelphia, 1817; 15th ed., Hartford, 1852). His *Life* was written by John P. Kennedy (2 vols., 1849).—His second wife, Elizabeth Washington Gamble, b. at Richmond, Va., Jan. 30, 1784; published at Baltimore in 1829 a handsomely-illustrated quarto volume entitled *Flora's Dictionary* (new ed. 1855), which was at once "a course of botany, a complete flower letter-writer, and a dictionary of quotations." D. at Annapolis, Md., Jan. 24, 1857.

**Wirt Court-house,** p.-v., cap. of Wirt co., West Va.

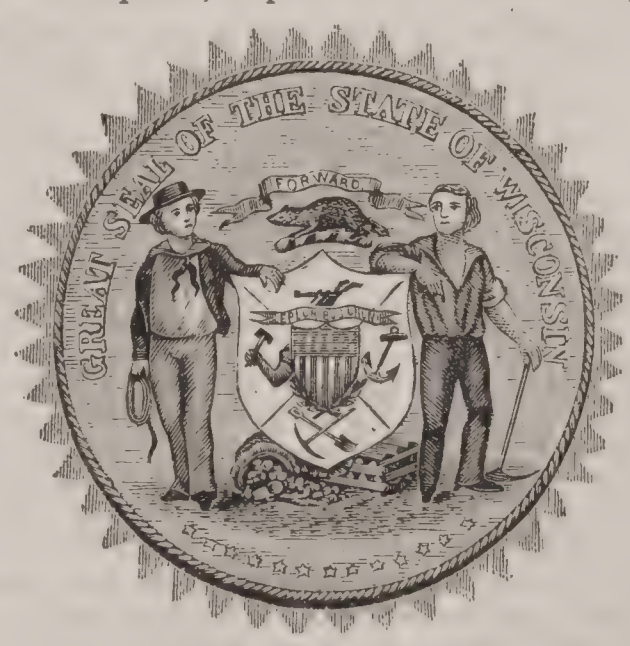
**Wis'beach,** or **Wisbech,** town of England, county of Cambridge, in the Isle of Ely, on the Nene, is well built, and carries on a great variety of manufactures and an active general trade. P. 9378.

**Wis'by,** town of Sweden, capital of the island of Gothland, was from the eleventh to the fourteenth century—when in 1361 it was taken and sacked by the Danish king Valdemar—the centre of the trade of Northern Europe, and contains many remains which show its former splendor, and are of great interest to the student of early Gothic. Its trade and manufactures are now small. P. 6430.

**Wiscas'set,** p.-v. and tp. and seaport, cap. of Lincoln co., Me., on Knox and Lincoln R. R., 50 miles N. E. of Portland, has a fine harbor, excellent schools, 3 banks, 1 newspaper, 2 steam saw-mills, and 2 hotels. Principal business, commerce, shipbuilding, manufacturing, and farming. Wiscasset is a favorite watering-place for tourists. P. 1977.

Joseph Wood, Ed. "Seaside Oracle."

**Wiscon'sin,** one of the north-western States of the upper Mississippi Valley, lying between the parallels of 42° 27′ and 47° N. lat., and between the meridians of 86° 53′ and 92° 53′ W. lon. from Greenwich. It is bounded N. by Lake Superior, Superior and St. Louis Bays, and




The Seal of Wisconsin.

St. Louis River; N. E. by the upper peninsula of Michigan and Green Bay; E. by Lake Michigan; S. by Illinois; and W. by Iowa and Minnesota, the Mississippi River forming the dividing-line for more than half of its W. boundary, and St. Croix Lake and River for most of the remainder. Its greatest length from N. to S. is 302 miles, and its greatest breadth 258 miles. Its area is 53,924 sq. m., or 34,511,360 acres.

*Topography.*—Wisconsin has properly no mountains; there are two watersheds, the highest in the northern portion of the State, known as the Iron range of hills, which divides the tributaries of the Mississippi from the waters which flow into Lake Superior; this near the Montreal River in Ashland co. is about 1800 feet above the sea, but slopes downward both to the N. and W. to an elevation not exceeding 1100 feet; the other watershed is in the southern and central portions of the State, E. of the central merid-

ian, and divides the tributaries of the Mississippi from the streams falling into Green Bay and Lake Michigan; this attains at one or two points an elevation of about 1000 feet, the general elevation of the State being nearly 600 feet. In the S. W. part of the State, in Dane and Grant cos., are elevations called "mounds" of considerable height; Blue Mound in Dane co. is 1729 feet; Platte in Grant co., 1281 feet; and Sinsinnewa, also in Grant co., 1169 feet above the sea, or 1100, 680, and 570 feet respectively above the adjacent country. The affluents of the Mississippi drain four-fifths of the State, and the general slope is south-westward.

*Rivers, Lakes, etc.*—The rivers which discharge their waters into Lake Superior are the Montreal, Bad River, Bois Brulé, and St. Louis. They are all short, and have a descent of about 800 feet in a length of 30 or 40 miles. The Menomonee, Peshtigo, Oconto, Pensaukee, and Fox or Neenah rivers run into Green Bay. The last named is a very important stream, rising in Green Lake or Columbia co.; passing so near the Wisconsin River that a canal 1¾ miles long connects the two, and navigation is possible between Green Bay and the Mississippi River, it passes through several lakes, receiving Wolf River from the N., traverses Winnebago Lake, and between it and Green Bay has a descent of 170 feet. The Kewaunee, Two Rivers (East and West Twin), Manitowoc, Sheboygan, and Milwaukee are tributaries of Lake Michigan. The Mississippi, as already stated, forms a part of the western boundary of the State, and receives within the State the St. Croix, Chippewa, Buffalo, Trempealeau, Black, and Wisconsin rivers, as well as several smaller streams. All these rivers have numerous affluents. The Rock, Illinois, Fox, and Des Plaines rivers, all directly or indirectly tributaries of the Mississippi in Illinois, drain the southern portion of the State. The Wisconsin, St. Croix, Chippewa, and Neenah or Fox rivers are navigable for a considerable distance. The State has a coast-line of 120 miles on Lake Superior, of 200 miles on Lake Michigan, and of 400 on the Mississippi and its larger tributaries. The State abounds in lakes, many of them of great beauty. Aside from Lakes Superior and Michigan, Lake Winnebago is the largest lake in the State, being 28 miles long and 10 broad; it is about 170 feet above Lake Michigan. Lake Mendota, and many hundreds of other lakes, especially in the northern part of the State, add beauty to the landscape. Around Madison, the capital, are four very beautiful lakes. Green Bay, an arm of Lake Michigan, extends far into the State. Superior Bay, St. Louis Bay, and Chequanegon Bay project into the State from Lake Superior, The Mississippi just before receiving the St. Croix River spreads out in a wide bay known as Lake Pepin, and the St. Croix forms a similar expanse of water called Lake St. Croix. A number of islands in Lake Superior and Green Bay belong to Wisconsin.

*Geology and Mineralogy.*—The geological formations of Wisconsin are as follows, beginning at the oldest and lowest: (1) Laurentian, consisting of rocks of metamorphic origin, composed of many mineral ingredients, as granite, gneiss, syenite, hornblende, schist, etc. Beds of kaolin exist. This formation occupies a large area in the N. central part of the State. (2) Huronian, consisting chiefly of quartzites, diorites, schists, slates, and iron ores. The Penokie iron ridge in the N., the Menomonee iron range in the N. E., the iron hills about Black River Falls, the quartzites and porphyrites in Central Wisconsin, belong to this formation. It abounds in iron. (3) The copper-bearing series, consisting of diorites and melaphyres, interstratified and overlaid with shales, sandstones, and conglomerates, the former of igneous and the latter of sedimentary origin. Native copper is widely distributed throughout this formation, which occupies a large area in the N. W. of the State. (4) The Potsdam sandstone, with which shales and limestones are interstratified, the whole group having a thickness of about 1000 feet. It occupies a crescentic area in the central part of the State. (5) The Lower Magnesian limestone occupies a narrow, irregular belt concentric to the Potsdam sandstone on the S.; thickness, 250 feet. (6) The St. Peter's sandstone, a still narrower belt, next to the last. This is generally a pure silicious sandstone, used for glassmaking, varying in thickness with the underlying magnesian limestone, from 1 foot to 200 feet. (7) Trenton limestone, partly dolomitic, shaly in portions, abounding in fossils; it occupies a large area in the S. W. of the State, and a belt running from N. to S. in the E. central part. In the S. W. it contains extensive deposits of lead and zinc ores, which are extensively mined near Mineral Point. (8) Galena limestone, a heavy-bedded, cherty dolomite, more than 250 feet in thickness, adjacent to the Trenton, but occupying larger areas, and is the great lead-bearing formation of the State. The lead ore galenite occurs in vertical fissures and flat openings, in connection with the zinc ores, blende or sphalerite and smithsonite, as well as with iron pyrites, calcite, and other minerals. (9) Cincinnati shale, consisting of blue clays, gray, yellow, blue, and purple shales, and magnesian limestones; highly fossiliferous. Its thickness is 200 feet. It forms a narrow N. and S. belt in the E. of the State, and the mounds in the S. W. also contain it. (10) The Clinton iron ore beds, occupying limited areas in the E. part of the State. At Iron Ridge the ore is 25 feet thick, and is made up of minute concretions like flaxseed, hence called seed ore; it is easily mined. (11) Niagara limestone (dolomite), covering immense areas in the E. part of the State, and capping the mounds in the lead region. It is 800 feet thick, has six subdivisions, some of which contain the purest sedimentary dolomites known. It abounds in interesting fossils. (12) The water-lime horizon of the Lower Helderberg group, occupying two small areas in the E. part of the State. (13) The Hamilton group, the only formation of the Devonian age in the State, is found in a small area near Milwaukee, and furnishes one of the best hydraulic cements known. (14) The drift deposits consist of moraines hundreds of miles long and hundreds of feet high, and extensive deposits of boulder-clay overlaid by three successive lacustrine clays and four associated beach deposits. The former represent the Glacial period, the latter the Champlain. (15, *a*) Peat deposits of great extent and depth; (*b*) soil of great strength and fertility.

The minerals of the State, as reported by Dr. I. A. Lapham in 1872, were—gold, silver, and copper in a metallic state, found in small quantities; two or three ores of silver; eight ores of copper; nine of iron; three of zinc; four of lead; two of arsenic; two of manganese; seven varieties of crystallized quartz; three of hornblende; two of feldspar, dolomite, and sulphates, carbonates, and phosphates of lime, fluor-spar, fluorite, potter's and porcelain clays, talc or steatite, serpentine, chlorite, garnet, epidote, tourmaline, laumonite, leonhardite, stilbite, chrysocolla, and numerous other rare minerals of scientific importance, together with petroleum, asphaltum, peat, and valuable building-stones. Amethyst, carnelian, agate, jasper, chalcedony, garnet, and malachite are among its precious stones, and gypsum, graphite, kaolin, steatite, and asbestos among its economic minerals.

*Soil and Vegetation.*—The greater part of the soil of the State is arable, and much of it very fertile. Much of the northern portion is covered with forests which furnish many millions of feet of lumber annually. A large portion of these forests is composed of coniferous trees, and especially of the white pine, though the balsam, hemlock, spruce, and fir are also found in considerable quantities. The burr and red oak and other deciduous trees also occur. The southern half of Wisconsin is partly prairie, though under cultivation it produces a fair amount of timber and fruit trees. There are in these prairie-lands, as in Illinois, occasional islands of timber, or, as they are called, "oak-openings," the trees being mainly the burr oak. A published catalogue of Wisconsin's indigenous plants contains over 1500 species, exclusive of mosses. Of these, more than 60 are forest trees, and about 150 shrubs, 100 grasses, 175 Compositæ or compound flowering plants; about 300 are reputed to possess medicinal virtues.

*Zoology.*—The late Dr. Lapham had catalogued 62 species of mammals, over 300 birds, 19 species of reptiles, and over 100 mollusks, natives of Wisconsin. Some of these, as the buffalo, antelope, and perhaps the wild-turkey, are now extinct, but the elk is still occasionally found, and deer, bears, beavers, the fisher, wolf, otter, wild-cat, and porcupine are not uncommon; while the rabbit, squirrel, striped gopher, mole, bat, and field- and shrew-mouse exist in great numbers. Of the Raptores, or birds of prey, the golden and bald eagle, several species of hawk, the great white owl, and the crow are best known; of game-birds, the quail, partridge, spruce, willow, prairie, and sharp-tailed grouse, woodcock, wild-goose, many species of duck and teal, and pigeons in immense numbers, as well as the pelican, loon, etc. The lakes and rivers abound with fish, especially the whitefish, lake-trout, siskewit, mascalonge, perch, pickerel, and sturgeon. The billfish and the spoonbill sturgeon are sometimes taken. The reptiles are those common to the North-west.

*Climate.*—Although the State extends over 4½° of latitude, its climate is in no part severe, its temperature being greatly modified by Lakes Michigan and Superior, which form a large part of its boundary on the E. and N. Its mean annual temperature does not vary much from 42° F., being on the southern border about 45°, and at the northern limit about 40°. Snow falls in the N. before the occurrence of heavy frosts, and continues till spring, thus protecting the roots of plants, trees, and shrubs from being killed by the frost. The winters are long and cold, but nearly uniform in temperature; the springs backward; the summers short, and usually hot, often dry; the autumns generally

mild and pleasant. The rainfall is less than on the Atlantic coast. The following table gives the meteorologic data for four points of the State, Duluth, Minn., being, from its location, the best representative of the climate of Northern Wisconsin which has recorded observations:

| Meteorological Data. | University of Wisconsin, Madison, lat. 43° 4′ 33″, lon. 89° 21′ 58″; altitude, 1088 feet. | La Crosse, lat. 43° 48′, lon. 91° 23′; altitude, 686.26 feet. | Milwaukee, lat. 43° 03′, lon. 87° 54′; altitude, 661.4 feet. | Duluth, Minn., lat. 46° 48′, lon. 92° 6′; altitude, 642.7 feet. |
|---|---|---|---|---|
| *Temperature.* | ° | ° | ° | ° |
| Mean annual temperature | 41.8 | 45.9 | 45.8 | 39.4 |
| Highest temp. of year... | 86 | 101 | 98 | 91 |
| Lowest " " ... | −25 | −19 | −8 | −21 |
| Range of annual temp... | 111 | 120 | 106 | 112 |
| Mean temp. of spring... | 41.5 | 44.7 | 41.3 | 35.6 |
| Highest " " ... | 83 | 96 | 90 | 91 |
| Lowest " " ... | 1 | 3 | 15 | 2 |
| Range of spring temp... | 82 | 93 | 75 | 89 |
| Mean temp. of summer.. | 68.9 | 73.3 | 68.6 | 63.2 |
| Highest " " ... | 86 | 101 | 98 | 89 |
| Lowest " " ... | 51 | 41 | 44 | 41 |
| Range of summer temp.. | 35 | 60 | 54 | 48 |
| Mean temp. of autumn.. | 45.9 | 43.9 | 46.9 | 42.5 |
| Highest " " ... | 81 | 91 | 94 | 90 |
| Lowest " " ... | −3 | −1 | 8 | −2 |
| Range of autumn temp.. | 84 | 92 | 86 | 92 |
| Mean temp. of winter... | 9.9 | 21.9 | 26.6 | 16.3 |
| Highest " " ... | 50 | 57 | ..... | 53 |
| Lowest " " ... | −25 | −19 | ..... | −21 |
| Range of winter temp... | 75 | 76 | ..... | 74 |
| *Rainfall.* | Inches. | Inches. | Inches. | Inches. |
| Amount of an. rainfall.. | 23.75 | 31.04 | 31.95 | 34.59 |
| Rainfall of spring..... | 5.38 | 6.70 | 7.66 | 4.12 |
| " summer..... | 6.91 | 12.23 | 9.05 | 19.13 |
| " autumn..... | 7.31 | 8.72 | 8.31 | 9.49 |
| " winter..... | 4.15 | 3.39 | 6.93 | 1.81 |
| *Prevalent winds in the order of mention.* | | | | |
| Spring..... | S. W., W., N. E., N. W., S. E., S., E. | S., N. W., N., W., N. E., S. W., S. E. | N. W., S. W., N. E., S. E., E., W., N. | N. E., N. W., S. W., calm, N. W. |
| Summer..... | S., N., W., S. E., N. W., S. W., W., N. E., E. | S., S. W., N., S. E., N. W., N. E., W. | N. E., S. E., S. W., W., N. W., E., S. | N. E., calm, N. W., S. W., N., W. |
| Autumn..... | N. W., S. W., S., W., N. | S., N., N. W., S. W., S. E., calm. | S. W., N. W., W., S. E., N. E., calm. | S. W., N. W., N. E., calm, W., N. |
| Winter..... | W., N. W., S. W., S., N., E. | S. W., N., N. W., S. W., N. E., S. E., W. | N. W., S. W., S. E., W., N. E., S., N. | S. W., N. W., calm, N. E., W. |

*Agricultural Productions.*—In 1870 the total amount of land in farms in Wisconsin was 11,715,321 acres; the assessors in 1875 reported for taxation 22,647,004 acres, or nearly double the quantity. One-half of that reported in 1870 was unimproved, but the taxation, as well as the valuation, indicates that a smaller proportion was unimproved in 1875. The census valuation of farms in 1870 was $300,414,064, which was probably about the market-value. For purposes of assessment farming-lands are never rated in the West beyond 40 per cent. of their value, yet they were valued in 1874 at $175,700,866, equal to over 450 millions of true valuation. This was aside from city and village lots, which were assessed at nearly 89 millions more. The value of farming implements and machinery in 1870 was $14,239,364; it has greatly increased since. The value of all farm products in 1870 was $78,027,032. In 1875 there were 3,406,085½ acres of growing crops of wheat, oats, corn, barley, rye, hops, tobacco, and flax, while 6 counties failed to report. The crop of Indian corn in 1875 was estimated at 24,784,000 bushels, valued at $15,613,920; of wheat, 18,436,000, valued at $15,301,880; of rye, 1,272,000, worth $992,160; of oats, 20,069,000, valued at $9,231,740; of barley, 2,304,000, worth $2,304,000; buckwheat, 375,000, worth $232,500; potatoes, 5,956,000, worth $2,978,000; tobacco, 4,500,000 pounds, worth $337,500; hay, 1,164,500 tons, worth $11,726,515. If to these be added the hops and flax, both large crops, as well as the minor crops, the product of the year will exceed $100,000,000. Dairy products in 1870 were 22,473,036 pounds of butter, 1,591,798 pounds of cheese, 2,059,105 gallons of milk sold. We have no later statistics on these products, though the advance is known to have been large. The value of all live-stock on farms in 1870 was $45,310,882, and this included 252,019 horses, 4195 mules, 308,377 milch cows, 53,615 working oxen, 331,302 other cattle (a total of 693,292 neat cattle), 1,069,282 sheep, and 512,778 swine. The estimates of live-stock in Wisconsin by the agricultural department, made in Jan., 1875, as compared with the assessors' returns, are as follows: Value of live-stock, $54,733,803, including 348,700 horses, 5100 mules, 464,800 milch cows, 435,900 other cattle (900,700 neat cattle), 1,211,300 sheep, 587,800 swine.

*Commerce.*—Wisconsin has a moderate foreign commerce, her only port of entry for this purpose being Milwaukee, but her coastwise and riverine commerce is very large, and is conducted for the lakes from Milwaukee, Sheboygan, Fond du Lac, and Superior City, and for the Mississippi River from La Crosse and Prairie du Chien, while steamers also ascend the Wisconsin, Chippewa, Fox, etc. The inter-State commerce by means of railways is also very large. Milwaukee claims to be the largest primary grain-port in the world; its elevators have a capacity for storing upward of 5,000,000 bushels of grain. It has also a large commerce in lumber, pig lead, etc. The total imports from foreign countries in the year ending June 30, 1875, for the customs district of Milwaukee was $56,646; the amount of domestic exports for the same year was $1,390,179. The entrances from foreign ports in the same year were 63 vessels, of 21,866 tons burden, and manned by 908 men. The clearances were 69 vessels, of 23,289 tons burden and manned by 975 men. The coastwise trade reported the entry of 7230 vessels, of 2,872,493 tons burden, with crews of 91,289 men, and the clearance of 7261 vessels, with a burden of 2,798,208 tons, and crews numbering 90,243 men. Milwaukee, for the lake-ports, reports 342 registered, enrolled, and licensed vessels, having a burden of 62,157.21 tons, and La Crosse, for the river-ports of Wisconsin, 35 vessels, of 3,497.98 tons. Twenty-five vessels of 3579.16 tons were built in the Milwaukee district in 1875, and one of 75.30 tons in the La Crosse district.

*Railroads in 1875.*

| Name of road. | Total miles operated in 1875. | Miles operated in Wisconsin in 1875. | Cost of road and equipment to June 30, 1875. | Total stock and funded and unfunded debt to June 30, 1875. | Proportion for Wisconsin of stock and debt. | Gross earnings for year ending June 30, 1875. | Net earnings for year ending June 30, 1875. | Number of passengers moved 1 mile in year ending June 30, 1875. | Tons of freight moved 1 mile in year ending June 30, 1875. |
|---|---|---|---|---|---|---|---|---|---|
| | | | $ | $ | $ | $ | $ | | |
| Chicago Milwaukee and St. Paul..... | 1458 | 724 | 54,647,002 | 55,226,641 | 28,185,135 | 7,464,299 | 2,281,421 | 53,847,931 | 232,530,091 |
| Oshkosh and Mississippi*..... | 20 | 20 | No separate report; Milwaukee and St. Paul. | | leased to Chicago | | 8,016§ | | |
| Chicago and Superior*..... | 39 | 39 | 920,950 | 994,300 | 994,300 | 26,504 | 8,016§ | 298,865 | |
| Chicago and North-western..... | 1991 | 564 | 67,369,714 | 66,866,254 | ..... | 12,597,095 | Expended in improvements, etc. | 106,123,087 | 454,546,468 |
| Chicago and Tomah..... | No | report. | | | | | | | |
| Galena and Southern Wisconsin..... | 31 | 20 | 444,251 | 438,691 | 43,000 | | | | |
| Green Bay and Minnesota..... | 217.5 | 217.5 | 6,032,945 | 13,290,162 | 13,290,162 | 300,883 | 28,614§ | 2,540,608 | 9,768,512 |
| Milwaukee Lake Shore and Western..... | No | report. | | | | | | | |
| Mineral Point..... | 51 | 49 | 1,131,175 | 1,520,000 | 1,428,874 | 104,722 | 29,447§ | 303,017 | 1,941,545 |
| Prairie du Chien and McGregor..... | 2 | 1.75 | 99,610 | 100,000 | 87,500 | 54,083 | 23,216 | ..... | 800,000 |
| Sheboygan and Fond du Lac..... | 79 | 79 | 2,674,098 | 3,068,509 | 3,068,509 | 100,222 | 5,562§ | 957,100 | 2,128,560 |
| Superior and St. Croix..... | 24 | 15.6 | ..... | No report. | | | | | |
| Western Union..... ..... | 212.75 | 85.2 | 7,982,543 | 7,874,973 | 3,153,692 | 1,086,119 | 317,353 | 5,820,730 | 43,598,652 |
| West Wisconsin†..... | 228.5 | 228.5 | 17,140,000 | 17,140,000 | 17,140,000 | 803,100 | 62,536 | | |
| North Wisconsin*..... | | | | | | | | | |
| Wisconsin Central‡..... | 323 | 323 | 7,091,164 | ..... | ..... | 599,754 | 237,422 | 5,340,070 | 14,370,688 |
| Wisconsin Valley..... | 88.7 | 88.7 | 1,901,541 | 2,457,598 | 2,457,598 | 112,447 | 31,429 | 626,885 | 1,605,442 |
| Totals..... | 4761.95 | 2455.25‖ | 165,938,592 | 168,878,128 | 69,848,770 | 23,387,400 | 8,066,723 | 175,559,428 | 760,850,158 |

*Manufactures, Mines, and Fisheries.*—For so young a State, Wisconsin has achieved a fair measure of success in her manufacturing industry. Few States have such abundant, available, and permanent water-power for driving machinery, but as yet only a small proportion of it is used. In 1870 there were 7013 manufacturing establishments in the State, employing 43,910 hands (40,296 men, 2114 women, 1500 children), reporting a capital of $41,981,872, paying $13,575,642 in wages, using $45,851,266 of raw material, and producing, annually, $77,214,326 of goods. At this census she ranked thirteenth in amount of production and eleventh in capital invested. The State census of 1875 makes no return of either manufacturing or agricultural productions, but the advance in manufacturing has been very great. The largest industry of the State is in flouring-

* The miles operated of these roads are included in the Chicago Milwaukee and St. Paul.

† This road leases and includes in its statement the Chippewa Falls and Western.

‡ This road leases and includes in its statement the Milwaukee and Northern.

§ Excess of expenses over gross earnings.

‖ Adding the known mileage of roads not reporting, the total mileage of lines operated was 4875.26, and of roads in Wisconsin 2565.73 miles. There is a (so-called) ship-canal between the Wisconsin and Fox or Neenah rivers at Portage City, and another around the falls of Fox River, below Winnebago Lake.

mill products, Milwaukee ranking very high as a grain-port; in 1870, 306 grist and flouring mills, employing 1344 hands and $4,397,400 capital, produced $16,035,734 of flour and meal; 566 saw and planing mills, employing 10,905 hands, produced lumber to the value of $15,382,531, and 81 sash, door, and blind factories added $1,852,379 to the product. Iron in its various manufactures produced in 81 foundries, etc., $3,290,023; there were 485 carriage-factories, employing 2184 hands and producing $2,596,534 worth of carriages and wagons; 82 factories produced $2,393,428 worth of agricultural implements; clothing was produced in 263 shops to the value of $2,340,458; leather tanned and curried in 155 tanneries was produced to the amount of $4,373,440; malt and distilled liquors in 184 distilleries and breweries to the amount of $2,215,613; furniture in 188 shops to the value of $1,542,356; boots and shoes in 78 shops to the value of $1,181,677; machinery of all kinds in 61 machine-shops to the amount of $1,294,016; woollen goods in 48 woollen-mills to the value of $1,115,646; tobacco for chewing, smoking, and cigars, in 113 factories to the amount of $1,100,032; printing and publishing in 66 offices to the amount of $855,115; tin, copper, and sheet-iron ware in 225 shops to the amount of $769,470; saddlery and harness, $711,695; cooperage, $627,190; pig lead in 13 smelting-works, $514,402; brick in 79 brick-kilns, $509,606. In 1870 there were 80 mines and quarries reported in Wisconsin, employing 701 men and boys, with a capital of $737,728, and producing ores, etc., to the value of $510,982. This was certainly an under-estimate, as the production of lead alone exceeded this. There were also 105 fisheries reported, employing 379 hands and producing $214,190 worth of fish.

*Finances.*—The gross receipts of both the general and trust funds for the year ending Sept. 30, 1875, were $2,129,151.46, including a balance of $378,344.98 on hand at the beginning of the year; the disbursements for the same period were $1,851,470.02, leaving a balance of $277,681.44 at the close of the year. The trust funds held by the State (all for educational purposes) amounted Sept. 30, 1875, to $4,058,993.68. The State debt (all but $14,057 being due to these educational funds) amounted at the same date to $2,252,057.

*Banks, Savings Banks, and Insurance Companies.*—There were in July, 1875, 47 national banks in operation in the State, having an aggregate capital of $3,890,000, $3,424,550 in bonds on deposit, and an outstanding circulation of $3,231,986. There were also 23 State banks regularly incorporated, of which 6 were savings banks (and there were also 2 or 3 other savings banks not reporting to the State). These 23 banks had an aggregate capital of $1,113,231.33, loans and deposits to the amount of $6,909,214.80, and other liabilities amounting to $1,977,742.75. Their resources amounted to $9,990,188.88, and showed a moderate surplus over all legitimate indebtedness. There are a large number of private banking-houses in the State. There were in June, 1875, 3 joint-stock and 7 mutual fire and marine insurance companies organized for business in the State; the 3 joint-stock companies had a paid-up capital of $969,743 and net assets of $1,534,559; their reinsurance reserve was $386,060; amount of risks written, $64,258,847; of premiums received during the year, $948,266; of losses paid, $561,560. The 7 mutual companies had $879,945 paid-up capital and $1,716,656 net assets. Their reinsurance reserve was $590,844; amount of risks written, $32,771,135; of premiums received, $473,057; and of losses paid during the year, $312,291. There was but one life insurance company organized for business in the State—the North-western Mutual of Milwaukee, founded in 1858. Its net assets in Jan., 1875, were $15,357,567, its computed premium reserve $12,388,147, its total income for the year preceding was $3,992,660; its total expenditure for the year, $2,466,356.

*Education.*—(1) *Public Schools.*—The number of school districts, not including independent cities, in the year ending Aug. 31, 1875, was 5423, and adding those of Chippewa co., which did not report, 5489. There are 27 cities which have an independent organization. The number of school-houses, aside from cities, is 5428; number of children of school age (4–20) in the State, 461,829; number between these ages who have attended school during the year, 277,884; total number of different pupils in the schools during the year, 279,854; average number of days school was maintained in the counties, 149 days = 29 weeks and 4 days; average number of days in the cities, 195 = 39 weeks; number of pupils in private schools, 10,733; number of graded schools, 394; number of teachers required to teach the schools, 6224; number of persons employed as teachers during the year, 9451; average monthly wages of male teachers in the counties, $43.50, of female teachers, $27.13; average monthly wages of male teachers in the cities, $109.40, of female teachers, $39.40; number of public school-houses in the State (cities and counties), 5260, giving accommodation for pupils to the number of 330,189; number of school-houses built of brick or stone, 686; total valuation of school-houses, sites, and apparatus, $4,979,169; total receipts for school purposes in 1875, $2,728,157; total expenditures, $2,066,375. The whole amount of productive educational funds in 1875 was $4,058,992.68; the amount of income from these funds was $306,415.85, of which $186,409.05 was from the school fund proper. The number of private schools is considerable, and they have over 10,000 children in attendance. There are about 20 academies and seminaries of high character. A strenuous effort is now making to establish township high schools in every township having 3000 or more inhabitants, and to organize such schools for a part of the year, if they cannot be maintained for the whole. Many of the high schools already established are doing excellent work, and form the connecting link between the public school and the university. (2) *Normal Schools and Teachers' Institutes.*—There are 4 normal schools in the State—viz. (1) at Platteville, with 4 departments, 460 pupils in all the departments, and a faculty of 10, of whom 6 belong to the normal department. The pupils are in about equal numbers of each sex; 9 graduated at the last commencement; 88 have graduated in all. The expenses of this school are about $20,500 per annum. (2) Whitewater normal school, which has 11 members of its faculty, 96 students, and expends about $15,000 per year. (3) The Oshkosh school, which has 293 pupils—171 females, 122 males; 13 professors and teachers in all its departments, and an annual expenditure of about $17,380. (4) River Falls normal school, opened in Sept., 1875. Fifty-seven teachers' institutes were held during the year; they were attended by 3668 teachers. The following table gives such particulars as are attainable in regard to the institutions for higher and professional education in the State. The State University at Madison, Wis. (see WISCONSIN, UNIVERSITY OF), is doing a good work, and not only maintains a high grade of scholarship among its students, but aids materially in elevating the character of the teaching in the public schools:

| UNIVERSITIES, COLLEGES, AND PROFESSIONAL SCHOOLS. | Location. | Date of organization. | Under what control. | No. of professors and instructors. | Students. | | | | Value of buildings, grounds, and apparatus. | Amount of productive funds. | Income from productive funds. | Income from all sources. | Scholarship funds. | Volumes in library. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Preparatory. | Collegiate. | Male. | Female. | | | | | | |
| | | | | | | | | | $ | $ | $ | $ | $ | |
| Beloit College | Beloit | 1847 | Congregational | 11 | 146 | 65 | 211 | ... | 88,400 | 121,281 | 12,242 | 14,926 | 15,000 | 8,056 |
| Carroll College | Waukesha | 1846 | Presbyterian | 4 | 154 | ... | 83 | 71 | 15,000 | ..... | 900 | 2,933 | ..... | |
| Galesville University | Galesville | 1859 | Meth. Episcopal | 9 | 101 | 29 | 72 | 58 | 20,000 | 10,000 | 1,000 | 2,800 | ..... | 4,500 |
| Lawrence University | Appleton | 1847 | " " | 11 | 252 | 86 | 193 | 145 | 62,500 | 95,000 | 6,151 | 9,600 | ..... | 8,700 |
| Milton College | Milton | 1867 | Seventh-Day Bap. | 10 | 176 | 79 | 151 | 104 | 39,850 | 6,000 | 425 | 4,072 | ..... | 1,700 |
| North-western University | Watertown | 1865 | Lutheran | 7 | 147 | 25 | 162 | 11 | 35,000 | ..... | ..... | 1,500 | 20,000 | 2,000 |
| Col. of Our Lady of the Sacred Heart | " | 1872 | Roman Catholic | 8 | 160 | ... | 100 | | | | | | | |
| Pio Nono College | St. Francis Station. | 1871 | Roman Catholic | 7 | 71 | 67 | 138 | ... | 50,000 | | | | | |
| Racine College | Racine | 1852 | Prot. Episcopal | 15 | 145 | 45 | 190 | ... | 93,000 | 26,000 | 2,080 | *65,541 | 26,000 | 2,500 |
| Ripon College | Ripon | 1863 | Congregational | 12 | 219 | 64 | 158 | 125 | 69,440 | 55,000 | 7,317 | 10,751 | ..... | 6,000 |
| St. John's College | Prairie du Chien | 1870 | Roman Catholic | 20 | 80 | 100 | 180 | ... | 150,000 | ..... | ..... | 20,000 | ..... | 3,500 |
| University of Wisconsin | Madison | 1848 | State | 26 | 120 | 200 | 236 | 84 | 165,840 | 441,829 | 53,008 | 77,091 | ..... | 70,000 |
| Wisconsin Female College | Fox Lake | 1860 | Congregational | 6 | 9 | 51 | ... | 60 | ..... | 6,200 | 500 | ..... | ..... | 700 |
| Milwaukee Female College | Milwaukee | 1853 | Non-sectarian | 16 | 87 | 89 | ... | 176 | 70,000 | ..... | ..... | ..... | ..... | 600 |
| St. Clara Academy | Sinsinawa Mound | 1848 | Roman Catholic | 20 | 37 | 57 | ... | 94 | 60,000 | ..... | ..... | 1,400 | ..... | 1,000 |
| *School of Science.* | | | | | | | | | | | | | | |
| College of Arts, Univ. of Wisconsin | Madison | 1866 | State | 6 | ... | 49 | 33 | 16 | ..... | 235,634 | 16,148 | | | |
| *Schools of Theology.* | | | | | | | | | | | | | | |
| Nashotah House | Nashotah Mission | 1842 | Prot. Episcopal | 6 | ... | 50 | 50 | ... | 70,000 | 25,000 | 2,000 | ..... | ..... | 6,000 |
| Seminary of St. Francis of Sales | St. Francis Station. | 1856 | Roman Catholic | 13 | ... | 63 | 63 | | | | | | | |
| *School of Law.* | | | | | | | | | | | | | | |
| Law department, Univ. of Wisconsin | Madison | 1868 | Un. of Wisconsin. | 8 | ... | 25 | 25 | ... | With | univers | ity. | | | |

*Includes board.

*Charitable and Corrective Educational Institutions.*—There is an institute for the education of the deaf and dumb at Delavan, which has 9 professors and instructors, and 6 other officers. It had in attendance in 1875, 181 pupils—112 males, 69 females—and on Oct. 1, 1875, 147 pupils were present. Its current expenditures are about $33,750. There is an institution for the education of the blind at Janesville, which had, Oct., 1875, 5 professors and instructors, and 2 other officers, and had during the year previous 82 pupils—36 males, 46 females. Its current expenses are about $19,000 a year. The present superintendent (1876) is a lady, the widow of the former superintendent. There is a State industrial school for boys at Waukesha. It is on the family system, having 6 family buildings, besides the main building, which contains the chapel, schoolrooms, office, residence of the superintendent's family, and rooms for officers, teachers, and employés. In the year ending Sept. 30, 1875, there had been 412 boys in the school, of whom 112 had been by one method or another discharged (4 by death, 7 by escape), and 300 were in the school Oct. 1, 1875. The current expenses are about $35,500 per annum, of which about $5500 is earned by the boys. A soldiers' orphan home at Madison, which had been in existence since the war, had fulfilled its mission, and the building was handed over to the University of Wisconsin in 1875.

*Charitable Institutions.*—There are two hospitals for the insane in the State—the Wisconsin State hospital at Madison, and the Northern Hospital for the Insane at Oshkosh, on Lake Winnebago. The State hospital was founded in 1859. It had under treatment, during the year, 507 patients, of whom 132 had been discharged, leaving 375 residents Sept. 30, 1875—190 males, 185 females. Of the 132 discharged, 32 (16 of each sex) were recovered, 53 (27 males, 26 females) improved, 27 (16 males, 11 females) unimproved, and 20 (11 males, 9 females) died. The current expenses are about $100,000. The Northern hospital was opened in 1872, and had under treatment during the year ending Sept. 30, 1875, 351 patients—185 men and 166 women; there were resident at that date 276—142 men, 134 women. Of the 75 discharged, 21 (13 men, 8 women) were recovered, 26 (14 men, 12 women) improved, 10 (7 men, 3 women) unimproved, 18 (9 of each sex) died. The hospital was enlarged in 1876, and accommodates about 550 patients. Current annual expenses, about $128,100.

*Population.*

| Census year. | Total population. | Males. | Females. | White. | Colored and Indians. | Natives. | Foreigners. | Density. | Ratio of increase. | No. of families. | Persons to a family. | No. of dwellings. | Persons to a dwelling. | Illiteracy. | Of school age, 5-20. | Of military age, 18-45, males. | Of voting age, 21 years and upward, males. | Citizens, males. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1840 | 30,945 | 18,858 | 12,087 | 30,749 | 196 | ..... | ..... | 0.57 | | | | | | | | | | |
| 1850 | 305,391 | 164,351 | 140,405 | 304,756 | 635 | 194,099 | 110,477 | 5.66 | 886.88 | 57,608 | 5.30 | 56,316 | 5.42 | 6,453† | 105,080 | 72,546 | 81,479 | 70,512 |
| 1855* | 552,109 | 291,795 | 260,314 | 550,927 | 1,182 | ..... | ..... | 10.24 | 80.79 | | | | | | | | | |
| 1860 | 775,881 | 407,449 | 368,432 | 773,693 | 2,188 | 498,954 | 276,967 | 14.39 | 40.53 | 147,473 | 5.26 | 154,036 | 5.04 | 16,546† | 271,977 | 161,103 | 193,044 | 154,435 |
| 1865* | 868,325 | 452,692 | 415,633 | 866,720 | 1,605 | ..... | ..... | 16.10 | 11.91 | ..... | .... | ..... | .... | ..... | 330,263 | | | |
| 1870 | 1,054,670 | 544,886 | 509,784 | 1,051,351 | 3,319‡ | 690,171 | 364,499 | 19.56 | 21.48 | 200,155 | 5.27 | 197,098 | 5.35 | 55,441† | 396,408 | 192,331 | 255,159 | 203,077 |
| 1875* | 1,236,729 | 635,217 | 601,512 | 1,234,052 | 2,677 | ..... | ..... | 22.93 | 17.26 | ..... | .... | ..... | .... | ..... | 433,407 | 226,734 | 306,182 | 244,946 |

*Prisons and Jails.*—The State prison is at Waupun. It had during the year 357 prisoners, of whom 341 were men, 16 women; 109 were discharged—103 men, 4 women; and 2 died, leaving 248 remaining in the prison—236 men, 12 women. The expenditures were $100,400, of which about $48,000 was received for convict labor, etc., and about $5000 more was earned, but not paid for. The system followed is of employment by the State, not by contractors. The directors think that hereafter about $27,875 will be all that will be required annually from the State. The State board of charities and corrections speak in high terms of the management of the prison. The jails of the State are, with a few exceptions, in a deplorable condition.

*Newspapers and Periodicals.*—In 1870 there were in the State 190 newspapers, having an aggregate circulation of 343,385, and issuing annually 28,762,920 copies. Of these, 14 were dailies, 2 tri-weeklies, 3 semi-weeklies, 160 weeklies, 2 semi-monthlies, 9 monthlies. In 1872 the number had increased to 201, and in 1875 to 226, the increase being almost entirely in the dailies and weeklies.

*Churches.*

| Denominations. | No. of organizations, 1870. | No. of church edifices, 1870. | Sittings, 1870. | Church property, 1870. | Church organizations, 1875. | Church edifices, 1875. | Ministers, clergymen, or priests, 1875. | Members or communicants, 1875. | Adherent population, 1875. | Church property, 1875. |
|---|---|---|---|---|---|---|---|---|---|---|
| All denominations⁇ | 1864 | 1466 | 423,015 | $4,890,781 | 2388 | 1855 | 1570 | 117,762 | 840,400 | $6,905,350 |
| Baptists (regular) | 145 | 109 | 32,480 | 414,223 | 185 | 152 | 135 | 11,718 | 66,500 | 571,300 |
| Baptists (Free-Will and Seventh-Day) | 67 | 33 | 10,500 | 91,400 | 87 | 49 | 41 | 5,220 | 28,250 | 128,700 |
| Christian Connection and Disciples | 13 | 5 | 1,450 | 9,000 | 18 | 9 | 7 | 1,050 | 5,100 | 17,000 |
| Congregationalists | 157 | 140 | 44,960 | 619,550 | 211 | 197 | 183 | 13,868 | 68,000 | 753,500 |
| Protestant Episcopalians | 82 | 70 | 21,200 | 389,585 | 78 | 74 | 69 | 4,699 | 23,500 | 412,500 |
| Evangelical Association | 179 | 88 | 24,175 | 237,450 | 107 | 93 | 83 | 8,739 | 45,000 | 281,400 |
| Friends | 2 | 2 | 375 | 1,100 | 3 | 3 | ..... | 400 | 2,000 | 2,300 |
| Jews | 4 | 3 | 750 | 8,500 | 5 | 4 | 5 | 300 | 1,500 | 12,800 |
| Lutherans | 171 | 156 | 36,780 | 302,860 | 222 | 201 | 133 | 24,321 | 100,000 | 401,250 |
| Methodists | 508 | 396 | 103,240 | 973,018 | 618 | 440 | 382 | 30,247 | 156,000 | 1,607,200 |
| Moravians | 13 | 10 | 2,500 | 21,700 | 15 | 11 | 18 | 2,000 | 8,000 | 29,400 |
| New Jerusalem Ch. or Swedenborgians | 5 | 4 | 800 | 14,000 | 5 | 5 | 5 | 300 | 1,500 | 16,500 |
| Presbyterians (regular) | 96 | 84 | 23,480 | 300,070 | 125 | 110 | 102 | 7,175 | 36,600 | 402,000 |
| Presbyterians (other) | 2 | 2 | 450 | 8,000 | 3 | 3 | 2 | 180 | 900 | 10,000 |
| Reformed Church (late Dutch) | 5 | 5 | 1,015 | 7,780 | 20 | 18 | 15 | 1,909 | 9,500 | 28,500 |
| Reformed Church (late German) | 18 | 14 | 3,260 | 24,595 | 35 | 29 | 20 | 2,450 | 12,000 | 35,300 |
| Roman Catholics | 329 | 304 | 104,000 | 1,334,450 | 455 | 384 | 305 | ..... | 260,000 | 1,795,000 |
| Second Adventists | 10 | 3 | 650 | 9,000 | 9 | 4 | 6 | 450 | 2,000 | 10,000 |
| Unitarians | 7 | 5 | 1,900 | 41,000 | 8 | 7 | 7 | 400 | 2,000 | 60,000 |
| United Brethren in Christ | 34 | 21 | 5,650 | 37,900 | 69 | 48 | 29 | 1,695 | 8,950 | 78,400 |
| Universalists | 12 | 10 | 3,150 | 43,000 | 18 | 12 | 21 | 486 | 2,400 | 51,500 |
| Union | 1 | 1 | 150 | 500 | 1 | 1 | 1 | 80 | 400 | 800 |
| Local mission | 1 | 1 | 100 | 1,800 | 1 | 1 | 1 | 75 | 300 | 2,000 |

*Constitution, Courts, Representatives in Congress, etc.*—The right of suffrage is accorded to the following classes of male persons, 21 years of age or over, who have resided in the State for one year next preceding any election: (1) citizens of the U. S.; (2) persons of foreign birth who shall have declared their intention to become citizens of the U. S.; (3) persons of Indian blood who have already been declared by act of Congress citizens of the U. S.; and (4) civilized persons of Indian descent who are not members of any tribe. The executive power is vested in a governor, who, as well as the lieutenant-governor, secretary of state, treasurer, and attorney-general, is elected by the people for two years. The superintendent of public instruction is also now elected by the people for two years. The legislative authority is vested in a senate of 33 members, elected by districts for two years, and an assembly consisting of 100 members, also elected by districts, and for one year. The sessions of the legislature are annual. The judicial authority is vested in a supreme court, circuit courts, courts of probate, and justices of the peace. The supreme court consists of one chief-justice and two associate justices, who are elected by the people for six years. It has appellate jurisdiction only, and general power of review of all action of the inferior courts, and in no case which comes before it is a jury called. There are 12 judicial districts, in each of which a circuit judge is chosen by the electors of the district for the term of six years. Circuit courts are held in every county twice a year. A judge of probate is chosen in each county for two years, and the justices of the peace are elected by the towns for two years. The State is entitled under the apportionment of 1872 to 8 members of Congress.

* State censuses.

† In 1850 and 1860 the illiterate were persons twenty years old and upward; in 1870, ten years old and upward.

‡ Including 1206 Indians out of tribal relations.

⁇ There were also reported, in 1870, 1 Mormon and 2 Spiritualist organizations, but no particulars were given.

*Counties.*—There are sixty counties, as follows:

| Counties. | Pop., 1875. | Males, 1875. | Females, 1875. | Pop., 1870. | True valuation (U. S. census), 1870. | Assessed valuation, 1874-75. |
|---|---|---|---|---|---|---|
| | | | | | $ | $ |
| Adams | 6,502 | 3,453 | 3,049 | 6,601 | 1,446,320 | 816,884 |
| Ashland | 730 | 409 | 321 | 221 | 167,280 | 1,033,920 |
| Barron | 3,737 | 2,068 | 1,669 | 538 | 665,478 | |
| Bayfield | 1,032 | 539 | 493 | 344 | 375,956 | 638,318 |
| Brown | 35,373 | 18,429 | 16,944 | 25,168 | 12,163,888 | 3,939,405 |
| Buffalo | 14,219 | 7,519 | 6,705 | 11,123 | 3,439,838 | 1,309,730 |
| Burnett | 1,456 | 779 | 677 | 706 | 538,832 | 342,021 |
| Calumet | 15,085 | 7,913 | 7,172 | 12,335 | 5,420,501 | 2,212,403 |
| Chippewa | 13,995 | 8,318 | 5,677 | 8,311 | 9,776,984 | 5,157,172 |
| Clark | 7,282 | 3,988 | 3,294 | 3,450 | 5,266,317 | 3,306,741 |
| Columbia | 28,803 | 14,725 | 14,078 | 28,802 | 17,420,017 | 8,995,169 |
| Crawford | 15,035 | 7,777 | 7,287 | 13,075 | 5,148,510 | 2,053,949 |
| Dane | 52,798 | 26,954 | 25,844 | 53,096 | 38,607,272 | 19,719,574 |
| Dodge | 48,394 | 24,820 | 23,574 | 47,035 | 34,132,064 | 14,158,412 |
| Door | 8,020 | 4,343 | 3,677 | 4,919 | 1,625,012 | 718,219 |
| Douglas | 741 | 389 | 352 | 1,122 | 1,414,422 | 1,125,437 |
| Dunn | 13,427 | 7,401 | 6,026 | 9,488 | 4,556,920 | 2,749,554 |
| Eau Claire | 15,991 | 8,737 | 7,254 | 10,769 | 5,238,944 | 5,743,029 |
| Fond du Lac | 50,241 | 25,547 | 24,684 | 46,273 | 35,861,740 | 14,802,206 |
| Grant | 39,086 | 20,102 | 18,984 | 37,979 | 30,651,881 | 10,201,922 |
| Green | 22,027 | 11,116 | 10,911 | 23,611 | 18,849,005 | 8,216,074 |
| Green Lake | 15,274 | 7,641 | 7,648 | 13,195 | 9,340,000 | 4,622,352 |
| Iowa | 24,133 | 12,410 | 11,723 | 24,544 | 17,941,107 | 5,754,300 |
| Jackson | 11,339 | 6,044 | 5,295 | 7,687 | 3,175,109 | 1,587,935 |
| Jefferson | 34,908 | 17,742 | 17,166 | 34,040 | 20,742,580 | 9,745,427 |
| Juneau | 15,300 | 7,996 | 7,304 | 12,372 | 3,817,146 | 2,263,425 |
| Kenosha | 13,907 | 7,085 | 6,822 | 13,147 | 12,622,543 | 5,762,880 |
| Kewaunee | 14,405 | 7,506 | 6,899 | 10,128 | 2,811,831 | 846,885 |
| La Crosse | 23,945 | 12,318 | 11,627 | 20,297 | 12,893,938 | 5,300,139 |
| La Fayette | 22,169 | 11,390 | 10,785 | 22,659 | 14,383,814 | 6,158,423 |
| Lincoln | 895 | 523 | 372 | New | county. | |
| Manitowoc | 38,456 | 19,536 | 18,921 | 33,364 | 11,316,963 | 5,024,427 |
| Marathon | 10,111 | 5,524 | 4,587 | 5,885 | 3,805,712 | 1,571,296 |
| Marquette | 8,697 | 4,490 | 4,207 | 8,056 | 1,464,227 | 909,278 |
| Milwaukee | 122,927 | 61,854 | 61,073 | 89,930 | 88,422,711 | 58,597,320 |
| Monroe | 21,026 | 11,047 | 9,979 | 16,550 | 5,038,162 | 2,912,576 |
| Oconto | 13,812 | 7,792 | 6,020 | 8,321 | 11,044,316 | 3,988,127 |
| Outagamie | 25,558 | 13,255 | 12,333 | 18,430 | 10,904,395 | 3,796,522 |
| Ozaukee | 16,547 | 8,517 | 8,030 | 15,564 | 5,727,248 | 3,180,109 |
| Pepin | 5,812 | 3,062 | 2,750 | 4,659 | 1,377,426 | 859,624 |
| Pierce | 15,101 | 8,021 | 7,080 | 9,958 | 5,373,662 | 3,044,580 |
| Polk | 6,736 | 3,626 | 3,110 | 3,422 | 1,950,365 | 1,254,676 |
| Portage | 14,857 | 7,843 | 7,014 | 10,634 | 4,022,646 | 2,138,217 |
| Racine | 28,712 | 14,685 | 14,027 | 26,740 | 20,827,105 | 10,133,934 |
| Richland | 17,353 | 8,912 | 8,441 | 15,731 | 6,180,000 | 2,442,814 |
| Rock | 39,039 | 19,848 | 19,191 | 39,030 | 40,900,000 | 19,192,870 |
| St. Croix | 14,957 | 8,015 | 6,942 | 11,035 | 7,796,551 | 3,804,704 |
| Sauk | 26,932 | 13,833 | 13,099 | 23,860 | 13,200,000 | 5,713,721 |
| Shawano | 6,635 | 3,574 | 3,061 | 3,166 | 2,809,159 | 1,199,817 |
| Sheboygan | 34,021 | 17,369 | 16,652 | 31,749 | 14,626,613 | 8,030,906 |
| Taylor | 849 | 549 | 300 | New | county. | |
| Trempealeau | 14,992 | 7,848 | 7,144 | 10,732 | 3,660,594 | 2,293,714 |
| Vernon | 21,524 | 11,224 | 10,300 | 18,645 | 9,429,411 | 3,271,247 |
| Walworth | 26,259 | 13,167 | 13,092 | 25,972 | 29,560,000 | 13,926,296 |
| Washington | 23,862 | 12,286 | 11,576 | 23,919 | 11,810,144 | 6,212,681 |
| Waukesha | 29,395 | 15,173 | 14,222 | 28,274 | 25,600,000 | 14,486,085 |
| Waupaca | 19,616 | 10,151 | 9,455 | 15,539 | 4,152,550 | 2,382,618 |
| Waushara | 11,523 | 5,957 | 5,566 | 11,279 | 3,784,234 | 1,705,665 |
| Winnebago | 45,033 | 23,157 | 21,876 | 37,279 | 25,625,512 | 15,165,849 |
| Wood | 6,048 | 3,297 | 2,751 | 3,912 | 1,402,374 | 1,277,496 |
| Totals | 1,236,729 | 639,217 | 597,512 | 1,054,670 | 702,307,329 | 337,758,068 |

*Principal Cities and Towns.*—Madison, the capital of the State, in 1870 had 9176 inhabitants; in 1875, 10,093; Milwaukee, 71,440 in 1870, and 100,775 in 1875; La Crosse, Racine, Fond du Lac, and Oshkosh had from 12,000 to 20,000 each in 1875; Green Bay, Eau Claire, Watertown, and Janesville, between 8000 and 11,000; Manitowoc, Chippewa Falls, Lake, Appleton, and Sheboygan, from 5000 to 8000; Baraboo, Neenah, Platteville, Jefferson, Wauwatosa, Oconto, Portage, Beloit, and Kenosha, from 4000 to 5000; Menasha, Prairie du Chien, Waukesha, Wausau, Mineral Point, Stevens' Point, Berlin, Beaver Dam, Koshkoning, Fort Howard, Ripon, and Sparta, between 2500 and 4000; while about 30 towns and villages range from 1800 to 2500.

*History.*—The first white settlement in Wisconsin was made at Green Bay in 1639 by the French, and during the next forty years several points, among them Prairie du Chien on the Mississippi, were occupied, and war waged with the Indians to secure the right of way through Lake Winnebago; but in the course of time this colony became so far assimilated to the Indian tribes of the region that but few traces of it now remain. It was under the laws of Canada, and the British government maintained its possession of it by a military force until 1796, when the U. S. obtained possession and annexed it for purposes of government to the North-west Territory, ceded by Virginia and other States to the U. S. In 1809 it was included in the Territory of Illinois, as then formed; in 1818, when Illinois was admitted into the Union as a State, Wisconsin was still a wilderness, and was annexed to Michigan Territory for such government as was needed. In 1827 lead was discovered in large quantities at Potosi, Mineral Point, etc., and there was a great rush of immigrants to that section. The Indians soon became troublesome, and the Black Hawk war ensued in 1832. Treaties were made with the Indians soon after, by which they removed to reservations beyond the Mississippi. In 1836 the population had increased to such an extent that a Territorial government was organized, which at first included a part of the upper peninsula of Michigan, the whole of Minnesota and Iowa, and that part of Dakota lying E. of the Missouri and White Earth rivers. On the admission of Michigan into the Union as a State, a part of the Lake Superior region was set off to her, and when the Territory of Iowa was formed, it included all the region W. of the Mississippi. The first effort to procure the admission of Wisconsin to the Union as a State was made in 1846, when Congress passed an enabling act under certain conditions. A convention was held in that year, and a constitution drafted, which was sent to Washington and submitted to the people for their acceptance. Congress passed an act admitting the State under this constitution in 1847, but the people rejected the constitution on account of some objectionable features. Another convention was called Dec. 15, 1847, which submitted a new constitution; this was ratified in Mar., 1848, and the State was admitted to the Union by act of Congress May 29, 1848. Under this constitution, with some amendments, it is still governed. The growth of the State has been rapid and peaceful. It has attracted a large immigration from the continent of Europe. In the late civil war its troops were distinguished for their courage and patriotic spirit.

*Governors of Wisconsin.*

(1) *Territorial Governors.*

Henry Dodge.....1836–41
James D. Doty.....1841–44
Nathaniel P. Tallmadge.1844–45
Henry Dodge.....1845–48

(2) *State Governors.*

Nelson Dewey.....1848–51
Leonard J. Farwell.....1851–53
William A. Barstow .....1853–55
Coles Bashford.....1855–57
Alexander W. Randall...1857–61
Louis P. Harvey.....1861–62
Edward Salomon (acting).....1862–63
James T. Lewis.....1863–66
Lucius Fairchild.....1866–72
Cadwallader C. Washburn.....1872–74
William H. Taylor.....1874–76
Harrison Ludington.....1876–78

*Electoral and Popular Vote for President and Vice-President.*

| Elect. year. | Candidates who received the electoral vote of the State. | Elect. vote. | Pop. vote. | Opposition candidates. | Pop. vote. | Third-party candidates. | Pop. vote. | Fourth-party candidates. | Pop. vote. |
|---|---|---|---|---|---|---|---|---|---|
| 1848 | Lewis Cass P.<br>Wm. O. Butler V.-P. | 4 | 15,001 | Zachary Taylor P.<br>Millard Fillmore V.-P. | 13,747 | Martin Van Buren P.<br>C. Francis Adams V.-P. | 10,428 | | |
| 1852 | Franklin Pierce P.<br>William R. King V.-P. | 5 | 32,658 | Winfield Scott P.<br>Wm. A. Graham V.-P. | 21,743 | John P. Hale P.<br>George W. Julian V.-P. | 8,780 | | |
| 1856 | John C. Fremont P.<br>William L. Dayton V.-P. | 5 | 66,090 | James Buchanan P.<br>J. C. Breckenridge V.-P. | 52,843 | Millard Fillmore P.<br>A. J. Donelson V.-P. | 579 | | |
| 1860 | Abraham Lincoln P.<br>Hannibal Hamlin V.-P. | 5 | 86,110 | Stephen A. Douglas P.<br>H. V. Johnson V.-P. | 65,021 | John C. Breckenridge P.<br>Joseph Lane V.-P. | 888 | John Bell P.<br>Edward Everett V.-P. | 161 |
| 1864 | Abraham Lincoln P.<br>Andrew Johnson V.-P. | 8 | 83,458 | George B. McClellan P.<br>George H. Pendleton V.-P. | 65,884 | | | | |
| 1868 | Ulysses S. Grant P.<br>Schuyler Colfax V.-P. | 8 | 108,857 | Horatio Seymour P.<br>Francis P. Blair V.-P. | 84,710 | | | | |
| 1872 | Ulysses S. Grant P.<br>Henry Wilson V.-P. | 10 | 104,997 | Horace Greeley P.<br>Benj. Gratz Brown V.-P. | 86,477 | Charles O'Conor P.<br>——— V.-P. | 834 | | |
| 1876 | Rutherford B. Hayes P.<br>Wm. A. Wheeler V.-P. | 10 | | Samuel J. Tilden P.<br>Thos. A. Hendricks V.-P. | | Peter Cooper P.<br>Samuel F. Cary V.-P. | | | |

(The writer is indebted to His Excellency, Hon. Harrison Ludington, governor of Wisconsin, for valuable documents and statistics used in preparing this article, and also to Prof. T. C. Chamberlin of Beloit College, State geologist, for documents and statistics.) L. P. Brockett.

**Wisconsin,** tp., Jackson co., Minn. P. 193.

**Wisconsin River** rises in Lake Vieux Desert (which is partly in Michigan and partly in Wisconsin), flows in a generally S. course to Portage City, Wis., where it turns to the S. W. It reaches Mississippi River 4 miles below Prairie du Chien. Breadth at its mouth, 1800 feet; elevation, 600 feet. Its length is over 600 miles. It is navigable 200 miles to Portage City, whence a short canal leads to Fox River. The channel of the Wisconsin is much injured by shifting sandbars. The upper part of the river passes through heavy pine forests. Several cataracts, of which the most famous are the Dalles of the Wisconsin and Grandfather Bull Falls, break the course of this picturesque stream. (See Fox River, and Navigation, Inland.)

**Wisconsin, University of,** at Madison, Wis., was incorporated in 1838 and organized in 1848. In 1849 a preparatory department was established, in 1850 the university was formally opened, in 1851 the first college classes were formed, and in 1875–76 the university comprised 27

instructors and 345 students. Congress in 1838 granted 46,080 acres of land to the Territory of Wisconsin for the support of a university, and in 1854 it made another grant of 46,080 acres of land. In 1866 the university also received those 240,000 acres of land which Congress had granted to the State in 1862 for the establishment of an agricultural school, and in 1867 it was reorganized in accordance with the conditions of this grant. Since 1866 it has received from the State appropriations to the amount of $170,000, among which were $50,000 in 1870 for the erection of the Ladies' Hall, and $80,000 in 1875 for the erection of Science Hall; and by a law of 1876 a tax of one-tenth of a mill on the total valuation of the State is to be levied annually for its benefit, whereby its annual revenue will be increased to about $40,000. The general management of the institution is vested in a board of 11 regents—namely, the State superintendent of public instruction, and 10 members, one for each of the eight Congressional districts of the State, and two for the State at large, appointed for three years by the governor. The president is chosen by the board of regents. The university comprises a college of letters, consisting of a department of ancient and a department of modern classics; a college of arts, consisting of a department of general science, agriculture, civil engineering, mining and metallurgy, mechanical engineering, and military science; a school of law, organized in 1868, of whose faculty the judges of the supreme court are members; and, finally, a sub-freshman and a post-graduate course. Tuition is free to all students from the State, and since 1867 all departments are open to women.

**Wis'coy,** p.-v. and tp., Winona co., Minn. P. 523.

**Wiscoy,** p.-v., Hume tp., Allegany co., N. Y.

**Wis'dom, Book of,** called by the Septuagint "Wisdom of Solomon," was considered canonical by some of the Fathers of the Church, who believed that Solomon was its author, and by the Roman Catholic Church. By most Protestant churches it is considered apocryphal, as most Protestant theologians agree that its author must have been an Alexandrian Jew of the second or first century B. C. Among the numerous commentaries on the book the most remarkable are by John Rainold (Oxford, 1618), Bauermeister (Göttingen, 1828), and Grimm (Leipsic, 1860).

**Wise,** county of N. Texas, drained by the W. fork of Trinity River; surface undulating, soil fertile. Cattle are the chief live-stock. Staples, Indian corn, oats, and a little cotton. Cap. Decatur. Area, about 900 sq. m. P. 1450.

**Wise,** county of S. W. Virginia, bordering upon Kentucky; surface mountainous, with much iron ore and bituminous coal: soil in the valleys fertile. Swine and sheep are the chief live-stock. Staples, Indian corn, oats, tobacco, wool. Cap. Wise Court-house. Area, 250 sq. m. P. 4785.

**Wise** (Daniel), D. D., b. at Portsmouth, England, Jan. 10, 1813; came to the U. S. 1833; became a minister of the Methodist Episcopal Church; was for five years editor of *The Sunday School Messenger*, and subsequently of the *Ladies' Pearl*, *The Rhode Island Temperance Pledge*, and *Zion's Herald* 1852; was corresponding secretary of the Methodist Sunday School Union and Tract Society 1856–72, and is editor of *The Sunday School Advocate* and of all the Sunday school and tract publications of the M. E. Church. Author of more than 30 religious works for youth, some of which have been very widely circulated.

**Wise** (Henry Alexander), b. at Drummondtown, Accomac co., Va., Dec. 3, 1806. His father, who was a lawyer, and had been Speaker of the house of delegates in the State legislature, died in 1812, and his mother in the year following; graduated at Washington College, Pa., in 1825; studied law at Winchester, Va., and then moved to Nashville, Tenn.; returned to his native county, where he continued the practice of law with great success, and soon became actively engaged in politics until the outbreak of the civil war. In 1832 he was sent as a delegate to the first national Democratic convention that ever assembled in the U. S. It met at Baltimore. In it he zealously advocated the nomination of Gen. Jackson for his second term, but positively refused to support the nomination of Mr. Van Buren for Vice-President, made by that convention. Soon after, when the question of nullification arose as a practical one in South Carolina, he took position against that doctrine, while with equal zeal he denounced the principles of Gen. Jackson's proclamation, as they were then understood in Virginia. Was elected to Congress in 1833; re-elected successively each year till 1843. He was at that time considered the greatest orator of the House. Prentiss had not as yet entered on that arena. Wise had become quite intimate with, and greatly attached to, Mr. Clay during this period of his life, and, it has been said, was a warm advocate of his nomination for the Presidency in the election of 1840. He certainly contributed greatly, by his influence, to the getting of Mr. Tyler's name put on the Harrison ticket for the Vice-Presidency at that election. In 1843, Mr. Tyler nominated him minister to France. He resigned his seat in the House in expectancy of its confirmation, but the Senate, which was so decidedly at war with Mr. Tyler at this time, rejected the nomination. Wise was immediately returned again to the House by his constituents. In 1844, Tyler nominated him minister to Brazil. This appointment was confirmed by the Senate, and for three years he represented his country at Rio Janeiro. Resigning in 1847, he returned and took an active part in the Presidential election of 1848. He was a Cass elector for his State. In 1850 he was a member of the reform convention of Virginia. In 1852 he was again Presidential elector on the Pierce ticket. In 1855 came off his great canvass for the governorship of the State. In this he made his most celebrated anti-Know-Nothing fight. He was elected by a majority worthy of his effort. He continued in the office of governor until after the John Brown raid in 1859. Mr. Wise was decidedly opposed to secession in 1860, but he went with his State after her ordinance of secession. He entered the Confederate service with the commission of brigadier-general, which position he held until the close of the war. After the war he took no active part in politics, but changed his residence to Richmond, where he resumed the practice of law. D. Sept. 12, 1876.

Alexander H. Stephens.

**Wise** (Henry Augustus), cousin of Gov. Wise of Virginia, b. at Brooklyn, N. Y., May 12, 1819; entered the U. S. navy as midshipman 1834; served on the coast of Florida during the Seminole war, and on the Pacific coast during the Mexican war 1846–48; married a daughter of Edward Everett; was flag-lieutenant of the Mediterranean squadron 1852–55; conveyed the Japanese ambassadors home in the U. S. frigate Niagara 1861; became assistant chief of the ordnance bureau, with the rank of commander, 1862; was promoted to captain and chief of that bureau Dec., 1866; resigned his post 1868, and went to Europe for his health. D. at Naples, Italy, Apr. 1, 1869. Author of *Los Gringos, or an Interior View of Mexico and California, with Wanderings in Peru, Chili, and Polynesia* (1849), *Tales for the Marines* (1855), *Scampavias, from Gibel-Tarek to Stamboul* (1857), *The Story of the Gray African Parrot* (1859), and *Captain Brand of the Centipede* (1860); all which appeared under the *nom de plume* of "Harry Gringo."

**Wise** (John), b. at Roxbury, Mass., in Aug., 1652; graduated at Harvard 1673; began to preach at Ipswich 1680; was settled as pastor there 1683; was imprisoned, fined, and deposed from the ministry by order of Gov. Andros for remonstrating against a violation of charter rights in imposing a province-tax without authority from the assembly; brought a suit against Chief-Justice Dudley for denying him the benefit of the habeas corpus act; was deputy from Ipswich in the legislature of 1689, after the overthrow of Andros; was chaplain to the expedition against Quebec 1690; subsequently opposed in several publications a scheme for placing the churches of Massachusetts under the jurisdiction of ecclesiastical councils, and favored the introduction of inoculation for small-pox 1721. D. at Ipswich Apr. 8, 1725. Author of *The Church's Quarrel Espoused* (1710), a work abounding in wit and satire, and *A Vindication of the Government of New England Churches* (1717), both of which were republished in a single volume in 1860 (4th ed.) by the Congregational board of publication.

**Wise** (W. C.), U. S. N., b. Nov. 8, 1842, in Virginia; graduated at the Naval Academy in 1863; became lieutenant in 1867, lieutenant-commander in 1868; served in the New Ironsides in several fights with the defences of Charleston harbor, and in the Minnesota at both the Fort Fisher fights. Commended for "gallantry." F. A. Parker.

**Wise Court-house,** p.-v., cap. of Wise co., Va.

**Wise'man** (Nicholas Patrick Stephen), D. D., b. at Seville, Spain, Aug. 3, 1802, of Irish parents; educated at Waterford, at Durham College, and in the English college at Rome, where he graduated 1824; was ordained to the priesthood 1825; became professor of Oriental languages in the Roman university, and vice-rector of the English college 1827; was advanced to the rectorship 1828; returned to England 1835; established with O'Connell the *Dublin Review*, and delivered a course of lectures on Roman Catholic doctrines at St. Mary's, Moorfields, during Lent, 1836; maintained a polemic on the "Real Presence" with Dr. Turton, bishop of Ely, and published several able works in advocacy of Roman Catholicism; lectured at Rome during Lent, 1837, at which time he induced Pope Gregory XVI. to appoint several additional vicars apostolic in England; was consecrated bishop of Melipotamos *in partibus infidelium*, and coadjutor to Dr. Walsh of the Midland dis-

trict of England June 8, 1840; became in the same year president of St. Mary's College, Oscott; visited Rome shortly after the accession of Pius IX., 1847, and gave his influence in favor of the measure then preparing for the restoration of the Roman Catholic hierarchy in England; was appointed pro-vicar apostolic of the London district 1848, and vicar apostolic on the death of Bishop Walsh 1849; was summoned to Rome Aug., 1850; aided in preparing the "apostolic letter" of Sept. 29, re-establishing the English hierarchy; was nominated archbishop of Westminster Sept. 30, and made cardinal Oct. 1, 1850—measures which gave rise to great excitement in England, where they were characterized as a "papal aggression," and gave rise to the "Ecclesiastical Titles act," prohibiting the assumption of local ecclesiastical titles by Roman Catholics, and which remained nominally in force until its repeal in 1872. Cardinal Wiseman was active in the exercise of his new functions, making frequent episcopal journeys through England and Ireland, delivering lectures and speeches, and publishing numerous volumes in support of his doctrines. D. in London Feb. 15, 1865. Author, among other works, of *Horæ Syriacæ* (Rome, 1828), *Lectures on the Connection between Science and Revealed Religion* (2 vols., 1836), *The Real Presence* (1836), *Lectures on the Doctrines and Practices of the Catholic Church* (2 vols., 1836), *Three Lectures on the Catholic Hierarchy* (1850), *Essays on Various Subjects* (3 vols., 1853), *Fabiola, or the Church of the Catacombs* (1855), and *Recollections of the Last Four Popes* (1858). PORTER C. BLISS.

**Wish'art** (GEORGE), supposed to be a native of Pittarow, Forfarshire, Scotland, b. about 1510; educated at a private grammar school; taught Greek at Montrose; began preaching the doctrines of the Reformation about 1535; had to flee to England about 1538; resided and taught at Corpus Christi College, associating with Bilney, Latimer, and other Reformers; published several theological tracts in Latin; returned to Scotland July, 1543; began anew to preach at Montrose, Perth, Ayr, and Dundee, with such effect that in the latter town the populace destroyed the convents and churches of the Black and Grey Friars; made a preaching-tour of the western counties; was arrested by the earl of Bothwell at Ormiston; was tried for heresy at St. Andrew's Mar. 1, before Cardinal Beaton's ecclesiastical court, composed of several bishops; condemned to the stake, and burned at St. Andrew's Mar. 28, 1546. At the stake he predicted the death "within a few days" of the cardinal, who was a spectator from the castle, and the assassination of the latter about three months afterward is alleged by recent historians to have been in pursuance of a plot to which Wishart was privy, the evidence being the mention of "a Scotishman called Wysshart" in a MS. account of the plot in the State Paper Office. A *Life* (1876) has been published by Rev. C. Rogers.

**Wishart,** or **Wiseheart** (GEORGE), D. D., b. at Yester, East Lothian, Scotland, in 1609; educated at the University of Edinburgh; became a parish minister at North Leith and at St. Andrew's; refused to take the covenant 1639, for which he was deprived of his living and imprisoned; made his way to Newcastle, England, where he preached, and was captured by the Scottish army Oct., 1644; was for some months imprisoned in the common jail at Edinburgh, suffering great hardships; succeeded in joining the celebrated royalist leader James Graham, marquis of Montrose, to whom he became chaplain; escaped to the Continent 1646; returned to Scotland in the expedition of Montrose 1650, and narrowly escaped sharing his fate; became chaplain the same year to Elizabeth, the ex-electress-palatine and titular queen of Bohemia; accompanied her to England at the Restoration 1660; became rector of Newcastle-upon-Tyne, and was consecrated bishop of Edinburgh June 1, 1662; was averse to the intolerant policy of Charles II., and recommended leniency to the Covenanters. D. at Edinburgh in 1671. Author of a *History of the Wars of Montrose* (Paris, 1647), in elegant Latin, a copy of which was tied to the neck of the marquis at his execution. A second part, completing the history to the death of Montrose, was left by Wishart in MS., but was never printed in Latin. English translations of the valuable work were published in 1720, 1756, and 1819.

**Wishart's,** tp., Robeson co., N. C. P. 624.

**Wis'mar,** town of Germany, in Mecklenburg-Schwerin, on a deep inlet of the Baltic, has an excellent harbor, shipbuilding docks, fisheries, breweries, distilleries, and manufactures of sailcloth, cordage, tobacco, and playing-cards. P. 13,883.

**Wis'ner,** p.-v. and tp., Tuscola co., Mich. P. 165.

**Wisner** (BENJAMIN BLYDENBURG), D.D., b. at Goshen, N. Y., Sept. 29, 1794; removed when three years of age to Geneva, N. Y., where he prepared for college under Rev. Dr. Axtell; graduated with honors at Union College 1813; was principal of Johnstown Academy 1813–14; tutor at Union College 1815–18, studying theology in the mean time under Rev. Dr. Andrew Yates; graduated at Princeton Seminary 1820; was ordained pastor of the Old South church, Boston, Feb. 21, 1821; resigned that post Oct., 1832, to accept the corresponding secretaryship of the A. B. C. F. M., in which he displayed rare executive abilities; visited different parts of the country, forming missionary associations, in which labors he was highly successful, and was an influential member of several benevolent and religious organizations. D. at Boston Feb. 9, 1835. Author of *A History of the Old South Church* (1830) and of several published sermons and addresses.

**Wisner** (MOSES), b. at Aurelius, N. Y., in 1818; received a good education; removed to Michigan 1839; studied law; was admitted to the bar at Pontiac 1842; became prosecuting attorney for Lapeer co. 1843–44; was defeated as a candidate for circuit judge 1852; was Republican governor of Michigan 1859–61; entered the army as colonel of the 22d Michigan Vols. 1862. D. at Lexington, Ky., Jan. 5, 1863.

**Wisner** (WILLIAM), D. D., b. at Warwick, N. J., in 1782; was admitted to the bar, and practised law in Orange co.; was pastor of a Presbyterian church at Ithaca for some years, of a church at Rochester 1830–62, and removed in 1870 to Cedar Rapids, Ia., where he d. Jan. 7, 1871. Author of *Incidents in the Life of a Pastor* (1851) and *Elements of Civil Liberty, or the Way to Maintain Free Institutions* (1863).

**Wissembourg',** town of Germany, province of Alsace, on the Lauter, is strongly fortified, manufactures tiles, bricks, soap, felt hats, and paper-hangings, and carries on an active general trade. From Wissembourg to Lauterburg, along the Lauter, extends a line of fortifications called the "Lines of Wissembourg." P. 5913.

**Wis'tar** (CASPAR), M. D., b. at Philadelphia Sept. 13, 1761, of Quaker parents, was grandson of Caspar, who emigrated from Germany in 1717 and established a glass-factory in New Jersey; was a volunteer nurse in the hospitals after the battle of Germantown, and was thereby induced to study medicine under Dr. Redman and in the University of Pennsylvania; completed his medical education at Edinburgh 1786; travelled on the Continent; began practice in Philadelphia Jan., 1787; was professor of chemistry in Philadelphia College and physician to the dispensary and hospital 1789–92; adjunct professor of anatomy and surgery 1792–1808; thenceforth sole professor of anatomy and censor of the College of Physicians from 1794 until his death, Jan. 22, 1818. He was highly distinguished in his profession, conferred great lustre upon the Philadelphia Medical School, was for many years vice-president and president of the American Philosophical Society, and succeeded Dr. Rush as president of the Society for the Abolition of Slavery 1813. Author of *A System of Anatomy* (2 vols., 1812) and other professional works.

**Wista'ria** [named in honor of Dr. Caspar Wistar], an interesting genus of climbing leguminous shrubs. *W. consequana*, a native of China, is one of our most beautiful spring flowering climbers. *W. frutescens* is a smaller ornamental species, growing wild in the West and South of this country in rich wet soils.

**Wis'ter** (ANNIS LEE **Furness**), daughter of Rev. Dr. William H. Furness, b. in Philadelphia about 1840; married Caspar Wister, M. D.; has contributed to *Lippincott's Magazine* and translated from the German several excellent novels, among which are Blum and Wahl's *Seaside and Fireside Fairies* (1864); E. Marlitt's *The Old Ma'mselle's Secret* (1868; 8th ed. 1870), *Gold Elsie* (1868), *The Countess Gisela* (1869), *The Little Moorland Princess* (1873), and *The Second Wife* (1874), Wilhelmine von Hillern's *Only a Girl, or a Physician for the Soul* (1870); Hackländer's *Enchanting and Enchanted, or Fairy Spells* (1871); Volkhausen's *Why Did he not Die?* (1871); Von Auer's *It is the Fashion* (1872); and Fanny Lewald's *Hulda, or the Deliverer* (1874).

**Wis'wall** (ICHABOD), b. in England in 1638; came to Massachusetts in childhood; studied three years at Harvard, but did not graduate; was minister of Duxbury from 1678 until his death; was many years a prominent instructor of youth; went to England in 1689 as agent for the colony of Plymouth, and labored strenuously to prevent the annexation of Plymouth to Massachusetts Colony, but was defeated by Increase Mather. D. at Duxbury July 23, 1710.

**Witch'craft.** The mediæval belief in witches and witchcraft had a very complex origin. Common superstition was one of its main roots; the science of magic, transmitted from the pagan philosophy, was another, etc.

But its definite character it received from the peculiar development of the doctrine of Satan. Closely connected with the speculations concerning the first origin of evil, the true constitution of free will, the absolute difference between good and bad, etc., and yet, on the other hand, singularly independent of the results of these speculations, there grew up during the Middle Ages a view according to which the world was subject not to one god, but to two—namely, God and the devil; and this view was held by every good Christian. Of course, the pious and devout man had no doubt as to which of these two princes was the mightiest, but as little did he doubt that it was possible for him and for any man to withdraw himself from the mercy and justice of God and sell his immortal soul to the devil. By this general view of the world the idea of witchcraft was formed as a supernatural power to inflict diseases and miseries of all kinds, acquired by a bargain with the devil. There are, however, features in this curious phenomenon in which the pagan element far exceeds the Christian. Thus, for every hundred witches there was only one wizard, and again of the one hundred witches the ninety-nine were old women. The explanation of this peculiar fact cannot be doubtful. With the old Germanic tribes, and generally with all barbaric nations, the art of healing wounds and curing diseases was entirely entrusted to their women. As now this art was not accompanied by a corresponding science, but rested almost exclusively on a totally blind tradition with respect to the power of certain herbs and processes, and was developed by an equally blind personal experience, something mystical became attached to it; and it was quite natural that with old, ugly women, and to the eyes of young, suffering, and impatient men, this mysticalness should assume the aspect of wickedness. On passing into the Christian world this phenomenon lost its true and natural explanation, and received an artificial and fantastic coloring: the seduction of Eve by Satan was given by the theologians as the reason why there were more witches than wizards, but the extensive development of the worship of the Virgin, which took place at the same time, shows that the coloring was very superficial.

After creeping around among people for centuries as a dumb superstition, the belief in witchcraft finally burst out, in the fifteenth century, into an open mania; and it was no doubt the papal bulls issued in its behalf which caused this dreadful outbreak. The first dates from 1484 and was issued by Innocent VIII., charging the inquisitors to hunt up and put to death all witches and other practisers of diabolical arts. It was specially directed to Germany, and here, in 1489, Krämer and Sprenger drew up the famous *Mallus Maleficarum* ("the Witch-Hammer"), in which the whole doctrine of witchcraft is set forth in systematic form, and rules laid down for the detection and trial of the crime. Other bulls followed—in 1494 by Alexander VI., in 1521 by Leo X., in 1522 by Adrian VI., etc. The misery caused by these bulls is indescribable. In the bishopric of Bamberg 600 persons were burned or hanged for sorcery in the course of four years, and 900 in the bishopric of Würzburg. In Geneva 500 persons were burned in four months in 1516, and 1000 in the district of Como in 1524. In England a statute of Elizabeth (1562) made witchcraft by itself a capital crime, whether it had been directed to the injury of others or not; and the hold which the belief had taken of the imagination of the nation is shown by Shakspeare's *Macbeth*. But the frenzy did not develop fully until the reign of James VI., who himself wrote a treatise on demonology, while Hopkins and his "witch-finders" scoured the country from one end to the other. During the Long Parliament 3000 persons are said to have been put to death for sorcery. The colonists of New England were also staunch enemies of witches, as shown by the Salem tragedy of 1691–92. The first to oppose these dreadful errors were Johann Weier, with his *De Præstigiis Dæmonum* (1563), and Friedrich von Spee, with his *Cantio criminalis* (1631), but it was not until after the publication of Balthasar Becker's *Bezauberte Welt* (1691) and Christian Thomasius's *Theses de Crimine Magiæ* (1701) that the dense clouds of superstition, malice, ignorance, and wilful lies began to disappear. In England the laws against witchcraft were repealed in 1736, and the last witch was officially tried and executed in 1793 in Posen. (A good exposition of the whole matter has been given by W. G. Soldan in his *Geschichte der Hexenprocesse*, 1843.) CLEMENS PETERSEN.

**Witch'-Elm, Wych-Elm,** or **Scotch Elm,** the *Ulmus montana*, a large fast-growing European elm, much planted for ornament and affording good timber. It is very hardy in this country.

**Witch'-Hazel,** a North American shrub, quite large, especially southward, the *Hamamelis virginica* of the order Hamamelaceæ. Its blossoms appear very late in autumn, just as the leaves are falling, and the fruit matures early in the succeeding autumn. Like the true hazel in Europe, its twigs are employed as divining-rods, whence the name. The bark is employed in medicine, and joins somewhat aromatic to astringent and sedative qualities.

**Wit'enagemot** [Ang.-Sax., "assembly of wise men"], the old Anglo-Saxon national council, the great court of justice and supreme legislative body of the English nation before the Conquest, superior to the *scir-gemot* or county assembly, and itself the offspring of the primitive *folk-mot*, an old Germanic institution. The great nobles, the high ecclesiastics, and the great landholders appear to have had seats in the *witan*, or witenagemot, as well as the higher shire officers; and probably the freemen who lived near the place of meeting were allowed to sit in the assembly. The witenagemot is interesting as being the original germ of the British Parliament.

**With'amsville,** p.-v., Union tp., Clermont co., O. P. 254.

**Withdrawing a Juror,** in law, is a proceeding on the trial of a cause by which one of the jurors is dismissed from the jury-box, in order that the trial may thus be stopped, and at the same time the issues may not be decided by nonsuiting the plaintiff or ordering a verdict for him, as the case may be. The party procuring a juror to be withdrawn can bring the same cause to trial at a subsequent term by paying the costs of the former term. Recourse is generally had to this method when by means of some unexpected event or some mistake, such as the absence of an important witness, a formal defect in the pleadings, etc., one of the parties would necessarily fail without regard to the real merits, and the judge suggests or consents that a juror be withdrawn without any decision of the case. The process itself, which has come down from an early day, is sufficiently absurd. It having been arranged between the court and the counsel that such a disposition shall be made of the cause, the clerk motions a juryman to step aside out of the jury-box. This being done, he informs the court, as though the fact were a sudden discovery of his own, that there appear to be only eleven jurymen present. The court thereupon orders the names of the panel to be called, and as only eleven answer, it announces that the trial must be stopped. JOHN NORTON POMEROY.

**With'er** (GEORGE), b. at Brentworth, Hampshire, England, June 11, 1588; entered Magdalen College, Oxford, 1604; was called home "to hold the plough" without a degree 1607, but soon proceeded to London 1608; studied law at Lincoln's Inn; printed in 1613 a volume of metrical satires on the manners of the time, entitled *Abuses Stript and Whipt*, for which he was thrown into the Marshalsea prison; published many political and devotional pieces in prose and verse; served as captain of horse and quartermaster-general of a regiment in the expedition sent by Charles I. against the Scotch Covenanters 1639; sold his estate and raised a troop of horse for the Parliament 1642; was soon promoted to the rank of major; was commissioned by the Long Parliament a justice of the peace; was made by Cromwell "major-general of all the horse and foot in the county of Surrey;" profited largely by the confiscations of royalist estates, but had to surrender his acquisitions at the Restoration, when he was imprisoned three years in Newgate, by order of the "Convention Parliament," on the charge (which he denied) of being the author of a "scandalous and seditious libel;" had his library taken from him, and passed his last years in poverty. D. in London May 2, 1667, and was buried in the Savoy church. His numerous poems were long forgotten, but have recovered popularity, and been frequently reprinted in the present century.

**With'erite,** a mineral carbonate of baryta, named after its discoverer, Withering. Crystallization right rhombic; almost as hard as fluor-spar; white, sometimes transparent; rare, so far as known, in America; one locality near Lexington, Ky.; occurs so abundantly at Fallowfield, Northumberland, England, as to be mined largely, and sold for making plate glass and for chemical uses. Molecular structures:

The mineral, $O_6.4^{C}_{20}.2^{Ba}_{28} = 4.329$ { Dana's *Mineralogy*.....4.29. Mohs.....4.301. Karsten.....4.302.

Artificial preparations, $O_6.4^{C}_{20}.\left(\begin{smallmatrix}Ba & Ba\\ 28 & 29\end{smallmatrix}\right) = 4.216$ (Schröder, 4.216).

$O_6.4^{C}_{20}.2^{Ba}_{27} = 4.557$ (Filhol, 4.557).

HENRY WURTZ.

**With'ers** (JONES MITCHELL), b. in Madison co., Wis., Jan. 12, 1814; studied at Greene Academy, Huntsville; graduated at West Point 1835; became second lieutenant of 1st Dragoons, and repaired to Fort Leavenworth, but resigned Dec. 5 of the same year; served on the staffs of Gen. B. S. Patterson and Gen. Jessup, commanding the Alabama volunteers for the threatened Creek war of 1836; studied law at Tuscaloosa; acted as private secretary to Gov. C. C.

Clay; was admitted to the bar 1838; settled at Mobile as lawyer and commission merchant 1841; was elected colonel of Alabama volunteers for the Mexican war 1847, but his regiment was not accepted for active service; was elected to the legislature 1855; was mayor of Mobile 1856–61; entered the Confederate service as colonel of the 3d Alabama infantry; became brigadier-general July, 1861; took command of the defences of Mobile; was appointed major-general early in 1862; had command of a division at Shiloh Apr. 6, and in the Western army organized at Tupelo June, 1862; took part in the memorable Kentucky campaign; was distinguished at the battle of Stone River Dec. 31, 1862, and afterward commanded a department with head-quarters at Montgomery. Since the war he has been editor of the Mobile *Tribune*.

**Withers** (Robert E.), M. D., b. in Campbell co., Va., Sept. 18, 1821; educated at a private academy and at the University of Virginia, where he graduated in medicine 1841; began practice at Danville, Va.; entered the Confederate military service in 1861 as major; was speedily commissioned colonel of the 18th Virginia regiment; was severely wounded in one of the battles near Richmond 1862; subsequently commanded the military post at Danville; removed to Lynchburg 1866; edited the *News* until 1868; was nominated by the Democratic party for governor 1869, but withdrew in favor of Gilbert C. Walker; was chosen Presidential elector at large 1872, lieutenant-governor 1873, and soon afterward U. S. Senator for the term 1875–81.

**With'erspoon** (John), D. D., LL.D., b. at Yester, Haddingtonshire (East Lothian), Scotland, Feb. 5, 1722, and said to be a descendant of John Knox; was educated at the University of Edinburgh; was licensed to preach 1743; was parish minister of Beith in the W. of Scotland 1745–57; joined the Pretender with a corps of militia at Glasgow; was taken prisoner at the battle of Falkirk, but released after two weeks' confinement in Donne Castle; became favorably known as a theologian by several learned treatises; was pastor of the Low church at Paisley from 1757 until 1768, when he accepted the presidency of Nassau Hall at Princeton, N. J., in which he was inaugurated Aug. 17, becoming also professor of divinity there and pastor of the church; identified himself with the interests of his adopted country, taking an active part in the political struggles of the time; was in 1776, the college being for a time broken up, chosen a member of the constitutional convention of New Jersey, and also of the Continental Congress, in which he sat "in full clerical dress" for six years, being one of the signers of the Declaration of Independence and of the Articles of Confederation; was an active worker on committees, including the "secret committee;" was the author of several of the state papers promulgated by Congress; was a member of the board of war, and visited the camps to inquire into and ameliorate the condition of the troops; sent his only son to war, in which he became a major and was killed at the battle of Germantown; opposed in Congress the repeated issues of paper currency, and showed great sagacity in anticipating political contingencies; gave lectures on moral philosophy and rhetoric at the college, of which he greatly raised the reputation and improved the financial condition; visited England in 1783, and again in 1784, to collect funds for the college, with but slight success, the war being too recent; made some unfortunate speculations in Vermont lands; married as his second wife, at the age of sixty-nine (1791), a young lady of twenty-three, and resided thenceforth on a farm near Princeton, which he called Tusculum, and was totally blind during the last two years of his life. D. at Tusculum Nov. 15, 1794. His two daughters by his first marriage married respectively Dr. David Ramsay the historian and Rev. Dr. Samuel Stanhope Smith, who succeeded him as president of the College of New Jersey. His *Works* were collected at New York (4 vols., 1800–01) and at Edinburgh (9 vols., 1804), edited with a *Memoir* by Dr. S. S. Smith; they comprise, besides academical lectures and sermons, *Ecclesiastical Characteristics, or the Arcana of Church Policy* (Glasgow, 1753), *An Essay on the Doctrine of Justification* (Edinburgh, 1756), *A Serious Inquiry into the Nature and Effects of the Stage* (Glasgow, 1757), *Essays on Important Subjects* (London, 3 vols., 1764), *Considerations on the Nature and Extent of the Legislative Authority of the British Parliament* (Philadelphia, 1774), *An Essay on Money*, and a series of essays on social and literary topics entitled *The Druid* (1781). A *Life* by Dr. Ashbel Green is in MS. in the library of the New Jersey Historical Society at Newark. His colossal statue was unveiled in Fairmount Park, Philadelphia, 1876. Porter C. Bliss.

**With'ington** (Leonard), D. D., b. at Dorchester, Mass., in 1789; graduated at Yale College 1814; became pastor of the First church at Newburyport, Mass., 1816, and still fills that post (1876), a colleague having been appointed in 1858. Author of *The Puritan, a Series of Essays* (2 vols., 1836), *Solomon's Song Translated and Explained* (1861), and other works.

**Wit'ness** [Ang.-Sax. *witnesse*], in law, is a person who testifies in a judicial proceeding as to the existence of facts material to the issue which is to be decided. In the different forms of trial known to the American and English law his testimony may be given orally in open court, or it may be taken before some officer, reduced to the form of a written deposition, and read on the hearing. The common law absolutely prohibited certain classes of persons from being witnesses, of which the following were the most important: (1) The parties in all civil actions and the accused in all criminal prosecutions. (2) Persons pecuniarily interested in the event of the action if the interest was in favor of the party by whom they were called; other kinds of interest, such as that resulting from the nearest relationship (except husband and wife) or friendship, were not grounds for rejection, and only affected the credibility of the testimony. (3) Husband and wife were not allowed to be witnesses for or against each other in civil suits, nor in criminal trials unless the prosecution was an offence committed by one against the other. (4) Persons who denied the existence of God or of a future state of reward and punishment. This rule was based upon the notion that for such disbelievers an oath would have no sanction. (5) Persons who had been convicted of a felony or other infamous crime, unless their capacity had been restored by a pardon. (6) Idiots, lunatics, and persons of unsound mind unable to apprehend the nature of the obligation assumed by them. (7) Children so young or uninstructed that they do not understand the nature of an oath. The application of this rule necessarily depends upon the circumstances of each particular case. Some of these rules were based upon a very low estimate of human nature. The second, concerning pecuniary interest, assumed that every one would certainly commit perjury if the truth and his slightest pecuniary interest were opposed. The legislatures of England and of the various States of the U. S. have at length adopted the wiser principle that every possible avenue of the truth, consistent with public morals and the privacy of domestic life, should be opened, and that the evidence of all those who have a knowledge of the facts, especially of those whose knowledge is the most immediate, should be weighed rather than rejected. As a result of this theory, several of the foregoing rules have been abrogated. The initiative in the reform consisted in removing all restrictions upon third persons pecuniarily interested in the event of the action. Statutes to this effect have been enacted in Great Britain and in most if not all of the U. S. Legislation soon followed permitting the parties in civil suits to be witnesses for themselves or for their adversaries, and husbands and wives to testify for and against each other. The latter modification of the common law is, however, subject to certain important limitations. Neither party is permitted to disclose facts and circumstances which came to their knowledge through the intimacy and confidence of the marital relation. In several States actions between husband and wife for divorce on the ground of adultery are wholly excluded from the operation of the enactment, while in other States the exclusion extends only to evidence upon the single issue of the adultery itself. In many of the States the accused parties in criminal trials are permitted, if they choose, to testify on their own behalf. There is also a difference in the details of this legislation. As all the State constitutions protect parties accused of crime from being compelled to furnish evidence against themselves, the prisoners can never be called as witnesses for the prosecution. In order that the statute may not infringe upon the constitutional guaranty, a provision has been added in some States that if the prisoner does not avail himself of the privilege and testify, this fact shall not raise a presumption against him, and shall not be animadverted upon by the court or the prosecution. It has been universally decided, however, that when the accused does become a witness, he may be cross-examined in the same manner as any other witness for the defence. The religious qualification has been wholly swept away in a great majority of the States, as being inconsistent with our policy in respect to the separation between the state and religion. The other common-law disqualifications, being based upon very different motives, have been retained. Besides the rules concerning the witnesses themselves, there are others touching certain classes of facts from which they are either privileged or prohibited from testifying: (1) No one can be compelled to state matters which would tend to criminate himself or render him liable to a penalty. This is a personal privilege of the witness, which he must assert on his own behalf or may waive. (2) An attorney or counsellor will

not be suffered to disclose facts communicated by or learned from a client in the confidence of a business relation actually existing between them. (3) This rule, which the common law admitted only in the case of lawyers, has been quite generally extended by statute to physicians and to clergymen, who are forbidden to disclose facts discovered concerning their patients or their penitents through the means of their professional relations. At the common law every witness was compelled to give his evidence under the sanction of an oath administered upon the Bible or the holy Gospels. This primitive rule has been modified by modern legislation. In the U. S. the statutes generally admit two forms of the oath—one by means of the Bible or the Gospels, the other by the uplifted hand—but in both methods the formula of the oath itself is the same, a direct appeal being made to God. If a proposed witness asserts that he has conscientious scruples against the use of an oath, he is then permitted to affirm—that is, he solemnly and sincerely declares and affirms that he will tell the truth, etc., the sanction presented to his mind being the pains and penalties of perjury. JOHN NORTON POMEROY.

**Wit'son,** tp., Pope co., Ark. P. 332.

**Witt, de.** See DE WITT.

**Wittekind,** or **Widukind,** in the wars between the Saxons and Charlemagne the leader of the Westphalian Saxons, as Albion was of the Eastphalians. When most of the Saxon chiefs submitted to Charlemagne at the Diet of Paderborn (777), Wittekind fled to Gotfred, king of Jutland, and with aid from him he returned in 778, while Charlemagne was in Spain, and renewed the war in the Rhine countries. But Charlemagne hastened back to Germany, and Wittekind was once more compelled to flee to Jutland. In 782, however, he again returned, and annihilated a Frankish army at Süntelberg on the Weser. Charlemagne took a cruel revenge by massacring 4500 Saxons at Verden on the Aller, but this cruelty occasioned a general rising of the Saxons under Wittekind and Albion. They were defeated, however, at Detmold and on the Hase, and the two chiefs fled to Holstein. Nevertheless, in the next year a reconciliation took place between the emperor and his two great antagonists; they repaired to his camp at Attigny in Champagne, and were baptized, after which event they are not mentioned in history, though legend still continued for a long time to be very busy with them. In 1377 the emperor Charles IV. raised a monument to Wittekind in the parish church of Enger, where he is said to lie buried. In 1812 another monument was raised to him in Minden, Westphalia.

**Wit'tenberg,** town of Prussia, province of Saxony, on the right bank of the Elbe, is famous as the place where the Reformation began. The houses of Luther, Melanchthon, and Lucas Cranach are still shown, also the spot, outside the Elster gate, where the papal bull was burned. In the Schlosskirche Luther and Melanchthon are buried. The university, once so famous, was incorporated with that of Halle in 1817. Breweries, distilleries, and tanneries are in operation, and woollen and linen goods manufactured. P. 11,934.

**Wittenberg,** p.-v., Brazeau tp., Perry co., Mo. P. 116.

**Wittenburg's,** tp., Alexander co., N. C. P. 848.

**Witts'burg,** p.-v., Smith tp., cap. of Cross co., Ark. P. 113.

**Witt'stock,** town of Prussia, province of Brandenburg, on the Dosse, has manufactures of woollen and linen fabrics. P. 6947.

**Woad** [Lat. *Isatis tinctoria;* Ang.-Sax. *waud;* Fr. *guède* or *pastel;* Ger. *Waid*], a biennial herbaceous plant, indigenous in Europe, which has been employed from the times of the Romans for dyeing blue. It is cultivated in France and Germany. The leaves possess a pungent odor and an acrid taste. These are either simply dried and sent to market, or are made into a paste by grinding, which is then prepared into balls and allowed to undergo fermentation, after which it is dried. Woad does not appear to contain either indigo-white or indigo-blue (see INDIGO), its coloring qualities being due to the presence of a body termed *indican* ($C_{26}H_{31}NO_{17}$), which is converted into indigo-blue and *indiglucine* by the action of dilute acids. At present it is chiefly used for the reduction of indigo in the "woad-vats," but is seldom employed by itself for dyeing purposes. J. P. BATTERSHALL.

**Wo'burn,** p.-v. and tp., Middlesex co., Mass., on Boston Lowell and Nashua R. R., 10 miles from Boston, was founded in 1640; has an area of 7750 acres and a pop. of 10,000. The principal industry is the manufacture of leather, a tannery having been established here as early as 1673. There is also a gaslight company, iron-foundry, chemical works, glue-factory, and the trades usual in a busy New England town. There are 1 national and 2 savings banks, a public library, 3 post-offices, 2 weekly newspapers, 11 churches, an academy, and 35 public schools. Horn Pond, a small lake in the S. part of the town, supplies pure water from a reservoir situated on Horn Pond Mountain, giving a head of 127 feet in the centre of the town, and ample pressure for fire and domestic purposes to all parts of the municipality. The Centre and N. villages are connected by a horse railroad 2 miles in length. Woburn has an excellent fire department, a military company, Masonic, Odd Fellows, Grand Army, and other associations. P. 8560. JOHN L. PARKER, ED. "JOURNAL."

**Wod'row** (ROBERT), b. at Glasgow, Scotland, in 1679; educated at Glasgow University, where he became librarian, and became in 1703 minister of Eastwood, Perthshire, where he d. Mar. 21, 1734. Author of a *History of the Sufferings of the Church of Scotland from the Restoration to the Revolution* (Edinburgh, 2 vols., 1721–22), *Lives of the Reformers and most Eminent Ministers of the Church of Scotland* (Glasgow, 3 vols., 1834–45), and *Analecta, or Materials for a History of Remarkable Providences, mostly relating to Scotch Ministers and Christians* (4 vols., 1842–43), both edited by Rev. Dr. Leishman for the Maitland Club. Many of his MSS. are preserved in the Advocates' Library. "Wodrow Society" was formed at Edinburgh in 1841 for the publication of the early writers of the Reformed Church of Scotland, and has published 24 volumes, of which the earliest consisted of Wodrow's *Correspondence* (3 vols., 1842–43), edited by Rev. Thomas McCrie.

**Wof'ford College,** named for Rev. Benjamin Wofford, who gave $100,000 "for the purpose of establishing and endowing a college for literary, classical, and scientific education, to be located in his native district, Spartanburg, and to be under the control and management of the conference of the Methodist Episcopal Church of his native State, South Carolina." The college was chartered by the legislature of South Carolina Dec. 16, 1851, and the board of trustees held their first meeting to organize under it at Newbury Court-house Nov. 24, 1853, when they elected a president and four professors, who opened the institution for regular scholastic exercises Aug. 1, 1854. An ample curriculum of studies was prescribed, philosophical and chemical apparatus were provided sufficient for an extended course of instruction, and the mineralogical and geological cabinet, originally selected with care, has grown in interest and importance by contributions made to it from year to year. The college library received at first valuable donations from sundry benevolent friends of literature, and with the additions made to it from time to time, both by donations and purchase, has grown to respectability and importance. The two literary societies—viz. the Calhoun and the Preston, the first organized Oct. 1, 1854, and the second Oct. 16, 1858, named respectively for the late Hon. John C. Calhoun and the late Hon. William C. Preston—are uncommonly well conducted to secure the laudable purposes for which they were instituted. The number of students has regularly increased, and now amounts in all departments to about 160. The buildings were completed Jan. 1, 1855, and consist of a large and elegant college edifice, a president's house, and houses for four professors. They stand on a beautiful and liberal campus, enclosing about 60 acres, within the corporate limits of the town of Spartanburg. The endowment of the college, originally comfortable, was almost entirely lost by the war, but the trustees and alumni society are making vigorous efforts to restore it, and are devising liberal things for the future welfare and success of the institution. The college is easily accessible by railroad to all parts of the country.

**Wöh'ler** (FRIEDRICH), b. at Eschersberg, near Frankfort, July 31, 1800; studied medicine and natural history, especially mineralogy and chemistry, at the universities of Marburg and Heidelberg 1819–23, then in Stockholm under Berzelius, and was appointed professor of chemistry at the Technical Institute of Berlin in 1825, at the Technical Institute of Cassel in 1831, and at the University of Göttingen in 1836. His principal work is *Grundriss der Chemie* (2 vols., 1831–40), which has been often reprinted and translated into several foreign languages. He also wrote *Die Schwefelwasserquellen zu Neundorf* (1836) and *Die Mineralanalyse in Beispielen* (1861), besides numerous papers in Poggendorf's and Liebig's *Annalen*, and translations of Berzelius's *Lehrbuch der Chemie* (4 vols.) and *Jahresberichte*.

**Woide** (CHARLES GODFREY), D. D., LL.D., F. R. S., b. in Poland (or Holland) in 1725; educated at German universities; became a Socinian minister; settled in England as preacher at the German chapel royal, St. James, 1770; was subsequently reader and chaplain at the Savoy; became assistant librarian at the British Museum 1782, and cultivated the less-known Oriental languages. D. in London. He edited La Croze's *Coptic Lexicon* (1775), Scholtz's

*Egyptian Grammar* (1778), and the Alexandrian MS. of the Greek Testament in fac-simile (folio, 1786).

**Wol'cot,** or **Wolcott** (JOHN), M. D., better known as PETER PINDAR, b. at Dodbrooke, Devonshire, England, in 1738; served an apprenticeship of seven years to his uncle, a physician and apothecary at Fowey, Cornwall, who ultimately left him a considerable property; accompanied Sir William Trelawney, governor of Jamaica, to that island as his physician 1767; took orders in the Church of England, and obtained a curacy in Jamaica 1768, but soon returned to England on the death of his patron; spent twelve years at Truro, Helston, and other towns in Cornwall as a physician; discovered the merits of the obscure painter Opie, with whom he went to London 1780; made himself conspicuous by his poetical productions, mostly satirical, which involved him in many quarrels, one of which, with Gifford, led to a personal encounter in which he was worsted. His attacks upon the king were so effective that at one time the ministry purchased his silence by the payment of £300 per annum. In his later years he became totally blind. D. at Somers Town, London, Jan. 13, 1819. His separate publications were above 70 in number, but few of them are now read. Several editions of his collected *Works* appeared in his lifetime, the last in 5 vols. (1816).

**Wolcott,** p.-v. and tp., New Haven co., Conn. P. 491.

**Wolcott,** p.-v., Princeton tp., White co., Ind. P. 109.

**Wolcott,** p.-v., Scott co., Ia.

**Wolcott,** p.-v. and tp., Wayne co., N. Y. P. of v. 658; of tp. 3223.

**Wolcott,** p.-v. and tp., Lamoille co., Vt. P. 1132.

**Wolcott** (OLIVER), LL.D., son of Gov. Roger, b. at Windsor, Conn., Nov. 26, 1726; graduated at Yale College 1747; served as a captain of New York volunteers on the Canada frontier 1748; studied medicine, but never practised; was elected sheriff of Litchfield co. 1751; became a judge of common pleas and of probate; was a member of the executive council 1774–86; commissioner of Indian affairs for the northern department 1775; was elected to the Continental Congress Jan., 1776; signed the Declaration of Independence; commanded as major-general the fourteen Connecticut regiments raised for the protection of New York; joined Gen. Gates with several hundred volunteers, and was present at the battle of Saratoga, where he gained the rank of brigadier-general of the regular army; served alternately in Congress, in the army, or on commissions throughout the war; was lieutenant-governor of Connecticut 1786–96, and governor 1796–97. D. at Litchfield, Conn., Dec. 1, 1797.

**Wolcott** (OLIVER), LL.D., son of the preceding, b. at Litchfield, Conn., Jan. 11, 1760; graduated at Yale College 1778; served as a volunteer to repel the British attack on Danbury 1777, as volunteer aide to his father 1779, and as an officer in the commissary department 1780–81; was admitted to the bar 1781; was employed in the financial affairs of the State government, and subsequently (1784) as a commissioner to settle its accounts with the U. S.; was a member of the society of "Hartford wits;" was comptroller of public accounts of the U. S. 1788–89, auditor of U. S. treasury 1789–91, comptroller 1791–95, secretary of the treasury 1795–1800, and judge of U. S. circuit court 1801–02; removed to New York City 1802; was a merchant there until 1812; took part with his brother Frederick in founding extensive manufacturing establishments at Wolcottville, near Litchfield; was president of the State constitutional convention 1817, and governor 1818–27, after which he resided in New York, where he d. June 1, 1833.

**Wolcott** (ROGER), b. at Windsor, Conn., Jan. 4, 1679; was apprenticed to a mechanic, and never attended a school, but acquired a good education by private study; was commissary in the expedition of 1711 against Canada; served as an officer in subsequent wars with France, and was major-general and second in command at the capture of Louisburg 1745; was successively a member of the assembly and of the executive council, judge of the county court, deputy governor, chief judge of the superior court, and was governor of the colony 1751–54. D. at East Windsor May 17, 1767. He published a volume of *Poetical Meditations* (New London, 1725), and a pamphlet on church government (Boston, 1761), and left a MS. poem of 1500 lines entitled *A Brief Account of the Agency of the Honorable John Winthrop, Esq., in the Court of King Charles the Second, Anno Dom. 1662, when he obtained a Charter for the Colony of Connecticut,* which contains a detailed account of the Pequot war. It was printed in the collections of the Massachusetts Historical Society (1st series, vol. iv.).

**Wol'cottville,** p.-v., Litchfield co., Conn.

**Wolcottville,** p.-v., La Grange co., Ind., on Grand Rapids and Indiana and Canada Southern R. Rs., has 2 churches, good schools, 1 bank, 1 newspaper, 2 hotels, and several manufactories. P. 80.

JAMES R. RHENBOTTOM, ED. "REGISTER."

**Wolcottville,** v., Orange tp., Noble co., Ind. P. 80.

**Wôlei,** or **Ôlei,** is the *papyrus* of India. It is the palm-leaf, the ancient paper of Hindoos. It is written on with a sharp iron style. After the writing, lamp-black or any other dark pigment is rubbed into the leaves. The most ancient documents of Hindoos which are neither upon rocks or metals are written on these leaves, which seem to defy the ravages of time. The writer has seen some which are at least eight centuries old, which, as far as the leaves are concerned, are as fresh as if they were turned out yesterday. The leaves are cut in long narrow slips. Yellow at first, by age they become brown. Holes are bored in them, and the leaf-books are attached and bound together by strings passing through these holes. The books were called nine centuries ago by the poetess Auveyâr, the *nîttolei* ("long leaves"). Some of them are curiously ornamented. R. C. CALDWELL.

**Wolf** [Ger. *Wolf*], the common name for those wild species of the family Canidæ and genus *Canis* that most resemble the dog, and which agree with the ordinary types of that animal in the possession of circular pupils to the eyes and a moderate bushy tail. The species are somewhat numerous, and the typical representatives are chiefly found in the northern hemisphere and southward to India; but allied species, which are properly called wolves, although more generally designated as wild-dogs or foxes, are also found in Africa, South America, and Australia. They agree essentially in their habits with the dogs, and hunt their prey either by surprising or running it down. At some seasons of the year they live, to some degree, in solitude, although they often associate in packs; and especially is this the case in winter, when they combine in the pursuit of game and other objects of prey. In America there are two well-marked species: (1) the large common wolf (*Canis lupus*), identical with the wolf of Europe and Northern Asia, and (2) the small prairie wolf (*Canis latrans*), occurring on the plains of the Western States and Territories. (1) The former has an average length of about four feet, with a tail of seventeen to twenty inches; its color is generally grizzly-gray above, but is quite variable, sometimes being black and sometimes white, and with various gradations between the two. These variations were formerly supposed to indicate specific differences, but as they are found in cubs of the same litter, they are now recognized as being not even of sub-specific or varietal importance. (2) The prairie wolf—or, as it is perhaps more generally known, *coyote*—is about three feet or somewhat longer, and has a tail about sixteen inches in length. Its color, as in the wolf, is generally gray, but is subject to much less variation than in the former species. It is found more generally on the plains of the great West and in the hydrographical basins of the Missouri and Saskatchewan rivers, and extends southward into Mexico. It is quite prolific, sometimes having as many as ten in a litter. It lives mostly in burrows. THEODORE GILL.

**Wolf,** tp., Lycoming co., Pa. P. 819.

**Wolf** (FRIEDRICH AUGUST), b. at Haynrode, Prussian province of Saxony, Feb. 15, 1759; studied classical literature and language at Göttingen; became teacher at the seminary of Ilfeld in 1779, rector of the gymnasium of Osterode in 1782, professor of philosophy and pedagogics at Halle in 1783; removed to Berlin in 1807, where he took a prominent part in the foundation of the new university. D. at Marseilles Aug. 8, 1824, during a journey in Southern France for the sake of his health. He was an excellent teacher and lecturer, and also a very prolific writer on philological and pedagogical subjects. His critical editions, with notes and introductions, gave the final decision on many points of long debate and great uncertainty; and his *Prolegomena ad Homerum,* in which he demonstrated that the Homeric poems were not the work of any single man, but a compilation or combination of various rhapsodies, made a sensation all over Europe, and started a multitude of new researches of the greatest critical and antiquarian interest. His biography has been written by Hanhart (1825), Körte (1833), Schulz (1836), by Gottholdt (1843), and by Arnoldt (2 vols., 1861).

**Wolf** (GEORGE), b. in Allen tp., Northampton co., Pa., Aug. 12, 1777, of German stock; was well educated; became a lawyer, postmaster of Easton, Pa., a clerk of the orphans' court; was in Congress 1824–29; was governor of Pennsylvania 1829–35, and was the proposer and one of the founders of the Pennsylvania public-school system; first comptroller of the U. S. treasury 1836–38, and then became collector of the port of Philadelphia. D. at Philadelphia Mar. 11, 1840.

**Wolf Creek,** p.-v. and tp., Mercer co., Pa. P. 555.

**Wolf Creek,** p.-v. and tp., Monroe co., West Va. P. 1424.

**Wolf'-Dog,** a large variety of the domestic dog, allied to the shepherd's dog, now found almost exclusively in Spain, though formerly common in Ireland and Scandinavia.

**Wolfe,** county in the S. E. of Quebec, Canada, is traversed by the river St. Francis. It contains extensive forests and has much mineral wealth. Cap. South Ham. P. 8823.

**Wolfe,** county of E. Kentucky, lying on N. fork of Kentucky River, and drained by its affluent, Red River; surface hilly and broken, soil moderately fertile in parts. Sheep and swine are the chief live-stock. Staples, Indian corn and oats. Cap. Campton. Area, 170 sq. m. P. 3603.

**Wolfe** (Charles), b. at Dublin, Ireland, Dec. 14, 1791; studied at Winchester School; graduated at Trinity College, Dublin, 1814; was a tutor there 1815–56; took orders in the Church of England 1817, and became curate of the parish of Donoughmore, Ireland. After a visit to the S. of France, he d. of consumption at the Cove of Cork (now Queenstown) Feb. 21, 1823. His poetical *Remains, with a Brief Memoir of his Life* (1825; 8th ed. 1846), were published by Archdeacon John A. Russell. His *Ode on the Death of Sir John Moore* is one of the most beautiful of modern poetical compositions.

**Wolfe** (James), b. at Westerham, Kent, England, Jan. 15, 1726, son of Lieut.-Gen. Edward Wolfe; entered the army as second lieutenant at an early age; was present at the battles of Dettingen, Fontenoy, Falkirk, and Culloden; distinguished himself at Lafeld 1747, and at the siege of Maestricht 1748; commanded a regiment in the Highlands of Scotland 1749–54; was quartermaster-general in the expedition against Rochefort 1757, and brigadier-general in that against Louisburg, Cape Breton, 1758; was appointed by Pitt major-general, and placed in command of an expedition for the conquest of Canada 1759; arrived with 8000 men in the St. Lawrence in June; was repulsed by Montcalm in a first attack, July 31, and fell in the moment of victory in the battle on the Plains of Abraham, Sept. 13, 1759. He was buried at Greenwich, and monuments to his memory have been erected in Westminster Abbey and at Quebec. His *Life* has been written by Robert Wright (London, 1864).

**Wolfe'borough,** p.-v. and tp., Carroll co., N. H., on North Conway division of Eastern R. R., and on the N. E. shore of Lake Winnipiseogee, has excellent schools, 3 banks, 1 newspaper, 1 woollen and 1 shoe factory, 2 tanneries, and several lumber-mills. It is much frequented during the summer. P. 1995. C. H. Potter, Ed. "State News."

**Wolfe Island,** an island tp. and p.-v. at the outlet of Lake Ontario, directly opposite Kingston, Canada, and Cape Vincent, N. Y. It belongs to Frontenac co., Ontario, is about 18 miles long, and has a lighthouse. P. of tp. 2737.

**Wolf'enbüttel,** town of Germany, in Brunswick, on the Ocker, has an excellent library of 220,000 volumes, of which Lessing was librarian for some time, several educational institutions, and manufactures of lacquered and japanned wares, paper-hangings, leather, and tobacco. P. 10,457.

**Wolff** (Albert), b. at Neu-Strelitz, Mecklenburg, Nov. 14, 1814; studied sculpture under Rauch, afterward in Rome, and was made professor at the Academy of Fine Arts in Berlin 1866. He is especially celebrated for his equestrian statues, of which he produced a great number—Frederick William III. in Berlin, Frederick William IV. in Königsberg, Ernst August in Hanover, Frederick Francis I. in Ludwigslust, etc.

**Wolff** (Emil), b. at Berlin Mar. 2, 1802; studied sculpture under Gottfried Schadow, and went in 1823 to Rome, where he has since resided. He treats mostly mythological subjects. Many of his works have gone to England and Russia. His *Fisher-Boy* (1833) became celebrated in Germany.

**Wolff** (Joseph), D. D., LL.D., b. at Weilersbach, near Bamberg, Germany, in 1795, son of a Jewish rabbi; studied at Stuttgart, Munich, and Weimar; was baptized into the Roman Catholic Church at Prague 1812; completed his education at the universities of Vienna and of Tübingen, devoting himself to Oriental languages; spent a year in the family of Count Stolberg at Frankfort; went to Rome in 1816; was presented by Niebuhr to Pope Pius VII.; admitted as a student into the Roman College, and afterward into the College of the Propaganda, from which, however, he was expelled in 1818 for heretical opinions; spent some months in the Redemptorist monastery of Val Sainte, Switzerland; went to London 1819; united with the Church of England; spent two years at Cambridge, studying Oriental languages under Dr. Samuel Lee, and enjoying the intimacy of the celebrated Evangelical theologian, Prof. Charles Simeon; was ordained as a missionary to the Jews Apr., 1821; made an extensive tour through the East, visiting Gibraltar, Malta, Egypt, Palestine, Persia, Circassia, the Crimea, and Turkey; returned to England 1826; married Lady Georgiana Mary Walpole, daughter of the earl of Orford, Feb., 1827; embarked with her in April upon another missionary tour; left her in Malta; penetrated through Persia to Bokhara, and thence to Afghanistan, Cashmere, and the Punjaub, reaching Calcutta Mar., 1833; visited Southern India; sailed from Bombay to Arabia; spent some time in Abyssinia, where he learned the Amharic language; returned to England 1834; published accounts of his labors; revisited Abyssinia, Arabia, and India 1836; proceeded thence to the U. S., reaching New York in Aug., 1837; was ordained deacon in the Protestant Episcopal Church; lectured in the principal cities and preached before Congress; reached England Jan., 1838; was ordained priest at Dublin; obtained the curacy, first of Linthwaite and afterward of High Hoyland, Yorkshire; made a second journey to Bokhara in 1843, at the instance of the British government, to attempt the release or learn the fate of Col. Stoddard and Capt. Conolly; was himself imprisoned and condemned to death, but saved by the interposition of the Persian ambassador; returned to England 1845, and spent the remainder of his life as parish priest at Isle Brewers, Somersetshire. His wife dying in 1859, he married a second time May, 1861, and d. at Isle Brewers May 2, 1862. He published, among other works, *Researches and Missionary Labors among Jews and Mohammedans* (Malta, 1835), *Journal of Missionary Labors* (1839), *A Narrative of a Mission to Bokhara* (2 vols., 1845), and an autobiography entitled *Travels and Adventures*, etc. (2 vols., 1860). Porter C. Bliss.

**Wolff** (Wilhelm), b. at Fehrbellin, Prussian province of Brandenburg; was educated in the royal iron-foundry at Berlin; worked afterward in the Soyer foundry in Paris and in the Stiglmayr foundry in Munich, but devoted himself more and more exclusively to purely artistic pursuits, and gained a great reputation as a sculptor of animals. Among his most celebrated groups are—*A Buffalo attacked by Greyhounds, The Lion and the Serpent, A Bacchante playing with Panthers, The Lion's Ride,* after Freiligrath's poem.

**Wolffian Bodies,** two fœtal organs in man and other animals which precede the development of the urinary and internal generative apparatus, and supposed to have a connection with their appearance, though how is as yet undetermined. In the human fœtus the Wolffian bodies appear almost as soon as the embryo takes shape, and at the end of one month of gestation are well-developed, symmetrical organs. They are larger than either the liver or intestine, these three viscera being the only ones formed at that early period. The Wolffian body, then at the height of its growth, is kidney-shaped, and has an internal structure resembling that of the kidney. From the first to the second month it fails to grow proportionately with the rapid increase of the fœtal body, and hence is soon relatively smaller than before, and smaller than the other organs which are appearing. Back of the Wolffian bodies the kidneys have appeared, and in front oval symmetrical bodies have sprung up which become the testes of the male or the ovaries in the female. These new bodies grow rapidly, and the Wolffian bodies waste, are scarcely noticeable after the second month, and unrecognizable at later periods of intrauterine or fœtal existence.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Wolf'-Fish,** a name given to the fishes of the family Anarrhichidæ and genus *Anarrhicas* on account of their fierce aspect and large canine teeth. They are elongated, but stout fishes, closely related to the blennies, with which they have been, by most authors, associated as members of the same family. The scales are rudimentary; the head has a steep profile; the mouth is widely cleft; the jaws armed with strong conical teeth in and toward the front, and with molars in two rows on the palate and sides of the lower jaw; the dorsal fin is long and sustained by flexible spines; the anal fin is less than half as long as the dorsal, and opposite the posterior half of that fin; the caudal is distinct from the dorsal and anal fins, and rounded behind; the pectorals are large; the ventrals absent. The species are peculiar to the northern seas. The best-marked, and possibly the only ones, are the *Anarrhicas lupus,* found on both sides of the Atlantic Ocean, and *Anarrhicas denticulatus* of Greenland. On the American coast the wolf-fish is found as far southward as Cape Cod, and occasionally even beyond, but becomes rarer toward its southern limits. It is a very ravenous and ferocious fish, and with its powerful jaws can inflict a severe wound even on man. Although repulsive in its appearance, and rarely if ever eaten on the American coast, it is regarded as palatable food in

different parts of Europe, and is even praised by many on account of its positive excellence. The skin is in some places taken off and used for bags and pockets. The species occasionally attains a length of six or seven feet, and even more, although specimens of such a size are rare. It mostly lives in deep water, but approaches the shore to deposit its spawn in May and June. This species is also called in various places sea-wolf and catfish, and in the Orkney Islands swine-fish, on account of the movements of its nose, which are supposed to similate those of a hog.

THEODORE GILL.

**Wolf Island,** p.-v. and tp., Mississippi co., Mo. P. 652.

**Wolf Pit,** tp., Richmond co., N. C. P. 1239.

**Wol'fram,** called **Wolframite** by Dana [Ger. possibly *Wolfrahm;* the ancient name of the mineral being *spuma lupi,* "wolf's spittle or froth" (*rahm* signifying "cream"). Agricola and other ancients considered it a spurious kind of tinstone (being found with the latter), and one name for it was *katzenzinn* ("tin's cat")], mineral *tungstate of iron,* ferrous tungstate, $O_4WFe$, though usually containing also from 4 to 20 per cent. of manganous oxide. It is right rhombic; dark brown or black; hardness between apatite and feldspar; lustre metalloidal; streak also nearly black, sometimes slightly magnetic; exceedingly heavy; density from 6.67 to 7.535. It is abundant with the Cornish tin ores and in many European localities; in America at Monroe, Conn., with native bismuth; Trumbull, Conn., with massive topaz; in Mecklenburg co., N. C., and a number of other localities. Its lesser hardness, dark opaque streak, and frequently greater density will distinguish it from tinstone or cassiterite, with which it so often occurs. Molecularly considered, it is probably a variable mixture of *ferberite,* ferrous tungstate, and *hübnerite,* manganous tungstate (the latter being also right rhombic), crystallized up together. Ferberite is $O_4 \cdot {}^{W\ Fe}_{24 \cdot 20} = 7.143$ (Breithaupt, 7.169; Genther and Forsberg, artificial crystals, 7.1); and hübnerite is $O_4 \cdot {}^{W\ Mn}_{24 \cdot 20} = 7.12$ (Breithaupt, 7.14). In wolframs the Fe and Mn molecules are sometimes larger and sometimes smaller. (See TUNGSTEN.) HENRY WURTZ.

**Wolf River** rises in Marion co., Miss., and flows S. into St. Louis Bay, an arm of the Mississippi Sound.—Another WOLF RIVER rises in Tippah co., Miss., and flows W. N. W. 100 miles, mostly in Tennessee. It reaches the Mississippi at Memphis.

**Wolf River,** in Wisconsin, rises in the N. E. part of the State, flows southward, and after passing through Pewaugan Lake flows into Fox River. It is navigable 150 miles for small steamboats, and affords passage to a vast amount of timber.

**Wolf River,** tp., Doniphan co., Kan. P. 1934.

**Wolf River,** tp., Winnebago co., Wis. P. 505.

**Wolfsbane.** See MONKSHOOD.

**Wolf'scrape,** tp., Duplin co., N. C. P. 1025.

**Wolf Spring,** tp., Lawrence co., Ala. P. 601.

**Wolf'ville,** port of entry of King's co., N. S., on Minas Basin, Cornwallis River, and Windsor and Annapolis Railway, 66 miles N. E. of Annapolis. It is the seat of Acadia College (Baptist), and has 4 churches, an academy, and a female seminary. Shipbuilding is a leading industry. P. of sub-district, 1697.

**Wolf, von** (CHRISTIAN), BARON, b. at Breslau, Silesia, Jan. 24, 1679, the son of a mechanic in good circumstances; studied first theology, then mathematics and philosophy at Jena and Leipsic, and began to lecture in the latter city, but was compelled by the invasion of Saxony by Charles XII. in 1706 to leave the country, and received in the following year an appointment as professor of mathematics and natural history at the University of Halle. Here his lectures attracted much attention and drew large audiences, and his writings, mathematical and philosophical, gained for him a great reputation all over Germany, but being opposed to the pietistical tendency which at that period characterized the University of Halle, he was formally accused of heresy by his theological colleagues, and by a cabinet order of Nov. 15, 1723, was ordered to leave Halle within twenty-four hours and the Prussian states within two days. He found refuge in Hesse-Cassel, and lectured for several years with great success at Marburg, but on the accession of Frederick II. he was recalled to Halle in 1740, made chancellor of the university in 1743, a baron in 1745, and d. there Apr. 9, 1754. He was an immensely prolific writer. He wrote on mathematics, law, and all the various disciplines of philosophy, and he often issued his works in double editions—one in Latin and one (generally abbreviated) in German. His strictly philosophical writings alone fill 22 large volumes, and exercised a decisive influence. He is a pupil of Leibnitz, and his philosophy is simply a modification and popularization of the ideas of his master; but to the development and representation of these ideas he applied the strict mathematical method, and by moving along through clear and often striking definitions he became intelligible to scores of readers who could never have understood Leibnitz himself. Thus, his prominence in the history of philosophy is due more to his method than to his ideas; and indeed his method became universally employed, not only in philosophy, but in all sciences, up to the time of Kant. (See his *Autobiography,* edited by Wuttke (1841), and the works of Ludovici on his philosophy and its influence.)

**Wol'gast,** town of Prussia, province of Pomerania, on the Peene, has some manufactures of soap, leather, and tobacco, some shipbuilding, and some general trade. P. 5200.

**Wol'laston** (WILLIAM), b. at Coton Clanford, Staffordshire, England, Mar. 26, 1659; studied at Lichfield School; graduated at Sidney-Sussex College, Cambridge, about 1678; took deacons' orders in the Church of England about 1681; became shortly afterward assistant master of Birmingham School; was ordained priest 1686; inherited a large estate from a cousin 1688, and thenceforth devoted his life to literary and philosophical studies. D. at London Oct. 29, 1724, and was buried at Great Finsborough, Suffolk. Author of a learned philosophical work, *The Religion of Nature Delineated* (1722; 8th ed. 1759). Benjamin Franklin was employed in setting type for the 2d ed. (1724), and wrote in reply to it *A Dissertation on Liberty and Necessity, Pleasure and Pain* (1725).

**Wollaston** (WILLIAM HYDE), M. D., F. R. S., great-grandson of William, b. in London, England, Aug. 6, 1766; educated at Caius College, Cambridge, where he graduated in medicine 1793; practised some time at Bury St. Edmunds; devoted himself to scientific researches, especially to experiments in chemistry, mineralogy, and physics; became secretary of the Royal Society 1806; was an intimate friend and associate of Davy; discovered the metals palladium and rhodium (1803), and a method of making platinum malleable, for which he was awarded the medal of the Royal Society Nov. 30, 1828, and by which he gained £30,000; was the first to detect the dark or Fraunhofer lines in the solar spectrum (1802), and to demonstrate the identity of galvanism and frictional electricity; made a galvanic battery so small as to be contained within a thimble; constructed a sliding scale of chemical equivalents; invented the reflecting goniometer, the camera lucida, and the cryophorus for freezing water by means of its own evaporation; improved the construction of the microscope by means of the "Wollaston doublet" or compound lens; was the first to describe cystic oxide and three new species of urinary calculi; rendered many other services to science, and was chosen president of the Royal Society 1820. D. in London Dec. 22, 1828. He presented to the Royal Society £1000 for the encouragement of experiments. He published no book, but his 38 papers in the *Philosophical Transactions* (1797–1829) form a repository of scientific data of rare value; and he also contributed some papers to Dr. Robert D. Thomson's *Annals of Philosophy.* He may be considered the founder of modern British chemistry.

**Wol'le** (PETER), b. in the island of St. John, West Indies, Jan. 5, 1792, son of a Moravian missionary; educated at the Moravian schools and theological seminary in Pennsylvania; became an eloquent preacher of that denomination; was made a bishop about 1830; had a thorough knowledge of music, and revised and rearranged the hymn-tunes in use by his denomination. D. at Bethlehem, Pa., Nov. 14, 1871. He was at the time of his death the senior bishop of the Moravian Church in Europe and America.

**Wollstonecraft.** See GODWIN (MARY WOLLSTONECRAFT).

**Wolow'ski** (LOUIS FRANÇOIS MICHEL RAYMOND), b. at Warsaw Aug. 31, 1810; studied in Paris 1823–27; served in the Polish revolution of 1830; retired after its suppression to Paris; was naturalized in 1834; became professor of law at the Conservatoire des Arts et Métiers in 1839, and was a member of the Constituent Assembly of 1848, and of the Legislative Assembly of 1849, but retired from politics in 1851. He founded in 1833 the *Revue de Législation et de Jurisprudence,* and established the first Crédit Foncier bank in Paris. Among his works are *De l'Organisation du Travail* (1845), *De l'Organisation du Crédit Foncier* (1849), *Les Finances de la Russie* (1864), *La Liberté commerciale et les Résultats du Traité de Commerce de 1860* (1868).

**Wolse'ley** (Sir GARNET JOSEPH), b. in Ireland 1833; entered the British service as ensign Mar. 12, 1852; colonel 1865; served with the 90th regiment in the Burmese war of 1852–53; with Sir John Cheape's expedition against the robber-chief Myattoon, and severely wounded while lead-

ing the storming-party against that chief's stronghold; engaged in the siege of Sebastopol from Dec., 1854, to close of the war, being employed in the trenches as acting engineer, and wounded in sortie of Aug. 30, 1855. During the Indian mutiny of 1857–59 he served under Sir James Outram at the relief of Lucknow, the defence of the Alumbagh, and the siege and capture of Lucknow; subsequently deputy assistant quartermaster-general under Sir Hope Grant, and engaged in all the actions of that division. In the war with China (1860) he served throughout that campaign upon the staff of the quartermaster-general, participating in all the engagements. In 1870, in command of the expedition from Canada to the Red River territory, he suppressed the insurrectionary government established by Riel and others at Fort Garry, and was created a knight of St. Michael and St. George for his services on that occasion. In 1873 was appointed governor of the Gold Coast settlements, the inhabitants of which had become involved in a war with the Ashantees, and as commander-in-chief of the British forces defeated the enemy's army, occupied and destroyed Coomassie, his capital, and the king's palace, and brought the war to a speedy and successful end. For these services he was made major-general in the "fixed establishment" of the army, created K. C. B., and the thanks of Parliament and £25,000 bestowed upon him; inspector-general of auxiliary forces 1874–76, when transferred to India office as military member of council.

**Wol'sey** (THOMAS), b. at Ipswich, Suffolk, England, in 1471, of humble parentage; was educated in Magdalen College, Oxford; studied theology; acted for some time as tutor to the sons of the marquis of Dorset; took holy orders, and received in 1500 the rectorship of Lymington, Somersetshire. Through the influence of Sir John Nafant he came into connection with the court; was appointed a chaplain to Henry VII.; went to Bruges in 1508 on a special diplomatic mission to the emperor Maximilian, and, having acquitted himself very brilliantly, was rewarded on his return with the deanery of Lincoln. Henry VIII. made him his almoner, and soon employed him in the most important affairs. He made him archbishop of York in 1514, lord chancellor of England in 1515, and showed him an almost unlimited confidence in all negotiations. Foreign princes courted his favor; the emperor and the king of France sent him great presents and bestowed pensions on him; the pope created him a cardinal in 1515 and legate in 1519; and from this last year to his fall he acted as if he were really the ruler of England and one of the sovereigns of Europe. His income was royal, and so were his expenses. He built Hampton Court; he founded Christ Church College and seven lectureships at Oxford; he kept a household of from 500 to 800 persons, and showed himself in many ways a great patron of science and art. In personal bearing he was haughty and arrogant toward his equals, exceedingly adroit in managing his superiors, and kind and generous toward his inferiors. The goal of his ambition was to become pope, and twice—on the death of Leo X., and again on that of Adrian VI.—the tiara seemed to be within his reach, but both times his plans were foiled by the intrigues of Charles V. and by the opposition of the French bishops. At last his ambition came into conflict with the king's passion. The king wished to be divorced from Catharine of Aragon, the aunt of Charles V., and Wolsey had to carry through the necessary negotiations; but this task, always difficult, proved impossible for a man who, for his own sake, had to tread cautiously and manage people with the greatest discretion. The negotiations seemed to be endless. The king lost his patience, and even began to distrust the cardinal. Moreover, after the divorce the king wished to marry Anne Boleyn, and to this marriage Wolsey was opposed, because it might endanger his own position at home by giving the widespread jealousy and enmity around him a firm centre. At last, Anne Boleyn demanded and obtained from the king the cardinal's dismissal in disgrace, and on Oct. 17, 1529, the great seal was taken from him and he left the court. He retired to his archbishopric, and seemed prepared to end his life in comparative obscurity. But the hatred of his enemies was not yet satisfied, and on Nov. 4, 1530, he was arrested at Cawood on a charge of high treason. He was conducted to London, but on the way thither he fell ill, and d. at the monastery of Leicester Nov. 29, 1530. His *Life* has been written by Cavendish (1641), Galt (1812), Howard (1824), and Martin (1862).

**Wol'verhampton,** town of England, county of Stafford, on the western outskirt of the rich mining districts of Staffordshire, and gradually the coal-mines and ironstone pits which occupy the whole adjacent district are supplanted by blast-furnaces, forges, rolling-mills, foundries, and every other kind of contrivance by which iron ore is transformed into pig, railway, sheet, rod, hoop, and nail iron, and worked into boiler-plates, locks, hinges, axles, bolts, vises, anvils, and edge tools. But besides hardware, in which branch of manufacture Wolverhampton is one of the leading centres of the world, it has extensive manufactures of tinware, articles of papier-mâché, and japanned and enamelled goods, such as kitchen utensils, etc. It is very indifferently built, and, as all large manufacturing places, rather unpleasant, but it has many good educational and benevolent institutions. P. 68,291.

**Wolverine',** the name of the GLUTTON (which see) of North America.

**Wolzo'gen, von** (KAROLINE), b. VON LENGEFELD, Feb. 3, 1763, at Rudolstadt, Germany; married as her second husband, in 1794, Baron von Wolzogen, chamberlain at the court of Saxe-Weimar, and d. at Jena Jan. 14, 1847. Her brothers were Schiller's fellow-pupils in the Karls Schule of Stuttgart; her sister Charlotte became his wife; she herself was through the whole latter part of his life an intimate friend of his, and her book, *Schiller's Leben* (2 vols., 1830), is one of the most vivid and trustworthy pictures of him. In the field of pure imagination she also gained reputation by her romances, *Agnes von Lilien* (2 vols., 1798), *Cordelia* (2 vols., 1840), etc.

**Wom'an's Rights,** a term used in the U. S. to designate the movement for woman's equal social, civil, political, industrial, religious, and educational rights with man. The first convention was called July 19, 1848, at Seneca Falls, N. Y., by Lucretia Mott, Elizabeth Cady Stanton, Martha C. Wright, and Mary Ann McClintock. The meeting was held in the Wesleyan Methodist church, and largely attended by leading men and women, who took part in the debates. James Mott, tall, dignified, in Quaker costume, presided; Lucretia Mott, accustomed to public speaking, led the discussions. The convention continued two days, and the interest was sustained to the close. A declaration of rights was adopted, setting forth similar grievances under a masculine dynasty to those the colonies endured under King George. Resolutions were adopted making every demand since claimed by the most radical friends of the movement, such as equal rights in the universities, in the trades and professions—equal civil, political, and social rights for married as well as single women. At this time the condition of married women under the law was nearly as degraded as that of the slave on the plantation. The resolution asserting "the duty of the women of this country to secure to themselves their sacred right to the elective franchise" was the only one that met with opposition. Some feared a demand for the right of suffrage would defeat others they deemed more rational, and make the movement ridiculous. But Mrs. Stanton and Frederick Douglass, seeing that the right to make laws was the power by which all others could be secured, advocated and carried the resolution. The convention was extensively noticed, ridiculed, and denounced by the press and the pulpit, much to the surprise and chagrin of the leaders. The declaration was signed by over 100 persons; many withdrew their names when the storm of ridicule began to break. But the brave protests sent out from this meeting touched a responsive chord in the hearts of women all over the country. Conventions were held soon after in Ohio, Indiana, and Pennsylvania, and one in Rochester, N. Y., within two weeks, called by Amy Post, Sarah Owen, and Mary Hallowell, and held in the Unitarian church, Abigail Bush presiding. The audience was large and the convention fully reported in the city journals. The New York *Tribune*, edited by Horace Greeley, noticed these early conventions with respect.

Among the immediate causes leading to this movement were—(1) The visits of Frances Wright, a Scotch lady, to this country in 1820, who lectured on political questions, slavery, and woman. She travelled North and South, and endured a pitiless persecution for radical ideas now generally accepted by the best minds of the age. (2) The opposition to woman on the anti-slavery platform. Most of the leaders in the woman's rights reform had been educated in the anti-slavery school, and, in advocating the emancipation of the black race, early found themselves compelled to defend the right of woman to speak in public assemblies. Thus, Abby Kelly, Sarah and Angelina Grimké, Lydia Maria Child, and Maria Weston Chapman had the double battle to fight of sex and color, not only with the clergy of New England, but with some of the most bigoted abolitionists, both in this country and Great Britain. Lucretia Mott, Sarah Pugh, Mary Grew of Pennsylvania, Ann Green Phillips, Emily Winslow, and Abby Southwick of Massachusetts, were delegates to the "World's Anti-slavery Convention" held in London in 1840, but were rejected. The debate on their admission occupied the first day. The leading men in favor were Daniel O'Connell, George Thompson, Wendell Phillips, and George Bradburn. William Lloyd Garrison, arriving too late for the debate, on learning the decision,

refused to take his seat in the convention. (3) The bill introduced into the New York legislature by Judge Hertell in 1837 for the property rights of married women roused a general discussion of the whole question of woman's true position in the State, the Church, and the home. Hon. John Savage, chief-justice of the supreme court, and Hon. John C. Spencer, one of the revisers of the statute laws of New York, assisted in framing this bill, which became a law in 1848. Ernestine L. Rose, a cultivated Polish lady, circulated petitions for this bill and addressed committees in the legislatures of several States about this period.

But underlying all these surface causes was the deeper one—that in the progress of civilization the time had come for the recognition of the feminine element in humanity, and women without concert of action, unknown to each other, in every civilized country began simultaneously to demand a broader sphere. The protests of Mercy Otis Warren, Abigail Smith Adams, Hannah Lee Corbin in 1776 against the exclusion of women from participation in the government; Mary Wollstonecraft's *Vindication of the Rights of Women;* Elizabeth Heyrick's demand for immediate emancipation of slavery in the British West Indies; Harriet Martineau's *Political Economy;* Madame de Staël's and Madame Roland's political utterances; Madame Anneke's influence in the German revolution; the novels of George Sand and Fredrika Bremer; Margaret Fuller's parlor conversations and *Woman of the Nineteenth Century;* the works of Eliza Woodson Farnham—were all parts of the general uprising, and helped to prepare the way for the woman's rights movement in 1848.

In 1850–51 conventions were held in Ohio by Maria Giddings, J. Elizabeth Jones, Frances D. Gage, Josephine S. Griffing, Mary A. Johnson, Caroline M. Severance, Hannah M. Tracy, Jane G. Swisshelm. They issued an able address to the women of the State, and a report on the common law. In 1851 the first convention was held in Indiana, a society organized, and annual meetings have been held ever since. The leaders were Dr. Mary F. Thomas, Amanda M. Way, Hannah Hyatt, and Mary B. Birdsall. Robert Dale Owen early exerted a liberal influence in that State, being a member of the legislature several times. In 1852, Lucretia Mott, Ann Preston, M. D., Sarah Pugh, Hannah Darlington, and others called the first convention in Pennsylvania, where the last will and testament of Martin Luther was discussed. In 1850–51 conventions were held in Worcester, Mass., and in 1855 in Boston. The leaders were Paulina Wright Davis, Abby Kelly Foster, Clarina Howard Nichols, Dr. Harriot K. Hunt, Caroline H. Dall, Lucy Stone, and others. Many distinguished men, such as Ralph Waldo Emerson, Theodore Parker, William Henry Channing, Thomas Wentworth Higginson, William Lloyd Garrison, and Wendell Phillips, took part in the discussions. The third national convention met at Syracuse, N. Y., in 1852. Ernestine L. Rose, Elizabeth Oakes Smith, Rev. Antoinette L. Brown, Lydia F. Fowler, Lydia Ann Jenkins, Matilda Joslyn Gage, Susan B. Anthony, Rev. Samuel J. May, Gerrit Smith, were the representatives of the State. The first convention, held in New York City in 1853, was disturbed by a mob, the only case of the kind in an experience of thirty years. Never was the heroism of woman more fully shown. Lucretia Mott presided over this convention, and when the fury of the mob was at its height Horace Greeley and other gentlemen on the platform counselled an adjournment. This Mrs. Mott refused to do, but held her place till the close. The immediate cause of this display of mob spirit was no doubt due to the fact that some of the same gentlemen were present who had insisted in the World's Temperance Convention the previous day that the Rev. Antoinette Brown, a delegate from the Wayne Co. Temperance Society, should be admitted as a member of the convention. The discussion was very bitter—T. W. Higginson, William H. Channing, and Wendell Phillips in favor; Bishop Potter and Rev. John Chambers of Philadelphia against; Neal Dow presided. The delegate from Wayne was rejected. In 1852, Mrs. Nichols addressed the legislature of Vermont; in 1853, Miss Brown, and in 1854, Mrs. Stanton and Mrs. Rose, that of New York; in 1855, Lucy Stone that of Massachusetts; in 1859, Mrs. Thomas, Mrs. Birdsall, and Miss Way that of Indiana; in 1861, Mrs. Jones, Mrs. Gage, and Mrs. Cutler that of Ohio. In 1855, Miss Anthony, alternately accompanied by Mrs. Rose, Miss Brown, and Carrie Filkins, held conventions in 54 different counties of New York, rolling up petitions for suffrage, and for the equal rights of married women to wages, children, and the joint earnings of the copartnership. A bill granting most of these civil rights passed in 1860.

While the agitation was increasing in this country, disturbing all organizations for temperance, education, agriculture, the movement started in England. The New York *Tribune*, containing a phonographic report of the first Worcester convention, fell into the hands of Mrs. Taylor, the future wife of John Stuart Mill, and called out her able essay in the *Westminster Review*—"The Enfranchisement of Woman"—which roused England's great philosopher to thought on the subject. In 1867 he moved an amendment to the Household Suffrage bill, then before Parliament, proposing to strike out "man" and substitute "person." He presented a petition numerously signed by distinguished people, made an able speech, and obtained 74 votes in favor of the amendment. Since the death of Mr. Mill, Jacob Bright and Mr. Forsyth have led the movement in Parliament. A large organization exists in Great Britain, with auxiliaries in Scotland, Ireland, and Wales, composed of women of rank. The last petition they sent into Parliament was signed by over half a million. Lydia E. Becker, Mrs. Butler, Mrs. Fawcett, Mrs. Tyndall, Mrs. Lucas, Lady Anna Gore Langdon, Lady Bowring, Frances Power Cobbe, Miss Julia Gaskell, Mrs. Jacob Bright, Rebecca Moore, Miss Ashworth, and Mrs. Peter Taylor are the leaders in England; Mrs. Duncan McLaren, Miss Taylor, Miss Nichol, Margaret Parker, Sophia Jex Blake, and Mrs. Wellstood in Scotland; Miss Anna Isabella Robertson, an eloquent speaker, is president of the Irish association; Lady Kane, Mrs. Knox, Deborah Webb, and Miss Ashworth are among her associates. Lydia Becker edits *The Woman Suffrage Journal*, in Manchester, and Caroline A. Biggs *The Englishwoman's Journal* in London. Women vote with the same qualifications as men in all municipal elections. They are now petitioning for the Parliamentary vote, with prospect of success. In 1875 an association of gentlemen was formed "to protect the franchise from the encroachments of women." The first lord of the admiralty, the attorney-general, Sir Henry James, Messrs. Bouverie, Childers, and Chaplin, lead this novel movement.

Switzerland has long had its organization, led by Marie Geogg. Women now vote in every canton of the republic. Its organ, *Le Droit des Femmes*, was an able journal. The association in Denmark has already secured many concessions from the government. Fröken Nathalie Zahle, Fröken Pauline Worm, Fru Professorinde Rowsing, the liberal-minded wife of Prof. Rowsing, are its leaders. In Sweden women have the right to vote on some questions, certain property rights have been secured, and the university at Upsal opened to them. The empress of Germany is the leader of the new idea in that country, and in 1874 called a general assembly of all associations at Frankfort to discuss the interests of woman. The queens of Saxony and Würtemberg and the duchess of Baden took part in the deliberations. Frau Schepler Lette, president of the Lette Verein, is actively engaged for the elevation of woman. She visited the U. S. in 1876 to study the movement. In Germany, Russia, Austria, and Prussia new industries have been opened to women under the sanction of the government. In France the most active efforts are concentrated on the civil and religious liberties of women. Mademoiselle Marie Deraismes, Madame Jennie d'Héricourt, Mademoiselle J. V. Daubrie, Madame Tirauly, are the prominent advocates. M. Léon Richer, editor of *L'Avenir des Femmes*, a journal published in Paris, is doing an effective work for the enfranchisement of woman. Italy has her societies, public meetings, and journals edited by women—*La Donna* at Venice, edited by Sig. Guallberti Alaide Beccari, and *La Cornelia* at Florence, edited by Madame Aurelia Cumino Zolliero de Suna. The Orient also shows progress. At Bucharest, in Romania, *The Dekebalos*, established in 1874, announced as one of its principles the participation of woman in the affairs of state. *The Enridike*, published in Constantinople, edited by Emilia Leonzias, aims to promote the intellectual development of woman. Egypt, India, Japan, China, Australia, and South America have all felt the force of this tidal wave of thought, and each in its own way is making progress toward woman's complete emancipation.

But in the U. S., while associations for all the varied interests of woman gradually started into existence, suffrage conventions and legislative hearings became a part of its yearly history. A National Committee, chosen at the annual conventions, controlled the movement in the beginning—Paulina Wright Davis, president; Lucy Stone, secretary until 1855; Mrs. Stanton, president; Miss Anthony, secretary until 1866, when the American Equal Rights Association was formed, with Lucretia Mott president. The suffrage conventions and other anniversaries were suspended during the war, the leaders in 1863 forming a National Loyal League—Mrs. Stanton, president; Mary F. Gilbert, Charlotte B. Wilbour, Mattie Griffith, Rebecca Shepherd, Lucy Stone, and Susan B. Anthony, committee in charge. Their purpose was to roll up a mammoth petition to Congress praying for an act emancipating all persons of African descent held to involuntary labor in the U. S. They succeeded in obtaining 300,000 signatures, the largest petition ever sent into Congress. It was pre-

sented by the Hon. Charles Sumner in an eloquent speech. From 1865 petitions from women were poured into Congress praying their representatives (1) not to insert the word "male" in the 14th amendment, and (2) to insert the word "sex" in the 15th. In 1866 a very important debate occurred in the Senate on the bill to enfranchise the black men of the District. Mr. Cowan of Pennsylvania moved to strike out "male." Able speeches were made for the amendment, and nine Senators voted in its favor. As the same persons were members of the anti-slavery and woman's rights organizations, an effort was made, after slavery was abolished, to unite them in demanding the enfranchisement of both classes. But the friends of the colored man, thinking his chance for political equality better than woman's, refused to cumber his case with another. Finding the abolitionists would not unite in demanding the political rights of women, a majority of the members of the Equal Rights Society organized in 1869 "the National Woman Suffrage Association," with the one object of securing national protection in the exercise of their right to vote. In 1867, New York held a constitutional convention. Mrs. Stanton and Miss Anthony, with Rev. Olympia Brown, Charles Lenox Remond, and Sarah P. Remond, held a series of conventions throughout the State, circulating petitions to strike "male" from Art. II. Sec. 1 of the Constitution. In presenting their petitions, numbering 20,000, they, with Lucy Stone and Henry B. Blackwell, had respectful hearings. Horace Greeley, chairman of the committee on suffrage, reported adversely, though his wife was among the petitioners. George William Curtis made an able argument, and 27 members voted in favor of woman suffrage. The question was submitted in Kansas the same year, and that State thoroughly canvassed with lectures and tracts by Lucy Stone, Henry B. Blackwell, ex-Gov. Robinson, Mrs. Stanton, Miss Anthony, George Francis Train, and Rev. Olympia Brown, the latter speaking every day for four consecutive months; 9070 votes—one-third of the whole number—were given for woman suffrage. The American Equal Rights Association sent Susan B. Anthony as their delegate to the Democratic Presidential convention held in Tammany Hall, New York, July 4, 1868. Horatio Seymour, presiding, graciously received her memorial, ordered the clerk to read it, and referred it to the committee on resolutions. In 1869 the women of Wyoming Territory were enfranchised, admitted into the courts as jurors, and Esther Morris made justice of the peace; she presided nearly two years, to the entire satisfaction of the people. The experiment there proves successful. The first national convention, held in Washington, D. C., Jan., 1869, was called by the Franchise Association of that city, Josephine S. Griffing president. Among those who joined our movement about this time were Virginia L. Minor of Missouri, Helen E. Starrett of Kansas, Lilie Peckham and Dr. Ross Wolcott of Wisconsin, Mary A. Livermore, Kate N. Doggett, and Jane Graham Jones of Illinois, Belva A. Lockwood and Sarah Andrews Spencer of Washington, D. C., Frances Ellen Burr and Isabella Beecher Hooker of Connecticut, Charlotte B. Wilbour, Elizabeth B. Phelps, Frances V. Hallock, and Lillie Devereux Blake of New York, Elizabeth Avery Meriwether of Tennessee, Elizabeth T. Schenck, Sarah J. Wallis, Laura De Force Gordon, and Ellen Clarke Sargent of California. Petitions were before Congress demanding a 16th amendment, championed by Hon. S. C. Pomeroy of Kansas in the Senate and Hon. George W. Julian in the House. During the fashionable seasons conventions were held at Saratoga, Lake George, Clifton Springs, Trenton Falls, Niagara and Newport with good success.

In the mean time, there was a division in our ranks, growing out of personal hostilities—a difference as to our affiliations, as to the discussion of social questions, and as to the true interpretation of the Constitution, the limit of State rights and Federal power. The seceders, led by Lucy Stone, centred in Boston, held their first convention in Cleveland, O., and organized the American Woman Suffrage Association in Nov., 1869. From the inauguration of this Boston movement its leaders have held annual conventions in different cities of various States, but confined their labors chiefly to New England and State work, appearing each year before their legislature and political conventions. In 1874 and 1875 they sent Margaret A. Campbell, Mary A. Eastman, and Matilda Hindman to aid in the canvass of Michigan and Iowa. But most of those who inaugurated the reform, seeing no sufficient cause for division, remained with the National Association—Lucretia Mott, Martha C. Wright, Ernestine L. Rose, Clarina Howard Nichols, Paulina Wright Davis, Sarah Pugh, Amy Post, Lydia Mott, Catharine F. Stebbins, Adelaide Thomson, Clemence S. Lozier, Rev. Olympia Brown, Josephine S. Griffing, Matilda Joslyn Gage, Elizabeth Cady Stanton, Susan B. Anthony.

Since 1869 the National Association has held two annual conventions—one at New York in May, and one at Washington in January—with hearings each year before Congress. Its leaders have seized every opportunity to make their points in testing law, rousing thought, and creating agitation. Some have tried to vote, and, being refused, have sued the inspectors; among these are Ellen R. Van Valkenburg of California, Catharine V. Waite of Illinois, Sarah R. Huntington of Connecticut, and Carrie S. Burnham of Pennsylvania. In 1871, Sarah Andrews Spencer and Sarah E. Webster, with 71 other women in Washington, D. C., marched to the city hall for registration; being refused, they took their cases into the district court, and appealed from Judge Cartter's decision to the Supreme Court of the U. S. Mrs. Virginia L. Minor also appealed from the Missouri courts, and in 1874, Chief-Justice Waite rendered an adverse decision. Others have succeeded in voting; among them are Mrs. Nolen, Mrs. Barker of Toledo, O., Nannette B. Gardner of Detroit, Mich., Mary O. Brown and 17 others of Washington Territory, Mrs. Mansfield of Nyack, N. Y., Mrs. Miller of New York City. In 1872, Susan B. Anthony and 14 other women of Rochester, N. Y., voted, were all arrested, put under bonds, and indicted. Miss Anthony's was made the test case, tried at Canandaigua, in the U. S. circuit court of the northern district of New York, June 17, 1873, before Hon. Ward Hunt of the U. S. Supreme Court, who wrested her case from the jury, ordered the verdict of "guilty," denied a new trial—ably argued by her counsel, Hon. Henry R. Selden—and pronounced sentence of "$100 fine and costs of prosecution." She appealed to Congress to remit the sentence; her memorial was presented by Hon. A. A. Sargent in the Senate and Hon. William A. Loughridge in the House. The judiciary committees brought in majority and minority reports, the latter by Hon. M. H. Carpenter of Wisconsin in the Senate and Hon. B. F. Butler in the House, most severely rebuking Judge Hunt's arbitrary and unprecedented procedure. The fine has never been paid nor Miss Anthony imprisoned. The position that women possess the right to vote under the U. S. Constitution, with its new guarantees of the 14th and 15th Amendments, was first taken by Virginia L. Minor in 1869 in a convention at St. Louis, and by Mrs. Stanton in 1870, who with Madame Anneke, Matilda Joslyn Gage, Sarah Andrews Spencer, Isabella Beecher Hooker, Paulina Wright Davis, Belva A. Lockwood, Charlotte B. Wilbour, addressed the District of Columbia committee, urging the amendment to strike out "male," and thus enfranchise the women of the District. Victoria C. Woodhull took the same ground in 1871, when, as an individual belonging to no association, she was granted a hearing before the judiciary committee of the House, Hon. John A. Bingham chairman; her memorial was most respectfully considered, and called out majority and minority reports—an honor never before conferred on woman by the Congress of the U. S.

Women have not only protested, like Dr. Harriot K. Hunt, against the "tyranny of taxation without representation," but many have resisted it, though the price is ever confiscation. Notable among these are the Smith sisters of Glastonbury, Conn., Sarah E. Wall and Abby Kelly Foster of Worcester, Mass. Thus has this question of woman's rights in the last few years been changed from vague complainings of general grievances under State statutes into one of constitutional law. The National Association takes the ground that under the Federal Constitution women, being citizens, are possessed of the right to vote; that the States may regulate, but may not abolish the suffrage for any class; that it is the duty of the U. S. to protect all its citizens in this right, and thus secure to every State a republican form of government. And this opinion is held by many leading statesmen. When the Pembina Territorial bill was before the Senate in 1874, Hon. A. A. Sargent moved to strike out "male," and sustained his motion with an able speech; 19 Senators voted for his amendment.

Space will not admit the mention of all the consecutive conventions, legislative and Congressional hearings, and all the noble men and women who have aided in this grand reform. But the result of their labors, running through a quarter of a century, is the advance legislation granting many of the privileges demanded. In some States married women now possess the right to their property, wages, children, the right to make wills and contracts, to sue and be sued in their own names, and to testify in the courts. Women now practise law in some States, and are regularly ordained for the ministry in some sects, and practise medicine everywhere. The colleges throughout the West are open to girls, and an increasing number of the more lucrative occupations in the world of work are being daily filled by women. Woman suffrage organizations now span the continent. California and Oregon have their conventions,

journals, continual agitation in social circles, the courts, and legislative halls, as have all the Northern and some of the Southern States of the Union. Not a year passes without some step of progress. In 1874, Michigan submitted the proposition of woman suffrage to a vote of her people, and 40,000 men voted ay. Iowa and many other State legislatures have had large minority votes on the proposition. In Kansas, Minnesota, and Colorado the women hold office and vote on all school questions.

Papers in the interests of woman have been published at various times and places. The first was *The Lily*, Seneca Falls, N. Y., by Amelia Bloomer; it continued six years and reached a circulation of 4000. Mrs. Stanton was a regular contributor, and its files contain the records of the early conventions; in 1853, *The Una* at Providence, R. I., edited by Paulina Wright Davis and Caroline H. Dall; in 1855, *The Woman's Advocate* at Philadelphia, by Anne E. McDowell, the first paper in which the owner, editor, and compositors were all women; in 1868, *The Revolution* in New York, established by Susan B. Anthony; Elizabeth Cady Stanton and Parker Pillsbury, editors; in 1869, *The Pioneer* at San Francisco, by Emily Pitts Stevens; *The Woman's Advocate* at Dayton, O., A. J. Boyer and Miriam M. Cole, editors; the *Frauen Zeitung* at Milwaukee, Wis., by Mathilde Franceska Anneke; *The New Era* at New York, by Mathilde F. Wendt; in 1870, *The Woman's Journal* at Boston, Lucy Stone, Julia Ward Howe, Mary A. Livermore editors; in 1871, *The New Northwest* at Portland, Or., by Abigail Scott Duniway; in 1876, *The Ballot-Box* at Toledo, O., Sarah L. Williams editor. Thousands of tracts and essays written by able advocates have been distributed annually throughout the country.

The Centennial year was one of great activity in this reform; documents long stowed away were brought to light; reports of the early conventions collected and bound into volumes; missing links of history supplied by diligent research. A protest against calling the Centennial a celebration of the people while one-half were denied representation was issued from the Washington convention Jan., 1876; the responses to which, coming from all parts of the country, proved that American women were already in rebellion. A memorial from the District and National Associations was presented to Congress Mar. 31, the very day Abigail Adams made her protest a hundred years before, by Hon. S. S. Cox, who gracefully asked that the petition with the names of the officers should be recorded with the regular proceedings. Hon. N. P. Banks seconded the motion with an able speech. The National Association opened Centennial Parlors in Philadelphia, where public receptions were held twice a week, and from which were issued over 20,000 documents. They sent addresses and delegates to the Republican and Democratic nominating conventions. Sarah Andrews Spencer and Elizabeth Boynton Harbert were received with "respectful consideration" by the Republicans at Cincinnati, and addressed the convention. Virginia L. Minor and Phœbe W. Couzins were courteously received by the Democrats at St. Louis, and Miss Couzins spoke from their platform. But the most important work was "A Declaration of Rights," signed by a large number of the leading women of the movement, and its presentation at the celebration in Independence Square on the morning of July 4, 1876. It had been handsomely engrossed on parchment by Sarah Andrews Spencer, and tied with the national colors. A delegation of ladies, consisting of Susan B. Anthony, Matilda Joslyn Gage, Sarah Andrews Spencer, Lillie Devereux Blake, and Phœbe W. Couzins, early took the seats assigned them on the platform by Gen. Hawley, president of the Centennial Commission; and the moment Richard Henry Lee finished reading the Declaration of 1776, Miss Anthony presented the document to Vice-President Ferry, who on that occasion represented the government, and said: "Mr. President, on behalf of the women citizens of the U. S. I present to you this Declaration of Rights." It was received with a formal bow, and the ladies retired to a rostrum in front of Independence Hall, scattering copies of the Declaration on all sides. There Miss Anthony read it to assembled thousands. At 12 o'clock a large and enthusiastic meeting was held in the First Unitarian church (Rev. William H. Furness's), where the Declaration was again read by Elizabeth Cady Stanton. Lucretia Mott, in her eighty-fourth year, presided and made several effective speeches. The Hutchinsons thrilled the audience with their songs of freedom. For five consecutive hours the interest was sustained; and thus woman celebrated the close of the first century of our national life. For further information see *History of Woman Suffrage Movement*, edited by Elizabeth Cady Stanton, Matilda Joslyn Gage, and

SUSAN B. ANTHONY.

**Womb** [Ang.-Sax. *wamb*], the uterus, the chief of the female sexual organs, in which conception takes place and the embryonic organism is retained during the period of gestation, and developed from step to step of fœtal growth until its birth as a living, independent individual. The womb (see Fig. 1 in article OVARIES) in healthy adult women is located in the abdominal cavity, in the median line of the pelvis: it has the bladder in front, the rectum behind; its position is one of slight anteversion—that is, its vertical axis is thrown slightly forward. It is a pyriform body, with base above, and measures about 3 to 3½ inches in length. It is chiefly muscular in structure; is hollow, having a small canal through its lower portion, the neck or *cervix uteri*, which widens into a triangular cavity within the body or broad base above. The length of this canal and cavity is usually 2½ to 3 inches. At the upper or basic end of the cavity the angles connect by small apertures with the Fallopian tubes, which bring the ovules at the menstrual periods from the ovaries to the uterus. The interior of the womb, both neck and body, is lined with mucous membrane, arranged in folds and rich in blood-vessels, and containing numerous glands. The substance of the organ comprises three distinct sets of muscular fibres—an external, middle, and internal layer—some of which are transverse or circular, others longitudinal, and others oblique. These give the organ a powerful contractility. The organ is retained *in situ* by ligaments and the cellular tissue surrounding it. It has attachments to the bladder in front, to the rectum behind, to the pelvic bodies on either side by the broad ligaments—to the ovaries by the ovarian ligaments. When in pregnancy the womb increases to accommodate the developing infant, its muscular fibres take on increased growth, and, following the expulsion of the child and placenta, these fibres contract in the direction of the several coats, as stated, and prevent hæmorrhage. By a slow process of involution or atrophy from disuse the womb gradually returns to its normal size. (For details of its functions see CATAMENIA, OBSTETRICS, OVARIES; for diseases to which it is liable see STERILITY and UTERINE DISEASES.)

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**Wombat.** See PHASCOLOMYIDÆ.

**Wom'elsdorf,** p.-b., Heidelberg tp., Berks co., Pa., is the seat of the orphans' home of the Reformed Church. P. 1031.

**Women, Medical Education of, in Europe and America.** As a practical outgrowth of the higher and more liberal education of women, facilities for medical instruction are now open to them in many of the countries of the Continent, in England, and the U. S. The medical faculty of Paris have granted diplomas to a number of women who have pursued the long, full, and difficult course of study which the French school prescribes, and some of whom have acquired high awards and most honorable mention. The German universities are less favorable, and women, chiefly from abroad, go to Berlin, Vienna, and the lesser medical schools chiefly to pursue the valuable special courses of private instruction which are open to them. The University of Zurich is most frequented by women pursuing medicine, having a constant number in attendance upon the full course, and already numerous women graduates. The admission of women to, and their recognition by, the University of Edinburgh has been agitated, and is unsettled, but with a strong education party in its favor. In London there is an independent medical school for women, chiefly inspired by Dr. Elizabeth Blackwell, who is aided by an active corps of coadjutors, including some of the best scientific names of the medical faculty.

In the U. S. the medical education of women has received general encouragement, and numerous colleges, hospitals, infirmaries, and dispensaries afford ample means of study and experience. The initiative taken by the various irregular schools and unscientific and irresponsible sects of doctors in educating women, and their readiness to extend diplomas to them without adequate tests of previous education, character, or fitness, have thrown a degree of opprobrium and suspicion on the cause of female medical education and practice. But this is being steadily dissipated by the conscientious and thorough teaching afforded in the better institutions. The Woman's Medical College of Pennsylvania at Philadelphia has had an existence of twenty-seven years; has an able and full faculty, comprising men and women, in good professional standing and unquestioned scientific attainments; possesses a large and valuable college building of most approved modern construction, with every convenience of lecture-rooms, laboratories, and apparatus; and has an adjacent hospital for women and children under its immediate supervision; it graduates a steadily-increasing number each year. The New York Infirmary for Women and Children has had an existence in 1876 of twenty-two years, having been founded by the sisters Drs. Emily and Elizabeth Blackwell, who are perhaps the foremost representatives of the medical education

of women. This institution from the first was under the charge of medical women, and afforded opportunities for medical study and experience. During the past ten years it has maintained an associated but distinct medical college, with a full faculty of regular professors, clinical lecturers, instructors, etc. The curriculum is equal to that of the best medical colleges for men, and has many superiorities. Good English education is requisite in all applicants, and the course is graded, the student being rigidly examined at the close of each year before she is advanced; the examination for graduation is first conducted by the faculty, and subsequently by a superior board of examiners, comprising such eminent men as Drs. Willard Parker, Isaac Tayler, Austin Flint, Stephen Smith, and Prof. Chandler, the chemist. The confirmation of their proficiency by such authorities, whose names are appended to their diplomas, gives a guaranty to the public that the college graduates are equal to the duties and responsibilities of medical practice. The infirmary is a capacious and elegant structure on Stuyvesant Square, and a new college building to replace the older is contemplated. The personal attendance upon a number of cases of midwifery is one of the conditions of graduation. The New England Woman's Hospital of Boston has educated many able women as physicians. The medical department of the University of Michigan at Ann Arbor is open equally to both sexes: they are taught in common, with the exception of a few branches which policy and propriety dictate should be taught separately. The well-known reputation and vigorous instruction at this university have secured a numerous class of women in the pursuit of medicine. The Woman's Hospital Medical College of Chicago, the University of Wooster at Cleveland, and some few other less-known institutions are doing similar work.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Wonders, Seven.** See Seven Wonders of the World.

**Wonewoc,** p.-v. and tp., Juneau co., Wis. P. 930.

**Wood.** See Timber and Timber Trees, by S. H. Shreve, in Appendix; also, Arboriculture, by J. J. Thomas.

**Wood,** county of S. E. Dakota, recently formed, and not included in the census of 1870. The surface is rolling, and there are a number of small lakes. Area, 576 sq. m.

**Wood,** county of N. W. Ohio, lying on Maumee River, drained by Portage River, and traversed by Lake Shore and Michigan Southern and Cincinnati Hamilton and Dayton R. Rs.; surface level, sometimes swampy, and generally heavily timbered; soil fertile. There are many saw-mills, flour-mills, and some manufactories of carriages and wooden ware. Horses, cattle, sheep, and swine are numerous. Staples, corn, wheat, oats, wool, hay, dairy products. Cap. Bowling Green. Area, 590 sq. m. P. 24,596.

**Wood,** county of N. E. Texas, lying on Sabine River; surface undulating, with considerable timber; soil fertile. Cattle and swine are numerous. Staples, cotton, corn, and sweet potatoes. Cap. Quitman. Area, 840 sq. m. P. 6894.

**Wood,** county of N. W. West Virginia, separated from Ohio by Ohio River, drained by the Little Kanawha, and traversed by Parkersburg branch of Baltimore and Ohio R. R.; surface hilly, and abounding in bituminous coal and iron ore; soil generally fertile. Cattle and sheep are the chief live-stock. Staples, Indian corn, oats, wheat, hay, and dairy products. Cap. Parkersburg. Area, about 400 sq. m. P. 19,000.

**Wood,** county of Central Wisconsin, drained by Wisconsin and Yellow rivers, and traversed by Green Bay and Lake Pepin R. R.; surface undulating, soil fertile. Cattle are the chief live-stock. Staples, hay, Indian corn, oats, wheat, and dairy products. Cap. Grand Rapids. Area, 828 sq. m. P. 3912.

**Wood,** tp., Clarke co., Ind. P. 730.

**Wood** (Alphonso), b. at Chesterfield, N. H., Sept. 17, 1810; graduated at Dartmouth College 1834; studied theology one year at Andover, Mass.; taught in Kimball Union Academy, Meriden, N. H., 1834–49; was president of Ohio Female College 1851–57; professor in Terre Haute Female College 1857–60; principal of Clinton Female Seminary, Brooklyn, N. Y., 1860–65; travelled 1865–66, and since 1867 has resided at West Farms, New York City. Botany has been his specialty, and he has published *Class-Book of Botany* (1845), which has gone through more than 50 editions; *First Lessons in Botany* (1848), *Leaves and Flowers* (1863), *American Botanist and Florist* (1870).

R. D. Hitchcock.

**Wood** (Anne T. **Wilbur**), daughter of Rev. Hervey Wilbur, b. at Wendell, Mass., in 1817; was editor of *The Ladies' Magazine* (Boston, 1848) and *The Ladies' Casket* (Lowell, 1848); has contributed to various periodicals, chiefly under the name of "Florence Leigh," and has translated from the French several novels, including two by Saintine and two by Edmond About.

**Wood,** or **à Wood** (Anthony), b. at Oxford, England, Dec. 17, 1632; graduated at Merton College, Oxford, 1652, and devoted most of his life to the collection of data illustrative of the history of Oxford University. D. at Oxford Nov. 29, 1695. Author of *Historia et Antiquitates Universitatis Oxoniensis* (folio, 1674), being a translation from Wood's original, which appeared in 5 vols., 1786–96, and of *Athenæ Oxonienses: an Exact History of all the Writers and Bishops who have had their Education in the Most Ancient and Famous University of Oxford, 1500–1695, with the Fasti or Annals of the said University* (2 vols., folio, 1691–92). For his strictures on the earl of Clarendon, Wood was expelled from the university and his book burned shortly after its publication. A second edition, with 500 new *Lives,* was edited by Tanner (2 vols., 1721), and a third edition was carefully superintended, with extensive *Additions and a Continuation,* by Rev. Philip Bliss, D. C. L., fellow of St. John's College, Oxford (4 vols., 1813–20). A fourth edition was projected by the short-lived Ecclesiastical History Society, and for it Dr. Bliss wrote vol. i., embracing the *Life of Wood* (1848), but the project was not further carried out, though abundant materials were left by the editor to the Bodleian Library.

**Wood** (De Volson), A. M., b. at Smyrna, N. Y., June 1, 1832; graduated at the State Normal School, Albany, 1853; taught mathematics in that institution 1854–55; graduated at the Rensselaer Polytechnic Institute, Troy, 1857; was professor of civil engineering in the University of Michigan 1857–72; has been since 1872 professor of mathematics and mechanics in the Stevens Institute of Technology, Hoboken, N. J.; has invented a steam-pump, a steam or pneumatic rock-drill, and an air-compressor; brought out revised editions of Mahan's *Civil Engineering* and of Magnus's *Lessons in Elementary Mechanics;* furnished many articles on engineering and on mathematical subjects to the *Journal of the Franklin Institute* (1858–71), and is author of *A New System of Alligation* and of treatises *On the Resistance of Materials, On Bridges and Roofs,* and on *The Elements of Analytical Mechanics.*

**Wood** (Eleazer D.), b. at New York; graduated at the U. S. Military Academy Oct. 30, 1806, when appointed a second lieutenant in the corps of engineers. In this capacity he assisted in the construction of Castle Williams, Governor's Island, N. Y., and of Fort Norfolk, Va. During the war with Great Britain he served with Gen. Harrison's North-western army during the memorable siege of Fort Meigs, where he conducted the defence, and was engaged in the sortie of May 5, 1813; was in command of the artillery at the battle of the Thames, Oct. 5. Transferred to the Northern army in 1814, he was engaged in all the events of that campaign, including the capture of Fort Erie, July 3, the battle of Chippewa, July 5, and that of Niagara, or Lundy's Lane, July 25. After the latter battle the American army fell back to Fort Erie, which work was enlarged and extended under the direction of Cols. McRee and Wood, and placed in a state to sustain the expected attack. In the repulse of the assault on Fort Erie, Aug. 15, Col. Wood led the 21st regiment of infantry, and in the sortie of the besieged from their works, Sept. 17, 1814, he fell almost at the outset at the head of a column of which he was in command. For distinguished services in the defence of Fort Meigs he was brevetted major, and lieutenant-colonel for gallantry in the battle of Niagara. His commanding general (Brown) erected a monument to his memory at West Point. The county in Michigan in which Fort Meigs was situated bears his name, as also the U. S. fort on Bedloe's Island, N. Y.

**Wood** (Ellen **Price**), better known as Mrs. Henry Wood, b. at Worcester, England, about 1820; contributed to many periodicals; was for some years editor of the *Argosy* magazine, and has published numerous popular novels, among which are *East Lynne* (1861), *The Channings* (1862), and *The Shadow of Ashlydyat* (1863).

**Wood** (Fernando), b. at Philadelphia, Pa., June 14, 1812, of Quaker parentage; settled in New York in childhood; became a successful shipping-merchant; was elected to Congress as a Democrat 1840; was mayor of New York 1856–57, and again 1861–62, and again member of Congress 1863–65 and 1867–77.—His brother Benjamin has also been a member of Congress, and is editor and proprietor of the New York *Daily News.*

**Wood** (George), b. at Newburyport, Mass., in 1799; educated by the noted writer Samuel L. Knapp; studied law; settled at Alexandria, Va., 1816; was a clerk in the war department at Washington 1819–22, and in the treasury 1822–45, after which he removed to New York; wrote the

popular novels *Peter Schlemihl in America* (1848), *The Modern Pilgrims* (2 vols., 1855), *Marrying too Late* (1856), and *Future Life, or Scenes in Another World* (1858), republished with the title *The Gates Wide Open, etc.* (Boston, 1869), when it passed through 4 eds. in a single week. Mr. Wood was a contributor to the *Knickerbocker Magazine* 1846–47; returned to Washington soon afterward, and resumed his clerical labors in the treasury department, where he became chief of the navigation division, and wrote for the *National Era* and other periodicals. D. at Saratoga Springs, N. Y., Aug. 24, 1870.

**Wood** (George B.), M. D., LL.D., b. at Greenwich, N. J., Mar. 13, 1797; graduated at the University of Pennsylvania 1815, and in medicine 1818; was professor of chemistry in the Philadelphia College of Pharmacy 1822–31, and of materia medica 1831–35; professor of the same branch in the University of Pennsylvania 1835–50, and of theory and practice of medicine 1850–60; was physician in the Pennsylvania Hospital 1835–59; became president of the American Philosophical Society in 1859; was long president of the College of Physicians of Philadelphia, and in 1865 endowed an auxiliary faculty of medicine in the University of Pennsylvania. Author of *A Treatise on the Practice of Medicine* (2 vols., 1847; 5th ed. 1858), *Therapeutics and Pharmacology* (2 vols., 1856; 3d ed. 1868), and *Lectures and Addresses on Medical Subjects* (1859); with Dr. Franklin Bache he prepared *The Dispensatory of the U. S.* (1833; 13th ed. 1870), of which more than 100,000 copies have been sold, producing to the authors about $100,000.

**Wood** (G. W.), U. S. N., b. May 29, 1843, in Ireland; graduated at the Naval Academy in 1861; became lieutenant in 1864, lieutenant-commander in 1866; served in the Oneida at the capture of New Orleans and passage of the Vicksburg and Port Hudson batteries in 1862; commended for "courage, coolness, and skill." F. A. Parker.

**Wood** (Horatio C.), M. D., b. in Philadelphia, Pa., Jan. 13, 1841; graduated in medicine at the University of Pennsylvania 1862, and became professor of medical botany and clinical professor of diseases of the nervous system in that institution. Author of numerous papers on myriapods, Scorpionidæ, Phalangidæ, botany of the coal periods, and on fresh-water Algæ in the *Proceedings* and the *Transactions* of the Academy of Natural Sciences of Philadelphia, of the American Philosophical Society, and of the Essex Institute; also of *The Fresh-Water Algæ of North America* in the Smithsonian *Contributions to Knowledge* (1873), of original physiological investigations upon Indian hemp, nitrite of amyl, *Veratrum viride*, the pneumogastric nerves, etc., in the *Proceedings* of the American Philosophical Society, the *American Journal of Medical Sciences*, and in the Philadelphia *Medical Times;* and of a number of papers on clinical medicine in the same journals; gained the Boylston prize by his *Essay on Thermic Fever or Sunstroke* (Philadelphia, 1872), and has published *A Treatise on Physiological Therapeutics* (1874) and *A Study of Fever* (1875) in the Smithsonian *Miscellaneous Collections*.

**Wood** (Isaac), M. D., b. at Clinton, Dutchess co., N. Y., Aug. 21, 1793; settled in New York City in childhood; studied medicine; was attending physician in the New York Hospital 1814–16; one of the physicians of the New York Dispensary until 1825, and resident physician of the Bellevue Hospital 1826–33; rendered great services during the cholera epidemic of 1832–33; was in high repute as an ophthalmic surgeon; was for twenty-five years a manager of the New York Institute for the Blind, and was active in founding many medical and charitable institutions. He was a member of the Society of Friends. D. at Norwalk, Conn., Mar. 25, 1868.

**Wood** (James), b. at Winchester, Va., about 1740, son of Col. James, founder of that town; was a member of the Virginia convention of June, 1776; was commissioned colonel in the Virginia service Nov. 15, 1776; became lieutenant-governor and member of the executive council, and governor of Virginia 1796–99. D. at Richmond June 16, 1813.

**Wood** (James), D. D., b. in England about 1760; graduated at St. John's College, Cambridge; took orders in the Church of England, and became dean of Ely. D. at Cambridge Apr., 1839. Author of a valuable series of textbooks known as the "Cambridge Course of Mathematics."

**Wood** (James), D. D., b. at Greenfield, N. Y., in 1799; graduated at Union College 1822; was pastor of a Presbyterian church at Amsterdam, N. Y., 1826–33; became professor in a theological seminary at New Albany, Ind., 1839; was president of Hanover College, Ind., 1859–66, and president of Van Rensselaer Institute at Hightstown, N. J., from 1866 until his death at that place Apr. 7, 1867. Author of *A Treatise on Baptism* (1850), *Old and New Theology* (1855), and other theological works.

**Wood** (James Frederick), b. in Philadelphia Apr. 27, 1813; educated partly in Philadelphia and partly in England, and in 1827 went to Cincinnati, where he became a bank-clerk, advancing subsequently to cashier; in 1837 went to Rome to study for the priesthood; studied there for seven years, and in 1844 was ordained priest, and returned to Cincinnati, where he was ordained assistant rector of the cathedral. He subsequently became pastor of St. Patrick's church in Cincinnati, and while in that position was appointed by papal bull coadjutor-bishop of Philadelphia, with the right of succession. He was consecrated Apr. 26, 1857, and in Jan., 1860, succeeded to the bishopric. He visited Rome by invitation of the pope in 1862, and again in 1867, and was present at the Vatican Council in 1869, recording his belief in papal infallibility, and desiring that it should be defined as a dogma of faith. On Mar. 15, 1875, the diocese of Philadelphia was raised to an archiepiscopal see, and Bishop Wood was elevated to the position of archbishop, being consecrated to that office June 18, 1875.

J. B. Bishop.

**Wood** (John), b. in Scotland about 1775; resided in Switzerland during the revolution of 1798; was master of the Edinburgh Academy for the Improvement of Arts in Scotland 1799; came to the U. S. about 1800; edited the *Western World* in Kentucky 1806, and the *Atlantic World* at Washington, D. C., 1817; resided afterward at Richmond, Va., where he was employed in making county maps. D. at Richmond in May, 1822. Author of a *History of the Swiss Revolution* (1799), a *History of the Administration of John Adams* (1802), suppressed by Aaron Burr and republished by Sherburne 1846, and *Trial of Aaron Burr* (1807).

**Wood** (John), b. at Elie, Fifeshire, Scotland, in 1811; educated at the Perth Academy; entered the East India navy 1826; explored the river Indus to Hyderabad in the first steamboat launched on that river 1835; accompanied Sir A. Burnes to Afghanistan, and explored the Oxus region of Central Asia 1838; settled in New Zealand 1841, and in Australia 1852; became in 1857 manager of the Oriental Navigation Co., and in 1861 commander of the Indus steam flotilla. D. at Highbury, near London, Nov. 13, 1871. Author of *A Journey to the Source of the River Oxus* (1841; new ed. 1872).

**Wood** (John George), F. L. S., b. in London, England, in 1827; educated at Ashbourne grammar school; became Jackson scholar at Merton College, Oxford, where he graduated 1848; was attached for two years to the anatomical museum at Christ Church, Oxford; took orders in the Church of England 1852; became chaplain to the Boatman's floating chapel, Oxford; was assistant chaplain to St. Bartholomew's Hospital, London, 1856–62; was examiner for the natural history university prize at Oxford 1855–57, and became in 1868 precentor of the Canterbury diocesan choral union. Author or editor of very numerous popular works on all the branches of natural history, many of them written for children; editor of *The Boy's Own Magazine* and *Every Boy's Magazine*, and contributor to several prominent periodicals. His most important works are *The Illustrated Natural History* (3 vols., 1859–63; new ed. 1865–66), with 1500 original illustrations; *The Natural History of Man* (2 vols., 1868–70), richly illustrated; *A Popular Natural History* (1866), *Homes without Hands, being a Description of the Habitations of Animals* (1864–65), *Bible Animals* (1869), *The Modern Playmate, a Book of Games, etc.* (1870), and *Man and Beasts, Here and Hereafter* (2 vols., 1874).

**Wood** (John Turtle), b. at Hackney, near London, Feb. 13, 1821. His father was a gentleman of moderate means. The son, after attending several grammar schools, was articled to an architect, H. E. Kendall, Jr. While pursuing his studies in Italy in 1849 he got involved in the political troubles of the country, and was imprisoned for a time. In 1858 he went to Asia Minor, under George Meredith, to assist in building the railway between Smyrna and Aidin (80 miles), and in 1863 returned to Smyrna to begin, at his own expense, the work of exploring the ruins of Ephesus (48 miles distant by rail). In 1864 he had help from the British Museum, as afterward from the British government, and continued the work of exploration, at intervals, until the spring of 1874. The discoveries made were of the greatest interest and importance. His *Ephesus* was published in 1875. R. D. Hitchcock.

**Wood** (Reuben), b. in Rutland co., Vt., in 1792; served as captain of Vermont volunteers in the war of 1812–15; settled as a lawyer at Cleveland, O., 1817; was State senator 1825–28; president judge of the 3d district 1833–45; Democratic governor of Ohio 1850–53, and U. S. consul at Valparaiso 1853–54. D. at Rockport, O., Oct. 2, 1864.

**Wood** (Robert), b. at Riverstown, Meath co., Ireland, in 1716; educated at Oxford; made several visits to Italy, and in 1750–53, with his friends Dawkins and Bouverie

and an Italian artist named Borra, made an antiquarian exploration of Asia Minor and Syria. He was appointed under-secretary of state by Pitt 1759; held that post until 1765, and d. at Putney, near London, Sept. 9, 1771. Author of magnificently-illustrated volumes, *The Ruins of Palmyra, otherwise Tedmor in the Desart* (atlas folio, 1753), with 57 plates, and *The Ruins of Balbec, otherwise Heliopolis, in Cœlo-Syria* (1757), with 46 plates, both of which were issued also in Paris with the text in French, and have remained the standard works on those subjects. He also printed privately *A Comparative View of the Ancient and Present State of the Troad, etc.* (folio, 1768), which after his death was edited by Jacob Bryant under the title *An Essay on the Original Genius and Writings of Homer, etc.* (4to, 1775), and was translated into French, German, Italian, and Spanish.

**Wood** (Silas), b. in Suffolk co., L. I., in 1769; graduated at Princeton 1789, and was a member of Congress 1819–29. D. at Huntington, L. I., Mar. 2, 1847. Author of a *History of Long Island* (1824; new ed. 1828), revised by Alden J. Spooner (1865), with the addition of a *Memoir*.

**Wood** (Thomas Jefferson), b. at Munfordsville, Ky., Sept. 25, 1823; graduated at U. S. Military Academy July 1, 1845; appointed brevet second lieutenant of topographical engineers, and as such engaged in the war with Mexico at Palo Alto and Monterey; transferred to the 2d Dragoons Oct., 1846, and brevetted first lieutenant Feb. 23, 1847, for gallantry at Buena Vista; adjutant 2d Dragoons and on frontier duty in Texas 1849–55; appointed captain 1st Cavalry Mar. 3, 1855, and served on N. W. frontier 1855–59; on expedition against the Sioux Indians 1855; Utah expedition 1858, etc. Promoted to be major Mar. 16, and lieutenant-colonel May 9, 1861, he was employed in organizing and mustering Indiana volunteers until Oct. 11, 1861, when appointed a brigadier-general of volunteers, and Nov. 12 attained the colonelcy of the 2d U. S. Cavalry. Commanded a division of the army of Gen. Buell in the second day's fight (Apr. 7) at Shiloh and at siege of Corinth; of the Army of the Ohio at Perryville; of the Army of the Cumberland at Murfreesboro', where wounded, and at Chickamauga; of the 4th corps at Missionary Ridge and march to Knoxville, and in the numerous battles in Sherman's Georgia campaign in 1864 from Dalton to Lovejoy's Station, Sept. 2, where severely wounded; in opposing Gen. Hood's advance into Tennessee, succeeding to the command of the 4th corps after Gen. Stanley was wounded at the battle of Franklin, Nov. 30, which he led in the battle of Nashville and pursuit of Hood to the Tennessee River. Promoted to be major-general of volunteers Jan. 27, 1865, he subsequently commanded various military districts and departments; was mustered out of the volunteer service Sept., 1866, but retained in command of the district of Mississippi until Jan., 1867, when he resumed his commission in the regular army. For gallant conduct at Chickamauga he was brevetted brigadier-general, and major-general for Nashville. He was placed on the retired list June 9, 1868, with rank of major-general, but by act of Congress of 1875 reduced to brigadier-general.

**Wood** (William), b. in England toward the close of the sixteenth century; was one of the original settlers of Massachusetts colony 1629; returned to England 1633; published an accurate and well-written description of the country under the title *New England's Prospect* (1634), accompanied by a map and interspersed with various passages of rhyme. He soon returned to Massachusetts; settled at Lynn; was its representative 1636; removed to Sandwich 1637; became town clerk, and d. there in 1639. His book was republished at Boston in 1764, with an *Introductory Essay* ascribed to James Otis, and in 1865 by the Prince Society.

**Wood** (William B.), b. at Montreal, Canada, May 26, 1779; removed in childhood to New York City, where he commenced life as a mercantile clerk; made his début on the stage at Annapolis, Md., 1798; became a popular favorite; was proprietor of the New Theatre from 1809 to 1820, when it was destroyed by fire; opened the new Chestnut Street Theatre at Philadelphia Dec. 2, 1822; sold it to William Warren 1826; opened the new Arch Street Theatre Oct. 1, 1828, and made his last appearance as an actor at the Walnut Street Theatre Nov. 18, 1846. D. at Philadelphia Sept. 24, 1861. Author of *Personal Recollections of the Stage* (1854) and of many adaptations of English plays.

**Wood** (William Maxwell), M. D., b. at Baltimore, Md., May 27, 1809; graduated in medicine at the University of Maryland 1829; entered the navy as assistant surgeon; became full surgeon 1838; was fleet-surgeon of the Pacific squadron 1844–46, and of the North Atlantic squadron during the civil war; became chief of the bureau of medicine and surgery in the navy department 1870, surgeon-general 1871, and was retired 1872. Author of *Wandering Sketches, etc.* (1849), *Fankwei, or the San Jacinto in the Seas of India, China, and Japan* (1859), and other works.

**Wood** (William Page), F. R. S., Baron **Hatherley,** b. in London, England, in 1801; educated at Winchester School and at Trinity College, Cambridge, where he obtained a fellowship; was called to the bar at Lincoln's Inn 1827; became queen's counsel 1845; entered Parliament 1847; was vice-chancellor of Lancaster 1849–51, solicitor-general 1851–52, vice-chancellor 1852–68; became in the latter year a chancery judge and privy councillor, and on the accession of the Gladstone administration was made lord chancellor with the title of Baron Hatherley Dec. 10, 1868. On account of failing eyesight he resigned Oct. 15, 1872. Author of *Vindication of the Marriage Law* (1861) and *The Continuity of Scripture, etc.* (1867).

**Wood and Richland,** tp., Texas co., Mo. P. 834.

**Wood'berry,** p.-v., Baltimore co., Md., on Jones's Falls and Northern Central R. R., 2 miles N. of Baltimore, contains 10 churches, a public library, 3 public schools, 2 savings institutions, 1 high school, 1 newspaper, 3 land companies, 4 large cotton-duck mills, 1 machine-shop, a handsome park, granite-quarries, and 2 hotels. P. 8275.

F. L. Morling, Ed. "Gazette."

**Woodberry,** b., Middle Woodberry tp., Bedford co., Pa. P. 294.

**Woodberry,** tp., Blair co., Pa. P. 2107.

**Woodbine.** See Caprifoliaceæ.

**Wood'bine,** p.-v. and tp., Jo Daviess co., Ill. P. 959.

**Woodbine,** p.-v., Harrison co., Ia.

**Wood** (or **Block**) **Books.** See Printing, by W. S. Paterson.

**Wood'bridge,** p.-v., York co., Ont., Canada, on Toronto Grey and Bruce Railway, 17 miles N. of Toronto. It has a large machine-shop and foundry and a lumber-trade. P. about 800.

**Woodbridge,** tp., New Haven co., Conn. P. 830.

**Woodbridge,** tp., Hillsdale co., Mich. P. 1321.

**Woodbridge,** p.-v. and tp., Middlesex co., N. J. P. 3717.

**Wood'bridge** (Benjamin), b. near Highworth, Wiltshire, England, in 1622; was entered at Magdalen Hall, Oxford, 1638, but soon came to Massachusetts with his family; graduated in the first class at Harvard College 1642; studied divinity; returned to England, and became minister of Newbury, Berkshire, where he d. Nov. 1, 1684. Author of *Justification by Faith* (London, 1652), *The Method of Grace in the Justification of Sinners* (1656), and *Church Members set in Joynt* (1656).

**Woodbridge** (William), b. in Norwich, Conn., Aug. 20, 1780. His father, becoming one of the earliest emigrants to the North-west Territory, removed to Marietta in 1791; received his earliest education in Connecticut; studied law at Litchfield, and was admitted to the bar in Ohio in 1806; in 1807 was elected to the assembly; was prosecuting attorney for his county 1808–14, during which period he was also a member of the State senate; in 1814 received from Pres. Madison the appointment of secretary of the Territory of Michigan, and removed to Detroit; in 1819 was elected the first delegate from Michigan to Congress; judge of the supreme court of Michigan Territory 1828–32; in 1835 was a member of the convention called to form a State constitution; in 1837 was elected to the State senate of Michigan; in 1839 was chosen governor of the State; was Senator in Congress 1841–47. Daniel Webster, in a note to his speech in defence of the Ashburton Treaty, attributed to Mr. Woodbridge the first suggestion that was ever made to him for inserting in that treaty a provision for the surrender of fugitives, under certain circumstances, upon the demand of foreign governments. For many years before his death he lived at Detroit. D. Oct. 20, 1861. In 1867 the *Life of William Woodbridge* was published by the writer. Charles Lanman.

**Woodbridge** (William Channing), b. at Medford, Mass., Dec. 18, 1794; graduated at Yale College 1811; studied for the ministry, but was never ordained; was principal of Burlington Academy, N. J., 1812–14; became a teacher in M. Gallaudet's institution for the deaf and dumb at Hartford, Conn., 1817; published, in conjunction with Mrs. Emma Willard, *Universal Geography, Ancient and Modern* (Hartford, 1824); issued also *Rudiments of Geography* (Hartford, 1833), *Modern School Geography*, and other textbooks for schools, and edited, with W. A. Alcott and M. F. Hubbard, the *American Annals of Education and Instruction* (1831–38), in which, in a series of *Letters from Hofwyl*, he gave an account of Fellenberg's system of instruction. D. at Boston Nov. 9, 1845.

**Wood'bury,** county of W. Iowa, bounded W. by Missouri and Big Sioux rivers, which separate it from Nebraska and Dakota, and traversed by Illinois Central, Sioux City and Pacific, and Dakota Southern R. Rs.; surface undulating, soil usually fertile. Cattle are the chief live-stock. Staples, Indian corn, oats, potatoes, hay. Cap. Sioux City. Area, about 800 sq. m. P. 6172.

**Woodbury,** p.-v. and tp., Litchfield co., Conn. P. 1931.

**Woodbury,** tp., Cumberland co., Ill. P. 1067.

**Woodbury,** tp., Woodbury co., Ia. P. 471.

**Woodbury,** p.-v., Butler co., Ky. P. 171.

**Woodbury,** p.-v. and tp., Washington co., Minn. P. 990.

**Woodbury,** p.-v., cap. of Gloucester co., N. J., at the junction of West Jersey, Swedesboro', and Delaware Shore R. Rs., 8 miles S. of Philadelphia, contains 7 churches, court-house and jail, good schools, a library, 1 bank, 1 newspaper, and town-hall. P. 1965.

A. S. Barber, Ed. "Constitution."

**Woodbury,** tp., Marion co., S. C. P. 210.

**Woodbury,** p.-v., cap. of Cannon co., Tenn., on the S. bank of Stone River, 50 miles E. S. E. from Nashville, is the seat of a flourishing college, and contains 2 tanneries, 3 churches, 2 newspapers, 1 hotel, and 1 flouring-mill. Principal business, live-stock and farming. P. 400.

M. L. Ford, Pub. "Press."

**Woodbury,** p.-v. and tp., Washington co., Vt. P. 902.

**Woodbury** (Augustus), b. at Beverly, Mass., in 1825; studied theology at Harvard, and became Unitarian pastor at Concord, N. H., 1849, at Lowell, Mass., 1853, and at Providence, R. I., 1857. Author of *Plain Words to Young Men* (1858), *Campaign of the First Rhode Island Regiment* (1862), *Major-General Burnside and the Ninth Army Corps, a Narrative of Campaigns, etc.* (1867), and of various sermons, addresses, and articles in the reviews.

**Woodbury** (Daniel Phineas), b. at New London, N. H., Dec. 16, 1812; graduated at U. S. Military Academy July 1, 1836, appointed 2d lieutenant of artillery. Soon after transferred to the engineers, his life's services were in that corps, going through the usual round of duties connected with construction or revision of sea-coast fortifications. In 1847–50 he directed the construction of Fort Kearney, Neb., and Fort Laramie, for the protection of the route to Oregon. Subsequently (1856–60), he was in charge of the important works of fortification—Forts Jefferson (Tortugas) and Taylor (Key West). At the outbreak of the civil war, assigned to duty under the writer of this sketch, he became thenceforth associated in the arduous duties involved in providing for the defence of the capital and in the engineering organization of the Army of the Potomac. In the advance to and battle of Bull Run (which see) he took an equally prominent part in the reconnaissances upon which the battle was based, accompanying the column (Gen. Hunter's) which was to turn the enemy's left flank. When the Army of the Potomac took the field, on Woodbury, as commander of the brigade of engineers (from the volunteer service, the organization and previous drilling of which, however, is due to Col. B. S. Alexander), fell the immediate control of a large portion of the engineering operations in the siege of Yorktown and subsequent operations before Richmond. In the memorable "Seven Days," and more especially in the engineering works by which the army was able to cross the White Oak Swamp and move to the James River, Gen. Woodbury rendered conspicuous services. At the unfortunate battle of Fredericksburg his personal gallantry in throwing bridges across the Rappahannock won him the brevet of brigadier-general "for gallant and meritorious services." Detailed for the important command at Key West Mar. 16, 1863, he (Aug. 15, 1864) fell a victim to the yellow fever. A true Christian soldier, he met death as calmly as he had more than once faced it on the battle-field. "My friends, I am passing from the known to the unknown, but all is peace with me," were among his last words. Gen. Woodbury ranked high as a scientific writer. His *Theory of Arches*, while based on the researches of Coulomb and Audoy, is really developed into an original work, and is now a standard one. This and his adaptation of the beautiful geometric constructions of Poncelet to the determination of the thickness of "retaining walls" form papers in the series of the *Professional Papers of the Corps of Engineers.*

J. G. Barnard.

**Woodbury** (Isaac Beverly), b. at Beverly, Mass., in 1819; studied music in Europe; became an eminent composer; teacher of music in the public schools of Boston; removed in 1845 to New York, and edited the *Musical Review* (1850 *seq.*) and the *Musical Pioneer.* D. at Columbia, S. C., Oct. 26, 1858. He compiled several widely-known collections of church music and glee-books, among which were the *Anthem Dulcimer* (1850), the *Cythara,* and the *New Lute of Zion,* and published several manuals of musical instruction.

**Woodbury** (Levi), son of Peter Woodbury, b. at Francistown, N. H., Dec. 22, 1789, descended from John Woodbury of Somersetshire, England, who settled first at Cape Ann in 1624, afterward at Naumkeag (now Salem, Mass.) in 1626–27. Levi Woodbury was graduated at Dartmouth College with the highest honors of the class in 1809; entered the law-school of Judges Reeves and Gould at Litchfield, Conn., that year; was admitted to the bar, and commenced the practice of the law in his native town in 1812. He was an earnest Democrat, and zealously supported the war then declared against Great Britain. He soon attained political distinction, and became eminent as a lawyer. In 1816, at the age of twenty-seven, he was appointed a judge of the supreme court of the State; in 1819 was married to Elizabeth, daughter of the Hon. Asa Clapp of Portland, Me., and removed to Portsmouth, N. H.; in 1823 was elected governor; in 1825 was elected Speaker of the house of representatives of the State, and to the Senate of the U. S.; in May, 1831, was appointed secretary of the navy, and in 1834 secretary of the treasury, by Pres. Jackson, and remained in the last-named position till the close of Mr. Van Buren's administration in 1841, when he was again elected to the Senate of the U. S. In 1845 he declined the mission to England, and was appointed a justice of the Supreme Court of the U. S., and held that position until his death, Sept. 4, 1851. Mr. Woodbury's mind was one of the highest order. He had great taste and aptitude for learning, and, although so much of his life was occupied with practical duties in the high public positions he continuously filled, he nevertheless found time to indulge his taste for learning, and his acquirements were large and varied. At the bar, in the legislature, in the cabinet, in the Senate, on the bench, in every body of which he was a member, he was a recognized leader, and was, at the time of his death, the candidate for the Presidency upon whom all factions of his party had agreed. For his part in the celebrated Senate debate on Foote's resolution in 1829–30 he was pronounced by Col. Benton "the rock of the New England Democracy;" was conspicuous also in the memorable called session of 1841 in defending the independent treasury system, first established under his administration of the department, and in defeating the banking system proposed by Mr. Clay, and also that proposed by Mr. Tyler's administration. He was thorough in his investigations. His reports on the preservation and supply of live-oak timber, upon cotton, currency, banking, and the independent treasury system, and his opinion in the Dorr case, illustrate this. But he was most effective in debate. In that field his ample knowledge, the earnestness imparted by his strong convictions, and his great advantage of person, manner, and voice, gave commanding force to his logical powers; and he did not impair the effect by elaboration. He was deeply imbued with the religious fervor of his race. The Psalms of David were the constant and best expression of his devotional feelings. He had a tinge of the melancholy which belongs to such natures; and it was perhaps to be cheered by the joyous spirits of his wife and children that he made his study the sitting-room of the family, whose unrestrained conversation and gayety did not at all interrupt his work, although not a word escaped him.—He had five children—one son, the eldest, Charles Levi, a lawyer, unmarried; the eldest daughter, Mary Elizabeth, married Montgomery Blair; the second, Frances Ann, married Archibald H. Lowery; the third, Virginia Lafayette, married G. V. Fox; the fourth, Ellen De Quincy, unmarried. His widow died in 1873.

Montgomery Blair.

**Wood-Carving,** an art which dates from immemorial antiquity in China and Japan, which countries are still noted for the wonderful skill of their artisans in this department. It was also brought to great perfection in Germany during the Middle Ages, especially in connection with the adornment of churches and convents. (See Engraving.)

**Wood-Charcoal.** See Charcoal.

**Wood'chat,** the *Lanius rutilus,* a shrike of the Old World which has a very wide geographical range. In South Africa it is called "magistrate bird," from its habit of impaling and hanging its victims. In some systematic treatises it is named *Enneoctonus rufus,* the "red nine-killer," from the belief that it kills nine victims before it begins to eat.

**Wood, Chemistry of.** Wood is chiefly made up of *cellulose,* the substance of the plant-cells, with the so-called "*incrusting matters*" of the cells, the soluble constituents

of the *sap*, with the water of the same, and the mineral matters of the *ash*. CELLULOSE (see this head) has been thoroughly described by Prof. Chandler. It forms the great mass of dry wood, cotton, hemp, linen, and other vegetable substances. The incrusting matters are not so well known. In dried wood they must be very mixed in character, comprising of course all the substances left during the drying up of the sap, which contains saline substances, albuminoid matters, tannin substances, gummy matters, and sugar. Payen claimed to have distinguished a definite solid incrusting matter of the cells, which he called *sclerogen*, but others have denied its individuality. In the making of paper from woody or other fibre, as also during the bleaching of vegetable tissues, almost or quite everything is dissolved and removed except pure cellulose and some albuminoid matter, which still gives a yellow-brown stain with nitric acid (see XANTHOPROTEIC ACID); and the writer has observed that the presence of woody fibre in paper can be proved by this stain with nitric acid, which is given by most of our printing paper, but not by letter paper, the latter being doubtless chiefly made from white rags, from which repeated washing has abstracted all but pure cellulose. Cotton also, when raw, contains little or none of this albuminoid, as nitric acid will show. (The paper on which this work is printed is found by the writer to stand this nitric-acid test perfectly.) Some woods, particularly if cut during winter, contain also *starchy* matters, as the iodine-test will indicate. Water is one of the most practically important constituents of wood, green or fresh-cut wood being usually completely filled in every pore with it. Indeed, as cellulose is a definite substance of a definite density (1.525), it is probable that the amount of water contained in fresh-cut woods will furnish a pretty close index to their relative degree of *porosity*. The following figures, from Schübler and Hartig, show the proportions of water in different kinds of common woods when just cut:

| | | | |
|---|---|---|---|
| Willow | 26.0 | Red beech | 39.7 |
| Sycamore | 27.0 | Aspen | 43.7 |
| Ash | 28.7 | Elm | 44.5 |
| Birch | 30.8 | Italian poplar | 48.2 |
| Oak | 34.7 | Larch | 48.6 |
| Horse-chestnut | 38.2 | White poplar | 50.6 |
| Pine | 39.7 | Black poplar | 51.8 |

Seasoned or air-dried wood contains much less, of course, but still the proportion is quite important, though some of it is possibly combined in a manner similar to that of water of crystallization. At any rate, Rumford found that a temperature above that of boiling water, but short of that which produced any chemical alteration of the fibre (277° F.), was needed to expel all this water. He thus removed from air-seasoned woods additional water, as follows:

| | | |
|---|---|---|
| Oak | 16.64 | per cent. |
| Elm | 18.20 | " " |
| Beech | 18.56 | " " |
| Maple | 18.63 | " " |
| Birch | 19.38 | " " |
| Poplar | 19.55 | " " |

What is usually called dry wood, used for fuel after exposure to the air for several months, may be regarded as containing still at least 20 per cent. of water.

*Specific Gravity.*—The fact that most wood floats on water must not be regarded as any indication of its true density. When sawdust or thin shavings are boiled with water, so as to expel the air from their pores, they are found then to sink readily, and have a density of about 1.5, approaching that of pure cellulose, 1.525. An instructive experiment is to dampen a wad of raw cotton with alcohol (which expels the air from its pores), squeezing out the excess. It will be found then to sink in water with great facility. The sinking of water-soaked wood is familiar to all.

*The Ash.*—Woods of different kinds, and even of the same kind, vary much in amount of ash and in its composition. Under ASHES (and also under POTASH, by H. WURTZ) will be found some information on these points. Oak wood was found by Berthier to contain 3.3 per cent. of ash, by Mollerat 1.4, and by Saussure only 0.2. In oak bark both Berthier and Saussure found 6 per cent. of ash. In pine wood Berthier found 0.83, Mollerat 1.8, and Saussure 2.9 per cent. Analyses of ashes of red-beech wood by Böttinger gave—

| | |
|---|---|
| Chlorine | 0.133 |
| Silica | 1.459 |
| Sulphuric acid | 1.351 |
| Phosphoric " | 3.065 |
| Ferric oxide | 0.803 |
| Lime | 63.244 |
| Magnesia | 11.270 |
| Potash | 15.794 |
| Soda | 2.887 |
| | 100.000 |

HENRY WURTZ.

**Wood'chuck, Ground-Hog,** or **Maryland Marmot,** the *Arctomys monax*, a large rodent mammal of North America, everywhere common except on the great Plains and westward. It is some eighteen inches long, and has a grizzled reddish-brown fur, which has a limited industrial use. The creature is very prolific, eats clover, young cabbages, and beans, hybernates in cold weather, and is sometimes used for food, for which it is quite unfit. It is a courageous creature, and will often successfully contend with a dog of larger size than itself. It digs a deep burrow. (See SCIURIDÆ.)

**Wood'cock,** a name applied to two different game-birds of the snipe family. The European woodcock (*Scolopax rusticola*, Linn.) ranges over the Eastern continent from Japan to the British isles, and attains a length of fourteen inches, while the American bird (*Philohela minor*, Gray), which attains only eleven inches, is found abundantly in the Northern U. S. and in Canada. Both are highly prized by epicures for the delicacy of their flesh.

**Woodcock,** p.-b. and tp., Crawford co., Pa. P. of b. 220; of tp. 1723.

**Wood'deson** (RICHARD), D. C. L., b. at Kingston-upon-Thames, Surrey, England, May 15, 1745; educated at Pembroke and Magdalen colleges, Oxford; became Vinerian scholar 1766, and fellow of Magdalen 1771; became deputy Vinerian professor of civil law at Oxford 1772; was full professor 1777–93, and subsequently bencher of the Middle Temple and commissioner of bankrupts. D. in London Oct. 29, 1822. Author of *Elements of Jurisprudence* (1783) and *A Systematical View of the Laws of England* (3 vols., 1792–93; 2d ed. 1834; Philadelphia, 3 vols. in 1, 1842), considered by good jurists superior to Blackstone.

**Wood Duck,** or **Summer Duck** (*Aix sponsa*), one of the most beautiful members of the family of Anatidæ, and whose only congener is the still more beautiful mandarin duck (*Aix galericulata*) of China. Both of these have in common the bill shorter than the head, high at the base, where the upper lateral angle runs back much behind the lower edge, the nail very large and hooked, the lamellæ broad and distant, the nostrils very large and open, the wing-coverts nearly as long as the feathers, and the tail truncate at the tip. The species has the head green, glossed with purple, with a line from the upper corner of the bill, one from behind the eye, and two bars on the side of the head confluent with the chin, and upper part of throat white, the jugulum and tail at sides purple, the under parts white, the sides yellowish, banded with black, and subterminally with white, the speculum bluish-green, the primaries silver white at tip, and the back uniform with various reflections. It is about nineteen or twenty inches long. (*Baird.*) The species range over most of North America—in the warmer regions as a permanent resident, and in the northern as a summer migrant. In this last respect, rather contrasting with most of the other ducks, it is called the "summer duck." It chiefly builds its nest in a hollow tree, and this habit gives origin to the name "wood duck." Its favorite haunts are "the solitary deep and muddy creeks, ponds, and mill-dams of the interior," and it makes "its nest frequently in old hollow trees that overhang the water." (*Wilson.*) Its eggs are smaller than a hen's, and have surfaces like polished ivory. It is generally seen in pairs, and rarely in flocks of more than three or four. It feeds chiefly on acorns, the seeds of wild oats, and insects. The flesh is tolerably good food. THEODORE GILL.

**Wood-Engraving.** See ENGRAVING.

**Wood'ensburg,** p.-v., Baltimore co., Md. P. 54.

**Wood'fall** (HENRY SAMPSON), b. in London, England, in 1739; was son of the proprietor of the London *Public Advertiser*, and succeeded to the management of that paper, which he edited from 1760 to 1793, including the period during which the celebrated *Letters of Junius* appeared in that paper (1769–71); was prosecuted and tried for their publication June, 1770; printed the standard edition of *Junius* in 1772, and became master of Stationers' Hall 1797. D. at Chelsea Dec. 12, 1805. He probably never knew the secret of Junius, though an argument to the contrary has been alleged by the advocates of the Franciscan theory, from the fact that he was a schoolfellow of Philip Francis. —His son GEORGE, b. about 1780, succeeded to the business; brought out a famous edition of the Bible (4to, 1804), in which only one erratum has been detected, and employed Dr. John Mason Good to edit the *Letters of Junius* (1812), whence that edition is usually called *Woodfall's Junius*, and is supposed to derive peculiar authority from the name of its publisher. In fact, however, the only real *Woodfall's Junius* is the edition of 1772, and Good's edition of 1812 is the most misleading of all, from the fact that it includes a multitude of anonymous letters under different signatures, culled from the columns of the *Public*

*Advertiser* by Dr. Good, and attributed by him to Junius without any warrant.

**Woodfall** (William), brother of Henry Sampson, b. in London, England, about 1745; assisted for some time his father and brother in the editorship of the *Public Advertiser;* established and conducted the *London Packet*, the *Morning Chronicle* 1772–89, and *The Diary* 1789 *seq.* In the latter paper he printed with great accuracy the *Parliamentary Debates*, also published separately (21 vols., 1794–99), which in great part were reported by himself. He was endowed with a wonderful memory, and sometimes wrote out many columns of a debate without any consultation of notes. D. in London Aug. 1, 1803.

**Wood'ford,** county of Central Illinois, lying on Illinois River, and having railway connection with Chicago; surface level, with an abundance of coal; soil fertile. Horses, cattle, and swine are numerous. Staples, Indian corn, oats, wheat, hay, and dairy products. Cap. Metamora. Area, about 500 sq. m. P. 18,956.

**Woodford,** county of Central Kentucky, lying on Kentucky and Elkhorn rivers, and traversed by Louisville Cincinnati and Lexington R. Rs.; surface diversified, soil fertile. Horses, mules, cattle, and swine are numerous. Staples, Indian corn, wheat, oats, hay, wool, and hemp. Cap. Versailles. Area, 185 sq. m. P. 8240.

**Woodford,** p.-v. and tp., Bennington co., Vt. P. 371.

**Woodford** (Edward), LL.D., b. near Elgin, Scotland, Apr. 15, 1800; educated at King's College, Aberdeen; was a classical tutor successively at Aberdeen, Edinburgh, and Jedburgh; became a royal inspector of schools for Scotland 1850, and was for many years principal of the Madras College at the University of St. Andrew's. D. at Edinburgh Jan. 6, 1869. Author of *Eclogæ Horatianæ* (1849; new ed. 1855), *Elements of the Latin Language* (1854; 3d ed. 1862), *Tables of Latin Verbs* (1855; new ed. 1862), an *Epitome of Cæsar's Commentaries* (4th ed. 1860), which enjoyed a wide reputation, and other works, religious and educational.

**Woodford** (James Russell), D. D., b. at Henley-on-Thames, England, Apr. 30, 1820; studied at Merchant Taylors' School, London; graduated with both classical and mathematical honors at Pembroke College, Cambridge, 1842; took orders in the Church of England 1843; was incumbent of Easton, Somersetshire, 1847–55, vicar of Kempsford, Gloucestershire, 1855–68; was for some years examining chaplain to Bishop Wilberforce of Oxford, who in 1867 appointed him an honorary canon of Christ church, Oxford; was vicar of Leeds 1868–73, select preacher before the University of Cambridge 1864, 1867, and 1873, and was consecrated in Westminster Abbey as bishop of Ely Dec. 14, 1873. Author of several volumes of *Sermons*, of *Lectures* on the Creed (1855), *Ordination Lectures* (1861), *Lectures on the Church, Past and Present* (1852); edited the third series of *Tracts for the Christian Seasons* (4 vols., 1863–64), and contributed to *Sermons for the Working Classes* (1858) and the Oxford *Sermons during Lent* (1865).

**Woodford** (Samuel), D. D., b. in London, England, in 1636; educated at Wadham College, Oxford; studied law at the Inner Temple; took orders in the Church of England 1669; became rector of Hartley-Mauduit, Hampshire; prebendary of Chichester 1676, and of Winchester 1680. D. in 1700. Author of *A Paraphrase upon the Psalms of David* (1667; 3d ed., 2 vols., 1713) and *A Paraphrase upon the Canticles and some Select Hymnes of the New and Old Testaments, with other occasional Compositions in English Verse* (1679), in the introduction to which he discusses the merits of Milton's blank verse, and commends his recently-issued *Paradise Lost.*

**Woodford** (William), b. in Caroline co., Va., in 1735; distinguished himself in the French and Indian wars; was appointed colonel of the 2d Virginia regiment on the assembling of the Virginia troops at Williamsburg in the autumn of 1775; repulsed the fleet of Lord Dunmore from Hampton Roads, sinking five vessels; commanded at the battle of Great Bridge on the Elizabeth River, Dec. 9, 1775, winning a signal victory; called to arms the militia of Norfolk and Princess Anne counties; occupied Norfolk in triumph Dec. 14; took command of the 1st Virginia brigade; was commissioned brigadier-general by Congress early in 1777; was wounded at Brandywine; took an active part in the battles of Germantown and Monmouth; went to the relief of Charleston, S. C., with Virginia and North Carolina recruits, marching 500 miles in 28 days; reached that city Apr., 1780; was taken prisoner during the siege, and carried to New York, where he d. Nov. 13, 1780. Counties in Kentucky and Illinois bear his name.

**Wood Grouse.** See Capercailzie and Tetraoninæ.

**Woodha'nus,** tp., Henry co., Ala. P. 600.

**Wood'head** (Abraham), b. at Maltham, Yorkshire, England, in 1608; graduated at University College, Oxford, about 1628; became a fellow there 1633; took orders in the Church of England; travelled repeatedly on the Continent; was proctor of Oxford University 1641; visited Rome in that year, and secretly became a Roman Catholic; was deprived of his fellowship by the Parliamentary visitors 1648; was restored 1660, but soon refused to conform to the Church of England, and spent the remainder of his life in concealment, chiefly at Hoxton, near London, writing controversial books of great ability in favor of Roman Catholicism. D. at Hoxton May 4, 1678.

**Wood'house** (James), M. D., b. at Philadelphia, Pa., Nov. 17, 1770; graduated at the University of Pennsylvania 1787, and in medicine 1792; served as a surgeon in Gen. St. Clair's expedition against the Western Indians 1791, and was professor of chemistry in the University of Pennsylvania from 1795 to his death, June 4, 1809. Author of *The Young Chemist's Companion* (1797), *Experiments and Observations on Vegetation* (1802), and other treatises; edited Parkinson's *Chemical Pocket-Book* (1802) and Chaptal's *Chemistry* (2 vols., 1807).

**Woodhouse** (Robert), b. at Norwich, England, Apr. 28, 1773; was a cousin of Mrs. Amelia Opie; graduated at Caius College, Cambridge, as senior wrangler and first Smith's prizeman 1795; became a fellow there 1798; Lucasian professor of mathematics 1820; Plumian professor of astronomy and experimental philosophy 1822, and first superintendent of the Cambridge Observatory 1824. He married a sister of William Wilkins, the architect, 1823. D. in London Dec. 23, 1827, and was buried in the chapel of Caius College. Author of *The Principles of Analytical Calculation* (1803), *Plane and Spherical Trigonometry* (1809; 5th ed. 1827), *Isoperimetrical Problems and the Calculus of Variations* (1810), and *An Elementary Treatise on Plane Astronomy* (1812), republished under the title *A Treatise on Astronomy, Theoretical and Practical* (2 vols., 1818–23). These works "produced a revolution in mathematical studies," and their author was regarded on high authority as "one of the most philosophical thinkers and useful guides of his time."

**Woodhouselee.** See Tytler (Alexander Fraser).

**Wood'hull,** p.-v., Henry co., Ill.

**Woodhull,** p.-v. and tp., Shiawassee co., Mich. P. 776.

**Woodhull,** p.-v. and tp., Steuben co., N. Y. P. of v. 392; of tp. 1997.

**Woodhull** (Nathaniel), b. at Mastic, Suffolk co., L. I., Dec. 30, 1722; served in the French war of 1755–63 as colonel of the 3d New York regiment; sat in the provincial legislature 1769–76; was president of that body 1776; took command as general of Long Island militia on the landing of the British in August; was surprised and taken prisoner a few days later by a party of British light-horse near Jamaica, when, after delivering up his sword, he was so brutually wounded that he died at Gravesend Sept. 20, 1776. A narrative of his capture and death was published by H. Onderdonk, Jr. (New York, 1848), and his *Journal* of the expedition to Montreal in 1760 was printed in the *Historical Magazine* for Sept., 1861.

**Wood Ibis.** See Ibis.

**Wood Island,** off the entrance to Saco and Winter harbors, Me., has a stone lighthouse, showing a flashing red light; lat. 43° 27′ 23″ N., lon. 70° 19′ 25″ W.

**Wood'land,** p.-v., cap. of Yolo co., Cal.

**Woodland,** tp., Carroll co., Ill. P. 906.

**Woodland,** tp., Fulton co., Ill. P. 1602.

**Woodland,** p.-v. and tp., Decatur co., Ia. P. 782.

**Woodland,** p.-v. and tp., Barry co., Mich. P. 1376.

**Woodland,** tp., Wright co., Minn. P. 593.

**Woodland,** tp., Burlington co., N. J. P. 389.

**Woodland,** tp., Sauk co., Wis. P. 891.

**Wood'land Planta'tion,** tp., Aroostook co., Me. P. 174.

**Wood'lawn,** tp., Dallas co., Ala. P. 1045.

**Woodlawn,** p.-v. and tp., Monroe co., Mo. P. 935.

**Wood'-Louse,** a popular name for various sessile-eyed, fourteen-footed isopod crustaceans, of the families Armidillidæ and Oniscidæ, and of the genera *Porcellio, Oniscus, Armadillo*, etc. They are otherwise called slaters, and the larger ones are also called sow-bugs and pill-bugs. They inhabit moist places, rotten wood, cellars, etc., and are often found under stones.

**Wood'man,** p.-v. and tp., Grant co., Wis. P. 559.

**Woodman** (John Smith), b. at Durham, N. H., in 1819; studied at South Berwick Academy; graduated at Dartmouth College 1842; taught school at Charleston, S. C.,

1842–46; made a tour of Europe on foot 1847–48; studied law at Dover, N. H.; practised his profession there and at Rollinsford; was professor of mathematics at Dartmouth College 1851–56; taught also in the Chandler Scientific School from its establishment in 1852; became in 1856 professor of civil engineering, vice-president, and practical head of that institution, and retained those posts until his death, at Durham, N. H., May 15, 1871.

**Wood'-Oil,** a fine aromatic drying oil used in making varnish, in preventing insect ravages, in making lithographic ink, and in medicine as a cure for gonorrhœa. It comes from Burmah, and is produced by the *Dipterocarpus turbinatus* and other trees.

**Woodpecker.** See PICIDÆ.

**Wood, Preservation of.** See PRESERVATION OF TIMBER, by H. WURTZ, A. M.

**Wood-Rat.** See RAT.

**Wood'ruff,** the *Asperula odorata,* a favorite herb of the European peasants, belonging to the order Rubiaceæ. It has, when dry, a pleasant odor, somewhat like that of the Tonquin bean or sweet clover. The Germans put it into their May-drink (*Maitrank*) and into homemade beer. In this country they substitute *Galium triflorum,* a related plant with a similar smell.

**Woodruff,** county of N. E. Arkansas, lying on White River, and intersected by Bayou Deview and Cache River; surface generally level, soil fertile. Swine and cattle are the chief live-stock. Staples, cotton and Indian corn. Cap. Augusta. Area, 575 sq. m. Pop. 6891.

**Woodruff,** tp., Spartanburg co., S. C. P. 1408.

**Wood-Rush.** See LUZULA.

**Woods** (ALVA), D. D., son of Rev. Abel Woods, a Baptist minister, and nephew of Dr. Leonard Woods of Andover Seminary, b. at Shoreham, Vt., Aug. 13, 1794; fitted for college at Phillips Andover Academy under Dr. John Adams; graduated at Harvard 1817, and at Andover Seminary 1821, having spent one year (1819) as assistant principal in Phillips Academy; was professor of mathematics and natural philosophy in Columbian College, D. C., 1821–24, spending one year of the time in Europe; professor of mathematics and natural philosophy in Brown University 1824–28; president of Transylvania University, Lexington, Ky., 1828–31, and president of the University of the State of Alabama at Tuscaloosa 1831–37. Since 1839 he has resided in Providence, R. I. The degree of D. D. was conferred upon him by Brown University in 1828. He has founded a lectureship of elocution in Newton Theological Seminary and five scholarships in Brown University. He has published several baccalaureate and other academical discourses. R. D. HITCHCOCK.

**Woods** (CHARLES R.), b. in Licking co., O., about 1831; graduated from the U. S. Military Academy July 1, 1852, when appointed brevet second lieutenant of infantry; served in garrison and on frontier duty until 1861. In the attempt to relieve Fort Sumter (Apr., 1861) he commanded the troops on the steamer Star of the West; served in the West Virginia campaign, and appointed colonel 76th Ohio Vols. Oct. 23, 1861. Engaged with his regiment at Fort Donelson and Shiloh; in command of brigade during siege of Corinth, of regiment at Chickasaw Bayou, Arkansas Post, and during siege of Vicksburg. Commissioned brigadier-general of volunteers Aug., 1863, and engaged in battle of Chattanooga. In Sherman's Atlanta campaign and subsequent march to Savannah and through the Carolinas to Washington he commanded a division of the 15th corps, participating in all the actions of those campaigns, and retained in the volunteer service, in command of districts, etc., until Sept. 30, 1866, when he resumed his regular army duties, having been appointed lieutenant-colonel 33d Infantry July 28, 1866. Became colonel 2d Infantry in 1874, in December of which year he was retired from active service. For gallantry in action during the civil war he was brevetted lieutenant-colonel, colonel, brigadier and major general.

**Woods** (LEONARD), D. D., b. at Princeton, Mass., June 19, 1774; graduated at Harvard 1796; studied theology; was ordained pastor of the Congregational church at West Newbury 1798; took an active part in the Unitarian controversy, vindicating "orthodox Calvinism" against Drs. Ware, Buckminster, and Channing; was prominent in the organization and management of tract, education, temperance, and foreign missions societies; was professor of theology in Andover Seminary from its establishment in 1807 until 1846, and emeritus professor from that time until his death, Aug. 24, 1854. Among his works were *Letters to Unitarians* (1820), *Reply to Dr. Ware's Letters to Trinitarians* (1821), *Lectures on the Inspiration of the Scriptures* (1829), *Letters to Rev. N. W. Taylor* (1830), *Memoirs of American Missionaries* (1833), *An Examination of the Doctrine of Perfection, etc.* (1841), *Reply to Mr. Mahan on the Doctrine of Perfection* (1841), *Lectures on Church Government* (1843), and *Lectures on Swedenborgianism* (1846). A collective edition of his *Works* appeared at Andover (5 vols., 1849–50; 4th ed. 1860). He left in MS., nearly completed, a *History of the Andover Theological Seminary,* which has not been published.

**Woods** (LEONARD, JR.), D. D., LL.D., son of the preceding, b. at Newbury, Mass., Nov. 24, 1807; graduated at Union College 1827, at Andover Seminary 1830, and was tutor there 1831; was ordained to the Congregational ministry 1833; translated George Christian Knapp's *Lectures on Christian Theology* (2 vols., 1831–33); edited the *Literary and Theological Review* (New York, 1834–37); was professor of sacred literature in Bangor Theological Seminary 1836–39, and president of Bowdoin College 1839–66. He received the degree of D. D. from Harvard in 1846 and of LL.D. from Bowdoin in 1866. In 1867 he visited Europe to obtain documentary materials on the early history of Maine. He has published occasional orations and discourses.

**Woods'boro',** p.-v. and tp., Frederick co., Md. P. 2064.

**Woods'dale,** p.-v. and tp., Person co., N. C. P. 1596.

**Woods'field,** p.-v., Centre tp., cap. of Monroe co., O. P. 753.

**Wood's Hole,** p.-v., Barnstable co., Mass.

**Wood'side,** p.-v. and tp., Sangamon co., Ill. P. 1385.

**Woodside,** tp., Essex co., N. J. P. 1172.

**Wood'son,** county of S. E. Kansas, drained by branches of Neosho and Verdigris rivers, and traversed in the N. E. corner by Missouri Kansas and Texas R. R.; surface generally undulating, soil fertile. Cattle and sheep are the chief live-stock. Staples, Indian corn, oats, wheat, hay, potatoes, butter, and wool. Cap. Defiance. Area, 504 sq. m. P. 3827.

**Wood'sonville,** p.-v. and tp., Hart co., Ky. P. of v. 140; of tp. 1420.

**Wood-Sorrel.** See OXALIS.

**Wood-Spirit, and the Alcohols.** In the article HOMOLOGY will be found a table of the alcohol-series, of which wood-spirit or METHYL ALCOHOL (which see, by PROF. CHANDLER) is the first member. The chemical properties of this compound have been described by Prof. Chandler, and the object of this present article is to present a very brief discussion of the alcohols as a natural group, and of their relations to each other and to other bodies (supplementary to what will be found under the two heads ALCOHOL and ALCOHOLS, also by PROF. CHANDLER), and particularly to convey an idea of the *molecular volumic* relations (see VOLUMES, MOLECULAR; also WATER OF CRYSTALLIZATION, by HENRY WURTZ) between the alcohols themselves, and between them and their derivatives; which have formed special subjects of investigation of the present writer.

The earliest important view regarding the constitution of common alcohol was presented by Dumas, to the effect that it was a compound of *water* and *ethylene:* $H_2O + H_4C_2 = C_2H_6O$. By simply doubling the assumed formulæ of all the alcohols—a step for which many strong reasons may be cited; among others, that this series is thus brought into immediate relation with the directly-derived *ether* series—they may *all* be brought under the view of Dumas, and expressed as compounds of two molecules of water with $n$ molecules of ethylene: $2H_2O.nH_4C_2$. Dumas's suggestion was superseded, in the minds of chemists, by the *alcohol-radical* hypothesis, which was supposed to establish an analogy between the alcohols and the "hydrates" of metallic oxides, the ethers being likewise thus made analogous to simple metallic oxides. The alcohol-radicals, having been invented for the purpose of establishing these entirely fallacious and delusive analogies, seem to have been adhered to, apparently, from habit, no other reason appearing clearly, since the invention of the radical *hydroxyl* (OH), now so much in vogue, and which in the school-books of the present day is represented as an essential constituent, with the alcohol-radicals themselves, of the alcohols.

One mode of derivation which is now imagined for the alcohols is from marsh-gas and its homologues, by substitution of hydroxyl for hydrogen. Several series are thus derived, according to the number of hydrogen-equivalents so replaced; but we have now only to deal with the so-called *monatomic* or ordinary alcohols, in which there has been but one such imaginary replacement. The substantial warrant for this view appears to be found in the fact that marsh-gas and chlorine react and form a compound having the formula $CH_3Cl$, which on treatment with potash yields

wood-spirit ($CH_4O$), there being here three assumptions made, that the product of the first reaction is $(CH_3).Cl$, chloride of methyl, and that of the second $(CH_3).OH$, potash itself being also assumed to be $K.(OH)$. The reactions may, on these hypotheses, be stated very simply, as follows:

$$CH_4 + Cl_2 = (CH_3)Cl + HCl;$$
Wood-spirit.

and $$(CH_3)Cl + K(OH) = CH_3.OH + KCl.$$

In like manner, common alcohol is derivable from the next homologue in the marsh-gas series, $C_2H_6$ (see HOMOLOGY); but it is usually considered as being also derived from marsh-gas itself, by the further substitution of methyl for another equivalent of hydrogen; thus, C.H.H.H.H becomes $C.H.H.OH.CH_3 = C_2H_6O$. If, instead of methyl, ethyl ($C_2H_5$) be the substituting agent, we get propionic alcohol ($C.H.H.OH.C_2H_5 = C_3H_8O$). Thus, "*ethylic*" alcohol contains *methyl*, and "*propylic*" alcohol contains *ethyl*. In the language of this newer theory, however, it would appear that ethyl may be regarded as $H_2C.H_3C$, and propyl as $H_2C.H_2C.H_3C$; thus *two alcohol-radicals only* being really admitted as essential. This is certainly a great step in simplification over the original alcohol-radical hypothesis.

A highly important element in the newer system is the reduction of compounds to *typical* groups, which is always sought for. The alcohols are regarded as belonging to the marsh-gas type. No idea of molecular structure appears to be attached to these types, except an arbitrary connection by the so-called "bonds of atomicity," which may even be *provisionally* placed upon the same plane, showing conclusively the artificiality of the system, and the impossibility that it can represent any true relations, such as must exist in nature. (See TYPE-THEORIES.) No definite entity seems even to attach to the group $H_2C$, although it occurs in the notation far oftener than any other group. It has been only considered as a "residue," representing so much atomicity or equivalence, and not as a compound radical; certainly not in the same sense in which *ammonium* and *cyanogen*, for example, are known to be compound radicals. The fact that in the alcohols and in all other series of homologues this group ($H_2C$) constitutes the invariable increment, seems strangely to have passed out of consideration altogether in the so-called "new" or "atomistic" chemistry. The idea of *serial relation*, and the fact itself, are indeed altogether and studiously suppressed, being swallowed up in that of *derivation from types*. The marsh-gas homologues or petroleum hydrocarbons themselves must be, on this system, and often are, looked upon as all derivable from the same type, by the help of the old alcohol-radicals; thus,

$CHHH.H = CH_4$,
$CHHH.CH_3 = C_2H_6$,
$CHHH.C_2H_5 = C_3H_8$,
$CHHH.C_3H_7 = C_4H_{10}$,
$CHHH.C_4H_9 = C_5H_{12}$.

Nevertheless, the present writer has ventured to conclude, from special studies of his own, that a return to the idea of universal *serial* relations, and of derivation of chemical compounds in series, instead of from types, is necessary to further real progress in the science of chemistry, and believes that conclusive evidence of this may be presented. Under VOLUMES, MOLECULAR, it has been shown that a simple chemical molecule is always reducible to a *cubical equivalent volume;* and the application of this discovery to the study of homologous series has proved—as there also shown—that the group of elements ($H_2C$) is a distinct *compound radical*—as much so as *ammonium* or *cyanogen*. The proof is moreover positive that it is impossible to accept any other group of C and H, such as $H_3C$, methyl, or $H_5C_2$, ethyl, as fulfilling any *radical* function, either real or imaginary.

This being the case, the application to the alcohol-series becomes a matter of immediate interest. The first step is to ascertain the increments of volume which accompany the derivation of each member of the series by the addition of successive molecules of $H_2C$, or *homologen*. In order to do this the *density* of each member of the series must be found, as closely as possible, at the temperature of 28° F. (see ZERO), that at which ice *begins to melt*, which has been found to be the standard point to which volumes are to be referred. An empirical or approximate rule has been arrived at by the writer for reducing densities taken at melting ice to this point, by deducting their products into .004. Column 4 of the following table contains these corrected figures, derived from the means, in Column 3, of *all the densities on record*, taken at melting ice. Column 5 contains the computed equivalent volumes (multiplied by 1000, as explained under VOLUMES, MOLECULAR). It should be stated that these volumes are double those usually calculated, the usual formulæ of the whole series having been doubled. The reason for this will appear at once, the demonstration of the necessity of this doubling being contained in the table itself:

| 1. | 2. | 3. | | 4. | 5. | 6. | 7. |
|---|---|---|---|---|---|---|---|
| | Compounds. | Experimental densities. | | Mean densities, corrected by deducting .004 D. | Equivalent volumes, corrected. | Increments of volume, representing $2H_2C$. | Theoretical cubical increments, according to the geometric law. |
| | | Determinations on record at 0° C. | Mean of determinations at 0° C. | | | | |
| 1. | Wood-spirit | 3 | .8176 | .8143 | 78595 | ..... | $4 \times (27)^3 = 78732$ |
| 2. | Spirit of wine | 7 | .81065 | .8074 | 113946 | 35351 | $2 \times (26)^3 = 35152$ |
| 3. | Propionic alcohol | 5 | .82062 | .8173 | 146825 | 32879 | $(25)^3 + (26)^3 = 33201$ |
| 4. | Butyric alcohol | 6 | .8252 | .8219 | 180048 | 33223 | " " = 33201 |
| 5. | Fusel oil | 18 | .8271 | .8238 | 213644 | 33596 | " " = 33201 |
| 6. | Caproic alcohols: Mean of Hecht | 2 | .8286 | .8253 | 247171 | 33527 | " " = 33201 |
| 7. | Dominant (normal?) form | 5 | .834 | .8307 | 245576 | 31932 | $2 \times (25)^3 = 31250$ |

Sums of increments 1 to 6 ..... 168576 ..... 167956
167956
Total error ..... = 620
Average error for each increment ..... = 125 = $\frac{1}{1350}$ +.

With regard to *caproic alcohol*, the view of the writer is that two isomeric modifications are indicated. Those who reject this view, however, will find that the result of averaging the whole (taking in then, of necessity, a still lower zero-figure of Buff, believed by the writer to indicate a third isomere) will give a still closer correspondence to the law of cubes, making the average of the eight figures .83, and the increment of No. 6 = 33130.

The conclusion drawn from these facts is, that the alcohols are derived from wood-spirit by successive additions of two molecules of the radical $H_2C$, *dihomologen*. Representing this by $Hm_2$, the alcohols must be $2(CH_4O).Hm_2$; $2(CH_4O).Hm_4$; $2(CH_4O).Hm_6$, and so on.

It remains, then, to be considered what is the constitution of the nuclear compound $C_2H_8O_2$, or wood-spirit. Analogy at once leads us to regard it as also containing dihomologen, $H_4C_2$; and on taking away from it this group we find remaining the nucleus $H_4O_2$, or the equivalent of $2H_2O$. Two hypotheses now beset us, which are susceptible of being tested and investigated by the geometric law. These involve the question whether this nucleus is really made up of two molecules of water, or contains the elements in dissociated forms, as $H_4$ and $O_2$; the latter being found to be unmistakably the case in large numbers of other organic series. (See, for example, the volumic formulæ of the *Fatty Acids* in the article upon WATER OF CRYSTALLIZATION.) Computations far too voluminous to be repeated here have established conclusively the probabilities in favor of the first hypothesis that wood-spirit actually contains $H_2O$, and in the cubical volume which it occupies in *ice*, the symbol adopted for which (see VOLUMES, MOLECULAR) is $\overset{H\delta}{}_{27}$. The alcohol-series becomes then, constitutionally,

1. $2^{\overset{H\delta}{}_{27}}.2^{\overset{Hm}{}_{27}}$;
2. $2^{\overset{H\delta}{}_{27}}.2^{\overset{Hm}{}_{27}}.2^{\overset{Hm}{}_{26}}$;
3. $2^{\overset{H\delta}{}_{27}}.2^{\overset{Hm}{}_{27}}.2^{\overset{Hm}{}_{26}}.\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right)$;
4. $2^{\overset{H\delta}{}_{27}}.2^{\overset{Hm}{}_{27}}.2^{\overset{Hm}{}_{26}}.\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right).\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right)$;
5. $2^{\overset{H\delta}{}_{27}}.2^{\overset{Hm}{}_{27}}.2^{\overset{Hm}{}_{26}}.\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right).\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right).\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right)$;
6. $2^{\overset{H\delta}{}_{27}}.2^{\overset{Hm}{}_{27}}.2^{\overset{Hm}{}_{26}}.\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right).\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right).\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right).\left(\overset{Hm}{}_{25}\ \overset{Hm}{}_{26}\right)$;

there being doubt remaining as to whether the sixth dihomologen or ethylene molecule in No. 6 may not be $2^{\overset{Hm}{}_{25}}$. (See the previous table.)

It appears, therefore, that by volumic investigation of the alcohols we are distinctly remanded back to the track

first indicated by Dumas, and must decide that they are really and truly compounds of water (or at least of $H_2O$) and *ethylene*. We learn further, however, that ethylene itself is not a simple radical, as inferred by Dumas, and still held by many, but is itself compounded of two groups, alike and equal. It must therefore be called dihomologen. We should expect, therefore, to find this double radical divided in some cases. This is found to be the case in the ether-series, in which the successive incremental volumes have been found to be single cubes, and which have been proved, by a mode of investigation similar to that applied to the alcohols, to have the constitution (for the dominant series)—

4. $H\delta_{26}.2Hm_{27}.2Hm_{28}$;
5. $H\delta_{26}.2Hm_{27}.2Hm_{28}.Hm_{26}$;
6. $H\delta_{26}.2Hm_{27}.2Hm_{28}.Hm_{26}.Hm_{25}$,
7. $H\delta_{26}.2Hm_{27}.2Hm_{28}.Hm_{26}.Hm_{25}.Hm_{24}$;
8. $H\delta_{26}.2Hm_{27}.2Hm_{28}.Hm_{26}.Hm_{25}.Hm_{24}.Hm_{26}$.

The numbers refer to the number of equivalents of carbon contained in each, serving to designate them—with an avoidance of all hypothesis—as *4-carbon, 5-carbon, 6-carbon ether*, and so on. The geometric molecule of $H_2O$ here contained is that which predominates in ordinary liquid water. The question naturally arises whether these geometric or cubical molecules of $H_2O$, or *hydor*, are of the same nature as those of crystal-water $H\delta_{24}$. (See article WATER OF CRYSTALLIZATION.) The reply that we appear to be conducted to by the course of investigation is that the difference is of the kind that has been called, in previous articles upon this subject, a *typical* one. Crystal-water, as it occurs in salts, $H\delta_{24}$, and in glacial sulphuric acid, $H\delta_{23}$ and $H\delta_{22}$, belongs to the Diametric Type 3, while the $H\delta_{26}$ and $H\delta_{27}$, found in liquid water and in the ethers and alcohols, belong to Type 4.

(The limits of this article forbid the adequate following up further of this subject, for which reference must be made to pending articles in the *American Chemist* and other scientific journals.) HENRY WURTZ.

**Wood's Shop,** tp., Chambers co., Ala. P. 1231.

**Wood'stock,** port of entry, cap. of Carleton co., N. B., on New Brunswick and Canada Railway, on the river St. John, which is navigable at high and medium stages of water. It is 12 miles E. of Houlton, Me., and is in a fertile region. Red hæmatite iron ore, charged with manganese, abounds here, and the town has iron-furnaces whose product is of the best quality for steel, and which is shipped to England for use in plating ships of war. The town has a county grammar school and a convent, and 1 monthly and 1 weekly periodical. P. of sub-district, 3963.

**Woodstock,** port of entry, cap. of Oxford co., Ont., Canada, on Great Western Railway, 28 miles E. N. E. of London, and on the river Thames and Cedar Creek, which affords water-power. It is well built, and finely situated in a healthy and fertile region, and has 9 churches and several fine schools, including the Canadian Institute, an academy, and the county grammar school. There are 3 five-story steam oatmeal mills, and 2 weekly newspapers. P. 3982.

**Woodstock,** p.-v. and tp., Windham co., Conn. P. 2955.

**Woodstock,** p.-v., cap. of McHenry co., Ill., on Northwestern R. R., 51 miles N. of Chicago, has 6 churches, 1 seminary, a public-school building, 1 bank, 2 newspapers, pickling and canning works, 2 mills, and 1 hotel. Principal business, farming and dairying. P. 2500.
G. S. SOUTHWORTH, ED. "SENTINEL."

**Woodstock,** tp., Schuyler co., Ill. P. 1503.

**Woodstock,** tp., Wright co., Ia. P. 144.

**Woodstock,** tp., Oxford co., Me. P. 994.

**Woodstock,** p.-v., Howard co., Md.

**Woodstock,** tp., Lenawee co., Mich. P. 1365.

**Woodstock,** p.-v. and tp., Grafton co., N. H. P. 405.

**Woodstock,** p.-v. and tp., Ulster co., N. Y. P. 2022.

**Woodstock,** v., West Farms tp., Westchester co., N. Y. P. 307.

**Woodstock,** p.-v. and tp., cap. of Windsor co., Vt., has a fine park, extensive water-power, utilized by a large number of manufactories, 2 banks, 6 churches, and 3 newspapers. P. 2910.

**Woodstock,** p.-v., cap. of Shenandoah co., Va., on the Valley branch of Baltimore and Ohio R. R., and on the N. branch of Shenandoah River, has 5 churches, good schools, 1 savings bank, 1 large manufactory, 2 newspapers, and 3 hotels. Principal business, manufacturing and farming. P. 1100. J. C. OTT, ED. "SHENANDOAH DEMOCRAT."

**Woods'town,** p.-v., Salem co., N. J., 25 miles S. of Philadelphia, with which it has communication by railway and steamboat, contains 6 churches, 1 academy, 1 bank, 1 newspaper, and 4 manufactories. Rich beds of marl exist here. P. 1914. WM. TAYLOR, ED. "REGISTER."

**Woods'ville,** p.-v., Grafton co., N. H.

**Wood'-Swallows, or Swift Shrikes,** a group of birds greatly resembling swallows in habits and appearance, but assigned to the Ampelidæ or chatterers, and to the sub-family Dicrurinæ. In the East Indies and Australia they abound. The *Artamus sordidus*, an Australian species, has the habit of forming clusters like those formed by honey-bees on their hives, the whole flock clinging together, and sometimes forming a mass as large as a bushel basket. They eat insects and seeds.

**Wood Type.** See PRINTING, by W. S. PATERSON.

**Wood'ville,** p.-v. and tp., Jackson co., Ala. P. 993.

**Woodville,** tp., Greene co., Ill. P. 1352.

**Woodville,** p.-v., McCracken co., Ky. P. 68.

**Woodville,** tp., Waseca co., Minn. P. 1031.

**Woodville,** p.-v., cap. of Wilkinson co., Miss.

**Woodville,** tp., Bertie co., N. C. P. 1535.

**Woodville,** v., Wayne tp., Clermont co., O. P. 72.

**Woodville,** p.-v. and tp., Sandusky co., O. P. 1418.

**Woodville,** p.-v., cap. of Tyler co., Tex.

**Woodville,** tp., Calumet co., Wis. P. 1023.

**Woodville, or Wydeville.** See RIVERS, EARL OF.

**Woodville** (RICHARD CATON), b. in Baltimore, Md., about 1825; educated at St. Mary's College; studied at Düsseldorf 1847–50, and at Paris 1851–53, and became a distinguished genre painter. D. at London, England, Sept. 13, 1855. Among his best pieces are *The Card-Players* (1847), *The Game of Chess* (1850), *Waiting for the Stage*, and *The Sailor's Wedding*.

**Wood'ville Planta'tion,** tp., Penobscot co., Me. P. 170.

**Wood'ward,** tp., Clearfield co., Pa. P. 1034.

**Woodward,** tp., Clinton co., Pa. P. 1061.

**Woodward,** tp., Lycoming co., Pa. P. 737.

**Woodward** (ASHBEL), M. D., b. at Wellington, Conn., June 26, 1804; graduated in medicine at Bowdoin College 1829; has since practised his profession at Franklin, Conn., and was for many years president of the Connecticut Medical Society. Author of *A Vindication of Gen. Putnam* (1841), *An Historical Account of the Connecticut Medical Society* (1859), *Biographical Sketches of the Early Physicians of Norwich* (1859; new ed. 1862), *Medical Ethics* (1860), *A Memoir of Col. Thomas Knowlton* (1861), *Life of Gen. Nathaniel Lyon* (1862), *An Historical Address, delivered in Franklin, Conn., Oct. 14, 1868, etc.* (2d ed. 1870); rendered assistance in Hollister's *Connecticut*, Bond's *Watertown*, and Stiles's *Ancient Windsor*, and contributed to medical and miscellaneous periodicals, having printed about 40 papers in the *Genealogical Register*.

**Woodward** (BERNARD BOLINGBROKE), F. S. A., son of Samuel (1789–1838), b. at Norwich, England, May 2, 1816; educated at Norwich School; was for a short time tutor in a private school, then clerk in the banking-house of Messrs. Gurney at Great Yarmouth; studied theology in the Independent college at Highbury, near London, 1839–40; took his degree of B. A. at London University 1841; was settled in 1843 as minister of a Congregational church at Wortwell, near Harleston, Norfolk; assisted his friend, the printer John Childs, in some of his larger undertakings, especially in preparing a new edition of James Barclay's *Universal English Dictionary* (1848); edited his father's *Norwich Castle* (1847); settled in London as a professional man of letters 1849; wrote for many periodicals; wrote a *History of Wales, from the Earliest Times to its Final Incorporation with England, etc.* (2 vols., 1850–52); completed a *History of the U. S. of North America to the End of the Administration of President Polk* (3 vols., 1855), which had been commenced by William Henry Bartlett; was co-editor (with John Morris and W. Hughes) of Maunder's *Treasury of Knowledge* (1859); wrote several admirable works for the young, including *First Lessons on the English Reformation* (1857); was appointed librarian in ordinary to Queen Victoria and keeper of the prints and drawings at Windsor Castle July 6, 1860; edited a *History of Hampshire* (1859–62), for which he wrote the portion relating to Winchester; founded the *Fine Arts Quarterly Review* (1863), a periodical of a high class, which was discontinued for lack of support 1865; published *Windsor Castle, Thirty Photographs, printed in Permanent Color,*

*with Descriptive Text* (1869), and *Specimens of the Drawings of Ten Masters, from the Royal Collection at Windsor Castle, with 20 Photographs* (1869), and translated Elisée Reclus's *The Earth* and *The Ocean, Atmosphere, and Life;* and was actively engaged upon his chief work when he d. at London Oct. 12, 1869. He had been a valued literary counsellor and assistant of the queen and of Prince Albert, and was much esteemed for his genial manners and his wide culture. He had projected at the outset of his literary career an historical and chronological cyclopædia for students and general readers, and in 1860 associated in the task Mr. William L. R. Cates, who completed and issued *The Encyclopædia of Chronology, Historical and Biographical* (1872), a work of the highest accuracy and value. Mr. Woodward had commenced, some years before his death, a *Life of Leonardo da Vinci*, to be illustrated by that artist's anatomical drawings in the royal collection at Windsor, and contemplated important works on the archæology of England and Wales.

**Woodward** (E. T.), U. S. N., b. Mar. 8, 1843, in Vermont; graduated at the Naval Academy in 1861; became lieutenant in 1864, lieutenant-commander in 1866; served in the Scioto at the capture of New Orleans and passage of the Vicksburg batteries in 1862, and was handsomely mentioned in official reports. FOXHALL A. PARKER.

**Woodward** (GEORGE W.), b. at Bethany, Pa., Mar. 26, 1809; received an academic education; became a lawyer; was a member of the State constitutional convention of 1837, president judge of the fourth judicial district 1841–51, judge of the supreme court of Pennsylvania 1852–67, and Democratic member of Congress 1867–73. D. at Rome, Italy, May 10, 1875.

**Woodward** (HENRY), F. G. S., brother of Samuel P., b. at Norwich, England, about 1825; obtained distinction as a geologist and writer on palæontology, having given special attention to the structure and classification of the fossil Crustaceæ, on which subject he wrote several reports for the British Association and several papers in the scientific periodicals, and contributed a monograph on the *Merostomata* to the volumes of the Palæontological Society. He is now (1877) assistant keeper of the geological department of the British Museum and editor of the *Geological Magazine*.

**Woodward** (JOHN), M. D., F. R. S., b. in Derbyshire, England, May 1, 1665; was originally a linen-draper; studied medicine, comparative anatomy, and natural history under Dr. Peter Barwick at the seat of Sir Ralph Dutton in Gloucestershire; received the degree of M. D. from Archbishop Tenison; devoted his attention to the fossils occurring in the shelly limestones of Gloucestershire, whence he derived an idea of the formation of the earth by the deposition of strata; travelled over the greater part of England, noting in a journal his geological observations; opened a correspondence with scientific men in foreign countries for the purpose of extending his geological data, and as the result of his inquiries published *An Essay toward a Natural History of the Earth and Terrestrial Bodies, especially Minerals; as also of the Sea, Rivers, and Springs, with an Account of the Universal Deluge, and of the Effects that it had upon the Earth* (London, 1695; 4th ed. 1726; in Latin, 1704), which was attacked by Arbuthnot, John Hutchinson, Lister, and others, ably defended by Dr. John Harris, and, though containing much that is fanciful and visionary, had a remarkable and permanent influence on the progress of English geology. It was subsequently criticised by Leibnitz and by Elias Camerarius, professor at Tübingen, to whose objections Woodward replied in a Latin treatise, *Naturalis Historia Telluris illustrata et aucta* (1714). He had settled in London as professor of physic in Gresham College 1692; became a fellow of the Royal Society 1693, and subsequently of the College of Physicians; attracted much attention by his *Account of Roman Arms and Antiquities digged up near Bishopsgate* (1712), in which he claimed to have discovered the iron "shield of Camillus," containing a representation of Rome previous to its destruction by the Gauls; wrote against Drs. Mead and Freind on the subject of small-pox, and collected a considerable museum of fossils and objects of natural history, which he bequeathed to the University of Cambridge, where by his will he founded that professorship of geology which has been held in the present century by Mitchell and Sedgwick. D. in London Apr. 25, 1722. He left many MSS., and from them was compiled *An Attempt toward a Natural History of the Fossils of England, or a Catalogue of English Fossils in the Collection of John Woodward, M. D., containing a Descriptive and Historical Account of each* (2 vols., 1729).

**Woodward** (SAMUEL), b. in Norwich, England, in 1789; spent most of his life as a clerk in the banking-house of Messrs. Gurney, and was a noted geologist and antiquary. D. at Norwich in 1838. Author of *A Synoptical Table of British Organic Remains* (Norwich, 1830), *Outline of the Geology of Norfolk* (1833), *The Norfolk Topographer's Manual* (1842; revised and augmented by W. C. Ewing), and *The History and Antiquities of Norwich Castle* (1847), edited by his son Bernard. He also privately printed four maps of Roman Norfolk and Norwich, and contributed papers to the *Archæologia* and to the *Magazine of Natural History*.

**Woodward** (SAMUEL BAYARD), M. D., b. at Torringford, Conn., June 10, 1787; began practice as a physician at Wethersfield 1809; became physician to the State prison; sat for several years in the State senate; was one of the founders of the Hartford Retreat for the Insane; was superintendent of the Massachusetts lunatic asylum at Worcester 1832–46, and was the projector of an asylum for inebriates and of the Massachusetts School for Idiotic Youth. In 1846 he settled at Northampton, Mass. D. Jan. 3, 1850. He published a valuable series of *Annual Reports* and various other professional treatises.

**Woodward** (SAMUEL PECKWORTH), PH. D., F. G. S., son of Samuel (1789–1838), b. at Norwich, England, Sept. 17, 1821; studied at London University 1839–41, being at the same time employed in the library of the British Museum; was sub-curator of the museum of the Geological Society of London 1839–45; professor of botany and geology in the Royal Agricultural College at Cirencester 1845–48; became assistant in geology and mineralogy in the British Museum 1848; was subsequently examiner in natural history to the military colleges of Woolwich and Sandhurst, and in geology to the University of London; was a leading member of the council of the Geological Society; contributed to many scientific periodicals; assisted Prof. Owen in the invertebrate portion of his *Palæontology;* prepared the geological map of England and Wales published by the Useful Knowledge Society; gained the Wollaston prizes for 1854 and 1857 by his paper on the *Rudistes* family, and was the first to work out the affinities of the family *Hippurites*. D. at Herne Bay, Kent, July 11, 1865. His chief work was *A Manual of Mollusca, or a Rudimentary Treatise on Recent and Fossil Shells* (London, 3 parts, 1851–54–56; 2d ed. 1866), illustrated by A. N. Waterhouse and J. W. Lowry. An *Appendix* appeared in 1869.

**Woodwaxen,** or **Woadwaxen.** See DYERS' BROOM.

**Wood'worth** (FRANCIS C.), nephew of Samuel, b. at Colchester, Conn., in 1812; was for eight years a printer, afterward for three years a minister, and subsequently devoted himself to juvenile literature, editing fifteen vols. of the *Youth's Cabinet*, a monthly magazine; issued *The American Miscellany of Entertaining Knowledge* (6 vols.), *Uncle Frank's Home Stories* (6 vols.), *Boys' and Girls' Library* (6 vols.), *Picture-Gallery* (2 vols.), *Theodore Thinker's Stories for Little Folks* (12 vols.), and published several volumes during a residence in England. D. at sea, on a voyage from Savannah to New York, June 5, 1859.

**Woodworth** (JOHN), b. at Schodack, N. Y., Nov. 12, 1768; graduated at Yale College 1788; studied law at Albany; commenced practice at Troy 1791; settled at Albany 1806; was surrogate of Rensselaer co. 1793–1804; member of the assembly 1803, of the senate 1804–07, attorney-general of New York 1804–08, commissioner (with W. W. Van Ness) to revise the laws of New York 1811–13, and judge of the supreme court of New York 1819–28. D. at Albany June 1, 1858. Author of *Reminiscences of Troy from its Settlement to 1807, etc.* (1853).

**Woodworth** (SAMUEL), b. at Scituate, Mass., Jan. 13, 1785; served an apprenticeship as a printer in the office of Russell's *Columbian Centinel;* commenced a short-lived weekly paper at New Haven, Conn., 1807; settled in New York 1809; conducted during the war of 1812–15 a weekly paper, *The War*, and a monthly Swedenborgian magazine, *The Halcyon Luminary*, both unsuccessful; wrote a romantic history of the war entitled *The Champions of Freedom* (2 vols., 1816); published a small volume of poems 1818, and another 1826; was one of the founders of the *New York Mirror* 1823–24; edited the *Parthenon* 1827, and wrote a number of dramatic pieces. D. in New York Dec. 9, 1842. His *Poetical Works* appeared in 2 vols. (1861), with a *Memoir* by George P. Morris. He is chiefly remembered by his song, *The Old Oaken Bucket*.

**Wool** (JOHN ELLIS), b. at Newburg, N. Y., Feb. 20, 1784; after engaging in the book-business for a time in Troy, the destruction of his stock by fire led to his turning his attention to the study of law, which he abandoned in Apr., 1812, to accept a commission in the army as captain of the 13th Infantry. At Queenstown Heights, his first action, he led his company, and was severely wounded Oct. 13, 1812; promoted to be major 29th Infantry Apr. 13,

1813, he again distinguished himself at Plattsburg (Sept. 11, 1814), and was brevetted colonel for gallantry. Under the act of Apr. 24, 1816, providing for the general staff, Wool was appointed (Apr. 29) inspector-general with the rank of colonel, which position he retained until June 25, 1841, when appointed a brigadier-general, to which rank he had been brevetted in 1826. As inspector-general he made in 1832 a professional tour of Europe, examining the various systems then prevailing there, and in 1836 negotiated the transfer of the Cherokee Indians W. of the Mississippi. In the war with Mexico he superintended the organization of Western volunteers, and after despatching some 12,000 to the seat of war, conducted himself a force of 3000 on the march from San Antonio to Saltillo, a distance of 900 miles, where he joined the army of Gen. Taylor as second in command. At Buena Vista, before the arrival of Taylor, he was in command during the early part of the day, and had made the disposition of the troops for the battle, which was approved of by Taylor on his arrival. After Taylor's return to the States, Wool remained in command of the army of occupation until the close of the war. For his services at Buena Vista he was brevetted major-general, and in 1854 Congress passed a joint resolution of thanks and presented him with a sword for his Mexican services. The State of New York also presented him with a sword. Returning East in July, 1848, he commanded the Eastern military division until 1853, the department of the East 1853–54, that of the Pacific 1854–57, when again in command of the Eastern department until 1860. In Aug., 1861, he was placed in command at Fort Monroe, Va., and in May, 1862, occupied Norfolk and Portsmouth. He was promoted to be major-general May 16, 1862; was in June placed in command of the Middle military department, including the 8th army corps; transferred to New York Jan., 1863, he commanded the department of the East until July 15, when relieved, and Aug. 1, 1863, was placed on the retired list. D. at Troy, N. Y., Nov. 10, 1869.

**Wool and Wool-Trade.** See APPENDIX.

**Wool, Chemistry of.** See KERATINE.

**Wool'ery's,** tp., Carroll co., Md. P. 2448.

**Wool'lett** (WILLIAM), b. at Maidstone, Kent, England, Aug. 27, 1735; was apprenticed to John Tinney, an obscure engraver at London, but soon adopted a style of his own, uniting in a single plate the use of aquafortis, the burin, and the dry needle; gained a high reputation, especially by his landscapes, in which he was unrivalled in representing foliage, water, and rocks, and became engraver to George III. D. in London May 23, 1785. His masterpieces are nine English landscapes after Richard Wilson, *The Death of Gen. Wolfe*, and *The Battle of La Hogue*, after Benjamin West. He has a monument in Westminster Abbey.

**Wool'man** (JOHN), b. at Northampton, Burlington co., West Jersey, in Aug., 1720; worked on a farm until his twenty-first year, when he became clerk to a shopkeeper at Mount Holly, and began to speak in the meetings of the Society of Friends; opened a school for poor children at Mount Holly; learned the trade of tailor, by which he supported himself during a tour with Isaac Andrews to visit the Friends in the back settlements of Virginia (1746); adopted itinerancy as his regular mode of life, visiting the societies of Friends in nearly all the colonies; spoke and wrote frequently against slavery; visited the Indians on the Susquehanna 1763; subsequently went to England. D. at York Oct. 7, 1772. He published *Some Considerations on the Keeping of Negroes* (Philadelphia, 1753; 2d part, 1762), *Considerations on Pure Wisdom and Human Policy, on Labor, on Schools, and on the Right Use of the Lord's Outward Gifts* (1768), *Considerations on the True Harmony of Mankind, and how it is to be maintained* (1770), and *An Epistle to the Quarterly and Monthly Meetings of Friends* (1772). He left various MSS., which appeared in an edition of his *Works* (1775). The *Journey of his Life and Travels in the Service of the Gospel* (1775) has been many times reprinted, and was edited with an *Introduction* by John G. Whittier (1871). Woolman's writings were enthusiastically praised by Charles Lamb, and have been highly esteemed by all who have read them.

**Wool Manufacture.** See APPENDIX.

**Wool'ner** (THOMAS), R. A., b. at Hadleigh, Suffolk, England, Dec. 17, 1825; educated at Ipswich; became a distinguished sculptor; was chosen an associate of the Royal Academy 1871, and an academician Dec., 1874. Among his principal statues are those of Lord Bacon and Prince Albert at Oxford, Lord Macaulay and Prof. Whewell at Cambridge, Lord Lawrence at Calcutta, Sir Bartle Frere and David Sassoon at Bombay. He has executed busts of Cobden, Sedgwick, Tennyson, Carlyle, Darwin, Gladstone, Hooker, Browning, Dickens, Father Newman, and other English celebrities; statuettes *Elaine, Guinevere,* and *Ophelia*, and has published a volume of poems, *My Beautiful Lady* (1863; 3d ed. 1866), which has received critical approval.

**Wool-Printing.** See APPENDIX.

**Wool'rych** (HUMPHREY WILLIAM), b. in England about 1795; became an eminent barrister and sergeant-at-law of Lincoln's Inn. D. in London July 2, 1871. Author of numerous and valuable professional treatises, of a *Life of Sir Edward Coke* (1826), *Series of the Lord Chancellors, Keepers of the Seal, etc.* (1826), *Memoirs of the Life of Lord Jeffreys* (1827), and *Lives of Eminent Serjeants-at-Law* (2 vols., 1869). He maintains that "Jeffreys's merits have not been sufficiently understood."

**Wool'sack,** the seat of the lord chancellor in the British House of Lords, a large cushion stuffed with wool. It is a long parallelopiped, without back or sides, and bears no resemblance to a sack or a cushion. Wool being formerly regarded as the principal source of England's wealth, the woolsack, covered with red cloth, was first introduced into the House in Queen Elizabeth's time to commemorate an act forbidding the exportation of wool.

**Wool'sey** (MELANCTHON B.), U. S. N., b. Aug. 11, 1818, in New York; entered the navy as midshipman Dec. 24, 1832; became lieutenant 1847, commander 1862, captain 1866, commodore 1871; served with gallantry on the Western waters during the civil war, and, refusing to leave the Pensacola yard during the prevalence of yellow fever there, although he had permission to do so from the secretary of the navy, he was attacked by that fearful disease, and died in the heroic discharge of his duty Oct. 2, 1874. Com. Woolsey was a man of refined tastes and most amiable character. FOXHALL A. PARKER.

**Woolsey** (THEODORE DWIGHT), D. D. Harvard 1847, LL.D. Wesleyan 1845, b. in New York Oct. 31, 1801; graduated at Yale College 1820; studied theology at Princeton; was a tutor in Yale College 1823–25; licensed to preach in 1825, and studied the Greek language in Germany 1827–30; elected professor of Greek in Yale College in 1831; elected president in 1846, resigned this office in 1871; has since resided in New Haven, giving occasional instruction in the law school, and busily occupied in researches and studies chiefly in political science; was ordained at the time of his inauguration, and has frequently preached in the college chapel and elsewhere with great acceptance; edited the *Alcestis* of Euripides (1833), the *Antigone* of Sophocles (1835), the *Electra* of Sophocles (1837), the *Prometheus* of Æschylus (1837), the *Gorgias* of Plato (1842); published his inaugural discourse on *College Education* (1846), an *Historical Discourse upon Yale College* (1850), *An Introduction to the Study of International Law* (12mo, Boston, 1860; 4th ed., New York, 1874), *An Essay on Divorce and Divorce Legislation* (New York, 1869), a volume of sermons entitled *The Religion of the Past and the Future* (New York, 1871), two sermons, *Serving our Generation* and *God's Guidance in Youth* (New Haven, 1871), several occasional sermons, many of them memorial and biographical, and numerous papers in the *New Englander* and other periodicals. After the death of Prof. Francis Lieber (1872), Pres. Woolsey re-edited, with notes, his work on *Civil Liberty and Self-Government* (Philadelphia, 8vo, 1874), also his *Manual of Political Ethics* (2 vols., 8vo, Philadelphia, 1874). Pres. Woolsey was for several years one of the regents of the Smithsonian Institution, and is now a member and the chairman of the American division of the committee for the revision of the New Testament. He is at present preparing a work upon political science, which will contain the results of the researches and reflections of many years. As a scholar, Pres. Woolsey is distinguished for the exactness of his knowledge, the extent of his erudition, and the breadth and sagacity of his judgment; as a teacher, for the glow of his imaginative and ethical spirit, and for the rigor of his impartiality in searching after and imparting the truth; as a theologian, for the extent of his biblical knowledge, the catholicity and candor of his theological opinions, and the fervor of his childlike faith; as a friend, for the warmth and endurance of his attachments; and as a man, for a rare assemblage of qualities which have secured to him an enviable place in the love and respect of his generation. Few men have been more distinguished in this country for eminence in so great a variety of departments of scholarship and culture, and few men have secured for themselves the solid respect of so great a number of their countrymen for high personal and moral excellence. NOAH PORTER.

**Wool'ston** (THOMAS), b. at Northampton, England, in 1669; graduated at Sidney-Sussex College, Cambridge, about 1688; became a fellow there; took orders in the Church of England; made a careful study of the works of Origen; wrote *The Old Apology for the Truth of the Christian Religion against the Jews revived* (1705), in which he

maintained, ostensibly in the interest of Christianity, that many seemingly historical portions of the Bible, including the Pentateuch, are to be interpreted allegorically, Moses and his miracles being merely types of Christ; maintained this view in letters addressed to Drs. Whitby, Waterland, Whitton (1720); and in letters to Dr. Bennet (1720) argued that the Quakers approach nearer in doctrine and organization to the primitive Church than any other religious body; went to reside in London 1720; was deprived of his fellowship 1721 on account of the scandal occasioned by his writings; published *The Moderator between the Infidel and the Apostate* (1725) and *Six Discourses on the Miracles of our Saviour* (1727–29), addressed to six bishops, in which he maintained the allegorical character of those miracles—a publication which elicited no less than sixty replies. Woolston was in consequence indicted for blasphemy at the instance of the attorney-general, tried, and convicted at the Guildhall Nov., 1729, fined £100, imprisoned for a year in the queen's bench prison, and failing to provide security for not repeating the offence, spent the rest of his life within the rules of that prison, dying Jan. 27, 1733.

**Wool'wich,** town of England, county of Kent, on the southern bank of the Thames, 9 miles below London, extends for a distance of 2 miles along the river, and has an excellent dockyard, provided with dry and wet docks, from which some of the largest ships of the English navy have been launched. This is also the seat of the chief arsenal of England, and contains all the different kinds of workshops in which cannons, bombs, shells, etc., are made. It has a military academy and extensive barracks. P. 41,695.

**Woolwich,** p.-v. and tp., Sagadahoc co., Me. P. 1168.

**Woolwich,** tp., Gloucester co., N. J. P. 3760.

**Woonsock'et,** p.-v. and tp., Providence co., R. I., on Providence and Worcester R. R. and on the Blackstone River, 16 miles from Providence and 37 from Boston by the Woonsocket branch of New York and New England R. R., of which the town is the present southern terminus. It is noted chiefly for its extensive manufacturing industries, and possesses an unusual prestige by reason of the numerous manufacturing villages that cluster about it and contribute to its trade and general business. Its water-power is the finest on Blackstone River. The town contains 9 churches (2 Roman Catholic, 2 Congregational, a Methodist, Universalist, Episcopal, Friends, and Baptist); the Harris Institute, an imposing and comely edifice, founded and permanently endowed by Edward Harris, embracing a free circulating library of about 7000 volumes, the first in the State, a lyceum, reading-rooms, hall, etc.; 6 national banks, 5 savings banks; a high school and 8 school edifices; 2 fine hotels; 2 daily, 1 semi-weekly, and 2 weekly newspapers; 6 Masonic, 5 Odd Fellows, 3 Hibernian, 1 Knights of Pythias, and 7 temperance organizations; and 2 opera-houses and several public halls. It has an efficient police system, a paid fire department, and negotiations are pending for an electric fire-alarm. In the southern suburbs is a fine agricultural and trotting park. The prosperity of the town is derived largely from the extensive manufactories, $6,000,000 of the $10,000,000 town valuation being thus invested. Among the leading industries are woollen and cotton mills, rubber works, wringing-machine manufactory, a tool and worsted company, lastings and serge mills, twist drill, loom harness, machine-works, foundry, 1 sewing-machine establishment, 1 washing-machine company, a braid company, several planing-mills, and other industries. The pop. of the town proper is 11,527 (census 1870), one-third being Americans, one-third Irish, and one-third Canadians.

LE ROY B. PEASE, ED. "DAILY REPORTER."

**Woorari,** or **Woorara.** See CURARI.

**Woos'ter,** p.-v. and tp., cap. of Wayne co., O., on Pittsburg Fort Wayne and Chicago R. R., 130 miles W. of the former city, is the seat of WOOSTER UNIVERSITY (which see); has 3 churches, 5 banks, 2 newspapers, fire department, waterworks, and manufactories of reapers, mowers, threshers, clover-hullers, engines, boilers, mill-gearings, straw-board, woollen goods, flax, flour, furniture, wire goods, whips and lashes, sash and doors, organs, carriages and wagons, and 5 excellent hotels. P. of v. 5419; of tp., exclusive of v., 1145. J. G. SANBORN, ED. "REPUBLICAN."

**Wooster** (DAVID), b. at Stratford, Conn., Mar. 2, 1710; graduated at Yale College 1738; married a daughter of Pres. Clap 1740; commanded a sloop-of-war in the expedition against Louisburg 1745; went to Europe in charge of a cartel-ship; visited England: was presented at court, and made a captain in Pepperell's regiment; was appointed colonel of the 3d Connecticut regiment 1755; served as brigadier-general in the northern campaigns of 1758–60; was one of the originators of Arnold's expedition for the capture of Ticonderoga Apr., 1775; was appointed brigadier-general June 22, 1775; succeeded to the command in Canada on the death of Montgomery; became major-general of State militia 1776; mortally wounded in the defence of Danbury against Tryon, dying there May 2, 1777. A monument was erected by the State in 1854.

**Wooster University,** an institution of learning at Wooster, Wayne co., O., was organized by joint action of the four synods of the Presbyterian Church of Ohio in 1866, 21 acres of forest-land on a commanding elevation 1 mile N. of Wooster being donated as a site, and $110,000 contributed by citizens of the county, with which a spacious brick building was erected and furnished for recitation-rooms, society halls, etc. A commodious chapel was also added, with rooms for library, museum and laboratories. Endowment to the amount of $250,000 was obtained from friends in the State, and liberal contributions were made for a valuable library, extensive museum, and apparatus for the various departments. Three courses of study were projected—classical, philosophical, and scientific—for the collegiate department. A full faculty of professors and teachers was chosen, Rev. Willis Lord, D. D., being inaugurated president, and in 1870 the university was opened for instruction to students of both sexes on equal terms. The standard of scholarship was established on a level with that of the best American colleges. The first year there was graduated a senior class of 6, formed mainly of students from other institutions. The second graduating class numbered 8, the third 13, the fourth 28. The same year a contract was made with the Charity Hospital Medical College of Cleveland by which it became the property of the university as its medical department, and G. C. E. Weber, M. D., was appointed dean of the medical faculty, with above 50 students in attendance. A preparatory department was organized at Wooster in 1872, and passed at once into successful operation. In 1874–75 there were in the medical department 71 students, in the collegiate 160, in the preparatory 75; total, 306. The plan of the co-education of the sexes has proved most satisfactory, the students attending the same classes. In 1874 one young lady was graduated in the scientific course, and in 1875 four—two in the classical and two in the scientific—above 40 young ladies being in attendance during the latter year. Dr. Lord having resigned the presidency in 1873, Rev. A. A. E. Taylor, D. D., of Cincinnati was inaugurated as his successor the same year. This is the only college owned and operated by the Presbyterian Church in Ohio, which Church has a membership of 60,000 and stands second in wealth among the Protestant churches of the State. The foundation of the university is substantial and secure; its endowment is being vigorously prosecuted; and its tone and grade of scholarship are faithfully maintained by a system of strict and frequent examinations. Being situated on Pittsburg Fort Wayne and Chicago R. R., there is easy access to it from all parts of the country, and students are already drawn to it from many States. A. A. E. TAYLOR.

**Worces'ter,** or **Worcestershire,** an inland county of England, on both sides of the Severn and its affluent the Avon, comprises an area of 738 sq. m., with 338,848 inhabitants. The surface is undulating and well wooded; the elm grows luxuriantly, and has received the name of "the weed of Worcestershire;" fruit trees also succeed well. Wheat, hops, vegetables, and pears are extensively cultivated. Coal and iron abound, and about one-third of the inhabitants are engaged in mining. Among the different manufactures which are carried on are those of carpets at Kidderminster, the most remarkable.

**Worcester,** town of England, capital of Worcestershire, on the Severn, has a fine cathedral, interesting remains of antiquity, and extensive manufactures. Tanning, currying, dressing, and staining of leather, glove-making, the manufacture of porcelain, vinegar, sauce, and chemicals, are the principal branches of industry, and several of them —as for instance, those of sauce, china, and gloves—enjoy a great reputation. P. 33,241.

**Worcester,** county of S. E. Maryland, bordering on Delaware and on the Atlantic Ocean, forming a part of the peninsula between Delaware and Chesapeake bays, and traversed by Wicomico and Pokomoke and Worcester R. Rs. Along the coast are low sandy beaches, separated from the mainland by inlets. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, and wool. Cap. Snow Hill. Area, 550 sq. m. P. 16,419.

**Worcester,** county of Central Massachusetts, bordering on New Hampshire, Connecticut, and Rhode Island, drained by Blackstone, Chicopee, Nashua, Ware, and other rivers, and traversed by numerous railroads. The surface is generally undulating; most of the soil is naturally or artificially fertile and under high cultivation. There are

nearly 2000 manufacturing establishments, among which are agricultural implements, axes, and edge tools, boots and shoes, bricks, cotton goods, carriages, combs, cutlery, flour-mills, furniture, firearms, flax and linen goods, hardware, hats, hosiery, iron castings, leather, musical instruments, machinery, paper, planing-mills, saw-mills, soap and candles, shoddy, straw goods, steel, woollens, worsted goods, wire and wire fabrics. Horses and cattle are the chief live-stock. Staples, manufactured articles, hay, potatoes, Indian corn, and garden and dairy products. Cap. Worcester. Area, about 1500 sq. m. P. 192,716.

**Worcester,** city, cap. of Worcester co., Mass., near the centre of the State, in one of the richest and most productive agricultural and manufacturing districts of New England. Boston and Albany R. R. runs through it, and it is the terminating point of four other important railroads—Norwich and Worcester, Providence and Worcester, Worcester and Nashua (which has a through line to Portland, Me.), and Worcester and Gardner, which goes into New Hampshire. It is noted for its various and extensive manufacturing industries. The ninth census reported the manufactures of Worcester as follows:

| Name of industry. | Number of establishments. | Number of hands employed. | Yearly products. |
|---|---|---|---|
| Boots and shoes | 136 | 10,478 | $18,904,922 |
| Carpets | 1 | 485 | 1,180,000 |
| Men's clothing | 44 | 477 | 552,444 |
| Cotton goods | 57 | 6,590 | 7,814,126 |
| Edge tools | 2 | 302 | 614,000 |
| Flouring-mill products | 49 | 124 | 1,298,216 |
| Furniture | 64 | 4,844 | 3,114,622 |
| Hardware | 32 | 707 | 988,493 |
| Hats and caps | 6 | 1,798 | 727,725 |
| Iron castings | 20 | 714 | 1,392,092 |
| Leather, curried | 24 | 325 | 1,371,393 |
| Lumber, sawed | 95 | 442 | 741,447 |
| Machinery, not specified | 55 | 1,318 | 2,578,191 |
| Machinery, cotton and woollen | 33 | 1,112 | 2,288,705 |
| Paper, printing | 6 | 275 | 1,037,104 |
| Printing and cotton goods, etc | 1 | 190 | 1,451,490 |
| Straw goods | 13 | 1,792 | 830,950 |
| Wire | 4 | 876 | 2,230,072 |
| Woollen goods | 63 | 5,165 | 9,543,908 |
| Worsted goods | 3 | 747 | 1,182,320 |

There are three large establishments for the manufacture of machine-card clothing; extensive rolling-mills that manufacture large amounts of railroad iron and car-wheels; establishments for the manufacture of railroad cars; and shops for the manufacture of firearms of all kinds, which do a large business; shops for brass-work, for the manufacture of musical instruments, and for manufactures not mentioned in the census returns. Worcester has an excellent system of graded free schools, which includes a classical and English high school. The Roman Catholic College of the Holy Cross is situated on high ground in the south-eastern part of the city. The Worcester County Free Institute of Industrial Science, a very important institution established in 1868, is finely situated in the northern part. There is a State normal school in the city. Among the more important private schools are the Highland Military Academy, the Worcester Academy, and the Oread Institute. The city has an electric fire-alarm, and works for supplying the city with water. A horse-railroad, 3 or 4 miles long, runs through Main street from Lincoln Square to Webster Square. There are two parks. On one of them, known as the Old Common, stands the imposing soldiers' monument, designed and executed by Randolph Rogers, and also a beautiful monument erected to the memory of Col. Timothy Bigelow, a gallant Worcester soldier of the Revolution. There are 13 public halls in the city, the largest and most important being Mechanic Hall, which is one of the finest rooms of the kind in the country. Worcester has a well-endowed city hospital and a home for aged women. There is also in the city a State lunatic asylum, which will accommodate 550 patients. The city has a flourishing free public library, with well-furnished circulating and reference departments and free reading-rooms. The hall of the American Antiquarian Society, with its library of about 70,000 volumes, is here. This society was founded by Isaiah Thomas, and incorporated in 1812. Three daily papers are published in Worcester. Among its more important and prosperous societies for mutual and general improvement are a mechanics' association; a lyceum and natural history association, which has a valuable cabinet of specimens; a very successful horticultural society, a law library association, 2 medical societies, and the Worcester County Musical Association, which has much reputation for excellence. There are 7 banks for discount, a safe-deposit and trust company, 4 savings banks with deposits amounting to $12,851,326, and 5 insurance companies.

The settlement of Worcester began in Apr., 1675, after several years of preparation. There was a formal purchase of the land from the Indians, who, for "twelve pounds in lawful money of New England," gave the settlers a deed of a tract 8 miles square. King Philip's war brought hostile Indians against the settlement, which was broken up for a time. Attempts to re-establish it were harassed by Indian hostilities until 1713, when the settlement became permanent and prosperous. The situation of Worcester being very favorable, it became important. It grew to be a flourishing town, and finally became the second city of the State in population, business, and wealth. During the Revolutionary war this was one of the most patriotic towns in the country. The first public reading of the Declaration of Independence in Massachusetts took place in Worcester on the steps of the Old South church, the reader being Isaiah Thomas. Mr. Thomas established the first printing-press in Worcester, and the first thing printed in the town was the *Massachusetts Spy* of May 3, 1775, which contained an account of the battle of Lexington. The first city government was organized in 1848. The growth of the city has been remarkable for an Eastern town. Since 1860 the population has more than doubled. There are in Worcester 10 Congregational churches (including 2 Unitarian), 7 Methodist, 4 Baptist, 5 Roman Catholic, 2 Episcopal, 1 Universalist, 1 Quaker, 1 Campbellite, and 1 Second Adventist. The oldest church in the city is the Old South, which was organized by the first settlers, and existed alone until 1786. In 1845 the pop. of Worcester was 11,556; in 1870, 41,105; it now exceeds 50,000.

JOHN D. BALDWIN, ED. "WORCESTER DAILY SPY."

**Worcester,** p.-v. and tp., Otsego co., N. Y. P. 2327.

**Worcester,** p.-v. and tp., Montgomery co., Pa. P. 1587.

**Worcester,** p.-v. and tp., Washington co., Vt. P. 775.

**Worcester,** EARL OF. See TIPTOFT (JOHN).

**Worcester** (EDWARD **Somerset**), SECOND MARQUIS OF, b. at Raglan Castle, England, about 1601, was the eldest son of Henry Somerset, Lord Herbert of Chepstow, created in 1642 first marquis of Somerset, a distinguished leader of the Roman Catholic party; received a careful education; spent some years in foreign travel; married in 1628; devoted himself to mathematical and mechanical researches at Raglan Castle; entered the military service of Charles I. in 1641, along with his father, raising and commanding a body of troops; was known from 1642 by the courtesy title of Lord Herbert; is alleged to have been created earl of Glamorgan by Charles I. Apr. 1, 1644; was sent to Ireland as a secret agent of the king to treat with the Irish Roman Catholics 1645; was imprisoned on the discovery of his errand, and at first disowned by the king; was released, and succeeded to the earldom 1646, and went into voluntary exile in France Mar., 1648; returned to England 1652; was imprisoned in the Tower 1652–55; drew up while in the Tower a little work entitled *A Century of the Names and Scantlings of such Inventions as at present I can call to mind to have Tried and Perfected,* etc. (1663), in which he describes a steam-engine as "an admirable and most forcible way to drive up water by fire," and spent a large sum of money upon the erection of water-works at Vauxhall. D. Apr. 3, 1667. He was regarded as a visionary by most of his contemporaries, but is now recognized as one of the greatest mechanical geniuses that have ever lived. A well-written account of his *Life, Times, and Scientific Labors* (1865), including a reprint of the *Century of Inventions,* was issued by Mr. Henry Dircks, who also published *Worcesteriana* (1865), consisting of notices of 180 works relating to the marquis or his connections.

**Worcester** (JOSEPH EMERSON), LL.D., b. at Bedford, N. H., Aug. 24, 1784; graduated at Yale College 1811; taught school at Salem, Mass.; studied theology two years at Andover Seminary; settled at Cambridge, Mass., 1819, and devoted himself thenceforth to the preparation of a series of valuable textbooks and of his dictionary, for which purpose he visited Europe 1830–31. D. at Cambridge Oct. 27, 1865. Among his works were a *Geographical Dictionary, or Universal Gazetteer* (2 vols., Andover, 1817), *Elements of Geography, Ancient and Modern* (1819), *Sketches of the Earth and its Inhabitants* (2 vols., 1823), *Elements of History, Ancient and Modern* (1826), *Elements of Ancient Classical and Scripture Geography* (1839), *The American Almanac* (1831–43), a revised edition of Todd's *Johnson's Dictionary* (1827), an abridgment of *Webster's Dictionary* (1829), a *Comprehensive Pronouncing and Explanatory Dictionary of the English Language* (1830), a *Universal and Critical Dictionary* (1846), and his great work, *A Dictionary of the English Language* (Boston, 1860, with 1000 illustrations), which divides with that of Webster the suffrages of the English-speaking world.

**Worcester** (NOAH), D. D., b. at Hollis, N. H., Nov. 25, 1758; received only a common-school education; served three

years as fifer and fife-major in the Continental army 1775–77, being present at Bunker Hill and at Bennington; taught school at Plymouth, N. H.; settled at Thornton, where he filled several civil offices, and was chosen to the legislature; turned his attention to theology; published a *Letter to Rev. John Murray concerning the Origin of Evil* (Newburyport, 1786); was pastor of the Congregational church at Thornton 1787–1809, receiving a salary of $200, and made up the deficiency by farming and shoemaking; removed to Salisbury, N. H., 1810, supplying there the pulpit of his brother Thomas until 1813, when he settled at Brighton, Mass.; edited the *Christian Disciple* 1813–19, and a quarterly magazine, the *Friend of Peace*, 1819–29; founded the Massachusetts Peace Society in Jan., 1816; was its secretary until 1828; published *Solemn Reasons for Declining to adopt the Baptist Theory and Practice* (1809); *Bible News, or Sacred Truths relating to the Living God, His Only Son and Holy Spirit* (Concord, 1810), which was censured by the Hopkinton Association as unsound on the doctrine of the Trinity; *Impartial Review of Testimonies in Favor of the Divinity of the Son of God* (1810), and other controversial treatises against the Trinitarians; *A Solemn Review of the Custom of War* (1814; 11th Amer. ed. 1833); *The Atoning Sacrifice a Display of Love, not of Wrath* (Cambridge, 1829); *The Causes and Evils of Contentions among Christians* (1831), and *Last Thoughts on Important Subjects* (1833). D. at Brighton Oct. 31, 1837. A *Memoir* (1844) was issued by Rev. Henry Ware, Jr., D. D.

**Worcester** (Samuel), D. D., brother of Noah, b. at Hollis, N. H., Nov. 1, 1770; graduated at Dartmouth College 1795; was pastor of the Congregational church at Fitchburg, Mass., 1797–1802, and thenceforth of the Tabernacle church at Salem; became corresponding secretary of the American Board of Commissioners for Foreign Missions at its organization in 1810; published several sermons and orations, and *Three Letters to Dr. Channing* (1815) on the Trinitarian controversy, and edited *Christian Psalmody* (1815) and *Watts and Select Hymns* (1818). D. at Brainerd, Ga., June 7, 1821. His *Life and Labors* (2 vols., 1852) were described by his son Samuel Melancthon, and a posthumous volume of his *Sermons* appeared in 1823.

**Worcester** (Samuel Melancthon), D. D., son of Samuel, b. in Fitchburg, Mass., Sept. 4, 1801; graduated at Harvard 1822; studied one year at Andover; was tutor in Amherst College 1823–25, and professor of rhetoric and oratory 1825–34; was pastor of the Tabernacle church in Salem 1834–60, when he resigned on account of impaired health; and, after having been a member both of the Massachusetts senate and house of representatives, d. in Salem Aug. 16, 1866. He re-edited his father's *Watts and Select Hymns*, with 240 additional hymns, in 1834, and also published *Essays on Slavery* (1826) and *Memorial of the Tabernacle, Salem* (1855). R. D. Hitchcock.

**Worcester County Free Institute,** at Worcester, Mass., was founded by John Boynton of Templeton by a gift of $127,000; the late Hon. Ichabod Washburn established the machine-shop, and otherwise enlarged the resources of the institute to a total amount of $130,000; further endowments by Hon. Stephen Salisbury of $250,000, and the State of Massachusetts of $50,000, increased the available annual income to $25,000. The school is free to all citizens of the county of Worcester, and 22 students, residents of the State of Massachusetts but not of the county of Worcester, may receive free tuition. Residents of any other place may be admitted upon payment of a tuition-fee of $100 per annum. The institute offers facilities for acquiring theoretical and practical knowledge of mechanical engineering, civil engineering, chemistry, physics, modern languages, and drawing. The course of study extends through three and a half years for mechanics, and three years for all others. The grounds of the institute cover nearly 11 acres in an elevated and attractive locality. Two buildings have been erected—Boynton Hall and the Washburn machine-shop. Boynton Hall, named in honor of the founder of the institute, is a three-story granite building, 146 feet long by 61 feet wide, built by citizens of Worcester at an expense of about $67,000, and devoted to recitations, lectures, and the general exercises of the institution. The Washburn machine-shop is a three-story brick building, 100 feet long by 40 feet wide, with a wing 65 by 40 feet for engine, boilers, and blacksmith-shop. The first floor is fully equipped for the manufacture of machinists' tools, the second floor for wood-work, and the third for general purposes. It is part of the gift of Hon. Ichabod Washburn. The institute confers the degree of bachelor of science in course upon all full graduates, and promises recognition of professional success in an honorary degree. There are 12 instructors, and the pupils number 105. C. O. Thompson.

**Word** [Ang.-Sax. *vor-d*, the *v* as Eng. *w*, as in Lat. *ver-b-um*; akin to Gr. *εἰρ-ω*, "I say, speak, tell"], the smallest portion of human language forming a grammatic part of speech; a vocable. Words may be as short as *a, O, go, 'm, hm,* or as long as *incomprehensibility;* they may be chiefly monosyllabic, as in Chinese, or extremely polysyllabic, as in Aztec, where it requires a combination of fourteen syllables to say "Curse not each other;" or in Chippeway, of which the Rev. Th. Hurlburt (in a letter) gives the analysis of an example in sixteen significant syllables meaning in their aggregate, "We will not desire to be able to come and cause the poor ones to see pleasantly." Some nations have many words composed of vowels and semi-vowels, as the Hawaiian *ai*, "food;" *ao*, "light;" *ia*, "fish;" *heiau*, "temple;" *wawae*, "legs;" *Beritani*, "Britain." Other languages have words composed chiefly or entirely of consonants, as English in *huskt, speakst, raspt, strike, screw;* and Bohemian in *mlz*, "a dainty;" *mnich*, "monk;" *mrsk*, "whip;" *mrzce* (*c* as *ts*), "ugly;" *jdauci* (*j* Ger. and Lat., Eng. *y*), "to go;" *jméno*, "name;" *jsem*, "am;" *smrt*, "death." These examples are illustrative of the fact that nations proceed differently in the construction of language.

English "go" is a simple word and a primitive; "going," "go-ne," "ga-ng," are derivatives. Compound words are derivatives composed of two or more integral or entire words, as "undercurrent," where both "under" and "current" are derivatives, but not simple words. In most compounds the earlier portion defines the later, which determines the part of speech, as in "wildgoose," "waylay." In forming derivatives, the parts should be taken from the same family of speech, but in a heterogeneous language like English, hybridism cannot be altogether avoided. "Chandelier" is properly formed on a basis in the Romish languages, but as "gas" (gaz) is based upon the Teutonic *ghost*, "gaselier" is a hybrid, and the affix "el" is without function. So "*joy*-ous" on a Romish basis is correct, while "*joy*-ful" is a hybrid. "Centennium" (formed like "millennium") is correct, but a proposed form "centenniad" (like "myriad") assigns a Greek suffix to a Latin base.

Words are chiefly used for the conveyance and interchange of ideas, and on this account many exclamations cannot be admitted as parts of speech, such as cries of pleasure, pain, fright, surprise, or annoyance, often made unintentionally and independently of a listener, whilst such as are intended to attract attention are true words. Exclamations and imitations are to a great extent the basis of words; and although this view has been strongly opposed, it seems to be founded on fact. (See Haldeman, *Relations between Chinese and Ind.-Eur. Langs.*, Amer. Assoc., Albany, 1856.) For the manner in which English (also Greek and Latin) words are constructed by means of additions to a root or stem consult Haldeman, *Affixes . . . exhibiting the Etymologic Structure of English Words* (Philadelphia, 1865, 1871). There (p. 247) the word "consti-tu-t-ion-al" is thus analyzed: *-al*, "pertaining to;" *ion*, "that which;" *-t-*, "has been;" *-tu-*, "caused to;" *sti-*, "stand;" *con-*, "together;" or, "consistent with that which has been mutually established."

S. S. Haldeman.

**Worde, de** (Wynkin), b. in Lorraine about 1455; was an assistant to Caxton in his first English press at Westminster, and after his master's death (1491) succeeded to the business; made many improvements in the art; introduced Roman letters and many fonts of different sizes, which he sold to other printers; was the first to adopt title-pages and to employ Greek characters; enjoyed the patronage of the queen-dowager Margaret, and was an intimate friend of Richard Pynson. D. in 1534. He had printed 408 works, many of them being grammatical and other schoolbooks, and all remarkable for neatness and elegance. The best specimens of his press are Higden's *Polycronicon* (1495) and Stephen Hawes's *Pastime of Pleasure* (1517).

**Wor'den** (John Lorimer), U. S. N., b. Mar. 12, 1818, in New York; entered the navy as midshipman Jan. 10, 1834; became lieutenant in 1846, commander in 1862, commodore in 1868, rear-admiral in 1872; commanded the Monitor in her famous fight with the Merrimack, Mar. 9, 1862, and the Montauk in the attacks on Fort McAllister of Jan. 27 and Feb. 1, 1863, and the first Fort Sumter fight Apr. 7, 1863. By his heroic conduct in the engagement with the Merrimack, Worden gained a world-wide reputation. Toward the close of that action a shell, exploding against the pilot-house of the Monitor, fractured one of the great iron logs of which it was composed, and filled his eyes with powder, so that for a long time he was blind. While lying in this condition after the battle an intimate friend, Lieut. Thomas A. Wise, U. S. N., visited him from shore, and, warmly grasping his hand, exclaimed, "Worden, you have whipped the Merrimack and saved the Minnesota." "Then," replied Worden quietly, "I am content." A few

days after this Mr. Lincoln called to see Worden at Wise's house in Washington, where he lay in bed with his eyes closely bandaged. "Mr. President," said the sufferer as Mr. Lincoln took his seat beside him, "you do me great honor." "No, sir, no, sir," answered the kind-hearted President hastily, and averting his face to conceal his emotion from Mrs. Worden, who was present at the interview; "it is you who do me honor and confer honor on the country." FOXHALL A. PARKER.

**Words'worth** (CHARLES), D. C. L., son of Dr. Christopher (1774–1846), b. at Bocking, Essex, England, in 1806; educated at Harrow School; graduated at Christ Church, Oxford, 1830, gaining a studentship and two chancellor's medals, and being distinguished for athletic exercises; took orders in the Church of England; was a tutor at Cambridge 1830–33, having among his pupils W. E. Gladstone, Cardinal Manning, and the late duke of Newcastle; was second master of Winchester College 1835–46, and first warden of Trinity College, Glenalmond, Perthshire, Scotland, 1846–54; contributed largely to the establishment of that institution on a firm basis, and built the college chapel (costing £8800) at his own expense; became bishop of the united dioceses of St. Andrew's, Dunkeld, and Dunblane 1853; has distinguished himself by his efforts to procure "a united Church for the United Kingdom," and by his vindications of the Anglican doctrines, and is one of the "New Testament Company for the revision of the authorized version of the Bible." Author of numerous theological and critical treatises, and of a Greek grammar in extensive use, *Græcæ Grammaticæ Rudimenta* (1839).

**Wordsworth** (CHRISTOPHER), D. D., youngest brother of William, b. at Cockermouth, Cumberland, England, June 4, 1774; studied with his brother at Hawkshead School, Lancashire; graduated at Trinity College, Cambridge, 1796; was elected a fellow there 1798; took orders in the Church of England; became chaplain to the bishop of Norwich, subsequently archbishop of Canterbury, 1802; rector of Ashby, Norfolk, 1804, dean of Bocking, Essex, 1808, rector of St. Mary's, Lambeth, of Sundridge, Kent, 1816, and of Buxted, Sussex, 1820; was master of Trinity College, Cambridge, 1820–41, and was instrumental in adding the new quadrangle or "court" to that famous seat of learning. D. at Buxted Feb. 2, 1846. Author of *Ecclesiastical Biography* (6 vols., 1810; 4th ed., 4 vols., 1853), *Sermons on Various Subjects* (1814), *Who Wrote Eikon Basilikè?* (1824), maintaining the authenticity of that work; *King Charles II. the Author of Eikon Basilikè further Proved* (1828), and *Christian Institutes, selected from the Writings of the Most Eminent Divines of the English Church* (4 vols., 1836).

**Wordsworth** (CHRISTOPHER), D. D., son of the preceding and nephew of the poet, b. at Ashby, Norfolk, England, in 1807; educated at Winchester School; graduated at Trinity College, Cambridge, 1830, having twice gained the chancellor's medal for English poems, and having also taken the Browne medals (1828) for the best Latin ode and Greek epigram; became a fellow; took orders in the Church of England; travelled in Greece 1832–33; prepared *Athens and Attica, Journal of a Residence there* (1836; 4th ed. 1869), *Inscriptiones Pompeianæ* (1837) and *Greece, Pictorial, Descriptive, and Historical* (1839; 4th ed. 1867); was appointed public orator of the University of Cambridge 1836; married Susanna, niece of John Hookham Frere, 1838; was head-master of Harrow School from Apr., 1836, until Nov., 1844, when he was made canon of Westminster Abbey by Sir Robert Peel; was Hulsean lecturer at Cambridge 1847–48; became vicar of Stamford-in-the-Vale, Berkshire, 1850; was consecrated bishop of Lincoln Feb. 24, 1869, and took a prominent part in the "Old Catholic" Congress held at Cologne Sept., 1872. Author, among other works, of several volumes of *Sermons* and *Charges*, of *Theophilus Anglicanus, or Instructions concerning the Church and the Anglican Branch of it, etc.* (1843; 9th ed. 1865), *Discourses on Public Education* (1844), *A Diary in France* (1845), *On the Canon of the Scriptures of the Old and New Testaments and of the Apocrypha* (1848; 6th ed. 1867), and *Lectures on the Apocalypse* (1849; 3d ed. 1852), being the Hulsean lectures for 1847 and 1848 respectively, *Memoirs of William Wordsworth* (2 vols., 1851), *St. Hippolytus and the Church of Rome* (1853), a volume of hymns, *The Holy Year* (1862; 5th ed. 1868), and *A Journal of a Tour in Italy* (2 vols., 1863); edited *The Correspondence of Richard Bentley* (2 vols., 1842), the works of *Theocritus* (1844), the Greek text of the *Apocalypse* (1849) and the *New Testament* (4 parts, 1856–60), and *The Holy Bible, with Notes and Introductions* (5 vols., 1864–70), and was a prominent contributor to Dr. Smith's *Dictionary of the Bible.*

**Wordsworth** (WILLIAM), b. at Cockermouth, Cumberland, England, Apr. 7, 1770, second son of John Wordsworth, attorney-at-law, and Anne Cookson, a mercer's daughter. A headstrong boy, with a moody, daring, and violent temper, but imaginative and meditative as a child, and early much given to books—which he took up pretty much as he liked, with little direction save his own tastes and an early requirement of his father that he should commit passages of the best English poets to memory—his first verses, written in his fifteenth year as a task imposed by one of his teachers, were not in themselves remarkable, being, as he says, "but a tame imitation of Pope's versification;" yet they first put it into his head to write poetry independently. In his eighteenth year (Oct., 1787) he entered St. John's College, Cambridge, at which he was graduated in Jan., 1791. His university life was not happy. He was self-willed, impatient of restraint, with much self-conceit and much contempt of others who differed from himself, with little taste for scholastic habits, and thus finding little sympathy between himself and the intellectual life of the university. This he afterward regretted. After leaving the university he spent over a year in France, catching the spirit of the French revolution, and embracing it enthusiastically and with a full share of self-willed impracticability. The political judgments which he thus formed were subsequently greatly modified and largely abandoned. At the close of 1792 he returned to England, with no pecuniary means, with no plans for life, urged by his friends to take orders as a clergyman, but unable to find any inner impulse that way, with his mind ill at ease, disturbed by his own opinions, by the state of society in France and England, by the uncertainty which hung over all his prospects, and by the coldness of his relatives, who were displeased and disappointed that he had done so little at the university, and that he seemed to them so little disposed to do anything now. In 1793 he published, "with great reluctance," as he himself says, two little poems, *The Evening Walk* and *Descriptive Sketches*, in order to show that he "*could* do something." He also revolved a plan for starting a monthly miscellany, to which he proposed "to communicate critical remarks on poetry, the arts of painting, gardening, etc., besides essays on morals and politics;" but the plan came to nothing. Next, he hoped he might find a maintenance by writing for a London newspaper, but before any arrangement of this sort was consummated he received in 1795 a legacy of £900 from a friend, which at once decided his course. He resolved to devote himself to poetry, and with his sister Dorothy, to whom he was ardently attached, and whose influence beguiled him of much of his waywardness, he settled down in a small and secluded house at Racedown, Dorsetshire, where the slender income which the annuity furnished, joined with his simple habits and frugal tastes, left him free to his meditations. In 1797, Coleridge paid him a visit, and the two were so charmed with each other that Wordsworth and his sister left Racedown for the neighborhood of Coleridge, and the three soon after went to Germany together, providing themselves with funds for the journey by publishing a thin volume of *Lyrical Ballads*, of which Coleridge's *Ancient Mariner* was the first, and all the rest by Wordsworth. Returning to England in 1798, Wordsworth and his sister found their home in the beautiful Westmoreland and Cumberland Lake country, to which Coleridge and Southey also resorted, and from which he and they received the name of "Lake poets"—a name at first of derision, but which has won for itself an abiding-place of dignity in the history of English literature. These three poets, differing in almost every other particular, agreed in their antagonism to the stiff and formal style of the poetry then in vogue—an antagonism, however, which each represented in a way peculiar to himself. In Wordsworth's case this antagonism was rooted in the same soil as his political sentiments. Imbibing, as he did so largely, the spirit of the French revolution, enthusiastic in behalf of the rights of the people, and earnestly opposed not only to hereditary kings and nobles, but to all social distinctions and privileges which the will of the people had not decreed, it was very easy for him to feel also that poetry should take its direction from the popular heart, and that the true poet should seek to represent exactly the sentiments which the common people feel, and in exactly the language which the common people employ. Into this theory he threw himself with all the ardor of his impetuous nature, with much self-will and no little self-conceit, illustrating it by poems in which the homeliest incidents were clad in the homeliest garb, and defending it by arguments in which he seeks to show that the nature exercised in common life needs only to be revealed to convey to any mind the sentiment of the supernatural. In a narrow circle his poems were at once welcomed with enthusiastic admiration, but with the general public they got little favor. The *Edinburgh Review* ridiculed them unmercifully, and their sale was for a long time small. But he kept on writing; his views of life grew larger; he became mellower and less

self-willed; and while the tender and thoughtful in common life still appealed to him as the fit theme for poetry, he relaxed somewhat from his extreme views of poetic construction, while his thoughts also took on a wider range; nature with its manifold mystery, and the human life wherever found—with its "first affections," its "shadowy recollections," its "obstinate questionings of sense and outward things"—gave him increasing inspiration; the circle of his readers and admirers grew; criticism ceased to jeer; and though he never possessed any sense of humor, and never could make merriment, he was recognized before he died, foremost in his generation, as the poet both of nature and of human life. This judgment of his contemporaries meets but little dispute since.

He was married in 1802, made poet-laureate on the death of Southey in 1843, and d. Apr. 23, 1850, the anniversary of Shakspeare's birth and death. J. H. SEELYE.

**Work.** In abstract mechanics this term generally designates the quantity which results from multiplying the intensity of a force by the distance passed over by its point of application; for instance, the force which is called *weight*, being the total action of gravity upon a body, is a force which passes through the centre of gravity of the body, and is measured by a certain number of units of weight (pounds in English measures); and when a weight falls through a given distance expressed in units of length (feet in English measures), the product W*h* is called the work of the falling body, W representing the total weight and *h* the height of fall. So also the pressure (P) of steam against a piston may be represented by a single force acting through the centre of pressures, and the length of stroke the distance passed over by this centre, and $P \times s$ will represent the work of the pressure of the steam during one stroke, this pressure being supposed constant. As action and reaction are always at each instant equal and directly opposed, the work of the resistance offered to the falling of the weight W in the first instance, and to the motion of the piston in the second, will also be equal respectively to W.*h* and P.*s*.

In machines the action of the resistance at the working-point is usually denominated the work of the machine. Thus, if the action of a machine be to raise a body from one level to another, the work of the machine will be the product W*h*. The work of a tool, such as a planing-machine, is the product of the resistance offered by the material to the cutter, multiplied by the distance passed over by the latter. In machines for accomplishing a particular kind of work there is always one part or piece which receives directly the action of the power, which is connected by other pieces with the part which performs the specific *work*. The action of the power must necessarily be sufficient not only to drive the working-point against the *useful* resistance to be overcome, but also to overcome the resistances in the machine itself, such as inertia, friction, and weight. In many machines the useless work of inertia and weight of moving parts may be avoided, but the work of friction always exists to absorb a part of the action of the power; and hence the efficiency of a machine can never be perfect; in other words, the work of the power must always be greater than the work of the useful resistance to be overcome.

The *rate of work* of a machine is the quantity of work which it performs in a given time, and is usually expressed in units of work per hour or per second; and the total work, if the rate be uniform, will be the rate multiplied by the time, the latter being measured in units of time corresponding to the unit employed for the rate of work. Thus, the *horse-power* (in English measures), a rate of work equivalent to 33,000 foot-pounds per hour, or 550 foot-pounds per second, multiplied by the time in hours or seconds, as the case may be, will give the total number of foot-pounds of work in the given time. Since velocity involves the element of time as well as of distance, the rate of work may also be expressed in terms of velocity. For instance, suppose a horse to exert a force of 200 pounds in drawing a plough at the rate of 2 feet a second, the number of foot-pounds per second of work performed will be 400, or 24,000 foot-pounds per hour. Representing the force of the draught, or the resistance overcome, by R, and the velocity or space traversed in one second by V, the rate of work per second will be R.V, and the total work in the time T by R.V.T.

W. P. TROWBRIDGE.

**Workhouse.** See PAUPERISM, by REV. C. L. BRACE.

**Work'ington,** town of England, county of Cumberland, on the Derwent, near its mouth, has a good harbor lined with convenient quays, furnished with a breakwater, and provided with docks. Breweries, distilleries, and factories for the manufacture of sailcloth, cordage, and chemicals are in operation, and large quantities of coal from the rich collieries of the vicinity are exported. P. 7159.

**Work'sop,** town of England, county of Nottingham, on the Ryton, is celebrated for its malt. P. 7215.

**Wor'man** (JAMES H.), b. at Berlin, Prussia, about 1835; educated at the university of that city; came to the U. S. 1860; became professor of modern languages in Knox College, Galesburg, Ill.; has been since 1867 librarian and instructor in Drew Theological Seminary, Madison, N. J., and on the death of Dr. John McClintock became one of the editors-in-chief of McClintock and Strong's *Cyclopædia of Biblical Literature*. Author of several textbooks for the modern languages, especially the German, including a *History of German Literature* and a *Complete German Dictionary*.

**Worms.** See APPENDIX.

**Worms,** town of Hesse-Darmstadt, on the Rhine, is one of the oldest cities of Germany. It existed before the time of the Romans, was the residence of Charlemagne, and the seat of the famous diet before which Luther was summoned in 1521, and which he would meet "even though there were as many devils in the city as tiles on its roofs." In 1689 it was taken and sacked by the French, and only the cathedral, a fine structure, built 996–1016 of red sandstone in Byzantine style, and a few houses, escaped destruction. It was soon rebuilt, but it never recovered its former prosperity. It manufactures leather, tobacco, and soap, and in its vicinity is produced the celebrated Rhenish wine called *Liebfraumilch*. P. 14,484.

**Worm'seed,** the name given in this country to the fruit of *Chenopodium anthelminticum*, a wild herbaceous plant, native in the U. S., and most commonly met with in the Southern States. The plant possesses a peculiar aromatic but disagreeable smell. Wormseed is found in commerce in the form of very minute grains, which have the characteristic odor of the plant. When distilled, they yield a volatile oil (*oleum chenopodii*). In Europe the term "wormseed" (*Semen cinæ, Semen santonici, Semen-contra*) is given to the small unexpanded flowers of *Artemisia vahliana, A. sieberi*, and *A. inculta*. The first (Levant wormseed) is indigenous in Persia and Asia Minor; the second (African or Barbary wormseed) is found in Persia, Barbary, and Arabia; the third is said to furnish the East Indian wormseed, but, according to some authorities, the latter is simply the *A. sieberi* mixed with turmeric. These varieties contain a volatile oil, an active principle (santonine or santonic acid ($C_{15}H_{18}O_3$); see SANTONINE), resin, with extractive matters, and other ordinary constituents of plants. The oil (*oleum cinæ, essence de Semen-contra*—which appears to be identical with *oleum chenopodii*) is prepared by distilling the wormseed with water, and forms a yellow or brownish-yellow liquid, possessing the peculiar disagreeable odor and aromatic burning taste of the plant; it has a sp. gr. ranging from 0.925 to 0.935, and boils at 340° to 350° F. The purified oil contains an oxygenated compound, $C_{10}H_{18}O$ (cinæbene-camphor), and a hydrocarbon, $C_{10}H_{16}$ (*cynene* or *cinæbene*), which is isomeric with, and resembles in some of its properties, oil of turpentine. (See TURPENTINE.) The oil is somewhat soluble in water, much more so in alcohol and in ether; on exposure to the air it gradually thickens and assumes a deeper color; when treated with *dilute* nitric acid, it yields either oxalic or toluic acid. Wormseed is employed in medicine as a vermifuge, but lately santonine has been generally used in its place. In the U. S. the seeds and oil of *Chenopodium anthelminticum* are most generally employed as an anthelmintic remedy. J. P. BATTERSHALL.

**Worm'wood** [Ang.-Sax. *wermod;* Ger. *Wermuth;* Fr. *absinthe*], the leaves and flower-tops of *Artemisia absinthium*, a perennial plant indigenous in Europe, but naturalized in the U. S. It possesses a strong, peculiar odor and a very bitter, unpleasant taste, which are imparted to its aqueous and alcoholic infusions. The dried plant furnishes by distillation a dark-greenish oil (*oleum absinthii*, $C_{10}H_{16}O$), which is isomeric with ordinary camphor, has a specific gravity of 0.932, and possesses the odor and taste of the plant. The bitter principle of wormwood (*absinthine* or *absynthiine*) is obtained by agitating the concentrated alcoholic extract of the leaves with ether, evaporating the solution so obtained to dryness, and purifying the residue by digesting it with dilute hydrochloric acid, dissolving in alcohol, precipitating by plumbic acetate, decomposing the precipitate with sulphuretted hydrogen, and evaporating the solution; or by agitating the concentrated aqueous infusion with animal charcoal, extracting the absinthine therefrom by treatment with alcohol, and then partially purifying it as directed above, afterward by precipitation with tannic acid and crystallization from alcohol. Absinthine forms a yellow, pulverulent mass, is neutral to test-papers, and has the odor and taste of wormwood; it is slightly soluble in water, but readily dissolves in alcohol and ether; fuses at about 218° F., and dissolves in concentrated sulphuric acid to a greenish-blue liquid which assumes a beautiful blue color on addition of

a little water; it is considered an aldehyde, with the composition $2C_{20}H_{28}O_4,H_2O$. The remaining constituents of wormwood are chlorophyl, albumen, fibrine, lignine, starch, and saline matters. It is occasionally employed externally in medicine as an antiseptic and discutient, and was formerly used also as a tonic. The volatile oil of wormwood, upon which its active qualities depend, possesses narcotic properties, and if given in large dose produces epileptiform convulsions, and even death; when mixed with oil of anise, fennel, etc., and dissolved in alcohol, it forms the well-known *liqueur* ABSINTHE (which see).

J. P. BATTERSHALL.

**Wor'num** (RALPH NICHOLSON), b. at Thornton, Northumberland, England, Dec. 29, 1812; educated at University College, London; made a preliminary study of art at London; visited the continental art-galleries 1834–39; became a portrait-painter in London; wrote largely on art for the *Penny Cyclopædia*, the *Biographical Dictionary* of the Society for the Diffusion of Useful Knowledge, the *Art Journal*, and Dr. Smith's *Dictionary of Greek and Roman Antiquities* (1841); was appointed to prepare the official catalogue of the National Gallery 1845; became lecturer on art to the government schools of design 1848; librarian to those schools 1852, and keeper and secretary of the National Gallery 1855. Author of *A Sketch of the History of Painting* (1846; 4th ed. 1861), *Analysis of Ornament* (1856), *The Epochs of Painting*, a *Biographical and Critical Essay on Painting and Painters of All Times* (1864), and a *Life of Holbein* (1867); edited Walpole's *Anecdotes of Painting* (1839; new ed. 1862), the *Lectures on Painting* by the Royal academicians Barry, Fuseli, and Opie (1848), and has published many essays, reports, and catalogues.

**Wor'saae** (JENS JACOB ASMUSSEN), b. at Veile, Jutland, Denmark, Mar. 14, 1821; studied Scandinavian history and archæology; travelled much in Great Britain and Ireland, France, Germany, and Italy, and was appointed professor of Northern archæology at the University of Copenhagen in 1854, director of the Museum of National Antiquities in 1861, and minister of public education in 1875. His principal works are—*Danmarks Oldtid* (1843; translated into English by Thoms as *The Primeval Antiquities of Denmark*, 1849), *Minder om de Danske og Nordmændene i England, Skotland og Irland* (1852; translated into English as *Account of the Danes in England, Ireland, and Scotland*, 1852), *Den Danske Erobring af England and Normandiet* (1863), *Danevirke* (1848), *Om Danmarks tidligste Bebyggelse* (1861), etc.

**Wor'ship** [Ang.-Sax. *weorth-scype*, to "deem worthy," "respect," "honor," "revere," "adore," "offer honor," etc.; to perform offices of honor, etc., social, civil, or religious, to God, men, angels, or other objects, used commonly only of religious worship]. Religion is the highest business of life; worship is the chief act of religion, and its natural expression. It is universal among men and angels. It belongs to the whole life, though specially manifested in exercises revealed or invented. Worship is *internal*, consisting of the inward homage which we owe to God, as in love and trust; and *external*, the outward expression of homage by the observance of God's ordinances. It is required by God, prompted by gratitude and hope, by the apprehension of God's infinite excellence and grace, and by our confidence in him as our chief good and only happiness. True worship is spiritual, and must be offered sincerely and with the whole soul, to God alone, through Christ as the only Mediator. It is inspired by the Holy Spirit, who reveals the will of God, helps our infirmities, teaches how and for what to pray, enlightens the understanding, and gives insight into divine truth. (See HOLY GHOST.) Worship involves faith, love, loyalty, dependence, desire for God, thankfulness, admiration, delight, reverence, humility, holiness, cheerfulness, purity, and entire devotion; and by its reflex influence assimilates the worshipper to the object of his worship. It is performed in various ways, from fetichism, the lowest form of human worship (see FETICH), to the highest adoration "in spirit and in truth" of Him who is the Supreme Spirit.

The *objects* of worship are the true God in the three persons of the Trinity (see GOD), angels, spirits of ancestors, saints, powers and objects of nature, relics, pictures, idols, etc. The Schoolmen emphasized the distinction between *latria* (service), rendered only to God, and *idolatria*, rendered to images. (See IDOLATRY.) Later distinctions (in theory rather than in practice) have been added—viz. *dulia*, to saints and angels—*hyperdulia*, to the Virgin Mary.

In the Old Testament worship, sacrifice appears as the central observance. Christian worship rests on the acknowledgment of a sacrifice offered "once for all." (See SACRIFICES.) Every pagan worship centres in sacrifices. (See PAGANISM.) They are offered to propitiate the divine favor and under a sense of guilt, or in thanksgiving, or to secure mercy and favor, or sometimes to serve as food or drink for the gods. Human sacrifices are offered under the notion that the most precious gift will buy the largest favor. As fire is deemed purifying, mysterious, and sacred, the highest sacrifice is by burning. In the Old Testament, sacrifice appears at first as an expression of faith in a present God, as an act of propitiation and thanksgiving, and a pledge of a covenant. Blood is the life; therefore the best sacrifices are bloody. The offerings were of "clean" domestic animals, grain, fruits, wine, oil, etc., offered on altars of stone and earth or metal, in sacred places, under trees, groves, on "high-places;" later in the tabernacle and the temple. Sacred times were sabbaths, new moons, the feasts of the Passover, Pentecost, Atonement, Tabernacles, Trumpets, Jubilee, Dedication, Purim. (See FEAST.) In the completed temple-service to sacrifice were added prayer, praise, instrumental and vocal music, instruction, purification; also circumcision, vows, tithes, etc. The synagogue-service, in which prayer took the place of the sacrifices of the temple, consisted of (1) prayer, with written forms; (2) reading of Scripture in three parts—(*a*) Shema (three extracts from Numbers and Deuteronomy); (*b*) the Law; (*c*) Prophets; (3) expounding the Scriptures. Services were held Saturday, Monday, and Thursday, morning, noon, and evening, and were conducted by the "elders," ministers or "angels," and deacons. (See SYNAGOGUE.)

The early Christians organized their services on the synagogue model, the essential elements of which were sanctioned and spiritualized by Christ, and to which he added preaching and the Lord's Supper. They met in private houses, or solitary places, or temple-courts at any convenient and safe time. No stress was laid at first on a particular order. They read from the Old Testament, and later from the Gospels and Epistles, explaining the passage in free discourse, in which at first all could join. Individual gifts were used under the promptings of the Spirit, according to mutual regard and utility. Singing and prayer followed. Then the love-feast (see AGAPÆ) and the covenant supper were solemnized, the kiss of charity given, and the voluntary offerings made. By the end of the second century the service was divided into the *missa catechumenorum*, called "Scripture reading"—in which were psalmody, Scripture lessons, the sermon, and some of the prayers—and the *missa fidelium*, called "prayers." In the latter the prayers, which were all offered at the altar, were for consecration, for the whole Church, for the peace of the world, and all orders of men. There were also the Eucharist, hymns, thanksgivings, and doxologies. (See MASS.) By the third century Christian temples were frequent, and sometimes splendid. They were divided into the porch, nave—where the pulpit stood—and the sacristy. (See CHURCH.) In the fourth century triumphant Christianity built magnificent churches or appropriated public buildings (see BASILICA), and adorned its clergy with peculiar costumes, kindled lights on the altars, used incense, and gave more attention to artistic music and responses. The agape was separated from the Lord's Supper and became a feast. With the union of Church and State the liturgical tendencies were rapidly developed, forms were multiplied, and became wordy and theatrical, and the ministers came to be held as a peculiar class. (See CLERGY.) One of the ideas of Christianity distinguishing it from Judaism and heathenism is that of the priesthood of all believers.

The worship of the Church includes—(1) Prayer, in the vernacular or some sacred though often unfamiliar tongue, written and formal or unstudied, standing or kneeling, rarely prostrate, with uncovered heads, with or without responses. (See PRAYER.) (2) Reading of Scripture in regular order, or not. (3) Preaching, exposition, exhortation, etc., founded or not on the passage read. (4) Singing, in the words of Scripture or human compositions, with or without instrumental accompaniment, by the congregation, or later by choirs. "Hymns are prayers in the festive dress of poetry," rendered with music on account of the strong influence it exerts on the emotions. (See HYMNOLOGY.) (5) Confession of faith. (6) Voluntary offerings; and (7) Sacraments, baptism, the initiatory rite, and the Lord's Supper, the rite of witnessing, and edification. The latter was celebrated every day, or every Lord's Day, or at longer intervals. (See SACRAMENT.) Christian worship has been held on the Lord's Day, or on daily or on yearly festivals or fasts which commemorate special events. (See FEAST.)

*Public* worship is of divine appointment, and can be rightly observed only according to God's prescribed way. It has been honored by God in the temple and by Christ in the synagogue. It is fitted to our social natures, and is of indispensable obligation. It sustains all worship, pri-

vate and social. Its regular recurrence wakens and cultivates the spiritual life, celebrates the communion of believers, gives opportunity for moral and religious instruction, and impresses the truth by social influences and by constant reiteration. It unites men, and makes them unselfish and humble. It should be orderly as to times, places, customs, and the persons who direct it.

The liturgical class emphasize the sacrificial side of worship—others, especially the Reformed churches, the didactic side. A multiplicity of ceremonies is commended, on the ground that they give expression to varied sentiments —that they enliven and increase devotion and piety by moving the senses, and lead the illiterate more easily to a knowledge of the mysteries of religion. It is condemned on the ground that it diverts the attention from the simple principles of worship, and that, as worship is a divine ordinance, nothing is to be allowed except that which is divinely ordained.

Worship implies the ascription of divine perfections to its object, the possession of such perfections giving the only claim for such homage. The Church has from the beginning made God in Christ the central object of its worship, offering to him and the Holy Spirit worship in its highest form, usually addressing the Father in the name of the Son and by the assistance of the Spirit, though also worshipping each Person immediately. The early Church forbade the worship of saints, martyrs, angels, etc., as superstitious and idolatrous, and giving to the creature that which is due to God alone. But in the fourth century the worship of saints had been developed from the veneration of martyrs. The worship of the Virgin Mary has gradually greatly increased from early days. In the Old Testament angels appear as mediators. They were supplicated by the later Jews and the Gnostics, and some of the Christian councils allowed the custom. Idolatry is the ascription of divine attributes to a creature. (See IDOLATRY.) The first commandment forbids the worship of any being except God, as it detracts from the supreme honor and love due to him. The second forbids the making and worshipping of images and every false mode of worship. The use of images and pictures was allowed by the Council of Nice (787), and the adoration of relics by the Council of Trent (1545). The use of images is defended on the ground that they adorn the churches, instruct the ignorant, impress the mystery of the incarnation and examples of saints, and excite pious feelings, and that in or by them God is worshipped. They are opposed on account of their universally and almost inevitably dangerous tendencies—that they displace God and become themselves the object of worship, and are forbidden. ISAAC RILEY.

**Wors'ley** (PHILIP STANHOPE), b. in Kent, England, about 1832; educated at Cholmeley School, Highgate, and at Corpus Christi College, Oxford, where he was elected scholar 1854, and subsequently fellow; took orders in the Church of England; gained the Newdegate prize for his poem, *The Temple of Janus* (1857); contributed poems to *Blackwood;* published a volume of *Poems and Translations* (1863), *The Odyssey of Homer, translated into English Verse in the Gregorian Stanza* (Edinburgh, 2 vols., 1861–62), and *The Iliad of Homer, translated into English Verse in the Spenserian Stanza* (vol. i., 1865), both of which have taken a high place among the versions of Homer. D. at Freshwater Bay, Isle of Wight, May 8, 1866.

**Worsley** (Sir RICHARD), BART., b. in the Isle of Wight, England, 1751; was for many years English diplomatic resident at Venice; gathered there, at a cost of over £25,000, a fine collection of antique bassi-rilievi, busts, statues, and gems, of which he printed an elaborate description in English and Italian under the title *Museum Worsleyanum* (2 vols. folio, 1794–1803; new ed., 12 parts, 1824); became a member of Parliament for Newport, comptroller of the royal household, and governor of the Isle of Wight, where he d. Aug. 8, 1805. He edited, with additions, a *History of the Isle of Wight* (1781) from the MS. of his grandfather, Sir James, and his father, Sir Thomas Worsley.

**Worsted.** See WOOL, MANUFACTURE OF.

**Wort** [Ang.-Sax. *wyrt;* Ger. *Meisch;* Fr. *moût*], the sweet infusion of malt obtained in the preparation of beer. (See BEER.)

**Wörth,** village of Alsace, with about 1200 inhabitants, at the junction of the Sulzbach and the Sauerbach, is noted as the point where the first decisive encounter took place between the French and German armies, Aug. 6, 1870. The principal point in the French position was Froschweiler. (See FRANCO-GERMAN WAR.)

**Worth,** county of S. W. Georgia, drained by Flint and Little rivers, and traversed by Brunswick and Albany R. R.; surface level, soil sandy. Cattle, sheep, and swine are the chief live-stock. Staples, cotton, Indian corn, and sweet potatoes. Cap. Isabella. Area, about 900 sq. m. P. 3778.

**Worth,** county of N. Iowa, bordering on Minnesota, and drained by Shell Rock River; surface undulating prairie, with much woodland. Cattle are the chief live-stock. Staples, wheat, oats, Indian corn, and hay. Cap. Northwood. Area, 432 sq. m. P. 2892.

**Worth,** county of N. W. Missouri, bordering on Iowa, and drained by Grand River; surface undulating, with much timber-land. Horses, cattle, sheep, and swine are numerous. Staples, corn, oats, wheat, hay, wool, and dairy products. Cap. Grant City. Area, 225 sq. m. P. 5004.

**Worth,** tp., Cook co., Ill. P. 1747.

**Worth,** tp., Woodford co., Ill. P. 1000.

**Worth,** tp., Boone co., Ind. P. 1343.

**Worth,** tp., Boone co., Ia. P. 975.

**Worth,** tp., Sanilac co., Mich. P. 1434.

**Worth,** tp., Jefferson co., N. Y. P. 727.

**Worth,** tp., Butler co., Pa. P. 893.

**Worth,** tp., Centre co., Pa. P. 650.

**Worth,** p.-v. and tp., Mercer co., Pa. P. 1084.

**Worth** (WILLIAM JENKINS), b. at Hudson, N. Y., Mar. 1, 1794. On the outbreak of war with Great Britain in 1812 he entered the army as a private soldier, but was appointed Mar. 19, 1813, a first lieutenant of the 23d Infantry, and during the campaign of that year served on the staff of Maj.-Gen. Lewis. In the campaign of 1814 he was on the staff of Gen. Scott, and engaged in the battles of Chippewa and Niagara, gaining the brevet of captain for the former and of major for the latter battle, where he was severely wounded. His promotion to captain in the 23d followed Aug. 19, and at the close of the war he was retained in the 2d Infantry, but transferred to the 1st Artillery on the reorganization of the army in 1821. From 1820 to 1828 he was commandant of cadets and instructor of infantry tactics at West Point; was director of the artillery school of practice at Fort Monroe 1829–30, and in garrison there until May, 1832, when transferred to the ordnance corps with the rank of major, having been brevetted lieutenant-colonel in 1824. Appointed colonel of the 8th Infantry July, 1838, he commanded the northern department during the insurrectionary movement on the Canada border 1838–39. In 1840 he was ordered to Florida, and in 1841 placed in command of the army there. During this and the next year the hostile Seminoles were subdued, and the greater part of them removed to the Indian Territory. For gallantry and highly-distinguished services in Florida he was brevetted brigadier-general Mar. 1, 1842, and retained in command of the department of Florida until 1846, when again called to the field by the outbreak of the war with Mexico. The battle of Monterey was his first opportunity for distinction, where his command stormed the heights commanding the Bishop's Palace, and carried the palace itself. He was now brevetted major-general and placed in command at Monterey, but soon after detached with his command from Gen. Taylor's army to support the movement under Gen. Scott by way of Vera Cruz, his brigade of regulars making the descent upon that city Mar. 9, 1847. He was one of the commissioners to negotiate the terms of capitulation, and in command of the city after the surrender. In the subsequent operations during the march to Mexico he commanded the first division, which was engaged in the battle of CERRO GORDO, Apr. 17–18 (which see), and which occupied the castle and town of Perote Apr. 19. Upon the resumption of active operations in August, Worth was directed, Aug. 20, to attack San Antonio, which was soon in his possession, and returning he was engaged in carrying the works of Churubusco the same day. (See CHURUBUSCO.) Reinforced by Cadwallader's brigade and Sumner's cavalry, his command fought the battle of Molino del Rey, Sept. 8, was engaged in the storming of CHAPULTEPEC (which see), and of the San Cosme Gate, and the occupation of the City of Mexico, Sept. 13–14, 1847. For his distinguished services at Monterey, Congress presented him with a sword of honor, and similar testimonials were bestowed upon him by his native State and county, and by the State of Louisiana. In Nov., 1848, he was placed in command of the department of New Mexico and Texas. D. at San Antonio, Tex., May 7, 1849. A handsome memorial monument was erected by the city of New York at the junction of Broadway and Fifth Avenue, beneath which rest his remains.

**Worth'ing,** town of England, county of Sussex, on the English Channel, is in a flat district, but has a beautiful promenade along the shore, and is much resorted to as a bathing-place. P. about 8000.

**Worth'ington,** p.-v., cap. of Barnes co., Dak.

**Worthington,** p.-v., Greene co., Ind., on Indianapolis and Vincennes and Terre Haute and Worthington R. Rs., 71 miles S. W. of Indianapolis, has an excellent graded school, 2 newspapers, 1 stock bank, 3 flouring, 1 woollen, and 2 planing mills. Large quantities of corn and wheat are grown here. P. 2028. F. N. Miller, Ed. "Times."

**Worthington,** p.-v. and tp., Hampshire co., Mass. P. 860.

**Worthington,** p.-v., cap. of Nobles co., Minn., on Sioux City and St. Paul R. R., 177 miles S. W. of the latter city, has 3 churches, 1 seminary and good public schools, 1 bank, 1 newspaper, a large public hall, 3 hotels, 1 flouring-mill, a public library, and Masonic and other societies. P. about 800. A. P. Miller, Ed. "Advance."

**Worthington,** p.-v., Franklin co., O.

**Worthington,** tp., Richland co., O. P. 1876.

**Worthington,** p.-b., Armstrong co., Pa. P. 216.

**Worthington,** p.-v., Lincoln tp., Marion co., West Va. P. 127.

**Worthington** (John), D. D., b. at Manchester, England, in 1618; educated at Emmanuel College, Cambridge, where he became a fellow; took orders in the Church of England; was master of Jesus College, Cambridge, from 1650 until after the Restoration, when he became curate of St. Benet Fink, London, and after that church was destroyed by the Great Fire was rector of Ingoldsby, Lincolnshire; became prebendary of Lincoln 1668, and lecturer at Hackney in Nov., 1670. D. at Hackney in 1671. He edited, with additions from the MSS., the *Works* of Joseph Mede (2 vols. folio, 1664) and the famous *Select Discourses* of John Smith of Cambridge (1660), and left many MSS., from which were posthumously published, at considerable intervals, *Miscellanies* (1704) and *Select Discourses* (1725). His *Diary and Correspondence* were edited by James Crossley for the Chetham Society (2 vols., 1847–55). His letters to Hartlib and others contain valuable biographical data concerning many literary and ecclesiastical celebrities of the great rebellion and the Restoration.

**Worthington** (Thomas), D. D., b. at Blainscough, Lancashire, England, about 1552; studied in the English colleges at Douay and Rheims; became a priest; labored as a missionary in England some years; was imprisoned in the Tower 1584; was banished 1585; corrected the Douay version of the Bible; was president of Douay College 1599–1613, and spent his latter years in England, where he joined the Society of Jesus about 1625. D. in Staffordshire in 1626. Author of *Annotations on the Old Testament* (2 vols., 1609), *Catalogus Martyrum Pontificiorum pro Religione in Anglia occisorum 1570–1612* (1612), *An Anker of Christian Doctrine, etc.* (2 vols., 1618–22), and wrote some of the *Notes* appended to the Rheims version of the New Testament (1582).

**Wort'ley,** town of England, county of York, manufactures cloth, clay, pipes, firebricks, and alum. P. 12,028.

**Wor'ton,** p.-v. and tp., Kent co., Md. P. 2454.

**Wot'ton** (Sir Henry), b. at Bocton (or Boughton) Hall, parish of Boughton Malherbe, Kent, Mar. 30, 1568; educated at Winchester School, at New College, and at Queen's College, Oxford, distinguishing himself in the study of optics; spent several years (1589–97) on the Continent, residing a year at Geneva, where he frequented the society of Beza and Casaubon; three years in Germany and five years in Italy, chiefly at Rome, Venice, and Florence, becoming well acquainted with Italian literature, science, and art; was for some time secretary to Robert Devereux, earl of Essex, whom he accompanied to Spain and Ireland, and at whose fall (1600) he took the precaution to revisit Italy, whence he was despatched by Ferdinand I., grand duke of Tuscany, to warn King James of a plot against his life 1602; made his way to Scotland in disguise *viâ* Norway, under the assumed name of "Octavio Baldi;" delivered his message to that monarch at Stirling, gaining his favor; returned to Florence; proceeded to England soon afterward on the accession of James, by whom he was knighted, and sent ambassador to Venice; wrote in an album at Augsburg while on his way to his post the often-quoted witticism, "An ambassador is an honest man sent abroad to lie for the good of his country," which, being maliciously printed by Scioppius some years later, caused him much inconvenience; was intimate at Venice with the celebrated Fra Paolo Sarpi; returned to England 1610; is believed to have sat in Parliament 1614; went on a mission to the Netherlands 1615; was reappointed to the Venetian embassy 1616; was sent to the duke of Savoy 1619, several times to Germany upon business connected with the claims of the elector-palatine, and went a third time to Venice; returned to England with broken fortunes 1623; became provost of Eton College July 26, 1625, and (as a condition of retaining that post) took orders in the Church of England 1637. D. at Eton in Dec., 1639. His *Poems* have been many times reprinted, usually in connection with those of Raleigh, but he is best known by his miscellaneous remains, entitled *Reliquiæ Wottonianæ* (1651), edited by his friend Izaak Walton, who prefixed a *Life*. Other of his works were *The Elements of Architecture* (1624) and *The State of Christendom* (1657).

**Wotton** (William), D. D., b. at Wrentham, Suffolk, England, Aug. 13, 1666, son of Henry, minister of that place, who taught him Latin, Greek, and Hebrew in his earliest childhood, with such results that this has been pronounced "the most remarkable of well-authenticated cases of intellectual precocity;" was able at five years of age to translate chapters and psalms from the Hebrew, Greek, and Latin into English—attainments which were minutely described by his father in a pamphlet published the following year (1672); was admitted to Catherine Hall, Cambridge, in his tenth year, when Dr. John Eachard, master of the college, certified (Apr. 1, 1676) that his classical attainments were equal to those of Hammond or Grotius, "nec Hammondo nec Grotio secundus;" graduated as bachelor of arts at twelve years of age (1679), at which time he was acquainted with twelve languages and was able to repeat an entire sermon after a single hearing; became fellow of St. John's College, Cambridge, 1685; took orders in the Church of England, and was presented with the sinecure living of Llandrillo, Denbighshire, 1691; became chaplain to the earl of Nottingham, who gave him the rectory of Middleton Keynes, Buckinghamshire, 1693; was made prebendary of Salisbury 1705; retired to his Welsh living 1714, and was able soon afterward to preach in Welsh. D. at Buxted, Essex, Feb. 13, 1726. Author of *Reflections upon Ancient and Modern Learning* (1694), *A History of Rome from the Death of Antoninus Pius to the Death of Severus Alexander* (1701), *Traditions and Usages of the Scribes and Pharisees* (2 vols., 1718), translated from the Mishna, and editor of the *Laws of Hoel the Good* (1730), in Welsh and Latin, with a glossary.

**Wounds.** Wounds are classified according to the nature of the injury, as (1) punctured wounds, made with pointed instruments; (2) incised wounds, produced by cutting instruments or sharp edges; (3) lacerated wounds, in which the borders of the wound are irregular, ragged, and torn, and the result of great force, dull instruments, or tearing; (4) poisoned wounds, in which either an animal venom or virus or some impure, poisonous, or irritating matter has gained entrance to the injured tissues and contaminated the blood; (5) gunshot wounds, which as a rule are penetrating and may be lacerated, but are peculiar from other wounds, owing to the character of the missile, the shock they give to the part and to the nervous system, and the grave complications to which they are liable. (6) Contusions and "contused wounds" are also classed with wounds, but the contusion is not properly a wound, since there is no actual solution of continuity of the flesh, unless it be an abrasion of the skin; and a contused wound is simply a punctured, incised, or lacerated wound whose borders and adjacent tissue are severely contused. The tissues at the seat of a contusion are often seriously injured, many minute blood-vessels are ruptured, and the escaped blood, settling in the tissues, causes an "ecchymosis," a black or blue-black mottling of the part. As the blood is decomposed and slowly absorbed, this color changes to blackish-green, greenish-yellow, dark leather-color, and lighter shades till it disappears. In other contusions there is subcutaneous laceration of tissues, or such shock to their vitality that they speedily disintegrate, and the devitalized part sloughs in a mass or becomes the seat of ulcers. Punctured wounds are relatively the most serious class, for they are often poisoned by the entrance, if not of venom or virus, of foreign matter, as rust, dust, splinters, clothing, etc., which cause suppuration at the bottom of the deep puncture, and lead to grave inflammation, erysipelas, and contamination of the blood by retained unhealthy pus. The punctured wound is to be well washed, cleansed of all blood-clots and dirt, and if deep, or in the vicinity of dense fibrous tissue, as in the hand or foot, or near joints, must be freely cut and converted into an incised wound. Incised wounds heal in several ways. They heal most promptly and simply when perfectly-smooth, clean cuts, free from clotted blood, and in the flesh of persons in perfect health. Thus, a clean cut, whose borders do not gape or separate, may, if instantly closed and sealed from the air by plaster or collodion, heal in a few hours, and approximately warrant the designation "immediate union." More often a day or two is required; the wound, being cleansed of clots or foreign matter, is exposed for a moment to the air, and closed either by adhesive plaster or stitches of silk or silver wire. The opposed surfaces are

glazed over by a film of coagulated nutritive fluid, exuded from the blood, and this, filling the interspace, agglutinates the walls of the wound and organizes a firm "scar" or cicatrix of fibrous tissue. This scar, if a mere line, may soon disappear by absorption and the part seem again perfect. Such speedy healing is termed "union by first intention" or "primary union." When a wound has been lacerated, or a considerable area of tissue has been removed, the deficit has to be made up by a slower process of new tissue-growth; new cells develop one by one, in superimposed strata, until the level of the surface is reached, when the skin begins to heal and shoot over the raw area. This is the process of "healing by granulation," far slower than the others, and, if the wound be large, a severe tax upon the strength and health of the patient. In lacerated wounds the more ragged points if left will be destroyed by ulceration or sloughing before the wound can begin to heal, and the delay often converts the wound into a suppurating, weak, and indolent ulcer; therefore, it is better, in cases of ulceration, to remove the irregularities and convert them into incised wounds, either straight or irregular, which can be brought together and heal. When an incised wound has failed of union by "first intention," its walls become granular; they may be approximated, and soon unite, constituting the process of "union by second intention." In the granulation the growth of tissue may become exuberant and rise above the surrounding healing parts on the healthy, intact surface. Such excess of granulation is popularly termed "proud flesh." It must be reduced by use of astringents or compression, or destroyed by caustics, and the site stimulated to a healthier action. Poisoned wounds, as a rule, should be laid freely open by incision, treated by disinfectant lotions, and the general strength of the patient sustained by diet, tonics, and stimulants. Contusions often call for stimulating lotions, as turpentine and oil, to counteract the shock of the part, and hot cloths to maintain the temperature and restore the circulation when cold. The healing of a wound is facilitated by pure air, regular hours for sleep, plain but rich diet, and abstinence from alcohol.

E. Darwin Hudson, Jr. Revised by Willard Parker.

**Wou'vermans** (Philip), b. in Haarlem, Netherlands, 1620. His father was an historical painter of no reputation; his teacher was Jan Wynants, a painter of landscape, but his genius led him to methods of his own, and he became not only the most popular of Dutch landscape painters, but one of the most eminent in the world; he delighted in subjects where horses were prominent, for he rendered them with wonderful spirit and truth. He is said never to have left Holland, but the variety in his landscapes makes that statement hard to believe. He worked carefully, but rapidly. His catalogued pictures are nearly 800 in number; they are seen in all large European galleries. Some of the most famous are familiar through engravings. D. in 1668.—Peter Wouvermans, younger brother of Philip, was also a landscape painter, after the manner of his brother, inferior in excellence; yet so good an imitator of his style that the two have been confounded. O. B. Frothingham.

**Wrack** [Fr. *varec*], or **Sea-Wrack,** names applied to many sea-weeds, especially to the Fucaceæ, useful as manures and as sources of iodine; also to wrack-grass, eel-grass, or grass-wrack, *Zostera marina*, a naiadaceous plant useful as manure, and extensively used for packing glass and pottery.

**Wran'gel** (Karl Gustav), Count, b. Dec. 13, 1613, at Skokloster, the family estate, on Lake Mälar, near Upsala, Sweden; received a military education, and fought in the Thirty Years' war under Gustavus Adolphus, Bernhard of Saxe-Weimar, Bauer, and Torstenson. In 1643, after the death of Admiral Flemming, he received the command of the Swedish fleet which was destined to join the Dutch fleet and carry the Swedish army from the Danish peninsula to the islands, but was defeated off the island of Femern, Oct. 13, and shut up in the Bay of Kiel. In 1646 he was made commander-in-chief of the Swedish force in Germany; joined Turenne, and defeated the Austro-Bavarian forces repeatedly. Under Charles X. he commanded in the campaigns in Poland (1655) and in Denmark (1658), and in 1674 led the army of 16,000 men which suddenly invaded the country of the elector of Brandenburg, who was a member of the coalition against Louis XIV., and stood with his whole force in the Rhine countries. But Wrangel's health failed, the elector hastened back with astonishing rapidity, and the Swedes were defeated at Rathenow and Fehrbelin, and driven out of Brandenburg. D. in the island of Rügen in July, 1676.

**Wran'gell, von** (Ferdinand), Baron, b. in Esthonia about 1795; was educated in the naval academy of St. Petersburg; accompanied Capt. Golownin on his journey around the world 1817–19; commanded an expedition to the Polar Sea Nov. 2, 1820–Aug. 15, 1824; made a second voyage around the world 1825–27; was governor of the Russian possessions in North America 1829–34, and received on his return various high positions in the naval department, and was made an admiral. D. at Dorpat June 6, 1870. His account of his polar expedition was published in Russian (2 vols., 1841), but an extract from his diaries appeared in German in 1839, and was translated into English by Mrs. Sabine in 1840—*Wrangell's Expedition to the Polar Sea in 1820–23*. The tract of land in the Arctic Ocean bearing his name was discovered in 1867 by Capt. Long.

**Wrang'ham** (Francis), F. S. A., b. at Raisthorpe, Yorkshire, England, in 1789; educated at Magdalen College and at Trinity Hall, Cambridge, where he graduated with high honors in classics 1790; was for some time a tutor; took orders in the Church of England; became curate of Chobham, Surrey, 1794, vicar of Hunmanby, Yorkshire, 1795, rector of Thorpe Basset 1819, archdeacon of Cleveland 1820, prebendary of York 1823, of Chester 1825, rector of Dodleston, Cheshire, 1827, and archdeacon of the East Riding of York 1828. He gained the Seatonian prize for the best English poem on a sacred subject 1794, 1800, 1811, and 1812. D. Dec. 27, 1843. Author of several volumes of poems and poetical translations from the Latin and Italian; revised Langhorne's translation of Plutarch (6 vols., 1808) and the second edition of *The British Plutarch* (6 vols., 1812), and published 3 vols. of *Sermons* (1816).

**Wrang'ler** [so called because formerly required to engage in public disputation], one of the first class of honormen of the mathematical tripos in the University of Cambridge, England. The number of these is not limited. The first of them is called the senior wrangler.

**Wrasse** [W. *gwrachen*], a name commonly applied in Great Britain to sea-fishes of the genus *Labrus*, family Labridæ. The species are numerous, not large, and mostly inferior as food. The ballan wrasse or oldwife (*L. maculatus*) is one of the most common sorts. It is employed as fish-bait, but is not considered fit for food.

**Wra'tislaw** (Albert Henry), b. in England in 1821, of Bohemian parentage; studied at Rugby School; graduated in 1844 at Christ's College, Oxford, where he was successively scholar, fellow, and tutor; became head-master of Felstead Grammar School 1852, and of that at Bury St. Edmund's on the resignation of Dr. J. W. Donaldson in 1855; has published several volumes of poems and prose translated from the Czech and other Slavonic languages, and has written several schoolbooks and educational and religious treatises.

**Wrax'all** (Sir Frederick Charles Lascelles), Bart., grandson of Sir Nathaniel, b. at Bologne, France, in 1828; educated at Shrewsbury and at St. Mary's Hall, Oxford; was assistant commissary of the field train in the Turkish contingent, with the rank of captain, during the Crimean war 1855–56; was editor of the *Naval and Military Herald* 1858, and of the *Welcome Guest* 1860–61; contributed largely to periodical literature from 1850, and succeeded to the baronetcy by the death of a maternal uncle May, 1863. D. at London June 11, 1865. He published many translations, including Victor Hugo's *Les Misérables* (3 vols., 1862), and was author of numerous volumes of military and historical memoirs, and of several novels.

**Wraxall** (Sir Nathaniel William), Bart., b. at Bristol, England, Apr. 8, 1751; was employed in civil and military service in India 1769–72; travelled for several years in Europe; was confidential agent of Caroline Matilda, queen of Denmark, in her negotiations with her brother, George III., 1774–75; entered Parliament 1780; was created a baronet 1813; and was imprisoned three months in 1815 for a libel on Count Woronzow in an autobiography published in that year. D. at Dover Nov. 7, 1831. Author of several amusing volumes of anecdotical history, including *Memoirs of the Kings of France of the House of Valois* (2 vols., 1777), *History of France from Henry III. to Louis XIV.* (3 vols., 1795), *Memoirs of the Courts of Berlin, Dresden, Warsaw, and Vienna 1777–79* (2 vols., 1779), *Historical Memoirs of My Own Time, 1772–84* (2 vols., 1815; 3d ed., revised, 3 vols., 1818), and *Posthumous Memoirs of his Own Time, 1784–90* (3 vols., 1836; 3d ed. 1845).

**Wray** (Daniel), F. R. S., b. in London, England, in 1701; graduated at Queen's College, Cambridge, 1722; was one of the authors of the celebrated *Athenian Letters* (4 vols., 1741–43), edited by Philip Yorke; became a distinguished antiquary; contributed to the *Archæologia*; collected a magnificent library, and was deputy teller of the exchequer 1745–82. D. in London Dec. 29, 1783.

**Wray** (John). See Ray.

**Wray** (Robert Bateman), b. at Broadchalk, Wiltshire, England, Mar. 16, 1715; became a seal-engraver, a branch of business which he first raised to importance in England, deriving great celebrity, especially in Italy, from his accurate copies of ancient gems, and settled in 1759 at Salisbury, where he d. in 1770. Among his best works are reckoned a *Dying Cleopatra*, a *Medusa's Head*, a *Magdalen*, heads of Milton, Cicero, Shakspeare, and Pope, and three ideal female heads.

**Wreck.** This term at the common law denoted all goods, merchandise, parts of a vessel, or even a vessel itself, which might be driven on shore by the force of the elements during or after a shipwreck. All such matter originally belonged to the Crown, without any regard to the claims of owners, and the right to what should be found upon a certain coast was often granted to the lord of an adjacent manor. By a statute of Henry I. it was enacted that if any person escaped alive, it should not be considered a wreck; and under Henry II. this provision was extended, so that if any animal, even a cat or a dog, escaped or was found alive among the ruin, there was no wreck. The rule was finally established that in all cases of wreck the merchandise and other articles of value should be taken into possession by a local officer; any that were perishable should be sold and the proceeds kept, and if no claim was made on behalf of an owner within a year and a day, the property fell to the Crown. When articles do not actually come to the shore, they are not legally wreck, but were designated in the old law by the following barbarous names: *jetsam* is what is thrown overboard and sinks, *flotsam* is what floats, and *ligan* is what sinks, but is identified or the place marked by a buoy or float. These all belong to their original owners if claimed by them; otherwise, to the Crown. The foregoing common-law rules have been greatly modified in the U. S., but while the right of the true owner to his wrecked or derelict property is fully protected, the principles of the English legislation have been closely followed. The maritime States have generally passed statutes which provide that articles driven on shore without an owner shall be kept in safety by a public officer for a designated time, and if no owner finally appears, that they shall be sold and the proceeds applied to some public use. The finders of goods or vessels derelict at sea, and those who aid in saving ship or cargo from a wreck on coasts, are entitled to be paid a compensation called *salvage* by the owner when he appears and claims his property, or from the proceeds when no claimant appears. (See Salvage.)

John Norton Pomeroy.

**Wren.** See Troglodytinæ, in Appendix.

**Wren** (Sir Christopher), b. at East Knoyle, Wilts, Oct. 20, 1632, son of Dr. Wren, dean of Windsor and chaplain in ordinary to Charles I.; was distinguished in boyhood for mathematical and inventive genius; entered Wadham College, Oxford, at the age of fourteen; at twenty-one was elected a fellow of All Souls', being already distinguished; at twenty-five was appointed professor of astronomy at Gresham College, Oxford, which three years later he resigned for the Savilian professorship. The Royal Society, established soon after the Restoration, owed to him, in considerable measure, its reputation, and even its existence. He was appointed by Charles II. assistant to the surveyor-general, Sir John Denham, and in 1663 was commissioned to report a plan for the reconstruction of St. Paul's cathedral; visited Paris in 1665. The great fire of 1666, which destroyed a large part of London, laid St. Paul's in ruins, and made necessary its entire rebuilding. Wren's scheme for rebuilding the waste city was rejected; his plan for the new cathedral was but partially adopted. The first stone was laid June 21, 1675; the choir was opened 1697; the whole was finished in 1710. D. Feb. 25, 1723, and buried in the crypt. Before the work was begun, in 1672, the architect was knighted; in 1680 was made president of the Royal Society; was elected to Parliament, but sat only a few times. Wren's fame rests chiefly on St. Paul's cathedral. His other churches are less admired—St. Stephen's, Wallbrook; St. James's, Westminster; St. Clement's, Eastcheap; St. Martin's, Ludgate; Christchurch, Newgate. The W. towers of Westminster Abbey, the steeples of Bow church and St. Bride's, Temple Bar, and Marlborough House were his constructions. His best work was ecclesiastical. Wren passed the best years of his long life in seclusion at Hampton Court, his office of surveyor-general having been taken from him by George I. and bestowed on an incompetent rival. He was twice married. His son Christopher in chief part composed the *Parentalia*, memoirs of the Wren family.

O. B. Frothingham.

**Wren'tham,** p.-v. and tp., Norfolk co., Mass. P. 2292.

**Wrest'ling,** a struggle without arms, ending with one of the adversaries throwing the other, formed an essential part both of the old Teutonic and of the ancient Greek and Roman education, and was by the latter developed into an intricate art, the palæstra or wrestling-ground forming a separate department of the gymnasium.

**Wrex'ham,** town of England, in Denbighshire, North Wales, has a fine church of the fifteenth century, rich coal and lead mines in the vicinity, and extensive breweries, ironworks, and paper-mills. P. 8576.

**Wriet'zen,** town of Prussia, province of Brandenburg, on the Oder, has valuable fisheries, extensive cultivation of fruit and vegetables, and wool and cotton weaving factories. P. 6433.

**Wright,** county of Central Iowa, intersected by Boone and Iowa rivers; surface generally undulating, soil fertile. Cattle are the chief live-stock. Staples, wheat, Indian corn, oats, and hay. Cap. Clarion. Area, 625 sq. m. P. 2392.

**Wright,** county of Central Minnesota, lying on the Mississippi, drained by Crow River, and traversed by St. Paul and Pacific R. R.; surface undulating, and diversified by prairie, woodland, and small lakes. Cattle are the chief live-stock. Cap. Buffalo. Area, 708 sq. m. P. 9457.

**Wright,** county of S. Missouri, drained by Gasconade River and the head-streams of White River; surface somewhat hilly, soil fertile. Cattle, sheep, and swine are the chief live-stock. Cap. Hartville. Area, about 650 sq. m. P. 5684.

**Wright,** p.-v. and tp., Greene co., Ind. P. 1104.

**Wright,** tp., Wayne co., Ia. P. 953.

**Wright,** tp., Hillsdale co., Mich. P. 1814.

**Wright,** tp., Ottawa co., Mich. P. 2077.

**Wright,** tp., Schoharie co., N. Y. P. 1525.

**Wright,** tp., Luzerne co., Pa. P. 603.

**Wright,** tp., Darlington co., S. C. P. 1535.

**Wright** (A. H.), U. S. N., b. Sept. 27, 1845, in Ohio; graduated at the Naval Academy in 1863; became lieutenant in 1867, lieutenant-commander in 1868; served on board the Richmond at the battle of Mobile Bay, and was commended for "coolness and courage." F. A. Parker.

**Wright** (Asher), b. at Hanover, N. H., in 1803; graduated at Dartmouth College 1828, and at Andover Theological Seminary 1831, and was a missionary of the A. B. C. F. M. to the Seneca Indians upon the Buffalo Creek and Cattaraugus reservations from 1831 until his death, at Cattaraugus in 1875. He acquired the Seneca language, into which he translated portions of the New Testament, which he printed at the mission-press; prepared several elementary schoolbooks in the same language, as well as a hymn-book, and for some time printed a small periodical. He was an accomplished scholar, possessed a good knowledge of medicine, and did much for the moral and material improvement of the Senecas.—His wife, Mrs. Laura Sheldon Wright, b. in Massachusetts about 1808, also possessed the Seneca language, in which she wrote a number of hymns.

**Wright** (Ambrose Ransom), b. Apr. 26, 1826, in Louisville, Jefferson co., Ga.; read law when between fourteen and fifteen years of age in the office of Hon. Herschel V. Johnson; was admitted to the bar, and after coming of age opened an office in Louisville. His talents soon won him distinction in his profession. He very soon entered the political arena as a Democrat, and became one of the most distinguished popular orators in the State. In 1854 he espoused the side of the American party, and remained one of its most distinguished leaders as long as that organization existed. In 1858 he was the candidate of his party for Congress, but was defeated by his Democratic competitor, Hon. John J. Jones; in 1860 removed to Augusta, Richmond co., and on the defeat of the Bell-Everett ticket for President and Vice-President that year, which he zealously supported, he, with many others of the most prominent leaders of his party, espoused the cause of secession. The secession convention of Georgia appointed him a commissioner to Maryland for the purpose of inducing that State to cast her fortune with her Southern sisters. In the discharge of the duties of this office he won considerable distinction. In Apr., 1861, he enlisted as a private in the Confederate Light Guards of the 3d Georgia regiment, and soon after the regiment was ordered to Virginia he was elected its colonel. His first service was in the battle of Chicamicomico, off the coast of North Carolina, where, being chief in command, he displayed great gallantry and military skill, and achieved an important victory. He was subsequently promoted to the rank of brigadier-general, and then to that of major-general, which position he held at the close of the war. After the surrender of the Confederate armies he resumed the practice of his profession in Augusta; became editor of the *Chronicle and Sentinel*, one of the leading journals in the Southern States, and

opposed with great ability the reconstruction measures of Congress. In 1872 he was elected a member from the 8th Congressional district to the 43d Congress as a Democrat, but d. (Dec. 21, 1872) before taking his seat. As a jury lawyer and popular orator Gen. Wright had few superiors in the State. ALEXANDER H. STEPHENS.

**Wright** (AUGUSTUS R.), b. at Wrightsborough, Ga., June 16, 1813; was educated at the university of the State, but left before graduating, and entered the law school of Hon. William T. Gould in Augusta, and was admitted to the bar in 1834; first settled in Crawfordville, then moved to Cassville, after the Cherokee Indians were removed from that country. Here he soon rose to the highest eminence in his profession; in 1842 was elevated to the circuit court bench; in 1854 was elected to the 34th Congress, and was re-elected to the 35th; opposed secession, but yielded to the sovereign will of his State, and espoused the Confederate cause with all his ability, serving as a member of Congress. After the war he resumed his profession at Rome, Ga., and has ever been an earnest advocate for the restoration of peace and harmony throughout all sections of the country upon the principles of the Constitution. Judge Wright is distinguished for integrity, probity, and piety. As an orator he is graceful, brilliant, and eloquent. He (Apr., 1876) resides in Rome.

ALEXANDER H. STEPHENS.

**Wright** (BENJAMIN), b. in Wethersfield, Conn., Oct. 10, 1770; had scanty advantages for improving his taste for the study of mathematics until 1786, when he entered the home of his uncle at Plymouth, where he had access to books and instruments, and made himself familiar with the art of surveying. With his parents in 1788 he located at Fort Stanwix (now Rome), N. Y.; became actively employed in laying out the purchases of the new settlers, and laid the foundation for his future success as civil engineer, his first employment as such being the execution of a map and profile of Wood Creek for the Western Inland Lock Navigation Co.; was further engaged to make a survey of the Mohawk from Fort Stanwix to Schenectady, and propose a plan for the improvement of that river; in 1811–12 conducted for the canal commissioners a survey of the N. side of the Mohawk from Rome to Waterford, and of the country from Seneca Lake to Rome, thence the S. side of the Mohawk to Albany, a complete report of which he made; was repeatedly elected to the State legislature, and during the war with Great Britain was appointed county judge, which office he relinquished in 1816 upon receiving the appointment of engineer of the middle section of the Erie Canal, and to him, with James Geddes, is mainly due the credit of the successful completion of the enterprise; was at different times chief engineer of the Delaware Canal, Chesapeake and Ohio Canal, Harlem R. R., St. Lawrence Ship-Canal; was street commissioner of New York 1834; conducted the survey for the route of the New York and Erie R. R. 1834–36, when he returned to Virginia. D. at New York City Aug. 24, 1842.

**Wright** (BENJAMIN H.), b. in New York Oct. 19, 1801; graduated at the U. S. Military Academy July 1, 1822; resigned June, 1823, to engage in the profession of civil engineering; by his personal efforts railroads were first introduced into the island of Cuba, the preliminary survey and subsequent construction of the first road, from Havana to Guines in the interior, being executed under his superintendence, as well as various other roads on that island. For a time he was associate principal engineer of Cuba, under the Spanish government.

**Wright** (CRAFTS J.), b. in New York about 1806; graduated at the U. S. Military Academy July 1, 1828, but, without serving, resigned and entered upon the practice of law in Cincinnati: was editor of the Cincinnati *Gazette* 1847–53; in the civil war became colonel of the 13th Missouri Vols. Aug., 1861; colonel of the 22d Ohio Vols. June 17, 1862, and served at Forts Henry and Donelson, Shiloh, and Corinth; resigned Sept. 16, 1862, and engaged in farming near Glendale, O.

**Wright** (EDWARD), b. at Garveston, Norfolk, England, about 1560; educated at Caius College, Cambridge, where he became a fellow; was noted for mathematical attainments and for mechanical ingenuity; was the projector of the water-supply of London from the New River at Ware; sailed on a voyage to the Azores with George, earl of Cumberland, 1589, in order to study practical navigation; devised the sea-chart now in use under the name of "Mercator's projection;" published *Certain Errors in Navigation detected and corrected* (1599; new ed. 1610; 3d ed. 1657); translated from Stevinus *The Haven-Finding Art, etc.* (1599), subsequently appended to the former treatise; was mathematical tutor to Prince Henry, son of James I., for whom he caused to be constructed in Germany a sphere which not only showed the motions of the heavenly bodies, but sufficed to foretell eclipses for 17,100 years; delivered lectures on navigation for the East India Company; wrote a *Description and Use of the Sphere* (1613) and a *Short Treatise of Dialling, shewing the Making of all Sorts of Sun-dials* (1614). D. in London in 1615. He left in MS. a translation of Napier's description of his canon of logarithms, which was printed in 1616 by his son Samuel, who was also a fellow of Caius.

**Wright** (ELIZUR), b. at South Canaan, Conn., Feb. 12, 1804; graduated at Yale College 1826; taught in the Lawrence Academy at Groton, Mass., 1827–28; was professor of mathematics and natural philosophy in Western Reserve College 1829–33; became secretary of the American Anti-Slavery Society 1833; edited the paper *Human Rights* 1834–35 and the *Quarterly Anti-Slavery Magazine* 1837–38; removed to Boston 1838; became editor of the *Massachusetts Abolitionist* Apr., 1839, of the *Daily Chronotype* 1845, and of its successor, the Boston *Commonwealth*, 1850; has since edited for short periods the Boston *Daily Chronicle* and the *American Railway Times;* was commissioner of insurance for Massachusetts 1858–66; translated La Fontaine's *Fables* (2 vols., 1841); wrote an introduction to Whittier's *Ballads and other Poems* (London, 1844); has contributed to the *Atlantic Monthly*, and published several anti-slavery pamphlets.

**Wright** (FANNY). See D'ARUSMONT (FRANCES).

**Wright** (GEORGE), b. in Vermont in 1803; graduated at West Point 1822; served in the Florida and Mexican wars; was brevetted lieutenant-colonel for gallantry at Churubusco Aug. 20, 1847; commanded the storming-party at Molino del Rey, where he was wounded Sept. 8, gaining the brevet of colonel; was distinguished in campaigns against the Indians of Washington Territory 1856 and 1858; became brigadier-general of volunteers Sept. 28, 1861; commanded the department of the Pacific Oct., 1861, to July, 1864, and the district of California 1864–65, and was drowned July 30, 1865, in the wreck of the steamer Brother Jonathan.

**Wright** (GEORGE C.), brother of Joseph A., b. at Bloomington, Ind., Mar. 24, 1820; graduated at the Indiana State University 1839; read law with his brother; removed to Iowa 1840; served as prosecuting attorney 1847; was elected to the State senate 1849; chosen chief-justice of the supreme court of the State 1854, and re-elected 1860 and 1865; was professor in the law department of the State University 1865–71; elected Republican U. S. Senator 1871.

**Wright** (GEORGE NEWNHAM), b. in England about 1812; graduated at Brasenose College, Oxford, 1835; took orders in the Church of England; became rector of St. Mary Woolnoth, London, and subsequently master of Tewkesbury grammar school. Author of *Landscape Historical Illustrations of Scotland and the Waverley Novels from Drawings by Turner, etc.* (1836), *Life and Reign of William III.* (2 vols., 1837), *Life and Campaigns of the Duke of Wellington* (4 vols., 1839–41), *Life and Times of Louis Philippe* (1841), *Lancashire, its History, Legends, and Manufactures* (2 vols., 1841); of the descriptive texts to illustrated works by T. Allom on *China* (4 vols., 1844), *France* (4 vols., 1847), and *Belgium, the Rhine, Italy, Greece, and the Mediterranean* (2 vols., 1849); edited the *London Cyclopædia* and the *Works of Bishop Berkeley, with a Life* (2 vols., 1843), of Dr. Thomas Reid (2 vols., 1843), and the *Philosophy of the Human Mind* by Dugald Stewart (1843).

**Wright** (HENRY C.), b. Aug. 29, 1797; was for many years a noted anti-slavery lecturer and advocate of peace and of socialism, and latterly of spiritualism, on all which points his convictions were vehement and were delivered with considerable eloquence. D. at Pawtucket, R. I., Aug. 16, 1870. Author of *Man-Killing by Individuals and Nations wrong* (1841), *A Kiss for a Blow* (1843; new ed. 1866), *Defensive War proved to be a Denial of Christianity* (1846), *Human Life Illustrated* (1849), *Marriage and Parentage* (1854), and *The Living Present and the Dead Past* (1865).

**Wright** (HORATIO G.), b. at Clinton, Conn., Mar., 1820; graduated at U. S. Military Academy, and commissioned second lieutenant in the corps of engineers July 1, 1841. After serving two years at West Point as instructor in the departments of French and of engineering, he was in 1846 sent to the Gulf coast, and for ten years had charge of the construction of Fort Jefferson, commanding the harbor of Tortugas, Fla., and for a portion of that period superintended the construction of Fort Taylor, Key West, being also charged with the duties of lighthouse engineer and the improvement of St. John's River. In 1856 he was called to Washington, and served as assistant to the chief of engineers until the outbreak of the civil war in 1861. As chief engineer he accompanied the expedition for the destruction of the navy-yard at Norfolk, Va., in Apr., 1861, and in May crossed the Potomac with Gen. Heintzelman's

column, and laid out and commenced Fort Ellsworth, covering Alexandria. At the first battle of Bull Run he was chief engineer of Heintzelman's division. He was commissioned a brigadier-general of volunteers Sept. 14, 1861, and assigned to the command of a brigade of the land-forces of the Port Royal expedition, which, as chief engineer, he had been engaged in organizing since July. In Feb., 1862, he set out from Port Royal with a brigade of volunteers, and by the middle of March had occupied Fernandina, Jacksonville, St. Augustine, and retaken possession of Fort Marion and Fort Clinch. Returning to South Carolina in April, he commanded a division in the assault on Secessionville, June 16; was promoted to be major-general of volunteers in July, and commanded the department of the Ohio until Mar., 1863. In May, 1863, he was assigned to the command of a division of the 6th corps, and engaged at Gettysburg on the second and third days of the battle and subsequent pursuit of Lee's army. In the spirited assault on Rappahannock Station (Nov. 7, 1863), he commanded the corps, and was brevetted lieutenant-colonel for gallantry. After the Mine Run affair, in which he led his division, he was called to Washington as a member of a board to devise modifications of our system of sea-coast defences. Returning to the army in the spring of 1864, he led his division in the severe fighting in the Wilderness and Spottsylvania battles (in the last of which he was wounded), succeeding to command of the 6th corps May 9, on the fall of Sedgwick. His subsequent war-record is that of the 6th corps. With the Army of the Potomac he was present at every engagement up to July, 1864, when summoned from the front of Petersburg with his corps to the defence of Washington, then threatened by the Confederates under Gen. Early. In the pursuit which followed the latter's retreat Wright, in command of all the troops, overtook Early, and after a sharp skirmish defeated him at Snicker's Gap. In the ensuing campaign of the Army of the Shenandoah under Sheridan he led his corps at Opequan and Fisher's Hill, and was in command of the army at Cedar Creek, where, after the surprise of the 8th corps on the morning of Oct. 19, he had re-formed the army in a favorable position upon the arrival of Sheridan, when, though wounded, Wright resumed command of his corps. The disposition of the troops by the latter was approved by Sheridan, and at the close of the day Early was hopelessly defeated and his army a wreck. The 6th corps was soon after returned to the Army of the Potomac, and bore a prominent part in succeeding operations resulting in the surrender of Lee. At Petersburg it was the first to break through the enemy's lines, thus ending the siege and effecting the capture of the city, and with the cavalry it fought the last battle and won the last victory of that army, at Sailor's Creek, Apr. 6, 1865. After the surrender of Lee the corps was sent to Sherman's aid in North Carolina, but upon the surrender of Gen. Johnston returned to Washington, where mustered out in June, 1865. In July, Wright was placed in command of the department of Texas. Mustered out of volunteer service in Sept., 1866, he returned to duty with the corps of engineers, in which he had attained a lieutenant-colonelcy Nov., 1865. For gallantry at Spottsylvania he was brevetted colonel; brigadier-general for Cold Harbor; and major-general for capture of Petersburg. Member of the board of engineers for permanent fortifications since 1867. G. C. Simmons.

**Wright** (Ichabod Charles), b. at Maperly Hall, Nottinghamshire, England, in 1795; educated at Eton; graduated at Christ Church, Oxford, 1817; was for some time a fellow of Magdalen College; became a wealthy banker at Nottingham; married the eldest daughter of Chief-Justice Denman 1825; wrote some able pamphlets on currency, and occupied his leisure with literary pursuits. D. at Nottingham Oct. 14, 1871. He published translations into English rhyme of Dante's *Inferno* (1833), *Purgatorio* (1837), and *Paradiso* (1840), collectively entitled *The Vision and Life of Dante* (3 vols., 1845; illustrated ed., "Bohn's Lib.," 1854), and *The Iliad of Homer, translated into English Blank Verse* (3 parts, books i.–xiv., 1859–64), and in reply to criticisms on the latter work by Prof. Matthew Arnold wrote *A Letter to the Dean of Canterbury on the Homeric Lectures, etc.* (1861).

**Wright** (James), b. in Rutlandshire, England, about 1644; educated at Oxford, and in law at the Middle Temple. Author of *The History and Antiquities of the County of Rutland* (1684), *Dugdale's Monasticon Anglicanum epitomized in English* (1693), and other antiquarian and historical works. D. about 1715.

**Wright** (Sir James), b. at Charleston, S. C., about 1720, son of Robert, who was chief-justice of that colony; became a lawyer at Charleston; served as attorney-general and as agent of the province in England; was appointed chief-justice and lieutenant-governor of South Carolina May 13, 1760; became royal governor 1764; was created a baronet Dec. 8, 1772; managed the affairs of the colony with prudence and success during a long administration, but ultimately became unpopular from his unwavering loyalty to the Crown; was imprisoned by the Revolutionary party Jan., 1776, but soon escaped to England; returned with the fleet 1779, and resumed the government, which he held until the evacuation of South Carolina, when he went to England, and his large estates in Georgia were confiscated. D. in England in 1786.

**Wright** (John C.), b. in 1783; settled as a lawyer at Steubenville, O., about 1805; was for many years a judge of the supreme court of Ohio; was a member of Congress 1823–29, and was long editor and proprietor of the Cincinnati *Gazette*. D. at Washington, D. C., Feb. 13, 1861, while a delegate to the national Peace convention. He published *Reports of Cases in the Supreme Court of Ohio* (1835).

**Wright** (Joseph), b. at Derby, England, in 1734; studied portrait-painting under Thomas Hudson; resided in Italy 1773–75; settled in the practice of his profession at Bath 1775; removed to Derby 1777, remaining there through life, occupied chiefly with portraits, but painting also historical and figure pieces; was especially fond of representing storm-scenes and the effect of firelight, which he had carefully studied in Italy during an eruption of Vesuvius; exhibited at Covent Garden in 1785 a collection of twenty-four of his pictures, the most striking of which was the *Destruction of the Floating Batteries off Gibraltar*. D. at Derby Aug. 29, 1797. Among his works were some fine copies of the frescoes of Michael Angelo in the Sistine Chapel, views of the so-called "villas of Cicero and of Mæcenas" at Tivoli, *The Blacksmith's Forge, The Dead Soldier, Belshazzar's Feast*, a view of Lake Ullswater, Westmoreland, and the *Storm-Scene in the Winter's Tale*, painted for Alderman Boydell. His moonlight pieces are much admired, and some of his landscapes are considered equal to those of Wilson and Claude.

**Wright** (Joseph), b. at Bordentown, N. J., in 1756; went with his family to England 1772; became a successful artist; painted a portrait of the prince of Wales; pursued his studies in Paris under the care of Dr. Franklin; was shipwrecked on a voyage to America, narrowly escaping with his life, and painted three portraits of Washington, by whom he was appointed first draughtsman and die-sinker in the U. S. mint, the first national coins and medals being his handiwork. D. at Philadelphia in 1793.

**Wright** (Joseph A.), b. in Pennsylvania Apr. 17, 1810; settled at Bloomington, Ind., early in life; studied at the Indiana University; was admitted to the bar 1829; sat in both houses of the legislature; was a member of Congress 1843–45, governor of Indiana 1849–57, minister to Prussia 1857–61, U. S. Senator 1861–62, U. S. commissioner to the Hamburg exhibition 1863, and again minister to Prussia from 1865 until his death, at Berlin May 11, 1867.

**Wright** (Martha Coffin), b. at Nantucket, Mass., in 1807; was a friend of temperance, anti-slavery, and woman suffrage; with her sister, Lucretia Mott, joined in the call for the first woman's rights convention in 1848; attended the National Woman's Rights conventions from year to year; was the presiding officer on many occasions. Though not a public speaker, her counsel and presence were invaluable at all times in preparing resolutions, criticising speeches, and suggesting new modes of agitation. Her place of residence was Auburn, N. Y. She was president of the National Woman Suffrage Association at the time of her death, Jan. 4, 1875. Susan B. Anthony.

**Wright** (Sir Nathan), b. in England in 1653; was called to the bar at the Inner Temple Nov., 1677; assisted at the trial of the seven bishops June, 1688; supported the Revolution; was knighted and appointed king's sergeant Jan., 1697; was appointed lord keeper of the great seal May 21, 1700, and was deprived of that post Oct. 11, 1705. D. in Warwickshire Aug. 4, 1721.

**Wright** (Robert), b. in Kent co., Md., about 1765; was at one time a member of the State executive council; was U. S. Senator 1801–06, governor of Maryland 1806–09, and member of Congress 1810–17, 1821–23. D. Sept. 7, 1826.

**Wright** (Robert E.), b. at Allentown, Pa., in 1810; became a distinguished member of the Pennsylvania bar. He published *Pennsylvania State Reports, etc.* (14 vols., 1861–66), edited William Graydon's *Forms of Conveyancing* (1845) and Samuel Roberts's *Digest of Select British Statutes, etc.* (1847), prepared several manuals of special legislation, and has printed several essays and addresses on legal and political topics.

**Wright** (Silas), b. at Amherst, Mass., May 24, 1795; graduated at Middlebury College 1815; studied law; was admitted to the bar 1819; settled at Canton, St. Lawrence

co., N. Y.; cultivated with his own hands a small farm; was appointed surrogate of that county 1820; became a magistrate and postmaster of Canton; was elected to the State senate as a Democrat 1823; distinguished himself as an opponent of the policy of Gov. De Witt Clinton; developed in a report to the senate in 1827 the financial policy with which he was identified throughout his political career; was commissioned brigadier-general of State militia 1827; was a member of Congress 1827–29; advocated the protective tariff of 1828 and the adoption of preliminary measures looking to the abolition of slavery in the District of Columbia; was comptroller of New York 1829–33, and U. S. Senator 1833–44; served on the committee on finance; supported Clay's Compromise bill and defended the removal of the deposits from the U. S. Bank by Pres. Jackson, 1833; opposed the recharter of the U. S. Bank, the distribution of the surplus Federal revenues among the States, and the admission of Texas; supported the tariff of 1842; maintained, in reference to the abolition of slavery, the right of petition, the inviolability of the mails, and the sovereignty of Congress over the Territories 1838; was chosen governor of New York in the exciting campaign of 1844; opposed in 1845 the revision of the State constitution by a convention; vetoed a bill appropriating money for canal improvements; took decided ground against the anti-rent rioters, declaring Delaware county in a state of insurrection; repeatedly declined appointments to foreign missions, as well as an offer of a seat in the cabinet or on the Supreme bench by Pres. Tyler, and of the secretaryship of the treasury by Pres. Polk, 1845; was defeated as a candidate for re-election 1846, and retired to his farm at Canton, where he d. Aug. 27, 1847. He appeared twice as a lawyer before the Supreme Court of the U. S.; enjoyed a high reputation as a consulting lawyer; and, though not distinguished as an orator by comparison with his colleagues, Webster, Clay, and Calhoun, was considered an eminently clear and practical statesman, a reputation which has become traditional. Biographies were published by John S. Jenkins and by Jabez D. Hammond (1848).

**Wright** (Thomas), F. S. A., b. on the Welsh border, near Ludlow, Shropshire, England, Apr. 21, 1810; studied at the Ludlow grammar school; graduated at Trinity College, Cambridge, 1834; began while an undergraduate to write for *Fraser's* and other magazines upon the archæological and historical subjects to which he devoted his life; settled in London as a professional man of letters 1835; was one of the founders of the Camden Society (1838), the Percy and Shakspeare societies (1840), and of the British Archæological Association (1843), editing its *Journal* and other publications until 1850, when he withdrew in consequence of the divisions which led to the foundation of the Society of Antiquaries, of which he became a fellow; has been a prominent contributor to the *Archæologia;* rendered services to M. Guizot's French record committee, which procured him, while still young (1842), the honor of an election as corresponding member of the Institute (Académie des Inscriptions et Belles-Lettres); was the originator in England of the annual archæological congresses (1844), and has successfully conducted the excavations upon several Roman sites in Britain, especially those which brought to light the remarkable ruins of the Roman Uriconium at Wroxeter, Shropshire. He has written or edited above 100 volumes, nearly all connected with British history, philology, or archæology, and was selected by the emperor Napoleon III. to translate his *History of Julius Cæsar* (2 vols., 1865–66). He has edited many of the literary relics of the Middle Ages in English, Anglo-Norman, French, and Latin. Among his original works are *The History of Ludlow and its Neighborhood* (2 parts, 1841–43; new ed. 1852); *Biographia Literaria* (2 vols., 1842–46), comprising the Anglo-Saxon and Anglo-Norman periods of Great Britain and Ireland; *The Archæological Album* (1845), *Essays on Subjects connected with the Literature, etc., of England in the Middle Ages* (2 vols., 1846), *England under the House of Hanover, illustrated from Caricatures, etc.* (2 vols., 1848), *A History of Ireland* (3 vols., 1848–52), *The Celt, the Roman, and the Saxon* (1852; 3d ed. 1875), *Wanderings of an Antiquary* (1854), *A Dictionary of Obsolete and Provincial English* (2 vols., 1857), *Essays on Archæological Subjects* (2 vols., 1861), *A History of Domestic Manners in England during the Middle Ages* (1862), *A History of Caricature and Grotesque in Literature* (1865), *Womankind in Western Europe* (1869), and *Uriconium, an Historical Account of the Ancient Roman City* (1872).

**Wright** (William), b. at Clarkstown, N. Y., in 1794; was a volunteer in the war of 1812–15 for the defence of Stonington, Conn.; was mayor of Newark, N. J., 1840–43, a Whig member of Congress 1843–47, a Democratic U. S. Senator 1853–59, and again from 1863 to his death, at Newark, N. J., Nov. 1, 1866.

**Wright** (William), Ph. D., LL.D., b. in Bengal, India, Jan. 17, 1830; educated at the universities of St. Andrew's and Halle; was appointed professor of Arabic in University College, London, 1855, in Trinity College, Dublin, 1856, and in the University of Cambridge 1870; has been employed in the MS. department of the British Museum since 1861, and became assistant keeper 1869. He has received the honorary doctorate of laws from the four universities of Cambridge, Dublin, Edinburgh, and St. Andrew's, and that of philosophy from the University of Leyden. He has edited in Arabic the *Travels of Ibn Jubair* (Leyden, 1852), Al-Makkari's *Analects* (1855), *Opuscula Arabica* (1859), and El-Mubarrad's *Kamil* (1864–74); has issued *The Book of Jonah in four Semitic Versions—Chaldee, Syriac, Ethiopic, and Arabic—with Glossaries* (London, 1857), a revised translation of Caspari's *Grammar of the Arabic Language* (2 vols., 1859–62; new ed. 1875), *Ancient Syriac Documents relative to the Earliest Establishment of Christianity in Edessa, etc.* (1864), *Contributions to the Apocryphal Literature of the New Testament, collected and edited from Syriac MSS. in the British Museum, with an English Translation and Notes* (1865), *The Homilies of Aphractes, "the Persian Sage"* (1869), *An Arabic Reading-Book* (1870), *The Apocryphal Acts of the Apostles* (Syriac and English, 2 vols., 1871), *A Catalogue of the Syriac MSS. in the British Museum* (3 vols., 1870–72), and *Oriental Series of Fac-similes of Ancient Manuscripts* (1876).

**Wright** (William Aldis), b. in England about 1836; educated at, and became librarian of, Trinity College, Cambridge; was the principal contributor in biblical geography and biography to Dr. Smith's *Dictionary of the Bible* (3 vols., 1860–63), and corrected the proofs of that important work; edited with notes and glossarial indexes Bacon's *Essays* (1862) and his *Advancement of Learning* (1869); was co-editor with William George Clark of *The Cambridge Shakspeare* (9 vols., 1863–66), and the Globe edition of Shakspeare's *Complete Works* (1 vol., 1864), and has edited *The Bible Word-Book* (1866), Chaucer's *Clerke's Tale,* and the *Metrical Chronicle* of Robert of Gloucester.

**Wright's,** tp., Morgan co., Ill. P. 2022.

**Wrightstown,** p.-v. and tp., Bucks co., Pa. P. 823.

**Wrightstown,** p.-v. and tp., Brown co., Wis. P. 1446.

**Wrights'ville,** p.-v., cap. of Johnson co., Ga.

**Wrightsville,** v., Monroe tp., Adams co., O. P. 63.

**Wrightsville,** p.-b., York co., Pa. P. 1544.

**Wriothesley.** See Southampton, Earls of.

**Writ** [Lat. *breve*], in law, is a formal instrument, issued by or in the name of a court, commanding the person to whom it is addressed to do a certain act therein specified. It is written in the form of a mandate from the highest authority in the state—the king in Great Britain, the President, people, or commonwealth in the U. S.—attested by the chief judge of the court, sealed and signed by the clerk, and may be issued either at the commencement of an action or proceeding, or during its progress, to the sheriff or to some other person, for the purpose of procuring various acts to be done in connection with such action or proceeding. Anciently, actions in the courts of law were commenced by a species of writs termed "original," which were issued by officers of the chancery, and were considered as the direct mandates of the king, stating the nature of the claim; but they were long ago abolished, and all writs became "judicial"—that is, were in the nature of process from the court in which the suit was brought or was pending. In the common-law practice the number of writs was very great; a separate one was adapted to every special proceeding and to almost every important stage in an action, and each had its appropriate name. Among the most familiar were the writs of "*capias*" and of "summons" for commencing legal actions, the writ of "*subpœna*" for summoning the defendants in an equity suit and for compelling the attendance of witnesses (see Subpœna), the writs of "error" and of "*certiorari*" for the review of judgments and other judicial decisions, and the writ of "*habeas corpus*" for the production of a person imprisoned in order that the cause of his detention might be inquired into. (See Habeas Corpus.) A large part of the common-law writs have been abolished by statute both in this country and in Great Britain. A few of the most common and important have been retained in those States which adhere to the ancient system of practice, while in those States which have adopted the reformed system writs have been wholly abrogated in civil actions, and simple orders of a court or a judge, or notices, have been substituted in their place. In these States, however, a few important writs belonging to the criminal practice, together with the writs of *habeas corpus* and of *certiorari*, are still used, though in a somewhat modified form. (See the articles Process and Procedure.) John Norton Pomeroy.

**Writer's Cramp.** See SCRIVENER'S PALSY.

**Writers to the Signet,** or **Clerks to the Signet,** a body of legal practitioners in Edinburgh, corresponding generally to the highest class of attorneys in London, derived their name from their original position as clerks in the office of the secretary of state, where the different writs that passed under the king's signet were prepared, and began to act as agents in the court of session in the latter part of the seventeenth century.

**Writing,** the art of conveying ideas by means of signs inscribed on some material, is either ideographic or phonetic. Ideographic writing, again, in which the signs represent the ideas themselves, is either pictorial, representing the ideas by direct imitation of the corresponding objects in nature, or symbolical, representing the ideas by hints or associations. Phonetic writing, in which the signs do not represent the ideas, but the sounds by which in speech they are conveyed, is either syllabic, each sign standing for a whole syllable, or alphabetic, each sign representing only a single sound. When writing was invented is not known, but it was certainly one of the oldest arts, and it is more than probable that its development passed from the merely pictorial stage, which is still occupied by savage tribes, through the symbolical to the phonetic; there are also various facts which show that the phonetic signs were originally derived, with slight modifications, from the pictorial. At present, however, the phonetic signs for the same sound are very different, not only in the different alphabets which have been created, but also, in many cases, in the various languages in which the same alphabet has been adopted; and very different methods of writing have been developed—in columns, such as the Chinese and Japanese use, or in lines, from the right to the left, such as the Semitic people use, or from left to right. (See for further details ALPHABET, CUNEIFORM INSCRIPTIONS, HIEROGLYPHICS, CHINESE, ARABIAN, EGYPT, ASSYRIA, GREEK LANGUAGE, WÔLEI, etc.)

**Writing-Machines.** See APPENDIX.

**Wrottes'ley** (JOHN), D. C. L., F. R. S., SECOND BARON **Wrottesley,** b. at Wrottesley Hall, England, Aug. 5, 1798; graduated as first-class in mathematics at Corpus Christi College, Oxford, 1819; assisted in founding the Royal Astronomical Society 1820; was called to the bar at Lincoln's Inn 1823; received the gold medal of the Astronomical Society for his *Catalogue of the Right Ascension of 1318 Stars* (1839); succeeded to the barony 1841, and was president of the Royal Society 1854–57. D. at Wrottesley Oct. 27, 1867. Author of a *Treatise on Navigation* (4 vols., 1829–38), *Thoughts on Government and Legislation* (1859), and of several occasional essays and addresses.

**Wry'neck** [named from its habit of twisting the neck in a serpentine manner], the *Yunx torquilla,* a common European woodpecker of the group Yuncinæ, not represented in the U. S. It is easily tamed, and is a great favorite with boys, who tie a string to its leg and allow it to climb trees, to run over their clothes, etc. It lives mostly on ants and caterpillars.

**Wulf'enite,** mineral *molybdate of lead,* $O_4MoPb$, named after the mineralogist Wulfen, who first distinguished the mineral in 1781 at Carinthian localities, where it had been mistaken by Klaproth for calcium-tungstate; called also *yellow lead ore, gelbbleierz,* and *bleigelb.* Dimetric in crystallization, having about the hardness of calcite; yellow or orange in color, sometimes red (containing then *vanadic acid,* as discovered by Dr. Lawrence Smith); sometimes translucent; found in several American localities, notably in very fine crystals at Phœnixville, Pa., where one variety is red, from vanadium. The geometric molecular forms of lead-molybdate are generally sharply defined:

$O_{4.\,24\,\cdot\,27}^{\mathrm{Mo\ Pb}} = 6.766$ { (Haidinger, 6.76). The melted lead and *minimum*-galena lead-molecule.

$O_{4.\,24\,\cdot\,26}^{\mathrm{Mo\ Pb}} = 7.039$ { (Cited as *maximum* by Dana, 7.01). The *maximum*-galena lead-molecule.

$O_{4.\,24\,\cdot\,22}^{\mathrm{Mo\ Pb}} = 8.118$ (Manross, artificial crystals, 8.11).

The yellow Phœnixville allotrope appears to contain the dominant elemental-molecule of lead, being therefore more complex:

$$O_{16}.4^{\mathrm{Mo}}_{24}.\left(3^{\mathrm{Pb\ Pb}}_{26\,\cdot\,27}\right) = 6.968 \text{ (J. L. Smith, 6.95).}$$

HENRY WURTZ.

**Wulf'stan,** or **Wolstan,** b. in Worcestershire, England, about 1007; educated in the monastic school at Evesham, and afterward in the seminary at Peterborough; became a monk and prior of the monastery at Worcester; was appointed bishop of Worcester in 1062, on the promotion of Aldred to the archbishopric of York; offered a vigorous resistance to the efforts of that prelate and of his successor to appropriate the estates of the see of Worcester; paid successful court to William the Conqueror; had the diocese of Worcester transferred to the jurisdiction of the archbishop of Canterbury; enjoyed the favor of William Rufus; defended the city of Worcester against the rebels led by Roger de Montgomery, and rebuilt Worcester cathedral. He was the last of the Anglo-Saxon prelates. D. at Worcester Jan. 19, 1095. There are two accounts of him by William of Malmesbury—one in his work, *De Gestis Pontificum,* the other a separate *Life* in 3 books, printed in Wharton's *Anglia Sacra* (2 vols., 1691). He has been supposed, though not on sufficient evidence, to be the author of the concluding portion (from 1034) of the *Anglo-Saxon Chronicle.*—Another WULFSTAN, b. about 950, was a prelate of considerable note; was bishop of Worcester 1002–16, and archbishop of York from 1002 until his death, in 1023, and was the supposed author of the Saxon *Sermones Lupi Episcopi,* published at Oxford by Elstob in 1701.

**Wup'per,** or **Wipper,** a short but copious stream which joins the Rhine 50 miles below Cologne. Elberfeld and Barmen lie on its banks, and the valley it forms is the most densely-peopled district, and the seat of the most extensive manufacturing industry, in Germany.

**Wurm'ser, von** (DAGOBERT SIGMUND), COUNT, b. in Alsace in 1724; entered first the French, afterward the Austrian army; fought in the Seven Years' war and the Bavarian succession war, and was made a general in 1787, and appointed military commander in Galicia. In the wars between Austria and the French republic he achieved some successes on the Rhine, and in 1796 he was sent to Italy with a reinforcement of 15,000 men to supersede Beaulieu as commander-in-chief. Advancing from Trent toward Mantua, which was besieged by Bonaparte, he marched his army in two columns, one on each side of the Lago di Garda, but Bonaparte at once raised the siege, fell with his whole force on the one column under Quosdanowich, and beat it back into the Tyrol, and then attacked the other under Wurmser himself, defeated him at Castiglione, Aug. 5, and compelled him too to retreat into the Tyrol. At the head of a new reinforcement he advanced toward Mantua a second time, through the valley of the Brenta, but Bonaparte, who in the mean time had penetrated into the Tyrol, now took him in the rear, beat him at Roveredo, Sept. 4, Bassano, Sept. 8, and under the walls of Mantua, Sept. 13, and shut him up in the fortress. Alvinczy, who was sent to his rescue, was defeated at Arcoli Nov. 15, and Rivoli Jan. 14, 1797, and on Feb. 2 Wurmser capitulated. Retiring to Vienna, he was appointed military commander of Hungary, but d. before entering his new position, Aug. 22, 1797.

**Wur'no,** town of Central Africa, on the Rima, an affluent of the Niger, is an extremely filthy place, but has some importance as a cotton-market. P. about 13,000.

**Wür'temberg,** a kingdom forming part of the German empire, and comprising an area of 19,503 quadrate kilomètres, with 1,881,505 inhabitants, bounded N., W., and S. by Bavaria and Baden, E. by Bavaria; on its southern frontier it is separated from Switzerland by Lake Constance. The larger part of it is mountainous, traversed by the Schwarzwald and the Rauhe Alp; the rest is plateau and terraces. The average elevation is 1535 feet; the highest peak rises 3732 feet; the lowest point is situated 437 feet above the level of the sea. The country is well provided with water. A minor part of it belongs to the basin of the Danube, the rest to that of the Rhine. The Danube traverses the southern part of the country for a distance of 90 miles. The Neckar, which rises in the south-eastern part of the country, where the Schwarzwald and the Rauhe Alp meet, flows northward to the Rhine for a distance of about 180 miles. The principal affluents of the Neckar are—to the right the Jaxt and the Kocher, and to the left the Enz and the Nagold. The Kocher, an affluent of the Main, flows through the northern part of the country. Of the canals the Wilhelmscanal is the most important, making the Neckar navigable from Cannstadt to Heilbronn. Lakes are numerous; a part of the Lake of Constance belongs to the country. The climate is moderate and healthy. The soil is good and well cultivated. Of the total area, 43 per cent. is arable land, 13½ meadow, 4 garden and vineyard, 7¾ pasture-land, and the rest mostly forest. Agriculture is flourishing. Of cereals, spelt, oats, millet, maize, rye, and wheat are raised in abundance, together with leguminous plants and tobacco, hops, chicory, etc. The garden and fruit cultivation is famous. Also, the vine cultivation is considerable; 150,000 eimers of wine are annually produced. Cattle-breeding is extensively carried on; the country has about 100,000 horses, 1,000,000 horned cattle, 700,000 sheep, 250,000 swine, 50,000 goats, and 120,000 beehives. The mining, which is chiefly in the hands of the government, is almost exclusively engaged in the production of iron and salt; 20 mines, 39 blast furnaces, and 8 salines produce annually 2,500,000 cwts., valued at about $3,500,000. The manufacturing industry, supported

by the copious water-power, is flourishing and steadily progressing. Noteworthy are the flax spinning and weaving establishments, the manufactures of iron goods and other metal ware—especially represented by the machine-factories of Stuttgart and Esslingen—the tileworks and manufactures of earthenware, glass, and chemicals, the rapidly-developing cotton manufactures, the dyeworks, the old, celebrated wool manufactures, the tanneries, the sugar-refineries, the manufactures of paper, tobacco, wooden ware, etc. The commerce is mostly confined to the country itself; the traffic with other countries shows a greater exportation than importation. The most important commercial places are Heilbronn, Cannstadt, Ulm, Friedrichshafen, Stuttgart, Reutlingen, and Tuttlingen. The principal articles of export are corn, cattle, wood and wooden ware, wool and woollens, cotton goods, salt, metal ware, fruit, and wine; and of import, colonial ware, cotton, coal, fancy articles, etc. The navigation on the Neckar, Tauber, Danube, and the minor streams, as well as on Lake Constance, is very lively, and the country is well provided with good roads and railways. In 1875 there were 1227 kilomètres of railway in operation. In 1874 the postal department comprised 488 offices, despatched 18,778,788 letters, 909,180 postal-cards, 3,527,946 official communications, 274,590 sample-cards, and 3,224,754 printed matter; total, 26,715,258 articles, besides 25,343,943 newspapers. The receipts amounted to 10,086,945 marks, the expenses to 9,972,374. At the end of 1874 the telegraph had 303 stations, 2414 kilomètres of line, 5620 kilomètres of wire, and carried 861,728 despatches; expenses, 459,612 marks; receipts, 437,337. The educational standard of the country is good. There are numerous elementary schools, and education is compulsory. There are 85 realistic and 76 Latin schools, 7 gymnasiums, 4 lyceums, 3 Roman Catholic and 5 Evangelical seminaries, a university at Tübingen, an agricultural academy at Hohenheim, a military school at Ludwigsburg, a veterinary school, a polytechnic school, an art school, an architectural school, a music conservatory at Stuttgart, and numerous industrial schools. Among the benevolent institutions there are 2 orphan asylums, 4 asylums for the deaf and dumb, and 2 for the blind. The population belongs in the southern part to the Alemannian, in the central to the Suabian, and in the north-eastern to the Frankish race. According to creed, 68 per cent. is Evangelical and 30 Roman Catholic; there are about 12,000 Jews and 4000 belonging to other denominations. The government is a constitutional monarchy. The crown is hereditary also in the female line. The constitution dates from Sept. 25, 1819. The representation consists of two chambers. The first chamber, the chamber of the peers, contains 45 members, of whom 36 are members by birth, and 9 are chosen for life by the king. The second chamber contains 93 members, chosen for six years—13 by the nobility, 6 by the Evangelical and 3 by the Roman Catholic clergy, 1 by the university, 7 by the cities, and 64 by the rural communities. The state council consists of the chiefs of the ministries and such persons as the king may see fit to call. There are six ministries—of justice, the interior, public education and worship, finance, war, and foreign affairs, but the two last are of little importance, as all military and diplomatic affairs are under the authority of the German empire. The military force forms the 13th corps of the German imperial army; it is commanded by a Prussian general and is under the inspection of the crown prince of the German empire; the other officers are appointed by the king. With respect to the finances, the budget of 1875–76 showed the following items (in marks): receipts, from domains, forests, mines, etc., 21,227,836; railways, post, telegraphs, etc., 40,120,529; direct taxes, 10,100,575; indirect taxes, 11,171,175, etc.; total brutto, 102,713,363, netto, 44,337,267. Expenses: royal appanage, 1,836,683; public debt, 15,892,766; pensions, 1,244,732; justice, 3,159,175; interior, 2,610,553; contributions to the imperial chest, 5,801,276. In 1875 the public debt amounted to 290,394,087 marks, of which 233,000,000 were borrowed for the construction of railways. For administrative purposes the country is divided into four circles—Neckar, Scharzwald, Danube, and Jaxt. Cap. Stuttgart.

*History.*—In olden times Würtemberg was occupied by the Sueves, a Germanic race. Afterward it came under Roman authority, and out of the Roman colonies grew up the cities. At the period of the great migration the Alemanni penetrated into the country. In 496 the Franks defeated the Alemanni, and about 900, under the German emperors of the Carlovingian dynasty, the duchy of Suabia was formed. The family of the counts of Würtemberg first appears in the eleventh century, but it soon enlarged its possessions in the country. The most remarkable of these counts was Eberhard VII., who was made a duke in 1495. In 1520, Würtemberg came under the dominion of Austria, but only for a short time. In 1633 the country entered into an alliance with Sweden against Austria, and was fearfully devastated by the imperial troops. It also suffered much from the French troops under Melac (1688–92), and still more from Duke Eberhard Ludwig and his concubines (1693–1733). In 1796 it became implicated in a war with France, and was compelled to cede Mömpelgard, but in 1803 Duke Frederick II. Wilhelm Carl received as a compensation the electoral dignity and extensive territories, which were formed into a particular division of the state and called Neu-Würtemberg. On Oct. 5, 1805, an alliance was concluded with Napoleon I., and on Jan. 1, 1806, the elector was made a king and his country much enlarged. The kingdom became a member of the Rhenish confederacy, and on May 14, 1809, Ulm, Mergentheim, etc. were added to it, but it had to furnish an army of 18,000 men for the campaign in Russia. By the Treaty of Fulda (Nov. 2, 1813) Würtemberg broke its alliance with France and joined the other German princes against Napoleon, having all its new and old possessions guarantied by the allies. King William (1816–64) gave the constitution of Sept. 25, 1819, but pursued a particularistic policy, though leaning toward Austria. His successor, Carl, married to a daughter of Nicholas I. of Russia, sided with Austria in the war of 1866, and the Würtemberg army corps was defeated (July 24) at Tauberbischofsheim. On Aug. 13 peace was concluded with Prussia. Würtemberg paid 8,000,000 florins in war indemnities, and formed an offensive and defensive alliance with Prussia, agreeing to reorganize its army after the Prussian model. On Nov. 25, 1870, it joined the other German states in the formation of the German empire.

AUGUST NIEMANN.

**Wurts'boro',** p.-v., Mamakating tp., Sullivan co., N. Y. P. 797.

**Wurtz** (CHARLES ADOLPHE), b. at Strasbourg Nov. 26, 1817; studied medicine and chemistry in his native city; settled at Paris in 1843; was appointed professor of medical chemistry at the Institute in 1854, and received in 1865 the biennial prize of 20,000 francs. Besides contributions to the *Annales de Chimie et Physique* and the *Répertoire de Chimie pure*, which he has edited since 1858, he has published *Traité élémentaire de Chimie médicale* (3 vols., 1864–65), *Leçons élémentaires de Chimie moderne* (1866–68), *Dictionnaire de Chimie pure et appliquée* (1868), etc. Selections from his works have been translated into English—*Chemical Philosophy according to Modern Theories* (1867) and *Theory from the Age of Lavoisier* (1869).

**Wurtz** (HENRY), A. M., b. at Easton, Pa., June 5, 1828; graduated at Princeton 1848; studied at the Lawrence Scientific School at Cambridge, Mass., and also privately under Prof. John Torrey of New York, giving his chief attention to chemistry; became in 1850 assistant in charge of the laboratory of the Yale (now Sheffield) Scientific School at New Haven, Conn.; was State chemist of New Jersey 1854–56, being also engaged on the geological survey of that State; was subsequently professor of chemistry in Queen's College, Kingston, Canada, professor in the National Medical College at Washington, D. C., 1858–59, and chemical examiner in the U. S. patent-office 1858–61; edited the *American Gas-Light Journal* 1871–75; has made several important discoveries in chemistry, among which are the use of sodium in the amalgamation of the ores of precious metals, the determination of alkalies in silicates by fusion with chloride of sodium (presented to the American Association 1850), and, above all, the discovery of the geometrical laws of the condensation of chemical molecules, first published in 1876, which will have important results in the reconstruction of the sciences of chemistry and chemical physics upon an exact basis. (For some account of the latter discovery see his articles VOLUMES, MOLECULAR, WATER OF CRYSTALLIZATION AND OF CONSTITUTION, and WOOD-SPIRIT, in this *Cyclopædia*.) Prof. Wurtz has published more than 60 scientific papers, a partial list of which may be found in Prof. B. Silliman's account of the labors of American chemists, prepared for the Priestley Centennial celebration (1874). He is also the originator of the *dynamic theory of metamorphic heat* in geology, having communicated the same to the American Association ten years since—in 1866. Of this Mallet's *theory of vulcanicity* is only an extreme case. (See article METAMORPHISM in this work.) PORTER C. BLISS.

**Würz'burg,** town of Bavaria, on the Main, which here is crossed by a splendid stone bridge of eight arches, was formerly the capital of the bishopric of Würzburg, which until 1803, when it was secularized and its territory conferred on the elector of Bavaria, formed an independent and very wealthy ecclesiastical principality of Germany. The episcopal palace, built in 1720, is one of the most magnificent royal residences of Europe. The cathedral, built in the eleventh century, is an elegant edifice. The univer-

sity, with which are connected a magnificent hospital and a library of 100,000 volumes, enjoys a great reputation, especially for its medical department. Besides its university, the city has many other good educational institutions, and manufactures of leather, tobacco, cloth, woollen fabrics, and surgical and mathematical instruments. The vicinity produces very fine wine. P. 40,005. ✓

**Wurz'en,** town of Germany, kingdom of Saxony, on the Mulde, has large bleaching establishments and manufactures of linen, hosiery, felt, paper-hangings. P. 6408.

**Wutt'ke** (HEINRICH), b. at Brieg, Silesia, Feb. 12, 1818; studied history at the University of Breslau; began to lecture in Leipsic in 1841; took part very energetically in politics; wrote against the Poles, the Danes, etc.; was appointed professor of history at Leipsic in 1848, and published, besides numerous minor essays, *Erdkunde und Karten des Mittelalters* (1854), *Die Völkerschlacht bei Leipzig* (1863), *Die deutschen Zeitschriften und die Entstehung der öffentlichen Meinung* (1866), *Denkschrift über das geistige Eigenthum* (1866), etc.

**Wyacon'da,** tp., Clarke co., Mo. P. 885.

**Wyaconda River** rises in Davis co., Ia., and after a S. W. course flows into the Mississippi at La Grange, Mo.

**Wyalu'sing,** p.-v. and tp., Bradford co., Pa. P. 1707.

**Wyalusing,** p.-v. and tp., Grant co., Wis. P. 800.

**Wyandot',** county of N. W. Ohio, traversed by Sandusky River and by several railways, and has a level surface, partly wooded and partly prairie. Staple productions, wheat, Indian corn, butter, wool, and hay. Sheep are numerous. Area, 350 sq. m. Cap. Upper Sandusky. P. 18,553.

**Wyandot Indians.** See HURONS.

**Wyandotte',** county of N. E. Kansas, separated from Missouri by Missouri River, intersected by Kansas River, and traversed by Kansas Pacific and Missouri Pacific R. Rs.; surface varied and well timbered, soil fertile. Cattle and swine are the chief live-stock. Staples, Indian corn, wheat, potatoes, and hay. Cap. Wyandotte. Area, 155 sq. m. P. 10,015.

**Wyandotte,** tp., Butte co., Cal. P. 731.

**Wyandotte,** p.-v. and tp., cap. of Wyandotte co., Kan., at the confluence of Missouri and Kansas rivers, on a gently undulating slope rising 250 feet above the surface of the rivers; is connected with Kansas City, Kan., by two free bridges, and is within 15 minutes' walk of the union dépôt at Kansas City, Mo. Wyandotte contains 8 churches, an academy and parochial school under the auspices of the Roman Catholic Church, a public library, a State blind asylum, 2 public schools, 2 banks, 3 hotels, 3 grist-mills, 2 public halls, and 2 weekly newspapers. It is the sixth city in population and importance in Kansas. Its prosperity and importance are derived from the machine-shops of Kansas Pacific R. R., the Kansas stock-yards, the Kansas rolling-mills, the immense pork and beef packing-houses, and large cooper-shops located in its outskirts, which give employment to hundreds of machinists, mechanics, artisans, and laborers. Nine railroads centre within 15 minutes' walk of its business-centre. It has 2 street-railways,—1 in operation and 1 in course of construction. It is underlaid with coal, two veins of which have been tested and will pay to mine. The pipes are being laid to utilize the gas which flows from a natural gas-well discovered in boring for coal, and from which 20,000 cubic feet of gas escape every hour; the company expects to be able to supply the city with sufficient gas for all heating and illuminating purposes by the 1st of Sept., 1876. A joint-stock company has been chartered to utilize the water-power afforded by Kaw River, which will afford abundant power for mechanical and manufacturing purposes, a preliminary survey showing a fall of 15 feet in 3 miles. It is surrounded by one of the richest and best agricultural districts to be found in the Missouri Valley, while the climate is peculiarly adapted to fruit-growing. P. of v. 2940; of tp., exclusive of city, 1851. V. J. LANE, EDITOR "HERALD."

**Wyandotte,** city, Wayne co., Mich., on Canada Southern and Lake Shore and Michigan Southern R. Rs., and on Detroit River, 12 miles below Detroit, contains 7 churches, large brick union and ward school-houses, 2 newspapers, 1 savings bank, extensive rolling-mills and blast furnaces, an iron shipyard, large silver-smelting works, and several saw-mills; incorporated 1867. P. 2731.

HENRY A. GRIFFIN, ED. "WAYNE COUNTY COURIER."

**Wyandotte Cave,** in Jennings tp., Crawford co., Ind., 5 miles N. of Leavenworth, a town on the Ohio River. The cave is in the St. Louis limestone, and is the rival of the Mammoth Cave in extent and grandeur. It has been explored for 22 miles (including the side-galleries), and numerous diverging branches have not yet been measured. It excels the Mammoth Cave in the number and variety of its stalagmites and stalactites, and in the size of some of its chambers, one of which is 350 feet long and 245 feet high, containing a hill 175 feet high, on which are three fine stalagmites. It has, however, no such large bodies of water as the Mammoth Cave. It has a rich cave-fauna, consisting chiefly of articulate organisms. Epsom salts, nitre, and alum have been procured from the earth of this cave.

**Wyanet',** p.-v. and tp., Bureau co., Ill. P. 1750.

**Wy'att** (Sir FRANCIS), b. in England about 1575; was governor of the colony of Virginia 1621–26, and again 1639–41; waged a protracted war with the Indians, and established the first courts of justice. D. at Bexley, England, in 1644.

**Wyatt** (JAMES), R. A., b. at Burton Constable, Staffordshire, England, Aug. 3, 1746; accompanied Lord Bagot, minister to Rome, 1760; studied architecture there and at Venice; returned to England about 1766; was the architect of the famous Pantheon in Oxford street, London, 1770–72; built many country-seats for the nobility and gentry, especially the famous Fonthill Abbey of Beckford, 1795; succeeded Sir William Chambers as surveyor-general to the board of works 1796; built the military academy at Woolwich 1796; designed the House of Lords 1800; made alterations in Windsor Castle, and erected a Gothic palace for George III. at Kew, now demolished. In 1802 he succeeded West as president of the Royal Academy. D. Sept. 5, 1813.

**Wyatt** (MATTHEW COTES), b. in England in 1775; educated at Eton; showed an early talent for the arts of design; was employed when only nineteen years of age by George III. in the execution of a cenotaph to Princess Charlotte in St. George's chapel; became an eminent sculptor, producing the monument of Nelson at Liverpool, that of the duchess of Rutland at Belvoir Castle, the equestrian statues of the dukes of York and Wellington, and the horse for the statue of George III. in Pall Mall. One of his finest specimens was his *Bashaw*, the favorite Newfoundland dog of the earl of Dudley. D. at Paddington Jan. 10, 1862.

**Wyatt** (Sir MATTHEW DIGBY), F. S. A., b. at Bowle, Wiltshire, England, in 1820; educated at Devizes; studied architecture in the office of his brother Thomas in London, and also at the Royal Academy; gained a prize from the Architectural Society for an essay when only sixteen years of age; spent two years on the Continent 1844–46, examining the monuments of art and antiquity in France, Germany, and Italy, publishing in fac-simile on his return a series of studies from churches; arranged and decorated the New Adelphi Theatre 1848; was employed by the Society of Arts to report upon the Exposition of Industry at Paris 1849; was associated as secretary with those members of the Society of Arts who originated the project of the Universal Exposition held at London in 1851, the appointment being confirmed by the royal commission; assisted Messrs. Paxton, Cubitt, Fox, and Owen Jones in settling the general plan of the Crystal Palace in Hyde Park, and superintended its erection; received for his services a gold medal from Prince Albert and a testimonial worth £1000 from the royal commission; was associated with Brunel in designing the Paddington station of the Great Western Railway and in other works; superintended the fine arts department and the decorations of the Crystal Palace at Sydenham 1852–54, visiting various parts of Europe to collect works of art; published guidebooks to that exposition; was one of the jurors of the French International Exposition of 1855, for which he had selected and arranged (with Dr. Royle) the contributions of the East India Company, and was reporter to the British government upon the department of decorative art; was created by Napoleon III. a knight of the Legion of Honor; became surveyor to the East India Company Dec., 1855, for which he made designs for great public works in India and for several important buildings in England; performed the confidential and laborious duties of superintending the transfer to the Crown of the vast properties owned by that corporation at the date of its dissolution in 1859; has since been architect to the council of India; has erected or restored many noble mansions for private individuals; was honorary secretary to the Royal Institute of British Architects 1855–59; was a commissioner of the Society of Arts to the Italian Exposition of Industry; was prominently connected with the British Universal Exposition of 1862; received Her Majesty's gold medal for architectural excellence 1866; was knighted Jan. 14, 1869, and was Slade professor of fine arts at Cambridge for the first term of three years, 1869–72. Author, among other works, of *Geometrical Mosaics of the Middle Ages* (1848), *Industrial Arts of the Nineteenth Century* (2 vols., 1851), *Metal-Work and its Artistic Design* (1852), *Notices of Sculpture in Ivory, etc.* (1856), *Art-Treasures in the United Kingdom* (1857), *What Illuminating Was*

—*What it Should Be* (1861), *Slade Lecture on Fine Art* (1870), and *An Architect's Note-Book in Spain* (1872).

**Wyatt** (Richard James), b. in London, England, May 3, 1795; was apprenticed at an early age to Charles Rossi, an eminent sculptor, with whom he remained seven years, studying meanwhile at the Royal Academy and gaining two medals; spent some time in Paris in the studio of Bozio 1820–21, and in the latter year entered the studio of Canova at Rome, where he gained considerable reputation, and resided until his death, May 28, 1850. Among his most noted productions are—*Ino and the Infant Bacchus*, *Glycera*, *Musidora*, two *Nymphs*, and a *Penelope* executed for Queen Victoria.

**Wyatt** (Sir Thomas), b. at Allington Castle, Kent, in 1503, son of Sir Henry (d. 1538), a prominent friend of Henry VII.; educated both at Oxford and at Cambridge, where he graduated at St. John's College 1518; made the tour of Europe; married Eleanor, daughter of Lord Cobham; became a gentleman of the king's bed-chamber; took part in a famous tournament before the king at Greenwich, Christmas, 1525; gained a high reputation at court by his poems, his skill at arms, in music, and in repartee, and his knowledge of continental languages; officiated for his father as "ewerer" at the coronation of Anne Boleyn July, 1533; soon fell into disfavor with the king on her account; was tried for seditious language, but acquitted and restored to favor; was knighted by the king Mar. 18, 1536; was made high sheriff of Kent early in 1537; was sent as minister to Spain Apr., 1537, and again along with Bonner in May, 1538; accompanied Charles V. to Nice in June; returned to England June, 1539; was accused by Bonner of treasonable correspondence with Cardinal Pole, but maintained his favor at court; was sent as ambassador to Charles V., whom he accompanied in his journey in France Dec., 1539; resided at the imperial court while at Brussels and at Ghent, and aided Cromwell in promoting the match between the king and Anne of Cleves (1540), thereby losing the favor of Henry; was involved in the fall of Cromwell, thrown into prison, and tried on the old charges brought by Bonner, but acquitted June, 1541; again recovered the royal favor; was created high steward of the king's manor of Maidstone, and received valuable grants of lands. D. at Sherborne Oct. 11, 1542. He left a considerable number of poems, which were published together with those of his friend the earl of Surrey 1557, and frequently reprinted. He was also an accomplished prose-writer, as shown by his state papers and his letters to his son. Among recent editions of his *Poems*, those of Gilfillan (1858) and of Robert Bell (1866) are the best. The best edition of his *Complete Works* is that of Rev. Dr. George F. Nott, along with those of Surrey (2 vols., 1815–16), with notes and a glossary.

**Wyatt** (Sir Thomas), called the Younger, only son of the above, b. at Allington, Kent, about 1521; married at the age of sixteen; succeeded to his father's titles and estate 1542; led for some time a life of reckless dissipation; was imprisoned in the Tower Apr., 1543, for riotous conduct in the streets of London, along with the earl of Surrey; was soon released; raised a body of soldiers at his own expense and took part in the siege of Landrecies 1544; commanded the English forces at Boulogne 1545, and was subsequently second in command there under Surrey, remaining there until that place was surrendered to the French 1550; lived in retirement at Allington until the accession of Mary, when he was involved with the duke of Suffolk in a conspiracy against her in favor of Lady Jane Grey; assembled a body of Kentish men under pretext of resisting Mary's marriage with Philip II.; took Rochester Castle Jan. 16, 1554; was joined by the forces sent against him under the duke of Norfolk Jan. 29; marched upon London and entered Southwark Feb. 3; retired to Kingston Feb. 6; returned to London, and attempted to surprise Ludgate Feb. 7; was captured in Fleet street; was tried and condemned to death Mar. 15, behaving with little self-control and implicating the princess Elizabeth and others in his confessions. He was executed on Tower Hill Apr. 11, 1554. His ill-judged movement proved fatal to Lady Jane Grey, who had been some months in prison, and was brought to the block a week after the attempt upon the city.

**Wy'atville** (Sir Jeffrey), originally Wyatt, b. at Burton-upon-Trent, England, Aug. 3, 1766, was a nephew of James Wyatt, under whom he studied architecture; was for many years engaged as a building contractor; was selected by George IV. in 1824 to remodel Windsor Castle, a task which employed him the remainder of his life; changed his name to Wyatville 1824, and was knighted 1828. D. at Windsor Feb. 18, 1840, and was buried in St. George's chapel. Among the mansions he designed or altered are Chatsworth, Longleat, Wollaton, and Ashridge halls. His great work, *Illustrations of Windsor Castle* (2 vols. columbier folio, 1841), was posthumously edited by Henry Ashton. Sir Jeffrey had spent £3000 upon the drawings and engravings connected with that work.

**Wych'erley** (William), b. at Clive, near Shrewsbury, England, about 1640; educated at Angoulême, France, where he became a Roman Catholic; returned to England 1660; studied at Queen's College, Oxford, where he conformed to the Church of England; was entered at the Middle Temple, London, but never called to the bar; produced with success in 1672 his play, *Love in a Wood, or St. James's Park*, which procured him the patronage of the duchess of Cleveland, who introduced him at court; was favored by the duke of Buckingham and by the king, who afforded him employment at court; brought out three other plays, *The Gentleman Dancing-Master* (1673), *The Country Wife* (1675), and *The Plain-Dealer* (1677); married clandestinely, about 1680, the countess-dowager of Drogheda, who soon died, leaving him her fortune, which, however, was disputed at law by her relatives, and having lost favor at court was several years a prisoner for debt in the Fleet until after the accession of James II., by whom his debts were paid and a pension of £200 settled upon him; succeeded to his paternal estates soon after, and published dull volumes of *Poems* (1704), corrected by Pope. D. in London Jan. 1, 1715. His *Posthumous Works* (1728) were published by Theobald, and his collected *Plays* (1712) were edited by Leigh Hunt in 1840, in connection with those of Congreve, Vanbrugh, and Farquhar. They are chiefly notable for licentiousness.

**Wyck'off** (Isaac Newton), D. D., b. at Hillsborough, N. J., Aug. 29, 1792; graduated at Rutgers College 1812; taught in academies in New York City and at Somerville and New Brunswick, N. J., pursuing also a course of theological studies in the seminary at the latter place, where he graduated 1817; was pastor of the First Dutch Reformed church at Catskill, N. Y., 1818–36, and of the Second Reformed church in Albany from 1836 to his death, Mar. 28, 1869. He was an eloquent preacher, an active worker in benevolent and charitable enterprises, received over 1000 communicants into his church, published many occasional sermons and addresses, and rendered great assistance to Dr. W. B. Sprague in his *Annals of the American Pulpit*.

**Wyckoff** (William H.), LL.D., b. in New York City Sept. 10, 1807; studied two years at Hamilton College; graduated at Union College 1828; was for many years from 1828 principal of the classical department of a collegiate school in New York City, in which he became a partner; fitted for Columbia College and New York University a larger number of students than any other private institution; was the founder and editor for several years (1839–46) of the *Baptist Advocate* (now the *Examiner*); was for many years president of the Young Men's City Bible Society and of the Baptist Domestic Mission Society; aided in the organization of the American and Foreign Bible Society 1835, and of the American Bible Union 1850; was corresponding secretary of the former 1846–50, and of the latter 1850–77, and was called to the ministry by the Laight street Baptist church 1846. Author of *The Bible Question, or the American Bible Society and the Baptists*; *The Bible, its Excellence*; *Rollin's Ancient History, condensed for Schools*; *The Bible Primer*; *The Early Guide to Knowledge*, and other religious or educational works, and was joint author with Rev. Dr. Everts of a *Scripture School-Reader*.

**Wyc'liffe, Wickliffe,** or **Wiclif, de** (John), b. at Sprewsel, in the parish of Wycliffe, near Old Richmond, Yorkshire, England, about 1324; was one of the original students of Queen's College, Oxford, upon its foundation by Queen Philippa in 1340; soon removed to Merton College, then the leading one at Oxford, and resided there many years; took orders as a priest; is supposed to have published in 1356 his first work, *The Last Age of the Church*, in which he argued that the millennium was past, that the world was then under the reign of Satan and of Antichrist, and that the day of judgment was near at hand; was soon led to identify the papacy with Antichrist; maintained about 1360 a vigorous polemic against the mendicant orders of preachers, who had begun to abound in England, and whom he accused of profligacy, of false doctrine, and of undermining the influence of the regular clergy; was chosen warden or master of Baliol Hall (now College) 1361; was in May of the same year presented by his college to the rectory of Fylingham (or Fillingham), Lincolnshire, which he subsequently (Nov., 1368) exchanged for that of Ludgershall, Buckinghamshire; took his degree of D. D., and began to read lectures on divinity at Oxford about 1363; was appointed warden of Canterbury Hall by its founder, Archbishop Islip, 1365, under a new arrangement which excluded monks from membership; was soon unseated by Archbishop Langham, the successor

of Islip; appealed to the pope, by whom an adverse decision was rendered seven years later; was appointed chaplain to King Edward III., and wrote against the papal demand for arrears of tribute from the English Crown 1365; was one of six commissioners sent in Aug., 1374, by Edward III. to Bruges to confer with the papal delegates upon questions of ecclesiastical authority in England; remained abroad nearly two years; was during his absence presented by the king with a prebend in the collegiate church of Westbury, Gloucestershire (Nov., 1375), and with the rectory of Lutterworth, Leicestershire (1376), probably through the influence of John of Gaunt, duke of Lancaster, whose acquaintance he seems to have made at Bruges; began to attack the pretensions of the papacy with great vigor; was accused of heresy by Archbishop Courtney, and summoned before a convocation of the clergy at St. Paul's, London; was attended thither (Feb. 19, 1377) by the two most powerful subjects of the kingdom, John of Gaunt and Henry Percy, the earl-marshal, whose defence of Wycliffe gave rise to a popular tumult in which the Savoy palace, the residence of the former prince, was attacked; was directly accused of heresy in four bulls issued by Pope Gregory VI. May, 1377, by virtue of which he was cited before a clerical synod at Lambeth early in 1378; was saved from active persecution by the intervention in his behalf of the queen-mother, and especially by the breaking out in that year of the great papal schism; was consequently allowed to depart with an admonition to refrain from preaching the obnoxious doctrines; was supported by the chancellor and many of the officers of Oxford University, and by a great part of the nation; began about this time to send out many disciples, who under the name of "poor priests" preached his doctrines in all parts of the kingdom; prepared with the assistance of his pupils a version of the entire Bible into English, which was rapidly disseminated among the people; lectured at Oxford against transubstantiation 1381, and was condemned by a synod of twelve doctors; was summoned before a clerical convocation at Oxford 1382, when he defended his opinions, presenting two confessions of faith in which they were reaffirmed, but in a conciliatory manner; was debarred by royal command from lecturing further at Oxford; retired to his living at Lutterworth, where he continued preaching and writing controversial and expository treatises until his death, which ensued two days after suffering a stroke of paralysis (Dec. 29) while celebrating mass. D. Dec. 31, 1384. His doctrines had many supporters in England (known as Wycliffites) for two generations, and being carried to Bohemia by the members of the suite of Queen Anne, gave rise there to the formidable Hussite movement. His opinions coincided in great part with those of Luther and Calvin, and he is justly called "the morning-star of the Reformation." The Council of Constance, as a preliminary to the martyrdom of John Huss and Jerome of Prague, examined and condemned forty-five articles of the doctrines of Wycliffe (May 5, 1415), formally declared him a heretic, and ordered his bones to be removed from consecrated ground and cast upon a dunghill. This sentence was not executed until thirteen years later, when, on the demand of the anti-pope Clement VIII., his remains were burned and the ashes thrown into the Swift, a tributary of the Avon. Wycliffe's writings were very numerous, more than 200 pieces being ascribed to him, chiefly brief tracts. Few of them were printed until recently, and many are still unpublished. His translation of the Bible was first edited by Rev. Josiah Forshall and Sir Frederick Madden for the University of Oxford (4 vols., 1850). His *Last Age of the Church* (Dublin, 1840) was edited by James Henthorne Todd, D. D., who also issued his *Apology for Lollard Doctrines* (1842) and his *Three Treatises* (1851). A collection of his English *Tracts and Treatises*, with *Selections and Translations from his Latin Works* (1845), was edited for the Wycliffe Society by Robert Vaughan, D. D., who was the author of the best biography of the Reformer (2 vols., 1828; new ed. 1853). His *Select English Works* (3 vols., 1871) have been edited by T. Arnold, and a *Life* by Lechler has recently appeared in Germany (Leipsic, 1873). (See also Rev. W. W. Shirley's *Catalogue of the Original Works of John Wiclif*, Oxford, 1865.) PORTER C. BLISS.

**Wycliffites.** See WYCLIFFE.

**Wycon'dah,** tp., Davis co., Ia. P. 1641.

**Wydeville,** or **Woodville.** See RIVERS, EARL OF.

**Wye River,** in Maryland, is an arm of Chesapeake Bay, extending for some distance between Queen Anne and Talbot cos. It divides into two navigable branches, the Front Wye and the Back Wye, which include Wye Island and the peninsula called Wye Neck.

**Wyke'ham, William of,** b. at Wykeham or Wickham, Hampshire, England, in 1324, of poor parents; was educated at Winchester School through the care of Nicholas Uvedale, governor of Winchester Castle; became private secretary to his patron, by whom he was recommended to the notice of Edward III., who received him into his service as clerk of the royal works then being carried on at Henley and at Yethampstead May, 1356; became "chief keeper and surveyor of the castles of the king at Windsor, Leeds, Dover, and Hadlee" Oct. 30, 1356; was virtually the architect of Windsor Castle, which was built under his eye, as also of Queensborough Castle in the Isle of Sheppey; took holy orders; became rector of Pulham, Norfolk, 1357, prebendary of Lichfield 1359, of London and Southwell 1361, of Lincoln 1362, of York Mar., 1363, and archdeacon of Northampton and of Lincoln the same year; was appointed keeper of the privy seal 1364, secretary of state 1366, bishop of Winchester 1367; was lord chancellor 1367–71; founded St. Mary's College at Winchester and New College, Oxford, 1373; was deprived of the temporalities of his see and excluded from Parliament 1376, but restored on the accession of Richard II. (1379); completed his munificent foundation at Oxford 1386; was again chancellor 1389–91, and rebuilt Winchester cathedral 1395–1405. D. at South Waltham Sept. 24, 1404. A splendid monument was erected to his memory in Winchester cathedral. (See *Three Chancellors —Lives of Wykeham, Waynflete, and Sir Thomas More* (1860), an interesting work by an anonymous writer.)

**Wy'lie** (ANDREW), D. D., b. in Washington co., Pa., Apr. 12, 1789; graduated at Jefferson College 1810; was licensed as a Presbyterian preacher 1812; was president of Jefferson College 1812–16, of Washington College 1817–28, and of Indiana University from 1828 to his death, at Bloomington, Ind., Nov. 11, 1851. In 1841 he took orders in the Episcopal Church. Author of an *English Grammar* (1822) and other publications.

**Wylie** (JAMES AITKEN), LL.D., b. in Scotland about 1810; received a classical education; became a distinguished minister of the Scottish Church; travelled or resided a considerable time in Italy, Spain, and the East, and is author, among other works, of *Modern Judea* (1841), *Ruins of Bible Lands* (1845), *A Pilgrimage from the Alps to the Tiber* (2d ed. 1855), *Wanderings and Musings in the Valleys of the Waldenses* (1858), *The Ter-Centenary of the Scottish Reformation* (1860), *The Awakening of Italy and the Crisis of Rome* (1866), *The Road to Rome viâ Oxford* (1868), and *Daybreak in Spain, a Sketch of Spain and its New Reformation* (1870).

**Wylie** (SAMUEL), D. D., b. in Ireland about 1792; came to the U. S. when a lad; was educated under the supervision of his uncle, Rev. Dr. D. B. Wylie of Philadelphia; graduated at the University of Pennsylvania and at the theological seminary of the Reformed Presbyterian Church; was ordained 1818; and acted as a home missionary until 1820, when he was settled as pastor of a church at Sparta, Randolph co., Ill., where he remained fifty-two years, until his death Mar. 20, 1872. He was an able and eloquent preacher, and wielded great influence in his denomination, above a dozen churches having been formed from the nucleus of his original congregation.

**Wylie** (SAMUEL BROWN), D. D., b. at Moylarg, near Ballymena, Ireland, May 21, 1773; graduated at the University of Glasgow 1797; came to Philadelphia, Pa., the same year; became tutor in the University of Pennsylvania 1798, and in 1801 pastor of the First Reformed Presbyterian church in that city, filling that post fifty-one years; conducted a private academy for many years; was a professor in the theological seminary of the Reformed Presbyterian Church 1809–51; professor of ancient languages in the University of Pennsylvania 1838–45, and vice-provost of that institution 1838–45; was an eminent classical and Oriental scholar, and co-editor of the *Presbyterian Magazine* 1821–22. D. at Philadelphia Oct. 14, 1852. Author of *The Faithful Witness for Magistracy and Ministry upon a Scriptural Basis* (1804), a *Greek Grammar* (1838), a *Life of Rev. Alexander Macleod, D. D.* (1855), and other publications.

**Wylie** (THEODORE W. J.), D. D., son of Dr. Samuel Brown, b. at Philadelphia in 1818; graduated at the University of Pennsylvania 1836; became associate pastor with his father over the First Reformed Presbyterian church 1843, and has been pastor since 1852; was at several periods professor in the theological seminary of his Church; has edited the *Missionary Advocate* 1838–41 and the *Banner of the Covenant* 1845–55, and is author of an *English, Latin, and Greek Vocabulary* (1839) and other publications.

**Wylie's,** tp., Marion co., Ala. P. 400.

**Wyl'lys** (GEORGE), b. at Fenny Compton, Warwickshire, England, about 1590; settled at Hartford, Conn., 1638; was an assistant 1639, deputy governor 1641, and

governor 1642. D. at Hartford Mar. 9, 1645.—His son SAMUEL, b. in England in 1632, graduated at Harvard 1653; was an assistant governor 1654–84. D. at Hartford May 30, 1709.

**Wyllys** (SAMUEL), a descendant of Gov. George, b. at Hartford, Conn., Jan. 15, 1739; graduated at Yale College 1758; was lieutenant-colonel of Spencer's regiment, and colonel of a regiment at the siege of Boston 1775; served through the war as colonel in the Connecticut line; became afterward general of militia, and was secretary of state 1795–1809. D. at Hartford June 9, 1823.—His grandfather, HEZEKIAH (d. 1641), became secretary of Connecticut colony in 1712, and transmitted it in 1734 to his father, GEORGE (1710–96), who held it until 1795. The three generations thus held that office for ninety-eight consecutive years.

**Wy'man** (JEFFRIES), M. D., b. at Chelmsford, Mass., Aug. 11, 1814; graduated at Harvard 1833, and at the Harvard Medical School 1837; became demonstrator of anatomy and curator of the Lowell Institute 1839, before which he delivered a course of lectures 1840; spent two years in Europe, studying medicine in the hospitals of Paris and natural history in the Jardin des Plantes; was professor of anatomy in the Hampden-Sidney Medical College at Richmond, Va., 1843–47, and from the latter date until his death Hersey professor of anatomy in Harvard University. He soon began the formation of the Museum of Comparative Anatomy, to the increase of which he devoted most of his energies for many years, making extensive journeys; delivered before the Lowell Institute in 1849 a second course of *Lectures on Comparative Anatomy and Physiology* (1849); became professor of comparative anatomy in the Lawrence Scientific School at Cambridge; was successively secretary of the Boston Society of Natural History, its curator in different departments, and its president 1856–70; was president of the American Association for the Advancement of Science 1857; became curator of the Peabody Museum of Archæology at Cambridge 1866, and laid the foundation of its remarkable collections; published over 60 papers in the scientific journals and in the *Transactions* or *Proceedings* of the numerous societies to which he belonged; made the first anatomical investigation of the gorilla, and gave it its scientific name; in conjunction with Dr. Savage investigated the question of spontaneous generation with remarkable carefulness and impartiality; made curious researches in regard to the action of light and polar force in embryology, and especially in teratology; exposed the spuriousness of the famous skeleton called the *Hydrarchus Sillimani*, alleged to be that of an extinct sea-serpent, and discovered in Florida and elsewhere pre-historic human remains in fresh water shell-heaps. He was regarded as among the first of American comparative anatomists. D. at Bethlehem, N. H., Sept. 4, 1874. Among his more important scientific monographs are—*The Osteology of Troglodytes gorilla* (1847), *The Anatomy of the Nervous System of Rana pipiens*, in the *Smithsonian Contributions* (vol. v., 1853), *On the Skeleton of a Hottentot* (1865), *An Unnoticed Fracture of the two Lower Lumbar Vertebræ*, *On the Changes of Bones subjected to Great Heat*, *On the Embryology of Raia batis*, and *Notes on the Cells of the Bee*.

**Wyman** (MORRILL), M. D., brother of Jeffries, b. at Chelmsford, Mass., about 1815; graduated at Harvard 1833, at Cambridge Medical College 1837, and was adjunct Hersey professor of the theory and practice of medicine there 1853–56. Author of *A Practical Treatise on Ventilation* (1846) and other publications.

**Wyman** (R. H.), U. S. N., b. July 18, 1822, in New Hampshire; became lieutenant in 1850, commander in 1862, captain in 1866, commodore in 1872; served on the W. coast of Mexico during our war with that country, and participated in the capture of Vera Cruz. In 1861 commanded the Pawnee at the battle of Port Royal, and in 1862 was many times engaged with the batteries and sharpshooters on the Potomac and Rappahannock rivers while commanding the Potomac flotilla. Highly commended in official despatches. Com. Wyman has been for several years in charge of the hydrographic office, Washington, where he has attained an enviable reputation by his valuable and thorough work. FOXHALL A. PARKER.

**Wynd'ham** (Sir WILLIAM), BART., b. at Orchard Wyndham, Somersetshire, England, in 1687; educated at Eton and at Christ Church, Oxford; made the tour of Europe, and on his return entered Parliament for Somersetshire 1710, which county he represented thirty years; married a daughter of the duke of Somerset; became secretary at war June 18, 1711, chancellor of the exchequer Aug., 1713, and privy councillor Nov., 1713; was dismissed from office on the accession of George I., Oct., 1714; was suspected of treasonable intrigues with Bolingbroke, and charged with supporting the rebellion of the earl of Mar, and committed to the Tower 1715, but never brought to trial, and soon liberated; became the leader of the parliamentary opposition, defending the duke of Ormond and the earls of Oxford and Strafford when impeached by the House of Commons. He was noted for his eloquence. D. at Wells July 17, 1740.—His eldest son, CHARLES, became first earl of Egremont, inheriting that title from a maternal uncle, and became secretary of state 1761. D. in 1763.

**Wynkin de Worde.** See WORDE.

**Wynn** (CHARLES WATKYN WILLIAMS), D. C. L., b. in Montgomeryshire, Wales, about 1770, grandson of George Grenville; was a member of Parliament for that county for the unprecedented term of fifty-three years from 1797; was president of the board of control 1822–28, secretary at war in the Grey administration 1830–31, and subsequently chancellor of the duchy of Lancaster 1834–35. He was an authority upon parliamentary precedents, and was a friend and correspondent of Southey. D. in London Sept. 2, 1850.—His sister FRANCES (1780–1857) kept a voluminous journal, from which was edited by A. Hayward, Esq., an entertaining volume, *Diaries of a Lady of Quality from 1797 to 1844* (1864).

**Wynne** (EDWARD), b. in England in 1734; became an eminent lawyer, and was author of several professional treatises, among which was *Eunomus, or Dialogues concerning the Law and Constitution of England* (4 vols., 1767; 5th ed., 2 vols., 1822), which has been recommended as an introduction to Blackstone's *Commentaries*. D. at Chelsea, near London, in 1784.

**Wynne** (JAMES), M. D., LL.D., b. at Utica, N. Y., in 1814; graduated at the University of New York both in arts and in medicine (1835); practised for some years in Baltimore, and afterward in New York, where he gave special attention to the subject of life insurance, and was lecturer on medical jurisprudence to the New York Medical College. Author of numerous professional and literary essays, of some poems, of an elaborate *Report on the Vital Statistics of the United States* (1857), and of *The Private Libraries of New York*, a magnificently printed monograph.

**Wyn'ter** (ANDREW), M. D., b. at Bristol, England, in 1819; educated at a private school; became a physician; has especially devoted himself to the study of mental diseases; edited the *British Medical Journal* 1845–60, and has contributed to the quarterly reviews and other periodicals, from the pages of which he has collected several volumes of essays—*Curiosities of Civilization* (1860; 8th ed. 1868), *Our Social Bees, Pictures of Town and Country and other Papers* (2 series, 1861–66), *Subtle Brains and Lissom Fingers, being some of the Chisel-Marks of our Industrial and Scientific Progress* (1863; 3d ed. 1868), and *Curiosities of Toil* (2 vols., 1870).

**Wyn'toun** (ANDREW), b. in Scotland about the middle of the fourteenth century; became a canon regular of the priory of St. Andrew's, and was chosen prior of St. Serf's Inch (or Island), Lochleven, before 1395. D. after 1420. Author of *De Orygynale Cronykil of Scotland*, in rhyme, first edited, with notes and a glossary, by David Macpherson (London, 2 vols., 1795).

**Wyoce'na,** p.-v. and tp., Columbia co., Wis. P. of v. 270; of tp. 1281.

**Wyo'ming,** one of the Territories of the Rocky Mountain region, lying between the 41st and 45th parallels of N. lat., and between the 104th and 111th meridians of lon. W. from Greenwich, is bounded N. by Montana, E. by Dakota and Nebraska, S. by Colorado and Utah, W. by Utah, Idaho, and Montana. Its length from E. to W. is 355 miles, its width from N. to S. 276 miles. Its area is 97,883 sq. m., or 62,645,120 acres.

*Topography.*—The main range of the Rocky Mountains, which to the N. constitutes the eastern boundary of the Territory of Idaho, enters Wyoming at the N. W., extending in a south-easterly direction through the Territory into Colorado. The Wind River Mountains are the culminating crests of the main range of the Rocky Mountains in the north-western part of Wyoming, like the Bitter Root Mountains between Idaho and Montana, and the Sierra Madre in Colorado, which form the main continental divides. The Snow Mountains lie E. of the Wind River Range, being a prolongation S. from Montana. This range has the valley of the Yellowstone on the W. and that of the Big Horn on the E. The Big Horn Mountains lie still farther E., also in the northern part of the Territory, between the valley of Big Horn and Powder rivers. The Rattlesnake Mountains are S. of the Big Horn Mountains, near the geographical centre of the Territory. The Black Hills, which constitute the eastern foot-hills of the Rocky Mountains, and which have of late become so famous for Indian battles

and the explorations for gold and for fossils there, occupy part of the eastern section of the Territory, extending from Dakota in a south-westerly direction. Medicine Bow Mountains are in the southern part of Wyoming, between Laramie River and the N. fork of the Platte. The Red Buttes are N. of Medicine Bow Mountains and the Laramie Plains. Independence Rock, near the eastern terminus of the Granite Ridge, is situated between the Rattlesnake and Medicine Bow Mountains, at the confluence of Sweetwater River with the N. fork of the Platte. The Sweetwater Range lies W. of Independence Rock, on the S. side of Sweetwater River; Bishop, Queen, and Horned Mountains E. of Green River, near the southern boundary of the Territory, being spurs of the Sierra Escalante in Colorado. The highest peak in the Territory is Fremont's Peak in the Wind River Range, near lon. 110° W. and lat. 43° 30′ N. The sources of Lewis or Snake River, one of the branches of Columbia River, of the Madison and Big Horn, affluents of Missouri River, and of Green River, one of the largest tributaries of the Colorado of the West, are all about the base of this peak, so that the waters from its slopes fall into the Pacific, the Gulf of Mexico, and the Gulf of California. The Great South Pass over the Wind River Range, which was used by the express lines before the railroad was completed, is 7489 feet above the sea. The Pacific R. R. crosses at Creston, a pass farther S. The whole Territory has an elevation of from 3000 to 8000 feet above the sea; the Laramie Plains, an excellent grazing region of great extent, are from 5000 to 6000 feet above the sea.

*Rivers, Lakes, etc.*—The N. fork of the Platte, with its tributaries, and a few of the smaller affluents of the S. fork of the Platte, drain nearly one-third of the Territory, the central, S. E., and S. S. E. portions; Green River and its tributaries traverse the S. W. section, W. of the Wind River Range; the affluents of Lewis or Snake River are formed in the N. W.; while the tributaries of the Yellowstone, the Big Horn, the Tongue, Powder, Little Missouri, and Shyenne drain the N. and N. E. of the Territory. Most of these rivers and streams flow through deeply-eroded beds or cañons. In the Yellowstone National Park (see YELLOWSTONE NATIONAL PARK), of which the greater part is in this Territory, there are several lakes of considerable size; there are also smaller lakes on the head-waters of Snake and Green rivers.

*Geology and Mineralogy.*—The crests, and indeed the bulk, of the mountain-masses of all the ranges of the Territory are Eozoic, being composed mainly of red feldspathic granite and syenite and gneiss, while the lower slopes are Silurian, forming narrow belts around the higher mountain-slopes. To these succeed the more distinctly fossiliferous formations, Devonian, Carboniferous, Triassic, Jurassic, and Cretaceous rocks succeeding each other in regular order. Between the Big Horn and Wind River ranges the plateau is mainly Carboniferous, Triassic, and Jurassic, with a small tract of Cretaceous groups in the centre. The elevated plains are mostly Cretaceous, but overlaid with Tertiary sands, gravel, and drift, with occasionally extensive deposits of lignite or brown coal. The coal-beds along and near Union Pacific Railway, near Evanston and at Rockspring and Carbon stations, are probably lignite, as they occur apparently in Tertiary deposits; but they differ in appearance and quality from the European lignites, and are equal to most of the better bituminous coals for all purposes of combustion. They contain from 50 to 54 per cent. of fixed carbon. They are extensively worked, and furnish most of the coal used not only on the Union and Central Pacific railways, but in the villages and towns on the line of those roads between Omaha and San Francisco. There are geological indications of the possibility of available coal-mines in the true coal-measures in the plateau between the Big Horn and Wind River ranges. Gold is found and mined in the Sweetwater region and in places on the slopes of Medicine Bow Mountains, and the indications of gold in the Black Hills are such as to warrant an expectation of profitable mining there. In the Seminoe Mountains and in the Ferris Mineral district, as well as at Crow Creek, 20 miles W. of Cheyenne, deposits of both silver and gold have been found and worked. In other localities, especially around Laramie Peak, gold has been discovered. Iron-mines have been opened at Rawlin's Springs, and are yielding large quantities of excellent ore. Other extensive iron deposits are known to exist, but have not yet been developed. Copper, lead, and gypsum are found in paying quantities, but await development.

*Soil and Vegetation.*—Notwithstanding the mountainous character of much of the Territory, which renders it better adapted to grazing than to cultivation, there is a large amount of arable land, which with irrigation will amply repay the toils of the husbandman. The explorations of Prof. Hayden and his party justify the estimate that about 5,000,000 acres are arable land, and that not far from 35,000,000 are available for grazing purposes. The mountains are clothed with a thick growth of pine, spruce, and hemlock trees of large size; the foot-hills have some pine, spruce, aspen, walnut, elm, ash, box elder, hackberry, and red cedar of smaller growth, while the river-bottoms are abundantly supplied with two species of cottonwood and thickets of willows. As a considerable portion of this Territory is included in the Great American Desert, the sagebush (*Artemisia*) and the buffalo-grass are of course very abundant, especially on the Laramie Plains, some of which are alkaline. But these alkaline lands when irrigated, as most of them can be, yield most bountiful crops. The U. S. exploring expedition under Prof. Hayden described and named 195 species of plants, many of them peculiar to the Territory.

*Zoology.*—The wild animals of the Territory are principally the grizzly bear, black bear, wolf, prairie wolf, badger, wolverine, otter, fisher, porcupine, mink, skunk, little ermine, buffalo, elk, mule or black-tailed deer, big-horn or mountain-sheep, prong-horn antelope, 4 species of hare or rabbits, 4 of squirrels, 2 of prairie-dogs, gopher, muskrat, 2 species of mouse, etc.; in all, about 30 species of mammals have been described in the Territory, and 124 species of birds, including 12 birds of prey; many gamebirds, including a dozen or more of the duck and teal family; 6 species of grouse, etc., and a large number of song-birds; there are more than 80 species of mollusks. Reptiles are not numerous. Many of the streams swarm with mountain-trout, and other fresh-water fish are abundant.

*Climate.*—The average mean temperature of the year is for the whole Territory about 44° F. In the mountains it is in some years as low as 36°, while on the plains in the E. it averages 45° to 46°, and in the Green River region (S. W.) it is about 42°. The summer is for the most part cool, though sometimes the temperature rises for a day or two to 103° at the hottest part of the day. The nights are cool. The cold of winter is at times intense, the winds and snow sweeping over the great plains with almost irresistible fury. In the winter of 1873–74, an exceptionally mild one, the lowest temperature at Cheyenne was —21°. Stock requires to be sheltered for two or three months, though stock-raisers too often neglect this, to their great loss. The small amount of rainfall is an objection to the settlement of the Territory, though not an insuperable one. The annual rainfall varies from 8 to 13 inches, but in all the arable portion there are streams flowing at such an elevation as permits ample irrigation, and under its influence would yield abundant crops.

*Agricultural Productions.*—These, except live-stock, are not of large amount. In 1870 there were but 338 acres of land reported as under cultivation, and but 4341 acres taken up in farms. The value of the farms was but $18,187, and the value of all farm-products but $42,760. There has been a very great advance in these particulars since that time, but the farming as distinct from the grazing interest is still small. The value of all live-stock in the Territory in 1870 was $441,795. In 1874 the cattle alone shipped from Eastern Wyoming to Chicago brought over $500,000. The number of horses and of sheep in the Territory is increasing with great rapidity.

*Manufactures* are in their infancy in the Territory, the total production of 1870 being but $765,424, employing but 502 hands. The exigencies of the Union and Central Pacific railways have increased the amount of manufacturing in certain directions, but the population is not yet sufficient to induce a very general interest in manufactures. The mining interests are also rapidly developing themselves; the coal product is large, and the production of gold and silver in 1875 is said to have reached $5,000,000, and is fast increasing. The iron of the Territory is likely soon to be in demand for railway purposes.

*Railroads.*—The only railways in the Territory as yet are the Union and Central Pacific, which together traverse the southern part of the Territory, having a length of 470 miles within it; and the Denver Pacific, extending from Cheyenne to Denver, 106 miles in length, but only 5 or 6 miles of it within the Territory. A railway is projected from Bryan or Point of Rocks on the Union Pacific to the Yellowstone National Park, but is not yet in progress.

*Finances.*—The assessed valuation of real and personal estate in 1870 was $5,516,748; the true valuation, $7,016,748. The total taxes, Territorial and county, were $34,471; there was no Territorial debt. The *commerce* of the Territory passes over Union Pacific Railway, but its amount cannot be determined.

*Banks, etc.*—There are 2 national banks in the Territory, having an aggregate capital of $125,000, and 3 or 4 private banking-houses.

*Population.*—The population of Wyoming in 1870 was 9118, of whom 7219 were males and 1899 females; 8726 white, 183 colored, 143 Chinese, 66 Indians; 5605 natives

of U. S., 3513 foreign born. The density of the population was 0.09 to the sq. m. There were 2248 families, of 4.06 to a family; 2379 dwellings, with 3.83 persons to a dwelling; 856 persons were of school age (5–18), 6056 of military age (18–45), 7156 of voting age (21 years old and upward: women are allowed to vote in Wyoming); the number of male citizens 5297. The surveyor-general estimated the population at the close of 1874 at 25,000.

*Education.*—At the close of 1874 there were 14 school districts in the Territory, and 10 school-houses, valued at $31,600 with their furniture. The whole number of teachers employed was 20—5 males and 15 females. The average wages of the teachers were $85 per month. The whole amount of wages paid to teachers, $14,200. Number of scholars enrolled, 1000. There are some private schools at Cheyenne, Laramie, and Evanston, mostly under the care of missionaries of the different denominations, but no institutions of higher education. There are no charitable educational institutions and no insane hospital in the Territory. There is a Territorial prison at Cheyenne, and a rude jail in each county.

*Newspapers.*—There were 6 newspapers in the Territory in 1870, with 1950 circulation, and an annual issue of 243,300; 2 were dailies and 4 weeklies. There were in 1875, 3 dailies and 7 weeklies.

*Churches.*—In 1870 there were 12 churches of all denominations, with 12 church edifices, 3500 sittings, and $46,000 of church property. Of these, 1 was Baptist, with 300 sittings and $4000 church property; 1 Congregational, with the same number of sittings and amount of church property; 3 Episcopal, with 750 sittings and $10,000 church property; 2 Methodist, with 600 sittings and $8000 church property; 3 Presbyterian, with 750 sittings and $12,000 church property; and 2 Roman Catholic, with 800 sittings and $8000 church property. In 1875 there were 2 Baptist churches, 1 ordained minister, 50 members, about 300 adherent population, and $7000 church property; 2 Congregational churches, 42 members, about 260 adherent population, and $6500 church property; 4 Episcopal churches, with 3 church edifices, 2 ministers, 116 communicants, 696 adherent population, and $12,000 church property; the Methodists had 3 churches, 3 ministers, 115 members, with 690 adherent population, and church property valued at $9000; the Presbyterians had 3 churches, 3 ministers, 104 members, 624 adherent population, and $12,000 church property; the Roman Catholics, 3 churches and 10 stations, 2 priests, about 1000 adherent population, and $10,000 church property. In all, 17 church edifices, 11 clergymen, 427 members, 3570 adherent population, $56,500 of church property.

The governor and secretary are appointed by the President of the U. S., usually for four years. The legislative assembly consists of a council of 13 members and a house of representatives of 27 members, each elected for two years. The judicial power is vested in a supreme court of 3 justices—1 chief and 2 associate, appointed by the President for four years; 3 district courts, presided over by the judges of the supreme court; probate courts and justices of the peace.

*Counties.*—There are five counties, as follows:

| Counties. | Pop. in 1870. | Males in 1870. | Females in 1870. | White in 1870. | Colored, including Chinese and Indians, 1870. |
|---|---|---|---|---|---|
| Albany | 2021 | 1635 | 386 | 1971 | 50 |
| Carbon | 1368 | 1193 | 175 | 1360 | 8 |
| Laramie | 2957 | 2240 | 717 | 2822 | 135 |
| Sweetwater | 1916 | 1492 | 424 | 1777 | 139 |
| Uintah | 856 | 659 | 197 | 796 | 60 |
| Totals | 9118 | 7219 | 1899 | 8726 | 392 |

The valuation was not given by counties for this Territory in 1870, and no later valuation is accessible.

*Principal Towns.*—Cheyenne, the capital, in 1870 had 1450 inhabitants; it is now said to have 2500. Laramie City and Evanston, both on Union Pacific Railway, have from 1500 to 2000 inhabitants each; South Pass City, Atlantic City, and Miners' Delight, all in the Sweetwater mining region, are growing towns, and Rawlin's Springs and Fort D. A. Russell are towns of some importance.

*History.*—The oldest white settlement is probably that at Fort Laramie, where a fur-trading post was established in 1834, rebuilt by the American Fur Company in 1836, and sold to the U. S. in 1849, since which time it has been garrisoned by white troops. Old Fort Bridger, 2 miles above the present site of the fort, was built and occupied by traders in 1841; removed to its present site in consequence of an Indian raid upon it. It was owned by Messrs. Bridger & Vasquez till 1854, then sold to the Mormons and burnt by them in 1857, but rebuilt by the U. S. in 1858. Forts D. A. Russell, Sanders, Fred. Steele, and Fetterman, and Camps Stambaugh and Brown, are of later date. They have been established for the protection of the Union Pacific Railway and the mining settlements. The Territory was organized by act of Congress approved July 25, 1868. Its growth has not been rapid, as the Indians have been somewhat troublesome and the land was not as easily cultivated as in some other of the Territories. There had been no serious fighting with the Indians until 1876, when the Sioux in the Black Hills in the extreme N. E. of the Territory attacked Gen. Custer's command and totally destroyed it. Changes now in progress in regard to the future location of the Indian tribes will probably lead to the more rapid development of this Territory in the near future.

*Governors of the Territory.*—John A. Campbell, 1869–75; John M. Thayer, 1875–77. The Territory has no vote for President. A. G. Brackett. Revised by L. P. Brockett.

**Wyoming,** county of W. New York, drained by Genesee, Buffalo, and Tonewanda rivers, and traversed by Erie R. R.; surface hilly and broken, but tolerably fertile, and well adapted for grazing. There are flour-mills, saw-mills, tanneries, and manufactures of agricultural implements, brick, carriages, paper, and woollen goods. Horses, cattle, and sheep are numerous. Staples, oats, wheat, Indian corn, potatoes, hay, wool, and dairy products. Cap. Warsaw. Area, 590 sq. m. P. 29,164.

**Wyoming,** county of N. E. Pennsylvania, intersected by the N. branch of Susquehanna River, drained by several large creeks, and traversed by the North Branch Canal and Delaware Lackawanna and Western and Lehigh Valley R. Rs.; the surface is hilly, and in some portions mountainous, abounding in timber, coal, and iron. There are saw-mills, flour-mills, tanneries, and manufactories of iron castings and carriages. Cattle and sheep are the chief live-stock. Staples, Indian corn, oats, buckwheat, wheat, potatoes, wool, hay, and dairy products. Cap. Tunkhannock. Area, 345 sq. m. P. 14,585.

**Wyoming,** county of S. West Virginia, bordering on Virginia, and drained by affluents of Guyandotte and Sandy rivers. The surface is mountainous, much of it being heavily timbered. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, oats, wool, and hay. Cap. Oceana. Area, about 500 sq. m. P. 3171.

**Wyoming,** p.-v., North Murderkill hundred, Kent co., Del. P. 280.

**Wyoming,** tp., Lee co., Ill. P. 1280.

**Wyoming,** p.-v., Stark co., Ill., at the junction of Chicago Burlington and Quincy and Peoria and Rock Island R. Rs., has 4 churches, 2 large school buildings, containing 4 departments each, 2 exchange banks, 2 large hotels, 1 newspaper, and 3 flouring-mills. P. 640.

E. H. Phelps, Ed. "Post."

**Wyoming,** p.-v. and tp., Jones co., Ia., on Davenport and St. Paul R. R., 51 miles N. of Davenport, contains 3 churches, a library, a graded school, 1 bank, 1 newspaper, and a steam flouring-mill. Principal business, stock-raising. P. 1733. P. D. Swigart, Ed. "Journal."

**Wyoming,** p.-v., Bath co., Ky. P. 120.

**Wyoming,** tp., Kent co., Mich. P. 1786.

**Wyoming,** p.-v. and tp., Chisago co., Minn. P. 522.

**Wyoming,** p.-v. and tp., Otoe co., Neb. P. 911.

**Wyoming,** p.-v., Middlebury tp., Wyoming co., N. Y. P. 338.

**Wyoming,** p.-v., Luzerne co., Pa.

**Wyoming,** p.-v. and tp., Iowa co., Wis. P. 735.

**Wyoming Valley,** in Luzerne co., Pa., was called *Wyoming* ("great plains") by the Delaware Indians, who, with the Shawnees and the Wyomings (Iroquois), inhabited this beautiful region, rich in agricultural resources, and in later days remarkably productive of anthracite coal of excellent quality. It is traversed by the N. branch of Susquehanna River. It was settled in 1762 by people from Connecticut, which colony claimed this region by virtue of its ancient charter, notwithstanding the protest of the government of Pennsylvania. In the following year the settlers were either driven away or slain by the Delawares, but the colonists soon returned, bought the claims of the Six Nations to the valley, and for several years were embroiled in a contest with other citizens, who recognized the government of Pennsylvania. In 1771, the British government having confirmed the Connecticut claim, peace was restored, but in 1775 a force of Pennsylvanians attacked the settlements without success.

During the Revolutionary war a large number of Tories from New York settled in the valley, which, from its seclusion, could not well be protected from hostile arms. The greater proportion of the able-bodied men were on duty

with Gen. Washington when on June 30, 1778, a body of 400 British troops and 700 Seneca Indians, with some Tories, invaded the valley. On July 3 the battle of Wyoming was fought between this force and a body of some 300 settlers, chiefly boys and old men, who were utterly defeated and driven into a fort, the Tories and Indians murdering all the prisoners. On the next day the fort capitulated, but the terms of the capitulation were not observed, and the greater part of the inhabitants were soon compelled to flee from the valley by the Indians. In 1782, Congress decided the dispute as to jurisdiction in favor of Pennsylvania; but when authorities attempted to eject the Connecticut people from the property they had acquired in the valley, they again took up arms, and the contest lasted until 1788, when the Pennsylvania legislature confirmed the titles of the residents; but for some twenty-five years there was much litigation in regard to the conflicting claims of those holding lands under the Connecticut and the Pennsylvania grants. This long series of contests was known as the "Pennymite wars," the settlers calling their opponents "Pennymites." The valley includes parts of the townships of Pittston, Jenkins, Plains, Wilkesbarre, Hanover, Plymouth, Kingston, and Exeter, but the Connecticut colony occupied a large tract in Luzerne and several other counties. The picture of the massacre of Wyoming given by Campbell in his *Gertrude of Wyoming* is greatly exaggerated in respect to the cruelties practised by the Indians. Above Kingston, opposite Wilkesbarre, stands a granite obelisk which commemorates the slain in the contest of July 3, 1778. (See Charles Miner's *Hist. of Wyoming*, 1845; George Peck, D. D., *Wyoming, its History and Incidents*, etc., 1858.)

**Wy'on** (William), R. A., b. at Birmingham, England, in 1795, son of a die-sinker of German descent; was apprenticed to his father; became extremely skilful in his art; was appointed in 1816 second engraver in the royal mint, the chief engraver being his cousin, Thomas Wyon (b. 1792), on whose death in 1817 he succeeded to that post, which he retained until his death, at Brighton in 1851. Besides the current British coins, Mr. Wyon executed most of the war-medals awarded during his time, as those of the Peninsula, Trafalgar, Jellalabad, and Cabool, also the civic medals of the Royal Academy, the Royal Society, the Geographical, Geological, Asiatic, and other learned societies. His heads have great force and delicacy, and are always fine likenesses. A *Memoir of his Life and Works* (1837) was published during his lifetime by Nicholas Carlisle.

**Wyrar'disbury,** or **Wraysbury,** village of England, county of Bucks, on the Thames, 12 miles S. E. of Eton. In the park of Aukerwyke House, close by, stands, still living and powerful, an oak tree, of which it is known from authentic documents that it was an old and mighty tree when in 1215 King John signed the Magna Charta on Runnymede meadow.

**Wyse** (Thomas), K. C. B., b. at the manor of St. John, near Waterford, Ireland, in 1791; educated at Stonyhurst and at Trinity College, Dublin; studied law at Lincoln's Inn; married in 1821 a daughter of Lucien Bonaparte, prince of Canino; was separated from her 1828; was a member of Parliament 1830–49, a lord of the treasury 1839–41, joint secretary to the board of control 1846–49, and minister plenipotentiary at Athens from 1849 until his death, Apr. 15, 1862. Author of *An Historical Sketch of the Late Catholic Association of Ireland* (2 vols., 1829), *Education Reform, or the Necessity of a National System of Education* (1837), and *An Excursion in the Peloponnesus* (2 vols., 1865), and published some poetical translations from the German.

**Wy'sox,** tp., Carroll co., Ill. P. 1331.

**Wysox,** p.-v. and tp., Bradford co., Pa. P. 1290.

**Wyss** (Johann Rudolf), b. at Berne, Switzerland, Mar. 13, 1781; studied philosophy at various German universities; was appointed professor in the academy of his native city. D. there Mar. 30, 1830. He published *Vorlesungen über das höchste Gut* (2 vols., 1811), *Idyllen, Volkssagen, Legenden und Erzählungen aus der Schweiz* (3 vols., 1815–22), and *Reise im Berner Oberland* (1808); but his most celebrated work is *Der Schweizerische Robinson* (1813), an educational treatise, which was translated into many languages.

**Wythe,** county of S. W. Virginia, intersected by the Great Kanawha (here called New River), and traversed by Atlantic Mississippi and Ohio R. R. The surface is mostly an elevated plateau, containing large quantities of iron ore, lead, bituminous coal, and gypsum. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, wheat, oats, hay, and wool. Cap. Wytheville. Area, about 600 sq. m. P. 11,611.

**Wythe,** tp., Hancock co., Ill. P. 1219.

**Wythe,** tp., Elizabeth City co., Va. P. 2932.

**Wythe** (George), b. at Elizabeth City, Va., in 1726; educated at William and Mary College; inherited a large fortune by the death of both of his parents before reaching mature age, and led for some a life of extravagance, but when thirty years of age devoted himself to legal studies; was admitted to the bar 1757; soon became eminent as a lawyer; was chosen to the house of burgesses as the representative of William and Mary College 1758; drew up in 1764 a remonstrance addressed to the British Parliament against the Stamp act; was elected to the Continental Congress Aug., 1775; signed the Declaration of Independence; was appointed Nov., 1776, along with Jefferson (who had been his pupil), to revise the laws of Virginia; was chosen Speaker of the house of delegates and appointed judge of the high court of chancery 1777; became sole chancellor on the reorganization of that court 1786, filling that post twenty years; was professor of law at William and Mary College 1779–89; was a member of the Virginia convention which ratified the Federal Constitution, of which he was a strenuous advocate, 1788; emancipated his slaves toward the close of his life, and furnished them with the means of subsistence. D. by accidental poisoning at Richmond June 8, 1806. Author of *Decisions of Cases in Virginia by the High Court of Chancery* (1795; 2d ed., with *Memoir*, by B. B. Miner, 1852).

**Wythe'ville,** p.-v., cap. of Wythe co., Va., on Atlantic Mississippi and Ohio R. R., has good schools, a court-house, excellent water-supply, wide streets regularly laid out, 2 newspapers, and is a favorite summer resort for tourists. P. 1671. John H. Caldwell, Ed. "Enterprise."

**Wyt'tenbach** (Daniel), b. at Berne, Switzerland, Aug. 7, 1746; studied 1760–64 at the University of Marburg, where his father had been appointed professor of theology; went thence in 1768 to Göttingen to enjoy the instruction of Heyne. Before this he had begun to read through the Greek authors in chronological order, bestowing especial attention on the later philosophers and rhetoricians. In 1769 he attracted the attention of Ruhnken by his *Epistola Critica super Nonnullis locis Juliani Imperatoris ad Dav. Ruhnkenium;* in 1770 visited Leyden to attend the lectures of Ruhnken and Valckenaer. Through the influence of these scholars he obtained the chair of philosophy and literature at the college of the Remonstrants in Amsterdam; in 1775 made a journey to Paris, where he became intimate with Larcher, Sainte-Croix, and Villoison; was appointed in 1779 professor of philosophy at the Athenæum of Amsterdam, and in 1799 was invited to succeed Ruhnken in Leyden as professor of Greek literature and librarian of the university. Wyttenbach was thoroughly imbued with the love and spirit of the Platonic philosophy, his acquaintance with which he used in illustrating the later philosophers. His principal writings are—*Præcepta Philosophiæ Logicæ* (Amst., 1781), *Plutarchi de Sera Numinis Vindicta* (Leyden, 1772), *Selecta principum Græciæ Historicorum* (Amst., 1793), *Platonis Phædon* (Leyden, 1810), various writings collected in *Opuscula* (2 vols., Leyden, 1821). In 1777, Wyttenbach, with Ruhnken, established the *Bibliotheca Critica*, a critical journal in Latin, of which 3 vols. appeared 1777–1808. His most important work was his edition of Plutarch's *Moralia*, on which the labor of nearly thirty years was bestowed, undertaken at the request of the delegates of the Oxford University press, but never completed. It appeared at intervals from 1795 to 1821 in 8 vols. 4to and 15 vols. 8vo. D. Jan. 17, 1820. From his papers was issued an *Index Græcitatis* (2 vols. 8vo, Oxf., 1830).—Madame Wyttenbach (Johanna Gallien), his niece, whom he married in 1817, when past seventy, was a learned woman, distinguished in philosophy and literature. In 1827 she received the title of doctor of philosophy from the University of Marburg. Though German by birth, she wrote in French. Her principal writings are—*Théagène* (Paris, 1815), *Alexis* (ib., 1823), *Symposiaques, ou Propos de Table* (ib., 1823). (See Mahne, *Vita Wyttenbachii*, 1823; Dezobry, *Dict. Biog.; Biog. Univ.;* B. B. Edwards on "School of Philology in Holland" in *Classical Studies.*)

H. Drisler.

**Wyttenbach** (Thomas), b. in 1472 at Bienne, canton of Berne, Switzerland; studied theology at Tübingen and Bâle, and was appointed preacher in his native city in 1507. In 1519 he began to preach against the sale of indulgences, the mass, and the celibacy of the priests, and in 1524 he, together with seven other priests from the vicinity, married. Although he had gained many adherents among the citizens, the Roman Catholic party, the council of Berne, and the bishop of Bâle were nevertheless powerful enough to drive him from his office and expose him to poverty and many persecutions. He continued, however, to preach according to his convictions, and two years after his death, which took place in 1526, Bienne became reformed.

# X.

**X,** a letter which represents in English the sound of *ks*. In Spanish it has the sound of the Spanish *j*, a rough aspirate. In French it has the sound of our *x*, *s*, or *z*. In Portuguese it commonly sounds like our *sh*. X stands for the numeral ten; *x* in mathematics is the most frequent symbol for the unknown quantity. X takes its form, but not its power, from the Greek aspirate χ (*chi*).

**Xabaten'ses** [from the French *sabot*], one of the names given to the Waldenses, from the wooden shoes they wore, which were distinguished in some way by the sign of the cross upon them. R. D. HITCHCOCK.

**Xalapa.** See JALAPA.

**Xalisco.** See JALISCO.

**Xan'thine** [Gr. ξανθός, "yellow"], a name given to the yellow principle contained in flowers, to a yellow coloring-matter found in madder, and to a gas formed by the decomposition of xanthates. J. P. BATTERSHALL.

**Xanthine,** or **Xanthic Oxide** [Gr. ξανθός, "yellow;" Ger. *Xanthin* or *harnige Säure*], the principal constituent of a rare form of URINARY CALCULI (which see), was discovered by Marcet. It also occurs in human urine, in the spleen and liver, in the muscular flesh of the horse and ox, and in the variety of guano found in the island of Jarvis. It is artificially produced by the reduction of URIC ACID (which see) with sodium amalgam, and by treating *guanine* ($C_5H_5N_5O$) with nitrous acid. It can also be obtained from xanthic calculi or Jarvis guano, but it is most often prepared from the muscular organs of the horse or ox. Xanthine has the composition $C_5H_4N_4O_2$. It separates from its solutions either in white flocks or in minute scales, which are sparingly soluble in water and are insoluble in alcohol and in ether. When distilled, it yields ammonic carbonate and cyanide, and when strongly heated in contact with the air, it burns, emitting an odor resembling that of burning hair. If reduced by means of sodium amalgam, it yields *sarcine* ($C_5H_4N_4O$). Xanthine unites with acids and bases, forming soluble crystalline compounds; the compound with nitric acid possesses a bright yellow color, whence the name of the base. Upon heating the silver compound of xanthine with methylic iodide, *dimethylxanthine* is formed; this is isomeric, but not identical, with THEOBROMINE (which see). J. P. BATTERSHALL.

**Xanthippe.** See SOCRATES.

**Xan'thophyl** [Gr. ξανθός, "yellow," and φύλλον, "leaf"], a modified form or product of transformation of *chlorophyl*, the green coloring-matter of leaves. Little is known about it chemically as yet, more than the fact that by some chemical change in the leaf, generally before separation from the tree, the green matter is changed into other compounds, sometimes yellow and sometimes red, this being the first stage of decay, the final product being brown.

HENRY WURTZ.

**Xanthoprote'ic Acid** [Gr. ξανθός, "yellow," and πρωτεῖον, "chief rank"]. When the fingers are wetted with nitric acid, they become stained of a deep and indelible yellow, which becomes orange-red on the subsequent application of an alkali. This phenomenon was investigated by Mülder, who found that the action of the nitric acid was upon the *albuminoid* matter of the skin, and he isolated the yellow substance, to which he gave the above name. He attributed to it the composition $C_{34}H_{26}N_4O_{14}$. White of egg and other albuminoid matters give the same compound. The stain produced upon wood by nitric acid is due to a similar compound formed with albuminoid matter in the wood. The indelibility of the stain on the fingers is due to the fact that this substance is soluble only in acids and alkalies so concentrated as to destroy all organized substances, and which hence cannot be applied to the skin with safety. Boiling potash solution dissolves xanthoproteic acid with a deep red color; hence the darkening of the stain by alkalies. From this solution xanthoproteates of other bases may be precipitated. The writer, having experimented extensively with these bodies, believes that xanthoproteic acid and its compounds may be made very useful substances in the arts. HENRY WURTZ.

**Xanthoram'nine** [Gr. ξανθός, "yellow," and *rhamnus*, a plant], a yellow coloring-matter, contained in the ripe Persian or Turkey berries and in Avignon grains. It appears to be formed by the decomposition of *chrysorhamnine* ($C_{23}H_{22}O_{11}$), which is present in the unripe berries. Its extraction is effected by boiling the ground berries with alcohol, allowing the decoction to stand until the various impurities present settle, then allowing the xanthorhamnine to crystallize, and afterward purifying it by recrystallization from alcohol. It is also obtained upon boiling chrysorhamnine with water. It forms yellow crystals, which are easily soluble in water and in alcohol, but do not dissolve in ether. It probably has the composition $C_{23}H_{28}O_{14}$, although, according to some authorities, it is identical with *quercitrine*, $C_{33}H_{30}O_{17}$. Xanthorhamnine is a glycoside, yielding, when treated with dilute acids, glucose ($C_6H_{12}O_6$) and *rhamnetine* ($C_{11}H_{10}O_5$). It forms precipitates with several metallic salts, and imparts a yellow color to fabrics mordanted with alumina, and a black color to those mordanted with iron salts. J. P. BATTERSHALL.

**Xanthoxylum.** See PRICKLY ASH.

**Xanthus,** city of Lycia. See LYCIA.

**Xavier, de** (FRANCISCO). See FRANCIS XAVIER (SAINT).

**Xavierian Brothers,** a Roman Catholic community of instructors, founded in 1839 at Bruges by T. J. Ryken (1797–1871). They have several houses in the U. S.

**Xe'bec,** or **Chebeque,** a three-masted Barbary vessel, formerly much used by pirates, and now used to a small extent in Mediterranean commerce. The xebec is sharp fore and aft, carries both square and lateen sails, according to the wind, has low sides, and a deck with so great a camber that the crew walk on gratings over the deck. Xebecs ship much water, but are rapid sailers. The name probably comes from the Turkish.

**Xe'nia** [Gr. ξένια], those gifts, honors, provisions, and securities which in ancient Greece, where hospitality was a religious duty, and often formed the foundation of important political relations, the host offered the guest. The 13th book of the Epigrams of Martial, which treats of subjects relating to this peculiar social feature, is inscribed *Xenia*, and hence Goethe and Schiller took the title under which, in 1797, they published in the *Musenalmanach* about 400 epigrams, which made an enormous sensation in Germany on account of their sharp criticism of authors, books, and literary affairs in general. (See the works on the subject by Boas (1851) and Saupe (1852).)

**Xe'nia,** p.-v. and tp., Clay co., Ill., on Ohio and Mississippi R. R., 87 miles E. of St. Louis, Mo., contains 3 handsome churches, an academy, 2 flouring-mills, 2 carriage and wagon manufactories, woollen-mills, 1 plough-factory, 1 newspaper, and 2 hotels. P. of v. 916; of tp. 2479. W. W. MCLIN.

**Xenia,** p.-v. and tp., cap. of Greene co., O., located in the midst of a highly-cultivated agricultural region, 3 miles from Little Miami River, on Shawnee Creek, 65 miles N. E. of Cincinnati and 52 miles S. W. of Columbus. The town was laid out in the year 1803 by John Vance, on the lands of John Paul, who donated the square now bounded by Main, Market, and Greene streets for the public buildings. The first cabin was erected in Apr., 1804, by John Marshall. Xenia is noted for the breadth and cleanliness of its streets, its broad and finely-shaded sidewalks, its numerous church edifices, and its excellent educational facilities. It was the original terminus of Little Miami R. R., the first of any considerable length constructed in the State, connecting the place with Cincinnati at an early period. This road was subsequently continued to Springfield, and the Columbus and Denver and Dayton and Xenia constructed. Besides these, the Dayton and South-eastern, a narrow-gauge railroad, passes through the place, connecting it with the coal and iron fields of Jackson co. The Miami Valley is another narrow-gauge railroad, now under contract, forming still another connection with Cincinnati *viâ* Lebanon. Xenia contains 13 churches, 5 public-school buildings, 1 female college, 1 theological seminary, 3 newspaper-offices, 2 banks, 3 weekly newspapers, and numerous mercantile and manufacturing establishments. The court-house is a handsome and commodious structure, with fire-proof vaults and other modern improvements, located upon the public square above referred to, which is surrounded by a beautiful stone and iron fence, and is devoted to the purpose of a public park. Opposite the park is the city building, containing a large and elegant hall, the city council chamber, and offices for the mayor and other city officers. The city has an efficient fire department, with 2 steam fire-engines. Located near Xenia are the Ohio Soldiers' and Sailors' Orphans' Home, the Greene county in-

firmary, and Wilberforce University. P. of v. 6377; of tp. 2254. STINE & MARSHALL, PROPS. "XENIA TORCHLIGHT."

**Xenoc'rates,** b. at Chalcedon in 396 B. C.; became a pupil of Plato, and gained his favor by his earnestness and energy, though the master was well aware of his slowness of comprehension and lack of elegance in manners. He accompanied Plato to Syracuse, and went after his death, together with Aristotle, to Asia Minor. Afterward he returned to Athens, and succeeded Speusippus as chief of the Academy, which position he occupied till his death, 314 B. C. He was highly respected by the Athenians for the integrity of his character, and was repeatedly sent as an ambassador to foreign princes—Philip of Macedon, Antipater, etc. Aristotle respected him for his insight and knowledge, but of his works none has come down to us. —To be distinguished from him is XENOCRATES the physician, a native of Aphrodisias in Cilicia, who flourished during the reign of Nero. A little essay by him, Περὶ τῆς ἀπὸ τῶν Ἐνύδρων Τροφῆς (*De Alimento ex Aquatilibus*), is still extant, and is very interesting on account of the picture it gives of the state of natural history at that time. It has been edited by Franz (1774) and by Coray (1794).

**Xenoph'anes,** b. at Colophon, Ionia, about 570 B. C.; went as an exile to Sicily, thence to Magna Græcia, and settled in 536 B. C. at Elea, where he d. about 480 B. C. He is the founder of the Eleatic school of philosophy. He attacked Homer and Hesiod, whose polytheism and theogonies were diametrically opposed to the necessary idea of the unity and oneness of the Divine Being; and he protested that the universe was one, and the one universe God; that is, he taught a decided pantheism. Of his philosophical poems only a few fragments have been preserved by Athenæus and Plutarch, and have been collected by Karsten in his *Philosophorum Græcorum veterum Reliquiæ* (Brussels, 1830, vol. i.).

**Xen'ophon,** b. in Athens about 444 B. C.; became a disciple of Socrates, who saved his life in the battle of Delium, 424 B. C., when he was thrown from his horse during the flight. In 401 B. C. he went to Sardis at the invitation of Proxenus, a friend of his, and he followed the younger Cyrus on his expedition against his brother, Artaxerxes Mnemon, as a sort of volunteer in the corps of 10,000 Greek auxiliaries. After the battle of Cunaxa, when Cyrus had fallen and the most prominent Greek chiefs had been treacherously murdered in the Persian camp, Xenophon led the Greek troops from the Mesopotamian plains, across the mountain-ranges and plateaus of Asia Minor, to Trapezus on the southern shore of Pontus Euxinus, thence to Chrysopolis, opposite Byzantium, and finally to the camp of Thimbron, the Lacedæmonian general who commanded against Tissaphernes and Pharnabazus. In 396 he stayed in the Lacedæmonian camp in Asia under Agesilaus, and all his life through, in his actions and in his writings, he showed a great partiality for Sparta. He accompanied Agesilaus to Greece, and fought on the Lacedæmonian side in the battle of Coronea, 394 B. C. He was then banished from Athens, and settled at Scillus, near Olympia in Elis; thence he was expelled in 371 B. C., after the battle of Leuctra, and took up his residence in Corinth, where he remained till his death, about 354 B. C., though in the mean time the decree of banishment from Athens had been reversed. His literary activity falls, no doubt, in the latter part of his life, during his residence at Scillus and Corinth, and comprises history, philosophy, and social and moral science. Of his historical writings the most remarkable is the *Anabasis,* which in a simple but fluent and agreeable style gives much curious information of the nations at that time inhabiting the interior of Asia Minor. It was the first work of its kind in Greece; it gave the Greeks for the first time an idea of the true composition of the Persian empire and the internal working of its government; and it exercised, no doubt, a considerable influence on Alexander the Great. Of his philosophical writings the most widely known is his *Apomnemoneumata* or *Memorabilia Socratis,* which gives a portrait of Socrates, not very elevated, but very vivid, and of the greatest interest as forming a complement to that drawn by Plato. He also wrote *Hellenica,* a history of Greece from the end of Thucydides' history to the battle of Mantinea; *Cyropædia,* a sort of political romance; and minor treatises on hunting, finances, etc. There is a valuable edition of his collected works by L. Dindorf (5 vols., Oxford, 1831–66), and another by Schneider and Bornemann (6 vols., Leipsic, 1821–38).

**Xen'otime** [Gr. ξένος, "strange," and τιμή, "honor;" the name having been given by Beudant, and having no distinct meaning, unless, as suggested by Dana, intended as a sneer at Berzelius, who announced it to contain a new metal, then held in doubt or disbelief], a beautiful and interesting mineral, essentially *phosphate of yttria,* but sometimes containing *zirconia* (then called *castelnaudite*), and sometimes *cerium oxide.* In crystallization dimetric; hardness between fluor-spar and apatite; density about 4.5 (4.54, Lawrence Smith, from Clarksville, Ga.). Its color varies much. In the Georgian mineral Dr. Lawrence Smith found 11 per cent. of cerous oxide. Berzelius's mineral, from Hitteröe, which appears to have contained yttria only, with density 4.557, appears to give yttrium the molecular diameter 17, that of alumina in corundums, and of magnesium in brucite. HENRY WURTZ.

**Xeres.** See JEREZ DE LA FRONTERA.

**Xe'res** (ha'res), **de** (FRANCISCO), b. at Seville, Spain, about 1500; was secretary to Pizarro during his conquest of Peru, of which he wrote from Caxamarca a narrative addressed to Charles V., *Verdadera Relacion de la Conquista del Pirú y de la Provincia del Cuzco llamada la Nueva Castilla, etc.* (Salamanca, 1547), which is sometimes appended to Oviedo's *Natural History of the Indies.* An Italian translation was given by Ramusio, and a French one by Ternaux-Compans.

**Xe'res-de-los-Caballe'ros,** or **Jeres-de-los-Caballeros,** town of Spain, province of Badajoz, is picturesquely situated at the foot of Sierra Morena, surrounded by an old Moorish wall and well built. P. 8295.

**Xerx'es,** king of Persia 486–465 B. C., b. about 519, the oldest son of Darius Hystaspis and Atossa, the daughter of Cyrus; succeeded to the throne on the death of his father in preference to his three elder brothers, sons of Darius by his first wife, a daughter of Gobryas. Herodotus calls him cowardly, cruel, and incompetent, but the facts related of him do not seem to warrant this judgment. In the picture which Herodotus gives of the war between the Greeks and the Persians, and which is in every respect one of the grandest pictures history contains, the part Xerxes plays is by no means a very prominent one. The war was not a contest between a regular social order on the one side and a single person, possessed of a tremendous ambition, and wielding, by his talents, his position, his good fortune, an enormous power, on the other. There is nothing in this war reminding the reader of the career of Tamerlane or Gengis Khan. The contest was one between two different phases of civilization—the one vague and fantastic in its purposes, loose and unjust in its organization, awkward and cruel in its working, but developed to the highest degree of splendor and power which it was capable of; the other perfectly clear and definite in all its aspirations, firm and nimble in its organization, shrewd and generous, full of tricks and full of reverence in all its devices, but very young yet, hardly more than a boy in its plays and in its passions. In this contest much cowardice, cruelty, and incompetence became apparent on the Persian side, but they characterize the Eastern civilization rather than the person of Xerxes. Immediately after his accession to the throne an insurrection took place in Egypt, but with one rapid campaign he suppressed it, and he then commenced his preparations for the war against the Greeks. They lasted for four years, and resulted in the largest military armament the world ever saw. The Egyptians and Phœnicians furnished the fleet, 1207 triremes and 3000 smaller vessels, manned with about 500,000 men; and in order to preserve this fleet from the fate which overtook Mardonius's in 492 B. C. at Mount Athos, a canal was dug from Strymonic to the Singitic Gulf—a work which cost the labor of several thousand workmen for nearly three years. The army was composed of contingents from all the countries between China and Sahara, and between the Black and the Arabian sea; forty-six nations were represented in the camp of Xerxes at Cratilla in Cappadocia, each with its own peculiar equipment and method of war. Immense stores of provision were accumulated at regular stations along the whole line of march from Cratilla to Athens, and a bridge was thrown across the Hellespont from Abydos to Sestos. A storm destroyed the bridge, and Xerxes ordered the engineers who had built it to be put to death. This was certainly very cruel, according to Greek views, but when we remember that at the same time he ordered the waters of the strait to be scourged as a kind of punishment, and a set of fetters to be cast into them as a means of handcuffing their waves, we feel that we are in another world, in which Greek views of morality cannot be used as measurement of personal character. A new bridge was constructed, and for seven days and nights one continuous line of soldiery marched across it. At Doriscus in Thrace, in the plains on the Hebrus, the gigantic army halted, and the great king, the tallest and handsomest man of the whole host, inspected and numbered it: 10,000 soldiers were packed as closely as possible in a square, and a wall raised around them. The whole army was then poured, portion after portion, into this square, which was filled 170 times, equalling 1,700,000 men. When to these are added

80,000 horse, 20,000 men employed with the war-chariots and camels, the naval force, the European reinforcement, and a proportionate number of women, children, slaves, and other attendants, the whole army led by Xerxes against Greece must have comprised about 5,000,000 persons. The figure is appalling, and has been rejected as fabulous. The only reason, however, which has been given for thus impeaching the trustworthiness of Herodotus is that it would have been a stupidity to attack Greece with such an army. For the very same reason Herodotus's report of the Mount Athos canal has been denied. Juvenal considered the canal a good specimen of Greek lies, and Niebuhr positively rejected the story as incredible. Nevertheless, recent researches have discovered undeniable traces of the canal. It must be remembered that Xerxes knew much less of the resources of the Greek nation than we do. He had heard from the Carthaginians that they inhabited the northern shores of a sea which it took as long a time to cross on a vessel as it took to traverse his own realm on a camel; and what other means than the number had he of asserting his power over this unknown nation? The account of Herodotus is somewhat loose, and the figures which result from it may be somewhat exaggerated, but the more we learn of the actual state of affairs at that time, the less incredible do they appear. Like an avalanche this host rolled down over Greece. There was some impediment at Thermopylæ, Artemisium, etc., but Xerxes barely heard of it. Athens was burnt, and on Sept. 23, 480 B. C., he sat on his throne of gold, raised on a promontory of Mount Ægaleos, to witness the battle of Salamis, looking at the spectacle as the day-dreamer looks at his own dreams. But the battle was lost, and the great king fled, panic-stricken, first to Sardis, and thence to Susa, where he buried himself in dissipations, sensualities, voluptuousness, and court intrigues. In 465 he was assassinated by Artabanus. CLEMENS PETERSEN.

**Xime'nes de Cisne'ros** (FRANCISCO), b. at Torre Laguna, New Castile, Spain, in 1436 or 1437; educated at the universities of Alcalá de Henares and Salamanca, where he graduated in both civil and canon law 1456; became a priest; went to Rome, where he practised as an advocate in the consistorial courts 1459–65, acquiring a great reputation for political ability; obtained from the pope a bull nominating him to the first benefice of a specified value which should become vacant in the archbishopric of Toledo; took possession in 1473 of the living of Uzeda, near his native village, against the will of the archbishop of Toledo, who regarded the papal bull as a violation of his rights, and on declining to surrender the living was imprisoned six years in the tower of Santorcaz; was released and given possession of his benefice 1480; exchanged it for a chaplainship near Siguenza, where he studied Hebrew and Chaldee, and acted as vicar to the bishop of the diocese; resigned his preferments in the Church and entered the Franciscan convent of San Juan de los Reyes in Toledo 1482; distinguished himself by his austerity in self-mortification; acquired a great reputation for sanctity, and was in great request at the confessional; retired to the secluded mountain-convent of Our Lady of Castañar, where he built with his own hands a cell in which he passed his time in prayer and meditation; was appointed superior of the convent of Salzeda; was appointed confessor to Queen Isabella 1492, retaining his monastic habits and residence, and soon acquired a national reputation for sanctity; was appointed provincial of his order in Castile 1494, and made his visits of inspection on foot, subsisting on alms; was nominated high chancellor of Castile, archbishop of Toledo, and primate of Spain 1495; refused for six months to accept that dignity, yielding only to the express commands of the pope; retained the austere simplicity of his former mode of life, dispensing the vast revenues of his see chiefly in charities; effected a vigorous reform among the Spanish clergy; founded the University of Alcalá 1498; insisted upon the conquered Moors of Granada receiving Christian baptism during the residence of the court at Granada 1499, thus giving rise to the rebellion in the Alpujarras 1500; is said to have ordered the destruction of many thousands of Arabic MSS.; commenced in 1502 the printing at his own expense, at Alcalá de Henares, of the famous Complutensian Polyglot Bible (from *Complutum*, the Latin name of Alcalá); displayed an enlightened zeal and munificence in providing for all the details of his new university; was the director of most of the public acts of Isabella up to her death in 1504; was mediator between Ferdinand and the archduke Philip in their rival claims upon the regency of Castile; became president of the Castilian council of regency on the death of Philip 1506; was appointed by Pope Julius cardinal and inquisitor-general of Castile 1507; led an expedition against the pirates of Oran on the Barbary coast 1509, securing thereby to Spain an important territorial acquisition; lived in comparative retirement several years on account of the jealousy of Ferdinand, but became again regent of the kingdom on the latter's death, 1516; effected the proclamation of Charles V. against the rival pretensions of the partisans of the insane queen Joanna; enlisted a national guard; quelled domestic disturbances; reduced the little kingdom of Navarre to quietude by dismantling its forces; made preparation against the Barbary corsairs; extended the Inquisition throughout the Spanish dominions; took measures for the protection of the rights of the American Indians and to check the growth of African slavery; introduced reforms into the revenue system; surrendered the regency on the arrival of the young king in Spain in September, and was allowed to retire to his diocese. D. at Roa, on the Douro, Nov. 18, 1517. (See his biographies by Gomez de Castro, and by Hefele, *Der Cardinal Ximenes* (Tübingen, 1844).) PORTER C. BLISS.

**Xime'nes de Quesa'da** (GONZALO), b. in Granada, Spain, about 1500; went to Santa Marta in a judicial capacity 1535; took command of an expedition against the Chibcha Indians; penetrated with 800 men into the heart of New Granada, experiencing great sufferings; conquered the rich cities of Tunja and Iraca; gained great victories over the Chibchas, and accumulated vast quantities of gold; founded the city of Bogota Aug. 6, 1538; had disputes about boundaries with Frederman, who came thither from Venezuela, and Benalcazar, who arrived from Quito; went to Spain 1539; returned with the title of marshal 1551; led an expedition in search of El Dorado, and founded the city of Santa Agueda 1572. D. of leprosy at Mariquita Feb. 16, 1579.

**Xiphiidæ.** See APPENDIX.

**Xisuthrus.** See XYSYTHRUS.

**Xorullo.** See JORULLO.

**Xy'lene,** or **Xy'lol** [Gr. ξύλον, "wood"], one of the series of coal-tar hydrocarbons, a homologue of benzole or benzene; composition $C_8H_{10}$. It has been called *dimethylbenzene*, from the notion that it was formed by the substitution of $H_2$ in benzene, $C_6H_6$, by two of methyl, $CH_3$, making it $C_6H_4(CH_3)_2$. The view of the present writer is that it is $C_6.10H_2C$, being formed by the further association of $4H_2C$ with benzene, which is $C_6.6H_2C$. This latter view is founded on the fact (set forth already under VOLUMES, MOLECULAR) that the difference in equivalent volume, between the dominant form of benzene and xylene, is closely four times the cube of 26, the latter being regarded as the molecular diameter of the radical molecule homologen, $H_2C$, in this case. Xylene is a colorless liquid of little odor, boiling, according to Warren, at 139.8°. Longuinine gives its density, at melting ice, as .877; the computed density, according to the new view of its constitution, is .8712 at — 2° C. HENRY WURTZ.

**Xylographic Books.** See BLOCK-BOOKS, in PRINTING, by W. S. PATERSON.

**Xylography.** See ENGRAVING.

**Xyloid'ine** [Gr. ξύλον, "wood"], an explosive substance discovered by Braconnet in 1832, prepared by dissolving starch in nitric acid; by the addition of water a white explosive compound is precipitated. (See EXPLOSIVES.)

**Xylol.** See XYLENE.

**Xyris.** See YELLOW-EYED GRASS.

**Xysythrus,** king of Babylon at the time when the Deluge occurred. The Chaldæan historian Berosus, of whose work some fragments have been preserved by Eusebius, tells how in the plain of Shinar many people of various descent dwelt together without laws, after the fashion of animals; how Oannes, a monster-god with the head of a man, the body of a fish, and the legs of a woman, arose from the Persian Gulf, sat down among the men of Shinar, and taught them all the arts of civilization—how to erect temples and build cities, how to make laws and maintain order, how to cultivate the soil and establish industry, etc. Thus Babylon was built, and Alorus became the first king of the new empire. He was followed by nine others, which together reigned for 100 *sares*, or 432,000 years. The last was Xysythrus. Warned of the coming of the Flood, he built a ship and was saved from the Deluge. When the waters subsided, the ship landed on the mountains of Koordistan. Xysythrus went out of the ship, built an altar, offered up a great sacrifice, and then disappeared among the clouds. But those who had been with him in the ship returned to Babylon, rebuilt the city, unearthed the sacred books, which had been deposited at Sippara when the Flood came, and formed a new empire, which stood for 33,000 years, ruled over by 86 kings, until it was conquered by the Medes. There is a striking resemblance in all the principal traits between this narrative of the Deluge and that contained in the Bible, and also between these two and that lately published by George Smith from the cuneiform inscriptions.

# Y.

**Y,** as an English vowel, represents our *i*, and has both its sounds, as seen in *by, lovely*. As a consonant in English it has a sound analogous to the vowel-sound of long *e* (English), but almost suppressed by the closure of the palatal passage by the tongue. Its consonantal power is that of the Latin, Polish, and German *J*. Properly, as derived from the Greek Y or ϒ, it should have its power in Danish and Anglo-Saxon (Ger. *ü*; Fr. *u*). In pure English words it was intended for the long vowel of *machine*, and was formed from *ii*, written *ij*—a combination still used (but with the perverted power of *y* in *by*) in Dutch, where *ijs* is the word spelled *eis* in German and *ice* in English. In chemistry, Y is the symbol of yttrium.

**Yacht,** a name of Dutch origin which became common in the English language in the latter part of the seventeenth century. In 1661 the Dutch East India Company presented Charles II. with a yacht, and the speed and buoyancy of this kind of vessel soon brought all other pleasure-vessels into disuse, even those gorgeous ones which were built "frigate-like." In 1720 the first yachting club was formed at Cork in Ireland, under the name of the Cork Harbor Water Club, now the Royal Cork Yacht Club. In 1815 the Yacht Club was founded, which took up its head-quarters at Cowes in the Isle of Wight, and used the Solent as its chief arena. It afterward changed its name to the Royal Yacht Club in 1817, and in 1833 to the Royal Yacht Squadron. According to its rules of organization, each member must be the owner of a vessel not smaller than ten tons, and it was said that William IV. wished to give its commodore the title of admiral, but dared not, lest he should thereby arouse the jealousy of the navy. In 1824 the Thames Yacht Club was founded; in 1844, the Royal Mersey Yacht Club; in 1845, the Royal Victoria Yacht Club, etc.; and in 1875 the number of British yachts was 1764, of which 610 measured 10 tons or less; 913 between 10 and 100 tons; 147 between 100 and 200; 51 between 200 and 300; 19 between 300 and 400; 3 between 500 and 600; 1 of 606, and 1 of 730 tons. The last is a steamer, and the number of steam yachts has greatly increased since 1870.

The first yachting club in the U. S. was formed at New York in 1844, comprising 9 members and as many yachts. In 1845 the number of yachts was 17 and of members 171; and in 1875 the club registered 38 schooners of 5566 tons, 27 sloops of 924 tons, and 13 steamers of 1000 tons. In the same year there were in all 34 regular yachting clubs organized in the U. S., registering 692 vessels—namely, 116 schooners, 394 sloops, 3 cutters, 145 cat-rigged, and 34 steamers. Some of the most prominent events in the rapid development of this kind of sport were—the first regular regatta, which took place in New York harbor July 17, 1845, from Robbin's Reef around the S. W. Spit buoy to the lightship and return, and in which 7 schooners and 3 sloops took part, the Cygnet being the winner; the first race-match between yachts, which took place on Oct. 10, 1846, between the sloop Maria, 154 tons, and the schooner Coquette, 74 tons, the course being 25 miles to the windward and return, from the lightship off Sandy Hook. The most exciting match-race took place in 1866, between the Henrietta, Fleetwing, and Vesta, from Sandy Hook to Cowes, for a sweepstakes of $90,000; the Henrietta made the run in 13 days 21 hours 55 minutes, and won. The first yacht which crossed the Atlantic was the America in 1851. Her arrival in the Thames made an immense sensation, and produced a revolution in English yacht-building. The oldest English yachts were built after the "cod's-head and mackerel-tail" model. Then followed the so-called "wave-line" type, which was a much-improved development of the former. But the America had, against all good rules, the mackerel tail in front and the cod's head in rear; and still more astonishing was the manner in which the sails were set, presenting flat surfaces to the wind, and practically reducing *in absurdum* the old conviction that sails should be able to "hold the wind." On Aug. 8, 1870, the American sloop Magic won the first race for the queen's cup in New York harbor, making a run of about 43 miles, from an anchorage off Stapleton, Staten Island, around the S. W. Spit to Sandy Hook lightship and return, in 4 hours 7 minutes 54 seconds.

By acts of Congress Aug. 7, 1848, and June 29, 1870, yachts have the privilege of going from port to port of the U. S., and by sea to foreign ports, without entering or clearing at the custom-house, and this privilege also extends to yachts belonging to a regularly-organized yacht club of any foreign nation which grants like privileges to the yachts of the U. S. A regulation with respect to the lights to be carried by yachts is given by a circular of Dec. 5, 1874, and an elaborate *Sailing Regulation* for yachts has been issued by the Royal Alfred Yacht Club of England.

**Yad'kin,** county of N. W. North Carolina, drained by Yadkin River; surface diversified, containing considerable iron ore; soil fairly productive. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, oats, tobacco, and wool. Cap. Yadkinville. Area, 310 sq. m. P. 10,697.

**Yadkin,** tp., Davison co., N. C. P. 954.

**Yadkin,** tp., Stokes co., N. C. P. 1758.

**Yadkin River,** rises in Caldwell co., N. C., near the Blue Ridge. After passing into South Carolina it is called the GREAT PEDEE (which see). In North Carolina it is a swift, turbulent, and unnavigable stream. Its valley is fertile and abounds in mineral wealth.

**Yad'kinville,** p.-v., Liberty tp., cap. of Yadkin co., N. C. P. 133.

**Yak.** The yak (*Bos grunniens*) is the ox of Thibet, but is widely known, chiefly because of the beauty of its tail and the extensive use to which it is everywhere put in the East. It is a huge animal, as tall as one of our largest oxen, very hairy, and like a bison in appearance. However, the long sweeping tail marks it out as a distinct species. It is generally black or white, or black and white, the latter most commonly. Its hair is not coarse, though long and thick; and though the creature, when wild and disturbed and wounded in its native haunts, can prove terribly fierce, yet it can be easily tamed and domesticated. Its hair protects it from the cold of the great mountain-heights which it loves to frequent. It is a most sure-footed animal, climbing over rocks with the agility of a chamois. The Thibetans frequently keep large domesticated flocks of yaks, and the milk of the female yak is much prized. It is very rich and in color yellow, and has a strong but pleasant odor. Herds of wild yaks have been met with on the Himalayas as high as 20,000 feet above the sea-level; they are, however, rarely seen above 16,000 feet. It has a small head, and horns half covered by a mass of hair, but its eyes are very large, soft, and brilliant. The legs and the neck are short. The yak has over the shoulders an immense mass of hair, resembling a hump. It does not low like an ox, but has a peculiar sharp, quick, deep voice, very much similar to the grunt of a boar. The yak is sometimes hunted by large dogs. Sportsmen declare that its flesh is superior to venison. The Thibetans frequently use its skin for their clothing. Some Thibetans ride long journeys on yaks, which, being so sure-footed, can be trusted to cross dangerous passes and to wend their way safely by the brink of precipices. The prince of Wales, during his recent tour through India, secured several splendid specimens of yak-tails. Those ordinarily purchased in India, generally cheaply, are very poor specimens of the perfect yak-tail, than which a finer mass of flowing hair can scarcely be conceived. Yak-horns are by no means so fine as those of the wild buffaloes of Indian hills. Rugs of yak-skin are much sought after, and a fine strong cloth is made out of the soft hair above the hump. R. C. CALDWELL.

**Yaki'ma,** county of S. Washington Territory, lying on the E. slope of the Cascade Mountains, reaching to the valley of the Columbia, and containing some fertile soil and valuable grazing and timber land. Cattle are the chief live-stock. Cap. Yakima. Area, about 5000 sq. m. P. 432.

**Yakima,** p.-v., cap. of Yakima co., Wash. Ter.

**Yakutsk',** or **Jakutsk',** province of Siberia, bounded E. by the province of Irkutsk, W. by Okotsk, S. by the Jablonvoy Mountains, and N. by the Arctic Ocean. Most of this province is a low, level plain whose northern part is frozen 100 feet deep, but which presents good pasturage in the southern part. Its inhabitants, numbering 228,363, consist mostly of tribes of Yakuts and Buriats, the former of which live as nomads with large herds of cattle, the latter as hunters and fishers, the country abounding in sables, martens, squirrels, foxes, and bears, and the rivers in fish, especially salmon.

**Yakutsk,** or **Jakutsk,** town of Siberia, capital of the province of Yakutsk, on the Lena, in lat. 62° 1′ N. It has hardly 4000 inhabitants, and is poorly built. The houses

of the native Yakuts have doors of hides and windows of ice. But it is the seat of the provincial government, and in June it has a large fair, where butter, furs, tallow, fish, and mammoth-tusks to the value of $300,000 are exchanged for European merchandise.

**Yâl,** the Indian lute, of a varying number of strings. It is esteemed as equalling the flute, and excelling all other instruments of music in sweetness. Wandering minstrels in India to the present day patronize this instrument in a marked degree. Tiruvalluvar, the greatest of Tamil poets, says, "The flute is sweet, the *lute* is sweet."

R. C. CALDWELL.

**Yalabu'sha,** county of N. Mississippi, drained by tributaries of Tallahatchie and Yalabusha rivers, and traversed by Mississippi Central and Mississippi and Tennessee R. Rs.; surface generally level, soil fertile. Mules, cattle, and swine are the chief live-stock. Staples, cotton and corn. Cap. Coffeeville. Area, 450 sq. m. P. 13,254.

**Yalabu'sha River,** one of the principal eastern affluents of the Yazoo River, entirely in the State of Mississippi, is navigable 90 miles to Grenada by steamboats.

**Yale** (ELIHU), F. R. S., b. at New Haven, Conn., Apr. 5, 1648; went to England with his parents when ten years of age, and never returned to Connecticut; went to the East Indies 1678; was governor of Fort St. George, Madras, 1687–92; gained a large fortune, and was afterward in England a governor of the East India Company. He made various gifts in books and money to the newly-established college at his birthplace, amounting between 1714 and 1721 to some £500, in consequence of which his name was in 1718 given to the collegiate building, and applied in the charter of 1745 to the whole institution. D. in London July 22, 1721, and was buried at Wrexham, North Wales, the ancient seat of his family.

**Yale College,** "the collegiate school of Connecticut," was chartered by the general assembly of the colony of Connecticut in Oct., 1701. From the first settlement of New Haven (1638) it had been intended to set up a college there, and it was in execution of this design that the minister of New Haven, James Pierpont, in concert with other Congregational ministers of the Connecticut seaboard, effected in 1701 the foundation of the collegiate school. The ten ministers made trustees by the charter were empowered to set up and carry on the school where they should see fit, and to perpetuate their own body. By an additional act (1723) the rector or head-master of the school was made a trustee *ex officio*. The school was formally established at Saybrook in Nov., 1701, though the classes until 1707 were taught at Killingworth (now Clinton), an adjoining town, where Abraham Pierson, the first rector, was pastor. After long dissatisfaction and amid much opposition the school was permanently settled in New Haven in 1716, and in 1718 its name was changed to Yale College, in recognition of a gift (in goods valued at £200) from Elihu Yale of London, a native of New Haven, who had amassed a fortune in India, where he had been (1687–92) governor of Fort St. George, one of the settlements of the East India Company. In 1745 the present charter was granted by the general assembly, confirming the trustees in all their powers under the title of "the president and fellows of Yale College in New Haven." Down to the period of the Revolution the college received from the colonial government stated or occasional grants of funds, without which it could hardly have survived. In 1792 the governor, lieutenant-governor, and six senior senators of the State were made, *ex officiis*, members of the corporation, the State making at the same time a grant valued at $30,000 to the college funds. In 1871 the assembly, with the assent of the corporation, substituted for the six senators six graduates of the college, who were chosen, as their successors (one vacancy occurring annually) are also chosen, by the votes of a plurality of graduates of the first degree of five years' standing. For the first 100 years instruction was chiefly given by the rector or president, assisted by two or three tutors chosen from among the recent graduates and serving for a brief period. A professor of divinity (or college pastor) was appointed in 1755, and in 1770 a professor of mathematics, though the chair was not permanently occupied till 1794. It was not until the present century that the system of permanent professors, assisted still by temporary instructors, was fully established. The instructors now number about 90, four-fifths of whom are permanent officers. The presidents for the last century have been—Ezra Stiles (1777–95), Timothy Dwight (1795–1817), Jeremiah Day (1817–46), Theodore D. Woolsey (1846–71), Noah Porter (since 1871). The president is the presiding officer of the board of trustees and of every board of instruction; he also takes an active part in teaching, mainly in the academical department. As at present constituted, there are four departments of instruction grouped under the name of Yale College—viz. the departments of philosophy and the arts, of theology, of law, and of medicine, the first of these including the academical department (the original Yale College, around which all the others have been developed), the Sheffield Scientific School, the School of the Fine Arts, and the school of graduate (or advanced non-professional) instruction. The degrees given in the department of philosophy and the arts are—bachelor of arts, bachelor of philosophy, master of arts, doctor of philosophy, civil engineer, and dynamic engineer. The degrees given in the other departments are—bachelor of divinity, bachelor of laws, master of laws, doctor of civil law, and doctor of medicine. Degrees in arts were first given in 1702, in medicine in 1814, in law in 1843, in philosophy in 1852, in theology in 1867. The whole number of graduates is over 11,000, of whom more than half are deceased. The annual commencement is held on the Thursday after the last Wednesday in June, and the college year begins eleven weeks later. The number of students enrolled on the annual catalogue for 1875–76 was 1051, of whom 769 were undergraduates, or candidates for the first degree in arts or philosophy (582 in the academical department and 187 in the Sheffield Scientific School), and of these, 171 received their degrees in 1876. The average age at graduation in the academical department is 22½ years.

The course of study in the academical department extends through four years. The requirements for admission are mainly in Greek, Latin, and mathematics, and the first two years of the course are given largely to further drill in these branches; while the studies of the last two years take a wider range, and about one-fourth of the time in these two years is given to advanced courses in subjects in which the student has already made some progress, and which he chooses from among a larger number offered to his option. The annual charge for tuition and incidental expenses is $140. Beneficiary funds help to meet this charge for those who need such relief, to the extent of over $15,000 yearly. About $3000 is also disbursed yearly to graduate and undergraduate students in premiums for the encouragement of scholarship. The permanent funds of the department (exclusive of real estate, buildings, and apparatus devoted to academical uses) are about $700,000. The college buildings occupy a square (about 850 feet by 400) in the centre of the city, adjoining the public green. There are six dormitories, built from 1752 to 1871, and accommodating over 400 persons. There are also on this square a chapel, a library, an art-school, and seven other buildings used as halls, recitation-rooms, and offices. The more recent buildings are placed with the intention of forming ultimately a quadrangle enclosing an open space. The rent of lodging-rooms varies, according to location, from $25 to $140 a year, the annual rent of a half-room averaging about $35. The buildings of the other departments are all in the neighborhood of the college square.

The Sheffield Scientific School, begun in 1847 as a school of applied chemistry, was gradually expanded until in 1860 it received its first considerable endowment from Mr. Joseph E. Sheffield of New Haven, who has since largely added to his original gift. The school provides for advanced and special students in the mathematical, physical, and natural sciences, and also for undergraduates who wish a training leading chiefly in this direction. The State legislature appropriated to the school in 1863 the national grant of 1862 for the benefit of agriculture and the mechanic arts, the income from which amounts to $8100 annually. The course of instruction leading to the degree of bachelor of philosophy occupies three years. The degrees of civil and dynamic engineer are given to bachelors of philosophy after a higher course of two years, and the degree of doctor of philosophy after a three years' course. The charge for tuition is $150 a year. The degree of Ph. D. is also given to bachelors of arts who have pursued advanced studies at the college for two years, and the degree of M. A. is given for one year's similar study.

The School of the Fine Arts was founded in 1864 by Mr. Augustus R. Street of New Haven, who erected a building for its use and otherwise endowed it. At present instruction is provided in drawing and painting only.

The theological department was founded in 1822 in connection with the Congregational denomination, and provides a three years' course of study. There is no charge for instruction or for room-rent in the buildings belonging to the school.

The law department, begun as a private school soon after 1800, was not recognized as part of the college until 1824. It now offers a three-years' course for the degree of LL.B., and also advanced courses with appropriate degrees at the end of one and two years. The annual tuition fees are $90.

The medical department was organized in 1813, and in 1814 received a grant of $30,000 from the State. The

requirements for a degree include attendance on two yearly courses of lectures. The annual lecture-fee is $105.

The college library, which is open to students in all departments, contains upward of 80,000 volumes. In the same building is a separate library of about 20,000 volumes, supported by the undergraduates and devoted to general literature. There are also special libraries belonging to the theological, law, medical, and scientific schools.

The Peabody Museum of Natural History, devoted chiefly to zoology, geology, and mineralogy, was established by a gift of $150,000 from the late Mr. George Peabody of London in 1866. At present only one wing of the proposed museum has been erected. FRANKLIN B. DEXTER.

**Yam,** the tuberous root of *Dioscorea sativa,* a climbing woody vine of the order Dioscoreaceæ. Many other species of yam are described, but they may be only very strongly-marked varieties, since the yam-vine has a tendency to assume various forms. Yams are extensively grown in all warm countries as food. The great tubers are cooked after the manner of potatoes, and most kinds are very palatable. Some of the wild sorts are nauseous, and even poisonous. Yams are successfully grown in the Southern States, and the Chinese yam (*D. batatas*) thrives in our Northern States, but its great roots, though often of excellent quality, have a tendency to bury themselves so deeply in the earth that they can only be reached at considerable trouble.

**Yam'a,** a god of the Hindu Pantheon. In the case of this deity, as in the case of many others worshipped from the earliest times by the inhabitants of Hindustan, we are obliged to separate between the idea of him primarily entertained and expressed and the latter-day idea, which has quite rehabilitated the divinity. The Yama of the Vedic hymns is quite a different being from the Yama of the *Purânas.* To the mind of the modern Hindu, Yama is an Oriental Pluto, the judge of the dead, the luminous lord of the manes, and the monarch of hell. Yama, as he appeared to the imagination of the primitive Aryans who first crossed the Indus, was simply an aërial phenomenon, a vague potency, worshipped vaguely. In the *Rig-Veda,* for instance, Yama is represented as being the son of Vivasvat and Saranyû, and the twin-brother of the lustful Yami. Yami tries to entice Yama to become her husband, but he resists resolutely. Whatever the emblematic significance of this may be—and this must be carefully inquired into hereafter—the episode is a strange one, yet quite in keeping with the early legends of the patriarchal times of the first Aryans in India. It recalls the lines from Milton's *Il Penseroso:*

> "Thee, bright-haired Vesta, long of yore
> To solitary Saturn bore:
> His daughter she; in Saturn's reign
> Such mixture was not held a stain.
> Oft in glimmering bowers and glades
> He met her, and in secret shades
> Of woody Ida's inmost grove,
> While yet there was no fear of Jove."

As a parallel in Hindu mythology to the legend of Yama and Yami it may be observed that Brahma himself is mentioned as having conceived a passion for his own daughter Tilôtumei. She fled from his incestuous embrace, and hid herself, whereupon Brahma assumed four visages, pointing to each of the four quarters of the globe, so that the maiden might not escape his observation. And, according to the same *Purâna,* from the four visages, thus assumed with a guilty purpose, the four pure and holy Vedas proceeded!

The reader, to have a clear conception of Yama as he was regarded in the Vedic period, should consult *Rig-Veda,* x. 17, 1. Dr. Muir thus translates a portion of the text: "Tvashtri makes a marriage for his daughter. Hearing this, the whole world assembles. The mother of Yama, becoming wedded, the wife of the great Vivasvat disappeared. They concealed the immortal bride from mortals. Making another of similar form, they gave her to Vivasvat. She bore the Asvins when that happened. Saranyû abandoned the two pairs of twins." Dr. Muir also gives a translation of the dialogue between Yami and Yama (*Rig-Veda,* x. 10. 1), in which she entices her twin-brother to take her to him as wife. Prof. Roth considers that Yami urges the union between herself and her twin-brother, as Yama and Yami are intended to represent the earliest pair of the human species, which she desires to propagate. Scholars have justly regarded Yama as intimately connected in the Hindu mind with belief in a future state of existence. In the *Rig-Veda* this is made abundantly plain. (See Muir's *Sanskrit Texts,* vol. v. p. 292.) In that veda he is thus apostrophized: "Worship with an oblation King Yama, son of Vivasvat, the assembler of men, who departed to the mighty streams and spied out the road for many." The meaning of this passage as referring to a future life for mortals is plainly exemplified in a paraphrase in the *Atharva-Veda* (xviii. 3. 13), which runs as follows: "Reverence ye with an oblation Yama, the son of Vivasvat, the assembler of men, *who was the first of men who died, and the first who departed to the celestial world.*" The *Rig-Veda* also says: "Yama was the first who found for us the way: this home is not to be taken from us; those who are now born follow by their own paths to the place whither our ancient fathers have departed. . . . Meet ye with the fathers, meet with Yama, meet in highest heaven with the recompense of the sacrifices you have (on earth) offered. Throwing off all imperfections, again go to your home. Become united to a body, and be clothed in a shining form;" and so on. It is almost impossible to resist the conclusion from the above and similar passages that Yama was regarded as the pioneer and patron of an after-life to mortals. He is represented as having two four-eyed, brindled dogs that call up the idea of Cerberus. They are termed "watch-dogs, observant guardians of the pathway;" "brown messengers of Yama, broad of nostril, and insatiable." In painting and sculpture we do not see these dogs about Yama. The god is generally represented as seated on a buffalo. He is four-armed and of austere aspect. In one hand he holds a mace, in another a noose. He guides the animal on which he is seated by the horns. His garments are of the color of fire, whilst the complexion of his skin is of a bluish-green. He is crowned, and demons of a dwarfed size are frequently represented as worshipping him at his feet. His eyes are inflamed and bloodshot, and his teeth are like those of a tiger. It is only as *Dharmarâja,* or king of virtue or justice, that Yama is ever represented as a benign divinity. Then he is placid of countenance, with a look of mild serenity, but this is only as he appears, so Hindus say, to those who, fortified by a life of purity and good actions, have no need to fear the lord of hell. In the later phases of Hindu mythology all kinds of attributes are applied to Yama, and innumerable legends are current concerning him. We need not even refer to these, but confine our attention to the important question—a question which has provoked much discussion—viz. What was the central idea which gave rise in primal Vedic times to the personifications of Yama and Yami? Prof. Max Müller understands *Vivasvat* to mean the sky, *Saranyû,* the dawn, *Yama* the day, *Yami* the night. Prof. Roth believes that *Vivasvat* is the representation of the light of heaven, *Saranyû,* the dark storm-cloud, and *Yama* and *Yami* the first human pair. Serious objections may be found to both of these interpretations. As for the latter, it is sufficient to remark that the *Vedas* represent Yama as *resisting* Yami's importunity, and not as cohabiting with her so to upraise a race of mortals. As for Prof. Max Müller's theory, it is, though ingenious, unsatisfactory. It is difficult to understand how *Vivasvat* can be considered as satisfactorily representing the sky, or *Saranyû,* "the moving one," the dawn. That wonderfully deep and able Sanskrit scholar, the late Prof. Goldstücker, furnishes an explanation which is the most satisfactory one yet published. He says: "Vivasvat, 'the expanding,' probably implies the firmament 'expanding' to the sight through the approaching light; *Gandharva,* as usual, the solar fire, and *Saranyû,* the dark and cool 'air' (the moving element); Yama and Yami seem to represent the current of air produced by the effect of the solar heat emanating from the firmament on the cool air of the night, when the antagonism between the warm and cold air, of which this current consists, would be Yama repelling his union with his sister Yami, though, at the same time, they are 'husband and wife while yet in the womb' (of the night air). And since this phenomenon extends over the whole atmosphere, the two four-eyed watch-dogs of Yama are probably the eight, or twice four, regions of the compass, either each couple of them taken together with their intermediate regions—whence both dogs are called spotted—or the four regions, or the intermediate four, taken separately, whence one dog is called dark, the other spotted." A part of this explanation may be deemed fanciful, but as a whole it appears to be more worthy of credit than any other. In the later phases of Hindu mythology Yama becomes more and more exclusively considered as the dire god of hell, the judge of all, and the relentless punisher of the unjust. His messengers use his mystic noose to draw out of the bodies of men the souls which are doomed to appear before his judgment-seat. To the modern Hindu, Yama is the embodiment of power without pity, and stern, unbending Fate. R. C. CALDWELL.

**Yamagata Aritomo,** b. in the province of Chosiu, Japan, and is about thirty-five years of age; was educated for the military profession; at the commencement of the late revolution was appointed an aide-de-camp to the general of the imperial army; in 1871 went to Europe with Gen. Saigo to obtain military information for the government; on his return to Japan was appointed vice-minister

of war, and in 1874 was called to hold the three high positions of *sangi* or privy councillor, minister of war, and lieutenant-general of the imperial army. F. A. P. Barnard.

**Yamas'ka,** county of Quebec, Canada, bounded N. W. by the St. Lawrence and Lake St. Peter, and traversed by the river St. Francis. Much of it is fertile. Lumber is the leading manufacture. Cap. St. François du Lac. P. 16,317.

**Yamachiche,** p.-v., St. Maurice co., Quebec, Canada, on Yamachiche River, near the St. Lawrence, 75 miles N. W. of Montreal. It has an academy, a convent, trade in grain and lumber, and some manufactures. P. about 1300.

**Yam'bu,** or **Yembo,** town of Arabia, in a hot and arid plain between a chain of barren and steep mountains and an inlet of the Red Sea. It is well built, has a good harbor, and is of great importance as the port of Medina and one of the principal stations for the pilgrims who visit the holy cities of Arabia. P. between 6000 and 7000.

**Yam Hill,** county of N. W. Oregon, bordering on the Coast Mountains, bounded E. by Willamette River, intersected by Yam Hill River, and traversed by Oregon Central R. R.; surface generally undulating, soil in the E. part fertile. Horses, cattle, sheep, and swine are numerous. Staples, wheat, oats, and wool. Cap. Lafayette. Area, 750 sq. m. Pop. 5012.

**Yan'cey,** county of N. W. North Carolina, bordering on Tennessee. The surface is mountainous, Mount Mitchell in the S. E. part being about 6500 feet above the level of the sea. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, wool, and tobacco. Cap. Burnsville. Area, about 600 sq. m. P. 5909.

**Yancey** (William Lowndes), b. at Ogeechee Shoals, Ga., Aug. 10, 1814; his father, Hon. Benjamin C. Yancey, was a distinguished lawyer of Abbeville, S. C.; the son was well educated at the North, and admitted to the bar in Abbeville, S. C.; moved to Alabama in 1836; edited the Cahawba *Democrat* and the Wetumpka *Argus;* served in both branches of the legislature; was a member of Congress 1844–47 and of the national Democratic convention of 1848; an ardent opponent of the Compromise measures of 1850, and a leader of the secession party of the South; advocated in 1858 the formation of committees of safety in the cotton States "to fire the Southern heart;" seceded from the national Democratic convention at Charleston on the nomination of Douglas; advocated the election of Breckenridge; was the reporter of the ordinance of secession in the Alabama convention Jan., 1861; went to Europe as a Confederate agent, and was subsequently a member of the Confederate Congress. D. near Montgomery July 28, 1863.

**Yan'ceyville,** p.-v. and tp., cap. of Caswell co., N. C. P. 2203.

**Yan'dell** (David Wendel), M. D., b. at Murfreesboro', Tenn., Sept. 4, 1826; graduated M. D. at Louisville University 1846; was in Europe 1846–47; practised and taught medicine at Louisville, Ky., 1848; was professor of various departments of medicine in the Louisville University from 1859; medical director in the Confederate army 1861–66; president of the American Medical Association 1871; professor of surgery in the Indiana Medical College 1874; has contributed valuable articles to the profession, and established the *American Practitioner* 1870. Paul F. Eve.

**Yandell** (Lunsford P.), M. D., b. in Tennessee July 4, 1805; graduated in medicine at Maryland University; professor of chemistry in Lexington Medical School 1831, and afterward a professor in a Louisville college; edited medical journals in both the latter cities, and wrote several medical works and addresses. He resides (1876) in Louisville. Paul F. Eve.

**Yang-tse-Kiang'** (the "son of the great water"), the principal river of China, rises in Eastern Thibet from two streams which unite in lat. 26° 30′ N., lon. 102° E.; flows with a very winding and tortuous course, first S. E., then N., and at last N. E., and enters the Yellow Sea in lat. 32° N., lon. 121° E., through a vast estuary several miles broad. Its entire length is probably more than 3000 miles, and it receives from both sides numerous and powerful affluents. The largest vessels can ascend it as far as Hang-Kow, 700 miles from its mouth, and it is navigable to within a few miles of its sources. As it runs through one of the most fertile and most densely-peopled regions on the globe, and is possessed of a tremendous draining and carrying power, it is, or will be, one of the most important rivers on earth. But as it was opened to foreign commerce only a few years ago, and only as far up as Hang-Kow, it has as yet seen only the beginning of its history. By the Imperial Canal it communicates with the Hoang-Ho.

**Yanina.** See Janina.

**Yan'kee,** a term originally employed familiarly to denote natives of the New England States, was applied during the American Revolution to the insurgents generally, and during the civil war was the usual designation given in the "Confederate States" to the Union soldiers. In Europe, especially in England, it is generally synonymous with Anglo-American. The etymology is uncertain, but the most probable explanation is that given by Heckewelder, who considers it a corruption of the word "English" by the Indian tribes.

**Yankee Doodle,** a popular air, considered, especially in parts of the Northern States, as one of the national airs. It is reported to have been a popular tune in England during the Commonwealth, at which time its doggerel words originated, Oliver Cromwell being designated as *Nankee Doodle.* Others say that it was the tune originally set to the well-known old English song, "Lydia Locket lost her pocket," and that the present words were composed in 1775 by a British sergeant in Boston. Still other accounts of its origin are given.

**Yankee Springs,** p.-v. and tp., Barry co., Mich. P. 1023.

**Yank'ton,** county of S. E. Dakota, separated from Nebraska by Missouri River, intersected by Dakota River, and partly traversed by Dakota Southern R. R., which terminates at the county-seat. Surface irregular, with fertile soil on the river-bottoms. Cattle are the principal live-stock. Staples, wheat, oats, and hay. Cap. Yankton, also the capital of the Territory. Area, 520 sq. m. P. 2097.

**Yankton,** city, cap. of Dakota, and seat of justice of Yankton co., on Missouri River, is the terminus of the Dakota Southern R. R., and is connected by steamers with the principal ports on the Missouri; has 1 daily and 3 weekly newspapers. P. 737.

**Yankton Indians.** See Dakota Indians.

**Yan'tic River,** a stream which unites with the Shetucket and Quinebaug at Norwich, Conn., to form the Thames. It affords large and well-utilized water-power.

**Yaphank',** p.-v., Suffolk co., N. Y.

**Yapock.** See Cheironectes.

**Ya'quis,** or **Hiaquis,** a tribe of Indians in Sonora, Mexico, on the river of the same name, allied to the Pimas and Cahitas, number some 20,000, are semi-civilized, having had Roman Catholic missions among them since 1590, and are usually peaceful, but have maintained several wars with the white settlers, the latest having been in 1825, 1832, and 1841. They practise agriculture and possess numerous domestic animals.

**Yard** [*geard,* "hedge," or *gyrdan,* "to gird," Old Saxon], the statutory unit of length in England, declared by the act of 5 Geo. IV. 1824, to be "to the pendulum beating seconds in a vacuum at the level of the sea in the latitude of London in the proportion of 36 to 39.1393." The same act declared the standard measure then in custody of the clerk of the House of Commons, bearing the engraved legend, "Standard Yard, 1760," to be "the original and genuine standard." This standard was constructed by Bird by direction of a parliamentary committee appointed in 1758, and was a copy of one prepared in 1742 by the eminent horologist and mechanician George Graham, after a careful comparison of the various yards and ells of Henry VII. and Elizabeth, kept in the Exchequer. In the earlier periods of British history the standards of weight and measure were very inexact. Before the Conquest, according to Prof. Wackerbarth of the University of Upsala, Sweden (*Tidskrift for Matematik och Fysik,* Stockholm, 1870), the length of this measure was about 39.6 inches. It was, as its name imports, the assumed length of the girdle of a man of ordinary size; but in 1101 it was adjusted to the length of the arm of Henry I., and it still measures the average length of the human arm with the fingers extended. As a cloth-measure, the yard is divided into 4 quarters = 16 nails. For other purposes it is divided into 3 feet = 36 inches, the foot being in general made practically the unit.

The yard is also the unit-base of the measures of length in the U. S., though not made so by any direct act of Federal legislation. The standards authorized by Congress to be constructed at the bureau of weights and measures in Washington, and presented to the executive authorities of the several State governments, were for many years adjusted from a scale of eighty-two inches length divided on brass by Troughton of London for Mr. Hassler, the first chief of the U. S. Coast Survey, the length being taken between the twenty-seventh and sixty-third divisions of the scale; but in 1856 an officially-certified copy of the imperial standard yard was obtained, and the recently-constructed American standards have been copies of this. (See Weights and Measures.) F. A. P. Barnard.

**Yard'leyville,** v., Bucks co., Pa.

**Yarkand',** city of East Toorkistan, in lat. 38° 20′ N., lon. 77° 30′ E., about 105 miles S. E. of Kashgar, on the left bank of the river Yarkand, is surrounded by an earthen wall and defended by two citadels, one within the walls and one on the southern side. As a fortress, however, the place is not of very great importance, but since the expulsion of the Chinese and the establishment of an independent East Toorkistan empire at Kashgar, Yarkand has become the centre of a very important trade. Caravans from India arrive here, carrying with them the manufactures of Manchester, and through Russian Toorkistan lines of commerce connect it with the Caspian Sea and Moscow. Its manufactures of silks, cottons, linen, and woollens are important. The city is well built; the houses are mostly of stone; the streets are frequently intersected by canals; the bazaars, caravanserais, and mosques are numerous. The population is variously estimated at from 30,000 to 100,000.

**Yar'mouth,** town of England, county of Norfolk, on a slip of land between the North Sea and the Yare, along the bank of which runs a quay nearly two miles long; the harbor is accessible for vessels of 200 tons burden. It is the principal seat of the English herring fisheries, and a considerable deep-sea fishing is also carried on, the produce of which is daily carried to London. Crape and silk goods are manufactured, and a great number of coasting vessels are built here. P. 41,819.

**Yarmouth,** county of S. W. Nova Scotia, bounded S. W. by the Atlantic Ocean. Its coast-line is deeply indented and its surface is broken, but portions are very fertile. Shipbuilding, the fisheries, and other marine pursuits are the leading industries. Cap. Yarmouth, but a part of the courts are held at Tusket. P. 18,550.

**Yarmouth,** port of entry, cap. of Yarmouth co., N. S. Cape Fourchu light, near the entrance to the harbor, is in lat. 43° 50′ N., lon. 66° 7′ W. It is a wealthy town, fishing, commerce, and shipbuilding being largely carried on. Yarmouth has 2 weekly newspapers, 3 seminaries and several other schools, 3 banks, gasworks, and some fine public buildings. P. of sub-district, 5335.

**Yarmouth,** p.-v. and tp., Cumberland co., Me. P. 1872.

**Yarmouth,** p.-v. and tp., Barnstable co., Mass. P. 2423.

**Yarmouth Port,** p.-v., Barnstable co., Mass.

**Yar'muk** [from the Talmudic *Jarmoch*], a permanent river in Eastern Palestine, which the Greeks called *Hieromax* or *Hieromiax* (Pliny, *Nat. Hist.*, v. 16), and which is now called *Sheriat el-Mandhur*, from a Bedouin tribe dwelling on its banks (Ritter, *Erdkunde*, xv. 372). It is not mentioned in the Bible, nor by Josephus, although now considered the southern boundary of ancient Bashan. Its principal tributaries drain the Hauran and Jolan. It traverses a limestone region overlaid here and there by basalt. In the latter part of its course it plunges down a wild gorge and empties into the Jordan, with a strong current 130 feet wide, about 5 miles S. of the Sea of Galilee. It is full of fish, and lined with oleanders. On its banks near Gadara, about 8 miles from the Jordan, are hot sulphur springs, mentioned by Eusebius (Ἐμμαθά) and Jerome (*Amatha*) in their *Onomasticon.* Tristram (*The Land of Israel*, pp. 457, 458) reports nine of these springs, chiefly on the N. side of the stream. R. D. Hitchcock.

**Yaroslav',** government of European Russia, in the central part of the country, traversed by the Volga. Area, 14,120 sq. m. P. 1,000,748. The ground is low and level, and the soil not very fertile. Rye, oats, hemp, and flax are raised, but not in great quantities; timber is scarce. The inhabitants of this government are described as the most intelligent and handsome race of the whole Russian people, and they know how to make up for an inferior soil by industry. Their manufactures of linen and hardware enjoy a great reputation, and smiths, masons, carpenters, and artisans of every description emigrate from this government to all parts of the country.

**Yaroslav,** town of European Russia, capital of the government of Yaroslav, on the Volga at the influx of the Kotorost, in lat. 57° 37′ N. It is a handsome, enterprising, and prosperous town, the seat of the governor and of a Greek archbishop. It has large manufactures of linen and hardware, and an extensive trade. P. 37,275.

**Yar'ra-Yar'ra,** river of Australia, in the colony of Victoria, passes Melbourne and enters Port Philip, 8 miles below. On account of a bar at its mouth, with but 9 feet of water at high tide, the Yarra-Yarra is navigable only for vessels of 60 tons burden; larger vessels unload at Williamstown, near its mouth. Above Melbourne it is not navigable.

**Yar'ranton** (Andrew), b. at Ashley, Worcestershire, England, about 1615; became a linen-draper; was a soldier in the civil wars; was subsequently engaged in ironworks and as a surveyor, engineer, and agriculturist. Author of various treatises on agriculture, credit and labor, etc., by which he earned the title of "founder of English political economy," given him by a modern economist, Patrick E. Dove, who has written a biographical sketch (Edinburgh, 1855). His principal work was entitled *England's Improvement by Sea and Land, to Outdo the Dutch without Fighting, etc.* (2 parts, 1677–81).

**Yar'rell** (William), F. L. S., b. at Westminster, England, in June, 1784; became a wealthy newspaper agent, an enthusiastic sportsman, and an eminent zoologist, forming an important collection of British fishes; was one of the originators, and long a vice-president, of the Zoological Society, and communicated above 80 papers to various societies with which he was connected. D. at Yarmouth Sept. 6, 1856. He published *A History of British Fishes, illustrated by 400 Woodcuts* (2 vols., 1835–36), of which the 3d edition was accompanied by a *Memoir of the Author* by Sir John Richardson (2 vols., 1859; *Supplement*, 1860), and *A History of British Birds, with 520 Wood Engravings* (3 vols., 1839–43; 3d ed. 1856). A new and thoroughly revised edition of the last is now (1876) being published under the supervision of Prof. Alfred Newton.

**Yarriba.** See Yoruba.

**Yar'row,** or **Milfoil** (*Achillea millefolium*), a European plant of the Compositæ family, nearly allied to camomile, wormwood, and tansy, is found as a common weed in England and the U. S., produces leaves and flowers which have a bitter, astringent taste and an aromatic odor, and yields a blue volatile oil. It was formerly much used as a vulnerary, and in Sweden is employed by brewers as a substitute for hops.

**Yarrow,** a river of Selkirkshire, Scotland, rises at Yarrow Cleugh, near Loch Skene, flows N. E. 25 miles through Lochs Lowes and St. Mary, and falls near Selkirk into the Ettrick, a tributary of the Tweed. On its banks are the ruins of the famous castle of Newark, and Bowhill, the family-seat of the dukes of Buccleuch. Its current is rapid, and it affords many picturesque views, which have been commemorated in three well-known poems of Wordsworth.

**Yassy.** See Jassy.

**Yates,** county of W. New York, lying on Seneca, Canandaigua, and Crooked or Keuka lakes, the latter of which penetrates halfway across the county, and traversed by Crooked Lake Canal and by Northern Central R. R. The surface is undulating or hilly, and contains considerable iron ore; soil a sandy loam. There are saw-mills, planing-mills, flour-mills, distilleries, and manufactures of agricultural implements, carriages, saddlery, and brick. Horses, cattle, and sheep are the chief live-stock. Staples, wheat, Indian corn, oats, barley, hay, wool, dairy products. Cap. Penn Yan. Area, about 500 sq. m. P. 19,595.

**Yates,** tp., McLean co., Ill. P. 1048.

**Yates** (A. R.), U. S. N., b. Oct. 28, 1838, in New York; graduated at the Naval Academy in 1857; became lieutenant in 1861, commander in 1872; served on board the Hartford at the battle of Mobile Bay, and is thus mentioned in Rear-Admiral Farragut's report of Aug. 12: "Lieut. A. R. Yates of the Augusta acted as an additional aid to me on board the Hartford, and was very efficient in the transmission of orders. I have given him command of the captured steamer Selma." Foxhall A. Parker.

**Yates** (Edmund Hodgson), b. in London, England, in July, 1831; became a professional man of letters; wrote for many periodicals; was a dramatic author and theatrical critic; edited *Our Miscellany, Temple Bar,* and *Tinsley's Magazine,* and held for some years a high position in the London general post-office. Author of numerous successful works of fiction, and now (1876) editor of the *World* newspaper.

**Yates** (James), b. at Highgate, near London, in 1789; educated at the universities of Glasgow and Edinburgh; studied theology at Berlin, and was pastor of Unitarian churches in Glasgow, Birmingham, and London; was an active member of several scientific societies, to which he communicated memoirs on antiquities, philology, botany, and geology. Author of *A Vindication of Unitarianism* (1815), in reply to Dr. Wardlaw; *Textrinum Antiquorum, an Account of the Art of Weaving among the Ancients* (1843); *Descriptive Catalogue of a Collection of Current Coins of all Countries in the International Exhibition* (1862), and other pamphlets on education, religion, and the decimal system, and was a contributor to Dr. William Smith's *Classical Dictionaries.*

**Yates** (John V. N.) was for many years secretary of the State of New York; edited a volume of *Select Cases Adjudged in the Courts of the State of New York* (1811), *A Collection of Pleadings and Practical Precedents* (2d ed., 1837); wrote a *Continuation* to Chief-Justice Smith's *History of the Province of New York* (Albany, 1814); was joint author with Joseph W. Moulton of a *History of the State of New York* (2 parts, 1824–26), and with John L. Tillinghast of a *Treatise on the Principles and Practice, Process, Pleadings, and Entries in Cases of Writs of Error, etc.* (Albany, 2 vols., 1840).

**Yates** (Joseph C.), b. at Schenectady, N. Y., Nov. 9, 1768; became a lawyer there; was one of the founders of Union College; served as mayor 1798–1808, as State senator 1806–07, as judge of the supreme court 1808–22, and governor of New York 1823–25. D. at Schenectady Mar. 19, 1837. A county in New York commemorates his name.

**Yates** (Richard), b. at Warsaw, Ky., Jan. 18, 1818; graduated at Illinois College, and studied law; served several terms in the Illinois legislature, and in 1850 was elected to Congress on the Whig ticket; in 1861 was elected governor of Illinois, and took an active part in raising troops for the Union army; served as U. S. Senator from Illinois from 1865 to 1871. D. in St. Louis Nov. 27, 1873. J. B. Bishop.

**Yates** (Robert), b. at Schenectady, N. Y., Jan. 27, 1738; educated in New York City, where he was admitted to the bar 1760; settled at Albany; was a member of the committee of public safety 1775, of the provincial congress, and chairman of committee of military operations 1776, of the constitutional convention 1777; was appointed a judge of the supreme court of New York the same year; became chief-justice 1779; was a member of the national convention which formed the Federal Constitution of 1787; took notes of its proceedings, which were printed by his widow (1839); retired from the bench 1798, and was appointed a commissioner to settle disputed land-titles in the "Military Tract" with the states of Massachusetts and Connecticut, and also to settle claims of New York against Vermont. D. at Albany Sept. 9, 1801.

**Yates** (William), D. D., b. at Loughborough, Leicestershire, England, Dec. 15, 1792; educated at Bristol College; went to Calcutta as a Baptist missionary 1815; settled at Serampore; devoted himself chiefly to the task of translating and of preparing textbooks; visited England and the U. S. 1827–29, and was on his way to England when he d. in the Red Sea, July 3, 1845. Author of *A Grammar of the Sanscrit Language* (1820), *A Sanscrit Vocabulary* (1820), *Introduction to the Hindostanee Language* (1827), *Dictionary of Hindostani and English* (1836), and a posthumous work, *An Introduction to the Bengali Language* (2 vols., 1847; new ed. 1864). He translated the whole Bible into Bengali, and the New Testament into Hindi, Hindostani, and Sanskrit. A *Memoir* (1847) was written by Dr. James Hoby.

**Yates City,** p.-v., Knox co., Ill.

**Yates'ville,** tp., Morgan co., Ill. P. 1440.

**Yaupon.** See Holly.

**Yav'apai,** county of N. E. Arizona, bordering on Utah and New Mexico. Only a small portion of its area has been explored. The greater part of it is 5000 or 6000 feet above the sea, and portions are considerably more elevated. Colorado River crosses the N. W. corner through precipitous cañons; as does also the Colorado Chiquito, which flows through the centre of the county. Among the other streams are tributaries of San Juan and the Gila. The mountain-chains are numerous, their general direction being N. and S. There are some mining districts in the county, and the Moqui Indians inhabit the north-eastern part. Cap. Prescott. Area fully 50,000 sq. m. P. 2142.

**Yawn'ing.** Yawning is in some respects analogous in its action on the respiratory process to sighing. It consists of a deep inspiration, accompanied by an involuntary opening of the jaws to their fullest extent. But it differs from sighing in these points—that it is entirely automatic; that is, not performed by the action of the will; that it is evidence of mental weariness, or rather of the existence of the state which the French call *ennui*—a word which has not its exact synonym in the English language; and that it is contagious. Its exciting cause is imperfect aëration of the blood, and it is sometimes a symptom of certain brain diseases, in which the encephalon is weakened in its functions of carrying on the operations of the organism. Yawning is performed by certain animals, as the dog, and in them, as in man, has a like cause, and is succeeded, so far as we can determine from observation, by a feeling of relief from sensations not altogether agreeable. W. A. Hammond.

**Yaws** (*Frambœsia*), a contagious disease of Africa, Malaisia, the Feejee Islands, the West Indies, etc. It has several varieties. It closely resembles the *Sibbens* of Scotland and the *Scherlievo* of Illyria. Some have considered it a form of leprosy, but it is more probably syphilis.

**Yazoo',** county of W. Mississippi, lying on Black River, intersected by the Yazoo, and skirted in the E. part by Mississippi Central R. R.; surface level, soil very fertile. Horses, mules, cattle, and swine are the chief live-stock. Staples, cotton and Indian corn. Cap. Yazoo City. Area, 650 sq. m. P. 17,279.

**Yazoo City,** p.-v., cap. of Yazoo co., Miss., in Yazoo Valley, one of the richest corn and cotton growing districts of the South, and 60 miles from Vicksburg, has 8 churches (3 colored), 4 good schools, 2 weekly newspapers, 1 bank, 2 mills, several manufactories, and an efficient fire department. Yazoo River is navigable for over 200 miles above the city. Drummond Burch, Ed. "Democrat."

**Yazoo Fraud, The.** This was the name popularly applied to the sale by Georgia in 1795 of the greater portion of her western territory. The treaty of peace of 1783 having made the Mississippi the western boundary of the U. S., and the treaty of Beaufort of 1787, between the States of Georgia and Mississippi, having settled the questions of boundary between these States, the State of Georgia was possessed of a vast and valuable western territory, extending to the Mississippi and lying between the parallel lines drawn from the head-waters of the Savannah River on the N. and the head-waters of the St. Mary on the S., including what afterward became the States of Alabama and Mississippi. In 1789 the State of Georgia sold to the South Carolina Yazoo Co., the Virginia Yazoo Co., and the Tennessee Co. lands in this territory estimated at 10,000,000 to 12,000,000 acres for about $140,000. Certain difficulties both as to the Indian title and the currency in which the purchasers were entitled to pay having arisen, suits were commenced in the Federal courts, which were abruptly terminated by the amendment to the U. S. Constitution declaring that such courts should have no jurisdiction to entertain suits brought against a State. These sales, therefore, seem to have been practically inoperative. But in 1795, under a reorganization of the purchasers, the State of Georgia sold to four companies—the Georgia Co., the Georgia-Mississippi Co., the Upper Mississippi Co., and the Tennessee Co.—for $500,000 an immense body of Western lands, the exact extent of which perhaps could scarcely be estimated, but which it was alleged extended from the Alabama and Coosa on the E. to the Mississippi on the W., and from the northern boundary of Georgia along the 35th nearly to her southern limit on the 31st degree of latitude. This sale naturally attracted the attention and excited the apprehension of the Federal government, to whose notice it was specially brought by a message of Pres. Washington. But it created an indignant excitement in the State of Georgia. It was charged, with apparent truth, that the legislation necessary for the sale had been obtained by the corruptest influences and by the wholesale bribery of the members of the legislature. Gov. James Jackson, then U. S. Senator from Georgia, resigned his seat, became a candidate for the State legislature, and the leader of the people in their determination to overturn the whole transaction. He succeeded, and in 1796 all acts authorizing the sale were repealed, the purchase-money paid was ordered to be returned, and every vestige of the transaction was obliterated from the records; which latter part of the sentence was executed in the presence of the governor, the legislature, and a vast assembly of citizens by burning the act itself, the fire being kindled by the use of a lens, so as to make it, in the words of one who has described the scene, "a consuming fire from heaven." Having thus cancelled the legislative sale, the State of Georgia, after a negotiation with the general government, ceded all this western territory to the U. S. in 1802, and the rights of the purchasers thus became a question for the Federal government. In 1803, Mr. Madison, secretary of state, Mr. Gallatin, secretary of the treasury, and Mr. Lincoln, attorney-general, appointed by Mr. Jefferson under an act of Congress to report on the Yazoo claims, made a very full examination of the history of the sale, and, while not positively confirming what had been done, expressed their belief that "the interest of the U. S., the tranquillity of those who may hereafter inhabit that territory, and various equitable considerations which may be urged in favor of most of the present claimants, render it expedient to enter into a compromise on reasonable terms;" and they recommended compensation in land or money. The popular feeling, however, against the transaction, partly on account of the alleged corruption of the State legislature, partly on account of the unwillingness to see this great territory monopolized by the combination of a few capitalists, prevented any action by Congress. The claimants finally sought their remedy in the U. S.

courts, and the case was carried by appeal to the Supreme Court of the U. S. In Fletcher *vs.* Peck, Chief-Justice Marshall in 1810 held that the original sale by the State of Georgia must be sustained; that the allegation of corruption on the part of the legislature could not be entertained by the court; that purchasers from the land companies were innocent holders without notice; that the repealing act of the Georgia legislature could not divest the rights thus acquired. Consequently, in 1814 Congress appropriated $5,000,000 to be raised by the sales of the lands to quiet and extinguish all the Yazoo claims.—Such is a brief outline of what was once a very famous and violent controversy, the crimination and recrimination of which are scarcely worthy of historical perpetuation. Those who may desire to examine it more closely will find material in the acts of the Georgia legislature; the debates in Congress; *Amer. Arch. Pub. Lands*, vol. i.; Fletcher *vs.* Peck, 6 Cranch & Chappells; *Georgia Miscellanies.*

L. Q. C. Lamar.

**Yazoo River** (the name signifies "River of death" in the Choctaw language, alluding to the malarial diseases which prevailed upon its shores), a navigable stream of Mississippi, originates in the Yazoo Pass, Coldwater River, Beaver Dam River, and other bayous and sloughs springing from the E. bank of Mississippi River. These join the Tallahatchie, a navigable stream from the N. E., at Polkville, Miss., where the Yockeney also comes in from the E., but the united stream is generally called the Tallahatchie down to the junction with the Yalabusha, which is also navigable. The Yazoo proper below this point is 290 miles long, deep, serpentine, and sluggish, and navigable the year round. It joins the Mississippi 12 miles above Vicksburg. At high water steamboats might pass, but for the levee at Moon Lake, from the Mississippi, through Yazoo Pass and the Coldwater River, throughout the whole length of the Yazoo system of bayous and streams. On the W. side the Sunflower River and other navigable channels pass from the Mississippi to the Yazoo. The region adjacent to the Yazoo is very fertile; on the W. side it is flat and often swampy, but on the E. more often bluffy or rolling.

**Yberville.** See Iberville, D'.

**Yea'mans** (Sir John), b. at Bristol, England, early in the seventeenth century; resided many years in Barbadoes; settled in South Carolina 1665, at which time he was the introducer of African slaves into the colony; was governor of South Carolina 1671–74; was removed from office for arbitrary conduct, and went to Barbadoes, where he d. soon afterward.

**Yeames** (William Frederick), b. at Taganrog, Russia, in 1835, son of the British consul at that place; studied art in London and Italy; acquired reputation as a painter of historical and genre pictures, and was chosen an associate of the Royal Academy 1866.

**Year** [Ang.-Sax. *gear;* Ger. *Jahr*], the time of one complete revolution of the earth round the sun, or of the apparent revolution of the sun in the celestial sphere. This is the sidereal year, so called because it is the interval between two consecutive returns of the sun to the same point among the stars; the sensible or natural year, called in astronomy the tropical or equinoctial year, is the period within which the cycle of the seasons is fully completed. The seasons are dependent on the progressive and periodical changes of the sun's place in declination. (See Climate.) The declination is maximum at the tropics and zero at the equinoxes. Hence, the tropical or equinoctial year is the interval between two successive arrivals of the sun at the same tropic or at the same equinox. The equinoxes have a very slow and not entirely uniform retrograde motion upon the earth's orbit, called precession, amounting in the mean to 50.2″ of arc per annum; and hence the tropical year is shorter than the sidereal by the amount of time occupied by the earth in passing over this small arc—an amount equal in the mean to 20*m.* 19.9*s.* of mean solar time. The mean annual arc of precession is at present undergoing an excessively slow increase, the effect of which is to diminish the length of the mean solar year at the rate of 0.595*s.* per century—a process which will at length be reversed.

If the earth's orbit were perfectly circular, or if it were a perfectly true ellipse, the major axis maintaining an invariable position in space, the length of the sidereal year would be absolutely, as it is very nearly, constant. The orbit is elliptical, but is somewhat distorted in figure by the disturbing attractions of other bodies, and its axis has an exceedingly slow direct angular motion, turning around the sun as a pivot. The annual increase in longitude of its extremities or apsides is 11.778″ of arc; and consequently, when the earth has completed a sidereal revolution, it is less advanced in the ellipse than it was at the beginning of the same revolution by this small space. If, therefore, there be drawn from the sun, in the plane of the earth's orbit, a straight line fixed in space, and if the beginning of the sidereal year be taken at the moment in which the earth's centre passes this line, the length of the sidereal year will slightly diminish as, in the revolution of the line of the apsides, the aphelion approaches this line, and will similarly increase after the aphelion has passed the line, and until the perihelion shall make the same passage; but the entire amount of variation will be so exceedingly minute that, as above stated, the length of the year will be very nearly constant.

The interval which elapses between the moment of the earth's departure from any given point in the ellipse till its return to the same point again is called an anomalistic year, and is greater than the length of the sidereal year by the time necessary to traverse the minute arc 11.8″, which time in the mean is 4*m.* 39.7*s.* The anomalistic year is usually reckoned from the aphelion or from the perihelion passage, but, whatever is the point of departure, the length is the same. The mean lengths of the several years above defined may be stated as follows:

| | |
|---|---|
| The mean solar or tropical year | 365*d.* 5*h.* 48*m.* 46.054*s.* |
| The mean sidereal year | 365*d.* 6*h.* 9*m.* 5.95*s.* |
| The anomalistic year | 365*d.* 6*h.* 13*m.* 45.65*s.* |

The length of the tropical year was approximately ascertained by the ancient Egyptians by measuring, from day to day at noon, the shadow of a vertical gnomon erected for the purpose upon a horizontal plane. The shadow is necessarily minimum on the day of the summer solstice, and the interval between two such minima is the number of entire days in the solar year. A calendar year of 365 days would, however, go backward, in reference to the natural year, about twenty-five days in a century, and the fact, if not the amount, of its error would soon become perceptible. The Thebans are said to have first discovered that six hours must be added to the length of the calendar year to prevent this displacement. Hipparchus, in the second century B. C., found six hours too great by 4*m.* 48*s.*, making the year 365*d.* 5*h.* 55*m.* 12*s.* Near the end of the ninth century of our era, the Arabian astronomer and prince, Albategnius, reduced the year of Hipparchus by 8*m.* 48*s.*; giving 46*m.* 24*s.*, instead of 55*m.* 12*s.* The Alphonsine Tables (1252) gave 49*m.* 16*s.*; Copernicus (1543), 49*m.* 6*s.*; Tycho Brahe (1602), 48*m.* 45½*s.* All these determinations having been made before the invention of the telescope, their near approximation to the truth is remarkable, especially that of the last.

As, in the practical affairs of life, convenience requires that the year should be composed of a definite number of entire days, the fractional excess of about a quarter of a day above 365 is allowed to go on accumulating for four years, and the fourth year is increased by the addition of another day, making it 366. But as the fractional excess is not quite a quarter of a day, falling short that amount by 11*m.* 13.95*s.*—a quantity sufficient to amount to eighteen hours in a century, or three days in four hundred years—allowance is made for this by omitting the intercalary day in three out of every four centurial years. This is the Gregorian correction, for a fuller explanation of which, and for the subdivisions of the year among different peoples, see Calendar, and on the latter point see also Month.

The epoch of the reformed Julian calendar (see Calendar) is Jan. 1, B. C. 45, as reckoned by the chronologists; or Jan. 1, B. C. 44, according to the reckoning of the astronomers.* The intercalation was first applied in the year 42 B. C., chronological reckoning, and subsequently every third year, instead of every fourth, as intended (the pontiffs who regulated the calendar forming the quadrennium, in accordance with the usage of the time, by counting the leap-year both at the beginning and at the end), until the 37th year of the era, which was the 9th B. C., by chronological reckoning, and was the final leap-year of this irregular series. Then, by order of Augustus, for the purpose of correcting the irregularity, the intercalary day was suppressed for three successive quadriennia; that is, in the 41st, 45th, and 49th of the era, being the fourth year before the birth of our Saviour, the year of that event, and the fourth year after. The birth of Jesus Christ is assumed, for chronological purposes, to have occurred on the 25th of December in the 45th year of the Julian era; and as, by the Julian calendar, Jan. 1 was made the beginning of the year, the first calendar year of the Christian era com-

* The astronomers, for convenience of calculation, make the supposed year of our Saviour's birth the year zero, the years following being accounted positive, and the years preceding negative. Thus, in comparing dates B. C. in the works of such writers as Delambre with those given for the same events by professed chronologists, like the authors of *L'Art de Vérifier les Dates*, etc. etc., it is necessary to bear in mind that the excess of a unit in the statements of the latter authorities, instead of being evidence of disagreement, implies practical identity.

menced seven days after the event from which it nominally dates, or on Jan. 1 of the 46th Julian year. The first century of the era terminated, therefore, Dec. 31, A. D. 100, and the eighteenth century Dec. 31, A. D. 1800. It would hardly be worth while to make so obvious a remark, if the question had not occasionally been gravely raised, whether the year 1800 belongs to the eighteenth or to the nineteenth century. The popular error on the subject has probably arisen from the fact that, in the ecclesiastical calendar, printed in all the prayer-books of the Roman and Protestant Episcopal churches, the centennial corrections are made on the centurial years, and each corrected century commences with the hundredth year of the century preceding, and ends with the ninety-ninth year of the century current. The reason for this practice is that the solar correction, being the omission of an intercalary day, must be made on a year which is regularly a leap-year; and in order to avoid complication the lunar correction when made is made synchronously with it. The centurial year is chosen as the year for applying the correction for the sake of simplicity and facility of recollection. Another fixed leap-year might be selected, as, for instance, the year 4 or the year 96 in each century; in which case the calendar centuries would end with the year 3 or the year 95. On this subject the following mode of reasoning is sometimes used; it is mentioned here because it has been seriously entertained, and not because it appears to the writer to be ingenious or even plausible: "A year is not counted in chronology until it is completed. Hence, the first year of the era was zero, and the count 'one' ran through the second year, which was not counted till after its close. In like manner, the count 'ninety-nine' ran through the hundredth year, the count 'one hundred' ran through the first year of the second century," and so on. The question, therefore, according to this reasoning, is not a question of opinion, but a question of fact.

The fact, nevertheless, is, that the count in chronology is not made as above asserted. The Christian era was only first used for the purposes of chronological reckoning some time in the sixth century, when it was adopted in Italy on the recommendation of Dionysius Exiguus, a Latin monk. It did not become well established in France and Germany until the time of Charlemagne (A. D. 742–814). The year of the Nativity was not then well known, and has never, in fact, been positively ascertained to this day. It was assumed, as above stated, for the purpose of establishing the era, that this year was identical with the 45th of the Julian era, and the 46th of that era was made the first of the Christian, the count applying equally to the first day and the last day of that year. The 145th Julian year was, therefore, the 100th Christian year, and the first Christian century ended with its hundredth year, so named. It is a little curious that those who employ the mode of reasoning above given do not apply it as well to the century as to the year. According to them, the first century should be called zero, and the present the eighteenth.

Different peoples have differed widely as to the place among the seasons of the beginning of the year. The Roman year, before the time of Julius Cæsar, began on the 1st of March. The civil year of the Jews began at the autumnal equinox, though their sacred year began at the vernal. The Greek year, before the time of Meton, began at the winter solstice; afterward at the summer solstice. The Egyptians, Persians, and other Eastern peoples began, like the Jews, at the autumnal equinox. The Mohammedan year, being a lunar year, has no determinate epoch, but continually goes backward among the seasons. The first of September was the beginning of the year in the Eastern Empire, and the same was true in Russia before the time of Peter the Great. In France, under the Merovingian kings, the year began March 1; under the Carlovingians, March 25; under the Capetians, at Easter; and from 1564 onward, Jan. 1. The ancient Northern nations of Europe placed the beginning of the year at the winter solstice. In England the year began on the 25th of March previously to the adoption of the Gregorian calendar, which took place in 1752. The same usage prevailed in the British American colonies from Nova Scotia to Georgia, and was abandoned at the same time.

F. A. P. BARNARD.

**Year and a Day** (in law). This space of time was constantly employed by the common law and by ancient statutes to designate the period by the full completion of which, after the happening of some specified event, a legal right connected with such event would be either gained or lost. The following examples will sufficiently illustrate its use and effect: A person feloniously assaulted and wounded by another must die within a year and a day from the infliction of the wound in order that the crime should be murder. Animals taken estray belonged to the lord of the manor unless claimed within a year and a day from their seizure. Wreck found and taken into possession by the proper officer fell to the Crown or its grantee unless an owner appeared within a year and a day from the finding. Certain actions and proceedings must be commenced within that time after the right accrued. Thus, an execution could not be issued on a judgment after a year and a day from its entry unless the judgment itself was revived by *scire facias*. It is useless to multiply examples, since the only matter of interest connected with this particular limit of time consists in the reasons for its choice and its actual meaning. A year and a day was not literally one year and one day in addition, or 366 days. It was simply a complete year, or 365 days, and the term was selected in order that, by taking into account another rule of the common law, the period of time which must elapse before the right was gained or lost might be *one full year*. This resulted from the established doctrine of the common law that in reckoning the continuous lapse of time each day was regarded as a single, indivisible, and instantaneous point of time, and was therefore condensed into its first moment, or, in other words, was legally ended as soon as begun. By virtue of this principle a minor attained his majority at the instant after midnight of the 364th day of his twenty-first year. He became of age when he was 20 years 364 days and a moment old. During the entire 365th day, although he had not completed his twenty-first year by perhaps twenty-four hours according to our popular computation, he was fully competent to perform all the acts belonging to the age of manhood. The same principle was applied to every lesser specified space of time, as, for example, a year. If a rule of the common law or of a statute should declare that some act could be done or some right acquired or lost after the expiration of a year from a given time, the act would be lawful, the right would be gained or lost, after the expiration of 364 full days—that is, immediately after the beginning of the 365th day at midnight—for that day being legally regarded as existing and finished in its first moment, the year would have been fully accomplished, although there might be twenty-four hours longer before the succeeding day would commence. In consideration of this well-known rule, and to furnish a complete year of 365 full days before the probationary period should end, the time "a year and a day" was invented. The result is, that a "year and a day" was exactly one complete year according to the modern popular computation of time.

JOHN NORTON POMEROY.

**Year Books,** early reports of cases decided in the English courts of law. (See REPORTS.) They are mainly interesting in an antiquarian and historical point of view, and are seldom resorted to as guides for modern decisions. Instances, however, may be found in which they are consulted. (See the cases of *Lumley* vs. *Gye*, 2 Ellis & Blackburn, 216; *Curtis* vs. *Hubbard*, 4 Hill (New York), 437; *Althorf* vs. *Wolfe*, 22 New York Reports, 366, 367.) The *Year Books*, as generally known to the legal profession, consist of an edition published by Sergeant Maynard (1678–80), beginning with the reign of Edward I. and coming down to the time of Henry VIII. The collection was an imperfect one, a number of the early reports still remaining in a manuscript form. Some of these have been published within a few years. The usually-received edition is in the form of thick and unwieldy folios, in black-letter type, in an obsolete language (Norman French), and with many abbreviations at the present time difficult to decipher. Few lawyers of our day could succeed in reading and understanding them. The volumes which have been recently published are in portable form, with excellent paper and clear type, and an English version is given in parallel columns with the Norman French. It is greatly to be hoped that the reports in Sergeant Maynard's work may go through the same process of republication, as the cases there collected, if presented in a readable form, would undoubtedly supply much curious and valuable information as to the manners and customs of the times when they were decided. (Consult Wallace on *Reporters*; Foss's *Judges of England*.)

T. W. DWIGHT.

**Yeard'ley** (Sir GEORGE), b. in England about 1580; was governor of Virginia 1616, 1619–21, and 1625; was a member of the council, and promoted many important improvements in Virginia. D. in 1627.

**Yeast, Yeast-Plant,** and **Yeast-Powders.** See BREAD and FERMENTATION, by PROF. C. F. CHANDLER.

**Ye'cla,** town of Spain, province of Murcia, on the Jumilla, has a trade in wine, brandy, and fruit. P. 11,669.

**Yeddo** or **Yedo,** now **Tokio** or **Tokei.** See JAPAN.

**Yeisk.** See JEISK.

**Yekaterinboorg',** town of European Russia, government of Perm, on the Isset, is the centre of a large mining district on the eastern side of the Ural Mountains in lat. 56° 50′ N. Cutting and engraving of precious stones and manufactures of marble, etc., are carried on. P. 24,500.

**Yekaterinodar′,** town of Russian Caucasia, government of Stavropol, in the midst of a swamp which serves as fortifications, is most wretchedly built, consisting for the greatest part of mud huts thatched with straw. P. 8765.

**Yekaterinograd′,** town of European Russia, in the Ciscaucasian territory of the Terek, on the left bank of the Terek, was founded in 1777 by Potemkin, is fortified, and forms a military Cossack station. P. about 5000.

**Yekaterinoslav′,** town of Russia, capital of the government of the same name. It was founded by Potemkin in 1784, is the seat of the governor and of a Greek bishop, and has several important manufactures. P. 22,548.

**Yelatom′,** town of Russia, government of Tambov, on the Oka, has 12 churches. P. 5983.

**Yêl-elei-kilangu,** the true Indian name for the tapioca. This plant is rapidly becoming the Hindû's potato. The crown prince of Travancore has been recently paying great attention to its proper cultivation. In India a method has frequently been adopted to cook the root of the tapioca-plant and serve it up to table in such a form that it is almost if not wholly impossible to recognize the difference between it and the "mealiest" and largest of potatoes. The tapioca-plant, having a sevenfold leaf, is thus called the *yêl-elei-kilangu,* or, literally, "root with seven leaves." In many parts of India it grows wild. R. C. Caldwell.

**Yeletz′,** town of Russia, government of Orel, on the Sosna, is old, but neatly built. It is celebrated for its manufactures of wheat flour, has trade in buckwheat and cattle, and iron-mines in the vicinity. P. 30,182.

**Yeli′ta,** tp., El Paso co., Tex. P. 799.

**Yelk** [sometimes called **Yolk,** which is considered incorrect by Noah Webster; derived, doubtless, from the Ang.-Sax. *gealew* and the German *gelb,* "yellow," the German *gelt,* "gold," being a kindred word]. The yelk of eggs is composed chiefly of an oily matter, forming a sort of emulsion with a solution which contains albumen and caseine, somewhat similar to white of egg. The albuminoid matters were formerly called *vitelline,* and supposed to be peculiar, but the contrary is now held. Henry Wurtz.

**Yell,** county of W. Arkansas, lying on Arkansas River, and intersected by Fourche, La Fave, and Petit Jean rivers; surface diversified, soil fertile. Cattle and swine are the chief live-stock. Staples, cotton and Indian corn. Cap. Danville. Area, 936 sq. m. P. 8048.

**Yell,** tp., Boone co., Ia. P. 1399.

**Yell,** tp., Webster co., Ia. P. 349.

**Yell** (Archibald), b. in Kentucky in 1797; settled in Arkansas; was appointed judge of the Territory; was a member of Congress 1837–39, and again 1845–46; was governor of Arkansas 1840–44; took part in the Mexican war, and was killed at the battle of Buena Vista, Feb. 23, 1847.

**Yellow Berries.** See French Berries.

**Yel′low-Bird,** the common name given to two varieties of birds, the American goldfinch (*Chrysomitris tristis*) and the yellow-poll warbler (*Dendroica æstiva*).

**Yellow Creek,** tp., Chariton co., Mo. P. 1016.

**Yellow Creek,** tp., Linn co., Mo. P. 3126.

**Yellow Creek,** tp., Columbiana co., O. P. 3088.

**Yellow-eyed Grass,** the common name of the Xyridaceæ, an order of endogens chiefly consisting of the *Xyris,* a genus of biennial or perennial rush-like plants with two-edged, sword-shaped leaves. More than 50 species have been described, and 15 are found in the Northern U. S., chiefly in sandy swamps and pine-barrens.

**Yellow Fever,** so called because of the peculiar yellow tinge of the skin characterizing it, and for the same reason technically designated *typhus icterode, icterus* being the classical name of "yellow jaundice." It is not a form of typhus fever, but resembles it in the prostration, blood-disorganization, and softening of internal organs which are features in both. Yellow fever prevails chiefly in tropical and warm climates. When occurring in temperate or cold zones, it has been imported in the course of commercial travel. It is indigenous chiefly in the West Indies, upper coasts of South America, the borders of the Gulf of Mexico, and the Southern U. S. It occurs in isolated, sporadic cases at all seasons in seaports, to which it has been transported in ships. Rigid quarantine of all ships coming from yellow-fever localities, and their fumigation before disembarking passengers and cargo, have averted the epidemics formerly so frequent. It is generally conceded that there is a specific morbific element, a portable *fomites* or fermentative substance, which propagates this disease. This *materies morbi,* when imported and let loose, will prove innocuous unless the weather be warm or mild and the air moist. It rarely develops when the mercury is below 70° F., and frost or freezing weather effectually terminates its career. Insalubrious, damp, low, and filthy localities are more likely to be its points of successful lodgment, as when emigrants from yellow-fever ports, on landing, go to the dense and uncleanly tenement districts of the larger cities. But in the same way it may be carried into the healthiest residences. It is thus the poison is imported and carried directly to certain points which become *foci* of the disease, from which, unless brought under immediate and rigid sanitary surveillance, it radiates with more or less havoc. By the intercourse of business and personal visits it may be carried from the infected localities to other points, which in turn become foci of contagion. But there is no general atmospheric contamination, no infection, no contagion necessarily, except as the air vitiated by the breath, vomit, and stools of the patient is inspired. Yellow fever is not now regarded, as formerly, a fever of malarial origin, allied to intermittent and remittent. It prevails on the coasts and in large cities, sparing the contiguous country, which is often swampy and afflicted severely by malaria. The negroes of the South, although susceptible to malaria, enjoy a relative immunity from yellow fever. Yellow fever has no periodicity—that is, alternations of febrile periods and remissions; from the onset of the attack to its termination it is a continuous fever. Quinine and other antimalarial remedies do not control it, or especially relieve it beyond their general tonic effect. Yellow fever has no definite duration of its period of incubation or formation. In some cases, for two or three days or more, there will be general lassitude, loss of appetite, and sense of debility. In graver cases the attack may be precipitate and speedily fatal; reversely, there are "walking cases," in which, with jaundice and even mental disturbance, the muscular power is retained. There is usually an initial chill, some headache, and slight increase of temperature. Exceptionally, the thermometer in the mouth or axilla will register a high degree, as in other fevers—103°, 104°, 105° F.—but more often the body-heat is but little elevated, and in some cases is lowered. The pulse is but little accelerated. The stomach is irritable at an early date, due to the poisonous influence of bile in the blood upon the origin of the pneumogastric nerve, as well as by sympathy with the congested liver. The mind may be mildly or actively delirious. The skin grows yellow, and, when vomiting causes exhaustion and wasting, is often shrivelled. The blood has become seriously impaired by the morbific poison, and its decomposed and watery elements tend to transude the coats of the vessels. Hence, with the effects of vomiting, vessels in the congested stomach are unloaded, and the already disorganized blood, being further perverted by the action of gastric juice, presents a coffee-ground, or again a tar-like, appearance, known as "black vomit." This is regarded as a critical or even fatal sign; and with reason, since it is an evidence of serious destruction of red blood-cells. Exhaustion and collapse are the result of such conditions unless stimulating and sustaining treatment is assiduously adhered to. The average duration is a week, and cases vary in character from a mild fever, with gastric disorder, to a malignant and incurable typhus icterode. There is no specific treatment. No depressing remedies should be employed. Cold and evaporating lotions to the head may prevent brain symptoms; ice, effervescing waters or champagne in small quantity, and other remedies for composing the stomach, are valuable. Carbonate of ammonia may help to oxygenate the blood. But quiet, discreet nursing, warm drinks, and blanketing, and, later, abundant nutrition, are found to be the most successful means of cure. The mortality varies with the character of the epidemic, the class of persons it has attacked, their hygienic surroundings, and the discretion with which cases are treated; it may be as low as 5 or as high as 75 per cent. E. Darwin Hudson, Jr. Revised by Willard Parker.

**Yel′low-Hammer** [Ger. *Ammer* or *Goldammer*], the *Emberiza citrinella,* a very common and quite handsome European bunting. In Great Britain it is looked upon with a superstitious dislike, and its nests and eggs are destroyed by the rustics. In Italy it is fattened and eaten.

**Yel′lowhead,** tp., Kankakee co., Ill. P. 1492.

**Yel′lowlegs,** the *Gambetta flavipes,* a North American snipe, found all along our Atlantic coast. It is a fine game-bird, and is esteemed by epicures.

**Yel′low Med′icine,** county of S. W. Minnesota, formed since the census of 1870. The surface is an uneven table-land, watered by Lac qui Parle and Yellow Medicine rivers. Cap. Granite Falls. Area, 792 sq. m. P. 2484.

**Yellow Medicine,** tp., Redwood co., Minn. P. 385.

**Yellow Medicine River** flows from Lake Hendricks, on the line between Minnesota and Dakota, and flows E. by N. to Minnesota River.

**Yellow River.** See Hoang-Ho.

**Yellow-Root,** a name given in the U. S. indifferently to several plants, most of which have been described under other names. (See CELASTRACEÆ, PUCCOON, RANUNCULACEÆ, and VIRGILIA.)

**Yellow Sea** [Chinese, *Whang-Hai* or *Hoang-Hai*], large inlet of the Pacific Ocean on N. E. coast of China, between China proper and the peninsula of Corea, and extending between lat. 33° and 41° N. It is rather shallow, and its depth is steadily diminished by the large amount of yellowish mud which the Hoang-Ho and Yang-tse-Kiang carry along with them, and which has given it its name.

**Yellow Springs,** tp., Des Moines co., Ia. P. 1743.

**Yellow Springs,** p.-v., Miami tp., Greene co., O., on the Little Miami division of Pittsburg Cincinnati and St. Louis R. R., has a mineral spring of considerable celebrity, was incorporated in 1854, has 7 churches, a graded school and an ungraded school for colored children, and is the seat of ANTIOCH COLLEGE (which see). P. 1435.

**Yellowstone Lake and River.** See YELLOWSTONE NATIONAL PARK.

**Yellowstone National Park.** Located in the north-western corner of Wyoming Territory is a tract of country more remarkable for the wonderful curiosities of nature than any other region on the globe. It may very properly be called the "Northern Wonderland," in contradistinction to a similar region in New Zealand, which is now known as the "Southern Wonderland." It is a singular fact that it is only within about six years that this marvellous region has been made known to the world. Vague rumors of great volcanoes, spouting hot springs, mud springs, etc. had reached the civilized world from time to time, but they were supposed to be the wild vagaries of the wandering mountaineer, and produced no lasting impression. In 1869 a small party of surveyors from Helena, Mon., penetrated a portion of this country, and the information thus obtained induced the organization in 1870 of an expedition under the direction of Gen. Washburne, surveyor-general of the Territory. To this expedition was attached Mr. N. P. Langford and Lieut. Doane, both of whom excited much interest among our people by their reports. In 1871, Prof. Hayden visited this region with a well-organized scientific corps, made a careful exploration of the most remarkable features, and on the return of the expedition to Washington the reports excited very general interest both at home and abroad. In Feb., 1872, the Congress of the U. S. passed an act reserving an area of about 3575 sq. m. in the north-western corner of Wyoming Territory, withdrawing it from settlement, occupancy, or sale under the laws of the U. S., dedicating and setting it apart as a public park or pleasuring-ground for the benefit and enjoyment of the people. (See act at the end of this article.)

It extends from the 44th to the 45th parallel of latitude, and from the 110th meridian to a short distance beyond the 111th. Its general elevation is high, averaging about 6000 feet, or nearly the height of Mount Washington in the White Mountains. The mountain-ranges have a general elevation of from 9000 to 10,000 feet above the sea-level, although many sharp and rugged peaks rise considerably above this. The country is so elevated that it could scarcely ever be available for agricultural purposes. The winter extends far into the spring, and it is no unusual thing to find snow covering September's flowers. During July and August the weather is delightful, the thermometer rarely if ever rising higher than 70° F. In the early morning, however, it often records 26°, and sometimes falls as low as 10° and 12°. The air is so dry and invigorating that the cold is not felt as much as higher temperatures are in the moister Eastern climate. Near the N. E. corner of the park heads Clarke's Fork of the Yellowstone. From the S. W. Snake River, or Lewis's Fork of the Columbia, starts toward the Pacific, while on the western side Madison and Gallatin rivers, two of the three branches that unite to form the Missouri, have their origin. The largest mass of water in the park is Yellowstone Lake, which lies near the south-eastern corner of the park, from the upper part of which Yellowstone River flows in a northerly direction, and after a course of 1300 miles reaches the Missouri, having descended about 7000 feet. Thus are found here the heads or sources of two of the largest rivers of the continent, rising in close proximity to each other. The divides or watersheds between them are comparatively low, and sometimes it is difficult to say in which direction the water flows, whether to the Pacific or to the Atlantic.

At the present time the traveller on his route to the Yellowstone National Park will find his best outfitting point at Bozeman or Fort Ellis as he takes his leave of the confines of civilization. Fort Ellis is located on the E. bank of Mill Creek, one of the sources of the E. Fork of the Gallatin, and from its position overlooks one of the most beautiful valleys in Montana. It is surrounded on the E. and N. sides by ranges of hills and mountains, which form the divide between the waters of Yellowstone and Missouri rivers. Fort Ellis, although considered one of the extreme frontier posts, and supposed to be located among hostile tribes of Indians, really commands the valleys of the Yellowstone and the three forks of the Missouri, the finest and most productive portion of Montana. It is a very pleasant station, surrounded with beautiful scenery, with a climate that can hardly be surpassed in any country. Streams of pure water flow down the mountain-sides, cutting their channels through the plains everywhere. The vegetation is most abundant. Bozeman is a pretty town, with about 500 inhabitants, situated 3 miles below, surrounded on every side with well-cultivated and productive farms. It is most probable that within a short period the Northern Pacific R. R. will pass down this valley, and then its beauty and resources will become apparent. Here guides, transportation, and all the necessary outfit for a tour of a few weeks or months may be secured. Leaving Bozeman, the tourist takes a slightly S. E. course, passing over the beautiful divide which separates the sources of the Missouri from the Yellowstone Valley. From the summit of this divide he begins to catch glimpses of the beautiful scenery which awaits him in the promised land. On the E. side of the Yellowstone Valley lies spread out before his vision one of the most remarkable ranges of mountains in the West. Persons who have visited Europe have spoken of this range as in no way inferior in beauty to any in that far-famed country. A series of cone-shaped peaks, looking like gigantic pyramids, are grouped along the E. side of the valley for 30 or 40 miles, with their bald, dark summits covered with perpetual snow, the vegetation growing thinner and smaller as the almost vertical sides are ascended, until long before reaching the summits it has entirely disappeared. On all sides deep gorges have been gashed out by aqueous forces, cutting through the very core of the mountains, and forming those wonderful gulches which only the hardy and daring miner has ventured to explore. This range, which is called on the map Snowy Mountains, forms the great watershed between two portions of Yellowstone River, above and below the first cañon, and gives origin to some of the most important branches of that river. Large numbers of springs and small streams flow down from the mountains into the Yellowstone on the S. W. side. Below the first cañon, but from the N. E. side, flow the Big Boulder, Rosebud, Clarke's Fork, and Pryor's Fork, with their numerous branches. This range continues on in a more or less broken condition to the S. E., until it connects with the Big Horn Range. From the summit of Emigrant Peak, one of the highest of these volcanic cones, one great mass of these basaltic peaks can be seen as far as the eye can reach, rising to the height of 10,000 to 11,000 feet above the sea. Emigrant Peak, the base of which is cut by Yellowstone River, is 10,629 feet above tide-water, while the valley-plain near Boteler's Ranch, on the opposite side of the river, is 5925 feet. This splendid group of peaks rises 5000 feet and upward above the valley of the Yellowstone.

Crossing the divide, the traveller descends the valley of Trail Creek into the valley of the Yellowstone, amid some of the wildest and most charming scenery in the W. On every hand he observes increasing proofs of modern volcanic action. In many places broad sheets of basalt have been poured out over the valley, forming mésas or broad table-lands. On the surrounding hills volcanic breccias are weathered into singularly fantastic forms, and present a great variety of sombre colors. Near the head of the valley two enterprising young men have established a ranch for the purpose of supplying travellers and miners with such accommodations as the scanty means of pioneers can afford. For many years the farm of Boteler Brothers formed the extreme western limit of settlement, but since the discovery of hot springs other settlers have advanced up the river to the borders of the park.

In the absence of a chart, the following tables of distance, compiled mostly from the reports of the U. S. geological survey of the Territories, will be of value:

| | |
|---|---|
| Ogden, Ut., to Franklin, Id., by rail | 80¼ miles. |
| Franklin to Virginia City, Mon., by stage | 317 " |
| Virginia City to Bozeman, by stage | 66 " |
| Franklin to Market Lake, Snake River Valley | 152 " |
| Point of Rocks Station, Union Pacific R. R., to Yellowstone Lake, by Capt. Jones's route | 289 " |

*Bozeman to Geyser Basins, viâ Yellowstone River.*

| | |
|---|---|
| Bozeman | 0 miles. |
| Fort Ellis | 3 " |
| Divide between Spring and Trail creeks | 16 " |
| Boteler's Ranch on Yellowstone River | 39 " |
| Foot of second cañon of the Yellowstone | 52 " |
| Devil's Slide at Cinnabar Mountain | 60 " |
| Bridge near mouth of Gardiner's River | 68 " |
| Cache Valley, the mouth of East Fork of Yellowstone | 84 " |
| Crossing of Tower Creek | 88 " |

| | |
|---|---|
| Divide on spur from Mount Washburne | 94 miles. |
| Crossing of Cascade Creek | 108 " |
| Mud Volcanoes | 117 " |
| Yellowstone Lake, at head of river | 124 " |
| Head of Yellowstone River to Hot Springs on S. W. arm of lake | 15 " |
| Hot Springs to Upper Geyser Basin | 15 " |
| Mud Volcanoes to Lower Geyser Basin | 24 " |
| Bridge near mouth of Gardiner's River to Mammoth Hot Springs | 4 " |

*Market Lake to Yellowstone Lake.*

| | |
|---|---|
| Market Lake | 0 miles. |
| Henry's Lake | 100 " |
| Tyghee Pass | 110 " |
| Gibbon's Fork | 133 " |
| Lower Geyser Basin | 140 " |
| Upper Geyser Basin | 148 " |
| Divide | 158 " |
| Shoshone Geyser Basin | 162 " |
| Lewis Lake | 172 " |
| Hot Springs, Yellowstone Lake | 180 " |

*Virginia City to Yellowstone Lake, viâ Wagon-road to Geyser Basins.*

| | |
|---|---|
| Virginia City | 0 miles. |
| Madison River, ⅛ mile from Wigwam Creek | 14 " |
| Driftwood, or Big Bend of Madison | 42 " |
| Henry's Lake | 60 " |
| Tyghee Pass | 63 " |
| Gibbon's Fork | 86 " |
| Lower Geyser Basin | 93 " |
| Upper Geyser Basin | 101 " |
| Yellowstone Lake | 116 " |

*The Mammoth White Mountain Hot Springs.*—This group of springs is one of the most remarkable within the limits of the National Park, and, as far as is known, has not its equal in grandeur in the world. The Te Tarata Spring of New Zealand is the nearest approach to it in appearance, but the formation is of a different character, the Gardiner's River springs depositing calcareous material, while that in New Zealand is silicious, like the deposits in the geyser region of Iceland and in our own geyser basins at the head of the Madison. The exploring party of 1870 did not discover these springs, and the Hayden exploring expedition of 1871 was the first organized party that ever visited them. The springs in action at the present time are not very numerous, or even so wonderful as some of those higher up in the Yellowstone Valley or in the Fire-Hole Basin; but it is in the remains that so instructive records of their past history were found. The calcareous deposits from these springs cover an area of about 2 sq. m. The active springs extend from the margin of the river, which is at an elevation of 5845 feet, to a height of 6522 feet, or nearly 1000 feet above. The entire side of the mountain presents a view of one of the finest displays of nature's architectural skill the world can produce. The snowy whiteness of the deposit at once suggested the name of White Mountain Hot Springs. The scene had the appearance of a frozen cascade. If a group of springs near the summit of a mountain were to distribute their waters down the irregular declivities, and they were slowly congealed, the picture would bear some resemblance in form. The steep sides of the hill are ornamented with a series of semicircular basins, with margins varying in height from a few inches to 6 or 8 feet, and so beautifully scalloped and adorned with a kind of bead-work that the beholder stands amazed at this marvel of nature's handiwork. Add to this a snow-white ground; there is every variety of shade of scarlet, green, and yellow as brilliant as the brightest of our aniline dyes. The pools or basins are of all sizes, from a few inches to 6 or 8 feet in diameter, and from 2 inches to 2 feet in depth. As the water flows from the spring over the mountain-side from one basin to another, it loses continually a portion of its heat, and the bather can find any desirable temperature. At the top of the hill there is a broad flat terrace covered more or less with these basins 150 to 200 yards in diameter, and many of them going to decay. Here we find the largest, finest, and most active spring of the group at the present time. The largest spring is very near the outer margin of the terrace, and is 25 by 40 feet in diameter, the water so perfectly transparent that one can look down into the beautiful ultramarine depth to the bottom of the basin. The sides of the basin are ornamented with coral-like forms, with a great variety of shades, from pure white to a bright cream-yellow; and the blue sky reflected in the transparent waters gives an azure tint to the whole which surpasses all art. The calcareous deposit around the rim is also most elegantly ornamented, but, like the icy covering of a pool, extends from the edge toward the centre, and this projects over the basin until it is not more than a fourth of an inch thick. These springs have one or more centres of ebullition, and in this group it is constant, seldom rising more than 2 to 4 inches above the surface. From various portions of the rim the water flows out in moderate quantities over the sides of the hill. Whenever it gathers into a channel and flows quite swiftly, basins with sides from 2 to 8 feet high are formed, with the ornamental designs proportionately coarse; but when the water flows slowly, myriads of the little basins are formed, one below the other, with a kind of irregular system, as it might be called, which constitutes the difference between the works of nature and the works of art. The water holds a great amount of lime in solution. It also contains some soda, alumina, and magnesia. The ebullition is largely due to the emission of large quantities of carbonic acid gas. As these waters flow down the sides of the mountains, they constantly deposit more or less of this calcareous sediment in almost every possible variety of form. Underneath the sides of many of these pools are rows of stalactites of all sizes, many of them exquisitely ornamented, formed by the dripping of the water over the margins of the basins. One of the most attractive features of this remarkable scene are the old ruins, which indicate the former existence of a far greater number of hot springs than are found at the present time, with here and there a dead geyser-mound. A high cone, which received the name of the "Liberty Cap" from its peculiar form, is 42 feet high and perhaps 20 or 30 feet in diameter at its base. These springs are also constantly changing their places. Some die, while others burst out in new places.

About 20 miles above the Mammoth Hot Springs is the lower end of the Grand Cañon and Tower Falls. Layers of basalt have been poured out over the basic rocks, of whatever age they may be, at different periods, and at the same time vast quantities of fragments of rocks which were cemented together with a kind of volcanic dust and tufa, forming thick beds of breccia. In the process of erosion by water, hundreds of curious pinnacles and columns, resembling groups of Gothic spires, were carved out of the solid beds of basalt and breccia. Tower Creek, which flows into Yellowstone River at the lower end of the Grand Cañon, has received its name from these remarkable columns. About 200 yards above its entrance into the Yellowstone the stream pours over an abrupt descent of 156 feet, forming one of the most beautiful and picturesque views to be found in any country. It is surrounded with pinnacle-like columns composed of volcanic breccia, rising 50 feet above the falls and extending down to the foot, standing like gloomy sentinels or like the gigantic pillars at the entrance of some grand temple. One could almost imagine that the idea of the Gothic style of architecture had been caught from such carvings of nature. In the walls of the lower end of the Grand Cañon are several rows of five-sided basaltic columns arranged in a vertical position, and so regular that they appear to have been carried and placed in the sides of the gorge by human hands.

The Grand Cañon is about 30 miles in length, carved out of the igneous rocks, with walls varying from 1500 to 2000 feet in vertical height. The sides of the walls incline from 45° to 80°, and in many places are vertical and worn into an almost unlimited variety of forms, as pinnacles, towers, spires, etc. But the most striking features are the great variety and brilliancy of the coloring. The pure whites of the decomposed feldspar are mingled with the sulphur-yellows and streaked with bands of bright red, colored with iron.

Besides the Grand Cañon, the objects of the deepest interest to the traveller are the Upper and Lower falls of the Yellowstone. No language can do justice to the wonderful grandeur and beauty of these scenes, and it is only through the eye that the mind can gather anything like an adequate description of them. The two falls are not more than one-fourth of a mile apart. Above the Upper Falls the Yellowstone flows through a grassy meadow-like valley with a calm, steady current, giving no warning until very near the falls that it is about to rush over a precipice 140 feet, and then, within a quarter of a mile, again to leap down a distance of 350 feet or more. After the waters of the Yellowstone roll over the upper descent they flow with great rapidity along the apparently flat, rocky bottom, which spreads out to nearly double its width above the falls, and continues thus until near the lower falls, where the channel again contracts, and the waters seem, as it were, to gather into a compact mass and plunge over the descent of 350 feet in detached drops of foam as white as snow. It is a sight far more beautiful than, though not as grand or impressive as, that of Niagara Falls. A heavy mist always arises from the water at the foot of the falls, so dense that one cannot approach within several hundred yards without being drenched. The yellow, nearly vertical wall on the W. side is covered, for 300 feet or more in height from the bottom, with a dense matting of mosses, sedges, grasses, and other vegetation of the most vivid green, which have sent their small roots into the softened rocks, and are nourished by the ever-ascending spray. From any point of view, these falls, as well as the cañon,

will strike the beholder as among the unique phenomena of the natural world.

At the very source of Yellowstone River is one of the most beautiful sheets of water in the West—Yellowstone Lake. It is about 22 miles in length and from 12 to 15 in breadth. Its shape is peculiar, and has not inaptly been compared to that of the human hand, the various bays or promontories representing the thumb and fingers. Its greatest depth was found, by a series of careful soundings, to be 300 feet. The elevation of the lake above sea-level is 7788 feet. Only four lakes are known to have so great an elevation in any part of the world up to this time—namely, Lakes Titicaca in Peru and Uros in Bolivia, which are respectively 12,874 and 12,359 feet above sea-level; and Lakes Manasasarowak and Rakastal in Thibet, Asia, both of which lie at the great height of 15,000 feet. The shore-line of Yellowstone Lake measures over 300 miles, and it presents some very beautiful curves or indentations in its shores, which have received a variety of names. The western side of the lake is covered with pine forests, as in the southern end, where also there are many lakelets and considerable marshy ground. There are no high mountains in this direction, low, broad hills forming the watershed between the lake and the sources of Snake River. One can cross almost anywhere to the Shoshone Geyser Basin. The eastern side of the lake is also well wooded, but more broken by small open prairies. The country on this side soon rises into a grand mountain-range, from which numerous volcanic peaks rise; prominent among them are Mounts Stevenson and Doane. The interesting localities of the lake on the eastern side are Brimstone Basin, Steam Point, and Steamboat Springs, Turbid Lake, and the springs of Pelican Creek and Sulphur Hills. On the south-western arm also is an interesting group of springs. Brimstone Basin is S. E. of Steam Point, and marks the seat of once active springs, evidenced by the deposits. The stream flowing through them is strongly impregnated with alum. At Steam Point, besides the springs, are several steam-jets. From one the steam escapes with a noise resembling that made by the escape-pipes of a large steamboat. Others resemble the escape of steam from the cylinders of a locomotive. Springs are found on the shore of the lake between Steam Point and Pelican Creek, and along the course of the latter stream. At Turbid Lake, 2 miles E. of the lake and back of Steam Point, the springs are mud-springs and sulphur-vents. The water of the lake itself is made turbid by the springs in its midst and on the shores. Sulphur Hills are between Pelican Creek and the Yellowstone. Sulphur is not characteristic, notwithstanding the name. The period of greatest activity of all the springs here is past, and they are gradually dying out.

The springs on the shore of the south-western arm of the lake occupy an area of about 3 miles in length and half a mile in width. There are no geysers. Some of the springs are found in conical silicious mounds, rising from the water of the lakes near the shore. One of these is named the "Fish Pot," from the fact that while standing on its crater one may extend his fishing-rod, catch trout, and, turning, may cook them in the spring. About 400 yards from the shore is a basin of boiling, pink-colored mud, with conical mud-craters, from which the mud is ejected. There are also a number of clear, flowing springs of hot water, and numerous springs of boiling, muddy water varying in color from white to dark yellow.

*Geyser Basins of Fire-Hole River.*—The geyser basins of the Upper Madison include, altogether, about 75 sq. m. In this area are thousands of springs and geysers, ranging in temperature from the boiling-point to cold. Their description would occupy the space of a volume. Only the salient features can be given here. The springs are divisible into three classes: (1) True geysers, which are agitated at stated intervals, and from which the water is projected. (2) Those which are constantly agitated or always boiling. They rarely have eruptions; most of the mud-springs can also be included under this division. (3) Those which are always tranquil. In the latter the water is generally of a lower temperature, and has a beautiful blue color or often a green tint like that of the beryl. In springs of the very lowest temperature there is often a low form of gelatinous vegetable growth. Some of the springs of the Lower Basin merit the title of small lakes. They are divided on the maps into eight groups. The first is on the East Fork; the second is about a mile farther to the S., and the third, fourth, and fifth groups still farther S., on the E. side of the basin. In the third group are the Fountain Geyser and the Mud Puffs, both worthy a visit. In the fifth group is the Architectural Geyser, probably the most powerful in the Lower Basin. The sixth group is on the main river, above the mouth of Fairy Fall Creek, the seventh is on the latter stream, and the eighth on Sentinel Creek, a stream joining the Fire-Hole below Fairy Fall Creek. There are but about half a dozen real geysers in the Lower Basin, but craters are seen which must once have been active spouters. The deposits are silicious, as is the case with the Upper Basin. There are many places where the springs are extinct, nothing remaining save the glaring white sediment. The scalloped rims, extending out over the water like cakes of ice, and the corrugated sides of the basin, are exceedingly beautiful. Before leaving the Lower Basin we must visit Fairy Falls, a very pretty miniature cascade at the head of Fairy Fall Creek. From the mouth of the latter creek to the mouth of Iron Spring Creek, which marks the lower boundary of the Upper Basin, the distance is 5 miles in an air line. About midway are the Halfway Springs. The principal one is a huge caldron 250 feet in diameter, with walls about 20 feet high. It is in constant agitation, giving off clouds of steam. On one side the wall is broken down, and thence the surplus water flows into the river through numerous channels, whose beds are lined with scarlet, yellow, and green, which contrast boldly with the white silicious sinter surrounding the spring. Farther back from the river, on a slight eminence, is an almost circular spring 150 feet in diameter.

*Upper Geyser Basin.*—The Upper Geyser Basin has been called the Great Basin, because it contains the principal geysers. It is about 2 miles long, and will probably average half a mile in width. The best view is obtained from the crater of "Old Faithful," at the upper end. Through the Lower Basin the course of the river is almost due N., while in the upper it flows W. of N. Its banks are made of geyserite, the silicious deposit of the springs, which is literally honeycombed with springs, pools, and geysers that are constantly gurgling, spitting, steaming, roaring, and exploding.

To describe all the remarkable hot springs and geysers of this interesting region would require a volume instead of a brief article, and only a few of the more conspicuous can be noticed. Entering the Upper Basin from the N., the traveller passes a series of rapids, at the upper end of which he enters the gateway, as it were, guarded by two sentinel geysers, one on either side of the river, that on the left being the most active. Following the river for about 250 yards, he reaches the "Fan Geyser," where there are several orifices from which the water radiates, the streams crossing each other and producing a fan-shaped eruption. A short distance above, on the opposite side of the river, is the "Grotto Geyser," which is easily recognized by the peculiar form of its crater, from which it takes its name. There are two orifices, the principal one being in the larger and more irregular mound, which is 8 feet high, while the smaller one is only 4 feet high. The interval between its eruptions is unknown. It throws a column of water and steam from 40 to 60 feet above its crater. Several hundred yards farther back from the river, S. W. from the Grotto, are the "Pyramid," "Punch-Bowl," "Bath-Tub," and "Black Sand" geysers. The "Giant" is about 400 feet S. E. of the Grotto. It has a rough, cone-like crater 10 feet high, with one side broken down. The orifice from which the water is expelled is about 5 feet in diameter. This curious crater is near the river's edge, on a platform of deposit measuring 342 yards in circumference. It has seldom been seen in eruption. Langford gives the height as 140 feet in 1870. It was also in action in 1874, but the height was not measured. Following up the river on the S. W. side, the next geyser observed is the "Castle." It is a cone rising a little over 11 feet above an irregular platform of sinter that measures 75 by 100 feet and is 3 feet high. The orifice of the geyser-tube is 3 feet in diameter and circular, and its throat is lined with large orange-colored globular masses. In 1870 its eruption threw a column of water 140 feet above its crater, continuing three hours. In 1872 the maximum height observed was 93 feet, and the duration fifteen minutes, after which steam escaped with a pulsating movement, the whole display lasting about an hour and twenty minutes. In 1874 the same succession of water and steam was noticed, the former lasting twenty minutes, and attaining an estimated height of 250 feet, and the latter lasting about forty minutes longer. The noise of the eruption is indescribable. After the eruption the exhausted geyser sinks into complete repose. Near the "Castle" is a beautiful blue hot spring, which has been given the fanciful name of "Circe's Boudoir." The water is perfectly transparent, and so intensely blue that one involuntarily plunges his hand in to see if it is water. The basin is of pure white silica, looking like marble. It is about 20 feet in diameter, and has a beautiful and regular scalloped margin. The white basin slopes to a funnel-shaped opening which is 40 feet deep, and here the water is intensely blue, its temperature 180° F.

"Old Faithful," standing at the head of the valley, is so named from the regularity of its spouting. Its mouth is 6

feet by 2, in a silicious mound that rises 11 feet above the general level. On this mound are small basins whose edges are ornamented with bead-like silica. The eruptions commence with a few abortive attempts, followed by a rapid succession of jets, which soon reach the maximum and then subside, only steam escaping from the orifice. The average interval between the eruptions observed in 1872 was one hour two and three-quarter minutes, and the average duration four minutes fifty-three seconds. As observed in 1873, the interval was fifty-six minutes and forty seconds, and the duration four minutes and thirty-three and one-half seconds. The height of the column was estimated at nearly 150 feet. The greatest height measured in 1872, out of seventeen eruptions, was 130 feet. The "Beehive" is on the opposite side of the river, nearly due N. of "Old Faithful," and about 300 yards distant. It is near the river, and readily recognized by its cone, 3 feet high and about 3 feet in diameter. From this cone the water is projected with great force in a steady stream. The column is fan-shaped. No water falls back, but it seems to be all resolved into vapor. The length of the eruptions is from four to fifteen minutes, and the interval unknown. The column rises from 100 to 250 feet. Two hundred yards back of the "Beehive" is the "Giantess," which has a large basin, 23 by 32 feet. It is on the summit of a gently-sloping silicious mound. Its eruptions are very irregular. They last from eight to eighteen minutes. The only eruption measured in 1872 was 69 feet; an immense mass of water was thrown up. Other estimates have given the height as 60, 200, and 250 feet.

Farther down the river and opposite the "Castle," from which it is distant 460 yards, is the "Grand Geyser." One would scarcely take it for an important geyser unless he witnessed one of its spoutings; for, unlike the others, it has no raised crater. Its basin, which is 52 feet in diameter, is depressed a foot below the general level. The mouth of the geyser-tube in the centre measures 4 by 2 feet, and from this, about once in twenty-four hours, a column is thrown to the height of from 175 to 250 feet. The eruption generally consists of three periods, after each of which the water sinks completely out of sight. Near the "Grand" are the "Saw-mill" and the "Turban." The latter is only a few feet from the "Grand," and will be known by the globular masses that look like huge squashes, and are easily seen, lining the sides and bottom of the crater when the water has disappeared from the basin. The eruptions are unimportant. Near the mouth of Iron Spring Creek, on the N. side, is the "Soda Geysers" group.

In the Shoshone Basin, on the W. side of the Great Divide, there is a group of geyser and hot springs not surpassed in beauty and hardly less active than those already noticed in the Fire-Hole. They are located at the extreme western end of the western arm of Shoshone Lake, on Shoshone Creek, up which they extend on either side for about half a mile.

Hot springs are also found on Lewis's Lake and Heart Lake, S. E. of Shoshone Lake, and doubtless they occur in many other localities yet undiscovered.

The probable origin of thermal springs is well known. The hot springs and geysers of Iceland have been studied with very great care by some of the ablest scientific men in Europe, as Bunsen, Bischoff, and Tyndall, and their conclusions have been accepted. The same phenomena as those of Iceland are repeated in New Zealand and the Yellowstone National Park, only on a much more extensive scale. That all thermal springs are remnants of former volcanic action, there can be no doubt. Geysers, or intermittent springs, may be regarded as volcanoes, except that the former throw out heated waters, while the latter eject melted materials, etc. We may take it for granted that the hot springs derive their temperature from heated aqueous vapors rising from below; and the only question which remains to be settled regards the actual sources of these vapors. Shall we adopt the theory that the interior of our globe is in an incandescent state, and that the origin of the heat is deep-seated below the earth's crust, rising from the melted nucleus? or shall we look to a far more superficial source? In the first place, the water of the hot springs is derived from the surface. Passing down through fissures in the earth's crust, it meets the heated vapors from below, and portions being expanded into steam, a force is produced the same as in a steam-engine. If this force can rise freely in a continual column, a simple boiling spring is produced. If the channel or passage upward is complicated, we have the phenomena of the spouting spring. According to Bischoff, the intermittent springs are caused by the existence of caverns in which the heated vapors are retained by the pressure of the column of water from above. The violent escape of the vapor produces the thunder-like, subterranean sound and the tremblings of the earth that precede the eruption. When so much vapor has escaped that the expansive force of that which remains has become less than the pressure of the confining column of water, tranquillity is restored, and this lasts until a quantity of vapor is again collected which is sufficient to produce a fresh eruption. The spouting of the spring is therefore repeated at intervals, depending upon the capacity of the cavern, the height of the column of water, and the heat generated below.

*Heights attained by the Eruptions of the Principal Geysers in Fire-Hole Basins, Yellowstone National Park.*

| Name of geyser. | Authority. | Height in feet. |
|---|---|---|
| Fountain, in Lower Basin | Hayden, 1871 | 30 to 60 |
| Architectural, in Lower Basin | Hayden, 1871 | 60 to 80 |
| Old Faithful, Upper Basin | Hayden, 1871 | 100 to 150 |
| Old Faithful, Upper Basin | Hayden, 1872 | *132 |
| Old Faithful, Upper Basin | Norton, 1872 | 150 |
| Old Faithful, Upper Basin | Comstock, 1873 | 150 |
| Old Faithful, Upper Basin | Dunraven, 1874 | 100 to 150 |
| Giantess, Upper Basin | Langford, 1870 | 250 |
| Giantess, Upper Basin | Hayden, 1872 | *39 |
| Giantess, Upper Basin | Norton, 1872 | 100 |
| Beehive, Upper Basin | Langford, 1870 | *219 |
| Beehive, Upper Basin | Hayden, 1872 | 100 to 150 |
| Beehive, Upper Basin | Norton, 1872 | 100 |
| Castle, Upper Basin | Langford, 1870 | 50 |
| Castle, Upper Basin | Hayden, 1871 | 10 to 15 |
| Castle, Upper Basin | Hayden, 1872 | *93 |
| Castle, Upper Basin | Comstock, 1873 | 30 |
| Castle, Upper Basin | Dunraven, 1874 | 250 |
| Grand, Upper Basin | Hayden, 1871 | 200 |
| Grand, Upper Basin | Hayden, 1872 | *173 |
| Grand, Upper Basin | Comstock, 1873 | 200 |
| Turban, Upper Basin | Hayden, 1872 | *25 |
| Turban, Upper Basin | Comstock, 1873 | 30 |
| Giant, Upper Basin | Langford, 1870 | 140 |
| Grotto, Upper Basin | Langford, 1870 | 60 |
| Grotto, Upper Basin | Hayden, 1872 | *41 |
| Grotto, Upper Basin | Comstock, 1873 | 25 |

*Elevations in the Yellowstone National Park.*

| | Feet above sea-level. |
|---|---|
| Mammoth White Mountain Hot Springs | 6278 to 7035 |
| Mud Volcanoes | 7756 to 7800 |
| Crater Hills Springs | 7828 to 7979 |
| Sulphur Springs, on divide between Yellowstone and E. Fork of Fire-Hole River | 8246 |
| Lower Geyser Basin | 7250 to 7350 |
| Upper Geyser Basin | 7300 to 7400 |
| Third Geyser Basin | 7772 |
| Shoshone Lake, Geyser Basin | 7900 |

*Lakes.*

| | |
|---|---|
| Yellowstone Lake | 7788 |
| Shoshone Lake | 7870 |
| Lewis Lake | 7750 |
| Madison Lake | 8301 |
| Henry's Lake | 6443 |

*Mountain-Peaks.*

| | Feet above sea-level. |
|---|---|
| Mount Hayden | 13,833 |
| Mount Washburne | 10,388 |
| Mount Sheridan | 10,343 |
| Mount Blackmore | 10,134 |
| Mount Delano (Yellowstone Valley) | 10,200 |
| Mount Doane | 10,118 |
| Electric Peak | 10,992 |
| Emigrant Peak | 10,629 |
| Red Mountain, S. of Yellowstone Lake | 9,806 |
| Lookout Hill, N. of Shoshone Lake | 8,257 |
| Old Baldy, near Virginia City | 9,711 |

*Passes and Divides.*

| | |
|---|---|
| Teton Pass | 8,464 |
| Tyghee Pass | 7,063 |
| Reynolds's Pass, Henry's Lake, N. to Madison River | 6,911 |
| Divide, Yellowstone and Gallatin, on road from Fort Ellis to Boteler's Ranch | 5,721 |
| Divide on Mount Washburne where trail crosses | 9,155 |
| Divide between Yellowstone and Madison, on trail from Mud Volcanoes and Geyser Basins | 8,164 |
| Divide between Madison and Shoshone lakes | 8,717 |
| Divide between Yellowstone and Lewis lakes | 8,024 |
| Togwater Pass (Upper Yellowstone to Wind River) | 9,621 |

*Analysis of Deposit from the Hot Springs of Gardiner's River.*

| | |
|---|---|
| Water and volatile matters | 32.10 per cent. |
| Lime | 57.70 " |
| Silica | 3.32 " |
| Ferric oxide | 3.62 " |
| Alumina | 3.31 " |
| Soda and magnesia | traces. |
| | 105.05 per cent. |

*Analysis of Geyserite from Lower Geyser Basin.*

| | |
|---|---|
| Water, etc | 9.00 per cent. |
| Silica | 88.60 " |
| Alumina and iron | 1.60 " |
| Lime | 0.95 " |
| Magnesia, soda, potash, and lithia | traces. |
| | 100.15 per cent. |

*Measured by triangulation; the others are estimated.

*Analysis of Pink Mud from Mud-Puffs in Lower Geyser Basin.*

| | |
|---|---|
| Water | 8.65 per cent. |
| Silica | 44.61 " |
| Alumina | 45.09 " |
| Magnesia | 2.66 " |
| Iron | 1.86 " |
| Lime and soda | traces. |
| | 102.87 per cent. |

*Analysis of Geyserite from Upper Geyser Basin.*

| | |
|---|---|
| Water | 13.42 per cent. |
| Silica | 79.56 " |
| Lime | 1.54 " |
| Alumina | 0.46 " |
| Magnesia | 1.78 " |
| Iron, chlorine, and soda | traces. |
| | 96.76 per cent. |

*Analysis of Geyserite from Shoshone Lake, Geyser Basin.*

| | |
|---|---|
| Water | 13.00 per cent. |
| Silica | 76.80 " |
| Alumina | 9.46 " |
| Lime | 1.80 " |
| Iron, magnesia, and soda | traces. |
| | 101.06 per cent. |

As has been previously stated, during the session of 1871–72 a bill was introduced into both houses of Congress to set apart the area about the sources of the Yellowstone and Missouri rivers, embracing these wonderful curiosities, as a public park for the benefit and instruction of the people. The bill was referred to the committee on public lands. At their request the writer prepared the following report, which explains the object of the bill, and on the strength of the information therein contained the bill became a law: "The committee on the public lands, having under consideration bill H. R. 764, would report as follows: The bill now before Congress has for its object the withdrawal from settlement, occupancy, or sale, under the laws of the U. S., a tract of land 55 by 65 miles about the sources of the Yellowstone and Missouri rivers, and dedicates and sets it apart as a great national park or pleasure-ground for the benefit and enjoyment of the people. The entire area comprised within the limits of the reservation contemplated in this bill is not susceptible of cultivation with any degree of certainty, and the winters would be too severe for stock-raising. Whenever the altitude of the mountain districts exceeds 6000 feet above tide-water, their settlement becomes problematical unless there are valuable mines to attract people. The entire area within the limits of the proposed reservation is over 6000 feet in altitude, and the Yellowstone Lake, which occupies an area 15 by 22 miles, or 330 sq. m., is 7427 feet. The ranges of mountains that hem the valleys in on every side rise to the height of 10,000 and 12,000 feet, and are covered with snow all the year. These mountains are all of volcanic origin, and it is not probable that any mines or minerals of value will ever be found there. During the months of June, July, and August the climate is pure and most invigorating, with scarcely any rain or storms of any kind, but the thermometer frequently sinks as low as 26°. There is frost every month of the year. This whole region was in comparatively modern geological times the scene of the most wonderful volcanic activity of any portion of our country. The hot springs and the geysers represent the last stages—the vents or escape-pipes—of these remarkable volcanic manifestations of the internal forces. All these springs are adorned with decorations more beautiful than human art ever conceived, and which have required thousands of years for the cunning hand of nature to form. Persons are now waiting for the spring to open to enter in and take possession of these remarkable curiosities, to make merchandise of these beautiful specimens, to fence in these rare wonders so as to charge visitors a fee, as is now done at Niagara Falls, for the sight of that which ought to be as free as the air or water. In a few years this region will be a place of resort for all classes of people from all portions of the world. The geysers of Iceland, which have been objects of interest for the scientific men and travellers of the entire world, sink into insignificance in comparison with the hot springs of the Yellowstone and Fire-Hole basins. As a place of resort for invalids it will not be excelled by any portion of the world. If this bill fails to become a law this session, the vandals who are now waiting to enter into this Wonderland will in a single season despoil, beyond recovery, these remarkable curiosities which have required all the cunning skill of nature thousands of years to prepare. We have already shown that no portion of this tract can ever be made available for agricultural or mining purposes. Even if the altitude and the climate would permit the country to be made available, not over 50 sq. m. of the entire area could ever be settled. The valleys are all narrow, hemmed in by high volcanic mountains like gigantic walls. The withdrawal of this tract, therefore, from sale or settlement takes nothing from the value of the public domain, and is no pecuniary loss to the government, but will be regarded by the entire civilized world as a step of progress and an honor to Congress and the nation.

'DEPARTMENT OF THE INTERIOR,
'WASHINGTON, D. C., January 29, 1872.

'SIR: I have the honor to acknowledge the receipt of your communication of the 27th instant, relative to the bill now pending in the House of Representatives dedicating that tract of country known as the Yellowstone Valley as a national park. I hand you herewith the report of Dr. F. V. Hayden, U. S. geologist, relative to said proposed reservation, and have only to add that I fully concur in his recommendations, and trust that the bill referred to may speedily become a law.

'Very respectfully, your obedient servant,
'C. DELANO, *Secretary.*

'Hon. M. H. DUNNELL, *House of Representatives.*'

The committee therefore recommend the passage of the bill without amendment."

The law which was passed by Congress in relation to the Yellowstone National Park reads as follows: "*An Act to set apart a certain tract of land lying near the head-waters of Yellowstone River as a public park. Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled,* That the tract of land in the Territories of Montana and Wyoming, lying near the head-waters of Yellowstone River, and described as follows—to wit, commencing at the junction of Gardiner's River with Yellowstone River, and running E. to the meridian passing 10 miles to the eastward of the most eastern point of Yellowstone Lake; thence S. along said meridian to the parallel of latitude passing 10 miles S. of the most southern point of Yellowstone Lake; thence W. along said parallel to the meridian passing 15 miles W. of the most western point of Madison Lake; thence N. along said meridian to the latitude of the junction of Yellowstone and Gardiner's rivers; thence E. to the place of beginning—is hereby reserved and withdrawn from settlement, occupancy, or sale under the laws of the U. S., and dedicated and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people; and all persons who shall locate or settle upon or occupy the same, or any part thereof, except as hereinafter provided, shall be considered trespassers and removed therefrom. *Sec. 2.* That said public park shall be under the exclusive control of the secretary of the interior, whose duty it shall be, as soon as practicable, to make and publish such rules and regulations as he may deem necessary or proper for the care and management of the same. Such regulations shall provide for the preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition. The secretary may, in his discretion, grant leases for building purposes, for terms not exceeding ten years, of small parcels of ground, at such places in said park as shall require the erection of buildings for the accommodation of visitors; all of the proceeds of said leases, and all other revenues that may be derived from any source connected with said park, to be expended under his direction in the management of the same and the construction of roads and bridle-paths therein. He shall provide against the wanton destruction of the fish and game found within said park, and against their capture or destruction for the purposes of merchandise or profit. He shall also cause all persons trespassing upon the same after the passage of this act to be removed therefrom, and generally shall be authorized to take all such measures as shall be necessary or proper to fully carry out the objects and purposes of this act. Approved Mar. 1, 1872." F. V. HAYDEN.

**Yellowstone Valley.** See YELLOWSTONE NATIONAL PARK.

**Yel'lowthroat,** the *Geothlypis trichas,* a very common warbler of the family Sylvicolidæ. This familiar little bird is found in nearly every part of North America. Its throat and breast are yellow, and its song is quite pleasant.

**Yellow Water River** rises in the S. E. of Alabama, and after a S. W. course reaches Pensacola Bay in Santa Rosa co., Fla.

**Yellow-Wood,** the valuable yellow timber of *Oxleya xanthoxyla,* a noble cedrelaceous tree of Eastern Australia. Also the wood of *Cladrastis tinctoria* (*Olim Virgilia*), a beautiful leguminous tree, a native of Tennessee and Kentucky.

**Yell'ville,** p.-v., Union tp., cap. of Marion co., Ark. P. 96.

**Yemassee',** p.-v. and tp., Beaufort co., S. C. P. 2778.

**Yemassees, or Savannahs.** See SHAWNEES.

**Yem'en** [Arab. *Yaman,* signifying (1) "the right hand or side;" (2) "the south," to one looking E.; (3) "fortunate, happy," corresponding to the Gr. Εὐδαίμων, and the

Lat. *Felix*], the south-western province of the Arabian peninsula, bounded N. by Hedjaz (including Mecca and Medinah), E. by Hadramaut and the great central desert, S. by the Indian Ocean, and W. by the Red Sea. It consists in part of a maritime belt of lowland from 10 to 30 miles in breadth, mostly sandy and sterile, but in some places tropically fertile; in part of high table-land some 4000 feet above the sea; and between these two, running N. and S., a chain of heavily-wooded mountains, some of whose peaks are said to be from 6000 to 8000 feet high. Amongst these mountains are well-watered valleys and terraced slopes of marvellous fertility. With no definite eastern boundary, the area can be only roughly estimated. Between Hali and Bab el-Mandeb there is a coast-line of about 500 miles, and, allowing a breadth of 150 miles, there would be in all not far from 70,000 sq. m. of territory. As to population, the Turkish (governmental) estimate for Hedjaz and Yemen together is 1,134,375, more than half belonging probably to Yemen. The nominal capital, formerly Hodeida on the Red Sea, is now Sanaa (100 miles inland), whose hereditary imam, subject to Turkey, shares dominion with numerous chieftains more or less independent and powerful. The principal port is Aden (ancient *Adane*), seized by Great Britain Jan. 11, 1839, and now her Asiatic Gibraltar. Other ports are Mocha, famous for the coffee which it exports, Loheia, and Aboo-Arish. Zebid, a place of some 7000 inhabitants, the seat of a Sunnite college, is on the plain (Tehama), 15 miles from the mouth of one of the very few permanent rivers of the country. Beit el-Fakih, with a population of some 8000, is also on the plain. Of highland towns, besides Sanaa, the capital, the most important are Taiz, Dhamar, the seat of a Saydi college, Marib, Khamir, and Saadeh. The principal exports are coffee, gums, wax, dates, senna, tamarinds, ivory, morocco, and some grain. The history of Yemen reaches back into a remote antiquity. The earliest inhabitants are supposed to have been of the Hamitic race, descended perhaps from Seba and Sheba, son and grandson of Cush (Gen. x. 7). Descendants of the Semitic Sheba (Gen. x. 28) came in afterward; and out of the amalgamation of these two peoples grew up the famous Himyarite kingdom, which dates probably from about 700 B. C. The high civilization of this ancient kingdom is attested by hundreds of inscriptions just beginning to be translated, by coins, and works of art. The bursting of a cyclopean dike near Marib about 120 A. D. led to important changes, great masses of people moving northward toward Syria. About 275 A. D. the king, Abd Kelal, became a Christian, but apparently without effecting the conversion of his people. In 356 A. D. an embassy was sent by Constantius, which resulted in the mission of Theophilus, the conversion of the king, and the building of three churches (Philostorgius, *H. E.* iii. 4). The kingdom was conquered by the Abyssinians 525 A. D., by the Persians 575–97 A. D., and in 628 A. D. submitted to Mohammed. The Turks have been there with but little interruption since 1538 A. D. R. D. HITCHCOCK.

**Yenika'le,** or **Jenikale,** the ancient *Cimmerius Bosporus*, is the strait connecting the Sea of Azof with the Black Sea. It is 20 miles long, in some places only 2 miles broad, and very shallow.

**Yenise'i,** or **Jenisei,** the principal river of Northern Asia, rises in Mongolia in lat. 51° N., lon. 98° E., flows northward through Siberia, and enters the Arctic Ocean in lat. 72° 30′ N., lon. 85° E. Its length is about 2500 miles.

**Yeniseisk',** or **Jeniseisk,** government of Asiatic Russia, extending on both sides of the Yenisei, between lon. 80° and 107° E., comprises an area of about 958,042 sq. m., with 350,848 inhabitants. The southern part is mountainous, rich in precious metals and forests; almost all the settled tracts of the government are situated here. The northern part is a frozen swamp, and the vast plain, sloping down from the mountains to the ocean, is inhabited only by a few tribes of Toongooses, Yakoots, and Samoyeds, who live as hunters or by their herds of reindeer. Cap. Yeniseisk.

**Yeniseisk,** or **Jeniseisk,** town of Asiatic Russia, government of the same name, on the Yenisei, in lat. 58° 27′ N., has important gold-washings, and in August a fair at which the larger part of the Siberian fur-trade is concentrated. P. about 6000.

**Yeo** (Sir JAMES LUCAS), b. at Southampton, England, in 1782; entered the British navy at an early age; distinguished himself in various engagements, especially by the capture of Cayenne, and commanded the British fleet on the lakes during the war of 1812–15. D. in 1819.

**Yeo'manry Cav'alry,** a body of British volunteers, not reckoned as militia, and liable to duty only in Great Britain. They can be called out to assist the civil power or to serve against an invader. There was formerly a body of yeomanry infantry. The yeomanry were first organized in 1797.

**Yeo'men of the Guard,** properly "His (or Her) Majesty's Body-guard of the Yeomen of the Guard," popularly called "Beefeaters" (*buffetiers*, "sideboard-men," since they serve at some state dinners at the sideboard), a body of 100 veteran soldiers, commanded by a captain (a nobleman), a lieutenant, an ensign, an adjutant, and four exons, all old soldiers. They were instituted in 1485 by Henry VII., are quartered in the Tower, armed with partisans, and wear the quaint garb of the fifteenth century.

**Yeo'vil,** town of England, county of Somerset, on the Yeo, carries on extensive glove manufactures, engaging over 2000 men, besides women and children. P. 7957.

**Yes'digerd III.,** the last king of Persia of the dynasty of the SASSANIDÆ (which see), b. in 617 A. D., and ascended the throne in 632. In 636 he fought the great battle of Cadesia with the Mohammedan invaders. It lasted four days, but Yesdigerd was defeated, and in 637 his capital, Ctesiphon, was taken by the Arabs. A new Persian army was organized, but in 641 it was almost completely dispersed at Nehavend, and all Persia was conquered by the caliph. Yesdigerd fled, and lived for ten years as a fugitive, but in 651 was assassinated by one of his own attendants.

**Yes'so,** an island of Japan, between lat. 41° 24′ and 45° 31′ N., and between lon. 139° 40′ and 146° 7′ E., separated N. from Saghalien by La Pérouse Strait, and S. from the main island by the Strait of Tsugaru. Its area is estimated at 30,000 sq. m.; its pop. at 125,000. Before the establishment of the present Japanese government the whole interior part of the island was unknown and uninhabited. On the southern coast some Japanese colonies were fixed, and the northern part was occupied by the Ainos, a peculiar race, probably of Tungusian descent, numbering about 20,000, who have domesticated the bear, and show considerable shrewdness and flexibility of mind in their dealings with the Russians and the Japanese. Roads have since been opened through the interior; Japanese, Chinese, European, and American colonies have been established, and the rich resources of the island have begun to be developed. The surface is mountainous and the soil volcanic. Active volcanoes, solfataras, and hot springs are frequent; coal, petroleum, salt, sulphur, etc. abound. The mountains are covered with forests containing excellent timber and swarming with bears, wolves, and deer. The principal towns are Matsmai, the capital, and Hakodadi.

**Yew** [Ang.-Sax. *eow*], the common name of evergreen coniferous trees of the genus *Taxus*, and sometimes extended to others of the family Taxeæ. Thus, TORREYA (which see) is called stinking yew, etc. The common yew tree (*T. baccata*) of Europe and N. W. America is often planted in churchyards, and, like the cypress and willow, has a funereal character, well supported by its gloomy appearance. Its leaves and seeds are poisonous. Its tough wood was once in great repute for bows; it is very hard, elastic, and durable. The tree is famous for its longevity. Of its varieties, the Irish yew is the finest. Among our American yews, *T. Floridana* considerably resembles the foregoing. It grows wild in W. Florida. *T. Canadensis* is a prostrate sort, very common northward.

**Yezd,** or **Jesd,** town of Western Persia, in lat. 32° 10′ N., lon. 56° E., in a small oasis watered by the river Mehris, and producing excellent grapes, figs, and melons; grain has to be brought from Ispahan. It has manufactures of velvet and silk stuffs, and its extensive bazaars are well stocked, as it is a gathering-place for many caravans. Among its inhabitants are several Parsees (fire-worshippers), and many Jews who live in the most abject condition, hated, despised, and persecuted by the Mohammedans. P. about 40,000.

**Yezidees.** See DEVIL-WORSHIPPERS.

**Ygdrasil,** in Scandinavian mythology, the name of a wonderful world-tree, an ash, whose roots were fastened in the deepest bottom-ground of the universe, while its branches spread far above the highest heavens. Under its three roots sprang three sacred fountains, the sources of all virtues, and from its leaves fell drops of honey-dew, the sweetest of all blessings. In its top sat an eagle; at its foot lay a serpent; up and down its trunk ran a squirrel trying to make strife between the eagle and the serpent. What was meant nobody knows, or probably ever knew. The whole myth, as related in the old Icelandic poems, is wild, vague, and formless—like many other elements of the Scandinavian mythology, the unfinished product of an imagination which overreached itself in attempting to give definite form to what was only a dumb feeling; and the manifold speculations which N. F. S. Grundtvig, N. M. Petersen, Jacob Grimm, and others have attached to it are no doubt more interesting than true. C. PETERSEN.

**Y'lang-Y'lang.** See IHLANG-IHLANG.

**Yoa'kum** (HENDERSON K.), b. in Claiborne co., Tenn., in 1810; graduated at West Point 1832; entered the 3d Artillery; resigned 1833; was a lawyer in Tennessee 1835–45; was a member of the State senate 1839; settled at Huntsville, Tex., 1845; was lieutenant of Texan Rangers in the Mexican war; contributed to periodicals, and wrote *History of Texas* (2 vols., 1855). D. at Houston Nov. 29, 1856.

**Yo'der,** tp., Cambria co., Pa. P. 1632.

**Yo'ga,** the name of one of the two divisions of the Sânkhya philosophy of the Hindoos, of which the first, the *Sânkhya* proper, teaches the principles and successive development of the creation, while the second, the *Yoga*, contains the doctrines of the Supreme Being, and explains the means by which the human soul may enter into union with him.

**Yokohama.** See JAPAN.

**Yo'kum Sta'tion,** tp., Lee co., Va. P. 1822.

**Yolk of Egg.** See YELK.

**Yol'land** (WILLIAM), R. E., b. in England in 1810; educated at the Royal Military Academy, Woolwich; was commissioned second lieutenant of royal engineers 1828; served in Canada 1830–35; was employed at the Tower of London in the map-office of the ordnance survey of Great Britain and Ireland 1838–52, being executive officer at the Tower and at Southampton from 1840; was transferred on the same service to Phœnix Park, Dublin, 1852, and to Enniskillen 1853; became one of the inspectors of railways under the board of trade 1854, and was engineer member of the commission appointed in 1856 by the secretary at war to consider the best mode of reorganizing the system for training officers for the scientific corps, "in order that patronage should be altogether abolished, and that admission to those corps should be obtained only by an open competing examination;" visited France, Prussia, Austria, and Italy with that commission, which prepared an elaborate *Report* published by Parliament; became lieutenant-colonel of engineers 1855, and was brevetted colonel 1858. He published the *Astronomical Observations* made with Ramsden's zenith sector, and subsequently those made with Airy's sector, from 1842 to 1850, for the determination of the latitudes of various trigonometrical stations in Great Britain and Ireland, and wrote the *Treatise on Geodesy* in the *Course of Mathematics for the Royal Military Academy*.

**Yo'lo,** county of W. California, bordering on the N. W. on the Coast Range, and on the E. on Sacramento River, by whose affluents it is watered, and traversed by California Pacific R. R. The surface is level in the E., undulating in the centre, rising in the W. to the lower slopes of the Coast Range; soil remarkably productive. Horses, mules, cattle, sheep, and swine are numerous. Staples, wheat, barley, hay, and wool. Cay. Woodland. Area, 1150 sq. m. P. 9899.

**Yolo,** p.-v., Yolo co., Cal.

**Yonge** (CHARLES DUKE), b. at Eton, England, in Nov., 1812; educated at Eton College, where his father was one of the masters; graduated at Oxford 1835; became professor of history and English literature in Queen's College, Belfast; compiled several classical textbooks, including a valuable *English-Greek Lexicon* (1849), edited in the U. S. by Profs. Charles Short and Henry Drisler (New York, 1870), a *Phraseological Dictionary* (1855–56), a *Dictionary of Latin Epithets* (1856), and an edition of *Virgil* (1862); translated for "Bohn's Classical Library" the works of Diogenes Laertius, Athenæus, Ammianus Marcellinus, and 6 vols. of Cicero; also for the "Ecclesiastical Library" the *Works* of Philo Judæus (4 vols., 1854–55), and is author of a *History of England* (1857), *Parallel Lives of Ancient and Modern Heroes* (1858), a *Life of Wellington* (2 vols., 1860), a *History of the British Navy* (2 vols., 1863), a *History of France under the Bourbons* (4 vols., 1866–67), a *Life of the Earl of Liverpool* (3 vols., 1868), *Three Centuries of Modern History* (1872), a *History of the English Revolution of 1688* (1874), a *Life of Marie Antoinette* (3 vols., 1876), and other works. He enjoys since 1859 a pension of £70 per annum for valuable literary services.

**Yonge** (CHARLOTTE MARY), b. at Otterbourne, Hampshire, England, in 1823; has published more than thirty novels, usually characterized by "High-Church" religious tendencies, several works of history and biography, chiefly for the young, and some miscellaneous works. The most popular of her novels were *The Heir of Redclyffe* (2 vols., 1853; 17th ed., illustrated, 1868) and *Daisy Chain, or Aspirations* (2 vols., 1856; 9th ed., illustrated, 1868). The profits of the former were largely devoted to fitting out for Bishop Selwyn of New Zealand the missionary schooner Southern Cross, and those of the latter work, amounting to £2000, were devoted to the erection of a missionary college at Auckland, New Zealand. Among her historical and miscellaneous books are *The Kings of England* (1848; 7th ed. 1862), *Landmarks of History, Ancient, Middle Ages, and Modern* (3 vols., 1852–57), *Cameos from English History* (1868), *Stories of English History* (1874), *The Book of Golden Deeds* (1864), *The Book of Worthies* (1869), *The History of Christian Names* (2 vols., 1863), *The Story of English Missionary Workers* (1871), and *The Life of John Coleridge Patteson, Missionary Bishop of the Melanesian Islands* (2 vols., 1873). She was joint author, with Miss Elizabeth M. Sewell, of *Historical Extracts* (1868).

**Yon'kers,** city and tp., Westchester co., N. Y., located on the E. bank of Hudson River, 17 miles from New York. Hudson River R. R. passes through Yonkers on the bank of the river, and has 18 trains each way stopping daily; 4 steamboats also land each way daily. It is built on a series of hills, the principal one being on the northern side. Between that and the southern and eastern elevations there is a small river called the Nepperhan, which gives eight valuable water-powers within a distance of 1 mile, on the banks of which are located 3 wool hat factories, 4 large buildings devoted to carpet-making, 1 brewery, the Eagle Pencil Co.'s works, and 3 silk-factories. The other manufacturing establishments are the Clipper Mower and Reaper Co.'s works, elevator-works, where is also made the new Haymaker mowing-machine, a machine tool-factory, the Yonkers Barrel Co., and 2 gas companies. Yonkers has 14 churches, 2 missions, 2 national banks, 2 savings banks, a large number of public and private schools, a public reading-room, and 3 weekly newspapers. An excellent supply of pure water has been introduced at an expense of about $600,000. The assessed valuation of the real estate in 1875 was $20,906,904. The city proper is mainly occupied with first-class residences, and private residences crown the heights on the N. side of the city. Many of these residences are owned and occupied by merchants doing business in New York. The prosperity of the city arises from its large manufacturing interests. The police department is most efficient, and consists of some 30 men, 8 of whom are mounted. A thorough patrol is maintained day and night. Numerous street stations, as well as a large number of private houses, the banks, and many offices, are in telegraphic communication with police headquarters, which in turn is in full communication with the New York City police telegraph. The venerable building, the property of the Phillipse family prior to the Revolution, built in 1752 (the bricks were imported from Holland), and still in a fine state of preservation, was a few years ago purchased for public use, and has been judiciously altered in the interior to accommodate a number of the public officers. Care has been taken to preserve the old style of ornamentation, and one of the ancient tiled fireplaces is in a good state of preservation. P. 18,357.

M. F. ROWE, ED. "YONKERS STATESMAN."

**Yonne,** department of North-eastern France, is situated on both sides of the river Yonne, and comprises an area of 2781 sq. m., with 363,608 inhabitants. The surface is undulating and the soil very fertile, producing wheat and vegetables in large quantities, excellent wine, and fine forests and pastures. Iron, ochre, marble, and lithographic stones are produced, and different kinds of manufactures carried on. Of 42,234 children of school age, 4672 remained without any school education in 1857. Cap. Auxerre.

**York,** or **Yorkshire,** county of England, extending along the North Sea from the mouth of the Tees in the N. to the estuary of the Humber in the S., comprises an area of 5710 sq. m., with 2,436,113 inhabitants, and is divided into three ridings—North, East, and West Riding—each with its own military and civil jurisdiction, lord lieutenant, and public buildings. The surface is greatly diversified, but the soil is everywhere fertile, and has been rendered still more productive by a most careful cultivation. The northern part is mountainous, and contains the highest mountains of England. Here are excellent pastures, rich mines of alum and lead, and extensive quarries of marble. The central part is a broad valley stretching from N. to S. and well suited for agriculture; wheat of superior quality is raised here. Extensive coal-beds are found in several places, and a manufacturing industry of the greatest importance is carried on in Leeds, Sheffield, and other large towns of the county.

**York** [Lat. *Eboracum*], capital of Yorkshire, at the confluence of the Ouse and the Foss, is one of the oldest and—on account of its monuments—most interesting cities of England. It is surrounded with walls, and generally closely built, with narrow streets and curious, old-fashioned houses. Its cathedral, built from the eleventh to the fourteenth century, is one of the finest specimens of Gothic architecture in the world. It is built in the form of a cross, 524 feet long, 250 feet broad across the transepts, with a square,

massive tower, 235 feet high, rising over the crossing, and two elegant towers, 196 feet high, flanking the western front. Many of its other churches and public buildings are also fine edifices, and it has good educational, scientific, and literary institutions. Its manufactures and trade are not important. It is the seat of the archbishop of York, whose residence is at Bishopthorpe, a short distance from the city, while the old archiepiscopal palace, N. of the cathedral and built in the twelfth century, is used as a library. In the time of the Romans, York was the seat of the general government for the whole province of Britannia; Septimius Severus and Constantius Chlorus died here, and here Constantine the Great was proclaimed emperor. In the Saxon period it was the capital of Northumbria, and afterward of Deira, and in connection with the Scots and the Danes it offered a fierce resistance to William the Conqueror, who after taking it razed it to the ground. It was only partially rebuilt, and suffered much by fire in 1137. In 1644 it was captured by Fairfax, and in 1688, James II. took away its charter to compel it to yield to his arbitrary measures. P. 43,796.

**York,** county of New Brunswick, traversed by the navigable river St. John, and in part bounded on the S. W. by Maine. Its central portion is very fertile, but large tracts are barren, except of timber. It is traversed by Fredericton Railway. Cap. Fredericton. P. 27,140.

**York,** county of Ontario, Canada, extending N. from Lake Ontario to Lake Simcoe. It is fertile, especially in the southern and central parts, and has large lumber interests. It is traversed by various railroads, centring at Toronto, the county-seat. P., inclusive of Toronto, 115,974.

**York,** county of S. W. Maine, lying on the Atlantic Ocean, bordering on New Hampshire, drained by Salmon Falls, Piscataqua, Saco, and other streams, and traversed by several railroads. The surface is very uneven—rugged and sterile near the sea-coast, and only moderately fertile in the interior. There are more than 400 manufacturing establishments, among which are boots and shoes, boxes, brick, carriages, clothing, cotton goods, flour-mills, furniture, leather, machinery, prints, saw-mills, shipyards, woollens, and worsted goods. Cattle, horses, and sheep are the chief live-stock. Staples, manufactured articles, wool, lumber, hay, Indian corn, potatoes, and dairy products. Cap. Alfred. Area, 878 sq. m. P. 60,174.

**York,** county of S. E. Nebraska, intersected by the Middle and W. forks of Big Blue River; surface undulating, soil productive. There is very little live-stock. Staples, wheat, Indian corn, and potatoes. Cap. York. Area, 576 sq. m. P. 604.

**York,** county of S. E. Pennsylvania, bordering on Maryland, bounded N. E. by Susquehanna River, and traversed by Northern Central R. R. and its branches, and along its E. border by Susquehanna Canal. The surface is generally hilly, and in the W. part mountainous, with extensive quarries of limestone, sandstone, and slate. There are more than 1000 manufacturing establishments, among which are agricultural implements, bricks, carriages, cigars, flour-mills, furniture, iron, lime, leather, paper, machinery, rag carpets, railway cars, saw-mills, stone and earthen ware, whips, and woollen goods. Horses, cattle, and swine are numerous. Staples, manufactured articles, wheat, Indian corn, oats, tobacco, hay, and dairy products. Cap. York. Area, 864 sq. m. P. 76,134.

**York,** county of N. South Carolina, bordering on North Carolina, drained by Catawba and Broad Rivers, and traversed by Charlotte Columbia and Augusta, King's Mountain, and Atlanta and Richmond Air-line R. Rs. The surface is hilly, in parts mountainous, abounding in iron ore and manganese; gold has been found in considerable quantities. There are flour-mills and manufactories of carriages and forged and rolled iron. Live-stock not numerous. Staples, cotton and Indian corn. Cap. Yorkville. Area, about 800 sq. m. P. 24,286.

**York,** county of S. E. Virginia, lying on the peninsula formed by James and York rivers, and bounded E. by Chesapeake Bay; surface undulating, soil originally fertile. Swine and cattle are the chief live-stock. Staples, corn and potatoes. Cap. Yorktown. Area, 150 sq. m. P. 7198.

**York,** tp., Carroll co., Ill. P. 1490.

**York,** p.-v. and tp., Clark co., Ill. P. 1090.

**York,** tp., Du Page co., Ill. P. 1799.

**York,** tp., Benton co., Ind. P. 433.

**York,** tp., Dearborn co., Ind. P. 986.

**York,** tp., Elkhart co., Ind. P. 906.

**York,** tp., Noble co., Ind. P. 1041.

**York,** tp., Steuben co., Ind. P. 857.

**York,** tp., Switzerland co., Ind. P. 995.

**York,** tp., Iowa co., Ia. P. 554.

**York,** tp., Pottawatomie co., Ia. P. 226.

**York,** tp., Tama co., Ia. P. 1000.

**York,** p.-v. and tp., York co., Me. P. 2654.

**York,** p.-v. and tp., Washtenaw co., Mich. P. 1575.

**York,** tp., Fillmore co., Minn. P. 819.

**York,** tp., Putnam co., Mo. P. 1484.

**York,** p.-v., cap. of York co., Neb.

**York,** p.-v. and tp., Livingston co., N. Y. P. 2564.

**York,** tp., Athens co., O. P. 2652.

**York,** tp., Belmont co., O. P. 1508.

**York,** tp., Darke co., O. P. 797.

**York,** tp., Fulton co., O. P. 2229.

**York,** tp., Medina co., O. P. 886.

**York,** tp., Morgan co., O. P. 916.

**York,** tp., Sandusky co., O. P. 2094.

**York,** tp., Tuscarawas co., O. P. 1041.

**York,** p.-v. and tp., Union co., O. P. 1361.

**York,** tp., Van Wert co., O. P. 983.

**York,** city and tp., cap. of York co., Pa., on both sides of Codorus Creek, and on Northern Central and the Frederick division of Pennsylvania R. Rs., 100 miles W. of Philadelphia, contains 24 churches, a public library, an academy, collegiate institute, and excellent public schools, 6 banks, an orphan asylum, 2 daily, 8 weekly, and 2 monthly newspapers, several foundries, car and coach manufactories, agricultural works, match, shoe, and whip factories, excellent water-supply, an efficient volunteer fire department, and several minor manufacturing interests. It is the W. terminus of Peachbottom R. R. P. of city, 11,003; of tp. exclusive of city, 2594.

JOHN B. WELSH, ED. "YORK DAILY."

**York,** tp., York co., S. C. P. 3200.

**York,** tp., Dane co., Wis. P. 1068.

**York,** tp., Green co., Wis. P. 1088.

**York, Cardinal.** See STUART (HENRY BENEDICT).

**York** (DUKES OF), a title formerly conferred upon younger sons of the kings of England, some of whom have come to the throne through the decease of their elder brothers. The first duke was Edmund Plantagenet, fifth son of Edward III., and from him were descended the princes who after the many vicissitudes of the wars of the Roses became kings under the titles of Edward IV., Edward V., and Richard III. The title was held by Charles I. and James II. before their accession to the throne, was bestowed by the latter upon his second son, Henry Benedict, known as Cardinal York, the last of his family, and was last held by Frederick, second son of George III. (b. Aug. 16, 1763; d. Jan. 5, 1827), who became distinguished as a general in the wars against Napoleon.

**York and Lancaster, Wars of.** See ROSES, WARS OF THE.

**Yorke.** See HARDWICKE, EARLS OF.

**Yorke** (CHARLES), brother of Philip, second earl of Hardwicke, b. in England Dec. 30, 1722; became a lawyer; sat in Parliament for the University of Cambridge; was appointed solicitor-general 1756; was attorney-general 1762–63 and 1765–70, and was elevated to the dignity of lord high chancellor, by the title of Baron Morden, Jan. 17, 1770, but d. by suicide three days later, Jan. 20, 1770. He was one of the authors of the celebrated *Athenian Letters* (1741–43), and wrote some legal treatises.

**Yorke** (Sir CHARLES), b. Dec., 1790; educated at Winchester; entered the British army as ensign Jan. 22, 1807, and served with the 52d regiment in the Peninsula, and was present at the battles of Vimiera, Fuentes d'Onor, Salamanca, Vittoria, Pyrenees, Nivelle (wounded), Nives, and Orthes (severely wounded); participated in the sieges of Ciudad Rodrigo and Badajoz, and wounded at the latter; also served in the campaign and battle of Waterloo. In the Kaffir war (1852–53) he served at the Cape of Good Hope. For Badajoz he has received the war-medal with ten clasps. In 1863 he was transferred from the colonelcy of the 33d Foot to be colonel-commandant of the rifle brigade. In 1871 he became a general in the British army.

**York River,** the noble tidal estuary of Mattapony and Pamunkey rivers, which unite at West Point, Va., whence it extends eastward 40 miles to Chesapeake Bay. On York Spit, at its entrance, stands an iron screw-pile lighthouse in water 12½ feet deep at low tide, and built on fourteen piles, showing a fixed red light; lat. 37° 12′ 31″ N., lon. 76° 14′ 57″ W.

**York'shire,** p.-v. and tp., Cattaraugus co., N. Y. P. 1575.

**York Springs,** b., Adams co., Pa. P. 356.

**York'town,** tp., Henry co., Ill. P. 659.

**Yorktown,** p.-v. and tp., Westchester co., N. Y. P. 2625.

**Yorktown,** p.-v. and cap. of York co., Va., on York River, notable from the two sieges which it has sustained. P. about 1000. On Aug. 1, 1781, Lord Cornwallis posted himself here with a force of something more than 8000 men, supported by several frigates and other vessels which were anchored in York River, fortifying his position by strong redoubts and batteries on the land-side, and by a line of batteries along the river; also strongly fortifying Gloucester Point on the opposite side of the stream. In the latter part of September the combined American and French forces under Washington and La Fayette, numbering about 16,000 men, invested Yorktown. On Oct. 9 the first parallel was established, and fire was opened, by which several of the British guns were dismounted, and on the following evening a frigate and three large transports were destroyed. On the 11th the second parallel was opened, and as the besiegers were annoyed by an enfilading fire from two redoubts, a successful attack was made upon them on the night of the 14th, and the captured works were included in the parallel. A large French fleet under Count de Grasse in the mean while prevented Cornwallis from receiving the reinforcements which were sent to him by Sir Henry Clinton from New York. On the 16th he made an ineffectual sortie, and on the next day offered to capitulate. The terms having been agreed upon, on the 19th he surrendered his whole force, consisting of 7247 regular troops, 840 sailors, with 235 guns; the entire British loss in killed, wounded, and missing was about 550; that of the Americans and French, about 300. This surrender virtually brought the war of the Revolution to a close.—The second siege of Yorktown was during the civil war. Gen. Magruder, with about 15,000 Confederates, had taken possession of the place early in the spring of 1862, and Gen. McClellan, who had about 112,000, opened a siege commencing Apr. 5. The Confederates were soon largely reinforced by Gen. Johnston, who took the command, having in all about 53,000 men. The besieging works were completed, and fire was to have been opened May 6, but two days previously Johnston secretly evacuated the works, carrying away everything worth taking.

**York'ville,** a thriving suburb of Toronto (which see), in York co., Ontario, Canada. It is connected with Toronto by street railway, and has many fine residences and important manufactures. P. 2203.

**Yorkville,** tp., Pickens co., Ala. P. 1593.

**Yorkville,** p.-v., cap. of Kendall co., Ill., on Fox River Valley R. R., 51 miles W. of Chicago, has 1 church, good schools, 2 newspapers, 1 bank, 1 paper-mill, an elevator, a tannery, 2 hotels, and 4 large ice-houses. It is the centre for a large trading community. P. including Bristol, 1200. J. R. Marshall, Ed. "Record."

**Yorkville,** v., Whitestown tp., Oneida co., N. Y. P. 213.

**Yorkville,** b., Schuylkill co., Pa. P. 553.

**Yorkville,** p.-v., cap. of York co., S. C., on King's Mountain R. R., 22½ miles N. of Chester, has 7 churches, military and female schools, a banking-house, 1 hotel, 2 newspapers, 1 carriage manufactory, 3 shoe-factories, a marble-yard, 1 tannery, and harness and saddle establishment. P. 1364. L. M. Grist, Prop. "Enquirer."

**Yorkville,** p.-v. and tp., Racine co., Wis. P. 1587.

**York von War'tenburg** (Hans David Ludwig), Count, b. at Potsdam, Prussia, Sept. 26, 1759; entered the army in 1772; was cashiered in 1780 for insubordination; served in the Dutch army in India 1783–84; re-entered the Prussian service as a captain, and was made a major-general in 1807, and governor of the province of Prussia in 1811. During the Russian campaign of 1812 he commanded the Prussian auxiliary corps in the grand army, and concluded (Dec. 30, 1812) a convention with the Russians, according to which his corps remained neutral during the retreat. The Prussian king was compelled to denounce this convention for some time, but when Prussia soon after declared war against Napoleon, York's conduct was highly praised. He fought with great distinction in the campaigns of 1813–14, was made a count and field-marshal, and d. at Klein-Oels, Siberia, Oct. 4, 1830.

**Yor'uba,** or **Yarriba,** country of Western Africa, in Upper Guinea, between lat. 6° and 9° N., and between lon. 2° and 6° E., bounded W. by Dahomey, and comprising an area of 70,000 sq. m., with about 3,000,000 inhabitants. The surface is an undulating plain, elevated 1000 feet above the sea, broken in some places by ranges of low rocky hills, and traversed by several short but copious and rapid streams. Extensive forests are found of teak, sassa-wood, ebony, figs, and different kinds of palms, such as the oil, wine, cocoanut, and fan palm. Elephants, rhinoceroses, lions, panthers, buffaloes, wild-hogs, monkeys, numerous kinds of birds, but only few fish, and serpents of huge size abound. European animals, cereals, and vegetables have been introduced, but most of them undergo changes when acclimatized; thus, the sheep becomes covered with hair instead of wool. The country contains many large cities, such as Katunga, Adu, Larro, and Janna, and its trade and manufacturing industry are considerable.

**Yosem'ite Val'ley** is a region of remarkable scenic attraction, situated in the Sierra Nevada of California, about 150 miles in a direct line a little S. of E. from the city of San Francisco. It was discovered in 1851, having been first visited by a party of settlers in the vicinity of the mining-camp of Mariposa while in pursuit of a band of Indians who had made themselves troublesome to the whites, and who were ascertained to have a stronghold in the mountains, where they imagined that they were safe from any attack, and in which they sought refuge when obliged to retreat from the neighborhood of the settlements. The Indian residents in and about the Yosemite Valley are said to have been a mixed race, made up of the disaffected of the various tribes from the Tuolumne to King's River. The word *Yosemite* means "a full-grown grizzly bear," and was not the aboriginal name of the valley itself, but that of a noted chief of the tribe. The present Indian name of the Yosemite is said to be *Ah-wah-nee.* That this was a favorite locality with the Indians is quite certain, and they have names for each and every important feature of the valley; which names, however, are not now in use among the whites, having been replaced by others which are partly Spanish and partly English.

The Yosemite Valley is nearly in the centre of the State of California, N. and S., and about midway between the E. and W. bases of the Sierra, which is here not far from 70 miles in width. It is a level area, about 6 miles in length, and from half a mile to a mile in width, and is sunk nearly a mile in depth below the general level of the adjacent region. It has very much the character of a gorge or trough hollowed in the mountains in a direction nearly at right angles to their general trend. This gorge has not a regular form, but while its general direction remains nearly the same, its sides advance and retreat, with angular projections and recesses, thus giving a great variety of outline to the enclosing masses. The river Merced, which heads in the Sierra some 15 miles higher up than the head of the valley, in the group of mountains of which Mount Lyell is the dominating peak, runs through the Yosemite with many graceful windings, and gives rise at the head of the valley to the remarkable waterfalls which will be noticed farther on. Two branches of the main Merced also enter the valley near its head: one, the Tenaya Fork, which rises in a beautiful mountain-lake of the same name, comes in from the N. E.; the other, the Illilouette, enters from the S. These tributaries join the Merced through deep cañons, as the mountain-gorges in the Sierra are always called; but there are several other smaller streams which also enter the valley, leaping over its walls, and giving rise in almost every instance to interesting falls; which, however, are not in general of any great size, except during the early part of the season, when the snow upon the adjacent mountains is melting.

The pleasure-traveller who visits the Yosemite does not confine his explorations to the valley proper, but from various commanding points adjacent to it obtains a great variety of views of the groups of peaks which form the crest of the Sierra in that region, as well as of the spurs which extend down from the main range or stretch along parallel with it. Thus, a journey to the Yosemite properly also includes a tour around its exterior, or at least one or more visits to prominent points of view above it, from which the observer cannot only look directly down into the depths of the valley below him, but also command a variety of views of lofty and in part snow-clad ranges, which offer among themselves most remarkable contrasts of form and structure.

In noticing the details of the scenery of the Yosemite the valley proper may first be considered. The prominent features here are—the great elevation of the walls which enclose it; the remarkable approach to verticality in these walls; their great height and their wonderful variety and beauty of form. To these features may also be added the attractions of the magnificent waterfalls which occur at various points on both sides of the valley, although these, as already noticed, must be seen early in the season in order that the traveller may be greatly impressed by them. In entering the Yosemite by the roads which approach it from the lower end, the visitor notices that he has before him a valley of a different type of form from those he has before been accustomed to see. He passes from a V-shaped

gorge or cañon into one which may be fairly called U-shaped, since its walls rise almost vertically from its floor. This change of form is strikingly impressed on the visitor as he approaches what may be called the gateway of the Yosemite. Here he sees before him, on the N. side of the valley, the mass of rock called El Capitan, and, exactly opposite, the Bridal Veil and Cathedral Rocks. At this point the distance across the valley is only a mile, measured from the summit of the Bridal Veil Rock to that of El Capitan, and at the base of these cliffs there is only just room for the river to pass. El Capitan is an immense block of granite projecting squarely out into the valley, and presenting two almost vertical faces, which meet in a sharp edge 3300 feet in perpendicular elevation. The sides or walls of this mass are bare, smooth, and entirely destitute of vegetation. It is doubtful if anywhere in the world there is presented so squarely-cut, so lofty, and so imposing a face of rock. On the opposite side of the valley is the grand mass of the Cathedral Rocks, divided into two parts by a deep notch between them. The most striking face of the larger Cathedral Rock is turned up the valley, but on the side facing the entrance there is a feature of great beauty — namely, the Bridal Veil Falls, made by the creek of the same name, which, as it enters the valley, descends in a vertical sheet of 630 feet perpendicular, striking there a pile of *débris*, down which it rushes in a series of cascades, with a vertical descent of nearly 300 feet more, the total height of the fall being 900 feet. This creek runs during the entire year, but the fall is only great when the amount of water is near its maximum. When the stream is neither too full nor too low, the mass of water in its fall vibrates with the varying pressure of the wind, blowing in the daytime up the valley in the most beautiful and remarkable manner. It is this fluttering and waving of the sheet of water which has given it the poetic but somewhat fanciful name it now bears, that of the Indians having been *Pohono*, a term having reference, it is said, to the chilliness of the air under the high cliff and near the falling water. There is also a charming fall in a deep square recess of the rocks opposite the Bridal Veil, and just below El Capitan. This fall, which is over 1000 feet high, is called the Virgin's Tears. It runs, however, but a short time during the early summer months.

Passing up the valley after entering between the Cathedral Rocks and El Capitan, the level area or river-bottom increases to nearly half a mile in width. This area is broken up into small meadows, gay with flowers in the early summer, and sandier regions on which grow numerous pitch-pines (*P. ponderosa*) and some oaks, cedar, and firs. The walls of the valley continue lofty and broken into the most picturesque forms. Of these the Three Brothers and the Sentinel Rock are the most conspicuous. Nearly opposite the Sentinel Rock is one of the most attractive features of the Yosemite—namely, the fall made by the descent of Yosemite Creek down the wall on the N. side of the valley. The vertical elevation of the edge of this fall is 2600 feet, but the descent is not in one unbroken sheet. There is first a vertical fall of 1500 feet, then a descent of 626 feet in a series of cascades, and finally one plunge of 400 feet on to a low talus of rocks at the foot of the precipice. The body of water is not large, and it decreases considerably as the season advances, becoming very small in ordinary years by the end of August. The width of the stream above the fall is usually, in June and July, about 20 feet, and its depth perhaps 2 feet. The beauty and grandeur of this fall, however, taken in connection with the majesty of its surroundings, give it a claim to be ranked among the most remarkable natural objects in the world. There are certainly very few waterfalls which can compete with it.

At the head of the valley the falls of the Merced River are of great interest. There are two of them, with beautiful intervening rapids. The lower one is called the Vernal Fall, and is about 400 feet in vertical height. The upper, the Nevada Fall, is about 600 feet in elevation. The body of water in these falls is large and the effect very grand. As the Merced River is fed by melting snows high up in the Sierra, the amount of water is not so much diminished toward the end of the season as it is in the case of the smaller creeks heading at an inferior elevation; thus, the falls of the Merced usually remain extremely picturesque and attractive objects during the whole summer.

The dome-shaped masses of granite which characterize the vicinity of the Yosemite are also extremely grand. The North Dome, on the N. side of the valley, lends itself to beautiful combinations of scenery, as seen from various points a little above the Yosemite Falls. The Sentinel Dome, on the opposite side, is not visible from the valley itself, but it affords a magnificent view from its summit of the valley and its surroundings, and especially of the high Sierras. A projecting cliff, called Glacier Point, a little lower than this, and just on the edge of the valley, is also much visited for the sake of the grand view which it offers of the whole region, but especially on account of its favorable situation with reference to the Half Dome, of which it commands a most wonderful view. The rock thus named is the highest point in the immediate vicinity of the Yosemite, rising to an elevation of 4737 feet above the general level of the valley. The Half Dome has the appearance of having been originally a dome-shaped mass which has been split into two parts, one of which has sunk down and disappeared; hence the name. It fronts the valley of the Tenaya Fork of the Merced with a very steep slope, crowned by a vertical wall of fully 1600 feet in elevation, forming together a mass of rock of the most astonishing form and imposing magnitude.

The Yosemite Valley was given by Congress to the State of California in 1864, to be "held for public use, resort, and recreation," to be also "inalienable for all time," with the condition that portions of the valley might be leased, the income arising from such leases to be expended "in the preservation and improvement of the property or the roads leading thereto." The grant is managed by commissioners appointed by the governor of the State. Great difficulty has been experienced in getting possession of the premises, which were held by squatters, and these difficulties have not yet been fully overcome. Wagon-roads have been made into the valley, leading into it from its lower end up the Merced River. These, however, have been built and are owned by private parties, and the same is true of the various excellent trails which have been built to afford access to Glacier Point, Union Point, and other elevations commanding remarkable views of the valley and its surroundings.

J. D. WHITNEY.

**Yoshida Kiyonari,** b. in the province of Satsuma, Japan, about 1845; educated in the Chinese classics and the history of his own country at the government college of his province, as well as by private tutors; visited Europe in 1865, where he spent more than two years, going through a course of studies at University College, London; subsequently spent three years engaged in study in New Jersey and Massachusetts; on his return to Japan was made one of the chief clerks of the finance department by cabinet appointment; was next made commissioner of internal revenue by imperial appointment, in which position, although then in his twenty-sixth year, he originated some measures of importance for the public weal; in 1871 was appointed assistant minister of finance, in which capacity he visited England and negotiated a loan of more than $12,000,000 under circumstances of special advantage; returned to Japan, still connected with the finance department, and in the latter part of 1874 was appointed the first envoy extraordinary and minister plenipotentiary to the U. S. He is the youngest Japanese who ever received an imperial appointment.

F. A. P. BARNARD.

**You'att** (WILLIAM), b. in England in 1777; was for many years professor in the Royal Veterinarian College, and proprietor and co-editor of *The Veterinarian*, established in 1828. D. in London Jan. 9, 1847. Author of *The Horse* (1831), a standard work, of which two American eds. have been published; *Sheep, their Breeds, Management, and Diseases* (1832), *Cattle, etc.* (1834), *The Dog* (1842), *The Pig* (1860), and *The Complete Grazier* (1846). Prof. Youatt's works are high authority for stock-raisers in England and America.

**Youghal,** town of Ireland, county of Cork, Munster, on the estuary of the Blackwater, has a good harbor, admitting vessels of 400 to 500 tons, extensive and valuable fisheries, and a large export-trade in agricultural produce. Here the first potatoes were planted by Sir Walter Raleigh, whose house is still preserved. P. 6039.

**You'mans** (EDWARD LIVINGSTON), M. D., b. at Coeymans, N. Y., June 3, 1821; studied chemistry, physics, and medicine, although, on account of an attack of ophthalmia which made him blind for several years, he could pursue his studies only by the aid of his sister, ELIZA ANNE YOUMANS, known by her educational publications. Besides delivering a number of lectures, he published *Chemical Chart of Colored Diagrams* (1851), *Classbook of Chemistry* (1852), *Atlas of Chemistry* (1854), *Alcohol and the Constitution of Man* (1855), *Handbook of Household Science* (1857), *Correlation and Conservation of Forces* (1864), *Observations on the Scientific Study of Human Nature* (1866), *The Culture demanded by Modern Life* (1867). In 1871 he founded the "International Scientific Series" (New York, London, Paris, Leipsic, St. Petersburg, and Milan), of which 20 vols. have appeared, and in 1872 he founded the *Scientific Monthly*.

**Young,** county of N. W. Texas, intersected by Brazos River; surface undulating, with much woodland; soil fertile. Cattle are very numerous, and grazing is the chief

industry, although a little Indian corn is produced. Cap. Graham. Area, about 900 sq. m. P. 135.

**Young,** tp., Indiana co., Pa. P. 1650.

**Young,** tp., Jefferson co., Pa. P. 954.

**Young** (ALEXANDER), D. D., b. at Boston, Mass., Sept. 22, 1800; graduated at Harvard 1820; taught in the Boston Latin School 1821–24; studied theology at Cambridge Divinity School, and was pastor of a Unitarian church at Boston from 1825 to his death, Mar. 16, 1854. He edited the *Library of Old English Prose-Writers* (9 vols., 1831–34), the *Chronicles of the Pilgrim Fathers of the Colony of Plymouth* (1841), and the *Chronicles of the First Planters of the Colony of Massachusetts Bay* (1846).

**Young** (ANDREW W.), b. at Carlisle, N. Y., in 1802; became editor of the *Warsaw Sentinel* 1830–31, the *Republican Advocate* 1832–35, and the *American Citizen* 1836. Author of a widely-circulated *Introduction to the Science of Government* (1839), *The American Statesman* (1855), *National Economy* (1860), and other political works.

**Young** (ARTHUR), b. at Bradfield, Suffolk, England, Sept. 7, 1741; was in early life engaged in mercantile business at Lynn, which he abandoned for the pursuit of scientific agriculture; managed a large farm at Samford Hall, Essex, 1765–70; travelled through most of the counties of England and Ireland in quest of information on the current methods of farming; made a careful tour through France for a similar purpose; wrote for the *Museum Rusticum* and for William Nicholson's *Journal of Natural Philosophy* (1792 *seq.*); edited the *Universal Museum;* was for some time parliamentary reporter for the *Morning Post* (1765 *seq.*); was engaged in practical husbandry from 1779; conducted through 45 volumes the *Annals of Agriculture,* established by him in 1784 at Bury St. Edmund's, and issued at London after 1808, a publication to which George III. sometimes contributed under the name of Ralph Robinson; corresponded with Washington on agriculture, and was secretary to the board of agriculture from 1789 to his death, at Bradfield Apr. 12, 1820. Among his many works may be specified *The Farmer's Letters to the People of England* (1767), *A Six Weeks' Tour through the Southern Counties of England and Wales* (1768), *A Six Months' Tour through the North of England* (4 vols., 1770), *The Farmers' Guide* (2 vols., 1770), *Rural Economy* (1770), *A Course of Experimental Agriculture* (2 vols., 1770), *The Farmer's Tour through the East of England* (4 vols., 1771), *The Farmer's Kalendar* (1771; 215th ed., revised by J. C. Morton, 1862), *Political Arithmetic* (2 parts, 1774–79), *A Tour in Ireland* (2 vols., 1780), *Travels, etc., with a View of Ascertaining the Cultivation, Wealth, Resources, and National Prosperity of the Kingdom of France* (Bury St. Edmund's, 2 vols., 1792–94; in French, Paris, 3 vols., 1794), *The Example of France a Warning to Great Britain* (1793), *An Essay on Manures* (1804), *The Progressive Value of Money as marked by the Price of Agricultural Products* (1812), and *The Rise of Prices in Europe, etc.* (1815). By order of the French Directory a collective edition of his agricultural works was published in French under the title *Le Cultivateur Anglais,* etc. (18 vols., 1800–01). Arthur Young was perhaps the most eminent of writers on agriculture, and his fame may be expected to increase for centuries to come. (See Allibone's *Dictionary of Authors,* McCulloch's *Literature of Political Economy,* and Donaldson's *Agricultural Biography.*)

**Young** (BRIGHAM), b. at Whitingham, Vt., June 1, 1801, the son of a farmer; was educated in the Baptist Church, and trained as a painter and glazier, but joined in 1832 the Mormons at Kirtland, O., and started in 1835 on his first missionary journey. He was very successful as a preacher, and made many converts, being possessed of a peculiar but very impressive eloquence, and at the same time rose to the highest dignities and acquired an almost boundless influence within the sect by his energy and shrewdness, and by the power of his personality. After the death of Joseph Smith in 1844, he was chosen president of the Church by the apostles, and from 1846 to 1848 he led the host of the Mormons from Nauvoo across the prairies to Great Salt Lake Valley, where he founded Salt Lake City. In Mar., 1849, a convention was held in this city, a constitution was framed, and a State was organized under the name of *Deseret,* which in the "reformed Egyptian" language is said to mean the "Land of the Honey-Bee." Congress, however, refused to admit the new State, but the Territory of Utah was organized, and Brigham Young was appointed governor for four years. Conflicts soon arose with the Federal government (see SALT LAKE CITY and UTAH), but the U. S. officers were expelled from the Territory, and Brigham Young declared, "I am and will be governor until the Lord Almighty says, 'Brigham, you need not be governor any more.'" In spite of the forcible measures which the government took from time to time, he continued to wield an almost unlimited power as president of the Church. On Aug. 29, 1852, he introduced polygamy as an institution, as the celestial law of marriage, and he carried it through in spite of considerable resistance from a division of the Church itself. Soon, however, the development of the mining interests of the Territory and of the commercial interests of Salt Lake City brought a great number of people to the Territory and the city who were not Mormons, and the control of the legislation and administration of the State is now rapidly passing out of the hands of Brigham Young and the Mormons.

**Young** (CHARLES AUGUSTUS), PH. D., LL.D., b. at Hanover, N. H., Dec. 15, 1834; graduated at Dartmouth College 1853; was assistant teacher in Phillips Academy, Andover, Mass., 1854–55; studied theology in Andover Seminary 1855–56; was professor of mathematics and natural philosophy in Western Reserve College, O., 1856–66; was called in the latter year to the professorship of natural philosophy and astronomy at Dartmouth, a chair which had been filled by both his father and his grandfather, Prof. Ebenezer Adams. Prof. Young was the discoverer, associated with Harkness, of the spectrum of the corona in 1869, in 1870 of the reversal of the solar spectrum by the lower strata of the sun's atmosphere, and in 1872 of the presence of sulphur, cerium, and strontium in the sun by observations upon the spectrum of the chromosphere, made at Sherman at an elevation of 8000 feet. He was chosen an associate fellow of the American Academy of Arts and Sciences at Boston in 1871, a member of the National Academy of Sciences in 1872, and in that year was also elected a foreign associate of the Royal Astronomical Society of Great Britain. Prof. Young is the author of numerous published papers on science.

**Young** (Sir CHARLES GEORGE), D. C. L., b. in England in 1795; educated at the Charter-house; entered the College of Arms as a pursuivant 1813; became York Herald May, 1820, register of the college July, 1822, and Garter King-at-arms Aug., 1842, on which occasion he was knighted. D. in London Sept. 1, 1869. Author of *A Catalogue of Works on the Peerage and Baronetage of England, Scotland, and Ireland* (1827), *A Catalogue of the Arundel MSS. in the Library of the College of Arms* (1829), *The Order of Precedence, with Authorities and Remarks* (1851), and other professional treatises.

**Young** (EDWARD), LL.D., b. at Upham, Hampshire, England, in 1684; educated at Winchester School and at Corpus Christi College, Oxford; obtained a law fellowship at All Souls' College, Oxford; took there the degree of doctor of laws 1719; was defeated as a candidate for Parliament at Cirencester; was tutor to Lord Burleigh, son of the earl of Exeter; took orders in the Church of England 1727; was appointed a royal chaplain 1728; became rector of Welwyn, Hertfordshire, 1730; married a daughter of the earl of Lichfield 1731; lost his wife 1741, and was appointed clerk of the closet to the princess-dowager of Wales 1761. D. at Welwyn Apr. 12, 1765. Author of several successful satires and dramas, of some volumes of political essays, and of a celebrated religious poem, *Night Thoughts* (1742–46), once very popular.

**Young** (J. R.), U. S. N., b. Nov. 27, 1826, in Ohio; entered the navy as a midshipman Oct. 18, 1841; became lieutenant in 1855, captain in 1873; served in the Susquehanna at the taking of Forts Hatteras and Clark, in the battle of Port Royal, and in command of the iron-clad Sangamon took part in all the engagements with the defences of Charleston from July, 1864, to the close of the civil war. Highly commended for "gallantry and good service." FOXHALL A. PARKER.

**Young** (JAMES), b. at Glasgow, Scotland, in July, 1811; was in early life a joiner; attended the chemical lectures of Prof. Thomas Graham at the Andersonian Institution; was assistant to that gentleman, first in Glasgow and afterward at University College, London, 1832–38; was employed in a scientific capacity in Muspratt's chemical works at Newton 1838–42, and in Tennant's works at Manchester 1842–46; analyzed about 1847 the petroleum found in a spring in a coal-mine in Derbyshire; obtained from it a lubricating oil for machinery and a lighter oil for burning in lamps; was led thereby to undertake the slow distillation of coal by a process for which he took out a patent, thus created a new and important industry, permanently cheapening the price of light; established coal-oil works at Bathgate, and subsequently at Addiewell, Scotland; acquired a large fortune, and contributed indirectly to the rise of the vast petroleum industry in America; gave £10,000 for the endowment of the chair of chemistry in the Andersonian Institution, Glasgow; erected a bronze statue to Prof. Graham at Glasgow, and sent out at his own expense in 1872 an expedition to Central Africa in search of his early and intimate friend, Dr. Livingstone. Mr. Young

lives at Kelly, on the Clyde, and spends much of his time on his yacht Nyanza.

**Young** (James Hamilton), b. at Newton-upon-Ayr, Scotland, in 1793; came to Philadelphia, Pa., 1801; became an expert engraver and a writer upon statistical subjects, and was the author of the famous series of geographies published by Samuel Augustus Mitchell, of which several millions of copies have been circulated, the maps as well as the text being from his hand.

**Young** (John), b. at Chelsea, Vt., in 1802; removed in childhood to Livingston co., N. Y.; became a lawyer; sat in the legislature 1831 and 1844–45; was a Whig member of Congress 1841–43; governor of New York 1847–49, and U. S. assistant treasurer at New York City 1849–52. D. in New York City Apr. 23, 1852.

**Young** (John), G. C. B., Baron Lisgar, b. at Bailieborough, county Cavan, Ireland, Apr. 30, 1807, son of Sir William, a director of the East India Company; graduated at Corpus Christi College, Oxford, 1829; entered Parliament as a Conservative member for the county of Cavan 1831; was called to the bar at Lincoln's Inn 1834, but never practised the legal profession; was a lord of the treasury under Sir Robert Peel 1841–44, and secretary of the treasury 1844–46; became a privy councillor 1852; was chief secretary to the lord lieutenant of Ireland 1852–55, lord high commissioner of the Ionian Islands 1855–59, governor of New South Wales 1861–67; was governor-general of Canada from Sept. 18, 1868, to June, 1872, and was created Baron Lisgar Oct. 8, 1870.

**Young** (John), LL.D., b. in Scotland about 1810; became pastor of Albion chapel, Moorfields, and subsequently of a church at Edinburgh. Author, among other works, of *The Christ of History, an Argument grounded on the Facts of his Life on Earth* (1855; 6th ed. 1870), the later editions of which included an *Appendix containing a Brief Criticism of M. Renan's Vie de Jésus; Evil and God, the Mystery* (1856); *The Province of Reason* (1860), being a criticism of Dean Mansel's *Bampton Lectures; The Life and Light of Men* (1866), and *The Creator and the Creation, how Related* (1870).

**Young** (John Clarke), D. D., b. at Greencastle, Pa., Aug. 12, 1803; graduated at Dickinson College 1823; studied theology at Princeton Seminary 1824–26; was a tutor in the College of New Jersey at Princeton 1826–28; became pastor of a Presbyterian church at Lexington, Ky., 1828, and was president of Centre College, Danville, Ky., from 1830 until his death, June 23, 1857. Author of *An Address to the Presbyterians of Kentucky, proposing a Plan for the Instruction and Emancipation of their Slaves* (1835), of which 100,000 copies were circulated; *Universal Education a Pecuniary Gain to a Nation*, and of several published sermons and addresses.

**Young** (John Radford), b. in London, England, in Apr., 1799; was almost entirely self-educated; became a distinguished mathematician, and was for many years a professor in Belfast College. Author of many mathematical and mechanical textbooks and memoirs, of *The Mosaic Cosmogony not adverse to Modern Science* (1861), *Science Elucidative of Scripture, and not Antagonistic to it, a Series of Essays* (1863), *Modern Skepticism viewed in Relation to Science* (1865), of a paper *On the Origin of Speech* (1866), and other works.

**Young** (Josue Marie), b. at Sanford, Me., in Aug., 1808; became a printer at Portland, Me., and at Cincinnati, O.; was converted to Roman Catholicism 1827; studied for the ministry at Mount St. Mary's College, Emmittsburg, Md.; was ordained 1837; labored many years near Cincinnati; declined the bishopric of Pittsburg 1853, and was consecrated Apr. 23, 1854, bishop of Erie, Pa., where he d. Sept. 18, 1866.

**Young** (Matthew). D. D., b. in Roscommon co., Ireland, in 1750; educated at Trinity College, Dublin, where he obtained a fellowship 1775; took orders in the Church of England; became professor of philosophy in Trinity College 1786, and subsequently bishop of Clonfert and Kilmacduach; was a distinguished mathematician, one of the earliest members of the Royal Irish Academy, and a liberal contributor to its volumes. D. at Whitworth, Lancashire, Nov. 28, 1800. Author of *An Inquiry into the Principal Phenomena of Sounds and Musical Strings* (1784), *On the Number of Primitive Colors in Solar Light, etc.* (1800), *An Analysis of the Principles of Natural Philosophy* (1803), and other works, and left in MS. *The Method of Prime and Ultimate Ratios*, still unpublished.

**Young** (Pierce), M. B., b. in Spartanburg, S. C., in 1838; removed to Georgia; graduated at the military institute of that State 1857; cadet at West Point 1858; resigned in 1861, and entered the Confederate military service; for gallant and distinguished services rose by successive promotions to the rank of major-general; in 1868 was elected to Congress from Georgia, and re-elected 1870 and 1872. Alexander H. Stephens.

**Young** (Thomas), b. at Milverton, Somersetshire, England, June 13, 1773; acquired early a comprehensive knowledge of history and languages, of natural science and mathematics; studied medicine at London, Edinburgh, and Göttingen; was appointed professor of natural philosophy at the Royal Institution in 1801; became a fellow of the College of Physicians in 1808, physician to St. George's Hospital in 1810, secretary to the board of longitude and conductor of the *Nautical Almanac* in 1818. D. in London May 10, 1829. His principal works are—*Syllabus of a Course of Lectures on Natural and Experimental Philosophy* (1802), in which he established the law of interference of light; *A Course of Lectures on Natural Philosophy and the Mechanical Arts* (2 vols., 1807), *Elementary Illustrations of the Celestial Mechanics of Laplace* (1821), the article "Egypt" in the *Encyclopædia Britannica, Rudiments of an Egyptian Dictionary* (1830), etc. His miscellaneous works were collected in 4 vols. (1855) by Dean Peacock and John Leitch, and his *Life* was written by the former.

**Young Amer'ica,** tp., Edgar co., Ill. P. 687.

**Young America,** v., Tompkins tp., Warren co., Ill. P. 1145.

**Young America,** p.-v. and tp., Carver co., Minn. P. 823.

**Young Hick'ory,** tp., Fulton co., Ill. P. 792.

**Young Men's Christian Associations** originated in 1844 in London, where George Williams invited his fellow-clerks to a meeting and organized the first association. The example was soon imitated in other cities of the country, and at present Great Britain and Ireland number about 300 associations; Germany has 200, Holland 200, France 40, Switzerland 30, Belgium 18, etc. In 1851 the first Young Men's Christian Association was formed in Montreal, and the growth of these institutions was still more rapid on this continent. In 1875 the U. S. and Canada numbered 519 associations, with 69,011 members; 337 reported their annual expenses at $360,365; 198 owned libraries containing 181,340 vols.; 56 had their own buildings, valued at $2,434,900, and 46 had building funds amounting to $408,756. The associations in the U. S. and Canada form an international convention, organized in 1854, and State and provincial conventions. Seven conferences of associations of all lands have been held: that of Paris in 1855 limited active membership to "young men who, regarding Jesus Christ as their God and Saviour according to the Holy Scriptures, desire to be his disciples in their doctrine and in their life." The last general conference was held at Hamburg in 1875. The practical test for admission to the American associations is membership of some evangelical church, a rule adopted in 1869 by the international convention of Portland. Young men of good moral conduct may be admitted, though not members of any church, but only as associate members—that is, they enjoy all the privileges of active members, but have no influence on the business of the society. Older church members are admitted as counselling members. The aim of the associations is to be intermediate agents between the churches and the young men, and, besides maintaining libraries, reading-rooms, lectures, classes of secular instruction, gymnasiums, they hold prayer-meetings, Bible-classes, and other religious meetings, and maintain an inner mission in various forms; in which latter respect they have worked with signal success. In 1857 the Ladies' Christian Union of New York was formed, and in 1866 the Young Women's Christian Association of Boston. There are now 47 women's Christian associations in the U. S. and Canada, with about 10,000 members. Of these, 19 have boarding-houses for young women, 19 industrial schools, 16 libraries, 17 assist in finding employment, 12 conduct Bible-classes, etc.

**Young's,** tp., Laurens co., S. C. P. 1961.

**Youngs'town,** p.-v., Porter tp., Niagara co., N. Y. P. 476.

**Youngstown,** city and tp., cap. of Mahoning co., O., on Mahoning River and on Atlantic and Great Western, Ashtabula Youngstown and Pittsburg, and Lake Shore and Michigan Southern R. Rs., 65 miles S. E. of Cleveland, and the same distance N. W. of Pittsburg, contains 11 churches, an endowed academy, 1 daily and 4 weekly newspapers, a handsome opera-house, court-house and jail, 4 rolling-mills, 7 blast furnaces, 2 foundries, 1 street-railway, a nut and bolt factory, and several minor manufacturing interests. There are 30 coal-mining companies, and the prosperity of the city depends largely upon its coal and iron industries. P. of city, 8075; of tp. exclusive of city, 2762.

A. R. Seagrove, Ed. "Register and Tribune."

**Youngstown,** b., Westmoreland co., Pa. P. 301.

**Youngs'ville,** p.-v., Warren co., Pa., on Brokenstraw Creek and on Dunkirk Allegheny Valley and Pittsburg and Pennsylvania R. Rs., 3 miles from Allegheny River, has a large school building, 2 extensive pump manufactories, several mills, and 1 newspaper.

E. W. Hoag, Ed. "Warren County Press."

**Young'ville,** tp., Tallapoosa co., Ala. P. 1680.

**Yount,** tp., Napa co., Cal. P. 1252.

**Ypres,** town of Belgium, province of West Flanders, on the Yperlee, was in the fourteenth century one of the leading manufacturing centres of Europe, and had about 200,000 inhabitants. A splendid monument of that time is the cloth-hall, a large structure in Gothic style, built in the thirteenth and fourteenth centuries, and now occupied by different public establishments. In the sixteenth century Ypres began to decline, and its present manufactures, though very varied, comprising linen, woollen, cotton, and silk, lace, and ribbons, oil, soap, salt, and leather, are comparatively of little consequence. It is fortified, and contains large barracks, hospitals, and many educational institutions. P. 17,190.

**Ypsilan'ti,** city and tp., Washtenaw co., Mich., on Michigan Central R. R., 30 miles from Detroit, on both banks of the Huron River. In 1807 the first trading-post was established here for the purpose of bartering with the Indians. It contains 6 churches and 1 chapel (Baptist), 1 high, the State normal school, and several excellent public schools, 3 newspapers, planing-mills, a carriage-factory, 2 whip-socket manufactories, an efficient fire department, and several capacious public halls. Two fine iron bridges span the Huron River at this place. P. of city, 5471; of tp. exclusive of city, 1561.

C. R. Pattison, Ed. "Commercial."

**Ypsilanti,** the name of a wealthy Greek family of princely rank, several members of which have become very prominent as enthusiastic champions of the emancipation of the Greek nation. Constantine Ypsilanti (b. at Constantinople in 1760) was appointed hospodar of Moldavia in 1799 and of Wallachia in 1802, but was dismissed in 1806 on account of his sympathy with Russia. Reinstated in 1807 by Russian influence, he incited the Servians to revolt, but, unable to carry through the revolution, fled to Russia, and d. at Kiev July 28, 1816.—His eldest son, Alexander Ypsilanti (b. at Constantinople in 1783), served in the Russian army, lost his right hand in the battle of Dresden, 1813, and was made adjutant to Alexander I., and major-general in 1817. As chief of the *Hetæria*, a secret association for the liberation of the Greek Christians in Turkey, he raised a revolution in Moldavia in 1821, and invaded the country with a considerable force of Russian and Greek volunteers, but was entirely defeated at Dragashan June 19, 1821; fled to Transylvania; was kept for several years in an Austrian dungeon, and d. at Vienna Jan. 31, 1828.—A younger brother of his, Demetrius Ypsilanti (b. at Constantinople Dec. 25, 1793), served also in the Russian army, joined the revolution in the Morea in 1821, and distinguished himself greatly at the capture of Tripolitza, the defence of Argos, and the encounter with Ibrahim Pasha at the mills of Lerna. In 1827 he was made commander-in-chief of the whole Greek army, but some disagreement between him and the president, Capo d'Istria, caused him to resign his command in 1830. D. at Napoli di Romania Aug. 16, 1832.

**Yre'ka,** city and tp., cap. of Siskiyou co., Cal. P. of city, 1063; of tp. 1816.

**Yriar'te, de** (Juan), b. at Orotava, Teneriffe, Canary Islands, Dec. 15, 1702; educated in Paris and London; became secretary to the royal printing-office at Madrid, librarian of the royal library, and translator to the secretary of state 1740; was elected to the Royal Academy 1743; prepared a system of orthography, punctuation, and accentuation for the Spanish language, which has since been generally adopted; published a Latin grammar in Spanish verse (1771), and collected 24,000 proverbs. D. at Madrid Aug. 23, 1771. His *Works* (2 vols., 1773) in prose and verse were posthumously published.

**Yriarte, de** (Tomas), nephew of Juan, b. at Orotava, Teneriffe, in 1750; educated by his uncle at Madrid; held during most of his life a post in the department of state; published translations from the French and many original dramas and poems, the most celebrated of which are his *Fábulas Literarias*, of which there are several English and French translations. He had many literary quarrels, and was accused before the Inquisition in 1786 of being addicted to "French philosophy," but escaped punishment. D. at Madrid in 1791.

**Ysle'ta,** p.-v., cap. of El Paso co., Tex.

**Y'ssel,** or **Ijssel,** a branch of the Rhine, separates from it near Arnhem in the Netherlands, receives the Old Yssel, which comes from Rhenish Prussia, and enters the Zuyder-Zee after a course of 80 miles.

**Yssingeaux',** town of France, department of Haute-Loire, manufactures blondes, laces, ribbons, and leather, and trades in grain, cattle, agricultural produce. P. 7971.

**Ys'tad,** town of Southern Sweden, on the Baltic, has a good harbor, some manufactures and trade, and regular steam-communication with Stralsund. P. 5234.

**Yt'trium** and **Yttria.** The words are derived from the locality, Ytterby in Sweden, of the mineral *gadolinite*, in which *yttria* was discovered in 1794 by the Russian chemist Gadolin. Yttria is a peculiar earthy oxide, contained in this and some other minerals, as Xenotime (which see), *yttrocerite, yttrotantalite, keilhanite, samarskite, euxenite, æschynite, polymignite, fergusonite.* They are all rare minerals. *Yttrocerite,* which is a fluoride of calcium, cerium, and yttrium, is found in several American localities, as at Amity, Orange co., N. Y., and at Paris, Me. The yttria obtained by the earlier investigators was found by Mosander in 1843 to contain another earth, which he called *erbia*, a third one, called by him *terbia*, not having been since found, so that its existence is deemed improbable. As obtained by igniting its oxalate, yttria is a soft white powder, infusible, and does not slake with water like lime, though it may be obtained as a hydrate by precipitation of its saline solutions. The metal yttrium is little known. Berzelius obtained it, by means of potassium, from its chloride, and describes it as metallic scales of blackish-gray color, not malleable. This, however, contained erbium. Yttrium forms a chloride, bromide, fluoride and iodide, selenide and sulphide. Its equivalent is uncertain; Cleve and Hoeglund, the latest experimenters, obtained 59.7; Bahr and Bunsen, 61.7; but Delafontaine obtained 74.5.

Henry Wurtz.

**Yu'ba,** county of N. E. California, bounded W. by Feather River, S. by Bear River, intersected by Yuba River, and traversed by the Oregon division of Central Pacific and by California Northern R. Rs. A portion of the county lies along the lower slopes of the Sierra Nevada, and the remainder is made up of large and fertile valleys. There is a little mining. Horses, cattle, sheep, and swine are numerous. Staples, wheat, barley, wool, hops, hay, and dairy products. Cap. Marysville. Area, about 600 sq. m. P. 10,851.

**Yuba,** city and tp., cap. of Sutter co., Cal. P. 998.

**Yuba River,** in California, rises by three forks (the N., Middle, and S.), which flow through deep, cañon-like gorges in the Sierra Nevada. The united stream joins Feather River at a point just below Yuba City.

**Yucatan',** a peninsula of Mexico, extending between lat. 17° 20′ and 21° 30′ N., and between lon. 87° and 92° 30′ W., bounded W. and N. by the Gulf of Mexico, E. by the Caribbean Sea, and S. and S. E. by Guatemala, the state of Tabasco, and British Honduras, comprises an area of 58,748 sq. m., with a pop. of 502,731 in 1869, mostly Indians. The eastern coast, along the Caribbean Sea, is rocky, bold, much indented, and presenting several good harbors, but both the northern and southern coasts are generally low, sandy, swampy, destitute of harbors, and frequently visited by yellow fever. The interior is hilly and high, gradually sloping down to the coasts, but here the soil is very productive, and the climate, although hot, is salubrious. The rivers are insignificant with the exception of the Usumasinta, which rises in Guatemala, forms part of the southern boundary, and sends one branch to the Laguna de Terminos. Immense forests cover a large part of the country, and excellent timber, fine cabinet-woods, dyewoods, and gums form the principal items of export. The chief occupation, however, is agriculture, and maize, rice, cotton, indigo, tobacco, hemp, etc., are raised, besides all kinds of tropical fruits. The manufacturing industry is confined to some coarse cotton stuffs. The country was discovered in 1517 by Fernandez de Cordova, and finally conquered in 1541 by Francisco de Montejo. It belonged to Spain until 1821; subsequently it has twice been independent, but belongs now to Mexico, forming the two states of Yucatan and Campeachy. (For the interesting ruins at Uxmal, Chichen, and Izamal, see articles under these names, and Architecture of the American Aborigines.)

**Yucatan,** p.-v. and tp., Houston co., Minn. P. 610.

**Yuc'ca,** the aboriginal and also the botanical name of a peculiar genus of liliaceous plants, species of which have the English names of bear-grass, Spanish bayonet, etc., natives of North America from New Jersey and from Iowa to Yucatan, but most abundant between the 25th and

35th degrees of N. lat. About a dozen species are well characterized (by Dr. Engelmann), with many varieties, and various doubtful forms are in cultivation. The stems of the more northern species are subterranean, so that the tuft of bayonet or dagger shaped leaves is next the ground; of the more southern, arborescent and palm-like in some species, forming a trunk ten to twenty feet high, crowned by a dense tuft of prickly-pointed leaves. In *Y. filamentosa* and some other species delicate threads separate from the edges of the needle-pointed leaf, whence the popular appellation, "Adam's needle and thread." The root-stocks are replete with mucilaginous and saponaceous matter, which, under the name of "amole," serves as a substitute for soap in many a Mexican household, is also used by the negroes of the Southern U. S., and gives the common name of soap-plant to *Y. angustifolia*, which abounds between the Mississippi and the Rocky Mountains. A stalk rising from the centre of the crown of foliage bears an ample panicle of large and white lily-like blossoms, showy at all hours, but most so at evening, when the blossoms fully spread. The fruit is dry and capsular in some species, fleshy and baccate in others. The latter are edible and savory. That of *Y. aloifolia*, the "Spanish bayonet," is eaten by the negroes of the coast of South Carolina and Georgia under the name of banana, which it somewhat resembles in appearance; that of *Y. baccata* of Arizona, etc., is largely consumed when fresh by whites and Indians, and is cured by the latter for winter provisions. Several species are planted for ornament, and are much prized in landscape gardening. A. GRAY.

**Yu'kon River,** the largest and longest stream emptying on the western coast of North America, supposed to rise about 58° 31′ N. lat. and 131° 50′ W. lon. At its head-waters it is known as the *Tahco*. The general direction of the river from its head-waters to Fort Yukon, the northernmost point of the river, is supposed to be about N. W. From Lake Labarge to Fort Yukon it is called the *Lewis River*. It drains a vast area, and flows 2000 miles in its course to the sea, at Norton Sound.

**Yule,** a name sometimes given to Christmas. It was originally the name of a heathen festival celebrated at the winter solstice. The burning of the Christmas log, or Yule clog, and the decoration of churches and firesides with green branches, are parts of the old Yule ceremony.

**Yule** (HENRY), b. in 1820; served in the British army in India; became minister of Indian public works; retired as colonel; settled in London, and published *Fortification* (1851); *A Narrative of the Mission sent by the Governor-General of India to the Court of Ava* (1858), *Cathay and the Way Thither* (2 vols., 1866), *The Book of Ser Marco Polo, a new translation*, 2d ed. (2 vols. 8vo, 1875), besides minor translations, essays, and memoirs; was made C. B.

**Yu'ma,** county of S. W. Arizona, bounded S. by Mexico, separated by Colorado River from California and Lower California, and intersected by the Gila. The valleys of the Colorado and Gila are very productive when irrigated; the remainder of the area consists of high table-lands nearly destitute of water, but during a part of the year covered with grass. The mineral wealth, in gold, silver, copper, and lead, is apparently considerable. Cap. Yuma. Area, about 10,000 sq. m. P. 1621.

**Yuma,** p.-v., cap. of Yuma co., Ara. Ter., on the E. shore of Colorado River, contains a fine court-house and jail, 1 church, an excellent public school, 1 newspaper, 2 hotels, and several large mercantile houses. Principal business, trade with the interior, mining, and navigation. P. 1300. W. J. BERRY, ED. "ARIZONA SENTINEL."

**Yumas,** a tribe of American Indians settled on both sides of the Colorado, near its junction with the Gila; they call themselves the "Sons of the River," and are also known under the name of Cuchans. They were visited in 1701 by Father Kühn, 1744 and 1748 by Sedelmayr, and in 1780 Spanish settlements were established among them; but in 1781 they fell upon their white neighbors and massacred them. Since they came within the dominion of the U. S. they have been faithful to the Americans with the exception of a short rising in 1853; but they are rapidly dying out. Their number was 3000 in 1791, but only 930 in 1876. Their language is allied to those of the Mohaves, Cocopas, and Yavapai.

**Yunnan′,** province of China, bounded S. and W. by Thibet, comprises an area of 107,983 sq. m., with 5,561,320 inhabitants. It is a wild mountain-land whose peaks rise considerably over the line of perpetual snow, and through whose gorges powerful streams break into the low plain. Large parts of the country are covered with forests. The fauna and flora of the valleys are tropical. Metals and precious stones abound. A peculiar feature of this province is its suspension bridges thrown across its gorges, and consisting of two lines on which slides a wooden box containing the traveller. Only parts of the population are Chinese, and the aboriginal inhabitants live almost independently, ruled over by native chiefs, whose acknowledgment of the supremacy of the Chinese emperor is merely formal.

**Yunnan,** town of China, capital of the province of the same name, is situated on the N. shore of Lake Chin, and is famous for its manufactures of silk stuffs, carpets, and tapestries.

**Yus′sef ben Abd′el-Rah′man Al-Fehr′i,** the last emir of Spain for the caliphs of Bagdad; was appointed to this office in 746, and ruled both with wisdom and energy. But in 753 the Ommyiade dynasty was overthrown in the East by an extensive insurrection, and shortly after a revolution also broke out in Spain. In 755, however, the Arab chieftains assembled at Cordova, and agreed to put an end to the anarchy by electing Abdel-Rahman ben Moawiyah, the last Ommyiade, who had escaped the massacre and lived in Egypt, as king. Yussef took arms against this decision, but was twice defeated, and finally killed in the battle of Loxa, in 759.

**Yus′sef ben Taxfyn′,** the second prince of the dynasty of the Almoravides in Africa, and the founder of Morocco, was b. at Velad Sahara in 1006, and gained great fame as a military leader. In 1086 he was invited to Spain by the Moorish king to aid him against Alfonso VI. of Castile, and he contributed much to the victory of Zalaca, near Badajoz. But after the defeat of Alfonso, Yussef began to turn his arms against his own countrymen, and by degrees came into possession of the kingdoms of Malaga, Granada, Murcia, Cordova, Seville, Almeria, Badajoz, and Valencia, and in 1103 his son, Aly, was acknowledged as his successor both in Africa and in Spain. D. in 1106, one hundred years old.

**Yus′te,** a monastery of Spain, province of Caceres, situated in a wild and lonely but romantic mountain-region, filled by the spurs of the Sierra de Gredos and cut up by numerous torrents which flow to the Rio de las Battuecas. A narrow mule-path leads across the main ridge, through the Puerto del Emperador, into the valley of the Ierte. Here the emperor Charles V. spent the last years of his life, from his abdication in 1555 to his death in 1558.

**Yu′thia,** city of Siam, Farther India, on the Menam, 40 miles N. of Bangkok, in lat. 14° 40′ N. It was formerly the capital of the empire and the residence of the king, and contained several structures of immense dimensions and gorgeous ornamentation; but in 1766 the king of Ava invaded Siam, besieged Yuthia for two years, and finally razed it to the ground; which event gave occasion to the building of Bangkok. A new town, however, soon arose on the ruins of the old, and the present Yuthia has between 30,000 and 40,000 inhabitants, among whom are many Chinese and Burmese. The river, which entirely encircles the city, is here exceedingly rich in fish, and fishing is one of the principal occupations of the inhabitants. Another circumstance which gives Yuthia some importance is its fine and salubrious climate, on account of which many of the merchants of Bangkok remove hither during summer. Close by is the famous Golden Mountain, a pyramid 400 feet high and rising in sections, of which the third contains a huge vault, 150 feet high, in which is placed a golden or gilded statue of Booddha of colossal size.

**Yut′ta,** town of Palestine, 4 miles S. of Hebron, is the *Juttah* of Scripture, situated in the mountain-region of Judah, in the neighborhood of Maon and Carmel (Josh. xv. 55), and allotted to the priests (Josh. xxi. 16). It has been conjectured by Reland that Yutta (*Juttah*) is the πόλις Ἰούδα, "city of Juda," in the hill-country, in which Zacharias, the father of John the Baptist, resided.

**Yverdun′** [ancient *Ebrodunun*], town of Switzerland, canton of Vaud, at the mouth of the Thiele in Lake Neufchâtel, was the seat of the celebrated institute of Pestalozzi (1805–25); has a library with Roman antiquities, a school for deaf mutes, and a gymnasium. P. 5889.

**Yvetot′,** town of France, department of Seine-Inférieure, manufactures cotton and linen fabrics, silk, and velvet, and trades in corn and wine. P. 8092.

**Yvon′** (ADOLPHE), b. at Eschweiler, Lorraine, in 1817; studied painting under Paul Delaroche, and began to exhibit in 1842; went to Russia in 1843, from which he exhibited a great number of sketches and drawings in 1847–48, and achieved subsequently a great reputation as a painter both of portraits and historical pieces. Among his most celebrated pictures are—*The First Consul descending the Alps* (1853), *Capture of the Malakhoff* (1857), *The Battle of Solferino* (1861), *Magenta* (1863).

# Z.

**Z,** the last letter in many alphabets, stands in English, French, and Polish for a vocalized sibilant *s*-sound. It is more frequently represented by *s*, as in Eng., Ger., and Fr. *rose*, It. *rosa*, a sound unknown to Latin, Spanish, and South German. Its original Greek power is *sd* (*zd*) in *wisdom*, whence the two spellings of *Ezra* and *Esdra*. In German its sound is our *ts;* in Italian *dz* and *ts;* the Scotch name *Dalzel* is pronounced *Dalyel;* in Spanish it usually sounds like our *th* in *thin*, but in Spanish America it has the sound of our *s*. In England it is named *zed*, in the U. S. *zed* and *zee*. In Scotland *z* was used for *y* up to 1543, as *ze, zow, zieres*, for *ye, you, yours*.

**Zaandam′,** town of the Netherlands, province of North Holland, on the Zaan, an affluent of the Yssel, has numerous corn, oil, and saw-mills, extensive paper manufactures, and considerable shipbuilding. The house in which Peter the Great lived while he worked here as an artisan on the wharves is still preserved. P. 12,320.

**Zabaka′no,** city of Western Africa, in lat. 11° 20′ N., lon. 2° 5′ E., in the south-western part of the dominions of the Foolahs, is celebrated for its beautiful and picturesque situation, for its excellent dyeworks, and for its leather manufactures. P. about 9000.

**Zabism.** See Sabaism.

**Zacapa.** See Sacapa.

**Zacate′cas,** one of the central states of the Mexican confederation, bounded E. by San Luis Potosi, comprises an area of 26,833 sq. m., with 397,945 inhabitants. It forms part of the large Mexican plateau, and its surface is a vast arid plain, elevated 6000 feet above the sea, almost destitute of water, unfit for agriculture, but affording pastures for large herds of sheep and goats. This plain is traversed by the Sierra Madre Mountains, which are still more barren and inhospitable, but which contain perhaps the richest silver-mines in the world. Mining and rearing of sheep are the principal, almost the only, occupations of the inhabitants. All kinds of manufactured articles and grain have to be imported from the neighboring states; in many places even drinking water must be procured from long distances and at great cost.

**Zacatecas,** town of Mexico, capital of the state of the same name, in a narrow valley between steep precipices, at an elevation of 7746 feet above the level of the sea. It is generally poorly built, but it contains many elegant residences and several fine churches. In the vicinity are numerous silver-mines which seem to be very rich, but which are very slovenly worked, and in many cases even completely abandoned. It has a college and a fine bazaar. P. 35,000.

**Zach, von** (Franz), Baron, b. at Presburg June 4, 1754; received a military education, but left the Austrian service and became chamberlain to the dowager duchess of Saxe-Gotha, with whom he resided in Germany, France, and Italy till her death in 1827. He then settled in Paris, and d. there of cholera Sept. 2, 1832. He was a very zealous student of astronomy; was director of the observatory of Seeberg, near Gotha, 1787–1806; participated in the foundation and building of the observatories of Naples and Lucca, and published *Monatliche Correspondenz zur Beförderung der Erd- und Himmelkunde* (28 vols., Gotha, 1800–13), afterward continued in Italy under the title of *Correspondance astronomique*. He also wrote *L'Attraction des Montagnes et ses Effets sur les Fils à Plomb* (2 vols., 1814), *Tabulæ Motuum Solis novæ et correctæ* (1792), and *Supplementa ad Tabulas Motuum Solis* (1804), etc.

**Zachari′æ** (Heinrich Albert), b. at Herbsleben, duchy of Saxe-Coburg-Gotha, Germany, Nov. 20, 1806; studied law at Göttingen; was appointed professor of jurisprudence there in 1830, and d. May 21, 1875. His principal works are—*Lehre vom Versuche der Verbrechen* (2 vols., 1836–39), *Deutsche Staats- und Bundesrecht* (3 vols., 1841–45), *Handbuch des deutschen Strafprocesses* (2 vols., 1861–68), besides a great number of monographs and essays referring to the juridical side of the political development of Germany, in which he took part as a member of the North German Diet, and subsequently of the upper house of the Prussian Diet.

**Zachari′as,** pope 741–752, increased the authority and power of the see of Rome very much by persuading Luitprand, king of the Longobards, to cede to him all that he had conquered of the exarchate; by consecrating Pepin le Bref king of the Franks; and by the manner in which he co-operated with Boniface in regulating and consolidating the Church in Germany. Personally, he was kind and possessed of literary taste. He bought multitudes of Christian slaves and liberated them, and translated the dialogues of Gregory the Great into Greek.

**Zacynthus.** See Zante.

**Zad′kiel** was the assumed name of a person not long since dead who believed, or pretended to believe, that events could be foretold through the aid of astrology. Stars at birth or at any critical period of the lifetime of an individual, or in the case of a community, city, or nation, were supposed to guide the course of events, so that an observation of them would lead the prophet to presage correctly all that which would subsequently happen. It is almost needless to say that this so-called science, believed in by millions, was, root and branch, merely audacious quackery. Such almanacs of astrological predictions have existed since the days of Confucius. The Latin poet Manilius wrote an astrological poem. There are many Arabian astrological almanacs extant. Cardinal d'Ailly calculated the horoscope of Jesus Christ. In Japan, India, Persia, and especially China, these pamphlets, containing wild, haphazard predictions, were known and proscribed before the first year of the Christian era. One great astrologer, *Vitsang-Ti-Hinghee*, is said to have been executed on account of publishing a prediction of the subversion of a provincial ruler. Yet such prophecies gain numerous readers to-day. Zadkiel is a name which of itself sufficiently savors of imposture. His almanac is in English, with utterances vaguer than those of a Delphic oracle; and yet there are men and women, reputed to be sane, who pin their faith to his vaticinations. (See Astrology.)

R. C. Caldwell.

**Zadonsk′,** town of European Russia, government of Voronezh, on the left bank of the Don, has several ecclesiastical, educational, and benevolent institutions, and some manufactures. P. 6897.

**Zafaran′-Bo′li,** town of Asiatic Turkey, in Asia Minor, on the Chatisoo, has a good bazaar, several fine mosques, and a large trade in saffron, which is extensively cultivated in the vicinity. P. about 15,000.

**Zaf′fre,** or **Zaffer** [Ger. *Zaffer*], a product obtained by roasting cobalt ores with sand. It is simply an impure oxide of cobalt, produced by the oxidation of the sulphides or arseniurets present, and the volatilization of the oxides of sulphur and arsenic. Zaffre is ground up with various compositions to be used for painting porcelain, in the decoration of the latter.

H. Wurtz.

**Zagaro′lo,** town of Italy, province of Rome, on a hill about 21 miles E. N. E. of the city of Rome, and commanding the magnificent scenery so peculiar to this region. Zagarolo contains some Roman antiquities of interest, and many of the houses, some of which are Saracenic, are as old as the thirteenth century. This town was a fief of the Colonna for a long period, though their possession of it was often fiercely contested by the popes. In the seventeenth century it passed to the Rospigliosi. In 1591, Gregory XIV. assembled here a theological council charged to correct the typographical errors which had crept into the Bible. P. 5463.

**Zagoskin** (Mikhail), b. at Penza, Russia, in 1789; fought in the campaigns of 1812; received afterward an appointment in the imperial library in St. Petersburg; became director of the theatre of Moscow in 1820, and keeper of the armory in the Kremlin in 1842. D. in Moscow in 1852. He wrote comedies which were brought on the stage with considerable success, and novels, of which one, *The Young Muscovite* (3 vols., Moscow, 1829), was translated into English (London, 1834).

**Zagros Mountains.** See Assyria.

**Zagazig,** town of Lower Egypt, capital of the province of Sharkieh, is connected with Suez by rail, and with Ismailia and Suez by a canal; forms the chief dépôt for the cotton produced in the eastern part of the delta of the Nile; and is increasing in commercial importance. Close by are the ruins of the ancient city of *Bubastis*. P. about 40,000.

**Zahn** (Johann Karl Wilhelm), b. at Rodenberg, Hesse, Germany; studied architecture and painting in Cassel 1817–23, Paris 1823–24, and Italy 1824–28; was ap-

pointed professor at the academy of fine arts in Berlin in 1829; visited Italy again 1830–40. D. in Berlin Aug. 22, 1871. By the application of his invention of colored lithographs he published *Die schönsten Ornamente und merkwürdigsten Gemälde aus Pompeji, Herculanum und Stabiä*, 3 series, with 100 plates in each (1828–63), *Auserlesene Verzierungen aus dem Gesammtgebiet der bildenden Kunst*, 25 plates (1842–44), and *Ornamente aller classichen Kunstepochen*, 100 plates (1832–39).

**Zaïre.** See CONGO, and also CONGO, in APPENDIX.

**Zakrzew'ska** (MARIE ELIZABETH), b. in Berlin, Prussia, Sept. 6, 1829. Her father was of Polish descent and an officer in the army; owing to his liberal opinions he lost his salary. His wife, in order to educate her children, six in all, studied midwifery and achieved a large practice. Marie, in assisting her mother, became interested in medical affairs, and made the acquaintance of many able professors. Dr. Schmidt lent her important aid in securing every advantage in her medical education. He was determined to make her a German La Chapelle. She passed her examinations with great credit, became the assistant of her professor; at his death she filled his chair, which in Prussia was an offence to the male profession. Her persecutions were so great that she resigned her position and emigrated to America, and in 1853 landed in New York, without means and without a knowledge of the language. She was compelled to earn her bread by working for fancy stores, instead of founding a hospital as she had long desired. At length she made the acquaintance of Dr. Elizabeth Blackwell. As she could not be admitted to the profession in Prussia, she was compelled to get a diploma in this country. Accordingly, she entered Cleveland College in Ohio and graduated. She returned to New York, and in company with Drs. Elizabeth and Emily Blackwell established the New York Infirmary, which she superintended for two years as resident physician and manager. She removed to Boston, and in 1863, through her untiring efforts and energy, the New England Hospital for Women and Children was incorporated—an institution that fully realizes the expectations of its friends.

SUSAN B. ANTHONY.

**Zaleu'cus,** the lawgiver of the Epizephyrian Locrians in Magna Græcia, flourished in the middle of the seventh century B. C., and his code is said to have been the first collection of written laws which the Greeks ever possessed. Of his personal life and of his legislation nothing is known but loose tradition, but from this it would seem that his laws were pretty severe. Adultery was punished by the loss of both eyes; the use of unmixed wine and journeys to foreign countries were forbidden; any one who wished to propose a new law or the abolishment of an old was compelled to step forward in the assembly with a rope around his neck, and if his proposition was rejected he was immediately strangled.

**Zalesczyk'y,** town of Austria, in Galicia, is beautifully situated on the Dniester, contains a fine palace, and has several annual fairs and a considerable trade in grain. P. 5158.

**Zale'ski,** p.-v., Madison tp., Vinton co., O. P. 690.

**Zalu'ski** (JÓZEF ANDRZEJ), b. at Rawa, present government of Warsaw, Poland, in 1701, of an old and wealthy family; made comprehensive theological and philosophical studies in Germany, Holland, France, and Italy, and took holy orders; was a partisan of Stanislaus Leszczynski, who sent him as ambassador to Rome to Pope Clement XII.; lived for some time after the abdication of the king at his court in Lorraine, but returned subsequently to Poland, and was made bishop of Kiev by Augustus III.; spoke with great vehemence in the diet of 1766 against the Dissidents, and as Russia had espoused their cause simply as a means of interfering in the affairs of Poland, Zaluski was arrested at the instance of the Russian ambassador, Repnin, and banished to Kaluga, where he was kept in a sort of confinement till his death, Jan. 9, 1774. His whole fortune he had spent on the collection of an excellent library, comprising over 230,000 volumes, which was placed in a separate building in Warsaw and opened to the public. On his death he bequeathed the library to the Polish people, but in 1795 Russia preferred to consider it state property, and carried it to St. Petersburg, where it was incorporated with the imperial library. Zaluski wrote several valuable bibliographical works.

**Za'ma,** town of Numidia, near the Carthaginian frontier, was a very strong place in the time of the Punic wars, and selected by King Juba as his residence and the depository of his treasures. Here was fought, on Oct. 19, 202 B. C., the famous battle in which Publius Cornelius Scipio defeated Hannibal, thereby bringing the second Punic war to an end. Strabo describes the city as lying in ruins, but it must subsequently have been restored, as Pliny speaks of it as a free city, and St. Augustine mentions a bishop of Zama. It was generally called *Zama Regia* by the ancients. At present there exist only a few insignificant remains of it.

**Zam'acoïs** (EDUARDO), b. at Bilbao, Spain, about 1837; studied art at the Madrid Academy, in Italy, and in Paris under Meissonier; alternated between Paris and Madrid for some years, and became eminent in the "new Spanish school" of genre painters, whose works have acquired great popularity, especially in the U. S., where some of his best works are owned. D. in Madrid in Jan., 1871.

**Zambe'si,** river of Eastern Africa, drains an immense territory extending between lat. 8° and 21° S., and between lon. 14° and 37° E., and enters into the Channel of Mozambique between lat. 18° and 19° S. through several mouths, of which, however, only the Quilimane is navigable.

**Zambro'ta,** tp., Goodhue co., Minn. P. 784.

**Za'mia,** a genus of cycadaceous plants, partly tree-like and partly stemless. The genus has a wide geographic range. *Z. integrifolia*, the COONTIE (which see) of Florida, *Z. tenuis* and *Z. furfuracea* of the Bahamas, *Z. cycadis* of South Africa, *Z. pumila* in the West Indies, and other species furnish starchy food from their stems. This product enters into commerce as arrow-root and sago, though in strictness it is neither.

**Zamoj'ski,** the name of a celebrated Polish family of old nobility and immense wealth, of which many members have been prominent in the history of Poland since the beginning of the sixteenth century: (1) JAN ZAMOJSKI, b. Apr. 1, 1541, at Skoków, palatinate of Chelm; studied in Paris and Padua, and was appointed, immediately after his return in 1565, to important positions in the government. On the death of King Sigismund Augustus in 1572, he succeeded in extending the elective franchise so that every nobleman who was able to serve personally in the army, with his own equipment and at his own expense, was entitled to participate in the election of the king; and this manœuvre enabled him to carry the election of Henry of Anjou. The choice proved a very unfortunate one, but when Henry ran away from Poland, Zamojski succeeded a second time in controlling the election, and established Stephen Báthori, prince of Transylvania, on the throne in 1576. Between the new king and the proud king-maker there existed perfect harmony, and Zamojski was made commander-in-chief of the Polish army and grand chancellor of the Crown. He fought with brilliant success along the frontiers of the empire against the Tatars, Cossacks, etc., but his support of Báthori's internal reforms made him unpopular, and his unflinching vindications of the law against the arrogance of the nobility procured him many enemies. Nevertheless, on the death of Báthori in 1586, he could have taken the crown for himself. He preferred, however, to tender it to some scion of established royalty, and Sigismund III., son of Johann III. of Sweden and Catharina Jagellonica, was elected king. But Sigismund was weak and suspicious, and Zamojski was soon superseded by incompetent favorites. The rest of his life he spent away from the court, either on his estates, in literary occupation, or in warfare, defending the frontiers at the head of armies which he raised and maintained at his own expense. He d. June 3, 1605, at Zamosc, which he had founded. He wrote *De Senatu Romano* (1563), *Testamentum Joannis Zamori* (1606), etc.; and in Lünig's *Literæ Procerum Europæ* are to be found several very interesting letters by him. His biography was written by Zurkowski (Lemberg, 1860).—(2) ANDRZEJ ZAMOJSKI, COUNT, b. in 1716 at Zdiezun, present government of Plock, received an excellent education, both scientific and military; was made a major-general in 1754, subsequently a senator, commander-in-chief, and finally, in 1764, grand-chancellor. But in 1767, when, at the instance of the Russian ambassador, Repnin, several senators had been banished to Kaluga, Zamojski resigned his offices and retired to his estates. Here he introduced many reforms, and even abolished serfdom, which raised a bitter enmity against him among other noblemen. On the invitation of the diet of 1776 he drew up a code of law, comprising an elaborate regulation of the rights and duties of the third estate, and in 1778 he published it—*Zbiór praw sadowych* (3 vols., Warsaw). It proved too liberal, however, for the moment. It was rejected by the diet of 1780, and not adopted until by the constitution of May 3, 1791. D. at Zamosc Feb. 10, 1792.—(3) His grandson, COUNT ANDRZEJ ZAMOJSKI, b. Apr. 2, 1800; was educated at Paris, Geneva, and Edinburgh; entered the civil service of the Polish government in 1823, and was minister of the interior during the revolution of 1830. After the fall of Warsaw he retired to his estates, where he abolished serfdom, founded schools, established the first

private bank, introduced steam navigation on the Vistula, issued a periodical, *Annals of Agriculture*, and formed a great agricultural association which held its meetings in Warsaw. In 1862 this beneficent activity was suddenly broken up. Zamojski was banished and settled in Paris.

**Zamo'ra,** town of Spain, capital of the province of Zamora, on the Douro, which here is crossed by a splendid bridge. It contains many fine churches, palaces, monasteries, hospitals, barracks, and other public buildings, but these edifices, like the dilapidated walls which surround the city, are now only monuments of a splendor long gone by. Its manufactures of serges, linens, leather, hats, brandy, and liqueurs are not important, but its trade in wine and grain is brisk. P. about 12,000.

**Zamora, de** (Antonio), b. in Spain about 1680; was a chamberlain of Philip V. and a popular dramatic author. D. after 1730. His best dramas were *Mazariegos y Monsalves*, *El Hechizado por Fuerza*, and *Don Juan*.

**Za'mosc,** town of Poland, government of Lublin, on the Wieprz, is well built, has a large, elegant palace and an arsenal, and is one of the strongest fortresses of the country. It was founded in 1588 by Jan Zamojski, who established here a scientific academy with a valuable library, which flourished for over two centuries, until it was closed by the Russians. The city, which was often besieged by the Cossacks, Swedes, Germans, and Russians, remained in the possession of the family of Zamojski until 1820, when it was bought by the Polish crown for an enormous sum. P. about 5000.

**Zampieri.** See Domenichino.

**Zancle.** See Messina.

**Zane,** tp., Logan co., O. P. 879.

**Zane** (Ebenezer), b. in Berkeley co., Va., Oct. 7, 1747, was of Danish descent; settled on the present site of Wheeling 1770, being the first permanent establishment on Ohio River; built there a blockhouse called Fort Henry, from which he repulsed several assaults made by the Indians during the Revolution; was a disbursing officer under Lord Dunmore; held several other civil and military posts, gaining the rank of colonel, and became owner of the land on which the city of Zanesville, O., now stands. D. at Wheeling in 1811.

**Zanes'field,** p.-v., Jefferson tp., Logan co., O. P. 282.

**Zanes'ville,** p.-v. and tp., Montgomery co., Ill. P. 1901.

**Zanesville,** city and cap. of Muskingum co., O., on the National Road, at the junction of Licking and Muskingum rivers, on the meridian of 40° N. lat. By rail it is 170 miles from Cincinnati, 137 from Cleveland, and 59 from Columbus. It is on the line of Baltimore and Ohio R. R., running E. and W., and Cincinnati and Muskingum Valley, extending from Cincinnati to Dresden Junction, where it connects with Pittsburg Cincinnati and St. Louis R. R. Muskingum River S. is navigable for steamboats of light draught to Ohio River the year round. Zanesville contains 22 churches, 19 public-school buildings (1 a high school in which the classics are taught), 2 benevolent institutions (1 for friendless women and the other for orphan children—the latter a private charity), 1 furnace, 2 large rolling-mills, 1 flooring tile and 1 roofing tile manufactory, 3 portable and stationary engine machine-shops, 2 wagon and carriage manufactories, 2 horse railroads, 1 public library, 1 national and 4 savings banks, 2 laundry-soap works, 1 cotton and 3 woollen mills, 4 glassworks (1 window and 3 bottle), and 1 file manufactory. It has 1 daily newspaper and 5 weeklies. Its waterworks are the second in extent in the State; the basins, three in number, are located on heights 183 feet above the level of the river, affording a pressure of 80 pounds to the square inch. A standpipe supplies residents on the high ground. The fire department is comparatively small, but efficient. The city is mainly built upon a level plain, and has beautiful surroundings and unsurpassed landscape. In the early history of Ohio (1810–12) Zanesville was its capital, and the first State-house was erected there. P. 10,011, now estimated at 20,000. T. J. Newman, Ed. "Daily Courier."

**Zanguebar.** See Zanzibar.

**Zan'te** [anc. *Zacynthus*], one of the largest of the Ionian Islands, comprises an area of 164 sq. m., with 39,367 inhabitants. It is of volcanic origin, and earthquakes are frequent, but the plain which occupies the greatest part of its surface is very fertile and produces currants in large quantities, wine of superior quality, citrons, pomegranates, and melons. A peculiar feature are the pitch-wells in the neighborhood of the capital, Zante, which has a good harbor protected by a mole, and carries on a considerable trade. P. 17,516.

**Zanzibar',** or **Zanguebar,** the name (1) of a large portion of the eastern coast of Africa; (2) of an island lying 25 miles off this coast; and (3) of a city, the capital of the island—all belonging to the dominions of the sultan of Zanzibar. The Zanzibar of the mainland extends along the Indian Ocean from lat. 2° N., where it is bounded by the territories of the Gallas tribes, to Cape Delgado, in lat. 10° 42′ S., where it is bounded by the Portuguese province of Mozambique; its western boundary, toward the interior, is entirely undefined. It is inhabited by heathen tribes of negroes, who in the interior live perfectly independent, while along the coast they acknowledge the authority of the sultan. The products are those common in the tropical zones, and they seem to be plentiful, but as yet they have not acquired any great importance in commerce. The heat is excessive, the climate very injurious to Europeans, and the country very seldom visited.—The island of Zanzibar, 48 miles long and 30 miles broad, is in lat. 6° S. It is of coral formation, low, flat, but exceedingly fertile, well watered by numerous rivulets, which are kept running during the whole year by the copious and steady rainfall, and with a healthy and equable climate, the thermometer never rising above 90° and never sinking below 70° F. The inhabitants, numbering about 250,000, consist partly of Arabs, who form the aristocracy, own the land, and cultivate it by slaves—partly of free negroes, who carry on its trade. The whole island is cultivated like a garden, and rice, sugar, cocoanuts, cloves, and fruit of the finest quality are raised in abundance.—The city of Zanzibar, the residence of the sultan, contains about 65,000 inhabitants, and carries on a considerable trade, exporting gum-copal, cloves, ivory, cocoanuts, and oil-seeds, and importing iron and cotton goods. Although it contains several fine, even magnificent, buildings, it is generally ill built, and it has a bad reputation on account of its extreme dirtiness. The natural drainage of the place is insufficient, and as nothing has been done by art, pestilential fevers are of frequent occurrence.

**Zapa'ta,** county of S. W. Texas, bounded W. by the Rio Grande, which separates it from Mexico; surface generally level, undulating, but hilly in the N. part. Horses, cattle, and sheep are numerous, stock-raising being the principal industry, although a little Indian corn is produced. Cap. Carrizo. Area, 1425 sq. m. P. 1488.

**Zapol'ya,** the name of a powerful Hungarian family which at one time maintained a protracted contest with the house of Hapsburg for the possession of the Hungarian crown: Johann Zapolya, b. in 1487; was proclaimed king of Hungary in 1526, and vindicated himself in Transylvania and Lower Hungary against Ferdinand of Austria by acknowledging himself a vassal of Solyman II. D. in 1540. —His son, Johann II. Zapolya, b. a short time before the death of the father; was recognized by Solyman II. as king of Hungary under the tutelage of his mother, Isabella. He married in 1560 a daughter of the emperor, but with his death in 1570 the male line of the family of Zapolya became extinct.

**Za'ra,** town of Austria, capital of Dalmatia, on a narrow peninsula in the Adriatic, strongly fortified and surrounded by bastions of Venetian construction which form beautiful public walks. It has a safe but somewhat shallow harbor, an arsenal, large barracks, a fine cathedral, and many other handsome public edifices and monuments, as it is the see of an archbishop and the seat of the provincial government. It manufactures silk fabrics, rosoglio, and maraschino; its trade is mostly coasting-trade, but its fisheries are extensive and valuable. P. 8014.

**Zara'te, de** (Agustin), b. in Spain about 1505; accompanied Blasco Nuñez de Vela, viceroy of Peru, to that country 1543 as treasurer of the Crown; became master-general of accounts in Peru and Terra Firma; took part in the civil wars of the Pizarros, and wrote *Historia del Descubrimiento y de la Conquista de Peru* (1555). D. about 1560.

**Zarathustra.** See Zoroaster.

**Zaslav',** town of Russian Poland, government of Volhynia, on the Gorin, has celebrated manufactures of cloth, and rich mineral springs in the vicinity. P. 8857.

**Zauschne'ria,** a beautiful flowering plant, a native of California, and named after M. Zauschner, a Bohemian botanist, who first brought it into general notice, is a perennial of the evening primrose family, with stem from one to two feet high and brilliant-colored flowers strongly resembling those of the fuchsia. It blooms late in the summer and during the fall, succeeds best in dry and sandy soil, and must in New York and New England be protected during winter.

**Zava'la,** county of S. W. Texas, drained by Nueces and Leona rivers; surface level, fairly adapted for grazing, though suffering from scarcity of water. P. 133.

**Zaylah.** See ZEILAH.

**Zba'raz,** town of Austria, in Galicia, on the Iwka, near the Russian frontier, has a trade in corn and pork. P. 6772.

**Ze'a** [anc. Κέως], one of the Cyclades Islands, in the Ægean Sea, is 13 miles long and 8 miles wide, fertile, with a healthy climate, and rich in cotton, wine, and figs. P. about 5000. Cap. Zea.

**Zea** (FRANCISCO ANTONIO), b. at Medellin, New Granada, Oct. 20, 1770; educated at Bogotá; took part in a revolutionary movement, for which he was imprisoned at Cadiz, Spain, 1797–99; became assistant director of the botanic garden at Madrid 1802; director-in-chief and professor of botany 1805; was a member of the junta of Bayonne 1808; was minister of the interior and governor of Malaga under Joseph Bonaparte; joined Bolivar in South America 1814; became intendant-general of the army; vice-president of Venezuela Feb., 1819; was accredited as minister plenipotentiary to all the European courts Sept. 24, 1819, and obtained in 1822 from English bankers a loan of £2,000,000. D. at Bath, England, Nov. 28, 1822.

**Zealand.** See ZEELAND.

**Zeal'ots,** a fanatical Jewish sect which struggled desperately against the Romans from about 6 A. D., when Judas the Gaulonite headed a revolt, till the fall of Jerusalem, in the year 70.

**Zea mays.** See INDIAN CORN.

**Zebid',** town of Yemen, Arabia, on the Zebid, 60 miles N. of Mocha, is surrounded with high walls surmounted by towers, and strongly fortified. Its harbor has been silted up, and it thus has lost much of its trade. P. about 7000.

**Zebo'im** [Heb., "gazelles" or "hyænas"], one of the five "cities of the plain" (Gen. xiv. 2), four of which were destroyed (Gen. xix. 28, 29). See ZOAR.

R. D. HITCHCOCK.

**Ze'bra,** the *Asinus zebra,* (1) a wild ass of the mountainous parts of South Africa, but now nearly extinct. It is of a creamy-white color, striped with a rich black on the head, trunk, and legs, except on the belly and inside of thighs; the nose is reddish; the tail blackish at end; the hoofs are narrow and deeply concave beneath. It is one of the handsomest, and also one of the wildest and least tractable, of animals. It hybridizes with the ass. (2) The name is also used as group-term for the *A. zebra* and related forms characterized by a similar style of ornamentation. Thus, the DAUW (which see) is sometimes called Burchell's zebra, but is a much less handsome beast than the true zebra. The quagga is another species. Only in a few instances has the zebra been domesticated and put to service, for it always retains its vicious nature.

**Zebra-Wood,** a beautiful striped wood used for veneering, is produced in Guiana by *Omphalobium Lamberti,* a large tree of the order Connaraceæ, and in the West Indies by *Eugenia fragrans* of the order Myrtaceæ.

**Zebu',** or **Brahman Bull,** the common domesticated ox of India, found also in China and East Africa. It differs from the common ox of Europe and America in having one, or more rarely two, humps of fat on the shoulders, and in having eighteen caudal vertebræ, while our cattle have twenty-one. The Brahman cow goes with young 300 days, the common cow 270. Hence, the zebu is assigned to another species, *Bos Indicus.* Nevertheless, it breeds freely with the common cattle. The zebu is of several breeds, varying much in size. The beef is of fair quality and the hump is prized. Zebus are trained to draw carriages, to plough, and to serve as beasts of burden. To this stock belong the sacred bulls of Siva.

**Zebu,** one of the Philippine Islands, in the Malay Archipelago, E. of Negros, in lat. 9° 20′ N., lon. 123° E., and forms, together with the islands of Matan and Bohol, a province with 389,073 inhabitants. The capital, Zebu, is a large and well-built town, with 8805 inhabitants, a fine cathedral, a handsome episcopal palace, and a good trade in the products of the islands.

**Zeb'ulon,** p.-v. and tp., cap. of Pike co., Ga. P. 745.

**Zeb'ulun** [Heb., "dwelling"], the tenth of the twelve sons of Jacob, the sixth and last by Leah. His personal history is a blank. In the exodus from Egypt the tribe of Zebulun marched in the van, next after Judah and Issachar, just ahead of the six wagons which carried the hangings, planks, and pillars of the tabernacle. The territory of the tribe in Palestine was bounded on the E. by the southern half of the Lake of Galilee, beginning just above the site of Tiberias, and included Nazareth and Rimmon, but especially the very fertile plain of *Buttauf* (10 miles from E. to W. and 5 from N. to S.), on whose northern edge, according to Robinson, stood Cana of Galilee.

R. D. HITCHCOCK.

**Zechari'ah,** the eleventh in order of the twelve minor prophets of the Hebrew canon. Zechariah is mentioned in chap. i. 1, and chap. vii. 1, as having received the word of the Lord in the second and fourth years of Darius (521 and 519). He would therefore be one of those who returned with Zerubbabel, Joshua, and Haggai. The first eight chapters correspond fully with this statement. They consist of discourses in which the prophet seeks to impress on the people the lessons of the Captivity, and to warn them against the sins of idolatry, etc., which had brought this calamity on their fathers. But chs. ix.–xiv. present great difficulty if we have to interpret them as written at this time and under these circumstances. Assyria and Egypt are referred to as powerful and dangerous neighbors of Judah (x. 11), though Assyria and Egypt were both provinces of the Persian empire in 520. Israel and Judah are represented as independent and hostile (xi. 14). Idolatry is condemned as a prevalent vice (xiii. 2). Prophets are rebuked as by Jeremiah (xiii. 3, 4). These features lead us back to the time before the Captivity, and even before the fall of Samaria, for the date of these prophecies, and the critics are generally agreed that we have here the works of two or three prophets combined in one book. Zech. xi. 12 and 13 is quoted in Matt. xxvii. 9, 10, though not closely or accurately; but it is quoted as from *Jeremiah.* Furthermore, we find several prophets by the name of Zechariah mentioned in the Old Testament, and some confusion as to their identity. Zachariah, son of Jehoiada, was tutor to King Joash, and was put to death by him (2 Chron. xxiv. In Matt. xxiii. 35 he is called son of Barachias). Another prophet by this name in the time of Uzziah is mentioned in 2 Chron. xxvi. 5; another in the time of Ahaz (Isa. viii. 2; cf. ver. 16) was the son of Jeberechiah (= Berechiah). In the superscription (Zech. i. 1) the author is called "son of Berechiah, son of Iddo." In Ezra v. 1, vi. 14, Neh. xii. 16, he is called the son of Iddo. It is evident that there is confusion here, and it is probable that there are combined in this book the works of two or three prophets of the same name who lived at different times. Probably, the author of the first eight chapters was the son of Iddo, and the remainder was from the hand of the son of Berechiah, contemporary with Isaiah. Hence the confusion in the superscription.

**Zedekiah.** See JEWS, by PROF. FELIX ADLER, PH. D.

**Zed'oary** [Arab. *jadwar*], the warm aromatic root (rhizome) of certain East Indian plants of the order Zingiberaceæ. The best is long zedoary, from *Curcuma zedoaria.* Round zedoary is from *Curcuma zerumbet* and *Kæmferia rotunda.* Zedoary, like cassimuniar, galangale, and zerumbet, considerably resembles ginger, but the latter is so much superior to them all as to have crowded them entirely out of general commerce.

**Zee'land,** or **Zealand,** province of the Netherlands, bounded S. by Belgium and W. by the North Sea, consists of the islands of Walcheren, Beveland, Tholen, Duiveland, and Schouwen, between the mouths of the Maas and the Scheldt, and comprises an area of 665 sq. m., with 181,650 inhabitants, of whom 130,557 are Protestants and 46,048 Roman Catholics. The ground is very low, and must be protected against inundation by dikes, but the soil is very fertile and very well cultivated. Large crops of wheat, oats, potatoes, beans, madder, and tobacco are raised, and cattle, sheep, and pigs are extensively reared. The fisheries are valuable and the manufacturing industry considerable.

**Zei'lah,** or **Zay'lah,** town of Egypt, on the Gulf of Aden, about 100 miles S. of the Strait of Bab-el-Mandeb, in lat. 11° 17′ N., on a sandy promontory, is surrounded with mud walls, the whole in a decayed condition, but its harbor is safe and has 15 feet of water at low tide, and the surrounding country is rich and populous. A considerable trade is carried on with various Arabic ports, ivory, myrrh, ostrich-feathers, and gums being the principal articles of export. It was the last point held by the Turks on the African coast of the Red Sea; it was ceded to Egypt in 1875. P. about 5000.

**Zei'lin** (JACOB), U. S. M. C., b. July 16, 1806, in Pennsylvania; entered the marine corps as second lieutenant Oct. 1, 1831; became captain in 1847, major in 1861, colonel in 1864, brigadier-general in 1867; brevetted for gallantry daring the Mexican war, and wounded at the battle of Bull Run; made commandant of the marine corps in 1864, and was retired in 1876.

FOXHALL A. PARKER.

**Zeis'berger** (DAVID), b. at Zauchtenthal, Moravia, Apr. 11, 1721; was educated in the Moravian settlements in Saxony and Holland, and joined then his parents, who some years previously had emigrated to Georgia. In 1740 he began his missionary work among the Indians, which he continued with unabated energy for more than sixty years. In 1781–82 his success received a severe check.

The settlements of Christian Indians which he had formed on the Tuscarawas, O., were in 1781 broken up by a body of Wyandot warriors at the instigation of the British commandant of Detroit, and the settlers were compelled to remove to Sandusky; and when, next year, some 96 of them returned to their former homes to gather their corn, they were murdered by the neighboring white settlers; which atrocity of course put a stop to further missionary progress among the Indians, at least for a long time. Zeisberger, however, did not lose courage, and when, in 1796, Congress granted to the Moravian Indians the tract of land in the valley of the Tuscarawas which they had formerly occupied, he was able to return to the place with a considerable number of converts and build the town of Goshen, where he d. Nov. 17, 1808. He published a spelling-book (1776), a collection of hymns (1803), *Sermons to Children* (1803), and a *Harmony of the Four Gospels* (1821), in Delaware, and a Delaware grammar and dictionary and an Iroquois dictionary by him exist in manuscript in the libraries of Harvard University and of the American Philosophical Society in Philadelphia.

**Zeitz,** town of Prussia, province of Saxony, on the White Elster, is surrounded with walls, and has breweries, distilleries, soapworks, and manufactures of cotton and linen fabrics, earthenware, leather. Large quantities of fruits and vegetables are raised in the vicinity. P. 15,417.

**Zela'ya,** town of the Mexican confederation, state of Guanajuato, consists of the town proper, which is handsome and well built, and a number of wretched suburbs inhabited by Indians. It has some cotton manufactures, and the surrounding districts are fertile and well cultivated. P. about 11,000.

**Ze'le,** town of Belgium, province of East Flanders, manufactures spirits and horse, sack, and sail cloth. P. 12,037.

**Zelieno'ple,** p.-b., Butler co., Pa. P. 387.

**Zelle.** See CELLE.

**Zel'ler** (EDUARD), b. at Kleinbattwar, a v. of Würtemberg, Jan. 22, 1814; studied theology and philosophy at Tübingen under Baur and Strauss; heard afterward Marheinecke, Neander, and Gans at Berlin; began to lecture on philosophy and theology at Tübingen in 1840; founded in 1842 the *Theologische Jahrbücher*, which was continued to 1857, and formed the principal organ of the new Tübingen school of theologians; was appointed professor of theology at Berne in 1847, of philosophy at Heidelberg in 1849, at Marburg in 1862, and at Berlin in 1872. Among his principal works are—*Die Philosophie der Griechen* (3 vols., 1844–52; translated into English by O. I. Reichel under the titles *Socrates and the Socratic Schools*, 1868, and *The Stoics, Epicureans, and Sceptics*, 1869), *Die Apostelgeschichte* (1854; translated into English by Joseph Dare, *The Acts of the Apostles*, 1875), *David Friedrich Strauss* (1874; translated into English in the same year). He also wrote *Platonische Studien* (1839), *Das theologische System Zwingli's* (1853), *Staat und Kirche* (1873).

**Zeller** (JULES SILVAIN), b. in Paris Apr. 23, 1820; studied in his native city, and subsequently in Germany; taught history in the lyceums of Bordeaux, Rennes, Strasbourg, and Aix, and was appointed professor of history at the Normal School of Paris in 1858, and of the École polytechnique in 1869. He wrote *Ulrich de Hutten* (1849), *Histoire de l'Italie* (1852), *Épisodes dramatiques de l'Histoire d'Italie* (1855), *L'Année historique* (4 vols., 1860–63), *Les Empereurs romains* (1863), *Histoire d'Allemagne* (1872).

**Zel'ter** (KARL FRIEDRICH), b. in Berlin Dec. 11, 1758; was trained as a mason, and became a master in 1783, but, although he worked at his trade with great enterprise and success, he nevertheless found time to make a thorough study of music; became the leader of the Fasch Singing Academy in 1800 and professor of music at the Academy of Fine Arts in 1809. In the same year he founded the first Liedertafel, a singing society of male voices, for which he composed a great number of excellent songs. He also composed much church music. D. at Berlin May 15, 1832. His correspondence with Goethe was published in Berlin in 6 vols. (1833–34). His *Life* has been written by Dr. W. Rintel (1861).

**Zena'na** [Pers. *zen*, "woman;" *zenanah*, "belonging to women"], the name given to that portion of the house devoted entirely to the use of the females in a family of good caste in India. The house of a native gentleman of Bengal is always divided into two distinct parts—the outer portion, which belongs to the gentlemen, and the inner or zenana, which is appropriated to the women. Each of these buildings is in the shape of a hollow square, with an open court in the centre—the men's building toward the street, the women's back of it. The house is from two to three stories high, with verandas on each story running round the inner part opening on to the open courts in the centre. In the men's portion of the building there are doors and windows opening toward the street, and the rooms are large and lofty, with handsome furniture. In the zenana, however, everything exhibits a condition of the utmost squalor and wretchedness, though it may be in a very high-caste or wealthy family. There sometimes will be from 50 to 100 ladies, or even more, residing in one of these houses, all of them belonging to one family, yet all of them wives of different individuals; for, though polygamy is permitted by their *shastras* or holy books, it is very little practised in Bengal. These ladies have no common parlor or sitting-room elegantly furnished, like the ladies of the Turkish harem, but each one has her own little room, where she lives all her life and brings up her children, though she is permitted to go into any room to visit the other women in the zenana, and the work-rooms and open court in the centre of the building are free to them all. But she must never go out into the outer portion of the building, that which belongs to the gentlemen, as it is considered the greatest disgrace that could happen to a zenana lady to be seen by any other man besides her own husband. Therefore, too, no man can enter the zenana, until late at night he may go to his wife's room, after every woman has retired to her own apartment. The rooms of these ladies are simply prison-cells, with one door and one window, the window merely an opening without glass, but with bars up and down the opening; and both window and door open on to the veranda surrounding the inner court, so that nothing outward is visible. They can only see what takes place in the court. The room is from ten to twelve feet square, with a brick or tile floor, no carpet or matting, and the only furniture is a wooden bedstead, with a piece of matting in lieu of a bed, a wooden box for the lady to keep her clothes, and a brass drinking-vessel, and sometimes in the corner of the room a strip of matting about four feet long, which the lady spreads on the floor to sit upon; but this is only an occasional luxury. The walls are black with dirt, filth, and cobwebs, looking as if they had not been whitewashed for fifty years, and with never any other ornaments but the ugly painted daubs of their gods; and these only rarely. These rooms of the ladies are always on the second or third floor, and are approached by a flight of brick steps, generally winding, three-cornered, and almost always in a state of dilapidation and perfectly dark, so that you are in constant dread of falling and breaking your neck. The ladies who inhabit these holes are, when young, lovely and gentle, loving and tender, of the true Caucasian race, descended from the ancient Aryans. They have magnificent black eyes and hair, beautiful, graceful forms, small, tapering hands and feet, which are continually dyed with henna—the foot in such a way as to make it look somewhat like a red slipper, and the nails and inside of the palms of the hands with the same red dye. The only garment they wear all the year round is a *sarree*, a straight piece of cloth about a yard wide and from five to six yards long. This is put on widthwise from the waist down, and then is wound once round the body, and then one end brought up so as to cover the back, breast, and head—simply one thickness of the cloth, that of cotton, and frequently the very sheerest of muslin, so that the drapery is often nothing more than the thinnest veil. No shoes or stockings are ever worn, but often a great many jewels. These jewels are always the bride's dowry. The wedding-garment is a similar sarree, only of a very thin red silk made in the country.

The inner court in the centre of the men's court is generally flagged with stone or paved with brick. This is very seldom done in the women's court, but the floor is generally only mud beaten hard. All the rooms on the first floor surrounding this court are the same, or else the floor is made of a plaster composed of mud and cowdung mixed together. These lower rooms are used as cooking-rooms and cow-sheds. When the birth of a child is expected, the poor mother is not allowed even the poor comforts of her own room, but she is brought down and made to share the cow-shed with the cow, simply a strip of matting being placed between them, and here, with nothing but a piece of matting on the cold, damp floor, she has to remain for twenty-eight days. All this time she is considered polluted, and no one must speak to her but the low-caste coolie-woman who has acted as midwife. She must never have a doctor, no matter how great may be her sufferings. After the child is born, for two or three months it is rubbed all over every day with mustard oil and laid out in the sun to dry, and all through life, when they are cold, the women frequently do this. To this custom, doubtless, the present color of their skin is owing, for we are told when they came first into Bengal they were as white as we: they certainly are

of the same style of feature; but this practice, continued as it has been for probably thousands of years, would darken any nation. They are of all shades of color, from the Italian up to the darkest brown, but the skin always pure and spotless. The little girls are married when they are six or seven years old, and most generally are mothers before they are quite eleven years of age. The son *always* lives in his father's house, and his little bride is taken there, so that often there are five or six generations living in one house. If the quarters become too straitened, they will build on another hollow square back of the former, or put on another story to the building; some of the larger buildings have three or four of these inner courts, all belonging to the one zenana.

Till within the last fifteen years no Christian step had ever passed the doors of these houses, and the ladies were brought up in utter ignorance of the outside world, as a zenana lady was never allowed to go anywhere but from her husband's house to her father's. Then she was carried shut up tight in a palanquin, with a very thick cloth or comfortable thrown over it to prevent her seeing out. They were never taught to read or to write or sew; indeed, they were told that if a woman learnt to read, she was doing that which only a man should do, and therefore she would instantly become a widow—a fate more to be dreaded than anything else, as a widow, if she were not burnt on the funeral pile of her husband, was a disgraced being, and suffered a lifelong agony, subject to every privation, contemned and ill-treated by all; and when she died, after suffering untold agonies for thousands of years in the other world, would be condemned to return to this world either in the form of a snake or some other vile animal. The only thing a zenana lady had to do was to pay her devotions to the gods, take care of her children, braid her hair, and cook for her husband. This latter every woman, from the highest to the lowest, must do. After the food is prepared, it is sent in on a large brass platter to the husband; he eats what he likes, and the remainder is sent back to the wife.

It is only in the province of Bengal that these rigid rules with regard to the zenana ladies are exacted; but in that province alone there are eighty millions of people. In other parts of India the women (though everywhere under some restrictions) are allowed much more liberty. The learned men of Bengal give this as a reason for the rigid seclusion of their women: Before the days of the Mohammedan invasion (about 800 years ago) their women were allowed as much liberty as English women in the matter of going out, etc., but their conquerors, the licentious Mohammedans, found the Bengal ladies so much more beautiful than their own that it did not matter, wife or maid, whoever they saw that struck their fancy, they would seize her and carry her off to their harems. To prevent this they were obliged to shut up their women. They of course greatly rebelled against this, so that the Brahman priests had to make it a part of their religion, and to write out some fresh shastras or holy books with very strict and rigid laws for the confinement of women; and they made them all the more strict because the women rebelled so much. The women could not read for themselves, and as the priests pretended to read these laws from the old shastras, they knew no better. Still, with that generation they had a great deal of trouble, but the priests so thoroughly instilled these laws into the minds of the rising generations that they became fixed; and now many a woman believes it to be such a great impropriety to be seen by any other man besides her own husband that she would rather die than submit to such disgrace. The Mohammedans did not so overrun the lower provinces, which sent their submission to the conquerors without their armies being marched thither; therefore there were few Mohammedans comparatively in those parts, so there was no need to enforce such very rigid seclusion on their women.

But Christian ladies are now permitted to visit these poor prisoners, and to carry to those who have so long sat in darkness the light of the glorious gospel of Jesus Christ; and with that and education, here and there a few little beginnings of comfort are being introduced into these squalid homes or abodes of misery. HARRIET G. BRITTAN.

**Zend-Aves'ta,** the collective name of the sacred books of the Parsees, contains the doctrines of the ancient Persian religion founded by Zoroaster. The collection consists of various parts, of which the most remarkable are—the *Vendidad*, or "Law-Book," giving the rules for avoiding and the means of expiating sin and impurity; the *Yaçna*, containing prayers and songs of praise; the *Yeshts*, the *Nyâyish*, etc. The first of these divisions is, generally speaking, the most interesting, and has been edited, translated, and annotated by Westergaard (Copenhagen, 1852) and by Spiegel (Leipsic, 1853–58); but the second, which has been edited, translated, and annotated by Haug (Leipsic, 1858–60) and by Kossowicz (1867–71), is the oldest. It is evident, however, not only that the writings comprised in the *Zend-Avesta* belong to various periods, but also that they are only fragments of a rich sacred literature which has been lost. Pliny says that Zoroaster composed 2,000,000 verses, and Attavari, an Arabian author, says that his writings covered 12,000 cow skins. But from the conquest of Persia by Alexander the Great, in 330 B. C., to the accession of the dynasty of the Sassanidæ, in 235 A. D., the religion of Zoroaster and the wisdom of the Magi were not only thrown into the background by Greek ideas, but became nearly lost. The accession of the Sassanidæ indicates a revival of the ancient Persian religion, and it is to their zeal that we owe the *Zend-Avesta*. New troubles, however, overtook the book and the confessors of its doctrines. In 651, Persia was conquered by the caliph Omar, and the inhabitants were forced to embrace Mohammedanism. A small number, the Parsees, who refused to give up the religion of their ancestors, fled to India, and through them the *Zend-Avesta* became known to Europeans. A manuscript of the book was brought to England in the seventeenth century, but no one could read it. The first who succeeded in making it accessible to European readers was a Frenchman, Anquetil-Duperron, who spent severl years in India, enjoyed the instruction of the priests of the Parsees, and in 1771 published a translation of the whole *Zend-Avesta* into French. The reception it received was very curious. The English simply repudiated it as a forgery, the Germans assigned it a vague place somewhere in space and time, and most people considered it a production of very doubtful origin. Thus stood the case until in 1826 the Dane Rasmus Rask, who had spent several years in India, established beyond doubt that the books of the *Zend-Avesta* were written in three different forms or developments of the same idiom—namely, the Zend, the Huzvaresh or literary Pehlevi, and the Parsi; that the Zend, in which the oldest parts of the book were written, was not a corrupted dialect of the Sanskrit, but an independent language closely allied to the oldest, the Vedic forms of the Sanskrit; and that, consequently, the *Zend-Avesta* contains documents of the oldest known tongue of the Aryan family. Soon after the Frenchman Eugène Burnouf took up the study of the Zend language, and it has subsequently been pursued vigorously by Bopp, Spiegel, Haug, Westergaard, and others, and throws much light on the most intricate philological questions.

**Zend Language.** See ZEND-AVESTA.

**Zen'ger** (JOHN PETER), b. in Germany about 1680; became a printer; settled in New York; established there a press in 1726, and founded (Nov. 5, 1733) the *Weekly Journal;* was imprisoned thirty-five weeks in 1734–35 for alleged libel upon Gov. Cosby and council, an offence of which he was acquitted on trial on the ground of the truth of his statements. D. in New York in 1746. The *Journal* was conducted by his widow and son John till about 1752.

**Zengg,** town of Austria, in Croatia, on the Adriatic, has a small and somewhat unsafe harbor, but carries on a very active trade in Hungarian produce, especially in grain and salt, with Italy and the Levant. P. about 5000.

**Zenick.** See SURICATE.

**Ze'nith** [from the Arab., signifying "the line of the head"], the point in the celestial sphere directly over the head of the observer; the opposite of the *nadir*.

**Zenith Telescope.** See APPENDIX.

**Zenjan',** town of Persia, province of Irak-Ajemee, on the Zenjan, is surrounded with walls and has extensive manufactures of carpets, woollen cloths, and arms, and large, well-stocked bazaars. P. 15,000.

**Ze'no,** emperor of the Eastern empire (474–491), was an Isaurian by birth, but married in 469 Ariadne, a daughter of the emperor Leo I. As Leo I. had no male children, he proposed to leave the crown to Zeno, but Zeno, besides being a foreigner, was very unpopular in Constantinople on account of his ugly character, and the imperial proposition caused such a commotion that it had to be given up. The succession was then fixed on Leo II., a son of Zeno and Ariadne, but as Leo II. died in the same year as Leo I., in 474, Zeno actually came into possession of the crown. During his reign revolts within alternated with miserable wars without. The attacks of the Goths were bought off, time after time, with enormous sums, but the emperor finally got rid of them by commissioning their chief, Theodoric the Great, to conquer Italy and expel the usurper Odoacer. Basiliscus, who was proclaimed emperor in Constantinople in 475, was overthrown by buying his two generals, Illus and Harmatius, and the intrigues and rivalries of the two ministers were ended by the assassination of Harmatius. The insurrection of Marcian in 479 was suppressed by buying his soldiers, and that of Illus, which

lasted for several years, was baffled by intrigues and assassination. At last Zeno was buried alive by his own wife, who married his successor, Anastasius.

**Zeno** (Apostolo), b. at Venice Dec. 11, 1668; devoted himself to literature, and acquired great fame by his dramatic compositions; founded in 1710 the celebrated periodical, *Giornale de' Letterati d'Italia;* went in 1715 to Vienna as court-poet and historiographer; returned in 1729 to Venice, and d. there Nov. 11, 1750. His dramatic works were published in 10 vols. at Venice in 1744, but his historical works have more interest than his poetical—*Istorici delle cose Veneziane* (10 vols., 1718–22) and *Dissertazioni istorico-critiche* (2 vols., 1752–53), *Epistole* (6 vols., 1785).

**Zeno of Elea,** b. 490–485 B. C. at Elea, a friend and disciple of Parmenides, whose doctrines he supported by indirect demonstration (*reductio ad absurdum*), is reported to have been adopted as a son by Parmenides, who was twenty-five years his senior. Aristotle names him as the father of dialectics, from the circumstance that his arguments in favor of the Eleatic doctrine of Being were based upon the self-refutation of its opposite. This negative dialectic established the truth of Being as One, by showing the contradiction inherent in the hypotheses (*a*) of motion, (*b*) of multiplicity, (*c*) of sense-perception: "The flying arrow is at rest, because at every moment it is only in one place;" "Achilles cannot overtake the tortoise, because as often as he reaches the place occupied by the tortoise the previous moment, the latter has left it;" "Motion cannot begin, because a body cannot arrive at a given place before it has passed through an infinite number of intermediate spaces." Aristotle in his *Physics* (vi.) pointed out the fallacy in his arguments against the reality of motion. In Plato's *Parmenides* a writing of Zeno's is referred to as containing a prolix argument to prove that Being is One, but this writing has been lost. Strabo reports him to have participated in the ethico-political efforts of Parmenides, and we are told by Diogenes Laertius that, being unsuccessful in that, he was taken by Nearchus the tyrant and put to a cruel death.

William T. Harris.

**Zeno the Stoic,** b. about 350 B. C., son of a Phœnician merchant residing in Cittium, a Greek city on the island of Cyprus; was occupied in commerce until near his thirtieth year, when a shipwreck caused him to visit Athens, where he read the works of Xenophon and Plato, and conceived a great admiration for their master, Socrates, and accordingly became a disciple of Crates the Cynic, who imitated the external peculiarities of Socrates. Becoming sated with this phase of the Socratic school, he resorted to Stilpo the Megarian, who initiated him into the dialectics by which the nugatoriness of sense-perception is exhibited. He afterward joined Xenocrates and Polemon of the first Academic school, and about the year 310 B. C. founded his own school in the Στοὰ ποικίλη (porch adorned with paintings by Polygnotus), whence the name "Stoic" arose. He taught fifty-eight years, according to Apollonius, dying about 258 B. C., by his own hand. Diogenes Laertius (vii.) mentions a number of works attributed to him, but none of them have been preserved. His doctrines were considered by the ancients to be not so much new in substance as new in terminology. He combined the ethics of the Cynic school with the physics of Pythagoras and Heraclitus, and introduced a modified logic. (See Stoics for details of his doctrines.)

William T. Harris.

**Zeno'bia,** the daughter of a Syrian chieftain; married in a second wedlock Odenathus, prince of Palmyra, who after his brilliant campaigns against the Persians was declared augustus and coregent of the empire by Gallienus. In 267, Odonathus was murdered, and Zenobia ascended the throne, assumed the title of "queen of the East," declared herself independent of Rome, extended her authority over all Syria, parts of Asia Minor, Mesopotamia, and Egypt, and governed her realm with prudence and energy. But in 271, Aurelian marched against her. Her armies, commanded by herself, were defeated at Antioch and Emesa, and she was shut up in Palmyra. She attempted to escape, was captured, and with her hands in chains walked before the emperor's chariot on his triumphal entry into Rome in 274. She afterward lived in elegant style in a villa near Tibur. Her daughters married into the highest Roman families, and her son received an independent principality on the Armenian frontier. Her beauty was most extraordinary, and so were her accomplishments; she spoke Latin, Greek, Syriac, and Egyptian. She marched at the head of her armies, and in the council-chamber was shrewd and sagacious. It was generally believed that she had been privy to the assassination of her husband.

**Zen'ta,** town of Hungary, on the Theiss, has 16,808 inhabitants, mostly engaged in cattle-rearing and fishing.

**Ze'olite** [Gr. ζεῖν, to "boil"], the name of a very large group of minerals which fuse under the blowpipe, whence the name. They are generally impure hydrated silicates, containing alkaline earths or alkalies, often alumina, and rarely magnesia. They are mostly crystalline or subcrystalline. They are often deposited in cavities in plutonic rocks, and have been found infiltrating ancient walls built by man. They are doubtless formed from watery solutions.

**Zephani'ah** [Heb. "watchman of the Lord"], one of the minor Hebrew prophets, was of noble birth. His ancestors for four generations are mentioned, ending with Hezekiah, probably the king of that name. He lived in the reign of Josiah (640–610 B. C.). His prophecy treats of idolatry and luxury, and is remarkable for its silence in regard to Josiah's reformation.

**Zerafshan',** the gold-bearing main stream of the Russian district of Zerafshan, which was formed in 1868, enlarged in 1870, and now comprises an area of 1756 sq. m., with 339,200 inhabitants, rises under the name of Masja at the foot of an immense glacier and passes through the Lake of Iskander. In its upper course it is a wild mountain-stream; during its middle course it provides for the irrigation of extensive and very fertile rice and cotton fields, orchards and mulberry plantations, for which purpose it is led into numerous canals above Samarkand. Below this city it disappears in a region of steppes whose sandy wastes are steadily extending their boundaries, so that since the transfer of the country to the Russian dominion about 100,000 Tadshiks and Usbeks have removed. The mountains among which the river has its sources rise about 19,000 feet. The inhabitants of the valleys of this mountain-region acknowledge only unwillingly the authority of the czar, and in the beginning of the winter of 1876 it was necessary for the Russians to make a difficult winter and mountain campaign hither. The Kiptshak Khokands made a vehement resistance, but in vain.

E. Schlagintweit.

**Zeram.** See Ceram.

**Zerbe,** tp., Northumberland co., Pa. P. 1446.

**Zerbst,** town of Germany, duchy of Anhalt-Dessau, on the Nuthe, has large breweries, distilleries, foundries, and manufactures of velvet, plush, leather, gloves, earthenware, and vinegar. P. 11,957.

**Ze'ro** [It. *zero*], in common language, *nothing;* in arithmetical language, *no number;* and in the language of analysis, *a quantity less than any assignable quantity.* If we subtract $a$ from $a$, the remainder is absolutely 0, and the result is purely *numerical:* the zero thus found is the *naught* of arithmetic. Again, if we take the fraction $\frac{a}{x}$, in which $a$ has a constant value, $x$ being arbitrary, it is obvious that the value of the fraction will diminish as the value of $x$ increases; if $x$ is made exceedingly great with respect to $a$, the value of the fraction will be exceedingly small; and finally, if $x$ is made greater than any assignable quantity, the value of the fraction will be less than any assignable quantity, or *zero.* The zero thus found is the zero of analysis. In the analytical sense, zero may be regarded as a quantity; and as such it is said to be an *infinitesimal.* In this sense of the term two zeros are not necessarily equal, as may be shown by the following course of reasoning: Let us have the two fractions $\frac{a}{x}$ and $\frac{n\,a}{x}$; now, if we suppose $x$ to increase from any value, the value of the second fraction will always be $n$ times that of the first, and in accordance with the principle that *what is true of a varying magnitude up to its limit is true at its limit,* the limiting value of the second fraction will be $n$ times the limiting value of the first; that is, the zero in the second case is $n$ times that in the first case.

W. G. Peck.

**Zero,** a term that has been applied by thermometer-makers to several more or less arbitrary points of temperature. Fahrenheit, one of these, imagined that he had obtained an absolute zero, or non-existence of heat, by mixing snow and salt, and the point at which his thermometer happened to stand in the particular mixture which he happened to make he called the zero of temperature. It is, however, a fact that in any considerable *mass* of this particular freezing mixture a temperature is often found of 6 Fahrenheit degrees, or even more, below his zero. The so-called zero of the Centigrade thermometer has a much more rational basis, because, being the temperature of water formed by ice at the moment of its fusion, it is easy to find it and verify it; but the application of the term *zero* to this case is no less a scientific solecism. It is indeed not even the *melting-point of ice,* as it has been shown by a distinguished investigator, Person, that ice begins to absorb latent heat, and therefore begins to melt, at about 2° C., or say 4° F., below this point; and it is therefore

obvious that the true initial melting-ice temperature is about 28° F., this being the point of temperature at which motion and change begin upon the solid earth, and therefore entitled to be regarded as an initial point or standard temperature in nature. The Centigrade zero is only the temperature of *melted ice*, that of *melting ice* having a range of 4° F. It is time these indisputable facts were recognized in science and stated in the textbooks.

*Zero, Absolute.*—This is another phrase in common use, which conveys what the writer believes to be an indubitable error. His reasons for this are stated under the head TEMPERATURE, NATURE OF, where it is shown that the so-called absolute zero of temperature is probably only that at which the most incondensable of our *gaseous* bodies—doubtless *hydrogen*—would lose its gaseous form and become a liquid. (See THERMOMETRY.) HENRY WURTZ.

**Zerub'babel** [Heb., "begotten in Babylon"], the prince of the tribe of Judah and civil (Joshua being the sacerdotal) head of the first Jewish colony returning from the captivity in Babylon by permission of Cyrus, 536 B. C. From his heathen name, *Sheshbazzar* (Chaldee or Persian, "fire-worshipper), it may be inferred that he had been in the service of the king of Babylon. His exact pedigree is uncertain. Called, in every place but one, the son of Salathiel, he may have been only his nephew, the son of Pedaiah, Salathiel's brother, according to 1 Chron. iii. 19, although Ewald supposes this to be a clerical error. In either case, he was descended from David in the line of Nathan. He lived to see the temple finished, 516 B. C., but when or where he died cannot now be determined. He had great energy as a ruler, but is most honored for the place he holds in the genealogy of Christ. R. D. HITCHCOCK.

**Zerumbet,** the rhizome of *Zingiber zerumbet*, an East Indian ginger-plant. By some it is considered identical with cassimuniar, the product of *Zingiber cassimuniar*, and by others it is erroneously confounded with round zedoary. It has quite disappeared from commerce, being inferior to true ginger.

**Zetland.** See SHETLAND ISLANDS.

**Zet'terstedt** (JOHAN WILHELM), b. in the circle of Östergotland, Sweden, May 20, 1785; studied natural history, especially botany, and subsequently also entomology, at the University of Lund; began to lecture there in 1810; was appointed professor in 1839; retired in 1853, and d. Dec. 23, 1874. He visited Öland in 1811 and 1817, Gotland in 1819 and 1841, and made extensive travels in Lappmark in 1821, 1832, and 1840. Besides reports of his travels and minor essays, he published *De Plantis cibariis Romanorum* (1808), *Dissertatio de Fœcundatione Plantarum* (3 vols., 1810–12), *Orthoptera Sueciæ* (1821), *Fauna Insectorum Lapponica* (1828), *Monographia Scatophagarum Scandinaviæ* (1835), *Insecta Lapponica* (1838–40), *Diptera Scandinaviæ* (14 vols., 1842–60).

**Zettinie.** See CETTIGNE.

**Zeuglodon'tia** [Gr. ζεύγλη, "yoke," and ὀδούς, "tooth," from the form of some of the teeth], an extinct group of mutilate mammals, generally regarded as a sub-order of the order Cete, but sometimes raised to independent ordinal rank. The distinctive characters were as follows: The skull was much more like the ordinary mammalian type than it is in either of the existing sub-orders; the intermaxillaries were expanded forward, normally interposed between the supramaxillaries, and formed the terminal as well as anterior portion of the lateral margins of the upper jaw; the nasal apertures opened more or less anteriorly, and never so far backward as in the Denticete or Mysticete; the olfactory organs must consequently have been moderately developed; the lower jaw had the rami connected by suture at the symphysis; the teeth approached to the normal mammalian type in that there were typically six (3 + 3) incisors in the intermaxillary bones, and those of the supramaxillary were mostly two- or three-rooted; the roots were so large and connected by the crowns in some of the species to such an extent as to have produced the resemblance to a yoke to which the ordinal name alludes. The representatives of the order existed during the Tertiary epoch, and ranged from the Eocene to the Pliocene, but are now entirely extinct. They were the least specialized of the cetaceans, and the older ones (those of the Eocene) had a skull comparatively little abnormal in comparison with terrestrial mammals. They were doubtless developed long before the Tertiary epoch, but no palæontological evidence thereof has yet been discovered. They are supposed to have been derived from the same common progenitors as the seals, but this supposition remains to be verified. Some of the species attained a gigantic size; *e. g. Basilosaurus cetoides* of the Jackson beds (Middle Eocene) of the U. S., of which remains found indicate a length of over seventy feet, while others were little larger than porpoises. They were prevalent in ancient times almost if not quite as extensively as the living cetacean types, remains having been found in North and South America, as well as Europe and Asia. They have been differentiated into two families—Basilosauridæ and Cynorcidæ. THEODORE GILL.

**Zeulenro'da,** town of Germany, principality of Reuss, has manufactures of stockings and hosiery and large trade in cattle. P. 6463.

**Zeus.** See JUPITER.

**Zeux'is,** b. about 450 B. C., was at the height of his reputation about 420 B. C.; lived to a great age, the latter part of his life in Ephesus; was celebrated for the grace, sweetness, and dignity of his feminine figures, for the skill of his technical drawing and color—as in the grapes the birds pecked at, and the face of the old woman whom the artist is said to have died of laughter on looking at—and for his lifelike delineation of men and animals, as in the picture of the Centaurs. To the genius of Zeuxis we have the testimony of Lucian, Cicero, Pliny. His greatest works were—*Helen, Penelope, The Infant Hercules strangling the Serpents, Jupiter, Menelaus, Marsyas, Cupid.* Of his personal life little is told, except that he was proud of his reputation and ostentatious of his wealth. The date of his death is unknown. O. B. FROTHINGHAM.

**Zevely** (ALEXANDER N.), LL.D., b. in Salem, N. C., Aug. 16, 1813; became the third assistant postmaster-general in 1859, filling this position until 1869, and inaugurating, while in the government service, many useful postal reforms, among them the money-order system and plans for the more prompt delivery of letters. His influence in all postal matters was very great.

**Ze'vio,** town of Italy, province of Verona, near the right bank of the Adige, about 11 miles S. E. of the city of Verona. Zevio is a well-built, prosperous town, and the adjacent country is very rich in agricultural products, especially rice and other grain. P. 6045.

**Zeyst,** village of the Netherlands, in the province of Utrecht, is situated in a beautiful district, and contains many fine villas and summer-residences, built by the wealthy citizens of Amsterdam. A colony of Moravian Brethren has settled here and established extensive manufactures of porcelain, soap, and candles. P. 5256.

**Zhitomeer,** or **Zytomiers.** See JITOMIR.

**Zhiz'dra,** or **Shisdra,** town of Russia, government of Kaluga, has large iron-works, smelting-furnaces, and cloth manufactures. P. 8890.

**Zhukoff'ski** (VASILI), b. in 1783; studied in Moscow, and devoted himself to literature; edited the *Viestnik Evropi* (1808–09); served in the campaigns against Napoleon, and attracted great attention by his war-songs and patriotic hymns; was tutor to the present emperor, Alexander II., 1824–48; resided subsequently in Germany, and d. at Baden-Baden Apr. 24, 1852. His collected works were published at St. Petersburg (1849–50) in 10 vols., and translations into English of some of his poems are found in Sir John Bowring's *Specimens of the Russian Poets* (1824). He was himself a very successful translator of German and English poetry.

**Zidon.** See SIDON.

**Ziem** (FÉLIX), b. at Beaune, Côte d'Or, about 1822; studied painting in Paris; travelled in Italy and the East 1845–48; exhibited at the Salon in 1849. His excellence is in marine subjects and landscape. The Bosphorus, Constantinople, Tripoli, Marseilles, Venice, have furnished themes for his best paintings. His pictures of Venice are much admired. He has also painted fruit-pieces and decorative designs. Two third-class medals were awarded to him in 1850 and 1855, a first medal in 1852, and the decoration of Honor in 1857. O. B. FROTHINGHAM.

**Zie'rikzee,** town of the Netherlands, province of Zeeland, on the island of Schouwen, has a good harbor, extensive shipbuilding, shipping, and fishing, and a large trade in agricultural produce. Its walls, behind which its citizens made an obstinate resistance to the Spaniards in 1576, are now transformed into promenades. P. 7844.

**Zie'then, von** (HANS JOACHIM), b. on his paternal estate of Wustrau, Prussian province of Brandenburg, May 18, 1699; received a military education, and entered a regiment of dragoons as lieutenant in 1726, but became entangled in the difficulties of one of his comrades, and was cashiered. In 1730, however, he was reinstated in the army as lieutenant in a regiment of hussars just then forming, and during the first Silesian war he became its commander. During the second Silesian war he made his famous march to Jägerndorf through the Austrian lines; distinguished himself at Hohenfriedberg, June 4, 1745, and at Hennersdorf, Nov. 23, and was made a major-general. Shortly after the peace some disagreement arose between him and the king, and a reconciliation did not

take place until 1755, but in the Seven Years' war he took a most brilliant part, as commander of the cavalry, in the battles of Prague, Kollin, Leuthen, Liegnitz, and Torgau: and after the peace he retired to his estates as the most popular and one of the most celebrated of the generals of Frederick the Great. D. at Berlin Jan. 26, 1786. His *Life* has been written by Hahn.

**Zif,** p.-v. and tp., Wayne co., Ill. P. 480.

**Zil'leh** [anc. *Zela*], town of Asiatic Turkey, in Asia Minor, manufactures sailcloth and coarse cotton fabrics, and has an annual fair in the middle of November, which often is frequented by 50,000 persons. It contains 2150 families, most of which are Turks.

**Zil'lerthal,** one of the principal valleys of the Tyrol, 50 miles long, enclosed by lofty glaciers and opening N. into the valley of the Inn, contains about 14,000 inhabitants, who are reputed for their beauty, fine song, and industry. Rearing of cattle and manufactures of gloves and essences of herbs are the principal occupation. In 1837, 399 persons, men, women, and children, emigrated to Prussia. They had left the Roman Catholic Church, and the Austrian emperor, although he first promised them toleration, decided that they had either to return to the Roman Catholic Church or remove to Transylvania, where there were Protestant congregations. They refused both propositions, and left Austria altogether.

**Zim'mermann, von** (Johann Georg), b. at Brugg, canton of Berne, Switzerland, Dec. 8, 1728; studied medicine at Göttingen; began to practise at Brugg in 1751, and was appointed court-physician at Hanover in 1768. D. Oct. 7, 1795. He enjoyed a great reputation as a physician; was invited to the court of Catharine II.; attended Frederick the Great in his last illness; and published *Von der Erfahrung in der Arzneiwissenschaft* (2 vols., 1764), which was often republished and translated into several foreign languages. But still greater was his fame as a philosophical writer. His *Vom Nationalstolze* (1758) and *Ueber die Einsamkeit* (4 vols., 1784–85) made his name celebrated throughout the whole of Europe, especially the latter, which is still quoted now and then, though it is a very dull book, and caught the attention of its time chiefly through its sentimentality and affectation. In 1788 he published *Ueber Friedrich den Grossen und meine Unterredung mit ihm kurz vor seinem Tode,* and in 1790 *Fragmente über Friedrich den Grossen* (3 vols.) implicated him in some very bitter controversies, and his last days were darkened by melancholy, a sickly sensitiveness, and finally by mental exhaustion. A collection of some of his letters was published at Aarau in 1830. (See also *Zimmermann's Krankengeschichte* (1786), by Wichmann.)

**Zinc** [Ger., Sw., and Dan. *Zink*], sometimes called **Spelter,** one of the metallic elements, very abundantly distributed, comparable in this respect to lead. It was not known in metallic form to the ancients, though they knew how to make alloys of it with copper (common brass) by adding zinc ores to melted copper. Zinc, being one of those metals, however, which must be procured by a process of *distillation,* was doubtless beyond the skill of the metallurgists of old. It was first, and for a long time, brought into Europe from the East, and it is not much more than 100 years since zinc was first smelted in Europe. The ores of zinc are not numerous, there being only six mineral species which furnish all the zinc and zinc-white of commerce. These are *blende, calamine, willemite, smithsonite, franklinite,* and *zincite,* including sulphide, silicates, carbonate, and oxide. (See Zinc, Compounds of.) The sulphide and carbonate are first roasted to expel sulphur and carbonic acid. Calamine also contains water, which must be expelled by roasting. The ores, thus prepared, are distilled, in admixture with carbon, in retorts or furnaces of special construction, the zinc-vapor generally carrying with it some lead, sulphur, and arsenic. Most commercial zinc, when required pure, must be redistilled. That which is made from calamine, or from the willemite, franklinite, and red zincite of New Jersey, is free from arsenic, and generally quite pure. When made from blende it sometimes contains Cadmium (which see), and more rarely traces of Indium (which see).

*The metal zinc* is one of much hardness, with a bluish color, with a brilliant lustre when freshly cut, but soon taking a tarnish, from the formation of a film of suboxide or carbonate, which protects it quite strongly from further oxidation, so that it is an extremely durable metal, resisting both air and water very persistently. When cast it is highly crystalline in structure, and somewhat brittle, though at the same time sectile; but by heating to a temperature somewhat below 300° F., it may be rolled into very thin plates, passing into a modification which is quite malleable, so that sheets as thin as tin-foil may be obtained. The best way to obtain it pure is by electrolysis. At a temperature but little higher than that mentioned still another allotropic modification appears, which is very brittle and fragile, and in a mortar heated to 400° F., or a little higher, the metal may be crushed to powder. It melts at about 780° F., and boils at about 1900° F., yielding a vapor which takes fire in the air and burns with a dazzling light to zinc-oxide. (See Zinc-White.) The relations of zinc to acids and other solvent liquids are highly interesting. When chemically pure it dissolves readily in nitric acid, but not so in dilute sulphuric and hydrochloric. Even ordinary commercial zinc, containing lead, iron, etc., may be almost absolutely protected from the latter two acids by the thinnest film of *mercury,* which in voltaic batteries (see Electricity) is used, therefore, for this purpose. On contact, however, with most other metals, and other substances capable of conducting electricity, voltaic circuits are set up, and the zinc dissolves, hydrogen being evolved from the surface of the other metal. Hence, through the formation of such circuits with its metallic impurities, commercial zinc is readily soluble in acids, and even in solutions of neutral salts. These same relations explain the well-known *protective* action of zinc upon iron or copper, even in sea-water (as in the case of sheathing of ships). The film of hydrogen formed upon the surface of the other metal prevents all oxidating action thereon. Zinc is largely used for coating iron and copper, exerting a protecting influence, both as a mere coating or impervious varnish, and through its voltaic relations. (See Zincking of Metals.) Zinc dissolves also in *alkalies,* whose compounds with its oxide are soluble (see Zinc, Compounds of), in a manner similar to that above described, its relations to other metals in such alkaline liquids being altogether similar to those in acid and saline solutions.

The density and molecular volume of zinc have a much smaller range than is usual among the metals, so far as has been investigated, indicating less tendency—at normal temperatures, at least—to allotropic variations. Indeed, it is not impossible that of 14 density-determinations of pure zinc on record, 12 may belong to one allotrope, the lowest of these being by Brisson, 6.861, and the highest by Wertheim, 7.146, and the mean 6.952. A simple zinc-molecule, $\underset{21}{Zn}$, corresponds to 7.019 at 28° F. This is doubtless the constitution of ordinary cast zinc, and the same molecule is found in the dominant form of zinc-oxide in the "hydrate," the heaviest sulphates, the densest *willemite,* in *gahnite,* in blende, and in some other compounds. When rolled, 1 molecule in 4 undergoes condensation, and rolled zinc appears to be

$$\underset{20}{Zn}.3\underset{21}{Zn} = 7.266 \left\{ \begin{matrix} \text{Bolley,} & 7.2 \\ \text{Daniell,} & 7.21 \end{matrix} \right\}.$$

When melted, zinc becomes $\underset{21}{Zn}\,\underset{22}{Zn} = 6.529$ (Playfair and Joule, 6.522). Henry Wurtz.

**Zinc, Alloys of.** Almost all the other common metals, except *lead* and *bismuth,* alloy readily with zinc, forming alloys that generally partake of the hardness of the zinc, and, when the latter is in excess, of its brittleness also. Under Brass will be found some mention of the highly-important alloys with *copper,* these being by far the most valuable of zinc alloys. In making brass and other zinc alloys care must be taken that the heat does not rise too high, to avoid volatilization of the zinc. With *lead,* zinc will not unite unless through intermediation of some other metal, such as *tin,* which alloys with both; with lead and bismuth also, equal quantities of each of the three metals, a *fusible alloy* is obtained which melts in boiling water. Bronze, which properly consists of tin and copper, is often alloyed with zinc, and triple alloys of these three metals are used for journal-boxes and some other purposes. An alloy with 11 times its weight of tin is beaten into leaves and used as a spurious substitute for silver-leaf. $ZnSn_6$ appears to form a definite compound, having the fixed fusing-point 500° F.; but in other proportions there is a separation during cooling into two distinct alloys. *Amalgams* of zinc have little interest except in connection with voltaic batteries. (See Zinc.) Henry Wurtz.

**Zinc, Compounds of.** Zinc forms a number of compounds which are useful in the arts, and several of its native mineral compounds are of much interest.

For the *oxide* see Zinc-White.

The *sulphide* of zinc is found constituting two mineral species, identical in composition, but differing in crystalline form—*blende* or *sphalerite,* which is of the regular system, and *wurtzite* (named after the French chemist, Adolphe Wurtz), which is hexagonal. Blende has a peculiar brilliant resinous lustre, sometimes black, but also sometimes transparent, brownish, yellowish, or even colorless. Hardness between calcite and fluor-spar. The localities are very numerous. A colorless variety is found at Franklin, N. J. (which was called by Nuttall *cleiophane*); handsome crys-

tals at the Wheatley and Perkiomen mines in Pennsylvania, also at Austin's lead-mines in Wythe co., Va., and in a multitude of other places. Blende appears to have the constitution—

$$2^{S}_{24}.\left(\begin{smallmatrix}Zn & Zn\\ 21 & 22\end{smallmatrix}\right) = 4.079 \left\{\begin{smallmatrix}\text{Henry, white, from New Jersey,} & 4.063\\ \text{Kuhlmann,} & 4.07\end{smallmatrix}\right\},$$

thus containing the *melted-zinc* molecule. (See ZINC.) Wurtzite, the hexagonal allotrope, is not much known. It was obtained from a Bolivian silver-mine. Hexagonal sulphide of zinc may be obtained artificially by several methods. For the mineral the density 3.98 is given by the discoverer Friedel, which is lower than average blende densities. Considering that Friedel's specimen contained iron and lead, which would augment its density, it seems not improbable that wurtzite, when pure, may be $^{S}_{24}.^{Zn}_{22} = 3.964$, containing a zinc-molecule which occurs in some *willemite*, also in *calamine*.

WILLEMITE.—(See this head.)

*Calamine*.—This is one of the commonest ores of zinc. It is right-rhombic in crystallization, of the hardness of apatite, generally white in color, brilliant in lustre when crystalline, particularly on the cleavage surfaces. Its density varies from 3.164 to 3.871, and one modification may be regarded as a hydrated willemite, containing, like the latter, the same zinc-molecule as in *wurtzite*, above:

$$O_4.2^{Zn\ Si\ H\delta}_{22\cdot 23\cdot 24} = 3.528 \text{ (Monheim, from Altenburg, 3.49).}$$

This volumic formula may be noted for its *plesymmetry*. (See under the head WATER OF CRYSTALLIZATION.) Calamine (*Galmei* in German) is said by Agricola to be derived from *calamus* (a "reed"), but the derivation is obscure and unlikely. This mineral constitutes an abundant ore of zinc in many countries. Enormous quantities have been mined at Friedensville, Pa., where, however, mining is stated to have been recently stopped by water, the cost of removing which exceeded the value of the ore. In Europe there are several rich mines.

*Smithsonite*, carbonate of zinc, named after the English chemist Smithson, the illustrious founder of the Smithsonian Institution at Washington.—Rhombohedral; hardness the same as calamine; white or light in color, and with vitreous lustre. The range of densities not so great as in the case of calamine. The zinc-molecule is enormously condensed, one whole type (4 diameters) below that in the oxide, hydrate, and cast metal (which is $^{Zn}_{21}$), smithsonite being, in its medium densities—

$$O_6.2^{Zn}_{17}.2^{C}_{20} = 4.391 \text{ (Karsten, 4.3765).}$$

The maximum densities, however, appear to correspond to another form—

$$O_6.\left(\begin{smallmatrix}Zn & Zn\\ 16 & 17\end{smallmatrix}\right).2^{C}_{20} = 4.455 \left\{\begin{smallmatrix}\text{Neumann,} & 4.45\\ \text{Levy,} & 4.45\end{smallmatrix}\right\}.$$

*Franklinite*.—This very interesting and valuable ore, which is found only sparingly in two or three European localities, occurs in New Jersey, at the Sussex zinc-mines, in immense quantities. It was named from Franklin Furnace, a place in this region near Hamburg, one of the localities. Franklinite is regular in crystallization, black and opaque, slightly magnetic, with metallic lustre, indistinct octahedral cleavage, of the hardness of feldspar, and a density somewhat over 5. Infusible before the blowpipe; contains about 20 per cent. of zinc-oxide, and 13–14 per cent. of manganic oxide, the rest being ferric oxide. It yields, when smelted, a species of *spiegel-iron*. (See IRON.)

*Gahnite—Zinc-Spinel*; also called *Automolite*.—Regular, like other spinels; hard as topaz; very variable in color, and generally opaque, but sometimes translucent. When pure composed of $Al_2O_3$, 61.3, and ZnO, 38.7, but always containing some $Fe_2O_3$, regarded as replacing the alumina. Densities from 4 to 4.91. Found also near Franklin Furnace, N. J., with the willemite and franklinite. Named after the Swedish chemist Gahn, who discovered it at Fahlun, Sweden. The name *automolite* is applied to varieties nearly free from iron.

*Zinc-Vitriol, White Vitriol, Zinc-Sulphate, Goslarite*.—This is a familiar commercial compound, also occurring in nature as *goslarite*. At the Rammelsberg mine, near Goslar, in the Hartz, it is abundant, but not common elsewhere. For commercial use it is prepared by roasting and then lixiviating blende, or by dissolving metallic zinc in dilute sulphuric acid, and crystallizing. Its composition is $O_4SZn.7H_2O$. Crystals right-rhombic, effloresceing in the air, with loss of part of their crystal-water. At 212° F. they lose $6H_2O$, the seventh equivalent requiring a much higher temperature. At bright redness the acid is decomposed into a mixture of oxygen and $SO_2$ gases, pure zinc-oxide remaining behind. This is a method of making *oxygen* proposed by Deville and Debray. (See OXYGEN, by HENRY WURTZ.) White vitriol dissolves in 2.33 times its weight of cold water, and less than its weight of boiling water. It has an acrid metallic taste, and is very powerfully emetic in its effect when swallowed in any quantity. It is used in medicine, both directly and as a material for preparation of other medicinal zinc-compounds. One (the heaviest) form of it contains the dominant cast-zinc molecule—

$$O_4.^{S}_{24}.7^{H\delta\ Zn}_{24\cdot 21} = 2.041 \left\{\begin{smallmatrix}\text{Filhol,} & 2.036\\ \text{Mohs,} & 2.036\end{smallmatrix}\right\};$$

but in the commonest modification the zinc-molecule is one type (4 diameters) larger:

$$O_4.^{S}_{24}.7^{H\delta\ Zn}_{24\cdot 25} = 1.953 \left\{\begin{smallmatrix}\text{Schiff,} & 1.953\\ \text{Stolba,} & 1.9534\\ \text{Buignet,} & 1.957\end{smallmatrix}\right\}.$$

There appear, however, to be other forms. Zinc-sulphates are known with other proportions of crystal-water—with one, five, and six molecules.

*Zinc-Chloride* ($ZnCl_2$), *Butter of Zinc*.—Zinc combines powerfully with chlorine, thin foil taking fire therein spontaneously. The substance formed is whitish, translucent, of the consistence of wax, melts at a low temperature, and sublimes at a red heat, condensing in white needles. It is highly deliquescent, and soluble in water and alcohol. The aqueous solution of zinc-chloride has several uses in the arts. It is used for "burnettizing" wood (see PRESERVATION OF TIMBER, by HENRY WURTZ) and as a disinfecting agent. If boiled with zinc-oxide, an oxychloride solution is formed, which Persoz found to have the power of *dissolving silk*, so that the latter may thus be separated from wool and from cotton. The writer has found that this may be accomplished, though special management is required.

*Organic Compounds of Zinc, "Zinc Radicals."*—By heating the compounds formed by the action of iodine on the marsh-gas homologues with zinc under pressure, a curious class of colorless liquid organic compounds, containing zinc in their constitution, is formed, called "methylide," "ethylide," "amylide," and so on, of zinc. Zinc "methylide" and "ethylide" take fire in the air spontaneously.

HENRY WURTZ.

**Zinc-Green.** See RINMANN'S GREEN.

**Zincite,** or **Red Zinc Ore,** a highly-interesting mineral species, very rare in Europe, but found in one district in the State of New Jersey in such profusion as to constitute an extremely valuable ore of zinc. Its range runs through Stirling Hill and Mine Hill in Sussex co., where it is found imbedded in calcite, associated largely also with *franklinite* and *willemite*. (See ZINC, COMPOUNDS OF.) The zincite of New Jersey, though essentially of the same composition as the pure white zinc-oxide of commerce (see ZINC-WHITE), is nevertheless very different therefrom in chemical and physical characters. Its color, in the mass, is a peculiar and beautiful deep orange-red, and in powder orange-yellow. Its density (see below) is also greater. In thin scales it is translucent and deep yellow, and Prof. Dana found it free from intermixed red oxide of iron or other matter, to which the color has been attributed by some. This color is therefore supposed by him—as well as by G. Rose and J. D. Whitney—to be due to the presence of some *oxide of manganese*, supposed to be $Mn_2O_3$, in unknown form of combination. This color being, however, a *constant* characteristic, and the proportion of manganese in the mineral exceedingly *variable*, and indeed sometimes almost if not altogether absent, the writer finds himself unable to accept this view, and is forced to put forth the belief that zincite is a special *allotropic form* of zinc-oxide. Under the head of ZINC it is shown that at least two allotropes of metallic zinc exist, the crystallized cast metal $^{Zn}_{21}$, and the malleable denser wrought zinc, which is $^{Zn}_{20}.3^{Zn}_{21}$. The density-figures given for red zincite are precisely in agreement with the view that this denser molecule of the metal is contained in it:

$$O_4.\left(\begin{smallmatrix}Zn\\ 20\end{smallmatrix}.3^{Zn}_{21}\right) = 5.732 \left\{\begin{smallmatrix}\text{Wm. P. Blake,} & 5.684\\ \text{Dana, } \textit{maximum,} & 5.7\\ \text{Karsten,} & 5.7344\end{smallmatrix}\right\}.$$

Blake's sample was composed of *orange-yellow crystals*, which contained, by his analysis, 99.5 per cent. of oxide of zinc, and but 0.68 of $Mn_2O_3$. When ordinary white zinc-oxide is heated, it turns yellow, but loses this color again on cooling. The suggestion occurs that if *crystallized* at the temperature at which this change of color occurs, it might remain permanently yellow on cooling, and turn out, in fact, to be the very modification found in nature as zincite. The higher density is in accordance with the fact of the generally higher densities of allotropes of metallic oxides formed by exposure to heat.

HENRY WURTZ.

**Zincking of Metals,** the plating of metals with a thin layer of zinc, by which they are protected from the oxidizing action of the air. Iron is the metal oftenest coated, but copper is also sometimes treated in the same manner. In the preparation of zincked iron (so-called "galvanized

iron") the metal is first cleansed by immersion in a warm bath of equal parts of sulphuric or hydrochloric acid and water, after which it is cleaned by rubbing with emery; it is next dipped in a bath of equal parts of saturated solutions of chloride of zinc and chloride of ammonium, then into a metallic bath consisting of 640 parts by weight of zinc, 106 parts of mercury, and about ⅓ part of sodium, where it is allowed to remain until it acquires the temperature of the melted metal (680° F.). In order to avoid the partial solution of the iron by the action of the molten zinc, it is advisable to add pieces of wrought iron to the bath, so that it may previously become partially saturated. Iron castings are treated by a somewhat similar process: they are first cleaned by rubbing with sand, then heated, and immersed while still hot in a concentrated solution of chloride of zinc containing sulphate or chloride of ammonium, after which they are dipped in a bath of molten zinc, the surface of which is kept free from oxide by means of a little sal-ammoniac. The protective action of the zinc coating obtained as above described is said to exceed that of the tin upon ordinary tinned iron; increased strength is also imparted to the iron by the zinc, and its welding properties are not impaired. Copper objects can be zincked by immersion in a concentrated and boiling solution of chloride of ammonium, in which granulated or powdered zinc has been placed, or by simply dipping them in a boiling solution of chloride of zinc. Zincked iron is extensively employed for telegraph wires, roofing purposes, water-coolers, etc. J. P. BATTERSHALL.

**Zincog'raphy** [*zinc*, and γράφειν, to "engrave"], the art of producing impressions of prints and other designs on zinc, from which a fac-simile on paper can be made, is very analogous to LITHOGRAPHY (which see). It embraces the processes of *anastatic printing* (*anastasis*, "resuscitation"), *zinc-printing*, *paneicanography*, and *photo-zincography*. In anastatic printing (first used in Germany in 1840) a printed sheet is moistened with water containing nitric acid, which affects only the parts where there is no printing, being repelled from the letters by virtue of the oily matter in them. The sheet is then pressed on a prepared zinc plate, whereby a typographical surface is produced, from which impressions can be printed on paper. *Zinc-printing* consists in first etching designs in the metal with the needle, cleaning them with acid, and covering the entire plate with a layer of fusible metal, which is afterward removed by planing until the etched lines appear at the surface; the plate is then dipped in an acid bath, when the surface of the plate will be dissolved, but not the fusible metal which fills the lines; in this way a relief-drawing, suitable for the printing of maps, plans, etc., can be obtained. In the process of paneicanography, by which crayon drawings, proofs of wood or copper plates, etc., are transferred to a zinc plate, a damp inked roller is passed over the drawing, and powdered rosin then spread on it, which adheres only to the parts that were moistened by the ink. Upon now placing the plate in a bath consisting of diluted nitric acid, the unprotected surface is etched, and a relief surface formed which can be used for printing. Photo-zincography is accomplished by first preparing a photograph, then transferring it to zinc, from which copies can be multiplied as from a lithographic stone; it is based upon the fact that bichromates render gelatine insoluble when a mixture of the two is exposed to the action of light. The paper used is prepared with a solution of bichromate of potash and gelatine, and exposed together with the negative of a drawing or other design to the light, the outline of the same being thus obtained in insoluble lines. On then covering it with printer's ink and wetting it at the back, the soluble portion swells up, and allows of the removal of the ink from this part, but not from the insoluble lines. A copy of the object photographed is thus produced in ink, which can be easily transferred to zinc. J. P. BATTERSHALL.

**Zinc-White.** This is the name of a very large commercial product used as a pigment, formerly made by the combustion of metallic zinc and collection of the fumes, but of late years obtained directly from zinc ores by a process which combines the reduction of the zinc from the ore to a metallic vapor, and the subsequent burning of this vapor in the same apparatus. This operation is conducted in several large establishments in this country on an immense scale, the commercial demand for this pigment having advanced very rapidly of late years. This advance has proceeded from its extensive substitution for *white-lead* in painting woodwork—a substitution due to an increasing appreciation among painters of the deleterious effects of handling the latter pigment. The general plan of the apparatus used consists in a perforated hearth, with a closed ash-pit below, upon which hearth is spread the charge of mixed ore and anthracite coal. The latter is kindled, and air blown in through the ash-pit. The products of combustion, containing an excess of air with vapor of metallic zinc, undergo another combustion after leaving the charge, forming fumes of zinc-oxide, which, after cooling, are caught by being forced through very long bags of some textile fabric, through which the gases gradually filter, leaving the finely-divided oxide within.
HENRY WURTZ.

**Zin'der,** town of Central Africa, dominion of Bornoo, near the frontier of the country of the Tuariks, is surrounded with walls and ditches, which also enclose many gardens and orchards, and carries on a considerable trade. P. estimated at 10,000.

**Zingarel'li** (NICOLÒ ANTONIO), b. at Naples Apr. 4, 1752; was educated in the conservatory of his native city; brought out his first opera, *Montezuma*, in 1781; was appointed chapel-master at the cathedral of Milan in 1792, and at St. Peter's church in Rome in 1804, but was dismissed because he refused to celebrate the birth of the king of Rome with a *Te Deum;* was made director of the music school of San Sebastian in Naples in 1812, and chapel-master at the cathedral in 1816. D. at Naples May 5, 1837. He composed about 40 operas, among which was *Romeo e Giulietta* (1796), and a great amount of church music, but most of it has now fallen into oblivion.

**Zing'el** [Ger.], a name of *Aspro vulgaris* and *A. zingel*, two perch-like fishes of German and French rivers. Both are rather small, but are good food-fishes.

**Zin'nia** [named in honor of Dr. J. G. Zinn, a German savant (1727–59)], a genus of showy American herbs of the composite order, much cultivated in flower-borders. The finest are varieties of *Z. elegans*, a Mexican plant. *Z. multiflora* grows abundantly in parts of the Southern States, where it was doubtless introduced.

**Zins'ser** (FREDERICK), M. D., b. in the Palatinate, Germany, Sept. 22, 1837; studied medicine at the universities of Giessen and Wurzburg, where he graduated in 1861; came to New York in 1862; is a member of the College of Physicians and Surgeons, and of the German Hospital and Dispensary of the City of New York, department of skin and venereal diseases.

**Zin'zendorf, von** (NIKOLAUS LUDWIG), COUNT, b. in Dresden May 26, 1700; was educated at Hennersdorf in Lusatia by his grandmother, an intimate friend of Spener, and afterward (1710–16) in the pædagogium at Halle under the special supervision of Francke. From 1716 to 1719 he frequented the University of Wittenberg, where he studied law; undertook then a journey through Holland, France, and Switzerland, and received in 1721 an appointment in the civil service of the Saxon government, but resigned this office in 1727. In 1722 he bought the estate of Berthelsdorf, near Hennersdorf, and here founded a colony of Moravian Brethren who had emigrated from Bohemia on account of religious persecutions. New colonists of other Protestant denominations, especially Pietists, were added, and the place, which was called Herrnhut, prospered very much. A strong religious life developed, and as it was Zinzendorf's wish to give form and order to this movement, he went in 1734 to Stralsund, passed the theological examination, was ordained in the same year at Tübingen, and began to preach. Having been awakened himself by Spener, practical piety was much more important to him than theological discriminations, and he took pains to avoid conflicts with the established Church. Nevertheless, in 1736 he was banished from Saxony as a dangerous innovator, and was not allowed to return until 1747. In the mean time he visited Santa Cruz and St. Thomas 1740, North America 1741, Livonia and Esthonia 1743, Holland and England 1745, preaching, forming congregations, and founding missons in the various countries. (See MORAVIAN CHURCH.) In 1747 he returned to Herrnhut, and d. there May 9, 1760. Of his numerous works his hymns and *Das gute Wort des Herrn*, a kind of catechism (1739), are the most remarkable. Of the former there is a collected edition by Knapp, *Geistliche Gedichte* (1845). His *Life* has been written by Spangenberg (1772), Varnhagen von Ense (1830), Verbeck (1845), Schrautersbach (1857), Völbing (1850).

**Zi'on,** or **Sion,** a mountain of Palestine, rises 2537 feet above the level of the sea. W. and S. it faces the valley of Hinnom with a steep precipice 300 feet high. On the northern slope stands that part of Jerusalem which was called the "city of David" or the "upper city;" hence Jerusalem was often called the "daughter of Zion."

**Zion,** p.-v. and tp., Stearns co., Minn. P. 471.

**Zion,** tp., Greenville co., Va. P. 1186.

**Zi'onsville,** p.-v., Eagle tp., Boone co., Ind., on Indianapolis Cincinnati and Lafayette R. R., 15 miles N. W. of the former city, has 4 churches, an academy, 2 banks, 1

newspaper, stave and heading factory, 1 wagon manufactory, 1 woollen mill, 2 hotels, and 1 flouring-mill. P. 956. THOMAS F. BRAGG, ED. "TIMES."

**Zir'con** [Cingalese], a silicate of zirconia, occurs in crystals, generally four-sided prisms terminated by four-sided pyramids, and also in grains of a white, red, brown, yellow, and green color, and is found in the sands of the rivers of Ceylon, in the sienite of Norway, at Strontian in Argyleshire, Scotland, and in the auriferous streams of the Croghan Kinshela Mountains in Ireland.

**Zirco'nia,** the earthy oxide contained in the mineral ZIRCON (which see), the dioxide of the metal ZIRCONIUM (which also see), $ZrO_2$.

*Preparation.*—Zircons are powdered—which may readily be accomplished after quenching in water while incandescent—fluxed with 4 parts of a mixture of carbonates of potash and soda with a little saltpetre. Berzelius added pieces of caustic soda during the fusion, using a platinum crucible, taking care to place the soda in the centre of the mass, to save the crucible. A silver crucible may be used, and caustic soda then altogether, for fluxing. Iron crucibles are objectionable, because iron oxides are the most difficult bases to separate from zirconia. The fluxed mass is dissolved in muriatic acid, and the silica separated by evaporation, as usual. From the aqueous solution of the residue ammonia precipitates the zirconia, with ferric oxide. One good method of obtaining the zirconia free from iron is to add tartaric acid before adding ammonia, which will hold the zirconia in solution, and then precipitate the iron with sulphide of ammonium. The filtrate, on evaporation, and ignition to burn off the carbon of the tartaric acid, leaves behind in pure form the *insoluble modification* of anhydrous zirconia. To obtain it in a form soluble in acids, the iron must be separated by another method, that of Hermann. This is by adding sodium hyposulphite and boiling, when zirconium hyposulphite is precipitated, leaving the iron in solution in ferrous condition. The precipitate, dissolved in hydrochloric acid and converted into chloride by continued boiling, is precipitated again with ammonia, which gives zirconia "hydrate" as a jelly. This, well washed with boiling water, dried and *gently* heated, is converted into amorphous zirconium-oxide, white and insoluble in water, but soluble in acids. Its molecular constitution (see VOLUMES, MOLECULAR) is—

$$O_4.2^{Zr}_{26} = 4.348 \left\{ \begin{matrix} \text{Klaproth,} & 4.3 \\ \text{Watts's } \textit{Dictionary,} & 4.35 \end{matrix} \right\}.$$

Heated to incipient redness, it glows brightly, undergoing a molecular change, indicated by an increase of density. It is now—

$$O_4.2^{Zr}_{24} = 5.022 \text{ (Berlin, 4.9).}$$

This is possibly the dominant form, or rather that corresponding to quartz, the insoluble modification of silicon-dioxide. There is, however, a *crystalline* form of zirconia, obtained by Nordenskjöld by fusing with borax, and dissolving out the latter with muriatic acid, which is in transparent, colorless, square prisms, and is—

$$O_4.2^{Zr}_{22} = 5.781 \text{ (Nordenskjöld, 5.742).}$$

This has the Zr condensed 4 diameters below that in the amorphous soluble allotrope, and may correspond to quartz, which latter, however, is $O_4.2^{Si}_{23}$.

Zirconia forms compounds with bases analogous to silicates, and zircofluorides analogous to silicofluorides. (See FLUO-SILICIC ACID; also under ZIRCONIUM.) Indeed, it is quite as well entitled to be called *zirconic acid* as silica to be called *silicic acid*.

*Zirconic "Hydrates."*—The gelatinous precipitate formed by ammonia (see above) dries to a yellowish gummy mass, which, like the "hydrates" of silica (see SILICA, HYDRATES OF), varies in composition. Berzelius found $O_3H_2Zr$, Hermann $O_4H_4Zr$. This is soluble in 5000 parts of water, and Prof. Brush of Yale College has made the remarkable observation that this solution reddens turmeric-paper like an alkali. HENRY WURTZ.

**Zirconium,** an element having characters approaching those of a metal, found principally in the mineral called ZIRCON (which see). Its chemical relations are very close and parallel to the great mineral element *silicon*, which gives to its study great interest. Like silicon—and carbon, which also belongs to the same natural group—it assumes different allotropic forms, widely varying in their physical characters. The amorphous allotrope of zirconium was obtained in 1824 by Berzelius by a method similar to that which yields amorphous silicon, by the action of an alkali-metal on the *zircofluoride of potassium*, $F_6ZrK_2$. It assumes a graphite-like lustre under the burnisher. It is unchanged by ignition apart from the air, but in air burns to zirconia. Its density has not been determined. *Adamantoid zirconium* was obtained by Troost by substituting for the alkali-metal above an excess of metallic *aluminum*, and dissolving out of the fused mass of aluminum the latter metal by muriatic acid. It resembles metallic antimony in appearance, and is very brittle and hard. It is incombustible except by Hare's blowpipe, and soluble with difficulty in acids, except hydrofluoric and *aqua regia*. Density = 4.15, which indicates an approximation to the 4th diametric type (see VOLUMES, MOLECULAR), $\frac{Zr}{28} = 4.077$, which is 4 diameters above that in zirconia which has been ignited. (See ZIRCONIA.) HENRY WURTZ.

**Zirk'nitz** (or **Czirknicz**), **Lake of,** in a deep valley in Carniola, Austria, between Laibach and Trieste, is famous on account of the occasional disappearance of its waters. It is 6 miles long, 3 miles broad, and 56 feet deep. At intervals—generally in August, though not regularly—its waters are entirely drawn off through a number of fissures in its bottom, and a harvest of hay, or even of buckwheat, is gathered in its bed. After the lapse of four or six weeks, or when the wet season sets in, the water begins to pour into the lake from a number of other fissures; but while it generally takes from twenty-two to twenty-five days to empty the lake, it takes often only twenty-four hours to fill it.

**Zis'ka** (JOHN), b. at Trocznow, Bohemia, in 1360; was educated at the court of Prague, and fought with the Teutonic Knights against the Lithuanians and Poles, in Hungary against the Turks, and on the English side in the wars between England and France. He had embraced the doctrines of Huss, and was conspicuous in the great commotion which was caused by the execution of Huss and Jerome. He was present on the famous 30th of July, 1419, when the commotion suddenly burst out into open violence. While a Hussite procession was passing by the town-house of Prague, a stone was thrown from the town-house and hit one of the ministers. In one moment the house was stormed, and the thirteen Roman Catholic magistrates were thrown out of the windows and massacred. The outburst spread rapidly over the whole country. Monasteries and convents were sacked and burnt, monks and priests were burnt at the stake or buried alive, negotiations from the side of Wenceslas and his successor, Sigismund, failed, and under the leadership of Ziska the Hussites formed a fortified camp on the top of Mount Tabor. They were in possession of the city of Prague, though not of the castle, and in order to defend it against the emperor Sigismund, who approached with an army of 30,000 men, Ziska took up a position on the hill of Witkow, just outside the city. He had only 4000 men, but such was the fanatical enthusiasm with which the Hussites fought that the emperor was unable to remove them, and had to retire with an immense loss after a most sanguinary struggle, July 14, 1420; the hill has since that day borne the name of Ziska Hill. In the autumn of the same year Ziska conquered the castle of Prague, but in the next year became blind. While a boy he had lost one eye, and now, while besieging the castle of Raby, also lost the other. But he continued, nevertheless, to command. Such was his knowledge of his country that from the descriptions of the terraine by his lieutenants he was able to make his dispositions and conduct the battle. In 1422 the emperor returned with another great army, and on Jan. 18 the battle took place at Deutschbrod. The emperor was completely routed, and, unable to raise a third army, he now began to negotiate. He was willing to grant liberty of conscience, to make Ziska governor of Bohemia, etc.; but before the negotiations could be brought to a close Ziska d. at Przibislaw Oct. 12, 1424. He was buried at Czaslau with his battle-axe suspended over his coffin, but in 1623 his tomb was disturbed and his bones removed on an imperial order from Vienna.

**Zit'tau,** town of Germany, kingdom of Saxony, at the confluence of the Mandau and Neisse, is surrounded with walls and well built. It contains many educational and benevolent institutions, and is the seat of the linen and damask manufactures of Saxony. Woollens, paper, oil, and iron goods are also manufactured. P. 17,869.

**Zlatoosk',** town of European Russia, government of Orenboorg, on the Ai, an affluent of the Oofa, in the Ural Mountains, is the centre of a rich mining district, and manufactures sword-blades and different articles of steel which enjoy a great reputation. P. 9640.

**Zmeinogorsk',** town of Siberia, government of Tomsk, on the Smievka, is situated at the richest silver-mines of the country. P. 6000.

**Znaim,** or **Znaym,** town of Austria, in Moravia, on the left bank of the Thaya, has large barracks and hospitals, and manufactures of mustard, chocolate, saltpetre, earthenware, leather, and cloth. P. 10,600.

**Zo'an** [Heb., "going out," indicating a frontier city; Coptic, *Gami* or *Dschane*; Arab. *Sân*], the *Avaris* of Manetho and the *Tanis* of the Greeks and Romans, an ancient

city of the Egyptian Delta, in N. lat. 31° and E. lon. 31° 55′, on the right bank of the Tanitic arm of the Nile, some 25 miles from the Mediterranean, and about 40 miles W. of Pelusium. Its high antiquity is incidentally recognized in Num. xiii. 22: "Now Hebron was built seven years before Zoan in Egypt," and perhaps by the same or a kindred people. But by whomsoever founded, it was probably rebuilt by the Hyksos, who made it their capital. The sanctuary of its great temple dates back, it is supposed, to the sixth dynasty (about 2200 B. C., according to Wilkinson, or about 3700 B. C., according to Mariette); and not till the twenty-sixth dynasty, in the seventh century B. C., did the city begin to decline. Strabo, who was in Egypt with his friend the Roman prefect, Ælius Gallus, 24 B. C., speaks of it as "a large city" (*Geog.*, xvii. 1. 20). Josephus, writing about 80 A. D., calls it "a small town" (*Jew. W.*, iv. 11. 5). It was probably the residence of the Pharaoh of the Exodus, and consequently the scene of the "marvellous things" that were done "in the field of Zoan" (Ps. lxxviii. 12), a geographical designation which corresponds exactly to a recently-discovered hieroglyphic inscription. (See Brugsch, *Zeitschr. f. Ægypt. Spr. und Alterthumsk.*, 1872.)—The desolation is now complete, fulfilling the prophetic threat to "set fire in Zoan" (Ezek. xxx. 14). "The field of Zoan" is described by Macgregor (*Rob Roy on the Jordan*, p. 83) as "a black rich loam, without fences or towns, and with only a dozen trees in sight." Close to what was once the Tanitic arm of the Nile, now only a canal, on its eastern bank, stands the miserable little fishing-village of *Sân*. The ruins of the ancient city are a mile away to the E., buried under mounds which rise at one point about 200 feet above the plain. These ruins (more than a mile in extent from N. to S., and about ¾ of a mile from E. to W.) have been carefully explored by Mariette, whose excavations, under the patronage of the Khedive of Egypt, accomplished by the forced labor of 500 men at a time, have thrown much light upon what had been the obscurest portion of Egyptian history. The great temple was one of the grandest in Egypt, with ten at least—if not twelve—obelisks, which were about 5 feet in diameter and from 50 to 60 feet high. The material employed in building was, much more largely than at Memphis or Thebes, the hard granite of the upper Nile, apparently in order to withstand the moister climate of the Delta. The famous Museum at Boolak, near Cairo, has been immensely enriched by the antiquities discovered at Sân. One of the most interesting of these antiquities is the "Canopus Stone," discovered in 1865. It is a limestone slab, six feet high, with a trilingual inscription (hieroglyphic, demotic, and Greek), resembling the Rosetta Stone, discovered by Boussard in 1799. It records a decree of the priests of Egypt assembled at Canopus in the year 254 B. C. Very little new light is thrown upon the history of the Israelites in Egypt. R. D. Hitchcock.

**Zo′ar** [Heb., "the little"], the only one that was spared of the five "cities of the plain." Originally it was called *Bela* (Heb., "swallowed, devoured," Gen. xiv. 2), Jerome says, because, according to Hebrew tradition, it was destroyed for the third time by an earthquake (*Com. in Isaiam*, xv. 5). The four cities that perished were Sodom, Gomorrah, Admah, and Zeboim. In the book of Wisdom, x. 6 (written about 100 B. C.), it is implied that Zoar likewise perished, mention being made of "the fire which fell down upon the five cities." Josephus also speaks (*Jewish War*, iv. 8. 4) of "the faint remains of five cities" as "still discernible." But according to the biblical narrative (Gen. xix.) Zoar escaped destruction in answer to the prayer of Lot, who sought refuge in it, although (Gen. xix. 30) he did not remain there long. It must not be looked for among the hills of Moab. It was, with the rest of the five cities, in the plain or circle (*siccar*) of Jordan (which is not to be identified, as it often has been, with the Vale of Siddim, where the battle occurred), and was near enough to Sodom to be reached between dawn and sunrise. It has generally been supposed that these five cities stood at or toward the southern end of what is now the Dead Sea. Jerome (d. 420 A. D.) evidently thought there was no Dead Sea at all till after the destruction of the cities of the plain (*Heb. Quæst. in Gen.*, xiv. 3). Since it was ascertained how deep the sea is (1316 feet) in its upper part, the theory has been that only the shallow lower third of it (in the autumn only three feet deep) covers the sites of the submerged cities. But there is no scriptural warrant for submersion at all, the Hebrew word constantly employed (*haphak*) indicating earthquake rather; while in Deut. xxix. 23 the picture set before us is of a land of "brimstone, and salt, and burning, that it is not sown, nor beareth, nor any grass groweth therein." As for Zoar, Irby and Mangles (in 1818) suggested its identification with ruins found by them at the mouth of the Wady Kerak, on the E. side of the shallow part of the Dead Sea, and Robinson is inclined to accept the identification. The principal objections are that this locality is not visible, as Zoar appears to have been, from the hill near Bethel (Gen. xiii. 10); nor does it answer very well to the description (Gen. xix. 28) of what was in sight from Hebron; nor could Moses have seen it (Deut. xxxiv. 3) from the top of Pisgah. Accordingly, George Grove, one of the editors of Smith's *Bible Dictionary* (1863), argued in favor of locating the cities of the plain at the northern end of the Dead Sea. And in 1876, Selah Merrill discovered there what he takes to be the remains of the five cities. One of the five tells examined by him, the one nearest the mouth of the Wady Hesban, is called *Ektanu*, a word which has no meaning in Arabic, but may have come from the Hebrew *Katan*, which means the same as *Zoar*. (See *Fourth Statement* (1877) of the American Palestine Exploration Society.)

R. D. Hitchcock.

**Zoar,** p.-v., Franklin co., Mass.

**Zoar,** p.-v., Lawrence tp., Tuscarawas co., O., on Tuscarawas River and Ohio Canal, 65 miles from Cleveland, and on the Tuscarawas branch of Cleveland and Pittsburg R. R., is pleasantly situated, has a meeting-house, school, hotel, woollen-factory, and other business places. It was settled in 1817 by a German community under the leadership of Joseph M. Bäumeler (or Bimeler), who were incorporated in 1833 as "the Society of Separatists of Zoar, O.," more generally known as the Zoar Society. This society holds a tract of land of about 7300 acres in common, through a system based on community of property, having a board of three trustees for its exterior management, and a committee of five, elected annually, for its interior government. P. 326. (See *Communistic Societies of the United States* (1875), by Charles Nordhoff.)

**Zo′diac** [Gr. ζωδιακός], an imaginary zone or belt in the heavens, extending from 9° N. to 9° S. of the ecliptic, and comprising that region of the heavens within which the apparent motions of the sun, moon, and all the greater planets are confined. It is divided into twelve equal parts, called "signs," which are designated by the names of the constellations Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces, which are supposed to have been invented in Egypt, and refer to the division of the seasons and the agriculture of that country. (See Sign and Constellation.)

**Zodiacal Light.** See Appendix.

**Zoë′ga** (Georg), b. at Dahler, Danish province of Jutland, Dec. 20, 1755; studied at the University of Göttingen; visited Italy in 1776, again in 1779, as tutor in a private family, and finally in 1782 with a stipend from the Danish government; embraced Roman Catholicism; devoted himself to antiquarian studies; was made Danish consul-general in Rome, and d. there Feb. 10, 1809. He wrote *Nummi Ægyptii Imperatorii* (1787), *De Origine et Usu Obeliscorum* (1797), and *I Bassi-Rilievi antichi di Roma, incisi da Tom. Piroli* (2 vols., 1808). He also published a catalogue of the Coptic manuscripts in the Museo Borgiano. His *Life* has been written in 2 vols. by Welcker (1819).

**Zo′etrope** [Gr. ζωή, "living," and τροπή, "turning round"], or **Wheel of Life,** a device invented before 1860 by P. H. Desvignes, and at first called mimoscope, by means of which pictured objects seem marvellously endowed with the movements of life. There are several forms of the instrument, in all of which the optical illusion depends upon the principle of the persistence of visual impressions. The phenakistoscope and thaumatrope are in principle precisely the same.

**Zol′licoffer** (Felix K.), b. in Maury co., Tenn., May 19, 1812; received an academical education; became a printer; edited a paper at Paris, Tenn., 1829; published the *Columbian Observer* 1834; was chosen State printer 1835; edited the leading Whig paper of the State, the Nashville *Banner*, from 1842; was State comptroller 1845–49; State senator 1849; member of Congress 1853–59; was an advocate of extreme Southern views, but served as a delegate to the Peace congress of Feb., 1861; became a brigadier-general in the Confederate service, commanding in Eastern Tennessee, Aug. 8, 1861; was defeated at Camp Wild Cat, Ky., Oct. 21, and by Gen. Thomas at the battle of Mill Spring, Ky., where he was killed Jan. 19, 1862.

**Zoll′verein** is the German name of a toll-union between the various states of the German empire, according to which all custom duties along the internal frontiers of the states belonging to the union are abolished, and the revenues proceeding from the custom duties levied along the external frontiers of the union are partitioned among the members according to population. The union was proposed by Prussia in 1827, but not accomplished until 1867, and has proved eminently beneficial by throwing down the vexatious and mischievous barriers which trammelled

all communication in Germany, and by reducing the cost of collecting the revenues.

**Zolotono'sha,** town of Russia, government of Poltava, on a river of the same name, an affluent of the Dnieper, has 6864 inhabitants.

**Zom'bor,** town of Austria, in the Serbian woiwodina, is the seat of several civil, ecclesiastical, and educational institutions, and has extensive silk manufactures and a large trade in corn and cattle. It communicates with the Danube through the Francis Canal. P. 24,309.

**Zon'aras,** b. in Constantinople toward the close of the eleventh century; was private secretary to Alexius Comnenus, but retired during the reign of Calo-Joannes to the monastery of Mount Athos, where he became a monk, and died, it is said, in the eighty-eighth year of his age. In his retirement he occupied himself with literature, and there exist several works by him, both printed and in manuscript. The most important are his *Chronicon* or *Annales*, a history of the world from its creation to 1118, edited by Dindorf (Leipsic, 1868–75), and his *Lexicon*, edited by Tittmann (Leipsic, 1808).

**Zone** [Gr. ζώνη], a part of the surface of a sphere included between two parallel planes. If the planes are secant, the zone has two bases; if one is secant and the other tangent, the zone has but one base; if both are tangent, the zone is equal to the surface of the sphere. If an arc of any curve is revolved about a line exterior to it, the surface generated is called a zone. W. G. Peck.

**Zones.** See Earth, IV., by Prof. A. Guyot, Ph. D., LL.D.

**Zook** (Samuel Kosciuszko), b. in Pennsylvania about 1823; became a practical telegrapher, and made some discoveries in his branch of science; settled in New York City 1848; went as lieutenant-colonel of the 6th New York State militia to Maryland Apr., 1861; was military governor of Annapolis; raised and commanded the 57th New York Vols.; commanded a brigade on the Peninsula; was made brigadier-general Nov. 29, 1862; distinguished himself at Chancellorsville, and was killed during the first day's battle at Gettysburg, July 2, 1863.

**Zoology.** See Appendix.

**Zo'ophytes** [from the Gr. ζῶον, "animal," and φυτόν, "plant"], a term introduced by Cuvier and applied to the lowest primary division of the animal kingdom, including the groups of Infusoria, Entozoa, and Radiaria. Subsequent writers, however, excluded the Infusoria and Entozoa from the zoophytes, and confined the name to animals constructed on the radiated type, and even in this narrow field it has of late fallen almost entirely into disuse.

**Zo'ospores** [from ζωός, "living," and σπορά, "seed"], the name of a certain kind of spores produced by acotyledonous plants, which by being furnished with cilia are enabled to move around for a short time after being discharged from the spore-case of the parent plant. The motion is probably owing to hygrometric and electric changes, but its appearance of spontaneity caused the spores to be mistaken for a long time for animalcules. (See Spores.)

**Zoril'la** ["little fox," a name given in Spanish America to certain skunks, but in many books transferred as a popular name to *Ictonyx* or *Rhabdogale*], a genus of South African mustelids, somewhat resembling the skunk. There is but one species, *Z. striata*, a handsome striped animal, which can emit an intolerable smell.

**Zorn'dorf,** village of Prussia, province of Brandenburg, is famous for the battle fought here on Aug. 25, 1758, between the Russians under Fermor and the Prussians under Frederick the Great; the Russians were defeated.

**Zoroas'ter** [the corrupt Greek and Latin version of the old Persian name *Zarathustra*, which the later Persians altered to *Zerdusht*], the founder of the ancient Persian religion. His family name was *Spitama*, and *Zarathustra* seems to have been a title, meaning "chief," "senior," or "high priest." He was born in Bactria; his father's name was Pourushaspa, and he had a daughter by the name of Pouruchista. But this is all that is known of his personal life. What the old Persian or Greek authors tell about him is mere myth; even the time in which he lived is utterly uncertain, some placing him 500 years before Christ, others 6000 years before Plato. The religious system which he developed is a complete dualism, Ormuzd being the creator and ruler of all that is bright and good, Ahriman the chief of that which is dark and evil. To each of these supreme beings belongs a number of subordinate spirits, Ameshaspentas to Ormuzd, Devas to Ahriman; and all that exists is divided between these two realms. Man has to choose, and according to his choice he will after death go to Ormuzd or to Ahriman; the way to the first is pure thought, pure speech, and pure actions. The only object of worship was fire, the symbol of that which is bright and good, and to fire all temples and altars were dedicated. The priests which maintained the fire and conducted the worship were the Magi. The developments which this system underwent from the time of Zoroaster up to our days are as yet points of contention. The monotheism which is now taught among the Parsees, and according to which Ormuzd and Ahriman are two principles only, not two causes, is by some scholars considered as the original idea of the religion of Zoroaster, while by others it is thought to be a later development.

**Zoroaster, Religion of.** See Zoroaster.

**Zorri'lla y Moral'** (José), b. at Valladolid, Spain, Feb. 21, 1817; educated in the College of Nobles at Madrid; studied law at Toledo and Valladolid; became widely known as a poet by his verses read at the funeral of Larra, Feb. 15, 1837; published *Cantos del Trovador* (3 vols., 1841), *Floras Perdidas* (1843), and *Granada* (2 vols., 1853–54); lived for some years alternately at Brussels and at Paris, and was some time director of the theatre in the City of Mexico during the last government of Santa Anna.

**Zos'imus,** a Greek historian of the fifth century, of whose personal life nothing is known, but whose work, a history of the Roman empire from Augustus to 410, is still extant, edited in 1837 by Bekker. Zosimus was a pagan, and attacks those Roman emperors who were Christians with great acrimony.

**Zosimus,** pope 417–18; declared first Pelagius orthodox, reproached the African bishops for their opposition, and summoned their leader, the deacon Paulinus, to Rome; but afterward, when the bishops procured a rescript against Pelagius from the emperor Honorius, Zosimus turned round and condemned him in an *Epistola Tractatoria*, thus furnishing an interesting illustration of the doctrine of the papal infallibility. His letters are found in Constant's *Epistolæ Romanorum Pontificum*.

**Zouaves** [from the *Zouaoua*, a Kabyle tribe of Algiers], originally bodies of Kabyle infantry mercenaries in the service of the Barbary states; in this sense the name is still employed, Tripoli having some 5000 such zouaves in her service. After the French conquest, the French incorporated in 1830 into the same battalions companies of Frenchmen and Kabyles, dressed in Algerine costume. But afterward the zouaves of the two nationalities were separated. The native Africans are called *Turcos*, and the French in modified African costume are called *zouaves*. Their uniform is very picturesque. The men are selected for their strength, courage, and good appearance. There are four regiments of zouaves, each of four battalions, besides some extra battalions and companies, and nearly as many Turcos. The name in the late civil war was applied to regiments of volunteers in zouave costume.

**Zrin'yi** (Miklós), Count, b. in 1508 of an illustrious Slovak family; fought with great distinction in the Austrian army against the Magyars under Zapolya and the Turks under Solyman II., and became celebrated by his defence of Sziget in 1566. With 3000 men he held the place from Aug. 1 to Sept. 7 against a Turkish force of 65,000 men under Solyman II. and his famous grand vizier, Sokolovich. Solyman died of rage, and the final capture of the castle cost the Turks over 20,000 men. Zrinyi was shot while fighting on the last bastion, and a few moments after the powder-magazine was fired. The place, which was conquered, was absolutely nothing but ruins.

**Zschok'ke** (Johann Heinrich Daniel), b. at Magdeburg Mar. 22, 1771; was educated in the gymnasium of his native city, but left it in 1788, and accompanied for some time a band of strolling actors as their play-writer. Shortly after, however, he went to the University of Frankfort-on-the-Oder, where he pursued various lines of study —theology, philosophy, history, political economy, and belles-lettres—and began to give lectures in 1792. Meanwhile, his dramatic compositions, *Abällino* (1793), *Julius von Sassen* (1796), etc., attracted considerable attention; but in 1795 he wrote against certain religious edicts of the Prussian government, and when he in 1796 applied for a professorship, he was rejected. Leaving Prussia immediately, he settled at Reichenau, canton of the Grisons, Switzerland, and took charge of a large educational institution. The institution prospered, and Zschokke was made a Swiss citizen. Soon he also began to take a most active and influential part in the politics of the country, acting, however, as a mediator rather than as a partisan. In 1798 he removed to Aarau, and was made chief of the department of public education, but in 1801, when the central government in Berne attempted to restore the old federal constitution, he retired from public life and took up his residence at Biberstein. In 1803, however, he was recalled

and made a member of the board of forests and mines, and from that time to his death, at Biberstein June 27, 1848, he continued to hold various positions in the government of the republic. His celebrity, however, and also his influence, rest chiefly on his literary activity. He edited the *Aufrichtigen und wohlerfahrenen Schweizerboten* (1804–07), *Miscellen für die neueste Weltkunde* (1807–13), and *Ueberlieferungen zur Geschichte unserer Zeit* (1817–23), which periodicals were much read; and his *Sämmtliche Werke*, relating to history, political economy, fiction, and devotion, comprise 40 vols. His most celebrated work is *Stunden der Andacht* (1806; twice translated into English, the last time in 1862 by Frederica Rowan, under the title *Meditations on Death and Eternity*). Of his historical works the most remarkable are *Geschichte vom Kampfe und Untergange der schweizerischen Berg- und Waldcantone* (1801), *Geschichte des baierischen Volks und seiner Fürsten* (4 vols., 1813–18), *Des Schweizerlandes Geschichte für das Schweizervolk* (1822; translated into English by F. G. Shaw, New York, 1855). Of his novels (10 vols.) selections have been made and published in English (Philadelphia, 1845; New York, 1848, by Parke Godwin; and London, 1848). His autobiography, *Selbstschau* (1842), has also been translated into English (London, 1845).

**Zuc'caro** (Federigo), b. in 1543; painted the dome of the cathedral of Florence, the Pauline chapel of the Vatican, the grand council-hall in Venice, several rooms in the Escurial; visited Flanders and England, where he painted portraits of Elizabeth, Mary Stuart, and others, and finished the frescoes in the Palazzo Caprarola which his brother (Taddeo Zuccaro, b. in 1529; d. in 1566) had begun. Federigo d. in 1609. Both brothers are curious instances of the decadence of the Italian art in the sixteenth century.

**Zschop'pau,** town of Germany, kingdom of Saxony, on the Zschoppau, has manufactures of linen, lace, woollens, and cotton. P. 7600.

**Zubly** (John Joachim), D. D., b. at St. Gall, Switzerland, Aug. 27, 1724; was ordained in 1744; came soon afterward to America; took charge of the First Presbyterian church at Savannah, Ga., 1760; preached in English and German, and occasionally in French; was active among the "Sons of Liberty" and as a member of the first provincial congress of Georgia 1775; was chosen to the Continental Congress the same year; opposed the Declaration of Independence, after which he suddenly went to Georgia, where he took sides with the Crown and had to conceal himself from popular resentment; was in that city during the siege of 1779, and afterward went to South Carolina, where he d. July 30, 1781. He was a man of learning, and published a number of patriotic discourses.

**Zug,** the smallest canton of Switzerland, nearly in the centre of the country, comprises an area of 85 sq. m., with 20,993 inhabitants, who speak the German language and belong to the Roman Catholic Church. The southern part is mountainous; rearing of cattle and dairy-farming are the principal occupations. The northern part, along the Lake of Zug, belongs to the Swiss plain, and is covered with cornfields, orchards, and vineyards. Some manufactures of paper, silk, and cotton are carried on.

**Zuider Zee.** See Zuyder Zee.

**Zuinglius.** See Zwingli.

**Zu'luland,** the name generally given to the country extending along the Indian Ocean on the south-eastern coast of Africa, from the colony of Natal in the S. to the Bay of Delagoa in the N., from lat. 29° 10′ S. to lat. 26° S., and bounded W. by the Orange River Free State and the Transvaal Republic. The country consists of a low coast-land 120 miles broad, marshy and swampy in the northern part, between St. Lucia River and the Bay of Delagoa, but presenting excellent pasture-plains in the southern part. Behind this coast-land the ground rises through undulating slopes, often covered with forests of timber-yielding trees, into a mountain-range from 6000 to 7000 feet high, which separates the lowland from the high inland plateaus. The soil is generally exceedingly fertile. Rice, sugar, cotton, and all kinds of tropical fruits can be grown advantageously, and it is only in the northern part that the climate is unhealthy and injurious to Europeans. The country is inhabited by independent tribes of Zulu Kaffirs, who, though evincing all the characteristic marks of the negroes, are vastly superior to them in almost every respect. They are described as industrious, trustworthy, cheerful, and kindhearted, except in case of war, when the excitement transforms them into demons. On the Bay of Delagoa the Portuguese have a miserable fort garrisoned by a few mulatto soldiers, and here some trade is carried on, gunpowder, muskets, and cotton manufactures being exchanged for gums, ivory, horn, and gold-dust.

**Zuma,** tp., Rock Island co., Ill. P. 787.

**Zumalacarre'gui** (Tomas), b. near Villa Real, Spain, in 1789; was a leader of guerillas during the Spanish war of independence 1808–14; served under Quesada 1822; was appointed by the pretender Don Carlos general-in-chief of his army Oct., 1833, and conducted its operations with great skill and daring until he was mortally wounded at the siege of Bilbao, June 15, and d. June 25, 1835.

**Zum'bro,** tp., Wabashaw co., Minn. P. 458.

**Zumpt** (Karl Gottlob), b. in Berlin Mar. 20, 1792; studied classical languages and literature at Heidelberg and Berlin, and was appointed professor of Roman literature at the University of Berlin in 1827. D. at Karlsbad June 25, 1849. He published much-esteemed editions of Quintilian, Curtius, several of Cicero's works, etc.; wrote a Latin grammar (1818), which has been translated into English and is still much used; and published numerous essays relating to Roman antiquities and history, among which are—*Annales Veterum Regnorum et Populorum, imprimis Romanorum* (1819), *Ueber den römischen Ritterstand* (1839), *Ueber den Stand der Bevölkerung und die Volksvermehrung im Alterthum* (1841), *Ueber die bauliche Einrichtung des römischen Wohnhauses* (1851).—His nephew, August Wilhelm Zumpt, b. at Königsberg Dec. 4, 1815; studied classical philology at the University of Berlin; was appointed professor at the Friedrich-Wilhelm Gymnasium in Berlin in 1851, and wrote, besides other works, *Ueber die Entstehung und historische Entwickelung des Colonats* (1845), *Commentationes Epigraphicæ ad Antiquitates Romanas pertinentes* (2 vols., 1850–54), *Das Criminalrecht der römischen Republik* (4 vols., 1865–68).

**Zuñiga.** See Ercilla y Zuñiga.

**Zuñi Mountains.** The Zuñi range of New Mexico lies between the 35th and 36th parallels of N. lat., and is intersected by the 108th meridian W. from Greenwich. Fort Wingate is at its north-western end, and old Fort Wingate at its south-eastern. Its length from N. W. to S. E. is 45 miles; its breadth is 20 miles. It rises 3000 feet above the surrounding country, which has a general altitude of 6500 feet. Its summit is broadly arched, and is clothed with timber. The proportions and scenery of the range are not imposing, and it is overtopped by the neighboring volcanic peak of Mount Taylor, but it is of great interest to the student of "mountain-building" on account of its simplicity of structure and its isolation. All about it the rocks lie in level strata; at its base they are bent upward, and they arch over its top in simple curves. At the S. E. end erosion has removed the crest of the arch and exposed the crystalline rocks which underlie the stratified, but at the N. the continuity of the lower strata is unbroken, and they can be traced from side to side. The flexure of the strata is comparatively abrupt on the south-western flank, and they descend with gentle inclination to the N. E. The crest or axis of the fold lies near the south-western base.

G. K. Gilbert.

**Zunz** (Leopold), b. at Detmold, principality of Lippe, Germany, of Jewish parentage, Aug. 10, 1794; studied philology at Berlin; was preacher at the synagogue of Berlin 1820–22; editor of the *Spenersche Zeitung* 1824–32; preacher at the synagogue of Prague 1835–39; director of the normal seminary at Berlin 1839–50, and since 1845 member of the board of commissioners for the educational interests of the Jews in Prussia. His first work, *Etwas über die rabbinische Litteratur* (1818), attracted much attention; also his principal work, *Die gottesdienstliche Vorträge der Juden* (1832), and several other of his writings, *Die Namen der Juden* (1836), *Die synagogale Poesie des Mittelalters* (1855), etc. A collected edition of his works was commenced in 1875.

**Zurbaran'** (Francisco), b. in Spain in Nov., 1598; studied painting under Juan de Roelas at Seville; became an imitator of Caravaggio; executed a notable series of pictures in the cathedral at Seville illustrating the life of St. Peter, and another series of the life of St. Jerome for a monastery at Guadalupe; was employed by many churches at Seville and Madrid, and became royal painter 1650. D. at Seville in 1662. His masterpiece is a *St. Thomas Aquinas received into Heaven*, executed about 1625.

**Zu'rich** [Ger. *Zürich*], canton of North-eastern Switzerland, bordering on the Rhine and on Lake Zurich, comprises an area of 687 sq. m., with 284,786 inhabitants, who speak German and are Protestants. It consists of three elevated valleys, and contains excellent pastures. The soil is not very fertile, but it is cultivated with the utmost care. Corn and wine are produced, though dairy-farming and manufactures are the principal occupations. In all mechanical arts Zurich competes with England, and in some surpasses her; in the building of locomotives the Zurich engineers have outstripped the English.

**Zurich,** town of Switzerland, capital of the canton of Zurich, on the Limmat where it issues from the Lake of Zurich, is well and substantially built, though somewhat old-fashioned in its appearance. It has a university, a public library of 45,000 volumes, a botanical garden, several museums of natural history, and a polytechnic school to which pupils from all Europe gather. Its manufactures comprise silk, cotton, leather, ribbons, lace, etc., and are extensive. P. 21,199; with the suburbs, 56,695.

**Zurich, Lake of,** lake of Switzerland, 23 miles long and 2½ miles broad, is bounded by the cantons of Zurich, Schwytz, and St. Gall, and is celebrated for the picturesque beauty of its scenery.

**Zuri'ta** (GERÓNIMO), b. at Saragossa, Spain, Dec. 4, 1512, son of the favorite physician of Ferdinand the Catholic; educated at Alcalá; became a magistrate and a member of the supreme council of Castile 1543; was employed in diplomatic service in Germany 1543–49; became chronicler of Aragon 1549; subsequently private secretary to the king, and travelled through Spain, Sicily, and Italy in search of historical data. D. at Saragossa Nov. 3, 1581. Author of *Anales de la Corona de Aragon* (6 vols., 1562–79).

**Zuru'ma,** town of Ecuador, South America, on the western slope of the Andes, was formerly an important place, but has now greatly declined, and has hardly 5000 inhabitants, mostly engaged in sugar cultivation and manufacture of preserved fruit and of jewelry.

**Zütphen,** town of the Netherlands, province of Gelderland, on the Yssel, is beautifully situated and well built, though an old city; its walls have been transformed into promenades. It has tanneries, soapworks, oil and paper mills, spinning and weaving factories, carpet manufactories, and a large trade in wood, bark, and grain. P. 15,304.

**Zuy'der-Zee** (*i. e.* "South Sea"), a gulf of the North Sea, land-bound by the provinces of Holland, Friesland, Overyssel, Gelderland, Utrecht, and North Holland. It is 80 miles long and 40 in greatest breadth. The islands Texel, Vlieland, Terschelling, and Ameland, continuations of the general coast-line, lie across its mouth, the communications with the North Sea passing between, the chief of which is that of Helsdeur ("Hell Gate"), between the HELDER (which see) and the island of Texel. The sea is quite shallow, especially in its southern part, and to avoid the difficulties of its navigation to Amsterdam the NORTH HOLLAND CANAL (which see) was constructed. The history of the changes which this sea has undergone is given under the head of INUNDATIONS, MARITIME, by P. CALAND. The Zuyder-Zee receives the waters of the Gueldrian Yssel and of the Amstel, both delta-branches of the Rhine; at the entrance of the latter (scarcely more than a wide canal) into the Y arm the city of Amsterdam, thus deriving its name (the *Dam of the Amstel*), is situated. The Gueldrian Yssel was probably, at a pre-historic date, a principal outlet of the Rhine. (See INUNDATIONS.) It is now comparatively small. The Ij, or Y, *was* a narrow




arm of the Zuyder-Zee, extending westerly from its S. W. corner toward the North Sea coast, to which, by the extension of the Wijkermeer, it approached within about 4 miles, constituting the *neck* or "narrowest part of Holland" (*Holland op Zijn Smalst*). This arm is now drained (see POLDER), the NORTH SEA CANAL (which see) being laid along its length and across the *neck* of Holland.* (See sketch.)

The southern part of the Zuyder-Zee (*shaded* on the sketch), of which the limits are indicated by the islands of Urk and Schakland, has only an average depth of 10 feet. The area is about 487,500 acres (195,000 hectares). It is now contemplated to drain this area, thus recovering to agriculture a surface about ten times as great as that gained from the HAARLEM LAKE (which see) and forty times that derived from the draining of the Y and Wijkermeer. To this end a dike is proposed through the sea, commencing on the W. at Enkhuizen, touching on the S. the island of Urk, and connecting with the eastern shore just S. of the mouth of the Yssel, a length of about 28 miles. Along the inner or southern side of this dike a wide drainage-receptacle (*Boezem Meer*) will be provided, from which powerful steam-pumps discharge the water into the Zuyder-Zee. From the Orange locks of the North Sea Canal a main navigation-canal (*Boezem Kanaal*) will lead by the island of Marken to Enkhuizen, and thence 2 or 3 miles farther N. (to the *Ven*), where a harbor will be constructed which will be the shipping-port of Amsterdam to ports of the Zuyder-Zee, to the Baltic, Norway, etc. Other canals for navigation or drainage will be led through the drained area. The area will be divided into *polders*, along the dikes of which the needed railways and other ways will be laid.

The estimate for the work (which it is supposed will occupy from twelve to sixteen years) is, exclusive of interest, nearly 125 million florins, or 50 million dollars. The project has as yet acquired no legal status. Parties petition the government for the concession of the privilege, with rights to the redeemed land and other allowances, while the government is itself interested in the redemption of an area nearly as large as the province of North Holland. In the sale of the Wijkermeer lands the hectare (2½ acres) brought fl. 2173 ($870), whereas the lands of the Haarlem Lake drainage brought in 1852 but fl. 473. Most of the sea-bottom to be redeemed (the area available, exclusive of canals, dikes, etc., being 176,000 hectares) is believed to be little different from newly-redeemed provinces in Zeeland, and of excellent quality. (Most of the facts concerning the proposed drainage are communicated to the writer by P. Caland, inspector of the Waterstaat, Holland. An article, "The Zuyder-Zee Reclamation," in *Engineering*, Sept., 1870, may be consulted; also *Revue des Deux Mondes*, Nov., 1875; and concerning the Zuyder-Zee, *La Holland pittoresque, Voyage aux Villes mortes du Zuyderzee*, Paris, 1875. This last work is summarized in *Blackwood's Magazine*, Nov., 1875, under "The Dutch and their Dead Cities.")

J. G. BARNARD.

**Zvenigorod'ka,** town of European Russia, government of Kiev, on the Tikitsch, has sulphurous springs in its vicinity. P. 10,010.

**Zvor'nik,** town of European Turkey, eyalet of Bosna, on the Drina, an affluent of the Save, is fortified and defended by a citadel. It has an extensive trade in wood and timber, and lead-mines in the vicinity. Pop. 12,000.

**Zweibrück'en** [Fr. *Deux Ponts*, the "two bridges"], town of Rhenish Bavaria, is finely situated on the Erbach near its influx into the Serre, and is well built, though it is an old city. Its manufactures comprise velvet, plush, cotton fabrics, oil, and leather, and it carries on a brisk trade in wine, corn, and timber. P. 8519.

**Zwick'au,** town of Germany, kingdom of Saxony, is beautifully situated on the Mulde, well built, and the seat of several civil, educational, and benevolent institutions. It has two fine churches with paintings by Wohlgemuth and Lucas Kranach, and many tanneries, breweries, and manufactures of cloth, glass, tobacco, oil, and porcelain, and trade in coal from the neighboring mines. P. 27,322.

**Zwin'gli** (ULRICH or HULDREICH), the Swiss Reformer and patriot, b. in a lowly shepherd's cot at Wildhaus, Toggenburg (canton of St. Gall), of honorable and pious parents, Jan. 1, 1484 (seven weeks after Luther); studied at Wesen, Vienna, 1499–1501, and Bâle, 1502–06; was carried away with the enthusiasm for classical learning, and got an insight into the corruptions of the Church; was ordained priest by the bishop of Constance, and elected pas-

*One of the ancient maps given in the *Atlas universel* (par A. Brué et C. Picquet, Paris, 1820–42) represents Lake Flevo (see INUNDATIONS) as having not only the river Flevium (or *Rheni Ostium Orient*) for outlet into the North Sea about where the northern island-channels now are, but also a *Medium Rheni Ostium* discharging from the Wijkermeer, about where now the North Sea Canal crosses the "neck" of Holland, thus making through the Y and the Wijkermeer another delta-arm of the Rhine. No trace of such an outlet exists, and I find no confirmatory evidence.

tor of Glarus 1506. He studied the Greek New Testament very carefully, and copied it with his own hand; preached against the mercenary service of his countrymen; in 1516 accepted a call to St. Mary's at Einsiedeln, and began to attack superstitious practices, but with the consent of his superiors; he even received for a while, as one of the most popular preachers, a pension from the papal nuncio in Switzerland to aid him in his studies and to secure his political influence. In Dec., 1518, he was called to the cathedral at Zurich, where he labored till his death. He preached "Christ from the fountains" and "inserted the pure Christ into the hearts;" broke loose gradually from Romanism; introduced the Reformation in Zurich 1524, after some public disputations with the champions of the old system; led the Reform movement in the other German cantons of Switzerland; attended the conference at Berne 1528, which resulted in the abolition of the mass. He was invited to a personal conference with Luther and Melanchthon at Marburg Sept., 1529, to adjust the only serious doctrinal difference between them on the Eucharistic Presence. He counselled energetic measures for the promotion of the Reform in his native land, but was defeated by the policy of hesitation which prevailed in Berne. He also entered into bold political combinations with Philip of Hesse for the triumph of the Protestant cause in Germany, and addressed the emperor of Germany and the king of France with a confession of his faith. But he was cut down in the midst of his career. At the outbreak of the war between the Roman Catholic and Protestant cantons he accompanied the Zurich regiment as chaplain, according to Swiss custom, and was pierced by a lance in the disastrous battle at Cappel, Oct. 11, 1531, while stooping to comfort a dying soldier. His last audible words were, "What of that? They can indeed kill the body, but they cannot kill the soul." His remains were burned, and the ashes scattered to the four winds. A plain monument in granite erected in 1838 marks the spot where he died.

Zwingli was a bold Reformer, an able scholar, an eloquent preacher, a patriotic republican, and far-sighted statesman. He lacked the genius and depth of Luther and Calvin, the learning of Melanchthon and Œcolampadius, but he was their equal in honesty of purpose, integrity of character, heroic courage, and devotion to the cause of Reformation, and surpassed them in liberality. His prominent intellectual trait was clear, strong common sense. He had no organ for the mystic element in religion. He loved music and poetry, but in public worship he favored puritanic simplicity, and removed all pictures from the churches to prevent the temptation to idolatry. In his theological views he was more radical than Luther, and departed farther from the mediæval traditions. He differed chiefly from his view of the real presence of Christ's body and blood in the sacrament, and held this ordinance to be merely a commemoration of the atoning death of Christ: but notwithstanding this difference he offered him with tears the hand of brotherhood, which Luther refused. In some articles he was ahead of his age, and held opinions which were then deemed dangerous and heretical. He had a milder view on original sin and guilt than the other Reformers, and believed that all infants dying before the age of responsibility, whether baptized or not, and all the nobler heathen who lived up to their standard of virtue and longed after the true religion, are saved by the grace of Christ, which may operate upon the heart without the ordinary means and visible signs. His principal works are a *Commentary on the True and False Religion* (1525), a sermon *On Providence* (preached at Marburg, 1529), his *Confession of Faith*, addressed to Charles V. at the Diet of Augsburg (1530), a similar *Exposition of Faith*, addressed to Francis I. of France (July, 1531, three months before his death). This last document is clear, bold, spirited, and full of hope for the triumph of the truth, warns the king against the slanderous misrepresentations of Protestant doctrines, and entreats him to give free course to the gospel, and to forgive the boldness with which he dared to approach His Majesty. A few years afterward (1536) Calvin dedicated in a most eloquent preface his famous *Christian Institutes* to the same monarch, but with equal want of direct success. It is questionable whether he ever read either document. Zwingli represents only the first stage in the history of the Reformed Church. His work was completed after his death by his successor, Bullinger, at Zurich, and still more by Calvin at Geneva.

*Literature.*—*H. Zwinglii Opera*, ed. Schuler and Schulthess (Zurich, 1828–42, 8 vols.); a popular edition of his works by Christoffel (Zurich, 1843 *seq.*, 15 vols.); *Biographies* of Zwingli by Myconius (1536), Nüscheler (1776), Hess (1811; trans. by Aiken, London, 1812), Schuler (1819), Hottinger (1843; trans. by Th. C. Porter, Harrisburg, 1856), Robins (in *Bibliotheca Sacra* for 1851), Röder (1855), Christoffel (1857; trans. by John Cochran, Edinburg, 1858), Güder (in Herzog's *Encykl.*, 1864), and especially Mörikofer (*Ulrich Zwingli nach den Quellen*, Leipsic, 1867–69, 2 vols.). On the theological system of Zwingli see Zeller, *Das theolog. System Zwingli's* (1853); Siegwart, *Ulrich Zwingli der Charakter seiner Theologie* (1855); Spörri, *Zwingli-Studien* (1866). Compare also Merle d'Aubigné's *History of the Reformation*, 4th vol.; Hagenbach, *Geschichte des Reform.* (1870, pp. 183 *seq.*), and Fisher, *The Reformation* (1873, pp. 137 *seq.*).

PHILIP SCHAFF.

**Zwinglians.** See ZWINGLI.

**Zwir'ner** (ERNST FRIEDRICH), b. at Jakobswald, Silesia, Feb. 28, 1802; studied at the building-school of Breslau, afterward at the architectural academy of Berlin; worked several years under Schinkel, and was appointed in 1833 architect to the cathedral of Cologne. He finished the restoration of the old building and erected the transept and the northern and southern portals. He also built a number of villas, palaces, and churches in the regions along the Rhine. D. at Cologne Sept. 22, 1861.

**Zwol'le,** town of the Netherlands, capital of the province of Overyssel, on the Zwarte-Water, is one of the finest and handsomest cities of the country, with broad and straight streets and many public squares and promenades planted with trees. It is the seat of many educational and benevolent institutions, and has extensive manufactures of oil, beer, spirits, linens, and iron goods. By canals it communicates with the Yssel and Vechte, and has a trade in corn, butter, cheese, cattle, fish, and oysters. P. 21,329.

**Zygade'nus,** or, less correctly, **Zygabenus** (EUTHYMIUS), a Byzantine theologian of the twelfth century, and "the last of the Greek commentators." He was monk of a convent dedicated to the Virgin Mary near Constantinople, and flourished under Alexius Comnenus (1081–1118 A. D.), at whose request he wrote his *Panoply against all Heresies*. His commentaries on the Psalms and Gospels are still referred to by scholars. Other commentaries (on the Pauline and Catholic Epistles), and other works (including letters), are extant in manuscript in the Vatican.

R. D. HITCHCOCK.

**Zygæn'idæ** [Lat. *Zygæna*—Ζύγαινα, from ζυγόν, "yoke," the ancient name—a name of the typical genus], a family of selachians of the order Squali, and containing the hammer-headed sharks. The body is moderately elongated, and like that of the typical sharks; the scales are rhomboid or leaf-like; the head is depressed, transverse, and extended outward or sidewise to a greater or less extent; the eyes are lateral and near the angles of the lateral extension of the head, and provided each with a nictitating membrane; the nostrils are developed in the front of the head; the mouth is inferior and convex forward; the teeth are moderate and in several rows (in all the known species nearly alike in both jaws, oblique and with a notch); the branchial apertures are five, of moderate size, and the last are above the pectoral fins; the spiracles are nullified in the adult; the dorsal fins are two, the first between the pectorals and ventrals, the second above the anal; the anal is normally developed; the caudal elongated, and with a well-developed liver-lobe; the pectoral fins are moderate; the ventrals small. The family is anomalous by reason of the peculiar extension of the sides of the head; this extension is carried to its maximum in the *Eusphyra Blochii* (*Zygæna laticeps* of some authors), and is least developed in the *Reniceps tiburo;* in the former it is T-shaped, and in the latter kidney-shaped. The common hammer-headed shark (*Sphyrna zygæna* = *Zygæna malleus*) exhibits an intermediate condition. Five species are known, which by some authors are combined under one genus, and by others are differentiated into three genera—*Eusphyra, Sphyrna*, and *Reniceps*. The *Sphyrna zygæna* is not uncommon on the coasts of the U. S., and the *Reniceps tiburo* is an occasional visitor. (See, also, HAMMER-HEAD.) THEO. GILL.

**Zymosis.** See ZYMOTIC DISEASES.

**Zymot'ic Diseases.** (See definition and list of, in article on NOSOLOGY; see also GERM THEORY OF DISEASE.) The so-called zymotic diseases are characterized by their division into successive periods and more or less regular sequence of symptoms and uniform duration. The period between exposure to the source of disease and its final development is termed the stage of "incubation" or "formative stage," and it is especially during this period that the morbific matter has multiplied by zymosis or ferment. The "germ theory," which has many supporters, assumes that each zymotic disease has peculiar cellular or organized vitalized elements, and that each, by its individual peculiarities of development, determines the stages and symptoms of the sickness which its access to the blood has created.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

# APPENDIX.

[EMBRACING SUPPLEMENTARY ARTICLES AND ARTICLES RECEIVED TOO LATE FOR INSERTION IN THEIR ORDER.]

## A.

**Aall** (JAKOB), b. at Porsgrund, Southern Norway, July 27, 1773; studied theology at the University of Copenhagen, afterward natural history and mineralogy at the mining school of Freiberg; settled in 1799 on his estate, Näs Ironworks, near Arendal, and divided his time between the development of his extensive possessions, public business, and literary occupations. He was one of the most prominent among the representatives who assembled at Eiswold in 1814 and formed the present free Norwegian constitution, and he sat in the Storthing from 1816–30. D. Aug. 4, 1844. His *Erindringer som Bidrag til Norges Historie fra 1800 til 1815* (3 vols., 1844–45) is one of the principal sources of the history of Norway during that period. He also published a translation of Snorre Sturleson's *Heimskringla* (2 vols., 1838).

**Aba'no, d'** (PIETRO), also called PETRUS DE APONO or DE PADUA, b. in 1246 at Abano, near Padua; studied Greek at Constantinople, mathematics at Padua, and medicine at Paris, and settled at Padua, where he taught alchemy and astrology according to the methods of Averroës, and practised medicine, also according to Arabic methods, with such success that he could charge Pope Honorius IV., who called him to Rome to consult him, 400 ducats a day. Envious of his fame and riches, the clergy denounced him as a sorcerer, as possessor of the philosopher's stone, etc., and the Inquisition sentenced him to be burnt. He d., however, a natural death in the dungeon, in 1315 or 1316, and his corpse was rescued by a friend, but his image was burnt in the public square. His principal work, *Conciliator differentiarum, quæ inter philosophos et medicos versantur*, has often been reprinted.

**Abbe** (CLEVELAND), M. A., b. in New York Dec. 3, 1838; graduated in 1857 from the New York City Free College; studied mathematics, astronomy, and meteorology; taught mathematics at Ann Arbor, Mich., and Cambridge, Mass.; was employed 1860–64 by the U. S. Coast Survey; visited Pulkova, Dorpat, and other European observatories 1864–66, and was appointed director of the observatory of Cincinnati in 1868, and of the government weather bureau in 1871. Among his numerous publications and contributions to scientific papers are—*Dorpat and Pulkova* (1867), *Annual Reports at Cincinnati* (1868–70), *Weather Bulletin of Cincinnati Observatory* (1869–70), *Solar Spots and Terrestrial Temperature* (1869), *Suggestions on the Use of Weather Reports* (1871), *The Nova Scotia Hurricane of Aug. 23, 1872, The Aurora of April 7, 1874*, etc.

**Ab'bot** (JOEL), M. D., b. Mar. 17, 1766, at Bridgefield, Conn., the son of a physician; commenced to study medicine about the year 1790; removed to Georgia, and commenced to practise in 1794; in 1809 was elected a member of the State legislature, and sat in Congress 1816–25; in 1820 was appointed by the Georgia Medical Society a delegate to assist in forming a national pharmacopœia. D. Nov. 19, 1826, at Lexington, Ga. PAUL F. EVE.

**Abbot** (JOSEPH HALE), b. at Wilton, N. H., Sept. 26, 1802; graduated at Bowdoin College 1822; was tutor there 1825–27; professor of mathematics and of modern languages at Phillips Academy, Exeter, N. H., 1827–33; principal for several years of a ladies' seminary at Boston, and subsequently of the Beverly High School; was long the recording secretary of the American Academy of Arts and Sciences, to whose *Transactions* he contributed papers on pneumatics and hydraulics; wrote in favor of Dr. Charles T. Jackson in the "ether controversy," and was an assistant of Dr. J. E. Worcester in the preparation of his *Dictionary*. D. at Cambridge Apr. 7, 1873.

**Ab'bott** (AUSTIN), son of Jacob, b. at Boston, Mass., Dec. 18, 1831; educated in New York City; was admitted to the bar about 1852; practised his profession in partnership with his brother, Benjamin Vaughan, and attained high reputation as a consulting attorney. He has published two novels, *Conecut Corners* and *Matthew Caraby*, in which he was assisted by his brothers, and has aided Benjamin in the preparation of his legal publications.

**Abbott** (BENJAMIN VAUGHAN), b. at Boston June 4, 1830, a son of Rev. Jacob Abbott; was admitted to the bar of New York in 1851, and formed a partnership with his younger brother, Austin. Conjointly, they published *Admiralty Reports* (1857), *C. P. Reports* (8 vols.), *Digest of U. S. Statutes and Reports, 1789–1867* (4 vols.), *Digest of the Law of Corporations* (2 vols., 1869), etc., and wrote much for the law magazines.

**Abbott** (EDWARD), son of Jacob, b. at Roxbury, Mass., July 15, 1841; educated in New York City; wrote several religious books for children, a *Paragraph History of the U. S.* (1876), and other historical treatises, and is the principal editor of the *Congregationalist* newspaper.

**Abbott** (EMMA A.), b. in Chicago Dec. 9, 1849; appeared as a public singer when only nine years old, and her musical gifts happened to attract the kind attention of Miss Clara Louise Kellogg in Toledo, O., who sent her to New York for musical instruction under Signor Errani. Her talent gradually developed, and she was afterward engaged as soprano of Dr. E. H. Chapin's church on Fifth Avenue. To finish her education she went in 1872 to Europe, her expenses being assumed by the members of Dr. Chapin's congregation; studied in Milan under San Giovani, and in Paris under Wartel, and during the four years of absence won the praise of some of the finest critics in Europe—Patti, Gounod, Titiens, Baroness Rothschild, etc. Feb. 26, 1874, she married in London, Eng., Mr. E. J. Wetherell, a native of Massachusetts, and May 2, 1875, she made her début as a dramatic singer at the Covent Garden Theatre in London in Donizetti's popular opera, *The Daughter of the Regiment*. After visiting several of the largest cities of Great Britain, singing both in concerts and operas, she returned in Dec., 1876, to New York, and made her American *début* in Chickering Hall Feb. 7, 1877.

**A'begg** (JULIUS FRIEDRICH HEINRICH), b. Mar. 27, 1796, at Erlangen, Bavaria; studied jurisprudence at various German universities, and was appointed professor in 1821 at Königsberg, in 1826 at Breslau, where he d. May 29, 1868. He was a very prolific writer. *Lehrbuch des Criminalprocesses* (1826), *Versuch einer Geschichte der preussischen Civilgesetzgebung* (1848), *Entwurf einer Strafprocessordnung für den preussischen Staat* (1865), are his principal works. Both directly and indirectly he exercised great influence on the criminal legislation of Prussia, Saxony, Bavaria, Würtemberg, Baden, and Norway.

**A'bich** (WILHELM HERMANN), b. in Berlin Dec. 11, 1806; studied natural science at the university of his native city; travelled in Italy and Sicily, and published *Erläuternde Abbildungen von geologischen Erscheinungen, beobachtet am Vesuv und Aetna 1833 und 1834* (1837), and *Ueber die Natur und den Zusammenhang der vulkanischen Bildungen* (1841); was appointed professor of mineralogy at Dorpat in 1842, and undertook extensive explorations in the Caucasus, Armenia, and Northern Persia, the results of which he communicated partly in the annals of the Academy of St. Petersburg, partly in independent works, the principal of which are—*Ueber die geologische Natur des armenischen Hochlandes* (1843), *Vergleichende geologische Grundzüge der kaukas.-armenischen und nord-persischen Gebirge* (1858), *Sur la Structure et la Géologie du Daghestan* (1862), *Die Schlammvulkane der Kaspischen Region* (1863).

**Acanthuridæ.** See TEUTHIDIDÆ, in CYCLOPÆDIA.

**Achard'** (FRANZ KARL), b. in Berlin Apr. 28, 1753; studied physics and chemistry, and published *Vorlesungen über Experimentalphysik* (4 vols., 1791–92); made extensive researches and experiments with reference to the production of sugar from the beetroot, the results of which he published in 1799–1800, and received from the Prussian king the estate of Cunern in Silesia for the purpose of establishing there a beetroot-sugar manufactory; succeeded in 1806 in developing the true practical process of manufacturing, and brought the establishment into splendid condition, especially during the enforcement of the continental system; wrote *Die europäische Zuckerfabrikation aus Runkelrüben* (3 vols., 1809). D. Apr. 20, 1821.

**Achil'les Ta'tius,** a rhetorician of Alexandria, lived probably in the fifth or sixth century of our era, and wrote a love-story, *History of Leucippe and Clitophon*, which has come down to us. The story is tedious, the characters insipid, and the style affected, but the book contains much curious information on Greek life and taste at that time. Edited, with commentary, by Fr. Jacobs (2 pts., 1821), and with revised text by Hercher in 1857, translated into English by A. H. (Anthony Hodges, Oxford, 1638). There exist some fragments of an astronomical treatise whose author bears the same name, but whether he is the same person is doubtful.

**Acipenseridæ.** See Sturgeon, in Cyclopædia.

**Acronuridæ.** See Teuthididæ, in Cyclopædia.

**Ad'albert,** a descendant of the famous Saxon family, the counts of Wettin; was appointed archbishop of Hamburg and Bremen—to which diocese the whole of Scandinavia belonged—in 1043 by the emperor Henry III., and in 1050 Leo IX. made him legate to the North. Endowed with a powerful intellect and an irresistible eloquence, and possessed of a vast ambition, he formed a plan for combining Germany and Scandinavia into a northern patriarchate—a plan which, if realized, would have changed not only the history of Germany, but probably that of the Roman Catholic Church. But all his exertions were frustrated by the resistance of the Norwegian king Harald, by the intrigues of Cardinal Hildebrand, and by the death of his great patron, Henry III. He now confined himself to German politics, and gained such an ascendency over the young Henry IV. that for years he was the actual ruler of the empire. In 1066 his enemies, the archbishops of Mayence and Cologne, succeeded in expelling him from the court; the Billmeyers, a rival Saxon family, invaded his territory; and the Slavs burnt down Hamburg. But Adalbert came victorious out of all his trials. In 1069 he returned to the imperial court, and vindicated himself in his position till his death, Mar. 16, 1072. (See Grünhagen, *Adalbert, Erzbischof von Hamburg*, 1854.)

**Adam of Bremen** (Adam Bremensis), the author of a history in four books *Of the Propagation of the Christian Religion in North Germany and Scandinavia* (the Bremen and Hamburg archbishopric) from the time of Charlemagne down to Henry IV., to which work is added *A Geographical Description of Denmark and the Countries beyond Denmark* (Sweden, Norway, Iceland, Greenland, the Faröes, etc.). The year of his birth is not known, but he was invited from Magdeburg to superintend the high school of Bremen, and all the schools of the Bremen church, in the year 1067. He was one of the best educated men of his time. He was thoroughly acquainted with the Church Fathers, such as Hieronymus, Ambrosius, Orosius, Cassiodorus, Gregory of Tours, Gregory the Great, and Beda. He had diligently studied the heathen poets, Virgil, Horace, Juvenal, Perseus, and Lucan, who were his favorites. Among the prose-writers he gave special attention to Sallust, Cicero, Macrobius, Solinus, and Martianus Capella. With such preparation he went to work, toward the close of his life, to write the history of the Church of the North. In order to get the facts, he went personally to Denmark, where he visited Svend Estridson, "who knew the history of the barbarians by heart, as if it had been written." Adam succeeded in getting at all the facts, and produced, writing in Latin, the most complete and the most reliable work on the propagation of Christianity in the North that we have. The appendix to his work, which gives a pretty complete geographical description of the North, is especially valuable, for it contains a distinct mention of America, which had been discovered by the Norsemen; and it is not beyond the range of possibilities that Columbus, who was a close student, had read Adam's work, and in it found good reasons for undertaking a voyage to Iceland in 1477. After Adam has described Iceland and Greenland he says: "Besides he (Svend Estridson, king of Denmark and nephew of Canute the Great) mentioned another land, which had been discovered in this ocean (the Atlantic), which is called Vinland, because the vine, producing excellent wine, grows there spontaneously; and corn grows there abundantly without being sown. This we know, not from fabulous conjecture, but from positive statements of the Danes." Adalbert, archbishop of Bremen, died in 1072, and Svend Estridson in 1076. Adam of Bremen's book being written after Adalbert's death, and before the death of Svend Estridson, it must have been composed some time between 1072 and 1076. Whether Adam himself died immediately after the completion of his celebrated work is not known. According to the Church Book of Bremen, he died on Oct. 12, but the year is not given. He was buried in a grove that was once his property, but which he had donated to the cloister of Romeslo. The oldest translation of his work is into French by De Chastelus of Saumur in the year 1796. It was translated into German by Miesegaes (1825) and by Laurent (1850). The geographical appendix was translated into Swedish by Peringskjold in 1817, and into Danish by Suhm in 1790. The whole work appeared in a Danish translation in Copenhagen by P. W. Christensen in 1862. There is yet no English version of the book, so far as we know. R. B. Anderson.

**Ad'ams** (Charles Francis, Jr.), b. at Boston, Mass., May 27, 1835; graduated at Harvard 1855; was admitted to the bar 1858; served as an officer of cavalry in the civil war, rising to the brevet rank of brigadier-general; has since taken a prominent part in the discussion of social, economical, and political questions; has written on railroad management in the *North American Review*, and was appointed railroad commissioner for Massachusetts in 1869. Author of *Chapters of Erie* (1871).

**Adams** (Henry Brooks), son of Charles Francis, b. at Boston, Mass., Feb. 16, 1838; graduated at Harvard 1858; was private secretary to his father when minister to England; became assistant professor of history at Harvard 1870, and was editor of the *North American Review* from 1870 to Oct., 1876.

**Adams** (Julius W.), son of Julius Walker, b. in Westfield, Mass., Apr., 1840; graduated at U. S. Military Academy June, 1861, and entered the army as second lieutenant of infantry; served at West Point as assistant instructor of infantry tactics till June, 1862, when he joined his regiment; at the battle of Gaines's Mill, June 27, he was severely wounded and taken prisoner; exchanged and promoted to be captain Aug., 1862, he rejoined his regiment, and served with distinction at Fredericksburg, Chancellorsville, and at Gettysburg, where he commanded his regiment, until finally struck down at Cold Harbor, Va. D. from effects of wounds and exposure Nov. 15, 1865, at Brooklyn, N. Y.

**Adams** (Julius Walker), b. in Boston, Mass., Oct. 18, 1812; entered the U. S. Military Academy June, 1830; assistant engineer of Stonington and Providence R. R. 1832, Norwich and Worcester R. R. 1836, Western R. R. of Massachusetts 1839, Albany and Schenectady R. R. 1842, U. S. dry dock, Brooklyn navy-yard, 1844, Cochituate waterworks, Boston, 1846; superintending engineer New York and Erie R. R. 1846; chief engineer Central R. R. of Kentucky 1852, Memphis and Ohio R. R. 1855; engineer for establishment of a system of sewers in Brooklyn, N. Y., 1856; engineer of New Haven waterworks 1860. Served with credit as colonel of the 67th New York Vols., and wounded at Fair Oaks. Since then has been engaged in many important hydraulic works; chief engineer city of Brooklyn; past president American Society of Civil Engineers; member of New York Academy of Science; author of various scientific papers.

**A'delaer** (Cort Sivertsen), b. at Brevig, Norway, Dec. 16, 1622; served in the Dutch navy under Tromp 1637–45; entered the Venetian service, and distinguished himself greatly in many actions; broke (May 13, 1654) with a single ship through a Turkish fleet consisting of 67 galleys stationed in the Dardanelles, and sank or burned 15 of the enemy's vessels; left Venice in 1661, and was placed at the head of the Danish navy in 1663, which he remodelled after the Dutch fashion. D. Nov. 5, 1675.

**Æ'gis,** the shield of Zeus, from αἴξ, a "she-goat," so called because, in his contest with the Titans, Zeus wore the hide of the goat Amaltheia, which had suckled him in his infancy, together with the head of the Gorgon.

**Ælia'nus** (Claudius), b. at Præneste; lived in Rome; flourished in the second century, and wrote several works in Greek, of which his *Varia Historia*, *De Animalium Natura*, and some *Epistolæ* are still extant, edited by Hercher (Paris, 1858), the *Varia Historia*, with commentary, by Perizonius (1701), the *De Animalium Natura* by Fr. Jacobs (1832, 2 vols.).

**Æpi'nus** (Franz Ulrich Theodor), b. at Rostock Dec. 13, 1724; studied medicine, physics, and mathematics; became professor of physics in St. Petersburg in 1757; was appointed teacher of physics to the czarowitz Paul, and superintendent of the normal schools in Prussia. D. at Dorpat in 1802. He improved the microscope, invented the electrophorus, discovered the electrical polarity of tourmaline, and wrote *Tentamen Theoriæ Electricitatis et Magnetismi* (1759), *Réflexions sur la Distribution de la Chaleur sur la Surface de la Terre* (1762), *Description des nouveaux Microscopes* (1789), etc.

**Afana'sieff** (Alexander Nikolaievitch), b. at Moscow in 1826; studied at the university of his native city; was secretary to the council of magistrates there. D. Oct., 1871. In 1863 he published a collection of Russian popular tales in 4 vols., and in 1869 a representation of the views of nature entertained by the ancient Slavs (3 vols.).

**Agobard′,** b. in 779, a Spaniard by descent; was ordained a priest in 804 by Archbishop Leidrad of Lyons; became his coadjutor in 813, his successor in 816. D. June 6, 841. He may be characterized as one of the men of Charlemagne, as representative of his ideas politically and theologically. His writings, which were collected and published in Paris by Masson in 1605, and by Balluze in 1666, were directed against the idea of the verbal inspiration of the Bible, against the worship of images, against the belief that hail and thunder storms were raised by sorcerers, against ordeals and against adoptionism, etc. A treatise by him against the Jews was translated into German, 1852. See Hundeshagen's monograph on the *Life and Writings of Agobard* (1831).

**Agoult′, d'** (Marie Catherine Sophie), Countess, b. in 1805 at Frankfort, whither her father, Count de Flavigny, had emigrated during the Revolution; was educated in Paris, and married in 1827 Count d'Agoult, who died in 1856. Under the pseudonym of "Daniel Stern" she wrote a number of novels and literary reviews, a volume of moral and political aphorisms, *Esquisses morales* (1849), and *Histoire de la Révolution de 1848* (2 vols., 1851).

**Aguesseau′, d'** (Henri François), b. at Limoges, department of Haute-Vienne, France, Nov. 27, 1668; studied law, and was appointed advocate-general in 1690, and procureur-general in 1700, to the Parliament of Paris, in which positions he acquired great reputation as an eloquent orator, a consummate jurist, and a man of perfect probity. In 1717 he became chancellor, but resigned in 1718 on account of his opposition to Law. In 1720 he was recalled, but resigned again in 1722 on account of his opposition to Cardinal Dubois. Once more, in 1737, he was installed in his chancellorship, and retained it till 1750. D. Feb. 9, 1750. His collected works were published in 16 vols. in Paris (1819–20). His *Lettres inédites* were published in 1823 (2 vols.).

**Ai′rey** (Richard), Baron, b. at Newcastle-on-Tyne, England, 1803; educated at the Royal Military Academy at Sandhurst, and entered the British army as ensign in 1821, rising through successive grades to be colonel in 1851; served on staff and regimental duty; appointed deputy adjutant-general 1838, military secretary to commander-in-chief 1852; appointed major-general in 1854, and commanded brigade in Crimean war, but after disembarkation of the army served as quartermaster-general during the campaign, and filled that office at the Horse Guards from 1857 to 1865; was governor and commander-in-chief of Gibraltar 1865–70, and adjutant-general to the forces 1870–76. In 1862 he became lieutenant-general, and general in 1871. He also held in succession the colonelcy of the 17th and 7th regiments; was created a K. C. B. in 1855; further honored with G. C. B.; and in 1876 was raised to the peerage, with title of Baron Airey.

**Alcmæon′idæ, The,** one of the most prominent families of ancient Athens, were expelled from the city in 596 B. C., their chief, Megacles, having committed sacrilege by allowing Cylon and his partisans to be massacred, though they had sought refuge in the temple of the Eumenides. The family went to Phocis, but its immense wealth and its connections with some of the most powerful families in Greece enabled it to return to Athens after an exile of about thirty years. Then followed the long and turbulent contest with Pisistratus, in which the Alcmæonidæ were once more driven from Athens. During this their second exile they spent a great deal of their wealth in rebuilding the temple of Apollo in Delphi, which was burnt down in 548 B. C., and the magnificence with which they accomplished this great undertaking made them so popular throughout all Greece that the Spartans finally restored them by armed force. Among the famous members of the family were Clisthenes, Pericles, and Alcibiades.

**Al′cock** (Sir Rutherford), b. in London in 1809; was a surgeon in the navy in Portugal 1833–34, inspector of hospitals under Sir Evans in Spain 1835–37, auditor of accounts of the English-Spanish legion 1839–44, consul at Foo-Chow, Shanghai, and Canton 1846–59, minister to Japan 1859–62, minister to China 1865–71, and published *Medical History of the British Legion in Spain* (1838) and *The Capital of the Tycoon* (2 vols., 1863).

**Alexan′der** (James Edward), b. in Scotland in 1803; served in the Burman war 1825, in the Russian war against Turkey 1829, under Dom Pedro in Portugal 1834, in Canada 1839, in the Crimean war 1858, in the Maori war 1863, and published *Travels from India to England* (1827), *Expedition into the Interior of Africa* (1838), *Incidents of the late Maori War* (1863).

**Alexander** (William Lindsay), D. D., b. at Edinburgh, Scotland, Aug. 24, 1808; educated at the universities of Edinburgh and St. Andrew's; became classical tutor in Lancashire College, and subsequently (1835) a Congregational minister at Edinburgh; professor of theology 1854, and a member of the Old Testament revision company 1870. Author of several doctrinal and miscellaneous works, including a *Life of Dr. Wardlaw* (1856) and *Christian Thought and Work* (1862), and was the editor of the 3d ed. of Dr. Kitto's *Biblical Cyclopædia* (3 vols., 1865–66).

**Algazza′li** (Abu Hamed Mohammed), b. at Tus, Persia, in 1058; taught philosophy, first in Bagdad, then in Nishapoor, where he d. in 1111. He was one of the most prominent philosophers of the Arabian literature, and a very prolific writer. Several of his works have been translated into French. (See Lewes's *Biographical History of Philosophy.*)

**Al′ison** (Sir Archibald, Jr.), Bart., son of the eminent historian, b. at Edinburgh Jan. 21, 1826; educated in the universities of Glasgow and Edinburgh; entered the army; served in the Crimea and in India, where he was military secretary to Lord Clyde; lost an arm at Lucknow, and distinguished himself as brigadier-general, second in command of the Ashantee expedition of 1873–74. He succeeded to the baronetcy 1867, and became deputy adjutant-general in Ireland Oct., 1874. Author of a treatise *On Army Organization* (1869).

**Alkin′di,** or **Alchindus,** a very prolific Arabian writer on medicine and philosophy, b. at Bassorah, flourished in the middle of the ninth century. Several works, translated into Latin, were much read during the Middle Ages; the most celebrated was *De Theoria Magicarum Artium.*

**Allan-Kardec′** (Hippolyte Léon Denizard), b. at Lyons Oct. 3, 1803; was the representative of the spiritualistic movement in France, and wrote *Le Livre des Esprits* (1857), *Le Livre des Médiums,* and *L'Imitation de l'Evangile selon le Spiritualisme* (1864). He also founded the *Revue spirite* (1858). D. in Paris Apr. 1, 1869.

**Al′len** (Charles), b. at Greenfield, Franklin co., Mass., Apr. 17, 1827; graduated at Harvard College 1847; was reporter of decisions of the supreme court of Massachusetts 1861–67, and attorney-general of Massachusetts 1867–72, and published 14 vols. of Massachusetts *Reports.*

**Allen** (Frederic de Forest), Ph. D., b. at Oberlin, Lorain co., O., May 25, 1844; was educated at Oberlin College; studied at the University of Leipsic; was appointed professor at the University of East Tennessee in 1866, and at the University of Cincinnati in 1874, and published an ed. of the *Medea* of Euripides.

**Allen** (George), b. at Milton, Vt., Dec. 17, 1808; studied law at the University of Vermont, and was admitted to the bar in 1831, but felt himself drawn to the study of theology both by his own interest and by the influence of Dr. James Marsh; was rector of the church of St. Alban's, Vt., 1834–37; professor of languages at the Delaware College, Newark, Del., and finally professor of Greek at the University of Pennsylvania; joined the Roman Catholic Church in 1847. D. at Worcester, Mass., May 28, 1876. He published a *Life of Philidor* (1865) and some papers in the *United States Service Journal,* but his chief work was as a teacher. (See *Penn Monthly,* July and Aug., 1876.) R. E. Thompson.

**Allen** (William), b. in 1806 at Edenton, Chowan co., N. C.; early lost both his parents, and received a poor education until he in 1822 settled at Chillicothe, O., and was enabled to study law. Having become a lawyer of reputation, he soon became an influential politician (Democrat); was a member of Congress 1833–35, U. S. Senator 1837–49, and governor of Ohio 1874–75.

**Al′lies** (Thomas William), b. at Bristol, England, in 1813; studied at Eton, where he gained the Newcastle scholarship; graduated at Wadham College, Oxford, 1832; became a fellow there; took orders in the Church of England; was rector of Launton, Oxfordshire, 1842–50, when he joined the Church of Rome, and became secretary to the (Roman Catholic) poor-school committee 1854. Author of *The See of St. Peter* (1850) and other controversial treatises, and of an unfinished work on *The Formation of Christendom* (2 vols.), a learned contribution to the philosophy of history from a Roman Catholic point of view.

**Allix′** (Pierre), b. at Alençon, France, in 1631; was minister to the Reformed congregation of Charenton, but emigrated to England on the Revocation of the Edict of Nantes in 1685; formed a French Reformed congregation in London; and in 1690 was made canon of Salisbury cathedral. D. in London Mar. 3, 1717. He was a prolific writer in Latin, French, and English, and intensely polemic. His principal historical works are—*Remarks on the Churches of Piedmont* (1690) and *Remarks on the Ancient Churches of the Albigenses* (1692).

**Almodo'var** (Ildefonso Diaz de Ribera), Count, b. in 1777 at Granada; was educated at the military academy of Segovia, and fought with distinction in the war against the French. By the reactionary government of Ferdinand VII. he was suspected of liberalism and confined in the dungeons of the Inquisition, but was liberated by the revolution of 1820. In 1823, however, he was compelled to flee to France, and did not return until after the death of Ferdinand, when he at once took rank as one of the leaders of the liberal party. In the cabinets of Mendizabal, Calatrava, and Espartero he was minister of war, but retired in 1843 from public life. D. at Valencia Jan. 26, 1846.

**Al'vord** (Thomas Gold), b. at Onondaga, N. Y., Dec. 20, 1810; graduated at Yale College in 1828; admitted to the bar in 1832; practised at Syracuse until 1846; elected to the legislature of 1844, and re-elected nine times; Speaker in 1858 and 1864; lieutenant-governor in 1865–66; member of the constitutional convention in 1867–68; is engaged in the manufacture of coarse salt, and resides at Syracuse.

**Amal'aric,** b. in 501, the son of Alaric II., king of the Visigoths; succeeded his father in 507 by the aid of his grandfather, Theodoric, king of the Ostrogoths, and married in 527 Clotilde, a daughter of Clovis, king of the Franks, but in order to compel her to embrace Arianism he treated her so cruelly that her brother, Childebert, came to her rescue with a great army in 531. Amalaric was defeated and slain, and Theudis succeeded him as king of the Visigoths, while Clotilde returned with her brother to the land of the Franks, where she died shortly after.

**Amalason'tha,** b. in 498, a daughter of Theodoric the Great, king of the Ostrogoths; married Eutharic and bore him a son, Athalaric, who in 526, when only ten years old, succeeded his grandfather as king of Italy under the guardianship of his mother, his father having died the previous year. The government of Amalasontha was very successful, but her son grew up a debauched and dissipated drunkard, utterly unfit to reign. He died in 534, and Amalasontha now married Theodatus in order to strengthen her power, but, instigated by Theodora, the Byzantine empress, who hated Amalasontha, Theodatus imprisoned her, and had her strangled in 535.

**Amal'rich of Be'na,** a scholastic philosopher who taught dialectics and the liberal arts at Paris in the twelfth and thirteenth centuries, was born at Bena (Bène), near Chartres, and attempted to reconcile theology with the Averroistic and materialistic interpretation of Aristotle's metaphysics. He and his book (*Physion*) were condemned by the university and the pope; and Amalrich, after an enforced recantation, d. of grief in 1209. In 1210 his bones and his books were burned together. His followers (Almericians) appear to have been a pantheistic and mystical sect, finally blended with the Brethren of the Free Spirit. They were subjected to severe persecutions.

**Amat'** (Felix de Torres), an Aragonese ecclesiastic and literary historian, was b. at Sallent Aug. 6, 1772; became bishop of Astorga, and a senator under the reformed constitution of 1837. In 1808 he was charged by the government of Spain to prepare and annotate a new Castilian translation of the Bible. Of this work the first edition appeared in 1823 in 8 vols., besides a volume of notes and appendices. In the edition of 1832 the notes are chiefly printed at the foot of the pages. D. at Madrid on Dec. 29, 1840. Amat is best known abroad by his *Memorias para ayudar a formar un Diccionario critico de los escritores Catalanes* (Barcelona, 1 vol. 8vo, 1836). A supplement to the *Diccionario*, by Juan Corminas, appeared at Burgos in 1 vol. 8vo in 1849. These works are valuable contributions to the history of Catalan literature, and indispensable to all who wish to become acquainted with that literature and its bibliography. George P. Marsh.

**Amelot' de la Houssaye'** (Abraham Nicolas), b. at Orléans, France, in 1634; served for some time as secretary to the French embassy at Venice, but devoted himself afterward exclusively to the study of history and literature. D. in Paris Dec. 8, 1706. He wrote *Histoire du Gouvernement de Venise* (3 vols., 1676); also translated Paolo Sarpi's history of the Council of Trent, and the *Prince* by Macchiavelli.

**Amelotte'** (Denis), b. at Saintes, France, Mar. 15, 1606; studied theology and joined the Congregation of the Oratory in Paris, where he d. Oct. 7, 1678. He maintained for many years a very bitter contest with the writers of Port-Royal, and is said not to have disdained to use his influence at court in order to defeat them. His translation of the New Testament, of which Louis XIV. subscribed for 100,000 copies, appeared in 4 vols. (1666–70).

**American Eclectic, The,** or **New School of Medicine** was first known in this country as a separate school about the year 1826, although physicians entertaining its peculiar sentiments flourished from the period of the Revolution. Wooster Beach of New York in 1826 established a college in that city for the dissemination of its doctrines. He also prepared works on practice, surgery, materia medica, midwifery, and physiology for his students, which were widely popular. Among his early associates were Thomas Vaughn Morrow and Isaac G. Jones. About this time Rev. Dr. Chase, bishop of Ohio and uncle of the statesman, had obtained a charter for the Worthington University. He invited thither the faculty of the New York Reformed Medical College. Profs. Morrow and Jones accepted, and a medical department was duly organized. After ten years of successful labor, Prof. Morrow left Worthington and established a college in Cincinnati. This was incorporated by the legislature of Ohio in 1845 by the name of the "Eclectic Medical Institute." He next undertook the organization of the reformed physicians of the U. S. as a school of practice, apart from Homœopathists, Thomsonians, and Mercurialists. To this new school he gave the name "Eclectic," that being the designation of the ancient Galenists and Alexandrian academicians. State societies were organized over the country, and colleges established in Massachusetts, New York, Philadelphia, Georgia, Tennessee, Missouri, and Illinois. The death of Prof. Morrow deprived the Eclectics of their wisest leader. The new practice continued to flourish, however, chiefly in the North-western States, but the national organization ceased to exist. After the civil war the cause received a new impetus, perhaps in part due to the fact that Eclectic surgeons were excluded from appointment in the army. New colleges were established in the cities of New York, Chicago, St. Louis, and Macon, which soon became prosperous. State societies were formed in all the Northern States, and in 1870 the National Eclectic Medical Association was revived under the auspices of these institutions and societies, and was incorporated the ensuing winter by the legislature of New York. Its sessions are held annually, and it is an influential organization. The number of Eclectic physicians in the U. S. is estimated at 12,000. There are also many Eclectics in the Dominion of Canada. Conspicuous among these are Thomas R. Fraser of Halifax, N. S., and Alexander M. Ross of Toronto, both authors of ability. There is also an Eclectic association in Great Britain, holding conferences annually. Dr. William Hitchman of Liverpool, George Sexton of London, and the late J. Hughes Bennett of Scotland, are classed as Eclectics.

The distinctive tenets of the New School relate to the hygienic treatment of the sick and the rejection of mercury, antimony, and other minerals as medicines. They aim in medicine and surgery at the strictest conservative practice, performing only necessary operations and carefully husbanding and promoting the vital powers. The Eclectics have the credit of discovering and introducing into the materia medica over 100 new remedies prepared from the indigenous American flora, all which are used more or less by rival practitioners. To Dr. Robert S. Newton, now of New York, is also due the merit of having first inculcated the doctrine of cellular pathology in 1845, and also the introduction of the antiseptic treatment in surgery in 1846. Joseph R. Buchanan of Louisville, Ky., is also the author of several anthropological works, and the late W. Byrd Powell was the originator of a novel theory of human temperaments. Alexander Wilder.

**American Museum of Natural History.** This institution was incorporated in 1869 for the purpose of establishing and maintaining in the city of New York a museum and library of natural history, of encouraging and developing the study of natural science, of advancing the general knowledge of kindred subjects; and to that end furnishing popular instruction and recreation. The collections it has already acquired, besides many smaller gifts and purchases, consist of the following specimens of scientific and popular interest: The first choice of all the mammals and birds left by the late Edward Verreaux of Paris, who possessed at the time of his death collections from all parts of the world, which were valued at 600,000 francs. These include what are regarded as the finest specimens of the art of taxidermy that Europe has yet produced. A nearly complete series of all the birds of America N. of the Rio Grande was purchased of Mr. D. G. Elliot; also the entire museum of Prince Maximilian of Neuwied, on the Rhine above Bonn (not Maximilian, late emperor of Mexico). This prince occupied the years 1815–17 exploring Brazil from Rio Janeiro up to Bahia, and a large proportion of his specimens were never before described, and the collection is therefore particularly rich in *types*. A collection of shells made during a long, active lifetime by Dr. John C. Jay and an unrivalled library on conchology have been presented by Miss C. L. Wolfe as a memorial of her father, the first president of the corporation. The most important department yet established is that of palæontology, which

comprises the great collections of Prof. James Hall of Albany, containing probably one-half of the authentically labelled specimens of palæozoic palæontology yet gathered on our continent. About 7000 of these specimens have been figured, and are types. The Tertiary beds of South Carolina are well represented by the collection of Prof. F. S. Holmes of Charleston, also gathered during many years. A department of archæology is now being formed from the specimens obtained by Hon. E. G. Squier on his Central American and South American travels, and from his labors, jointly with those of Dr. E. H. Davis, in exploring the ancient mounds of the Mississippi Valley.

These collections are the property of the corporation above mentioned, and not of the city, the corporation undertaking to furnish specimens and books and take care of them, and the city to supply the required land and buildings. For this purpose that part of the Central Park formerly known as Manhattan Square, on the W. side of the park proper, which contains 18¼ acres, has been set aside for ever. The section of the building now finished is 200 feet long by 66 feet wide, and about 100 feet high, and forms one-eighteenth part of the whole plan to be ultimately finished, which is to occupy the whole square, and be six times larger than that now in course of erection by Her Majesty's government in London, and five times greater than the Capitol at Washington. The part completed consists of a series of magnificent halls 170 feet long by 60 feet wide, and severally of 18, 30, and 22 feet in height, for exhibition, and a curator's room on each floor. Over the whole is a Mansard story 16 feet in height, divided into laboratories for the free use of scientific gentlemen who may visit our shores from other lands, and for the national and State surveys, and other scientific investigators of our own land, the aim of the museum being to be the means both of creating and diffusing knowledge. The number of its visitors during 1876 was 1,120,494, or one-half more than that of the most popular museum in Europe.

A. L. Bickmore.

**American Sunday-School Union, The,** was organized at Philadelphia May 25, 1824. It was, however, the immediate successor of the Philadelphia Sunday and Adult School Union, which was organized in 1817, and had auxiliary "unions," or branches, in eleven of the States when, in 1824, it transferred its capital and schools to the new national organization. The American Sunday-School Union is under the direction of thirty-six managers, of whom at least twenty-four must reside in Philadelphia and its vicinity. All these managers are laymen, and they are selected from various Christian denominations. The Union is not a union of denominations, but of individual Christians of different denominations. The object of the Union was, at its formation, "to concentrate the efforts of Sabbath-school societies in the different parts of our country, to strengthen the hands of the friends of pious instruction on the Lord's Day, to disseminate useful information, circulate moral and religious publications in every part of the land, and to endeavor to plant a Sunday-school wherever there is a population." Various denominational Sunday-school societies have resulted from the work of the Union, but it has continued its operations without interruption, and its aim still is to improve existing Sunday-schools and to organize new ones. Its plan is, to publish books and papers suited to the wants of Sunday-schools, and to send out missionaries, lay and clerical, of various denominations, to organize new Sunday-schools wherever there is a needy population. No Sunday-schools are under the control of the Union, but its missionaries watch and help as they have opportunity the pioneer schools they have organized. Many of these schools have proved the foundation of Christian churches. Indeed, a large share of all the Protestant churches organized in the newer States within the past thirty years have had their beginning in union Sunday-schools. The Union has been the parent of most of the distinctive agencies and methods of the American Sunday-school system. Sunday-school libraries, question-books, periodicals, teachers' helps, conventions, plans for teacher-training, schemes of limited lessons uniform throughout the country, were originated by or first gained prominence through the agency of the Union or of its officers and managers. Moreover, its work created or stimulated a demand in these departments which has greatly increased the supply in them all. Its list of separate publications exceeds 2000. The value of these, circulated by sale and donation, up to Mar. 1, 1876, amounts to nearly $6,500,000. Up to the same date its missionaries had organized 63,793 Sunday-schools, including, at the time of their organization, 419,796 teachers and 2,745,610 scholars. In addition to this, its missionaries have visited and helped many thousands of existing schools, including several millions of scholars. (See Sunday-Schools, in Cyclopædia.)

Henry Clay Trumbull.

**Amphacanthidæ.** See Teuthididæ, in Cyclopædia.

**Amyot'** (Jacques), b. at Melun, France, Oct. 30, 1513; taught Latin and Greek at the University of Paris; visited Italy; became tutor to the two youngest sons of Henry II.; was made grand almoner under Charles IX., and finally bishop of Auxerre, where he d. Feb. 6, 1593. He published a number of translations of Greek authors, which are highly esteemed for the purity of their language and the simplicity of their style. The most celebrated is that of the *Lives* of Plutarch, which has been often reprinted, the last time in 25 vols. (Paris, 1801–06).

**Amyraut',** or **Amyrault** (Moïse), b. at Bourgueil, department of Indre-et-Loire, France, in 1596; studied at the Calvinist school of theology in Saumur, where he afterward became a professor, and d. in 1664. He was a very prolific writer, and enjoyed great reputation in his time; his *Theses Salmurienses* were considered a high authority among the Calvinists. In order to reconcile and unite the various branches of the Reformed Church against Romanism, he composed the treatise *De Secessione ab Ecclesia Romana, deque Pace inter Evangelicos in Negotio Religionis instituenda.* He also wrote a *Vie de François de la Noue.*

**Andra'da, de** (Antonio), a Portuguese missionary, b. in 1580; entered the Society of Jesus in 1596, and went in 1600 to Goa, where he d. Aug. 20, 1633. He made two journeys to Thibet (in 1601 and in 1625), and his *Novo Descobrimento do Grão Catayo, ou dos Reynos de Tibet* (Lisbon, 1626), attracted much attention and was translated into other languages.

**Anicet-Bourgeois'** (Auguste), b. in Paris Dec. 25, 1806; was clerk in a lawyer's office when in 1825 he wrote his first melodrama, *Gustave,* which was very successful, and after which he devoted himself entirely to play-writing. He produced, alone or in company with others, over 200 plays, vaudevilles, dramas, and melodramas, many of which are still represented in Paris with great effect. His best piece is *La Vénitienne* (1834). D. at Pau Jan. 12, 1871.

**An'neke** (Mathilde Franceska Giesler), b. on the estate of her grandfather, near Blankenstein, Prussia, Apr. 3, 1817. Early in life she engaged in literary pursuits, and took a deep interest in the political and social freedom of her country. When her husband, a Prussian officer and powerful leader in the revolution of 1848, was imprisoned under sentence of death at Cologne, Madame Anneke put a printing-press into her parlors, and herself edited a paper in the interests of the revolution. She had actual service on the battle-field as one of her husband's staff, of which Carl Schurz was also a member. When the revolutionists were overpowered she, with her family, sought refuge in America, where she has been one of the most earnest champions of woman's enfranchisement. She edited the *Frauen Zeitung* at Milwaukee, Wis., in 1850, where she now (1877) is principal of an academy for young ladies.

Susan B. Anthony.

**An'tony** (Milton), b. Aug. 7, 1789, in Virginia; removed early with his parents to Georgia; studied medicine at the University of Pennsylvania; began to practise as a physician in New Orleans; removed subsequently to Augusta, Ga., and founded the Medical College of Georgia. D. of yellow fever Sept. 19, 1839. Paul F. Eve.

**Ap'pleton** (James), b. at Ipswich, Mass., Feb. 14, 1785; was early in life elected a member of the legislature of the State, and served during the war with England as a colonel of Massachusetts militia, having been entrusted with the command of the district of Gloucester; after the close of the war he was made a brigadier-general. He subsequently removed to Portland, Me.; was also a member of the Maine legislature, but returned finally to his native town, where he d. Aug. 25, 1872. He exercised much influence as an energetic champion of total abstinence and as a decided enemy of slavery, on which two points his speeches and publications contributed much to form public opinion. By his elaborate report to the Maine legislature in 1837 he was the first expounder of the principle underlying the Maine law.

**Apron.** In the Authorized Version of Gen. iii. 7, *apron* is used to render the Heb. *chagorah* (which is rendered "girdle" in 2 Sam. xviii. 11): "And they sewed fig-leaves together, and made themselves aprons"—in the margin, "or, *things* to gird about." In the Geneva (Barker) Bible (1599) it is rendered, "And they sewed figge tree leaues together, and made themselues breeches"—in the margin, "*Ebr. things to gird about them to hide their priuities.*" Because of the translation "breeches," this is called "the Breeches Bible." In Acts xix. 12 *apron* is the rendering of σιμικίνθιον, from the Latin *semicinctium,* a half-girdle, or belt covering half the person—an apron worn by workmen, servants, etc.

T. O. Summers.

**Argyrop'ulos** (Johannes), b. in Constantinople in 1416; went early to Italy, where he contributed much to the revival of letters. He taught the Greek language and literature and Aristotelian philosophy at Padua 1434–56, Florence 1456–71, and Rome, where he d. in 1486. Pallas Strozza, Politianus, and Reuchlin were among his disciples. He became a master of the Latin language, and translated the works of Aristotle into Latin. But for the Latin authors he showed a sovereign contempt; of Cicero he said that he understood neither Greek nor philosophy.

**Arm'strong** (James Loudon), M. D., b. in Greenbrier co., Va., Apr. 2, 1782. His parents came West, and he became a student of medicine under the celebrated Dr. Dudley. In 1809 he settled in Rutherford co., Tenn., and served his country as surgeon in the war of 1812. He was one of the early advocates of temperance. D. Apr. 5, 1868.

**Ar'nold** (John William Schmidt), A. B., A. M., M. D., b. at Charleston, S. C., May 16, 1845; graduated at Columbia College, New York, 1868; studied medicine; was appointed curator of the Bellevue Hospital in 1871, professor of physiology and histology at the University of New York in 1874, and pathologist at the lunatic asylum of Blackwell's Island in 1875; and contributed to various medical papers.

**Arrhidæ'us** (Philip), a son of Philip II. of Macedon by a dancing-girl, Philinna of Larissa; accompanied his half-brother, Alexander the Great, in his campaigns in Asia, and was always kindly treated by him, but never held any civil or military command. He was imbecile, and it was said that he had become so from a potion administered to him while a boy by Olympias, his father's wife and Alexander's mother. He was present at Babylon when Alexander died, and was immediately proclaimed king by the army, though the son of Alexander by Roxana, born shortly after, was associated with him. He now married Eurydice, a granddaughter of Philip II., a daughter of Cynane, his own and Alexander's half sister. Eurydice was, like her mother, a woman of thoroughly masculine education, of many masculine talents, and of an exorbitant ambition. She wished to get rid of Roxana and her son, of Olympias, and of Alexander's generals; and after the death of Antipater (in 319) she collected an army and marched against Polysperchon. But in Polysperchon's army was Olympias, and the Macedonian soldiers declared that they would never fight against Alexander's mother. Eurydice was deserted, captured in her flight, and confined, together with her husband, in a narrow dungeon, whither Olympias sent to her a sword, a rope, and a cup of hemlock. She accepted the presents, made Arrhidæus drink the hemlock, and then hanged herself (317 B. C.).

**Ar'thur** (William), b. in the county of Antrim, Ireland, in 1796; graduated at the College of Belfast; emigrated shortly after to America; settled at Bennington, Vt.; studied first law, then theology; was minister of a Baptist church at Bennington, and subsequently at various other places—at New York from 1855 to 1863. D. at Newtonville Oct. 30, 1875. He is the author of the well-known book on family names.

**Articles of Confederation.** See Confederation, Articles of.

**Ar'widsson** (Adolf Ivar), b. at Padasjoki, Finland, Aug. 7, 1791; studied at the University of Åbo, and was appointed professor of history there in 1817. A periodical which he founded in 1821 was suppressed in the same year by the Russian government, and in 1822 he was exiled. He went to Stockholm, where he was made director of the royal library. D. June 21, 1858. He published *Svenska Fornsånger* (3 vols., 1834–42), *Stockholm förr och nu* (1837–40), and a translation of Frithiof's *Saga*.

**Asbjörn'sen** (Peter Christian), b. in Christiania, Norway, Jan. 15, 1812; studied botany and zoology; visited Asia Minor and Egypt in 1849–50; spent two years at the academy of Tharand, Saxony, 1856–58, and on his return was appointed inspector-general of the forests of Norway. Besides a number of popular books on natural history and essays on forest-culture, he published *Norske Folke-Eventyr* (1842–43) in connection with Jorgen Moe, and *Norske Huldreeventyr og Folkesagn* (1845–48); which two books not only exercised a considerable influence on the development of the Norwegian literature, but also attracted much attention in the other Scandinavian countries, in Germany, and in England.

**As'pinwall** (William H.), b. in the city of New York in 1807; was trained as a clerk in the house of G. G. & S. S. Howland; became a partner in 1832; formed the firm of Howland & Aspinwall in 1837; retired from the firm in 1848. D. in New York Jan. 19, 1875. He was the chief promoter of the construction of the Panama R. R., the eastern terminus of which is named after him.

**As'selijn** (Jan), b. at Antwerp in 1610; studied painting, first in his native city under Isaiah Vandervelde, then in Rome, where Bamboccio and Claude Lorraine became his models; settled subsequently in Amsterdam, and d. there in 1660. He painted battle-pieces, animals, and landscapes, and his views of the neighborhood of Rome are much appreciated.

**As'sing** (Ludmilla), b. in Hamburg Feb. 22, 1827, a daughter of the poetess Rosa Maria Assing and the poet Dr. D. A. Assing; was educated in Berlin in the house of her uncle, Varnhagen von Ense; wrote for various periodicals, and edited the diaries and correspondence of her uncle. On account of the irreverence which these works show for the king of Prussia, the queen, etc., Ludmilla Assing was prosecuted twice, and sentenced to eight months', and then to two years', imprisonment; but she lives in Florence.

**As'ter, von** (Ernst Ludwig), b. at Dresden in Nov., 1778; received a military education, and served first in the Saxon, then in the Russian, and finally (after 1815) in the Prussian service. In 1810, while still in the Saxon army, he attracted the attention of Napoleon by a plan for the fortification of Torgau, and while in the Prussian service he undertook the fortification of Coblentz and Ehrenbreitstein; was made inspector-general of all the Prussian fortresses and general of infantry in 1842. D. at Berlin Feb. 10, 1855. His *Nachgelassene Schriften* were published at Berlin, in 5 vols. (1856–61).—His brother, Karl Heinrich von Aster, b. at Dresden Feb. 4, 1782; d. there Dec. 23, 1855; colonel in the Saxon army; wrote several valuable military works, of which the most noted are *Lehre vom Festungskriege* (2 vols., 1812; often reprinted and translated into other languages) and *Die Gefechte und Schlachtene bei Leipzig* (2 vols., 1852–53).

**Asteroids.** At the date of the publication of our Vol. I. there had been discovered 135 of the small planets revolving in orbits between those of Mars and Jupiter, commonly called asteroids. The latest contained in the list then given was of date Feb. 18, 1874. Since that time there have been discovered (Jan. 1, 1877) thirty-four more, of which the dates and names (so far as they have yet been named), and the names of their discoverers, are given below. This list has been obligingly communicated by Prof. C. H. F. Peters, Ph. D., M. N. A. S., of Hamilton College, Clinton, N. Y., himself the discoverer of a larger number of these bodies than any other observer:

*Asteroids discovered since Feb., 1874.*

| No. | Name. | Date of discovery. | Discoverer. |
|---|---|---|---|
| 136 | Austria | 1874, March 18 | Palisa. |
| 137 | Melibœa | April 21 | Palisa. |
| 138 | Tolosa | May 19 | Perrotin. |
| 139 | Juewa | October 10 | Watson, U. S. |
| 140 | Siwa | October 13 | Palisa. |
| 141 | Lumen | 1875, January 13 | Paul Henry. |
| 142 | Polana | January 28 | Palisa. |
| 143 | Adria | February 23 | Palisa. |
| 144 | Vibilia | June 3 | Peters, U. S. |
| 145 | Adeona | June 3 | Peters, U. S. |
| 146 | Lucina | June 8 | Borelly. |
| 147 | Protogeneia | July 10 | Schulhof. |
| 148 | Gallia | August 7 | Prosper-Henry. |
| 149 | Medusa | September 21 | Perrotin. |
| 150 | Nuwa | October 18 | Watson, U. S. |
| 151 | Abundantia | November 1 | Palisa. |
| 152 | Atala | November 2 | Paul Henry. |
| 153 | Hilda | November 2 | Palisa. |
| 154 | Bertha | November 4 | Prosper-Henry. |
| 155 | Scylla | November 8 | Palisa. |
| 156 | Xantippe | November 22 | Palisa. |
| 157 | Dèjanira | December 1 | Borelly. |
| 158 | Koronis | 1876, January 4 | Knorre. |
| 159 | Æmilia | January 26 | Paul Henry. |
| 160 | Una | February 20 | Peters, U. S. |
| 161 | Athor | April 16 | Watson, U. S. |
| 162 | ——* | April 21 | Prosper-Henry. |
| 163 | Erigone | April 26 | Perrotin. |
| 164 | Eva | July 12 | Paul Henry. |
| 165 | Loreley | August 9 | Peters, U. S. |
| 166 | Rhodope | August 15 | Peters, U. S. |
| 167 | Urda | August 28 | Peters, U. S. |
| 168 | Sibylla | September 27 | Watson, U. S. |
| 169 | Zelia | September 28 | Prosper-Henry. |

In the list of Vol. I. the following were unnamed. Their names are here supplied:

| | |
|---|---|
| 125 Liberatrix. | 127 Johanna. |
| 126 Velleda. | 135 Hertha. |

The following is a list of all the discoverers of asteroids, with their places of observation and the number of asteroids discovered by each. The arrangement of the names is in the order of these numbers, and not in the order of time:

*This asteroid has not yet been named.

| Name. | Locality. | No. discovered. | Name. | Locality. | No. discovered. |
|---|---|---|---|---|---|
| Peters | Clinton, N. Y. | 26 | Hencke | Driesen | 2 |
| Luther | Bilk | 20 | Tuttle | Cambridge, Mass | 2 |
| Watson | Ann Arbor, Mich. | 19 | Piazzi | Palermo | 1 |
| Goldschmidt | Paris | 14 | Harding | Lilienthal | 1 |
| Hind | London | 10 | Graham | Markree | 1 |
| De Gasparis | Naples | 9 | Marth | London | 1 |
| Palisa | Pola | 9 | Laurent | Nismes | 1 |
| Pogson | Oxford and Madras | 7 | Searle | Cambridge, U. S. | 1 |
| Borelly | Marseilles | 7 | Forster and Lesser | Berlin | 1 |
| Chacornac | Marseilles and Paris | 6 | Schiaparelli | Milan | 1 |
| Prosper-Henry | Paris | 6 | D'Arrest | Copenhagen | 1 |
| Tempel | Marseilles | 5 | Tietjen | Berlin | 1 |
| Paul Henry | Paris | 5 | Stephan | Marseilles | 1 |
| Ferguson | Washington | 3 | Coggia | Marseilles | 1 |
| Perrotin | Toulouse | 3 | Schulhof | Vienna | 1 |
| Olbers | Bremen | 2 | Knorre | Berlin | 1 |

F. A. P. Barnard.

**Astié** (Jean Frédéric), b. in 1822 at Nerac, department of Lot-et-Garonne, France; was for some time a pastor in New York, afterward professor of philosophy at Lausanne, and wrote, besides various theological works, *Le Réveil religieux des États-Unis* (1857) and *Histoire de la République des États-Unis* (2 vols., 1865).

**As'tor** (William B.), b. in the city of New York Sept. 19, 1792; studied at Göttingen and Heidelberg; settled in New York; married a daughter of Gen. Armstrong, secretary of war under Pres. Madison, and was known as a good linguist and an able administrator of the enormous property in real estate left to him by his father, John Jacob Astor. D. in New York Nov. 24, 1875, and left $249,000 to the library which was founded by his father, and which bears the name of the family.

**At'kins** (John D. C.), b. in Henry co., Tenn., June 4, 1825; was educated at the University of East Tennessee, and graduated there in 1846; was elected to the lower branch of the legislature in 1849 and 1851, and to the State senate in 1855; was a Presidential elector on the Buchanan ticket in 1856, and a member of Congress from Tennessee from 1857 to 1861; then resigned and espoused the cause of the Confederates, serving in the field part of the time, as well as in the public councils. He was a member of the Confederate Congress at the time of the general surrender in 1865; was again returned to the Federal Congress 1872–74, and was re-elected to the 45th Congress.

Alexander H. Stephens.

**At'terbom** (Peter Daniel Amadeus), b. Jan. 19, 1790, at Åsbo, in Southern Sweden; studied (1805) at the University of Upsala languages and literature, history and philosophy; travelled in Germany and Italy 1817–19; became tutor to the crown prince Oscar 1819–22, and was appointed docent in 1822 and professor in 1828 at the University of Upsala, where he d. July 21, 1855. In 1807 he formed the literary association *Aurora*, and in 1810 he founded the critical periodical *Fosforus;* and it was through these two institutions that the French or pseudo-classical taste which reigned in all Swedish literature and art received its first and its heaviest blows. The romantic ideas which started this whole movement were afterward developed by Atterbom in a long series of brilliant writings, poetical and historico-critical—*Lycksalighetens Ö* (2 vols., 1824–27), *Samlade Dikter* (2 vols., 1836–37), *Svenska siåre och skalder* (6 vols., 1841–55), and *Poesiens historia* (4 vols., 1862); but, as can be seen from the article on Swedish Language and Literature, in Cyclopædia, that form of the romantic school which was represented by Atterbom and the Fosforists did not become the model of modern Swedish poetry.

**Audouard'** (Olympe), b. about 1830 at Aix, department of Bouches-du-Rhône, France; married a notary from Marseilles, but separated very soon from him; visited in 1859 Egypt, Turkey, and Russia, and in 1868 the U. S., where she gave a number of lectures. She wrote *Comment aiment les Hommes* (1861), *Les Mystères du Sérail et des Harems turcs* (1863), *Guerre aux Hommes* (1866), *Lettre aux Députés* (1867), *À Travers de l'Amérique du Nord* (1871).

**Au'ersperg** (Adolph Wilhelm Daniel), Prince, b. July 21, 1821, a son of Prince Wilhelm Auersperg and brother to Prince Carlos; entered the army very early, and was a major in Prince Eugene's dragoons when he left the military service in 1870. In 1867 he was elected a member of the Bohemian Diet, and in the same year was appointed president of the assembly on the resignation of Count Hartig. In 1869 he was nominated a member for life of the upper chamber of the Austrian Reichstag, and in 1870 was made governor of Salzburg. Finally, he succeeded Count Beust as president of the Austrian ministry, Nov. 25, 1871. Like his brother, who at an earlier date was president of the Cisleithanian ministry, he represents the German interest in Austria, and supports the present organization of the empire, established by Beust, and comprising an Austrian division, in which the German element predominates, and a Hungarian, in which the Magyars rule.

**Aurelle de Paladines, d'** (Claude Michel Louis), b. at Malezieux, department of Lozère, France, Jan. 9, 1804; received a military education; served in Algeria 1841–48; distinguished himself and was made a general of division in the Crimean war, and was commander-in-chief of the ninth military division (Marseilles) at the outbreak of the Franco-German war. In the battle of Coulmiers (Nov. 9, 1870) he defeated Von der Thann, and compelled the Germans to retire from Orleans. On Nov. 14 he was made commander-in-chief of the first army of the Loire, but his attack on the left wing of the army of Prince Frederick Charles at Beaune-la-Rolande (Nov. 28) failed; on Dec. 2 he was defeated at Artenay by the grand duke of Mecklenburg, and on Dec. 3 and 4 was driven farther back by Prince Frederick Charles, who again occupied Orléans. Gambetta now instituted a committee of inquiry into the conduct of D'Aurelle, who immediately resigned his command, and afterward declined to accept any command under the then government. He sat in the National Assembly of Bordeaux, was one of the members associated with Thiers in the negotiations of peace, and was appointed commander first of the national guard in the department of Seine, afterward of the fourteenth military division (Bordeaux). In 1872 he published *La Première Armée de la Loire.*

**Au'rifaber** (the Latinized form of Goldschmidt, Johann), b. in the countship of Mansfeld, part of the present Prussian province of Saxony, in 1519; studied theology in Wittenberg; was chaplain to a Saxon regiment in the Smalcaldic war; became amanuensis to Luther in 1545; was appointed court-chaplain at Weimar in 1551, and minister at Erfurt in 1566, where he d. in 1579; edited several manuscripts of Luther's, and his *Epistolæ* and *Table-Talk.*

**Aus'tin** (Coe F.), b. at Mount Hope, Orange co., N. Y., June 20, 1831; published *Musci Appaladiani et Hepaticæ Boreali-Americanæ*, and is now preparing a *Synopsis of the Hepaticæ of North America.*

**Auzoux'** (Théodore Louis), b. at St. Aubin d'Ecroville, department of Eure, France, about 1797; studied medicine in Paris; invented the so-called *anatomie clastique*, a method of making permanent models of anatomical preparations in papier-mâché, and wrote *Mémoire sur le Choléra Morbus* (1832), *Leçons élémentaires d'Anatomie et de Physiologie* (1839), *Des Tares molles et Osseuses dans le Cheval* (1853), *Insuffisance des Chevaux forts et légers, du Cheval de Guerre et de Luxe* (1860).

**Avent** (Benjamin Ward), M. D., b. in Greenville co., Va., May 19, 1812; graduated at La Grange College, Ala., and in medicine at Transylvania University in Lexington, Ky.; was appointed surgeon-general for Tennessee 1861; since the war has held the chair of surgery in the Medical College of Memphis.

**Azaïs'** (Pierre Hyacinthe), b. at Sorrèze, department of Tarn, France, Mar. 1, 1766; was educated in the Benedictine college of his native city, and became secretary to the bishop of Oléron; was condemned to transportation on account of a bitter criticism of the excesses of the revolutionists, but escaped and lived for several years in retirement; went to Paris in 1806; professor of history at the military school of St. Cyr, and afterward inspector of public libraries of Avignon and Nancy; lost this position in 1815 because he wrote a defence of Napoleon; received a pension from the government through the influence of Madame de Staël, and lived quietly in Paris, lecturing on philosophy in his garden, and publishing a great number of books. D. Jan. 22, 1845. His two most characteristic works are *Le Système de Compensation* (1806) and *Le Système universel* (1812).

# B.

**Baa'der, von** (Franz Xaver), b. at Munich Mar. 27, 1765; studied medicine at Ingolstadt and Vienna 1781–86; then natural science, especially mineralogy, at Freiberg, under Werner, 1788–92; visited England 1792–96, and held various positions in the Bavarian mining department from 1797 to 1820. In this period he wrote *Vom Wärmestoff* (1786), *Versuch einer Theorie der Sprengarbeit* (1802), and *Anleitung zum Gebrauche der schwefelsäuren Soda oder des Glaubersalzes zur Glaserzeugung* (1815), for which he received a prize of 12,000 florins from the Austrian government. Meanwhile, he cultivated the study of philosophy and theology with great energy, became acquainted with all the leading men of the time and with their ideas, and finally brought himself to rest in the mysticism of Jakob Böhme. In 1826 he was made professor of philosophy and speculative theology at the University of Munich, and the deep enthusiasm and ingenious argumentation of his lectures and writings attracted great attention, though his ideas were mystical and the form in which he represented them aphoristical. His views tended to a reconstruction of the whole civilization on the basis of religion, of the Church, but in this new Church there should be no pope. In 1814 he presented a memorial to the sovereigns of Russia, Prussia, and Austria in which he urged the necessity of bringing politics once more into close connection with religion, but in 1837, during the troubles at Cologne, he spoke with much sharpness against the pope. He died, however, a good Roman Catholic, May 23, 1841, at Munich. His philosophical writings have been published in a collected edition in 16 vols. by Franz Hoffmann (1850–60), who also has given a general representation of his standpoint—*Vorhalle zur speculativen Lehre Baader's* (1837).

**Bab'ington** (Churchhill), b. in England in 1821; graduated at St. John's College, Cambridge; held the chapelry of Horningsea, Cambridgeshire, 1848–61; was Disney professor of archæology 1865, and rector of Cockfield in 1866; edited from MSS. the recently-discovered orations of Hyperides; has written largely on botany, ornithology, archæology, and numismatics for various works and Transactions, and contributed to Smith's *Dictionary of Christian Antiquities*.

**Bage'hot** (Walter), A. M., b. at Langport, England, Feb. 3, 1826; graduated at University College, London, and passed A. M. at London University; wrote *The English Constitution, Physics and Politics* (1872), and *Lombard Street* (1873); editor of *Economist* till his death, Mar. 26, 1877.

**Bag'ley** (John J.), b. in Orleans co., N. Y., in 1832, and emigrated with his father to Michigan in 1840. Since 1847 he has been a tobacconist in Detroit, and very successful in business. He has held numerous public offices in the city government, and filled places of financial trust; governor 1873–77. During his administration the educational and charitable institutions of the State have received special care and encouragement.

**Bai'ley** (Silas), D. D., b. in Massachusetts about 1808; president of Granville College (now Denison University), Granville, O., and of Franklin College, Lafayette, Ind., and subsequently professor of theology in Kalamazoo College, Mich., and pastor for several years of a Baptist church in Lafayette, Ind., and author of several books; made a tour of Europe. D. at Paris June 30, 1874.

**Bailey** (William Whitman), B. P., b. at West Point, Orange co., N. Y., Feb. 22, 1843; was educated at Brown University, Providence, R. I., whence he graduated in 1864; was botanist of the U. S. geological survey of 40th parallel in 1867; deputy secretary of state of Rhode Island in 1868; assistant librarian of Providence Athenæum 1869–71, and contributed largely to periodical literature.

**Ba'ker** (John Gilbert), b. at Guisborough, England, Jan. 13, 1834; educated at the Friends' schools at Ackworth and York; assistant curator of the Kew Gardens since 1856; is lecturer on botany at the London Hospital, and an assistant editor of *Seemann's Journal of Botany;* and has written a large number of works on ferns, flora, botany, etc.

**Ball** (George H.), A. M., D. D., b. at Oxford, Sherbrook co., East Canada, Dec. 7, 1818; studied at the theological seminary of New York, whence he graduated in 1847; was pastor of the Niagara Square Baptist church, Buffalo, N. Y., for about twenty years; pastor of Roger Williams church, Providence, R. I., for two years; editor of the *Baptist Union*, and published *Guide to the Lord's Supper, Christian Baptism*, etc.

**Ba'ring-Gould** (Sabine), b. at Exeter, England, Jan. 28, 1834; was educated at Clare College, Cambridge; visited Iceland in 1862; took orders in 1865; was appointed curate of Horbury, subsequently of Dalton, and published *Iceland, its Scenes and Sagas* (1863), *Post-Mediæval Preachers* (1865), *The Book of Were-Wolves* (1865), *Myths of the Middle Ages* (1869), *The Origin and Development of Religious Belief* (1870), *Legends of the Patriarchs and Prophets* (1871), *Lost and Hostile Gospels* (1874), and other works.

**Bar'low** (Samuel Latham Mitchill), b. at Granville, Hampden co., Mass., June 5, 1826; was educated in New York City; admitted to the bar in 1848, and practised subsequently in the city of New York.

**Bartolomme'o** (Fra), whose true name was Baccio delle Porta, b. at Savignano in 1469; studied under Cosimo Rosselli and Leonardo da Vinci, and had already acquired a great reputation as a painter when the condemnation and execution of his friend, Savonarola, caused him to give up his art and retire to a Dominican convent in 1500. In 1504, however, he again took up painting, chiefly at the solicitation of Raphael, who came to Florence at that time, and he subsequently visited Rome in order to study the works of Michael Angelo. Most of his life he spent in Florence, where he d. Oct. 8, 1517, and here are his most celebrated pictures, the *Nativity, Circumcision*, and the *Virgin on the Throne*, in the public gallery; the *St. Mark* and the *Descent from the Cross*, in Palazzo Pitti; and *Last Judgment*, in chapel of Santa Maria Nuova.

**Bar'ton** (Clara), b. on a farm at Oxford, Mass., a daughter of Capt. Stephen Barton, and educated at Clinton, N. Y. Early in life she engaged in teaching, and founded a free school at Bordentown, the first in New Jersey, which she opened with six pupils, but which numbered nearly 600 when, in 1854, she went to Washington. Here she was appointed clerk in the department of patents, but on the outbreak of the civil war she resigned her clerkship and devoted herself to the alleviation of the sufferings of the soldiers, serving not in the hospitals, but on the battle-field. She was present at several battles, and after the close of the war originated, and for some time carried on at her own expense, the search for missing soldiers. Having lectured (1866–67) on *Incidents of the War*, she went to Europe for her health, and settled in Switzerland, but on the outbreak of the Franco-German war she accepted the invitation of the grand duchess of Baden to aid her in the establishment of her hospitals; and she afterward followed the German army, and was decorated with the Golden Cross by the grand duke of Baden, and with the Iron Cross by the emperor of Germany.

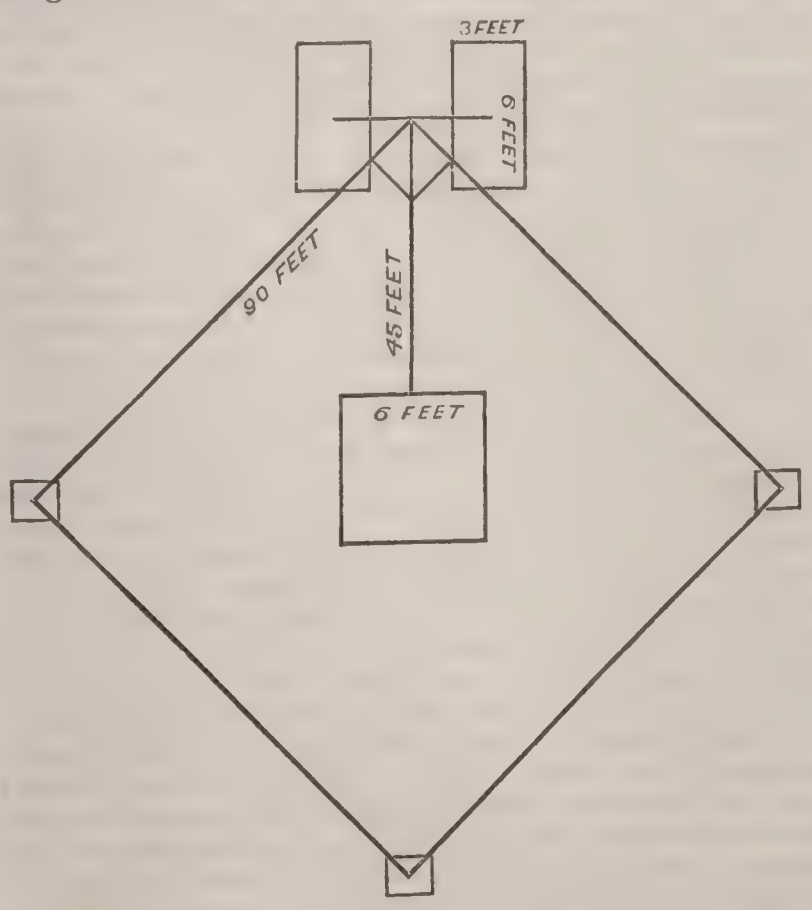
**Barycen'tric Calculus,** an application to geometry of the mechanical theory of the centre of gravity, executed in two distinct ways, according as metrical or descriptive geometrical properties are to be investigated. It was developed almost completely by Möbius in his *Der barycentrische Calcul* (1827).

**Base-Ball.** This most popular of all the field-games in vogue in the U. S., and now known as the national game of the country, may be said to date its existence from the organization of the National Association of Base-Ball Players in 1857. Prior to this period the game was not played under any general code of rules, a different method of playing it prevailing in different sections of the country; it being known as the "New England game" in the Eastern States and as the "New York game" in the Middle States. But not long after the establishment of the National Association all other rules were superseded, and ultimately but one code of playing-rules governed the game throughout the entire country. Base-ball is of English origin, it being the American successor of the old English school-boy game of "rounders;" but to this old pastime base-ball, as now played, bears about as much resemblance as draughts to chess, the only similarity which exists being that both are played on the same plane, the two ball-games being played on a diamond-shaped field, and draughts and chess on a checkered board. This similarity between the English and American games, however, does not interfere with the legitimacy of the claim of base-ball to its existing title of "the national game of America."

In the earlier period of its history base-ball was confined exclusively to the amateur class of the fraternity, professional playing being comparatively unknown before the

last decade; but as it progressed in popularity, and thousands of spectators began to be attracted to witness the leading contests of each season where only hundreds had congregated before, the opportunity for pecuniary gain in connection with the game began to exist, and as a consequence the professional class sprang into existence; and henceforth there will necessarily be two classes of base-ball players in existence—the amateur majority and the professional minority. The first regularly-organized base-ball club which sustained a permanent existence was the Knickerbocker Club of New York, which was organized in Sept., 1845. In 1876 this pioneer club celebrated its thirty-first season of playing, and many of the veteran members participated in the proceedings. It is now composed of bankers, brokers, and merchants of the city, and occupies the enviable position of being the model amateur base-ball club of America. From 1845 to 1856, inclusive, the rules of play in vogue at Hoboken—the early home of the game—were those adopted by the Knickerbocker Club, and afterward endorsed by the kindred organizations of the Gotham, Eagle, Empire, Baltic, and Harlem clubs of New York; the Putnam, Excelsior, Atlantic, Eckford, and Continental clubs of Brooklyn; and the Union of Morrisania—all organized between 1845 and 1856, the leading clubs of this list playing at the Elysian Fields at Hoboken, N. J. The rapid growth of popularity base-ball has attained within the past fifteen years is due to the fact of its adaptability to the peculiar temperament of our people. It is a game quickly played, it is full of excitement, and it can be enjoyed with equal zest by the youngest school-boys and the trained professional; to the latter of whom it affords full scope for the exercise of those mental as well as physical qualifications which characterize the intelligent and skilful athlete.

Before the organization of the National Association in 1857 the rule of play gave the victory in a game to the club first making the score of twenty-one aces. The association changed this to the rule awarding the victory to the club scoring the largest number of runs after nine innings' play on each side. Improved as the rule of play was by the old association, these revised rules were nothing in comparison to the complete code of rules which was prepared for the Professional Association in 1872, and which has continued in force ever since with some slight amendments. There is no field-game which is more simple in its theory than that of base-ball, and yet to excel in the game as a noted expert requires not only the possession of the physical qualities of endurance, agility, and strength, with good running and throwing powers, but also the mental attributes of sound judgment, quick perception, thorough control of temper, and the presence of mind to act promptly in critical emergencies, together with courage, pluck, and nerve. The simple theory of the game is as follows: A space of ground being marked out on a level field in the form of a diamond with equal sides, bases are placed on the four corners thereof. The contestants include nine players on each side; one side takes the field and the other goes to the bat. When the field-side take their positions the pitcher delivers the ball to the batsman, who endeavors to send it out of the reach of the fielders, and far enough out on the field to enable him to run round the




bases; and if he reaches the home-base—his starting-point—without being put out, he scores a run. He is followed in rotation by the others of his side until three of the batting party are put out, when the field-side come in and take their turn at the bat. This goes on until nine innings have been played to a close, and then the side scoring the most runs wins the game. A regular base-ball field occupies a space of ground of from 300 to 500 feet in width and 400 to 600 in length. At the upper end of this field the "infield" is laid out, this being formed by the diamond-shaped space, on the corners of which the four bases are located. The sides of this square are 90 feet, the home-base being located at the upper corner, the second base at the lower corner, and the first and third bases on the right and left corners. The pitcher's position is within a space of ground 6 feet square and 45 feet distant from the home-base, situated on a line between home and second bases. The catcher stands behind the home-base, either close to it or some distance behind as occasion may require. The basemen occupy positions within easy reach of their respective bases, and the short-fielder takes his position between the third and second bases, and not far from the pitcher, his duty being to "back up" the infielders. These six players comprise the "infielders" of the nine, the "outfielders" being the three players located at left, centre, and right fields. The field-side open the game—choice of first innings having been decided by a toss—by the pitcher's delivering the ball to the batsman, either by a toss, a jerk, or an underhand throw, the limit of this throw being the swinging of the arm and hand in which the ball is held below the line of the waist. If the ball be fairly hit by the batsman—that is, if it be not called "foul" by the umpire—the batsman then becomes a base-runner, and he is obliged to run to the first base; and should the ball he has hit be caught before touching the ground, or if it be held by a fielder while touching the first base before the base-runner reaches that base, the latter is out. The batsman is also liable to be put out when a foul ball from his bat is caught on the fly or on the bound, and also if he fails to hit it after striking at it three times. Also, if he refuses to strike at good balls four times he is out, or if he wilfully strike out. Base-runners are liable to be put out when touched off a base, or when forced off by the action of the batsman in hitting a fair ball, or by running out of the line of the bases to avoid the ball in the hands of a fielder, as also from wilfully obstructing a fielder in his effort to catch a ball. To score a run it is necessary for the base-runner to touch each base in regular order from home-base to first, second, and third bases, and thence to the home-base, before he is put out, and before three members of the batting-side are put out. Until three men are out the batting goes on indefinitely until darkness stops play. Each nine in the game are entitled to nine innings' play. No game can be scored unless five innings' play have been completed on each side. An umpire is mutually agreed upon to decide all disputes in the game, and from his decision there is no appeal except to the national association the clubs belong to, and then only in case of a palpable misinterpretation of the rules.

The three special departments of the game are batting, fielding, and base-running. Any one possessing muscular strength and quick sight can readily learn to handle the bat with effect; but fielding requires a special aptitude for one or other of the several positions, and constant practice and training, while base-running needs quick perception, good judgment, and prompt action. In the former a mere tyro may achieve the questionable honor of a "home-run," but none but a practised expert can excel in the other two departments. Different degrees of skill are needed for different positions. The pitcher requires powers of endurance and considerable pluck, together with the ability to pitch the ball swiftly and accurately, not forgetting the judgment required to make strategy a strong point of his attack. The catcher should be a swift and accurate thrower, a sure catch, and a plucky facer of swiftly-delivered balls. These essentials are also necessary in base-players, and the short-fielder requires to be an unusually active player besides; while the outfielders should all three be long-distance throwers and good judges of catches. To complete a nine a change pitcher and catcher is necessary, as also a field-captain. These are essentials of success alike in amateur as in professional nines, but the training and discipline characteristic of a well-managed professional team can never be at the command of an amateur nine, except perhaps in the case of a university nine, and then only to a limited extent. Hence, professional nines must always be the superiors of amateur nines in fielding and base-running, if not in batting.

In 1871 the old National Association, which had apparently fulfilled its mission after thirteen years' existence, gave place to the class organizations known as the National Association of Professional Players and the National Association of Amateur Base-Ball Players. The former was run in the interests of the professional class until 1876, when it was superseded by the League Association of Pro-

fessional Clubs, the co-operative class of professionals still keeping up the National Professional Association, and the amateurs their association.

The prominent events in the history of base-ball were the grand tour made by the Excelsior Club of Brooklyn in 1860; the great Western tour of the National Club of Washington to St. Louis and Chicago in 1867; the brilliant career of the Cincinnati Club in 1869, when they played every club of note from Maine to California without losing a single game; and the trip of the Boston and Athletic clubs to England in 1874, where by their skill as base-ball fielders in the English game of cricket they were enabled to escape defeat in contests with some of the strongest elevens of England and Ireland. The most successful of the professional organizations have been the Boston "Red Stockings," which from 1871 to 1876 won the championship pennant each season. HENRY CHADWICK.

**Batrachidæ.** See TOAD-FISH, in CYCLOPÆDIA.

**Batrachophrynidæ.** See TOAD, in CYCLOPÆDIA.

**Bat'tershall** (JESSE PARK), PH. D., b. in Troy, N. Y., May 26, 1851; began his chemical education 1867 at School of Mines, Columbia College, N. Y.; in 1869 studied under Prof. Wöhler at the University of Göttingen, Germany, where he remained for a year, after which he passed a semester at the University of Leipsic with Prof. Kolbe; then continued his studies for two years under the instruction of Prof. Fittig at the University of Tübingen, Würtemberg, where, after the necessary original research and examination, he received the degree of doctor of natural sciences; his inaugural dissertation is a description of several new derivatives of naphthalene, including the aldehydo of isonaphthoic acid ($C_{11}H_8O$), its amido-compound, hydroisonaphthamide ($C_{33}H_{24}N_2$), sulphonaphthoic and isosulphonaphthoic acids ($C_{11}H_2O_5S$) and salts, and several isomeric oxynaphthoic acids ($C_{11}H_8O_3$). After attending the chemical course of Prof. Marignac in Geneva he returned to this country, where he is engaged as analytic and consulting chemist; an English translation by him of Naquet's *Legal Chemistry* has recently been published.

**Bat'tey** (ROBERT), M. D., b. in Augusta, Ga., Nov. 26, 1828; took his degree in medicine at the Jefferson Medical College; practised his profession in Rome, Ga., and by his contributions to the journals (one to the London *Lancet* on vesico-vaginal fistula) soon acquired reputation; was called to the chair of obstetrics in the Atlanta Medical College; claims to have first performed normal ovariotomy, and is attempting regurgitation in the alimentary canal. He is editor of the Atlanta *Medical and Surgical Journal.*

**Bea'man** (FERNANDO C.), b. in Chester, Vt., June 28, 1814; studied law at Rochester, N. Y., and in 1838 became a lawyer of Michigan; was prosecuting attorney of Lenawee co., judge of probate, Presidential elector in 1856, and member of Congress from Michigan 1861–69.

**Beat'ty** (ORMOND), A. M., LL.D., b. at Washington, Mason co., Ky., Aug. 13, 1815; was educated at Centre College and Yale College, whence he graduated in 1835; was appointed professor of Centre College in 1836, and president in 1872, and has contributed to various papers.

**Beck'er** (KARL FRIEDRICH), b. at Berlin in 1777; studied philosophy and history at Halle; was a teacher in Berlin, but gave up all kinds of business on account of ill-health, and d. Mar. 15, 1806. From 1801 to 1805 he published his *Weltgeschichte für Kinder und Kinderlehrer* (9 vols.), which has been often reprinted and translated into other languages. On account of a singular felicity both in arrangement and style, it was to young readers a very pleasant and useful book, but since the death of the author it has been so much augmented, continued, corrected, and improved as to become nearly valueless.

**Be'dle** (JOSEPH D.), b. at Middletown Point (now Mattawan), Monmouth co., N. J., Jan. 3, 1831; graduated with honor at the law school at Ballston, N. Y.; practised law in New York City; entered the law-office of W. L. Dayton at Trenton, N. J., where he completed his term of study; practised at Mattawan until 1855, when he entered upon a very successful professional career at Freehold, N. J.; was appointed a judge of the New Jersey superior court in 1865, and again in 1872, and acquired high reputation; and was elected governor of New Jersey in 1874.

**Bed of Justice** [Fr. *lit de justice*], meant, first, simply the seat on which the French king sat when in council with the peers of the realm; then those meetings of the Parliament in which, on account of the importance of the business at hand, the king partook personally; and finally, such measures as the king by his presence compelled the Parliament to pass, though it disapproved them.

**Belgiojo'so** (CRISTINA), PRINCESS OF, b. at Milan June 28, 1808, a daughter of Marquis Geronimo Isidoro Trivulzio; married on Sept. 14, 1824, Prince Emilio Barbian e Belgiojoso. She embraced the Italian cause with great enthusiasm; was expelled from Italy by the Austrian government in 1830, and settled in Paris, where her salon soon became the centre of a most brilliant political and literary circle. In 1848 she returned to Italy, equipped a corps of volunteers at her own expense, and took part most actively in the revolution in Milan and Rome. But in 1850 she was once more exiled; visited Greece and Turkey, and settled in 1855 once more in Paris, still working indefatigably for the cause of her country. In 1861 she finally returned to Italy, and d. in Milan July 5, 1871. Besides being a frequent contributor to various French and Italian journals, she published *Essai sur la Formation du Culte dogmatique* (1846), *Souvenirs d'Exile* (1850), *Emina, Récits turco-asiatiques* (2 vols., 1856), *Asie mineure et Syrie,* and *Scènes de la Vie turque* (1858), *Histoire de la Maison de Savoie* (1860), and *Réflexions sur l'État actuel de l'Italie, etc.* (1869).

**Bell'mann** (KARL MICHAEL), b. in Stockholm Feb. 15, 1740; received a rather desultory education; vacillated for several years between business and literature; received in 1776 a small office in the state lottery from Gustavus III., but hired another to perform its duties and gave himself up to his passion for gay company and poetry. D. in Stockholm in poverty and melancholy Feb. 11, 1795. His works consist of songs, both words and melodies by himself, a kind of ballad in which he gives a most burlesque representation of the companions of his nightly revelries and of their exploits. But these characters are drawn with the most exquisite elegance; their extravagances are blended with something which is exceedingly sweet and innocent; and the whole picture is borne along by a stream of striking, joyous melody, in which, however, a peculiar undertone of romantic sadness now and then becomes very perceptible. These songs have made his name one of the most celebrated within the Scandinavian countries. They have been printed over and over again, and are sung at the courts and by the peasants; and in Sweden they have given rise to a very rich song-literature of considerable merit, both poetically and musically, and to innumerable and generally excellently-trained singing associations which form a characteristic feature of Swedish social life. His statue has been raised in Djurgården, near Stockholm, and May 1 is celebrated there with an annual festival in his honor. CLEMENS PETERSEN.

**Bel'ton** (JAMES S.), b. in South Carolina Sept. 7, 1833; graduated at La Grange College; joined the Tennessee conference of the Methodist Episcopal Church, South, in 1852, and was transferred to the Alabama conference; in May, 1854, went as a missionary to China, but after two years' arduous labor returned to his native land. D. in New York City Mar. 17, 1856. T. O. SUMMERS.

**Be'miss** (SAMUEL MERRIFIELD), M. D., b. in Nelson co., Ky., Oct. 15, 1821; graduated M. D. in the medical department of the University of New York City 1846; was elected professor in the medical department of the University of Louisville 1858; has been professor of the theory and practice of medicine since 1866 in the University of New Orleans, which chair he still holds. He has been connected with the medical press since 1858, and is now editing the *New Orleans Medical and Surgical Journal;* has also published essays on croup, marriages in consanguinity, registration in Kentucky, etc., besides furnishing valuable contributions to our medical journals. PAUL F. EVE.

**Benét** (STEPHEN VINCENT), b. at St. Augustine, Fla., Jan. 22, 1827; after a preparatory course at Hallowell's school in Alexandria, Va., and at the University of Georgia, he entered the U. S. Military Academy at West Point, N. Y., on July 1, 1845, whence he graduated July 1, 1849, and was promoted brevet second lieutenant in the ordnance corps. In 1853 he published a translation of Jomini's *Political and Military History of the Campaign of Waterloo,* and in the fall of 1859 was detailed as principal assistant professor of ethics and law at the U. S. Military Academy, which position he filled until 1861, being then assigned to duty at that institution as instructor of ordnance and the science of gunnery, remaining there until 1864; was promoted captain of ordnance Aug. 3, 1861; in 1862 published his valuable treatise on *Military Law and the Practice of Courts-Martial,* which at once became the standard textbook on military law at the Military Academy. In Feb., 1864, he was relieved from the academy, and placed in charge of the cannon and projectile branch of the inspection service of the ordnance department, and continued in that branch of service until assigned to the command of Frankford arsenal at Philadelphia, Pa., in Aug., 1864, where, in addition to his duties as commanding officer, he discharged the duty also of inspector of gunpowder. At the close of the war he received the honorary distinction of major and lieutenant-colonel by brevet

"for faithful and meritorious services in the ordnance department." In the year 1866 he published his work on *Electro-ballistic Machines and the Schultze Chronoscope*, and Dec. 22, 1866, was promoted to the rank of major in his corps. The office of chief of ordnance becoming vacant by death, he succeeded to that position June 23, 1874, with rank of brigadier-general. GEO. C. SIMMONS.

**Betts** (BEVERLEY ROBINSON), A. M., b. in the city of New York Aug. 3, 1827; graduated at Columbia College in 1846, and at the General Theological Seminary of the Protestant Episcopal Church in that city in 1850; was ordained deacon in the same year, and admitted to the priesthood in 1851. After a short charge of Trinity church, Rockaway, he was in 1855 made rector of St. Saviour's church, Maspeth, Long Island, which position he held for nearly fourteen years; in 1865 was appointed librarian of Columbia College. Prepared for the press a full catalogue of the library of the college (1874); has been a frequent contributor to Church reviews and journals. Wrote *Sketches of Professors McVickar and Anthon*, which appeared in the *Church and the World*, July, 1873.

**Bid'dle** (JOHN), b. in Philadelphia about 1790; served with distinction in the war of 1812, and became a paymaster in the army and Indian agent; delegate in Congress from Michigan Territory 1829–31, and afterward register of the land-office at Detroit. He resided for some years in Europe. D. at White Sulphur Springs, Va., Aug. 25, 1859.

**Big'ney** (MARK F.), b. in Cumberland co., Nova Scotia, in 1814; educated in the provincial schools; visited Europe in 1846, and settled in Louisiana, where he adopted journalism as his profession. For seven years he was managing editor of the New Orleans *Times*, and published a volume of poems in 1867, *The Forest Pilgrims*. He has also contributed largely to the literary magazines of the times, particularly the *Weekly Mirror*, of which he was editor. C. G. FORSHEY.

**Bil'lings** (JOHN SHAW), A. M., M. D., b. Apr. 12, 1839, in Switzerland co., Ind.; graduated at Miami University in 1857, and at Ohio Medical College in 1860; entered the U. S. army as assistant surgeon in 1861, and had charge during the war of hospitals and with the Army of the Potomac. Since the war he has been on duty in the surgeon-general's office at Washington; is the author of Circular 4, *Report on Barracks and Hospitals*; Circular 8, *Report on the Hygiene of the U. S. Army*, and of several medical, bibliographical, and hygienic essays. He is now in charge of the National Medical Library and of the hygienic division of the surgeon-general's office, and is medical adviser to the Johns Hopkins Hospital in Baltimore.

**Bishop Seabury Mission,** an organization of the Protestant Episcopal Church at Faribault, Minn., was founded in 1860 by Bishop H. B. Whipple and Rev. Drs. Breck and Mauney, and owns the Bishop Seabury Divinity School, Shattuck School, Cathedral of Our Merciful Saviour, and buildings and grounds worth $200,000.

**Bit'tle** (DAVID FREDERICK), D. D., b. in Frederick co., Md., Nov. 19, 1811; graduated at Pennsylvania College 1835; studied theology at the Theological Seminary of the Lutheran Church at Gettysburg, Pa.; pastor in the Valley of Virginia, and afterward in Middletown, Md., until 1853, when he was elected to the presidency of Roanoke College, Salem, Va., during which he d. Sept. 25, 1876.

**Black'ie** (GEORGE STODART), A. M., M. D., PH. D., b. at Aberdeen, Scotland, Apr. 10, 1834; educated at the universities of Bonn, Paris, and Edinburgh, graduating A. M. and M. D. at the last in 1855, obtaining the gold medals for botany and his thesis; came to the U. S., and became professor of natural history at the University of Nashville 1856–61; served during the civil war as surgeon, medical inspector, etc.; has been professor of botany in Tennessee College of Pharmacy, and of chemistry in Nashville Medical College, since 1875; held prominent positions in Masonry, among them that of grand commander of the State; has published *Cretins and Cretinism* (Edinburgh, 1855), *Botany the Ally of Medicine* (Nashville, 1859), *Medical Flora of Tennessee* (Nashville, 1859), *History of the Knights Templar* (Nashville, 1871), besides numerous other works; and edited the *Nashville Medical Journal* 1858–70, and the *Masonic Record* 1870–71.

**Blake** (LILLIE DEVEREUX), b. in Raleigh, N. C., of a wealthy Southern family; educated in New Haven, Conn.; first advocated woman suffrage in 1869; addressed conventions and the legislature of New York several years in succession; a writer of novels and newspaper articles. *Fettered for Life*, published in 1874, is the best of her stories. Was a member of the delegation from the National Association who presented woman's declaration of rights at Independence Square July 4, 1876. She was twice married, and resides in New York City. SUSAN B. ANTHONY.

**Blake** (WILLIAM), b. in London Nov. 28, 1757. In 1783 appeared *Poetical Sketches by W. B.* This was printed and published in the ordinary way, and was without illustrations. In 1789 came *Songs of Innocence*; in 1793, *The Gates of Paradise*; in 1794, *Songs of Experience*, and later several volumes of poetic rhapsody. All these were published by the author, and all were illustrated. Both text and illustrations were engraved, and when printed off Blake tinted both text and border in a style of his own, making each page a picture. Much of his loveliest and sublimest work is in these illustrations. But he produced so much that a mere list of his engravings, water-colors, and drawings in distemper would fill a page of this work. He is best known to the public by his *Canterbury Pilgrims*, his *Inventions to the Book of Job*, and his designs to Blair's *Grave*. D. in London Aug. 12, 1827. *Life* by Alexander Gilchrist; Cunningham's *Lives*; *William Blake*, by A. C. Swinburne. *The Poetical Sketches* and *The Songs of Innocence and Experience* were reprinted in 1874. The *Inventions to the Book of Job* have been reproduced by heliotypy by James Osgood (Boston, Mass.).

**Blatch'ford** (RICHARD M.), b. at Stratfield, Conn., in 1798; graduated at Union College, Schenectady, in 1818; taught school for a couple of years at Jamaica, Long Island, but studied law at the same time, and was admitted to the bar of New York in 1821; was appointed counsel and financial agent of the Bank of England for the U. S. in 1825; elected member of assembly in 1855, and appointed commissioner of Central Park in 1859; represented the U. S. at the court of Rome 1862–63. D. at Newport Sept. 4, 1875.

**Bliss** (PHILIP PAUL), b. at Clearfield, Pa., in 1838; received instruction in music from George W. Root; became the chorister of the First Congregational church of Chicago, and superintendent of the Sunday-school; joined afterward in the lay evangelistic labors of Major Whittle, and perished at the Ashtabula railway accident, Dec. 30, 1876. His hymns "Hold the Fort," "Hallelujah, 'tis Done!" "More to Follow," etc.—of which he generally composed both text and melody—became very widely used in the Christian Church, especially in revival meetings.

**Bliss** (PORTER CORNELIUS), A. M., b. on the Cattaraugus reservation of Seneca Indians, Erie co., N. Y., Dec. 28, 1838; studied at Hamilton and Yale colleges; travelled in Maine, New Brunswick, and Nova Scotia 1860–61, investigating the condition of the Indian tribes in behalf of societies at Boston; was employed for some months as clerk in the Indian bureau, and subsequently in the post-office department at Washington, 1861; took part in volunteer organizations for the defence of the capital; visited England the same year; accompanied Gen. J. W. Webb as private secretary on his mission to Brazil 1861–62; was commissioner of the government of the Argentine Republic for the exploration of the Indian country called the Gran Chaco 1863; edited at Buenos Ayres a monthly periodical, *The River Plate Magazine* (1864); was appointed by Pres. Lopez historiographer of Paraguay; became secretary to Hon. C. A. Washburne, U. S. minister to Paraguay, 1866; aided him in collecting materials for his *History of Paraguay* (2 vols., 1871); was imprisoned by command of Lopez on a charge of treason and conspiracy for his assassination Sept. 10, 1868; was rescued by an American squadron Dec. 10, 1868; was appointed translator to the state department at Washington Mar., 1869; was editor of the Washington *Chronicle* 1869–70, and secretary of legation in Mexico 1870–74, and was acting minister for several months 1872–73. He has resided in New York since 1874, and is vice-president (1876) of the American Philological Society.

**Bloom'er** (AMELIA), b. in Homer, N. Y., in 1818; married in 1840, and settled at Seneca Falls, N. Y.; wrote frequently on reformatory subjects, and Jan. 1, 1849, established *The Lily*, a semi-monthly publication, of which she was editor and proprietor. It was devoted to the interests of women, and attained a circulation of over 4000. She has earnestly advocated the enfranchisement of woman through her paper, the public press, and from the lecture-stand for the last quarter of a century. Since 1855 she has resided in Council Bluffs, Ia., where she has taken active part in the woman's suffrage work of that State. Mrs. Bloomer did not originate the costume which bears her name, as is generally supposed, but after seeing it worn by Elizabeth Smith Miller, daughter of Hon. Gerrit Smith, who was the first, so far as known, to wear the dress in public, she with Elizabeth Cady Stanton, Lucy Stone, and others, adopted it, and introduced it to the public through *The Lily*. The need felt by women for some reform in dress was evidenced by letters of inquiry from all parts of the country. SUSAN B. ANTHONY.

**Blount** (JAMES H.), b. in Jones co., Ga., Sept. 12, 1837; graduated at the State University in 1857. He was quite a young man when the question of secession was mooted in

1860, and opposed it as long as it was an open question. But as soon as the war broke out he went with the people of his native State, and entered the Confederate army as a private in the 2d Georgia battalion of infantry; before the close of the war was promoted to the rank of lieutenant-colonel of cavalry. Soon after his graduation he studied law, and was admitted to the bar. At the close of the war he resumed the practice of his profession in Macon, Ga., where he still resides. In the fall of 1865 he was elected to the State convention for the formation of a new constitution under the reconstruction policy of Pres. Johnson. In 1872 he was elected to represent his district in the 43d Congress; re-elected in 1874 to the 44th Congress, and in 1876 to the 45th Congress. In the 44th Congress he was on the committee of appropriations. ALEXANDER H. STEPHENS.

**Bolintinea'no** (DEMETER), b. at Bolintina, Wallachia, in 1826; was educated at Bucharest; studied in Paris; edited in 1848 a revolutionary paper, and was banished by Prince Stirbey; settled once more in Paris, but returned home under Prince Cuza; edited another journal, and received a high governmental position after the *coup d'état*, May 2, 1864. His novel *Manila* and several of his lyrical poems have been translated into French (*Brises d'Orient*) by himself, and attracted considerable attention.

**Bonan'za,** a Spanish word probably derived from *bueno*, "good" (adj.), and by the termination *anza* it becomes a noun signifying "goodness." In Old Spain this word is generally used in a nautical sense, indicating fair weather at sea. It is also used to indicate prosperity or success. In California and in Northern Mexico it is used as a mining term to signify an abundance of metal or an ore-body. The mines of Northern Mexico are principally what are called "pocket mines," with thin veins of poor metal connecting the pockets. When a pocket of rich ore is struck the mine is said to be in *bonanza*. When the veins run out without leading to pockets, the mine is said to be in *borra* ("useless words"), from the verb *borrar*, to "rub out" or "to blot out." In the Comstock Lode in the State of Nevada enormous bonanzas, usually in the form of lenticular masses of argentiferous and auriferous ore, have been found. (See COMSTOCK LODE.) In popular language the word *bonanza* is frequently used in a still more extended and metaphorical sense to indicate any sudden fortunate change, as an unexpected augmentation of wealth, or even a copious and timely rainfall. JOHN LE CONTE.

**Boot** (JOHN FLETCHER), a Cherokee, a member of the executive council of the nation; he was also a brave warrior. Two years after his conversion in 1825 he was licensed to preach, and was subsequently ordained deacon of the Methodist Episcopal Church, South, in Nashville, Tenn., and elder in Lebanon. He was an eloquent and powerful preacher in his native tongue, and was the first Cherokee that administered the Lord's Supper. He was also one of the founders of the Cherokee Bible Society. D. of hæmorrhage of the lungs Aug. 8, 1853, aged about sixty years. T. O. SUMMERS.

**Booth** (NEWTON), b. in Salem, Washington co., Ind., Dec. 25, 1825; graduated at Asbury University in 1846; studied law in Terre Haute, and was admitted to the bar in 1850; went to California soon afterward, and engaged in business in Sacramento; returned in 1857 to Terre Haute, and practised law till 1860, when he went back to California. In 1863 he was elected to the California State senate; in 1871 was elected governor of California on an independent ticket; in Mar., 1874, was elected U. S. Senator for six years from Dec., 1875, and resigned his governorship. J. B. BISHOP.

**Bo'reas,** in Grecian mythology, the personification of the north wind, the brother of Hesperus, Zephyrus, and Notus; was imagined to dwell in the caves of Thrace, and represented with wings, hair, and beard dripping with snow-flakes.

**Bouguereau'** (ADOLPHE WILLIAM), b. at La Rochelle, France, Nov. 30, 1825; studied in the School of Fine Arts in Paris 1843–50, and in Rome 1850–55, and began to exhibit in 1855. Among his most celebrated pictures are *Triomphe de Vénus* (1856), *La Bacchante* (1863), *Enfants endormis* (1868), and a series of historical and religious representations in the churches of Ste. Clotilde and St. Augustine in Paris. A considerable number of his works are found in the U. S.

**Bo'vidæ** [from *Bos*, the ancient Latin name of the ox, one of the most prominent of the genera], an important family of mammals rich in species, and including a large number of those most useful to man. The form is quite diversiform, the average type, or that represented by the greatest number of species, being exemplified in the antelopes, while extremes are represented by the oxen, the sheep, and the goats. The head is more or less contracted forward, and the nose generally naked, rarely hairy, with the nostrils large and open; the teeth are of the typical ruminant type—*i. e.* M. $\frac{3}{3}$, P. M. $\frac{3}{3}$, C. $\frac{0}{1}$ or $\frac{1}{1}$, I. $\frac{0}{3}$; the molars have mostly four crescentic lobes; in the upper jaw the canines are generally absent or small, but rarely hypertrophied; in the lower jaw the canines are approximated to and of the same form as the incisors, so that they are very often regarded as being true incisors, although quite erroneously; the combined canines and incisors form a series uninterrupted at the symphysis; the frontal appendages are persistent, common to both sexes, and developed as sheaths of true "horn" on osseous cores originating from the frontal bones; the feet are provided each with two hoofs, and generally small false hoofs, though these are sometimes absent; the skull has the palatine axis declivous from the occipito-sphenoid axis; the auditory bullæ are produced forward, especially toward the inside, and applied behind to the paroccipital processes; the styloid processes are deflected more or less forward, and enclosed in oblique folds on the outer surfaces of the auditory bullæ; the nasal bones are elongated, and straight or declivous forward, and connected by suture with the lachrymals, supramaxillaries, and sometimes with the intermaxillaries; the supramaxillary and intermaxillary bones are well developed forward; the olfactory organ is normal in size; Cowper's glands exist, and a gall-bladder, generally of considerable size. The family as thus defined excludes the genera *Antilocapra* of America and *Saïga* of the plains of the middle Palæarctic region, each of which represents apparently a distinct family. The genera still embraced are quite numerous, and are susceptible of being grouped into several sub-families; these are the (1) Bovinæ, with 6 genera; (2) Ovibovinæ, with 1 genus; (3) Caprinæ, with at least 2 genera; (4) Rupicaprinæ, with 1 genus; (5) Oryginæ, with 1 genus; (6) Budorcinæ, with 1 genus; (7) Nemorrhedinæ, with 3 genera; (8) Aleclaphinæ, with 3 genera; (9) Cervicaprinæ, with 6 genera; (10) Cephalophinæ, with 1 genus; (11) Antilopinæ or Gazellinæ, with 5 genera. The latest scheme of classification has been contributed by Sir Vincent Brooke to Wallace's work on the *Geographical Distribution of Animals* (1876). (See also the articles ADDAX, ANOA, ARNEE, BISON, BLAUW-BOC, BLES-BOC, BOVIDÆ (properly Bovinæ), BUFFALO, CHAMOIS, ELAND, GAYAL, GAZELLE, GNU, GOAT, IBEX, KOODOO, OVIBOS, SPRING-BOC, STEINBOC, URUS, YAK, and ZEBU, in CYCLOPÆDIA; and SHEEP.) THEODORE GILL.

**Boy'den** (URIAH ATHERTON), b. at Foxboro', Mass., Feb. 17, 1804, descended from a family of skilful mechanics and manufacturers, and acquired early, at the workbench and the forge, an intimate knowledge of materials and considerable skill as a workman, with which he connected, as a natural gift, a great power of concentration. Having worked as an engineer on the construction of the railroad from Boston to Nashua, he was for many years employed in hydraulic engineering at Lowell and at Manchester, and here he found opportunity to make a comprehensive study of the theory of the turbine water-wheel, which resulted in a practical reconstruction of the engine. The old theory was comparatively simple, but many of its statements differed widely from the facts, and were worse than useless as guides for practice. To correct these errors demanded an exhaustive knowledge of the laws of force of motion and very laborious computations. Mr. Boyden, however, accomplished the task, and his work received practical confirmation by the tests of some of his turbines, which utilized about 95 per cent. of the total power of the water expended, while the water-wheels of the old construction utilized hardly 76 per cent. He donated $1000 to his native town, known as the "Boyden Fund," the interest being expended for educational purposes; the interest was afterward applied to the public library, named the Boyden Library, established in the Soldiers' Memorial Building of the same town. In 1850 he withdrew from business, settled in Boston, and devoted himself to the study of physics and chemistry, which sciences have received much encouragement and support from him. EDWARD SAWYER.

**Boy'land** (GEORGE HALSTED), M. D., b. in Cincinnati, O., Jan. 19, 1845; graduated at Yale College 1864, and in medicine at Leipsic, Germany, 1874. Is the author of *Six Months under the Red Cross with the French Army*, also of "Salicylic Acid" in London *Lancet*, Nov. 28, 1874, etc. Decorated for services in the French army during the late Franco-Prussian war. Is now a practitioner in Baltimore, Md. PAUL F. EVE.

**Bran'dreth** (BENJAMIN), M. D., b. at Leeds, England, Jan. 9, 1807, grandson of Dr. William Brandreth, who introduced Brandreth Pills in 1770 in England; came to America 1835; started a laboratory at Sing Sing, N. Y.; State senator 1849 and 1858; proprietor of "Allcock's Porous Plasters" and Brandreth Pills; in 1874 presented to Dr.

Robert S. Newton and his associates the building used by the Eclectic Medical College of the City of New York.

**Bray** [in ancient Gallic, *Bray* meant "marsh"], a fashionable watering-place of Ireland, at the mouth of the river Bray, 12 miles S. E. of Dublin, partly in the county of Dublin, but chiefly in the county of Wicklow, is connected by 2 railways with Dublin; has 2 hotels, 6 churches and chapels, a bank, a court-house, a dispensary, a savings bank, a newspaper, and some trade by sea. P. 6086.

**Bray,** a small parish in Berks co., England, 22½ miles W. of London. P. about 4000. Famous for its vicar, who changed his religion three times during the reigns of Henry VIII., Edward VI., Mary, and Elizabeth, that he might "live and die the vicar of Bray."

**Bre'mer** (Charles), b. in Germany in 1814; was at first a Pietist, but was licensed to preach in the Methodist Episcopal Church, South, by Rev. Dr. Winans in New Orleans in 1842; organized the first two German M. E. churches in New Orleans. D. Sept. 14, 1847. T. O. Summers.

**Brew'er** (Thomas Mayo), A. M., M. D., b. in Boston, Mass., Nov. 21, 1814. His grandfather, Col. James Brewer, was a well-known patriot of the Revolution and a leader in the "Boston tea-party" of 1773. Dr. Brewer graduated at Harvard College in 1835, and at the Massachusetts Medical School in 1838. After two years of professional labor, in 1840 he became editor of the Boston *Atlas*, then a leading Whig paper; in 1857 became a partner in the publishing-house of Brewer & Tileson. Although actively engaged for a lifetime in professional and business duties, Dr. Brewer is best known as a thorough and enthusiastic ornithologist. In 1839 he edited a new edition of Wilson's *Ornithology*, for which he prepared a synopsis of all North American birds then known. He was a personal friend of Audubon. One volume of a fine work of his on the *Oölogy of North America* was published by the Smithsonian Institution, but the publication was suspended on account of its great cost. He also wrote most of the biographical portion of the *History of North American Birds*, of Baird, Brewer, and Ridgway, 3 vols. of which were published by Little, Brown & Co. in 1874.

**Bridge of Allan,** so named from the bridge across the river Allan, which bounds it on the W., is situated at the southern base of the western termination of the Ochil Hills in Stirlingshire, Scotland. P. 3055. It has several elegant churches, fine hotels, and numerous lodging-houses. About 50,000 visitors frequent it annually to derive benefit from the mineral waters and its mild and salubrious climate.

**Brieg,** or **Brig,** small town of Switzerland, canton of Valais, at the junction of the Saltine and the Rhone, and at the commencement of the road across the Simplon; carries on a considerable transit-trade. P. about 1200. Near by is the Brieger Bad, whose mineral springs formerly enjoyed a great reputation for their curative power, and which are still much used.

**Briggs** (Charles Augustus), D. D., b. in New York City Jan. 15, 1841; studied at the University of Virginia 1857–60, the Union Theological Seminary of New York 1861–63, and the University of Berlin 1866–69; became pastor at Roselle, N. J., in 1870, and professor of Hebrew at the Union Theological Seminary of New York in 1874, and translated and edited the commentaries to the Psalms and to Ezra in Lange's *Commentaries;* received the degree of D. D. from the College of New Jersey 1876.

**Bris'tow** (Benjamin H.), b. at Elkton, Todd co., Ky., in 1833; studied law, and practised his profession successfully in Kentucky till 1861, when, on the outbreak of war, being of strong Union sentiments, he volunteered his services, and as major of the 25th Kentucky Vols. was engaged at Fort Donelson and Shiloh, being wounded in the last-named battle. Afterward, as colonel of the 8th Kentucky Cavalry, he served throughout the war with distinction. About the close of the war he received the appointment of U. S. district attorney for the Louisville district. The ability here exhibited led to his appointment as solicitor-general on the organization of the department of justice in 1870. After two years' service he resigned and became attorney of the Texas Pacific R. R., which position he held but a short time when he returned to the practice of his profession at Louisville, Ky.; was appointed attorney-general in 1873; became secretary of the treasury in 1874–76. Geo. C. Simmons.

**Britan'nicus,** a surname which, on account of some alleged victories in Britain, the Roman senate bestowed in 42 A. D. on the emperor Claudius and his newly-born son by Messalina, Claudius Tiberius Germanicus, and which afterward became the distinguishing appellation of the latter. In 48, Messalina was executed, and Agrippina, the second wife of Claudius, induced him to exclude Britannicus from the throne and appoint Nero, her son by her former husband, successor. After the accession of Nero, however, Agrippina used Britannicus as a means of intimidating him, and to get rid of this rival, Nero poisoned him Dec. 15, 55.

**Brom'ley** (Isaac H.), b. at Norwich, Conn., Mar. 6, 1833; entered Yale College in 1849, remaining there two years, and was admitted to the bar in 1854; in Dec., 1858, established the Norwich *Bulletin*, and was its editor till the spring of 1868, when he became editor of the Hartford *Evening Post;* was a member of the State legislature from Norwich in 1866; in 1862 was captain in the 18th Connecticut Vols., and was provost-marshal for two years during the late war. In July, 1872, he left the Hartford *Post*, and assumed a position on the editorial staff of the New York *Tribune* in the following February. J. B. Bishop.

**Brönd'sted** (Peter Olaf), b. at Horsens, Danish province of Jutland, Nov. 17, 1780; studied at the University of Copenhagen, then in Paris 1806–08, and undertook comprehensive explorations in Greece and Asia Minor from 1808 to 1813. In the latter year he was made professor of Greek in Copenhagen, but went in 1818 to Rome, and resided there till 1832, visiting Sicily, the Ionian Islands, Greece, and France. Returning to Copenhagen in 1832 as director of the royal museum of antiquities and professor of archæology, he d. there June 26, 1842. His principal work, *Reise i Grækenland* (2 vols., 1826–30), was published at once in Danish, French, and German. He also wrote—*Bidrag til der danske Historie af Nordfranske Manuscripter fra Middelalderes* (1817–18), *Description of Thirty-two Ancient Greek Painted Vases* (1832), *The Bronzes of Syria* (1836), and finally made a very fine translation into Danish of Æschylus's *Orestias*.

**Brontotherium.** See Titanotherium, in Cyclopædia.

**Bross** (William), b. at Montague, Sussex co., N. J., Nov. 4, 1813; graduated at Williams College, Mass., in 1838; lived several years as a teacher; settled in 1848 in Chicago; was associated from 1849 to 1851 with Rev. J. A. Wight in the publication of the *Prairie Herald;* established in 1852, in connection with the late J. L. Scripps, the *Daily Democratic Press*, which was consolidated with the *Tribune* July 1, 1858, and was for several years president of the *Tribune* company. He published a *History of Chicago*, and was lieutenant-governor of Illinois 1865–69.

**Brown** (Olympia), b. in Kalamazoo co., Mich., Jan. 5, 1835; educated at home; commenced teaching a district school at the age of fifteen, at intervals attending the village academy, Mount Holyoke Seminary, and Antioch College, O.; graduated in 1860; entered the theological school, under the auspices of the Universalist denomination, at Canton, N. Y.; graduated and was ordained in June, 1863; in Feb., 1864, installed over her first parish in Weymouth, Mass.; in 1869–76 preached at Bridgeport, Conn., in the mean time being married to Henry Willis.

Susan B. Anthony.

**Buchan'an** (Joseph Rodes), M. D., b. at Frankfort, Ky., Dec. 11, 1814; graduated in medicine at Louisville University in 1842; in 1846 became professor of physiology in the Eclectic Medical Institute of Cincinnati; was for several years dean of the faculty; edited the medical journal connected with this school; published for several years *Buchanan's Journal of Man*, and gave in 1854 a synopsis of his lectures.

**Buch'tel Col'lege.** The corner-stone of this institution was laid July 4, 1871, and it was opened for the reception of students Sept. 11, 1872. It was founded by the Universalists of Ohio and Pennsylvania, and named Buchtel College in honor of John R. Buchtel, who consecrated his wealth to its support. It is a first-class college, offering to students of both sexes equal opportunities for a thorough practical and liberal education. S. H. McCollester.

**Buck** (Gurdon), b. in New York City May 4, 1807; graduated at the College of Physicians and Surgeons in 1830; studied in Paris, Vienna, and Berlin, and began to practise in New York in 1833; visiting surgeon of New York Hospital 1837; was, during the latter part of his life, intimately connected with all the most prominent medical organizations in the city of New York. D. Mar. 3, 1877. He was successful in the most difficult surgical operations. In 1876 he published an elaborate treatise, *Contributions to Reparative Surgery*.

**Buck'hout** (Isaac Craig), b. in Morrisania, N. Y., 1830; studied civil engineering at New York College; held several important positions in the Harlem R. R. Co., and designed the Grand Central R. R. dépôt in New York City. He also designed the plan for sinking the tracks of the railroads entering New York through Harlem; also a plan for an underground railway beneath New York City, and a dépôt for the city of St. Louis. D. at White Plains, N. Y., Sept. 27, 1874. J. B. Bishop.

**Buck'ley** (Samuel Botsford), Ph. D., b. in Torrey, Yates co., N. Y., May 9, 1809; graduated at Wesleyan University in 1836; has travelled extensively, chiefly in the Southern States, as a student of botany, malacology, geology, geodesy, etc.; was assistant naturalist and geologist in the State survey of Texas 1860–61; was connected with the U. S. Sanitary Commission 1862–65; State geologist of Texas 1866–67, and was 1871–72 editorially connected with the *State Gazette*, Austin, Tex.; is author of many scientific and other papers, and has prepared a work on the trees and shrubs of the U. S. He discovered the flowers and fruit of the shrub or small tree *Buckleya distichophylla*, named in his honor by Dr. Torrey.

**Bufonidæ.** See Toad, in Cyclopædia.

**Bull'dozing, Bulldoser,** or **Bulldozen,** a slang term in process of adoption in Louisiana, having as yet a variable significance. Its first use was in the parishes of Feliciana and Baton Rouge, in the spring and summer of 1876, in describing the doings of a band of a dozen Regulators styled the "Union Stop," who undertook, in the absence of law, to check the stealing and killing of stock, which was destroying the cattle and hogs of that region. The punishment of offenders was with the well-known bull-whip—a hickory handle of 12 or 15 inches and a plaited thong of 3 to 5 feet. A dozen lashes (or the dozen composing the band) gave the name to the process or dose of strapping, and it was called "bulldosing" or "bulldozing." It soon was applied to all summary punishment not authorized by law. More recently, since August and September, 1876, it has become a political term, particularly as applied to the influencing of negro voters by those of their own color. It is now charged and denied that it was used by the whites, but bulldozing has become a term used to describe all the various kinds of intimidation, real or imaginary, used at elections. It has very rapidly grown into use since the Presidential election by editors and political writers. (See the investigation in Louisiana by the House committee of Congress.) The first use of the term is claimed in Clinton, East Feliciana, and imputed to a German soldier of fortune, who was awakened from a drunken sleep in the street by a sudden dash of the Regulators. He exclaimed, "Hurra for the bulldozers!" It is also traced, with more ingenuity than probability, to the pulldoo, a Southern water-fowl, that arrives in the night and surprises by his numbers. Bulldozing is supposed to be a corruption of pulldoo, the mysterious arrival by night lending plausibility to the theory. Its rapid adoption by political writers of every class in the U. S. to describe all sorts of political influence warrants this analysis of its origin. Its meaning, however, is not yet well determined. C. G. Forshey.

**Bü'low, von** (Friedrich Wilhelm), Baron, b. on the paternal estate of Falkenberg, Prussian province of Brandenburg, Feb. 16, 1755; entered the army in 1769, and was a lieutenant-general at the opening of the war of independence in 1813. Twice he defeated Oudenot in minor encounters, and by his victory over Ney at Dennewitz (Sept. 6, 1813) he prevented the French from pushing onward to Berlin. In the battle of Leipsic he took a conspicuous part, and drove then the French out of Westphalia, Holland, and Belgium, joining the allies in Paris, where the Prussian king made him count of Dennewitz and gave him estates worth $200,000. He also distinguished himself at Waterloo. D. at Königsberg Feb. 25, 1816.

**Bülow, von** (Hans Guido), b. at Dresden Jan. 8, 1830; studied law in Leipsic and Berlin, but determined, under the influence of Richard Wagner and Liszt, to devote himself exclusively to music; studied under Liszt at Weimar 1851–53, and settled in 1854 in Berlin, where he was made professor of the piano at the Conservatory of Music in 1855. Having made several concert-tours in Germany and Russia, and acquired a great reputation as a pianist, he removed in 1867 to Munich, where he became chapel-master to the king. He has composed several pieces both for the pianoforte and orchestra, and written much for the *Neue Zeitschrift für Musik*, and both his compositions and his writings show the enthusiasm with which he has embraced the ideas of Wagner.

**Bu'reau Ver'itas,** an institution for the classification of the steamships and sailing vessels of all nations, for use by underwriters, maritime insurance agents, etc., with head-quarters at Brussels in Belgium. It was founded at Antwerp, Belgium, in 1828, by Charles Bal, Esq. During the revolution of 1830, which separated Belgium from Dutch rule, the Bureau Veritas was removed to Paris, France, where it was long known as the French Lloyd's. In the Franco-German war of 1870–71 the bureau was finally located at Brussels. Its surveyors and agents are found in the seaports of all maritime countries, and their ratings of vessels are the fruit of the utmost severity in examination. H. H. McFarland.

**Bur'gess** (John W.), b. at Cornersville, Giles co., Tenn., Aug. 26, 1844; was educated at Cumberland University, Lebanon, Tenn., and Amherst College, Mass., whence he graduated in 1867; studied law, and was admitted to the bar of Massachusetts in 1869; was appointed professor of English literature and political economy at Knox College, Galesburg, Ill., in 1869; went to Europe in 1871; studied history and public law at Göttingen, Leipsic, and Berlin; was appointed professor of history and political science at Amherst College in 1873, and professor of political history and public law at Columbia College, New York, in 1876.

**Business Colleges** are modern institutions, designed to give a knowledge of the science, laws, and customs of all departments of business. Previous to 1850, schools for the education of young men were established in several cities of the U. S.; these, however, were independent of each other and without uniformity in their courses of instruction. But in 1851, E. G. Folsom obtained an act of incorporation for his college in Cleveland, O., and in 1853, Messrs. H. B. Bryant and H. D. Stratton established there the first of their prospective "chain of international business colleges;" in 1857 these two were consolidated. From that date they rapidly extended into all the principal cities of the U. S. and Canada. In 1865 there were about fifty colleges in the "chain," their pupils annually numbering from 15,000 to 25,000, and at present there are between 100 and 150 colleges, with between 30,000 and 50,000 pupils. In June, 1867, the principals and proprietors of these colleges met in Buffalo, N. Y., and organized under the name of the International Business College Association, which holds an annual meeting for the promotion of business education. Nearly all business colleges give individual instruction, and each pupil can advance and complete the course according to his ability. Students can enter at any time and select their studies, but must complete the full course and pass a rigid examination to be entitled to a diploma. The course of study is specific, theoretical, and practical, applicable to all branches of business—book-keeping in a great variety of forms; penmanship, with special reference to legibility, grace, and rapidity; arithmetic, as designed for practical purposes; commercial law, special attention being given to negotiable paper, partnerships, agencies, contracts, etc.; banking, each college having one or more banks in constant practice; general merchandising, including importing, jobbing, retailing, etc.; commission in all its applications, and business correspondence on a great variety of topics. In a few of these institutions modern languages are taught. J. E. Soulé.

**But'ton** [Fr. *bouton*, "bud"], the name applied to an article of dress of various forms used either for ornament or for fastening together the parts of a dress by means of a loop or worked buttonhole. Buttons are used for various articles of male and female apparel, and for hats, bonnets, shoes, and gloves. The word is also applied in *carpentry* to a flat oblong piece of wood or metal, turning on a nail or screw, to fasten doors and the like; and in *assaying* to a round mass of metal remaining in the cupel after fusion; but the use of the word in relation to articles of dress is the one of most importance. The button is generally considered a sign of civilization. The savage fastens his blanket or tunic, his leggings and moccasins, with strings, and has no idea of buttonhole or button; and it is only when a considerable degree of civilization is attained that we find buttons taking the place of strings or lacings, while fashion, in the artificial condition of society in great cities, requires a profusion of buttons, not so much for use as for ornament. Except the occasional use of a gem to fasten the toga at the neck, the Greeks and Romans seem to have had no idea of buttons, as indeed their flowing robes did not require them. They were first applied to dresses (probably in the thirteenth or fourteenth century) for purposes of ornament only, but somewhat later the buttonhole, an expansion of the idea of the loop, was invented, and the button became indispensable for the dress. In the beginning of the seventeenth century the manufacture of buttons had attained some importance in England, Birmingham being then, as now, its principal seat. These buttons were of cloth, covering a wooden disk, of gold, steel, and ivory, the last three the work of the goldsmiths, who were very expert in the arts of chasing and carving metals. Some of the steel buttons made at the Soho works about this time were sold at 140 guineas the gross, or almost $5 the button. About 1745, Matthew Boulton made many improvements in inlaid and steel buttons. Gilt buttons came into use soon after the accession of George III. in 1760, and John Taylor of Birmingham, originally a cabinetmaker, patented many improvements in gilt, plated, and lacquered buttons. The making of the shanks or eyes of these buttons was improved by Ralph Heaton, also of Birmingham, not far from 1800. This is still a separate branch of the business at Bir-

mingham. From 1760 to the present time the manufacture of buttons has been a constantly-growing industry in England, France, Switzerland, and the U. S. All descriptions of buttons may be classed under three distinct heads—viz. shank buttons, hole buttons, and covered buttons—but each kind is made of a great variety of materials and an almost infinite diversity of forms. The shank buttons, those having a wire loop, eye, or shank to attach them to the dress, are made of gold, silver, brass gilt or bronzed, copper or bronze, nickel, iron, steel, ivory, bone, mother-of-pearl, and other shells, Whitby jet and other forms of coal, glass, jade, malachite, amber, tortoise-shell, horn, vegetable ivory, wood, papier-mâché, bois brulée, India-rubber, gutta-percha, steatite, clay, etc. The hole buttons (two, three, or four holes) are made of iron, sheet iron, sheet brass, sheet tin, wood, paper—of both these combined with brass or sheet tin—ivory, bone, porcelain, or white glazed ware, glass, mother-of-pearl, papier-mâché, clay, etc. The covered buttons, having a basis of wood, brass, zinc, or tin, have their covering of farmers' satin, prunella, broadcloth, brocade, velvet, silk, mohair, grenadine, twist, linen, cotton, and, in short, every description of textile fabric. Both the shank and the covered buttons are to a considerable extent made on the *shell* plan—*i. e.* the face of the button is stamped out of a thin sheet of metal—and may have a flat, oval, or round surface as desired; and the back or under surface is also stamped, and its edges being turned, it is pressed into the upper shell and locked there by the pressure. The principle on which all shell buttons are made was first devised by B. Sanders, a Dane who had lost most of his property in Copenhagen in the bombardment of that city in 1807, and removed to Birmingham, England, where he commenced the manufacture of buttons. He applied it only to covered buttons, which he made of sheet brass or tin in two parts, the upper blank or disk having its edge turned up and being covered with cloth, silk, or lasting, and the under blank, which was smaller than the upper and convex in form, having a wire shank, and the cloth and paper or cardboard which was to keep it in place put inside of it, and the two were pressed together, the turned edges interlocking so as to make a perfect button. An improvement was made in these by a son of Mr. Sanders, the lower blank having a circular hole in it (and receiving in consequence the name of "collet"), through which in the act of pressing the two blanks together a portion of the cloth or textile inside of the collet was thrust, so as to make a flexible cloth shank in place of the wire one. Other modifications were made by other inventors which reduced the price and greatly increased the facility of production. One of these was the production of what is known as the silk-back button, which dispenses with the collet, though it substitutes for it a round piece of sheet iron smaller than the upper blank. The so-called silk-back is a very thick heavy cloth having a silk face, which is cut out, of the proper size, by a die, its back having first been coated with a heavy sizing; a filling of soft spongy paper is placed upon this sizing, and the back is then gathered over the small blank of sheet iron and pressed into the upper blank or shell, which had previously been covered with the proper material, and the button is completed, no metal appearing upon either surface. In the shell covered buttons sheet iron is now used for the blanks, and where the metal shows, as in the ordinary flexible shank buttons, it is lacquered. The process for making the metallic shell buttons is different, though the principle is the same. These buttons, whether of flat or oval surface, and whether figured or plain, are made from rolled brass plate; originally, the flat buttons were solid and struck out as blanks from a thick plate, the eye or shank soldered on, and the whole finished, polished, and gilt or silvered by the old cream-of-tartar process for silvering or the mercury amalgam for gilding. It was said that by this latter process six cents' worth of gold would suffice for gilding a gross of buttons. Both processes have been superseded by electro-plating. (See GILDING and ELECTRO-PLATING, in CYCLOPÆDIA.) When buttons began to be made on the shell-plan the upper blank was forced by the falling of a heavy weight into a finely-engraved die of hardened steel, which gave it the oval form and the beautifully-ornamented surface, and the under blank into another die, which stamped upon it the maker's name or trade-mark, and at a later date riveted the shank (which before had been soldered to it) into this plate; a filling of stout paper or binder's board was then placed upon it. The two plates were then pressed together by a fly-press, and the button was trimmed and ready for the gilding. When gilt it was burnished and set on cards containing a dozen, when it was ready for market. Subsequent improvements have combined and simplified these processes, so that now a single machine completes the button except the gilding, burnishing, and carding; and the last process is also performed by a machine. Embossed buttons have been made of horn softened by heat, dyed and pressed in a die, of *bois brulée* (sawdust and shellac heated), and of India-rubber and gutta-percha vulcanized, which were for some years very popular. These have now mostly given place to oval and flat buttons of ivory, bone, vegetable ivory, mother-of-pearl, and celluloid. The ivory, bone, and vegetable ivory buttons are engraved and dyed in a variety of patterns and checks. The mother-of-pearl may be either of the ordinary color of pearl or what is known as smoked pearl. The celluloid buttons are made in moulds and dies like the vulcanite and horn. Those made of VEGETABLE IVORY (see in CYCLOPÆDIA), at present very popular, are cut from slabs sawed out of the vegetable ivory-nut by bits attached to spindles and made to turn very rapidly, and are then turned, polished, dyed, and worked in figures in a lathe. They are then carefully sorted and put upon cards. The hole buttons, when made of ivory, vegetable ivory, pearl, malachite, onyx, etc., are cut by a tubular saw or bit revolving with great rapidity; the eyes are made by fine revolving drills. Pearl shirt buttons are made in great quantities both in this country and Europe, and many of them are made of cheap substitutes for pearl. Agate or feldspar buttons for under-clothing, as well as clay buttons, are made in moulds and baked and glazed like porcelain. They are mostly imported, requiring very cheap labor for their production. The greater part of the pantaloon buttons in use are made either from japanned iron stamped out by a heavy die or embossing swedge, or are made as shell buttons, with the back of paper or wood, and the whole button made by one machine and almost by a single blow. They are afterward japanned. Fancy and ornamental buttons for ladies' dresses are sometimes made of combinations of cloth and glass or papier-mâché, pearl, metal, or choice woods, sometimes of vulcanite, glass, pearl, or Whitby jet, but oftener at the present day of silk, velvet, silk cords and figures, or what is known as passementerie, or of brocade and embroidered silk. These are usually made upon a wood foundation, especially if they are oval or of fanciful shape. Their manufacture is often carried on in connection with other dress trimmings.

The manufacture of covered buttons in this country, except in its simpler forms of hand-made covered buttons, was not attempted earlier than 1825 or 1826. Samuel Williston, who was the founder of the covered-button business in this country, commenced covering buttons by hand at Easthampton, Mass., in 1826, and by the gradual introduction of machinery and a consolidation of his methods and machines with those of the Haydens at Haydenville in 1834 (the Haydens had been making buttons in a small way after the Sanders patterns from 1831), laid the foundations of the extensive works of the National Button Co., which employs 175 hands and can turn out 2500 gross per day. Waterbury, Conn., was one of the early seats of the manufacture, but has been largely occupied with the production of metal buttons. There are 8 button-factories in Waterbury; 19 factories were reported in New York City in 1870, besides 3 in Brooklyn, the larger part making ornamental dress buttons; 13 in Philadelphia; 13 in Massachusetts; 22 in Connecticut, and 8 in New Jersey. In Great Britain five-sevenths of the manufacture are concentrated in Birmingham, 4980 hands being employed in the business there, and not quite 2000 elsewhere. London has 58 factories; Germany, 65; Austria, 39; Hamburg and Lubeck, 7; Brussels, 5; Switzerland a large number, though most of them on a small scale. France has great numbers of shops where dress buttons are made in connection with other dress trimmings, and also many engaged in the production of pearl buttons. The statistics of the button manufacture in the census report of 1870, like those of many other branches of manufacture, were very imperfect. That report gives 64 establishments (there are known to have been 78 in five States at that time), employing 1912 hands (617 men, 949 women, 346 children), with a capital of $1,013,700, paying $580,380 in wages, using raw material to the amount of $751,183, and producing annually buttons to the value of $1,778,893. The present condition of the manufacture would require the trebling of all these figures.

C. B. JOHNSON.

**Byrd** (HARVEY LEONIDAS), M. D., b. in Salem, S. C., Aug. 8, 1820; received his degree in medicine from the University of Pennsylvania 1847; was first professor of materia medica and therapeutics in the Savannah Medical College; then professor of principles and practice in the Oglethorpe Medical College, Ga.; professor of obstetrics in the Washington University, and professor of the diseases of women and children in the College of Physicians and Surgeons of Baltimore; was also dean of the three first named, and president of the last; served as surgeon during the civil war, and has written largely for the medical journals.

PAUL F. EVE.

# C.

**Ca'bell** (James Lawrence), A. M., M. D., LL.D., b. in Nelson co., Va., Aug. 26, 1813; studied medicine at the universities of Virginia, Maryland, and Pennsylvania, and finally in Paris; was appointed professor of anatomy and surgery in the University of Virginia in 1837; published a volume on the unity of mankind and numerous minor essays and monographs, and is president of the State board of health and vital statistics of Virginia. Paul F. Eve.

**Ca'dy** (Daniel), b. in Columbia co., N.Y., in 1773; admitted to the bar in 1795, and practised with great distinction for over sixty years; was several times a member of the legislature of New York and of Congress, and for eight years judge of the supreme court and the court of appeals of New York. His wife was a daughter of Col. James Livingston, an officer in the army of the Revolution, and one of his five daughters is the celebrated Elizabeth Cady Stanton. D. at Johnstown, N. Y., 1859. A sketch of his life by his son-in-law, Henry B. Stanton, is contained in vol. xviii. of Barbour's *S. C. Reports*.

**Cal'laway** (Elisha), b. in Delaware Jan. 8, 1792; joined the South Carolina Methodist Episcopal conference Jan., 1818, and was a most laborious minister, laboring in extensive fields in South Carolina, Georgia, Alabama, and Mississippi. He represented the Alabama conference in the Louisville convention, at which the Methodist Episcopal Church, South, was organized. He belonged to the North Mississippi conference at the time of his death, June 21, 1870. T. O. Summers.

**Cam'eron** (Angus), b. at Caledonia, Livingston co., N. Y., July 4, 1826; studied law in Buffalo, and in 1857 removed to La Crosse, Wis.; served two years as representative, being Speaker one year, and four years as senator in the legislature of Wisconsin; was regent of the University of Wisconsin 1866–75, and in 1875 was chosen U. S. Senator from that State. J. B. Bishop.

**Cameron** (Sir Duncan A.), b. about 1808; entered the British army as ensign in 1825, and in 1854 became colonel; commanded the 42d regiment at the battle of Alma; the Highland brigade at the battle of Balaklava, in the expedition to Kertch, the siege and fall of Sebastopol, and assault of the outworks; was created a C. B., officer of the Legion of Honor, and received a medal with three clasps from his own government, besides the Sardinian and Turkish medals. He was in command of the forces in New Zealand during the war of 1863–65, with the local rank of lieutenant-general, where he distinguished himself; was appointed colonel of the 42d Highlanders in 1863, lieutenant-general in 1868, and general in 1874; governor of the Royal Military Academy at Sandhurst 1868–75; was nominated a K. G. C. B. in 1873.

**Cameron** (Henry Clay), Ph. D., D. D., b. at Shepherdstown, Jefferson co., Va., about 1830; graduated at the College of New Jersey in 1847, and at the Princeton Theological Seminary in 1855; was appointed adjunct professor of Greek in 1855, and professor in 1861, at the College of New Jersey; was licensed to preach in 1859, and ordained to the ministry in the Presbyterian (O. S.) Church Feb. 1, 1863; was appointed a member of the board of visitors of the U. S. Military Academy at West Point in 1876, and has contributed largely to various magazines and periodicals.

**Cameron** (James Donald), eldest son of Hon. Simon Cameron, b. at Harrisburg, Pa., May 14, 1833; graduated at Princeton College in 1852, and has since been interested and identified with the development of the coal, iron, lumber, and manufacturing interests of Pennsylvania, residing at Harrisburg; was cashier, and afterward president, of the Middletown Bank, and in 1861 was made vice-president, and in 1863 president, of the Northern Central R. R., which position he held until his resignation in 1874, being then succeeded by Hon. Thomas A. Scott. This road was of great service to the government during the war (although several times cut by the Confederates) as a means of communication between Pennsylvania and the national capital *viâ* Baltimore, and after the war, under Mr. Cameron's administration, it was extended to Elmira, so as to realize its original purpose of forming a direct communication from the lakes to tide-water at Baltimore. He has always been an active Republican; on May 22, 1876, was appointed secretary of war in Pres. Grant's administration, and in 1877 took his father's place in the Senate.

**Can'dler** (Milton A.), b. in Campbell co., Ga., Jan. 11, 1837; received a classical education, graduating at the University of Georgia in 1854; studied law, and was admitted to the bar in 1856, commencing practice in De Kalb co., Ga.; was elected to the lower house of the State legislature, occupying a seat in that body 1861–63; was elected to the State constitutional convention in 1865, and to the State senate 1868–72; was elected to the 44th Congress, and re-elected to the 45th. Alexander H. Stephens.

**Canos'sa,** small town of Italy, 24 miles S. W. of Modena, contains the ruins of the famous castle belonging to Matilda of Tuscany, before whose gates the German emperor, Henry IV., stood three days bareheaded and barefooted before Pope Gregory VII. would admit him to his presence.

**Ca'pen** (Elmer Hewitt), b. at Stoughton, Norfolk co., Mass., in 1838; graduated at Tufts College in 1860, studied law one year in the Harvard Law School, and was admitted to the bar in 1863; was elected to the legislature in 1859, while still in college. After practising law for a short time in his native town, he began the study of theology, and was ordained in Gloucester in 1865, where he preached for four years; then preached for one year at St. Paul, Minn., and in 1870 accepted a call to the First Universalist church in Providence, R. I. In 1875 he became president of Tufts College. J. B. Bishop.

**Ca'pers** (Rev. Samuel Wragg), b. in Georgetown, S. C., Mar. 5, 1797; after receiving a classical education entered the legal profession, which he abandoned for the ministry, and joined the South Carolina Methodist Episcopal conference in 1828. He was a member of the Louisville convention at which the Methodist Episcopal Church, South, was organized. D. in Camden, S. C., June 22, 1855. T. O. Summers.

**Car'nochan** (John Murray), M. D., b. at Savannah, Ga., in 1817; studied medicine at Edinburgh and various places on the European continent; began to practise in New York in 1847, and soon gained distinction for his bold and successful surgical operations. Thus, he excised the whole trunk of the second branch of the fifth pair of nerves for the cure of neuralgia depending upon disease in the nerve. This nerve was cut out from the infraorbital foramen to the foramen rotundum, and consequently involved an operation through the malar bone to the base of the skull. In 1852 he tied the femoral artery, and thus ingeniously cured a disease of exaggerated nutrition, *elephantiasis arabum*, which operation has been accepted in Europe and extensively practised. He also tied the primitive carotid artery on both sides for the cure of elephantiasis of the head-base and neck. He exsected the entire radius in 1853, the entire ulna in 1854, and has also exsected the entire lower jaw and the calcaneum. In 1851 he became professor of surgery at the New York Medical College and surgeon-in-chief to the State Immigrant Hospital. He has published many valuable professional monographs and lectures, a treatise on *Congenital Dislocations* (1850), a translation of Rokitansky's *Pathological Anatomy*, etc.

**Caron',** or **Carron** (Franciscus), descended from a French Protestant family which had sought refuge in the Netherlands; visited Japan in the service of the Dutch East India Company; was appointed director-general of French commerce in India in 1666 by Colbert, but was recalled from the East in 1674, and perished by shipwreck off Lisbon. In 1636 he published a description of Japan in Dutch, and in 1698 appeared his *Journal du Voyage des grandes Indes*.

**Carruth'ers** (Robert), b. at Dumfries, Scotland, Nov. 5, 1799; was apprenticed to a bookseller; became in 1828 editor, and in 1831 proprietor, of the Inverness *Courier;* published in connection with Robert Chambers the *Cyclopædia of English Literature*, and alone an annotated edition of Boswell's *Journal of a Tour to the Hebrides*, a *Life of Pope*, etc.

**Ca'ry** (Samuel Fenton), b. in Cincinnati, O., Feb. 18, 1814; graduated at Miami University 1835, at the Cincinnati Law School 1837; retired from law-practice in 1845, and became a farmer; was in Congress 1867–69, serving on important committees, and was the only Republican in the House of Representatives who voted against the impeachment of Pres. Johnson; was nominated by the Inde-

pendent party at Indianapolis, May 18, 1876, for Vice-President of the U. S., with Peter Cooper as President.

**Ca'sey** (THOMAS LINCOLN), b. at Madison Barracks, N. Y. (a U. S. infantry station near Sackett's Harbor), May 10, 1831; was graduated at the U. S. Military Academy in 1852, and assigned to the corps of engineers as brevet second lieutenant, rising through successive grades to be lieutenant-colonel 1874; served as assistant engineer on fortifications and river and harbor improvements Delaware Bay and River until 1854; assistant professor (1854–57) and principal professor of engineering at the Military Academy 1857–59; in command of engineer troops department of Oregon 1859–61; on staff of general commanding department of Virginia season of 1861; in charge of construction of fortifications on coast of Maine and New Hampshire 1861–67, except while on special duty with fleet during the first expedition to Fort Fisher 1864; brevet lieutenant-colonel and colonel for services during the rebellion. Since 1867 in charge of the fortification division of the engineer department at Washington. G. C. SIMMONS.

**Cass,** north-eastern county of the Territory of Dakota, is bounded E. by Red River of the North, which separates it from Minnesota, and whose tributaries, such as the Cheyenne and others, drain it. The surface is gently undulating and the soil productive, especially along Red River. Cap. Fargo.

**Castanhe'da, de** (FERNÃO LOPEZ), b. probably about the year 1500; d. in 1559; went to India with his father in 1528, and devoted many years to study, personal examination of local records and scenes of important events, and to the composition of his valuable *Historia do Descobrimento e Conquista da India pelos Portuguezes*, the several books of which were printed in different years from 1551 to 1561. The publication of the first and second books preceded that of the first decade of the *Asia* of De Barros, but by so short an interval that the work of Castanheda could hardly have been used by De Barros, who no doubt derived his material chiefly from original sources. For some not obvious reason, the *Historia* of Castanheda seems to have made a greater impression on the European public than the more attractive labors of De Barros, for the first book of the *Historia* was translated into French in 1553, and the whole work into English some years later, while De Barros, we believe, has never been translated into either language, and even Camoëns is said by Portuguese critics to have drawn his historical facts altogether from Castanheda. Castanheda has the merits of fulness of detail, clearness of exposition, and fidelity to the best authorities, and, though inferior as a writer to his distinguished rival, he is, by no means, superseded as a source of information on his subject. The best edition of the *Historia* is that of Lisbon (1833 *seq.*), in 7 vols. sm. 4to, which conforms to the original orthography. GEORGE P. MARSH.

**Cat'alan Language and Literature.** After the consolidation of the different political jurisdictions of Spain into a single state was consummated under Ferdinand and Isabella, near the close of the fifteenth century, the predominance of Castile completely overshadowed the other provinces, and gradually threw into obscurity their languages and their literature. The local dialects were sooner or later abandoned to the populace, and Castilian became the almost universal language of culture and of public life. But the independent and insubordinate Catalans long held tenaciously to their native tongue; it was not till the close of the seventeenth century that Castilian supplanted it, and there are instances of its employment, not only for literary but for official purposes, for a century later. It has now, however, followed the fate of the other provincial dialects, and though still spoken in a great variety of forms by the inferior classes over a wide range of territory, and not unfrequently employed as a vehicle for *belles-lettres* dilettanteism, it can no longer be said to have a living status in the literature of Europe.

Considered simply as an object of linguistic study, the Catalan shares with the other dialects of the Hispanic peninsula the advantage of having an approximately known origin and date. For, notwithstanding the opinion of Pers, who holds it to be an indigenous speech, there is no room for doubt that it originated in the dialect of the Roman camps and public offices, and of course its history begins with the Roman conquest. Hence, it, as well as the other Spanish provincial tongues, is essentially younger and less primitive than the numerous local dialects of Italy, many of which are probably as old as Latin itself. Of course, Catalan, as well as Castilian, Galician, and the other provincial tongues, was developed under circumstances peculiar to itself, and like them has maintained in all its multifariousness a marked individuality. The linguistic—or at least the rhetorical—affinities of the Catalan, or as, since the end of the fourteenth century, it has often been called, the Lemosin, with the Provençal, and in some points of structure even with Northern French, are greater than with Castilian, although its vocabulary, with certain wide orthoepical, orthographical, and inflectional differences, is the same as that of this latter dialect. The frequent dropping or contraction of the inflected endings shortens the words to that degree that a Catalan original ordinarily covers not more than three-fourths as much letter-press as a literal Castilian translation, and monosyllables are so common that Ballot cites a poem in ninety-six verses, each of seven words of a single syllable. The brevity of the words and their frequent consonantal endings in Catalan necessitate an abruptness of utterance and an *accent* or rhythmic modulation much less agreeable to the ear than the pronunciation of the sonorous Castilian, but this disadvantage is compensated by a simplicity, a directness, and a logical precision of periodic structure which give to it, at least as a vehicle of prose composition, a decided superiority over the periphrastic and cumbrous language of Castile.

So large a proportion of the early monuments of the Catalan and Valencian speech—for the shades of distinction between the two are slight, and we must treat them as practically one—remain still unpublished, and have not yet been subjected to thorough critical examination, that the chronology of the dialect and its literature is not definitively established. Doubtless, it existed for centuries only as a spoken tongue, but its most ancient written relic yet discovered is said to be a document of the year 1037, in which Catalan words and phrases are intermixed with the Latin text. As a literary language it cannot be said to have become fairly established until toward the close of the thirteenth century. At the beginning of the fourteenth century the various very closely-allied dialects then grouped under the general name of Catalan composed the vernacular of so large a population in Northern Spain and Southern France that Ramon Muntaner, writing in 1325, can hardly be charged with exaggeration in affirming (*Cronica*, cap. xxix.) that "in no nation are there so many who use one and the same language as of the Catalans." The important commercial and political relations of the Aragonese kingdom with the other Spanish Moslem and Christian states, with France, with Italy, with Sicily, and finally with Greece, brought the Catalans constantly into friendly or hostile contact with all these nations, and their literary men imbibed more or less of the intellectual culture of all of them. The writings of Ramon Lull and other writers show traces of a familiarity with Arabic, and the Italian poets were studied, imitated, and translated by Catalans in the very infancy of Italian literature. But though the native character, sentiments, and habits of thought were never entirely obliterated, yet most of the Catalan poets have too little individuality and originality to make them really worthy of study for the general purposes of literary culture.

In our survey of this literature our limits of space must confine us to its published and generally-accessible monuments, and as the works of Catalan and Valencian poets who either wrote in Provençal or followed Provençal models belong rather to the history of that school than to that of the native literature of North-eastern Spain, we shall but very briefly notice their productions.

Apart, then, from the linguistic interest of Catalan as a distinct and peculiar offshoot from the ancient Italic stock, its prose, and especially its historical literature, forms its chief and almost only claim to attention of the foreign general student. The oldest published work of this class we possess is the *Cronica del Rey En Pere e dels seus antecessors*, by Bernat d'Esclot. This very interesting and valuable chronicle covers the period between the early part of the twelfth century and the death of King Don Pedro in 1285, in which year it is supposed to have been written. (See D'ESCLOT.) The spirited and justly-celebrated *Cronica Catalana* of Ramon Muntaner embraces the same period, but comes down to 1328. (See MUNTANER, in CYCLOPÆDIA.) Of not inferior interest to either of these, supposing it authentic, is the *Libre dels Feyts . . . d'En Jacme lo Conqueridor*, or autobiography of King Don James the Conqueror, which, though considered genuine by the patriotic criticism of most native investigators, is thought by many foreign scholars to be a production of about the middle of the fourteenth century. (See JACME, in CYCLOPÆDIA.) The *Cronica del Rey En Pere* (Peter the Cruel, Peter the Punctilious), by himself, is, we believe, of undisputed authenticity, and carries the history down to 1380. The *Libre dels Feyts d'Armes de Catalunya*, by Mossen Bernat Boades, continues the military annals to 1420. Many original historical documents of earlier and later periods are contained in the *Coleccion de Documentos ineditos del Archivo-general de la Corona de Aragon*, now in course of publication at Barcelona, of which about forty octavo volumes have appeared. The principal Catalan historians since the invention of print-

ing are Tomich, *Historia dels Reys de Arago é Comptes de Barcelona* (Barcelona, folio, 1495); Carbonell, *Chronica de Espanya* (folio, Barcelona, 1546); and Pujades, *Chronica General de Catalunya* (parte prim., Barcelona, 1609, folio; the following parts are in Castilian). The Catalan prose-writer whose name is oftenest noticed abroad is Ramon Lull (A. D. 1235–1315), a very voluminous philosophical and mystical author, best known by his *Ars Magna*, or *Lulliana*, in Latin. A Latin religious romance by him was translated into Catalan and published at Valencia in 1521 under the title *Blanquerna, qui tracta de cinq estements de persones*, etc., etc. Many of the Latin writings of Lull are contained in an edition published at Mayence (1721–42) in i.–vi., ix.–x volumes. His works in his own tongue remain chiefly in manuscript, though Konrad Hofmann printed in the *Transactions* of the Royal Bavarian Academy (xii. B. iii. Abth. 1812) an apologue by Lull in the original, with a German translation. This is one of 365 tales narrated in a huge work entitled *Libre de Maravelles*, and is a new, or rather old, version of the story of *Reynard the Fox*, agreeing, however, with the French and Dutch fables only in subject. (See LULL, in CYCLOPÆDIA.) Translations of parts, at least, of the Bible into Catalan were made at an early date, and there exist several romances of chivalry in the same dialect, one of which, *Tiraut lo Blanch*, professedly translated from English into Portuguese, and from Portuguese into Valencian, by Juan Martozell, was published at Valencia in 1480.

To what we have said of the general character of Catalan poetry the works of Ausias March (*circa* 1400–60) form a conspicuous exception. They were indeed, if not inspired, certainly suggested, by the poems of Petrarch and the Provençals, but they are generally simple, unaffected, tender, and graceful, and not wanting in originality. (See MARCH, AUSIAS, in CYCLOPÆDIA.) The *Libre de les Dones* of Jayme Roig also possesses interest, if not high literary merit.

In the present generation much has been done by private individuals and by literary associations to revive the cultivation of the native tongue by the republication of old works and by original composition, and French and German scholars have essentially aided this movement. Buchon published in 1841 a translation of Muntaner, and in the same volume the original text of D'Esclot; Lanz printed an edition of Muntaner in Catalan at Stuttgart in 1844; Bofarull, an edition of the same chronicler at Barcelona in 1860, and of the *Cronica de Don Pedro el Ceremonioso* at Barcelona in 1850. The beautiful *Biblioteca Catalana*, now in course of publication by Verdaguer at Barcelona, is devoted to the publication of old rare or inedited works, and deserves warm encouragement. Briz has printed (Barcelona, 1867) a *Llibre dels Poetas*, or anthology of poems of the twelfth to the eighteenth centuries, an edition of Ausias March (Barcelona, 1864), and with Caudi and Salto a collection of *Cants Populars Catalans* in 4 vols. 8vo (Barcelona, 1866–74). Of modern original authors in this dialect we may cite Ros Carlos, *Rondalla de Rondalles* (Valencia, 1776); Balaguet, *Poesias Catalanas* (2 vols., Barcelona, 1814); *Los nous Trovadors* (a collection), by Bofarull (Barcelona, 1858–59, 2 vols.), and the Catalan Academy, *Jochs Florals* (Barcelona, 1859–73, 15 vols. 8vo).

For more detailed information see, besides general works on Spanish literature, Fuster, *Biblioteca Valenciana* (Valencia, 1827–30, 2 vols. folio); Torres Amat, *Memorias para ayudar a formar un Diccionario critico de los escritores Catalanes* (Barcelona, 1836, 1 vol. 8vo), and supplement by Corminas (Burgos, 1849, 1 vol. 8vo); Ballot, *Gramatica y Apologia de la Llengua Cathalana* (Barcelona, 1814, 12mo); Bofarull, *Estudios Sistema Gramatical y Crestomatia de la Lengua Catalana* (Barcelona, 1864, 12mo); Pers, *Historia de la Lengua y de la Literatura Catalana* (Barcelona, 1857, 8vo); Camboulin, *Essai sur l'Histoire de la Littérature Catalane* (Paris, 1858, 8vo); and especially Helfferich, *Raymund Lull und die Anfänge der Catalonischen Literatur* (Berlin, 1858, 8vo). The various French and German journals devoted to Romance literature may be consulted with advantage. Perhaps the best dictionary is that of Labernia, Catalan, Castilian, and Latin, and Castilian, Catalan, Latin (Barcelona, 1839, 4 vols. 8vo).

GEORGE P. MARSH.

**Catastom'idæ** [from *Catastomus*—κατά, "below," and στόμα, "mouth"—the typical genus of the group], a family of fishes of the order Teleocephali and sub-order Eventognathi, containing the fresh-water suckers of North America. The body varies between an elongated subcylindrical and an oblong more or less compressed contour; the scales are of medium or rather large size, and cycloid; the lateral line is generally present and decurved, but sometimes absent; the head is diversiform; the opercular bones normally developed; the nostrils double; the mouth more or less inferior, and provided with fleshy and generally papillose or crenated lips; the upper jaw is formed in the middle by the small and lamelliform intermaxillaries, and on the sides by the supramaxillaries; teeth are wanting in the jaws; the pharyngeal bones are developed in a falciform manner, and provided with a row of numerous comb-like teeth; the branchial apertures are restricted to the sides; branchiostegal rays three on each side; dorsal variable in development; anal posterior, and generally short and high; caudal large, and more or less emarginated; pectoral fins low down, but lateral and with their rays branched; ventral fins abdominal; the intestinal canal is very long; the stomach simple and destitute of pyloric cæca; the air-bladder is large, unprotected by an osseous capsule, and divided by transverse constrictions into two or three regions. The family is a very characteristic one, and is richly developed in the fresh waters of the North American continent, but a few species are also found in Northern Asia (Siberia, China, and Japan). The species are generally known in the U. S. under the name of sucker, but some of the forms are also called chub, carp, etc. About eleven or twelve genera may be recognized, which represent three quite distinct groups of perhaps sub-family rank; these are—(1) Catastominæ, including the genera *Catastomus, Hypentelium, Ptychostomus, Moxostoma, Placopharynx, Pantosteus;* (2) Bubalichthyinæ, comprising the genera *Carpiodes, Bubalichthys, Ichthyobus,* and *Myxocyprinus,** and (3) Cycleptinæ, represented by the single genus *Cycleptus.* (1) The Catastominæ are elongated fishes, provided with a moderate dorsal fin of from ten to twenty rays; its species are the ordinary suckers and chubs of the inland inhabitants. (2) The Bubalichthyinæ are deep, compressed fishes, with a long dorsal, generally more or less elevated and falciform anteriorly; its species are known as carps, carp-suckers, buffalo-fishes, etc. (3) The Cycleptinæ are very elongated fishes, with an elongated falciform dorsal; the typical species is recognized in the West under the names of black horse, long buffalo, etc. About fifty species of the family have been described. They are among the most abundant fishes in the regions where they occur, and sometimes, in favorable localities, and when they are exempt from the attacks of enemies, they literally swarm, and cover the bottom of the waters with their compact masses. The mouths of the typical species are small and protractile, and well fitted for sucking in the aliment upon which they feed. Such species do not often bite at a hook; there are, however, species, especially of the sub-family Bubalichthyinæ, which can readily be caught with bait. Many of the species are quite apathetic, and remain basking in the sun or suspended almost motionless in the waters for a long period of time; and this habit is taken advantage of by boy-anglers, who attach a stiff loop at the end of a pole and drawing it over a fish toward the middle, suddenly jerk it from the water. (See SUCKER, in CYCLOPÆDIA.)

THEODORE GILL.

**Cathar'tidæ** [from *Cathartes*—καθαρτής, "one that purifies," *i. e.* by the consumption of the impure—the typical genus], a family of birds of the so-called order or superfamily Raptores or Ætomorphæ. It comprises the vultures of the New World, or the turkey-buzzards, carrion-crows, condor, etc. These are at once distinguishable from all others of the group by the imperfect or perforated nasal septum, which enables one to see anything on the opposite side through the perforation. In form the species contrast considerably with the typical birds of prey, such as the hawks and owls; and they resemble some of the gallinaceous birds, such as the turkeys, almost as much as they do the typical Raptores; this likeness is indicated by one of the names ("turkey-buzzard") applied to some of the species. The feathers are destitute of after-shafts, and the oil-gland has no circlet of feathers; the head is rather narrow, and the skin of the head as well as neck is naked; the eyes stand outward prominently, and are not overarched by superciliary shields; the bill is more or less elongated and compressed, and its base provided with an elongated and much-depressed cere; the upper mandible is boldly decurved and hooked; the nostrils have longitudinal apertures, and are confluent together through the perforated nasal septum; the wings are elongated, and pointed at the third or fourth primaries; the legs are moderate; the tarsi rather thick, and the inner edges rounded and not much thinner than the other; the toes three anterior on a uniform plane; the posterior somewhat elevated, not reversible, short, and with the second and third phalanges together at least as long as the basal phalanx; the middle anterior toe is very long, and a web is developed between its base and that of the inner one; the claws are rather feebly developed in comparison with those of the Falconidæ, and much less curved. The anatomical characters distinctive of the group

* *Myxocyprinus* is a name proposed for the *Carpiodes asiaticus* of Bleeker, which is distinguished by the multiradiate dorsal and anal fins (*e. g.* D. 52, A. 13).

are important, and amply corroborate the differentiation of the family from the vultures of the Old World; these, according to Huxley, are as follows: The skull is provided with basi-pterygoid processes; the valley between the lamellar maxillo-palatines is deep as well as wide; the lachrymal bones are so completely ankylosed with the frontals, as well as with the broad prefrontal processes, that all traces of their primitive distinctness are lost; the sternum has, at most, a mere rudiment of the manubrial process, and its posterior margin exhibits either four slight excavations, or two holes externally and two notches internally; the proximal ends of the clavicles are greatly expanded and recurved, and their outer sides present a deep and wide excavation, at the bottom of which lies the pneumatic foramen; a great part of this excavated surface is left uncovered in front of the clavicular process of the coracoid when the bones are articulated together; the scapular process of the coracoid is not prolonged forward to meet the clavicles; the posterior or ischio-iliac edge of the os innominatum presents a deep notch, which is not found in the other Ætomorphæ; no lower larynx is developed. The family is entirely restricted to America, and its head-quarters are the tropical and warm regions of its two continents, although wanderers extend more or less beyond the warm temperate regions both to the northward and southward. The species fulfil an important function in the economy of nature, especially in the tropics, by devouring the putrid flesh of animals that have been for some time dead, although they by no means disdain fresh meat. They are to some extent gregarious in their nature, inasmuch as they assemble in large numbers around the carcasses of animals, and on them gorge themselves to repletion: afterward they rest in the neighborhood. "When thus gorged," says Coues, "they appear heavy and indisposed to exertion, usually passing the period of digestion in the laziest attitude, with their wings half spread." They are, however, birds of very powerful flight, and on the wing they are easy and graceful in their motions; they are fond of circling high up in the air. On the ground they walk with a somewhat stilted gait, but rarely leap. The species are not numerous, at most only ten being known. These, however, represent several decidedly distinct types of structure of generic value. According to Ridgway, the genera are—(1) *Sarcorhamphus*, with two sub-genera—*Sarcorhamphus* proper, represented by the condor, and *Cathartes*, typified by the king of the vultures; (2) *Pseudogryphus*, formed for the large Californian vulture (*P. Californianus*); (3) *Rhinogryphus*, including the red turkey-buzzard of the Southern States (*R. aura*) and a related species of Brazil (*R. burrovianus*); and (4) *Catharista*, restricted to the carrion-crow or black vulture (*C. atrata*) of the Southern States. (See also CONDOR, CATHARTES, VULTURE, in CYCLOPÆDIA.) THEODORE GILL.

**Cay'ley** (ARTHUR), b. at Richmond, England, in 1821; educated at King's College, London, and Trinity College, Cambridge, where he graduated with high honors; was scholar and fellow of his college; called to the bar in 1849; was elected Sadlerian professor of pure mathematics upon its establishment at Cambridge in 1863; is a member of various astronomical, philosophical, and mathematical societies, and a frequent contributor on mathematical subjects to these societies, as well as to English and foreign scientific publications; is correspondent of the French Institute for section of astronomy.

**Centennial Exposition.** See INTERNATIONAL EXHIBITION.

**Centrarch'idæ** [from *Centrarchus*—κέντρον, "spine," ἀρχός, "anus"—one of the genera], a family of fishes of the order Teleocephali and sub-order Acanthopteri, peculiar to North America. They constitute a very characteristic type in at least the Eastern and Mississippi regions. The body is oblong and compressed, and divided into nearly equal and corresponding halves by a longitudinal axis coincident with the commencement of the lateral line and the middle of the caudal fin; the scales are well developed, and generally ctenoid, but in some cycloid; the lateral line is continuous; the head is compressed, and covered with scales on the opercula and cheeks; the eyes are lateral; the opercular bones normally developed; the preoperculum generally entire, sometimes feebly serrated; the operculum has a more or less developed membranous extension around the posterior spine; the nostrils double; the mouth is cleft laterally and obliquely; the upper jaw more or less protractile; teeth are developed in bands on the jaws and, to a variable extent, on the palate; the branchial apertures are ample and continuous below; branchiostegal rays generally six—exceptionally seven—in number; the dorsal fin is elongated, and consists of an anterior spinous and a posterior rayed portion of varying extent; the anal fin in its soft portion corresponds to that of the dorsal, and is armed in front with a variable—frequently large—number of spines; the caudal fin distinct, and generally emarginated; the skeleton has a slightly increased (beyond the normal) number of vertebræ (*e. g.* D. 14 + C. 16–18). The species are quite numerous (about fifty having been described), and generally among the most common fishes of the waters which they frequent. They are all carnivorous, and mostly quite bold and gamy fishes. In the breeding season they generally select a spot which they clear of weeds and obnoxious substances for depositing their eggs; these the male and female guard with zealous care, rushing boldly forward to drive away any intruder not too large for their powers. It is to this family that the black bass, as well as rock-bass, sun-fish, crappie, etc., belong. Several distinct types of structure are exemplified by the species: these are (1) Centrarchinæ, (2) Lepominæ, and (3) Micropterinæ. (1) The Centrarchinæ are fishes with very compressed bodies, and the dorsal and anal fins are correspondingly developed and obliquely opposed to each other; each is armed with approximately equal numbers of spines: to this group belong the many-spined bass (*Centrarchus irideus*), the grass-bass or crappie (*Pomoxys hexacanthus* and *P. annularis*), etc. (2) The Lepominæ are fishes with the soft portions of the dorsal and anal fins almost vertically opposed to each other, and with the spinous portion of the dorsal much longer than that of the anal: it includes the sun-fishes or pond-fishes (*Pomotis* and *Lepomis*), the rock-basses (*Ambloplites*), as well as a number of less conspicuous genera (*Acantharchus, Archoplites, Chænobryttus, Bryttus, Hemioplites, Enneacanthus,* and *Mesogonistius*). (3) The Micropterinæ are oblong fishes, with the soft portions of the dorsal and anal fins vertically opposite, as in the former, but with the spinous portion of the dorsal long and low; and the spines of the anal only three in number and of small size: these are restricted to the celebrated black basses of the U. S. (*Micropterus salmoides* and *M. nigricans* or *floridanus*). (See also SUN-FISH, etc., in CYCLOPÆDIA.) THEODORE GILL.

**Ceratodon'tidæ** [from *Ceratodus*—κέρας, κέρατος, "horn," and ὀδούς, "tooth"—the chief representative genus], a family of fishes of the order Sirenoidei, supposed, until recently, to be extinct, but lately discovered to be represented by living species in certain Australian rivers. The discovery of these living forms is one of the most important, if not actually the most important of modern additions to ichthyology. The body is elongated, and of nearly equal height from the head to the post-ventral region, but thence tapers backward toward the tail; the scales are large, oblong, and are regularly imbricated; they have the surfaces sculptured with several concentric lines of growth, and the margins are rounded, entire, and membranaceous; the lateral line is slightly decurved from the shoulder, and thence straight and concurrent with and nearer to the abdominal than the dorsal outline; the head is conic in profile, and depressed and oval above; the eyes are lateral, and much nearer the snout than the operculum; the opercular region is covered with scales, and the bones are scarcely apparent externally; on dissection, however, the operculum is seen to be well developed; the other opercular elements are wanting; the anterior nostrils open on the margin of the snout just outside of the oral aperture, the posterior in the roof of the mouth; the mouth is transverse, and the lateral cleft very shallow; no separate maxillary bones are differentiated, as in ordinary fishes; the lips are thick; teeth are developed in pairs upon the mandible, palate, and vomer; the vomerine teeth are small, broad, and rather low laminæ, with convex and trenchant margins, the outer or posterior parts of which are slightly serrated; the palatal and dentary plates are oblong, with a convex entire inner side and a concave outer side, armed with a number of compressed trenchant teeth-like processes; the palatal and mandibular teeth are traversed by numerous medullary canals terminating in punctate impressions on the surface of the crowns; the branchial apertures extend from the sides of the occipital region to below the pectoral fins, and are covered by the broad cutaneous fringes of the opercula; the dorsal and anal fins are confluent with the caudal, and form together an undistinguishable whole, pointed behind and sustained by indefinitely numerous fine rays; the dorsal fin commences somewhat in advance of the posterior half of the length, and the anal considerably behind it; the pectoral fins are elongated, paddle-like elements, pointed backward, covered with scales, except near the margins, with the dorsal margin slightly convex and the inferior sigmoidally sinuated; the ventral fins are also elongated paddles, pointed behind, and of a somewhat hastiform shape. The anatomical peculiarities are numerous, but cannot be here signalized; suffice it to say, that, as in the other members of the order, the notochord is persistent—that is, there is no differentiation into vertebræ, but a single cartilaginous element extends from the head backward. Some of the elements of the skull, as well

as the ribs, are more or less ossified. The pneumatic apparatus, according to Günther, "may be described either as a single lung, with symmetrical arrangement of its interior, or as two lungs confluent into a single sac, without any trace of a septum. The sac is wide, and extends from one end of the abdominal cavity to the other." Its external surface shows numerous small rounded prominences corresponding to the minor cells of its cavity, except in the stripe running along the middle of its ventral surface, which stripe is indicative of the differentiation of the lung into two lateral halves: "the right half is contracted at its anterior extremity, slightly bent toward the right side, and opens by a very short duct, terminating in a glottis, into the ventral side of the œsophagus, somewhat to the right of the median line;" the interior of the lung is divided into a number of compartments formed by well-developed transverse septa. The heart in its internal structure resembles, in some respects, the typical ganoids, rather than the previously-known dipnoians.: "there are two pairs of (ganoid) valves, narrow and rather long, with stiff, non-collapsing walls, thicker along the middle than on the sides, and without tendinous chordæ, in a single transverse series; their tunics are continued in four narrow raised strips behind their bases;" sometimes small papillary prominences exist in a line between the series of stripes and the special valves immediately in front of the latter. Such are some of the most noteworthy characters of the living Ceratodontidæ. Previous to the discovery of these it had been supposed that the representatives of the family were characteristic of the Secondary epoch, and that they had not survived beyond the Triassic period. It was with great astonishment, therefore, that the discovery of living species in the fresh waters of Australia was hailed. The living forms have even been generally regarded as actually congeneric with the Triassic species, but this seems to be questionable, and the differences between the dental laminæ of the living and extinct species are sufficiently great to warrant generic differentiation, independent of any hypothetical considerations. For the living forms the name *Neoceratodus*, proposed by Count Castelnau, may be retained. The only *certainly* known living species (*N. Fosteri*) was first discovered in 1870 by Mr. Girard Kreft, curator of the Australian Museum at Sidney, in a river of Queensland, but has since been found in other streams. The fish is said to frequently leave the water and go on the land at night. It feeds chiefly, if not entirely, on vegetable matter, such as the leaves, etc., of various plants. It attains a length sometimes of about six feet. The extinct species of the family flourished chiefly during the deposition of the Jurassic and Triassic formations in Europe and America, and were among the most abundant and characteristic of the fishes of those epochs. Until the discovery of the living forms they were supposed to have been shark-like animals; thus, the finding of the Australian species has not only greatly extended the range in time of an ancient type, but has enabled us to recognize the affinities of the later, and, in connection with them, of a long series of other extinct forms. THEODORE GILL.

**Cer'vidæ** [from *Cervus*, the Latin name for deer, the typical genus], a family of mammals of the order Ungulata and sub-order Artiodactyla, containing the deer and related types. The form is for the most part typified by the familiar species of deer, but deviations are exhibited by the moose and reindeer; the head is attenuated forward, and the nose generally tapering, with a moist, naked muffle, but sometimes more or less broad and hairy; the teeth are of the usual ruminant type (M. $\frac{3}{3}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$ or $\frac{0}{1}$, I. $\frac{0}{3}$); the molars with four crescentiform lobes, two anterior and two posterior; the canines in the upper jaw generally rudimentary or absent, especially in the females, but sometimes hypertrophied and developed as tusks; the canines in the lower jaw and in the incisors alike and proclivous; frontal appendages are generally present, at least in the males, and consist of horns, called "antlers," which are periodically developed preliminary to and during the rutting season, and subsequently cast off, but in some forms they are always absent; they are rarely possessed by the females, the reindeer being, however, an exception; the feet have two main hoofs, and almost always lateral or false ones high up on each side; the skull has its palatine axis nearly parallel with the occipito-sphenoid axis; the auditory bullæ are little produced outward, and are applied only to the inner surfaces of the paroccipital processes; the styloid processes are directed downward, and interposed between the bullæ and paroccipital processes, and not enclosed in oblique folds of the auditory bullæ; the stomach is quadripartite, and exhibits the typical ruminant characters; Cowper's glands and the gall-bladder are generally, but not always, absent. The family thus defined is exemplified in quite a number of genera, which are combinable in seven groups. Commencing with the most generalized forms, there are (1) *Moschus;* (2) *Hydropotes;* (3) *Cervulus;* (4) *Pudu, Furcifer, Coassus, Blastocerus, Cariacus,* and *Capreolus;* (5) *Hyelaphus, Rucervus, Rusa, Cervus, Elaphurus,* and *Dama;* (6) *Rangifer;* and (7) *Alces.* By recent writers these have been further combined in three sub-families, the first two genera being approximated under the name Moschinæ; the third (3) genus isolated as the type of a peculiar sub-family, Cervulinæ, and the remaining (4–7) segregated as the sub-family, Cervinæ. There are reasons for doubting, however, whether this is a natural classification. A remarkable distinction exists between two of the major groups of deer in the structure of the anterior feet. (1) In the genera of the first, second, fourth, sixth, and seventh groups the lateral metacarpals are well developed at their distal extremities, and atrophied at their proximal, and thus distinguished from other *Pecora;* in the genera of the third and fifth sections the corresponding bones are developed at their proximal extremities, and atrophied at the distal, as in most *Pecora.* The indications are that in the primitive deer the said bones were complete, although slender. (See DEER, FALLOW DEER, ELK, MUNTJAK, REINDEER, ROEBUCK, etc., in CYCLOPÆDIA.) THEODORE GILL.

**Chal'mers** (LIONEL), b. at Cambleton, Scotland, about 1715; studied medicine at the University of Edinburgh; emigrated to South Carolina; practised in Christ Church parish and in Charleston. D. in 1777. He published *Useful Remarks on Opisthotonos and Tetanus* (1754), *Essay on Fevers* (1767), and a work in 2 vols. on the weather and diseases of South Carolina (1776).

**Chalybä'us** (HEINRICH MORITZ), D. D., b. at Pfaffroda, Saxony, July 3, 1796; received the doctor's degree at Leipsic 1820, and held various professorships, the most important of which was that of philosophy at Kiel (1839–62). Author of *Hist. Entwickelung der Speculativen Philosophie* (1836), *System der Speculativen Ethik* (1850), *Philosophie und Christenthum* (1853), *Fundamental-Philosophie* (1861), etc. D. at Dresden Sept. 22, 1862.

**Cham'berlain** (DANIEL HENRY), A. M., LL.D., b. at West Brookfield, Mass., June 23, 1835; graduated A. B. at Yale College 1862, and at Harvard Law School 1863; entered the army in 1864 as lieutenant in the 5th Massachusetts Colored Cavalry; promoted to be captain, and served in Maryland, Louisiana, and Texas; went to South Carolina in 1866, and for two years was engaged as a cotton-planter. Upon the call for a constitutional convention he was chosen as a delegate, and was attorney-general of the State 1868–72; resumed the practice of his profession with Judge Melton at Columbia upon retiring from office; in 1874 was elected governor of the State by the Republicans; renominated in 1876; declared elected by the board of canvassers, and took the oath of office Jan., 1877.

**Chamberlain** (Sir NEVILLE B.), b. at Rio Jan. 18, 1820; appointed to the Indian army in 1837, rising through successive grades to be colonel in 1857; in the Afghan campaign 1839–42; was wounded six times and received two medals; commanded a division of cavalry 1855–57; became adjutant-general of the Bengal army, and wounded severely in a sortie at Delhi July 18, 1857; created a C. B. and appointed A. D. C. to the queen; subsequently commanded force on N. W. frontier of India; made major-general 1864, lieutenant-general 1872; honored with knighthood in the order of the Bath and Star of India; in 1876 was appointed commander-in-chief of the Madras army.

**Chan'celor** (CHARLES M.), M. D., b. in Spottsylvania co., Va., 1832; educated in Georgetown, D. C., and the University of Virginia; graduated M. D. at the Jefferson Medical College, Pa., in 1853; settled in Alexandria, Va., in 1861; offered his services to Gov. Letcher, and was assigned to Gen. Pickett's division, in which he served until 1863, when he was transferred to Charlottesville. At the close of the war he located in Memphis, Tenn., but in 1868 was elected professor of anatomy in Washington University, Baltimore; the next year transferred to the chair of surgery and also made dean of the faculty; resigned these appointments, and was elected emeritus professor. He is now sanitary officer of the port of Baltimore.

**Cha'pin** (WILLIAM), b. in Philadelphia in 1802; engaged in literary pursuits; was commissioner of schools in Yates co., N. Y., for six years; became superintendent of the Ohio State institution for the blind in 1840; visited Europe in 1845; was appointed principal of the Pennsylvania institution for the instruction of the blind in 1849; published a report *On the Benevolent Institutions of Great Britain and Paris* (1846), and prepared the article on the blind in the U. S. census of 1860.

**Chap'man** (Sir FREDERICK E.), b. in British Guiana in 1816; graduated at the Royal Military Academy at Woolwich, and entered the royal engineers in 1835; became a

captain in 1846, and colonel commandant of engineers in 1872; was present at the battles of Alma and Inkerman; during the siege of Sebastopol directed the left attack in the early part of the siege, and later was executive engineer to the army; was frequently mentioned in official despatches, and brevetted major, lieutenant-colonel, and colonel; was created a C. B., officer of the Legion of Honor, and received a medal with three clasps from his own government, besides the Turkish and Sardinian medals, and the 3d class of the Medjidie. He became a major-general in the army in 1867, and lieutenant-general in 1872; was made K. C. B. in 1867; served as governor and commander-in-chief in Bermuda 1867–70; inspector-general of fortifications and director of works 1870–75.

**Chapman** (James A. M.), D. D., b. at Greenland, N. H., Aug. 21, 1830; graduated at Waterville College, Me., in 1854; studied at the Biblical Institute, Concord, N. H.; entered the Methodist Episcopal ministry in 1855; has held pastorates in various towns and cities of New England; was stationed in Boston, Mass., 1863–71, and in Brooklyn, N. Y., 1871–74, taking a leading position in his denomination. In 1871 he received the degree of D. D. from the Wesleyan University, Middletown, Conn.

**Chartres** (Robert d'Orléans), Duc de, b. Nov. 9, 1840, second son of the late duke of Orleans, and grandson of the late King Louis Philippe of France. After the death of the duchess (1858) he entered the military school of Turin. In the war with Austria (1859) the duke served with distinction in the Nice cavalry regiment. (For his services in the civil war in the U. S. in 1861–62 see Paris, Comte de.) Many acts of individual gallantry are recorded, among which may be noticed the capture on the eve of the battle of Williamsburg of seventeen prisoners. Though an exile when the Franco-German war of 1870 broke out, he succeeded (see biography of the Prince de Joinville), though not until after the catastrophe of Sedan, in serving his country as a captain under the assumed name (that of a ducal ancestor) "Robert le Fort." His services, mostly about Rouen and Cherbourg, exhibited his wonted dash and gallantry. Under his borrowed name the duke was proposed by Gen. Chanzy for the grade of chevalier de Légion d'Honneur, which he received. As an officer of the 3d Chasseurs d'Afrique he has more recently served in Algiers. "The duke de Chartres is a *soldier* whom no one, even at first glance, could mistake." (Yriarte, *Les Princes d'Orléans.*) "He is a cavalry soldier" (*officier*) "to whom the life of the camp, its alarms, its dangers, and its glory, are necessary, as are its incessant movement, its physical exposures, and even the stern discipline, in which he is in his element." The duke wedded in 1863 the princess Frances Marie Amélie d'Orléans, daughter of the prince de Joinville. J. G. Barnard.

**Chase** (William H.), b. in Massachusetts; graduated at the U. S. Military Academy in 1815; appointed brevet second lieutenant of engineers; first lieutenant 1819, captain 1825, major 1838. The events of the war of 1812 having shown the vulnerability of the ports of the Gulf coast, and especially of the key to its western territory, New Orleans, Chase was assigned to duty for their defence in 1819. Forts Pike and Macomb (which see) were his earliest works. His most important were Forts Pickens, McRee, and Barrancas (which see), for the defence of Pensacola, regarded then as the great naval station of the Gulf. But subsequently, as senior engineer officer, all the works of fortification and of river and harbor improvement (*e. g.* the Mississippi mouths) came under his supervision. Energetic, observing, but impulsive, there was, moreover, scarce a project connected with the development of the region of his adoption in which he did not take an influential part. The Alabama Georgia and Florida R. R. (projected 1835, a quarter of a century too early) and the associated commercial development of Pensacola, his home, may be cited. Original and bold in conception, want of early discipline alone impaired the value of his projects. Few men have acquired more or warmer friends. In 1856 he was appointed by Pres. Pierce superintendent of the Military Academy, but resigned Oct. 31 from the army without entering on its duties. He espoused the Confederate cause, and was prominent in the seizure of the Pensacola navy-yard, but subsequently took no part in the war. D. at Pensacola Feb. 8, 1870. J. G. Barnard.

**Chaun'cey** (John S.), b. in New York; entered the U. S. navy as midshipman in Jan., 1812; was promoted to be lieutenant in 1825, commander 1841, captain 1855, and commodore 1862; in 1822, Chauncey commanded the sloop Peacock, and was engaged in the capture of a fleet of armed pirate vessels off Bahia Honda, Cuba; from 1838 to 1843 and from 1843 to 1847 he was assistant inspector of ordnance; in 1861 he commanded the Susquehanna, and was second in command in the engagements of Forts Hatteras and Clark; subsequently in command of blockade on coasts of Virginia and North Carolina. D. at Brooklyn, N. Y., Apr. 11, 1871. Geo. C. Simmons.

**Cheape** (Sir John), b. in 1792; entered the royal engineers in 1809; served in the Pindaree war 1815–16, and was present at the siege of Dhamounee and Mundela, siege of Asseerghar 1818; throughout the Burmese war 1824–26, the Punjaub campaign 1848–49, and chief engineer at siege and capture of Mooltan and battle of Goojerat; was second in command in the Burmese war of 1852–53, and in command of the expedition which captured Donaben; succeeded to command of the entire force on the departure of Gen. Godwin, and nominated a K. G. C. B. in acknowledgment of his services; appointed major-general in 1854, lieutenant-general 1859, and general 1866; became colonel-commandant of engineers (late Bengal) in 1844. D. at the Isle of Wight Mar. 30, 1875.

**Chesapeake and Ohio Canal.** (See Navigation, Inland.) The "eastern division" (from Georgetown to Cumberland), as it now exists, follows the N. side of the valley of the Potomac, to the eastern foot of the Alleghany Mountains, at Cumberland, Md. It departs from the immediate valley of the river by a cut-off and a tunnel of 3118 feet in length at Paw Paw Bend, 27 miles E. of Cumberland. The distance saved by this tunnel is about 6 miles. The total lockage from tide-water to the feeding-reservoir at Cumberland is 613¾ feet, and is overcome by 74 locks, varying from 6 to 10 feet lift, with chambers 100 feet long and 15 feet wide. From Georgetown to Harper's Ferry, 60 miles, the canal-surface is 60 feet wide, and from Harper's Ferry to Cumberland it has an average of 70 feet width, the depth throughout its length being 6 feet. The canal is supplied with water from the Potomac River by means of seven dams thrown across the river at suitable distances. The boats used on this canal are ordinary flat-bottomed boats from 90 to 95 feet long and 14 feet wide, drawing 5½ feet when loaded. They carry from 110 to 115 tons of 2240 pounds. The terminus of the canal at Cumberland is 20 miles from the coal-field by the Cumberland and Pennsylvania R. R., its principal connection therewith.

The law of Apr. 30, 1824 (see article cited), was (mainly): "that the President of the U. S. is hereby authorized to cause the necessary surveys, plans, and estimates to be made of the routes of such roads and canals as he may deem of national importance in a commercial or military point of view, or necessary for the transportation of the public mail." . . . "That, to carry into effect the objects of this act, the President be, and he is hereby, authorized to employ two or more skilful civil engineers, and such officers of the corps of engineers, or who may be detailed to do duty with that corps, as he may think proper," etc. Under this law the board of engineers for internal improvements was organized, consisting of Gen. S. Bernard, Col. J. G. Totten (see biographies), and Mr. John Sullivan, civil engineer. One of the earliest works of this board was the survey of this canal communication, for which it sent into the field three "brigades" of surveyors—two under Maj. J. J. Abert and William Gibbs McNeil (see biographies), each with five assistant lieutenants; and one under James Schriver, with five civil engineer surveyors. The recent surveys by T. S. Sedgwick, C. E., under direction of Col. W. E. Merrill, corps of engineers, were for a canal extension from Cumberland to Connellsville on the Youghiogheny, of 70 feet surface-width and 7 feet depth, with locks 120 feet long and 20 feet wide, with a summit-tunnel 3¾ miles long and 45 feet wide, without tow-paths, and to be operated by steam-propulsion boats or endless ropes. Inclined Planes (which see) were considered in connection with the eastern slope (from Cumberland to the summit near Meyersdale). The canal proper would extend from Cumberland to Connellsville, 92 miles, thence by slack-water to McKeesport, 46 miles. The cost of canal and slack-water is estimated at $25,000,000. (For reports of last surveys see *Ex. Docs. 208* and *265*, 43d Congress, 1st session, and *Ex. Doc. 137*, 44th Congress, 1st session.)

T. S. Sedgwick. Revised by J. G. Barnard.

**Ches'ney** (Charles Cornwallis), b. in England in 1829; entered the British army as second lieutenant in the corps of royal engineers; became lieutenant-colonel in 1868 and brevet colonel 1873. Although he bore an excellent reputation as an officer of engineers, it is by his contributions to military literature his name is best known. He was for many years professor of military art and history at the Staff College, Sandhurst. In 1863 he published his *Campaigns in Virginia*, in 1868 his *Waterloo Lectures*, in 1870, jointly with Mr. Reeve, *Military Resources of Prussia and France;* in 1870 his *Military Biographies*, contributed mainly to the *Edinburgh Review*, including essays on Gens. Grant, Lee, and others, were published in 1 vol. D. Mar. 19, 1876.

**Chionididæ.** See SHEATH-BILL, in CYCLOPÆDIA.

**Chironectidæ.** See TOAD-FISH, in CYCLOPÆDIA.

**Chris'tiancy** (ISAAC P.), b. at Jamestown, Montgomery co., N. Y., Mar. 12, 1812; went to Monroe, Mich., in 1836, and was admitted to the bar in that place in 1838; was a delegate to the Free-Soil convention which nominated Martin Van Buren to the Presidency, and was one of the founders of the Republican party in Michigan; served two terms in the Michigan senate; was editor for a year of the Monroe *Commercial*, and in 1857 was elected a judge of the supreme court of the State; was re-elected in 1865, and again in 1873, both times without opposition. In Jan., 1875, he was elected U. S. Senator from Michigan. J. B. BISHOP.

**Christian Union Churches** is the name adopted by a denomination which first came together in convention at Columbus, O., in 1863, though the organization was not completed until 1865. Their principles, as stated by themselves, are—(1) the oneness of the Church; (2) Christ the only Head; (3) the Bible the only rule of faith and practice; (4) good fruits the only condition of fellowship; (5) the repudiation of controversy; (6) each local church governs itself; (7) no preaching of partisan politics. Their motto is, "In things essential, *unity;* in non-essentials, *liberty;* and in all things, *charity*." They practise baptism as a condition of membership, but are practically unrestricted in their communion. They have about 30,000 members and an adherent population of about 150,000, principally in Ohio, Indiana, Michigan, Iowa, Illinois, Missouri, Arkansas, Texas, Nebraska, and Kansas. There is some probability of their absorbing the general convention of Christians of the South, a branch of the Christian Connection, which holds to similar views. They have one newspaper, *The Christian Witness*, published at McArthur, O., and have issued several books and tracts. They are active in revival and missionary work. L. P. BROCKETT.

**Chris'tie** (WILLIAM D.), b. in 1815, and after thorough collegiate training became a member of the bar in 1840. He quickly distinguished himself, and enjoyed many distinctions. In 1842 he gained a seat in Parliament, which he held until 1847, for Weymouth, Dorsetshire. He entered the diplomatic service, and continued in it until 1870, holding last the important post of minister plenipotentiary at the court of Brazil. D. in 1874. His last years were spent in England in literary labors, one of which is *Life of the First Earl of Shaftesbury*. J. H. WORMAN.

**Church** (JOHN ADAMS), E. M., b. Apr. 5, 1843, at Rochester, N. Y.; graduated in 1867 at the School of Mines in New York City. After three years of professional travel in Europe, he published in 1871 a pamphlet on *Mining Schools in the United States*, and in 1873 *Notes on a Metallurgical Journey in Europe*. Mr. Church has contributed largely to recent technical literature, and was for two years associate editor of the *Engineering and Mining Journal of New York*. From 1872 to 1874 he filled the chair of mineralogy and metallurgy in the School of Mines, and is now engaged in the active practice of his profession.

**Cigna'ni** (CARLO), b. at Bologna in 1628; studied painting under Francesco Albani; spent several years in Florence and Rome; was made director of the Clementine Academy in 1708 by Pope Clement XI. D. at Forli Sept. 6, 1719. His principal pictures are frescoes in the cathedral of Forli, the church of St. Michael in Bologna, and the Farnese Palace in Florence. Among his oil-paintings is a *Joseph and the Wife of Potiphar*, which was often copied by himself and pupils.

**Cinq-Mars', de** (HENRI COIFFIER DE RUZÉ), MARQUIS, b. in 1620; came to the court in 1639 as a protégé of Richelieu, who intended to make him the favorite of the king, in order to use him as a spy. The cardinal, however, mistook the young man. Cinq-Mars, proud, noble, and brilliantly gifted, had an ambition of his own, and a deadly hatred soon sprang up between the favorite and the minister. Cinq-Mars joined the Orleans party, a conspiracy was formed for the overthrow of Richelieu, and an alliance was concluded with Spain. Meanwhile, the cardinal had watched the movement from the very beginning, and just as the conspiracy was ripe to enter into action he laid all its traitorous documents before the king, and had Cinq-Mars and his friend De Thou arrested at Narbonne June 13, 1642. In order to save himself, the duke of Orleans confessed all, and Cinq-Mars was executed at Lyons Sept. 12, 1642. Alfred de Vigny has given a very interesting description of his life and character in his romance, *Cinq-Mars, ou une Conjuration sous Louis XIII.*

**Clai'borne** (JOHN HERBERT), A. M., M. D., b. in Brunswick co., Va., Mar. 10, 1828; studied medicine at the University of Virginia and in Jefferson Medical College, Pa.; was a delegate, then a senator, to the Virginia general assembly; entered into the Confederate service as a surgeon in 1861; organized in 1862 the general hospitals of Petersburg, of which he became chief executive officer, and settled in that city. PAUL F. EVE.

**Clai'borne, Clayborne,** or **Cleborne** (WILLIAM), b. in England about 1585, was the second son of Sir Edmund Cleburne of Cleburne Hall, Westmoreland; was appointed by Charles I. his secretary of state for the dominion of Virginia Mar. 4, 1626, and treasurer of Virginia for life Apr. 6, 1642. He discovered, purchased, and planted Kent Island in 1631, and owned a large portion of the land upon which Annapolis now stands. He battled for his rights against Lord Baltimore with varying success until 1651, when he withdrew into Virginia, and was appointed by Cromwell a commissioner for the reduction of the colonies. Recent investigations into colonial history prove him to have been the victim of court-favoritism, injustice, and misrepresentation. He has been styled "the champion of Virginia" and the "evil genius of Maryland." D. about 1676. C. J. HUBBARD.

**Clarke** (Sir ANDREW), entered the corps of royal engineers June 19, 1844, in which he became a captain in 1854, lieutenant-colonel in 1867, and brevet colonel in 1872; was acting secretary of the British government in Van Diemen's Land 1851–52, and surveyor-general and chief commissioner of crown lands in Victoria 1853–58. In 1856 he became an executive councillor and member of the first cabinet in the latter colony, and in 1858 was strongly urged to accept the premiership, but declined. For his distinguished services in successfully inaugurating the new government in the young colonies, and for his vigorous and sagacious administration during the period of excitement which followed the discovery of gold, he was subsequently created a knight commander of St. Michael and St. George. In 1863 he made an inspection of the west coast colonies. In 1864 he was appointed director of engineering and architectural works of the navy under the admiralty, and as such designed and executed the great docks at Malta and Bermuda, also the extensive new works at Portsmouth, and other enormous works connected with the extension of the principal dockyards, until 1873, in which year he was appointed governor of the Straits Settlements, including Penang, Singapore, and Malacca. In 1875 he relinquished this office, and became minister of public works, and member of the council of the governor-general in India. For his services at the admiralty he was created a C. B. in 1869.

**Clarke** (WILLIAM TRAVIS), b. at Walpole, Mass., Oct. 1, 1829; educated for the pulpit at Meadville and Cambridge; ordained at Hingham, Mass., in 1855, and afterward preached at Haverhill and Chelsea; removed to New York in 1866, and edited the *Liberal Christian* till 1870; associate and afterward sole editor of the *Golden Age* till its discontinuance, Oct., 1875; gathered a Liberal society known as the Unity Chapel Congregation in 1869, of which he was the pastor till the close of 1876; editorially connected with the *Daily Graphic* from its start, Mar., 1873. Several of his discourses have been published, and he has contributed largely to magazines and newspapers.

**Cleve'land** (ORESTES), b. at Duanesburg, Schenectady co., N. Y., Mar. 2, 1829; came to New York in 1844, and entered the service of an importing fancy-goods house; became a partner in the business in 1854; withdrew in 1858; bought out the partner of his father-in-law, Joseph Dixon of Jersey City, manufacturer of crucibles and graphite articles, and developed the Dixon Crucible Co. to one of the largest and most successful establishments of the kind; was elected mayor of Jersey City in 1864, and re-elected in 1865 and 1866, and was elected to the 41st Congress in 1868, and chosen first vice-president of the U. S. Centennial Commission. H. L. STUART.

**Clyt'ia,** or **Clyt'ie** [Gr. Κλυτία or Κλυτίη], the name of three mythical personages mentioned by Hesiod, Ovid, Pausanias, and Tzetzes. With Ovid (*Metamorphoses*, iv.) she is a nymph loved by Apollo, the god of the sun, but who, having offended and being forsaken by him, pined away with her eyes fixed on the sun, and was turned into a flower, which (from its ever turning toward the sun) was called *heliotropium* (ἡλιοτρόπιον).

**Cole'man** (LEIGHTON), b. in Philadelphia May 3, 1837; graduated at the General Theological Seminary in New York City in June, 1861, and settled at once as rector of the memorial church of St. Luke in Philadelphia. In the autumn of 1863 he became rector of St. John's church in Wilmington, Del. Three years later he became rector of St. Mark's church at Mauch Chunk, Pa., remaining there nearly eight years, when he removed to Toledo, O., assuming the rectorship of Trinity church. In 1875 he was elected bishop of the diocese of Wisconsin. J. B. BISHOP.

**Col'lins** (THOMAS WHARTON), b. in New Orleans 1812; was educated a printer; rose from the case to be editor, and

then studied law; distinguished himself as a jurist; was several times a judge of the district court; was a prominent member of the constitutional convention of Louisiana in 1852, and is the author of several literary and philosophical works—*The Martyr Patriots*, in blank verse, a tragedy, *Humanics* and the *Eden of Labor*, a new theory of political economy, eposited in the form of a Utopia; also of many essays published in the magazines of the day.

C. G. FORSHEY.

**Col'yar** (ARTHUR ST. CLAIR), b. in Washington co., Tenn., June 23, 1818; was self-educated; became a successful lawyer; opposed secession in 1861, but was a member of the Confederate Congress 1861–65; after the war gave his attention to the development of the Sewanee coal-mines, Tracy City, Tenn.; reorganized the Tennessee Coal and R. R. Co., of which he became president, and also gave attention to manufacturing. His enterprise has made the Tracy City mines a great success, and has done much to develop the material interests of his State.

**Comstock Lode.** This gigantic and famous silver-and-gold-bearing lode is situated in the western part of the State of Nevada, in Storey co., at a point about 12 miles N. E. of Carson City, and about 19 miles E. of the California State line, in lat. (about) 39° 22′ N. and lon. 119° 39′ W. from Greenwich. It lies on the eastern slope of the Virginia Mountains, a nearly due N. and S. offshoot of the Sierra Nevada, near the base of Mount Davidson, the loftiest peak of this secondary range, which is 7827 feet above the sea-level. The most important portion of the lode is included within the limits of Virginia City, which at C street is 1635 feet below the summit of this peak, or about 6192 feet above the level of the ocean.

*Discovery.*—According to J. Ross Browne, as well as Henry Degroot (*Overland Monthly*, June, 1873), the discovery of the Comstock Lode was a fortuitous occurrence. The sides of the Virginia range of mountains are furrowed by many deep ravines. Two of these, named respectively Gold and Six-Mile cañons, afforded as early as 1849 a considerable amount of placer-mining. In the spring of 1858 the miners working in Six-Mile Cañon found their rockers clogged with particles of a dark-colored mineral, which on account of its weight it was difficult to separate from the gold. This "black stuff" consisted of small pieces of rich sulphuretted silver ore that had been released from the Comstock Lode, which crossed the ravine a short distance above. Being ignorant of its value, these men threw away this material with the tailings. Among these pioneer miners was an elderly man who had taken unto himself the cognomen of James Fennimore. His associates first contracted it into "Old Finny," and afterward it was corrupted into "Old Virginny," probably from the fact that he hailed from the State of Virginia. This old man set about examining the croppings from which the cañon below had been enriched. These, being much decomposed, were found to contain a good deal of free gold, and he forthwith (Feb. 22, 1858) proceeded to take up a "claim" along them. This claim covered a portion of what is now the Mexican and Ophir grounds, at one time the most productive section of the Comstock Lode. It was not, however, until the following spring (1859) that the character of the deposits at this point became fully known. A couple of miners, at that time sinking a shaft at this place for the purpose of obtaining water for their rockers, discovered that this stratum of decomposed ore was not only very rich, but that it extended to a considerable depth beneath the surface. As soon as this became known the belt of croppings on both sides of this spot was "taken up" for a long distance along the ledge. These claims were originally taken up for placer-mining, but it was not long before its value as a silver-bearing lode became known. Indeed, as early as 1857 miners were actually engaged in placer-mining on the southern portion of what is now known to be the Comstock Lode, near Gold Hill, but they failed to recognize its argentiferous character. In the same year (1857) H. B. and E. A. Grosch, two educated metallurgists, first discovered silver ore while engaged in placer-mining in the portion of Gold Cañon near the site of Silver City. But the operations of these gentlemen were conducted at a point more than 2 miles S. E. of the Comstock Lode; so that they failed to recognize the existence of this celebrated ledge.

*Origin of Name.*—Among the comrades of "Old Finny" was Henry P. Comstock, who offered to purchase the old man's claim, tendering him in part payment an "old bob-tailed Indian pony," the balance consisting of a whisky consideration. The simple-minded Finny accepted the offer, and made over to his friend, "in consideration of the premises," a property which in less than a year after sold for more than a million of dollars. How little Comstock himself appreciated its real value is apparent from the fact that he shortly after disposed of his interest therein for some $5000 or $6000. In the second sale the claim was described as the "Comstock" ground, and being at the time supposed to cover the most important part, the name came soon after to be applied to the entire lode. And thus was poor Finny doubly defrauded—first, out of his interest in the lode itself, and second, out of the honor to which he was entitled as its original discoverer. To atone for this wrong, the miners, when they came to select a name for the new town to be laid out here, called it "Virginia."

*Character of the Lode.*—The Comstock is probably a true fissure-vein. The jaws of the fissure at the surface are from 250 to 1100 feet apart, gradually approaching each other in descending, forming a V-like section, until the fissure is reduced to an average width of 150 feet or less; in many places, however, swelling out to 500 feet in thickness, and in others contracting to not more than 20 feet in width. Its outcrop is not by any means continuous. In fact, the Comstock, though properly characterized as a single lode, is rather a broad metalliferous belt or ore-channel, carrying a congeries of subordinate lodes, bunches, and chimneys of ore, all reposing in as many distinct clefts, separated by "horses" and dikes of porphyry, belts of quartz, seams of clay, making up a body of vein-matter unparalleled for magnitude and complexity in the history of mining. "In point of geological time," Clarence King says, "the system of fissures which constitutes the Comstock Lode are subsequent to the propylite outflow, and belong in all probability to the dynamical disturbance connected with the eruptions of andesite. It is considered certain that the whole series of volcanic outbursts are *since* the Miocene epoch, and we may safely call the Comstock a Tertiary lode." In general terms, the course or "strike" of the lode may be said to be N. 25° E. (true meridian), to pitch or "dip" toward the E. at an angle of from 35° to 50°, and to have been definitively traced along a linear extent of more than 4 miles in the general direction (a little E. of the magnetic meridian) of the Virginia range of mountains. The *productive* portions of the vein, however, cover a linear space of scarcely over 2 miles.

*Character of Ores.*—The ores of the Comstock Lode consist chiefly of native gold, native silver, vitreous silver ore (argentite), stephanite, and argentiferous galena imbedded in a quartz gangue. Besides these, ruby silver, horn silver, polybasite, pyrargyrite, and sternbergite occur in small quantities; also, iron and copper pyrites, zinc blende, and several carbonates and sulphates.

*Bonanzas or Ore-Bodies* (see BONANZA).—These productive masses—variously designated as bonanzas, ore-bodies, ore-chambers, chimneys, zones, etc.—are irregular in shape, with a general tendency to a lenticular form, something like a concavo-convex lens. They usually occur in the swells of the vein, and their position is more vertical than the dip of the lode. Under existing circumstances it is impossible to obtain trustworthy data in relation to the dimensions and present prospects of such of these bonanzas as are at this time yielding more or less productive ores. Indeed, so long as these mining stocks are manipulated in San Francisco and elsewhere for speculative purposes it will be found to be impossible to elicit such information from mining engineers, superintendents, and others who are cognizant of the true condition of the mines. In fact, since the publication of the admirable volume on *Mining Industry* (vol. iii. of the *U. S. Geological Exploration of the 40th Parallel*) by James D. Hague and Clarence King, which indicated the true condition of these mines up to the end of 1869, nothing reliable has been published in regard to the precise dimensions and character of the bonanzas that have been exposed since that time. In the excellent atlas accompanying this volume the topography of the mining explorations on the Comstock Lode are given with all the precision and truthfulness which science demands. During the seven years that have elapsed since that time immense and important developments have been made on this remarkable lode, particularly on the *deep levels;* but our knowledge of them is exceedingly vague and imperfect. Most of these mines have had their prosperous eras, holding for a certain period, to be followed by seasons of restricted production; and it is obviously to the interest of speculators to conceal these fluctuations of productiveness from the public.

From the topographical surveys of 1869, Clarence King estimated that in the longitudinal elevations or sections of the lode not more than one-fourth, or 25 per cent., of the actual face of the lode has been occupied by argentiferous bodies; and that it is safe to say that not more than $\frac{1}{500}$th, or 0.2 per cent., of the lode materials have been charged with silver to a workable percentage. (*Mining Industry*, p. 76.) The true limits of these bonanzas or ore-bodies

cannot be definitely assigned, since the only clues to the bonanza outlines are the measurements of actually "stoped" ground. These deposits of silver ore occur in the quartz, distributing themselves capriciously in segregated bonanzas, separated from each other by intervals of entirely barren gangue, or of ore so poor as not to be workable. Hence their boundaries only represent the limits of the *pay ore* on a grade rarely less than $20 per ton. Moreover, as some of the earlier exploration-workings were scarcely ever surveyed at all, and of which, when measured, the records have not been preserved, it is impossible to obtain a few important features. In relation to the dimensions of the bonanzas that have been exposed since 1869, as has already been intimated, the data are very unreliable, and sadly in need of verification. The numbers contained in the following table relating to the dimensions of the bonanzas are obtained partly from measurements taken from the longitudinal and cross-sections of the lode, as given in atlas-plates 6, 7, 8, 9, and 10 of the volume on *Mining Industry*, and partly from other and less trustworthy sources:

| | Bonanza. | Depth of upper limit, feet. | Length along vein, feet. | Extent in depth, feet. | Width or thickness, feet. |
|---|---|---|---|---|---|
| 1 | Mexican and Ophir | Surface. | 600 | 650 | 2– 70 |
| 2 | Gould and Curry | Surface. | 600 | 540 | 3–100 |
| 3 | Savage (continuation of No. 2) | 440 | 500 | 300 | 5– 60 |
| 4 | Hale and Norcross | 260 | 520 | 600 | 3– 40 |
| 5 | Chollar-Potosi | Surface. | 580 | 500 | 5– 85 |
| 6 | Gold Hill | Surface. | 1040 | 550 | 10–100 |
| 7 | Yellow Jacket | 80 | 340 | 500 | 5– 60 |
| 8 | Kentuck | ..... | 300 | 400 | 2– 40 |
| 9 | Crown Point and Belcher | 850 | 600 | 600 | 5– 60 (?) |
| 10 | Con. Virginia and California | 1050 | 700 | 600 | 20–250 (?) |

*Product of the Big Bonanza for the year 1876.*—The *last* in the foregoing table (No. 10) constitutes the world-renowned "Big Bonanza." Scarcely three years have elapsed since its discovery, and there are no trustworthy data from which an estimate can be made of the probable aggregate value of the gold and silver contained in this gigantic ore-body. In fact, until its complete outlines are exposed, and the exact quality of the ore of its various portions is determined, we have no basis for an estimate. It has been *supposed* to contain, in the aggregate, ore to the value of about $150,000,000.

The official returns for the year 1876 furnish the following numbers in relation to the Consolidated Virginia and the California mines, both of which operate upon the Big Bonanza:

| Mine. | Ore in tons of 2000 lbs. each. | Value of gold, dollars. | Value of silver, dollars. | Total value, dollars. | Average yield per ton of ore. |
|---|---|---|---|---|---|
| Con. Virginia | 142,678 | 7,378,145 | 9,279,504 | 16,657,649 | $116 75 |
| California | 127,541 | 6,488,641 | 6,912,201 | 13,400,842 | 105 07 |
| Both | 270,219 | 13,866,786 | 16,191,705 | 30,058,491 | $111 24 |
| Comstock Lode | ..... | 17,125,000 | 19,875,000 | 37,000,000 | |

It is obvious that nearly five-sixths of the precious metals have come from the Big Bonanza mines.

*Bullion-Product.*—It is difficult to obtain trustworthy data in relation to the bullion-product of the Comstock Lode. The amount of precious metals yielded by this group of mines has indeed been enormous, but there is scarcely a doubt but that there has been a tendency to publish *exaggerated* estimates. The following figures, taken from a careful estimate furnished by Mr. James D. Hague, the able colleague of Clarence King in the preparation of the admirable volume on *Mining Industry* (vol. iii. of *Report on the Geological Exploration of the 40th Parallel*), exhibit, probably, a more accurate statement of the annual bullion production of this lode since the date of its discovery than any that has heretofore been published:

| Year. | Value of bullion. | Year. | Value of bullion. |
|---|---|---|---|
| 1860 | $100,000 | 1870 | $8,254,272 |
| 1861 | 2,000,000 | 1871 | 10,644,704 |
| 1862 | 6,000,000 | 1872 | 13,159,093 |
| 1863 | 12,400,000 | 1873 | 23,216,062 |
| 1864 | 16,000,000 | 1874 | 23,051,496 |
| 1865 | 16,000,000 | 1875 | 24,885,617 |
| 1866 | 11,739,100 | 1876 | 37,000,000 |
| 1867 | 13,738,618 | | |
| 1868 | 8,479,769 | Total..... | $234,074,309 |
| 1869 | 7,405,578 | | |

Hence we may assume the total value of bullion-product of this celebrated lode from the date of its discovery to the end of 1876 to be, in round numbers, about $235,000,000. Comparing this amount with the estimated aggregate value (previously given) of the bullion-product of the Bonanza mines, it is evident that the great bulk of the precious metals comes from a few prominent mines.

The proportional value of *gold* contained in the bullion-product varies from 33 to 70 per cent. In the Big Bonanza it is stated at 42 per cent.; in the product of the Comstock Lode for 1876 it is estimated at 46 per cent. In the total product of the lode from its discovery to the end of 1876 the value of the gold cannot, therefore, be less than 40 per cent.; hence we have to the end of 1876—

Total bullion-product = $235,000,000
" gold " = 94,000,000
" silver " = 141,000,000

By reference to the table it will be seen that the bullion-product of the lode attained a maximum in 1864–65, diminished until 1869–70, and then increased again until 1876, at which time it probably reached its second maximum.

*Comparative Product in 1876.*—Taking the number furnished by the report of J. J. Valentine, general superintendent of Wells, Fargo & Co. (Dec. 30, 1876), as the basis, we have calculated the following table relating to the comparative product of gold and silver for the year 1876:

*Product of Gold and Silver for the Year 1876.*

| | Value in dollars. | | | Per cent. of world's product. | | |
|---|---|---|---|---|---|---|
| | Gold. | Silver. | Total. | Gold. | Silver. | Both. |
| World | 101,328,501 | 77,006,672 | 178,335,173 | | | |
| United States | 44,328,501 | 41,506,672 | 85,835,173 | 43.75 | 53.90 | 48.12 |
| Comstock | 17,125,000 | 19,875,000 | 37,000,000 | 16.90 | 25.81 | 20.75 |
| | | | | Per cent. of United States product. | | |
| Comstock | ..... | ..... | ..... | 38.63 | 47.88 | 43.11 |

It thus appears that the gold and silver product of the Comstock Lode for the year 1876 was more than one-fifth of the total world's product for the same year; and that its yield of silver was more than one-fourth of the aggregate silver-product of the world for that year. The proportional yield of gold, although very large, is not so extraordinary. The percentages in relation to the product of the Comstock Lode, in comparison with the aggregate product of the whole U. S., are equally striking in illustrating the enormous productiveness of this lode. The following table presents the latest summary:

*Statement of Ore and Bullion Products, Assessments, and Dividends of the Principal Mines of the Comstock Lode during a series of years; prepared from Official Sources by James D. Hague.*

| Name of mining company. | Period of time considered. | Product of ore in tons during said period. | Approximate yield in gold and silver of said ore-product. | Average yield per ton of said ore. | Amount received from assessments during said period. | Amount paid in dividends in same time. | Percentage of product paid in dividends. | Percentage of product paid in net dividends (after deducting assessments). |
|---|---|---|---|---|---|---|---|---|
| Ophir | 1860 to Dec., 1876.....16 years | ..... | $10,598,055 | ..... | $2,038,344 | $1,394,400 | 13.15 | 0. |
| California | Year ending Dec. 31, 1876.... 1 year | 128,800 | 13,589,841 | $105.07 | None. | 8,640,000 | 63.58 | 63.58 |
| Consolidated Virginia | Apr. 14, 1867, to Dec. 31, 1876. 9 years | 403,153 | 39,007,570 | 96.75 | 438,500 | 27,000,000 | 69.22 | 68.10 |
| Gould and Curry | 1860 to Nov. 30, 1876.....16 " | 314,101 | 15,672,376 | 49.90 | 2,245,052 | 3,826,800 | 24.40 | 10.9 |
| Savage | Apr., 1863, to July 1, 1876.....13 " | 474,055 | 15,755,705 | 33.23 | 2,730,200 | 4,208,000 | 26.71 | 9.36 |
| Hale and Norcross | Mar. 20, 1866, to Mar. 20, 1876.10 " | 324,459 | 7,930,668 | 24.44 | 1,421,450 | 1,598,000 | 20.15 | 2.23 |
| Chollar-Potosi | 1865 to May 31, 1876.....11 " | 472,019 | 13,168,900 | 27.90 | 1,022,000 | 3,081,080 | 23.40 | 15.74 |
| Imperial | 1863 to Apr. 15, 1876.....13 " | 218,484 | 5,580,054 | 25.54 | 1,751,000 | 1,067,500 | 18.14 | 0. |
| Empire | 1863 to Apr. 15, 1876.....13 " | 81,020 | 2,678,518 | 33.06 | 477,100 | 489,600 | 18.27 | 0.46 |
| Yellow Jacket | 1863 to July 1, 1876.....13 " | ..... | 14,320,905 | ..... | 2,478,000 | 2,184,000 | 15.25 | 0. |
| Kentuck | Nov. 1, 1865, to Nov. 1, 1874.. 9 " | ..... | 4,326,536 | ..... | 280,000 | 662,000 | 15.30 | 8.83 |
| Crown Point | May 1, 1865, to May 1, 1876...11 " | 798,110 | 29,576,467 | 37.06 | 684,526 | 11,898,000 | 40.23 | 38. |
| Belcher | 1863 to Dec. 31, 1876.....13 " | 725,096 | 34,002,486 | 46.89 | 660,400 | 15,397,200 | 45.28 | 43.34 |
| Totals | ..... | ..... | 206,208,081 | ..... | 16,226,572 | 81,446,580 | 39.49 | 31.63 |
| The average yield per ton of | | 3,939,297 | tons of ore | is $44.92 | | | | |

In the foregoing table the stated yield of the ore includes only that derived from the first milling, by which process something more than 70 per cent. of the assay-value is obtained. The treatment of the tailings gives a further revenue from the ore. Of the total bullion value, about 40 per cent. is gold and 60 per cent. silver. In the value stated no allowance is made for the discount on silver—a considerable percentage in recent years. Besides the mines named in this statement, there have been other important sources of bullion, of which no complete records are now available. Among them are the old Mexican mine (now comprised in the Ophir ground); the early surface-workings of what is now the Chollar-Potosi; the old and now consolidated claims in the region of Gold Hill and other points. The Overman and some other less important mines have produced in the aggregate a considerable amount of bullion. The total bullion product of the Comstock Lode at the end of 1876 is not far from $250,000,000.

*Future Prospects.*—The recent discovery of rich bodies of ore on the deeper levels has brought to notice the various difficulties incident to the execution of mining operations at such great depths. Of course, the economy of such work is of prime consideration. The Comstock now furnishes employment to over 2000 miners: its daily "output" of ore is nearly 2000 tons, estimated to contain about one ton of bullion, valued at nearly $56,000. To obtain this amount of ore, in addition to the labor of mining 15,000 tons of dead weight (cable, cages, and cars) must be hoisted daily; 8640 tons of water are pumped; and 1000 tons of waste rock must, in order to reach the surface, pass daily up shafts 2000 feet in depth. And to this must be added the expense of milling and reducing the ore. Moreover, the great heat experienced in the lower levels of the deeper mines is a very serious obstacle to future developments. "Currents of heated waters still penetrate the lode below, and are unquestionably the lingering traces of solfataric action;" "chemical decomposition is yet active here;" "nearly the whole interior of the lode is in a condition of gentle chemical activity." (*King.*) The unusually rapid augmentation of temperature with increasing depth thus produced is a feature which demands the most serious consideration. In some of these mines at the depth of 1700 feet the temperature has ranged from 110° to 120° F., thus converting the lower levels into a vast sweat-house. Although clothing is reduced to a minimum, it is impossible for the miners to continue operations for more than fifteen or twenty minutes at a time without cooling off preparatory to renewing their labors. The application of more efficient means of ventilation has recently mitigated this evil, but it still remains a serious difficulty. It seems to be evident that the construction of a deep adit is a necessary adjunct to safe, economical, and permanently successful mining on this lode. Whether the Sutro Tunnel will perform in an efficient manner this twofold function of economy in mining and of thorough ventilation remains to be seen.

JOHN LE CONTE.

**Confederation, Articles of,** adopted in 1781, and forming the Constitution of the U. S. of America until 1788. (See UNITED STATES (*History*), in CYCLOPÆDIA.)

ARTICLES OF CONFEDERATION.—*To all to whom these presents shall come, we, the undersigned, delegates of the States affixed to our names, send greeting:* Whereas the delegates of the United States of America in Congress assembled did, on the fifteenth day of November, in the year of our Lord one thousand seven hundred and seventy-seven, and in the second year of the independence of America, agree to certain articles of confederation and perpetual Union between the States of New Hampshire, Massachusetts Bay, Rhode Island and Providence Plantations, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia, in the words following, viz.:

*Articles of Confederation and perpetual Union between the States of New Hampshire, Massachusetts Bay, Rhode Island and Providence Plantations, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia.*

ARTICLE 1. The style of this confederacy shall be "The United States of America."

ART. 2. Each State retains its sovereignty, freedom, and independence, and every power, jurisdiction, and right, which is not by this confederation expressly delegated to the United States in Congress assembled.

ART. 3. The said States hereby severally enter into a firm league of friendship with each other for their common defence, the security of their liberties, and their mutual and general welfare; binding themselves to assist each other against all force offered to, or attacks made upon them, or any of them, on account of religion, sovereignty, trade, or any other pretence whatever.

ART. 4. The better to secure and perpetuate mutual friendship and intercourse among the people of the different States in this Union, the free inhabitants of each of these States, paupers, vagabonds, and fugitives from justice excepted, shall be entitled to all privileges and immunities of free citizens in the several States; and the people of each State shall have free ingress and regress to and from any other State, and shall enjoy therein all the privileges of trade and commerce, subject to the same duties, impositions, and restrictions, as the inhabitants thereof respectively; provided that such restrictions shall not extend so far as to prevent the removal of property imported into any State to any other State, of which the owner is an inhabitant; provided also, that no imposition, duties, or restriction shall be laid by any State on the property of the United States or either of them.

If any person guilty of or charged with treason, felony, or other high misdemeanor, in any State, shall flee from justice, and be found in any of the United States, he shall, upon demand of the Governor or Executive power of the State from which he fled, be delivered up and removed to the State having jurisdiction of his offence.

Full faith and credit shall be given in each of these States to the records, acts, and judicial proceedings of the courts and magistrates of every other State.

ART. 5. For the more convenient management of the general interests of the United States, delegates shall be annually appointed in such manner as the Legislature of each State shall direct, to meet in Congress on the first Monday in November in every year, with a power reserved to each State to recall its delegates, or any of them, at any time within the year, and to send others in their stead for the remainder of the year.

No State shall be represented in Congress by less than two, nor by more than seven members; and no person shall be capable of being a delegate for more than three years in any term of six years; nor shall any person, being a delegate, be capable of holding any office under the United States, for which he, or another for his benefit, receives any salary, fees, or emoluments of any kind.

Each State shall maintain its own delegates in a meeting of the States, and while they act as members of the committee of the States.

In determining questions in the United States in Congress assembled, each State shall have one vote.

Freedom of speech and debate in Congress shall not be impeached or questioned in any court or place out of Congress; and the members of Congress shall be protected in their persons from arrests and imprisonments during the time of their going to and from and attendance on Congress, except for treason, felony, or breach of the peace.

ART. 6. No State, without the consent of the United States in Congress assembled, shall send any embassy to, or receive any embassy from, or enter into any conference, agreement, alliance, or treaty, with any king, prince, or state; nor shall any person holding any office of profit or trust under the United States, or any of them, accept of any present, emolument, office, or title of any kind whatever, from any king, prince, or foreign state; nor shall the United States in Congress assembled, or any of them, grant any title of nobility.

No two or more States shall enter into any treaty, confederation, or alliance whatever, between them, without the consent of the United States in Congress assembled, specifying accurately the purposes for which the same is to be entered into, and how long it shall continue.

No State shall lay any imposts or duties which may interfere with any stipulations in treaties entered into by the United States in Congress assembled, with any king, prince, or state, in pursuance of any treaties already proposed by Congress to the courts of France and Spain.

No vessel of war shall be kept up in time of peace by any State, except such number only as shall be deemed necessary by the United States in Congress assembled for the defence of such State or its trade; nor shall any body of forces be kept up by any State in time of peace except such number only, as in the judgment of the United States in Congress assembled, shall be deemed requisite to garrison the forts necessary for the defence of such State; but every State shall always keep up a well-regulated and disciplined militia, sufficiently armed and accoutred, and shall provide and have constantly ready for use, in public stores, a due number of field-pieces and tents, and a proper quantity of arms, ammunition, and camp equipage.

No State shall engage in any war without the consent of the United States in Congress assembled, unless such State be actually invaded by enemies, or shall have received certain advice of a resolution being formed by some nation of Indians to invade such State, and the danger is so imminent as not to admit of a delay till the United States in Congress assembled can be consulted; nor shall any State grant

commissions to any ships or vessels of war, nor letters of marque or reprisal, except it be after a declaration of war by the United States in Congress assembled, and then only against the kingdom or state, and the subjects thereof, against which war has been so declared, and under such regulations as shall be established by the United States in Congress assembled, unless such State be infested by pirates, in which case vessels of war may be fitted out for that occasion, and kept so long as the danger shall continue, or until the United States in Congress assembled shall determine otherwise.

ART. 7. When land forces are raised by any State for the common defence, all officers of or under the rank of colonel, shall be appointed by the legislature of each State respectively, by whom such forces shall be raised, or in such manner as such State shall direct, and all vacancies shall be filled up by the State which first made the appointment.

ART. 8. All charges of war, and all other expenses that shall be incurred for the common defence or general welfare, and allowed by the United States in Congress assembled, shall be defrayed out of a common treasury, which shall be supplied by the several States in proportion to the value of all land within each State granted to or surveyed for any person, as such land and the buildings and improvements thereon shall be estimated according to such mode as the United States in Congress assembled shall from time to time direct and appoint.

The taxes for paying that proportion shall be laid and levied by the authority and direction of the legislatures of the several States, within the time agreed upon by the United States in Congress assembled.

ART. 9. The United States in Congress assembled shall have the sole and exclusive right and power of determining on peace and war, except in the cases mentioned in the sixth article—of sending and receiving ambassadors—entering into treaties and alliances; provided, that no treaty of commerce shall be made whereby the legislative power of the respective States shall be restrained from imposing such imposts and duties on foreigners as their own people are subjected to, or from prohibiting the exportation or importation of any species of goods or commodities whatsoever—of establishing rules for deciding in all cases what captures on land or water shall be legal, and in what manner prizes taken by land or naval forces in the service of the United States shall be divided or appropriated—of granting letters of marque and reprisal in times of peace—appointing courts for the trial of piracies and felonies committed on the high seas, and establishing courts for receiving and determining finally appeals in all cases of captures; provided, that no member of Congress shall be appointed a judge of any of the said courts.

The United States in Congress assembled shall also be the last resort on appeal in all disputes and differences now subsisting or that hereafter may arise between two or more States concerning boundary, jurisdiction, or any other cause whatever; which authority shall always be exercised in the manner following: whenever the legislative or executive authority or lawful agent of any State in controversy with another shall present a petition to Congress, stating the matter in question, and praying for a hearing, notice thereof shall be given by order of Congress to the legislative or executive authority of the other State in controversy, and a day assigned for the appearance of the parties, by their lawful agents, who shall then be directed to appoint by joint consent commissioners or judges to constitute a court for hearing and determining the matter in question; but if they cannot agree, Congress shall name three persons out of each of the United States, and from the list of such persons each party shall alternately strike out one, the petitioners beginning, until the number shall be reduced to thirteen; and from that number not less than seven nor more than nine names, as Congress shall direct, shall, in the presence of Congress, be drawn out by lot; and the persons whose names shall be so drawn, or any five of them, shall be commissioners or judges, to hear and finally determine the controversy, so always as a major part of the judges, who shall hear the cause, shall agree in the determination; and if either party shall neglect to attend at the day appointed, without showing reasons which Congress shall judge sufficient, or being present shall refuse to strike, the Congress shall proceed to nominate three persons out of each State, and the secretary of Congress shall strike in behalf of such party absent or refusing; and the judgment and sentence of the court, to be appointed in the manner before prescribed, shall be final and conclusive; and if any of the parties shall refuse to submit to the authority of such court, or to appear, or defend their claim or cause, the court shall, nevertheless, proceed to pronounce sentence or judgment, which shall, in like manner, be final and decisive, the judgment or sentence and other proceedings being in either case transmitted to Congress, and lodged among the acts of Congress for the security of the parties concerned; provided, that every commissioner, before he sits in judgment, shall take an oath, to be administered by one of the judges of the supreme or superior court of the State, where the cause shall be tried, "well and truly to hear and determine the matter in question, according to the best of his judgment, without favor, affection, or hope of reward;" provided, also, that no State shall be deprived of territory for the benefit of the United States.

All controversies concerning the private right of soil, claimed under different grants of two or more States, whose jurisdiction as they may respect such lands and the States which passed such grants are adjusted, the said grants or either of them being at the same time claimed to have originated antecedent to such settlement of jurisdiction, shall, on the petition of either party to the Congress of the United States, be finally determined, as near as may be, in the same manner as is before prescribed for deciding disputes respecting territorial jurisdiction between different States.

The United States in Congress assembled shall also have the sole and exclusive right and power of regulating the alloy and value of coin struck by their own authority, or by that of the respective States—fixing the standard of weights and measures throughout the United States—regulating the trade and managing all affairs with the Indians not members of any of the States; provided that the legislative right of any State within its own limits be not infringed or violated—establishing and regulating post-offices from one State to another throughout all the United States, and exacting such postage on the papers passing through the same, as may be requisite to defray the expenses of the said office—appointing all officers of the land forces in the service of the United States excepting regimental officers—appointing all the officers of the naval forces, and commissioning all officers whatever in the service of the United States—making rules for the government and regulation of the said land and naval forces, and directing their operations.

The United States in Congress assembled shall have authority to appoint a committee to sit in the recess of Congress, to be denominated "a committee of the States," and to consist of one delegate from each State; and to appoint such other committees and civil officers as may be necessary for managing the general affairs of the United States, under their direction—to appoint one of their number to preside, provided that no person be allowed to serve in the office of president more than one year in any term of three years—to ascertain the necessary sums of money to be raised for the service of the United States, and to appropriate and apply the same for defraying the public expenses—to borrow money or emit bills on the credit of the United States, transmitting every half year to the respective States an account of the sums of money so borrowed or emitted—to build and equip a navy—to agree upon the number of land forces, and to make requisitions from each State for its quota, in proportion to the number of white inhabitants in such State; which requisition shall be binding, and thereupon the legislature of each State shall appoint the regimental officers, raise the men, and clothe, arm, and equip them, in a soldier-like manner, at the expense of the United States; and the officers and men so clothed, armed, and equipped, shall march to the place appointed, and within the time agreed on by the United States in Congress assembled; but if the United States in Congress assembled shall, on consideration of circumstances, judge proper that any State should not raise men, or should raise a smaller number than its quota, and that any other State should raise a greater number of men than the quota thereof, such extra number shall be raised, officered, clothed, armed, and equipped, in the same manner as the quota of such State, unless the legislature of such State shall judge that such extra number cannot safely be spared out of the same; in which case they shall raise, officer, clothe, arm, and equip as many of such extra number as they judge can be safely spared. And the officers and men so clothed, armed, and equipped, shall march to the place appointed, and within the time agreed on by the United States in Congress assembled.

The United States in Congress assembled shall never engage in a war, nor grant letters of marque and reprisal in time of peace, nor enter into any treaties or alliances, nor coin money, nor regulate the value thereof, nor ascertain the sums and expenses necessary for the defence and welfare of the United States or any of them, nor emit bills, nor borrow money on the credit of the United States, nor appropriate money, nor agree upon the number of vessels-of-war to be built or purchased, or the number of land or sea forces to be raised, nor appoint a commander-in-chief of the army and navy, unless nine States assent to the same; nor shall a question on any other point, except for adjourning from day to day, be determined, unless by the

votes of a majority of the United States in Congress assembled.

The Congress of the United States shall have power to adjourn to any time within the year, and to any place within the United States, so that no period of adjournment be for a longer duration than the space of six months; and shall publish the journal of their proceedings monthly, except such parts thereof relating to treaties, alliances, or military operations, as in their judgment require secrecy; and the yeas and nays of the delegates of each State on any question shall be entered on the journal, when it is desired by any delegate; and the delegates of a State, or any of them, at his or their request, shall be furnished with a transcript of the said journal, except such parts as are above excepted, to lay before the legislatures of the several States.

ART. 10. The committee of the States, or any nine of them, shall be authorized to execute, in the recess of Congress, such of the powers of Congress as the United States in Congress assembled, by the consent of nine States, shall from time to time think expedient to vest them with; provided that no power be delegated to the said committee, for the exercise of which, by the articles of confederation, the voice of nine States in the Congress of the United States assembled is requisite.

ART. 11. Canada, acceding to this confederation, and joining in the measures of the United States, shall be admitted into, and entitled to all the advantages of, this Union; but no other colony shall be admitted into the same unless such admission be agreed to by nine States.

ART. 12. All bills of credit emitted, moneys borrowed, and debts contracted, by or under the authority of Congress, before the assembling of the United States, in pursuance of the present confederation, shall be deemed and considered as a charge against the United States, for payment and satisfaction whereof the said United States and the public faith are hereby solemnly pledged.

ART. 13. Every State shall abide by the decision of the United States, in Congress assembled, on all questions which, by this confederation, are submitted to them. And the articles of this confederation shall be inviolably observed by every State, and the Union shall be perpetual; nor shall any alteration at any time hereafter be made in any of them, unless such alteration be agreed to in a Congress of the United States, and be afterwards confirmed by the legislature of every State.

And whereas it has pleased the great Governor of the world to incline the hearts of the legislatures we respectively represent in Congress, to approve of and to authorize us to ratify the said articles of confederation and perpetual union; *know ye*, that we, the undersigned delegates, by virtue of the power and authority to us given for that purpose, do, by these presents, in the name and in behalf of our respective constituents, fully and entirely ratify and confirm each and every of the said articles of confederation and perpetual union, and all and singular the matters and things therein contained; and we do further solemnly pledge and engage the faith of our respective constituents, that they shall abide by the determinations of the United States in Congress assembled, on all questions which, by the said confederation, are submitted to them; and that the articles thereof shall be inviolably observed by the States we respectively represent; and that the Union be perpetual.

In witness whereof, we have hereunto set our hands, in Congress. Done at Philadelphia, in the State of Pennsylvania, the ninth day of July, in the year of our Lord one thousand seven hundred and seventy-eight, and in the third year of the independence of America.

NEW HAMPSHIRE.
Josiah Bartlett,
John Wentworth, Jr.

MASSACHUSETTS BAY.
John Hancock,
Samuel Adams,
Elbridge Gerry,
Francis Dana,
James Lovell,
Samuel Holton.

RHODE ISLAND.
William Ellery,
Henry Marchant,
John Collins.

CONNECTICUT.
Roger Sherman,
Samuel Huntington,
Oliver Wolcott,
Titus Hosmer,
Andrew Adams.

NEW YORK.
James Duane,
Francis Lewis,
William Duer,
Gouverneur Morris.

NEW JERSEY.
John Witherspoon.
Nath. Scudder.

PENNSYLVANIA.
Robert Morris,
Daniel Roberdeau,
Jonathan Bayard Smith,
William Clingan,
Joseph Reed.

DELAWARE.
Thomas McKean,
John Dickinson,
Nicholas Van Dyke.

MARYLAND.
John Hanson,
Daniel Carroll.

VIRGINIA.
Richard Henry Lee,
John Banister,
Thomas Adams,
John Harvie,
Francis Lightfoot Lee.

NORTH CAROLINA.
John Penn,
Cornelius Harnett,
John Williams.

SOUTH CAROLINA.
Henry Laurens,
William Henry Drayton,
John Matthews,
Richard Hutson,
Thomas Heyward, Jr.

GEORGIA.
George Walton,
Edward Telfair,
Edward Langworthy.

**Con'go, or Zaïre.** This river, one of the largest four streams of Africa, and of which a few years ago hardly more than its mouth and a small portion of its lower course were known, has been unexpectedly proved, by the latest investigations of Livingstone and Lieut. Cameron from 1868 to 1875, to be one of the most remarkable of the continent. Its most remote head-waters, like those of the Nile, are found in the high table-lands forming the main axis of Eastern Africa, and are collected in two large lakes, Tanganyika on the N. and Bangweolo on the S., from which issue its two main branches. The northern branch rises in the plateau of Uniamesi, about 5° S. lat. and 4500 feet of elevation, almost touching the southernmost sources of the Nile; enters Lake Tanganyika, 2700 feet in altitude, at Ujiji, whence it issues under the name of Lukuga, and joins the southern or main branch. This last rises in the plateau S. of Lake Tanganyika, near the waters of the Zambesi, and enters the large lake of Bangweolo, 3700 feet in altitude, from which it flows northward, under the name of Luapula, into the smaller lake of Moero, 3000 feet high. Continuing its course, it takes the name of Luvwa, receiving the Lukuga from Lake Tanganyika, and from the S. W. the large river Lualaba, which itself passes through a series of lakes of considerable size. Preserving this last name, it forms the Lake Lanji, whence, entering its middle course along the 4th degree of S. lat., it passes through the great Lake Sankorra, and is believed to flow thence due W. until, after having received two large tributaries from the S., the Kassabi and the Quango, it breaks through the coast-chains in rapids and cataracts to the sea. The basin of the Congo seems thus to occupy a long central depression 1000 to 1400 feet above the sea, extending from E. to W. between the plateaus of 4000 to 5000 feet which surround it on all sides. The main tributaries, however, come from its southern edge, which has been explored by Lieut. Cameron. The northern border of the basin is still a *terra incognita*. Unlike the Nile, which, having its head-waters within the regions of the tropical rains, hastens to the N. through dry and desert tracts without receiving any affluent, the Congo throughout its course remains within the regions of frequent equatorial rains. This situation makes it a purely tropical river, and explains the superabundance of its waters, which are said to exceed those of any other of Africa. The Congo is for that continent what the Amazon is for South America, and its basin is a land of exuberant vegetation and great fertility. Its turbid waters are said to be still visible 100 miles from the coast. A. GUYOT.

**Congressional Term, Limits of.** The Constitution of the U. S. provides that members of the House of Representatives in Congress shall be elected every second year. This determines the duration of each succeeding Congress. By a law of the Congress elected under the Articles of Confederation, passed Sept. 13, 1788, Wednesday, the 4th day of March, 1789, was appointed for the assembling of the first constitutional Congress and the inauguration of the new government. No quorum, however, was obtained in the House of Representatives on that day, or until the 1st of April following, and the President was not inaugurated till the 30th of the same month. Subsequently, by an act of the constitutional Congress, passed Mar. 1, 1792, it was declared that "the term of four years for which a President and Vice-President shall be elected, shall in all cases commence on the 4th day of March next succeeding the day on which the votes of the electors shall have been given." At Washington's second inauguration, and at the inauguration of every President since his time, the oath of office has been administered, in each fourth succeeding year, on the 4th of March, at 12 o'clock M.; and until 1851 it was understood that his term of service expired on the 3d of March at midnight of the fourth year following. The limit of the Congressional term was supposed to be the same; so that the legislative powers of each succeeding Congress were presumed to cease at midnight of the 3d of March of each alternate odd-numbered year. At the close of the 31st Congress, however, in 1851, a discussion arose in which the propriety of this limitation was called in question, and the point was made that, since in the Presidential years, a new administration is not inaugurated until 12 o'clock on the 4th of March, the interpretation of law commonly received would create an interregnum of twelve hours' duration. In conclusion, Mr. Speaker Howell Cobb of Georgia ruled that the term of an outgoing Congress did not expire until 12 o'clock noon of the 4th of March, and that rule has since stood. In conformity with this rule, on the 25th Feb., 1853, Pres. Fillmore, in calling a special session of the Senate to organize the administration of his successor, Franklin Pierce, issued a proclamation in the following words: "The attention of the President having been called to the proceedings of Congress at the close of its session on the 4th of Mar., 1851, from which it appears that the constitutional term of that body was held not to

have expired until 12 o'clock at noon of that day; and a notice having been issued, agreeably to former usage, to convene the Senate at 11 o'clock A. M. on the 4th of March next, it is apparent that such call is in conflict with the decision aforesaid. Now, therefore, as well for the purpose of removing all doubt as to the legality of such call, as of establishing a precedent of what is deemed a proper mode of convening the Senate, I, Millard Fillmore, President of the United States, do issue this my proclamation," etc. etc. (convening the Senate for the 4th of March at 12 o'clock noon).

In 1867 a statute was passed declaring the rule specifically as follows: "In addition to the present regular times of the meeting of Congress, there shall be a meeting of the Fortieth Congress of the United States, and of each succeeding Congress thereafter, at 12 o'clock, meridian, on the fourth day of March, the day on which the term begins for which the Congress is elected, except that, when the fourth of March occurs on Sunday, then the meeting shall take place at the same hour on the succeeding day." (Approved Jan. 22, 1867.) This act was repealed Apr. 20, 1871, but as an authoritative declaration of the limits of the Congressional term it must be regarded as still of force. A new Congress, therefore, comes into existence at 12 o'clock at noon on the 4th of March of each odd-numbered year, and ceases to exist at the same hour of the same day in the second year next following, unless one or the other of those days happens to be Sunday, when the 5th of March is taken instead of the 4th of March. Under this rule it further appears that the political day throughout the sessions of Congress properly begins, for legislative purposes, at 12 o'clock M. of the calendar day of the same name. This rule was enforced in a manner to attract public attention during the progress of the count of the Presidential vote in February, 1877, when the Speaker, in the midst of an exciting debate, repeatedly arrested the discussion at 12 M. by announcing the beginning of a new political day, and the chaplain appeared and opened the new session with prayer. F. A. P. BARNARD.

**Congressman at Large,** a member elected to the House of Representatives by the voters of the entire State, instead of by districts in accordance with the ordinary plan. By the act of Feb. 2, 1872, a new apportionment was made of members of that House, the number being fixed at 292. A specific number of members was assigned to each State. It was then provided that in each State entitled under the apportionment to more than one Representative the number to which such State may be entitled in the Forty-third and each subsequent Congress shall be elected by districts composed of contiguous territory, and containing as nearly as possible an equal number of inhabitants, etc.; but on the election of members to the *Forty-third* Congress in any State to which an increased number of Representatives is given by this apportionment, the additional Representative or Representatives may be elected by the *State at large.* (*Revised Statutes Congress*, § 20–22.) It will thus be seen that the office of "Congressman at large" was a mere makeshift, devised in order to carry into effect the Apportionment act of 1872. The purpose having been accomplished, the office has ceased to exist. T. W. DWIGHT.

**Con'way** (MONCURE DANIEL), b. in Stafford co., Va., Mar. 17, 1832; graduated in 1849 at Dickinson College, Carlisle, Pa.; studied law; became a Methodist minister, and afterward a Unitarian pastor; in 1863 went to England, and in 1867 became a minister at Camden Town; has published *Tracts for To-day* (1858), *The Rejected Stone* (1861), *The Golden Hour* (1862), *The Earthward Pilgrimage* (1870), *Republican Superstitions* (1873), *Sacred Anthology*, besides numerous contributions to magazines, etc.

**Cook** (MARTHA WALKER), sister of Robert James Walker, b. in Pennsylvania in 1807; was married to Lieut. (afterward Gen.) William Cook 1825. D. at Hoboken, N. J., Sept. 15, 1874. In 1864 she published the popular hymn, "In some way or other the Lord will provide."
R. D. HITCHCOCK.

**Cook** (PHILIP), b. in Twiggs co., Ga., July 31, 1817; studied at Oglethorpe University and the University of Virginia; was admitted to the bar in Georgia; in 1861 joined the Confederate service as a private, and at the end of the war was a brigadier-general. In 1865 he was elected to the State convention for the formation of a new constitution; was subsequently elected to the 39th Congress, but not permitted to take his seat. After the removal of all disabilities he was elected to the 43d, 44th, and 45th Congresses. ALEXANDER H. STEPHENS.

**Cooke** (JOHN ESTEN), b. at Boston, Mass., Mar. 2, 1783; graduated in medicine at the Pennsylvania University 1805; professor at Transylvania University in 1827, and at the Louisville Medical Institute in 1837. D. near Louisville Oct. 19, 1853. He published a *Treatise on Pathology and Therapeutics* (2 vols., 1827–28), and a number of minor essays. PAUL F. EVE.

**Coryph'odon** [from Gr. κορυφή, "point," and ὀδούς, "tooth"], an extinct genus of ungulate mammals from the lowest Eocene of Europe and America. The skull in this genus presents many perissodactyl features. It is elongated in the facial region, and the nasal opening is large. The dental formula is—incisors, $\frac{3}{3}$; canines, $\frac{1}{1}$; premolars, $\frac{4}{4}$; molars, $\frac{3}{3} \times 2 = 44$. The brain-cavity is quite small, as in all Eocene mammals, and indicates that the brain itself was of a very inferior type. Its most striking features were the small size of the hemispheres and the large expanded cerebellum. The limbs were short, and the femur had a third trochanter. The feet are especially interesting, as they present a primitive or generalized type, having five toes both before and behind. The first known species was described by Prof. Owen under the name *C. Eocenus*, and was from the London clay. *C. Oweni* is from the lowest Eocene of France. *C. hamatus*, the best-known American species, is from the base of the Eocene in Wyoming, and other species occur in the lowest Eocene of Utah and New Mexico. The genus is thus of great importance, as indicating the parallelism of European and American strata. The animals were about the size of the tapir. O. C. MARSH.

**Cot'ton** (Sir ARTHUR T.), b. 1803; entered the British service as second lieutenant of royal engineers (late Madras) in 1820; served throughout the Burmese war of 1824–26; became colonel and colonel-commandant (late Madras) engineers in 1854. In recognition of his services in promoting the growth of cotton in India he was knighted in 1861, and in 1866 was nominated K. C. of Star of India; appointed major-general in 1862, lieut.-gen. in 1867.

**Couthon'** (GEORGES), b. at Orcet, Puy-de-Dôme, France, in 1756; practised as an advocate in Clermont, when in 1791 he was elected a member of the Legislative Assembly. He voted for the execution of the king without appeal; moved the resolution for the arrest of the Girondists; was active in the overthrow of Danton and Hébert, etc.; was accused and condemned together with Robespierre and St. Just, and was guillotined July 18, 1794.

**Cowry.** See CYPRÆIDÆ.

**Cox** (GEORGE WILLIAM), b. in 1827; was educated in Trinity College, Oxford, England; took holy orders in 1850; was a curate for several years; received an assistant mastership in Cheltenham College in 1860, and published *Tales of Ancient Greece* (1868), *A History of Greece* (2 vols., 1874), *Latin and Teutonic Christendom* (1870), *The Mythology of the Aryan Nations* (2 vols., 1870). In connection with W. T. Brande he edited the new edition of the *Dictionary of Science, Literature, and Art* (London, 3 vols., 1865–67).

**Cra'po** (HENRY H.), b. in Dartmouth, Mass.; was police-justice and tax-collector of New Bedford; removed to Michigan in 1857; engaged in the manufacture of lumber, and also in farming; was mayor of Flint, State senator, and performed great service as governor near the close of the rebellion. D. at Flint, Mich., July 23, 1869.

**Crich'ton** (JAMES). The evidence of the extraordinary accomplishments of this remarkable person is very strong, and it is contradicted by little but its extreme improbability. But the close coincidence of the accounts of Crichton and another young literary prodigy of an earlier age—a fact not hitherto noticed, so far as we are aware—suggests a doubt whether his panegyrists have not borrowed their eulogiums, at least in part, from a chronicler of the preceding century. In the *Journal d'un Bourgeois de Paris de 1409 à 1449*, published in one of the volumes of Buchon's collection, *Choix de Chroniques, etc., XVe Siècle* (Paris, 1838), under the year 1446 is a narrative of the appearance at Paris of "a young man of about twenty, who, according to the testimony of all the clerks of the university, knew the seven liberal arts, played all instruments, practised chant and discant, painted and illuminated, better than any other at Paris or elsewhere. In military exercises none so dexterous; he wielded a two-handed sword incomparably, and sprang upon his opponent with a leap of twenty or more paces; he was a master in the arts and in medicine, a doctor of canon law and theology; he disputed publicly with more than fifty perfect clerks of the University of Paris and more than 3000 other clerks, and answered admirably all questions; he spoke excellently Latin, Greek, Hebrew, Chaldee, Arabic, and all other tongues. He was a dubbed knight, he surpassed the four doctors of the Church, and in fine was the nonpareil of the world." His knowledge, of course, came from the Evil One, though he himself was unaware of this diabolic possession, and thought his acquirements merely natural. The chronicler gives the predictions as to his future history, ending with his being caried off by devils at the age of thirty-three. (See CRICHTON, in CYCLOPÆDIA.) GEORGE P. MARSH.

**Cro'ly** (David G.), b. in New York City Nov. 3, 1829; learned the trade of silversmith; was for a time a student in New York University; taught phonography; was employed on the *Evening Post* and New York *Herald* from 1854 to 1858; was editor and proprietor of Rockford *Daily News;* city editor upon the New York *World* when it first started, subsequently managing editor; resigned in 1871, and has been since then managing editor of the *Graphic*, an illustrated newspaper. He is the writer of a *Life* of Horatio Seymour, and the author of a brochure entitled *The Positivist's Primer;* issued two numbers of the *Modern Thinker;* was the first to introduce the subject of minority representation to the American public in the *Galaxy* in 1866; has written on journalism in the magazines. In 1856 married the lady now known as "Jennie June."

**Croly** (Jennie Cunningham), "Jennie June," b. in Leicestershire, England; came early to the U. S. with her parents, and married in 1856 Daniel G. Croly of New York. Shortly after she began her literary activity as a contributor to the *Sunday Dispatch*, and she has ever since written for the press; inaugurated the system of duplicate fashion correspondence; has edited *Madame Demorest's Magazine* for several years. She called the first women's congress in New York, 1856, and also the second, 1869, and in 1868 inaugurated the Sorosis (see in Cyclopædia).

**Cru'se** (Christian Frederic), b. in Philadelphia, Pa., in 1794; in 1817 graduated with honor in the University of Pennsylvania, having been the first moderator of the Philomathean Society of that college; after several years as Lutheran minister he was ordained in the Episcopal Church by Bishop White; was elected to a chair in the university in which he had been educated, and then held several pastoral cures, finishing his official service as librarian of the General Theological Seminary of the Episcopal Church, New York, Sept., 1865. "He was a library in himself," says the writer in an obituary notice of him at the time, "especially in theology and sacred literature in all their departments and languages, and of history extensively, both ancient and modern. Never have I known one who in my judgment understood his Bible so well. He was my living commentator, always ready on the most difficult texts, often original, yet strikingly natural in their interpretation. He was a true Christian philosopher, serene and patient as philosophy itself. Modest, meek, and reverential, in a saintly degree, he was yet a most independent thinker. Profound in his affection for the truth of God, but most impatient of the glosses of men. He had a strong aversion to ecclesiasticism, and yet was equally free from rationalism. He was simply and entirely a disciple of Christ; in patience, gentleness, and in loving acquiescence with the Divine will, he benignly reflected the spirit of his Master. . . . When the end came the saint, the scholar, and the sage, in the fulness of his years, gently glided to his rest among the beatified within the veil." He translated the *Ecclesiastical History of Eusebius Pamphilus* (Philadelphia, 1833) and the whole of Eschenburg's *Classical Manual*, only the part relating to Roman literature being incorporated in N. W. Fiske's translation (Philadelphia, 1836). W. A. Muhlenberg.

**Cul'lom** (Shelby M.), b. in Kentucky in 1829; studied law, was admitted to the bar, and began to practise at Springfield, Ill., in 1848; was elected to the State legislature in 1856, and re-elected in 1860; was a member of the war commission which sat in Cairo in 1862, and of the 39th and 40th Congresses; was again elected to the State legislature in 1872, and re-elected in 1874, and was nominated governor on the Republican ticket in 1876.

**Cumulative Voting.** See Proportional Representation, in Cyclopædia.

**Cur'tis** (Edward), A. B., M. D., b. at Providence, R. I., June 4, 1838; was educated in New York; graduated in 1859 at Harvard College; studied medicine at the University of Pennsylvania, where he took his degree in 1861; served in the regular army as a surgeon 1861–70; was appointed professor of materia medica and therapeutics at Columbia College, New York, in 1872; has devoted himself much to the study of photographing microscopic objects by means of the microscope, and has published various papers on the subject.

**Cut'ler** (Hannah Conant Tracy), b. Dec. 25, 1815; married in 1834 the Rev. J. M. Tracy, who died in 1843: prepared herself for the office of teaching; was appointed matron of a deaf and dumb asylum in Ohio; went in 1851 to Europe as a correspondent of the *Ohio Statesman*, and lectured in London on woman's rights; married in 1852 Samuel Cutler, and settled in Illinois, where she worked assiduously for the reform of the laws concerning women; was president of the Union Aid Commission in the war; graduated in 1869 at the Women's Medical College, Cleveland, O.; visited Europe again 1873–75, and settled at Cobden, Ill., where she is practising.

**Cyclostomoi'dea** [from *Cyclostomus*—κύκλος, "circle," στόμα, "mouth"—the typical genus], an extensive group of gasteropod mollusks of the order Pectinibranchiata and sub-order Tænioglossa, containing numerous species distinguished by a modification of the breathing apparatus for the respiration of air direct, and consequently for life on land, and by the circular mouth or peritreme of the shell. The animal has its chief viscera contained in a spiral hernia-like sac, and a corresponding large shell to protect it; the mantle has a simple margin, and the pulmonary cavity is quite open above the neck; the branchiæ are vascular and branched, and analogous to the lungs; the head is rather broad; the muzzle quite long, extensible at the extremity, and frequently used to assist in progression; the tentacles are clavate or attenuated, and simply contractile; the eyes sessile on the outer sides of the bases of the tentacles; the lingual ribbon is narrow, and the teeth in seven rows (3—1—3), and recurved at their apices; the foot is broad, and with the sole frequently divided by a longitudinal groove; the shell is spiral and well developed, so as to perfectly include the animal on retraction, and the aperture is always nearly or quite circular, and with the peritreme continuous; an operculum is developed, and has a median nucleus. The forms thus distinguished are not only not at all related, as was formerly generally thought, to the typical land shells and slugs (Helicidæ, etc.) of the temperate regions, but belong even to a different order. Their affinities are certainly with forms that are for the most-part dwellers in the salt or fresh waters, and especially with the family Littorinidæ. The characters of the species combined under the general head above designated, and which by most authors, until within a few years, have been considered to constitute a simple family, are quite various; recent writers have therefore admitted several distinct families. These are—(1) Cyclostomidæ, (2) Cyclophoridæ, and (3) Pomatiidæ. The chief differences between these families are to be found in the modifications of the armature of the lingual ribbon or odontophore (and especially of the external lateral teeth), and modifications of the operculum. (1) In the Cyclostomidæ the external lateral teeth are very large and broad, and their recurved free margin deeply and finely pectinated: no jaws are developed. (2) In the Cyclophoridæ the external lateral teeth are of the same type as those of the innermost and median rows—*i. e.* rather narrow or simply lobate at the extremities: two lateral jaws of goodly size exist. (3) In the Pomatiidæ the external lateral teeth are atrophied or very small, and liable to be overlooked; jaws are present; other differences are coincident with these, but less obvious and universal. The genera recognized by recent authors are very numerous, and many of them are chiefly based upon modifications of the operculum: this may be paucispiral, as in the typical Cyclostomidæ and Pomatiidæ, or multispiral, as in the Cyclophoridæ; other characters exist in the structure, texture, and sculpture; *e. g.* whether provided with one or two layers, whether thick or thin, etc. The chief modifications have been used for the segregation of the genera into distinct sub-families. (1) The Cyclostomidæ, for example, have been divided into the sub-families Cyclostominæ, Cistulinæ, and Licineinæ; (2) the Cyclophoridæ into the sub-families Cyclophorinæ, Cyclotinæ, Pupininæ, and Diplommatininæ: the Pomatiidæ are monotypic. The numbers of genera recognized by the best authors are from thirty to fifty, according to the degree of knowledge or conservatism of the individuals. Over 600 species have been described. These are mostly inhabitants of tropical or subtropical countries: numerous species, especially of Cyclostomidæ, are inhabitants of the West Indian islands, and in India and the neighboring regions the Cyclophoridæ are predominant. Very few species extend into the north temperate region, but more in Europe than in America. Theodore Gill.

**Cypræ'idæ** [from *Cypræa*—Κύπρις, a name of Venus—the typical genus], a family of gasteropod mollusks of the order Pectinibranchiata and sub-order Tænioglossa, distinguished by the beauty of the shells of most of the species. These are much sought after by shell-collectors, and popularly known under the name of cowries. The animal has a broad, flattened foot, more or less truncated in front and pointed behind; the mantle is expanded on each side, and forms lobes which meet over the back of the shell near its median line, and the surface is usually provided with filaments; the siphon is moderate; the head broad; the rostrum rather long and with an invertible tip; the tentacles elongated and subulate; the eyes sessile or in prominences on the head near the external bases of the tentacles; the lingual ribbon is long, and partly contained in the visceral cavity; the teeth are in seven rows, one rhachidian, and

three uncinal on each side: the shell in youth is cylindrical or olive-form, and with a conspicuous spire, but toward maturity the outer lip encroaches upon the spire and becomes thickened, while an extensive deposit of callous material is secreted upon the columella, and the shell consequently becomes involute and ovoid in form, and assumes the aspect represented in COWRY, in CYCLOPÆDIA; the aperture is then narrow and longitudinal, and occupies the whole length of the shell, and each of the lips is plicated by numerous transverse teeth. The species embraced under the name Cypræidæ by almost all conchologists, and agreeing in the characteristics of the animal so far as given above, differ, however, quite widely in other respects, especially in the presence or want of jaws, as well as in the nature of the teeth of the lingual ribbon. Two groups are thus distinguished, and have been differentiated by Troschel as distinct families—(1) the true cowries, retaining the Cypræacea, and (2) the Triviæ, or small ribbed forms, as well as *Eratos*, or marginella-like forms, being contradistinguished under the name Triviacea. (1) The Cypræacea or Cypræidæ are destitute of jaws, and the rhachidian teeth have each a peculiar flat basal appendage; (2) the Triviacea or Triviidæ are provided with two jaws covered with imbricated scales, and the rhachidian teeth are simple and destitute of basal appendages. The classification of the Cyprænidæ is far from being perfected. There are, however, two well-marked sections, distinguished by their dentition—one represented by pustuliferous species, forming the genus *Pustularia*, and the others with smooth shells: these latter have been separated by Troschel into two genera and a number of sub-genera—*i. e.* (1) *Cypræa*, with the sub-genera (*a*) *Talparia* (*C. talpa*, *C. lurida*, etc.), (*b*) *Tigris* (*C. tigris*, *C. exanthema*, etc.), (*c*) *Lyncina* (*C. Lynx*, etc.), (*d*) *Mauritia* (*C. mauritiana*, *C. arabica*, etc.); and (2) *Aricia*, with the sub-genera (*a*) *Erronea* (*C. errones*, *C. caurica*, etc.), (*b*) *Erosaria* (*C. erosa*, *C. caput-serpentis*, etc.), (*c*) *Monetaria* (*C. moneta*, *C. flaveola*, etc.). The Triviidæ are divisible into two very distinct genera or groups of even higher value: these are (1) *Trivia*, including the globose, transversely-ribbed species, with the spire invisible; and (2) *Erato*, embracing the smooth species, with the spire exserted. The last are more like the Marginellæ in superficial aspect than the Triviæ, although they in other respects agree with the latter, and are evidently members of the same natural group. The species of the two families are numerous, between 150 and 200 having been described. (See further the article COWRY, in CYCLOPÆDIA.)

THEODORE GILL.

# D.

**Dacres** (Sir SYDNEY C.), b. at Totnes, Devonshire, England, Jan. 9, 1804; entered the British navy 1817; became captain 1832, rear-admiral 1858, vice-admiral 1865, and admiral 1870; was distinguished as lieutenant in the reduction of the Morea Castle in 1828; as captain in the Crimean war; and as rear-admiral commanded the first iron-clad squadron, and in 1861, when trouble between England and America was imminent on account of the Trent affair, was selected as second in command on the North American and West India station; was senior lord of the admiralty 1868–72; governor of Greenwich Hospital 1872–76; in 1874 was placed on the retired list. In 1865 he was created a K. C. B., and has been decorated with numerous foreign orders and medals.

**Dale** (SAMUEL), b. in 1772 in Rockbridge co., Va.; became a famous Indian fighter and trader among the Creeks and Cherokees; was major of Kentucky volunteers in the Creek war 1814, and brevetted brigadier-general; became a merchant at Dale's Ferry, on Alabama River, and was much in public life. D. in Lauderdale co., Miss., May 23, 1841.

**Dall** (CAROLINE HEALY), b. in Boston, Mass., 1824; engaged very early in literary pursuits; was married in 1844 to Charles Henry Apple Dall, a Unitarian minister; became in 1850 a regular contributor to *The Liberty Bell*, and in 1852 corresponding editor of *The Una;* lectured frequently, and published *The College, the Market, and the Court*, *Life of Marie E. Zakrzewska*, *Historical Pictures retouched*, and *Egypt's Place in History*.

**Dan'iel** (WILLIAM COFFEE), M. D., b. in Greene co., Ga., 1792. In 1821–22 he originated the revulsive stimulating treatment in opposition to calomel and purgatives. He is the author of extension by weights in fractures of the thigh; was a collaborator several years to the Philadelphia *Journal of Medical and Physical Sciences;* was also editor of the Savannah *Daily Republican;* in 1825 published a monograph on autumnal fevers; in 1866–67 wrote several articles on fish-culture; in 1818 was health officer of Savannah; in 1823–24 was mayor of that city. He was also member of the Georgia legislature, and during the war was receiver for that State. D. in Liberty co., Ga., 1868.

PAUL F. EVE.

**Dark Day,** a term traditionally used in speaking of those remarkable days, of which a number are recorded in history, when the light of the sun has been to such a degree obscured by clouds, or smoke, or other foreign matters filling the atmosphere, as, without the aid of artificial light, to render the transaction of ordinary business impossible, and practically to turn day into night. These extraordinary occurrences have differed considerably from each other in several respects, such as the intensity of the obscuration, its duration, and the extent of territory over which it has prevailed. In some instances the darkness is described as total; in others, such as to make it very difficult for pedestrians to find their way; while in others its intensity has not been so great as to prevent surrounding objects from being more or less distinctly visible. The duration has varied from a few hours to five or six days. The extent of territory obscured has in general been ascertained only very indefinitely, but has certainly in some instances measured several hundreds of miles in every direction, while in most it has doubtless been comparatively limited.

In New England and in the neighboring States of New York and New Jersey, the term "Dark Day" is usually understood to refer to the dark day of 1780, notices of which are found in Barber's (J. W.) *Historical Collections of Connecticut* (New Haven, 1838), and of New England and New York (Worcester, 1841); in Webster's (N.) *History of Pestilential Diseases* (Hartford, 1799); in Munsell's (J.) *Every-Day Book of History and Chronology* (New York, 1858), and in the *Collections* of the Massachusetts Historical Society (1st series, vol. i.). Except the last, these notices are brief, and none of them, with the same exception, give any description of the meteorological phenomena accompanying the approach of the darkness, or prevailing during its continuance. Barber, in his chronological table, records the event in the briefest terms, thus: "1780, Dark Day—candles necessary at noon-day, May 19." In his notice of Stamford, however, in eulogizing Col. Abraham Davenport, of Revolutionary fame, and a member for twenty-five years of the executive council of Connecticut, he cites from Dr. Dwight an interesting anecdote connected with this day, as follows: "The 19th of May, 1780, was a remarkable dark day. Candles were lighted in many houses, the birds were silent and disappeared, and the fowls retired to roost. The legislature of Connecticut was in session at Hartford. A very general opinion prevailed that the day of judgment was at hand. The house of representatives, being unable to transact their business, adjourned. A proposal to adjourn the council was under consideration. When the opinion of Col. Davenport was asked, he answered, 'I am against an adjournment. The day of judgment is approaching or it is not. If it is not, there is no cause for adjournment; if it is, I choose to be found doing my duty. I wish, therefore, that candles may be brought.'" A beautiful poetic version of this anecdote is given by Whittier in *The Tent on the Beach*.

Webster's notice is not descriptive. He refers to the phenomenon as one of the many evidences which he supposes himself to have found, that the atmosphere is often charged with foreign matters emanating from the bowels of the earth, sublimed by internal heat; but owing also more or less to electric influences in some undefined manner operating. These emanations which, in his view, are the chief cause of epidemic diseases, he supposes to be more or less constantly escaping, though usually invisible. To them and to the causes producing them, he attributes most abnormal, if not in fact the normal, meteorological phenomena, such as extreme temperatures whether of heat or cold, mild or severe seasons, violent storms, especially those of lightning and thunder, extraordinary droughts, auroral displays, etc., etc., not forgetting comets; and he certainly supposes that all these phenomena mutually influence each other. His reference to the dark day of 1780 seems therefore to be intended among other things to connect it with the Aurora Borealis, as he had already associated the Aurora with severity of winter temperature. Thus he gives this narrative as received from his father: "In the month of Jan., 1741, in the midst of one of the coldest winters of this century, there was a little relaxation of the rigorous

cold, during which the heavens were overcast with clouds and a little rain fell. Late at night during the falling weather, the heavens appeared all in a flame, so as to illuminate the earth and render objects everywhere distinctly visible. Many people saw it and were alarmed, supposing the great day was at hand. The rain which fell during the night had precisely the appearance of drops of blood distilling from the clouds. . . . The well-known dark day of May, 1780, was distinguished by a similar light in the heavens; but not occurring in the night, it was less an object of wonder." The luminous appearance of 1741 here described was very clearly auroral, though not recognized as such by the writer. Analogous examples are numerous enough in which the clearing up of the sky before the cessation of the phenomena has exhibited the auroral columns in full activity. Such an example occurred on Nov. 14, 1837, when a blood-red aurora suddenly manifested itself in New York and the States adjacent in the midst of a storm of snow, imparting its color not only to the heavens but to the whole surface of the snow-covered earth, and to the falling flakes, which, like the raindrops in the case above described, were brightly red. After this manifestation had continued for about half an hour, the storm abruptly ceased and the clouds passed away; but the auroral display persisted, with intervals of intermission, throughout the night. The light which Webster associates with the dark day of 1780 was probably not auroral. It seems to have been a peculiar yellowish tint characterizing such feeble solar rays as struggled successfully through the clouds, and is more particularly described in the extracts from Dr. Tenney, below. Munsell's notice of this occurrence is as follows: "1780, Dark Day in New England, occasioned by a thin cloud or vapor. The people dined by candlelight, and the darkness is represented as Egyptian."

The notice of this day embraced in the *Collections* of the Mass. Hist. Society, is of some length, and is in the form of a letter from Samuel Tenney, M. D., of Exeter, N. H., a surgeon of the army during the war of the Revolution. Its more important points may be briefly summarized as follows: The darkness was preceded by common clouds, with "in some places a slight sprinkling of rain." . . . "Between these [the common clouds] and the earth, intervened another stratum, to appearance of great thickness. As this stratum advanced, the darkness commenced and increased with its progress till it came to its height, which did not take place till the hemisphere was a second time overspread. The uncommon thickness of this second stratum was probably occasioned by two strong currents of wind from the southward and westward, condensing the vapors and drawing them in a N. E. direction." The doctor proceeds to say that having on this day left Rowley (Essex co., Mass.) to join his regiment in New Jersey, he had a very favorable opportunity to observe the differences of appearance between his residence and Pennsylvania. He remarks: "The darkness was grossest in Essex co., in Lower New Hampshire, and in the old province of Maine; in Rhode Island and Connecticut, it was not so great, and was less in New York." In New Jersey the lower cloud stratum was observed but did not appear to be thick, and the darkness was not remarkable. In Lower Pennsylvania nothing unusual was noticed. The letter proceeds: "Through the whole extent the lower stratum had an uncommon brassy hue, while the earth and trees were adorned with so enchanting a verdure as could not escape notice even amidst the unusual gloom that surrounded the spectator." This is doubtless the appearance to which Webster refers in speaking, in the passage cited above, of the peculiar light observed in the heavens during the dark day. It is further remarked that the gradual increase of the darkness nearly corresponded in direction with the drift of the clouds. The portion of Dr. Tenney's article following this description is occupied principally with an attempt to account for the obscuration on physical principles, a matter we shall presently consider. Toward the end, we have some hint of the persistency of the phenomenon which seems to have extended into the succeeding night; the writer remarking that "the darkness of the following evening was probably as gross as ever has been observed since the Almighty fiat gave birth to light. It only wanted palpability to render it as extraordinary as that which overspread the land of Egypt in the days of Moses. And as darkness is not substantial but a mere privation, the palpability ascribed to that by the sacred historian must have arisen from some peculiar affection of the atmosphere, perhaps an exceeding thick vapor that accompanied it. I could not help conceiving at the time that if every luminous body in the universe had been shrouded in impenetrable shades, or stricken out of existence, the darkness could not have been more complete. A sheet of white paper held within a few inches of the eyes was equally invisible with the blackest velvet."

These meagre notices embrace all that we have been able to find on record descriptive of a phenomenon which produced upon those who beheld it a more profound impression than any other event in the natural world occurring within the same century. Meagre as they are, however, they are more full than those we have of any of the not very rare similar occurrences of earlier or later date. Of these the earliest of all mentioned in history is the darkness which fell on Egypt at the command of Moses, and which by some chronologists has been assigned to the fourteenth century, and by others to the fifteenth, sixteenth, or seventeenth B. C. The entire account which we have of this is briefly given in a single sentence: "And Moses stretched forth his hand toward heaven; and there was a thick darkness in all the land of Egypt three days: they saw not one another neither rose any from his place for three days; but all the children of Israel had light in their dwellings." The phenomenon here described is not wholly explicable upon any hypothesis involving purely natural causes only. Commentators generally concur nevertheless in the belief that the physical instrumentality by which the darkness was produced was the same which still at certain seasons continues to produce in the same country a similar though less enduring effect—viz. a sand-cloud from the Lybian desert.

Dr. Webster, in his work above referred to, names, without citing authorities, the years B. C. 366 and B. C. 295, and also the years A. D. 252, A. D. 746, and A. D. 775, as years in which there occurred remarkable dark days. In A. D. 252 the darkness is said to have continued three days, in A. D. 746 several, and in A. D. 775 as many as six days; but this is all we know of them. At the time of the crucifixion of our Saviour, it is recorded in the first three Gospels that there was darkness over all the land from the sixth to the ninth hour—*i. e.* according to our reckoning from 12 M. to 3 P. M. The expression, "over all the land" is the reading of the first and second Gospels; the third has it, "over all the earth." The expression in the original is *ἐπὶ πᾶσαν τὴν γῆν*, or *ἐφ' ὅλην τὴν γῆν*, which admits of either interpretation. No natural cause can be assigned for this. The event occurred the day before the feast of the Passover—that is, at the period of the full moon—so that it could not have been owing to a solar eclipse; not to mention that the darkness accompanying such an eclipse is but momentary.

To come down to more recent times, in 1678, Munsell records "a remarkable darkness at noon in England," and in a paper by Dr. W. Derham, published in the *Philosophical Transactions* of the Royal Society, vol. xxxvii., the 1st of Jan., 1807, is said to have been a "cloudy dark day" at Upminster in Essex co., England. In the same paper the author makes the 1st of Oct., 1816, also a "close dark day." He presents, in addition to this, a meteorological table kept at Cambridge, Mass., by Mr. Thomas Robie, by concert with himself in England, for the years 1815 and 1816, and cites the following from Mr. Robie's annotations: "On Oct. 21 (1816) the day was so dark that people were forced to light candles to eat their dinners by; which could not be from an eclipse, the solar eclipse being the 4th of that month." This day is also referred to by Webster, who says that "in Oct., 1816, a dark day occurred after a severe winter in Europe;" adding that "the next winter in America was very severe," a juxtaposition of statements suggested by his theory of the interdependency of these widely-differing meteorological phenomena. Barber also mentions this day as "a remarkable dark day in New England and New York." The 9th of Aug., 1732, is mentioned by Webster as another dark day (apparently in Europe), followed by an earthquake and a winter of unusual severity. In Munsell we find the 19th of Oct., 1762, set down as a "dark day at Detroit—one of the darkest days that ever was known." This is likewise spoken of by Webster, who adds that "there was a dark-red or yellowish tinge in the heavens [before sunrise] which gave to the sun when it appeared the color of blood. Rain fell and the water was of a dirty sulphurous smell." And in connection with this statement, he thinks it pertinent to remark that there were two earthquakes and a catarrh in 1761; and that in 1762 catarrh was epidemic in Europe. A very remarkable instance of intense darkness of only brief duration occurring by day, is mentioned by Munsell, as having taken place in Canada Oct. 16, 1783. He says: "The inhabitants of Canada were surprised by a very extraordinary phenomenon. About 2 o'clock P. M., an unusual darkness, equal it is said to the darkest night, took place. Its approach was instantaneous. This continued about forty minutes, when there was a short interval of light, but soon was succeeded by darkness horrible as before though not of so long duration. The whole is said to have continued upward of an hour, and to have extended more or less throughout the province." Webster also refers to this, adding that "thunder-squalls and a meteor followed the great

darkness in Canada in 1783." In Howard's *Climate of London*, vol. ii., we find the following relating to a dark day in London: "1812, May 10, London was this day involved for several hours in palpable darkness. The shops, offices, etc., were necessarily lighted up, but the streets not being lighted as at night, it required no small care in the passenger to find his way and avoid accidents. The sky, where any light pervaded it, showed the aspect of bronze. Such is occasionally the effect of the accumulation of smoke between two opposite gentle currents, or by means of a misty calm. I am informed that the fuliginous cloud was visible, in this instance, at a distance of forty miles. Were it not for the extreme mobility of our atmosphere, this volcano of a hundred thousand mouths would in winter be scarcely habitable." Less than two years later than the occurrence here described, the same city was visited by a succession of dark days beginning with an extremely dark night caused by a great fog which came on with the evening of Dec. 27, 1813. The following is from Hone's *Every-Day Book*, under the title of "Great Frost, 1814:" "Cabinet business of great importance had been transacted [in the afternoon] and Lord Castlereagh left London about two hours before to embark for the Continent. The prince-regent (since George IV.) proceeding toward Hatfield on a visit to the marquis of Salisbury, was obliged to return to Carlton House, after being absent several hours, during which period the carriages had not reached beyond Kentish-town, and one of the outriders fell into a ditch. Mr. Croker, secretary of the admiralty, on a visit northward, wandered likewise several hours in making a progress not more than three or four miles, and was likewise compelled to put back. It was 'darkness that might be felt.' On most of the roads excepting the high North road, travelling was performed with the utmost danger, and the mails were greatly impeded. On the 28th, the Maidenhead coach coming to London, missed the road near Harford bridge and was overturned. . . . On the 29th, the Birmingham mail was nearly seven hours in going from the post-office to a mile or two below Uxbridge, a distance of 20 miles only; and on this and other evenings the short stages in the neighborhood of London had two persons with links running by the horses' heads. Pedestrians carried links or lanterns, and many who were not so provided lost themselves in the most frequented and at other times well-known streets. Hackney coachmen mistook the pathway for the road and the greatest confusion prevailed. On the 31st, the increased fog in the metropolis was at night truly alarming. It required great attention and thorough knowledge of the streets to proceed any distance, and persons who had material business to transact were unavoidably compelled to carry torches. The lamps appeared through the haze like small candles. Careful hackney coachmen got off the box and led their horses, while others drove only at a walking pace. There were frequent meetings of carriages, and great mischief ensued. . . . Innumerable people lost their way." This tremendous fog was followed by the heaviest snows that had fallen within the memory of man, and the winter was of unexampled severity. In Howard's *Climate of London*, above referred to, the 26th Nov., 1816, is entered with the annotation, "Very misty A. M.; cirro-stratus sweeps the ground;" and the following foot-note is added, being an extract from the London *Evening Mail* of the next day, Nov. 27, viz.: "The atmosphere was so darkened yesterday morning, in the vicinity of the metropolis, by the thick fog combined with smoke, that in some parts it appeared like a cloudy night. In the neighborhood of Walworth and Camberwell it was so completely dark, that some of the coachmen driving stages were obliged to get down and lead their horses with a lantern."

This completes the list of the dark days of which we have been able to find accounts. A careful exploration of old records would probably bring to light many more. It remains only to add a few words as to the causes to which these remarkable occurrences are probably owing.

In order to facilitate the inquiry, the several hypotheses which have been suggested on the subject, and which seem to exhaust the limited list of possibilities, are here enumerated in advance. These are—(1) The smoke of vast burning forests loading the atmosphere and shutting out the light of the sun. (2) Dense exhalations of smoke and ashes from volcanoes, transported by the upper currents of the air. (3) Vapors generated by the internal heat of the earth, and escaping through fissures in its crust. (4) Smoke produced by the combustion of large meteors traversing the atmosphere. (5) Cosmical dust drifting into the atmosphere from the regions of outer space. (6) Terrestrial dust raised in clouds from deserts, and swept to great distances by atmospheric currents. (7) Ordinary clouds of extraordinary density, reinforced in the neighborhood of large towns by the smokes of countless fires, as well as by those of furnaces and factories.

The first of these hypotheses is disposed of by Dr. Webster very summarily, by presenting two conclusive considerations, which are—(1) that there has been no evidence of the occurrence of great forest conflagrations immediately before these days of darkness or simultaneously with them; and (2) that if such conflagrations had existed, the cause is not adequate to the observed effect. "Had the woods," he remarks, "from the 40th to the 50th parallel of latitude been consumed in a day, the smoke would have been insufficient to produce the darkness of the 19th May, 1780." And as a further confirmation of this conclusion, he adds that the color of smoke is very different from that of the obscuring stratum on the day referred to. But though the cause here considered may not be adequate to produce the intense darkness of these days of exceptional obscurity, it is no doubt the frequent occasion of a slighter and more lasting obscuration of the atmosphere, such as occurs pretty regularly every year in the U. S., in November or the latter part of October, and is known by the name of the Indian summer. During this period the atmosphere is hazy and dry, the sky is red, the temperature mild, and rain is absent for an unusual length of time. According to Loomis, "This appears to result from a dry and stagnant state of the atmosphere, during which the air becomes filled with dust and smoke arising from numerous fires by which its transparency is greatly impaired. A heavy rain washes out these impurities and effectually clears the sky. This phenomenon is not peculiar to the U. S., a similar condition of the atmosphere being frequently observed in Central Europe. Moreover, this dry and stagnant state of the atmosphere is not limited to a single season of the year. The long periods of drought which frequently prevail in summer are characterized by a like condition of the atmosphere." This last remark of Prof. Loomis may be correct, but it is believed that the peculiar characteristic of the true Indian summer of November—viz. the blueness or smoke-color of the haze—is not observed at other seasons. This haze was supposed by the early colonists to be a real smoke from the burning over of the Western prairies at this season by the aborigines. Hence the name, Indian summer.

The second hypothesis above mentioned is equally untenable with the first. It is not indeed to be questioned that the exhalations of volcanoes are often dense enough and voluminous enough to shut out the light of the sun from the regions which they overhang. During the eruption in which Pompeii was destroyed the whole country surrounding Vesuvius was involved in the darkness of night. But the dark days we have described above occurred in localities far distant from any volcanic crater, and it is not conceivable that the fumes of volcanic eruptions should have been borne so far and maintained in density sufficient to produce the observed effect, without obscuring the intermediate region. There have been, nevertheless, some examples, not indeed of darkness, but of a very remarkable haziness widely diffused through the atmosphere, much more extensive and intense than that of the Indian summer just mentioned, and involving a whole hemisphere or perhaps the entire globe at once, to which such exhalations may have contributed. Such was the extraordinary phenomenon known as the dry fog of 1783. Of this, the characteristics are given by Mr. Arago (*Astronomie populaire*, vol. ii. liv. xvii. ch. xxxvi.) as follows: "The fog commenced almost on the same day (18th June) in places very distant from each other, such as Paris, Avignon, Turin, Padua. It extended from the N. of Africa to Sweden, and was observed over a great part of North America. It lasted more than a month. The air, at least that of the lower regions, did not seem to be its vehicle, for, in certain places it appeared with a wind from the N., and in others with winds from the S. and E. Tourists found it on the highest summits of the Alps. The abundant rains which fell in June and July, and the most powerful winds, failed to dispel it. In Languedoc its density was such that the morning sun remained invisible for more than 12 degrees from the horizon, and during the remainder of the day the disk was red, and could be steadily observed with the naked eye. This fog, or smoke, as some meteorologists have called it, emitted a disagreeable odor. The property by which it was most remarkably distinguished from ordinary fogs was that, while the latter are generally very humid, all accounts agree in affirming that this was extremely dry. At Geneva, Senebier found that the hair-hygrometer of Saussure, which in fogs properly so called marks 100°, indicated in that here in question not more than 68°, 67°, 65°, and sometimes even 57° only. Finally, and this is especially worth noting, the fog of 1783 appeared to possess a certain phosphorescent virtue, or a kind of self-luminosity. I find, indeed, in the accounts of some observers, that it diffused even at midnight a light which they compared to that of the full moon, and which sufficed to enable them to distinguish objects 200 mètres distant. I add, in order to remove all un-

certainty as to the origin of this light, that the observation was made at the time of new moon."

Mr. Arago gives also an account of an entirely similar phenomenon which occurred in 1831. He says: "This fog was noticed for the first time, upon the coast of Africa, Aug. 3; at Odessa, Aug. 9; in the S. of France and at Paris, Aug. 10; in New York, Aug. 15; and at Canton, in China, about the end of the same month. From these observations it is impossible to infer either the velocity or the direction of its propagation. This haze so enfeebled the light which traversed it, that it was possible to observe the sun all day long, without black or colored glasses, or any of the instrumentalities to which astronomers resort for the protection of the sight. On the coast of Africa, the sun did not begin to be visible until its distance from the horizon exceeded 15° or 20°. At night the sky sometimes cleared so far as to make possible the observation of the stars. Mr. Rozet, staff officer at Algiers; the observers at Annapolis, in the U. S.; those of the S. of France, and the Chinese at Canton, remarked that the solar disk was of an azure-blue, or greenish, or of emerald-green color." Mr. Arago hereupon observes that, while it is no doubt possible that a vapor or gas may possess the property of imparting color to white light traversing it, yet as in general the light transmitted by clouds and fogs is red or purple, the greenish or bluish-green color ascribed in this case to the sun belonged to the class of so-called accidental colors, and was not real. To the writer of the present article, however, who had an opportunity of observing the phenomenon on many successive days at Baltimore, Washington, and elsewhere, the entire mass of the fog itself, especially near the horizon, exhibited the greenish hue, no less than the sun, so that the tint could not have been accidental. This fog was also phosphorescent, as well as that of 1783. "During its existence," proceeds Mr. Arago, "there was, properly speaking, no night in the places where the atmosphere was strongly charged with it. Thus at midnight even, in the month of August, writing in small characters could be read without difficulty in Siberia, at Berlin, at Genoa, and in other places." The immediate object of Mr. Arago in discussing the details of these extraordinary phenomena was to settle the question whether they present any evidence of the earth's having been at these particular times involved in the tail of a comet. He concludes that they do not, although such an occurrence is by no means impossible and perhaps by no means rare, and even though an incident of the kind did probably happen in 1819 and again in 1823 though not in the least perceived by the inhabitants of the planet; but because if such a thing had occurred in 1783 or in 1831, the nucleus of the comet could not have escaped notice, either when approaching the sun or in its subsequent departure. He is compelled therefore to look for an explanation in one or other of the hypotheses which we have above enumerated as 2d, 3d, 4th, or 5th—viz. volcanic fumes, exhalations through terrestrial fissures, the combustion of huge bolides, or the accession to the atmosphere of cosmical dust. The first and third of these hypotheses had already been suggested by Franklin, in a communication concerning the fog of 1783 made during his residence in Paris in the following year, to the Literary and Philosophical Society of Manchester (England). He says: "The cause of this universal fog is not yet ascertained. Whether it was adventitious to the earth [from without] and merely a smoke proceeding from the consumption by fire of some of those great burning balls or globes which we happen to meet with in our rapid course round the sun, and which are sometimes seen to kindle and be destroyed in passing our atmosphere, and whose smoke might be retained by our earth; or whether it was the vast quantity of smoke long continuing to issue during the summer from Hecla, in Iceland, and that other volcano which arose out of the sea near that island, which smoke might be spread by various winds over the northern part of the world, is yet uncertain." Mr. Arago reproduces both these hypotheses of the American philosopher, but observes, more generally, "The year 1783 was marked at the opposite extremes of Europe by great physical commotions. It was in 1783, in the month of February, that there occurred in Calabria those continual and frightful earthquakes which shattered the country from top to bottom, and buried more than 40,000 inhabitants under the débris of its uprooted mountains, under the rubbish of ruined churches and private dwellings, and in the profound chasms with which its vibrations, so violent and so constantly renewed, furrowed the soil. That same year Mount Hecla, in Iceland, was subject to one of the greatest eruptions of which the annals of meteorology have preserved the remembrance. New volcanoes even arose from the sea, at a considerable distance from the island. Could it therefore be very astonishing if, in the midst of a disorder of the elements of this kind, gaseous matters of unknown nature were to issue from the bowels of the earth through the numerous fissures in its solid envelope, and were afterward to diffuse themselves through the air? Is not this idea of terrestrial emanations to a certain point confirmed by the remark that, on the open sea, the fog was either wanting or was imperceptible? And will it not add something to its probability to observe, that fogs of the same kind sometimes appear in quite circumscribed localities; that, for example, on the 12th Sept., 1812, M. de Gasparin, in climbing Mont Ventoux, in Provence, passed through a thick cloud which did not moisten his clothes, nor tarnish metals, nor affect the hygrometer, but appeared in all respects similar to the fog of 1783?" It is perhaps sufficiently remarkable that the violent convulsion in Iceland began but a little before the first appearance of the fog of 1783 in Europe. The volcano, referred to by Arago, which rose from the sea about 200 miles from Hecla, appeared earlier than June, and threw out so vast an amount of pumice and light scoriæ as to cover an area of the ocean 150 miles in diameter and seriously to impede the progress of vessels. On the 1st of June, the Skaptar Jökull began to be agitated; on the 8th it threw out volumes of smoke; and on the 11th it burst into one of the most violent and long-continued eruptions known in history, of which the violence was redoubled on the 18th, the very day on which the fog first appeared in places so widely distant from each other in Europe. Mr. Arago, however, being apparently not wholly satisfied with any one of the three hypotheses up to this point proposed, or desiring to exhaust the list of possibilities, adds the following: "The aërolites which fall to the earth from time to time, are sometimes very compact metallic masses. Most commonly, however, they would be liable to be confounded with common stones, if it were not for the thin vitrified coating which covers their surfaces. Frequently specimens have been found of a spongy character. The dust which occasionally falls, either by itself or mixed with rain, is a fourth condition of cosmic substances. Let us imagine such dust to be still further attenuated, let us reduce it in thought to impalpable molecules, such that they can only descend through the atmosphere with extreme slowness, and we shall have a final hypothesis to account for dry fogs. It may be mentioned in conclusion, as a matter to be regretted, that no one undertook a chemical analysis of the air of these fogs for the purpose of obtaining some positive notion as to the elements which compose them."

But though it thus appears that volcanic fumes, or exhalations from fissures in the earth, or the smoke of burning meteors, or accessions of impalpable dust from the regions of space may be presumed with reason sometimes to affect the general transparency of the atmosphere, no one of these causes suggests an explanation applicable to a case of darkness like that of May 19, 1780. We have seen why volcanoes will not meet the case. A similar difficulty will be encountered if we resort to the hypothesis of emanations from less obvious but more numerous and more generally distributed fissures of the earth's crust. Such fissures must be most numerous where earthquakes are most frequent; and the escape of pent-up gases is certainly to be looked for chiefly in precisely those places where the convulsions of the crust now immediately going on give evidence of their presence. If, therefore, such exhalations can take place in a country like New England, in which for centuries earthquakes have been almost unknown, and can take place in sufficient abundance to shut out the light of the sun for many hours, they ought to produce the same effect frequently, perhaps several times a year, in countries like Italy and portions of Central and South America, where the earth is scarcely ever absolutely at rest.

We must equally reject the hypothesis which finds an explanation of these phenomena in the smoke of meteoric bodies consumed in the atmosphere. It is surprising that it did not occur to men like Franklin and Arago, that a fire-ball large enough to leave behind it so voluminous and permanent traces of its passage, must have been altogether too bright to escape observation somewhere in its flight, if not indeed over half a continent. Every object of this kind, if of more than average brilliancy, pursues a course of some hundreds of miles through the atmosphere. Many have been bright enough to be seen by day, and few fail to leave behind them the products of their combustion in the form of glowing trains which often remain for many minutes visible. Yet no one of these was ever known to produce any permanent effect upon the transparency of the air even along the very line of its path. Moreover, even after the great star-shower of 1833, when for many hours the whole sky was full of blazing meteors, and the number which traversed the atmosphere could be estimated only by hundreds of thousands, the day which followed was not in the slightest perceptible degree less bright or clear than that which immediately preceded. If it be said

that these meteors were all small, we may reply that this is by no means proved. Many of them were certainly marvellously brilliant, and some left trains which remained visible for more than an hour. The fact that all these together were so wholly without effect in impairing the transparency of the air, must tend greatly to exalt our ideas of what must be the splendor of a combustion capable in a few brief minutes of so loading the atmosphere of a whole hemisphere with haze, as for more than a month to shut out from the planet half the light of the sun. This hypothesis must therefore be regarded as untenable.

Nor is it possible to speak more favorably of that which ascribes the darkness to a cloud of dust falling into the atmosphere from the regions of space; inasmuch as, except the fact of the darkness itself, there is no evidence to sustain this notion, while the circumstances attending the cessation of the phenomenon seem decidedly to contradict it. Such a cloud could disappear only by subsidence, or by dissipation through the agency of atmospheric currents, or by the joint effect of these causes combined. A cloud so dense could not subside without leaving a deposit on all exposed surfaces; and a cloud so extensive could not be dispersed without exhibiting a succession of phases of gradually diminishing darkness extending probably through many days, and producing at the same time a greater or less amount of obscuration over the adjacent territory; none of which phenomena are recorded as having been observed after any of the dark days we have been considering. In saying this it is not intended, however, to question the possibility that the earth may sometimes encounter such cosmical clouds, though no past observation either meteorological or celestial would seem to indicate that they can ever be dense. The most plausible theory of the dry mists of 1783 and 1831 appears to be that which would ascribe them to such encounters. Careful examination, moreover, of the fine dust which always falls in quiet nights, whether in the interior of continents or over the ices and snows of the arctic seas, has led to the conclusion that this deposit must to some extent be derived from extra-terrestrial sources; but its quantity is altogether too minute to affect in the slightest degree the transparency of the atmosphere.

The hypothesis next in order—viz. that which ascribes the darkness of the remarkable days we have been considering to clouds of terrestrial dust or sand, transported by atmospheric currents—must be dismissed equally with the others already disposed of. The cause is no doubt a sufficient one, since when the sand-storms of Northern Africa are at their height, the light of the sun is often completely extinguished; but in these cases, the cloud sweeps along the earth's surface and fills the lower air, so as to produce literally "a darkness which may be felt," suggesting what is possibly the true interpretation of this doubtful passage of the sacred narrative. Moreover, it may be said of this cause, as has been already said of volcanic ejections, that if it produces a sensible effect at a distance from its source, it must produce a corresponding effect over all the intermediate region. But there is no source within New England or the adjacent States from which a dust-cloud could have been raised adequate to produce the darkness of May 19, 1780, nor was there in that instance any mixture of such dust in the lower air, nor any deposit left behind. It is true that terrestrial dust and volcanic ashes are often conveyed by atmospheric currents to vast, and it would seem incredible, distances. Dust has often fallen in Southern Europe, as at Lyons in France and Genoa in Italy, which on microscopic examination has proved to contain species of minute organisms belonging to the valleys of the Orinoco and Amazon in South America, and not known to occur elsewhere. These organisms must have been borne through the upper regions of the atmosphere, not less than 5000 miles. In the year 1812, the volcano Morne Garou, in St. Vincent, threw out immense volumes of ashes, of which a large quantity fell on the island of Barbadoes, 90 miles toward the E. In 1835, a great eruption took place of the volcano Coseguina in Nicaragua, ashes from which were gathered on the island of Jamaica, 700 miles N. E. from the volcano, while other portions fell upon a ship in the Pacific, 1200 miles distant in the opposite direction. In 1815 occurred "one of the most frightful eruptions recorded in history," of the volcano Tomboro in the island of Sumbawa. During this, remarks Lyell, "so heavy was the fall of ashes that they broke into the resident's house at Bima, 40 miles E. of the volcano, and rendered it, as well as many other dwellings in the town, uninhabitable. On the side of Java, the ashes were carried to the distance of 300 miles, and 217 toward Celebes, in sufficient quantity to darken the air. . . . The darkness in Java was so profound that nothing equal to it was ever witnessed in the darkest night." But, as has been already remarked, when darkness has been thus a consequence of the transportation to a distance of volcanic ejections, this darkness has necessarily affected also the intermediate region, so that the cases of darkness we are considering are not capable of explanation upon this hypothesis.

In the absence therefore of any other supposable cause, we are compelled to attribute these examples of extraordinary darkness simply to the presence of ordinary clouds of very unusual volume and density. Nor will this explanation appear insufficient, when we consider that, in the experience of every one, occasions are not of very rare occurrence when, for intervals of a few minutes, the darkness produced by heavy rain-clouds is so great as to make it impossible to read or write without artificial light. In such cases it would be only necessary that the cloud should be a little more dense, more general and more persistent, to reproduce the dark day of 1780. The circumstances attending the cessation of the darkness are moreover in harmony with this theory. The immense volume of precipitated vapors discharges itself in torrents of rain, or heavy falls of snow, or is revaporized by the solar heat, and the atmosphere resumes its previous transparency. No deposit of dust or sediment appears upon the earth, and no lasting haziness lingers in the air. In reference to the dark days of London, it may be remarked, that the truth of the explanation here proposed is unquestionable. In the most remarkable of those instances the fog was the obvious cause of the darkness, and fog is but a cloud resting on the earth. The smoke of countless fires, of course, contributed to the effect, but this alone could not have sufficed; otherwise, during winter, London would never enjoy the natural light of day.

Dr. Tenney in his explanation of the darkness of May 19, 1780, given in the *Collections* of the Mass. Hist. Society, while substantially adopting this theory, expresses the opinion that the extreme obscuration observed on that occasion was owing to the presence of a double instead of a single stratum of clouds. He argues that the penetrating power of the solar rays was so enfeebled in struggling through the upper stratum, as to make it almost impossible for them to traverse the second at all. This loss of penetrating power he ascribes to a reduction of the velocity of the rays, an assumption or inference which is not in accordance with the laws of physics, and which requires therefore no particular examination. Observation seems to have shown that there were actually two strata of clouds present on this particular occasion, but we are not compelled to accept the presence of both as necessary to the occurrence of the phenomenon, when it is just as easy to imagine a single one having the density and volume of both. The extreme infrequency of these phenomena shows that they can only occur under very exceptional atmospheric conditions.

F. A. P. Barnard.

**Da'sent** (George Webbe), b. about 1818; graduated in 1840 from Magdalen Hall, Oxford; was called to the bar at the Middle Temple in 1852, and appointed civil service commissioner in 1870; was for many years a steady contributor to the London *Times*, and became in 1871 editor of *Fraser's Magazine*. He has translated *The Younger Edda* (1842), and published *The Norsemen in Ireland* (1855), *The Story of Burnt Njal* (1861), *Selection of Norse Tales* (1862), etc.; also edited *An Icelandic-English Dictionary, based on the MS. collections of the late Richard Cleasby, enlarged and completed by Gudbrand Vigfusson* (1874). ✓

**Dasyuridæ.** See Thylacinidæ, in Cyclopædia.

**Da'vidson** (George), A. M., Ph. D., b. at Nottingham, England, May 9, 1825, of Scottish parents; came to the U. S. in 1832, and graduated in 1845 at the Central High School of Philadelphia; entered the U. S. Coast Survey; served in the States bordering the Atlantic and Gulf coasts until 1850, when selected to take charge of a party to the Pacific coast; worked continuously upon the western coast, except during the civil war, when he served on the Atlantic and Gulf coasts; was appointed chief engineer of an expedition for the survey of a ship-canal route across the Isthmus of Darien; in 1867 made a geographical reconnaissance of the coast of Alaska, and reported upon its products, etc., to Congress; in 1868 returned to the Pacific coast, and had charge of the field-work of the parties there; in 1869 brought the San Francisco observatory in telegraphic longitude connection with Greenwich; in 1869 took charge of the expedition to Alaska to observe the total solar eclipse of August; in 1873 determined the 120th meridian; in 1874 conducted the U. S. transit-of-Venus party to Japan; at Nagasaki connected the American and French transit-of-Venus stations by triangulation; visited China, India, Egypt, and Europe for scientific study, the results of which have been embodied in a special report to the superintendent of the Coast Survey; returned to the Pacific coast, and is now in charge of the telegraph-longitude work and of the main triangulation and astronomical party carrying

the geodetic work across the continent. During the last twenty-seven years he has continued determinations of the magnetic elements from lat. 32° to 60°; and in 1874 carried a series of dip and declination observations across the Pacific; has improved the character of the instruments used in his observations; published numerous works on transit instruments and observations, irrigation, harbor and river improvements, and many communications in the *Proceedings* of the California Academy of Sciences, of which he has been president for several years, and is a member of various scientific societies.

**Davidson** (Samuel), D. D., LL.D., b. in 1807 near Ballymena, Ireland; studied at the Royal College of Belfast, where he was appointed professor of biblical criticism and literature in 1835; removed in 1842 to Manchester as professor of biblical literature and Oriental languages at the Lancashire Independent College, but subsequently resigned this position and settled in London. Of his numerous works the most remarkable are—*Introduction to the New Testament* (3 vols., 1848–51; new ed. in 2 vols., 1868), *Introduction to the Old Testament* (3 vols., 1862).

**Davidson** (Thomas), M. A., b. Oct. 25, 1840, near Fetterangus, parish of Deer, Aberdeenshire, Scotland; graduated with highest classical honors and the Simpson Greek prize at Aberdeen in 1860; was for several years rector of the grammar (Latin) school of Old Aberdeen, and subsequently master in several English schools; spent considerable time in France and Germany; came to Canada in 1866, and to the U. S. in 1867, and after spending eight years in St. Louis, removed to Cambridge, Mass., in 1875. Mr. Davidson has contributed to various periodicals numerous philological and philosophical articles. He was for several years connected with the *Round Table*, and at the same time edited the *Western Educational Monthly*, which afterward, under his conduct, changed its name and became *The Western*. He is at present engaged on a translation of the complete works of Aristotle.

**Da'vis** (Paulina Wright), b. at Blumfield, N. Y., Aug. 7, 1813; was married in 1833 to Francis Wright of Utica, N. Y., and after his death in 1844 was married in 1849 to Thomas Davis of Providence, R. I. D. Aug. 24, 1876. She was an uncompromising advocate of the enfranchisement of women, established *The Una*, wrote a history of the woman suffrage reform, and gave lectures frequently.

**Dawes** (Rev. William Rutter), b. at Christ's Hospital, London, Mar. 19, 1799, where his father was mathematical master. Educated for the Church, but dissatisfied with some of its tenets, he studied medicine under Abernethy and Sir William Lawrence; gave up practice in 1826, and assumed charge of a small Independent church at Ormskirk, where was his first small observatory, though previously he had done much work privately with a telescope supposed to be but 1.6 inches aperture; took charge of Mr. Bishop's observatory, Regent's Park, 1839, where he remained until 1844; in 1846 began work in his own observatory at Cranbrook, in Kent, which he finally (1857) removed to Hopefield, Haddenham-near-Thame, where he resided until his death, Feb. 15, 1868. His work was mostly with the double stars, and is justly distinguished for its accuracy. It is mostly contained in *Memoirs R. A. S.*, vols. viii., ix., and xxxiv., and the separate volume published by Mr. Bishop. (For a catalogue of his scientific papers, see *Royal Society's Index of Scientific Papers.*) Elected F. R. A. S. in 1830; received the gold medal R. A. S. 1855; elected F. R. S. 1865. L. Waldo.

**Death Valley,** California, so called because a party of emigrants, on their way to California, perished there from thirst and starvation in 1849. About eleven years afterward Dr. I. R. N. Owen, of the U. S. and California boundary survey, followed the marks of their wagon-wheels, and discovered the remains of their fires and the iron of their wagons on the spot where they had camped, these remains being perfectly preserved in this rainless region. This valley is the most northern of a chain of desert basins extending from the head of the Gulf of California northward, embracing the Colorado Desert, the Mohave Desert, and the Amargosa Desert, or "Death Valley." It is situated in the south-eastern portion of Inyo co., Cal., about lat. 36° 15′ N. and lon. 116° 50′ W. The basin or sink is about 39 miles long and 11 miles wide, extending in a direction nearly N. and S. It is surrounded on all sides by very high and precipitous mountains, the most conspicuous of which are the Panamint Mountains on the W. and the Amargosa Mountains on the E. It is a dreary and desolate region, nearly destitute of water and vegetation, fearfully hot in summer, and occasionally swept by terrible sand-storms. The Amargosa River flows into the southern end of the valley, and Furnace Creek runs into the eastern side of its northern extremity; all the waters *sink* when they reach the valley. The soil is covered with a white alkaline efflorescence, but in winter it is somewhat marshy near the centre. The formations surrounding it are, to a large extent, volcanic, obsidian being abundant on the W. slope of the Amargosa Mountains. One of the most interesting features connected with the topography of this portion of California is the fact that this valley, although far in the interior of the continent—being on the E. side of the lofty Sierra Nevada range and 200 miles from any sea—*is from 150 to 200 feet below the sea-level.* This fact has been established by careful barometric measurements. Until recently this was supposed to be true of no other part of the North American continent at any considerable distance from the coast; but it is now known, by means of careful levellings, that a large portion of the Colorado Desert in San Diego county, about 200 miles farther S., is below the level of the sea, the greatest depression near the northern extremity, Dry Lake, being from 250 to 300 feet below the sea-level. It may be interesting to add that the remarkable depression of Death Valley occurs in comparative proximity to the loftiest peaks of the Sierra Nevada Mountains, the crowning peak, Mount Whitney, being about 75 miles to the W. of it. John Le Conte.

**Decal'comanie** [Fr. *décalquer*, to "counterdraw," and *manie*, "fancy"], the art of transferring pictures and designs permanently upon fabrics of various descriptions, china, glass, marble, wood, leather, etc. The process is very simple. The article to be decorated is carefully washed from grease or dust; the picture to be applied is coated thinly with prepared cement. The picture is then placed in the position required and pressed tightly with a cloth or rolled over with a heavy roller. Finally, a damp sponge is applied to the upper surface till the paper becomes sufficiently moist, after which it can be easily removed, and the picture will remain firmly and permanently upon the object.

**De Ko'ven** (James), b. at Middletown, Conn., Sept. 19, 1831; graduated at Columbia College, New York, in 1851, and at the General Theological Seminary in the same city in 1854; was admitted to the diaconate of the Protestant Episcopal Church the same year, and to the priesthood the year following; was rector of a church at Delafield, Wis., for five years, and became warden of Racine College in the same State in 1859; in Feb., 1875, was elected bishop of Illinois, but failed to be confirmed on account of his extreme High Church views. J. B. Bishop.

**Del'afield** (Edward), b. in the city of New York in 1794; had every advantage of education, and graduated at Yale College at the age of eighteen in 1812; began the study of medicine in the office of Dr. Samuel Borrowe of New York, and at the age of twenty-one graduated at the College of Physicians and Surgeons in 1815. Soon after this he went to London for clinical study, and became a pupil of Sir Astley Cooper and Mr. Abernethy; remained abroad about a year, and on his return to New York he, in conjunction with Dr. J. Kearny Rodgers, established the New York Eye and Ear Infirmary in 1820. He was attending surgeon to the same till 1850, when he resigned and was made one of its consulting surgeons; in 1825 was appointed professor of obstetrics and diseases of women and children in the College of Physicians and Surgeons, and resigned in 1838; in 1834 was appointed physician to the New York Hospital; in 1842 organized the Society for the Relief of the Widows and Orphans of Medical Men, and was its first president; in 1855 was elected consulting surgeon to the Woman's Hospital, and in 1866 was elected president of its medical board; in 1858 was elected president of the College of Physicians and Surgeons; in 1870 became, by virtue of his presidency of the College of Physicians and Surgeons, one of the governors of the Roosevelt Hospital, was elected first president of the board of governors, and was chairman of the building committee. D. Feb. 13, 1875. J. Marion Sims.

**Delafield** (Francis), M. D., b. in the city of New York Aug. 3, 1841; graduated at Yale College in 1860; was appointed adjunct professor of pathology and practical medicine in the College of Physicians and Surgeons of New York, and published a *Handbook of Post-mortem Examination.*

**Depuy'** (Henry Walter), b. at Pompey Hill, Onondaga co., N. Y., in 1820; studied law, and was admitted to the bar, but adopted the profession of journalism, and settled in Indianapolis; was private secretary to Gov. Seymour 1853–54; then secretary of legation at Berlin, but returned in 1860, and was appointed secretary of Nebraska, and subsequently Indian agent to the Pawnees. D. in New York Feb. 2, 1876. He wrote *Kossuth and his Generals, Louis Napoleon and his Times, Ethan Allen*, etc.

**D'Esclot, Esclot,** or **Sclot** (Bernat), an important Catalan historian, whose *Chronicle* was first published in the original text by Buchon, together with a translation of

Muntaner and other matter in his *Collection* of *Chroniques étrangères relatives aux Expéditions françaises pendant le XIIIe Siècle* (Paris, 1841, 8vo). The years of D'Esclot's birth and death are unknown, but his *Cronica del Rey En Pere e dels seus antecessors passats* appears to have been composed in 1285. It embraces a summary view of the earlier history of the Aragonese kings of the family of the counts of Barcelona, but its proper subject is the reign of King Don Pedro, extending from 1276 to 1285. This period comprises the Sicilian Vespers and the expulsion of the French from that island, the intended duel between Charles of Anjou and Pedro, the excommunication of Pedro and the bestowal of his kingdom upon Charles de Valois by the "apostle" or pope, the invasion of Catalonia by Philip the Bold, and the death of that monarch at Perpignan; respecting all which stirring events D'Esclot is one of the best authorities. D'Esclot's *Chronicle* has not the fervor, the "wrath and partiality," of Muntaner's chivalric narrative, but it is not therefore less trustworthy; and it often contains piquant details which Muntaner sacrificed to his rhetoric. Buchon praises with justice D'Esclot's account of the Sicilian Vespers, his description of the wild soldiery called *Almogavares*, and of the arrival of Roger de Loria's fleet at Barcelona, and other passages; but in the opinion of the present writer the narrative of the challenge to Charles d'Anjou by Pedro (chap. xcix.), its acceptance by Charles (chap. c.), the journey of Pedro to Bordeaux, where the duel was to be fought (chaps. civ. and cv.), is surpassed by nothing in the *Chronicle;* and indeed a more striking historical recital of an actual occurrence of the "age of chivalry" is not to be found in any other mediæval annalist. D'Esclot's is the oldest historical composition of any moment which remains to us from the early stage of the Catalan language, and it is therefore of great linguistic as well as literary interest.

GEORGE P. MARSH.

**Des'eret, University of,** located in Salt Lake City, Ut., was incorporated in 1850 by an act of the legislative assembly of the State of Deseret, and in 1851, after the organization of the present Territory of Utah, this act of incorporation was legalized by the Territorial legislature. The government of the institution is vested in a chancellor and twelve regents, and in Nov., 1851, it was opened for the reception of students under the supervision of Orson Pratt, Sr. Owing to lack of patronage, the school was discontinued till 1867, when, under the leadership of David O. Caldee, it was started as a commercial college. In 1869, under the presidency of John R. Park, M. D., a scientific, a classical, and a normal department were added to the commercial, and in 1870 were established an academical and a model school department, preparing the students for the college course; which two departments have been in very successful operation since that time.

**Desmoulins'** (BÉNOIT CAMILLE), b. at Guise, Aisne, France, in 1762; studied law in Paris, and embraced the ideas of the Revolution with boundless enthusiasm. His two pamphlets, *La Philosophie au Peuple français* (1788) and *La France libre* (1789), not only attracted attention, but exercised influence; and his wild, passionate addresses in the gardens of the Palais Royal (July 12, 1789) raised the public excitement to a point where it could not be controlled, and became the immediate introduction to the Revolution. In his periodical, *Révolutions de France et de Brabant*, which was reprinted in 1833, and is still read with a singular mixture of horror and admiration, he gave to the passion of the moment some of its most brilliant and some of its most revolting catchwords, and the Reign of Terror, although enacted by other persons and overtaking him as one of its first victims, was nevertheless begotten within his brain. He was one of the founders of the Jacobin Club and one of the leaders of the rising Aug. 10, 1792; as a member of the Convention he voted for the death of the king without appeal, and he dealt the party of the Girondists the decisive blow by his *Histoire des Brissotins*, which covered them with ridicule and contempt. But when, after the fall of the Girondists, the Jacobins separated into two parties, the *Enragés* under Hébert, and the *Indulgents* under Danton, Camille Desmoulins joined the latter, and his paper, *Le vieux Cordelier*, is a courageous, often a noble, denunciation of the excesses of the Revolution. These excesses, however, were in reality simply the consequences of his own ideas, and it seems not unnatural that he should fall a victim to them. He was twice accused as a traitor, but saved by Robespierre, his former schoolmate, who felt a kind of personal attachment for him, and who gave in his speeches some very striking characterizations of his noble enthusiasm and dangerous talent, of the peculiar tenderness and waywardness of his character. But when at last it became necessary for Robespierre to crush Danton, Camille Desmoulins could not be saved. He was arrested Mar. 30, 1794, sentenced to death without being allowed to defend himself, and dragged to the guillotine Apr. 4, while tearing his clothes in agonies of terror and despair, and making the most piteous appeals to the surrounding populace. His young wife, whom he loved tenderly, tried to rouse the mass in his defence, but was arrested and guillotined about two weeks afterward.

CLEMENS PETERSEN.

**Det'mold** (WILLIAM), M. D., b. in 1808 in Hanover, where his father was court-physician; studied medicine in Göttingen, where he graduated in 1830, and soon after entered the Hanoverian army as surgeon. After visiting England and France, he came in 1837 to New York, where he settled after resigning his commission in the army. He introduced orthopædic surgery in this country, and held the chair of clinical and military surgery in the College of Physicians and Surgeons, Columbia College. During the war of the rebellion he volunteered his services on most of the large battle-fields in Virginia. He introduced an improved knife for the use of one-armed men, which under the name of "Dr. Detmold's knife" is furnished by the government to all men who have lost an arm or hand in the line of duty. He has largely contributed to the periodical medical literature of this country.

**Devereux'** (JOHN HENRY), b. in Boston, Mass., Apr. 5, 1832; was educated at Portsmouth, N. H., as a civil engineer, and began to work at once upon the construction of railroads. From 1848 to 1861 he was engaged in the building of railroads in Ohio and Tennessee. He was called to Washington by the government Mar. 31, 1862, and in April following was appointed superintendent of military railroads. In Mar., 1864, he resigned the charge of Virginia railroads, and became superintendent, and subsequently vice-president, of the Cleveland and Pittsburg R. R.; resigned the latter position in 1868, and became president of the Lake Shore R. R., and afterward became general manager of the consolidated Lake Shore and Michigan Southern R. R. Resigning in June, 1873, he was elected president of the Cleveland Columbus Cincinnati and Indianapolis R. R. Co., and president of the Atlantic and Great Western Railway Co.; he is now president of the former and receiver for the latter (1877). J. B. BISHOP.

**De Witt** (THOMAS), D. D., b. at Kingston, N. Y., Dec. 13, 1791; graduated in 1812 at the theological seminary, New Brunswick, N. J.; entered the Dutch Reformed ministry; was minister of the Collegiate church, New York, 1827–74. He was a man of profound learning, and an able preacher in the English and Dutch languages. Among the important positions held by him were the presidency of the board of publication of his own denomination; the presidency of the New York Historical Society, of the New York City Mission and Tract Society, etc. He was connected with many educational and charitable enterprises, and was widely known. D. in New York May 18, 1874.

**Dexip'pus** [Δέξιππος], a Greek philosopher, pupil of Iamblichus, lived about A. D. 355. He wrote commentaries on Plato and Aristotle, and sought to defend the latter against the attacks of Plotinus. There is extant a treatise of his on the *Categories* of Aristotle, but only in a Latin translation, which was printed at Paris (8vo, 1549).

HENRY DRISLER.

**Dexippus** (PUBLIUS HERENNIUS), (Δέξιππος Πόπλιος Ἑρέννιος), son of Ptolemæus, an Athenian of the deme Hermus, a celebrated rhetorician, historian, and soldier; lived in the third century after Christ. He was a man of great learning, and attained the highest honors in his native state. He also was appointed commander of the army against the Goths (Scythians), who had invaded Attica, and defeated them. Though Athens was captured by the Goths, yet they were driven out of Attica by Dexippus, and their fleet was destroyed at the Piræus. A public statue was erected to his honor, the base of which, with its inscription, still exists. Photius gives the titles of three historical works by Dexippus: (1) Τὰ μετὰ Ἀλέξανδρον, the history of Macedonia after Alexander, in 4 books; (2) a chronological history (Χρονικὴ Ἱστορία) from the beginnings of history to 268 A. D., which was continued by Eunapius; (3) Σκυθικά, history of the war with the Scythians (Goths), in which he himself had taken part. The style of Dexippus, though not at all superior to that of the rhetoricians of the day, is highly praised by Photius, who even compares him to Thucydides. The fragments of Dexippus have been published under the editorial care of Niebuhr in the 1st vol. of the *Byzantine Historians* (Bonn, 1829), and most recently by Müller, *Fragm. Hist. Græc.* (vol. iii. pp. 666–687).

HENRY DRISLER.

**Dick'son** (Sir COLLINGWOOD), b. 1817; entered the royal artillery as second lieutenant in 1835; became captain in 1846 and colonel in 1866; served during the Eastern campaign of 1854–55 on the staff of Lord Raglan, and was

present at the actions of Bulganac and McKenzie's Farm, battles of Alma and Inkerman, capture of Balaklava, expedition to Kertch, siege of Sebastopol; wounded Feb. 4, 1855; commanded the right siege-train, and was present at the bombardment, gaining the Victoria Cross for gallantry Oct. 17; was brevetted lieutenant-colonel and colonel; received medal with four clasps from his own government, also the Turkish medal, and was appointed aide-de-camp to the queen, officer of the Legion of Honor, and created a C. B. He is also a knight of the order of Charles III. and of Isabella the Catholic. In 1870 he was appointed inspector-general of artillery, and in 1871 nominated a K. C. B. In 1875 he was made a colonel-commandant of the 9th brigade of royal artillery.

**Dinoceras.** See TINOCERAS, in CYCLOPÆDIA.

**Dog'gett** (KATE NEWELL), b. in Charlotte, Vt.; educated at Castleton, Vt., and at the Albany (N. Y.) Female Academy; was married to William E. Doggett of Chicago, Ill., in 1858; invited to take charge of the herbarium belonging to the Academy of Science in that city, and was elected member of the academy in 1869; Nov. 9, 1869, she attended the Frauen Conferenz at Berlin as delegate of the National Woman Suffrage Association, and has since delivered several series of lectures on art; established French and German clubs and a literary society of ladies called the Fortnightly, of which she is the president; and translated *The Grammar of Painting*.

**Dole** (Rev. GEORGE THURLOW), b. Oct. 30, 1808, in (Byfield) Newbury, Essex co., Mass. Having spent eight years in the Lowell Machine-Shop and become master of the arts, he left in 1833, and graduated at Yale College in 1838; spent the three succeeding years in the theological seminaries of New Haven and Andover, Mass.; ordained pastor of the Washington street Congregational church in Beverly, Mass., Oct., 1842; dismissed in 1851; pastor in North Woburn, Mass., from Oct., 1852, to Oct., 1855; pastor in Lanesboro', Mass., 1856 to 1863; principal of Williams Academy, Stockbridge, 1863–64; pastor in Stockbridge 1864–72.

**Dore'mus** (SARAH PLATT), b. in New York Aug. 3, 1802; married Sept. 11, 1821, to Thomas C. Doremus; in 1828, with eight other ladies, organized the Greek Relief Society; in 1836 aided Madame Feller in her Grande Ligue mission to the French peasantry of Canada; in 1840 began to visit the female prisoners in the city prison, and with Miss Catherine Sedgwick established in 1842 the Home for Women from Prison, now called the Isaac T. Hopper Home; was one of the founders of the House and School of Industry, and a manager of the City Bible Society and of the City Mission and Tract Society from their beginning; in 1869 labored efficiently for the relief of the famine-stricken people of Ireland; in 1854 became vice-president of the Nursery and Child's Hospital; in 1855 aided the writer in organizing the Woman's Hospital Association, and was first directress from 1864 till her death; in 1863 assisted in organizing the Presbyterian Home for Aged Women. For fifty years she labored in behalf of foreign missions with untiring zeal. Her labors in behalf of the sick and wounded soldiers from North and South during the civil war were not excelled by those of any other woman in the land. Measured by the practical results of her labors, Mrs. Doremus was the most remarkable woman of her time. D. Feb. 5, 1877.—Her son, Prof. R. Ogden Doremus, three daughters, and her husband, survive her. J. MARION SIMS.

**Dors'heimer** (WILLIAM), b. at Lyons, Wayne co., N. Y., Feb. 5, 1832; was educated at Harvard University; studied law, and was admitted to the bar in 1854; practised law in the city of Buffalo, and formed a partnership in 1859 with the late Salomon G. Haven; served in 1861 as aide-de-camp to Gen. Fremont in Missouri; was appointed U. S. district attorney for the northern district of the State of New York in 1867, and became lieutenant-governor of New York in 1877.

**Doyle** (Sir C. HASTINGS), entered the British army as ensign in 1819; became captain 1825, colonel 1854; has served in the East and West Indies; was on the staff as assistant adjutant-general and assistant quartermaster-general 1847–56, serving as A. A. G. 3d division of the army of the Crimea; was inspector-general of the militia of Ireland 1856–61; appointed to command of troops in Nova Scotia in 1861, and in 1867 made lieutenant-governor of that province upon the confederation of the British provinces in North America, and placed in command of Her Majesty's forces in North America. For his services in these capacities he was rewarded by the appointment of knight-commander of the order of St. Michael and St. George. In 1874 he was assigned to the command of the southern district, head-quarters at Portsmouth, England. In 1860 he became a major-general, and lieutenant-general in 1870. He is also colonel of the 87th regiment (Royal Irish Fusileers).

**Dra'per** (HENRY), b. in Prince Edward co., Va., son of John William Draper, Mar. 7, 1837; graduated at the medical department of the University of the City of New York in 1858; became professor of physiology there in 1860, and also professor of physiology and analytical chemistry in the scientific department, and published *On the Construction of a Silvered-Glass Telescope* and *Textbook of Chemistry* (1864). He has devoted much attention to photographic and spectroscopic examination of the moon and other heavenly bodies, and has, at Hastings on the Hudson, the largest telescope in the U. S. (28 inches aperture).

**Draper** (JOHN CHRISTOPHER), b. in Prince Edward co., Va., Mar. 31, 1835, a son of John William Draper; graduated in 1857 in the medical department of the University of the City of New York; was professor of physiology there 1858–60; subsequently professor of chemistry in the Cooper Union, professor of chemistry in the University Medical College, and of physiology and natural history in the College of the City of New York; published *On Respiration* and *Textbook on Anatomy, Physiology, and Hygiene*.

**Drown** (THOMAS MESSINGER), M. D., b. in Philadelphia Mar. 19, 1842; graduated in 1859 at the Philadelphia High School; studied at the University of Pennsylvania, whence he graduated M. D. in 1862; at the Sheffield Scientific School, New Haven, 1862–63; at the Lawrence Scientific School 1863–65; at Freiberg and Heidelberg 1865–68; and was appointed professor of analytical chemistry in Lafayette College, Easton, Pa.

**Ducis'** (JEAN FRANÇOIS), b. at Versailles Aug. 22, 1733; devoted himself entirely to poetry; declined the seat in the senate which Napoleon offered, and lived in deep retirement in his native city, where he d. Mar. 31, 1816. Of his original works, the tragedy *Abufar* (1795) became very celebrated, but he is now best known from his having translated and arranged for the French stage *Hamlet* (1769), *Romeo and Juliet* (1772), *Lear* (1783), *Macbeth* (1784), *King John* (1791), and *Othello* (1792).

**Dud'ley** (THOMAS U.), b. in Richmond, Va., in 1837; graduated at the University of Virginia; served in the Southern army during the civil war; studied theology after the close of the war, and was ordained deacon in the Protestant Episcopal Church in 1867. He became rector of Christ church in Baltimore in 1869, and in 1874 he was chosen assistant bishop of Kentucky. J. B. BISHOP.

**Du'niway** (ABIGAIL SCOTT), b. Oct. 22, 1834, at Pleasant Grove, Ill.; removed to Oregon in 1852 with her parents; was married in 1853; lived on a farm nine years; taught school and music six years; was milliner and dressmaker five years; established the *New North-west* at Portland, Or., in 1871, a paper devoted to woman's enfranchisement, of which she is the editor and her boys the type-setters, and published an epic entitled *David and Anna Matson*.

**Du Pont** (HENRY), b. in Delaware; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of artillery in 1833, from which he resigned in 1834, and became proprietor of the celebrated powder-mills bearing his name near Wilmington, Del. For many years he was adjutant-general of the State of Delaware, and during the civil war served as major-general of militia in command of the home guards.

**Du Pont** (HENRY A.), son of Henry Du Pont, b. in Delaware; graduated at the U. S. Military Academy, and entered the army as second lieutenant of engineers May, 1861; during the same month was transferred to the 5th Artillery as first lieutenant; promoted to be captain in 1864; served in camp and garrison 1861–63; in command of battery in West Virginia 1863–64; chief of artillery Army of West Virginia 1864–65, being engaged at Opequan, Fisher's Hill, and Cedar Creek, besides numerous skirmishes and engagements; chief of artillery department of West Virginia, Jan.–July, 1865; since the close of the war he has served as instructor in the Artillery School at Fort Monroe and on special duty at West Point.

**Dur'yea** (JOSEPH TUTHILL), D. D., b. at Jamaica, Long Island, N. Y., Dec. 9, 1832; graduated with the highest honors in 1856 at the College of New Jersey, where he afterward taught Greek and rhetoric 1857–59; graduated at the Princeton Theological Seminary 1859; was pastor of the Second Presbyterian church, Troy, N. Y., 1859–62; associate pastor of the Collegiate Reformed church, N. Y., 1862–68; and since 1868 has been pastor of the Classon Avenue Presbyterian church, Brooklyn, N. Y. He is an able and impressive extemporaneous speaker.

**Dus'ton** (HANNAH), wife of Thomas Duston of Haverhill, Mass.; was married Dec. 3, 1677, and became the

mother of thirteen children. She was taken prisoner by the Indians in the attack on Haverhill, Mar. 15, 1698, her nurse and infant one week old being also taken, but the child was soon after killed. She was placed in an Indian family of twelve persons on an island (Duston's Island) in the Merrimack River, near the mouth of the Contoocook, in New Hampshire, and with the aid of the nurse and a white captive boy she killed all the Indians in their sleep except a squaw and a boy who escaped. She returned to Haverhill with their scalps.

# E.

**Eads** (James B.), b. at Lawrenceburg, Ind., May 28, 1820; removed with his parents in 1829 to Louisville, Ky., and in 1833, after the death of his father, to St. Louis. From 1839 to 1842 he served as clerk on a river steamboat on the Mississippi, and in the latter year entered a firm engaged in recovering sunken property, a business which under his management assumed such dimensions and was carried on with such success that in 1857 he was able to retire with a fortune. At the outbreak of the civil war in 1861 he submitted to the government a plan for the defence of the Western waters, and contracted for the construction of seven iron-clad gunboats for service on the Mississippi; and in the following year he constructed for the same purpose six iron hull propellers carrying two turrets each. Many new features of his own invention were introduced in the construction of these gunboats. He has since acquired great reputation as a civil engineer, as projector and constructing engineer of the Illinois and St. Louis Bridge. (See Bridge and Foundation, in Cyclopædia.) He is now still more prominent in connection with the work of opening the mouths of the Mississippi to the heaviest draught ships. Instead of a ship-canal (see Ship-Canals), he proposed the deepening of the South-west Pass by jetties —a method which had proved so successful at the Sulina mouth of the Danube (see Harbor, in Cyclopædia), and discussed by the writer (*Ex. Doc.*, $113\frac{43}{1}$ H. R.). A board of engineers, civil and military, to which the question was referred, adopted the South Pass (see Jetty, in Cyclopædia) instead of the South-west. The work under his own designs is now in successful execution, he having obtained the requisite 20 feet depth (over a bar on which was but 8 feet) which entitles him to the first payment of $500,000.

J. G. Barnard.

**Ec'cleston** (James Houston), b. in Baltimore, Md., in 1838; graduated at Princeton College in 1856; studied law for three years, when he was admitted to the bar. After practising law for two years, he began the study of theology at the Philadelphia Divinity School, where he was graduated in 1864. He was rector of St. Matthew's parish in Philadelphia for a time after graduation, and subsequently became rector of the Church of the Saviour in the same city. In the spring of 1875 he was elected bishop of the diocese of Iowa. J. B. Bishop.

**Echeneid'idæ** [from *Echeneis*—Gr. ἐχενηΐς, ἴδος, "stopping" or "retarding vessels"—the typical genus], a family of fishes of the order Teleocephali and sub-order Acanthopteri, particularized by the development of a broad oval sucking-disk on the top of the head. The body is more or less elongated, and the scales very small and imbedded in the skin; the lateral line is continuous; the head oblong and very depressed; the eyes lateral, and just under the disk; the opercular bones are normally developed and unarmed; the mouth is moderate, slightly oblique, and cleft laterally, and the lower jaw projects considerably beyond the upper; the upper jaw is scarcely protractile; teeth are developed in bands on the jaws, vomer, and palatine bones; the branchial apertures are large and continuous below; the branchiostegal rays generally nine in number; the dorsal fin exhibits, in part, a perfectly anomalous structure—viz. the anterior portion, instead of being a fin, is developed into the broad oval disk characteristic of the group; of this the skeletal portion is constituted by the spines, whose dichotomous elements divaricate, and are depressed sideward in opposite directions and otherwise modified; the cutaneous portion is a leathery development of the membrane which completely invests the skeleton, and gives rise at the spines, or cross-pieces, to numerous denticles; the structure is surrounded by a smooth, broad leathery margin; by means of this disk the fishes are enabled to adhere to various objects; the posterior portion of the dorsal is normally developed as a true rayed fin; the anal fin corresponds in form and structure with the soft dorsal; the caudal fin is distinctly developed; the pectorals are broad, and low on the scapular arch; the ventral fins are thoracic, and formed each of a spine and several rays; the skeleton is composed of vertebræ in increased number (*e. g.* D. 12–14 + C. 15–16); the pyloric appendages are in moderate number. The fishes comprised in this family are among the most singular of the class, and are familiar to all seafaring people. By sailors and shoremen they are generally designated as suckers; but this name is given to so many different animals that, unfortunately, it is not at all characteristic, although so applicable in other respects to the species. Their peculiar aspect and the depression of their head induce persons unfamiliar with ichthyology to believe that the back is the abdominal surface, and, *vice versâ*, that the belly is the true back. They are sluggish in their movements, and depend for transportation rather upon others than their own exertions. They are to a large extent commensals, or parasitic upon other fishes, and, to a considerable degree, they seem to restrict their attentions to special animals. Thus, of the common species, one (*Echeneis remora*) chiefly attaches itself to large sharks (*e. g. Eulamia, Galeocerdo*, etc.), and another (*Leptecheneis naucrates*) is partial to the sea-turtles. These are the most common; the former is a short, stout species, with about seventeen or eighteen transverse laminæ in the disk; and the latter are elongated, slender species, with about twenty to twenty-six transverse laminæ. Both of the species particularized are cosmopolitan; the others are more limited and much rarer. The more notable are *Remoropsis brachyptera*, which is a parasite of sword-fishes, and *Phtheirichthys lineatus*, which is parasitic upon the barracuda (a large *Sphyræna*). (See also Sucker, in Cyclopædia, and Remora.) Theodore Gill.

**Eck'ermann** (Johann Peter), b. at Winsen, on the Luhe, Hanover, in 1792; served in the army during the campaigns of 1813–14; subsequently studied law at Göttingen; became private secretary to Goethe in 1823. D. at Weimar Dec. 3, 1854. His *Gespräche mit Göthe* (3 vols., 1836–48) were translated into English by Margaret Fuller (Boston, 1839) and by John Oxenford (London, 1850).

**Eclectic Medical College, The,** of the city of New York, was founded by Robert S. Newton, M. D., Horace Greeley, Henri L. Stuart, William Moller, and Samuel Sinclair. A special charter, with dispensary and hospital privileges, was obtained Apr. 22, 1865, and was immediately organized. Robert S. Newton, M. D., was elected president of the faculty, a position he has held to the present time (1877). The first session of the college was held in 1865–66. The distinguishing doctrines of this school in pathology are that inflammation and fever are not disease *per se*, but an effort of the system to expel disease, hence depletion or a reduction of the vital energy is never admissible—to maintain the vital force of the system by the use of such therapeutical agents as act in harmony with the laws of the same, and do not deplete, but build up. Blood-letting is never practised, nor the use of remedies which may be retained in the system as cumulative poisons, such as mercury, antimony, etc. It has its distinctive materia medica, in which vegetable agents largely preponderate, with its own textbooks. It teaches that the brain and the nervous system as a whole are involved in all forms of disease, and only such remedies as produce a positive effect upon the brain and nervous system are employed. Cancer in its incipient stages is in all cases recognized as a local disease and curable by local means. Alexander Wilder, M. D., is now president of the board of trustees. W. P. Strickland.

**Eclectic School of Medicine.** See American Eclectic School of Medicine.

**Eg'leston** (Thomas), A. M., E. M., Ph. D., LL.D., b. in the city of New York Dec. 9, 1832; graduated in 1854 from Yale College; went in 1855 to Europe; was assistant in the laboratory of geology at the Garden of Plants, and in the palæontological laboratory at the School of Mines in Paris; graduated at the latter institution in 1860; was appointed mineralogist at the Smithsonian Institution in 1861; formed in 1863 the plan for the School of Mines in Washington, and was appointed professor of mineralogy and metallurgy at the School of Mines in New York in 1864; has published a number of papers on mineralogy and metallurgy.

**Elasmobran'chiates** [from ἔλασμα, a "thin plate," and βράγχια, "gills"], or **Sela'chians** [from σέλαχος, pl. σελάχη, "cartilaginous fishes"], the class of vertebrates

containing the sharks, rays, and chimæras; the fifth, in a descending series, of recently-proposed classifications of vertebrates, and intermediate between the true fishes and the Marsipobranchiates. They may be briefly defined as lyriferous vertebrates, destitute of membrane or dermal bones, and with the branchial chambers separate from each other. The following are the principal modifications which they offer in contrast with the other classes of the vertebrate branch:

*Tegumentary System.*—The body is generally provided with small scales and spines, but not infrequently naked; when fully developed the armature assumes the characteristic structure known under the name of placoid plates. In the sharks the plates are always very small, mostly imbricated upon each other, and very closely appressed or adherent to the skin: they are so small, even in large species, as to be perceptible through the roughness to the touch, rather than as the well-developed scales of the true fishes; the small size and tenacity enable the skin covered with them to be used as a file, and skin thus armed is known under the general term of "shagreen." In the rays the armature is much more variable: in some forms (Rhinobatidæ, etc.) it approximates to the condition exemplified by the sharks; in others it is developed chiefly in the form of spines, which generally have more or less circular and radiated bases; in still others it is entirely wanting, and the skin is completely naked.

*Osseous System.*—The skeleton is cartilaginous, but well defined, and is subject to a considerable number of modifications. These are best exemplified in the two primary groups or super-orders of the class known as the Plagiostomes (including the sharks and rays) and the Holocephals (limited to the chimæras). Both of these types are alike deficient in membrane bones; in other words, (1) the plates which cover the roof of the head (and some others) in the sturgeons and ganoids, and which, by ingrowth, develop into the dorsal bones of the skull in the true fishes, as well as (2) the external bones of the scapular arch developed in the true fishes, are in this class entirely wanting, and have no analogues; in other respects, however, the differences between the respective members are very considerable. In the Plagiostomes, a distinct quadrate element intervenes between the lower jaw and the cranium, and is articulated with both. In the Holocephals the quadrate element is fused with the rest of the skull, and in an undistinguishable mass, and an articulation only exists between the jaw and the fused mass. In the Plagiostomes no opercular elements are developed, but in the Holocephals a rudimental one exists on each side. In both groups the scapular arch is represented by a single cartilage on each side, with which are articulated the elements of the fore limbs; these are, primarily, (1) a basal segment, answering to the humerus; (2–3) articulating with these, and generally also, but sometimes not, with the scapula, two other elements, (2) a metopterygium homologous with the ulna, and (3) a propterygium, homologous with the radius; (4) with these, and generally interposed between them, are articulated a number of parallel radiating and elongated segments; (5) with the extremities of these, finally, are connected the proximal of several rows of shorter and not entirely coincident segments; upon these are inserted the numerous rays of the pectoral fins, which are enclosed in the leathery skin. The hinder limbs have essentially a similar form; the pelvic cartilages are distinct, and with them are articulated cartilages analogous to those of the fore limbs, and like them capped by a fin composed of numerous cartilaginous rays and intervening membrane, covered by skin and constituting the ventral fins.

*Nervous System.*—The brain is quite highly developed. Using the generally-accepted terminology—which, however, will doubtless have to be modified when our knowledge is perfected—it may be described as follows: the cerebral hemispheres are of moderate size; the foramen of Munro is quite large; the optic nerves are connected by a chiasma; the prothalami and thalami are distinct; the olfactory lobes pedunculated: in other respects there is considerable difference between the brains of the primary groups—*i. e.* in the Plagiostomes and Holocephals.

*Dentary System.*—The teeth are developed in the mucous membrane which covers the upper jaw, or rather palato-quadrate cartilage, and the lower jaw, or dentary bone, and are never fixed in sockets: in other respects they are quite diversiform. In the Plagiostomes they rise from papillæ at the bottom of folds within the mucous membrane of the jaws, and are developed in rows which are successively pushed forward and renewed from the tooth-forming groove. In the typical sharks the successional development of the teeth is very obvious, and the teeth of the foremost row are the only ones which are erect and form an incisorial edge: it is only when these are cast that the teeth of the succeeding row are erected and assume their place functionally. In other sharks the teeth are molar-like, and present a common surface for the attrition of food ingested. In the rays the teeth are in some forms pointed, in others molar, and in a few absent, from the under jaw at least. In the Holocephals the teeth are developed upon the palato-quadrate and dentary cartilages in the form of laminæ, and are not renewed.

*Circulatory System.*—The blood is red, and the corpuscles nucleated and of moderate size, generally intermediate between those of amphibians and the typical fishes. The heart is divided into an auricle for the reception of the blood, and a ventricle for its transmission; anteriorly there is an aortic bulbus anteriosus, which contains striped muscular fibres, and which is contractile rhythmically and pulsates like the auricle and ventricle: its interior is provided with several rows of semilunar valves, which assist, in connection with the muscular walls, in the propulsion of the blood.

*Respiratory System.*—Respiration is effected, as in the typical fishes, by branchiæ, which are developed from the hyoidean apparatus. This apparatus has generally five, sometimes six, and sometimes seven, arches; coincident with these are branches of the aortic arch transmitting the blood; this is carried to tufts arising from the branchial arches and thus brought in connection with the oxygen-bearing water, and aërated, after which it is again transmitted, rejuvenated, through the body. The branchiæ are attached, and their interspaces form separate chambers; these chambers, in the Plagiostomes, discharge by as many external apertures as there are chambers, but in the Holocephals they secondarily discharge through a single external aperture on each side. The arches corresponding to the branchiostegal and pharyngeal of typical fishes are, in the Elasmobranchiates, much less specialized, and their primitive common origin and mode of development readily appreciable.

*Alimentary System.*—The alimentary canal is generally short, rarely long; its anterior portion is dilated into a tract forming the so-called *bursa enteana;* this is separated from the stomach by the "pyloric valve;" into the bursa empty the hepatic and pancreatic ducts. In the small intestine the mucous membrane gives origin to folds which are spirally arranged or straight, and parallel with the axis of the intestine, and form the spiral or intestinal valves. The rectum is short, and terminates in a cloaca, into which are also discharged the products of the urinary and reproductive organs by special ducts. The peritoneal cavity behind opens externally by two abdominal pores.

*Reproductive System.*—The ovaries are generally two in number, but sometimes single and median; their oviducts are Fallopian tubes; they are free at the proximal ends, and at the distal ends dilated into uterine chambers, which discharge into a cloaca; the testes are furnished generally with an epidydimis and vas deferens, and discharge into a dilated part of the ureter. In connection with the sexual organs are developed, in the male, peculiar appendages connected with the posterior margins of the ventrals, which are known under the name "claspers," but which are true intromittent organs. The eggs are quite large, and correspondingly few in number: in some they are hatched within the body of the mother, and in others are issued forth to be developed externally; in the oviparous types they are provided with quadrate leathery or parchment-like cases.

Such are a few of the most notable characters of the class. This class is divisible primarily into two very distinct groups, already referred to—*i. e.* (1) the Plagiostomi and (2) the Holocephali, which must be considered as subclasses or super-orders. (1) The Plagiostomes are again divisible into two principal groups of ordinal value: (*a*) the Squali, including the sharks, which has the branchial apertures lateral, and (*b*) the Raiæ, embracing the rays, in which the branchial apertures are ventral. (2) The Holocephali are monotypic, and represented by but one order of the same name. In the present epoch there are very few species, and they all belong to one natural family (Chimæridæ), but in past ages they were quite diversiform.

*Geographical Distribution.*—The class, which appears to have been a predominant one, and of which the members outnumbered those of the true fishes, is now on the wane, and not much more than 300 species exist at the present day. These 300 are quite generally distributed, and have the following systematic relations: Of the Squali nearly 150 species are known; of the Raiæ about 165 have been described; and of the Holocephali but 4 or 5 species are inhabitants of the waters of the present epoch. The class, as a whole, is developed in the greatest perfection in the tropical and warm oceans, but representatives extend toward both poles, and some are found in the high polar regions. Many of the Squali are animals of great activity, and endowed with the power and will for extensive wandering, and are met with in mid-ocean: the species, therefore, sometimes have a great range and approach widely distant coasts. Among the most cosmopolitan are the typical sharks

of the family Galeorhinids or Carchariids; these are, in some respects, the highest and most wide-ranging of the class, and to the family belong several of the most common species of the eastern American coasts. Equally wide-ranging, and perhaps still more admirably adapted for a wandering life, and even more formidable in their armature, are the Lamniids, which include the mackerel sharks and the formidable man-eater (*Carcharodon Rondeletii*, etc.). The families at present of more limited distribution are the Scylliids, which are chiefly represented along the shores of the Old World and Australia; the Pristiphorids, which are peculiar to the oceans of China, Japan, and the neighboring seas; and the Heterodontids, which are at present confined to the Pacific. The representatives of the order Raiæ are distributed in an analogous manner. The most widely diffused of the types is the family of Raiids; all the others are more limited in their range, at least toward the northward and southward, and are, on the whole, less richly represented by species as well as individuals in the regions where they occur at all. The Chimærids of the present epoch are rather cold-water types, and of the generic or super-generic types one (*Chimæra*) is represented by species in the northern seas, and another (*Callorhynchus*) by species in southern waters. The oceans and salt water are the stations for which all the members of the class are most fitted; but although, on the whole, they are essentially marine types, nevertheless some are found at times, and a few permanently, in fresh waters: thus, a species of shark of the genus *Eulamia* is a permanent inhabitant of Lake Nicaragua, and another species of the same or an allied genus occurs in a fresh-water lake of Manila, in the Philippine Islands: in the same bodies of fresh-water likewise occur species of *Pristis*, or sawfish. Certain species of rays also ascend high up or are permanent residents of certain rivers of South America—*e. g.* the Amazon and Orinoco.

*Geological Range.*—The Elasmobranchiates, as already intimated, were in the early epochs of our earth's history the principal types of swimming vertebrates, and were then manifested under many forms and by numerous individuals. Their remains have been preserved for us in the rocks deposited from the Devonian age to the present one. The earliest known of these forms were true representatives, apparently, of the order Squali; but the oldest known belong in all cases to different types—that is, different families as well as different genera from any of the existing forms. These early animals mostly had molariform teeth, and have been supposed to be related to the living Heterodontids or Cestracionts, and in some cases this approximation has probably been correct, but by no means in all. Doubtless, however, the Heterodontids of the present day are in some respects the most generalized representatives of the class, and exemplify best the structure of the older types of the order. The rays are not known from rocks earlier than the Carboniferous, and thence and for some time after existed in numbers or under circumstances which have not proved favorable for the preservation of their remains. The Holocephals, or Chimæroids (if *Rhynchodus* is truly of that type), are now known from rocks of the Devonian age, and have existed from that epoch to the present time, but for the later periods in decreasing numbers. Such are the facts so far as known; but in view of the high development of the class we must, of course, be prepared to admit that the several types came into existence at a much earlier epoch than we have palæontological evidence of.

*Modifications.*—The principal modifications of the class, as expressed in the sub-classes or super-orders Plagiostomes and Holocephals, have been already adverted to. The representatives of the orders Squali and Raiæ severally differ, *inter se*, chiefly in dentition, the position of the branchial apertures, the development of the fins, and details of skeletal modifications, etc. There are two notable cases of modifications, in corresponding directions, of very different types, exemplified in the "sawfishes," for some of these (the true sawfishes or Pristids) belong to the order Raiæ and some (the Pristiophorids) to the order Squali; both are characterized by the development of the rostrum into an elongated, flat, dagger-like process armed with teeth on each of the said processes. This is such a remarkable development that it may yet prove that the types are more closely related than is now supposed. The most generalized of the sharks are perhaps the species of the family of Heterodontids, and thence divergence takes place in several directions. Two of the highest culminations of the series are expressed in the Galeorhinids on the one hand and Scylliids on the other. The rays have probably originated from the sharks, and their most generalized forms are seen in the Rhinobatids, while their most specialized are exhibited in the Myliobatids and Cephalopterids. (See also Fossil Fishes, Holocephali, Plagiostomi, Raiæ, Squali, etc., in Cyclopædia.)

Theodore Gill.

**Electoral Commission.** See Presidential Electoral Commission.

**Eli'jah,** a Hebrew prophet, appeared before King Ahab and announced a terrible drought as a punishment for the introduction of the idolatry of Baal, and fled then to Cherith, and subsequently to Zarephath, to avoid the wrath of the king. Three years afterward, when the drought had devastated the whole country, and the king had gathered all the priests of Baal at Mount Carmel to make a huge sacrifice, Elijah again appeared before Ahab; and this time the idolatrous priests were massacred, and the people returned to the true worship; but the prophet was compelled to flee and seek refuge in a cavern in the wilderness of Mount Horeb, in order to escape the revenge of Jezebel. Once more, however, he returned to public life, appointed Elisha his pupil and successor, and announced to Ahaziah, the son and successor of Ahab, who lay sick in Samaria, that his illness should end with death; visited the school of prophets at Bethel, and retired then with Elisha to the other side of the Jordan, whose waters he divided by smiting them with his mantle; and while stopping there he was taken up into heaven in a chariot of fire. His history is told in the Old Testament in the last chapters of the first book and the first chapters of the second book of Kings. In the New Testament he is called Elias, and is mentioned as appearing, together with Moses, in the transfiguration on the mount. He has been canonized in both the Latin and the Greek Church; his day is July 20.

**Eli'sha,** a Hebrew prophet, was called to the prophetic office by Elijah, and received his mantle when he was taken up into heaven; was recognized by the other prophets as their spiritual head, and enjoyed great respect throughout his whole life from the people of Israel. His history is told in the second book of Kings, and his death is commonly fixed at 840 B. C. He has been canonized in the Greek Church, and his day is June 14.

**El'liot** (George Thomson), b. in the city of New York May 11, 1827; was educated at Columbia College; studied medicine at the University of New York, in Dublin, and Edinburgh; was appointed resident physician to the New York Lying-in Asylum in 1852, and attending physician to Bellevue Hospital in 1854; lectured on operative midwifery in the College of Physicians and Surgeons 1858–59, and became professor of obstetrics and diseases of women and children in Bellevue Hospital medical college in 1861. D. Jan. 29, 1871. Besides contributions to various medical journals, he published *Obstetric Clinic* (1868).

**El'liott** (Robert Woodward Barnwell), S. T. D., b. at Beaufort, S. C., Aug. 16, 1840; was educated at South Carolina College, whence he graduated in 1861; was aide-de-camp 1861–62 to Brig.-Gen. Lawton of the Confederate States army, and wounded in the second battle of Manassas, and adjutant-general of McLaw's division 1864–65; was ordained a deacon in 1868, priest in 1871, and bishop of Western Texas in 1874, and has published a number of essays and sermons.

**Elliott** (Samuel Mackenzie), b. at Inverness, Scotland, Apr. 9, 1811; studied at the Royal College of Surgeons in Glasgow, where he graduated in 1828, and in London, where he made the treatment of diseases of the eye his specialty; came in 1833 to America; visited Cincinnati and Philadelphia, and settled finally in New York, where he acquired a great reputation as an oculist. At the outbreak of the civil war he was lieutenant-colonel of the Highland Guard, and was wounded in the first battle of Bull Run. He was subsequently commissioned to raise the Highland brigade, which commission he fulfilled with great personal sacrifices, and was made a brigadier-general. D. at Elliottville, Staten Island, May 1, 1873.

**Elliott** (Washington L.), b. in Pennsylvania; was appointed second lieutenant in 1846, first lieutenant in 1847, captain in 1854, major of 1st Cavalry in 1862; chief of the cavalry of the Army of the Potomac; wounded in the second battle of Bull Run; chief of the cavalry of the Army of the Cumberland; commander of the 4th corps Dec., 1864–Apr., 1865; engaged in battles around Nashville, Tenn., for which he was brevetted brigadier-general U. S. A., and brevetted major-general for gallant services in the war. Author of *Manual for Cavalry.*

**El'lis** (Alexander John), F. R. S., F. S. A., b. at Hoxton, a suburb of London, June 14, 1814; graduated at Trinity College, Cambridge, in 1837; studied law at the Middle Temple for some time, but devoted himself finally to the study of phonetics, and published *Alphabet of Nature* (1845), *Essentials of Phonetics* (1848), *Plea for Phonetic Spelling* (1848), *Universal Writing and Printing* (1856), *Early English Pronunciation* (parts i.–iv., 1869–75), *Glossic* (1870), *Practical Hints on the Quantitative Pronunciation of Latin* (1874), besides papers on various subjects.

**E'ly** (Smith, Jr.), b. in New Jersey in 1825; studied law, and was admitted to the bar in 1846; did not practise, but entered a wholesale leather business in New York; was elected a school trustee in 1856; member of the State senate in 1857; county supervisor from 1866 to 1870; Representative from New York to the 42d and 44th Congresses; commissioner of public instruction in 1872; chairman of the committee on expenditures in the treasury department in 1875; mayor of New York 1877.

**Embiotic'idæ** [from *Embiotica*—ἔμβιος, "living," and τόκος, "bringing forth"—the typical genus], a remarkable family of fishes limited to the northern Pacific Ocean, and especially represented on the shores of the Pacific States, and distinguished by their viviparity. It belongs to the order Teleocephali and sub-order Acanthopteri. The body is compressed and oblong; the scales are cycloid and of moderate size, and cover the entire trunk as well as head; on the back they form a sheath of from one to three rows wide at the base of the dorsal fin; this sheath diminishes backward to the end of the fin, and is separated from the back by a well-defined groove; the lateral line is continuous, and parallel with the back; the head is compressed and moderate; the nostrils double; the eyes lateral; the mouth has a moderate or slight lateral cleft; the lips simple, and more or less developed; teeth are present on the jaws, but absent from the palate; the branchial apertures are ample, and continuous below; branchiostegal rays five or six on each side; the dorsal fin is oblong, and modified in two ways, severally characteristic of distinct sub-families; the anal fin is oblong, and armed in front with three slender spines; the anterior portion of the anal fin is developed in a peculiar way as a conduit for the milt and eggs; the pectoral fins are produced and more or less angulated, and the rays branched; the ventrals are inserted behind the bases of the pectorals, and each has a spine and five branched rays; the vertebral column has an increased number of vertebræ; the lower pharyngeal bones are confluent together; the stomach is simple, and pyloric cæca are absent. The family exhibits two distinct modifications of structure; in one (Embioticinæ) the dorsal has its spinous portion rather less developed than the soft, and only composed of from nine to eleven spines. In the other (Hysterocarpinæ) the dorsal has the spinous portion much longer than the soft, and sustained by about fifteen or more spines. (1) The Embioticinæ are by far the most numerous in forms, and the species are marine. By American naturalists fourteen genera are admitted—viz. *Ditrema*, *Hypsurus*, *Phanerodon*, *Embiotica*, *Tæniotica*, *Damalichthys*, *Rhacochilus*, *Amphistichus*, *Holconotus*, *Cymatogaster*, *Hypocritichthys*, *Hyperprosopon*, *Brachyistius*, and *Abeona*. (2) The Hysterocarpinæ are, as far as known, represented by but one species (*Hysterocarpus Traskii*), which is peculiar to the fresh waters of the Sacramento River. All the species are viviparous, and the young are developed in small number in special uterine sacs. Some of the species are among the most common of the Californian fishes, and are brought to the markets in large numbers: they are known to the inhabitants of the coast indicated under the name of "perch," although they have no relation whatever with the perches properly so called of Europe and the Eastern U. S. On the whole they are mostly nearly related to the Labridæ and Gerridæ, but their differential characters are very positive. Theodore Gill.

**Enomoto,** or **Inomoto,** b. in the province of Shidzuoka, Japan, but known as a Yedo-man; went to Holland when quite young as a naval student under the tycoon's government; was appointed an admiral under the old government; toward the close of the rebellion in 1868 he took a fleet of seven ships to Yeso for the purpose of making a last stand against the imperial government; was forced to capitulate at Hakodadi; was imprisoned for three years; on his release in 1872 was appointed to a position of the fourth rank in the *Kai-ta-kushi*, or colonization department of Yeso; and in 1874 was appointed vice-admiral of the imperial navy, and also envoy extraordinary and minister plenipotentiary to Russia.

**Eohip'pus** [Gr. ἠώς, "dawn," and ἵππος, "horse"], an extinct genus of the horse family, occurring in the Lower Eocene deposits of the West, and allied to *Orohippus* (see Horse, Fossil, in Cyclopædia), but of a less specialized form, and apparently in the direct ancestral line. The feet had four toes in front and three behind, with a rudiment of the outer or fifth metatarsal, and may have had a rudiment of the first toe in the fore foot. This genus is represented by species from the lowest Eocene beds of New Mexico and Wyoming. O. C. Marsh.

**Ernst** (Oswald H.), b. June 27, 1842, near Cincinnati, O.; entered Harvard College July, 1858; graduated at the U. S. Military Academy in June, 1864, and was commissioned first lieutenant in the corps of engineers; served as assistant chief engineer of the Army of the Tennessee to the close of the Atlanta campaign; as assistant engineer in construction of fortifications on the Pacific coast 1864–68, having the immediate superintendence of the great blast at Lime Point, Cal., 1868; commanded a company of engineer troops at Willett's Point, N. Y., 1868–71, being detached to serve as astronomer with the commission sent by the U. S. government to Spain to observe the solar eclipse of Dec., 1870; was appointed instructor of practical military engineering and military signalling and telegraphy at the U. S. Military Academy in 1871; which chair he now occupies, performing also the duties of architect for the more important structures at that place. He was brevetted captain for "faithful and meritorious services" in 1865, and commissioned captain of engineers in 1867. His principal publication is a *Manual of Practical Military Engineering* (1873).

**Esclot** (Bernat). See D'Esclot.

**Esoc'idæ** [from *Esox*, an ancient name, later applied to species of this family], a family of fishes of the order Teleocephali and sub-order Haplomi, containing the true pikes. The body is elongated, with the back and abdomen nearly straight and parallel; the scales are cycloid and of small size, and cover the whole of the body and more or less of the head; the lateral line is nearly straight and continuous; the head is oblong, and produced into a broad, depressed, and flattened snout; the eyes are lateral; the opercular bones developed in normal number and proportions; the nostrils double; the mouth is large, and has a deep lateral cleft; the upper jaw formed toward the middle by the intermaxillaries, and at the sides, backward, by the supramaxillaries: the teeth are developed on the jaws, vomer, palatine, and hyoid bones: on the jaws they are enlarged and sharp, and on the other bones are aggregated in cardiform bands; the branchial apertures are wide and confluent below; the branchiostegal rays in large number (11–19); the dorsal and anal fins are situated far behind, opposite each other, and higher than long; the caudal fin is well developed and more or less emarginated; the pectorals are inserted near the breast, and moderately developed; the ventrals are abdominal; the skeleton has numerous vertebræ, and the abdominal ones are much more numerous than the caudal (*e. g.* D. 41–43 + C. 20–21); the stomach is siphonal, and has no pyloric appendages; the air-bladder is simple, and connected by a duct with the œsophagus. The family, as thus limited, is entirely confined to the northern hemisphere, and is characteristic of the "arctogæan" division of the globe. It is chiefly represented in America, where about ten species are known, while in Europe only a single species—and that also common to the two continents—is found. All the members of the family are very voracious, and by the nature of their dentition well adapted for making havoc among their cohabitants of the water. The most notable species of the U. S. are the *Esox nobilior*, or true mascalonge, which is pre-eminent among the species of the family for the delicacy of its flesh; the *E. lucius*, or *E. estor*, which is the same as the common pike of Europe; and the *E. reticulatus*, or ordinary pickerel, of the Middle and Eastern States. The *Esox nobilior* is not only the best, but also the largest, species of the family, and is the most distinctly differentiated of them all, and perhaps entitled to generic distinction. In England the name "pike" is bestowed on the *Esox lucius* as a specific term, as well as a designation implying maturity, while the name "pickerel" is restricted to the young. In the U. S., however, both these appellations are very diversely applied. (See Pike and Pickerel, in Cyclopædia.) Theodore Gill.

**Etchers' and Engravers' Proofs.** It was formerly universally believed—and Gilbert Hamerton, in his treatise on *Etching*, holds—that there is no other mode of getting a good proof of etchings and engravings than by means of a press. Mr. T. C. Chapman, however, an American artist living in Rome, and a distinguished etcher himself, has succeeded in taking perfect proofs without the use of a press—by pouring over the inked plate a solution of gelatine (isinglass) in alcohol. When hard it is easily removed, and resembles an India proof. The proof may be backed with paper, and preserved or not at pleasure.

**Ev'ans** (Edward P.), b. at Remsen, N. Y., Dec. 8, 1833; graduated at the University of Michigan in 1854; studied at Göttingen, Berlin, and Munich 1858–62; was appointed professor of modern languages in the University of Michigan in 1862, and visited Europe again in 1870. He published *Abriss der deutschen Literaturgeschichte* (1869), and translations of Stahr's life of Lessing and Coquerel's *First Historical Transformations of Christianity*.

# F.

**Fal'lows** (Samuel), D. D., b. at Pendleton, near Manchester, England, Dec. 13, 1835; removed with his parents to Wisconsin 1845; graduated as valedictorian at the University of Wisconsin 1859; became a minister of the Methodist Episcopal Church; entered the army as chaplain 1861; afterward engaged in active military service; reached the rank of colonel and brevet brigadier-general; was seven years a regent of the University of Wisconsin; was State superintendent of public instruction 1870–72; became president of the Illinois Wesleyan University at Bloomington 1874; rector of St. Paul's Reformed Episcopal church, Chicago, May, 1875; editor-in-chief of the *Appeal*, the organ of the Reformed Episcopal Church, Jan., 1876, and was chosen a bishop July 15, 1876, at the fourth general council of that new organization, held at Ottawa, Canada.

**Fel'ton** (William H.), b. in Oglethorpe co., Ga., June 19, 1823; graduated at the State University in 1842, and at the Medical College in Augusta in 1844; did not practise his profession, but settled at Cass, now Bartow, Cass co., engaging in farming and planting, and devoting much interest to the affairs of the Methodist Episcopal Church; was elected a member of the State legislature in 1851 on the famous Georgia platform; opposed the policy of secession in 1861, but went with his State when she adopted that cause; was elected a member of Congress in 1874, and re-elected in 1876. Alexander H. Stephens.

**Ferra'ri** (Giuseppe), b. in Milan in 1811; studied law at Pavia, but devoted himself subsequently to literature; published in 1835 a complete edition of the works of Vico; went in 1837 to Paris, where in 1839 he published *Vico et l'Italie;* was appointed professor of philosophy in 1840 at Rochefort, and afterward at Strasbourg, but was removed on account of his radical ideas; published in 1847 *Essai sur le Principe et les Limites de la Philosophie de l'Histoire;* was reinstated in his chair in Strasbourg in 1848, but again removed, and returned in 1859 to Italy, where he was successively made professor in Turin, Milan, and Florence. Of his numerous works, the most remarkable are *Filosofia della Rivoluzione* (1851), *Histoire des Révolutions d'Italie* (4 vols., 1856–58), *Corso di Lezioni sugli Scrittori Politici Italiani* (1862–63), besides a number of articles in the *Revue des Deux Mondes.*

**Flem'ing** (Walter M.), M. D., b. at Portland, Me., June 14, 1838; graduated at Antioch College, O., 1859, and at the Albany Medical College 1862; went to Rochester, where he became health physician 1862–65, and during the same time was surgeon to the 7th division N. G. S. N. Y.; removed to New York; was appointed surgeon to the 3d brigade N. G. S. N. Y. 1870–77, and became consulting physician and surgeon to St. Elizabeth's and Roosevelt hospitals; is a member of various medical and other associations, and published *Catarrh, and its Relation to Throat and Lung Diseases* (1873), *Motive-power of the Human System* (1868), *Pathology of Female Diseases* (1875), *Treatment of Cerebral and Nervous Diseases* (1876), etc.

**Fol'som** (Joseph L.), b. in New Hampshire in 1816; graduate of the U. S. Military Academy, and brevet second lieutenant of infantry July 1, 1840; served in Florida against the Indians, and on the Northern frontier 1840–44; transferred to the quartermaster's department, with rank of captain, Sept., 1846, and served in California during the war with Mexico. He was among the first to appreciate the discovery of gold in California, and communicate the information officially to his government. He was identified with the early history and development of San Francisco, where he became a large property-owner. Folsom City, on the American River, near the locality where gold was discovered, is named in his honor. D. at San José, Cal., July 19, 1855.

**Fol'well** (William Watts), b. Feb. 14, 1833, at Romulus, Seneca co., N. Y.; graduated at Hobart College 1857; was teacher in Ovid Academy for two years, then became adjunct professor of mathematics in Hobart College; in 1860 and 1861 studied philology in Berlin and travelled extensively in Europe; in Jan., 1862, was commissioned first lieutenant in the 50th U. S. Engineers, with which command he served through all the campaigns of the Army of the Potomac till the close of the war, attaining the actual rank of major of engineers and the brevet rank of lieutenant-colonel U. S. Vols. After some years spent in business he became in 1869 professor of mathematics in Kenyon College, Gambier, O., and later in the same year was elected president of the University of Minnesota, where he is still employed. He has published various papers and addresses, among which is *Public Instruction in Minnesota*, in the *Transactions* of the Nat. Ed. Assoc. (1875), and is now preparing *Lectures on Political Economy, the Science of Industry.*

**Fos'ter** (Abby Kelley), b. at Amherst, Mass., Jan. 15, 1811; was educated at Worcester; worked several years as a teacher; began in 1838 to lecture against slavery; married in 1845 Stephen L. Foster, and continued to deliver lectures and circulate papers and tracts against slavery, the subjection of woman, intemperance, and kindred evils.

**Fos'ter** (Ellen Horten), b. in Lowell, Mass., 1840; early moved to Clinton, Ia.; married 1869; admitted to practise law 1874; argued a case in the supreme court 1875. A leading woman in the temperance crusade.

**Foster** (George Whitefield), b. at Swanton, Vt., May 9, 1794; studied law, and was admitted to the bar, attaining prominence in his profession, and for twenty years held a prominent place in the affairs of his State. Was State's attorney, commissioner of the Vermont Central R. R., and repeatedly chosen to the legislature and State senate; though without political ambition, he had been selected for nomination to the U. S. Senate just previous to his death, which occurred Oct. 12, 1848.

**Fow'ler** (Samuel), M. D., b. near Newburg, N. Y., Oct. 30, 1799; studied medicine at Penn Medical College of Philadelphia; was licensed in 1800, and began to practise at Hamburg, N. J.; after a few years removed to Franklin, N. J. D. Feb. 20, 1844. He was highly esteemed as a physician. He took an active part in politics, representing his county in the upper branch of the State legislature, and afterward his State in the 24th and 25th Congresses, during the administration of Gen. Jackson, of whom he was a warm supporter and one of the earliest friends in New Jersey. As a mineralogist and geologist he was regarded by men of science as among the first in the country; was made a member of the Geological Society of Pennsylvania and of the New York Lyceum of Natural History; an honorary member of the Literary and Philosophical Society of New Jersey, and corresponding member of the Academy of Natural Sciences of Philadelphia; was also an honorary member of the scientific societies of London and Dublin, and others. In 1825 he published in *Silliman's Journal of Science*, vol. ix., *An Account of some New and Extraordinary Minerals discovered in Warwick, Orange co., N. Y.;* in 1832, in the same journal, vol. xxi., *An Account of the Sapphire and other Minerals in Newton township, Sussex co., N. J.;* contributed to Gordon's *Gazetteer and History of New Jersey* an article on *The Franklinite, Red Oxide of Zinc, and other Minerals, found in the Valley at the foot of the Hamburg Mountains;* also a notice of the geology and mineralogy of the same region, for Cleavland's *Mineralogy.* The rare mineral fowlerite was discovered by and named for him, and the iron and zinc ore franklinite is supposed to have been so called by him; he made it known to eminent naturalists in Europe, and awakened an interest in it which has since resulted in its successful development and manufacture. The extensive zinc-mines of New Jersey were once owned by him. A. Guyot.

**Fran'cis** (James Bicheno), b. at Southfield, Oxfordshire, England, May 18, 1815; adopted engineering as his profession; came to the U. S. in 1833, and obtained employment with George W. Whistler on the Stonington R. R.; went to Lowell in 1834, and became engineer of the proprietors of locks and canals on Merrimack River. Published in 1855 his first ed. of *Lowell Hydraulic Experiments*, followed by a second in 1858, with many additions. These experiments, in their practical range of the measurement of the flow of water and the percentage of effective power obtained from hydraulic motors, especially turbines, are much more extensive than any other, and are not only standard for the rules obtained, but also for the methods and accuracy with which the experiments were conducted.

**Fred'erik,** the name of seven kings of Denmark, belonging to the Oldenburg dynasty. Under the reign of Frederik III. (1648–70) the constitution of the country was changed from an elective monarchy, in which the power of the Crown was circumscribed within very narrow

limits by the privileges of the nobility, to an hereditary monarchy, in which the Crown was invested with an absolute and unlimited power (Nov. 14, 1660). Under FREDERIK VII. (1848–63) this constitution was again changed, and the present constitution established (June 5, 1849), according to which the executive power rests with the king and his responsible ministry; the legislative power, with the *Thing*, consisting of an upper and a lower house, elected indirectly and directly by the people; and the judicial power, with courts, in which the judges are appointed by the king, but for life. At the death of Frederik VII. (Nov. 15, 1863) the Oldenburg dynasty became extinct.

**Fur'ness** (HORACE HOWARD), son of Rev. Dr. William H., b. in Philadelphia Nov. 2, 1833; was graduated at Harvard College 1854; studied law in the office of Hon. William M. Meredith, and was admitted to practice 1859; furnished chapters in Troubat and Haly's *Practice* on "Ejectment," "Domestic" and "Foreign Attachment," etc.; has published the first 3 vols. of a New Variorum ed. of Shakespeare's plays—viz. *Romeo and Juliet* (1871), *Macbeth* (1873), and *Hamlet* (1877); is an honorary member of the German Shakespeare Society, and one of the vice-presidents of the New Shakespeare Society of London. His library ranks among the best in the world in Shakspearean literature.

# G.

**Gad'idæ** (See Vol. II.). The importance of this family demands a more extended notice than has been given. It is one of the most useful to man, and quite characteristic in its range. The body is elongated, and more or less compressed and conoidal backward, and tapers into the caudal fin; the scales are cycloid and very small; the lateral line continuous and parallel with the back; the head is generally conic; the eyes lateral and large; the nostrils double; the opercula normally developed and unarmed; the mouth has a more or less extensive lateral oblique cleft; the upper jaw is little protractile; the supramaxillary bones straight and rather narrow—*i. e.* very little expanded backward; the teeth acute, and aggregated in bands on the jaws, and mostly on the palate; the branchial apertures cleft far forward below; the branchiostegal rays generally seven on each side; the dorsal fin is diversiform, and its modifications distinctive of several sub-families; the anal fin is also diversiform, but always much shorter than the dorsal; the caudal fin is distinct, but encroaches above and below on the caudal peduncle; the pectoral fins are moderately narrow, and their rays branched; the ventral fins jugular, but otherwise diversiform; the vertebræ are developed in increased number; the pyloric cæca are few or moderate in number. The species are chiefly confined to the cold waters of the globe, and mostly to those of the northern hemisphere, but a few types are found in the cold deep waters of the lower latitudes, and reascend toward the surface in oceans of the southern hemisphere. Several well-marked subfamilies express the chief modifications of the vertical and ventral fins. (1) The Gadinæ have three dorsal and two anal fins, and the ventral fins are complete—*i. e.* have five to seven rays: this sub-family includes the true cod-fishes (*Gadus*), the pollocks (*Pollachius*), the haddock (*Melanogrammus*), the tom-cods (*Microgadus*), whitings (*Merlangus*), etc. (2) The Phycinæ have two dorsal fins (a first short and a second very long one) and one anal fin, and the ventral fins are simply bifurcated: to this group belong the so-called "hake" (not the true hake, which is a *Merlucius*) of the New England and neighboring provincial coasts. (3) The Lotinæ have also two dorsal fins (an anterior short and a posterior long one) and undivided anal, but the ventral fins are complete: this group has two types, *Molva*, the true ling, which is marine and restricted to the fresh waters, and *Lota*, embracing the cusks or burbots of the interior lakes and rivers of the North. (4) The Ciliatinæ are distinguished by an anterior dorsal fin composed of small fringes, preceded by a long slender ray and a long posterior dorsal; the anal is long and simple: this includes the smallest and least useful species of the family; those of the American coasts are rare and of no economical importance, and unknown to the fishermen; on the European coasts, however, they are more common, and in England are known under the name of rockling. (5) The Brosminæ are forms with the dorsal rays confluent in a single long fin extending from near the neck to near the tail; the anal is also simple; the ventral fins are perfect: the sub-family includes the *Brosmius*, which is consumed in large quantities on some portions of the New England and northern coasts of America, and known under the names of cusk and torsk. About 60 or 70 species of the family have been described, among which are several genera peculiar to the depths of the tropical or sub-tropical seas (*e. g.* the Mediterranean), where the water has a low temperature compared with the surface and the land. As many as 17 species have been discovered along the eastern coast of North America, but only 3 or 4 in the western or Pacific region. THEODORE GILL.

**Gage** (MATILDA JOSLYN), b. at Cicero, N. Y., Mar. 24, 1826; was married in 1845 to Henry H. Gage; entered the Woman Rights movement in 1852; was presiding officer of the New York State and the National Woman Suffrage Association; wrote a work on *Woman as Inventor;* was one of the editors of the *History of the Woman Suffrage Movement*, and a member of the committee to prepare and present the "Woman's Declaration of Rights" in Independence Square July 4, 1876.

**Gaines** (RICHARDSON WILSON), M. A., b. in Maysville, Ky., Dec. 9, 1825, where he received his early education. In 1837 the family removed to Tuscaloosa, Ala., the seat of the State University, at which institution he graduated in 1845 at the head of his class; was appointed tutor, and subsequently adjunct professor, of ancient languages in the university, and in 1851 resigned to visit Europe, where he spent three years in travel and study; was elected at his return professor of Latin and French in the University of Mississippi, and in 1860 professor of ancient languages in Oakland College; from 1861 to 1864 was paymaster in the Confederate army; was afterward professor of ancient languages in Davidson College, N. C., and in 1874 professor of Latin and French in Central University, Richmond, Ky., where he still remains. At the instance of the bureau of education at Washington, he has lately prepared an exhaustive treatise on *Latin Pronunciation in the Colleges of the United States.* Prof. Gaines was for some years associated with the principal editor of this CYCLOPÆDIA in the University of Alabama, and subsequently in the University of Mississippi.

**Gale** (LEONARD DUNNEL), A. M., M. D., b. July 25, 1800, in Sutton, Millbury, Mass.; in 1821 entered Brown University, Providence, R. I., but graduated at Union College, Schenectady, N. Y., 1825. Studying medicine, he received in 1830 his degree of M. D. from the College of Physicians and Surgeons of the city of New York. In 1832 was resident physician in the Crosby street cholera hospital, New York; was afterward assistant professor of chemistry in the New York College of Physicians and Surgeons, and professor of chemistry in the New York College of Pharmacy.

**Gav'it** (JOHN E.), b. in New York City Oct. 29, 1817; went early in life to Albany, and began business there, when twenty years old, as a bank-note engraver and printer. He felt a great interest in astronomy, and took an active part in establishing the Dudley Observatory, being sent to Europe, together with Spencer the optician, to secure the most perfect equipment for the observatory. He was an expert microscopist, his investigations being rare and extensive. His knowledge of optics and the canons of art was minute and exhaustive, and at his death he was president of the New York Microscopical Society. As an engraver of bank-notes his attention was early called to the study of finance and banking in their relations to his art, and his great mental activity and inventive mechanical talent soon produced great and decisive improvements in his art and in his business. In 1855 he organized the American Bank-Note Co. in New York, of which he was superintendent until 1866, when he became its president, and under his direction the company furnished bonds, bank-notes, revenue-stamps, etc., not only to the U. S., but also to the governments and banks of Spain, Italy, Greece, Switzerland, all the states of Southern and Central America, and Japan. D. in New York Aug. 25, 1874. H. L. STUART.

**Gelatine Proofs.** See ETCHERS' AND ENGRAVERS' PROOFS.

**Ge'nus** [from the Lat. *genus;* Gr. γένος, "kind"], the lowest group in the animal or vegetable kingdom with which a name is habitually connected that enters into the composition of the specific designation of each independent species; thus, we have in the wolf (1) a representative of a genus (*Canis*), to which it belongs in common with a number of other animals; and (2) of a peculiar species (*Canis lupus*): the specific name (*Canis lupus*) is, as a whole, peculiar to itself and shared with no other species. The genus, as now limited, has been defined as the expres-

sion of the ultimate modification of structure; and this definition is perhaps as good as one of such few words can be, but without explanation it will convey an erroneous idea to those who are otherwise unacquainted with natural science, and the definition can only be appreciated when the group itself is thoroughly understood; and hence it cannot be considered as a definition in the true sense of the word. An adequate idea can only be given by example; thus, the wolf, in common with the dog, coyote, jackal, and certain other like forms, constitutes a genus, *Canis*, in contradistinction to the red fox (*Vulpes*), which is also composed of a number of species, and the gray fox (*Urocyon*), of which there are at most but two species: the species, in each of these genera, are defined by trivial differences in detail of structure or color, and they differ from each other in certain distinctive anatomical characters which are more prominent than any observable within the limits of any one of the genera. A necessary element of the genus, at least in the opinion of the best naturalists, is the possession of some peculiar character, or peculiar combination of characters, which distinguishes it from others. The number of species is no criterion, as a genus may have one or several species, or, exceptionally, hundreds of species. The genus was at an early period employed in natural history, but was not definitely and invariably distinguished and limited to a single name until the time of Linnæus: since his time the limits of genera have been undergoing gradual modifications. The genera recognized by him in the animal and vegetable kingdoms were quite differently appreciated; his genera of plants were little if at all more comprehensive than those admitted in the present age, while those in the animal kingdom corresponded rather with those groups which are now designated as families, or were even still more comprehensive. The tendency until within a few years past was toward an excessive differentiation into genera distinguished by trivial and superficial characteristics; but a reverse movement commenced first in botany, and subsequently in zoology, and a certain conservatism in the adoption of genera is now prevalent. THEODORE GILL.

**Ger'hard** (JOHANN), b. at Quedlinburg, Saxony, Oct. 17, 1582; studied theology in Wittenberg, Jena, and Marburg; was superintendent, and subsequently superintendent-general, of Saxe-Coburg 1606–16; returned then to Jena as professor of theology. D. there Aug. 17, 1637. His *Loci Communes Theologici* (9 vols., 1626) was received with much applause as the most complete and learned exposition of the doctrines of Protestantism; also, his *Meditationes Sacræ* (1606) were often reprinted.

**German'icus** (CÆSAR), b. in 15 B. C., a son of Nero Claudius Drusus, the brother of Tiberius, and Antonia; was adopted in 4 A. D. by Tiberius, and accompanied him in his campaigns in Pannonia and Dalmatia (7–10) and in Germany (11). In 14 he was made commander-in-chief of the legions on the Rhine, and gained greater victories than had been achieved by the Roman arms for many years. But Tiberius became afraid of his popularity, and recalled him in 17, before he could perfectly consolidate his conquests and make them useful to the empire. He was then sent to the East against the Parthians and Armenians, and d., probably poisoned, at Epidaphne, near Antioch, Oct. 9, 19. By his wife, Agrippina the Elder, he had nine children, six of whom survived him; the two most famous of them were Caligula, the emperor, and Agrippina the Younger, mother of Nero.

**Gibbs** (ROBERT W.), M. D., b. in Charleston, S. C., 1809; was educated in what is now called the University of South Carolina; received his medical degree from the college in Charleston 1830; was immediately appointed assistant to Dr. Cooper, and at his death became his successor in the chair of chemistry, geology, and mineralogy; was also associated with Prof. Josiah C. Nott, M. D., in teaching medicine; formed an extensive collection of fossils, made comprehensive researches in palæontology, and wrote extensively for the *Southern Quarterly Review* on ornithology, artesian wells, microscopy, etc. During the civil war he was surgeon-general of his State. D. in Columbia, S. C., Oct. 15, 1866. PAUL F. EVE.

**Gill** (THOMAS), B. A., b. at Sweet Farms, the family seat, Enniscorthy, Ireland, 1783; commissioned a lieutenant in the British army; came to New York, and joined the expedition of Gen. Don Francisco de Miranda for the liberation of Colombia, S. A., from Spanish rule; was captured, but escaped, and returned to New York in 1809; was bookkeeper and business-manager of the New York *Evening Post* till 1832, when he joined with Major M. M. Noah in founding the New York *Evening Star*. D. Apr. 29, 1839.

**Gil'lett** (EZRA HALL), D. D., b. at Colchester, Conn., July 15, 1823; graduated at Yale College 1841, and at Union Theological Seminary 1844; was pastor of the Presbyterian church in Harlem, N. Y., 1845–68; in 1868 was appointed professor of political economy, ethics, and history in the University of New York. D. Sept. 2, 1875. He was a remarkably industrious and patient scholar; wrote much for the *American Theological Review*, the *Presbyterian Quarterly*, the *Historical Magazine*, and other periodicals, and, besides several minor works, published *The Life and Times of John Huss* (2 vols., 1861; 3d ed. 1870), *History of the Presbyterian Church in the United States of America* (2 vols., 1864; revised ed. 1875), *God in Human Thought* (1875), *The Moral System* (1875). R. D. HITCHCOCK.

**Godet'** (FRÉDÉRIC L.), D. D., b. in Neufchâtel, Switzerland, in 1812. After having finished his college course and studied theology in his native town, he continued the study of theology and philosophy in the University of Berlin; was ordained minister in Neufchâtel; in 1838 was called by the present emperor of Germany, then prince royal of Prussia, to the high office of civil governor, or director of the education of his only son, Frederick William, now prince imperial of Germany, a post which he occupied with honor and success until 1844; became in 1850 one of the principal pastors of the city of Neufchâtel and professor in the theological school of the national Church of the canton. At the disruption of the church of Neufchâtel in 1873, in consequence of the encroachments of the political power, he became the prominent leader of the independent Church then established, and professor in the theological school of the same. Among his numerous works and pamphlets the most important are a *Commentary on the Gospel of John* (2 vols.), a *Commentary on the Gospel of Luke* (2 vols.), and 2 vols. of *Biblical Studies*—one on the Old, the other on the New, Testament. All these works have passed through several editions, and some have been translated into both English and German. He received the degree of D. D. from the University of Bâle, Switzerland. Author of the articles on the four Evangelists and on the book of Revelation in this CYCLOPÆDIA. A. GUYOT.

**God'frey** (THOMAS), b. in Philadelphia; worked as a glazier in his native city, and studied mathematics with great energy; he even learned Latin in order to read mathematical works in that language. In 1730 he communicated an improvement he had made in Davis's quadrant to James Logan, and the invention was subsequently laid before the Royal Society in London. In the mean time, Edmund Hadley had made a very similar invention, and communicated it to the society, which now investigated the case and declared that both claimants were entitled to the honor of invention, awarding to each of them a prize of £200. The instrument is still in general use, and is called either Godfrey's or Hadley's quadrant. Godfrey d. in Philadelphia in 1749.

**Goto Shojiro,** b. in the province of Tosa, Japan; at the commencement of the late revolution was appointed one of the *Sanyo*, but resigned in 1868; in 1871 was made vice-president of the Sa-in or assembly; afterward minister of justice and a sangi or state councillor, but resigned in 1873, and in 1875 was appointed vice-president of the Genro-in or new parliament. F. A. P. BARNARD.

**Gra'ham** (JOHN), VISCOUNT DUNDEE and LORD GRAHAM OF CLAVERHOUSE, b. near Dundee, Scotland, in 1643; studied at the University of St. Andrew's; served in the French and Dutch armies 1670–77; was made captain of dragoons by Charles II., and sent into the Western Lowlands against the Covenanters; was defeated at Drumclog, but was victorious at Bothwell Bridge, and obtained a fearful notoriety by his atrocities. In 1688 he was ennobled by James II., whose cause he supported against William III. At Killiecrankie Pass he defeated William's troops, but fell himself July 17, 1689. (See Mark Napier, *Memorials and Letters illustrative of the Life and Times of John Graham of Claverhouse*, 3 vols., 1859–62.)

**Great'orex** (ELIZA), b. at Manor Hamilton, Leitrim co., Ireland, Dec. 25, 1820; came early to America; studied painting in New York under William H. Wotherspoon and James Hart, and in Paris under Émile Lambinet; visited England in 1857, France 1861–62, Germany and Italy 1870–73, and was made an associate of the National Academy of Design, New York, in 1870. Her principal works are—*Bloomingdale* (1868), *Château of Madame Oliffe* (1869), *The Old Porch, Views of Amsterdam, Old St. Paul's* (1876), besides a number of pen-and-ink drawings, of which *Albert Dürer's House in Nuremberg* is in the possession of Pius IX.; *The Homes of Oberammergau* was reproduced and published in Munich in 1871; and *Sixty Pen-and-Ink Drawings of Old New York, from the Battery to Bloomingdale*, were reproduced and published by G. P. Putnam's Sons (New York, 1876).—Her two daughters, ELEANOR and KATE GREATOREX, are distinguished as artists, having illustrated several books, and exhibited paintings at the Academy of Design and at the Centennial.

**Grimké** (Angelina Emily), b. in Charleston, S. C., Feb. 20, 1805; joined her sister Sarah in Philadelphia in 1828, and held in 1836, with Sarah, a series of drawing-room séances in New York, in which she gave her views on slavery to large audiences of ladies. At the invitation of the Massachusetts Anti-Slavery Society the sisters went to New England. Rev. Samuel J. May, at South Scituate, Mass., invited them to lecture in his church, and introduced them in neighboring towns. (See his *Recollections of the Anti-Slavery Conflict.*) In 1837 she wrote several letters to Catharine Beecher in reply to an essay on slavery and abolitionism. In 1838 she twice addressed the legislature of Massachusetts. May 14, 1838, she was married to Theodore Dwight Weld.

Susan B. Anthony.

**Grimké** (Sarah Moore), b. in Charleston, S. C., Nov. 6, 1792; made in 1821 Philadelphia her place of residence, and published in 1827 *An Epistle to the Clergy of the Southern States.* This was considered one of the most efficient anti-slavery documents of the day. While lecturing in New England she wrote *Letters on the Condition of Woman and the Equality of the Sexes,* and afterward made her home with the Weld family, and assisted as a teacher in their school, established in Belleville, N. J., in 1840; moved to Englewood, N. J., 1854; to West Newton, Mass., 1863; to Hyde Park, N. Y., 1864. D. at Hyde Park Dec. 23, 1873. She also published a translation of Lamartine's *Biography of Joan of Arc* and other smaller works.

Susan B. Anthony.

# H.

**Had'ley** (John), an English astronomer, the date and place of whose birth are unknown, became a fellow of the Royal Society in London in 1717, and published in the *Transactions* of the society for 1731 an account of an invention he had made with respect to the quadrant. Shortly after, however, Thomas Godfrey of Philadelphia laid before the society a very similar invention. The case was investigated, both parties were declared entitled to the honor of invention, and each of them received a prize of £200. Hadley d. Feb. 15, 1744.

**Haines** (Daniel), b. in New York Jan. 6, 1801: graduated at Princeton 1820; studied law with Judge Thomas C. Ryerson at Newton, N. J.; was admitted to the bar 1823, and settled at Hamburg 1824; in 1837 entered public life as a member of the council (now called senate), and as, *ex officio,* one of the board of canvassers resisted Gov. Pennington in giving certificates of election to the Whig candidates in the famous "broad seal" election; in 1843 the legislature made him governor and chancellor for the usual term of one year; while in office he proclaimed the new constitution made that year, and his efforts in behalf of education have left their impress in the improved condition of the common schools and in the State normal school, which was first proposed by him. He was re-elected governor in 1847 for a term of three years; in 1852 was appointed one of the judges of the supreme court, and served for fourteen years; was also, *ex officio,* a member of the court of error and appeals. From 1870 to 1876 was a member of several judicial commissions relating to State boundaries and the municipal affairs of Jersey City and Paterson. In politics he was a Democrat, and actively supported the Union cause during the civil war. One son, Capt. Thomas R. Haines, of the 1st New Jersey Cavalry, was killed at the battle of Harrisonburg, Va., June 6, 1862; another son, Rev. A. A. Haines, entered the army soon after, and served as chaplain of the 15th New Jersey till the close of the war. He was a man of deep religious convictions and active benevolence, a ruling elder in the Presbyterian Church for many years, and his counsels were often sought in ecclesiastical courts. He was one of the committee for the reunion of the two branches of that Church, and several times at critical junctures saved the project from defeat. He was influential in the establishment of the insane asylum at Trenton, the home for disabled soldiers at Newark, and the reform school for juvenile delinquents at Jamesburg; was a commissioner to the National Prison Reform Congress at Cincinnati in 1870, and one of the committee to organize an international congress on prison discipline and reform, which met in London in 1872. He was made vice-president, and presided at one of its sessions. D. at Hamburg, Sussex co., N. J., Jan. 26, 1877. At the time of his death he was president of the Sussex County Bible Society and the oldest trustee of Princeton College. A. Guyot.

**Halicor'idæ** [from Gr. ἅλς, "sea," and κόρη, "maid," with the patronymic *-idæ*], a family of mammals of the order Sirenia (see in Cyclopædia), having a fish-like form, with the tail emarginated or forked behind; the head moderate; intermaxillary bones with the anterior portion deflected, and with the branches prolonged backward; with two upper incisors, in the male at least; and with the molars successively increasing in size backward; with simple hollow roots, and with crowns capped by few tubercles. A single living genus (*Halicore*) represents this family: its species are found in the Red Sea and along the eastern coasts of Africa and the shores of the Indian Ocean. Australia, etc. The best-known species is the dugong (*Halicore dugong*) of the Red Sea, which is also the taschasch of the Bible, whose skin was employed in the construction of the tabernacle, and hence it was called by Ruppell *Halicore tabernaculi.*

Theodore Gill.

**Halitheri'idæ** [from Gr. ἅλς, "sea," and θήρ, "beast"], a family of extinct mammals belonging to the order Sirenia and closely related to the Halicoridæ (which see), from which they principally differed in the molars having each two or three roots (they were mostly three-rooted above and two-rooted below), and their crowns being studded with obtuse tubercles arranged in transverse yoke-like eminences, and in the posterior ones having an additional narrower tuberculated yoke behind the principal ones. The family was represented in Europe by species during the greater portion of the Tertiary period (from the Eocene to the Pliocene), and these have been referred to a number of distinct genera, but which appear to be reducible to two, or even one—*Halitherium.* The pelvic bones seem to have been more developed than in the existing sirenians.

Theodore Gill.

**Halosau'ridæ** [from the Gr. ἅλς, "sea," and σαῦρος, "saurus" or "lizard-like fish"], a family of abdominal malacopterygian fishes represented by a single known species, having an elongated and compressed body, covered with cycloid scales, and terminating in a very long and tapering tail, beneath which the anal extends forward to the vent; the dorsal fin is short, and belongs to the abdominal region; the pectorals are inserted high up on the sides; the head is small and with a produced snout; the opercular apparatus incomplete, the operculum being produced behind into a long flat process which replaces, according to Günther, the subopercular and interopercular; the margin of the upper jaw formed above by the premaxillaries, and on the sides by the maxillaries. The stomach has a blind sac, and the pyloric appendages are in moderate number. The air-bladder is large and simple. The single known species (*Halosaurus Owenii*) is a deep-sea fish, and has hitherto only been found off the island of Madeira. Nothing is known of its habits.

Theodore Gill.

**Han'aford** (Phebe Coffin), b. in the island of Nantucket in 1829; educated in the public schools; became a teacher and writer at fifteen; in 1868 ordained as minister in the Universalist church in Hingham, Mass.; called to New Haven, Conn., in 1870, thence to Jersey City, where she now resides. She has edited several papers and published a number of books; among these the *Life of Abraham Lincoln* and *Life of George Peabody.* Performed the duty of chaplain in the legislature of Connecticut on several occasions; married in 1849.

**Haplochiton'idæ** [from Gr. ἁπλόος, "simple," *quasi,* "smooth," and χιτών, "coat," with the patronymic termination *-idæ*], a family of fresh-water malacopterygian fishes with abdominal ventrals, having the physiognomy of the salmonids, and, like them, possessing an adipose dorsal fin: the body is naked or scaly; the head small; the margin of the upper jaw is formed entirely by the intermaxillary bones; the branchiostegal rays are few in number (3 to 6); the ovaries laminated, and not provided with an oviduct, and consequently the eggs fall into the cavity of the abdomen; the stomach is simple, and has no pyloric appendages; the air-bladder is simple. This family is composed of two genera, which represent the salmonids in the southern hemisphere: one (*Haplochiton*) is naked, whence the name, and the two known species inhabit Tierra del Fuego and the Falkland Islands; the other (*Prototroctes*) has scales, and is represented by a single known species, found in Southern Australia. (See Günther, *Catalogue of the Fishes in the British Museum,* vol. v. pp. 381–383, etc.)

Theodore Gill.

**Haploodon'tidæ** [from Gr. ἁπλόος, "simple," and ὀδούς, "tooth"], a very peculiar family of mammals belonging to the simplicidentate rodents, with the fibula and tibia

separated, and distinguished by the breadth of the skull behind (resulting from the lateral extension of the mastoid bones); the elongated bony tubes of the auditory bullæ, which are closely attached to the mastoid processes; the development of the anteorbital foramen as a contracted round canal; and the structure of the lower jaw: the latter is very peculiar, the dentigerous areas being parallel, or rather converging backward, and the descending ramus between the inferior angle and the condyle is abruptly and greatly bent outward into a triangular extension, and terminates in a sharp angular apex: the molar teeth are rootless $\left(\frac{4-5}{4}\right)$. In external appearance the animals have some resemblance to the woodchucks or ground-hogs (*Arctomys*), having a squat body and the tail almost wanting. A single genus (*Haploodontia*) is known, with one or perhaps two species, confined to a few regions in Washington Territory and the Rocky Mountains: the size is about that of the muskrat, and they burrow in the ground. In the vicinity of Puget Sound the *H. leporina* is called the sewellel or showt'l. THEODORE GILL.

**Har'denberg, von** (KARL AUGUST), PRINCE, b. at Essenroda, Hanover, May 31, 1750; studied law at Leipsic and Göttingen, and held various positions in the service of the king of Hanover, the duke of Brunswick, and the margrave of Anspach, until he became Prussian minister of state in 1791. His opposition to the policy of Napoleon compelled him to resign immediately after the battle of Austerlitz, but when war nevertheless broke out between Prussia and France, he was recalled to power, and was minister of foreign affairs till 1807. He lived for some time in exile in Russia, but was recalled to Berlin, made chancellor in 1810, and carried out the plans of Stein for the reorganization of the Prussian state. He signed the Treaty of Paris, was made a prince, received a great dotation, and sat in the congresses of Vienna, Aix-la-Chapelle, and Verona. D. at Genoa Nov. 26, 1822. He left some *Memoirs*, which were not to appear until fifty years after his death.

**Harpagifer'idæ** [Lat. *harpago*, "hook," and *ferre*, to "bear"], a family of acanthopterygian fishes with a cottoid or sculpin-like body; with vertebræ in increased numbers (11 + 18–24?); a naked skin; head with unarmed cheeks; with six branchiostegal rays; operculum and suboperculum spinigerous; mouth terminal and with the cleft moderate; two dorsal fins, anal fin shorter than the second dorsal; caudal fin not forked; pectoral fins well developed, and with the inferior rays branched. To this family belongs a genus (*Harpagifer*) of marine fishes, represented by two species hitherto found only about the Falkland Islands. They are analogous in appearance, and probably in habits, to the cottoids of the northern seas. (See Gill, *Proc. Acad. Nat. Sc. 1861*, pp. 501–512.) THEO. GILL.

**Have'land** (LAURA SMITH), b. at Ketley, county of Leeds, Canada West, Dec. 20, 1808; was received at thirteen as a birthright member of the Society of Friends; was married at 17 to Charles Haveland, Jr., and joined some years after the Wesleyan Methodist Church; in 1842 founded the River Raisin Institute for manual labor, near Adrian, Mich.; and in 1869 founded the Michigan Orphan Asylum. During the war she was indefatigable in bringing aid and consolation to the suffering in the hospitals and camps.

**Hayes** (RUTHERFORD BIRCHARD), 20th President of the U. S., b. at Delaware, O., Oct. 4, 1822; graduated from Kenyon College, O., 1842, and from Harvard Law School 1845; began the practice of law at Fremont, O.; removed to Cincinnati 1849; was city solicitor 1858–61; was appointed June 7, 1861, major 23d Ohio Vols., of which W. S. Rosecrans was the first colonel and Stanley Matthews (now U. S. Senator) lieutenant-colonel. In July the regiment was sent to West Virginia. He (see Reid, *Ohio in the War*) was promoted lieutenant-colonel Oct. 15, 1861, from which date he commanded the 23d until Dec., 1862. After the unimportant (as compared with subsequent events) campaign in West Virginia and the disastrous result of the Peninsular campaign, the 23d Ohio was ordered to Washington, arriving there Aug. 24, 1862, and ten days later, with the army of Gen. McClellan, was on its way into Maryland, following the invading Confederate force of Gen. Lee. In the brilliant action of South Mountain, attached to the advance brigade of Cox's division, 9th corps, it was the first infantry engaged, and early in the day Hayes received a severe wound in the left arm which compelled him to leave the field. After the battle of Antietam the regiment was returned to West Virginia, where, Nov. 30, 1862, Hayes rejoined it as colonel, having been promoted Oct. 15. He was soon after placed in command of the 1st brigade of the Kanawha division, which he retained until Sept., 1864, when he succeeded to the command of the division. In the summer of 1863 his command was engaged in the pursuit and defeat of Morgan, then raiding through Ohio, and in Apr., 1864, took part in Crook's raid on the Virginia and Tennessee R. R. His subsequent military history may be briefly told in the language of his farewell order to his command, Apr., 1865: "With many of you I have been associated in the service almost four years, with three of the regiments of the brigade more than three years, and with all the regiments during the memorable campaign of 1864. The battle of Cloyd Mountain, the burning of New River bridge, and the night-march over Salt Pond Mountain under Gen. Crook in May; the days and nights of marching, fighting, and starving on the Lynchburg raid in June; the defeat at Winchester, and the retreat on the 24th and 25th of July; the skirmishing, marching, and countermarching in the Shenandoah Valley in August; the bloody and brilliant victories in September; the night-battle at Berryville; the turning of the enemy's left at Sheridan's battle of Winchester; the avalanche which swept down North Mountain upon the rebel stronghold at Fisher's Hill; the final conflict in October; the surprise and defeat of the morning and the victory of the evening at Cedar Creek, . . . form part of our common recollections." He was soon after commissioned brigadier-general of volunteers, to date from the latter battle, at the close of which he received news of his election to Congress from the 2d district of Ohio. He was now brevetted major-general for gallant services during the war, and June 1, 1865, resigning from the army, returned soon after to Cincinnati. In December he took his seat in Congress; was re-elected in 1866, but left his seat in 1867, having been nominated for governor of Ohio, to which office he was elected in October, and re-elected in 1869. In 1872 he suffered his first defeat for Congress; in 1875 he reluctantly consented to allow his name to be used once more as a candidate for governor, and was elected for a third time—an honor never before conferred on a citizen of Ohio. The prominent issues were the currency and school questions, which attracted the attention of the whole country and caused his name to be favorably mentioned as the Republican candidate for President for the proximate term; and on June 16, 1876, he was nominated at Cincinnati on the seventh ballot, receiving 384 votes, to 351 for J. G. Blaine and 21 for B. H. Bristow. The ensuing canvass, one of the most bitter and exciting known in our national history, was closed by a disputed election, the electoral votes of Florida, South Carolina, and Louisiana, and one of those of Oregon, being claimed by both parties. Under the head PRESIDENTIAL ELECTORAL COMMISSION the proceedings are related which terminated in the announcement that R. B. Hayes had been duly elected President of the United States, to which office he acceded Mar. 4, 1877, the inauguration ceremonies taking place on the Monday following. G. C. SIMMONS.

**He'liotype** [Gr. ἥλιος, "sun," and τύπος, "mark," "outline"], generally, any process of reproducing pictures obtained by the actinic power of the sun's rays on a prepared surface, by printing in fatty inks, but more especially the process invented by Poitevin in 1855, and afterward developed and completed by Edwards. Poitevin discovered that on a plate covered with bichromated gelatine, and exposed to light under a negative, some pores of the gelatine would become completely, others only partially, closed, while others, again, would remain entirely unchanged. If, now, this plate be steeped in water and rubbed over with grease, the grease will speedily attach itself to those places of the gelatine sheet where the light has closed the pores, while it will not touch those places where the pores have remained open and consequently become filled with water. Thus, if the grease employed be lithographic ink, which is simply grease to which coloring-matter has been added, the light-produced image will at once be revealed. The development which this process received from Edwards consisted principally in the production of a movable film. He discovered that gelatine, without losing its property of being acted upon by light in presence of a bichromate, and of receiving and refusing greasy ink, might be converted into a tough, insoluble substance, like leather or parchment, by the addition of alum or chrome alum. The gelatine, with a sufficient quantity of bichromate of potash to make it sensitive to light, and of alum to make it hard and durable, is poured on a level plate, and dried in the dark by means of heat. When dry or required for use, the sheet of gelatine is stripped from the plate and printed under a photographic negative.

**Her'on** (MATILDA), b. in Labby Vale, Draperstown, Ireland; came to the U. S.; made her début in Philadelphia in 1851, as Bianca in *Fazio;* performed throughout the country; visited London in 1861; was married to Robert Stoepel 1857, and divorced 1862. D. at New York Mar. 7, 1877. Her principal rôles were Camille in *La Dame aux Camélias*, and Ulah in *De Soto*.—Her daughter, MISS BIJOU HERON, is also an actress.

**Hesperor′nis** [Gr. ἕσπερος, "west," and ὄρνις, a "bird"], an extinct genus of birds belonging to the sub-class Odontornithes, and found in the Cretaceous of Kansas. These birds had the legs fitted for swimming, and closely resembling those of the modern divers, but the sternum was destitute of a keel, as in apteryx and the ostrich, and the diminutive wings were incapable of supporting the body in flight. The most remarkable feature was, however, the presence of well-developed teeth both above and below. These teeth were not set in sockets, as in Ichthyornis, but in a groove, as in Ichthyosaurus. Other reptilian characters were shown in the skeleton, but the vertebræ are of the true bird type, with cylindroid articular surfaces on the centra. *H. regalis* was nearly six feet in height. (See also Odontornithes, in Cyclopædia.) O. C. Marsh.

**Hey′ne** (Christian Gottlob), b. at Chemnitz, Saxony, Sept. 25, 1729; studied law and Greek and Roman archæology at Leipsic; was *professor eloquentiæ* at the University of Göttingen from 1763 till his death, July 12, 1812. Besides contributions to learned periodicals and valuable editions of Tibullus, Pindar, the *Iliad*, Epictetus, etc., he published *Opuscula Academica* (6 vols., 1785–1812).

**Hill′yer** (Rev. Shaler Granby), D. D., b. in Wilkes co., Ga., June 20, 1809; graduated at the State University with distinction in 1829; taught school for two or three years; studied law and was admitted to the bar, but abandoning this profession early in 1832, devoted himself to the ministry. After having had pastoral charge of several churches, he was in 1846 called to the chair of belles-lettres and metaphysics in Mercer University, which position he held for two years. He then resigned and took charge of the Baptist church in Rome, Ga. In 1859 he was urged by the trustees of Mercer University to return to that institution and take charge of the chair of theology. This position he held until 1862, when the institution was suspended in consequence of the war. In 1867 he was called to the presidency of the Monroe Female College, located at Forsyth, Ga., where he is also pastor of the Baptist church. Alexander H. Stephens.

**Hitch′man** (William), M. D., D. C. L., b. at North Beach, Gloucestershire, England, in 1819; was articled to a physician; entered subsequently Guy's Hospital in London; passed through the Royal College of Surgeons; devoted several years to the study of lunacy and anatomy; graduated in medicine in 1841 at the University of Erlangen, Bavaria; was for a number of years president of the British Medical Reform Association, is one of the representatives of the Eclectic school of medical practice, and has published essays on *Consumption, Physiology of Inflammation, Homœopathy, Hydropathy,* and *Mesmerism; Vaccination and its Compulsory Enforcement,* etc.

**Hiwas′see College,** in a post-village of the same name, in Monroe co., Tenn., was designed to secure a thorough practical training to those young men of bright intellects who had not the means to attend the more expensive colleges. It was organized in 1849, and has been quite successful; its first graduate was Hon. D. M. Key, who recently succeeded the late Andrew Johnson in the Senate of the U. S. The college is 7 miles from the East Tennessee Virginia and Georgia R. R., but is supplied with a daily mail. J. Key Brunner.

**Holy Grail.** See Sangreal, in Cyclopædia.

**Ho′mer** (Winslow), b. in Boston, Mass., Feb. 24, 1836; went with his family to Cambridge, Mass.; in 1854 was placed by his father with Mr. Bufford, a lithographer of Boston, to learn the business. Bufford had been a fellow-pupil of A. F. Bellows, S. Rowse, and Eastman Johnson under Pendleton, a pioneer in the art of lithography in America. On leaving Bufford, Homer took to drawing on the block for wood-engravers, and was at first employed on *Ballou's Pictorial.* His work attracted attention, and he was invited to New York by the Harpers, for whom he made many drawings. In 1859, becoming acquainted with artists in New York, he felt his way in painting, and in the winter of 1860–61 studied in the school of the Academy of Design under Mr. Cummings, and had a month's instruction from Mr. Rondel, a landscape painter. In 1863 he exhibited for the first time at the Academy exhibition, sending two pictures, both subjects relating to war-times: *Home, Sweet Home!* a soldier listening to the band playing that air, and *The Last Goose* at Yorktown, two soldiers foraging, creeping up to a sleeping goose. These pictures made a strong impression upon the public, but Homer's name had already been gradually making itself known as that of a man who had something to say, and knew how to say it tersely, clearly, and strongly. In 1865 he painted *Prisoners at the Front,* a squad of Southern prisoners brought up before a Northern captain. The personages of this scene are all portraits; the Northern officer is Gen. Francis A. Barlow. This picture is perhaps the one artistic result of the war, and made Homer's name famous. In the Paris Exposition of 1867 it was one of the two or three pictures in the American department at which French artists would look. In this year (1867) Homer went to Paris, where he stayed nine months. He joined J. Foxcroft Cole and W. R. Baker in their studies from the life-model pursued independently and under no master, though Homer acknowledges a great impulse received from the paintings of Mr. John La Farge. Since 1867, Homer has resided in New York. Clarence Cook.

**House** (James Alford), b. in New York City Apr. 6, 1838; was brought up as an architect, but his taste and his studies in mechanical engineering led him in 1860 to prefer that pursuit to architecture. Having invented the Wheeler & Wilson buttonhole machine, first patented by him and his brother in 1862, he became in 1864 the mechanical engineer of the Wheeler & Wilson Manufacturing Co., and has held that position to the present time. In 1866 he invented the india-rubber trunk shield, and the same year a buttonhole attachment for the Wheeler & Wilson family sewing-machine, a silent feed for the same, and many other valuable sewing-machine patents, the most important of which are those on the new manufacturing and family machines, Nos. 6, 7, and 8, of the Wheeler & Wilson Manufacturing Co., in which he has made very novel and ingenious adaptations of the variable motion by means of a steel pin moving over unequal distances in equal times in a slotted disk. L. P. Brockett.

**How′ard** (Edward Loyd), M. D., b. in Baltimore Jan. 14, 1837; graduated at the University of Maryland 1861; served in the Confederate army from Oct., 1861, to the close of the war, and rose to be chief surgeon in Jackson's corps of artillery; was professor of anatomy in Baltimore College of Dental Surgery, and is now professor of physiology in the College of Physicians and Surgeons of Baltimore; was editor of the *Baltimore Medical Journal* for three years, and has contributed largely to the medical journals.

**Hu′lett** (Alta M.), b. near Rockford, Ill., June 4, 1854; learned telegraphing when ten years old, and was for some time an operator; subsequently taught school and studied law; in 1872 passed the required examination and applied for admission to the bar, but was refused because of her sex. She then succeeded in getting a bill through the legislature giving all women, married and single, the right to practise law; went to Chicago, spent a year in the office of Messrs. Sleeper & Wheton; was again examined, received her diploma on her nineteenth birthday, and began practising her profession. D. in California Mar. 27, 1877.

**Hulls** (Jonathan), obtained in 1736 a patent for a "machine for carrying ships out of or into any harbor against wind and tide." This machine was to be moved by steam-power, being thus one of the earliest applications of steam to locomotion; but it failed because the inventor did not use the proper means of transferring the motion from the piston to the axle.

**Hunt** (Harriot K.), M. D., b. in Boston, Mass., in 1805; taught school in 1827; studied medicine in 1833 under private instructions from Dr. Mott; opened an office in 1835, and was probably the first woman physician in the U. S. She organized a Ladies' Physiological Society in Charlestown in 1843 with fifty members, and there had her first experience in lecturing. In 1847 she was refused admission to the medical lectures of Harvard College; in 1853 the Woman's Medical College of Philadelphia, Pa., conferred upon her the honorary degree of M. D.; in 1850 she attended the Woman's Rights Convention at Worcester, Mass.; was an able speaker. As she was a property-holder, she was obliged to pay taxes, but she did that uniformly under protest; which protests have been filed in the treasurer's office for twenty-five years. D. Jan. 2, 1875.

**Hutch′inson** (Abby), b. at Milford, N. H., Aug. 29, 1829; was of a musical family, and early showed a remarkable talent for singing. At the age of eleven years she began to sing in public. Her summers were spent acquiring a good education; the winter seasons were devoted to public life, in company with her brothers, Judson, John, and Asa. They soon made a popularity unknown before in the Northern States of this country by their harmonies and the sentiment of their songs. Much of this success was owing to Miss Hutchinson, who seemed the "bright particular star," and possessed a voice of great sweetness and pathos. In 1845 she, with her brothers, crossed the Atlantic, and spent one year singing with great acceptance and financial success through Great Britain and Ireland. In common with her brothers, she was also gifted in song-writing. Miss Hutchinson was married Feb. 28, 1849, to Ludlow Patton, a banker of New York City, since which time she has only occasionally appeared before the public. Susan B. Anthony.

# I.

**Igle'sias** (José Maria), b. in the city of Mexico Jan. 5, 1823; was a professor of English and French in the College of San Ildefonso at twenty, and at twenty-four a professor of law. As early as 1846 he entered official life as a member of the ayuntamiento (council) of the city of Mexico. During the occupation of the capital by the American army (1847–48), having followed the Mexican government to Querétaro, Iglesias was employed first as an official of the supreme tribunal of war, and subsequently as military judge for the army of the East. In 1850 he was made chief of a bureau of the board of public credit, which he gave up to enter the Mexican congress in 1852. In 1855 he returned to the bureau of public credit as its chief, and in 1857 was entrusted with the portfolio of the ministry of justice in the cabinet of Pres. Comonfort, to the duties of which place were soon added for a time those of minister of the treasury. Subsequently, in the cabinet of Pres. Juarez, he continued to be minister of justice, aiding the treasury, however, in the customs bureau. In 1863, Señor Iglesias, following the fortunes of Juarez, was charged successively with the functions of minister of the treasury, of justice, and of the interior. At the same time he wrote many papers of conspicuous force upon the subject of foreign intervention in Mexican affairs. Upon the re-establishment of the government of Pres. Juarez at Mexico, Señor Iglesias acted as minister of the treasury until 1868, when he re-entered congress, but soon returned to the cabinet as minister of gobernacion, as also minister, *ad interim*, of justice, holding both portfolios until 1872, when he resigned the latter. In 1873 he was called by election to the high post of president (chief-justice) of the supreme court of the republic. Señor Iglesias has been an active writer in periodical literature. Thomas Jordan.

**Illustrated Journalism.** The *Penny Magazine* of London was the first publication that made a systematic use of the pictorial cut, and its popularity led to the establishment of a number of illustrated ventures. *Punch* was started in 1841, but its first pictures were poor and trivial; afterward the efforts of John Leech, Richard Doyle, Thackeray, A Becket, and Mark Lemon made it successful. The true pioneer, however, of all the illustrated papers was the *Illustrated London News*, started May 14, 1842, by Messrs. Ingram and Cook, two London compositors. They had been engaged in a small printing business in Nottingham, where they had become agents for the sale of Morrison's pills, printing the advertisements and posters in their office and travelling around the country as their own salesmen. In the course of their wanderings they met a Mr. Roberts, a large druggist in Manchester, who offered to sell them a recipe for a far better pill than Morrison's. Mr. Ingram purchased the recipe, written hurriedly and in the spirit of a joke, returned to London, and with his partner began the manufacture of the pellets, to which Mr. Roberts had given the name of Parr's Life Pills, after the greatest subject of authenticated longevity on record. Their success was so rapid that within a short time they started the well-known publication as an advertising medium, the first issue being printed by their former employers. In the course of time they began the publication of books in addition to the *Illustrated News*. Mr. Ingram next purchased his partner's interest in the *News*, and abandoned book-publishing to Mr. Cook, who carried it on for a time. In 1860, Mr. Ingram visited the U. S. with his son, and on the 7th of September both perished in the Lady Elgin disaster on Lake Michigan. The next prominent journal started was *L'Illustration*, which made its first appearance in Paris, Mar. 4, 1843. In the latter part of the same year the *Illustrirte Zeitung* was established in Leipsic. Then followed, in chronological order, *The Illustrated American News*, New York, June 7, 1851; *The Illustrated News*, Boston, Jan. 1, 1853; the *Illustrated Times*, London, June 9, 1855; *Frank Leslie's Illustrated Newspaper* (Eng.), New York, Dec. 15, 1855; *La Ilustracion Española y Americana*, Madrid, 1856; *Harper's Weekly*, New York, Jan. 3, 1857; *Le Monde Illustre*, Paris, Apr. 18, 1857; *Frank Leslie's Illustrirte Zeitung* (Ger.), New York, Aug. 22, 1857; the *Illustrated News of the World*, London, 1858; *L'Univers Illustre*, Paris, and *Ueber Land und Meer*, Stuttgart, each same year; the *New York Illustrated News*, New York, Nov. 19, 1859; *Illustreret Tidende*, Copenhagen, later in the same year; *Frank Leslie's Ilustracion Americana* (Spanish), New York, 1866; *Harper's Bazar*, 1867; the *Canadian Illustrated News-paper*, Montreal, 1869; the *Illustrated Midland News*, Birmingham, England, Sept., 1869, which in Mar., 1871, was brought out in London as the *Illustrated Newspaper*; the *Graphic*, London, Nov., 1869, started by Mr. Cook, formerly of the *Illustrated London News*, with a number of artists, engravers, etc., upon a co-operative basis; the *Neue Illustrirte Zeitung* (semi-weekly), Vienna, 1872; *L'Illustrazione Italiana*, Milan-Rome, *La France Illustrée*, Paris, and the *Graphic* (daily), New York, each 1873; the *Pictorial World*, London, 1874, and the *New York Illustrated Times*, New York, Oct., 1876. The first daily illustrated paper in the world was the New York *Daily Graphic*, which was started Mar. 4, 1873. Its pictures are produced by a photo-lithographic process, and in many notable instances it has given full illustrations of events the day after their occurrence.

In America, whose illustrated press now occupies a conspicuous place in the illustrated press of the world, the first illustrated paper was started in Boston by Messrs. Ballou and Gleason, but the first successful attempt to start a real, live illustrated newspaper in the U. S. was made by P. T. Barnum and the Beach Bros. Their paper was the *Illustrated News*, and the first number (Jan. 1, 1853) had a sale of 150,000 copies. The entire art department was placed in the hands of Frank Leslie. In consequence of a lack of mechanical accessories, the founders relinquished it in about a year. Mr. Leslie being an artist, engraver, and printer, and perfectly familiar with all the mechanical details of the business, started his *Illustrated Newspaper*, and began a series of experiments and inventions. He introduced the first cylinder press, with *inking-table attached*, ever used in this country, and substituted for the large solid blocks upon which drawings were made for the engravers small ones firmly bolted together. By this arrangement of the blocks a full-page drawing, instead of requiring the work of one engraver for several weeks, can be taken apart and distributed among sixteen men, and finished in a few hours. He also introduced the system, now generally adopted in all newspaper offices, of printing with card overlays. A solid impression is taken on a piece of card-board, and the plan consists in cutting away the lights, in contradistinction to the old system of building up the overlays on the cylinder. Instead of a week, but three or four hours are now requisite for the forms to be made ready for the press.

Various attempts have been made to cheapen the cost of production of illustrated papers, founded upon the experiments and discoveries of M. Albert of Munich, but the only successful ones have been valuable in imitating pen-and-ink drawings; none have guarantied the sharpness and finish of wood-engraving. When illustrated papers were first started, it was considered a bold thing to expend $200 per week for illustrations; now more than that is often laid out upon a single page. Frank Leslie.

**Inclined Planes,** engineering devices for raising and lowering boats from one level to another on a canal, as substitutes for lift-locks. The plane consists of an ordinary railway track of wide gauge laid on a graded plane leading from the lower to the higher level or pool to be connected. The track leads from the bottom of the lower pool along the plane, over, into, and down to the bottom of the upper pool. The boats are carried up or down the plane on wheeled carriages running on the railway track. The carriages are moved by an endless wire rope passing around large horizontal pulleys fixed at the head and foot of the planes in each pool, and attached to a winding drum operated by a turbine motor. The turbine is operated by a head of water taken from the upper pool. The boats are received by being floated over the carriage in either level, and made fast thereto, and the machinery being put in motion the boat settles down upon the carriage as it rises along the plane, and is carried to the other level, where the carriage sinks to the bottom of the pool, the boat floats, is detached, and passes on its way. Planes may have one or two tracks, and are single or double track planes. The carriages may be arranged with caissons filled with water carrying the boats. The boats are taken into and discharged from the caisson at the foot of the plane in the same general manner as for the carriage-planes. At the upper end of the plane there is a masonry chamber with one pair of gates, the caisson having a falling gate and a projecting end. The caisson is drawn up to the masonry

chamber, which receives the projecting end of the caisson, making a water-tight connection. The gates of the chamber and the door of the caisson being opened, the boat passes into the pool of the canal. Boats are taken into the caisson and down the plane by the reverse operation.

The economy of these planes is in their cost, in time saved on lockage, and in expenditure of water. A single-track carriage-plane for a lift of 64 feet costs about one-sixth, and a double-track plane about one-third, as much as eight locks of 8 feet lift each. The cost of caisson-planes is about twice as much as for carriage-planes of equal height. A boat can be passed over a plane of this height in about the same time occupied in passing a lock of 8 or 10 feet lift. The most effective economy is in the use of water. Having found the weight of carriage and boat to be moved on a given inclination of plane, the required power of turbine, and the consequent expenditure of water under a fixed head, which may be the difference of elevation of the connected pools, are readily found by established formulas. The expenditure of water is as the load moved. An empty boat can be taken over the plane with one-third the expenditure of water required for a loaded one. With locks the difference in expenditure is the difference in the displacement of the loaded and the empty boat. In the comparison of a single-track carriage-plane of 64 feet height with a lock of 8 feet lift, the boats carrying 120 tons, in the case of two loaded boats passing each way the expenditure of water by the plane was 84 per cent. of that by the lock; and in the case of two loaded and two empty boats passing each way the expenditure by the plane was 58 per cent. of that by the lock. If locks overcoming an equivalent height be grouped in a flight, they expend for upward-bound boats eight times as much water as an isolated lock. If boats should not alternate in direction regularly in passing over the summit-level, the expenditure of water by locks is increased 50 per cent.; but such irregularity does not affect the expenditure by planes. In the case of double-track planes, loaded boats going in opposite directions and passing the plane at the same time balance each other on the plane, and but a small quantity of water need be expended in moving them; and if the ascending boat is empty, the descending loaded boat will draw it up after passing the crest of the plane. In the case of caisson-planes a like economy in expenditure of water takes place in regard to empty boats, as no more water need be kept in the caisson than will float the boat; and the same balance of loads obtains on the double-track caisson-planes as noted in the case of the double-track carriage-planes.

In a mountainous country, where the inclination of the valley to be followed by the canal is great and the water-supply not abundant, indicating a great number of locks of low lift, a great saving in cost of construction, in time of transit, and in expenditure of water for operating the canal can be made by the use of inclined planes; also, an increase in tonnage capacity.

Carriage-planes, varying in height from 40 to 100 feet, are in use on the Morris Canal in New Jersey, U. S., and others on the Duke of Bridgewater's Canal in England; and caisson-planes are in use on the Monkland Canal near Glasgow, Scotland, and are said to be in use in Switzerland. A caisson-plane has lately been put in use as an outlet of the Chesapeake and Ohio Canal, near Georgetown, D. C. (A detailed discussion of carriage-planes, by Thomas S. Sedgwick, Amer. Soc. Civ. Engrs., is given, in connection with the report of surveys for the extension of the Chesapeake and Ohio Canal, in the annual report of the chief of engineers U. S. army for 1874.) THOMAS S. SEDGWICK.

**Inomoto.** See ENOMOTO.

**International Exhibition, 1876.** The "International Exhibition of Arts, Manufactures, and Products of the Soil and Mine" was held in the city of Philadelphia, Pa., in the summer of the year 1876, in accordance with the act of Congress of Mar. 3, 1871, providing that such an exhibition should be held in celebration of the completion of the centenary of American independence. A commission for the management of the exhibition, consisting of two persons from each State and Territory of the Union, was appointed. A general invitation to all nations to participate was extended by the President and Congress. The exhibition was opened on the 10th of May by the President in the presence of the commission, the foreign commissions, diplomatic representatives, and members of the cabinet, and it was closed by the President on the 10th of November, according to the official programme. It thus remained open daily, except Sundays, for six months consecutively. During this period there were upwards of 10,000,000 admissions, over 8,000,000 paying the uniform admission fee of half a dollar, excepting a comparatively small number of scholars' tickets sold at twenty-five cents. These visitors came from all parts of the U. S., and many of them from abroad.

Nearly all the foreign countries were represented by commissioners and by their raw products and manufactures. Amongst these countries, Great Britain and her colonies were especially prominent. Japan, China, Spain, Portugal, Egypt, Sweden, Brazil, Mexico, and the South American States made more extensive displays than at any previous exhibition. The total number of exhibitors was about 40,000, but this number would be much larger if the methods of enumeration adopted at Paris and Vienna were used. The original systematic classification adopted by the commission aud reported to Congress contemplated the arrangement of objects by classes, as well as by countries, upon the plan initiated at Paris in 1867, but in planning the buildings and allotting the space this system was disregarded and abandoned, and there was no systematic arrangement of objects or grouping of countries in either of the five chief buildings of the exhibition. (For a description of these buildings, with illustrations, reference is made to PHILADELPHIA in CYCLOPÆDIA.) The total area of floor-space of the chief buildings was approximately 50 acres, and of the exhibition enclosure 236 acres, or 10,000,000 square feet, which last number represents also the aggregate of admissions and of the capital stock. The financial portion of the work and the erection of the buildings were entrusted to a board of finance elected by the holders of Centennial stock, which was issued in shares of $10 each by authority of Congress, in order to raise the money needed for the construction of the buildings and the management of the exhibition. The board was authorized to issue stock to the extent of $10,000,000, but the total subscriptions did not exceed $2,500,000. The city of Philadelphia appropriated $1,500,000 for the construction of buildings to remain the property of the city, and the State of Pennsylvania appropriated $1,000,000 for the construction of Memorial Hall, the permanent building used as the art-gallery. Congress appropriated $1,500,000 in aid of the work, besides the expenditure of a similar amount in the government display. Several of the States made large appropriations—notably, New Jersey $100,000, and the State of Connecticut $25,000—$10,000 being a subscription to the stock. The aggregate cost of the exhibition, exclusive of the expenditures by States and governments, and including the $2,500,000 expended for the permanent structures, was about $9,000,000. The receipts from admissions were about $4,000,000, and from the sale of concessions and privileges $500,000.

The aggregate weight of the exhibits amounted to about 28,000 tons, according to the data obtained from the terminal railway service. A large part of the exhibits in the U. S. section was delivered by wagons, but the bulk of the objects arrived by rail, and were expeditiously delivered without confusion to the respective sections by an organized force known as the "terminal agency," under the direction of the bureau of transportation. At the close of the exhibition the goods were removed in the same manner, and without cost to the exhibitors.

The plan of awards for meritorious products differed from any adopted at other exhibitions. Instead of indicating the relative excellence of objects by means of medals differing in value or in name, one uniform bronze medal was given, to serve merely as a token or indication of some merit expressed in writing by the judges. The essence or value of the award is found in the report, which is presumed to express the qualities or points of excellence deserving special recognition. This plan is based chiefly upon the recommendation of the foreign commissioners at the close of the Paris Exhibition in 1867. It contemplates the consideration of each product upon its own inherent merits, rather than in comparison with others of the same class. Under this system, therefore, there is no "highest" or "lowest" award. The appreciations of merit were made by a board of 225 judges, selected from the most distinguished specialists in the several branches of science, art, and technology in this country and abroad.

Popular judgment accords to this exhibition an unparalleled success, and it is pleasant to know that this view is accepted and promulgated by many of the foreign commissioners and visitors. Probably no exhibition has been more productive of direct and prospective good. Its effects upon the U. S. and foreign countries are already manifest. The results are manifold, and broader perhaps than even the projectors of the work anticipated. They are as varied as the occupations of men, and as general as civilization. In a broad sense, the effect of the exhibition has been educational, this being the grand function and aim of well-ordered exhibitions, but the results are also commercial and industrial. For convenience, the results may be grouped as political, industrial, scientific, and moral.

Politically, the exhibition has made the people of all sec-

tions better known to each other. The administrative and constructive functions of the general government have, for the first time, been shown to the people in a connected manner. The patriotism of the people has been stimulated, and an increased respect for the institutions and history of the U. S. has been aroused. The crude resources of the country have been made known at home and abroad. The productive capacity and advantages of the U. S. have been shown to foreign capitalists and artisans. Immigration in general, and especially of skilled labor, has been stimulated.

Industrially, the effects of the exhibition have been to thoroughly inform American and foreign manufacturers of the relative merit of domestic and foreign products, and to show conclusively that the manufactures of the U. S., particularly those dependent upon the use of labor-saving machinery, are in general superior to those abroad, where the products of cheap hand-labor have not wholly disappeared. This superiority is especially manifest in the hardware, edge-tools, cutlery and cheap brasswork, machinery and machine tools. At the same time, the great superiority of certain foreign products, notably of ceramics and artistic manufactures generally, was evident. This superiority has aroused the quick sense of American manufacturers and of consumers, and has stimulated the already existing germs of higher art-work in American manufactures. A great impetus has been given to the appreciation of art in its application to household decoration, and the importance of permanent museums of industrial art is more than ever recognized and acted upon. The Pennsylvania Museum of Industrial Art, founded at Philadelphia, obtained its already choice collection in great part from the exhibition, while the Metropolitan Museum in New York, the Art Museum in Boston, and the Corcoran Museum and the National Museum in Washington, have been enriched from the same source. The new Connecticut Museum of Industrial Art at New Haven may also be considered as one of the direct fruits of the exhibition.

Another great industrial result is the establishment of new industries upon American soil based upon superior natural and undeveloped advantages, and also the transfer of industrial establishments from the Old World to the New. The foreign demand for American manufactures has been largely increased by the exhibition, and thus a fresh impetus has been given to commerce.

In a scientific point of view the exhibition has been productive of great good in bringing together in a common field of labor so many of the leading minds of the time, thus greatly promoting the dissemination and unification of knowledge. The general educational effects of the exhibition may here be included. Not one of the ten millions of visitors could avoid learning something of consequence. To the diligent seeker of instruction it was an exhaustless mine. It was object-teaching upon a large scale. By covering in its universality the whole range of natural products and of human effort, all classes of men, from the humblest to the most highly cultured, found something to learn. The exhibition period was a season of national and international education.

High moral and social effects are inseparable from such an international concourse in the interests of industry and peace. Industrial and educational occupation preclude immorality. The presence of foreign commissioners, judges, and visitors gave opportunities for the exercise of liberal hospitality by the citizens of Philadelphia and throughout the country, which were freely improved. One of the most gratifying results of the official and social intercourse of the celebration was found in the heartiness and good-will uniformly manifested by the British people and sovereign toward the U. S., and the enthusiastic reciprocation of such kindly feelings on all occasions by our citizens. This friendliness was emphasized at the close of the exhibition by the presentation, with the special approval of the British crown, of the beautiful English buildings to Fairmount Park. W. P. Blake.

**Iowa Agricultural College, The,** was established by an act of the State legislature passed in 1858, providing for the purchase of a farm, for the erection of the college buildings, and for experiments in agriculture. In 1859 the trustees selected and secured a section of land near Ames, Story co., for the college farm. The present college buildings were erected at an expense of some $250,000, and on Mar. 20, 1869, the main college building was formally opened, and more than 100 students of both sexes were enrolled. Since then the yearly attendance has reached nearly 300. There are four courses of study, requiring four years each—namely, (1) the course in agriculture, embracing practical farming, farm engineering, stock-breeding, horticulture, and forestry; (2) the course in mechanics, embracing civil and mechanical engineering; (3) the ladies' course; (4) the course in general science. The library has nearly 6000 volumes. The museum contains large collections. The garden and forest cover over 50 acres. The farm has 500 acres under the plough.

**Iowa State University** is located at Iowa City, on the Chicago Rock Island and Pacific R. R., 57 miles W. of Davenport. It was founded in 1855, and organized on its present basis in 1860. It comprises four departments—the academical, which dates from the beginning; the law, established in 1868; the medical, in 1870; and that of civil engineering, in 1873. The faculty of the university consists of the president and 20 professors, whose work of instruction is supplemented by a large number of assistants. It has a permanent fund of about $22,000, derived from the sale of lands given by the Federal government to the State for the support of a university. The annual income from this source is not far from $20,000. Besides this, the legislature makes a biennial appropriation for the purposes of the institution, and a few thousand dollars are received yearly from the students for tuition and for incidental expenses. George Thacher.

**Itagaki Taiske,** b. in the province of Tosa, Japan; educated for the military profession; was aide-de-camp to the general of the imperial army during the late revolution; took an active part in the subjugation of the prince of Aidzu; after the war retired to his province, but was subsequently called again into public life; in 1871 was appointed one of the Sangi or privy councillors of the empire; held the office two years and resigned, but was reappointed in Mar., 1875, to the same high position. F. A. P. Barnard.

**Ito Hirobumi,** b. in the province of Choshiu, Japan, about the year 1840, and received a good education in his native tongue as well as in English; took part in the negotiation of the treaty which called for the payment of $3,000,000 to the four powers; was at one time governor of Hiogo and Kobe; was a special commissioner to the U. S. in 1871 to investigate the coinage system, and his report resulted in the establishment of the mint of Japan; was acting minister of public works in Yedo; one of the ambassadors who visited America and Europe in 1872, and was subsequently connected with the government, taking great interest in all measures calculated to develop the material interests of his country. F. A. P. Barnard.

**Iwakura Tomomi,** b. in 1825; was an inveterate opponent of the tycoon in the late civil war, and was for several years a prisoner of state before the government was changed; his first audience at the imperial court was in 1858; soon after the formation of the mikado's government he was appointed to the privy council; in 1868 was appointed vice-president of the imperial cabinet; in 1869 the title of *sionii* was conferred upon him, and he received a distinguished mark of the emperor's approbation; in 1871 was appointed minister of foreign affairs, and raised to the rank of junior prime minister; soon afterward visited America and Europe as the head of a special embassy. After his return to Japan a party of desperadoes attempted to assassinate him, and were executed for the crime. He continues to be at the present time the leader of the public men of Japan, and is a man of superior culture in all matters connected with the empire of Japan. He does not speak English, but is an advocate of modern progress, and has manifested his respect for education by sending three of his sons to America to be educated. F. A. P. Barnard.

# J.

**Jack'son** (Mercy B.), M. D., b. in Hardwick, Mass., Sept. 17, 1802; graduated from the New England Female Medical College in 1860; previously practised in Plymouth, Mass., eighteen years; was the first woman admitted to the American Institute of Homœopathy in Philadelphia, June, 1871; was admitted to the Massachusetts Homœopathic Society in 1872 and the Boston Homœopathic Medical Society in 1873; made professor of diseases of children in the Boston University School of Medicine in 1873, which office she now holds (1877); wrote in favor of woman suffrage in 1854, and has ever since been an active worker in that cause.

**Jaco'bi** (Mary Putnam), M. D., b. in London in Aug., 1842, of American parents; came to New York in 1848;

was educated in the Twelfth street grammar school by Prof. G. W. Greene, and in the Woman's Medical College in Philadelphia, and was the first woman who graduated from the College of Pharmacy in New York. In 1868 she went to Paris, and was the first woman admitted to the Paris École de Médecine, from which she graduated in 1871, receiving the second prize, a bronze medal, for her graduating thesis; returned to New York, commenced practice, and was made professor of materia medica in the medical college established by Elizabeth Blackwell, M. D., a chair she still (1877) holds. In 1873 she was married to Dr. A. Jacobi. Since 1873 many of her papers have been published in the *Medical Record* and *Journal of Obstetrics*. In the spring of 1876 she was awarded the Boylston prize offered by Harvard College for the best essay on the subject, "Do women require rest during menstruation?"

**Janse** (Anneke) came to this country in the year 1630, with her husband, Roeloff Jansen of Maesterlandt in Holland, his servant, and family, said Roeloff having been sent out by Patroon Van Rensselaer to his colony at Albany as assistant *bouwmeister*, or steward. She subsequently removed to New Amsterdam (now New York) with her husband, where in 1636 they obtained, jointly, a grant of 62 acres of land on the W. side of Broadway, extending from about Warren to Christopher street, in the city of New York, now in possession of Trinity church. Roeloff Jansen dying, his widow married, in the spring of 1638, the Rev. Everardus Bogardus, minister of the Dutch church of said city, who was drowned on his passage to Holland in 1647, leaving her again a widow, with eight children—four by each husband. In 1654, Anneke Janse obtained a patent in her own name of the farm above mentioned W. of Broadway, about which time she returned to Albany, where she died in 1663, and lies buried in the churchyard of the Middle Dutch church. For a century or more her descendants have maintained a claim to the real estate above described, and have intermittently threatened to institute legal proceedings against Trinity church.

**Jenckes** (Thomas A.), b. at Providence in 1818; graduated at Brown University in 1838; studied law, and became a prominent member of the Rhode Island bar; was clerk of the State legislature 1840–45, and member of the 38th, 39th, 40th, and 41st Congresses. D. at Cumberland Nov. 5, 1875. He was the author and advocate of the bill which established a uniform system of bankruptcy throughout the U. S., and in the 40th Congress he introduced a bill to regulate the civil service of the U. S., and to promote the efficiency thereof.

**Johns Hopkins University,** Baltimore, Md., was founded by Johns Hopkins of Baltimore Aug. 24, 1867, and at his death (Dec. 24, 1873) endowed by a bequest of over $3,000,000. The only condition he imposed was that the principal should not be used for building. The university will eventually be located at Clifton, the late residence of Johns Hopkins, just outside the city, containing 330 acres, which will be appropriately laid out. Prior to the erection of buildings at Clifton, chemical, physical, and biological laboratories, lecture and recitation rooms, library, etc., have been provided in Baltimore. The philosophical department, comprising the chairs of ancient and modern languages, chemistry, physics, biology, history, etc., was opened Oct. 3, 1876. The faculties of law and medicine will be organized at a later date. The university is entirely unsectarian in its character, and designed to promote special advanced study, which it is enabled to do by its large endowment. In order to give young men opportunities to carry on their studies, the trustees have offered to college graduates from any place twenty fellowships or graduate scholarships for special excellence in either philology, literature, history, ethics and metaphysics, political science, mathematics, engineering, physics, chemistry, or natural history. These are valued at $500, tenable for a year and renewable. Twenty scholarships, freeing the holder from tuition, are open to students from Maryland, Virginia, and North Carolina, and five to students from any place. Mr. Hopkins also left $3,000,000 to establish a hospital, which he desired should co-operate in the advancement of medical science and education. Daniel C. Gilman is the first president of the university.

**Joynes** (Levin Smith), M. D., b. in Accomack co., Va., May 13, 1819; was educated at Washington College, Pa., receiving there A. B. in 1835, and the same degree subsequently from the University of Virginia, as well as that of M. D. from that institution. He then attended lectures in the University of Pennsylvania, and spent two and a half years in Europe; in 1846 was elected professor of physics and legal medicine in Franklin Medical College, Philadelphia; then professor of the institutes of medicine and medical jurisprudence in the Medical College of Virginia (Richmond) 1856; was also made dean of its faculty. In 1872 he was appointed permanent secretary of the State board of health for Virginia. He has contributed largely to various medical journals. Paul F. Eve.

# K.

**Katz Awa,** b. in the province of Shidzuoka, Japan, but known as a Tokio-man; early became attached to the navy; commanded one of the government ships which brought the Japanese embassy to San Francisco in 1861; was assistant minister under the tycoon's government, also a member of the tycoon's cabinet; several years after the close of the rebellion was made assistant minister of the navy under the new government; in 1873 was made a Sangi or privy councillor, as well as minister of the navy, and in 1875 he was appointed a member of the Genro-in or new parliament of Japan. F. A. P. Barnard.

**Kawamoora Smiyoshi,** b. in the province of Satsuma, Japan, about the year 1835; was well educated, and made the tour of the world for purposes of information; during the late change of government he rendered important service to the cause of the mikado in various capacities, and was subsequently made vice-minister of the navy department, in which position he was still serving as late as the close of 1875. F. A. P. Barnard.

**Kel'ly** (John), b. in the city of New York Apr. 21, 1821, in the public schools of which he was educated; was apprenticed to the grate and furnace-setting trade, and subsequently engaged in that business; was elected alderman in 1853, member of Congress in 1854 and 1856, sheriff of New York in 1858 and 1864; undertook in 1872 the reorganization of Tammany Hall in opposition to the Ring, and was appointed comptroller in 1876.

**Kem'ble** (John Mitchell), oldest son of Charles Kemble, b. in London in 1807; graduated at Trinity College, Cambridge; visited Germany in 1829, and became acquainted with the brothers Grimm, Thiersch, and other eminent philologists; devoted himself to the study of the earliest Teutonic dialects, and published in 1833 *The Anglo-Saxon Poems of Beowulf*, with a glossary and translation; edited from 1835 to 1844 the *British and Foreign Quarterly Review*, and published in 1839–40 the *Codex Diplomaticus Ævi Saxonici*, and in 1849 *The Saxons in England*, his best-known work. During a residence of six years in Hanover (1849–55) he made extensive excavations in sepulchral barrows for the Hanoverian Museum, and published numerous essays in both German and English periodicals. His *Horæ Ferales, or Studies in the Archæology of the Northern Nations*, begun in 1857, was completed after his death by Dr. R. G. Latham. D. at Dublin Mar. 26, 1857.

**Keo'ta,** Ia., p.-v., on the line of Keokuk and Washington cos., has 1 flouring-mill, 1 foundry, 4 churches, Wilson's Park (presented by Hon. J. F. Wilson), good city school, and 2 private banks. Oskaloosa branch of Chicago Rock Island and Pacific R. R. runs through the town. P. 1287. G. L. Reed, Ed. "Keota Eagle."

**Key** (David M.), b. in 1824 in Greene co., E. Tenn.; graduated at Hiwassee College 1850; admitted to the bar 1853; in the Confederate army 1861–65; was appointed Andrew Johnson's successor in the Senate in 1875, and entered Pres. Hayes's cabinet in 1877 as postmaster-general.

**Kido Takayossi,** b. in the province of Choshiu, Japan, about 1833. His province was one of the first to raise the standard of revolt against the late tycoon, and he was one of the chief emissaries in organizing the army; after peace was restored he was made a member of the privy council; was a member of the embassy which visited America and Europe in 1872, but returned home before the embassy, and received the appointment of Sangi, which he accepted and held for a time; was next appointed to a distinguished position in the imperial household, and in the early part of 1875 was again elevated to the rank of Sangi. F. A. P. Barnard.

**Kin'zua,** or **Kenjua,** p.-v. and tp., Warren co., Pa., on Alleghany River, near mouth of Kinzua Creek. P. 318.

**Knapp's Leather.** In 1855, Belford patented a process for tanning leather with oxide of iron, but the leather produced was of poor quality. The use of solutions

of ferrous and ferric, chromous and zinc salts was also tried, but without success, till Knapp suggested fixing the oxides of these metallic salts in the form of insoluble soaps in the substance of the hides. This he accomplished by immersing the skins in a solution of soft soap (3 to 5 per cent.), and then in a solution of a salt of iron or chromium (5 per cent.). The treatment was repeated till a sufficient quantity of the insoluble metallic soap was produced in the skins. They were then washed in water and dried. Although the appearance of good leather can thus be imitated, its best properties are wanting. (See LEATHER, in CYCLOPÆDIA.)

**Knox** (THOMAS W.), b. at Pembroke, N. H., June 26, 1835; spent several years as a teacher at Kingston; went in 1860 to Colorado; was for some time editor of the Denver *Daily News*, and subsequently correspondent of the New York *Herald;* accompanied in 1866 an expedition sent to construct a telegraph through Northern Asia, and crossed the Pacific and Siberia from Kamtchatka to the Ural; travelled in 1873 from Vienna through Southern Russia, Turkey, Asia Minor, Palestine, and Egypt; visited in 1875 Spain, Morocco, and the Desert of Sahara, and published, besides numerous articles, *Overland through Asia*, *Backsheesh, Camp-Fire and Cotton-Field*, *Underground*, etc.

**Kunzé** (RICHARD E.), M. D., b. at Altenburg, Germany, Apr. 7, 1838; emigrated to the U. S. in 1854; entered the office of Dr. Charles J. Stearns, Plainfield, N. J., in 1856; graduated from the Eclectic Medical College of New York in 1868, of whose board of trustees he subsequently became a member, and published a series of monographs on *Cactus* (1874), *Cereus grandiflorus and Cereus Bonplandi* (1875), *Cereus triangularis and Phyllocactus grandis* (1876), etc.

**Kuroda Kiyotaka,** b. in the province of Satsuma, Japan; is about forty years of age; was well educated; at the beginning of the late revolution was an aide-de-camp to one of the generals of the army; after the war was made chief assistant of the department for colonizing Yeso; visited England and America in 1871; concluded the arrangement which resulted in the appointment of Horace Capron as an adviser in Japan; in Aug., 1874, was made chief of the Kaitakushi, or colonization department of Yeso, and was also promoted to the rank of Sangi or state councillor, and also made lieutenant-general of the imperial army. Under his orders two steamships were built in the U. S., to one of which his name was given by the government; and it is eminently to his honor that he was the first of his countrymen who proposed and carried out the scheme to secure the education of the women of Japan in foreign lands, the importance of which had greatly impressed him while travelling in America.

F. A. P. BARNARD.

# L.

**Labyrinth'odon** [Gr. λαβύρινθος, a "labyrinth," and ὀδούς, a "tooth"], the typical genus of an extinct order of reptiles, or, more properly, amphibians, the Labyrinthodontia, which appeared in the Carboniferous period, but attained their greatest development in the Triassic, soon after which they seem to have finally disappeared. They are regarded as belonging with the amphibians, but possess characters allying them with the ganoid fishes on the one hand and with true reptiles on the other. The head is defended by a casque of sculptured bony plates, usually hard and polished. There are two occipital condyles. The vomer is divided and supports teeth. The bodies of the vertebræ, as well as the neural arches, are ossified, except in some of the earlier forms, and the former are biconcave. The ribs, when present, are short. There are usually large palatine openings. The body is covered with plates or scales.

The structure of the teeth is peculiarly complicated, and suggested the name for the order. The thin coating of cement upon the exterior of the teeth is striated lengthwise, and from each of the striæ proceeds a vertical fold or duplicature of cement inflected into the dentine, constituting the body of the tooth. This fold runs straight for a short distance, then becomes wavy, and the undulations, at first simple, become exceedingly complex toward the interior of the tooth, until the fold, in the case of the comparatively few that extend so far into the tooth, terminates in a slight dilatation or loop close to the pulp-cavity. The disposition of the dentine is still more complicated. It consists of a slender, central, conical column surrounding the pulp-cavity, and radiating outward from its circumference is a series of vertical plates which divide into two once or twice before reaching the periphery of the tooth. Each of these plates gives off also, through its course, smaller processes, which often divide in turn before they terminate, and their contour is seen in the transverse section of the tooth to partake of all the undulations of the folds of cement which invest the dentinal plates and separate them from one another. From the pulp-cavity fissures also radiate, corresponding in number with the radiating plates of dentine continuing along the middle of each plate, dividing where it divides, and extending with each process to within a short distance of the cement. The main fissures extend nearly to the circumference of the tooth, where they expand into subcircular openings. Throughout every part of this complicated tooth the calcigerous tubes of the dentine obey the usual law, traversing it nearly at right angles to the surface invested by the dentine, forming, as Prof. Owen has said, "the most beautiful and complicated modification of dental structure hitherto known."

*Labyrinthodon* (*Mastodonsaurus Jaegari*) has a skull upward of three feet long and nearly two feet broad, and is from the Triassic formation of Würtemberg in Germany. Several other species are found in the same formation of Warwickshire, England. The genus *Metopias* has the skull broad and obtuse, orbits small and distant, and is from the Keuper. *Zygosaurus*, from the Permian beds at Orenburg, has the orbits large and approximate. *Dasyceps Bucklandii*, from the Permian of Kenilworth, England, has the cranium ten inches long. In this country, *Baphetes planiceps*, from the Pictou coal, Nova Scotia, has the head broad, the muzzle obtuse, and the orbits large. *Amphibamus grandiceps* had an elongated tail like a salamander, large orbits, and numerous teeth. The skull is about three-fourths of an inch across. It is from the coal-measures of Illinois. *Raniceps Lyelli*, from Ohio, is named from the similarity of its head to that of a frog. Other labyrinthodons of the Triassic in this country are perhaps indicated by tracks in the sandstone of the Connecticut Valley. These are four- or five-toed, and often hand-shaped. Some of these animals used all four feet in walking; others, only the hind feet. The largest of these supposed labyrinthodons was *Otozoum Moodii*. The length of its track was twenty inches, and its stride three feet. Others were quite small, some tracks being not over one-fourth of an inch in length. Nearly twenty genera of labyrinthodons have been described from the Carboniferous strata of Great Britain and Germany, and more than half as many more from North America. The Triassic species were mostly of large size, and their remains occur in India, South Africa, and Australia, as well as Europe and America. Later than the Triassic very few are known, but *Rhinosaurus* is from the Jurassic of Russia.

O. C. MARSH.

**Lacer'tidæ** [from *lacerta*, "lizard," and the patronymic affix *-idæ*), a family of the reptile order Sauria, sub-order Pleurodonta, and group Leptoglossa (in which the tongue is elongated and bifid), characterized by the simple premaxillary bones, roofing of the temporal fossæ, the development of the nostril on an intersquamal suture, and the presence on the tongue of oblique plicæ, which project forward and inward: the head is covered with large and regular plates; the scales on the back and tail are imbricated, those on the sides granular, and those on the abdomen are oblong or squarish and in transverse bands. This family is composed of the typical lizards and those resembling them, and is quite rich in species: most of them are inhabitants of the Old World, and the representatives of the family in America are aberrant. The genera *Lacerta* and *Zootoca* are the best known, as those to which the familiar European species belong; the sand lizard (*Lacerta agilis*), the green lizard (*Lacerta viridis*), and the "common lizard" of England (*Zootoca vivipara*) are examples.

THEODORE GILL.

**Lacertil'ia,** a name used as the ordinal designation of the Sauria or lizards by some recent authors. (See SAURIA, in CYCLOPÆDIA.)

THEODORE GILL.

**Lamm** (ÉMILE). See FIRELESS ENGINE, in CYCLOPÆDIA.

**Land Law and Ownership in the U. S.** The fundamental conceptions in regard to the ownership, acquisition, and transfer of lands in the U. S., while natural and exceedingly simple, form an important and peculiar element of the American jurisprudence, and are most intimately related to the national progress. Originating

among the early colonists, these notions have reacted most powerfully upon the habits of thought, mode of life, and institutions of the entire people, have aided their material and social development, and have contributed much to the successful establishment of a democratic republic. The object of the present article is to show the practical operation and results of this theory in the commercial activities of the country and in the constitution of society. The peculiarities of our American system can be best perceived and understood by placing it in contrast with that which exists in England, the country from which a great part of our jurisprudence was originally derived.

The manners, customs, and institutions of feudalism left deeply imbedded in the common law the principles from which the entire body of doctrines and rules concerning real property were logically deduced by the courts. While these ancient doctrines and rules have been greatly modified by modern parliamentary legislation, the effects which had been wrought upon society during the domination of feudal notions cannot be obliterated by statutes; they remain, and doubtless will remain until the English national character undergoes a radical change. The feudal system itself, and the real-property law which resulted from it, have been fully described in articles under various titles. Its fundamental conception was the double ownership of land and the doctrine of *tenure*, the ultimate absolute property residing in a superior, from whom the beneficial owner *held* his estate, his right being thus derived and subordinate. The practical rules which were deduced from this principle need not be recapitulated. It is sufficient to say that, according to the common-law theory, no occupant or possessor, no owner of the fee even, is clothed with a complete and absolute property in the soil; in the king alone, as the original source, is this right finally vested. The most remarkable and important of the social effects wrought by feudalism are the preference given to land as an object of property, the personal distinction conferred by its ownership, and the consequent desire to hold it in large quantities, and to perpetuate such acquisitions undiminished from generation to generation in the same families. These motives, operating in Great Britain for centuries, have greatly reduced the number of proprietors, have favored the growth of enormous private estates, have impeded the free transmission of land, and practically withdrawn a large part of it from the operations of trade and commerce, and have upheld the overwhelming social and political power of the landed aristocracy. Opposed to the complex and artificial rules of feudalism is the simple and apparently natural mode of ownership termed "allodial." Wherever it prevails every proprietor owns his tract of land absolutely, in his personal right, and not as a tenant from, or subordinate to, any superior. The notion of "tenure" is utterly foreign to the system. Even the state is not regarded as possessing the ultimate right and as the source of title in the feudal sense, but only in a political sense and from reasons of public policy. When all private property in a certain parcel of land fails, the ownership must of course pass to some one, and a political necessity requires that it should at once vest in the state and not in the first occupant of the vacant soil. For this reason and to this extent the allodial theory regards the state as the final proprietor in case of escheat, but not as the original source from which the right of property was derived by the doctrine of tenure. It also admits the right of eminent domain; but this right is political, and not feudal, in its nature; from it is derived the power to take private property by taxation, and for public uses upon making just compensation. (See EMINENT DOMAIN, in CYCLOPÆDIA.) The feudal theory of landed property has exerted, and still continues to exert, a most powerful influence not only upon legal literature, but upon the conceptions and habits of thought of the entire legal profession, upon the judicial opinions of courts, and even upon the form and language of statutes. Although the common law of real estate, as derived from the feudal institutions, has been much modified in its details by modern acts of Parliament, yet the underlying principles of the system have never been abolished in England. Allodial ownership is there unknown; the doctrine of tenure is still retained, and extends to every private estate in the kingdom. The English legal writers necessarily discuss and expound these dogmas. Their works are constantly consulted by the American lawyers and judges, many of them being regarded as treatises of the highest authority; indeed, it is from Blackstone, who sets forth the feudal elements of the common law unaffected by legislation, that a vast majority of our bar obtain their first knowledge of jurisprudence, and his account enters into and colors all their conceptions and opinions. The same mode of treatment is pursued by the leading American writers upon the law of real property. The institutions of the feudal system, its fundamental doctrine of tenure, and its technical terminology, occupy as prominent a place in their writings as in Blackstone's *Commentaries* or Cruise's *Digest*. The American law concerning land is thus represented, in the treatises generally used by the profession, as founded upon and fashioned by the doctrines of feudalism, while the fact is practically ignored that in every State of the Union, by the most solemn modes of legislation, the peculiar principles of that system, its underlying forms and conceptions of property in the soil, have been wholly abrogated, and the simple method of allodial ownership has been substituted in their stead.

The very basis of the land laws prevailing throughout the U. S. is the legislation which abolishes the theory of a double ownership, abrogates the doctrine of tenure, and creates an absolute, personal, underived right in every individual proprietor. It has been expressly adopted by the statutes of many States, and in some of them has even been incorporated into the constitutions which form their organic law. Although these statutes and constitutional provisions may differ somewhat in their language, their meaning and legal effect are everywhere the same. They utterly repudiate the feudal conceptions and notions upon which the common-law rules were constructed, and declare all property in the soil to be purely allodial. The abolition of tenure and the substitution of allodial in the place of feudal ownership have worked a change in every department of the law concerning land, but this change is the most radical and complete in the following general branches or subdivisions of the system: escheat, the doctrine of seizin, inheritance, the liability of land to be taken for debt, and conveyancing, which last branch includes mortgages, land-contracts, and the statutory methods of registration or recording. (For the modifications and amendments which have been thus wrought in these portions of the real-estate law the reader is referred to the various titles in which they are described.)

Before proceeding to describe the practical operation and social effects of the law, I shall briefly explain the "public-land" system of the U. S. government. The importance of this system as an element of our national development cannot be over-estimated. The greater part of the soil throughout the Ohio and Mississippi valleys, and stretching across the continent to the Pacific Ocean, was once or is now the public domain of the U. S., and the U. S. is therefore the source of title to the great majority of private owners in the States and Territories which have been formed within that vast area. There are, however, some exceptions to this general statement. The French, Spanish, and Mexican private grants in the Louisiana purchase, in Texas, in California, and in some other States of the Pacific slope, were protected by the various treaties of cession, so that the present owners of such grants do not derive their titles directly from the U. S. A few of the original thirteen States, claiming to be proprietors of the unoccupied soil lying W. of their boundaries, had granted some portions thereof to private purchasers before they surrendered their rights to the nation; and, finally, large gifts of the public lands have from time to time been made to individual States. With all these exceptions, a very great majority of the private ownerships in the States occupying the Ohio and Mississippi basins, and in the territory extending to the Pacific, are derived from the national government as the first proprietor. At an early day Congress adopted an exceedingly simple and beautiful method of dividing and laying out the public domain, which, with a few local changes, has been pursued to the present time. The following are the general features of this system: Certain "principal meridians" and parallels of latitude are first carefully established by astronomical measurement for the purpose of being used as "base-lines." The entire domain is laid out into squares of six miles on each side by means of meridians and parallels of latitude six miles apart. Each of these squares, containing 36 square miles, or 23,040 acres, "as nearly as may be," is termed a "township." All the townships situated N. and S. of each other constitute one "range;" and it is plain that the land would thus be divided into contiguous ranges each six miles wide, and containing a greater or less number of townships according to its length. These ranges are numbered in order I., II., III., etc., E. and W. from the "principal meridians," which meridians are designated by particular names. The townships in each range are also numbered in order 1, 2, 3, etc., N. and S. from a parallel of latitude established as a "base-line." Thus, taking any given "principal meridian," the ranges would be R. I. E., R. II. E., R. I. W., R. II. W., etc., and in each of these ranges the townships would be T. 1 N., T. 2 N., T. 1 S., T. 2 S., etc. A township is divided by parallels of latitude and longitude one mile apart into 36 squares called "sections," each containing 1 square mile, or 640 acres, "as nearly as may be." The sections in every township

are numbered from 1 to 36, always commencing at the N. E. corner of the township and going W. from 1 to 6, then going E. from 7 to 12, then W. from 13 to 18, and so on alternately to No. 36, which is always at the S. E. corner of the township. These sections are divided into "quarter sections" half a mile square, and containing 160 acres. The quarter sections are sometimes subdivided into halves of 80 acres, and even into quarters of 40 acres. This system of measurement is so simple and perfect that not only may the smallest subdivision be accurately described, but may be readily found and located from the description. Thus, the N. W. quarter of Section 7 in Township 3, N., in Range 4, W., of —— Meridian, describes a certain 160 acres of land without any possibility of doubt, and this 160 acres can be located by the purchaser without any possibility of mistake. The statute provides means for correcting the errors which result from the "convergency" of meridians as they run northwardly, and also special modes for surveying lands bordering upon rivers and the shores of lakes and of the ocean; but as these provisions are somewhat complicated and technical, and do not affect the general features of the system, it is unnecessary to attempt their explanation. The management of the public lands under the various acts of Congress is committed to a bureau of the department of the interior called the general land-office, which is presided over by a commissioner. Each of the Western States and Territories in which the lands are situated is divided into one or more "districts," and in every district is established a "land-office," with two officials, a "register" and a "receiver." The principal duties of the register are the supervision of sales and the entry and location of tracts selected by purchasers or by the holders of warrants and scrip. All payments of purchase-money are made to the receiver. The system as now established by law, and which extends generally to all unappropriated domain except mining and saline regions and the portions within the limits of cities and villages, contemplates public and private sales, the pre-emption of tracts by actual settlers, and the donation of homesteads. The general price fixed for private sale and for the minimum at public sale is $1.25 per acre; but for land situated in townships alternating with those granted to railroads the price is $2.50 per acre. No sale is ever made upon credit. The purchaser either at public or private sale must pay the price immediately. Upon presenting the "receiver's" receipt for this payment to the register, that officer locates and enters the land in the purchaser's name by its range, township, section, and quarter section numbers, and delivers a certificate of such location and entry. This certificate confers an equitable title which is recognized and protected by the courts. The legal title is conveyed by a "patent," which is issued by the commissioner of the land-office in the name of the President. Any citizen, or foreigner who has declared his intention to become a citizen, if twenty-one years of age, who has actually settled upon an unappropriated quarter section and has erected a dwelling-house thereon, acquires a right of "pre-emption;" that is, he acquires the right to purchase that specific 160 acres at the minimum price, although he had not applied to the district office or located the tract before his settlement. Finally, such an actual resident is permitted to take up, without payment of any price except certain fees, 160 acres of $1.25 land or 80 acres of $2.50 land as a homestead; but the patent therefor will not be issued to him until he has resided upon the land for a period of five years. In case of his death before the five years have expired, the privilege extends to his heirs. In addition to its sales and homestead gifts, the government has also adopted the policy of making extensive donations to others than actual occupants. This policy, which was at first acted upon with caution and for very special objects, has of late years been pursued to such an extent that a large portion of the most valuable lands have been recklessly squandered, and vast amounts have fallen into the hands of private owners, who hold them for purposes of speculation. These donations have been made in two forms: (1) of specific tracts, ascertained and described in the statute itself; and (2) of scrip and warrants, which are written instruments issued by the government entitling the holder to a designated number of acres, which may be located by him out of any lands remaining unappropriated. Of the former kind are the cessions made to various Western and Southern States for educational and other purposes and the grants made to railroads; of the latter are the military-bounty warrants issued to soldiers and sailors on account of services during war, and the scrip which was a few years ago distributed in proportional quantities among all the States for the endowment of agricultural schools and colleges. The railroad grants have generally conveyed to the corporations the alternate townships lying on both sides of their projected routes, and as these routes, excepting the Pacific roads, usually run through regions at least partially settled and improved, the lands thus alienated have always been valuable and of a character that would most readily have found a market. Military-bounty warrants and agricultural scrip before location simply represent a right to obtain the designated amounts of land; they do not confer even an equitable title to any specific tracts, but are merely things in action. Upon the presentation of a warrant or scrip to a register the number of acres called for are selected, and the certificate of location and entry is issued, which is consummated by a patent as in cases of ordinary purchase. The original policy of the general government was well adapted to prevent the accumulation of large tracts in the hands of single owners. To this end the statutes provide that at public sales the land must be offered in quarter sections, at private sales in sections or their subdivisions; that no person can obtain a pre-emptive right who already owns 320 acres; and that the right of pre-emption cannot be exercised more than once. It is to be feared that the beneficial effects of these restrictions have been seriously interfered with by the extensive donations to railroad companies and the enormous issue of bounty warrants and land scrip.

As a preliminary or introduction to an explanation of the practical operation of this American theory of land-ownership, I insert a table of exceedingly interesting facts taken from the U. S. census of 1870. It contains for each State the number of farms, the number of acres of improved and of unimproved land therein, the average size of these farms, and the assessed value of all the real estate belonging to private owners. The true value of the latter item would be at least one-half greater. The census returns do not furnish the total number of private ownerships occupied and used for manufacturing and business purposes, for dwellings, and the like, nor the amount or value of the public domain belonging to the U. S. Although it is impossible, therefore, to present the complete results of the national land-system, its necessary and beneficent effects are clearly and sufficiently illustrated by subjoined statistics concerning the present condition of agricultural property:

*Table of Farms in the U. S., with the Amount of their Improved and Unimproved Land, and their Average Size—compiled from the Census Returns of 1870.*

| States, etc. | Number of farms. | Total number of acres. | Do. improved. | Do. not improved. | Average size of farms. | Total value of real estate (assessed). |
|---|---|---|---|---|---|---|
| Alabama .... | 67,382 | 14,961,178 | 5,062,204 | 9,898,974 | 222 | $117,223,043 |
| Arizona ..... | 172 | 21.807 | 14,585 | 7,222 | 127 | 538.355 |
| Arkansas.... | 49,424 | 7,597,296 | 1,859,821 | 5,737,475 | 154 | 63.102.304 |
| California.... | 23,724 | 11,427,105 | 6,218,133 | 5,208,972 | 482 | 176,527,160 |
| Colorado..... | 1,738 | 320,346 | 95,594 | 224,752 | 184 | 8,840,811 |
| Connecticut.. | 25,508 | 2,364,416 | 1,646,752 | 717,664 | 93 | 204,110,509 |
| Dakota ..... | 1,720 | 302,376 | 42,645 | 259,731 | 176 | 1,695,723 |
| Delaware.... | 7,615 | 1,052,322 | 698,115 | 354,207 | 138 | 48.744,783 |
| D. of Columb. | 209 | 11,677 | 8,266 | 3.411 | 56 | 71,437.468 |
| Florida..... | 10.241 | 2,373,541 | 736,172 | 1,637,369 | 232 | 20,197,691 |
| Georgia..... | 69,956 | 23,647,941 | 6,831,856 | 16,816,095 | 338 | 143.948,216 |
| Idaho..... | 414 | 77,139 | 26,603 | 50,536 | 186 | 1,926,565 |
| Illinois ..... | 202,803 | 25,882,861 | 19,329,952 | 6,552,909 | 128 | 348,433,906 |
| Indiana..... | 161,289 | 18,119,648 | 10,104,279 | 8,015,369 | 112 | 460,120,974 |
| Iowa..... | 116,292 | 15,541,793 | 9,396,467 | 6,145,326 | 134 | 226,610,638 |
| Kansas ..... | 38,202 | 5,656,879 | 1,971,003 | 3,685,876 | 148 | 65,499,365 |
| Kentucky.... | 118,422 | 18,660,106 | 8,103,850 | 10,556,256 | 158 | 311,479,694 |
| Louisiana.... | 28,481 | 7,025,817 | 2,045,640 | 4,980,177 | 247 | 191,343,376 |
| Maine..... | 59,804 | 5,838,058 | 2,917,793 | 2,920,265 | 98 | 134,580,157 |
| Maryland.... | 27,000 | 4,512,579 | 2,914,007 | 1,598,572 | 167 | 286,910,332 |
| Massachu'tts. | 26,500 | 2,730,283 | 1,736,221 | 994,062 | 103 | 901,037,841 |
| Michigan.... | 98,786 | 10,019,142 | 5,096,939 | 4,922,203 | 101 | 224,663,667 |
| Minnesota ... | 46,500 | 6,483,828 | 2,322,102 | 4,161,726 | 139 | 62,079,587 |
| Mississippi .. | 68,023 | 13,121,113 | 4,209,146 | 8,911,967 | 193 | 118,278,460 |
| Missouri. ... | 148,328 | 21,707,220 | 9,130,615 | 12,576,605 | 146 | 418,527,535 |
| Montana..... | 851 | 139,537 | 84,674 | 54,863 | 164 | 2,728,128 |
| Nebraska.... | 12,301 | 2,073,781 | 647,031 | 1,426,750 | 169 | 38,365,999 |
| Nevada..... | 1,036 | 208,510 | 92,644 | 115,866 | 201 | 14,594,722 |
| New Hamp... | 29,642 | 3,605,994 | 2,334,487 | 1,271,507 | 122 | 85,231,288 |
| New Jersey.. | 30,652 | 2,989,511 | 1,976,474 | 1,013,037 | 98 | 448,832,127 |
| New Mexico.. | 4,480 | 833,549 | 143,007 | 690.542 | 186 | 9,917,991 |
| New York.... | 216,253 | 22,190,810 | 15,627,206 | 6,563,604 | 103 | 1,532,720,907 |
| N. Carolina.. | 93,565 | 19,835,410 | 5,258,742 | 14,576,668 | 212 | 83,322,012 |
| Ohio..... | 195,953 | 21,712,420 | 14,469,133 | 7,243,287 | 111 | 707,846,836 |
| Oregon ..... | 7,587 | 2,389,252 | 1,116,290 | 1,272,962 | 315 | 17,674,202 |
| Pennsylvania | 174,041 | 17,994,200 | 11,515,965 | 6,478,235 | 103 | 1,071,680,934 |
| Rhode Island. | 5,368 | 502,308 | 289,030 | 213,278 | 94 | 132,876,581 |
| S. Carolina.. | 51,889 | 12,105,280 | 3,010,539 | 9,094,741 | 233 | 119,494,675 |
| Tennessee ... | 118,141 | 19,581,214 | 6,843,278 | 12,737,936 | 166 | 223,035,375 |
| Texas..... | 61,125 | 18,396,523 | 2,964,836 | 15,431,687 | 301 | 97,186,568 |
| Utah ..... | 4,908 | 148,361 | 118,755 | 29,696 | 30 | 7,047,881 |
| Vermont..... | 33,827 | 4,528,804 | 3,073,257 | 1,455,547 | 134 | 80,993,100 |
| Virginia..... | 73,849 | 18,145,911 | 8,165,040 | 9,980.871 | 246 | 279,116,017 |
| Washington . | 3,127 | 649,139 | 192,016 | 457,123 | 208 | 5,146,776 |
| West Va..... | 39,778 | 8,528,394 | 2,580,254 | 5,948,140 | 214 | 95,924,774 |
| Wisconsin ... | 102,904 | 11,715,321 | 5,899,343 | 5,815,978 | 114 | 252,322,107 |
| Wyoming.... | 175 | 4,341 | 338 | 4,003 | 25 | 863.665 |
| Totals..... | 2,659,985 | 407,735,041 | 188,921.099 | 218,813,942 | 153 | $9,914,780,825 |

This table exhibits at one view, more clearly than can be done by any commentary, the surprising results of a free ownership and commerce in lands—results which are identified with our material development, the stability of our political institutions, and our very national life. It appears that in 1870 there were throughout all the States and Territories 2,659,985 separate farms. (The census also shows that the farmers and planters were 2,977,711.) This enormous number does not include town and city lots

for dwellings, tracts devoted to mining, manufacturing, and business, nor any other lands not exclusively agricultural. With very few exceptions these farms are all owned in fee (either legally or equitably) by their occupants. An exceedingly small proportional part of them are held by lessees, while a very few comparatively are possessed by life-tenants. The average size throughout the whole country is 153 acres. By far the largest average is found in California, 482 acres; the smallest among the States occur in Connecticut, 93; Rhode Island, 94; New Jersey and Maine, 98; among the Territories, in Wyoming, 25, and Utah, 30. The average through the Southern States is somewhat greater than through the Northern, but the difference in this respect is less than it has been usually supposed to be. Alabama, 222; Arkansas, 154; Georgia, 338; Mississippi, 193; South Carolina, 233; Tennessee, 166, may be contrasted with Wisconsin, 114; Vermont, 134; Oregon, 315; New Hampshire, 122; Michigan, 101; Minnesota, 139; Illinois, 128; New York, 103. The census discloses in this connection another very important fact, which demonstrates the irresistible workings of our free system. It has been generally supposed that in the Northern and Western States, especially in the oldest and most populous, the size of individual farms was gradually increasing; that smaller estates were absorbed in the greater; and that the number of separate ownerships was thus growing less as the rich and prosperous became richer and the poor and unsuccessful were obliged to succumb to their more powerful neighbors. The tables tell a very different story. In every State and Territory, with four exceptions, the average size of farms has decreased during the period between 1860 and 1870. The exceptional four are California, where there has been an increase from 466 to 482; Massachusetts, from 94 to 103; Utah, from 25 to 30; and Wisconsin, where the average, 114, was the same in both years. The decrease has been the greatest throughout the Southern States, because the plantations have been to a considerable extent subdivided into small farms and sold to negro owners—a change which will prove to be of incalculable advantage to the South. The following are the averages in several of the former slave States for the years 1860 and 1870: Virginia, 324–246; Tennessee, 251–166; Texas, 591–301; South Carolina, 488–233—the increase in the number of farms being from 33,171 to 51,889; North Carolina, 316–212; Mississippi, 370–193; Kentucky, 211–158; Florida, 441–232; Georgia, 430–338; Alabama, 346–222; Louisiana, 536–247—the greatest amount of decrease being in South Carolina, 255; Louisiana, 289; and Texas, 290 acres. Some other examples of this decrease are—Illinois, 146–128; Indiana, 124–112; Iowa, 165–134; Kansas, 171–148; Maine, 103–98; Minnesota, 149–139; Missouri, 215–146; New Jersey, 108–98; New York, 106–103. These statistics show that notwithstanding all the power of wealth to accumulate and retain, and notwithstanding all the opportunities offered by Congressional grants to mere speculative investments, the social and commercial law of free exchange has thus far proved irresistible in its operation; the tendency to multiplication of owners and diminution of estates has not been overcome, and it probably cannot be overcome until there is a radical change in the customs and habits of thought of the American people or in the circumstances by which they are surrounded.

The effect of this free system of land ownership and transfer upon the business and social activities, the habits of thought, and general plan of life of the American people, cannot be over-estimated. In the opinion of many foreign statesmen, among whom was Macaulay, the vast supplies of virgin soil open to cultivation, and the ease with which it may be acquired, have been the chief elements of security to our political institutions. Without accepting these extreme opinions, it is certain that the democratic republican principles of our government, and the theory of our land law and ownership, mutually correlate and support each other; both are essential to our conception of a free, self-governing people and to the organization of a free society. The feudal customs of entailing inheritances, of accumulating vast estates, and retaining them from generation to generation in the same families, of granting peculiar privileges to landed proprietors, and of withdrawing any considerable portion of the soil from active commerce, would long ago have arrested the national development, and would probably have undermined and overthrown our democratic institutions. In describing the practical operations of the system, the first important feature to be noticed is the fact that land has been brought within the domain of commerce, and, as far as is possible from its physical nature, has been assimilated to personal property. This result is produced by the law and the popular habits of thought working upon each other. There is no tendency to the accumulation of family estates on account of the pre-eminence or social superiority which real property confers upon its possessor. No such pre-eminence and superiority exist. There is no worship of land *as* land. It is regarded like chattels, as a commodity merely. It is bought and used as a means of production or of habitation or of speculation, but most owners are ready to sell at a profit. It is seldom that a farmer or a householder can be found who is not willing to dispose of his estate if he can gain thereby a reasonable advance upon his investment. This assimilation of land to chattels, this mode of treating it as an article of commerce, produces the utmost activity among the people themselves; it prevents stagnation; it affords constant opportunities for individuals to change their residence in order to improve their personal, domestic, or social condition. No communities or persons are rooted to the soil; everything is life, change, improvement, or at least the desire and anticipation of improvement. This is a picture of society which many English writers, under the influence of feudal and aristocratic notions, have severely criticised and harshly condemned; but every intelligent American knows that this very social condition has developed and contained the freedom, enterprise, and energy which subdued the wide domains of the Mississippi Valley and the Pacific slope to civilization, and within the period of fifty years built up populous commonwealths out of an unbroken wilderness. It should be particularly remarked that the freedom in the commerce of lands, and the absence of any tendency to their accumulation in families, which characterize the American social life, are not the results of any compulsory enactment or legal necessity. We have no law, as in France, restraining the owner in the disposition of his property and compelling the equal distribution of his land among his heirs. The great family estates in England, handed down from father to eldest son, are not, as a matter of fact, the result of ancient entails nor of the rule of primogeniture. They are invariably created and preserved by voluntary family settlements, by which the power of alienation may be suspended during lives in being. The same law prevails in every State of the Union, with the single modification in some of them that the suspension must be during *two* lives in being. The statutes, however, are a dead letter so far as they have produced any appreciable effect upon the ownership of land. The national habits of thought and customs, and the democratic principles which form a part of our social life, are opposed to the withdrawal of land from the activities of trade and commerce. These habits and principles have been efficient to prevent the evil, which has grown to such an enormous extent in England that the only adequate remedy which can be suggested for it by the most thoughtful economists and statesmen is legislation which shall deprive owners of their power of free disposition, and shall prevent the creation of any partial or future estates. The statistics of one county are given to illustrate the ease and frequency of transfer which characterize the ownership of land in the U. S. The county of Monroe is a wealthy agricultural district of New York, and includes the city of Rochester. Its farming population is remarkably intelligent and prosperous. The county was created in 1821. Its population was 49,855 in 1830, and has steadily increased, until in 1870 it was 117,868. From the first entry made in 1821 to the present day the records of deeds preserved in the registry office completely fill 295 folio volumes of 500 pages each, one deed, except in a very few instances, occupying a single page. Ten additional volumes are partly filled. During the fifty-five years since the organization of the county at least 147,500 different transfers of land lying within its boundaries have thus been made; of this enormous number a large portion were conveyances of lots in the city of Rochester. Another remarkable and necessary effect of our land-system is the enormous number of owners. The statistics already quoted show that in 1870 there were 2,659,985 farms, and that their average size had somewhat decreased, while their aggregate number had steadily and rapidly increased, during the last three decades. The law of free property has wrought the same result in the ownership of land occupied and used for all other purposes besides agricultural. In Great Britain a very few hundred thousand persons hold the fee of the entire kingdom; the millions are content to occupy the soil as tenants for life or for years; no one, as a general rule, acquires an absolute title by ordinary purchase unless he is already wealthy and wishes to enlarge his ancestral domain, or is ambitious to found a family which shall take its place among the landed gentry. In the U. S. a widely-different sentiment pervades all ranks and classes of society. Although land is regarded as an article of commerce, the desire to obtain its absolute ownership is universal. Farmers, merchants, professional men, mechanics, and even the common laborers, become proprietors. The American must at least own the tract on which he resides—his dwelling and its appurtenances;

without this his life would seem to have been a failure. The mechanic, artisan, or workman, with no resources but his wages, upon attaining his majority or upon marriage enters into an agreement for the purchase of a lot; the possession is given at once; the price is distributed into small instalments extending over several years, so that a homestead is finally secured by an annual payment saved from the daily wages not greatly exceeding the sum which would otherwise be expended for rent. The investment thus made, besides furnishing a home, may through its rise in value become a moderate fortune for the owner's children at his death. One example will sufficiently illustrate this general tendency to acquire the ownership of land, and the very large number of freeholders compared with the total population. Rochester, in the State of New York, is a typical American city. Its growth has been rapid and steady; its inhabitants are intelligent, enterprising, and prosperous. By the census of 1870 the population was 62,386; at present (1877) it is estimated at 80,000, as the city-limits have been recently extended. The assessment-rolls for the year 1876 show that the land within the municipal boundaries subject to assessment and taxation is owned in fee by 14,465 different proprietors. The proportionate number of householders or heads of families who are tenants and not owners is therefore very small, not exceeding 1 in every 10. This is not an isolated case. The same results will be found in every inland city and village of the U. S., though perhaps not to so great an extent in the seaport cities. The influence of this widespread ownership, and of this tendency among all classes of citizens to acquire a property in the soil, is most beneficial, not only upon society at large, but upon the personal character of its individual members. It promotes all the economic virtues—thrift, industry, care for the future, and the like—and the higher social virtues of love for the soil, patriotism, and conservatism in the true sense of that term. JOHN NORTON POMEROY.

**Lane** (JONATHAN HOMER), A. M., b. at Geneseo, Livingston co., N. Y., Aug. 9, 1819; graduated at Yale College in 1846; was appointed an assistant examiner of patents in 1848, and a principal examiner in 1851.

**Lay** (JOHN L.), b. at Buffalo, N. Y., Jan. 14, 1832; entered the U. S. navy in 1861 as assistant engineer; invented and designed the torpedo device with which Lieut. Cushing destroyed the Confederate ram Albemarle; and went, after the fall of Richmond, up the James River in the Spuyten Duyvel, removing the obstructions in advance of Admiral Porter's fleet. After the close of the war he entered the service of Peru, and while engaged in preparing fixed mines and placing suspended torpedoes in order to prevent the Spanish fleet from approaching the harbor of Callao, he first conceived the idea of a locomotive torpedo. In 1867 he returned to the U. S., and his idea then ripened into the invention of the so-called "Lay electro-travelling torpedo," which can be sent from shore or from shipboard to any point within its range, all its movements being under the control of the operator. H. L. STUART.

**Leath'er-Board,** an article much used in the manufacture of boots and shoes. It is made of old manila rope, hemp rope, jute or linen canvas, and leather scraps, to which are added certain chemicals and a cement which makes it more impervious to water than leather. The rope or canvas and leather scraps are first ground to a pulp, the same as in the manufacture of paper. The pulp is then run off by a wet-cylinder machine and cut into sheets, usually 2½ by 3 feet; these sheets are then dried either in the sun about ten hours or by steam two hours, and are run through calendering-machines to smooth them, and are afterward pressed by still heavier machines to give an even surface and still greater solidity. It is also pressed into different forms convenient for use, among which are counters or stiffenings for boots and shoes, which by a patent process are made perfectly waterproof. These forms, being pressed by machines into a perfect fit for the various sizes, are considered superior to leather, as they hold their form better, and after being wet retain their original shape. The larger the percentage of manila rope or jute and linen waste, the better will be the quality of the board. This will be apparent when it is considered that manila retains its fibre, while leather does not. Although much used in the manufacture of boots and shoes, it is not confined to this industry alone, but is used considerably in the manufacture of toys, chair bottoms, etc. It was first manufactured in this country in Exeter, N. H., about thirty years ago. There are at present about 20 factories in the U. S., more than half of which are in Massachusetts, the largest being in Leominster, Groton, and Sudbury. There are also a few small factories in Canada, and an inferior article is made in England, but in limited quantities. Large quantities are annually exported, principally from Boston, to England, Germany, France, and elsewhere. The value of leather-board made in the U. S. in 1876 was about $1,600,000. There are about $1,000,000 invested in the business, employing about 500 men, to whom are paid wages to the amount of $300,000 annually. NAHUM HARWOOD.

**Leather, Knapp's.** See KNAPP'S LEATHER.

**Lighthouse Construction.** Three additions to the "lighthouses of the world," important specimens of engineering construction of "sea-rock lighthouses," have called for notice since the article in the CYCLOPÆDIA was written. On the Great and Little Bassas (or Basses: see note Vol. III. p. 19) rocks, lying off the S. E. coast of Ceylon, in the direct path of vessels plying between the Suez Canal and ports of India, China, Japan, etc., the Trinity House Corporation has constructed two lighthouses. The former (Dec., 1876) is completed, and the latter nearly so. "The Great Bassas rock is about 6 feet above mean water-level, and the Little Bassas is only awash at low water, and is 7 miles from the shore. These reefs, which are composed of hard red sandstone, are exposed to the full fury of the sea during the N. E. and S. W. monsoons, so that the days available for working are few, and these are almost exclusively during the prevalence of the N. E. monsoon, which commences in November and terminates in April; and even of this short period only half of it can be relied upon as safe for working. The towers are built of Scotch granite, the blocks of which were fitted together in the quarries before shipment. The blocks forming the walls and floors of both lighthouses are dovetailed together, both vertically and horizontally, upon the system adopted by Mr. Douglass in the Wolf Rock and Hanois lighthouses." To land the stone "a strong mast 45 feet high, and supported by chain-guys, was shipped into the rock in a vertical position, and from this was supported a derrick which could be swung over toward the tower by means of a chain and a crab. The steamer was moored at a distance of 180 feet from and parallel to the rock, and the blocks of granite contained in the hold were ranged on two tiers of rollers, so as to facilitate their being brought under the hatchway, where an iron lifting, working in guides, conveyed them to the level of the deck." The method of transference to the shores with the aid of the shore derrick cannot here be described. "By the very ingenious contrivance by which the stones were conveyed from the ship to the rock below the surface of the water they were out of the influence of the wind, and at the same time more than two-fifths of their weight was taken off, due to the difference between the specific gravities of granite and water. As these two lighthouses are but 20 miles apart, and very similarly situated, it was of the utmost importance to prevent the one being mistaken for the other either by day or night. Hence, a difference in the forms of the heads of the two towers, and also a difference in their lights. The Great Bassas light is distinguished at night by giving red flashes at intervals of 45 seconds, the duration of each flash being about 7 seconds, and that of the eclipses about 38 seconds." The illuminating apparatus of the Little Bassas lighthouse is of a novel character, being upon the very beautiful "group-flashing" system of Dr. Hopkinson, whereby flashes in groups of two or more are given in quick succession, instead of single flashes at stated intervals of time. (For a full description of the arrangement see *Engineering*, Oct. 27, 1876.)

A still more interesting engineering construction is that of the "Phare d'Ar-Men." The rock called Ar-Men, but 5 feet above the extreme low tide (which here rises — feet), is a part of a reef (Chaussée de Sein) stretching seaward 8 miles from the Isle of Sein, 20 miles S. of the port of Brest (France). The Chaussée de Sein had long maintained a sad celebrity amongst nautical men. "To anchor a floating light at its extremity had been recognized to be impossible, owing to the great depth of water and to the bottom being thickly studded with rocks. An iron structure was considered impracticable, since the boring of holes (of 0.18 m. or 0.20 m. in diameter) for receiving the posts would be one of the most tedious and difficult operations. Moreover, it was feared, owing to the principal planes of rock-cleavage being vertical, that the structure would not resist the shocks it would be subjected to; besides, it would be almost impossible to land the cumbrous pieces of the iron framing." The dimensions of the rock were ascertained to be 7 or 8 mètres in breadth by 12 to 15 mètres in length at the level of ebb-tides; the surface was very unequal, and divided by profound fissures. The surface descended gradually on the western side, but almost perpendicularly on the eastern. "The following mode of construction was therefore decided upon—viz. to bore holes 30 centimètres in depth and 1 mètre apart all over the site, and other holes outside this limit, in order to hold the ringbolts necessary for craft coming alongside, and to fasten the shrouds. The object of the first set of holes was to receive wrought-

iron gudgeons, to fix the masonry to the rock, and to make the construction itself serve to bind the different parts and fissures, and thus consolidated a base the precarious nature of which gave rise to some misgivings. It was proposed that in addition to these gudgeons others should be added, and strong iron chains introduced horizontally into the masonry as it rose, to prevent any possible disjunction."

The services of the fishermen of the Isle of Sein were resorted to for boring the holes. "Two men from each boat landed on the rock, and, provided with their cork belts, lay down upon it, holding on with one hand and using the jumper or hammer with the other; they worked with feverish activity, the waves constantly breaking over them. . . . At the close of the season seven landings had been effected, and eight hours of work accomplished, during which fifteen holes had been bored in the highest parts of the rock. . . . In the following year sixteen landings were effected, eighteen hours of work accomplished, forty new holes bored; and they even succeeded in partially levelling and preparing the work for the first course of masonry. The construction, properly so called, was undertaken in 1869. The galvanized wrought-iron gudgeons, 0.06 mètre square and 1 mètre in length, were fixed in the holes, and the masonry was commenced with small undressed stone and Parker-Medina cement. In fact, a cement of the most rapidly-hardening character was essential, for the work was carried on in the midst of waves breaking over the rock, and which sometimes wrenched from the hand of the workman the stone he was about to lay. . . . When a landing was practicable, the stones and small bags of cement were landed by hand, and care was taken to dress the surface of the masonry before commencing a new course. At the close of the season of 1869, 25 cubic mètres of masonry had been executed, and these were found intact the following year." At the date of the account quoted the masonry was raised 2.60 mètres above the highest tides. "The success of the undertaking may therefore be looked upon as assured, and at this stage the work may be expected to advance more rapidly."

From the foregoing, the Phare d'Ar-Men is *sui generis* among sea-rock "lighthouses;" it is the only one in which, instead of massive blocks dowelled and dovetailed into cohesive continuity, small irregular stones have, through necessity, been made to serve. (The foregoing is taken from *Notices sur les Modèles, Cartes et Dessins*, etc., kindly furnished the writer by M. Lavoinne, delegate of the French minister of public works to the Exposition at Philadelphia. In the same work are to be found notices of the lighthouses of Barges d'Olonne and Héaux de Bréhat, mentioned in LIGHTHOUSE CONSTRUCTION, in CYCLOPÆDIA.) J. G. BARNARD.

**Lock'wood** (BELVA ANN BENNETT), b. at Royalston, N. Y., Oct. 24, 1830; educated in a district school; taught school at fifteen for $5 per month and "boarded round;" was married at eighteen, but lost her husband next year; wrote for papers and magazines; graduated at Genesee College, Lima, N. Y., at twenty-seven; taught school eleven years; was married to Dr. E. Lockwood in 1868; studied law; graduated at the National University at Washington, D. C., and was admitted to the bar of the District in 1873. SUSAN B. ANTHONY.

**Long** (CRAWFORD W.), M. D., b. Nov. 1, 1815, in Danielsville, Madison co., Ga.; educated at the University of Georgia, graduating with honor in 1835; began to study medicine under Dr. George R. Grant in Jefferson, Ga., in 1836; graduated at the medical department of the University of Pennsylvania in 1839; soon after began to practise medicine in Jefferson, Ga. In 1842 he conceived the idea of using sulphuric ether as an anæsthetic in surgery, and on Mar. 30, 1842, performed the first operation on a patient fully etherized that the world has any account of. He performed other operations on etherized patients in 1842, 1843, and 1845. His discovery of anæsthesia in surgery antedates the claims of Horace Wells two years and eight months, and those of Morton four years and six months. (For a more circumstantial account of Dr. Long's claims see article WELLS (HORACE), in CYCLOPÆDIA.)
J. MARION SIMS.

**Long'shore** (HANNAH MYERS), b. May 30, 1819, in Ohio; married and moved to Philadelphia, where she began the study of medicine; entered the Woman's Medical College in Philadelphia in 1849; graduated with honor, and began practice. SUSAN B. ANTHONY.

**Lophobran'chii** [Gr. λόφος, "tuft," and βράγχια, "gills"], an order of fishes distinguished by the fibro-cartilaginous skeleton; the development of the bones of the head, and especially by the presence of but a single large operculum on each side; the production of the snout and lower jaw into a tube, at the end of which is the mouth, which is formed above by the intermaxillaries, behind which are the supramaxillaries; and especially by the gills, which (instead of being laminated, as in other fishes) are developed in the form of a row of tufted lobes on each of the branchial arches. The air-bladder is simple and closed, having no duct communicating with the intestinal canal. In all the species the dermal skeleton is largely developed, and composed of numerous angular plates in longitudinal rows. The muscles are mostly very little developed. This order, distinguished from all others by a peculiar modification of the gills, is represented by two types, which differ so much from each other as to have been elevated into sub-orders—viz. (1) Syngnathi, in which there is only a single dorsal fin and ventrals are entirely absent; and (2) Solenostomi, in which there are two distinct dorsal fins, the spinous one being developed, and ventral fins are present, and inserted near the scapular arch and under the spinous dorsal. Both groups are distinguished by peculiarities in the care which the parent fishes take of the eggs. In the Syngnathi the male receives from the female her eggs, and carries them on different parts of his body—*i. e.* on the breast or under the tail, either in a modification of the integument or a special pouch; while in the Solenostomi the female carries the eggs in a pouch formed by the coalescence of the ventral fins at the inner sides with the integuments of the breast. The family Pegasidæ, formerly included in this order, is now regarded as a teleocephal.
THEODORE GILL.

**Lo'zier** (CLEMENCE HAMED), M. D., b. Dec. 11, 1812, in Plainfield, N. J.; moved to New York 1814; taught a school for young ladies for eleven years; studied medicine, and graduated at the Syracuse College 1853; helped to found the New York Medical College and Hospital for Women and Children in 1863, and is dean and professor at that institution. SUSAN B. ANTHONY.

**Lub'bock** (FRANK R.), b. at Beaufort, S. C., Oct. 16, 1815; went to Texas in 1836; was chosen secretary of the house of representatives in the extra session of the first congress 1838; was twice appointed comptroller; held the position of county clerk of Harris county from 1843 to 1856; was elected lieutenant-governor in 1856 and governor in 1861; joined the Confederate army; took part in all the actions on Red River; served on the staff of Pres. Davis in Richmond; was captured, and imprisoned at Fort Delaware from Apr. to Dec., 1865; is at present (1877) treasurer of the city of Galveston. C. G. FORSHEY.

**Lu'kis** (WILLIAM COLLINGS), b. in England in 1817; graduated at Trinity College, Cambridge; held several benefices, and became rector of Wath-juxta-Ripon, Yorkshire, and rural dean of the deanery of Catterick East, which he now fills; is a member of various antiquarian societies, and published, besides other works, *Church Bells and Bell Foundries* (1858), *Danish Cromlechs and Burial Customs compared with those of Brittany, Great Britain, etc.* (1861); contributed articles on cromlechs, tumuli, and barrows to the *Journal of the British Archæological Society*, and written on "The Stone Avenues of Carnac," "Brittany Sepulchral Chambers, and their Chronological Order," and other antiquarian researches.

**Lycod'idæ** [from *Lycodes*—one of the genera—λυκῶδης, "wolf-like," and the family termination], a family of fishes of the order Teleocephali and sub-order Jugulares, whose representatives have an elongated, eel-like body, with the soft-rayed dorsal and anal fins confluent with the pointed caudal, and invested, like the body, in a loose skin; the anus submedian or anterior, and with a raised margin; the branchial apertures more or less restricted to the sides; minute jugular ventral fins or entirely wanting; and, generally, two rudimentary pyloric cæca. The family embraces three sub-families—(1) Zoarceinæ, (2) Lycodinæ, and (3) Gymnelinæ, the first of which is represented by a species along the coast of the U. S. (*L. anguillaris*), and the second and third by a number of species in the polar and especially Greenland seas. THEODORE GILL.

**Ly'man** (JOSEPH BARDWELL), b. Oct. 6, 1829, in Chester, Mass.; graduated at Yale College in 1850; was admitted to the bar in New Orleans, La., in 1856. Near the close of the civil war he came to New York, adopted journalism as a profession, and had been at the time of his death (Jan. 28, 1872) for several years agricultural editor of the New York *Tribune*. He was the author of several treatises on agricultural subjects, and with his wife wrote *The Philosophy of Housekeeping*.

**Lyman** (LAURA ELIZABETH BAKER), b. at Kent's Hill, Me., Apr. 2, 1831; graduated at the Wesleyan Academy, Wilbraham, Mass., in 1849; was married to Joseph B. Lyman July 14, 1858; in 1870 became known by a series of articles published in *Hearth and Home* under the *nom-de-plume* of "Kate Hunnibee." For years she has been editor of the "Home Interest" department in the New York *Tribune;* now edits also the *Dining-Room Magazine*, and is a contributor to several periodicals.

# M.

**McAdoo** (William Gibbs), A. B., A. M., b. Apr. 4, 1820, near Knoxville, Tenn.; graduated at East Tennessee University, Knoxville, 1845; was a member of the Tennessee legislature 1845–46; an officer in the Mexican war 1847; entered the law; was attorney-general of the Knoxville judicial district 1851–60; removed to Georgia in 1862; was captain in the Confederate service; appointed judge of the 20th judicial district of Georgia 1871; is author of published addresses, etc., and with Prof. H. C. White of Georgia, of *Elementary Geology of Tennessee*. Resides at Milledgeville, Ga. In 1857 he married Mary Faith Floyd, b. Sept. 8, 1832, who wrote *The Nereid*, a romance, and contributed largely to Southern periodicals.

**McCal'lum** (Daniel Craig), b. at Johnston, Renfrewshire, Scotland, Jan. 21, 1815; came to America with his parents at an early age; settled at Rochester, N. Y., and became an architect and builder; in 1851 invented the "inflexible arch truss bridge;" was general superintendent of the New York and Erie R. R. 1855–56; on Feb. 11, 1862, was appointed military director and superintendent of railroads in the U. S. Though to no individual belongs the credit altogether of the military railroad operations, McCallum was the acknowledged efficient head, and "for faithful and meritorious services" was brevetted brigadier and major-general. In June, 1865, he was mustered out of service, and in 1866 made a valuable report upon the military railroads under his charge during the war.

**McCra'ry** (George W.), b. at Evansville, Ind., Aug. 29, 1835; removed very early to that part of Wisconsin Territory which afterward became the State of Iowa; was educated in a Western academy; studied law at Keokuk, and was admitted to the bar in 1855; was elected to the State legislature in 1857, and served in the State senate from 1861 to 1863, holding the position of chairman of the committee on military affairs; devoted himself chiefly to his profession from 1863 to 1868, when he was elected to Congress, and re-elected four times in succession, serving on the naval committee, the committee on the revision of the laws, and as chairman of the committee on elections; entered the cabinet of Pres. Hayes in 1877 as secretary of war.

**McLa'ren** (Edward William), A. B., A. M., S. T. D., b. Dec. 13, 1831, at Geneva, Ontario co., N. Y.; graduated at Jefferson College in 1851, and at the Western Theological Seminary, Pittsburg, in 1860; was ordained to the Presbyterian ministry in the same year, and went to South America as a missionary; returned in 1863, and became pastor to the Second Presbyterian church, Peoria, Ill.; moved in 1866 to Detroit, Mich., as pastor to the Westminster church; entered the Episcopal Church in 1872; became rector of Trinity church, Cleveland, O., and was elected bishop of Illinois in 1875.

**Maclean'** (John), D. D., LL.D., b. in Princeton, N. J., Mar. 3, 1800; was graduated at the College of New Jersey in 1816, and at the Princeton Theological Seminary in 1821; in 1822 was made teacher of mathematics and natural philosophy at the College of New Jersey; in 1823 professor of mathematics, in 1829 professor of ancient languages and vice-president, and in 1853 president, from which position he retired in June, 1868. He has contributed articles to the *Princeton Review*, and published a number of pamphlets on education, temperance, and other subjects. Since his retirement he has devoted his leisure to the preparation of a *History of the College of New Jersey*, which is now ready for publication. Henry C. Cameron.

**McLeod'** (Hugh), b. in Georgia about 1814; graduated at West Point Military Academy in 1836; joined Texas in her struggle with Mexico, and commanded a company in the battle with the Cherokees in 1839. In 1841 he commanded as brigadier-general an expedition to Santa Fé, sent out by Pres. Lamar to open trade with New Mexico, but was betrayed into the hands of the Mexicans, and held a prisoner for nearly a year, until released by intercession from the U. S. In 1842–43 he was a member of the congress of the republic; in 1861 commanded the 5th Texas, and took part in the battle of Manassas; contracted pneumonia at Dumfries, and d. in Feb., 1863.

**McPher'son** (John Roderic), b. in Livingston co., N. Y., May 9, 1833; engaged in farming and stock-raising, and settled in 1858 in Hudson City, N. J., where he dealt in stock and established a new stockyard in 1863. He was the originator, designer, and constructor of the great buildings used by the Central Stockyard and Transit Co. at Harsimus Cove, N. J.; also of the abattoir and stockyard of Philadelphia; and the inventor of a new stock-car, and the great improvements he introduced soon attracted the attention of sanitarians and philanthropists. He was alderman of Hudson City 1863–69, and State senator from Hudson county 1872–74. Elected U. S. Senator for New Jersey Jan. 24, 1877. H. L. Stuart.

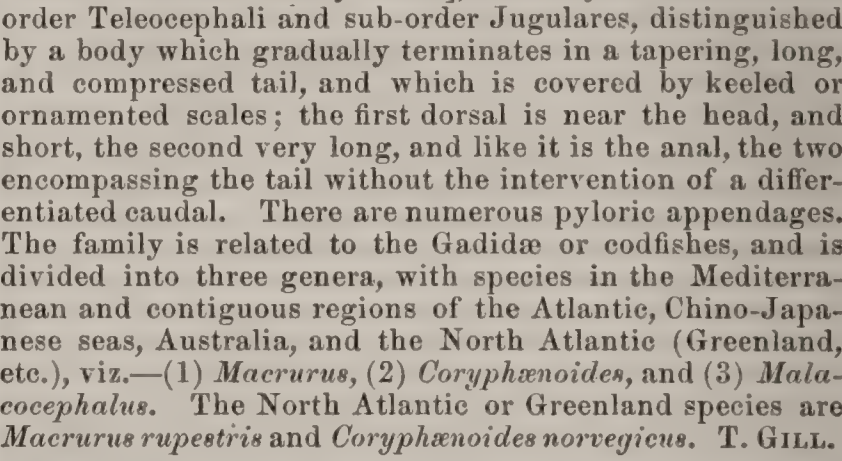
**Macroscel'idæ** [from *Macroscelis*—μακρός, "long," and σκελός, "thigh"—and *-idæ*], a family of typical Insectivores of mouse-like appearance, clothed with soft hair, and adapted for leaping, the hind limbs being much elongated. The skull has a transversely convex muzzle; orbits open behind; the lachrymal foramen within the margin of the orbit, and a suboptic foramen; the teeth are I. $\frac{3}{3}$ or $\frac{1}{3}$, C. $\frac{1}{1}$, P. M. $\frac{3}{3}$, M. $\frac{3}{3}$ or $\frac{3}{4} \times 2$; the upper molars are quadricuspid, the anterior and posterior cusps connected by transverse ridges. The intestinal canal has a long cæcum. The family is peculiar to Africa, and its representatives are distributed into two sub-families and three genera—viz. Macroscelidinæ, with the genera *Macroscelides* (Africa generally) and *Petrodomus* (Mozambique), and Rhynchocyoninæ, with genus *Rhynchocyon* of Mozambique.

Theodore Gill.

**Macru'ridæ** [from *Macrurus*—μακρός, "long," and οὐρά, "tail"—and the family suffix], a family of fishes of the order Teleocephali and sub-order Jugulares, distinguished by a body which gradually terminates in a tapering, long, and compressed tail, and which is covered by keeled or ornamented scales; the first dorsal is near the head, and short, the second very long, and like it is the anal, the two encompassing the tail without the intervention of a differentiated caudal. There are numerous pyloric appendages. The family is related to the Gadidæ or codfishes, and is divided into three genera, with species in the Mediterranean and contiguous regions of the Atlantic, Chino-Japanese seas, Australia, and the North Atlantic (Greenland, etc.), viz.—(1) *Macrurus*, (2) *Coryphænoides*, and (3) *Malacocephalus*. The North Atlantic or Greenland species are *Macrurus rupestris* and *Coryphænoides norvegicus*. T. Gill.

**Mag'ic Lan'tern,** an optical contrivance, the device of Father Athanasius Kircher, a German Jesuit, of the seventeenth century, for producing enlarged images of transparent or translucent objects, usually paintings, drawings, or photographs on glass. Optically considered, it consists of two distinct parts, an illuminating apparatus, and a magnifying apparatus. The illuminating apparatus embraces a source of light (in the original construction, a lamp), enclosed in a tightly-shutting box or chamber opening on the side, a condensing lens some inches in diameter adapted to an opening in the front of the box, and a concave mirror behind the light within, and opposite to the lens. This is properly the lantern; the magnifying apparatus is external to it, and consists of one or more converging lenses fixed in a sliding tube. Fig. 1 shows the entire

Fig. 1.




The Magic Lantern.

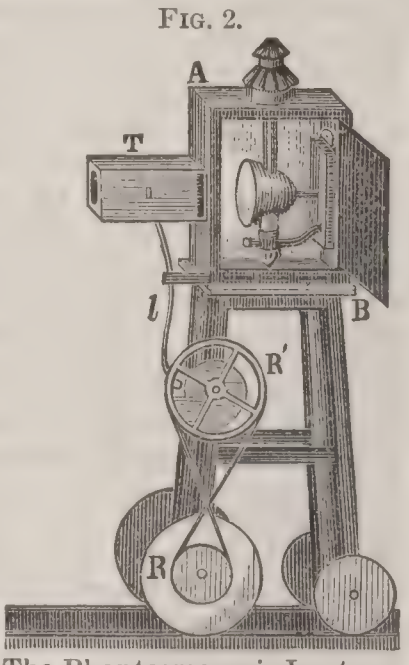
apparatus in section. M is the mirror, here shown as attached to the oil-chamber of the lamp, which is secured to the back of the lantern by means of bracket-hooks; L is the condensing lens; *a b* is a figure upon a glass plate, supported by a frame which slides in the grooves or ways shown in the diagram; *m* is the magnifying system of lenses; and A B is the magnified image as received upon a plane white surface, or screen. In order to give distinctness to this image, the tube carrying the lenses *m* is drawn

out or pushed in till the true focus is found. The mirror, M, in this design, is parabolic, and is supposed to be perforated, or notched, at top to accommodate the lamp-chimney; but in the simpler forms it is of spherical curvature, and is entirely behind the lamp.

In order to exhibit the optical effects of this apparatus, the room must be darkened; and inasmuch as there must be provision for the admission of air to the lantern, and for the escape of the gaseous products of combustion, care must be taken that the apertures so provided are screened against the escape of light into the apartment.

For a very long time after its invention, the magic lantern was employed for no more important purpose than to surprise or to amuse. It was in high esteem with professional conjurers and jugglers, who found in it a means of producing very startling effects. A construction much employed by them was the phantasmagoria lantern, represented in Fig. 2. This is a lantern supported by a stand on wheels, and designed to run upon a horizontal table. One of these wheels carries a pulley, R, which is connected by a band with another pulley, R′, higher up. On the axis of the pulley R′ is a cam, against which rests one extremity of a lever, *l*, the other extremity acting on a sliding tube carrying the magnifying lenses within the larger tube, T. The proportions of the cam and lever are such that if, when the magnifiers are at the nearest practicable approach to the object, and the size of the image is therefore maximum, the lantern be placed at the distance from the screen which gives a distinct image, then on rolling the apparatus toward the screen, the magnifiers will be drawn backward at precisely the rate necessary to preserve the distinctness of the image, while this will rapidly diminish in size till it vanishes in a point. In preparing designs for phantasmagorial displays, the ground is made absolutely black, so that no light may pass except that which exhibits the figures. The lantern is also placed behind the screen, so as to be invisible to the spectators of the display, the screen being of dampened or varnished muslin, and translucent. Under these circumstances, the sudden increase of size of the image creates irresistibly the impression that the object represented is rapidly approaching the observer; and the sudden diminution of size of the same image causes the object to seem to recede. It contributes to the force of these impressions, that, by means of another simple contrivance, not here represented, the aperture of the lantern is gradually closed as the image diminishes in size, and gradually reopened as it again increases, so as to preserve a harmony, such as we see in nature, between the brightness of the image and the imagined distance. The exhibitor often avails himself of the opportunity when the image has dwindled to so minute a point as to be unrecognizable, to change the slider in the lantern; so that when the object, after apparently receding into the distance, returns again, it appears with a new and often formidable aspect. Thus, a being of angelic beauty may seem to fade away almost to the point of vanishing, and then come suddenly rushing back in the character of a gorgon or a fiend.

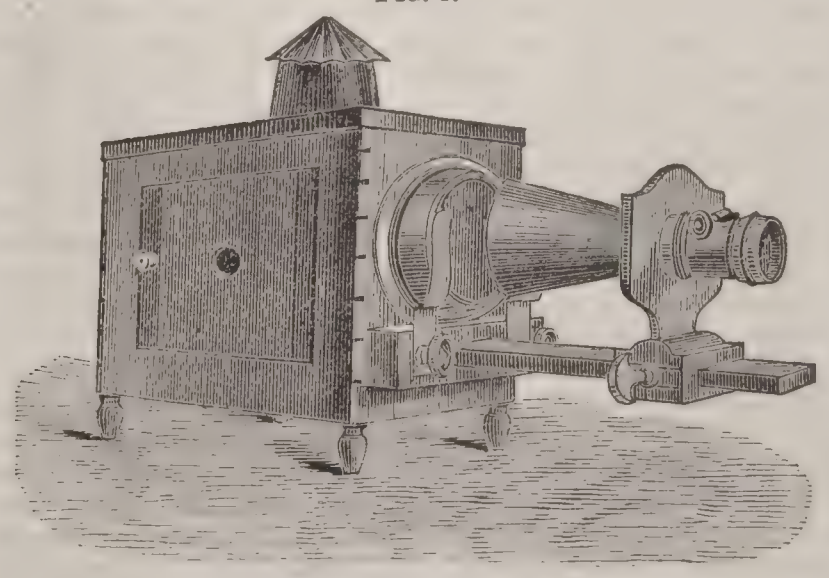
FIG. 2.




The Phantasmagoria Lantern.

Within the last half century the magic lantern has been very greatly improved. Designs on glass of objects of every kind in nature and art are so expeditiously, accurately, and cheaply produced by means of photography, as almost indefinitely to have increased its resources, and to have made it an invaluable auxiliary to the teacher and public lecturer. The substitution also of the oxyhydrogen or calcium light, or, better still, of the electric light, for the oil lamp, as a source of illumination, has added immensely to the power and brilliancy of its displays. Both the mechanical and the optical arrangements have, moreover, been carried to a high degree of perfection. Fig. 3 presents a very usual form of the modern improved instrument. The object is held in place by the spring clamps shown in the figure, and the magnifying apparatus is sustained by a single upright which slides along a projecting bar.

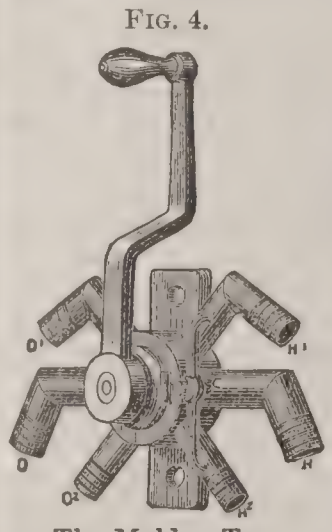
FIG. 3.



Improved Magic Lantern.

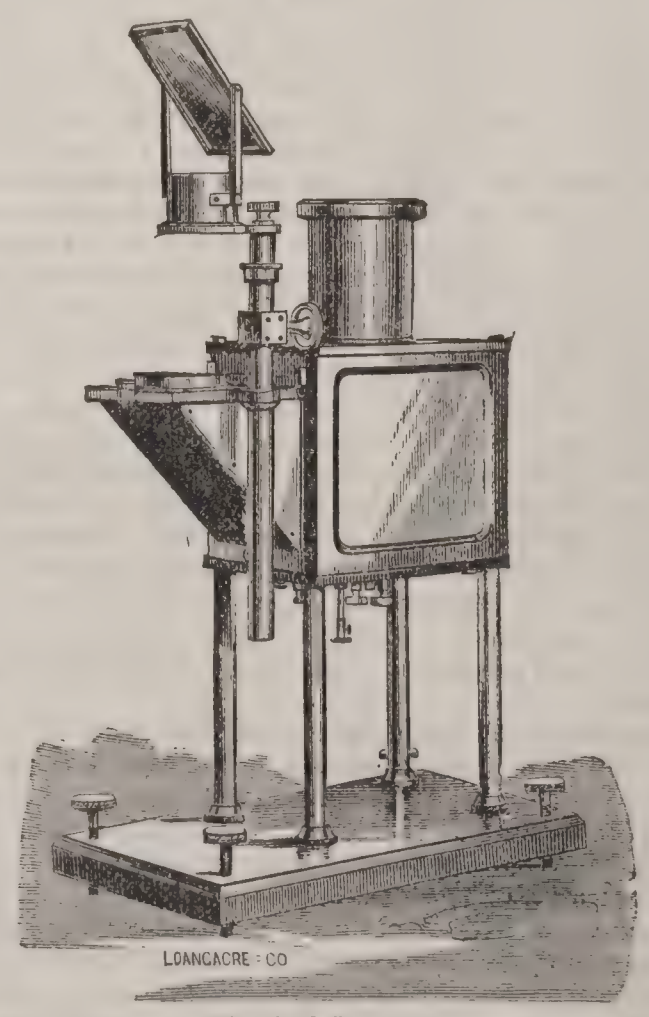
A very popular use of the magic lantern is for the production of the optical illusions called "dissolving views." For these, two lanterns are necessary, placed either side by side, or one above the other. They must be adjusted in position so as to have a common luminous field upon the screen. Each has a different object, and the two images when superposed to a great extent obliterate each other. A sliding or rotating stop placed before the lanterns is so constructed as, on being moved to left or right, to close the aperture of the one while it opens that of the other. At the mean position, both are half open and half closed; at either extreme position, one is wholly open and the other wholly closed. The movement of this stop, therefore, causes the images alternately to come out distinctly and to melt away. Advantage is taken of the moments when the lanterns are successively closed to change the objects, so that each dissolution is followed by the presentation of a new picture. When the calcium light is used, a stop is not necessary for the dissolving effect; but this is produced more simply by gradually and alternately shutting off and turning on the gases which feed the light in the lanterns severally. For this purpose, a six-way cock is employed, originally introduced by B. G. Malden, Esq., of the Royal Polytechnic Institution, London, called the "Malden tap." It is represented in Fig. 4. The gases enter from the reservoirs through H and O; they pass to one of the lanterns through $H^1$ and $O^1$, and to the other through $H^2$ and $O^2$. When the lever is upright, as in the figure, the gas flows to both lanterns freely; when it is turned down to the right the supply to the left-hand lantern is cut off; when to the left, the supply to the right is cut off. A small cock at C allows a small quantity of hydrogen to flow constantly into either lantern, serving to prevent extinction when the light is cut off.

FIG. 4.




The Malden Tap.

FIG. 5.

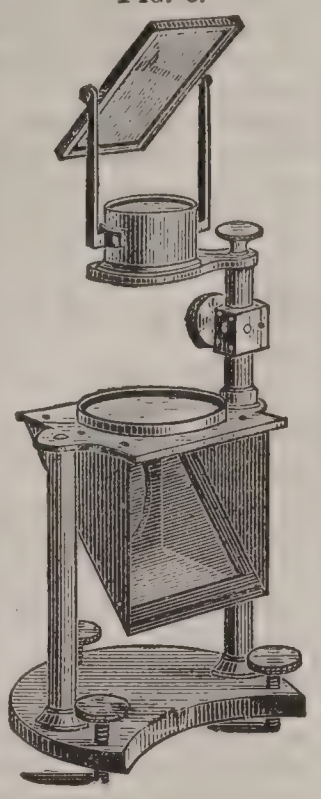



Vertical Lantern.

In the illustration of scientific subjects by means of lantern views, it is frequently desirable to present objects

which cannot be secured in a vertical position, as, for instance, objects immersed in a liquid. This case may be provided for by removing the magnifying apparatus from the lantern, Fig. 3, and placing before the condensing lenses a diagonal mirror mounted as in Fig. 6, by which the illuminating beam is thrown vertically upward, passing through a horizontal stage of glass, intended to receive the objects. Immediately above this is fixed the magnifying apparatus, as represented; and above this still is a second diagonal mirror which restores the beam to the horizontal direction.

FIG. 6.



Prof. Henry Morton, of the Stevens Technological Institute, Hoboken, N. J., has constructed a lantern which admits of being used either as a horizontal or vertical lantern at pleasure, the transformation being effected very expeditiously and easily. This is shown in Fig. 5, arranged as a vertical lantern. Since the introduction of this improvement, most constructors have adopted it, and it has come into general use.

F. A. P. BARNARD.

**Magne'to-Electric'ity.** Magneto-electricity is electricity which is produced by means of magnets. Like thermo-electricity, voltaic electricity, frictional electricity, etc., the term has reference solely to the means employed to generate the electricity, the electricity itself being identically the same from whatsoever source it comes. Magneto-electricity is the correlate of electro-magnetism; and precisely as magnetism is developed in an iron bar when an electric current flows through a coil surrounding it, on the one hand, so does the disappearance of the magnetism in the bar give rise to an electrical current in the coil, on the other. This, obviously, is a magneto-electric current.

The conditions under which magneto-electric currents are produced are simple. A magnetic field is commonly defined as the space surrounding a magnet; but since magnetic fields exist where there is no magnet, it is better defined as a space where a freely-suspended magnet will take up a definite direction. This directive tendency of the field is clearly due to the magnetic force pervading it; and since a force is known when its direction and magnitude are known, the properties of the field are due to the direction and intensity of the magnetic force which it contains. To facilitate reference, the direction is generally replaced by a number of parallel or non-parallel lines called lines of force. A magnet free to move will, when placed in a magnetic field, place itself parallel to a line of force. Now, the only condition necessary for the generation of a magneto-electric current is that a conductor should move through a magnetic field in such a way as to cut the lines of force. It matters not whether the field be produced by a magnet or by an electric current: if a metallic wire move through it so as to cross its lines of force, a current will flow through the wire. Of course, if the conductor be at rest and the lines of force move across it, the effect will be the same. This latter result takes place whenever the strength of the magnetic field is varied; because, since the strength of the field is proportional to the number of lines in it per unit of area, any change in this strength must cause a variation in the position of the lines, they either separating or closing up as the field is weakened or strengthened. In general, then, a current may be generated in a conductor placed in a magnetic field, either by motion of the conductor, the strength of the field remaining uniform, or by an increase or decrease in the strength of the field, the conductor remaining at rest, or by both causes combined. Hence, the only two things needed to produce a magneto-electric current are a magnetic field and a metallic conductor, one of which must be in motion.

The strength of the current generated, it is evident, depends in the first place on the number of lines of force which are cut by the conductor in a unit of time. Hence, for a given field it is increased by increasing the velocity with which the conductor or the field itself moves; and for a given velocity of motion it is increased by increasing the strength of the field—*i. e.* the closeness of the lines of force. If E represent the electro-motive force, H the strength of the magnetic field, L the distance moved, and T the time occupied by the motion, the relations of these quantities show that $E = H\frac{L}{T}$. But since $\frac{L}{T}$ represents the velocity with which the conductor moves, we may say that the electro-motive force per unit of length is equal to the strength of the field, multiplied by the velocity of the motion. (*Jenkin.*) If the resistance of the circuit be constant, as in the case of a given machine, this increase of electro-motive force with the velocity necessarily increases the strength of the current in the same ratio. In the second place, the strength of the current generated is proportional to the sine of the angle which the line of force cut makes with the axis of the conductor, and hence has its maximum value when the one is perpendicular to the other. From this relation it also follows that no current at all is produced when a conductor moves parallel to a line of force.

The direction of the current is a joint function of the direction of the motion and the direction of the lines of force, and may be readily deduced from the law of Ampère or from the law of Lenz. Ampère's law, which has reference primarily to the production of electro-magnetic phenomena, asserts that if a person places himself parallel to and facing a magnetic needle, and supposes the electric current to flow from his feet toward his head, the motion of the north-seeking end of the needle will be toward the left hand. As a wire conveying a current experiences, when placed in a magnetic field, a force which is at the same time perpendicular to its length and to the lines of force, it follows that if the current is from foot to head, and the lines of force —the pole being north-seeking—run from before backward, the force experienced by the wire will be a force to the right. So, on the other hand, if, under the same circumstances, a wire be placed in a magnetic field the direction of whose lines of force is from before backward, then a motion of this wire to the right generates a current in it passing from head to foot, and motion to the left an opposite current. If the conductor be at rest, and the lines of force—whose direction is from front to back—move from right to left, the current in the conductor will be from head to foot. It also follows from Ampère's law that if a watch be laid face upward upon the upper end of a vertical bar of iron surrounded by a coil, this upper end will be a south-seeking pole if the current flows through the coil in the direction in which the hands move, and a north-seeking one if the reverse. So, also, if a north-seeking magnetic pole be introduced into the upper end of a coil of wire whose axis is vertical, a current will be generated in the coil instantaneous in character, whose direction will be opposite to that of the hands of the watch; or in the inverse direction to that in which it would be necessary to send a current through the coil to produce a pole of the same name. Lenz's law states that the currents induced by the relative movement of a wire and a magnet are always in such directions as to produce mechanical forces tending to oppose the movement. If, for example, a bar of iron surrounded by a coil be approached to a north-seeking pole, the current flowing through the coil under the influence of magnetic induction will be in the direction required by the law of Ampère to make the forward end of the iron bar also a north-seeking pole; since the two north-seeking poles, being similar, will repel each other, and will in this way tend to oppose the movement.

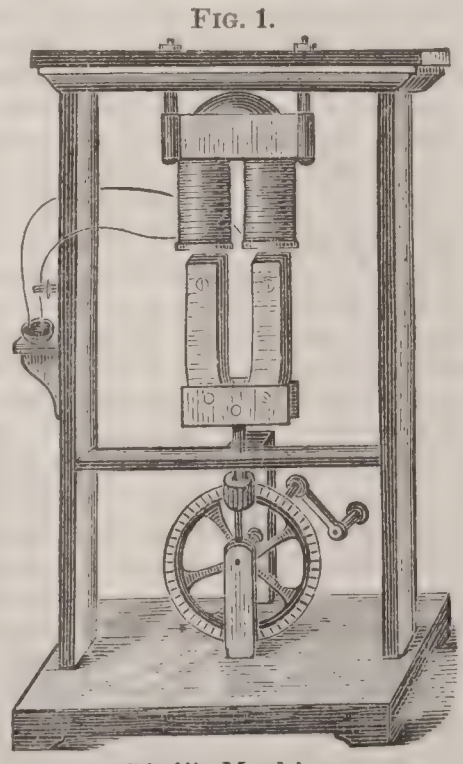
The discovery of electro-magnetism by Oersted in 1819, and its rapid development during the next decade by Arago, Henry, and Ampère, prepared the way very naturally for the converse discovery of magneto-electric induction by Faraday in 1831. The experiment which led to the discovery is thus described: "A welded ring was made of soft round bar iron, the metal being seven-eighths of an inch in thickness and the ring 6 inches in external diameter. Three helices were put round one part of this ring, each containing about 24 feet of copper wire one-twentieth of an inch thick; they were insulated from the iron and each other, and superposed in the manner before described, occupying about 9 inches in length upon the ring. They could be used separately or conjointly; the group may be distinguished by the letter A. On the other part of the ring about 60 feet of similar copper wire in two pieces were applied in the same manner, forming a helix B, which had the same common direction with the helices of A, but being separated from it at each extremity by about half an inch of the uncovered iron. The helix B was connected by copper wires with a galvanometer 3 feet from the ring. The helices of A were connected end to end, so as to form one common helix, the extremities of which were connected with a battery of ten pairs of plates 4 inches square. The galvanometer was immediately affected, and to a degree far beyond what has been described when with a battery of tenfold power helices *without iron* were used; but, though the contact was continued, the effect was not permanent, for the needle soon came to rest in its natural position, as if quite indifferent to the attached electro-magnetic arrangement. Upon breaking the contact with the battery, the needle was again powerfully deflected, but in the contrary

direction to that induced in the first instance." The experiment was then varied by introducing into a helix formed of 220 feet of copper wire, first, an iron bar with which magnets were brought in contact; and second, the magnets themselves. In both cases currents were generated, flowing in the inverse direction to those which by Ampère's law would be required to produce a magnet of the same name. The cause of these phenomena is thus clearly stated in a subsequent paper, read Jan. 12, 1832: "If a terminated wire move so as to cut a magnetic curve, a power is called into action which tends to urge an electric current through it; but this current cannot be brought into existence unless provision be made at the ends of the wire for its discharge and renewal;" the "one simple condition" of the production of a current being "that all parts of the mass shall not move in the same direction across the curves and with the same angular velocity."

Early in the year 1832, and entirely without knowledge of Faraday's discovery, Joseph Henry, then at Princeton, performed the following experiment: "A piece of copper wire about 30 feet long and covered with elastic varnish was closely coiled around the middle of the soft-iron armature of a galvanic magnet, which, when excited, would readily sustain between 600 and 700 pounds. The wire was wound upon itself, so as to occupy only about 1 inch of the length of the armature, which is 7 inches in all. The armature thus furnished with the wire was placed in its proper position across the ends of the galvanic magnet, and there fastened, so that no motion could take place. The two projecting ends of the helix were dipped into two cups of mercury, and there connected with a distant galvanometer by means of two copper wires each about 40 feet long. The arrangement being completed, I stationed myself near the galvanometer, and directed an assistant at a given word to immerse suddenly in a vessel of dilute acid the galvanic battery attached to the magnet. At the instant of immersion the N. end of the needle was deflected 30° to the W., indicating a current of electricity from the helix surrounding the armature. The effect, however, appeared only as a single impulse, for the needle, after a few oscillations, resumed its former undisturbed position in the magnetic meridian, although the galvanic action of the battery, and consequently the magnetic power, was still continued. I was, however, much surprised to see the needle suddenly deflected from a state of rest to about 20° to the E., or in a contrary direction, when the battery was withdrawn from the acid, and again deflected to the W. when it was reimmersed." During the year 1832 these experiments were repeated and varied by other observers, and the strength of the current was so much increased by Faraday, Nobili and Antinori, J. D. Forbes, Henry, and Saxton, that sparks were obtained from permanent steel magnets.

This step having been taken, and electric sparks produced at the ends of a wire coil surrounding an iron armature whenever this was rapidly removed from or brought near to the poles of the magnet, it was an easy matter to contrive a mechanical method of making the motion continuous, and so to produce a continuous current. In Sept., 1832, Pixii, an instrument-maker of Paris, mounted a steel horseshoe magnet upon the end of the arbor of a lathe, and caused it to revolve with its ends opposite to those of a piece of soft iron bent into the form of a U and wound with 400 mètres of silk-covered copper wire. When the ends of this wire were placed in a vessel of water, oxygen and hydrogen gases were evolved from them during the rotation of the magnet, and the more rapidly the quicker this rotation. Subsequently, a larger machine was constructed by Pixii for Ampère's lectures at the Sorbonne. (Fig. 1.) In this machine the magnet —which was powerful enough to lift 100 kilogrammes—was supported on a vertical axis and revolved by bevel gear. Above it a fixed electro-magnet was placed, wound with 1000 mètres of covered wire. The machine when in action gave vivid sparks and strong shocks, diverged gold-leaves, and decomposed water rapidly. The currents produced by it, however, were alternately direct and inverse, and hence when water was decomposed the collecting tubes contained both gases. To remedy this defect, the maker added Ampère's bascule or rocker, working automatically, by which the current, reversed every half revolution of the magnet, was re-reversed at the same intervals, thus making the current uniform in direction.

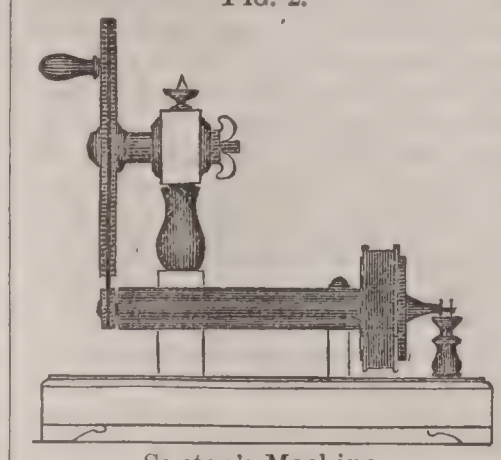
FIG. 1.



Pixii's Machine.

In June, 1833, Joseph Saxton of Philadelphia, then residing in London, constructed a magneto-electric machine having marked improvements. (Fig. 2.) In place of a rotating magnet and a fixed armature, he used a fixed magnet and a rotating armature, since the armature was lighter than the magnet. The plane of the magnet was horizontal, and contained the axis of rotation of the armature. In this machine there was used for the first time the principle discovered by Henry, that for currents of high tension a fine wire must be used on the armature, and for currents of low tension a coarse wire was necessary. This machine was provided, therefore, with a double armature, one pair of coils being wound with fine wire, the other pair with coarse wire. The two coils of each pair were wound in opposite directions, their ends terminating, the one in a copper disk on the axis of rotation, and beyond the armature, the other in an acute rhomb, also of copper, placed beyond the disk, and insulated from it and from the axis. A mercury cup placed below received the disk and the rhomb, the former continuously, the latter intermittently; the rhomb being so adjusted that its points left the mercury at the instant of maximum current, thus producing a strong spark. By means of a switch on the axis either pair of coils could be brought into action at pleasure, and by using the fine coils, in connection with a mercury cup divided into two parts by a vertical partition, in one of which the disk ran, and in the other the rhomb, the two portions of mercury being made the terminals of the external circuit, strong shocks could be obtained every time that contact was broken by the rhomb. If the rhomb were replaced by a disk, the current was uniform, though alternating in direction, and could be used for the decomposition of water, for the production of magnetic phenomena, and other similar experiments.

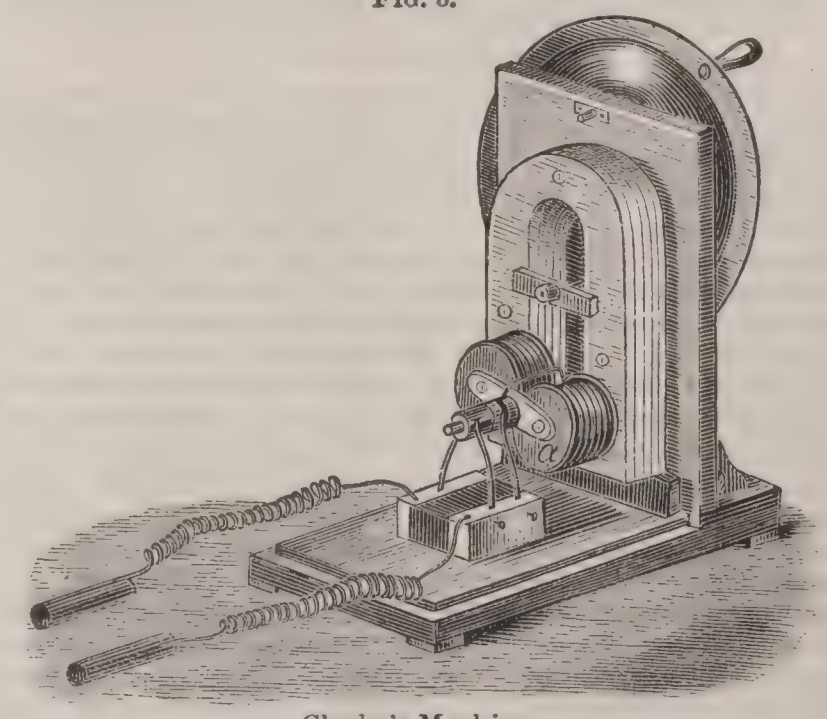
FIG. 2.



Saxton's Machine.

In 1836, Clarke, an instrument-maker of London, described a machine essentially similar to that of Saxton, but with some variations of detail. (Fig. 3.) The magnet in this machine was placed vertically, with its poles downward. The armature with its coils was placed in front of these poles, and revolved about a horizontal axis passing between them, being driven, as in the machine of Saxton, by a multiplying-wheel. One end of the wire constituting the armature coil was connected with one of two brass rings or ferules upon the prolongation of the axis in front, the other end with the other ferule. Both ferules were insulated from the axis, and they were arranged to give at will the various modifications of the current desired. Two armatures were provided, one wound with coarse, the other with fine, wire.

FIG. 3.



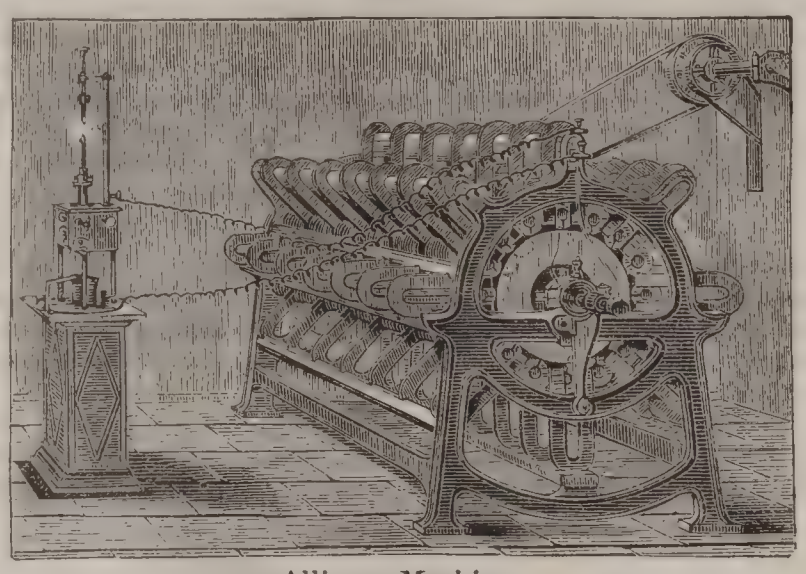
Clarke's Machine.

In 1845, C. G. Page of Washington contrived an improved form of Saxton's machine, in which he used two large compound U-magnets, placed horizontally, instead

of one, their poles being reversed in direction. Two separate coils of covered copper wire, with cores of iron wire, revolved between these magnets about a vertical axis, the speed being increased by means of a multiplying-wheel. The currents from these coils were made uniform in direction by means of a commutator or pole-changer of the following simple construction: Upon opposite sides of the axis of rotation, and just above the coils, two semi-cylindrical segments of sheet silver were placed, insulated from the axis and from each other, the vertical spaces separating the two segments being perpendicular to the line joining the centres of the coils. Two springs, also of silver, pressed upon these segments, so placed that at the instant when the coils began to leave a pole to go to the next the springs changed from one segment to the other. In this way, although the current flows in opposite directions through the coils at each half revolution, the springs through which it issues are also changed to the opposite segments every half revolution. Hence, the current through the springs, and through the wires connected with them, is always in the same direction, though it is intermittent, having two maxima and two minima every revolution.

In 1849, Nollet, professor of physics in the Military School of Brussels, proposed to construct a magneto-electric machine on a large scale, the general details being the same as in Clarke's machine, but very greatly improved. His death prevented him from realizing all his expectations, but the machine he had devised, extended and perfected by Berlioz and Van Malderen, constitutes what is known to-day as the "Alliance machine," because it is constructed by the Alliance Co. of Paris. This machine, which has been for some years employed in several of the lighthouses on the French coast, is the only one in use on the large scale for the production of the electric light, in which the field of force is generated by permanent magnets. (Fig. 4.)

FIG. 4.



Alliance Machine.

It consists of 48 compound U-magnets of steel, arranged in 6 rows of 8 each. The 8 magnets are arranged radially in a circle, their poles facing inward and alternating, thus forming a circle of 16 alternate poles, and in all a cylinder of 96 alternate poles. On a horizontal axis passing through this cylinder 6 bronze disks are placed, upon the periphery of each of which are 16 coils of copper wire, each having a tubular core of iron slit lengthwise, the axes of the coils being horizontal and parallel to the axis of rotation. The length of a coil is such that it will just pass between the poles of two successive circles of magnets. The coils upon a single disk are united alternately right and left, the first end of one coil being joined to the last end of the preceding one. When the disks are rotated the coils are brought alternately between opposite magnetic poles at both ends, the current generated being reversed by each successive pair of poles. These alternating currents are re-reversed and given a uniform direction by means of a commutator devised by Serrin, which is simply a multiple pole-changer of Page's. Experiments made by Jamin and Roger with a four-disk machine carrying 96 coils showed that when the coils were connected consecutively, or for tension—in which case the resistance was equal to that of 655 Bunsen cells—the electro-motive force of the current produced by a speed of 200 revolutions per minute was equal to that of 226 Bunsen cells. When the coils were connected in parallel series, or for quantity, the resistance then being that of only 18 Bunsen cells, the electro-motive force was equal to that of 38 such cells. Used to produce the electric light, this machine gave a light equal to that of 230 Carcel burners, equivalent to 1610 candles, the cost of the light in motive-power being 1.1 francs per hour. This is less than one-tenth the cost of the same amount of light obtained from the battery, and about one-seventh the cost of this amount of light obtained from oil.

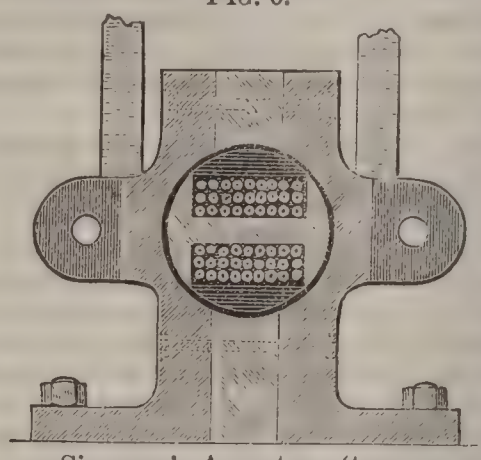
Up to this time the magneto-electric machines had all been constructed on one general plan, this being that of the original Saxton machine. In 1857, Werner Siemens of Berlin made an important advance by devising a new form of armature, since known as the "Siemens armature." To construct it, a cylinder of soft iron whose length is five or six times its diameter is deeply grooved on opposite sides longitudinally, so as to make its cross-section nearly the shape of an I. Covered copper wire is then wound lengthwise in the grooves, and the two ends of the cylinder are furnished with bearings on which the armature can rotate. The ends of the wire coil communicate with a commutator placed on the axis at one end. (Figs. 5 and 6.) The advan-

FIG. 5.



Siemens's Armature (longitudinal).

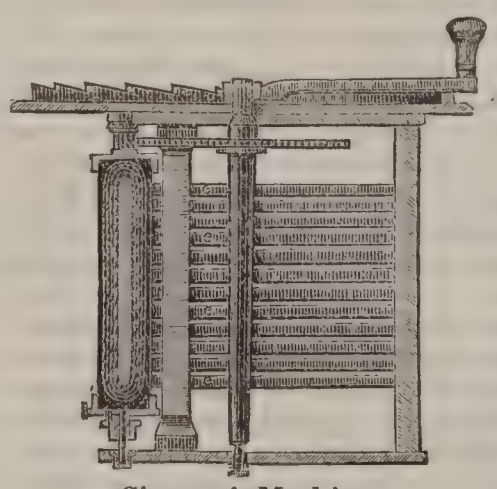
FIG. 6.



Siemens's Armature (transverse.)

tages of this form of armature, which are decided, consist chiefly in its compactness, the magnetic surface being large, and at the same time capable of complete action within a very intense and uniform magnetic field. Moreover, from its construction the coils cut the lines of magnetic force nearly at right angles. In Siemens's machine a series of from 12 to 30 steel U-magnets were fastened together in a row, but not in contact, their planes being parallel. A cylindrical space was made between the poles of these magnets, and in this space the armature revolved, being driven by a belt running to a pulley on one end of the axis. One of the forms of the Siemens machine is shown in Fig. 7.

FIG. 7.

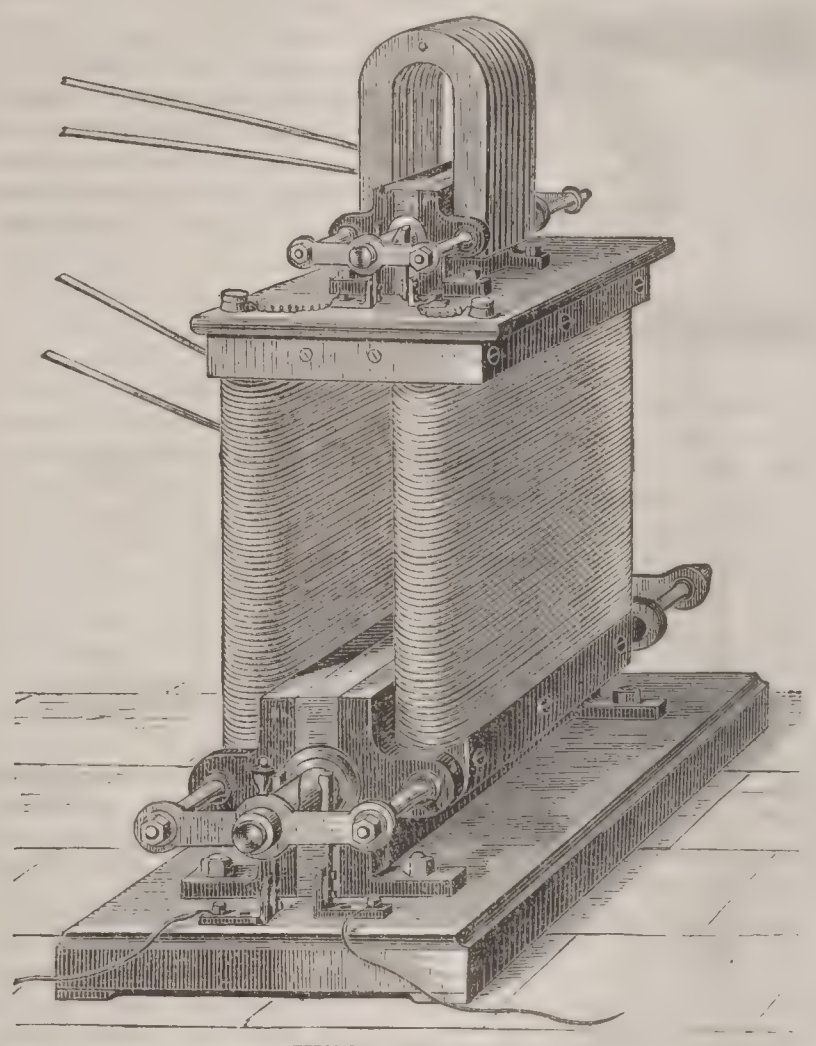


Siemens's Machine.

In 1866, Wilde of Manchester produced the first magneto-electric machine in which permanent steel magnets were replaced by the vastly more powerful electro-magnets. To charge these magnets the current from a small Siemens permanent-magnet machine was used. The machine represented in Fig. 8, which is the size adopted for the Scotch lighthouses, consists of the Siemens machine, slightly altered in its details, placed above, and of the electro-magnet machine placed below. The former, or Siemens machine, contains from 12 to 16 U-steel plates, each weighing 1.5 kilogrammes, with their poles downward, attached to two cheeks or poles of iron, separated by a thick brass plate, and bored through from end to end for the reception of the armature. This armature was covered with 50 mètres of copper wire three millimètres in diameter, wound lengthwise and forming an elongated coil 6 centimètres thick, the ends of which passed to a commutator on the axis. The latter, or electro-magnet machine, is made of two vertical wrought-iron plates, 91 by 66 centimètres in area and 2.5 centimètres thick, bolted above to a horizontal iron plate, and each wound with 500 mètres of covered copper wire, No. 10, arranged in seven parallel strands, the ends being connected to the springs, which press upon the commutator of the upper machine. The lower ends of these iron plates, like the magnets above, are extended by two massive cheeks or poles of iron, separated by a thick plate of brass, and having a hollow cylinder through them lengthwise. In this cylindrical space revolves a Siemens armature of proportionate size, being 1 mètre long and 18 centimètres in diameter, wound with 30 mètres of copper wire 6 millimètres thick. The entire weight of the machine is 1500 kilogrammes. To drive it at full speed, which is 1700 revolutions per minute for the smaller armature and 1500 for the larger, requires about three horse-powers. The energy developed by this machine was astonishing; pieces of iron rod 6 millimètres in diameter and nearly 40 centimètres long

were at once melted by it. By carrying the principle involved in this machine one step further, and causing the second current to magnetize a third and still larger electro-

FIG. 8.



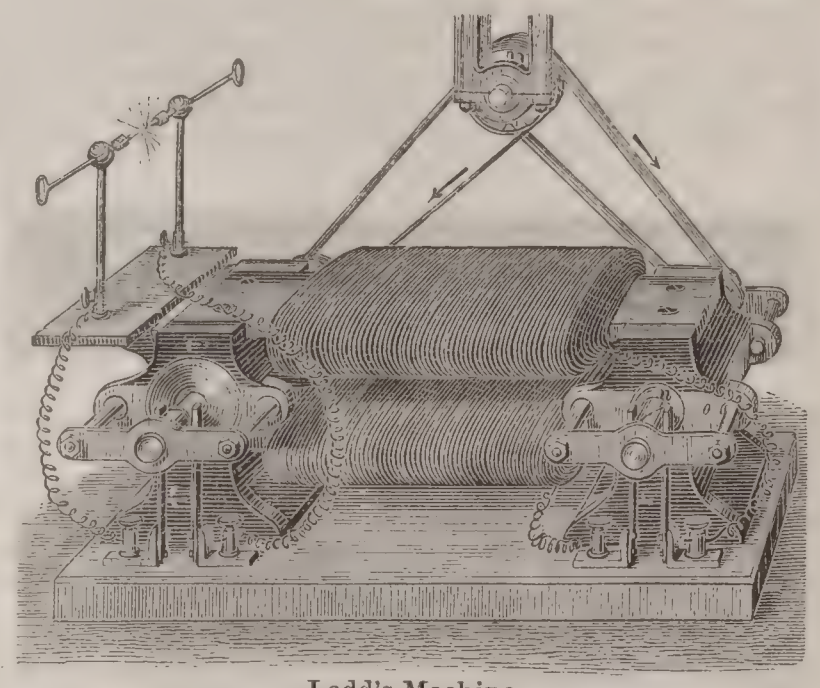
Wilde's Machine.

magnet similarly arranged, Wilde succeeded in vastly increasing the effect. The machine which he constructed on this plan consumed fifteen horse-powers of force, and gave a current which melted a bar of platinum 60 centimètres long and 6 millimètres in diameter. The principle seemed capable of an indefinite extension in this direction until Wilde showed that it was limited.

In February, 1867, C. W. Siemens of London read to the Royal Society a paper received from his brother, Werner Siemens of Berlin, in which he proposed a very important but obvious modification in these machines.* He proposed to do away with the permanent magnet machine, and to place the terminals of the coils surrounding the electro-magnet which produced the field of force in direct communication with the springs which pressed upon its own commutator. To start the current, Siemens at first proposed to introduce momentarily into the circuit a small battery. On revolving the armature the small amount of magnetism developed by the battery-current would react on the armature coil to produce a magneto-current in it. This passing round the electro-magnet would in its turn increase its magnetism, which again would react on the revolving coil, the current increasing in a geometric ratio until the iron reaches its maximum of saturation and the power applied is balanced by the resistance. The battery being removed, the machine itself will continue to furnish the current necessary for its own magnetization. He also suggested, to start the machine, the momentary placing of a steel magnet against the iron of the electro-magnet while the armature was revolved. The small amount of magnetism thus produced becomes the starting-point of a series of actions and reactions similar to those above mentioned, until the full power of the machine is reached. It was soon found in practice, however, that this auxiliary assistance, whether battery or magnet, was entirely unnecessary. The purest commercial iron after magnetization always retains residual magnetism, which is sufficient to start the current. Moreover, the position of the iron cores of the magnet with reference to the lines of dip always causes their magnetism by induction from the earth. But a new difficulty now arose. The field of force being in the main circuit of the machine, whenever the external circuit was broken the magnetism at once disappeared from the magnets and the machine lost its power. In some cases—as, for example, in heating wire for blasting, where the external circuit is always complete—no difficulty is experienced from the above cause. The magneto-electric or dynamo-electric machines of Farmer, which have been for several years in use in the U. S. navy for firing torpedoes by the ignition of fine platinum wire, have precisely the construction above given. Siemens, however, remedied the defect by placing upon his blasting-machines an automatic arrangement by which the current was diverted into the external circuit at regular intervals. The same result, practically, was attained by Wheatstone by dividing the current, and sending one portion around the magnets, while the other part was utilized for the performance of external work.

In March, 1867, Ladd, an instrument-maker of London, described a new form of machine, in which the difficulty arising from having the field of force in the main circuit was very ingeniously obviated. In this machine only one electro-magnet was used, but its peculiarity consisted in its having two Siemens armatures upon it, one at each end, both being simultaneously driven. (Fig. 9.)

FIG. 9.



Ladd's Machine.

This machine, the first large machine in which residual magnetism was used as the starting-point, was called a dynamo-electric machine, the name magneto-electric machine being restricted to machines with permanent magnets. In the Ladd machine the current produced in the smaller of the two armatures charged, through its commutator, the electro-magnets of the field of force. The current from the larger armature was utilized externally. This machine was exhibited by its inventor at the Paris Exposition of 1867, and excited much attention. Although the plates composing the cores of the magnets were only 60 centimètres long, 30 wide, and 1.5 thick, the machine developed a current equivalent to that from 25 or 30 Bunsen cells, and maintained in a state of incandescence a platinum wire more than a mètre long and half a millimètre in diameter. Ruhmkorff, into whose hands the French patent for this machine passed, improved its construction by placing the magnets vertical instead of horizontal, and by using only one armature. This armature, however, was divided into two sections of unequal length, each having its own coil and commutator, the two coils being in planes at right angles to each other. The current from the smaller coil excited the field of force, as in Ladd's machine. The larger coil furnished the useful current. Schellen and Gaiffe appear to have suggested a similar improvement about the same time, though in their plan the same armature-core carried two separate and distinct coils wound over its whole length, and of course parallel. Since one-third more wire can be carried by an armature wound in this way, the results obtained with this armature are proportionally greater than with the one devised by Ruhmkorff.

The machines which have now been described, and which use the Siemens armature for the production of the current, have all of them a serious defect which has prevented their coming into general use. Since the polarity of the armature is reversed twice every revolution, there are several thousand magnetizations and demagnetizations effected every minute. But as the magnetizing and reversing of polarity develops heat in the iron, as Joule has shown, the result is an enormous development of heat in the armature. This is not only so much actual loss of power, but it actually endangers the safety of the machine, the cotton covering of the wire in one of Siemens's machines having been completely charred from this cause. In the machines both of Wilde and Ladd the portion surrounding the armature is of necessity made hollow, so that a stream of water can

* Wheatstone also communicated a paper to the Royal Society on the same day upon the same subject. But as Werner Siemens's paper had been read to the Berlin Academy as early as the middle of January, and the machine had been exhibited in that city in Dec., 1866, there can be no more doubt of Siemens's priority of publication than there is of Wheatstone's independence of discovery. Farmer of Salem, Mass., in a letter to Wilde received in Nov., 1866, states that the same idea had occurred to him, and that he had constructed a machine in which a thermo-battery furnished the current to start it, and then a branch of the main current sustained the magnetism.

be passed through it to keep it cool. Moreover, the currents produced in the armature-coil are alternately positive and negative in direction. For the electric light this is of no practical importance, provided the lamp is constructed accordingly. But for many purposes, as in electro-plating, this alternating current is inadmissible; then it becomes necessary to use a commutator to render the direction of the currents uniform. Under these circumstances there is produced, whenever the spring passes from one segment to the other, a long vivid spark or flame which heats and burns the surfaces in contact, thus lessening the conductivity at these points, and consequently the current-strength. But even then the current is not uniform in strength, but is intermittent—a defect fatal to its use for many purposes, as in telegraphy.

In July, 1871, Z. T. Gramme, an artisan of Paris, presented to the French Academy of Sciences a description of a new form of magneto-electric machine, in which an entirely novel principle appeared. Like all other similar machines, an iron armature surrounded with coils was caused to revolve in the vicinity of a magnet; but, unlike all others, this armature was shaped like a ring, its plane coinciding with that of the U-magnet to which it was attached, and its rotation in that plane being continuous in one direction. The principle involved in the Gramme machine may be illustrated by means of the annexed cut. (Fig. 10.) Let N S represent a bar magnet, and X a coil of

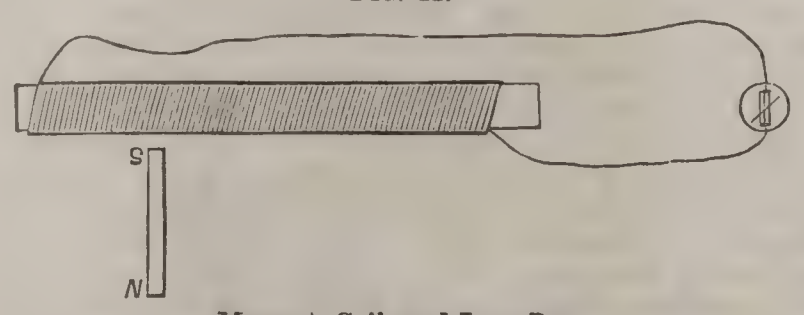
FIG. 10.




Coil and Bar Magnet.

copper wire, if the coil be made to approach the end of the magnet marked N, a current of electricity will be developed in it which will continue in the same direction until the coil reaches M, the neutral point; then it will change, continuing inverse until the coil passes off the bar at S. If the current produced when the coil moves from N to M be called positive, it will become negative as the coil moves from M to S. If the coil move from right to left, the current will be positive from S to M, and negative from M to N. To this magnet let a second one be now added, S′ N′, the two similar poles S and S′ being placed together. If now the coil move over this double bar as before, the current developed from N to M will be positive, from M to S negative, from S′ to M′ negative, and from M′ to N′ positive; all these currents being reversed when the coil moves back again. Substitute now in place of the magnet an iron bar surrounded with a permanent coil (Fig. 11), and place at a little distance from it a steel magnet

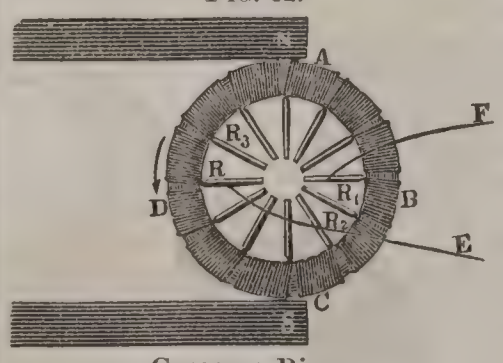
FIG. 11.




Magnet, Coil, and Iron Bar.

with its axis perpendicular to that of the bar. Whenever the magnet is moved to or fro along the bar, being kept parallel to itself, a current of electricity will flow through the coil, which under the circumstances given is due to three separate causes acting together—first, to the magnetization and demagnetization of the bar due to the approach and the recession of the magnet; second, to the constant change in polarity in the bar as the magnet moves along, while preserving constantly the same distance from it; and third, to the current which is generated in the coil itself when it cuts the lines of force of the moving magnet. The first of these currents may be demonstrated by moving the magnet to and from the bar in the direction of its own axis; the second, by keeping the magnet and the coil at rest, and moving the bar through the coil only; the third, by removing the bar entirely, and then moving the coil alone before the magnet, or the magnet before the coil. If the bar be annular, however—if it be in the form of a ring instead of a straight rod—the currents first named will, as Gaugain has shown, disappear entirely. Suppose now such a ring of iron be caused to rotate in its own plane between the poles of a U-magnet, the plane containing these poles coinciding with that of the ring, and the axis of rotation being of course perpendicular to this plane. (Fig. 12.) It is evident that upon the ring at the points A and C, opposite to the poles of the magnet, there will be double poles or consequent points; the S. pole of the magnet developing a double N. pole at the point C, and the N. pole developing a double S. pole at the point A. The ring may therefore be considered as made up of two semicircular magnets reversed in direction, so that the two N. poles are together and the two S. poles together, the neutral points being halfway between the poles, or on a line perpendicular to that joining the two poles. If now we suppose this ring to be covered with a series of coils of copper wire all wound in the same direction, it is obvious that as the coils move from B to A in the quadrant B A, a current will be generated in them, at first feeble, but gradually increasing in strength as the pole is approached. As above stated, this current will be due to two causes—first, to the fact that the spires of wire cut the lines of force of the magnet as they rotate; and second, to the fact that the iron nucleus is changing the distribution of its polarity constantly. Since these two currents flow in the same direction, they will of course reinforce each other. In the second quadrant A D the former of the two currents will remain unchanged in direction, since the lines of force are cut in the same way; the latter will, because the direction of motion of the ring with reference to the polarity of the magnet remains unchanged. The four currents thus developed in the two quadrants will therefore unite to produce a single current, the direction of which will depend on the polarity of the magnet, the direction in which the coils are wound, and the direction of rotation, following the laws of Lenz and Ampère. In the case assumed above the coil in moving from B to A approaches a N. pole. By Lenz's law the direction in it of the current will be such that the advancing end will be a N. pole, and thus oppose the rotation. In moving from A to D the coil is moving away from a N. pole. By the same law there will be developed S. polarity at the end of the coil nearest N, since this, by its attraction, will resist the motion. But the direction of the current which makes one end of a coil N. necessarily makes the other S.; hence the current is the same in both quadrants—*i. e.* from B to D. The same phenomena go on, of course, in the lower half of the ring, but the currents here flow in the opposite direction. It is clear, therefore, that corresponding to the two neutral magnetic points of the ring there are two neutral electrical points where no current flows, situated one on each side of the ring and halfway between the poles of the magnet; on the one side of the line joining these points a current flows through the coils in one direction, and on the other in the opposite. If no arrangement is adopted for removing these currents, they simply flow into and neutralize each other. But if to each wire between two consecutive coils—representing, therefore, the end of the previous coil and the beginning of the succeeding one—a piece of metal be attached, R, $R_1$, $R_2$, $R_3$, placed radially to the ring, and upon these two metallic springs F and E, placed on a line normal to that joining the poles, be allowed to press, it is evident that metallic contact will take place at the neutral points, and that these springs will represent the electrodes. The positive current will flow in one direction from all the coils on that half ring, and will accumulate at the one spring; the negative current will flow in the other direction from all the coils on the other half ring, and will accumulate at the other spring. The minimum number of coils which could act at all is therefore two; but, since the radial arms from them would make contact with the brushes only near the neutral line, the current from them would be weak, and of course intermittent. The best effect is obtained when the number of coils, and therefore the number of radial arms, is such as to allow contact of the springs with the succeeding arm before their contact with the preceding one is broken. Increasing the coils beyond this number increases the effect only by increasing the electro-motive force, which follows the same law as in the battery, where it increases directly as the number of cells.

FIG. 12.

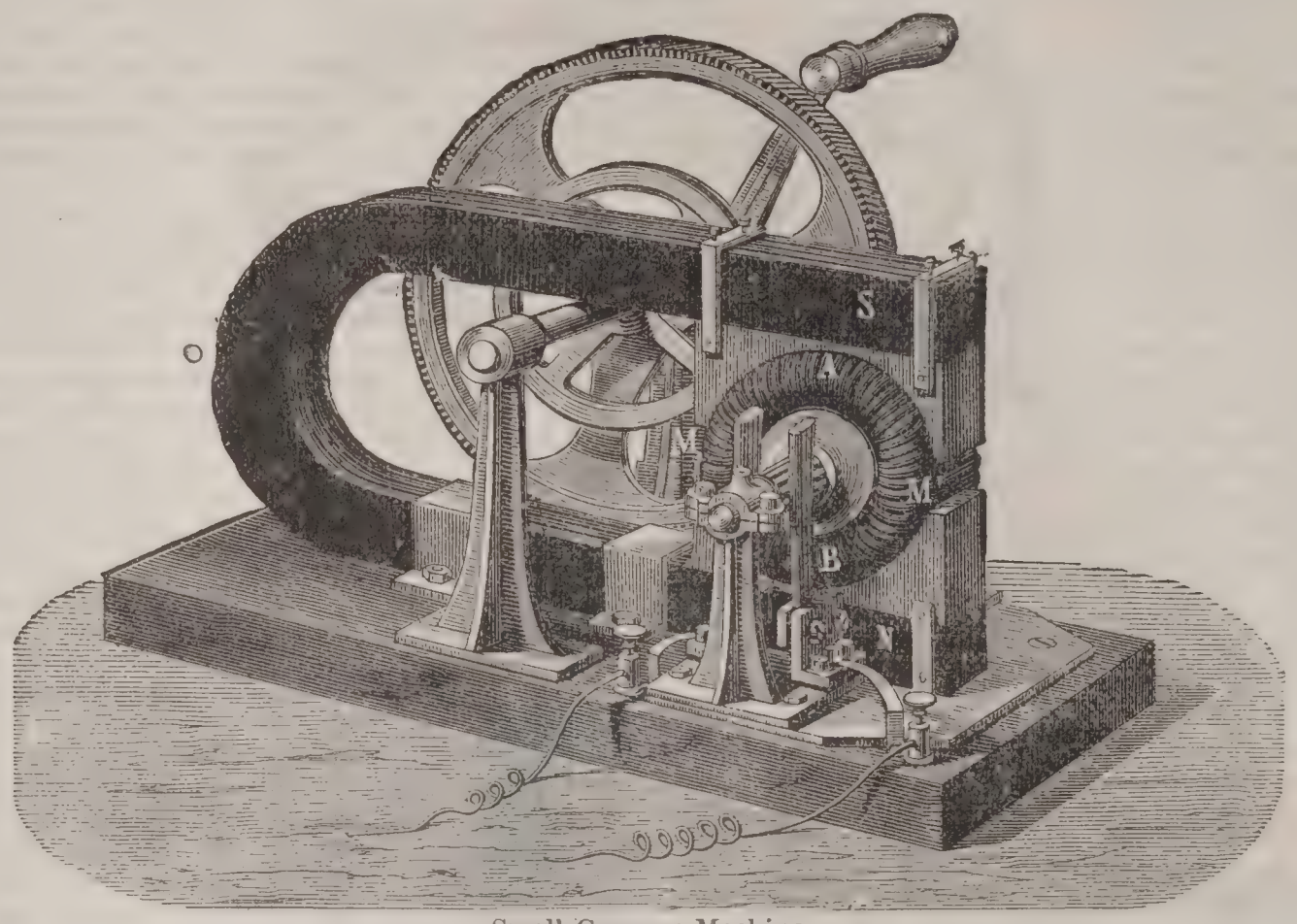



Gramme Ring.

The Gramme machine as first constructed is represented in the annexed wood-cut. (Fig. 13.) The field of force was produced by permanent steel magnets N O S. The armature was an iron ring A B, wound with coils as above described. Its construction is shown in detail in Fig. 14, where A represents the iron wires composing the ring, and B the coils of copper wire. A loop of wire is taken out between each coil and attached to a strip of copper R, which passes first radially, then turns at right angles, and passes through the ring parallel to the axis of rotation, each strip being insulated from the next and from the axis.

A cylinder of copper strips is formed in this way around the axis, each representing the end of one coil and the beginning of the next. Upon opposite sides of this cylinder two brushes formed of moderately fine copper wire press at the neutral points, thus constituting the electrodes. It was not long, however, before Gramme adopted the dynamo-

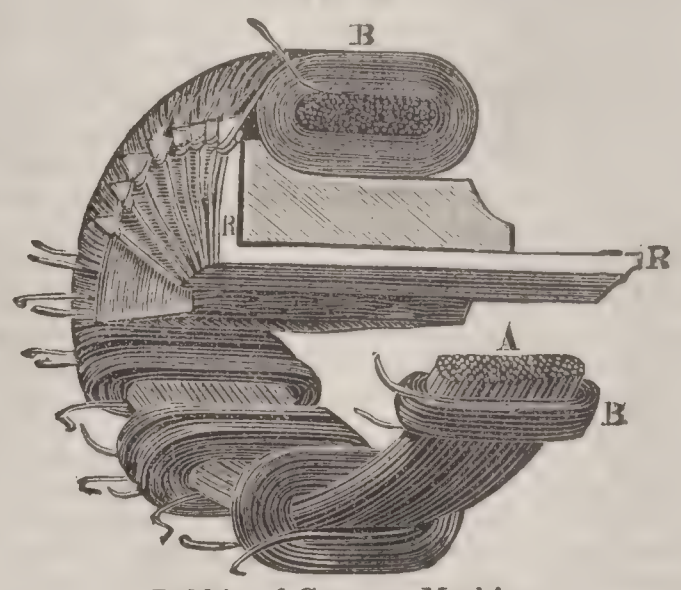
Fig. 13.




Small Gramme Machine.

principle of Siemens, and used electro-magnets in place of steel ones. The form of machine exhibited at the Vienna

Fig. 14.

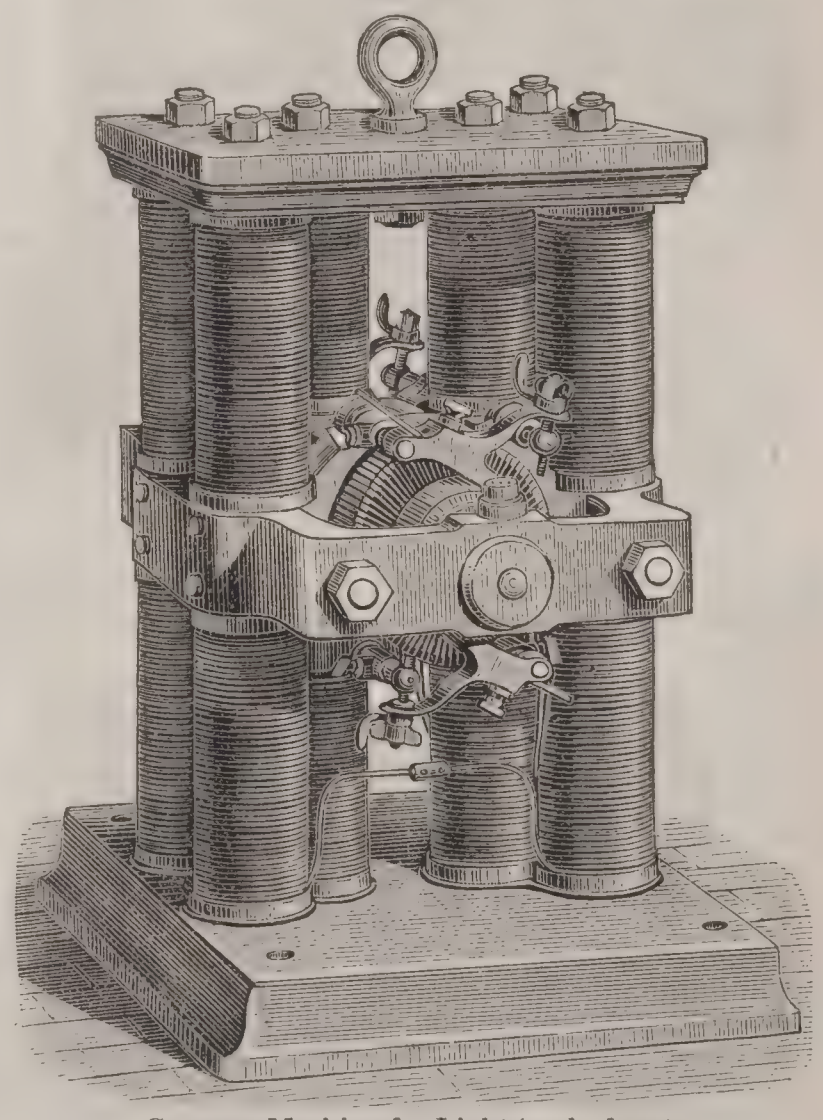



Bobbin of Gramme Machine.

Exposition of 1873 (Fig. 15) involved the principle which Ladd had devised—*i. e.* that of two separate rings or bobbins, one to magnetize the field, the other for external work. The largest of these machines had twelve electro-magnets —six above and six below—arranged in sets of three. It had also two separate rings or bobbins, as above mentioned. It weighed 700 kilogrammes, was 90 centimètres high by 65 centimètres square, had 180 kilogrammes of copper wire on the magnets and 40 kilogrammes on the bobbins, and gave from 3500 to 7000 candlelights, according to the speed. It consumed six horse-powers.

In 1874, Gramme communicated a paper to the French Academy in which he described several important improvements in his machines. In the smaller or magneto-electric machines he substituted Jamin's laminated magnet, formed of a large number of thin plates, for the thick-plate compound magnets before used, and otherwise improved their construction. (Fig. 16.) In the larger or dynamo-electric machines the bobbin for generating the current to charge the magnets was suppressed, and the electro-magnets were included in the main circuit of the machine; Gramme believing, and justly, apparently, that when the magnetic equilibrium was once obtained, its maintenance would not require the expenditure of work. According to the purpose for which the machine is to be used the number of coils on the bobbin is small or large (of course never falling below the minimum number determined as above), and the wire with which they are wound is coarse or fine. As in all rheomotors, so here; the maximum current strength is obtained when the external and internal resistances are equal, when the resistance of the machine itself is equal to that of the circuit outside of it. Hence it follows that for low external resistance the number of coils on the bobbin must be a minimum, and these, as well as the field of force-coils, must be wound with very coarse wire. Where the external

Fig. 15.

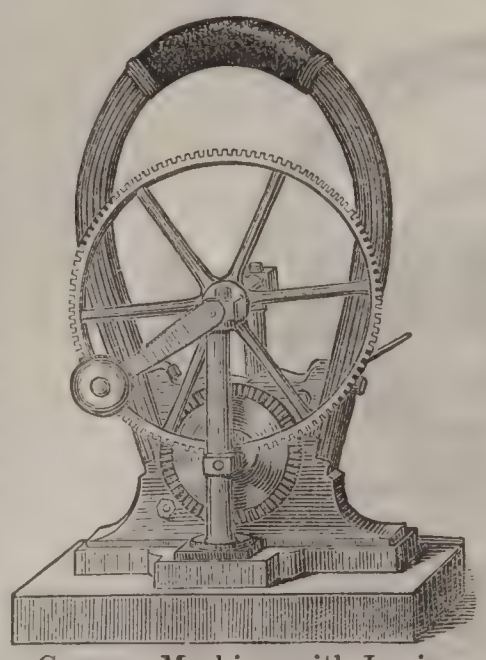


Gramme Machine for Light (early form).

resistance is high the number of coils must be increased (to increase the electro-motive force), and the wire used on them and on the field of force must be proportionally fine. In the plating-machines of Gramme, for example (Fig. 17), the magnet is wound with broad strips of sheet copper, as wide as the core of the magnet is long, and the bobbin consists of twenty coils wound with narrow flat copper strips. In the lighting-machines, the resistance of the electric arc being considerable, the electro-motive force is increased by increasing three or four fold the number of coils on the bobbin, and the internal resistance is increased by winding both the bobbin and the field of force with wire. An excellent machine of the newer construction, imported by the writer in Feb., 1875, for the University of Pennsylvania, and which continues still to be the largest light-machine on Gramme's principle in the country, is represented in Fig. 18. It is 55 centimètres square at the base and 60

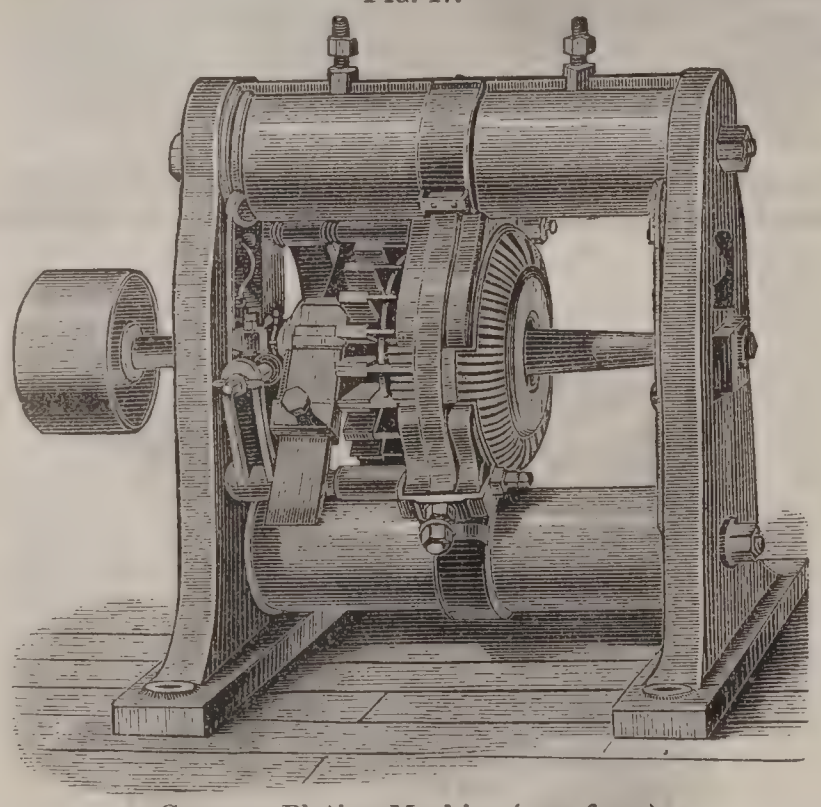
centimètres high. It weighs in all 183 kilogrammes, has 47 kilogrammes of copper wire on the magnets, and 4.7 kilogrammes on the ring. The peculiarity of the instrument lies in the construction of the bobbin. Upon the ring of iron wires ordinarily used two distinct sets of coils are wound, the entire number on the ring being 80. The loops of wire between these coils come out alternately upon the right and the left side of the ring, and are attached to two separate break-pieces on the axis, one on either side of the bobbin. The total resistance of the machine at rest is 1.57 ohms, that of the field of force being 1 ohm, and that of the bobbin 0.57 ohm. The electro-motive force developed at a speed of 600 rotations is about 50 volts. From the above description it will be seen that this machine is really two machines in one; it is therefore capable of various modifications. If the field of force be connected with two alternate brushes, and the external circuit with the other two, the current from both coils traverses the entire circuit, external and internal, and the maximum electro-motive force is developed, producing an electric light of from 1400 to 2000 candles, according to the speed. If one-half the field of force be connected with one set of coils, and the other half with the other, both being independent, two separate currents are generated, and two electric lights can be simultaneously produced. If the entire field of force be connected with one set of coils, the other set furnishes a strong continuous current, admirably adapted for working an induction coil or for telegraphy. If the two sets of coils be connected in parallel circuit—technically, in multiple arc—with the field of force and the external circuit, the electro-motive force lessens, but so also does the resistance, and to a greater degree; so that when the external resistance is small a considerably stronger current is obtained. Finally, if the bobbin-coils be connected together in the way just stated, a portion of the current may be sent through the field of force and a portion be diverted to external use. By means of these various combinations a double machine of the sort mentioned may be made to produce five quite different results. Since there are no rapid magnetizations and demagnetizations in the armature, the machine does not develop appreciable heat in the bobbin. Moreover, the sparks at the break-pieces are insignificant.

FIG. 16.



Gramme Machine, with Jamin magnet.

FIG. 17.



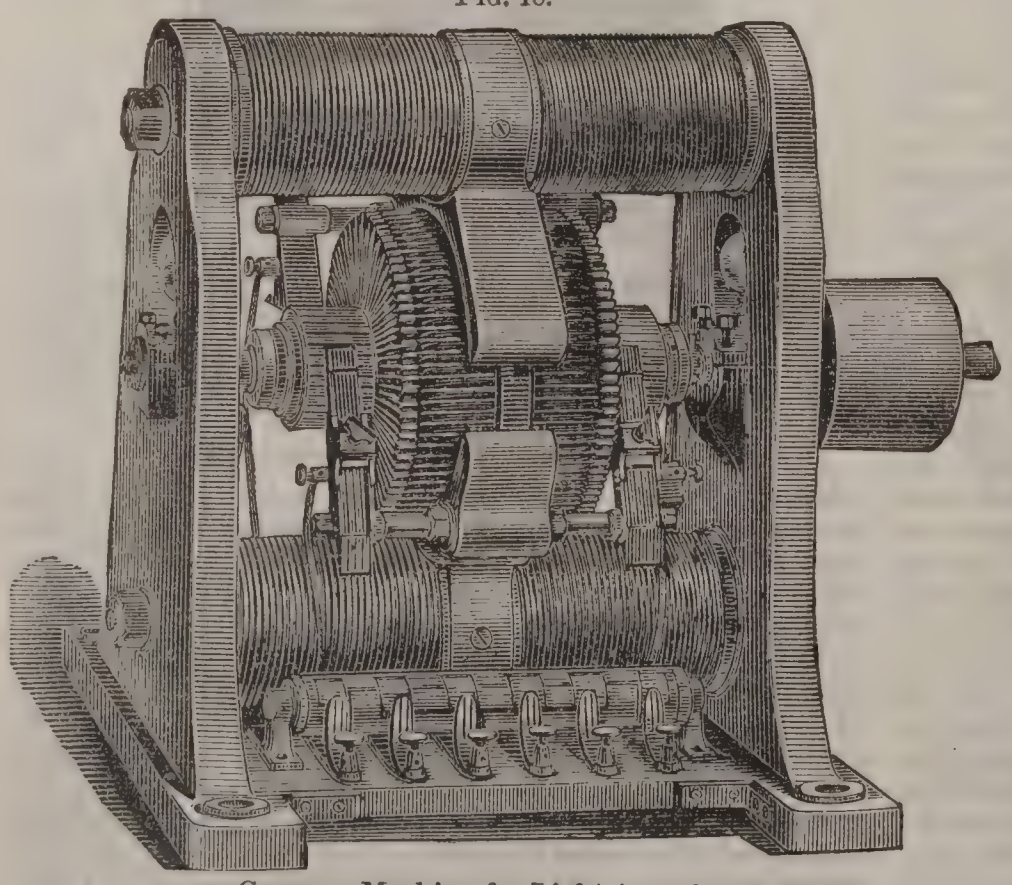
Gramme Plating-Machine (new form).

The question of the absolute efficiency of the Gramme machines has been pretty thoroughly investigated. Tresca has made a series of experiments with the machines for light, in which he used two machines of different sizes. The larger machine had eight electro-magnets, each wound with 24 kilogrammes of wire 3.3 millimètres in diameter. The bobbin was double, and was wound with 140 kilogrammes of wire 2.6 millimètres thick. The smaller machine had four magnets, each wound with 14.32 kilogrammes of copper wire 3.8 millimètres thick, and a single bobbin having on it 4.65 kilogrammes of wire 2 millimètres in diameter. The large machine gave a light of 1850 Carcel burners, of seven candles each, and consumed 7.68 horse-powers; the small machine gave a light of 302.4 burners, and consumed 2.81 horse-powers. The former machine, therefore, required an expenditure of 0.31 kilogrammètre per burner per second, the latter of 0.69 kilogrammètre, showing a large economy in favor of the larger machines. To produce the amount of light given by the larger machine by means of coal-gas would cost 50 times, and by means of oil 100 times, as much. Hagenbach, using a still smaller machine, and measuring not only the light produced and the power consumed, but also the current-strength developed, obtained the following results:

| Number of rotations per minute. | Luminous intensity in standard candles. | Current strength in c. c. of gas per minute. | Electro-motive force in Deleuil cells. |
|---|---|---|---|
| 1700 | 506 | 119 | 40.8 |
| 1800 | 567 | 126 | 43.2 |
| 1900 | 628 | 133 | 45.6 |
| 2000 | 689 | 140 | 48.0 |

The Deleuil cell here used as a unit is a Bunsen cell equivalent to 1.6 Daniell cells. Moreover, he found that to give 1800 revolutions per minute, and therefore to produce 567 candlelights, equivalent to 80 Carcel burners, a force of 90 kilogrammètres (1.2 horse-powers) was required, or 1.1 kilogrammètres per Carcel burner—a result agreeing well with those of Tresca when the size of the machine is taken into the account. The power used in these experiments was water-power, the cost of the light being only 3 francs 40 centimes per hour. To give the same amount of light with Deleuil cells which the machine gave with 1700 rotations would require 72 cells; with 2000 rotations, 86 cells.

FIG. 18.



Gramme Machine for Light (new form).

The plating-machines in their most recent form have a weight of 117.5 kilogrammes, are 60 centimètres high and 55 centimètres wide, and have upon them 47 kilogrammes of copper wire. Driven with a force of 50 kilogrammètres per second—two-thirds of a horse-power—they have deposited 600 grammes of silver per hour.

The exhibit of the Gramme Magneto-electric Machine Co. of Paris at the International Exposition at Philadelphia in 1876 consisted of five large machines for light, ranging in power from 500 to 20,000 candles, one large low-resistance machine for electro-plating, and two smaller hand machines, constructed with the Jamin laminated magnet. One of the large light-machines was put in operation almost daily, the Serrin regulator being used with it.

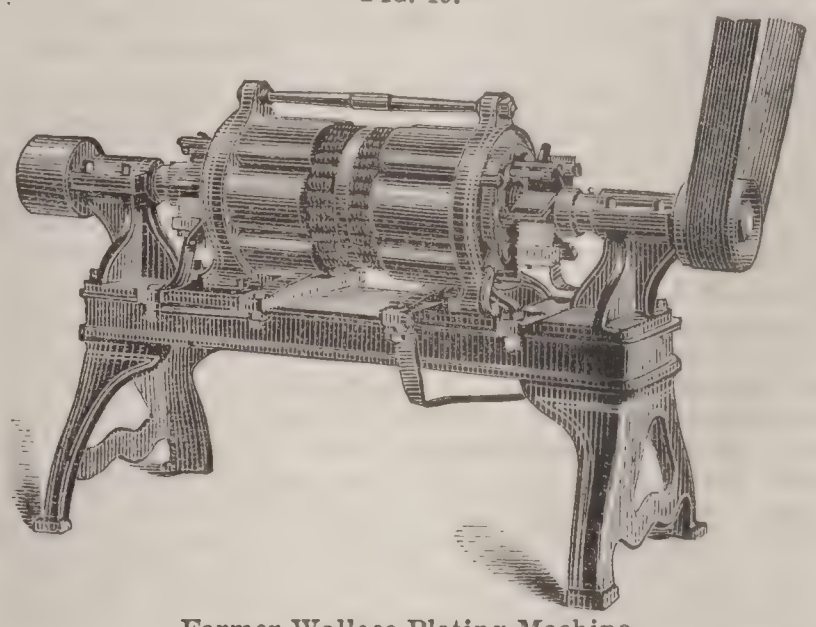
In 1873, Siemens and Halske exhibited at the Vienna Exposition a powerful dynamo-electric machine for light, in which the iron armature was at rest, the coil being supported upon a frame of brass, and revolving in the annular space between the armature and the magnets.

In April, 1873, Wilde proposed a new form of dynamo-electric machine, in which he sought to obviate the inconveniences arising from the high speed at which the Sie-

mens armature requires to be driven. The field of force consists of two sets of cylindrical electro-magnets, 16 in each set, their axes being horizontal and their poles facing each other, firmly bolted to a circular framing placed vertically. In the cylindrical space enclosed by these magnets runs, on suitable bearings, a horizontal shaft carrying an iron disk at its centre, near the periphery of which, and opposite to the poles of the electro-magnets, are 16 iron cores with their axes perpendicular to the disk, and extending through it about two inches on each side. These cores are wound with wire, and constitute the bobbin. When driven at 1000 revolutions per minute the machine consumes about ten indicated horse-powers, and produces a current which fuses 12 feet of No. 15 B. W. G. iron wire (.075 inch diam.), and gives a light of 9600 candle-powers, thus yielding twice the power with one-quarter the weight of materials of the earlier Wilde machine. Though the machine did not produce serious heating of the armature, yet the commutator difficulties were not altogether overcome in it.

In April, 1875, a patent was taken out in the U. S. by Farmer, then of Newport, for a machine essentially similar in mechanical construction to that of Wilde, just described. The form of the plating-machine is shown in Fig. 19. It

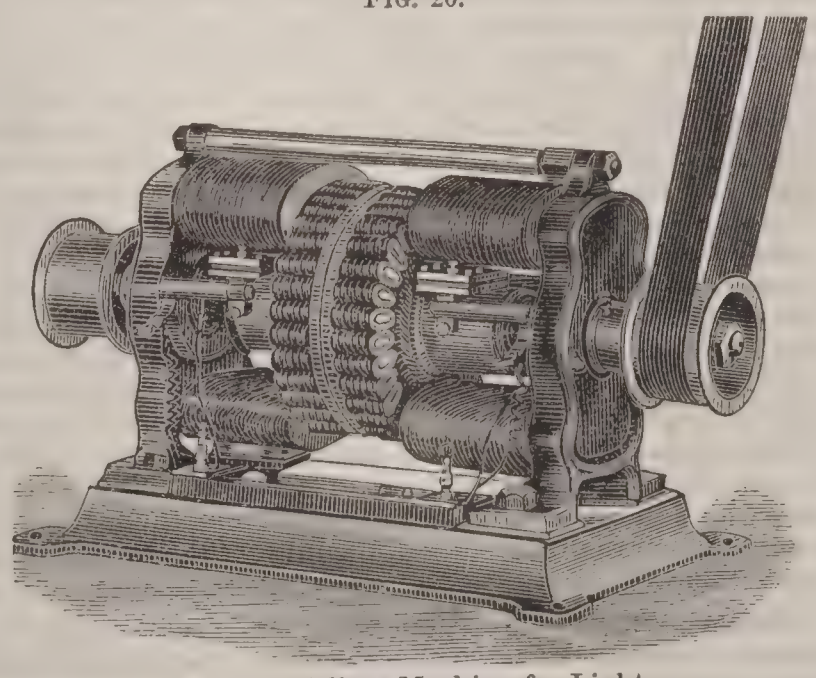
Fig. 19.



Farmer-Wallace Plating-Machine.

had two sets of electro-magnets of 6 each, facing inward for the field of force, and 17 coils on each face of the disk for the bobbin. The machine was 61 inches long, 12 wide, and 16 high, and stood on a table 2 feet from the ground. These machines have undergone considerable modifications and improvements in the hands of the manufacturers, Wallace & Sons of Ansonia, Conn., and have come into very general use, especially for electro-deposition of metals. In the newer forms of the Wallace machine eight of the field-of-force coils are dispensed with, and the machine is made duplex by placing a break-piece upon each side of the bobbin. One of these machines, 39 inches long, 14 inches wide, and 19½ inches high, at 425 revolutions per minute has deposited 64 ounces of copper per hour, working day and night with but little attention. A huge machine of this description has recently been completed (Nov., 1876) which is 60 inches long, 48 inches high, and 33 inches wide, weighs nearly three tons, and at a speed of only 230 rotations per minute, gained with the expenditure of ten horse-powers, it deposits 15 pounds of copper per hour, and

Fig. 20.



Farmer-Wallace Machine for Light.

heats to incandescence 17 feet 3 inches of copper wire, 0.226 inch in diameter, and 2½ feet of ¾-inch iron gas-pipe; and this for months together without producing any heat in the bobbin or coils, and without giving sparks at the break-piece. The magnetic field of this machine is so intense that a 5-inch iron spike held 7 feet distant is so strongly magnetized as to sustain an ordinary tenpenny nail.

The machines for lighting have also been similarly modified. In place of 12 magnets in the field of force, only 4 are used, though these are somewhat larger than formerly. Fig. 20 represents one of the four machines employed in lighting the grounds of the Philadelphia Exhibition of 1876. It had 25 armature coils on each side, wound with wire 0.045 inch in diameter, the wire on the field-of-force coils being 0.188 inch in diameter, and the total resistance of the machine being 4.62 ohms. The total weight of this machine is about 1500 pounds (680 kilogrammes), and with a speed of 800 revolutions it consumes five horse-powers and gives a light of 5000 candles. The sparks at the break-piece were not serious, and the heating was inconsiderable. Wallace has also built a machine for light in which the armature has 200 coils, and which with 800 rotations gave a light of 15,900 candles, being 85 candles per pound of copper wire used in its construction.

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**Malthe'idæ** [from the genus *Malthæa* and the suffix *-idæ*], a family of fishes of the order Pediculati, distinguished by the large depressed, heart-shaped (pointed forward) or orbicular anterior part and slender subcylindrical but tapering posterior part of the body, which is naked or covered with scattered spinous disks or tubercles; no lateral line is developed; the head is covered by the integument in common with the shoulder-girdle, and this combination forms the anterior disk, which is abruptly distinguished from the small posterior region; the mouth is inferior, and the cleft mostly transverse; the teeth are villiform, and at least on both jaws; the branchial apertures are small dorsal slits, and in the upper axillæ of the pectoral limbs; there are five branchiostegal rays; the dorsal fins are peculiarly developed—(1) the first being represented by a tentacle on or under the snout, and (2) the second is a small but true fin (with four rays) on the slender body; the anal is like the dorsal; the pectorals are

at the end of the long arms, which appear to have elbows, and are flexed outward and to some extent forward; the ventrals are small, but perfect (with a spine and five rays), and far forward on the throat; the skeleton is fibro-cartilaginous, and has seven or eight abdominal and ten or eleven caudal vertebræ; no air-bladder or pyloric appendages are developed. The very singular and grotesque fishes belonging to this family are found chiefly in warm waters. Only three genera are known, which represent, however, two very distinct types of structure or sub-families—viz. (1) Maltheinæ, with the genus *Malthe*, whose several species inhabit the Atlantic coast waters and the Gulf of Mexico; and (2) Halieutæinæ, with the Japanese and Chinese genus *Halieutæa* and the rare Caribbean genus *Halieutichthys*. They are able to progress on the ground by clumsy leaps by means of the arms, which are *far behind* the ventrals or representatives of the hind legs of land vertebrates. The *Malthe*, or bat-fish, is sometimes caught from the wharves of New York, and the *Halieutæa* often comes in boxes of Chinese insects and other "curiosities." THEODORE GILL.

**Manumis'sio,** in Roman law, the form by which slaves were made free, took place in three different ways—namely, by *vindicta*, a word signifying the liberating rod or staff, by *census*, and by *testamentum*. In the first case the master brought his slave before the magistratus and stated the grounds of the intended manumission. After certain ceremonies the master pronounced the words, "*Hunc hominem liberum volo*," turned the slave around, and let him go, *emisit e manu*. Manumissio by census took place by the slave enrolling his name as a citizen of the *census lustralis* with the consent of his master.

**Manid'idæ** [from *Manis*, the typical genus, and the suffix *-idæ*], a family of mammals of the order Bruta or Edentata and the sub-order Squamata. These animals are at once distinguished from all other mammals by the peculiar modification of the integumentary appendages, which are developed as large leaf-like scales arranged in regular rows and simulating the appearance of a pineapple or pine-nut: the body is elongated, with a long flattened tail, and the scales extend on the tail as well as the head, and sometimes the feet; so much do they mimic lizards that the older authors confounded them with the latter under the name *Lacertus;* the feet are normal in form, and the digits are developed in full number—*i. e.* five to each foot—but the external are much shortened; the animals, however, are club-footed, and walk on the *outer side* of the feet. The skull is quite peculiar, depressed conic in outline, with small intermaxillaries; maxillaries short, and with the malar processes declivous; the palatines expanded in front; no malars or lachrymals; a large lachrymal opening; and the zygoma deep, thin, and "pushed downward to the anterior and inferior angle of the squamous portion" (*Turner*); teeth are entirely wanting. The family has about eight species, which differ among themselves in the size, form, and extension of the scales, the length of the tail, the size of the digits, etc. They have been by some combined in a single genus, and by Gray divided among five—viz. (1) *Manis*, (2) *Phatagin*, (3) *Pholidotus*, (4) *Pangolin*, and (5) *Smutsia;* the representatives of the first and second (genus *Manis*), as well as fifth groups (genus *Smutsia*), inhabit Africa, and those of the third and fourth (genus *Pholidotus*), India. They feed upon termites, ants, and other insects. THEODORE GILL.

**Mardi Gras.** See NEW ORLEANS, in CYCLOPÆDIA.

**Marseilles',** p.-v., La Salle co., Ill., 77 miles S. W. of Chicago, on the N. bank of Illinois River, and upon Chicago Rock Island and Pacific R. R., has a fine water-power, 5 churches, 2 graded schools, a national bank, 1 weekly newspaper, 4 grain-elevators, 3 paper and 2 grist mills, and 2 agricultural, plough, and other factories. P. 758; in 1877, 2000.

J. H. GOODELL, ED. "HISTORY MARSEILLES."

**Mar'shall** (WILLIAM R.), b. in Boone co., Mo., Oct. 17, 1825; was educated at Quincy, Ill.; went to Minnesota (then Wisconsin Territory) in 1847; was a member of the first legislature of Minnesota in 1849; founded the St. Paul *Daily Press* in 1861, together with J. A. Wheelock; entered the army in 1862 as lieutenant-colonel of 7th Minnesota Vols.; commanded a brigade in the battles of Nashville (Dec. 15 and 16, 1864); was elected governor of Minnesota in 1865, and re-elected in 1867.

**Mastacembel'idæ** [from *Mastacembelus*, the typical genus, and the suffix *-idæ*], a family of fishes of the order Opisthomi. The body is eel-like (but comparatively much less elongated than in the eels), the tail being stout and tapering gradually; it is covered with very small cycloid scales; the lateral line is distinct; the head is elongate-conic and declivous, and the snout produced into a flexible appendage; the mouth is inferior, the cleft narrow, and the jaws little movable; the teeth are minute and pointed; the branchial apertures limited to the inferior portion of the head; branchiostegal rays six; the rayed portions of dorsal and anal fins are equal, and limited to the posterior half or third of the body; there are also numerous free dorsal spines and three anal ones; the caudal is either separately developed (in *Rhynchobdella*) or united, as in the eel, with the dorsal and anal (in *Mastacembelus*); the pectoral fins are normally developed; ventrals wanting. The vertebræ are in large number (in *Rhynchobdella* 32 + 40); there are two pyloric cæca. The family has two genera, *Mastacembelus* and *Rhynchobdella*, confined to Asia and West Africa, and best represented in the fresh waters of the East Indies. Under the name of "eels" they are esteemed by the English residents of India. THEODORE GILL.

**Masticu'ra** [from Gr. μάστιξ, "whip," and οὐρά, "tail"], a sub-order of Raiæ, distinguished by the attenuated caudal region or quasi whip-like tail, and the absence of a rayed terminal fin, thus contrasting strongly with all other fishes, in which that region is more or less fleshy and forms a considerable portion of the body. All the systems (osseous, muscular, etc.) are atrophied in this region in the Masticura. The sub-order is represented by three families—viz. Trygonidæ, "sting-rays;" Cephalopteridæ, comprising the "devil-fish" of our southern coast; and Myliobatidæ, or eagle and cow-nose rays. (See also PACHYURA and RAIÆ, in CYCLOPÆDIA.) THEODORE GILL.

**Matile'** (GEORGE AUGUSTE), b. at La Chaux-de-Fonds, canton of Neufchâtel, Switzerland, May 30, 1807; was educated in the colleges of Neufchâtel and Berne; studied law in Berlin, Heidelberg, and Paris, and was admitted to the bar in Neufchâtel in 1830. He served several terms in the legislature of his canton, and was appointed professor of law at the University of Neufchâtel in 1838, and one of the judges of the supreme court; emigrated in 1849 to the U. S.; was naturalized as an American citizen in 1856, and appointed professor of history at Princeton, N. J., in the same year, and professor of French literature at the University of Pennsylvania in 1858. From 1863 to 1876 he held various positions in the state department in Washington. The principal of his works are *Points de Coutume* (1838), *Autorité du Droit romain de la Coutume de Bourgogne et de la Caroline dans la Principauté de Neufchâtel* (1838), *Musée historique de Neufchâtel* (3 vols., 1841–59), *Monuments de l'Histoire de Neufchâtel* (2 vols. fol., 1844–48), *Histoire de la Seigneurie de Valangin* (1852), *La Loi Gombette* (4to), *Collégiale de Neufchâtel* (fol.), *Political Economy* (translated from List), etc. A. GUYOT.

**Meek** (FIELDING BRADFORD), M. N. A. S., b. at Madison, Ia., Dec. 10, 1817; educated in the city school of that place, and became at an early age interested in the study of the Silurian fossils, which are very abundant there. At majority, by advice of friends, but against natural inclinations, he engaged in commercial pursuits, continuing, however, his scientific studies. In 1848 and 1849 he was employed as an assistant in the U. S. geological survey of the upper Mississippi country, under D. D. Owen. From about 1852 to 1858 he worked as an assistant of Prof. Hall at Albany on the palæontology of New York, but meanwhile engaged two summers with the State geological survey of Missouri. In 1853, assisted by Dr. F. V. Hayden, he brought a valuable collection of vertebrate and other fossils from the *Mauvaises Terres* or "Bad Lands" of Dakota for Prof. Hall. In 1858 he took up his residence at Washington, D. C., and devoted most of the time while living there to investigating and reporting on organic remains brought in by government exploring expeditions. His labors have been largely published jointly with others; his minor papers on palæontology and geology were successively given in *Trans. Albany Inst., Am. Jour. Sci. and Arts, Proceed. Acad. Nat. Sci.* (Philadelphia, 1856–74), *Smithsonian Contr. to Knowledge, Proceed. and Trans. Chicago Acad. Sci., Proceed. Am. Philos. Soc.*, etc.; his most important are in *Palæont. California* (vol. i., 1864), *Reports Ill. State Geol. Survey* (vols. ii., 1866, iii., 1868, and v., 1873), *Palæont. State Geol. Survey of Ohio* (vols. i., 1873, and ii., 1875); and, last and above all, *A Report on the Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country* (Washington, 1876, liv. 629 pp., 45 pl.). On the completion of this last great work he rested from his labors, and was on the eve of starting for Florida to spend the winter there, when he was attacked by a hæmorrhage of the lungs, and shortly afterward died on Dec. 28, 1876, at the Smithsonian Institution. THEODORE GILL.

**Megalosau'ridæ** [from the generic name, *Megalosaurus*], a family of the extinct order of dinosaurian reptiles, established by Huxley in 1869 for those gigantic reptiles of the Triassic epoch characterized by the want of dermal armor or scales; the deep and thick mandibular rami which meet by rounded ends in the symphysis; the

sharp-pointed maxillary teeth, whose crowns have severally a longitudinal serrated ridge, either on the middle of the posterior face only or on the middle of its anterior face as well, its serratures being directed at right angles to the long axis of the tooth; the teeth not worn by mastication; the ilium with its anterior prolongation about as large as the posterior; the femur with its proximal end flattened, curved, and twisted in such a manner that its plane is oblique to that of a flat surface on which the condyles rest. By Huxley the genera *Teratosaurus, Palæosaurus, Poikilopleuron, Lælaps,* and provisionally *Euskelosaurus,* are referred to the family. (See also MEGALOSAURUS, in CYCLOPÆDIA.)

THEODORE GILL.

**Melani'idæ** [from *Melania*—μέλας, "black"—the typical genus], a family, or rather a group of families, of gasteropod mollusks of the order Diœca, characterized, in common with the Cerithiidæ, Vermetidæ, etc., by the absence of a distinct copulatory organ (penis or verge), and comprising an immense number of fresh-water shells found in all parts of the globe. These have been united together with the following common characters by the Adams Brothers: Lingual membrane long and linear; teeth in seven series (3.1.3), the lateral teeth uncinate, multicuspid. Rostrum broad, annulated. Tentacles subulate, with the eyes on bulgings at their outer sides. Mantle margin produced into a rudimentary siphonal fold in front. Gill simple and pectiniform. Foot broad and short, angulated in front. Operculum horny, ovate, subspiral. Shell spiral, turreted, covered with a thick, dark-colored epidermis; aperture often channelled or emarginate in front; outer lip simple. These characters, however, are not strictly applicable to all, or diagnostic; the group, indeed, is rather a heterogeneous one, which has been differentiated into several groups equivalent to families by Troschel, and named (1) Ancyloti, (2) Thiaræ, (3) Melaniæ, and (4) Pachychili, and have been chiefly distinguished by differences in the lingual dentition.

I. The Ancyloti of Troschel (Ceraphasiidæ) are oviparous animals, with a plain or unfringed mantle, and with the snout projecting beyond the foot; they have the median or rhachidian tooth broader than high, round behind, and swollen out before; the laterals have a rhombic form, with the outer posterior angle somewhat drawn out; the uncini are narrow, but dilated at their apices and multidentate, the outer having more numerous teeth than the inner; the shell has generally a more or less canaliculated aperture; the operculum is paucispiral. This group includes all the species that have been confounded under the name Melania, distributed so abundantly in the streams of the U. S. Nearly 500 species have been admitted by Mr. Tryon in a recent monograph of the family, but this number will undoubtedly have to be reduced. The species have been arranged under nine genera by Tryon—viz. *Pleurocera, Angitrema, Lithasia, Strephobasis, Eurycælon, Goniobasis, Schizostoma, Meseschiza,* and *Anculosa.* These, however, are not natural sections. *Anculosa prærosa, Mudalia dissimilis, Schizostoma ovoidea, Goniobasis depygis,* and *Io fluvialis* seem to be the most differentiated (but not the only) types, around which the various species of our waters can respectively be grouped.

II.–III. The Thiaræ and Melaniæ of Troschel (Melanidæ proper) are viviparous animals, with a fringed border to the mantle, and with the snout also projecting beyond the foot. They have the median tooth broader than high, and angulated behind; the laterals are long and cleaver-like, or sigmoidal, with the bases extended far sidewise; the uncini are elongated, triangular, and crenulate or dentate. To this group belong most of the species of the rivers of the Old World, and which are especially abundant in Southern Asia.

IV. The Pachychili of Troschel (at least embracing the Melanopidæ) are animals with a plain margined mantle, and with the foot in progression normally projecting beyond the snout; the median teeth of the radula are in general quadrangular, and broader than high, and with rounded angles; toward the base in the middle are four characteristic lines of insertions, etc., more or less concave toward the base of the tooth; the lateral teeth are rhombic; the uncini moderately developed in length and width. The group as distinguished by Troschel includes the tropical and sub-tropical American genus *Pachychilus* and the Old World genera *Melanopsis, Vibex,* etc.

THEODORE GILL.

**Michel'** (Sir JOHN), b. in 1804; entered the British army as ensign 1823; served in the Kaffir wars of 1846–47 and 1852–53, and nominated a C. B. in the latter year for his distinguished services; for service with the Turkish contingent was nominated to the second class of the Medjidie, and for the Indian campaign of 1858–59, when he defeated the rebels at Beorora, pursuing and dispersing them and capturing twenty-seven guns, he was created a K. C. B. In the China campaign of 1860 he commanded a division. He became a colonel in 1854, major-general in 1858, lieutenant-general 1866, general 1874; colonel of the 86th Foot since 1862. In 1875 he was appointed to the command of Her Majesty's forces in Ireland.

**Miles** (JAMES BROWNING), D. D., b. in Rutland, Mass., in 1823; graduated at Yale College 1849; studied theology at Andover and New Haven; tutor in Yale College two years; ordained and installed pastor of the First Congregational church in Charlestown, Mass., in 1855; chaplain of the senate of Massachusetts 1866–67; in 1872 resigned his pastorate to take the office of secretary of the American Peace Society. In this position he became identified with the Association for the Reform and Codification of the Laws of Nations, and was made its general secretary. D. in Worcester, Mass., Nov. 13, 1875.

**Mil'ler** (JOAQUIN), b. in Cincinnati, O., in 1841; in 1854 ran away from home and went to the California mining regions; was taken prisoner by the Modoc Indians, and lived with them five years, learning their language and fighting their wars with them; left them in 1858, and went to San Francisco; in 1860, after studying law a short time, was admitted to the bar in Oregon; in 1862 edited a newspaper for a short time; in 1866 was elected district judge of Oregon, and served in that position four years. His poetical works are—*Pacific Poems* (1873), *Songs of the Sierras* (1873), *Songs of the Sun Lands* (1873), *Ship in the Desert* (1875), *Adrianne, a Dream of Italy* (1876); his prose works are—*Unwritten History* (1874), *First Families of the Sierras,* a novel (1875), *One Fair Woman,* a novel (1876).

J. B. BISHOP.

**Mi'nor** (VIRGINIA L.), better known as Mrs. FRANCIS MINOR, b. in Virginia; resides in St. Louis. She started the woman suffrage movement in Missouri 1866; organized the Woman Suffrage Association in 1867; presided over the convention of woman suffragists in St. Louis, 1869; and brought in 1872 the proper suit for woman suffrage which finally reached the Supreme Court of the U. S., and was decided adversely.

SUSAN B. ANTHONY.

**Mitsukuri Rinsho,** b. in Tokio, Japan, about the year 1844; was of the Samuari class; when only fifteen years of age had acquired considerable reputation as a scholar, and was not long in acquiring a knowledge of the Japanese, Chinese, Dutch, French, and English languages, and before ever leaving his native land was considered a better English scholar than any of his fellow-countrymen who had studied abroad. Just before the abdication of the late tycoon he visited Europe, and with the Japanese minister was present at the French Exposition. Both before and after that date he had translated many foreign books into Japanese, among which was the *Code Napoléon.* By the mikado's government he was appointed a professor in the European college of Tokio; was also secretary to the council of state; and of late years has been a tutor of foreign languages in the imperial household. He belongs to what is called the fourth rank in the judicial department; and it is a remarkable fact that his father, an uncle, and a brother are all distinguished for their scholarly attainments.

F. A. P. BARNARD.

**Mnioltiltidæ.** See WARBLERS.

**Mon'ument,** the general term for any architectural structure, from a complete building to a simple heap of stones, erected or arranged in commemoration of some person or event, will be found treated under the headings ARCH, ARCH TRIUMPHAL, COLUMN, CROMLECH, MAUSOLEUM, OBELISK, PYRAMIDS, in CYCLOPÆDIA.

**Morell** (GEORGE W.), b. at Cooperstown, N. Y., Jan. 8, 1815; graduated at the U. S. Military Academy 1835; resigned 1837; studied law, and began practising in New York in 1842; served with the New York State militia in the civil war, and became major-general in 1862.

**Mor'row** (THOMAS VAUGHN), M. D., b. in 1804 in Kentucky; founded a reformed medical school at Worthington, O., under the auspices of Bishop Chase, and on the close of that institution in 1845 he established the American Eclectic School of Medicine at Cincinnati, O., which became the nucleus of the American Eclectic system of medical reform. D. July 16, 1850.

ROBERT S. NEWTON.

**Mor'tars,** short cannon for throwing shells, usually fired at angles from 35° to 45° elevation, called "vertical fire," in contradistinction to the fire of long cannon, usually made at low angles. *Mortars*—so called from their similarity of form to the mortar for pulverizing, which has retained its familiar shape from the earliest ages—are believed to have been the first guns used, and, though changed from age to age frequently in form of chamber, size, and projectile, all ages have found them too useful in their special way to suppress or to essentially alter them. The "Coehorn" mortar—so called from the famous Dutch engineer, Gen. Coehorn, who first proposed them in 1674—is

to-day in use, of the same pattern and for the like service then suggested. Monster mortars have been constructed from time to time, in the hope of producing immense destruction in bombardments with single shells containing a large quantity of powder. (See BOMBARDMENT, in CYCLOPÆDIA.) The most recent of these, the monster mortar made by Mallet for the British government, weighing 114,000 pounds, with a bore of 36 inches and a shell of 2912 pounds, failed to be of any service: 13-inch sea-coast mortars and 8-inch and 10-inch siege mortars are the calibres now in use in our own and some other services. Mortars to the present time have been made with smooth bores to fire spherical projectiles, but it has been proposed, here and elsewhere, of late years, to rifle the bore and to fire elongated projectiles. P. V. HAGNER.

**Mott** (LYDIA), b. at Manhasset, Long Island, in 1807, of Quaker parentage; moved to Albany, N. Y., in 1823; taught school for a few years; opened, with her two sisters, a furnishing store for gentlemen's clothing, and kept a boarding-house during the sessions of the legislature. Being an abolitionist and an advocate of temperance and woman suffrage, she planned and secured many hearings before the legislature for woman's civil and political rights. D. Aug. 20, 1875. SUSAN B. ANTHONY.

**Mun'dy** (Sir RODNEY), b. 1800; entered the British navy in 1818, and served in the various grades of his profession in every quarter of the globe; was promoted to flag rank in 1857, and as second in command in the Mediterranean was stationed with his division in Italian waters during the revolution of 1860, and off the coast of Syria in 1861 after the Lebanon massacres; was appointed vice-admiral in 1863, and in Jan., 1867, commander-in-chief in North America and the West Indies, which command he held until 1869, when promoted to be admiral, and in 1872 became commander-in-chief at Portsmouth. He was created a C. B. at the close of the Russian war, and K. C. B. in 1862. In May, 1875, he was placed on the retired list.

**Mur'phy** (JOHN MCLEOD), b. at Northcastle, Westchester co., N. Y., Feb. 14, 1827; entered the U. S. navy as midshipman in 1841; served in the war with Mexico; as hydrographic assistant on Maj. (now Gen.) Barnard's survey of the Isthmus of Tehuantepec 1851; resigned from the navy 1852; was on mission to Mexico 1853; city surveyor of New York 1855; constructing engineer New York navy-yard 1856–57; member of State senate of New York 1860–61; colonel 15th New York (Engineers) Vols. 1861–63, and in the campaigns of the Army of the Potomac; acting lieutenant U. S. navy 1863, and in command of the Carondelet during Vicksburg campaign. Resigned Aug., 1864, resumed his profession of civil engineering, and contributed frequently to the press of New York and various periodicals. D. at New York June 1, 1871.

**Murphy** (WILLIAM MITCHELL), b. in Granville co., N. C., in 1806; was educated in the schools of Tuscaloosa and at the University of Virginia; read law at Tuscaloosa; commenced practice at Erie, Greene co., Ala., about 1828; represented his county in the legislature 1840; was defeated as a Whig candidate for Congress 1847; served in the State senate 1849–51, and removed in 1852 to Austin, Tex., but soon returned and settled at Selma, where he d. in 1855.

**Mur'ray** (DAVID), PH. D., LL.D., Oct. 15, 1829, at Delhi, N. Y.; graduated at Union College in 1852; was successively a professor and principal of the Albany Academy from 1853 to 1863, and from 1863 to 1873 professor of mathematics and physics in Rutgers College. In 1873 he entered the service of the Japanese government as foreign adviser to the department of education, which position he now (1877) holds under a renewed engagement. He is the author of a *Manual of Land Surveying* (New York, 1872), a contributor to Mori's *Education in Japan* (New York, 1872), and the editor of an *Outline History of Japanese Education* (New York, 1876), prepared for the Philadelphia Exhibition, to which he contributed the introductory chapter.

**Müt'ter** (THOMAS DENT), M. D., b. in Richmond, Va., Apr., 1811; graduated at Hampden-Sidney College; studied medicine under Dr. Semmes of Alexandria, Va.; became a pupil of Dr. Samuel Jackson of Philadelphia, and took his degree from the University of Pennsylvania in 1830. He then went to Paris, where he became an *interne* under Dupuytren. On his return home he settled in Philadelphia, and in 1841 was elected professor of surgery in the Jefferson Medical College. He wrote an account of the salt-sulphur springs of Virginia, an essay on club-foot, and issued an American edition of Liston's *Surgery*. His health failing, he resigned his professorship, and again visited Europe, but soon returned, worn out by gout, etc. D. in Charleston, S. C., Mar. 16, 1859. His pathological collection he bequeathed to found the Mütter Museum in the Philadelphia College, which he endowed with $30,000, and left $20,000 more to provide a ward for the incurable.

# N.

**Nematisti'idæ** [from *Nematistius*—*νῆμα*, *-ατος*, "thread," and *ἱστίον*, "standard"—*i. e.* dorsal fin], a family of teleocephalous fishes, related to the mackerels and dolphins, with the body oblong and compressed, covered with cycloid scales; the lateral line simple and unarmed; the head compressed; the opercula unarmed; the nostrils double, in front of the eyes; the mouth with an oblique cleft; the jaws little protractile; the teeth villiform on the jaws as well as palate; branchiostegal apertures extensive; branchiostegal rays six; dorsal fins two, folding in a deep sheath, the first short (with eight filamentous spines), the second elongated; anal shorter than the second dorsal; caudal forked; pectorals with branched rays; ventrals thoracic, each with a long spine and six rays, the internal of which is wide and composed of several branches. The family thus distinguished is represented by a single species, *Nematistius pectoralis*, an inhabitant of the Pacific coast of Mexico. It is especially distinguished as the type of a family by the composition of the ventral, as well as structure of the other fins. THEODORE GILL.

**Nematoi'dea** [Gr. *νῆμα*, "thread," and *εἶδος*, "like"], an order of helminths whose species are also known under the name of "thread-worms," distinguished by their simple thread-like form. The body is not segmented, and usually tapers toward each end; the integument is non-ciliated and dense; under it are the muscles, which vary in several groups; the mouth is at one extremity, and the anus at or near the other; the alimentary canal is differentiated into a thick-walled pharynx, and the intestinal canal a simple tube, there being no differentiation into stomach and intestine, a narrow œsophagal portion connecting the pharnyx and the canal; (in some entozoic forms the intestinal canal is entirely atrophied;) the nervous system is developed in the form of a ring of fibres and nerve-cells encircling the gullet, but no certain organs of sense have been detected; the sexes are generally differentiated in different individuals, but occasionally united in the same; in the females the genital aperture is near the centre of the body, but in the males at or near the posterior extremity; the spermatozoa are cell-like and amœboid in their movements. The order has been separated by Prof. Huxley into three primary groups, distinguished by their muscular system—viz. (1) Polymyarii, (2) Meromyarii, and (3) Holomyarii. In the first "the muscles of the parietes of the body are divided into many series, each made up of many muscle-cells." In the second "there are only eight longitudinal series of such muscle-cells, two between each lateral area and the dorsal and ventral lines." In the third "the muscles are not divided into series of muscle-cells." The representatives of the order are quite numerous; some of them live in a free state, and others, at least during a part of their life, in the interior of other animals. About a dozen species are the guests of man, the most injurious being the TRICHINA SPIRALIS (see in CYCLOPÆDIA). THEODORE GILL.

**Nerit'idæ** [from *Nerita*], a family of gasteropod mollusks of the order Rhipidoglossa, whose shells are generally readily distinguished by their form as well as by the shape of their apertures. The animal has its visceral part stout, and coiled almost in a plane upon itself; the mantle is little developed; the head ends in a broad and short muzzle; the tentacles are elongated and slender; the eyes situated at the extremities of rather long peduncles arising at the outer base of the tentacles; the teeth of the radula are in numerous rows, and in each transverse series are (1) a small central tooth varying in form according to the genera; (2) a transverse inner lateral tooth expanded obliquely outward; (3) two very small outer lateral teeth; (4) a wide plate with an adze-like apex; and (5) numerous approximated slender and elongated pectiniform teeth, incurved at their tips; the foot is oblong and quite broad. The shell is more or less thick, semiglobose, with a depressed spire and a semi-lunate aperture, the columellar lip being expanded, flattened, and nearly rectilinear; the interior is always more or less absorbed as the animal increases in age. The operculum has a process on its inner side arising near the nucleus and interlocking with the columella.

The family is rich in species, containing over 200 generally-recognized species. Most of these are found in the tropical seas, but many also in fresh or brackish waters. They are generally distributed among the genera *Nerita*, *Neritina* or *Neritella*, *Navicella* or *Catillus*, and these severally into a number of sub-genera, several of which, however (*e. g. Dostia*, *Alima*, *Clithon*, etc.), are rather of generic rank. The family was early introduced into the ancient fauna, species apparently belonging to it being found in rocks of the Carboniferous epoch, and typical species occur in the Jurassic period—*e. g. Neritella Nebrascensis* in Nebraska. Several genera also have been especially established for extinct species supposed to belong to the family—*e. g. Velates*, *Neridomus*, *Deshayesia*, *Neritoma*, and *Pileolus*. THEODORE GILL.

**Neritop'sidæ** [from the generic name, *Neritopsis*], a family of gasteropods, chiefly represented by extinct species and of long-disputed affinity, but which has very recently been shown to be related to the Neritidæ. The animal resembles the Nerita in form, the visceral sac being an incurved cone; the mantle moderate (with a fimbriated free edge); the head very broad and slightly emarginated in front; the tentacles tapering, and the eyes on short peduncles at the outer base of the tentacles; the lingual ribbon has numerous rows, but is especially distinguished from that of the Neritidæ by the want of (1) the median or rhachidian tooth, as well as of (2) the inner lateral; (3) the two outer laterals are larger than those generally developed in Neritidæ, and the inner margin is broad, with an expanded recurved apex; (4) the uncini are (as in the Neritidæ) very numerous and closely approximated, pectiniform and incurved at their extremities. The shell is ovate, like that of the Neritidæ, with a short spire and semicircular aperture, but the columellar lip is flattened and emarginated or broadly notched toward the middle. The operculum corresponds to the aperture, and is vertically semi-oval, but with its inner edge produced and describing the three sides of a hexagon. The family is represented by but a single known living species—the *Neritopsis radula*—but has more extinct representatives. For a long time the affinity of the type was in dispute, some (Grateloup and Desmoulins) having referred it near the Nerita, and others near the Natica, but most (Gray, Adams, Deshayes, etc.), with Vanicoro, to a peculiar family. It has, however (July, 1875), been shown by Fischer to be closely related to the Neritidæ, as by some suspected. In former geological epochs species flourished in seas which covered what now forms Europe, and the type is supposed to have existed as early as the Triassic epoch. THEODORE GILL.

**Nesodon'tidæ** [Gr. *νῆσος*, "island," and *ὀδούς*, "tooth," in allusion to the insular folds of enamel in the teeth], a family of mammals of the order Toxodontia, distinguished by the dentition. The teeth are 44 in number (M. $\frac{3}{3}$, P. M. $\frac{4}{4}$, C. $\frac{1}{1}$, I. $\frac{3}{3} \times 2$); those of the opposite jaws are quite dissimilar; in the upper jaw the molars are for the most part (P. M. 3, 4, M. 1) oblong, moderately narrowed backward, with two folds (the anterior of which is divided) re-entering from the inner side; the incisors have simple fangs; those of the first pair are largest, compressed, and widely separated; the second molar and trihedral: the third lateral, behind the second, and rudimentary: in the lower jaw the molars are comparatively broad and complex; the canines moderate; the incisors implanted in a curved row. The family includes but a single known genus (*Nesodon*), which flourished in the later Tertiary epoch in South America. The species attained a moderate size, being at least larger than the ass. THEODORE GILL.

**New'ton** (ISAAC), b. in New York in 1838; educated at New York University, where he studied civil engineering; subsequently studied practical mechanical engineering; commissioned engineer U. S. navy in 1861, and at Mr. Ericsson's request assigned as chief engineer of the original Monitor, which position he held during her combat with the Merrimack, and commended for coolness, skill, and energy; shortly after was ordered on duty as superintendent of construction of iron-clads and principal assistant New York office, where drawings, specifications, etc., were prepared for iron-clads building on Atlantic seaboard; resigned from navy at close of war, and entered the employ of a large coal and iron company; was principal assistant engineer department of docks of New York 1871–72, and as such planned and built the 100-ton floating derrick and superintended the construction of the masonry pier near the Battery; member of board to examine the condition of the navy 1869.

**Newton** (ROBERT SAFFORD), b. in Gallia co., O., Dec. 12, 1813; was educated at the academy of Lewisburg, Va.; studied medicine under Dr. Navet, Gallipolis, O., and at the Medical University of Louisville, Ky., whence he graduated in 1841; commenced immediately to practise at Gallipolis; removed in 1844 to Cincinnati; joined the American Eclectic School of Medicine founded by Dr. Morrow; devoted much attention to the subject of cancer, and laid the results of his researches before the National Eclectic Medical Convention in 1848, and before the public in the *Eclectic Medical Journal* of 1849; was appointed professor of surgery at the Eclectic Medical College of Cincinnati in 1851; removed in 1863 to New York, where he established in 1866 the Eclectic Medical College and the Eclectic Medical Dispensary, and started, in connection with H. L. Stuart, the *American Eclectic Medical Review*. WILLIAM P. STRICKLAND.

**Nich'ols** (CLARINDA HOWARD), b. in Townshend, Windham co., Vt., Jan. 25, 1810; for ten years edited the *Windham County Democrat*, published by her husband at Brattleboro', Vt.; in 1847 began to speak on the laws of that State in regard to the property disabilities of married women, and was influential in securing the first bill that passed the Vermont legislature (1848) recognizing the civil existence of wives. In 1854, with her two eldest sons, she joined a company of 225 men, women, and children, emigrants from the East to Kansas. Helping her two sons to locate and prepare a home, she remained in Kansas one year, and then returned for her husband and younger children, and in company with another party of 250 emigrants went back to Kansas in 1855 and took claims in the vicinity of Baldwin City. She now resides with a son in Pomo, Cal., actively engaged in farm-life.

**Nie'mann** (AUGUST), b. in Hanover June 27, 1839; entered the Hanoverian army in 1857 as a lieutenant, and fought against Prussia in 1866; settled at Geneva as a teacher of history, geography, and languages after the annexation of Hanover to Prussia, but returned in 1868 to Germany as editor of the *Almanach de Gotha*; took part as a captain in the Franco-German war 1870–71, and published *Military Description of the French Campaign* (translated into English by Col. E. Newdigate, 1872), *Spezial Supplement zu Meyers Konversations-Lexikon* (1873), *Geschichte des 95 Infanterie-Regiments* (1874), *Militär Handlexikon* (1874); also several novels.

**Nile, Sources of the.** The sources of the Nile, considered among the ancients as the greatest geographical problem, and so long sought for in modern times, are no longer a mystery. Thanks to the daring of the latest explorers of equatorial Africa, Speke and Grant, Sir Samuel Baker, Stanley, Gordon, and others, we now know that they are found in a high plateau forming a part of the main axis of Africa, on its eastern border, and situated between the equator and the 5th degree S. lat. Here, at an elevation of 3800 feet above the sea, lies the great lake of Ukerewe, or Victoria Nyanza, with an area, as far as known, of about 27,000 sq. m., or little less than Lake Superior, and whose northern border is under the very equator. This vast basin receives the waters from all the surrounding heights. From the Unyamwesi plateau on the S., 4500 feet in altitude, flows the Shimiyu, the southernmost source of the Nile, discovered by Speke; the Kagera, explored by Stanley, the most abundant in water, descends from the high chains of mountains on the W., with peaks of 10,000 and 15,000 feet elevation; and from the plateaus on the E., where rise the snowy peaks of Kenia and Kilimanjaro, several other streams find their way into the same reservoir. From the middle part of the northern shore of the Victoria Nyanza these waters now issue as a rapid and powerful stream, the true Nile, flowing down toward the N. and N. W. into another great sheet of water, Lake Mwutan, or Albert Nyanza, of 2500 feet elevation, which it enters at its lower or northern end. Along this descent of 1300 feet it forms the cataracts of Ripon Falls, near Lake Victoria Nyanza, expands into Lake Kabeki or Ibrahim Pasha, and rushes through Murchison Falls into Lake Mwutan. From this last lake, which was circumnavigated in 1876 by Gessi, by order of Col. Gordon, for the Egyptian government, and was seen in the same year by Stanley, the Nile resumes its rapid course to Dufflee, 2300 feet in altitude. Soon after it leaves the regions of plateaus and enters the great plains of Central Soudan, where it receives from the W. the waters of a vast network of rivers, collected by the Bahr-el-Arab and the Bahr-el-Gazal, and those of the eastern plateaus through the Sobat. After the junction of these rivers it follows again a northern course between the table-lands of Kordofan and the plains of Sennaar to Khartum, where the Abyssinian or Blue Nile, the Bahr-el-Azrek, brings to it the united waters of the Abyssinian plateau and its snowy mountains.

The waters of the Nile, which cause that wonderful and so long mysterious inundation of Egypt, are gathered from three distinct regions—that of its head-waters in the plateaus of the great equatorial lakes, that of the great plains

of Central Soudan, and that of the plateaus and alpine regions of Abyssinia, all situated within the domain of periodic and abundant tropical rains. It is well known that below the Atbara, the last of the Abyssinian rivers, the Nile does not receive a single tributary for the last 1400 miles of its course. Well may the inhabitants of its rainless valley have wondered whence came those abundant waters which converted it temporarily into a flowing sea. A. Guyot.

**Nov'el,** in the English language, means any fictitious prose narrative which pretends to describe real life, past or present, while "romance" is generally applied only to narratives of a more or less fantastic character. In the other European languages the distinction between the two terms is another, "novel" meaning simply a small romance, a short, light tale of an every-day character, not much different from what we might call "news;" whence its name. Here, however, where we simply propose to give a supplement to the main article on the subject, and mention some of the most prominent novel-writers of continental Europe, we use, of course, the term in its special English signification.

The novel originated in Italy in the fourteenth century with *Il Novellino*, a collection of stories by unknown authors, and *Il Decamerone*, by Boccaccio. Its success was immense, and hundreds of writers cultivated with eagerness this new branch of literature during the following two or three centuries. Also in Spain, whither it was transplanted very early, the novel produced excellent fruit in the works of Cervantes, but it has subsequently almost died out in both countries, or at least sunk very low, Manzoni's *I Promessi Sposi* being nearly the only Italian novel which in the last century has found its way across the Alps.

At present it is France which takes the lead in this field of literature. Not that the French novels are much imitated in other countries, but almost every kind of novel has reached its highest perfection in French literature. In the historical novel Alfred de Vigny, Prosper Merimée, and Victor Hugo may be called disciples of Walter Scott, but they are all superior to him in that one point in which every pupil ought to surpass his master: they are nearer to us; their conception of history conforms better to ours; they have utilized the advance which the study of history has made since the days of Walter Scott. They have a firmer grasp on the spirit of the age they describe; they are more true. In the psychological novel—that is, in the analysis of human characters and destinies, such as they develop from certain natural dispositions and under certain social circumstances—Balzac has no equal, and *La Comédie humaine* no counterpart. In the tendency novel, which purports to propagate certain social views or moral ideas, Rousseau, Madame de Staël, George Sand, Émile Souvestre are the first names, and have remained the greatest. Finally, besides producing a great multitude of writers—Jules Sandeau, Henri Murger, Ernest Feydeau, Octave Feuillet, Edmond About, Erckmann-Chatrian—whose drawings after life, correct, elegant, and spirited, fulfil in a satisfactory and often in a noble manner the general object for which art exists, France has at one time—Eugène Sue, Alexandre Dumas, Maquet, Frédéric Soulié—furnished the whole civilized world with that kind of material which through the imagination exercises the same influence on the mind as alcohol exercises on the body through the stomach.

In Germany the novel flourished abundantly during the great literary period of which Goethe was the founder and the centre. His own novels, *Wilhelm Meister* and *Die Wahlverwandtschaften*, are solutions of speculative problems. What is it to live? what is it to love? has the author asked himself, and his novels are his answers. The novels of Tieck, and many other remarkable productions from the same time—Jacobi's *Waldemar*, Schlegel's *Lucinde*, etc.—bear the same character of having originated from some moral, æsthetic, or metaphysical problem. But besides this, the truly German novel, many excellent novels were written which pretended to be nothing more than true conceptions of real life—Heinrich von Kleist, Töpffer—or the free creations of an impassioned imagination—Hoffman, Richter. After the middle of this century, however, the novel degenerated rapidly. Minor sketches of great sweetness, of exquisite humor, of fine sense of character, are still written—Auerbach, Klaus Groth, Fritz Reuter, Hackländer, Paul Heyse—but the novel on a great scale, attempting to give a comprehensive view—Gutzkow, Freytag—has become overstrained, hollow, and pretentious; and the historical novel, which once occupied a very respectable place—Willibald Alexis, Zschokke—has sunk with Mügge and Louise Mühlbach into mere trash.

From the Scandinavian countries several novels by Fredrika Bremer, H. C. Andersen, M. A. Goldschmidt, F. H. Ewald, Björnstjerne Björnson, and Magdalene Thoresen, have of late attracted considerable attention.

Clemens Petersen.

**Noyes** (Edward Follansbee), b. at Haverhill, Mass., Oct. 3, 1832; graduated at Dartmouth College in 1857, and removed to Cincinnati, graduating a year later from the law school there. The outbreak of war in 1861 found him successfully engaged in the practice of his profession, but abandoning law, he turned his office into a recruiting head-quarters, and in July, 1861, the 39th Ohio Infantry was organized with Noyes as its major; a year later he was promoted lieutenant-colonel, and Oct. 1, 1862, succeeded to the colonelcy of his regiment, which he led until July, 1864, when he was incapacitated from further active field-service by the loss of a leg. Upon his convalescence he was assigned to the command of Camp Dennison, which position he held until Apr. 22, 1865, when he resigned. The brevet of brigadier-general was bestowed upon him for gallantry. While in the army he had been chosen city solicitor of Cincinnati, which office he accepted upon resigning from the army. In Oct., 1866, he was elected probate judge of Hamilton county, and in 1871 was chosen governor of Ohio on the Republican ticket. In 1873 he was renominated, but defeated by William Allen.

# O.

**Ogi Takato,** b. in the province of Hizen, Japan; was highly educated; at the commencement of the late revolution was appointed one of the Sanyo, which position was afterward called Sangi; in 1870 he became vice-minister of the home department, afterward minister of education, then a councillor of state or Sangi, and in 1873 was reappointed to that office, in conjunction with the position of minister of justice. F. A. P. Barnard.

**Okuma Shigenobu,** b. in the province of Hizen, Kiusiu, in 1837; was well educated in a local high school, and early noted for his superior talents; studied the Dutch language at Nagasaki, and also English, and became a good scholar in both, but held no public position before the revolution. In 1868 he was appointed chief assistant in the department of foreign affairs; in 1869 was made an assistant or secretary in the then joint departments of the interior and finance, in which he displayed ability; in 1870 was made a councillor of state or Sangi, still having charge of the finance department, the interior department having been organized separately. In 1871 he was superseded as head of the finance department, but still held the position of Sangi; was appointed president of the commission that attended the Vienna Exposition; took a leading part in the expedition to Formosa, and in the latter part of 1872 was again made minister of finance, and is still a member of the Japanese cabinet or privy council. F. A. P. Barnard.

**Onosan'der,** or **Onesan'der** ['Ονόσανδρος, also 'Ονήσανδρος], is described by Suidas as a Platonic philosopher, who wrote on tactics (Τακτικά), military stratagems (περὶ Στρατηγημάτων), and commentaries on the *Republic* of Plato. No one of these has come down to us under the title given by Suidas, but there is a treatise extant, ascribed to Onosander, much used by later military writers, entitled Στρατηγικὸς λόγος, no doubt the same with or a part of the *Tactica*. Onosander lived about the middle of the first century A. D., as his work is dedicated to Q. Veranius, consul 49 A. D. The treatise is divided into 42 parts, and gives instruction on the duties of a commander; the style is based on that of Xenophon, and imitates its model with considerable success. The work was first published in a Latin translation, often reprinted; the 1st ed. of the Greek text was by N. Rigaltius (Paris, 1599); best editions by Schwebel (Nuremberg, 1762, fol.) and A. Köchly (Leipsic, 1860). Henry Drisler.

**Oracan'thus** [Gr. ὡραῖος, "beautiful," and ἄκανθα, "spine"], a genus of defensive fin-spines worn by sharks which lived in the Carboniferous age. They are usually conical in form, broad at the base, and ornamented with numerous pustular tubercles. J. S. Newberry.

**Orbil'ius Pupil'lus,** a somewhat celebrated grammarian and teacher at Rome in Horace's boyhood, b. at Beneventum. He served at first, as stated by Suetonius, who mentions him in his list of distinguished grammarians,

as an attendant on the magistrates of his native place, then in the army in Macedonia. In his fiftieth year he removed to Rome, in the consulship of Cicero, where he taught school for many years, and had among his pupils the poet Horace, who recalls in his *Epistles* the severity of his master. He seems to have been the prototype of Dr. Busby, and could boast of the distinguished men he had flogged in their youth. His teaching brought him more fame than profit, for he died poor at a very advanced age. His fellow-townsmen erected a marble statue to his honor in Beneventum. (See Teuffel, *Lat. Lit.*, § 187; Estré, *Prosopogr. Horat.*, p. 437.)

HENRY DRISLER.

**Ordnance.** The progress made in the construction of ordnance, even since the preparation of our article on that subject in the CYCLOPÆDIA, calls for a notice of the more remarkable guns recently produced, and which have rapidly gone from 38 to 81, and even to 100, tons, while those of much heavier weights are proposed. As these guns are all of the class described as tubed and banded of the English system—that is to say, are constructed with steel tubes for the bore and large wrought-iron coils for the body of the gun—we shall confine our remarks to the largest yet made, the 100-ton gun constructed for the Italian government.

The central steel tube has a diameter of bore of 17 inches, and is 30 feet 3 inches long, 6 inches thick at the powder-chamber, and 3½ inches thick at the muzzle. The breech portion of the tube is enveloped in three coils. The trunnion coil, with two others, come next, and four single coils, with the tube enclosed, form the chase of the gun. These coils are made to interlock with and overlap one another at their junction, in order to hold them together in a longitudinal direction. At the trunnion coil the gun has a diameter of 5 feet 4½ inches, at the breech 6 feet 5 inches, and at the muzzle 2 feet 5 inches. The extreme length of the gun is 32 feet 10½ inches. The rifling consists of 27 grooves, with a twist increasing from 1 turn in 150 calibres at the chamber to 1 turn in 50 calibres, or say from 1 turn in 212 feet to 1 turn in 70 feet at the muzzle.

The following is one of the results obtained on the firing of this gun:

| | |
|---|---|
| Charge of powder | 375 pounds. |
| Weight of projectile | 2000 " |
| Velocity at muzzle | 1512 feet. |
| Indicated pressure | 21.4 tons. |

Three targets were employed in testing the penetrating power of the projectile of the 100-ton gun. No. 1 was composed of two steel plates, each 22 inches thick, 4 feet 8 inches wide, 12 feet long, placed one above the other, and the whole supported by a wood backing 28 inches thick. No. 2, wrought-iron plates of same dimensions and arrangement as No. 1. No. 3, upper half, wrought-iron plates, one 12 and one 10 inches thick; lower half, 8-inch wrought-iron plate outside, and 14-inch cast-iron chilled plates inside. These targets were placed 100 yards from the gun, and proved quite inadequate to resist the destructive effect of the projectile. The steel was somewhat superior to the wrought iron, and the cast iron proved utterly unfit for the purpose of protection.

The gun was mounted with the trunnions resting upon a slide, and in the rear of each trunnion was placed a water-cylinder with pistons, and by means of which the recoil could be controlled. The gun was carried into battery loaded, and elevated by hydraulic power worked by a small engine. For such guns it need not be repeated that a special powder of large grain, and capable of developing its power slowly in comparison with ordinary powder, is absolutely necessary.

In regard to their construction, there is no difficulty which could not be readily overcome in this country. Large bands of coiled wrought iron have long been successfully made here for cannon, and more recently the coiled wrought-iron tubes for the conversion of smooth-bore into rifle cannon have been manufactured at the West Point Foundry, and have sustained thorough and satisfactory tests. On this system the 10-inch Rodman and the 11-inch Dahlgren guns have been converted into rifle cannon of 8-inch bore, and have fully sustained the charge of 35 pounds of powder and projectiles of 180 pounds, which is the "battering charge" of the 8-inch Woolwich gun of 9 tons—a weight exceeding that of either of the first-named guns. This plan of constructing a cast-iron body with wrought-iron tube has proved so successful that it is now proposed by our ordnance department to construct a 12-inch gun on the same system; and it is probable that larger calibres will follow.

Without discussing the theory of the subject, we may conclude that the interposition of a material so little liable to fissures as wrought iron, and which by its position is subjected to the most severe strains of the discharge, permits only such a degree of it to reach the cast iron as this material is perfectly able to resist. In the naval service the application of the French plan of closing the breech of rifled cannon has been made to 20-pounder howitzers and the 100-pounder rifle gun with satisfactory results.

R. P. PARROTT.

# P.

**Paixhans Guns.** See ARTILLERY and COLUMBIAD, in CYCLOPÆDIA.

**Palpita'tion** [Lat. *palpitatio*; Fr. *palpitation*; Gr. παλμός; Ger. *Herzklopfen*]. The heart usually performs its important work without attracting any attention, the person, to use a common phrase, "not knowing that he has a heart." The perceived and forcible beatings are called "palpitation." It may occur in a healthy as well as in a diseased heart, caused by physical exertion, mental excitement, the use of tobacco, flatulent dyspepsia, a watery state of the blood (*anæmia* or *hydroæmia*), or a sense of palpitation may arise from increased nervous sensitiveness, without any real increase in the force of the heart-beats; while, on the other hand, in enlargement of the heart the beats may be very strong, and yet not be recognized, except by an external examination. In hypertrophy and in fatty degeneration of the heart palpitation is a common occurrence, generally coming in paroxysms, lasting from a few minutes to some days, with equally varying intervals. The extract of nux vomica and the tincture of aconite are much relied on to subdue the excited heart when it is diseased, while secondary palpitation in the healthy heart is treated by removing the cause.

ALONZO CLARK.

**Pang'born** (Z. K.), b. at Peacham, Vt., July 31, 1829; graduated at the University of Vermont in 1850; became principal of the Lamoille Academy in Johnson, Vt., and subsequently of the St. Alban's Academy; was editor of the *Vermont Tribune* for some time, and subsequently established the *Teacher's Voice*, an educational periodical; removed in 1855 to Worcester; became editor of the Boston *Daily Bee*; served during the civil war as paymaster of volunteers; visited Europe in 1864; became editor of the Jersey City *Daily Times*, and established in 1867 the *Evening Journal*, of which he is still editor and senior publisher.

H. L. STUART.

**Parsons College,** situated at Fairfield, Ia., at the crossing of the Chicago Burlington and Quincy with the Chicago and South-western R. R., was founded by the late Lewis B. Parsons, a citizen of Iowa, who died in Keokuk, Ia., in 1856, and in his will directed his sons and executors to locate and found a college, to be under the control of the Presbyterians of Iowa. On Feb. 24, 1875, Gen. L. B. Parsons, having selected a board of trustees and transferred to them the legacy, valued at $40,000, founded the college in accordance with the provisions of the will. The citizens of Fairfield contributed to the institution for its location $27,000. A tract of 20 acres, with a large brick residence, was purchased, and during the summer of 1875 an additional brick building, 40 × 52 feet, of two stories, was erected. A course of three years for the preparatory department and four years for the collegiate was arranged, at the end of which the degree of bachelor of arts is conferred. The preparatory department opened Sept. 8, 1875, and in 1876 there were on the roll 62 students. The college was tendered to and accepted by the Presbyterian Synod of Iowa, South, Oct. 22, 1875. A freshman class was organized in Sept., 1876. The college grounds, buildings, etc., are valued at $25,000; the productive funds amount to $22,500, and there are unmatured notes and unimproved lands valued at $20,000.

JOHN ARMSTRONG.

**Pa'terson** (WILLIAM SLEIGH), b. at Haddington, Scotland, Mar. 6, 1844; came to New York in 1848, where he was educated in the common schools; taught school for a short time; served a seven years' apprenticeship at printing; devoted himself to proof-reading, and became familiar with technology and with various languages under the tuition of Rev. Dr. W. A. Muhlenberg and others; and has occasionally contributed to journals and society reports.

**Pat'ton** (FRANCIS LANDEY), D. D., b. on the island of Bermuda Jan. 22, 1843; educated at University College, Toronto, Canada; studied theology at Knox College, To-

ronto, and at Princeton, graduating in 1865; was ordained by the presbytery of New York, and became successively pastor of Presbyterian churches in Eighty-fourth street, New York, Nyack on the Hudson, and Brooklyn, and in 1872 was chosen professor of didactic and polemical theology in the Theological Seminary at Chicago. In 1873–76 he edited the *Interior*, a religious journal at Chicago; published a *Treatise on the Inspiration of the Scriptures*, a *Summary of Christian Doctrine*, and is (1877) engaged upon a work on *The Doctrine of a Future Retribution*.

**Patton** (William), D. D., b. in Philadelphia Aug., 1798; educated at Middlebury College and Princeton Theological Seminary; became successively pastor of the Central and Spring street Presbyterian, and of the Hammond street Congregational church in New York; was the original proposer of the Union Theological Seminary, New York, and of the Evangelical Alliance. Besides many pamphlets he has published a treatise on *The Wines of Scripture*, prepared the American edition of *The Cottage Bible* and *The Village Testament*, was one of the editors of the *Christian Psalmist*, put forth editions of *Edwards and Finney on Revivals*, and recently a series of lectures on *The Destruction of Jerusalem by Titus*. He now resides at New Haven, Conn.

**Patton** (William Weston), D. D., son of the preceding, b. in New York Oct. 19, 1821; educated at the University of the City of New York and at Union Theological Seminary; became successively pastor of Congregational churches in Boston, Hartford, and Chicago; afterward, for five years, principal editor of the *Advance*, a religious journal at Chicago, and is now lecturer in the theological seminaries at Chicago and Oberlin. Besides numerous pamphlets he has published *Slavery and Infidelity*, *The Young Man*, and *Prayer and its Remarkable Answers*.

**Pearse** (John Barnard), A. M., M. E., b. in Philadelphia Apr. 19, 1842; graduated at Yale in 1861; studied chemistry till June, 1863, with Booth and Garrett, Philadelphia, and had charge of the chemical division of the U. S. army laboratory in Philadelphia till July, 1865; spent over two years in practical studies of mining engineering at schools of mines at Freiberg (Saxony) and Leoben (Styria), and made a specialty of metallurgy, particularly iron and steel, visiting and working at German works and mines. In Jan., 1868, he connected himself with the Pennsylvania Steel Co. at Harrisburg, and in 1870 became general manager of the company. Here he successfully improved the design and product of Bessemer steel plant, made various inventions (cupola, improved steel plant, etc.), since generally adopted, and was instrumental in first making Bessemer pig iron from native New Jersey and Pennsylvania ores. In June, 1874, he was appointed a commissioner and the secretary of the second geological survey of Pennsylvania. He published in 1869 a *Treatise on Roll-Turning for Manufacture of Iron*, translated with additions from the German of P. Tunner, and has prepared a *History of the Iron Trade of America* from its inception in 1621.

**Phil'ip** (Thomas Tyson), b. June 23, 1799, in Baltimore, Md.; first president of the Maryland Academy of Sciences after its reorganization; author of reports of survey of State; agricultural chemist; married Rebecca Webster in 1824.

**Pine Oil,** or **Fir Oil,** oils resembling oil of turpentine, extracted (1) from the seeds of *Pinus picea* and *P. abies* in the Black Forest, for the preparation of paints and varnishes; (2) from the young branches and needles of the dwarf pine, *P. pumilio*, by distilling with water, for medicinal use. (See Gerhardt's *Traité*, ii. 901, and *Jahresb.*, 1860, 477, 714.) C. F. Chandler.

**Pine Res'ins.** (1) Resin of turpentine, called rosin or colophony. It occurs dissolved in the volatile oil ($C_{10}H_{16}$) in the crude turpentine which exudes from incisions in the stems of firs, pines, and other conifers. It is formed by the oxidation of the oil, and consists chiefly of two isomeric acids ($C_{20}H_{30}O_2$), sylvic acid, crystalline, and pinic acid, amorphous. (See Turpentine and Resins, in Cyclopædia.) (2) Resins of *Pinus sylvestris*, which consist chiefly of kinovous acid ($C_{12}H_{18}O_2$?), ceropic acid, and a resin ($C_{15}H_{14}O_3$). (See Watts's *Dict.*, iv. 649.)
C. F. Chandler.

**Pi'nic Ac'id** ($C_{20}H_{30}O_2$), the amorphous resin of colophony, pine-rosin. It constitutes the chief part of this rosin. It is soluble in ether, alcohol, and oils. (See Turpentine and Resins, in Cyclopædia.) C. F. Chandler.

**Pleu'ra** [Gr. πλευρά, the "side," a "rib"], a thin membrane that lines the cavities of the chest, extending over the external surface of the lungs. It consists of two closed sacs. The portion lining the chest is distinguished as the costal pleura, and is a sheet of elastic cellular tissue loosely attached to the ribs, muscles, and adjacent parts. That lining the lungs, known as the pulmonary pleura, is composed of a superficial layer of fine cellular tissue and a second elastic layer of coarser fibrous tissue, which materially assists in expiration. Both portions of the pleura are covered inside with a delicate layer of epithelium, and the narrow spaces enclosed in each sac are known as the pleural cavities, and are kept constantly supplied with a serous vapor which enables the opposite layers to glide easily upon each other in the movements of respiration. These pleural cavities may become distended in disease by an excess of water, as in hydrothorax, or they may become obsolete by the adhesion of the surfaces, as in plastic inflammation or pleurisy. In entomology the pleura is the side of the stethidium between the thorax and pectus. C. V. Riley.

**Po'lo.** The game of polo, introduced into America by Mr. James Gordon Bennett in 1876, is a modification of a recreative exercise indulged in by the officers of the British army in the East Indies, chiefly by those of the cavalry service. The game came into vogue in India through the practising of foot-ball, which game it has superseded there. The officers, finding the climate unfavorable to physical exertion necessary in playing foot-ball, substituted polo by using ponies and having a long stick to hit the ball, instead of kicking it with their feet. Briefly, polo is simply playing the English game of "hockey"—called in this country "shinny"—or the Scotch game of "golf," on horseback. In hockey the game consists of knocking a ball, with a stick having a crook at its end, from one goal to another. Polo is a similar game, except that the players, instead of being on foot, are mounted on ponies. By the club rules as played at Jerome Park the height of the ponies is limited to fourteen hands, and the "mallets" to be used must be four feet four inches in length. The ponies used are what is called "hog-maned," and have their tails cut short. In this country Mexican mustangs are now trained for polo-playing, and the game is rapidly attaining popularity out West. It is a dangerous game, especially for those not well up in horsemanship, severe injuries having been sustained, not only from accidental blows by the mallets, but from being thrown from the ponies and coming into rapid collision. At present the game is confined to the wealthy class of the larger cities of the country. Henry Chadwick.

**Porce'lain, Japanese.** (The new facts stated in this article are due to a special official report which was addressed to the judges of Groups I. and II. of the International Exhibition of 1876 at Philadelphia, by Henry Wurtz, one of the judges of Group II. (*Ceramics and Glass*), attached also as a delegate-judge to Group I. (*Minerals, Mining, and Metallurgy*).)

The unprecedentedly magnificent display of Oriental Japanese porcelain—unprecedented in the beauty, variety, novelty, and delicacy of the forms and artistic decorations, as well as in the grandeur of dimensions of individual pieces—made at the International Centennial Exhibition of 1876 has passed into history; but there was nevertheless one element of this display, most striking and interesting of all to the man of science and the ceramic expert, which was naturally passed over by the mass of visitors. To those competent to form an intelligent opinion the most surprising and pleasing part of the display was an extensive suite of the crude *native mineral materials* from which these inimitable fabrics are produced by this skilful people. This special exhibit was made by the department of the imperial government of Japan which had charge of the affairs of the Japanese contributions, called the "Kuwangiyo-Riyo," or "Imperial Board of Agriculture, Industry, and Commerce," and was designated as "minerals used in the manufacture of the pottery and porcelain of Hizen, Owari, and Ise." In the minds of the writer and others this was perceived to offer the best opportunity yet found, in the history of ceramics, by the nations of the West to learn with some degree of scientific precision the nature of the materials employed under the highest developments of this art in the far Orient, near where the art itself was born. The writer at once suggested to his associates that the occasion for obtaining this information and putting it on record should not be lost. The suggestion met with unanimous approval, and the result was a quite extended chemical investigation of these minerals, in connection with analyses of the wares made from them, together with the collection of a number of items of information regarding the ceramic technology of Japan never before brought to the knowledge of the world in general.

*Porcelain Quarries of Japan.*—A very complete collection of these minerals came from the neighborhood of the small town of Arita, province of Hizen (now called Nagasaki), the chief centre of the porcelain manufacture in Japan. This province of Hizen, or Nagasaki, lies almost at the S. E. extremity of the empire, separated from the Corean penin-

sula only by the Straits of Corea, and constituting the most westerly portion of the large island of Kiusiu. According to information received by the writer from Prof. H. S. Munroe of the Imperial University of Tokio, accompanied by a map, Arita lies on a small bay, and is within the borders of what he calls the *Karatsu coal-field;* but the porcelain-stone quarries lie some miles distant from Arita, in an area marked by him as "feldspathic rocks, sandstones, etc." The principal quarries of porcelain-stone, as exhibited at Philadelphia, are at a locality known as Idzumi-Yama, described as a high mountain-valley surrounded by hills, in which irregular diggings are made for the several qualities of mineral used, whose names and composition are given below. In the famous work of Stanislaus Julien, entitled *Histoire et Fabrication de la Porcelaine chinoise,* there is given, as an appendix, a short *Mémoire sur la Porcelaine du Japon* by Dr. J. Hoffmann, professor at Leyden, and "Interprète du Gouvernement des Indes Nêerlandaises pour la Langue Japonaise," in which these quarries are mentioned as follows: "The *terre blanche* which is used for the fabrication of the porcelain comes from the mountain Idzumi-Yama, and forms the principal article of commerce of the province of Hizen. No mountain in the whole empire is comparable to this one. This material is white, but as hard as rock, and has to be broken with hammers and pulverized in mills." The information obtained from the sources available at the Philadelphia Exhibition agreed essentially with this.

*Historical Facts about Japan Porcelain.*—It appears that the higher developments of ceramic art in Japan were not altogether indigenous, but received important aid from the earlier experience of Chinese and Corean artisans, and that the first impulse was given about 300 years since. Real porcelain was first made under the direction of Gorodayu-Shonsui, a native of Ise, somewhere about 1580. After studying in China, he settled in the province of Hizen and used the Idzumi-Yama porcelain-stone. He made the *sometsuki,* or blue ware painted with cobalt under the glaze, the *kanyu* or *hibiki* (craquelé ware), the *seidji* or *sei-ji* (seladen ware), the *akai* (red ware), and the *gosai,* also called *nishikide* (porcelain painted with various colors on the glaze). In 1592 also, after a war with Corea, a Japanese prince, Nabeshima Naoshige, brought Corean workmen to Hizen, who contributed to the improvement of the new art. Other Coreans were also at this time brought as captives to Kagoshima, a point somewhat farther S. than Arita, in the province of Satsuma, who originated the "Satsuma-ware."

*Preparation and Use of the Idzumi-Yama Minerals.*—The machinery for crushing this stone is very rude, consisting merely of large wooden hammers worked by water-power, the iron-shod heads falling into stone mortars. The powder is sifted, and the finer parts washed out with water, the proportion thus obtained being from 40 to 50 per cent. of the whole. This material, which can have but very little plasticity compared with true clays and clay compositions, they have the skill to fashion into vases of six and seven feet in height! Vases are chiefly made in Arita, whereas porcelain tables, painted slabs, fireplaces, and similar articles are mostly made in Owari. The throwing and shaping of the mass is said to be accomplished on the common potter's wheel, which at Arita consists of a fly-wheel and a working-disk, the latter twelve or fifteen inches above the former. These are united by a sort of hollow wooden prism, so as to form one system, which has at its lower extremity a hollow socket of porcelain running on a pointed stick set in the ground, their expedient to lessen friction. By means of this lathe the workmen in Arita turn out large dishes of three feet in diameter, as well as the so-called egg-shell porcelain, not thicker than paper. For very heavy and large pieces the lathe is turned by means of a driving-cord. Moulds are also used made of ordinary clay, and it seems that it is only since the Vienna Exhibition that they have learned the use of *gypsum* moulds, which are now being introduced. When the pieces have been sufficiently dried in the open air they are shaped with sharp iron tools on the same lathe on which the first throwing has been done, and are then coated with a pure white mineral called *kudaru-yama-tsuchi,* or *kesso-tsuchi,* of which the analysis is given below. This gives the finished ware a better appearance, and brings out with more intensity the fine blue color of the cobalt. After this coating the ware receives the preliminary baking in small special kilns. It is then painted with cobalt-oxide, and afterward glazed in the same way as in European factories; then baked finally. The glazes are composed of certain felsitic minerals, of which three, called *shira-kawa-tsuchi, uwa-kuszuri-tsuchi,* and *sei-ji-tsuchi,* were exhibited, and have been analyzed, as below. These are mixed with wood-ashes, previously freed from alkali by careful lixiviation, which imparts fusibility. The proportion of ashes depends on the places which the pieces are to occupy in the kilns, the heat of which is not uniform.

Three minerals quarried at Idzumi-Yama, called *tsuji-tsuchi, shiro-tsuchi,* and *sakaime-tsuchi,* are the principal materials for the body of the wares (in washed form, as above described), the first being the purest and whitest, while at the same time the most refractory, and is used therefore for the thin egg-shell ware to the extent of 70 per cent., the other 30 per cent. being usually *shiro-chuchi.* The latter, with equal parts of *sakaime-tsuchi,* constitutes a common composition for thicker wares. It is understood that the termination *tsuchi* is regarded as equivalent to our own generic word *clay,* but the analyses and other examinations of the Idzumi-Yama minerals show that there are among them no true clays. In fact, it seems that in the wares made from these minerals nothing of the nature of *kaolin* enters as an ingredient—a remarkable result developed by this investigation.

*The Kilns.*—The Japanese kilns are peculiar in construction, and are always built on the slope of a hill, in sets of from four to twenty, according to the importance of the locality. The base of each kiln lies about three feet higher than the base of the preceding one, so that, if all the kilns were uncovered, the whole of them would present the aspect of terraces formed by a series of platforms each three feet high. The ground-plan is trapezoidal, the kilns growing wider and wider as they extend up the hill. The walls on the four sides of the ground-plan, being vertical to the height of a few feet above the base, gradually form a vault above of a peculiar form and structure, difficult to explain without drawings. The wall facing the lower end of the set of kilns is pierced on the level of its floor by a series of vents 8 to 12 inches high and 3 to 4 inches wide; and in the opposite wall, which, on account of the trapezoidal ground-plan, is a little longer than the front wall, there is a second series of similar holes, but at three feet above the floor, and consequently opening upon and level with the floor of the next kiln above. Thus, a series of draughts is established through the whole line of the kilns, which ends in a range of short chimneys, corresponding to the vents of the last kiln. There are no separate furnaces or fire-spaces, the fuel—pine wood, barked and dried in ovens—being thrown directly into the kilns, into narrow fire-spaces which are constructed on the front side of each kiln, next the indraught vents, by placing thick fire-clay slabs perpendicularly. These fire-spaces are from 2 to 3 feet wide, and communicate with the outside by means of narrow openings in the side walls, the latter being about 20 inches high by 6 inches wide. Through these openings the wood is thrown in with such dexterity that kilns which are sometimes 26 feet in length are heated uniformly throughout. The draught reaches the wood through the holes in the front wall after passing through the lower kilns, and the flame, deflected by the perpendicular fire-clay slabs, does not strike the pieces directly, but follows along the vault, eddying around, by reason of the back wall of the vault being made steep, as as to take the pieces in the rear. The flame passing through from the lower kiln, where the firing is actually going on, into the following kiln, produces sufficient heat to render this latter red by the time the firing of the first is finished. At this moment the opening through which the first kiln has been fired is closed with fire-bricks, and the firing begins in the second one.

By this arrangement, the principle of which is very similar to that of the circulating furnaces for burning bricks, the draught is made to pass through kilns that have already been fired, and strikes the fresh fuel, already at a high temperature. The effect is therefore cumulative along the line of kilns, the last kiln of a set being of course the hottest. Hence, the practice of gradually increasing the width and size of the succession of kilns. The kilns at Arita increase gradually from 7 feet long, 6 deep, and 6 high, to 27 feet long, 18 deep, and 15 high. The usual maximum time of firing is fourteen hours. The details of setting the pieces in the kiln and other manipulations are too voluminous to be admissible here. The more especial object of this article is to set forth the results of the chemical examinations of the Idzumi-Yama porcelain-stone in its different varieties, or rather of the materials prepared from it, as used in compounding the body and glaze, together with the composition of the porcelain itself.

*The Minerals.*—In order to obtain useful analyses, it was necessary to imitate as nearly as possible the manipulation of the Japanese operatives in preparing the materials. This was done by crushing by blows of a pestle in a mortar, sifting, and washing. The materials thus obtained were analyzed with great accuracy by a method of the writer which he calls *absolute analysis,* which consists, first, in making a set of analyses simultaneously and under uniform conditions, all the reagents being weighed and measured; and second, in condueting a simultaneous *blank* analysis, in which no material is started with. The figures obtained from the blank analysis serve to eliminate all the

errors from the other analyses. The alkali-determinations were made by a modification of the original method of the writer, first published in the *American Journal of Science* for Nov., 1850, by fusion with chloride of calcium. The chloride of calcium is used in the form of thick, syrupy alcoholic solution, measured out from a burette, mixed with the mineral, and the alcohol burned off, the mass being then fused. Water extracts then all the alkali. This is the simplest and surest method known for alkalies in silicates. A parallel blank analysis has also been made in this case, as in the former, in order to obtain absolute results, free from errors arising from traces of alkali in the chloride of calcium itself.

The following table gives the results of such *absolute* analyses of some of the Idzumi-Yama minerals, the first four being from this locality, the other two, used as glaze materials, being from other localities in the same region. These minerals all contain a small percentage of combined water, but, for convenience of comparison with the porcelain, the figures are here given as computed for the anhydrous minerals:

| | (1.) Tsuji-tsuchi, washed. | (2.) Shiro-tsuchi, washed. | (3.) Sakaime-tsuchi, washed. | (4.) Kudaru-yama-tsuchi, washed. | (5.) Uwa-kuszuri-tsuchi, washed. | (6.) Sei-ji-tsuchi, raw. |
|---|---|---|---|---|---|---|
| Silica | 80.652 | 80.920 | 81.141 | 54.072 | 81.772 | 80.101 |
| Alumina | 16.194 | 15.822 | 14.542 | 41.951 | 15.059 | 13.901 |
| Ferrous oxide | .684 | .932 | 1.060 | 1.713 | 1.471 | 1.574 |
| Lime | None. | .152 | .196 | None. | .102 | None. |
| Magnesia | .102 | .100 | .242 | .223 | None. | .316 |
| Soda | 1.799 | 1.530 | 1.789 | 1.565 | 1.447 | } 4.108 |
| Potash | .569 | .530 | .999 | .476 | .149 | } |
| Manganous oxide | Trace. | .014 | .031 | | | |

Of the above, No. 4 is the only one which presents any approach in composition to a clay. The entire composition of the washed kudaru-yama tsuchi, with the water, is given below, together with that of the tsuji-tsuchi, the first one in the table above:

| | Kudaru-Yama. | Tsuji. |
|---|---|---|
| Combined water | 7.607 | 2.409 |
| Silica | 49.931 | 78.491 |
| Alumina | 38.738 | 16.016 |
| Ferrous oxide | 1.582 | .669 |
| Magnesia | .206 | .098 |
| Soda | 1.445 | 1.761 |
| Potash | .440 | .556 |
| | 99.949 | 100.000 |

It was found that a small percentage of the silica in each of these was present in the form of opal, and deducting this, the remainders, which may be called *kudaruyamite* and *tsujilite*, give essentially the following compositions:

| | | |
|---|---|---|
| Combined water | 7.79 | 2.4 |
| Silica | 47.95 | 79.1 |
| Alumina | 40.82 | 16.0 |
| Ferrous oxide | 1.67 | .7 |
| Soda | 1.77 | 1.8 |
| | 100.00 | 100.0 |
| Densities at 32° F | 2.651 | 2.699 |

This brings *kudaruyamite* under the group of minerals called by Dana *pinites*. It gives the constitution $O_{129}Si_{37}Al_{36}FeNa_4.20H_2O$, and the volumic formula (see VOLUMES, MOLECULAR) is, most probably,

$$O_{129}.37\,{}^{Si}_{20}.36\,{}^{Al\ Fe}_{20\cdot 24}.20\,{}^{H\delta}_{24}.4\,{}^{Na}_{36} = 2.658.$$

*Tsujilite* has the volumic constitution

$$O_{142}.59\,{}^{Si}_{20}.14\,{}^{Al\ Fe}_{20\cdot 42}.6\,{}^{H\delta}_{24}.4\,{}^{Na}_{41} = 2.6971.$$

The following table gives the figures obtained by *absolute analysis* of the body or "biscuit" of two of the porcelains, the glaze having been carefully ground off:

| | Egg-shell ware, stated to be tsuji-tsuchi 70 p. c., shiro-tsuchi 30 p. c. | Thick-body porcelain, stated to be shiro-tsuchi 50 p. c., sa-kaime-chuchi 50 p. c. |
|---|---|---|
| Silica | 78.763 | 74.545 |
| Alumina | 17.847 | 19.315 |
| Ferrous oxide | .638 | 1.916 |
| Lime | .213 | .106 |
| Magnesia | .029 | .176 |
| Soda | 1.975 | 2.832 |
| Potash | .203 | .566 |
| | 99.668 | 99.456 |
| Densities at 32° F | 2.3367 | 2.3079 |

The volumic formulæ of these compute very beautifully to the same molecular type:

The egg-shell porcelain to $O_{146}.60\,{}^{Si}_{24}.16\,{}^{Al}_{24}.\ 4\,{}^{Na}_{33} = 2.331.$

The common porcelain to $O_{150}.60\,{}^{Si}_{24}.18\,{}^{Al}_{24}.2\,{}^{Fe}_{24}.6\,{}^{Na}_{33} = 2.3.$

Comparisons with the volumic formulæ of kudaruyamite and tsujilite show that the transformations which occur in the burning of this porcelain consist mainly in an *expansion* of both the *silicon* and the *aluminum* molecules through 4 diameters. The *sodium* molecules, however, undergo *contraction*, those of the tsujilite—the main constituent of the egg-shell body—through $2 \times 4$, or 8 diameters.

Whether the facts in this case represent the *general* theory of the molecular changes in the baking of porcelain cannot of course be asserted as yet, this being the first investigation of this kind as yet made.

It may be remarked, on comparing the figures of the analyses, that those from the egg-shell ware support very satisfactorily the specification of the manufacturers as to its components, but that this is not the case with the commoner porcelain, about which there has been possibly some small mistake in stating the component minerals. It seems, indeed, a conclusion that must be drawn from the facts, that this latter body (at least the sample analyzed) contains, besides the shiro- and sakaime-tsuchi, some of the more aluminous kudaru-yama-tsuchi incorporated with it—more than can be attributed to a mere coating or ground for the colors, such as the latter mineral is stated to be used for solely. Nevertheless, the substantiation, by the analyses, of the specification of the manufacturers regarding the finer egg-shell ware, is of the utmost interest and importance, as establishing the fact that we have here proof of the manufacture of porcelain of a quality unrivalled elsewhere in the world without the use of the special mineral *kaolin*, which has been generally deemed indispensable as a component of porcelain-pastes, both to impart plasticity during the shaping and to confer the refractory character needed in the kiln. The Chinese have a proverbial expression, that while the *petuntse*, the felsitic or petro-silicious constituent, constitutes the *flesh* of the porcelain, *kaolin* is essential to form its *bones*. This is evidently totally inapplicable to the finest of porcelain, made from the Idzumi-Yama porcelain-stones in Japan. HENRY WURTZ.

**Presidential Electoral Commission,** a board appointed during the second session of the 44th Congress of the U. S. to determine questions arising out of the presentation of two or more discordant certificates of the votes of the electoral colleges of certain States in which the election of Presidential electors had been contested. The canvass had been one of the most exciting in the history of the government, and at its close the vote was almost evenly balanced. The result depended on the voice of three States, Florida, Louisiana, and South Carolina, in which both parties claimed the victory; and of a fourth, Oregon, in which one elector was claimed to have been elected by a minority, in consequence of a constitutional disqualification affecting one of the candidates of the majority. From Louisiana, Oregon, and South Carolina the certificates presented were in each case twofold, and from Florida threefold. An angry controversy arose as to the constitutional mode of deciding between these competing certificates. The dispute assumed proportions which even threatened the peace of the country. With a view to avert the impending danger, a joint committee of the two houses was appointed early in January, 1877, to devise, if possible, some means satisfactory to all of ascertaining the legal result of the election. This committee consisted of Senators George F. Edmunds of Vermont, Frederick T. Frelinghuysen of New Jersey, Roscoe Conkling of New York, Allen G. Thurman of Ohio, Thomas F. Bayard of Delaware, Matthew W. Ransom of North Carolina, and Oliver P. Morton of Indiana; and Representatives Henry B. Payne of Ohio, Eppa Hunton of Virginia, Abram S. Hewitt of New York, William M. Springer of Illinois, George W. McCrary of Iowa, George F. Hoar of Massachusetts, and George Willard of Michigan. On the 18th Jan. this committee almost unanimously—Senator Morton only dissenting—reported a bill providing for the creation of a tribunal to be composed of five Senators, five Representatives, and five associate justices of the Supreme Court of the U. S., four of the latter being designated by their districts in the bill itself, the fifth to be subsequently chosen by these four; to which tribunal should be referred the conflicting certificates and accompanying documents from the contested States, and all questions relating to the powers of Congress in the premises, with the authority to exercise the same powers in ascertaining the legal vote of each such State. The bill further provided that the decisions of such tribunal in every case should stand, unless rejected by the concurrent vote of both houses. Also that objections which might be made to any votes from States not presenting double certificates should be considered, not by the commission but by the houses separately, and unless sustained by both should be of no effect.

The bill, after a sharply-contested debate in both houses, passed the Senate Jan. 25, and the House of Representatives Jan. 26. In the former the vote was 47 yeas to 17 nays; the Republicans voting 24 yeas to 16 nays, and the Democrats 23 yeas to 1 nay; absent or not voting, 9 Republicans and 1 Democrat. In the House there were 191

yeas to 86 nays; the Democrats voting 158 yeas to 18 nays, and the Republicans, 33 yeas to 68 nays; absent or not voting, 7 Republicans and 7 Democrats.

On the 31st Jan. the commission was elected, three Republicans and two Democrats being taken by agreement from the Senate, and three Democrats and two Republicans from the House. The commissioners elected were Senators George F. Edmunds, Frederick T. Frelinghuysen, Oliver P. Morton, Allen G. Thurman, and Thomas F. Bayard; and Representatives Josiah G. Abbott of Massachusetts, James A. Garfield of Ohio, George F. Hoar of Massachusetts, Henry B. Payne of Ohio, and Eppa Hunton of Virginia. The justices designated by the bill were Nathan Clifford of Maine, Samuel F. Miller of Iowa, Stephen J. Field of California, and William Strong of Pennsylvania. The fifth justice, who was promptly selected by these, was Joseph P. Bradley of New Jersey. The commission perfected its organization on the 1st Feb., and on the same day received the certificates of the first disputed State, which was Florida. Those of Oregon, the last disputed State, were not reached until Tuesday, 27th Feb., and the decision was communicated to the joint convention of the houses of Congress on Thursday, Mar. 1. The convention then proceeded with the count, which, with much interruption, was pursued to its completion, which took place at 4*h.* 10*m.* A. M. of Friday Mar. 2, at which hour the president of the convention, Hon. Thomas W. Ferry of Michigan, the president *pro tem.* of the Senate, announced that Rutherford B. Hayes of Ohio had received 185 electoral votes, being a majority of the whole number, and had been duly elected President of the U. S.; and that William A. Wheeler of New York had received a like majority, and had been duly elected Vice-President of the U. S.

F. A. P. BARNARD.

**Projec'tion, Method of,** in geometry [Lat. *pro*, "forward," and *jacere*, to "throw"], in general, such a delineation of an object upon a plane surface as would result were the contours of points of the object *thrown forward* upon it by lines drawn from some fixed point assumed as the point of vision. If the point be supposed infinitely distant, and in direction perpendicular to the plane, we have the usual orthographic projection; if the direction be not perpendicular, we have *oblique projection;* if the point is at a finite and proper distance for ordinary vision, we have *perspective projection*, or *linear perspective.* Other systems of projection are used for delineating the earth's surface (see MAP, in CYCLOPÆDIA). In geometry the object projected is a geometrical figure, the fixed point is called the *vertex*, the joining lines form a *cone*, and the section by which the cone is cut by any plane (*plane of projection*) is called the *projection.* Important conclusions, by which from a particular theorem the general one under which it is contained may be inferred. The method is due to Poncelet, whose *Traité de Propriétés projectives* (1822) "may be regarded as the foundation of modern geometry." By this method theorems concerning infinitely distant points may be extended to finite points on a right line; theorems concerning systems of circles may be extended to conics having two points common; and theorems concerning imaginary points and lines may be extended to real points and lines. In this last postulate we have the PRINCIPLE OF CONTINUITY as applied by Poncelet in the work named; in virtue of which, certain properties of a figure in which certain points and lines are real, are asserted equally to obtain when some of those points or lines are imaginary.

J. G. BARNARD.

**Prokesch-Osten, von** (ANTON), BARON, b. at Gratz, Styria, Dec. 10, 1795; studied law and philosophy at Freiburg; entered the Austrian army in 1813, and made the campaigns in France; was appointed professor of mathematics at the military academy of Olmütz in 1816; accompanied Prince Schwartzenberg as aide-de-camp in 1818 to Dresden; travelled from 1824 to 1827 in Greece, Asia Minor, and Egypt; distinguished himself as a diplomat in the Austrian negotiations with Turkey, Greece, and Egypt 1827–33; and was sent as ambassador to Athens in 1834, to Berlin in 1849, to Frankfort in 1853, and to Constantinople in 1855, whence he retired in 1867. He has written *Erinnerungen aus Ægypten und Kleinasien* (3 vols., Vienna, 1829–31), *Das Land zwischen den Katarakten des Nil* (Vienna, 1832), *Reise ins Heilige Land* (Vienna, 1831), *Geschichte des Abfalls der Griechen vom türkischen Reich* (4 vols., Vienna, 1867).

**Proofs, Etchers' and Engravers'.** See ETCHERS' AND ENGRAVERS' PROOFS.

**Propon'tis,** the present Sea of Marmora, between Thrace and Asia Minor, forming an intermediate sea between the Ægean and the Euxine, with the latter of which it communicates through the narrow strait of the Thracian Bosphorus, and with the former through the Hellespont.

**Pros'per of Aquitaine,** SAINT, commemorated June 25, was b. in the S. W. part of Gaul about 400, and d. about or not long after 455. Little is known of his personal history, but he was certainly only a layman, and, though he visited Rome during the pontificate of Celestine (in 431), was probably never secretary to Leo the Great. The greater part of his life appears to have been spent in Marseilles, where he came in contact with Semi-Pelagianism, and wrote those tracts against it on which his fame now principally rests. His *Carmen de Ingratis*, in defence of Augustine and his anthropology, shows him to have been a poet of considerable merit. He was author also of a *Chronicon Consulare*, in continuation of Jerome, reaching down to 455. The standard edition of his works is by the Benedictines Le Brun de Marette and Mangeant (Paris, 1711; Rome, 1758).

R. D. HITCHCOCK.

**Proterog'lypha** [Gr. πρότερος, "in front," and γλυφίς, "a notch"], a sub-order of ophidians or serpents, containing the poisonous snakes. The superior maxillary bone is horizontal and supports venom-fangs anteriorly, and is posteriorly more or less elongated. The serpents thus distinguished are differentiated into the families (1) Elapidæ and (2) Najidæ, in which the tail is conical, and (3) Hydrophidæ, in which the tail is compressed and adapted for swimming.

THEODORE GILL.

**Psychom'etry.** [Concerning this subject we submit to our readers the following paper, prepared by DR. BUCHANAN, who first started the question, and still is its principal investigator.—EDS.] The word *psychometry*, which etymologically signifies "soul-measuring," was introduced by the undersigned in 1843 to represent the science and the process just discovered, by which the soul or mind may measure and estimate correctly any soul or mind, investigated by means of its emanations and the impressions which it has left upon physical objects. The form in which this power was first displayed and brought before the public in his lectures at New York and Boston in 1843 was that of appreciating and describing the character of any one by means of his autograph, the impression or conception being obtained by a sensitive person from contact with the manuscript alone, without seeing it or knowing anything of its contents or its source. But the scope of the science and its philosophic and practical applications have been much more extensively developed in his lectures and in his essays in *Buchanan's Journal of Man.*

The first step of the discovery was taken in 1841, by ascertaining that persons of a sensitive or impressible temperament were capable of feeling the influence of anything with which they were brought into contact, so as to recognize metals, when touched for a few minutes, by their influence on the nerves, including those of the sense of taste. Substances generally of any distinct taste were recognized in the same way, and medicinal substances were felt, in the same manner as if they had been swallowed, in all their constitutional influences. In following up this line of investigation, the writer, as a medical professor, would distribute medicinal substances among the members of his medical class, sealed up in paper envelopes (the contents unknown to the pupil), to be held in their hands until they felt the peculiar medical impression of the substance, as a narcotic, a stimulant, a tonic, an emetic, etc., the effects becoming so distinct in ten or twenty minutes as to enable them to recognize the substance, if they had ever taken it, by the identity of the effects. Frequently, they would lay it aside to stop an unpleasant influence. Different persons would experience similar influences from any medicine, with such variations as might be expected from their peculiar temperaments or idiosyncrasies. The general result of his experiments was that about one-third of the members of a medical class were sufficiently sensitive or impressible to succeed in this experiment.

The next step was the discovery that persons of the highly impressible temperament could feel the influences of contact with living persons as distinctly as with medicines, and thus, by placing the hand or the fingers on different parts of the head, could realize the action of the subjacent convolutions or organs of the brain; and not only perceive them understandingly, but feel them, in powerful effects upon themselves, in proportion to their own impressibility, giving them amiable and happy feelings from the upper surface of the brain, animal energy from the occiput, and intellectual brightness from the forehead. With higher endowments of impressibility, his pupil, Mr. Inman, could not only feel the influence of each organ or portion of a convolution, but describe accurately its power, influence, direction, and cultivation in the individual examined by this sympathetic diagnosis of psychometry. By the same process all the physiological and pathological conditions of the person were ascertained, making a complete medical diagnosis.

The investigation of the human constitution by this method, in addition to the direct excitement of the organs of the brain, resulted in the discovery of the functions of the cerebral organs, correcting and vastly enlarging the discoveries of Gall and Spurzheim, and explaining in a novel manner the relations and sympathies between the mind and body—constituting, therefore, a complete "system of anthropology," as taught in 1842–43 and published at Cincinnati in 1854.

This development of the cerebral functions was achieved before *autographic psychometry*. The writer found that the influence of a cerebral organ was a portable reality; that it could be imparted to many substances held in contact with the head, and afterward recognized by the sensitive; that the influence of an organ could be transmitted to the hand of the sensitive through a metallic conductor. He inferred that the emanations of nervous force in writing would in like manner become attached to the paper, and might be recognized by the impressible. His first experiment in the winter of 1842–43 at the Astor House, New York, fully verified this opinion, Mr. Inman describing with great accuracy the characters of four distinguished gentlemen, whose letters were placed in his hands or held on his forehead, without his having the slightest knowledge of their source.

In the exercise of psychometry the faculty of intuition is brought into play, and the revelations made are often truly wonderful. As everything with which human beings have been in contact—not only letters, but clothing, pictures, works of art, houses, amulets, and relics of all kinds—is a prolific source of impressions, it is apparent that psychometry may be used extensively in illuminating all history and ascertaining the conditions of the ancient world, as well as the characters of its prominent personages. Psychometers of superior powers enter so thoroughly into sympathy with the mind investigated as to determine the sphere or position in life the person occupied, his leading opinions or sentiments, and the outlines of his career. What is still more remarkable, they often discover whether he is living or dead, and speak of his sentiments and his situation as he is at the moment. Of course these highest manifestations are not very common, but a moderate degree of psychometric power may be found, according to the writer, in at least 5 per cent. of our population, and in warm climates in from 25 to 50 per cent. It is most abundant among the refined, emotional, amiable, and sensitive. There are many public practitioners of psychometry in this country who give opinions upon any writing sent them or upon any personal relic. There are many practitioners who prescribe for patients at a distance, guided only by the psychometric impressions derived from their letters or a lock of hair. The psychometric or intuitive perception is indeed essential to any great skill in medical practice. Without this intuitive perception at a glance of the condition of his patient, the most learned physician fails to exhibit curative skill, while with this power very illiterate physicians have been remarkably successful.

The psychometric faculty is so closely connected with clairvoyance, and even prevoyance, as to lead to very marvellous revelations. In the *Journal of Man*, vol. i., the writer says: "The ancient manuscripts, paintings, and other works of art which still exist, the crucifixes, garments, armor, and other ancient relics still preserved, are doubtless still instinct with the spirit that produced them, and capable of revealing to psychometric exploration the living realities with which they were once connected. At present these relics are barren of significance. Their hidden meaning lies waiting the future explorer, as the hieroglyphics of Egypt awaited the arrival of Champollion, to interpret their significance. . . . *The past is entombed in the present.* The world is its own enduring monument, and that which is true of its physical is likewise true of its mental career. . . . The discoveries of psychometry will enable us to explore the history of man, as those of geology enable us to explore the history of the earth." The truth of these propositions has been illustrated by the remarkable experiments of Prof. William Denton, given in his three interesting volumes entitled *The Soul of Things* (published at Boston, 1873–74). Mr. Denton is an able geologist, a popular and eloquent lecturer, and a vigorous, independent, philosophical thinker. In *The Soul of Things* he claims for psychometry even more than the writer in the way of geologic and cosmic revelations, which are in fact scientific clairvoyance. The subjects of Prof. Denton practice their clairvoyant psychometry by taking any mineral specimen in their hands and describing the situation from which it was brought and the surrounding strata and scenery, as though the mineral had received an impression of surrounding things, such as the letter receives from the mind of the writer, the descriptions being so full and accurate as to be of utility in geological and mining explorations, in some of which psychometry has made profitable revelations. Marvellous as the doctrine seems, there need be no difficulty in verifying its practical value, as the subject who investigates a specimen of known origin must inevitably fall into error if he has no other guide than his imagination. When two different subjects describe the same specimen (of which they know nothing) in the same manner, and correctly describe its origin and surroundings, the experiment has all the precaution and accuracy demanded by science.

In the *Soul of Things* Prof. Denton describes extensively the geology, ethnology, domestic life, and historic scenes of ancient America, ancient Europe, Egypt, and Syria. The cave-dwellers, lake-dwellers, Romans, Pompeians, and Carthaginians of antiquity, the mound-builders and copper-miners of ancient America, are described as if just seen by a traveller, while Mars, Jupiter, Venus, the moon, and the sun are described by clairvoyant vision.

The practical utilities claimed for psychometry are—(1) The demonstration of a complete anthropology; (2) the perfecting of the materia medica; (3) the accurate diagnosis of health and disease; (4) the accurate description of character; (5) the investigation of geology and of many other sciences to which experiments show its adaptation.

J. R. Buchanan.

**Pteran′odon** [Gr. *πτερόν*, "wing," *ἀν-*, "without," and *ὀδούς*, "tooth"], a genus of pterodactyls, or extinct flying reptiles, from the Cretaceous of Kansas, distinguished from all previously known genera of the order by the entire absence of teeth, and hence regarded as the type of a new sub-order, Pteranodontia. The typical species, *P. longiceps*, has the skull about thirty inches long and the lower jaw nearly two feet. The rami of the lower jaw are closely united for more than half their length, as in the *Rhynchops*, or skimmer. *P. comptus* is a small species, while *P. ingens* was very large, and the skull must have measured nearly four feet.

O. C. Marsh.

# Q.

**Quar′ry** [Old Fr. *quarré*, "square"], an excavation made for procuring building-stone—sandstone, granite, marble, etc. Quarries are more generally open to the day, but are sometimes completely subterranean. The ordinary processes of quarrying are so simple and so frequently seen that they do not demand detailed description. As the stone is usually required to be of symmetrical form, it is generally split out in large quadrangular blocks, a series of drill-holes or shallow pits being sunk along a line parallel with the face of the ledge, and in these wedges are placed which are driven simultaneously. Wooden wedges are also sometimes used; these are subsequently wet, and by their expansion, which develops almost irresistible force, the rock is split. Blocks of granite of immense size are sometimes detached in this way, and the nations of antiquity, especially the Egyptians and Assyrians, seem to have taken great pride in quarrying and using in their structures masses of unusual size. The largest of these which have been described are those at Baalbec, some of which are 17 feet square and 70 feet long. The quarrying of marble as now practised in this country has been carried to great perfection, and, as it is conducted in a peculiar way, it merits a few words of description. As this rock is very crystalline in texture, and liable to be shattered by any violence, and as it is also much more valuable than other building-stones, and hence is carefully economized, the blocks are all *cut* from the quarry, and never blasted or wedged out. This is, for the most part, done by machinery. After removing the unsound surface-rock, a piece of several thousand square feet is smoothed off, and this is called the quarry-floor. Upon this steam channelling-machines are set, which move on temporary railroad tracks, and carry one or two ranges of long and heavy drills or chisels. These, alternately lifted and dropped, cut narrow channels to the depth of six feet on either side of the track. When the floor is thus all channelled in one direction, the machines are turned and made to cut channels at right angles to the first. The quarry-floor is thus all divided into blocks. One of these blocks is now broken out, and the others are cut across at base by horizontal drills, a process called *gadding*. They are then wedged free, and lifted out by cranes. The diamond drill is also successfully employed in quarrying marble, both for channelling and gadding. (See also Blasting, in Cyclopædia.)

J. S. Newberry.

# R.

**Railroad Laws in the U. S.** RAILROADS are treated under that title in CYCLOPÆDIA wholly as works of engineering science, and are considered solely from the standpoint of the engineer. The articles on CARRIERS, COMMON, and on NEGLIGENCE contain many doctrines of the law applicable to railroad companies, and describe many of their obligations and liabilities toward the shippers of goods, passengers, and other persons who may be injured or may suffer loss through the careless or wrongful conduct of their servants and employés. There remain, however, a large number of legal rules concerning the creation, organization, and operation of railroads in the U. S. which constitute a peculiar and most important department of its jurisprudence, and which will be collected and arranged in the present article. The subject-matter may be conveniently divided into two general heads: I. The creation and organization of railway companies; II. The operation of railroads as means of transit and transport.

I. *The Creation and Organization of Railway Companies.*—This head contains several subdivisions which will be separately considered. 1. *Their Corporate Existence.*—In order that a railroad may be possible a legislative authority is indispensable. Without such permission the necessary lands could not be acquired, while the very structure itself and the methods of its operation would at the common law constitute both a public and a private nuisance. Although the States might undoubtedly build the railways within their territory as works of public improvement, without the intervention of private enterprise and aid, as the Erie and many other canals were constructed, it has become the settled and universal practice for them to act through corporations, which they create and to which they delegate the requisite authority. Even in those cases where some governmental interest exists, and some direct governmental control of the management is retained—as, for example, in the Pacific Railway—this has been accomplished by means of directors or trustees appointed by the legislature or the executive, who act in concert with those chosen by the stockholders. Railway companies may either be incorporated by special charters, or may be organized and acquire their corporate existence under general statutes. While the former mode was once universal, and is still employed, the tendency of late years has been very strongly in favor of general statutes, enabling private persons to associate themselves and assume the corporate character without any direct appeal to the legislature, and several of the recent State constitutions expressly prohibit the granting of special charters. This modern legislation is substantially the same in all its essential features wherever it has been adopted. The following are the provisions of the New York statute prescribing the manner in which individuals may form themselves into a railway corporation, and thereby acquire all the corporate rights and franchises conferred by the law; and they may be taken as the common type of all similar statutory enactments throughout the country: Any number of persons not less than twenty-five sign articles of association, which must state the corporate name, the termini of the road, the counties through which it will run, the length as near as possible, the amount of capital stock (which must be at least $10,000 per mile of length), and the names of thirteen directors. At least $1000 per mile of the capital must be subscribed in good faith, and 10 per cent. thereof must be actually paid in cash. To this instrument must be annexed an affidavit of at least three directors showing that the required amount of capital stock has been subscribed and paid in cash. These papers are filed in the secretary of state's office, and are there recorded. The persons subscribing the articles, and all others who become shareholders, thereupon constitute a railroad corporation under and by virtue of the statute. It will be seen that certain facts are made the necessary conditions of the incorporation, and their existence must be established by certain proof which the statute makes adequate, and a public record of this evidence must be made and deposited in some department of the State executive. These fundamental and essential facts are—(1) The termini of the projected road, with the general course and direction through which it is intended to run, so that its length can be approximately (at least) determined at the outset, and it can thus be ascertained whether the capital stock subscribed, and the portion thereof paid in, reach the minimum amount per mile of length required by the law. (2) A certain amount of capital stock must have been subscribed in good faith, equalling at least a specified sum for every mile in length of the contemplated road, and of this stock a designated percentage at least must have been actually paid in cash. Both the object and the wisdom of this requirement are plain. The construction of any railroad must largely interfere with private rights; private domains are invaded, lands are taken, farms are cut through and injured, all the ordinary industrial pursuits along the route are deranged; and although these private inconveniences and losses must be endured for the sake of the higher good to the whole commonwealth, yet it would be a grievous wrong if such damage to individuals should be inflicted *without* producing the ultimate benefit to the many which is expected to follow the completed work. The legislature endeavors, therefore, by requiring a fixed minimum of capital stock, to secure the completion of every railroad that is commenced, and thus to prevent the injury to private interests, without any compensating advantage, which would result from partially-finished and abandoned enterprises. In many instances, however, this precaution has proved unavailing. The minimum amount established by the statutes is undoubtedly too small, and the legislatures have often been persuaded to lessen this meagre sum by special acts in behalf of corporations organized under the general laws. Companies have been formed and extensive lines projected and commenced with capital stock hardly sufficient to defray the cost of a thorough preliminary survey; the enterprises have been carried through and the works completed, if at all, by means of funds raised upon mortgages of the corporate franchises and property, and by means of aid obtained through the vicious system of municipal bonding. To this cause is largely due the sudden and complete collapse of all railroad construction and extension which occurred in the year 1873, and which prostrated the entire business activities of the country. The theory of general statutes under which railroad corporations may be formed is doubtless the correct one, and is peculiar to the legislation of the U. S.; it is one of the many and great improvements upon the old common-law principles and methods which characterize our jurisprudence. The theory, however, requires that the safeguards contained in the general laws should be sufficient to protect private owners and communities, by demanding in every case a capital stock subscribed in good faith adequate for the completion of the work, and that all attempts to remove these safeguards or to lessen the requirements by special acts passed in behalf of particular companies should be effectually defeated. The truth of these views has been so fully demonstrated by the experience of the past twenty-five years that the most stringent provisions have been added to the constitutions of several States in their recent revisions, restricting the powers of their legislatures, prohibiting all special charters and special legislation in behalf of railroads, and requiring the passage of general statutes under which all new corporations must be created and by which their organization and management must be regulated. In addition to the clauses already described, which relate to the association of persons for the purpose of acquiring a corporate character and capacity, these general statutes also contain a great number and variety of rules for the government of the companies when thus organized—rules prescribing the methods of electing directors and other officers, and their functions, powers, and duties; the proceedings for the acquisition of lands under the right of eminent domain; the mode of constructing the track and other works belonging to the road; the arrangements to be made for the benefit of adjacent proprietors; the safeguards against accidents from the running of trains; the manner in which shares of stock may be transferred, and many other powers, capacities, or limitations which have seemed expedient to the legislatures of the different States. Some of the most important of these statutory regulations will be referred to under a subsequent head.

2. *Nature of the Corporations.*—At the very commencement of the railroad system in this country the question was presented, upon the answer to which depended its development and its very existence, Whether railroad companies were to be regarded as purely private corporations, or whether they were not, to a certain extent at least, and for certain purposes, public in their nature? This question first came before the courts in connection with the exercise of the right of eminent domain. In the case of one of the very first railroads incorporated by the legislature of New

York, which was authorized in its charter to take lands of private owners upon payment of a just compensation, the court of last resort determined, after great consideration and in the face of a strong dissent, that a railway company is not strictly and solely a corporation created for private purposes to subserve the private ends of the shareholders. On the contrary, the business which it carries on is a public use; it is created and operated for the public benefit; and its nature is therefore public, so far at least as certain of its functions are concerned. As the State provides ordinary highways which are public, as it has constructed canals which are public, so it might itself construct a railroad which would be public. That it sees fit to delegate its power to a corporation does not change the nature of the functions which are entrusted to such artificial body. Receiving this *quasi* public character from the legislature, a railway company also holds by derivation, and may exercise, the State's right of eminent domain, and may thereby take the lands of private owners upon paying them the just compensation required by the constitution. Probably no more important and far-reaching decision was ever pronounced by a State tribunal, for upon it depended the very existence of the railroad system throughout the country. Although it has been often questioned and its reasoning severely criticised, yet it has been followed in all the other commonwealths, and has become the settled law of the land. It is plain that this conception of railroads as in some sense public corporations was necessary, if it was intended that they should be used at all as means of intercommunication and traffic, for without it there was no possible ground upon which they could acquire and exercise the right of eminent domain, and the possession of that right was absolutely indispensable. It is equally plain that the conception is directly opposed to another necessary class of facts, which show that railroads are private in their nature, objects, purposes, and management. They are certainly not public in the sense in which municipal corporations are public; they are not subordinate parts of the local government, like towns, cities, and counties. In fact, from the necessities of the case, and in order that they might be legally clothed by delegation with the governmental right of eminent domain, railroad companies in the U. S. were declared by the courts to be public; on the other hand, from their organization, operation, and purpose as a means of investing capital and of obtaining profits therefrom, they are naturally and necessarily private. They thus possess a double legal nature. It may be stated as a general proposition that, in respect to many of the powers and functions with which they are clothed, and their obligations toward the State, they must be regarded as public or *quasi* public bodies, while in respect to their duties and liabilities toward individual citizens, shippers, passengers, and others who come into relations with them through contract or tort, and in respect to their stockholders, they are private corporations. This dual character gives rise to some complications, since the line which separates the two capacities has never been accurately defined. As it may be found expedient to place railroad corporations under a more direct control by the States, in order to prevent extensive combinations and oppressive monopolies, it is probable that, through the action of the courts and the legislatures, their public nature and uses will be brought into greater prominence and be more definitely established. The relations between railroad companies and the State already present a problem of great difficulty and importance, which, it would seem, can only be solved by holding these artificial bodies to be public in respect to their duties and liabilities, as well as in respect to their powers.

3. *Legislative Control.*—In recent charters and general laws railroads are subjected to numerous regulations, partly restrictive and partly mandatory, all intended to secure the welfare of the public, the safety of shippers, passengers, and persons crossing the tracks, and the convenience of adjoining proprietors. These provisions are peremptory in their nature and minute in their detail, and their violation may render a company liable sometimes to a fixed penalty, sometimes to an action for damages on the ground of negligence. One class of them defines the manner in which the road itself must be constructed, with sufficient fences, farm-crossings, gates opening into fields, cattle-guards, guards and signs at highway crossings, ditches, culverts, watercourses, and the like; another class is concerned with its operation, prescribing the rates of speed for trains, the ringing of bells, the blowing of whistles, the use of signals, the employment of watchmen, and many other precautions intended to prevent accidents to or by the trains when in motion. There can be no doubt that a State legislature, in the exercise of its general police power and for the protection of its citizens in their persons and property, may establish such a code of rules limiting and defining the mode of operating railroads, even though the original charters or acts of incorporation might have left the companies entirely free from any such restrictions. All private persons are subject to the police authority of the government, and railway corporations possess no attributes which relieve them from this common subjection for the general welfare. While the legislatures have thus uttered many positive commands as to the manner of building and working railroads, much is still left to the voluntary action of the companies themselves. Such action on their part is enforced, however, by a legal principle which has proved to be more efficacious than statutory mandates. This principle, which has been universally approved by the State courts, is briefly expressed in the following proposition: If any accident—*e. g.* the breaking of an axle or of a rail, or the running off the track—which was not immediately occasioned by carelessness or violation of rules on the part of employés, could certainly, or even with reasonable probability, have been prevented by the adoption and use of any known means, instrument, or improvement in the construction of the track or of the rolling stock, or in the manner of operating the same, the absence thereof or failure to adopt or use such means may be regarded as a negligence on the part of the company which renders it liable to all the damages and losses caused by the accident. Certain cases hold that such a failure is negligence as matter of law; others say that it is a sufficient ground from which the jury may infer negligence; the practical result, however, is the same in whichever mode the rule is stated, for juries always hold railway companies to a most rigid accountability. Special charters and general laws, especially the recent ones, frequently prescribe the maximum rates of fare for passengers and of freight for the carriage of goods, and prohibit all discrimination in favor of any classes of shippers or passengers, or in favor of through as compared with local traffic. Thus, the legislature of New York, in a statute authorizing the different companies between Albany and Buffalo to consolidate and form one corporation, the New York Central R. R., imposed as a condition that the fare for passengers travelling any distance except a fraction of a mile should not exceed the rate of two cents per mile. A legal question has recently arisen from an attempted exercise of this legislative control of the utmost practical importance both to railroads and to the public—to those who are either directly or indirectly concerned in their use and management. It has been the occasion of a bitter forensic controversy, and in some of the States has even passed beyond the domain of the courts and has entered the region of partisan politics. This question may be put into the following general form: Where an existing charter or statute under which a railroad has been organized contains no clauses regulating the rates of fare and of freight, or placing any limits upon their amount, or restricting the company in respect to its transport of goods and passengers, or prohibiting any discrimination between the through and the local traffic, can the legislature by a subsequent law enact provisions of such a character and impose them upon the railroad which it had previously incorporated? Can it prescribe the maximum rates of compensation which shall be demanded for the carriage of goods and passengers, require the same rates for through and local traffic, or in any manner directly or indirectly interfere with, control, limit, or reduce the revenue which the railway company would receive from the conduct of its ordinary business of transportation? The power is now invariably reserved, either in the charters themselves or in general laws, for the legislature to repeal, alter, or amend the acts of incorporation from which the railroad companies have derived their existence. This reservation has become thus universal in consequence of the judicial construction put upon that clause of the U. S. Constitution which prohibits the States from passing laws which impair the obligation of contracts. A charter of incorporation is held to be an executed contract, and without such reservation it is beyond the reach of legislative interference. (See OBLIGATION OF CONTRACTS, in CYCLOPÆDIA, in which this subject is fully explained.) In discussing the legal question above mentioned, it is argued, on the one hand, that by virtue of this reservation a State legislature has absolute control over all the affairs, internal and external, of every railroad corporation to which it applies; that the fixing a statutory rate of compensation for the business done, or the establishment of statutory modes or limitations for that business, is one method of altering and amending the charter; that if a legislature may repeal the charter, and thus entirely deprive the stockholders of this means and instrument for the acquisition of private property, much more may it enact any law which will simply have the effect to modify that instrument, and at most lessen its efficiency and diminish the amount of private property acquired by its use; in short, that the broad language of the reservation includes every possible subordinate measure,

no limit upon the legislative authority being either expressed or implied. On behalf of the companies it is urged that, while a legislature has retained a complete power over the franchises which it had itself bestowed, and may not only alter but even wholly withdraw them, it cannot, by reason of other constitutional prohibitions, deprive the corporation or the stockholders of their private property so long as the franchises are permitted to remain in existence; that the income and profits of the business—the revenue received by the company—are in every sense of the term the private property of the individual stockholders; that a law purporting to reduce the rates of fare and freight, or interfering with the management in respect to the earning of revenue, operates directly upon the means and facilities of acquisition which had been granted to the corporators, and so far deprives them not only of the property which they would receive, but also of their existing property by diminishing the permanent value of their railway shares. It is said that if a legislature may thus assume to fix the rates of compensation for services performed, it may place them at such a low point that no profits whatever would be earned, and even that the road would be operated at a loss. This argument, it will be seen, is based upon the conception already described, that a railroad corporation possesses a double character, that it is partly public, partly private, and that while the former functions are subject to legislative interference, the latter are protected therefrom by the constitutional safeguards of private property. In certain of the Western States the grave constitutional question thus presented by their recent statutes has been considered by the local tribunals and decided in favor of the legislative authority; it has yet to be passed upon by the national court of last resort. It might be supposed that the rates of fare and freight would be settled by the natural laws of trade, of supply and demand, and would be kept down to the lowest possible point by the competition between rival lines. Experience, however, has thus far shown that, while at occasional and short intervals such a competition exists and produces sudden and large reductions in freights and fares, yet, as a general practice and during the long intervening periods, a combination is perfected among the great companies which control the transportation business of the country between the East and the West, whereby the natural effects of competition are obviated, and the highest prices are fixed and maintained among the associated parties. The relations between several rival railways have sometimes been made most intimate, and their interests for the time being rendered almost identical, by the adoption of a system for which the name "pooling" has been invented. Under this arrangement, and during its continuance, the gross receipts from all the lines which are parties to the agreement are collected and combined into a common fund, the "pool," which is placed in the hands of a committee representing all the interests involved. After defraying the expenses of their operation, the residue of this "pool" is distributed among the various railroads according to some plan or ratio of allotment established by the contract. These combinations, interfering with the natural laws of trade, of supply and demand, and maintaining the freights and fares at an artificial and exaggerated standard, were a principal cause, or at least occasion, of the restrictive legislation above described recently resorted to in certain of the Western States. Whether this legislation will accomplish the object proposed, or whether it does not itself violate well-settled principles of political economy, are questions which I shall not discuss, and which, perhaps, can only be determined by time and experience. Although the railroads situated within the territory of the various States are the creatures of State laws, the enormous magnitude and increasing complications of the system as a whole have suggested the inquiry whether they may in any circumstances and to any extent be brought under the control of the U. S. government. Over a railroad whose line is wholly within a single State, and whose business also is confined to the same limits, it is plain that no such national jurisdiction exists. Congress, however, has power "to regulate commerce among the several States." The transit of merchandise by land as well as by water is commerce. If, therefore, the line of a single railway company extends into the territory of two or more States, or if, being situated wholly within one State, it forms through its connections a link in a chain of railroads over which traffic is continuously carried on from State to State, it then becomes a means and instrument of inter-State commerce, and as such is subject to regulation by Congress. This general principle, that the traffic or transportation by land from one State into or through another, and the railroads over which it is conducted, may be regulated by the national legislature, has been definitely established in an abstract form by several recent decisions of the U. S. Supreme Court. What particular measures may be enacted as specific modes of regulation has not, however, been determined. Congress has exercised its power in a very few instances only, and has not interfered to any considerable extent with the management and operation of railroads incorporated by the States. That some general system of control, containing uniform rules applicable at least to the great through-routes of the country, will ere long be adopted, is probable. Such a system might be as advantageous to the associated and connected companies as to the public, since it would relieve them from the discriminating and often conflicting enactments imposed by the different States. Perhaps the difficulties thus far experienced in dealing with the more powerful railroads in respect to their rates of freight and fare, and to their preference given to through over local traffic, can only be met and overcome by the interposition of Congress. Whether railroad corporations may be created within the territory of the States by the national legislature—or, in other words, whether Congress has the power under the Constitution to grant charters of incorporation which shall become operative within State jurisdiction—is a much more doubtful question. It is certain that Congress may pass acts of incorporation for Territories, which are under its immediate legislative authority, and it may extend its aid, by donations of public lands or of the public credit or of money, to companies created by the States.

4. *The Power to acquire Property.*—As has already been mentioned, the doctrine is now well settled that the State's right of eminent domain may be delegated to railroad corporations, and by its exercise they are enabled to acquire from private owners the lands reasonably necessary for their purposes. The charters or other statutes establish certain special proceedings through which the lands are condemned and the compensation therefor is ascertained. The law of some States provides for a commission—generally of three—appointed by the court, to determine the amount awarded to the proprietors, while that of the others leaves this function to a jury. According to the doctrine generally adopted, the compensation includes the fair market-value of the land actually taken, and also damages for the injury caused to the remaining portion (if any) of the same farm, lot, or other tract. In several of the States the estimated benefits to the land may be applied in reduction or total extinguishment of these damages, but in the others all such benefits are wholly rejected and cannot be used to reduce the award of compensation. (See EMINENT DOMAIN, in CYCLOPÆDIA.) The extent of this power is limited only by the legitimate objects contemplated in the charter. Not only may the lands of individual owners be taken, but the property of other corporations, even that which had itself been acquired by an exercise of the right of eminent domain, may in like manner be appropriated. For example, the legislature may authorize a second corporation to construct its line across the existing tracks of another company, or even to use a portion of such track for the running of its own trains. In these and all similar cases compensation is of course necessary, for there is a taking of private property. The legislature may also permit a railroad to occupy a highway without compensation to the State or to any local public authorities or municipalities; but compensation must then be made to the abutting proprietors who own the fee of the highway. The authority to acquire and hold property by negotiation and purchase depends upon the provisions of the charters or of the statutes which stand in the place of charters. No corporation possesses attributes beyond those conferred by the organic law of its creation, and this doctrine should apply with special force to railroads. Under all ordinary acts of incorporation, therefore, the property acquired must be reasonably adapted not only to the general uses and purposes of a railroad, but to those of the *particular* railroad created by the legislature. As illustrations, a railway company cannot without express authority purchase and hold lands for the mere purposes of speculation, or of carrying on manufacturing operations, trades, or any other business enterprises having no direct connection with the objects for which it was incorporated. There are, however, many instances—some of them very prominent ones—in which railroad corporations have been clothed with extraordinary powers and functions, and have therefore been enabled to hold property not necessary for their business of transportation, and even to combine several distinct industries and sources of revenue under one single management. Companies incorporated in one State have been permitted to acquire by purchase or by lease the franchises and property of other roads created perhaps by the laws of different States, and by this means to extend a trunk-line with numerous branches, all controlled by one board of directors, across the territory of several commonwealths. Other companies have purchased or leased coal-lands, and have even made the business of transportation subsidiary to that of mining. One great corporation—the Delaware

and Hudson Canal Co.—now owns or holds by perpetual lease and operates lines of railway extending from the interior of Pennsylvania across New York to Albany, and thence by several branches to the northern extremity of that State and into Vermont, a canal reaching from Honesdale in Pennsylvania to Rondout on the Hudson River, and vast tracts of coal-lands which it mines, and for the products of which its railroad lines and canal serve as the outlets. I shall not discuss the financial wisdom of such combinations, regarded merely as means for investment, nor the policy of permitting such enormous accumulations of property and powers in the hands of single corporations; these cases are mentioned simply to show the present condition of the railroad system in the U. S.

5. *Funds for the Construction of Railroads.*—The principal sources from which the funds have been obtained to construct the existing railroads of the U. S. are the following: the capital stock of the various corporations, subscribed and paid in by the shareholders; bonds issued by the companies themselves, often secured by mortgages of their franchises and property; municipal bonds, issued in aid of particular enterprises by cities, towns, and counties; farm-mortgages, given or loaned by the landed proprietors along the route of a projected road; and land-grants or donations of public lands, made to many roads situated in the Western States and Territories. At the commencement of the railroad system, and during the earlier periods of its development, the requisite funds for construction were contributed by the shareholders in the form of capital stock. After a time resort was had to borrowing upon the security of bonds and mortgages, and this practice finally became universal. In all or nearly all the Western roads, and in very many of those at the East, the cost of construction is represented by a capital stock, and by a bonded debt secured by a mortgage of the corporate franchises and property. Successive series of bonds based upon successive mortgages are often issued by the same company, and sometimes this form of indebtedness exceeds in amount the capital stock. It has been the fate of many a railroad corporation to have its capital extinguished by a foreclosure and sale, and a reorganization with the bondholders as corporators. In New York, and perhaps in other States, a species of bonds has been invented, issued by some of the roads, and sanctioned by the legislature, termed "convertible," which the holder may at his option exchange for or convert into shares of the capital stock, and by their means such capital may be augmented. Hardly any contrivance has furnished greater facilities for ruinous and fraudulent management by boards of directors. The mortgages usually include in express terms the "rolling-stock" as well as the lands of the companies; and the prevailing doctrine established by the courts regards the articles embraced in that description—locomotives, cars, and the like—as fixtures, and not as chattels, so that the ordinary railroad mortgage is held to be wholly one of real estate. The practice of aiding railroad enterprises by means of city, town, and county bonds donated or loaned to the companies has for many years been quite common in the Western States, and even at the East this vicious method has recently been adopted to a considerable extent. The evils resulting from it, however, are so great that in all the latest revisions of State constitutions prohibitions have been inserted which render any further municipal bonding impossible in those commonwealths; and it is probable that the system has been completely abandoned. Farm-mortgages executed by private owners along the contemplated lines have been resorted to in one or two Western States as a means of obtaining funds, and have invariably caused great trouble, and even distress, when the time for enforcing payment arrived. The railroad system at the West has been largely developed and built up through land-grants made by the U. S. government. The policy has been steadily pursued by Congress for a number of years of donating lands to corporations created by the States whose lines traverse the public domain. These gifts have generally embraced the alternate townships lying within a designated distance on each side of the contemplated route; and they have been made upon certain conditions, which have usually required a speedy completion of the road, and that the lands themselves should be located, surveyed, and brought into market before the expiration of a specified period. The aggregate amount of the public domain thus granted to different companies is enormous. The donations to the two corporations forming the Pacific Railway include several millions of acres, of which, however, a large part is at present worthless.

II. *The Operation of Railroads.*—Although this general division is of great practical importance, considered from a legal point of view, yet little remains to be said concerning it in the present article. The law relating to the capital stock, the subscription, transfer, and ownership of shares is sufficiently explained in STOCKS, in CYCLOPÆDIA. The rules which determine the rights, powers, duties, and responsibilities of railroads as carriers of goods, of passengers, and of baggage will be found in CARRIERS, COMMON, in CYCLOPÆDIA. In NEGLIGENCE, in CYCLOPÆDIA, are given those principles and doctrines which are the foundation of all liability for injuries done to persons and property through the carelessness or unskilfulness of servants and employés. One or two special points, however, remain to be briefly considered. Passenger tickets are sometimes issued containing a notice printed on their face that they are good only for one continuous trip, commencing on the day and on the train for which they are sold. This notice is expressed in different terms, but the gist of it is always to warn the passenger that he cannot stop at any intermediate station and then resume his journey upon the same ticket. The validity and effect of these notices upon the purchaser have been frequently discussed by the courts. The question generally arises in the following manner: A passenger having purchased such a ticket stops off for a while at an intermediate place, and resumes his journey by another train and on a subsequent day; the conductor declines to accept the offered ticket and demands the ordinary fare; payment thereof being refused, the passenger is put off the train, and thereupon brings an action for assault and battery against the conductor, or for damages against the company. It has been uniformly decided that when a person is found on a train without a valid ticket and refusing to pay the lawful fare, he is a trespasser and may be put off by the conductor and other servants, they using no more force than is reasonably necessary. Statutes have sometimes limited this right of putting off a trespasser in respect to time and place, but have never denied it. Such a suit, therefore, directly presents the question whether the notice contained on the ticket is valid and constitutes a justification for the act of the conductor. The doctrine, as now established by a great preponderance of judicial authority, may be summed up in the following propositions: Railroads, like other corporations, may make all by-laws or rules for the conduct of their business which are reasonable, and these by-laws may apply to their transactions with passengers as well as to their dealings with servants and employés; for many plain reasons a by-law requiring tickets to be used upon the trains for which they are sold is exceedingly reasonable and proper, and in fact may be necessary to the keeping of correct accounts and the preserving of any check upon conductors, while it does not impose any burden or hardship upon passengers; and, finally, the notice of such regulation placed upon the ticket is sufficient to charge the purchaser with knowledge. It is tacitly, if not expressly, conceded that without the by-law and notice the contract between the railroad and the passenger is a continuing one, and having paid the consideration the holder of the ticket is entitled to a full performance by the company; but the by-law, being reasonable, enters into and becomes part of the agreement, and cannot be violated by the passenger except at his own peril. On the same principle, a rule requiring the passengers to purchase their tickets at the offices of the company, and adding a certain amount to the ordinary fare when it is paid to a conductor, is held to be reasonable and lawful.

JOHN NORTON POMEROY.

**Rampoor',** in lat. 31° 31′ N., lon. 77° 37′ E., at an elevation of 3398 feet above the sea, is the capital of Bisser (Biss-ahir), a feudatory state in the British Himalaya which stretches on both sides of the Sutlej River, borders N. on Chinese Thibet, and has 90,000 inhabitants. The country cannot be easily approached except from the river; the valleys opening toward Thibet offer good hunting-grounds; the lower parts contain many villas belonging to Englishmen who have removed hither from Simla. The inhabitants are mostly engaged in commerce with Thibet. The religion is Brahmanism; the first caste, the Rajpoots; the language, a corrupted Hindoo. The dependency on British India dates from 1815. The town of Simla is built on ground ceded by the rajah of Bisser; his annual income amounts to £7000, the tribute to £400.

E. SCHLAGINTWEIT.

**Regela'tion** [Lat. *re* (particle inseparable), "again," and *gelatio*, "freezing"], a freezing together, after rupture, of ice-surfaces in contact, a principle much employed in theories of glacial motion. In June, 1850, Faraday brought to the notice of the members of the Royal Institution the fact that moistened surfaces of ice at 32° F. freeze together, even when the surrounding air is very warm. No such effect is observable in ice at a much lower temperature. Many experiments made subsequently by Tyndall, and also by Huxley, prove that crushed masses of ice, at or near the freezing-point, when subjected to pressure powerful enough to bring their surfaces into contact, become frozen into a solid mass of translucent ice,

assuming the form of their mould. A bar of ice passed through a series of moulds may be changed into a semiring; vast masses of glacial ice moving down their channels are forced in the same way, by the presence of enormous superincumbent masses of snow and ice which every year accumulate on the mountain-tops, into a series of moulds, the channels of the glacial stream. Rupture takes place each instant at a thousand points, a thousand new surfaces are brought into contact and freeze together; so that the mass, while conforming itself to its bed, does not become wholly disintegrated. The theory of regelation is as follows: Just as particles on the free surface of water attain their gaseous liberty sooner than those in the interior, because the molecular motion which constitutes the vapor is, at the surface, least controlled by the surrounding molecules of water, in the same way, and for the same reason, particles of ice upon the surface attain their "liberty of liquidity" first. Let two pieces of ice at 32° F., and, in consequence of the temperature, melting on their surfaces, be placed in contact. The surface particles are now virtually transferred to the interior of the mass, and the molecular motion, by virtue of which the ice has assumed a liquid state, is arrested by the controlling power of the surrounding ice-particles. The liquid, in consequence, becomes instantly frozen. The fact that ice is, in effect, plastic to pressure, but not at all so to tension, is conclusive against the viscous theory of Rendu and Forbes and the plastic theory of Agassiz. (For application of these facts to glacial motion see GLACIER, in CYCLOPÆDIA.)

S. B. HERRICK.

**Repoussé,** a French term for the art of producing reliefs, and even rounded forms, in metal by beating thin plates from behind (Ger. *das treiben;* Eng. *embossing*). The metals employed are those that by their malleability lend themselves most easily to the work—gold and silver, brass, copper, tin, and lead. This is a very ancient art: the Egyptians, Cypriotes, and Etruscans practised it, and specimens of their skill in the art are preserved. The Hebrews brought the knowledge of this "beaten work" with them from Egypt, and employed it in some of the furniture of the tabernacle, on the cherubim and the candlestick (Ex. xxv. 18, 31, 36). It may be noted that in the description of the temple and palace built by Solomon there is no mention made of "beaten work," only of casting and of overlaying—*i. e.* gilding. In the Middle Ages it was widely employed both in Europe and in the East, and it has continued in use down to our own times. Some splendid pieces of repoussé work were produced in Italy in the fifteenth century; these were chiefly for the decoration of altars and shrines and for use in the ceremonies of the Church. The art was in a flourishing state in Europe in the seventeenth and eighteenth centuries, but the design was artistically inferior to that of an earlier time. The aim was rather magnificence than art. In the best times repoussé ornament was rarely used alone: it was combined with chasing, niello-work, or enamel. Until lately the art had fallen into disuse, but it has shared in the general revival of the arts, and is now much in fashion. In Italy, France, England, and America much repoussé work is now produced, and, so far as mechanical excellence is concerned, American smiths are not behind the rest of the world. The vase made by Tiffany & Co. of New York to commemorate the eightieth birthday of the poet William Cullen Bryant is an extraordinary exhibition of mechanical skill in repoussé. The results produced by this process are superficially similar to those attained by casting, but the effects are more artistic and free, and in the best work, whether of semi-barbarous or of civilized peoples, there is more individuality expressed than any casting could give. In the old repoussé work, the coarse as well as the fine, the relief is distinguished by softness of outline and the design has a look of spontaneity. The workman has used his tools as if they were the pencils of a painter or the dab-sticks of a modeller in clay. In the Castellani collection of antique jewelry exhibited at Philadelphia in 1876 were specimens of Etruscan repoussé work which, though small in size and minute in execution, had all the largeness of antique sculpture. These were extraordinary pieces, but much of the Japanese, Indian, Arabic, Persian, and Moorish work of modern times has the same quality, though more rudely manifested. The repoussé work of modern French, English, and American smiths is chiefly applied to gold and silver, and is distinguished by great sharpness and decision of line, so that the work is scarcely to be told from casting. Here the spirit of our age has triumphed, as in other fields, and we see an art with qualities and characteristics of its own striving to emulate another and different procedure. Repoussé work is a process by itself, and the application of it is limited, or ought to be, to work which it alone can do. The modern smiths have produced some specimens of repoussé that are remarkable as exhibitions of mechanical skill, but in honesty less must be said of their artistic excellence. Less mechanics, however, and more art, is the widespread want among us; and therefore it is not surprising that it should make itself felt here as everywhere else. The true art of the *repoussoir* is as little mechanical in its methods or in its aims as can be conceived of any art, and the nearer it can be kept to the simplicity of its origin and to the practice of the ancient craftsmen, the more satisfactory will be the result. Here, as in works reckoned higher—in a painting or a statue—we want to see the human hand the direct minister of the mind. A piece of true repoussé work ought neither to demand in the making nor to suggest to the spectator more aid from machinery than does an Indian shawl, a piece of old Italian lace, or the air-drawn fancy of a goblet of Venice glass.

CLARENCE COOK.

**Reproduction in Animals,** a term used to designate the phenomena observable in the numerical development of animals from pre-existing ones, and the immediate antecedents and sequels thereof. Reproduction may be the result either of the concurrence of two dissimilar elements (the male or female sexes) or of outgrowths from or division of an already developed body. In the lowest forms of animal life (*e. g. Monera*, etc.), where there is no true organization, and where, of course, sexes are undistinguishable, under certain conditions two individuals come together and combine into a single one, which assumes a subglobular form, becomes segmented, and finally gives origin to a number of new and independent beings. In all the regularly-organized forms (*i. e.* those in which various organs are differentiated) there is a development of sexes, which may be either combined in one individual or separated among two. The germs, or female elements, are specialized as eggs —the sperms, or male, as spermatozoa. The conjunction of the two, resulting in the fertilization of the eggs by the spermatozoa, is necessary for the growth and development of the embryo. The egg is a spheroidal body whose essential constituent is the vitellus or yolk, and in the central portion of this is generally a distinct cell known as the germinative vesicle, or vesicle of Purkinje.* This is either transparent or contains spots, one or more in number, designated germinal dots; the vitellus is enclosed in an envelope of various consistency called the vitelline membrane. The albumen, so prominent in birds' eggs, in which it forms the "white," is a subordinate and superadded element, and is wanting in some types. The male elements consist of a liquor (the seminal liquor), in which are innumerable filiform or worm-like corpuscules, generally inflated at one end and attenuated at the other, and which move about with great rapidity in the liquor; these are the so-called spermatozoa (for which see STERILITY).

When the eggs have been fecundated by the conjunction or penetration into their substance of the spermatozoa, a course of development commences which finally results in the production of an organism like the parent; but this development may be either consecutive and gradual, as in mammals, birds, etc., or distributed into several stages of more or less persistency. In the latter case the adult form may be ultimately either (1) evolved by a modification of all the parts of the preceding state, as in amphibians, insects, etc.; or (2) developed by a peculiar growth, analogous to birth (exhibiting thus the phenomena of "alternation of generations"), as in most acalephs, etc. The future course of the egg is various. In the lowest forms frequently an amœbiform body is a first result—*i. e.* a creature like a mass of jelly, but with an interior vesicle; in the higher, the egg becomes segmented, and successively divided and subdivided into "blastomeres" or cells, and forms a mulberry-like mass (hence called *morula*). Often these cells become differentiated into two kinds, of which a few retain their spheroidal form, but most become elongate and prismatic, and furnished each with a cilium, thus resembling the planula of an acaleph (and hence receiving the name as indicative of the stage). Generally, the cells become differentiated into the roundish ones and the prismatic ones, and an involution of the mass takes place by which a cavity is formed, the inner roundish cells remaining unfurnished and forming an endoderm, and the outer prismatic ones becoming ciliated and forming an ectoderm: this stage has been named *gastrula*, and is by some supposed to recall the ancestral condition of most or all of the higher animals. The terms thus indicated—*amœba*, *morula*, and *gastrula*—are employed for the brief characterization of the correspondent stages through which the embryos of different types manifesting them pass. The notices of the various phases of reproduction in the several classes of the animal kingdom must necessarily be very brief and general.

Some late systematic writers (*e. g.* Haeckel and Huxley)

*The germinative vesicle and germinal dots have not been detected in Tubularia, etc.

divide the animal kingdom into two primary divisions, distinguished (1) by the homogeneity of the mass, or (2) by its differentiation into cells or organs and tissues, (1) the former being called Protozoa and (2) the latter Metazoa. These divisions are based upon, or at least supported by, considerations derived from the observation of the generative system and embryology.

In the Protozoa much remains to be learned concerning the details of sexual reproduction. In the Infusoria, according to Gegenbaur, sexual reproduction is manifested, "in which the nucleus as well as the nucleolus, a smaller body situated by the side of the first, takes part in the economy. The nucleus is a solid body, of very variable form, sometimes encircled with an exterior envelope. It is situated in the cortical substance of the body, or, if it is lodged more deeply in its mass, it is still surrounded by an expansion of this substance. It is oval or round, or has the form of a sinuous ribbon or that of a cane provided with regular constrictions. The nucleolus appears to differ from the nucleus only by its size, which is less; nevertheless, its substance appears, in the course of differentiations, to have another functional value. The act of reproduction is, as a rule, preceded by a complete or partial fusion of two individuals, a conjugation which gives the impulse to the transformations of different parts. The nucleus becomes the seat of a segmentation which gives origin to distinct spheres. They, reuniting anew, produce a body which, by a new segmentation, develops so-called 'embryonal spheres,' in the interior of which is formed a new individual. The nucleolus also undergoes modifications in consequence of conjugation: it increases in size, and develops in its interior elements of a thread-like form which are comparable with the seminal elements of the higher animals. It seems to be the male element, the nucleus representing the female organ. It is, however, impossible at present to compare specially the parts which are developed from this last with the female products of other animals, because data respecting the sexual conditions of the Infusoria are still very far from being sufficient to permit us to arrive at a satisfactory conclusion."

The Metazoa all propagate by means of ova; the ovum in every case undergoes segmentation into "blastomeres," and assumes the *morula* stage, already described; the morula next becomes invaginated or pervious, and converted into a *gastrula* in all except certain intestinal worms (Acanthocephala and Cestoidea). The subsequent development varies according to the type. The morulæ and gastrulæ also differ in details of structure and development. There is always, however, a differentiation of the blastomeres or cells into two sets or membranes, one forming the walls of the alimentary cell, and called by Haeckel the endoderm or gastral lamella, and the other limiting the exterior, and known as the ectoderm or dermal lamella.

The sponges, formerly regarded as Protozoa, are true Metazoa in the sense indicated. The eggs and sperm-cells are irregularly developed among the cells of the inner walls of the mature sponge, and combined in the same individual: they are, in fact, developed from endodermal cells. After fecundation the eggs undergo development into, first, the morula state, and finally the gastrula state: the walls of the gastrula subsequently become perforated, and inhalent ostioles and canals are the result, while the primitive aperture and canal are converted into an exhalent aperture. Thus it assumes its sponge-like characteristics. (See also SPONGES.)

In the development of numerous mouths and convergent canals the sponges differ from all other types, and have been consequently isolated as representatives of one of two primary divisions of the Metazoa, which has been named Polystomata. In all the other forms only one oral aperture is developed, which may be either identical with the aperture of the gastrula, or a subsequent development or perforation of the body-wall. These forms, characterized by the single oral aperture, have been designated Monostomata.

In the acalephs the sexes are differentiated in distinct individuals. The sexual products are variously placed, according to the type to which the species belong, but generally arranged coincidently with the rays. (See HYDROIDA, etc., in CYCLOPÆDIA.)

In the polyps the sexes are also distinct, and closely correspondent in form and superficial appearance. The eggs as well as sperm-cells are developed in leaflets attached to the radiating partitions between the outer wall and stomach of the animal, and are discharged through the intestinal canal and mouth.

In the echinoderms the sexes are in distinct individuals in most forms, but united in the same in the Synaptæ. The two genital products are alike superficially, but distinguishable at maturity by color and general appearance, as well as, of course, by microscopical characters. They are arranged in masses in a radiated manner, corresponding with the external form, and chiefly between the rays in one or two masses between approximated rays. There are no specialized intromittent or other organs, the eggs being fertilized by the semen through the medium of the water, and yet certain species are viviparous.

In the forms thus referred to the organs of generation are reduced to their simplest elements. In the lower worms are the first indications of complexity by specialization and combination in distinct sacs of the eggs and spermatozoa, and the development of deferent canals. These organs differ greatly in detail in the several groups, but the enforced limits of this article forbid a specification of such modifications. It can only be stated that the development of the sexes in the same or distinct individuals is, in at least some of the orders, of very little systematic significance, and closely-related forms may be different in this respect, some being diœcious and others monœcious or hermaphrodite. Thus, the turbellarians, trematods, cestods, chætognaths, and chætopods are all, so far as known, monœcious; the leeches are mostly so, but a few are diœcious; the few known gephyreans and acanthocephali are diœcious; so are most of the nematoids and polychæta, but some of each order are hermaphrodite. (See WORMS.)

The arthropods (crustaceans, arachnids, insects) for the most part exhibit a further degree of complexity in the structure of the organs of generation. The sexes, too, are almost always distinct, although in some (*e. g.* most cirripeds and tardigrades) they are combined in a single individual. In most of the cirripeds they are, as just indicated, united in one and the same individual; in others of the cirripeds (*e. g. Ibla*, *Scalpellum*, *Alcippe*, and *Cryptophialus*) they are in distinct individuals, but singularly disproportioned. The males are entirely unlike the females, often exceedingly minute and destitute of mouth and stomach, and live (sometimes as many as fourteen at a time) on a single female; "they may, in fact, be said to exist as mere bags of spermatozoa," says Darwin, who first made known the remarkable features of the sexual economy of these animals. In some of the spiders, too, there is a great dissimilarity in size at least between the sexes. As for the sexual organs, they vary much, and are to a considerable degree characteristic of the several types—classes, subclasses, or orders—of the different animals. They are either simple or in pairs. The females have a sort of uterus, resulting from an enlargement of the canal for the outlet of the eggs, and in this the eggs undergo further development and receive their coverings or shells; the males have deferent canals as reservoirs of the sperm, and intromittent organs, which, however, vary in position, in extent, and in complexity.

The true mollusks also vary greatly in their generative organs, as well as in the combination or separation of the sexes in different individuals. The conchifers exhibit the organs in their simplest condition, and they are incapable of copulation, the males being destitute of anything like intromittent organs. The gasteropods and cephalopods have the organs much complicated, and impregnation is effected by copulation of the sexes (although the males are often destitute of special intromittent organs), and even when hermaphrodite, different individuals conjoin and mutually impregnate each other. In the gasteropods generally the male as well as female organs are situated on one side (usually the right), well forward, and often at the base of the tentacle, and sometimes (*e. g.* Viviparidæ) the intromittent organ is adnate with the tentacle itself; sometimes, however (*e. g.* heteropods), it is near the anal orifice, and exceptionally (in Polyplacophora) there are two deferent canals, discharging at the respective sides far backward. The cephalopods have, of all the mollusks, the most complicated organs. They are much alike in both of the sexes, and the testes as well as ovary are enclosed within sac-like envelopes. The most notable feature in the economy is, in certain dibranchiates, specialization and separation, elsewhere unparalleled, of one of the members of the male, which becomes a spermatophore and wanders forth to be attached to a female. It is one of the arms (sometimes one, sometimes another) that becomes thus specialized: this originally is enclosed within a sac, which it at length ruptures, and being then filled with spermatozoa, it becomes liberated from the body and assumes the functions for the time being of an independent organism. It was at first supposed to be a parasitic worm, and described under the name of *Hectocotylus*, and this has been retained to designate the modified organ.

The relations of the sexes are of various systematic value in the mollusks. In the conchifers some types are monœcious or hermaphrodite, and some diœcious. In the gasteropods the systematic value of the character is greater, hermaphroditism and bisexuality being co-ordinate with morphological characters. Thus, of the typical gasteropods as a whole, the inferior orders are hermaphrodite, the

superior bisexual; yet the Valvatidæ are distinguished among their diœcious relatives by a monœcious generative apparatus. In the cephalopods all the species have the sexes developed in distinct individuals.

In the vertebrates, although there is a wide range of variation, there is traceable a more graduated homological resemblance than in the other primary groups of the animal kingdom. In all the types the sexes are normally differentiated in distinct individuals, although some high fishes (species of Serraninæ and Lutjaninæ) are hermaphrodite. In the lower types the ovaries and male organs are sac-like envelopes containing in one case eggs and in the other sperm. In the leptocardians (*Amphioxus*) the eggs are discharged through the mouth; in all the other forms, through an aperture near the end of the abdominal cavity. In some fishes the eggs are discharged at first in the abdominal cavity, and thence through an aperture into the water, but in most they are carried by a special duct outward. Most fishes are destitute of organs of copulation, and the eggs of the female are impregnated by the sperm of the male discharged over them in the water; but some fishes are viviparous, and intromittent organs developed which vary in type in the several families they characterize. The selachians are quite peculiar in their economy. In the higher vertebrates with the ovaries are connected ducts developed from certain embryonic structures (the so-called Müllerian ducts), known as the Fallopian tubes. Through these the eggs are discharged; the ducts remain separate in all the types except the monodelphous mammals; in these they unite behind, and a single vagina is the result, with which a double uterus in the lower forms, and a single one in the higher forms, communicates. The male organs are highly specialized, and are developed to a large extent *pari passu* with the female. Thus, the ovaries are homologically represented by the testes, the penis by the clitoris, the uterus by the rudimentary uterus masculinum, etc. Such is a brief and imperfect résumé of a few facts respecting the organs of reproduction and their relations. (For further details other articles and works must be consulted.)

Asexual Reproduction.—The higher forms of animal life are reproduced solely in course of generation, but in many of the lower forms reproduction is effected by peculiar processes—*i. e.* either (1) by the subdivision of a given organism into distinct entities (scissiparity or fissiparity), or (2) by an outgrowth of buds from the surface of an organism, and the subsequent development thereof into animals similar to the primitive form, which may either remain connected with it, or become liberated and assume an entirely independent existence.

Fissiparity is manifested by many of the lower forms of animals. The polyps, acalephs, at least in certain stages, and many worms, exhibit this phenomenon. The unlimited power of multiplication of *Hydra* in this manner is well known. The medusiform acalephs in their strobiliform stage thus increase. Certain worms also increase in this manner, a strangulation taking place at certain intervals, head and eyes developing, and finally independent worms resulting.

Gemmiparity is also of common occurrence in the inferior animals, and is the mode of increase and development of the colonies of coral animals, hydroid acalephs, polyzoans, tunicates, etc. (More details may be found by reference to the articles on these groups.)

Reproduction by other means than generation is very limited in the higher animals, and becomes less and less so as a whole in ratio to the specialization and high organization of the type. In vertebrates it is manifested to a very slight extent. In some fishes the tail may, at least in part, be reproduced. In amphibians, as salamanders or newts, the members, with their bones, muscles, blood-vessels, and nerves, have been reproduced after destruction. It is well known that lizards often reproduce their tails after they have been lost. In mammals, however, the power of reproduction is only manifested to the extent of repairing wounds to a limited extent.

The bibliography of this subject is very extensive. The student may consult with most profit Carpenter's *Principles of Comparative Physiology* (various editions); Duvernoy's *Fragments sur les Organes de Génération de divers Animaux* (1850); H. Milne-Edwards's *Leçons sur la Physiologie et l'Anatomie comparée de l'Homme et des Animaux*, t. viii. (1863), ix. (1870); and Gegenbaur's *Manuel d'Anatomie comparée*. (See also the articles Egg, Embryology, Hydroida, and Individuality, in Cyclopædia, and Sterility.)

Theodore Gill.

**Rhinophrynidæ.** See Toad, in Cyclopædia.

**Ring, Tammany.** See Tweed (W. M.), in Cyclopædia.

**Rio Grande College,** situated at Rio Grande, Gallia co., O., was founded by the bequests of ground and funds for the erection of buildings by Mr. and Mrs. Atwood, and comprises a classical course of four years and a scientific course of four years, conferring the degrees of A. B. and B. S. It also gives preparatory instruction and instruction in the ordinary English and commercial branches. Its main building, a three-story edifice of brick, was dedicated Aug. 30, 1876, and Sept. 13 of the same year the first term was opened under the presidency of Ransom Dunn, D. D. A second building for dormitory and study-rooms has since been erected. According to the articles of incorporation, two-thirds of its board of trustees shall be members of the Free-will Baptist denomination.

**Rob'erts** (Oran M.), a native of South Carolina; educated in Alabama; settled in 1841 in the practice of law in San Augustine, in the republic of Texas; was appointed district attorney in 1844, and district judge in 1846. In 1857 he was elected to the supreme bench as associate justice, which he held till the civil war began in 1861. He was then elected president of the convention of secession, and commanded a regiment in the Confederate army 1862–64, when he was recalled from the field to assume the chair of chief-justice of the supreme court. In 1866 he was elected to the U. S. Senate, but denied his seat, in common with all Senators from the South.

C. G. Forshey.

**Rob'inson** (Lucius), b. at Windham, Greene co., N. Y., Nov. 4, 1810; educated at the Delaware Academy, Delhi; studied law, and was admitted to the bar in 1832; appointed master in chancery in 1843, and reappointed in 1845; joined the Republican party on its formation; elected to the legislature in 1859, and appointed comptroller of the State in 1861, and again 1863; accepted in 1865 the Democratic nomination to the same position, but was defeated: served as a member of the constitutional commission 1871–72; was elected comptroller of the State on the Democratic ticket in 1875, and governor in 1876.

**Roden'tia** [Lat. *rodere*, to "gnaw"], or **Gli'res** (plural of *glis*, a kind of gnawing animal), an order of mammals of the sub-class Monodelphia or Placentalia, comprising the gnawing animals, such as the rats, mice, squirrels, rabbits, etc. These may be briefly defined as ineducabilian placentiferous mammals, with the incisors in pairs in the upper and lower jaws, rootless and ever-growing, and in their growth describing the segment of a circle or open spiral. In more detail they are distinguished, on comparison with one or other of the related orders, by the following characters: The skull has the facial or rostral portion quite produced and enlarged; the pteriotic and tympanic elements are ankylosed with each other, and together form a unit separable from the contiguous bones; the temporal and orbital fossæ are confluent into each other; the lachrymal foramen opens within the orbits; the teeth are diphyodont, and are limited to molars and incisors; the molars have tuberculated or flattish crowns, and are especially adapted for attrition of food; the series is composed chiefly of the true molars, the premolars sometimes being absent, though generally developed in small number; the incisors are long, and continuously reproduced and shoved outward from their bases; in the typical species they are covered with enamel on their outer faces, but not on the inner ones, and hence the latter are soft; a trenchant anterior edge is the result, produced by the unequal wearing away of the teeth; the canines are entirely absent, and a wide interval exists between the incisors and the molars; the members are completely developed, and their proximal joints are mostly confined within the common integument; the feet are well developed, and provided with callous pads on the soles; the digits are generally four or five in number; the claws moderately curved, and generally of the unguiform type, but sometimes almost hoof-like; the scapula is narrow, and has a deep notch, a small coracoid, and a more or less divided acromion; the clavicles are diversiform, sometimes being completely developed and at others rudimentary; the scaphoid and lunar bones generally coalesce, but sometimes are separate; the tibia and fibula are either distinct or ankylosed toward their distal extremities; the intestinal canal is long; the cæcum generally large, sometimes, however, rudimentary; the placenta is deciduate and of the discoidal type. The order thus defined is the most numerous in species of the class of mammals, and between 800 and 900 species are known. Two well-defined sub-orders are recognizable: (1) the Simplicidentati, and (2) the Duplicidentati. The Simplicidentati have the incisors strictly limited to two in each jaw, and the enamel is entirely confined to their anterior faces; the skull has a true alisphenoid, as well as an external alisphenoid, canal; the bony palate is well developed; the fibula never articulates with the calcaneum; the testes are abdominal, but descend periodically. To this sub-order belong nineteen families—viz. (1) Lophiomyidæ, (2) Pedetidæ, (3) Dipodidæ, (4) Merionididæ, (5) Muridæ, (6) Myoxidæ, (7) Saccomyidæ, (8) Geomyidæ, (9) Castor-

idæ, (10) Sciuridæ, (11) Anomaluridæ, (12) Haploodontidæ, (13) Spalacopodidæ, (14) Hystricidæ, (15) Dasyproctidæ, (16) Caviidæ, (17) Hydrochœridæ, (18) Chinchillidæ, and (19) Dinomyidæ. Of these, the first to sixth represent the super-family Myoidea; the seventh and eighth, the super-family Saccomyoidea; the ninth, the super-family Castoroidea; the tenth and eleventh, the super-family Sciuroidea; the twelfth, the super-family Haploodontoidea; and the thirteenth to nineteenth, the super-family Hystricoidea. The Duplicidentati are distinguished by the presence of four incisors above, but two below; the external incisors are, however, very small, and situated behind the principal ones; in early life even six incisors are present in the upper jaw; the enamel is developed behind as well as in front, although behind it is in a very thin layer; the skull has no true alisphenoid canal; the bony palate is represented by a simple bridge between the alveolæ; the fibula articulates distally with the calcaneum; the testes are external. Of this sub-order two families are known—viz. (1) Lagomyidæ and (2) Leporidæ. These are the only groups represented by species now living. A third and apparently distinct sub-order has, however, been established by Mr. Alston for an extinct type. This sub-order has been named Hebetidentati; the incisors were two in the upper and four in the lower jaw; the supernumerary pair in the lower jaw were very small, and placed rather behind the principal ones; the enamel was continuous around the teeth, and their crowns were transversely hollowed and had a chiselled edge; the fibula articulated with the calcaneum. But one family has been distinguished—viz. Mesotheriidæ, represented by a species whose remains have been found in the Pliocene of South America. Several peculiar families have been also constituted for the reception of typical forms of simplicidentate rodents now extinct. (See also the names of the different families.) THEODORE GILL.

**Romantic School, The,** was at first simply the name of a peculiar movement in German literature, but as this movement spread to other countries and over other fields, revolutionizing the fine arts, forming new issues in history, philology, and philosophy, and influencing even theology, the name assumed a broader signification, and was applied to a general tendency in modern civilization. A cause, however, capable of such an expansion in its effects must itself be the product of large general powers which met in this point and took life; and the romantic school, although it originated simply as an opposition to the reigning pseudo-classical taste in literature, was indeed the result of many, much more comprehensive spiritual agencies which gathered in the genius of Goethe, and were organized there into a form fit for action. The first author who set forth a romantic view of life with any degree of consistency and decisiveness, though still in a somewhat dreamy and flickering condition, was Rousseau (1712–78). But with him romanticism is a moral rather than a literary opposition. It is the revolt of a passionate nature against a false spirit, the protest of sentimentalism against rationalism. Rousseau felt that in spite of all its proud conquests, real and imaginary, the philosophy of the eighteenth century was a huge lie, which brutalized and depraved mankind; but his longings remained vague and his despair grew sickly. His opposition ended in an inarticulate cry. His *Confessions* make the reader smile and shudder; they remind him of the lunatic asylum; they are unfit for action. In Germany, Rousseau found two disciples, Lavater (1741–1801) and Pestalozzi (1746–1826), far inferior to him in genius, but purer and stronger characters, and thereby enabled to connect his views with real issues in practical life. Lavater's religious mysticism turned into fanaticism, and passed by with but small effect, but his *Physiognomical Fragments* are a powerful conception, the result of much love and true enthusiasm, and they exercised a widespread influence in modern life. It is only necessary to compare the love-poems from any European literature of the nineteenth century with those of the Latin literature from the period of Augustus, and it is at once apparent that a thousand lines and movements of the human body, which to the ancient poet were nothing but forms of abstract beauty or incitements to sensual pleasure, have become so many spiritual revelations to the eyes of the modern man. This, with the myriads of small but omnipresent consequences involved in it, is due to Lavater. Still more palpable was the influence of Pestalozzi's attempts at finding the true educational method; a new idea of human destiny loomed up amidst his new ideas of human nature. Both these men were from Switzerland; an influence as powerful and tending the same way came at the same time from Northern Germany, from Kant (1724–1804). It must be confessed that there was nothing romantic either in Kant's personal life or in the æsthetic impression of his reasoning. Personally, he was a pedant, and in literary respects he is as stiff as the philosophers of the mathematical method whom he superseded. Nevertheless, no Kant, no romantic school. His opposition was not directed against rationalism, but against dogmatism. By showing that nothing can enter the human consciousness unless representing itself under certain forms or categories of time and space, quality and quantity, etc., which have nothing to do with the thing itself, he crushed a mountain of prejudices and made a reconstruction of all science necessary; and by showing that the only certainty man can find by himself are those postulates which he finds inherent in his own nature, of the existence of God, the immortality of the soul, and the necessity of duty, he laid an emphasis on moral freedom and responsibility which became an emancipation of the human personality. A moral enthusiasm burst upon Germany, and the connection between this movement and the romantic school became very apparent when Kant's nearest disciple, Fichte (1762–1814), gave that singular demonstration of the relations between the Ego and the non-Ego of which the romantic school afterward made so surprising an application. Meanwhile, a multitude of minor movements brought this whole commotion to concentrate itself on the field of literature. By his wonderful illustrations of classical art, its history, its artistic methods, its æsthetic aims, etc., Winckelmann (1717–68) had already earlier thrown a peculiar light on the pseudo-classical reproduction which was the pride of the French nation and the rule in all European literatures; and now came Lessing (1729–81), and attacked this very same ideal in a most unceremonious manner from another side. He showed that it often stood in direct opposition to human nature, being nothing but a conglomerate of conventionalities, and simply ridiculous in the moment these conventionalities lost their prestige; Shakspeare served him as evidence. At the same time Herder (1744–1803) demonstrated theoretically and practically, and with the happiest applications, that nationality is a necessary element in all that is truly great in literature and art; while Klopstock (1724–1803), with a peculiar excitement which nevertheless caught the heart, called his countrymen back from all worship of the foreign and bade them stay with their own. Under these influences Goethe wrote in 1773 *Götz von Berlichingen*, the foundation-stone of the romantic school.

The principle of the old pseudo-classical school was *beauty;* that of the new romantic was *life*. The classicist represented the ideas *metaphysically*, and he seldom reached beyond a logical explication which might or might not strike the understanding with its pointed antitheses; the romanticist represented the ideas *lyrically*, as they ring in the raptures or agonies of the human heart, and by thus appealing directly to the sentiment he gave them a force which hitherto they had had only in religion. The classicist represented the passions *plastically*, as fixed systems of reflections, and his highest creation was a statue of ambition, love, jealousy, honor, etc.; the romanticist represented the passions *picturesquely*, as they may burn in an individual character belonging to a certain age, race, stage of life, etc., and by thus painting a broad picture of infinite suggestiveness he gave them a presence which hitherto men had experienced only in actual life. The new principle commanded an enormous wealth of new impressions; and it was only natural to apply this magic wand also on other fields. In architecture the Greek temple was considered the absolute norm, and the Gothic cathedral was looked upon as a wild eccentricity of a barbaric taste; but only a few years elapsed before it was generally felt that Gothic architecture contains some of the most powerful and most delicate forms which the human imagination has ever produced. In painting the enthusiasm engendered by the French revolution for the ancient republics, and the marvellous energy and fertility of David (1748–1825), had made the representation of the heroic in its sublime but distant magnificence the acme of the art; and when Géricault (1790–1824) painted *The Wreck of the Medusa*, people were startled; but soon followed Ary Scheffer (1795–1863), Horace Vernet (1798–1863), Delaroche (1797–1856), and others. In music the brilliant but abstract Italian melody still held the sway, in spite of Gluck and Mozart, and only the more refined minds felt that it was vague and without character, though not without passion; but when Weber (1786–1826) and Boieldieu (1775–1835) made the popular song the basis of their operas, everybody understood them, and Auber (1782–1871) actually ransacked the whole of Europe from Naples to Drontheim to find characters for his compositions. Still more surprising were the results which the new principle produced in science. Languages ceased to be considered as systems of signs, and were studied as productions of nature; history ceased to be narrated as a game of bodily force, shrewd tricks, and chance, and was depicted as an evolution of life; Nature herself ceased to be studied as a mechanical workshop, and her

philosophy became in the hands of Schelling a kind of psychology.

Nevertheless, in the midst of all these splendors an internal decay very soon became visible, and the decline was owing to the principle itself. The partiality which the romantic school showed for the Middle Ages has often been set forth as one of its most essential characteristics and as the principal reason of its rapid decay. But this is a mistake. *Life* was the principle of the school, but of the whole history of mankind the Middle Ages was that period which presented the most powerful forms, the most brilliant colors of life. Hence the predilection of the school for this period. It was not inborn with it, but simply a consequence of its principle, which becomes evident by a study of the different literatures. In England, whose mediæval history is very rich and interesting, the romantic school, after a quiet transition of nature-worship, represented by the poets of the Lake school, especially by Wordsworth (1770–1850), naturally settled down with Walter Scott (1771–1832) in an enthusiastic representation of the Middle Ages. But in the Scandinavian countries, whose mediæval history presents a picture only of decay and stagnation, Ohlenslæger in Denmark (1779–1850) and Geijer (1783–1847) and Tegnér (1782–1846) in Sweden did not draw their materials from the Middle Ages, but from a somewhat earlier period, when the spirit of the *Vikinger* had not yet died out, but either struggled against Christianity or entered into its service. And in France, where actual life was so noisy that it could not well be overheard, mirrorings of the time being are visible not only with the precursors of the romantic school, Madame de Staël-Holstein (1766–1817) and Chateaubriand (1769–1848), but still more with its master, Victor Hugo (1802). Just in the same manner the decay of the school was a simple consequence of its artistic principle. *Life* is not the highest principle of art; the highest principle is *truth*. Whenever *life*—that is, life-like representation of the phenomenon—is set up as the highest goal of art, as its principal aim, art is apt to swerve into particularism, to mistake that which strikes by its extraordinary peculiarity for that which is truly living, to exhaust itself on singularities and fill its galleries with curiosities; just as in actual life a one-sided emphasis on the rights of the individual leads men to mistake anarchy for liberty, and dissolves society into chaos. In Germany the romantic school fell very soon into this mistake (see HOFFMANN (ERNST), MÜLLNER, GRILLPARZER, etc.), and the life-likeness which it opposed to the lifeless beauty of the classical school was a revolting hideousness. The question then arose, What is it which in actual life secures general freedom by restricting individual liberty? or what is it which in artistic representation secures beauty to the whole by restricting the impressiveness of the parts? It is of course *truth*. But what is truth? The romantic school attempted a double answer, but failed in them both. In Germany the romanticists (see A. W. and F. SCHLEGEL) said, Truth is only a symbol, and the highest symbols mankind possesses are the Roman Catholic Church and the absolute monarchy. Hence followed political reaction, conversion to Romanism, extravagancies, eccentricities, insanity, and suicide. In England the romanticists said, There is no truth outside of the individual; take away all those abstract generalities which enslave the individuality, and the unbound Prometheus will show himself the truth. The result was disgust at life, despair at all; and although Byron (1788–1824) and Shelley (1792–1822) found disciples among the Jews and among the Slavic nationalities, this branch of the romantic school has now also withered. CLEMENS PETERSEN.

**Rose** (ERNESTINE LOUISE LASMOND POTOWSKY), b. in Peterkoff, Poland, Jan. 18, 1810, of Jewish parents; abandoned early the Jewish creed; visited England in 1829; became a disciple of Robert Dale Owen, and was married to William E. Rose. In 1836 she came to New York, and circulated the first petition for the property rights of married women, as there was a bill pending in the New York legislature, introduced by Judge Hurtell in 1837. She lectured in all the chief cities North and South; was a delegate from the National Woman Suffrage Association to the Woman's Industrial Congress, held in Berlin Nov. 9, 1869, and subsequently attended all the woman's right conventions, and frequently addressed legislative assemblies. Of late years she has spent most of her time in France and England, speaking on many public occasions on religious topics, temperance, and the enfranchisement of woman.

SUSAN B. ANTHONY.

**Rougemont', de** (FRÉDÉRIC CONSTANT), b. in the canton of Neufchâtel, Switzerland, July 28, 1808, by his mother a descendant of J. F. d'Osterwald, the translator of the Bible into the French language; educated at Neufchâtel, Berne, and the universities of Göttingen and Berlin; studied law under Savigny, theology under Neander and Schleiermacher, philosophy under Hegel, comparative geography under Karl Ritter; on his return to his own country from extensive travels he soon began a series of publications in the French language on a great variety of topics, which exhibit an extraordinary erudition as well as a deep philosophical and wonderfully acute mind. His principal works are—a *Geography and Statistics, or an Essay on the Geography of Man* (2 vols., 1837), which began in Switzerland the reform of geographical teaching according to Ritter's method; *Description of the Holy Land* (1837); *History of the Earth according to the Bible and Geology* (1856); *The Primeval People, or Essay of Comparative Mythology and Key to the Symbolic Language* (3 vols., 1857); *The Age of Bronze, or the Shemites in Occident* (1866); *The Two Cities, or Philosophy of History in the Various Periods of Mankind* (2 vols., 1874), reviewing all the systems of philosophy of history published both in Europe and America, etc. D. Apr. 3, 1876. Rougemont was a man of profound religious convictions, and wrote several works which place him in the first rank among the apologists for evangelical Christianity: *A Commentary on the Minor Prophets* (1841), *Explanation of the Book of Ecclesiastes* (1844), *Christ and His Witnesses, or Letters on Revelation and Inspiration* (2 vols., 1856), *A History of Astronomy in its Relation to Religion* (1865), *Revelation of St. John explained by the Scriptures, and explaining History* (1866), *Human Life with or without Faith* (1869), *A Mystery of the Passion and Theory of Revelations* (1876). Most of these works have been translated into several languages of Europe. Rougemont was no less powerful as a political writer against the all-invading radicalism now prevailing in Switzerland. At the time of his death he was writing what he considered the work of his life—*The Two Cities*, of which the two volumes published were but the prolegomena. A. GUYOT.

**Ruth'erfurd** (LEWIS MORRIS), b. Nov. 25, 1816, at Morrisania, N. Y.; graduated in 1834 at Williams College; studied law with W. H. Seward; admitted to the bar 1837; entered into partnership with Hamilton Fish; visited Europe 1849–52; has devoted his leisure hours to science, and is one of the original corporators named in the act of Congress passed in 1863, creating the National Academy of Sciences. For the last twenty-five years he has been engaged in making original investigations, particularly in connection with the subject of astronomical photography, of which he may properly be considered the father. The following are a few of the papers published by him: In July, 1862, a short article on the companion to Sirius, which had then just been discovered; measurements are given; in May, 1863, a series of observations upon the fixed lines exhibited by the moon, also on the lines and bands of Jupiter and Mars; maps of the spectra of seventeen of the fixed stars are given; in the same year, a second article on the companion to Sirius, also observations on the stellar spectra and on the spectroscope, which at that time was a new instrument; also remarks on the two Ds, between which he observed seven lines. In the same year he published criticisms on different forms of the stellar spectroscopes which had been used by Secchi, Airy, and Donati; in 1865 gave an automatic form of a six-prism spectroscope, which still continues the best in use. In the same year he published an article on astronomical photography, and described the method by which he had succeeded in constructing an achromatic telescopic objective eleven and a quarter inches in aperture, and corrected for the photographic rays; this was the first successful attempt to produce a lens of this kind; in 1872 an article on the stability of the collodion film, in which he proved by measurements that the film underwent no alterations, such as would vitiate it as a record for astronomical observations; in Aug., 1876, an account of a glass circle for the measurement of angles, accompanied by a series of observations which proved that in the instrument as constructed by him the probable error of any single reading was considerably less than one-half a second of arc. In 1870 he perfected a small dividing-engine, by which he was able to rule diffraction-gratings on glass (see RULING-MACHINE, in CYCLOPÆDIA) surpassing those of Nobert. Some of these plates furnished larger spectra than spectroscopes with nine prisms. They are now used as the most efficient means in possession of the astronomer for the study of the spectra of celestial objects. He has also devised and constructed a very admirable micrometer for measuring the photographs taken with the telescope. (See MICROMETER, in CYCLOPÆDIA.)

**Ry'an** (JOHN GEORGE), brother of Gen. W. A. C. Ryan, "the martyr of the Virginius," b. at Toronto, Canada, June 18, 1841; educated to the law; colonel in the Confederate army during the civil war, and many times wounded. In 1865, having been arrested in Memphis, Tenn., by mistake for J. H. Surratt, one of the conspirators concerned in

the assassination of Pres. Lincoln, and carried to Washington in chains, he attained an unexpected and national notoriety, being styled "the mysterious prisoner."

**Ryan** (WILLIAM ALBERT CHARLES), b. in Toronto, Canada, Mar. 28, 1843; educated in Buffalo; in 1861 entered the army in the civil war, and rose from the rank of private in the 132d New York to that of captain in the 192d New York; in 1869 espoused the Cuban cause; was chief of staff and inspector-general under Jordan, and distinguished for gallantry; returned to the U. S. repeatedly, and took part in several hazardous expeditions for the relief of Cuba. His last adventure, which proved fatal, was in the noted Virginius, which sailed from Kingston, Jamaica, Oct. 23, 1873, and was captured on the 31st by the Spanish war-steamer Tornado, and carried into Santiago de Cuba, where the whole company of passengers and crew, to the number of 151, were court-martialled by Gen. Burriel and condemned as pirates. Fifty-two of these, including Gens. Ryan, Varona, Del Sol, and Cespedes, and also Capt. Fry, the captain of the Virginius, were shot, the first four on the 4th, and the others between the 4th and 8th of November, when the British man-of-war Niobe steamed into port, and her commander, Sir Lambton Lorraine, interposed to arrest the slaughter.

# S.

**Sabine' Pass,** p.-v., Jefferson co., seaport-town of Eastern Texas, is the terminus of St. Louis and Mexican Gulf R. R., and is also in communication with the interior of Texas and Louisiana by the Neches and Sabine rivers; has the best bar and harbor on the Gulf of Mexico, and will be among the most important seaports on the completion of St. Louis R. R. The water in its inner harbor is 25 to 40 feet deep. W. F. MCCLANAHAN, ED. NEWS-BEACON.

**Saf'ford** (ROBERT), b. July 7, 1767, in Worcester, Mass.; emigrated in his twenty-second year to the North-western Territory, then an unbroken wilderness from the Ohio River to the lakes; did much to reclaim the Western wilderness; was appointed judge over a vast district, embracing nearly all of what is now known as the State of Ohio; filled nearly all the offices of honor and trust which could be conferred at that time, taking an active part in the Indian wars, being commissioned colonel by the then governor of the Territory, Gen. St. Clair, and fought gallantly under the late President, Gen. William Henry Harrison, at the battle of Tippecanoe and others, until Tecumseh, at the battle of the Thames, was killed. D. at Gallipolis, O., July 26, 1863. ROBERT S. NEWTON.

**Sa'hara** [properly *Eç-Çahrâ*, an Arabic substantive meaning "a reddish waste plain deprived of vegetation"], the name of the great desert of North Africa, which extends from the Red Sea on the E. to the Atlantic Ocean on the W., and from the last ranges of the mountains of Berberia on the N. up to the fertile regions of the Negroland on the S. It covers 15° in latitude and 49° in longitude—about 8,530,000 square kilomètres, or 3,293,000 American sq. m., the half of which fall S. of the tropic of Cancer. The eastern part of the Sahara has a northerly slope. This is cut by the Nile, a river which, fed by the rains of the equatorial belt, receives a constant supply of water and pours it into the Mediterranean after forming a long oasis, Egypt. With that exception no other river cuts through the breadth of the Sahara. Westward from the Nile Valley various ranges, clumps of mountains, and table-lands occupy the central parts of that desert on its whole length. Among these the mountains of Wanyanga and of Tou or Tibesti, the table-land of Mourzouk and the table-land or Tassîli of Âzjer, the mountains of Azben and those of Âhaggar, the Tassîli of the Âhaggar, the table-lands Tân Ezroûft and Warân, and lastly the mountains of Adrâr, following one after the other from E. to W. on a sinuous line, form what might be called the spinal bone of that extensive country, and separate the two principal northern and southern watersheds. The Sahara has not been a desert from the date of its emersion out of the sea-waters. During the period that preceded the present aspect and life of the earth's surface, the valleys of the Sahara were real rivers, and extensive low tracts of that country were true lakes. A complete change in the climate of the whole of North Africa brought a diminution of the quantity of rain, stopped the flow of the rivers—some of which were as large as the Tennessee or the Platte—and caused the Sahara to be what it now is. The height of the soil varies considerably, according to the places. In the Algerian Sahara there is a large tract of country at a lower level than that of the sea, and that country, filled with the beds of salt lagunes, called *shott*, was about twenty-five centuries ago a part of the Mediterranean, which it joined at Gâbes. Another tract, lower than the level of the sea, extends in the eastern half of the Sahara S. of the table-land of Barga or Barca (anc. *Cyrenaica*); it includes the oases of Sîwa and Awjela. This last low country was probably also united to the Mediterranean a little W. from the modern delta of the Nile and in the bottom of the gulf of the Syrtis Major. The highest parts of the Sahara are the mountains of Tou, the Tassîli of Azjer, and, above all, the mountains of Âhaggar, which cover the centre of that desert, and form there properly three different knots of one raising, equally distant from the Red Sea and from the Atlantic. Some parts of the mountains of Tou are 2300 mètres high, and these are the basis of still loftier peaks. The table-land of Mourzouk, between Tou and the Tassîli of Âzjer, ranges from 560 to 580 mètres. The Tassîli, itself a table-land falling from S. to N., may be 1500 mètres, or perhaps 2000 mètres, above the sea-level in the highest parts, and the Âhaggar evidently exceeds the height of the Tassîli. Extinct volcanoes, masses of lava, basaltic rocks, show here and there the first cause of the rising of these mountains, which are mostly composed of sandstone and of limestone, but whose oldest fossiliferous banks are a submarine formation of the Devonian period.

From the Âhaggar, seemingly the highest point of the Sahara, come down in the plains, three large valleys, formerly rivers—the Igharghar, which had its mouth in the western desiccated gulf of the Mediterranean; the Tîrhehêrt, which was apparently a tributary of the Dhra'a River in Morocco; the Tâfasâsset, which flowed through the Kwâra or Niger into the Atlantic Ocean, like the last-named dry river. The waters of the Tassîli of Azjer went partly to the first and to the third of those rivers. The waters of the Tou Mountains fell in the direction of the Tsâd Lake, S., and on the opposite side they took the direction of the oasis of Ghebabo and Awjela. Another remarkable feature in the hydrography of the Sahara is the bed of a large river called Fêdé. That river acted to the waters of the Tsâd as a channel of derivation into the eastern Sahara or Libyan Desert, where they were first received in the hollow of Bodelé N. E. from the Tsâd. Although none of the *wâdi*, or valleys, of the Sahara, save perhaps one in the Âhaggar, has a constant flow, and although they are almost destitute of fountains, yet the supply of the rains—generally tropical rains, falling in the central Sahara only once about every nine, twelve, or even twenty years—is drained into these wadi or valleys, where, after an ephemeral flowing, it soon disappears, being absorbed by the loose sandy soil forming the beds of the valleys. Henceforth the waters are protected from evaporating by the alluvial ground, and reaching below an impervious stratum, they either become stagnant, or, shielded from the sun's rays, assume a subterranean course along the valley and nourish the wells digged on its extent, as well as the scarce shrubs and trees which are to be found only in such places.

At present the climate of Sahara is the genuine desertic, a climate of extremes, of sudden leaps from hot to cold, and of constant dryness. During the winter the temperature of the air falls sometimes to even more than 2° C., and that of the soil to 4° or 5° below the freezing-point. During the summer the temperature of the air in the shade reaches up to 44°, 45° on the table-lands, and to about 50° in some low countries; on such days the heat of the soil under the sun's rays may surpass that of the air, about 28°. In the short space of a few days the air itself shows differences of 28° in the shade. And the dryness of the atmosphere is such that the simultaneous indications of the dry and of the wet thermometer give differences of more than 23°. Under the influence of these meteorological processes operating through centuries, the particles composing the sandstone and other rocks are disintegrated, and these particles, carried away by the mighty winds that sweep the soil, wander afar till they come to a standstill in the hollow parts. Such is the origin of the extensive sandy tracts of the Sahara, which, although an exception in the general features of the North African desert, form there a large belt extending from close to the Gulf of Gâbes up to the Atlantic, and cover also other considerable spaces in the Libyan Desert, as well as in the N. of the Senegal. In these belts or strips the sand, halting against the smallest obstacles, accumulates around them, and generally the downs thus created assume the form of the waves of the sea, their ab-

rupt fall and their slow motion being with the direction of the prevailing wind. But the effects of these meteorological and physical phenomena are not confined to the Sahara. The heating of that immense mineral surface produces there an atmospheric current from S. to N. toward Europe (the *sirocco*), whose calorific action is felt upon the glaciers of the Alps; a current from N. E. to S. W. toward Senegambia (the *harmattan*); and a current from E. to W. (the *este*), which acts with the same scorching effects upon Madeira as the harmattan upon Sierra Leone.

The natural productions of the Sahara are not many. Salt, alum, saltpetre, natron, iron, sulphur of antimony, among the minerals, are the most common. Although in some places the strata both inferior and superior to the Carboniferous are met with, up to the present no mineral coal has been found in the Sahara. Peculiar plants compose its flora, and the natural families represented by the greater number of species are the Cruciferæ, Zygophyllæ, Leguminosæ, Compositæ, Globularieæ, Salsoleæ, Gramineæ; whereas other families, the Capparideæ, Rhamnæ, Tamariscinæ, Asclepiadeæ, Solaneæ, Salvadoraceæ, and Coniferæ, show species not so varied or common, but as much peculiar, or even more remarkable. On account of the similarity of soil and climate, the flora of the Sahara shows greater affinities with the flora of Arabia and Persia than with any other. Strange it is that plants growing in the neighborhood of Montpellier (France), and one growing in the island of Java, are met with in the Central Sahara. In the oases the date-palm tree (*Phœnix dactylifera*) and S. the *Crucifera thebaica*, the indigo, wheat, barley, sorghum, panicum, penicillaria, tomato, and some other edible plants, as well as a little cotton, are cultivated. Of the animals none are more copiously represented than the insects, and among these the coleopters prevail. A quantity of species of lizards and snakes, even the python and the horned adder (*Cerastes*), the Naja haje, deserve notice among the reptiles. As a living proof of the past existence of the large rivers, the crocodile is found in some lakes in the higher part of their valleys. Rather few species of birds inhabit the Sahara; vultures and other birds of prey, small insectivorous birds, are the most frequent, and the large ostrich the most remarkable. The principal wild Mammalia are the hyæna, the jackal, several descriptions of antelopes, the mufflon, the hare, *Ctenodactylus*, jumping rats, and other kinds of rats. The one-humped camel, introduced after the beginning of our era, is the most useful of all the domestic Mammalia; without that animal life would be now impossible for man in the Sahara. The other domestic Mammalia are the horse, the ass, the dog, sheep, and goats.

Negroes were the first inhabitants of the Sahara, and it seems very likely that, at the time when water was plentiful, as shown by the contour of the country and the presence of semi-fossil water shells, men of the negro races alone lived in the Sahara. Subsequently, branches of that primeval population sought a refuge in the lowest, hottest, less dry, and more fertile parts of the country, in Wâd Rîgh, in Fezzân, to pursue there a life of agriculture. Another branch of that race, the Tibbou or Tédâ, with the Teraïyé, turned toward the centre of the country, where, unlike their brethren, the Barâbra of Nubia, they became nomads, and as herdsmen remained masters of the eastern portion of the North African desert. Those of the Saharian negroes who settled in the oases have accomplished certain improvements in agriculture, and particularly in the management of water. In flat-bottomed hollows they dug artesian wells, and on slopes gallery wells, to irrigate the oases.

Two migrations of the white races afterward scattered over the western Sahara its present inhabitants, the Berbers and the Arabs. The Berbers, whose first dwellings seem to have been on the N. coast of Africa, on the borders of Egypt, where they had kin, and whence they received the beginnings of civilization, and in the mountains of Morocco, passed into the Sahara, and since, under the names of Zenâga, Zenâta, and, above all, under the Arabic surname of Touâreg, they peopled the largest part of its territory now kept by the white race—viz. the western half. The nomadic Arabs followed; coming over Egypt, they spread the religion of Mohammed over the whole Sahara, and now their tribes are scattered on the borders of the Nile and on all the most northern and western districts of the Sahara, close to the Berber tribes, or intermixed with these.

With respect to the part it plays in the intercourse of mankind, the Sahara, wanting almost all the elements of richness, and even of comfort, is principally a mere thoroughfare. The numerous tracts that cut its surface are used not only by shepherds to convey the herds and flocks to the scanty pasture-grounds, but also by small and large caravans, which carry, between the Mediterranean and the countries of the Negroland, the European or Asiatic wares asked for in the last countries, and the natural products of these which are employed in the first and in Europe.

In a commercial point of view the Sahara is a country of transit much more than a country of production. From early times there existed commercial transactions between the states bordering the Mediterranean and the Negroland, and after ages—even now that African trade has found many outlets on the Kwâra, on the Guinea coast, and in Senegambia—the commerce by caravans across the Sahara has not ceased. These caravans convey into the Negroland various products coming from Barbary, from Europe, inclusive of the Turkish empire, and from America, such as calico, cloth, muslin, silk wares, wool carpets, red caps, sugar, coffee, tea, needles, paper, guns, powder, sword-blades, looking-glasses, copper, coral, essence of rose or of geranium, ancient Spanish and Austrian dollars, and new French dollars. They bring back cotton garments manufactured in the Negroland, very fine red or yellow leather bags and cushions, sandals, yellow or red tanned sheepskins, gooro-nuts (fruit of the *Sterculia acuminata*), and slaves destined for the markets of the Sahara; beeswax, frankincense, civet, ostrich-feathers, ivory, indigo, gum-arabic, and gold, either in dust or worked into rings; which last wares are partly consumed in Barbary and partly forwarded to Europe. Formerly, the merchants of the Sahara were much engaged in the slave-trade, and furnished with negro slaves the countries of Barbary. They discovered that, on account of the deaths occurring when crossing the Sahara—probably, also, in consequence of the scarcer demand resulting from prohibitions—slaves were not remunerative enough, and now their sale is an exceptional sight in the Sahara. Many white slave-dealers of Ghadâmés and Sôkna confess that the slave-trade is not agreeable to Allah, and that there is a curse upon the merchant. Cruelties against the slaves brought across the Sahara are most frequent among the Tédâs, who are themselves negroes.

Eleven principal routes are used at present by the caravans which exchange goods from the Mediterranean or the Atlantic with those of Negroland. These are, beginning at the E.—the road from Çiyoût in Egypt to El-Obüd in Kordofân; the road from Dongola to El-Fâsher in Fôr, and that from Sîwa to the same city; the road from Ben-Ghâzy to Wâra and Abêshé in Wâdâï; the road from Tripoli to Koûka in Bornou; the roads from Tripoli and Tunis to the celebrated manufacturing town of Kanô in the Houssa country, and another passing, like the former, by Ghadâmés, then by In-Çâlah, and joining Timbuctoo; the roads from Oran and Algiers to Gourâra and In-Çâlah, with no present direct extension of the trade farther S.; and, lastly, the Morocco roads from Mogador and from Tangiers, this, *viâ* Tafilêlt, to Timbuctoo. Almost the whole of the trans-Saharian exchanges take place by these routes or by their ramifications, which must be considered as the arteries of the meagre international life of the Sahara.

The Sahara proper produces for exportation salt, alum, natron, asses, camels, sheep, and wool, in the northern parts. Of these products, sheep are exported to Barbary, and wool even to Europe, while salt is the only object of a very extensive and important commerce in the markets of the western half of Nigritia, where there is a great demand for that article of first necessity. In Bilma, in Amadghôr, in Teghâza, in Taodenni, and in Ijil are the inexhaustible mines which have furnished, or still furnish, with salt the numerous inhabitants of the basins of the Tsâd and of the Kwâra or Niger, whose territories are deprived of that mineral. These natural circumstances have apparently been the first cause of the trans-Saharian commerce. Even in the eastern part of the Sahara we see, by the valuable reports of Herodotus, that the routes of the Ammonians and Libyans to the W. went along a chain of salt-mines, and, although the father of history does not mention its digging and sale, the salt of this region must have been in his time an object of trade. The richest of the salt-mines known in the Sahara, that of Amadghôr, is found in its western half, below the N. E. slopes of the table-land of Âhaggar. The salt of Amadghôr was anciently carried S., to Azben and to the Houssa country, by caravans, which exchanged at the fair of Amadghôr the merchandise of the Negroland against the wares brought by the caravans from Warglâ, and which had always the certainty of finding at Amadghôr at least one product wanted in the Negroland. No certain date can be ascribed to this trade, which slackened, and afterward ceased, in the sixteenth century, in consequence of political changes, causing the fall of the commercial importance of Warglâ, and the suspension of the part Algeria had played in the commerce of Nigritia. At present the inhabitants of the basin of the Tsâd draw their stores of salt from the mines

of Bilma, and the inhabitants of the basin of the Niger from Taodenni.

The commerce of the interior of Africa across the Sahara has become a subject of attention in our days. Three French projects for a railway from Algeria to the Niger River were published in 1875—one from Tougourt, *viâ* Warglâ and Wâd Mîya, to Timbuctoo, proposed by M. Duponchel; the second from Algiers, *viâ* El-Golea'a and In-Çâlah, proposed by M. Soleillet; the third from Oran, *viâ* Wâd Ghîr (or Wâd Es-Sâwra), proposed by M. Du Mazet, this last scheme being perhaps the least difficult of execution in the Saharian northern part on account of the long watered valley it follows to the southernmost villages of Touât. It would be too soon to discuss the remoter parts of the projected lines toward Timbuctoo, for no traveller has brought home even the slightest sketch of an itinerary in that country, which has a calcareous table-land, without wells, extending for about 95 kilomètres in its narrowest part. It seems necessary to wait until the whole tract is explored by a geographer before submitting the question to railway constructors; yet M. Duponchel, a practician, quite prematurely calculates upon a length of 2535 kilomètres, an expense of 400,000,000 francs, and an advance of the work at the rate of 3 kilomètres a day for the line he proposes.

Of the ordinary commercial routes that, more probably than railways, are destined to serve to revive the commerce of Algeria in the southern direction, we mention the ancient trans-Saharian route *viâ* Warglâ and Amadghôr to Kanô, which made the fortune of Warglâ, and offered a steady source of benefits to the Âzjer and Âhaggar Touâreg, and the routes *viâ* Touât to Timbuctoo. In the mean while, England might establish a port and colony close to Cape Bojador, in order to get a much more healthy land-route to the countries of the Niger than the river-route is known to be.

Closely related to the commercial questions are the projects of submersion of large parts of the Sahara, which originated during the French geodetic survey conducted by Capt. Roudaire, S. of Biskra, into the Shott Melghîgh. Capt. Roudaire was commissioned in 1874 to complete the topographical survey of the depression existing in the Sahara of Constantine, and he found upon the French territory an inundable space of 6000 square kilomètres, which forms a part of the dried-up *Tritonitis Palus*, anciently communicating with the Mediterranean near Gâbes (*Tacape*). Westward from the boundary of Tunisia, the soil is higher than the level of the Mediterranean for 18 kilomètres, and the depression begins again in the Shott El-Gharsa. The distance eastward of the depressions of —15 metrès in the 10,000 square kilomètres of the Tunisian shotts is still unknown; yet there exist some indications that the Shott El-Gharsa is not connected with the Shott El-Jerîd, and the soil of the last may have a greater elevation than the first. On the other hand, an Italian scientific commission has verified what former travellers had already noticed—viz. that the coast of the Gulf of Gâbes is the result of an elevation of the soil that shut up the entrance of the *Palus Tritonitis*, and left it to dry for want of a sufficient alimentation by the rivers falling into it. M. Fuchs, another practician, has ascertained that the breadth of the bank of chalk and sandstone now shutting the entrance of the ancient bay is 20 kilomètres, and he has calculated that the cost of a canal across that bank only would amount to 300,000,000 francs.

Much more plausible than the almost impossible restitution to the Mediterranean of its ancient Bay of Triton is the conception according to which Messrs. Mackenzie and Skertchly dreamed to inundate the western portion of the Sahara, from the coast facing the Canary Islands as far as the country of Azawâd and Timbuctoo. The whole of that fallacious scheme rests upon a misconception—viz. that there exists a large hollow called El-Joûf westward from Timbuctoo. El-Joûf is a depression with regard to the table-lands surrounding it, but certainly not in comparison with the sea, and a river, Belta, by which it would communicate with the ocean in the latitude of the Canary Islands, does not exist at all. On the contrary, broad table-lands, and even mountains, extend for 700 kilomètres between El-Joûf and the Atlantic.

A similar conception had its origin in the nature of a considerable depth of the soil of the Sahara at the oasis of Sîwa or *Ammon*, which is a part of the Egyptian territory. It was thought possible that the whole of the Libyan Desert could be converted into a lake or a sea. But the results of the recent work of an expedition sent for that object by the Egyptian government, with M. Rohlfs as chief, demonstrate that the only result would be the inundation of an insignificant portion of the country from Sîwa (—29 mètres) to Aradj (—75 mètres) and Sittra (—15 mètres), E. S. E. from the first oasis; in other words, the enormously difficult, expensive, useless, and therefore criminal, destruction of some of those rare places of the North African desert where sedentary life is now possible to man.

As far as it may be guessed, considering the condition of Sahara and of its inhabitants, improvement can take place solely by perfecting the modes of cultivation, of travelling, and of commerce in practice there for the last sixteen centuries, and by giving to the inhabitants a more regular national life, which will result from material improvements. Such are the sure ways of progress for the Sahara and for the Saharians. HENRI DUVEYRIER.

**Saigi'idæ,** or **Saigi'inæ** [from *Saiga*, the Latinized form of the proper name], a peculiar family of antelope-like ruminants, or perhaps a sub-family of the Bovidæ, distinguished by the peculiarly enlarged muzzle and the co-ordinated modifications of the nasal region of the skull. The form is that of the antelopes or sheep; as in them, too, the skull has the auditory bullæ produced downward, especially toward the inside, and applied behind to the paroccipital processes; the styloid processes are deflected more or less forward, enclosing oblique folds on the outer surfaces of the auditory bullæ, and the palatine axis is declivous from the occipito-sphenoid axis; the horns are also persistent, and developed as osseous cores originating from the frontal bones. The peculiar characters are dominant in the olfactory organ, which is extremely expanded and inflated above, and the nasal bones are much shortened, directed upward, and entirely separated from the supramaxillaries, as well as the lachrymals, by the projection of the frontals between the lachrymals and the nasals; the supramaxillaries and intermaxillaries are reduced and attenuated forward; the posterior nasal cavity has its walls inflated outward. The form thus distinguished is represented by but a single species, *Saiga tartarica*, which was made known by Pallas in 1777, under the name *Antilope saiga*. The species is an inhabitant of the plains of Northern Asia, especially in the region of Mount Altai, but it extends also into Eastern Europe as far as the Crimea. It is about the size of a small deer, and its body is yellowish above and whitish below. It associates in large herds. When it wishes to drink, it is said to plunge its entire snout into the water, and to take in the liquid through the nostrils. The flesh is very disagreeable, but is eaten in winter, although in summer it is rejected, because then there is found under the skin the larva of a gad-fly. (See, among other articles, James Murie, *On the Saiga Antelope, Saiga tartarica*, in *Proc. Zool. Soc. London*, for 1870, pp. 451–503.) THEODORE GILL.

**Sale, in Law.** By the term "sale" is meant the transfer of the property in a thing, whether real or personal, for a price in money, and not in goods or other property. Owing to the peculiar theories of the English law concerning real estate, the rules governing the sale of land are not the same as those governing the transfer of chattels, though bearing a general resemblance. They are accordingly treated separately by law-writers, the doctrines governing in real property law being usually found under the head of "vendor and purchaser." A convenient arrangement, therefore, will be to treat the subject under two general divisions, one of them referring to sales of real estate and the other to personal property.

DIVISION I. SALES OF GOODS OR CHATTELS.—This is one of the most important branches of the law of contracts (see CONTRACT, in CYCLOPÆDIA, where will also be found the articles referred to below), and extremely fruitful in distinctions. Only a very general survey of the subject can be made. As there is an important statute, first enacted in England, and generally adopted in this country, affecting the subject, and termed "the statute of frauds" (see FRAUDS, STATUTE OF), the subject will be considered both at the common law and as affected by this statute.

I. *Sales at Common Law.*—As a sale is a contract, it must have all the ordinary ingredients of an agreement. There must be parties competent to contract, mutual assent, and a thing of which the ownership or property is transferred from the buyer to the seller, and a price in *money*. If no money be paid or promised to be paid, the transaction is a barter or exchange instead of a sale. An exchange is for most purposes governed by the same rules prevailing in the law of sales, but not in all respects. In discussing this topic it will not be necessary to consider in detail such matters as are generally applicable to contracts, as they have been sufficiently considered under the articles CONTRACT, CONSIDERATION, FRAUD, etc., to which reference is made. The special rules governing this division of the present article will be treated under the following heads: *First*, the effect of the contract in passing the ownership of the goods to the buyer; *second*, the general duties of each party as created by the contract; *third*, remedies against each in case of their violation.

*First.* An important distinction must be taken at the

outset between an executed and executory contract of sale. The former passes the title in the subject of the sale to the purchaser; the latter gives no title, but simply creates a right. The buyer in this case has a right to have the ownership of the thing contracted to be sold, but if that be wrongfully denied to him, he has his remedy only in damages. The same rule is applicable to the seller should the buyer refuse, without cause, to take the article at the stipulated time. In an executed sale the buyer, though the goods are not yet delivered to him, takes all the responsibilities of ownership. In case of destruction by fire or other casualty the loss falls on him. In the executory contract, as ownership remains in the seller, he must bear all such losses.

To constitute an executed contract of sale independent of the statute of frauds the assent of the parties is only necessary. As soon as the minds of the seller and buyer concur the title passes to the latter. This is not necessarily true of the possession. Where the sale is not understood to be upon credit, it is a ready-money sale. If the price is not paid, the seller has a lien (see LIEN) upon the goods so long as they remain in his possession, and can thus retain the goods until the price is paid. On the other hand, if the sale be upon credit, the purchaser is entitled to immediate possession, and if he receives it the seller has lost all control over the goods, and his claim assumes the form of a debt. Still, if the seller happens to retain possession until the credit expires, his lien will revive. It thus appears that under the rules of the English common law delivery of the goods is not a necessary element in a sale. It will be enough that there be sufficient subject-matter, a price, and mutual consent. Delivery may become important for other reasons. There is an ancient rule of law, still in full force, that an inference of fraud may be derived from the fact that delivery does not accompany the transfer of ownership. This does not mean fraud entering into the sale as between the parties to it, but refers to third parties likely to be affected by the transaction, such as subsequent purchasers from the vendor in good faith and his creditors. There has been much controversy upon the point whether the fraud must necessarily be inferred as a rule of law, or whether it must be treated as a question of fact, so as to make each case depend upon its own special circumstances. If the latter view should be taken, evidence might be offered to repel the presumption of fraud, so that the good faith of the transaction might thus become a question of fact for a jury. After much vacillation of judicial opinion the latter view has gained the preponderance, and is likely to become generally recognized. It is still true that if no affirmative evidence of good faith be offered a presumption of fraud may be derived from the mere fact of the detention by the vendor of the goods beyond a reasonable time. It is a fundamental rule that the seller must be the owner of the goods or no title will be conferred upon the purchaser, though he act in good faith. There is an exception to this rule recognized in England, though not in this country, where the sale is made in open market (market overt). Accordingly, a thief or a bailee cannot in the U. S. by any devices so cover up the defects in his title as to transfer the ownership to a purchaser. The single exception to this rule which has general prevalence is found in the case of money and its substitutes in the nature of credit passing from hand to hand in the ordinary course of business.

The thing sold must have an actual or potential existence. By the expression "potential" is here meant, within the range of ordinary possibility. Thus, a vine-grower may make a valid sale of the grapes to grow in his vineyard during the coming season, but he cannot make a strict sale of property which is to be hereafter acquired; as, for example, in the instance just supposed, of grapes to grow in a vineyard which he has not yet planted. Such a transaction would amount to an executory contract of sale, and would, as already pointed out, confer no ownership, but only a right of action. Some have gone so far as to maintain that it is illegal, as contrary to public policy, to offer to sell what one does not own, but can only acquire by subsequent purchase. This view is deemed to be extreme, and is not sustained by modern authority.

A rule of much importance requires that the subject of the sale should be a specific chattel. If not, the agreement is executory. An illustration or two may be given: Thus, a sale of twenty tons of oil from the seller's stock in his cisterns or of fifty hogsheads of sugar (more being mentioned), or of ten tons of hemp out of thirty, belongs to the class of executory contracts. The general ground is, that where there is a bargain for a certain quantity to be taken from a larger quantity, with a power of selection in the vendor to deliver which he thinks fit, the right does not pass to the vendee until the selection is made. "There is no *individuality* until there has been a division." There may, however, be another theory in such a case. Although there be no selection, the purchaser may become the owner of an undivided share of the property. For example, it is possible to conceive that an owner of thirty tons of hemp might sell ten tons from the mass in such a way as to make the purchaser owner of an undivided third. Should this be conceded, the whole question would be narrowed down to a consideration of the intent of the parties. This view has of late become somewhat prevalent in this country.

But if the chattel be specific, there will not necessarily be a sale. There may something remain to be done to put the chattel in a condition fit for delivery. A distinguished English writer and judge, Blackburn, has laid down two general rules as applicable to this subject. One is, that in case the vendor by the agreement is to do anything to the goods for the purpose of putting them in that state in which the purchaser is bound to accept them, the performance of the thing will presumptively be taken to be a condition preceding the vesting of the ownership in the purchaser. The other rule requires that if any act, such as weighing, measuring, or testing, remains to be done by the seller to the goods, for the purpose of ascertaining the price, which is made to depend on quantity or quality, such act shall in like manner be deemed a condition precedent. These rules are adhered to with much rigor by the English courts, though they have been to some extent relaxed in the courts of a number of our States. Thus, in the State of New York it has been decided that if the owner of a large mass of wheat stored in a specified place gives the vendee a receipt acknowledging that he holds a parcel of it (*e. g.* 6000 bushels), sold for a specified price, subject to the purchaser's order, the title passes. (*Kimberly* v. *Patchin*, 19 New York Reports, 330.) This case proceeds upon the ground that the seller and buyer may be regarded as the joint owners of the entire mass, one of the 6000 bushels and the other of the residue, provided there is sufficiently clear evidence of the intention of the parties to the contract. It will be observed that in the case referred to the ends of justice did not require any selection, as all the grains of wheat must be assumed to have been of equal value. If articles of unequal value were so mingled together as to require an act of selection in order to ascertain them and separate them from the mass, a different rule might prevail.

Assuming, however, the correctness of the English decisions, and that in such cases as have been considered the sale is executory, and that no title passes, it may pass into an executed transaction, by *a subsequent act of appropriation* by the parties, without any new contract. The element that was originally wanting to make the sale complete is by this means supplied. Though the sale is made by two successive acts, it is, after all, but one contract. The case seems very clear when the act of "subsequent appropriation" is performed by both parties. Thus, if a vendor had agreed to sell to B 1000 bricks, not yet counted from a pile, but to be selected by the buyer, the sale might at that point be deemed to be executory. Should B subsequently send his carts for the bricks, and they should be counted out by him and set apart as his own, it would be difficult to maintain that the contract was not executed. The matter, however, would assume a much more complex form if the act of appropriation were to be done by the seller. In that case it might not be easy at first sight to determine when the appropriation was actually made. The seller might, for example, make a selection, and then change his mind and choose others *ad libitum* until he had done some overt act called for by the contract which would make his election irrevocable. This rule will become more clear by applying it to an instance frequently occurring in the ordinary course of business. By the terms of an executory contract the vendor is to despatch unspecified goods to the vendee. As soon as he *despatches* them the act is irrevocable; the sale is complete, and the title is vested in the vendee. Before the act of despatching the goods is performed no evidence of intention on the vendor's part to send particular goods will have any bearing on the question. Under these rules, if a vendor delivers goods to a carrier by order of the purchaser, the appropriation is absolutely made, and the ownership of the property vests in the latter. It may not be out of place to add, by way of qualification, that if the act of appropriation be in its own nature conditional, the sale will partake of the same character. Accordingly, the vendor may make the appropriation dependent upon payment, and may take the bill of lading from the carrier to himself with a view of retaining the ownership in himself until payment is made or some other act performed. Presumptively, it would appear that the appropriation is absolute, unless there is some evidence of intention to the contrary. Cases of this kind present questions of great difficulty and complexity, of which an example may be found in the recent English case of *The Calcutta Company* v. *De Mattos*, the most eminent judges showing an extraordinary diversity of opinion. (See 32

*Law Journal* (Queen's Bench) *Reports*, 322; 33 *Id.*, 214.) Of course, no appropriation can be forced by the seller upon the buyer which does not accord with the terms of the contract. He cannot, for instance, compel him to take a larger quantity than he has contracted for. A single special application of the doctrine of appropriation may be referred to. This is the case of an article manufactured by special order, and perhaps paid for in whole or in part. The point in controversy will be, whether the title remains in the builder, or whether, by reason of the payment, it has vested in the buyer. The decision, in the absence of special agreement, will turn upon the point whether the manufacturer has so fully performed an act evincive of his intention to appropriate the goods to this particular order as to make his election irrevocable. In one case it was said, "A tradesman often finishes goods which he is making in pursuance of an order given by one person, and sells them to another. If the first customer has other goods made for him within the stipulated time, he has no reason to complain; he cannot claim the goods from the purchaser to whom they were in fact sold." Where the payment is made by specified instalments a question may arise whether it was the intention of the parties that the ownership should be transferred upon payment of one or more instalments. If so, it will be carried into effect. This intention may be exhibited by their acts as well as by words. Thus, it has been laid down that if there be a provision in the contract for payment regulated by particular stages of the work, with a view to give the purchaser the security of certain portions of the work for the money he is to pay, this is equivalent to an express provision that on payment of the instalment the general ownership of so much of the chattel as is then constructed shall pass to the purchaser. In the absence of evidence of intention the manufacturer remains owner until the chattel is completed and appropriated to the purchaser.

There is an important qualification of the rules concerning "subsequent appropriation" which must now be noticed. This is, that owing to special circumstances, notwithstanding a complete and certain designation has been made, the seller desires to remain owner until a particular act on the part of the purchaser has been performed. A common instance is where the seller and buyer transact business in different places, and the former desires to secure himself against the possible insolvency of the latter. This is commonly done by means of a bill of lading (see BILL OF LADING), taken from the master of the ship on which the goods are transported. If the intention were to cause the transaction to be unconditional, the bill of lading would be so drawn as to declare that the goods were to be delivered to the purchaser on his order. On the other hand, if the seller, as in the case now under consideration, desires to retain ownership, he would have the goods, notwithstanding they had been so set apart as to make his election in favor of the purchaser irrevocable, deliverable to himself or to his own order, or to some other specified person; *e. g.* one who, not being the buyer, had advanced the money to pay for the goods. In either event the goods would regularly be delivered to the purchaser, and his ownership would become complete on direct payment for the goods or of a bill of exchange drawn on the buyer in favor of the money-lender for the price. In such instances the seller is said to retain the *jus disponendi*, or power of disposal. The whole question is resolved into one of intention. In some instances the evidence of intention is such as to lead to much doubt, in which case the matter must be disposed of on a view of all the circumstances of the case, and might become a question of fact for a jury. It follows from these principles that there is an important distinction between the case of a mere delivery of goods pursuant to an order of purchase to a carrier, and the case where a bill of lading accompanies the transaction. In the first instance, the carrier may properly be deemed the agent of the purchaser, and the delivery accordingly complete, subject to the vendor's right of *stoppage in transitu* in case of the former's insolvency. (See STOPPAGE IN TRANSITU.) In the second instance, he is the bailee (see BAILMENT) of the person pointed out in the bill of lading. If the seller is that person, the presumption is that he reserves to himself the power of disposal or control, and the transaction is not complete; and the same rule would be applied to any act made requisite by the seller, such as the acceptance of a bill of exchange by the buyer. This presumption may be overthrown by evidence that the seller did not, in fact, intend to reserve any control over the property. So, on the other hand, where the goods are delivered on board of the purchaser's own ship: while the general rule is that this is a delivery to the buyer, it may be shown that the seller intended to reserve the "power of disposal," even though the bills of lading declare that the goods are free from freight or "free on board" because they are the ship-owner's property.

A distinction must next be pointed out between an absolute and a conditional sale. An absolute sale is readily understood, and is one where the title passes to the purchaser free from all restriction or limitation. A conditional sale may be one where, owing to some condition (see CONDITION) or restriction, the title does not pass at all, or if it does vest in the purchaser, it is liable, on the happening of some event, to be defeated and to revest in the seller. One of these would be a precedent, and the other a subsequent, condition. An important instance of a precedent condition is the ordinary mercantile contract of "sales to arrive" or "on arrival." Such a contract is in general conditional, and does not take effect as a complete sale unless the goods arrive at the place and in the manner designated in the contract. If the stipulation concern their arrival by a particular ship, they must come in the ordinary course of navigation upon the ship specified, and no other. On the other hand, if the arrival takes place in the manner designated, the sale is absolute. Sometimes there is a clause in such a contract, where no ship is specified, that the vendor shall give notice of the name of the ship on which the goods are expected to arrive as soon as it becomes known to him. Such a clause must be strictly complied with. The contract must be treated as in the outset executory, to become executed on the arrival of the ship. The goods must accordingly be merchantable, and the rule of *caveat emptor* (see CAVEAT EMPTOR) is not applicable, since the purchaser at the time the contract was entered into had no opportunity to inspect the goods. There are other contracts having in them a like conditional element, such as "sales on trial" or "approval," or a "sale or return." These will become absolute on the failure on the part of the vendee to observe the conditions, and by his retention of the goods beyond the time mentioned in the contract as allowed to him for the purposes specified. Quite a common case of a conditional contract is one where the goods are delivered to the buyer before they are paid for, with a stipulation that no title shall pass until payment is made. An illustration may be found in the case of a safe sold to a banker. Though he might under such a contract have free use of the article, he would have no interest which he could so sell or otherwise dispose of as to prejudice the rights of the original owner. One of the most important instances of a sale upon a condition subsequent is a mortgage of chattels. This so-called mortgage is really a sale, which the original owner may defeat by performing the condition at the appointed time. If not performed, the transaction becomes absolute in the view of a court of law, and the mortgagor has only a right in a court of equity to redeem. The transaction is quite different from a pawn or pledge, as in the latter case no title passes to the pledgee or pawnee, but only a special property, the general ownership still remaining in the pledgor. It is a species of bailment rather than a sale. The chattel mortgage has become in modern times an important contract, and is much resorted to. There are important rules governing it bearing upon the question of fraud. One of these, of a statutory nature, is, that if the goods continue, as they commonly do, in the possession of the mortgagor, the mortgage deed, or a copy of it, must be filed in a specified office (*e. g.* in that of the clerk of the town where the mortgagor resides), and if it continues in force beyond a fixed time, the amount remaining due must be stated by endorsement on the mortgage or otherwise. A failure to observe these regulations may avoid the mortgage as to such third persons as creditors of the mortgagor and innocent purchasers from him, while the transaction may still be upheld as to the parties to it. A further rule of general application prevents the mortgagee, as far as creditors are concerned, from retaining the power to sell the goods and apply the proceeds of the sale to his own use. This would be evidence of an intent to defraud creditors by interposing a nominal mortgage between himself and his creditors to delay the enforcement of their claims. The correct course in such a case would have been to have provided that any surplus beyond necessary expenses should be applied to the reduction of the debt. A like question may arise as to the case where a mortgage should be so drawn as to embrace not only property then owned by the mortgagor, but such as he should thereafter acquire. While this transaction might be upheld, as between the parties, as an executory contract to be enforced by a court of equity when the property was obtained, it would in general be regarded as inoperative as to creditors of the mortgagor. Assuming the mortgage to be valid, if the debt is not paid at the appointed time, or, if demand be necessary, after demand, the mortgagee may proceed to sell the property after giving due notice, or he may foreclose in a court of equity, in each case yielding any surplus, beyond what is necessary to pay his debt and legal expenses, to the mortgagor.

*Second.* The leading duty of each party to the contract is to perform it according to its terms. If there are any conditions to be observed, they are to be strictly followed, unless there is good ground for excuse, either in the failure of the opposite party to fulfil his duties or in the intervention of some act of God or of the law. More specifically, there may be on the part of the seller such obligations as warranty of the title or quality of the goods on delivery, and on the part of the buyer acceptance of the goods and payment or tender of the price. These will now be considered.

A. *Warranty.*—This may as to its substance be twofold, either of title or quality, and in each case, as to its form, may be either express or implied. A warranty is to be regarded as a collateral contract accompanying the principal contract of sale. Where it is not implied by law it may or may not exist at the pleasure of the parties. If an express warranty be broken, and there be no fraud, the principal contract will still remain. The sale is valid, and the only remedy of the buyer is an action upon the collateral contract of warranty. This is not true of the implied contract of warranty. This enters by a rule of law so completely into the main contract that it forms an ingredient in it, and if it be broken the buyer, if acting promptly, may rescind the contract of sale itself. Considering, in the first instance, the implied warranty, it may be remarked that there has been much discussion among jurists whether in a sale of chattels the law will imply a warranty of title. The English authorities are not so distinct upon this point as the American. It is well settled in this country that there is in every sale where the chattel is in the possession of the seller an implied warranty of ownership. If it be out of his possession, the buyer is put upon his guard and the implied promise does not exist. As to warranty of quality, there is a close accord between English and American views. There is in general no implied warranty of quality where the goods are open to the purchaser's inspection, as he must look out for himself (*caveat emptor*). A single distinct exception is found in case of the sale of provisions for domestic use. The rule itself has no application to a case where there is no opportunity on the part of the purchaser for inspection, as in the case of a sale by sample (the bulk of the commodity being absent), or where an article is made by a manufacturer to fulfil an order, or where the selection of an article fitted for a particular purpose is undertaken by the seller, or where goods are sold "to arrive." In all of these last cases the risk is thrown upon the seller (*caveat venditor*). If he does not supply the requisite article, the buyer may reject what he presents him. The rule of *caveat emptor* has no application in the case of fraud or undue concealment. (See FRAUD and CAVEAT EMPTOR.) If there be no implied warranty and no fraud, the buyer has no redress if the goods are of an inferior quality, even though he may have paid the price, except he have an express warranty. It will sometimes be quite difficult to determine whether words of commendation constitute an express warranty or not. A certain amount of unwarranted praise on the part of sellers is tolerated by the courts as being an exaggerated expression of opinion on which purchasers have no right to rely. On the other hand, if there is an assertion on which the seller knew, or had reason to know or to suppose, that the buyer would rely, the question will be left to the jury whether there was not a warranty intended. A similar question arises as to the effect of a statement in a bill of parcels—*e. g.* "sold to A B — cases of indigo." Such a statement would be in general held an affirmation by the seller that the article sold was indigo, and if it turns out to be a different commodity the seller is answerable.

B. *Delivery.*—It has been well remarked by a recent writer on the law of sales that there is no branch of the law of sales attended with so much confusion as this. The word "delivery" is used in various senses. Sometimes it is employed in reference to the origin of the contract itself under the provisions of the statute of frauds. This point of view will be regarded hereafter. At other times it refers to the performance of a contract which is conceded to have been properly entered into. Again, a delivery is sometimes assumed where in point of fact none has been made, and hence termed "constructive." The matter at present to be considered is delivery so far as it concerns the performance of the contract.

The general rule of law is, that the buyer is not entitled to the possession of the goods until the price is paid, delivery and payment being concurrent acts. If, however, the sale is on credit, the buyer may in general insist upon immediate possession, unless he be insolvent, when the vendor may retain them, as he might under the same circumstances detain them in the hands of a carrier in the course of transportation to the buyer under the exercise of the right of "stoppage in transitu." (See STOPPAGE IN TRANSITU.) Assuming that there is no ground of detention, and that the seller is bound to deliver, his duty will in general be discharged by placing the goods in such a position that the buyer is free to take them at the place where the sale is made. There may, however, be special terms in the contract imposing further obligations upon the seller. He may, for example, agree to carry them to the buyer's residence or place of business, or to put them in the possession of a carrier or other middleman to be transported to the buyer. In such a case the law will infer that they are to be sent within a reasonable time, which will be made to depend upon all the circumstances of the case. If the time be specified—*e. g.* twenty days—the rules are somewhat complicated. Much will depend upon the point whether the place is also fixed. If it be not, then, the goods being deliverable to the buyer *anywhere*, the seller must find him within the specified time and make tender of the goods at some "convenient" hour before midnight of the last day. The word "convenient," as here used, would imply that the tender should be made long enough before midnight to give the buyer sufficient opportunity before the time specified in the contract expired to examine the goods for the purpose of determining whether they complied with the contract. If the *place* be fixed as well as the time, then it is the duty of the buyer to attend as well as the seller. It would be inconvenient to require that this attendance should take place on every day named in the contract. The rule is, accordingly, that it will be enough if the buyer is present on the last day at some "convenient" hour *before sunset*, that the whole transaction may be completed by daylight. It follows that if the seller makes the tender of the goods at this hour, it will suffice whether the buyer be present or absent. Should the buyer happen to be present at other hours on the last day, the delivery may be made to him down to a convenient hour before midnight, as before. The delivery, when made, must correspond with the contract. More goods than are called for must not be sent, nor must they be mixed with other chattels. The seller has no right to impose upon the buyer the duty of unpacking the goods and separating those that he had purchased from others. A difficult question arises when the seller delivers a less amount than the contract requires. It is agreed that the buyer is not bound to accept the smaller parcel. The perplexity is occasioned by his acceptance, and the consequent inquiry whether he must pay for what he has received so long as he demands the entire fulfilment of the contract. On this point the authorities are hopelessly at variance. While the English courts under such circumstances hold the buyer liable, the New York tribunals emphatically repudiate this view, and urge that on an entire contract the seller can recover nothing so long as a substantial part of it remains unperformed. The rigor of the general rule will be lessened by the insertion in the contract of the words "more or less" or their equivalents, showing that the parties do not intend to be bound to any specific number or amount.

When the contract requires that the goods shall be sent by a carrier, the usual precautions must be observed. If none be specified, regard must be had to the usual course of trade, the nature of the articles, etc. If a carrier be named, delivery must be made to him, using due care as to directions, packing, etc. Delivery to the carrier is in general delivery to the buyer, subject to the seller's right of stoppage *in transitu*. However, it may be agreed that delivery be made to the buyer personally, in which case the carrier will be the seller's agent.

Symbolical delivery is in some instances recognized as equivalent to actual delivery. Thus, if goods are bulky and actual delivery is not convenient, there may some act be done evincing the intention which will be deemed equivalent to delivery; as, for example, delivering the key of a warehouse in which the goods are stored. This notion has in some cases been pushed to an extreme, and the tendency of modern decision is to confine it within reasonable limits. There may perhaps be a symbolical delivery sufficient to constitute performance, which would not be enough at the time of the formation of the contract to satisfy the provisions of the statute of frauds, as considered hereafter in this article.

C. *Acceptance by the Buyer.*—Most of the points under this subdivision have been anticipated in considering delivery. The duty to accept arises only when the corresponding duty on the part of the seller to be ready to make delivery has been properly discharged. When this exists, if the buyer does not accept on his part, he has committed a breach of duty. The law allows him a reasonable time for inspection, as well as to remove the goods, where that act devolves upon him, from the seller's possession. There is a distinction between a *receipt* of the goods and an *acceptance* of them. The latter word implies an assent of

the buyer to the fact that the goods correspond with the contract. This assent may be in so many words, or it may be inferred from the buyer's act; *e. g.* by keeping the goods, without returning them, beyond a reasonable time.

D. *Payment and Tender.*—The duty of payment in money usually arises at the time of the delivery, so that they may be regarded as concurrent acts. However, by agreement credit may be given, or payment be made conditionally. An instance of this is found in the case where a negotiable note or bill of exchange is accepted by the seller. In such a case it is a presumption of law that the note is taken simply as a means of payment, and if not paid the seller has his claim against the buyer on the original contract. The seller may, however, agree to take the note in absolute payment, in which case he has no remedy against the buyer upon the contract, but can only enforce the note. The buyer may tender payment, and if this be not accepted he has done an act which is equivalent to payment so far as to enable him to sue the seller for non-delivery or to successfully resist an action for non-acceptance, provided that he properly presents the fact of the tender to the attention of the court. (See TENDER.)

*Third.* Remedies for breach of the contract must be presented under two aspects: A. for the seller; B. for the buyer. (A) The seller's remedies are either in the nature of an action for damages for non-acceptance or for the price, or else they are proceedings directly affecting the goods which are the subject of the contract. The only remedy in the case of an executory contract is an action for damages for non-acceptance. If the sale is executed, there may be an action for the entire price, on the principle that the ownership has vested in the buyer. This will be the only remedy in case the goods have been unconditionally delivered to the buyer. There may be intermediate cases in which the ownership has vested in the buyer, but he has not yet taken possession, or the delivery has been to a carrier, or is in some form conditional. From these circumstances spring various rights of the seller over the goods themselves, such as the vendor's lien, stoppage *in transitu*, and the right of resale. The lien of the vendor (see LIEN) exists wherever he retains possession and the price has not been paid, unless credit has been given. If credit has been given, the lien is lost except under special circumstances, as where the vendee is insolvent. If the goods are not taken away by the vendee before the credit expires, the lien will revive. After delivery the lien will expire unless there be an agreement between the parties to the contrary. So the lien may be lost under the doctrine of estoppel (see ESTOPPEL), where the vendor permits the vendee to sell to a second or sub-vendee under the supposition that the lien no longer exists. In regard to the right of resale when the buyer fails to perform his contract, there is considerable variety of opinion, so that the English and American decisions are not in accord. The English view now is that there is no strict right of resale unless that is expressly reserved in the contract. If such a reservation is made, the contract is rescinded by the act of resale. If there be no such reservation, the title is in the vendee in such a sense that the vendor by selling is guilty of a breach of contract for which he is liable in damages—viz. the difference between the contract-price and the market-value. Still, as the vendee is in default, he can bring no action for the goods themselves or their value, as he could have done had he performed his side of the contract. In this country the rule is, that the vendor may sell the property, acting as the agent for the vendee, and recover the difference between the contract-price and the amount realized upon the resale, or he may, at his option, retain the goods as his own, and recover the difference between the market-value at the time and place of delivery and the contract-price. This theory is maintained, although there is no reservation in the contract of the right of resale. The final right of the unpaid vendor is stoppage *in transitu*. This is sufficiently considered under that article. (See STOPPAGE IN TRANSITU.)

(B) The remedies on the part of the buyer. It is necessary here also to distinguish between the executory and the executed contract. In the case of the executory contract the only remedy is an action for damages, except in some special cases, where a court of equity will order that the contract be specifically performed; *e. g.* pictures, statues, etc. If the contract be executed, the title passes, and the vendee has the usual remedies appertaining to owners whose property is wrongfully converted by others to their own use. (See CONVERSION.) There are cases where the buyer has the right to reject the goods, though the property in them has passed to him, as where they are not of the kind called for by the sale. As already stated, this right does not exist in the case of a breach of an express warranty of quality.

II. *Sales of Goods as affected by the Statute of Frauds.*—In the reign of Charles II. (A. D. 1677) a statute of great importance was enacted, requiring evidence in writing or of some outward act as to certain contracts, as a substitute for the common-law rule which permits nearly all contracts to be made orally. (See FRAUDS, STATUTE OF.) This statute in its application to sales of goods over £10 requires as a preliminary to the formation of the contract that there should be either delivery of the goods or a part of them, and acceptance by the buyer, or earnest or part payment of the price, or else a memorandum in writing to be signed by the party to be charged or by his authorized agent. This statute has generally been re-enacted in this country, with some variation in some of the States as to details, such as the amount or mode of signature, etc. The practical result is, that there is one rule for the formation of the contract where the price of the goods is under $50, and another where it is of that amount and upward. In the first instance only consent orally expressed is necessary, while in the other one of the statutory requisites must be superadded. After the contract in the latter instance has once become valid, the same general rules as to its effect, the duty of performance, and the remedies in case of breach will be applicable, as have been already stated. The statute has been fruitful in producing nice legal distinctions, some of which are still under discussion. (For a brief statement of some of these see FRAUDS, STATUTE OF.) It may be added to what is there stated that a troublesome question frequently arises where the contract is made by a broker (see BROKER) through the medium of a so-called "bought-and-sold note." (See BOUGHT NOTE.) It is the practice of brokers when negotiating such sales to sign two "notes" or memorandums of the sale, giving one of them to the buyer and the other to the seller. He has authority to do this, as being agent for both parties. It is a well-settled rule that if the two notes do not in substance correspond the statute of frauds is not complied with, and the sale is void. The regular course of business is for the broker to make an entry of the sale in a book kept for the purpose, of which the bought-and-sold notes, if regular, would be a transcript. If they all agree, the contract is established beyond dispute. The difficulty occurs when the notes differ from the entry, or when one agrees with it and the other does not, or when there is no entry and the notes differ, or when there is an entry and no notes are issued. The underlying principle governing these supposed cases is, that the entry, where it exists, constitutes the contract. Accordingly, where there is an entry alone the parties are bound. If the notes vary from each other the entry will govern. If the notes agree, but vary from the entry, these will be evidence from which the jury may find that a *new* contract has been made by way of substitution for that found in the entry. If there be no entry whatever, the contract will be valid if the notes agree, but will be void if they differ. In order that the variation may have this effect, it must be one of substance, and the use of different but equivalent words will not be fatal. Similar rules will be applicable where the contract is claimed to have been made through the medium of letters passing between buyer and seller. If the letters fail to correspond in substance, the contract is void, and they must contain the entire contract, nothing being left to be supplemented by evidence of oral stipulations between the parties.

DIVISION II. SALES OF REAL ESTATE.—The subject here referred to is an executory contract for the sale of land. Its actual transfer falls under the head of deeds (see DEED), and is governed by special and technical rules appertaining to the law of real estate. The executory contract to sell is a branch of the ordinary law of contracts.

The executory contract in important transactions almost uniformly precedes the conveyance of land. One important reason for this is, that the purchaser will desire to have the title investigated before accepting the deed. There may not only be a flaw in the vendor's title, but there may be various liens or incumbrances upon the land, such as mortgages, judgments, claims of mechanics, taxes, assessments, etc. Most of these are created by statute law, and the statutes of the respective States must be consulted. After the executory contract is entered into the purchaser commonly employs persons skilled in the law to make an investigation as to the condition of the title. In doing this a so-called "abstract of title" is prepared, in which the conveyancer in writing traces the title to some well-established source, and then gives in chronological order an account of all facts materially affecting it. Should it appear on this examination that the title is defective, the purchaser will refuse to take a conveyance unless the defect is removed, as the law does not compel the purchaser to take a doubtful title. The advantage of having an executory contract before making this investigation is, that if the title is good the purchaser can insist, as will hereafter be seen, on hav-

ing the very thing contracted for; and on the other hand, if it turns out to be bad, he has an action for damages, including his necessary expenses in conducting the investigation.

The statute of frauds is applied to this case, and the contract must regularly be in writing, and either signed or subscribed by the party to be charged as the statute may happen to require. Where this is done by both parties, each has a remedy against the other. The remedy is twofold—either an action for damages for breach of contract, known as an action at law, or a suit in equity for specific performance. By this term is meant a direction by the court that the party in default shall do the very thing which he has agreed to do, instead of paying damages for the violation of his contract. Applying this rule to the vendor, he would be compelled to make a deed or else would be punished for contempt of court. Of course, this remedy would fail if the vendor should be unable to make a conveyance. Where he can partly perform the contract specifically the vendor may accept that as far as it goes, and for the rest have compensation in damages. The remedy by specific performance proceeds upon the ground that as the contract is for specific property, the remedy in damages does not afford adequate relief, as it is assumed that there were special reasons why the land in question was selected as the subject-matter of the contract.

Notwithstanding the statute of frauds, an oral contract for the sale of land will sometimes be specifically enforced. This will happen where writing has been prevented by the fraud of one of the parties, or where one of the parties has been induced by the other to so change his position that he cannot otherwise be restored to his original condition. An illustration is where a vendor having gone into possession under an oral contract has expended his money in buildings, etc., the value of which he would lose if the transaction were regarded as void. While the courts of the various States agree upon the general principle, they differ as to the question whether substantial expenditure is necessary, some holding that the mere act of taking possession under the terms of the contract will withdraw the case from the operation of the statute of frauds. An oral contract must be clearly proved in all its terms, and possession must have been taken under its provisions, and not in spite of them. As a rule, the remedy by specific performance is mutual, so that where the vendee can insist upon performance the vendor can also. The oral contract in the case supposed will not be recognized in a court of law. Accordingly, no action for damages can be maintained upon it.

It is necessary to a clear comprehension of the subject to refer briefly to the theory prevailing in a court of equity as to the nature of the executory contract. The vendor in that court is no longer deemed to be the owner of the land, but only to have a right to the price. In other words, his interest is regarded as personal property. On the other hand, the purchaser is deemed to be the owner of the land, although the formal title remains in the vendor. The vendor is thus a trustee of the vendee as to the land, and the vendee a trustee for the vendor as to the purchase-money. So, if the vendee dies, his interest descends as real estate to his heirs, while the vendor's right to the unpaid purchase-money passes as personal estate to his executors or administrators. On this view "specific performance" of the contract is but the enforcement of a trust. The same remedies may be had against the representatives of the respective parties as would have prevailed had the parties themselves lived. One of the consequences of this view is, that it is not in general material in a court of equity though the contract be not performed on the appointed day. The trust remains, and it may be enforced at one time as well as another. This rule is expressed by the maxim that "time is not of the essence of the contract." It may, however, be made so by express agreement, or in case of a default by one of the parties by reasonable notice from the other insisting upon performance. If this is not complied with, the contract may be broken off.

A question may arise as to the effect upon the executory contract of the deed given according to its provisions. The usual rule is, that the contract is merged in the deed. Still, if there be evidence of an intent that any of its provisions shall continue in force notwithstanding the conveyance, there will be no merger to that extent. A party may thus have a right to enforce certain provisions in the contract, while as to others he must refer to his deed.

(For further information as to sales of personal property see Blackburn on *Sales;* Benjamin on *Sales*, Am. ed.; Long on do.; Story on do.; Langdell's *Leading Cases;* also the works on *Contracts* of Chitty, Comyn, Parsons, and Addison, and Browne on the *Statute of Frauds*. As to sale of real property consult Sugden on *Vendors and Purchasers;* Dart on do.; Fry on *Specific Performance;* Gerard on *Titles to Real Estate;* Curwen on *Abstracts of Title;* Cruise's *Digest*, Greenleaf's ed. For information on the rules of the Roman law consult the treatises of Pothier, Troplong, Ortolan, etc., etc., and the *Institutes of Justinian*, by Sandars.) T. W. DWIGHT.

**Salmon Breeding and Fisheries.** See FISH-CULTURE, FISHERIES, SALMON, and SALMONES, in CYCLOPÆDIA, and SALMONIDÆ.

**Salmon'idæ** [from the Lat. *salmo*, a "salmon"], a famous family of fishes, containing species among the most gamy and savory of the inhabitants of the water. The body is always elongated, and generally more or less fusiform; the scales cycloid and more or less small; the lateral line distinct, and nearly concurrent with the abdomen; the head conic in profile, more or less compressed from side to side, and covered by a naked skin; the cheeks unprotected, the suborbital bones being small or moderate; the eye moderate, and rather in the anterior than the posterior half of the head; the opercula unarmed and normally developed, the subopercular being moderate, and the interopercular small; the mouth has an oblique lateral cleft extending under the eyes and more or less backward; the upper jaw is not protractile, and is constituted above by the intermaxillaries, and on the sides by the supramaxillaries; the teeth are in the typical forms (*Salmones*) well developed and conic, in others (*Coregoni*) very small or none, and one form (*Plecoglossus*) in part laminated; the branchial apertures are capacious and confluent below; the branchiostegal rays numerous; the true dorsal fin composed of articulated and mostly branched rays, and situated about the middle of the body; a second adipose dorsal is developed far behind; the anal is smaller than the dorsal, and situated below, about midway between the rayed and adipose dorsal fins; the caudal is generally more or less emarginated, or at least truncated, the margin not being convex; the pectoral fins are placed low down, and have a narrow base; ventral fins abdominal and under the dorsal. The skeleton is characteristic, the cranium being in good part cartilaginous, but overlaid by well-developed cartilage and membrane bones; the vertebræ are numerous. The viscera are noteworthy in the following articles: the stomach cæcal; pyloric appendages developed in great number, and closely applied together; the air-bladder is large and simple, and of course communicates with the intestinal canal; the ovaries discharge their eggs into the cavity of the abdomen, from which they are directly excluded. Such are the characters common to all the forms of the family as now limited. From the family are excluded the genera *Argentina*, *Osmerus*, *Mallotus*, etc., which appear to form a peculiar family, distinguished by the skeleton as well as modifications of the intestinal track; as thus limited, it includes the salmons, trouts, charrs, whitefishes, inconnus, and related species. The genera require to be elaborated, those generally adopted being in part heterogeneous and artificial. By Günther, *e. g.*, all the representatives of the family are combined under the genera *Salmo*, *Oncorhynchus*, *Brachymystax*, *Thymallus*, *Luciotrutta* (= *Stenodus*), and *Coregonus*. These naturally fall into three groups—(1) Salmoninæ, including *Salmo*, *Oncorhynchus*, and *Brachymystax;* (2) Thymallinæ, represented by *Thymallus;* and (3) Coregoninæ, of which *Coregonus* is the type. If *Plecoglossus* actually belongs to the family, it is the representative of another distinct sub-family, Plecoglossinæ. (See further SALMON, SALMONES, and FISH-CULTURE, in CYCLOPÆDIA.) THEODORE GILL.

**Sambalpur',** the most eastern district of the Central Provinces, British India, lies between 19° 10′ and 22° 15′ N. lat. and 82° 40′ and 85° 5′ E. lon. Its area is 4200 sq. m. The greater part of this country is an undulating plain, with rugged hills rising in every direction, the underlying rock being, as a rule, highly silicious and indurated; the soil is light and sandy. The principal river is the Mahanadi; the climate is very unhealthy; foreigners suffer terribly from fever. Iron ore of the best description is found in nearly every subdivision. The chief exports are rice, oil-seeds, stick-lac, silk, cotton, and iron; in ordinary years a very high profit is made on these exports. The imperial lines of road run from Raipur to Cattak; wooden bridges are thrown over the principal rivulets; a railway connecting Sambalpur with Nagpur, as well as Cattak, was sanctioned in 1875. The total population was in 1866, 812,348, of whom 497,774 were classed as agriculturists, 666,960 as Hindoos, and 142,758 as aborigines; these belong chiefly to the tribes of the Gonds, Kols, or Dhangars, and are a hard-working, honest, and light-hearted class. Among the Hindoos are excellent weavers and goldsmiths; the Mohammedans are chiefly merchants and government servants. According to tradition, the rajah of Sambalpur acquired his independency from the maharajah of Patna in 1460 A. D.; in 1732 occurred the first collision of these

wild chiefs with the spreading Mahratta power; in 1804 a British force restored the district to the rajah of Nagpur, who had conquered it in 1797, but had been superseded in 1817 by a descendant of the ancient line to the throne, and his successor, Narayan Singh, having died 1849 without male issue, the country was held to have lapsed to the British government, and is now administered by an English deputy commissioner with his assistants. Education has made wonderful progress; there are not less than 442 schools in the district; 13,091 boys and 1273 girls are receiving instruction. The chief town of the same name is situated on the northern bank of the Mahanadi, which is here nearly a mile broad. The native town with formerly narrow streets has of late been much improved; two large streets have been opened; of the 1500 houses most are tiled. The fort is N. W. of the town proper. P. 9450. E. SCHLAGINTWEIT.

**San Francisco Mountain,** the loftiest mountain in Arizona, in N. lat. 35° 10′, W. lon. (from Greenwich) 111° 45′. In 1853, Lieut. Whipple measured the altitude of its base by barometer, and that of its summit by angulation from the base. In 1871, Lieut. Wheeler carried a barometer to its summit. The former gives 12,124 feet as its altitude above the ocean; the latter, 12,561. The mountain stands on the Colorado Plateau, near its southern edge. Near it are the lesser cones of Bill Williams, Kendrick, and Sitgreaves, but they are not united with it. It stands quite alone, and, rising abruptly from the plain to a height of 5000 feet, is a conspicuous landmark from all directions. Its base is 10 miles across, and its form is irregularly conical. Its crest takes the form of a crescent, with the concavity turned to the E. Geologically, San Francisco is partly a mountain of eruption and partly a mountain of circumdenudation. Its upper part is composed of dark trachyte, which was extended before the plain had been degraded to its present level. The tough trachyte opposed a more stubborn resistance to the agents of erosion than did the sedimentary rocks of the plain, and not merely held its own while the latter were worn away, but protected and preserved that portion of the strata which it covered. As erosion proceeded, fragments of the trachyte fell down upon the sedimentary escarpment, and so nearly covered it that it can be detected at a few points only. The strata which are preserved under the trachyte are of Triassic age; the bed which now constitutes the surface of the plain is the upper member of the Carboniferous formation. So the mountain is an insular table of Triassic sandstone, standing on a Carboniferous floor, and capped by a cone of trachyte. Since the removal of the Triassic strata new fissures have opened in the plain, and basaltic lava has flowed out, spreading over the surface in broad black sheets and throwing up hundreds of low cones. From the summit of San Francisco one can look down into the throats of more than a hundred volcanoes. G. K. GILBERT.

**San Gimigna′no,** town of Italy, province of Siena, on the slope of Monte Cornocchio, about 24 miles S. W. of the city of Siena. This town is very old, though its documentary history begins only in the eighth century. Few towns in Italy preserve so much of their mediæval physiognomy, its numerous lofty and picturesque towers recalling the dark and stormy days when every palace in Florence and Siena was crowned by a similar structure. P. 8094.

**San Gine′sio,** town of Italy, province of Macerata, on a high, broad hill overlooked by the neighboring Apennines. Itself a very old town, the numerous remains of still greater antiquity found near it show that a yet older city once flourished here. It is now a place of considerable activity; the climate is very healthful, though subject to violent thunderstorms. P. 6000.

**San Gior′gio Morge′to,** town of Southern Italy, province of Reggio di Calabria, on a high Apennine hill, the foot of which is washed by the Vacale. The old castle is still standing, but the town is almost inaccessible for want of roads. P. 5258.

**San Giovan′ni a Teduc′cio,** town of Italy, province of Naples, one of the most attractive villages in the immediate neighborhood of the great city. It lies on the road between Portici and Castellamare di Stabia, contains some fine villas, and enjoys all the advantages of climate and position peculiar to that enchanting coast. P. 11,116.

**San Giovan′ni in Fio′re,** town of Southern Italy, province of Cosenza. The most thickly populated part of the town is around the old castle, but it has no post-office nearer than Cosenza, 42 miles distant. P. 9500.

**San Giovan′ni in Persice′to** [anc. *Forum Marcelli*], town of Italy, province of Bologna, lying in a broad fertile plain producing rice, hemp, vines, etc. In the tenth century it was governed by its own municipal council, but in the thirteenth it passed under the rule of Bologna, whose fortunes it afterward shared. It is now a thriving town, with a somewhat scattered population of 15,295.

**San Giovan′ni Roton′do,** town of Italy, province of Foggia, pleasantly situated on the southern slope of Monte Calvo, but supplied with water only by a shallow and impure lake. Linen and hempen fabrics are manufactured here to some extent. P. 7745.

**San Giusep′pe Ja′to,** town of Sicily, province of Palermo, about 18 miles S. W. of the city of Palermo. It is a modern town, built in the last century and in part of fragments from the ancient *Jatæ* or *Jetæ*, a city of Greek origin which once occupied the hill above. Many interesting remains of the old city may still be seen. P. 5100.

**San Laz′zaro,** a small island of the Venetian lagoons, first mentioned in the twelfth century, when a hospital for lepers was established there. After the disappearance of this disease it was used for other hospital purposes, until the Venetian republic ceded it to Peter Mechitar and his Armenian followers who had fled before the Turks. The Armenian church and convent contain many objects of interest to the scholar and to the general traveller. Lord Byron spent some time here.

**San Marcel′lo Pistoje′se,** town of Italy, province of Florence, 18 miles N. of Pistoia, on the high-road to Modena, and more than 2000 feet above the level of the sea. The paper and other manufactories are of considerable importance, and the place is resorted to in summer as a healthful retreat from the heat of the lower towns.

**San Mar′co in La′mis,** town of Southern Italy, province of Foggia, at the western foot of Monte Calvo, about 13 miles N. E. of San Severo. The district is mountainous, but very rich in woods and pasturage, and the town itself is the centre of an active internal trade. P. 14,540.

**San Minia′to,** town of Italy, province of Florence, about 27 miles W. of the city of Florence, embracing several distinct fractions, the most important being San Miniato al Tedesco. This was once a fortress, and it took its name from a church erected here about the year 700. Guelphs and Ghibellines were alternately masters of San Miniato for several centuries, but the fortress and adjacent country formed a part of the commonwealth of Florence throughout the period of its greatest prosperity. This town was the cradle of the Bonaparte family. P. 16,187.

**San Pier′ d'Are′na,** or **Sampierdarena,** town of Italy, province of Genoa, occupying a tongue of land about 2½ miles W. of the city of Genoa. Though it may in some respects be regarded as a suburb of Genoa, it has a completely distinct city organization. The churches contain some valuable works of art, and there are some noticeable public buildings as well as private palaces. It is a place of much commercial and manufacturing activity, and its rapid advance in this latter direction has given it the surname of the "Manchester of Italy. P. 17,000.

**San Re′mo,** town of Italy, province of Porto Maurizio, nearly 32 miles E. N. E. of Nice. It is picturesquely situated on a slope descending to the sea, with rich olives behind it, and surrounded by luxuriant lemon and orange orchards. The date-palm also flourishes here as an ornamental tree, but its fruit does not ripen. The old part of the town is characteristically Italian, with narrow, steep, and crooked streets, but the new quarter lies along the shore, and has altogether a modern aspect. San Remo is a favorite resort of invalids, for whom ample accommodations are provided, and is preferred by many to either Nice or Mentone, as being more sheltered than the former and less confined than the latter. P. 12,000.

**Sanscrit.** See SANSKRIT.

**San Secon′do Parme′se,** town of Italy, province of Parma, on the high-road between Parma and Cremona. This town was for centuries the stronghold of the Rossi, a powerful family of Parma. P. 5246.

**Sansepol′cro,** town of Italy, province of Arezzo, in the upper valley of the Tiber, in a charming plain surrounded by mountains, about 23 miles from the city of Arezzo. It is a walled town with a castle, and the churches and other public buildings, very respectable as to architecture, are adorned with pictures by Perugino and other less distinguished but meritorious old artists. This town, named from an oratory erected here in the tenth century by two pilgrims from Palestine, was placed, by papal authority (1163), under the government of the monks of Camaldoli, who had erected a large monastery here. The inhabitants, however, soon rebelled against their spiritual lords, and the governing power was then exercised alternately by two rival families until the town was nearly destroyed by a terrible earthquake (1351), in which 2000 persons are said to have perished. It was soon after rebuilt, and subsequently shared largely in the

internal factions and external wars of the times. It was the episcopal seat of a diocese containing 136 parishes, and was renowned for its woollen and silk manufactories. It is still a place of lively traffic. P. 8068.

**San Severi'no Mar'che,** town of Italy, province of Macerata, at the foot and on the slope of a hill near the right bank of the Potenza. It is a pretty, well-built town, and the new cathedral contains some admirable paintings, among which may be specially mentioned a *Virgin*, long supposed to be by Mantegna, but now known as one of the finest works of Pinturicchio. In the municipal palace, besides many curious portraits, there is an interesting collection of inscriptions and other ancient objects from the old Greco-Roman *Settempeda*, the site of which is in this immediate neighborhood. The churches and convents within the town and in the suburbs are very numerous, and contain valuable pictures. There are several remarkably fine villas on the hills near the town. San Severino was a place of some importance during the Middle Ages. Besides the traffic in agricultural products, the inhabitants are engaged to some extent in manufactures. P. 14,182.

**San Seve'ro,** town of Italy, province of Foggia, in the N. E. corner of the great plain of Apulia, overshadowed by Monte Gargano on one side and by Liburno on the other. It lies about 15 miles N. of the town of Foggia, with which it has railway communication. San Severo is surrounded by a half-ruined wall, two only of the seven original gates being still standing. The general aspect of the town, however, is agreeable, and the inhabitants are, for the most part, in comfortable circumstances, the district being fertile in grain and fruit and not lacking in pasturage. This town, of mediæval origin, was wellnigh destroyed by an earthquake in 1627. It suffered severely from the same cause in 1828 and in 1851. P. 17,124.

**Sanskrit Language and Literature.** The word *Sanskrit* or *Sanscrit*, derived from *sam* (Gr. σύν), "together," and *krita*, "done," with an epenthetic *s*, and signifying "perfected" or "refined," was applied by Hindoo grammarians to the literary language of their race, and by a natural extension of meaning now designates also the same language in its earliest discoverable form, which, as is evident from the Vedas, must have been much simpler in its structure than the Sanskrit proper. It was formerly believed that the Sanskrit was not only the oldest of Indo-European tongues, but the parent of all the others; hence it was considered as identical with the primitive speech of the undivided Aryan stock on the N. W. slopes of the Hindoo-Koosh, while the land afterward known as India was still exclusively occupied by the dark-skinned races, now called Dravidians; but recent advances in ethnological and philological research have dispelled this error, and revealed the primitive Sanskrit as a sister-tongue of the ancient Aryan or Iranian, from which latter sprang the old Bactrian and old Persian languages, while the former gave rise not only to the polished Sanskrit, but to the Pali and the numerous Prakrit languages. (See LANGUAGE and INDIA, in CYCLOPÆDIA.) While it is doubtful whether the palm of antiquity should be awarded to the Sanskrit or to the "old Bactrian" of the Zend-Avesta, the abundance of the literature preserved in the former, and the enormous amount of critical apparatus supplied by the plodding industry of the grammarians, render Sanskrit the most important of languages for the comparative philologist. The period at which it ceased to be spoken as a vernacular cannot be ascertained; some would place it as early as the Christian era, while others contend for a comparatively modern date, or even assert that down to the present time there has always been a considerable number of Brahmans to whom Sanskrit has been imparted as the mother-tongue. However this may be, the knowledge of Sanskrit by Europeans dates only from the close of the eighteenth century, and its rapid spread through the universities of Europe is one of the distinctive features of the nineteenth century. The founder of the critical school of Sanskrit philology, Franz Bopp, survived until 1867, and the study of the text of the Vedas in Europe has been pursued for but little more than a generation.

The usual written character of the Sanskrit is the so-called *Deva-nagari* ("divine city") alphabet, which is of comparatively modern origin, certainly several centuries later than the Christian era. No trace of the history of writing in India can now be found, but from internal evidence the earliest alphabets are believed to have been of Shemitic origin. The Deva-nagari, however, is written from left to right, and extremely complete, expressing with perfect clearness nearly every syllabic combination of letters by single characters, a letter *a* being supposed to be inherent in every consonantal character when no other vowel-sign is subjoined, while the ancient alphabet was notably deficient in vowels and spirants. Notwithstanding the vast number of rules invented by Sanskrit grammarians, word-building and syntax are extremely simple, and in fact consist of nothing but a process of mere aggregation, in which the original words, roots, affixes, and terminations, may be discriminated with the greatest ease. This is an important fact in the practical applications of Sanskrit to purposes of comparative philology, which have in consequence been too frequently limited to the discovery of roots. There is a general agreement of a marked nature between the Sanskrit and the Greek inflectional systems, but the latter language marked a decided advance in the direction of artistic elegance and logical convenience by rejecting some of the too numerous Sanskrit declensions and more than doubling the conjugational forms, while the Sanskrit pursued an opposite tendency, the classical language having dropped, for the most part, the imperative, optative, and subjunctive moods, which may still be traced in the Vedic literature. The Sanskrit vocabulary is wonderfully and even vexatiously copious, abounding in epithets formed *ad libitum* from almost every root.

*Literature.*—The mass of treatises which have been preserved is enormous, but of very unequal value. Not one work in twenty has been, or deserves to be, printed, but until a more careful examination of Indian libraries has been made it is obviously impossible for European scholars to make very positive statements as to what may or may not be found in Sanskrit literature. One great fact, however, is sufficiently certain—the classical Sanskrit contains no historical works in the ordinary acceptation of the term. It would seem to be an inherent defect in the Hindoo mind to attach little importance to *facts* as such, and no one of the thousands of writers who have elaborated to the minutest detail their religious and metaphysical classifications has ever thought it worth while to write the history of his times. Hence, the whole literary as well as political chronology of India is involved in the utmost uncertainty, and the opinions of European scholars vary hundreds of years as to the date of almost every important literary work. The authorship of Sanskrit writings is involved in scarcely less uncertainty. They are all essentially anonymous, and though names of writers have been traditionally ascribed to them, it is rare that any work can be received with confidence as the genuine production of the celebrated sages to whom they are attributed. It is therefore impossible at present to trace the development of Sanskrit literature, or to characterize the style of Sanskrit authors, with any accuracy, as the more important works are hopelessly interpolated, so that the ideas and practices of successive ages are found mixed up in the same poem or treatise. The only classification possible is that of subjects, and the dates and authorship must be understood as approximations.

The chief religious, philosophical, and poetical books are treated in separate articles. (See MAHÂBHÂRATA, RÂMÂYANA, and HINDU PHILOSOPHY.) Upon the substructure of the Vedas and the two great epic poems a vast edifice of comment and mystical interpretation has been reared by the different sects and schools of philosophy under the names of Puranas, Tantras, and Upanishads. The Puranas (Sansk. *pura*, "past"—*i. e.* "ancient") are works which stand to the modern Hindoo religions in the same relation which the Vedas, upon which they are built, formerly bore to the primitive Brahmanical religion—a relation somewhat resembling that of the New to the Old Testament. Like the Vedas and the Mahâbhârata the eighteen Puranas are all ascribed to the mythical Vyasa (*i. e.* "the compiler or arranger"), who is at once the Indian Homer and Plato. They consist of dialogues upon almost every subject, but their chief purpose is to establish the supremacy and inculcate the ritual either of Vishnu or of Siva, the two gods who have replaced as objects of popular worship the pantheon of the Vedas. Eight of the eighteen Puranas may be classified as Vaishnava, six as Saiva; one, the *Markandeya*, is in part the textbook of the worshippers of Durga, the female power or *Sákti* of Siva: one, the *Vamana*, "divides its homage between Siva and Vishnu with tolerable impartiality," and may therefore be presumed to be more ancient than the rest. Prof. Wilson places the authorship of the Puranas between the twelfth and seventeenth centuries. Only three of the Puranas have been edited in the Sanskrit text, the *Bhagavata*, *Markandeya*, and *Linga*, but the contents of all have been subjected to analysis; and the most important, the *Vishnu-Purana*, has been translated by Prof. Wilson (*Works*, vols. iii. and vi., 1864). Considerable extracts are also given in Muir's *Sanskrit Texts*. There are also eighteen *Upa-Puranas*, or "little Puranas," of the same general character, but shorter, more modern, and sectarian, and less authoritative, which are almost unknown to European scholars, as none of them have been printed. The Tantras are the sacred books of the Saktas, or worshippers of the female power of Siva, who constitute a numerous and important class of modern Hin-

doos. They are in the form of dialogues between Siva and his wife, who is variously called Durga, Uma, or Parvati, and consist chiefly of rituals and *mantras*, and prayers containing incantations of supreme efficacy. The *Upanishads*, or works containing the mystical doctrines of the nature of God and his relations to the earth and man, are a branch of the later Vedic literature, though some of them are confessedly of quite modern date, written for the purpose of reconciling philosophy with the sectarian worship of Vishnu and Siva. Some commentators have discovered striking resemblances between the doctrines of the *Kathaka Upanishad* and the Platonic philosophy. The celebrated "code of laws" of Manu or Menu, which has become so well known in Europe through the translations of Sir William Jones, is in reality a religious and ethical treatise, the Hindoos never having had any conception of law in the European sense of the term. The *Yajnavalkya* and *Parasara* are later "codes" of similar character, the latter being the one considered especially binding upon the present age.

In poetry the modern epics are mere variations upon the themes of the two great poems; it will be sufficient to name as the best the works attributed to Kalidasa—viz. the *Raghuvansa*, the *Kumara-Sambhava*, and the *Nalodaya*, the *Sisupalabadha* by Magha, and the *Raghava-Pandaviya* by Kaviraja. In lyric poetry the palm is again to be assigned to Kalidasa for his *Ritusanhara* and *Meghaduta*, of which the only rival in popularity is the *Gita-Govinda* by Jayadeva, devoted to the adventures of Krishna among the shepherdesses.

Dramatic literature is comparatively rare, and the structure of the plays extremely artificial, the hero and chief persons speaking Sanskrit, while the women and servants speak Prakrit. We here again meet with Kalidasa as author of the celebrated dramas *Abhijnana-Sakuntala*, "The Fatal Ring," *Vikramorvasi*, and *Malavika agnimitra*, of which the former, a really beautiful work of art, was translated by Sir William Jones in 1789. The earliest drama is supposed to be the *Mrich-hakati*, "The Toy Cart," attributed to King Sudraka, who reigned in the first century B. C.

The collections of fables known as *Panchatantra* and *Hitopadesa* are undoubtedly of extreme antiquity, since they became known to the Western World under various disguises many centuries since. (See PANCHATANTRA.) The large collection of tales known as the *Kathasaritsagara*, "the Ocean for the Rivers of Tales," by Somadeva of Kashmir, is the Sanskrit equivalent, and perhaps the prototype, of the *Arabian Nights' Entertainments*.

The immense grammatical literature of the Sanskrit language is chiefly based upon the labors of a single writer, Panini, who is usually assigned to the third or fourth century B. C., but in the opinion of some recent inquirers should rather be placed several centuries later. More than 4000 rules are laid down in his work, of which the phraseology is technical in the extreme. The commentaries of Sayana upon the Vedas are next in value to the works of Panini in this branch of literature.

Works upon astronomy, mathematics, music, medicine, architecture, and other of the exact sciences are quite numerous. In lexicography the foremost places belong to Yaska, author of the *Nirukta*, the oldest known glossary of Vedic words, and to Amarasinha, author of the *Amarakosha*, the earliest glossary of classical Sanskrit, believed to date from the third century A. D.

The only modern dictionary with any pretensions to completeness is the great work of Böhtlingk and Roth (St. Petersburg, 1855–75). The most useful manual lexicons are those of Monier Williams (London, 1872) and Benfey (London, 1866). Westergaard's *Radices Linguæ Sanscritæ* is also very useful to the student. The most complete grammars are those of Benfey (Leipsic, 1852) and Bopp (4th ed. 1868). Among the briefer grammatical manuals those of Monier Williams, Müller (1870), Oppert (1859), and Elihu Burritt (1876) deserve commendation. As reading-books for the beginner there are none better than the *Sakuntala* (1853) and *Nala* (1860), both edited by Monier Williams, which may be advantageously followed by the *Hitopadesa* (1864) and *Meghaduta* (1867), as edited by Johnson, and the *Bhagavad-Gita* (Hertford, 1855), by J. C. Thomson. Most of the above-named works may be read in poetical versions, but the most instructive translations from the Sanskrit are Muir's *Sanskrit Texts* (5 vols., 1858–70) and many treatises in the *Works* of Prof. H. H. Wilson (17 vols., London, 1862 *seq.*).

PORTER C. BLISS.

**San'ta Cateri'na Villarmo'sa,** town of Sicily, province of Caltanissetta, near the right bank of the Salso, 12 miles N. of the town of Caltanissetta. It is a fortified place, and the adjacent country is fertile in the common products of the island. P. 6490.

**San'ta Cro'ce sull' Ar'no,** town of Italy, province of Florence, on the right bank of the Arno, 6 miles N. of San Miniato. Florence, Pisa, and Lucca were successively masters here from the twelfth to the sixteenth centuries, and several old monuments of this period still exist. P. 6197.

**San'ta Eufe'mia d'Aspromon'te,** town of Southern Italy, province of Reggio di Calabria, in a very fertile region, about 10 miles S. E. of Palma. P. 6252.

**San'ta Fio'ra,** town of Italy, province of Grosseto, picturesquely situated in the midst of vast masses of peperino, on the S. side of Mont' Amiata, very near the sources of the Fiora. It is surrounded by noble chestnut, beech, and fir forests, and is abundantly supplied with excellent water from the mountain-streams, which are also utilized for mechanical purposes. Santa Fiora was long a fief of the Aldobrandeschi, whose family castle, once strongly fortified, occupies the highest point of the town. Distance from Grosseto, 50 miles. P. 6304.

**Sant' A'gata de'i Go'ti,** town of Italy, province of Benevento, on a hill at the foot of Monte Taburno. It is a walled town, and its ancient castle, famous for many a mediæval siege, is still standing. Great antiquity is claimed for this town, and Etruscan vases, coins, etc., are often found here. P. 8014.

**Sant' A'gata di Pu'glia,** town of Southern Italy, province of Foggia, on a mountain about 10 miles from Bovino, in an olive and vine bearing district. P. 5268.

**Sant' Agosti'no,** town of Italy, province of Ferrara, on the right bank of the Reno, about 7 miles from Cento. It contains some noticeable buildings, and the *campanile* or bell-tower (sixteenth century) is remarkable for its height and for the architecture of the spire. P. 7544.

**San'ta Luci'a del Me'la,** town of Sicily, province of Messina, about 8 miles S. E. of Milazzo, contains several churches and large, well-built convents. The highest point of the town is occupied by an old castle with round and triangular towers and enclosed by lofty walls. P. 6284.

**San'ta Margheri'ta di Beli'ce,** town of Sicily, province of Girgenti, in a district abounding in good pasturage and in all the choice productions of the island, is situated about 15 miles N. W. of Sciacca, and manufactures cottons and leather. P. 7493.

**San'ta Margheri'ta Ligu're,** town of Italy, province of Genoa, beautifully situated on a small bay about 9 miles W. of Chiavari, is a well-built town, and the churches contain both paintings and statuary worthy of notice; among the former should be mentioned two remarkable pictures by Luke of Leyden in the church of San Lorenzo. There are some fine palaces in the neighborhood, and the heights are still crowned by ruins of the strong old castles that once protected the town. The inhabitants of Santa Margherita Ligure are very laborious; the women make large quantities of the lace known as Genoese, and the men, besides many other industries, are extensively engaged in coral fishing, no less than 80 small vessels from this port being constantly employed in this business. P. 7188.

**San'ta Mari'a Ca'pua Vete're,** town of Southern Italy, province of Caserta, in a very fertile district, about 5 miles from the town of Caserta. Santa Maria Capua Vetere occupies the site of the ancient *Capua*, and remains of old catacombs, of the amphitheatre, a triumphal arch, etc., still exist. The present town is well built, and the inhabitants are industrious, prosperous, and better educated than is usual in Southern Italy. P. 17,896.

**San'ta Mari'a in Mon'te,** town of Italy, province of Florence, on a mountain-spur descending to the Arno. It is a walled town, with castle, etc., and dates back to the eighth century. P. 5780.

**Sant' Anasta'sia,** town of Italy, province of Naples, at the foot of Somma, about 5 miles N. E. of the city of Naples, in a region of extreme fertility, but greatly exposed to danger from the eruptions of Vesuvius. P. 6616.

**Sant' An'gelo de'i Lombar'di,** town of Southern Italy, province of Avellino, on a hill about twenty miles from the town of Avellino. This town, the seat of a bishop as early as the close of the eleventh century, was almost entirely destroyed by an earthquake in 1666. P. 6654.

**Sant' An'gelo di Bro'lo,** town of Sicily, province of Messina, about 10 miles W. of Patti, stands near the sea in a fertile district, and the churches and convents possess some works of art worthy of notice. P. 5306.

**Sant' An'gelo Lodigia'no,** town of Italy, province of Milan, at the junction of the Lambro with the Canal Vettabbia, on the high-road between Lodi and Pavia. It is a well-built, rich, and thriving place, with city municipal privileges. P. 8500.

**San'ta Nin'fa,** town of Sicily, province of Trapani, in a very fertile valley about 8 miles from the sea. P. 6685.

**Sant' Anti'mo,** town of Italy, province of Naples, about 5 miles from the city of Naples. P. 8651.

**Sant' Arcan'gelo di Roma'gna,** town of Italy, province of Forli, on the right bank of the Luso, about 7 miles from Rimini. The antiquity of this town is proved by the remains of ancient structures and by the vases, bronzes, and coins found in and near it. The most striking architectural object in the town is a kind of triumphal arch dedicated to Clement XIV. (Ganganelli), who was born here. P. 7938.

**Sant' Eli'a Fiumera'pido,** town of Southern Italy, province of Caserta, about 4 miles from Cassino. P. 5288.

**Sant' Elpi'dio à Ma're,** town of Italy, province of Piceno, on a hill overlooking the Adriatic, from which it is about 3½ miles distant. It is a walled town, with respectable buildings, both public and private. The inhabitants are industrious, and carry on a modest traffic by means of their small harbor. This town occupies the site of the ancient *Cluana*, and interesting Roman and mediæval remains are found here. P. 9177.

**Sant' Era'mo in Col'le** (St. Erasmus), town of Southern Italy, province of Bari delle Puglie, in a healthy and fruitful district, about 11 miles from Altamura. P. 9305.

**San'thia,** town of Italy, province of Novara, about 12½ miles W. of Vercelli. It was anciently the chief town of the Ictimuli, a Lybian race, according to Pliny and Strabo. Charlemagne here received (801) the ambassadors of Haroun-al-Raschid. This town is now made unhealthy in summer by the neighboring rice-fields. P. 5207.

**San'to Stefa'no Quisqui'na,** town of Sicily, province of Girgenti, in a very fertile district about 4 miles from Bivona. The name *Quisquina* is derived from a celebrated sanctuary here dedicated to Santa Rosalia, who is said to have dwelt many years in a neighboring grotto. P. 5593.

**Sanvi'to al Tagliamen'to,** town of Italy, province of Udine, on the right bank of the Tagliamento, about 15 miles from Udine. There is considerable commercial and manufacturing activity here. P. 8578.

**San Vi'to de'i Norman'ni,** town of Southern Italy, province of Lecce, about 12 miles from Brindisi, in the midst of a most fertile plain and in the neighborhood of a very fine forest. P. 7257.

**Sar'no,** town of Southern Italy, province of Salerno, about 15 miles N. of the city of Salerno. It is situated on the western slope of the spur of the Apennines which divides the valley of the Volturno from that of the Sarno, is surrounded by old crenated walls, and the castle of its mediæval dukes is still standing. The manufactories here are numerous and flourishing, silk, cotton, linen, and hempen fabrics being exported. Besides the more common products of Southern Italy, cotton is grown extensively in this vicinity. Sarno is believed to have been a Pelasgian settlement, but its proper history begins in the tenth century. P. 15,382.

**Saron'no,** town of Italy, province of Milan, near the torrent Lura, on the post-road from Milan to Varese. It is a well-built town, containing churches, convents, and other public buildings, unusually rich in objects of artistic interest. The Madonna dei Miracoli, for example (begun 1498), besides a fine exterior, possesses admirable frescoes by Luini, Gaudenzio Ferrari, Cesare da Sesto, Procaccini, etc. Sarcophagi and other remains of Roman and ante-Roman times are found in and near this town. P. 6546.

**Sarza'na,** town of Italy, province of Genoa, about 12 miles E. of La Spezia and 4 miles from the sea, is a walled town, with bastions and a citadel (1268) at the N. E. angle of the town. The cathedral (begun 1200) contains noticeable works of art, as does also the church of San Francesco outside the walls. Candles, leather, cottons, straw hats, etc., are manufactured in this town on a considerable scale. For many centuries Sarzana was subject to Pisa, and shared its fortunes. P. 9533.

**Sas'sari,** town of Sardinia, capital of the province to which it gives its name, in the N. W. portion of the island, about 12 miles from the sea-shore. The commerce of Sassari is almost entirely carried on by the Genoese. The principal exports are oil, grain, and cheese. P. within the old walls, 22,000; including suburbs, 32,674.

**Sassoferra'to,** town of Italy, province of Ancona, on a high hill at the foot of which flows the Sentino. The town is divided into the Castello and the Borgo, the former occupying the crest of the hill, the latter extending to its foot. The Castello contains the best buildings, and in the church of Santa Chiara and also in several private dwellings may be seen some of the best works of Salvi, better known as Sassoferrato. This town occupies the site of the ancient city of *Sentinum*, destroyed by the Lombards in 774, and many antique objects—marble columns, mosaics, bronze tablets, inscriptions, etc.—have been found here. The chief industry of Sassoferrato is the manufacture of nails. P. 7693.

**Sassuo'lo,** town of Italy, province of Modena, near the left bank of the Secchia, about 10 miles S. W. of the city of Modena. Portions of the strong fortifications which made it a place of importance during the mediæval period still exist. It is now a town of considerable manufacturing activity and is otherwise thriving. P. 6245.

**Sat'lej,** originally **Satadru** (the "hundred-channelled"), was also called **Gara** by the Hindoos, and **Langchen-Khabab** ("descended from the mouth of an elephant") by the Thibetans, is the name of the eastern of the five rivers which traverse the province Panjab of the British Indian empire. It issues from the Mansaraur Lake in Western Thibet at an elevation of 15,200 feet, traverses in a western direction the sterile mountain-valley along the northern slope of the Himalaya, bursts through these mountains, and flows in a south-western direction through Bisser, and is 98 feet broad where it enters the plain, which it traverses first in a western, then in a south-western, direction, until it joins the Indus below Sitapur. It is navigable for steamers from its mouth to Adamwatan; at Phillar the Dehli-Lahor Railway crosses it on a bridge. E. Schlagintweit.

**Satpu'ra** ("hundred towns"), a name originally the appellation of that portion of the range which divides the Narbada and Tapti valleys, is now generally applied to the great range or table-land, which, commencing E. of the famous Amarkantak plateau, runs nearly up to the western coast. Accepting Amarkantak as the eastern boundary, the Satpuras have a range from E. to W. of about 600 miles, and in their greatest depth exceed 100 miles from N. to S. The shape of the range is almost triangular; from Amarkantak, 3328 feet above the level of the sea, an outer ridge runs S. W. to a point in the Bhandara district. The average height at the crest of the chain is but little under 2000 feet above the sea; the highest peak, Dhupgarh, in Hoshungabad, rises as high as 4454 feet. Nearly the whole range consists of trap; toward the W. a series of craggy peaks is met with. The Amraoti-Nagpur branch of the Bombay-Agra Railway runs at the southern foot of the range; its continuation from Nagpur to Orissa, touching Satpura, was sanctioned 1875. E. Schlagintweit.

**Saun'ders** (Frederick), b. in London in 1807; established himself in the publishing business in New York in 1836, but, the enterprise not succeeding, he subsequently became for some time an assistant editor of the New York *Evening Post*. In 1859 he received the appointment of assistant librarian of the Astor Library, which office he continued to hold until the beginning of 1876, when he was made chief librarian or acting superintendent. He published *Memories of the Great Metropolis* (1852), *Salad for the Solitary* (1854), *Salad for the Social* (1856), *Pearls of Thought* and *Mosaics* (1858), *Festival of Song* (1865), *About Woman, Love, and Marriage* (1868), *Evenings with the Sacred Poets* (1871), and a revised and illustrated edition of *Salad for the Solitary and the Social* (8vo, 1872).

**Sau'ry Pike,** or **Skipper** (*Scomberesox saurus*), a European marine fish of the family Scomberesocidæ, represented on our Atlantic coast by *S. storeri*, one of the so-called bill-fishes. These fishes go in great shoals, and are very active, leaping far above the surface of the water. They are highly esteemed for the table.

**Scafa'ti,** or **Scafatti,** town of Southern Italy, province of Salerno, about 5 miles from the city of Salerno, on the banks of the Sarno, near the sea. Besides the usual products of Southern Italy, cotton is grown to some extent in this neighborhood, which, however, is on the whole neither very fertile nor very healthful. P. 10,462.

**Scandia'no,** town of Italy, province of Reggio nell' Emilia, is pleasantly situated at the foot of a hill about 8 miles S. E. of Reggio, and is a place of much industry and traffic. The wine of Scandiano has an excellent reputation. For many centuries this town was a possession of the house of Este, and in the old castle, still standing, Petrarch is said to have been magnificently entertained. Scandiano was the birthplace of Bojardo, the author of *Orlando Innamorato*, who also established a printing-press here, the editions issued from which are of great rarity. P. 7742.

**Scar'borough** (John), D. D., b. in the State of New York about 1826; was educated at Trinity College, Hartford, Conn.; graduated at the General Theological Seminary of the P. E. Church in New York; was settled as a minister first at Poughkeepsie, N. Y., and subsequently at Trinity church, Pittsburg, and was elected bishop of the diocese of New Jersey Nov. 12, 1874.

**Scelidosau'ridæ** [Gr. σκελίς, -ίδος, "leg," and σαῦρος, a "lizard"], a family of large extinct reptiles, belonging to the order Dinosauria or Pachypoda, established by Prof. Huxley. As defined by Huxley it includes species in which the integument was (at least usually) provided with a dermal armature in the form of bony scales or spines; the teeth of both jaws had sharp-edged triangular crowns with serrated margins, the serrations being oblique to or parallel with the long axis of the teeth; the rami of the lower jaw were slender, and tapered to their symphysis; the femur at its proximal end had a subglobular articular head, connected with a neck which was set nearly at right angles to the axis of the shaft, while its direction was nearly parallel with the flat surface on which the condyles rested; and the ilium had its anterior prolongation more slender than the posterior. To this family have been referred by Huxley the genera *Thecodontosaurus, Hylæosaurus, Polacanthus* (?), and *Acanthopolis*. These forms were inhabitants of Europe during the Triassic period. (See Huxley, *On the Classification of the Dinosauria*, in the *Quarterly Journal of the Geological Society of London*, vol. xxvi. pp. 32–50, 1870.) THEODORE GILL.

**Seabury Mission.** See BISHOP SEABURY MISSION.

**Sel'la** (QUINTINO), b. at Biella, Italy, July 7, 1827, of a family then and still largely interested in manufactures; educated at the University of Turin; received a special training at the School of Mines at Paris; successively filled the professorships of applied geometry and of mathematics at Turin, and was long employed in the general direction of the mines of Northern Italy; was elected to the national parliament in 1861, and was minister of finance in 1862, 1864–65, and 1869–73. His *Lezioni di Cristallografia* (Torino, 1867) and his numerous memoirs on that and other branches of science are widely known, and his paper *Sulle forme cristalline di alcuni sali di Platino a del Boro adamantino* created almost universal attention among mineralogists. He is a member of many scientific and literary bodies, and is president of the Accademia dei Lincei.

**Sel'lon** (PRISCILLA LYDIA), b. in England in 1821, daughter of a captain in the royal navy; was for many years engaged at Plymouth and Devonport in providing for the educational and spiritual destitution of the lower classes in those cities by the establishment of industrial infant and ragged schools under the auspices of the late bishop of Exeter, and eventually founded for that purpose, at Devonport in 1845, the semi-conventual order of "Protestant Sisters of Mercy," modelled upon the Roman Catholic orders for a similar purpose, of which similar "sisterhoods" were soon founded in London and other large cities of Great Britain. Some of the members were sent to the hospitals of the Crimea in 1854, and a body of "Missionary Sisters," organized by Miss Sellon, went to the islands of the Pacific in 1864 under the patronage of the Church of England Missionary Society.

**Semitic Languages.** This group of tongues was by Jerome called "Oriental," a designation which is no longer sufficiently distinctive, and might with as much propriety be applied to the languages of India or China as to those of Syria or Arabia. The name "Syro-Arabian" has also been proposed, which is formed after the analogy of Indo-European by combining the extreme limits of the territory which these languages have occupied. The most prevalent name is "Semitic," which is justified by the fact that the principal nations belonging to this family were descended from the patriarch Shem. (See Gen. x.)

The most important and best-known languages of this family are the Aramean (including Chaldee and Syriac), Hebrew, Arabic, and Ethiopic. Of these, the Arabic is the most, while the Aramean is the least, copious, flexible, and soft. The Hebrew, which lies geographically between them, occupies an intermediate position also in respect to these qualities. The Samaritan is a corrupt form of Aramean. The Phœnician language, or that of Tyre and its colonies, is shown by its scanty remains, mostly inscriptions, to be Semitic; and the cuneiform inscriptions have established the same thing with regard to the Assyrian. Some scholars have contended that the Coptic belonged to this family, but without sufficient reason. Its chief modern representative is the Arabic, to which a few unimportant local dialects may be added; *e. g.* the modern Syriac, the Amharic (descended from the Ethiopic), and the Maltese (a corrupt Arabic).

The proper home of the Semitic tongues is the territory bounded by the Tigris on the E., the Mediterranean Sea on the W., Mount Taurus on the N., the Red Sea and Arabian Gulf on the S., and embracing Syria, Mesopotamia, Palestine, and Arabia. They have occupied this region from the dawn of history, and they have rarely, and only to a limited extent, passed beyond it, chiefly as carried by Phœnician trade and by Mohammedan conquest.

The Semitic, like the Indo-European family, belongs to the inflective as distinguished from the agglutinative and isolating languages. The prime distinction between these two great families of cultivated tongues is that in the Indo-European the formation and flexion of words is conducted by the external addition of significant syllables, but in Semitic by typical forms, and for the most part internal changes. Thus, from the English root "love" come such derivatives as *lover, loving, lovable, beloved, lovely, loveliness, unloveliness*, in which each of the various prefixes or suffixes was in its origin separate and independent, with a force and meaning of its own, but has in usage sunk to a mere formative or modifying adjunct. In Hebrew, on the other hand, from the root *gdl* came such words as *gâdal*, "to be great;" *giddâl*, "to cause to grow;" *higdîl*, "to make great;" *gâdêl*, "growing great;" *gâdôl*, "great;" *giddêl*, "too great;" *gôdel*, "greatness;" *gdullâ*, "magnificence;" *gâdîl*, "tassel" (twisted together and so enlarged); *migdâl*, "tower" (something great). Here, except in the last example (where the prefixed *m* is of pronominal origin), there are no significant appendages, but merely forms following an established model to which a special signification has been attached. The clearest illustration of this is perhaps to be found in the verbs, which are modified by a series of symbolic changes known as species or conjugations. Thus, in Arabic the simple idea of the verb in its active form is expressed by employing the consonants of the root in their single power, and giving to each the simplest of the short vowels, *a*; thus, *katala*. This *light* form, as it has been technically called, may be loaded in various ways, each of which expresses the inclining or determining of the thought in some particular direction. A consonant may be doubled, thus giving new energy to its pronunciation and symbolically adding energy to the idea conveyed, or some special force may be imparted by lengthening or prefixing a vowel, and thus protracting the utterance of the word, its idea being intensified in some particular direction by its being thus dwelt upon or extended in one or other of its parts. Thus, *kattala* is intensive; *kâtala*, relative; *aktala*, causative; *iktalla* or *iktâlla* (the *i* is purely euphonic) denotes color more or less intense. Middle—*i. e.* reflexive or reciprocal—forms are produced by prefixing (or inserting) the consonants *n* or *t* to the active forms; thus, *inkatala, iktatala, takattala, takâtala, istaktala* (with euphonic *s*). Passives are formed by substituting the obscurer vowels *u* and *i* for the simple open *a*; thus, *kutila, kuttila*, etc. All these several forms express definite modifications of the thought, not by combining separate significant elements, but by symbolically attaching a given phase of thought to words moulded after a particular pattern.

The compounding of words, which enters so largely into the constitution of Indo-European tongues, is entirely unknown to the Semitic, the only semblance of it or approach to it being in the inseparable particles, the fragmentary pronouns, and the construct state of nouns. Particles of but one consonant (the article, conjunction, or prepositions) are attached in writing and pronunciation to the following word. So pronouns, whether the subject or object of verbs, or dependent upon other parts of speech, are reduced to fragmentary forms, which are attached to the words to which they belong. Thus, the Hebrew *ûmêartsô* ("and from his land") is written as one word, though it embraces a conjunction, preposition, noun, and pronoun; but this is a mere aggregate, in which each element retains its separate force and value unchanged, not a compound, in which the several constituents combine in the expression of one idea.

When one noun is modified in meaning by another, Indo-European tongues attach a case-ending to the latter, suggestive of this relation; Semitic tongues, for the most part, adopt a method the reverse of this—viz. the construct state, which is a change in the modified noun, and that not by an added ending, but an interior abbreviation, the first word being, as it were, hurried over to reach the second, which completes the sense; thus, Heb. *bayith*, "house," but *bêthêl*, "house of God," *domus dei*. Expressions of this sort, even when employed as proper names, are, however, strictly speaking, phrases rather than compound words.

Several remarkable consequences flow from this fundamental peculiarity of Semitic tongues—viz. their adoption of the internal and typical method of word-formation and inflection as opposed to that of compounding them with added significant elements. One is the superior stability and prominence of the consonants as compared with the vowels. The former constitute the permanent framework of words to which the essential idea is attached, while the intervening or accompanying vowels are subjected to numerous changes in producing the various typical forms suggestive of the various shades and modifications of the thought. In Indo-European tongues the ultimate roots consist of a syllable—*i. e.* either a vowel alone, or a vowel with one or more consonants, the vowel being as essential and im-

mutable as the consonants. The Semitic root, on the other hand, is purely consonantal; no vowel enters into it whatever. The root is wholly abstract and unpronounceable: the insertion or addition of vowels converts it from a root into a word of some particular form and determinate signification. This higher rank of the consonants and subordinate function of the vowels are reflected in the Semitic alphabets, in which consonants are denoted by distinct letters or characters, while the vowels are either not written at all, or expressed by points or minor appendages to the letters.

A further consequence is, that Semitic roots as a rule are triliteral. In order that the introduction of given vowels may produce forms of a fixed type to represent different classes of words, it is necessary that the roots should themselves be formed upon one unvarying model. Biliteral roots would not admit of sufficient variation; three is the lowest number of letters consistent with the variety of forms required by the necessity of the case.

A still further consequence is the poverty of the Semitic tongues in inflections as compared with the Indo-European. The number of inflections possible where these are formed by welding external significant additions to the root is practically unlimited. But where these are discarded the resources at command must be restricted within narrow bounds. The same limitation tends to restrict the range of mutual divergence in the members of the Semitic family. Instead of branching out into numerous divisions and subdivisions as the Indo-European family, the number of its dialects is small, and their differences are more like such as obtain between members of the same branch of the Indo-European—between English and German, for example, or French and Italian—than between distinct branches, as the Iranian and Italic, or Teutonic and Celtic. It likewise conspires with the immobility of the Orientals and their fixed habits and modes of life to preserve the languages from change, so that in their comparative freedom from the attrition and decay of words incident to Occidental tongues Renan calls them "languages of steel."

The first main peculiarity which affects the structure of these tongues has now been sufficiently illustrated and traced to its consequences. A second peculiarity affects the style of thought; they are more pictorial and less reflective than the Indo-European. Thus, the Semitic languages have uniformly but two genders. The distinction of sex existing in living beings is carried by them throughout inanimate nature, as well as into all abstract terms and words expressive of mental conceptions. Again, while many words in Occidental tongues are figurative in their origin, the metaphor is lost sight of as they are ordinarily used, and is only brought to light by philological analysis. But in Semitic words the original metaphor abides in the consciousness of those who use the language as palpable as when it was first employed. Thus, anger is variously denominated in Hebrew by words that denote excited *breathing*, *heat*, *burning*, *boiling*, *breaking* asunder with violence, and *roaring*. Discouragement or despair is a *melting* of the heart, the reins, or the knees. The essence of anything is its *bone*, etc., etc.

Connected with this is a want of that precision or exactness of expression which the Indo-European labors to attain. The pictorial and imaginative Semite barely suggests the thought in outline or in substance, which he leaves to the intelligence or fancy of his hearer to fill up and complete. Thus, he requires but two tenses, deeming it sufficient to refer all action to the past or to the future; the Indo-European not only distinguishes from both these the vanishing present, but makes distinctions in the regions of the past and the future themselves by the perfect, imperfect, and pluperfect, or by the simple future and future perfect, and still further notes the mode of action as indicative, subjunctive, potential, optative; of all which the Semite makes no account, or leaves it for the most part to be inferred from the connection. The Semite, again, never employs long and complicated periods. He utters his sentences in succession, but without concatenation or exhibiting their mutual relations of dependence. Whether the clauses be cumulative or adversative or inferential, they are simply joined by the copulative *and*, the precise nature of the connection being left to the determination of the hearer or reader.

This quality of the Semitic tongues rendered it eminently fitting that one of them should be selected to record the revelation of the Old Testament, which was one of types and figures, while an Indo-European tongue was made the vehicle of the New Testament, in which truth was set forth in completed form, with precision of language and in its logical relations. It was likewise fit that the stationary Semite should receive that divine Word which was to be held from generation to generation in its native seats, but that what was to be propagated over the world should be committed to the restless and enterprising Indo-European.

It has already been stated that the Semitic alphabet is purely consonantal. It contains some consonants peculiar to itself, and which other races find great difficulty in pronouncing, particularly among the gutturals, which are remarkable for their number and variety. The written characters of all Semitic tongues (except the Assyrian cuneiform) are traceable to one common source, the Phœnician, from which the Indo-European alphabets are likewise descended; and except in the case of the Ethiopic they are traced and read from right to left.

The question whether a pre-grammatical relationship can be scientifically demonstrated between the Semitic and Indo-European families of tongues has been vehemently disputed, and can scarcely be said to have reached a definitive conclusion yet. It is sufficient, perhaps, to say upon this point, that their common origin is not disproved by the divergence existing between them, great as this is acknowledged to be. (See HEBREW LANGUAGE.) W. H. GREEN.

**Seni'se,** town of Southern Italy, province of Potenza, at the foot of a hill on the right bank of the Serrapotamo. P. 5050.

**Sepi'no** [anc. *Sæpinum*], an old Samnite city of Southern Italy, province of Campobasso. Interesting remains of the ancient town still exist. (See Keppel, *Excursion in the Abruzzi*, vol. ii. p. 92.) P. 5300.

**Sere'gno,** town of Italy, province of Milan, nearly on the railway between the city of Milan and Como. It is as old as the seventh century, and has been the theatre of some curious incidents in modern history. In 1796 the women of Seregno rose against the conscription, prostrated the liberty tree, and headed an insurrection so tumultuous that Bonaparte was with difficulty induced to rescind an order for the bombardment of the town. In 1848 the Austrians dealt severely with it for its turbulent patriotism. P. 6800.

**Seri'no,** town of Southern Italy, province of Avellino, on a hill on the W. slope of Monte Fermolo, near the right bank of the Sabato. The ruins of the ancient *Sabatia*, mentioned by Livy, may be seen near this place. P. 6306.

**Sermi'de,** town of Italy, province of Mantua, on the right bank of the Po, on the railway between Mantua and Verona. It is a place of more than usual industry. P. 6655.

**Ser'pents** [Lat. *serpens;* Gr. ἕρπειν, to "creep"], a group of the class of reptiles, distinguished by naturalists as an order under the scientific name Ophidia (Gr. ὄφις, a "serpent"). They are recognized by their very elongated and flexuous body and the absence of true external limbs; the body regularly graduates into the tail, and there is no abrupt distinction between the two; the back and sides are covered with imbricated scales, generally imbricated, rarely granular, while the lower surface is generally covered in front of the anus with a row of very broad plates, and behind the anus with usually two, sometimes one, row; sometimes, however, the scales extend upon the abdomen as well as on the sides and back; the head is covered with plates, which in the typical forms are developed as follows from before backward: (1) one rostral, (2) two prefrontals, (3) two postfrontals, (4) a vertical in the middle and upon each side thereof, and over the eye a superciliary; and (5) two occipitals; the lips above and below are bordered respectively by the upper and lower labials, and the chin by peculiar oblique plates; in others the scales encroach upon the head, and are little differentiated from those on the back and sides. The principal characteristics of the order, in contrast with those of others, especially as given by Prof. Huxley, are as follows: The skull has the floor of the cranium nearly flat, and the vertical height of its cavity diminishes gradually in front, so that it remains spacious between the eyes in the frontal regions generally; the periotic region is not produced into parotic processes; the walls of the cranial cavity are well ossified in its anterior as well as posterior half, and the bones which gird it are firmly united; the premaxillaries are generally rudimentary, and represented by a single small bone, which is connected with the maxillaries only by fibrous tissue; the palatine bones never unite directly with the vomer or with the base of the skull, but are usually connected with the maxillaries by transverse bones, and by the pterygoids with the movable quadrate bones; thus the connection of the palato-maxillary apparatus with the rest of the skull is more or less lax, and in the typical species exceedingly so; in certain worm-like forms, however, this is not the case; the lower jaw has its rami connected at their symphysis, generally by ligamentous and extremely elastic fibres: the result of the mechanism exemplified in the typical serpents is, that the mouth-pieces are extremely dilatable, and hence prey of much greater diameter than that of the serpent in its ordinary condition can be ingested. The teeth are acute, and directed more or less backward, and are generally developed simply upon the maxillary, palatine, and dental

bones; sometimes on other bones as well; *e. g.* the premaxillary and pterygoid; sometimes (as in Uropeltidæ) they are wanting in the palatines, and in at least one genus (*Rhachiodon*) the inferior spines of eight or nine of the anterior vertebræ are developed by tooth-like processes. In the typical species they are in a long series on each of the bones designated; in the specialized poisonous species, however, only poison-fangs are developed on the maxillaries, but the rows on the palatines and dentaries exist as in the typical species; in an intermediate type, but containing very poisonous species, there are also rows of teeth behind the poison-fangs. The vertebræ and ribs are very numerous, and every vertebra from the head to the end of the tail has its ribs: they all have ball-and-socket articulations, the anterior extremity of each vertebra being developed into a ball, which articulates with a corresponding cup in the posterior face of the antecedent vertebra; they are provided with processes connected with each other, and limiting the motion of the animal to lateral undulations; the ribs are articulated with the vertebræ by ball-and-socket joints. True limbs, as already remarked, are wanting, and the anterior are not present in all forms, but the posterior are in some types represented by rudiments which are occasionally exserted and appear as hooks. The alimentary canal is differentiated into an œsophagus, a stomach, a small intestine, and a large intestine: the small intestine has its folds united by fibrous tissue and enclosed by a common sheath of peritoneum. A cloaca passes all the contents of the viscera. The lungs are unequal in size, and in the typical forms the disparity is very great, the left one usually being the smaller of the two; to such an extreme is this disparity sometimes carried (especially in the venomous species) that only one of the lungs is developed: the form of the lungs is that of an elongated sac, in which the walls are produced into numerous septa "which render the cavity highly cellular near the bronchus, while at the opposite end they become smooth and but little vascular; in this latter region the lung may receive its blood from the systemic, and not from the pulmonary, circulation." The bronchus opens directly into the lung. The heart is divided into two auricles and a single very imperfectly-separated ventricle.

Although serpents are more or less familiar to every one, their movements are often misconstrued. They progress by sinuous flexures from side to side, and are incapable of the vertical undulating movements which are sometimes accredited to them in pictorial illustrations. Though destitute of members, the typical species can progress with great rapidity upon surfaces that are rough; and this progression is greatly facilitated by the transverse plates with which the abdomen is covered. Many serpents are also capable of ascending trees, and almost or even quite vertical surfaces; but they are quite unable to progress on polished or glass-like surfaces, and are there utterly helpless. Their habitats are various: some live in marshy regions, some in rocky, some on sandy desert plains, others among the trees, and still others burrow in the earth; again, some affect fresh waters, while a few are even modified as sea-serpents and for swimming in the ocean. Among the most noteworthy perhaps are species of rattlesnakes, found in the deserts of the south-western portion of the U. S., the sea-serpents, or Hydridæ of India, and the worm-snakes or scolecophidians. The sea-serpents in question are not to be confounded with the mythical sea-serpents, for the Hydridæ are comparatively small species, whose tail is strongly compressed and adapted for swimming, and which have small poison-fangs. The Scolecophidea, in part at least, burrow in the earth, and thus by their habits, as well as form, justify the term of worm-like snakes.

Most serpents are oviparous, and lay eggs whose shell is generally more or less soft and yielding, but which have, at the same time, a greater or less amount of lime; and sometimes this is developed in sufficient quantity to give a considerable rigidity to the shell: other serpents are ovoviviparous. The distinction, however, between these two modes of generation is very trifling, and species not distantly related, and at least belonging to nearly-allied genera, sometimes contrast in this respect. So slight, indeed, is the value that even there may be individual exceptions to the mode prevalent in a species; so that, for example, a normally ovoviviparous species may exclude its eggs before the birth of the young. Nevertheless, as a rule it may be said that the innocuous species are oviparous, and the venomous ovoviviparous, but the exceptions are numerous. The eggs are generally excluded in a chain, being connected by a viscous substance. In most cases the mother, after laying her eggs, leaves them to be hatched by the sun or decaying vegetable matter, but some species coil themselves around the eggs and thereby hatch them. Many species go with their young for some time after birth, and protect them from enemies. It is now quite well ascertained that some species open their mouth at the approach of danger, and receive therein their young, which are allowed to depart therefrom unharmed.

The principal subdivisions of the order are based upon modifications of the cranium and the dentition. The generally-admitted groups are (1) Solenoglypha, (2) Proteroglypha, (3) Asinea, (4) Tortricina, and (5) Scolecophidia; these are enumerated in an order inverse to their evolution, the first containing the most specialized forms of the order, and the last the most generalized types. The Solenoglypha, Proteroglypha, and Asinea best express the general idea of a serpent; while the Tortricina and Scolecophidia are rather worm-like in their appearance, and approach, most of the ophidians, to the lizard type. The Solenoglypha are those serpents which are provided with great poison-fangs on each side of the upper jaw, and include the Crotalidæ (rattlesnakes, etc.), Viperidæ (vipers), Causidæ, and Atractaspididæ. The Proteroglypha are also poisonous serpents which have less modified maxillary bones, although the poison-fangs are well developed, and embrace the families Najidæ, Elapidæ, and Hydrophidæ. The Asinea include the great bulk of non-venomous serpents, and are divisible into quite a large number of families, of which are recognized by Cope the Rhabdosomidæ, Colubridæ, Homalopsidæ, Achrochordidæ, Lichanuridæ, Boidæ, Pythonidæ, and Xenopeltidæ. The Tortricina are worm-like snakes, which have teeth developed on the ecto-pterygoid and maxillary bones, and are represented by a few species, forming the families Uropeltidæ and Tortricidæ. The Scolecophidia are worm-like snakes, destitute of teeth on the maxillary and ecto-pterygoid bones, and its few species have been combined under the families Stenostomidæ and Typhlopidæ.

The order is represented by about 1000 living species. The geographical distribution of its members is to a large extent determined by thermometrical conditions. The representatives of the order as a whole affect hot regions, and are averse to cold. They are absent altogether in the extreme northern and southern countries, and sparingly developed and hibernating during cold weather in the temperate regions, but almost equally abundant in the tropical regions of the several quarters of the globe. In the North American or "Nearctic" realm are found, according to Cope, 132 species of the order; of these, 19 belong to the family Crotalidæ (including the rattlesnakes and copperheads), 3 to the Elapidæ (the so-called coral snakes), 103 to the Colubridæ (almost all of the common snakes), 2 to the Boidæ, 3 to the Lichanuridæ, and 2 to the Stenostomidæ. The number of species increases toward the S., as does also the proportion of the venomous to the harmless species. In the Northern States only three species of poisonous snakes (the scale-headed and plate-headed rattlesnakes and the copperhead) occur, and the greatest number in any one region within the U. S. are found in Arizona and New Mexico. The poisonous species are confined to the families Crotalidæ and Elapidæ, and number only 22 species, or one-sixth of the total of the ophidian fauna of the country. (See Poison of Serpents, Thanatophidia, in Cyclopædia, and the names of different families, as well as other groups and species.) Theodore Gill.

**Serran'idæ** [from the Lat. name, *Serranus*, of a Mediterranean form of the family], a family of fishes of the order Teleocephali and sub-order Acanthopteri, containing numerous species found in the tropical and, to some extent, temperate seas of the globe. The body is more or less compressed; the scales ctenoid, imbricated, and generally of moderate or small size; the lateral line entire and nearly concurrent with the back; the head compressed, and more or less pointed forward; the cheeks unarmed; the opercular bones generally armed, the preoperculum being serrated and the operculum spinigerous; the mouth with a lateral cleft; the upper jaw slightly protractile; teeth conic, and generally dense and in numerous rows on the jaws as well as palate; branchial apertures large and confluent below; branchiostegal rays generally seven, rarely six, on each side; dorsal fin composed of a longer spinous and shorter soft portion; anal like the soft portion of the dorsal, and with, generally, three spines; caudal distinct; pectorals well developed, with branched rays; ventrals thoracic, each with a spine and five branched rays. The stomach is cæcal, and pyloric appendages are developed, generally in moderate, but sometimes in very large, numbers. The skeleton has typically the vertebræ developed in normal number—*i. e.* dorsal 10 and abdominal 14. The exact limits of this family are not yet determined, it being uncertain to what extent it conflicts with the families Pristipomatidæ, Sparidæ, etc.; but the typical genera are *Serranus* and its subdivisions and allies, *Paralabrax*, *Epinephelus*, *Trisotropis*, *Plectropoma*, *Hypoplectrus*, *Centropristis*, *Anthias*, and numerous others. In the Atlantic coast waters of the U. S. are to be found twelve species, belonging to

the genera *Epinephelus*, *Trisotropis*, *Promicrops*, *Centropristis*, *Triloburus*, *Diplectrum*, *Dules*, *Hyporthodus*, and *Promicropterus*, and in the waters of the Pacific slopes four species, representing the genera *Paralabrax* and *Stereolepis*. The variation in size among the species of the family is great, some being only a few inches long, while others exceed seven or eight feet. Among the gigantic forms are the *Promicrops guasa*, or jew-fish of the Southern States and Cuba, of which a skeleton and cast of a specimen of 700 pounds weight is in the Smithsonian Museum, and the analogous *Stereolepis gigas*, or jew-fish of California, which appears to attain an equally large size. Almost all the species are esteemed as food. They are carnivorous, and feed on smaller fishes with avidity.

THEODORE GILL.

**Sew'ard** (AUGUSTUS H.), son of William H., b. in Auburn, N. Y., about 1825; graduated at the U. S. Military Academy in 1847, and entered the 8th Infantry as brevet second lieutenant; was engaged in the war with Mexico 1847–48; in active service in Texas and the Indian Territory 1848–51, and on Coast Survey duty 1851–59; promoted to be captain 5th Infantry in the latter year, and accompanied the Utah expedition 1859–60, serving subsequently in the Navajo expedition in New Mexico; was appointed paymaster in the army Mar. 27, 1861, and was brevetted lieutenant-colonel and colonel for faithful and meritorious services during the war. D. at Montrose, N. Y., Sept. 11, 1876.

**Seward** (FREDERICK W.), b. at Auburn, N. Y., July 8, 1830, son of William H.; educated at the academies of Albany and Auburn; graduated at Union College in 1849; studied law, and was admitted to the bar at Rochester in 1851, and to the U. S. Supreme Court in 1854; was associate editor of the Albany *Evening Journal* up to 1861; assistant secretary of state of the U. S. 1861–69; member of the assembly in 1874; edited *Autobiography of William Henry Seward, 1801–34*, with *Memoir* (1877); and is again assistant secretary of state of the U. S.

**Sha'ler** (ALEXANDER), b. in Haddam, Conn., Mar. 19, 1827; for many years prominently identified with the New York State militia, which he entered as a private in 1845, and in 1867 became major-general 1st division N. G. S. N. Y.; was major of the 7th New York on the outbreak of war in 1861, but in June was appointed lieutenant-colonel 65th New York Vols.; became colonel July, 1862; served with the Army of the Potomac in its many engagements; in command of a brigade, 6th corps, from Mar.–Nov., 1863; commissioned brigadier-general of volunteers May 20, 1863; commanded military prison at Johnson's Island, O., during winter of 1863–64. Returning to the field at the opening of the campaign in 1864, he was taken prisoner May 6, and held three months in Charleston; subsequently to his exchange he served in the South-west until mustered out. Brevet major-general for gallant and meritorious conduct. As president of the Metropolitan Fire Department 1867–70, and a commissioner of that department 1870–73, he contributed largely to the present efficient condition of that body. Is president of the National Rifle Association, also of an automatic telegraph company.

**Shar'key** (WILLIAM LEWIS), b. in Tennessee in the beginning of this century, but removed with his parents to the Territory of Mississippi in 1804; graduated at Greenville College, Tenn.; studied law in Natchez, under Turner and Metcalf; was admitted to the bar in 1822; began to practise at Warrenton; moved in 1825 to Vicksburg; was elected a member of the State legislature in 1827, and chief-justice of the high court of errors and appeals in 1832, to which position he was re-elected four times in succession; settled in 1850 at Jackson; was appointed provisional governor of Mississippi in 1865, and elected U. S. Senator in 1866; removed to Washington, and d. there Apr. 29, 1873.

ALEXANDER H. STEPHENS.

**Sheep** [Lat. *Ovis*], a genus—or, according to some authors, a group of genera—of mammals belonging to the family Bovidæ, group Pecora or Ruminantia, and sub-order Artiodactyli, of the order Ungulata. The form is familiar in connection with the common sheep, which, in its ordinary variety, tolerably well exemplifies all species, save that the trunk is more massive and the legs more slender, and consequently the aspect less graceful, than in the wild species; the head is rather broad; the forehead flat or concave; the nose is naked; the chin is not bearded, either in the males or females; the horns arise behind the orbit, are more or less spirally curved and the apices directed sidewise, and are somewhat trihedrally compressed and longitudinally angulated on the adorbital sides, and have the surface transversely rugose; though developed generally in both sexes, they are not infrequently wanting in the females; the incisors are nearly equal in size, and sloping; the molars destitute of supplemental lobes; the hoofs mostly triangular, and shallow behind; the tail is diversiform, but generally quite short, though sometimes well developed; the skull, according to Turner, is characterized by a flat basioccipital, which is more or less expanded anteriorly by the extension of the anterior pair of tubercles, the posterior ones being small; the auditory bullæ are small; a more or less marked round suborbital depression exists, but there is no fissure; the masseteric ridge ascends high before the orbit. The species are quite numerous, and the latest systematic writer on the group, Dr. W. Peters, enumerates twenty-one. These have been combined by that author under the genus *Ovis*, but by a few (*e. g.* J. E. Gray) they have been separated into as many as four genera. The geographical range of the genus is moderately extensive, and covers several of the islands of the Mediterranean (Corsica, Sardinia, and Crete), the greater portion of the temperate parts of the highlands of Asia and the Rocky Mountains of North America; while, as is of course well known, in a domestic state its distribution is almost coequal with that of man. Of the wild species, two at most (*Ovis montana* and *O. californica*)—and perhaps only one—are inhabitants of America, the others being mostly Asiatic. By Dr. Peters the species have been grouped under two sub-genera—*Ovis* and *Musimon*. (I.) *Ovis* is characterized by having each horn form a complete whorl of a spiral, the right curving to the left, and the left to the right, and the direction of the points is always forward, and, in general, also outward. To this belong the following species: (1) *O. montana*, inhabiting the Rocky Mountains northward; (2) *O. californica*, the Rocky Mountains southward; (3) *O. nivicola*, Kamtschatka; (4) *O. borealis*, the mountains of the highlands of Pjassina and Chatanga in Northern Siberia; (5) *O. Hodgsoni*, the Himalayas and Thibet; (6) *O. Blythi*, also Thibet; (7) *O. argali*, Eastern Mongolia and around Lake Baikal; (8) *O. collium*, the lower steppes to the northward of Lake Balchat; (9) *O. Karelini*, the Tjantjanish mountain-system; (10) *O. Polii*, the sources of the Kaschgar-Darya and Amu-Darya; (11) *O. Heinsii*, Western Tjantjan; (12) *O. nigrimontana*, Karatan, N. W. of the preceding. (II.) *Musimon* is distinguished by the horns forming an incomplete whorl of a spiral, of which the right turns toward the right, and the left toward the left; the points are directed inward. To this belong the species (13) *O. nahoor*, Himalaya, about the sources of the Ganges; (14) *O. burrhel*, Himalaya; (15) *O. orientalis*, Northern Persia; (16) *O. anatolica*, Asia Minor, etc.; (17) *O. cypria*, Cyprus and Candia; (18) *O. cycloceros*, the North-western Himalayas in Punjaub; (19) *O. vignei*, Little Thibet, etc.; (20) *O. musimon*, Sardinia and Corsica; and (21) *O. arkal*, the eastern side of the Caspian Sea.

The domestic sheep is generally supposed to be derived from the musimon of Corsica or the argali of Asia. Whatever may be its origin, however, it has deviated considerably from the wild stock, and, like most of the long domesticated animals, has broken into a great number of varieties, some of which are very marked and distinct. Among the most eccentric of these varieties are the fat-rumped sheep of some parts of Asia, and especially of Tartary, distinguished by an excessive development of fat upon the buttocks and its long, pendulous ears; the Fezzan sheep of Africa, noteworthy for its arched forehead, pendulous ears, long legs, and the mane on the neck and shoulders; both of these species thus contrast greatly with the wild types, and even the generic diagnosis must be widened to admit them in the genus. The fine breeds prevalent among the modern civilized nations are to a great extent due to the intermixture of the celebrated stock of merino sheep, which is supposed to have originated in Spain, or which at least has been imported from Spain into other countries to improve their breeds. The merino sheep is celebrated for the fineness of its wool, which is also developed on the forehead and cheeks, and is very long, fine, soft, and curly. The care which has been devoted to sheep-culture in various countries, such as the U. S., England, etc., has resulted in the development of breeds which are even superior to the original merino. While many are raised for the fleece, others are cultivated chiefly for food, and in some countries mutton is the principal meat diet. In the U. S., in 1870, the principal sheep-raising State was Ohio (which produced 4,928,635); California, the next, yielded 2,768,187; and New York, the third, raised 2,181,578; the other States furnished each less than 2,000,000, and those producing between 2,000,000 and 1,000,000 in a descending order were Minnesota, Pennsylvania, Indiana, Illinois, and Wisconsin. A report of the department of agriculture in Jan., 1874, gives the number then in the U. S. as 34,038,200, valued at about $89,000,000.

THEODORE GILL.

**Shep'hard** (E. M.), U. S. N., b. Sept. 16, 1843, in New York; graduated at the Naval Academy in 1861; became a lieutenant in 1864, a lieutenant-commander in 1866; served on board the steamer Mississippi in several hard fights on the Western waters, and with the naval battery at the siege of Port Hudson, and highly commended in official despatches. FOXHALL A. PARKER.

**Ship-Canals.** By "ship-canal" is meant a canal intended for the passage of *ships* proper; hence, therefore, canals to connect sea with sea, and thus by a "short cut" to obviate a long ocean navigation. As the fitting localities are rare, such canals in the full sense of the phrase cannot be numerous. Such canals are usually laid across an isthmus or peninsula. The Suez Canal is an apt instance; so also are the *projected* canals across the Central American isthmus and our own isthmus of Florida. The Gotha Canal of Sweden, the Caledonian of Scotland, are instances of a minor class of ship-canals. In another sense, those proposed to connect routes of *natural navigation* (rivers or lakes), by allowing the passage of the vessels, whatever they may be, used in such navigation. To this class belong many of the works described in the CYCLOPÆDIA under separate heads—*i. e.* The ILLINOIS AND MICHIGAN CANAL, the ST. MARY'S RIVER CANAL, and also the *Louisville and Portland*, the *Delaware and Chesapeake Canal*, and others mentioned under the head of NAVIGATION, INLAND, where the subject of this class of canals is treated in relation to the U. S. To the same class would belong the projected Niagara Falls Canal, for which a survey and plans were made by the late Capt. W. G. Williams, Top. Engrs. U. S. A. (see *Ex. Doc. No.* $214\frac{24}{1}$ and $463\frac{25}{2}$ H. R.), and the Bay Verte Canal. (See CANALS OF CANADA.)

The Gotha Canal of Sweden (constructed 1794–1800) joins the Cattegat with inland navigation and with the Baltic. Its cuttings at one point, around the Troshoetta Falls, are 72 feet in depth through solid rock. The Languedoc, or *Canal du Midi*, of France, though constructed (1666–70) to save a distance in transportation of 2000 miles *viâ* the Straits of Gibraltar, by connecting Toulouse on the Garonne with Agde, or the created port of Cette, on the Mediterranean, a distance of but 148 English miles, cannot be called a ship-canal, since its depth was but 6½ feet and width 65 feet. Twenty-six locks on the Atlantic side and seventy-four on the Mediterranean surmounted a summit-level of 117 feet above the sea.

The CALEDONIAN CANAL (which see), constructed by the British government for military purposes and for the transportation of Baltic timber, though a monument to Telford's engineering skill, requiring twenty years for its construction and an expenditure of £1,000,000, has nevertheless scarcely paid expenses of maintenance. The locks do not admit ships of more than 160 feet in length. The three canals just mentioned, though they scarcely claim to rank with true ship-canals, since they admit but an inferior class of sea-going vessels, or (as the Languedoc and Gotha) exclude such vessels, are yet interesting as among the earliest of the great works intended to connect sea with sea.

(For a description of existing ship-canals proper see NORTH HOLLAND CANAL, NORTH SEA CANAL, SUEZ CANAL.)

The importance of a navigable connection between the Atlantic and Pacific oceans through the American isthmus calls for a condensed view of the chief plans proposed at different dates, and of the natural obstacles baffling them all up to the present time. No commercial, geographical, or speculative problem has had a history more marked. From the era of the Spanish conquest of America the search for the secret of the supposed natural strait was carried on along the whole coast-line of the two continents; and when this ceased, the possibility of the construction of an artificial route began to be discussed. During the last fifty years, governments, companies, and individuals have devoted much time and money to the search for a practical route for a ship-canal. Tehuantepec, Nicaragua, Chiriqui, the Isthmus of Panama (or Darien), and the Atrato River, have all figured in connection with this question, and a full statement of the various surveys and projects made prior to 1866 will be found in the report of the superintendent of the U. S. Naval Observatory (Admiral C. H. Davis), made in compliance with a resolution of the Senate (*Ex. Doc.* $62\frac{39}{1}$).

The successful accomplishment of the Suez Canal construction in 1868 called public attention again to the corresponding project for the American isthmus; and the U. S. government, through its navy department, undertook a fresh exploration of the various routes of alleged practicability, the more important results of which will be here stated. (For a description of the American isthmus, their common *locale*, reference is made to "Central America" in article AMERICA.)

Commencing with Tehuantepec (see also the article TEHUANTEPEC), Capt. R. W. Shufeldt, U. S. N., who surveyed this route (see *Reports of Explorations and Survey, etc., Ex. Doc. No.* $64\frac{2}{2}$, *Senate*), affirms the practicability of, and recommends, a ship-canal of top breadth of 122 feet, bottom breadth 60 feet, and depth of 22 feet. "These dimensions were assumed as a basis, because a canal of that width and depth would be amply sufficient to accommodate at least nine-tenths of the commerce of the world, and certainly wide and deep enough for our own domestic trade; and I question," he says, "if a surface-canal with as many locks as will be required for this one will not present so many difficulties in the transit of very large ships as to fail to fulfil its object." The terminal harbors are, on the Atlantic or Gulf extremity, the mouth of the Coatzacoalcos River, "one of the best harbors in the Gulf of Mexico," having 14 feet of water on its bar (through which a deep channel can be made), and the natural harbor of Salina Cruz, on the Pacific (a mere indentation in the coast-line), where "a magnificent port may be made with comparatively small outlay of money." Other engineers have recommended the Ventosa Bay, and others the "Lagoons," avoiding the difficult passage of the Tehuantepec River and of the chain of hills which surround the harbor of Salina Cruz. This route would be eminently a *national* one to the U. S., both from its proximity and from its being, as it were, a prolongation of our *coasting* navigation from the Atlantic and Gulf shores, and from the inland navigation of the Mississippi River to our Pacific shores. It would, too, be as a *national* work one more easily defensible in war than others.

*The Nicaragua Route* follows the most deeply-marked depression of the American isthmus, and has the natural advantage of the great lake of the same name as a canal-feeder, and would perhaps be more directly in the world's highway. A route for a ship-canal was surveyed by O. W. Childs, C. E., in 1850, whose report will be found in the *Journal of the Franklin Institute*, June, 1870, *seq.* The government survey has been recently executed by Commander E. P. Lull, U. S. N. The canal, as it results from his survey (*Ex. Doc.* $57\frac{43}{1}$, *Senate*), commencing at Greytown, follows the San Juan River to the mouth of the tributary San Carlos, 41.9 miles; thence a slackwater navigation of the river by the construction of four dams, the highest of which at Castello raises the lake to 107 feet above tide, or 4 feet above its mean high-water level, to Lake Nicaragua; thence lake navigation to the Rio del Medio, 56 miles; thence to the Pacific at Brito, a canal of 16⅓ miles in length fed from the lake. For 7½ miles there is an average cutting of 54 feet, with a maximum of 134 feet. The absence of natural harbors is the most serious objection to this route, the once commodious and excellent harbor of Greytown having been converted by the extension and emergence of its bar into a mere lagoon. The restoration of this harbor, and the construction of an artificial one at Brito, are therefore necessary features of the canal project. The estimate for the whole work, as made by Commander Lull, is $66,000,000, nearly.

*Across the Isthmus of Panama* occurs, next to Nicaragua, the greatest depression yet found on the isthmus, the summit-level of the railroad being but 287 feet.

The route from Porto Bello or Chagres to Old or New Panama has been the established line of communication since the year 1653, nearly coeval with the first settlement in America. A survey was made in 1843 by the French engineer M. Garella (*ingénieur en chef des mines*), of which an account is given in the document referred to, and of which the report was printed in the *Journal of the Franklin Institute*, also in the French *Journal des Ponts et Chaussées*, 1844.

Mr. G. M. Totten, chief engineer of the Panama R. R., subsequently made an estimate for a canal to cost from $60,000,000 to $115,000,000, according to the summit-level adopted. The survey was renewed by our government by Commander E. P. Lull, U. S. N., resulting in the location of a practicable line for an interoceanic ship-canal 26 feet deep from the Bay of Aspinwall on the Caribbean Sea to Panama on the Pacific. The total length of the line is 41.7 statute miles. Twelve lift-locks on each side will be required, and one tide-lock at Panama, or twenty-five in all. The lift of the locks will be 10.3 feet each; that of the tide-lock, 10 feet. It is proposed to cross the river Chagres by means of a viaduct 1800 feet in length. The water-supply is to be drawn from the river Chagres, and to be conveyed to the canal by a feeder 10.22 miles in length. The Chagres was found by careful gauging to discharge at an unusually low stage 55,900,800 cubic feet per day—a quantity considerably in excess of the maximum possible demand of the canal. Estimated cost, $94,911,360.

In the selection of the Isthmus known as Darien the U. S. government surveys and reconnaissances made by the navy department (see *Report of Explorations and Surveys, etc.*, by Commander T. O. Selfridge, published in 1874

by the navy department) embrace the following alleged favorable crossings:

I. From the Gulf of San Blas to the Bay of Panama *viâ* the Chepo River. There being no water-supply for a summit-level, this route, 27 miles in length, with an excellent harbor at San Blas, could only be utilized as a *sea-level* canal by a tunnel 10 miles in length.

II. From Caledonia Bay to the junction of the Sucubti and Chucunaqua rivers (flowing to the Pacific), thence to the junction of the Lara with the Savanna River, which it follows to the Bay of San Miguel. "Its noble harbors, and the assertions of Dr. Cullen, but partially contradicted by the meagre reports of Gisborne and Strain, required that this route should be surveyed—a route celebrated in history as the path by which Balboa in 1513 crossed and beheld for the first time the mighty Pacific; the road of the buccaneers in their raids upon the Spanish settlements of the W. coast; the spot where perished the ill-fated Scottish expedition of Patterson; the wilderness which witnessed the heroic and disastrous sufferings of Lieut. Strain and his party." The route is found impracticable for the same reasons that apply to the San Blas. A tunnel of 7 miles would be required. A variation of this route by the Morti River is found equally inadmissible. At 3½ miles from the beach (Caledonia Bay) an elevation of 250 feet is attained, with but insignificant mountain-streams to supply water.

III. Another route with the same Pacific terminus (Gulf of San Miguel), ascending the Atrato River and its tributary, the Caricara, thence connecting with the sources of the Tuyra River, which through the Boca Chica (or Darien harbor) discharges into the gulf first named, promised eligibility (see *Putnam's Magazine*, Mar., 1869). This route is pronounced impracticable for nearly the same reasons as have applied to the two just mentioned. Lowest elevation, 410 feet.

IV. Through the valley of the Atrato many explorations have been made to various points of the Pacific coast. An alleged ancient "Raspadura Canal" (so called), connecting its head-waters with those of the San Juan River, which enters the Pacific near the Bay of Choco, finds place in the authoritative *Atlas Universel* of Brué (see ZUYDER-ZEE) and in a chart of Malte Brun (*Annales des Voyages*, 1811). Its existence is now disproved, though Indians may have taken canoes across. A public-spirited citizen of New York, F. M. Kelley, Esq., fitted out several different expeditions successively under Messrs. J. C. Trautwine, Lane, Porter, and Kennish, in 1852, 1853, 1854, the last of which selected the Truando, the heads of which (about 100 miles from the mouth of the Atrato) are but 10 miles from Humboldt Bay of the Pacific. The U. S. government was thereupon induced to institute a survey of this route by an expedition under Lieut. (now Bvt. Brig.-Gen.) N. Michler, U. S. Engineers, and Lieut. (the late Commander) T. A. Craven, U. S. navy (*Ex. Doc.* $9\frac{36}{2}$, *Senate*). The lowest point of the divide is about 900 feet, and two tunnels, one of 12,250, another of 850 feet, are required; summit-level, about 100 feet above tide. The results of the two surveys under Com. Selfridge (1871–73) was the choice of the Napipi tributary, which 40 feet above the sea-level enters the Atrato about 150 miles from its mouth, through which length the latter affords ship navigation of 26 feet depth. The canal, 28 miles long, follows the Napipi and Doguado rivers, penetrates the dividing ridge, here 660 feet high, by a tunnel 3 miles long, and reaches the Pacific at the Bay of Chiri-Chiri, 10 miles S. of Cupica Bay. The summit-level, 125 feet above tide, is fed by the Napipi River. The harbors are the mouth of the Uraba delta-arm of the Atrato, to be improved by "artificial banks" (jetties), and the open Bay of Chiri-Chiri on the Pacific, where "two short breakwaters are necessary." This was resurveyed in 1875 by Lieut. F. Collins, according to whose report (*Rep. Secy. of Navy*, 1875) the length of tunnel necessary to carry the canal under the dividing ridge, which attains a height of 778 feet, was found to be 3.5 miles. The total length of the canal by this route, as determined by Lieut. Collins, is 32.2 miles, and his estimates of the probable cost of the construction of a suitable canal, with all the works necessary for its preservation and successful operation, amount to $98,000,000.

All the different projects, and the various surveys upon which they were based, have been submitted by order of the President to a commission consisting of Gen. A. A. Humphreys, chief of engineers U. S. army, Prof. Benj. Peirce (succeeded by Capt. Carlisle Patterson), chief of the Coast Survey, and Commodore D. Ammen, chief of the bureau of navigation, U. S. navy. As stated by them, the route known as the Nicaraguan, beginning at or near Greytown on the Atlantic side, and ending N. of the Rio del Brito on the Pacific, offers fewer difficulties from engineering, commercial, and economical points of view than any one of the other routes shown to be practicable by survey sufficiently in detail to enable a judgment to be formed of their relative merits; that the cost will be at least $100,000,000, and the time ten years; and that an interoceanic canal across this continent should be under the protection of all the nations interested.

Another class of ship-canals comprises the works, few in number, intended to provide access for sea-going vessels to a port the connection of which with the sea is obstructed by shoals, or to connect a naturally-accessible port with an interior ship navigation. Such, in an inferior sense, was the ancient canal of Alexandria, connecting that port with the Canopean delta arm of the Nile; the two "maritime canals" of the emperor Claudius at the mouth of the Tiber; and the FOSSA MARIANA (which see) at the mouth of the Rhone. In reality, both the North Holland and the North Sea (or Amsterdam) Canal of Holland belong to the category; so also the Canal *St. Louis*, connecting the Rhone with the Gulf of Foz (a name derived from the *Fossa* Mariana), which, after an ineffectual attempt to make a deep channel through the "bar" of a natural mouth by closing other outlets (delta-arms), has been recently (1864–73) made by the French government.* To this class belong also the much-discussed Fort St. Philip Ship-Canal, intended to connect the Mississippi River with Breton Bay of the Gulf of Mexico (see *Ex. Doc.* $113\frac{43}{1}$, *H. R.*, and $114\frac{43}{2}$, *H. R.*; also the article JETTIES), and the canal projected to connect the port of St. Petersburg with the Gulf of Finland. (See Van Nostrand's *Engineering Magazine*, Feb., 1876.) As bearing upon the general question of ship-canals, reference is made to the *Memoir on the Possibility of a Ship-Canal between the North Sea and the Mediterranean* (*Revue maritime et coloniale*, July, Aug., 1870). J. G. BARNARD.

**Shoe'buryness,** a promontory on the northern shore (Essex co., England) of the estuary of the Thames, directly opposite Sheerness. The termination *ness* is from Anglo-Saxon *näss* or *naze* (identical with the Fr. *nez*), signifying *nose*, common to *promontories* on that part of the English coast, and which is probably transformed into "news" in our James River promontory "Newport News." Shoeburyness has acquired celebrity in recent years as the locality of experimental firing at armored targets and for trial of the new guns. Here were subjected to test the iron constructions used in fortifications (see IRON-PLATING FOR FORTIFICATIONS, in CYCLOPÆDIA), models of sides of iron-clads (see SHIPS, IRON-CLADS), as well as trials of the new monster guns themselves. (See ARTILLERY and ORDNANCE.) The sandy and little-frequented shores and the open range seaward determined its selection. The place has become a permanent post, with a small garrison of artillerymen; but with the residences of the officers in charge and of the numerous artificers, and with the experimental constructions and relics of old ones, is one of great interest, especially so on days of firing; and it may be said to have brought there, in its numerous gatherings, all the renowned military and naval men of the age. J. G. BARNARD.

**Shreve** (HENRY MILLER), son of Col. Israel Shreve of the American army, b. in Burlington co., N. J., Oct. 21, 1785; was reared in Western Pennsylvania, and became interested in the navigation of the Western rivers when quite young. In 1810 he brought the first cargo of lead, buying it of the Indians, from Galena River to New Orleans, and opened a business which had been previously monopolized by the British. In 1814 he took command of the fourth steamboat, of which he was part owner, built in the West, and a few days before the battle of New Orleans, at the request of Gen. Jackson, carried supplies to Fort St. Philip, passing the British batteries, and protecting his vessel from their fire by cotton-bales. In May, 1815, he ascended the Mississippi to Louisville in the Enterprise, the first steam vessel that had ever performed that voyage, all previous attempts having signally failed. Convinced of the defects of the engines of Fulton and French, he commenced the construction of the Washington, of 400 tons burden, upon an entirely new plan. It was a "two-decker," and resembled a dismasted frigate, the cabin being between the decks. Previously, the boiler had always been placed in the hold of the vessel, and under Fulton's patent upright and stationary cylinders used—under French's, the vibrating cylinder. Capt. Shreve placed his

* There being but 2 mètres *navigable* depth in the Rhone, and no hope of ever obtaining more than 4 up to Arles, while the canal has 5 mètres navigable depth (*actual* depth 6*m.*), the creation not merely of a sea-entrance "port" (formed by two jetties), but of a *port on the Rhone* capable of receiving vessels coming from sea by the canal, was necessary. This is a basin of 400 × 300 mètres. The canal, 2 miles (3330*m.*) long, has a single lock (the lift into the Rhone even at flood heights being slight) of 22.7*m.* width by 160*m.* length of chamber; depth on sills, 7.50 mètres.

cylinder in a horizontal position, and gave the vibration to the connecting-rod or "pitman." He used a double high-pressure engine, with cranks at right angles and the boilers on the main deck. Mr. David Prentice had previously employed the cam-wheel for working the valves to the cylinder; to this Capt. Shreve added his great invention of the cam cut-off, saving three-fifths of the fuel. The result was a steam vessel unlike any other then known, machinery far lighter than Fulton's, and using half the fuel. On Mar. 3, 1817, heavily laden both in descending and ascending, and crowded with passengers, the Washington made her first trip. The return trip from New Orleans was made in twenty-five days, and Capt. Shreve's prediction that it could be made in ten days was received with incredulity. In 1806 there were 6 keel-boats and 2 barges only owned on the Ohio River. In 1819, so rapid was the increase after Capt. Shreve's success, 25 steamboats, aggregate tonnage of 6050, were owned by the citizens of the Ohio Valley, and 26 others, tonnage of 6720, were nearly ready to be launched. Fulton, associating himself with Robert R. Livingston of New York, with a view of monopolizing the trade of the Western States and Territories, obtained in 1811 an act of incorporation from Orleans Territory granting to them the exclusive right "to navigate all vessels propelled by fire and steam in the rivers of said Territory." The enterprise of Capt. Shreve soon excited the hostility of the corporation; his boats were seized in New Orleans, and he was arrested. A protracted lawsuit followed, which was finally decided in his favor. After building other boats and making other improvements, he finished the George Washington in 1824 upon a new model, that which is in use at the present day, and with side-wheels, each worked by a separate engine. In 1829 he completed his snag-boat, the Heliopolis, for removing snags and sawyers from the Ohio River. This was done after the failure of the government in attempting to remove these obstructions, and against many remonstrances. This boat had twin hulls about 11 feet apart, firmly connected together "abaft midships," with a wedge-shaped "snag-beam" at the bows and on the water-line: its success was complete. Capt. Shreve was then placed in charge of the removal of the Red River raft: the result is thus stated in official reports to Congress: "The great raft of the Red River, consisting of an accumulation of trees, logs, and driftwood of every description, firmly imbedded in its channel for more than 160 miles, was removed, and the navigation of that river opened, inclusive of the raft, a distance of nearly 1200 miles. In 1829, Capt. Shreve invented a steam marine battering-ram for harbor defence at the request of Gen. Jackson. He was made superintendent of Western river improvements in 1826, and continued in that position until 1841. D. in St. Louis Mar. 6, 1854. S. H. Shreve.

**Shreve** (Samuel Henry), A. M., LL.B., b. at Trenton, N. J., Aug. 2, 1829; graduated at Princeton 1848, at Harvard University 1850; studied civil engineering; was chief engineer of several railroads; published in 1873 a treatise on the *Strength of Bridges and Roofs*, and became in 1875 engineer of the New York Rapid Transit Commission and consulting engineer of New York Elevated R. R. and of the Gilbert Elevated Railway. At present he is preparing a work on *Arch and Suspension Trusses*.

**Sicard'** (Montgomery), U. S. N., b. Sept. 30, 1836, in New York; graduated at the Naval Academy in 1855; became a lieutenant in 1861, a commander in 1870; served on board the Oneida at the battle of New Orleans and the passage of the Vicksburg batteries in 1862, and led the men of the Seneca in the naval assault on Fort Fisher, Jan. 15, 1865; highly commended by Commander S. P. Lee, and recommended for promotion by Rear-Admiral Porter.

Foxhall A. Parker.

**Sight, Defects of.** Defects of sight are due either to (1) errors of refraction, (2) opacities of the refractive media, (3) lesions of the optic nerve, retina, or choroid, or (4) continued exclusion of the eye from visual purposes.

(1) In the lesser degrees of deviation from the normal condition of refraction (emmetropia) the vision can generally be raised to the normal standard by the use of suitable glasses, but in very high degrees of ametropia the sight can rarely be raised to over one-half or two-thirds the normal. In high degrees of myopia and myopic astigmatism there is usually an affection of the choroid (staphyloma posticum), which increases the area of Mariotte's "blind spot," and, when extensive, encroaches upon the region of the macula and interferes very seriously with the acuity of the sight. In high degrees of hypermetropia and of hypermetropic and mixed astigmatism all objects are seen under large circles of dispersion, and hence with great indistinctness. The eyes are thus, under the influence of prolonged bad vision, so affected that they do not, even when an existing refractive error has been corrected, at once exhibit the expected sharpness of vision. In young subjects this defect often passes away quickly under exercise of the organs with the correcting lens. It is difficult, and often impossible, to correct with glasses those defects of vision arising from irregular astigmatism.

(2) Serious defects of sight may arise from opacities of the cornea so slight that they can only be perceived by the aid of the ophthalmoscope or of a powerful convex lens. In the other extreme the cornea may be entirely opaque, thus reducing the vision to bare perception of light. Where the pupil is covered with opaque cornea, and another part of the cornea is transparent, vision is often in a great measure restored by making an artificial pupil immediately behind the clear portion of the cornea. The deformity produced by opacity of the cornea is sometimes removed by tattooing the white spot with India-ink.

Next we have opacities of the crystalline lens and its capsule. An infrequent form of opacity of the anterior capsule is the unabsorbed remains of the pupillary membrane of fœtal life. This usually consists of one or more filaments of opaque tissue stretched from the pupillary border of the iris to a point of attachment near the centre of the anterior capsule. Opacities of the lens constitute what is known as cataract. This, like nearly all other affections of the eye causing defects of sight, may be either congenital or acquired. It may be the result of a blow upon the eye, or of diabetes, or of the general breaking down of the system, and consequent malnutrition of the lens, due to old age. Whatever may be its cause, it can in no case be removed except by surgical operation.

Opacities of the vitreous may be due to hæmorrhage from the retinal or choroidal vessels, and the consequent mingling of blood with the vitreous humor, or to inflammatory or degenerative changes in the humor itself. A curious form of vitreous opacity is produced by the formation of numerous crystals of cholesterine in that fluid, presenting a brilliant ophthalmoscopic picture, like a shower of sparkling meteors.

(3) Inflammation or atrophy of the optic nerve, or of either of the coats forming the back wall of the eye, separation of the retina from the choroid, tumors of the optic nerve and retina, hæmorrhages into the substance of the retina, all produce grave defects of vision, and can be diagnosticated only by means of the ophthalmoscope.

(4) In cases of squint of one eye, either convergent or divergent, the image of the object formed upon the retina of the deviating eye is almost always involuntarily suppressed. Thus the eye is excluded from vision, and gradually loses the power of performing its function, as would be the case with any other unused organ. When such an eye has been restored by operation to parallelism with its fellow, the visual power not unfrequently increases to a marked degree. In alternating squint, where the individual sees first with one eye and then with the other, the sight remains good in both eyes. Hence in these cases there is not the same urgent necessity for an early operation. In cases where one eye is emmetropic and the other very hypermetropic, more or less impairment of vision of the latter usually occurs. This, if it has not gone too far, may often be remedied by daily and regular exercise of the amblyopic eye with a glass correcting the refraction, the perfect eye being temporarily excluded. Cases occasionally come under observation where it is impossible to detect any cause for the defect, which may range from a slight impairment of vision to total blindness. Ophthalmologists not very infrequently meet with cases in which defective vision of one eye had existed for many years before it was accidentally discovered. (See also Vision.)

David Webster. Revised by Cornelius R. Agnew.

**Sigs'bee** (C. D.), U. S. N., b. July 16, 1845, in New York; graduated at the Naval Academy in 1863; became a lieutenant-commander in 1868; served on board the Monongahela at the battle of Mobile Bay, Aug. 5, 1864, and in both the Fort Fisher fights. He was commended for "gallantry."

Foxhall A. Parker.

**Silk-Printing,** a process not differing essentially from that of calico-printing (see Calico-Printing in Cyclopædia), is not largely practised on silk goods, as in all the higher classes of silks the desired effect is produced with much greater beauty by Jacquard weaving. The thin summer silks and mixed goods, such as India silks, foulards, pongees, the so-called Japanese silks, and the thinner millinery goods, handkerchiefs, neck-ties, etc., etc., are generally printed, though of late the guipure lace scarfs and ties woven by the Jacquard process have taken the place of printed goods. The methods employed in silk-printing are those of topical printing and steam color-printing.

L. P. Brockett.

**Silk'worm, The,** is the larva or caterpillar of *Bombyx mori*, which feeds upon the mulberry, and was originally derived from the northern or mountainous provinces of

China, though the wild worm has not been rediscovered. The moth, one of the types of the lepidopterous family Bombycidæ, is white, with falcate fore wings, while the hinder pair do not reach to the tip of the abdomen, and the antennæ are well pectinated. The eggs are about .05 of an inch in their longest diameter, and flattened ovate. When hatched, the caterpillar is of the usual form of the bombycid larvæ when hatched, and is hairy, with a large head. When fully fed it is naked, not very thick-bodied, cylindrical, with a tubercle on the second thoracic ring and a long horn on the tail. It is three and a half inches long, and of an ashy or cream color. In almost every batch of worms raised in India, observes Capt. Hutton, there will be seen, after the first moult has occurred, some dark-colored worms, which at the first glance appear to be a distinct species, but they are actually types of the original species. The silkworm is an annual, though some allied species yield two or three broods in the warmer parts of India. It moults four times, but occasionally only three times. There being four moults, there are five ages of the caterpillar. The eggs are about the size of mustard-seeds, and the larvæ of the first age are one or two lines long, and of a dark color. In five days begins the second stage. In the third stage the worm is naked, whitish, and lives six days before attaining the fourth. The fifth stage is the longest, lasting nine days; and at this time the worm is very voracious. It then ceases to eat, walks about, and in about thirty-six days after the worm hatches it begins to make its cocoon, which is spun from the large silk-glands opening in the under lip (labium). The silk-glands may be taken out, stretched on a board, and dried to form "gut" for fishing-lines. (See ENTOMOLOGY for illustration.)

The cocoon is spun of a continuous thread about 1000 yards long, and is finished in about four days. The cocoon is white or whitish-yellow, and is over an inch long and nearly half as broad; 360 cocoons weigh a pound and a half. Within the cocoon the insect remains in the pupa state from fifteen to seventeen days. When about to break through, the moth moistens the anterior end of the cocoon with a liquid thrown out from the head, so that the threads are moistened and separated, and the moth is able to extricate itself. In an hour or two after exclusion the sexes unite, and the female lays from 300 to 700 eggs within the space of three days. A few females have been observed to lay unfertilized eggs which have produced caterpillars. This very rarely happens, however, for M. Jourdain found that out of about 58,000 eggs laid by unimpregnated silk-moths many passed through their early embryonic stages, showing that they were capable of self-development; but only twenty-nine out of the whole number produced caterpillars. (*Darwin.*)

Our account of the rearing of the silkworm, as carried on in France, is from Figuier's *Insect World*, compiled by him from the works or articles of MM. Robinet, Guérin-Méneville, Eugène Robert, Le Clerc, and Dandolo. The work-room should be well ventilated and warmed, with racks containing frames from 1 to 1¾ yards in breadth, with a border to prevent the worms from falling, and lined with paper on the bottom. The eggs laid before the end of winter are hung up in woollen cloths in a cool, dry place exposed to the N. As soon as the buds of the mulberry tree begin to unfold the eggs are spread out on sheets of paper in very thin layers, placed for three or four days on a table in a room having a southern aspect, but out of the direct rays of the sun. The temperature of the room is gradually raised until of 25° C., and maintained till all the eggs are hatched. The larvæ are fed six to eight times a day on chopped leaves. The worms are removed to new food by nets placed upon the old food, the worms ascending through the meshes to the fresh leaves placed above. When fully fed the worms ascend into sprigs of heather placed at intervals on the tables. Here they spin their cocoons, some of which are white, producing the best silk, while most of them are yellow. Before the cocoons are sold to the silk-spinners the chrysalis is killed by steaming in wicker baskets. The process of spinning is thus described by Figuier: "The woman who is spinning stands before a sort of loom which is called *tour*. Under her hand is a copper containing water, which she heats to the required degree by opening the tap of a tube, which brings a current of steam. She plunges the cocoons into the hot water, and moves them about in it, to soften the gummy substance which sticks the silken threads of the cocoon together. Then she beats them, with a light hand, with a small birch broom. The threads of the cocoons get caught in the extremities of the twigs of which the little broom is made, and the work-woman seizes with her fingers the bundle of threads, and shakes them about till she perceives that they are all single and in a fit state to be joined together. Let us suppose now that she wishes to make up a *brin*, or staple, by uniting together the ends of five cocoons. She chooses five ends in the mass, makes of these a bundle, and introduces it into the hole of the *filière*. She makes two staples (*brins*) at once—one on her right, the other on her left hand. She then brings them together; she crosses them, rolls them and twists them, the one on the other, several times; after which she separates them from above and keeps them well apart, making each of them pass into a hook at a distance, from which they are going to twist round into a hank, separately, on a wheel. The two threads thus twisted are drawn close together, compressed, and become one, getting round by rolling on each other, and being kept in continual motion, drawn out as they are by the rapid motion of the wheel."

Of the diseases which affect the silkworm, muscardine was until lately the most prevalent, the losses in France being estimated at one-sixth of the profits. When affected, the worm changes to a duller white, its movements are slower, it becomes soft, and soon dies. Seven or eight days after death it turns hard and reddish, and in a day after the whole body becomes floury. The disease was found by Bassi, an Italian, to be due to the attacks of a fungus, *Botrytis bassiana*. But still more destructive is the new disease, called *pebrine*, in allusion to the dark spots peppering (whence the term *poivrine*, *pebrine*) the skin of the worm. This disease was probably unknown before 1842. Quatrefages believes that the disease is not a new one, but was confounded with muscardine; he compares it with the Asiatic cholera, and states that it is an hereditary epidemic, and that it may become accidentally contagious and infectious. It originates from the presence of exceedingly minute corpuscles, probably a parasitic fungus, which multiply by self-division and infest the tissues and viscera of the larva, pupa, and adult, as well as the scales of the latter. The disease first showed itself in France, and spread eastward until it reached China, and, in 1865, Japan. It was also a few years ago introduced into the native silk-worm establishment of Mr. Trouvelot at East Medford, Mass., and carried off from $5000 to $10,000 of worms of *Telea polyphemus*, the American silkworm, which he then had under domestication. In France also it attacked native caterpillars. Pebrine, then, differs from muscardine in being hereditary. Another formidable disease is called *flacherie*, where the worms become enfeebled by the fermentation of the food in the stomach, resulting in the development of vibrios or fermentation-fungi. This disease is also hereditary, but, like muscardine, more or less accidental, and not an epizoötic, as pebrine is, and does not affect the eggs.

Alarmed by the fearful ravages of pebrine, silk-raisers, particularly M. Guérin-Méneville, turned their attention to the importation of other silkworms. Of these the Tusseh and Arrinda moths are the most manageable and promising. The Tusseh moth (*Antheræa paphia* or *mylitta*, with its Chinese variety *peryi*, and Japanese form *A. yama-mai*) has a closed cocoon, spun from an unbroken thread. It is semi-domesticated in India, and the silk is an article of commerce. It spins a hard, most durable silk of a dark-brownish color. While the Tusseh moth proper of India cannot be reared in Europe, the yama-mai variety does well in the climate of France in the open air.

The AILANTHUS SILKWORM (which see) can be reared in Europe and the U. S., and is double-brooded. Though the cocoon is open at one end, the thread with care can be unwound; in one case an unbroken thread 800 yards long was unreeled. The silk, however, like that of the Tusseh moth, is coarse, ill-colored, and cannot be placed in competition with the most inferior mulberry silk. (*Murray.*)

A similar article is furnished by the American silkworm (*Telea polyphemus*). The thread is coarser than that of the *Bombyx mori*, but has a rich gloss, and can be used very extensively in commerce. The thread of which the closed cocoon is spun is unbroken, and can be readily unwound. Its larva feeds on the oak, and is thick, fleshy, striped obliquely with white on the sides, with angulated segments, on which are tubercles giving rise to a few short hairs. The pupa is very thick, and the cocoon is regularly oval-cylindrical. Mr. L. Trouvelot gives an account in the *American Naturalist* (vol. i.) of this silkworm. So successful was he in raising it that in a single season "not less than a million could be seen feeding in the open air upon bushes covered with a net." The moths leave the cocoons late in May, appearing until the middle of June. They then lay their eggs, generally singly, on the under side of the leaves. In ten or twelve days the caterpillars hatch. The worm moults five times, the first four moults occurring at intervals of ten days, while about twenty days elapse between the fourth and fifth moults. It spins its cocoons late in September, and in six or eight days after beginning its cocoon assumes the pupa state, and in this condition passes the winter.

Mr. Trouvelot's experiments were brought to a sudden termination by an unfortunate attack of the epizoötic disease pebrine, which was imported in some Japanese silk-

worm eggs carried by way of France. When the larvæ hatched, the disease was diagnosed, and the worms were at once destroyed, but the infection remained about the house, and though the native worms had not hatched out, yet "a few days after the third moultings the worms began to manifest symptoms of the deadly disease, and two or three days after, of a million, I had but a single one left, and this one even died in the pupa state. The following year I thought I could begin anew, but I found that the epidemic had spread further, as I had feared, and the third year the wild individuals were as robust as usual, but the disease, or at least the seeds of it, was infesting my buildings, and as soon as the healthy wild *polyphemus* would approach them they became sick and died." (Riley's *Fourth Rep. Ins. Missouri.*) Mr. Trouvelot gave the writer substantially the same account, and added that any further attempts at raising the native silkworm would have to be carried on in some other town, at least twenty miles away from Medford. It is possible that the liberal use of a disinfectant like carbolic acid would arrest the spread of pebrine. The culture of the Chinese silkworm in this country, especially with the aid of Chinese skilled labor in unreeling the silk, can be made a profitable business. (See SILK AND SILK MANUFACTURE, etc.) A. S. PACKARD, JR.

**Silver-Mines** must have been worked from a very early age, as silver is mentioned in the Old Testament among the riches of Abraham, and, according to the same authority, was employed in great masses by Solomon in the ornamentation of the temple and his palace. It was obtained from Nubia and Ethiopia and from the countries of Eastern Asia and Southern Europe. From the very dawn of the historic age in Europe we know that silver-mines were worked in Attica and Epirus by the Greeks, and in Spain by the Phœnicians and Carthaginians. The latter mines were especially famous, and Pliny tells us that Hannibal opened a mine at the present Guadalcanal, at the foot of the Sierra Morena, which yielded 300 pounds of silver daily. The mines of Schemnitz, Hungary, were worked in the tenth century, and they still yield from 30,000 to 40,000 marks of silver annually. Those of Joachimsthal, Bohemia, are as old, but they have now lost much of their productiveness, yielding only about 8000 marks of silver a year. In 1873 the total production of silver by the Austro-Hungarian empire amounted to $1,600,000. The silver production of the German empire is larger, amounting in 1873 to $3,000,000; the principal mines are found in the Hartz and the Erzgeberge, especially in the vicinity of Freiberg, where no less than twenty-four mines producing silver ore are in operation. They were discovered in 1196. In 1623 the Kongsberg mines in Norway were opened, and they have been worked continuously since that time, with a short interruption from 1805 to 1815, yielding, in the period from 1624 to 1864, 1,817,710 pounds troy of silver. During the Middle Ages the Spanish mines, so celebrated in antiquity, fell entirely into decay, and even the Guadalcanal mine was abandoned in the seventeenth century and filled with water. After 1825, however, the silver-mining industry was once more taken up in Spain, and two new and rich mines were discovered —that of the Sierra Almagrera in 1839, and that of Hiendelaencina in 1843. The total production of silver by Spain in 1865 was estimated by J. Arthur Phillips at 110,000 pounds troy. By the discovery of America, and the conquest of Mexico and Peru by the Spaniards, the silver production received an enormous increase. Humboldt estimates that, for the period from 1492 to 1803, Mexico and Peru produced silver to the value of $4,152,000,000, while the production by Europe during the same period hardly amounted to $200,000,000. For the period from 1804 to 1848, Danson estimates the production of silver in Mexico and Peru at $1,244,380,947, and in Europe and Asiatic Russia at $325,000,000. The most celebrated silver-mines in Mexico are those of Catorce, Guanajuato, Sombrerete, Valencia, and Zacatecas, situated in the central group of the Cordilleras. Most of them were discovered and opened in the sixteenth and seventeenth centuries, and about 3000 distinct mines were in operation when Humboldt visited the country. One of the richest of these mining districts is that of Guanajuato. In 1873 it employed 8979 miners and laborers, and 1815 tons of ore were raised each week, a ton of ore yielding on an average 34 ounces troy of silver. The famous mines of Potosí, Bolivia, were discovered in 1545, and have yielded from that time, and up to our days, about $1,300,000,000. Other rich South American silver-mines are those of Gualanca, Pasco, Lucanas, etc., in Peru; of Lipes, Porco, etc., in Bolivia; of Copiapó in Chili, etc. The total production of silver in South America during the period from 1848 to 1868 was estimated by W. P. Blake at $200,000,000, and during the period from 1868 to 1875 at $56,000,000. Silver production received a new impetus from the discovery in 1859 of the COMSTOCK LODE (which see). The total production of silver in the U. S. since 1859 is estimated as follows by R. W. Raymond:

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|---|---|---|---|
| 1859 | $100,000 | 1867 | $13,500,000 |
| 1860 | 150,000 | 1868 | 12,000,000 |
| 1861 | 2,000,000 | 1869 | 13,000,000 |
| 1862 | 4,500,000 | 1870 | 16,000,000 |
| 1863 | 8,500,000 | 1871 | 22,000,000 |
| 1864 | 11,000,000 | 1872 | 25,750,000 |
| 1865 | 11,250,000 | 1873 | 36,500,000 |
| 1866 | 10,000,000 | 1874 | 38,200,000 |

(See, for further details, the articles on SILVER, in CYCLOPÆDIA, COMSTOCK LODE, etc.)

**Sim'mons** (GEORGE C.), b. at Portland, Me., Apr. 17, 1840, where educated; removed to Boston in 1859; served during the civil war in the 35th Massachusetts Vols. 1862–64; clerk of U. S. board of engineers for fortifications since 1868, and has contributed largely to this CYCLOPÆDIA articles on American and foreign military biography and other subjects.

**Simmons** (Sir J. LINTORN A.), K. C. B., b. about 1816; entered the corps of royal engineers as second lieutenant Dec. 14, 1837; was engaged for three years on the Maine frontier during the disputed territory controversy; served in Turkey in 1853; joined Omar Pasha in 1854; present during the siege of the fortress of Silistria, having been escort to the new governor; in the Danube campaign the lines of Slobodzie and Georgevo were laid out and constructed by him —an operation of which he had entire charge; was present during the occupation of Wallachia; during the Crimean war was present at the battle of Eupatoria, which place he fortified; was in front of Sebastopol from Apr., 1855, until after its fall; served subsequently in Mingrelia, and in command of the division which forced the passage of the Ingur, turned the enemy's position, and captured his works and guns, the success of the day being accorded him by Omar Pasha; was British commissioner to the Ottoman army throughout the war; also commissioner for laying out the Turco-Russian boundary in Asia. In 1868 he was appointed major-general, and lieutenant-general in 1872; colonel commandant since 1872, and governor of the Royal Military Academy at Woolwich 1870–75; inspector-general of fortifications and works since 1875.

**Simmons** (WILLIAM HENRY), b. in London June 11, 1811, pupil of Messrs. Finden, and while such obtained the Society of Arts' silver medal in 1833 for an engraving finished from his own design. His works, very numerous, comprise engravings of the principal works of Millais, Holman Hunt, Salomon, Faed, Frith, and others, among which are *The Proscribed Royalist, The Verdict and Acquittal, The Poor the Poor Man's Friend, The Last of the Clan, The Marriage of the Prince and Princess of Wales, Christ and his Disciples, A Wee Bit Fractious*, etc.

**Simpson Centenary College,** Indianola, Ia., founded in 1867, has the full classical course of four years, and a scientific course, differing from the classical chiefly by the substitution of the modern languages for the ancient. The law department was organized at Des Moines, the capital of the State, in 1875, and opened with 38 students. The institution has also a commercial department and a musical, and classes in telegraphy and phonography. No distinction is made in any degree or work on account of sex. The last meeting of the board of trustees ordered the establishment of a medical department at the capital, and preliminary steps have all been taken. The school was opened in 1877. The present attendance is 297. The president is Rev. Alexander Burns, D. D.

**Skin Diseases.** The human skin is subject to the same morbid processes to which other organs of the body are. The diseases appear as primary or secondary eruptions, the former being immediate products of the morbid processes, the latter produced by further development or changes of the primary eruptions. Primary forms are—(1) The *macule* or *spot*, a change of the normal color of the skin without elevation, not uniformly distributed over the surface, arising from hyperæmia, hæmorrhage, or inflammation, sometimes from anomalies of the distribution of the coloring granules of the skin, the pigmentum. More or less uniform changes of the color of the surface are termed *discolorations*. (2) The *papule* or *pimple*, a projection above the surface, varying in size between a millet-seed and a lentil, produced by diseases of the cutaneous glands, inflammation, and new growths of the papillary layer. (3) The *tubercle*, a solid projection of the size of a lentil up to that of a hazel-nut. (4) The *wheal* is slightly raised above the surface, and greatly exceeds the thickness in horizontal extension, varying in size from that of a finger-nail to that of the palm of the hand. (5) The *tumor* forms a solid projection of the size of a walnut to that of a man's fist. (6) *Vesicles* are elevations of the epithelial layer of the skin produced by a transparent or milky fluid, corresponding in size to that of papules, and as such never being of a long duration;

while (7) *blebs* surpass the size of vesicles up to that of a goose's egg, and (8) *pustules* always contain pus, and therefore form superficial abscesses of the skin. Vesicles, blebs, and pustules almost always are surrounded by inflammatory areas.

Secondary forms of eruptions are—(1) The *excoriation*, a flat abrasion of the epithelial layer of the skin, arising from destruction and rupture of primary eruptions, very often through scratching with the finger-nails. They always heal without the formation of a scar. (2) The *ulcer* presents a loss of substance penetrating into the derma, which heals slowly and with formation of a cicatrix. (3) *Fissures* are elongated cracks in the skin on parts liable to much stretching. (4) *Scales* are produced by detached epidermis. (5) *Crusts* result from drying of an exuded fluid or of extravasated blood. If the scales or crusts or the sebaceous secretion be placed one over the other in strata, they are termed (6) *lamellated crusts*. (7) *Scars* or *cicatrices* are connective-tissue formations, which replace deeper losses of substance of the derma.

The causes of diseases of the skin are either rooted in the whole organism, or they are local ones, by which the skin is primarily or chiefly attacked; hence the division into *symptomatic* and *idiopathic* affections of the skin. There exist eruptions on the general covering which are intimately connected with and caused by diseases of the whole organism, such as in variola, scarlet fever, measles, syphilis. Certain rashes occur in typhoid fever, in purulent infection of the blood, so-called pyæmia, in scrofulosis, scorbutus, etc. Moreover, diseases of internal organs may involve the skin, especially affections of the intestinal tract, of the liver and spleen, of the internal genital organs, of the urinary apparatus, of the nerve-centres. There are, lastly, normal processes—the dentition, menstruation, pregnancy—which lead to various kinds of cutaneous affections. Hereditary transmission is of a doubtless influence in causing skin diseases (syphilis, psoriasis, leprosy, etc.); furthermore, the age, the business, the mode of life, and climate. But the most potent agencies for producing affections of the skin are those external to the body, attacking the skin directly. Besides general injurious influences—heat and cold, dryness and moisture, different arts and trades—merely local diseases are caused by the operation of caustic substances, neglect of cleanliness or exaggerated washing and rubbing with strong kinds of soap, long-continued pressure upon certain parts, and parasitic organisms which penetrate the skin. The scratching of the patient himself who suffers from itching is an important cause for producing mechanically lesions of the skin. Thus, parasites give rise to such affections by irritating the skin directly or by exciting the sensibility of the cutaneous nerves by producing the sensation of itching. Besides the vegetable parasites, living within the skin, *Trichophyton*, *Microsporon*, *Achorion*, and *Oidium*, there exist animals which dwell within the tissues of the skin—the itch-insect (*Acarus scabiei*), the pimple-mite (*A. folliculorum*), the sand-flea (*Pulex penetrans*), the Guinea-worm, the harvest-bug—or merely seek their food upon the skin's surface, such as the different kinds of lice, the flea, the bed-bug, the mosquitoes, and gnats.

With regard to these causing agencies of skin diseases the treatment will either be a universal or a merely local one. If we succeed in removing the cause of the disease, perfect cure is possible, especially of affections produced by local injurious agencies, parasites, external irritations, and the like. Skin diseases rooting in the general constitution need a general treatment, either surgical or internal. There exist many skin diseases which can be radically cured, while other ones can be removed temporarily only, without the view of radical cure; and still other ones are incurable. Many diseases run their course without any treatment, or their course cannot be modified by the physician; in these diseases, therefore, the indifferent treatment is attended with the best results. The treatment of certain skin diseases varies, however, greatly, depending upon the views about their causation; thus, very often internal remedies are given unnecessarily where mere local treatment is sufficient to cure a skin disease.

In considering the different varieties of affections of the skin, we propose to follow in all essential points the classification adopted by the Vienna school, the champion of which is Hebra. His experience, together with an unprejudiced mind, led him to doctrines more in accordance with clinical observation than those of other dermatologists of either the past or the present time. The changes of the skin, by too great an afflux of blood (hyperæmia) or lack of blood (anæmia), as such do not produce diseases of their own, being always of a transient character or rooted in diseases of the whole organism. We therefore omit their consideration.

1. *Diseases due to Perverted States of the Secretions of the Cutaneous Glands.*—The sweat-glands of the skin (see HISTOLOGY) produce a fluid, the perspiration, which contains 99.3–99.5 per cent. of water, the residue consisting of solid matters, among which are chloride of sodium, phosphate of lime, hydrochlorate of ammonia, and traces of iron and of fatty matters. Even in the normal state each individual diffuses around him a special odor. There are persons with a peculiar rancid odor of their perspiration, a disease called *bromidrosis*, either universal or local—for instance, lasting in the armpits, on the feet—in spite of the most scrupulous cleanliness. This disease is always dependent on too copious perspiration (*hyperhidrosis*), and curable by repeated treatment with diachylon ointment. The secretion of a colored perspiration is termed *chromidrosis*. The sebaceous glands, which secrete a fatty mass, may produce the sebum in excessive quantity, there being no impediment to its secretion—the so-called *seborrhœa*. The disease is very common on the scalp (dandruff), and always leads to loss of the hair. It yields readily to certain preparations of tar, and a new growth of hair can very often be obtained. If, on the contrary, the excretion of the sebaceous mass be interfered with, the result is its accumulation within the glands or their ducts, the so-called "flesh-worms"—*comedones*. In the mass of a flesh-worm there is often found an insect, the *Acarus folliculorum*. The flesh-worms, again, are the most common causes of pimples, as they act upon their neighborhood like foreign bodies. Hardened flesh-worms are termed *milium*. Sometimes the sebaceous glands become very much enlarged, giving rise to appearance of tumors, *atheroma*, which if pedunculated are termed *molluscum*, but are not contagious at all. Too scanty production of sebaceous matter leads to brittleness and desquamation of the epidermis—*pityriasis simplex* and *xerosis*.

2. *Diseases due to Inflammation.*—Inflammatory affections of the skin either terminate within a short period of time, with a definite duration, these being called *acute*, or the development and involution of the eruption take place less quickly, the inflammation being of a longer duration from repeated relapses—*chronic inflammatory processes*. The acute inflammations, again, are either caused by contagion, and themselves generate an infectious matter, or they do not owe their origin to contagion nor develop it during their course. *The acute contagious inflammations*, so-called *exanthemata*, are due to diseases which attack the whole organism, are attended with febrile symptoms, present certain definite appearances on the surface of the body, and run a course the duration of which can be computed beforehand. In these diseases—*measles*, *scarlet fever*, and *small-pox*—the sympathy of the entire organism is manifested by symptoms of various kinds, both while the rash is present and also after its disappearance. They therefore cannot be regarded as mere skin diseases. *The acute, non-contagious inflammations* have a definite typical course, as their symptoms succeed one another in regular order. If the inflammation be manifested mainly by redness, with a slight exudation of the fluid part of the blood, fugitive rashes are produced, which when spread over large parts of the surface and do not produce the sensation of itching, are termed *erythema*, but when presenting isolated red spots are termed *roseola*. Extended and isolated superficial inflammations, accompanied with stinging or itching sensation, receive the name of *urticaria*, the latter being always characterized by the development of wheals. Diseases of this kind often are produced by disturbances of the stomach or by local irritations of the skin—for instance, by certain coloring-matters of cloths, stockings, etc.—and accompanied by fever. They usually disappear after a short period of time without special treatment, but are very liable to recurrences. To the group of acute, non-contagious inflammations belong all diseases produced mechanically or by poisons, by too high or too low a temperature; furthermore, the *erysipelas* and *furuncles*. The difference in the anatomical characters depends on the extent, the penetration into the depth, and the termination of the inflammation. Lastly, there exist acute inflammations with accumulation of fluid beneath the epidermis, leading to the formation of vesicles and blebs, with short duration and no liability to return. In this group we enumerate the *herpes* (hives) and *miliaria*. The *herpes zoster* (shingles) is the most important of the forms of herpes, it being more extensive and the number of groups of vesicles much larger than in common forms of hives. The seat of shingles always corresponds to the distribution of certain cutaneous nerves; they almost always are confined to one-half of the body, and always accompanied with intense pains. Shingles attack the individual, in most instances, only once in the life; unfortunately, very little can be done for the relief of the pains. *The chronic inflammations* are characterized by a tendency to repeated relapses and the protracted course which they run. One group of these diseases is formed by eruptions which manifest themselves by a superficial redness and

slight swelling, affecting principally the papillæ of the derma, and are attended with an excessive production of epidermis, but only with trifling sensations of itching, tension, or pain. Such are *psoriasis*, *lichen*, and *pityriasis rubra*. *Psoriasis* is a very common disease, characterized by white, rough, uneven epidermical patches on a dark-red ground, dispersed all over the body, mainly on the elbow and knee joints. The patches are not liable to any further change, such as suppuration and ulceration; they leave no scars, though they are sometimes followed by persistent pigmentation. Sensations of pricking or itching are complained of only when the patches first come out; afterward there are no subjective symptoms. The disease occurs almost only on otherwise healthy and strong individuals. It is, however, harmless, but very liable to recur after it has been removed by local caustic and tar applications, together with internal administration of arsenic, carbolic acid, etc.

A second group of inflammatory skin affections is characterized by intense itching, and besides the primary form of eruption they irresistibly provoke scratching in consequence of the itching; this, again, gives rise to those further changes in the skin which are known under the name of excoriations. To this group belongs a very common disease termed *eczema*, and a rare disease termed *prurigo*. The *eczema* (moist tetter or salt rheum) is a skin disease of usually chronic course, characterized either by the formation of aggregated papules and vesicles, or by more or less deeply-red patches covered with thin scales, or in other cases by a moist surface; while in any of these forms there may be developed in addition partly yellow and gummy, partly green or brown, crusts. The different stages of one and the same malady are, therefore—papular, vesicular, squamous, weeping, and crustous eczema. The disease rarely turns into a dangerous one, but is very troublesome on account of great itching and the consequences of scratching. It is curable in every stage—by indifferent remedies when acute; by ointments, especially the diachylon and zinc ointment, when weeping; by tar preparations when scaly; and caustics when chronic and having led to hardening, so-called hypertrophy of the skin. Internal remedies almost always are useless.

A third group of chronic inflammatory skin diseases embraces those pimply and pustular affections which arise from inflammation of the hair-sacs and sebaceous glands. They are recognized as forms of *acne*, and distinguished into *dispersed acne*, *sycosis*, and *acne rosacea*. The dispersed acne on the face, the chest, and the back—one of the most disfiguring diseases—is always produced by accumulation of sebaceous masses in the glands (flesh-worms), and is entirely curable by repeated emptying of the glands and irritating agencies, without internal treatment. Analogous are the cause and the treatment of acne rosacea, which produces the most common forms of red nose. Even this disease is, if not neglected too much, entirely curable. The healing of *sycosis* (barber's itch) can be obtained by application of diachylon ointment, repeated shaving and pulling of the hairs, in the sheaths and follicles of which the inflammation is mainly situated.

To the fourth group of chronic inflammations belong the eruptions in shape of blebs, termed *pemphigus*, an incurable disease. Chronic inflammations of the skin of very variable but characteristic forms are produced by a general disease, *syphilis*; here the skin is merely symptomatically attacked, besides different other organs. With traumatic lesions of the skin, as well as with its inflammatory diseases, very often *hæmorrhage*, escape of blood from the vessels into the tissues, is combined. Hæmorrhage is furthermore a symptom of universal disease in *scorbutus*, in *purpura rheumatica*, and *morbus maculosus*.

3. *Diseases due to Hypertrophy.*—Too copious production of any tissue of the skin may be a consequence of a chronic inflammatory process, or it may occur without the symptoms of irritation as a consequence of anomalous congenital productivity. The *corn* and the *tyloma*, for instance, are products of a long-continued local irritation of the skin, but we know of instances in which tyloma, the hardening and hypertrophy of the skin of the palms and the soles, must be considered as a congenital disease. The *elephantiasis arabum*, an immense hypertrophy of all constituting tissues of the skin, is doubtlessly due to chronic inflammation of the lymphatics; while *ichthyosis*, the exuberant growth of epidermis, is due to the congenital hypertrophy of the papillæ. *Warts* and *papillary growths* of the skin may be produced by either kind—local irritation as well as anomalous function of papillæ. *Horns* of the skin, hypertrophy of the nails and the hairs—*polytrichia*—always are dependent on congenital anomalies in the formation of the tissues of the skin. The pigment-granules of the rete mucosum are very often hypertrophied, leading to formation of brown spots, *ephelides* (freckles), *chloasma* (liver-spots), while long-continued irritation of the skin leads to universal dark discoloration—*melasma*.

4. *Diseases due to Atrophy* are based on the same principles as the too copious formation of certain parts of the skin—hypertrophy. Inflammation often produces first hypertrophy, afterward ulceration, loss of substance, and atrophy. *Leprosy*, *lupus*, and *sclerodermia* are instances of such combined diseases. In leprosy tumors first appear, which subsequently shrink or ulcerate, or the shrinkage is the immediate symptom of the disease—*morphea*; here the decreased sensibility of the attacked parts is one of the main symptoms. All these diseases lead to secondary ulceration, loss of parts of the skin, even parts of the body. The treatment is only in *lupus* successful, but even here not invariably. Hypertrophy of the pigmentum is not rarely combined with its partial atrophy in *vitiligo*, *leukopathia*, etc. Merely to atrophy are due the senile changes of the skin, the white color of the hairs, the early falling out of the hairs without visible cause, the localized atrophy of hairs in *alopecia areata*. A plain atrophy is also the *xerodermia*. But very little can be done with regard to the cure of these diseases.

5. *Diseases due to New Growths.*—New growths or tumors either belong to the connective-tissue formations of the skin, the derma, or they are products of an anomalous epithelial growth. Tumors of the former kind may be benign or innocent—viz. painless, not ulcerating, not recurring after extirpation, and not infecting the organism, such as *fibroma*, a variety of which is the formation of scars without preceding lesion, the so-called *cheloid*; furthermore, *papilloma*, growth of the papillary layer, embracing most of the *warts* and *nævi*; lastly, *angioma*, erectile tumors produced by copious new formation of blood-vessels. Or the connective-tissue tumors are malignant—viz. painful, ulcerating, producing new growths around the first-formed tumor, and easily recurring after extirpation, even leading to secondary formations of identical tumors in the lungs, the liver, etc., such as *sarcoma*, one variety of which, the *pigmented* or *melanotic sarcoma*, forms the most malignant kind of tumors of the organism. Cancer is considered to be essentially an epithelial formation, which always is malignant. In all tumors the radical extirpation is the only reliable means of curing the disease, very often of saving the life of the patient.

6. *Diseases due to Anomalies of Innervation—Neuroses.*—Many of the already-named diseases of the skin can be looked upon as being disturbances of the nerves in the first instance (*urticaria*, *herpes zoster*, *leprosy*, *atrophy of pigment*). Besides, we know disturbances in the property of sensation of the skin, lowered sensibility—*anæsthesia*—and excited sensibility—*hyperæsthesia*. To the latter kind belongs the itching of old persons, *pruritus senilis*, which malady often is treated successfully by internal administration of carbolic acid.

7. *Diseases due to Parasites*—The *scabies* is produced by the presence of the itch-insect within the epidermis. It begins with development of small vesicles, mostly on the skin of the hands, especially that between the fingers, these places being the most exposed to invasion of the insect. The eruption is accompanied with severe itching, which compels the patient to scratch. By simply scratching a certain length of time, all symptoms of *eczema* arise, even boils and furuncles. The disease is readily curable by local application of preparations of sulphur. Analogous is the action of the flea, the bed-bug, the louse. By vegetable parasites are produced slightly-scaling and itching brown spots, *pityriasis versicolor*; furthermore, *herpes tonsurans* (ring-worm), a very common disease, appearing first in the shape of small vesicles or ring-like red eruptions, which, when situated on the parts provided with hairs, lead to baldness; lastly, *favus*, a disease kindred to ring-worm. If we succeed in killing the parasites locally, a perfect cure can be obtained in a short period of time; but on the scalp and the beard, where the parasites advance deeply into the root-sheaths of the hairs, these diseases usually are very obstinate.

C. HEITZMANN.

**Slavery,** the condition in which one person is the property of another, is found in the earlier stages of the history of almost every nation known. It originated, no doubt, from war, which then was not so much a settlement by force of some disputed question as a struggle for existence, in which the vanquished, naturally enough, became the property of the victor who spared his life. Among the ancient Assyrians, insolvent debtors, as well as captives taken in war, were reduced to slavery, and the slavery was perpetual. The Hebrew system was one of great mildness. Native Hebrews might either sell themselves on account of poverty, or be sold in punishment of theft; but only for six years at most, and not even for that length of time if the jubilee year came sooner. Foreign slaves appear not to have shared in the jubilee release, but their personal

rights were carefully guarded. The smiting out of a servant's eye, or tooth even, brought freedom to the servant. A master who killed his servant, man or maid, was to be "punished" (Ex. xxi. 20)—the law does not say how, but probably, as in Egypt, with death. With the Greeks and Romans slavery formed the very basis of the political constitution, and Plato, although he recognized it as being opposed to the true idea of human nature, declared it, nevertheless, necessary for the maintenance of the state. In all the Greek states the slaves outnumbered the freemen, and in some—as, for instance, in Sparta—they were treated very harshly (see HELOTS), while in others—as, for instance, in Athens—the institution assumed a much milder character, and attempts were made to give the slave some rights and a certain dignity. In Rome the slave had originally no rights at all. For the smallest misdemeanor he could be legally punished with death—crucifixion—and he was never admitted as a witness without being put to the torture. Subsequently, the rich Romans fed the murænas for their tables by throwing their old slaves into the ponds, and hosts of young slaves were annually educated to fight and kill each other in the arena. The institution was not only cruel, however; it also by degrees assumed almost incredible dimensions. Many a rich Roman possessed from 10,000 to 20,000 slaves—a large number in his luxurious house in the city, the rest on the immense sheep-walks, vineyards, olive-plantations, etc., from which he derived his income. Slave revolts occurred in 140 and 104 B. C. in Sicily, and in 73 B. C. under SPARTACUS (which see), and led to the introduction of some milder measures. But it was not until the time of the emperors that any great change took place in the condition of the slaves. Augustus granted every ill-treated slave a hearing before the magistrates when he sought refuge at his statue. Antoninus deprived the master of his right over the lives of his slaves. Manumissions became very frequent for political reasons; and finally, the institution vanished before the spirit of Christianity, or assumed another character. (See SERF.)

The Koran forbids the Moslems to keep their co-religionists as slaves, and neither Mohammed nor his next successors subjected their conquered enemies to slavery. They kept negro slaves, however, imported from Africa, but they treated them very mildly. It was the contact between the Mohammedans and the Christians during the Crusades which gave a new impulse to slavery. The Christian knights made slaves of their Mohammedan captives; the Mohammedan warriors took redress, and from the tenth to the fourteenth century there grew up a considerable slave-trade, of which Rome was the centre. Here the Spaniards brought their Moorish prisoners into the market, and here, under the very eyes of the popes, the Venetian merchants sold Christian men and women into Mohammedan slavery. Slavery still exists in most Mohammedan countries, but in a very mild form, and as a political rather than as a social institution, it being possible for the slave not only to acquire liberty, but even to attain the highest social position. Among the Berbers, however, along the northern coast of Africa, slavery and the slave-trade developed, as early as the fifteenth century, into a terrible calamity. Merchants, sailors, casual passengers, and others, crossing the Mediterranean, were kidnapped by the Berbers, and if not ransomed sold into slavery. Charles V. fought against this evil with some momentary success, but it was not fully suppressed until 1830 by the French conquest of Algeria. Another and still more powerful impulse the institution and the trade received after the discovery of America. The invention of hunting negroes in the interior of Africa to use them as slaves in the colonies is due to the Portuguese, but for its application to the New World and its establishment as a regular and legal business the world is indebted to the Spanish priest, Las Casas. In 1517, Charles V. gave the marquis de la Bresa a monopoly for eight years of importing negro slaves to the American colonies; but soon a very extensive and profitable trade sprang up, in which the English procured their share by the Peace of Utrecht (1713), where Spain was compelled to allow them to import 144,000 slaves to her American colonies. But the history of this part of the subject is fully treated under the heads ABOLITION OF SLAVERY, ANTI-SLAVERY, AMENDMENT, CONSTITUTION, REPUBLICAN PARTY, and UNITED STATES (*History*), in CYCLOPÆDIA.

**Sloane** (JAMES RENWICK WILSON), D. D., b. at Topsham, Orange co., Vt., May 29, 1823; graduated at Jefferson College in 1847; studied theology at the Reformed Presbyterian seminary of North-western Ohio, where he graduated in 1853, and in 1854 became pastor of the Reformed Presbyterian church in Rushsylvania, O., and in 1855–56 of the Third Reformed Presbyterian church in New York City. In 1868 he was elected professor of theology in the Reformed Presbyterian theological seminary at Allegheny City, Pa.—a position which he still holds. He has published a number of sermons and some literary addresses.

**Smal'ley** (DAVID A.), b. at Middleton, Addison co., Vt., Apr. 6, 1809; studied law, and entered the Franklin county bar in 1831; was made a State senator in 1842; admitted to the bar of the U. S. Supreme Court in 1844; appointed collector of customs for Vermont in 1853, and U. S. district judge of Vermont in 1857, from which position he retired on full pay, by act of Congress, in 1875. D. Mar. 10, 1877.

**Smith** (BENJAMIN BOSWORTH), b. at Bristol, R. I., June 13, 1794; studied theology at Brown University; was ordained deacon in 1817, and priest in 1818, and was consecrated bishop of the Protestant Episcopal diocese of Kentucky Oct. 31, 1832, at New York. He edited the *Episcopal Register of Vermont* in 1827, and the *Episcopal Recorder*, Philadelphia, from 1829.

**Smith** (E. P.), b. at South Britain, Conn., in June, 1827; was educated at Dartmouth and Yale colleges, and graduated from the theological seminary of New Haven; was settled for several years as a minister of the Congregational church at Pepperell, Mass.; became one of the most active members of the U. S. Christian Commission during the war, and published in 1869 a large volume, *Incidents of the Christian Commission;* was appointed, after the war, general field-agent for the American Missionary Association in the Southern States, and in 1873 U. S. commissioner of Indian affairs, but retired from this position in 1875, and went next spring to visit the African mission-field for the American Missionary Association; arrived at the mouth of the Gambia Apr. 27, but died at Aura in July, 1876.

**Smith** (HAMILTON LANPHERE), A. M., LL.D., b. at New London, Conn., Nov. 5, 1819; graduated at Yale College in 1839; was appointed professor of natural philosophy and astronomy at Kenyon College in 1854, and at Hobart University in 1869, and has published *Natural Philosophy* (1847–50), *World* (1848), *Sundry Papers on Microscopy, Diatomaceæ, etc.*, in *Silliman's Journal*, etc.

**Smith** (JOHN COTTON), D. D., b. at Andover, Mass., Aug. 4, 1826; graduated at Bowdoin College in 1847, and studied theology in the divinity school of the diocese of Ohio; was ordained in 1849, and immediately became rector of St. John's church, Bangor, Me.; in 1852 became assistant minister on the Greene foundation of Trinity church, Boston, whence in 1860 he was called as rector of Ascension church, New York City. He has written essays on evolution and a personal Creator, and on the modern schools of thought, collected in his *Miscellanies, Old and New* (New York, 1875). JAMES APPLETON MORGAN.

**Spen'cer** (SARAH ANDREWS), b. at Lavonia, N. Y., in 1837; graduated from high and normal schools in St. Louis, Mo.; was a teacher from the age of sixteen to her marriage in 1864 with Henry C. Spencer, when she removed to Washington, D. C., where she conducts a school for the business training of women. In 1871–72 she defeated attempts to license the "social evil" in Washington; in 1873 she secured a bill from the District of Columbia legislature for the reform of outcast girls, and has a girls' reform school bill now (1876) pending in Congress. Apr. 14, 1871, Mrs. Spencer and 72 other ladies of Washington were refused their right to register and vote. Mrs. Spencer brought suit in the supreme court of the District, and Judge Cartter's decision that "women are citizens, but have not the right to vote without local legislation," was reaffirmed by the U. S. Supreme Court in 1874. Mrs. Spencer represented the National Woman Suffrage Association at the Republican Presidential convention at Cincinnati in 1876, and addressed both the convention and the committee on resolutions and platform. Mrs. Spencer engrossed and signed the Woman's Declaration of Rights, and was one of the committee of five who presented it to Vice-President Ferry at the Centennial celebration in Independence Square, Philadelphia, July 4, 1876. SUSAN B. ANTHONY.

**Sponges** [Gr. σπογγιά]. Until quite recently these animals have held a doubtful position, but the observations of Grant and Lieberkuhn, Carter, Clark, Haeckel, have placed them unquestionably in the animal kingdom. They are structurally remarkably uniform, though differing greatly in external aspect. They (Fig. 1) consist internally of a mass or layer of sarcode or mesoderm containing a greater or less number of true cells, and have an ectoderm and endoderm of cellular issue. The majority of the forms are supported by a skeleton of interwoven threads or spicules, or both, of various forms. The exterior is perforated by innumerable pores leading into channels in the interior, which enlarge and join with groups of neighboring channels, forming large branches. These in turn form junctions with other branches, and finally all of them unite into one or several

large trunks, which open outwards like minute craters on the external surface. These are lined with another membrane, differing from anything else of its kind in the animal kingdom. It is composed of minute cells furnished on the free side with a long whip or flagellum surrounded by a collar. Their interiors contain a nucleus and digestive vacuoles, and they in all respects resemble the independent animals known as Flagellate Infusoria. They take in and digest food in the same manner, and eject excrements in great profusion from the area enclosed by the membranous collar, as shown by Carter and Clark. In the silicious sponges these flagellate cells are surrounded by a distinct bag-like membrane, and the whole is called an ampullaceous sac. The eggs and spermatozoa, as shown by Schultze, are derived from modified cells of the mesoderm, whereas the skeleton is either built up partly from the external membrane and partly from the sarcode by exogenous growth, or by the transformation of the loose cells of the sarcode into spiculæ, as shown first by Lieberkuhn. The function of the smaller external pores is to admit the water, which is thus strained and deprived of its coarser floating material. It is then carried along the canals by the motion of the cilia, and conveys its load of minute food to the ampullaceous sacs and zoöidal cells. The hydraulic pressure occasioned by the inward flow of the innumerable minute streams forces it through the larger trunks and out at the craters or ostioles with great rapidity. The excrements of the zoöidal cells and other fæcal matters are thus cast out of the ostioles at such a distance from the body that they are not affected by the inward currents through the pores, and are carried away by the water. This peculiar structure induced Carter and Clark to consider them compound animals, and the latter associated them directly with the Flagellate Infusoria. The observations of Haeckel, however, substantiated and corrected by those of Metschnikoff, Carter, and especially Schultze and Barrois, show that this view is not consistent with the history of their development. They have true eggs, derived from the mesodermic layer. These undergo segmentation, and a single layer of cells is formed around the exterior. Those on one hemisphere of the larva of the Calci-spongiæ speedily acquire the collars and flagelli and elongated forms of the mature zoöidal cells, but those of the other hemisphere remain simple. The next stage is a gastrula made by the invagination of the simple-celled membrane (Fig. 4). Subsequently, the opening of the bag-like stomach becomes filled again by an extension or evolution of the same cells, according to Barrois, and the larva penetrates through the endoderm into the channels, and from thence into the water. The larvæ of Silicioidea and Carneo-spongiæ differ from these in not having a gastrula stage. The endoderm either occupies one pole at first, as in the Calci-spongiæ, or fills the interior with a granular mass. This last or solid form is the more common one, and is also distinguished by the fact that the endoderm is visible at one end of the larva in what might be called the basal area, a circular space, which is usually surrounded by a thickened rim or tumid collar, the basal collar. The area is in the Silicioidea marked with bright spots, the bases of a primitive bunch of spicules, and in the Carneo-spongiæ these spicules are absent. This space is the homologue of the mouth of the gastrula of the Calci-spongiæ, and like that, also, is the true base of the larva and the end by which it usually attaches itself. The ampullaceous sacs are developed from the endoderm, and the canals are subsequently hollowed out of the mesoderm. Holes or perforations, the pores, are formed, connecting the interior with the surrounding waters, a large ostiole or cloacal aperture breaks through at the top, and the simplest sponge form is complete. Huxley and Lieberkuhn ascertained that the sponges are hermaphroditic, developing both eggs and spermatozoa in the same individual. Besides this means of propagation, they also possess another class of reproductive bodies known as gemmules, which are usually protected by a leathery or horny case, in most cases strengthened by spines or spicules of various shapes. These contain a cellular mass, whose development has been followed by Lieberkuhn in Spongilla. The earlier stages of the development of the gemmule are not well understood, but the result is the same as in the development of an egg, the first form of the sponge being a body with a ramifying cavity and ostiole, permeated on the sides by pores leading into a system of canals and ampullaceous sacs.

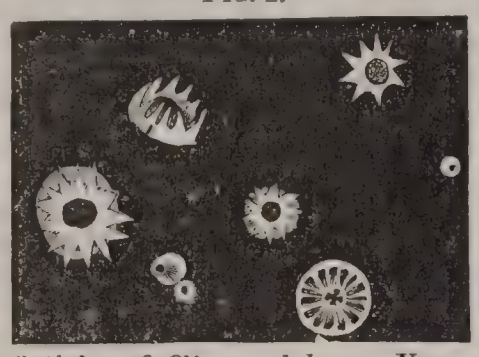
The structural evidence, therefore, leads to the following anomalous conclusion: that the sponge, though developed like other individual animals from a single egg or bud, eventually acquires a membrane, either partially or wholly lining the interior, which is partly composed of cells functionally and structurally homologous with Flagellate Infusoria. It is therefore in its simplest adult form homologically a single animal with the internal structure and functions of a colonial organization. This transformation is so complete that the distinguishing characteristic of the group, the water-system with its innumerable pores and oscules, and all the modifications of the form and skeleton, are directly subordinate to the function of supplying the zoöidal cells with floating food of suitable size and the efficient exportation of the excrements. Haeckel and some other authorities consider the water-system of the sponges as homologous with the gastro-vascular system of the Cœlenterata. The true stomach of the Cœlenterata, however, is formed either by a division of the contents of the planula, or by the invagination of the external membrane. The gastrula stage, therefore, arises in a different way in the two groups, but even if similarly formed, I cannot see that this agreement would necessarily associate the sponges with the Hydrozoa and corals, when the young differ so essentially in all the succeeding stages. Huxley was the first to recognize the importance of the characteristics of the sponges, but was completely misled by the too hasty adoption of Haeckel's gastrea theory and his low estimate of the value of taxonomy, which makes his own attempts in that direction, though very original and often very valuable, more remarkable for the strong light they throw on some single

Fig. 1.



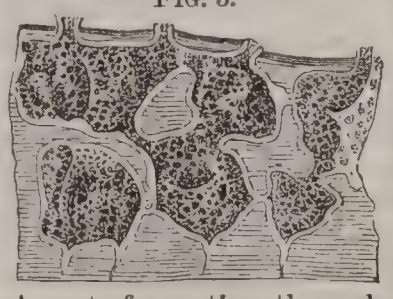
*Tethya gravata*, Hyatt (N. S.).

Fig. 2.



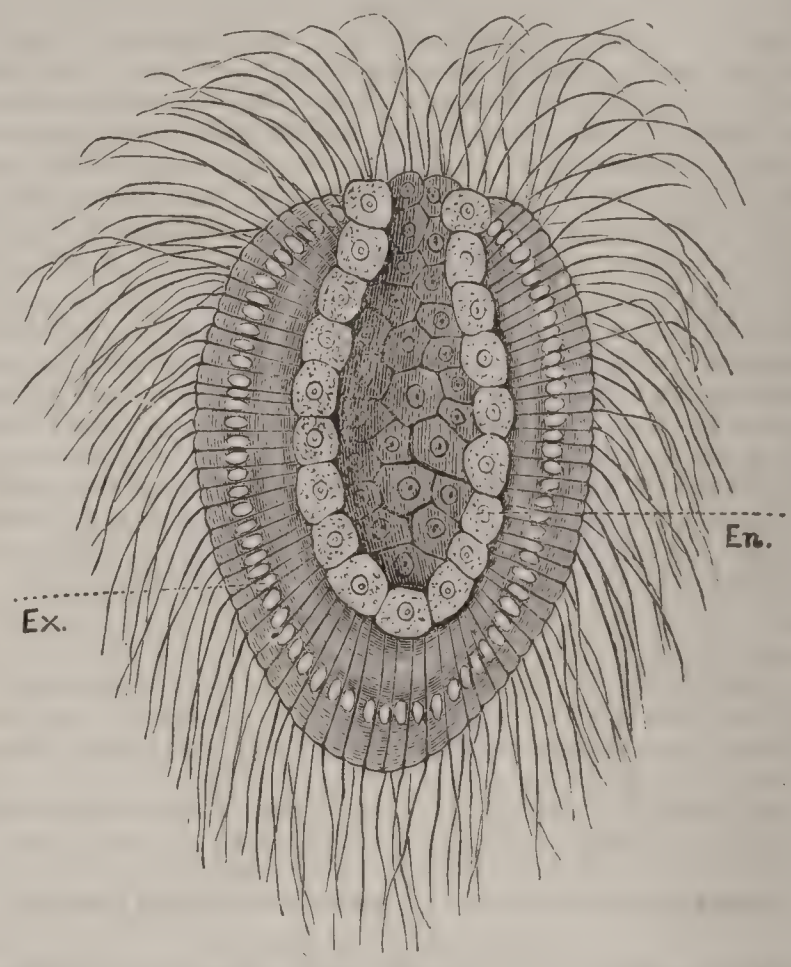
Ostioles of *Cliona sulphurea*, Verr., projected through the epidermis of the shell of a mussel.

Fig. 3.



Aspect of a section through Fig. 2.

Fig. 4.




Gastrula of *Luculmis echinus*, Haeckel: *En*, endoderm; *Ex*, ectoderm. (From *American Naturalist*.)

structural character than for their comprehensiveness. The Poriferata or Poriferæ were called by him, in his classification of the animal kingdom founded on embryological data, the Metazoa Polystomata, and considered the equivalent in this respect of the remaining sub-kingdoms or branches, the radiates, articulates, and vertebrates, which were united under the name of Metazoa Monostomata. Though the sponges, like all animals except the Protozoa, as shown by Haeckel, have eggs which undergo segmentation, and they may therefore be called Metazoa, they cannot be said to be monostomatous, since, as above described, the homologue of the mouth is the basal area, and this does not persist in the adult colony, but serves as the base of attachment. MacAllister, in his *Animal Morphology*, subsequently corrected this mistake, and gave the true value of the characteristics of the Poriferata, considering them a distinct sub-kingdom of animals. The conclusion recorded in this article was reached independently of either of these authors, MacAllister's book not having been seen until after the manuscript was sent to the publisher, and it may therefore be considered more reliable than if it stood alone. From the Protozoa the sponges are still more remote, since their nearest allies, the Flagellate Infusoria, propagate either by direct fission or by the encystment of one individual alone, or by the fusion of two individuals into one, and the subsequent encystment and division of this one into many others, as shown by Dallinger and Drysdale. Viewed in every light, therefore, the sponges appear distinct from all other animals, and we must consider them as a branch or sub-kingdom. The older classifications were founded upon the peculiarities of the external form, and are now useless. The modern classifications, though based on an extended knowledge of the skeletons, are also necessarily very imperfect, owing to the slight and fragmentary nature of our existing information with regard to the fossil forms. The following is a modification of various other classifications, especially those of Schmidt, Carter, and Haeckel, but is based on original observations and adopted by the author in his *Memoirs on the Poriferæ (Poriferata) of North America*, now in course of publication by the Boston Society of Natural History:

## BRANCH OR SUB-KINGDOM—PORIFERATA.

### CLASS CALCI-SPONGIÆ.

Animal supported by a skeleton of calcareous material, disposed in lines or columns at right angles to the walls.

#### ORDER OLYNTHOIDEA.

Skeleton spicular. Spicules calcareous and of three kinds; single axis or needle-shaped, and three or four rayed. These last are arranged usually in one or two rows, so that the rays of the bases interlace and are the principal supports of the walls.

##### Sub-order Ascones.

Described by Haeckel as having thin walls, with pores which are not permanent, but may close, and open again anywhere through the wall. The skeleton spicules are in one row, except in Ascyssa.

##### Sub-order Leucones.

Described by Haeckel as having irregular, branching, permanent canals and thick walls. The skeleton spicules are in two rows in most species.

##### Sub-order Sycones.

Described by Haeckel as having regular, tubular, permanent, radiatory canals and thick walls. The skeleton spicules are in two rows in most of the species.

#### ORDER COLUMNOIDEA.

This is instituted for the reception of those fossil forms which like Receptaculites and Stromatopora have columnar instead of spicular supports between the walls of the body, the walls themselves being in the fossils largely calcareous, and partly composed of the expanded bases of the columns. Receptaculites, though its affinity with sponges has been very clearly shown by Billings, may be still considered doubtful, but there can be no question of the affinities of Stromatopora since the figures published by James Hall in the *Reports of the State Museum of New York* and the analysis of the structure of the genus by Nicholson in the *Annals and Magazine of Natural History*.

### CLASS CARNEO-SPONGIÆ.

The central layer or mesoderm is exceedingly thick. The skeleton may be either of keratode or silicious, and may consist of fibres or spicules, or a combination of both. These are distributed with reference to the greater or less irregularity of the form in a more or less radiatory manner, but this plan is subordinate to the necessity of producing a strong supporting framework for the canals and form by the interlacement of fibres and skeletal spicules. Some species have no skeleton, but they lead by slight gradations into true keratose and silicious sponges.

#### ORDER HALISARCOIDEA.

No skeleton. Animal gelatinous. Only one genus, *Halisarca*, has as yet been described, which can be properly referred to this group.

#### ORDER KERATOIDEA.

Skeleton consisting of horny fibre, either wholly or partly formed by the external layer, and therefore frequently containing foreign materials.

##### Sub-order Gumminiæ.

Skeleton consists of very fine keratose threads, according to Schmidt. Animal very tough and leathery. The external layer thick and cortical. Only one genus, *Gumminia*, can be referred to this order.

##### Sub-order Darwinellinæ.

Has the primary fibres similar to those of the Aplysinæ, but with a solid core and horny flesh spicules.

##### Sub-order Spongiæ.

Fibre solid, rounded, not generally thickened by exogenous growth.

##### Sub-order Aplysinæ.

Fibres hollow, thickened by exogenous growth, generally flattened.

#### ORDER KERATO-SILICIOIDEA.

Skeleton composed of solid keratose fibre and silicious spiculæ.

##### Sub-order Chondrillinæ.

This is established in order to include the singular genus *Chondrilla*, Schmidt excluding the genus *Columnitis* and *Chondrilla phyllodes*, Schm., which are true Siliciæ. The skeleton consists of very fine keratose fibre and scattered star-like silicious spiculæ.

##### Sub-order Rhaphidonemata.

Fibres with a core of silicious, simple spiculæ. Equivalent to the order thus described by Carter.

##### Sub-order Echinonemata.

Fibres with a core of silicious spicules, and a secondary system of spicules projecting from the fibres. Equivalent to Carter's order of the same name.

#### ORDER SILICIOIDEA.

Skeleton composed of silicious spicules, either separate or arranged in bundles.

##### Sub-order Chondrosinæ.

This division includes the *Chondrosia* of Nardo, which has been described by Schmidt as permeated by hard granules and distinct silicious spicules. It is likely, also, that the two species, *Chondrilla phyllodes* and *Columnitis squamata*, Schmidt, both belong to this sub-order, since they have the silicious star-like spicules and also a system of true skeletal spicules.

##### Sub-order Holoraphidota.

The fibres are composed of silicious spicules of the single-axis system in great abundance, intertwined and bound together by sarcode (*Carter*).

##### Sub-order Ancorinæ.

This group, according to Schmidt, contains the Lithistidæ, Leodinidæ, and Ancorinidæ. They have anchor-shaped spicules or spiculæ, belonging to the pyramidal type.

##### Sub-order Hexactinellæ.

Skeleton spicules with six rays.

The Poriferata are probably universal in distribution, but none have been described from the extreme arctic or antarctic zones, and but few species of one genus, *Spongilla*, inhabit the fresh waters. They are almost invariably attached or anchored to the bottom and to stationary or floating objects, and are only found in pure waters. None seem to be truly parasitic—that is, capable of living upon the juices or in the interior of other animals—though several are externally parasitic, and several are borers in shells or limestone. None are used as food either by animals or by man, though frequently serving as the abode of larval and adult forms, especially of the worms and Zoanthidæ.

The Calci-spongiæ are generally small in size, and attracted but little attention until Haeckel published his great work on the *Kalkschwämme*. They are inconspicuous in color, and generally fusiform, or if branching the branches are of the usual fusiform shape, with the single opening at the apex (Fig. 6). There are many exceptions to this rule in the shape of solid branching and irregular forms, but these do not come under general observation. They are all

marine, and, so far as known, generally distributed, but are only found in the shallower waters.

The order Keratoidea is the best known of the Carneospongiæ through their common representatives, the commercial sponges. The marketable kinds are all of one genus, that from which all the sponges derive their common name, *Spongia*. There are six species only, with numerous varieties, which are offered for sale. Three of the species are from the Mediterranean and the Red Sea, and three from the Bahamas and Florida. Other species of this genus have a very general distribution, but they are all confined to the equatorial and south temperate zones, within an area on either side of the equator which is limited by the isotherm or average temperature for January of 50° F. The *Spongia graminea*, Hyatt, and *Spongia cerebriformis*, Duch. et Mich., are occasionally used in Florida and Bermuda, but not exported. The marketable sponges owe their excellence to the closeness, fineness, and resiliency of the interwoven fibre of the skeleton. The Mediterranean appears to be particularly favorable to the production of specimens with skeletons possessing these desirable qualities in the greatest perfection. Those from the Red Sea are next in rank, while those of our own shores, though corresponding species to species with these and the Mediterranean forms, are coarser and less durable. Thus, *Spongia equina*, Schm., the horse or bath sponge of the Mediterranean, is finer than the *Spongia gossypina*, Duch. et Mich., the Wool-sponge of Florida and Nassau, though it otherwise resembles it closely. The *Spongia zimocca*, Schm.—Zimocca sponge—represents in the Mediterranean waters the much coarser *Spongia corlosia* and *Spongia dura*, Hyatt, the Yellow-sponge and Hard-head, on the American side. The *Spongia adriatica*, Schm., the Turkey-cup sponge and Levant toilette sponge of the Mediterranean, answers to the finest of our own sponges, the *Spongia tubulifera*, Duch. et Mich., the Glove-sponge. It is probable that the Mediterranean and Red Sea were both colonized from the Caribbean Sea, and, strictly speaking, the six marketable species ought to be classed as three species, with six principal varieties, differing from each other according to their habitat. This conclusion is borne out by the facts that the Caribbean Sea contains more species of this genus than any other locality, that no marketable sponges are found in the Indian or Pacific Ocean, and that the differences in quality cited above are occasioned in these and other sponges with fibrous skeletons by any change from shallower to deeper water, or from waters loaded with sediment to clearer waters. In each and all of these cases a finer texture is the result, and this correlates directly with the fact that even in the Mediterranean the marketable kinds are found in waters which are probably very rarely reduced even during the month of January to 55°, and perhaps for the best qualities not below 60°. They are confined to the coast between Trieste and Ceuta on the African side of the Straits of Gibraltar, none being found in the Black Sea, on the coasts of Italy, France, or Spain, or the islands of Corsica, Sardinia, the Balearic Islands, or even Sicily.

When living, the commercial sponges have the general aspect and consistency of a piece of beef's liver, but the color is darker. They are gathered by means of hooks on long poles, or directly by the hands of divers, or, as in case of some of the coarser kinds, dragged up roughly by dredges. When secured they are exposed to the air for a limited time, either in the boats or on shore, and then thrown in heaps into the water again in pens or tanks built for the purpose. Decay takes place with great rapidity, and they are soon fished up again and the animal matter squeezed and washed out, leaving the cleaned skeleton ready for the market. In this condition, after being sorted, they are sold to the dealers, who have them trimmed, re-sorted, and put up in bales or on strings ready for exportation. There are many modifications of these processes in different places, but in a general way these are the essential steps through which the sponge passes before it is considered suitable for domestic purposes. Bleaching-powders or acids are sometimes used to lighten the color, but these, unless very delicately handled, injure the durability of the fibres. The genus *Spongia* does not usually appear in water deeper than 30 fathoms, but other members of the order may occur at a depth of even 75 fathoms. The Keratoidea are all marine, and are found on stony ground or coral-reefs; muddy and sandy bottoms are not favorable to their growth.

FIG. 5.



Aspect of a specimen of *Spongia corlosia* (yellow sponge) when dried, before the animal matter is washed out. Near the top of the figure the outer membrane, ectoderm, is unbroken except by the pores and the large ostioles, but below it is much torn.

The Kerato-Silicioidea resemble the Keratoidea closely in appearance, but possess less consistency and are the most difficult to preserve, the mesoderm being, even in the strongest alcohol, liable to wash out of the skeleton. The fibres are harsh and stiff, and the forms generally bush-like. The distribution is general, so far as known, and they are found on clean hard bottoms or in situations exposed to the full sweep of the strongest currents. They are all marine, and vary from the most brilliant colors to the dullest whitish-brown. They are found principally in the shallow water near the shore, but probably occur at all moderate depths on the proper kind of bottom.

The order Silicioidea has the greatest range in all respects. The forms differ, from those like *Vioa* and *Cliona*, which may be of any shape, to those like the *Euplectella* or Venus's flower-basket, which excel all others in the beauty and regularity of their spun-glass skeletons. They are found on all kinds of bottom, in all climates, and at all depths, in both salt and fresh water, and contain the only species known to occur in situations periodically exposed to the air, such as the *Spongillæ* in the tanks of India and one marine species, not yet described, from the coast of California. They are best known by the mud-dwelling forms belonging to the sub-order Hexactinellæ, or spun-glass sponges, so called on account of the aspect of the long fibres, which spring out in all directions from the base of the mass, and serve to anchor them in the mud. These are almost exclusively found in the deeper waters and on muddy bottoms. Some of the forms of the sub-order Holoraphidota are also remarkable for their habit of growing in the bottom itself, between and around the particles of sand, but no ampullaceous sacs have yet been described in these forms, so that their true nature is still doubtful. Perhaps the most remarkable are the boring sponges, which dissolve the interior of shells, destroying vast numbers of oysters, mussels, and scallops. One of these, *Cliona sulphurea*, Verrill, does not confine itself alone to the shell in which it generally starts, but spreads out on all sides, killing the animal, surrounding and dissolving the entire shell, and continuing to grow, taking in sand and stones in great quantities, until some of the masses reach the diameter of a foot or more. No other species of the Poriferata is known to have such varied habits, since it is sometimes also found attached to rocks, with a perfectly clean interior. One species also, *Suberites compacta*, Verrill, inhabits shifting sands on exposed coasts, where it must lie loose upon or partly buried in the surface. This, however, is no exception to the rule that all sponges are normally attached, since one specimen found on stony bottom was fastened at one end to a stone, and the skeleton was modified, as usual, to form the base. A. HYATT.

FIG. 6.



*Sycandra ciliata*, Haeckel. (From *American Naturalist.*)

**Squier** (MILES POWELL), D. D., b. in Cornwall, Vt., May 4, 1792; graduated at Middlebury College 1811, and at Andover Theological Seminary 1814; ordained first pastor of the First Presbyterian church of Buffalo, N. Y., May 3, 1816, where he continued eight years; in 1824, for one year, financial agent of Auburn Theological Seminary; from 1825 to 1833 Western agent of the American Home Missionary Society; founded Geneva Lyceum in 1831; elected professor of intellectual and moral philosophy in Beloit College in 1849; retained that connection till he d. at Geneva, N. Y., June 22, 1866. Dr. Squier was a frequent contributor to religious papers and reviews, and was author of the following works—viz. *The Problem Solved* (1855), *Reason and the Bible* (1860), *The Being of God and Moral Government* (1867). A. L. CHAPIN.

**Staff and Staff Schools** [Fr. *état major;* Ger. *Stab;* It. *stato maggiore;* Span. *estado mayor*], the body of officers and their assistants whose special function is the direction of the mass which constitutes the force of an army. Its constitution varies in different armies. In the French army the *état major général* (the general staff) comprises the marshals of France, the generals of division, the gen-

erals of brigade. The service of the staff comprises—(1) the officers of the staff, as follows: 40 colonels, 40 lieutenant-colonels, 120 chiefs of squadron, 200 captains; (2) officers of the records: 24 captains (*archivistes*); total, 400 officers. The special staff of the artillery comprises 37 colonels, 37 lieutenant-colonels, 98 chiefs of squadron, 112 first and second captains—total, 284 officers—and 514 guards, 160 arms-keepers, 170 artificers, 260 battery-keepers.

The duty of the artillery staff is to assure to the several armies the service of the staff of the artillery of the armies and of the army corps, and the general direction of the different services of the artillery arm. The staff of a regiment of artillery comprises the following: (1) officers: 1 colonel, 1 lieutenant-colonel, 4 chiefs of squadron, 1 major, 1 surgeon first class, 3 first and second captains—viz., 1 instructor of equitation, 1 adjutant-major, 1 treasurer—the clothing officer, 1 lieutenant or sub-lieutenant as assistant treasurer, 1 assistant surgeon, 1 first veterinary, 1 second veterinary, 1 assistant veterinary; total, 16 officers. (2) Enlisted men: viz. non-commissioned staff (*petit état major*), 3 adjutants (of whom one has charge of barracks), 1 chief artificer, 1 sergeant, chief machinist, and guard of the park, 1 sergeant-bugler, 1 corporal-bugler; total, 7 non-commissioned officers; 1 adjutant in charge of arms and harness, 1 chief armorer, 1 chief sergeant, 1 fencing-master (an adjutant or a sergeant), 8 sergeants—viz. 1 baggage-master, 1 librarian, in charge of the school apparatus, 1 hospital steward, 1 veterinary-hospital steward, 1 in charge of remounts, 1 first secretary to the treasurer, 1 storekeeper and first secretary to the clothing officer, 1 master saddler; 1 quartermaster, 6 corporals—viz. first secretary to the adjutant in charge of arms, first armorer, first tailor, first shoemaker, first saddler, second secretary to the treasurer; cannoniers, 1 for the veterinary hospital, 2 armorers, 2 tailors, 2 shoemakers, 2 secretaries of the colonel and of the major, second secretary to the clothing officer, 3 secretaries to the treasurer, 1 *enfant de troupe;* total, 16 officers, 37 non-commissioned officers and men, 1 *enfant de troupe,* making, as the staff of each regiment of artillery on the peace footing, 16 officers and 38 men.

Special staff of the engineers comprises—(1) 33 colonels, 33 lieutenant-colonels, 124 chiefs of battalions, 148 first captains, 148 second captains; total, 486 officers. (2) Assistant engineers: 20 principal assistants first class, 100 principal assistants second class, 100 assistants first class, 150 assistants second class, 200 assistants third class. (3) 6 workmen. (4) 292 artificers of various classes; total, 486 officers, 868 men—1354 in all.

The staff of a regiment of engineers comprises 16 officers, 79 men, and 1 *enfant de troupe.* That of a regiment of infantry of the line comprises 19 officers and 93 men, and 1 *enfant de troupe;* and in the regiments of other arms the staff is not very different.

In this organization, which is that adopted by the law of Mar. 13, 1875, after the French state had in a measure recovered from the shock of the destruction of the old French army in 1870–71, it is seen that the staff includes all ranks from the "marshal" of France to the artificer and enlisted man. It is a complete organization, whose business it is to think for and provide for, and to direct and use, the mass.

In the service of the U. S. the annual army registers from 1815 to 1827 contained a section devoted to the general staff, which included (1) the general officers of the army; (2) the adjutant-general's department; (3) the inspector-general's department; (4) the topographical department; (5) the ordnance department; (6) the quartermaster's department; (7) the judge advocates; (8) the hospital department; (9) the chaplains; (10) the Military Academy; (11) the purchasing department; (12) the pay department. Now, the word staff does not appear as a heading to any branch of the army in our army registers, except in the index, where the staff departments are named as (1) the adjutant-general's, (2) the inspector-general's, (3) the medical, (4) the ordnance, (5) the pay, (6) the quartermaster's, and (7) the subsistence departments.

All European states since the great success of the Prussian armies in their contests with Denmark, with Austria, and with France, in the campaigns of 1864, 1866, 1870–71, are remodelling their armies and their staffs, and have made the Prussian staff-system in some degree their exemplar. A sketch of this system will perhaps be most interesting to the military student. The Prussians recognize the fact that forms are not the essentials. The Prussian system of staff has been subjected to constant and great changes. The value of a staff lies in the practice, the instruction, the activity, the zeal, the patriotism, and the capacity of its components. The perfection of the present Prussian staff is due, doubtless, to the ability and personal devotion of its chief, since 1857, Gen. Field-Marshal Count von Moltke.

We find in the army of the elector of Brandenburg, before the erection of the Prussian monarchy, the seeds of a staff organization. Lieut.-Col. Gerard von Bellicum was in 1655 the first quartermaster-general of the army of Brandenburg. He soon had assigned to him as an assistant Col. Jacob Holtzen. The quartermaster-general was only one member of the staff, to which at that time belonged all the generals and high military officers. In 1657 we find a Feld-zeugmeister as general-in-chief; a commissary-general ranking as lieutenant-general, who united the functions of chief of staff and intendant-general; a "general wachtmeister," ranking as major-general, assistant to the commissary general, charged with the regulation of the order of march, the encampment, and the order of battle; 2 general aides-de-camp; 1 auditor-general; 2 quartermaster-generals, for the engineer service, the establishment of trenches and of camps, and in time of peace for the administration of castles and fortresses; 1 master-general of subsistence (general proviant-meister); 1 staff quartermaster, charged with the lodging of the troops; 1 field treasurer; 1 field preacher; 1 field apothecary; 1 field surgeon; 1 wagonmaster-general; 1 provost-marshal-general, who had 1 provost and 2 executioners with him. Between 1670 and 1673 we find as assistants to the quartermaster-general 2 lieutenant quartermaster-generals, 2 engineers, and 1 captain of guides. There was an intimate relation between the staff and the engineers for more than a century, which lasted till 1806, and even in that year Lieut.-Gen. von Geusau was chief of engineers, chief of staff, and quartermaster-general.

Frederick the Great had few officers of the staff of the quartermaster-general. This great captain was not only his own chief of general staff, but he often assumed the functions of a staff officer of an inferior grade. He wrote or dictated the plans of operations, formations, and instructions. His orders of battle were given aloud. If he wanted assistance, he had at his command his aides-de-camp, some officers of engineers, and mounted jägers. The staff of the quartermaster-general then had already more than a nominal existence. In the summer of 1757, Frederick wrote out "instructions of the king for his quartermaster-generals," which consist principally of information on the construction of fortresses, the establishment, attack, and defence of entrenched camps. In 1758 he dictated another instruction for his field engineers, whom he used for surveys of ground, reconnoissances of the camp and positions of the enemy, and for the discovery and establishment of routes for his columns. During the Seven Years' war he revived the offices of captain of guides and brigade-major. The first commanded the field or column jägers, who in absence of maps guided the columns of troops on the march. The latter received the countersign and parole, placed the guards, and kept the daily rolls and prepared the reports. But all these officers retained the uniforms of their corps. In 1764, Frederick increased the staff of the quartermaster-general, which in the army list for 1767 consists of 1 quartermaster-general, 1 quartermaster, and 15 lieutenant quartermasters. These last he required to do at stated times a course of duty in the regiments of the guard for practical acquaintance with military duty. In 1785 the general staff included all officers without troops. The staff of the quartermaster-general then contained only 10 officers. In 1791 the staff corps consisted of 19 officers; in 1796, of 15, with 15 engineer geographers added; and in 1796 the trigonometric survey of Prussia was committed to the staff of the quartermaster-general.

In 1800, Gen. von Le Coq of this staff drew up instructions for staff service under the following heads: (1) selection of camps; (2) reconnoissance of routes of march; (3) guiding of columns; (4) establishment of the troops in camp; (5) reconnoissance of military positions; (6) foragers and their support; (7) reconnoissance of the enemy's positions; (8) duties of aides-de-camp with the general in battle; (9) guiding of columns or detachments in battle; (10) execution of engineer duties in sieges, in absence of regular engineers; (11) field fortification in the same circumstances; (12) intelligence and "spy" service; (13) keeping of the journal.

After the destruction of the Prussian army by Napoleon in the campaign of 1806, Col. von Schornhorst in 1808 became lieutenant quartermaster-general of the Prussian army, with rank of major-general. His staff consisted of 2 quartermasters, 6 lieutenant quartermasters, 10 assistants, and 15 officers attached—34 in all. After 1815 the organization of the staff, which had rendered distinguished and important services during the closing campaigns against Napoleon, was seriously studied. A part of its officers, placed under a special chief as the *great general staff,* was assembled at Berlin, while its other officers, doing staff duty in the general and divisional commands, were in direct contact with the troops. The general staff was under the minister of war till 1821, when the king named Lieut.-

Gen. von Mueffling chief of the general staff, which then acquired an independent position, taking its orders directly from the chief of the state and commander-in-chief of the army—a position it still retains. To this independence of all subordinate authority the Prussian staff attributes its ability to render the services in its late campaigns which have placed it as first among the military organizations. Lieut.-Gen. von Mueffling was succeeded in 1829 by Lieut.-Gen. von Krauseneck, who was followed in 1848 by Lieut.-Gen. von Reyer, on whose death, in 1857, Gen. Field-marshal Count von Moltke became chief of the general staff. The part played by this general staff in changing the map of Europe in our day makes its history one of great interest.

There is a great advantage in giving to the person who has digested and prepared the work the general plan of operations and the measures to carry it out—the actual direction of its execution. A modern European army is transformed in a few days from a number of independent bodies of scholars, of officers and men under training, education, and preparation for war, into a compact, well-organized manœuvring and fighting army, of which the army corps, hitherto independent and scattered over the whole country, are the members, the whole directed by a brain whose thinking and reasoning power is represented by the general staff, while its *will* is the monarch and his trusted councillors, ministers, and officers. Were the preparation and issue of the innumerable orders and instructions necessary at the moment of mobilization to complete the several army corps, to carry their numbers up to the full war complement, to assemble the individuals at the corps dépôt, and to transport the corps to the place of rendezvous on the frontier, to be committed to new hands, to officers selected and designated at the outbreak of hostilities, much valuable time would be lost. In the opening of the campaign of 1870 it was a question of days, of hours, whether the war should break out on the soil of Germany or of France. Germany, through her independent and trained great general staff, was the better prepared, and made her concentration first. She crossed the boundary, and France fought a defensive campaign ending at Paris. In 1824, several years of peace having intervened, economic considerations led to the suppression of that part of the general staff which was attached to the divisions, and the general staff was reduced to 1 lieutenant-general as chief, 13 colonels—9 of them chiefs of staff of the army corps—3 chiefs of staff for the three great theatres of war into which Prussia was divided, 1 chief of the general staff of the inspection of artillery, 13 field officers, 10 captains, and 9 lieutenants. The campaign of 1866 showed the necessity of having ready at the moment of mobilization of the army a great general staff, capable of being doubled, and of leaving behind it when the army took the field a sufficient number of trained staff officers to make sure of the means and measures of military transportation, and of continuing to supply the wants which in course of a campaign occur in the army of operations. In 1867 a royal order established the staff on the following footing: *Higher list:* 1 chief of general staff of the army; 3 chiefs of division at the great general staff; 12 chiefs of staff of the army corps; 1 chief of staff of the inspector-general of artillery; 7 field officers of the great general staff; 12 field officers on the division staffs; 15 captains of the great general staff; 12 captains with the higher army commands; total, 88 officers. *Scientific list:* 4 chiefs of division; 5 field officers; 12 captains; total, 21 officers at the office of the great general staff. Total, 109 officers, of which 46 belong to the great general staff.

At the breaking out of the war of 1870 the German army contained 200 staff officers, which number was considerably increased in the course of the campaign. In 1875 the general staff consisted of 190 officers—147 Prussian, 23 Bavarian, 10 Saxon, 10 Würtembergers. Of the 147 Prussian staff officers, 72 are attached to the staff of the troops, 74 to the great general staff. The work of the great general staff is distributed to separate divisions. The chief of the general staff directs the whole. In his office, under direction of his aide-de-camp, questions relating to the personnel of the staff, to its organization and administration, are considered. The work of collecting military information, domestic and foreign, the use of railroads, the pursuit of military science, preparation of maps, etc., are distributed to various sections, grouped according to their work or to the countries to whose study they are devoted. The staff is divided into three sections, whose duty is to study attentively all military events, domestic and foreign; to keep themselves acquainted with the changes affecting the organization, recruiting, arming, and equipment of armies; to study the military geography of different countries, the establishment or demolition of fortresses, the development of the network of roads, railroads, canals, etc. The first section devotes itself to Sweden, Norway, Russia, Turkey, and Austria; the second to Germany, Denmark, Italy, and Switzerland; the third to France, England, Belgium, Holland, Spain, Portugal, and America. Each is directed by a chief. Some staff officers, and some officers ordered on staff duty and charged with the special study of military questions in different countries, are under the orders of each chief.

The fourth section is that of railroads. It is directed by a chief, to whom are attached officers, some of whom belong to the scientific corps of the staff. This section is charged with all that relates to military transportation. It should know the connections of the railroads at home and abroad, the equipment and rolling stock; and it elaborates the great schemes for army transportation by railroad. Considering the great number of officers needed to manage the movement of a great army by railroad, as many officers as possible are from time to time attached to this section in order to their instruction in these duties.

In the scientific corps of the staff are the officers who have charge of the section of military history, who have charge of the archives and of the library. In this scientific corps belong also the section of geography and statistics and the preparation of military maps of foreign countries. The general service of charts belongs, under a chief of the trigonometric survey, to another part of the great general staff. Under him are three sections—(1) the trigonometric, (2) the topographical, (3) the cartographical sections. In the first section are 7 staff officers and 26 experts, trigonometers. In the topographic section are 6 staff and civil officers, 15 officers on special duty, and 79 topographers. The cartographic section has charge of all the completed charts and engraved plates. It prints and draws all charts for the staff. It has a chief and 2 staff officers, 16 cartographers, and 21 other persons, experts in various branches of its service.

The present scheme of organization of the German army requires at the outbreak of war 220 staff officers—on a peace footing, 190. But, judging from the experience of 1870–71, not less than 253 would be called into active service should a great war break out.

This sketch will give an idea of the organization which carried the Prussian army to the gates of Vienna and of Paris, and which enabled the German armies to capture the whole of the regular army of France. Its success was not, however, a mere question of organization. It depended upon severe selection and training under the eye of one whose whole thoughts were devoted to preparing a body of officers competent to advise whoever might be in command of troops in such a way that their advice would be taken as the best. These officers are selected from the ablest graduates of the military schools after a certain term of service in the line. They serve on the staff in greater number than can possibly become permanent staff officers. They return to the line and serve a term with their regiments, not knowing whether they will ever be recalled to the staff. As vacancies occur in the permanent staff, at the discretion of Gen. von Moltke they are filled by selection from those officers who have while under his eye given proof of greatest capacity and devotion. Such men's advice carries weight, and is followed, and to the "staff" the Germans attribute a great share of the glory of their arms.

*Russian Staff.*—It is not limited by any formal rule; it embraces—(1) the chiefs of staff of military districts and officers doing staff duty with troops and commands. (2) Military agents abroad; professors and assistant professors of the three military academies, the staff, the artillery, and the engineer schools; the chiefs of the schools of war and of the "Jünkers." (3) The aides-de-camp of the emperor and of the members of the imperial family, and of the officers attached to their persons. (4) The officers on staff duty at the war ministry; those attached to other ministries or to the schools of war and of the Jünkers, provided they have served three years in the staff. (5) The highest officers of the military hierarchy, such as the commanders of troops in the military districts, commanders of divisions, chiefs of the principal divisions of the war department, directors of military gymnasia, and finally certain officers of high rank who by order of the emperor are placed on the rolls of the staff.

On the staff in 1874 were 18 generals, 52 lieutenant-generals, 71 major-generals, 196 colonels, 55 lieutenant-colonels, 51 captains, 12 second captains.

*Austro-Hungarian Staff.*—On a peace footing this comprises 348 officers.

*Italian Staff* (*corpo di stato maggiore*) comprises (1) The general in command of the corps (chief of general staff, and the officers placed under his command), with the military bureau and the bureau of accountability. (2) The staff of the troops. On a peace footing, 2 generals, 9 colonels, 34 lieutenant-colonels and majors, 75 captains, 20 first lieutenants; total, 140 officers. Also, 60 captains on staff duty. Of the whole, 85 officers belong to the great

general staff and 115 to the staff of the troops; 90 other officers are temporarily added to the staff. They are generally officers who have served in the staff or have distinguished themselves at the military schools. They are officers liable to be called into the staff in case of preparation for war.

*English Staff.*—The English differs from all other European armies in its method of recruiting and in its division into corps and bodies of troops. It can scarcely be said that there is any English military staff as a separate and distinct corps of officers. The English military staff is composed of the higher commanders of troops, and of the officers who are attached personally to them in time of peace or war when they are invested with commands.

The English war department is dual, embracing a set of political and of military officers—an outgrowth of the English constitution, jealous of the military power, and always maintaining, as a cardinal principle of the liberty of the citizen, the subordination of the military to the civil power. The war office and the Horse Guards, long distinct, were united into one department by act of Parliament in 1870. The general commanding-in-chief was thus brought into the war office, which is under the secretary of state for war. In the war office are three branches: (1) The military department, at the head of which is the field-marshal *commanding* in chief (not the *commander-in-chief*). (2) Until Nov., 1875, the control department, the department of administration, placed under the surveyor-general of ordnance. (3) The financial department, under the financial secretary; 2 under-secretaries of state are placed immediately under the secretary of state for war: first, the parliamentary secretary; second, the permanent under-secretary. The first retires at a change of ministry, and assists his chief in Parliament; the second does not sit in Parliament; he has the real direction of business, and does not go out with the ministry. The surveyor-general of ordnance and the financial secretary are members of Parliament, and fall with the ministry.

There are four bureaux: (1) the central division; (2) the division of the engineers; (3) division of artillery; (4) division of finance.

The system is complicated, and in Nov., 1875, the control department, which had been in existence for only six years, was abolished, and a new distribution of duties ordered by royal warrant. While the pay sub-department was retained, a commissariat and transport department and an ordnance-store department were created by this warrant. The details of the new service have not yet reached us. Provision is made for commissary-generals, deputy commissary-generals, assistant commissary-generals, commissaries, deputy, and assistant and sub-assistant commissaries. A commissary-general with an army in the field has a special rank, otherwise he ranks as a major-general. A deputy commissary-general ranks as colonel; assistant commissary-general as lieutenant-colonel; commissary as major; deputy commissary as captain; assistant commissary as lieutenant; sub-assistant commissary as sub-lieutenant.

For all the work which in the Prussian system is done by the great general staff there are available in the English army but 7 staff officers and 4 officers attached to the intelligence branch, created in 1873 by law, and placed under the orders of the quartermaster-general attached to the Horse Guards. This bureau receives the despatches and memoirs of the military officers attached to all foreign English legations to observe and study the military condition, force, and science of foreign nations.

The three divisions of the English general staff are the departments of the quartermaster-general, of the adjutant-general, and of the military secretary. In the annual army list the commanders of colonial military districts appear in the staff, which may be divided thus: (1) Generals commanding districts, divisions, etc. (2) Staffs attached to the various commands: 1, Adjutant-general's department; 2, quartermaster-general's department. (3) Personal staff: 1, military secretaries; 2, aides-de-camp.

The officers of the staff are taken exclusively from the regular army, and should have spent two years at the staff college or passed the final examination for graduation at that college. A condition of eligibility to examination for admission to the staff college is five years' service in the army. Every officer who presents himself for the graduating examination at Sandhurst Staff College must have had seven years' service.

*Department of the Adjutant-General.*—I. In time of peace there are only 4 adjutants-general—1 at the Horse Guards and 3 in India. A fifth is appointed when an army takes the field. The adjutant-general at the Horse Guards is always a general officer belonging to the staff of the sovereign. In the Indies an adjutant-general is a colonel, and in an army in the field he is a colonel or a general. II. A deputy adjutant-general assists and replaces his chief, and is at the head of his department whenever there is no adjutant-general; he is always a field officer, generally a colonel. III. An assistant adjutant-general is a field officer, and is often the head of his department; every division has one. IV. A deputy assistant adjutant-general is of the lowest rank in this department. He should be a captain, but his duties are often performed in India by lieutenants. In time of war one is attached to each division. V. The brigade-major is the brigade adjutant, always a captain. VI. Subalterns fill the position of place majors or adjutants of garrisons at posts.

*Department of the Quartermaster-General.*—This department has charge of transports by sea and land, preparation of orders of march, barracks and cantonments, camp equipage, all information in relation to geography and topography, the preparation and distribution of plans and dispositions for attack and defence. I. A quartermaster-general exists only at the Horse Guards (he is on the staff of the sovereign) and at the Indian presidencies, and in case of mobilization of a grand army. At the Horse Guards and with an army in the field the quartermaster-general is always a general; in India, a colonel or lieutenant-colonel. II. A deputy quartermaster-general is always a field officer, generally colonel or lieutenant-colonel. III. An assistant quartermaster-general is attached in peace to certain districts, and in war to every division; excepting in India he is always a field officer. IV. A deputy assistant quartermaster-general is often in peace the only officer of the quartermaster's department in a district. In time of war one is attached to each division. In time of peace only captains are eligible to the office. In time of war lieutenants are occasionally assigned to this duty. The duties of the adjutant-general's and of the quartermaster-general's departments are often performed by the same officer.

*Military Secretaries.*—Military secretaries are attached only to the higher commands. Their duties are confidential. When attached to civil governors they are military advisers, and then, as in India, their positions are of great importance. I. There are 9 military secretaries—viz. with the officer commanding-in-chief, with the viceroy or governor-general of India, with the governors of Madras and Bombay, with the commanders-in-chief in the three presidencies in India, with the governor-generals of Canada and of the Cape of Good Hope. II. Besides these 9 military secretaries, assistant military secretaries are attached to less important commands; 7 of them appear in the military budget. III. The aides-de-camp granted to governors and to generals are captains, attached to these officers personally.

The staff of the general-in-chief in England consists of 1 military secretary, 1 assistant military secretary, 4 aides-de-camp, 1 adjutant-general, 1 deputy adjutant-general, 2 assistant adjutant-generals, 1 deputy assistant adjutant-general, 1 quartermaster-general, 1 deputy assistant quartermaster-general. To this staff are added for the artillery and engineers, of which the general-in-chief is inspector, 2 deputy adjutant-generals, 1 assistant adjutant-general, 2 deputy assistant adjutant-generals.

Staff Schools are so connected with other military schools that a general sketch of the whole scheme of military schools is necessary in order to an understanding of the system. The following, in addition to those described under the head Military Academies (see in Cyclopædia), are mentioned here.

*Austria.*—In 1868 a general reorganization of the Austrian military schools was decreed on the following basis: A. For the education of youth—(1) the Military Orphan Asylum; (2) the Military Technical School; (3) the Military College; (4) the Military Academy. B. Schools attached to regiments and divisions for soldiers, non-commissioned officers, and cadets or aspirants for commissions—(1) regimental or troop schools; (2) regimental officers aspirant schools; (3) division officers aspirant schools. C. For education of officers, to qualify them for promotion to higher grades—(1) the higher artillery course; (2) the higher engineer course; (3) the War School (staff college); (4) the course of instruction in military frontier administration; (5) the Central Cavalry School; (6) the Medical and Surgical Academy (Josephinum); (7) the Military Veterinary Institute; (8) the School of Intendance (administration).

*Bavaria* has four establishments for military education: (1) the Cadet Corps; (2) the War School; (3) the Artillery and Engineer School; (4) the War Academy.

*Russia.*—The Nicholas Academy is the principal staff school. It has a corps of military professors of high rank, embracing one general as director, one lieutenant-general, 4 major-generals, and 7 colonels as professors, besides other officers. The staff is recruited, though not entirely, from the officers who have distinguished themselves at this

academy. There are two courses—one of two and a half years, one of four years. Fifty officers are admitted annually. In September the examinations are held, and the students are divided according to their result into three classes. Those of the first class are recommended for immediate employment; those of the third class are considered as not sufficiently instructed. Thirty officers may be annually sent into the staff for service and further study and practice. The most capable among these are selected for staff service; the others re-enter the regiments. None are admitted to this academy until they have served four years as officers, and have passed the required examinations for admission. M. C. MEIGS.

**Stars.** To the number of stars mentioned in the article under this title in its regular place in the CYCLOPÆDIA as having suddenly made their appearance in the heavens, is to be added a new one discovered by Schmidt of Athens Nov. 24, 1876, in A. R. 21*h*. 36*m*. 50*s*.; decl. 42° 16.9′ N. Its spectrum has been described by Cornu of Paris as interrupted and exhibiting bright lines. From the 3d magnitude, to which it belonged when discovered, it passed to the 5th on the 30th of November, and to the 7th on the 15th of December. If the observations of Mr. Cornu are correct, this spectrum belongs to the category of the variable in the Crown and R Geminorum, showing the direct lines G and F of hydrogen, with others undetermined.

To the catalogue marked "*Table C*" in the article STARS should have been appended the following note:

"This catalogue was published originally by Schjellerup of Copenhagen in the *Astr. Nach.*, No. 1591, July 18, 1866; and was afterward reproduced, with additions and corrections, in No. 1613 of the same journal, Oct. 13, 1866. It is founded on that of Lalande, *Con. des Temps*, year III. of the Republic, on that of Zach, *Corresp. Astr.*, vol. vii., and on that of Sir John Herschel, *Cape Observ.* It has been more recently inserted by Chambers in his *Descriptive Astronomy*.

"We have added to it some new stars of our own more recent discovery, with others discovered by Birmingham of Tuam, and have inserted in notes brief descriptions of the spectra determined by our observations, and of those later described by D'Arrest in the *Astr. Nach.*, Nos. 2009, 2016, 2032, 2044. The positions of all of these stars have been reduced to 1870, which is that of the last catalogue of Chambers. Some of these have been verified in the heavens. On a comparison, it appears that some stars referred by us to the second type are classed by D'Arrest as of the third; in part because of a real variability, and in part because of the difference of instruments.

"The present catalogue is a supplement to those of the first and second types heretofore given. There can be no doubt that many spectra are variable; and hence, to the variability of stars in *magnitude* must now be added variability of *spectrum*. This undertaking of ours will be continued, and what we give here is presented only as a prodromus of a more extended labor. P. A. SECCHI."

Stars which are variable in color are necessarily variable in spectra. A remarkable example of periodical variation of this kind has been recently found by Klein of Cologne in α Ursæ Majoris, which varies between yellow and fire-red, the period being about five weeks. F. A. P. BARNARD.

**Starva'tion** [Ang.-Sax. *steorfan*, to "die" or "perish"], or **Inanition,** the condition of tissue-waste, exhausted vitality, and death resulting from prolonged privation of food. A slower starvation ensues when food is scanty and impure, or is persistently deficient in one or more of the several constituents essential to the mixed diet of man. Animals have been fed experimentally on single classes of food—one upon albuminoid matter, another partaking of only farinaceous substances, a third only of the hydrocarbons or fats. Such exclusive diet, of whichever kind, proved disastrous; emaciation, enfeeblement, and death by starvation ensued. The phenomena of starvation, complete and partial, have often been studied and recorded by the shipwrecked, by persons immured in mines, soldiers deprived of supplies, arctic explorers, as also the insane and others practising voluntary starvation. Prolonged abstinence necessitates bodily waste; hence, the reported cases of prolonged subsistence without food, usually women apparently in a state of trance or catalepsy, are not to be accredited; carefully investigated, they invariably prove to be artful deceptions by hysterical or demented persons. Rigid exclusion of food and drink causes death, as an average, in from five to eight days. Water, freely supplied, with exclusion of solid food, may prolong life two or three weeks, exceptionally longer. Water constitutes over half the weight and bulk of the body; it is the solvent for all nutritive matter entering the body, and all azotized products which are to be excreted. Even solid food, so called, is in part water. If desiccated food alone be supplied, with no drink, death will result in a few days. Starvation at the outset produces urgent hunger; this may gradually lessen, be replaced by faintness, loss of appetite, and even loathing. The strength fails, the body wastes, the mind becomes enfeebled; in some cases there is listlessness and stupor, in others marked nervous excitement and delirium—phenomena excited by non-excreted effete matter accumulated in the blood. The starving person is liable to intercurrent disease, and the community suffering privation is often visited by epidemics of contagious and infectious diseases, which assume an unusually malignant and fatal type, consequent upon the nervous depression and vitiated blood of the persons attacked. Starving persons, when rescued, should not be supplied too suddenly or freely with food; the enervated digestive apparatus can retain and assimilate but small quantities at a time, an excess exciting irritation and dangerous and fatal diarrhœa. Certain diseased conditions may cause starvation; such are stricture and cancer of the œsophagus and upper orifice of the stomach, gastric ulcer, atrophy of the peptic and intestinal glands, and tubercle of the intestine.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

**State.** The word *state* brought with it from its Latin parentage no necessarily political meaning. The Romans said *status nostræ civitatis* ("the state or condition of our civic community"); but never, so far as I have noticed, does *status* itself mean what our *state* means—that is, a self-governing community, organized under permanent law which has for its aim justice and the security of all. It is, however, at present, the best term for denoting communities on their political side, whatever their form of government be. The term *nation* implies common origin and language, and so Cicero spoke of the *Greek nation*, although the Greeks never formed a state, nor even a confederation, embracing all who spoke the Greek tongue. And on the other hand, the kingdom of the Netherlands, such as it was before the disruption in 1830, consisted of inhabitants speaking three languages, Dutch, Flemish, and French, with various earlier institutions and political connections. This was in no sense a nation, but was a state. So Austria at present is not a nation, but is a state, where three nationalities at least—a German, a Hungarian, and a Slavonic, to say nothing of Italian and Wallachian subjects—are bound together under the same political institutions. And the British *nation*, which is in use, while we never hear of the British state, is objectionable, because the nationality of Ireland is certainly different from that of those of the other parts of the kingdom.

The political senses which the word *state* and others from the same source put on were more than one. Thus, the *estates* of the later feudal kingdoms were the three or four groups holding the property and represented in the assemblies called the assemblies of the estates. These were the clergy, nobles, burghers, and, in a few countries, the peasants. In the Dutch republic much later each province held a meeting of its estates, and the general meeting of the provinces was called the states general, where all were represented. The abstract sense of an organized body politic also came into the word. When the American colonies called themselves free and independent States, this sense was adopted, and this sense remained in the term *United States*, which was attached to the new federal republic for want of a better. The reasoning from this term, and from *sovereignty*, as to what the rights of the States and of the Union are under the Constitution, instead of discovering from their attributions and powers what they are, has been a source of much confusion and error. Political science, however, is not responsible for this confusion. It knows of independent and of dependent states, of states formed out of states, and of simple states, of states under the most varied and dissimilar forms. From the word *state*, then, we can argue nothing positively of the attributes of that which is so called. The most that can be said is that a state entirely independent and self-governing in order to carry out the ends of its existence ought to have such and such powers. (See also SOVEREIGNTY, in CYCLOPÆDIA.) T. D. WOOLSEY.

**Steel, Chemical Nature and Relations of.** No questions now mooted before the scientific and practical world can surpass in interest those which relate to the nature of steel and its relations to elementary iron. In the article on STEEL, in CYCLOPÆDIA, Mr. Alex. L. Holley, a distinguished engineer, has presented a large mass of facts of practical bearing, embracing nearly all that is known regarding the elementary chemical composition of the various products that are now designated by the name of steel, but there still remain some facts and considerations that are more or less significant, or at least pregnant, in connection with the great question above referred to: What is the chemical nature of steel? Moreover, when such a question is under examination it is always of value to set

forth distinctly what we do not yet know, to stimulate the discovery of such yet unknown facts as may help us in the problem.

Though it is at present evidently impossible to satisfy all, by any *definition*, as to what modifications of iron are or are not entitled to be denominated steel, yet no one disputes that there is a certain range of chemi-physical characters, defining in a salient manner one modification of this metal, known by that name from time immemorial, and used for making tools, blades, and springs. The chief characters of this modification (or mixture?) may be stated as follows:

*Composition.*—Mr. Holley has sufficiently set this forth under STEEL. (See also IRON AS A METAL, by JOHN B. PEARSE, in CYCLOPÆDIA.)

*Fusibility.*—This character depends on the presence of foreign elements, mainly carbon, and is unquestionably due to the formation, at least at high temperatures, of some definite chemical compound or compounds, *as yet uncertain*, of iron and carbon. Here, then, is one essential point wherein our knowledge is as yet insufficient to enable us to meet the problem. Until we know and understand with precision the definite compounds of iron with carbon, we cannot expect fully to understand steel. The most reliable fact in this direction has recently been announced by Boussingault, who has made it at least probable that the *highest* carburet of iron is $Fe_5C$, corresponding to 4.11 per cent. of carbon. This, however, is but an initial step in the investigation, which chiefly remains yet to be made. Even of this compound Boussingault has omitted to give us what is doubtless its most significant character, its *density*. Nor did he investigate the nature of the carbon contained in this compound, $Fe_5C$. The degree of fusibility of steel varies widely with the proportion of carbon. An authoritative work states it at "probably about 1800° C.," equal to 3272° F.

*Malleability*, or rather susceptibility of being forged and welded, like soft malleable iron, at high heats.—Steel containing above 1.25 per cent. of carbon is generally found to be still malleable, but difficult to weld; at 1.5 per cent. of carbon the weldability has disappeared, though it may still be forged with some difficulty. Above this latter proportion of carbon it will usually be rated as cast iron.

*Temper.*—This most important character is definable as the capability of assuming a great degree of hardness, combined with strength and elasticity (resilience), on being rapidly cooled from incandescence. The same steel, on slow cooling, will be found soft, inelastic, and susceptible of bending without breaking. The usual idea, or rather form of words, applied to this familiar but remarkable phenomenon is that a different "molecular structure" is produced; which explains nothing. To a chemist the known behavior, under similar treatment, of iron somewhat more highly carburetted, with other analogous known cases, strongly suggests the hypothesis that the tempered steel has a different chemical constitution from soft steel. More distinctly, this hypothesis is that both when incandescent and when tempered the carbon present is all in chemical combination with the iron, forming a homogeneous molecular mixture of definite carburets of iron, but that during slow cooling more or less dissociation occurs into free carbon and soft, less-carburetted compounds. A mode of testing this hypothesis, or at least of throwing light on the general problem, would be found in the minute chemical investigation of the comparative condition and character of the carbon separated by solvents from the same steel when softened and when hardened. A number of investigations, though as yet a very inadequate number, has been made of the changes of *density* during tempering. (See under *Density*, below.) Tempered steel is said to be *whiter*, and when polished more lustrous, than the same steel when soft. The hypothesis that the hardness, whiteness, highly crystalline texture, and other qualities of tempered steel are simply attributable to an intimate admixture, with lower carburets, of the highest *spiegeleisen*, or Boussingault's $Fe_5C$, appears quite plausible enough to demand tentative investigation from chemists.

*Magnetic Persistency.*—This is a remarkable characteristic of hardened steel, in which, however it participates with cast iron. The remarkable recent discovery of Jamin, that soft iron, in filings, acquires *by compression* the same power of retaining magnetism possessed by tempered steel, will of course be hereafter found to throw light upon the nature of steel, but its bearing at present is unintelligible.

*Density of Steel.*—The study of the changes of density of steel with change of composition and other conditions is only beginning to receive some attention of late years from practical men, although in the laboratory as yet but a minor regard is paid to this character, with reference not only to steel, but also to iron generally; many skilful investigators often omitting to record the densities of important samples and varieties of metal. In the case of ordinary steels the records of density-figures are lamentably meagre. More is known of the densities of what are sometimes called "special" than of common steels. The following compilation of figures is therefore given here as in a measure new, and to furnish a starting-point for investigation of this part of the subject:

*Densities of Varieties of Steel.*

| | |
|---|---|
| Wootz, by Pearson | 7.181 |
| " " fused | 7.2 |
| " " forged | 7.647 |
| Soft steels, *minimum*, by Karsten | 7.6224 |
| Wootz, by Henry | 7.727 |
| Col. Wade's *minimum* for cast steels | 7.729 |
| Soft blister steel, by Rinman, *minimum* | 7.751 |
| Soft steels, *maximum*, by Karsten | 7.8131 |
| Wootz, by Rammelsberg | 7.822 |
| Bessemer steels, mean of 7, by Buchner | 7.837 |
| Chrome steels, mean of 12, by Bauer (said to contain *no carbon*) | 7.839 |
| Wade's *maximum* of cast steels | 7.862 |
| Bessemer steels, mean of 10, by Koppmayer (0.55 of carbon) | 7.863 |
| Bessemer ingot, by Belani | 7.866 |
| " " " | 7.8851 |
| " steel, *maximum* of 6, by Buchner (0.11 of carbon) | 7.8718 |
| " " " 10, by Koppmayer (0.14 of carbon) | 7.922 |
| Soft cast steel, by Elsner | 7.93 |
| Soft blister steel of Rinman, *maximum* | 7.991 |
| Remelted cast steel, of Elsner | 8.0923 |
| Rolled Bessemer rails, by Belani, mean | 7.9828 |
| " " densest part | 8.408(!) |

To the above may be added some records of the changes of density during tempering. Réaumur and Rinman stated that an expansion of volume occurs during tempering, of $\frac{1}{48}$th part; but this was doubted by Karsten. It has since appeared that steel sometimes becomes heavier and sometimes lighter when tempered, though generally lighter. The following figures have been collected for this work:

| | Before tempering. | After tempering. |
|---|---|---|
| Fused wootz, Pearson | 7.2 | 7.166 |
| Steel tempered 30 times successively, by Caron | 7.817 | 7.743 |
| Cement or blister steel, *minimum*, Rinman | 7.751 | 7.553 |
| " " " *maximum*, " | 7.991 | 7.778 |
| Styrian steel | 7.782 | 7.822 |
| Cast steel, Elsner | 7.9288 | 7.6578 |
| " remelted | 8.0923 | 7.7647 |
| Common steel, Pearson | 7.79 | 7.67 |
| Hammered steel, A. Riche | 7.839 | 7.735 |
| " " " | 7.846 | 7.749 |
| " " " | 7.839 | 7.738 |
| " " " | 7.841 | 7.843 |
| " " " | 7.839 | 7.845 |
| " " " | 7.841 | 7.843 |

HENRY WURTZ.

**Steril'ity,** an incapacity for procreation, whether in the male or female. A knowledge of the causes of sterility implies a knowledge of the laws of conception. Generation is effected in both the animal and vegetable kingdoms by the conjoint action of male and female germs. In animals the male and female are twain. In the vegetable kingdom this is sometimes so, but usually the male and female elements are found in juxtaposition in the same organism. In man and other animals the semen of the male must be brought into direct contact with the ovum of the female to ensure fecundation; but if the semen should be wanting in any of its essential constituents, conception cannot occur, and the male is said to be sterile. If the male, by cause of old age or other influences, is incapable of performing the part allotted by the laws of nature, he is said to be impotent, and therefore sterile. But the male may be able to perform in the most complete manner the sexual act, and yet be incapable of procreation, because the semen may not possess zoösperms, without which fructification is impossible. This deficiency may be natural or acquired. A man may be born with but one testis (monorchid), and then as a rule it does not secrete zoösperms (those strange microscopic animalcules, full of a vigorous instinctive activity, destined to be nourished and developed into the future man, in which we are compelled to recognize the

FIG. 1.




Spermatozoa: *a*, human; *b*, of rat; *c*, of *Menobranchus*.

commencement of the mysterious incarnation of soul in matter). Or he may have two, but they may be so imperfectly developed as to remain always in the cavity of the abdomen, as in the fœtus, and then the seminal fluid is deficient in the all-important property necessary for fecundation. This condition is also often acquired, and is then most generally the consequence of youthful indiscretion. Whatever produces an inflammation of the testes (orchitis) in the male may bring about such a change in the secretory apparatus of these organs as to destroy the vitalizing power of the semen. A fall or a blow on these glands may do this. But the most common cause is inflammation communicated to them by continuity of surface from the urethra, neck of the bladder, and vesiculæ seminales, sequels of urethritis (gonorrhœa). Not unfrequently this happens as a consequence of parotitis (mumps), where from cold or other cause the inflammation is suddenly translated from the parotid (salivary) gland to the testes. Any man who has suffered from orchitis from any of these causes may suspect himself of incapacity for procreation, notwithstanding the normal strength of his animal propensities. He is not of necessity sterile, but he may well feel anxious about it till it is proven otherwise.

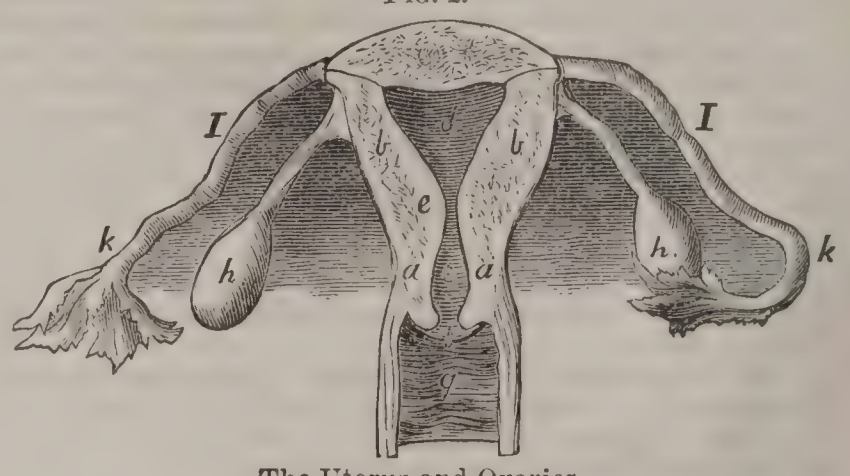
To determine the source of unfruitfulness in any given case it is necessary to inquire into the condition of both male and female: (1) Is the male competent to perform the sexual act? (2) Is the female competent for the married relation? (3) Does the seminal fluid possess zoösperms? (4) Do these pass into the canal of the neck of the uterus? (5) Is the mucous secretion of this canal fit for the viability of the zoösperm? The first point is ascertained by a question, the second by examination; the other three can only be determined by the microscope. A drop or two of semen taken from the vagina or the neck of the uterus soon after coition and placed under the microscope will show the presence of zoösperms in great abundance if the secretion is normal and suitable for fecundation. But if these are wanting, then fructification is impossible. This condition is found oftener in men than is generally supposed. It is sometimes curable, often incurable. A man may be sterile or incapable of procreation at one time, and by appropriate treatment under favorable circumstances he may possibly regain the lost power. But the removal of this incapacity in the male is not generally so successful as the removal of the obstructive causes in the female.

If we find that the male is capable of performing the sexual act even feebly, and if we find the seminal fluid in a normal state or full of living zoösperms, we may take it as proven that the fault does not lie with the male; and we then proceed to inquire into the aptitude of the female for conception.

We have said that to ensure conception the zoösperm of the male must be brought in direct contact with the ovum of the female. We must then determine what obstacles intervene to prevent this important junction. To fully comprehend these points, some idea of the physiology of conception, based on a knowledge of the anatomical relations of the female generative organs, is necessary. These organs are external and internal. The latter only will here engage our attention. They are the vagina, uterus, ovaries, and Fallopian tubes. The vagina is the canal leading from the external organs to the neck of the uterus. The uterus is the organ for the reception and maturation of the ovum till the full term of parturition. The ovaries are the source of the ova, without which there can be no conception. The Fallopian tubes serve to conduct the ova from the ovaries to the cavity of the uterus. Conception can only occur during menstrual life. As soon as the female menstruates she is capable of conception. It has often taken place at the early age of ten years. It is possible as long as menstruation continues, even irregularly. It has often occurred at the age of fifty-two, and even at fifty-five. It is said to have occurred as late as the sixtieth year, but these cases are not based on sufficiently well-authenticated facts.

Fig. 2 shows a longitudinal bilateral section of the uterus and vagina, with the ovaries and Fallopian tubes on the sides. The uterus is a hollow muscular body, pear-shaped, slightly flattened antero-posteriorly, nearly three inches long, an inch and three-quarters in its broadest transverse diameter, and an inch and a quarter in its antero-posterior diameter. It is nominally divided into two portions—the cervix or neck *a a*, and the body *b b*. The cavity of the uterus *c d* is called the utero-cervical canal, and is about two inches and a half long. The upper portion *d* is the true cavity of the uterus, from which the menses flow. It is about an inch and a quarter long, and perhaps an inch wide at the top, where the Fallopian tubes enter. The lower portion *c* is called the cervical canal, is somewhat elliptical in shape, about an inch and a quarter long, and one-third of an inch in its broadest diameter. The narrowest portion *e*, where the cervical canal *c* becomes continuous with the cavity of the uterus *d*, is called the os internum. The outer orifice of this canal *t* is the os tincæ. The vagina *g* is the membranous canal leading from the ex-

Fig. 2.




The Uterus and Ovaries.

ternal organs to the neck of the uterus; *h h* the ovaries, one on each side, floating in the cavity of the abdomen, with a membranous attachment to the body of the uterus; I I the Fallopian tubes leading from their fimbriated extremities *k k* up to points near the top of the uterus on each side, where they enter the cavity *d* of this organ.

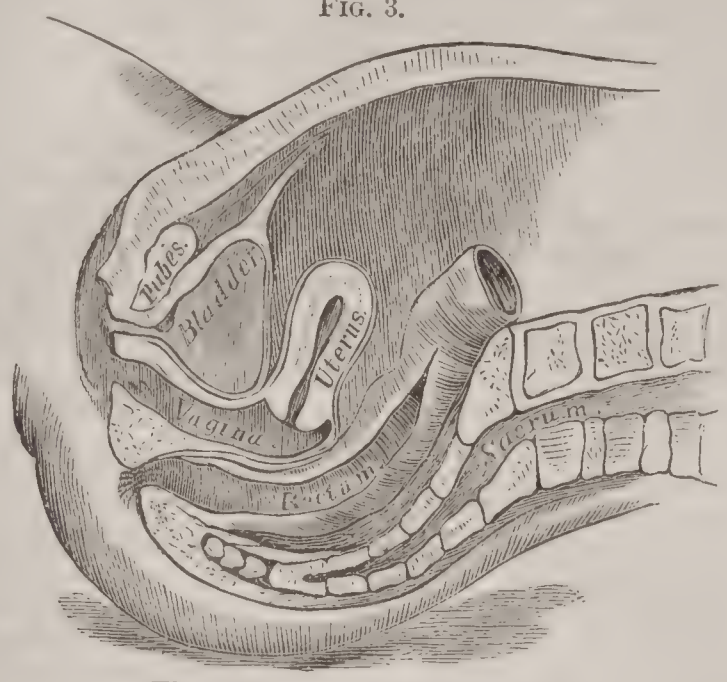
Thus understanding the anatomical relations of these several parts of the female generative apparatus, we can more easily comprehend the physiology or laws of conception, and by consequence the causes operating to produce the sterile condition. Menstruation may be taken as a sign of the fitness of the female for conception. Near the period of each menstruation a vesicle (or two or three in case of twins or triplets) in the ovary *h* swells, bursts, and discharges an ovum, which is grasped by the fimbriated extremity *k* of the Fallopian tube I, and is slowly carried along the canal of said tube into the cavity of the uterus *d*, where, if it meets with the vitalizing zoösperm of the male, it becomes a living organism, attaching itself to some portion of the walls of the womb, where it grows and develops till at the fulness of time a child is born. But if, when the ovum reaches the cavity of the uterus, it does not encounter the male zoösperm, then it passes off as effete material with the secretions that belong to the uterine cavity. The duration of the passage of the ovum along the Fallopian tube, which is only large enough to admit a bristle, varies from two to six days. Conception usually occurs within the ten days following menstruation, but it may occur at any time between the menstrual periods. The zoösperm, entering the cavity of the uterus and not meeting the ovum, sometimes finds its way along the Fallopian tube, and occasionally encounters the ovum on the surface of the ovary or in the fimbriated extremities of the Fallopian tube, where, if the ovum becomes vitalized, it attaches itself to the neighboring parts and begins to grow, and we then have what is termed extra-uterine pregnancy, which endangers the life of the woman. If this occurs in the canal of the Fallopian tube, we have tubal pregnancy, which is equally dangerous. Fortunately, these cases are not of frequent occurrence.

With this knowledge of the laws of conception we can better understand the operation of causes that interfere with them, thus producing the sterile condition. Whatever obstructs the passage of the ovum from the ovary to the cavity of the uterus, and whatever obstructs the passage of the zoösperm to the same, are causes of sterility. Some of these are incurable, while many are amenable to treatment. If menstruation is normal, we take it for granted that ovulation is normal—that the ovum is at the regular time discharged from the ovary and starts on its way to the cavity of the womb. But some previous pelvic inflammation may have obstructed the Fallopian tubes or bound down their fimbriated extremities, so as to prevent them from fulfilling their functions in conducting the ovum to the cavity of the uterus. This state of things we can hardly hope to diagnose with accuracy or to treat with any degree of certainty. Our efforts at diagnosis and treatment must therefore be directed mainly to the state of the uterus itself, or to such conditions of it as are capable of preventing the passage of the zoösperm to the cavity of the uterus.

Fig. 3 represents a vertical antero-posterior section of the pelvis (lower part of the body), with the female generative organs contained therein. The uterus is here shown in its normal position, in the middle of the pelvis, standing at about right angles with the axis of the vagina, the os tincæ pointing toward the extreme end of the sacrum (end of the spine), while the top of the organ points toward the umbilicus. Any marked and permanent deviation of the uterus from a normal position, whether anteriorly, posteriorly, laterally, or by descent, may, and does at times, interfere with conception. When the body of the uterus falls far forward, on the bladder, toward the pubes (or cross-

bone in front), it may so displace the os tincæ or produce such a degree of congestion in the whole organ as to prevent the zoösperm from reaching the cavity of the uterus.

Fig. 3.




The Female Generative Organs.

It is then important to remedy this malposition, with its consequences, before we can ensure the desired result. When the body of the uterus falls far back under the hollow of the sacrum, pressing upon and obstructing the rectum, it must be restored to its normal position and kept there. Fortunately, this can be done in a great majority of cases, and with considerable facility and certainty. Lateral malpositions and descent may require the same attention and the same nicety of rectification. But a more frequent cause of the sterile condition is found in the neck and cavity of the uterus. The cavity of the uterus may contain a tumor or polypus, which must be removed, or it may be in a state of inflammation (endometritis), which must be cured. Again, the mouth of the uterus (os tincæ) may be so small that the semen cannot enter it. Then it must be enlarged by surgical means, either by forcible dilatation with bougies, etc., or by incision, which is easy enough in the hands of the skilled practitioner. Abnormal curvature of the neck of the womb is a frequent cause of sterility. It is sometimes, indeed often, curved almost or quite to an angle instead of being comparatively straight, as shown in the diagram. And when this is not complicated with the presence of a fibroid tumor or other adventitious growth, it may be remedied, and is often easily and promptly cured, by surgical means.

But perhaps the most frequent of all the well-recognized causes of sterility is an abnormal condition of the secretions found in the utero-cervical canal. The mucus of the cervical canal examined from the third to the tenth day after the end of menstruation should be translucent, clear as the white of a new-laid egg, without any opaque or milky-looking spots. But even when it presents to the naked eye all the characteristics of a normal secretion, it may not be so. The microscope can alone determine this point, and for this purpose it is necessary to remove a drop or two of mucus from the cervical canal with a suitable instrument a few hours after sexual intercourse, and then place it under the microscope. If we find living zoösperms in abundance twenty-four hours or more after coition, we can safely pronounce the case one capable of conception. But if we find the zoösperms all dead or in a dying state, then we know that there is some abnormal condition of the utero-cervical canal which gives rise to the abnormal secretion. A healthy secretion is the result of a healthy state of the secretory organ; a diseased secretion is evidence of a deranged state of the apparatus producing it. We must here, then, continue to investigate, and to treat the diseased condition of the utero-cervical canal till its mucous secretion is restored to a normal state, which will be proven only when we find that it is favorable to the viability of the zoösperms. This deranged state of secretion in the utero-cervical canal is often found where the general health is perfect. While it seems to be local, requiring mostly local remedies, constitutional treatment is not to be overlooked. We now see that the causes of sterility, in most cases, can by the light of science be accurately determined, and that many cases may be entirely remedied. A few years ago we knew comparatively nothing on this subject, but now it is no longer a question wrapt in doubt and darkness, for almost every case is capable of explanation, even when incurable. (See also Reproduction.) J. Marion Sims.

**Ste'venson** (Alan), son of Robert, b. at Edinburgh, Scotland, 1807; educated at the University of Edinburgh; subsequently studied natural philosophy under Sir John Leslie, and for the profession of a civil engineer in the office of his father, with whom he entered into partnership. In 1843 he succeeded his father as engineer to the commissioners of northern lighthouses, to which his subsequent practice was confined. Among many other important improvements in lighthouse apparatus, he introduced the dioptric system in 1836. Of the many lighthouses designed and constructed by him, the "Skerryvore" was his chief work (see Lighthouse Construction), an *Account* of which he published; also a *Treatise on Lighthouse Illumination;* contributed articles "Harbors," "Lighthouses," etc., to the *Encyclopædia Britannica,* and various scientific articles to *Edinburgh Philosophical Journal,* etc. The emperor of Russia and the kings of Prussia and Holland bestowed medals upon him in recognition of his services as a lighthouse engineer. Fellow of the Royal Society of Edinburgh, member of the British Institution of Civil Engineers, etc. D. at Portobello, near Edinburgh, Dec. 23, 1865.

**Stock'ton** (John P.), son of Commodore Robert F. Stockton, b. at Princeton, N. J., Aug. 2, 1826; graduated at Princeton College 1843; was licensed to practise law 1846; was a commissioner to revise the laws of New Jersey, and subsequently reporter to the court of chancery; published 3 vols. of equity reports (Trenton, 1856–60); was minister resident at Rome 1858–61; was chosen U. S. Senator as a Democrat in 1865 for the term ending in 1871, but was unseated for alleged informality in the election after holding the position more than a year, and was subsequently Senator 1869–75, after which he returned to the practice of his profession, and took an active part in the Presidential campaign of 1876.

**Stoichiom'etry** [from Gr. στοιχεῖον, "element," and μέτρον, "measure"], "that department of chemistry which considers the numerical relations of atoms. All calculations, therefore, which can be made from the atomic weights and volumes are stoichiometrical calculations." (Barker's *Chemistry.*) *Illustrations:* (1) Silver is weighed as silver chloride (AgCl); to deduce the weight of silver from 1.312 grammes AgCl, the following equation is used:

| Molecular weight. | | Atomic weight. | | Absolute weight. | | Absolute weight. |
|---|---|---|---|---|---|---|
| AgCl | : | Ag | = | AgCl | : | Ag |
| 108 + 35.5 | : | 108 | = | 1.312 | : | |
| 143.5 | : | 108 | = | 1.312 | : | 0.987 Ag |

This expresses the fact that as 143.5 AgCl contain 108 Ag, then 1.312 grammes AgCl contain 0.987 gramme Ag. (2) For determining the strength of an alkali a standard acid is used in measured solution, the process being called titration. 1 molecule of nitric acid ($HNO_3$) is diluted to 1000 cubic centimètres. The molecular weight of $HNO_3$ being 63, each c. c. contains 0.063 of the acid. One molecule of sodic hydrate NaOH is 40. To test a sample of sodic hydrate, weigh out 4 grammes, for example; dissolve in water; add litmus, and run in from a graduated burette the standard nitric acid till the alkali is exactly neutralized. If the sodic hydrate is pure, 100 per cent. in strength, it will require $\frac{40}{4} = \frac{1}{10}$ of a molecule of nitric acid, or 100 c. c. of the standard acid. If it is only 80 per cent. sodic hydrate, it will require 80 c. c. Thus, using 4 grammes of the commercial article, the number of c. c. standard acid required will indicate at once the percentage of sodic hydrate. (See Josiah P. Cooke's *Chemical Problems and Reactions;* Karl Stammer, *Sammlung von chemischen Rechenaufgaben;* Albert Frickhinger, *Katechismus der Stoechiometrie;* G. F. Barker, *Textbook of Chemistry;* and the article Chemistry.) C. F. Chandler.

**Stomiat'idæ** [from *Stomias*—στόμα, "mouth"—the typical genus], a family of fishes of the order Teleocephali and sub-order Isospondyli, distinguished by the enormous gape (whence the name), combined with other characters. The species are all elongated and of a club-shaped form, tapering from before backward; the skin is naked, or covered with very thin and readily-deciduous scales; the lateral line is indistinct; the head is oblong, with the snout short and rounded; eyes large and anterior; opercular apparatus imperfectly developed and very oblique; mouth with a very deep lateral cleft; upper jaw with its margin formed by the supramaxillary as well as intermaxillary bones; teeth on the jaws acute, and often barbed; palate sometimes toothed, sometimes unarmed; branchial apertures very deep and continuous below; branchiostegal rays numerous (12–17); dorsal fins variable, according to subfamily; anal fin very far behind and small; caudal distinct; pectoral fins low down on the scapular arch, and narrow; ventral fins inserted far backward. The stomach is cæcal, and pyloric appendages are wanting (at least in *Stomias*). The ovaries have oviducts, and consequently the eggs are discharged directly through them into the water. The air-bladder appears to be absent. The family is composed of a few species, which are of rather small size (all being considerably less than a foot in length), and inhabitants of the open sea and deep water. At present only eight species are known, all of which have been obtained from the At-

lantic Ocean and the Mediterranean Sea, and many doubtless remain to be discovered. The forms differ much as to the dorsal fins, the Stomiatinæ having a single dorsal, which is directly opposite the anal, and the Astronesthinæ having two dorsal fins, the first of which is rayed and opposite the interspace between the ventral and anal fins, while the second is adipose and opposite the anal. The first has three genera (*Stomias, Echiostoma,* and *Malacosteus*), and the second one (*Astronesthes*). THEODORE GILL.

**Stone'-borer,** a name applied to certain species of bivalve or conchiferous mollusks belonging to several distinct families (Pholadidæ, Gastrochænidæ, Saxicavidæ, Veneridæ, Petricolidæ, and Mytilidæ) which have the faculty of perforating stone. Most of them belong to the order Dimyiaria, and have the mantle behind prolonged into siphons, but otherwise they differ considerably. Only the differences in the shells can, however, be here noticed.

The Pholadidæ have a shell which gapes more or less in front as well as behind, to accommodate the large animal, and is generally divided externally into two regions (an anterior and posterior), characterized by differences of sculpture; the hinge-margins are usually reflected, and there are generally, also, one or two dorsal or umbonal valves. The cartilage is small and internal; the ligament external. The anterior surface of the shell is provided with a rasp-like armature. Species in greater or less number are found on almost every coast.

The Rocellariæ (family Gastrochænidæ) have a shell which also gapes at the two extremities, and which is irregular and inequivalve. The surface is rugose. The ligament is external and small, the hinge edentulous. The living species are confined to the Eastern seas.

The Saxicavæ (family Saxicavidæ) also possess a shell which gapes somewhat at the anterior and posterior extremities, but the valves are not differentiated into distinct regions of sculpture, but simply concentrically striated and folded and rugose. The cartilage is external and well developed. The species are very generally distributed.

The Rupellariæ (family Veneridæ) have shells which gape backward, but not forward, and which are concentrically plicated and striated on their outer surfaces; the ligament is external; the hinge armed in one valve with two, and in the other with three, small diverging teeth. The species are quite widely distributed.

The Petricolidæ have shells which gape posteriorly, and which are covered with a hard, thin, and often muricated epidermis; the ligament is external and short; the teeth in the hinge generally two, but often in part rudimentary or atrophied. Species are very generally diffused in the different seas.

The Lithodomi or Lithophagi (family Mytilidæ) have shells which are of a finger-like form (hence a typical species is called *Lithodomus dactylus*), and have closely-fitting valves, whose surfaces are generally provided with a fine reticulated or file-like sculpture; the ligament is marginal and chiefly internal, the hinge toothless. The species are common in most tropical and subtropical seas. These belong to the order Heteromyiaria.

Such are the several types of stone-borers. It will be seen that they have scarcely any one character in common, and it is possible that their excavations into rocks may be effected in different ways. It is, however, tolerably certain that most, at least, effect their labors by mechanical means and by grinding away the rock with the anterior portion of their shells. This is frequently muricated or file-like. M. Cailliaud, a French naturalist, who long ago investigated the subject, experimented with the shells of Pholadidæ, and by rotation of the valves excavated a burrow such as the living animals might. (See also Robertson, *Rep. Brit. Assoc. Adv. Sc.*, 1872.) An Italian naturalist, Signor C. Caramagna, has also (1870) made confirmatory observations on the Lithodomi. He observed the *Lithodomus lithophagus* make its appearance at regular intervals at the entrance of its cavity, and then let itself drop with an audible noise to the bottom. "In the fore part of many specimens there can be traced spots which have been injured, and have been repaired by the animal; which tends also to prove the mechanical action of the burrowing. In a mole built only seven years ago specimens of a length of 13 millimètres and 11 in circumference have been found." (*Bull. Mal. Ital.*, iii. pp. 46–49, quoted in *Zool. Rec.* for 1870, p. 177.) Some of the species (Pholadidæ and Rocellariæ) form tubes or linings to their burrows, in which they live (and hence were combined by Lamarck under the name Tubicola), while others live in the simple burrows excavated. The species are liable to do great damage by excavation into piers, etc., and gradually breaking them down, although there appear to be no marked instances on record. The columns of the temple of Serapis at Puteoli (Pozzuoli) are frequently alluded to as having been perforated by "stone-borers," and their burrows indicate the former position of the columns in the water. Some species may be found in brackish or almost fresh water; *Martesia fluminalis, e. g.*, is a species of Pholadidæ which is found in creeks of the delta of the Irrawaddi River in India, and bores in the soft argillaceous sandstone of the banks. (See Blanford, *Journ. As. Soc.*, n. s., ii. p. 67, 1867.)

Besides the mollusks thus enumerated, species of worms and echinoids also excavate stone, and to that extent are also "stone-borers." THEODORE GILL.

**Stone'man** (GEORGE), b. at Busti, N. Y., Aug. 8, 1822; graduated at the U. S. Military Academy in 1846, and entered the 1st Dragoons, which he joined at Fort Leavenworth, from whence he conducted a supply-train to Santa Fé, New Mexico, where he became acting quartermaster of the Mormon battalion, which he accompanied to California in 1847, remaining actively engaged on the Pacific coast until 1855, in March of which year he became a captain in 2d Cavalry, and served mainly, until 1861, in Texas, and was in command at Fort Brown when ordered to surrender by order of Gen. Twiggs in February, but refused to do so, and evacuating the fort reached New York in a steamer chartered for the purpose; promoted major 1st Cavalry May, 1861, and served on the staff of Gen. McClellan in W. Virginia until Aug. 13, when appointed brigadier-general of volunteers and chief of cavalry of the Army of the Potomac, which branch he organized and commanded during the Virginia Peninsular campaign of 1862; succeeded to command of Kearny's (1st) division, 3d corps, on the death of the latter, and of the 3d corps, Nov. 15, 1862; promoted major-general of volunteers Nov. 29, 1862, and led his corps at the battle of Fredericksburg; commanded cavalry raid to Richmond Apr.–May, 1863; chief of cavalry bureau July, 1863–Jan., 1864; in command of 23d corps Jan.–Apr., 1864; of cavalry corps department of Ohio Apr.–July, 1864, participating in the Atlanta campaign May–July, 1864; conducted a raid for the capture of Macon and Andersonville and liberation of prisoners, but was compelled himself to surrender July 31, and held prisoner until Oct. 27; in temporary command of department of Ohio Nov., 1864; conducted raid to S. W. Virginia Dec., 1864; in command of various districts and departments until mustered out of volunteer service Sept. 1, 1866. Became colonel 21st Infantry July 28, 1866; brevetted colonel, brigadier and major general for gallant conduct; retired from active service Aug. 16, 1871.

**Stough'ton** (EDWIN W.), LL.D., b. at Springfield, Windsor co., Vt., May 1, 1818; came to New York in 1837, and commenced studying law in the office of P. T. Ruggles; became in 1839 a contributor to *Hunt's Merchants' Magazine*, and was admitted to practise in the Federal courts and in the superior court of New York in 1840, and in the supreme court in 1841; commenced immediately practising in the city of New York, and acquired soon a large and very important practice. Some of his most remarkable successes have been achieved in the trial of extremely difficult and intricate patent cases. He was engaged as counsel and advocate on the Republican side before the Electoral Commission, after which Hayes and Wheeler were declared elected.

**Stra'chey** (RICHARD), served in the Sutlej campaign 1845–46, on the staff of Sir Henry Smith at battles of Alsival and Sobraon; appointed to the Bengal engineers in 1836, and promoted to major-general 1871; was nominated a member of the council of the governor-general of India in 1868; acted as assistant secretary in the public works department 1869, and appointed member of the council of the secretary of state for India in 1875.

**Strong** (JAMES WOODWARD), D. D., b. Sept. 29, 1833, at Brownington, Orleans co., Vt.; graduated at Beloit College, Wis., in 1858, and at Union Theological Seminary, New York, in 1862; was ordained Sept. 28, 1862, and commenced his ministry at Brodhead, Wis. After two years he went to Faribault, Minn., where in Jan., 1866, he was installed pastor of the Plymouth Congregational church; in 1870 became the first president of Carleton College (then called Northfield College), at Northfield, Minn.; subsequently the duties of professor of mental and moral philosophy were also assigned to him.

**Submarine Blasting.** For a general description of the preparations for and mode of submarine blasting see HELL-GATE and BLASTING, in CYCLOPÆDIA.

**Sunday-School Union.** See AMERICAN SUNDAY-SCHOOL UNION.

**Sur'gery.** The term "surgery," or "chirurgery," as it was formerly written (χείρ, the "hand," and ἔργον, "work"), at once suggests the province to which this branch of the healing art was once restricted, and the source from which our earliest information regarding it is derived. For, while the investigations of Oriental scholars indicate traces of a knowledge and practice of this art in yet earlier

civilizations, our first definite traditions regarding it, and first collected body of doctrine, come from the Greeks. They looked on surgery as that branch of the healing art that administered to injuries or diseases by the hand alone, the employment of instruments, or the use of topical remedies. It has been maintained that therapeutics must be coeval with mankind, and those who accept the theory of evolution, and have studied the manners of existing savage tribes, and observed the habits of highly-organized inferior animals, will not hesitate to assign a yet more remote origin to the healing art. It is altogether probable, also, that in antiquity of origin surgery must take precedence of medicine, since attempts to assuage the pain or to remove the inconveniences of wounds or injuries resulting from external violence would be likely to be made before internal diseases were in any degree understood or supposed to be within the control of human means. Baron Percy has remarked that, while the internal diseases of mankind were still ascribed to the anger of the gods, and the smoke of expiatory sacrifices ascended from altars, surgeons had already become renowned by bold and salutary operations; and is inclined to attribute the origin of this art to the first occasion when some one, pierced by a foreign body, invoked the aid of a skilful comrade for its removal; remarking that in ancient times it was sufficient to extract adroitly darts or arrows, and to place on the wounded part some soothing balm, in order to be reckoned a benefactor of humanity entitled to divine honors (Homer, *Iliad*, lib. xi.). Percy is even inclined to admit with Sextus Empiricus (Πρὸς τοὺς μαθηματικοὺς ἀντιῤῥητικοί, lib. i. cap. 2) that the word *ἰατρός*, or *medicus*, denotes the primitive function of the medicine-man, and that it is derived from *ἰός*, signifying *sagitta*—an opinion from which modern Sanskrit scholars would probably dissent. Students of the recently-revived Sanskrit literature, and those who have sought to decipher the inscriptions of Egyptian and Assyrian ruins, find some grounds for the belief that surgery was more advanced among those ancient peoples than is commonly supposed, pictures and *bassi-rilievi* having been found displaying surgical instruments and operations not unlike many in use in modern times. We can be sure, at least, that the custom of embalming the dead, which implies some anatomical and surgical knowledge, was prevalent in very early times, and that among the Jews the operation of circumcision was practised by divine command through many ages. The Asiatics and Egyptians were the preceptors of the Greeks; and Dujardin in his erudite *History of Surgery* has carefully traced the channels through which information was transmitted to a more gifted and brilliant nation. He would accept Plutarch's account, that Agenor, a Phœnician king, practised surgery with distinction, dressing the wounded arm of a son of Priam, and devising the scarf or sling now almost indispensable in many injuries of the upper extremity. Chiron, the Thessalian centaur, is more generally accredited the father of surgery in the fabulous ages of Grecian history. He was celebrated for his knowledge of plants and skill in applying soothing herbs to wounds and bruises. His reputation is eclipsed by that of Æsculapius, a son of Apollo, by some reckoned the pupil of Chiron, by others his contemporary and superior, believed to have been deified fifty years before the Trojan war, although skeptics have called his very existence in question. That his temples in Epidaurus, Cnidos, Cos, and Pergamus became the repositories of surgical knowledge is a respected tradition, and that he was esteemed the most venerable authority in surgery we are assured by the testimony of Celsus. In the dim light of fable we discern that Jason, Theseus, and Hercules practised surgery, and that Epione, the wife of Æsculapius, as well as Medea, proved that women thus early not only shared with men the perils of war, but aided in repairing its ravages. A Thracian king, Orpheus, had such knowledge of the virtue of plants that he cured a woman bitten by a snake, whence arose the fable that he had rescued her from hell. The Greeks, prodigal in apotheosis, made many demigods partly because of their achievements in the healing art. Two sons of Æsculapius are not inconspicuous among the heroes of the *Iliad*. Homer always names Podalirius the first, but it appears that Machaon was the elder and most celebrated, and that his precedence is sacrificed to the exigencies of the poet's verse. Menelaus, wounded by an arrow from Pandarus, and Philoctetes, struck by a poisoned javelin, are cured by the skilful Machaon; and Pausanias records that the Messenians, over whom he reigned, raised a temple in his honor. Podalirius, his brother, though much praised for his surgical skill in the Trojan war, has no important cures circumstantially ascribed to him, except that of the daughter of Damœtus, king of Caria, whom he bled from both arms when she was stunned by a fall, and, on her survival, married her, receiving the province of the Chersonese as a dowry. Hence the origin of phlebotomy is attributed to this surgeon, although Pliny (*Hist. Nat.*, l. viii. cap. 35) refers this remedial means to the lower animals. The surgical attainments of these sons of Æsculapius seem not to have extended further than the extraction of darts, the suppression of hæmorrhage by pressure or styptics, and the application of lenitive salves. When the warriors at the Trojan siege sustained fractures of the bones, Homer tells us that recourse was had, as when pestilence arose, to invocations to the gods. Thus we find surgery developed amid the contentions of men, and practised by those who were themselves warriors. As Lucretius tells us (lib. v. 1282), men fought first with their teeth and nails, and with clubs and stones afterward:

> "Arma antiqua manus, ungues, dentesque fuerunt,
> Et lapides, et item sylvarum fragmina ramei;"

and then swords and lances were employed, and arrows and javelins, and then the more effective projectiles devised in the progress of the art of methodically and gloriously destroying life.

Surgery may boast of a noble origin, since the earliest accounts we have of its practice refer it to one of the most generous sentiments of humanity, that sympathetic benevolence which inspires pity for the suffering and an anxious desire to alleviate their pain.

For six centuries after the Trojan war we have little information of any advances in surgery. In common with other branches of knowledge, it was passing through that theological stage in which the intervention of supernatural powers is recognized rather than the scope of human possibilities. The infancy of the art in every nation is the same; the priests of India, the magi of Egypt, the jugglers of China and Japan and of the savage tribes of the two hemispheres, combine, with their manual interference, mysterious practices on which their cures are supposed mainly to depend. It was thus with the Asclepiadæ, or reputed descendants of Æsculapius. They supplemented their ignorance by appeals to the gods, founding temples, delivering oracles, receiving gifts, and doing nothing for the progress of their art. Kurt Sprengel has minutely described this stationary period in the history of medicine and surgery, and Dr. John Watson, in a discourse before the New York Academy of Medicine in 1855 on the *Medical Profession in Ancient Times*, reviewed it with equal conciseness and erudition. In the course of this long monopoly of the Asclepiadæ schools for the instruction in such surgical information as the professors possessed or were willing to impart were established about the temples, and the schools at Rhodes, Cnidos, and Cos became distinguished. Real achievements in surgery appear to have been known during this period, such as cutting for the stone and operating for cataract, although these advances were discredited by the priests, as suitable only for specialists of the baser sort. Empirical improvements were all that were possible, since there was an almost complete ignorance of anatomy, save notions of the human skeleton derived from practice in fractures and luxations, and vague ideas of the relations of the viscera from examination of the lower animals or through instructions from the Egyptians, enlightened by their practice of embalming. It was not until Pythagoras brought the light of philosophy to bear upon the practice of the healing art that the way was paved toward raising its dignity in the direction of positive knowledge. The school that he founded at Crotona not only produced surgeons of distinction (among others, Damocedes, who, made captive by the Persians, treated Darius with a dislocated ankle and his queen Atossa with a cancer of the breast), but also inspired the schools of Cnidos and Cos with the philosophic spirit, so that, a century later, there appeared in the latter that splendid genius, Hippocrates. Born in the 80th Olympiad, about 460 years before the Christian era, a contemporary of Socrates, this great man did much to free medicine from the absurdities with which superstition and ignorance had surrounded it, and through a long and honored life gave a noble example of persevering industry, of philosophical research, and of lofty moral worth. His attention was more turned to medicine than to surgery, yet in the latter branch his practice was bold and decisive. It was with him a maxim that when medicine failed recourse should be had to the knife or to fire, and he used courageously the cautery and knife. He commended some operations that are even now hardly approved as ordinary surgical resources, such as tapping the chest for empyema, nephrotomy for calculus lodged in the kidney, and trepanning the skull for headache. He was familiar with cataplasms and venesection and cupping; with operations on ranula, nasal polypi, and ganglia; with the treatment of piles and fistules by ligature; with tapping in dropsies, advising even paracentesis in hydrocephalus; with all the surgical procedures known in his day except the operations for lithotomy and cataract, which seem to have been con-

fined to specialists. He gave rules, for the most part rude and cruel, for the reduction and treatment of dislocations and fractures, and anticipated a multitude of the practices that have been vaunted by the moderns. He had the privilege of the friendship of Democritus, that happy sage, and on his death was commemorated by a statue of gold voted him by the inhabitants of Argos, and by almost universal tributes and honors. For many generations after Hippocrates surgery made little progress. The religious prejudices that forbade the dissection of the human body precluded the acquirement of any definite knowledge of anatomy, and there was a barren interval of several centuries. Of the more immediate successors of Hippocrates, Diocles of Carystus was one of the most prominent in surgery. He devised sundry bandages, especially for wounds of the head, and improved the *belulcon*, an instrument for extracting arrow-heads and darts, invented during the Peloponnesian war. Praxagoras of Cos is reported to have been a very bold surgeon, incising the fauces freely in cases of cynanche, and laying open the abdomen for the removal of intestinal obstructions. The labors of Aristotle had probably some influence in promoting the healing art; but we look in vain for any practical important advance until, on the dismemberment of the great empire of Macedonia, the chief centre of learning was transferred to Alexandria, and the Egyptian school took its rise (B. C. 300). Herophilus of Chalcedon and Erasistratus were the most conspicuous leaders of the Egyptian school. The former was a pupil of Praxagoras. He was the first to direct attention to the radial pulse as an index of the varying conditions of health and disease. According to Fallopius, he held as an anatomist among the ancients the same place as Vesalius among the moderns. Marx of Göttingen in 1840 published an elaborate analysis of his labors. That he dissected human bodies is expressly asserted by Galen. That he even dissected living criminals has been generally credited, the Carthaginian father Tertullian, with evident exaggeration, declaring that he made not less than 600 such examinations. Dr. Marx is satisfied that he discriminated nerves of motion from those of sensation; that he described the occipital depression now known as the "torcular Herophili" as the point at which the sinuses of the dura mater converge; distinguished the cerebrum from the cerebellum; and named the *calamus scriptorius* of the medulla oblongata, and the *duodenum*, and also carefully dissected the tunics of the eye and originated the term *retina;* and came near anticipating Aselli in the discovery of the lacteals, recognizing their relation with the mesenteric glands. Yet he fell into palpable mistakes, confounding the tendons and ligaments with nerves, and possibly the trachea with the aorta. Erasistratus, a native of Chios, who had studied philosophy under Theophrastus, is also greatly distinguished as an anatomist, but his erroneous interpretation of the function of the arteries, overthrown by Galen, retarded the discovery of the circulation, reserved for the illustrious Harvey. Erasistratus is reported to have been a very bold surgeon, not hesitating to excise portions of the liver and of the spleen. The invention of a metallic catheter is ascribed to him. He decried drugs, and insisted on the utility of diet, bathing, regimen, gymnastic exercises, and other hygienic resources as therapeutic measures. Xenophon of Cos, a pupil of Erasistratus, is said to have been among the first to restrain hæmorrhage from the limbs by tightly encircling the member with a ligature. Mantius, another pupil, devised many complicated surgical dressings. Philoxenus wrote extensively on surgery, and Andreas invented machines for reducing luxations. All of the surgeons of the Alexandrian school seem to have had a predilection for complex dressings and apparatus. Among them the practice of lithotomy, as in the times of Hippocrates, seems to have been relegated to specialists. One of them, Ammonius, surnamed *Lithotomus*, invented an instrument for crushing vesical concretions too large to be extracted through the ordinary incision—what would now be called a lithoclast—and hence is erroneously accredited with anticipating Civiale in the invention of the lithotrite, an instrument for crushing stone without a cutting operation. As Dr. John Watson well remarked in his anniversary discourse, already cited, the brightest era in science at Alexandria was the earliest. The leaders felt the impulse of Aristotle's teachings in natural history, and of those of Euclid and his great associates in scientific investigation at the Museum under the protection of the Ptolemies. Their successors seem to have been incapable of appreciating and following the road that was opened to them. Philinus and Serapion, and the surgeon from Bithynia who assumed the name of Asclepiades, and is sometimes reckoned the founder of surgery in Rome, and Themison, added nothing to the stock of knowledge, abandoning dissections, wasting time over futile discussions on the materia medica, or in vain speculations that they essayed to dignify by calling themselves Dogmatists, Rationalists, Methodists, and Eclectics.

From the time when the empire of the world was transferred to Rome until the reign of Augustus there appeared no surgical practitioner or writer of note until Aulus Cornelius Celsus. Tryphon, Euelpistus, Themison, Archagathus, and Meges—the latter graciously noted by Celsus as "the most learned of them all"—are among the few whose names have left a trace in history. Asclepiades by insinuating manners acquired the favor of the patricians, and even the friendship of Cicero, his influence leading the great orator to proclaim the dignity of the healing art, and to make the oft-quoted declaration, that "nothing brought men nearer to the gods than by giving health to their fellow-creatures." Asclepiades originated the famous surgical aphorism, "Officium esse medici, ut tuto, ut celeriter, ut jucunde curet." Yet he appears to have been but a clever charlatan, adding nothing to the real knowledge of his profession. But little scientific advancement in surgery could be looked for among the slaves, freedmen, and Greek adventurers into whose hands the practice of the art fell in those days. Yet we owe to this period a compendium of surgical knowledge which is by far the most valuable contribution to the subject that has come down to us from ancient times. Of the numerous writings of Celsus, the eight books *De Re Medica* are alone preserved. The last four books treat exclusively of surgery. With equal sagacity, erudition, and impartiality the author sums up all of value that was known on this subject to the Greeks in the great school of Alexandria and among his immediate predecessors and contemporaries in Rome. He advises the amputation of limbs affected by gangrene, pronouncing the operation very dangerous, as subjects frequently died in the course of it, either from bleeding or shock, but declaring that it was the only means of saving life, and giving excellent precepts for the performance of the operation. The method of lithotomy he describes is still regarded as of value, especially in children. He gives rules for the removal of cataract by depression, for forming an artificial pupil, and for the recognition and reduction of several varieties of hernia. The diagnosis and treatment of fractures and luxations he treats of judiciously and in detail. He is thought to have been the first to point out ruptures of the intracranial blood-vessels unattended by fracture. In the twenty-sixth chapter of his fifth book occurs the remarkable passage in which he advises that the bleeding from a wounded vessel, if it cannot be otherwise restrained, shall be controlled by two ligatures, placed one above and the other below the bleeding point. He recommended the ligature also in varices and hæmorrhoids. But it would be an endless labor to particularize. Not only the value of his subject-matter, but the purity and elegance of his style, have made the works of Celsus classical and immortal. Not many authors have said so much in a few words. A contemporary of Virgil, Ovid, and of Horace, who is supposed to refer to him (*Ep. I.*, iii. 15), his literary art is as conspicuous as his erudition and sound judgment. No Latin writer has been more fortunate in his editors. Rhodius, Almeloveen, Casaubon, Morgagni, Daremberg, and Targa—the latter devoting his life to this object—are among his illustrious commentators. Morwitz (*Geschichte der Medicin*, Leipsic, 1849) enumerates over sixty Latin editions of his work, and there are annotated translations of it in the principal modern languages. Aretæus of Cappadocia practised in Rome in the latter part of the first century. The earliest use of blisters by means of cantharides is ascribed to him. Dr. John Watson (*op. cit.*) regards him as "one of the most original and elegant writers of antiquity." He treated chiefly of medical topics, but his surgical was in keeping with his medical ability. His instructions on catheterism and on lithotomy are interesting; he opened hepatic abscesses and used the trephine for the cure of epilepsy. Heliodorus, the medical adviser of Trajan, was the author of some good observations on injuries of the head. Rufus of Ephesus is said to have been the first to tie successfully an artery for an aneurism at the bend of the elbow caused by venesection. He left a treatise on diseases of the bladder. Archigenes wrote on surgery, but his writings have been lost. No great surgical writer appeared from the time of Celsus to that of Galen, toward the close of the second century. He was a surgeon at Pergamus (A. D. 165), and afterward practised his profession at Rome. Dazzled by the prevalent taste for philosophical systems and speculations, he gradually neglected surgery, yet his commentaries on various surgical subjects are of value, and he indirectly aided surgical science by making a step toward the knowledge of the circulation of the blood, as Flourens has well shown in his history of that great discovery. According to Kühn, he prepared not less than 300 separate papers, several on surgical topics. His essay on bandaging shows that he was well acquainted with even the minor details of the art

as then practised. While he had a great contempt for theological superstitions, and individually exercised great freedom in intellectual inquiry, it must be admitted that he founded a school imbued with such reverence for professional authority that it hindered rather than advanced the progress of surgical knowledge.

After Galen, in the third century came Antyllus, who was a bold and successful surgeon. He recommended extraction for hard cataract, but cautiously, advising the operation only when the cataract was small. He also suggested arteriotomy in place of venesection in some cases, arguing that there was not risk of excessive bleeding, since the hæmorrhage might be controlled by cutting the vessel completely across. In this slight outline of the historical development of surgery we might pass without notice several centuries of the Byzantine era, which was most unfavorable to the advance of the sciences—surgery in particular making little progress, or indeed occasionally retrograding. We owe to this period, however, an encyclopædic performance by Oribasius (326–403 A. D.), a pupil of Zeno and friend of the emperor Julian, at whose request he compiled, in seventy-two books, all that he considered of value in the medical and surgical literature then extant. Seventeen of these books, with some fragments, have come down to us, and have lately (1851) been edited in magnificent style by Daremberg under the auspices of the French minister of public instruction. Oribasius was a judicious and honest compiler, prefixing to each chapter the names of the authors from whom it was abridged or textually copied. His observations on operations on the urinary organs and on fractures and luxations are of value. He alludes to the partial or bent fracture of the long bones of children (willow fracture)—an observation for which the erudite Malgaigne accredits Lanfranc, a surgeon of the thirteenth century. The next surgical writer commonly thought worthy of mention, after a lapse of nearly two centuries, is Aëtius (550 A. D.). One of the earliest and best historians of the art of healing, Dr. Freind, says that "in his chirurgical pieces there are many things worth taking notice of." He was a compiler for the most part, and a compiler who made no acknowledgment of what he copied; but Freind insists that he sometimes speaks from his own experience, as in his chapter on castration, in which he tells much that is neither in Celsus nor in Galen. He was the first Greek medical man of prominence to embrace Christianity, and the bias of his religious ideas is clearly indicated in his writings. If a foreign body is arrested in the gullet, and the surgeon has vainly exhausted every means of extracting it, he must turn the patient on the side, and, exhorting him to attention, say, "Come forth, as Lazarus from the sepulchre, or Jonas from the whale's belly!" In bites of bees and wasps a disk of iron, "engraved with the venerable image of the cross of Christ," will, according to Aëtius, "avert any inflammation." Costly Aldine and other editions of his sixteen books have been printed by Cornarius, Montanus, and others, but they have now little interest save as illustrating the influence of Christianity on the progress of medicine and surgery. After the decadence of the sciences in the second century, when magic, astrology, thaumaturgy, and theurgy conspired to bring about a blind dogmatism that paralyzed the pursuit of knowledge, very few surgeons freed themselves from the dense ignorance that surrounded them. Alexander of Tralles (570 A. D.), however, though not uncontaminated by the vices of his time, appears to have been an independent thinker, and at the close of a long and useful career wrote from his own experience with such sound judgment that the work in twelve books he has bequeathed to us is a valuable relic. Paulus Ægineta, who was a professor at Alexandria about the time (640 A. D.) of its final subjugation by the Saracens, had the good fortune to write a compendium of the healing art which is more circumstantial than any that has reached us, even that of Celsus. The excellent translation by Adams, published by the Sydenham Society, has made the work familiar to English-speaking surgeons. The sixth book is esteemed the best body of surgical knowledge prior to the revival of letters; and the reputation Paulus still enjoys is based on this treatise. Although in his preface he says that "it is not because the ancient writers had omitted anything relative to the art that I have composed this work, but in order to give a compendious course of instruction," he wrote from his own experience as well as that of his predecessors. In lithotomy he advised, after exploring by the rectum, an incision to the left of the raphe, or the modern lateral operation, instead of the median incision of Celsus. He discriminated aneurism by anastomosis, and performed ablation of the mamma, laryngotomy, and herniotomy in strangulation. He first treats of fractures of the patella. He was pre-eminent as an accoucheur, and is reputed to have devised the procedure of embryotomy. He was indeed surnamed *Obstetricus*. Though he was not devoid of the slavish prejudices of his day, we have reason to be grateful to him for transmitting much valuable information. He was the last of the Alexandrian school of any note. Freind and Le Clerc can discover no other Greek or Roman surgeon of mark until the beginning of the twelfth century, when Actuarius is mentioned as practising with distinction at Constantinople, where he compiled several surgical treatises that contain no vestige of original research. With the decline of the vast communities that composed the Roman empire and its relapse into barbarism, the best of the surgeons "were content to reverence what they had neither the skill to equal nor the temerity to set aside."

In the seventh century, contemporaneously with the vast achievements and conquests of the followers of Mohammed, learning was gradually communicated to the Arabians, and for the next five centuries we must look for anything noteworthy in surgery in this direction. At the medical schools early founded by the munificent caliphs the works of the great Greek authors were translated and studied, and some teachers of prominence appeared, as Mesue and Serapion; but these were pure physicians, and no writer distinguished in surgery arose until Rhazes (852–932 A. D.), who practised and taught at Bagdad at the close of the ninth and beginning of the tenth century. He was the first to describe spina bifida. He cauterized the bites of rabid animals. He gave a better account of hernia than his predecessors. He seems to have had little confidence in ophthalmic surgery, for when he was old he had cataract, but could not be induced to submit to an operation. Numerous editions of his writings have been printed at Venice, Bâle, and Paris. Hally Abbas lived at the end of the tenth century, and was a voluminous writer. He was surnamed "the Magician," because of the extent of his attainments. His work on surgery, which is preserved, presents scarcely anything new. In tapping for ascites he preferred to puncture in the linea alba, and he used caustics for the cure of hydrocele. Avicenna (980–1037 A. D.), educated in the schools of Bagdad, acquired an extraordinary distinction, but his *Canon* is esteemed by the best critics a servile compilation; and, as Bostock says, he seems to have regarded a familiarity with Aristotle and Galen as the ultimate aim of a physician or philosopher. The most important to surgery among the Arabian celebrities is Albucasis (1110 A. D.). The edition of his *Chirurgia* by Channing of Oxford is still consulted, and contains the most complete view we have of the knowledge of surgery that then existed. He seems to have abused the actual cautery, and enthusiastically extols the surgical virtues of fire. He employed the cautery to suppress hæmorrhage, and styptics likewise, but also complete division of the vessel, and even the ligature. He was the first, apparently, to remark the occlusion of a divided artery by a coagulum. He practised enterorrhaphy, and invented a probang for dislodging foreign bodies from the gullet, and an instrument for operating in lachrymal fistula. These and various other instruments he figures in his writings. He disapproves, fond of operating as he was, of interference with cancerous tumors, saying that he never cured, or saw cured, a single instance of the disease. After Albucasis arose two notabilities of the Saracenic school, who were natives of Spain, yet wrote in the Arabic language. Avenzohar (1162 A. D.), a Jew, practised at Seville in Andalusia, and his compendium entitled *Thaissyr*, though mainly a compilation, contains some original matter. He describes abscess of the mediastinum, and a case of suppuration of the kidney with discharge of fourteen pints of pus. He treats judiciously of fracture involving the hip-joint, and of wounds of the blood-vessels. Freind, Sprengel, and others regard him as an improver of his art, yet he spoke of lithotomy and kindred operations as "filthy and abominable, and unfit for any man of character to perform," and can hardly be admitted as one of the promoters of surgery. His pupil, Averroës (1198 A. D.), a native of Cordova, achieved a great reputation. Dante mentions him in canto iv. of the first part of the *Divine Comedy*. He was an obsequious follower and copious commentator of Galen. His principal work, the *Universal*, passed through many editions in Hebrew and Latin, and was republished at Venice in the seventeenth century. Yet it contains not a single permanent addition to knowledge, and may be considered the last of the dregs of the Arabs. It is reported in the *Deutsche Zeitschrift für Chirurgie* for 1873 (B. ii. p. 263) that a manuscript of 336 quarto pages, by an unknown author, was discovered in 1863 in the library of the University of Madrid, which gives an extended view of the Arabic treatment of wounds, including shot wounds by missiles of iron and stone. In a prize-essay by Dr. Don Antonio, entitled *Memoria sobre el Origen y Vicissitudes de la Terapeutica que han usado los Cirujanos españoles en las Heridas de Arma de Fuego* (Madrid, 1863), it is claimed that the nature and treatment of shot wounds are judi-

ciously discussed in this parchment, and that it dates from the closing part of the fourteenth century, or shortly after the introduction of gunpowder in warfare. Should the date and authenticity of this manuscript be established, it would be the earliest treatise on shot injuries extant. Neither Arnold of Villanova nor Guy of Chauliac mentions these injuries, and priority in adverting to them has, until lately, been ascribed to the German surgeon Heinrich von Pfolsprundt (1460 A. D.), whose manuscript, *Buch der Bündth-Ertzney*, was printed in 1868 by Haeser and Middeldorpf. The contempt with which the Saracenic school has been regarded in Christendom seems not altogether undeserved. The works of its most eminent teachers are characterized by a horror of the effusion of blood and of human dissections, and a passion for endless multiplication of instruments and appliances and for the mechanical parts of surgery, and a want of any enlightened spirit of improvement. They appear to have calculated the efficacy of surgery by the richness of its arsenal, but every mechanic knows that the skilful workman is not often changing his tools. In polypharmacy they excelled the professors of materia medica and nostrum-vendors of the present day. They seemed anxious to inspire terror rather than confidence, and the employment of boiling pitch for the suppression of bleeding is due to them. They have been praised for transmitting the works of the Greek masters, but there is reason to believe that even Averroës knew their classics only through translations, and, making them poorer by additions, conveyed to posterity only enormous compilations. It may be said, however, that by the systematic division of the medical art into physic, surgery, and pharmacy they made a certain progress; and the best of them, Albucasis, rendered service by figuring in his text the surgical instruments known in his day. The intellectual darkness that surrounded the neighboring nations accounts for the credit ascribed to the feeble illumination of the Saracens. For several centuries we find among the successors of the Greeks and Romans no name in surgery to arrest our attention by association with improvements either in theory or practice. The only attempts worthy of notice are in connection with the schools established at Salerno and Monte Casino, which maintained their prestige until the thirteenth century, when they were eclipsed by the rising reputation of the schools of Bologna and Paris (Freind, p. 355–357; Eloy, art. "Salerne;" Lauth, p. 291; Ackerman, cap. xxxi.). The origin of the school of Salerno is not well ascertained, though it was probably founded by Charlemagne in 802. It had already some renown in the eleventh century, and was a resort for crusaders of all nations passing between Europe and Palestine. It is chiefly remembered by a poem in rhyming Latin verse on the "Preservation of the Health" (*Regimen Sanitatis*), addressed to Robert of Normandy, a son of William the Conqueror. It attained the dignity of a university, and initiated the scholarly titles "magister" and "doctor." When Constantinus Africanus, a Benedictine monk from Carthage, arrived here (1087), expelled from Babylon as a sorcerer, he found preferment at court, but caring more for repose than social distinction, he retired to Monte Casino and occupied himself with translating the Greek and Arabian medical writings. Most of the Italian surgeons of the thirteenth century whose names have left any trace in the history of the art appear to have derived their knowledge from one or the other of these schools. The first of these in date is Rogerius of Parma (*circa* 1206). His *Chirurgia Magna* was long a textbook in Italy. It is but a servile compilation from the Arabs. He practised enterorrhaphy, even in cases of complete division of the intestine, attempting to unite the divided surfaces by direct apposition over a cylinder of elder-wood. His disciple, Roland Capelluti, professed surgery at Bologna (1264), and composed a voluminous commentary on the work of his preceptor—whom he far surpasses in erudition—citing the Greek classics as well as the works of the Arabians. In a case of hernia of the lung he excised the protruding part, and the patient survived. Another disciple of Rogerius was Jamerius, who is described by Guy of Chauliac as a brutal and eccentric surgeon, but is placed by Peter of Argelata among celebrated operators of his time. Great obscurity envelops the history, and even the names, of the Four Masters, to whom are ascribed some important improvements in surgery, especially a method of suture of wounded intestines which still holds a place in the art. According to Devaux, they were four monks living at Paris in the time of Lanfrancus (at the close of the thirteenth century), devoting themselves to good works. According to others, they were four teachers of surgery, who professed in four languages—Magister Salernus in Latin, M. Pontus in Greek, M. Abdallah in Arabic, and Rabbi Elimus in Hebrew. Weber and others believe that Rogerius, Jamerius, Theodoric, and William of Salicet are the four teachers referred to under the designation of the Four Masters. The little evidence extant gives most plausibility to the first of these conjectures. Manuscript copies of their voluminous work on surgery existed in the seventeenth century at Avignon and at Paris, and some fragments are said to be still preserved in the Bodleian Library at Oxford; but the work was never printed, and the opinions of these skilful masters are known to us only through citations in the works of their contemporaries. Hugo of Lucca (d. 1252) is regarded as the founder of the Bolognese school. He is said to have been an experienced practitioner, rather than a man of erudition. He reduced a luxation at the hip of a year's standing in a man of twenty-five. He used alcoholic lotions largely as topical applications to wounds. After Hugo came Brunus of Longobucco, a professor at Padua (1262). He composed a *Chirurgia Magna*. He approved of dry dressings to wounds. He was familiar with the translations of the Greek and Arabian authors then known in Italy. His works are printed in the Venetian collection of 1499. Theodoric of Cervia, a pupil—and, according to Tiraboschi, a son—of Hugo of Lucca, expounded the views of his predecessors. He was confessor to Pope Innocent IV., and afterward (1266) bishop of Cervia, but he resided in Bologna, and amassed great wealth by the practice of surgery. His *Chirurgia*, in four books, describes the practice of Hugo, but he quotes much from Brunus. A folio edition was printed at Bergamo in 1498. Theodoric is accredited with having substituted soft and simple bandages and splints in fractures for the cruel appliances in vogue in his day. He used dry applications or desiccating lotions in dressing wounds. According to Guy of Chauliac, the Italian surgeons of this period may be classified in two schools. One, with Rogerius, Rolandus, Jamerius, and the Four Masters as its exponents, treated all wounds and ulcers by emollient fomentations and cataplasms; the other, in which Hugo, Brunus, and Theodoric were conspicuous, employed dry dressings or desiccating lotions. William of Salicet (born at Piacenza in 1210) practised in armies, and at Cremona, Pavia, and Verona, and finally went to Bologna and lectured on surgery; and there (June 8, 1275) completed his work on surgery. It is much more complete than the writings of his contemporaries and immediate predecessors. Writing at the close of a long life, he speaks from his own experience. He is the first Italian surgeon who treats at any length of the surgical affections of women. Nicholas of Fernham, after teaching surgery at Bologna, returned to England in 1241 as bishop of Durham, but wrote nothing. Gilbertus Anglicanus (1290) appears to be the first English writer on surgery. There is a Venetian edition (of 1510) of his poor compilations. In 1271, Pitard founded the college of St. Côme at Paris, which was the origin of the academy of surgery that became so famous in later years. Pitard was a man of eminence in his day, and his observations on wounds of the head and on poisoned wounds are still remembered. The thirteenth century is conspicuous as the era in which most of the great European universities were founded—Padua in 1221, Salamanca in 1222, Naples in 1224, Vienna in 1237, Oxford in 1249, Cambridge in 1257, Upsala in 1277, Lisbon and Coimbra in 1290, and Bologna in 1295. Surgical writings were preserved at these seats of learning, but the professors wore the philosophical robe and were enslaved in a blind devotion to the systems of Galen or of the Arabs, and even men of intellect could not free themselves from the prevalent mental servitude. Manuscripts were very rare and very costly, and were for the most part in the hands of the clergy. In the middle of the thirteenth century they were forbidden by an edict of the Council of Tours from causing the effusion of blood for the purpose of healing bodily ailments, although bloodshed for the suppression of heresy was not interdicted. Thus, the practice of surgery fell into the hands of the uneducated laity, and reached a deplorable abasement. Lanfrancus, a Milanese and a pupil of William of Salicet, is generally regarded as the creator of surgery in France. Implicated in the contests of the Guelphs and Ghibellines, he fled to Paris in 1295, and there practised with high reputation, and composed his *Chirurgiæ* (*parva et magna*)—works still consulted. He was the first to speak of the healing of wounds by "first intention." Malgaigne, in his charming introductory chapter to the works of Paré, speaks with enthusiasm of the services rendered the profession by Lanfrancus. At this time flourished Master Jehan Ypermann (1295–1350), lately styled the father of Flemish surgery, whose manuscript treatise on the art was discovered and published as late as 1854 by the medical society of Ghent. During the fourteenth century surgical science was dead in Italy. Rienzi states that Bartolomeo de Varignana dissected human bodies in 1290. Mondini de Lucci also publicly dissected at Bologna the cadavers of two women, braving the prejudices of his time, and published an anatomical work illustrated

by wood-engravings (1325). His efforts to revive anatomical studies were followed by Nicolo Bertrucci. But civil disorders ruined the Italian universities, and thirty years later Petrarch lamented the utter decay of their ancient splendor, and Boccaccio, visiting the library of Monte Casino, found the doors and windows overrun by herbs and vines and the books buried in dust. A few of the more ambitious students went to pursue their studies in France. Early in the fourteenth century John of Gaddesden, after studying at Montpellier, practised surgery with success at Oxford, and composed his *Rosa Anglica*. John of Ardern flourished in Newark about 1350, and later removed to London. He compiled voluminously, but a treatise on *fistula in ano*, published in 1588 by John Reed, is the only one of his writings that was printed. Contemporaneously with the removal of the papal see to Avignon the neighboring school of Montpellier acquired a reputation that cast all its rivals in the shade. Guy of Chauliac practised in Avignon in the middle of the fourteenth century with renown. He is accounted "one of the revivers of the languishing art," and his numerous works on surgery are still consulted. In them we find the first mention of the Cæsarian operation and the only account of the writings of some authors whose works are lost. He operated on the king of Bohemia for cataract without success, but the heroic blind old man nevertheless led a charge against the English at the battle of Cressy, ordering his horse to be fastened to those of two of his noblemen. Guy is esteemed a bolder surgeon than Lanfrancus. Ackerman declares that his *Grande Chirurgie* embraces all of value written on surgery up to its epoch. Pre-eminence in surgical knowledge seems to have passed from Salernum to Bologna, and thence to Montpellier. The latter school, fostered by the neighboring papal court at Avignon, was enriched by manuscripts from both Spain and Italy. Guy possessed the works of not less than eighteen Arabian authors, and had the good fortune to obtain the sixth book of Paulus Ægineta, then unknown in the West. He made good use of his materials. He made no discoveries of much moment. The special forms of the knives and cauteries he invented are forgotten, and his treatment of indolent ulcers by binding on them a leaden plate is perhaps the only innovation of his that is remembered; but he was thoroughly familiar with the surgical information accessible in his day. His definition of the essentials of a good surgeon is classic. He should be "lettered, expert, ingenious, and fertile in resources—bold when sure, but wary in doubtful and dangerous circumstances. He should avoid all doubtful or discreditable practices, and should be gracious to his patients, kindly to his colleagues, wise in his prognosis. He should be chaste, sober, compassionate, merciful; not covetous or extortionate, regulating his remuneration according to the service rendered, the ability of his patient, the result of the case, and his own dignity." These words indicate the character of the man, and worthily re-echo the precepts of Hippocrates and of Celsus. Guy of Chauliac in preparing his writings enjoyed one great facility denied his predecessors. Prior to his time, parchment or silk or papyrus had been used for manuscripts, but early in the fourteenth century began the manufacture of paper from rags. The exact date of that invention and the name of the inventor are unknown, but Tiraboschi states that at the middle of the century paper was fabricated at Padua, and afterward at Treviso, by a certain Pax de Fabiano, whom he styles *primus inventor* (t. v. lib. i. cap. 4). Guy makes no mention of gunshot wounds, although artillery was used in the defence of fortified places early in the fourteenth century, and field guns were employed at the battle of Cressy (1346). The frightful injuries inflicted by these new weapons would naturally attract the attention of all observers interested in surgery. In the latter part of the fourteenth century the school of Montpellier rapidly declined. Both Italy and France were desolated by contending factions; the library of Guy was scattered. Balescon of Taranta, a Portuguese professor who succeeded to the chair of surgery, laments the loss of the works of Paulus, Rufus, etc. Balescon (or Valescus, as his name is sometimes Latinized) is said to have first advised the employment of mercurial ointment for the removal of lice and other parasitic vermin. In the fifteenth century the discovery of the art of printing (c. 1450) rendered the accumulated stores of knowledge more accessible, and surgery shared in the impulse given to the sciences. On the capture of Constantinople by Mohammed II. (1453), Christians fleeing from the city brought to Western Europe many manuscripts of the Greek writers, which were printed and slowly disseminated. A copy of Celsus was discovered in 1443 at Milan; three manuscripts of Paulus were found about the same time, together with some Greek versions of Hippocrates and Galen. Nicolo Falcucci (d. 1412), or Nicholas of Florence, a contemporary of Balescon, compiled voluminously on surgery, borrowing from the same sources as Guy of Chauliac, but with less discrimination. Peter of Argelata (1493) professed surgery at Bologna, where a statue was erected in his honor in the amphitheatre of the university. He dissected and embalmed the body of Pope Alexander VI. His work, still occasionally referred to, is creditable only when considered in relation with the abased condition of surgery in Italy in his day. Leonardo Bertapaglia (1429) is said to have practised human dissections, and to have brought a certain lustre upon the chair of surgery at Padua. He wrote on ulcers and wounds, and enumerates twenty-two kinds of punctured wounds by darts and arrows. He seems to have first described the tenaculum. Among other Italian surgeons who in some measure aided in the progress of surgery may be mentioned Guainerius, professor at Pavia, who wrote on diseases of the joints; his successor, Matthew of Gradi, and Bartolomeo Montagnana (1441), professor at Padua, who wrote on hernia, and first distinguished that variety of ventral hernia that protrudes through the linea alba. Arculanus also (1427) taught with credit at Verona and Ferrara, and devised several kinds of trusses and an instrument for extracting foreign bodies from the ear. He ligated the spermatic vein in varicocele, and wrote judiciously of ectropion. Marcellus Cumanus was a surgeon in the Venetian army in 1495 at the invasion of Charles VIII., and treated harquebuse wounds with boiling oil, regarding them as poisonous. Antonio Benivieni, a Florentine nobleman (1460), is probably the first writer treating systematically of morbid anatomy. He dissected two cases of coxalgia, an affection which J. L. Petit is sometimes supposed to have first described. Sprengel has hardly done him justice. Nicholas Colnet and Thomas Morstede were the chief surgeons attending Henry V. in his invasion of France (1415). Heinrich von Pfolsprundt, after participating in the great war in Poland in 1454, wrote his *Buch der Bündth-Ertzney*, containing an early observation on shot wounds. He describes a rhinoplastic operation, anticipating Tagliacozzi by a century. From 1467 to 1500 a large number of medical and surgical works were printed at Venice, and a few at Rome, Paris, Strasbourg, London, Oxford, and in Spain and Portugal, and made available for general circulation. Hieronymus Brunswig (b. 1430) published a treatise on the *Handwuerckung der Wundtartznei*, which was translated into English, and was one of the earliest works relating to medicine, if not the earliest, *printed* in that language. In 1480, Colot, a French surgeon in favor with Louis XI. of France, performed lithotomy successfully on a condemned criminal; and this operation, previously abandoned to itinerant quacks, became a part of the legitimate practice of surgery. With the revival of letters and of the natural sciences in the sixteenth century a new era dawned on surgery. Observation and experimental investigation gradually reassumed their proper places, students slowly perceiving that they could not equal their predecessors by a servile following in their footsteps. Investigation of anatomy in the true spirit was undertaken by Vesalius (1513–64). Senac compares his great work with the discovery of the New World. Fallopius (1532–62) and Eustachius (1520–79) worthily succeeded this founder of modern anatomy. Fabricius of Acquapendente (1537–1619), a pupil of Fallopius, was the teacher of William Harvey (1578–1675) the immortal discoverer of the circulation of the blood. Gasparo Aselli (1581–1626) followed with the discovery of the lymphatic vessels. The way was thus paved for advances in surgery, which, illuminated by science, became a worthy pursuit for men of talent and education. Preceded by John de Vigo (1520), who still believed shot wounds poisonous, and by the Swiss surgeons Hans von Gersdorf (1520) and Felix Würtz (1576), who have left original observations of value, the latter being reputed the first surgeon who ventured to amputate in the thigh, appears Ambrose Paré, the founder of the modern French school, and reckoned the ablest of early army surgeons. He made authority yield to observation or sought to reconcile them. If not the inventor, he was the restorer of the art of securing arteries by ligature after amputation—an advance which alone sufficed to secure for him immortality. Though originally a barber-surgeon, he became the counsellor of four kings of France, and acquired such esteem that "his mere presence in a besieged town was enough to reanimate the garrison. 'We are saved,' exclaimed the defenders, 'for Paré is with us.'" Dr. O. W. Holmes terms him "the great king-honored, man-loving, God-serving chirurgeon." Brantôme tells us that on the horrible night of the St. Bartholomew massacre his reputation saved his life. The weak and cruel Charles IX. concealed him in a closet in his apartments, remarking that, although he was a Protestant, "it was unreasonable that one who could save a whole city should be thus massacred." This great man subjected the works of his predecessors to sharp criticism, and rejected the farrago of problematical remedies with which they had encumbered the

art. He had great reliance on the restorative powers of nature. *"Je le pansay et Dieu le guarit"* is the significant expression from his writings inscribed on the bronze statue by David (d'Angers) in the courtyard of the School of Medicine at Paris. His first work, on harquebuse wounds, was of 1545; other surgical writings appeared in 1551. His complete works were collected and published by his pupil, Guillemeau, in 1582, and have passed through many editions in many languages. (For further details of the life of this illustrious surgeon the reader must turn to the biography by the erudite Malgaigne, prefixed to the latest edition (Paris, 1840) of the works of the master.) Pigrai of Cremona succeeded Paré in his high dignities, and received great praise from his contemporaries. Morwitz accredits him with instituting ambulance-wagons, an advance in medico-military administration usually ascribed to Larrey in the present century. He gave a poor Latin synopsis of his master's writings. Guillemeau, besides editing Paré, distinguished himself in operative midwifery. In Italy at this period appeared several treatises on shot wounds. Maggius wrote *De Vulnerum Bombardorum et Sclopetorum Curatione* at Bologna in 1552. Ferrius published the next year a work on shot wounds at Lyons; and Rota, a professor at Bologna, followed on the same subject in 1555. These writings are printed in the Gesner collection (Tiguri, 1555). The authors shared the prevalent notions regarding the poisonous nature of gunpowder and actual "ustion" produced by the ball. The work of Leonardo Botal on the cure of shot wounds (Lyons, 1560) is, after the writings of Paré, the most valued of the treatises on shot wounds of this period. Carcanus of Milan (1573) and Berengarius of Carpi (1550) published original but little-known treatises on injuries of the head. Marianus Sanctus of Barletta, near Naples (1550), suggested improvements in lithotomy, and Tagliacozzi published in 1597 at Venice his treatise on plastic operations. The English surgeons of this period are not conspicuous. Thomas Gale, who served in 1544 with the army of Henry VIII. at Montreuil, published (1563) the *Institution of a Chirurgeon* and a treatise on gunshot wounds, which had the merit of denying the poisonous nature of such injuries. J. Hall (1561) also treated of shot wounds. John Woodall, who served in France in 1589, and was afterward surgeon-general of the East India Company's forces, published a *Military and Domestic Surgery*. W. Clowes, a naval surgeon, wrote (1591) a *Proved Practice in Burnings by Gunpowder*. Peter Lowe, who served in France and Flanders, printed (1597) an *Army Surgery* that went through several editions. The work of Duchesne (*alias* Quercetanus) on shot wounds (1576) was translated into English. In Germany, J. Schenckius, professor at Freiburg (1531–98), compiled a voluminous work of rare surgical cases, which remains a mine of interesting information.

In the seventeenth century the impulse given to the sciences by the diffusion of learning led to further improvements. Cæsar Magatus, professor at Ferrara, simplified the treatment of wounds. His work (*De Rara Medecatione Vulnerum*, Venice, 1616) is still consulted with advantage. Fabricius Hildanus of Berne (1560–1634), by some styled the father of German surgery, was a man of great acquirements, but clung to old prejudices and amputated with red-hot knives. Gottfried Purmann of Breslau (1685) was an acute observer, who has recorded most interesting cases, especially in military surgery. Peter Marchetti of Padua (1589–1656) was also an industrious collector of interesting observations. Scultetus of Ulm (1595–1645) compiled a surgical armamentarium more complex than those of the Arabs. Richard Wiseman, surgeon to Charles II., has often been styled the true father of English surgery, but his *Severall Chirurgical Treatises* (1676) really contain no positive addition to the knowledge of the time. John Brown, another chirurgeon in ordinary to Charles II., a naval surgeon, published a *Discourse on Wounds, general and particular*, and a *Treatise of Gunshot Wounds*, at London in 1678—a work deduced from his practice in the navy in the Dutch war of 1665, in which he was severely wounded. Holland, restored to liberty in this century, furnished several good surgeons who promoted their art. J. J. Rau of Leyden was probably the most successful lithotomist on record. Palfyn (1649–1730) was distinguished for devising a new plan for intestinal sutures. The famous Ruysch of Amsterdam aided surgery by his anatomical discoveries. Roonhuysen (1663), by his operations for wry neck, may be regarded as the inventor of tenotomy. Van Meekeren and Barbette (1672) contributed important reports of cases, and Stalpart Van der Wiel (1688) collected a series of rare surgical cases which is a standard work of surgical reference. Solingen (1677) rivalled Scultetus in descriptions of complicated apparatus. Peter Verduin of Amsterdam proposed (1693) an important modification in the flap method of amputating the leg. In France the tourniquet was first used in amputations by Morel at the siege of Besançon (1674). The first printed reference to this instrument is in the rare *Currus Triumphalis è Terebintho* of James Young (or Yonge) of Plymouth, printed at London in 1679. Lowdham of Exeter and his friend Young dispute with Verduin priority in suggesting the flap method of amputation. Dionis (1690) figures Morel's tourniquet in his *Course on Operative Surgery*. Verduc of Paris (1685) wrote instructively on fractures and luxations. Frère Jaques improved the manual procedure of lithotomy. Belloste (1696) deserves credit for denouncing the abuse of tents and complicated dressings then in vogue; and Saviard for recording reports of interesting surgical cases. Earlier in the century Cabrol and Covillard of Montpellier had added many curious observations to surgical literature. Yet surgery was in a languishing condition in France, as exemplified by the oft-cited illustration that Louis XIV. could not find any one to treat rationally his anal fistule. Voltaire in his attempt to depict mental progress in what he calls the "most enlightened age ever known," and to enumerate those who promoted science, literature, and art, does not mention a single surgeon.

In the eighteenth century we find great advances in surgery, and the French surgeons in the front rank. J. L. Petit (1674–1768) occupies a proud prominence among the early educated writers on the art. His treatise on diseases of the bones is classic; his work on general surgery is still consulted with profit. He devised the screw tourniquet, esteemed for a century an essential appliance in amputations. Le Dran (1685–1773), with less genius, was an original and excellent author. His copious writings abound in practical wisdom. P. J. Desault (1744–95) is one of the great names in surgery. He was the first who taught, systematically, surgical anatomy. His improvements in the treatment of fractures are illustrated in the every-day practice of the present time. He substituted straight amputating knives for the formidable sickle-shaped weapon previously employed. He improved the procedure for ligating arteries, and proposed the plan for the cure of aneurisms by distal ligature that bears the name of "Brasdor's method." Dominic Anel of Toulouse (1678–1725) secured a permanent niche in the annals of surgery by first proposing the proximal ligature of the main trunk in aneurism. The majority of French surgical writers claim that he thus anticipated the discovery of Hunter. Most English writers, with some tinge of special pleading, maintain that the application of the ligature at a *distance* from the tumor, on a sound part of the vessel, is the distinctive feature of this improvement. The institution of the Royal Academy of Surgery at Paris (1731) had great influence on the advancement of surgery not only in France, but throughout the world. Its *Mémoires*, composed of contributions from the most eminent men, constitute a rich mine of information, which has been diligently worked by modern compilers, for the most part with scanty acknowledgment. The presidents, La Peyonie, La Martinière, and Maréchal, furnish judicious dissertations. The secretaries, Louis, Morand, and Hevin, contribute exhaustive discussions on a great variety of topics. Hevin may be regarded as the leading authority on wounds of the abdomen. Daviel, the oculist, Belloq, well known by his canula, Le Cat, the lithotomist, and Moreau, the founder of the practice of excision or resection of joints, are conspicuous among the specialists. Garengeot, Bagieu, Faudacq, Dufouart, and Quesnay were military surgeons whose writings may still be referred to with advantage. Sabatier, Chopart, and Hoin yet enjoy the highest reputation as authorities in operative surgery. Bordenave, Saucerotte, Boucher, and Andouillé are still quoted on gunshot wounds. The list of contributors includes many honored names in surgery besides these, as Brasdor, Tenon, Grima, Petit (the younger), Desormeaux, the obstetrician, La Faye, and Pipelet. Besides these academicians were many French writers who hold an honorable place in surgical literature. The works of Ravaton (1750), Pouteau (d. 1775), Hautesierk (1766), on military surgery are estimable, and Baron Percy, whose invaluable manual for the army surgeon was published in 1792, may be esteemed the foremost military surgeon between Paré and Larrey. De la Motte (1655–1735) compiled a systematic treatise on general surgery which is still an important work of reference. The name of Xavier Bichat (1771–1802) grandly closes this era in French surgery. The illustrious founder of general anatomy, the great genius who accomplished so much in his short space of life, commenced his career as a surgeon, and his earlier works are annotated editions of the teachings of his great preceptor, Desault.

In England surgery attained great eminence in this century. William Cheselden (1668–1752), Samuel Sharpe (1700–65), Percival Pott (1713–88), W. Bromfield (1712–92), Benjamin Bell (1749–1806), and the brilliant John

Bell (1763–1820), all secured a permanent place in the literature of surgery, while the illustrious John Hunter (1728–93), a philosopher as well as an anatomist and surgeon, is justly ranked with the greatest minds that have graced the profession. Munro (1697–1767) is indissolubly associated with the birth and fame of the Edinburgh school. C. White of Manchester (1770) rivalled the achievements of the Moreaus in France in excising the larger joints. Atkins (1734), a naval surgeon, Ranby (1744), surgeon to George II. at Dettingen, and Neale (1784) wrote on shot wounds, but their works are of little value. The latter attended the British troops that failed to subjugate the American colonies.

In Italy, Scarpa (1747–1832) by his researches on hernia and aneurism attained a high reputation. Bertrandi of Turin and Troja were progressive surgeons; and Morgagni (1682–1771), by his magnificent labors in pathological anatomy, lent great aid to surgery as well as medicine. In Spain the name of Gimbernat is eminent; Morraba y Roca (1725), Velasco (1793), and Villaverde (1788), Canivel (1789), and Queralto (1796), are mentioned as writers and prominent practitioners, but their works are little known outside of their own country. H. Callisen (1740–1824) is the most prominent surgeon of Denmark of the last century. His *Systema Chirurgiæ Hodiernæ* is often quoted.

Prof. Billroth laments that the names of the German surgeons of this century are insignificant. They brought what knowledge they had from Paris, and added little that was original. Heister (1683–1758), however, wrote a system of surgery that was translated into many languages and still enjoys a certain repute. Bilguer (1720–96), an illiterate military surgeon who sought to abolish amputations, made a noise only on account of his official position. Schmucker (1712–86) and Theden (1714–97) were good practical military surgeons. Mursinna (1744–1823) and Richter (1742–1812) are valued by students for their important collections of cases. Siebold (1736–1807) wrote respectably on surgical subjects. The encyclopædic Albert Haller (1708–77) was professor of surgery at Göttingen, and with Meckel (d. 1774), Wrisberg, and the excellent Sömmering (1755–1830) (whose anatomical labors must have indirectly advanced surgery) should shield the German school from any very disparaging comments.

"It is about the middle of this century," says the author of the excellent review of "Surgery" in the *Encyclopædia Britannica* (8th ed., 1859, vol. xx. p. 819)—a paper to which we have been much indebted in the preparation of this article—"It is about the middle of the eighteenth century that our attention is first attracted to our Transatlantic brethren. In 1763 lectures on anatomy and surgery were delivered in Philadelphia by Dr. Shippen, and in 1791 the medical school of that city was completely established under Benjamin Rush, the Hippocrates of Columbia—a school which has since lent invaluable aid to the progress of both medicine and surgery." Prof. Gross in his Centennial review of surgery (*American Journal of Medical Science*, 1876, vol. lxxi., p. 433) adds the names of John Warren (1753–1815), professor of surgery at Harvard, and of James Tilton (1745–1822), a surgeon of the Revolutionary war, and afterward (1813) surgeon-general of the army.

At the threshold of this century French surgeons are still in the foreground. Jean Dominique Larrey (1776–1842), the friend of Napoleon I. (who pronounced him the most upright man he had ever known), was an almost undisputed authority in military surgery in his time. He was an indefatigable writer, and his memoirs are still read with the greatest interest. Boyer (1757–1833) prepared a systematic treatise on surgery that was long a standard textbook. Delpech (1776–1832) taught surgery at Montpellier with nearly equal reputation. Dupuytren (1777–1835) may be regarded almost as the founder of a school. Many of the great French surgeons of the middle of the century were his pupils—the encyclopædic Velpeau (1795–1867), the erudite Malgaigne (1806–65), the audacious Jobert (1799–1868), Vidal (1803–56), the excellent systematic writer, and Nélaton (1807–73), and that solid surgeon, Goyrand of Aix; Roux (1780–1854) was Dupuytren's contemporary and rival. It would be endless to enumerate the eminent surgeons of the time. Lisfranc (1788–1847) acquired an unrivalled distinction in operative surgery. Cloquet (1790–1855) was renowned as a clinical teacher. Civiale (1794–1867) originated, and Leroy (1798–1861) improved, lithotrity. Bonnet of Lyons (1809–58) was among the first to treat in a scientific manner of diseases of the joints. In our own time we lament Follin (1823–67), one of the most solid of modern French surgeons. In Germany the advance of surgery, if not as brilliant, was relatively as decided. Kern of Vienna (1760–1829), Rust of Berlin (1775–1840), Von Walther of Munich (1782–1842), Graefe of Berlin (1787–1840), C. J. M. Langenbeck of Göttingen (1776–1850), Dieffenbach of Berlin (1795–1847), C. von Textor of Würtzburg (1782–1860), all aided the progress of surgery by their writings, and several of them made important improvements in the art. At the commencement of the century the Vienna school in ophthalmology was pre-eminent. G. J. Beer (1762–1821) was perhaps its most distinguished representative. The great illustrator of military surgery in Germany, the illustrious Louis Stromeyer (1804–76), the worthy successor of Paré and Larrey, has just passed away after fifty years of brilliant professional service. He was one of the founders of modern conservative surgery in cases of injury. In Belgium, Seutin devised the method of treating fractures by starch bandages, which has led the way to the plaster treatment of the present time. In Italy, Assalini (1765–1840) and Porta acquired distinction. In Great Britain a succession of surgeons of the first merit rivalled their French contemporaries. The London school points with pride to Cline (1750–1827); to Abernethy (1764–1831), the original thinker and daring innovator; to Sir Astley Cooper (1768–1841), who became such an unimpeachable authority; to Wardrop, Earle, Stanley, Travers, Hodgson, Lawrence, and Aston Key; to Sir Charles Bell, admirable alike in physiological investigations, in surgery, in literature and art; to the ophthalmic surgeons Tyrrell, Saunders, and Dalrymple; and to the illustrious Sir Benjamin Brodie (1783–1862), at once philosopher and surgeon. In England, Colles, Carmichael, Jacob, and Bellingham are known by original researches, and Cusack and Crampton earned high reputations. Scotland may boast of Liston, the almost incomparable operator; of Miller, the sound systematic writer; of Syme, one of the most progressive and successful of modern surgeons; and of Sir J. Y. Simpson, the obstetrician, who introduced chloroform as an anæsthetic. The annals of English surgery in this century are further advanced by two names that will always be remembered in the front rank of military surgeons—John Hennen (1770–1829) and G. J. Guthrie (1785–1856). Worthy contemporaries of Larrey, their works will ever be read with reverence by students of army surgery. Hennen died of yellow fever at Gibraltar in the prime of life. Guthrie lived quite into our time, to encourage and guide the army surgeons in England's last great European war. There are many men now living who maintain the honor of British surgery at as high a standard as their predecessors. Prof. Billroth has justly remarked that in the scientific as well as the practical part of surgery England is now more advanced than any other country, and that from the time of Hunter to the present English surgery has had about it something noble.

In the U. S. in this century "great advances have been made in practical surgery" (*Billroth*). A pupil of John Hunter, Philip Syng Physick (1778–1837), is often styled the father of American surgery. He left no works to record his vast experience, but his views have been to some extent recorded by his nephew, J. S. Dorsey (1783–1818), the author of the first systematic treatise on surgery published in this country. Physick's ingenious practice in ununited fractures merits particular attention. His claims to priority in internal urethrotomy have hardly received sufficient appreciation. John Collins Warren of Boston (1778–1856) wrote a treatise on tumors, and was the first to perform (Oct. 16, 1846) an operation of importance on a patient anæsthetized by sulphuric ether. Valentine Mott (1785–1865) acquired an immense fame by his daring operations on the arteries. According to Prof. Gross, "no surgeon, living or dead, ever tied so many vessels, or so successfully, for the cure of aneurism, the relief of injury, or the arrest of morbid growths." Benjamin Winslow Dudley (1785–1870) of Kentucky had marvellous success as a lithotomist, and was noted for his dexterity in bandaging. Ephraim McDowell (1771–1830) of Kentucky first performed ovariotomy (1809). William Gibson (1788–1868) of Philadelphia was the first to tie the common iliac artery and to successfully repeat the Cæsarian operation on the same subject. Nathan Smith (1762–1829) of New Haven was a bold surgeon of indomitable industry and great versatility. T. D. Mütter (1810–59) was noted for his skill in the treatment of deformities. He bequeathed a valuable surgical museum to the Philadelphia College, with a liberal endowment fund. George Hayward of Boston (1791–1863), George W. Norris (1808–75) of Philadelphia, and J. Mason Warren (1811–67) of Boston were able hospital surgeons, whose contributions to the literature of the art are of permanent value.

As the middle of the century is approached the boundaries of nationality seem to vanish from the domain of surgery. With marvellously increased facilities of intercommunication, all advances in the art are speedily known

throughout the civilized world. At no former period, assuredly, has there been greater scientific activity. One result of the emulative ardor with which surgery has been latterly cultivated is the prevalent tendency to pursue special branches of the art. This practice is not devoid of the danger of narrowing the views of the practitioner and debasing him to the grade of a clever artisan, but undoubtedly it has already promoted most valuable advances in surgery. Ophthalmology, invoking the aid of physical science, has been revolutionized, and in many other directions some light has been thrown upon branches of surgery until lately enveloped in the deepest obscurity. The discoveries and improvements in surgery in the nineteenth century are not inferior to those of any preceding age. The practical use of anæsthetics, introduced in the shape of ether-inhalation by Morton in 1846, and by the use of chloroform by Simpson in 1847, constitutes an epoch-making advance in the art. The introduction of ovariotomy (1809) by MacDowell, of lithotrity (1822) by Civiale, are improvements of the first order. The extensions of reparative surgery to the relief of cleft palate, vesico-vaginal fistulæ, and of a great variety of deformities, have been of great value. The employment of metallic sutures and ligatures (Levert, 1829), of immovable apparatus in the treatment of fractures (Seutin, 1842), and of manipulation in the reduction of luxations (W. W. Reid, 1855), are most important innovations. The bloodless method of Esmarch (1873) and the antiseptic method of Lister (1869) are of far-reaching application. The great advances made in the treatment of diseases of the joints, of blood-vessels and nerves, of the eye, ear, larynx, urethra, and rectum, and of outgrowths and tumors, are most creditable. It would be profitable to review these in detail, but many of the subjects are discussed in other parts of this work, and the limits assigned to this article have already been attained, if not exceeded. Enough has been said to illustrate the progress of this beneficent art, and to encourage the hope that now, for ever freed from the fetters of the schools and entrusted to enlightened and original workers, it may steadily advance toward that absolute perfection that is probably unattainable. GEORGE A. OTIS.

**Sylves'ter** (JAMES JOSEPH), M. A., F. R. S., b. in London Sept. 3, 1814; educated at the University of Cambridge; was for a short time a professor in the University of Virginia, then professor of natural philosophy in University College, London; became a member of the Royal Society in 1839; professor of mathematics in the Royal Military Academy at Woolwich 1855, and professor of mathematics at Johns Hopkins University, Baltimore, Md., 1876, and is author of a large number of scientific memoirs, 112 of which, published prior to 1863, are recorded in the Royal Society's *Index of Scientific Papers*. Among the most important of these is a paper of great value, both from a mathematical and historical point of view, on Newton's rule for discovering the number of real and imaginary roots of an equation; also his researches on the *Reversion of Series and the Partitions of Numbers*, and his papers on the *Analytical Development of Fresnel's Optical Theory of Crystals* and on *The Rotation of a Rigid Body*, and his discoveries on the *Involution of Six Lines in Space*, culminating in the result that if these six lines represent forces in equilibrium, they must lie on a ruled cubic surface, are of high value. He has invented an instrument, the plagiograph or modified pantagraph, which, in addition to altering the magnitude, possesses the property of rotating the image of a figure through any desired angle; and another, the geometrical fan, which has been applied to the construction of a cheap astronomical spectroscope. Prof. Sylvester's most distinguished work has, however, been done in the modern algebra. A very large portion of the theory of determinants is due exclusively to him, and the great modern theory of invariants owes its origin and early development almost wholly to his efforts and those of Prof. Cayley. THOMAS CRAIG.

**Sylvicolidæ and Sylviidæ.** See WARBLERS.

# T.

**Tal'bot** (JOHN), rector of Fretherne, Gloucestershire, England, 1701; chaplain on the ship Centurion, which brought to America, in June, 1702, the first missionaries of the Society for the Propagation of the Gospel in Foreign Parts; was himself appointed a missionary of this society Sept. 18, 1702; founder and first rector of St. Mary's church, Burlington, N. J., Mar. 25, 1703; for twenty years a leader of the Church of England in the northern colonies of America; consecrated bishop in 1722 by nonjurors in England. D. in Burlington, N. J., Nov. 29, 1727. His *Life* and *Letters* are given in the *History of the Church in Burlington, N. J.* GEORGE M. HILLS.

**Tammany Ring.** See TWEED (WILLIAM MARCY), in CYCLOPÆDIA.

**Tar'box** (INCREASE N.), D. D., b. at East Windsor, Conn., Feb. 11, 1815; graduated at Yale College 1839; pastor of the Congregational church at Framingham, Mass., 1844–51; since 1851 secretary of the American Education Society at Boston; author of *Winnie and Walter Stories* (4 vols., juvenile, 1860), *Nineveh, or Buried City* (1858), *Missionary Patriots* (1864), *Uncle George Stories* (4 vols., juvenile, 1865), *The Curse* (1863), *Tyre and Alexandria* (1865), *Life of Major-General Israel Putnam* (1876).

**Têche, Bayou.** What is now termed Bayou Têche was once the lower portion of the ancient channel of Red River (which then discharged its waters directly into the sea, and formed high and fertile alluvial banks, or a *delta*, sloping regularly seaward), extending from the present Bayou Courteaubleu, E. of Opelousas, La., around and to the W. and S. of what is now the Grand Lake basin—then probably an inland bay into which the Mississippi River discharged—to the Gulf of Mexico, but now, too, the lower Atchafalaya River, S. of Grand Lake. The lower half of the Têche is a currentless (except for brief periods after heavy rainstorms or during the flood-period of the Mississippi River) tide-water channel, and is only navigable for small steamboats to St. Martinsville, about 100 miles above the railroad terminus at Morgan City on the lower Atchafalaya. Above St. Martinsville the Têche is only navigable for flat or keel boats during the flood-season or for brief periods after heavy rains, but it has been proposed to elevate its surface by means of locks and dams, and so convert it into a canal. The ancient channel of Red River, of which the Têche formed a part, comprised what are now known as the Courteaubleu, Bœuf, Robert, Rapides, and Jean de Jean or Cotile, but there is now no connection between Red River, at or above the falls (at Alexandria), and the Bœuf, which itself is not navigable. Pattersonville, Centreville, Franklin, New Iberia, and St. Martinsville are prominent towns on the Têche. The Têche, below the head of navigation, comprises one of the richest sugar-regions of Louisiana, and its lands generally, especially on the right bank, are above the reach of overflow, and do not require leveeing. G. W. R. BAYLEY.

**Teeth** [Ang.-Sax. *tôdh*; Lat. *dens, dentis*; Gr. ὀδούς, ὀδόντος], certain hard bodies situated in the mouth or at the commencement of the alimentary canal. This definition, comprehensive and vague as it may appear, is as exact as the nature of the case permits. Under this definition are included not only the teeth of mammals and other vertebrates, but the hard bodies that stud the surface of the odontophore or lingual ribbon of mollusks, etc. Homologically speaking, however, there is no similarity between the homonymous parts in the representatives of the different branches: inasmuch, too, as the term belongs specially to the vertebrates, the appendages in the representatives of that branch will alone be considered here. These are sufficiently variable in development, as well as form and position, and their characteristics in the several classes may be briefly examined in the order of their development.

The leptocardians or pharyngobranchiates are entirely destitute of teeth.

The marsipobranchiates have teeth developed on the tongue, and more or less from the surface of the oral disk; in the myxinoids a single tooth is present on the roof of the mouth; but in the petromyzonts numerous teeth exist in oblique rows on the disk.

The selachians or elasmobranchiates exhibit a very considerable diversity in their dentition, of which the chief types have been briefly adverted to in the article ELASMOBRANCHIATES.

The fishes are, more than any other class, distinguished by the diversity in development and position of the teeth, as well as form and mode of attachment.

As to position, they may be entirely absent from at least the mouth proper, or they may be present on almost all the bones—*i. e.* the intermaxillaries, the supramaxillaries, the vomer, the palatines, the pterygoids, the ento-pterygoids, and the tongue, as well as the pharyngeal bones, the branchial arches, and the commencement of the œso-

phagus. There may be also a considerable diversity in dentition within the limits of the same natural family, although, as a rule, the differences are inconsiderable: as examples among American fishes the cyprinoids and centrarchoids may be mentioned. All of the cyprinoids are totally devoid of teeth in the mouth, although they have them well developed on the pharyngeal bones. The centrarchoids offer considerable diversity: in *Pomotis* and *Lepomis* teeth are present only on the jaws and vomer, but in *Ambloplites* and *Chænobryttus* they exist not only on the jaws and vomer, but also on the palatine and pterygoid bones. A still more noticeable case of diversity is afforded by the family of clupeids, including the herrings, shad, etc.: in *Alosa* (the shad) the mouth is almost edentulous, while in *Clupeoides* teeth are developed on the intermaxillaries and supramaxillaries (as crenulations), as well as on the dentaries, vomer, palatines, pterygoids, and tongue: between these there is almost every gradation. These variations in the clupeids are generally to such an extent unaccompanied by other modifications of structure that their systematic value is very slight. Nevertheless, in most cases there is a quite close concordance between the development of the teeth and other characters, so that, on the whole, the nature of the dentition may be tolerably well predicated from the associated characters. The most common combination, too, at least among the specialized acanthopterygian fishes, is expressed in the aggregation of teeth on the intermaxillaries, dentaries, vomer, and palatines. The Percidæ, Serranidæ, and Scombridæ (but not all their species) are examples of this class. Closely-related types, however, have the teeth confined to the intermaxillaries and dentaries; such are, *e. g.*, the typical Pristipomatidæ and Sparidæ. In one family (Stromateidæ) teeth are developed on plates at the entrance of the œsophagus.

In form there is great variety. The most common is an elongated conic, but more or less curved, contour, or some slight modification thereof. The most noteworthy examples of other types are the following: Extremely elongated, slender, and almost hair-like teeth are found in the chætodontids; incisors like those of mammals, superficially at least, are developed in the Sargi (sheepshead, etc.); molar-like teeth are present in the jaws of many Sparidæ and on the palate in Anarrhicadidæ; barbed or arrow-like teeth are exemplified in the Trichiuridæ and related forms; compressed, lancet-like teeth exist in the jaws of *Pomatomus* or *Temnodon* (the blue-fish); slender, spoon-like teeth are to be seen on the lips of the loricariids; squamiform, imbricated teeth cover the jaws in the Scaridæ; and broad, incisorial teeth are confluent with the jaws in the diodontids and tetrodontids.

In their combinations and mode of attachment there is almost equal variety. In most fishes they are very numerous, and aggregated in many rows on the jaws as well as palate; in many they are uniserial; often they are differentiated into two or more kinds—*e. g.* the foremost tooth or the hindmost ones, and sometimes (as in different labrids) both, may be developed as canines, while the others are small; often, too, the teeth of the anterior row are much larger than the others; again, in the sparids *e. g.*, the teeth of the front of the jaws are conic or incisorial, and those of the sides molar. In fishes generally the teeth are immovably implanted in sockets in the jaws, but readily detached therefrom; in some, however (*e. g.* in *Salarias*, *Euchalarodus*, certain Serranidæ, etc.), they are more or less movable, while in loricariids they seem to be loosely attached to the lips; in the scarids they are imbricated on the jaws; and in the diodontids and tetrodontids they are inseparable from the jaws.

In respect to development, according to Tomes, the following are the facts: "In all cases the whole series of changes take place beneath an unbroken surface, and often at some little depth; in this respect, however, differences are met with upon different bones in the mouth of the same fish, so that this would appear to be influenced by accidents of reflection. From the deepest layer of the oral epithelium, which is very thick in many fishes, there dips downward a blunt-ended process, descending into the loose connective tissue beneath. When it approaches the surface of the bone a dentine pulp is developed in the subjacent connective tissue, which it eventually covers over like a cap or bell-jar. The epithelial process, making its way downward, is recognizable before the dentine papilla can be distinguished; its end becomes transformed into an enamel-organ, but no very definite capsule is formed around the dental germ."

In the amphibians there is much less diversity than in the fishes, or even the selachians. In form they are mostly slender, conic, and pointed. In position they exhibit much greater diversities: in the Gradientia (salamanders and other tailed species) they are present on the jaws and palate under various combinations. (See GRADIENTIA, in CYCLOPÆDIA.) In the Salientia they are less constantly present; in many (*e. g.* the frogs) they are suppressed in the lower jaw, and present only in the upper; in numerous others (*e. g.* the toads) they are absent from the upper as well as the lower jaw; in the frogs teeth are developed in the vomer, but in the toads are entirely wanting on the palate as on the jaws. The other modifications of dentition must be sought for under special articles.

In the reptiles the varieties of dentition are quite numerous, but less so than in the fishes. The principal modifications are adverted to in the articles on the different orders, and to them reference must be made. It need only be added here that, according to Tomes, but contrary to the older authors, "the teeth, as far as known, consist of dentine, to which is very generally superadded an investment of enamel, partial or complete, but that cementum is only present in a few instances," the only forms having teeth covered with cementum being "those which have them implanted in more or less complete sockets or in a groove," as the crocodilians and ichthyosaurians.

The birds of the present epoch are entirely destitute of true teeth, and the mandibles have generally more or less trenchant, unarmed linear edges, but sometimes they are armed with processes of bone simulating teeth, but in no other respect entitled to that name. In former epochs, however, there existed types actually provided with true teeth, having all the structural characteristics of those organs, and fitting in sockets in the jaws: these have been combined by Marsh under the general term Odontornithes (*i. e.* toothed birds).

In the mammals teeth are confined to the jaws—*i. e.* the intermaxillary, supramaxillary, and dentary bones—and are almost always developed, although in a few forms, representing several orders, they are entirely wanting. It may at the same time be recalled that while true teeth are confined to the jaws, there are certain asperities on the tongue (*i. e.* in the Felidæ, monotremes, and some other mammals) which are almost as much entitled to be called teeth as are analogous processes in other animals: these, nevertheless, differ entirely in histological characters from teeth; and in this respect are quite dissimilar from the teeth on the tongues of fishes, which are essentially similar to those of the jaws and other parts of the mouth. In the existing monotremes of the family Ornithorhynchidæ molar tooth-like appendages are developed in the jaws on each side, and have been designated as teeth; but, although functionally they are such, they must not be confounded with the molar teeth of other mammals: with them they are not at all homologous, but rather are epidermal appendages like whalebone, etc. In the marsupials and placental mammals the teeth are homologous with each other, and developed in the same manner. The fully-developed teeth are composed essentially of three elements—(1) the dentine, (2) the enamel, and (3) the cement. (1) The dentine is the chief component of the teeth, and is exemplified under several conditions. "In most mammals (according to Owen) the body of the tooth consists of a gelatinous animal basis and calcareous earth, combined and arranged according to the plan which characterizes the tissue called 'unvascular dentine.' (2) The compartments of the basal substance, [by Owen] called 'calcigerous' or 'dental cells,' and which contain the hardening salts in their densest state, are subcircular or subhexagonal. The calcigerous and nutrient tubes, varying from $\frac{1}{10000}$th to $\frac{1}{20000}$th of an inch in diameter, and placed with intervals equal to from two to six of their own diameters, proceed at first with strong, and then with gentle, curves from the pulp-cavity to the outer surface of the dentine, their general direction being always more or less at right angles to that surface: those tubes which proceed from the apex, and from the basal third part of the pulp-cavity, are the straightest. They are nearly parallel to one another, both in their general course and curvatures; but, as the outer surface of the tooth exceeds the inner one in extent, the tubes slightly diverge in their course and divide, decreasing in diameter to their peripheral extremities, and rapidly so near their termination, where they become irregularly flexuous and often interlaced. The dichotomizing calcigerous tubes send off from their sides much more minute branches, which quickly divide and subdivide in the interspaces of the trunks, and penetrate the dentinal cells. In the unvascular dentine of all mammalian teeth the tubes present the 'primary curvatures' and 'secondary gyrations' described in the introduction. (3) These curvatures are strongest and least regular in the dentine of the elephant's grinders. In that of the tusks of the elephant and mastodon the form, extent, and parallelism of the secondary curvatures of the dentinal tubes cause the peculiar appearance of the decussation of curved lines, like the ornamental work called 'engine turning,' upon the surface of transverse or oblique

sections or fractures of the tusk, which is characteristic of true 'ivory.'"

In a few mammals, *e. g.*, in the incisors of some rodents, and in the molars of the Bruta, of the sub-order Tardigrada, more or less of the dentine is modified by the persistence of certain tracts of the pulp-cavity, forming vascular or medullary canals. "In certain other Bruta of the sub-order Fodientia (family Orycteropodidæ) the dentine of the long and slender prismatic denticles which are aggregated to form the compound tooth is unvascular, and is characterized chiefly by the frequent division and wide angles at which the branches of the bifurcating calcigerous tubes diverge, before resolving themselves into their minute wavy terminations." (2) The enamel is generally more or less developed around the dentine on the crown of the tooth, and is excessively hard and composed of extremely minute fibres standing outward over the dentine. The enamel is developed around the teeth of most mammals, but to a varying extent, and is wanting chiefly in most of the representatives of the order Bruta. (3) The cement is quite like bone in appearance and composition, and enters to a varying extent into the composition of the tooth. It is, however, generally most developed around the roots, and least so on the crowns; but in some forms there is a large deposit around the crowns also.

The teeth of mammals are always inserted in sockets in the jaws, surrounded by gums. They are severally divided into two portions—the exposed portion or crown, and the inserted portion, known as the fangs or roots. The difference is generally well defined, but in some forms, especially in certain rodents (Arvicolinæ), etc., there is no abrupt distinction between the inserted and exserted portions, and true roots are not developed.

The characteristic features in the development of mammals, according to Charles S. Tomes (*Phil. Trans. Royal Soc. London*, clxv. pt. 1, 1875, p. 285) are as follows: "i. There is never, at any stage, an open groove from the bottom of which papillæ rise up. ii. That the first recognizable change in the vicinity of a forming tooth-germ is a dipping down of a process of the oral epithelium, looking, in section transverse to the jaw, like a deep simple tubular gland, which descends into the submucous tissue, and ultimately forms the enamel-organ. iii. That subsequently to the descent of the so-called enamel-germ the changes in the subjacent tissue resulting in the formation of the dentine-papilla take place opposite to its end, and not at the surface. iv. That the permanent tooth-germs first appear as offshoots from the epithelial process concerned in the formation of the deciduous tooth-germ (*Köl-liker*), the first permanent molar being derived from a primary dipping down (like a deciduous tooth), the second deriving its enamel-germ from the epithelial neck of the first, and the third from that of the second (*Legros* and *Magitot*)."

The teeth of mammals not increasing in size, as do the other parts of the body, a provision must exist for the accommodation of their size and development to that of the animal. This is effected in part by (1) the late development of some of the teeth, which do not appear until the animal has attained a large size; and, in part, as well, (2) by the replacement of some of the teeth developed about the time of birth by subsequent ones of larger size. Those animals which have only one set of teeth—the non-deciduous—are said to be monophyodont (μόνος, "one," φύειν, to "put forth," and ὀδούς, "tooth"); those which have two sets of teeth, an early (deciduous) and a later (non-deciduous) set, are called in contrast diphyodont (δίς, "two," φύειν, to "put forth," ὀδούς, "tooth"); these characters, however, are not co-ordinated with others, and mammals, therefore, cannot be contrasted, as has been attempted, into natural sections distinguished by such characteristics. In the marsupials only four teeth (one in each jaw on each side) are succeeded by larger teeth. These are, therefore, imperfectly diphyodont. The teeth of the second set are developed from diverticula of the sacs in which originated those of the first set. In the brutes or edentates the teeth, so far as known, in most of the sections are monophyodont, only one set being developed, but in the armadillos they are diphyodont, a set of milk teeth existing for a longer or shorter time after birth, and being finally succeeded, sometimes not until near maturity, by a second permanent set. Among the Carnivores, in the Fissipedes, or terrestrial species, the diphyodont type is well exemplified, the milk teeth being of a more or less large size, and retained for quite a long period, until finally replaced by the permanent set; but in the Pinnipedes, or swimming Carnivores, the milk teeth are extremely rudimentary, and replaced before birth by those of the permanent series. In the cetaceans but one set of teeth has been found, and it is probable, from the phases of development in allied types, that this represents the permanent or second set of the typical mammals, the first set being probably suppressed. In the rodents the great incisor teeth are permanent, and have no deciduous predecessors. In the case of those forms which have only three molars or less, as in the Muridæ, etc., these all belong to the permanent set, being true molars, and consequently the animals in question are strictly monophyodont. In those forms, however, where the number of molars exceeds three, the teeth in front of them are pre-molars, or teeth which have had deciduous predecessors.

The rows of teeth in almost all species exhibit interruptions of varying extent. These interruptions most frequently exist between the incisors and canines of the upper jaw for the reception of the canines of the lower, and in the lower jaw between the canines and molars for the reception of the canines of the upper jaw. The interruptions are designated as diastemas or diastemata, and result from the increased size of the canines in the respective jaws, and the necessity for space in the opposite jaw to receive them. When the canines are reduced in size, there is often a corresponding reduction in the extent of the diastemas; and in man, where the teeth are all nearly on the same level, the series in both jaws are perfectly uninterrupted; and in this respect man is distinguished from all the other living mammals, although approached by certain of the lemuroid species. The character is, however, an exclusive one, and in certain extinct forms belonging to the ruminant family of Anoplotheriidæ there are also uninterrupted series of teeth in the two jaws. The diastemas, however, are by no means always co-ordinated with the development of the canine teeth, but very frequently result from the elongation of the jaws and the reduction of the anterior molar teeth, as in most of the ungulates and in all the rodents, in which latter the canines are never developed.

As to structure and functional development, the teeth throughout the series of mammals are differentiated on the whole into three groups: (1) Those in the front of the jaws have compressed cutting crowns, and have therefore been denominated *incisors* (*incidere*, to "cut"). In the lower forms there may be as many as ten (5 + 5) in the upper jaw, but in the higher forms the normal number is six (3 + 3), and this is never exceeded, although frequently the number is less, some being suppressed. The incisors are recognizable always by their position: in the upper jaw they, and they alone, are implanted in the intermaxillary or premaxillary bone, and in the under jaw those corresponding in position, or opposite the upper ones, are incisors. (2) On the sides behind the incisors are the *canines*, which are exemplified especially in the dog, whence the name (*caninus*, pertaining to the "dog"); these have generally more or less elongated, compressed, conic, but recurved crowns, but they vary much in this respect. Whatever may be the form, however, their character is determined by their position. Those teeth which are inserted in the supramaxillary bone in front, and immediately behind the suture between that bone and the intermaxillary in the upper jaw, are canines; and the teeth in the lower jaw which fit just in front of these are homonymous. They never exceed four in number—that is, one on each jaw on each side. (3) The molars are all the other teeth behind the canines, whatever may be their shape. Those of the set which are developed at birth, and not long thereafter shed, are designated deciduous or milk teeth, and the ones which succeed them are the premolars; these are always toward the front; the molars behind, which are permanent and have no deciduous predecessors, are known as true molar teeth. The number of the teeth in the lower types of mammals is so variable that a typical number can scarcely be said to exist. In the higher or educabilian series, however, a typical number exists, and in all the forms of that great group or superorder it is generally easy to locate the teeth which correspond to those of the primitive series, however much they may be developed or modified, and however few may ultimately remain. The number in question is 44. These are divided as follows: I. (incisors) $\frac{3}{3}$, C. (canines) $\frac{1}{1}$, P. M. (premolars) $\frac{4}{4}$, M. (molars) $\frac{3}{3} \times 2 = 44$. This formula is best exemplified among recent mammals in the common hog, but in the species of the early Tertiary period it was a very common, if not the predominant, one for the representatives of the educabilian series. But it is now very uncommon, and in almost all of the recent forms more or less of the teeth of the suppressed, not distantly-related types, however, may differ in this respect: thus, in the Canidæ (dogs, etc.) nearly or quite the archetypical number may be developed, but in the Felidæ (cats, etc.) the number may be reduced to as low as 30, or even 26, the missing ones being the anterior of the premolars and the posterior of the true molars.

Such are, in short, some of the principal characteristics

of the dentition in the various classes of vertebrates. The imperatively forced limits of this article forbid a detailed notice of the modifications in the several orders and families, but this has in part been already given in special articles on these groups. Inasmuch as the views respecting the development of the teeth promulgated by the most expert recent investigators differ much from those of the older odontologists, the latest results of one of the most approved students of the subject are given in his own carefully-selected words: "1. It is desirable to entirely abandon the terms 'papillary,' 'follicular,' and 'eruptive' stage, inasmuch as these are hypothetical and arbitrary, and correspond to no serial conditions verified by observation. 2. In all animals the tooth-germ consists primarily of two structures, and two only—the dentine-germ and the enamel-germ. The simplest tooth-germ never comprises anything more. When a capsule is developed, it is derived partly from a secondary upgrowth of the tissue at the base of the dentine-germ, partly from an accidental condensation of the surrounding connective tissue. 3. The existence of an enamel-organ is quite universal, and is in no way dependent upon the presence or absence of enamel upon the completed tooth, although the degree to which it is developed has distinct relation to the thickness of the future enamel. 4. So far as researches go, a stellate reticulum, constituting a large bulk of the enamel-organ, is a structure confined to the Mammalia. (It is absent in the armadillo, and, I should infer from Mr. Turner's description, in the narwhal.) 5. As laid down by Prof. Huxley and Prof. Kölliker, the dentine-papilla is beyond all question a dermal structure, the enamel-organ an epithelial or epidermic structure. As I believe it can be shown that the enamel is formed by an actual conversion of the cells of the enamel-organ, this makes the dentine dermal and the enamel epidermic structures. 6. In Teleostei the new enamel-germs are formed directly from the oral epithelium, and are new formations arising quite independently of any portion of the tooth-germs of the teeth which have preceded them. In mammals and reptiles, and in some, at all events, of the Batrachia, new tooth-germs are derived from portions of their predecessors. 7. In all animals examined the phenomena are very uniform: a process dips in from the oral epithelium, often to a great depth; the end of the process becomes transformed into an enamel-organ coincidently with the formation of a dentine-papilla beneath it. The differences lie rather in such minor details as the extent to which a capsule is developed; and no such generalization as that the teeth of fish in their development represent only an earlier stage of the development of the teeth of Mammalia can be drawn." (Tomes, *Phil. Trans. Royal Soc. London*, vol. clxvi. pp. 265–266, 1876.) THEODORE GILL.

**Teeth, Chemistry of.** The teeth of different animal races present considerable variations in composition and in the relative proportions and arrangement of the different structural materials that make up the tooth—the enamel, the dentine, and the cement. Human teeth, of course, present the most direct interest. For the enamel of the teeth of young children Hoppe-Seyler found as follows:

| | |
|---|---|
| Tricalcium phosphate | 75.23 |
| Calcium carbonate | 7.18 |
| Calcium chloride | .23 |
| Trimagnesium phosphate | 1.72 |
| Ferric phosphate | .63 |
| Soluble saline matter | .35 |
| Soluble organic matter | 1.23 |
| Insoluble organic matter | 14.36 |
| | 100.93 |

From an extensive research of Von Bibra upon the composition of teeth of different animals the following figures, relating to human teeth, are selected:

| | Enamel of male molar. | Enamel of female molar. | Dentine of male molar. | Dentine of female molar. |
|---|---|---|---|---|
| Tricalcium phosphate and calcium fluoride, | 89.82 | 81.63 | 66.72 | 67.54 |
| Calcium carbonate | 4.37 | 8.88 | 3.36 | 7.97 |
| Trimagnesium phosphate | 1.34 | 2.55 | 1.08 | 2.49 |
| Soluble salts | .88 | .97 | .83 | 1.00 |
| Fat | .20 | trace. | .40 | .58 |
| Total organic matter | 3.59 | 5.97 | 28.01 | 21.00 |
| Total inorganic matter | 96.41 | 94.03 | 71.99 | 79.00 |

Von Bibra does not appear to have made any determinations, in these important analyses, of the actual proportions of fluoride of calcium in human teeth. He gives, however, a number of analyses of *fossil* teeth, in which he has separated the calcium fluoride and phosphate. In a molar of a mammoth he found the phosphate to vary from 62.83 to 68.43 per cent., and the fluoride from 4.15 to 3.72. In parts of this tooth the organic matter was 15.6 per cent., which is much less than in recent teeth, and the calcium carbonate was 15 per cent., so that it may have been somewhat altered. HENRY WURTZ.

**Teeth, Human.** Referring to the article TEETH for information respecting those characters of the teeth of man as to development and morphology which are common to him with other mammals and other vertebrates, the present article will be restricted to a notice of the peculiarities of the dentition of the human subject. These will be considered under two stages: (1) the milk or deciduous, and (2) the permanent set.

(1) The deciduous set is composed of 20 teeth—viz. I. $\frac{2}{2}$, C. $\frac{1}{1}$, D. M. $\frac{2}{2} \times 2$; *i. e.* in the upper and lower jaws, each, incisors 2, canines 1, deciduous molars 2, on each side. These correspond with the median and second incisors (I. $\frac{1^o\ 2^o}{1^o\ 2^o}$), the canines (C. $\frac{1}{1}$), and the last two of the three molars (D. M. $\frac{2^o\ 3^o}{2^o\ 3^o}$) of the dentition of the complete typical educabilian deciduous number. In the order of development they are cut at the following periods: at the age of seven months, the median incisors (I. $\frac{1^o}{1^o}$); at seven to ten months, the lateral incisors (I. $\frac{2^o}{2^o}$); at twelve to fourteen months, the anterior molars (D. M. $\frac{2^o}{2^o}$); at fourteen to twenty months, the canines (C. $\frac{1}{1}$); and at eighteen to thirty-six months, the posterior molars (D. M. $\frac{3^o}{3^o}$). The crowns exhibit successively the following modifications: the incisors have an incisorial edge; the canines are subconical; the molars of the upper jaw have, the first, three cusps, and the second, four cusps; and those of the lower jaw, the first, four cusps, and the second, five cusps. The roots are developed as follows: The incisor and canine teeth have each single fangs, the molars of the upper jaw have three widely-divergent roots, and those of the lower jaw each two divergent roots.

(2) The permanent series is constituted, when complete, of 32 teeth—viz. I. $\frac{4}{4}$, C. $\frac{1}{1}$, P. M. $\frac{2}{2}$, and M. $\frac{3}{3} \times 2$; *i. e.* in the upper and lower jaws, each, incisors 2, canines 1, premolars 2, and true molars 3, on each side. These correspond with the first and second incisors (I. $\frac{1^o\ 2^o}{1^o\ 2^o}$), the canines (C. $\frac{1}{1}$), the third and fourth premolars (P. M. $\frac{3^o\ 4^o}{3^o\ 4^o}$), and the several molars (M. $\frac{1^o\ 2^o\ 3^o}{1^o\ 2^o\ 30}$) of the typical educabilian number: the suppressed teeth of the series are thus seen to be I. $\frac{3^o}{3^o}$ and P. M. $\frac{1^o\ 2^o}{1^o\ 2^o}$. These teeth are erupted severally at the following periods: at the age of six and a half years, the first true molars (M. $\frac{1^o}{1^o}$); at seven years, the median incisors (I. $\frac{1^o}{1^o}$); at eight years, the two lateral incisors (I. $\frac{2^o}{2^o}$); at nine years, the first premolars (P. M. $\frac{3^o}{3^o}$); at ten years, the second premolars (P. M. $\frac{4^o}{4^o}$); at eleven to twelve years, the canines (C. $\frac{1}{-}$); at twelve to thirteen years, the second true molars (M. $\frac{2^o}{2^o}$); and finally, at seventeen to twenty-one years (whence they are called the "wisdom" teeth), the third true molars (M. $\frac{3^o}{3^o}$). The crowns are characterized as follows: the incisors present an incisorial edge; the canines are subconical; the premolars have each two cusps (whence called bicuspid), an external and an internal: the molars of the upper jaw have each four cusps, two external and two internal; and the third five cusps, two external and three internal: the corresponding teeth in the lower jaw have, the first, three external and two internal cusps; the second, four cusps, indicated by a very distinct crucial groove; and the third, five cusps, two external and three internal. A characteristic feature is that the posterior external and the anterior internal cusps of the molars of the upper jaw are connected by an oblique ridge. The roots exhibit the following characters: the incisor and canine teeth have single undivided fangs, the incisor smaller, and the canine larger ones; the premolars, or bicuspids, have each fangs single, but more or less grooved on their sides; of the molars, the first and second of the upper jaw have each three fangs, two external and one internal, and the third is also incompletely three-fanged, but with the fangs more or less coalesced or undifferentiated; in lower jaw all the molars have each two fangs, an anterior and a posterior, but slightly divergent.

The teeth of the permanent as well as temporary series form an oblong semi-oval or parabolic series, with the crowns nearly uniformly prominent, and uninterrupted by any breaks or diastemata in either the upper or lower jaw. The incisors and canines are comparatively small; next are the premolars, and considerably largest of all are the molars. The dentition in both stages exhibits a general agreement with the teeth of the anthropoid Primates or Quadrumana, and diverges as follows:

In the number and development of the teeth (*i. e.* P. M. $\frac{2}{2}$, M. $\frac{3}{3}$) man agrees with all of the Old-World apes and monkeys (Simiidæ and Cercopithecidæ), and differs from the New-World forms (Cebidæ and Mididæ), which are characterized by a reversed number of premolars and molars (*i. e.* P. M. $\frac{3}{3}$, M. $\frac{2}{2}$).

In the structure of the molars of the upper jaw, especially in that the front inner and the hind outer cusps are connected by an oblique ridge running between them, man agrees with the great apes, or Simiinæ (*Anthropopithecus, Gorilla,* and *Simia*), and differs from the long-armed apes, or gibbons (Hylobatinæ), in which the molars of the upper jaw are not so connected.

In the reduced size of the anterior teeth, and especially of the canines, and, concomitantly, the shortening of the jaws, as well as in the absence of diastemata, man is *sui generis*, and contrasts with all the other anthropoid Primates.

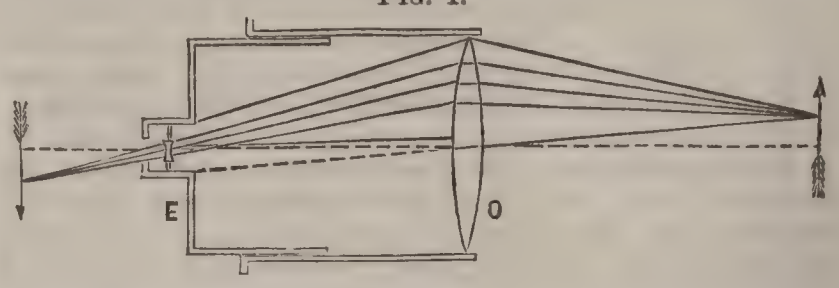
The diseases of the teeth and their cure are partially treated of under the head of DENTISTRY. THEO. GILL.

**Telephone.** See TELEGRAPH, Sec. IV., Subd. E, in CYCLOPÆDIA.

**Tel'escope** [from τῆλε, "afar," and σκοπεῖν, to "see"], an optical instrument for viewing distant objects. Its early history is involved in obscurity. It is asserted that Democritus could not have announced that the Milky Way is composed of small stars unless he had seen them with a telescope. But it is hardly credible that he or any of the Greek and Latin writers could have referred to this instrument, though some of their sentences have seemed to allude to its use. Roger Bacon, in his *Opus Majus*, in referring to the refraction of light through lenses, says: "Thus also the sun, moon, and stars may be made to descend hither in appearance, and to be visible over the heads of our enemies, and many things of the like sort which persons unacquainted with such things would refuse to believe." Leonard Digges, in a preface to an edition of Euclid published in 1570, seems to imply the existence of telescopes in England at that date. Two Italian philosophers, Battista Porta in 1561, and Antonio de Dominis in 1611, both published works relating to the combination of lenses so that objects might seem enlarged thereby. Other names might be mentioned, but since the question is still involved in controversy, the reader is referred to Grant's *History of Physical Astronomy* for a statement of the various claims. Many astronomers concede the invention to Hans Lippersheim of Holland, who used a convex object-lens in 1608. To Galileo belongs the fame of the first brilliant discoveries with an instrument so modest that at this distance it excites our surprise that he should have seen so much. After many years of patient labor the utmost power he could attain to was about thirty-three diameters. His first discoveries were in 1610. All of his telescopes were of the opera-glass pattern, and he reached the limit of power with that construction without achromatic lenses. It was not until the middle of the seventeenth century that telescopes composed of two convex lenses came to be generally used in astronomical observations, though Kepler in 1611 pointed out their advantages. The skilled philosopher Huyghens, to increase the magnifying power of his telescopes without encountering the aberrations of unachromatic lenses of short foci, made object-glasses of so great as 210 feet focal length. These telescopes were mounted without a tube, and could only be used with extreme difficulty; and even then the images formed by such object-glasses were unsatisfactory. Since it seemed that the refracting telescope had reached its highest development, the attention of philosophers was early directed to the construction of reflecting telescopes, the invention of which is involved in some obscurity. In 1663, James Gregory proposed that the light from a distant object be brought to a focus by a parabolic reflector. But the first person who actually constructed such an instrument was NEWTON (see in CYCLOPÆDIA). In 1672, Cassegrain, a Frenchman, brought forth still a third form of reflecting telescope. The reflector from this date began to supplant the refracting telescope, and maintained its lead until Dollond, about 1753, pointed out the error which Newton had made in regard to the refraction of light through different media. By combining together two or more lenses of crown and flint glass he produced the modern achromatic telescope, an instrument which from that day to this has steadily increased in size with the perfecting of the manufacture of optical flint glass—*i. e.* flint glass which is homogeneous throughout. (For the history of reflectors see SPECULUM.) For the tracing of the history of the competition between refractors and reflectors to the present date, a volume would be required.

*Theory.*—(For elementary explanation of refraction, lenses, and achromatism see MICROSCOPE and LENS.)—As in the microscope, so in the refracting telescope, the image of an object is first formed by a lens or system of lenses, and then in the common form of telescope this image is examined by means of a microscope. In the first telescopes made, however, and in the opera-glass of to-day, the rays of light from the object-glass are brought into the eye before they come to a focus, by means of a concave lens placed as in Fig. 1, where the distance OE equals the difference of

FIG. 1.




the focal lengths of the two lenses. The object seen will be erect, and in using it the eye should be placed exactly centrally behind the eye-lens, and the eye-lens should be limited by diaphragm to the size of the pupil of the eye. The magnifying powers usually range between three and eight diameters, and the best modern makers of opera-glasses construct them with both object and eye glass achromatic. The astronomical telescope, which must possess a much higher magnifying power and large field of view, is constructed differently, and in this case the object-glass forms the image, which is then examined by eye-pieces, which may be of many different forms.

*The Object-Glass.*—From a mathematical consideration of the subject it is found that an object-glass can be rendered achromatic (see ACHROMATISM and MICROSCOPE) for any two or more colors of the spectrum by combining together two or more simple lenses of known refractive indices and of certain focal lengths. From the extreme difficulty of centring more than two such lenses, it is the custom to combine two of the most prominent colors of the spectrum at the focus of the object-glass by means of a convex crown lens and a concave flint lens. The correction for the two colors selected depends upon the focal lengths of these two lenses. The formation of a sharp image at the focus of the object-glass depends upon the curves of the four surfaces of glass, supposing the glass to be perfectly homogeneous, though practically the theoretical curves are slightly altered by the skilled optician to compensate for defects in the glass itself. The determination of the radii of these curves has occupied the attention of geometers from the time of Newton, and the theory is so well understood at present that the manufacture of object-glasses with the minimum of distortion and color is limited by the difficulties in the manufacture of the materials used. Figs. 2, 3, 4, 5, with the accompanying data, indicate the most approved modern forms; they are taken from a paper published by Prof. G. P. Bond (*Proc. Amer. Acad.*, vol. vi. p. 169). Figs. 2 and 3 show the forms of object-glass best adapted for correcting chromatic aberration.

FIG. 2.

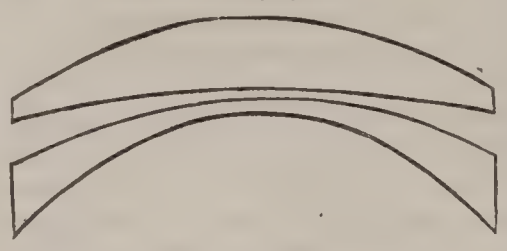


FIG. 3.

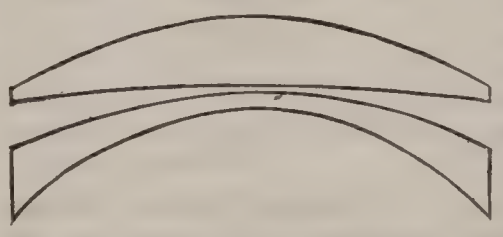


FIG. 4.

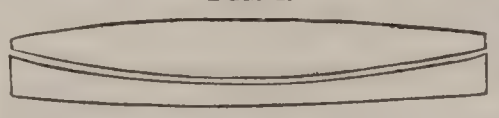
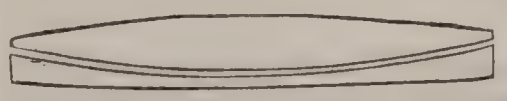


FIG. 5.



*Gauss's Curves.*

| | | | | | | Feet. |
|---|---|---|---|---|---|---|
| 1st. | Surface of the crown lens, | | | convex, | radius = | + 2.535 |
| 2d. | " | " | " | concave | " = | — 7.521 |
| 1st. | " | " | flint " | convex | " = | + 3.123 |
| 2d. | " | " | " | concave | " = | — 2.084 |
| | | | | Compound focus = | | 21.00 |

*Herschel's Curves, I.*

$$\frac{r}{l} = 7.4922.$$

| | | | | | | Feet. |
|---|---|---|---|---|---|---|
| 1st. | Surface of the crown lens, | | | convex, | radius = | + 2.803 |
| 2d. | " | " | " | concave | " = | — 9.525 |
| 1st. | " | " | flint " | convex | " = | + 3.482 |
| 2d. | " | " | " | concave | " = | — 2.361 |
| | | | | Compound focus = | | 21.00 |

Where $r$ denotes the radius of the first surface of the lens, and $l$ denotes the compound focal length.

*Herschel's Curves, II.*

$$\frac{r}{l} = 1.3964.$$

| | | | | | | Feet. |
|---|---|---|---|---|---|---|
| 1st. | Surface of the | crown lens, | convex, | radius | = | + 15.038 |
| 2d. | " | " | " | convex | " | = + 5.397 |
| 1st. | " | flint | " | concave | " | = — 5.507 |
| 2d. | " | " | " | convex | " | = + 22.135 |
| | | | | Compound focus | = | 21.00 |

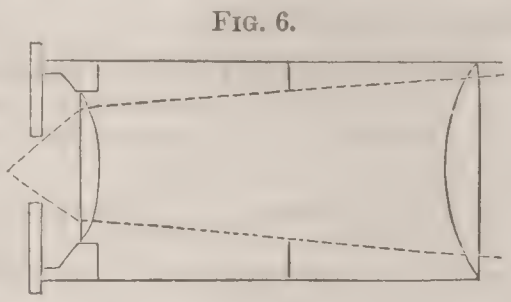
*Fraunhofer's Curves.*

| | | | | | | Feet. |
|---|---|---|---|---|---|---|
| 1st. | Surface of the | crown lens, | convex, | radius | = | + 14.157 |
| 2d. | " | " | " | " | " | = + 5.635 |
| 1st. | " | flint | " | concave | " | = — 5.775 |
| 2d. | " | " | " | convex | " | = + 25.945 |
| | | | | Compound focus | = | 21.00 |

It is worthy of remark that since the forms given above all have the two lenses in contact, the indistinctness and the curvature of the image cannot be diminished. The distinguished opticians Alvan Clark and Sons have separated the two lenses in some of their latest instruments, and find the definition improved thereby. Many attempts have been made to avoid the necessity of large flint-glass disks by interposing a small concave lens of high refractive index between the eye-piece and the crown lens. Bisulphide of carbon seems to have been the favorite with experimenters.

*The Eye-Piece.*—If a perfect image could be formed by an object-glass, a single lens used to magnify it would both color and distort it. Accordingly, except in the very highest powers of a few telescopes, opticians have not used single lenses, but a combination of two or more. For a description of the Huyghenian or negative, which is the most common, eye-piece, see MICROSCOPE. This form, as modified by Sir George Airy, gives the best views of celestial objects, but cannot be used in the great part of astronomical work, since the image is formed between the lenses, and from theoretical considerations a micrometer could not be placed at that point. In a positive eye-piece the lenses are placed as shown in Fig. 6. This form is commonly used in all cases where measurements are required. Sometimes its place is taken by a single achromatic lens or an achromatic doublet. Steinheil, Kellner, and Clark have made such achromatic eye-pieces.

FIG. 6.



The preceding eye-pieces show the object inverted, an item of little consequence with celestial objects. For terrestrial viewing an eye-piece of four lenses is commonly employed, which furnishes an erect image. For the construction of the three common eye-pieces the astronomer-royal, Sir George B. Airy, has furnished the following practical rules for making: "For a negative eye-piece: (1) For distinctness, let the first lens be a meniscus lens of focal length 3, the radii of its surfaces as 11 : 4, and its convexity toward the object-glass. Let the second lens be a double-convex lens of focal length 1, the radii of its surfaces as 1 : 6, and its more convex side toward the first. Let the distance of the lenses be 2. (2) If plano-convex lenses be used, there is a considerable loss of distinctness, and no diminution of distortion. (3) The field-bar should be at the distance 1 from the eye-glass. (4) Any other proportion of the focal lengths of the lenses may be adopted; the distance between the lenses must, in all cases, be half the sum of their focal lengths. The forms of the lenses, without great error, may be the same as those just given. (5) If a bright object appears yellow, or a dark one blue, at the edge farthest from the centre of the field, the lenses must be brought a little nearer together.

"For a positive eye-piece: (1) Let the two lenses be plano-convex of focal length 3, placed at the distance 2, with the convex side of each turned toward the other. (2) This distance is somewhat less than that adopted by some of the most eminent opticians. I prefer it, because there is a smaller chance of seeing the dust, etc., on the field-glass, which, when the lenses are nearer, happens frequently, especially if the observer be near-sighted. (3) The distance of the field-bar from the first lens must be $\frac{3}{4}$.

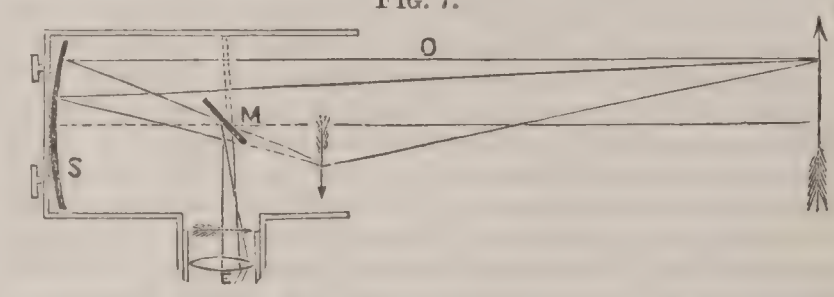
"For a four-glass eye-piece: (1) For distinctness, let the first and last lenses be double-convex lenses of focal length 3, the radii of the surfaces being as 1 : 6, and the more convex side of each turned to the other. Let the field-glass be plano-convex, of focal length 4, its plane side toward the eye, and the remaining glass a meniscus of focal length 4, the radii of its surfaces as 25 : 11, and its convexity toward the field-glass. Let the distance of the centre of the second lens from that of the first be 4, the distance of the field-glass from the second lens 6, and that of the eye-glass from the field-glass 5.13. (2) The distortion in this eye-piece is very small. (3) The first diaphragm should be at the distance 3 from the first lens; the last diaphragm, or field-bar, at the distance 3 from the eye-glass. (4) Any other focal lengths and distances may be adopted if the following conditions be attended to: Let $p$ be the focal length of the lens next the object-glass; $q$ that of the next lens; $r$ that of the field-glass; and $s$ that of the eye-glass. Let $a$ be the distance between the two first (or the length of the second pipe); $c$ the distance between the field-glass and the eye-glass (or length of the first pipe); $b$ the distance between the two middle glasses (or the distance between the two pipes). Then $p$, $q$, $r$, $s$, $a$, and $c$ may be taken at pleasure, and then $b$ must be

$$= \frac{qr\,[2(a+c)-(p+s)]-(q+r)\,[3ac+ps-2\,(cp+as)]}{3\,[c\,(p+q)+a\,(r+s)]-4ac-2\,(p+q)\,(r+s)}.$$

The forms of the lenses may be determined, without sensible error, by the rules given above. (5) If a bright object appears yellow, or a dark one blue, at the edge farthest from the centre of the field, the two pipes must be pushed a little nearer together."

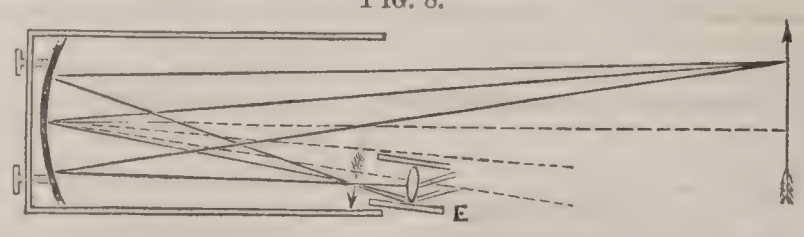
A little remains to be said in regard to the theory of reflecting telescopes. (See SPECULUM.) The four forms in which it has been constructed are shown in Figs. 7, 8, 9,

FIG. 7.



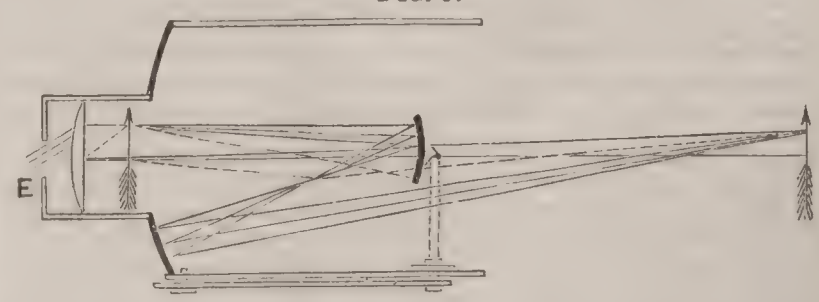

and 10, in which Fig. 7 is the form commonly adopted, the Newtonian, where the light enters through the aperture O and is brought to a focus at the eye at E, by reflection from the speculum S and the plane reflector M. In the Herschelian reflector, indicated in Fig. 8, the light is received directly from the reflector by the eye at E, and

FIG. 8.



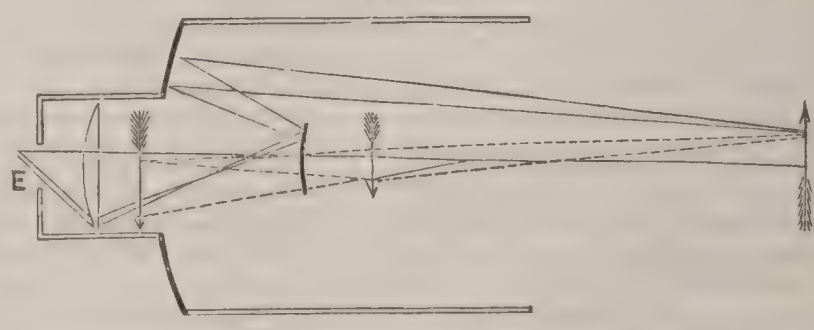

the observer has his back to the object. In the third form, shown in Fig. 9, the light is brought to a focus at

FIG. 9.




E by a concave mirror (the Gregorian telescope). In the fourth form, Fig. 10, a convex mirrror answers the same purpose (the Cassegrainian telescope).

FIG. 10.




*Construction.*—The mechanical means for grinding lenses in themselves are simple enough. The disk of rough glass is made to revolve rapidly on a spindle, and its first shape is given by grinding with water and sand, using an iron tool which has the approximate curvature. Next, it is removed to another iron tool, where it is brought still further into shape by grinding the lower surface against the iron tool, which has a spherical surface, pressed against it by means of the hand alone. Five or six grades of emery-powder with water are used before this stage is finished. The iron tool is then covered with a coat of pitch, over which is sprinkled rouge; the polishing is then completed, still using the hand as a motor-power. After each surface of the lens has been polished in this manner—which re-

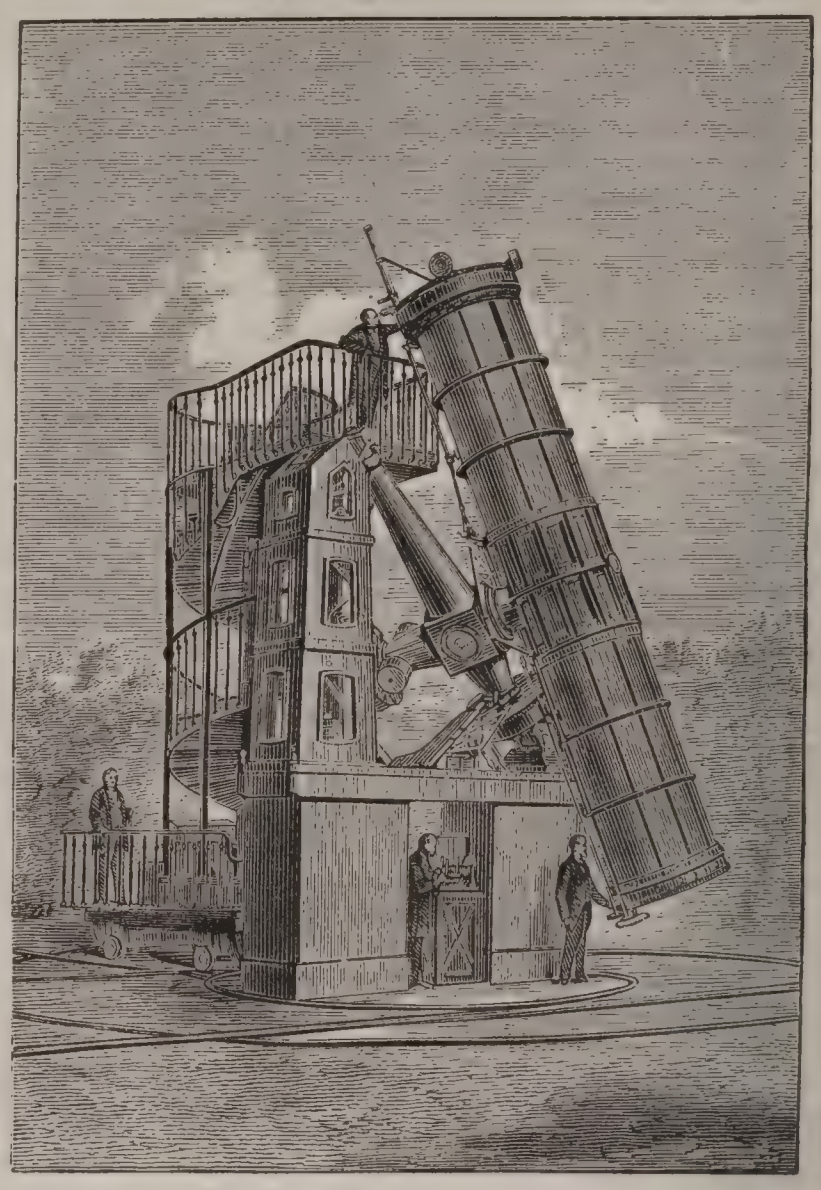
quires from a few days to several months, depending on the size of the glass—the lens is rigorously tested, and from this point the highest skill of the optician develops itself. The effect of every flaw in the glass itself or imperfection caused by the grinding process must be counteracted by polishing here and there each of the four surfaces, if it be an object-glass. The finger alone, or the finger with a little of the finest rouge and water, is used in this process. It will be readily understood that the most patient trial and perseverance, coupled with conscientiousness, are necessary to produce a fine object-glass.

The prices of object-glasses, as established by the firm of A. Clark & Sons, are fixed by the rule that a 4-inch glass costs $100, and to add one-fourth to its diameter doubles the cost of the glass; thus, a 5-inch glass costs $200, a 6¼-inch, $400.

The tube holding the object-glass and eye-piece of a telescope in the large German instruments is made of Spanish mahogany, but several of the largest modern equatorials have their tubes constructed of steel or iron riveted in plates. In the case of some kinds of telescopes the tube is partly or wholly wanting. Thus, in the photographic telescope, suggested by Prof. Winlock and used by the U. S. transit-of-Venus expeditions in 1874, the object-glass is on one pier, and a glass plate placed on a pier 40 feet distant receives the image formed by it, a mirror being used before the object-glass to avoid the necessity of pointing so long a telescope itself. The great equatorial of the Washington Observatory is illustrated under the heading OBSERVATORY. We add here an engraving of the large Paris equatorial reflector, completed in 1875 under Le Verrier. It is of the Newtonian construction, and its mirror is silver on glass, deposited by the processes of M. Ad. Martin upon a surface which is truly parabolic. The weight of the whole instrument is 10,000 kilogrammes, and the total cost of the instrument and its building amounted to 190,000 francs.

Subjoined is a table of the largest telescopes in existence, for which the writer is indebted to the *Popular Science Monthly* for Mar., 1877.

FIG. 11.



The Paris Equatorial Reflector.

*Size of Principal Telescopes in the World.*

(1 French inch = 12 Paris lines; 1 English inch = 11.26 Paris lines; 1 mètre = 443.30 Paris lines.)

| Owner or director, and observatory. | Constructed by— | Aperture. | | | Focal length. | | Remarks. |
|---|---|---|---|---|---|---|---|
| | | English inches, etc. | French inches. | Mètres. | English feet, etc., and inches. | Mètres. | |
| REFRACTORS. | | | | | | | |
| Lyman, Yale College | A. Clark & Sons | 28 | ... | ... | ..... | ... | Constructing. |
| Littrow, Vienna | Grubb | 27 | ... | ... | ..... | ... | Constructing. |
| McCormick, (?) | A. Clark & Sons | 26¼ | ... | ... | 33 feet. | | |
| C. H. Davis, Washington | A. Clark & Sons | 26 | ... | ... | 390 ins. | | |
| Newall, Gateshead | Cooke | 25 | ... | ... | 29 feet. | | |
| Buckingham, London | Buckingham | 21 | | | | | |
| University of Chicago | A. Clark & Sons | 18.5 | ... | ... | 23 feet. | | |
| Winnecke, Strasbourg | Merz | 18 | ... | ... | ..... | ... | Constructing. |
| Pickering, Harvard College | Merz | 14.95 | ... | ... | 270 ins. | | |
| O. Struve, Pulkova | Merz | 14.93 | ... | ... | 270.6ins. | | |
| Lord Lindsay, Dun Echt | Grubb | 15 | ... | ... | 15 feet. | | |
| Huggins, Royal Society, near London. | Grubb | 15 | | | | | |
| Downsede College, Bath | ..... | 14.5 | ... | ... | ..... | ... | Destroyed by fire in 1867. |
| Cooper, Markree Castle | (?) | 14 | ... | ... | 25 feet. | | |
| Oom, Lisbon | Merz | ... | 14 | | | | |
| C. H. F. Peters, Clinton | Spencer | 13.5 | | | | | |
| Boss, Albany | Fitz | 13 | ... | ... | 15 feet. | | |
| Rutherfurd, New York | Rutherfurd & Fitz | 13 | ... | ... | ..... | ... | Photographic. |
| Watson, Ann Arbor | Fitz | 12.5 | ... | ... | 17 feet. | | |
| Airy, Greenwich | Merz & Simms | 12.5 | ... | ... | 16.6 ft. | | |
| Mitchell, Vassar College | Fitz, reworked by Clark | 12.5 | | | | | |
| Pritchard, Oxford | Grubb | 12.25 | | | | | |
| Pritchett, Glasgow, U. S. | A. Clark & Sons | 12.25 | ... | ... | 17 feet. | | |
| Le Verrier, Paris | Secretan & Eichens | ..... | 12 | | | | |
| Littrow, Vienna | A. Clark & Sons | 12 | ... | ... | ..... | 5 | |
| Adams, Cambridge | Cauchoix | 12 | ... | ... | 20 feet. | | |
| Ball, Dublin | Cauchoix | 12 (?) | 12 (?) | | | | |
| H. Draper, near New York | A. Clark & Sons | 12 | | | | | |
| Main, Oxford | Cauchoix | 12 (?) | 12 (?) | | | | |
| Pritchard, Oxford | Grubb | 12 | | | | | |
| Stone, Cincinnati | Merz | 11.5 | | | | | |
| And many others. | | | | | | | |
| REFLECTORS. | | | | | | | |
| Lord Rosse, Birr Castle | Rosse | 6 feet | ... | | 55 feet. | | |
| William Herschel, Slough | W. Herschel | 4 " | ... | ... | 40 " | ... | Out of use. |
| Lassell, Liverpool, etc | Lassell | 4 " | ... | ... | 37 " | ... | Since destroyed. |
| Ellery, Melbourne | Grubb | 4 " | ... | ... | 32 " | | |
| Le Verrier, Paris | Martin, Eichens | ..... | ... | 1.20 | ..... | 7 | Silvered glass. |
| Lord Rosse, Birr Castle | Rosse | 36 ins. | ... | ..... | ..... | ... | Silvered glass. |
| Tisserand, Toulouse | Foucault | ..... | ... | 0.80 | | | |
| Stephan, Marseilles | Foucault, Eichens | | | | | | |
| H. Draper, near New York | H. Draper | 28 ins. | ... | 0.80 | 13 feet. | 4.80 | Silvered glass. |
| Lassell, Maidenhead | Lassell | 24 " | ... | ..... | 20 " | ..... | Metal. |
| W. & H. Herschel, Slough, and C. G. H. | W. & J. Herschel | 18 " | ... | ..... | 20 " | ..... | Several mirrors. |
| H. Draper, near New York | H. Draper | 15 " | | | | | |
| Maclean, Tunbridge Wells | With & Browning | 15 " | | | | | |
| Pritchard, Oxford | De la Rue | 13 " | ... | ..... | 10 feet. | | |
| Worthington and Buxendell, Manchester | With & Browning (?) | 13 " | | | | | |
| And many others. | | | | | | | |

*Literature.*—Robert Grant, *History of Physical Astronomy* (London, 1852); William Chauvenet, *Manual of Spherical and Practical Astronomy* (Philadelphia, 1874); J. F. W. Herschel, *The Telescope* (from the *Encyclopædia Britannica*, Edinburgh, 1861); T. W. Webb, *Celestial Objects for Common Telescopes* (London, 1868); S. Parkinson, *A Treatise on Optics* (London, 1870); G. A. Grunert, *Optische Untersuchungen* (Leipsic, 1846); the volumes of the *Monthly Notices* of the Royal Astronomical Society of London; the volumes of the *Astronomische Nachrichten*, where will be found Bessel's valuable paper on the method of determining the focal length of a compound (achromatic) object-glass, Bd. xvii. col. 289.

L. Waldo.

**Temperaments, Human.** W. Byrd Powell, M. D., classified the human temperaments as follows: *Four Primary Temperaments.*—1st, sanguine; 2d, bilious; 3d, lymphatic; 4th, encephalic. He styled the two first *vital*, and the other two *non-vital*.

The Combinations of the Elementary Temperaments.—I. *Binary Combinations.*—1st, the sanguine bilious: 2d, sanguine lymphatic; 3d, sanguine encephalic; 4th, bilious lymphatic; 5th, bilious encephalic; 6th, encephalo-lymphatic.—II. *Ternary Combinations.*—1st, the sanguine bilious lymphatic; 2d, sanguine encephalo-bilious; 3d, sanguine encephalo-lymphatic; 4th, bilious encephalo-lymphatic.—III. *Quarternary Combination.*—1st, sanguine bilious encephalo-lymphatic.

He entertained the opinion that physiological incompatibility should be regarded as an unlawful marriage, and laid down two laws illustrating this point: (1) The marriage of a person with another of the same temperament is incompatible. (2) When an adjunctive temperament enters into the constitution of both progenitors or parties to a marriage, it will be incompatible. These two laws he held as sufficient to enable those who understood the temperaments to distinguish accurately all incompatible parties.

He gave cases to illustrate both of these laws: (1) When both of the parties to a marriage have the sanguine encephalic temperament, their children will die young of dropsy of the brain or tubercular inflammation of its membranes. (2) When both of the parties to a marriage have the bilious encephalic temperament, their children will be idiotic. (3) When both of the parties to a marriage have the bilious encephalic lymphatic temperament, their children, in the proportion of 5 to 7 or 9 to 11, will be dead-born, and the others will not live two years respectively. These three cases illustrate both laws.

He then illustrated the second law: (4) When one party is bilious lymphatic, and the other is sanguine bilious encephalic, their children will all die young of tubercular consumption of the lungs or abdominal glands, although neither of these forms of disease was ever in the ancestry of either party. (5) If one party be sanguine encephalic, and the other bilious lymphatic, the progeny will die young of tuberculous forms of disease. (6) If one party be bilious encephalic, and the other sanguine encephalic bilious lymphatic, the children will sooner or later become insane, for the reason that both parties partake constitutionally of an adjunctive temperament. All such marriages are incompatible.

*Law 3.*—In all marriages with a view to or expectation of progeny, one of the parties should have an exclusively vital temperament, and the other more or less adjunctive. *First Illustration.*—One party sanguine, the other bilious encephalic or lymphatic bilio-encephalic. *Second.*—One party bilious, the other sanguine encephalic, or lymphatic, or sanguinio-encephalic lymphatic. *Third.*—One party sanguine bilious, the other sanguine lymphatic, or bilious lymphatic sanguine, or bilious encephalic, or bilio-encephalic lymphatic. These are all physiological marriages.

Robert S. Newton.

**Ter'ni, Falls of,** otherwise called the **Cascade of the Marmore,** about 5 miles from the town of Terni, formed by the waters of the Velino, which are brought hither by an artificial canal and dashed over an almost perpendicular precipice, the height of which is variously estimated at from 700 to 1200 feet, and the foot of which they reach by three unequal leaps. The canal, cut through the living rock of the Marmore Mountains, was executed by the Roman censor M'. Curius Dentatus in the year of Rome 481, the object being to drain the marshes near Rieti. The extraordinary beauty and grandeur of the surrounding scenery, added to the highly-imposing character of the falls themselves, which in fine weather are either spanned by a single lofty iris-colored arch or seen through a thousand smaller rainbows, shifting and crossing as the breeze sinks and swells, makes this cascade one of the most attractive in Europe.

Caroline C. Marsh.

**Tes'timony** (in law) is the oral statement of facts made under oath by witnesses upon the trial of a civil or criminal action, or upon the hearing of any other judicial proceeding, as contradistinguished from the evidence furnished by written instruments, or by any other mere physical facts or appearances which can be exhibited to the court or jury. "Evidence" is the generic term, while "testimony" is specific. (See the article Evidence.) At the common law the witnesses in a legal action must be produced before the jury, unless they are without the kingdom or state, in which case their examination is taken in writing by means of a commission sent to the foreign country. In the English equity, admiralty, probate, and ecclesiastical proceedings the testimony was always taken by deposition and read on the trial. The modern radical changes in procedure have altered most of these ancient rules. Even the testimony in legal actions, both in many of the American States and in England, may now be written if the parties agree to that method; while by the practice of some States and of the U. S. tribunals it may always be in the form of a deposition if the witness lives at a fixed distance from the court or in certain counties other than that in which the trial is held. There is one important exception to this relaxation made necessary by the national and State constitutions. In all criminal trials the prisoner must be confronted by the witnesses against him, so that the testimony for the prosecution must be produced and delivered orally before the jury. Wherever the reformed American procedure prevails, with the exception of three or four States, the testimony in equitable suits is given in the same manner and is governed by the same rules as that in legal actions; in the few exceptions just mentioned the parties may elect between the ancient and the new methods; while in the U. S. courts and in a few States which still retain a separate administration of equity the original form of deposition continues to be used. The recent reform in the English procedure allows the parties a free selection between the written and the oral modes. (In respect to the compelling the attendance of witnesses, the administration of the oath or of the affirmation, the examination and cross-examination, and the rules as to the competency of witnesses, see Subpœna, Oath, Trial, and Witness, in Cyclopædia.)

John Norton Pomeroy.

**Test Oath.** By the act of 25 Car. II. ch. 2, all persons holding any office—except a few of a very inferior degree—or holding any place of trust under the Crown, including members of Parliament, were required to take certain oaths—viz. that of allegiance, which was purely civil, that "of supremacy," which acknowledged the Crown as the lawful head of the English Church and abjured all civil or ecclesiastical allegiance to any foreign potentate, and to subscribe a certain declaration against transubstantiation, and finally to partake of the communion in the Church of England. Those who disobeyed any of these provisions were not only unable to hold office, but were also liable to fine. The effect of these statutes, which were collectively known as the "Test-Oath acts" or the "Test acts," was to prevent all Romanists, dissenters, and Jews from attaining to any public and official position. After a long political struggle the severity of these requirements was broken by the 9 Geo. IV. ch. 17, which partly abolished the restrictions laid upon Romanists, and the reform gradually but steadily proceeded; until finally all tests except the oath of civil allegiance have been removed, and members of the Church of England, dissenters, Jews, and Romanists are alike admitted to Parliament and to any other official positions and places of trust.

Test oaths have been largely resorted to in the U. S. as a consequence of the civil war. Prior to and at its close statutes were enacted by Congress forbidding any member of Congress to take his seat, or any U. S. officer to enter upon his duties, or any person to be admitted as an attorney or counsellor in a U. S. court, unless he should take an oath, in substance, that he had not been engaged in the rebellion, nor had in any manner given it aid and comfort. Many States repeated this legislation, extending it not only to State officers, but even to members of professions, such as lawyers, clergymen, college professors, teachers, and the like. The validity of these statutes, national and State, was soon brought before the Supreme Court of the U. S. That tribunal held that these oaths were highly penal in their nature; that their effect in some instances was to deprive persons of political rights which they would otherwise have enjoyed, and in other instances was to deprive persons of vested civil rights which the law regarded as tantamount to property. The Supreme Court finally declared that so far as the test oaths were made applicable to persons who had been connected with the rebellion, or who had given it aid and comfort prior to their enactment, and so far as their object was to destroy vested civil rights by preventing persons from pursuing their various callings, the statutes creating them were null and void, either as

*ex-post facto* laws or as bills of attainder. (See EX-POST FACTO and BILL OF ATTAINDER, in CYCLOPÆDIA.)

JOHN NORTON POMEROY.

**The'atre** [Gr. *θέατρον*, a "show-place"]. The ancient theatre, established by the Greeks and only slightly modified by the Romans, reflects very strikingly in its architectural construction the ideal character of the ancient drama. In the centre of the whole building stood the thymele (*θυμέλη*), an altar raised in honor of Dionysus (Bacchus), and every dramatic representation was opened and closed by a sacrifice being offered up on this altar; for in ancient Greece theatrical representations formed a kind of religious festival. The buildings in which these religious festivals were celebrated were often of enormous size, capable of seating 80,000 spectators; for, since theatrical representations had become an official form of public worship, recognized and supported by the state, it was necessary that every citizen should be provided with a seat. No less striking are the circumstances that these enormous and costly buildings were originally used only twice a year, and only for a few days; that the ornamentation of the stage and the actors was entirely conventional, without any attempt at imitating nature; that the building was roofless, admitting the natural light's full influx, and thereby excluding illusion, and forcing the actor to give any allusion to natural objects which the text might contain—as, for instance, Iphigenie's farewell to the sunlight—a direct application, etc. Such circumstances show that in studying the ancient drama and its theatrical representation it is best to start from a comparison with the modern sermon, the divine service, and the church; and, indeed, as soon as the ancient drama lost its religious signification, it withered away and disappeared; and as soon as the ancient theatre attempted to adopt illusion as the principle of its representation, it sank into utter depravity, was deserted, and fell into ruins.

The ground-plan of an ancient theatre may be most easily understood by imagining a circle divided by a diameter. In the centre stood the thymele. The space on the one side of the diameter, between the thymele and the first row of seats, which rose in semicircles, one behind the other, was called the orchestra (dancing-place), and was occupied by the choir, which here sang their hymns and performed their choral dances. On the other side of the diameter, a little behind the thymele, rose the stage, a long parallelogram of comparatively little depth, raised to the same height as the first row of seats, and closed on the three sides by walls of the same height as the last row of seats. For location was generally chosen the slope of a hill with a natural inward curve, which facilitated the construction of the auditorium; the theatre of Athens was situated on the south-eastern slope of the Acropolis. In many cases, however, the whole amphitheatre had to be raised on immense substructures. Access to the auditorium was effected partly from below, through the passages between the stage and the auditorium, partly from above, whence stairs led down to the different rows. The lowest rows nearest the orchestra were reserved for the dignitaries of the community; the highest and farthest off were left to the women. The scene generally represented the front façade of a palace, and was stationary. It could be altered, however, or even entirely changed, by opening the back wall and showing the interior of the palace, and by turning the wings (*περίακτοι*), which bounded the proscenium on both sides, to the left and to the right. But as a rule the scene was stationary, and its ornamentation entirely conventional. Thus, the back wall showed three doors, and the very character of a person was indicated by the door through which the actor entered the stage. A flight of steps led from the stage down into the orchestra, and by these the choir sometimes ascended the stage; the actor never descended into the orchestra. A machine—rather formidable, it would seem, from the effect it sometimes produced—was employed for bringing the gods down from heaven or carrying the mortals up into the heavens. The costume of the actors was also essentially conventional. Women's parts were always performed by men. The tragic actor wore cothurni, a mask, sometimes of marble, and a prodigious amount of padding, and his means of representation were thus confined to attitudes and modulations of the voice, facial expression and all gesticulation proper being excluded. Between the lips of the mask was fixed a metallic device which greatly increased the strength of the actor's voice, and sounding vases were placed at fixed intervals in the auditorium. The oral delivery of the part was song rather than speech, probably very much like the recitative of modern opera. Performances took place, originally, only twice a year, in spring and fall, at the great festivals of Dionysus; and as a rule the same drama was never played more than once, though instances occurred in which a drama first brought out in spring was repeated in the fall. Several dramas by various poets were represented on the same occasion, and the representation often began at sunrise and ended after sunset. The expenses—often very considerable, as it took several months to prepare a drama for representation—were defrayed by wealthy citizens, and a competition was established between the actors, the poets, the patrons, etc. The prize was a laurel crown, and was one of the greatest honors the ancient community could confer; on the other hand, an actor who once happened to mispronounce a word was immediately dragged down from the stage and flogged in the orchestra. Poor people received from the state treasury one day's wages, besides the entrance-fee, in order that they should not be prevented by poverty from being present in the theatre.

The changes which the Romans introduced in the construction of theatres were comparatively small. The first stone theatre in Greece was built in Athens in the time of Themistocles; the first in Rome by Pompey. The most interesting remains of ancient theatres are those of Ephesus, Miletus, Cnidus, Syracuse, Tauromenium, Rome (the theatre of Marcellus), Nîmes, etc. The principal writers on the subject are, among the ancients, Pollux and Vitruvius; among the moderns, Schneider, Geppert, Strack, Ferrara, Donaldson, etc.

The history of the modern theatre is closely connected with the history of the modern drama, and its origin has been traced in the article on MYSTERIES. From the time when the miracle-plays and moralities disappeared, and up to the time when theatres were built and theatrical representations maintained at every court as a part of the royal household, during the whole period from the fifteenth to the seventeenth century, in which strolling bands acted in the courtyards of the inns or in temporary buildings of wood, all theatrical matters are involved more or less in obscurity. Certain general traits, however, are well authenticated. In most cases only the stage was roofed, while the pit was left open. Hence the custom that noble and wealthy people were seated on both ends of the stage itself—a custom which continued a long time after the circumstances which had caused it disappeared; it was Voltaire who finally drove this intrusive kind of spectators back into the boxes. That a stage thus occupied by spectators could have no decoration resembling the scenery of our days is self-evident. The stage directions with which Jacob Ayrer accompanies the texts of his plays, an old print dating from Shakspeare's time and representing the stage of the Red Bull Theatre in London, the technical construction of Shakspeare's dramas, etc., give us some ideas of the general outfit of the stage. In the centre of the background was found a platform raised a few steps from the floor. From front corners of this platform arose two pillars on which rested a balcony, and the space between the pillars was filled with a movable curtain hanging down from the balcony. This device, which probably originated from the use of the inn-door as the centre of the background of the stage, formed the principal feature in the scenery of that time. Here Banquo was murdered and Desdemona strangled; here Romeo met Juliet; here the blind Gloucester sprang into the abyss and was carried by angels into the arms of Edgar, etc. Meanwhile, the revival of letters in Italy, and the attempts at representing the antique tragedy, occasioned the construction of stages and theatres after the antique model. In the middle of the sixteenth century Palladio built theatres in Vicenza and Venice after the rules of Vitruvius. The stage had here a merely architectural ornamentation, and its various parts—doors, balconies, etc.—a merely conventional signification. This plan was afterward adopted in France, and carried out in the tragic stage of the Palais Royal, erected by Richelieu in 1639, and forming the scene on which the tragedies of Corneille were enacted, and in the comic stage of the Hôtel de Bourgogne, finished in 1645. The combination, however, and gradual amalgamation of these two types of stages, the mediæval originating from the courtyard of the inn, and the classical originating from an imitation of the Greek scene, cannot be traced in details; but in the middle of the eighteenth century it was consummated, and by this combination the modern stage was formed. It is said that movable scenery was invented in 1657 by Bibbiena, and the curtain introduced in 1698 by Dorbay, but the dates of both these devices, the two most characteristic features of the modern scene, are uncertain.

The first theatre in England was probably the London Theatre, a wooden but stationary structure erected before 1576. In Shakespeare's time London had three private and four public theatres; his own plays were enacted in the house in Blackfriars and at the Globe. The first theatre in America was opened at Williamsburg, Va., in 1752; the next in Nassau street, New York, in 1753. The two largest theatres are the Della Scala in Milan and the San Carlo in Naples, seating between four and five thousand people; the two most magnificent are the opera-house in Vienna, opened in 1869, and the Grand Opéra in Paris,

opened in 1875. The principal writers on the subject are Tieck, Ulrici, Lehwald, Magnin, Taillandier, Leroy, Wright, and Doran. CLEMENS PETERSEN.

**Thermal Springs.** Warm water having a greater power of dissolving the mineral constituents of the rocks through which it passes, thermal springs are usually at the same time *mineral* springs and are used for medicinal purposes. They are classified, in this respect, according to the characteristic and prevailing gaseous or mineral elements which they contain. Carbonic acid gas abounds in the gaseous, *acidulous* waters of Pyrmont and Seltz, in Germany, Spa, in Belgium, and Vichy, in France. Sulphur compounds predominate in the *sulphurous*, like the celebrated waters of the Virginia Springs, in the Alleghanies, and Saratoga; Barèges, in the French Pyrenees; Louèche, in Switzerland; Aix, in Savoy: common salt, associated with many others, in the *saline* waters of Plombières, in the Vosges; Aix, in Provence; Schlangenbad, in Germany; Baden, in Switzerland; Seidlitz, in Bohemia: a great variety of salts, without especial preponderance of any one, in the *complex* springs of Carlsbad and Töplitz, in Bohemia; Wiesbaden, Ems, and Baden-Baden, in Germany: salts of iron in the *chalybeate* springs which abound in all countries rich in this metal. The number of mineral springs is very great: there is scarcely a country which cannot boast of many. Europe, however—in which, among all the continents, the earth's crust is most broken and dislocated—is perhaps also the richest in mineral springs. Over 800 have been described in France, 400 in Spain, a greater number still in Germany, Bohemia, Switzerland, Italy, and England, their various temperatures ranging as high as 180° F. In this country the numerous springs found in Arkansas vary from 110° to 165° F. (See, further, EARTH, VI.) A. GUYOT.

**Ther'mo-Chemistry.** Like every other human study, chemistry includes a science of facts and a science of law; the latter, the highest aim of the science, consisting of the investigation and exposition of the *laws of change* in nature. That branch of the study called thermo-chemistry in its widest sense must be admitted to cover the whole science of chemical change and chemical law, because no chemical change probably occurs, or is possible, without disturbance of thermal equilibrium. The investigation of thermal changes in chemical transformations has therefore of late years been placed in the highest rank of human pursuits, and has occupied some of the best intellects. It cannot, however, be claimed as yet that much substantial progress has been accomplished, the field being too great and the laborers too few. The measurement of the exact amounts of positive thermal development, and of negative thermal absorption, accompanying various kinds of chemical operations—such as combinations, oxidations, combustions, decompositions, solutions, fermentations, explosions, and so on—has occupied much of the labor of such investigators as Bunsen, Berthelot, Thomsen, Favre and Silbermann, Andrews, Woods, Joule, and others. Many important classes of facts have been put on record, but as yet scarcely sufficient to justify any very broad generalizations. It would appear also that the modes of *measurement* of the thermal changes accompanying transformations are subject to errors and uncertainties that have not yet been eliminated, by reason of which independent observers do not yet attain results of sufficient uniformity to inspire implicit confidence. The practice of these modes of measurement is known as the art of

*Calorimetry.*—This art differs from those of THERMOMETRY and PYROMETER (which see) in seeking to determine not merely the temperature or calorific *intensity* that may appear during a chemical change, but the total *quantity* of heat—or, more correctly speaking, of heat-force—that appears or is developed. According to the view taken in the article TEMPERATURE, NATURE OF (which see), that temperature is energy or motion of the *molecule* as a whole, calorimetry may be defined as the measurement of the amount of potential chemical energy of the atom inside the chemical molecule, that appears or is transmuted into actual or kinetic energy of the molecule itself in the course of changes of constitution of the said molecule. Under VOLUMES, MOLECULAR, it is further explained how, according to the new views of the writer, such conversion of atomic energy into molecular energy is necessarily accompanied by a change in the volume of the molecule by reason of a change in the amplitude of the atomic motions. The importance of calorimetry thus becomes apparent, as furnishing an index to the changes of internal chemical constitution of matter.

The first calorimetric work was done by Lavoisier and Laplace almost a century ago, in 1780. They operated only to determine heat of *combustion*, and adopted the device—often since used by others, including Bunsen among the latest experimenters—of determining the amount of ice melted by the products of combustion. The most important disturbing cause or source of error in making this determination precise is the loss of temperature of these products of combustion through transmission—by radiation and conduction—to other bodies before reaching the ice to be melted. Every known precaution is therefore taken to confine the heat by means of non-conducting materials, such as eider down, etc. Our great American philosopher, Rumford, invented a beautiful device looking to the elimination of this cause of error. He cooled his calorimeter before beginning the experiment to a temperature just as much below that of the air as it was found to rise above it during the combustion going on within it, the latter having been ascertained by a preliminary experiment. Then the heat lost during the later stages of the process was about compensated by that gained during the earlier stages, absorption being equal to radiation. When the melting of ice is the criterion, there seems another error, on which too little stress has been laid. It appears from experiments of Person that there is an intermediate state between ice and water, during which the ice absorbs a little *latent heat of fusion* without a corresponding appearance of liquid water. This absorption begins at about 3½° F. below the putative thermometric "melting-point of ice." In other words, the change involved in the melting of ice is not precise or sharp, but extends throughout three and a half degrees of temperature. Those methods, therefore, in which the effect is measured by the rise in temperature of a known weight of liquid water through which the products of combustion are passed are preferable. This was done by Favre and Silbermann, and by Andrews, to whom we owe the most extensive and valuable determinations of the calorific development during *combustion*, that branch of thermo-chemistry which has the most immediate *practical* importance. The methods of these experimenters, described in detail, would require cuts and occupy too much of our space. They will be found in the chemical books of reference. The following are some of the more important of their results that bear upon the subjects of fuel, practical calorifics, and metallurgy. The figures represent the number of pounds of water heated 1° F. by 1 pound of the substance while burning with pure oxygen:

| Substance. | Burning to— | Water heated. | Experimenters. |
|---|---|---|---|
| Hydrogen | Water | 60986 | Andrews. |
| | | 62032 | Favre & Silbermann. |
| Charcoal | Carbonic acid | 14220 | Andrews. |
| | | 14524 | Favre & Silbermann. |
| Diamond | " " | 13986 | Favre & Silbermann. |
| Carbonic oxide | " " | 4325 | Andrews. |
| | | 4376 | Favre & Silbermann. |
| Sulphur | Sulphurous acid | 4153 | Andrews. |
| | | 4032 | Favre & Silbermann. |
| Phosphorus | Phosphoric acid | 10345 | Andrews. |
| Iron | Magnetic oxide. | 2848 | " |
| Copper | Black oxide | 1085 | " |
| Zinc | White oxide | 2391 | " |

In the case of gaseous substances it is usually of much more immediate practical interest to know the comparative calorific power or effectiveness of *equal volumes*, instead of equal weights of combustible, as in the above statement. In the following tabulation, therefore, the comparative weights of water heated equally by equal volumes of some combustible gases, burning with pure oxygen, are given; the standard volume adopted being that of 1 pound of hydrogen gas, in order to bring them into direct comparison with the above:

| Equal volumes of | Burning to— | Water heated 1° F. | Experimenters. |
|---|---|---|---|
| Hydrogen | Water | 60986 | Andrews. |
| | | 62032 | Favre and Silbermann. |
| Carbonic oxide | Carbonic acid | 60550 | Andrews. |
| | | 61264 | Favre and Silbermann. |
| Marsh gas | $CO_2$ and $H_2O$ | 188104 | " " |
| Olefiant gas | " " | 298844 | " " |
| Carbon disulphide | $CO_2$ and $SO_2$ | 232560 | " " |
| Sulphuretted hydrogen | $H_2O$ and $SO_2$ | 83878 | " " |

It must be noted that these are the total amounts of heat-energy developed during these combustions with pure oxygen; that is, the products of combustion being cooled down to the same temperature as the combustible and the oxygen were before burning, that temperature, moreover, being below 212° F., the temperature of steam. When these combustible bodies burn practically in air, and the flame is applied for practical purposes, modifying conditions of great magnitude step in. The products of combustion often remain at a high temperature after being used, generally above 212° F.; and therefore, in cases where hydrogen is a constituent of the combustible, there is not only lost the energy corresponding to this residual temperature, but also the latent heat of the steam produced by the combustion. The great volume of nitrogen in the air carries off its proportion of the energy, and so many and various new factors are introduced that calculations of some complexity are required in connection with prac-

tical calorifics; the figures in the above tabulations giving no idea in most cases of the practical calorific effectiveness of the bodies named.

Apart from so-called combustion, other chemical operations are now occupying, with reference to the determination of the thermal changes accompanying them, the labors of some eminent minds. Few general principles have yet been established, and only a few examples of the results that have been obtained can be cited. For mixtures of *oil of vitriol* and *water* Thomsen obtained heat-developments as follows:

| | Total heat. |
|---|---|
| $O_4SH_2$ with $1H_2O$ | 6513 |
| " " 2 " | 9757 |
| " " 3 " | 11598 |
| " " 4 " | 12777 |
| " " 5 " | 13662 |
| " " 6 " | 14416 |
| " " 7 " | 15008 |
| " " 8 " | 15474 |
| " " 12 " | 16537 |
| " " 16 " | 17020 |
| " " 20 " | 17243 |
| " " 24 " | 17384 |
| " " 28 " | 17471 |
| " " 32 " | 17536 |
| " " 36 " | 17579 |
| " " 40 " | 17612 |

Up to the *sixtieth* molecule of water added, some molecular change still occurred as a little heat still appeared. Favre and Silbermann found for the thermal development by the union of equivalents of nitric and muriatic acids, with equivalents of various bases, the following:

| | Nitric acid. | Muriatic acid. |
|---|---|---|
| Potash | 15510 | 15656 |
| Soda | 15283 | 15128 |
| Ammonia | 13676 | 13536 |
| Baryta | 15360 | 15306 |
| Lime | 16943 | 16982 |
| Magnesia | 12840 | 13220 |

(In Watts's *Dictionary of Chemistry*, article "Heat," will be found an extremely useful account, by Prof. George C. Foster of University College, London, of the various researches in thermo-chemistry, to which the inquiring reader may refer.) HENRY WURTZ.

**Thomp'son** (RICHARD M.), b. in Culpeper co., Va., June 9, 1809; received a classical education; was a clerk in a store in Louisville, Ky.; afterward a school-teacher in Lawrence co., Ind., but studied law at the same time, and was admitted to the bar in 1834. In the same year he was elected to the State legislature of Indiana, and re-elected in 1835. In 1836 he became a State senator; in 1841 was chosen to Congress, and again in 1844 and 1847. Various appointments which were offered to him by the administration he declined, but took part very actively in politics; was a delegate to the Republican conventions of 1860, 1864, 1868, and 1876, and entered Pres. Hayes's cabinet in 1877 as secretary of the navy.

**Tides, Theories of.** In the article TIDES, OCEANIC WAVES, AND CURRENTS, a popular explanation is given of the cause of the tides. In Fig. 1 of that article is shown how the moon causes "high water," not only immediately under itself, but at the point diametrically opposed, while "low water" occurs on a great circle along which the moon is in the horizon. Were the earth a solid spheroidal body *held fixed in space* and covered by an ocean, a foreign attraction (*e. g.* that of the moon) would move *all* the waters, both those directly under and those opposite, *toward* the attracting body; those under it would be elevated, those opposite depressed. But the earth is *not* thus held fixed in space; its solid nucleus and its enveloping waters are alike affected by the foreign attraction, the convergence of lines of direction of which toward its source, and the *law of distance*, generating differential action on the fluid particles and the rigid nucleus. The latter obeys the attraction as if exerted upon its centre, the actual motion the earth thus receives being a recognized element in our astronomical tables. The waters nearer the moon than that centre are more powerfully attracted—those more remote less so—than the solid nucleus. Let D be the distance from the moon to centre of the earth, $r$ the radius of the earth, and M* the moon's mass. Then the attraction upon the earth's centre will be $\frac{M}{D^2}$; upon a particle of water immediately under the moon $\frac{M}{(D-r)^2}$; upon a particle opposite $\frac{M}{(D+r)^2}$. The first of these attractions is less than the second and greater than the third; hence the difference between the first expression and the two latter, $\frac{2Mr}{D^3}$ (very nearly), will express, in either case, a force drawing the particles (respectively) *away* from the earth's nucleus. With respect to particles along the great circle to which the moon is on the horizon, there is a compressing component (*i. e. toward* the diameter directed to the moon), expressed by the total attraction, $\frac{M}{D^2}$, into $\frac{r}{D}$, or $\frac{Mr}{D^3}$. This component is due to the convergence of lines of attraction upon centre and upon external point, and is equal to $\frac{M}{D^2}$ into sine, $\frac{r}{D}$, of the minute angle. If we consider an intermediate superficial particle, in any plane, at an angular distance $\phi$ from a radius directed to the moon, we find it subject to *both* these actions, as expressed by components:

$$-2\frac{M}{D^3}r\cos\phi \text{ and } \frac{M}{D^3}r\sin\phi \qquad (a)$$

(in which $\phi$ is counted from 0 to $\pi$ only).

By the superadded foreign components of force ($a$) the spherical form of fluid surface will evidently be *elongated*, the water will be *raised* at the point under the moon and its antipodes, and it will be depressed along the perpendicular circle to which the moon is in the horizon. The disturbing forces, very minute compared to forces ($b$), being equal all around the axis of elongation, the induced figure will be one of revolution, which we may *assume* to be an ellipsoid, prolate and of slight eccentricity. That it should be a surface of *equilibrium*, its normal at any point must coincide in direction with the resultant of the forces. But when we come to consider gravitation as proceeding from an ellipsoid, and not a sphere, its components are themselves modified by the induced change of form; "that is, one of the elements necessary to the determination of the form depends itself on the form" (*Airy*).

Fortunately, the attraction of homogeneous ellipsoids has been determined, and if we develop, with neglect of powers of the eccentricity above the square, and apply the known expressions (*Méc. Cél.*, Bowditch, vol. ii. p. 54; Airy, *Figure of the Earth*, § 23; or Thomson and Tait, § 771) to the earth considered as a homogeneous, slightly-prolate ellipsoid of revolution, we shall find the expressions (E representing the *mass* of the earth)

$$\frac{E}{r^2}(1-\tfrac{2}{5}e^2)\,r\cos\phi,\ \frac{E}{r^2}(1+\tfrac{1}{5}e^2)\,r\sin\phi. \qquad (b)$$

The small increments of these components of gravitation (terms in $e^2$) are due only to the change of form—*i. e.* to the *raised or depressed superficial matter*; and if the earth is not homogeneous, if (covering a solid and denser nucleus) this is water, its *relative density*, $\delta$, must be introduced as a factor. Combining these forces thus modified with the foreign attractions ($a$), the total forces, normal and parallel to the axis of figure, become (since $\frac{E}{r^2}=g$, or gravity)

$$\left[g(1+\tfrac{1}{5}e^2\delta)+\frac{Mr}{D^3}\right]\sin\phi,$$

$$\left[g(1-\tfrac{2}{5}e^2\delta)-2\frac{Mr}{D^3}\right]\cos\phi.$$

Their quotient expresses the tangent of the angle made by *resultant* with axis. The tangent of angle made by the *normal* to the ellipsoid is the quotient

$$r\sin\phi \div (1-e^2)\,r\cos\phi.$$

That there should be equilibrium, these quotients should be identical, and their equalization (developing with neglect of quantities of the second order of minuteness) gives

$$e^2=\frac{3Mr}{D^3g}\cdot\frac{1}{1-\frac{3}{5}\delta}.$$

We find, therefore, that a prolate ellipsoid of revolution of the slight eccentricity thus determined satisfies with sufficient exactness the conditions of equilibrium.

The polar equation of the generating ellipse, referred to its centre, may be written $r^2=\frac{b^2}{1-e^2\cos^2\theta}$, in which $b$ is the *lesser* axis. If we take $a$ for the mean radius of the generated ellipsoid—*i. e.* the radius of sphere of same volume $=b(1+\frac{1}{5}e^2)$, and put $r=a(1+y)$, and substitute in above and omit higher powers of eccentricity, we get (taking, finally, $a$ for unity)

$$y=\tfrac{1}{2}e^2(\cos^2\phi-\tfrac{1}{3}).$$

Substitute the value previously found (for the ellipsoid of equilibrium) of $e^2$, putting $r=1$, and we get

$$y=\frac{3M}{2D^3g}\cdot\frac{1}{1-\frac{3}{5}\delta}(\cos^2\phi-\tfrac{1}{3}), \qquad (c)$$

in which $y$ expresses the amount of elevation or depression of the water, in terms of earth's radius as unity, for any point for which the zenith distance of the moon is $\phi$.

*The moon, as the most influential agent of the tides, is *mentioned*, but what is said applies equally to the sun.

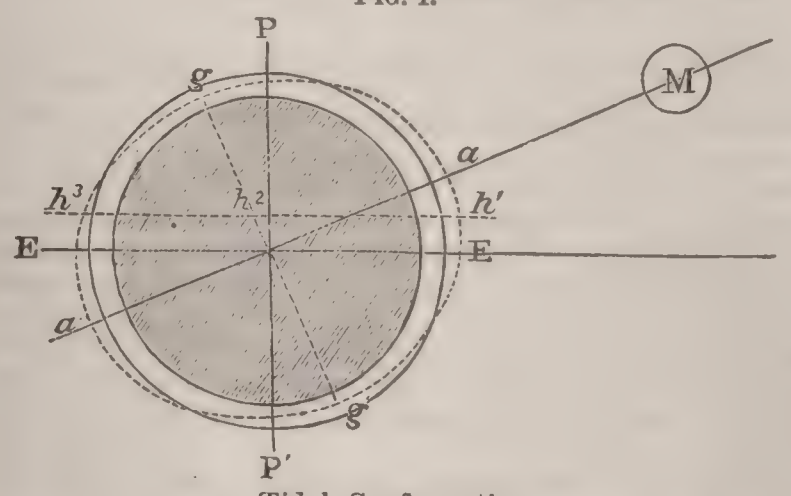
If $\phi$ be zero, or 180°, $y = \frac{M}{D^3 g} \cdot \frac{1}{1 - \frac{3}{5}\delta}$.

If $\phi$ be 90°, $y = -\frac{1}{2}\frac{M}{D^3 g} \cdot \frac{1}{1 - \frac{3}{5}\delta}$.

The maximum elevation of the water is therefore double its maximum depression. In case of the earth, $\delta$ is about $\frac{2}{11}$, and the factor in which it enters amounts to but $1\frac{1}{8}$. But were the earth a *homogeneous fluid throughout*, this coefficient would become $\frac{5}{2}$; and we find in that case the *direct effect* due to the foreign attraction exaggerated in that ratio by the mutual attractions (or want of them) in raised and depressed portions. The factor in question will be omitted hereafter, its effect being understood.

We have now to refer the tidal configuration we have

FIG. 1.




Tidal Configuration.

found to the co-ordinates by which we usually express position on the surface of the earth. Since it revolves daily about its axis P P′, while the configuration remains fixed in relation to the moon, any point of the nucleus, as $h$, will be borne along a parallel of latitude, and will at $h^1$ have, above it, high water—at $h^2$ (when the great circle $g\,g$ is intersected), its lowest water—at $h^3$, high water *again*, but yet of inferior height to that belonging to position $h^1$; unless, indeed, the moon be on the equator, when the two opposite high waters will be equal. In the difference between the high tides $h^1$ and $h^3$ we have what is called the *diurnal inequality*; and the phenomena just delineated indicate the analysis into *diurnal* and *semi-diurnal* tide.

Let $\theta$ represent the polar distance (complement of the latitude) of a fluid particle; $\hat{\omega}$, its longitude measured from a meridian fixed on the earth's surface; $nt$, the angle that this diurnally-rotating meridian makes at any moment with a fixed *celestial* meridian (in which $t$ represents the time and $n$ the angular velocity of the earth's rotation on its axis); $\psi$, the moon's right ascension (measured from the same celestial meridian), and v its declination N. or S. as may be.

The cos $\phi$ of the foregoing equation ($a$) becomes transformed, so that the equation reads thus:

$$y = \tfrac{3}{2}\frac{M}{D^3 g}\left\{ [\cos\theta \sin v + \sin\theta \cos v \cos(nt + \hat{\omega} - \psi)]^2 - \tfrac{1}{3} \right\}.$$

The foregoing may be developed as follows:

$$\text{(I.)}\quad y = \frac{M}{4D^3 g}\left\{ \sin^2 v - \tfrac{1}{2}\cos^2 v \right\}\left\{ 1 + 3\cos 2\theta \right\} \text{ (secular).}$$

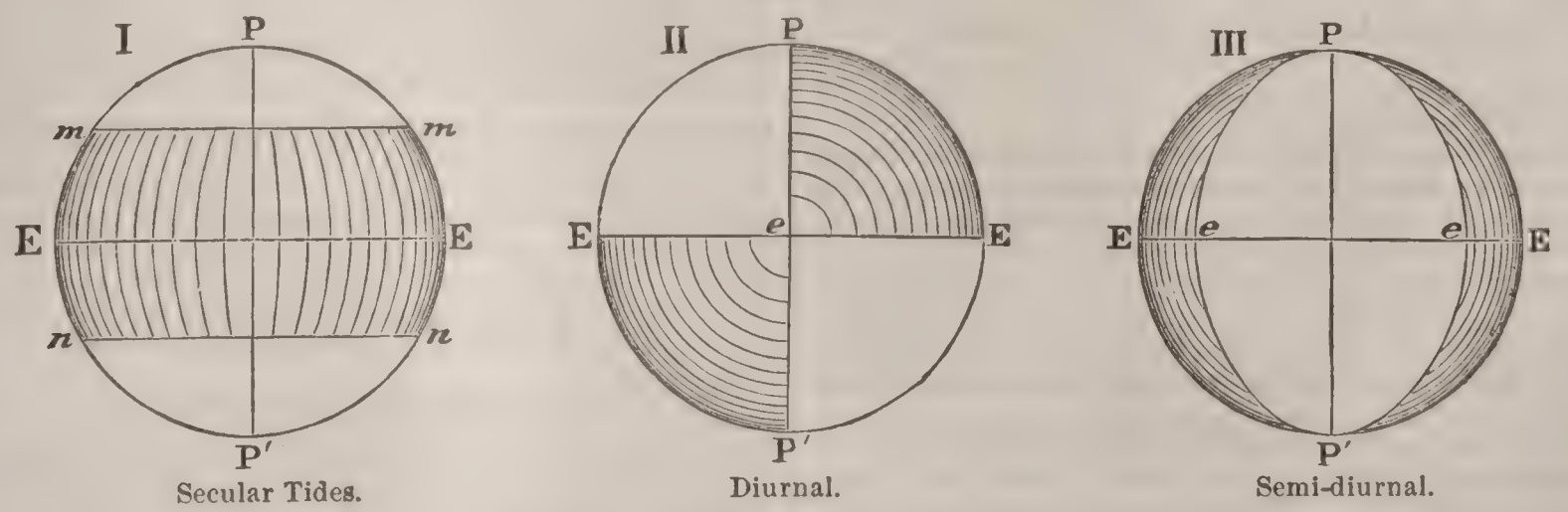
$$\text{(II.)}\quad + \frac{3M}{D^3 g}\sin\theta\cos\theta \sin v \cos v \cos(nt + \hat{\omega} - \psi) \text{ (diurnal).}$$

$$\text{(III.)}\quad + \frac{3M}{4D^3 g}\sin^2\theta \cos^2 v \cos 2(nt + \psi - \hat{\omega}) \text{ (semi-diurnal).}$$

The value of $y$ is thus made up of three terms of marked characteristics, indicated by the diagrams I., II., III. of Fig. 2, on which protuberant portions are shaded. (I.) is independent of the earth's diurnal rotation $nt$, and also of the longitude, $\hat{\omega}$, of the locality. It is the same, therefore, at all hours, and the same throughout each parallel of latitude. It is zero for latitude which makes $1 + 3\cos 2\theta = 0$, or for lat. 35° 16′ (N. or S.); it is negative (a depression) for higher latitudes; it is positive (a protuberance) for the equatorial belt between these parallels. It is least when the moon has its greatest declination, but is the same whether that be positive or negative (N. or S.). It is a *secular* disturbance, depending on the moon's variable angular distance from the equator, and is what would be produced were an imaginary moon and anti-moon each of half the mass of the actual moon distributed in two parallel circles of radius equal to the moon's distance from the earth's axis. "As these circles of matter gradually move each fortnight from the equator to maximum declination and back, the tide produced will be exactly the 'fortnightly tide.'" (Thomson and Tait, *Nat. Philos.*) A "half-yearly" one will also be due to the sun.

The term II. (Fig. 2) goes through all its phases as the

FIG. 2.




Secular Tides. Diurnal. Semi-diurnal.

arc $nt + \hat{\omega} - \psi$ increases from zero to 360°, whether (for the same place) it depends on the *time*-term, $nt$, which thus increases in 24 hours, or (for the same instant) the longitude, $\hat{\omega}$. It gives high tide in the northern hemisphere (*vice versâ* for the southern) when, the moon's declination being northern, the meridian of the *locality* is under the moon, low tide when opposed to it. Its highest or lowest water occurs for the parallel of latitude for which the product $\sin\theta \cos\theta$ is maximum —(*i. e.* when $\theta = 45°$). Its neutral lines are the equator and the meridian P$e$P′ at right angles to that passing through the moon. As depending on the declination, it is maximum when that has its highest attainable value, and vanishes when that is zero.

The *oblateness* of the earth, as having no sensible influence on the amount and distribution of tidal elevation, has not been hitherto referred to. But, as pertinent to this diurnal tide, I remark that if we attribute to Diagram II. the small ellipticity $e$ of the earth, the distortion expressed is a slight turning *of the figure* about an equatorial axis perpendicular to the plane of the diagram through the angle $\frac{3}{2}\frac{M}{D^3 ge}\sin v \cos v$; but if the spheroid were *wholly* fluid, the distortion would be magnified two and a half times (by coefficient of formula ($c$)), and if it have a rotation, $n$, about PP′, then $ge = \frac{5}{4}n^2$, and the above angle becomes $3\frac{M}{D^3 n^2}\sin v \cos v$. If the planes of diurnal rotation (or parallels of latitude) be tilted through the small fraction of this angle denoted by $2e$ (through about $\frac{1}{30}$ *second* of arc)—that is, if they all be that much deviated from true perpendicularity to the axis of rotation—the distortion of Fig. II. will result; hence, *this* is the *internal motion* by which this tidal development would be accomplished in a homogeneous fluid ellipsoid of revolution; a fact important in its relations to the phenomenon of the precession of the equinoxes.

The term III. (Fig. 2) goes through all its phases *twice* while $nt + \hat{\omega} - \psi$ increases from zero to $2\pi$, whether by increments of time for the same place, or without change of time, by following a parallel of latitude. It is a *semi-diurnal* tide. As effected by latitude, it is proportional to the $\sin^2$ of the polar distance of the locality. If we reckon longitude from the meridian under the moon, the neutral (or zero-elevation) lines will be the two meridians P$e$P′; the line of low water will be the meridian at right angles to that which passes through the attracting body.

Thus, we find the total distortion represented by our Fig. 1 to be susceptible of analysis into the three distinct distortions represented by Diagrams (Fig. 2) I., II., III. (*spherical harmonics*), which, superimposed one upon the other, would reproduce it.

In what precedes, the earth has been treated as if it were a truly spherical solid enveloped by water. No account has been taken of the diurnal rotation (except as it

relates to the *manifestation*), none of *the motion required in the waters themselves* to assume the attributed forms.

When we consider diurnal rotation, and the centrifugal force developed by it, the *primitive form* on which the tides are generated must be taken as that of an ellipsoid of revolution equatorially oblate. But this oblateness being really very slight, the tidal developments *upon it* are essentially the same as upon the perfect sphere. Disregarding the motion of the water required to produce them (and depths not *very* many times greater than found in existing seas are sufficient to allow the motions to be disregarded), the forms I., II., III. would be the *actual* tidal forms developed in an ocean *covering the whole earth*.

In the foregoing we have what is known as the "equilibrium theory" of the tides, first indicated by Newton, and developed into its ultimate form by Daniel Bernouilli in his work *Du Flux et Reflux de la Mer*.

When the motion required of the water is taken into account, we have what is called the dynamic theory, or rather what, *if it could be successfully applied to the tidal phenomena*, would be the true theory of the tides; for it is evident that the expressions I., II., III. refer to hypothetical conditions widely different from the real ones. If a particle of fluid be running southward with angular velocity $\frac{du}{dt}$ (in which $u$ is the *displacement in latitude* of a particle of which the normal latitude is $\theta$), with an *acceleration* represented by $\frac{d^2u}{dt^2}$, there must to produce this acceleration be an increment of the pressure (or head) northward, $-\frac{dp}{d\theta}$ (negative sign due to $\theta$ decreasing northward). But if it be running likewise toward the E. with small angular velocity $\frac{dv}{dt}$ ($v$ being displacement in longitude of particle of which $\omega$ is the longitude), its centrifugal force is increased from $n^2 \sin\theta$ to $\left(n+\frac{dv}{dt}\right)^2 \sin\theta$, or by $2 \sin\theta \frac{dv}{dt}$; the horizontal or southern component of this force southward is $2 \sin\theta \cos\theta \frac{dv}{dt}$. Hence,

$$\text{A.} \begin{cases} \frac{dp}{d\theta} = -\frac{d^2u}{dt^2} + 2n \sin\theta \cos\theta \frac{dv}{dt}; \text{ and the similar expression can be found—viz. } \frac{dp}{d\hat{\omega}} = -\sin^2\theta \frac{d^2v}{dt^2} - 2n \sin\theta \cos\theta \frac{du}{dt}. \end{cases}$$

To these two conditions of tidal *motion* must be added another derived from the principle of fluid *continuity*. It is not necessary here to introduce the analytical expression.

It is clear that the pressure, the differential coefficients of which are expressed by equations (A), will (divided by the gravity or weight of the water) be so much height taken from or added to the tidal rise expressed by I., II., III., so that, for the *diurnal tide*, for instance, we should have $y = \text{II.} + \frac{p}{g}$, in which the *diurnal* currents only are considered in calculating $p$.

The secular disturbance expressed by I. is so slowly developed* that (Thomson and Tait, *Nat. Philos.*, § 844) it may in all cases be expressed with sufficient accuracy by I., multiplied by the coefficient $\frac{5}{5-3\delta}$, which, for the case of nature ($\delta = \frac{1}{3}$, nearly) differs little from unity.

The equilibrium configuration indicated by Diagram II. for *the diurnal tide* has its axis of figure at $e$ normal to the plane of the paper; a situation quite incompatible with the relative motion around the earth's axis of this figure as an ordinary wave. It may be regarded, however, as a *stationary* wave† developing itself meridionally between the northern and southern hemispheres, the equator being the locus of its "nodes," and its *phases* varying progressively from meridian to meridian. It can, however, be shown (see *Proceedings A. A. A. S.*, 1876) that (if the ocean be *continuous* and the depth *uniform*) the relative motions of the water due to a shifting of the axis of diurnal rotation of the fluid (as *if* it were a solid shell), through the angle already mentioned, $\frac{3M}{D^3 n^2} \sin v \cos v$ (scarcely more than three seconds of arc for moon), will give values to $p$, as resulting from expressions (A), exactly neutralizing the action of the attracting body to produce the tidal elevations, $y$, of II. If, while uniform along parallels of latitude, there be an increment (or decrement) of depths along meridians proportionate to $\cos^2\theta$, such a shifting of axis through a somewhat different angle will not only neutralize the attractive force, but sustain the abnormal elevations due to the *displacement* of the quasi-solid shell. A slight separation of the axes would (geometrically) require the resulting *displacements*, $u$ and $v$, of the fluid particles in lat. and lon. to be expressed by (C being a small arbitrary constant)

$$u = C \cos(nt + \hat{\omega} - \psi); \; v = C \frac{\cos\theta}{\sin\theta} \sin(nt + \hat{\omega} - \psi);$$

and if *the depth be uniform*, and C made equal to $\frac{3M}{D^3 n^2} \sin v \cos v$, we shall have from the expressions (A)—

$$\frac{p}{g} = -\frac{M}{D^3 g} \sin v \cos v \sin\theta \cos\theta \cos(nt + \hat{\omega} - \psi),$$

which exactly neutralizes II. (the lunar attraction), and reduces $y$ to zero. The expressions just given for the displacements $u$ and $v$ indicate an elliptical orbit, very much elongated meridionally as we approach the equator (where it is purely a *meridional* oscillation) to each particle. It appears by the foregoing that the motion in such an orbit more or less completely neutralizes the diurnal (II.) tide-producing force.

In what precedes is found the *rationale* of Laplace's discovery, that for uniform ocean-depths there is no diurnal tide. It relates to a continuous ocean, and depends upon the exclusion of the right ascension and *declination motion* of the attracting body. A continuous change in the angle of separation is made necessary by the latter—a change which cannot be effected without disturbing this equalization of pressures by which the diurnal tide is neutralized. The right-ascensional motion is even more incompatible with the theorems. This celebrated *dictum* expresses, therefore, a mere mechanical theorem alien to essential conditions under which the "tides" of nature are generated.

With regard to the semi-diurnal tide, III., supposing a uniform depth to a continuous ocean, or an ocean limited by parallels of latitude equidistant from the equator, or, finally, a depth increasing from nothing at the poles, with the $\sin^2$ of the polar distance, we find that elevations (or depressions) and motions corresponding to a *wave* of semi-diurnal period having the same neutral lines as Fig. III., fulfil the condition $y = \text{III.} + \frac{p}{g}$. But, curiously, for small or even moderate depths these elevations and depressions under certain circumstances change places. "*By a remarkable singularity, the low water takes place when the two bodies*" (sun and moon) "*are in the meridian, and the high water when they are in the horizon; so that the tide subsides, at the equator, under the body that attracts it.*" (*Méc. Céleste*, Bowditch.)

The kind of motion required for this tide may be inferred by reference to Diagram III., considered as representing a wholly fluid spheroid revolving around its axis P P′. In *this* case it is that of a minute approximation of normally equidistant meridional planes toward the meridian under or opposite the moon (where there is high tide), and an eloignment of those at right angles (low tide). As a consequence, the former are moving slower, the latter faster, than the earth's rotation; both, however, by differences quite inappreciable. If there be, however, a solid nucleus with uniform ocean depth, and we conceive the water down to the bottom divided by equidistant meridians, their relative motions to produce the same elevations will become quite sensible, and, through the equations (A), give rise to *meridional* motions which importantly augment the development of these elevations. The waters on the meridians of low tide will be running *east*—those on meridians where there is high water running *west*, or retrograde; at the place of mean elevation the current will be slack. And were it the question of a cylindrical instead of a spherical surface, this would be throughout a true wave-motion, as it will be so quite nearly on the earth's surface between the tropics, where the elliptical orbits of the fluid particles lie nearly in *vertical* planes, of which the range from low to high water is the dimension of the conjugate diameter. The single case which furnishes a finite integral (*i. e.* when the depth increases from pole to equator *as* $\sin^2\theta$) illustrates this. The meridional motion disappears at the equator, and the oscillation becomes that of a true wave. This motion, increasing the centrifugal force at place of low water and increasing it at high water, has the same tendency as the superficial elliptical motion of the diurnal

* This stationary wave, rising and falling synchronously with the waxing and waning of the forces which generate it, would tend, however, to an indefinitely increased development, as Laplace's analyses show, were it not for the counteracting resistances of friction, etc.

† The motion (progressive) of the folds of a shaken carpet, or of the waves seen rolling up our sea-beaches, is, as regards *form-motion*, illustrative of the ordinary wave; that of a vibrating string with "nodal points" (see art. VIBRATION, Fig. 6) illustrates the stationary wave.

tide to *diminish* the tidal elevations; but this effect is more than counteracted by the rapidly-increasing meridional oscillations of the higher latitudes, which exaggerate the *vertical* oscillations at the equator. It would appear, therefore, that, near the equator, besides the wave just described, there was superadded a *stationary* wave with crest (in its different progressive phases) along the equator, the superposition of which exaggerates the development of the other. The analysis (see Airy, *Tides and Waves*, § 100) shows they increase there rapidly as the equatorial depth diminishes toward seven miles (about), when, theoretically, they become infinite; that with *less* depths, passing (analytically) through infinity, they change signs, or they are *reversed*—a peculiarity already described in the language of Laplace.

From the foregoing we readily conclude that the "dynamic theory," the results of which have been sketched, is equally at fault with the equilibrium theory as an exponent of the tides of the actual oceans. Indeed, to quote the language of its illustrious author, "*The irregularity of the depth of the ocean, the manner in which it is spread over the earth, the position and declivity of the shores, their connections with the adjoining coasts, the currents, and the resistances which the waters suffer, cannot possibly be submitted to accurate calculation, though these causes modify the oscillations of this great fluid mass.*" (*Ibid.* See also article LAPLACE.)

The theoretical investigation of the celebrated Dr. Thomas Young appeared nearly at the same time as the last (5th) volume of the *Mécanique Céleste*. "He distinguishes the results of the *forced* and *free* oscillations of the sea; the former resulting from the direct action of the sun and moon, combined with the rotation of the earth, and whose periods of rise and fall are determined solely by those external causes (external, I mean, to the mass of the ocean); the *free* waves, on the contrary, derived from the former, are transmitted with velocities depending on the mechanism of the fluid itself, on its depth, and on the resistances arising from friction to which those motions are exposed." This work of Dr. Young's, rather a sketch than a full development (*Encyc. Brit.*, 6th, 7th, and 8th eds.), anticipates Mr. Airy's *wave-theory*, and though not carried out to the same detail of application, the results are "generally coincident."

It remains to notice the "wave-theory" of Mr. Airy (*Encyc. Metrop.*). The link between "waves" and the "tides" is found in the determination of the law which defines the "forced" wave, for which the periodically waxing and waning action of the sun or moon shall supply the needed force. The dynamic theory, indeed, seeks this in the most general manner; but, except in a few restricted cases, it fails, or rather it attempts more than our mathematics can carry out and give expression for. It is easily accomplished for *canals* of uniform section; and by considering ocean tides as "waves in canals," expressions for their development can be obtained with a completeness of detail far exceeding what the "dynamic theory" has yielded. "Its great and important defect," in the words of its author, "as applied to the explanation of the tides of the earth, is that, in the case of nature, the water is not distributed over the surface of the earth in canals of uniform breadth and depth, or in any form very nearly resembling them." But, besides ocean tides, the wave-theory deals with an important class of tidal phenomena with which none other can deal—viz. the propagation of free waves, originating in the ocean tides, up tidal rivers and estuaries.

A reference to the article TIDES, OCEANIC WAVES, etc., or a glance at the "tidal charts" of an atlas of physical geography, will show that even our Atlantic does not offer the longitudinal scope necessary for the large semi-diurnal tides which are observed on its shores. "They are but the offspring of the great *parent tide* from the Pacific" (or rather the great Southern Ocean), and as *waves* they reach our shores. Hence a "wave-theory" would seem to be the true instrument of analysis. But Mr. Airy tells us "the power of mathematics fails totally in the attempt to express the transmission of the tide-wave or waves through the Atlantic Ocean. It has some analogy to a canal, . . . but not so much as to enable us to predict what will become of the tide-wave in its general progress; and of course the analogy fails totally as regards the effect of these very important features which have no existence in a canal; huge promontories projecting into its sides, or vast bays opening large lateral expanses for the spread of the tide-wave."

Dr. Young demanded for the application of his theory a "series of minutely accurate observations," of which there was at that date an almost absolute destitution. Mr. Lubbock took up this matter in 1829 (see *Philos. Trans.*, 1831), and was soon followed by Mr. Whewell. Their joint researches extend through ten successive volumes (1831–44) of the *Philosophical Transactions*. To them we are indebted for the chart of co-tidal lines (see article TIDES), first sketched by Dr. Young, for comparison of theory with observation at certain places, and for investigation of the diurnal tide. The "theory" with which their observations are compared is the equilibrium theory. "By referring the tide not to the moon's preceding transit, but to one of one, two, or more days preceding, the theory is brought in near accordance with observed irregularities in the heights and times of the tides due to changes in the moon's parallax; but in one respect it is unsatisfactory, . . . for at the same place different anterior epochs are required for the several irregularities."

Both the "equilibrium" theory (Bernouilli) and the "dynamic" theory (Laplace) neglect friction and other resistances to the motion of the water. Under this aspect of the problem the foreign attraction *does no work*. Indeed, the resulting tides themselves are not *their* work. They are motions which once *initially established* will be *maintained*, the foreign attraction being merely the agent of *interchange of vis viva* between different parts of the fluid mass. Such, at least, is the state in which Laplace ultimately leaves the problem—a defective basis for an otherwise defective solution. *Hence* the crests (positive or negative) of the tidal elevations are always exactly under the attracting body. But when *resistances* are taken into account, the foreign attraction *must do work*;* but to do "work" it is essential that the tidal crests should *lag behind* the meridian of the luminary. Dr. Young has exhibited by analysis this "lagging," of which he says, "for this simple reason only (*i. e.* the *resistance* encountered) the highest spring tides ought to be a day later than the conjunction and opposition of the luminaries." Mr. Airy's wave-theory also exhibits it. Besides which, there is the retardation due to the time of travelling of the tide as a free wave to the point of observation from that part of the ocean where it is actually generated. In the Atlantic the diurnal tides are believed to come mainly as waves from the great Southern Ocean, and to be one and a half days old when they reach our shores.

The great continental barriers are *meridional* in their extension. They lie across the track of the semi-diurnal waves in all but high southern latitudes, in *non*-accordance with the conditions which the Laplace solutions impose. The semi-diurnal tides *of these oceans* could only be theoretically arrived at by the methods first pointed out by Dr. Young. The Southern Ocean presents, however, zones of continuous longitudinal water-surface, and from these in great degree our Atlantic tides are believed to proceed; the great exaggeration of height they show at certain localities being attributed to the action upon them, as "free waves," of shore or bottom configuration.

The diurnal wave has been spoken of as a "stationary wave" of meridional development. For such development both the great oceans offer ranges almost from pole to pole. They furnish scope for the development of this tide on the equilibrium theory—they are wanting in the conditions requisite to the very peculiar motion† of Laplace's dynamic theory.

"If," says Mr. Airy, "we look to the Pacific Ocean with reference to diurnal tides, and consider the Southern Sea as a part of it, we seem to have a case which possesses considerable analogy with Laplace's assumption. Yet it is remarkable that here we appear to find a more complete failure than anywhere else of Laplace's celebrated result as to the non-existence of diurnal tide (all the large diurnal tides being in that sea). It is true that this failure might be explained by supposing the depth of the sea to be extremely unequal."

We have seen that in order that there should be *rise* or *fall* of this tide, according to Laplace's solution, a *continuously* increasing (or decreasing) depth from equator to poles is demanded, they being due to the *bodily* moving of ocean masses as rigidly solid *on to* shoaler (or deeper) sea-bottoms. *Such* a tidal rise and fall is evidently out of the question, except under the absolute and complete existence of the conditions Laplace's solution is based upon; and it is moreover evident that mere irregularity of bottom, *without* continuously progressive shoaling or deepening from equator to poles, would not *alone* greatly interfere with Laplace's result for that case.

On our Pacific coast, and almost everywhere in the Pacific, the diurnal tide is of considerable magnitude, and as well marked and regular in its developments as is the semi-diurnal tide. On the Atlantic coast, where the regu-

*Hence the "retardation" of the earth's rotation by tidal friction, as propounded by M. Delaunay to account for *a part* of the moon's *apparent* "acceleration," for which Mr. Adams has shown Laplace's discovery (see LAPLACE) does not account.

†The requisite shifting of rotation-axis of the water, as that of a continuous and solid shell, is of course out of the question; nevertheless, throughout these oceans the shore outline is not wholly incompatible with the requisite horizontal elliptical orbits of the fluid particles.

lar semi-diurnal tides are large and easily reduced to the forms prepared by Lubbock and Whewell, the diurnal, though easily recognized at certain periods, when it is quite characteristic, is in general difficult to trace. Portions of our Gulf of Mexico coast (*e. g.* mouths of the Mississippi) exhibit the peculiarity of an almost *exclusively* diurnal tide of small range (about 1¼ feet). It is beautifully illustrative of the equilibrium theory, disappearing, and shifting as it should its interval from lunar culmination, 12 hours (about), with the moon's passage of the equator. It evidently has its origin in the Atlantic, whence it is propagated as a wave; the elimination of the semi-diurnal being conjecturally explained by the supposition that the two separately-propagated waves through the Florida and Yucatan channels arrive with epochs differing by a quarter of a day, and thus neutralize each other.

The diurnal tide is observable (though of relatively very inferior magnitude) on the eastern and Channel coasts of England, and throughout the coast of Ireland, "approaching from the W., and flowing round the island N. and S., enters the Irish Sea at both extremities, meeting off the coast of Down and Antrim." Their range is slight (2 to 12 or 15 inches), while the semi-diurnals in the Irish Channel range from 10 to 20 feet. A discussion of these tides by the Rev. Samuel Haughton will be found in *Transactions of the R. Irish Acad.*, vol. xxiii. 1855, based on observations styled "the most perfect that have ever been made on so large a scale and for such a length of time" (*i. e.* twelve to sixteen months).

On the equilibrium theory the maximum elevation due to the sun would be 0.6 foot (in which the small effect of the attraction of the water itself is considered), and that due to the moon 1.35 feet. The maximum depressions are one-half the elevations, and, taken together, the greatest *range* of height would be nearly 3 feet.

If we consider separately the absolute maximum of diurnal and semi-diurnal elevations (expressed by II., III.) as functions both of $\theta$ and $\tilde{\omega}$, and of the declination v (which cannot *exceed* 23° to 28°), we find them to be about as 2 to 3. The existing ocean configurations are apparently quite as favorable to the development of the diurnal tide as of the other; the above fractional ratio is not, therefore, small enough to account for the comparative inconspicuousness of this tide. That Laplace's theorem of *nil* diurnal elevations does not really apply to the case, I have shown; but nevertheless there is a strong presumption that the motion developed in our actual oceans is similar to that which his theorem implies, and that it, to an important degree, neutralizes the diurnal tides.

Since the observed tides are due to the joint action of the sun and moon, and their individual effects are (on the equilibrium theory) directly proportional to their respective *masses*, and inversely to the cubes of their *distances*, the tidal phenomena furnish a clue to the ascertaining of their masses relatively to that of the earth. Newton made, on the imperfect data at his command, an estimate of $\frac{1}{40}$th as ratio of moon's mass to earth's. Laplace, after an elaborate investigation founded on observations made at Brest (*Méc. Céleste*, vol. v), fixed the ratio at $\frac{1}{75}$th. Mr. William Ferrell of the U. S. Coast Survey has made a similar investigation based on observations in Boston harbor, with result not greatly different. A ratio of $\frac{1}{80}$th is, however, in better harmony with other astronomical phenomena.

Although theory fails in exhibiting either the actual development of the tides or the time of their culminations, there is in the equilibrium theory of Bernouilli and the dynamic theories of Laplace, Young, and Airy, a perfect confirmatory demonstration of their *cause*, and such a general *resemblance* to actual developments as to make them valuable in reducing observations and in establishing empiric formulæ for particular ports. And in this respect none has thus far done greater service than the much-decried equilibrium theory—a service which has been hinted at in alluding to the works of Messrs. Lubbock and Whewell. The volumes of the U. S. Coast Survey reports from 1851 to the present date furnish numerous examples of the adaptation of their labors to the reduction of tidal observations made throughout our extended coasts, along which, Atlantic, Pacific, and Gulf, every variety of tidal phenomena finds place for characteristic exhibition. The Coast Survey charts of our seaports give, in a tabular form, the "corrected establishment," "rise of highest observed tide," "fall of lowest tide," "mean low water of spring tides"—all referred to a fixed plane, usually that of ordinary low water. Also the "mean rise and fall of spring tides," "mean rise and fall of neap tides," "mean duration of rise," "mean duration of fall," and the "mean duration of stand." They also give a table of "tidal currents," showing their "set" (direction) and "drift" (velocity in nautical miles), for the more important localities embraced in the chart.

The interval between the moon's passage over the meridian of a place and the time of high water is styled the "establishment" of the port, or the luni-tidal interval—a constant as regards *lunar* high water. As the *actual* high water depends upon the combination of the lunar and solar tides, this interval is subject to a variation known as the semi-monthly inequality. The mean of all the luni-tidal intervals for this period is called the "mean" or "corrected" establishment, to distinguish it from the "vulgar" establishment, which (the observed interval at full and change) is that which belongs to the lunar (or solar) tide taken by itself. J. G. Barnard.

**Till'man** (Samuel D.), A. M., LL.D., b. at Utica, Oneida co., N. Y., Apr. 1, 1815; graduated at Union College in 1831; studied law at Canandaigua; practised for several years there and at Seneca Falls, but removed subsequently to New York; gave up his profession, and devoted himself exclusively to the study of science; was a prominent member of the American Association for the Advancement of Science; became a member of the American Institute in 1863, and afterward its corresponding secretary and editor of its *Transactions*. D. Sept. 4, 1875. Possessing a remarkably active and inventive mind, he was the originator of a number of ingenious contrivances, among which may be mentioned a rotating planisphere to serve as a substitute for the artificial globe, for the use of schools; and also a revolving musical scale, called the tonometer, designed to illustrate the theory of temperament, and exhibiting visibly the relations between the true and tempered notes in every key.

**Timber and Timber-Trees.** Although the more important of these have been treated of or mentioned under their names or under appropriate heads, yet the most prominent species of timber-trees used in this country may here be referred to, although very briefly.

Indigenous North American Timber-Trees.—(1) *Coniferous Division.*—Of those of the Atlantic U. S. and Canada, the most important, and for its uses the best in the world, is white pine (*Pinus strobus*), in England called Weymouth pine. Hard-pine lumber, variously called yellow pine, pitch pine, etc., is most largely furnished, and of best quality, by *P. australis*, the long-leaved pine of the Southern States. *P. rigida*, the Northern pitch pine, both in the Northern and Southern States furnishes a similar but inferior and generally smaller timber; and excellent hard pine is yielded by the short-leaved pine (*P. mitis*); while the loblolly pine at the South (*P. tæda*) and the red or Norway pine at the North (*P. resinosa* or *rubra*) furnish a softer and less resinous lumber. Larch or hackmatack (*Larix Americana*) of the North furnishes a very valuable lumber, important in shipbuilding. Next are the spruces, with wood tougher than white pine, but more liable to shakes and splits. Black spruce (*Abies nigra*) has the widest range and yields the best lumber, especially prized for spars. White spruce (*A. alba*) is a smaller tree, and the wood inferior. Hemlock spruce (*A. Canadensis*) furnishes at the North a valuble but coarse lumber, very liable to shakes and of moderate durability. The balsam-firs, both the Northern species (*A. balsamea*) and that of the mountains in the South (*A. Fraseri*), are of no account for timber, being small trees, with soft wood, lacking strength and durability. Of the cypress tribe, the bald cypress of the Southern States (*Taxodium distichum*) furnishes lumber of great size and much durability, but light and shaky; while the arbor-vitæ or white cedar of the North (*Thuja occidentalis*) and that of the Middle and Southern States (*Cupressus thyoides*) yield small timber of exceeding durability, especially for posts; and red cedar (*Juniperus Virginiana*) furnishes a red and fragrant fine-grained wood of the greatest durability and value. The yew occurs as a tree only in a limited part of Florida, as does its relative the stinking cedar (*Torreya taxifolia*), rendering their excellent timber practically unimportant.

In the Pacific States and Rocky Mountain region the coniferous trees are numerous, and some of immense height and girth. Of soft-wooded or white pines no one equals our white pine of the East. The sugar pine (*Pinus Lambertiana*), with its immense trunks, takes its place, but the wood is much coarser-grained. *P. ponderosa*, with its heavy wood (as the name denotes), furnishes excellent hard-pine lumber, less resinous than our Eastern species; and there are several other species intermediate as to the character of the wood. For spruces, the *Abies Douglasii* or Douglas spruce, of Oregon and California, is far the best of the race, as well as the largest. The hemlock spruce and the larch are represented by species very like the Eastern; while the Menzies spruce (*A. Menziesii*) surpasses our black spruce; and our balsam-firs are represented by several nobler species, which furnish better lumber. The cypress tribe is represented by several cypresses of considerable value; also in Oregon and northward by an arbor-

vitæ (*Thuja gigantea*), vastly surpassing the Eastern species in size and value for timber, and in California by the famous redwood (*Sequoia sempervirens*), the light and reddish wood of which is incomparable for building purposes and excellent for interior finish. (For an account of this tree, and of its even more gigantic relative (*S. gigantea*) of the Sierra Nevada, see article SEQUOIA.) The yew (*Taxus*) of the Pacific coast is very like the European.

(2) *Amentaceous Trees.*—The oaks are the most important, and the most valuable species is the white oak (*Quercus alba*), which in the Atlantic States takes the place of the *Q. robur* of Europe. It grows to a height of 70 to 80 feet and a diameter of 6 or 7 feet, and yields handsome logs. The wood is of a pale reddish color, straight-grained, compact, tough, strong, durable, and shrinks but little. It is used for frames of structures where strength and durability are required, coachmaking, coopering, shipbuilding, and for a great variety of purposes in the domestic arts. For cabinetmaking and interior decoration it is highly valued. The other annual-fruited species come next to this in value—viz. chestnut-oaks, post-oak, bur-oak, etc. At the South, along the coast, the live-oak (*Q. virens*) represents a peculiar type, and for shipbuilding is prized above all others, but it does not give large timber. Its height is from 40 to 50 feet; diameter, 1 to 2 feet. The wood is of a yellowish color when first cut, which deepens to a dark brown with age; it is hard, tough, strong, heavy, and very difficult to work, on account of the grain being waved or twisted. The pores are minute, and the silver-grain very bright and distinct. The biennial-fruited oaks have a more porous wood, unfitted for casks to hold liquids, less durable, and less strong. The best of them—viz. black oak (*Q. tinctoria*)—is found on poorer soils than the white oak, and grows to the height of 80 to 90 feet, with a diameter of 4 to 5 feet. The wood is reddish in color, porous, and coarse-grained. The outer bark is greatly used for tanning, and the inner bark, called quercitron, for dyeing. Red oak (*Q. rubra*) is used for similar purposes, though it is inferior in quality. Spanish oak (*Q. falcata*) and willow-oak (*Q. Phellos*) are superior; and so are laurel or shingle oak (so called because the wood was used for shingles). California and Oregon have oaks of peculiar species, some of them valuable timber-trees, but none which equal white oak. Chestnut (*Castanea vesca*) is a large tree, of the Atlantic States only, essentially of the same species as the European, yielding a coarse-grained and porous but durable lumber, easily worked, and valuable for wainscoting, etc. The medullary rays cannot be traced in it. The American beech (*Fagus ferruginea*) has a very close-grained and hard wood, like that of the European species, of which joiners' tools are made. Iron-wood (*Ostrya*) and horn-beam (*Carpinus*), as the names denote, have very hard wood, but they are rather small trees, peculiar to the Atlantic States, with corresponding species in the Old World. The hickory, in several species, is peculiar to the Atlantic States. The shell-bark or shag-bark (*Carya alba*) is the best, but all have a very tough and hard wood of remarkable strength, much prized for tools and the like. The walnut (*Juglans*) is known in the Atlantic States by two species—*i. e.* white walnut or butternut (*J. cinerea*), the favorite wood for gunstocks and of late for wainscoting and cabinet-work, but a small tree; and black walnut (*J. nigra*), the most important of our woods for the cabinetmaker, a tree of ample size. The heart-wood is of a violet color when first cut, but upon exposure becomes dark. It is far superior to the European walnut; it is strong, tough, durable when seasoned, and not apt to warp and split. It has a fine and compact grain, and is susceptible of a high polish. The birches are valuable timber-trees of the second class, having a hard and fine-grained wood, valued by cabinetmakers. Of the five species which in the Atlantic States and Canada form good-sized trees, the black or sweet birch, sometimes called cherry birch (*Betula lenta*), is most prized, being excellent for furniture; and yellow birch (*B. lutea*) is equally good, but lighter in color. Poplars or cottonwoods (*Populus*) make large trees, as do some willows, but the wood is weak, soft, and of no durability.

(3) *Other Deciduous Trees.*—Only the most important can be mentioned. Plane tree, buttonwood, or sycamore (*Platanus occidentalis* of the Atlantic States, and a corresponding species in California) deserves notice on account of the size which the trunk may attain, but it soon becomes hollow, and the wood, which is handsome on account of the strong silver-grain, is useless for the purposes it would otherwise be well adapted for. The laurel family is represented in the East by the sassafras, and in California by a laurel (*Tetranthera Californica*), the light-colored and variegated wood of which is extremely beautiful. Elms are given only to the eastern side of our continent, and white elm (*Ulmus Americana*) is the most noted species, a large tree, with handsome but not very durable wood. Slippery elm (*U. fulva*) is a smaller tree, and the reddish wood is tougher. The ashes are timber-trees of the first class, of which there are six species in the Atlantic and two in the Pacific States. The yellowish wood is very firm and tough, but comparatively light, straight-grained, and easy to work. White ash (*Fraxinus Americana*) is the best and most used, and is unexcelled for purposes where strength, elasticity, and durability are needed, and it is preferred to chestnut for interior finish. Black ash (*F. sambucifolia*), a smaller tree, has tougher wood, easily separable into layers, and is therefore used for hoops and strong basket-work. American holly (*Ilex opaca*) of the Atlantic States, like the European species, has a very fine-grained and compact white wood, used for ornamental cabinet-work, wooden screws, etc. Tupelo, pepperidge, or sour-gum trees (*Nyssa*) of two or three Atlantic States species, and sweet-gum (*Liquidambar styraciflua*), mostly have a very tough wood, of various uses, but not much used as timber; and flowering dogwood (*Cornus florida*), although the wood is prized, is seldom large enough to form a timber-tree. The Kentucky coffee tree (*Gymnocladus Canadensis*) is a stately tree, of peculiar aspect, with handsome rosy or brownish wood, well suited for cabinet-work. Honey-locust is of little account, but the true locust (*Robinia pseudacacia*) affords a timber equal to live-oak and red cedar in durability, especially valued for treenails and in naval architecture generally. Maples are fine trees, of which one species on the Pacific coast and two or three on the Atlantic side are important for timber. Sugar-maple (*Acer saccharinum*) is much the most valuable, having a hard and close-grained wood, of light color and silky lustre when polished, and the varieties called "curled" and "birdseye" maple are greatly prized for cabinet-work. The soft maples, so called from the character of their wood, are the white or silver maple (*A. dasycarpum*) and the red or swamp maple (*A. rubrum*), the former a large and the latter a medium-sized tree, the wood of which is used for lasts, for carvings, etc. Lindens or limes, here commonly called basswood, of which there are two well-marked species in the Atlantic, but none in the Pacific States, are first-class forest-trees for size, and their soft and white fine-grained wood is excellent for coach-bodies, interior of cabinets, and various purposes where lightness with moderate strength is demanded. Tulip tree (*Liriodendron tulipifera*), sometimes called white-wood, but in the Western Atlantic States (where it abounds and develops its noblest proportions) commonly known as poplar, has a light and soft wood, like that of the linden, but more valuable and much more extensively employed for the same purposes. This noble and most valuable tree is of the magnolia family, which in the cucumber tree and in the great-flowered magnolia of the Southern States furnishes two other fine trees of the same character of wood, but of comparatively small use.

EXOTIC TIMBER TREES.—Those of Europe need not be enumerated, as they are analogues of our own—*i. e.* different species of pine, larch, spruce, oak, beech, elm, ash, linden, etc., only the chestnut being the same or nearly so—but are far fewer in species and in kind, tulip trees, gum trees, locusts, hickories, sassafras, bald cypress, redwood, etc., being wholly wanting. As to foreign woods of tropical regions imported for the use of cabinetmakers—such as mahogany, Spanish cedar (*Cedrela odorata*), rosewood, lignum-vitæ, and the like—they are mostly treated under their names in the pages of this work. (See PRESERVATION OF TIMBER and ARBORICULTURE.)

ASA GRAY.

**Time Signals.** In 1852 the astronomer-royal, with Mr. C. V. Walker, began the transmission of standard time from Greenwich to London by telegraph. The system thus originating has gradually spread until all the principal cities of England are furnished with standard time from some one of its observatories. On the Continent as well clocks are controlled and the time furnished from the astronomical observatories. In the U. S., through the exertions of Prof. Abbe at Cincinnati, Prof. Langley at Pittsburg, Prof. Winlock at Cambridge, and the U. S. Naval Observatory at Washington, the matter has been brought before the public. At the present writing the observatories at Washington, Cambridge, Allegheny, Cincinnati, Albany, and Chicago all furnish the standard time by telegraph to the railroads and jewellers of their locality. Two methods of transmitting time are in common use. A standard clock at an observatory, which is kept as nearly free from error as possible, and has its small error corrected daily, so that its face indicates the true mean time it is desired to furnish, breaks or makes an electric current automatically each second. This circuit, in one method, passes through the various cities or buildings which are to receive the time. By merely introducing a number of electro-magnets the beats of the standard clock are audible at various points through-

out the entire circuit. The beginning of each minute is indicated by the omission of one clock-beat, and the beginning of the five minutes is indicated by the omission of any other given number of clock-beats, these omissions being made automatically by toothed wheels in the standard clock. In the second method the clocks are placed in the same circuit as the standard clock, and the electric current is used as a regulating power by causing a helix so placed in the clock to be controlled as to alternately encircle two magnets placed with their opposite poles toward each other, and attached to the bottom of the pendulum, to attract and repel the two magnets. This latter method, known as the Jones plan, has superseded the methods in which the electric current passing through the standard clock was used as a motor-power. The controlled clocks in the Jones system, in case a circuit is interrupted, run on, merely accumulating their individual errors, since they are clocks of the ordinary construction with the addition of the electric apparatus. Where electricity is the motor, however, and the current is interrupted for any reason, the clock stops running entirely. For long circuits, especially over several hundred miles, the introduction of the electro-magnet into the same circuit with the standard clock is found to be the simplest and most effective method of distributing standard time. For distributing it over large areas at any fixed moment a gun may be fired, or a bell may be struck, or a ball may be dropped from the top of a flagstaff, by means of the electric current, controlled automatically by the standard clock. (See a valuable paper on this subject by W. Ellis, F. R. A. S., *Horological Journal*, Apr., 1865; also *Nature*, vol. xi. p. 431; *ibid.*, xiv. pp. 50 and 110—all on the Greenwich time system; *Amer. Jr. Arts and Sci.*, vol. cviii. p. 377, on the Allegheny system of electric time signals, by S. P. Langley; *Bulletin de la Société des Sciences naturelles de Neufchâtel*, Dec. 9, 1875, M. Hirsch on the system at Berne for time signals.)

L. Waldo.

**Tin, Geology of,** or **Tin-Mines.** Though found abundantly in certain localities, and very extensively used by all civilized nations, tin is more sparsely distributed over the earth's surface than perhaps any other of the useful metals. It also has a very limited geological range, and is almost always found in the oldest rocks. The most important mines of tin are those of Cornwall, England, Island of Banca, Malayan Peninsula, and Australia. The Cornwall mines have been worked from the time of the Phœnicians, and for nearly 2000 years were the chief source of supply of this metal to the world. Here, as elsewhere, the tin occurs in the form of oxide (cassiterite), and it is found in the surface deposits, in veins, stock-works, and contact-deposits in crystalline rocks—granite, porphyry, and slate, called by the Cornish miners respectively *growan*, *elvan*, and *killas*. The tin ore of Cornwall is associated with copper and gold, both of which have contributed so much to the revenues derived from the mines that without their aid they would long since have become unprofitable. The excavations are becoming constantly deeper, mining more expensive, and the yield of tin diminishing, so that the markets of the world are already chiefly supplied from other sources.

From its great weight and indestructibility, the oxide of tin is left behind and concentrated by the erosion of the rock which contains it; hence, in all tin-producing districts a large part of the ore collected is obtained from the superficial deposits. This is called *stream tin*, as it is specially found in stream-beds, and is washed out of sand, gravel, and clay much as gold and platinum are obtained. The tin of the island of Banca and the peninsula of Malacca is obtained exclusively from the surface-deposits, where it has accumulated by the decomposition of the underlying granitic rocks which formed its original matrix. The process of mining in these localities is very simple, and consists merely of the excavation of a series of trenches or pits, by which all the surface materials are worked over for the removal of the tin ore they contain. The greater part of the work is done by Chinese laborers, and the method pursued is not unlike that followed in the gold-diggings of California. In commerce, the tin of the Malay Peninsula is known as *Straits tin*, while that from the island of Banca, a Dutch colony, is known as *Banca tin*; this latter is chiefly sold at auction at Rotterdam and Amsterdam.

Quite recently very extensive deposits of tin have been found in Australia and Tasmania. Those of the latter country have not yet been fully explored, but the Australian tin-fields are already extensively worked, and are producing large quantities of metal. The geological position of the tin ore in Australia is apparently similar to that of Banca—viz. it is sparsely distributed through granitic rocks, which have been decomposed at the surface, and the tin ore is now obtained by "diggings" in the superficial material. The tin-ground of Australia is said to extend along the MacQuarie River for 150 miles, and the quantity of tin obtainable there is reported to be so great that the entire demand of the civilized world could be supplied for an indefinite period from that source.

Tin occurs in several localities upon the continent of Europe in sufficient quantity to make it an object of exploitation, as at Altenburg and Zinnwald in Saxony, etc., but the quantity produced here is insignificant as compared with that derived from the Cornwall and East India mines. In France and Spain tin ore has been discovered, but the annual production of these countries amounts to but a few tons.

The American continent seems to be remarkably deficient in the ores of tin, and at present the entire consumption of that metal in this country is supplied from England and the East Indies. Tin is known to occur, and perhaps in considerable quantity, in Guanuni in Bolivia, but it is only worked to a trifling extent. In North America the only tin-deposits yet discovered which can have any economic importance are those of Durango in Mexico, and we have no accurate information in regard to the quantity obtainable there. A few tons of stream-tin have been collected from hasty and superficial excavations, and this has been sent to San Francisco, but the expenses of transportation and the unsettled state of the country make it impossible to work the mines there profitably at present.

Within the U. S. tin is known to occur at what is called the Temescal Mine in the southern part of California and in some parts of Montana, but up to the present time no considerable quantity of ore has been found in either locality. In the Eastern States tin exists in Maine, New Hampshire, and Massachusetts, but only as a mineralogical curiosity. The so-called tin ore of Central Missouri, about which there was so much excitement a few years since, has been found to contain little or no tin, and it is generally supposed that this mining scheme, like a similar one of which the scene was laid on the N. shore of Lake Superior, was a pure and unqualified fraud. Within the great area of North America there still exists so much unexplored territory that there is room for the discovery of important deposits of tin; but with our present knowledge of the subject it appears very doubtful whether tin can ever be reckoned as an important element in our mineral resources.

J. S. Newberry.

**Todd** (Sereno Edwards), b. at Lake Ridge, Tompkins co., N. Y., June 3, 1820; engaged in farming, and wrote on agricultural and horticultural subjects; is author of Todd's *Young Farmer's Manual* (2 vols. 12mo), *The American Wheat-Culturist*, Todd's *Country Homes, and How to Save Money*, and Todd's *Apple-Culturist*. At present Mr. Todd occupies the position of agricultural editor of the New York *Herald*.

**Ton** [Ang.-Sax. *tunne*, a "tun," a "large vessel;" Fr. *tonne*; D. *ton*], the unit of weight in Great Britain and the U. S. for heavy and bulky commodities. It is equivalent to 20 cwt., and as, in Britain and in the U. S. custom-houses, the hundredweight is reckoned at 112 pounds, the ton contains 2240 pounds. In the domestic commerce of the U. S., however, it has become customary to reckon only 100 pounds to the cwt., and 2000 pounds to the ton; and this usage, in some of the States, if not in all, has received the sanction of law. Thus, in the revised statutes of the State of New York it is provided that "the hundredweight shall consist of one hundred avoirdupois pounds, and twenty hundredweight shall constitute a ton" (2 *Rev. Stat.*, 800, § 7, 6th ed.). This law was passed in 1851. Connecticut has a similar provision, and the same is probably true of other States. In New York State selling less than 100 pounds of coal to the cwt. is declared by law to be a misdemeanor punishable by fine or imprisonment, or both. In the *Revised Statutes of the U. S.*, sec. 2951, taken from the tariff act of Mar. 2, 1861, it is declared that "wherever the word 'ton' is used in this chapter in reference to weight, it shall be construed as meaning twenty hundredweight, each hundredweight being one hundred and twelve pounds avoirdupois." The ton of 2240 pounds is commonly called "the long ton," that of 2000 pounds "the short ton."

The words *ton* and *tun* are etymologically the same, but the former orthography is usually applied to weights, and the latter to measure. The tun in old British ale or beer measure was equal to 216 gallons of 282 cu. in. each, and in old British wine measure to 252 gallons of 231 cu. in. each. A tun of water of the larger of these measures weighs a little over 2200 pounds; and hence it is supposed that the ton weight was originally derived from the tun measure, of which it is a rough equivalent. (See Weights and Measures.)

F. A. P. Barnard.

**Ton'nage,** a measure of the capacity of a ship, used for the purpose of registry at her port and for levying harbor and other dues. The rule of measurement prevailing

in England prior to the year 1835 was erroneous in principle and led to mischievous consequences. It was arbitrarily assumed in the so-called "old measurement" (O. M.) that the depth and the breadth of the ship were equal. One step in obtaining the cubic contents of a ship was to multiply the length by the square of the breadth, and the tonnage dues were levied accordingly. This rule led ship-builders to build vessels that were narrow and deep, and accordingly dangerous in rough weather, as well as highly faulty in their plan of structure. The English Parliament adopted in 1835 a new plan, suggested by Mr. Riddle of the Royal Hospital, Greenwich. The statute of 1835 was modified in 1854, and the Merchants' Shipping act of that year (17 and 18 Vict. c. 104) is the basis of the legislation existing in the U. S. This runs out into detail, and cannot be brought within the compass of this article. Suffice it to say, that the principle at the outset is to establish a mode of ascertaining the length, breadth, and depth of the ship, as well as a *tonnage deck* for the purpose of measurement. This is the upper deck of ships of less than three decks, and the second from below in those having three or more. The length of the "tonnage deck" is then ascertained by the following rule: Measure the length of the vessel in a straight line along the upper side of the tonnage deck from the inside of the inner plank, average thickness, at the side of the stem, to the inside of the plank on the stern timbers, average thickness, deducting from this length what is due to the rake of the bow in the thickness of the deck, and what is due to the rake of the stern timber in the thickness of the deck, and also what is due to the rake of the stern timber in one-third of the round of the beam. The "tonnage length" as thus ascertained is then divided into a number of equal parts, depending upon that length. The statute thus creates six classes of ships for the purpose of measurement. The principle of the classification is to commence with vessels not exceeding fifty feet in "tonnage length" (measured by the prescribed method), and to proceed with a regular increment of fifty feet. Vessels belonging to these classes are then respectively divided into six, eight, ten, twelve, fourteen, and sixteen parts, according to their length.

The next thing is to find the "transverse area" of the vessel. For this purpose the depth of the ship is to be measured at each point of division as above given, according to a prescribed rule. If the depth at the midship division of the length do not exceed sixteen feet, each depth is to be divided into four equal parts. "Then measure the inside horizontal breadth at each of the three points of division, and also at the upper and lower points of the depth, extending each measurement to the average thickness of that part of the ceiling which is between the points of measurement. Number these breadths from above, numbering the upper breadth one, and so on down to the lowest breadth; multiply the second and fourth by four, and the third by two; add these products together, and to the sum add the first breadth and the last or fifth; multiply the quantity thus obtained by one-third of the common interval between the breadths, and the products shall be deemed the transverse area." When the midship depth exceeds sixteen feet, the "transverse area" is obtained by dividing each depth into six equal parts, instead of four, and with corresponding changes in other respects. This mode of reckoning gives the "transverse area" at each point of division of the length of the vessel, as already noticed.

The final step is to obtain the register tonnage. For this purpose the "transverse areas" found as above are numbered, commencing with the extreme limit of the length at the bow. The even-numbered areas are multiplied by four, and the odd, with the exception of the first and the last, by two. These products are added together, and to the sum the first and last "transverse areas," if they "yield anything," are added. The quantities thus obtained are to be multiplied by one-third of the common interval between the areas. This product is the cubical contents of the space under the tonnage deck. Divide it by 100, and the quotient is the "register tonnage," subject to certain special additions now to be named. Additions (in accordance with a fixed rule) are made to the tonnage under deck, as above ascertained, in case there be a break, a poop, or any other permanent closed-in space on the upper decks or spar deck available for cargo or stores or the "berthing" or accommodation of passengers or crew. The same addition is to be made when a vessel has a third deck or a spar deck, the tonnage of the space between it and the *tonnage deck* being ascertained in a specified way.

In ascertaining the tonnage of open vessels the upper edge of the upper "strake" (line of planking extending from stem to stern) is to form the boundary-line of measurement, and the depth is to be taken from an athwart-ship line extending from the upper edge of such strake at each division of the vessel's length.

The register of the vessel at the custom-house must express the number of decks, the tonnage under the tonnage deck, that of the between decks above the tonnage deck, and that of the poop or other enclosed space, each separately. It is deemed of such importance that the registered tonnage should be known that the law provides that it shall be deeply carved or permanently marked upon the main beam of the vessel, and so continued, or it shall no longer be recognized as a registered vessel of the U. S.

The measurement of a foreign vessel is made upon a different principle. Double and single decked vessels are distinguished from each other. If the vessel be double-decked, the course is to take the length from the fore part of the main stem to the after part of the stern-post above the upper deck, and the breadth at the broadest part above the main "wales" (lines of planking in a ship's side), half of which breadth shall be accounted the depth of the vessel. Then deduct from the length three-fifths of the breadth; multiply the remainder by the breadth, the product by the depth, and divide this last product by 95. In the case of single-decked vessels the depth is ascertained specifically by measuring from the under side of the deck-plank to the ceiling in the hold. In other respects the same rule is followed as before.

No vessel need be registered for tonnage that is used for cabins or state-rooms, and constructed entirely above the first deck, which is not a deck to the hull; nor do the provisions concerning this kind of measurement apply to any vessel not required by law to be registered or enrolled or licensed, unless otherwise specially provided.

On these principles the system of tonnage duties now prevailing is based. It is not necessary to state these *in extenso*, but only to refer to the principles governing them. (1) Discriminations in the rate of duties are made between vessels of the U. S. and those belonging wholly or in part to subjects of foreign powers, though these are not to be held to impair any rights or privileges acquired by any foreign nation under the laws or treaties of the U. S. (2) Tonnage duties imposed on all vessels engaged in foreign commerce are levied but once a year. This rule does not apply to vessels belonging to any foreign port which vessels of the U. S. are not ordinarily permitted to enter and trade with. The amount is regularly payable at their first clearance from or entry at (according to priority) a custom-house in the U. S. in each calendar year. If not collected then, it may be afterward. Vessels making regular daily trips between any port of the U. S. and any port in the Dominion of Canada wholly upon interior waters not navigable to the ocean, shall only be charged tonnage fees upon the first clearance of such vessel in each year. (3) No tonnage duties are to be levied upon any licensed, registered, or enrolled vessel of the U. S. belonging to a citizen and trading from one port of the U. S. to another; nor are any tonnage duties to be paid by enrolled or licensed vessels on the northern frontiers of the U. S. trading from a port in one district to a port in another, though they may touch at intermediate foreign ports. (4) A duty of fifty cents per ton, to be denominated "light-money," is levied and collected in the same manner as strict tonnage duties on all vessels not of the U. S. which may enter their ports. Unregistered vessels, but carrying a sea-letter, etc., belonging to citizens of the U. S., are under certain restrictions exempted from the operation of this rule. In other words, they are not to be regarded as vessels "not of the U. S." (5) None of these rules impair any rights or privileges obtained by any foreign nation under any treaties or laws of the U. S. (6) Yachts belonging to a regularly-organized yacht club of a foreign nation extending like privileges to yachts of the U. S. need not pay any tonnage tax on entering our ports. (7) In certain cases tonnage duties are imposed in connection with forfeiture or a penalty for an evasion of the laws for the collection of duties upon merchandise or for non-compliance with other statutory regulations. (*Rev. Statutes Cong.*, § 3110 and § 4335.) (8) The decision of the collector of the port at which the vessel enters as to the rate of tonnage duties applicable to the case is final, unless an appeal is taken from his decision within a specified number of days.

A word should be added as to tonnage *fees*. Consuls, etc., are not to exact tonnage fees from any vessel of the U. S. touching at or near ports in Canada on her regular voyage from one port to another within the U. S., unless they perform some official services required by law for such vessel when at a Canadian port. (§ 4224.) Another section of the statutes provides that no consul, etc., is to be allowed tonnage fees for any service, actual or constructive, rendered any vessel owned and registered in the U. S. that may touch at a Canadian port. (§ 1722.)

Tonnage duties, as already considered, are levied exclusively by Congress. Under Art. I. § 10 of the U. S. Constitution such duties may be levied by a State with the

consent of Congress; without such consent a State has no power to levy them. While a tonnage duty may be considered as a part of the taxing power, it may also be regarded as a regulation of commerce. The constitutional provision is unquestionably a wise one, as it restrains a State from doing an act which as an interference with commerce might act injuriously upon the interests of other States. (Reference should be made for further information to the following sections of the *Revised Statutes of Congress:* § 1722, § 2793, § 2931, § 4150–54, § 4216, § 4219–27.) T. W. Dwight.

**Tor'rey** (Charles Warren), M. D., b. in New York City Sept. 16, 1836; educated at Columbia College; studied at the universities of Paris, Göttingen, and Halle, and graduated in medicine and surgery at Würtzburg; entered the army during the civil war, and was assistant surgeon U. S. volunteers and medical inspector in the department of Virginia and North Carolina; was for a time associate editor of the *American Gaslight and Mining Journal,* and has contributed to various journals.

**Torrey** (Joseph W.), b. at Bath, Me., Apr. 22, 1828; graduated at the Roxbury Latin School in 1846; went to Hong Kong in 1859, where he was for a short time editor of the *Hong Kong Times;* was made rajah of Ambong and Maloodu, on the N. coast of Borneo, in 1867, and as such was acknowledged by the U. S. in 1868; he governs a territory of 22,000 sq. m. and about 2,000,000 inhabitants, and holds under the sultan of Borneo, to whom he pays a small yearly tribute; and is also president of the American Trading Company of Borneo. Joseph G. Torrey.

**Tower of London, The,** stands just *without* the ancient city, on the left bank of the Thames. "This tower" (says Stow) "is a citadel to defend or command the city; a royal palace; a prison of state for the most dangerous offenders; the armory for warlike provisions; the treasury of the ornaments and jewels of the Crown; and general conserver of most of the records of the king's courts of justice at Westminster." Its government has been entrusted since the days of the Conqueror to a high officer called the constable, which office has been held by




The Tower of London.

the duke of Wellington, Field-Marshals Sir John Burgoyne, Sir George Pollock, Sir William Gomm. The present constable is Gen. Sir Charles Yorke. The oldest portion is the isolated donjon or keep called the *White Tower,* built by William the Conqueror. This is now surrounded by a rampart and moat, with inner wall (the *Inner Bail*), flanked by half-circle towers, each of which has a distinctive name, as the *Bell Tower,* the *Beauchamp Tower, Wakefield Tower, Bloody Tower, Bowyer Tower.* There is also within the enclosure the Jewel-House, where are kept the regalia; the Horse-Armory, a museum of ancient armor; St. Peter's church, where are interred the remains of Anne Boleyn, Katherine Howard, dukes of Somerset ("Protector") and Northumberland, Lady Jane Grey and her husband, and many other celebrated victims of the headsman. Closely adjacent to the Tower is *Tower Hill,* the famous place of execution for persons delivered from the Tower to the sheriffs of London for execution. Here suffered (among others) Bishop Fisher, Sir Thomas More, Lord Guilford Dudley, earl of Strafford, Archbishop Laud, Algernon Sydney, and (1747) Lord Lovat, the last person beheaded in England. Queen Anne Boleyn and Lady Jane Grey were beheaded on scaffolds within, the site of which is shown, as also the block on which the former suffered. Within the Bloody Tower took place the murders of the princes, sons of Edward IV., and, elsewhere within the precincts, of Henry VI., of the duke of Clarence, of Sir Thomas Overbury, and of the earl of Essex. The history of the Tower may be called the "tragedy of England." (See *Historical Memorials of the Tower,* by Lord de Ros.) J. G. Barnard.

**Town'send** (Franklin), b. at Albany, N. Y., Sept. 28, 1821; educated at Pittsfield, Mass., and Albany, N. Y.; has served as alderman (1847), supervisor (1848–50), mayor (1850–51), of his native city and county, and in 1857 was a member of the legislature; was adjutant-general of the State of New York 1869–72, 1875–76, and again since 1876.

**Tribe** (*gens, phratry, tribe,* and *confederacy* among the American aborigines). *Gens,* γένος, and *ganas,* in Latin, Greek, and Sanskrit, have alike the primary signification of *kin,* springing from the same root as *gigno,* γίγνομαι, and *ganamai,* "I beget," and implying in each of these languages a common descent. A gens, therefore, is a body of *consanguinei,* of persons descended from the same ancestor, and as such it represents the most primitive social organization, contains the first germ of government, and is found in the earliest stages of the history of all nations. In American ethnography, *tribe* and *clan* have been used for *gens,* and *nation* for *tribe,* but there is no sufficient reason for this deviation, and in the following explanation of *gentes, tribes,* and *confederacies,* as developed among the American aborigines, we shall use the words in their common acceptation.

The *gentes* of the Iroquois will be taken as the standard exemplification. They carried out their plan of government from the gens to the confederacy, complete in each of its stages, and furnish an excellent illustration of the capabilities of the gentile organization in the archaic period.

I. The Gens as an Individual Organism.—The Senecas, Cayugas, and Onondagas were each composed of eight gentes, arranged and named as follows:

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|---|---|---|---|---|
| First, | 1, Wolf; | 2, Bear; | 3, Beaver; | 4, Turtle. |
| Second, | 5, Deer; | 6, Snipe; | 7, Heron; | 8, Hawk. |

The Mohawks and Oneidas, the two remaining Iroquois tribes, had but three gentes, the Wolf, Bear, and Turtle, and have but three at the present time. When the confederacy of the Iroquois was formed (about A. D. 1450), seven of the eight gentes were in existence, as is proven by the fact that sachemships were established in them; but the Mohawks and Oneidas had apparently at that time but the three named.

A description of the rights, privileges, and obligations of the members of a gens, considered as the unit of the social system, will show both its own internal organization

and the manner into which it entered into the higher organizations of a tribal and confederate government.

1. *The Right of Electing its Sachems and Chiefs.*—Nearly all the American Indian tribes had two grades of chiefs, who may be distinguished as sachems and common chiefs, the office of the former class being hereditary, and the other non-hereditary. The office of sachem was made perpetual in the gens by filling the vacancy as often as it occurred, while that of chief was bestowed as a reward of merit, and died with the individual. Moreover, the duties of a sachem were confined, theoretically, to the affairs of peace. He could not go out to war in his capacity of sachem. On the other hand, the chiefs, who were raised to office for personal bravery, for wisdom in affairs, or for eloquence in council, were the superior class in ability, but not in authority over the gens. The relations of the chiefs were primarily to the tribe, composed of several gentes, as that of the sachem was primarily to the gens, of which he was the father and official head.

Upon the death of a sachem, among the Iroquois, a council of the gens was convened to fill the vacancy. After the choice was made it still required the acceptance of the candidate by the other gentes before the election was complete. If the councils of the remaining gentes, separately convened, refused their assent, a new choice was made by the gens. When the person nominated by the gens was accepted by the remaining gentes, it was still necessary that the new sachem should be installed by a council of the confederacy before he could assume the duties of the office.

2. *The Power of Deposing its Chiefs.*—As the members of the gens had the right to elect, so they possessed the equal power to depose their chiefs. Unworthy behavior, followed by a loss of confidence, furnished a sufficient ground for deposition. When a sachem or chief had been deposed in due form by a council of his gens, he ceased thereafter to be regarded as an official character, and became a private person.

3. *The Right of bestowing Personal Names upon the Gentiles.*—Among savage and barbarous tribes single personal names are in common use, but they have none for the family or indicating a family connection. Their personal names, however, are usually sufficient to indicate the gens of the individual. As a rule, each gens had its names for persons which were its special property, and as such could not be used by other gentes. These names either proclaimed by their signification the gens to which they belonged, or were known as such by common reputation. After the birth of a child a name was selected by its mother from those not in use belonging to the gens, with the concurrence of the chief and nearest relatives. It was then bestowed upon the infant, but it still required to complete the christening that the birth and name of the child, together with the names of its father and mother, should be announced at the next ensuing council of the tribe. There were two classes of names in use—one adapted to childhood, and the other to adult life—which were exchanged at the age of fifteen or sixteen in the same formal manner. In some tribes the youth was required to go out upon the war-path and earn his new name. If a person was elected a sachem or chief, his name was "taken away," to use their form of expression, and a new one bestowed in its place.

4. *Mutual Rights of Inheritance of the Property of a Deceased Member of the Gens.*—In savage, and also in barbarous tribes below the Middle Status, the amount of property was inconsiderable, consisting of personal effects, to which possessory rights in houses and garden-beds were superadded after cultivation commenced. The most valuable personal articles were interred with the body of the deceased owner. Nevertheless, the question of inheritance was certain to arise, to increase in interest with the growth of property in variety and amount, and to result in a settled rule of inheritance. Accordingly, we find, as a substantially universal custom, that the property remained in the gens of the decedent and was distributed among his gentiles (pro. *gen'ti-les*) as the nearest of kin. Among the Iroquois the distribution was made under the auspices of the chief to the nearest of kin; the right of inheritance was, theoretically, in the gentiles at large, and it was in the power of the gens to make an arbitrary distribution without regard to the nearness of persons; but, practically, a discrimination had begun to be made in favor of those nearest in degree.

The land-tenure of savage tribes, and of tribes in the Lower Status of barbarism, is perfectly simple. Lands are universally owned in common by the tribe. After tillage had commenced, among the American aborigines occupation of land gave a possessory right to so much as was brought under cultivation, and it passed by inheritance, the same as personal effects. In these two principles of the ownership in common of the public domain, and of a possessory right to cultivated tracts, the natural basis is found of the arable mark, common pasture, and common waste of the Teutonic and Hindoo village communities discussed by Nasse and Maine.

5. *The Obligation not to Marry in the Gens.*—The prohibition must have originated in a powerful motive, which seems to lie on the surface—namely, to provide a permanent shield against promiscuity, and against the intermarriage of brothers and sisters as well. We are led by necessary inferences to accept the gentile organization as the result of an organic movement of society by means of which it was extricated from the evil against which this prohibition was directed. The condition of savage tribes who have not advanced to a knowledge of the gens, or who possess it in an inchoate form, and of barbarous tribes now organized in gentes, but whose systems of consanguinity have survived the state of society in which they originated, indicates that the intermarriage of brothers and sisters was practised in ancient times. In the midst of this condition, or when but slightly removed from it, and in the midst of the conjugal system which then prevailed, the gens was instituted. The main object at which it aimed was fully accomplished by the prohibition of intermarriage in the gens. Brothers and sisters would in any event be of the same gens; and since the paternity of children was unknown, descent was necessarily reckoned in the female line. Moreover, the gens at the outset did not look beyond this prohibition. An explanation of the origin of the gens at once adequate and complete is thus obtained. Had it attempted to uproot the entire conjugal system of the period, there is not the slightest probability that it would have worked its way into final establishment. Brothers still shared their wives in common, and sisters their husbands the same; which practice must have been coextensive with the punaluan family in the midst of which the gens was instituted, and which prevailed as widely as the Turanian system of consanguinity.

6. *Reciprocal Obligations of Help, Defence, and Redress of Injuries.*—Accustomed to look to the state for the protection of personal and property rights, there has been in civilized society a corresponding abatement of the strength of the bond of kin. But in the previous conditions the individual depended for security upon his gens and kinsmen.

Among the Iroquois, and other Indian tribes generally, the obligation to avenge the murder of a kinsman was recognized. It was the duty of the gens of the slayer and of the slain to attempt the adjustment of the crime if possible before proceeding to extremities. A council of each was held separately, and propositions were made for the condonation of the offence, usually in the nature of expressions of regret and of presents of considerable value. If there were justifying or extenuating circumstances, and the matter was judiciously managed, it generally resulted in a composition; but if the relations of the slain person were implacable, one or more avengers were appointed by the gens from among its members, who were charged with the duty of pursuing the criminal and of slaying him wherever he might be found. If they accomplished the deed, it was no ground for offence to any of his gentiles. Life having answered to life, the demands of justice were appeased.

7. *The Right to Adopt other Persons into the Gens.*—Another distinctive attribute of the gens was the right of adoption. Captives taken in war were either put to death or adopted by the different gentes. Women and children usually experienced clemency in this form. In no other way could a status be gained in the tribe than by adoption in a gens. Adoption not only conferred gentile rights, but also the nationality of the tribe. Among the American aborigines the person adopting a captive placed the latter in the relation of a son or daughter usually, but sometimes in that of a brother or sister, and ever afterward treated the person in all respects as though born in that relation. The Iroquois ceremony of adoption was performed at a public council of the tribe, which gave to it the solemnity of a religious rite.

It may be further remarked that the gauntlet had some connection with adoption, because the person who succeeded in running through the lines was entitled to this reward for his hardihood and endurance. Captives, when adopted, were often assigned the places in the family of persons destroyed in battle in order to fill the broken ranks of relatives. The concurrence of the other gentes was not essential to the exercise of this right. Through the practice of adoption a declining gens might be, and probably was, replenished in its membership.

8. *The Council of the Gens.*—The history of the council, gentilic, tribal, and confederate, is the history of the growth of the idea of government. The simplest and lowest form of the council was that of the gens, which was a democratic assembly, because upon the most important questions

every member had a voice. It elected and deposed chiefs, avenged or condoned the crime of murder, elected "keepers of the faith," performed the ceremony of adoption, and distributed the property of a deceased member. It was the germ of the higher council of the tribe, and of that still higher of the confederacy, each of which was composed exclusively of chiefs.

Such and so substantial were the rights, privileges, and obligations of the members of a gens in its archaic form, as it is still found in full vitality among the American aborigines.

At the epoch of their discovery the American aborigines in general were organized in gentes, with descent in the female line. In some instances, as among the Dakotas and the tribes in the valley of the Columbia, the gentes had fallen out, but with every probability that they once possessed them. In some cases, as among the Omahas and Ojibways, descent had been changed from the female line to the male. But in no case had any of the tribes advanced out of gentile society into political society, out of a government founded upon persons into a state founded upon territory and upon property.

Throughout aboriginal America the gens took its name from some animal or inanimate object, and never from a person. In some tribes the members of a gens claimed to have descended from the animal whose name they bore, having been transformed by the Great Spirit from the animal into the human form.

With respect to the number of persons in a gens, it varied with the prosperity of the tribe, and again with the number of the gentes. Three thousand Senecas divided equally among eight gentes would give three hundred and seventy-five to a gens. Fifteen thousand Ojibways divided equally among twenty-three gentes would give six hundred and fifty-one persons to a gens. The Cherokees would average more than a thousand to a gens. In the present broken and reduced state of the tribes the number in each gens will range from a hundred to a thousand.

II. The Indian Phratry.—The phratry (*φρατρία*) is a brotherhood, as the term imports, and a natural growth from the organization into gentes. It is an organic union or association of two or more gentes of the same tribe for certain common objects. The gentes united in a phratry were usually such as had been formed by the segmentation of an original gens.

The phratry existed in a large number of tribes of the American aborigines, where it is seen to arise by natural growth, and to stand as the second member of the organic series, as it did among the Grecian and Latin tribes. It did not possess original governmental functions, as the gens, tribe, and confederacy possessed them, but it was endowed with certain useful powers in the social system, from the necessity for some organization larger than a gens and smaller than a tribe, and especially when the tribe was large.

The Seneca-Iroquois phratry presents the organization in its archaic form and with its archaic functions. A knowledge of the Indian phratry is necessary to an intelligent understanding of the Grecian and the Roman. The eight Seneca gentes are in two phratries, as follows:

*First Phratry.*

*Gentes.*—1, *Bear.* 2, *Wolf.* 3, *Beaver.* 4, *Turtle.*

*Second Phratry.*

*Gentes.*—5, *Deer.* 6, *Snipe.* 7, *Heron.* 8, *Hawk.*

Each phratry is a brotherhood (De-ă-non-dă'-a-yoh), as this term also imports. The gentes in the same phratry are brother gentes to each other, and cousin gentes to those of the other phratry, but the two are equal in privileges and functions. The phratries concerned themselves with the public games, in which the people divided by phratries, with cases of murder, with the funerals of distinguished men, and with the confirmation of the nomination of sachems and chiefs made by the gentes.

III. The Indian Tribe.—The tribe was not only a well-marked organization, but the principal or ultimate stage of organization of the great body of the American aborigines. Their striking characteristic was the large number of independent tribes into which they had fallen by the process of segmentation. Each tribe was individualized by a name, by an independent dialect, by a supreme government, and by the possession of a territorial area which it claimed and defended as its own. It was composed of several gentes gradually developed from two or more, all the members of which were intermingled by marriage and spoke the same dialect. As the gens was founded upon consanguinity, so the tribe, as an assemblage of gentes of the same lineage, was founded upon dialect. The instances are extremely rare among the American aborigines in which the tribe embraced peoples speaking different dialects. When such cases are found, it resulted from the union of a weaker with a stronger tribe speaking a related dialect, as the union of the Missouris with the Otoes after the overthrow of the former.

A constant tendency to disintegration, which has proved such a hinderance to progress in savage and barbarous life, existed in the elements of the organization into gentes. New tribes were constantly forming by natural growth, and the process was sensibly accelerated by the great expanse of the American continent. The method was simple. In the first place, there occurred a gradual outflow of people from some geographical centre possessing superior advantages in the means of subsistence, which was continued from year to year until a considerable population was developed at a distance from the original seat of the tribe. In course of time the migrants became distinct in interest, strangers in feeling, and last of all divergent in speech: separation and mutual independence followed, although their territories were contiguous. This is a concise statement of the mode of formation of the existing tribes of the American aborigines, taking it as a general proposition.

At the epoch of their discovery the eight Missouri tribes occupied the banks of the Missouri for more than 1000 miles, together with the margins of its tributaries, the Kansas and the Platte and the smaller streams of Iowa. Their dialects show that they were in three tribes before their last subdivisions occurred—namely, first, the Punkas and Omahas; second, the Iowas, Otoes, and Missouris; and third, the Kaws, Osages, and Quappas. The three original tribes were undoubtedly subdivisions of one people, because their several dialects are still much nearer to each other than to any other dialects of the Dakotan stock-language to which these dialects belong. There is therefore a linguistic necessity for their derivation from each other and from an original tribe.

Numbers within a given area were limited by the amount of subsistence it afforded. Where fish and game were the main reliance, it required an immense area to maintain a small tribe. After horticultural products were superadded to fish and game, the area was still a large one in proportion to the number of the people. New York, with its 47,000 square miles, never contained at any time more than 25,000 Indians, including the Algonkins on the E. side of the Hudson and upon Long Island. A personal government founded upon gentes was incapable of developing a central power able to follow and control its increase of numbers after they had spread over wider areas. Divergence in speech completed the work of disintegration.

Among the Village Indians of New Mexico—which was doubtless equally true of those in Mexico and Central America—an increase of numbers in a small area did not change the result. Each pueblo was an independent self-governing community. When several were seated near each other on the same river or stream, they were usually kindred in speech, and a confederacy for mutual protection was the highest organization they were able to form. The relations concerning Coronado's expedition to New Mexico in 1540–42 mention the seven villages of Cibola and the seven villages of Tucayan, thus implying that each group was composed of kindred tribes standing in close governmental relations; they were probably confederated. No Indian confederacy has been found in North America which extended beyond the bounds of a stock-language, excepting when a fragment of an overthrown tribe had been admitted as a favor, as the remains of the Natchez in the Creek confederacy. Thus the Indian tribe appears to have been a very simple as well as humble organization, requiring but a few hundred, and at most but a few thousand, people to place it in a respectable position in the Ganowánian family.

The following are its principal attributes: (1) The possession of a tribal territory and a tribal name; (2) the possession of an independent dialect; (3) the right of investing chiefs elected by the gentes; (4) the possession of a religious faith and worship; (5) a supreme government through a council of chiefs; (6) in some cases a head-chief of the tribe.

IV. The Indian Confederacy.—A tendency to confederate for mutual defence would spring up very naturally among kindred and contiguous tribes. When its advantages were appreciated by actual experience, the organization, at first a league, would cement into a confederate unity. To such a union of tribes speaking dialects of the same stock-language the individual gens, and the individual tribes composed of gentes, were eminently adapted. The chronic state of warfare in which they lived and the severe straits to which they were frequently reduced would quicken this tendency into action among such tribes as were sufficiently advanced in intelligence and in the arts of life to perceive its benefits. It would be simply a growth from a lower into a higher organization by an extension of

the principle which united the gentes in a tribe. Several confederacies, as might have been expected, were found in different parts of North America when discovered, some of which were quite remarkable in plan and structure. Among the number may be mentioned the Iroquois confederacy of five independent tribes, the Creek confederacy six, and the Dakota league of "the seven council-fires." To these may be added the Aztec confederacy of three tribes in the Valley of Mexico, and the Tlascalan, and perhaps Cholulan and Michoacan confederacies, in other parts of Mexico. It is probable that the Village Indians of Central and South America were thus confederated, but if such were the fact, the knowledge of it has been lost in the general shipwreck of their historical affairs at the Spanish conquest.

The two highest exemplifications of Indian confederacies were the Iroquois and the Aztec. From their superiority as military powers and from advantages of position, their confederate organizations, which were externally singularly complete, led in both instances to remarkable results. Our knowledge, however, of the structure and principles of the Aztec confederacy is limited, and far from satisfactory, but measurably definite with respect to that of the Iroquois.

The Iroquois tribes furnish an excellent illustration of the manner in which a confederacy was formed by natural growth, assisted by skilful legislation. When discovered (A. D. 1608) they occupied the whole area between the Hudson and the Genesee river, and southward down the Susquehanna into Pennsylvania. In numbers they never at any time exceeded 20,000 persons.

When the confederacy was formed, about A. D. 1400–50, they were in five independent tribes, occupied contiguous territories, and spoke dialects of the same stock-language which were still mutually intelligible. Beside this, three gentes were common in the five tribes—namely, the Wolf, Turtle, and Bear; and four other gentes—namely, the Beaver, Snipe, Heron, and Hawk—were common in the Seneca, Cayuga, and Onondaga tribes. Three common gentes in all the tribes afforded an ample basis for the confederacy; the remaining five in the three tribes, being in excess, interposed no hinderance, while they served to bind the three more closely together. With all the necessary elements in their hands, the formation of a confederacy became a question of intelligence and progress. It is affirmed by the Iroquois that the confederacy was formed by a council of the wise men and chiefs of the five tribes, which met for that purpose on the N. bank of Onondaga Lake, near the site of the present city of Syracuse, and that before its session was concluded the organization was perfected and set in immediate operation. They further affirm that the confederacy, as formed by this council, with its powers, regulations, and mode of administration, has come down to them through many generations to the present time, with scarcely a change in its internal organization. When the Tuscaroras were afterward (1712) admitted as a sixth tribe into the confederacy, their sachems were allowed, by courtesy, to sit in the general council of sachems, but they were never recognized as forming a part of the ruling body.

The general features of this confederacy may be indicated by the following propositions: (1) A union of tribes composed of the same gentes, and on the basis of equality, each tribe remaining independent in all matters pertaining to local self-government within its own territories. (2) A general council of sachems, limited in number, equal in rank, and holding the supreme authority over all matters pertaining to the confederacy. (3) Sachemships were created in perpetuity in certain gentes of the several tribes, with power in the latter to fill vacancies as often as they occurred; but the right to invest the sachems with office was reserved to the general council. (4) The sachems of the confederacy were also sachems of their respective tribes, and the council of the tribe was left supreme over all matters pertaining to it exclusively. (5) In the general councils of the confederacy unanimity was made essential to every public act. (6) The council of each tribe had power to convene the general council, but the latter had no power to convene itself. (7) The general council was open to the orators of the people for the purpose of discussing public questions, but the council alone decided. (8) The confederacy recognized no official head: in the administration of its affairs one sachem possessed as much authority as another. (9) They had reached the idea of general military commanders, but they created two principal war-chiefs of the confederacy, instead of one, and made their powers equal. This was probably the office held by Montezuma among the Aztecs, that of a general commander, which grew in a more advanced condition of society into the *basileus* of the Greeks and the *rex* of the Romans.

As the central tribe in position, the Onondagas were made the "keepers of the council brand," which made the Onondaga Valley in effect their seat of government. But each tribe had power to summon the general council, and in its own territory, if it chose to do so, and to appoint the time and place. Originally, the principal object of the general council was to raise up sachems to fill vacancies in the ranks of the ruling body occasioned by death or deposition; but it transacted all other business which concerned the common welfare. In course of time, as they increased in numbers and strength, and their intercourse with foreign tribes became more extended, the council fell into three distinct kinds, which came to be distinguished as the "civil" (Ho-de-os′-seh), the "mourning" (Hen-nun-do-nuh′-seh), and the "religious." The first declared war and made peace, sent and received embassies, made treaties, regulated the affairs of subjugated tribes, and took all needful measures for the common welfare. The second raised up sachems to fill vacancies. It received its name from the first of its ceremonies, which was a lament for the deceased ruler whose vacant place was to be filled. The third was held for the observance of a general religious festival. It was made the occasion for the five tribes to unite, under the auspices of a general council, in common religious observances, and for the celebration of their public games. But as the mourning council was always attended with religious ceremonies, it came in time to answer for both.

With respect to the mode of conducting business adopted by the council, there was a prescribed way in which it was summoned, and five days was the usual length of the session. Unanimity was necessary to any decision, in arriving at which they voted by tribes, which ensured the independence of each. These councils were opened and conducted with established forms and ceremonies, and were great occasions in Indian life, particularly when sachems were installed, when the structure and principles of the confederacy were explained from belts of wampum for the instruction of the newly-inducted sachem.

"This belt preserves my words," was a common expression of an Iroquois chief in councils held with the colonial authorities, at the same time delivering the belt as the evidence of what he had said. They experienced the necessity for an exact record of a proposition made, because it involved their honor in its execution. The belt or string of wampum was devised to this end. Into it "was talked," to use their expression, the proposition or statement made, of which it became the sole evidence, but it required an interpreter to render its meaning.

The Iroquois name for a sachem (Ho-yar-na-gó-war), which signifies "a counsellor of the people," was singularly appropriate to a ruler in a species of free democracy. It not only defines the office well, but suggests the analogous designation of the members of the council among the Grecian gentes. They also are described as "counsellors of the people" (*δήμου πρόβουλοι*). (Æschylus, *The Seven against Thebes*, 1005.) From the nature and tenure of the office the chiefs of the gentes among the Iroquois were not masters, ruling by independent right, but holding from the gens by free election, with the reserved right in the gens to depose. It is worthy of notice that an office which originated in savagery and continued through the period of barbarism should reveal its archaic character after the gentes had carried a portion of the human family to the confines of civilization, as among the Greeks. It shows further how deeply inwrought the principle of democracy became under gentile institutions.

The designation for a chief of the second grade signifies "an elevated name" (Hä-seh-no-wä′-na). Among the Iroquois the celebrated orators, wise men, and military commanders were chiefs of this grade. One reason for this is found in the provision which limited the duties of the sachems to the affairs of peace. As the office of chief was bestowed in reward of merit, it fell necessarily upon their ablest men. Red Jacket, Brandt, Cornplanter, Frost, Johnson, and other well-known Iroquois were simply chiefs.

Under the confederacy the office of a general military commander makes its first appearance. The introduction of this office as a permanent feature of the government was a great event in the history of human progress. At a later stage of advancement it became identified with a materially-changed condition of society. It was the beginning of a chief executive magistrate, the germ from which in the course of time sprang both the king and the president. In the Lower Status of barbarism, with property inconsiderable and numbers small, the affairs of society were simple, and the military office unimportant; but in the Middle Status, with an increased amount of property and augmented numbers gathered in villages, affairs became more complex, suggesting the need of administrative officers, and making the general military commander more conspicuous. When the Iroquois confederacy was formed, a necessity was felt for general commanders. Accordingly, two war-chiefships were established, one of which was made hereditary in the Wolf gens and the other in the Turtle gens of the Senecas.

The reason for giving both to the Senecas was the greater danger apprehended from the West. They were elected, and afterward raised up by the general council, the same as the sachems, and were equal in rank and authority. Gov. Blacksnake, recently deceased, held one of these offices. As general commanders they had charge of the military affairs of the confederacy, and commanded in person the confederate forces when united on an expedition. The creation of two instead of one argues a calculating policy, an unwillingness to entrust the military command to a single person.

The character and functions of the council, the mode of its appointment, the limitations upon its authority, and the tenure and powers of the office of chief, are the principal points to be considered to understand the structure and principles of a confederacy of tribes. That of the Iroquois is an excellent exemplification of a society or *populus* under gentile institutions. It seems to reveal nearly all the capabilities of gentile society in the archaic state, leaving no subsequent plan of government radically different until political society was attained and the gentes themselves were overthrown. The intermediate stages, which were transitional, gave nothing higher than a military democracy resting upon the gentes. LEWIS H. MORGAN.

**Triodon'tidæ** [from *Triodon*—τρεῖς, "three," and ὀδούς, "tooth"—the generic name of the type], a family of teleost fishes of the order Plectognathi and sub-order Gymnodontes, and comprising the most generalized forms of the sub-order and those nearest the Sclerodermi. The body is oblong, with a very dilatable abdomen, and with a slender conic tail; the skin is covered with "small osseous, scale-like, spiny subimbricate laminæ;" the lateral line well marked; the head oblong, with the snout rather long; the opercular apparatus concealed by the skin; the nostrils represented by two distinct openings on each side; the mouth is terminal and small; the upper jaw divided by a median suture, the lower undivided (thus together forming three tooth-like pieces, whence the name); the teeth are only represented by the trenchant edges of the jaws; the branchial apertures are narrow clefts in front of the pectoral fins; the branchiostegal rays entirely concealed; dorsal and anal fins very short and far behind, the former more advanced forward than the latter; caudal separate and emarginated; pectorals rather narrow; ventrals entirely wanting. An air-bladder is present. The skeleton is tolerably well ossified, and distinct ribs are developed; the so-called pelvic bone is large, and serves to keep expanded the abdominal sac-like expansion, "the lower part of which is merely a flap of skin into which the air does not penetrate" (*Günther*). The family is especially interesting on account of its relations, and as serving to demonstrate the affinity of the gymnodonts with the scleroderms. But one species is known, the *Triodon bursarius* of the Indian Ocean and Archipelago. THEODORE GILL.

**Trionych'idæ** [from *Trionyx*—τρεῖς, "three," and ὄνυξ, ὄνυχος, "claw"—the typical genus], a family of reptiles of the order Testudinata (tortoises), containing the soft-shelled tortoises, and distinguished by the leathery and scaleless shell. The head is oblong, covered with a naked skin, and without plates, with the eyes near the front, and with the snout produced and attenuated, and the nostrils terminal; the jaws are covered by fleshy lips; the neck is elongated and retractile in a longitudinal axial curve; the shell has its upper and lower parts (carapace and plastron) connected by broad bridges, and covered with a soft skin having an expanded and reflexible margin; the pelvis is attached to the vertebral column, and not connected with the plastron; the feet are expanded; the toes spreading, but connected by a web, their internal margins provided with a web-like membrane, and the three outer toes clawed. The family includes the soft-shelled turtles. "The principal habitat of the members of this family is the muddy bottom of shallow waters. They bury themselves in the soft mud, leaving only the head, or a small part of it, exposed. They take breath from time to time, without moving the body, by raising up the long neck and head and carrying the leathery snout above water. They sometimes stay under water a long time without taking breath; in one instance, a specimen has been seen to remain under water for more than half an hour without raising its snout above the surface. The nature of the habitat is clearly connected with some of the prominent family characteristics." They rarely emerge from the water to take to the land, and when on the land their locomotion is laborious and constrained. In the water, however, they are very active and quick in their movements. "They feed upon shells, especially upon anodontas and paludinas." "They lay from twelve to twenty and more eggs, of a spherical form and above the size of a musket-ball, which they deposit on the shore by the water's edge. The shell of these eggs is thick, but very brittle." Such are the principal features of the habits of the American species, as observed by Agassiz. (*Contributions to the Natural History of the U. S. of A.*, vol. i. pp. 333–334.) Representatives of the family are found most abundantly in the tropical regions of Asia and Africa, but a number of species also extend through a considerable area in the U. S., and equally far northward in Asia. The number of known species has been considerably increased within the last fifteen years, and by Dr. J. E. Gray they have been classified under three families (which would by most authors be regarded as not more than sub-families) and nineteen genera. N. American species, according to Agassiz and Cope, are (1) *Amyda mutica*, (2) *Platypeltis ferox*, (3) *Aspidonectes spinifer*, (4) *A. asper*, (5) *A. nuchalis*, and (6) *A. emoryi*. The first and third of these extend northward to the St. Lawrence basin, and elsewhere are inhabitants of the northern as well as middle tributaries of the Mississippi River; the others are more southern in their range. THEODORE GILL.

**Trochil'idæ** [from *Trochilus*—the Greek name, τροχίλος, of an unknown bird, but perhaps the wren—applied by Linnæus to the humming-birds], a family of birds peculiar to America, and constituted of the humming-birds. The general physiognomy is familiar in connection with the common North American form; the bill is slender and elongated, but otherwise very diversiform; the gape moderate; the tongue is "composed of two lengthened cylindrical united tubes, capable of great protrusion, and bifid at the tip" (*Gould*); the nostrils are linear, and near the base of the upper mandible; there are no rictal bristles; the wings are long and narrow, and have ten (rarely nine) primaries, rapidly graduated from the first (or second) to the tenth, and only six very short secondaries; the tarsi are very short and slender; the toes small, three in front and one behind; the tail is composed of ten feathers, but in shape is extremely diversiform. The most notable features of the internal organization are as follows: The skull is essentially like that of the Cypselidæ (swifts) and Caprimulgidæ (goatsuckers), though of course very much modified in many minor respects; the sternum has a very deep keel, and its posterior margin is rounded; the humerus is extremely short, and the manus quite elongated; the hyoid bones are very long, "in their position resembling those in the Picidæ (woodpeckers); trachea of uniform diameter, destitute of muscles of voice [?]; bronchia very long; œsophagus funnel-shaped, slightly contracted on approaching the proventriculus, which is small and scarcely perceptible; gizzard small, moderately muscular" (*Eyton*); the ambiens muscle is wanting in the knee; the primary femoro-caudal is present, but the accessory femoro-caudal, semitendinosus, and accessory semitendinosus are deficient; the pectoral muscles are very large. The affinities of these birds were long misappreciated, and by the older authors they were universally approximated to the "tenuirostral" Passeres (such as creepers, hoopoes, etc.), but it is now proved that they are most nearly related to the swifts. The two families have indeed by some authors (*e. g.* Nitzsch and Garrod) been even combined in one family (called Macrochires), on account of their general agreement, and especially in the relative shortness of the humerus and length of the manus. They are, however, generally (and apparently with great propriety) regarded as two quite distinct families. The Trochilidæ are very numerous in genera and species: Mr. Gould, in his great monograph, has admitted 416 species, ranked under 123 genera, and Mr. G. R. Gray, in his *Handlist*, has recognized 469 species grouped under 2 sub-families, 10 genera, and (including generic types) 163 sub-genera. The species differ extremely in the form of the bill and that of the tail: the bill, *e. g.*, varies in extent from almost less than the length of the head to that of the rest of the body, and is sometimes upcurved (*e. g. Avocettula*), sometimes straight, and sometimes, again (*e. g. Eutoxeres*), boldly decurved; while generally, too, the mandibles are unarmed, sometimes (as in *Grypus*) they have "a row of numerous and thickly-set teeth," and "a strong hook at the end of the mandibles" (*Gould*). The tail is equally variable; "in some species (*e. g. Lesbia amaryllis*) it is four times the length of the body, in others (*e. g. Calothorax micrurus*) it is so extremely short as to be entirely hidden by the coverts;" in some, again, it is extremely forked, while, on the contrary, in others, it is to an almost equal degree wedge-shaped. It is chiefly on such modifications that the numerous genera are based. Much yet remains to be done in the combination of the genera into natural groups. The species, as already intimated, are most numerous in equatorial countries, but heat is by no means a necessary condition of their existence, as in those countries not a few species dwell in the high mountainous, and consequently cold, regions. On Chimborazo, "just below the line of prepetual congelation," one notable species (*Oreotrochilus chimborazo*) is found. Several species also ascend far into

the uplands or plains of North America, the most northern being the common humming-bird (*Trochilus colibris*) of the Eastern States, which wanders as far N. as British America, and the rufous-backed humming-bird (*Selasphorus rufus*) of the Pacific States, which is said to extend upward to British Columbia and Alaska. Other species migrate to equally cold regions in Patagonia. There is a remarkable difference between the males and females in most of the members of the family: the males are generally very brilliantly colored, their head, neck, and breast feathers especially reflecting iridescent hues of various kinds, while their feathers are frequently developed in some fantastic manner; the females, on the contrary, are mostly quite plain in their colors, and have little exuberance of plumage. The species are mostly the smallest of birds, the largest of the family, the *Patagona gigas* of the western slope of South America (Ecuador, Peru, Bolivia, and Chili), being about eight inches long, or the size of a swallow, while the smallest, the *Mellisuga minima* of Jamaica and San Domingo, is barely an inch and a quarter in length. The species frequently stop, poised in mid-air, rapidly vibrating their wings and producing a humming sound, which has procured for them their popular name. They especially exhibit this peculiarity in their visits from flower to flower in search of the nectar and the minute insects contained therein. They are fearless little creatures, and readily accommodate themselves to the presence of man, but are very difficult to keep in confinement. They mostly build in bushes or vines or on the sides of rocks cup-shaped nests, and therein lay generally two eggs (but sometimes, it is believed, only one), which are hatched in about two weeks or little more. Thirteen or fourteen species are found within the limits of the U. S. (See also HUMMING-BIRD, in CYCLOPÆDIA.) THEODORE GILL.

**Troglodyt'inæ,** or **Troglodytidæ** [from *Troglodytes*—τρωγλοδύτης, a "cave-dweller"—the name of the typical genus], a sub-family or family of passerine birds, containing the wrens. The characters have been best formulated by Baird, who considers the group as a family. The form is exemplified in the familiar wren: the bill is slender, and the upper mandible is generally entire, but sometimes notched; no rictal bristles are developed, but the loral feathers have bristly points; the nostrils are diversiform, "exposed or not covered by feathers, and generally overhung by a scale-like membrane;" the wings are rounded, and have ten primaries, the first of which is generally about half as long as the second; the tarsi are moderately long and scutellate; the toes are moderate; the middle "usually united to half the basal joint of the inner and the whole of that of the outer, or more," and the lateral about equal, or the outer a little longer; the hinder one enlarged; the tail is moderate. The group comprises the wrens of the northern hemisphere and numerous related species, the greater part of which are American. By G. R. Gray, 126 species are recognized as members of the group, dignified by him as a family, and are grouped under two sub-families—viz. Troglodytinæ, with 5 genera (20 sub-genera), and Tatarinæ, with 1 genus (2 sub-genera). By most authors, however, about 15 genera are admitted under the first group. The species of the northern hemisphere are rather plain-looking but prepossessing birds, and the attitude of the common species—head stretched forward and upward and tail bent upward while singing—is characteristic. They are chiefly insectivorous. Their nests are mostly built in trees, often in cavities, and the eggs are rather numerous (seven to nine in *Troglodytes ædon*), and short for their length. The North American species admitted by Baird, etc., are *Campylorhynchus brunneicapillus, C. affinis, Salpinctes obsoletus, Catherpes mexicanus, Thryothorus ludovicianus, Thryomanes Bewickii, Troglodytes ædon, T. parvulus* or *hyemalis, Cistothorus stellaris,* and *C. palustris,* besides varieties.

THEODORE GILL.

**Trogon'idæ** [from *Trogon*—τρώγειν, to "gnaw"—the designation of the typical genus], a family of birds common to the tropical and subtropical regions of America, as well as Asia and Africa. The bill is rather short, stout, broad at the base, and rapidly narrowed forward, with the culmen decurved and with the edges more or less toothed; the gape is furnished with bristles; the cleft is quite deep; the nostrils are sublaterally basal, and more or less concealed by bristly feathers; the wings are moderate and rounded or angulated at about the fifth primary; the legs are rather weak; the tarsi short and partially or entirely covered with feathers; the toes separated in pairs, the first and second directed backward, and not versatile, and the third and fourth forward, the anterior connected by their basal joints; the tail is more or less elongated and graduated. The species are mostly rather large and showy birds, which in great part live in the depths of the equatorial forests, often perched on the highest branches. They are believed to subsist to a large extent on fruits and berries, but also prey on insects. About 50 species are known, which have been variously grouped in genera. About 35 species represent the family in America and constitute the genera *Prionoteles, Temnotrogon, Trogon, Leptuas,* and *Pharomacrus* (= *Calurus*); some dozen or more are found in Asia and form the genus *Harpactes* and its subdivisions; and a couple of species in Africa have been isolated to form the peculiar genus *Hapaloderma.* The relations of the family are with the Momotidæ, Alcedinidæ (kingfishers), Cuculidæ (cuckoos), and allied forms, and it is a member of the sub-order Coccygomorphæ of Huxley or Coccyges of some other authors. THEODORE GILL.

**Trout** [derived through the Fr. *truite* from the mediæval Latin *trutta*], a name variously applied in different countries. (1) Primarily, and by right, however, the name belongs alone to the well-known fish so called of Great Britain and related species of northern countries. These species belong to the family Salmonidæ, and, as generally understood, to the genus *Salmo,* and form a group distinguished by their habits as well as structure. They are in the main confined to fresh waters, and there reside during the whole of the year, feeding therein and propagating near their habitual abiding-place. In this respect they contrast with the salmons and salmon-trouts. They are also generally spotted with red or black. Although thus contrasted with the salmons as non-anadromous fishes (*i. e.* not living for the greater part of the year in salt, and returning to fresh waters for merely breeding purposes), they are not averse to salt water, and may even be, to a limited extent, anadromous. Species are found in clear and cold streams and lakes of most northern countries. They are voracious fishes, and possess great agility, and are therefore favorite fishes for anglers. About 20 species are found in Europe, 4 or 5 in Siberia, and over 20 in North America. The pre-eminent species, however, are the *Salmo fario* of Europe and the *S. fontinalis* of North America.

(*a*) The *Salmo fario* belongs to a group distinguished by dentition; the vomer has a triangular head, broader than long, and across its front is a transverse series of teeth, while on the shaft is a double row of strong teeth placed opposite to each other or alternately, and which are persistent throughout life; the scales are of moderately small size, about 120 being along the lateral line; the trunk and head are usually thickly covered with red spots and black ones, bordered with a light rim; these are often more or less irregular in shape; the dorsal and anal fins at their anterior margins and the ventrals along their outer edges are yellowish; the dorsal is also spotted with red and black. The species attains a length of about thirty inches, although individuals become able to procreate when about eight inches in length.

(*b*) The *Salmo fontinalis* is the representative of another group, distinguished by the vomerine dentition; the vomer has also a broad head and teeth on its front portion, but there are none on its shaft; the scales are very small, there being somewhere about 200 along the lateral line; the skin on the trunk as well as head is covered with yellowish spots, and more or less dotted with vermilion; the dorsal has five or six transverse rows of dark spots; the ventral and anal edged with whitish, followed by a slightly oblique blackish band crossing lengthwise the second and third rays, and the rest orange; the pectorals are margined along the upper rays with black. It does not attain as large a size as the European species, but is regarded by many as even a superior fish for the table and sport.

(2) The name "trout" is also applied in the Southern U. S. to the species of *Micropterus* (black bass) and *Cynoscion* (weak-fish), and elsewhere to many other fishes, but always quite erroneously. (See also SALMONIDÆ, etc.)

THEODORE GILL.

**Trum'bull** (HENRY CLAY), A. M., b. at Stonington, Conn., June 8, 1830; was educated at Williston Seminary, East Hampton, Mass.; settled at Hartford, Conn., in 1851; was appointed State missionary of the American Sunday School Union for Connecticut in 1858, and ordained as a Congregational clergyman in 1861; served during the war as chaplain of the 10th Connecticut Vols., and was taken prisoner before Fort Wagner in 1863; was appointed missionary secretary for New England in 1865, and normal secretary in 1871, and removed in 1875 to Philadelphia, where he became the editor of the *Sunday School Times.* He has published *The Sabbath School Concert* (1861), *The Knightly Soldier* (1865), *Memorial of E. B. Preston* (1866), *Falling in Harness* (1867), *Childhood Conversion* (1868), *The Captured Scout of the Army of the James* (1869), *Children in the Temple* (1869), *The Worth of an Historic Consciousness* (1870), *Review Exercises in the Sunday School* (1873), etc.

**Tun.** See TON, by F. A. P. BARNARD.

**Tupai'idæ** [from *Tupaia*—a latinized form of a native name—the typical genus], a family of mammals of the order Insectivora and sub-order Animalivora, peculiar to the East Indies and neighboring islands. In form they resemble the squirrels: the head, however, runs out in a pointed snout; the pelage is soft and abundant; the hind legs are notably larger than the front ones, and all have five well-developed toes; the tail is long; the teeth are 38—viz. M. $\frac{3}{3}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$, I. $\frac{2}{3} \times 2$; "upper molars with four more or less marked cusps and an external cingulum, which tends to form, with the two outer principal cusps, two triangular prisms;" lower with two subequal halves (anterior and posterior), the posterior being almost as much developed as the anterior, triangular and narrowed outward; canines more or less remote from the sutures between the premaxillaries and supramaxillaries; the skull has the dorsum of the muzzle transversely convex; the orbits are more or less encircled by bone; there are no suboptic foramina; alisphenoid canals are developed; malar bones perforated; the lachrymal foramina open at the margin of or outside the orbits; the tibiæ and fibulæ are separate; the metatarsi are moderately long—*i. e.* little or no longer than the tarsi; the pubic symphysis is elongated; the intestinal canal has a large cæcum. The family embraces mammals about the size of squirrels; the resemblance to those animals is an adaptive one, and, like the squirrels, the tupaias live chiefly in trees; their resemblance to the squirrels is sufficiently striking to have obtained for them in certain places the same name, the native word "tupaia" being applied to the animal in question as well as true squirrels. The species are most abundant in the islands of Sumatra, Borneo, and Java. They are generally grouped in two genera, *Tupaia* and *Ptilocercus*. They are truly insectivorous. THEODORE GILL.

**Tur'dinæ,** or **Turdidæ** [from *Turdus*—the ancient Latin name of the thrush—the typical genus], a sub-family or family of passerine birds, typified by the common thrushes, and comprising the catbird, mocking-bird, and related species. The form is familiar in connection with the species just enumerated, and all are essentially alike in that respect; the bill is rather slender, elongated, and subulate, compressed toward the tip, with the culmen more or less curved from the base, and with the upper mandible generally notched near the tip; the loral and frontal feathers are bristly; the mouth is also usually well provided with bristles; the nostrils are oval and naked; the wings furnished with ten moderate and rounded primaries, and with the "spurious primary sometimes half the length of second quill; the second quill shorter than the fourth; in the closed wing the outer secondary reaches three-fourths or more the length of longest primary" (*Baird*); the legs are moderately developed; the tarsi in some (Turdinæ) anteriorly "booted"—*i. e.* covered with an undivided sheath; in others (Miminæ) scutellate; the toes rather long, the outer united to the middle by the basal joint, the inner mostly separate; the tail is well developed, and generally even or cuneate. Such are the characters assigned by Gray, Baird, Coues, Lilljeborg, and others to this group, by all of whom it is considered as a family. Like almost all other so-called families of Passeres, however, it requires confirmation by osteological characters, and is probably of less than family value. The group is extensively represented in almost all countries except the polar regions, though sparingly in Australasia and Polynesia. The species feed upon insects and their larvæ, as well as berries and fruit. Among the members of the group are some superior songsters, such as the mocking-bird and wood-thrush of North America, etc. They mostly build their nests in trees or bushes, and lay about four or five eggs. Not far from 250 species have been made known (G. R. Gray recognizing 232 species in his *Handlist*), of which about 100 are inhabitants of America and represent some 13 genera. Fourteen species are found within the limits of the U. S., and belong to five genera. The most notable are the *Turdus mustelinus* (wood-thrush), *T. fuscescens* (tawny thrush), *T. migratorius* ("robin"), *Harporhynchus rufus* (brown thrasher), *Mimus polyglottus* (mocking-bird), and *Galeoscoptes carolinensis* (catbird). THEODORE GILL.

**Turkish Language and Literature.** The Turkish language belongs to the Ural-Altaic or Scythian or Turanian group, and is allied to the Finno-Hungarian, Samojedic, Tungusian, and Mongolian languages. It is spoken in various dialects over a vast tract of land stretching from the Lena across Central Asia, Asia Minor, and the Balkan peninsula to the Adriatic. Several of these dialects, or rather branches, of the primitive stock-language have obtained a literary development, such as the Uigur, the Jagatai, and the Osmanli, but none of them have as yet received a thoroughly scientific investigation. Of the Uigur, most of its literary monuments have been lost; the Jagatai, which flourished E. of the Caspian Sea from the time of Tamerlane to that of Baber, is very little known; best known is the Osmanli, spoken at present throughout the whole Turkish empire in Europe, Asia, and Africa, and much used both in literature and in political and commercial business. It is very mixed with respect to its materials, half of its words being either Persian or Arabian; it has no relative pronoun but that borrowed from the Persian, and no conjunctions but those borrowed from the Arabic. Its grammar, however, is strictly Turkish, and places a sharp difference between it and the Indo-European and Semitic languages, with which it in other respects has intermingled very freely. It is generally written with Arabic letters, which are very poorly suited to express it; sometimes, however, Armenian characters are used. There are grammars by Davids (London, 1836), Redhouse (Paris, 1846), and Kasem-Beg (translated into German, Leipsic, 1848), and dictionaries, Turkish-French, by Kieffer and Bianchi (1846) and Redhouse (1857).

The Turkish literature is rich, but not very original. Much of what it contains is translation or imitation, especially from the Persian, but also from the Arabic, and, of late, even from various European literatures. Lyrical poetry flourished among the Turks even before the establishment of their empire in Europe, but the influence of Persia is very marked, even with the most prominent poet of that period, Mohammed Tschelebi, whose romantic epics and mystical lyrics are still highly appreciated. The golden age of Turkish poetry was the times of Solyman the Magnificent, when Fasli (d. 1563) and Bâki (d. 1600) wrote. The former is the author of the celebrated poem, *Gul u Bulbul* ("The Rose and the Nightingale"), which has been translated into almost all European languages; and the latter is by his countrymen placed equal to Hafiz and Motanebbi. Of great importance among the numerous historical productions are the annals of the empire from its establishment to the end of the eighteenth century, commenced by Saad-ed-din, and continued by Naima (1591–1659), Reschid (1660–1721), Tschelebisade (1721–27), Sami (1730–43), Issi (1744–52), and Wasif (1752–73). Particularly interesting are the so-called *Fetwas*, judicial decisions of entangled juristical cases, of which there are several collections—by Sheikh Mustafa-el-Kudusi (1822), Mufti Abdur-Rahim (1827), Numan Effendi (1832), etc.—giving a vivid picture of the life of the people and of the peculiar connection between its religion and its legislation. (See *Litteratura Turchesca*, by Toderini (1787), and *Geschichte der Osmannische Dichtkunst*, by Hammer (1836), which contains numerous specimens of Turkish lyrical poems, excellently translated.)

# U.

**Ubii,** the name of a Germanic people settled, in the time of Cæsar, on the right bank of the Rhine, from the Sieg to the Lahn, between the Sigambrii to the N. and the Suevi to the S. Cæsar describes them as being quite familiar with Gallic manners and civilization, and he found them ready to make an alliance with him and furnish him with vessels for the crossing of the Rhine. Afterward they remained faithful to the Romans, and when they were too hard pressed by their wild neighbors, the Suevi, Agrippa removed them, in the time of Augustus, to the left bank of the Rhine. Agrippina, the daughter of Germanicus and the wife of Claudius, was born in their capital, *Ara* or *Civitas Ubiarum*, which after her was called *Colonia Agrippinensis*, the present Cologne. The whole people was sometimes called *Agrippinenses*. In the insurrection of Civilis (70 A. D.) they participated only for a short time, and because they were compelled by force. Soon after, however, they became merged into the Franks, and disappeared as an independent nation.

**U'lybuschew,** or **Oulibicheff** (ALEXANDER DMITRIWICH), b. in 1791 in the government of Nizhnee-Novgorod, Russia, descended from a Tartar family; studied at various German universities; entered the Russian ministry of foreign affairs, but resigned his position in 1831; devoted himself exclusively to the study of music. D. in Nizhnee-Novgorod Feb. 5, 1858. He wrote, in French, *Nouvelle Biographie de Mozart* (3 vols., 1843) and *Beethoven, ses Critiques et ses Glossateurs* (1857), which were translated

into both German and English. In Russian he wrote a great number of musical essays and criticisms in various periodicals, which exercised a great influence on the development of musical taste in Russia.

**Um′bridæ** [from *Umbra*—the ancient name of a fish—the typical genus], a family of fishes of the order Teleocephali and sub-order Haplomi, represented in North America and Eastern Europe. In form they resemble the "killie-fishes" or "minnows" (Cyprinodontidæ): the body is covered with cycloid scales, which are moderately large and destitute of radiating striæ; the lateral line is obsolete; the head is oblong, conic in profile, transversely arched, and covered with moderate scales like those on the body; the eyes are lateral; the opercula normally developed and unarmed; the mouth is moderate, and has a lateral oblique cleft; the upper jaw is formed by the intermaxillaries as well as supramaxillaries; teeth are developed on the jaws as well as palate; the branchial apertures are ample; branchiostegal rays five or six; the dorsal fin has articulated and branched rays, and is submedian and above the ventrals; the anal is smaller and farther back than the dorsal; the caudal well developed; the pectorals normal; the ventrals abdominal and with six rays. The intestinal canal has a simple stomach and no pyloric cæca; the air-bladder is simple. The species of the family live in fresh and brackish water ponds and the waters in the eastern parts of Europe (*e. g.* in certain parts of Austria, Hungary, and the Crimea) and many portions of the U. S. The European representatives have been designated *Umbra Crameri;* the American *Umbra limi, Melanura limi*, etc. Although there may be generic differences between the American and European forms, they have not yet been demonstrated. The American species live, it may be said, in the mud itself, and patches of water which appear destitute of fishes may yield considerable numbers of this kind by being dragged and the bottom stirred up. The species are generally about three to five inches long. THEODORE GILL.

**Ungula′ta** [Lat. *ungulus*, a "hoof"], a name applied in various senses to placental mammals having digits terminated by hoofs.

I. By Ray, and especially Linnæus, the name was employed for all the hoofed mammals in contradistinction to the clawed and muticate (finned) mammals. These, again, were differentiated by Linnæus into two orders—(1) Pecora, including all the ruminating forms, and (2) Belluæ, embracing the equine and hippopotamine forms: *Rhinoceros* was referred to the Glires (rodents), and *Elephas* to the Bruta (chiefly edentates).

II. The errors of Linnæus in his references of the genera *Rhinoceros* and *Elephas* were soon corrected by his successors, and in their works (*e. g.* Pennant's *Synopsis of Quadrupeds*, 1771) all the true ungulate mammals were combined together under the name Ungulata or hoofed quadrupeds.

III. By Cuvier (1817, etc.) the ungulate mammals were differentiated into two orders—(1) "les Pachydermes," equivalent to the Belluæ of Linnæus after the inclusion of *Rhinoceros* and *Elephas*, and (2) "les Ruminans," identical with the Pecora of Linnæus. This classification for a long time prevailed, and is the one found in most of the popular works on natural history up to within a few years past.

IV. By De Blainville (in 1816) the group, under the name "les Ungulogrades," was restricted to the ordinary hoofed quadrupeds, the elephants being isolated as the representatives of a distinct order named "les Gravigrades." The Ungulogrades were in turn differentiated into two groups—(1) those with unpaired digits, embracing the normal pachyderms and equines, and (2) those with paired digits, including the suilline forms as well as the ruminants. The manatee was added, erroneously, as an anomalous form of the order. These modifications, except the last, constituted a very decided advance in classification. They, however, attracted but little attention till Owen (in 1840, etc.) revived the same views, and adopted the groups in question under other names. Accepting the division of ungulates as a natural whole, he divided it into three subordinate ones—(1) Isodactyle or Artiodactyla, answering to the paired-toed Ungulogrades of De Blainville; (2) Anisodactyle or Perissodactyla, equivalent to the odd-toed Ungulogrades of De Blainville; and (3) Proboscidea, identical with the Gravigrades of De Blainville. These three divisions were finally raised to ordinal rank by Owen.

V. By Huxley and later writers the living ungulate mammals have been mostly distinguished into three orders, characterized by placental as well as skeletal features. (1) The name Ungulata has been reserved for the bulk of the species, which have again been divided into the sub-orders Perissodactyla and Artiodactyla; (2) the term Hyracoidea has been introduced as an ordinal term by Huxley to cover a form (*Hyrax*) which had been confounded with the perissodactyle ungulates and approximated to the *Rhinoceros* by Cuvier and others; (3) the group Proboscidea has been accepted as another order.

VI. In addition to the recent forms of ungulate mammals, there are several extinct types which are also by some authors regarded as the representatives of other orders; such are the Toxodontia of South America, the Dinocerata of North America, etc.

The order Ungulata, in the sense now generally used, is characterized as follows: The teeth are, archetypically, in full number (44), but often a number are suppressed; the molars have generally grinding surfaces, and are two or three rooted; the canines are very diversiform, generally rudimentary or wanting, sometimes (as in Tragulidæ, Suidæ, etc.) extremely developed; the incisors are, typically, six in each jaw, but often wanting entirely in the upper, and are implanted by simple roots and have incisorial crowns; the legs at their proximal joints (humerus and femur) are more or less enclosed in the common abdominal integument (least in the camels); the feet are upraised, and their palmar and plantar surfaces are invested in a hairy skin undistinguishable from the rest of the integument; the carpal bones are in two interlocking rows; the cuneiform narrow, and affording a diminished surface of attachment forward for the ulna (which is retrorse beside the radius); the unciform and lunar articulating with each other, and interposed between the cuneiform and magnum; the hind foot has the astragalus at its anterior portion scarcely deflected inward, and articulating more or less with the cuboid as well as navicular; the scaphoid and lunar are separate; the toes of all the feet are never more than four in number, and the terminal joints are invested in thick nails or "hoofs;" the brain is well developed, and the cerebrum covers more or less of the olfactory lobes and cerebellum; the placenta is non-deciduate; the rectal and generative apertures are well separated; the testes more or less exposed. The order thus defined embraces a large number of species, about 225 now living. The existing forms are grouped under two sub-orders and fourteen families—viz. (I.) Artiodactyla, with the families (1) Camelidæ, (2) Giraffidæ, (3) Saigiidæ, (4) Bovidæ, (5) Antilocapridæ, (6) Cervidæ, (7) Tragulidæ, all of which are ruminants, and (8) Phacochœridæ, (9) Suidæ, (10) Dicotylidæ, and (11) Hippopotamidæ, which are non-ruminants; and (II.) Perissodactyla, with the families (12) Equidæ, (13) Rhinocerotidæ, and (14) Tapiridæ. Of these, the second, third, seventh, eighth, ninth, eleventh, twelfth, and thirteenth are now peculiar to the Old World, and the fifth and tenth to the New World. But in ancient times the case was very different, the Rhinocerotidæ and Equidæ having abounded in the Miocene epoch in North America. A large number of extinct forms are now known which connect together types that are at present far removed. Among the most notable are the Anoplotheriidæ, Oreodontidæ, and Hyopotamidæ, which bridged the existing chasm between the ruminant and non-ruminant ungulates. These had fully-developed upper incisors, combined with the characteristic double lunate-ridged molar teeth of the living ruminants, and thus on the one hand were related to the typical ruminants, and especially the Tragulidæ, and on the other to the omnivorous artiodactyles, and perhaps most to the peccaries. Also to be noticed in this connection are Orohippidæ and Anchitheriidæ, as well as *Hipparion*, which form a series with the Palæotheriidæ, and demonstrate the relation between the Rhinocerotidæ and Equidæ of the present epoch. The order was represented by typical examples as early as the commencement of the Eocene period, and undoubtedly very long before, although no remains of an earlier date have been yet discovered. Nearly twenty families, now entirely extinct, are known from their fossil remains. The order has therefore played a very important part in the earth's past history, and the extinct types already known outnumber the recent. Why certain of the forms formerly existent in America, but now confined to Africa and Asia, became extinct, can scarcely be surmised, as when reintroduced (as have been the horse and hog) they multiply and flourish as much as in their native lands. The order is also noteworthy as furnishing by far the largest portion of the meat food which man uses, as also the beasts of burden which he employs. Almost all the species—and, above all, the ruminants—are hunted or kept for the meat they yield, and even the perissodactyles—horse, rhinoceros, and especially tapir—are esteemed as food by some peoples. Beasts of draught and labor are obtained chiefly from the Equidæ (horse and ass, etc.), the Bovidæ (ox, buffalo, etc.), and Cervidæ (reindeer). Their contributions in other ways are manifold, of which the most noteworthy are milk, hides, glue, etc. (For further information see the names of the different sub-orders and families, as well as the domesticated animals, and especially the article HORSE, in CYCLOPÆDIA.) THEODORE GILL.

# V.

**Van der Wey'de** (PETER HENDRIK), PH. D., M. D., b. in Nymwegen Feb. 5, 1813; studied in the University of Delft; obtained in 1845 a gold medal from the Society for the Advancement of Science in Amsterdam for a new textbook on physics in 3 vols.; edited from 1843 till 1849 a journal in Amsterdam devoted to the diffusion of mathematical and physical knowledge; took an active part in the politics of his country as editor of two dailies, and was the author of pamphlets advocating republican principles; came in 1849 to the U. S., and settled in New York City as a private teacher. He studied medicine in the New York University 1852–56; graduated there, and became a physician of the New York City North-western Dispensary; later, professor of chemistry in the New York Medical College, and in 1859 of physics and mechanics in the Cooper Institute; was called in 1864 to Girard College, Philadelphia, to fill a new chair, that of industrial sciences, but resigned in 1866 and returned to New York, where he has since occupied the chair of chemistry in the Dental College and in the Medical College for Women; is now editor-in-chief of a mechanical paper, the *Manufacturer and Builder*, founded by him in 1859, and is preparing a new textbook on the theory and practice of mechanics.

**Van Len'nep** (HENRY JOHN), D. D., b. in Smyrna Mar. 18, 1815, descending from a distinguished Dutch family of scholars and writers; was sent to the U. S. at fifteen; attended school at the Mount Pleasant Institution in Amherst, Mass., and graduated at the college in the same town in 1837; studied theology in Andover, and returned as a missionary to the land of his nativity in 1839; first acted as a pioneer, and established new posts in European Turkey, Asia Minor, and Syria; was subsequently, and during most of his thirty years' foreign labor, connected with collegiate and theological institutions in Constantinople, Smyrna, and Tocat; made many exploring tours, travelling extensively in Greece, Roumelia, Asia Minor, Syria, Palestine, and Egypt, and became familiar with most of the Oriental languages, so that he can read and write in ten different dialects and preach extempore in five. Having lost his eyesight from cataract, he returned to the U. S. in 1869, and devotes himself to literary labors. He has published *Travels in Asia Minor* (2 vols., 1870) and *Bible Lands* (1875).

**Van Rens'selaer** (MAUNSELL), D. D., LL.D., b. Apr. 15, 1819, at Albany, N. Y.; educated at the Albany Academy; graduated at Union College in 1838, and at the General Theological Seminary of the Protestant Episcopal Church in 1841; was admitted to holy orders June 30, 1841; was missionary at Whitehall, N. Y., till 1845; founder and first rector of Grace church, Albany, till 1847; was rector in succession of St. John's church, Mount Morris, St. Paul's, Oxford, and Grace, Rochester, in the diocese of Western New York; president of the De Veaux College from 1859 to 1869, and of Hobart College from 1872 to 1876.

**Vege'tius** (FLAVIUS RENATUS), probably b. in Rome about the middle of the fourth century A. D.; wrote an *Epitome* (*Institutionum*) *Rei Militaris*, which was dedicated to the emperor Valentinian II. (375–392); Teuffel (*Hist. Rom. Lit.*, § 424) says to Theodosius I. (378–395). The work is in five books, and is chiefly a compilation from previous writers. The first book treats of the levying and training of soldiers; the second of the early discipline and of the formation of the Roman army; the third of strategy; the fourth of the art of defending and of assaulting fortified places; the fifth of naval warfare. From some expressions of Vegetius it is believed that he was a Christian. Best editions by Schwebel, with the notes of Oudendorp and Bessel (Strasbourg, 1806), and with revised text by C. Lang (Leipsic, 1869).

HENRY DRISLER.

**Vel'vet** [It. *velluto*, from Lat. *vellus*, a "fleece," or more probably from Lat. *villus*, a "flock of hair or wool," "the nap of cloth"], a woven fabric composed of a warp and weft, usually twilled, as in what is called Genoa velvet, with a thick additional filling consisting of single, double, or formerly triple (whence *three-pile*) threads of a finer quality passed under the ordinary weft and brought up in loops on the *right* side. The loops are so close as entirely to cover the proper web, and are generally cut and evenly singed or sheared, so as to form a soft and somewhat lustrous surface, like the fine fur of small quadrupeds; but they are sometimes left uncut. The term velvet is usually applied only to fabrics of silk or silk and cotton, and we shall treat only of such tissues, though the word generically embraces all stuffs of similar texture with a face of *pile* or loops woven into the fabric, by which they are distinguished from cloths having a *nap*, or furry surface composed of filaments spontaneously loosened from the yarn or raised by *teasing* the web.

It has been generally supposed that velvet, like other fabrics of silk, is of Chinese origin, but we find no evidence that it was anciently manufactured in China or in any other Oriental country, or that it was first introduced into Europe from the East. Merchandise of foreign production usually brings its native designation with it, or is called by a name indicative of the locality of its growth or manufacture. Most silk and cotton stuffs are, or have been, known in commerce by such terms, but we believe that velvet is not called by an Oriental name in any European language. Italian velvets were exported from Venice to Persia before the discovery of the Cape of Good Hope, and we do not find this article specified in any of the old tariffs as an object of importation from the East. It is a curious fact that velvet was common in Europe long before any specific name seems to have been generally applied to it. An apparently related word, indeed, occurs in the twelfth century, and even earlier, but very rarely, and with some uncertainty of signification, and velvet took its ordinary designation from its color, probably because rich colors show to best advantage in this rich stuff. Hence, in the early literature of the modern languages it is spoken of simply as *pourpre, cramoisi, écarlate* (It. *porpora, chermisì, scarlatto*), though these terms were probably sometimes used to designate other fine fabrics. *Samit* indeed (Gr. ἑξαμίτος) appears often to have signified velvet, as *sammt* now does in German, but it was frequently applied to stuffs clearly distinguished from velvet. It is worth noticing that an inferior quality of velvet, probably a tissue with a web of cotton and a pile of silk, was known at a very early period, for in the old poem of *Parzival*, in a passage where there is every reason to believe that *samit* means velvet, mention is made of

> "Ein grüener samit,
> Des niht von der hohen art;
> Er was ein samit pastart."

The old German *phelle*, which often occurs, and in a great number of forms, as *phellel, pfeller*, etc., is thought not to be cognate in etymology with velvet, but derived from Lat. *pallium*, and it appears to signify a mantle or other vestment composed of silk, but of a texture different from velvet, though sometimes possibly of similar fabric.

The silk industry is commonly said to have been introduced into Western Europe by the Norman dynasty in Sicily about the middle of the twelfth century, but Amari, a very high authority, believes that it was exercised in Sicily at a much earlier period. If the hitherto received opinion on this point is correct, and if velvet was known in France or Italy before that date, it could not have been of domestic manufacture, but must have been imported from Greece (where the fabrication of the more costly silk stuffs, probably including velvets, appears to have been an imperial monopoly and confined to the precincts of the palace of the sovereign himself) or from some remote Eastern country. But there is no direct evidence of the production of this particular fabric in those regions at the period in question, and, so far as we can positively trace the history of velvet, its primitive annals belong exclusively to insular and peninsular Italy.

The most ancient existing specimens of velvet, as of other European silk tissues, consist of fragments of ecclesiastical and regal vestments, covers of books, scabbards, and saddles, still preserved in public museums or church treasuries, and especially of broad strips of fine fabrics of silk or other soft material found in illuminated mediæval manuscripts, where they served, like modern tissue-paper, to protect the miniatures, borders, and ornamented capitals. Thus, a manuscript of one of the works of Theodulf, a bishop of the time of Charlemagne, which Michel appears to consider as contemporaneous with its author, contained originally sixty-six of these *guards*, of which fifty-three still remain in the volume, including one of velvet and several of other curious textures, several of which have lately been reproduced by French industry. But though from these and from purely literary sources we gather sufficient proof of

the existence of velvet at a remote period of the Middle Ages, we are not able to point out with certainty any of the seats of its production before the establishment of the silk-works of Italy, and especially those of Lucca and Florence, in the thirteenth and fourteenth centuries. The secrets of the processes of this complicated industry were jealously guarded, like those of other mediæval *mysteries*, and but slowly extorted from the Italian producers by the cunning of foreign artisans; but the manufacture of velvet is now not confined within geographical limits, and great as is the skill of the dyers and weavers of Genoa and Lyons, the descendants of Huguenots driven out from France by religious persecution now send forth from the looms of Crefeld, in Rhenish Prussia, velvets not surpassed in quality by those of any other country. The velvets of France are protected against foreign competition by a considerable import duty, but nevertheless those of Crefeld have been and still are largely exported to France, where they are able to undersell the native fabric.

Velvets shot with gold or silver thread, and figured velvets in which the design only was provided with a cut pile, were formerly in vogue, but the simple elegance of the plain fabric is more pleasing to modern taste. The beauty of velvet, its warmth, its durability, and the skill required for its fabrication, have made it at all times a costly stuff. In our day the increased demand for velvet, and the diminished supply of the raw material in consequence of the prevalence of the silkworm disease, have rendered it still dearer, and there is perhaps no material of dress the price of which has risen so much in the course of this generation as that of velvet.

The principal defect of velvet is its liability to lose the regularity and beauty of its surface by *crushing* from folding or pressure. This arises partly from a want of elasticity in the filaments of which the pile is composed, and partly from their adhesion to each other by a sort of felting, and the surface thus injured is very difficult to restore. Some manufacturers have succeeded in overcoming this defect to a considerable extent, and there is reason to believe that further improvement in this respect may be looked for.

There are no climatic reasons why this and all other branches of silk industry should not succeed in the U. S.; but, though the cost of the purely mechanical processes of weaving and dressing may be diminished by American ingenuity, yet the high rates of manual labor make the gathering of the mulberry leaves, the feeding and tending of the worms, and other preliminary processes far more expensive with us than in Europe or the East, and form a minor obstacle to the prosperity of this manufacture in America. (See Francisque Michel, *Recherches sur le Commerce, la Fabrication et l'Usage des Étoffes de Soie d'Or et d'Argent et autres Tissus précieux* (Paris, 1852, 2 vols. 4to). Pietro Pinchetti, *Corso Teorico-Pratico per la Fabbricazione delle Stoffe di Seta*, a valuable work now in course of publication at Como, illustrated with engravings and with specimens of silk fabrics, will embrace a special treatise on velvets.)

GEORGE P. MARSH.

**Venereal Ulcer,** or **Chancroid,** an acute, contagious ulceration, recognized as resulting from venereal contact. It is a purely local disease, possessing characteristics which entitle it to be considered, *par excellence*, the highest type of acute ulcerative action. In the great majority of cases it is the result of inoculation of the purulent secretion of an already existing ulcer of a similar character. Applied to sound integument or mucous membrane, it is capable, under favoring circumstances, of effecting a solution of continuity of the part, and of communicating to it at once its destructive and contagious properties. More commonly and readily it is established upon an abrasion of the skin or mucous membrane produced *in coitu*. On application of the purulent secretion of the *venereal ulcer* to an abrasion, either on the person already affected or on one previously free from the disease, congestion, inflammation, suppuration, rapid destruction of tissue follow in quick succession. The ulcer thus formed presents all the characteristics of rapid destructive action; it is sharply cut, with ragged edges and pultaceous floor, and secretes pus freely. Chiefly characterized by its contagious property, the venereal ulcer is seldom single, several distinct lesions usually presenting at the same time. Occurring under circumstances of good general health, cleanliness, and temperate living, its progress is usually self-limited; gradually increasing from two to five weeks, it acquires a diameter of from six to twelve lines; the loss of tissue is then slowly restored, and a scar like that of an ordinary burn is left. From first to last its secretion is inoculable, and the sore is capable of being reproduced upon the person bearing it. When reproduced by artificial inoculation (see article SYPHILIZATION) it loses its contagious power in each successive inoculation until the secretion from it is no longer inoculable. It will thus be seen that the tendency of the disease, under favoring conditions, is always toward recovery. When acquired, however, under unfavorable conditions, such as a depraved constitution, irregular life, filth, and alcoholic excess, the chancroid assumes its most vicious type. Characterized now by a high grade of inflammatory action and an increased destructiveness, it not unfrequently takes a peculiar action which is termed phagedenic (from Gr. φαγεῖν, to "eat"), through which, in a few days or even hours, important loss of tissue ensues, not rarely resulting in irretrievable mutilation, and possibly in loss of life. In other rarer instances the *chancroid* takes on a sluggish but persistent form known as the *serpiginous*, with a gradual irregular loss of tissue, involving the integument only, but continuing often for years in spite of every means and mode of treatment. The extension of the *chancroid*, usually by continuous tissue, not unfrequently takes place through the entrance of the contagious secretion into a lymphatic vessel (opened by chancroidal ulceration), and its passage along that vessel to the adjacent lymphatic gland. This accident may occur at any period during the continuance of the chancroid. The gland in this manner affected (usually in the groin, and known as the chancroidal bubo) becomes tender and swollen. Evidences that the peculiar destructive chancroidal action is going on within the substance of the gland become daily more distinct, until in a few days an abscess is formed. On the discharge of the purulent contents of this abscess, they are found to possess the peculiar properties of pus from the original ulcer, and the open bubonic abscess takes on the appearances and other characteristics of the typical chancroid.

The *venereal ulcer* or *chancroid*, in its early stages, is promptly amenable to judicious remedial measures. The application of any caustic, of sufficient power to destroy completely all the tissue which has been implicated in the diseased action, suffices to change the contagious venereal ulcer to a simple sore, when it goes on to recovery without other treatment than such simple sores require. The conditions which determine the severer forms of the venereal ulcer are recognized, as already stated. It is also found that the particular lesion which may present partakes in great degree of the activity, greater or less, which characterized the lesion from which it was derived, so that every grade from the simple excoriation to the sharply-defined and most active ulcer may be met. Hence, all do not require the prompt and energetic course necessary to arrest and cure the typical chancroid. In the milder varieties the judicious application of carbolic acid, iodoform, sulphate of iron, and other, even simpler, antiseptic, sedative, and astringent agents, may suffice to bring about an arrest and cure. In the lightest forms it is often difficult to distinguish from non-venereal pustules which result from acrid sebaceous secretions, or from connection with a female suffering from an acute form of simple leucorrhœa.

In regard to its history, the venereal ulcer or chancroid is conceded to be of ancient origin, even to antedate the advent of *syphilis*. It has various synonyms—viz. "pseudo-syphilis," "soft chancre," "non-infecting chancre," "chancroid," etc. By the latter term, *chancroïd*, it is almost universally known at the present day. It was distinctly recognized and described by the ancients as a disease known from the earliest times. Notwithstanding this, shortly after the recognized appearance of syphilis in Europe in 1494, it became confounded with that disease. Its purely local character was lost sight of, and it was subjected to constitutional treatment as a form of syphilis. Its chief characteristics, however, always most marked, were never quite lost sight of. Evincing its destructive property *at once* on inoculation of its secretion upon healthy tissue, and commonly associated with inflammatory enlargement and suppuration of contiguous lymphatic glands, it was thus directly opposed to the sluggish course of the syphilitic local affection and its non-suppurating glandular concomitants. Yet it was so often found associated with and followed by the constitutional manifestations of syphilis that its distinctive significance was doubted; and when, after a time, the well-known acute venereal ulcer was occasionally observed to exchange its soft edge and base for the indurated tissue known to characterize the early syphilitic lesion, the fallacious theory of *post hoc ergo propter hoc* prevailed, and thus the confusion of the two distinct diseases became complete. From this time *all* the contagious venereal diseases, gonorrhœa, chancroid, and syphilis, were accepted as practically identical, requiring the same constitutional treatment. It was found, however, after the habitual mercurialization of persons afflicted with soft sores or with gonorrhœas, for more than two hundred years, that constitutional syphilis did not necessarily follow the occurrence of the soft ulcer nor of a gonorrhœa, even when no treatment was resorted to, while the ulcer with indurated base and edge was invariably succeeded by the general manifestations of syphilis. John Hunter in

1786 was the first to recognize publicly the value of the induration characteristic of the venereal sore which was followed by constitutional syphilis, thus making the first positive step toward identifying and restoring to the different venereal disorders their distinctive individuality. Hunter, however, misled by an experiment upon his own person, taught that while the local manifestations of the venereal diseases were different, their source of origin was identical, and that the peculiar form and nature which they assumed in any given case was dependent upon some peculiar condition or idiosyncrasy of the affected individual. In 1798, Benjamin Bell of London claimed a simple origin for gonorrhœa, and in 1830, M. Ricord of Paris, after a series of observations and elaborate experiments in inoculating the purulent fluid of gonorrhœas and of the soft and hard venereal lesions, demonstrated the purely simple, non-specific nature of gonorrhœa, thus completely and for ever eliminating it from among the manifestations of syphilis. Ricord, however, notwithstanding his numerous and carefully-observed inoculations, and while distinctly recognizing the local and ultimate differences between the hard or Hunterian chancre and the soft sore or chancroid, yet accepted and taught Hunter's view, that the difference between them was not one of origin, but of personal condition or idiosyncrasy. It was reserved for M. Bassereau of Paris (a pupil of M. Ricord) in 1852 to demonstrate the fact that in the disease then known as syphilis, comprising the soft local venereal ulcer and the indurated infecting venereal sore, with its consequences, two separate diseases existed. Upon the confrontation (*i. e.* personal comparison) of a very large number of persons affected by venereal disease with those from whom their disease had been acquired, Bassereau found that in every person presenting a venereal ulcer, accompanied by well-pronounced evidence of constitutional syphilis, the person from whom the disease had been acquired was also, or had recently been, the subject of ulcers which were followed by constitutional syphilis, and that in no case was syphilis ascertained to originate from a person bearing the local venereal ulcer alone. Similar observations by confrontation were made by Messrs. Dron, Clerc, Diday, Rollet, and Fournier in 1856, and in 1857 by Messrs. Fournier and Caby, under the supervision of M. Ricord, with the result of proving that in all cases of chancroid the type of ulcer remained unchanged in passing from one individual to another. Nevertheless, M. Clerc, while accepting and confirming the observations above alluded to, claimed to have produced the typical chancroid by inoculation of the secretion of an infecting (syphilitic) chancre upon a person previously the subject of syphilis, and thus to have demonstrated that the chancroid was the product of the inoculation of the syphilitic virus upon persons then or previously affected with syphilis. Clerc also claimed that while, as a rule, the chancroid, thus originated, usually transmitted only chancroid, yet on being inoculated upon a healthy person it was capable of reverting to its original type, and hence of communicating syphilis; thus asserting the unity of origin of the two diseases; and those holding this view were known as *unicists*. Rollet and others held, on the contrary, that not only were chancroid and chancre (the initial lesion of syphilis) separate and distinct diseases, but that they owed their origin to separate and distinct poisons; and thus the school of so-called *dualists* was initiated. The position of M. Clerc was supported by the observations of Henry Lee of London, the late Prof. Böck of Christiana, Melchior Robert, and others, who succeeded in producing the typical chancroid upon persons syphilitic and non-syphilitic by inoculations of pus from an irritated syphilitic chancre. It was required that the degree of irritation in all cases should be sufficient to induce a free *purulent* secretion. Sores produced in this manner were inoculated in successive generations upon persons quite free from syphilitic taint, and behaved in all respects like the ordinary venereal chancroid. It was, however, found that when the superinduced irritation subsided, and the secretion was no longer purulent, it was no longer auto-inoculable; and hence it became evident that the property of inoculability was consequent upon a peculiar action resulting from the persistent irritation of an already-diseased surface. The fact that the chancroid could be established upon persons entirely free from syphilitic taint, and not be followed by syphilis, demonstrated that its existence was not necessarily dependent upon the syphilitic principle. Experiments were then made by Pick, Bidencap, Koebner, Böck, and others to ascertain the effect of inoculations of pus from simple lesions on persons free from syphilitic taint. The result showed that affections in non-syphilitic persons which are of slight virulence, the secretions of which are not inoculable, can be made to produce an inoculable secretion by the application of an irritant. Kaposi states that in his experiments the pus taken from acne and from scabies in non-syphilitic individuals has produced pustules, the pus from which was inoculable in generations on the bearer as well as on other non-syphilitic persons. In 1866, Dr. Edward Wigglesworth, Jr., of Boston (reported by Dr. Bumstead in his paper *On the Unity and Duality of Venereal Sores*, read before the Centennial Medical Congress at Philadelphia), while studying under Prof. Zeissl of Vienna, and being entirely free from any suspicion of venereal taint, but in somewhat impaired general health, inoculated his own arm with pus taken from a simple pustule of acne. This produced a similar pustule at each of the three points of inoculation. Pus from these being again inoculated, a third generation was established. Nine distinct sores, the result of the inoculations, were present at the same time, and, pursuing a similar course, finally healed, leaving as many distinct cicatrices, indicative of loss of tissue through the process of ulceration. This experiment during its progress was under the personal observation of Prof. Zeissl, and was repeatedly exhibited to his class as demonstrating the contagious and destructive properties of non-specific pus under certain circumstances unconnected with syphilis or with any venereal influence. Observations (personal) have shown that the muco-purulent secretion from non-specific nasal catarrh will sometimes produce excoriations of sound cuticle, and that contact with secretions from non-specific leucorrhœas will sometimes promptly cause pustular eruptions (*herpes*) of the preputial mucous membrane of the male; and these more or less rapid in development and progress according to the degree of activity of the inoculating secretion—in some instances so simple that they are scarcely more than sero-purulent vesicles, and in other cases observed so vicious that in appearance they do not differ at all from the typical chancroid, the secretion being also *auto-inoculable*, as proven by the occasional occurrence of similar lesions upon opposing surfaces.

Mr. John Morgan of Dublin, in his work on venereal diseases (1873), cites numerous instances in which he has observed the typical chancroid to result from inoculation of the muco-purulent secretions of leucorrhœas in syphilitic women upon other women, also subjects of syphilis. Vidal cites a case where pus taken from a pustule of simple ecthyma, in a patient suffering from typhoid fever, was promptly inoculable on the patient, but failed when inoculated upon a healthy person. It is therefore shown that the quality of pus is variable, according to the circumstances under which it is produced and the condition of the person upon whom it may be inoculated—that a low condition of the general system from any cause predisposes the healthy tissues to take on ulcerative action and to elevate the accompanying purulent secretion to a point of contagiousness. Lesions, especially of mucous membrane of the human genital apparatus of both male and female, are common under the circumstances peculiar to the venereal act. Inflammations of mucous membrane in the same locality are frequent, and characterized by muco-purulent secretions, often profuse and acrid; and this, too, when the subjects of them are in good general health and living under the most favorable hygienic conditions. When, therefore, it comes to be considered that the most frequent habitat of the venereal ulcer or chancroid is in localities where venereal excess and every kind of debauchery abound, when to this are often added the potent elements of syphilis and scrofula, hereditary and acquired, filth, and irregular living, and when (as has been shown by Fournier and others) chancroid is found by far the most frequent in proportion to syphilis among the debased and dissolute, the conclusion is inevitable that chancroid is, and of necessity must be, a self-engendered disease, possessing no specific virus, but acquiring its power for destruction and contagion through the stimulation and vitiation of benign natural processes.

The venereal ulcer or chancroid acquires its chief importance from its liability to be mistaken for, and treated as, the initial lesion of syphilis; and the more so as it is often through the lesion established by the destructive agency of the chancroid that the syphilitic principle or disease-germ is permitted entrance into the system. The distinction between the two lesions at the outset is often impossible. The active characteristic of the chancroid is recognized as a necrosis—that of the syphilitic lesion one of growth or proliferation. The surface of a sore, then, may be the field of chancroidal action, while the living tissue beneath may be at the same time a centre of proliferation of syphilitic disease-germs, which are constantly gaining access to the general circulation through the contiguous lymphatic vessels. These germs may be originally deposited upon a simple abrasion or one already the seat of chancroidal action, or may be subsequently inoculated through the breach of tissue made by the chancroid. If the former, the imposition of the secretion of a chancroid upon the same point, if the disease-germs have been freshly deposited, might cause their destruction, and thus leave

only the chancroidal element; but once the syphilitic principle has extended below the surface and has entered a lymphatic vessel (see article on SYPHILIS), it has gone beyond the sphere of action of the chancroid. The only method of determining whether a given chancroid or other lesion, occurring after a suspicious venereal contact, is or is not to be followed by constitutional syphilis, is to reserve a final decision for a full month subsequent to the exposure. This course should be pursued even though during the interval the suspected lesion, possessing all the characteristics of the typical chancroid, should have fully healed. If during or after the month no hardening of the tissues composing the edge and base of the sore, nor, if healed, of the cicatrix, nor any enlargement of the adjacent lymphatic glands, can be discovered, then, and not until then, can the patient be assured that he has had an uncomplicated chancroid, and that no syphilis will follow. Those milder forms of ulcerative action which are just within the line of distinction between the simple so-called herpes and the chancroid are the most frequent to exhibit subsequent evidences of syphilitic infection. By reason of their inactivity they are less likely to destroy any of the germs of syphilis which may come in contact with their surface.

The frequent association of chancroid with syphilis will never lead to mistaken identity if it is constantly borne in mind that syphilis is always, in all its manifestations, a process of growth, of proliferation, of *exaggerated life*. The most scientific and critical examination of the products of syphilis, from the *initial lesion* to the *gummy tumor*, has never been able to detect any abnormal material—nothing but excessive accumulations of tissue-building cells. Chancroid, on the other hand, from its inception to its cicatrization, is a process of necrosis—literally, *death* of tissue. So that *syphilis* and *chancroid* are always and only in relation to each other as *life* to *death*—each the highest type of its own peculiar action. F. N. OTIS.

**Ver'tebrates** [Lat. *vertebratus*, from *vertebra*, "provided with a backbone"], the most important and the most natural and distinct branch or sub-kingdom of the animal kingdom. Vertebrates may be briefly defined as those animals provided with an axial skeleton and two cavities—one dorsal, or above the vertebral column, for the accommodation of the cerebro-spinal nervous system, and the other ventral, or below the vertebral column, and containing the intestinal canal and other viscera. The animals possessing these characteristics are the Mammals or viviparous warm-blooded quadrupeds and cetaceans, the Birds, the Reptiles, and Amphibians, and those known under the collective name of Fishes. The relative affinities of these groups were recognized from an early period, and even to some extent their consociation and segregation were realized, for even Aristotle contrasted them as *Zoa enaima* (ζῶα ἔναιμα—*i. e.* animals with blood) with all others collectively designated as *Zoa anaima* (ζῶα ἄναιμα—*i. e.* animals without blood). It was not, however, until 1812 that the distinctness and contrast of the types in question with other animals were fully recognized in the systematic nomenclature under the name now adopted. Cuvier in that year (in *Annales du Museum d'Histoire naturelle*, vol. xix.) proposed the name Vertebrata, and contrasted the branch ("embranchemen") so designated with three others, under which were combined all other animals. The branch has remained unaltered as to its limits since its introduction, but various views have been entertained as to the taxonomic value of its several constituents, as well as the nature of their mutual relations. The principal of the various propositions for the classification of the branch will be briefly considered.

(1) By Cuvier, as by Linnæus and his predecessors generally, the Vertebrates were separated into four classes—the Mammals, the Birds, the Reptiles, and the Fishes. These were the only classes generally recognized for many years, although several propositions were made by different writers, from time to time, for the introduction of other groups of that value. (See HERPETOLOGY and ICHTHYOLOGY.)

(2) By De Blainville the old class of reptiles was differentiated into two classes—Reptiles proper and Amphibians; or, as he preferred to call them, Squamifera and Nudipellifera. The five classes were called Pilifera (Mammals), Pennifera (Birds), Squamifera (Reptiles), Nudipellifera (Amphibians), and Pinnifera (Fishes). Naturalists were very tardy in the adoption of the two classes proposed in place of the old Reptiles, but they finally gained acceptance.

(3) By recent naturalists the branch has been divided into a still greater number of classes, and chiefly at the expense of the old class of Fishes: thus, some recent authors recognize as classes of Vertebrates, (1) the Mammals, (2) the Birds, (3) the Reptiles, (4) the Amphibians, (5) the Fishes, (6) the Elasmobranchiates or Selachians, (7) the Marsipobranchiates (lampreys, etc.), and (8) the Leptocardians.

The various modifications, it will be thus seen, have affected the class in the following way:

(1) The class of Mammals has remained intact.

(2) The class of Birds has also been retained without modifications except as to diagnosis, wherein change has been necessitated on account of the discovery of fossil forms.

(3) The old class of Reptiles is now universally admitted to be unnatural, and its differentiation into the two classes Reptiles proper and Amphibians is entirely accepted.

(4) The ancient class of Fishes is also now very generally conceded to be a heterogeneous mixture. By some of the best systematic zoologists in its place four classes have been established: (*a*) Fishes proper, or Teleostomes, (*b*) Selachians, (*c*) Marsipobranchiates, and (*d*) Leptocardians.

The views relative to the relations of these classes have also undergone very considerable modifications.

(1) By some (*e. g.* De Blainville) the Mammals have been contrasted as a sub-type ("Vivipara") with another sub-type ("Ovipara"), containing all the other classes.

(2) For a long time it was customary to distinguish, as did Linnæus, on the one hand, the Mammals and Birds as a natural group named "Warm-blooded animals," or *Calida animalia* by Storr and *Hæmatotherma* by Owen, and on the other hand the Reptiles and Fishes as another group, designated "Cold-blooded animals," or *Hæmatocrya* by Owen. This condition of the blood, however, is simply the result of complete circulation and aërial respiration on the one hand, and incomplete circulation or respiration through the medium of the water on the other; it is a physiological adaptation correlated with no morphological distinctions, and is now conceded to be of little systematic value.

(3) The Mammals, Birds, and Reptiles have as common characters an amnion and allantois, and breathe air directly through lungs; contrasting with these are the Amphibians and Pisciform Vertebrates, which are destitute of an amnion, and for the most part of an allantois, and breathe air through the intervention of branchiæ. The first series has, therefore, been antagonized under the term Abranchiate Vertebrata, against the last, which have been grouped under the name Branchiate Vertebrata.

(4) By Prof. Huxley and some of his disciples several classes have been grouped under three primary divisions or provinces—viz. "(I.) The Ichthyoids (comprising Fishes and Amphibia), defined by the presence of branchiæ at some period of existence, the absence of an amnion, the absence or rudimentary development of the allantois, nucleated blood-corpuscles, and a parasphenoid in the skull; (II.) the Sauroids, defined by the absence of branchiæ at all periods of existence, the presence of a well-developed amnion and allantois, a single occipital condyle, a complex mandibular ramus articulated to the skull by a quadrate bone, nucleated blood-corpuscles, and no parasphenoid, comprising Reptiles and Birds; and (III.) the Mammals, devoid of branchiæ, and with an amnion and allantois, but with two occipital condyles and a well-developed basi-occipital, and no parasphenoid; a simple mandibular ramus articulated with the squamosal, and not with the quadratum; with mammary glands, and with red non-nucleated blood-corpuscles."

(5) By recent zoologists a still different combination has been proposed, and appears destined to increase in popularity. The main features of the method in question are due to Haeckel and Gegenbaur. Ignoring previous essays, they have divided the branch, first, into two groups—(1) Subphylum Leptocardia or Acrania, with the class of Leptocardians; and (2) Subphylum Pachycardia or Craniota, containing all the others. The Craniota are then separated under three minor groups—(1) a cladus "Cyclostoma" (formed for the Marsipobranchiates), (2) a cladus "Anamnia" (embracing the Fishes and Amphibians), and (3) a cladus "Amniota" (containing the Reptiles, Birds, and Mammals). This classification is recommended by many important considerations, and seems to be a better exposition of the degrees of differentiation of the several classes from a common stock, and their mutual relations, than any of the older schemes.

The most apt expression of the structural modifications and relations of the classes admitted will probably be slightly modified from the arrangement last referred to. The classes are combinable as follows:

BRANCH VERTEBRATA.

SUB-BRANCH CRANIOTA.

Super-class Malleifera.
  Class Mammalia (Mammals).
Super-class Sauropsida.
  Class Aves (Birds).
  Class Reptilia (Reptiles).
Super-class Batrachopsida.
  Class Amphibia (Batrachians).
Super-class Lyrifera.
  Class Pisces (Fishes).
  Class Elasmobranchiata (Selachians).

Super-class Monorrhina.

Class Marsipobranchiata (lampreys, etc.), adopted as a class by Agassiz, Haeckel, Gegenbaur, Cope, Schmidt, Wilder, Jordan, etc.

SUB-BRANCH ACRANIA.

Super-class and class Leptocardia, etc.

Class Leptocardia (Branchiostoma), adopted as a class by Isidore Geoffroy St.-Hilaire, Bonaparte, Moquin-Tandon, Haeckel, Gegenbaur, Schmidt, Cope, Jordan, Wilder, and by many others under different names.

(Generalizations respecting the morphology of the Vertebrates and the constituent classes will be found under the heads COMPARATIVE ANATOMY, MORPHOLOGY, OSTEOLOGY, TEETH, the English names of the different classes, as well as SAUROPSIDA, and also HERPETOLOGY, ICHTHYOLOGY, MAMMALOGY, ORNITHOLOGY, etc.) THEODORE GILL.

**Veterinary Science** [Lat. *veterinum*, "beast of burden"], the application of the principles and practice of medicine and surgery to domestic animals. Etymologically, the word *veterinary* applies to *draught* animals, but in actual use to all that come under man's influence or control. It is therefore as intimately connected with comparative anatomy, comparative physiology and pathology, as human medicine and surgery are with the anatomy, physiology, etc., of the human body. This gives it immense scope, and opens fields of investigation directly connected with veterinary science which are absolutely limitless; and not only so, but promising and achieving results of great importance to the welfare of mankind. There is so much that is crude and constantly changing in all medical and surgical practice, and we are learning so much year by year to modify views as to animal structure, the nature and causes of disease, animal chemistry, etc., that it may be confidently predicted that great advances will soon be made in this as in other branches of the healing art. The facts that man is heir to many of the identical maladies that afflict his domestic animals; that he takes disease from them to an alarming extent; that their diseases may not only be communicated to him, but many which are not affect him perhaps even more seriously in diminishing his supply of food, in influencing disastrously commercial interests, in rendering beasts of burden and draught unfit for use in peace, and, more frequently, in war, where their energies are most severely taxed, indicate, considered separately or altogether, the bearing and importance of veterinary knowledge. It is certain that all nations in all past time that were devoted either to pastoral or warlike pursuits have not only regarded the health of their animals with solicitude, but have made more or less successful efforts to cure their ailments and to preserve them in health and soundness. This led to the shoeing of horses, and formed a natural connection between the proper healing art and that of the farrier—a connection, by the way, which led almost throughout Europe, and especially in England, to the great degradation of the veterinary profession, and to its being practised almost solely by blacksmiths and horse-shoers for several centuries; while in Arabia and Turkey, and among allied peoples, and through the influence of the Moors in Spain also, the animal physician and the farrier were entirely distinct. The medical treatment of animals, especially of horses, was especially valued and its practitioners honored by the Greeks and Romans. A work on horse-medicine was indeed attributed to Æsculapius—with how little of probability that he was its author it would be hard to tell. Ancient military and agricultural writers, however, wrote frequently and well upon the general subject, and among the Arabians there have been many books and treatises written, some of them having great antiquity and considerable value.

Modern veterinary medicine and surgery dates from the founding of the school at Lyons, France, in 1762. The French government appropriated some $10,000 to this end, and entrusted its expenditure and the whole management of the school to M. Bourgelat, an eminent advocate and political economist. This school increased rapidly in popularity and efficiency. It was attended by pupils sent by all the more powerful European states, and through these graduates of the school similar institutions sprang up, first or last, in Russia, Prussia, Austria, Denmark, Sweden and Norway, Würtemberg, Holland, and Belgium, and doubtless others in smaller states. So rapidly did the number of students increase that it was soon necessary to establish other schools, and M. Bourgelat selected and purchased the site of the school at Alfort, not far from Paris, and established that famous veterinary school and hospital, as well as also the institution at Toulouse; and it is not detracting from the undisputed excellence of other institutions to say that in all important veterinary matters France still maintains this early pre-eminence.

Nothing was done in Great Britain toward the establishment of veterinary colleges until M. St. Bel, a graduate of the Lyons school, visited London armed with an enthusiasm for his art, great perseverance, and good letters of introduction. This was in 1788. He labored with little encouragement until 1791, when the Veterinary College of London was organized. The next year it was opened to students, and the next (1793) St. Bel died. The college, however, lived, and veterinary education in London, and subsequently in Edinburgh, was established.

In America there have been several attempts made to establish veterinary colleges. A charter was granted for one by the State of Pennsylvania in 1853, and again in 1866, but nothing came of either. In 1855, George H. Dadd and others obtained a charter from the legislature of Massachusetts for the Boston Veterinary Institute, and announced lectures and a faculty; and that was the end of it. In 1857, Dr. John Busteed secured a charter from the State of New York for the New York College of Veterinary Surgeons, which after one false start was finally successful in offering in the city of New York educational facilities of a high order to students. Its classes increased rapidly, its diplomas were valued and honored, and its permanence seemed assured, when an unfortunate rupture occurred, the entire faculty of instructors withdrawing with the students and establishing themselves as the American Veterinary College, which is now the only institution of its kind in America. Its professors are all graduates in medicine, while those of anatomy, surgery, theory and practice, cattle pathology, and obstetrics are veterinary surgeons having large outside practice. A veterinary hospital is connected with the college, and free "clinical" lectures are given in connection with it. Several of the agricultural colleges of the different States have chairs of veterinary medicine and surgery, and some with but a single veterinary professor give or propose to give degrees and diplomas.

The vast amount of our national wealth which consists of horses, cattle, sheep, and swine, and the industries which depend upon them or their products, make the whole subject of their health and profitable breeding one of immense importance, and as a matter of commercial interest one vital to every citizen. The total value of the live-stock of the country, exclusive of poultry—which should of right be considered—is variously estimated at from $1,400,000,000 to $2,000,000,000. Alarming murrains or epizoötics have occasionally broken out and had considerable sway for a time, causing general alarm; for instance, the pleuro-pneumonia among cattle in Massachusetts and Connecticut in 1859, the Texas fever in 1868, the influenza among horses in 1872, with hog cholera occurring at various times, and the foot and mouth disease, which appeared and died out again among our cattle a few years ago, while its results have been so serious in Great Britain.

The study of comparative anatomy and physiology has been the most important means by which physicians and physiologists have arrived at conclusions in regard to the structure and functions of the human body, while at the same time the knowledge of animals has been increased in like degree. Consequently, many of the most distinguished physicians of the world have been and are contributors to our knowledge of veterinary matters. Among purely veterinary practitioners, however, the number who have distinguished themselves, either by original research or by their erudition, is very small. The art of healing is the same whether applied to man or animals, and the fact that so many of our American veterinarians are graduates in medicine, who take up animal practice as a specialty, as it were, indicates the elevation of veterinary practice in this country above its position in other lands. M. C. WELD.

**Vin'cent of Le'rins** (VINCENTIUS LERINENSIS), so called from the monastery to which he belonged in the island of LERINS (which see), flourished in the middle of the fifth century A. D., but little is known of his life. He was the author of a treatise entitled *Communitorium pro Catholicæ fidei Antiquitate et Universitate* (A. D. 434), directed against the heretics, which came to be regarded as a textbook of orthodoxy, in which he lays down as the test of catholic doctrine, "*Quod semper, quod ubique, quod ab omnibus creditum est.*" D. A. D. 450. The best edition of his work is that of Balusius (Paris, 1684). HENRY DRISLER.

**Vin'ci** (veen'chee) **da** (LEONARDO), painter, sculptor, architect, engineer, inventor, and man of science, b. at Vinci, near Empoli, in the Val d'Arno, in 1452. He was the natural son of one Piero, an obscure notary of Florence, and a woman named Catarina. His father took him home, treated him as his son, and gave him a good education. The boy showed such an aptitude for the arts that Piero placed him with Verrocchio, a distinguished Florentine painter and sculptor, with whom he remained from his fourteenth to his twentieth year. In 1480 or 1483 he went to Milan, having offered his services to the duke Lodovico

il Moro in a remarkable letter, of which an autograph copy exists in the Ambrosian Library at Milan. In this letter Leonardo appears less as an artist than as a military engineer; he declares himself prepared to undertake any work that may be required for military offence or defence—to make bridges, scaling-ladders, cannon, batteries; and after long detail of his skill in such matters, only at the end of his letter refers to his accomplishments as a sculptor, architect, and painter. In the service of Lodovico he executed several important works—the model for the equestrian statue of Lodovico Sforza, the duke's father, the plans for the Martesana Canal, and the famous *Last Supper*, a fresco in oils painted on the wall of the refectory of the convent of Sta. Maria delle Grazie. The model for the statue has disappeared; it was probably destroyed in the course of the war between France and Milan. The fresco, owing partly to ill-treatment and partly to the process by which it was painted, is so damaged that it cannot be said to exist. In 1499, Leonardo returned to Florence, but after a short stay he entered the service of Cæsar Borgia, who made him his chief engineer and employed him in studying various plans for the improvement of the territory of the Romagna and Urbino. At this time he was invited by the seignory of Florence to paint the walls of the council-hall of the Palazzo Vecchio in conjunction with Michelangelo. He began the work, but wearied of it, and abandoned it on the invitation of Charles d'Amboise, who called him to Milan, where he governed as the lieutenant of Louis XII. of France. Leonardo remained in Milan till it was abandoned by the French, when he went to Rome in the company of Giulian de' Medici, who was to assist in the consecration of his brother, Leo X., as pope. He found no employment under Leo, and hearing that Francis I. had entered Lombardy, he hastened to join that monarch, who had already in 1507 desired to attach him to his service, and had named him his court-painter. He was welcomed by the king, whom he accompanied to France in 1516, and who gave him a house at Cloux, near his château of Amboise, with a pension of 700 gold crowns. Leonardo's health failed after his arrival in France, and beyond some engineering projects he accomplished nothing during the three years and a half that elapsed between his coming and his death in 1519 (May 2). The authentic existing paintings of Leonardo are few in number, and of these the Louvre possesses the finest. These are the *Virgin of the Rocks*, the *Portrait of Madonna Lisa del Giocondo* (called *Monna Lisa* or *La Joconde*), the *Virgin on the knees of Saint Anna*, and the *John the Baptist*. It is impossible in the space at command to give an account of Leonardo's scientific labors. He made perhaps no distinct discovery, but his curiosity and his ingenuity led him to investigate in every direction, and had he not been of so unstable and discursive a mind he might have produced some fruit from his speculations. No doubt much more would have come of them if they had been made common property by being printed, but they were only committed to writing, and remain to this day in manuscript. (Vasari, *Lives of Painters, Sculptors, and Architects;* Charles Clément, *Michel-Ange, Léonard de Vinci, Raphael*, Paris, 1866; Arsène Houssaye, *Histoire de Léonard de Vinci;* De Stendhal, *Histoire de la Peinture en Italie; Leonardo da Vinci and his Works*, consisting of the *Life*, by Mrs. Charles Heaton, and an *Essay on his Scientific and Literary Works*, by C. C. Black, illustrated by twenty permanent photographs, London, 1875.)

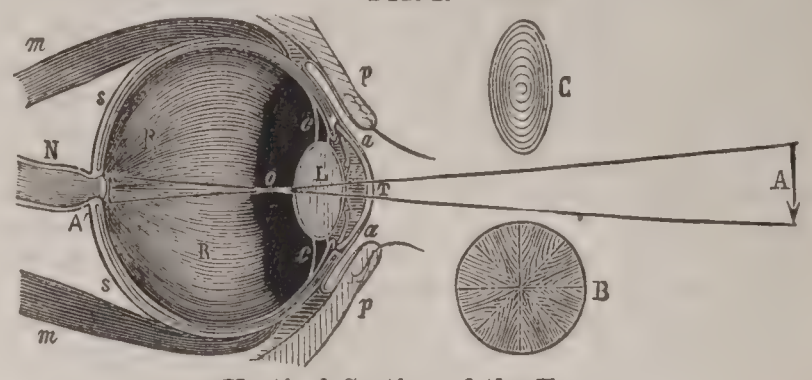
CLARENCE COOK.

**Vin'ton** (SAMUEL FINLEY), LL.D., b. at South Hadley, Mass., Sept. 25, 1792; graduated at Williams College, Mass., in 1814; studied law in Middleton, Conn., and was admitted to the bar in 1816; removed to Ohio, where he practised with eminent success; was a member of Congress from 1823 to 1837 and from 1843 to 1851; was appointed a commissioner under the act emancipating the slaves in the District of Columbia in 1862. D. in Washington in May, 1862.

**Virginius Expedition.** See RYAN (GEN. WILLIAM A. C.).

**Vi'sion** [Lat. *visio*, "seeing," *videre*, to "see"], the power or faculty by which we perceive the forms and colors of objects through the sense of sight. The faculty itself it is impossible to explain, but the physical conditions necessary to its manifestation are capable of very explicit statement. The medium of vision is light, and the organ of vision is the eye. Of this organ the structure has been described under its proper title, and the anatomy of its tissues has been given under HISTOLOGY. It remains to consider its functions. In Fig. 1 here given is represented a vertical section of the eye made through its axis. We have here a closed cavity bounded by opaque walls, and filled in its interior with perfectly transparent humors, into which light can find admittance only through a single small aperture, immediately behind which is placed a double convex lens. The construction answers in every essential point to the definition of a camera obscura. Accordingly, if an

FIG. 1.




Vertical Section of the Eye.

object, as A, be situated at some distance before the eye, its image will be formed inverted as at A′ in the interior. This theoretic conclusion is easily verified by experiment. Let the eye of an animal recently killed, after having been freed from the surrounding muscular and fatty substances, and having had the sclerotic coat carefully reduced in thickness until it becomes translucent, be held between the observer and the distant landscape, and an exquisitely beautiful picture of the scene will appear inverted on the membrane. In the eyes of albino rabbits, the sclerotic is naturally translucent, and the images are seen without any special preparation; and in those of any animal they may be observed through a puncture made in the sclerotic anywhere near the front of the globe. This image is the immediate physical cause of the sensation of vision, and the seat of this sensation is the retina. The two propositions here stated may be experimentally demonstrated together. If any small object—as, for example, a pin—be held at a little distance before the eye and gradually brought nearer, it will be seen distinctly up to a certain limit, which to the ordinary eye is found at the distance of six or eight inches; after which, if the distance is still further diminished, it will appear indistinct, or with hazy or shadowy borders. If while this is the case, a card in which a minute perforation has been made be placed immediately before the eye, the distinctness of the object will be restored; but if the card have two such perforations not more distant from each other than the diameter of the pupil, the object will appear not only distinct, but double. Then, while continuing to look through the two perforations, let the object be gradually removed to a greater distance, and the two images will be seen to approach each other and finally to coalesce in one. On removing the card it will be found that the distance now reached is precisely the limit up to which, in the first experiment, distinct vision was maintained, and beyond which it ceased. The interpretation of the phenomena here described is easy. When a candle is placed at some distance before a convex lens, a screen placed behind the lens at the distance of the conjugate focus will receive a distinct image of it inverted. If the candle be brought near the lens the image will become confused. By placing a diaphragm of very small diameter before the lens, however, the distinctness will be sensibly restored, not because the pencils of rays from the different points of the object are truly converged to corresponding points of the image, but because they are so slender as to approximate a true focalization. If instead of a simple diaphragm we employ a plate with two small perforations, the rays passing through these will meet the screen before coming together at their common focus, which is more distant, and therefore two images will appear. Then as, by withdrawing the candle, this distant focus is brought forward toward the screen, the images will necessarily approach each other, and when the focus reaches the screen, they will unite in one. In like manner, in looking through the perforated card, the object will be seen singly when the image formed by the crystalline lens falls on the surface which is the seat of sensation, and double when it is virtually more distant. Also, in this case, on the removal of the card, vision becomes confused. Now the seat of sensation must be either the retina or the choroid, since the light is wholly arrested by this last. It is natural to suppose it the retina, since this is the expansion of the nerve by which unquestionably the sensation is communicated to the sensorium. Yet some, among them Brewster, have expressed doubts on this point, founded on the curious fact, first observed by Mariotte, that the point of the internal surface of the eye where this nerve enters the ball is nearly insensible to light. Of the fact any one may satisfy himself by a personal experiment. Let a small bright object, as a dime, be placed upon a dark-colored table, and let the observer, closing one eye, place the other directly over the coin. Then, as the insertion of the optic nerve is at a little distance from the centre of the ball toward the nose

(about $\frac{1}{8}$ inch), if the right eye is open, push the coin gradually toward the right, and if the left eye is open, toward the left, keeping the eye in the mean time motionless. The object will presently go into eclipse, or disappear, and on being pushed still farther will emerge, or reappear. During this time the image moves over the insensible point. This phenomenon, however, offers no substantial reason for presuming the retina not to be the seat of sensation; for it is not at all surprising that the trunk of the nerve should possess a less sensibility to light than its delicate ramifications. Moreover, if the retina be not the seat of vision, it has no assignable function whatever, while it is one of the most curious developments of nervous tissue to be found in the system.

*Adjustment of the Eye to Distance.*—When a photographer desires to take a view, he adjusts the focus of his camera, by either moving the lens or varying the length of the body, until the image is seen distinctly formed upon the screen. A similar adjustment takes place in the eye when it is directed toward objects differently distant from the observer. The adjustment takes place without the observer's consciousness, although it is determined by a distinct effort of the will. When there is no such effort, the eye relapses into its normal condition, which appears to be that in which parallel rays, or rays from objects infinitely distant, are brought to a focus on the retina. The question how the adjustment is effected has been a subject of much discussion. Some, among whom may be mentioned Kepler, Boerhaave, Rohaut, and Olbers, imagined that, as the object observed is brought nearer, the globe of the eye becomes elongated, and *vice versâ;* attributing this effect to the reciprocal action of the straight and oblique muscles which control it; but this hypothesis is untenable, for the reason that such an elongation would alter the curvature of the cornea, an effect which demonstrably does not take place. Moreover, a case is recorded by Graefe, in which a man who had suffered paralysis of the muscles of the eye continued to distinguish objects perfectly at different distances. Kepler admitted the alternative supposition that the crystalline might be drawn forward by the ciliary processes as the object of vision approaches the eye; and this view found favor with Scheiner, Porterfield, Zinn, and Camper; but such a displacement could not occur without a transfer of some portion of the aqueous humor from one side to the other of the crystalline, and without changing, as before, the curvature of the cornea. Jurin, Musschenbroek, and others believed that a change of curvature of this membrane does actually take place, but numerous experiments made by Young show conclusively the contrary. This investigator very carefully measured, by means of a telescope and micrometer, the distance between the images formed by the reflection of two candles from the anterior surface of the cornea of an eye which, while remaining motionless, was adjusted successively to the different distances of several objects situated in a common direction before it, and found this interval to remain unaltered. He found also that when his own eye was completely immersed in water, of which the refracting power is almost exactly that of the aqueous humor, thus neutralizing the effect of any change of curvature in the cornea, it was still capable of adjusting itself to distinct vision at different distances. Another hypothesis in regard to this matter was that of Lahire, entertained also by Haller, Leroy, and Treviranus, and more recently by Pouillet, which supposes the crystalline lens to be composed of strata of different densities increasing from the surface to the centre, in such a way that, provided the rays be more and more intercepted from the borders inward as the object is brought nearer, the image will remain at a constant distance. As it is a fact of observation that the pupil of the eye contracts when an object under constant illumination is brought nearer, this theory has in it so far something plausible; but it would apparently be an optical impossibility, under the conditions supposed, to produce perfectly distinct vision at any distance. The theory of Descartes, afterward adopted by Hunter and by Young, regarded the adjustment of the eye as due to changes in the form of the crystalline effected by means of a contractile power residing in the crystalline itself. Though this body is transparent, it is made up of fibres regularly arranged, and these fibres were presumed to possess the properties of muscle. In order to make this structure manifest, it is necessary to macerate the crystalline for a long time in warm nitric acid. It thus becomes white on the surface and bright yellow in the interior, when the fibres are distinct and easily separated, resembling raw silk. The arrangement of these fibres is at once complicated and regular. They form several layers superimposed upon each other. Radiating sutures extend in each layer from the centre to the circumference, formed by the meeting of fibrillæ at a very oblique angle. These sutures are most numerous in the outer layers, and diminish in number in those beneath. In the outermost layer there are as many as sixteen; in the layers near the centre not more than three. The appearance of the fibrillæ and sutures, as seen with a lens, after coagulation in alcohol has commenced, is shown in Fig. 1 at B, while C shows the laminated structure of the crystalline in section. The sutures do not correspond in position on the two sides of the crystalline, but are alternate to each other; each fibrilla after passing round the edge of the body taking an opposite curvature to that which it had on the front, and those which originate near the centre on one of the faces terminating near the margin on the other. The discovery of this fibrous structure naturally led to the supposition that the crystalline might be capable of changing its own form by the contraction of the fibrillæ. Moreover, the investigations of Cramer and Helmholtz have conclusively demonstrated that it does actually undergo such a change of form in the adjustments of the eye for distance. The demonstration is made as follows: A light is placed near a person in a darkened room, and the person is required to look at an object as distant as possible. In the eye of the person thus situated the observer perceives three images of the light—viz. a first, erect and small, formed by reflection from the cornea; a second, also erect, behind the first, and formed by reflection from the anterior surface of the crystalline; and finally a third, smaller and inverted, produced by reflection from the posterior surface of the crystalline, which acts as a concave mirror. If the person under experiment now fix his attention upon a much nearer object in the same direction as the first, the eye remaining motionless, the first image undergoes no change, the second abruptly moves forward nearer to the first, becoming at the same time somewhat smaller and brighter, and the third maintains its position sensibly unaltered, but is also diminished in size and increased in brilliancy. These phenomena indicate that the curvature of the cornea remains unaltered, while both surfaces of the crystalline have an increased convexity. But while it is thus demonstrated that the adjustments of the eye for distance are due to changes of figure of the crystalline, the more recent investigations of Dr. Allen Thomson have made it evident that these changes are produced not by the contractile power of its own fibres, but by a compression exerted by the combined action of the ciliary muscle and the iris, which latter is in immediate contact with the crystalline in its capsule. This action only takes place when the eye is fixed on objects at finite distances, and is more energetic in proportion as these are nearer; but when attention ceases the organ resumes its normal state by its own elasticity.

*Character of the Eye as an Optical Instrument.*—Many writers have spoken of the eye as the most perfect of optical instruments. The normal eye must be here intended, since among the eyes actually encountered it is rare to find one unaffected by some more or less obvious defect. But the statement is not true even of the normal eye, since in this there may be detected a very sensible amount of aberration of color, and there are indications also of the existence to some slight extent of aberration of sphericity. The small size of the organ, however, and the consequent nearness of the image to the lens, make practically imperceptible the effects of errors of convergency sufficient to introduce in a larger instrument manifest confusion of details in the image. Spherical aberration is supposed to be almost entirely prevented by the form of the cornea, which is that, or nearly that, of an ellipsoid of revolution around the major axis. That the surface is not spherical, and that its curvature decreases from the centre outward, is manifest from the change of apparent form and magnitude of the image of a window seen reflected from it as the position of the eye under observation is changed. In the case of the eye of an ox, the form was more exactly determined by Chaussat, by projecting a magnified image of it upon a screen by means of a megascope, and after tracing its contour measuring co-ordinates to its several points from axes of reference. The curve which satisfied these was an ellipse. The same result was obtained by Sœmmering from an examination of the eye of a horse. Chaussat found in the cornea of an elephant the curvature of a hyperboloid, and Demours is of opinion that that of the human eye is similar, which may be true in near-sighted persons; but the inference justified by the numerous investigations of Chaussat, Vallée, and Krause is that, in general, the human cornea is ellipsoidal in form. While, however, this figure would favor the suppression of aberration of sphericity, the form found by Chaussat for the curvature of the surfaces of the crystalline, which is that of an ellipsoid of revolution around its minor axis, would have an opposite effect. It is asserted by many writers that the density of the crystalline diminishes from the centre outward, and that it is to this cause that the freedom of the organ from spherical aberration is owing. Others, who regard this imperfection

as not wholly absent, suppose that its manifestations are checked by the varying aperture of the pupil, which (illumination remaining constant) always contracts as the object approaches, and dilates as it recedes. There can be little doubt that the absence of any perceptible spherical aberration in the eye is largely owing to the cause here pointed out.

*Chromatic Aberration.*—It was long a popular belief that the eye is perfectly corrected for color. In a badly-corrected microscope or telescope bright objects are seen bordered with colored fringes which impair the distinctness of their outlines. No such fringes attending natural vision, the conclusion seemed to be justified that the eye is achromatic. Here again, however, the seeming perfection of the organ is due mainly to its small dimensions, and to the short distance between the lens and the retina. It is nevertheless by no means difficult to prove that rays of different colors require different adjustments to bring them correctly to focus on the retina. One of the simplest of such demonstrations is found in an observation of Wollaston, that the spectrum of a luminous point—as, for instance, of a star—seen through a prism held before the eye, does not appear to be what it really is, a simple uniform line of light, but has this character only in the small portion to which the optic axis of the eye is immediately directed, being dilated in the parts distant from the centre of the field of vision. Thus, when we look at the red, the violet is dilated, and when we look at the violet the red is dilated; and if we direct attention to the middle of the spectrum, both ends are dilated. An experiment of Matthiessen is equally conclusive. A sharply-defined figure is traced upon a plate of glass, and this, in a dark room, is illuminated from behind. It is then advanced by sliding along a scale toward the observer, until the limit of distinct vision is reached, and this point is marked on the scale. By successively illuminating with lights of different colors, there is found a different limit for each, the red giving the longest limit, and the indigo or violet the shortest. In long-sighted persons, the difference between the extremes is sometimes as great as two to one. A curious effect of this want of achromatism in the eye is often observed in looking at the figures of a carpet of strongly-contrasted colors. The red figures will appear to be situated in a plane some inches higher than the green or blue.

*Field of Vision.*—According to Brewster, the eye is capable of receiving rays from an angular space extending 150° in a horizontal direction and 120° in a vertical. This is called the field of view. Its unequal dimensions in the two rectangular directions are not owing to anything in the construction of the eye itself, but to the interference of the neighboring features of the face, principally the brow. It is remarkable that, in some animals, such an inequality is favored by the form of the pupil, which being elongated and not circular, increases the range in the direction of the longer axis. It is also remarkable that this elongation has an obvious relation to the habits of the animal, since in the climbing animals, as those of the feline tribe, it is vertical, and in the grazing, as the bovine, it is horizontal.

But notwithstanding the wide extent of the field of general vision, the field of distinct vision is quite limited. It is confined to a very small space about the point where the optic axis of the crystalline meets the retina. The retina itself presents here a peculiarity, there being a circular spot with a faintly yellowish border subtending an angle of about 4° at the centre of the ball, in which it is transparent. This spot, which is called the *foramen centrale*, might be supposed to be conterminous with the field of distinct vision, if observation did not prove that the latter is not so large, and that, moreover, it has not a definite boundary, but shades off insensibly into indistinctness. It is a fact which when first stated seems scarcely credible, that the field of distinct vision is hardly large enough to cover, on a surface ten inches before the eye—as, for instance, on the page of a book—a space an inch in diameter; but this assertion may be verified by directing the axis of the eye to a given letter, and noticing to how small a distance from this, in any direction, other letters are distinguishable. The prevalent impression, that the field of distinct vision is large, is owing to the extreme mobility of the eye, which enables it to gather up the details of an object in so rapid succession that we imagine them to be seen simultaneously.

*Sharpness of Vision.*—Between distinctness and acuteness of vision we may note this difference, that while vision is distinct in which all the boundaries or markings of an object are well defined, acuteness is the power of discerning minute details. It is not true that all persons who see with equal distinctness possess the same degree of acuteness of vision. But there is probably a limit below which it is physiologically impossible for any eye to discriminate details. Assuming, as we must, that it is by a tremor in the nervous fibrillæ that the sensation of vision is excited, we are compelled to believe that this tremor will to some extent be communicated to the neighboring fibrils, so that the agitation will not be confined exclusively to the point on which the light immediately falls. The little space to which the disturbance extends has been named by Jurin the circle of dissipation of energy. If, therefore, the separate images formed on the retina by the details of an object are not distant from each other by at least a diameter of a circle of dissipation, these circles will overlap, and the details can no longer be separately perceived.

*Sensibility of the Retina.*—It is only to light that the retina is sensible. It may be compressed, injured, or torn without producing pain, as has been proved by the experiments of Magendie on living animals, and by analogous experiments upon men in operations for cataract. Mechanical action, such as pressure, or more remarkably a blow, upon the ball of the eye, excites the sensation of light, the effect resembling a brilliant scintillation or an electric flash. The force of the impression produced by light varies with the intensity. There is doubtless a minimum of intensity below which no sensible impression would be produced, but this, which has been estimated at about $\frac{1}{90000}$th of the light of the full moon, has been but vaguely ascertained. In regard to this sense, moreover, as to every other, the differences of sensibility between different individuals are great; and even in the same individual, in different conditions, similar differences occur. Some investigators—as, for instance, Lavoisier—in order to prepare themselves for experiments on photometry, have spent several days in darkness, and have found the retina under these circumstances to acquire an extreme sensibility. It is a matter of common experience, moreover, that continued exposure to a strong light depresses the sensibility of the organ; every one who has ever entered a dimly-lighted apartment from the full light of a summer day being aware that some little time must elapse before the objects around him will be distinctly visible. What is called snow-blindness, which is sometimes quite lasting, is owing to this cause. On the other hand, an excess of light so overpowers the nerve that it is impossible to distinguish anything. Thus it happens that after remaining in a dark apartment until we see clearly in it, on sudden emergence into full day we are dazzled.

The iris fulfils a very important function in regulating the amount of light admitted into the eye. It is excessively sensitive, expanding and contracting in sympathy with the stimulation of the optic nerve, and on a sudden exposure to excessive illumination it closes the aperture of the pupil almost entirely. In darkness, on the other hand, the pupil so enlarges as to reduce the iris to a narrow border. These changes are particularly noticeable in the eyes of animals which prowl by night. In these during the day, the pupil, which is elongated vertically, is reduced to a mere line; but at night it is circular and the iris is scarcely seen.

*Extinction of One Impression by Another.*—When two luminous impressions fall upon the retina together, if the intensity of one greatly exceeds that of the other, the feebler will cease to be perceived. The minimum ratio of intensities necessary to produce this effect has been stated at 64 : 1, it having been experimentally proved by Bouguer that, of two shadows cast by two equal lights upon the same screen, one becomes imperceptible when the light producing it is carried eight times as far off as the other. On this principle is explained the invisibility of the stars by day, the brightness of the atmosphere derived from the sun exceeding that of these objects more than 64 times. It is nevertheless true that the stars may be seen by day by a person in the bottom of a well. This phenomenon, which is somewhat difficult of explanation, would seem to indicate that, if Bouguer's proposition is true independently of the absolute intensities of the lights compared, the brightness of the stars must be more than $\frac{1}{64}$th part of that of the atmosphere. It is certain that the observer at the bottom of the well receives, at the point of the retina on which the image of the star falls, quite as much light directly as one in the open atmosphere; yet the first sees the star and the other does not. The explanation suggested by Arago is, that the humors of the eye scatter more or less the light which enters them from whatever direction, so that when the whole sky is visible there is added to the direct light coming from the region of the star, an amount of diffuse light derived from other quarters sufficient to make a total more than adequate to overpower the brightness of the star. Another explanation would seem to be possible. Since the observer in the free air receives the atmospheric light in all directions, the entire retina is subject to the depressing effect of excessive illumination; and the sensibility at each point is depressed not only by the direct action of the light which falls upon that point, but

also indirectly by sympathy with the diminished sensibility of other portions. And as the power to distinguish differences of brightness must be a function of the sensibility, it is probable that this power will be greater in proportion as the extent of that portion of the sky which is visible to the observer is reduced.

*Irradiation.*—It is a fact very generally known that a bright object upon a dark ground appears larger than a similar and equal dark object upon a white ground. Also, if a dark screen be held before a candle so as to intercept a portion of the blaze, the screen will appear indented where it crosses the flame. A striking example of a similar effect is afforded by the crescent moon, while still so young that the body within the crescent is visible by the earth's reflected light. The bright and the dark limbs seem to belong to two unequal spheres, the bright being materially the larger. So, also, if a chessboard of which the squares are alternately white and black be observed under strong illumination at a little distance, the dividing lines of the several vertical or horizontal rows will appear broken at all the intersections. The term *irradiation* has been employed to denote the phenomenon here described. The explanation of it is not entirely simple. It is attributed by Plateau to the propagation of the nervous tremor to a small portion of the retina bordering that which receives the direct stimulus of the light—an explanation identical with that above given in accounting for the necessity of a *minimum visibile;* but this is not satisfactory, since irradiation manifestly very much exceeds the extent of the *circle of dissipation,* as determined by the observation of minute objects. Moreover, irradiation absolutely disappears at the distance of distinct vision, a fact quite inconsistent with the explanation proposed. A different theory suggested in 1854 by Mr. Trouessart assumes that the image formed on the retina is not simple but multiple, the individual images being not quite concentric, so that in their superposition they cover a somewhat larger space than would be covered by a simple image. He ascribes the formation of these images to the presence of opaque or imperfectly transparent points in the cornea, the crystalline, or the humors of the eye, which are presumed to produce an effect like that seen when a distant luminous point is observed through a reticulated grating, in which case multiple images of the point appear; but this still fails to explain the disappearance of irradiation at the distance of distinct vision. The theory of Helmholtz, and of recent physiologists generally, is that irradiation is caused by an irregular aberration of sphericity due to imperfections in the form or structure of the crystalline. These imperfections are supposed to scatter a portion of the light beyond the boundaries of the true image, but not in quantity sufficient to be perceptible unless the object is bright. To the same cause they ascribe the phenomenon considered under the title next following, which is not in their view essentially different, but only a different form of irradiation.

*Radiancy.*—In looking at a minute and distant brilliant object, such as a star, we seem to see rays shooting from it to some distance in different directions. These rays have certainly their cause in the eye itself, since when the head is inclined to right or left, the rays turn with it. Young was disposed to attribute the phenomenon to the sutures of the crystalline, an opinion accepted by Dugès. Trouessart explains it upon the principle applied by him to irradiation; that is, the formation of a multitude of images in consequence of imperfections in the crystalline or of imperfectly transparent points in the vitreous humor. The view of Helmholtz, above referred to, differs very little from this. It does not appear, however, that the two phenomena can properly be ascribed to the same cause, since one of them, irradiation, disappears at the limit of distinct vision, while the other, radiancy, does not.

*Duration of the Impression upon the Retina.*—Experience proves that the sensation of light continues to be perceived for an appreciable time after the cause which produced it has ceased to act. If, in a disk mounted so as to rotate upon an axis passing through its centre, there be made a series of equidistant perforations forming a circular row of apertures, and this series be made, by turning the disk, to pass slowly before the eye, the view of objects on the other side will be intermittent; but when the rotation is very rapid the view is constant, the sensation excited by the light received through any one aperture persisting until reinforced by the passage of the next. In like manner a brilliant object moving rapidly (as a shooting star) seems to draw after it a luminous train; and a dark object moving with similar rapidity over a bright surface is unperceived. The absolute duration of the sensation of light has been ingeniously determined by Aimé and Plateau, by experimenting with two disks rotating in opposite directions upon a common axis, one of these being perforated with numerous equidistant and narrow rectangular openings, while the other has but a single such opening. If the rotation take place in front of a source of light, there will be seen intermittently, while it is slow, a single luminous rectangle. By accelerating the rotation, two rectangles will become simultaneously visible; with greater velocity, three, and so on. When two only are seen, of course one of them is due to an impression which has lasted as long as the interval in time between two successive coincidences of the perforations. Mr. Plateau's conclusions from experiments of this kind are the following: (1) The mean duration of the sensation of sight is about 0.84 sec. (2) Some little time is necessary that the excitation may become the greatest possible under a given intensity of light; in other words, that the impression may be complete. (3) This maximum impression persists undiminished for a time which is greater in proportion as the impression is less energetic, but which is always exceedingly brief, being less than 0.008 sec. for light from a sheet of white paper in full daylight. (4) The total duration of the impression is greater as the intensity of the light is greater. (5) The total duration is diminished by a long exposure of the eye to the light producing it.

The optical toys known as the thaumatrope and the phenakisticope depend for the illusions they produce upon the persistence of impressions upon the retina. The thaumatrope is a disk made to revolve rapidly around one of its own diameters. On one side of this disk is drawn a part of a design, and on the other side the remaining portion; during the revolution of the disk the design will appear complete. The phenakisticope is a disk also, but revolving around its axis and not around a diameter. It bears, arranged in a circular order, a series of equidistant designs of the same subject in successive attitudes, each differing slightly from the last, and as many perforations or sight-holes, also equidistant, near the circumference. The disk is made to rotate rapidly before a mirror toward which the designs are turned, and the observer, looking through the sight-holes, sees them by reflection. The effect is that the subject appears to be stationary in position, but executing a rapid succession of movements. In another form of this instrument the designs are made to line the interior of a hollow cylinder which revolves around a vertical axis, openings for observation being made through the sides of the cylinder near the top.

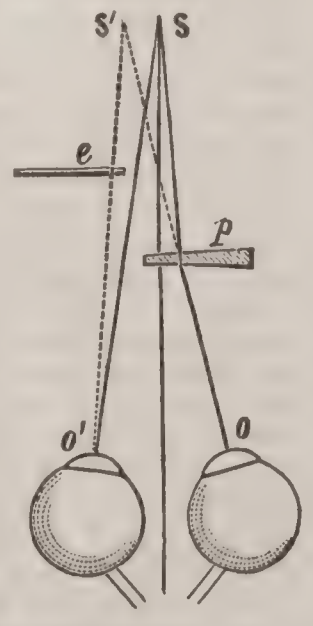
*Time necessary to excite the Sensation of Vision.*—When a body is in rapid motion—as, for instance, a rotating wheel—the persistence of impressions upon the retina causes the successive images formed by it in different positions to be superposed upon each other, so that the details of its structure are indistinguishable. Thus, a wheel with radial arms presents the appearance of a shadowy disk. But if such a wheel be looked at through the apertures of a rapidly-moving screen, like the disk of a phenakisticope, each glimpse will be of so brief duration as to permit the arms of the wheel to be distinctly visible. Moreover, if the wheel and the disk have precisely the same angular velocity of rotation, or are both firmly attached to the same axis, and the number of equidistant apertures in the disk is just equal to the number of arms of the wheel, the appearance presented will be that of a wheel absolutely motionless. If each aperture occupy but one $\frac{1}{100}$th part of an entire circumference, and if the disk revolve ten times in a second, it is evident that a perfect impression of the wheel is received on the retina in $\frac{1}{1000}$th part of a second. But this is an immensely longer time than is necessary; for if, in a room entirely dark, a wheel rapidly revolving, as above supposed, be momentarily illuminated by an electric spark, it is still distinctly seen, and appears of course stationary. Thus far, the minimum of time necessary to produce an impression upon the retina has not been ascertained. Some very interesting experiments in reference to this point were made in 1871 by Prof. Rood of Columbia College, New York, of which the results were communicated in April of that year to the National Academy of Sciences. In these experiments a grating of 600 lines to the inch was observed, in a mirror revolving 340 times per second, under the illumination of the spark from a small Leyden jar. The image of the grating appearing perfectly sharp and distinct, it followed directly from the data that the duration of the spark could not exceed $\frac{40}{100000000}$ths of a second; and indirectly, that this minute interval of time is more than sufficient for the purposes of vision, while probably not a tenth part of that interval would be necessary to excite the sensation.

*Why Vision is Erect while the Image is Inverted.*—The question has been very much mooted why it is that objects appear to us erect although their images on the retina are inverted. Metaphysicians, among them Locke and Condillac, have ascribed our judgments of the positions of things to the experience acquired by comparing visual impressions with those derived from touch; but persons blind from birth who have been restored to sight have,

without any such experience, seen objects upright from the beginning. Geometers like Descartes and Kepler have taken the view that we necessarily refer any point of an object to the direction of the axis of the pencil of rays which comes to the eye from that point. Brewster takes substantially the same view, but expresses it differently; saying that we refer the object to the direction of the perpendicular on the retina drawn from the point where the ray from the object strikes it. Lamé suggests further that as, in order to see any given point of an object distinctly we must direct the axis of the eye toward it, the movement of the ball of the eye necessary for this purpose compels us to refer the object to its proper position relatively to the ground, the sky, and to the members of our own body. It is a little curious that, though the image in the eye is reversed from right to left as well as inverted, the question has never been raised why we see objects unreversed. But certainly this ought to be as puzzling a question as the other, if there is any puzzle in either. Perhaps, in regard to both, it should suffice to remark, that though the sensation is in the eye, the perception is in the sensorium; and that the thing perceived is the object, while the inversion of the image is not a fact of consciousness, but of acquired knowledge, and of knowledge, moreover, which the majority of mankind do not acquire.

*Single Vision with Two Eyes.*—Another question which has some analogy with the foregoing, has been much discussed—viz. why the object of vision appears single though two images of it are formed, one in each eye. There is nothing in this more surprising than in the fact that an object handled by both hands still appears single—a fact which continues to be true though the experiment be made with the hands behind the back, so as to ensure that no sense but that of feeling is concerned in the perception. Here, again, we remark that it is the external object which is perceived, while we remain unconscious not only of the duplicity, but of the existence of the images. We are even unconscious, until careful observation has assured us of the fact, that we ordinarily attend or look with one eye only though both eyes are open. In order, however, that an object may appear single, it is necessary that the axes of both eyes should be directed toward it. A simple experiment proves this. Let any small object—as, for example, a pencil—be held between the observer and a window; if the axes of the eyes be directed toward the object, the window-bars will appear double; if toward the bars, the object will appear double. If while the axes of both eyes are directed toward a given object, the position of one be disturbed by pressing the ball with the finger, the object will appear double. Again, if we close one eye and look at any near object with the other, on opening the closed eye the object will appear momentarily double, but the two images will promptly coalesce; the axis of the eye while closed assuming the normal position, or that in which it is parallel to the other, but becoming immediately convergent on opening.

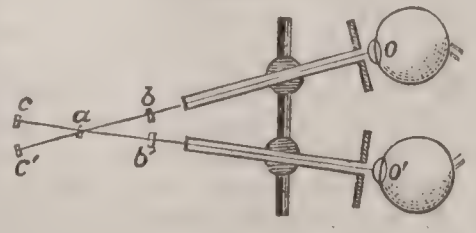
Fig. 2.




The proposition above stated admits of some curious experimental illustrations. In Fig. 2 suppose a light at $s$ to be observed by the two eyes at $o$ and $o'$. Then let a prism of small angle (2° or 3°) be interposed in the way of $o$, as at $p$; the deviation produced by the prism will cause the light to appear at $s'$ for that eye, while it is at $s$ for the other; but by the readjustment of the eyes the two soon coalesce. Place now a second light at $s'$ which is concealed from the eye $o'$ by the screen $e$, and then suddenly remove the prism $p$; the two lights will appear as one.

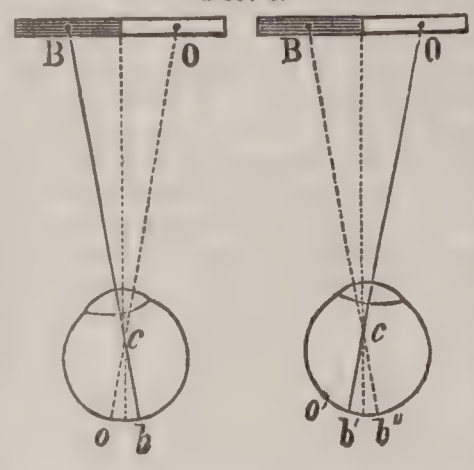
Fig. 3 represents an experiment of Wheatstone. Two tubes blackened internally converge toward $a$, at which point is placed a well-defined object, which is observed by the eyes at $o$, $o'$. On removing the object at $a$, and placing two objects precisely similar to it at $b$ and $b'$, or at $c$ and $c'$, both in the axes of the two tubes produced, the impression continues still to be that of a single object. This simple experiment naturally led to the investigation of the agency of binocular vision in assisting perceptions of solidity, and to the invention of the stereoscope.

Fig. 3.




*Accidental Colors.*—It is matter of common observation, that, after the eye has rested for some time upon any strongly-lighted object, and is then turned suddenly away, an image of the object still continues to be visible, usually faint, but sometimes quite intense, and of different color from the object itself. The color is that which united with the color of the object produces white—hence called *complementary*. Thus, a portrait in which the colors are the reverse of those of nature—as, for instance, in which the hair is white, the complexion greenish, the eyes yellowish-red, and the teeth black—after being intently viewed in a strong light, will reproduce, upon a white surface to which the eyes may be immediately after directed, a counterpart exhibiting tints perfectly natural. Colors appearing under such circumstances are called *accidental*, and are of course purely subjective. They make their appearance even if, without turning the eyes away from the object, the eyelids merely are closed; but in this case the natural colors usually persist for a time, and are succeeded by the complementary; after which there may occur several successive alternations between the real colors and their complements. Scherffer has shown that the color which results from the combination of two accidental colors is the same as the resultant of two similar real colors. Fig. 4 illustrates this.

Fig. 4.




B and O are two squares (seen in section), one being orange and the other blue. On the left, the axis of the eye $b$ B is directed to the centre of the blue square, a blue image being formed at $b$ in the middle of the retina, and an orange image at $o$ toward the left from the middle. On the right, the axis, $b'$ O, is directed to the centre of the orange, and an orange image is formed where the blue was formed before, in the middle of the retina, while a blue image is formed at $b''$ to the right of the middle. Now, if with this arrangement an observer alternates his view from B to O many times, say thirty or forty, pausing about two seconds at each alternation, and then suddenly looks upon a white surface, he will see three images, the extremes being severally complementary in color to the squares on the same side with them, and the middle one exhibiting a color compounded of the two—in the case supposed, white. This last would therefore not be visible upon a white ground, but on a colored ground of any tint it would appear.

Two theories have been proposed to explain the phenomenon of accidental colors. The first is that of Scherffer, who holds that the sensibility of the retina to any particular color is enfeebled by a long continuance of its action, while not similarly enfeebled as to the other colors contained in white light. In this condition of the eye, white light appears deficient in the tint for which its sensibility is blunted, or in other words appears of the tint complementary to that. This theory, however, fails to account for the colors seen when the eyes are closed, and is therefore not wholly satisfactory. The theory of Plateau is founded on the fact above referred to, that the accidental colors seen on closing the eyes are not immediately complementary, and that, if the eyes after having been strongly impressed are kept closed long, the accidental image appears, and fades many times successively, passing even from the complementary to the direct and from the direct to the complementary by a sort of oscillation. Plateau supposes, in fact, that such an oscillation does really take place; that the highly-excited nerve returns to its state of repose only after passing, like a pendulum, repeatedly from one side to the other of that condition; and that these alternations are the cause of accidental colors. This theory does not necessarily exclude that of Scherffer, which, though not a complete explanation, is without doubt to a certain extent true.

*Range of Vision.*—As the normal eye forms a perfect image on the retina with parallel rays, the range of vision is unlimited, or limited only by the diminution with distance of the intensity of radiant light. Thus, the fixed stars at unknown distances are visible. But the range of *distinct* vision for an object of any determinate magnitude is limited by the consideration that there is a *minimum visibile*, and that when an object is so remote that its image is reduced to this limit, it can no longer be perceived as a magnitude. The fixed stars are visible because of the intensity of their light, but they have no sensible disks.

*Judgment of Distance.*—Within certain moderate limits all persons judge pretty accurately of distance by sight. Practice and experience enable men whose vocations take them much into the open country, greatly to extend these

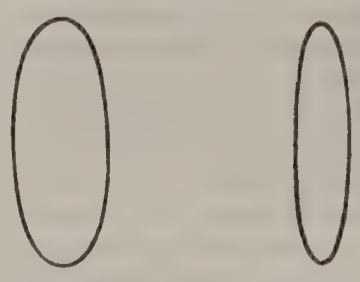
limits, but no one can extend them indefinitely. The means by which we form these judgments are various, partly depending on the conditions indispensable to distinct monocular vision, and partly on the relation of the two eyes to each other. We have seen that a certain adjustment of the eye is necessary in order that a well-defined image of an object before it may be formed on the retina. This adjustment is apparently made instantaneously, but from the nature of the case the process by which it is made must be tentative. The distance of the object is unknown. The eye as it were feels it out. And as a different adjustment is found for each different distance, we learn by experience to associate a particular adjustment with a particular distance. What we are conscious of, it is true, is not the adjustment, but the effort required to make it, and the sense of this effort becomes the measure of distance. Beyond a very limited range, however, this adjustment becomes a very imperfect guide; and it is only in the case of persons who, having had the misfortune to be deprived of one eye, have been compelled to rely on the remaining one alone, that sufficient experience is acquired to make it trustworthy. The judgment is aided in this case by comparing the visual angle under which the object is seen with that which the same object subtends at a known distance. This too fails when the distance is extreme, and moreover it requires that the object be known, or that it belong to a class of which the mean dimensions are familiar. A third aid to the judgment is perspective. The relative apparent positions of the various objects in a landscape, especially when arranged according to geometrical law, the architectural features of buildings, and the converging lines of streets, serve as means of carrying forward a measurement of distance step by step. Hence the well-known difficulty of accurately estimating distances over surfaces where such diversity of features is absent. In such cases our judgments almost invariably fall short of the truth.

It is, however, upon the conspiring testimony of the two eyes that our usual and most correct estimates of distance are founded. The optic axes of the eyes always intersect upon the point to which the vision is directed, and the inclination of these axes to each other must vary with variations of distance. Here also, however, it must be said that for remote objects the test becomes very uncertain, since for such the axes approach parallelism, and change their inclination very little throughout a large range of differing distances.

*Judgment of Magnitude.*—Of a number of bodies equally distant we judge of the relative magnitude by comparing the visual angles which they subtend, whether vertical, horizontal, or oblique; in other words, we infer their real magnitudes to bear to each other the same relation as their apparent magnitudes. But when the distances are different, the process of judgment is more complex, and involves an estimate of the effect of varying distance upon the visual angle. It is only by experience that we learn how to make this estimate; but as the experience of all of us in this respect has been largely acquired in our earliest years, our judgments of the magnitudes of objects immediately around us are seemingly instinctive and are approximately just. In respect to objects more remote, the differences between individuals are very great, persons whose lives are spent in the open country or at sea acquiring a power of discernment of the dimensions of distant objects which most inhabitants of towns do not possess.

*Judgment of Form.*—The images of objects on the retina are pictures of only two dimensions, yet we conceive of bodies without difficulty as solids, having not only length and breadth, but also depth. This facility arises from the fact that the two images formed in the two eyes are not identically similar, as they represent the object from different points of view; and there is no possibility of reconciling them with each other as images of the same object except by imputing to the object a third dimension. To a person possessing from birth but a single eye, the earliest conceptions of all objects must be that they are plane pictures. The touch, however, for such persons soon corrects the error of the sight; and after the conception of solidity has been formed, the effects of perspective become practically familiar after a little experience, and the true forms of solids, or of surfaces seen obliquely, are inferred by observation unaided by contact. Thus, though the image of a circle on the retina, unless its plane be perpendicular to the axis of the eye, is not circular but elliptical, yet after experience its true figure is not liable to be mistaken. The possession of two eyes, however, makes an experience of this kind unnecessary in judgments of form. A circle placed obliquely would produce an elliptic image in each eye, but one of these two ellipses would be more eccentric than the other, and nothing could satisfy the two impressions but a circle in an oblique position. It follows that if two ellipses be drawn on the same surface of paper near each other, having the differing degrees of eccentricity which would belong to the images thus formed in the two eyes by a circle seen obliquely, and if these drawings be so placed before the eyes that each eye can see but one only, the two will be referred to a single non-existent object which the observer will imagine himself to see as a circle placed obliquely. This can easily be proved by an experiment with the following small figures. Placing a card upright between the two, each eye will see but one only, and the combined images will produce the impression of an oblique circle more distant than the paper. Or, without attempting concealment, let the point of a pencil be held above the two figures, so as to range between the left eye and the right ellipse, and at the same time between the right eye and the left ellipse; then on directing the axes of both eyes to the point of the pencil there will presently be seen above the paper and apparently suspended in the air, a circle in an oblique position as before, but inclined in the opposite direction. It was upon this principle that Wheatstone founded his beautiful invention of the STEREOSCOPE (which see).

FIG. 5.



At great distances, the inclination of the axes is too slight to be of much assistance in judging of the forms of bodies. In such cases we must depend on perspective, which, except in the case of geometrically regular bodies, is an uncertain reliance. Shadows, however, particularly the strong shadows cast by the sun, are of great assistance in these judgments.

*Pseudoscopic Effects.*—If we take the designs of any object intended for the two eyes in the stereoscope, and transpose them, placing each under the eye for which it was not intended, we obtain the singular result that all the reliefs in the real object appear as depressions, and all the depressions as reliefs. Such effects are called pseudoscopic. An interesting example of pseudoscopic effect may be produced by the simple experiment of placing a coin or medal on the window-seat or on a table in the sunlight, and observing the inverted image of it formed by a convex lens. The coin appears as an intaglio, and cannot be conceived otherwise. The reason is that the shadows are on the side from which the sunlight is known to come, which fact we can only reconcile with the supposition that they fall into depressions. The illusion may, however, be dispelled by fixing a pin into the wood on which the coin rests, so as to be seen with it through the glass; the shadow of the pin gives an irresistible evidence that the direction of the source of light is not what we had before supposed, and the device of the coin appears in relief once more.

*Defects of Vision.*—The imperfections of vision most frequently occurring are myopism, or short-sightedness, and presbyopism, or long-sightedness. The cause of short-sightedness, is, in general, too great a curvature of the crystalline, but it may also arise from excessive convexity of the cornea or malformation of the ball, causing the image in either case to be formed in front of the retina within the vitreous humor, unless the object is near. This defect varies much in degree. There are cases occasionally in which distinct vision can hardly be obtained at any distance, however short. There are others in which the eye seems to have no power of adjustment at all, so that vision is distinct only at one particular distance, but these are rare. Short-sightedness is sometimes congenital, and is sometimes the consequence of the habitual limitation of the view to near objects, as in the case of students, engravers, etc. It is more rare in the country than in the city, and is said to be unknown among savages or among nomadic peoples like the Arabs, Tartars, etc. The indistinctness of vision occasioned by this defect may be removed by placing before the eyes concave lenses of a degree of curvature to be ascertained by trial.

Long-sightedness is rare except among people of advanced years. Persons whose sight is good in early life usually become long-sighted in age; while those who are short-sighted when young sometimes find the imperfection gradually to diminish as they grow older. Long-sighted persons see very well at a distance, but for objects near at hand the vision is confused. Relief under this imperfection is obtained by the use of convex glasses.

A more serious defect than either of those above named arises from inequalities of curvature of the crystalline sometimes found in the different planes passing through the optic axis. There are usually two planes at right angles to each other in which occur the maximum and minimum curvatures; so that the surface resembles that of a portion of an ellipsoid around the major axis. To this defect has been applied the term *astigmatism*. When it exists, perfect distinctness of vision is impossible at any

distance. It may be obviated by a lens with a contrary astigmatism, or by a cylindric lens either concave or convex, having a curvature equal to the difference of the maximum and minimum curvatures of the crystalline. This defect is probably not very uncommon, though extreme cases are rare. It was discovered in himself by Prof. Airy, the present astronomer-royal of Great Britain, who also invented the remedy. Prof. Stokes of Cambridge has proposed the following method of ascertaining the kind of lens adapted to correct astigmatism in any particular case: Let a plano-convex and a plano-concave cylindrical lens of moderate but equal curvature be set in a circular frame with their plane surfaces in contact, so that one may be made to rotate on the other. When the axes of the two are parallel, the combination will not affect the inclination of rays transmitted through them, since the curved surfaces are parallel; but when the axes are perpendicular to each other, the compound lens will be convex in the direction of one axis and concave in that of the other, while at 45° from either of these directions it will be neither. By diminishing the angle between the axes, the effective convexity and concavity in the two rectangular directions will be gradually diminished, and when the axes are once more parallel, will be zero. By trial, such a difference may be found as will correct the astigmatism of the eye under examination. As the astigmatism of the eye is not necessarily in the vertical and horizontal planes, the correctional combination should be tried in different azimuths about the optic axis. When the proper correction has thus been found, simple lenses may be constructed for the use of the person laboring under the defect.

Another imperfection is COLOR-BLINDNESS, or DALTONISM, which has been noticed under those titles. Numerous instances of this have been cited by Seebeck, D'Hombres-Firmas, J. Herschel, Brewster, and others. No very satisfactory explanation of this phenomenon has been given. It has been suggested that the filaments of the retina, like the strings of a harp, respond only to those vibrations with which they are severally in unison, and that in the color-blind the filaments which correspond to certain tints are either wanting or are insensible. This explanation assumes that the color-blind are actually blind, at least to some extent; but no evidence has been produced to show that their vision, except as it respects colors, is less acute than that of other persons.

The subject of vision is very fully treated in all extended works on optics. The most important special work on the subject is Helmholtz's *Handbuch der physiologischen Optik* (Leipsic, 1867). F. A. P. BARNARD.

**Vital Statistics** may be defined as that branch of statistical science which has for its office the collection and arrangement of facts relative to the three epochs of human life, including special information bearing upon the preservation of health and the causes of disease; and from the study of these facts the discovery of certain laws bearing upon the increase of population and the duration of human life. The birth, the marriage, and the death of an individual are the three events which should be recorded and preserved among public archives for future reference; and with these should be included whatever attending circumstances may serve to substantiate the main statement—the names of proper vouchers or witnesses, and, in case of death, the remote and immediate causes of the event. Certain information concerning the pedigree of each and every subject of these records should also be included, that no question may arise in subsequent years as to identity should it become necessary to appeal to such records for the settlement of matters in dispute or litigation. In all well-regulated cities and towns it is provided that no interment shall take place or that no dead body shall be removed for interment without a permit from the properly-constituted authorities; which permit is based upon a certificate from the physician who last attended the deceased, setting forth in plain language the place and cause of death, duration of sickness, the age, nativity, and social relations of the deceased, and such other items of information as may be required in order to satisfy the authorities of the correctness of the statement made, as well as for proof afforded in case of a necessity for subsequent reference or identification. All accidental deaths, and all deaths from poison, violence, or any illegitimate cause whatever, as well as cases in which the genuineness of the certificate or the integrity of the person signing it is questioned, are referred to the coroner of the county for investigation. In consequence of this provision, it is extremely difficult to secure the hasty burial of the remains of any human being who has met death by foul or criminal means, and society is to some extent protected, in proportion, at least, as the concealment of crime is prevented. These restrictions also secure full reports of deaths for registration, while for births and marriages very much depends upon the faithfulness of the attending physician in the one case or of the officiating clergyman or magistrate in the other. In order that vital statistics may have their full value, there should be complete registration alike of births, marriages, and deaths, for it is often necessary to appeal to such records for legal as well as scientific purposes; and of such importance are they deemed as aids or evidence in settling questions of litigation, of right to property, pension claims, and various other questions involving the rights of individuals, that in many large cities the entire time of special clerks is occupied in searching records and making transcripts therefrom, in answer to the frequent applications for such documents.

Birth-rates are usually estimated in proportion to the entire population or to every 1000 of the population; and in countries where the registration has been brought to any considerable degree of perfection it is found that the annual number of recorded births varies from 29 to 40 for every 1000—more in some countries than in others, and more in the country than in the city. It is also shown that more boys than girls are born, the proportions, according to Quételet, being in Russia 108.9 boys to 100 girls, and the mean for Europe 106 boys to 100 girls; while, according to the 34th annual report of the registrar-general of Great Britain, we find that the average proportion was 104 boys to 100 girls; twice within twenty years the ratio reached 105 to 100, and twice it fell below 104 to 100. Several ingenious theories have been advanced in explanation of this excess of male over female births, such as the occupation of the parents, whether it be such as to develop sound physical qualities; the comparative ages of the parents, male births being in excess in proportion as the age and physical development of the father excel those of the mother; and, again, the preference for male infants tending to prevent the increase of the family after the birth of a boy. Whatever value may belong to the first and third of these explanations, it is pretty generally believed that one strong determining cause of the excess of male over female births is the difference in the ages of the parents. It is well known that the husband is generally a few years older than the wife, and that, the world over, more boys than girls are born; and although there may be other causes operating toward this result, the more careful observers regard this difference in age as the predominating one. Times, places, and seasons all exert their influence upon birth-rates. In times of prosperity and plenty we may expect more births than during periods of reverses, pestilence, and famine. In northern countries, where many marriages occur late in life, there will be fewer births than among the more precocious inhabitants of warmer countries. According to the report of the registrar-general, already referred to, the birth-rate is usually highest in the first three months of the year—a calculation based on the birth-records of thirty-four consecutive years; while of the whole number of births recorded in Philadelphia from 1861 to 1873, inclusive, the quarterly divisions were—first quarter, 56,072; second, 50,519; third, 57,256; fourth, 57,454; and of the whole number recorded in New York from 1866 to 1873, inclusive, being a period of eight years, the quarterly divisions were—first quarter, 31,958; second, 28,436; third, 35,125; and fourth, 33,920. The time of day at which the greater number of births occurs has been made a subject of investigation by Quételet, Dr. Buek of Hamburg, and others. According to Dr. Buek, of 1000 births, 312 take place between midnight and 6 A. M.; 249 between 6 A. M. and noon; 183 between noon and 6 P. M., and 256 between 6 P. M. and midnight. The approximate proportion of plural to single births may be deduced from the following: In Philadelphia (see report of the board of health for the year 1873) "the whole number of cases of plural births for the thirteen years, 1861–73, was 2088, of which 28 were triplets. One case of twins occurred in every 107.4 births, and one of triplets in every 7903 births." In the report of the board of health of the city of New York for the year 1873 (the last published report) we are told that during the year there were returned 22,683 certificates of children born alive, of which 242 were twins and 4 were triplet births. The number of still-births in the city of Philadelphia during the year 1873 amounted to 891, a percentage of 4.76, or 1 still-birth to every 20.9 births; and during the thirteen years the percentage of still-births was 4.61, or 1 in every 21.8 births. In the city of New York during the year 1873 there were 2312 still-births, the proportion to the number of living births being 1 to 9.81. This apparently large ratio is doubtless due to the imperfect registration, or rather the failure on the part of physicians and midwives to furnish complete returns of living births, while a return of every still-born child is absolutely required, in order to secure the necessary burial permit. In European statistics the proportion of still to living births is found to be nearly the same as in Philadelphia—larger in towns and cities than

in the country, and, as in living births, the proportion of boys excelling that of girls.

The following table, taken from the report of the board of health, already referred to, shows the number of births to 1000 persons living, and the number of persons living to 1 birth, in different countries and cities:

| Countries and cities. | Births to 1000 persons living. | Persons living to 1 birth. |
|---|---|---|
| England, 1861–70 | 35.2 | 28.40 |
| London, 1861–70 | 35.2 | 28.40 |
| Prussia, 1861–70 | 39.6 | 25.25 |
| Austria, 1861–70 | 39.8 | 25.12 |
| France, 1861–70 | 26.2 | 38.16 |
| Berlin, 1871 | 34. | 29.33 |
| Massachusetts, 1857–70 | 37.27 | 26.83 |
| Boston, 1863–72 | 30.86 | 32.40 |
| Providence, R. I., 1855–72 | 29.54 | 33.85 |
| Philadelphia, 1870–72 | 25.26 | 39.64 |
| Philadelphia, 1873 | 23.74 | 42.10 |

Marriage under ordinary circumstances is favorable to longevity. According to the statistics of France, Belgium, and Holland, as analyzed by M. Bertillon and quoted by Dr. Cameron (*Manual of Hygiene*, p. 28), married men from 25 to 30 years of age die at the rate of 6, unmarried at the rate of 10, and widowers at the rate of 22, per 1000 per annum; from 30 to 35, the death-rates of these several classes are respectively 7, 11, 19½; and from 35 to 40, married men die at the rate of 7½ per 1000 per annum, unmarried at the rate of 13, and widowers at the rate of 17½. On the other hand, men who marry between the ages of 18 and 20 years die as rapidly as men aged from 65 to 70. From 30 to 35 years of age spinsters die at the rate of 11, and wives at the rate of 9, per 1000 per annum, while under 25 the mortality is somewhat greater in wives than in spinsters. The expectation of a man married at 25 is that he will live to the age of 65, while that of the unmarried man of the same age is that he will live to the age of 60. The married woman at 25 may expect to attain the age of 65, the unmarried that of 56. Crime is least rife among the married, more so among the widowed, and most common among those who have never married. From the vital statistics of the city of Philadelphia during thirteen years (1861–73) certain conclusions are drawn by the board of health concerning the probabilities of marriage at different ages, to the effect that the probabilities of marriage under 20 years of age are about 42 times as great with females as with males; between the ages of 20 and 25 the probabilities are nearly equal, though still in favor of females; and after 25 they increase yearly in favor of males. The chances of females being married before the age of 20 are as 1 to 5 of all the probabilities that they will ever marry; at the age of 20, one-fifth, at 25, a little over two-thirds, and at 30, nearly six-sevenths of all their probabilities are lost. At the age of 20 the chances of males being married are scarcely lessened; at 25, three-fifths of their chances remain; but from this period on they diminish, but in smaller proportion than with females. The most favorable period for marriage is between 20 and 25 years of age; the next most favorable is, for females, under 20; for males, between 25 and 30. Causes which affect national prosperity will always exert a marked influence on marriages, more marriages occurring in years when business is lively, wages are good, and crops are abundant than during years when the opposite conditions obtain.

In the report to the registrar-general of the births, marriages, and deaths in Scotland during the year 1872, it is found that during the year there were 25,641 marriages registered in Scotland, and that there were also registered 107,838 live legitimate births, or an average of 4.20 + births for each marriage. During the same year there were registered in England 201,267 marriages and 781,141 live legitimate births, or an average of 3.88 births to each marriage. In Sweden, where the records of vital statistics are kept with a great deal of care, there were registered in 1872, 29,470 marriages and 112,989 live legitimate births, or an average of 3.83 births to each marriage. In the city of New York the ratio of registered births to registered marriages for the year 1873 was 2.55 births to each marriage, and in Philadelphia for the same year, 2.25.

Of the parties contracting marriage in Scotland during 1872, there were 21,637 bachelors with spinsters, 2269 widowers with spinsters, 889 widowers with widows, and 798 bachelors with widows. Of the 8871 registered marriages in the city of New York during 1873, there were 6487 bachelors with spinsters, 627 bachelors with widows, 420 widowers with widows, 746 widowers with spinsters, and in 591 of the marriages the condition of the respective parties is not stated.

Marriages of consanguinity are regarded as tending to some imperfection in the physical and mental development of children. According to French statistics and statistics compiled by Drs. Bemiss and Howe of this country, it appears that there is in the offspring of such marriages a strong tendency to insanity, idiocy, deaf-mutism, scrofula, or some physical deformity, although it is well known that in many instances the marriage of cousins has not been followed by such results. Doubtless, the degree of consanguinity exercises a good deal of influence in either modifying or aggravating this tendency to imperfect development; and cousins in whom the same family traits are prominent—as, for instance, the children of sisters, in whom the characteristics of the mother's family are strongly marked—would incur greater risk in marrying than would persons of the same relationship in whom were most prominent the constitutional peculiarities of their respective fathers, between whom there is no tie of consanguinity. Hereditary tendency to disease, especially to consumption, cancer, or insanity, is often an obstacle to a fortunate marriage, and more especially is this the case when in addition to this hereditary tendency there are ties of blood-relationship.

In order to be able to estimate accurately the value of death-records as indicating the rate of mortality and the sanitary condition of a city or country, it is necessary to have a complete registration of births, the amount of yearly immigration, together with a frequent and correct census of the population. It is customary to estimate the death-rate, as well as the birth-rate, in proportion to every 1000 of the inhabitants as given by the last census or as estimated year by year according to the usual rate of yearly increase. There seems to be a fixed law requiring that at least 11 human beings out of every 1000 of the entire population die annually. These are regarded as inevitable deaths, and any considerable number in excess of these are generally set down as resulting from the ignorant or wilful violation of some one or more of nature's laws. The actual death-rate of some of the more populous American and foreign cities may be seen in the following table, taken from a more elaborate one published in the report of the board of health of New York for 1873. No city with a population of less than 125,000 is included in this extract:

| City. | Population estimated for middle of year 1873. | Number of deaths. | Death-rate per 1000 inhabitants. | Deaths under 5 years of age. | Percentage of deaths under 5 years of age to total mortality. | Number of persons married. | Registered births. |
|---|---|---|---|---|---|---|---|
| New York | 1,000,000 | 29,084 | 29.08 | 14.182 | 48.76 | 17,744 | 22,683 |
| Philadelphia | 775,000 | 15,224 | 19.64 | 6,260 | 42.72 | 15,782 | 18,702 |
| St. Louis | 440,000 | 8,551 | 19.44 | 4,014 | 46.94 | No record. | No record |
| Brooklyn | 435,314 | 10,968 | 25.19 | 5,539 | 50.50 | 5,040 | 5,027 |
| Chicago | 400,000 | 9,557 | 23.89 | 5,676 | 59.39 | 6,448 | 9,718 |
| Baltimore | 305,000 | 7,614 | 24.96 | 2,301 | 30.22 | 2,200 | No record. |
| Boston | 276,500 | 7,869 | 28.46 | 3,289 | 41.79 | 3,916 | 9,688 |
| Cincinnati | 246,923 | 5,641 | 22.84 | 2,511 | 44.51 | 2,772 | 1,555 |
| Buffalo | 170,000 | 2,336 | 13.74 | 1,016 | 43.49 | No record. | No record. |
| San Francisco | 192,000 | 4,002 | 20.84 | 1,460 | 36.48 | 3,826 | 763 |
| New Orleans | 200,000 | 7,505 | 37.52 | 2,562 | 34.13 | No record. | No record. |
| Cleveland | 137,000 | 2,641 | 19.28 | 1,431 | 54.18 | No record. | 4,752 |
| Pittsburg | 133,900 | 3,519 | 26.46 | 1,781 | 50.61 | 3,564 | 5,175 |
| Newark | 125,000 | 3,735 | 29.88 | 1,891 | 50.63 | 2,560 | 3,648 |
| London | 3,356,073 | 76,634 | 22.83 | 31,789 | 41.48 | 66,878 | 121,100 |
| Liverpool | 505,274 | 13,042 | 25.81 | 5,889 | 45.15 | 11,470 | 18,716 |
| Birmingham | 355,540 | 8,990 | 25.28 | 4,424 | 49.12 | No record. | 14,497 |
| Manchester | 354,000 | 10,015 | 28.29 | 4,802 | 48.04 | No record. | 13,563 |
| Glasgow | 514,295 | 14,876 | 28.92 | 6,805 | 46.42 | 9,994 | 20,202 |
| Edinburgh | 208,322 | 4,577 | 21.97 | 1,567 | 34.23 | 7,840 | 6,785 |
| Stockholm | 147,249 | 4,484 | 30.45 | 1,838 | 41.00 | 2,658 | 4,347 |
| Rotterdam | 125,893 | 3,963 | 31.48 | No record. | No record. | 2,120 | 5,097 |
| Antwerp | 153,645 | 3,795 | 24.69 | 1,733 | 45.66 | 2,942 | 5,433 |
| Mexico | 225,000 | 6,963 | 30.94 | 2,667 | 36.86 | 1,066 | 9,273 |
| Montreal | 165,000 | 4,954 | 30.02 | 2,986 | 60.27 | 2,870 | 6,086 |
| Vienna | 700,000 | 24,701 | 35.28 | 9,202 | 37.13 | 14,756 | 27,880 |
| Dresden | 179,678 | 6,257 | 34.82 | 3,080 | 47.62 | 4,288 | 7,251 |
| Munich | 169,400 | 7,705 | 45.48 | 3,589 | 46.58 | 2,474 | 7,865 |
| Rome | 248,307 | 8,479 | 34.14 | 3,343 | 30.42 | 2,996 | 7,201 |
| Milan | 271,135 | 9,272 | 34.19 | 2,852 | 30.75 | 5,618 | No rec. |
| Genoa | 135,282 | 4,972 | 36.75 | 1,636 | 32.90 | 1,914 | 4,321 |
| Venice | 135,644 | 4,919 | 36.26 | 1,873 | 38.07 | 1,626 | 3,648 |

By examining the above table it will be seen that in each of these cities there is annually a greater or less number of preventable deaths, varying from 7 to 34 for each 1000 persons living, supposing the number of inevitable deaths to be 11 in each 1000. But this system of measuring the sanitary condition of a city or a locality according to the number of deaths occurring therein for every 1000 of its living inhabitants is not altogether without fallacy. One city may have from time to time large numbers of transient visitors, some of whom die during a temporary residence there, without ever having been numbered as a portion of the permanent population. Such is the case with the city of New York, among the temporary sojourners of which may be included large numbers of business men, who make periodical visits to the city in the interests of their respective callings; immigrants, numbers of whom

are constantly arriving on their way to different parts of the country; and paupers from adjoining States and counties, who are easily persuaded that it is more desirable to live and die by the charity of a great commercial emporium than to support a comfortable existence by honest industry. In addition to this, it is well known that the medical talent and medical institutions of New York attract to the city large numbers of invalids for medical treatment, many of whom are suffering with incurable disease. Of these several classes of persons, certain numbers die from diseases contracted elsewhere, and thus contribute to increase the ratio of mortality to the living population. Could New York eliminate these from her bills of mortality, she would be able to exhibit a death-record far more creditable to her health administration than appears in the foregoing table. There are many conditions peculiar to cities which exert a considerable influence upon death-rates, and among these not the least in importance is that of the homes of the poor. The crowded tenement-houses of New York give a large percentage of infant mortality, though we shall presently see that this is yearly decreasing, while the more comfortable homes of Philadelphia give a death-rate, both of adults and infants, considerably below that of her sister city. The peculiar shape of one city, bounded as it is by two large rivers and extending only in one direction, makes it necessary, in the absence of cheap and rapid transit, for the laboring classes to reside in near proximity to the places of their daily labors, and hence this apparent necessity of accommodating large numbers of people within limited areas. The other city, its area extending in different directions, affords comfortable homes for its laboring classes without adopting the system of crowded tenements so common in New York. Thus, the poor in Philadelphia have more breathing-space than the city of New York affords to its poor, and are less exposed to contagion, the danger from which is always in proportion to the amount of crowding.

Continued extremes of temperature, it is well known, tend to increase death-rates, in spite of all sanitary efforts to the contrary. During a protracted term of hot weather numbers die from diseases traced directly to the excessive heat, while many invalids and persons debilitated from age and other causes, not being able to withstand this additional tax upon their vital powers, have their deaths hastened by their original complaints plus the exhausting influences of long-continued heat. Excessive death-rates during heated terms are sometimes followed by low death-rates for a number of weeks, from the fact that so many invalids and sickly persons having died during the hot weather, those who are left enjoy more than an average degree of health. Severe cold also has the effect to increase death-rates by pneumonia, pleurisy, etc., while it is well known that the very old and the very young are peculiarly susceptible to the effects of low temperature.

The greatest number of deaths occur during the third quarter of the year, and the smallest during the fourth quarter. The first and second quarters have nearly the same proportion, sometimes one excelling in the number of deaths, and sometimes the other. The time of day at which the greatest number of persons die has been made a subject of study by many vital statisticians, though with somewhat varying results. While Buek of Hamburg, Schneider of Berlin, and Quételet of Belgium found that the greatest number of deaths occurred between midnight and 6 o'clock A. M., Watson of Glasgow and some others found that the greatest number died between the hours of 6 A. M. and 12 noon.

The subject of infant mortality is one of great interest alike to the sanitarian and the philanthropist. It is a melancholy fact, as seen by the foregoing table, that of all the deaths which occur throughout the world, a large percentage is of children under five years of age. This is more so in cities, where there are large tenement populations, and less so in the country, where the children are fed upon good milk and are allowed to breathe a pure atmosphere. In cities it is necessary for health authorities to pay a good deal of attention to the sanitary wants of tenement populations, with a view of saving infant life. The following table of yearly deaths in the city of New York since 1867 will show what sanitary effort in that city has accomplished toward reducing the percentage of infant mortality:

| Year. | Total deaths. | Deaths under 5 years of age. | Percentage under 5 years. |
|---|---|---|---|
| 1867 | 23,264 | 12,274 | 52.99 |
| 1868 | 24,705 | 13,067 | 52.50 |
| 1869 | 25,167 | 12,859 | 51.09 |
| 1870 | 27,174 | 13,333 | 49.06 |
| 1871 | 26,976 | 12,971 | 48.08 |
| 1872 | 32,423 | 16,188 | 49.58 |
| 1873 | 29,027 | 14,182 | 48.76 |
| 1874 | 28,589 | 13,956 | 48.81 |
| 1875 | 30,623 | 14,839 | 48.28 |

From the above table it will be seen that since the year 1867 the ratio of infant mortality to the total mortality has diminished from 52.99 to 48.28 per cent. The percentage of infant mortality in 1867 being 52.99, that of the remaining mortality (all over five years of age) was of course 47.01. If from 30,623, the total number of deaths occurring in 1875, we subtract 14,839 deaths under five years of age, we have left 15,784 deaths of those over five years of age. Now, estimating on the ratio of 1867, we have $47.01 : 52.99 :: 15{,}784 : x = 17{,}791$, the number of deaths under five years that would have occurred in 1875 had the ratio of 1867 continued. If now from 17,791 we subtract 14,839, the actual number of infant deaths, we find that we have a saving of 2952 children; and furthermore, as it is estimated that for each death there are 28 cases of sickness, $2952 \times 28 = 82{,}656$, therefore in the saving of the lives of 2952 children, as compared with the ratio of 1867, we have as a gratifying consequence 82,656 cases of serious illness prevented.

In order that vital statistics may be of the greatest value, it is important that they be complete in every branch of the science. While the necessity for burial-permits secures a full report of all deaths and still-births, those of marriages and living births are not so easily secured. Clergymen may sometimes by negligence forget to make returns of marriages which they solemnize, and physicians may fail to report in full all of the births which occur under their care; and furthermore, many births take place without any medical attendant, and on such an occasion the poor woman who in haste runs in to assist a neighbor in her extremity has not the least suspicion that she is bound by any law to report the event which has occurred under her observation, and thus it is that a considerable number of births among the poor are never registered.

The value of a complete system of collecting and preserving vital statistics is appreciated by the medical man, the sanitarian, and life insurance companies. By it physicians are enabled to determine the percentage of mortality attending each disease, the ages at which certain diseases are most common and most fatal, and many other matters which may be to them of practical value. It will enable sanitarians to determine the degree of success attending their efforts to raise the standard of public health, by comparing the birth and death rates of one year with those of another, a steady decline in the death-rate year by year, with a marked increase in the yearly number of births, showing that the causes of sickness and mortality are diminishing, and that we are nearing the condition in which inevitable deaths alone figure in the records. Some striking evidence of the good results following the introduction of sanitary works is afforded by the following extract from a table compiled by Dr. Buchanan and published in the ninth annual report to the privy council. It illustrates the improvement resulting from the introduction of works of drainage and water-supply, by showing the difference in the ratio of deaths per 10,000 inhabitants before and after the works were introduced:

| Population. | Towns. | General death-rates. | | Typhoid fever. | | Phthisis. | | Infant mortality. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Before. | After. | Before. | After. | Before. | After. | Before. | After. |
| 160,714 | Bristol | 245½ | 242 | 10 | 6½ | 31 | 25½ | 54 | 52 |
| 68,056 | Leicester | 264 | 252 | 14⅜ | 7¾ | 43½ | 29¼ | 84½ | 81 |
| 52,778 | Merthyr | 332 | 262 | 21⅓ | 8⅔ | 38⅔ | 34⅓ | 80¼ | 61 |
| 39,693 | Cheltenham | 194 | 185 | 8 | 4⅝ | 28¾ | 21¼ | 40½ | 37 |
| 32,954 | Cardiff | 332 | 226 | 17½ | 10½ | 34¾ | 28⅔ | ? | ? |
| 30,229 | Croydon | 237 | 190 | 15 | 5½ | ? | ? | ? | ? |
| 29,417 | Carlisle | 284 | 261 | 10 | 9¾ | 32 | 35⅔ | 71 | 65½ |
| 27,475 | Macclesfield | 298 | 237 | 14¼ | 8½ | 51½ | 35⅔ | 77½ | 59⅔ |
| 24,756 | Newport | 318 | 216½ | 16⅓ | 10⅓ | 37 | 25 | 67¼ | 53¼ |
| 23,108 | Dover | 225½ | 209 | 14 | 9 | 26½ | 21¼ | 47⅔ | 46¼ |
| 10,570 | Warwick | 227 | 210 | 19 | 9 | 40 | 32⅓ | 51¼ | 46¾ |
| 10,238 | Banbury | 234 | 205 | 16 | 8½ | 26⅔ | 15⅔ | 53 | 45 |

From a careful study of vital statistics the life insurance actuary derives most of his knowledge concerning the probable duration of life under varying circumstances and conditions and at successive periods. By making himself familiar with the ratio of births to the population, the number of children dying during the first year, ratio of sickness to population, the ratio of deaths to the living, the ages of those who die, and the various other changes in population caused by emigration, immigration, etc., he is enabled to construct his tables of the expectation of life at various ages. The following table, abridged from Dr. Farr's life tables by Dr. Parkes (*Pract. Hygiene*, 3d ed. p. 516), is sufficient to illustrate their construction and signification. (See also, for further information on this topic, the *Table of Mortality* in the article on LIFE ASSURANCE, in CYCLOPÆDIA.)

*Expectation of Life in England.*

| Age. | Males. | Females. | Age. | Males. | Females. | Age. | Males. | Females. |
|---|---|---|---|---|---|---|---|---|
| 0 | 39.91 | 41.85 | 10 | 47.05 | 47.67 | 70 | 8.45 | 9.02 |
| 1 | 46.65 | 47.31 | 20 | 39.48 | 40.29 | 80 | 4.93 | 5.26 |
| 2 | 48.83 | 49.40 | 30 | 32.76 | 33.81 | 90 | 2.84 | 3.01 |
| 3 | 49.61 | 50.20 | 40 | 26.06 | 27.34 | 95 | 2.17 | 2.29 |
| 4 | 49.81 | 50.43 | 50 | 19.54 | 20.75 | 100 | 1.68 | 1.76 |
| 5 | 49.71 | 50.33 | 60 | 13.53 | 14.34 | | | |

It will be seen from this table that after the first year the chances of living increase up to the fourth year, and that they then begin slowly to lessen. It will also be seen that throughout the different periods of life the chances of females are a little above those of males. The "probable duration of life" is the age at which a given number of children born into the world at the same time will be reduced one-half; while "the expectation of life" is the average length of time a person of any age may be expected to live. This latter is regarded as the true test of the health of the people. But circumstances other than age must be considered as affecting the expectancy of life. According to Mr. Radcliffe, rural laborers may expect on an average to live 45.32 years; carpenters, 45.28; domestic servants, 42.03; sawyers, 42.02; bakers, 41.92; shoemakers, 40.87; weavers, 41.92; tailors, 39.40; hatters, 38.91; stonemasons, 38.19; plumbers, 38.13; mill operatives, 38.09; blacksmiths, 37.96; bricklayers, 37.70; printers, 36.66; clerks, 34.99; and the average population of England and Wales, 39.88 years. Dr. Guy, in the *Journal* of the Statistical Society (London, vol. ix. p. 346), gives the average age attained by persons who have survived their fifty-second birth-day as follows: clergy, 74.04; gentry, 74.00; medical men, 72.95; lawyers, 72.78; navy, 72.62; commercial men, 72.32; literary and scientific (native), 72.10; aristocracy, 71.69; army, 71.58; literary and scientific (foreign), 71.44; fine arts, 71.15; painters, 70.96; chemists, 69.71; kings of England, 64.12. Statisticians of other countries have presented similar statements which do not vary much from the foregoing. According to the studies of Casper of Berlin, of 100 theologians, 42 attained the age of 70 years; and of the same number of commercial men, lawyers, and physicians, the numbers attaining the age of 70 are respectively 35, 29, and 24. It may be inferred from the above references that the condition most favorable to longevity is a life not subject to excess of either bodily or mental labor, but in which a fair competence is enjoyed from moderate and steady occupation at some calling not in itself injurious to health.

E. H. JANES.

# W.

**Wads'worth** (STRONG), b. at Hastings, Oswego co., N. Y., Sept. 10, 1833; removed 1845 to Chicago; graduated at Yale College 1851; studied law in the office of J. Young Scammon at Chicago; was admitted to the bar 1853, but soon gave up practice, and was afterward for many years engaged in banking. In 1864 he removed to New York, joined the Stock Exchange 1868, and has since been occupied almost wholly with the business of stock-brokerage. In 1874 he was for a short period connected with the New York *Times* as financial editor.

**Wake'ley** (JOSEPH B.), b. at Danbury, Conn., in 1804; was apprenticed at an early age to a hat manufacturer of that place, but studied subsequently for the ministry; was admitted in 1828 to the New York conference; labored in New York, Trenton, Jersey City, and Newark; settled in 1857 at Poughkeepsie; was subsequently appointed pastor of the Lexington Avenue church. D. in New York Apr. 27, 1876. He is the author of *Lost Chapters recovered from the History of Methodism*, the *Temperance Cyclopædia*, etc.

**Wal'do** (LEONARD), b. at Cincinnati, O., Mar. 4, 1853; graduated at Woodward College 1871, and subsequently at Marietta in 1872; spent some little time at the Cincinnati Observatory, and, entering the School of Mines, Columbia College, New York, was appointed assistant in the observatory of that institution, then just completed, in 1873; the following year (1874) was appointed by the secretary of the navy assistant astronomer U. S. transit-of-Venus expedition, and in that capacity, representing Columbia College, accompanied the chief of the expedition to one of the most important stations, Hobart Town, Tasmania; the succeeding year (1875) was appointed assistant at Harvard College Observatory, Cambridge, Mass., where he now resides.

**Walk'er** (JOSEPH REDDEFORD), b. at Knoxville, Tenn., in 1798; removed to Jackson co., Mo., in 1818; began his career as a mountaineer and guide on the frontier in 1822; was guide to Bonneville's expedition to the Rocky Mountains in 1832; conducted a party from Great Salt Lake to California, discovering Walker's River and Lake and Yosemite Valley in 1833; found Walker's Pass in 1834; and made many subsequent trips across the Plains. D. Oct. 27, 1876, at Ygnacio Valley, Contra Costa co., Cal., where he resided during the latter part of his life.

**Wal'laby,** the Australian name applied as an equivalent of the generic name *Halmaturus*. The species so designated are kangaroos (Macropodidæ), which average next in size to the typical kangaroos of the genus *Macropus*, ranging up to fifty pounds in weight. The upper incisors of the third pair are comparatively elongate, and have rather narrow crowns and deep grooves, and the premolars are well developed and mostly persistent through life; they mostly "have a bridle-mark behind the shoulder and a horizontal stripe across the haunch." They are chiefly nocturnal in their habits. According to Krefft, sixteen species of the genus are known: of these, six are large and attain to nearly or quite fifty pounds in weight, and are the wallabies *par excellence*; three others range more or less below thirty pounds, and seven vary between ten and fifteen pounds. "The largest species live in Tasmania; the smallest are found in New South Wales and in West Australia." (*Krefft.*)

THEODORE GILL.

**Wallaroo',** a name given to two species of kangaroos, constituting a section of the genus *Macropus*—viz. (1) *Macropus antilopinus*, the red wallaroo, and (2) *Macropus robustus*, the black wallaroo; the former inhabits the country about Fort Essington, and the latter the mountain-ranges of the coast of New South Wales.

THEODORE GILL.

**Wal'ler** (ELWYN), A. M., E. M., PH. D., b. in New York City Mar. 22, 1846; graduated at Harvard College in 1867, and at the School of Mines, Columbia College, in 1870; was appointed instructor of analytical chemistry in the latter institution in 1871, and assistant sanitary inspector (analyst to the metropolitan board of health) in 1872, and has published—*Disinfection and Disinfectants, Notes on Petroleum of San Domingo, New Method for the Quantitative Estimation of Carbolic Acid*, and several papers in the *American Chemist*.

**Wal'ling** (GEORGE WASHINGTON), b. in Monmouth co., N. J., May 1, 1823; prepared himself for the profession of the law until the death of his father in 1842; took employment on a steamboat as engineer; served during the Mexican war on a U. S. revenue cutter; settled in New York City after the close of the war; was appointed a police officer in 1847; promoted to captain in 1853, and to inspector in 1869, and was chosen superintendent of the entire police force of the metropolitan district in 1874.

**Wal'ton** (WILLIAM), b. at Teddington, Middlesex co., England, Aug. 30, 1810; came to New York in 1821; graduated at Columbia College in 1828; studied law, and was admitted to the bar, but gave up practising in 1835, and devoted himself to the study of theology; was ordained a deacon in 1838 and a priest in 1840; was rector of St. Paul's church, Tompkinsville, L. I.; editor of the *Churchman* 1849–52, and professor of Hebrew in the Theological Seminary of the Protestant Episcopal Church in New York. D. Sept. 21, 1869.

**Wanderoo'.** (I.) The common name of a monkey of the coast of Malabar—the *Macacus silenus* of authors—distinguished by its long hair and venerable appearance; whence it has been also called *Silenus veter*. The head is oblong and the face rather produced; the hair on each side of the face and on the neck and chest is elongated and forms a sort of ruff round the face, and is of a gray or whitish color; the face about the eyes is naked and flesh-colored; the snout black; the fur is mostly black on the back and sides, and whitish beneath and inside the limbs; the tail is rather short and tufted; it is chiefly brown, but its tuft is whitish. The species lives in the depth of the forests, and its appearance has given rise to several legends, and to the idea that it is the lord of the monkey race. It was known to the ancients, and has been supposed to be the "race of men" described by Ctesias as "inhabiting the mountains of India, having heads like dogs, but with larger teeth. They have nails, but larger and more rounded. They bark, but do not talk; they have tails like dogs, but

more hairy." It attains a length of about eighteen inches. II. The name is also given to, and in fact appears to have been primarily employed for, species of the genus *Semnopithecus*, and especially for the *S. leucoprymnus* of Ceylon, where the name is said to have originated.

THEODORE GILL.

**Wap'iti,** a name of the *Cervus canadensis*, or large deer of the Northern U. S. and British provinces. It is more generally called elk, but very improperly, inasmuch as that name belongs by right to the *Alces malchis*, otherwise called moose. The wapiti is very closely related to the common red deer or stag of Europe, but is a still larger and more noble-looking beast, attaining the dimensions of a moderate-sized horse. The color above and about the lower jaw is yellowish-brown; the circles around the eyes brown; the rump has a large pale disk extending far above the base of the tail, and with a black streak on each side of it; the tail is very short; the hoofs are broad and semicircular. Such are the chief characters alleged to differentiate the species from the *Cervus elaphus* of Europe. (See further DEER and ELK, in CYCLOPÆDIA.) THEODORE GILL.

**War'blers,** the popular name of numerous species of birds, mostly belonging to the so-called families Sylviidæ and Sylvicolidæ. The groups thus designated have been best distinguished by Baird, and essentially defined as follows:

I. The Sylviidæ have a slender, broad, and at base depressed bill, which is decurved and distinctly notched at the tip; the culmen is sharp-ridged at base; the rictal bristles extend beyond the nostrils; the frontal feathers reach to the nostrils; the nostrils are oval, protected by membrane, and overhung (but not concealed) by a few bristles or a feather; the wings are moderate and more or less pointed, and have each ten primaries, of which the first or spurious is almost half as long as the second; the tarsi are booted or scutellate; of the toes the lateral are subequal, and the middle has its basal joint attached for its whole length externally and halfway internally. The group as thus defined is quite comprehensive, and has been differentiated into the sub-families Sylviinæ, Regulinæ, and Polioptilinæ. It is to the first that most of the warblers of England and the Old World generally belong. This contains nearly 150 species, most of which are confined to Europe, Asia, and Africa, although a few are peculiar to Australia, and one species (*Phyllopneuste borealis*) is an occasional visitor to North-western America from Asia. The species resemble considerably in external appearance and habits the warblers of North America, which belong to the family Sylvicolidæ, but their differences may be appreciated by a comparison of their characters above given with those of the latter, below appended.

II. The Sylvicolidæ have also a slender bill, which is conical or depressed, and has the culmen straight or convex; there is no distinct notch; rictal bristles are variously developed; the nostrils are oval and rounded; the wings are moderate and rather rounded or bluntly angulated, and have each nine primaries, of which the first is nearly as long as the second or third; the tertials are generally not longer than the secondaries, and not emarginated; the tarsi are distinctly scutellate along their entire front faces; the lateral toes are nearly or quite equal; the middle has its basal joint nearly free to its base externally, but united for about half its length internally; the claws are all much curved, and the hind one not much longer than the median anterior. The forms thus combined, according to Baird, "are essentially characterized among the Oscines with nine primaries by their small size, the usually slender and conical insectivorous bill, shorter than the head, without angle in the gape near the base; the toes deeply cleft, so as to leave the inner one free almost to its very base (except in Mnioltilteæ), etc. The shallow notch at the end of the tongue, instead of a deeply-fissured tip, distinguishes the family from the Cœrebidæ, to some of which there is otherwise so great a resemblance. The absence of abrupt hook and notch in both mandibles separates it from such of the Vireonidæ as have nine primaries." The distinction of the group as a family is of very questionable policy, but the group as defined by Baird is apparently a natural one, and has been adopted by recent authors (*e. g.* Carus, Gray, Sclater and Salvin, etc.) either under the name Sylvicolidæ or Mnioltiltidæ. The forms are peculiar to America, and are quite numerous, between 110 and 120 species being known. They are all of small size; they feed mostly on insects. Some are quite agreeable songsters, and, as their name indicates, "warblers," but none are famous for musical ability. About 18 genera are recognized by the most recent writers on American birds, and by Baird, etc., they have been segregated under four sub-families and minor sections—viz. (1) Sylvicolinæ, with the sections Mnioltilteæ, Vermivoreæ, and Sylvicoleæ or Dendroeceæ; (2) Seiurinæ, with the groups Seiureæ and Geothlypeæ; (3) Icterianæ, with the groups Icterieæ and Teritristeæ; and (4) Setophaginæ, with the groups Setophageæ, Myiodiocteæ, and Cardellineæ. THEODORE GILL.

**Warehousing System,** a plan adopted by governments for lessening the pressure of the duties levied by the tariff upon the importer by retaining the goods on which they are levied in the possession of the government, and postponing the payment of the duties until the goods are to be delivered to the parties to whom they are sold. The cost of maintaining the bonded warehouses with their storekeepers comes out of the importer in storage charges, which are a little higher than those of private warehouses, but the interest of the money saved by the postponement of the payment of duties usually more than offsets this. Although this would seem to be the most obvious method of relieving the importer from the hardship of having to pay duties long before the goods could be sold, it is somewhat remarkable that the system has been adopted but recently in Great Britain and in the U. S. It was first proposed in Great Britain by Sir Robert Walpole in 1733 as a part of his excise scheme, but was defeated. The principle was first recognized in 1802, but has been repeatedly and materially modified at each change and consolidation of the customs laws. In 1846 there was a separate "act for the warehousing of goods." In 1853 the warehousing system formed a considerable portion of the text of the customs consolidation act. In the U. S. the warehousing system, though agitated and petitioned for by the Philadelphia Chamber of Commerce in 1828, and urged by both the Philadelphia and New York chambers in 1838, was not established till Aug. 6, 1846. Previous to this time, and probably as early as 1819 or 1820, it had been the practice of the government to give the importers credit on the payment of the duties upon their filing satisfactory bonds. It was proposed in 1828 and in 1838 to require the cash payment of all duties in connection with the warehouse system; this proposition was strongly opposed by the New York Chamber of Commerce on both occasions, though accepted by the Philadelphia Chamber. When it was finally established the old credit system on importations was abandoned, and the immediate payment of duties was only postponed on those goods which were warehoused. The principal provisions of the act of Aug. 6, 1846, were—that the payment of all duties in cash on the entry of the goods was henceforth to be the rule, but that unclaimed goods, and goods not wanted for immediate consumption by the importer, might be sent to the public stores or such other warehouses as the collector and importer might agree upon, the importer giving bonds with sufficient sureties in twice the amount of the duties for their payment, together with all other charges, when the goods were withdrawn from the warehouse. As there might be cases in which the importer would desire to withdraw from bond a portion of his goods at a time, it was provided that where the goods were in packages, nothing less than an entire package should be withdrawn, and where they were in bulk, not less than one ton, except on special order from the secretary of the treasury. Subsequent provisions were made at a later date for the repacking under proper supervision and conditions of goods in bond where this was found necessary. By the act of Aug. 6, 1846, goods were allowed to be withdrawn for exportation without the payment of duties on the payment of the storage and other expenses. It was provided also that all goods remaining in the public stores or bonded warehouses for more than a year might be sold at auction after appraisal, and the excess, if any, over duties and expenses should be paid over to the importer, consignee, or agent, a receipt being taken therefor; but if such excess was not claimed within ten days, the collector was directed to pay it into the U. S. treasury, giving complete information concerning the sale to the treasury department, and that department then assumed to itself the responsibility for all claims of the owners of the goods, releasing the master or owners of the vessel which brought them from such claims. Perishable and explosive goods might be sold in less than a year if not removed and the duties and expenses paid. Provision was also made for the transportation of goods from one port to another by the giving of bonds in double the amount of the duties, such bonds being cancelled when they were deposited in a bonded warehouse in the collection district to which they had been transported, but the time during which they should be kept in the warehouse should not be extended in consequence of this removal. Suitable penalties were prescribed for removing or fraudulently gaining access to warehoused goods, and for any attempt to alter or efface any marks placed thereon by a revenue officer. The collector was required to make quarterly (afterward changed to monthly) returns of all goods remaining in the warehouses, which returns were to be published in papers in Washington. The secretary of the treasury was authorized

to make such regulations, not inconsistent with the laws of the U. S., as he should see proper from time to time, and to report the same to the next session of Congress. In Aug., 1854, this act was amended in some important particulars. Hitherto, the policy of the government had been to own or lease its warehouses, and store all goods under bond therein; but its policy was now changed, and the establishment of private bonded warehouses encouraged, the proprietors of which were required to pay the salary of the government storekeeper and other government charges, and to collect from the importers or consignees of the goods certain rates of storage, cartage, etc., which should be established by a joint board. Where these private bonded warehouses were established in sufficient numbers, the whole warehousing business was to be relinquished to them, the government neither leasing nor owning any bonded warehouses; but in those ports where there were no private bonded warehouses the collector was authorized to maintain government warehouses. There are now no government warehouses in the port of New York, nor, we believe, in any other of our largest ports. There have been some later amendments to this act, affecting only minor details. The regulations of the secretaries of the treasury are issued from time to time, but concern only the classification of warehouses and the details of their management. Under the provisions of this act and the amendments thereto the warehouses in which unclaimed and bonded merchandise may be stored are divided into six classes—viz. *Class I.* Stores owned or hired by the U. S. These are to be maintained only in those ports and cities in which there are no private bonded warehouses, and are intended for the warehousing of unclaimed goods and of foreign goods. In these the labor and charges for storage, etc., come directly from the owners of the goods. *Class II.* Warehouses in the possession of an importer and in his sole occupancy, which he may desire to place under the customs lock, in addition to his own lock, for the purpose of storing dutiable merchandise imported by himself or consigned to him, or purchased by him in bond. The entire building must be appropriated to this sole purpose, and the importer must pay for the services of the customs officer in charge such sum as the collector of the port deems fair and proper. *Class III.* Warehouses in the occupancy of persons desiring to engage in the business of storing dutiable merchandise under the warehouse acts, and of performing the labor on such goods in what is usually termed the storage business. These warehouses must be used solely for the storage of warehoused goods and of unclaimed and seized goods, and must consist of an entire building. *Class IV.* Yards or sheds of suitable construction for the storage of wood, coal, mahogany, dyewoods, lumber, molasses, sugar in hogsheads and tierces, railroad, pig, and bar iron, anchors, chain cables, and other articles specially authorized. These yards or sheds must be built and enclosed in a prescribed way. *Class V.* Bins or parts of warehouses or elevators separated from the rest of the building may be bonded for the storage of grains. *Class VI.* Cellars or vaults may be used, under certain prescribed conditions, as bonded warehouses for the storage of wines and distilled spirits only. Warehousing when practised under the third class, and to some extent under the fourth, is usually known as general-order business. In the port of New York there are about 260 bonded warehouses belonging to Class III.; 2 belonging to Class II.; 15 belonging to Class IV. The number belonging to Classes V. and VI. is small, but is not reported. The rates of storage and labor in New York for the different kinds of goods imported are prescribed by a joint committee appointed by the Chamber of Commerce, the collector of the port, and the proprietors of private bonded warehouses.

| Date of monthly reports. | Warehoused. | Withdrawn from warehouse. | Remaining in warehouse. | Total withdrawn and remaining in warehouse. |
|---|---|---|---|---|
| | $ | $ | $ | $ |
| July 1, 1870 | 76,874,135 | 18,078,327 | 58,795,808 | 76,874,135 |
| July 1, 1871 | 89,691,281 | 21,366,622 | 68,324,659 | 89,691,281 |
| July 1, 1872 | 155,791,265 | 33,579,999 | 122,211,266 | 155,791,265 |
| July 1, 1873 | 96,144,964 | 18,560,986 | 77,583,978 | 96,144,964 |
| July 1, 1874 | 75,850,707 | 16,150,589 | 59,700,218 | 75,850,707 |
| July 1, 1875 | 70,409,346 | 13,702,344 | 56,707,002 | 70,409,346 |
| July 1, 1876 | 56,230,663 | 13,125,711 | 43,104,952 | 56,230,663 |
| **Annual statement.** | **Entered for consumption.** | **Entered for warehouse.** | **Entered for immediate transportation.** | **Total importation of the year.** |
| | $ | $ | $ | $ |
| For year ending July 1, 1875 | 393,371,697 | 152,562,872 | 7,971,584 | 553,906,153 |
| For year ending July 1, 1876 | 338,987,753 | 128,567,978 | 9,122,140 | 476,677,871 |
| Decrease, 1876 | 54,383,944 | 23,994,894 | *1,150,556 | †77,228,282 |

* Increase. † Decrease.

The foregoing table shows the amount of goods warehoused, withdrawn, and remaining at the dates named.

(For many facts and statistics contained in this article we are indebted to Samuel P. Russell, Esq., warehouse superintendent of the New York custom-house, and to George Wilson, Esq., secretary of the New York Chamber of Commerce.) L. P. Brockett.

**Warm-blooded Animals,** those vertebrates possessed of warm blood, and which is such simply by virtue of a complete circulation of the fluid, and its aëration through the medium of lungs at each revolution. The animals must consequently all breathe air direct, and this is done by the fish-like whales and porpoises as well as by the true terrestrial quadrupeds and birds. The only warm-blooded animals are the mammals and birds, and these were almost always collocated by the older naturalists under the name above signalized or its equivalents, "Calida animalia," "Hæmatotherma," etc. This combination is now known, however, not to be a natural one, inasmuch as the birds are much more nearly related to the reptiles than to the mammals, and the character combining them is a mere physiological adaptation for the same functions of life. (See also Vertebrates.) Theodore Gill.

**Warming and Ventilation of Buildings.** These two subjects are so closely connected as to make it desirable to treat of both in the same article; for it is now generally admitted that no system of warming inhabited buildings can be pronounced complete which does not include arrangements for ventilation.

When a building or room exposed to outside cooling influences has once attained the proper temperature, it is only necessary, in order to maintain its warmth, to furnish sufficient heat to replace the continual loss by transmission through the walls, window-glass, and roof, in addition to what is needed for warming to the temperature of the room all the cold air that may enter. When the heating apparatus is outside the apartments, sufficient air must be admitted to convey the heat generated by the heater into the rooms; and this air may be more than is required for ventilation. A cubic foot of air at zero and atmospheric pressure requires 0.02 heat-unit to warm it 1°, and therefore 1.4 heat-units to warm it to 70°.‡ The transmission of heat is in direct proportion to the difference between the temperature of the air outside and inside the walls. According to Peclet's data, when the outside air is calm at −10° and the inside air at 70°, the transmission per square foot of wall-surface through a solid wall and through a wall lined with lath and plaster 1 inch thick, separated from the wall by a 2-inch air-space, is as follows:

| Kind of wall. | Thickness of brick or stone. | | | | |
|---|---|---|---|---|---|
| | 8 ins. | 12 ins. | 24 ins. | 30 ins. | |
| Solid wall, brick | 23 | 18 | 11 | | Heat-units per hour. |
| " stone | ... | 31 | 24 | 22 | |
| Plastered wall, brick | 17 | 14 | 10 | | |
| " " stone | ... | 21 | 17 | 16 | |

These numbers apply to partitioned buildings or to buildings having several stories, but not to high empty buildings, like churches, for which the transmission is less. Each square foot of window-glass from $\frac{1}{16}$ to $\frac{3}{8}$ inches thick, in a building warmed to 70°, transmits 40 to 45 heat-units per hour in calm weather, when the outside air is at −10°, and nearly twice as much when exposed to a high wind at that temperature. With double windows not less than 1 inch apart the loss in calm weather is about two-thirds the loss through a single window, but the saving by their use is much greater when the wind blows than when the air is quiet. In a cold climate the maximum cooling influences may be of long duration; the heating apparatus therefore must be of sufficient capacity to provide for the maximum loss of heat, instead of the mean loss, and to furnish enough heat during a few hours of the morning to compensate for a deficiency which may result from a less active heating effect through the night.

It is customary in designing a heating apparatus for any building to make the heating surface proportional to the cubic contents of the apartments; but as the cooling of the rooms does not depend on their capacity, but on the quantity of cold air supplied to them, and on the extent and character of their walls, no general rules can be useful which do not take these details into account.

Only a few of the many appliances for utilizing the heat of fuel can be noticed in this article.

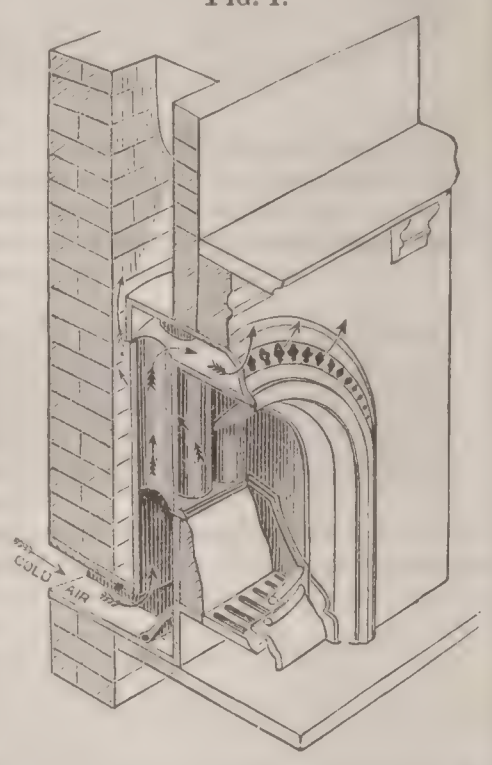
Although the open grate is the most popular device for warming apartments in dwellings, it cannot be depended on in its common forms as the only source of heat in a cold climate. The large volume of air which passes into the open

‡ In this article English units and Fahrenheit temperatures are used. (See article Heat, in Cyclopædia.)

chimney-throat must be replaced by out-door air, which flows into the room through the crevices of the doors and windows, and produces uncomfortable and dangerous draughts. Experiments show that only 12 to 14 per cent. of the heat produced by the fuel is rendered available in an open chimney-grate of good form and proportions, being only from one-fourth to one-third of the heat due to radiation alone. The grate is then uneconomical, and, in view of the other defects, cannot be pronounced desirable as the only means of warming a room. Yet certain advantages are recognized universally. The genial effect of the luminous rays striking directly on the person, and the benefit of inhaling cool air while the surrounding objects are warmed sufficiently to prevent undue abstraction of heat by radiation from the body, cannot be overlooked. These render the open fire a delightful source of heat when used in connection with a hot-air furnace, which introduces into the room the supply of air demanded by the chimney warmed to a comfortable temperature, and prevents an inflow at doors and windows by supplying the demand through the registers. The ventilating power of the open chimney, then, becomes an invaluable means of changing the air of an apartment and maintaining a healthful atmosphere.

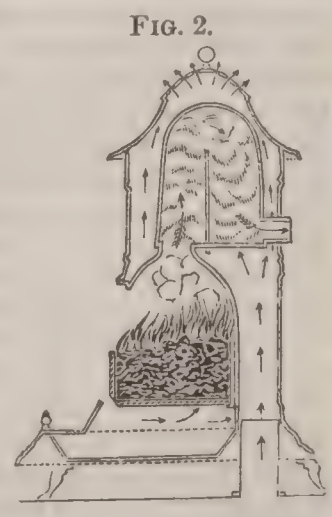
The advantages secured by combining the fireplace and furnace can be obtained also from "ventilating fireplaces" and from "ventilating stoves," of which the original Franklin stove is an ancient type. The essential features of Franklin's invention are not, however, usually carried out in the stoves which bear his name, for the admission of fresh out-door air to the stove is seldom provided for. A good example of the ventilating fireplace was exhibited in the English department of the Centennial Exposition. The principal features of this grate are shown in Fig. 1. It is virtually a double-cased open stove set in the chimney. The gases of combustion pass into the chimney-flue between pipes which connect the upper and lower portions of the double case at the back. Fresh out-door air is admitted inside the double case, and, after being warmed by contact with the extensive surface afforded by the back of the grate and the inside of the pipes, the air enters the room through openings in the front piece, which has the appearance of the usual ornamental mantel setting.

Fig. 1.



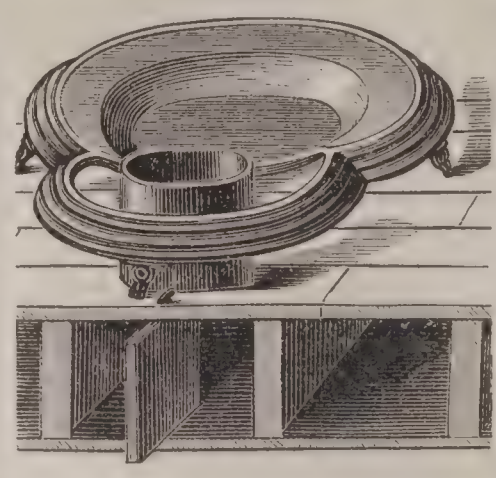

An excellent open-grate ventilating stove, called "the fire on the hearth," was exhibited in the U. S. section of the Exposition. A sectional view is given in Fig. 2. This is a double-cased open stove, intended to stand out in the room. The space between the two cases is open at the bottom, and forms a channel through which the air of the room or fresh air from out doors can circulate and become heated, after which it issues into the room through the perforated top. The course of the hot gases in the stove and of the air between the cases is shown in the figure by arrows. The cast-iron base of the stove, arranged to take fresh out-door air from a cold air-box beneath the floor, is represented in Fig. 3. To secure a uniform temperature at different heights in the room, it is desirable that a portion of the air-supply to the case shall flow from the bottom of the room, and space is left for this purpose around the fresh-air pipe, which, as Fig. 3 shows, does not fill the opening in the base.

Fig. 2.



Close stoves do not assist essentially in promoting ventilation, for the quantity of air withdrawn from the room is only what is needed to support combustion. Morin estimates the ventilation from these to be less than 120 cubic feet of air for every pound of coal consumed. Simple close stoves act imperfectly even in warming a room, for the circulation of air they produce is so sluggish that the temperature of the room varies greatly at different heights. Ruttan, whose observations were made in Canada, states that in a stove-heated basement room over a cold cellar he has frequently seen water freeze on the floor when the temperature of the air at the ceiling was 100°, and has often observed a difference of 4½° in the temperature of the air for every foot of height in a stove-heated school-room 16 feet high which was exposed on two sides to outside air at zero. But if a casing is arranged around a stove, with a space between it and the stove for air to enter from near the floor and issue at the top of the stove, a rapid circulation of the air of the room is produced and the temperature equalized.

Fig. 3.



Hot-air furnaces are simply encased stoves placed outside the apartments to be warmed, usually in basements and cellars. They act indirectly by warming air which passes from them into the rooms, and which ought always to be taken from out doors rather than from the cellar, the latter plan being dangerous to health. Several important points must be considered in proportioning and placing a furnace, in order to secure a healthful condition of the heated air. The most essential, perhaps, is a good chimney-draught, which ought always to exceed the draught-power of hot-air pipes, whose powerful action is shown by the force with which the warm air issues from the registers. It is neglect of this requirement, or the inability to meet it, which occasions the prevalent trouble of a leakage of coal-gas into the house; for if the chimney-draught exceeds that of the air-pipes, there will be a tendency for the surrounding air to flow *into* the furnace through whatever open joints there may be, and it will be impossible for the gases to escape in opposition to this inward pressure. But if the chimney-draught be sluggish or its action unduly checked, the contrary effect necessarily results. It is therefore important that the combustion in the furnace be controlled entirely *by regulating the apertures for the admission of air below the grate*, rather than by a damper or draught-check in the smoke-pipe. This can be done only by ensuring that all joints below the grate shall be practically air-tight.

To obtain economy of fuel the heating-surface must be large in proportion to the grate-surface. Gen. Morin recommends that it be made from 150 to 200 times greater, but this proportion is unnecessarily large for a cold climate, at least if the furnace is so arranged that the fresh air will be brought into close contact with the heating-surface and pass rapidly over it. A rule for proportioning the surface which is more nearly in accordance with good American practice is to provide 10 square feet of heating-surface for every pound of coal consumed per hour when the combustion is active, and to make the grate-area about $\frac{1}{50}$th that of the heating-surface. It may be estimated that one-half of the fuel required to warm a dwelling in the coldest month is burned during the ten coldest days, and two-thirds of this daily consumption occurs during the ten hours of daylight; so that the hourly consumption in a cold day may be $\frac{1}{300}$th of the greatest monthly consumption; and the furnace should be proportioned to this demand. Its useful heating efficiency may be from 60 to 70 per cent. of the heat produced by the fuel.

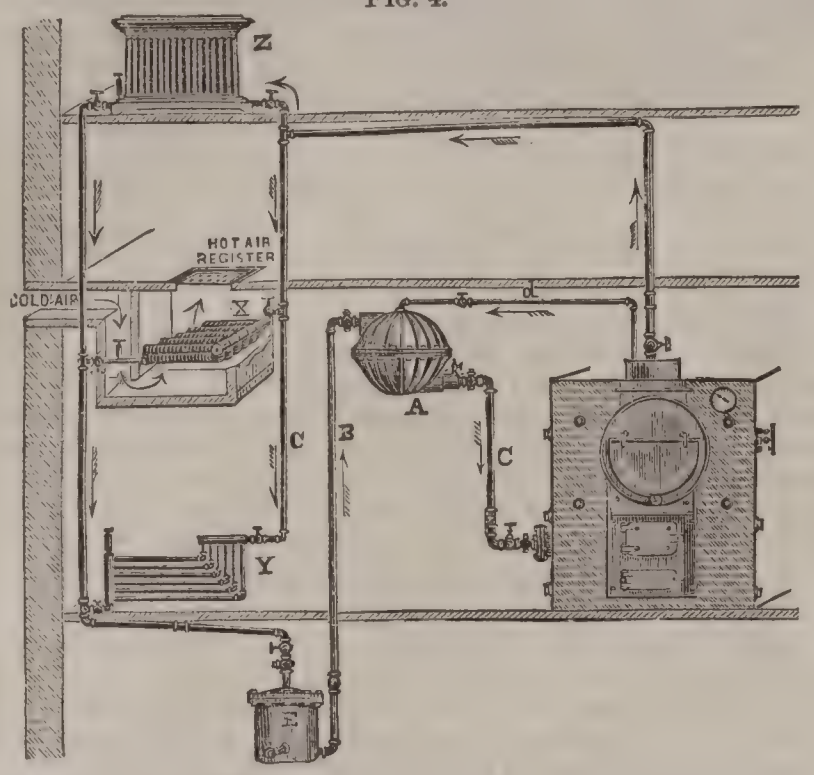
In order that the air which enters the room may not be overheated, it is only necessary to provide sufficiently liberal channels through the furnace for its passage, while suitable ventilation must be secured in the house by which the quantity of air required to absorb the heat without becoming too warm may be drawn through the furnace. The area of the smallest part of the inlet for cold air should be one-sixth of a square foot for every pound of coal burned per hour in cold weather, this being estimated at $\frac{1}{300}$th of the probable monthly consumption, as stated above; and to prevent, in a measure, the possible inconvenience of one pipe drawing air from another, the collective area of the hot-air pipes should not be more than one-sixth greater than the least area of the cold-air inlets. These proportions are established by assuming that the heated fresh air shall enter the rooms at a temperature of about 120° when at zero outside, and its velocity in the hot-air pipes not exceed 5 feet per second.

Cast iron when highly heated is permeable to hydrogen and carbonic oxide gases, and on that account wrought-iron plate has been recommended as a more suitable material for the heating-surfaces of furnaces. The liability to the vitiation of the air in this way is greatly lessened by having the fire-pot lined, and by locating it entirely within the furnace-shell, and separate from it, so that the fresh air

cannot come in contact with the fuel-chamber. The diffusion of gases referred to in this connection cannot be prevented by the draught of the chimney, for it will occur in opposition to a considerable counter-pressure.

Steam (for the properties of which see the article STEAM) is the most convenient medium for conveying heat to a distance from its source, and on this account it is generally used in factories and public buildings. Two systems of steam-heating are employed—one corresponding to heating by stoves, and the other by furnaces. In the first or direct method the heater stands in the room which is to be warmed, while in the indirect method it is placed in the cellar or basement, and warms the out-door air which is led into the room. Several forms of steam-heaters are shown in Fig. 4. An indirect heater with its cold-air box

FIG. 4.




and hot-air register is seen at X. A "running coil" of parallel pipes, indicated by Y, serves as a direct heater. These coils lie along the walls of a building, and the ends of the pipes are turned upward to permit unequal expansion of the horizontal portions to take place without straining the joints. Another form of direct radiator or steam-stove is represented at Z, consisting of a cluster of short vertical pipes closed at the top, but opening at the lower ends into a cast-iron box which forms the steam-chamber and base of the radiator. The boiler for supplying steam and the various pipes are shown, also a particular form of steam-trap which will be described. Direct heaters are quite properly called radiators, as they give out heat by radiation as well as by contact with the air of the room. But indirect heaters part with heat chiefly by communicating it to the air which passes over them.

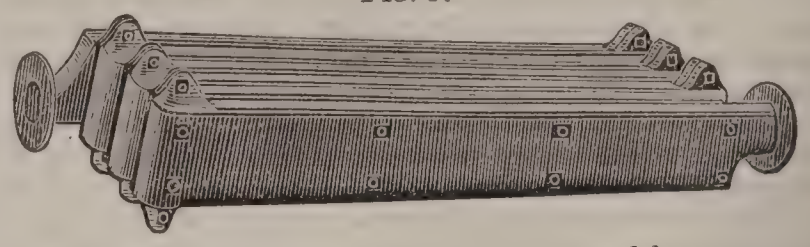
Steam when saturated, which is its ordinary condition, parts with heat only in condensing, and the water which is formed in a steam-heater by the condensation is an exact measure of the quantity of heat given off by the steam to the air and surrounding objects. The quantity of heat given by any form of direct-steam radiator is nearly in proportion to the difference of temperature between the steam within the radiator and the air of the room in which it stands. It varies slightly with the temperature of the walls of the room, and greatly with the form and condition of the radiating surface. The kind or thickness of the metal of the heater has but little effect within practical limits, for the quantity of heat which can be conducted through the thickness of metal usually employed is much greater than can be carried away from the surface by radiation and contact of air. Polishing the surface diminishes its radiating power materially.

A horizontal cast-iron pipe $\frac{3}{4}$ inch thick and 12 inches diameter, and a radiator composed of thin wrought-iron vertical pipes, like the one shown in Fig. 4 at Z, each gave 690 heat-units per hour per square foot of outside surface when supplied with steam at 40 pounds pressure, and standing in a room whose air was maintained at 70°; while a radiator like the last, but with thin, polished brass pipes, yielded only 540 units. It may be assumed that rows of unpolished horizontal iron pipes or short vertical pipes will yield $3\frac{1}{2}$ heat-units per hour per square foot of outside surface for each degree difference of temperature between the steam and the air of the room, when this difference amounts to 300°, and nearly 3 units when the difference is 180°.

Extensions of the surface formed by projecting spurs or "gills" on the outside of a steam-filled pipe or box are only about half as valuable for direct radiating surface as the plain surface of the box between the spurs; but as both sides of the spurs are exposed, while only one side of the plain surface acts as a radiator, twice as much surface is afforded by the spurs for the same weight of metal as is given by the plain surface; and the extended surface is not uneconomical in first cost.

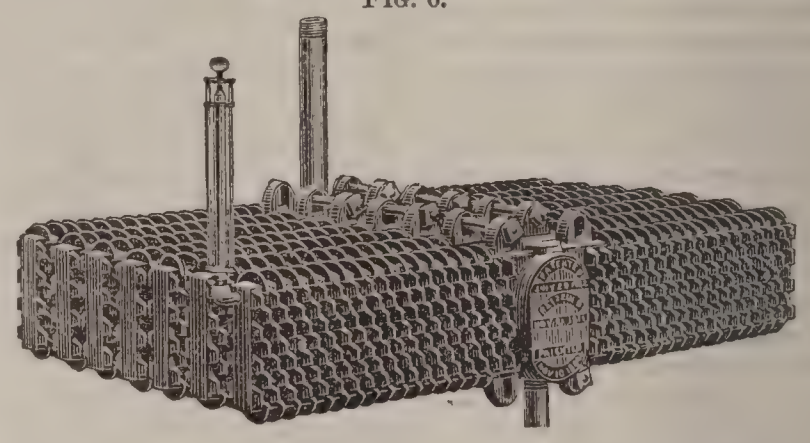
In indirect heaters some kinds of extended surface are peculiarly valuable. Several forms of these heaters are illustrated. Fig. 5 shows a cluster of plain, flat pipes set

FIG. 5.



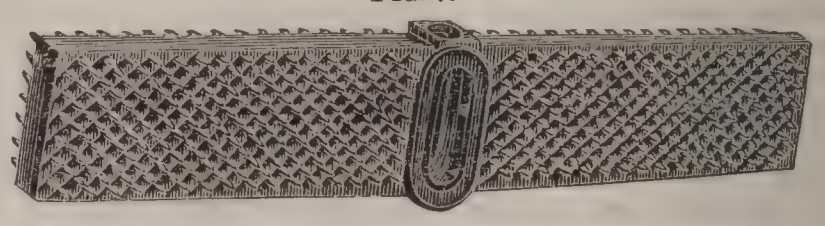
on edge, through which steam circulates, and between and around which the fresh air passes on its way to the room. A similar cluster of steam-boxes, whose outside is provided with extended surface formed by thin projecting gills ar-

FIG. 6.



ranged in rows with the gills over one another, as shown in Fig. 6, while a single element of a cluster is represented in Fig. 7. In this last, however, the extended surface consists of projecting conical spurs which are in quincunx

FIG. 7.



order, by which is meant that the spurs in one row stand over the spaces in the next. This difference of arrangement has an important effect on the heating efficiency of the surface. The heat which an indirect heater yields to the air varies directly with the difference between the temperature of the steam in the heater and that of the cold air when it first strikes the heating-surface; it increases in a peculiar proportion, varying for every different heater, with the velocity with which the air passes over the heater.

In estimating the extent of surface of these heaters, the whole of the exposed surface, even of the projecting spurs or gills, is measured, and their heating effects per square foot of external surface are given below, denoting the indirect heaters shown in Figs. 5, 6, and 7 by the letters A, B, and C, respectively. The heat-units given out per hour for each degree Fahrenheit difference of temperature between the entering air and the steam, with different quantities of air passed over them stated in cubic feet per hour per square foot of surface, are as follows:

| Cubic feet of air per square foot. | Kind of heater. | | | |
|---|---|---|---|---|
| | A. | B. | C. | |
| 100 | 1.3 | 1.3 | 1.5 | Heat-units per hour. |
| 200 | 1.7 | 1.9 | 2.9 | |
| 300 | 2.0 | 2.5 | 3.7 | |
| 400 | 2.2 | 3.0 | 4.7 | |

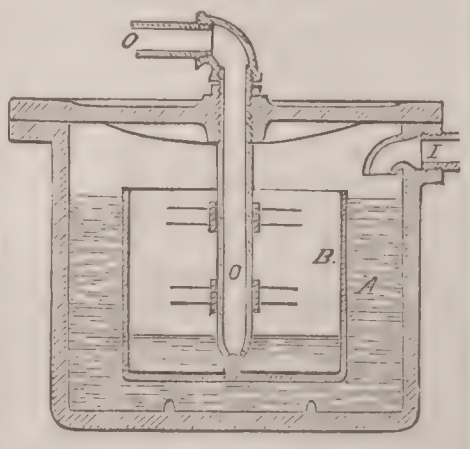
And if the steam be at 40 pounds gauge-pressure, with the entering air at zero Fahrenheit, then the temperature of the air as it issues from the heater will be—

| Cubic feet of air per square foot. | Kind of heater. | | | |
|---|---|---|---|---|
| | A. | B. | C. | |
| 100 | 176° | 179° | 213° | Temperatures Fahrenheit. |
| 200 | 119° | 136° | 186° | |
| 300 | 93° | 115° | 171° | |
| 400 | 77° | 103° | 162° | |

The air may lose its heat rapidly after leaving the heater, and if led through exposed pipes its temperature may become reduced many degrees before entering the room. In order that all the interior surface of the heater may continue to have the hot steam in contact with it, the water

resulting from condensation must be removed as fast as it is formed. When the heaters are placed above the level of the boiler, and the steam-pressure in them is nearly as great as in the boiler, the removal of the water may be accomplished by allowing it to drain into the boiler through a special return-pipe which enters the boiler below the water-line. Should it be impracticable to return the water of condensation directly to the boiler, it must be blown out by the steam-pressure into the open air; but an automatic device is then necessary to prevent waste of heat by the steam following the water when the latter has been discharged. Such contrivances are called *steam-traps*, and are of several kinds. In one the discharge is controlled by a float which rises and falls with the varying accumulation of the water in a steam-tight case which receives the drainings from the pipes. The principle, but not the details, of one of the best of these is illustrated by Fig. 8.

FIG. 8.




Steam and the water which drains from the heaters flow through I into the case A, which contains an uncovered pail B. This, when nearly emptied of water, floats in the water which surrounds it, and closes the lower end of the discharge-pipe O, which reaches downward into the pail. When, however, the water rises in the case by accumulation and overflows the edge of the pail, this, becoming heavier, sinks and uncovers the end of the outlet-pipe O, which permits the contents of the pail to be discharged by the pressure exerted by the steam on the surface of the water. The discharge continues until the pail becomes so much lightened that it again floats and closes the pipe. The end of the outlet-pipe O is always under water, so that no steam can escape. An entirely different kind of steam-trap is shown at A in Fig. 4, by which the water of condensation may be returned directly to the boiler, even when the heaters are below it, and when the steam-pressure in them is less than the boiler-pressure. A is the case of the trap, containing a float which controls the opening and closing of a pipe *d* leading from the steam-space of the boiler to the top of the case. Another pipe B, proceeding from the bottom of a tank E into which the heaters drain, enters the top of the case, while a pipe C leads from its bottom, which is above the boiler-level, to the bottom of the boiler. The operation is as follows: The case A being filled with steam, the float falls and closes *d*. A check-valve in B prevents the escape of steam from the case, but permits the water from the tank E to rise and fill the case after the condensation of the steam in it forms a vacuum there. As soon as the case is filled with water the float rises and opens the pipe *d*, admitting steam at boiler-pressure above the water, which then drains into the boiler through the pipe C, which is furnished with a check-valve for preventing water from the boiler returning to the case. The float then falls, and the operation is repeated.

Automatic air-valves should be provided for releasing air which accumulates in the heaters. Air is heavier than steam of the same temperature and pressure—47 per cent. heavier at 100 pounds, and 61 per cent. at 1 pound gauge-pressure. The air tends then to sink to the lowest points of the heating apparatus, but it will accumulate wherever the circulation is impeded, and will increase the obstruction.

Experience has shown that in warming factories of the usual proportions, 1 square foot of radiating surface heated by steam at 1 pound gauge-pressure will be required for every 150 cubic feet of space in the rooms; and it is therefore safe to estimate that in a cold climate the steam required for 1 horse-power will warm about 12,000 cubic feet of space to 70° by direct radiation, which will allow for a complete change of air every hour by natural ventilation. When low-pressure steam is used for warming dwellings by indirect heaters, it is customary to provide 1 square foot of heating surface for every 40 cubic feet of space in the house.

VENTILATION.—The atmosphere is never found in its natural purity in densely-inhabited places nor in occupied apartments; the act of respiration and emanations from the person, which are constantly taking place, vitiate it in various ways. An adult man gives off in breathing $\frac{6}{10}$ths to $\frac{7}{10}$ths of a cubic foot of carbonic acid in an hour while awake, and from $\frac{5}{10}$ths to $\frac{6}{10}$ths of a cubic foot when asleep. He inhales at least 20 cubic inches of air at each breath, which at 20 respirations per minute gives 14 cubic feet as the quantity passed through the lungs per hour. The air exhaled contains from 4 to 5 per cent. of carbonic acid, or more than 100 times the normal proportion in pure air, and is saturated with moisture, however dry it may have been when taken into the lungs. The vapor given off by the lungs is accompanied by from $\frac{1}{12}$th to $\frac{1}{6}$th of a pound of vapor emanating from the skin each hour, and is diffused through the surrounding air.

The vapor which escapes from even the healthy human system contains volatile substances and effete matter, which it is one of the functions of breathing and perspiration to remove from the body as injurious, and which it is evident should not be again taken into the system. These last impurities when present in comparatively small quantities render air unfit to support life, and when habitually breathed are insidious, and often unsuspected, causes of gradual deterioration of vigor and health. It has been estimated that at least 40 per cent. of all fatal diseases are indirectly due to impure air. Carbonic acid gas itself is not poisonous, but acts rather as an obstructor of respiration by preventing the oxygen of the air from being absorbed by the lungs; and it is not impossible to live for a short time in an atmosphere containing more than 3 per cent. of this gas, produced artificially, without bad consequences. But the presence of a small proportion of carbonic acid in air contaminated by respiration indicates a highly deleterious condition of the air; and although the relation between the quantity of carbonic acid and the poisonous vapors in respired air is by no means a simple and constant one, yet the quantity of carbonic acid serves as an approximate measure of the other impurities which are poisonous; and it is practicable and customary to estimate the quality of air thus vitiated by the excess of carbonic acid in it over the proportion contained in pure air. The carbonic acid of respiration, though heavier than air of the same temperature, does not fall to the floor of a warm room. Its power of diffusion in air is great, and a larger proportion of all the impurities from the breath is found in the higher and warmer parts of a heated, unventilated room than in the lower parts—a condition which is reversed, however, if the room be allowed to cool.

It has been ascertained, from careful observations and experiments on a practical scale, that the air of a room designed to be occupied for a considerable time by any person ought not to be allowed to become vitiated by respiration to an extent which is indicated by the presence of more than $\frac{6}{10000}$ths or $\frac{8}{10000}$ths by bulk of carbonic acid, or an excess of $\frac{2}{10000}$ths or $\frac{4}{10000}$ths over the average proportion in the atmosphere of cities. Yet it is sometimes impossible to realize this condition, for the outside air itself may be below either standard. This, however, rarely happens, and numerous analyses of air from the streets of cities show that the proportion of carbonic acid seldom exceeds $\frac{4}{10000}$ths; but an extreme exceptional case was discovered in Manchester, England, where the air of a street contained $\frac{15}{10000}$ths. The following list is compiled from official reports of careful analyses, and shows how far below the standard of purity the air is permitted to become in rooms habitually occupied for many hours by children and pleasure-seekers. The numbers in the second column give the volume of carbonic acid gas found in air collected from the various sources:

| | Carbonic acid. |
|---|---|
| School-rooms in New York and Boston, mean of 60 | 15 |
| Worst air in one of the schools | 31 |
| A school in Paris | 57 |
| Theatres in New York, mean | 26 |
| " in London | 15 |
| " in Paris | 33 |
| Worst air in New York theatre | 76 |
| To these may be added— | |
| Soldiers' barracks at night | 9.5 |
| Air in a sick-room | 15 |

parts in 10,000.

In practice, it is found that different quantities of air are required for ventilation under different circumstances. Morin recommends the following volumes of air to be supplied to an apartment for each occupant; and these estimates are generally admitted to be correct:

*Volumes of Fresh Air required for Ventilation.*

| | |
|---|---|
| Hospitals for ordinary sickness | 2400 |
| " " wounded | 3600 |
| " " epidemics | 5000 |
| Prisons | 1800 |
| Workshops for ordinary trades | 2100 |
| " " unhealthy " | 3600 |
| Halls for long meetings | 2000 |
| " " short " | 1000 |
| Barracks at night | 1600 |
| Schools for children | 500 |
| " " youths | 1000 |

cubic feet per hour.

These quantities seem large when the volume of air actually breathed is considered, but are insignificant when compared with the quantity which comes in contact with

the body when in the open air; for the motion of the atmosphere in a nearly calm day is rarely less than 2 miles an hour, and with this velocity over the 10 square feet presented by the body the ventilation amounts to the enormous figure of 100,000 cubic feet per hour of perfectly pure air.

To permit the proper distribution of fresh air in an apartment, and to provide for a temporary suspension of ventilation, the capacity of a room should be not less than 600 to 1000 cubic feet for each adult occupant, nor the floor-space less than 60 square feet for each, while for hospitals 100 square feet of floor-space and 1500 or 1800 cubic feet of capacity should be allowed for each bed.

The problem of introducing into a room the large quantities of properly-warmed air required for ventilation without producing draughts upon the occupants, and of distributing it thoroughly through the room, is a difficult one. Fortunately, during cold weather a spontaneous ventilation, amounting to more than is generally suspected, occurs through the apparently solid walls of our dwellings when these are of dry, unpainted brick or stone. Pettenkofer states that the interchange of air which takes place in this way varies with the difference of temperature between the inside and outside air, and that for brick and stone walls it amounts respectively to 0.49 and 0.40 cubic foot per hour per square foot of wall-surface for each degree difference of temperature.

A reliable natural ventilation—by which is meant any spontaneous change of air occurring without artificial assistance—cannot be obtained except when a difference of temperature exists between the in-door and out-door air. Hence, open windows cannot be depended on to effect a proper change of air unless the room be kept either warmer or cooler than the atmosphere outside. The open fireplace and open stove are efficient artificial ventilators in winter if suitable fresh-air inlets be provided, but the chimney-flues must be heated in summer also or they will then cease to act. A gaslight in the flue affords the most convenient source of heat, and it may be so placed as to be accessible through an opening over the mantel, which may be hidden by a movable picture or other ornament. According to Morin, 7 cubic feet of gas burned per hour in a flue 11 inches square and 66 feet high will produce a draught sufficient to withdraw 13,300 cubic feet per hour from the room, but 50 cubic feet of gas per hour in the same flue will remove only 22,500 cubic feet, so much higher temperature is required to produce the greater velocity. The size of the flue ought therefore to be so proportioned as to produce the necessary ventilation with a velocity of flow through it of 4 or 5 feet per second. The draught will be in proportion to the square root of the height of the chimney, other conditions being the same.

The source from which air is drawn for ventilation should be carefully selected, for otherwise injuriously impure air may be obtained. The custom of supplying air to a furnace or any indirect heater from the cellar of the house is dangerous. The ground and cement which form the cellar-floor are surprisingly permeable to the deleterious gases which the earth of cities is liable to contain. The first step in arranging for ventilation is to furnish suitable inlets for fresh air, and equally capacious channels for the outflow of foul air. These being provided, the renewal of the air of a room may be accomplished by either of two methods. In the one known as "exhausting ventilation" foul air is withdrawn and fresh air made to enter by reducing the pressure of the air in the outflow passages, and consequently the pressure in the room, to less than the atmospheric pressure. This is done by leading the outlet-ducts to a heated ventilating shaft or chimney, or by applying an exhausting fan to them. In "plenum ventilation" the fresh air is forced by a fan-blower through the inlets at a greater than atmospheric pressure, and the air of the room is expelled through the outlets in consequence. The first plan does not require the employment of machinery, and is the only one suited to dwellings. The plenum process is frequently applied to public halls and extensive public buildings, such as asylums and hospitals, but its installation is expensive, and the cost of maintaining it so great that the use of a ventilating chimney is preferable wherever it is practicable. In applying the ventilating chimney the outlet-openings and their ducts should be so proportioned that the velocities of the air in them shall increase from the openings in the rooms to the chimney to which the ducts all lead. Several outlets from one or more rooms may open into a receiving-duct, of which there may be several leading from different parts of the house into one or more collecting-ducts which proceed to the ventilating chimney The velocities in these openings and ducts ought to be—

1.5 feet per second at the openings;
4 " " " in the receiving-ducts;
5 " " " " " collecting-ducts;
7 " " " " " chimney.

The velocity at the inlets should not exceed 1.5 feet per second if they are near the occupants of the room, but if they are near the ceiling, and the air enters horizontally, the velocity may be from 3 to 4 feet. These velocities can usually be obtained from a chimney 30 or 40 feet high when the temperature of the air in the chimney is 50° or 60° greater than that of the out-door air.

The question as to the best relative positions of the inlets and outlets for the air of a room has until recently been disputed. "Upward" ventilation involves the introduction of the air below the place of its withdrawal, while in the "downward" system the outlets must be the lower. As the quality of the air in a ventilated room does not vary greatly at different levels, this need not enter into the discussion; but the uniformity of distribution of the ventilation over the whole room is the most important requirement to be considered in determining the relative values of the two plans; and from this point of view it can be seen that when the entering air is warmer than that of the room, it is injudicious to place the outlets near the ceiling, unless the inlets are well distributed over the floor, for the tendency of the heated air is to rise to the ceiling directly, and to seek the outlets without diffusing itself thoroughly through the space to be ventilated, while at the same time a large proportion of its heat is wasted and great inequalities of temperature at different levels result. If, however, the outlets are at the bottom, the heated air rises as before, and finding no escape at the top, spreads over the ceiling, while the cooler portions near the floor are removed through the outlets, and are replaced by strata of air which descend uniformly over the whole area, the place of the descending air being constantly filled by a fresh supply rising from the inlets to the ceiling. A nearly uniform temperature at different heights may be secured by this means. In winter, then, when the entering air is warmed, the ventilation should be downward; and a familiar example of a successful application of this system is an open fireplace used in connection with a hot-air furnace. In summer, however, the conditions are changed, for the entering air is cooler than the room, and when the inlets are not numerous the proper distribution of the air requires that it should be introduced near the floor, over which its heaviness causes it to spread. In this case the outlets should be near the ceiling for the removal of the warmest air, which will be displaced by the inflow of cool air filling the lower parts of the room.

When practicable, the gas-jets for lighting a public hall should be placed outside the hall, and the light be admitted through glass skylights, or else the lights ought to be so placed that the products of combustion can be collected and conveyed away through special ventilating-tubes, without being allowed to mix with the air of the room; for the burning of 1 cubic foot of gas yields 0.9 of a cubic foot of carbonic acid gas, or nearly one-third more than the quantity given off by a man in an hour. Either plan avoids the necessity of providing the excessive ventilation required to dilute the products of combustion when they escape into the room. But the special outlets ought to be as small as possible, so as not to interfere with the general system of ventilation.

The limits of this article will admit of illustrating only two examples of practical ventilation. The first is from plans by Mr. A. C. Martin of Boston for heating and ventilating a small school-house, of which Fig. 9 shows a longitudinal section. The heater is an encased stove, by

FIG. 9.




which the fresh air for ventilation, which enters beneath it from outside, is warmed and discharged into the room above the heads of the pupils. The foul air is drawn out of the room through numerous hooded apertures in the floor, which open into four ducts beneath the floor, only one of which can be seen in the figure. The ducts lead to

a ventilating-chimney B, which is kept warm by the smoke-pipe of the stove passing upward inside the chimney. A small stove may be placed in the chimney for summer ventilation. Cold-air inlets are provided at the ceiling to temper the air of the room when it is too warm, and to furnish additional fresh air. Horizontal deflectors under these openings direct the currents of cold air along the ceiling. The second example is that of a hospital ward, from plans suggested by Dr. Folsom for the Johns Hopkins Hospital. Figs. 10 and 11 show sections through the heat-

FIG. 10.

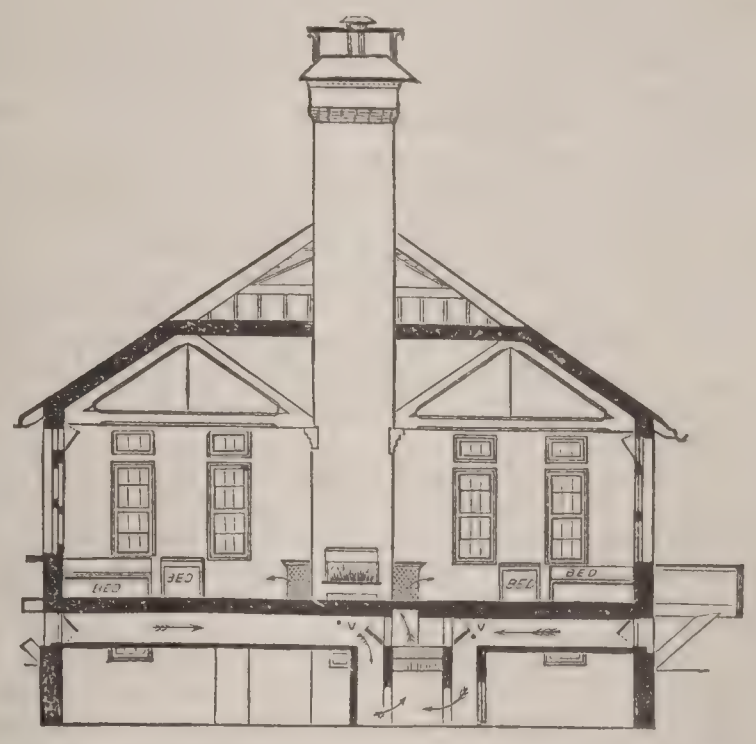
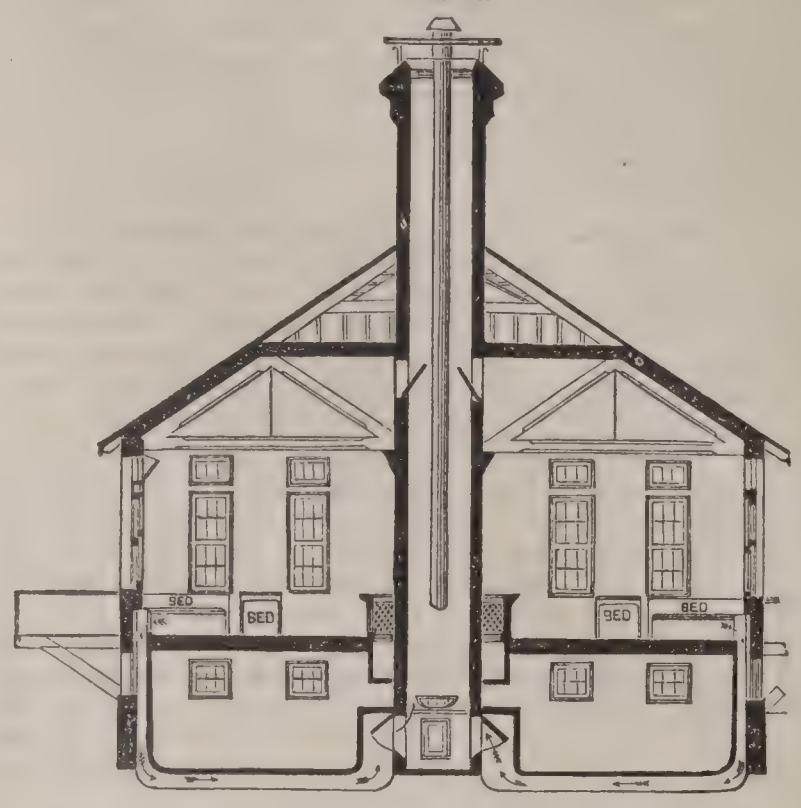


FIG. 11.




ing apparatus and the ventilating-ducts. The ward is heated chiefly by two steam-heaters in the basement, to which the out-door air is supplied through two cold-air boxes which cross the basement from side to side, so that the air may always enter from the windward side; a provision which ensures the possibility of regulating the ventilation in windy weather. A mixing valve at V permits the cold air to pass above the heater when it is necessary to cool the air, which enters the ward through two registers situated one each side of a large ventilating-chimney in the centre of the ward. Two open stoves, built into the ventilating-chimney, serve as auxiliary heaters, and their smoke-pipes, which pass upward inside the ventilating-chimney, heat the chimney and produce ventilation. A small grate in the lower part of the chimney can be used to heat it in summer. The main openings for removing foul air are at the floor level. They are ten in number, and distributed at equal distances around the walls of the room. A down-cast flue from each opening leads to the floor of the basement, beneath which all ten ducts converge to the bottom of the central chimney. Two openings into the chimney are provided near the ceiling for summer ventilation, and there are louvres over the windows, all of which can be opened and closed at will.

A general system for ventilating a dwelling can be arranged with a view to utilizing the waste heat from the kitchen fire to produce a motive force which will be active winter and summer. Ducts should be led from all the rooms to a tight collecting-chamber in the basement or cellar. A pipe must pass from this to the bottom of a large ventilating-flue, through the centre of which the hot smoke-pipe from the kitchen range must rise to the roof. If any such general system is adopted for a dwelling, there will be times when some of the openings to the ventilating-ducts will need to be closed; as, for example, when open fires are burning whose draught tends to produce a reversal of the current of foul air. Indeed, it is probable that no system can be designed for any building which will not require some attention to ensure its regular operation, so many variable conditions occur which tend to counteract the necessarily feeble forces by which the movement of the air is produced.

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C. B. RICHARDS.

**War'ren** (JOSEPH), b. at Waterbury, Vt., July 24, 1829; studied at the Vermont University; became assistant editor of the *Country Gentleman* in 1849, associate editor of the Buffalo *Courier* in 1853, and chief editor of the latter paper in 1858; was chosen president of the New York State Associated Press in 1870. D. at Buffalo Sept. 30, 1876. He was a very active citizen, labored with great energy for the construction of a public park in Buffalo, and for the establishment there of the State insane asylum, the State normal school, etc., and held various offices of honor and trust.

**Was'son** (DAVID ATWOOD), b. May 14, 1823, at Brooksville, Me., of Scotch-Irish ancestry, who came to the country in 1724. In the remote village where he lived school was kept ten weeks in summer and eight in winter. At ten the lad's summer schooling was discontinued; at fifteen he studied Latin with the minister of the place; at sixteen had a term of study at a village academy; at nineteen was a teacher; in 1845 entered Bowdoin College, but stayed only a year; went to sea as a common sailor in hope of restoring tone to an overwrought frame and mind; studied law at Belfast, Me., but practised it for a short time only, being repelled by disagreeable features in it. An acquaintance with Carlyle's *Sartor Resartus* set his spiritual nature aflame. In 1848 he entered the theological seminary at Bangor; finished the course there; was approved by an examining council, and settled in 1851 at Groveland, Mass.; remained in that connection a year; then became preacher of an "Independent" church in the same village; stayed there, with an interval of six months in Worcester, till 1857, when a severe attack of spinal disease put an end to all continuous labor for several years. In the spring of 1865 the society of Theodore Parker, worshipping in the Boston Music Hall, invited him to be their minister, but after some fifteen months of service ill-health compelled him to retire. Since then, save four years of subordinate service in the custom-house in Boston and a residence of two or three years in Germany, he has resided at West Medford, Mass., engaged in literary work. In spite of a hopelessly broken constitution, Mr. Wasson has been a diligent, brilliant, powerful, and original writer. The pages of the *North American Review*, the *Atlantic Monthly*, the *Christian Examiner*, and the *Radical* have been enriched by his contributions in prose and verse. Since his return from Germany he has printed in the *Unitarian Monthly* a paper on "State and Church in Germany," and another in the *Index* on "State and Church in America." For the last eight or nine years Mr. Wasson has given much thought to political theories, and has in preparation two works on government, with especial reference to American problems.

O. B. FROTHINGHAM.

**Wa'ter-Boatmen,** a name given to the hemipterous insects of the family Notonectidæ. These have a boat-like supinate form, the rostrum is free, the antennæ concealed beneath the eyes and four-jointed, and the posterior pair of legs have the coxæ very slightly movable in a longitudinal direction and longitudinally grooved, and the other joints are elongated and provided with a ciliated fringe, which enables them to swim rapidly through the water. Representatives of the family occur very generally in pools, etc. They are good divers, and also fly readily. Their eggs are laid in spring, and are attached mostly to the stems and leaves of aquatic plants. The young are comparatively broad and flattened. THEODORE GILL.

**Wa'ter-Gas.** This is a term applied to the mixture of *hydrogen, carbonic oxide,* and *carbonic acid* gases, which is produced by the contact of water or steam with carbon at the temperature of incandescence, or higher. It has been considered preferable, in practice, to heat the steam itself to as high a temperature as practicable, before contact with the carbon, by passing it through some superheating apparatus. The general result of this is to produce a mixed gas containing more carbonic oxide and less carbonic acid, the last gas being not only a useless but a detrimental constituent, as involving the consumption of lime (or other adequate purifying agent) in its removal from the gaseous mixture. It would appear that no temperature, however high, altogether prevents the formation of carbonic acid; but the process has been conducted with such success as to involve the formation of but little, if any, more carbonic acid than occurs in ordinary illuminating gas from gas-coal. If *no* carbonic acid were formed, the reaction (supposing the carbon pure) should be as follows:

$$H_2O + C = H_2 + CO,$$

and the resulting gas would consist of equal volumes of hydrogen and carbonic oxide. More than one circumstance conduces, however, to prevent the volume of carbonic oxide from being equal to that of the hydrogen. One is the formation of carbonic acid. Another is the presence of more or less iron pyrites in the carbon (which in America is always *anthracite coal*), the iron of which decomposes some steam without forming the equivalent of carbonic oxide. Another is the fact that no natural form of carbon (anthracite included) is free from hydrogen.

It must also be added, that *marsh-gas,* so far as the analytical experience of the present writer extends, is a constant component of water-gas made from anthracite coal. The consequence of all this is that water-gas, after purification to separate its carbonic acid impurities, has been found to contain a proportion of carbonic oxide as small as 36 per cent., with about 56½ per cent. of hydrogen and 3½ of marsh-gas; the remainder, about 4 per cent., being nitrogen, which latter is derived from several sources. These special figures resulted from analyses by the writer, in conjunction with Prof. Silliman, upon water-gas made at New Haven in 1869 by the plan known as the "Gwynne-Harris process."

Most of the experiments that have been made, involving the preparation of water-gas—of which the most prominent in America have been by the different modifications known as the "Gwynne-Harris," the "Tessie-du-Motay," and the "Lowe" systems—have had as their object to produce a cheaper substitute for ordinary coal-gas for *illuminating* purposes; and the product is therefore usually combined with other gases made from gas-coal, petroleum, and the like, so that in the few chemical investigations that have as yet been conducted of the products of these different systems, there has been scarce any opportunity of analyzing or experimenting upon water-gas pure and simple. Its practical qualities and behavior, therefore, under various conditions, and its peculiarities when handled in the way in which other gases are handled, on a large scale, must be admitted to be in some measure matters of inference. That it can be produced in great volume and with great rapidity from comparatively compact apparatus, whose first cost is much less (per capacity of production) than in case of ordinary coal-gas, has become a demonstrated fact; and, as the great advantages of fuel in gaseous forms have long been admitted, the future of the water-gas manufacture seems an assured one whenever its uses for purposes of heating and in metallurgy shall have become matters of experimental demonstration. HENRY WURTZ.

**Wa'ter-Glass** [Ger. *Wasserglas*], also called **Soluble Glass,** a term applied to a class of compounds of silica with alkalies which contain a sufficient proportion of the latter to confer solubility in water. The first formation of a definite compound of this kind was by the chemist Fuchs. This has the chemical composition $K_2O.4SiO_2$, and should contain very nearly 72 per cent. of its weight of silica. It may be obtained in *pure* state by saturating a boiling solution of pure potash with amorphous precipitated silica, evaporating to dryness, and fusing; but cheaper methods must be employed in the preparation on a large scale for commercial uses. One of these is by melting together sand or quartz 15, potash 10, and charcoal 1 part. The charcoal decomposes carbonates and sulphates, thus assisting in the formation of a perfect glass. Indeed, the American chemist Ordway found it preferable to substitute sulphate of potash altogether for the potash, using more charcoal, and obtaining thus more readily a purer product. Water-glass may also be made containing soda instead of potash, even more readily and of greater purity. It is stated to contain less silica than the potash glass. It is also often made by dissolving silica under great pressure in superheated alkaline solutions.

Fuchs's soluble glass is not deliquescent, and is insoluble in cold water, solutions being made with boiling water. Such solutions, when strong and pure, are syrupy in consistence, transparent, and colorless, and of specific gravity 1.25 or higher. The material is insoluble in alcohol, and the latter decomposes it when in aqueous solution, precipitating a silicate which contains, according to Forchhammer, twice the amount of silica corresponding to the above chemical formula.

A solution of water-glass, when applied to surfaces, dries to a glossy varnish, which is not removable by cold water, and has been used to protect wood against fire, though such superficial protection can have but very limited value. Yet, as it is cheap, and may often ward off accident, this device cannot be deemed without importance. For this purpose it must be of good quality and purity, as otherwise efflorescences may occur. The water-glass made from soda is regarded as preferable for fireproofing uses. Water-glass solutions are not often used alone, however, for coating surfaces, some pigment being usually combined therewith. Sulphate of baryta has been found well adapted for this. One of the most important adaptations of soluble-glass solutions is in the making of cement-compositions and artificial stone. When brought into contact with lime, or its carbonate or sulphate, insoluble, hard, glassy silicates of lime are formed; and this fact has been extensively applied, not only in hardening the surfaces of artificial-stone compositions, but in compounding the whole mass thereof. In this kind of work there are many chemical characteristics of water-glass solutions which must be familiarly known to ensure success. Thus, many chemical substances are incompatible with these solutions, even some *neutral alkaline salts* being among them. For these essential details the works upon chemical technology must be consulted. Other applications of water-glass are as a detergent, as a dressing for textile fabrics, for reducing the explosiveness of gun-cotton, as a cement for broken glass and porcelain, and even as a substitute for common glue, for some surgical applications, etc. HENRY WURTZ.

**Wat'kins** (WILLIAM BROWN), A. M., D. D., b. May 2, 1834, in Bridgeport, Belmont co., O.; began the study of law, but abandoned it in 1856 to enter the Pittsburg conference of the Methodist Episcopal Church. His ministry has been about equally spent in the States of Ohio and Pennsylvania, he having been for four years presiding elder of the Steubenville (O.) district, and has been twice appointed to churches in the city of Pittsburg; has lectured very extensively on philological and educational subjects, and prepared a *Graded Spelling-book,* with Dr. Horner a *Cyclopædia of Methodism,* and is engaged in the preparation of a work entitled *An Etymological Dictionary of Ancient and Modern Geographical Names.*

**Wed'ekind, von** (GEORG WILHELM), BARON, b. at Strasbourg July 28, 1796; was educated at the gymnasiums of Mentz and Darmstadt; studied at the University of Göttingen; fought in the French campaigns of 1814–15; received afterward an appointment in Hesse-Darmstadt in the administration of the state forests, of which he finally became director-general; retired from public life in 1852, and d. at Darmstadt Jan. 21, 1856. He wrote *Grundriss zu einem System der Forststatistik* (1818), *Beiträge zur Kenntniss des Forstwesens in Deutschland* (1819–21), *Anleitung zur Forstverwaltung und zum Forstgeschäftsbetriebe* (1831), *Anleitung zum Betriebsregulirung und Holzertragsschätzung der Forsten* (1834), *Umriss der Forstwissenschaft für Staatsbürger und Staatsgelehrte* (1839), *Encyklopädie der Forstwissenschaft* (1847), *Neue Jahrbücher der Forstkunde* (1828–50).

**Wei'gel** (VALENTINE), a remarkable mystic and theosophist, b. at Hayn, near Dresden, Saxony, in 1533; became a Lutheran preacher at Zschoppau; strove in his writings to give a profound basis for Lutheranism by the introduction of ideas borrowed from Paracelsus, Tauler, Nicolaus Cusanus, and others. D. in 1594. His life, writings, and influence have been discussed by Hilliger and J. O. Opel. W. T. HARRIS.

**Weights and Measures,** instrumental means employed for the exact determination of quantity. Such instrumentalities are indispensable in science, in mechanical and ornamental art, and in all the variety of exchanges which constitute commerce. And as the usefulness of a system of weights and measures to those who employ it depends on the unvarying identity of its determinations, it has been a part of the public policy of every organized community, from the earliest period of civilization, to regulate such systems by law, defining the units which shall be used in measuring each species of quantity, with their multiples and sub-multiples, and providing carefully-constructed standards to which the measures in actual use among the people shall be required to conform. The misfortune has been that, in past centuries, this kind of legislation has been left almost wholly in the hands of local magistracies, who have proceeded without any attempt at concert; so that in Europe, previously to 1800, scarcely a town of any commercial importance could be found, from one end of the Continent to the other, which had not its independent system of weights and measures. The embarrassment to commerce growing out of this diversity of systems was enormous. Simply to learn them was a task which few attempted, and fewer accomplished. To transform values from one into another, resort was necessary to tables, or to arithmetical rules mechanically applied, involving a large expense of both time and labor.

It is a rather curious fact that, while the mediæval systems of European weight and measure are so almost endlessly various, the similarity of their nomenclature throughout would seem to indicate a common origin. All the way from Norway, for instance, to Spain, Italy, Greece, and the Mediterranean islands, we find the unit of length called everywhere the foot, and the unit of weight, the pound; and these terms we find, moreover, to have been in use for more than 2000 years, and to have been handed down directly from the republics of Greece and the Roman empire. The word "pound" is simply the Roman *pondus*, a "weight," and the unit it originally represented was doubtless entirely arbitrary; but the word "foot" is significant, and points at once to an original prototype in nature.

The foot, as a measure of length, made its first appearance in Greece. Tradition asserts that the Olympic foot (for there were several Grecian foot-measures) was derived from the foot of Hercules. As Hercules is a mythic character, this is only to say that, at some time, a unit of length of determinate value was adopted for general use, in order to remove the uncertainties which necessarily existed when the human foot was the measure, and every man was at liberty to use his own. This determinate standard may very possibly or probably have been the length of some particular foot—the foot of some chief or hero—but after its adoption it became practically arbitrary, and the unit of length could no longer have been a dimension of the human person, but must have had for its representative an invariable bar of wood or metal.

In this example of the Grecian foot we have an illustration of the manner in which, until the introduction of the modern metric system, all units of measure originated. They were not the creation of legislation. Legislative authorities have only interposed to regulate and secure uniformity and permanence in systems found already in existence. These systems have grown up in the rudest stages of society by a sort of social necessity. Without some standard of measurement, however imperfect, there can be no exchange of commodities founded on the idea of equivalence of value. And even in isolation, the uncultivated savage is forced, by the exigencies of his situation, to adopt some expedient by which to compare magnitudes of length, or bulk, or height, or distance. He will have need of measures in providing for his immediate personal wants—in the construction of his rude dwelling, his garments, his implements of labor, and the weapons with which he pursues his game. These must, of course, bear some convenient proportion to the dimensions of the person whose use they are designed to subserve; and nothing is more natural than that the person itself, or some of its members, should be directly employed as instruments of measurement in their construction. The probability that units of length originated in the manner here suggested is strengthened by the consideration that the idea of an artificial or material scale for the measurement of dimensions is one which involves processes of reflection and abstraction which men in a state of nature have not learned to employ; while the person, with its several members, which is the first thing to be provided for, is always present, so that the same standards of measurement which are employed in satisfying its exigencies are naturally applied to other objects between which in the progress of time similar comparisons become necessary.

In regard to measurements of distance, another idea suggests itself, equally growing out of the circumstances and habits of uncivilized man. Before man had learned to subjugate animals to his service, his only means of locomotion were such as he possessed in common with these; and in estimating the moderate distances from his dwelling to which his daily walks might extend, no expedient would be more likely to suggest itself than to count his steps. Thus arose the fundamental unit of itinerary measure, which is still more or less employed for rude determinations—*i. e.* the pace. The Romans employed this measure, and when the distances to be measured were such as to require a larger unit, they used its third decimal multiple, *mille passuum*, 1000 paces, from which has been derived the "mile" of the present day.

The nomenclature of the metrological systems of all nations furnishes abundant evidence of the original derivation of measures of length everywhere from the dimensions of the human person. The foot is a unit of comparatively modern origin. Long before Greece made any figure in history, the Egyptians, the Assyrians, and the Babylonians, with whom the Israelites were contemporaneous, monopolized whatever of science and cultivation the world then possessed; and among these the cubit, derived from the length of the fore arm of which it is the name, was the unit of linear measure, as it continues to be among their descendants to this day. The cubit is the unit of the Old Testament, of the tabernacle, and the temple, and the ark of the covenant; it was the unit of Cheops when he built the first pyramid; of Ninus when he laid the foundation of the Assyrian capital; and probably of those early postdiluvians who began the erection, on the plains of Shinar, of a tower "whose top should reach unto heaven." With the Israelites, moreover, all the subdivisions of this unit purported to be dimensions of the person. The cubit contained two spans; the span, three palms; the palm, four digits. By a curious accident, one of the identical original rules employed by Egyptian builders has been preserved to our time, and is now in the British Museum. It had been carelessly left in a hollow portion of the masonry of a temple at Karnak, and built up out of sight. Modern inquisitiveness, burrowing among the ruins of 3000 years of decay, at length discovered it in its hiding-place, and brought it out to light perfectly uninjured. It is a two-cubit rule, and it measures exactly the breadth of the descending entrance-passage of the great pyramid of Ghizeh. Considering that the pyramid is some centuries older than the temple in which the rule was found, this accordance furnishes a striking evidence of the care bestowed on the preservation of standards of measurement in that early age.

Other measures derived from the person, of which the origin or date is unknown, are the ell (*ulna*), derived, like the cubit, from the fore arm; the Italian *braccio*, the Portuguese *braça*, the Swiss *brache*, and the South American *braza*, all signifying the length of the arm; the English yard, from the Saxon *gyrdan*, to "gird," as signifying the girdle or measure of the body's circumference; the English fathom, also from Saxon *fadhm*, "embrace," the length of two arms; to which may be added the hand, and perhaps the nail, in England, the *pouce*, or thumb's breadth, in France, and the *pulgada* in Spain, and *pollegada* in Portugal, meaning the same thing.

For standards larger than the person affords, the names of measures early introduced indicate an equal indefiniteness. The Israelites had the reed—probably the average length of a reed of the Nile; the Romans, the *pertica*, a "pole;" the modern Italians, the *canna*, which may mean either "cane" or "reed;" the Germans, the *stab*, a "staff;" the Austrians, the *ruthe;* the Dutch, the *roede*, and the English, the *rod*, all being different forms of the same word; and finally, the French have the *toise*, from the Latin *tesa* (*tendere, tensum*), signifying "stretching," which indicates that the earliest toise was a flexible measure.

It is only for measures of length that the dimensions of the human person can furnish prototypes. For other descriptions of quantity the original units must have been chosen very much at random. Measures of capacity may have been derived from the content of some natural vessel, as, for instance, a gourd or the shell of a cocoanut. The smallest measure of capacity among the Hebrews—viz. the *log*—was estimated by the rabbinists to be equal in volume to six hen's eggs, a quantity ascertained by measuring the water they displaced. There is no evidence, however, that the log was originally so derived; the whole subject of the absolute origin of weights and measures being involved in complete obscurity. The *homer* or *chomer*, a measure of dry capacity among the same people, signified a "heap," and the *omer*, a diminutive of this, and the hundredth part of a *chomer*, signified a heap also. These names indicate that the estimate of quantity must have been made by the eye alone, and must have been vague in the extreme. Some

of the capacity-measures in use among the Greeks and Romans bear names no less significant. The *cyathus* of the Romans or κύαθος of the Greeks is derived from κυάρ, a "hollow," and one of its meanings is "the hollow of the hand." It was equal as a measure to two κόγχαι, "mussel-shells," among the Greeks, or two *cochlearia*, "spoonfuls" (from *cochlea*, a "snail-shell"), among the Romans. The cyathus of the Romans was also defined to be as much as one could swallow at a gulp. But none of our inferences from these early forms of nomenclature can give us more than hints of the manner in which particular measures sprang up or acquired the values belonging to them in later times. The similarity in the scale of progression between the Greek and Hebrew measures of capacity indicates a common origin for both; and Boeckh in his *Metrologische Untersuchungen* finds this common origin in Babylon, whence he supposes all the metrological systems of civilized antiquity, and consequently of modern Europe and America, to have been derived.

The use of weights implies some acquaintance with the balance, and therefore some degree of advancement in the arts of industry. Weights were therefore not introduced till some time after measures of length, capacity, and probably surface, had become familiar. Measures of surface were naturally derived from those of length. These four classes —viz. measures of length, of surface, of volume, and of weight—are all that are commonly understood in speaking of weights and measures. But more or less intimately connected with these is the measure of value (treated under MONEY and COINAGE); besides which there are sundry measures belonging more properly to science, such as TIME (treated under that title and under CALENDAR); temperature (treated under HEAT, THERMOMETER, and PYROMETER), and angular quantity (treated under TRIGONOMETRY).

Though the descriptions of quantity to be measured requiring consideration here are only the four first above enumerated, yet the numbers of systems of measurement which have been simultaneously in use in the same country and among the same peoples have been usually much greater, and in our own country are even so still. Thus, of measures of length there are at present among us one unit for carpentry and mechanics, the foot; another for textile fabrics, the yard; another for field-surveying, the chain; and another for road-measure, the mile. The foot is subdivided to inches and lines, or inches and binary sub-multiples; the yard, to quarters and nails; the chain, to links and decimals; and the mile, to furlongs and rods. The superficial measures, which are the squares of these units, are equally diverse, with the addition of the agrarian dimension of the acre. Of capacity-measures, there are, for liquids, the gallon, quart, pint, and gill; for cereals and other dry substances, the bushel and peck; for firewood, the cord; for coal, the chaldron; and for engineering, the cubic perch. Of weights, there are, for ordinary commerce, the avoirdupois pound, with its sexdecimal subdivisions, and for large masses its irregular multiples of the quarter, hundred, and ton; for bullion, plate, and coin, the pound troy, irregularly subdivided; for drugs and medicines, the apothecaries' pound, equal to the troy pound, but differently subdivided; and for gems, the carat. This multiplication of systems, which is wholly unnecessary, has added much to the difficulty of dealing with problems relating to quantity.

When the necessities of organized society demanded that weights and measures should be regulated by law, the rude natural standards previously in use were of course abandoned. Attempts were also made to connect the measures of capacity with those of length, by prescribing their linear dimensions; and weights were connected with measures of capacity, by taking as a unit the quantity by weight of water, wine, or some cereal grains which would fill a given measure. Or this latter process was reversed, and weights were employed to determine measures of capacity — a method which in modern times is of universal acceptance. Thus, the Jewish *log* measure of water is said to have weighed 108 Egyptian drachmæ, each drachma being the weight which would fill a vessel capable of containing 61 barleycorns.

The weights and measures in use in the U. S. have been derived from Great Britain. Although the Constitution gives to Congress the power to establish a national system, this power has never been exercised by any acts of direct legislation except such as concern the coinage. The secretary of the treasury, as stated in the article GALLON (which see), has assumed authority to provide standards of length, weight, and capacity identical with those of Great Britain, and to enforce their use in the public service; and Congress, by providing that copies of these standards shall be presented to the several State governments, has given them its indirect sanction. The earliest legislation of Great Britain, however, relating to this subject, which is contained in the 25th chapter of the reaffirmation of the Great Charter under Henry III. (9 Hen. III., A. D. 1225), throws no light upon the origin of the British weights and measures, but only declares that they shall be uniform throughout the realm; and a more explicit statute of the following year founds the measures of capacity upon weight. A later statute of 1266 (51 Henry III.) founded measures of weight upon determinate numbers of wheat-corns. Moreover, in this early period, as among the ancients, the units of commercial weight were also units of coin-weight. Thus, the statute referred to provided that "an English penny, called a *sterling*, round and without any clipping, shall weigh thirty-two wheat-corns in the midst of the ear, and twenty pence do make an ounce, and twelve ounces one pound, and eight pounds do make a gallon of *wine*, and eight gallons of wine do make a London bushel, which is the eighth part of a quarter." The pound thus determined, known as the tower pound, or the sterling or easterling pound, continued to regulate the metrological system of England down to 1496, when it was superseded for this purpose by the troy pound (12 Hen. VII.). It was a pound of 15 ounces, each ounce being equal to 360 troy grains, or to three-quarters of a troy ounce; whence the weight of the penny sterling was only 22½ grains troy. The grain-weight troy was not, therefore, the weight of a grain of wheat, as the word would seem to indicate. The grain of *marc*, used in France in the time of Charlemagne and later, was about four-fifths as heavy as the troy grain; and this, though still exceeding the grain of wheat, is nearer to it, and was probably derived from it. The easterling pound was the pound of the Eastern nations of Europe, and, as we may infer from Camden, was introduced into England in the time of Richard Cœur de Lion. This writer remarks: "In the time of Richard the First, monie coined in the east parts of Germanie began to be of especiall request in England for the puritie thereof, and was called Easterling monie, as all the inhabitants of those parts were called Easterlings; and shortly after, some of that countrie, skillfull in mint matters and allaies, were sent for into this realme to bring the coine to perfection; which since that time was called of them sterling for Easterling."

It is matter of controversy at what period the troy and avoirdupois pounds were introduced into England. The earliest statute in which the troy pound is mentioned is one of 1414 (2 Hen. V.), intended to regulate the charges of goldsmiths for gilding silver plate. In 1496, however, it was by statute of 12 Hen. VII. substituted for the sterling pound for the regulation of measures of capacity, the sterling pound continuing to be used at the mint; but by a subsequent statute of 1527 (18 Hen. VIII.), this last was definitely abolished, it having been "determined by the King's Highness and his Councille that the foresaid pounde towre shall be no more used and occupied, but al manner of golde and sylver shall be wayed by the pounde troye, which maketh xii oz troye, which exceedeth the pounde towre in weight iii quarters of the oz." As to the name of the pound troy, which some have derived from Troyes in France, and some from the numeral *trois*, "three," in reference to the three principal denominations of pounds, shillings, and pence, the parliamentary commissioners were of opinion that it refers to the monkish name of *Troy Novant* given to London, and therefore means simply London weight. The same commissioners suppose the name avoirdupois, which is that of the weight by which heavy or bulky goods have been weighed in England time out of mind, to have been derived from *avoirs* (*averia*), "havings," the ancient name for portable property or chattels, and *poids*, "weight." This view is corroborated by the fact that, in the earliest statutes in which the word is used—viz. 9 Edw. III. (1335) and 27 Edw. III. (1353)—it is applied not to a system of weights, but to the goods themselves which are to be weighed. The latter statute, for example, declares that, "Forasmuch as we have heard that some merchants purchase avoirdupois woollens and other merchandise by one weight and sell by another, . . . we therefore will and establish that one weight, one measure, and one yard be throughout the land, . . . and that woollens and all manner of avoirdupois be weighed," etc., etc. Two centuries later (1532, 24 Hen. VIII.), it was decreed that "beef, pork, mutton, and veal shall be sold by weight called haverdupois;" showing that the denomination once applied to the goods had now passed to the system of weights by which they were commonly weighed.

The earliest legislation in regard to measures of length found in the British statute-book is of date 1324 (17 Edw. II.), and provides that the inch shall have the length of three barleycorns, round and dry, laid end to end; that twelve inches shall make a foot, and three feet a yard. This form of words, "round and dry," was intended to indicate that the seeds should be fully developed, perfect, and well-seasoned. Previously to the Conquest, the Brit-

ish yard, according to Prof. Wackerbarth of the University of Upsala, Sweden, had about the length of 39.6 inches, exceeding the more modern mètre by less than a quarter of an inch. It was reduced in length in 1101 by being adjusted to the arm of Henry I.; but the artificial standards, deposited in the exchequer, were very ill-cared for, and became soon untrustworthy; which may have perhaps suggested this reference to a new though exceedingly imperfect natural standard, the barleycorn. It is in regard to measures of capacity that the early British legislation was most various and unstable. This has been sufficiently illustrated in the article GALLON.

During the eighteenth century the attention of some very able men was drawn to this subject, and legislation was proposed, if not perfected, aiming at an exactness before unattempted. Careful comparisons of the British, French, and Roman standards appear in the *Transactions* of the Royal Society for 1736, 1742, and 1743. Graham, the eminent horologist, determined the length of the seconds' pendulum in London to be 39.130 inches, afterward corrected to 39.14 inches; and prepared for the society a standard yard in 1742. A committee of the House of Commons was appointed in 1758, which employed the distinguished artisan, Bird, to construct two copies of Graham's standard, one of which was presented to the House with the expectation that it would be adopted as the legal standard; but this proposition at that time failed, although the same or an equivalent standard was adopted later. Another committee was appointed in 1790, which has left no record. Still another, in 1814, after calling on Dr. Wollaston and Prof. Playfair for their opinions, presented a valuable report, which led to no legislation. Finally, in 1818, a royal commission was appointed by a writ of the privy seal, with Sir Joseph Banks, president of the Royal Society, as chairman, and embracing, among others, Dr. Wollaston, Dr. Young, and Capt. Kater as members; which, after making a thorough investigation and presenting three successive elaborate reports, recommended the adoption of certain specific provisions of law for the construction, verification, and preservation of the public standards of weight and measure; and, in regard to measures of capacity, the abolition altogether of the existing system or systems and the adoption of an entirely new one. The recommendations of the commission were embodied in a bill introduced into the House of Commons in 1822, and again with some modification in 1823, and finally passed June 17, 1824, to go into operation May 1, 1825, a date afterward postponed to Jan. 1, 1826. This bill enacted that "the straight line or distance between the centres of the two points in the gold studs in the straight brass rod now in the custody of the clerk of the House of Commons, whereon the words and figures 'Standard Yard, 1760,' are engraved, shall be, and the same is hereby declared to be, the original and genuine standard of that measure of length or linear extension called a yard;" and that the same distance, "the brass being at the temperature of sixty-two degrees by Fahrenheit's thermometer, shall be, and is hereby denominated, the 'Imperial Standard Yard,' and shall be, and is hereby declared to be, the unit, or only measure of extension wherefrom or whereby all other measures of extension whatsoever, whether the same be linear, superficial, or solid, shall be derived, computed, and ascertained." The bill then proceeded to provide that, in case such standard should be "lost, destroyed, defaced or otherwise injured," it should be restored by reference to the length of "the pendulum vibrating seconds of mean time in the latitude of London in a vacuum at the level of the sea;" which length was declared to be 39.1393 inches. In regard to weights, it declared a brass one-pound weight made in the year 1758, then in the custody of the clerk of the House of Commons, to be authentic, and to be "the original and genuine standard measure of weight;" and proceeded to say that "such brass weight shall be, and is hereby denominated, the 'Imperial Standard Troy Pound,' and shall be, and is hereby declared to be, the unit, or only standard measure of weight from which all other weights shall be derived, computed, and ascertained." It further declared that the said standard pound shall contain 12 ounces of 20 pennyweights, each pennyweight containing 24 grains, "so that 5760 such grains shall be a troy pound; and that 7000 such grains shall be, and are hereby declared to be, a pound avoirdupois." For the case in which such pound should be "lost, destroyed, defaced or otherwise injured" provision was made for its restoration by reference to the weight of a cubic inch of water, which, as weighed in a vacuum, "by brass weights also in a vacuum, at the temperature of 62° of Fahrenheit's thermometer," was declared to be "equal to 252.724 grains, of which, as aforesaid, the imperial standard troy pound contains 5760." As to measures of capacity, it was enacted that the standard measure, whether for liquids or for dry goods, should be the gallon, containing, at the temperature of 62° F., with the barometer at 30 inches, 10 pounds avoirdupois weight of distilled water weighed in the air; and the construction of such a measure of brass was ordered, which was to be called the "Imperial Standard Gallon.". It is further declared that the standard gallon ascertained by this act is equal in bulk to 277.274 cubic inches at the temperature of 62° F. Before the final passage of this bill, in 1824, the weight of the cubic inch of water weighed by brass weights *in air* (declared to be 252.458 grs. at 62° F. and 30 inches barometric pressure), was substituted for the weight *in vacuo* above given.

In 1834 the houses of Parliament were destroyed by fire, and with them the "original and genuine" standards. Practical difficulties were found in the way of replacing the yard by the means prescribed in the act, and it was restored from accurate copies previously taken, especially one in the possession of the Royal Astronomical Society. The pound was reproduced from the copy in the mint. The new standards were legalized by act of Parliament of 1855 (17 Vict.).

The only more recent legislation in Great Britain practically affecting commercial transactions in which weights and measures are used, is the law of 1835 (5 & 6 Will. IV.), which abolished heaped measure, previously allowed in the case of dry commodities which do not admit of being stricken. But in 1867 a new royal commission was appointed, with Mr. Airey, astronomer-royal, as chairman, to inquire into the condition of the exchequer standards of weights and measures; which commission was reconstructed and continued in the following year, and in five successive reports presented a series of practical recommendations of great interest. The most important of these were a proposition to abolish the pound troy, and another to introduce the metric system into the postal and customs service. Neither of these propositions has as yet prevailed.

No government has probably used more strenuous endeavors during the last half century than that of England, by a wide distribution of local standards throughout its territory, and by an untiring vigilance of inspection, to enforce an absolute uniformity of the weights and measures in use among its people. The importance of such uniformity we have seen to have been set forth in Magna Charta itself between 600 and 700 years ago, and it has been aimed at ever since, especially since the introduction of the imperial standards in 1826; but such is the inveteracy of habit that, so late as 1871, in a debate in the British Parliament on the expediency of adopting the metric system for England, it was stated by a member (Mr. Clare Read) that in Oxfordshire, Norfolk, and Pembrokeshire different articles of merchandise continue to be sold by different kinds of weight, and that in Shropshire there were actually different weights employed for the same merchandise on different market-days.

Early in the colonial history of the U. S. the British exchequer standards of weights and measures had been legalized by many of the colonial legislatures. They were not always specified by name in the earlier acts, but were always implied, and in subsequent legislation were sometimes incidentally named. Thus, in Virginia, an order of the general assembly of Mar. 5, 1623 (N. S. 1624), directed that no weights or measures should be used, but such as should be sealed by officers appointed for the purpose. But by an act of Feb. 23, 1631–32, it was ordained "that a barrel of corn should be accounted five bushels of Winchester measure," which was then the British bushel; and another act, of Oct. 5, 1646, provided that "no merchant or trader, whether English or Dutch, shall trade with other weights and measures than according to the statute of Parliament in such cases provided." In Massachusetts also, an act of 1647 directed the treasurer of the commonwealth to "provide weights and measures of all sorts for continual standards." Other statutes provided that casks should be "of London assize." In 1730, a set of brass and copper avoirdupois weights and measures was imported from the British exchequer, and in 1765, the treasurer was required to procure a balance and a nest of troy weights. After the Revolution, by act of Feb. 26, 1800, the principal provisions of the colonial statutes in regard to weights and measures were confirmed. New Hampshire and Vermont appear to have followed Massachusetts in their colonial legislation as to measures of capacity, but in neither of them was there any distinct recognition of troy weight. Rhode Island passed no statute on the subject at all. In Connecticut, after the Revolution, it was enacted (Oct., 1800) "that the brass measures, the property of this State, kept at the treasury—that is to say, a half-bushel measure containing one thousand and ninety-nine cubic inches, very near, a peck measure, and a half-peck measure, when reduced to a just proportion—be the standard of the corn-measures of this State which are called by those names respectively; that the brass

measures ordered to be provided by this assembly—one of the capacity of two hundred and twenty-four cubic inches, and the other of the capacity of two hundred and eighty-two cubic inches—shall be, when procured, the first of them the standard of a wine-gallon, and the other the standard of the ale or beer gallon in this State; that the iron or brass rod or plate ordered by this assembly to be provided—of one yard in length, to be divided into three equal parts for feet, in length, and one of those parts to be subdivided into twelve equal parts for inches—shall be the standard of those measures respectively; and that the brass weights, the property of the State, kept at the treasury—of one, two, four, seven, fourteen, twenty-eight, and fifty-six pounds—shall be the standard of avoirdupois weight in this State." By the colonial laws of the same State, it appears that there were public standards provided as early as 1670, and in 1752, the gallon of 231 cubic inches had been established. As this was the gallon of Queen Anne (1706), which continued from her time down to 1826 to be the standard wine-gallon of England, and as the gallon of 224 cubic inches is the old gallon of Henry VII. (1496), it is difficult to account for the enactment just cited. The half-bushel of 1099 cubic inches was never at any time a British measure. Connecticut never by express law sanctioned the use of troy weights, but, in her tax-laws, silver plate is rated at one dollar and eleven cents per ounce, by which a troy ounce must have been intended. The earliest legislation sanctioned the London assize of casks. New York, which was early occupied by the Dutch, fell into the hands of the British near the close of the seventeenth century, and on June 19, 1703, an act of the provincial legislature established all the British weights and measures for the province "according to the standards in the exchequer." In 1829, however, in a revision of the statutes, a provision was embodied adopting the then recently-introduced British imperial bushel, and a gallon measure capable of containing 8 pounds of distilled water at maximum density. In the same code it was also provided that the standard yard should bear to the pendulum beating seconds at Columbia College, New York City, *in vacuo*, at the level of the sea, the proportion of 1,000,000 to 1,086,141. In the revised statutes of 1851, however, these provisions were abolished, and the standards furnished by the bureau of weights and measures of the treasury department at Washington were made the standards for the State. New Jersey, in Aug., 1725, adopted the exchequer standards of England. The same was done in Pennsylvania in 1700, in Delaware in 1705, and in Maryland in 1671. North Carolina, by a law of which the date is not definitely ascertained, but which was passed under Gabriel Johnson, the second of the royal governors, whose term of office extended from 1734 to 1753, prohibited the use of any weights and measures but such as should be constructed "according to the standard in the English exchequer." South Carolina, in 1768, passed an act requiring the public treasurer to procure avoirdupois weights of brass or other metal, and also a bushel and other measures of capacity, "according to the standard of London." In Georgia no colonial legislation appears to have taken place upon this subject. After the Revolution, by act of Dec. 10, 1803, the standard of weights and measures established by the city corporations of Savannah and Augusta is declared to be the standard of the State till such time as the Congress of the U. S. shall have made a different provision. Of the States admitted to the Union since the adoption of the Constitution of 1787, some have passed laws similar to those above described, and some have not legislated at all. The case of Louisiana was peculiar. Before the acquisition of that territory by the U. S. the weights and measures used in the province were those of the old standard of Paris. An act of the legislature of Dec. 21, 1814, required the governor to procure, at the expense of the State, weights and measures corresponding with those used by the revenue officers of the U. S., to be deposited with the secretary of state, and to serve as the general standard for the State.

The origin of the standards now in actual use in the U. S. has been sufficiently explained in the article GALLON, to which the reader is referred. There is no act of Congress on the statute-book directly establishing any standard, whether of length or weight or capacity (except for coinage purposes the troy pound). But Congress has provided by law that copies of the standards constructed by executive authority in the treasury department, which are identical with the British as to length and weight, and which represent as to capacity the wine-gallon of Queen Anne (of 231 cu. in.) and the Winchester bushel (of 2150.42 cu. in.), shall be presented to the governments of all the States. A similar distribution has also been ordered of metric standards.

If we are to suppose that our present system of weights and measures will be permanently maintained, and that England will maintain hers also, it must be always a subject of regret that the capacity measures of the U. S. were regulated upon patterns which Great Britain had, only a few years previously, definitely discarded. Early after the adoption of the Federal Constitution, the desirability of a uniform system of weights, measures, and moneys for all the States seems to have presented itself to the minds of many leading American statesmen. So far as money is concerned, the object was very early accomplished, by the adoption, in 1792, of the dollar for a monetary unit, with decimal multiples and subdivisions. This was as direct an interference with popular usages, habits of thought, and methods of transacting business, as could have been the substitution of weights and measures entirely new for those in common use. But it was an interference less likely to provoke complaint, because of the great variety of provincial currencies which then prevailed in different parts of the country. Nevertheless, the spectacle of a great metrological reform then going on in France, and promising to become continental, could not fail to attract attention on this side of the Atlantic also; and there were not a few who believed that it would be an act of the highest political wisdom to introduce here, while our system of metrology, though approximately uniform, was still quite unsettled, the simple and beautiful decimal system founded on the mètre. This feeling found expression in a resolution of the House of Representatives adopted Dec. 14, 1819, calling on the secretary of state—at that time Mr. John Quincy Adams—to report to the House "a statement relative to the regulations and standards for weights and measures in the several States, and *relative to proceedings in foreign countries for establishing uniformity of weights and measures*, together with such a plan for fixing the standard of weights and measures for the U. S. as he might deem most proper for their adoption." An opportunity was here presented, such as rarely occurs to a statesman, of rendering his country a service destined to be memorable for all time; and Mr. Adams missed the opportunity. His report, made in 1821—the importance of which he clearly showed that he by no means underrated, by presenting it, with obvious design, on the birthday of Washington—though very voluminous and very learned, was altogether discouraging to the friends of metrological reform. It was, moreover, so far from being a model of logical method as utterly to bewilder the most attentive reader, and to make it difficult clearly to state its points so that they might be met with argument. But no further argument was attempted. The fog of the report enveloped the whole subject, and it was lost to sight for nearly half a century. Mr. Adams went very largely into the history of British legislation on weights and measures, showing by abundant examples how contradictory and inconsistent it had been; but he dwelt with almost fond admiration upon that feature of the system which provides two different measures of capacity and two different pounds, discovering between these the same ratio as exists between the specific gravities of corn and wine, which gives them what he calls the beautiful property of a "uniformity of proportion." He is, however, by no means insensible to the merits of the metric system, of which he gives a clear exposition and speaks in terms of eulogy sufficiently warm to satisfy its most ardent advocates. More than that, he even predicts the time when that system shall be universally adopted; but when it comes to the question, What shall we do here to further this ultimately inevitable result? what is the "plan" which, in reply to the demand of Congress, the secretary has to suggest? he has nothing better to offer than that the President of the U. S. should invite an exchange of diplomatic communications with France, Spain, and Great Britain "upon the subject of weights and measures with reference to the principle of uniformity as applicable to them;" and that, "in the mean time, should Congress deem it expedient to take immediate steps for accomplishing a more perfect uniformity of weights and measures within the U. S., they should assume as their principle that *no innovation upon the existing weights and measures should be attempted.*" The reasons for this lame and impotent conclusion, so far as they can be extricated from the mist of words, seem to be, that it is difficult to induce people to accept new things, even though they be better than the things they have, and still more difficult to force upon them the use of new words; that the decimal system is very nice for computations, but possibly not always the most convenient for the subdivision of commodities; and, finally, that we ought not to move in this matter without England. Five years after this report was rendered, however, England chose to move without us; her whole system of measures of capacity, from which ours were derived, having been, as above narrated, abolished at a stroke, and replaced by the imperial measures, which she still maintains. Yet only six years later, these same measures, discredited and abandoned in the land of their birth, by the action of one of the executive departments at Wash-

ington, and without any legislation by Congress at all, were fastened upon us; and the uniformity between ourselves and the mother-country, which Mr. Adams was so unwilling to disturb, was, in this part of our system, lost for ever.

Nothing has been said, except incidentally, in this article in regard to the history of the metric system of weights and measures, now so widely prevalent throughout the world, nor in regard to the details of the system itself, those matters having been already given under the proper title. The use of this system has been made legal, though not compulsory, in the U. S., and active efforts are now in progress, with a fair promise of early success, for its practical introduction into the every-day affairs of business in this country.

One remark may be added, before concluding, as to the mode of adjusting or verifying standard weights and measures. The adjustment of weights requires no explanation, except to remark that neither the weights under trial nor the prototype standards must be touched by the hand, as any moisture or oxidation would vitiate the result. They must be moved by instruments constructed for the purpose, which, to prevent abrasion, are armed with buckskin. The verification of measures of length is made by means of what is called a comparator, a piece of mechanism upon which the bar to be verified may be placed and determined in length by closely-divided scales and verniers with microscopic observation, or by micrometers with finely-divided screws, and large screw-heads divided on their circumferences to one or more hundred parts. If the bar is an end-measure, or one in which the distance between the terminal surfaces gives the dimension required, the comparator is furnished with levers called *palpi*, touching the extremities of the bar by one end, while the other and longer arm traverses a divided arc. If it is a line measure, or one in which the required dimension is the distance between two lines delicately traced on one side, micrometer microscopes are used to observe these lines, and the bar is not touched. Measurements may thus be made to fractions almost incredibly minute — less than a quarter of a *mikron* (the $\frac{1}{1000}$th part of a millimètre), say the $\frac{1}{100000}$th of an inch. To secure uniformity of temperature, the whole apparatus is immersed in a bath of pulverized ice. An exactness so rigorous as this may seem to be unnecessary, and even, to some, absurd. But its importance will be recognized when it is considered that quite as much of the diversity of length-measures, by which business affairs in past times have been confused, has been owing to careless methods of verifying standards, as to actual original differences between the measures themselves.

Measures of capacity are verified by ascertaining the weight of pure water they will contain at the temperature of maximum density (3.945° C. or 39.101° F.). During the process of weighing, the measure is closed by means of a plate of glass ground truly plane, the upper edge or rim of the measure being similarly ground. It would not, of course, be possible, by any exercise of dexterity, to fill an open vessel exactly full of liquid, and no more; nor, supposing that condition reached, could it be verified by simple observation. Should any air-bubbles be enclosed within the covering, they are brought by management to the centre of the plate, where there is a small perforation through which the deficiency of fluid may be supplied. The filling having been perfectly accomplished, the exterior of the vessel and the cover are then carefully dried before weighing. Though the requisition is that the standard shall contain a certain amount of water at maximum density, and under a barometric pressure of thirty inches, yet the actual weighings are made at the ordinary temperature and in any state of the barometer; the test-weight which the vessel is to contain being that which the expansion of the material from the standard temperature to the temperature of observation would adapt it to hold, of the liquid which also expands simultaneously. If it were true that the capacity of the vessel and the bulk of the contained liquid expanded equally throughout the range to which observation extends, then it would happen that the vessel would hold the same weight of liquid at all temperatures. But this is not the case. Near the standard temperature the capacity is enlarged, by elevation of temperature, more rapidly than the bulk of the liquid; and therefore, for a range of about 12° or 13° above the temperature of maximum density, the vessel is capable of holding a somewhat larger weight than at that temperature. But above 46° F., the volume of the liquid expands faster than the capacity of the vessel; so that at about 52° F. the weight of water which the vessel will contain is once more equal to what it was at the standard temperature. This makes the temperature of 52° F. a particularly favorable one for the practical operations of adjustment, and one which it is more easy to command than that of 39° F. If, however, the weighing is at a temperature above or below 52°, the standard weight must be diminished or increased by a small amount, to be ascertained from a previously-prepared table. The barometric correction in this operation is nearly insensible.

The standards now used as prototypes in the bureau of weights and measures of the U. S. are, for length, a copy of the British imperial yard, obtained in 1856; and for weight, a copy of the British imperial troy pound, obtained in 1827, and made by act of Congress of the following year the standard for the coinage. It is deposited at the principal mint in Philadelphia.

(For information in regard to particular weights and measures see their several titles.)

The following is a succinct statement of the more important weights and measures in use in the world at present.

### I. Length.

Abyssinia.—The measures are derived from Asiatic Turkey. For dry goods the pik of Smyrna is in use = 27 inches = 685.8 mm. The unit of itinerary measure is the agasche or farsang = 3.1075 miles = 5.001 kilomètres; 1 farsang = 3 berri; 1 berri = 1.0558 miles = 1.667 km.

Algeria.—The metric system is established by law. The former unit of length was the (so-called) Turkish pik = 25.197 inches = 640 mm., which is not, however, that of Constantinople, nor equivalent to any of the various piks in use in the Levant. The so-called Moorish or Arabian pik = $\frac{3}{4}$ths of the foregoing = 18.898 inches = 480 mm., was also used; but this is not the pik used in Morocco or in Arabia. Sub-multiple, the robi = $\frac{1}{8}$ pik.

Annam, or Cochin-China.—For merchants' measure the thuoc = 25.58 inches = 649.7 mm., is the unit base. Multiples, 10 thuoc = 1 truong; 3 truong = 1 that; 10 that = 1 gon = 213.17 yards = 194.92 mètres. Sub-multiples, $\frac{1}{10}$ thuoc = 1 tac; $\frac{1}{10}$ tac = 1 phan; $\frac{1}{10}$ phan = 1 li = 0.0258 inch. For builders' measure, the thuoc = 19.18 in. = 487.16 mm. Multiples, 5 thuoc = 1 ngu; 3 ngu = 1 sao; 10 sao = 1 mau = 79.92 yards = 72.8775 mètres. Sub-multiples, as before, the li being $\frac{1}{1000}$th thuoc, or 0.01918 inch = 0.487 mm. For road-measure, the dam = about 0.55 mile = 0.885 km., is the unit; sub-multiple, $\frac{1}{2}$ dam = 1 li = 0.275 mile = 0.4476 km.

Arabia.—There are several measures which are not multiples of each other. The guz = 25 in. = 634.98 mm.; the cobido = 19 in. = 482.6 mm.; the kassaba = 4.1 yards = 3.75 mètres.

Argentine Confederation.—The metric system is established by law. The old measures were those of Spain, and still continue to be used.

Australia.—The same as Great Britain.

Austria.—The metric system has been in force since Jan. 1, 1876. Of former measures, the fuss is the unit = 12.44556 in. = 316.11 mm. Multiples, 6 ft. = 1 klafter; 2 klafter = 1 ruthe = 12.44556 ft. = 3.79332 mètres. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie; $\frac{1}{12}$ linie = 1 punkte. Unit for textiles, the elle = 30.676 in. = 779.2 mm. Surveyor's unit, the ruthe; sub-multiples, $\frac{1}{10}$ ruthe = 1 decimal fuss; $\frac{1}{10}$ dec. fuss = 1 dec. zoll; $\frac{1}{10}$ dec. zoll = 1 dec. linie. Road-measure, the mile = 4000 klafter = 24,000 fuss = 24,891.12 feet = 4.714227 miles = 7.5866 kilomètres.

Belgium.—The metric system was established by law in 1817.

Birmah.—The taim or cubit of Rangoon = 18 inches = 457.2 mm. Sub-multiple, $\frac{1}{18}$ taim = 1 paulgat = 1 English inch. Also, 22 paulgats = 1 saundaung, or royal cubit. For road-measure, 7 saundaungs = 1 dha or bambou; 1000 bambous = 1 dain or taing = 2.4306 miles = 3.9115 km.

Bolivia.—The legal system is the metric, but the old measures, which are Spanish, continue to be used.

Brazil.—The metric system was adopted in 1867 to take full effect in 1873. The old measures were Portuguese.

Central America.—The several states classed under this general name derive their weights and measures from Spain.

Chili.—The system, formerly Spanish, has since 1848 been metric.

China.—The chik of Peking = 13.125 inches = 333.369 mm., is the unit. Multiples, 10 chik = 1 cheung; 10 cheung = 1 yan = 109.375 feet = 33.3369 mètres. Sub-multiples, $\frac{1}{10}$ chik = 1 tsun; $\frac{1}{10}$ tsun = 1 fan. Surveyor's chik = 12.7 in. = 322.57 mm. Chik of Canton = 14.76 in. = 374.9 mm. Road-measure, the li = 1825.5 feet = 556.41 mètres.

Colombia.—The Spanish system was abandoned in 1863 for the metric.

Denmark.—The fod, the same as the Rheinfuss or foot of the Rhine = 12.357 in. = 313.85 mm. Multiples, 2 fod = 1 aln; 3 aln = 1 favn; 5 favn = 1 rode = 30.895 feet. Sub-multiples, $\frac{1}{12}$ fod = 1 tomme; $\frac{1}{12}$ tomme = 1 linie. The road-measure unit is the miil = 12,000 aln = 4.6812 miles = 7.5335 km.

ECUADOR.—The Spanish system was abandoned in 1856 for the metric.

EGYPT.—The metric system was established in 1871. Of the old measures, the derah or pik is the unit. There are several kinds of pik, and the authorities differ materially as to their value. Dourstber gives, as ascertained through the Belgian consulate in 1838, the piks of Alexandria as follows: the pik hendâsi, for Indian muslins and cotton stuffs generally = 24.823 in. = 630.5 mm.; the pik beledi, for linens = 22.048 in. = 560.0 mm.; the Constantinople pik, for cloths = 26.378 in. = 670.0 mm. He adds that the French ell of 44 French inches is used and valued at $1\frac{3}{4}$ pik, which gives for the pik 26.796 in. = 680.6 mm. Dourstber also gives the piks of Cairo as follows: the pik hendasi = 25.134 in. = 638.4 mm.; the pik beledi = 22.381 in. = 568.47 mm.; the Constantinople pik = 27.221 in. = 691.4 mm.; the pik mehandese, or itinerary and engineers' pik = 30.374 in. = 771.5 mm. Multiple of the pik, 4 piks = 1 gasab; sub-multiples, $\frac{1}{2}$ pik = 1 kadam; $\frac{1}{3}$ kadam = 1 abdat; $\frac{1}{4}$ abdat = 1 kerat. Multiples for road-measure, $2\frac{1}{2}$ piks = 1 bââh; 2 bââh = 1 cassaba; 500 cassaba = 1 mili = 1.148 miles = 1.847 km.

FRANCE AND ITS DEPENDENCIES.—The system is the METRIC, for which see that title. The old Paris foot, called *pied du roi*, and its sub-multiples, $\frac{1}{12}$ pied = 1 pouce; $\frac{1}{12}$ pouce = 1 ligne; $\frac{1}{12}$ ligne = 1 point, are, however, often encountered. The pied du roi = 12.789 inches = 324.839385 mm. The toise = 6 pieds du roi, is interesting as being the unit employed in the survey of the great French meridian arc on which the mètre was founded.

GERMAN EMPIRE.—The metric system has been compulsory since Jan. 1, 1873. Previously to the consolidation, many of the component states had partially or wholly adopted it. Their former measures were very various. A few only are here given:

*Baden.*—The fuss = 11.457 in. = 291.0 mm., is the unit. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie; $\frac{1}{10}$ linie = 1 point.

*Bavaria.*—The fuss = 11.491 inches = 291.86 mm., is the unit. Multiples, 6 fuss = 1 klafter; 10 klafter = 1 ruthe. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie. Cloth-measure, the elle = 32.796 in. = 833.0 mm. Road-measure, the meile = $\frac{1}{15}$ equatorial degree = 4.6143 miles.

*Bremen.*—The fuss is the unit = 11.386 in. = 289.2 mm. Multiples, 2 fuss = 1 elle; 3 ellen = 1 klafter; 8 klafter = 1 ruthe. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{10}$ zoll = 1 linie. Road-measure, 20,000 Rheinfuss (the Rheinfuss = 12.357 in. = 313.85 mm.) = 1 meile = 3.9 miles = 6.277 km.

*Brunswick.*—The schuh is the unit = 11.235 in. = 285.36 mm. Multiples, 2 schuh = 1 elle; 8 ellen = 1 ruthe. Sub-multiples, $\frac{1}{12}$ schuh = 1 zoll. Road-measure, the meile = 34,124 Rheinfuss = 6.736 miles = 10.71 km.

*Hamburg.*—The fuss = 11.279 in. = 286.5 mm., is the unit. Multiple, 2 fuss = 1 elle. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{8}$ zoll = 1 achtel. Road-measure, the meile = 24,000 Rheinfuss = 4.68 miles = 7.53 km.

*Hanover.*—The fuss = 11.496 in. = 292.0 mm. Multiples and sub-multiples as in Brunswick. The zoll is also divided, as in Hamburg, into 8 achtel. The meile = 25,400 fuss = 4.6086 miles = 7.4168 km.

*Hesse-Cassel.*—The fuss of the electorate = 11.327 in. = 287.7 mm. Sub-multiples as in Bremen. The surveyors' fuss = 11.217 in. = 284.9 mm.; multiples, 2 fuss = 1 elle; 7 ellen = 1 ruthe = 13.088 feet = 3.9886 mètres; sub-multiple, $\frac{1}{10}$ ruthe = 1 decimal foot = 15.706 inches = 398.86 mm.

*Hesse-Darmstadt.*—This was one of the earliest German states to assimilate its system to the metric by adopting an aliquot part of the mètre as its unit-base, and making its derivative denominations decimal. The fuss was made in 1818 equal to $\frac{1}{4}$th mètre = 9.843 in. = 250.0 mm. Multiple, 10 fuss = 1 klafter; sub-multiples, $\frac{1}{10}$ fuss = 1 zoll; $\frac{1}{10}$ zoll = 1 linie. Cloth-measure, the elle = 23.622 in. = 600 mm.

*Lubeck.*—The fuss = 11.335 in. = 287.9 mm. Multiple, 2 fuss = 1 elle; sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{6}$ zoll = 1 linie; $\frac{1}{12}$ linien = 1 punkte.

*Mecklenburg.*—The same as Lubeck. The fuss of Baden and the fuss of Hamburg were also used with similar derivative denominations.

*Prussia.*—The Rheinfuss is the unit = 12.357 in. = 313.85 mm. Multiples, $2\frac{1}{8}$ fuss = 1 elle; 12 fuss = 1 ruthe. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie; $\frac{1}{12}$ linien = 1 scrupel. As a field-measure the ruthe is divided decimally into 10 feld-fuss = 100 zoll = 1000 linien. Road-measure, the gesetzliche postmeile was fixed in 1816 at 2000 ruthen = 4.6806 miles = 7.5325 km.

*Saxony.*—The fuss = 11.146 in. = 283.1 mm. Multiples, 2 fuss = 1 elle; 8 ellen = 1 ruthe. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie. Road-measure, the postmeile = 1500 ruthen = 4.222 miles = 6.7946 km. The polizeimeile = 2000 ruthen = 5.6294 miles = 9.0594 km.

*Wurtemberg.*—The fuss was fixed in 1806 at 11.279 in. = 286.5, which is the fuss of Hamburg. Its derivatives are mostly decimal. Multiples, 10 fuss = 1 ruthe; 6 fuss = 1 klafter. Sub-multiples, $\frac{1}{10}$ fuss = 1 zoll; $\frac{1}{10}$ zoll = 1 linie; $\frac{1}{10}$ linie = 1 punkte. Cloth measure, the elle = 2.144 fuss = 24.183 in. = 614.2 mm. Road-measure, the meile = 4.4272 miles = 7.1248 km.

GREAT BRITAIN AND DEPENDENCIES.—The yard is the legal unit. Practically, the foot = 304.8 mm., is the unit for carpentry and mechanical purposes, and the yard = 914.4 mm., for cloth measure. Multiples of the foot, 3 ft. = 1 yard; $5\frac{1}{2}$ yards = 1 rod. Sub-multiples, $\frac{1}{12}$ ft. = 1 inch; $\frac{1}{3}$ in. = 1 barleycorn; $\frac{1}{12}$ inch = 1 line. Sub-multiples of the yard, $\frac{1}{4}$ yard = 1 quarter; $\frac{1}{4}$ qr. = 1 nail = $2\frac{1}{4}$ in. = 57.15 mm. Field and road measure, the chain is the unit = 66 ft. = 20.1164 mètres; multiples, 10 chains = 1 furlong; 8 furlongs = 1 mile = 1.6093 km.; 3 miles = 1 league; sub-multiples, $\frac{1}{4}$ chain = 1 rod; $\frac{1}{25}$ rod = $\frac{1}{100}$ chain = 1 link = 7.92 inches = 201.16 mm.; 1 mile old Scottish = $1\frac{1}{8}$ mile; 1 mile old Irish = $1\frac{3}{11}$ mile. Other measures are the hand = 4 inches; the span = 9 inches; the ell English = 45 inches; the ell Scotch = 37.06 inches; the fathom = 6 feet.

GREECE.—The legal system is the metric, but there is yet great confusion. The mètre is called the pik, and the kilomètre the stadion. The old pik of Patras for textiles generally was = 27.008 in. = 686.0 mm., and the pik for silks was = 25.01 in. = 635.24 mm. The large pik of Scio agreed with the first above named, and the small pik was = 25.996 in. = 660.3 mm.

GUINEA.—The jaktan = 12.005 feet = 3.659 mètres.

INDIA, BRITISH.—The metric system has been adopted, and the local governments are empowered to make it compulsory in the different ports, cities, and provinces at their discretion. The old measures are as follows:

*Presidency of Bengal.*—The unit is the covid, haut or hath = 18 inches = 457.2 mm. Multiples, 2 covids = 1 guz; 2 guz = 1 fathom. Sub-multiples, $\frac{1}{2}$ covid = 1 span; $\frac{1}{3}$ span = 1 moot; $\frac{1}{4}$ moot = 1 unglee; $\frac{1}{3}$ unglee = 1 jow. These are the measures of Calcutta, in which the guz = 1 English yard = 914.4 mm. The guz of Patna = 33 inches = 838.2 mm. for stuffs generally, and 42.5 in. = 1.0795 m. for fine goods. Road-measure, the coss = 1000 fathoms = 1.1364 miles = 1.8288 km.

*Presidency of Bombay.*—The cubit or hath = 18.12 in. = 460.248 mm.; $1\frac{1}{2}$ cubits = 1 guz = 27.18 inches = 690.372 mm.; $\frac{1}{16}$ cubit = 1 tussoo. At Surat the cubit is 20.9 inches = 530.85 mm.; at Gaulnah = 18.8 in. = 477.5 mm.; at Ahmednuggur = 14 inches = 355.6 mm. In the district of Anjar the guz = 26.4 inches = 670.55 mm.; at Guzerat = $23\frac{1}{3}$ in. = 592.66 mm.

*Presidency of Madras.*—The covid at Madras = 18.6 in. = 472.44 mm.; at Masulipatam = 19.125 in. = 485.8 mm.; at Mysore = 19.1 inches = 485.165 mm. Two covids of Mysore = 1 gujah. The kole of Travancore, carpenters' measure = 29.065 in. = 738.2377 mm. Sub-multiples, $\frac{1}{24}$ kole = 1 borrel or Malabar inch = 1.211 in. = 30.76 mm. The ady, the Malabar foot = 10.46 in. = 265.68 mm. Field-measure, the culy = 24 ady = 20.92 feet = 6.376 mètres. Road-measure, the coss = 3.6458 miles = 5.8675 km.; multiple, 2 coss = 1 gavada. This is the coss of Seringapatam. The common coss or hordary is $\frac{3}{4}$ of this = 2.7344 miles = 4.4005 km. There are many values of the coss in use; in the province of Malwah these values vary between $1\frac{1}{2}$ and 2 miles English.

ITALY.—The metric system has been compulsory over the Italian peninsula and Sicily since Jan. 1, 1863. The old measures were different in the different states, and very various. A few of the more important are given:

*Naples.*—The palmo is the unit = 10.316 in. = 262.015 mm. Multiple, 8 palmi = 1 canna. Sub-multiples, $\frac{1}{12}$ palmo = 1 oncia; $\frac{1}{5}$ oncia = 1 minuto. Field-measure, $7\frac{1}{2}$ palmi = 1 pertica. Road-measure, the miglio = 1.1965 miles = 1.9257 km.

*Rome.*—The palmo of commerce = 9.803 in. = 249.0 mm. Multiples, 8 palmi = 1 canna. The builders' palmo = 8.796 in. = 223.425 mm.; multiples, 10 palmi = 1 canna; sub-multiples, $\frac{1}{12}$ palmo = 1 oncia; $\frac{1}{5}$ oncia = 1 minuto; $\frac{1}{2}$ minuto = 1 decimo. The sacred palmo (*palmo de ara*) = 4.921 inches = 125.0 mm. = $\frac{1}{8}$ mètre. The pié = $1\frac{1}{3}$ palmo = 11.729 in. = 297.9 mm. Cloth-measure, the merchants' braccio = 33.387 in. = 848.0 mm.; sub-multiple, $\frac{1}{4}$ braccio = 1 palmo = 8.347 in. = 212.0 mm. The weavers' braccio is three-fourths of this, and the sacred braccio = 6 sacred palmi = 29.528 in. = 750.0 mm. = $\frac{3}{4}$ mètre. Road-measure, 5000 piede = 1 miglio = 0.92555 mile = 1.4895 km.

*Sardinia.*—The pié is the unit. At Turin the pié liprando = 20.227 in. = 513.77 mm.; the pié manuale = 13.485 in. = 342.51 mm. Multiples, 6 piede liprando = 1 trabucco; 2 trabucci = 1 pertica. Sub-multiple, $\frac{1}{12}$ pié liprando = 1 oncia; $\frac{1}{12}$ oncia = 1 punto; $\frac{1}{12}$ punto = 1

atomo. Cloth-measure, the raso = $1\frac{1}{6}$ piede liprando = 23.598 = 599.37 mm. = 14 oncie. Road-measure, the miglio = $4333\frac{1}{3}$ piede liprando = 1.381 miles = 2.2263 km.

*Tuscany.*—The palmo is the unit = 11.488 in. = 291.8 mm. Multiples, 2 palmi = 1 braccio; 4 braccie = 1 canna of commerce; 5 braccie = 1 surveyors' canna. Sub-multiples, $\frac{1}{10}$ palmo = 1 soldo; $\frac{1}{12}$ soldo = 1 denaro. Road-measure, the miglio = $2833\frac{1}{3}$ braccie = 1.0275 miles = 1.6535 km.

JAPAN.—The shaku = 11.93054 = $\frac{10}{33}$ mètre, or 303.03 mm. Sub-multiples, $\frac{1}{10}$ shaku = 1 sun; $\frac{1}{10}$ sun = 1 bu. For field-measure, the djo = 10 shaku, is employed.

MEXICO.—The metric system was established in 1856. The old measures are Spanish.

MOROCCO.—The covid, as given by Doursther = 21.0 in. = 533.4 mm. The values given by different authorities are very various. The pik = 26.022 in. = 660.96 mm. In some of the Barbary States the pik is subdivided into 3 palmi.

NETHERLANDS AND DEPENDENCIES.—In 1817 the metric system was adopted, with the names of the old measures. More recently the metric names have been also adopted.

NORWAY.—In 1866 the system was reformed and decimalized, but the old names and the value of the unit-base were retained. The unit is the fot = 12.357 in. = 313.85 mm. This is the Rheinfuss in use at Christiania. Some authorities make the fot = 11.6904 in. = 297.0 mm., which may be a provincial value. Multiples according to the old system, 2 fot = 1 aln; 3 aln = 1 famn; 5 aln = 1 rode. Sub-multiples: $\frac{1}{12}$ fot = 1 tum; $\frac{1}{12}$ tum = 1 linie. Multiples according to the new system, 10 fot = 1 stang; 10 stang = 1 ref. Sub-multiples, $\frac{1}{10}$ fot = 1 tum; $\frac{1}{10}$ tum = 1 linie.

PERSIA.—The gueza of Ispahan = 37.435 in. = 950.8 mm. The covid of Gomron = 37.8 in. = 960.1 mm. The archine arisch = 38.28 in. = 972.3 mm. These measures were probably originally the same. There is an archine schah = 31.46 in. = 799.07 mm. No uniformity prevails through the country.

PERU.—The metric system was introduced in 1863. The old measures, which still continue in use, are Spanish.

PORTUGAL AND DEPENDENCIES.—The metric system was established by law in 1864. Of the old system the covado is the ordinary unit = 25.985 in. = 660.0 mm. Multiples, $1\frac{2}{3}$ covado = 1 vara; 2 varas = 1 braça. Sub-multiples, $\frac{1}{2}$ covado = 1 pied; $\frac{1}{3}$ covado = 1 palmo; $\frac{1}{8}$ palmo da craveira = 1 pollegada; $\frac{1}{12}$ pollegada = 1 linha; $\frac{1}{12}$ linha = 1 ponto. Sub-multiples of the pied, $\frac{1}{12}$ pied = 1 pollegada; $\frac{1}{18}$ pied = 1 dedo; $\frac{1}{4}$ dedo = 1 grão; $\frac{1}{2}$ grão = 1 linha. A palmo of commerce, called *palmo da craveira avantejado*, or "good-measure palmo" = $8\frac{1}{4}$ pollegadas, was also used. In 1756 the junta da commercio, or chamber of commerce, of Lisbon, introduced a palmo called *palmo da junta*, designed to be a standard-base for all measures, whether of length or capacity. The palmo da junta = 7.882 in. = 200.20 mm. Road-measure, the milha = 1.2785 miles = 2.058 km.; 3 milhas = 1 legoa; $\frac{1}{8}$ milha = 1 estadio.

ROUMANIA.—The metric system has been compulsory since Jan., 1865. Of old measures, the palma = 10.89 in. = 276.6 mm.; the khalebi, for cloths = 26.43 in. = 671.31 mm.; the kot, for silks and linens = 24.86 in. = 631.33 mm.; the endèse = 26.076 in. = 293.6 mm.

RUSSIA.—The sagene is the legal unit = 7 fut = 2.1336 mètres. There are two modes of subdivision: First, $\frac{1}{7}$ sagene = 1 foute; $\frac{1}{12}$ foute = 1 duime; $\frac{1}{12}$ duime = 1 linia; also, $\frac{1}{3}$ sagene = 1 archine; $\frac{1}{4}$ archine = 1 tchetverk; $\frac{1}{4}$ tchetverk = 1 verschok. Road-measure, 500 sagenes = 1 verst = 3500 ft. = 1.06678 km. The meile of Lithuania = 4.9958 miles = 8.039816 km.

SANDWICH ISLANDS.—The system is that of the U. S.

SIAM.—The ken = 37.835 inches = 961 mm. Multiples, 2 ken = 1 vouah; 20 vouah = 1 sen. Sub-multiples, $\frac{1}{2}$ ken = 1 sok; $\frac{1}{2}$ sok = 1 keub; $\frac{1}{12}$ keub = 1 niou. Road-measure, the röenung = 2000 vouahs = 2.3886 miles = 3.84401 km.

SPAIN AND DEPENDENCIES.—Since 1859 the system has been the metric. The vara of Burgos = 32.91 in. = 835.9 mm., was the former legal unit. This value was assigned by Messrs. Ciscar and Pedrayès, Spanish deputies, members of the commission charged with the measurement of the arc of meridian for the determination of the length of the mètre, after a careful comparison at Paris in 1799. The vara in actual use in the present and former dependencies of Spain in America is, however = 33.385 in. = 847.96 mm. Multiple, 4 varas = 1 estadal. Sub-multiples, $\frac{1}{3}$ vara = 1 piè; $\frac{1}{2}$ piè = 1 sesma; $\frac{1}{6}$ sesma = 1 polgada; $\frac{1}{12}$ polgada = 1 linea; $\frac{1}{12}$ linea = 1 punto. Also, 9 polgadas = 1 palma; $\frac{1}{12}$ palma = 1 dedo; $\frac{1}{9}$ dedo = 1 linea. Road-measure, the legua of 1766 = 8000 varas = 4.1508 miles = 6.6800 km.

SWEDEN.—The fot = 11.688 in. = 296.87 mm. The system has been decimalized, retaining this value of the unit-base. The multiples and sub-multiples, new and old, are the same as given above for Norway.

SWITZERLAND.—The system, since 1856, is partly decimal, with units in simple relations with the metric. The unit of length is the pied = 11.8112 in. = 300.0 mm. Multiples, 2 pieds = 1 brache; 2 braches = 1 aune; 3 aunes = 1 toise. Sub-multiples, $\frac{1}{10}$ pied = 1 pouce; $\frac{1}{10}$ pouce = 1 ligne; $\frac{1}{10}$ ligne = 1 trait. Field-measure, 10 pieds = 1 perche. Road-measure, 16,000 pieds = 1 lieue = 2.983 miles = 4.8 km.

TRIPOLI.—The pik or dreah = 26.42 inches = 671.05 mm., is the ordinary cloth-measure. Sub-multiple, $\frac{1}{3}$ pik = 1 palmo. A lesser pik = 19.03 inches = 483.35 mm., is used for ribbons and linens from Alexandria and the Levant, and sometimes also for the stuffs of the country.

TUNIS.—For woollens the pik or dreah = 26.493 inches = 672.91 mm.; for silks, $\frac{15}{16}$ of the above = 24.852 inches = 630.73 mm.; and for linens, $\frac{3}{4}$ of this last = 18.624 inches = 473.05 mm.

TURKEY.—There is no system common to all parts of the empire. In Constantinople the pik halebi, now called the archine, has a metric value = 750. mm. = 29.528 inches. The pik of Smyrna = 27.00 in. = 685.8 mm.; the pik of Aleppo = 26.626 in. = 676.3 mm.; and there are many other values. Sub-multiples, $\frac{1}{24}$ pik or archine = 1 parmack; $\frac{1}{12}$ parmack = 1 hatt; $\frac{1}{12}$ hatt = 1 mocktat. Cloth-measure, the pik hendèse or endèse = 27.06 in. = 687.3 mm.; sub-multiples, $\frac{1}{8}$ hendèse = 1 ooroub; $\frac{1}{2}$ ooroub = 1 guirah.

UNITED STATES OF AMERICA.—The measures of length are the same as those above given for Great Britain.

URUGUAY.—The metric system has been adopted, but Spanish measures continue to be used.

VENEZUELA.—These measures are also Spanish.

WEST INDIES.—These islands still retain the measures originally introduced from the countries from which they were colonized. They are classified thus:

*Spanish.*—Cuba, Porto Rico, Isle of Pines, Culebra.

*French.*—Martinique, Deseada, Guadaloupe, Marie Galante, Les Saintes, St. Martin (in part).

*Dutch.*—St. Martin (in part), Buen Ayre, Curaçoa, Oruba, Tortuga.

*Danish.*—Santa Cruz, St. Thomas, St. Jan.

*Swedish.*—St. Bartholomew.

*British.*—Jamaica, Barbadoes, Grenada, Santa Lucia, St. Vincent, Trinidad, Tobago, Antigua, Barbuda, Dominica, Nevis, Montserrat, St. Kitt's, Tortola, the Bahamas, and various minor islands.

*Independent.*—Hayti, with the republic of St. Domingo.

In the Spanish islands and in Curaçoa the vara = 33.385 in. = 847.96 mm. The French, with Hayti and St. Domingo, retain the old French measures, except Les Saintes, which has the British system.

ZANZIBAR.—The ohra = 24.48 in. = 571.0 mm.

## II. SURFACE.

Superficial measures are usually the squares of the measures of length. Some agrarian measures are exceptions. These only will be considered here:

ARABIA.—The feddan = 400 cassabas (the cassaba for this purpose = 3.84 mètres = 12.5986 ft.) = 1.4782 acres = 0.589824 hectare.

AUSTRIA.—The joch, the unit of land-measure = 1600 sq. klafter = 57,600 sq. fuss = 1.4223 acres = 0.5755 hectare.

CANADA, DOMINION OF.—In the French portion the arpent = 0.8449 acre = 0.33796 hectare.

DENMARK.—The töndeland = 14,000 sq. aln = 1.3635 acres = 0.552 hectare.

EGYPT.—The feddan = $333\frac{1}{3}$ sq. cassabas (the cassaba for this purpose = 3.55 mètres = 11.6472 feet) = 1.038 acres = 0.42008 hectare; $\frac{1}{24}$ feddan = 1 kérat.

FRANCE.—The metric land-measuring unit is the hectare = 100 ares = 2.47112 acres. The old unit was the arpent, of which there were various values, varying from less than 32 to more than 60 ares, or from about $\frac{3}{4}$ acre to an acre and a half. The *arpent d'ordonnance*, or legal arpent = 1.262 acres = 51.072 ares, and contained 100 square perches of 22 pieds du roi on a side.

GERMAN EMPIRE.—The land-unit is called the morgen, except in a few states, as Hesse-Cassel, where it is called an acker. The values of the morgen and its modes of subdivision are various:

*Baden.*—The morgen = 0.8897 acres = 0.36 hectare; $\frac{1}{4}$ morgen = 1 viertel; $\frac{1}{100}$ viertel = 1 sq. ruthe.

*Bavaria.*—The morgen (otherwise called juchart or tagewerk) = 0.8416 acre = 0.340536 hectare, and is decimally subdivided.

*Bremen.*—The morgen = 0.6343 acre = 0.2569 hectare.

*Brunswick.*—The morgen = 0.6208 acre = 0.2502 hectare.

*Hamburg.*—The morgen = 2.3852 acres = 0.9652 hectare.

*Hanover.*—The morgen = 0.6472 acre = 0.2619 hectare.

Sub-multiples, $\frac{1}{2}$ morgen = 1 vorling; $\frac{1}{60}$ vorling = 1 sq. ruthe.

*Hesse-Cassel.*—The acker = 0.5897 acre = 0.2387 hectare.

*Hesse-Darmstadt.*—The morgen = 0.6178 acre = 0.2500 hectare. Sub-multiple, $\frac{1}{4}$ morgen = 1 viertel.

*Prussia.*—The morgen = 0.6309 acre = 0.2553 hectare.

*Saxony.*—The morgen = 1.5216 acres = 0.6166 hectare.

*Wurtemberg.*—The morgen = 0.7789 acre = 0.3152 hectare.

Great Britain.—The land-unit is the acre = 0.404671 hectare. Sub-multiples, $\frac{1}{4}$ acre = 1 rood; $\frac{1}{40}$ rood = 1 sq. rod.

India, British.—In Bengal and Bombay the land-unit is called the biggah; in Madras, the cawney.

*Bengal.*—The biggah = 0.3306 acre = 0.1338 hectare. Sub-multiples, $\frac{1}{20}$ biggah = 1 cottah; $\frac{1}{16}$ cottah = 1 chattack; $\frac{1}{20}$ chattack = 1 sq. covid.

*Bombay.*—The biggah = 0.6074 acre = 0.2458 hectare.

*Madras.*—The cawney = 1.3223 acres = 0.5352 hectare. In the Carnatic the cawney = 1.0047 acres = 0.4066 hectare. Sub-multiples, $\frac{1}{4}$ cawney = 1 biggah; $\frac{1}{6}$ biggah = 1 maoney; $\frac{1}{10}$ maoney = 1 sq. covid.

Italy.—The old land-units are different in name and in value in the several states:

*Naples.*—The moggio is the unit = 0.8584 acre = 0.3475 hectare.

*Rome.*—The rubbio is the unit = 4.5658 acres = 1.8485 hectares.

*Sardinia.*—The giornata is the unit = 0.9392 acre = 0.3801 hectare.

*Tuscany.*—The saccato is the unit = 1.389 acres = 0.5620 hectare.

Norway.—The land-unit is the tunna or töndeland = 1.2132 acres = 0.4909 hectare. Sub-multiples, $\frac{1}{8}$ töndeland = 1 spannland; $\frac{1}{4}$ spannland = 1 fjerding; $\frac{1}{4}$ fjerding = 1 kappland.

Portugal.—The unit is the geira = 1.4287 acres = 0.5856 hectare.

Russia.—The deciatine is the unit = 2.6997 acres = 1.0925 hectares.

Spain.—The fanegada of 1801 is the unit = 1.5871 acres = 0.642563 hectare. Multiple, 50 fanegadas = 1 yugada.

Sweden.—The unit is the square ref = 0.2175 acre = 0.088007 hectare.

Switzerland.—The arpent is the unit = 3.558 acres = 1.44 hectares.

United States.—The acre = 4 roods = 10 sq. chains = 160 sq. rods = 0.404671 hectare.

## III. Volume.

Besides the measures of capacity and solidity here given, the cubes of linear measures are everywhere more or less used as units of volume.

Abyssinia.—For liquid capacity the cuba is the unit = 0.2684 U. S. gallon = 1.01594 litres. For dry capacity the ardeb is the unit, which is different in different parts of the country. The ardeb of Gondar = 10 madegas = 0.49936 U. S. peck = 4.39902 litres. The ardeb of Massouah = 24 madegas = 1.1991 peck = 10.5635 litres.

Algeria.—For liquid capacity the khoullé = 4.4027 gallons = 16.675 litres. For dry measure, the tarrie = 0.56295 U. S. bushel = 19.84 litres. Multiple, 16 tarries = 1 caffiso. The saâ is a little less than 3 tarries; it is = 1.646 bushels = 58.0 litres.

Annam.—Commodities sold by weight; no ascertained system of measures of capacity.

Arabia.—For liquid capacity, the gudda or cuddy = 1.999 gallons = 7.567 litres. Sub-multiples, $\frac{1}{8}$ cuddy = 1 noosfia; $\frac{1}{16}$ noosfia = 1 vakia. Dry measure, the teman or toman = about $2\frac{1}{4}$ pints or 2 litres. Its value is not well ascertained; $\frac{1}{40}$ teman = 1 mecdema or kella. The teman of rice-weight, 168 lbs. avoirdupois = 76.2 kgm.

Argentine Confederation.—The legal measures are metric. The old Spanish measures continue also to be used.

Australia.—The measures are British.

Austria.—Liquid capacity, the mass is the unit = 0.3738125 gallon = 1.4149 litres. Multiples, 10 mass = 1 viertel; 4 viertel = 1 eimer; 24 eimer = 1 dreiling; 32 eimer = 1 fuder. Sub-multiples, $\frac{1}{2}$ mass = 1 kanne; $\frac{1}{2}$ kanne = 1 seidel; $\frac{1}{2}$ seidel = 1 pfiff. Dry measure, the metze = 1.745 bushels = 61.496 litres is the unit. Multiple, 30 metzen = 1 muth; sub-multiples, $\frac{1}{4}$ metze = 1 viertel; $\frac{1}{2}$ viertel = 1 achtel; $\frac{1}{2}$ achtel = 1 müller massel; $\frac{1}{2}$ müller massel = 1 grosse massel; $\frac{1}{2}$ grosse massel = 1 kleine massel; $\frac{1}{2}$ kleine massel = 1 becher.

Belgium.—System metric.

Birmah.—Commodities of all kinds, liquid or dry, are sold by weight.

Bolivia.—System metric; old Spanish measures are also used.

Brazil.—System metric; old Portuguese measures continue in use.

Central America.—The old Spanish measures are used in these states.

Chili.—System metric; old Spanish measures still used.

China.—Liquid capacity, the shing-tsong = 0.1375 gallon = 0.5205 litre. Multiple, 10 shing-tsong = 1 tan-tsong; sub-multiple, $\frac{1}{10}$ shing-tsong = 1 kop-tsong. Dry capacity, the shing-shi = 0.08708 peck = 0.7671 litres. Multiple, 10 shing-shi = 1 tan-shi; sub-multiple, $\frac{1}{10}$ shing-shi = 1 kop-shi. The foregoing are according to Clarke. Doursther gives the tching, a measure which contains a catty-weight = 6 hectogrammes of rice not heaped, as the principal unit of capacity = 0.70 litre = 1.4794 pints. Multiples, 10 tching = 1 ten; 5 ten = 1 ho; $1\frac{7}{25}$ ho = 1 fu; $1\frac{6}{16}$ fu = 1 tché; $1\frac{3}{5}$ tchè = 1 yu; $2\frac{1}{8}$ yu = 1 tchung = 340 tching = 238 litres = 62.87635 gallons. Sub-multiples, $\frac{1}{10}$ tching = 1 ho; $\frac{1}{10}$ ho = 1 cho; $\frac{1}{10}$ cho = 1 chao; $\frac{1}{10}$ chao = 1 ço; $\frac{1}{10}$ ço = 1 quei. The term ho occurs in both series.

Colombia.—System metric; Spanish measures still occur.

Denmark.—Liquid capacity, the pot = 0.966 litre = 0.2552 gallon, is the unit. Multiples, 2 pots = 1 kande; $19\frac{1}{2}$ kanden = 1 anker; 60 kanden = 1 tönde for tar; 68 kanden = 1 tönde for beer. Sub-multiple, $\frac{1}{4}$ pot = 1 poegel. Dry capacity, the tönde = $4\frac{1}{2}$ Rheinfuss cube = 3.9478 bushels = 139.11 litres. Sub-multiples, $\frac{1}{8}$ tönde = 1 skjœppe; $\frac{1}{4}$ skjœppe = 1 fjerdingkar; $\frac{1}{4}$ fjerdingkar = 1 halvotting.

Ecuador.—System metric; Spanish measures still occur.

Egypt.—Legal system metric since 1871. Old liquid measure, the guirbeh = 17.6117 gallons = 66.6639 litres. Dry measure, the kaddah = 0.5049 gallons = 1.9112 litres. Multiples, 2 kaddah = 1 malouah; 2 malouah = 1 roubouh or rob; 2 roubouh = 1 kélé; 2 kélé = 1 ouebeh; 6 ouebeh = 1 ardeb = 5.2059 bushels = 183.475 litres. Sub-multiples, $\frac{1}{2}$ kaddah = 1 nisf-kaddah; $\frac{1}{2}$ nisf-kaddah = 1 roub-kaddah; $\frac{1}{2}$ roub-kaddah = 1 thoumn-kaddah; $\frac{1}{2}$ thoumn-kaddah = 1 kharroubah; $\frac{1}{2}$ kharroubah = 1 kérat.

France.—The legal system is the metric. The old unit of liquid capacity for Paris was the pot = 1.8626 litres = 1.9683 quarts. Sub-multiples were, $\frac{1}{2}$ pot = 1 pinte; $\frac{1}{2}$ pinte = 1 chopine; $\frac{1}{4}$ chopine = 1 posson; $\frac{1}{4}$ posson = 1 roquille. Dry measure, the boisseau = 13.01 litres = 0.3692 bushels; multiple, 12 boisseaux = 1 setier; sub-multiples, $\frac{1}{4}$ boisseau = 1 picotin; $\frac{1}{4}$ picotin = 1 litron; $\frac{1}{16}$ litron = 1 mesurette.

German Empire.—System metric. For a few of the states the old measures are given below:

*Baden.*—The old mass of Heidelberg for liquids was 1.977 litres = 2.089 quarts, divided into 4 schoppen. This was replaced by a metric mass of 1.5 litre = 1.565 qts. about 1840. For dry measure, the malter = 111.40 litres = 3.1613 bushels, was the unit; sub-multiples, $\frac{1}{4}$ malter = 1 viernsel; $\frac{1}{2}$ viernsel = 1 simmer; $\frac{1}{2}$ simmer = 1 kümpfe; $\frac{1}{2}$ kümpfe = 1 immel.

*Bavaria.*—Liquid measure, the mass = 2.2593 pints = 1.069 litres, was the unit = 4 quartels and $\frac{1}{60}$ eimer. The dry-measure unit was the metze = 1.0517 bushel = 37.059 litres; multiple, 6 metzen = 1 scheffel; sub-multiples, $\frac{1}{2}$ metze = 1 viertel; $\frac{1}{4}$ viertel = 1 achtel or massel; $\frac{1}{2}$ achtel = 1 maesslein; $\frac{1}{2}$ maesslein = 1 dreissiger.

*Bremen.*—The viertel = 1.912875 gallons = 7.2405 litres, was the ordinary unit of liquid measure. Multiples, 5 viertel = 1 anker; 4 anker = 1 ohm = 38.2575 gallons = 144.81 litres; sub-multiples, $\frac{4}{5}$ viertel = 1 stübchen; $\frac{1}{4}$ stübchen = 1 quartier; $\frac{1}{4}$ quartier = 1 mingel. The scheffel = 2.10195 bushels = 74.064 litres, is the dry-measure unit. Multiple, 40 scheffel = 1 last; sub-multiples, $\frac{1}{4}$ scheffel = 1 viertel; $\frac{1}{4}$ viertel = 1 spint.

*Brunswick.*—The stübchen = 0.988 gallon = 3.74 litres, was the unit. Multiples, 40 stübchen = 1 ohm; 6 ohm = 1 fuder. Sub-multiples, $\frac{1}{4}$ stübchen = 1 quartier; $\frac{1}{2}$ quartier = 1 nössel. The dry-measure unit, the scheffel = 8.82676 bushels = 311.03 litres, for wheat, and 10.5922 bushels = 373.24 litres, for oats. Multiple, 4 scheffel = 1 wispel; sub-multiples, $\frac{1}{10}$ scheffel = 1 himt; $\frac{1}{4}$ himt = 1 vierfass; $\frac{1}{4}$ vierfass = 1 becher or löcher.

*Hamburg.*—The viertel for liquid measure = 1.9127 gallons = 7.24 litres. Multiples, 5 viertel = 1 anker; 4 anker = 1 ahm; 6 ahm = 1 fuder. Also, 4 viertel = 1 eimer; 6 eimer = 1 tonne; $1\frac{1}{4}$ tonnen = 1 oxhoft; sub-multiples, $\frac{1}{2}$ viertel = 1 stübchen; $\frac{1}{2}$ stübchen = 1 kanne; $\frac{1}{2}$ kanne = 1 quartier; $\frac{1}{2}$ quartier = 1 össel. Dry measure, the scheffel = 2.99399 bushels = 105.50 litres, for wheat, rye, and pease, and = 4.49098 bushels = 158.25 litres, for oats and barley; multiples, 10 scheffel = 1 wispel; 3 wispel = 1 last. Sub-multiples of the wheat scheffel, $\frac{1}{2}$ scheffel = 1 fass; $\frac{1}{2}$ fass = 1 himt; $\frac{1}{4}$ himt = 1 spint; of the barley scheffel, $\frac{1}{3}$ scheffel = 1 fass; $\frac{1}{2}$ fass = 1 himt; $\frac{1}{4}$ himt = 1 spint. It thus appears that $1\frac{1}{2}$ wheat scheffel = 1 barley scheffel.

*Hanover.*—The viertel, liquid measure = 2.0543 gallons = 7.776 litres. Multiples, 5 viertel = 1 anker; 4 anker = 1 ahm; 6 ahm = 1 fuder. Also, 8 viertel = 1 eimer; $3\frac{3}{4}$ eimer = 1 oxhoft; sub-multiples, $\frac{1}{2}$ viertel = 1 stübchen; $\frac{1}{2}$

stübchen = 1 kanne; ½ kanne = 1 quartier; ½ quartier = 1 nössel. The dry-measure unit, the malter = 5.2961 bushels = 186.62 litres; multiples, 8 malter = 1 wispel; 2 wispel = 1 last; sub-multiples, ⅙ malter = 1 himt; ⅓ himt = 1 drittel; ¼ drittel = 1 vierfass.

*Hesse-Cassel.*—The liquid unit-measure is the mass = 0.524145 gallon = 1.984 litres, for wine, and one-eighth more, or 0.589663 gallons = 2.232 litres, for beer. Multiples, 4 mass = 1 viertel; 20 viertel = 1 ohm; 6 ohm = 1 fuder; sub-multiple, ¼ mass = 1 schoppen. The dry-measure unit, the scheffel = 2.27685 bushels = 80.23 litres; sub-multiples, ½ scheffel = 1 himt; ¼ himt = 1 metze; ¼ metze = 1 mässchen.

*Hesse-Darmstadt.*—The old mass for wine = 0.4584 gallons = 1.735 litres, and for beer = 0.51675 = 1.956 litres. Multiples, 4 mass = 1 viertel; 20 viertel = 1 ohm; 6 ohm = 1 fuder. Sub-multiples, ¼ mass = 1 schoppen. The metric mass is = 2 litres = 2.1135 quarts. Dry measure, the malter = 3.6325 bushels = 128 litres; sub-multiples, ¼ malter = 1 simmer; ¼ simmer = 1 kumpfe; ¼ kumpfe = 1 gescheid; ¼ gescheid = 1 mässchen.

*Lubeck.*—The viertel for liquids = 1.9127 gallons = 7.240 litres. Multiples, 5 viertel = 1 anker; 4 anker = 1 ahm; 6 ahm = 1 fuder. Also, 4 viertel = 1 eimer; 7½ eimer = 1 oxhoft; sub-multiples, ½ viertel = 1 stübchen; ½ stübchen = 1 kanne; ½ kanne = 1 quartier; ½ quartier = 1 planke; ½ planke = 1 ort. Dry measure, the scheffel for wheat = 0.94787 bushels = 33.40 litres; for oats = 1.11359 bushels = 39.24 litres; multiples, 4 scheffel = 1 tonne; 3 tonnen = 1 drömt; 8 drömt = 1 last; sub-multiple, ¼ scheffel = 1 fass.

*Mecklenburg.*—The measures of capacity are those of Lubeck.

*Prussia.*—The quart, the unit of liquid capacity = 1.20997 quarts of the U. S. = 1.145 litres. Multiples, 30 quarts = 1 anker; 2 anker = 1 eimer; 2 eimer = 1 ohm; 6 ohm = 1 fuder. Sub-multiple, ½ quart = 1 össel. Dry measure, the scheffel = 1.5597 bushels = 54.9577 litres; multiples, 12 scheffel = 1 malter; 6 malter = 1 last; 1½ malter = 1 wispel; sub-multiples, ¼ scheffel = 1 viertel; ¼ viertel = 1 metze; ¼ metze = 1 mässchen. Cubic measure, the klafter = 108 Rheinfuss cube = 117.8 U. S. cubic feet; 4½ klafter = 1 haufen.

*Saxony.*—The kanne is the unit, and has several values. The kanne of Dresden = 0.2782 gallon = 0.936 litre; the kanne of Leipsic = 0.31808 gallon = 1.204 litres; the gauger's kanne = 0.37092 gallon = 1.404 litres; 9 kannen of Dresden = 7 kannen of Leipsic = 6 gauger's kannen. Multiples, 63 kannen = 1 eimer; 2 eimer = 1 ohm; 6 ohm = 1 fuder. Also, 54 kannen = $\frac{6}{7}$ eimer = 1 anker; 3 eimer = 1 oxhoft; 1⅔ oxhoft = 1 fass. Sub-multiples, ½ kanne = 1 nössel; ¼ nössel = 1 quartier. Dry measure, the scheffel, as established by law in 1819 for all Saxony = 3.00505 bushels = 105.89 litres; but Doursther gives 3.04876 = 107.43 as being the actual value in Dresden in 1840. Multiples, 12 scheffel = 1 malter; 2 malter = 1 wispel; sub-multiples, ¼ scheffel = 1 viertel; ¼ viertel = 1 metze; ¼ metze = 1 mässchen.

*Wurtemberg.*—There are three values of the mass, the unit of liquid capacity—viz. the hellaichmass = 0.48531 gallon = 1.837 litres; the trübaichmass = 0.506446 gallon = 1.917 litres; and the schenkmass = 0.44119 gallon = 1.670 litres. It thus appears that 167 hellaichmass = 160 trübaichmass, and that 10 hellaichmass = 11 schenkmass. Multiples, 10 mass = 1 immi; 16 immi = 1 eimer; 6 eimer = 1 fuder. Sub-multiples, ¼ mass = 1 schoppen. For dry measure, the scheffel = 5.02962 bushels = 177.23 litres; sub-multiples, ⅛ scheffel = 1 simri; ¼ simri = 1 viertel; ½ viertel = 1 achtel; ½ achtel = 1 masslein; ½ masslein = 1 ecklein; ¼ ecklein = 1 viertlein.

GREAT BRITAIN AND DEPENDENCIES.—There is no distinction in Great Britain between liquid and dry measures. The gallon, having the capacity of 277.274 cubic inches, and containing 10 pounds avoirdupois, or 70,000 grains, of distilled water, at the temperature of 62° F., as weighed with brass weights under an atmospheric pressure of 30 inches of the barometer, is the standard unit, and is called the imperial gallon. The bushel has the capacity of 8 gallons. Previously to Jan. 1, 1826, the British wine-gallon was 231 cubic inches, and the beer-gallon 282 cubic inches. This wine-gallon is now the sole standard gallon of the U. S. The bushel called the Winchester bushel, from the favorite royal residence of the early kings, formerly the chief market-town of England, was made the standard in 1701 (13 Will. III.), and was of the capacity of 2150.42 cubic inches. This continued to be the standard till 1826, and it is still the standard of the U. S. The eighth part of this was the corn-gallon of 268.8 cubic inches. The multiples of the unit at present are—2 gallons = 1 peck; 4 pecks = 1 bushel; 8 bushels = 1 quarter. The sub-multiples are—¼ gallon = 1 quart; ½ quart = 1 pint; ¼ pint = 1 gill.

GREECE.—The legal system is the metric. Some old measures are used. The bachel for dry measure used at Patras contains 0.8495 bushel = 29.933 litres; and the stajo, similarly used at the same port = 2.5484 bushels = 3 bachels, according to Clarke, but only 2.33049 bushels = 82.12 litres, according to Doursther.

GUINEA.—No ascertained system.

INDIA, BRITISH.—Though the metric system has been legalized, it has not been fully introduced. Both liquid and dry commodities are usually sold by weight, and the measures of capacity are intended to contain certain weights. This circumstance has doubtless contributed to the multiplication of discordant measures in the same places, while every considerable town has, or has had, its own system.

*Bengal.*—The soallee, a measure of dry capacity of Calcutta = 3.0933 bushels = 109.07 litres, about. Multiple, 16 soallee = 1 khahoon = 49.5216 bushels = 1745 litres. Sub-multiples, ⅖ soallee = 1 maund; ⅛ maund = 1 pallie; ¼ pallie = 1 raik; $\frac{1}{16}$ raik = 1 khoonke; ⅕ khoonke = 1 chattack. The khahoon is also said to be capable of containing 2986⅔ pounds avoirdupois of grain.

*Bombay.*—The parah for salt of Bombay = 0.7476 bushel = 26.3426 litres. Multiple, 8 parahs = 1 candy. Sub-multiple, $\frac{2}{21}$ parah = 1 adowly. The parah for grain contains 19⅗ pounds avoirdupois. Assuming the mean specific gravity of grains at 0.6, the capacity should be 1.246 bushels = 43.9044 litres, and the candy = 8 parahs = 9.968 bushels = 3.512352 hectolitres. Sub-multiples, ⅐ parah = 1 pailie; ¼ pailie = 1 seer; ½ seer = 1 tippree. At Anjar, the shye = 0.88241 bushel = 31.094 litres; multiple, 16 shye = 1 culsey; sub-multiples, ¼ shye = 1 mapp; ⅛ mapp = 1 pallee.

*Madras.*—The parah of Madras for either liquids or grains = 1.7439 bushels = 61.45 litres. Multiples, 4 parahs = 1 candy; 20 candies = 1 garce. Sub-multiples, ⅕ parah = 1 marcal; ⅛ marcal = 1 puddy; ⅛ puddy = 1 olluck. At Mangalore, the mudi or morah = 1.27953 bushels = 45.85 litres, and = 38 seers. At Mysore, the morah = 1.3917 bushels = 49.04 litres, and = 40 seers.

ITALY.—The legal measures are metric. The old measures are given below for a few of the states; they are often discordant in the same state:

*Naples.*—The caraffa, the unit of liquid capacity for wine = 0.19202 gallon = 0.727 litre. Multiples, 60 caraffi = 1 barile; 22 barile = 1 botta; 2 botti = 1 carro. For oil, the quarto = 0.16352 gallon = 0.61894 litre; multiples, 16 quarti = 1 stajo; 16 staji = 1 salma; sub-multiple, ⅙ quarto = 1 misurelle. For dry measure, the tomolo = 1.5671 bushels = 55.224 litres; multiples, 36 tomoli = 1 carro; sub-multiple, $\frac{1}{24}$ tomolo = 1 misura.

*Rome.*—The boccale for wine = 0.48214 gallon = 1.825 litres. Multiples, 32 boccale = 1 barile; 16 barile = 1 botte. Sub-multiples, ¼ boccale = 1 foglietta; ¼ foglietta = 1 quartucco. Dry measure, the quarta = 2.0888 bushels = 73.605 litres; multiple, 4 quarti = 1 rubbio; sub-multiples, ¼ quarta = 1 starello; $\frac{8}{11}$ starello = 1 scorzo; ¼ scorzo = 1 quartucco.

*Sardinia.*—In Genoa, the barile for liquids = 29.6105 gallons = 74.23 litres; multiple, 2 barili = 1 mezzaruola; sub-multiples, $\frac{1}{50}$ barile = 1 pinta; $\frac{1}{90}$ barile = 1 amola. In Turin, the rubbio for liquids = 2.4658 gallons = 9.22 litres; multiples, 6 rubbij = 1 brenta; 10 brente = 1 carro; sub-multiples, ⅛ rubbio = 1 pinta; ½ pinta = 1 boccale; ½ boccale = 1 quartino. For dry measure, in Genoa, the mina = 3.4253 bushels = 120.70 litres; sub-multiples, ⅛ mina = 1 quarto; $\frac{1}{12}$ quarto = 1 gombetta. In Turin, the sacco = 3.26443 bushels = 115.03 litres; sub-multiples, ⅓ sacco = 1 stajo; ½ stajo = 1 mina; ½ mina = 1 quartièra; ¼ quartièra = 1 copello; $\frac{1}{20}$ copello = 1 cucchiaro.

*Tuscany.*—The fiasco for wine = 2.2075 quarts = 2.089 litres. Multiple, 20 fiasci = 1 barile. Sub-multiples, ½ fiasco = 1 boccale; ½ boccale = 1 mezzetta; ½ mezzetta = 1 quartucco. For oil, the barile = 16 fiasci; 2 barile = 1 soma. Dry measure, the sacco = 2.0739 bushels = 73.08 litres; multiple, 8 sacci = 1 moggio; sub-multiples, ⅓ sacco = 1 stajo; ½ stajo = 1 mina; ½ mina = 1 quarto; ¼ quarto = 1 metadella; ½ metadella = 1 mezzetta; ½ mezzetta = 1 quartuccio; ½ quartuccio = 1 bussolo.

JAPAN.—The koku = 6482690 Japanese cubic lines = 31.737 gallons = 180.39 litres. Sub-multiples, $\frac{1}{10}$ koku = 1 to; $\frac{1}{10}$ to = 1 sho; $\frac{1}{10}$ sho = 1 go. The measures of capacity are square wooden boxes with a diagonal iron rod stretched across the top, the upper surface of which is on a plane with the rim of the box.

MEXICO.—The legal system is the metric. In liquid measure the frasco = 2.25 quarts = 2.13 litres, is still used. In dry measure, the fanega = 1.603 bushels = 56.40 litres.

MOROCCO.—No system well ascertained. The muhd or mud, for dry measure, is said to be = 5.184 bushels = 182.669 litres.

NETHERLANDS.—The measures are metric.

Norway.—The kanna is the unit for liquids = 2.0416 qts. = 1.932 litres. Multiple, 48 kannas = 1 tunna. Sub-multiples, $\frac{1}{2}$ kanna = 1 stop; $\frac{1}{4}$ stop = 1 qwarter; $\frac{1}{4}$ qwarter = 1 jungfrus. For dry measure, the span = 2.0774 bushels = 73.25 litres, is the unit; multiple, 2 span = 1 tunna; sub-multiples, $\frac{1}{4}$ span = 1 fjerding; $\frac{1}{4}$ fjerding = 1 kappe; $\frac{1}{7}$ fjerding = 1 kanna; $\frac{1}{2}$ kanna = 1 stop; $\frac{1}{4}$ stop = 1 qwarter; $\frac{1}{4}$ qwarter = 1 ort.

Persia.—There is no distinction between measures of liquid and dry capacity. The artaba = 1.8514 bushels = 65.236 litres, is the unit. Sub-multiples, $\frac{1}{8}$ artaba = 1 collothun; $\frac{1}{25}$ artaba = 1 capicha; $\frac{1}{2}$ capicha = 1 chenica; $\frac{1}{4}$ chenica = 1 sextario.

Peru.—The metric system is legal, but Spanish measures continue to be used.

Portugal and Dependencies.—The metric is the legal system. Of the old liquid measures, the alquière, pote, or cantaro = 2.148 galls. = 8.27 litres, is the unit. Multiples, 2 alquières = 1 almude; 26 almudes = 1 pipa or bota; 2 pipas = 1 tonelada. Sub-multiples, $\frac{1}{6}$ alquière = 1 canada; $\frac{1}{4}$ canada = 1 quartilho. The dry-measure unit is the fanga = 1.5347 bushels = 54.0768 litres in Lisbon; multiple, 15 fangas = 1 moio; sub-multiples, $\frac{1}{4}$ fanga = 1 alquière; $\frac{1}{4}$ alquière = 1 quarto; $\frac{1}{2}$ quarto = 1 outava; $\frac{1}{2}$ outava = 1 maquia.

Roumania.—The legal system is the metric. A liquid capacity-measure is used, called the viadra = 3.7434 gallons = 14.1699 litres. Sub-multiple, $\frac{1}{10}$ viadra = 1 oka. For dry measure, the kilo = 12.345 bushels = 434.98 litres.

Russia.—The liquid capacity unit is the vedro = 3.249 gallons = 12.299 litres. Sub-multiples, $\frac{1}{2}$ vedro = 1 polou-vedro; $\frac{1}{5}$ polou-vedro = 1 kronchka; $\frac{1}{4}$ polou-vedro = 1 stoff; $\frac{1}{2}$ stoff = 1 polou-stoff; $\frac{1}{2}$ polou-stoff = 1 quor. For dry measure, the tschetverik is the unit = 0.74397 bushel = 26.216 litres; multiples, 2 tschetveriks = 1 pajak; 2 pajaks = 1 osmina; 2 osminas = 1 tschetviert or chetviert. Sub-multiples, $\frac{1}{4}$ tschetverik = 1 tschetverka; $\frac{1}{2}$ tschetverka = 1 garnetz.

Sandwich Islands.—The weights are those of the U. S.

Siam.—For liquid measure, the can or canan = 1.299 qts. = 2.38 litres. Sub-multiple, $\frac{1}{4}$ canan = 1 leeng. The sesti is also a measure designed to hold 1 pecal = 135 lbs. av. = 61.25 kgms. of wheat or rice; multiple, 40 sesti = 1 cohi or coyang; sub-multiple, $\frac{1}{40}$ sesti = 1 sat. The actual capacity is variously stated, as estimated from the assumed specific gravity of the grain measured, and is put by Doursther = 80 litres = 21.136 gallons.

Spain.—The legal system is the metric. For liquid measure, the cantara or arroba is the unit. The arroba mayor, for wine = 4.079 gallons = 15.44 litres; the arroba menor, for oil = 3.186 gallons = 12.06 litres; sub-multiples, $\frac{1}{8}$ arroba = 1 azumbre; $\frac{1}{4}$ azumbre = 1 quartillo or cuartillo; $\frac{1}{4}$ quartillo = 1 copa. In dry measure the fanega is the unit = 1.5551 bushels = 54.80 litres; multiple, 12 fanegas = 1 cahiz; sub-multiples, $\frac{1}{12}$ fanega = 1 almude; $\frac{1}{2}$ almude = 1 medio; $\frac{1}{2}$ medio = 1 quartillo; $\frac{1}{4}$ quartillo = 1 racion; $\frac{1}{4}$ racion = 1 ochavillo.

Sweden.—Measures as in Norway, but in both liquid and dry measures the cubes of the measures of length are used.

Switzerland.—The measures are now metric in values. The unit is the pot = 1.585 quarts = 1.5 litres; multiples, 25 pots = 1 setier; 4 setiers = 1 muid. There is a binary subdivision of the pot down to the eighth. The old values of this measure were various in the different cantons. In Lausanne, Canton de Vaud, the pot was = 1.4133 quarts = 1.35 litres, and 30 pots were = 1 setier, and $\frac{1}{10}$ pot = 1 verre. In Neufchâtel, canton of the same name, the pot was = 1.5123 quarts = 1.9043 litres, and 16 pots = 1 setier. In Geneva the pot was = 1.0061 quarts = 0.9521 litre, and 2 pots = 1 quarteron. The dry-measure unit is the quarteron = 0.38312 bushel = 13.500 litres in Lausanne, or = 0.4976 bushel = 17.535 litres at Castels, or = 0.2266 bushel = 7.984 litres at Freiburg; multiple, 10 quarterons = 1 sac at Lausanne, Gruyères, Boll, and Murten; 12 quarterons = 1 sac at Corbières and Staeffis; and 8 quarterons = 1 sac at Castels; sub-multiples, $\frac{1}{10}$ quarteron = 1 émine; $\frac{1}{10}$ émine = 1 copet. At Freiburg, also 4 quarterons = 1 kopf; $\frac{1}{6}$ quarteron = 1 immi.

Tripoli.—The maturo is a measure for oil, now disused = 6.4161 gallons = 23.34 litres. The tibero is another old measure, formerly used for grain = 0.37857 bushel = 13.34 litres; multiples, 20 tiberi = 1 caffiso. The *caraffa* is the measure in actual use, and holds 3.4286 lbs. av. = 1.5552 kgm. of oil, or has about the capacity of 1.8387 quarts = 1.74 litres; multiple, 6 caraffas = 1 herbaia. For dry-measure, the temen = 0.76157 bushel = 26.836 litres; multiple, 4 temens = 1 ueba; sub-multiples, $\frac{1}{4}$ temen = 1 orbah; $\frac{1}{2}$ orbah = 1 nufsorbah.

Tunis.—The mettar or mataro for oil = 5.2268 galls. = 19.69 litres; the mettar for wine = half this capacity. For dry measure, the whiba or weba = $\frac{15}{16}$ bushel = 0.9375 bushel = 33.03 litres; multiple, 16 whibas = 1 caffiso; sub-multiple, $\frac{1}{12}$ whiba = 1 saws or zahs.

Turkey.—The almude for liquids = 1.38086 gallons. The kiloz, the unit of dry capacity = 0.99638 bushel = 35.11 litres; multiple, 4 kiloz = 1 fortin or fortun; sub-multiple, $\frac{1}{4}$ kiloz = 1 chénik.

United States of America.—The unit of liquid capacity is the wine-gallon of Queen Anne of 231 cubic inches. The origin of this gallon, which is somewhat curious, is explained in the article Gallon. It arose out of a series of legislative misapprehensions, and had been some time in use when sanctioned by the statute of 5 Anne (1706). The statute defined it by requiring that the gallon-measure should be a cylindrical vessel 7 inches in diameter and 6 inches deep. As the area of a circle = $\frac{1}{2}$ radius × circumference, and as diameter is to circumference nearly as 7 : 22, the capacity of such a vessel would be $\frac{1}{4} \times 7 \times 22 \times 6 = 7 \times 11 \times 3 = 231$. This gallon was adopted by the treasury department of the U. S. in 1832, on the recommendation of Mr. F. R. Hassler, chief of the U. S. Coast Survey, and the standard gallon-measure is a cylindrical brass vessel which at a temperature of maximum density—*i. e.* 39.1° F. or 3.945° C.—contains 58372.1754 grains = 8.33888220 pounds avoirdupois, of distilled water. The multiples of the gallon commonly cited are 31$\frac{1}{2}$ gallons = 1 barrel; 2 barrels = 1 hogshead; 42 gallons = 1 tierce; 2 tierces = 1 puncheon; 1$\frac{1}{2}$ puncheons = 1 pipe; 2 pipes = 1 tun; besides which are the smaller measures—10 gallons = 1 anker; 18 gallons = 1 runlet; but casks are made of any convenient size, and sales are made according to the number of gallons contained. Sub-multiples are—$\frac{1}{4}$ gallon = 1 quart; $\frac{1}{2}$ quart = 1 pint; $\frac{1}{4}$ pint = 1 gill. For dry measure the unit is the bushel, which is the Winchester bushel, made standard for England by statute of 13 Will. III. (1701), and abolished in 1826. Its capacity is 2150.42 cubic inches, and the standard gallon-measure is a cylindrical brass vessel which holds of distilled water, at the temperature of maximum density, 543391.89 grains = 77.627413 pounds avoirdupois; multiple, 36 bushels = 1 chaldron. Old English multiples, now disused, were—4 bushels = 1 coomb; 2 coombs = 1 quarter; 5 quarters = 1 wey or load; 2 weys = 1 last; sub-multiples, $\frac{1}{4}$ bushel = 1 peck; $\frac{1}{2}$ peck = 1 gallon; $\frac{1}{4}$ gallon = 1 quart; $\frac{1}{2}$ quart = 1 pint. For firewood, 128 cubic feet = 1 cord; sub-multiples, $\frac{1}{8}$ cord = 1 cord foot; $\frac{1}{16}$ cord foot = 1 cubic foot.

Uruguay.—System metric, but old Spanish measures are yet in use.

Venezuela.—Measures of Spanish origin.

West Indies.—Measures derived from their earliest European occupants. (For their distribution see *Length* measures above.)

Zanzibar.—The only native measure of capacity ascertained is the djezla = 7.305 bushels = 257.4 litres.

## IV. Weight.

Abyssinia.—The rotl or rottolo = 4800 grs. = $\frac{6}{7}$ pound troy = 311.035 grammes, is the unit. Multiple, 32 rotl = 1 maund. Sub-multiples, $\frac{1}{12}$ rotl = 1 wakea; $\frac{1}{10}$ wakea = 1 dirhem. Also, 12 dirhems = 1 mocha = 480 grains = 1 ounce troy.

Algeria.—The rotl or rottolo is the unit, and has different values for different commodities. The rotl-kébir (large rotl), for honey, butter, oil, dates, and soap = 1.806 lbs. avoirdupois = 0.81912 kgm.; the rotl-ghredouri, for fruits and leguminous vegetables = 1.35453 lbs. av. = 0.61434 kgm.; the rotl-feudi, for precious metals and gems = 1.0968 lbs. av. = 0.49743 kgm; and the rotl-attari, for drugs and commodities generally = 1.20403 lbs. av. = 0.54608 kgm. The rotl-feudi and the rotl-attari are subdivided into 16 onces each, the rotl-ghredouri into 18 onces, and the rotl-kébir into 24 onces. The rotl-attari has a multiple by 100, called the kantar-attari, for commodities generally; a multiple by 110 for cheese, almonds, cotton, and some other things, called the kantar-fromage; a multiple by 166 for honey, butter, oil, soap, etc., called the kantar-beurre; and a multiple, called the kantar de lin, of 200 rotl-attari. There are a kantar-ghredouri and a kantar-kébir, each of 100 times the corresponding rotl. The kharouba or karob is a small weight for pearls and jewels = 3 grains = 0.1944 gramme; multiple, 24 karobs = 1 métical.

Annam.—The cân or catti = 1.3775 lbs. av., or 624.913 grammes. Multiples, 10 cân = 1 yen; 5 yen = 1 binh; 2 binh = 1 ta; 5 ta = 1 quăn. Sub-multiples, $\frac{5}{8}$ cân = 1 nen; $\frac{1}{10}$ nen = 1 luong; $\frac{1}{10}$ luong or liang = 1 dong; $\frac{1}{10}$ dong = 1 phan; $\frac{1}{10}$ phan = 1 li. The li = 0.602 grain = 0.03905 gramme, and is fancifully subdivided decimally to the millionth part.

Arabia.—The unit of weight is the maund = 3 lbs. av. = 1.3608 kgms. Multiples, 10 maunds = 1 frazil; 15 frazils = 1 bahar. Sub-multiples, $\frac{1}{2}$ maund = 1 rottle; $\frac{1}{15}$ rottle

= 1 vakia. At Mocha the maund of coffee contains but 29 vakias. Egyptian weights are also used.

ARGENTINE CONFEDERATION.—The legal system is the metric; old Spanish weights are also in use.

AUSTRALIA.—The weights are British.

AUSTRIA.—Since Jan. 1, 1876, the legal weights are metric. The pfund is the old commercial unit. The pfund of Vienna = 1.2347 lbs. av. = 560 grammes; multiples, 20 pfund = 1 stein; 5 stein = 1 centner; 4 centner = 1 karch; 20 centner = 1 schifflast, or shipping ton; 40 centner = 1 ordinary last. The saum = 339.53 lbs. av. = 154 kgms. The saum for steel = 308.68 lbs. av. = 140 kgms.; sub-multiple, $\frac{1}{2}$ saum = 1 lägel. Sub-multiples of the pfund, $\frac{1}{2}$ pfund = 1 mark; $\frac{1}{2}$ mark = 1 vierding; $\frac{1}{4}$ vierding = 1 unze; $\frac{1}{2}$ unze = 1 loth; $\frac{1}{4}$ loth = 1 quentchen; $\frac{1}{4}$ quentchen = 1 pfennige. For precious metals the mark is the unit = 0.75226 lb. troy = 280.774 grammes; sub-multiples, $\frac{1}{16}$ mark = 1 loth; $\frac{1}{4}$ loth = 1 quentchen; $\frac{1}{4}$ quentchen = 1 pfennig. The karat for jewels = 3.1799 grains = 0.206085 gramme. For drugs, the pfund = 0.92843 lb. av. = 421.1287 grammes; sub-multiples, $\frac{1}{12}$ pfund = 1 unze; $\frac{1}{8}$ unze = 1 drachmen; $\frac{1}{3}$ drachmen = 1 scrupel; $\frac{1}{20}$ scrupel = 1 gran.

BELGIUM.—The weights are metric.

BIRMAH.—The vis of Rangoon = 3.3333$\frac{1}{2}$ lbs. av. = 1.511966 kgms. Multiple, 150 vis = 1 candy = 500 lbs. av. = 226.7959 kgms. Sub-multiples, $\frac{1}{100}$ vis = 1 tical; $\frac{1}{100}$ tical = 1 moos.

BOLIVIA.—The legal weights are metric; other weights in use are old Spanish. The quintal = 101.4179 lbs. av. = 46 kgms. Sub-multiple, $\frac{1}{4}$ quintal = 1 arroba.

BRAZIL.—The metric system is legal; other weights in use are of Portuguese origin. For gems, the quilate = 3.075 grains = 0.19458 gramme; for topazes, the outava = 57.17 grs.

CENTRAL AMERICA.—The weights used in these states are Spanish.

CHILI.—The legal system is metric.

CHINA.—The catty = 1.33333 lbs. = 604.7 grammes; multiples, 2 catties = 1 yin; 50 yin = 1 pecul or tam; sub-multiples, $\frac{1}{16}$ catty = 1 tael; $\frac{1}{10}$ tael = 1 mace. The shik = 160 lbs. av. = 72.575 kgms.; sub-multiple, $\frac{1}{4}$ shik = 1 kwan. The chu = $\frac{8}{9}$ drachm av. = 1.575 grammes; 10 chu = 1 lui.

COLOMBIA.—The legal system is the metric.

DENMARK.—The pund is the unit = 1.102368 lbs. av. = 500 grammes. This is the metric pound used by the old Zollverein. Multiple, 100 pund = 1 centner. Sub-multiples, $\frac{1}{10}$ pund = 1 quint; $\frac{1}{10}$ quint = 1 ort. The old Danish pund was $\frac{1}{62}$d part of the weight of a cubic foot of pure water at the ordinary temperature, and was = 1.10114 lbs. av. = 499.4 grammes; multiples, 16 pund = 1 lispund; 20 lispund = 1 skippund; sub-multiples, $\frac{1}{2}$ pund = 1 marc; $\frac{1}{8}$ marc = 1 once; $\frac{1}{2}$ once = 1 lod; $\frac{1}{4}$ lod = 1 quintin; $\frac{1}{4}$ quintin = 1 ort. The pund for precious metals was = 1.038 lbs. av. = 470.8 grammes; sub-multiples, $\frac{1}{2}$ pund = 1 marc; $\frac{1}{16}$ marc = 1 lod; $\frac{1}{4}$ lod = 1 quintin; $\frac{1}{4}$ quintin = 1 ort; $\frac{1}{16}$ ort = 1 as; $\frac{1}{8}$ as = 1 grain. For drugs, the pund = 0.788974 lb. av. = 357.85 grammes. This is the old pharmaceutical pfund of Nuremberg, Bavaria. Sub-multiples, $\frac{1}{12}$ pund = 1 unze; $\frac{1}{8}$ unze = 1 drachme; $\frac{1}{60}$ drachme = 1 gran.

ECUADOR.—The system is metric.

EGYPT.—The oka, occa, or oockeeyeh = 2.7275 lbs. av. = 1.237 kgms. Sub-multiples, $\frac{1}{400}$ oka = 1 darhim; $\frac{1}{24}$ darhim = 1 kérat; $\frac{1}{4}$ kérat = 1 kamha. Also, 144 darhims = 1 rotl or rottolo = 0.9819 lb. av. = 445.41 grammes, and 100 rotl = 1 cantaro.

FRANCE.—(See METRIC SYSTEM.) The old livre of Paris, called *livre poids de marc*, was = 1.0792857 lbs. av. = 489.5 grammes. Sub-multiples, $\frac{1}{2}$ livre = 1 marc; $\frac{1}{8}$ marc = 1 once; $\frac{1}{8}$ once = 1 gros; $\frac{1}{3}$ gros = 1 scrupule or denier; $\frac{1}{24}$ denier = 1 grain; $\frac{1}{24}$ grain = 1 prime or carobe.

GERMAN EMPIRE.—The only legal system since Jan. 1, 1873, is the metric. Previously, several of the states had introduced the system wholly or partially. The old weights in some of the states are given below:

*Baden.*—In 1810 the metric pfund = $\frac{1}{2}$ kilogramme = 500 grammes = 1.1023 lbs. av., was established by law, with decimal multiples and sub-multiples. Multiples, 10 pfund = 1 stein; 10 stein = 1 centner. Sub-multiples, $\frac{1}{10}$ pfund = 1 zehnling; $\frac{1}{10}$ zehnling = 1 centass; $\frac{1}{10}$ centass = 1 dekass or pfennig; $\frac{1}{10}$ pfennig = 1 ass. The pfund of Carlsruhe was = 1.0305 = 467.4 grammes, divided into 32 loth or 128 quentchen. For apothecaries' weight the same pfund was used in Baden and throughout the states now forming the German empire as is above given for Denmark, with similar subdivisions.

*Bavaria.*—The pfund of Bavaria, by law of 1811, was made = 560 grammes exactly = 1.23486 lbs. av. Sub-multiples, $\frac{1}{16}$ pfund = 1 once; $\frac{1}{2}$ once = 1 loth; $\frac{1}{4}$ loth = 1 quentchen. On joining the Zollverein in 1833, the metric pfund was introduced for customs purposes = 500 grammes = 1.10231 lbs. av., with the sub-multiples, $\frac{1}{4}$ pfund = 1 vierling; $\frac{1}{8}$ vierling = 1 loth; $\frac{1}{4}$ loth = 1 quentchen. For drugs, the same weights as in Baden.

*Bremen.*—The pfund = 1.09906 lbs. av. = 0.498 kgm. Sub-multiples, $\frac{1}{2}$ pfund = 1 marc; $\frac{1}{8}$ marc = 1 unze; $\frac{1}{2}$ unze = 1 loth; $\frac{1}{4}$ loth = 1 quentchen; $\frac{1}{4}$ quentchen = 1 ort. The centner = 116 pfund. For drugs, the same as in Baden.

*Brunswick.*—The pfund = 1.0305 lbs. av. = 0.4674 kgm., which was the old pfund of Carlsruhe, Baden. Sub-multiples, $\frac{1}{2}$ pfund = 1 mark; $\frac{1}{16}$ mark = 1 loth; $\frac{1}{4}$ loth = 1 quentchen; $\frac{1}{4}$ quentchen = 1 pfennig; $\frac{1}{2}$ pfennig = 1 heller. For drugs, the same as in Baden.

*Hamburg.*—The pfund = 1.0680286 = 0.4844 kgm. Sub-multiples, $\frac{1}{8}$ pfund = 1 mark; $\frac{1}{8}$ mark = 1 unze; $\frac{1}{2}$ unze = 1 loth; $\frac{1}{4}$ loth = 1 quentchen; $\frac{1}{4}$ quentchen = 1 pfennig. For drugs, the same as in Baden.

*Hanover.*—The pfund = 1.0797 = 0.4896 kgm. Sub-multiples, $\frac{1}{2}$ pfund = 1 mark; $\frac{1}{8}$ mark = 1 unze; $\frac{1}{2}$ unze = 1 loth; $\frac{1}{4}$ loth = 1 quentchen; $\frac{1}{4}$ quentchen = 1 örtchen. For drugs, the same as in Baden.

*Hesse-Cassel.*—The pfund = 1.06768 lbs. av. = 0.48424 kgm. Sub-multiples, $\frac{1}{16}$ pfund = 1 unze; $\frac{1}{2}$ unze = 1 loth; $\frac{1}{4}$ loth = 1 quentchen. For drugs, the weights are the same as in Baden.

*Hesse-Darmstadt.*—The commercial pfund for wholesale = 1.114106 lbs. av. = 0.505296 kgm. The retail commercial pfund = 1.03158 lbs. av. = 0.4679 kgm. Sub-multiples of both, $\frac{1}{2}$ pfund = 1 marc; $\frac{1}{8}$ marc = 1 once; $\frac{1}{2}$ once = 1 loth; $\frac{1}{4}$ loth = 1 quentchen; $\frac{1}{4}$ quentchen = 1 pfennig; $\frac{1}{2}$ pfennig = 1 heller. For drugs, the same weights as in Baden.

*Lubeck.*—The pfund = 1.0687 = 0.4846, almost identical with that of Hamburg, with which its sub-muitiples correspond. For drugs, the same weights are used as in Baden.

*Prussia.*—The pfund was fixed by law in 1816 at the weight of the $\frac{1}{66}$th part of a cubic fuss of distilled water weighed *in vacuo* at the temperature of 15° Réaumur; and, according to the report of a commission in 1826, is = 1.031236 lbs. av. = 467.7 grammes. Its subdivisions are the same as those above given for Darmstadt. For drugs, the same weights are used as in Baden. On the formation of the Zollverein the pfund of 500 grammes = 1.1023 lbs. av., was adopted, with multiples and sub-multiples as follows: 100 pfund = 1 centner; 3 centner = 1 tonne; $\frac{1}{30}$ pfund = 1 loth; $\frac{1}{10}$ loth = 1 quentchen; $\frac{1}{10}$ quentchen = 1 zent. Apothecaries' weight as in Baden. For precious metals and coinage, the marc, called the marc of Cologne = 233.77 grammes = 3608 grains troy, is the unit.

*Saxony.*—The weights are the same as given above for Brunswick. For drugs, the Nuremberg weights are used, as in Baden.

*Würtemberg.*—The old pfund = 1.03143 = 467.8 grammes, very closely approximating to that of Prussia, to which its subdivisions correspond. More recently, the Zollverein pfund of 500 grammes = 1.1023 lbs. av., has been used. For gold and silver, the mark = 3610 grains troy = 233.855 grammes.

GREAT BRITAIN.—For commercial purposes generally the pound avoirdupois = 7000 grains troy = 0.45359265 kgm., is the unit. Multiples, 14 pounds = 1 stone; 2 stone = 1 quarter; 4 quarters = 1 hundredweight; 20 hundredweight = 1 ton = 2240 lbs. = 1016.04754 kgms. Sub-multiples, $\frac{1}{16}$ lb. = 1 ounce = 28.35 grammes; $\frac{1}{16}$ ounce = 1 dram = 1.77184 grammes. For the precious metals and coinage, the pound troy = 5760 grains = 0.37324195 kgm.; sub-multiples, $\frac{1}{12}$ lb. = 1 ounce; $\frac{1}{20}$ ounce = 1 pennyweight; $\frac{1}{24}$ pennyweight = 1 grain. For drugs, the pound has the same weight, but is differently subdivided. Thus, $\frac{1}{12}$ lb. = 1 ounce; $\frac{1}{8}$ ounce = 1 drachm; $\frac{1}{3}$ drachm = 1 scruple; $\frac{1}{20}$ scruple = 1 grain.

GREECE.—The legal system is metric. The cantaro of 44 oke is also used. The cantaro of Patras = 116.31 lbs. av. = 52.75 kgms.; that of the Morea generally = 125.71 lbs. av. = 56.11 kgms. The gramme is used under the name drachma, the kilogramme as the mina, and 1$\frac{1}{2}$ kgms. = 1 talanton.

GUINEA.—The benda = 2.262 oz. av. = 64.12 grammes. Sub-multiples, $\frac{1}{2}$ benda = 1 benda-offa; $\frac{1}{4}$ benda-offa = 1 piso; $\frac{1}{2}$ piso = 1 aguirage; $\frac{1}{2}$ aguirage = 1 media-tabla = 30.925 grains troy = 2.0039 grammes. Multiples of the media-tabla are, also, 3 media-tabla = 1 quinto; 2 quintos = 1 seron; 1$\frac{7}{9}$ seron = 10$\frac{2}{3}$ media-tabla = 1 eggeba = 0.75396 oz. av. = 21.375 grammes. There is also a rotl = 0.95378 lbs. av. = 0.43263 kgm.

INDIA, BRITISH.—The metric system is legalized, but only as yet partially introduced. The native weights are very various in different cities and provinces.

*Bengal.*—The maund is the unit for large weights. At Calcutta, the maund of the British factory = 74.672 lbs. av. = 33.865 kgms; the maund of the bazaar of Bengal exceeds this 10 per cent. and = 82.1392 lbs. av. = 37.2515 kgms.

Grains are sold by the factory-maund, and liquids by the bazaar-maund: 40 maunds of grain = 1 khahoon; sub-multiples, $\frac{1}{8}$ maund = 1 pally; $\frac{1}{4}$ pally = 1 raik; $\frac{1}{4}$ raik = 1 khoonke; $\frac{1}{5}$ khoonke = 1 chattack. Sub-multiples of the bazaar-maund, $\frac{1}{8}$ maund = 1 pussaree; $\frac{1}{5}$ pussaree = 1 seer; $\frac{1}{4}$ seer = 1 pouah or pice; $\frac{1}{4}$ pouah = 1 chattack; $\frac{1}{5}$ chattack = 1 sicca.

*Bombay.*—The maund = 28 lbs. av. = 12.699 kgms. Multiple, 20 maunds = 1 candy. Sub-multiples, $\frac{1}{40}$ maund = 1 seer; $\frac{1}{30}$ seer = 1 pice; $\frac{5}{12}$ pice = 1 tauk. This is the maund of the capital; several others are used in the presidency.

*Madras.*—The native maund = 24.114 lbs. av. = 10.937 kgms.; the British maund = 25 lbs. av. = 11.339 kgms. Multiple, 20 maunds = 1 candy. Sub-multiples, $\frac{1}{8}$ maund = 1 visay or vis; $\frac{1}{5}$ vis = 1 seer; $\frac{1}{4}$ seer = 1 pollam; $\frac{1}{10}$ pollam = 1 varahun or pagoda.

Italy.—The metric system is now established by law. The old weights are given below for a few of the states:

*Naples.*—The rottolo, the unit-weight for ordinary commerce = 1.9645 lbs. av. = 0.891 kgm. Sub-multiple, $\frac{2}{25}$ rottolo = 1 libbra = 0.70717 lb. av. = 320.76 grammes. The libbra is the unit for precious metals, spices, cochineal, indigo, wax, and some few other things; the rottolo, for merchandise in general. Sub-multiples of the libbra are—$\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{30}$ oncia = 1 trapeso; $\frac{1}{20}$ trapeso = 1 accino. For drugs, the same libbra is subdivided thus: $\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{10}$ oncia = 1 drachma; $\frac{1}{3}$ drachma = 1 scrupolo; $\frac{1}{20}$ scrupolo = 1 accino.

*Rome.*—The libbra, the unit of commerce of the capital = 0.747714 lb. av. = 0.3391 kgm. Sub-multiples, $\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{24}$ oncia = 1 denaro; $\frac{1}{24}$ denaro = 1 grano. In other parts of the late Roman States the libbra has different values and is differently divided. In Bologna it is 0.79814 lb. av. = 362 grammes, and the sub-multiples are—$\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{8}$ oncia = 1 ottavo; $\frac{1}{2}$ ottavo = 1 ferlino; $\frac{1}{10}$ ferlino = 1 carato; $\frac{1}{4}$ carato = 1 grano.

*Sardinia.*—In the capital, the libbra = 0.81326 lb. av. = 368.85 grammes. Sub-multiples, $\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{8}$ oncia = 1 ottavo; $\frac{1}{3}$ ottavo = 1 denaro; $\frac{1}{24}$ denaro = 1 grano; $\frac{1}{24}$ grano = 1 granotino. For precious metals, the marco = $\frac{2}{3}$ libbra, is the unit; for drugs, the libbra = $\frac{5}{4}$ marco. In Genoa there is a libbra *peso grosso* and a libbra *peso sottile* or *peso scarso*. The former exceeds the latter by 10 per cent. The libbra peso scarso is used in ordinary commerce, and also for precious metals. It is = 0.69887 lb. av. = 317 grammes. Subdivisions, like those of the city of Rome.

*Tuscany.*—The libbra of Florence = 0.74864 = 339.55 grammes, and is very nearly equal to the libbra of Rome. Sub-multiples, $\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{8}$ oncia = 1 dramma; $\frac{1}{3}$ dramma = 1 denaro; $\frac{1}{24}$ denaro = 1 grano.

Japan.—The unit of weight, called the mome, or in modern times, the sen = 57.2705 grains troy = 3.756521 grammes, and is decimally subdivided to tenths, hundredths, and thousandths, and has decimal multiples up to 1000 sen = 1 ku-wan-me = 3.756521 kgms. For many kinds of goods, the kin, called by foreigners the catty = 160 sen = 1.325073 lbs. av. = 601.04 grammes, is used. This weight is different for various localities and commodities.

Mexico.—The legal weights are metric. Old Spanish names continue in use. The value of the old libra of the capital was 1.0143 lbs. av. = 460 grammes, divided into 16 onces. The libra of Vera Cruz was 1.01534 lbs. av. = 460.5 grammes. Both are derived from Spain.

Morocco.—The rotl is the unit, and at Mogadore = 1.186614 lbs. av. = 538.18 grammes; at Tangiers = 1.07086 lbs. av. = 481.15 grammes; elsewhere = 1.11243 lbs. av. = 504.54 grammes. Multiple, 100 rotl = 1 cantaro.

Netherlands.—The system is metric.

Norway.—The skälpund is the unit = 1.10114 lbs. av. = 499.4 grammes, and is identical with the pund of Denmark. Multiples, 20 skälpunds = 1 lispund; 400 lispunds = 1 skippund. Sub-multiples, $\frac{1}{2}$ pund = 1 marc; $\frac{1}{8}$ marc = 1 untz; $\frac{1}{2}$ untz = 1 lod; $\frac{1}{4}$ lod = 1 qwintin; $\frac{1}{4}$ qwintin = 1 ort.

Persia.—The rattel or rotl is the unit = 1.027 lbs. av. = 464.88 grammes. This is the value in Tauris. It is different at the capital, and in almost every other place of importance. Multiple, 6 rattels = 1 batman. Sub-multiples, $\frac{1}{50}$ rattel = 1 dirhem; $\frac{1}{2}$ dirhem = 1 mascal.

Peru.—The legal system is metric; Spanish weights and measures are still in use. The libra of Lima is identical with that of Mexico.

Portugal.—The unit is the arratel = 1.01186 lbs. av. = 459 grammes. Multiples, 32 arratels = 1 arroba; 4 arrobas = 1 quintal; 13½ quintals = 1 tonelada. Sub-multiples, $\frac{1}{16}$ arratel = 1 onça; $\frac{1}{8}$ onça = 1 outava; $\frac{1}{3}$ outava = 1 escropolo; $\frac{1}{24}$ escropolo = 1 grão. For the precious metals the marco of 8 onças = $\frac{1}{8}$ arratel, is the unit, similarly subdivided. For drugs, the libra of 12 onças = $\frac{3}{4}$ arratel, is employed.

Roumania.—The littra of Bucharest = 0.707143 lb. av. = 320.7 grammes. Multiples, 4 littra = 1 oka; 44 okas = 1 cantaro. Sub-multiple, $\frac{1}{100}$ littra = 1 drachma.

Russia.—The funte = 0.902643 lb. av. = 409.4 grammes. Multiples, 40 funtes = 1 pood; 10 poods = 1 berkowitz or berkovetz; 3 berkovetz = 1 packen. Sub-multiples, $\frac{1}{12}$ funte = 1 lana; $\frac{3}{8}$ lana = 1 loth; $\frac{1}{3}$ loth = 1 zolotnik or solotnik; $\frac{1}{96}$ zolotnik = 1 doli. The pharmaceutical funte = $\frac{7}{8}$ commercial funte, and is subdivided as in the U. S.

Siam.—The catty = 1.370 lbs. av. = 612.3 grammes. Multiple, 50 catties = 1 pecul. Sub-multiples, $\frac{1}{20}$ catty = 1 tael; $\frac{1}{4}$ tael = 1 tical.

Spain.—The present system is metric. The legal unit of the realm was previously the libra of Castile = 1.0143 lbs. av. = 460.0 grammes. Multiples, 25 libras = 1 arroba; 4 arrobas = 1 quintal; 20 quintals = 1 tonelada. Sub-multiples, $\frac{1}{2}$ libra = 1 marco; $\frac{1}{8}$ marco = 1 onza; $\frac{1}{8}$ onza = 1 ochava; $\frac{1}{2}$ ochava = 1 adarme; $\frac{1}{3}$ adarme = 1 tomine; $\frac{1}{12}$ tomine = 1 grano.

Sweden.—The skålpund = 0.93374 lb. av. = 423.54 grammes. Multiples, 100 skålpunds = 1 centner; 100 centners = 1 last. Sub-multiples, $\frac{1}{100}$ skålpund = 1 korn; $\frac{1}{100}$ korn = 1 ort. Old subdivision, $\frac{1}{16}$ skålpund = 1 uns; $\frac{1}{2}$ uns = 1 lod; $\frac{1}{4}$ lod = 1 qwintin.

Switzerland.—The weights have metric values, the unit being the livre or pfund of the Zollverein = $\frac{1}{2}$ kilogramme = 1.10231 lbs. av. = 500 grammes. Multiple, 100 livres = 1 quintal. Sub-multiples, decimal, and also $\frac{1}{16}$ livre = 1 once; $\frac{1}{2}$ once = 1 loth.

Tripoli.—The rotl = 1.09714 lbs. av. = 497.60 grammes. Multiples, 2½ rotl = 1 oka; 40 oke = 1 cantaro. Sub-multiples, $\frac{1}{16}$ rotl = 1 uckia; $\frac{1}{10}$ uckia = 1 drachma; $\frac{1}{16}$ drachma = 1 kharouba. For precious metals, the metical or miscal = 24 kharouba = 72 grains troy = 4.665 grammes.

Tunis.—The rotl = 1.1107 lbs. av. = 503.66 grms. Sub-multiples, $\frac{1}{16}$ rotl = 1 uckia; $\frac{1}{4}$ uckia = 1 metical or termine.

Turkey.—The chequi or cheki, also called yusdrome, of Constantinople = 0.707143 lb. av. = 320.7 grammes. Multiples, 4 chequis = 1 oka; 44 okas = 1 kantar or cantaro. Sub-multiples, $\frac{1}{100}$ chequi = 1 dirhem or drachma; $\frac{1}{4}$ dirhem = 1 deuke; $\frac{1}{4}$ deuke = 1 karat. The chequi of opium = 250 dirhems = 2½ ordinary chequi. At Smyrna the ordinary chequi = 0.7082143 lb. av. = 321.2 grammes, similarly subdivided; and the chequi of opium = 2½ ordinary chequi, as above. The batman = 6 okas.

United States of America.—The weights are identical with those of Great Britain.

Uruguay.—The legal system is metric; old Spanish weights continue in use. The libra = 1.0143 lbs. av. = 460.0 grammes.

West Indies.—The weights are those introduced by the first occupants from their respective countries. (For the distribution see *Measures of Length.*)

Zanzibar.—The rotl = 0.98006 lb. av. = 444.547 grammes. Multiple, 36 rotl = 1 franzella. Also, the mane = 3.0071 lbs. av. = 1.365 kgms., and the bazla = 34.226 lbs. av. = 15.525 kgms.

On this subject the following works may be consulted with advantage: Kelly's *Universal Cambist* (2d ed., London, 1842); Tate's *Modern Cambist* (12th ed., London, 1862); Tarbé, *Manuel des Poids et Mesures* (Paris, 1839); Altés, *Traité des Monnaies, Poids et Mesures* (Marseilles, 1832); Nelkenbrecher, *Allgemeines Taschenbuch* (Berlin, 1832); Paucton, *Metrologie, ou Traité des Mesures, Poids et Monnaies des anciens Peuples et des modernes* (Paris, 1780); Shuckburgh Evelyn, *Experiments in Weights and Measures, Phil. Trans.* (London, 1798); Kater, *Account of the Operations of the Standards Commission of 1818, Phil. Trans.* (London, 1826); Doursther, *Dictionnaire universel des Poids et Mesures, anciens et modernes, contenant des Tables des Monnaies de tous les Pays* (Brussels, 1840). [This is a wonderful monument of industry and accuracy, and is almost exhaustive of the subject.] Alexander, *Universal Dictionary of Weights and Measures* (Baltimore, 1850); Hassler, *Reports on Construction of Standards,* etc., made to the secretary of the treasury of the U. S. (Washington, 1832–43); Bache, *Reports of Bureau of Weights and Measures 1845 et seq.* (Washington, 1845–63); Adams, J. Q., *Report to the H. of R. of the U. S. on Weights and Measures* (Washington, 1821); Boeckh, *Metrologische Untersuchungen* (Berlin, 1838); *Royal Standards Commission of 1818, Reports to the Prince Regent* (i.–iii., Parliamentary Blue-Books, London, 1819–21); *Royal Standards Commission of 1867–68, Reports to Her Majesty the Queen* (i.–v., Parliamentary Blue-Books, London, 1868–71); Herschel, J., *The Yard, the Pendulum, and the Mètre,* etc. (Leeds, 1863); Barnard, *The Metric System* (New York, 1872); Hübner, *Statistische Tafel aller Lander der Erde* (Berlin, 1876); Clarke, *Weights and Measures of all Nations* (New York, 1875); Browne, *Money, Weights, and Measures of the Chief Commercial Traders in the World, with British Equivalents* (Lond., 1876).

F. A. P. Barnard.

**Welck'er** (Friedrich Gottlieb), b. at Grünberg, Hesse, Nov. 4, 1784; studied philology at the University of Giessen; lived (1806–09) as tutor in the house of W. von Humboldt in Rome, in intimate intercourse with Zoega, Thorwaldsen, etc.; was appointed professor of archæology at Giessen in 1809; volunteered in the French campaigns 1814–16; became professor at Göttingen in 1816, and at Bonn in 1819. D. at Heidelberg Mar. 10, 1869. He exercised great influence on the study of Greek literature and art both by his lectures and by his numerous writings, of which the most prominent are—*Die Æschylische Trilogie* (1824), *Die Griechische Tragödien mit Rücksicht auf den epischen Cyklus* (3 vols., 1839), *Griechische Götterlehre* (3 vols., 1857–62), etc.

**Wells** (William Charles), M. D., F. R. S., b. at Charleston, S. C., in May, 1757; educated at Dumfries and at Edinburgh, Scotland; studied medicine at Charleston; was a surgeon in the English service in Holland; completed his medical studies at Edinburgh Dec., 1780; returned to Charleston early in 1781; practised medicine there, and became a printer, bookseller, and merchant, being noted, like his father, for his loyalty to Great Britain; went with the loyal troops to St. Augustine, Fla., Dec., 1782; published there the first weekly newspaper in that province, and was captain of loyal volunteers; went to England May, 1784; settled in London 1785; became physician to the Finsbury Dispensary 1790, and to St. Thomas's Hospital 1798; published his *Essay on Single Vision with Two Eyes* (1792) and his celebrated *Essay on Dew* (1814), for which he was awarded the gold and silver Rumford medals by the Royal Society 1816. D. in London Sept. 18, 1817. His *Autobiography* was published in 1818, and a new ed. of his *Essay on Dew* appeared in 1866.

**Wells** (William Harvey), b. at Tolland, Conn., in 1812; was principal of the Massachusetts Normal School at Westfield for some years, and subsequently superintendent of public schools at Chicago, Ill. He was one of the original editors of the *Massachusetts Teacher;* has contributed to several educational journals; is author of a *Grammar of the English Language* (1846), of *A Graded Course of Instruction for Public Schools* (1848), and other educational works.

**Welsh** (David), D. D., b. at Moffat, Dumfriesshire, Scotland, Dec. 11, 1793; educated at the High School and University of Edinburgh; became minister of the parish of Crossmichael 1821, and of St. David's, Glasgow, 1827; was professor of church history in the University of Edinburgh 1831–43; visited Germany 1834; was prominently associated with Drs. Chalmers and Gordon in 1843 in the foundation of the Free Church of Scotland, of whose General Assembly he was the first moderator, thereby sacrificing his professorship and the secretaryship of the Bible Board; became professor of ecclesiastical history in the new college of the Free Church, and was the founder and first editor of the *North British Review* 1844. D. at Camis Eskin, on the Clyde, Apr. 24, 1845. Author of *An Account of the Life and Writings of Dr. Thomas Brown* (1825), *Sermons on Practical Subjects* (1834), and *Elements of Church History* (1844), and wrote the articles *Jesus* and *Jews* in the *Encyclopædia Britannica* (7th and 8th eds.). A volume of posthumous *Sermons* (1846) was edited, with a *Memoir*, by Alexander Dunlop, Esq.

**Welsh,** or **Welch** (John), b. in Scotland about 1568; graduated at the University of Edinburgh 1588; became parish minister of Selkirk 1589, of Ayr 1590, and of Kirkcudbright 1594; was noted as a pulpit-orator; preached before the General Assembly (1596) a sermon which was denounced by his enemies as "violent, seditious, and treasonable," being adverse to the royal project of suppressing the general assemblies, for which he was prosecuted by the agents of the king and outlawed, but relieved from the sentence after six months; settled at Ayr 1600; was imprisoned for opposition to royal dictation in ecclesiastical affairs, tried for high treason, and sentenced to exile Jan., 1606; went to France, and there labored many years, at St. Jean d'Angély, among the Huguenots, by whom he was much esteemed. His wife, Elizabeth, was the youngest daughter of John Knox. D. at London in Mar., 1622. His *Life*, by Rev. James Young, appeared in 1866.

**Welsh** (William), b. in Philadelphia, Pa., about 1810; became a prominent merchant of that city, where he has filled many public posts, including the presidency of the board of trusts, and is widely known as a philanthropist, especially in connection with the Indian peace commission, of which he was one of the members during the early years of the administration of Pres. Grant, but resigned in consequence of differences with the Indian bureau. He is a director of Girard College; was for some years proprietor of the *North American* and of the *Philadelphia Gazette*. Author of *Lay Co-operation in St. Mark's Church* (1861), *Letters on the Home Missionary Work of the P. E. Church* (1863), *The Bishop Potter Memorial Home* (1868), and (with Bishop Whipple and Rev. S. D. Hinman) *Taopi and his Friends, or Indians' Wrongs and Rights*, etc. (1869).—His brother and business partner, John, is also prominent as a philanthropist.

**What Cheer,** p.-v., Keokuk co., Ia., on Coal Creek, a tributary of North Skunk River, 45 miles S. W. of Iowa City, has 1 church, 1 graded school, and 2 grist-mills. It is a coal-mart for the neighboring country, over 200,000 bushels having been mined in 1876. J. Andrews.

**Wheat'on** (Frank), b. in Providence, R. I., May 8, 1833; educated for the profession of civil engineering at Brown University; employed as assistant on the U. S. and Mexican boundary survey and government surveys 1850–55, when appointed (Mar. 3) first lieutenant in the 1st U. S. Cavalry; served on frontier duty, and engaged in combat on Wood River Aug. 26, 1856: Cheyenne expedition 1857, participating in the battle of Solomon's Fork, etc.; appointed A. D. C. to Gen. P. F. Smith Nov., 1857, and rejoined his regiment July, 1858, and on frontier duty until June, 1860; became captain Mar., 1861, and engaged in mustering New York volunteers Apr.–July; appointed lieutenant-colonel 2d R. I. Vols. July 16, and engaged in the battle of Bull Run, July 21, succeeding to command of the regiment during the battle upon the fall of Col. Slocum; led his regiment through the Peninsular campaign, at the second battle of Bull Run, Chantilly, Antietam, and Fredericksburg; promoted brigadier-general of volunteers from Nov. 29, 1862, and commanded a brigade 6th corps at the storming of Marye Heights and battle of Salem Heights, May 3–4, 1863; in command of a division at battle of Gettysburg; detached from the Army of the Potomac Dec. 30, 1863, to defence of Harper's Ferry; rejoined that army Mar., 1864, and in command of brigade 6th corps from Wilderness battles to front of Petersburg; detached with his corps to defence of Washington July, 1864, participating in the Shenandoah campaign, and in command of a division from Sept. 20 to close of the war; was brevetted from lieutenant-colonel to major-general for gallantry in battle, and in July, 1866, appointed lieutenant-colonel 39th U. S. Infantry; became colonel 2d Infantry in 1874.

**Wheel'er** (Daniel), b. in London, England, in 1771; served six years in the British navy; enlisted in the army as a private soldier; rose to the rank of sergeant-major; joined the Society of Friends 1799; became a tradesman; began to preach 1815; was employed several years from 1818 in Russia by the emperor Alexander, superintending works and agriculture; spent his closing years in missionary travels in Australasia and Oceanica. D. in New York City in 1840. Four volumes of *Extracts* from his letters and journals were published 1835–39. A *Memoir* by his son Daniel appeared in 1842, and another was published in 1859.

**Wheeler** (John), D. D., b. at Grafton, Vt., Mar. 11, 1798; settled at Orford, N. H., in 1804; graduated at Dartmouth College 1816, at Andover Seminary 1819; was pastor of a church at Windsor, Vt., 1821–33, and president of the University of Vermont 1833–48. D. at Burlington, Vt., Apr. 16, 1862. He published several funeral sermons and historical and anniversary discourses.

**White'bait,** a name given in England to small fishes which were long supposed to belong to a peculiar species (*Clupea alba*), and even to a special generic type (*Rogenia*) of the Clupeidæ, but which are now known to be merely the young of the common herring (*Clupea harengus*). The differences in physiognomy and in dentition between the young and old of the Clupeæ are sufficiently considerable to have afforded some reasons for a distinction originally, especially in connection with the differences of habits. The name "whitebait" is limited to fishes under six inches in length and whose sides are almost uniformly white. Such fishes begin to make their appearance in the river Thames in England about the end of March or early in April, and during the summer months are caught in immense quantities, and are served up to the epicures who frequent, for the purpose of eating them, the taverns of Greenwich and Blackwall. They are mostly fried with fine flour: it has been customary for the cabinet ministers and parliamentary leaders of England to mark the parliamentary season with a dinner of which the chief dainty is the whitebait. Theodore Gill.

**White'fish,** a name given to fishes of the family Salmonidæ and genus *Coregonus*. These have the form essentially similar to that of the salmons and trouts, although less graceful, and with a stouter tail; the scales are also larger, but are of moderate size; the mouth has a narrow cleft, and the upper jaw projects more or less beyond it, or is truncated; the maxillary bones are short and

broad; the teeth are wanting or extremely minute; the suborbital bones are well developed; the dorsal fin has 13 to 15 rays, the anal 13 to 16; the adipose dorsal fin is moderately developed; the stomach recalls a horse-shoe by its form; the pyloric appendages are very numerous. The species are generally distributed in the colder waters of the northern hemisphere, especially affect the still waters of lakes and ponds, and are rather local in their distribution. About 30 species are known, distributed between Europe, Asia, and North America. Among the most notable of the American species is the *Coregonus albus*, or common whitefish of the lakes. This is one of the most important of the economical fishes of the great system of northern lakes, and employs a large capital. Extensive warehouses exist for its storage in and near the large cities and towns on the lake borders. (For some statistics respecting the species see FISHERIES, in CYCLOPÆDIA.) THEODORE GILL.

**White'hall,** v. of Livingston parish, La., on the Amite, 75 miles from New Orleans, with which it has communication twice a week by the Amite River packets; has 1 newspaper, manufactures shingles, staves, etc., and is the shipping-point for the produce of the surrounding country. P. about 200. ROBT. BENEFIELD, ED. "WHITEHALL GAZETTE."

**Wil'lard** (ARCHIBALD M.), b. at Bedford, near Cleveland, O., Aug. 22, 1836; received a rather scanty instruction in drawing and painting; worked as an ornamental painter in a carriage-factory; served during the war, first in the 86th Ohio Vols., then in the 176th; made a more thorough study of painting under J. O. Eaton of New York, and was very successful in 1874 with his *Roman Prisoner*, and in 1876 with his *Yankee Doodle*.

**Wil'lis** (FREDERICK ARTHUR), entered the British army as ensign in 1844; advanced through successive grades to be colonel in 1865; was distinguished in the Indian mutiny of 1857, being present with Sir Henry Havelock in the actions of June; commanded the 84th regiment, and was severely wounded at the relief of Lucknow; commanded right column at storming of Hirn Khannah; with Outram at the Alumbagh; present at the fall of Lucknow. Brevetted major and lieutenant-colonel and created a C. B. for gallantry.

**Wood'ford** (STEWART L.), LL.D., b. Sept. 3, 1835, in New York City; graduated at Columbia College 1854; appointed assistant U. S. attorney 1861; entered the U. S. volunteer army in 1862, and was in active service till he resigned in 1865, having been chief of staff in the department of the South, military commandant of Charleston, Savannah, etc., attaining the rank of colonel and brevet brigadier-general; elected lieutenant-governor of New York in 1866; defeated as Republican candidate for governor by Mr. Hoffman in 1870; elected to Congress in 1872; also chosen Presidential elector at large and made chairman of the New York electoral college in 1872; appointed U. S. attorney at New York 1877; is trustee of Cornell University, and author of several pamphlets on classical, financial, and legal subjects. F. A. P. BARNARD.

**Wool-Printing,** a process somewhat analogous to CALICO-PRINTING (which see in CYCLOPÆDIA), by which figures and colors are impressed and fixed on woollen goods. As woollen goods receive and hold colors printed on them more readily than cotton goods, the proportion among the lighter fabrics which are printed is greater than in cottons or silk goods. Some of the lighter woollen fabrics are woven in figures and colors, as the checks, plaids, etc., woven in the Crompton loom, and some of the figured worsted goods, upholstery and coach laces, etc., which are wrought on looms with Jacquard attachments. But all the figured delaines, and many of the figured worsted goods, scarfs, ties, some descriptions of shawls, felt and woollen druggets, and the so-called Crossley printed carpets, carriage-cloths, a part of the woollen quilts, and many of the felt skirtings, are printed. The process varies little from that employed in printing silk and cotton goods, the patterns and colors being applied either by blocks or by cylinders, but as wool is more susceptible to mordants than cotton, the colors are generally fast. (See WOOL, etc.) L. P. BROCKETT.

**Wool, Woollen Manufactures, and the Wool-Trade.** (1) *Wool.*—Strictly, wool is the covering or fleece of the sheep, but the term has been extended to include the hair of the angora, cashmere, and other goats, the hairy fleece of the alpaca, vicuna, and other species of the llama, the soft down from the belly of the camel, several kinds of fur which are spun and woven, and even cows-hair, which is made up into a cheap quality of woollen goods. Wool is, however, to be distinguished from all these varieties of hair, as well as from all vegetable fibres, by the corrugated character of its fibres and by its property of felting, which is due to the scales or imbrications which overlap each other along the course of its fibres, and which, under certain conditions, from their corrugation, interlock with each other and form a felted fabric. (See FELT and HAT-MAKING.) Hair possesses very little of this felting property, but by long beating and rubbing develops it to some extent. Wool was the earliest of the textile fibres to be used for the purpose of clothing, and the transition from the use of the pelts rudely fastened together, which formed the only garment of the pre-historic man, as it does of some of the savage tribes at the present day, was made at a very early period in the history of the race. The earliest woven cloths were made from the wool of the sheep, and perhaps a century or two later the hair of the goat was used for the same purpose; but both preceded fabrics of linen and silk. The use of wool in the manufacture of clothing early became universal among all the more civilized nations of the world. Garments, of all sorts—royal robes, head-dresses, and shawls of the finest wool—as well as tent-coverings, carpets, and curtains of that which was of coarser texture, were produced by the Asiatics in such profusion that it would seem to have been for ages almost the only textile in use. The imperial purple of Rome and the kingly robes of all the Oriental nations were of pure wool colored with the Tyrian dye, whose perfect beauty, after being lost for ages, has been reproduced in our own time by the superb aniline dyes. Sheep formed a large part of the wealth of the Oriental nations, particularly of those which were more or less nomadic in their habits; and as these were kept very largely for food, though shorn every year, it is remarkable that in the absence of any special efforts to improve the character of their wool it should have retained its good qualities to such an extent as to enable those nations with their rude processes to have produced fabrics of such delicate and exquisitely fine texture, as we know from the testimony of the writers of those times, issued from their looms.

The first attempts to improve the breeds of sheep with special reference to the production of a finer quality of wool were made by the Romans about the second century B. C. Their Tarrentian sheep produced a long and finely-stapled wool, and their fleeces were very heavy, but the color was either brown or black, and the sheep were so delicate in constitution that they were reared with difficulty, and were kept covered even in the mild climate of Italy. Columella, an eminent Roman agricultural writer, whose active life was passed in the first forty years of our era, relates in his *Re Rustica* that his uncle, Marcus Columella, who was a wealthy agriculturist in Spain, transported some white African rams of great size and beauty to his estate in Boetica (a part of the present province of Estremadura), and by continually crossing them with his Tarrentian ewes and their progeny succeeded in producing a breed of white fine-woolled sheep of vigorous and hardy constitution and yielding a heavy fleece. This cross is supposed by many to have been the original of the Spanish merino sheep, which, with its various modifications and crossings, has been the parent of most of the fine-woolled sheep of Europe and America. Its transportation to France and careful improvement there have led to the production of the French merino, one of the finest of the long-wool breeds. Its introduction into Germany, and modification by crossing and by climatic influences, have produced the fine Saxon wools, adapted to the making of the best broadcloths; and the French sheep of Naz, which yields a still finer and more silky wool of great lustre, though now a distinct breed, bears traces of its early merino origin. In America the Spanish merino, introduced here by Delessert, Livingston, Col. Humphreys, and William Jarvis between 1801 and 1812, has exerted a wide influence, and together with the Saxony sheep, the sheep of Naz, and the French merino constitutes to this day the largest proportion of those flocks which are grown mainly for their wool. The Australian and Cape Colony wools are also largely indebted to the merino sheep for their good qualities. During the last thirty or forty years the greatly-increased demand for mutton as an article of food has led to the breeding of sheep which have larger food-producing value, and with which the wool is an incidental rather than the principal product. The Leicester, Cotswold, and South Down among the English sheep are the best of this class, while the undistinguished breeds of South America, as well as those of our Western States, have some of the same characteristics. These all yield coarser wools, and while the best grades are valuable for the worsted manufacture, for which our native wools are not adapted, the coarser are equally in demand for carpets, friezes, and negro cloths.

Wool is divided by the sorters primarily into pulled and clipped or fleece wools, the former being pulled by the roots from the pelt or skin of the dead animal, and the latter clipped or shorn from the living one. The clipped or fleece wools form the greater part of the wool in market, and these are again divided into long and short staple, or clothing and combing wools. These, again, are classed accord-

ing to their fineness, though as a rule the short-staple clothing or carding wools are much finer than the combing wools, and they also possess the felting property in a high degree, having more serratures or scales to interlock than the others. The clothing wools are used mainly for broadcloths and the thicker woollen cloths; the finer combing wools for soft and thin fabrics for women's wear; the medium for worsted goods, delaines, alpacas, mohairs, etc.; and the coarser for carpets, blankets, and coarse goods generally. The quantity of wool grown has increased very rapidly during the present century in Europe, America, Australia, and Southern Africa. In Asia, where the sheep is valuable alike for its flesh, its fleece, and its pelt, it does not probably vary much from what it was in past ages. The increase in quantity in Europe and America has been largely due to improved methods of breeding and feeding the sheep, which caused them to mature earlier and to yield larger and more uniform fleeces. Much of this improvement and the introduction of the new Leicester breed, the Lincoln, the South and Norfolk Downs, the Dorset and Cheviot, now the best grades of English wools, were due to Robert Bakewell of Dishley and to John Ellman and Jonas Mills, his enterprising and successful competitors in this good work. In this country, since the time of Humphrey and Livingston, already mentioned, the most eminent and successful wool-growers have been Messrs. Stephen Atwood, H. S. Randall, Grove, D. C. Collins, William Chamberlain, Edwin Hammond, and George Geddes. The increase in the production and consumption of wool in Great Britain during the present century is enormous. In 1801 the wool-clip of the United Kingdom amounted to 94,000,000 pounds, and the imports of unmanufactured wool to 8,000,000 pounds more. In 1828 the production was about 112,000,000 pounds, and the imports in round numbers 30,000,000. In 1851 the production was 208,000,000 pounds, and the importation 83,000,000. In 1865 the production was estimated at 250,000,000 pounds, and the importation was 212,206,000 pounds. The next ten years increased the production to 298,000,000 pounds, and the importation to 325,000,000 pounds; and to this was to be added for manufacturing purposes about 85,000,000 pounds of shoddy and wool extract. The exportation of wool at this time was, however, about 100,000,000 pounds. The wool production of France has increased almost as rapidly as that of Great Britain, though mainly in the finer descriptions of wool. France imports also considerable quantities of fine wools from other countries. The Australian colony of New South Wales alone exported in 1875, 75,600,000 pounds of wool. In the U. S. the demands for wool for our own manufactures have increased the production from very small beginnings to 193,000,000 pounds in 1875, and about 195,000,000 pounds in 1876 (of which 51,000,000 were from California), while the amount imported was nearly 55,000,000 pounds in 1875 and 44,642,836 pounds in 1876. Our importation consists of three kinds of wool, neither of which we produce to any great extent—viz. the fine wools of Saxony for broadcloths, etc., the Leicester and other combing wools of high lustre for worsted goods, from Canada and Great Britain, and the coarse long-stapled South American wools for carpets, etc.

(2) *Woollen Manufactures.*—The manufacture of wool into fabrics for clothing is one of the oldest industries in the world. At precisely what date the primitive man, or rather the primitive woman, discovered that the coarse wool of the sheep, the first of domesticated animals, could be spun into long threads, woven on the rude and improvised looms, and then, by rubbing with clay and beating in water, thickened or fulled till it furnished a satisfactory substitute for the pelts of the sheep, which had till then formed the clothing of man, history does not inform us; but it must have been prior to that dispersion of the nations which took place on the plains of Shinar, for this and the traditions of the Creation and the Flood are the only things common to all the tribes of the world. From these rude garments the transition to those of finer and more skilful workmanship was gradual; the production of dyed garments, of shawls, and of carpets, often of elaborate patterns and requiring protracted labor, was attempted at a very early period, and the manufacture of tent and curtain cloths, of tapestry hangings embroidered with needlework, and of those vestments of lamb's wool and the rich imperial purple robes, came somewhat later. Some of the Persian, Greek, and Roman cloths, robes, and shawls must have been very beautiful; but in the ages which followed the downfall of the Western Roman empire the art of manufacturing them, like most of the fine arts, was nearly lost; the says and serges of the Dark and the Middle Ages were made from coarse and harsh wools, and were not what we should regard as pleasant or desirable goods for wear. The rough friezes, made of still coarser wool in Friesland, were still more objectionable, and the manufacture, such as it was, existed mainly in Florence, in Flanders, in England, and in France. After the thirteenth or fourteenth century silks, satins, and velvets became the favorite and distinguishing clothing of the wealthy. Until after the period of the Reformation the manufacture of woollen goods was almost entirely domestic; the large spinning-wheel and the reel had indeed taken the place of the distaff; and the hand-loom, gradually improved, of the rude contrivances of the Oriental weavers. Among the thousands engaged in this domestic manufacture, some possessed greater manual skill and higher ingenuity than others, and consequently their cloths were more in demand; and the assembling of their looms and spinning-wheels in a single building gave them some advantages. The dyeing and fulling of the cloths was a separate business, and for this a water-power was required, and so fulling-mills sprang up wherever there were considerable quantities of cloths made. The use of the teasel for combing out a nap on the fulled cloths dates from an unknown antiquity. There were frauds in those days—stretching of the goods and the use of flocks or chopped wool—the predecessor of the shoddy of our day—to give the cloths a fraudulent appearance of greater thickness and body. From the end of the thirteenth to the end of the seventeenth century this domestic manufacture of worsteds, baizes, kerseys, serges, friezes, broadcloths, and other cloths was carried on very extensively in England, and considerable quantities of each were exported. The English cloths were mainly of coarse qualities, and inferior to some of those made on the Continent, the Spanish and Flemish fine wools enabling them to make finer and more desirable goods. In the eighteenth century the manufacture of both worsteds and woollens began to be concentrated in Yorkshire, and Leeds, Stroud, Chippenham, and Huddersfield gradually became the seats of the woollen goods manufacture; while Bradford, Halifax, Norwich, and their vicinities absorbed the manufacture of worsted goods and carpets. But, though large quantities of goods were made and sold, their quality was far from uniform, and there was no improvement in the processes of manufacture until the invention of the carding-machine by Lewis Paul, which first came into use for wool in England about 1753, and the spinning-jenny, invented by Hargreaves and improved by Arkwright (1767–69). The gradual introduction of these machines, and the application of steam both as a motor and for dyeing and dressing purposes, greatly improved the character of the English and French cloths, but until the introduction of the power-loom (which, though invented in 1785, did not come into general use till about 1800) and the Jacquard loom (invented in 1811), the woollen and worsted manufactures had not received their greatest impulse in Great Britain. The French manufacturers were progressing meanwhile in a somewhat different direction. With their fine and soft wools they directed their attention very largely to the production of fabrics for women's wear, and with their admirable taste and delicacy of workmanship soon achieved great success. The French merino goods, introduced by Pallotan at Rheims in 1801, have never been surpassed by any all-wool product in softness, durability, and beauty. Other goods, both of wool and worsted, pure and in combination with silk, cotton, and linen, have been produced in vast quantities in England and France. The broadcloths of the highest grade made in France are of better quality than any others, except some of the German goods; but the practice of adulterating these, as well as cassimeres, satinets, and indeed almost every description of the heavier wool goods, with shoddy or the ground and picked fibres of old woollen rags, first proposed in 1813 at Batley, England, but not largely used till 1840, has done much to impair the value and durability of the lower and medium-priced goods. This practice has been carried to a greater excess in Great Britain and Belgium than elsewhere.

In the U. S. the manufacture of woollen goods was almost entirely domestic as late as 1790, and though there had been fulling-mills from the first settlement of the colonies, there was no woollen-factory in successful operation before 1794, when one was established in Byfield parish, Newbury, Mass. The same year the first carding-machine for wool was put in operation in Pittsfield, Mass. Between that time and 1801 four or five were started. Gray-mixed broadcloth of good quality was made at Pittsfield in 1804, and President Madison's inaugural suit of black broadcloth was made there in 1808. In 1809 a woollen-mill was erected by Dr. Capron at Oriskany, Oneida co., N. Y., and in 1812 what was then considered a large manufactory of fine cloths was established at Middletown, Conn., which made thirty or forty yards of broadcloth a day. The same year an American inventor produced what are known as the helicoidal shears, a cutting-machine with spiral blades on a cylinder acting against a straight steel blade, and shearing the nap of the cloth evenly and perfectly. This was first adopted in France. The American inventors were pro-

lific of inventions for the improvement of these manufactures, and to them the world is indebted for the original and best processes for making felted goods, carpetings, broadcloths, hat-bodies, etc.; the knitting-frame, and later the various knitting-machines, the burring-machine, the Crompton loom for weaving by power fancy cassimeres, which, with its successive improvements, is now far superior to any other loom for this purpose; and the still more wonderful automatic Bigelow carpet-loom; the best processes for making a mixed mousseline delaine; Simpson's woolcomber; the Smith moquette carpet-loom; and, latest of all, the compounder or new machine, which makes by a novel and ingenious process, from comparatively thin goods, the heavy pile goods known as the "Windsor fabrics." The woollen manufacturers in this country have had great difficulties to contend with. In addition to the high price of labor as compared with European countries, and the lack for many years of native wool of those qualities best adapted to their use, they have been alternately fostered and ruined by high and low tariffs, and their goods systematically depreciated by the importers and free-traders; but they have at length reached a position in which they can supply more than three-fourths of the woollen and worsted goods consumed here, and, except in a few classes of goods, produce those of better quality than their European rivals. Comparatively few of the finest grades of broadcloths or black cassimeres are made here, none of the finest French merinos or cashmeres, nor some varieties of worsted goods, nor, to any considerable extent, the Persian or Axminster carpets—the broadcloths, merinos, etc., because we have not a sufficient supply of the very finest wools, nor is it profitable either to grow or import them; and the carpets and some of the worsted goods because they are only in demand to a limited extent, and will not pay a fair interest on the costly "plant" necessary for their production. But our mills do produce nearly all the fancy cassimeres, plaid and striped cloths, tricots, and cheviots for business suits, and the larger part of the meltons and silk mixtures used for the same purpose; the beavers, moscows, chinchillas, diagonals, and other cloaking goods for outer garments; knit goods of all grades and for all purposes; and flannels and blankets of superior quality to any in the world for bed-coverings; woollen shawls of exquisite beauty and serviceableness, broche and other fine shawls; delaines, both the all-wool and the mixed goods so generally worn, and now all-wool merino plaids and matelasses; horse blankets, rugs, and felted carpeting, and clothing of all descriptions; felt and wool hats of several grades; ingrain carpets of all qualities; Brussels, velvet, tapestry, and recently some Wilton, Axminster, and Aubusson carpets; printed carpets and floor-cloths; worsted poplins, serges, cloakings, printed cashmeres, alpacas, mohair lustres, and brilliantines; satin lastings and prunellas of excellent quality; all descriptions of upholstery fabrics, including reps, all-wool and union damasks, silk cotelines, lambrequin cloths, carriage trimmings and lace, wool fringes, yak fringes and lace, bunting superior to the British; while in our newly-invented "Windsor fabrics," in which, by a new process, we are able to thrust the fibres of the wool through lighter fabrics and lock and felt them on the under side, we have achieved a great victory both in cheapness and durability over the foreign manufacturers of heavy pile goods.

The growth of the woollen manufacture in the U. S. within the past fifty or sixty years has been very rapid. From 1790 to 1810 there was a large domestic manufacture in proportion to the population, and the greater part of the men and all the boys were clothed in homespun, while the women wore, for every-day use, linsey-wolsey, a fabric composed of linen and wool. In 1810 this domestic manufacture was estimated at $25,608,788. But after this date the domestic production fell off rapidly, and at first the factory-made goods did not supply their place. In 1820 the total value of woollen goods reported was $4,413,068; in 1830, $14,528,166; in 1840, $20,696,999; in 1850, $43,207,545; in 1860, $68,865,963; in 1870, $217,668,826. In 1876, owing to the depression of business, there was a slight falling off in production, and a still larger one in importation. The value of the woollen goods produced in 1876 is estimated at $208,118,875, being the product of 9650 sets, as against 10,073 sets in 1870. Massachusetts has from the first maintained the leading position in these manufactures, her production of all-wool goods, carpetings, worsted, and mixed goods of cotton, linen, or silk and wool, amounting in 1875 to $57,629,587, or more than one-fourth of the whole production of the country. Pennsylvania, New York, Connecticut, and Rhode Island are the other largest producers, though nearly every State has some woollen manufactures. The importations in 1821 were $7,437,737; in 1831, $12,627,229; in 1841, $11,001,939; in 1851, $19,507,309; in 1861, $28,487,166; in 1870, $34,049,070; in 1876, $33,208,808. As the imports are reckoned at gold value, and without duty, their market-value would be about double, or $66,417,616, and the total value of imports and manufactures $274,536,493; so that a little more than three-fourths of the whole amount is produced by American manufacturers.

*Processes of Manufacture of Woollen and Worsted Goods.*—The variety of goods wholly or in part made of wool, and of those wholly or in part of worsted, is so great that we can only name in the most general way the processes to which each is subjected in its manufacture. The distinction between the woollen and worsted goods begins, as we have already intimated, in the character of the wool used: for all descriptions of heavy wool goods a more or less fine, short-stapled, and readily-felting wool is required; for all goods wholly or in part of worsted the wool must be of long staple (fibres 2¾ to 5 or 6 inches in length), not very fine, and either naturally or by the combing process freed, as much as possible, from those serratures or imbrications which constitute the felting property. This primary difference in the character of the wools required, of course, governs the purchase of the wool, and restricts it to the quality adapted for the use of the particular kind of goods to be made. In the case of the woollen manufactures the wool, which is usually purchased in bales, and not scoured, is (1) sorted, the sorter arranging each pile or lot according to its fineness, length of staple, and silkiness of texture. (2) Scoured; this is accomplished by throwing it into large tanks filled with water and an abundance of soap, and kept at a high temperature by means of steam, and continually moved by means of rakes or stirring-sticks driven by steam-power. When thoroughly cleansed it is drawn out through rollers to squeeze out the water, and then dried by revolving fans or other means. By this scouring and washing not only is the dirt and soil removed from the fleeces, but the yolk or suint—a peculiar fatty secretion of the sheep most abundant in the merino breeds—is also discharged. The English manufacturers extract these matters from the water by a chemical process, and make candles from the product. The wool is next dyed (if it is necessary to dye it in the wool). The next process is willying, or, in the case of Western and South American wools, burring. The object of this is to remove seeds and burs which have become entangled in the wool. The American burring-machine of Mr. S. R. Packhurst does this very perfectly and in combination with the carding-machine. Picking, teasing, or moating is the next process, and is performed by a machine which tears open the matted portions and separates the wool into small tufts, the larger impurities and knots being frequently removed by hand-picking. Either before or immediately after this process the wool is oiled, oleic acid or oleine being now generally used for this purpose, instead of olive oil, and sometimes a mixture of oleine and paraffine oil; these oils are much more readily removed from the yarn or tissues by a brief scouring with carbonate of soda and pure water than the olive oil, and there is much less danger of spontaneous combustion than from the use of the vegetable oils. The wool is now ready for the scrubbing, carding, and slubbing processes, which, though formerly separate, are now continuous by the use of the patent feeder and condenser. Their office is to convert the wool into rolls, which are drawn out and slightly twisted before they are spun. The spinning is the next process, and herein is another difference between woollen and worsted yarns, the yarns for woollen cloths being but slightly twisted, so as to leave them more free for felting, but those for the warp twisted more than those for the weft, as they have to bear more strain; while the worsted yarns are hard-spun and made into a much stronger thread. The slight twisting and comparative lack of strength in woollen yarn renders it more difficult to weave it on a power-loom than the worsted, cotton, silk, or linen yarns. The yarn, when spun, is reeled, and, if to be made into cloth, warped, beamed, singed, sized, and otherwise prepared for weaving. The weaving may take place on a hand-loom, on an ordinary power-loom for broadcloths, flannels, cassimeres, satinets, blankets, etc., etc.; on a Crompton loom for fancy cassimeres, yarns of different colors being introduced; or on the Earnshaw needle-loom, where the goods are made with two faces or different colors are used. Broadcloths, and indeed most woollen goods, are next scoured to remove the oil, and then, if thought necessary, dyed again, and tentered or stretched upon hooks to dry. Burling, or picking off irregular threads, hairs, and dirt, succeeds this, and then, for the cloths, come the fulling process and the teaseling or raising the nap, which is sheared evenly by the helicoidal shears. It is next steamed or scalded to prevent its spotting unevenly from the rain, and pressed between polished iron plates in a powerful hydraulic press. The flannels, blankets, etc., do not go through these last processes. The knit goods are made from the yarn on knitting-machines

and finished by hand. Delaines have usually cotton weft, and are woven on cotton looms, and printed, like calicoes, from rollers. Carpets are made from coarser wools, and do not go through so many preliminary processes before spinning; they are woven on the Bigelow carpet-looms or some modification of them. The worsted wools are combed on a combing-machine with heated teeth, to make the fibres straight and parallel, and the shorter fibres are combed out; these are called *noils*. The other processes before the spinning are much the same as already described; the yarns are hard-twisted, and for some purposes, as for alpacas, mohairs, and lustred goods, the lustred wools and the hair or wool of the alpaca and vicuna and of the angora goat are used. The weaving and dyeing of these goods are watched with great care. The cow's hair, camel's hair, and calf's hair goods are of cheaper grades, and in quality belong rather to the woollen than the worsted trade. Most of them contain a considerable proportion of the lower grades of wool, woollen waste, and shoddy.

(3) *Wool-Trade.*—The business of dealing in wools is a very ancient one. There are evidences of its existence probably not less than four thousand years ago. Syria and Persia, with their immense flocks, whose fleeces formed an important item of traffic as early as the time of Abraham, whose white wools were sold in the Tyrian market a thousand years later, and at a subsequent period Greece, Asia Minor, and Rome, were all largely interested in the wool-trade. In the Middle Ages the dealer in wool was called a wool-stapler, from his selection and appraisal of the different qualities of wool. This was the calling of Shakspeare's father, and was not an uncommon one at that day. With the vast increase of the wool manufacture throughout Europe and America in the present century, the wool-trade has become one of the most important branches of traffic. Its weekly, monthly, and annual reports are carefully studied in all the great marts of trade. The business is complicated by the great variety of qualities and prices of wools. The report of the wool-trade in the U. S. for 1875 specifies six different classes in the U. S., and embraces so many different qualities that the prices ranged from 24 cents to $1 per pound. Of foreign wools there were importations from twelve or fifteen different ports, and twice that number of grades, ranging from 15 to 50 cents per pound. The total wool-clip of the U. S. in 1875 was about 193,000,000 pounds, and the amount imported 54,901,760 pounds. Of this amount, only 1,164,673 pounds came from Great Britain. (For many important facts and statistics used in this article the writer is indebted to the kindness of John L. Hayes, Esq., secretary of the National Association of Wool Manufacturers, Boston, Mass., and Franklin Allen, Esq., secretary of the Silk Association of America, New York City.) L. P. Brockett.

**Worms** [Ang.-Sax. *wurm;* Lat. *vermis*], a name given to numerous invertebrates whose sole common character is the possession of an elongated flexible body. Under the term are embraced the representatives of not only different classes, but forms so diverse in morphological characters that they have been by some naturalists separated under two or more of the primary divisions (sub-kingdoms or branches) of the animal kingdom: it follows, therefore, that their relations to each other are not only in some cases very distant, but that they may even be most intimate with forms entirely dissimilar in configuration and adaptive characters. The organization may be of the most primitive and simple character (especially so if we extend the term to the Gregarinidæ), or it may be of the most complex nature. The development is also so extremely diverse in the different groups that no common characters can by any possibility be formulated for them in contrast with other groups of animals. Even in habitat, too, they are more than usually variable, and to such an extent, indeed, that kindred forms may vary greatly in this respect; *e. g.* some species are terrestrial, as in the case of the common earthworm and certain planarians; others closely related are inhabitants of the fresh waters; others still are found in the sea; and, finally, species even not distantly related may be parasitic and pass their whole life under some condition or other in the interiors of various animals. "It should also be remembered," says Dr. Packard, "that among worms are many synthetic types which, as regards some organs, remind us of other groups of animals. For example, the rotifers recall the lower Crustacea, and are by some naturalists regarded as such; the planarians have been considered by Girard as mollusks; the polyzoans and brachiopods are still regarded as mollusks by eminent naturalists; and there are very few who do not place the tunicates among the latter. On the other hand, the echinoderms are regarded as worms by some, and *Amphioxus* has been called a worm. Indeed, if any one has any prejudices regarding fixed types in nature, and would learn how regardless of preconceived zoological systems the actual state of our knowledge of the lower animals must lead one to become, let him study the animals now placed among 'worms.'" The truth of these observations will be rendered still more manifest by our subsequent exposition of the diverse views of authors. Under these circumstances it is impossible to give any generalized characters. (1) The general idea of worms, however, is best exemplified in the common earthworms and the species related to them found in the fresh waters and in the sea: this type has been distinguished under the name of Oligochæta. (2) Closely related to these are the worms with well-developed and numerous setiform appendages, common in almost every sea; these have been distinguished as Polychæta. (3) Another type is manifested under the form of the familiar leech, and for it and the quite numerous species more or less resembling this animal has been established a group of variously assessed value under the name of Discophora or Hirudinea. (4) A fourth form is exemplified in animals resembling, superficially, the *bêche-de-mer*, or holothurians, rather than the typical worms; and for such species has been framed the name Gephyrea. (5) A few singular swimming, finned, and comparatively short animals have been segregated under the name Chætognatha. (6) Certain worms passing through a remarkable series of metamorphoses, the first of which greatly resemble those undergone by echinoderms, have, for this and other reasons, been isolated under the name Enteropneusta. (7) More or less elongated, smooth, inarticulated worms are the Turbellarians. (8) Leech-like worms, generally provided with one or more suckers, and with the body flattened and inarticulated, typified by the common fluke, are called Trematods. (9) The tapeworms form another group, named Cestoidea. (10) A peculiar type of parasitic worms without an intestinal canal and with an armed head is called Acanthocephala. (11) Elongated, round, inarticulated forms of simple structure are the Nematoids. (12) Certain microscopic forms are well known under the name of wheel-animals, Rotatoria, and Rotifera. These several forms have been variously combined. Until within the last few years the most common combination was under two classes: the first, second, third, and fourth were grouped under one class as true annelids, while the remaining were segregated under another class as scolecids. By a few authors all the groups above named have been regarded as distinct classes, but by more the first two groups have been recognized as orders of a common groups named chætopods. Recently, there has been a disposition to recast the groups of the animal kingdom based upon developmental characters. Thus, Prof. Huxley, after having primarily grouped all animals into Protozoa and Metazoa, has separated the latter into Gastræa, which have an intestinal canal, and Agastræa, which are destitute of an intestinal canal; the former are further differentiated into Polystomata (the sponges) and Monostomata (all the other animals); and the Monostomata into Archæostomata, or those whose mouth coincides with the primitive aperture of the embryo, and Deuterostomata, or those whose mouth is developed independently of the primitive aperture. The Deuterostomata are again separated into Schizocœla and Enterocœla. Of the groups of worms above enumerated, the first, third, seventh, eighth, eleventh, and twelfth are considered as *Gastræa monostomata archæostomata Scolecimorpha;* the second and fourth as *Gastræa monostomata deuterostomata Schizocœla;* the fifth and sixth as *Gastræa monostomata deuterostomata Enterocœla;* and the ninth and tenth as *Agastræa*. With certain of the forms thus enumerated have also been associated animals very different in general appearance, and at least in the characters of the adult. Thus, the brachiopods and polyzoans have been approximated to the annelids by some recent authors (*e. g.* Morse, Kowalevsky, etc.); and certainly in their developmental history there are many facts which seem to show that they have sprung from one and the same common stock, although subsequently their divergence has been very great. Other types formerly combined with the worms have subsequently been demonstrated to be very different. Thus, *Linguatula* has now for a long time been shown to be a modified arachnoid, and *Peripatus* has recently (by Moseley) been shown to be related to the myriopods. The entire subject-matter is still, however, in a transition stage, and the systematic value of the various characters exhibited by the adult as well as young of the different groups requires re-examination. But it is at least certain that the great assemblage of animals known as "worms" is a heterogeneous mixture of very unlike types. (See also Annelides, Oligochætæ, Leech, Nematoidea, Parasites, Rotifera, Sterelmintha, Tapeworm, Trematods, Turbellaria, etc.) Theo. Gill.

**Writing-Machines.** This term may include all contrivances for recording, either for mechanical purposes or for preserving language written or spoken, as well as to aid in writing. Of the former class are all those means

for permanently recording the pressure of steam, the force and direction of the wind, meteorological phenomena, the investigations of the astronomer, etc. Examples of this class are the steam-engine indicator (see STEAM-ENGINE, Fig. 40), the meteorograph (see OBSERVATORY, METEOROLOGICAL), and the delicate recording apparatus now used in large observatories. The latter class are usually termed type-writers, the simple elements of which are a movement to bring the type into position, an inking device, an impression movement, and means for letter and line spacing. The earliest form perhaps was invented in England in 1714, and many modifications have since been patented in various countries. The most successful seems to be the Sholes and Glidden type-writer, patented by C. L. Sholes of Wisconsin, in 1868, which is about the size of a sewing-machine, and is worked with lettered keys arranged in four rows, each type-carrier being thrown up as its key is struck. The type letters are engraved on the ends of steel bars, which are pivoted in the circumference of a circle, so that the end of each bar will strike at the same point in the centre of the circle. An inked ribbon passes over the centre of the circle, and over the whole a cylinder carries the paper to receive the impression. The cylinder by a spring and ratchet movement revolves the width of a letter, and when a line is completed it has also a lateral movement for each new line. With practice it will print from 60 to 75 words a minute. This machine, used by the Automatic Telegraph Co., has been modified by substituting for letters on the bars the Morse telegraphic characters, which are perforated through the paper, and the sheet is then passed through the apparatus connected with the telegraph, as described in the article TELEGRAPH. The typograph was invented by Charles A. Washburn of San Francisco, Cal., in 1859 and patented in 1870. This machine, like the type-writer, has the different types fixed to the ends of small steel bars connected to a series of keys, which, on being struck by the fingers, throw the types against the paper to be written on. These type-bars are of different lengths, and have different radii, but are so pivoted as to bring the types to a common centre by touching the keys to which they are attached. The paper is made to move laterally a single space as each key is struck, and at the end of each line it is drawn back and thrown up a line space, the letters being impressed on the paper as fast as the fingers can be made to touch the different keys. Several machines have been invented for the use of the blind, among which is Johnson's, which enables a blind person to impress characters in rows and lines so as to be read by the sense of touch. The matrix compositors of John E. Sweet and Pierre Flamm (see PRINTING, in CYCLOPÆDIA) may be used as type-writers by interposing inked ribbon and paper between the type and the impression-bar.

Attempts have been made to record the spoken word by automatic means. One of these is the machine invented by M. H. Huppinger, a Frenchman, which is about the size of the hand, and is put in connection with the vocal organs, recording their movements on a moving band of paper in dots and dashes. The person using it repeats the words of a speaker after him inaudibly, and this lip-language is afterward written out. The phonautograph, described in the article ACOUSTICS, may yet be utilized for recording language by its unerring sound-lines.

A stenographic machine has been invented in France, which has a keyboard of 12 black and 12 white keys on a plane, arranged in three groups of four black and four white keys. The keys, operated like a piano, produce indications in ink on a roll of paper, the black keys giving long marks, and the white ones simple dots. These keys may be simultaneously struck, so that the combinations may give several letters or words for every movement of the operator's fingers. It is said that six months' practice will enable one to follow a speaker. A similar machine was invented by J. C. Zachos of New York, designated the "Zachos steno-phonotype reporter," in which the types are placed on twelve shuttle-bars, two or more of which may be simultaneously placed in position. The impression is given by a plunger or platen common to all the bars. This machine, according to the inventor's scheme, will enable a person to follow a speaker.

Attention may here be drawn to the type-wheel used in the recording telegraph, the telephone for conveying to a distance vocal and musical sounds, and the automatic telegraph, all of which are described under TELEGRAPH. Mention may also be made of the Edison electrical pen, which by electricity rapidly moves a needle while the pen is forming the letters on paper as in ordinary writing. The paper, having every line of the letters perforated by the needle, may be placed on carbon paper or other coloring medium, and a large number of impressions taken on paper by simple pressure, the copy receiving the coloring-matter through the fine holes. WILLIAM S. PATERSON.

**Wun'derlich** (KARL AUGUST), b. Aug. 4, 1815, at Sulz on the Neckar, in Würtemberg; studied medicine at Tübingen; visited France and Belgium 1837–39; was appointed professor of medicine at Tübingen in 1840 and at Leipsic in 1850. He wrote *Handbuch der Pathologie und Therapie* (3 vols., 1846–54), *Versuch einer pathologische Physiologie des Bluts* (1844), *Geschichte der Medicin* (1859), and *Eigenwärme in Krankheiten* (1868). With Roser in 1841 he founded the *Archiv für physiologische Heilkunde*, which represents his peculiar standpoint as a physician and scientist.

**Wut'tke** (HEINRICH), b. at Brieg, Silesia, Feb. 12, 1818; was educated in the gymnasium of Breslau; studied history in the universities of Breslau and Berlin, and was appointed professor of history at the University of Leipsic in 1848. His principal writings are—*Entwickelung der öffentlichen Verhältnisse Schlesiens* (2 vols., Leipsic, 1842–43), *Die Völkerschlacht bei Leipzig* (Berlin, 1863; often reprinted), *Die Deutschen Zeitschriften und die Entstehung der öffentlichen Meinung* (1866).

**Wyck** (THOMAS), b. at Haarlem in 1616; resided for several years in Italy; settled afterward in London, where he enjoyed a great reputation as a genre painter, and d. there in 1682 or 1686. Among his most celebrated pictures are those of London during and after the conflagration of 1660. His drawings and etchings, which are very scarce, are also highly esteemed.

**Wy'nants** (JOHN), b. at Haarlem in 1600, and d. there in 1677. Of his personal life nothing is known, but his pictures, generally representing prospects from the surroundings of his native city, sandhills in the background and old tree-trunks and wild flowers in the foreground, are highly esteemed and command a very high price. Among his pupils were Wouverman and Adrian van der Velde.

**Wysock'i** (PIOTR), b. at Warsaw in 1799; entered the royal guard in 1817; received his higher military education in the academy of Warsaw, and was a lieutenant in one of the regiments stationed in that city when in 1828 he formed a secret union of all the younger officers of the garrison for the re-establishment of an independent Poland. On Nov. 29, 1830, the insurrection burst forth, and as aide-de-camp to Prince Radziwill he fought with distinction at Wavre and Grochow. He afterward followed Dwernicki in his unfortunate campaign into Volhynia and crossed the Galician frontier, but succeeded in escaping and returned to Warsaw. As colonel of the 10th regiment he was severely wounded at the storming of Wola, Sept. 6, 1831, and taken prisoner by the Russians, who sent him to work in the Siberian mines, where he d. in 1837.

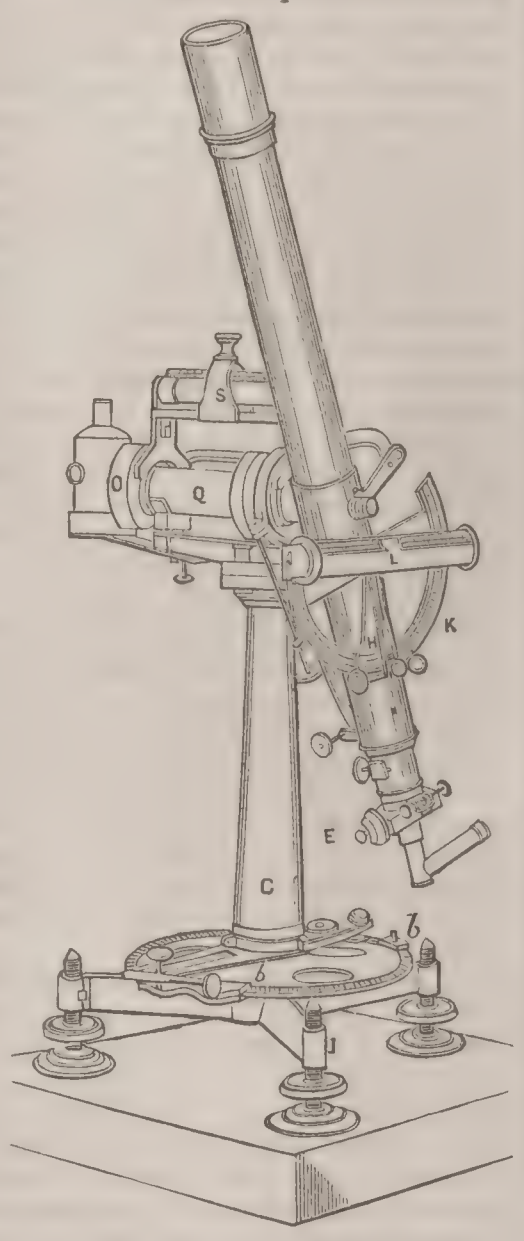
# Y.

**Young** (ROBERT ANDERSON), D. D., b. at Campbell's Station, Knox co., Tenn., Jan. 23, 1824; graduated at Washington College, East Tennessee; was licensed to preach Jan., 1845; was ordained by Bishop Paine at Clarksville, Tenn., 1848, and elder by Bishop Andrew at Athens, Ala., in 1850; has filled important stations in the Tennessee conference of the M. E. Church, South, of which he has been secretary for many years, and which he has several times represented in the General Conference; was seven years in the St. Louis conference, and three years president of Florence University, Ala.; has been since May 9, 1873, secretary of board of trust of Vanderbilt University; is the author of *Personages* and other publications.

**Young'husband** (C. W.), entered the Royal Artillery Dec. 14, 1837; became captain in 1846 and colonel 1863; was employed in making a magnetic survey in Canada 1841–46, and at Woolwich in reducing his observations 1846–54; served in the Crimean campaign Oct.–Nov., 1854, including the battle of Inkerman and siege of Sevastopol; was appointed secretary to the Royal Artillery Institution 1855; superintendent of contracts in Belgium and Prussia in 1857; member of the ordnance select committee in 1863; superintendent of the royal gunpowder factory, Waltham Abbey, in 1868; which latter position he vacated in 1875, when appointed superintendent of the royal gun-factories, royal arsenal, Woolwich.

# Z.

**Ze′nith Tel′escope,** an astronomical instrument for measuring small differences of zenith distances. It was designed by Capt. Andrew Talcott, U. S. Engineers, about the year 1834, and the method of determining the latitude, in which it is principally used, is hence known as *Talcott's method.* The results obtained with this portable instrument rival in accuracy those of the instruments of a fixed observatory. In our own Coast Survey it is used exclusively for the determination of latitude, and occasionally for the determination of local time. The figure represents a zenith telescope of the Coast Survey, having an aperture of about 3½ inches, a focal length of about 45 inches, and a magnifying power varying between 160 and 120. Stars of the seventh magnitude may be observed with it. The tube rotates around a horizontal axis Q, and is counterpoised by a weight at O. A striding-level at S indicates the deviation of this axis from horizontality. The essential parts of the instrument consist in the sensitive level L and the micrometer E. The level is connected with the telescope, so that the inclination of its line of collimation may be known. The graduated semicircle K is attached to the tube, and by means of the vernier H, which is attached by an arm to the movable level L, zenith distances can be read to within 30″. The micrometer-screw is used for measuring apparent differences of zenith distance when the telescope is pointed alternately from the first star to the second star of a pair which culminate at opposite zenith distances, differing from each other by less than the diameter of the field of view of the telescope. The value of one revolution of the screw is about 45″, and the value of one division of the level L is about three-fourths of a second.




In using the instrument, pairs of stars are selected at approximately equal and opposite zenith distances, and having small differences of right ascension. This condition often limits the observer to the selection of stars whose places are comparatively doubtful, and it is quite probable that in these cases the errors of star-places exceed all the other errors combined of Talcott's method in the hands of a skilful observer. After setting up the instrument, the stops *b b* are set, so that the instrument may turn upon its vertical axis C, and be checked at two points 180° apart, with the telescope in the meridian in each position. By means of the vertical semicircle the instrument is set for the star which culminates first, and the observer bisects the star when it is on or near the meridian with the micrometer-thread. He then reads the micrometer-head and level, turns the instrument 180° in azimuth, and observes the second star in the same manner. This completes a single observation for latitude.

The general expression for the latitude from observations made in this manner is

$$\phi = \tfrac{1}{2}(\delta + \delta') + \tfrac{1}{2}(z - z') + \frac{b}{4}\left\{(n + n') - (s + s')\right\} + \tfrac{1}{2}(r - r') + \tfrac{1}{2}(m' - m),$$

$$\text{in which } \tfrac{1}{2}(z - z') = \tfrac{1}{2}(\mathrm{M} - \mathrm{M}')\mathrm{R}.$$

Where

$\phi$ = the desired latitude;

$\delta$ and $\delta'$ = the declinations of the N. and S. stars respectively;

$z$ and $z'$ = the observed zenith distances of the N. and S. stars;

$b$ = the value of one division of the level;

$r$ and $r'$ = the refraction; and

$m$ and $m'$ = the reduction to the meridian for the N. and S. stars respectively, where the stars are bisected a short distance from the meridian.

(See *Appendix No. 10 U. S. Coast Survey Report* (1866); *App. No. 12 U. S. C. S. Report* (1869); Chauvenet's *Manual of Spherical and Practical Astronomy* (1874, vol. ii. pp. 340–367).) L. Waldo.

**Zodi′acal Light.** A faint illumination, not wholly unlike an aurora-borealis, which, at certain seasons especially, is visible soon after sunset, or also a little before sunrise, in the region of the *zodiac;* whence its name. In our latitudes it is most conspicuous when the plane of the ecliptic in the region in which the light is visible, and also the plane of the sun's equator, make the greatest angle with the horizon. Hence it is most distinctly seen in the evening in the months of April and May, and at the opposite seasons of the year before sunrise. The apparent distance of its vertex from the sun is found to vary according to circumstances from 40° to 90° or 100°; and sometimes, indeed, it has been seen to extend entirely across the heavens. Its breadth at its visible base, in a direction perpendicular to its axis, varies from 8° to 30°. It is best seen in tropical countries. Humboldt says that it is almost always visible in those regions, and that he has seen it sufficiently luminous to cause a sensible glow on the opposite quarter of the heavens. Numerous observations of this opposite glow are detailed in the *Astronomische Nachrichten,* as the same are reported by European observers; and the light has been observed to extend entirely across the sky by Lias in Brazil; by George Jones, A. M., late chaplain in the U. S. navy; by Col. Charles G. Forshey, U. S. A., while he was stationed in an elevated and dry region of Texas; and by Henry C. Lewis of Germantown (Philadelphia), Pa.

The Zodiacal Light appears to many observers to be of a reddish hue, especially at its base, where also it is by far the most bright, and where "it effaces small stars." Chaplain Jones also speaks confidently of undulations, and likewise of a sort of flashing which he had noticed in it. George F. Chambers, Esq. (*Descriptive Astronomy,* p. 257), intimates that the historian Nicephoras must be regarded as the first to (unequivocally) record the existence of the Zodiacal Light, as observed in 410 A. D. It was treated of by Kepler, and soon afterward by Descartes (about the year 1630); then by Childrey in 1659. It was, however, J. Dominique Cassini who called special attention to the phenomenon, and gave it its name. He first observed it on Mar. 18, 1683. Unusual attention has recently been attracted to the observation of the Zodiacal Light.

The glow opposite to the sun (Ger. *Gegenschein*) described by Humboldt, and frequently observed by others, and the observations of the light extending entirely across the sky, already alluded to, together indicate that the material to which the light is to be attributed extends beyond the orbit of the earth. Various hypotheses have been framed to account for the phenomena presented by the Zodiacal Light, which all have one feature in common—viz. that they make the material in question, whatever may be its composition, to be a direct appendage of the sun. But all these hypotheses, whatever may be the composition of the material in question, seem to be inconsistent with the *very broad base* to the more dense, and so also *distant,* portion of the material in question, the very conditions seeming to require that the apparent form of the Zodiacal Light should be somewhat like that of the head of a comet, with the *expansion* beyond it extending *upward* from the sun. And then there ought, it would seem, to be a conspicuous central core or beam, which we do not find. And, lastly, what shall be said of the planetary perturbations due to a closely-arranged group of meteors? It would seem, then, that the material or materials in question cannot be regarded as a direct appendage to the sun.

Rev. George Jones, chaplain on board the flagship of Commodore M. C. Perry in the U. S. naval expedition to Japan in 1852, during which he conducted an elaborate and long-continued series of observations upon this phenomenon, proposes a very different hypothesis when he says with respect to all the data in his possession: "It seems to me that those data can be explained only by the supposition of *a nebulous ring, with the earth for its cen-*

*tre, and lying within the orbit of the moon.*" (Vol. iii. of *U. S. Exploring Expedition Narrative.*) The author of this article has so far modified this hypothesis as to substitute a *girdle* for the ring, the middle plane of the girdle approximating to a coincidence with the plane of the ecliptic, or more nearly, perhaps, with the plane of the moon's orbit (for the time being), and extending to a very considerable distance as measured perpendicularly to that plane. (*Smithsonian Contributions to Knowledge*, 280.) But in order to preserve such a girdle from the destructive action of the moon's attraction, it would seem to be requisite that the *periodic time of revolution* (or rather *rotation*) *of the girdle around the earth should be the same with that of the moon.* The dimensions of the girdle to ensure this are stated in the number of the *Smithsonian Contributions* here already quoted, and they place the greater part of the girdle, if not the whole of it, *beyond* the moon. This hypothesis in its application will exhibit the following consistencies: (1) That it provides a conservative force for the maintenance of such an appendage. (2) It will account for the phenomena common to all appearances of the Zodiacal Light, *broad* base and all. (3) It accounts for certain periodical changes in form and intensity, etc., of the same, which seem to be completed in a synodical revolution of the moon. (4) It provides for the *Gegenschein* (opposite glow) in form and position, and possibly also for "a lunar zodiacal light." (5) It renders a plausible account for the fading at times and total disappearance of the Zodiacal Light. (6) It accounts for the absence of a determinate parallax of the girdle. (7) It shows that when E. and W. lights are visible at the same time, the middle even of the zodiacal arch need not be wholly obscured by the earth's shadow. (8) It provides for the "pulsations."

S. ALEXANDER.

NOTE.—The foregoing article on the Zodiacal Light, while presenting the theory of Mr. Jones, and the same theory as modified by the author of the article, is incomplete in omitting any reference to the very rigorous examination of this theory by the principal editor of this CYCLOPÆDIA, in a memoir published in the 21st volume of the *Am. Journal of Science and Arts*, Second Series, 1856. In the memoir referred to it is conclusively shown that the light cannot proceed from a ring or girdle of any supposable dimensions concentric with the earth, because—

(1) The aspects of the light are not such as, on optical principles, a ring or girdle like that supposed ought to exhibit.

(2) If the light is due to such a cause, certain phenomena require that the girdle should be quite near, in which case it would be largely affected by a parallax which is not manifested.

(3) The geometrical inferences to which the theory legitimately leads, as they are deduced from different observations, are inconsistent with each other.

(4) To adopt this theory in order to explain phenomena which are actually observed involves unavoidably a necessity that other still more striking phenomena should present themselves which are never observed.

These four propositions are established in the memoir referred to with all the rigor of mathematical demonstration. The memoir concludes as follows:

"We appear, therefore, to be conducted to one and the same conclusion by the application to this theory of four distinct tests; each one of them having no slight independent weight, and all of them combined possessing an irresistible force. The Zodiacal Light must consequently be regarded as presenting a problem still unsolved. The observations of Mr. Jones, when published [they have since been published, and form vol. iii. of the *Report of the Japanese Exploring Expedition*] may possibly present some clue to the mystery which has not yet been detected in them. But whatever else they may show, the present writer cannot but believe that they will furnish in themselves the most conclusive proof that the luminosity does not reside in any substance physically connected with the earth. Upon the whole, whatever difficulties may attend the theory which regards the Zodiacal Light as having its seat in some appendage of the sun, there seems to be as yet no other supposition possessed of greater plausibility."

No more recent discovery has made it necessary to modify in any manner this conclusion, which expresses at present the general opinion of the astronomical world. (See Chambers's *Descriptive Astronomy*, London, 1867, book iii. chap. v. p. 256.)

F. A. P. BARNARD.

**Zoological Geography** is that department of science which treats of the zoological peculiarities of the various regions into which the globe may be divided, or, in other words, its faunas or combinations of animals. The term was employed first by Van der Hoeven, and later by Andrew Murray and other authors, with this signification, and in contrast with *geographical zoology*, which treats of the range of animal forms. On a consideration of the geographical range of various animals it soon becomes evident that they are mostly combined in groups which are more or less distinctive of certain regions of varying extent. This truth was first clearly appreciated by the great French naturalist Buffon.

HISTORICAL RÉSUMÉ.—The natural regions, however, were not scientifically distinguished until within a comparatively recent period, and we have to pass by the many writers who contributed to our knowledge of the subject, and limit our notices to a very few writers.

Swainson was perhaps the first to recognize *per se* the chief zoological divisions. In *A Treatise on the Geography and Classification of Animals*, published in 1835,* he proposed the following subdivisions: "1. The European or Caucasian range includes the whole of Europe, properly so called, with part of Asia Minor and the shores of the Mediterranean; in Northern Africa the zoological peculiarities of this region begin to disappear; they are lost to the eastward of the Caucasian Mountains, and are blended with those of Asia and America to the N. 2. The Asiatic range, comprehending the whole of Asia E. of the Ural Mountains, a natural and well-defined barrier between the two continents. The chief seat of this zoological region is probably in Central Asia; its western confines blend into the European toward Persia, and disappear on the W. of the Caucasian chain; it is united to the African range among the provinces of Asia Minor, and is again connected with Europe, and also with America, by the arctic regions of the three continents; finally, its most southern limits are marked by the islands of Java and Sumatra, where the zoological character of the Australian region begins to be apparent. 3. The American range. United to Europe and Asia at its northern limits, this region or province comprehends the whole of the New World, but into which it blends at the other extremity is uncertain. 4. The next includes the whole of Africa S. of the Great Desert: a part, at least, of the countries bordering on the Mediterranean exhibit a decided affinity to the European range; while the absence of large animals in Madagascar, and the presence of genera peculiar to New Holland and the extreme point of Southern Africa, lead us to the fifth or the Australian range. 5. To this region nature has given peculiar characters, both in regard to its geographic situation and to its animal productions. New Guinea and the neighboring islands mark its limits in that direction; Australia proper is its chief seat, and it spreads over the whole of the numerous islands of the Pacific Ocean: whether this province blends with that of America or of Europe remains for future discovery, but its connection with Africa and Asia has been already intimated."

The chief comment to be made upon this is, that the author was evidently influenced rather by the differentiation into land and water, or into the various continents of geographers, than by the distribution of animal life over the surface of the globe. There is far from being a coincidence between the two, and even naturalists to-day need to appreciate this truth. Various investigators, however (*e. g.* Pucheran, Brandt, Forbes, etc.), perceived that the zoological regions were quite different from the geographical ones; and in the case of the European division demonstrated that Northern Asia and Africa N. of the Sahara exhibit essentially the same combinations of animals, and therefore together form one great zoological province. While thus some naturalists were influenced chiefly by geographical considerations or the distribution of land and water in determining zoo-geographical provinces, others were led to combine animals into regions characterized chiefly by thermometrical data. Among such were Humboldt, Agassiz, Wagner, Dana, etc.

Prof. Louis Agassiz,† *e. g.*, divided the earth into faunas, characterized chiefly by temperatures, into three principal divisions—(1) the arctic, (2) the temperate, and (3) the tropical.

(1) The arctic fauna was homogeneous, and embraced the northern extremities of the several boreal continents (Europe, Asia, and America) down "to the isothermal zero; that is, the line where the average temperature of the year is at 32° of Fahrenheit."

(2) The temperate faunas were divided into four: on the one hand were distinguished a northern temperate and a northern warm, and on the other hand a southern warm and a southern temperate. "Taking the contrast of the vegetation as a basis, and the consequent changes of habit

* *A Treatise on the Geography and Classification of Animals.* By William Swainson, Esq. (London, 1835, 16mo.)

† *Essai sur la Géographie des Animaux* (*Revue suisse et Chronique littéraire*, t. viii. pp. 441–452, 538–585, 1845); *Principles of Zoology* (pp. 161–181, 1848); *Geographical Distribution of Animals* (*Christian Examiner*, vol. xlviii. pp. 184–204, 1850; also *Ed. New Phil. Journ.*, vol. xlix, pp. 1–25, 1850). The extracts are from the *Principles of Zoology.*

imposed upon the denizens of the forests, the temperate fauna has been divided into regions; a northern one, where the trees, except the pines, drop their leaves in winter, and a southern one, where they are evergreen." "A peculiar characteristic of the faunas of the temperate regions in the northern hemisphere, when contrasted with those of the southern, is the great similarity of prevailing types on both continents." "The predominant types among the mammals are the bison, deer, ox, horse, hog, numerous rodents, especially squirrels and hares, nearly all the Insectivora, weasels, martens, wolves, foxes, wild-cats, etc." "Among birds there is a multitude of climbers, passerine, gallinaceous, and many rapacious birds. Of reptiles there are lizards and tortoises of small or medium size, serpents, and many batrachians, but no crocodiles. Of fishes there is the trout family, the cyprinoids, sturgeons, the pikes, the cod, and especially the great family of herrings and scombroids, to which latter belong the mackerel and the tunny." The division of the northern faunas into northern temperate and northern warm, above noted, is, however, contravened by another division into minor faunas. Thus, the author distinguished "(1) the fauna of the U. S., properly so called, on this side of the Rocky Mountains;" and "(2) the fauna of Oregon and California, beyond those mountains," for North America: for Europe, (1) "the fauna of Europe;" (2) "the fauna of Siberia;" (3) "the fauna of the great Asiatic table-land;" and (4) "the fauna of China and Japan." "The faunas of the southern temperate regions differ from those of the tropics as much as the northern temperate faunas do; and, like them also, may be distinguished into two provinces, the colder of which embraces Patagonia. But besides differing from the tropical faunas, they are also quite dissimilar to each other on the different continents." "Each of the three continental peninsulas which jut out southerly into the ocean represents, in some sense, a separate world."

(3) "The tropical faunas are distinguished, on all the continents, by the immense variety of animals which they comprise, not less than by the brilliancy of their coverings." "The tropical region is the only one occupied by the Quadrumana, the herbivorous bats, the great Pachydermata, such as the elephant, the hippopotamus, and the tapir, and the whole family of Edentata. Here also are found the largest of the cat tribe, the lion and tiger. Among the birds we may mention the parrots and toucans as essentially tropical; among the reptiles, the largest crocodiles and gigantic tortoises; and finally, among the articulated animals, an immense variety of the most beautiful insects. The marine animals, as a whole, are equally superior to those of other regions."

Such are the essential features considered as common. The differentiation into sub-regions need not be here given. The ideas involved are so strange that we have been careful to justify the synopsis given by exact quotations of the author's own words. It need only be added that Prof. Agassiz was peculiar in his views, and it is indeed difficult to conceive how a naturalist of his ability could have ever seriously proposed such a grouping as the expression of natural relations.

Mr. Philip Lutley Sclater in 1858, in a special memoir on the geographical distribution of birds,* proposed the division of the earth into primary regions, which had some good features in common with previous authorities, and some very bad ones originating with the author. The memoir has become very well known, and the views of the author have been quite generally accepted by at least his compatriots. Evidently availing himself, but without any acknowledgment, of the labors of his predecessors, and selecting with considerable judgment (not a slight merit), he has recognized the various primary regions of the earth, and distinguished them as follows: (1) Palæarctic, or Northern Old World region; (2) Western Palæotropical or Ethiopian region; (3) Middle Palæotropical or Indian region; (4) Eastern Palæotropical or Australian region; (5) Nearctic or North American region; and (6) Neotropical or South American region. These regions had already been recognized before, and their approximate limits even appreciated, and Mr. Sclater has simply connected new names with already determined generalizations. But he deserves the credit of having first co-ordinated them into one systematic whole. The chief and novel feature of his arrangement was, however, the combination of the first four regions into a "Palæogean or Old World creation," and the last two into a "Neogean or New World" creation. In so far as zoological geography was concerned, this plan was original with Mr. Sclater, although long adopted by geographers. But no reasons were adduced that could at all justify such combinations as zoo-geographical divisions, and the result was obtained by violently ignoring the essential differences between the several constituents of each, on the one hand, and, on the other, the common characteristics of the members of the two "creations." In defence of Mr. Sclater, however, it may be urged that the class of birds presents some phenomena of distribution which could be used in plausible justification of such a grouping to a greater extent than any other class of animals.

Prof. T. H. Huxley in 1868, in a special memoir on gallinaceous birds,† discussed the geographical distribution of those forms, and, in connection therewith, of other vertebrates, and proposed to recombine the several regions of Mr. Sclater into primary groups totally unlike those of his predecessors, and contrasting especially with those of Mr. Sclater. (1) The Palæarctic and Nearctic regions, as well as Asia and Africa, were united under the common name of "Arctogæa;" (2) the Neotropical region was contrasted as "Austro-Columbia;" and (3–4) the Australian region was differentiated into two—(3) Australasia and (4) New Zealand. "But," continued Mr. Huxley, "this arrangement would leave out of sight the important fact that in some respects the three latter are less unlike one another than they are unlike the first—for example, in the paucity or absence of ungulate mammals, the abundance of edentates and marsupials among mammals; and in the class of birds nothing can be more remarkable than the great development of the Psittacomorphæ [parrots] in both Australasia and Austro-Columbia, while they are comparatively so feebly represented in India and South Africa, and are absent, save a stray species or two, in North America. Not only in this circumstance, but in the wonderful uniformity of the osteology, the Psittacomorphæ nearly repeat the phenomena presented by the Peristeropodes [Cracidæ and Megapodidæ], and help, with them and the three-toed Ratitæ [Rheidæ, Dromæidæ, etc.], to bind together the widely-separated portions of the south world, and justify the adoption for it of the title Notogæa, in contrast to the north world, or Arctogæa."

Mr. P. L. Sclater in 1874‡ published a new scheme for the geographical distribution of animals, and completely abandoned the essential features of his former memoir—*i. e.* the combination of the regions into a "Palæogean or Old World creation" and a "Neogean or New World creation." Profiting by the demonstrations of Prof. Huxley, he recombined his several regions as follows: (1) The Palæarctic, the Ethiopian ("with the lemurian sub-province of Madagascar"), the Indian, and the Nearctic regions were segregated under the common name of "*Arctogæa*, or North Land;" (2) the Neotropical region was differentiated as a second major division—"*Dendrogæa*, or Tree Land;" and (3–4) the former Australian region was divided into two other major divisions—(3) the Australasian region, restricted to Australia and the Malayan Archipelago up to Wallace's line, being named "*Antarctogæa*, or South Land;" and (4) New Zealand being distinguished as "*Ornithogæa*, or Bird Land." As will be perceived, the only essential difference between this and Prof. Huxley's distribution, except the ignoring of the two primary groups, is one of nomenclature, Mr. Sclater, with his usual proclivity, having given in part new names to the four divisions recognized by Prof. Huxley.

Mr. Alfred Russel Wallace, in an extensive work on the geographical distribution of animals,§ published in 1876, distributed the several faunas of the earth under six primary regions, with the names given by Mr. Sclater—viz. (1) The Palæarctic, (2) the Ethiopian, (3) the Indian, (4) the Australian, (5) the Neotropical, and (6) the Antarctic regions. Each of these regions was divided into four subregions—viz. (1) the Palæarctic into (*a*) North Europe, (*b*) Mediterranean (or S. Europe), (*c*) Siberia, and (*d*) Mantchuria (or Japan); (2) the Ethiopian into (*a*) East Africa, (*b*) West Africa, (*c*) South Africa, and (*d*) Madagascar; (3) the Oriental into (*a*) Hindostan (or Central India), (*b*) Ceylon, (*c*) Indo-China (or Himalayas), and (*d*) Indo-Malaya; (4) the Australian into (*a*) Austro-Malaya, (*b*) Australia, (*c*) Polynesia, and (*d*) New Zealand; (5) the Neotropical into (*a*) Chili (or S. Temperate America), (*b*) Brazil, (*c*) Mexico (or Tropical North America), and (*d*) Antilles; and (6) the Nearctic into (*a*) California, (*b*) Rocky Mountains, (*c*) Alleghanies (or East U. S.), and (*d*) Canada.

The Primary Zoological Regions or Realms.—We

* *On the Geographical Distribution of the Members of the Class Aves* (*Jour. of the Proc. of the London Soc.*, vol. ii.—Zoology—pp. 130–139, 1858).

† *On the Classification and Distribution of the Alectoromorphæ and Heteromorphæ* (*Proc. Sc. Meetings Zool. Soc. London*, for 1868, pp. 294–319, with map).

‡ *On the Geographical Distribution of Mammals* (*Science Lectures for the People*, 6th series, No. 5, 1874).

§ *The Geographical Distribution of Animals, with a Study of the Relations of Living and Extinct Faunas as elucidating the past changes of the Earth's Surface.* With maps and illustrations. In two volumes. (London, 1876, 8vo.)

may conveniently consider, as have done Wallace and his predecessors, those regions of the earth over which are severally distributed essentially the same animals, and which are six or seven in number. The combinations of animals characteristic of these are partly determined by thermometrical conditions, and partly by natural barriers, such as oceans and mountains. Commencing, naturally, with that region which is most familiar to us, we will proceed to those which are successively more differentiated by the nature of their inhabitants.

I. *The North American or Nearctic Realm* embraces North America from its northern boundaries, where it is fused into the European, southward into Northern Mexico, projecting into that country to a considerable distance along the extension of the Rocky Mountains, and ceasing near the south-western borders of the U. S. on the lowlands. It has representatives of 26 families and about 250 species of mammals, exclusive of the marine types; 60 families and about 800 species and sub-species of birds (*Baird, Brewer*, and *Ridgway*); 25 families and about 250 species of reptiles; 14 families and about 100 species of amphibians; 17 families and about 600 species of fresh-water fishes; and 1 family and 6 or 7 species of marsipobranchiates: of these several are peculiar to the region. These are, of mammals, Antilocapridæ and Haploodontidæ; of birds, Chamæidæ (of very doubtful value); of reptiles, Lichanuridæ; of amphibians (according to Cope), Scaphiopodidæ, Plethodontidæ, Amblystomidæ, Amphiumidæ, and Sirenidæ; and of fishes, Centrarchidæ, Aphredoderidæ, Amblyopsidæ, Percopsidæ, Hyodontidæ, and Amiidæ. Of the others, those characteristic of the northern portions of the region are shared in common with Europe and Northern Asia, while those more especially represented in the southern portions are held in common with South America. On the whole, however, the predominant type of the region—and only more decidedly so to the northward—is that of the Eastern hemisphere, and the South American aspect given to the region is apparently due rather to the (geologically) recent intrusion of South American types than to its being the natal abode of such forms.

Of the other classes of animals, those most noteworthy are the gasteropods and conchifers: the former is extremely rich in species of the family Ceraphasiidæ, or Melaniidæ of peculiar genera; the latter is even to a still greater degree exuberant in species representing also numerous sections, or sub-genera, peculiar to the region. In fact, over 400 species of gasteropods, most of which belong to the family Ceraphasiidæ, and about 600 species of conchifers, the greater portion of which are members of the family Unionidæ, have been attributed to the region; but these numbers are undoubtedly greatly exaggerated. It may be added, in conclusion, that several of the families and genera now peculiar to the realm were, in early geological epochs, represented elsewhere; the family Amiidæ, *e. g.*, having formerly had members in Europe. Several of the peculiar genera are also of great antiquity, characteristic sections or genera of Viviparidæ, Melaniidæ, and Unionidæ having existed as early as the Cretaceous, and even the Jurassic, period.

The realm has been variously subdivided into sub-regions by different authors—*e. g.* Agassiz, Baird, Verrill, Allen, and Cope—each of whom has based his divisions primarily upon special classes, though availing himself of his knowledge of other vertebrates. For present purposes perhaps the most useful will be that of Prof. Cope, and although liable to certain objections, his divisions on the whole are the most truthful expressions of the general assemblages characteristic of different portions of the continent. The sub-regions that may be thus recognized are as follows:

(1) The Northernmost or Circumpolar region has essentially the same features as the corresponding zone in Northern Europe and Asia, and is characterized by its pinnipeds of the families Phocidæ and Rosmaridæ; the arctic fox, the musk ox, the lemmings, and water-birds belonging to the various genera of Anatidæ, etc.

(2) The Eastern region extends from about the isotherm of 50° F. in the N. to that of 77° in the S., and from the Atlantic Ocean on the E. to the prairies of the Far West. To this region the mole genus *Condylura* is restricted, and it is especially the home, although not peculiarly so, of the several genera of North American Siluridæ, as well as the Ceraphasiidæ and Unionidæ; to it is also limited the fish genus *Polyodon*. It is, however, perhaps distinguished from the Austro-riparian region rather by its negative than by its positive characteristics. The region has been subdivided by several American authors into several ultimate districts or faunas—*e. g.* the Hudsonian or sub-frigid district, the Canadian or cold temperate district, the Alleghanian or sub-temperate district, and the Carolinian or temperate district.

(3) The Austro-riparian region, according to Cope, "commences near Norfolk, Va., and occupies a belt along the coast, extending inland in North Carolina. It passes S. of the Georgia mountains, and to the north-westward up the Mississippi Valley to the southern part of Illinois. W. of the Mississippi the boundary extends S. along the southern boundary of the highlands of Texas, reaching the Gulf at the mouth of the Rio Grande." In it are found a number of peculiar genera of mammals, birds, and reptiles, or, more generally, such as extend from South America into the region, but no farther. The most noteworthy mammals are the cotton rat (*Sigmodon hispidum*), the Florida rat (*Neotoma floridana*), and two species of hare of a peculiar section; among the reptiles are species of *Anolis* (the so-called "chameleon"), *Cemophora*, and *Alligator*; among the amphibians the genus *Siren* is peculiar; there are also several genera of fishes, and among them may be especially enumerated the centrarchoid types *Acantharchus, Mesogonistius, Enneacanthus*, and *Centrarchus*. It has been differentiated into the Floridian, Louisianian, and Texan districts.

Both the preceding (second and third) regions have many characteristics in common, and among the most noticeable is the development of percoid and centrarchoid fishes.

(4) The central region includes the elevated plains of the West and the eastern decline of the "backbone of the continent." Botanically, it is distinguished by the paucity of forests. It has a number of peculiar generic and, still more, specific types. To it are almost restricted the genera *Mazama* (Rocky Mountain goat), *Ovis* (sheep), and *Antilocapra* (antelope), as well as the black-tailed deer (*Cariacus macrotis*); here are also found in their greatest development the genera *Taxidea* (badger), *Cynomys* (prairie-dog), *Dipodomys, Perognathus*, and *Lagomys*; the most remarkable birds are the sage-cock (*Centrocercus urophasianus*) and the cock-of-the-plains (*Pediocætes phasianellus*); the reptiles and amphibians are not numerous nor especially noteworthy; the class of fishes is very poor in family types, and lacks almost altogether the characteristic American types.

(5) The Pacific region embraces the western slope of the territory of the U. S. between the Sierra Nevada and the Pacific Ocean. Its arboreal vegetation is generally very richly developed. Its characteristic, if not entirely peculiar, types are, among birds, *Geococcyx* (chaparral-cock or ground-cuckoo), *Chamæa*, and several species of Ortyginæ ("quails"); among reptiles, *Charina* (a genus of boas) and several lizard genera; among amphibians, the salamandroid genera *Anaides, Batrachoseps*, and *Dicamptodon*; and among fresh-water fishes, the genera *Archoplites* (centrarchoid), *Hysterocarpus* (embiotocoid or viviparous fish), and several peculiar genera of cyprinoids. The terrestrial mollusks are peculiar, and recall the types of Europe and Northern Asia rather than those of Eastern America.

Both of the last two agree in the paucity of fishes of peculiar American types. The species belong chiefly to the families of Salmonidæ, Cyprinidæ, and Catastomidæ; and *Archoplites*, peculiar to California, is the only known representative in that region of any special American family.

If, now, we should combine the regions thus defined, we would be much tempted to unite, on the one hand, the Eastern and the Austro-riparian, and, on the other, the Central and Pacific. Two other regions have been distinguished whose affinities seem to be also greatest with the last.

(6) The Sonoran region, according to Cope, "includes parts of Nevada, New Mexico, Arizona, and Sonora in Mexico. It does not cross the Sierra Nevada nor the Mojave Desert, nor extend into the peninsula of Lower California. It sends a belt northward on the E. side of the Sierra Nevada as far as, including Owen's Valley in Eastern California, lat. 37°, and enters other valleys in Nevada in the same way. It occupies the lower valley of the Rio Grande, and extends into Texas as far as the desert E. of the Rio Pecos. It extends southward in Western Mexico as far as Mazatlan." It is poor in mammals, and not rich in birds, but, according to Cope, four genera of lizards (*Heloderma, Sauromalus, Uma*, and *Cleonyx*) and five of serpents (*Gyalopium, Chionactis, Sonora, Rhinochilus*, and *Chilopoma*) "are not found in any of the other regions described." It is the paradise of rattlesnakes, nine species inhabiting its territory. Into this region also extend peculiar South American types, the cichlid genus *Heros* and the characinid genus *Astyanax* being represented each by a single species.

(7) The Lower Californian region, also defined by Cope, "occupies the peninsula of that name as far N. as San Diego." It has many characters in common with the So-

noran region, but has many species of birds and reptiles peculiar to itself. It has, according to Cope, three genera of lizards (*Verticaria*, *Diplodactylus*, and *Cyclura*) and one of serpents (*Lichanura*) peculiar to the region or found elsewhere only farther southward.

Such are the regions into which some of the best authorities have divided the North American realm. It is impossible in the limits within which this article must be restricted to fully define them or explain wherein they may be modified in the future. Some idea, however, will be conveyed of the approximate distribution in general of several of the more familiar types of animals, and others, on the whole, are determined by the same laws. The distribution of the marine types is governed by other laws, and must therefore be considered in another connection.

II. *The European or Palæarctic Realm* is the largest of all, and embraces the entire northern portion of the Old World. Its southern limits nearly coincide with the tropic of Cancer in the lowlands, and its isotherm projected therefrom in the more rugged countries. In Africa it extends into the Desert of Sahara, and in Asia it is limited by the Himalaya Mountains and their spurs. It possesses members of 31 families of terrestrial mammals, 55 of birds (according to Wallace), 25 of reptiles, 9 of amphibians (according to Günther), and 16 of fresh-water fishes. None of these families, however, are continuous over the entire area and at the same time peculiar to it. It is true that several families are restricted within its limits, such as the Trogonophidæ and Ophiomoridæ among reptiles, and the Comephoridæ among the fishes, but these are very limited in their distribution: the family Comephoridæ, *e. g.*, is represented by a single species, confined to a single lake (Baikal) of Siberia. The realm is characterized, therefore, rather by what it has not than by what it has. Its subdivisions, or regions, have been variously distinguished. As it is impossible to enter into a discussion of the relative merits of these divisions, we simply reproduce the views of the latest writer on the subject, Mr. A. R. Wallace. According to him, there are four regions, or "sub-regions," which he contends are "in the present state of our knowledge at once the most natural and the only practicable ones." These are—(1) the European, (2) the Mediterranean, (3) the Siberian, and (4) the Mantchurian.

(1) The European region coincides with the homonymous continent and its outlying islands northward, but is limited southward by the Pyrenees and the Alps, the Balkans, the Black Sea, and the Caucasus range. A few genera of vertebrates are peculiar to the region, among which are *Rupricapra*, containing the chamois, and *Myogale*, or the "desman," among the mammals; *Alytes*, *Pelodytes*, and *Proteus* among the amphibians; and *Acerina*, *Percarina*, *Aspro*, and a number of cyprinoid genera among the fresh-water fishes. Other classes of animals present noteworthy features, but the limits of this article forbid even an allusion to them.

(2) The Mediterranean region includes the countries bounded on the N. by the Pyrenees, the Alps, and the Caucasus Mountains, and on the S. by the great desert of Africa: it also embraces Asia Minor, Persia, and part of Afghanistan, as well as the northern part of Arabia. As might be naturally expected from the nature of its climate, it is the richest of all the European regions in the number of species, and herein forms of North and South Europe meet on common ground, and a few African types have wandered into it. It has been subdivided into (*a*) "the Mediterranean sub-region" and (*b*) "the Persian sub-region."

(3) The Siberian region includes the whole of Northern Asia from the Arctic Ocean southward to the borders of Persia and Afghanistan, the Himalaya Mountains, Northern China, and the Amoy River. A number of peculiar genera are present, but these are quite limited in their range, and none extend over the entire area. It is divisible into (*a*) "the Siberian sub-region" and (*b*) "the Tartarian sub-region."

(4) The Mantchurian region includes Mantchuria, as well as the Chinese empire and the Japanese islands, and is characterized by quite a large number of peculiar species of the several classes of vertebrates, which however, are mostly quite limited in their distribution, and few, if any, extend over even the greater part of the territory. It has been differentiated into (*a*) "the Mantchurian sub-region" and (*b*) "the Japanese sub-region."

III. *The Indian or Oriental Realm* is of less extent than either of the two preceding ones, but is nevertheless richer than either in the number of species. It extends northward from the Himalayan range to the Indian Ocean southward, and toward the S. E. is limited by the narrow but deep strait which intervenes between Celebes Island and its dependencies on the S., and Borneo on the N., and between the islands of Lumbok and Sumbawa on the one hand, and Bali and Java on the other; it thus includes the peninsulas of Hither and Farther India and the Indo-Malayan Archipelago and Philippine Islands. In it are found 33 families of terrestrial mammals, 71 families of birds (according to Wallace), 25 families of reptiles, 9 of amphibians, and 15 of fresh-water fishes. Of these, 12 are peculiar—viz. among mammals, the Tarsiidæ, Galeopithecidæ, and Tupaiidæ; among birds, the Liotrichidæ, Phyllornithidæ, and Eurylæmidæ; among reptiles, the Xenopeltidæ, Uropeltidæ, and Acrochordidæ; and among fishes, the Luciocephalidæ, Ophiocephalidæ, and Mastacembelidæ. As in the case of other regions, there is considerable diversity of opinion as to the relations of it with others and as to its various several subdivisions: by Wallace four are admitted: these are here particularized without the assumption of any personal responsibility by the present writer, and even with the proviso that they will require considerable modification and differentiation, as, *e. g.*, the Philippine Islands.

(1) The first or Hindostan region includes the Indian Peninsula from the Himalayas on the N. to the delta of the Ganges and its approximate isotherm on the S.; "and it probably reaches to about Cashmere in the N. W., and perhaps to the valley of the Indus farther S.; but the great desert tract to the E. of the Indus forms a transition to the S. Palæarctic sub-region." It is impossible in a few words to give the zoological peculiarities of the region; these rather consist in the development of the types than in the exclusive presence of any one.

(2) The Ceylonese region—so called because its characteristics are exhibited in the highest degree in the island of Ceylon—includes not only that island, but also the southern portion of the Indian Peninsula to the confines of the first, or Hindostan, region. Acccording to Wallace, "the main features of this division are—the appearance of numerous animals allied to forms only found again in the Himalayas or in the Malayan sub-region, the possession of several peculiar generic types, and an unusual number of peculiar species."

(3) The Indo-Chinese or Himalayan region includes the peninsula of Farther India and Southern China, and extends from the Himalayas in the N. southward to the Malaccan peninsula. "Taking this sub-region as a whole," says Wallace, "we find it to be characterized by 3 genera of Mammalia [Urva, Arctonyx, and Ælurus], without counting bats, and 44 genera of land-birds, which are altogether peculiar to it; and by 13 genera of Mammalia and 36 of birds, which it possesses in common with the Malayan sub-region." This region, according to some authors, admits of a further subdivision into three—(*a*) Southern and Central China, (*b*) Burmah, Siam, and Cochin, and, as an appendage, (*c*) the Andaman and Nicobar islands.

(4) The Indo-Malayan region includes all the islands of the Indo-Malayan Archipelago and the Philippine Islands, as well as the Malayan Peninsula. "Here alone, in the Oriental region," says Wallace, "are found the most typical equatorial forms of life—organisms adapted to a climate characterized by uniform and not excessive heat, abundant moisture, and no marked departure from the average meteorological state throughout the year. These favorable conditions of life only occur in three widely-separated districts of the globe—the Malay Archipelago, Western Africa, and Equatorial South America. Hence, perhaps [not probably], it is that the tapir and the trogons of Malacca should so closely resemble those of South America, and that the great anthropoid apes and crested hornbills of Western Africa should find their nearest allies in Borneo and Sumatra." The region is capable of subdivision into several others; Mr. Sclater, *e. g.*, has distinguished (*a*) the Malay Peninsula, (*b*) the Indian Islands, and (*c*) the Philippine Archipelago. The last is remarkable for the exuberant development of the terrestrial gasteropods.

The Andaman and Nicobar islands have been combined by some naturalists, as already indicated, with the Indo-Chinese region, but by Wallace have been referred, one (the Andamans) to the Indo-Chinese, and the other (the Nicobars) to the Indo-Malayan.

IV. *The African or Ethiopian Realm*, as the name indicates, includes the greater part of the African continent, but not all, it being limited on the N. by the Desert of Sahara, although on all other sides bounded by the ocean; but it also comprises, according to most recent authors, the island of Madagascar and the Mascarenes, as well as the peninsula of Arabia. It is distinguished especially in that it possesses the highest types, after man, of the order Primates, and which are in all respects the most anthropoid. This region is also further distinguished by the restriction to it of as many as 9 isolated families of mam-

mals—viz. Daubentoniidæ, Cryptoproctidæ, Protelidæ, Camelopardidæ, Hippopotamidæ, Centetidæ Centeninæ, Potamogalidæ, Chrysochloridæ, and Orycteropodidæ. Among birds there are 6 so-called families peculiar to it—Paictidæ, Musophagidæ, Coliidæ, Leptosomidæ, Irrisoridæ, and Serpentariidæ. The most marked, however, are the fishes, of which there are 14 families; of these, 5 are peculiar—viz. Pantodontidæ, Kneriidæ, Mormyridæ, Gymnarchidæ, and Polypteridæ, and three are shared with South America alone—Cichlidæ, Characinidæ, and Lepidosirenidæ. This realm, like all the others, has been subdivided by Wallace into four regions, or, as he designates them, "sub-regions"—viz. (*a*) the East African, (*b*) the West African, (*c*) the South African, and (*d*) the Malagasy.

(1) The East African sub-region, or that of Central or East Africa, includes "all the open country of tropical Africa S. of the Sahara, as well as an undefined southern margin of that great desert." It embraces Nubia and the country toward the S., as well as the entire width of the continent between about the 10th degree of S. lat. and the tropic of Capricorn. "The surface of all this sub-region," in the words of Wallace, "is generally open, covered with a vegetation of high grasses or thorny shrubs, with scattered trees and isolated patches of forests in favorable situations." It is mostly distinguished by negative characters in contrast with the others.

(2) The West African region comprises the western half of the continent at its greatest width, and is bounded on the N. by the Desert of Sahara, and on the E. and S. by the East African region, its southern bounds being nearly coincident, toward the coast, with the river Congo, but further inland with about the 10th degree of S. lat. Among the characteristic animals of the region are the gorilla, the chimpanzee, and two genera of Lemuridæ (*Perodicticus* and *Arctocebus*), constituting a peculiar section of the family Lemuridæ. *Hyomoschus*, the most generalized living type of the family Tragulidæ, *Potamogale*, the sole representative of its family, and *Anomalurus*, also the type of an independent family, are other characteristic mammals.

(3) The South African region embraces the southern portion of the continent, and its limits toward the N. are nearly coequal with the tropic of Capricorn, except along and near the eastern coast, where it extends northward to the vicinity of Mozambique; on all other sides it is bounded by the ocean. To this region, so far as known, are limited several of the forms already enumerated as peculiar to Africa—viz. the Protelidæ, the Chrysochloridæ, and the Orycteropodidæ. A large number of genera in various classes of animals are also peculiar to it.

(4) The Malagasy region comprises the island of Madagascar, as well as the islands of Bourbon, Mauritius, Rodriguez, and the Seychelles. These, however, exhibit remarkable differences among themselves. (*a*) Madagascar is distinguished by the development of several peculiar types of mammals—*e. g.* Daubentoniidæ, Cryptoproctidæ, and Centetidæ;* birds and invertebrates of remarkable character further specialize it as an independent region. (*b*) The Mascarene Islands include all the small ones enumerated, and several of them are remarkable for the large birds provided with imperfect wings which formerly existed on them, but which through the agency of man have now become extinct.

V. *The South American or Neotropical Realm* extends from the N. near the northern boundaries of Mexico in the lowlands, and lower down in the highlands, to the extremity of South America and its dependencies in the S., and with it are also generally associated the West Indian Islands. It has 30 families of mammals, 73 of birds, 35 of reptiles, 16 of amphibians, and 17 of fresh-water fishes. An unusual proportion of these are peculiar to the region, or nearly so. Among the mammals are the Cebidæ, Mididæ, Desmodidæ, Chinchillidæ, Caviidæ, Hydrochœridæ, Bradypodidæ, Dasypodidæ, Chlamyphoridæ, and Myrmecophagidæ. Several of the families which are shared in common with North America are also almost as characteristic, the North American species being rather intruders therein from the region under question than true autochthones. Such are the Procyonidæ, Bassarididdæ, Saccomyidæ, Cercolabidæ, Phyllostomidæ, and Didelphididæ. Other families are peculiar in their distribution: for example, of the Tapiridæ two genera and several species are found in South America, and the only other representative is distant as far as the Indo-Malayan Archipelago, and of the Camelidæ one genus (*Auchenia*) is found along the western slope of the Andes, and another (*Camelus*) in Asia and Northern Africa; these are anomalies, however, that become readily explicable when it is recalled that in previous geological epochs both of the said families were extensively distributed over the northern hemisphere, and consequently the widely-separated living forms are evidently simply surviving representatives of formerly widespread types. Of birds, according to the views of Wallace and many ornithologists, 23 families are restricted to the region, and 7 others are common and peculiar to it and the North American region. The peculiar families of birds, according to Wallace, are the Cærebidæ, or sugar-birds; Phytotomidæ, or plant-cutters; Pipridæ, or manakins; Cotingidæ, or chatterers; Formicariidæ, or ant-thrushes; Dendrocolaptidæ, or tree-creepers; Pteroptochidæ; Rhamphastidæ, or toucans; Bucconidæ, or puff-birds; Galbulidæ, or jacamars; Todidæ, or todies; Momotidæ, or motmots; Steatornithidæ, the guacharo or oil-bird; Cracidæ, or curassows; Tinamidæ, or tinamous; Opisthocomidæ, the hoazin; Thinocoridæ; Cariamidæ; Aramidæ; Psophiidæ, or trumpeters; Eurypigidæ, or sun-bitterns; and Palamedeidæ, or horned screamers. The Trochilidæ, or humming-birds, are especially noteworthy on account of their great numbers. Six families of reptiles have also been claimed as peculiar for the realm, and among the lizards the family of Iguanidæ is remarkably developed. Four families of amphibians and four of fishes are also considered as restricted to the realm. The relation between the fishes of South America and Africa is another feature of special significance: there are three families shared between the two, and found nowhere else, and genera of the respective families are not distantly related, although none are actually common to the two realms.

This realm has been subdivided into four regions ("sub-regions") by Wallace, but it is at least convenient to recognize a larger number.

(1) The Mexican or Central American region extends from Northern Mexico near the coast, and from Central Mexico in the highlands, southward to about the Isthmus of Panama. It is distinguished by the intermixture of North and South American types; here many of the birds that pass their summers in the U. S. sojourn during the winter. There is, however, quite a large number of species and not a few genera peculiar to the region. The most noteworthy of these are *Bassaricyon* (family Procyonidæ), *Elasmognathus* (family Tapiridæ) of the mammals; 37 genera of terrestrial birds; and of the family Cichlidæ of the fishes, *Heros*, and a number of less widely-distributed and species-containing genera. The terrestrial mollusks also deserve special mention, and types otherwise characteristic of the North American, West Indian, and Brazilian regions, besides several peculiar ones, commingle on common ground.

(2) The Antillean, West Indian, or Caribbean region, as it has been variously called, includes most of the islands of the Caribbean Sea. On the whole, the types found on the several islands are most closely related to those of the Mexican region, and there are many species and quite a large number of genera peculiar to it. Undoubtedly, the most noteworthy feature of this region is the great development of terrestrial gasteropods: these exhibit an extraordinary range of variation, both specific and generic. The larger islands (Cuba, Hayti, and Jamaica) are especially remarkable for the manifestation of this form of animal life. The region is susceptible of subdivision into several others well defined by differences in the combinations of land-shells. Cuba, Jamaica, Hayti, Porto Rico, etc., are all centres of peculiar combinations of species.

(3) The Brazilian or Amazonian region embraces the most of tropical America, and its limits are coextensive with the Atlantic Ocean on the N., and generally also on the E., while toward the S. it extends into Uruguay, and toward the W. terminates in the highlands of the Andes. It is extremely rich in representatives of almost every class of terrestrial animals. It is the head-quarters of the platyrhine monkeys, the Caviidæ, the spiny rats, the ant-eaters, the sloths, the armadillos, and the opossums among the mammals; the toucans, the curassows, the tinamous, and many other families among the birds; and the Polycentridæ and Gymnotidæ among the fishes; the insects and terrestrial as well as fluviatile mollusks are also as a whole characteristic.

(4) The Patagonian or Chilian region, as understood by Wallace, includes the western slope of the South American continent from near the equator southward to Cape Horn, and on the eastern slope Patagonia, the Argentine Confederation, and Paraguay. It is deficient in many of the types so characteristic of the other regions, and has several peculiar to itself. Chief of the peculiar ones are *Aucheniæ* (llama, etc.), *Tremarctos*, mountain tapir, Chinchillidæ, and Chlamyphoridæ among the mammals; Phytotomidæ and Thinocoridæ among the birds; and Percilia and Percichthys among the fishes. Further, of the fishes

* An aberrant type of this family (Solenodontinæ) is represented in the West Indian Islands.

the Haplochitonidæ and Galaxiidæ are elsewhere found only in the Australian or Polynesian realms.

(5) The Gallapagos region includes the archipelago so named, with about fifteen islands situated on either side of the equator and distant about 600 miles westward from South America. Perhaps it is properly a mere faunal district of the Chilian region, and as such Wallace has considered it. It is, however, at least convenient to isolate it as an independent region. Of birds, it has, according to Salvin, 57 known species, 38 of which are peculiar to the islands, and only 19 (and those mostly water-birds) are found elsewhere. The 57 species represent 39 genera, of which 27 are widely diffused, 7 common to the islands and South America, and 5 peculiar, but related to South American types. Of reptiles it has two snakes of South American types, and two lizards typifying peculiar genera, but members of the characteristic South American family Iguanidæ: it is also noteworthy for the immense land-tortoises of several species peculiar to different islands. The insects and gasteropods indicate the same relationship to South America as do the forms specified.

VI. *The Australian Realm* is of all the most distinctly defined by its fauna. As it will be here limited, it comprises Australia and the immediately outlying islands and the Austro-Malayan Archipelago: it is limited northward by Wallace's line or strait, which separates Lumbok from Bailly and Celebes from Borneo, including Papua or New Guinea and the Solomon Islands to the eastward, and southward embraces Tasmania or Van Diemen's Land. It is especially distinguished by its numerous marsupial mammals, and by the almost complete restriction of the class to representatives of that order, the rodents and the bats: the monotremes are also characteristic of the realm, and entirely confined to it. The class of birds likewise has a number of very characteristic types: chief of these are Megapodidæ and Casuaridæ, but there are several others —*e. g.* the Paradiseidæ, Meliphagidæ, Menuridæ, and Atrichidæ—that are almost equally peculiar. The reptiles and amphibians are perhaps less noteworthy, although they present some interesting features of detail. The fresh-water fishes are, however, especially remarkable; while many of what may be called marine families are represented by fluviatile species, there are several that are peculiar to it or only found elsewhere in South America. Among the former is the family Ceratodontidæ, which in former geological epochs was extensively represented in other parts of the world, but is now peculiar to Australia. Among the latter are the families Percophodidæ, Haplochitonidæ, Galaxiidæ, Osteoglossidæ, and Symbranchidæ. The articulates and mollusks also afford a large number of characteristic forms. The primary subdivisions of the realm are two:

(1) The Australian region includes the continent of Australia and the island of Tasmania, as well as several smaller ones near the coast. This is especially the home of the existing types of marsupials, and all the surviving families, with the exception of Didelphididæ, are here best exemplified, and several of them are peculiar. To this region also the family Ornithorhynchidæ of the monotremes is restricted.

(2) The Austro-Malayan or Papuan region includes the island of Papua or New Guinea, and likewise Celebes and the multitudinous islands lying toward the S. and between it and Papua, as well as the Solomon Islands. Among the mammals there is one species of the genus *Sus* known, and one species of Muridæ, but all the others belong to the orders of marsupials and monotremes: the former is represented by the families Macropodidæ, Phalangistidæ, Peramelidæ, and Dasyuridæ; the latter by the family Tachyglossidæ, a large species of which has been very recently described as an inhabitant of the Arfak Mountains of New Guinea. Among the birds the most noteworthy forms are those of the family Paradiseidæ, which are developed to the greatest extent in New Guinea: the family Casuaridæ is also here well represented.

Both of the above-specified regions of the Australian realm, but especially the Papuan one, are susceptible of subdivision into well-marked faunal districts; but for information respecting these reference must be made to Wallace's work, as well as to memoirs by Australian and other naturalists.

VII. *The Polynesian Realm* is one distinguished by negative rather than positive characters, and is to some extent a "refuge of the destitute." It includes all the islands of the Pacific Ocean combined under the general name Polynesia, as well as New Zealand. It is distinguished from all others by the total—or almost total—absence of indigenous types of mammals. The other common characters are very few; the avine types, on the whole—and especially those of New Zealand—recall mostly the Australian forms. It is possible that these islands are the remains of one or more continental areas, and that at least most of them may have been submerged and lost their mammals, and on emergence been repeopled from other territories. However this may be, they are at present sufficiently specialized by their animal inhabitants as independent groups or islands, and sufficient is known to permit of a very decided differentiation of birds and other animals into well-marked faunas. The realm, provisionally so called, is primarily divisible into two sections—(1) New Zealand and (2) Polynesia.

(1) The New Zealand region is a homogeneous one, and characterized by quite a large number of peculiar species of birds. According to Wallace, 145 species are natives of the group, and among these are representatives of 21 peculiar genera; the most remarkable type is the family Apterygidæ. Other specially noteworthy forms are the parrots of the isolated genera *Nestor* and *Stryngops*, and *Notornis*, a peculiar genus of rails.

(2) The Polynesian Islands form a heterogeneous combination, and probably, when the natural productions of the different islands are known, they will require to be segregated into several distinct regions. The most characteristic forms, or some at least, belong to the class of gasteropods. Especially remarkable in this respect are the Sandwich Islands, to which are restricted a peculiar group or sub-family (Achatinellinæ) of land-shells, and which is represented by very numerous species.

This completes the résumé of the realms and regions of the globe distinguished by the combinations of terrestrial and fluviatile animals. In accepting them we have mainly relied on Wallace, and in many instances unquestionably the boundaries of the several divisions, as well as the divisions themselves, will be hereafter materially modified; but the present would scarcely be the place to enter into a discussion of their defects.

One question, however, remains to be considered. The "realms" or "regions" admitted by naturalists generally exhibit among themselves relations which can be generalized under still more comprehensive captions. The evidence for these combinations is of very unequal value, and at first appears even to be contradictory: for example, the range of species of passerine birds on the one hand over the eastern hemisphere, and on the other over the western, was taken by Sclater for the combination of the realms into two primary divisions—a *Palæogæa*, corresponding to the Old World of geographers, and a *Neogæa*, identical with the New one. Even the birds, however, do not give unqualified testimony to this effect, and, as we have already seen, by a study of the distribution of gallinaceous types Prof. Huxley was led to segregate Europe and North America, as well as Asia and Africa, into a primary combination which he called *Arctogæa* (northern land) in contradistinction with a *Notogæa* (southern land), which embraces the remaining continents of Australia and South America, as well as Polynesia. The evidence derived from the fresh-water types of animals indicates, too, a still different combination. Which of these points to the most natural is, then, a subject for inquiry.

On the one hand, those forms of animal life which are capable of easy extension over extensive bodies of land or water, such as the birds, which represent the highest types, physiologically speaking, of life, are distributed in a manner to a large extent co-ordinate with the present arrangement of land and water. The birds seem to have especially become modified and adapted to the present topographical features of our earth at a (geologically speaking) recent epoch. On the other hand, those animals of a more lethargic character, or which are prevented by physical environments from extending their range, are grouped entirely otherwise. This is especially the case with the fresh-water animals of various kinds, and especially with the fresh-water fishes.

If the inhabitants of the fresh waters of the globe are taken into consideration, the several realms we have defined may be combined in quite a curious manner, which entirely contradicts the relations which the present combinations of land and water would suggest. It will then be seen that the inhabitants of the northern portions of the several continents of North America, Europe, and Asia belong, in a great degree, to the same types; and although the realms thus associated are characterized by a number of forms peculiar severally to each of them, they form a natural whole in contradistinction with the others. Very closely connected with this division is the East Indian, and this forms with them an integral portion of a whole.

In striking contrast with the association of forms characteristic of the several divisions alluded to are the fresh-water types of Australia. Most closely related to Australia in this respect is South America, and in the fresh waters of that continent are to be found several types which are

common to the two continents. The only remaining continent—Africa—although presenting some forms that are common to it and India, on the whole furnishes us with an association of fresh-water forms which recalls the South American realm more than it does any other. Several families of fishes and a number of types of other animals are common to the two and found nowhere else.

Combining these facts into a systematic whole, it has been proposed to segregate the several realms in the manner hinted at, and to combine under the name *Eogæa* (1) the Australian, (2) South American, and (3) African realms; and under the name *Pliogæa* (4) the North American, (5) the European, and (6) the East Indian realms. *Eogæa* gives to us a number of forms which remind us of the ancient inhabitants of the northern hemisphere, and hence the name, while *Pliogæa* has lost most of the forms that were characteristic of the past, and presents the newest aspect of the earth-faunas in contradistinction with the other.

An explanation of these relations may be found in one or other of two hypotheses: (1) The like forms may have originated where they are now found, and have been ever confined within approximately their present limits; or (2) they may be the survivors of anciently widely-distributed races. Neither hypothesis of itself is a sufficient explanation of all the associations in question, but each is applicable to different cases.

The marine animals by no means follow the distribution of the terrestrial ones, and must be considered apart therefrom; simply the main features of their distribution can be adverted to.

If we take into consideration the cetaceans, the true fishes, the selachians, the crustaceans, the worms, the mollusks, and the radiates, all more or less demonstrate that marine life is primarily distributed rather in zones than in districts conforming with the terrestrial regions indicated. Thus, the arctic region is distinguished by one association of animal forms, the tropical by another; and the antarctic has also its peculiar combination. The intermediate regions exhibit a commingling of the forms characteristic of these, and approximate at their respective termini to the characters of the adjoining ones. The bounds of all the regions are inconstant, and determined mostly by the temperature of the water, which fluctuates with the seasons: sometimes, however, the bounds are nearly coincident with, and to some extent determined by, headlands. One especially noteworthy fact, and which strikingly illustrates the influence of temperature on the distribution of animals, is the not infrequent recurrence, at the opposite poles, of the same or very closely-related types which are absent in the intermediate expanse. This phenomenon can apparently be most rationally accounted for by the hypothesis of the origin of the forms in cold waters either in the deep seas or the polar regions, and their subsequent dispersion northward and southward, or from either extreme, over the bottom of the ocean. This hypothesis is sustained by many facts revealed by the late deep-sea dredgings. The several marine regions are as follows:

(1) The NORTHERN faunas are distinguished by rosmarids and phocine phocids among mammals; pleuronectids, gadids, cottids, etc., among fishes; as well as many peculiar invertebrates.

(2) The TROPICAL faunas are characterized by the great development of the delphinine delphids among mammals; of plectognaths, scarids, labrids, pomacentrids, gerrids, serranids, carangids, etc., among fishes; and of volutids, mitrids, cypræids, etc., among mollusks, etc.

(3) The SOUTHERN faunas are specialized by the presence of stenorhynchine phocids among mammals; nototheniids, harpagiferids, etc., among fishes; and by a goodly number of invertebrate types.

These are divided into regions roughly bounded as follows:

NORTHERN.

1. *Arctic*, extending from the farthest N. to the North Cape and Newfoundland in the Atlantic, and to the Shumagin Islands and northernmost Japan in the Pacific.
2. *Boreal*, N. from the Arctic to Cape Cod and the Naze of Norway S.
3. *Aleutian*, including chiefly the Aleutian Islands.

NORTH TEMPERATE (Intermediate).

4. *Virginian*, N. from Cape Cod S. to Florida.
5. *Celtic*, N. from the Naze and the Shetland Islands S. to the Bay of Biscay.
6. *Japanese*, embracing for the most part the Japanese empire and the neighboring isothermal waters.
7. *Oregonian*, extending N. from the Arctic to Monterey and the Japan Sea S.

TROPICAL.

8. *Caribbean*, N. from Florida to near Rio de Janeiro S.
9. *Panamic*, N. from Monterey, Cal., to Payta in Peru S.
10. *Indo-Pacific*, embracing all the islands of the tropical portions of the Pacific Ocean, as well as the Indian Ocean.
11. *Lusitanian*, S. from about the tropic of Capricorn to the Bay of Biscay N.

SOUTH TEMPERATE (Intermediate).

12. *Patagonian*, N. from near Rio de Janeiro to Point Melo S.
13. *Peruvian*, N. from Payta (Peru) to Concepcion (Chili) S.
14. *Australo-Zelandic*, including the waters of New Zealand and temperate Australia.
15. *Capetonian*, embracing the southern temperate portion of Africa.

SOUTHERN.

16. *Magellanic*, E. from Point Melo to Concepcion W., and including southernmost Patagonia and the neighboring islands.
17. *Antarctic*, embracing the little-known southern polar waters.

Such are the regions most generally recognized; but it may be again recalled that in many cases the limits are only provisional, and that in almost all they must ever be to a considerable degree indeterminate and overlap. From the very nature of the case, each of the regions indicated is further subdivisible into faunas or districts, but these cannot be here particularized. (See also the articles FISH, MAMMALS, etc.) THEODORE GILL.

**Zool'ogy** [Gr. ζῶον, "animal," and λόγος, "discourse"], that part of biology which relates to animal life, and, as generally understood, the science which treats of the structure, classification, distribution, habits, and derivation of living animals. In its broadest sense, however, zoology includes the structure, relations, and histories of extinct as well as living forms, but this branch of the science is generally considered by itself under the title of "palæontology." The two divisions are, however, so inseparably connected that they can only be properly studied or fully and systematically stated together.

Up to a recent date our knowledge of extinct animals was so limited that the attention of naturalists was exclusively directed to living species, and there are numerous and elaborate treatises on zoology which make little or no reference to extinct forms. On the other hand, of the vast number of fossil animals hitherto described, comparatively few exhibit such a degree of preservation as to show fully their relations to existing species. Hence a large amount of literature has accumulated which could not be woven into the fabric of zoological science. Every day has, however, seen additions made not only to the already long catalogue of well-preserved fossils, but to our knowledge of their structure and relations, learned by more careful study and a wider range of observation.

The derivation and life-histories of many groups of animals have been found written in the records of the past, and many mysteries not only of relation, but of structure, have been solved by going back to find dwarfed organs in full development and widely-separated forms linked together. The zoology of the future will therefore include the animal life of both the past and the present. Even recent zoology has now assumed such dimensions that it is impossible for one intellect in one lifetime to cover the entire ground. The science has therefore been divided and subdivided among specialists, who, cultivating each his special field, furnish to the systematic zoologist materials for his generalizations. In this way the science is growing both in detail and as a whole, and assuming a unity and symmetry which it has hitherto lacked.

No full and satisfactory exposition of the *principles of zoology* has yet been written, though important contributions toward this end have been made by Cuvier, La Marck, Von Baer, Oken, Owen, Agassiz, Gegenbaur, Haeckel, Darwin, Huxley, and others. No résumé even of what has been done and proposed by these great naturalists could be brought within the limits of this work, and the student of general zoology must go to their writings to find what he seeks. Even there he will meet with such diversity of view and discordance of statement that he will have abundant proof that zoology has not yet reached the condition of an exact science.

Some of the more important subdivisions of zoology are MAMMALOGY, ORNITHOLOGY, HERPETOLOGY, ICHTHYOLOGY, ENTOMOLOGY, etc., under which titles, or in the descriptions of families, genera, and species belonging to these larger groups, as well as under the heads of COMPARATIVE ANATOMY, EVOLUTION, OSTEOLOGY, PALÆONTOLOGY, etc., a large amount of information bearing on the general subject of zoology will be found. J. S. NEWBERRY.

# JOHNSON'S UNIVERSAL CYCLOPÆDIA SUPERIOR TO APPLETONS' AND OTHERS.

**From Rev. M. W. Jacobus, S. T. D., LL.D., Professor in the Theological Seminary, Allegheny, Pa.**

(*Reprinted.*) We are most agreeably surprised to find such a wealth of valuable material compacted within the covers of JOHNSON'S UNIVERSAL CYCLOPÆDIA. It well answers the admirable purpose of the editors—to make it a manual for most convenient use, to be at the elbow for most familiar reference. The names of the distinguished Editors-in-Chief, as well as of the several Associate Editors, had prepared us to expect much, but we find more than we had expected within this compass. Everything cannot be set forth in full under such limitations of space and cost; but, comparing it with *Appletons'* last edition on our shelves, we find thirty additional geographical items on one page of this work, taken at random, and on the next page eight additional items—historical, geographical, and botanical—between two words. And as yet we have found no item in *Appletons'* not found in this, though there may be such. We write this as a part of our testimony to the very valuable and wonderfully complete material to be found in this Cyclopædia, justifying the epithet of "Universal."

**From Rev. J. E. Latimer, S. T. D., Dean of Boston University and Prof. of Systematic Theology.**

A. J. JOHNSON, ESQ.—MY DEAR SIR: I am pleased with Volume II. of JOHNSON'S UNIVERSAL CYCLOPÆDIA even more than with the first. That commended itself to me as most excellent, but now that you have enlarged the plan and compass to embrace a fourth volume, all doubt vanishes, and I pronounce it *the* cyclopædia for scholars and for the people. (1) It contains far more material than its most imposing rival, the *New American Cyclopædia*. The four volumes will contain as many words as sixteen volumes of *Appletons' Cyclopædia*. (2) In view of this fact, the price which JOHNSON'S CYCLOPÆDIA costs renders it cheaper than any other comprehensive work of this character. (3) I have no hesitation thus in commending it to all who desire a cyclopædia in preference to the *Britannica*, *Knight's*, *Chambers's*, or even *Appletons'* new one. (4) The *Britannica*, as all other English cyclopædias, fails in adequate presentation of topics relating to German and French subjects, and markedly so in philosophy. The articles in JOHNSON'S on philosophic subjects are written *con amore* and by adepts, as, for instance, on Kant, Fichte, Hegel, and Hamilton. These are original articles, having no flavor of earlier cyclopædias and of opinions received at second hand, like most articles on these subjects. (5) The articles on natural science in general are full, quite exhaustive, and speak "the last word" on the subject. To mention examples would be unnecessary, since the statement may be verified by turning to any related topic. (6) I venture to say that no cyclopædia so fully and in so brief compass presents a statement of ancient and modern literature and their chief products as does JOHNSON'S. (7) Great value attaches to this Cyclopædia because of the fulness of its information on all matters pertaining to geography, and the valuable maps which are interspersed throughout the work. In fact, it supersedes in great part any gazetteer. In brief, then, the scholar may read other great cyclopædias, such as Ersch and Gruber's, Larousse's *Dictionnaire*, and the *Britannica*, but for popular use I have no hesitation in giving chief commendation to JOHNSON'S.

**From J. C. Freeman, A. M., B. D., Prof. of Latin Lang. and Lit. in the University of Chicago, Ill.**

MR. C. G. G. PAINE.—DEAR SIR: For some time I have felt the need of a cyclopædia, and it was my intention to buy the new *Appleton*, but I was dissuaded by the high price of the work. When you first showed me JOHNSON'S, I felt sure that it was not the one for me, because a four-volume cyclopædia could not be full enough for my purposes. A brief examination, however, was sufficient to show that the work was strong and full in its presentation of recent scientific results. "Yes," said I, "this is strong in science, but it does not contain enough on classical and literary topics for me." But an examination of two hours surprised me: it showed that the judicious labors of Barnard, Guyot, Seelye, and their able coadjutors were placing between the covers of those four volumes all of value which is in the sixteen volumes of *Appletons'*, and many thousand topics besides. I am decidedly of the opinion that for the average American JOHNSON'S is better than *Chambers's*, better than *Appletons'*, better than the *Britannica*, and is *the* American Cyclopædia.

**From Prof. Isaac M. Wellington, Principal of the Detroit (Mich.) High School.**

Though in possession of Chambers's and Appletons' *Cyclopædias*, and always within easy reach of the *Encyclopædia Britannica*, yet so highly do I value JOHNSON'S forthcoming work that I at once subscribed for it. To one who has time to read the prefaces to this Cyclopædia by the parties responsible for the work, its great and peculiar value must become so evident that nothing short of lack of present means can induce him to forego the ownership of it. To such as have not the time to ascertain its worth in this manner I give this opinion of it: To the busy business-man, who desires to be generally well informed, and has but a few minutes daily to devote to this purpose, this work will furnish in the shortest possible time, and in a reliable and pointed manner, the pith of what he wants to know. To the scholar, who wants only facts in their most concise form, this work, giving the cream of knowledge of the centuries, must prove indispensable. The work is conceived and executed in the spirit of the age. Horace Greeley, pre-eminently a representative man of his time, not only planned it, but gave a portion of his busy life to its preparation, because he felt that it was needed by the American people.

**From Rev. I. O. Kimble and W. M. Glenny, M. D., of Albia, Iowa.**

MR. WILLIAM RAMSAY—DEAR SIR: We have subscribed for *Appletons' Cyclopædia*, last edition, but in comparing it with JOHNSON'S we are frank to say that we would be glad to make an even exchange for the latter. Our reasons are briefly these: that JOHNSON'S is the more *scholarly*, *more reliable* on the most *important subjects;* and, besides, the names of the eminent authors are attached to the articles, and it also includes many subjects not named in *Appleton*.

**From Charles O. Thompson, A. M., Prin. and Prof. of Chem., Worcester (Mass.) Free Institute.**

(*Reprinted.*) I have carefully examined the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and diligently compared it, title by title, with *Chambers's* and with *Appletons'*. For infor-

mation about facts, events, things, localities, and persons, level with the times and properly condensed, it is, in my judgment, vastly superior to either of its competitors. It is especially strong in the applied sciences.

**From Prof. J. F. Everett, A. M., Supt. Rock Island City Schools, Illinois.**

(*Reprinted.*) DEAR SIR: In reply to your request I would say, that when you placed JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA in my hands for examination, I had not the least idea of purchasing it. Having *Appletons' American*, with the *Annuals*, I supposed my library was complete in that line, but having examined Volume First of JOHNSON'S, I cheerfully gave you an order for one set. The list of editors is a sufficient guaranty of its worth. In comparing it with *Appletons' American Cyclopædia*, I find that it is far more exhaustive in the number of subjects treated, and better arranged in the subject-matter presented. There are many features in this work that are interesting and valuable to the student. Any one carefully examining the maps of this work will find that they are not equalled in any other work of the kind. In fact, Prof. Guyot (one of the Editors-in-Chief) has surpassed himself. In my opinion, no library is quite complete without JOHNSON'S UNIVERSAL CYCLOPÆDIA. I heartily commend it to the public.

**From Hon. P. R. L. Pierce, Mayor of the City of Grand Rapids, Mich.**

(*Reprinted.*) I take great pleasure in certifying to so capital a work as JOHNSON'S UNIVERSAL CYCLOPÆDIA, and I have spent some time in comparing it and its merits with *Appletons'*, which I own. I find that it contains more than twice the amount of information found in *Appletons'*, and the price is remarkably low, considering the vast amount of information it contains. It is a universal history and epitome of the world's knowledge in paragraphs of great value to the ordinary reader as well as the scholar.

**From A. S. Packard, Jr., M. D., Prof. in the Peabody Academy of Science, Salem, Mass.**

(*Reprinted.*) A. J. JOHNSON, ESQ.—DEAR SIR: I must say that I like JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA exceedingly. I have been surprised to see what a diversity of talent has been brought out in physical science. I think the whole work is certainly in advance of *Appletons'*, so far as I have examined the geological and zoological articles. I hope you will be well repaid for your venture. I shall cheerfully notice it in the *American Naturalist*, and will have the number containing the notice mailed to you.

**From Prof. J. H. Ely, Principal of Mt. Carroll Union School, Mt. Carroll, Illinois.**

(*Reprinted.*) I have carefully examined JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and I am fully persuaded that it is the most complete work of the kind published. I have therefore disposed of the volumes I had purchased of D. Appleton & Co. (*The American Cyclopædia*), and cheerfully given an order for JOHNSON'S. I think the change warrantable, both in view of the superiority of the work over the *American*, and the low price at which the UNIVERSAL is sold.

**From J. G. Evans, Pres. of Hedding College, Abingdon, Illinois.**

(*Reprinted.*) I have examined JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and am highly pleased with the plan of the work and its execution. When completed it will be a scientific and literary library in itself. The list of contributors to the remaining volumes is a sufficient assurance that they will not fall below the first. *Appletons' Cyclopædia* is a rich treasury of knowledge, but JOHNSON'S is in many respects superior, while it falls below it in none. Its discussions are sufficiently elaborate, and yet, by a conciseness not found in other works of the kind, room has been secured for the treatment of numerous and important subjects not found in other encyclopædias. It ought to be in every library. Indeed, no library can be complete without it.

**From Rev. Wm. H. Wyckoff, LL.D., Cor. Sec. American Bible Union, New York.**

(*Reprinted.*) A. J. JOHNSON, ESQ.—DEAR SIR: I have carefully examined JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA so far as published, and take the liberty of expressing to you my gratification in observing the following excellences by which it appears to me to be characterized:

1. *Its Convenience.*—It can lie on my table as a dictionary, and I can refer to its contents without rising. But a work in twenty or thirty volumes must be kept on the shelves of a library, and to consult it a writer must lay aside his pen, rise from his seat, and look out a particular volume. Perhaps in five minutes he has to repeat the same operation, or, which is equally as likely, forego the advantages of consulting the cyclopædia rather than leave his place.

2. *Its Comprehensiveness.*—I have four encyclopædias convenient for reference, as far as works in so many volumes can be made convenient. They are REES'S, BRITANNICA, PENNY, and APPLETON'S, THE AMERICAN. All of them together do not embrace *one-third* of the subjects comprehended in the UNIVERSAL. A rapid writer feels harassed and provoked when he has hastily risen from his chair and examined four different works of this kind, and finds that the topic on which he wishes information has not been mentioned in any one of them. But the UNIVERSAL is properly named. It supplies pressing wants, meets every reasonable expectation, and, by the universality of its comprehensiveness, fully vindicates its title.

3. *Condensation.*—It excludes the superfluous and the unnecessary, condenses expressions without excluding needed facts, and thus simplifies and facilitates reference.

4. *Arrangement.*—So far as my examination has extended, the facts collected in articles of any length are arranged with uncommon propriety and perspicuity.

5. *Titles.*—The words or names under which subjects are explained in a work of this kind should be those under which the information conveyed is most likely to be sought. In this your work excels all its predecessors.

6. *On subjects of universal dispute*, such as systems of dogmatic theology, you occupy the only tenable ground, allowing both sides to appear, each for itself, and not assuming the authority of judge to decide upon the merits of their respective pretensions.

7. *You Exhibit the World as it Is.*—The necessities of the present progressive age, and the new aspects of every description of business, with the modern developments of facts and theories, have created the urgent want of a new style of cyclopædia; and I do not hesitate to say that yours meets that want.

## *TESTIMONIALS OF COMPARISON CONTINUED.*

**From Hon. H. A. M. Henderson, LL.D., State Supt. of Public Instruction, Frankfort, Ky.**

A. J. JOHNSON & SON—GENTS: JOHNSON'S UNIVERSAL CYCLOPÆDIA supplies the greatest want of modern literature. It is comprehensive without being diffuse. It is in itself a family library. For ready reference I prefer it to any other cyclopædia in existence. What is needed in a book of this character is a concise and clear statement of facts that can be readily comprehended. While other books are more pretentious, they are no more valuable. The topics in your work are more numerous than in the *Britannica*, *Chambers's*, or *American* by Appleton, and what is said under them far more satisfactory because of their terseness and transparency of treatment. Aside from the vain show of great array of volumes, I prefer your Cyclopædia to any other even at the same cost. We do not desire in a work of the kind generally long and exhaustive treatises. What is desired is a truthful presentation of facts, leaving the use that is to be made of them to the independent exertion and original conception of the mind. While your Cyclopædia is of inestimable value to the editor, professional man, and *littérateur*, it leaves little, if anything, to be desired as a full compendium of useful knowledge for the home library. I regard it a *vade mecum* to all classes, and have never seen a book that I could so confidently commend to all.

**From Rt. Rev. Edmund de Schweinitz, S. T. D., Pres. of Moravian Col. and Theol. Sem., Bethlehem, Pa.**

MR. A. J. JOHNSON: I cannot forbear adding that I consider JOHNSON'S UNIVERSAL CYCLOPÆDIA the best work of the kind with which I am acquainted. I have carefully compared the two volumes you sent me with Appletons' new edition of the *American Cyclopædia*, and I find yours not only far more complete, but the articles far more satisfactory than the equivalent articles in that cyclopædia. A notable instance is the article on *Evolution*.

**From Prof. D. W. Lewis, Supt. of City Schools, Washington, Iowa.**

I have *Zell's* and ten volumes of *Appletons'* revised *American Cyclopædia*, but after a fair examination, finding JOHNSON'S UNIVERSAL CYCLOPÆDIA in so many respects the best reference work with which I am acquainted, I will take a full set of JOHNSON'S before finishing *Appletons'*. To all who want an immense amount of information, briefly stated and at a reasonable expense, I heartily recommend JOHNSON'S CYCLOPÆDIA.

**From Prof. W. L. Klein, Supt. of Woodstock Public Schools, Illinois.**

JOHNSON'S UNIVERSAL CYCLOPÆDIA seems to me to be the best work of the kind in the market. The articles are written by men who stand at the head of their respective professions, and each article seems to contain the best information to be found anywhere upon the subject of which it treats. The author's name at the end of the article is a guaranty that the matter is not merely compiled, but is the result of original investigation, and the names—recognized as authorities—thus placed preclude the necessity of verifying the information. The work is condensed, and it contains much more matter than the other encyclopædias; but I do not think the condensation has been made at the expense of accuracy and completeness. I have examined the work by seeking information upon points which have arisen during my school-work and general reading—points not satisfactorily explained either in *Appletons' American* or *Zell's*, to which I have access—and in every case I find clear, concise, and full information in JOHNSON'S.

**From Prof. Henry N. French, Supt. of Marshall Public Schools, Michigan.**

I have been permitted to examine with some care JOHNSON'S UNIVERSAL CYCLOPÆDIA, and also in connection and comparison with Appletons' revised *American*, of which I am the possessor. I am very greatly pleased with this work in every respect, and had I seen it before purchasing *Appletons'*, am sure I should have given JOHNSON'S the preference. In the value and amount of matter contained, in method of arrangement and general execution, it is in no respect inferior to any of the more voluminous cyclopædias, while in price it has a great advantage over them all. I trust it may meet with a good sale, for it is really a most meritorious work.

**From Rev. D. Nicoll, S. T. D., De Witt, Iowa.**

Having examined to some extent the First and Second Volumes of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and having compared them with the *American Cyclopædia* and also with *Zell's Encyclopædia*, which I have in my library, I have no hesitation in saying that I regard JOHNSON'S in many respects superior to either of the other two, and can cheerfully recommend it as a valuable work and worthy a place in every library.

**From Hon. W. W. Wylie, Supt. of Public Schools, Lyons, Iowa.**

I have examined JOHNSON'S UNIVERSAL CYCLOPÆDIA, and must say that I believe it to be the best cyclopædia published, so far as I know. It is certainly far superior to *Zell's*, which is no more than a good dictionary. Appletons' revised *American* comes short of it in many respects, and costs more than double the price of JOHNSON'S. All the recommendation it needs is to be compared, subject by subject, with any other cyclopædia. It should have a place in every library. No live teacher can afford to be without it.

**From Prof. B. F. Barge, Supt. of Schools, Geneseo, Henry Co., Illinois.**

I have carefully examined JOHNSON'S UNIVERSAL CYCLOPÆDIA, and regard it superior to any other in use; and although I have *Chambers's* in my private library and Appletons' *American* and *Chambers's* in the high school library, I think so highly of JOHNSON'S that I could not afford to do without it, and will have a set for my own and also one for the high school library.

**From Prof. I. L. Kephart, Western College, Iowa.**

Having examined JOHNSON'S UNIVERSAL CYCLOPÆDIA, I pronounce it to be by far the most thorough, complete, and desirable work of the kind extant, quite surpassing Appletons' revised *American* and *Chambers's* in many important and highly-essential particulars. I take pleasure in recommending it to all as an invaluable work, especially to the student and all engaged in literary pursuits.

**From D. G. Brinton, M. D., Editor Medical and Surgical Reporter, Philadelphia, Pa.**

Among the several encyclopædias which now dispute the American market, JOHNSON'S UNIVERSAL CYCLOPÆDIA justifies in many respects its claims to pre-eminence. It is as far superior to *Zell's Encyclopædia* as Trousseau's *Clinical Lectures* are to old Gunn's *Domestic Medicine;* compared to the unwieldy and costly *Encyclopædia Britannica,* it is what an American trotting-wagon is to the lumbering mail-coach; while its more formidable rival, Appletons' *American Cyclopædia,* is not only three times more in price, but is notoriously disfigured by partisan views in a number of its historical articles, and unfavorable discriminations in regard to contemporaries. On the whole, we have no hesitation in commending JOHNSON'S as the most desirable work of its class to own that is now to be had.

**From Rev. William B. Watkins, S. T. D., Pittsburg, Pa., Author of Cyclopædia of Methodism, also of an Etymological Dictionary of Ancient and Modern Geographical Names, etc., and one of the most eminent scholars in the Methodist Episcopal Church.**

JOHNSON'S UNIVERSAL CYCLOPÆDIA.—*To the Editor of the McKeesport Paragon, Pa.:* The subject of rival cyclopædias has taken the place of the rival dictionaries of a few years ago, and the real question for decision now is, Which is the *best* cyclopædia? This is the more imperative from the fact that a good cyclopædia is an admitted necessity. A library, however elaborate otherwise, would be barren and incomplete without it. A college, an academy, or a public school deprived of this prolific source of knowledge must ever remain in the rear of those thus properly equipped. The family reared without the aid of such advantageous instruction must take its place in society in a lower scale of intelligence than that which has had daily access to these treasuries of knowledge. In a word, all professions, occupations, and spheres of society in the present age demand a book of universal reference—a want created by the habit of general reading and the spirit of universal inquiry. Hence arises the necessity that the work appealed to should be *trustworthy, unbiassed, comprehensive, condensed, and inexpensive.* These qualities it must have to meet the popular want, and without these it will be more or less of a failure. Several works professing to embody these qualities have been presented to the American public. Among these are the *Encyclopædia Britannica, Chambers's Cyclopædia, Zell's Cyclopædia, The American Cyclopædia,* and JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. That all these works have merit it cannot be disputed, but do they all meet the demand of the people and fill the requirements of the hour? Let us see.

Partly from a taste in that direction, and partly from the pursuit of certain studies which demanded thorough research and investigation, the writer hereof has given considerable attention to this subject, and the result of these examinations he desires to record. Concerning the books referred to above, three of them can be dismissed with a word or two concerning each. The *Encyclopædia Britannica* is a British work, although the plates of the ninth edition are sent to this country and it is reprinted here; but the articles are usually from a Transatlantic standpoint, are too elaborate, and the work is in the main too costly for the average American reader. The articles are unquestionably able and exhaustive, but they are oftentimes prolix, and are mainly of subjects in which American minds are not keenly interested. *Chambers's Cyclopædia* is also a reprint, is in ten volumes, but many of the same objections may be urged to it as to the former. American subjects, especially the thrilling events of the past sixteen years, do not enter into its general plan. Of *Zell's Cyclopædia* we need only say that it assumes too much the character of a dictionary and a gazetteer to satisfy the demand for general knowledge.

The question, indeed, narrows itself down to *two competitive* cyclopædias — *The American Cyclopædia,* published by D. Appleton & Co., and edited by George Ripley of the New York *Tribune,* and Charles A. Dana of the New York *Sun,* and JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, published by A. J. Johnson & Son, and edited by Dr. Barnard, president of Columbia College, and Dr. Arnold Guyot, professor in the College of New Jersey, aided by *thirty-two* Associate and Assistant Editors of such national reputation and acknowledged ability as Drs. Asa Gray, R. D. Hitchcock, Philip Schaff, and Abel Stevens, in connection with Prof. Seelye, Hon. George P. Marsh, and ex-President Theodore D. Woolsey. *Between these two, and these alone, lies the issue.* The editors, publishers, and contributors to both works are regarded as of the highest respectability as well as ability, and they both have the same general aim—that is, to provide the American people with a work demanded by the nature and want of the times. Which of these has fulfilled the requisition?

*The American Cyclopædia* is a *revised* edition of the *New American Cyclopædia,* which appeared just before our recent war, and was supplemented by *Annuals* until the present revision. The first edition, a copy of which is in my library, met with considerable favor, both on account of its unbiassed character and its better adaptation to our wants than the cumbersome English cyclopædias which it superseded; notwithstanding which, it was felt to be too expensive for the amount of information conveyed, and was in many of its parts *hastily thrown together,* and consequently marked by *numerous inaccuracies* and *obsolete statements.* To remedy these defects, as well as to embody the stirring events of later times, the publishers and editors set about the thorough revision of the work. These two editions of *Appleton* I have examined *article by article* and *volume by volume.* The first I consider to be unbiassed; the second is *not.* All the articles of the former edition—many of which were written by Roman Catholics—that appertain to the issues between the Protestants and Catholics, have been *altered, modified, expunged, condensed,* or made to say the *opposite* of what they *formerly* said. I care nothing now about the merits of these controversies and historical differences, and have no disposition to assail any Church; it is the question of *fairness* and *honesty* in the editors of a professedly trustworthy and elaborate work, who in one edition should utter certain statements as *truth,* and in the next contradict or *whitewash* them in perhaps *thirty* or *forty instances.* The thing is too *inconsistent* for fairness, and the books are there to show for themselves. Let me give one instance: In the old cyclopædia, in speaking of the popular or common schools about the time of the Reformation, it says: "Beyond this mingled scholastic and religious training, meagre as it was, *the idea for the education of the masses had not gone;*" in the revised edition it says: "This idea of popular education has been carried out by the zealous efforts *of the Jesuits* and other religious orders."

## *TESTIMONIALS OF COMPARISON CONTINUED.*

Alongside of this revised edition and the old edition I have also examined the first two volumes of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and the following is the result of the examination: JOHNSON'S work is in *four* portable, convenient, and well-printed volumes, while the other is in *sixteen;* but the former has an average of 1700 words in each of its 7000 pages, while the latter has an average of 940 words in each of its estimated 13,088 pages, which would make JOHNSON'S work, if printed in Appletons' type and page, to occupy fifteen and forty-seven one-hundredth volumes of the other. So, in reference to the amount of matter given, there is not much choice between them. But there is much difference in the cost: for the margins and larger type of Appletons' the subscriber must pay more than one-half more than for the former. JOHNSON'S work is not only general in the scope of its details, but it is concise in its articles, and at the same time *thoroughly accurate*, and the information given has been brought down to the *very latest date*. These articles are written by the most eminent authorities on these specialties, and the names of more than eight hundred of these specialists, embracing all departments of literature, science, arts, history, and political economy, are attached to the articles they have written. What adds to its immense practical worth is the fact that it is full of matters pertaining to subjects of interest in our own country, and which are of every-day importance to men, women, and children. *Twenty-three thousand* subjects are found here that have no place in Appletons' *revised edition*, including a condensed account of the different towns of our country, for the accuracy of which the pens of more than *two thousand* gentlemen connected with the press have been brought into requisition.

I conclude, therefore, by awarding to JOHNSON'S CYCLOPÆDIA the merit of *trustworthiness*, of *unbiassed fairness*, of *comprehensiveness*, of *condensation*, and of *inexpensiveness*, and believe it to be fully abreast of the times and that it eminently meets the wants of the period.

### TO WHOM IT MAY CONCERN.

Messrs. D. Appleton & Co., publishers of the *American Cyclopædia*, by their laborious efforts through the public press and otherwise to injure the credit of JOHNSON'S UNIVERSAL CYCLOPÆDIA, have practically declared their own work to be immaculate, and therefore we are justified, and really compelled, not only to protect our own work, but to show the public the real object of their assaults, which can be done in no better way than to expose one of their *tricks* in employing a well-known *Jesuit priest* to make history stultify itself, in order, doubtless, that they might be pecuniarily benefited thereby. We could, if space would permit us, right here clearly establish the fact to any intelligent mind (*and we have done so in a pamphlet*) that Appletons' *revised American Cyclopædia* is but a *poor compilation* at best; and very many of the articles in the *first work* have been reset in the present edition; and that, too, without the least revision by their authors, and hence are nearly *twenty years* behind the times; and that *scores* and *scores* of the most important, as well as the most interesting, subjects upon which every inquiring cultivated mind would desire information, and would be almost certain to turn to even a smaller than a *sixteen-volume* cyclopædia, and at a much less price than $112, or even $80, and expect to find them accurately treated, are *entirely omitted.*

A. J. JOHNSON & SON.

[From the *Republican*, Lansing, Mich.]

### APPLETONS' NEW CYCLOPÆDIA JESUITIZED.

We heard several months ago that a circular had been issued by D. Appleton & Co. of New York, and distributed, with due reserve, to the Catholics of America, inviting subscriptions to their *New Cyclopædia* on the ground that it is especially edited to suit the views of Roman Catholics, and to keep itself out of the *Index Expurgatorius*, in which the infallible Church names the books that it forbids the faithful to read, under penalty of *eternal damnation* for disobedience. After much delay and difficulty, and by efforts made through several parties, we have at last obtained a copy of this curious circular. If it be said that it is addressed *to* D. Appleton & Co., and not *by* them, we reply that it is on the same sheet with the description and terms of the work, evidently printed *by them;* and, furthermore, we are credibly told that it is held in reserve by canvassing agents, under instructions to use it *only* as an inducement for Roman Catholics to subscribe. Here is the remarkable recommendation:

From Rev. BERNARD O'REILLY, D. D., late Professor of Mental Philosophy, Holy Cross College, Worcester, Mass.; also St. John's College, Fordham, N. Y.

NEW YORK, June 25, 1873.

TO MESSRS. D. APPLETON & CO.—GENTLEMEN: I am gratified to learn that you intend addressing a circular to the Catholic clergy throughout the country, soliciting their patronage for the revised edition of the *Cyclopædia*. Allow me to say this much for the articles which touch in any way on the Catholic religion—that I have the hearty sanction of the Most Reverend the Archbishop of New York in my supervision of these articles, and his co-operation and advice at all times when any question or difficulty arises which needs the *eye of authority*. Moreover, so far as my own poor ability can go, I can only promise that no industry or labor shall be spared by me to make every article I touch as satisfactory as it can be; and, furthermore, that the editors are resolved that this edition shall, in every department, be distinguished by the utter absence of sectarian spirit. Very respectfully yours, B. O'REILLY.

Little comment is necessary. Rev. Dr. O'Reilly was for several years a leading professor in the Jesuit college of the Holy Cross at Worcester, Mass. He is an accomplished teacher of that insidious and despotic foreign order. Any "articles which touch in any way on the Catholic religion" are to go through his hands, be colored and varnished to suit him, and, if need be, submitted to Archbishop McCloskey of New York as the supreme "eye of authority" in America.

Rev. Dr. O'Reilly gives his promise that the editors of the *New Cyclopædia* "are resolved that this edition shall, in every department, be distinguished by the utter absence of sectarian spirit." When a Roman Catholic talks of *sectarianism*, we know very well his meaning: his Church is the true Church, and everything different from it is *sectarian*. This is a pledge that one class of religionists in this country—and that not the most favorable to intelligence or liberty—shall have the shaping of "the articles," historic, dogmatic, or otherwise, "which *touch in any way*" on their religion. If people who do not bow their necks to the Romish yoke want to buy a Romish cyclopædia under false pretences, they can get it of D. Appleton & Co.

If we are to have (as seems likely) a hot contest on the common-school question, those who oppose the insolent demands of the Romish Church should look to it that their fountains of infor-

mation are not poisoned by Jesuit hands. We advise fair-minded men to let this cyclopædia alone until D. Appleton & Co. show clean hands and religious impartiality. If they are fishing for Roman Catholic subscribers, then let them get all they can of that class alone, and let those who do not want Romish flavoring in their soup take some other mental food.

[From the New York *Baptist Weekly*.]

### JESUITIZING A CYCLOPÆDIA.

It may be a matter of surprise to some that the religious papers generally have not taken hold of this matter. It may not, however, be known that pretty much every office has been visited by gentlemen connected with the work, who have made apologetic pleas to disarm and frustrate criticism. The *Christian Intelligencer* has taken up the matter, and with a zeal worthy of the noble Protestant Church it represents, it exhibited the remarkable changes made, and condemned them. The *Methodist* tries to palliate this outrage, but declares that if the people could be persuaded that this important work is tainted with Roman Catholic opinion on the questions which are dear to them as life, they would utterly reject it. If we have not shown that it is thus tainted, we should like to know what is necessary to prove it. Every little while books are adapted for various denominations by changes. We have seen quite a number of hymn-books, for instance, which have been manipulated to suit. It seems to us the best thing the Messrs. Appleton could do—because, in view of the charges made, the most honest—is to put on their future issues of the new *Cyclopædia*, "Roman Catholic Edition," and then on the title-page, to commend it to the faithful, they might announce that it was supervised by a priest with the sanction of the Archbishop of New York, and passages favorable to Protestantism expurgated under "the eye of authority."

[From the New York *Christian at Work*.]

### AN EXPLANATION WANTED.

Messrs. Appleton & Co. can do themselves and the public no better service than to explain just what is the position which their new *Cyclopædia* holds with reference to the Roman Catholic element. That they have put their proof-sheets under the supervision of a Catholic prelate in this city; that they have significantly changed the head-lines of articles, and notably in the interests of the Catholics; that the article on the "St. Bartholomew Massacre" is toned down in the new edition to "Bartholomew;" that they have already assured the supervisory prelate in question that nothing should go in the *Cyclopædia* to which he may object,—all this looks badly enough, and will occasion widespread regret and surprise. The treatment of the unfortunate Huguenots by the Catholics is quite too well understood in this country for the Messrs. Appleton to simply call it, as they do in their new *Cyclopædia*, "a desperate struggle for many years waged in France between the Catholics and the Huguenots, *in which both parties committed numerous outrages.*" Fine words butter no parsnips! We bear no ill-will against the Catholic Church, but facts are facts, and the St. Bartholomew Massacre, as well as the persistent persecution of the unfortunate Huguenots, is not to be covered up in this way.

The course which the publishers of Appletons' new *Cyclopædia* have adopted will greatly weaken, if it does not destroy, the confidence of the Christian public in their work, nor need they be surprised if the distrust extends to others of their publications.

[From the New York *Methodist*.]

### THE CRITICS OF APPLETONS' CYCLOPÆDIA.

Dr. O'Reilly should know that the critics of the *Cyclopædia* are not such persons as he here describes. The tone of his letter proves conclusively that they were right in questioning his fitness for the work which has been assigned him. A writer who is so quick to give the lie may do for a partisan, but cannot make an impartial historian; especially is he unfit to furnish history for the American people. This book, as every other, is a fair subject of criticism, and it is no answer to specific objections to call them slanders; they must be met fairly, point for point.

We have already called attention to the impossibility of reconciling the Roman Catholic and the Protestant view of many modern questions. When Isaac Barrow wrote his treatise on the supremacy of the pope, he considered the claim of such supremacy in matters temporal so far abandoned as not to need refutation. The papal authors, he said, had grown ashamed of it. We have lived to see this very claim revived; its revival has changed the tone of Roman Catholic thought. When the first edition of the *Cyclopædia* was issued, there was still a liberal Catholicism; since then liberal Catholicism has been annihilated. The head of the Church has denounced all the principles which are distinctive of the American state. A few weeks ago he bade a company of French pilgrims to pray for the suppression in France of universal suffrage, which, he said, would more correctly be called universal falsification. An American cyclopædia can take no other than the American—which is, as to its principles, the Protestant—view of the questions of our time. An article on common schools which omits to state that they are the product of the Reformation omits the vital principle of the whole subject. The emancipation of the laity in the Church had for its legal consequence their elevation in knowledge. Our fear is that the editors of the *Cyclopædia* are attempting to compromise where compromise is impossible. If the Church is right, then modern society must be revolutionized, and a revolution is precisely what the Church contemplates; if the modern world is right, the claims of the Church must be met by the coercive power of law. Both parties are aroused all over Christendom; in Europe the battle has begun, and the blows are heavy. The new *Cyclopædia* must choose between the two, for the contention runs into morals, politics, education, history; in short, all the interests of mankind.

**From James W. White, M. D., D. D. S., Ed. of the Dental Cosmos, Philadelphia, Pa.**

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a marvel of compactness, fulness, and precision. Orderly and systematic in its comprehensiveness and universal in its range, it is indeed a "Treasury of Useful Knowledge," containing concise and accurate information upon almost every subject within the field of human knowledge. Its science articles especially commend it to students, writers, and professional men. Its convenient form and unequalled cheapness must secure it a place upon the library-table of every one who can afford its price. It is unquestionably superior to any other.

# TESTIMONIALS

FROM

## GENTLEMEN DISTINGUISHED IN PUBLIC AFFAIRS, SCIENCE, ART, EDUCATION, Etc. Etc.

**From the Ex-President of the United States, Gen. U. S. Grant, LL.D.**

JOHNSON'S UNIVERSAL CYCLOPÆDIA will supply a want long felt, by furnishing a *complete* and *valuable* cyclopædia which will be available for all.

**From the Ex-Vice-President of the United States, Hon. Henry Wilson, LL.D.**

I am very favorably impressed with both its *design* and *execution*, and with the amount of *valuable information* it contains and the compact form in which it is presented.

**From the Chief-Justice of the United States, Hon. M. R. Waite, LL.D.**

The names of your Editors and Contributors furnish an abundant guaranty that the work you have undertaken will be well done. It seems to me to be *very complete.*

**From the Ex-Secretary of State of the United States, Hon. Hamilton Fish, LL.D.**

The mechanical execution of the book is *very fine*, and the examination which I have been able to give it commends to me very strongly the plan of the work and its *literary* and *scientific excellence.* I have already spent an hour with much interest and instruction in looking into a subject which was presented shortly after the volumes arrived. I have no doubt that the work will prove all that it aims to be.

**From the Quartermaster-General of the U. S. Army, Gen. M. C. Meigs, M. N. A. S.**

The plan of the work is well devised, and it appears to be executed in a most liberal manner. I have read carefully the articles which I felt myself the best entitled to speak of, and I find them evidently prepared by persons well skilled and learned in the branches of knowledge of which they treat. I believe that Mr. Johnson has succeeded in making what is so well set forth as the need of the man of affairs—*a book to lie always ready on the desk or table, and containing what is desired on almost all the subjects for which such a cyclopædia is consulted.*

**From Gen. Q. A. Gillmore, Lieut.-Col. U. S. Engineers and Bvt. Maj.-Gen. U. S. Army.**

I believe it to be *unsurpassed* in general excellence and usefulness by any similar work heretofore published. The leading articles are not only interesting in style, but *able* and *exhaustive*, while the briefer definitions are suitably condensed and full of *the most instructive information.*

**From Samuel D. Tillman, LL.D., Prof. of Mech'l Phil. and Technology Am. Ins., New York City.**

The work is a *marvel of abbreviation*, being both *concise* and *comprehensive.* It is not an abridgment by simply curtailing, nor by omitting such essential parts as would disclose deformity. Brevity has not been attained by keeping out of view any fruitful portion of the field of knowledge, but rather by that judicious lopping of a luxurious overgrowth of thought and opinion which more clearly reveals the solid trunk and root of truth. This method of condensation, which deals only with verified and significant facts, must meet the approval all who desire a reliable work of ready reference. A perusal of its expositions on other branches of knowledge will convince the reader at once that this Cyclopædia is not a mere epitome of older works, but is an *original compendium, just adapted to the present wants of the American people.*

**From Hon. Charles O'Conor, LL.D., New York.**

The grand moving panorama of the world's entire life being kept, as it were, under immediate observation, it is obviously desirable that some ready means of comprehending its infinitely diversified features should be ever at command. The thing needed to this end is a handbook comprising the whole circle of science, literature, and art; and this could be formed only by selecting from the vast records of knowledge the large and distinctive features of each article, to the careful exclusion of all such minor details as thorough skill could pronounce not essential for the purposes of ordinary or incidental reference. The necessity not having become apparent until a recent period, the first conception of such a design appears in JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. I have examined with some care the advance volumes of this work, and take the liberty of saying that, according to my best judgment, it exhibits in great perfection the indispensable qualities—that is to say, *compactness* and *brevity*—without any sacrifice of adequacy to the end in view. *I think it will be found extremely useful to all classes.*

**From Hon. Lewis H. Morgan, LL.D., Rochester, N. Y.**

I have examined the work with care, and commend it for the *number* and *thoroughness* of its original articles, for the care with which other articles have been revised, for the *richness* of its illustrations, and for its *breadth* and *range.* As a product of individual enterprise, and in mechanical execution, it is *more than creditable* to its publisher.

**From Rev. W. A. Stearns, D. D., LL.D., late Pres. of Amherst College, Amherst, Mass.**

From an examination of the work, in connection with what I have learned respecting it from other sources, I have come to regard it as a book of no common merit. *Happily conceived, admirably executed, clear, sufficiently full, condensed,* while it will be welcomed by scholars, it seems better adapted for ordinary uses than any other work of the kind with which I am acquainted.

## *TESTIMONIALS CONTINUED.*

**From Rev. W. S. Tyler, D. D., LL.D., Williston Prof. of the Greek Lang. and Lit. in Amherst Coll., Mass.**

I have examined carefully some of the articles of the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and find that they bear the test well. The subjects are judiciously selected, they cover so wide a field that the work deserves the epithet "Universal," and they are treated with the conciseness, fulness, clearness, and accuracy which constitute the chief merit of a cyclopædia. Comprehensive without being superficial, comprising the whole circle of useful knowledge within the compass of three large royal octavo volumes, the entire work promises to meet a felt want, not only of professional and educated men, but of cultivated families generally and an intelligent community.

**From Edward Hitchcock, A. M., M. D., Prof. of Hygiene and Physical Education, and Lecturer on Natural History in Amherst College, Mass.**

I am very glad to look over the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA just from the press. It pleases me, because it seems to be based on common sense, is fresh, and fully up to the times in both theory and fact. I believe it will prove a public benefaction.

**From R. H. Mather, Prof. of Greek and German in Amherst College, Amherst, Mass.**

A brief examination of the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA convinces me that it is correctly called a "Treasury of Knowledge." I do not believe it is possible to find elsewhere the same amount of interesting, useful, and accurate information within the same compass as you offer here. The great mass of readers, to whom the many-volumed cyclopædias are a sealed book because of their expense, ought to be very grateful to you for giving them in such a compact and intelligible form that which heretofore it has taken half a dozen large volumes to express. It bears the marks of careful and thorough scholarship, and the typographical execution is everything that could be desired.

**From E. S. Snell, LL.D., Prof. of Math. and Nat. Philosophy in Amherst College, Mass.**

The ILLUSTRATED CYCLOPÆDIA published by Mr. Johnson pleases me much. I judge, from the examination which I have given to the first volume, that it answers well to its descriptive title, "A Scientific and Popular Treasury of Useful Knowledge." The many distinguished names among its editors and contributors are a sufficient guaranty of the fidelity and thoroughness with which the work will be performed.

**From E. P. Crowell, Prof. of Latin in Amherst College, Amherst, Mass.**

An examination of some of the articles in JOHNSON'S ILLUSTRATED CYCLOPÆDIA upon subjects in which I am especially interested has enabled me to appreciate the ability with which this work has been prepared, and its superior merits. It seems to me to be an invaluable book of reference for every household and every student.

**From Elijah P. Harris, Ph. D., Prof. of Chemistry in Amherst College, Amherst, Mass.**

From a brief examination of the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, I conclude that it is well adapted to the most general use. The most essential matter is condensed to convenient articles, which are clear and comprehensive. It lacks the more elaborate character of much larger works, which renders them valuable to a few, but tedious, cumbersome, and too expensive for the many.

**From John W. Burgess, LL.B., Prof. of History and Political Science in Amherst Coll., Mass.**

I have examined those articles in the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA which pertain more nearly to my own line of work, and am able to express myself as highly pleased with the same. They bear the stamp of original investigation and composition by men of learning and experience in the departments to which they relate.

**From Charles Upham Shepard, M. D., LL.D., Massachusetts Prof. of Nat. Hist. in Amherst Coll., Mass.**

I have carefully examined Vol. I. of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and am fully satisfied that if completed on the same plan it will constitute the most valuable work of a similar character in the English language.

**From George A. White, A. M., Instructor in Latin and Greek in Amherst College, Amherst, Mass.**

I have examined with some care several articles in JOHNSON'S UNIVERSAL CYCLOPÆDIA, especially such articles as the teachers of our schools need to consult. I find them complete and accurate, and calculated to supplement the information given in our school text-books. If the articles I am not able to judge of are as valuable as those I have seen, the work is superior to any now in use, while its reasonable price will place it within the reach of thousands in our State, who have always felt the need of such a work, and have not been able to procure it. I believe that parents and teachers will find it a wonderful help in enlarging their own knowledge and bringing it up to the times, and in answering the many questions which bright children are constantly asking. I should advise them to examine this work before purchasing books on the various subjects to which they need to refer.

**From W. L. Montague, Prof. of French, Italian, and Spanish in Amherst College, Amherst, Mass.**

An examination of the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA has given me a very favorable impression of the work. It is excellent in design and in execution. It is concise, and at the same time comprehensive. Though it contains many subjects which are not found in other works of a similar character, still, all the important topics are treated with great clearness, and with a fulness amply sufficient for the general reader. As a library of useful information it is a work which is almost indispensable to every scholar and every reader of literature.

## *TESTIMONIALS CONTINUED.*

**From W. S. Clark, Ph. D., Pres., and Prof. of Botany and Horticulture in Mass. Agr. Coll., Amherst, Mass.**

Having carefully examined the first volume of your NEW UNIVERSAL CYCLOPÆDIA, I am greatly pleased with many of its peculiar merits. It seems to me that, after the Bible and the Dictionary, it is the most indispensable book for every library. The number of topics is immense, and the treatment of them admirable. As a gazetteer and biographical dictionary it is worth its cost, while its scientific articles are rendered specially valuable by the appended names of their authors, who are without exception first-rate men in their several departments. This "Treasury of Useful Knowledge," faithfully studied, will render any person of ordinary ability really intelligent and well informed.

**From Lieut. A. H. Merrill, U. S. Army, Prof. of Mil. Sci. and Tactics in Mass. Agr. Coll., Amherst, Mass.**

I have examined the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and I esteem it to be a work well worthy of national pride. I heartily commend this volume, above others of its kind, for its clear, terse, and able treatment of so great a number of current issues, and especially those in reference to all matters of technical science.

**From Henry W. Parker, M. A., Prof. of Mental, Moral, and Social Sci. in Mass. Agr. Coll., Amherst.**

The names of its editors and principal contributors vouch for the excellence of JOHNSON'S UNIVERSAL CYCLOPÆDIA. They are well known as men of high rank in their departments of study. Every family should possess some work of this kind, though at the cost of abstinence from some luxuries.

**From Henry H. Goodell, M. A., Prof. of Modern Languages in Mass. Agr. Coll., Amherst, Mass.**

After a careful comparison of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA with other works of the same nature, we can heartily commend it to the public. In all matters of art and science it presents the latest information, carefully prepared by the best scholars. If the succeeding volumes carry out the promise of the first, it will indeed be what it claims, "a Treasury of Useful Knowledge" for every household.

**From Hon. Levi Stockbridge, Professor of Agriculture in Mass. Agricultural College, Amherst, Mass.**

I have examined the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and can find no fault in it. In perfection and thoroughness it abundantly sustains the reputation of your editors and contributors, and cannot fail of being extremely valuable to all who have occasion to consult a work of the kind.

**From William B. Graves, Prof. of Physics and Civil Engineering in Mass. Agr. Coll., Amherst, Mass.**

A cursory examination of the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA impresses me very favorably. It seems to be all that is claimed for it,—brief, comprehensive, exact. The amount of matter condensed in so small a space is surprisingly large. This fact, together with its comparative cheapness, will cause it to be welcomed by those whose means will not allow the more expensive works of the same class.

**From S. T. Maynard, Assist. Prof. of Botany and Horticulture in the Mass. Agr. Coll., Amherst, Mass.**

I find, after a careful examination of JOHNSON'S UNIVERSAL CYCLOPÆDIA, that it is very complete in botanical information, giving, as it does, a concise and accurate description of the different *families* of plants, a careful description of each *genus*, and also of all the useful or particularly interesting *species*, making it quite as valuable as any botanical dictionary we now have. It is particularly valuable in that it contains the latest information upon this as upon all other subjects.

**From Prof. J. Thomas, M. D., LL.D., Philadelphia, Pa.**

MESSRS. A. J. JOHNSON & SON: DEAR SIRS—I have examined with much interest the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and have been exceedingly pleased with it. On account of its great comprehensiveness, as well as the superiority of its leading articles, I do not hesitate to place it above every other cyclopædia with which I am acquainted. The names of the many eminent men connected with the work, either as editors or contributors, are an ample guaranty of its high character, and give the fullest assurance that the articles furnished by them ably and adequately represent their respective departments. I may add, in conclusion, that this volume contains a vast amount of valuable information not to be found in any other cyclopædia, or indeed in any other work, of whatever class, hitherto published.

**From Henry Hartshorne, A. M., Prof. of Hygiene in the University of Pa.**

(*Extract from a Letter to the Publisher.*)

A. J. JOHNSON: DEAR SIR—Absence from home has delayed acknowledgment of receipt of first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA; for which, thanks. Examination satisfies me that it is the best table-book of facts—of things, places, persons, and events—in existence; its especial merits being freshness, reliableness, and availability.

**From Prof. S. S. Haldeman, of the University of Pa.**

In my opinion, JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA is worthy of the patronage of an intelligent public. The sciences are well represented by writers of known ability, the results are brought down to the latest period, and the necessary figures and maps are given in illustration. Judging from the names associated with important articles which come later in the alphabet, I anticipate a high degree of excellence for the entire work.

**From John G. Whittier, West Amesbury, Mass.**

(*Extract from a Letter to the Editor-in-chief.*)

MY DEAR PRESIDENT BARNARD: I have received the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and have looked it over with admiration at its completeness and accuracy. It more than

fulfils the promise of its publisher. One is appalled at the amount of labor it suggests on the part of its editors and writers.

**From Prof. Joseph Henry, LL.D., M. N. A. S., Sec. of Smithsonian Institute.**

(*Extract from a Letter to the Editor-in-chief.*)

PRES. F. A. P. BARNARD, LL.D.: MY DEAR SIR—I am much pleased with the plan and with the execution of your Cyclopædia so far as the latter has been carried out. If the work is completed in the same manner in which it has been commenced, it will truly be a convenient and trustworthy source of useful knowledge. It will give me pleasure to be associated with it by the contribution of articles.

**From Edmund R. Peaslee, M. D., LL.D., Prof. Med. Dept. of Dartmouth College, N. H.**

(*Extract from a Letter to the Editor-in-chief.*)

I have seen enough of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA to give me a very high estimate of the value of the work.

**From John Ordronaux, LL.B., M.D., Prof. of Med. Jurisprudence, Columbia College, N. Y.**

(*Extract from a Letter to the Editor-in-chief.*)

MY DEAR SIR: Your CYCLOPÆDIA is a magnificent collection of sterling monographs, which have the flavor of originality about them to a degree not common in American Cyclopædias.

**From Hon. J. L. M. Curry, S. T. D., LL.D., Pres. of Richmond College, Va.**

MESSRS. A. J. JOHNSON & SON: DEAR SIRS—JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA has been lying on my table long enough for me to appreciate its great value. For accuracy and fulness of information, brought down to the latest date, condensed in a brief and manageable compass, so as to facilitate reference—for all that constitutes a *vade mecum* for students and men of business—the Cyclopædia is invaluable.

**From W. D. Whitney, Ph. D., LL.D., M. N. A. S., Prof. of Sanscrit and Com. Philology in Yale Coll.**

(*Extract from a Letter to the Editor-in-chief.*)

PRES. F. A. P. BARNARD, LL.D.: MY DEAR SIR—I have felt a little embarrassed about expressing myself in praise of JOHNSON'S UNIVERSAL CYCLOPÆDIA, because such testimonials coming from expected collaborators have a little the look of "mutual-admiration-society" proceedings. As I have not, however, contributed anything to this first volume, I do not think there can be any serious objection to my reporting my very favorable impressions of its ability and value. No one person is capable of really judging of more than a small part of such a work, nor any one, perhaps, without long experience of it or a week of labor devoted to testing it; and I have tried it in neither way. But I have been much struck with the ability and freshness of many of the articles at which I have looked, and by the comprehensiveness, within moderate compass, of the plan of the whole; and I feel no doubt that it will prove to the end a collection of very high value and utility.

**From Benjamin Silliman, M. D., M. N. A. S., Prof. of Chemistry in Yale College.**

MESSRS. A. J. JOHNSON & SON: GENTLEMEN—I have examined the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, especially in the departments which fall within the range of my own special studies. I have also examined many of the other articles, and I am happy in being able to say that I find it a very valuable contribution to knowledge, presenting a large amount of matter prepared especially for this work by the most eminent men in their various departments in this country and Europe. It is not the province of an encyclopædia to present original contributions to human knowledge, but where its leading articles are prepared by authors who are themselves prominent in original investigations, the quality of the work rises much above that of a mere compilation. This is the distinguishing character, as it appears to me, of your Cyclopædia, which is truly "a Scientific and Popular Treasury of Useful Knowledge." The names of its Editors-in-chief, and of their Associate and Assistant Editors, are a guaranty of its high character; and an examination of the 1677 closely-printed pages of the first volume will show, by the frequent recurrence of eminent names, that the editorial labors have been faithfully performed.

**From George Woods, LL.D., Chancellor of the Western University, Pittsburg, Pa.**

MESSRS. A. J. JOHNSON & SON: I have examined with care JOHNSON'S UNIVERSAL CYCLOPÆDIA, and find it to be a scientific and popular "Treasury of Useful Knowledge," and, as such, well suited to the people, and also equally well adapted to the scholar and professional man. The editors and authors of the important articles are among the most accomplished scholars in their departments in our own and other countries, and are the highest authorities on the subjects on which they write. The novel feature, in such a work, of giving the names of the writers, will enable the intelligent reader to judge of the value of the authority. The clearness, conciseness, and at the same time the completeness of the articles, the binding—of the most durable kind—and the extremely low price for a work containing so much valuable knowledge, so ably prepared, render this work the best of the kind ever, within my knowledge, offered to the public, and cannot fail to secure for it a wide circulation.

**From Edward P. Crane, Prof. of Logic and Rhetoric in the Western University, Pittsburg, Pa.**

I have of late made frequent chance reference to the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA—the only one as yet issued—and have carefully read several of the more extended articles. The expectations raised by my confidence in Mr. J. as what I may term a *literary engineer*—no small matter in such a connection—and by my familiarity with the names appended to the articles in question, were in no instance disappointed. I regard this work as eminently adapted to meet the wants of the great mass of the constituency it has in view—the intelligent, but not

necessarily learned and scientific, American public. In the praiseworthy endeavor to put the average reader in possession of the prominent facts and principles of history, literature, the arts, science, and even theology, I have detected nothing that struck me as loose, slipshod, or of but merely local and ephemeral interest. Considering the object of the publisher, to furnish us with a *table encyclopædia*, as distinguished from an alphabetically arranged library of recondite treatises, I think the condensed form in which the matter is presented a recommendation rather than the contrary. As to price, Mr. Johnson has certainly done his best to realize Mr. Greeley's germ-idea—that of putting the most valuable encyclopædic matter within reach of the million, whose thirst for exact knowledge brings them so often into contact with the limits of their resources.

**From Rev. M. W. Jacobus, S. T. D., LL.D., Professor in the Theological Seminary, Allegheny, Pa.**

We are most agreeably surprised to find such a wealth of valuable material compacted within the covers of JOHNSON'S UNIVERSAL CYCLOPÆDIA. It well answers the admirable purpose of the editors—to make it a manual for most convenient use, to be at the elbow for most familiar reference. The names of the distinguished Editors-in-chief, as well as of the several Associate Editors, had prepared us to expect much, but we find more than we had expected within this compass. Everything cannot be set forth in full under such limitations of space and cost; but, comparing it with *Appleton's* last edition on our shelves, we find thirty additional geographical items on one page of this work, taken at random, and on the next page eight additional items—historical, geographical, and botanical—between two words. And as yet we have found no item in *Appleton's* not found in this, though there may be such. We write this as part of our testimony to the very valuable and wonderfully complete material to be found in this Cyclopædia, justifying the epithet of "Universal."

**From Rev. Wm. H. Hornblower, S. T. D., Professor in Western Theological Seminary, Allegheny, Pa.**

I have examined the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA. It is literally a "Treasury of Knowledge." While not intended as a substitute for other cyclopædias, it contains information on such a variety of subjects not usually found within the compass of such works that it may be regarded as a valuable supplement with which even literary men cannot dispense, and for business, practical men, and men who can afford only one such costly work of reference, or have not time to consult others, it promises to be the best cyclopædia in the English language.

**From Prof. S. J. Wilson, D. D., Theological Seminary, Allegheny, Pa.**

I have examined the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and can cordially recommend it. The aim of the publisher is to make a cyclopædia which shall contain the greatest amount of accurate information on a wide range of subjects in the most condensed and available form. Thus far, the plan has been carried out with a remarkable degree of success. I know of no single volume which gives so much varied and valuable information in the same space as this volume gives.

**From Ransom Dexter, A. M., M. D., Lecturer on Com. Anat. and Zoology in the Univ. of Chicago.**

(*Extract from a Letter to the Editor-in-chief.*)

PRES. F. A. P. BARNARD, LL.D.: MY DEAR SIR—I have the pleasure as well as the honor to acknowledge the receipt of the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, for which please accept my thanks. Please allow me to gratuitously add that I think its value is much enhanced by the pronunciation of its terms, its concise and yet precise style of dealing with its subjects, as well as its very general excellence in almost every other particular. It is in my opinion the best cyclopædia for general use published.

**From Rev. William Porter, A. M., Prof. of Latin in Beloit College, Wis.**

I think it may be safely said of JOHNSON'S UNIVERSAL CYCLOPÆDIA—the first volume of which I have examined with care—that it promises to rank among the very best of the works of its class. On a very wide range of subjects it gives in the most compact form just the information one seeks from such a work. In its treatment of all the more important subjects it presents in clear, full, accurate, and often quite exhaustive statements the best thoughts and the best results of study and research of many of the ablest thinkers and writers of our century—of men who in their several departments have earned the right to speak with authority on the subjects of which they treat. In the matter of American biography and geography I think the work can have no equal. I do not believe it possible to find elsewhere within the same compass and at so small a cost such an amount of information on such a variety of subjects—such a treasury of really useful knowledge.

**From James H. Eaton, Ph. D., Prof. of Chemistry and Mineralogy in Beloit College, Wis.**

I have carefully examined several of the science-articles of the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. They are admirable. They are concise, and at the same time are adapted to the understanding of those who have not made a special study of the sciences themselves. They contain the results of recent investigations, and have been written by men who are familiar with the present stand-points of theoretical science. The list of authorities at the close of each article is of great value. If the entire work is of equal excellence, as it doubtless will be, judging from the names of the contributors, it will be for every one a "Treasury of Useful Knowledge."

**From P. Hendrickson, A. M., Prof. of Modern Languages in Beloit College, Wis.**

The practical writer and the man of affairs want at their hands facts and statistics clear and easily accessible, upon which to build premises and from which to draw conclusions. The common reader and the critic want answers to innumerable questions, and explanations of the many allusions which are continually met in the newspapers and other publications of the time. JOHNSON'S UNIVERSAL CYCLOPÆDIA meets these wants in a most satisfactory manner, and, I think, better than any other publication of the kind. Almost every question in history, geography, and science is

clearly and concisely answered, many beautifully illustrated, in three manageable volumes. As a means of self-culture this work is invaluable, and renders ignorance more inexcusable than ever.

**From Rev. H. M. Whitney, A. M., Professor of Rhetoric and English Literature in Beloit College, Wis.**

I have just spent several hours with great pleasure in examining JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, Vol. I. It seems to me to combine in an admirable manner correctness and thoroughness with compactness. For busy men it seems to possess, in this fact, an advantage over works entering more largely into criticism or detail. The prepossession which I received from the names of its editors and principal contributors is confirmed by careful reading of several articles in different departments.

**From T. C. Chamberlin, A. M., Professor of Geology, Zoology, and Botany in Beloit College, Wis.**

I have examined the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA with care, giving especial attention to those subjects with which I am most familiar, and I find it to be clear, concise, thorough, and reliable. The selection of matter is excellent and the authors are trustworthy. It is well adapted to serve the purpose for which it is designed.

**From Rev. Joseph Emerson, A. M., Williams Prof. of Greek in Beloit College, Wis.**

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA is truly a "Treasury of Knowledge." I know not where else so much, so varied, and such fresh information can be had at so small expense of time, pains, and means.

**From I. W. Pettibone, M. A., Principal of the Preparatory School of Beloit College, Wis.**

Having devoted some little time to an examination of the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, I am greatly pleased with the plan and execution of the work, so far as completed. Its articles, ably written and thoroughly condensed and digested, place before the reader just the information he is most likely to need upon any topic, in its most accessible form.

**From Prof. Wm. F. Phelps, A. M., Pres. of First State Normal School of Minn.**

Having made a careful and thorough examination of the first volume of JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA, and having compared it with other publications of its class, I feel prepared to express my unqualified preference for it over any other work of the kind that has come under my notice. In the breadth and comprehensiveness of its scope, in the fulness of its details, in the severe conciseness of its style, in the accuracy of its statements of fact, and in the beauty of its artistic and mechanical execution, I know of nothing that can compare with it. If this great enterprise shall be completed as it has been begun, as it unquestionably will be, it will supply to the student and the man of business a library of information drawn from every field of human thought, within a compass and at a price never before realized.

In the absence of any special examination, I should have considered the names of the eminent men comprised in the catalogue of its Editors and Contributors a sufficient guaranty of its extraordinary merit as a "Treasury of Universal Knowledge." The freshness and originality of its more important articles are in striking contrast with the mere compilations of many similar publications, and are among its crowning excellences. The work will certainly prove to be an enduring monument to American scholarship and American enterprise. It cannot fail to receive a welcome commensurate with its inestimable value.

**From James B. Angell, LL.D., President of the University of Michigan.**

I have examined the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA. The plan is happily conceived, and the execution of the plan is excellent. The geographical, biographical, and scientific articles seem to be especially well done. The writers of the important articles on scientific topics will be recognized everywhere as authorities in their respective fields.

**From Benjamin F. Cocker, D. D., Professor in the University of Michigan.**

I have taken time to carefully examine JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and feel justified in expressing my full approval both of the plan and execution of the work. I feel sure it will meet a real want which has been felt by the public, and must become the most popular of all the cyclopædias. There is a large amount of valuable information judiciously condensed in the articles, especially the scientific articles, where the business-man, the farmer, and the college-student in his early career will find much that they need to know without wading through large treatises; and they may be sure that their information is accurate. Were a young man of limited means to ask me which encyclopædia he should procure, I should certainly recommend this in preference to *Chambers's*, or even the *American*. I certainly prefer the scientific articles I have looked over in JOHNSON'S to those in the *American*.

**From C. K. Adams, Professor of History in the University of Michigan.**

I have devoted the greater part of an evening to an examination of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and I have no hesitation in saying, as the result of this examination, that, in my opinion, as a work of reference it is superior to any other work with which I am acquainted. For the purposes of a student I cannot see how a work could be more convenient or more valuable. It contains a greater variety of information than the larger cyclopædias, and for this reason it is likely for ordinary purposes to be quite as valuable.

**From Hon. George W. Dobbin, Judge of the Superior Court of Baltimore, Md.**

Being a subscriber to JOHNSON'S UNIVERSAL CYCLOPÆDIA, I have carefully examined the First, Second, and Third Volumes as they have been delivered to me. In my opinion, the work most satisfactorily executes the liberal plan upon which it was projected, and is truly the most complete, comprehensive, and at the same time compendious book of general reference which has yet been published.

## *TESTIMONIALS CONTINUED.*

**From Rev. P. A. Chadbourne, D. D., LL.D., Pres. of Williams College, Williamstown, Mass.**

An examination of the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA has convinced me of its great excellence. Its articles are well written, and such reference is given to other cognate articles as to render most of the topics more complete than they could otherwise be without greatly enlarging the work. The list of writers given as contributors to the two remaining volumes is a guarantee for excellent material, and the well-known character of the Editors gives assurance that the work, as a whole, will have all that thoroughness and accuracy so essential in a standard book of reference.

**From Hon. Henry Stockbridge, Attorney-at-law, Baltimore, Md.**

(*Extract from a Letter to the Editor-in-Chief.*)

MY DEAR PRES. BARNARD: I have given the first volume of your Cyclopædia the test of several weeks' constant reference on a wide range of subjects, and of special examination of the articles connected with my own (the legal) profession. The result has been satisfactory far beyond anticipation—almost beyond belief, as it seems hardly credible that so much breadth, fulness, clearness, and accuracy of information can be brought within the number of pages composing the volume. I have not found that the extreme condensation—which enables the work to be in fact as well as in name a "cyclopædia"—has involved any obscurity or inaccuracy. On the contrary, the definitions of technical terms and statements of abstract propositions are as precise and clear as the discussions are learned, candid, *wise*. The dissatisfying part is that we must wait a year or two for the other volumes.

**From Hon. L. Q. C. Lamar, Member of Congress from Miss.**

(*Extract from a Letter to the Editor-in-Chief.*)

JOHNSON'S UNIVERSAL CYCLOPÆDIA treats with ability and unusual fairness all political questions, giving the views of the best minds on all sides. I have had occasion to examine with special care the contributions of Dwight, Stephens, and others. The articles from the former are marked by great clearness and precision as well as by their exhaustive treatment of the subjects, and with Stephens my own views are in such perfect accord that a criticism would be out of place. I have already formed the habit of referring to the Cyclopædia for information, and I find it very valuable.

**From Hon. William Windom, United States Senator from Minn.**

From an examination of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, I fully concur in the estimate of Prof. W. F. Phelps in relation to its great value and its adaptation to meet a public want not hitherto supplied by any similar work. The distinguished names of its editors and contributors are a sufficient guarantee of its trustworthiness.

**From Paul F. Eve, M. D., Prof. of Operative and Medical Surgery in the University of Nashville, Tenn.**

JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA convinces me, after an examination of the work, that no expense has been spared and no labor withheld from making it just what is so much required in our households—reliable information of events, of things, of locations, and of brief biographical sketches of noted persons the world over. I know of no better book, except the Bible, than this one for our families.

**From Rev. Dr. Ludwig Niffert, A. M., Director of the Theological School, Frankfort, Germany.**

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a treasure indeed; it cannot fail to be highly prized as a book of reference, especially by students and literary workers. I place it as one of the very best standards in the library of our theological school. Its brief articles are well condensed, retaining all essential data; its larger papers, on more important topics, are unusually able. Of the latter class, the articles on CALVINISM, by Dr. Hodge, and on ARMINIANISM, by Dr. Whedon, are of sterling worth, and show the complete impartiality of the work. The plan of this Cyclopædia is unique, and renders it a special convenience for literary men, without detracting from its popular adaptation.

**From. Rev. Dr. Sulzberger, A. M., Prof. in Theological School, Frankfort, Germany.**

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a masterly production, sound and full in its science and extraordinary in its practical adaptations. Mr. Greeley's suggestion of such a work as a table-book for ready and reliable reference was one of the wisest things in that great journalist's life; and Mr. Johnson has completely exemplified the suggestion. I find its articles severely and uniformly accurate. The comparative treatment of subjects in the long and the short articles is a striking feature of the work. The former are given thoroughly and with the latest results of science; the latter are given with skilful condensation. Literary men, as well as intelligent families, have much needed just such a work. It deserves a place in the first rank of encyclopædias by its literary and scientific ability, while its merits, on the score of practical adaptation, are quite peculiar to it.

**From S. H. McCollester, LL.D., Pres. of Buchtel College, Akron, Ohio.**

After having spent some time in examining the contents of the first volume, comparing many of its articles with those on the same subjects in four other cyclopædias, I am forced to the conclusion that for accuracy, completeness, taste, and scholarship it is not surpassed by any work of the kind. Its publication must be hailed with satisfaction by all scholars who learn its intrinsic worth, and must be acknowledged an invaluable treasury of information for all who would *seek* and *know*. It is a perfect library of itself. It is marvellous how so much knowledge could be so ably prepared, carefully compiled, and neatly presented in three volumes for so small a sum of money as advertised. It is a fund of knowledge placed within the reach of the mass. It would seem that almost every laboring man could afford to purchase the work. No home ought to be without it. Let the young be educated to make daily use of it, and they cannot fail to grow in wisdom and extensive learning, for it furnishes the best products of many of the best minds.

## *TESTIMONIALS CONTINUED.*

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**From the Faculty of Yale College and other distinguished gentlemen of New Haven, Conn.**

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, a work in four volumes, of nearly 1700 pages each, or about 6800 closely printed pages, presents the following important features:

It is convenient for ready reference; its most important articles are original productions, prepared for this work by men who are well known to be distinguished in the several departments of learning which they represent, each article being signed by the writer; it embraces a wide range of subjects—about 20,000 in each volume—and is especially adapted to the needs of American readers.

An examination of the first volume must convince any one that, as a table-book for the homes of the people, and for the use of professional men, merchants, and manufacturers, it will prove to be a work of great usefulness.

It is practically a geographical gazetteer, a biographical dictionary, a medical and legal manual, and a scientific repertory. The treatment of the subjects is thorough and comprehensive, and at the same time simple and judiciously adapted to the requirements of general readers.

A fortunate combination of circumstances has, under the energetic and persevering efforts of the chief editors, contributed to the securing of the co-operation of a large number of eminent writers, whose names will be recognized as among the first in the country in their respective branches of learning.

The work, when complete, will contain a vast amount of useful knowledge, presented in a popular and convenient form, and at a moderate price.

THEODORE D. WOOLSEY,
*Ex-President of Yale College.*

NOAH PORTER,
*President of Yale College.*

WM. P. TROWBRIDGE,
*Higgin Prof. Dynamical Engineering, Yale Col., Adj.-Gen., etc.*

W. A. NORTON,
*Prof. of Civil Engineering, Yale College.*

LEONARD BACON,
*Kent Prof. of Law, Yale College.*

SAMUEL W. JOHNSON,
*Prof. of Theoretical and Agricultural Chemistry, Yale Col.*

A. E. VERRILL,
*Prof. of Zoology, Yale College.*

JOHNSON T. PLATT,
*Prof. of Pleading and Equity Jurisprudence, Yale College.*

JAMES E. ENGLISH,
*Ex-Governor of Conn.*

B. G. NORTHROP,
*Sec. of Conn. Board of Education.*

B. SILLIMAN,
*Prof. of Chemistry, Yale College.*

J. M. HOPPIN,
*Prof. of Homiletics and Pastoral Charge, Yale College.*

GEORGE P. FISHER,
*Prof. of Ecclesiastical History, Yale College.*

STEPHEN G. HUBBARD,
*Prof. of Obstetrics and Diseases of Women and Children, Yale College.*

THOMAS A. THACHER,
*Prof. of Latin Language and Literature, Yale College.*

LEONARD J. SANFORD,
*Prof. of Anatomy and Physiology, Yale College.*

H. A. NEWTON,
*Prof. of Mathematics, Yale College.*

HENRY B. HARRISON,
*Fellow of Yale College, Attorney-at-Law, etc.*

CHAS. R. INGERSOLL,
*Governor of Conn.*

S. R. DENNIN,
*Pastor of Third Congregational Church.*

**From Prof. W. P. Blake, A. M., Ph. B., Vice-Pres. of American Institute of Mining Engineering, etc., New Haven, Conn.**

MESSRS. A. J. JOHNSON & SON: GENTLEMEN—I find the first volume of JOHNSON'S NEW UNIVERSAL ILLUSTRATED CYCLOPÆDIA to be very useful to myself and to the members of my family, and I hope that the other volumes will soon be completed in the same thorough and satisfactory manner. The contributions have the great merits of freshness and originality, and of being prepared for the work by specialists of acknowledged authority. I congratulate you upon the editorial management, and upon a success which cannot but be regarded as assured.

**From Rev. James W. Hubbell, Pastor of College Street Church, New Haven, Conn.—A characteristic letter.**

TO MY FRIENDS AND PARISHIONERS: This will introduce Mr. B. S. PRICE, who represents the well-known publishing-house of A. J. JOHNSON, New York. I have been looking for a cyclopædia, and had not found the one I wanted until I examined JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, loaned me by Mr. PRICE. It is universal in its information. It is not too full, and yet complete. Its information is reliable, and presented by some of the best minds in the country. Horace Greeley was a busy and practical man, and as he conceived the idea that is wrought out in this work, and wrought upon it himself, you may be sure that it is designed not only for professional and scholarly men, but also for plain and practical people, for use in the family every day. It is a work which must be of especial value where children are growing up into active and useful life. The small economy of three cents a day for one year will procure a volume of this work, which is not perishable like food and clothing, but which will be a lasting blessing to the members of the household. I earnestly hope that not a person who can possibly purchase the work will fail to do so. And also, that the wealthy and public-spirited, who may have a copy of some similar work, will procure this, because, in the first place, it will be valuable as supplementing the others, and is more thoroughly American than any that has yet appeared; and then by so doing they will furnish an example which will encourage others to the higher education of their families.

This letter is written with the simple desire of promoting the cause of education in the community.

**From Rev. John S. C. Abbott, Author, etc., New Haven, Conn.**

I have, with some care, examined JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and consider it an admirable work. In the above commendation by Rev. Mr. Hubbell I cordially concur.

## *TESTIMONIALS CONTINUED.*

### From Col. Thos. Wentworth Higginson, Clergyman, Author, etc., Newport, R. I.

(*Extract from a Letter to the Publisher.*)

A. J. JOHNSON, ESQ.: DEAR SIR—I shall find JOHNSON'S UNIVERSAL CYCLOPÆDIA a possession of great value. There are purposes for which a student needs a more voluminous work, but he is pretty sure to make more use of a shorter one; and in your book, by the judicious distribution of space, many departments are treated as completely as in much larger compilations. It is impossible for a cyclopædia to attain more than an approximation to accuracy—at least, I have never met with one which did; and, so far as I have examined, the percentage of errors is as small in that bearing your name as in any work of its class; certainly not large enough to furnish any drawback worth the mentioning upon its usefulness.

### From Gen. Winfield S. Hancock, Major-Gen. U. S. Army.

(*Extract from a Letter to the Editor-in-Chief.*)

PRES. F. A. P. BARNARD, Editor-in-Chief: MY DEAR SIR—I have examined your first volume of JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA, and find it to be a work of rare usefulness and merit. It contains a vast amount of information on important subjects, which is so compactly and clearly presented as to make it a most valuable book of reference.

### From Gen. William F. Barry, Col. Second Reg. U. S. Artillery and Bvt. Major-Gen. U. S. Army.

Head-quarters Artillery School, U. S. A., Fortress Monroe, Va.: MESSRS. A. J. JOHNSON & SON: DEAR SIRS—During the two months that the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA has been in my possession I have had occasion to make frequent reference to it, and have never failed to find the subjects I was in search of readily accessible, and, although briefly, nevertheless tersely and satisfactorily, treated. In constituting a book of handy reference you seem to have attained the happy mean of great condensation and a sufficiently elaborate definition or description of each of the numerous articles which make up its contents. In compiling a scientific and popular treasury of useful knowledge, a busy man's cyclopædia, a *table*-book in which facts, and not critical opinions, are set forth, it seems to me that you have fully attained the end which you had in view.

### From Albert G. Brackett, Lieut.-Col. Second U. S. Cavalry, Fort Sanders, Wyoming Terr.

MY DEAR MR. JOHNSON: I have secured an elegant copy of the first volume of JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA, and am charmed with it. You have certainly succeeded in making it, what you aimed to make it, the most comprehensive and complete work of the kind ever published, considering its size. The articles are written by men who thoroughly understand what they are writing about, and purity of style is added to accurate information. I have shown it to several people who are excellent judges, and they are all so much pleased with it that they say they will never be satisfied until they have secured copies for themselves. It is fresh, vigorous, and strong: exactly the book that is needed for business-men, and others who are not able to carry considerable libraries about with them. In my opinion it cannot fail to meet with great success, covering as it does a vast deal of information of the most valuable character.

### From Gen. P. V. Hagner, Bvt. Brig.-Gen. U. S. Army, Watervliet Arsenal, West Troy, N. Y.

MESSRS. A. J. JOHNSON & SON: DEAR SIRS—I have carefully examined JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA with increasing interest and admiration to the end, and it seems to me that (quoting your own words) "the approach to that ideal of excellence which should be the object of all human effort" has been made "by a leap."

### From Gen. J. Watts de Peyster, A. M., New York.

The American people have great reason to be grateful to Mr. A. J. Johnson for his NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA. Although it does not come under the category of those books which the celebrated Dr. Samuel Johnson says are the more useful because they may be carried to the fire and held readily in the hand, it surpasses all other cyclopædias in that it approaches the nearest to this handy class; perhaps as nearly as any work of extensive reference can assimilate without sacrificing its usefulness. To ensure its most favorable reception by the public it ought to be sufficient to mention the names of its editors and principal contributors, some of whom—like President Barnard and his distinguished brother, the general, likewise Gens. Abbott, Cullum, Gillmore, besides others too numerous to cite in such a letter, but all well known to the writer—in illustrating their peculiar domains in literature and science possess a weight from their capacity, education, and experience sufficient to inspire the most unwavering faith in their facts and opinions.

Few authors stand higher in their several ways than those who have contributed the majority of the articles of importance and of interest. As a gazetteer alone for the epoch it is invaluable. In a private library of reference almost without a superior, questions were decided by reference to the first volume of your CYCLOPÆDIA, by important facts therein stated, which could not be found elsewhere.

Complete in four volumes, it will constitute a library in itself, not only for reference and instruction, but for relaxation and suggestive entertainment.

It is a pleasure to recommend such a work—a credit to its publisher, a glory to its editors, an honor to its contributors. All that remains to say is to express the hope that it will repay not only in credit, but, what is still more agreeable, solid profit.

## *TESTIMONIALS CONTINUED.*

### From Rev. Wm. H. Wyckoff, LL.D., Cor. Sec. American Bible Union, New York.

A. J. JOHNSON, ESQ.: DEAR SIR—I have carefully examined JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA so far as published, and take the liberty of expressing to you my gratification in observing the following excellences by which it appears to me to be characterized:

1. *Its Convenience.*—It can lie on my table as a dictionary, and I can refer to its contents without rising. But a work in twenty or thirty volumes must be kept on the shelves of a library, and to consult it a writer must lay aside his pen, rise from his seat, and look out a particular volume. Perhaps in five minutes he has to repeat the same operation, or, which is equally as likely, forego the advantages of consulting the cyclopædia rather than leave his place.

2. *Its Comprehensiveness.*—I have four encyclopædias convenient for reference, as far as works in so many volumes can be made convenient. They are REES'S, BRITANNICA, PENNY, and AMERICAN. All of them together do not embrace *one-third* of the subjects comprehended in the UNIVERSAL. A rapid writer feels harassed and provoked when he has hastily risen from his chair, and examined four different works of this kind, and finds that the topic on which he wishes information has not been mentioned in any one of them. But the UNIVERSAL is properly named. It supplies pressing wants, meets every reasonable expectation, and, by the universality of its comprehensiveness, fully vindicates its title.

3. *Condensation.*—It excludes the superfluous and the unnecessary, condenses expressions without excluding needed facts, and thus simplifies and facilitates reference.

4. *Arrangement.*—So far as my examination has extended, the facts collected in articles of any length are arranged with uncommon propriety and perspicuity.

5. *Titles.*—The words or names under which subjects are explained in a work of this kind should be those under which the information conveyed is most likely to be sought. In this your work excels all its predecessors.

6. *On subjects of universal dispute*, such as systems of dogmatic theology, you occupy the only tenable ground, allowing both sides to appear, each for itself, and not assuming the authority of judge to decide upon the merits of their respective pretensions.

7. *You Exhibit the World as it Is.*—The necessities of the present progressive age, and the new aspects of every description of business, with the modern developments of facts and theories, have created the urgent want of a new style of cyclopædia; and I do not hesitate to say that yours meets that want.

### From Hon. Andrew D. White, LL.D., Pres. of Cornell University, Ithaca, N. Y.

A. J. JOHNSON, ESQ.: MY DEAR SIR—I have looked over the first volume of JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA, and those of the articles that I have specially examined seem to me calculated to serve an excellent purpose for the community at large, and to indicate carefully the sources for the special information of students wishing to make large and thorough studies.

### From Prof. Theophilus Parsons, LL.D., Cambridge, Mass.

A. J. JOHNSON, ESQ.: The plan of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA seems to me well adapted to make it an eminently serviceable family-book. Of its fulness, accuracy, and trustworthiness the public have a sufficient assurance in the ability and care of the eminent gentlemen to whom you have entrusted its superintendence.

### From Hon. Joseph P. Bradley, LL.D., Supreme Court of the U. S., Washington, D. C.

A. J. JOHNSON, ESQ.: DEAR SIR—The first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA has reached me. For a rare combination of comprehensiveness and compactness I do not think it is equalled by any publication of the kind. So much matter—and all useful matter, too—was never compressed in so small a compass before. It will take the place of larger works, because it contains all they do in a much more convenient form. And no smaller work can approach it in usefulness.

### From Charles A. Joy, Ph. D., Prof. of Chemistry, Columbia College, New York.

DR. F. A. P. BARNARD, EDITOR, MR. A. J. JOHNSON, PUBLISHER: DEAR SIRS—I have the honor to acknowledge the receipt of Volume I. of JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA, and to thank you heartily for the valuable gift. The accurate knowledge and literary skill of the editors, and the well-known practical experience of the publisher, ought to secure for this work the unqualified appreciation of the public.

### From W. G. Peck, LL.D., Prof. of Mathematics and Astronomy, Columbia College, New York.

A. J. JOHNSON, ESQ.: DEAR SIR—Be kind enough to accept my sincere thanks for your letter of the 20th inst., with the accompanying volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. Independently of your very kind letter, which is very gratifying to me, I attach a high value to the book itself. From my knowledge of the great ability of its editor-in-chief, as well as from the character of the articles I have had an opportunity to examine, I am convinced that it will be the most valuable compendium of the principles of modern science that has ever been published.

### From Ogden N. Rood, A. M., M. N. A. S., Prof. of Mechanics and Physics in Columbia College, N. Y.

A. J. JOHNSON, ESQ.: DEAR SIR—I have received a copy of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and although unable thus far to give it more than a slight examination, yet I have no hesitation in saying that the profound learning, excellent judgment, and untiring industry of the editors-in-chief, Drs. Barnard and Guyot, are to me a sufficient guaranty for the excellence of the work.

## *TESTIMONIALS CONTINUED.*

### From Prof. J. R. Herrick, S. T. D., South Hadley, Mass.

JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA, *The Atlas*, *The Analysis*, and the *Natural History*, or *Animal Kingdom*, issued by the same enterprising publisher, all show that no pains or expense were spared to render them—in matter and form, in maps, illustrations, engravings, type, and binding—as perfect of their kind as it was possible to make them. This last, the CYCLOPÆDIA, may be called his *great* work. The outlay for apparatus and for articles is immense, while the editors-in-chief (President Barnard and Professor Guyot), with their able *associate* and *assistant* editors, give assurance both for the *plan* and its *execution*. The plan is to render the work thoroughly *comprehensive* of men and things about which correct information may be desired; and the wide range presented in this CYCLOPÆDIA is wonderful. What is really needed can be readily found, and what is not needed is excluded. And for most who desire to consult such a work this is better than an elaborate discussion of topics. The more extended cyclopædias may have their own merits, but certainly this must impress itself upon the mind of one who carefully examines it as most admirably realizing its aim in being, to an unprecedented extent, "*a Scientific and Popular Treasury of Useful Knowledge.*"

### From J. P. Weston, D. D., Principal of Dean Academy, Franklin, Mass.

I have examined with some care and with much interest the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA.

From my knowledge of Mr. Johnson as a publisher, and from my acquaintance, personally or through their writings, with a very considerable number of the editors, I expected to find a valuable book; but in comprehensiveness, thoroughness, accuracy, and in mechanical execution, it exceeds my expectations.

If the other volumes shall be equal to this, JOHNSON'S CYCLOPÆDIA will be a wonderful compendium of knowledge; in short, a library in itself.

For students and for practical men it will be a storehouse of facts, to which it will be well for them to find a way of access.

I wish you great success in the good work you have undertaken.

### From Prof. Allen H. Weld, the great Author of School-books, and an experienced Teacher.

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA.—The first volume of this most useful and practical work is already published, and meets with the highest commendations from eminent scholars in every department of literature and science. It promises to be, when completed, a grand epitome of human knowledge, comprising a vast array of facts so conveniently arranged and so tersely stated as to render the work invaluable as a book of reference. It justly claims an advantage over other cyclopædias published in this and foreign countries, in giving to the public a book superior to them in many respects at so reasonable a cost as to bring it within the reach of thousands who have hitherto been debarred from purchasing the larger works. A valuable and marked feature of the work is the elaborate conciseness and clearness of style. In this can be discovered the secret of the remarkable fulness and completeness that characterizes the special articles in the first volume in so limited a space. The more one examines this excellent work, and knows of the distinguished men under whose supervision and authorship the first volume has come to light, the more will he admire and praise it; and if his means are limited, he will study economy and retrenchment with a view to become the possessor of a work which will be a source of permanent benefit and pleasure to himself and family, and to which he will daily resort for knowledge and authority on matters of inquiry, doubt, and perplexity.

### From Rev. A. A. E. Taylor, D. D., Pres. of University of Wooster, O.

Having examined with considerable care and critical design JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, I have been surprised to find so much valuable and carefully culled material condensed into such small space. It is comprehensive and well arranged for reference. The editorial work shows discrimination in selection and keen insight into the wants of those who consult such books. *I heartily recommend this* CYCLOPÆDIA *as at once the most compact and the most complete work of the kind of which I have any knowledge.*

### From Rev. W. H. Jeffers, A. M., Prof. of Greek Language and Literature, University of Wooster, O.

Having examined with some care the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, I take pleasure in adding my testimonial to the many recommendations it has already received. Condensation and thoroughness are prominent characteristics of the work. The brevity of its articles, though a feature to which some might object, will be found by most who consult it of very high excellence; for the essential facts are in each case clearly presented, and the attention is not liable to be distracted and the time lost upon unimportant detail.

In the number of articles it contains, in the accuracy of its statements, and in its convenience for reference this work is probably without a rival in our language.

### From O. N. Stoddard, LL.D., Prof. of Nat. Science, University of Wooster, O.

I have examined the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and I am much pleased with the accuracy of its statements, and the amount of information comprised in them. They are condensed and yet clear. I have no doubt of its great value as a work of reference, not only to the student, but to others, and it seems especially adapted to *family use*. It is rather a repository of facts than of discussion about them.

### From J. A. Schmitz, Prof. of Mod. Lang. and Lit., University of Wooster, O.

I have examined JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA, and am satisfied that as

a practical compend of human knowledge it is superior to any work I know of. The articles, which are more numerous than usual in such works, are short and to the point, giving the reader all the information he desires, and sparing him the reading of long essays and one-sided theories, which, because incomplete, are of little or no value.

**From D. S. Gregory, S. T. D., Professor of Metaphysics and Logic, University of Wooster, O.**

I have examined with a good deal of care the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and am satisfied that nothing else of the kind accessible to the American public approaches it in its peculiar excellences. Among the features that must recommend it to all thinking men who have need of a work of this kind are the following:

It is unequalled in cheapness. It costs less than half as much as other works of this kind with which it comes into competition.

It is of convenient size for use as a work of reference. The whole will not exceed four volumes, which may be kept upon the table for constant use. This compactness is indispensable to the greatest usefulness of a work of this kind.

It contains at least as much matter as the books in competition with it. I find by comparison that the work will contain as much as do the works which fill four or five times as many volumes and cost two or three times as much. Its treatment of all important subjects is fuller and more complete than in other works of its kind.

Its crowning excellence, however, is that what it does contain is inconceivably better than that of other works of like character with which I am acquainted. Over such works it has all the advantages which the exclusive employment of first-class brain can give it. I should have been willing to accept, almost without examination, anything, in almost any department of science, which has received the endorsement of Pres. Barnard and of my old friend and teacher, Dr. Arnold Guyot; but when, on examination, I find the foremost men in the country in every department have been engaged as co-laborers with them, aided by some of the ablest scientists of Europe, I am more than satisfied that it is just what I want upon my study-table.

**From F. C. Daugherty, Prin. of Wooster High School, O.**

*To whom it may concern:* JOHNSON'S UNIVERSAL CYCLOPÆDIA, whose publication has been announced, is now before the public. The galaxy of talent which lights its pages makes it almost presumptuous to examine before bearing witness to its merits. Having, however, scrutinized the first volume with considerable care, I do not hesitate in pronouncing it fully up to the standard of excellence which its efficient management argued, and which its publishers claimed for it.

It is especially fine in politics. The article on the "Confederate States" by Horace Greeley contains all of importance to be found in his complete history of the civil war, and in addition is a wonder of composition. In the department of *science* it is quite exhaustive. I would instance the article on "Electricity" as evidence of the same. In *natural history* the work deserves especial praise.

It would be futile to enumerate the excellences of this work. In all respects it is equal, and in many superior, to any extant. I commend it to the favor of all.

**From B. A. Hinsdale, A. M., Pres. of Hiram College, Hiram, O.**

(*Extract from a Letter to Mr. Johnson.*)

A. J. JOHNSON, ESQ.: Your list of editors and contributors is a noble one, and of itself is a sufficient guaranty of the excellence of JOHNSON'S CYCLOPÆDIA. I have looked over the volume as fully as my time would allow, and find that the expectation raised by the names of writers and editors is fully met. There is certainly room for a cyclopædia of the sort contemplated by Mr. Greeley, and I can see no reason why it should not be occupied by JOHNSON'S UNIVERSAL.

**From Rev. Geo. F. Magoun, D. D., Pres. Iowa College, Grinnell, Ia.**

From some opportunities for examining JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and from such testing of its merits in the treatment of particular subjects as I have been able to give, I am persuaded that it has great claims on the confidence of all who need—and what intelligent person does not?—such a book of reference. Not only have the articles been committed to unusually competent persons, but the important ones which I have examined have been prepared with great care, and are at once full and succinct, brought down to the present condition of information and learning, trustworthy and satisfactory. The multitude of topics and titles in the first volume has surprised me, and the evident pains and caution in respect to the prevention of errors in so large a compilation, covering so vast a field of human knowledge, have convinced me that the work, when complete, will be a safe guide.

**From Prof. P. Henderson, A. M., Beloit College, Wis.**

The practical writer and the man of affairs want at their hands facts and statistics clear and easily accessible, upon which to build premises and from which to draw conclusions. The common reader and the critic want answers to innumerable questions and explanations of many allusions which are met in the newspapers and other publications of the times.

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA meets these wants in a most satisfactory manner, and I think better than any other publication of the kind. Almost every question in geography, history, and science is clearly and concisely answered, many beautifully illustrated, in only four manageable volumes. As a means of self-culture this work is invaluable, and renders ignorance more inexcusable than ever.

## *TESTIMONIALS CONTINUED.*

### From A. A. Hodge, S. T. D., Professor of Theology in Allegheny Seminary, Allegheny City, Pa.

A. J. JOHNSON, ESQ.: DEAR SIR—I have examined JOHNSON'S UNIVERSAL CYCLOPÆDIA, and regard it as admirably adapted to accomplish the end designed. Its staff of editors is unparalleled, and is the highest possible guaranty for the excellence of the work.

### From Hon. John R. Willis, Halifax, N. S.

MESSRS. A. J. JOHNSON & SON: GENTLEMEN—I am in receipt of the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and beg to return you my grateful acknowledgments therefor, and hope that it may meet with the well-merited success which its minute accuracy, fine typography, and general appearance fairly demand for it.

### From Rev. Rufus Anderson, D. D., LL.D., Congregational House, Boston, Mass., formerly Sec. of the A. B. C. F. M.

I have leisurely examined the first volume of JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA, and the topics seem to me to be well selected and judiciously discussed. With the high aim of the publisher, the ability of the editors, and the amount of enlisted talent, the proposed four volumes must meet the wants of intelligent families all over the United States.

### From Geo. B. Emerson, LL.D., the great American Teacher and Author, Boston, Mass.

REV. PRESIDENT F. A. P. BARNARD: DEAR SIR—I have examined the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and I find it the most valuable book I have ever received. It takes the place of nearly all other dictionaries, besides giving a vast deal of matter in the most agreeable form. You have selected the very best men to give notices of our Massachusetts men—Winthrop to notice Everett, and Higginson for R. W. Emerson. These notices are most satisfactory; they give the highest gratification to one who has been or is an intimate friend of all the persons concerned. I am a lover of natural history. Your CYCLOPÆDIA will save me the trouble of consulting many volumes in my own library, thus saving time and thought. On every subject I have had time to examine you have given the work of preparing articles to some one of the ablest and most suitable persons to be found.

### From Hon. H. H. Haight, Ex-Governor of California.

H. D. WATSON, ESQ.: DEAR SIR—I have examined the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA with some care, in order to be able to give you an intelligent opinion of its merits. Its list of editors and contributors would be a guaranty for thoroughness and fidelity, comprising as it does many of the ablest men in this country in their various departments. I found the anticipation created by these names fully justified by scrutiny of the work. In my judgment it is *far superior to any cyclopædia* yet published in this country, and will render those which have preceded it of *little practical value.* It comes near fulfilling the idea of a perfect manual of reference for the scholar as well as for those in the professions and in other employments. The plan of appending the names of the authors to the principal articles attaches more responsibility to their work than if the articles were anonymous. In biography the *Cyclopædia* is full, and yet judicious; and in science, geography, law, and history it is at once comprehensive and condensed. I cordially recommend it to all who may attach any importance to my indorsement as the best work of the kind for general use that has come under my notice.

### From Rev. H. D. Lathrop, S. T. D., Rector of the Church of the Advent, San Francisco, Cal.

H. D. WATSON, ESQ., PUBLISHER JOHNSON'S CYCLOPÆDIA: DEAR SIR—After a somewhat careful examination of the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA I find that it meets my wants and satisfies my ideas of what such a book should be *better than any book in the English language.* It is comprehensive, concise, complete, and accurate. I am sure that whoever examines the book will say as I do, This is not only what I want, but what I cannot do without.

### From Prof. J. F. Everett, A. M., Supt. Rock Island City Schools, Ill.

DEAR SIR: In reply to your request I would say, that when you placed JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA in my hands for examination, I had not the least idea of purchasing it. Having *Appletons' American*, with the *Annuals*, I supposed my library was complete in that line, but having examined Volume First of JOHNSON'S, I cheerfully give you an order for one set. The list of editors is a sufficient guaranty of its worth. In comparing it with *Appletons' American Cyclopædia*, I find that it is far more exhaustive in the number of subjects treated, and better arranged in the subject-matter presented. There are many features in this work that are interesting and valuable to the student. Any one carefully examining the maps of this work, will find that they are not equalled in any other work of the kind. In fact, Prof. Guyot (one of the Editors-in-Chief) has surpassed himself. In my opinion no library is quite complete without JOHNSON'S UNIVERSAL CYCLOPÆDIA. I heartily commend it to the public.

### From Hon. P. R. L. Pierce, Mayor of the City of Grand Rapids, Mich.

I take great pleasure in certifying to so capital a work as JOHNSON'S UNIVERSAL CYCLOPÆDIA, and I have spent some time in comparing it and its merits with *Appletons'*, which I own. I find that it contains more than twice the amount of information found in *Appletons'*, and the price is remarkably low, considering the vast amount of information it contains. It is a universal history and epitome of the world's knowledge in paragraphs of great value to the ordinary reader as well as the scholar.

## *TESTIMONIALS CONTINUED.*

**From Rev. E. G. Robinson, S. T. D., LL.D., President of Brown University, Providence, R. I.**

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, Pres. Barnard and Prof. Guyot, Editors-in-chief, and published by A. J. Johnson & Son of New York, is an attempt to improve on the existing cyclopædias in accuracy, in comprehensiveness, and in condensation; and the attempt, so far as the first volume is concerned, is a manifest success. Its articles on important subjects are all written by competent men, whose names are attached, and who, instead of being mere compilers, have written from their own investigations. New subjects not hitherto treated of even in more voluminous cyclopædias here find place and adequate treatment, and the compactness and precision of nearly every article in the volume are especially noticeable.

JOHNSON'S CYCLOPÆDIA, judging from the first volume, will be especially valuable, in comparison with other works of its kind, as an American gazetteer, and in all that pertains to the natural sciences, whether in the way of discovery or of application to the mechanic arts, on all the diversified branches of law and philosophy, of ecclesiastical usage and belief, of American history and biography, and, in short, on whatever is unfamiliar but useful, it is intended to be, above all the cyclopædias which have preceded it, a condensed, comprehensive, and trustworthy treasury of information.

**From Rev. Alexis Caswell, S. T. D., LL.D., Ex-President of Brown University, Providence, R. I.**

I have given considerable time and attention to JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. Judging the whole work from this volume, I am free to say that I regard it as a work of great value, as well to the professional man as to the man of practical pursuits. I believe it is what it claims to be, truly a "thesaurus of useful knowledge." I know of no work of this description within the same compass that I could so confidently recommend.

**From John L. Lincoln, LL.D., Prof. of the Latin Language and Literature, and Instructor in German, Brown University, Providence, R. I.**

MR. E. H. GLIDDEN: DEAR SIR—I thank you for the opportunity of examining JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. It seems to me to have the great merit of furnishing most valuable and well-digested knowledge in a form fitted for direct and practical use. Indeed, it takes the reader on a grand tour through the whole realm of knowledge, securing for him at every stage whatever is capable of permanent instruction and entertainment.

**From T. Whiting Bancroft, A. M., Prof. of Rhetoric and Eng. Lit., Brown University, Providence, R. I.**

It gives me great pleasure to recommend to public attention and patronage JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. From the variety and extent of its information, from the care and accuracy with which its articles have been prepared, and from the popular and attractive style in which it has been written, it is worthy of a place not only in the library of the clergyman, the lawyer, the doctor, and the teacher, but also in the home of the merchant, mechanic, and farmer. The knowledge it imparts, whether in the realm of religion, science, art, or literature, is given with a freedom from technicalities, and with a clearness and simplicity of statement, that makes the work highly valuable as a source of information for those whose time is too limited for extensive research. The publisher's name, already familiar in town and country from the variety and usefulness of his publications, by means of this work will be still more widely known and more highly esteemed.

**From Benjamin F. Clarke, A. M., Prof. of Math. and Civ. Eng'g, Brown University, Providence, R. I.**

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA seems admirably fitted to fill the place for which it was designed. The conciseness and clearness of statement will doubtless make it a popular work for general reference. While it may not furnish the student all the details of a single department of science or literature, it furnishes so wide a range of subjects as to make it a most useful work for all departments.

**From Hon. John J. Bagley, Governor of the State of Mich.**

A. J. JOHNSON & SON: GENTLEMEN—I have received the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, ordered a few days since, and cannot forbear saying to you that I am more than pleased with it. I am astonished at the amount of information contained in so small a compass. On the subjects of which I am at all familiar I find it very correct and reliable. I certainly hope its sale may be such as to warrant the large expenditure you have evidently made in its publication. It cannot help but become a standard among books of its class.

**From Prof. James A. Whitney, Pres. of the New York Society of Practical Engineering.**

MESSRS. A. J. JOHNSON & SON: DEAR SIRS—The first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA has occupied a shelf at the end of my desk during the time since its issue. Among fourteen different cyclopædias in my office library, I have found it the best for general reference, both as concerns its wide scope and the care taken to bring the information down to the most recent dates. Great praise is also due to the condensed style of the articles, which, in the briefer ones, gives much in little space, and in those of greater length the thoroughness and finish of compact treatises. The work combines the convenience of smaller ones and the comprehensiveness of those of far more pretentious bulk, and will be valued accordingly by all students, writers, and professional men to whom reliable works of reference are, or should be, felt to be an absolute necessity.

**From Prof. John Bascom, LL.D., Pres. of the University of Wisconsin, Madison, Wis.**

I have examined the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. It seems to be very full in topics, and to present them in a clear, practical form. These qualities, with its illustrations and its compactness, fit it exceedingly well for the work of a popular cyclopædia.

**From Rt. Hon. Wm. E. Gladstone, D. C. L., London, England.**

PROF. PHILIP SCHAFF, S. T. D.: MY DEAR SIR—Pray accept my best thanks for your obliging gift of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. The amount of valuable information presented seems to me to be truly wonderful. Kindly present my compliments and thanks to your colleagues.

**From R. H. Thurston, C. E., Prof. of Mech. Eng'g in the Stevens Tech. Institute, Hoboken, N. J.**

A. J. JOHNSON & SON: GENTLEMEN—I have recently secured a copy of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. I hardly know which to admire most, the excellence of the work as a specimen of book manufacture, the comprehensiveness and practical character of the plan, the wonderfully thorough, yet concise, character of the articles, or the completeness with which the whole ground, both in science and in art, is covered in the selection of contributors. The work promises to fill a very important place in my library, and I cannot too strongly express my appreciation of its value.

**From Rev. S. Y. McMasters, S. T. D., LL.D., St. Paul, Minn.**

TO ANY WHOM IT MAY CONCERN: I have received the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and after a month's use of it have no hesitation in saying that it is far the most useful work of the kind that I have ever seen. If the three remaining volumes prove equal to this one, it will be a work of incalculable value.

**From Rev. J. W. Hamilton, S. T. D., Pastor First M. E. Church, Boston, Mass.**

After a careful, and in some respects a studied, review of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, I do not hesitate to give the work my unqualified endorsement. Of making many books there is no end, and much less can one book be the end of all books; but in closely comparing American books, and in critically reading the strictures made upon the two books—JOHNSON'S and *Appletons' Cyclopædias*—by the publishers, each upon the other, my preference has been given to Johnson's book, for the following reasons:

1st. It is the busy man's cyclopædia, carefully written by representative men, making it complete, and yet so condensed as not to be cumbersome.

2d. It is the most universal American book of its class, considering the multiplicity and variety of fields it surveys.

3d. It is the cheapest book published, and therefore the most needed by teachers, clergymen, and other persons of limited means.

I have been specially gratified with its *résumé* of recent researches, and can satisfactorily call attention to the articles, or papers, called "Architecture of the American Aborigines," "Darwinism," and "Embryology." Though I have *Appletons'* first edition, I buy this because I need it.

**From Hon. Lorin Blodgett, Philadelphia, Pa.**

ALBERT ELLIS, ESQ.: DEAR SIR—I have carefully examined the copy of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA delivered by you a few days since, and I am gratified to find it more full and complete than any work of its kind yet issued in all the more valuable departments, and particularly in recent practical research as applied to arts and manufactures. Very great advances have been made in chemical science, as in other departments of physics, and all these appear to be fully represented in the articles of this first volume. I do not know of any work which would supply its place in the necessary reference of those who would keep pace with the general advance of knowledge, or whose business requires works of authority in special departments.

**From Rev. R. Irvine, S. T. D., Augusta, Ga.**

T. K. OGLESBY, ESQ.: DEAR SIR—I have looked with care into the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. The testimonials appended to the volume are from the pens of the most eminent scholars of this country. They embrace the opinions of distinguished statesmen, jurists, lawyers, philosophers, and divines, who unanimously concur in commending this great treasury of universal knowledge to the perusal and patronage of the reading public.

The work possesses merits which excel those of any other of the kind now extant.

It embodies more knowledge in less compass than any other book I have ever seen. In fact, it is surprising that so much of the essence of human thought could be compressed into such narrow bounds.

It embraces the whole range of *pure* and *mixed* science, of *natural*, *mental*, and *moral* philosophy, of political, national, and civil economy, of government, of history and theology, ancient and modern, in all its branches.

It presents discoveries in the domain of modern thought up to the present moment, dealing only with *facts*.

The book furnishes the *records* rather than the *dogmas* of government, philosophy, and theology. It does not shrink from controversy, but professes to give the *history* rather than the *philosophy* of modern inquiry.

This work is, in fact, a well-arranged compendium of all that the volumes of *Nature*, *Providence*, and *Inspiration* teach.

In fact, there is no question in any branch of human learning that is not discussed closely and forcibly in this admirable repertory.

In order to make this work all that such a work should be, the enterprising publishers have secured (in some cases at great cost) the very best talent of the continent in every department of learning and knowledge, so that there is not a single article in the whole volume that would rank as mediocre. When completed, I doubt not that the book will be received as *the* cyclopædia of the century and the country in which we live.

Apart from what I have thus written of the work, there are two considerations which strengthen my confidence in its worth and ultimate success:

1st. The publishers are gentlemen of the highest *caste* in their line. Their great Atlas excels in literary merit any other work of the kind ever given to the American people; and

2d. One of the editors is our own distinguished statesman, Hon. Alexander H. Stephens, whose gifted mind and diversified attainments in questions of State policy and the government of nations pre-eminently qualify him for the editorial work in these departments.

## *TESTIMONIALS CONTINUED.*

### From Hon. William Lloyd Garrison, Boston, Mass.

A. J. JOHNSON, ESQ.: DEAR SIR—Although the first recorded mandate, "Let there be light," had reference to the material universe, it is not less applicable to the vast realm of mind—mind, the growth of which in knowledge is illimitable. Your great work, JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, is in direct furtherance of this sublime object, every page being luminous, and in its completeness presenting a brilliant constellation of genius, learning, science, art, literature, philosophy, and whatever relates to human development and progress. In a careful examination of the two handsomely-printed volumes already published, I have not been less delighted than surprised at the amount of information skilfully and concisely embodied in them, covering as they do the broadest field of observation, research, discovery, invention, enterprise, whether relating to the remote past or the present hour, and illustrated with maps, plans, and engravings very creditably executed. The subjects treated are legion, and as alluring by their variety as they are instructive. It is indeed "a treasury of useful knowledge," to be coveted by all classes as a most valuable personal or family possession, and made a component part of every public or private library as far as practicable. What accomplished and cultured Editors-in-Chief and Associate Editors stand responsible for its accuracy and worth! What a host of well-known, reliable, well-qualified contributors appears in its pages, each one judiciously chosen for the task especially assigned to him! Then, in addition to this imposing array, think of the statement that "more than fifteen hundred gentlemen connected with the press in the principal centres of population scattered throughout the United States have already furnished for this CYCLOPÆDIA succinct accounts of the cities, towns, and villages in which they respectively reside; and the number of these contributions is daily increasing, and will continue to increase to the end of the work"! But, dear sir, you do not need my testimony, especially seeing what "a cloud of witnesses," far better qualified to judge of the value of your CYCLOPÆDIA than I am, have bestowed upon it the highest encomiums. I heartily wish that its sale may amply remunerate you for the hazard, toil, and expense incurred in its publication, so worthy of this centennial year and so creditable to our republic.

### From Hon. Wendell Phillips, Boston, Mass.

MR. A. J. JOHNSON: DEAR SIR—I have carefully examined the first two volumes of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. In fulness of information given, and in accuracy, they can safely challenge comparison with any other encyclopædia I know. Indeed, the titles of themselves furnish very interesting reading for a leisure hour. It seems to me that you have fully succeeded in your purpose to produce a work which the counting-room, the editor's desk, the store, and the scholar's table shall find just what they need. If a young man would keep this work at his elbow, and turn to its pages whenever in reading book or daily journal he met name or term unknown or obscure, he would find himself at thirty a well-informed man.

### From the "Quaker Poet," John G. Whittier, Amesbury, Mass.

A. J. JOHNSON, ESQ.: DEAR SIR—I have received by express the second volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. The extraordinary accuracy and clearness of statement which characterized the first volume are conspicuous in the second. It is a most valuable work.

### From the eminent Boston Congregationalist, Rev. S. E. Herrick.

I have examined with considerable care the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA which was projected by the late Hon. Horace Greeley. So complete a *multum in parvo* I think I have never seen. It is a veritable university. All the faculties are here, and all on duty. It is thoroughly up to the times. The latest discoveries, the newest inventions, the freshest presentations of scientific questions, are all here. You cannot catch it napping. To have it at one's elbow is to have at one's command the advantages of an immense library, without its inconvenience. As a saver of time it must soon pay for itself to any man.

### From Hon. John D. Philbrick, LL. D., Supt. of Schools in Boston, Mass.

Having examined with care the first volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, I am fully convinced that it is a work of extraordinary excellence. It is admirably adapted to the wants of the times. By judicious compression a vast amount of information has been brought into a comparatively limited compass. All useless lumber has been rigidly excluded. The matter is in a remarkable degree interesting, accurate, useful, and *fresh*. It seems to me it is a work which every scholar must desire, and at the same time it is just such a book as I should like to see in every household. It is pre-eminently suited to the purposes of a comprehensive work for reference in schools of all grades above the primary. Every teacher needs such a work in his private library; and I hardly know how a teacher could expend to better advantage the amount of its cost than in buying it. In a word, it is a genuine treasury of science and knowledge, which I wish might be put within reach of every American capable of reading.

### From Hon. J. E. Hilgard, M. N. A. S., Assist. Supt. of the United States Coast Survey, Washington, D. C.

MESSRS. A. J. JOHNSON & SON: DEAR SIRS—Having had time to read many of the articles in the second volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, I am impressed with the fact that the great promise of the first volume is fully maintained. Most of the modern subjects of science, history, and literature are treated with vigor and exactness, and there is no other work in which so much valuable and exact information is compressed in the same compass.

### From Charles O. Thompson, A. M., Principal and Prof. of Chemistry, Worcester Free Institute, Worcester, Mass.

I have carefully examined the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and diligently compared it, title by title, with *Chambers's* and with *Appletons'*. For information about facts, events, things, localities, and persons level with the times, and properly condensed, it is, in my judgment, vastly superior to either of its competitors. It is especially strong in the applied sciences.

## *TESTIMONIALS CONTINUED.*

**From Francis J. Child, Ph. D., LL. D., Prof. of Rhetoric and Oratory, Harvard University, Cambridge, Mass.**

A. J. JOHNSON, ESQ.: DEAR SIR—I had the pleasure of receiving the second volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA yesterday, and beg to thank you for it. It is the only kind of great book that is a great good, and not, as Dr. Johnson said, a great evil. I expect to be grateful to you all the rest of my days for the use I shall have of it.

**From E. N. Horsford, M. D., late Prof. of Chemistry in Harvard University, Cambridge, Mass.**

A. J. JOHNSON, ESQ.: DEAR SIR—The first and second volumes of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA I am delighted with. They promise to save me much labor and great consumption of time. It is quite charming to find an encyclopædia so fresh and complete notwithstanding the necessary and desirable concentration. When one looks at these two volumes, so admirably printed, and at the list of contributors, and considers the ability of the gentlemen at the head of the editorial department, it is not easy to see how the series should fail to become the standard resource for the general professional man and for families of culture.

**From Rev. Orville Dewey, S. T. D., LL. D., Sheffield, Mass.**

I have looked over the second volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and it confirms the impression which I received from the first, that it is a work of exceptional value—exceptional, *i. e.*, in embracing a greater variety of topics, while compressing some into briefer statements, and enlarging upon others of special practical utility. I am not competent to pronounce upon many of the articles, especially those of a scientific character, but so far as I have read I see nothing to find fault with. The work seems to me to meet a special want, as Mr. Greeley conceived of it.

**From Hon. J. Hammond Trumbull, LL. D., M. N. A. S., Hartford, Conn.**

The first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA has now been more than eight months on my writing-table, and I have had sufficient opportunity to test its value "for the every-day uses of practical men." I have frequently consulted it, and seldom without finding the name or date or fact I wanted; and I appreciate the convenience of obtaining such information without leaving my chair to look for it, two rooms off, in a long range of volumes on the book-shelves. I have read with much interest some of the longer articles, to which the names of their authors impart the highest authority; but the distinctive excellence of the work is in its comprehensiveness and in the system of judicious *compression* by which, in almost innumerable items, what the scholar or the general reader cares to know is brought into a few lines or the fraction of a page. If the succeeding volumes sustain the character of the first, I know no work that will so well deserve the name or serve the purposes of a "universal cyclopædia."

**From A. S. Packard, Jr., M. D., Prof. in the Peabody Academy of Science, Salem, Mass.**

A. J. JOHNSON, ESQ.: DEAR SIR—I must say that I like JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA exceedingly. I have been surprised to see what a diversity of talent has been brought out in physical science. I think the whole work is certainly in advance of *Appletons'*, so far as I have examined the geological and zoological articles. I hope you will be well repaid for your venture. I shall cheerfully notice it in the *American Naturalist*, and will have the number containing the notice mailed to you.

**From Charles A. Young, Ph. D., M. N. A. S., Prof. of Natural Philosophy, Dartmouth College, Hanover, N. H.**

I have received, and already examined with a good deal of care, the two volumes of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA now published. It is with the greatest pleasure that I testify to their extreme value, for I find them even better than I expected. Your plan of having the important articles written by specialists who have an intense personal interest in the subjects on which they write, and who sign their names, and thus become responsible to the public, works admirably; and as the result the amount of reliable and authoritative information contained within the comparatively restricted limits of your work is really surprising. I know of nothing so good at all comparable with it as regards size or price.

**From Miss Mary L. Booth, Editor of Harper's Bazar, New York.**

DEAR MR. JOHNSON: The more I examine JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, the more I marvel at the skill with which you have condensed whole libraries within the limits of four convenient volumes, and put within the reach of the masses the results of the wisdom of ages. The names of your editors of themselves are a guaranty of the accuracy of this vast repertory of knowledge. I congratulate you most sincerely on the successful manner in which you have carried out Mr. Greeley's great idea. I am certain that I shall find in these volumes an ever-ready and safe counsellor, and shall prize them the more for being enriched with your autograph. That their sale may equal their merit is the wish of yours cordially.

**From Prof. Edward D. Cope, A. M., M. N. A. S., Corresponding Secretary of the Academy of Natural Sciences, Philadelphia, Pa.**

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA presents the following points of superiority in the department of the natural sciences: Its articles on these subjects are fuller and more complete than those of any other American cyclopædia known to me; they are written by the best American authorities, and an unusually large number of these have been engaged on it; it is therefore fuller in the results of the recent labors of American students than any other cyclopædia. While there is, therefore, much information embraced in its articles not to be obtained from any other American cyclopædia, its bulk is not so great as to render it inconvenient in the family or school.

**From Benjamin Silliman, M. D., M. N. A. S., Prof. of Chemistry in Yale College, New Haven, Conn.**

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA is, as its title declares, "a treasury of useful knowledge," scientific and popular. It is rich in original contributions from American scholars, whose names, appended to the several articles, are vouchers for the care which has been bestowed on their preparation. To a very large class of persons who are not in possession of large libraries or numerous books of reference JOHNSON'S CYCLOPÆDIA will be found of peculiar value. Its scientific and technical articles are often of unusual fulness and excellence. An example of this is the essay on *Blasting*, by Gen. Foster, U. S. A., in which the operations of the diamond drill are fully described; and the article *Bridge*, by Gen. Barnard, U. S. A., has the completeness of a treatise with cyclopedic compactness. The same is true of Dr. Morton's article on *Electricity*. But a glance at the list of chief contributors will show that the names of the authors are an ample voucher for the accuracy of the text. To a greater extent than in any other contemporaneous work of this nature the articles which fill its pages are the productions of men of original research in the lines of study and investigation for which they are responsible; for example, Gen. Gillmore writes the article *Cements and Mortars*, Prof. Lewis H. Morgan that on the *Architecture of the American Aborigines*, and so on, to a remarkable extent. In fact, it may seem almost invidious to select a few among so many names of note and authority. In biography, geography, commerce, law, medicine, chemistry, mechanics, and other departments the articles are numerous and full of interest.

**From Hon. John P. King, formerly United States Senator from Georgia.**

I have examined the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA which you kindly placed at my disposal. I consider it a work of rare excellence, and well calculated to answer its design. It will meet the wants of a very large class of readers. It will be found a ready aid and time-saver to every reader in search of reliable information, at the least cost of time and labor. It supplies the "busy man's cyclopædia" in a *table-book*, the want of which was so much felt by Mr. Greeley. The "circle of eminent contributors" is a sufficient guaranty of the ability with which the work has been edited, and the compilation itself affords abundant internal evidence that the work is entirely free "from every shade of political prejudice or taint of sectional jealousy." His [Mr. G.'s] own contribution of the article on *The Confederate States* stamps the character of the work, and verifies the purpose which he intended to serve by it. Mr. Greeley was a man of some eccentricities of character, but his great ability was generally acknowledged, and, judging from his own stand-point, he was the synonym of candor, truth, and patriotism. My shelves are filled with cyclopædias; and though so fully supplied with works of similar character and purpose, I verify my appreciation of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA by adding that work to the number.

**From Hon. Newton Bateman, LL. D., Pres. of Knox College, Galesburg, Illinois, and late State Supt. of Schools in Illinois.**

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA has, I think, the following claims to public favor: (1) It is very comprehensive. When completed it will contain nearly 7000 closely-printed, double-column pages, or about 1700 pages to each of the four volumes; and it will treat of nearly 80,000 different subjects. (2) Notwithstanding this immense range and variety of topics, the work is in compact form and comparatively small compass, so that it may always be within easy reach of the student or writer—an advantage that will be readily appreciated. (3) It is not a mere compilation of old materials. Its most important articles are all original and fresh, having been written especially for this work by men of pronounced ability and eminence in the departments of learning of which they severally treat. (4) The most difficult achievement in works of this kind is to determine wisely what to include or what to omit—what subjects to treat with fulness, what ones with brevity, and what ones to dismiss with a mere mention. I think the present work will bear these critical tests of a good general cyclopædia remarkably well. The Editors appear to have eliminated wisely and discriminated with good taste and judgment. I find, as a general rule, that the treatment of subjects corresponds, in respect of elaborateness or brevity, with their apparent relative importance. (5) The prevailing style of the articles is simple and clear, yet comprehensive and thorough—exceptionally well adapted to readers of fair average intelligence. So far as I am able to compare and judge, the work as a whole is very accurate and trustworthy, the scientific articles being abreast of the actual progress of investigation and discovery, those on speculative subjects being characterized by a spirit of fairness and candor, while the facts and statistics have been collected from the latest and best sources. The work impresses me as one honestly designed and successfully adapted to meet the needs and requirements of general readers, and as such I can and do heartily commend it. I have found the first volume so convenient and useful that I hardly know how to await the coming of the remaining three.

**From S. B. Luce, Capt. United States Navy.**

The second volume, like the first, of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA seems to me a miracle of brevity and conciseness, while at the same time its range of topics is fully as broad as that of more pretentious works of the same character, and fully up to the times in its treatment of the progressive sciences. The more I consult it, the better I like it. It answers every question in the clearest and most direct way. While all the departments appear to have been judiciously treated, you will permit me to especially commend the unusual pre-eminence given to military subjects, which are so thoroughly and compactly discussed, and so rich in brief biographies of distinguished leaders, as to make the work invaluable to officers of the army and navy.

**From Thomas Chase, A. M., Pres. of Haverford College, West Haverford, Pa.**

Admirable as was the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, it is even surpassed by the second. The work is a library in itself, and will answer any question likely to arise in an intelligent man's mind on any point of history, science, art, the various occupations of men, and the different fields of human inquiry. The information given is furnished uniformly by *the highest authorities*, and is brought down fully to *the present time.*

## *TESTIMONIALS CONTINUED.*

**From Edward Orton, A. M., President Ohio Mechanical and Agricultural College, Columbus, O.**

I have been acquainted with the general plan and scope of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA for a year or two, and from the recognized ability of its editorial staff I have been expecting a work of a very high character; but I am free to confess that my expectations are more than met by the first volume, which I have had an opportunity of examining. I am sure that to me, at least, the well-considered opinions of the eminent men who are connected with the editorial staff and in the list of contributors on the weightiest topics of our day, *over their own signatures,* will be worth many times over the price of the work.

**From Samuel Sprecher, Pres. of the Theological Department of Wittenberg College, Springfield, O.**

The claims of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA to superior method seem to be well founded; and this method has been so successfully applied in the first volume that there is good reason to believe that the completed work will be, for convenient and available use, one of the best cyclopædias ever presented to the English reader.

**From A. D. Hyde, S. T. D., Prof. of Greek and Hebrew, Allegheny College, Meadville, Pa.**

I have examined with great pleasure JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA. I find it all it claims to be—"a treasury of useful knowledge." In all matters on which my own studies have enabled me to have an opinion it is full, accurate, and up even with the best progress of our times. I do not doubt it is as good in all others. Certainly it is a convenient, attractive volume, and he who has it at hand need not be ignorant of anything worth knowing.

**From J. G. Evans, Pres. of Hedding College, Abingdon, Illinois.**

I have examined JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and am highly pleased with the plan of the work and its execution. When completed it will be a scientific and literary library in itself. The list of contributors to the remaining volumes is a sufficient assurance that they will not fall below the first. *Appletons' Cyclopædia* is a rich treasury of knowledge, but JOHNSON'S is in many respects superior, while it falls below it in none. Its discussions are sufficiently elaborate, and yet, by a conciseness not found in other works of the kind, room has been secured for the treatment of numerous and important subjects not found in other encyclopædias. It ought to be in every library. Indeed, no library can be complete without it.

**From Prof. J. B. Young, Principal Davenport (Iowa) High School.**

Having examined with care the first volume of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and compared several articles in it with those on similar subjects in other works of like character, I do not hesitate to say that for *all* purposes of reference and practical use it is *much* superior to any other work of the kind extant. Its editorship is under the supervision of the most distinguished scholars of the day. The abundance and excellence of the illustrations, as well as the *fulness* with which the more important topics are treated, challenge attention and approval, while in scope and variety of subjects treated the work is unsurpassed. No library, however full, is complete without it, and especially is it indispensable as a source of information and a means of education in every household where there are children, for no other work embodies so much in so small a compass, and its extremely low price brings it within the reach of all. We most heartily commend the work to the public.

**From Prof. J. H. Ely, Principal of Mt. Carroll Union School, Mt. Carroll, Illinois.**

I have carefully examined JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and I am fully persuaded that it is the most complete work of the kind published. I have therefore disposed of the volumes I had purchased of D. Appleton & Co. (*The American Cyclopædia*), and cheerfully given an order for JOHNSON'S. I think the change warrantable, both in view of the superiority of the work over the *American,* and the low price at which the UNIVERSAL is sold.

**From Rev. John Wheeler, S. T. D., late Pres. of the Iowa Wesleyan University, Mt. Pleasant, Iowa.**

An examination of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA convinces me of the great value of the work upon the following points, among others: (1) The high character for ability and scholarship of the Chief, Associate, and Assistant Editors; (2) the superior extensiveness of the *Cyclopædia* alphabet of subjects embraced and treated; (3) the enlarged treatment of subjects not easily accessible at present, eliciting public attention, and which also must be of future and permanent value; (4) the contributions of articles by the editors and contributors in the departments in which each, in the main, is especially skilled; (5) the signatures of the authors to the main articles contributed.

**From Col. A. R. Clarke, F. R. S., Member of the Academy of Imperial Sciences, and also Corresponding Member of the Ordnance Survey Office, Southampton, England.**

(*Extract from a letter to Pres. Barnard.*)

PRES. F. A. P. BARNARD, LL.D.: MY DEAR SIR— . . . . Not having heard from you, I was beginning to wonder whether my article on the *Ordnance Survey* and the *Fac-similes of Ancient Manuscripts* had gone astray. Pray accept my very best thanks for your splendid present. JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA is a most valuable work—of undeniable authority and admirably executed.

**From Joseph Milliken, Prof. English and Modern Languages, Ohio Agricultural and Mechanical College, Columbus, Ohio.**

I have given some four hours to the examination of Vol. I. of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, especially to the articles on literature, language, history, biography, and biblical and ecclesiastical matters. As the result of it, I have subscribed for the work, and wish to express my admiration of it as a masterful carrying out of a wisely-planned scheme. It seems to me to be singularly full, concise, accurate, and free from all suspicion of scissor-work. The mention of leading accessible authorities on important topics, and a thorough system of cross-reference to articles on related subjects, are very valuable features.

## *TESTIMONIALS CONTINUED.*

**From Rt. Rev. Horatio Potter, S. T. D., LL.D., D. C. L., Bishop of New York.**

A. J. JOHNSON & SON—GENTS: I cannot refrain from expressing my surprise and admiration at the extent and usefulness of JOHNSON'S UNIVERSAL CYCLOPÆDIA. The names of the Editors-in-Chief and of the Associate Editors would have justified high expectations, but the work, for order, for exactness and variety of fulness of information, exceeds one's highest hopes, and it is an honor to the country.

**From Hon. John Austin Stevens, Ex-President of Board of Commerce, New York City.**

A. J. JOHNSON & SON—GENTLEMEN: I have examined with interest and satisfaction the volumes of JOHNSON'S UNIVERSAL CYCLOPÆDIA. It is an admirable and compact digest of the information daily needed in every pursuit of life.

**From A. H. Buck, A. M., Prof. of Greek in College of Liberal Arts, Boston University.**

After a somewhat careful examination of several hundred articles of the two volumes of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA which have already appeared, I am so much pleased with the work that I should regard it as a serious deprivation to be without it. In fact, I know not where else one could find so much concentrated and authentic knowledge in a form so available and convenient. The names of the Editors and Contributors are a sufficient guaranty that the work will be finished with the same judgment, scholarship, and general accuracy which characterize the published volumes, and thus will be established its claims to popular recognition as a "Treasury of Useful Knowledge."

**From Hon. Richard H. Dana, Jr., LL.D., Boston, Mass.**

MESSRS. A. J. JOHNSON & SON—GENTS: Having contributed to the Third Volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA, I have been led to look more carefully into it, and I wish to say that, while I have not the scientific knowledge to judge of most of its articles, I have been struck with the fairness with which you have chosen the writers upon all controverted subjects, and the care you have taken to select men whose names are guaranties of thoroughness and competency. I hope you will meet with the success your enterprise, judgment, and good faith deserve.

**From Hon. C. R. Buckalew, U. S. Senator from Pennsylvania.**

To the publishers of JOHNSON'S UNIVERSAL CYCLOPÆDIA: An examination of three volumes of the work enables me to pronounce a confident opinion upon its merits. I think it to be one of high value alike to the student and to the general reader, and to be commended for both what it includes and what it omits. Its fresh, original, and (within proper limits) varied character result from its design, the expense incurred in its preparation, and the large number of contributors employed. Doubtless, it will at once take its place as one of the standard works of the country, and maintain that position in the future.

**From Hon. James L. Ridgely, Grand Sec. of U. S. Grand Lodge of I. O. O. F., Baltimore, Md.**

A. J. JOHNSON & SON—GENTS: JOHNSON'S UNIVERSAL CYCLOPÆDIA is emphatically a colossal collection of learning and practical knowledge. Its articles are manifold, varied, clear, succinct, learned, and exhaustive. They concern every conceivable interest or pursuit of men, and every sphere, whether moral, religious, political, philosophical, scientific, or practical—whether it relates to history, events, men, measures, government, or society at large, or to the career, learning, or personal influence of men, systems, or organizations for general objects. In literature and scholarship it is an inexhaustible storehouse and library, and has no superior in any language. Such a work is a public benefaction, because its real value is universal, and it especially enriches and enlightens the people.

**From George J. Fisher, M. D., Pres. of the N. Y. State Medical Society, Sing Sing, N. Y.**

A. J. JOHNSON, ESQ.—MY DEAR SIR: I hope and believe that your stupendous enterprise, JOHNSON'S UNIVERSAL CYCLOPÆDIA, will prove a success as a financial venture, while it is absolutely certain to be a great educator in the land. I congratulate you personally and the country generally on the production of such a monument of literary labor.

**From Rev. A. Owen, S. T. D., Pastor of Lafayette Av. Baptist Church, Detroit, Mich.**

I have examined with some care the Second Volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA and some articles also from the First, and have no hesitation in giving testimony to the excellence of the work. It is exceedingly comprehensive in its scope, and yet the discussions are so condensed as to bring the whole within a reasonable space. It is quite successful in saying just what a reader wishes to know, while it leaves the more elaborate details to special treatises. It has the merit of giving the *present aspect* of the subjects of which it treats, and of reflecting the knowledge of to-day. Having been largely prepared by men of special qualifications for the departments in which they have written, the articles have a value beyond that of any mere compilation. For constant use I prefer this Cyclopædia to any other with which I am acquainted.

**From Hon. C. I. Walker, of Detroit, Michigan, late Professor of Law in the University of Michigan.**

I have examined with much interest Volumes I. and II. of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA, and have read with great care many articles upon subjects with which I am especially familiar. These articles are clear and accurate in their statements, and compress within a narrow compass just the kind of information that one seeks in a book of reference. I am more than satisfied with the manner in which they are prepared. From these articles thus carefully examined and a more general examination of the volumes, I can speak with very great confidence as to the merits of the work. For all purposes of ordinary reference by the intelligent inquirer I think this Cyclopædia quite as useful as the larger ones that contain more exhaustive articles upon the several topics discussed. A student of any given subject who desires to make exhaustive examinations would go beyond any cyclopædia. This one is admirably adapted to all the purposes for which the general reader desires to examine such a work.

## *TESTIMONIALS CONTINUED.*

**From Rev. William Aikman, S. T. D., Pastor of Westminster Presbyterian Church, Detroit, Mich.**

JOHNSON'S UNIVERSAL CYCLOPÆDIA seems to me to be a very valuable work, and I am surprised at the extent and thoroughness of its articles.

**From E. W. Jenks, M. D., President of Detroit Medical College, Mich.**

I have examined JOHNSON'S UNIVERSAL CYCLOPÆDIA with sufficient care to convince me that it is a work of no common merit. It cannot but prove invaluable to a large class—to the student as well as the business-man.

**From C. B. Gilbert, M. D., Professor in Detroit Medical College, Mich.**

A comparison of JOHNSON'S UNIVERSAL CYCLOPÆDIA with other similar works convinces me of its great superiority over them. Its plan and execution are excellent. The more I examine the more I like it.

**From George P. Andrews, M. D., Professor in Detroit Medical College, Mich.**

After a somewhat careful examination of the UNIVERSAL CYCLOPÆDIA I have no hesitation in expressing myself as very much pleased with both the general scope and the execution of the work. The gentlemen who are pledged as the authors of the articles, no less than the editorial corps, are a sufficient guaranty for the value of the whole.

**From G. Weitzel, Major of Engineers, Brevet Major-General U. S. A., Detroit, Mich.**

I have examined, as carefully as my time permitted, the First and Second Volumes of JOHNSON'S UNIVERSAL CYCLOPÆDIA. Those subjects of which they treat of which I have any knowledge are presented in the concise, clear, and thorough manner which might be expected from the eminent editors and their associates.

**From Rev. N. C. Mallory, S. T. D., Pastor of First Baptist Church, Detroit, Mich.**

Another invaluable addition to modern literature is JOHNSON'S UNIVERSAL CYCLOPÆDIA. It is pre-eminently *the busy man's book.* Though compressed into smaller space than other works of this character, it transcends them all in the number of subjects treated. The Chief Editors, Barnard and Guyot, a host in themselves, have brought to their aid an array of scholarly ability which cannot be surpassed in the world. Their effort has evidently been to make a *standard work* in this department. If the young people of our land, especially those who are just establishing themselves in homes, could realize the inestimable value of such a work as this upon their literary and intellectual future, they would certainly spare from their apartments some articles of household furniture, if need be, that they might adorn their homes and minds with the world-wide treasures of this UNIVERSAL CYCLOPÆDIA.

**From Rev. W. T. Sprole, S. T. D., Pastor of Second Congregational Church, Detroit, Mich.**

I have examined the First Volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA with great pleasure and profit; and if the rest are equal to it in comprehensiveness and compactness, *it is undoubtedly the best work of the kind* which, so far as my knowledge extends, has ever been offered to the American public. Men of every profession and walk in life may find in it a satisfying answer to any question likely to claim their attention. It is an extensive library in itself—a *thesaurus of knowledge* from which the learned and the ignorant may obtain information.

**From Rev. Robert J. Laidlaw, S. T. D., Pastor of Jefferson Av. Presbyterian Church, Detroit, Mich.**

On examining the First Volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA a year and a half ago, I took pleasure in commending it as a work of great value, destined to occupy a prominent place among books of its kind, and in some respects calculated to meet wants not met by any other cyclopædia. An examination of the Second Volume has only heightened my appreciation of this admirable work.

**From Rev. C. H. Fowler, S. T. D., LL.D., President North-Western University, Evanston, Illinois.**

Having examined JOHNSON'S UNIVERSAL CYCLOPÆDIA, I gladly testify to the satisfaction I have experienced in scrutinizing some of its extended articles. It is a valuable library in itself. For the uses of the general reader it is not surpassed. Many of its articles are of great value even to specialists. Familiarity with its contents would make the fullest and readiest man of the time.

**From Rev. Samuel C. Bartlett, S. T. D., late Prof. of Biblical Literature, Chicago Theol. Sem., Illinois, and now President of Dartmouth College, Hanover, N. H.**

I have examined with care the plan and some of the articles of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and am strongly impressed with its value. It embodies a vast amount and variety of matter, presented, so far as I can judge, with great skill, fairness, and thoroughness, and from the latest sources of information.

**From Rt. Rev. Charles E. Cheney, S. T. D., LL.D., Bishop of Ref. Epis. Church, Chicago, Illinois.**

I have examined two volumes of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and am greatly pleased with it. It is especially rich in points of knowledge relating to our own country, and in which all the foreign encyclopædias are notoriously deficient. Its recent date of publication gives to it a great advantage both in securing the latest information upon the constantly progressing science and history of the age, and also in supplying the defects and omissions of earlier works of the kind.

**From Rev. R. W. Patterson, S. T. D., President of Lake Forest University, Illinois.**

I have given such examination to JOHNSON'S UNIVERSAL CYCLOPÆDIA as my engagements would permit. The names of the Editors and Assistant Editors afford a sufficient guaranty that the plan of the work will be well executed. In the volumes already published comprehensiveness, thoroughness, compactness, accuracy, and adaptation to popular use are admirably united. Many subjects are more clearly treated than in larger works of the kind, and numerous topics are embraced which are entirely unnoticed in other cyclopædias. On American geography and history the articles are remarkably full and satisfactory. The illustrations are numerous and beautiful. For sufficiency of information on most topics, and for convenience of reference and use, I know of no other work that occupies so well the place which JOHNSON'S CYCLOPÆDIA promises to fill in professional and family libraries.

**From Rev. D. B. Cheney, S. T. D., Pastor of Fourth Bap. Ch.; Rev. J. M. Gibson, S. T. D., Pastor of Second Presb. Ch.; Rev. Arthur Mitchell, S. T. D., Pastor of First Presb. Ch.; Rev. W. M. Blackburn, Prof. in Presb. Theol. Sem.; and Hon. E. S. Williams, Judge of Circuit Court, Chicago, Ill.**

Having examined Volumes I. and II. of JOHNSON'S UNIVERSAL CYCLOPÆDIA, we are prepared to concur with what the Rev. Dr. Patterson has so well said concerning it.

**From Rev. W. W. Patton, S. T. D., late Editor of the "Advance," Chicago, Illinois.**

It has been with great satisfaction that I have completed the examination of the two volumes of JOHNSON'S UNIVERSAL CYCLOPÆDIA. The editorial work is well done in general and in special respects. There is brevity where brevity is the desirable quality, and expansion where expansion is required by the nature of the subject. The difficult and disputed topics are properly assigned to writers who are authorities on those subjects, and sometimes opposing views have each a representative. The maps and numerous illustrations add much to the positive value of the work, as do the multitude of cross-references. It comes nearer to meeting the practical wants of a professional man or of an intelligent family than any other similar work I have seen.

**From Rev. J. C. Burroughs, S. T. D., Chancellor of the University of Chicago, Illinois.**

The two volumes of JOHNSON'S UNIVERSAL CYCLOPÆDIA seem to me to give evidence of a scope in the selection of topics unequalled by any work of similar compass, and of much thoroughness in the treatment of its important articles. Of the latter quality the names of its contributors would be a sufficient guaranty, especially under the excellent system by which the names of the writers are attached to their contributions.

**From Rev. L. J. Halsey, S. T. D., Prof. of Theology in Theol. Sem. of the N. W., Chicago, Illinois.**

I have examined briefly the two volumes now published of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and feel assured that it is a work of great excellence. It is a comprehensive treasury of information on all subjects. It seems to be especially full and satisfactory on the great discoveries, inventions, events, and characters of the present century. On such subjects as the Franco-German war, the German Empire, the history of India, bridge-building, aëronautics, Australia, it gives the most ample and accurate information, drawn from the very best authorities. For complete and thorough knowledge on all important topics, brought within a reasonable limit, I regard it as the best work yet published in our country.

**From Capt. August Niemann, Editor of the "Almanach de Gotha," Saxony.**

A. J. JOHNSON & SON—GENTS: I find JOHNSON'S UNIVERSAL CYCLOPÆDIA a magnificent work, surpassing all other works of the kind known to me in its value of text, in its richness in maps and other illustrations; and it also seems to me that the general arrangement is eminently practical. Its editors have succeeded admirably in throwing overboard much useless stuff which such books generally drag along with them from old times, and have therefore gained space for the more important articles. The treatment of the various topics is uniform and remarkably well done. I consider it a great honor to me to have had a part in a work so eminently scientific and valuable to the public.

**From Hon. Alexander H. Stephens, LL.D., M. C.**

[*Extract from a Letter to the Publisher.*] . . . . With the kindest regards and best wishes for you and all yours, and the triumphant success of the greatest work of the age of its kind, JOHNSON'S UNIVERSAL CYCLOPÆDIA, I remain yours very truly.

**From Benjamin Silliman, M. D., M. N. A. S., Prof. of Chemistry in Yale College, New Haven, Conn.**

MR. A. J. JOHNSON—MY DEAR SIR: I am very sorry that an acute and severe illness prevented my *assisting*, as the French say, at the gathering of Authors and Contributors to the CYCLOPÆDIA which you made a few weeks since. It would have given me much pleasure to have made a humble member of such a company. My own contributions to the CYCLOPÆDIA are not numerous, and I may therefore without impropriety say that it appears to me you have great reason to be satisfied with the result, as a whole, of the prolonged and costly labors which have been concentrated within its covers from such an army of authors. The amount of original matter in it is *remarkable*, and so many men of authority in their several departments have united to give it the character of an original work that it cannot fail to be considered in that light by the public and by workers in various departments. Quite lately I had occasion to cite it in an *important cause* in one of our *highest courts* as an *authority* upon a matter of *great interest in chemical geology;* and no doubt it must be constantly cited by others in a like manner on a great variety of subjects. I hope you may be abundantly rewarded for your enterprise and risks.

# OPINIONS OF THE PRESS OF JOHNSON'S CYCLOPÆDIA.

**From the New York Independent.**

We have constantly used the volumes ever since their appearance, and with an ever-increasing sense of their completeness and reliability.

**From the New York Christian at Work.**

JOHNSON'S CYCLOPÆDIA is a credit to its publishers, a credit to its editors, and a marvel of industrious research, ability, and general correctness.

**From the New York Evangelist.**

With the addition of Shakspeare and the Bible, no family possessing it can be said to be destitute of a full and well-selected library.

**From the New York Baptist Union.**

The denominational articles are written by representative men in the respective bodies described, so that no complaint can be urged of partiality or unfairness.

**From the New York Church Journal and Gospel Messenger.**

Any family owning a copy of this work will find itself in possession of a valuable library.

**From the New York Christian Intelligencer.**

No other cyclopædia that we have examined is so completely satisfactory.

**From the New York Home Journal.**

It is a pyramid of brains, and becomes thus not a mere report of what has been said, but a veritable congress of scholars where each one gives with his own word the testimony of that which he knows.

**From the New York Jewish Messenger.**

It is one of the most desirable acquisitions, not only for the student, but for every man who is desirous of enriching his store of knowledge.

**From the New York Christian Advocate.**

We can conscientiously say that in all these qualities we believe it surpasses anything of its kind published in the country.

**From Harper's Monthly Magizine.**

The Third Volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA keeps fully up to the standard of its predecessors. Its illustrations illustrate; they are not mere pictures brought in to justify the title-page. It is characteristic of the work that the moral and religious topics are put into the hand of disciples, not enemies. The work appears to be brought well up to the latest time in its historical as well as in its scientific articles.

**From the New York Daily Evening Post.**

The fame of the undertaking to which President Barnard and his colleagues are devoting so much labor and scholarship has already gone abroad through the country. The man does not live who is qualified to judge thoroughly such a work as this. The aim of the work has been to combine brevity with sufficiency, and to get within a space as small as possible the *facts* most essential to be known.

**From the Rochester (N.Y.) Daily Union and Advertiser.**

It should be understood that this is no old cyclopædia, rewritten and brought down to date, but an entirely new one of greatly-extended scope, and intended to convey a large amount of information not to be found in any other similar work; and it should also be as distinctly understood that while condensed in form it is not abridged in material.

**From the Boston (Mass.) Zion's Herald.**

This universal dictionary of all departments of human knowledge, so remarkably condensed and ably edited, will become, as it is known, a necessity upon the desk of both literary and business men. No poor man can afford to be without this work.

**From the Boston (Mass.) Watchman and Reflector.**

In the very careful and critical examination we have given it we find little to censure and a great deal to commend. We now have, for reference, what we have often wished for—a truly American cyclopædia.

**From the Boston (Mass.) New England Journal of Education.**

We can most fully and heartily recommend JOHNSON'S CYCLOPÆDIA for its completeness in matter, convenience in form, cheapness, and the ability and accuracy with which it has been compiled.

**From the Boston (Mass.) Daily Journal.**

The signatures appended to all important articles lend weight and authority to the statements.

**From the Worcester (Mass.) Daily Spy.**

Every department of knowledge gets attention; nothing is overlooked. The science articles are from men familiar with the present condition of science and scientific speculation. It certainly fills a peculiar place—a place entirely its own—among important books of reference.

**From the Worcester (Mass.) Daily Palladium.**

For the first time we have a general cyclopædia which does *equal* justice to American geography, biography, or indeed art, science, literature, or institutions.

**From the Greenfield (Mass.) Gazette and Courier.**

It is a library in itself, and a man with limited means to invest in books can in no way make a more satisfactory outlay than in subscribing for this Cyclopædia.

**From the Greenfield (Mass.) Franklin County Times.**

It is a work of great merit, and it is safe to say that no library can be complete without a set of JOHNSON'S CYCLOPÆDIA.

**From the Stoneham (Mass.) Independent.**

It seems to be about as near perfection as any work of human origin can be.

**From the Westfield (Mass.) Times and News-Letter.**

We have now for reference what we have long desired, a truly *American* cyclopædia—not, like so many of its class, a compilation, but an original work.

**From the Leominster (Mass.) Enterprise.**

It proves not only a companion, but a friend, and grows upon the esteem of the merchant, the man of affairs, the student, and the scholar. It is an indispensable.

**From the Worcester (Mass.) Daily Press.**

The array of talent engaged upon this work is perhaps as great as was ever brought to the aid of a literary project.

**From the Springfield (Mass.) Daily Republican.**

One excellent thing for the purposes of reference is the subdivision of articles by *italic* heads, so that under the head of any country, its government, its geology, its literature, its finances are learned at a glance—a method that would be much to the advantage of more elaborate cyclopædias. Its comparative cheapness will commend it to many who might prefer Appletons'.

**From the Springfield (Mass.) Daily Union.**

The advantage of JOHNSON'S work over *Appletons'*, in reference to the number of topics treated, appears from a comparison of the first six volumes of *Appleton* with the First Volume of JOHNSON, both embracing the same alphabetical space. In *Appletons'* 11,071 topics are treated, and in JOHNSON'S 19,943, giving an excess of 8872 in favor of the latter. It is difficult to speak too highly of the rigid and skilful condensation that is exhibited in the preparation of the articles.

**From the Hartford (Conn.) Daily Courant.**

Almost any man who has anything to expend for books can secure the work without a serious encroachment upon his resources, and at a moderate price he is able to possess a work which to the majority of families serves the purpose of quite an extensive library.

**From the Meriden (Conn.) Daily Republican.**

We could continue this article into numerous columns, and not tire the reader, if we could only do justice to the real merits of this work and the great master-minds that enrich its pages.

**From the New Haven (Conn.) Daily Union.**

The work is a complete gazetteer, biographical dictionary, popular medical and legal guide, and a comprehensive and condensed family library, very full in everything American, especially historical, political, geographical, and statistical matters.

**From the New Haven (Conn.) Daily Journal and Courier.**

We counsel all who stand in need of a compact, accurate, and every way excellent cyclopædia to procure this one without fail.

**From the New Haven (Conn.) Daily Palladium.**

We feel justified in commending it cordially to all who desire a full, accurate, and yet handy work of reference.

**From the New Haven (Conn.) Daily Evening Register.**

It is a most valuable work.

**From the Milford (Conn.) Telegram.**

We exhort you all to secure a copy of the greatest, cheapest, and best book in the world, JOHNSON'S UNIVERSAL CLYCOPÆDIA.

**From the Milford (Conn.) Sentinel.**

It will prove invaluable in the home, the school, the counting-room, and the factory.

**From the Newark (N. J.) Daily Journal.**

Every doctor, lawyer, minister, business-man, and family needs just such a work.

**From the Newark (N. J.) Daily Advertiser.**

Of the merits of the work there is sufficient assurance in the list of Editors.

**From the Philadelphia (Pa.) Daily Evening Telegraph.**

It contains very full and very complete articles upon a great number of important subjects which are entirely overlooked in other cyclopædias. It can be kept on the table, always ready, always reliable—a book whose place can be filled with no other.

**From the Philadelphia (Pa.) Daily Bulletin.**

The new Cyclopædia is the most comprehensive we have ever had. It is a whole library in itself, and should have a place on the shelf of every man who wishes to keep himself well informed.

**From the Philadelphia (Pa.) Daily American and Gazette.**

The work is a credit to the country, for it shows by its completeness that general and solid information is wanted by the majority.



[OVER.]

# OPINIONS OF THE PRESS—Continued.

**From the Philadelphia (Pa.) Press.**

The design of the Editors of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA appears to have arrived at the happy mean, and their four volumes will contain an immense quantity of condensed and accurate information upon all subjects. We conclude as we began, by declaring that JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA is extremely well executed in all its departments.

**From the Philadelphia (Pa.) Daily Times.**

There has been no work prepared in this country for a great many years of equal importance with the NEW UNIVERSAL CYCLOPÆDIA.

**From the Philadelphia (Pa.) Daily Inquirer.**

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**From the Grand Rapids (Mich.) Post.**

This great work embraces the whole circle of human knowledge. As such we cordially commend it to the reading public.

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**From the Chicago (Ill.) Post and Mail.**

No library can be complete without it; it is invaluable alike to the editor, the lawyer, the physician, the merchant, the manufacturer, the clergyman, the student, the farmer, and the mechanic.

**From the Chicago (Ill.) Educational Weekly.**

It embraces all subjects within the ordinary range of human investigation, treating them succinctly, accurately, and thoroughly, and has already taken the highest rank among our literary men and scholars.

**From the Chicago (Ill.) Standard.**

We feel like commending this work with especial emphasis to those wishing to secure an encyclopædia which shall be full, accurate, available, serviceable, and at the same time not cost a small fortune.

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JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA has been carefully examined by us, and we do not hesitate to place it in the front rank of cyclopædias.

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Here we have the ideal book of reference, a model of completeness, brevity, freshness, comprehensiveness, and accuracy.

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Within its pages is a fund of information impossible to express, were it not for the rigid system of condensation, which has stripped knowledge of all its husks and left nothing but the kernel. It is a master-work.

**From the Chicago (Ill.) Appeal.**

The more we see of this Cyclopædia the better we like it.

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It bears the test of practical use splendidly.

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It is certainly the greatest literary work of the century, and is destined to become the standard cyclopædia of America, if not of every nation where the English language is spoken or read.

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It is invaluable to every student and business-man.

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We can most fully and heartily recommend JOHNSON'S CYCLOPÆDIA for its completeness in matter, convenience in form, cheapness, and the ability and accuracy with which it has been made. No home ought to be without it. Let the young be educated to make daily use of it.

## OPINIONS OF THE PRESS—Continued.

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He who possesses this treasury when completed may consider himself rich indeed in intellectual stores.

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**From the Davenport (Ia.) Daily Democrat.**

The entire work, so far, bears the impress of great thoroughness.

**From the Davenport (Ia.) Gazette.**

We do not see how any really intelligent American can afford to be without this work.

**From the Burlington (Ia.) Hawkeye.**

In no respect do we believe this work inferior to the best, and in many respects it is vastly superior to any other.

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It is destined to adorn more libraries throughout the country than any other book of a similar character.

**From the Cedar Rapids (Ia.) Daily Republican.**

In JOHNSON'S NEW CYCLOPÆDIA you have but four volumes, and they cover a wider and more comprehensive range of subjects than any cyclopædia ever published. Beyond a shadow of a doubt, it must in common justice be said that it now stands at the head of its class.

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This is no clap-trap, catch-penny, ephemeral work, but as reliable as it is extensive, and as practical as it is important. We do not hesitate to pronounce it altogether the most complete and comprehensive work of the kind with which we are acquainted, not excepting the *American Cyclopædia*, over which it has many advantages.

**From the Des Moines (Ia.) State Register.**

This is indeed a cyclopædia! You get in a sentence or a paragraph what you will wade through pages and volumes to find elsewhere.

**From the Des Moines (Ia.) State Leader.**

It is only necessary to mention the names of a few of the Associate Editors to indicate the sterling value of the work.

**From the Omaha (Neb.) Daily Bee.**

We give the work our unqualified endorsement, and bespeak for it a circulation equal to its merits.

**From the Omaha (Neb.) Daily Herald.**

We think a careful examination will justify the claim that JOHNSON'S UNIVERSAL CYCLOPÆDIA is more comprehensive in its scope, more condensed in its statements, and at a less price than any work of its class hitherto published.

**From the San Francisco (Cal.) Daily Evening Bulletin.**

We cannot too highly commend the literary and artistic quality of JOHNSON'S UNIVERSAL CYCLOPÆDIA.

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All will find in this work more information in small space, more real knowledge to be obtained at less expenditure of time, than can possibly be found in any other book or in any other way. No library can be complete without it.

**From the San José (Cal.) Daily Mercury.**

We can conscientiously say that we believe it surpasses anything of its kind published in this country.

**From the San José (Cal.) Patriot.**

We heartily commend it to the inspection of all.

**From the Santa Rosa (Cal.) Daily Democrat.**

Its superiority over all other cyclopædias with which we are acquainted may be found in the fact that it treats of many thousand subjects which they ignore or their compilers were ignorant of, and yet treats them in no prolix manner.

**From the Santa Cruz (Cal.) Local Item.**

As compared with the other cyclopædias in the field, we find JOHNSON'S much more thorough in its treatment of subjects, its information so clearly and tersely given as to be more readily available, and the authority of all the most important articles placed beyond question by having the writers' names signed to them, making it incomparably superior to any other, of whatever name or pretensions now before the American public.

**From the Santa Cruz (Cal.) Sentinel.**

The titles are treated in a thorough and exhaustive manner by masters.

**From the Yolo (Cal.) Mail.**

The work is strictly American in its inception and execution, and we commend it to all as a work of value.

**From the Petaluma (Cal.) Weekly Argus.**

As compared with other cyclopædias, we believe its information is more clearly and tersely given: we know of no more compact literary work.

## A PARTING WORD TO THE PUBLIC.

The above encomiums of the press, together with the preceding personal testimonials from men of eminence, will doubtless suffice to establish the fact that JOHNSON'S UNIVERSAL CYCLOPÆDIA is accepted by the best judges as being *the best* work of the kind in the English language. The Rev. William B. Watkins, S. T. D., of Pittsburg, Pa., after a thorough comparison of JOHNSON'S work with all the rest, and preferring it, said, "The question, indeed, narrows itself down to *two competitive* cyclopædias—*The American Cyclopædia*, by D. Appleton & Co., and JOHNSON'S UNIVERSAL CYCLOPÆDIA, by Alvin J. Johnson & Son." The *quality* of the two cyclopædias being settled decidedly in favor of JOHNSON'S, it may be well to make an estimated comparative statement giving the *quantity* of matter and the *retail prices of each*. This we are justified in doing, because of the allegations of our opponents and their agents, that JOHNSON'S must be, and is, only a "cheap affair," and that Appletons' *16 volumes* will contain much more *type-matter* than JOHNSON'S; and upon these fallacious statements they proceed to convince people who have never seen JOHNSON'S CYCLOPÆDIA that Appletons' is to be preferred, and is much cheaper at $80 in cloth or at $112 in half turkey a set, than JOHNSON'S at $43 in cloth or $51 in half turkey.

## ESTIMATED COMPARISON OF TYPE-MATTER OF THE TWO CYCLOPÆDIAS.

**JOHNSON'S, complete in four volumes:**

| | |
|---|---|
| *Estimated* number of *words* in JOHNSON'S, counting the space occupied by the *wood-cuts* as *type-matter* | 12,087,510 |
| Average number of words per page | 1,730 |
| Total number of pages in JOHNSON'S | 6,987 |

The actual number of *words* in JOHNSON'S, put into APPLETONS' *page*, using APPLETONS' *type* and *wood-cuts*, would make OVER SIXTEEN VOLUMES.

**APPLETONS', complete in sixteen volumes:**

| | |
|---|---|
| *Estimated* number of *words* in APPLETONS', counting the space occupied by the *wood-cuts* as *type-matter* | 12,455,940 |
| Average number of words per page | 940 |
| Total number of pages in APPLETONS' | 13,251 |

The actual number of *words* in APPLETONS', put into JOHNSON'S *page*, using JOHNSON'S *type* and *wood-cuts*, would make LESS THAN FOUR VOLUMES.

**Besides, JOHNSON'S contains twenty thousand subjects more than APPLETONS', while not an important subject in APPLETONS' is left out in JOHNSON'S, the principal subjects in the latter being signed by eminent specialists, and not one in the former is signed.**

Thus it turns out in the end that *Appletons' Cyclopædia* has lost largely in *type-matter*, and JOHNSON'S gained as largely, by the former containing so many *old views of cities, public buildings*, etc., while the latter has utilized space to the best advantage in illustrating *only* where it seemed necessary in order to convey a clearer idea of the subject treated. As *Harper's Monthly Magazine* said, "Its illustrations illustrate; they are not mere pictures brought in to justify the title-page; and it is characteristic of the work that the moral and religious topics are put into the hands of disciples, and not enemies."


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